

## **KAIROS Manager Function Manual**

Revision: 1.21  
Last Updated: 12. Mar. 2021  
Language: English  
Document No. AN-19-0002

## Revision History

| Revision    | Edition                                                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>1.10</b> | <ul style="list-style-type: none"><li>• Add to the Call Interrupt and the Analog CWID features</li><li>• Add Chapter 4&amp;5</li></ul> |
| <b>1.20</b> | <ul style="list-style-type: none"><li>• Updating information and minor error correction</li></ul>                                      |
| <b>1.21</b> | <ul style="list-style-type: none"><li>• Add to the setting for IP Gateway connecting.</li></ul>                                        |
|             |                                                                                                                                        |
|             |                                                                                                                                        |
|             |                                                                                                                                        |

## Document Revision

This document shall from time to time be changed without notice. This document is created and published for the products having the following design specifications.

## Version information's

|                     | Item                      | Version        | Built No | How to Verify                         |
|---------------------|---------------------------|----------------|----------|---------------------------------------|
| Firmware            | Main Firmware             | 1.6.C.5_stable | -        | Software > Versions of KAIROS Manager |
|                     | Controller Firmware       | 1.1.0.2        | -        |                                       |
|                     | DSP Firmware              | 4.67           | -        |                                       |
|                     | PLD Firmware              | 4.13           | -        |                                       |
|                     | Operating System Firmware | 01             | 8        |                                       |
| Programing Software | KAIROS Manager            | 1.7.14         | -        | ? > About... of KAIROS Manager        |

## &lt;&lt;Note&gt;&gt;

This version is not included any new function. If a current system has no problem, you don't need to update the firmware. In detail, refer to the TM-20-0005 KAIROS Firmware Update Information for KAS-20 (Tier III / S-Trunking).

## Disclaimer

This document is intended to provide basic and general information about the product specifications of the products listed above and the system configuration. The intended purpose of all technical descriptions herein shall be to improve your understanding of the product specifications and system configuration. The descriptions provided in this document are carefully examined and are believed to be entirely reliable. JVCKENWOOD Corporation shall be entirely free from any responsibility and liability for inapplicability, damage or loss arising from inaccuracies in this document and reserves the right to change the product specifications herein in order to improve readability, function or product design.

Applicability of the descriptions in this document may vary depending upon the product specifications and configurations of relevant equipment. Furthermore, you are not licensed nor entitled to use and divert to your application any descriptions in this document. Contact the JVCKENWOOD Corporation for further details.

## Document Copyright

Copyright 2019 by JVCKENWOOD Corporation; All rights reserved.

No part of this manual may be reproduced, translated, distributed, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, for any purpose without the prior written permission of JVCKENWOOD Corporation.

## About Trademarks and Intellectual Properties

- AMBE+2™ is a trademark of Digital Voice Systems Inc.

This product uses the AMBE+2™ voice encoding technology and the technology is protected by intellectual property rights including patent rights, copyrights, and trade secrets of Digital Voice Systems, Inc.

- All other product names referenced herein are trademarks or registered trademarks of their respective manufacturers.

|                                                       |        |
|-------------------------------------------------------|--------|
| KAIROS Manager.....                                   | 1      |
| Function Manual .....                                 | 1      |
| Revision History .....                                | - 1 -  |
| Document Revision .....                               | - 2 -  |
| Disclaimer .....                                      | - 3 -  |
| Document Copyright .....                              | - 3 -  |
| About Trademarks and Intellectual Properties .....    | - 3 -  |
| 1. KAIROS_Manager Installation .....                  | - 8 -  |
| 1.1. Installation .....                               | - 8 -  |
| 2. Connection setup .....                             | - 9 -  |
| 2.1. Connection setup .....                           | - 9 -  |
| 3. Main window .....                                  | - 11 - |
| 3.1. KAIROS Manager.....                              | - 12 - |
| 3.1.1. Regional Settings .....                        | - 12 - |
| 3.1.2. Select Measurement Units .....                 | - 12 - |
| 3.1.3. File Transfer Setting .....                    | - 12 - |
| 3.1.4. DMR ID Format .....                            | - 13 - |
| 3.1.5. Add/Modify Users.....                          | - 13 - |
| 3.2. Software.....                                    | - 14 - |
| 3.2.1. Versions.....                                  | - 14 - |
| 3.2.2. Upload.....                                    | - 15 - |
| 3.2.3. Automatic Update.....                          | - 16 - |
| 3.3. KAIROS .....                                     | - 18 - |
| 3.3.1. Configuration .....                            | - 18 - |
| 3.3.1.1. Network Settings .....                       | - 18 - |
| 3.3.1.2. Logging Options .....                        | - 19 - |
| 3.3.1.3. Main Setup .....                             | - 19 - |
| 3.3.1.4. TRX Operating Modes.....                     | - 23 - |
| 3.3.1.4.1. TRX Configuration.....                     | - 23 - |
| 3.3.1.4.2. Analog Selective Calls Configuration ..... | - 27 - |
| 3.3.1.4.3. Service Class .....                        | - 27 - |
| 3.3.1.5. Channel Table.....                           | - 28 - |
| 3.3.1.6. Calibration Parameters .....                 | - 30 - |
| 3.3.1.7. Primary Synchronization .....                | - 30 - |
| 3.3.1.7.1. Synchronization mode.....                  | - 30 - |
| 3.3.1.7.2. Internal PTP Handling .....                | - 33 - |
| 3.3.1.7.3. PPS Signal Handling .....                  | - 34 - |
| 3.3.1.7.4. RF Sync Source .....                       | - 35 - |
| 3.3.1.8. TX Control .....                             | - 35 - |
| 3.3.1.9. RX Control.....                              | - 36 - |
| 3.3.1.10. Audio Lines Settings .....                  | - 37 - |
| 3.3.1.11. Subtone/Supertone.....                      | - 38 - |
| 3.3.1.12. Base Station Basic Data.....                | - 39 - |

|             |                                           |        |
|-------------|-------------------------------------------|--------|
| 3.3.1.13.   | Base Station Layer Configuration .....    | - 40 - |
| 3.3.1.14.   | Base Station Operating Modes .....        | - 42 - |
| 3.3.1.14.1. | Base Station Parameters.....              | - 43 - |
| 3.3.1.14.2. | IP Parameters .....                       | - 48 - |
| 3.3.1.14.3. | Physical Console Parameters .....         | - 48 - |
| 3.3.1.14.4. | Master-to-Master Parameters.....          | - 49 - |
| 3.3.1.14.5. | Tier III Parameters.....                  | - 50 - |
| 3.3.1.15.   | RTP Configuration .....                   | - 51 - |
| 3.3.1.15.1. | TS A(B) / ANALOG Channel Parameters ..... | - 52 - |
| 3.3.1.16.   | SIP Configuration .....                   | - 53 - |
| 3.3.1.16.1. | Account Parameters.....                   | - 55 - |
| 3.3.1.16.2. | SIP Calls from AIR.....                   | - 56 - |
| 3.3.1.16.3. | AIR Call from SIP .....                   | - 56 - |
| 3.3.1.16.4. | SIP Server .....                          | - 56 - |
| 3.3.1.16.5. | SIP Trunk Configuration .....             | - 57 - |
| 3.3.2.      | Alarm Configuration .....                 | - 58 - |
| 3.3.2.1.    | Alarm Treatment.....                      | - 58 - |
| 3.3.2.2.    | Events Setup.....                         | - 60 - |
| 3.3.3.      | Controls .....                            | - 62 - |
| 3.3.3.1.    | KAIROS Overall Status.....                | - 63 - |
| 3.3.3.1.1.  | TRX Status.....                           | - 64 - |
| 3.3.3.1.2.  | Feature Status.....                       | - 65 - |
| 3.3.3.1.3.  | Commands.....                             | - 67 - |
| 3.3.3.1.4.  | Synchronization Status.....               | - 67 - |
| 3.3.3.1.5.  | AF Lines Status .....                     | - 68 - |
| 3.3.3.1.6.  | Vocoders Status .....                     | - 69 - |
| 3.3.3.1.7.  | Check Status .....                        | - 69 - |
| 3.3.3.1.8.  | 1+1 Status .....                          | - 69 - |
| 3.3.3.1.9.  | DSP Measures .....                        | - 70 - |
| 3.3.3.1.10. | RX Measures.....                          | - 70 - |
| 3.3.3.1.11. | Analog Measures.....                      | - 71 - |
| 3.3.3.1.12. | DMR Status .....                          | - 71 - |
| 3.3.3.2.    | DSP and PLD Status .....                  | - 72 - |
| 3.3.3.3.    | Loop Test Result.....                     | - 73 - |
| 3.3.3.3.1.  | Test Results.....                         | - 73 - |
| 3.3.3.3.2.  | Test Measures .....                       | - 74 - |
| 3.3.3.3.3.  | Test to Execute.....                      | - 74 - |
| 3.3.3.4.    | Vtune Test Result.....                    | - 75 - |
| 3.3.3.5.    | GPS Status.....                           | - 77 - |
| 3.3.3.5.1.  | Status .....                              | - 77 - |
| 3.3.3.5.2.  | View.....                                 | - 77 - |
| 3.3.3.5.3.  | Coordinates .....                         | - 77 - |
| 3.3.3.5.4.  | GSP Satellites in View.....               | - 78 - |

|            |                                              |         |
|------------|----------------------------------------------|---------|
| 3.3.3.6.   | Primary Synchronization Status .....         | - 79 -  |
| 3.3.3.6.1. | Synchronization Status.....                  | - 79 -  |
| 3.3.3.6.2. | Timing Measure.....                          | - 80 -  |
| 3.3.3.6.3. | Superaudio Synchronization.....              | - 80 -  |
| 3.3.3.7.   | Audio Line Control .....                     | - 81 -  |
| 3.3.3.7.1. | Line Status .....                            | - 82 -  |
| 3.3.3.7.2. | Active Line.....                             | - 82 -  |
| 3.3.3.8.   | AF Test.....                                 | - 84 -  |
| 3.3.3.8.1. | AF Test Configuration.....                   | - 85 -  |
| 3.3.3.8.2. | Test Mode Settings.....                      | - 85 -  |
| 3.3.3.8.3. | Decoded Sel Call / DTMF.....                 | - 85 -  |
| 3.3.3.8.4. | AF Generator Settings.....                   | - 86 -  |
| 3.3.3.8.5. | Sw Module Status .....                       | - 87 -  |
| 3.3.3.8.6. | Measures.....                                | - 87 -  |
| 3.3.3.8.7. | DTMF sending Parameters .....                | - 87 -  |
| 3.3.3.8.8. | Modem Sequence Test Parameters .....         | - 87 -  |
| 3.3.3.9.   | DMR Test .....                               | - 88 -  |
| 3.3.3.10.  | P25 BER Test - TX .....                      | - 89 -  |
| 3.3.3.11.  | P25 BER Test - RX .....                      | - 90 -  |
| 3.3.3.12.  | SRT-DL Cell Status.....                      | - 90 -  |
| 3.3.3.13.  | Base Stations Viewer .....                   | - 91 -  |
| 3.3.3.14.  | Date and Time .....                          | - 91 -  |
| 3.3.4.     | Statistics .....                             | - 92 -  |
| 3.3.4.1.   | Station Statistics.....                      | - 92 -  |
| 3.3.4.2.   | Network Statistics .....                     | - 93 -  |
| 3.3.4.3.   | Packets Counter.....                         | - 93 -  |
| 3.3.5.     | Restart.....                                 | - 94 -  |
| 3.3.6.     | Configurations Utility .....                 | - 94 -  |
| 3.3.6.1.   | Save configurations .....                    | - 94 -  |
| 3.3.6.2.   | Load Configurations.....                     | - 95 -  |
| 3.4.       | ? .....                                      | - 96 -  |
| 3.4.1.     | About... ..                                  | - 96 -  |
| 3.4.2.     | KAIROS Equipment Info .....                  | - 97 -  |
| 4.         | KAIROS Setup Guide .....                     | - 98 -  |
| 4.1.       | System .....                                 | - 98 -  |
| 4.1.1.     | Multi-Site .....                             | - 98 -  |
| 4.1.2.     | Master and Slave .....                       | - 98 -  |
| 4.1.2.1.   | Data exchange between Master and Slave ..... | - 98 -  |
| 4.1.3.     | Key point.....                               | - 99 -  |
| 4.2.       | Synchronization .....                        | - 99 -  |
| 4.2.1.     | Process to select best data by Master.....   | - 99 -  |
| 4.3.       | Timing .....                                 | - 100 - |
| 4.3.1.     | IP Network Multi-Site .....                  | - 100 - |

|                                                                            |         |
|----------------------------------------------------------------------------|---------|
| 5. System Case Study .....                                                 | - 101 - |
| 5.1. Single-Site .....                                                     | - 101 - |
| 5.2. Multi-Site .....                                                      | - 102 - |
| 5.2.1. 2 Sites Multi-Site .....                                            | - 102 - |
| 5.2.2. 2 Sites with Analog FM .....                                        | - 104 - |
| 5.2.3. 2 Sites with PTP Sync .....                                         | - 106 - |
| 5.2.4. 3site synchronized with GPS/GLONASS and PTP .....                   | - 108 - |
| 5.2.5. Multisite Roaming System (2Sites) .....                             | - 110 - |
| 5.2.6. Simulcast System (2Sites) .....                                     | - 112 - |
| 5.2.7. Receiver Voting by RX only repeater in the Simulcast (2Sites) ..... | - 114 - |
| 5.2.8. RF Link (DMR) 2Sites .....                                          | - 116 - |
| 5.2.8.1. Access to RF-Linked Repeater's .....                              | - 119 - |
| 5.2.9. RF Link (DMR) 3Sites .....                                          | - 120 - |
| 5.3. Redundancy .....                                                      | - 125 - |
| 5.3.1. Backup Master (Multi-site & PTP) .....                              | - 125 - |
| 5.3.2. 1+1 Redundancy .....                                                | - 128 - |
| 5.4. KAIROS IP Gateway for the SIP Phone System .....                      | - 130 - |
| 5.5. Multi System .....                                                    | - 133 - |
| 5.5.1. Muster to Master .....                                              | - 133 - |
| 5.6. Security .....                                                        | - 135 - |
| 5.6.1. Tier II Access Control Lists .....                                  | - 135 - |
| 5.7. KAIROS Physical Console .....                                         | - 136 - |
| 5.8. KAIROS IP Gateway for the KAS-20 and the KPG-180AP .....              | - 139 - |
| 5.8.1. RTP Configuration .....                                             | - 139 - |
| 5.8.2. Main Setup .....                                                    | - 140 - |
| 5.8.3. Base Station Layer Configuration .....                              | - 140 - |
| 5.8.4. TRX Operating Modes .....                                           | - 141 - |
| 6. Appendix .....                                                          | - 142 - |
| 6.1. IP Discover .....                                                     | - 142 - |
| 6.2. I/O Port .....                                                        | - 143 - |



## 1. KAIROS\_Manager Installation

"KAIROS\_Manager" is a PC Application to configure a KAIROS.



### 1.1. Installation

Installation of "KAIROS\_Manager" requires a PC with Windows O.S.; insert the thumb drive with the installation package into the PC.

**Important! Run "SetupKA.bat" application with "Administrator rights".**

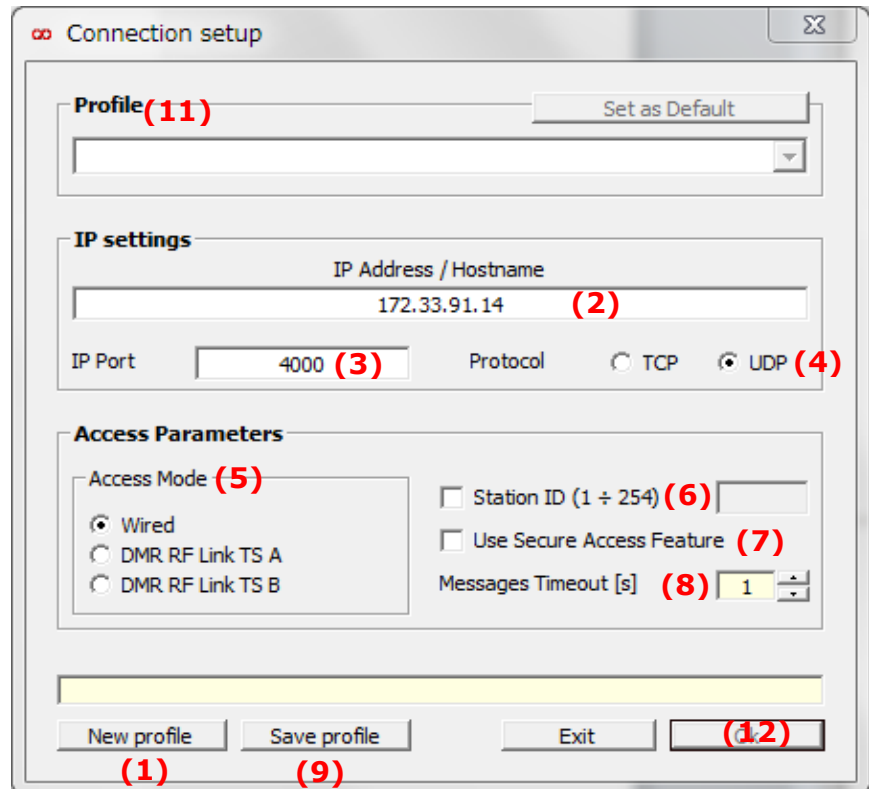
|               |                    |                    |      |
|---------------|--------------------|--------------------|------|
| Docs          | 9/9/2020 10:27 AM  | File folder        |      |
| Files         | 9/9/2020 10:27 AM  | File folder        |      |
| Fonts         | 9/9/2020 10:27 AM  | File folder        |      |
| Libs          | 9/9/2020 10:27 AM  | File folder        |      |
| RA.ico        | 9/7/2004 2:00 AM   | Icon               | 4 KB |
| autorun.inf   | 10/27/2010 2:00 AM | Setup Information  | 1 KB |
| Uninstall.bat | 12/18/2014 2:00 AM | Windows Batch File | 1 KB |
| SetupKA.bat   | 11/18/2019 3:16 PM | Windows Batch File | 3 KB |
| Readme.txt    | 3/17/2020 4:56 PM  | Text Document      | 3 KB |

After installing, the application is available from the folder  
 "C:\Radio\_Activity\KAIROS\KAIROS\_Manager.exe".

## 2. Connection setup

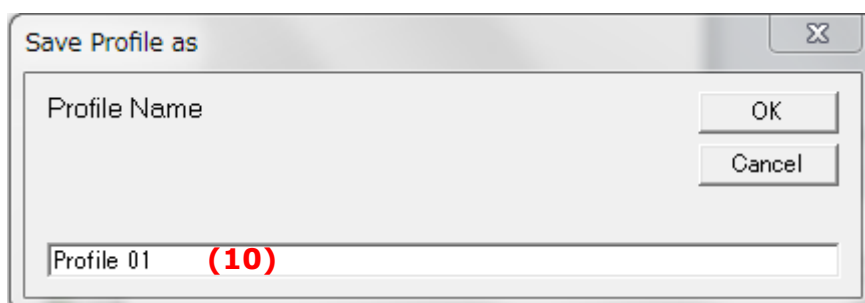
### 2.1. Connection setup

After double clicking on "KAIROS\_Manager.exe" the following window will appear. The IP address of the target equipment must be set to get access to the device. The main control window will appear which will give access to each equipment setting.



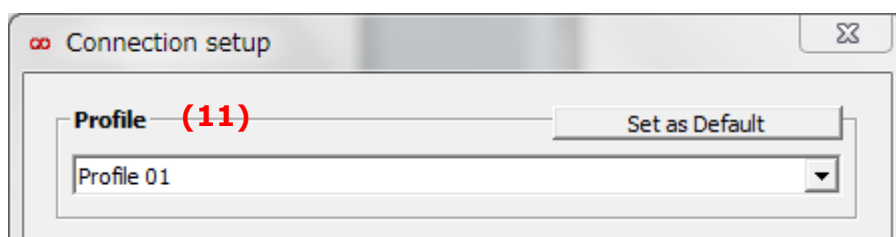
- (1) New Profile: Press this button to create New Profile.
- (2) IP Address / Hostname: Enter target KAIROS IP address.  
If you don't know the target KAIROS IP address, there is a simple way to discover the IP by switching on KAIROS. Please refer to Appendix 4.1
- (3) IP Port number: Default is "4000".
- (4) Protocol: Select "UDP"
- (5) Access Mode: Select "Wire" normally for cable LAN connection.  
DMR RF Link TS A: Connection via RF-LINK on Time Slot A  
DMR RF Link TS B: Connection via RF-LINK on Time Slot B  
\* To connect Remote KAIROS via RF-LINK, please refer to Appendix 4.2.
- (6) Station ID: Uncheck for cable LAN connection.  
Check here for RF-LINK connection.  
\* To connect Remote KAIROS via RF-LINK, please refer to Appendix 4.2.
- (7) Use Secure Access Feature: Uncheck if first time use the KAIROS.  
If you want to set password to open KAIROS setting, you need to set User / Password in TLC secure Access, then you can check here and use secure access. (Refer to 3.1.5 Handle Users)
- (8) Messages Timeout [s]: Timeout timer in case no connection.
- (9) Save profile: To save profile, press this button.

- (10) Profile Name: Enter Profile Name to save, press OK.



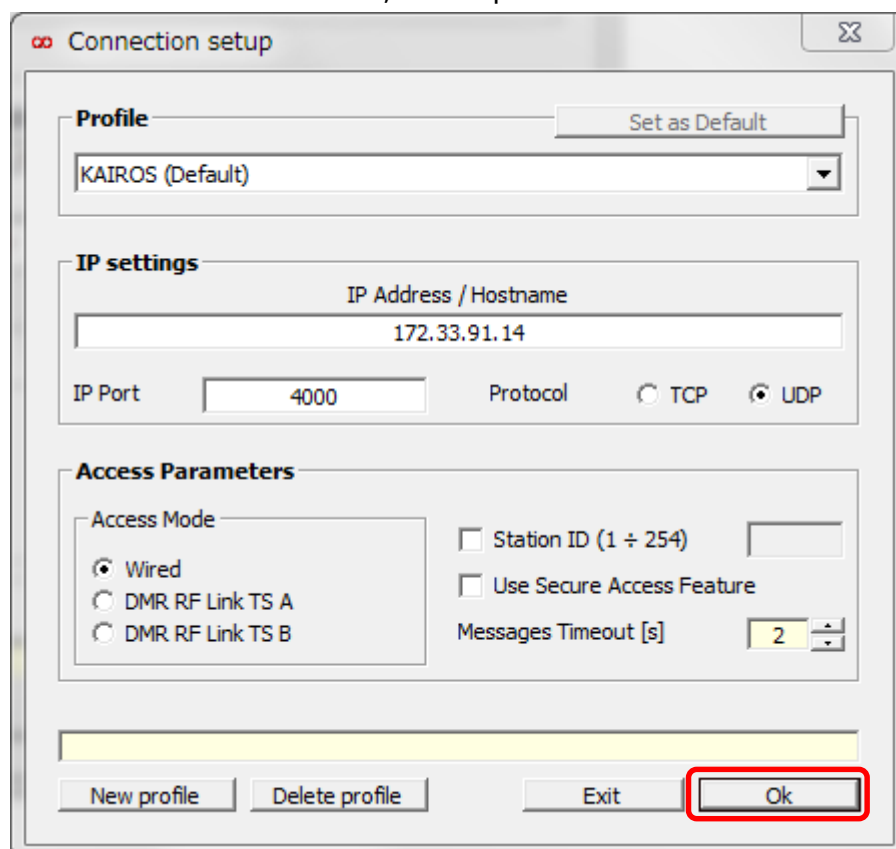
A dialog box titled "Save Profile as" with a close button (X) in the top right corner. It contains a text input field labeled "Profile Name" with the text "Profile 01" entered. To the right of the input field are two buttons: "OK" and "Cancel". Below the input field, the text "Profile 01" is followed by a red "(10)" indicating the step number.

- (11) Profile: Select Profile to connect KAIROS.



A dialog box titled "Connection setup" with a close button (X) in the top right corner. It contains a section labeled "Profile" with a dropdown menu showing "Profile 01". To the right of the dropdown is a button labeled "Set as Default". A red "(11)" is placed next to the "Profile" label.

- (12) Click "OK" to connect KAIROS, then open Main window.



A dialog box titled "Connection setup" with a close button (X) in the top right corner. It contains several sections:
 

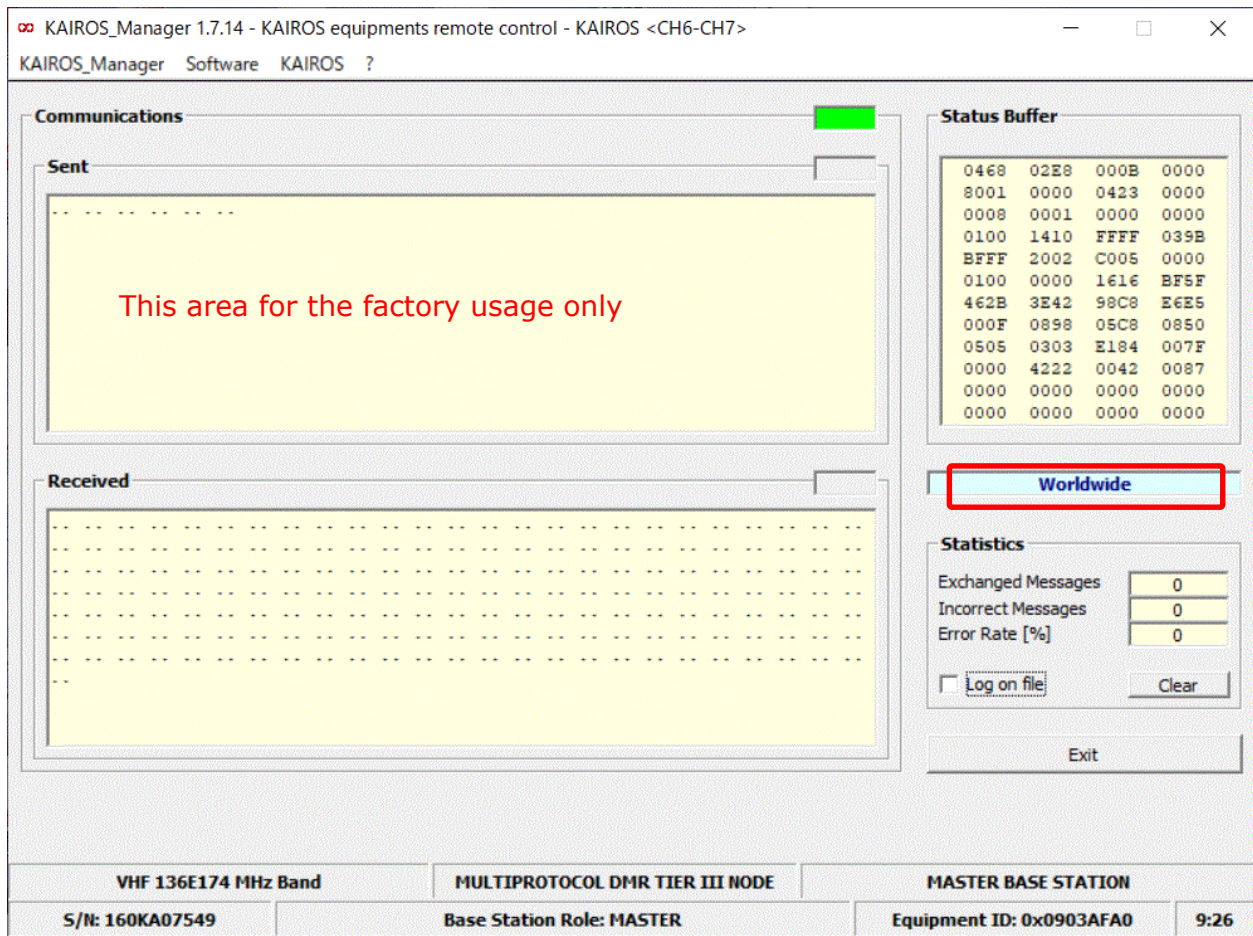
- Profile:** A dropdown menu showing "KAIROS (Default)". To the right is a button labeled "Set as Default".
- IP settings:** A section with a label "IP Address / Hostname" and a text input field containing "172.33.91.14". Below this is a row with "IP Port" and a text input field containing "4000", followed by "Protocol" with two radio buttons: "TCP" (unselected) and "UDP" (selected).
- Access Parameters:** A section with a group box labeled "Access Mode" containing three radio buttons: "Wired" (selected), "DMR RF Link TS A", and "DMR RF Link TS B". To the right of the group box are two checkboxes: "Station ID (1 ÷ 254)" (unchecked) and "Use Secure Access Feature" (unchecked). Below these is a label "Messages Timeout [s]" and a spinner box showing the value "2".

 At the bottom of the dialog are four buttons: "New profile", "Delete profile", "Exit", and "Ok". The "Ok" button is highlighted with a red rectangle.

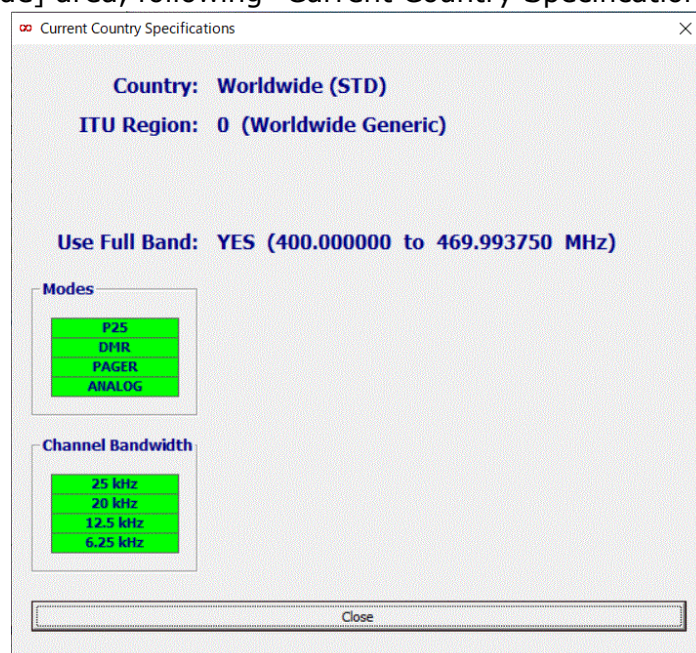


### 3. Main window

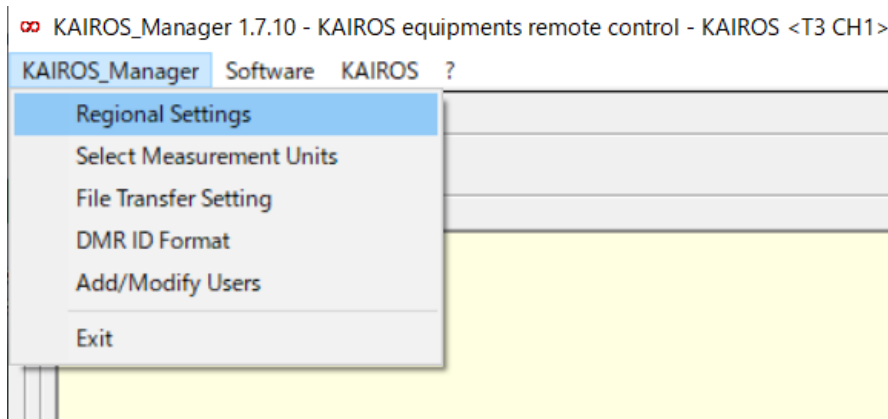
Following is a description of the function menus of the main window.



If you click [Worldwide] area, following "Current Country Specifications" will appear.

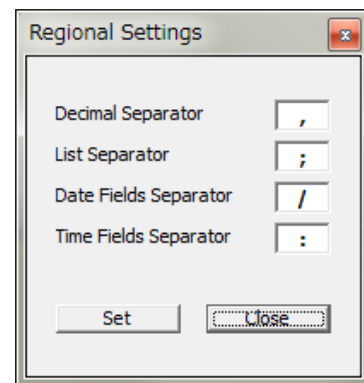


### 3.1. KAIROS Manager



#### 3.1.1. Regional Settings

The separators which you would like to use can be set in here.

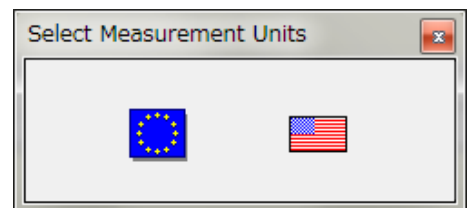


#### 3.1.2. Select Measurement Units

You can define Measurement Units from EU or US.

The selection affects the measurement units of distance and temperature; they switch from km/°C to miles/°F and vice versa.

These units are used for modifying the network delay ("distance advance timing [km]") and for detecting the board and VCTCXO temperature.

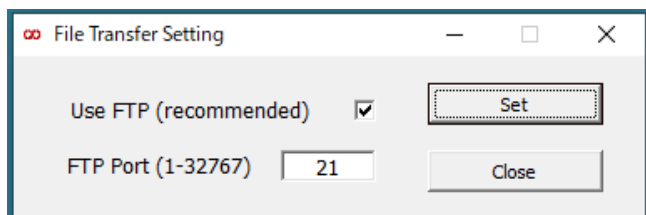


#### 3.1.3. File Transfer Setting

You don't need to change setting from default.

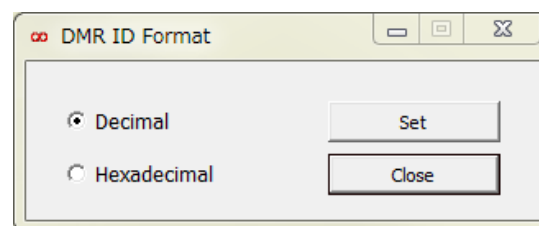
If uncheck "Use FTP" the data will be transferred by KAIROS manager port 4000.

If FTP default port is blocked by a router setting, you can change it.



### 3.1.4. DMR ID Format

This is the selection to indicate DMR ID in Decimal or Hexadecimal.

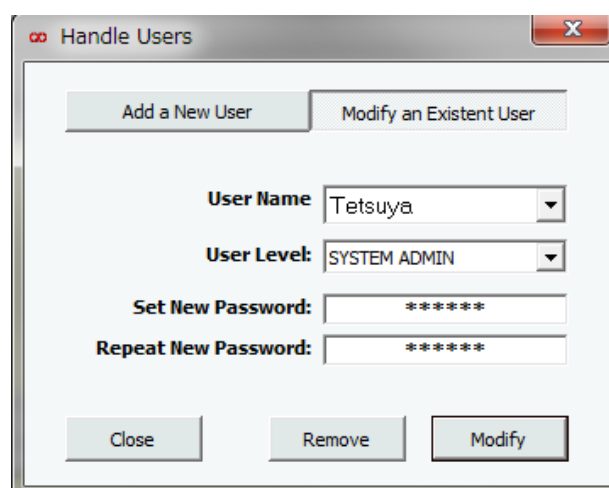


### 3.1.5. Add/Modify Users

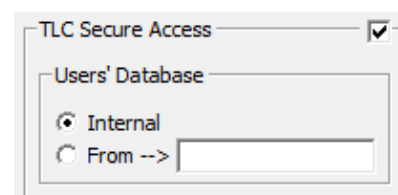
This is the setting for secure access for the KAIROS Manager.

After this setting, you will be no longer able to access the KAIROS in a standard way, but in the following mode:

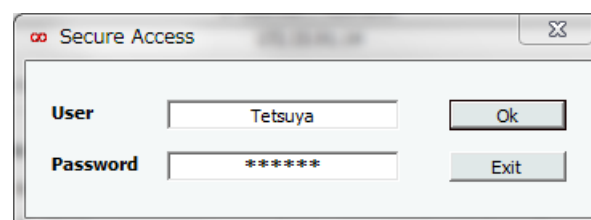
- launch KAIROS Manager
- In the connection setup window, select the box "use Secure Access Feature"
- Select your user and your password to access the station



To use secure access, select "TLC secure access" box.  
KAIROS-Configuration-Main Setup



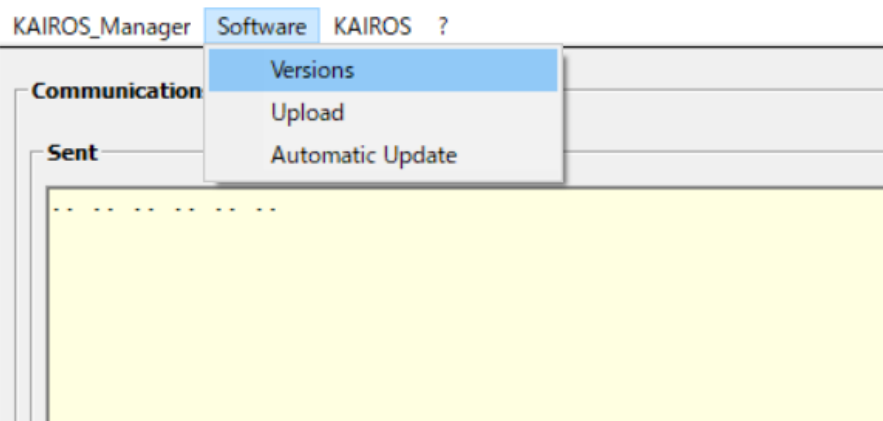
After you added a new User Name and Password, you have to open KAIROS manager by entering User Name and Password when you open KAIROS Manager the next time.





## 3.2. Software

KAIROS\_Manager 1.7.14 · KAIROS equipments remote control - KAIROS <T3 CH1>

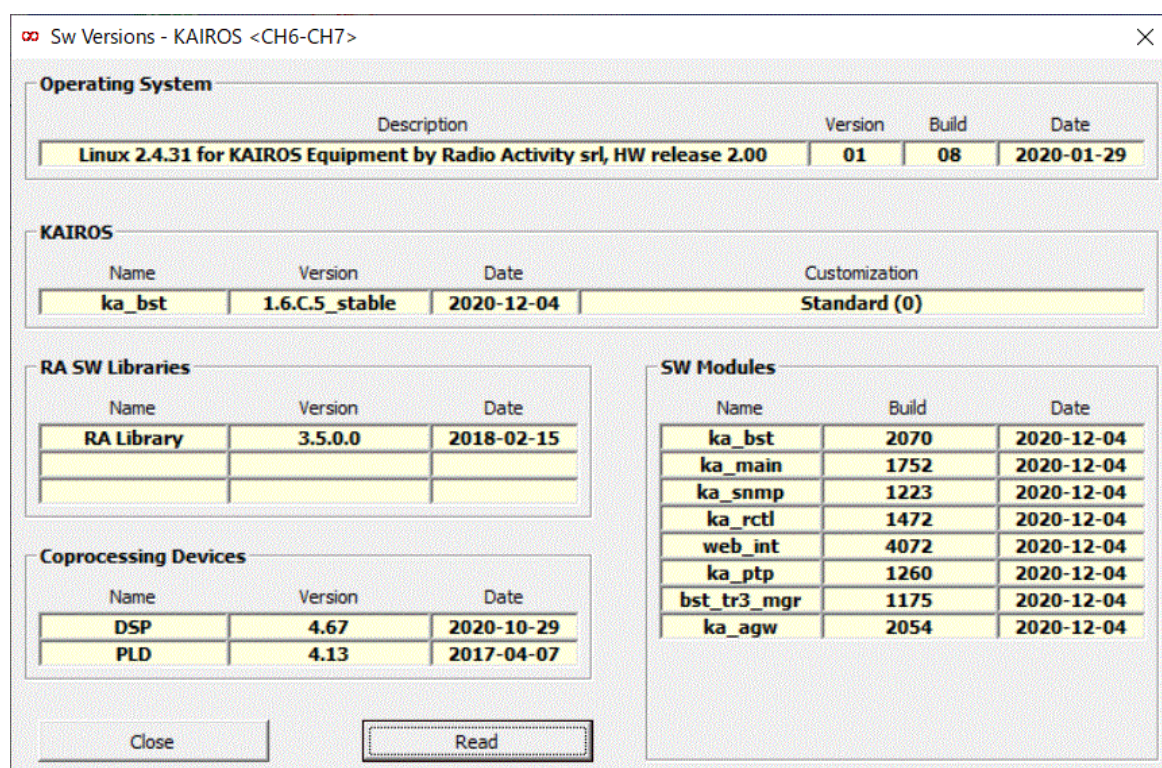


### 3.2.1. Versions

“Versions” allows the user to view versions of downloaded files in KAIROS.

After Updating a firmware, the Software Versions in the SW Versions window are not reflected immediately. Correct versions are shown after;

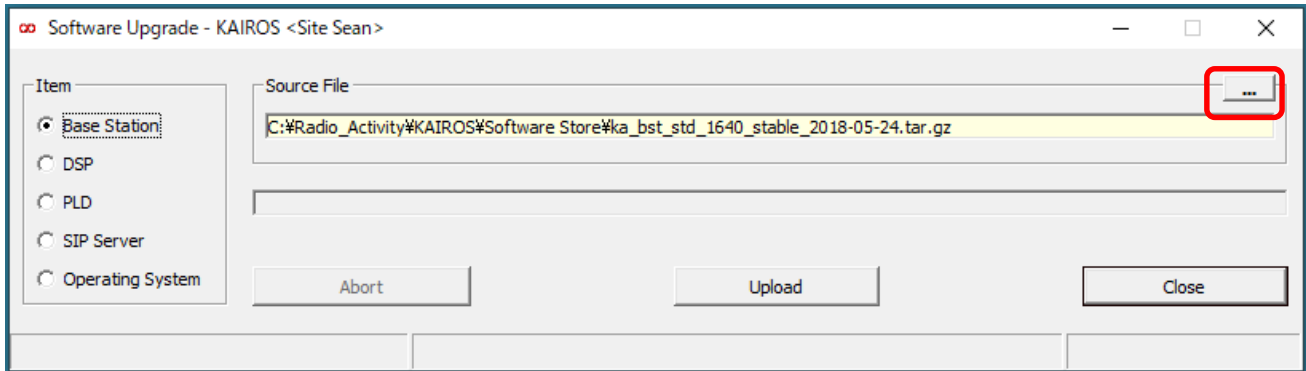
- Restart one more time
- Or power off/on again



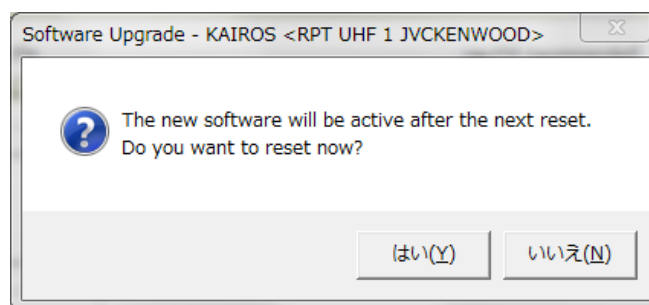
### 3.2.2. Upload

To upload new SW,

1. Select the type of firmware you need to download (microprocessor/DSP/FPGA/SIP/OS).
2. Select the file to be downloaded through "...” button (browse).
3. Push "Upload” button.
4. Wait for the end of the process.



After completed uploading, following window appears.



[Note]

Do not power off after firmware upgrade (Base Station / Tier3 Controller)

After Firmware upgrade finished on Kairos Manager, Kairos starts to write the data to FLASH from RAM. Power off on this condition will make broken Kairos sometime.

Do not cut the power line when restart is required after the updating.

Uploading time: No downtime required while uploading software.

Base Station: Approx. 1m 20s

DSP: Approx. 0m 12s

PLD: Approx. 0m 20s

SIP Server: Approx. 0m 40s

OS: Approx. 1m 0s

No KAIROS downtime required while uploading software.

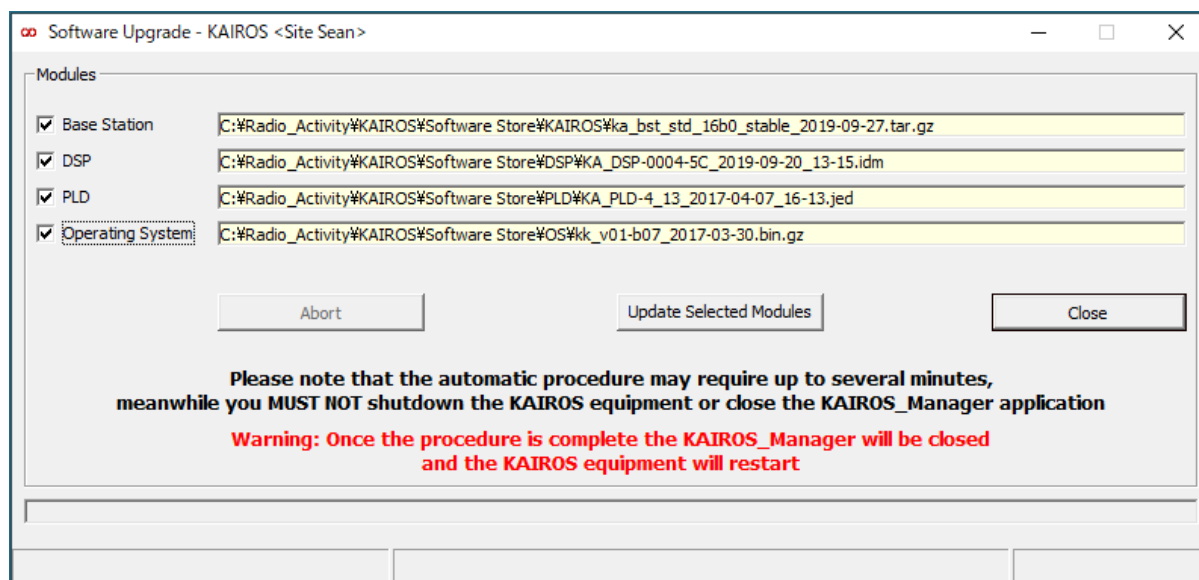
Down time: To upgrade KAIROS, takes approx. 0m 40s to 4m 10s to reboot. (OS takes the longest downtime)



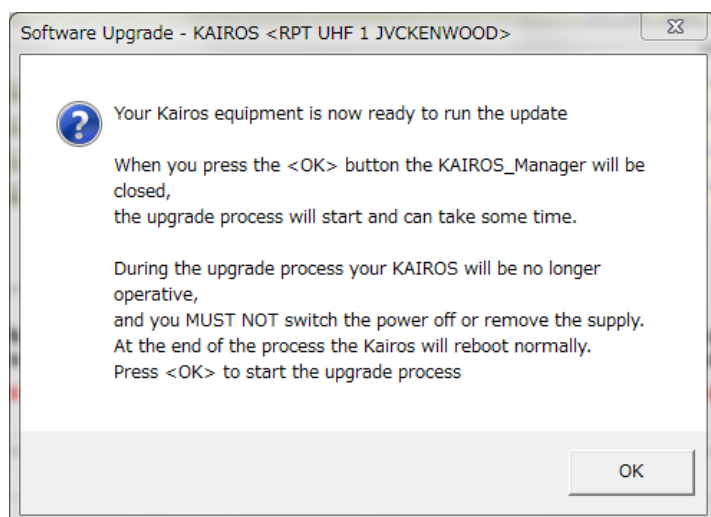
### 3.2.3. Automatic Update

To upload new SW automatically,

1. Select the module/s you need to download (microprocessor/DSP/FPGA/OS).
2. Select the file to be downloaded by clicking over the bar (browse).
3. Push "Update selected modules" button.
4. Wait for the end of the process.



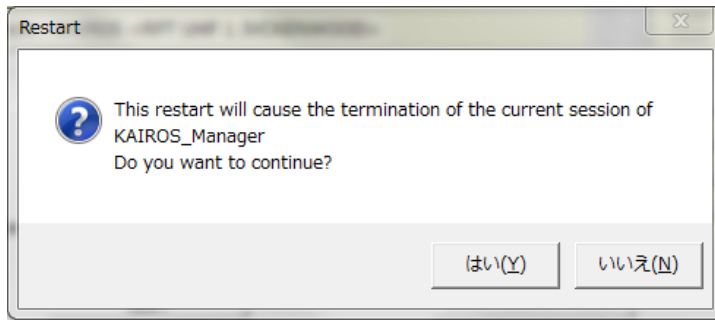
After update is completed, the following window appears.



[Note]

Uploading time: if update all is selected, it takes total 3m 0s.

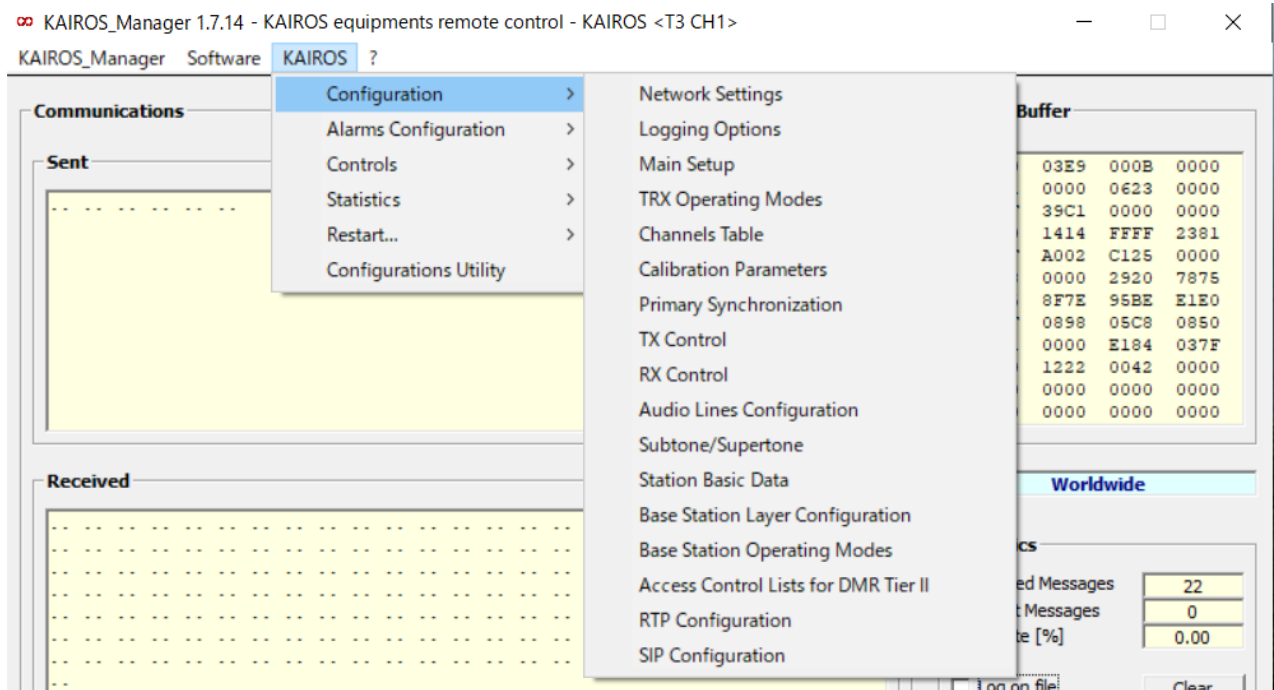
During the uploading, the KAIROS maintains normal operation. At the end of the upload process, the KAIROS restarts and the Firmware will be stored in flash memory. During this period, the KAIROS is upgrading and it takes about 4 minutes to resume normal operation.



### 3.3. KAIROS

“KAIROS” menu is the most frequently used and contains windows for systems setup, configuration, control, and restart of equipment. It is continuously changing according to the product developing and updating, but its main functions remain the same and they are explained here.

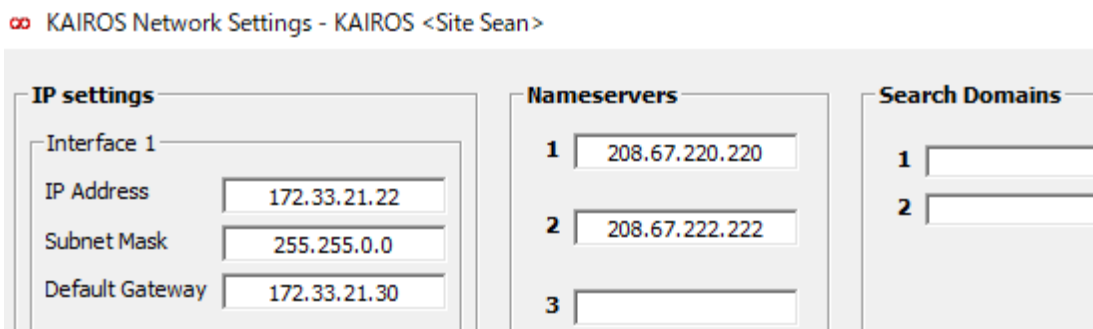
#### 3.3.1. Configuration



##### 3.3.1.1. Network Settings

###### ➤ IP Settings

It allows the user to set-up the IP Address of the radio for remote control over Ethernet. It is important to define the Subnet Mask and the gateway address (if present).



### 3.3.1.2. Logging Options

This setting is for developers only. Users don't need to touch it.

Uncheck all the items in Logging Options, by checking some of them may affects longer call setup time in Tier3 or S-Trunking.

The contained information are referred to communication layer, not to physical one. Logs are temporally stored in internal KAIROS, then a remote Syslog server saves the logs by entering the IP Address and the IP port.

### 3.3.1.3. Main Setup

Allows the user to set-up identifying parameters for the equipment and other parameters referring to hardware configuration (internal serial ports settings, remote control port settings and GPS module interface settings).

**(1) Equipment Name:**

You can name the equipment here.

The name you assigned is shown on top of the window.

**(2) Geographic Data:**

This field is reference only. It doesn't affect KAIROS performance.

Manual coordinates source is, it will simply allow to write the position of the site for information purpose only, in case GPS is not mounted. This setting has no effect on any behavior of the system.

**(3) Identify Data**

- Station ID: It is the ID of the station, to be used in RF link; or generally for accessing a station while being physically connected to another one; or for identifying a station in status messages and alarms messages.
- Network ID: It is used for identifying a network when sending DMR status messages from mobiles to network; or in Tier 3 configuration.
- 1+1 Address: ID for "1+1 Hot Standby" Redundancy. Refer to "3.3.1.4.1 TRX Configuration, (3) Type" for more detail.
- DMR ID: Unit ID as Mobile/Fixed Station also uses it for RF-Link.
- Group ID: It is the default destination ID for calls and messages generated by the station, if no other destination is specified.

**(4) Remote Control**

- LAN Connection: Enter IP port number to connect from KAIROS Manager and etc.
- Remote Control via RF Link: Check if you want to access a KAIROS through RF Link must be enabled here for all KAIROS which is on RF-Link.
- TLC Secure Access: This is the setting for secure access for the KAIROS Manager.

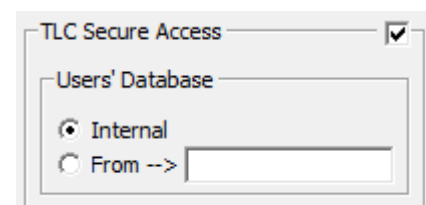
After this setting, you will be no more able to access the KAIROS in a standard way, but in the following mode:

- launch KAIROS Manager
- In the connection setup window, select the box "Use Secure Access Feature"
- Select your user and your password to access the station

Internal: Use internal User's Database.

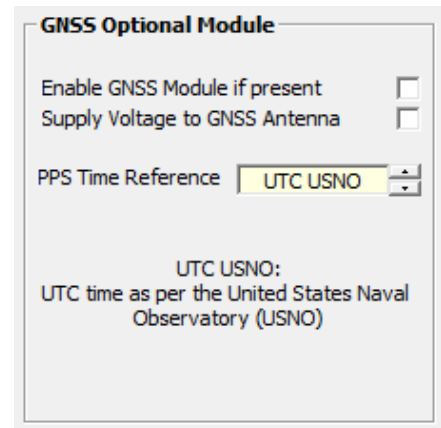
From→: Use another KAIROS User's Database

After you check this, you have to open KAIROS manager by entering User Name and Password.

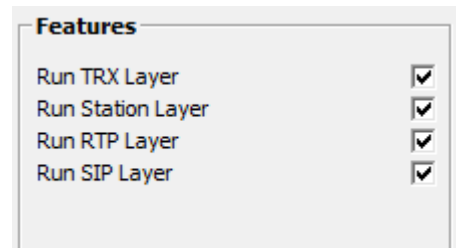


**(5) GNSS Optional Module**

- Enable GNSS Module if present: Check if the KAIROS has built-in GPS receiver
- Supply Voltage to GNSS Antenna: Check to supply +5V 100mA for external GPS antenna through GPS antenna cable.
- PPS Time Reference: Set all KAIROS as same selection.
  - UTC USNO: UTC time as per the United States Naval Observatory (USNO), choose this normally.
  - GPS: GPS time
  - GLONASS: GLONASS time
  - UTC-SU: UTC time as per Russia. It is derived from GLONASS time and the application of the UTC delta-time parameter from GLONASS satellites
  - GP-GL: GPS time derived from GLONASS time. It is derived from the application of the GPS delta-time parameter from GLONASS satellites

**(6) Features**

- Run TRX Layer: Microprocessor manages TX and RX peripheral modules. It is needed to make the DSP to start. It must always be active.
- Run Station Layer: Microprocessor manages the role of the base station inside the network. It manages the correct routing of signals, depending on the base station role. It is needed to make the processor to launch the main application. It must always be active.
- Run RTP Layer: Microprocessor manages (generates and receives) the RTP fluxes. RTP layer should be activated only if RTP interface is used. It must be checked if you use IP-Gateway.
- Run SIP Layer: Microprocessor manages the onboard SIP server and SIP fluxes. SIP and RTP layer should be activated only if SIP interface is used.

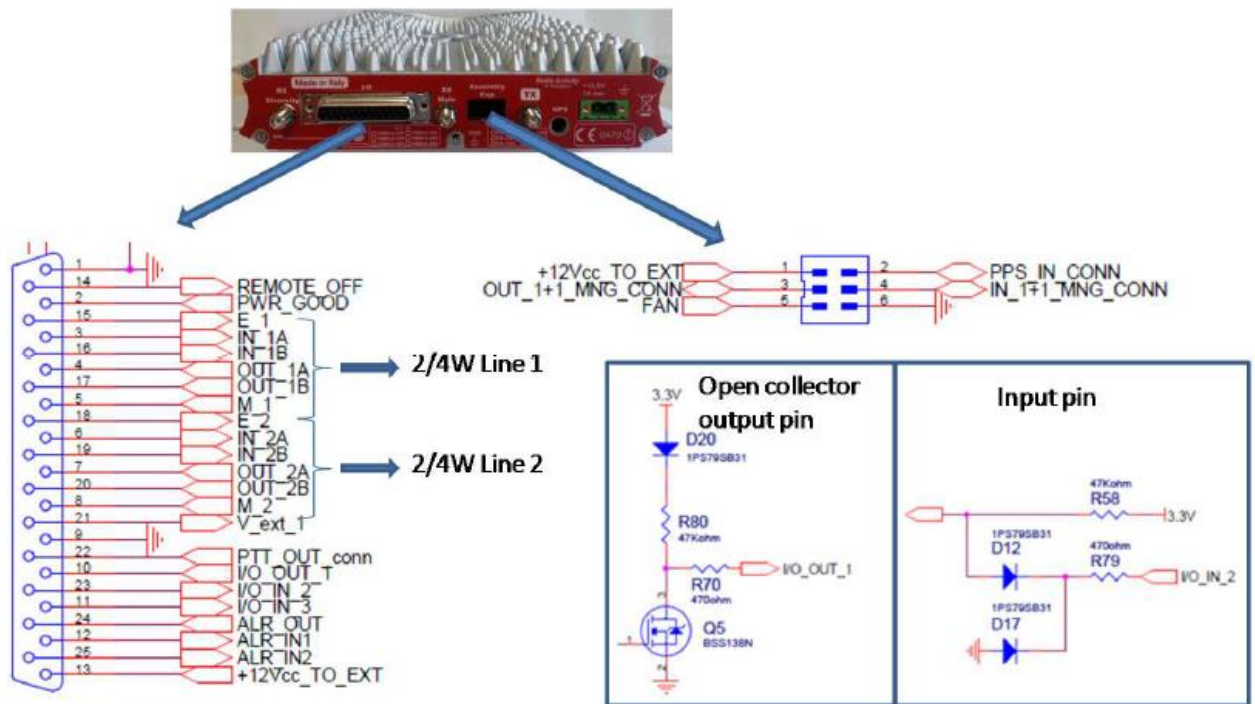
**(7) I/O Contacts**

KAIROS provides some I/O ports fitted into the 25 pin D-SUB connector and the 6 pins connector placed in the back. Some of these I/O are specialized (e.g.: PTT\_out or ALRM\_out) but can be re-defined for special applications.

I/O contacts are not isolated from ground, they are referred to ground and pre-polarized by +3.3V. Due to this configuration, for safety reason, they can be connected to very low voltage external circuits only. Here following it is described the standard

| I/O Contacts          | AUTO                             | ON                    | OFF                   |     |
|-----------------------|----------------------------------|-----------------------|-----------------------|-----|
| ALARM OUT (ALR_OUT)   | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (1) |
| EXT-1 IN (ALR_IN_1)   | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (2) |
| EXT-2 IN (ALR_IN_2)   | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |     |
| AUX-1 OUT (IO_OUT_1)  | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (3) |
| AUX-2 OUT (PTT_OUT)   | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (4) |
| Fans Activation (FAN) | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (5) |
| ALARM Status Flag     | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> | (6) |

applications of these auxiliary pins.



The I/O output pins (PWR\_GOOD, M\_1, M\_2, PTT\_OUT\_conn, I/O\_OUT\_1, ALR\_OUT, FAN, OUT\_1+1\_MNG\_CONN) are open collector type able to switch up to 20mA/40Vdc. A 470 Ohm resistor limits the maximum current and a 47k resistor refers the output to the internal 3.3V.

The I/O input pins (REMOTE\_OFF, E\_1, E\_2, I/O\_IN\_2, I/O\_IN\_3, ALR\_IN1, ALR\_IN2, PPS\_IN\_CONN) are internally pull-upped to the 3.3V. A pair of diodes protect the input from voltage below zero. This input switch on closing it to GND.

- (1) ALR\_OUT: [OUT] it is open from GND when the equipment detects an alarm condition. Power off is an alarm condition.
- (2) ALR\_IN1, ALR\_IN2: [IN] alarm input; closing them to GND produces an alarm advice to the Supervisor Centre. Each alarm can be configured via the setup tool; it is possible to define a DMR TXT message or a SNMP trap for the 0 to 1 transition and for the 1 to 0. Typical application is the open site/cabinet event.
- (3) [OUT] general purpose output; it can be used in special applications that need to set an external device/relays.
- (4) [OUT] it is closed to GND when the transmitter goes on air. It is possible to insert a pre-time to allow the right switching on time to an external RF power amplifier.
- (5) [OUT] it is closed to GND when the temperature of the internal RF power amplifier rises above the threshold (typ. 65°C). It can be used to switch on cooling fans in a cabinet.
- (6) [OUT] it is open from GND when the equipment detects an alarm condition. Power off is an alarm condition.

For more detail for I/O port, please refer to Appendix 6.2



### 3.3.1.4. TRX Operating Modes

"TRX Operating modes" concerns how to process the signals, depending on the base station role, and which parameters are managed by the DSP.

This window allows setting the operative configuration of the base station:

**TRX Configuration**

- Operative mode (1): MASTER BASE STATION
- Service (2): FULL DUPLEX
- Type (3): SINGLE UNIT
- Active/Hot-Spare Parameters (4): Automatic Role Self-Switching Time [min] 480
- 30s AUTO ID (needs a codec) (5):
  - ☒ Automatic
  - ☐ Forced OFF
  - ☐ Forced ON
- Use external PA (6): ☐
  - Gain [dB] (0÷25.5)
  - Max Input Power [W]

**Enabling TRX (7)**

- ☒ Enabling TX
- ☒ Enabling Main RX
- ☒ Enabling Diversity RX
- ☐ Enabling Repeater Mode
- ☒ PCM 1 (Analog Line 1) Enabled
- ☒ PCM 0 (Analog Line 0) Enabled
- ☒ Line 3 (Local TRX) Enabled
- ☒ Line 2 (IP Line) Enabled
- ☒ Line 1 (Physical Line 1) Enabled
- ☒ Line 0 (Physical Line 0) Enabled

**Analog Selective Calls Configuration**

- Codec to be used: NULL
- Tone length (10 € 255 ms): 100
- Enable Analog Selective Calls sending: ☐
- Enable Analog Selective Calls reception: ☐
- Enable repetition code insertion: ☒
- Enable repetition code detection: ☒

**Service Class**

- ☐ Multiprotocol DMR Tier II Node
- ☒ Multiprotocol DMR Tier III Node

**SRT-DL Feature**

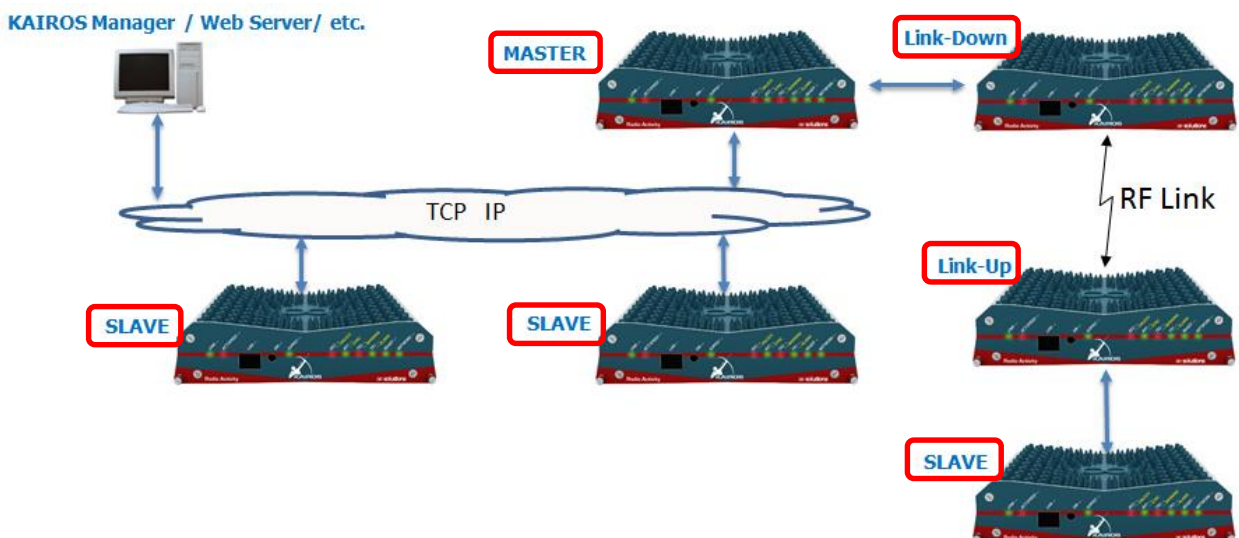
- Role inside the Cell: DISABLED
- Auto ID Gallery: ☐

Buttons: Read from File, Write on File, Read, Write, Close

#### 3.3.1.4.1. TRX Configuration

##### (1) Operative mode

You have to assign "Operative mode" for each KAIROS.



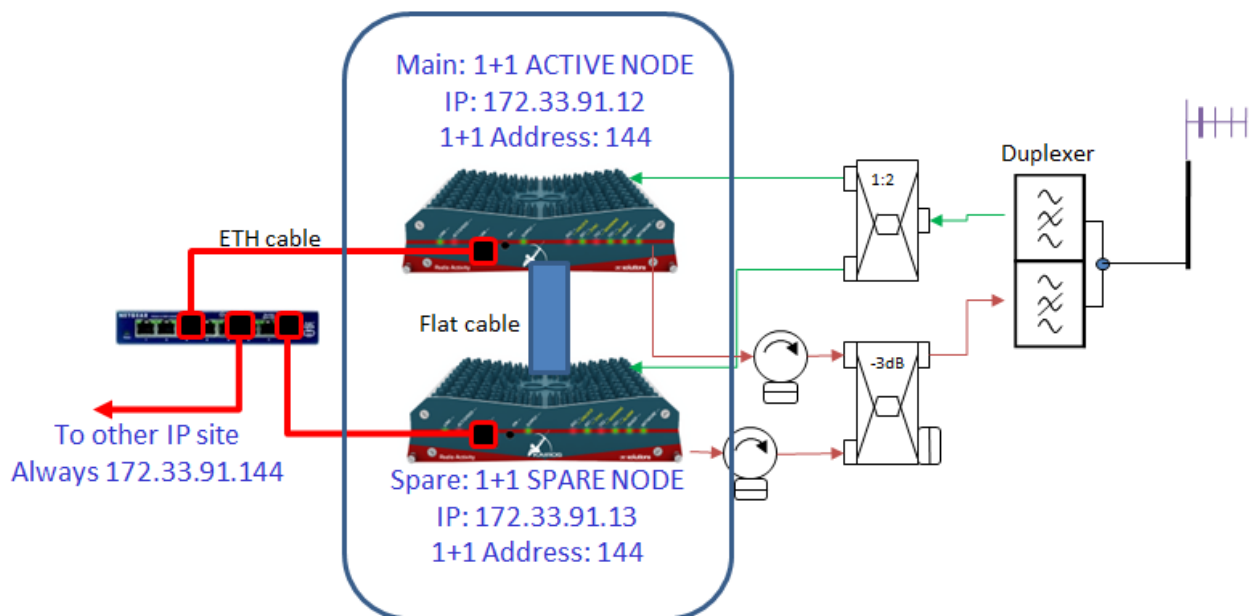
- BASE STATION NOT CONFIGURED: Not use normally.
- SINGLE REPEATER OR MOBILE/FIXED: Select this for Single repeater or Use KAIROS as Mobile/Fixed Station.
- MASTER BASE STATION: Select this for Master base station. Master is the only one in the network.
- SLAVE BASE STATION: Select this to all Slave stations.
- RF LINK-DOWN NODE: Select this for RF Link-Down node. For more detail for RF-Link, please refer to Appendix 4.4
- RF LINK-UP NODE: Select this for RF Link-Up node. For more detail for RF-Link, please refer to Appendix 4.4

## (2) Service

- FULL DUPLEX: For Full Duplex operation. Select this normally.
- HALF DUPLEX: For Half Duplex operation.
- SIMPLEX: For Simplex mode operation.

## (3) Type

- SINGLE UNIT: Select this normally.
- 1+1 ACTIVE NODE: If the station is very important and must not be broken, you can set Spare KAIROS as redundancy. This selection is for Active node.  
"1+1 Address" which configured in "Main setup" is required. Both Main/Spare's "1+1" address must be set same address which is used as 2<sup>nd</sup> IP address for KAIROS.



Eg) Main KAIROS IP address is "172.33.91.12"  
 Spare KAIROS IP address is "172.33.91.13"  
 Both KAIROS's "1+1 Address" is "144"  
 2<sup>nd</sup> IP address for both Main and Spare become same address as "172.33.91.144".  
 Thus the IP address for "1+1 Station" is always seen the same IP address from others.

- 1+1 HOT SPARE NODE: For redundancy, this selection for Hot-Spare node.

Note: 1+1 stations cannot be master for PTP for Synchronization.

| Identity Data           |      |
|-------------------------|------|
| Station ID (1 ÷ 254)    | 11   |
| Network ID (1 ÷ 4095)   | 160  |
| 1+1 Address (1 ÷ 254)   | 144  |
| DMR ID (1 ÷ 16776415)   | 2011 |
| Group ID (1 ÷ 16776415) | 101  |

- (4) **Automatic Role Self-Switching Time [min]**: In case the Station is set as "1+1" redundancy, Active KAIROS can roll over by defined time in [min]. It effects for KAIROS lifetime.
- (5) **30s AUTO ID (needs a codec)**: In Analog mode only, this box sends the station ID with the selective call that you have set into main setup window. To send the ID of the base station in the format that is specified by the "Analog selective call configuration" box, into the upper right side of the same box. The ID is an automatic string, depending on the MAC address of the KAIROS.
- (6) **Use external PA**: Check here if use external power amplifier. In case an external power amplifier is present. By entering the gain of the external amplifier, the displayed power into channel table is the product of the measured one with the gain. The "max input power" selects the maximum power that can be selected in channel table, to avoid destroying the amplifier.

Ex) External PA: Gain 10 dB, Max Input Power 3.0W,

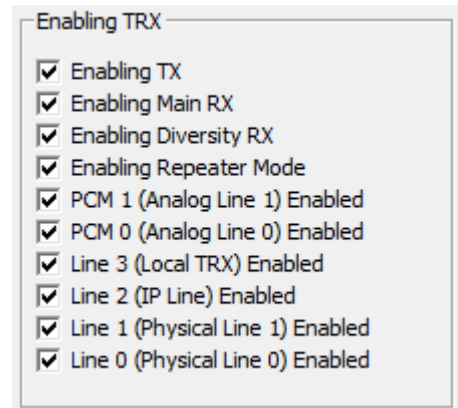
| Use external PA     |      |
|---------------------|------|
| Gain [dB] (0÷25.5)  | 10.0 |
| Max Input Power [W] | 3.0  |

TX power selection in Channel Table becomes like following picture,

| TX Power [W] |
|--------------|
| 0.0          |
| 10.0         |
| 20.0         |
| 30.0         |

(7) **Enabling TRX:**

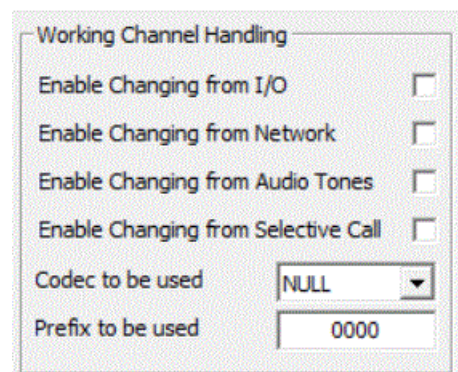
- Enabling TX: Check here to use TX.
- Enabling Main RX: Check here to use Main RX.
- Enabling Diversity RX: Check here to use Diversity RX. If no Diversity Antenna, uncheck.
- Enabling Repeater Mode: If check here, the repeater repeats while it is isolated from the network in Analog mode.  
Although check or uncheck here, it never affects to digital repeating mode.
- PCM 1(Analog Line 1) Enabled: To send Audio by RTP on IP network check here (Need Vocoder option). This is for TSB. If you use IP gateway, it must be checked.
- PCM 0(Analog Line 0) Enabled: To send Audio by RTP on IP network check here (Need Vocoder option). This is for TSA. If you use IP gateway, it must be checked.
- Line 3 (Local TRX) Enabled: If the KAIROS is used by local input/output by local PTT, check here.
- Line 2 (IP Line) Enabled: For DMR Simulcast / Multicast, check here.
- Line 1 (Physical Line 1) Enabled: If the KAIROS has local console (Old type), check here.
- Line 0 (Physical Line 0) Enabled: If the KAIROS has local console (Old type), check here.

(8) **Working Channel Handling:**

- Enable Changing from I/O: It is able to change channel (CH 0 to CH 8) by applying DC voltage 1V to 8V to "V\_ext\_1" (See page 145)

| V_ext_1 | Channel table No |
|---------|------------------|
| 0V      | No change        |
| 1V      | CH 0             |
| 2V      | CH 1             |
| 3V      | CH 2             |
| 4V      | CH 3             |
| 5V      | CH 4             |
| 6V      | CH 5             |
| 7V      | CH 6             |
| 8V      | CH 7             |

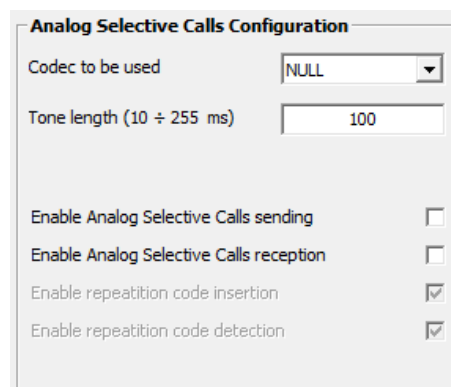
- Enable Changing from Network: This function is not available.
- Enable Changing from Audio Tones: This function is not available.
- Enable Changing from Selective Call: This function is not available.



**3.3.1.4.2. Analog Selective Calls Configuration**

This setting is for Selective Calls for Analog 5-tone.

In Digital communication, you can omit here.



**Analog Selective Calls Configuration**

Codec to be used: NULL

Tone length (10 ÷ 255 ms): 100

Enable Analog Selective Calls sending: ☐

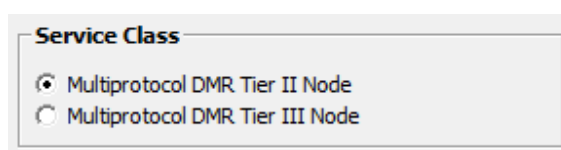
Enable Analog Selective Calls reception: ☐

Enable repetition code insertion: ☒

Enable repetition code detection: ☒

**3.3.1.4.3. Service Class**

- Multiprotocol DMR Tier II Node: Tier II
- Multiprotocol DMR Tier III Node: Tier III or S-Trunking



**Service Class**

☒ Multiprotocol DMR Tier II Node

☐ Multiprotocol DMR Tier III Node

## 3.3.1.5. Channel Table

You can see the channel setting in this table.

Total number of channels is 200. (Channel 0 to 199)

Channels Table - KAIROS <RPT UHF 1 JVCKENWOODi½i½>

|                                 | Channel 0 | Channel 1 | Channel 2 | Channel 3     | Channel 4     | Channel 5     | Channel 6     | Channel 7     | Channel 8     |
|---------------------------------|-----------|-----------|-----------|---------------|---------------|---------------|---------------|---------------|---------------|
| Channel Name                    | Channel 0 | Channel 1 | Channel 0 | Empty Channel | Empty Channel | Empty Channel | Empty Channel | Empty Channel | Empty Channel |
| Channel present                 | YES       | YES       | YES       | NO            | NO            | NO            | NO            | NO            | NO            |
| Channel enabled                 | YES       | YES       | YES       | NO            | NO            | NO            | NO            | NO            | NO            |
| ANALOG mode                     | YES       | YES       | YES       | NO            | NO            | NO            | NO            | NO            | NO            |
| DMR ETSS mode                   | YES       | YES       | YES       | NO            | NO            | NO            | NO            | NO            | NO            |
| DMR MotoTRBO mode               | NO        | YES       | YES       | NO            | NO            | NO            | NO            | NO            | NO            |
| Digital P25 mode                | YES       | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| POCSAG mode                     | NO        | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| Channel Bandwidth [kHz]         | 12.5      | 12.5      | 12.5      | 12.5          | 12.5          | 12.5          | 12.5          | 12.5          | 12.5          |
| TX Frequency [MHz]              | 452.59500 | 440.00000 | 440.00000 | 0.00000       | 0.00000       | 0.00000       | 0.00000       | 0.00000       | 0.00000       |
| RX Frequency [MHz]              | 442.59500 | 435.00000 | 470.00000 | 0.00000       | 0.00000       | 0.00000       | 0.00000       | 0.00000       | 0.00000       |
| Simplex Frequency Shift         | NO        | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| TX Power [W]                    | 1.0       | 1.0       | 1.0       | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| Maximum continuous tx time [s]  | 0         | 0         | 0         | 0             | 0             | 0             | 0             | 0             | 0             |
| Transmission delay [ms]         | 0         | 500       | 500       | 500           | 500           | 500           | 500           | 500           | 500           |
| TX DPL Code [oct]               | --        | --        | --        | --            | --            | --            | --            | --            | --            |
| RX DPL Code [oct]               | --        | --        | --        | --            | --            | --            | --            | --            | --            |
| TX TCS Frequency [Hz]           | 146.2     | 123.5     | 123.5     | 123.5         | 123.5         | 123.5         | 123.5         | 123.5         | 123.5         |
| RX TCS Frequency [Hz]           | 146.2     | 123.5     | 123.5     | 123.5         | 123.5         | 123.5         | 123.5         | 123.5         | 123.5         |
| Multitone TCS                   | NO        | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| Squelch Tail Cutoff on TX       | YES       | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| Squelch Tail Cutoff on RX       | YES       | NO        | NO        | NO            | NO            | NO            | NO            | NO            | NO            |
| RX Emergency TCS Frequency [Hz] | 0.0       | 0.0       | 0.0       | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| RX TCS hold time [ms]           | 500       | 500       | 500       | 500           | 500           | 500           | 500           | 500           | 500           |
| Subtone deviation [Hz]          | 250       | 250       | 250       | 250           | 250           | 250           | 250           | 250           | 250           |
| Supertone Frequency [Hz]        | 0         | 0         | 0         | 0             | 0             | 0             | 0             | 0             | 0             |
| RX Squelch level [dB]           | 20.0      | 20.0      | 20.0      | 20.0          | 20.0          | 20.0          | 20.0          | 20.0          | 20.0          |
| RX Squelch Hysteresis [dB]      | 6.0       | 6.0       | 6.0       | 6.0           | 6.0           | 6.0           | 6.0           | 6.0           | 6.0           |
| RX DMR Colour Code (main)       | 5         | 1         | 1         | 1             | 1             | 1             | 1             | 1             | 1             |
| TX DMR Colour Code (main)       | 5         | 1         | 1         | 1             | 1             | 1             | 1             | 1             | 1             |
| RX DMR Colour Code (aux)        | 5         | 1         | 1         | 1             | 1             | 1             | 1             | 1             | 1             |
| TX DMR Colour Code (aux)        | 5         | 1         | 1         | 1             | 1             | 1             | 1             | 1             | 1             |
| Downlink P25 NAC code [hex]     | 093       | 093       | DEFAULT   | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       |
| Uplink P25 NAC code [hex]       | 093       | 093       | DEFAULT   | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       | DEFAULT       |

■ Default Channel  
■ Current Working Channel  
■ Default and Working Channel  
■ Channel Selected for operations

Modify Channel    Set as Default Channel    Apply Working Channel Modifications  
 Delete Channel    Set as Working Channel    Read from File    Read    Write on File    Write    Close

|                             |     |       |         |         |         |
|-----------------------------|-----|-------|---------|---------|---------|
| RX DMR Colour Code (main)   | 5   | (1) 1 | 1       | 1       | 1       |
| TX DMR Colour Code (main)   | 5   | 1     | 1       | 1       | 1       |
| RX DMR Colour Code (aux)    | 5   | 1     | 1       | 1       | 1       |
| TX DMR Colour Code (aux)    | 5   | 1     | 1       | 1       | 1       |
| Downlink P25 NAC code [hex] | 093 | 093   | DEFAULT | DEFAULT | DEFAULT |
| Uplink P25 NAC code [hex]   | 093 | 093   | DEFAULT | DEFAULT | DEFAULT |

■ Default Channel  
■ Current Working Channel  
■ Default and Working Channel  
■ Channel Selected for operations

(4) Modify Channel    (3) Set as Default Channel  
 Delete Channel    (2) Set as Working Channel

- To change Channel, click on the target channel (1), then press button (2).
- To set the channel as Default channel (Start-up channel), press button (3).
- To modify the channel, press button (4) or double click on the target channel.



Channel Name: channel 0

TRX Channel Spacing [kHz]: 12.5

TX Frequency [MHz]: 452.595000

RX Frequency [MHz]: 452.595000

TX Power [W]: 1.0

(1) Max Continuous TX [s]: 0

(2) TX Cutoff Delay [ms]: 0

(3) RX Squelch level [dB]: 20.0

(4) RX Squelch Hysteresis [dB]: 6.0

Channel Present: ☒

Channel Enabled: ☒

(5) Simplex Shift: ☐

(6) ANALOG Mode: ☒

(7) ETSI DMR Mode: ☒

(8) MotoTRBO (TM) DMR Mode: ☐

(9) P25 Digital Mode: ☐

(10) POCSAG Mode: ☐

(11) Squelch Tail Cutoff on TX: ☒

(12) Squelch Tail Cutoff on RX: ☒

(13) Multitone TCS: ☐

Main TX Subtone: ☒ TCS Freq. [Hz] 123.0 ☐ DCS Code [oct]

Main RX Subtone: ☒ TCS Freq. [Hz] 123.0 ☐ DCS Code [oct]

Uplink Emerg. Subtone [Hz]: 0.0

TCS Hold on RX [ms]: 500

Subtone Deviation [Hz]: 250

Superaudio Frequency [Hz]: 0

P25 TX NAC (14): ☒ Default ☐ Any ☐ Open ☐ --> [ ]

P25 RX NAC: ☒ Default ☐ Any ☐ Open ☐ --> [ ]

(15) Main DMR Color Code: RX 1 TX 1

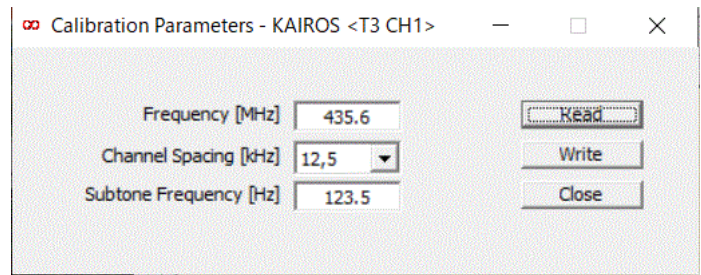
(16) Aux DMR Color Code: RX 1 TX 1

- (1) Max Continuous TX [s]: Time out timer for Analog only. (0(off) to 600)
- (2) TX Cutoff Delay [ms]: TX Hang time for Analog only. (0 to 5000)
- (3) RX Squelch level [dB]: Threshold level for both Analog in SINAD and it affects Digital as well. (0 to 25.5)
- (4) RX Squelch Hysteresis [dB]: Squelch Hysteresis in dB for Analog only. (0 to 25.5)
- (5) Simplex Shift: To avoid desensitization of the RX by TX VCO frequency, it consists in moving the frequency of the TX VCO, out of the current channel during reception.
- (6) ANALOG Mode: Analog FM mode.
- (7) ETSI DMR Mode: Check here for KENWOOD DMR
- (8) MotoTRBO™ DMR Mode: N/A
- (9) P25 Digital Mode: For P25 Phase 1
- (10) POCSAG Mode: POCSAG for paging feature.
- (11) Squelch Tail Cutoff on TX: "Squelch tail cutoff on TX" is normally never used, unless you are dealing with RF-linked networks. It consists in deleting the last 30ms of audio signal before deactivating the TX.
- (12) Squelch Tail Cutoff on RX: It cuts the last approx. 30 ms of voice before the squelch close, in order to cut the noise at the end of a call in RX.
- (13) Multitone TCS: Check for multiple TCS for RX, Enter other Subtones in "Subtone Control - Additional Subtones".
- (14) This is NAC setting for P25 Phase 2.
- (15) DMR Color Code for TX and RX
- (16) DMR Color Code as 2<sup>nd</sup> color code. A KAIROS can support two different color codes.



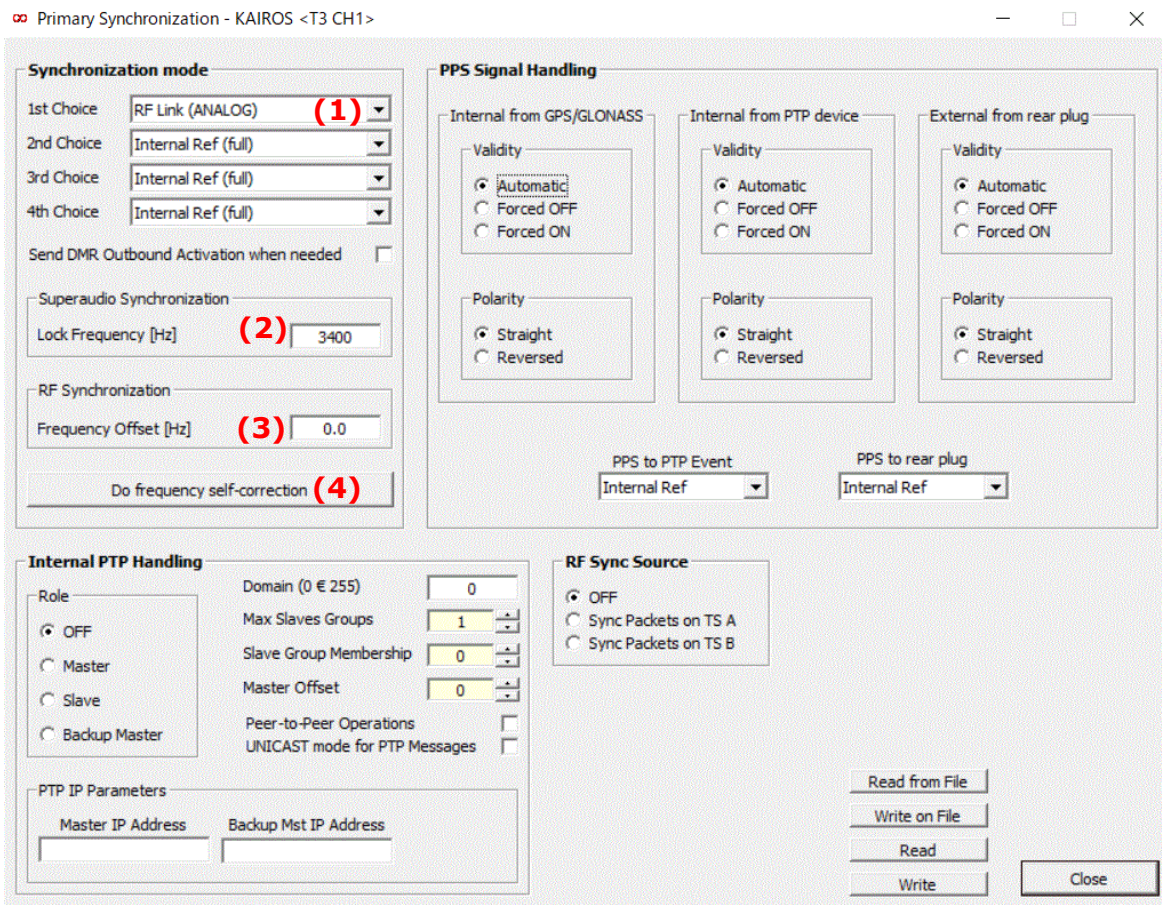
### 3.3.1.6. Calibration Parameters

To obtain better results from self-test process, it is recommended to set the calibration frequency as near as possible to the transmitter frequency; if there is a range of allowed frequencies for transmission, it is recommended to set the center of this range as the calibration frequency.



### 3.3.1.7. Primary Synchronization

KAIROS has various kind of Synchronization, such as GPS, PTP, PPS and so on. This window is settings for Synchronization.



#### 3.3.1.7.1. Synchronization mode

This is used for setting the source of synchronization of the current KAIROS.

(1) Choices: There are 4 level priorities for synchronization choice.

KAIROS use 1<sup>st</sup> Choice for its synchronization. If 1<sup>st</sup> choice is not available, it will shift to 2<sup>nd</sup> choice. If 2<sup>nd</sup> is not available, will shift to 3rd. It will try until 4<sup>th</sup> choice.

Followings are synchronization choices; (Choices which are often use written in **Bold** letters)

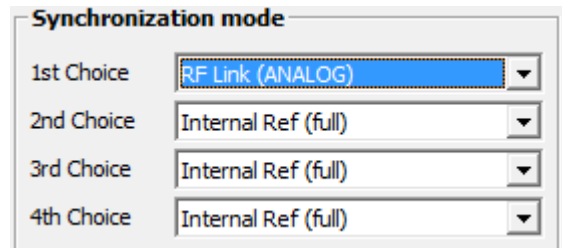
- Internal Reference (timing only): This is used for accessing a base station like a mobile, without the need to align the status machines to network delays. Not use this normally.
  - **Internal Reference (full)**: This is used for accessing a base station like a mobile, with the need to align the status machines to network delays. In case, Network Synchronization is not using GPS for all slaves, the Master of Synchronization can use this choice.
  - **Internal PPS (GPS/GLONASS)**: PPS stands for Pulse per Second. This is used for the synch source of PPS is generated by internal GPS receiver in the KAIROS.
  - External PPS (uncolored): This is used for if the synch source of PPS is not generated by a Kairos, that is without a PWM modulation for aligning the status matches.
  - **External PPS (full)**: This is used for if the synch source of PPS is generated by a KAIROS, which is modulated aligning the status match by PWM modulation.
  - **Internal PTP**: Precision Time Protocol over IP. If this protocol is supported by the IP network, KAIROS can synchronize through TCP/IP network without GPS.  
1+1 stations cannot be master for PTP.
  - Superaudio tone: This is an old style synch source, via 4Wire, through a pattern made by tones on super-audio band (3-3.4kHz). Not use this nowadays.
  - RF Link (ANALOG): In case of GPS failure, the link transceiver is able to recover a time and frequency reference from the Analog signaling coming from the Master station.
  - **RF Link (DIGITAL)**: In case of GPS failure, the link transceiver is able to recover a time and frequency reference from the DMR signaling coming from the Master station. This reference isn't as precise as the GPS one but it is enough accurate to assure simulcast operation with small degradations in the overlap area.  
Note: If you use RF link as Synchronization, KAIROS network synchronizes only while DMR transmitting by any call. If nothing calls, RF-Linked stations transmit DMR synchronization packets every 90 sec.
  - External Radio Network: It was used in the past to extend existing networks by competitors, with Radio Activity's systems, but it is unused nowadays.
- (2) Superaudio Synchronization, Lock Frequency [Hz]: Old Synchronization method in Analog FM. Nowadays it is not used.
- (3) RF Synchronization, Frequency Offset [Hz]: Old Synchronization method in Analog FM. Nowadays it is not used.

- (4) Do frequency self-correction: As long as KAIROS is connected GPS or PTP as synchronization, its TX/RX frequency is always corrected by them. But if a single KAIROS repeater on mountain which is isolated from IP network, also no GPS used. In this case, KAIROS frequency only can rely on VCTCXO for its reference. If technicians need to align TX frequency, there are two choices by "Do frequency self-correction".

#### [Method 1]

Select RF link (analog) as first choice of synchronization mode; push "write" button.

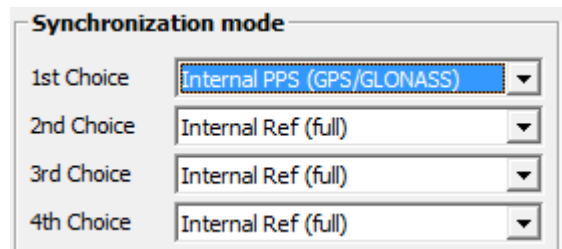
- Apply to the main RX input an RF signal by the RF signal generator, with a field strength of -70dBm, at the RX nominal frequency.
- In case the squelch is not opening, move the generated frequency until the squelch opens.
- Push the button "Do frequency self-correction"
- Move the generated frequency towards the nominal frequency, at steps of 1 kHz typically.
- Push the button "Do frequency self-correction" at every step, until you will be able to maintain the squelch open with generating the nominal frequency.
- Push the button "Do frequency self-correction" to complete the self-tuning!



#### [Method 2]

In case the Kairos is equipped with GPS board, the method is simpler:

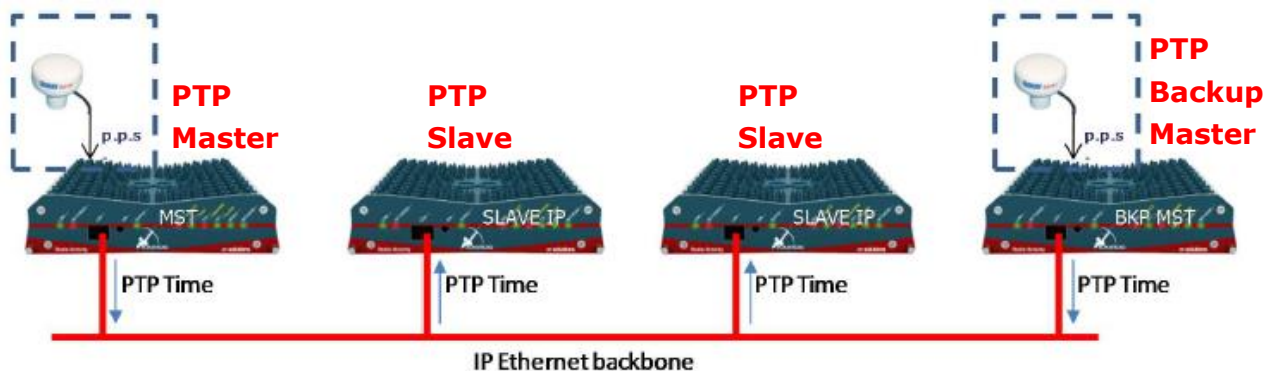
- Launch KAIROS Manager and open the menu: Kairos – Configuration - Primary Synchronization
- Select Internal PPS (GPS/GLONASS) as first choice of synchronization mode; push "write" button.
- Wait for the Kairos to be synchronized by GPS.
- Push the button "Do frequency self-correction" to complete the self-tuning!





**3.3.1.7.2. Internal PTP Handling**

For synchronizing KAIROS through PTP, equipment must be connected via TCP/IP backbone. The PTP standard we are using is IEEE-1588-2008, end-to-end/one-step type. It requires an IP connection that is transparent to multicast (because PTP works with multicast packets) and with a quite stable latency in order to evaluate the delay with the minimum error as possible. Typically, this requirement is satisfied if the available bandwidth is very greater than the used one (>10 times) and if it is dedicated to radio connection, that is, if there are no other services which may suddenly change the latency.



- (1) **Role:** it is the role of KAIROS from the point of view of the PTP Master: It is the only one PTP Master in the KAIROS IP Network. Note: 1+1 Hot Standby Station cannot be assigned PTP Master. Slave: Others are all slave. Backup master: It is working as Slave normally. In case of Mater is broken, it will promote to be a Master.

**Internal PTP Handling**

Role — (1)

☐ OFF

☒ Master

☐ Slave

☐ Backup Master

(3) Domain (0 ÷ 255)

(4) Max Slaves Groups

(5) Slave Group Membership

(6) Master Offset

(7) Peer-to-Peer Operations ☐

(8) UNICAST mode for PTP Messages ☐

PTP IP Parameters — (2)

Master IP Address

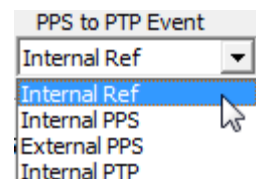
Backup Mst IP Address

- (2) **PTP IP Parameters:**
- Master IP Address: IP Address for PTP Master. All PTP Slaves including Backup Master must be set PTP Master IP Address here.
- Backup Mst IP Address: IP Address for Backup Mater. All PTP Slaves must be set this in case PTP Master broken.
- (3) **Domain** (0 to 255): like for TCP/IP systems, it represents a sub-set of PTP devices; All the devices of the same system must have the same domain.
- (4) **Max Slaves Groups:** The number of messages generated by the master, each time it starts a delay detection process. Each message is targeted to a group of slaves, which will immediately answer to the master, as soon as they receive such a message. The less the number of slaves per group (ideally just one), the better the estimation of the delay

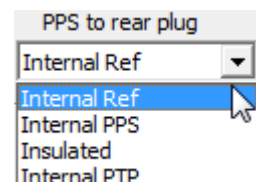
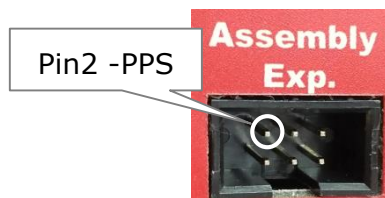
- (5) **Slave Group Membership:** the number of the group, which the slave belong to. Enter different membership number for Slaves here. If PTP Synchronization network has 10 PTP Slaves, each Slave have different member ship number from 1 to 10 in this box. For the PTP Master, enter 0 in it.
- (6) **Master Offset:** practically unused, it is aimed to add a fixed time offset to the instant when messages are sent.
- (7) **Peer-to-Peer Operations:** it may be checked if the Ethernet switches are set in transparent clock, 1 step mode.
- (8) **UNICAST mode for PTP Messages:** It is still unused; it is intended for a future proprietary method for using PTP over networks which do not allow multicast packets.

### 3.3.1.7.3. PPS Signal Handling

- (1) **Internal from GPS/GLONASS:** Normally, choose "Automatic" and "Straight".
- (2) **Internal from PTP device:** Normally, choose "Automatic" and "Straight".
- (3) **External from rear plug:** Normally, choose "Automatic" and "Straight".
- (4) **PPS to PTP Event:** This is setting which PPS source will be used to make PTP event. Normally, Internal Ref is fine.



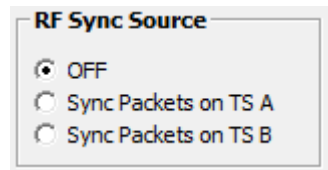
- (5) **PPS to rear plug:** This is setting to choose PPS source to rear plug (Pin2) for PPS. By selecting "Internal Ref", PPS signal outputs from 6-pin connector on rear panel that can support up to 10 units of other KAIROS to support their External PPS input for Synchronization.



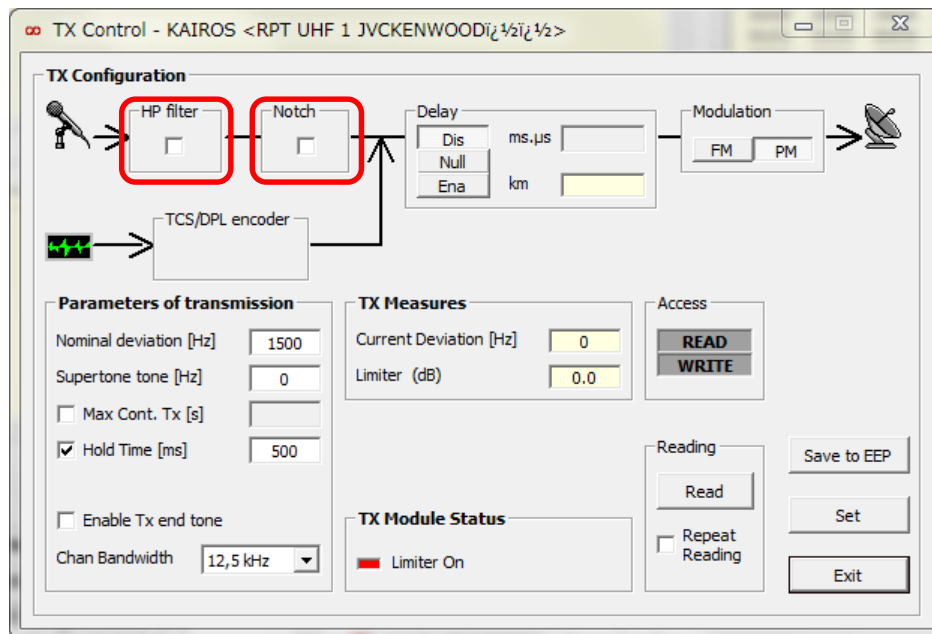
Option cable: KA-1+1

**3.3.1.7.4. RF Sync Source**

RF Link station should use GPS for Synchronization. But in case of its GPS has some problem, DMR RF Sync supports Synchronization for as temporary. This selection is for choosing time slot for it.

**3.3.1.8. TX Control**

This window allows configuring transmitter parameters for Analog FM only, especially RF-Link on Analog FM. For other DMR typical parameters please refer to "Configuration - Base Station layer configuration" menu.



TX Control configuration in RF-Link

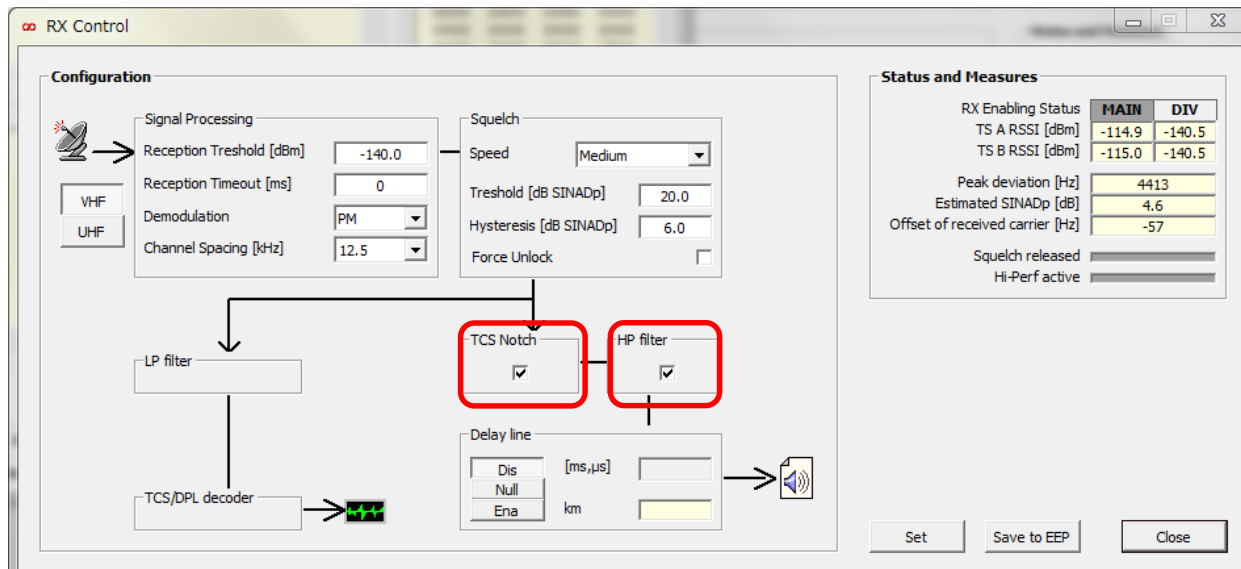
| Operating Mode               | HP filter | Notch   | Squelch Tail cut off on TX in Channel Table |
|------------------------------|-----------|---------|---------------------------------------------|
| Master/Slave For a Broadcast | Check     | Uncheck | Uncheck                                     |
| Link-up                      | Uncheck   | Uncheck | Uncheck                                     |
| Link-down                    | Uncheck   | Uncheck | Uncheck                                     |





## 3.3.1.9. RX Control

This window allows configuring receiver parameters for Analog FM only. For others DMR typical parameters please refer to "Configuration - Base Station layer configuration" menu.



RX Control configuration in RF-Link

| Operating Mode               | 300Hz HP filter | TCS Notch | Squelch Tail cut off on RX in Channel Table                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------|-----------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              |                 |           | <div> Channel Enabled <input checked="" type="checkbox"/><br/> Simplex Shift <input type="checkbox"/><br/> ANALOG Mode <input checked="" type="checkbox"/><br/> ETSI DMR Mode <input checked="" type="checkbox"/><br/> MotoTRBO (TM) DMR Mode <input checked="" type="checkbox"/><br/> P25 Digital Mode <input type="checkbox"/><br/> POCSAG Mode <input type="checkbox"/><br/> Squelch Tail Cutoff on TX <input type="checkbox"/><br/> Squelch Tail Cutoff on RX <input checked="" type="checkbox"/><br/> Multitone TCS <input type="checkbox"/> </div> |
| Master/Slave For a Broadcast | Check           | Check     | Check                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Link-up                      | Uncheck         | Uncheck   | Check                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Link-down                    | Check           | Uncheck   | Check                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 3.3.1.10. Audio Lines Settings

This window allows configuring the physical analog line interface of the base station. Line 1 and 2 correspond to the physical 4W lines on the I/O connector; line RX/IP is a virtual line over TCP/IP connection; Vocoders are virtual internal line to DSP.

For each input and output line it is possible:

- to set nominal signal level
- to enable HP and/or LP filters with programmable cut-off frequency
- to insert a time delay
- to enable and define nominal level and frequency of eventual control tones

## 3.3.1.11. Subtone/Supertone

Subtone means Sub-Audio on Analog FM such as TCS (QT) and DCS (DQT).

The screenshot shows the 'Subtone Control - KAIROS' window with the following sections and settings:

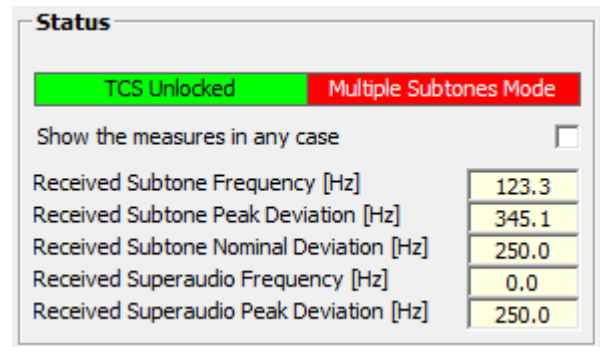
- Main Settings:**
  - Unlock TCS (1):** A checkbox that is currently unchecked.
  - FFSK Modem (2):** Radio buttons for 'Disabled' (selected), 'Use FFSK as RX key', and 'ETSI-230 Codec'.
  - TCS Reversed Phase (3):** Checkboxes for 'Enable RX Detection' and 'Enable TX sending', both unchecked.
  - SuperAudio (4):** Checkboxes for 'Use SuperAudio as RX key' and 'Send SuperAudio bursts', both unchecked. Below is a 'Bursts to send' field set to 12.
- Subtone Parameters:**
  - Main TX Subtone (5):** Radio buttons for 'TCS Mode (freq. [Hz])' (selected) and 'DCS Mode (code [oct])'. The frequency field is set to 67.0.
  - Main RX Subtone (6):** Radio buttons for 'TCS Mode (freq. [Hz])' (selected) and 'DCS Mode (code [oct])'. The frequency field is set to 67.0.
  - Thresholds (7):** Fields for 'Fast Acceptance [Hz]' (0.0), 'Slow Acceptance [Hz]' (2.0), 'Var. liv. Hi-Energy (+) [dB]' (25.5), and 'Var. liv. Lo-Energy (-) [dB]' (16.6).
  - Other TCS setting (8):** Fields for 'TX Nominal Deviation [Hz]' (250), 'TCS hold time [ms]' (500), and 'Slow Acceptance waiting [ms]' (50).
  - Additional RX Subtones (9):** A list of six empty 'Frequency [Hz]' input fields.
- Status (10):**
  - Buttons for 'TCS Unlocked' and 'Multiple Subtones Mode' (highlighted in red).
  - A checkbox for 'Show the measures in any case' is unchecked.
  - A table showing received measures:

|                                         |     |
|-----------------------------------------|-----|
| Received Subtone Frequency [Hz]         | N/A |
| Received Subtone Peak Deviation [Hz]    | N/A |
| Received Subtone Nominal Deviation [Hz] | N/A |
| Received Superaudio Frequency [Hz]      | N/A |
| Received Superaudio Peak Deviation [Hz] | N/A |

At the bottom are buttons for 'Clear', 'Apply now', 'Read All', 'Write', 'Save', and 'Close'.

- (1) Unlock TCS: To by-pass the TCS/DPL controls check here.  
If check here, KAIROS repeats by all RX signal without Decoding TCS.
- (2) Use FFSK as RX key: It is a FFSK modulated code sequence that is used to unlock the squelch.  
ETSI-230 Codec: It is an ETSI-230 modulated code sequence that is used to unlock the squelch. Normally, this codec is not used in our system.
- (3) Enable RX Detection: This is selection whether TCS decodes reverse burst tone to close Squelch without tail-noise or not. Normally check here.
- (4) SuperAudio: No use.
- (5) Main TX Subtone: Select TCS or DCS and enter its value for TX. You don't need to change this setting because this is set by channel setting.
- (6) Main RX Subtone: Select TCS or DCS and enter its value for RX. You don't need to change this setting because this is set by channel table setting.
- (7) Thresholds: This is setting for characteristic for TCS. Don't change here.
- (8) Other TCS setting: Don't change here.

- (9) Additional RX Subtones: If the KAIROS has Multi CTCSS license to decode Multi TCS, you may enter other tones here.
- (10) Status: This is Status monitor for TCS.

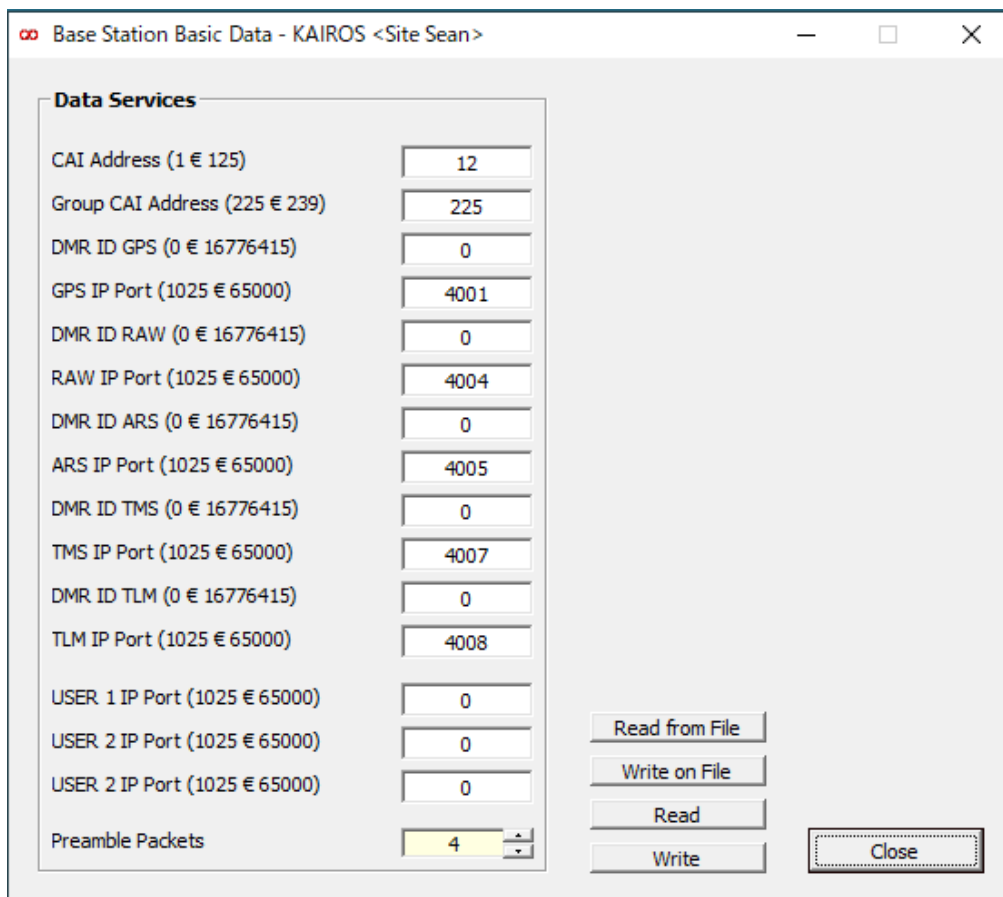


| Status                                                 |                        |
|--------------------------------------------------------|------------------------|
| TCS Unlocked                                           | Multiple Subtones Mode |
| Show the measures in any case <input type="checkbox"/> |                        |
| Received Subtone Frequency [Hz]                        | 123.3                  |
| Received Subtone Peak Deviation [Hz]                   | 345.1                  |
| Received Subtone Nominal Deviation [Hz]                | 250.0                  |
| Received Superaudio Frequency [Hz]                     | 0.0                    |
| Received Superaudio Peak Deviation [Hz]                | 250.0                  |

### 3.3.1.12. Base Station Basic Data

This setting is for a KAIROS act as Motorola repeater.

It is not necessary to change port setting from default basically.



| Data Services                 |      |
|-------------------------------|------|
| CAI Address (1 € 125)         | 12   |
| Group CAI Address (225 € 239) | 225  |
| DMR ID GPS (0 € 16776415)     | 0    |
| GPS IP Port (1025 € 65000)    | 4001 |
| DMR ID RAW (0 € 16776415)     | 0    |
| RAW IP Port (1025 € 65000)    | 4004 |
| DMR ID ARS (0 € 16776415)     | 0    |
| ARS IP Port (1025 € 65000)    | 4005 |
| DMR ID TMS (0 € 16776415)     | 0    |
| TMS IP Port (1025 € 65000)    | 4007 |
| DMR ID TLM (0 € 16776415)     | 0    |
| TLM IP Port (1025 € 65000)    | 4008 |
| USER 1 IP Port (1025 € 65000) | 0    |
| USER 2 IP Port (1025 € 65000) | 0    |
| USER 2 IP Port (1025 € 65000) | 0    |
| Preamble Packets              | 4    |

Read from File Write on File Read Write Close

## 3.3.1.13. Base Station Layer Configuration

**Configuration**

|                                   |                                     |                                          |
|-----------------------------------|-------------------------------------|------------------------------------------|
| Enable Repeater Mode (1)          | <input checked="" type="checkbox"/> | Hang Times [30 ms ticks] (0 ÷ 32767) (9) |
| Direct Mode Reception (2)         | <input type="checkbox"/>            | Private Calls                            |
| Send RC on Same Timeslot (3)      | <input checked="" type="checkbox"/> | Group Calls                              |
| Display IDLE Packets (4)          | <input type="checkbox"/>            | Data Response                            |
| Manual AT bit handling (5)        | <input type="checkbox"/>            | Channel                                  |
| Enable ETSI Tier III features (6) | <input type="checkbox"/>            |                                          |

|                                                   |                                                   |                                              |
|---------------------------------------------------|---------------------------------------------------|----------------------------------------------|
| <b>TX: act as... (7)</b>                          | <b>RX: act as...</b>                              | <b>Timeslots Validity [30 ms ticks] (10)</b> |
| ... Base Station <input checked="" type="radio"/> | ... Base Station <input checked="" type="radio"/> | <input type="checkbox"/> Automatic           |
| ... Mobile Station <input type="radio"/>          | ... Mobile Station <input type="radio"/>          |                                              |

|                                   |                                   |                                         |
|-----------------------------------|-----------------------------------|-----------------------------------------|
| <b>MAIN Color Codes (8)</b>       | <b>AUX Color Codes</b>            | <b>Network Delay [30 ms ticks] (11)</b> |
| RX <input type="text" value="1"/> | RX <input type="text" value="1"/> | <input type="checkbox"/> Automatic      |
| TX <input type="text" value="1"/> | TX <input type="text" value="1"/> |                                         |

|                               |                                     |
|-------------------------------|-------------------------------------|
| RX Pkts Advance [30 ms ticks] | <input type="text" value="0"/> (12) |
| Distance for timing adv [Km]  | <input type="text" value="0"/> (13) |

- (1) Enable Repeater Mode: If check here, the repeater repeats while it is isolated from the network in Digital mode.  
Check here if the KAIROS needs to be Local Repeater when isolated from network. Although check or uncheck here, it's never affect to Analog repeating mode.
- (2) Direct Mode Reception: Usually uncheck here. If check it, the KAIROS receives in direct mode (Not repeater mode) which is different from Mobile station mode in repeater.
- (3) Send RC on Same Timeslot: Check if the KAIROS has to support "Enhanced Encryption" feature of Mobile Station. (From the Firmware on Nov. 2019, "Enhanced Encryption" can work even if uncheck this item.)
- (4) Display IDLE Packets: Uncheck normally. To remote control the stations via RF, enable it on Ts A or Ts B on all the repeaters used as links, including Master if necessary; enable the flag «display IDLE packets» on slave links.
- (5) Manual AT bit Handling: Uncheck. This is for factory usage only.
- (6) Enable ETSI Tier III features: Uncheck while Tier 2 operation.

- (7) TX: act as... / RX: act as...: Select Base Station normally. For RF up link and down link, must transmit as Base Station and Receive as Mobile Station.
- (8) MAIN (AUX) Color Codes: Color code setting for Main and AUX. You don't need to change this setting because the Color code should be set in the Channel table setting.
- (9) Hang Times: Setting for Hang Times for each call.
- Private Calls: Hang time after Individual Call.
  - Group Calls: Hang time after Group Call.
  - Data Response: Hang time after Data TX.
  - Channel: Additional Hang time follows by Private/ Group/ Data.
- This can be Beacon transmission length as well.
- Ex) Hang time for Individual call:  $150+16=166$ . ( $166 \times 30\text{ms} = 4980\text{ms}$ )
- In RF-down-link, Channel Hang Time is used for synchronization. In up-link it is set to 16, its minimum value. In down-link, there is not a minimum value, but normally it is worth to keep that value greater than 30, Recommendation is 100 (about 3 second). For more detail for RF-Link, please refer to Appendix 4.4
- (10) Timeslots Validity: "Timeslot validity" makes sense in a radio network: it has no meaning in case of a single repeater. "Timeslot validity" is the duration of the interval of time from current instant backward, which the time-stamps of received packets must belong to, in order to be taken into account for elaboration (transmission or voting). It is normally never used, but in case of critical linking backbones, where it is preferable to reduce the duration of the acceptance time window of some stations. It is not referred to mobiles, but to repeaters. It can be seen as the maximum lifetime of a packet, reaching a repeater of a network. If the radio network is well-designed, that parameter can be left to its maximum value, which does not affect any of the network.
- (11) Network Delay: Delay compensation, to compensate for different path delays in simulcast network. For 2 Level network, enter 6 here. If the network is complex, ask JVCKENWOOD Tech support.
- (12) RX Pkts Advance: Set some value in only RF-Link station.
- (13) Distance for timing adv [km]: Normally No use here for IP linked station. For the RF-linked remote site, on up-link to master only. In order to compensate for the flying delay in case of GPS failure on the up-link. The same setting on broadcast base is used for reducing the network delay correspondingly.



3.3.1.14. **Base Station Operating Modes**

This window allows configuring the role of the base station both in a network and in a standalone condition. It concerns the logical function of the base station, considered as a block of the radio system, and its parameters are managed by the microprocessor.

**Base Station Operating Modes - KAIROS <Site Sean>**

**Base Station Parameters**

**Base Station Parameters**

Base Station Role: MASTER

Stand-Alone: ☐ TX end-tone: Analog ☐ Digital ☐

Audio Gateway: ☐

Cross-Busy Detection: DISABLED

RX Interferences: DISABLED

**Network Parameters**

Voting Delay [ts]: 3

LAN Compression Rate: 0

**Repetition Policy**

☒ DMR TS A

☒ DMR TS B

☐ ANALOG Voice

☐ ANALOG Data

☐ P25

**Analog CW ID**

Message: KAIROS

Interval [min]: 1

Speed [wpm]: 20

CW ID Policy: Polite ☒ Impolite ☐

**DMR Beacon**

Beacon interval [mm:ss]: --

Beacon Policy: Polite ☒ Impolite ☐

**Call Interrupt Handling**

None ☒ MotoTRBO Protocol ☐ JVCKENWOOD Protocol ☐

**Master-to-Master Parameters**

**Static Routes**

|                          | IP Address | TSA                      | TSB                      | ANA                      |
|--------------------------|------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> |            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Buffering**

Reception latency [ms]: --

**DMR Tier III Settings**

Read from File

Write on File

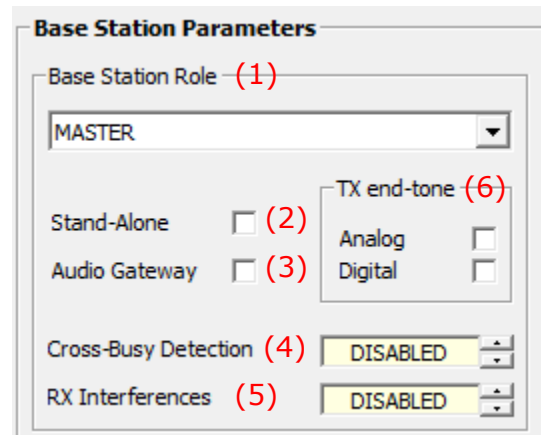
Read

Write

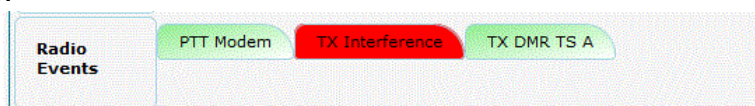
Close

**3.3.1.14.1. Base Station Parameters****(1) Base Station Role**

- MASTER: For Master station which choose best signal from Voted signals from slave (Including Master itself).
- SUBMASTER: MASTER supports up to 32 Slaves, in case the system is more than 33 Slaves, by adding SUBMASTER supports another 32 SLAVES.  
SUBMASTER works as a SLAVE to the MASTER.
- BROADCASTER: Usually for Slave. A KAIROS needs to cover Mobile stations as a repeater selects this.
- HALF-TK AUX MASTER: N/A
- LINK DOWN TO NET: For a KAIROS for RF-Link which is near to Master Side select this. For more detail for RF-Link, please refer to Appendix 4.4
- LINK UP TO MASTER: For a KAIROS for RF-Link which is Slave Broadcaster select this. For more detail for RF-Link, please refer to Appendix 4.4
- SUBM LINK DOWN TO NET: This is as same as LINK DOWN TO NET, but for Sub-Master.
- SUBM LINK UP TO MASTER: This is as same as LINK UP TO MASTER, but for Sub-Master.
- MOBILE/FIXED: KAIROS will be Mobile/ Fixed Station. It doesn't support repeat function.

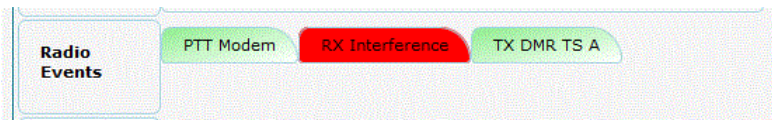


- (2) Stand-Alone: Check if the site is single. Uncheck if the system is multisite. The KAIROS will be isolated from the other KAIROS by checking.
- (3) Audio Gateway: In case you need to assign a KAIROS to be a Gateway, Check here. This item is for Master Role only. Need Vocoder option board.
- (4) Cross-Busy Detection: Cross Busy is a function that prevents interference from other radio systems and reduces interference to others, in case of sharing frequency. This parameter is for Cross-Busy input. Refer to 3.3.1.3 Main Setup -> I/O Contacts.  
Select the pin to Auto.
  - DISABLED: Cross-busy detection doesn't work.
  - EXT-1: Pin12 of DB25 connector becomes Cross-busy Input.
  - EXT-2: Pin25 of DB25 connector becomes Cross-busy Input.
 When you select EXT-1 or EXT-2, you can monitor Cross-busy External detection to display "TX interference" on the KAIROS WEB Interface, that displays Home -> Radio Events.

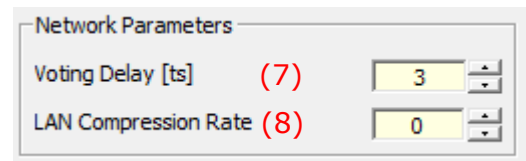


- (5) RX Interferences: This parameter is for Cross-Busy input. You can select the behavior of the Internal operation for Cross-Busy input function. Refer to 3.3.1.3 Main Setup -> I/O Contacts. Select the pin to Auto. Internal operation means that KAIROS detects undesired signal at the RX frequency. Cross-Busy detection includes Internal operation and the KAIROS TX status.
- DISABLED: It stops behavior of the "Internal" operations.
  - DETECT ONLY: Same as DISABLED. And it sends the detection status to SNMP, when detected Cross-Busy.
  - FULL ACTION: When detected Cross-Busy, it performs the internal operation and send the detection status to SNMP.

When you select DETECT ONLY or FULL ACTION, you can monitor Cross-busy detection to display "RX interference" on the KAIROS WEB Interface, that displays Home -> Radio Events.

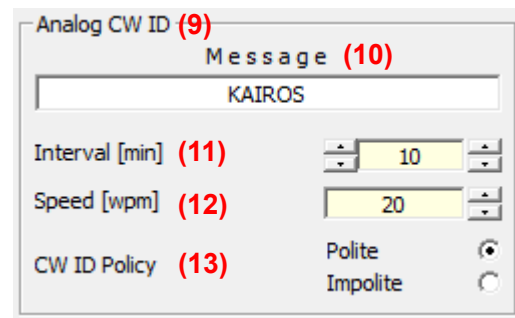


- (6) TX end-tone: KAIROS will add 0.5 sec TX end-tone before stop transmission. It can be applied for Master station and Single repeater.
- (7) Voting Delay [ts]: Delay compensation, to compensate for voting delays in simulcast network. For 2-Level network, enter 3 here normally. If the network is complex, ask JVCKENWOOD Tech support.



- (8) LAN Compression Rate: Parameter is 0 or 1 at this moment.
- 0: No compress packets on IP
  - 1: Compress packets on IP

- (9) Analog CW ID: Analog CW ID is a function to send a Morse code as channel identifier with an analogue signal. "CW" means Continuous Wave or Cutting Wave. KAIROS repeater sends the Morse code assigned to each channel automatically at regular intervals. CW ID is sent only when both of the timeslots are idle. The following table shows the operation of the repeater when CW ID transmission and the repeat transmission of voice/data occurs at the same time.



|                                                                                 | Repeat Transmission | Repeater Operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The repeat transmission of voice/data has occurred during CW ID transmission    | Analog              | <p><b>&lt;If "Polite" is configured in "Analog CW ID"&gt;</b></p> <ul style="list-style-type: none"> <li>CW ID transmission is interrupted by the repeat transmission of Analog signal.</li> <li>The repeater restarts CW ID transmission from the beginning after five seconds from the end of the repeat transmission.</li> </ul> <hr/> <p><b>&lt;If "Impolite" is configured in "Analog CW ID"&gt;</b></p> <ul style="list-style-type: none"> <li>CW ID transmission is never interrupted by the repeat transmission of Analog signal.</li> </ul> |
|                                                                                 | DMR                 | <ul style="list-style-type: none"> <li>CW ID transmission is interrupted by the repeat transmission of DMR voice/data signal.</li> <li>The repeater restarts CW ID transmission from the beginning after five seconds from the end of the repeat transmission.</li> </ul>                                                                                                                                                                                                                                                                            |
| CW ID transmission timing has come during the repeat transmission of voice/data | Analog              | <p><b>&lt;If "Polite" is configured in "Analog CW ID"&gt;</b></p> <ul style="list-style-type: none"> <li>The repeat transmission of Analog signal is never interrupted by CW ID transmission.</li> <li>The repeater starts CW ID transmission after five seconds from the end of the repeat transmission.</li> </ul> <hr/> <p><b>&lt;If "Impolite" is configured in "Analog CW ID"&gt;</b></p> <ul style="list-style-type: none"> <li>The repeat transmission is always interrupted by CW ID transmission.</li> </ul>                                |
|                                                                                 | DMR                 | <ul style="list-style-type: none"> <li>The repeat transmission of DMR voice/data signal is never interrupted by CW ID transmission.</li> <li>The repeater starts CW ID transmission after five seconds from the end of the repeat transmission.</li> </ul>                                                                                                                                                                                                                                                                                           |

## I. Note

A) The function of CW ID is available even if Analog Mode in KAIROS Manager is unchecked. In this case, the modulation mode of KAIROS switches to Analog only when KAIROS sends CW ID.

B) While Enabling TX in KAIROS Manager is unchecked, KAIROS doesn't transmit CW ID even if a timing of transmitting CW ID has come.

- (10) Message: Configures one string up to 32-digits which is able to be encoded into a Morse code. If the configured string is available as a Morse code, the function is enabled and KAIROS sends CW ID. If Message is configured for blank, the function does not work. One CW ID can be configured to each channel. The available characters are as follows.

| Symbol /letters | Explanation                                                       | Symbol /letters | Explanation                   |
|-----------------|-------------------------------------------------------------------|-----------------|-------------------------------|
| A,B···Y,Z       | Alphabets (capital)                                               | 0 - 9           | Figures                       |
| (               | Left-hand bracket (parenthesis)                                   | =               | Double hyphen                 |
| )               | Right-hand bracket (parenthesis)                                  | /               | Fraction bar or division sign |
| +               | Cross or addition sign                                            | .               | Full stop (period)            |
| “ ”             | Inverted commas (quotation marks)<br>(before and after the words) | ,               | Comma                         |
| ?               | Question mark                                                     | '               | Apostrophe                    |
| -               | Hyphen or dash or subtraction sign                                | :               | Colon or division sign        |
| A space         | Space (First entry and continuous entry is inhibited.)            | @               | Commercial at                 |

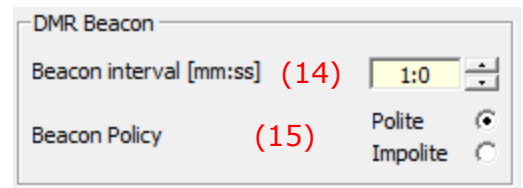
- (11) Interval [min]: Configures an interval of transmitting CW ID.
- Range: --, 1 to 255 [min], Default: --
  - If "--" is configured, CW ID is not sent. Please note that if "--" is configured for Slave Repeater(s), the Slave Repeater(s) operates a CW ID transmission depending on the Master Repeater configuration.
- (12) Speed [wpm]: Configures a speed for sending Morse code.
- Range: 10 to 40 [wpm], Default: 20 [wpm]
  - The calculation of Speed is based on CODEX which has 60 units (dots) per a word. In the case of 20 words/min, it is 1200 units/min. One unit is 50ms long.
- (13) CW ID Policy: Polite/Impolite: Configures lower priority (Polite)/higher priority (Impolite) for CW ID transmission than an Analog conversation.
- If "Polite" is configured, an Analog conversation is never interrupted by CW ID transmission. When the conversation is in progress at the timing of starting CW ID transmission, CW ID transmission does not start until after five seconds from the end of the conversation.
  - If "Impolite" is configured, CW ID transmission is never interrupted by an Analog conversation. When a conversation is in progress at the timing of starting CW ID transmission, the conversation is terminated and CW ID transmission starts.

- (14) Beacon interval [mm:ss]: You can set here for Master Base station only.

Enter Beacon interval timing here in 30 second step. This setting for Master Station only. Slave stations follow the timing of Master station.

Beacon transmission duration is defined by Channel Hang time in Base Station Layer Configuration

[Note] Beacon interval timer will be renewed by last transmission such as repeating TX.



- (15) Beacon Policy:

Polite: The beacon never disturbs conversation.

Impolite: The beacon disturbs conversation.

| TRX Status          |             |
|---------------------|-------------|
| DSP Ready           | TRX Active  |
| Clbr Running        | Clbr OK     |
| M. RX Fail          | D. RX Fail  |
| Interrupts from PLD |             |
| SQ                  | Analog PTT  |
| TCS/DPL             | Digital PTT |
| RX DMR TS A         | TX DMR TS A |
| RX DMR TS B         | TX DMR TS B |
| RX P25              | TX P25      |

Polite

| TRX Status          |             |
|---------------------|-------------|
| DSP Ready           | TRX Active  |
| Clbr Running        | Clbr OK     |
| M. RX Fail          | D. RX Fail  |
| Interrupts from PLD |             |
| SQ                  | Analog PTT  |
| TCS/DPL             | Digital PTT |
| RX DMR TS A         | TX DMR TS A |
| RX DMR TS B         | TX DMR TS B |
| RX P25              | TX P25      |

Impolite

- (16) Call Interrupt Handling: Call Interrupt is a function to interrupt an ongoing call from a Mobile Station (hereinafter called MS) except for the originating MS. When KAIROS receives interruption request

from the MS, KAIROS sends a message to

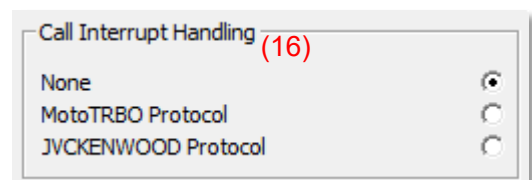
inform the interruption to a transmitting MS and stops repeating. There is no

interoperability with other vendor system and MS because this function is our

proprietary. Therefore, it can operate by only a request from the MS which supports

either other MS or a JVCKENWOOD Protocol Call Interrupt. Selects the method of

Call Interrupt function.





**3.3.1.14.2. IP Parameters**

- (17) Master IP address: You must set Master IP address for all slaves. (including Sub-master)
- (18) In case a Slave is assigned as a Backup Master, enter this setting. (It is recommended for network redundancy)
- (19) Voice/ Data reception from Master: Choose one to be same as IP network.

**IP Parameters**

**Master (17)**

☒ Present IP Address 172.33.91.10

**Backup Master (18)**

☒ Present IP Address 172.33.91.11

☐ This BS

☒ Become Master on broken connection

**Voice/Data reception from Master (19)**

Multicast ☒

Broadcast ☐

Unicast ☐

**3.3.1.14.3. Physical Console Parameters**

- (20) Full-Duplex Console: It allows Full Duplex conversation by physical console from rear 25pin port.
- (21) Line 1 Console: The setting for Physical console from rear 25pin port line 1.
- (22) Line 2 Console: The setting for Physical console from rear 25pin port line 2

**Physical Console Parameters**

Full-Duplex Console (20) ☒

**Line 1 Console (21)**

Operating Mode: MAINLY ANALOG

16777215 Dest DMR ID

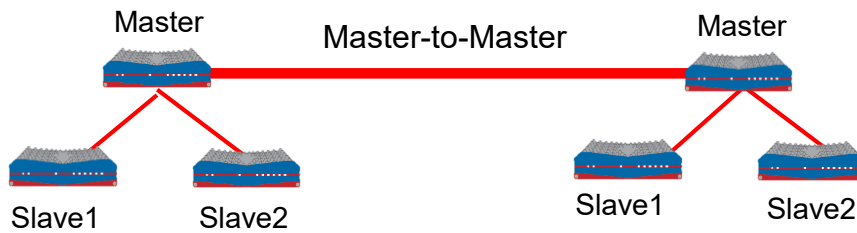
Reply to incoming communication ☐

**Line 2 Console (22)**

Operating Mode: MAINLY DMR

16777215 Dest DMR ID

Reply to incoming communication ☐

**3.3.1.14.4. Master-to-Master Parameters**

The Tier II, even in Analog, Controller can now instruct a Master Base Station to set up one or more dynamic Master-to-Master (M2M) route to exchange data with another Master Base Station. This is required for a Multisite Network.

Note: Master-to-Master functions is totally ASYNCHRONOUS, thus it cannot be used for any simulcast purpose.

(22) Static Routs: Set target Master IP address and check DMR slot/ Analog which you want to transfer Voice/Data to other Master.

(23) Buffering: Choose Reception latency in 60 [ms]

**Master-to-Master Parameters**

Static Routes **(22)**

|                                     | IP Address   | TSA                                 | TSB                                 | ANA                      |
|-------------------------------------|--------------|-------------------------------------|-------------------------------------|--------------------------|
| <input checked="" type="checkbox"/> | 172.33.60.10 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 172.33.60.11 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 172.33.60.12 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input type="checkbox"/>            |              | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input type="checkbox"/>            |              | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> |
| <input type="checkbox"/>            |              | <input type="checkbox"/>            | <input type="checkbox"/>            | <input type="checkbox"/> |

Buffering **(23)**

Reception latency [ms]

**3.3.1.14.5. Tier III Parameters**

This is a part of Tier III or S-Trunking setting. Please refer to the following Application Note;

Tier III: AN-19-0001\_DMR\_Tier3\_KAIROS\_Trunking

S-Trunking: AN-19-0005\_KAIROS\_S-Trunking\_V101

**DMR Tier III Settings - KAIROS <Site Sean>**

**Tier III Parameters**

| Static Configuration            |                                                             | Run-Time Data                                               |  |
|---------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|--|
| Tier III Controller             | <input checked="" type="checkbox"/>                         |                                                             |  |
| IP Address                      | 172.33.21.222                                               | 172.33.21.222                                               |  |
| <b>Tier III Network</b>         |                                                             |                                                             |  |
| Model                           | SMALL                                                       | SMALL                                                       |  |
| Net (0 € 127)                   | 1                                                           | 1                                                           |  |
| Site (0 € 31)                   | 1                                                           | 1                                                           |  |
| Par                             | PAR A+B                                                     | PAR A+B                                                     |  |
| TS A Role                       | TCC PAR A+B                                                 | TCC PAR A+B                                                 |  |
| TS B Role                       | PAYLOAD CH                                                  | PAYLOAD CH                                                  |  |
| Idle Time [s]                   | 3                                                           | 3                                                           |  |
| Accept not registered terminals | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/>                         |  |
| C-syscode [hex]                 | 4087                                                        | 4087                                                        |  |
| Net-Site [hex]                  | 0021                                                        | 0021                                                        |  |
| Allow Tier II traffic           | <input type="checkbox"/> TS A <input type="checkbox"/> TS B | <input type="checkbox"/> TS A <input type="checkbox"/> TS B |  |

**Control Channel Mode**

Control Channel Mode: Standard

Inactive Timer [ms]: 1000

**JVCKENWOOD S-Trunking Timing**

Interval [ms]: 1440

Active [ms]: 420

**ETSI Versions Compliance**

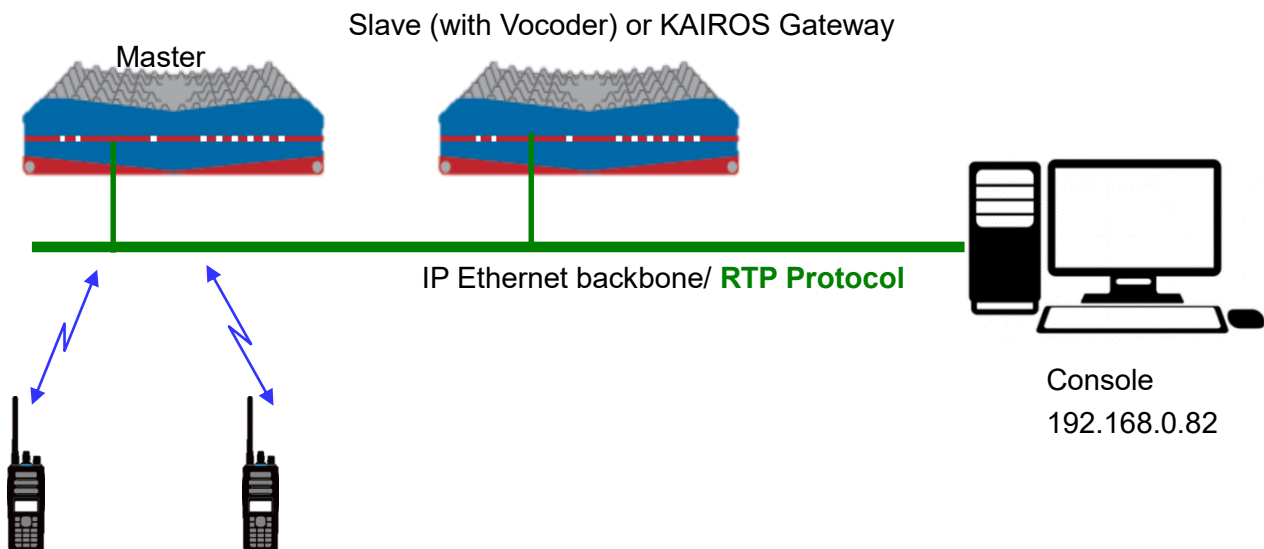
ETSI Version >= 1.7.1

Read Set Close

3.3.1.15. **RTP Configuration**

This window is for configuration of RTP which connect KAIROS Tier 2 and Tier 3 networks to dispatching applications using Real Time Protocol to exchange voice and data along with the current status of the radio channels using RTP extension header.

[Note] Optional Vocoder Unit is required for RTP.



- (1) Console IP Address: Enter Console IP Address. If you use IP gateway, set the IP address for IP Gateway.  
Use OLD Equipment-ID Format: Uncheck.  
Use incremental timestamp on Header: Uncheck.
- (2) TS A Channel Parameters: For Timeslot A  
TS B Channel Parameters: For Timeslot B

ANALOG Channel Parameters: For Analog FM.

### 3.3.1.15.1. TS A(B) / ANALOG Channel Parameters

- (3) Channel Enabled: Check here if you need RTP.
- (4) Send Data: To send RTP data to console, check here.
- (5) Send RTP Extension: Normally Uncheck. In order to send Extension header data, check here.
- (6) Send Local Echo: Normally Uncheck. In order to send Local Echo check here. If you use IP gateway, check here.
- (7) Raw Data Exchange: Uncheck. N/A
- (8) Symmetric RTP: If check here, TX port number will be same as RX port number.
- (9) Voice Codec: Choose one from ANA, a-Law, u-Law to be same as console codec. Select u-Law normally. If you use IP Gateway, set to "DMRAI".
- (10) Buffering: This buffer applies to received RTP data form IP ports.
- (11) Voice IP Ports: Set IP ports for Voice to be same as Console IP ports. If you use IP Gateway, match the value to Channel List for IP Gateway.
- (12) Data IP Ports: Set IP ports for Data to be same as Console IP ports. If you use IP Gateway, match the value to Channel List for IP Gateway.

**TS A Channel Parameters**

Channel Enabled (3) ☒

Send Data (4) ☒

Send RTP Extension (5) ☒

Send Local Echo (6) ☒

Raw Data Exchange (7) ☐

Symmetric RTP (8) ☐

Voice Codec (9) U\_LAW

Buffering [ms] (10) 180

**Voice IP Ports (11)**

From Console (RX) 43000

To Console (TX) 43000

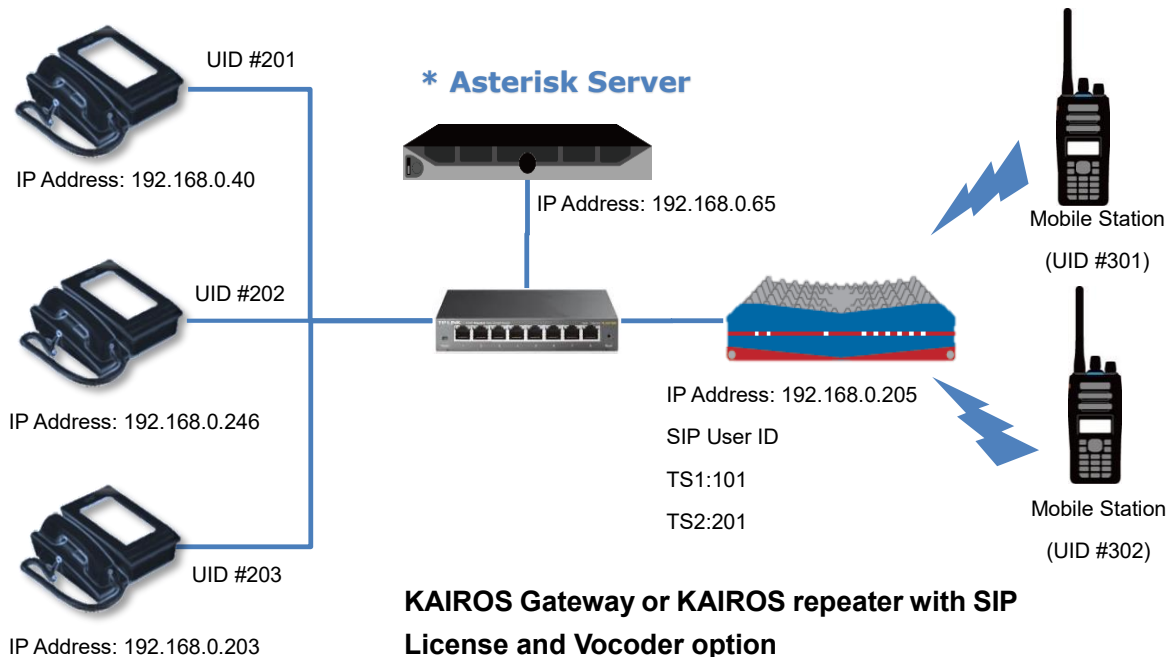
**Data IP Ports (12)**

From Console (RX) 40200

To Console (TX) 40300

## 3.3.1.16. SIP Configuration

KAIROS supports SIP Server (Asterisk) which can make communication between Mobile unit and SIP Phone.



If the target KAIROS for SIP is not activated SIP License, you need to activate SIP license by Web Server (Browser), and upload SIP library file to KAIROS by KAIROS Manager. Confirm the KAIROS is installed SIP server Library from Software – Versions.

Sw Versions - KAIROS <T2 GTW>

| Operating System                                                         |         |       |            |  |
|--------------------------------------------------------------------------|---------|-------|------------|--|
| Description                                                              | Version | Build | Date       |  |
| Linux 2.4.31 for KAIROS Equipment by Radio Activity srl, HW release 2.00 | 01      | 08    | 2020-01-29 |  |

| KAIROS |              |            |               |  |
|--------|--------------|------------|---------------|--|
| Name   | Version      | Date       | Customization |  |
| ka_bst | 1.6.B.2_rc-9 | 2020-07-07 | Standard (0)  |  |

| RA SW Libraries |         |            |
|-----------------|---------|------------|
| Name            | Version | Date       |
| RA Library      | 3.5.0.0 | 2018-02-15 |
| SIP Server      | 1.B.3.0 | 2017-06-29 |

| SW Modules  |       |            |
|-------------|-------|------------|
| Name        | Build | Date       |
| ka_bst      | 2177  | 2020-07-07 |
| ka_main     | 1854  | 2020-07-07 |
| ka_snmp     | 1320  | 2020-07-07 |
| ka_rctl     | 1571  | 2020-07-07 |
| web_int     | 4157  | 2020-07-07 |
| ka_ptp      | 1351  | 2020-07-07 |
| bst_net_mgr | 3006  | 2020-07-07 |
| ka_agw      | 2143  | 2020-07-07 |

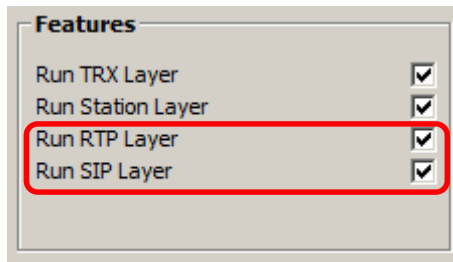
| Coproprocessing Devices |         |            |
|-------------------------|---------|------------|
| Name                    | Version | Date       |
| DSP                     | 4.64    | 2020-04-21 |
| PLD                     | 4.13    | 2017-04-07 |

Close Read

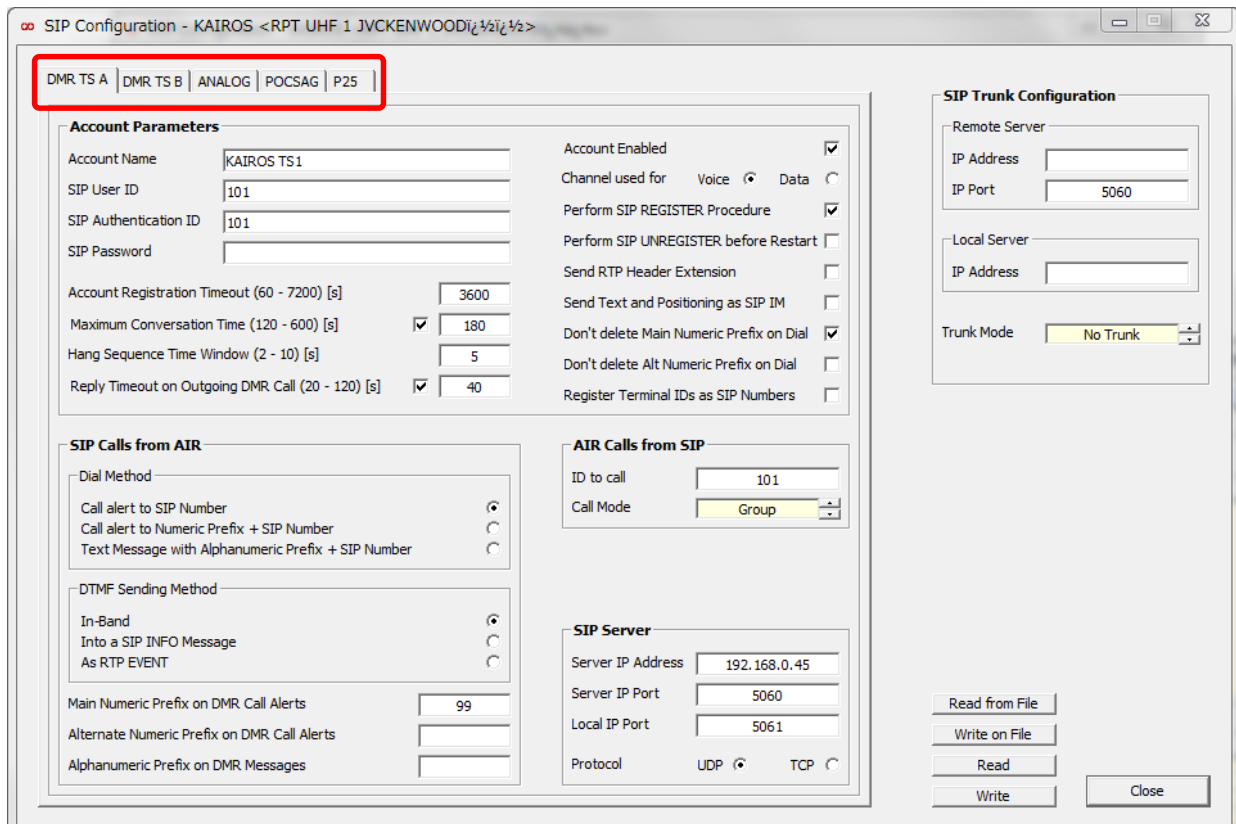


### 3. Main window 3.3. KAIROS

Also confirm “Run RTP/SIP Layer” from Configuration – Main Setup.



It is possible to enable a KAIROS as a SIP client account for each radio channel. (At the moment only DMR TSA, TSB and Analog are supported)



**3.3.1.16.1. Account Parameters**

- (1) Account Name: Enter any name.
- (2) SIP User ID: Extension number which is same as SIP server (Asterisk).
- (3) SIP Authentication ID: Enter same number as SIP User ID.
- (4) SIP Password: N/A (Do not enter)
- (5) Account Registration Timeout: Timeout time for registration to SIP server.
- (6) Maximum Conversation Time: If uncheck here, no limitation. (Managed by repeater TOT)
- (7) Hang Sequence Time Window: Time window for detecting the 3 PTTs On/Off sequence to hang-up a SIP call.
- (8) Reply Timeout Outgoing DMR Call: Time until hang-up a SIP to DMR call if nobody answers on the radio.
- (9) Account Enabled: Check here to use SIP feature on target time slot.
- (10) Channel used for: Choose "Voice" normally.
- (11) Perform SIP REGISTER Procedure: Check here normally.
- (12) Perform SIP UNREGISTER before Restart: Uncheck here normally.
- (13) Send RTP Header Extension: It allows sending RTP Header Extension.
- (14) Send Text Positioning as SIP IM: It allows text message from console
- (15) Don't delete Main Numeric Prefix on Dial: Uncheck here normally.
- (16) Don't delete Alt Numeric Prefix on Dial: Uncheck here normally.
- (17) Register Terminal IDs as SIP Numbers: Uncheck here normally.

**3.3.1.16.2. SIP Calls from AIR**

- (1) Dial Method: Choose middle. Using this method each call alerts whose destination DMR ID's initial digits matches with one of the two numeric prefixes (Main Numeric Prefix and Alternate Numeric Prefix) will produce a SIP call addressed to a SIP resource having the same SIP contact URL of the target DMR ID. It is possible to set whether or not sending the selected prefix to the SIP Server. This is the only method currently available in the current release 1.6.0.0 and it will be provided in a future software release.
- (2) DTMF Sending Method: Choose "In-Band". It is the only way to exchange DTMF tones between radio portables and SIP Telephones in the current release.
- (3) Main Numeric Prefix on DMR Call Alerts: Additional prefix of extension number. e.g.) SIP phone extension: 101  
Numeric Prefix on DMR: 99  
UID to call SIP phone from mobile: 99101
- (4) Alternate Numeric Prefix on DMR Call Alerts: 2<sup>nd</sup> Prefix if you need.
- (5) Alphanumeric Prefix on DMR Messages: N/A

**SIP Calls from AIR**

Dial Method (1)

Call alert to SIP Number ☐

Call alert to Numeric Prefix + SIP Number ☒

Text Message with Alphanumeric Prefix + SIP Number ☐

DTMF Sending Method (2)

In-Band ☒

Into a SIP INFO Message ☐

As RTP EVENT ☐

Main Numeric Prefix on DMR Call Alerts (3)

Alternate Numeric Prefix on DMR Call Alerts (4)

Alphanumeric Prefix on DMR Messages (5)

**3.3.1.16.3. AIR Call from SIP**

- (1) ID to call: ID for Air calls between KAIROS and mobile.
- (2) Call Mode: Choose Individual / Group

**AIR Calls from SIP**

ID to call (1)

Call Mode (2)

**3.3.1.16.4. SIP Server**

- (1) Server IP Address: IP address of SIP Server
- (2) Server IP Port: Enter same port number with SIP server.
- (3) Local IP Port: Enter same port number with SIP server.
- (4) Protocol: Select same protocol with SIP server.

**SIP Server**

Server IP Address (1)

Server IP Port (2)

Local IP Port (3)

Protocol (4) ☒ UDP ☐ TCP

**3.3.1.16.5. SIP Trunk Configuration**

It is a Server to connection between two different SIP servers (usually KA-SIP Server and customer's external PBX). It provides an alternative to a SIP Client – Server connection between the KA-SIP layer which acts as a SIP client and the customer's external VoIP PBX acts as SIP Register Server.

- (1) Remote Server: Set IP information for SIP Trunk Server.
- (2) Local Server: If assign SIP Trunk Server to another KAIROS, enter IP address in here.
- (3) Trunk Mode: No Trunk means using KAIROS itself.

The screenshot shows a 'SIP Trunk Configuration' dialog box. It is divided into three main sections. The first section, 'Remote Server (1)', contains two input fields: 'IP Address' and 'IP Port', with the value '5060' entered in the port field. The second section, 'Local Server (2)', contains a single 'IP Address' input field. The third section, 'Trunk Mode (3)', features a dropdown menu currently displaying 'No Trunk'.

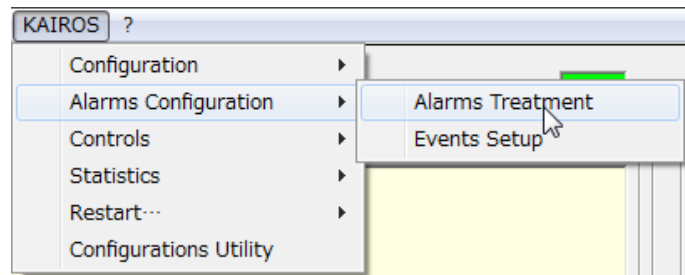
### 3.3.2. Alarm Configuration

The software on a KAIROS Base Station continuously monitors a lot of functional parameters, which can take the state of good or bad during a period. We can divide them into two major groups: analog parameters and logic parameters.

The analog parameters can take any value

between a minimum and a maximum (i.e.: voltage, temperature...)

The logic parameters normally point out specific facts occurred over time (i.e.: the activation of an input contact)



#### 3.3.2.1. Alarm Treatment

It sets the general parameters of the Alarm or Notice Events notification.

 A screenshot of the 'Alarms Treatment - KAIROS <MST CRI>' window. The window is divided into several sections:
 

- SNMP Traps (1):** Includes 'Community Data' with fields for 'Name' (public) and 'Password' (admin).
- SNMP Servers (2):** A table with columns 'Present', 'IP Address', and 'IP Port'. It shows two active servers: 172.33.2.105 and 172.33.2.44, both on port 162.
- SNMP Parameters (3):** Includes 'Threshold level' set to 'NOTICE' and 'Common severity for CLEAR' set to 'UNDEFINED'.
- DMR Messages (4):** A table with columns 'Present', 'Destination ID', 'Timeslot', 'Destination Type', and 'Message Format'. It shows two active destinations: 101 (Group, ETSI) and 16777215 (All Call, ETSI).
- Message Parameters (5):** Includes 'Prepend date' and 'Prepend time' (both checked), 'Base Station Identification' set to 'Equipment Name', and 'Custom ID' set to 'KAIROS'.

 At the bottom right, there are buttons for 'Read from File', 'Write on File', 'Read', 'Write', and 'Close'.

- (1) Community Data
  - Name: Name of the SNMP Community
  - Password: Password of the SNMP System
- (2) SNMP Servers
  - Present: If adding a SNMP server is possible, specifying its IP Address, at first must check this checkbox; to remove a server, simply uncheck this checkbox.

- IP Address: Specifies the IP Address of an SNMP Server to which the Trap will be sent.
- IP Port: Specifies the IP Port number (in the range 20 - 65000) of the server to which the Trap will be sent.

(3) SMNP Parameters

- Threshold level: Specifies the severity level under which an SNMP trap will not be sent.
- Common Severity for CLEAR: Specifies a unique severity degree for all the CLEAR Events, which takes priority over the per-Alarm CLEAR severity degree (in addition to the already shown severity degrees (see above, Severity Degree of an Alarm Event), this list-box provides an UNDEFINED value, which means that a CLEAR Event will assume the severity degree specified in the Events Setup window).

(4) Destination

- Present: To add a DMR Destination, you first must check this checkbox; to remove a DMR Destination, simply uncheck this checkbox.
- Destination ID: Specifies the Destination ID, which can be an Individual ID or a Group ID, according to the Destination type.
- Timeslot: Specifies the Timeslot (A or B) which a text message will be sent on.
- Destination Type: Specifies the type of the Destination ID (currently the only choice is between "ALL CALL" and "GROUP ID")
- Message Format: Specifies the format of the text messages that will be sent.

(5) Message Parameters

- Prepend date: If it is checked, the related text of an Event will be prepended by the UTC date of an Event occurrence, in (YYYY-MM-DD) format.
- Prepend time: If it is checked, the related text of an Event will be prepended by the UTC time of an Event occurrence, in (HH:MM) format.
- Base Station Identification: You can choose here how the Base Station will be identified in the DMR text message sent; the current choices are:
  - None: No identification string will be inserted.
  - Equipment Name: The name of the Station, as set in the Main Setup window.
  - Station ID: The Station ID value, as set in the Main Setup window.
  - Equipment S/N: The Serial Number of the Station, assigned from Factory, normally displayed in the main window of KAIROS Manager.
  - Equipment ID (hex): The Equipment ID of the Station, assigned by Factory, normally displayed in hex format in the main window of KAIROS Manager.
  - Custom String: The identification will be the string chosen by the user, set in the following item
- Custom ID: Sets your own Identification String to be sent if Custom String has been chosen in the previous item.



## 3.3.2.2. Events Setup

Configures how to handle and dispatch every single event.

Events Setup - KAIROS <T3 CH1>

The screenshot shows the 'Events Setup' window for 'KAIROS <T3 CH1>'. The 'Ethernet Link Status' tab is active. The window contains several configuration sections:

- SNMP Traps (1):** Includes a table for 'Traps Destination' with columns for IP Address and Port, and checkboxes to select servers. Below it is the 'Traps Sending Policy' section with checkboxes for 'Merge Auxiliary Data in Text Messages' and 'Send the CLEAR TRAP on a CLEAR Event', and a 'Repeat RAISE TRAP every' field.
- On-Air Messages (2):** Includes a table for 'DMR' with columns for Destination, TS, Call Type, and Format, and checkboxes to select destinations. Below it are 'Repetitions' and 'Interval [s]' fields.
- Properties and Methods (3):** Includes 'Alarm Enabled' checkbox, 'Consecutive events to toggle' (set to 2), and 'Insert into ACTIVE/HOT-SPARE analysis' checkbox.
- Alarm Raise (4):** Includes a 'Message' field (Broken Ethernet Link), 'SYSTEM Defined Severity' (MAJOR), and 'User-Defined Level' (0).
- Alarm Clear (5):** Includes a 'Message' field (Ethernet Link Restored), 'USER Defined Severity' (MAJOR), and 'User-Defined Level' (0).
- I/O Contacts Activation (6):** Includes 'Activate EXT-OUT contact' checkbox.

At the bottom of the window are 'Write', 'Read', and 'Close' buttons.

- (1) **SNMP Traps / Traps Destination:** In this section you will find all the previously configured SNMP Servers (IP Address + IP Port number): if you want the Station to send the trap related to the Event to one or more of the listed servers, simply check the checkboxes associated to the servers. If you don't want the Station to send the trap, then uncheck all.  
**SNMP Traps / Traps Sending Policy:** For every Alarm Event, in this section you can decide Traps sending policy.
- (2) **On-Air Messages:** In this section you will find all the previously configured DMR Destinations (ID + Timeslot + Type + Format): if you want the Station sends to one or more of the listed destinations the event-related text message, simply check the checkboxes associated to the destinations. If you don't want the Station sends the message, uncheck all.
- (3) **Properties and Methods:** In this section you will define the behavior of an Event, as follows:



- Alarm Enabled: Enables or disables all the actions subsequent to the detection of the Event.
- Consecutive events to toggle: Specifies how many consecutive detections of the Event are needed to toggle the status of the Alarm; note that in some Events this parameter is not enabled to the User.
- Insert into ACTIVE/HOT-SPARE analysis: Here you can specify if the Event participates to the Equipment Status Analysis which can produce an ACTIVE-to-SPARE role exchange in a 1+1 environment; please, note that not all Events are qualified to participate to that analysis, and currently not all qualified Events, even selectable, will participate to the analysis: it is limited to the followings:
  - Ethernet Link Status
  - No TX Power
  - TX Power too low
  - TX Power too high
  - TX SWR Alarm
  - TX Power Reduction
  - BS Temperature
  - TX Temperature

- (4) Alarm Raise / Message: Here you can specify the text of the messages that will be sent to configure SNMP Server(s) and through the DMR RF channel; you can insert a free-format ANSI text up to 47 alphanumeric characters. Please note that some Alarms don't have a CLEAR event: in this case an appropriate reminder will be displayed instead of the Message textbox of the Alarm Clear section.

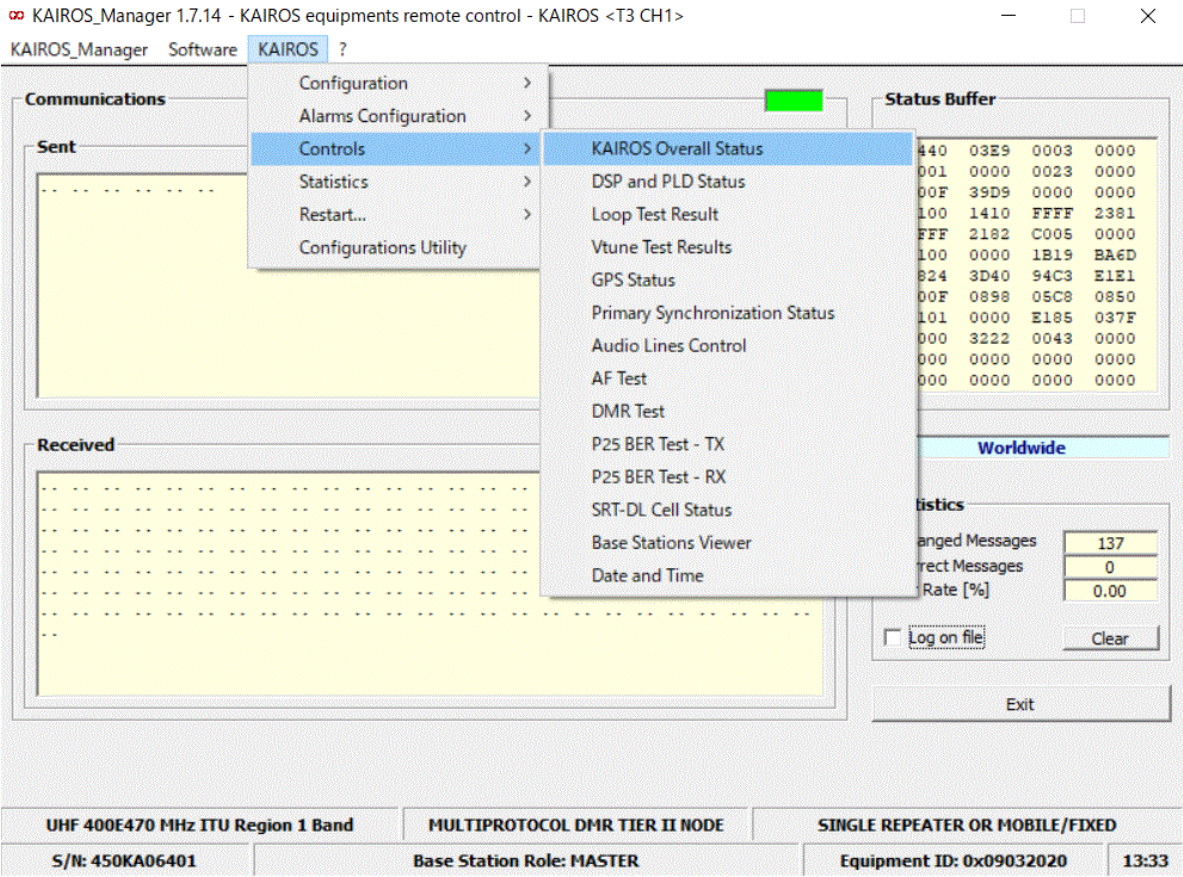
Alarm Raise / System Defined Severity: Here you can specify the severity degree for the displayed alarm. While the user can define the CLEAR Event severity degree for every alarm, the user can define the RAISE Event severity degree only for some alarms, because for some others it is still Factory-defined and cannot be changed. The range of values is as shown above, in Severity Degree of an Alarm Event. If you didn't specify any SNMP Server in the Alarms Treatment window, the User-Defined Severity value has no meaning.

Alarm Raise / User-Defined Level: Here You can specify a value, in the range 0 to 15, which will be inserted into the SNMP Trap; the SNMP Server can use this value as an additional filter, or a customized priority/significance for that alarm. If you didn't specify any SNMP Server in the Alarms Treatment window, the User-Defined Level value has no meaning.

- (5) Alarm Clear: it is written in the (4) Alarm Raise.
- (6) I/O Contacts Activation: If checked, the RAISE Event of the alarm will participate in the activation of the ALARM OUT contact on the rear DB25 connector.

3.3.3. Controls

To know KAIROS Statuses, Click Controls then choose the one which you want to know.



## 3.3.3.1. KAIROS Overall Status

You can know various basic statuses from this window.

 Gray means "Not Active"

 Green means "Active"

KAIROS Overall Status - KAIROS <Site Sean>

**TRX Status**

|                     |                   |
|---------------------|-------------------|
| <b>DSP Ready</b>    | <b>TRX Active</b> |
| Cbr Running         | Cbr OK            |
| M. RX Fail          | D. RX Fail        |
| Interrupts from PLD |                   |
| SQ                  | Analog PTT        |
| TCS/DPL             | Digital PTT       |
| RX DMR TS A         | TX DMR TS A       |
| RX DMR TS B         | TX DMR TS B       |
| RX P25              | TX P25            |

**Synchronization Status**

|                                         |         |       |      |
|-----------------------------------------|---------|-------|------|
| PPS Signal from GPS                     | Present | Valid | Lock |
| PPS Signal from PTP                     | Present | Valid | Lock |
| External PPS Signal                     | Present | Valid | Lock |
| Superaudio Tone                         | Present | Valid | Lock |
| Synchronization from RF Signal or 4FSK  | Lock    |       |      |
| Synchronization from Internal Reference | Lock    |       |      |

**DSP Correctly Synchronized**

**DSP Measures**

Clear Packets Counters

**Last DSP Startup:**  
2020-04-23 15:18:19

|                               |        |
|-------------------------------|--------|
| DMR Packets Out of Window     | 0      |
| ANA Packets Out of Window     | 0      |
| Safety Margin for DMR Packets | 2      |
| Safety Margin for ANA Packets | 0      |
| Timing Error [µs]             | 0.000  |
| PPS Position [µs]             | 42.468 |

**Features Status**

|                         |           |     |
|-------------------------|-----------|-----|
| DMR                     | ANALOG    | P25 |
| TX                      | SIMULCAST |     |
| MULTITONE TCS           |           |     |
| SIP                     | POCSAG    |     |
| SNMP                    |           |     |
| NETCONTROL Access       |           |     |
| Radio Amateurs Features |           |     |
| External Raw Access     |           |     |
| Audio from Web          |           |     |
| VVF Features            |           |     |
| 1+1 Redundancy          |           |     |
| ETSI Tier III           |           |     |
| T3 Controller           | T3 NMS    |     |
| Multisite Trunking      |           |     |

**AF Lines Status**

|                   |        |        |
|-------------------|--------|--------|
| AF to DMR Codecs  | TS A   | TS B   |
| DMR Codecs to AF  | TS A   | TS B   |
| Output Signalling | Line 1 | Line 2 |
| Input Signalling  | Line 1 | Line 2 |

**Emergency Self-Repeating Mode**  
**Promoted to Master for Emergency**  
**Registered to Master**  
**Registered to Tier III Controller**

**RX Measures**

|                                 |      |
|---------------------------------|------|
| Peak Deviation [Hz]             | 4246 |
| Estimated SINADp [dB]           | 2.6  |
| Offset of received carrier [Hz] | -141 |

**Analog Measures**

|                          |       |
|--------------------------|-------|
| Input Supply Voltage [V] | 13.0  |
| TX Temperature [°C]      | 43    |
| TX Input Current [A]     | 0.000 |
| Forward Power [W]        | 0.780 |
| Reflected Power [W]      | 0.729 |
| S W R                    | > 10  |

**Commands**

Set

Unlock SQ ☐

Unlock TCS/DPL ☐

Start Transmission ☐

Disable TX ☐

Line 2 Output Signal ☐

Local TRX Test ☐

Disable Digital Squelch ☐

**Vocoders Status**

|           |           |
|-----------|-----------|
| Vocoder 1 | Vocoder 2 |
|-----------|-----------|

**Clocks Status**

|                           |             |
|---------------------------|-------------|
| TX PLL Lock               | RX PLL Lock |
| DSP <=> PLD Communication |             |

**1+1 Status**

Force to SPARE

|          |                    |
|----------|--------------------|
| 1+1 Node | Link between Nodes |
|----------|--------------------|

Last role change: --

Close

**DMR Status**

|                             |        |        |
|-----------------------------|--------|--------|
| Internal Second/Timeslot    | --     | 122    |
| Last Received Timeslot      | TS A   | TS B   |
| Frequency offset rx [Hz]    | 0      | 0      |
| Time offset rx [ms]         | 0.000  | 0.000  |
| Error Vector                | 0      | 0      |
| Last Received Color Codes   | 0      | 0      |
| Last Transmitted Data Types | 3      | 9      |
| RSSI Main [dBm]             | -129.1 | -129.0 |
| RSSI Diversity [dBm]        | -129.3 | -129.3 |

UHF 400E470 MHz ITU Region 1 Band (1) MULTIPROTOCOL DMR TIER III NODE (2) MASTER BASE STATION (3)

S/N: 450KA06402 (4) Base Station Role: MASTER (5) Equipment ID: 0x09032040 (6) 172.33.21.22 (7)

There is some useful information on the bottom bar.

- (1) Frequency Band Information
- (2) Service Class
- (3) TRX Operative Mode
- (4) Serial Number
- (5) Base Station Role
- (6) Equipment ID which is match with MAC address. You can't change it.
- (7) Own IP address

Detail explanation for each item is written from the next page.

**3.3.3.1.1. TRX Status**

| TRX Status          |             |
|---------------------|-------------|
| DSP Ready           | TRX Active  |
| Clbr Running        | Clbr OK     |
| M. RX Fail          | D. RX Fail  |
| Interrupts from PLD |             |
| SQ                  | Analog PTT  |
| TCS/DPL             | Digital PTT |
| RX DMR TS A         | TX DMR TS A |
| RX DMR TS B         | TX DMR TS B |
| RX P25              | TX P25      |

| Item                | Description                                                                                                                          |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| DSP Ready           | The ready for the DSP working. Basically Green.                                                                                      |
| TRX Active          | The activeness for TX/RX. Basically Green. In case the KAIROS in stand-by mode in 1+1 Hot stand-by for redundancy here will be Gray. |
| Clbr Running        | During calibration is running it turns to Green.                                                                                     |
| Clbr OK             | It turns to Green if the calibration was done as OK.                                                                                 |
| M.RX Fail           | Normally Gray unless Main Receiver has a problem.                                                                                    |
| D.RX Fail           | Normally Gray unless Diversity Receiver has a problem.                                                                               |
| Interrupts from PLD | The status for the DSP is interrupted from PLD. (Programmable Logic Device) Basically Green.                                         |
| SQ                  | Busy Status. While the RX block is receiving signal, it turns on Green. If the KAIROS is disabled RX, here is always Gray.           |
| Analog PTT          | On-Air Status for Analog. While transmitting in analog, it turns on Green. If the KAIROS is disabled TX, here is always Gray.        |
| TCS/DPL             | It turns Green when the received correct QT / DQT signal.                                                                            |
| DIGITAL PTT         | On-Air Status for Digital. While transmitting in digital, it turns on Green. If the KAIROS is disabled TX, here is always Gray.      |
| RX DMR TS A         | It turns green when the DMR signal (Slot A) is being received.                                                                       |
| TX DMR TS A         | It turns green when the DMR signal (Slot A) is being transmitted.                                                                    |
| RX DMR TS B         | It turns green when the DMR signal (Slot B) is being received.                                                                       |
| TX DMR TS B         | It turns green when the DMR signal (Slot B) is being transmitted.                                                                    |
| RX P25              | It turns green when the P25 is being received.                                                                                       |
| TX P25              | It turns green when the P25 is being transmitted.                                                                                    |

**3.3.3.1.2. Feature Status**

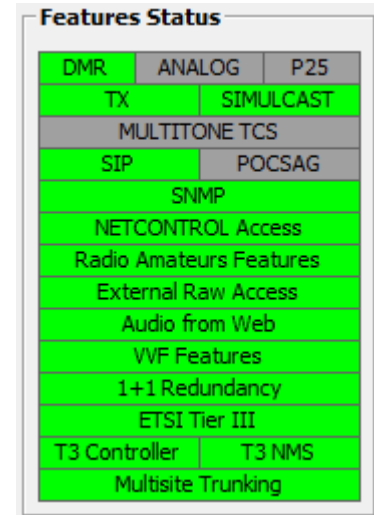
You can see various licensed feature's enabling status. Enabling features are turned on Green.

For example, on the picture case, SIMULCAST is Gray but it doesn't mean the KAIROS is not activated SIMULCAST License.

In case you don't use Simulcast mode, it turns off Green.

If you just want to check feature's license activated status, use Web server function by Firefox browser.

Procedure to activate license, we have the other document "KAIROS LICENSES GUIDE", please contact to JVCKENWOOD.



| Item                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DMR Features           | It turns green if the DMR Feature is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| ANALOG Features        | It turns green if the Analog mode license is enabled.<br>This license is always activated for all KAIROS as default setting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| P25 Features           | It turns green if the P25 Feature is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TX Features            | It turns green if the TX Feature is enabled. This license is always activated for all KAIROS as default setting except KA-TI-02 (Gateway).                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| SIMULCAST Features     | It turns green if the Simulcast Feature is enabled.<br>If the Simulcast license is not present, the repeater will not work in simulcast mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| MULTITONE TCS Features | It turns green if the MULTITONE TCS license is activated. It allows the use of up to 8 different CTCSS contemporary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SIP Features           | It turns green if the SIP Feature is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| POCSAG Features        | It turns green if the POCSAG (Post Office Code Standardization Advisory Group) Feature is enabled.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| SNMP Features          | It turns green if the SNMP license is activated. If you want the Station to send the trap related to the Event to SNMP servers need this License.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| NETCONTROL Access      | It turns green if the NETCONTROL license is activated.<br>Net Control is the Radio equipment monitoring and remote control SW tool for Windows-based platforms. It allows sites supervision both by the final Customer and the Installer/Maintainer via an IP-link. License to connect and remotely manage the radio base stations is included. Each base station of the network is displayed as a colored icon showing its status. The NetControl license must be activated on the KAIROS itself (not on the DMR NetControl software tool), so you need a NetControl license for every KAIROS you have. |

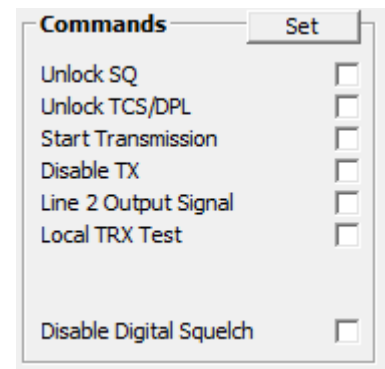
|                         |                                                                                                                                                                                                                                   |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radio Amateurs Features | It turns green if the Amateur Radio license is activated.<br>Amateur radio feature consists in enabling all the features of a KAIROS, apart from the SIP agent, and to limit the usable bandwidth to the Amateur Radio band only. |
| External Raw Access     | It turns green if the External RAW Access license is activated.<br>This is for software developer only.                                                                                                                           |
| Audio from Web          | It turns green if the Audio from Web license is activated. This license is always activated for all KAIROS as default setting.                                                                                                    |
| VVF Features            | It turns green if the VVF Feature is enabled.                                                                                                                                                                                     |
| 1+1 Redundancy          | It turns green if the 1+1 Redundancy Feature is enabled.                                                                                                                                                                          |
| ETSI Tier III Features  | It turns green if the DMR Tier III (Trunking) Feature is enabled.                                                                                                                                                                 |
| T3 Controller           | It turns green if the DMR Tier III Controller is enabled.                                                                                                                                                                         |
| T3 NMS                  | It turns green if the Network Management System for DMR Tier III and S-Trunking System are enabled.                                                                                                                               |
| Multisite Trunking      | It turns green if the Multisite Feature for a multisite trunking system is enabled.                                                                                                                                               |



**3.3.3.1.3. Commands**

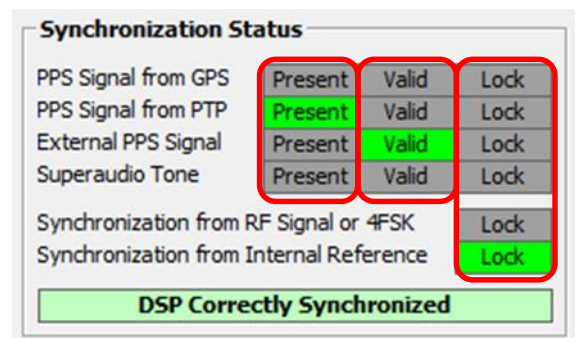
The "Commands" section contains the following radio related controls:

- Unlock SQ: To unlock the squelch threshold in order to activate the Rx in Analog mode.
- Unlock TCS/DPL: To by-pass the TCS/DPL controls;
- Start Transmission: To start transmitting silence;
- Disable TX: To block the transmission;
- Line 2 Output Signal: To activate the signal of "channel on air" sent to the console connection.
- Local TRX Test: Check here to lock RX and DSP mode of Analog signal to perform RX performance test.
- Disable Digital Squelch: While receiving DMR signal, if you check and set here, the KAIROS will maintain its behavior as receiving.

**3.3.3.1.4. Synchronization Status**

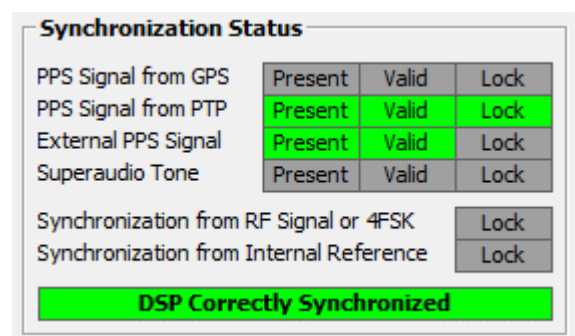
You can check the synchronization status of KAIROS.

- Present: It turns green if the Signal for Synchronization exists. There may be more than one Green.
- Valid: It turns to Green when the synchronization signal is Valid. There may be more than one Green.
- Lock: It turns to Green the signal KAIROS uses for synchronization. It displays only one.



DSP Correctly Synchronized: You can see that the figure above is not synchronized with other devices. It uses the Internal Reference only. (Light Green means "Synchronization" is locked by Internal Reference as 2nd choice)

The figure on the right shows the status of synchronization with PTP.





The figure on the right shows that it is not synchronized. DSP Correctly Synchronized turns to Red.

| Synchronization Status                  |         |       |      |
|-----------------------------------------|---------|-------|------|
| PPS Signal from GPS                     | Present | Valid | Lock |
| PPS Signal from PTP                     | Present | Valid | Lock |
| External PPS Signal                     | Present | Valid | Lock |
| Superaudio Tone                         | Present | Valid | Lock |
| Synchronization from RF Signal or 4FSK  |         |       | Lock |
| Synchronization from Internal Reference |         |       | Lock |
| DSP Correctly Synchronized              |         |       |      |

### 3.3.3.1.5. AF Lines Status

- AF to DMR Codecs: If the KAIROS installed Vocoder option, it turns Green when Vocoder input AF from external input line. (Physical console)
- DMR Codecs to AF: If the KAIROS installed Vocoder option, it turns Green when Vocoder output AF by receiving DMR signal.
- Output Signaling: If the KAIROS installed Vocoder option, while Analog signal outputs to Line1, Line2, and/or IP Line by receiving signal or IP network, turns on Green.
- Input Signaling: If the KAIROS installed Vocoder option, while Analog signal inputs from Line1, Line2, and/or IP Line, turns on Green.
- Emergency Self-Repeating Mode: Normally Gray. If a Slave failed to register the Master, here will be Red, and Slave enters Self-Repeating Mode as fail-safe. Under this mode, the repeater works as isolated from other repeaters. Repeater adds "Pi-Pi-Pi" tone on Down-link signal to indicate that the repeater working as this mode.
- Registered to Master: Normally Green. If a Slave failed to register the Master, here will be Red. You need to check the Master IP address setting on Slave.

| AF Lines Status                   |        |        |         |
|-----------------------------------|--------|--------|---------|
| AF to DMR Codecs                  | TS A   | TS B   |         |
| DMR Codecs to AF                  | TS A   | TS B   |         |
| Output Signalling                 | Line 1 | Line 2 | IP Line |
| Input Signalling                  | Line 1 | Line 2 | IP Line |
| Emergency Self-Repeating Mode     |        |        |         |
| Promoted to Master for Emergency  |        |        |         |
| Registered to Master              |        |        |         |
| Registered to Tier III Controller |        |        |         |

| AF Lines Status                   |        |        |         |
|-----------------------------------|--------|--------|---------|
| AF to DMR Codecs                  | TS A   | TS B   |         |
| DMR Codecs to AF                  | TS A   | TS B   |         |
| Output Signalling                 | Line 1 | Line 2 | IP Line |
| Input Signalling                  | Line 1 | Line 2 | IP Line |
| Emergency Self-Repeating Mode     |        |        |         |
| Promoted to Master for Emergency  |        |        |         |
| Registered to Master              |        |        |         |
| Registered to Tier III Controller |        |        |         |

|                                   |
|-----------------------------------|
| Emergency Self-Repeating Mode     |
| Promoted to Master for Emergency  |
| Registered to Master              |
| Registered to Tier III Controller |

|                                   |
|-----------------------------------|
| Emergency Self-Repeating Mode     |
| Promoted to Master for Emergency  |
| Registered to Master              |
| Registered to Tier III Controller |

- Promoted to Master for Emergency: In case Master stopped its role, a Slave which is assigned Back-up-Master will be automatically promoted to Master with indicating Yellow. If damaged Master was recovered, Back-up-Master, which is temporarily promoted to Master, will automatically be demoted back to Slave.

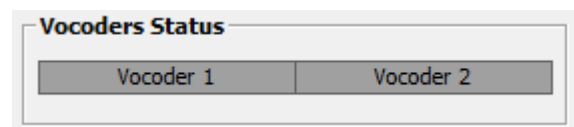
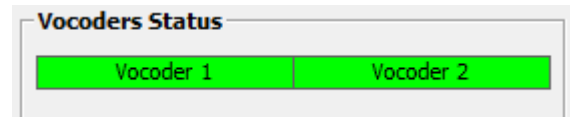


### 3.3.3.1.6. Vocoders Status

If the KAIROS has Option Vocoder, it turns on Green here.

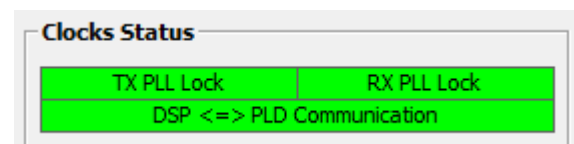
If no built-in Vocoder, always gray.

Note: Vocoder 1 for TS A, Vocoder 2 for TS B.



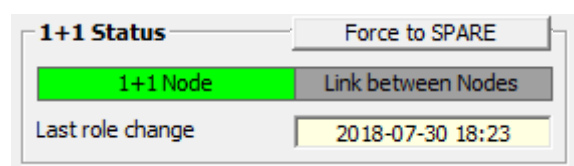
### 3.3.3.1.7. Check Status

- TX PLL Lock: It turns green if clock for TX PLL working.
- RX PLL Lock: It turns green if clock for RX PLL working.
- DSP <=> PLD Communication: It turns green if the communication between DSP and PLD work fine.

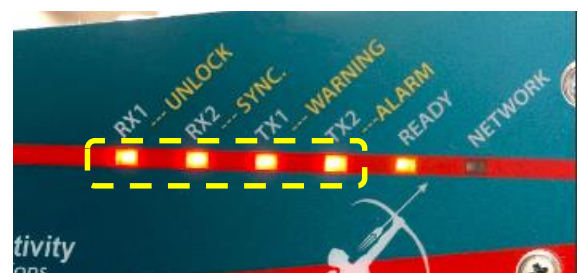


### 3.3.3.1.8. 1+1 Status

- Force to SPARE: By pressing this button, KAIROS which is working as Main in 1 + 1 redundancy turns to SPARE.
- 1+1 Node: It turns green if the KAIROS is set as 1+1 Hot/Standby redundancy.
- Link between Nodes: It has not been developed yet. It's for future usage.
- Last role change: It shows last role date and time on 1+1 Hot/Standby mode.



Note: The KAIROS while TRX is not active, 4 LEDs (RX1, RX2, TX1, TX2) light orange for 1 sec every 10 sec.



**3.3.3.1.9. DSP Measures**

| DSP Measures                            |        |
|-----------------------------------------|--------|
| Clear Packets Counters                  |        |
| Last DSP Startup:<br>2018/07/13 9:14:08 |        |
| DMR Packets Out of Window               | 0      |
| ANA Packets Out of Window               | 0      |
| Safety Margin for DMR Packets           | 2      |
| Safety Margin for ANA Packets           | 0      |
| Timing Error [µs]                       | 0.000  |
| PPS Position [µs]                       | 42.468 |

| Item                          | Description                                                                                                  |
|-------------------------------|--------------------------------------------------------------------------------------------------------------|
| DMR Packets Out of Window     | Normally 0. If the number is stable (not increasing), the DMR network is working well.                       |
| ANA Packets Out of Window     | Normally 0. If the number is stable (not increasing), The Analog network is working well.                    |
| Safety Margin for DMR Packets | Normally greater than 1. If the number is often 0, increase the network delay.                               |
| Safety Margin for ANA Packets | Normally greater than 1. If the number is often 0, increase the network delay.                               |
| Timing Error [us]             | Receiving Signal Timing error from expected timing.<br>Less than 10 [us] is OK.                              |
| PPS Position [us]             | PPS Position error from expected timing of PPS based on current synchronization.<br>Less than 10 [us] is OK. |

**3.3.3.1.10. RX Measures**

| RX Measures                     |      |
|---------------------------------|------|
| Peak Deviation [Hz]             | 3987 |
| Estimated SINADp [dB]           | 15.6 |
| Offset of received carrier [Hz] | -65  |

| Item                            | Description                           |
|---------------------------------|---------------------------------------|
| Peak Deviation[Hz]              | It shows Peak Deviation while RX.     |
| Estimated SINADp [dB]           | It shows Peak SINAD while RX.         |
| Offset of received carrier [Hz] | It shows carrier offset of RX signal. |

**3.3.3.1.11. Analog Measures**

| Analog Measures          |       |
|--------------------------|-------|
| Input Supply Voltage [V] | 12.8  |
| TX Temperature [°C]      | 28    |
| TX Input Current [A]     | 1.222 |
| Forward Power [W]        | 9.755 |
| Reflected Power [W]      | 1.018 |
| S W R                    | 1.23  |

| Item                     | Description                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Supply Voltage [V] | It shows DC input Voltage.                                                                                                                        |
| TX Temperature [°C]      | It shows Temperature around TX circuit.                                                                                                           |
| TX Input Current [A]     | It shoes the drained current by the TX Final power amplifier.                                                                                     |
| Forward Power [W]        | It shows forward TX power which is detected by KAIROS internal circuit. Normally it shows similar power to the setting of TX power.               |
| Reflected Power [W]      | It shows reflected TX power which is detected by KAIROS internal circuit. If this number is close to Forward Power, check TX cabling and Antenna. |

**3.3.3.1.12. DMR Status**

| DMR Status                  |       |        |
|-----------------------------|-------|--------|
| Internal Second/Timeslot    | 3     | 126    |
|                             | TS A  | TS B   |
| Last Received Timeslot      | 24    | 0      |
| Frequency offset rx [Hz]    | -60   | 0      |
| Time offset rx [ms]         | 0.021 | 0.000  |
| Error Vector                | 114   | 0      |
| Last Received Color Codes   | 1     | 0      |
| Last Transmitted Data Types | 0     | 9      |
| RSSI Main [dBm]             | -69.2 | -106.7 |
| RSSI Diversity [dBm]        | -93.9 | -126.8 |

| Item                        | Description                                                                |
|-----------------------------|----------------------------------------------------------------------------|
| Internal Second/Timeslot    | It's internal counter.                                                     |
| Last Received Timeslot      | It shows Last received Timeslot.                                           |
| Frequency offset rx [Hz]    | It shows Frequency offset of RX Signal. Normally it's less than 100.       |
| Time offset rx [ms]         | It shows Time offset of RX. Normally it's less than 0.05                   |
| Error Vector                | It shows Vector Error                                                      |
| Last Received Color Codes   | It shows Last Received Color Code                                          |
| Last Transmitted Data Types | It shows Last Transmitted Data type                                        |
| RSSI Main [dBm]             | It shows RSSI (Received Signal Strength Indication) of Main receiver.      |
| RSSI Diversity [dBm]        | It shows RSSI (Received Signal Strength Indication) of Diversity receiver. |

## 3.3.3.2. DSP and PLD Status

This Window shows DSP and PLD Status that is for factory usage.

Some of them are repeated from Overall Status on here.

Basically, you can refer to Overall Status to know the KAIROS information.

As long as there is no Red indicator, you can omit this window.

**DSP Status - KAIROS <Site Sean>**

**Startup Status**

- DSP Alive and Started
- SPORT-0 Started
- PLD and Clocks
- Audio Codecs Start
- Digital Loop on Codecs
- Clocks from RXs IF
- RXs LC and IF Calibrated
- IFs Alive and Calibrated
- AF Loop on Audio Codecs
- EEP Bank 0 First Reading
- EEP Bank 1 First Reading
- EEP Bank 2 First Reading
- EEP Bank 3 First Reading
- EEP Bank 4 First Reading
- EEP Bank 5 First Reading
- EEP Bank 6 First Reading

**Clocks Status**

- 12.8 MHz Main Clock
- 20 MHz ETRAX Clock
- 40,960 MHz DSP Clock
- 16.384 MHz Codecs Clock
- 5 MHz PTP Input Clock
- SPORT\_0 Clock
- Main RX IF Serial Clock
- Diversity RX IF Serial Clock
- ETRAX Clock Lock
- PLL Inside PLD Lock
- TX PLL Lock
- RX PLL Lock
- DSP<=>PLD Communication

**TRX Status**

| DSP Ready           | TRX Active  |
|---------------------|-------------|
| Clbr Running        | Clbr OK     |
| M, RX Fail          | D, RX Fail  |
| Interrupts from PLD |             |
| SQ                  | Analog PTT  |
| TCS/DPL             | Digital PTT |
| RX DMR TS A         | TX DMR TS A |
| RX DMR TS B         | TX DMR TS B |
| RX P25              | TX P25      |

**Features Status**

| DMR                     | ANALOG    | P25 |
|-------------------------|-----------|-----|
| TX                      | SIMULCAST |     |
| MULTITONE TCS           |           |     |
| SIP                     | POCSAG    |     |
| SNMP                    |           |     |
| NETCONTROL Access       |           |     |
| Radio Amateurs Features |           |     |
| External Raw Access     |           |     |
| Audio from Web          |           |     |
| VVF Features            |           |     |
| 1+1 Redundancy          |           |     |
| ETSI Tier III           |           |     |
| T3 Controller           | T3 NMS    |     |
| Multisite Trunking      |           |     |

**Synchronization Status**

|                                         | Present | Valid | Lock |
|-----------------------------------------|---------|-------|------|
| PPS Signal from GPS                     | Present | Valid | Lock |
| PPS Signal from PTP                     | Present | Valid | Lock |
| External PPS Signal                     | Present | Valid | Lock |
| Superaudio Tone                         | Present | Valid | Lock |
| Synchronization from RF Signal or 4FSK  |         |       | Lock |
| Synchronization from Internal Reference |         |       | Lock |

**DSP Correctly Synchronized**

**DSP Measures**

Last DSP Startup:  
2020-04-24 11:16:16

| Measure                        | Value  |
|--------------------------------|--------|
| Board Code [hex]               | 36     |
| Option Board 1 Code [hex]      | EA     |
| Option Board 2 Code [hex]      | DE     |
| DMR Packets Out of Window      | 0      |
| ANA Packets Out of Window      | 0      |
| Safety Margin for DMR Packets  | 2      |
| Safety Margin for ANA Packets  | 0      |
| DSP Schedule Time [μs]         | 1000   |
| PLD Stack Depth                | 97     |
| DAC Stack Depth                | 10     |
| Timing Error [μs]              | 0.000  |
| PPS Position [μs]              | 42.468 |
| Interrupt Time [μs]            | 62.415 |
| DAC Interrupt Position [μs]    | 15.653 |
| System Resets Committed by DSP | 0      |
| System Resets Committed by PLD | 0      |
| DSP Resets Count               | 1      |
| AXIS Resets Count              | 0      |

**AF Lines Status**

| AF to DMR Codecs                                  | TS A   | TS B    |
|---------------------------------------------------|--------|---------|
| DMR Codecs to AF <td>TS A</td> <td>TS B</td>      | TS A   | TS B    |
| Output Signalling <td>Line 1</td> <td>Line 2</td> | Line 1 | Line 2  |
| Input Signalling <td>Line 1</td> <td>Line 2</td>  | Line 1 | Line 2  |
|                                                   | Line 2 | IP Line |

**Emergency Self-Repeating Mode**

**Analog Measures**

| Measure                        | Value |
|--------------------------------|-------|
| Input Supply Voltage [V]       | 13.0  |
| Board Main Voltage [V]         | 3.15  |
| 12.8 MHz PLL Vtune [mV]        | 1290  |
| 20 MHz PLL Vtune [mV]          | 1310  |
| 43 MHz PLL Vtune [mV]          | 310   |
| 15 MHz PLL Vtune [mV]          | 680   |
| TX LO PLL Vtune [mV]           | 2460  |
| RX LO PLL Vtune [mV]           | 2290  |
| Voltage on V-EXT Input [V]     | 0.000 |
| Voltage on Option Board 1 [mV] | 4780  |
| Voltage on Option Board 2 [mV] | 4760  |
| Equipment Temperature [°C]     | 24    |
| TX Temperature [°C]            | 34    |
| TX Input Current [A]           | 0.000 |
| Forward Power [W]              | 0.780 |
| Reflected Power [W]            | 0.729 |
| S W R                          | > 10  |
| η [%]                          | 0.0   |

**Commands**

Set

Clear Packets Counters

Clear Reset Counters

Unlock SQ ☐

Unlock TCS/DPL ☐

Start Transmission ☐

Disable TX ☐

Line 2 Output Signal ☐

Local TRX Test ☐

Disable Digital Squelch ☐

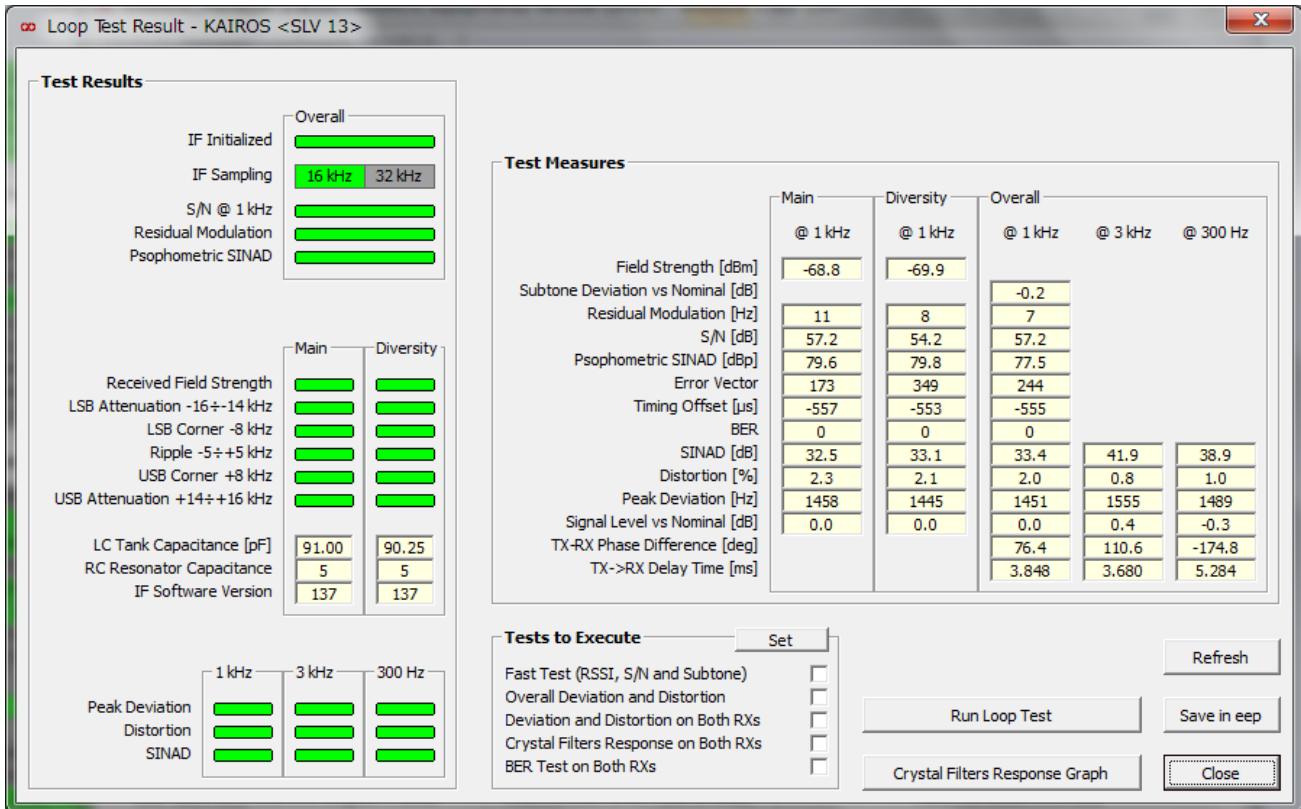
**Force Role to HOT-SPARE**

Close

- Force Role to HOT-SPARE: By pressing this button, KAIROS which is working as Main in 1 + 1 redundancy turns to SPARE.

### 3.3.3.3. Loop Test Result

This menu allows to check the overall performances of synthesizer and of RX. Check all the boxes about "Test to execute"; push "set" button and then "Run loop test". At the end of the test the table with the measurements is filled in and the corresponding flags are green if the test is positive, or red if the test is negative. In this case, depending on the red flags, it is possible to identify the possible cause of the problem.



#### 3.3.3.3.1. Test Results

| Item                | Description (Overall)                               |
|---------------------|-----------------------------------------------------|
| IF Initialized      | Normally Green when IF block ready.                 |
| IF Sampling         | Sampling mode for IF. 16kHz on DMR. Green means OK. |
| S/N @ 1kHz          | 1kHz internal test tone. Green means OK.            |
| Residual Modulation | Residual noise on Modulation. Green means OK.       |
| Psophometric SINAD  | SINAD test. Green means OK.                         |

| Item                           | Description (Main, Diversity)                                       |
|--------------------------------|---------------------------------------------------------------------|
| Received Field Strength        | Test result of field strength for Main and Diversity receiver.      |
| LSB Attenuation-16 to -14 kHz  | Attenuation test result of Lower Side of IF Filter at -16 to -14kHz |
| LSB Corner -8 kHz              | Attenuation test result of Lower corner of IF Filter at -8kHz       |
| Ripple -5 to +5 kHz            | Ripple Test result of IF filter at +/- 5kHz.                        |
| USB Corner +8 kHz              | Attenuation test result of Upper corner of IF Filter at +8kHz       |
| USB Attenuation +14 to +16 kHz | Attenuation test result of Upper Side of IF Filter at -16 to -14kHz |



|                          |                                                                    |
|--------------------------|--------------------------------------------------------------------|
| LC Tank Capacitance [pF] | This is the Value of LC Tank Capacitance which is in the PLD.      |
| RC Resonator Capacitance | This is the Value of RC Resonator Capacitance which is in the PLD. |
| IF Software Version      | Software Version for IF.                                           |

| Item                | Description (1kHz, 3kHz, 300Hz) |
|---------------------|---------------------------------|
| Peak Deviation [Hz] | Green means OK.                 |
| Distortion          | Green means OK.                 |
| SINAD               | Green means OK.                 |

### 3.3.3.3.2. Test Measures

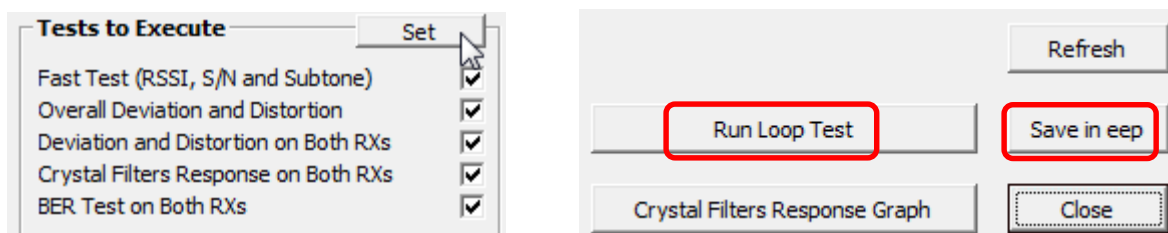
The table with the measurements is filled in

| Test Measures                     |         |           |         |         |          |
|-----------------------------------|---------|-----------|---------|---------|----------|
|                                   | Main    | Diversity | Overall |         |          |
|                                   | @ 1 kHz | @ 1 kHz   | @ 1 kHz | @ 3 kHz | @ 300 Hz |
| Field Strength [dBm]              | -68.8   | -69.9     |         |         |          |
| Subtone Deviation vs Nominal [dB] |         |           | -0.2    |         |          |
| Residual Modulation [Hz]          | 11      | 8         | 7       |         |          |
| S/N [dB]                          | 57.2    | 54.2      | 57.2    |         |          |
| Psophometric SINAD [dBp]          | 79.6    | 79.8      | 77.5    |         |          |
| Error Vector                      | 173     | 349       | 244     |         |          |
| Timing Offset [μs]                | -557    | -553      | -555    |         |          |
| BER                               | 0       | 0         | 0       |         |          |
| SINAD [dB]                        | 32.5    | 33.1      | 33.4    | 41.9    | 38.9     |
| Distortion [%]                    | 2.3     | 2.1       | 2.0     | 0.8     | 1.0      |
| Peak Deviation [Hz]               | 1458    | 1445      | 1451    | 1555    | 1489     |
| Signal Level vs Nominal [dB]      | 0.0     | 0.0       | 0.0     | 0.4     | -0.3     |
| TX-RX Phase Difference [deg]      |         |           | 76.4    | 110.6   | -174.8   |
| TX->RX Delay Time [ms]            |         |           | 3.848   | 3.680   | 5.284    |

### 3.3.3.3.3. Test to Execute

Check all the check-boxes in "Test to execute"; push "set" button and then "Run loop test". Please make sure that no signal is applied to the RX input while performing this test, else some wrong results are possible.

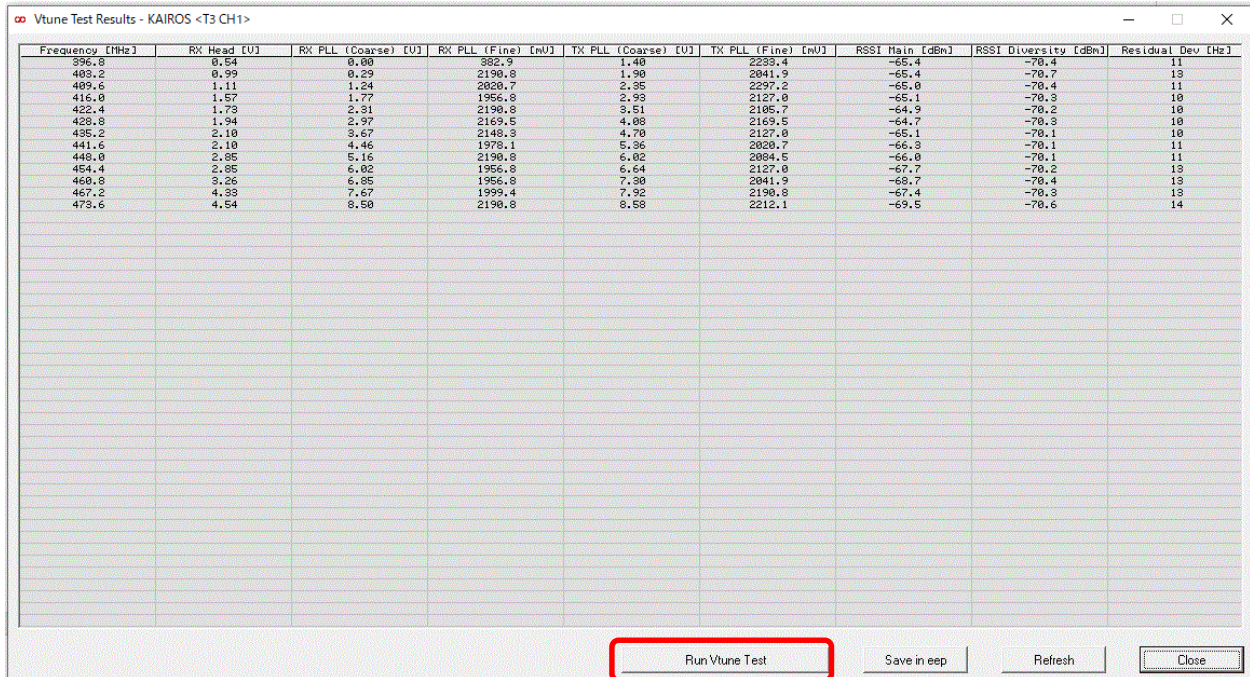
At the end, save the results by pushing the "Save in eep" button.



The tuning of Kairos is completed. The self-test is able to check every parameter of the modulator and of the demodulator, except for the TX output power and the RX sensitivity, which should be tested by external devices.

### 3.3.3.4. Vtune Test Result

The Kairos embeds a DSP based algorithm for self-tuning the input filters of the main and diversity RX, the coarse control voltage of the local VCOs of TX and RX and for self-testing the overall performances of the synthesizer and receiver. This test is performed by internally connecting the output of the synthesizer to the input of the RX and by comparing the transmitted pattern to the received one.



| Frequency [MHz] | RX Head [V] | RX PLL (Coarse) [V] | RX PLL (Fine) [mV] | TX PLL (Coarse) [V] | TX PLL (Fine) [mV] | RSSI Main [dBm] | RSSI Diversity [dBm] | Residual Dev [Hz] |
|-----------------|-------------|---------------------|--------------------|---------------------|--------------------|-----------------|----------------------|-------------------|
| 396.8           | 0.54        | 0.00                | 382.9              | 1.40                | 2233.4             | -66.4           | -70.4                | 11                |
| 403.2           | 0.99        | 0.29                | 2190.8             | 1.90                | 2041.9             | -66.4           | -70.7                | 13                |
| 409.6           | 1.11        | 1.24                | 2039.7             | 2.35                | 2297.2             | -65.0           | -70.4                | 11                |
| 416.0           | 1.57        | 1.77                | 1956.8             | 2.93                | 2127.0             | -65.1           | -70.3                | 10                |
| 422.4           | 1.73        | 2.31                | 2190.8             | 3.51                | 2105.7             | -64.9           | -70.2                | 10                |
| 428.8           | 1.94        | 2.97                | 2169.5             | 4.00                | 2169.5             | -64.7           | -70.3                | 10                |
| 435.2           | 2.10        | 3.57                | 2148.3             | 4.70                | 2127.0             | -65.1           | -70.1                | 10                |
| 441.6           | 2.10        | 4.46                | 1978.1             | 5.36                | 2020.7             | -66.3           | -70.1                | 11                |
| 448.0           | 2.05        | 5.16                | 2190.8             | 6.02                | 2004.5             | -66.0           | -70.1                | 11                |
| 454.4           | 2.05        | 6.02                | 1956.8             | 6.64                | 2127.0             | -67.7           | -70.2                | 13                |
| 460.8           | 3.26        | 6.85                | 1956.8             | 7.30                | 2041.9             | -68.7           | -70.4                | 13                |
| 467.2           | 4.33        | 7.67                | 1999.4             | 7.92                | 2190.8             | -67.4           | -70.3                | 13                |
| 473.6           | 4.54        | 8.50                | 2190.8             | 8.58                | 2212.1             | -69.5           | -70.6                | 14                |

To make this test,

Step 1: If the KAIROS is in **UHF band (KA-450 and KA-500 only)** connect a **50 ohm dummy load to the input of diversity RX**; else if the KAIROS is in **VHF or other band, leave the RX input (both Main and Diversity) open**.

Step 2: Push the button "Run Vtune test"; wait the end of the test and "save to EEPROM".

During this test the Kairos fills in a lookup table with the tuning voltage (as a function of the frequency) of the RX input filters and the coarse control voltage of the VCOs. This test is performed by Factory just once during the life of the equipment, because every slight change during aging will be compensated by internal fine tuning.

Step 3: Remove the dummy load.

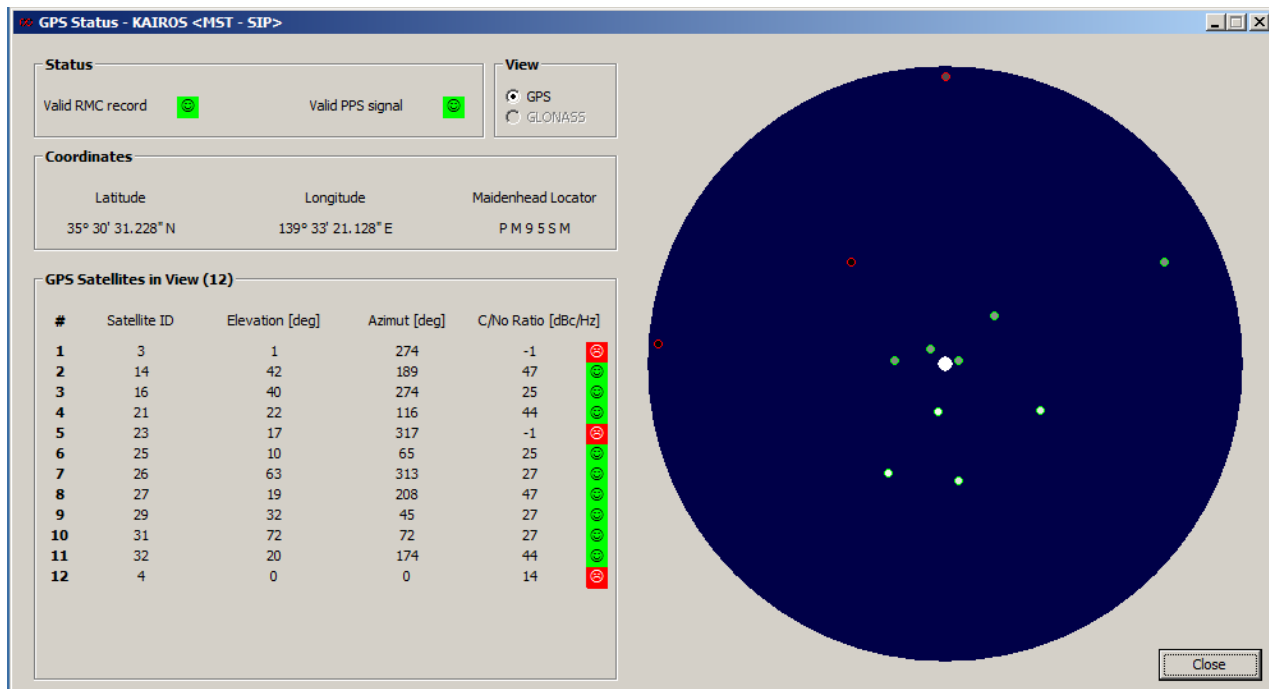
Step 4: Open the menu Kairos – Controls - Loop test result.

Step 5: Do Loop Test Result (3.3.3.3)

| Item                | Description                          |
|---------------------|--------------------------------------|
| Frequency [MHz]     | Test Frequency                       |
| RX Head [V]         | BPF Voltage for RX front-end         |
| RX PLL (Coarse) [V] | Coarse adjustment Voltage for RX PLL |
| RX PLL (Fine) [mV]  | Fine adjustment Voltage for RX PLL   |

|                      |                                     |
|----------------------|-------------------------------------|
| TX PLL (Coarse) [V]  | Coase adjustment Voltage for TX PLL |
| TX PLL (Fine) [mV]   | Fine adjustment Voltage for TX PLL  |
| RSSI Main [dBm]      | RSSI level for Main RX              |
| RSSI Diversity [dBm] | RSSI level for Diversity RX         |
| Residual Dev [Hz]    | Deviation by Residual noise         |

## 3.3.3.5. GPS Status



Bad Condition



Good Condition

## 3.3.3.5.1. Status

| Item             | Description                                                          |
|------------------|----------------------------------------------------------------------|
| Valid RMC record | While the GPS receiver Re-code Valid RMC sentence, it becomes Green. |
| Valid PPS Signal | While the GPS receiver outputs Valid PPS signal, it becomes Green.   |

## 3.3.3.5.2. View

| Item        | Description                    |
|-------------|--------------------------------|
| GPS/GLONASS | It Shows a GPS receiving mode. |

## 3.3.3.5.3. Coordinates

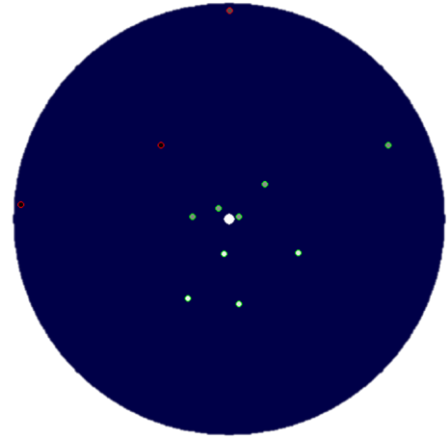
| Item               | Description                                  |
|--------------------|----------------------------------------------|
| Latitude           | Latitude information                         |
| Longitude          | Longitude information                        |
| Maidenhead Locator | Grid Square Locator of positioning location. |

**3.3.3.5.4. GSP Satellites in View**

It can show Signal Status of each Satellite.

If GPS receiver receives more than 3 Satellites (More than 3 Greens), it can positioning location, also output valid PPS signal.

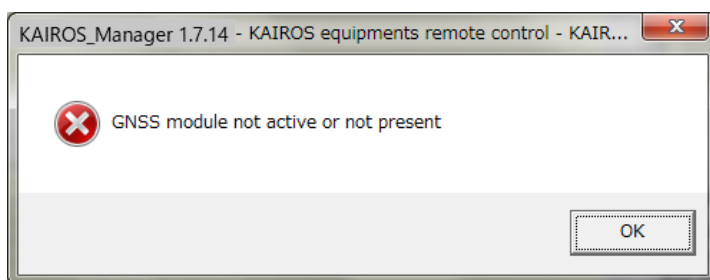
| #  | Satellite ID | Elevation [deg] | Azimuth [deg] | C/No Ratio [dBc/Hz] |   |
|----|--------------|-----------------|---------------|---------------------|---|
| 1  | 3            | 1               | 274           | -1                  | 🔴 |
| 2  | 14           | 42              | 189           | 47                  | 🟢 |
| 3  | 16           | 40              | 274           | 25                  | 🟢 |
| 4  | 21           | 22              | 116           | 44                  | 🟢 |
| 5  | 23           | 17              | 317           | -1                  | 🔴 |
| 6  | 25           | 10              | 65            | 25                  | 🟢 |
| 7  | 26           | 63              | 313           | 27                  | 🟢 |
| 8  | 27           | 19              | 208           | 47                  | 🟢 |
| 9  | 29           | 32              | 45            | 27                  | 🟢 |
| 10 | 31           | 72              | 72            | 27                  | 🟢 |
| 11 | 32           | 20              | 174           | 44                  | 🟢 |
| 12 | 4            | 0               | 0             | 14                  | 🔴 |



If the GPS receiver can't catch GPS signal due to GPS antenna or cable problem, it shows "POOR RECEPTION"

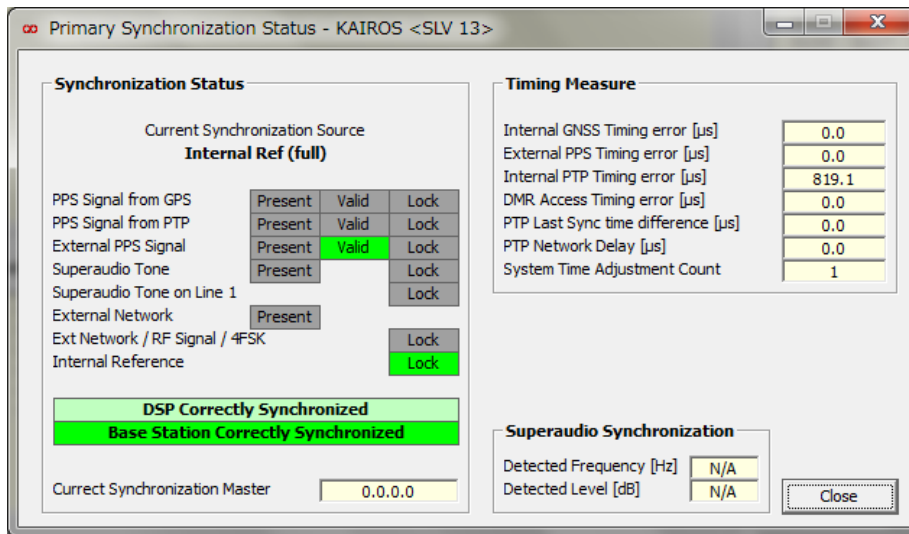
|    |              |                 |               |                     | POOR RECEPTION |
|----|--------------|-----------------|---------------|---------------------|----------------|
| #  | Satellite ID | Elevation [deg] | Azimuth [deg] | C/No Ratio [dBc/Hz] |                |
| 1  | 8            | 0               | 219           | -1                  | 🔴              |
| 2  | 9            | 1               | 328           | -1                  | 🔴              |
| 3  | 14           | 25              | 185           | -1                  | 🔴              |
| 4  | 16           | 50              | 295           | -1                  | 🔴              |
| 5  | 21           | 30              | 100           | -1                  | 🔴              |
| 6  | 23           | 25              | 305           | -1                  | 🔴              |
| 7  | 25           | 0               | 76            | -1                  | 🔴              |
| 8  | 26           | 65              | 353           | -1                  | 🔴              |
| 9  | 27           | 36              | 214           | -1                  | 🔴              |
| 10 | 29           | 18              | 40            | -1                  | 🔴              |
| 11 | 31           | 62              | 111           | -1                  | 🔴              |
| 12 | 32           | 5               | 171           | -1                  | 🔴              |

If KAIROS is not installed GPS receiver unit or not active due to some reason, following message pops up.



### 3.3.3.6. Primary Synchronization Status

This is a specialized window for Synchronization.



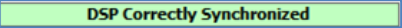
#### 3.3.3.6.1. Synchronization Status

- Present: It turns green if the Signal for Synchronization exists. There may be more than one Green.
- Valid: It turns Green when the synchronization signal is Valid. There may be more than one Green.
- Lock: It turns Green the signal KAIROS uses for synchronization. It displays only one.

| Item                           | Description                                                                                                                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Current Synchronization Source | Here it shows what method KAIROS is currently synchronizing by.                                                                                                                                                                 |
| PPS Signal from GPS            | Here it shows PPS signal from Internal GPS receiver. (Option)                                                                                                                                                                   |
| PPS Signal from PTP            | Here it shows PPS signal from PTP.                                                                                                                                                                                              |
| External PPS Signal            | Here it shows PPS signal from External connector Pin2.<br>Connector locates on its rear panel.                                                                                                                                  |
| Superaudio Tone                | Here it shows presence and lock status of Superaudio tone which is an old style synch source, via 4Wire, through a pattern made by tones on super-audio band (3-3.4kHz). Not use this nowadays.                                 |
| Superaudio Tone on Line 1      | Here it shows Superaudio Tone which on Line 1 status.                                                                                                                                                                           |
| External Network               | Here it shows whether External Network for Synchronization is present.                                                                                                                                                          |
| Ext Network / RF Signal / 4FSK | Here it shows Lock status by External Network for Synchronization.                                                                                                                                                              |
| Internal Reference             | Here it shows Lock status by Internal Reference for Synchronization. Though "Internal Reference" is not the 1st choice for Synchronization but in case it lights here up, it means 1st choice Synchronization has some problem. |





|                                                                                   |                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>Here it shows whether DSP is synchronized correctly or not.<br/>Usually here is Green as Correctly Synchronized.<br/>Light Green means “Synchronization” is locked by Internal Reference as 2nd choice</p> |
|  | <p>Here it shows whether Base Station is synchronized correctly or not.<br/>Usually here is Green as Correctly Synchronized.</p>                                                                              |

### 3.3.3.6.2. Timing Measure

This window shows Timing measure information for various synchronization source.

| Timing Measure                     |       |
|------------------------------------|-------|
| Internal GNSS Timing error [μs]    | 0.0   |
| External PPS Timing error [μs]     | 0.0   |
| Internal PTP Timing error [μs]     | 819.1 |
| DMR Access Timing error [μs]       | 0.0   |
| PTP Last Sync time difference [μs] | 0.0   |
| PTP Network Delay [μs]             | 0.0   |
| System Time Adjustment Count       | 1     |

### 3.3.3.6.3. Superaudio Synchronization

This is Old Synchronization method in Analog FM. It is not used nowadays.

| Superaudio Synchronization |     |
|----------------------------|-----|
| Detected Frequency [Hz]    | N/A |
| Detected Level [dB]        | N/A |

### 3.3.3.7. Audio Line Control

Audio line control is a tool for a technician to investigate KAIROS connections by generate signal by DSP. Line Out for the generator, Line In for the detector.

**Audio Lines Control - KAIROS <SLV 13>**

**Lines Status**

| LINE    | IN  | SYNC   |
|---------|-----|--------|
| LINE 1  | OUT | PTT IN |
| LINE 2  | OUT |        |
| LINE IP | IN  |        |
| LINE RX | OUT |        |
| AMBE 1  | IN  |        |
| AMBE 2  | OUT |        |

**Received Tones on Line 1**

| Level [dBm] | PTT   | Sync |
|-------------|-------|------|
| -20.0       | -20.0 |      |
| 0           | 0     |      |

**Lines Calibrations**

Echo Line 1: Absolute line delay [ms]

Equal. Line 1:

Equal. Line 2:  Store on Flash

**Access**

**Reading**  ☐ Cont. Reading

**Active Line**

☐ Force Input Signalling

Line In: 1, 2, IP, RX, AMBE1, AMBE2, NONE

Decoder off

**Decoded Sel Call / DTMF**

SEL CALL: 0000 0000 0000 0000

DTMF: 0000 0000 0000 0000

**Measures**

S+N+D level [dB]: -57.2

Estimated SINAD [dB]: 25.1

Distortion [%]: 5.5

Decoded audio freq. [Hz]: 0

Instant audio freq. [Hz]: 1000

In/Ref Sig. phase [deg]: 90.0

Network Delay [ms]: 0.00

Errs detected in BER test: 0

Error vector in BER test: 0

BER:

**Line Out**

☐ Force Output Signalling

Line Out: 1, 2, IP, TX, AMBE1, AMBE2, NONE

Encoder off

**DTMF Sending Parameters**

Number to send:

**Not connected**

Test Frequency [Hz]: 1000

Sq. wave ON [ms]: 30

Sq. wave OFF [ms]: 970

☐ Hi-Pass flt. [Hz]:

☐ Lo-Pass flt. [Hz]:

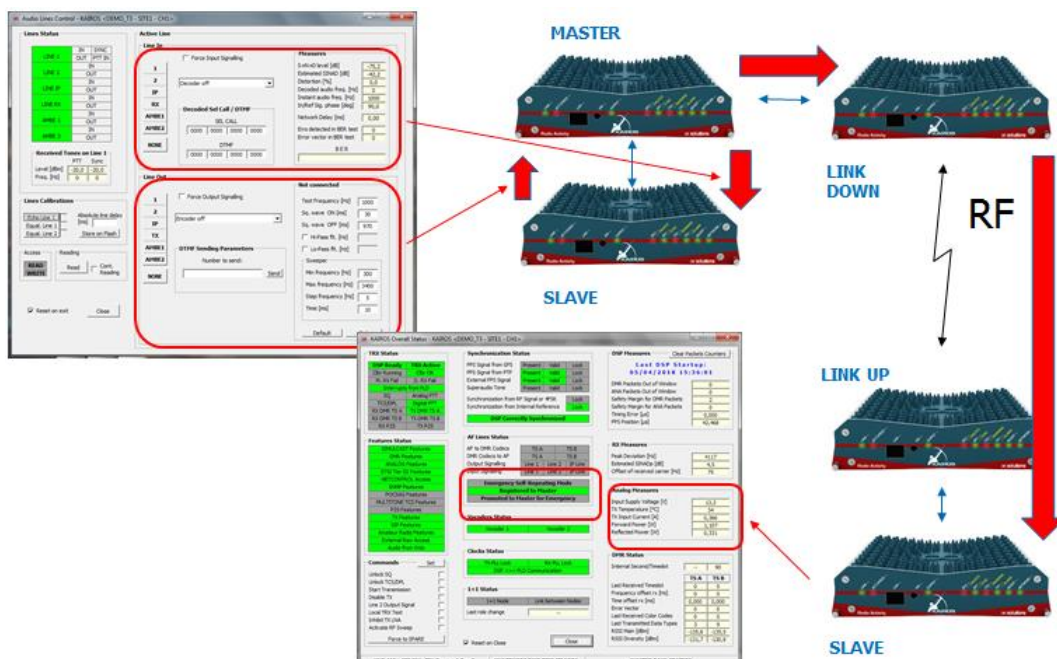
**Sweeper**

Min frequency [Hz]: 300

Max frequency [Hz]: 3400

Step frequency [Hz]: 5

Time [ms]: 10



**3.3.3.7.1. Line Status**

This is indicator to show which LINE of IN/OUT is active now.  
IN means "Line In", OUT means "Line Out".

| Lines Status |     |        |
|--------------|-----|--------|
| LINE 1       | IN  | SYNC   |
|              | OUT | PTT IN |
| LINE 2       | IN  |        |
|              | OUT |        |
| LINE IP      | IN  |        |
|              | OUT |        |
| LINE RX      | IN  |        |
|              | OUT |        |
| AMBE 1       | IN  |        |
|              | OUT |        |
| AMBE 2       | IN  |        |
|              | OUT |        |

| Item    | Description                     |
|---------|---------------------------------|
| LINE 1  | Input port Line 1 for AUX port. |
| LINE 2  | Input port Line 2 for AUX port  |
| LINE IP | Input from IP Network           |
| LINE RX | Input from RX                   |
| AMBE 1  | Input from AMBE 1               |
| AMBE 2  | Input from AMBE 2               |

**3.3.3.7.2. Active Line**

## ➤ Line In

It is a tool to force input audio from selected Input Line to decode the signal.

Check "Cont. Reading" then press "Read" to display the Measures in "Line In" window.

Reading

Read ☐ Cont. Reading

Select button such as "IP", then check "Force Input Signalling" to update Measures.

**Line In**

☐ Force Input Signalling

1  
2  
IP  
RX  
AMBE1  
AMBE2  
NONE

Decoder off

**Decoded Sel Call / DTMF**

SEL CALL  
0000 0000 0000 0000

DTMF  
0000 0000 0000 0000

**Measures**

|                           |       |
|---------------------------|-------|
| S+N+D level [dB]          | -57.2 |
| Estimated SINAD [dB]      | 25.1  |
| Distortion [%]            | 5.5   |
| Decoded audio freq. [Hz]  | 0     |
| Instant audio freq. [Hz]  | 1000  |
| In/Ref Sig. phase [deg]   | 90.0  |
| Network Delay [ms]        | 0.00  |
| Errs detected in BER test | 0     |
| Error vector in BER test  | 0     |
| BER                       |       |

## ➤ Line Out

It is a tool to force output audio from selected Output Line.

If you would like to send audio on IP line, press "IP" then check "Force Output Signalling", you can choose signal pattern from pull-down selection.

You can modify the signal waveform by entering numbers on the right side.

## 3.3.3.8. AF Test

This is a setting window to support Audio Line Control.

**AF Test**

**AF Test Configuration**

- ☒ Enable AF Generator
- ☒ Enable Audio Analyzer
- ☐ Activate PTT on AF presence
- ☐ Insert psofo filter

**Test Mode Settings**

Encoder off

Decoder off

**Decoded Sel Call / DTMF**

SEL CALL

0000 0000 0000 0000

DTMF

0000 0000 0000 0000

**AF Generator Settings**

Test Frequency [Hz] 1000

Min sweep frequency [Hz] 300

Max sweep frequency [Hz] 3400

Sweep step frequency [Hz] 5

Sweep Time [ms] 10

Sq. wave ON Time [ms] 30

Sq. wave OFF Time [ms] 970

☐ Hi-Pass filter [Hz]

☐ Lo-Pass filter [Hz]

Default Set

**Sw Module Status**

- ☒ Parameters carrying enabled
- ☒ AF Generator enabled
- ☒ Audio Analyzer enabled

**Measures**

S+N+D level [dB] -57.2

Estimated SINAD [dB] 25.1

Distortion % 5.5

Decoded audio freq. [Hz] 0

Instant audio freq. [Hz] 1000

In/Ref Signals phase [deg] 90.0

Network Delay [ms] 0.00

Errors detected in BER test 0

Error vector in BER test 0

BER

**DTMF Sending Parameters**

Number to send: 0123456789ABCDE

Send

Tone length ms

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |

Default

Set

**Modem Sequence Test Parameters**

| 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
|------|------|------|------|------|------|------|------|
| 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   |

Words per bit-sequence hex

Set

**Access**

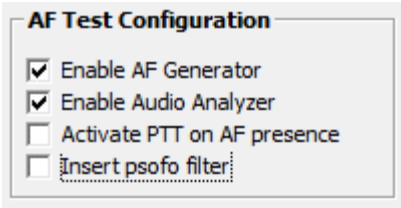
Read Write

**Reading**

Read ☐ Cont. Reading

Exit

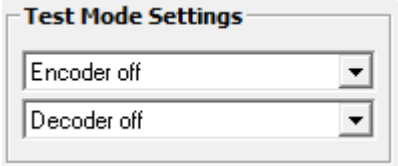
**3.3.3.8.1.      AF Test Configuration**



| Item                        | Description                                      |
|-----------------------------|--------------------------------------------------|
| Enable AF Generator         | Check here normally to generate AF signal.       |
| Enable Audio Analyzer       | Check here normally to activate Audio Analyzer.  |
| Activate PTT on AF presence | If check here active PTT by Audio source.        |
| Insert psofo filer          | If check here decoder adds DSP filter (300-3kHz) |

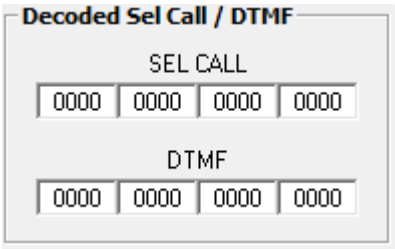
**3.3.3.8.2.      Test Mode Settings**

You can set Encoder / Decoder on /off by pull-down setting.



**3.3.3.8.3.      Decoded Sel Call / DTMF**

Decoded Sel call / DTMF code will be displayed here.





**3.3.3.8.4. AF Generator Settings**

**AF Generator Settings**

Test Frequency [Hz]

Min sweep frequency [Hz]

Max sweep frequency [Hz]

Sweep step frequency [Hz]

Sweep Time [ms]

Sq. wave ON Time [ms]

Sq. wave OFF Time [ms]

☐ Hi-Pass filter [Hz]

☐ Lo-Pass filter [Hz]

| Item                      | Description                                         |
|---------------------------|-----------------------------------------------------|
| Test Frequency [Hz]       | You can define Test tone frequency. Usually 1000Hz. |
| Min sweep frequency [Hz]  | Minimum frequency of sweep tone.                    |
| Max sweep frequency [Hz]  | Maximum frequency of sweep tone.                    |
| Sweep step frequency [Hz] | Step frequency of sweep tone.                       |
| Sq. wave ON Time [ms]     | Square Wave On time.                                |
| Sq. wave OFF Time [ms]    | Square Wave Off time.                               |
| Hi-Pass filter [Hz]       | Hi-Pass filter Enable/Disable, cutoff Frequency     |
| Lo-Pass filter [Hz]       | Low-Pass filter Enable/Disable, cutoff Frequency    |

**3.3.3.8.5. Sw Module Status**

**Sw Module Status**

☒ Parameters carrying enabled  
☒ AF Generator enabled  
☒ Audio Analyzer enabled

| Item                        | Description                                                     |
|-----------------------------|-----------------------------------------------------------------|
| Parameters carrying enabled | It turns on Green if AF Generator Settings are loaded correctly |
| AF Generator enabled        | It turns Green if the AF Generator Module is ready.             |
| Audio Analyzer enabled      | It turns Green if the Audio Analyzer Module is ready.           |

**3.3.3.8.6. Measures**

Here you can read the Measures

**Measures**

S+N+D level [dB]   
 Estimated SINAD [dB]   
 Distortion %   
 Decoded audio freq. [Hz]   
 Instant audio freq. [Hz]   
 In/Ref Signals phase [deg]   
 Network Delay [ms]   
 Errors detected in BER test   
 Error vector in BER test   
 B E R

**3.3.3.8.7. DTMF sending Parameters**

**DTMF Sending Parameters**

Number to send:

Tone length ms

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |

**3.3.3.8.8. Modem Sequence Test Parameters**

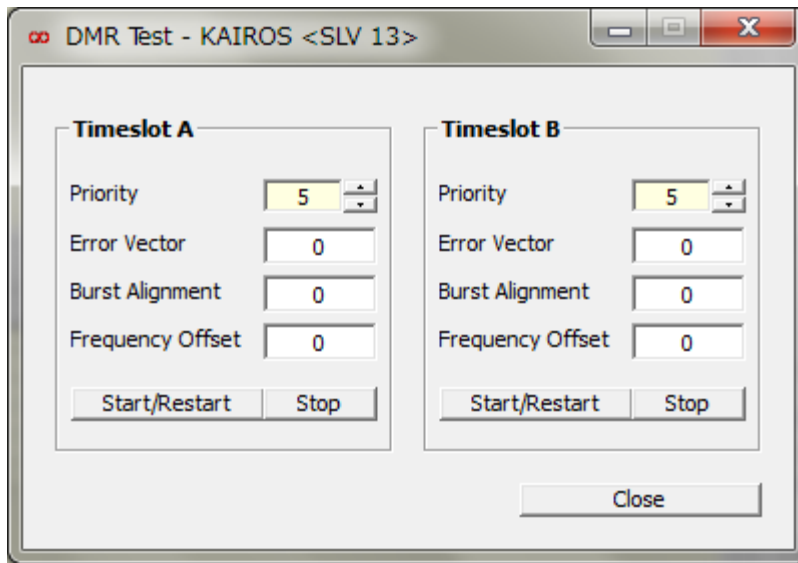
**Modem Sequence Test Parameters**

Words per bit-sequence hex

|                                   |                                   |                                   |                                   |                                   |                                   |                                   |                                   |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| 1                                 | 2                                 | 3                                 | 4                                 | 5                                 | 6                                 | 7                                 | 8                                 |
| <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> |
| <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> | <input type="text" value="0000"/> |
| 9                                 | 10                                | 11                                | 12                                | 13                                | 14                                | 15                                | 16                                |

## 3.3.3.9.DMR Test

Here you can set DMR Test signal.



| Item             | Description                                                                                                                               |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Priority         | TX priority setting. Bigger number is higher priority.                                                                                    |
| Error Vector     | 0-200: Very Good<br>200-600 Good<br>600-800: Critical<br>800-1200: Intermittent receiving.<br>1200-1500: No communication, Squelch Closed |
| Burst Alignment  | Time offset in DMR                                                                                                                        |
| Frequency Offset | Frequency offset in DMR                                                                                                                   |

3.3.3.10. **P25 BER Test - TX**

TX test for P25 Phase 1 protocol.

**P25 BER Test - KAIROS <Site Sean>**

**TX Test**

**Test Type**

Calibration Pattern

Start Test Stop Test Clear Test Abort Test

**Test Status**

Calibration Pattern

**Transmitted Bits**

Current Frame 0

Total 0

Close

3.3.3.11. **P25 BER Test - RX**

RX test for P25 Phase 1 protocol.

**P25 BER Test - KAIROS <Site Sean>**

**RX Test**

**Test Status**

|           |              |
|-----------|--------------|
| RX Active | Synchronized |
|-----------|--------------|

Acceptance threshold: HIGH RSSI

Current NAC:

Current Data Type:

Current RSSI: --

Frames Sequence Errors: 0

Start Test Stop Test Clear Test Abort Test

Toggle Acceptance Threshold

**Automatic restart every...**

seconds

In the text box you can indicate a time, even in decimal form that will be rounded to the first decimal number and converted to the specified unit (i.e., 0.5 s will be 500 ms, 2.5 min will be 150 s, 1.3 days will be 31 h and 12 min, and so on). The lower limit is 0.2 s, the higher limit is 3 days. A blank field or a 0 will mean 'never restart'.

**Current Frame**

Received bits: 0

Wrong Bits: --

Error Rate: --

**Instant**

Received bits: 0

Wrong Bits: --

Error Rate: --

**Last Cycle**

Received bits: 0

Wrong Bits: --

Error Rate: --

3.3.3.12. **SRT-DL Cell Status**

"SRT-DL Cell Status" is not available.

3.3.3.13. **Base Stations Viewer**

| BS ID    | BS Name | BS Role | Node Type | Private IP   | Public IP    | Delay [ms] | Activity      |
|----------|---------|---------|-----------|--------------|--------------|------------|---------------|
|          |         |         |           |              |              |            | TS A TS B ANA |
| 08408930 | SLV 13  | MASTER  | --        | 172.33.91.14 | 172.33.91.14 | --         |               |

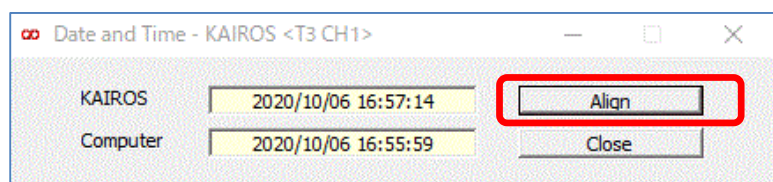
| Item       | Description                                                                                                                                                                                      |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BS ID      | Base Station ID                                                                                                                                                                                  |
| BS Name    | Base Station Name                                                                                                                                                                                |
| BS Role    | Base Station Role                                                                                                                                                                                |
| Node Type  | Node type                                                                                                                                                                                        |
| Private IP | Private IP address                                                                                                                                                                               |
| Public IP  | Public IP address                                                                                                                                                                                |
| Delay [ms] | Delay time of IP network                                                                                                                                                                         |
| Activity   | It can display Active slot for each station of network in here.<br>Yellow for the KAIROS which is receiving.<br>Green for the KAIROS which is receiving and chosen as the best signal by voting. |

3.3.3.14. **Date and Time**

Date and Time alignment is required.

In Tier III or S-Trunking, a KAIROS which is installed TSC must require this alignment.

This is time alignment for the KAIROS to adjust to your Computer time.



### 3.3.4. Statistics

KAIROS can show following Statistics;

#### 3.3.4.1. Station Statistics

It shows station statistics in Analog only.

You can know the RX frequency is affected by interference by comparing Network Commitment.

| Station Statistics - KAIROS <BDCST SITE MASTER VHF> |                       |                       |                       |
|-----------------------------------------------------|-----------------------|-----------------------|-----------------------|
| UTC Date/Time                                       | Network Commitment    | RX Commitment         | RX Interferences      |
| 2018-07-25 01:00 - 01:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 02:00 - 02:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 03:00 - 03:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 04:00 - 04:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 05:00 - 05:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 06:00 - 06:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 07:00 - 07:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 08:00 - 08:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 09:00 - 09:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 10:00 - 10:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 11:00 - 11:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 12:00 - 12:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 13:00 - 13:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 14:00 - 14:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 15:00 - 15:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 16:00 - 16:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 17:00 - 17:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 18:00 - 18:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 19:00 - 19:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 20:00 - 20:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 21:00 - 21:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 22:00 - 22:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-25 23:00 - 23:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| 2018-07-26 00:00 - 00:59                            | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        | 0.0 s (0.00 %)        |
| <b>24-Hours Summary</b>                             | <b>0.0 s (0.00 %)</b> | <b>0.0 s (0.00 %)</b> | <b>0.0 s (0.00 %)</b> |

Dump to Text File

Dump to CSV File

Close



## 3.3.4.2. Network Statistics

Network Statistics - KAIROS <BDCST SITE MASTER VHF>

BDCST SITE MASTER VHF

| UTC Date/Time            | RX DMR TS A | RX DMR TS B | RX ANALOG  | VT DMR TS A | VT DMR TS B | VT ANALOG  |
|--------------------------|-------------|-------------|------------|-------------|-------------|------------|
| 2018-07-25 04:00 - 04:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 05:00 - 05:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 06:00 - 06:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 07:00 - 07:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 08:00 - 08:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 09:00 - 09:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 10:00 - 10:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 11:00 - 11:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 12:00 - 12:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 13:00 - 13:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 14:00 - 14:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 15:00 - 15:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 16:00 - 16:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 17:00 - 17:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 18:00 - 18:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 19:00 - 19:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 20:00 - 20:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 21:00 - 21:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 22:00 - 22:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-25 23:00 - 23:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-26 00:00 - 00:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-26 01:00 - 01:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-26 02:00 - 02:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |
| 2018-07-26 03:00 - 03:59 | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) | 0 (0.00 %)  | 0 (0.00 %)  | 0 (0.00 %) |

Tab View  
Hours of the day  
Stations

ID View  
Station Name  
Station ID  
IP Address  
Equipment S/N  
Equipment ID

Close

## 3.3.4.3. Packets Counter

Packets Counter - KAIROS <BDCST SITE MASTER VHF>

**DIGITAL Branch**

Voter Margin [30 ms ticks]: 4

**DMR**

Received Packets: 243  
Transmitted Packets: 1076  
Packets Out of Rx Window: 0  
Packets Out of Tx Window: 0  
LAN Compression Rate [%]: 0

**P25**

Received Packets: 0  
Transmitted Packets: 0  
Packets Out of Rx Window: 0  
Packets Out of Tx Window: 0

**ANALOG Branch**

Voter Margin [30 ms ticks]: 3

**ANALOG**

Received Packets: 0  
Transmitted Packets: 562  
Packets Out of Rx Window: 0  
Packets Out of Tx Window: 0  
LAN Compression Rate [%]: 0

**DATA MESSAGES**

Received Packets: 0  
Transmitted Packets: 0  
Packets Out of Rx Window: 0  
Packets Out of Tx Window: 0

**Physical Audio Lines**

**LINE 0**

Input Packets from Line: 0  
Output Packets to Line: 0

**LINE 1**

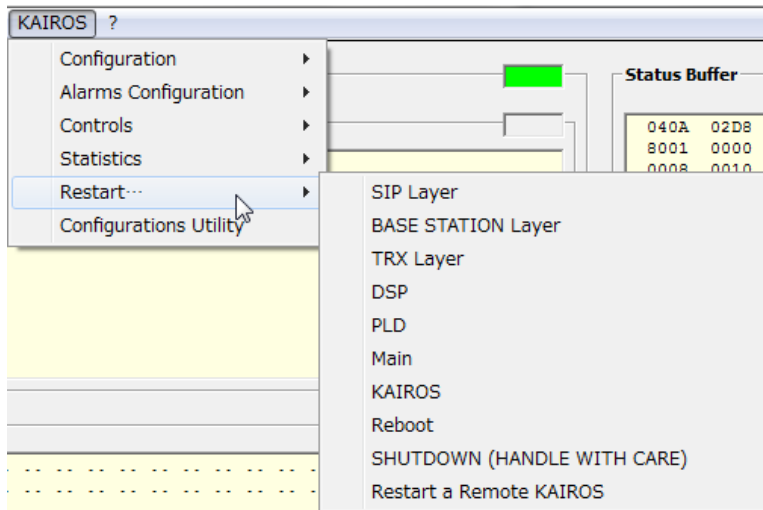
Input Packets from Line: 0  
Output Packets to Line: 0

Clear Close

### 3.3.5. Restart...

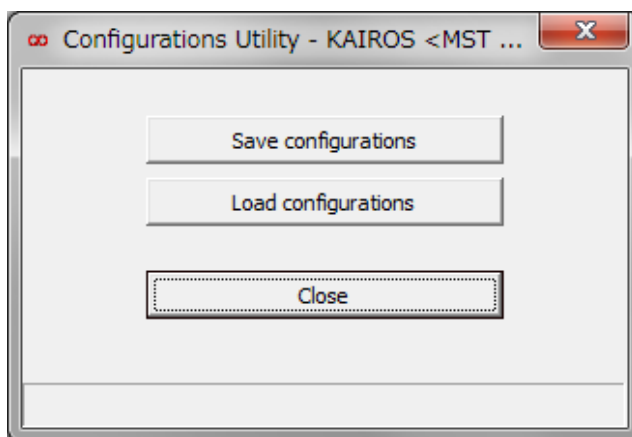
From this menu, you can choose to perform a layer-specific re-start, or a complete restart of a power off.

Warning: If you Shutdown a remote equipment, the only way to power it back on is by hitting the physical button on-site.



- KAIROS: Restart all application in KAIROS.
- Reboot: Linux OS restarts and all the applications will restart.
- Restart a Remote KAIROS: If you need to restart a KAIROS which is beyond RF-Link. (A KAIROS which cannot be connected by IP network)

### 3.3.6. Configurations Utility



#### 3.3.6.1. Save configurations

You can save KAIROS (TRX+DSP) configurations into file.

### 3.3.6.2. Load Configurations

After press Load configurations, following "Select Items to Load" window will appear.

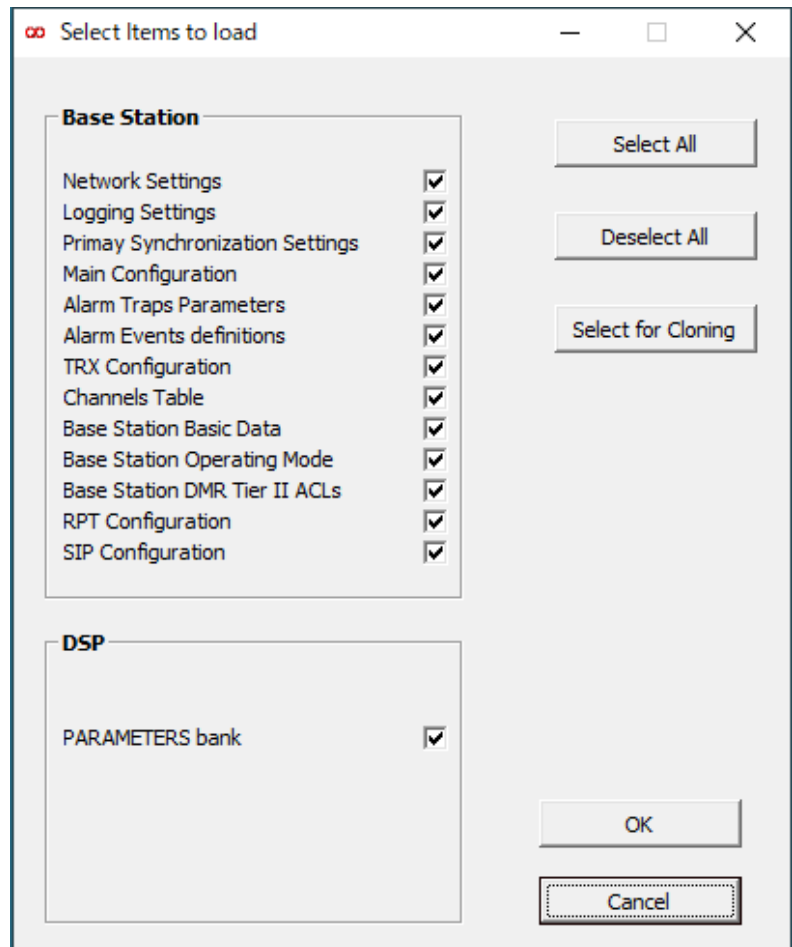
In this window, you can select item which you want to load.

By using Load Configurations, you can do not only save/load, but also do cloning.

If you clone KAIROS by load data, please take note following Tips,

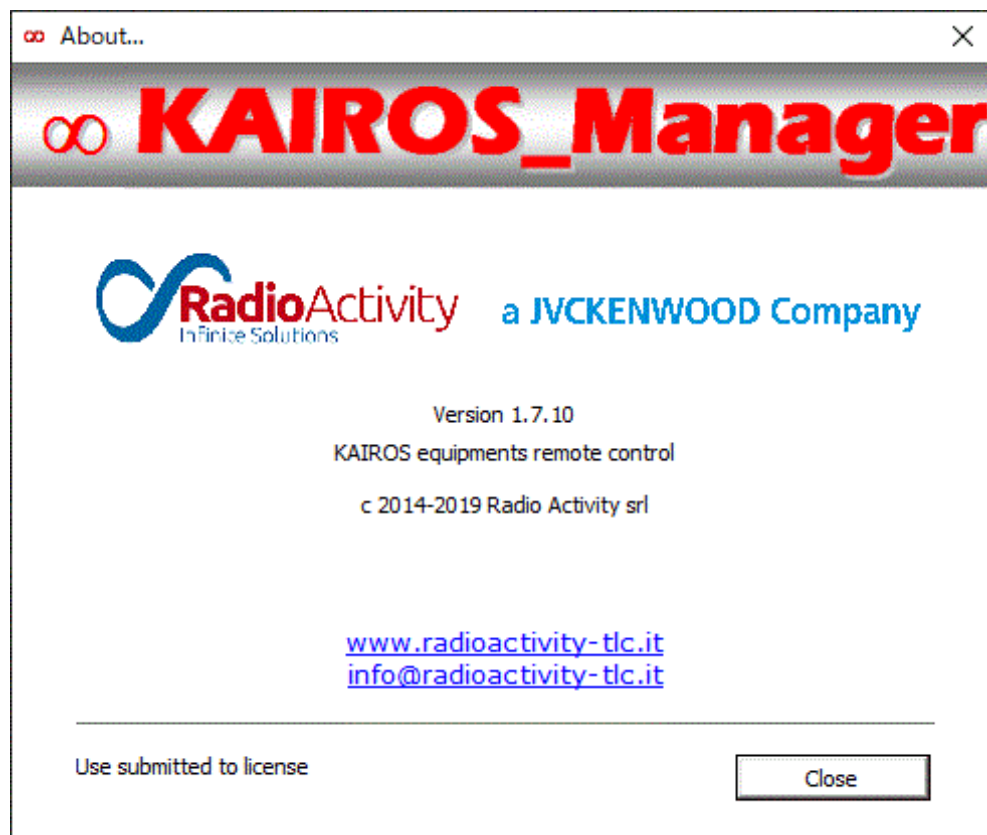
Note:

- Network Settings: You need to pay attention in case you check "Network Settings", it will affect KAIROS IP address after restart.
- Main Configuration: This part includes some Identify Data.
- Channels Table: You can load file to different frequency's model, like Load VHF file to UHF, in that case, you need to uncheck Channels Table, otherwise your KAIROS will be unlocked.



### 3.4. ?

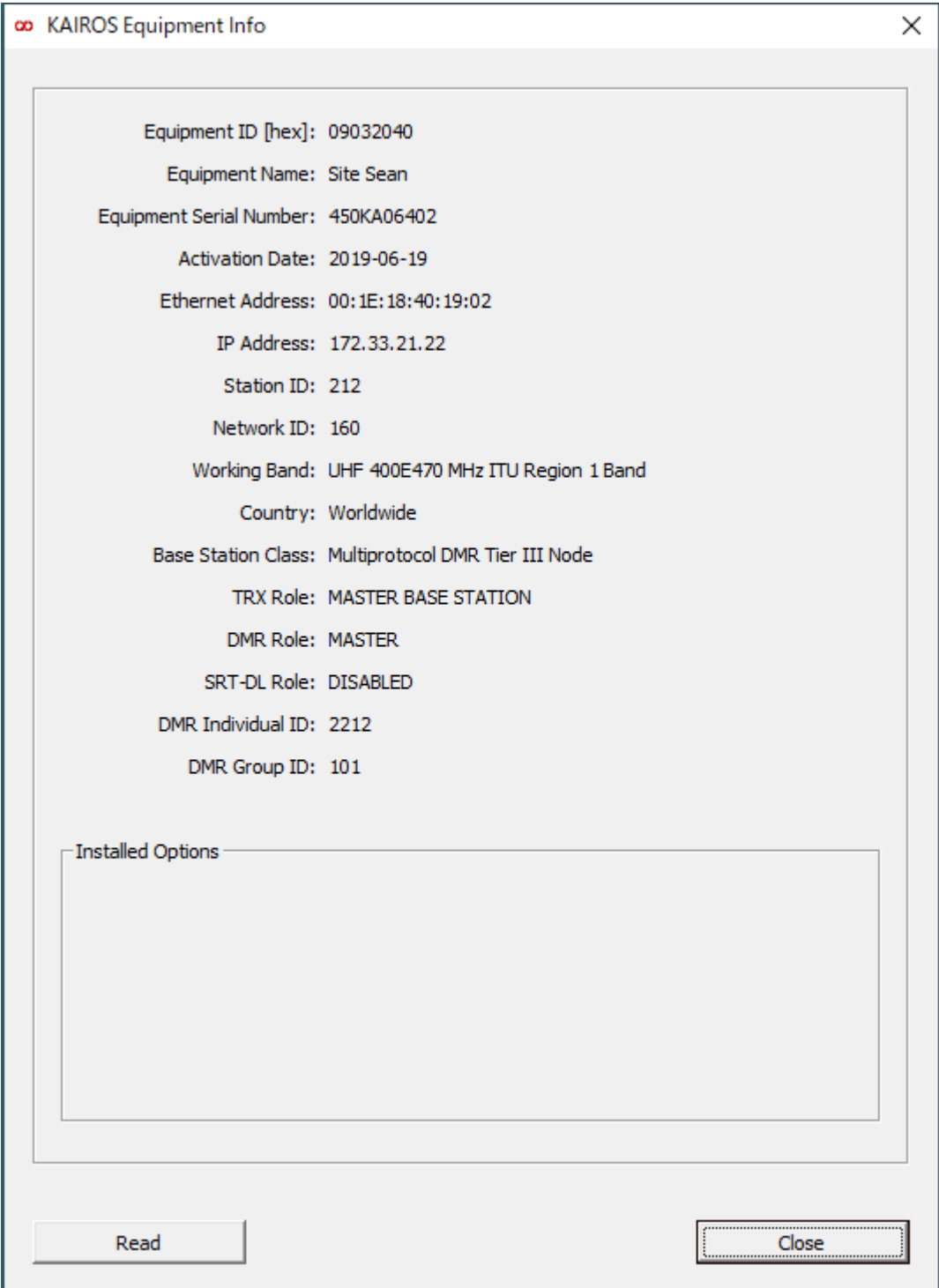
#### 3.4.1. About...



### 3.4.2. KAIROS Equipment Info

It shows some Equipment Information.

You can know installed options status by this window without open physical KAIROS.



The screenshot shows a window titled "KAIROS Equipment Info" with a close button (X) in the top right corner. The window displays the following information:

- Equipment ID [hex]: 09032040
- Equipment Name: Site Sean
- Equipment Serial Number: 450KA06402
- Activation Date: 2019-06-19
- Ethernet Address: 00:1E:18:40:19:02
- IP Address: 172.33.21.22
- Station ID: 212
- Network ID: 160
- Working Band: UHF 400E470 MHz ITU Region 1 Band
- Country: Worldwide
- Base Station Class: Multiprotocol DMR Tier III Node
- TRX Role: MASTER BASE STATION
- DMR Role: MASTER
- SRT-DL Role: DISABLED
- DMR Individual ID: 2212
- DMR Group ID: 101

Below the information, there is a section labeled "Installed Options" with a large empty box. At the bottom of the window, there are two buttons: "Read" and "Close".

## 4. KAIROS Setup Guide

This session is described to know how make Multi-Site system.

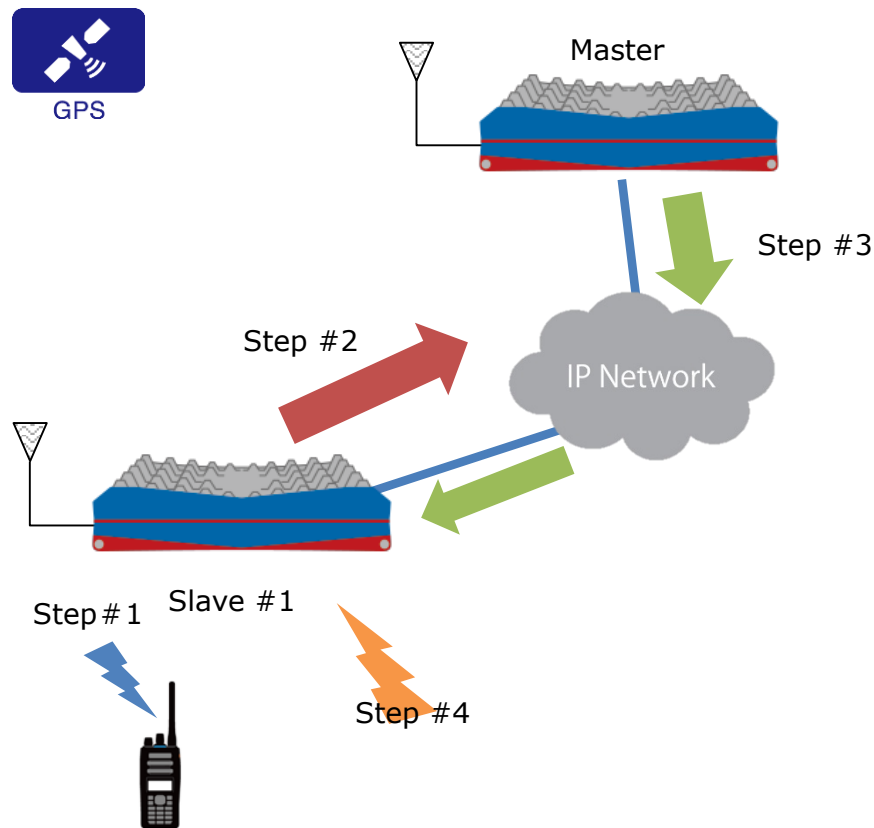
### 4.1. System

#### 4.1.1. Multi-Site

Multi-Site is a system connecting multiple Kairos through IP Network and DMR Air Interface. It contains one Master repeater and multiple slave repeaters.

#### 4.1.2. Master and Slave

Master receives Uplink data from Slaves through IP and distributes best data to Slave repeaters. Slave forwards radio uplink data to Master for Master voting and transmits the data distributed by Master. Slave repeater never repeat receiving data without control by Master.



##### 4.1.2.1. Data exchange between Master and Slave

Step #1. Caller Radio starts a call

Step #2. Slave1 forwards the call to Master.

Step #3. Master distributes a call to all Slave repeaters for Inter-Site Call.

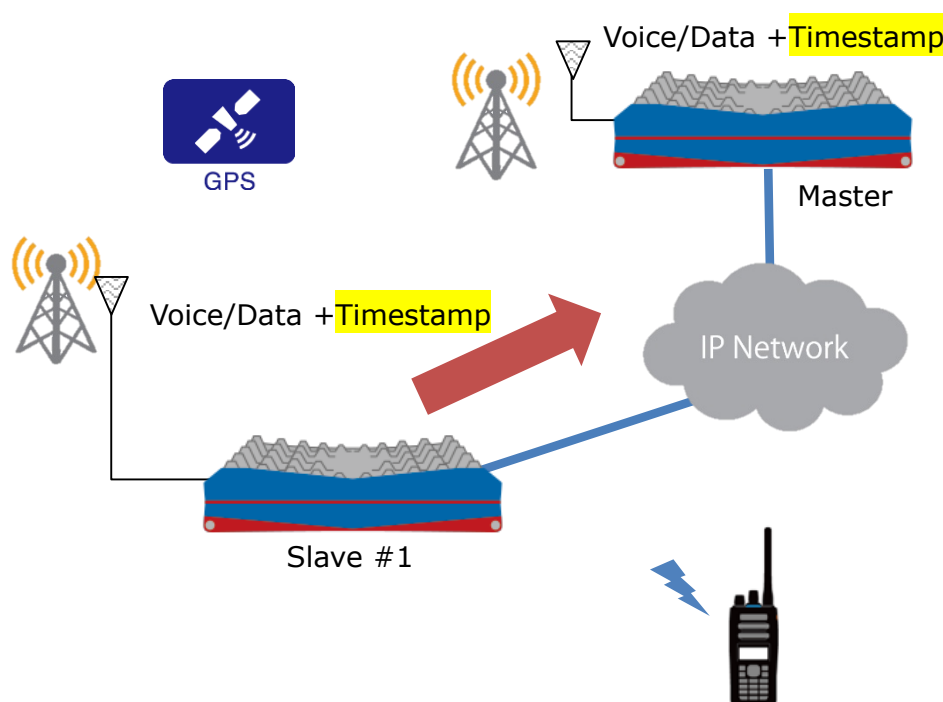
Step #4. Slave repeaters transmit the call (Downlink) to provide the call to the radios.

### 4.1.3. Key point

- TKR-Dx10 Series starts repeating received call by itself but Kairos never without controlling by Master. Kairos Slave just forwards receiving call to Master for Voting.
- Master is always required synchronization with Master to compare data coming from multiple Slave repeaters. It needs not only Simulcast but also multi frequencies system.

## 4.2. Synchronization

### 4.2.1. Process to select best data by Master



Slave forwards IP Packet (Voice/Data) with timestamp to the Master. By the timestamp, Master compares and select the best voice/data information even the packet from the slave is later than the one received by the Master.

Vice versa, down link packet transmits at the same timing by the timestamp. That's why Synchronization is required and really important.

Note:

Basically, GPS/GLONASS is the best choice for Synchronization.

This is required for RF Link application as well.



## 4.3. Timing

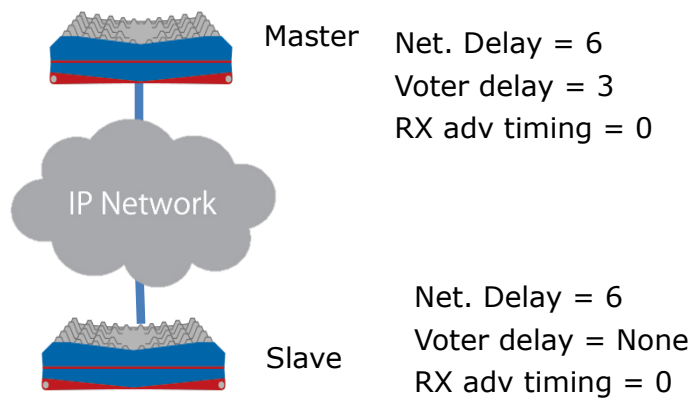
On Multi-Site/RF Link system, it might be considered frame delay. The chapter describes about time delay consideration.

### 4.3.1. IP Network Multi-Site

In case of Multi-Site, it should be considered some delay between Master and Slave.

Voting Delay should be 3ts. Network Delay should be double of Voting Delay.

$(3 \times 2) \times 30\text{ms} = 180\text{ms}$ .



## 5. System Case Study

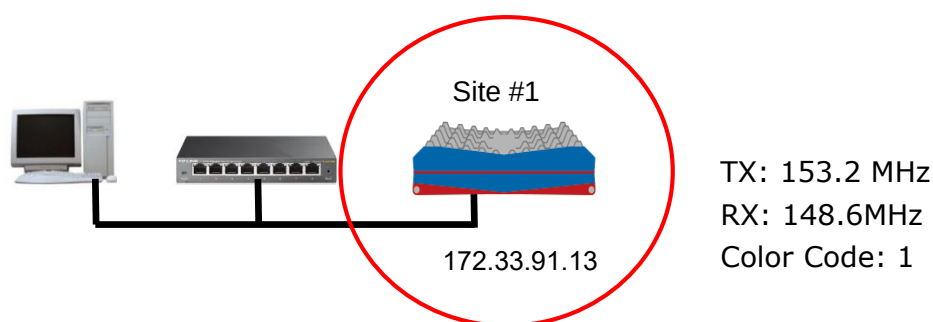
This chapter describes to introduce system example and its configuration. It starts from simple and proceeds to complicated system. it is recommended to start beginning if you need to study Kairos configuration from initial.

Note:

Important items are written in **Bold** into tables.

### 5.1. Single-Site

This is basic 1 site structure.



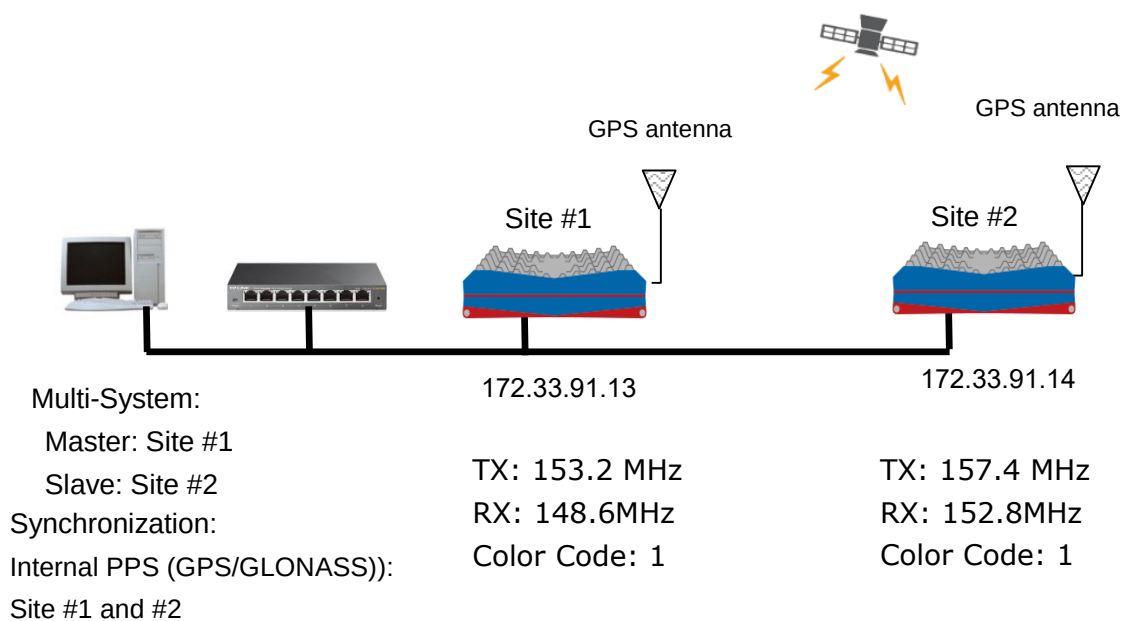
| KAIROS Manager<br>KAIROS – Configuration | Site #1                                | Note        |
|------------------------------------------|----------------------------------------|-------------|
| Network Settings                         |                                        |             |
| IP Settings                              | 172.33.91.13                           |             |
| Subnet mask                              | 255.255.0.0                            | Recommended |
| Default Gateway                          | 172.33.91.254                          |             |
| Main Setup                               |                                        |             |
| Identity Data                            | -                                      | Unique ID's |
| - Station ID                             | 112                                    |             |
| - Network ID                             | 160                                    |             |
| - DMR ID                                 | 2112                                   |             |
| TRX Operation Modes                      | -                                      |             |
| Operative Mode                           | <b>SINGLE REPEATER OR MOBILE/FIXED</b> |             |
| Service                                  | FULL DUPLEX                            |             |
| Type                                     | SINGLE UNIT                            |             |
| Enable TRX                               |                                        |             |
| Enabling TX                              | Checked                                |             |
| Enabling Main RX                         | Checked                                |             |

| KAIROS Manager<br>KAIROS – Configuration | Site #1        | Note                          |
|------------------------------------------|----------------|-------------------------------|
| Channel Table -<br>Channel data editing  |                |                               |
| TX Frequency [MHz]                       | 153.200000     |                               |
| RX Frequency [MHz]                       | 148.600000     |                               |
| Channel Enabled                          | <b>Checked</b> |                               |
| ETSI DMR Mode                            | <b>Checked</b> |                               |
| Main DMR Color Code                      | RX: 1, TX: 1   |                               |
| Base Station Layer Configuration         |                |                               |
| Enable repeater Mode                     | Checked        | Recommended by<br>Single-Site |
| Network Delay [30 ms] ticks              | <b>6</b>       |                               |
| Base Station Operating Modes             |                |                               |
| Base Station Role                        | “Master”       |                               |
| Stand-Alone                              | <b>Checked</b> |                               |
| Network Parameters                       |                |                               |
| Voting Delay [ts]                        | <b>3</b>       |                               |

## 5.2. Multi-Site

### 5.2.1. 2 Sites Multi-Site

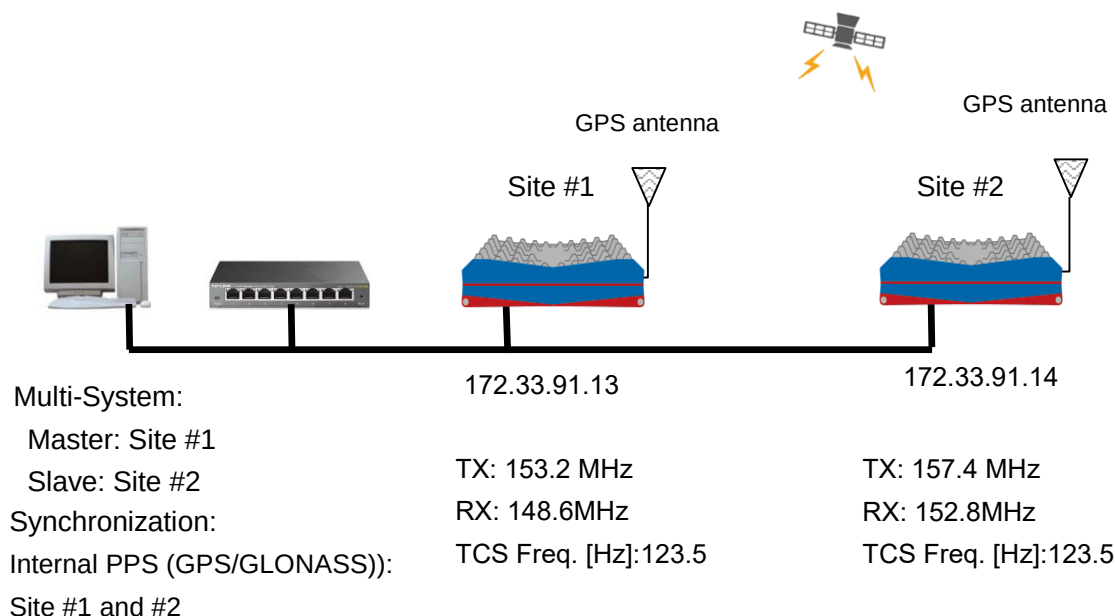
This is basic 2 site structure.



| KAIROS Manager<br>KAIROS – Configuration                                 | Site #1                       | Site #2                     | Note        |
|--------------------------------------------------------------------------|-------------------------------|-----------------------------|-------------|
| Network Settings                                                         |                               |                             |             |
| IP Settings                                                              | IP Address:<br>172.33.91.13   | IP Address:<br>172.33.91.14 |             |
|                                                                          | Subnet Mask: 255.255.0.0      |                             | Recommended |
| Main Setup                                                               |                               |                             |             |
| Identity Data - Station ID                                               | 112                           | 212                         | Unique ID's |
| Identity Data – Network ID                                               | 160                           |                             | Same ID     |
| Identity Data - DMR ID                                                   | 2112                          | 2212                        | Unique ID's |
| GNSS Optional Module                                                     |                               |                             |             |
| Enable GNSS Module if present<br>Supply Voltage to GNSS Antenna          | Checked<br>Checked            |                             | Important   |
| TRX Operation Modes                                                      | -                             |                             |             |
| Operative Mode                                                           | Master Base Station           | Slave Base Station          | Important   |
| Service                                                                  | FULL DUPLEX                   |                             |             |
| Type                                                                     | SINGLE UNIT                   |                             |             |
| Enable TRX<br>Enabling TX<br>Enabling Main RX<br>Line2 (IP Line) Enabled | Checked<br>Checked<br>Checked |                             |             |
| Channel Table - Channel data editing                                     |                               |                             |             |
| TX Frequency [MHz]                                                       | 153.200000                    | 157.400000                  |             |
| RX Frequency [MHz]                                                       | 148.600000                    | 152.800000                  |             |
| Channel Enabled                                                          | Checked                       |                             |             |
| ETSI DMR Mode                                                            | Checked                       |                             |             |
| Main DMR Color Code                                                      | RX: 1, TX: 1                  |                             |             |
| Primary Synchronization                                                  |                               |                             |             |
| 1 <sup>st</sup> Choice                                                   | Internal PPS (GPS/GLONASS)    |                             |             |
| Base Station Layer Configuration                                         |                               |                             |             |
| Network Delay [30 ms] ticks                                              | 6                             |                             | Important   |
| Base Station Operating Modes                                             |                               |                             |             |
| Base Station Role                                                        | "MASTER"                      | "BROADCASTER"               |             |
| Stand-Alone                                                              | Unchecked                     |                             |             |
| IP Parameters                                                            |                               |                             |             |
| - Master Preset IP Address                                               | N/A                           | 172.33.91.13                |             |
| Network Parameters                                                       |                               |                             |             |
| Voting Delay [ts]                                                        | 3                             | None                        |             |

### 5.2.2. 2 Sites with Analog FM

This is basic Analog FM 2site Multi-Site structure.

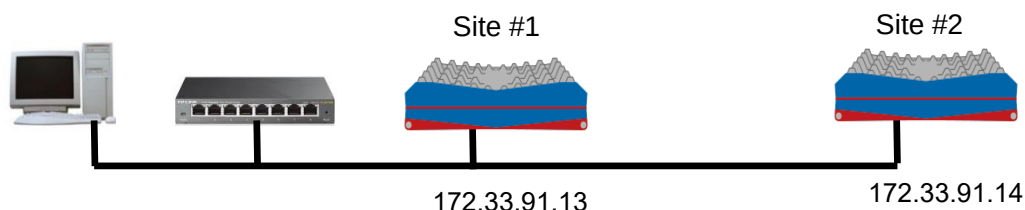


| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask: 255.255.0.0    |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | Unique ID's |
| GNSS Optional Module                     |                             |                             |             |
| Enable GNSS Module if present            | Checked                     |                             | Important   |
| Supply Voltage to GNSS Antenna           | Checked                     |                             |             |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Master Base Station         | Slave Base Station          |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     |                             |             |
| Enabling Main RX                         | Checked                     |                             |             |
| Line2 (IP Line) Enabled                  | Checked                     |                             |             |

| KAIROS Manager<br>KAIROS – Configuration | Site #1                    | Site #2      | Note      |
|------------------------------------------|----------------------------|--------------|-----------|
| Channel Table - Channel data editing     |                            |              |           |
| TX Frequency [MHz]                       | 153.200000                 | 157.400000   |           |
| RX Frequency [MHz]                       | 148.600000                 | 152.800000   |           |
| Channel Enabled                          | Checked                    |              |           |
| ANALOG Mode                              | <b>Checked</b>             |              |           |
| Main TX Subtone                          | 123.5                      |              |           |
| Main RX Subtone                          | 123.5                      |              |           |
| Primary Synchronization                  |                            |              |           |
| 1 <sup>st</sup> Choice                   | Internal PPS (GPS/GLONASS) |              |           |
| Base Station Layer Configuration         |                            |              |           |
| Network Delay [30 ms] ticks              | 6                          |              | Important |
| Base Station Operating Modes             |                            |              |           |
| Base Station Role                        | MASTER                     | BROADCASTER  |           |
| Stand-Alone                              | Unchecked                  |              |           |
| IP Parameters                            |                            |              |           |
| Master Preset IP Address                 | N/A                        | 172.33.91.13 |           |
| Network Parameters                       |                            |              |           |
| Voting Delay [ts]                        | 3                          | None         | Important |

**5.2.3. 2 Sites with PTP Sync**

This is basic 2sites structure with PTP synchronization.



Multi-System:

Master: Site #1

Slave: Site #2

Synchronization:

PTP Master: Site #1

PTP Slave: Site #2

TX: 153.2 MHz

RX: 148.6MHz

Color Code: 1

TX: 157.4 MHz

RX: 152.8MHz

Color Code: 1

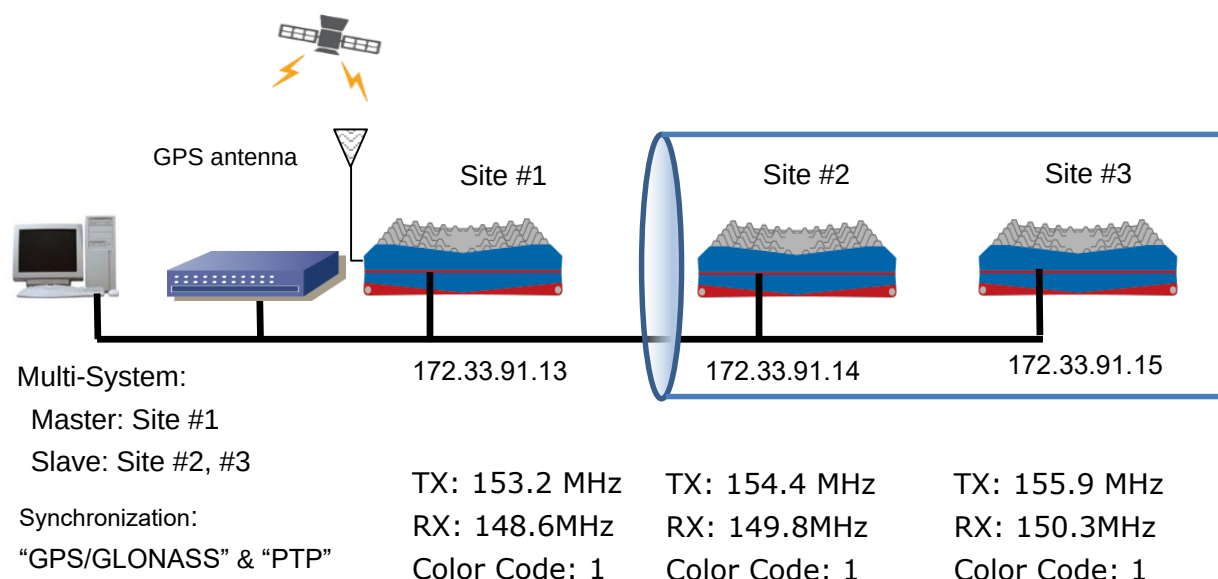
| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask: 255.255.0.0    |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | Unique ID's |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Master Base Station         | Slave Base Station          |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     |                             |             |
| Enabling Main RX                         | Checked                     |                             |             |
| Line2 (IP Line) Enabled                  | Checked                     |                             |             |
| Channel Table - Channel data editing     |                             |                             |             |
| TX Frequency [MHz]                       | 153.200000                  | 157.400000                  |             |
| RX Frequency [MHz]                       | 148.600000                  | 152.800000                  |             |
| Channel Enabled                          | Checked                     |                             |             |
| ETSI DMR Mode                            | Checked                     |                             |             |
| Main DMR Color Code                      | RX: 1, TX: 1                |                             |             |



| KAIROS Manager<br>KAIROS – Configuration                                                                                                           | Site #1                                                                                         | Site #2                                                                                                        | Note                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Primary Synchronization                                                                                                                            |                                                                                                 |                                                                                                                |                                      |
| 1 <sup>st</sup> Choice                                                                                                                             | <b>Internal PTP</b>                                                                             | <b>Internal PTP</b>                                                                                            |                                      |
| Internal PTP Handling -Role                                                                                                                        | <b>Master</b>                                                                                   | <b>Slave</b>                                                                                                   |                                      |
| Domain                                                                                                                                             | <b>0</b>                                                                                        |                                                                                                                | <b>Same Number</b>                   |
| Max Slave Groups                                                                                                                                   | <b>1</b>                                                                                        |                                                                                                                | <b>Same Number</b>                   |
| Slave Group Membership                                                                                                                             | <b>0</b>                                                                                        | <b>1</b>                                                                                                       | <b>Master :<br/>always zero</b>      |
| Internal PTP Handling – PTP IP Parameters                                                                                                          | Master IP Address:<br>None                                                                      | <b>Master IP Address:<br/>172.33.91.13</b>                                                                     | The Slave needs the Mater IP Address |
| PPS Signal Handling<br>- Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rea plug<br>PPS to PTP Event<br>PPS to rear plug | Forced OFF /Straight<br>Automatic/Straight<br>Forced OFF /Straight<br>Internal Ref<br>insulated | <b>Forced OFF/</b> Straight<br>Automatic/ Straight<br><b>Forced OFF/</b> Straight<br>Internal Ref<br>insulated |                                      |
| Base Station Layer Configuration                                                                                                                   |                                                                                                 |                                                                                                                |                                      |
| Network Delay [30 ms] ticks                                                                                                                        | <b>6</b>                                                                                        |                                                                                                                | <b>Same</b>                          |
| Base Station Operating Modes                                                                                                                       |                                                                                                 |                                                                                                                |                                      |
| Base Station Role                                                                                                                                  | <b>MASTER</b>                                                                                   | <b>BROADCASTER</b>                                                                                             |                                      |
| Stand-Alone                                                                                                                                        | <b>Unchecked</b>                                                                                |                                                                                                                |                                      |
| IP Parameters                                                                                                                                      |                                                                                                 |                                                                                                                |                                      |
| - Master Preset IP Address                                                                                                                         | <b>N/A</b>                                                                                      | <b>172.33.91.13</b>                                                                                            |                                      |
| Network Parameters                                                                                                                                 |                                                                                                 |                                                                                                                |                                      |
| Voting Delay [ts]                                                                                                                                  | <b>3</b>                                                                                        | <b>None</b>                                                                                                    |                                      |

**5.2.4. 3site synchronized with GPS/GLONASS and PTP**

This is basic 3sites structure with GPS/GLONASS and PTP synchronization.

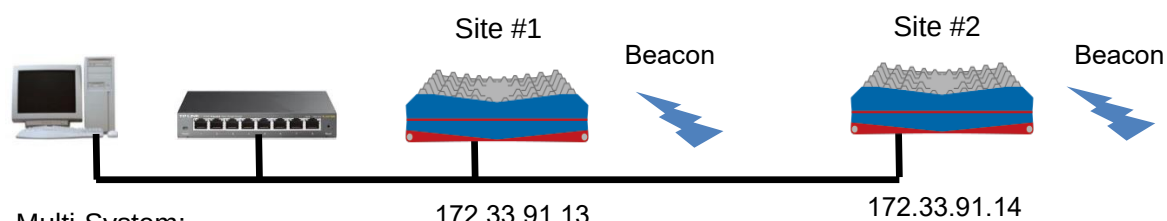


| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Site3                       | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 | IP Address:<br>172.33.91.15 |             |
|                                          | Subnet Mask: 255.255.0.0    |                             |                             | Recommended |
| Main Setup                               |                             |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | 213                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | 2314                        | Unique ID's |
| GNSS Optional Module                     |                             |                             |                             |             |
| Enable GNSS Module if present            | Checked                     | None                        |                             |             |
| Supply Voltage to GNSS Antenna           | Checked                     | None                        |                             |             |
| TRX Operation Modes                      |                             |                             |                             |             |
| Operative Mode                           | Master Base<br>Station      | Slave Base Station          |                             |             |
| Service                                  | FULL DUPLEX                 |                             |                             |             |
| Type                                     | SINGLE UNIT                 |                             |                             |             |
| Enable TRX                               |                             |                             |                             |             |
| Enabling TX                              | Checked                     |                             |                             |             |
| Enabling Main RX                         | Checked                     |                             |                             |             |
| Line2 (IP Line) Enabled                  | Checked                     |                             |                             |             |

|                                                                                                                                                   |                                                                                             |                                                                                                 |            |                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------|--------------------------------------------|
| Channel Table - Channel data editing                                                                                                              |                                                                                             |                                                                                                 |            |                                            |
| TX Frequency [MHz]                                                                                                                                | 153.200000                                                                                  | 154.400000                                                                                      | 155.900000 |                                            |
| RX Frequency [MHz]                                                                                                                                | 148.600000                                                                                  | 149.800000                                                                                      | 150.300000 |                                            |
| Channel Enabled                                                                                                                                   | Checked                                                                                     |                                                                                                 |            |                                            |
| ETSI DMR Mode                                                                                                                                     | Checked                                                                                     |                                                                                                 |            |                                            |
| Main DMR Color Code                                                                                                                               | RX: 1, TX: 1                                                                                |                                                                                                 |            |                                            |
| Primary Synchronization                                                                                                                           |                                                                                             |                                                                                                 |            |                                            |
| <b>1<sup>st</sup> Choice</b>                                                                                                                      | Internal PPS<br>(GPS/GLONASS)                                                               | Internal PTP                                                                                    |            |                                            |
| <b>2<sup>nd</sup> Choice</b>                                                                                                                      | Internal PTP                                                                                | Internal PTP                                                                                    |            |                                            |
| Internal PTP Handling -Role                                                                                                                       | Master                                                                                      | Slave                                                                                           |            |                                            |
| Domain                                                                                                                                            | 0                                                                                           |                                                                                                 |            |                                            |
| Max Slave Groups                                                                                                                                  | 2                                                                                           |                                                                                                 |            | Same Number                                |
| Slave Group Membership                                                                                                                            | 0                                                                                           | 1                                                                                               | 2          | Master :<br>always zero                    |
| Internal PTP Handling –<br>PTP IP Parameters<br>Master PTP Address                                                                                | N/A                                                                                         | 172.33.91.13                                                                                    |            | The Slave needs<br>the Mater IP<br>Address |
| PPS Signal Handling<br>-Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rea plug<br>PPS to PTP Event<br>PPS to rear plug | Automatic/Straight<br>Automatic/Straight<br>Automatic/Straight<br>Internal Ref<br>insulated | Forced OFF /Straight<br>Automatic/Straight<br>Forced OFF /Straight<br>Internal Ref<br>insulated |            |                                            |
| Base Station Layer Configuration                                                                                                                  |                                                                                             |                                                                                                 |            |                                            |
| Network Delay [30 ms] ticks                                                                                                                       | 6                                                                                           |                                                                                                 |            |                                            |
| Base Station Operating Modes                                                                                                                      |                                                                                             |                                                                                                 |            |                                            |
| Base Station Role                                                                                                                                 | Master                                                                                      | BROADCASTER                                                                                     |            |                                            |
| Stand-Alone                                                                                                                                       | Unchecked                                                                                   |                                                                                                 |            |                                            |
| IP Parameters                                                                                                                                     |                                                                                             |                                                                                                 |            |                                            |
| - Master Preset IP Address                                                                                                                        | N/A                                                                                         | 172.33.91.13                                                                                    |            |                                            |
| Network Parameters                                                                                                                                |                                                                                             |                                                                                                 |            |                                            |
| Voting Delay [ts]                                                                                                                                 | 3                                                                                           | None                                                                                            |            |                                            |

### 5.2.5. Multisite Roaming System (2Sites)

Similar with NEXEDGE Conventional IP Network Site Roaming System, a Repeater transmits Beacon signal. Mobile Radio starts roaming according to comparing signal strength.



Master: Site #1

Slave: Site #2

Synchronization:

PTP Master: Site #1

PTP Slave: Site #2

TX: 153.2 MHz

RX: 148.6MHz

Color Code: 1

TX: 157.4 MHz

RX: 152.8MHz

Color Code: 1

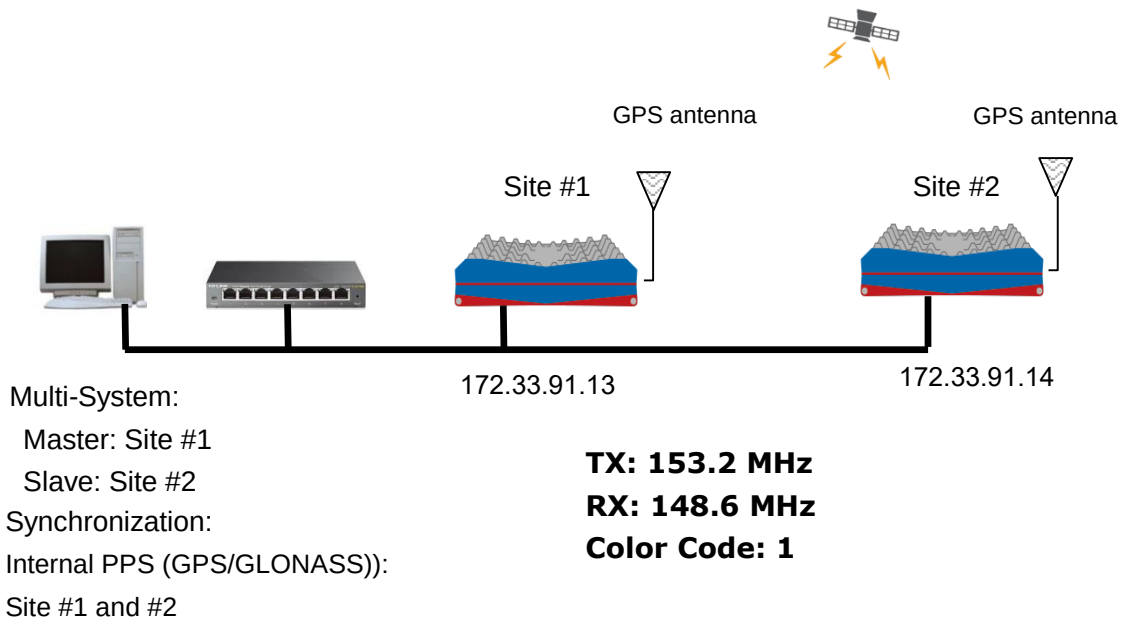
**Beacon: The Interval time 1min, the length is 3sec**

| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask:<br>255.255.0.0 |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | Unique ID's |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Master Base Station         | Slave Base Station          |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     |                             |             |
| Enabling Main RX                         | Checked                     |                             |             |
| Line2 (IP Line) Enabled                  | Checked                     |                             |             |
| Channel Table - Channel data editing     |                             |                             |             |
| TX Frequency [MHz]                       | 153.200000                  | 157.400000                  |             |
| RX Frequency [MHz]                       | 148.600000                  | 152.800000                  |             |
| Channel Enabled                          | Checked                     |                             |             |
| ETSI DMR Mode                            | Checked                     |                             |             |
| Main DMR Color Code                      | RX: 1, TX: 1                |                             |             |

| KAIROS Manager<br>KAIROS – Configuration                                                                                                           | Site #1                                                                                     | Site #2                                                                                          | Note                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------|
| Primary Synchronization                                                                                                                            |                                                                                             |                                                                                                  |                                            |
| 1 <sup>st</sup> Choice                                                                                                                             | Internal PTP                                                                                | Internal PTP                                                                                     |                                            |
| Internal PTP Handling -Role                                                                                                                        | Master                                                                                      | Slave                                                                                            |                                            |
| Domain                                                                                                                                             | 0                                                                                           |                                                                                                  | Same Number                                |
| Max Slave Groups                                                                                                                                   | 1                                                                                           |                                                                                                  | Same Number                                |
| Slave Group Membership                                                                                                                             | 0                                                                                           | 1                                                                                                | Master :<br>always zero                    |
| Internal PTP Handling – PTP IP Parameters                                                                                                          | Master IP Address:<br>None                                                                  | Master IP Address:<br>172.33.91.13                                                               | The Slave needs<br>the Mater IP<br>Address |
| PPS Signal Handling<br>- Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rea plug<br>PPS to PTP Event<br>PPS to rear plug | Automatic/Straight<br>Automatic/Straight<br>Automatic/Straight<br>Internal Ref<br>insulated | Forced OFF/ Straight<br>Automatic/ Straight<br>Forced OFF/ Straight<br>Internal Ref<br>insulated |                                            |
| Base Station Layer Configuration                                                                                                                   |                                                                                             |                                                                                                  |                                            |
| Network Delay [30 ms] ticks                                                                                                                        | 6                                                                                           |                                                                                                  |                                            |
| Hang times[30ms ticks] (0 32767)                                                                                                                   |                                                                                             |                                                                                                  | Same Number                                |
| <b>Channel</b>                                                                                                                                     | <b>100</b>                                                                                  | <b>100</b>                                                                                       | 3sec =100x30ms                             |
| Base Station Operating Modes                                                                                                                       |                                                                                             |                                                                                                  |                                            |
| Base Station Role                                                                                                                                  | <b>MASTER</b>                                                                               | <b>BROADCASTER</b>                                                                               |                                            |
| Stand-Alone                                                                                                                                        | Unchecked                                                                                   |                                                                                                  |                                            |
| IP Parameters                                                                                                                                      |                                                                                             |                                                                                                  |                                            |
| - Master Preset IP Address                                                                                                                         | N/A                                                                                         | 172.33.91.13                                                                                     |                                            |
| DMR Beacon<br><b>Interval Time [mm:ss]:</b><br>Beacon Policy                                                                                       | <b>1:00</b><br>Polite                                                                       | N/A<br>N/A                                                                                       | Should configure<br>to the Maser           |
| Network Parameters                                                                                                                                 |                                                                                             |                                                                                                  |                                            |
| Voting Delay [ts]                                                                                                                                  | 3                                                                                           | 3                                                                                                |                                            |

### 5.2.6. Simulcast System (2Sites)

Most simple 2Site simulcast structure.



Note:

It requires Simulcast License authentication. It is possible to review license condition on Function Status window. Refer 3.3.3.1.2 Feature Status.

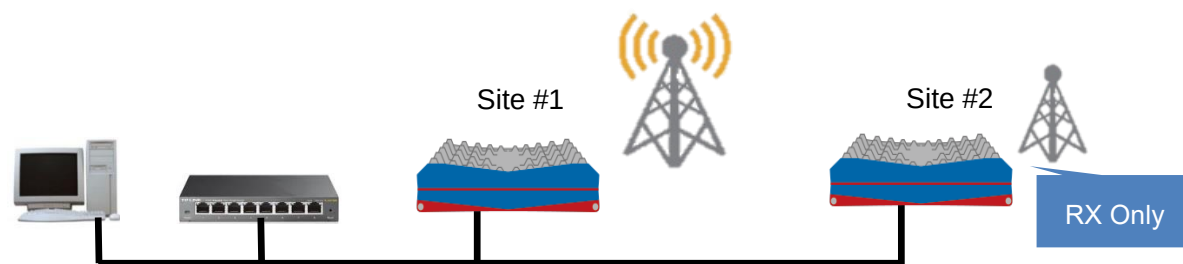
| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask: 255.255.0.0    |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | Unique ID's |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Master Base Station         | Slave Base Station          |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     |                             |             |
| Enabling Main RX                         | Checked                     |                             |             |

| KAIROS Manager<br>KAIROS – Configuration                                                                                                            | Site #1                                                                                          | Site #2      | Note           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------|----------------|
| Channel Table - Channel data editing                                                                                                                |                                                                                                  |              |                |
| TX Frequency [MHz]                                                                                                                                  | 153.200000                                                                                       |              | Same Frequency |
| RX Frequency [MHz]                                                                                                                                  | 148.600000                                                                                       |              | Same Frequency |
| Channel Enabled                                                                                                                                     | Checked                                                                                          |              |                |
| ETSI DMR Mode                                                                                                                                       | Checked                                                                                          |              |                |
| Main DMR Color Code                                                                                                                                 | RX: 1, TX: 1                                                                                     |              |                |
| Primary Synchronization                                                                                                                             |                                                                                                  |              |                |
| 1 <sup>st</sup> Choice                                                                                                                              | Internal PPS (GPS/GLONASS)                                                                       |              |                |
| PPS Signal Handling<br>- Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rear plug<br>PPS to PTP Event<br>PPS to rear plug | Forced ON /Straight<br>Forced OFF /Straight<br>Forced OFF /Straight<br>Internal Ref<br>insulated |              |                |
| Base Station Layer Configuration                                                                                                                    |                                                                                                  |              |                |
| Network Delay                                                                                                                                       | 6                                                                                                |              |                |
| Base Station Operating Modes                                                                                                                        |                                                                                                  |              |                |
| Base Station Role                                                                                                                                   | MASTER                                                                                           | BROADCASTER  |                |
| Stand-Alone                                                                                                                                         | Unchecked                                                                                        |              |                |
| IP Parameters                                                                                                                                       |                                                                                                  |              |                |
| - Master Preset IP Address                                                                                                                          | N/A                                                                                              | 172.33.91.13 |                |
| Network Parameters                                                                                                                                  |                                                                                                  |              |                |
| Voting Delay [ts]                                                                                                                                   | 3                                                                                                | 3            |                |



### 5.2.7. Receiver Voting by RX only repeater in the Simulcast (2Sites)

The Multi-Site can be configured with Receive-only KAIROS and Repeater. This Multi-Site configuration can reduce frequency resources.



Multi-Site:

Master: Site #1

Slave: Site #2

TX: 153.2 MHz

RX: 148.6MHz

RX: 148.6MHz

Synchronization:

PTP Master: Site #1

Color Code: 1

Color Code: 1

PTP Slave: Site #2

Beacon: The Interval time 1min, the length is 3sec

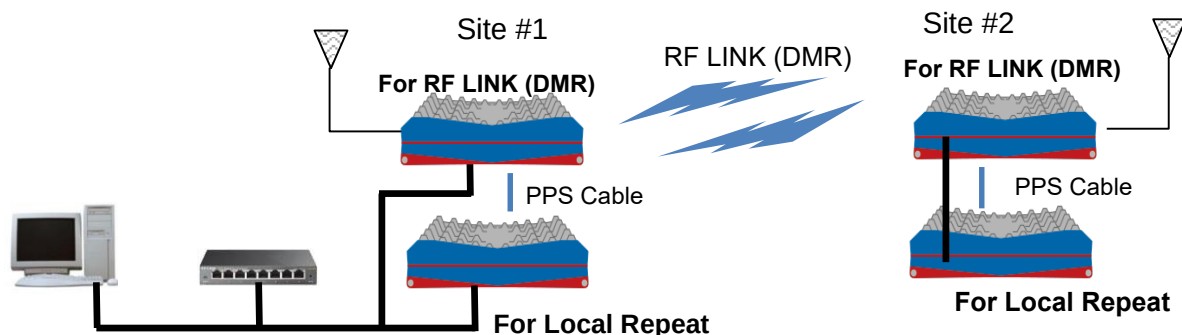
| KAIROS Manager<br>KAIROS – Configuration | Site #1                     | Site #2                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask:<br>255.255.0.0 |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 112                         | 212                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Same ID     |
| Identity Data - DMR ID                   | 2112                        | 2212                        | Unique ID's |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Master Base Station         | Slave Base Station          |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     | Uncheck                     |             |
| Enabling Main RX                         | Checked                     |                             |             |
| Line2 (IP Line) Enabled                  | Checked                     |                             |             |
| Channel Table - Channel data editing     |                             |                             |             |

| KAIROS Manager<br>KAIROS – Configuration |                                                                                                                                                    | Site #1                                                                                      | Site #2                                                                                      | Note                                                              |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
|                                          | TX Frequency [MHz]                                                                                                                                 | 153.200000                                                                                   | <del>153.200000</del> <sup>*1</sup>                                                          | *1: Should enter something when the Enabling TX is not available. |
|                                          | RX Frequency [MHz]                                                                                                                                 | <b>148.600000</b>                                                                            |                                                                                              | Same Frequency                                                    |
|                                          | Channel Enabled                                                                                                                                    | Checked                                                                                      |                                                                                              |                                                                   |
|                                          | ETSI DMR Mode                                                                                                                                      | Checked                                                                                      |                                                                                              |                                                                   |
|                                          | Main DMR Color Code                                                                                                                                | RX: 1, TX: 1                                                                                 | RX: 1, TX: 1                                                                                 |                                                                   |
| Primary Synchronization                  |                                                                                                                                                    |                                                                                              |                                                                                              |                                                                   |
|                                          | 1st Choice                                                                                                                                         | Internal PPS (GPS/GLONASS)                                                                   |                                                                                              |                                                                   |
|                                          | 2 <sup>nd</sup> Choice                                                                                                                             | Internal PTP                                                                                 | Internal PTP                                                                                 |                                                                   |
|                                          | Internal PTP Handling -Role                                                                                                                        | Master                                                                                       | Slave                                                                                        |                                                                   |
|                                          | Domain                                                                                                                                             | 0                                                                                            |                                                                                              | Same Number                                                       |
|                                          | Max Slave Groups                                                                                                                                   | 1                                                                                            |                                                                                              | Same Number                                                       |
|                                          | Slave Group Membership                                                                                                                             | 0                                                                                            | 1                                                                                            | Master : always zero                                              |
|                                          | Internal PTP Handling – PTP IP Parameters                                                                                                          | Master IP Address: None                                                                      | Master IP Address: 172.33.91.13                                                              | The Slave needs the Mater IP Address                              |
|                                          | PPS Signal Handling<br>- Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rea plug<br>PPS to PTP Event<br>PPS to rear plug | Forced ON /Straight<br>Forced ON /Straight<br>Forced OFF /Straight<br>Internal Ref insulated | Forced ON /Straight<br>Forced ON /Straight<br>Forced OFF /Straight<br>Internal Ref insulated |                                                                   |
|                                          | Hang times[30ms ticks] (0 32767)<br>Channel                                                                                                        | 100                                                                                          | 100                                                                                          | Same Number<br>3sec =100x30ms                                     |
| Base Station Layer Configuration         |                                                                                                                                                    |                                                                                              |                                                                                              |                                                                   |
|                                          | Network Delay                                                                                                                                      | 6                                                                                            |                                                                                              |                                                                   |
| Base Station Operating Modes             |                                                                                                                                                    |                                                                                              |                                                                                              |                                                                   |
|                                          | Base Station Role                                                                                                                                  | MASTER                                                                                       | BROADCASTER                                                                                  |                                                                   |
|                                          | Stand-Alone                                                                                                                                        | Unchecked                                                                                    | Unchecked                                                                                    |                                                                   |
|                                          | IP Parameters                                                                                                                                      |                                                                                              |                                                                                              |                                                                   |
|                                          | - Master Preset IP Address                                                                                                                         | N/A                                                                                          | 172.33.91.13                                                                                 |                                                                   |
|                                          | Network Parameters                                                                                                                                 |                                                                                              |                                                                                              |                                                                   |
|                                          | Voting Delay [ts]                                                                                                                                  | 3                                                                                            | 3                                                                                            |                                                                   |
|                                          | DMR Beacon<br>Interval Time [mm:ss]:<br>Beacon Policy                                                                                              | 1:00<br>Polite                                                                               | N/A<br>N/A                                                                                   | Should configure to the Maser                                     |

### 5.2.8. RF Link (DMR) 2Sites

Most basic 2 site RF Link structure.

To connect KAIROS via IP by the KAIROS Manager, Administer needs to pay attention for some settings



Multi-System:

Master: Site #1

Slave: Site #2

Synchronization:

1st Choice: "GPS/GLONASS"

2nd Choice: "RF LINK (DMR)"

| KAIROS Manager<br>KAIROS –<br>Configuration | Site #1               |               | Site #2               |               | Note        |
|---------------------------------------------|-----------------------|---------------|-----------------------|---------------|-------------|
|                                             | For RF<br>LINK(DMR)   | For Local     | For RF<br>LINK(DMR)   | For Local     |             |
| Network Settings                            |                       |               |                       |               |             |
| IP Settings                                 |                       |               |                       |               | Unique IP   |
| IP Address                                  | 172.33.91.13          | 172.33.95.13  | 172.33.91.14          | 172.33.95.14  | Address's   |
| Subnet Mask                                 | 255.255.0.0           |               |                       |               | Recommended |
| Default Gateway                             | 172.33.91.254         | 172.33.91.254 | 172.33.91.254         | 172.33.91.254 |             |
| Main Setup                                  |                       |               |                       |               |             |
| Identity Data - Station ID                  | 112                   | 113           | 212                   | 213           | Unique ID's |
| Identity Data – Network ID                  | 160                   |               |                       |               | Same ID     |
| Identity Data - DMR ID                      | 2112                  | 2113          | 2212                  | 2213          | Unique ID's |
| Remote Control Via RF Link                  | Enabled on TSA or TSB | Uncheck       | Enabled on TSA or TSB | Uncheck       |             |
| GNSS Optional Module                        |                       |               |                       |               |             |
| Enable GNSS Module if present               | Checked               | None          | Checked               | None          |             |
| Supply Voltage to GNSS Antenna              | Checked               | None          | Checked               | None          |             |

|                                       |                                             |                        |                                             |                                  |                  |         |
|---------------------------------------|---------------------------------------------|------------------------|---------------------------------------------|----------------------------------|------------------|---------|
| TRX Operation Modes                   |                                             |                        |                                             |                                  |                  |         |
| Operative Mode                        | <b>RF LINK DOWN</b><br><b>NODE</b>          | Slave<br>Station       | Base                                        | <b>RF LINK UP</b><br><b>NODE</b> | Slave<br>Station | Base    |
| Service                               | FULL DUPLEX                                 |                        |                                             |                                  |                  |         |
| Type                                  | SINGLE UNIT                                 |                        |                                             |                                  |                  |         |
| Enable TRX                            |                                             |                        |                                             |                                  |                  |         |
| Enabling TX                           | Checked                                     |                        |                                             |                                  |                  |         |
| Enabling Main RX                      | Checked                                     |                        |                                             |                                  |                  |         |
| Channel Table - Channel data editing  |                                             |                        |                                             |                                  |                  |         |
| TX Frequency [MHz]                    | 153.2                                       | 457.4                  | 148.6                                       | 453.2                            |                  |         |
| RX Frequency [MHz]                    | 148.6                                       | 452.8                  | 153.2                                       | 448.6                            |                  |         |
| Channel Enabled                       | Checked                                     |                        |                                             |                                  |                  |         |
| ETSI DMR Mode                         | Checked                                     |                        |                                             |                                  |                  |         |
| Main DMR Color Code                   | RX: 1, TX: 1                                |                        |                                             |                                  |                  | Same CC |
| Primary Synchronization               |                                             |                        |                                             |                                  |                  |         |
| 1 <sup>st</sup> Choice                | <b>Internal PPS</b><br><b>(GPS/GLONASS)</b> | External PPS<br>(FULL) | <b>Internal PPS</b><br><b>(GPS/GLONASS)</b> | External PPS<br>(FULL)           |                  |         |
| 2 <sup>nd</sup> Choice                | Internal Ref(Full)                          |                        | <b>RF LINK(DMR)</b>                         |                                  |                  |         |
| PPS Signal Handling                   |                                             |                        |                                             |                                  |                  |         |
| -Internal from GPS/GLONASS            | Automatic/Straight                          | Forced OFF/Straight    | Automatic/Straight                          | Forced OFF/Straight              |                  |         |
| -Internal from PTP Device             | Forced OFF/Straight                         | Forced OFF/Straight    | Forced OFF/Straight                         | Forced OFF/Straight              |                  |         |
| -External from rea plug               | Forced ON/Straight                          | Forced ON/Straight     | Forced ON/Straight                          | Forced ON/Straight               |                  |         |
| PPS to PTP Event                      | Internal Ref                                | Internal Ref           | Internal Ref                                | Internal Ref                     |                  |         |
| PPS to rear plug                      | <b>Internal Ref</b>                         | N/A                    | <b>Internal Ref</b>                         | N/A                              |                  |         |
| <b>RF Sync Source</b>                 | <b>Sync Packets on</b><br><b>TS A or B</b>  | <b>OFF</b>             |                                             |                                  |                  |         |
| Base Station Layer Configuration      |                                             |                        |                                             |                                  |                  |         |
| Display IDLE Packets                  | <b>Checked</b>                              | None                   | <b>Checked</b>                              | None                             |                  |         |
| TX:act as...                          | Base Station                                |                        |                                             |                                  |                  |         |
| RX:act as...                          | <b>Mobile Station</b>                       | Base Station           | <b>Mobile Station</b>                       | Base Station                     |                  |         |
| Hang Timer [30 ms ticks] (0 to 32767) |                                             |                        |                                             |                                  |                  |         |
| Private Calls                         | 0                                           | 150                    | 0                                           | 150                              | Recommend        |         |
| Group Calls                           |                                             |                        |                                             |                                  |                  |         |

|                               |               |                  |                              |                     |                  |
|-------------------------------|---------------|------------------|------------------------------|---------------------|------------------|
| Data Response                 |               | 16               |                              | 16                  |                  |
| Channel                       | 100           | 16               | 100                          | 16                  |                  |
| Network Delay [30 ms ticks]   | <b>8</b>      | <b>8</b>         | <b>6</b>                     | <b>8</b>            | <b>Important</b> |
| RX Pkts Advance [30 ms ticks] | <b>0</b>      | <b>0</b>         | <b>2</b>                     | <b>0</b>            | <b>Important</b> |
| Base Station Operating Modes  |               |                  |                              |                     |                  |
| Base Station Role             | <b>MASTER</b> | BROADCAST<br>TER | <b>LINK UP TO<br/>MASTER</b> | BROADCAST<br>ER     |                  |
| Stand-Alone                   | Unchecked     |                  |                              |                     |                  |
| IP parameters                 |               |                  |                              |                     |                  |
| Master -<br>Preset IP Address | N/A           | 172.33.91.13     | N/A                          | <b>172.33.91.14</b> |                  |
| Voting Delay[ts]              | 3             | 3 (Not Affected) |                              |                     |                  |
| Act as Master for...          |               |                  | None                         |                     |                  |

## 5.2.8.1. Access to RF-Linked Repeater's

**IP settings**

IP Address / Hostname  
172.33.95.91

IP Port 4000 Protocol ☐ TCP ☒ UDP

**Access Parameters**

Access Mode

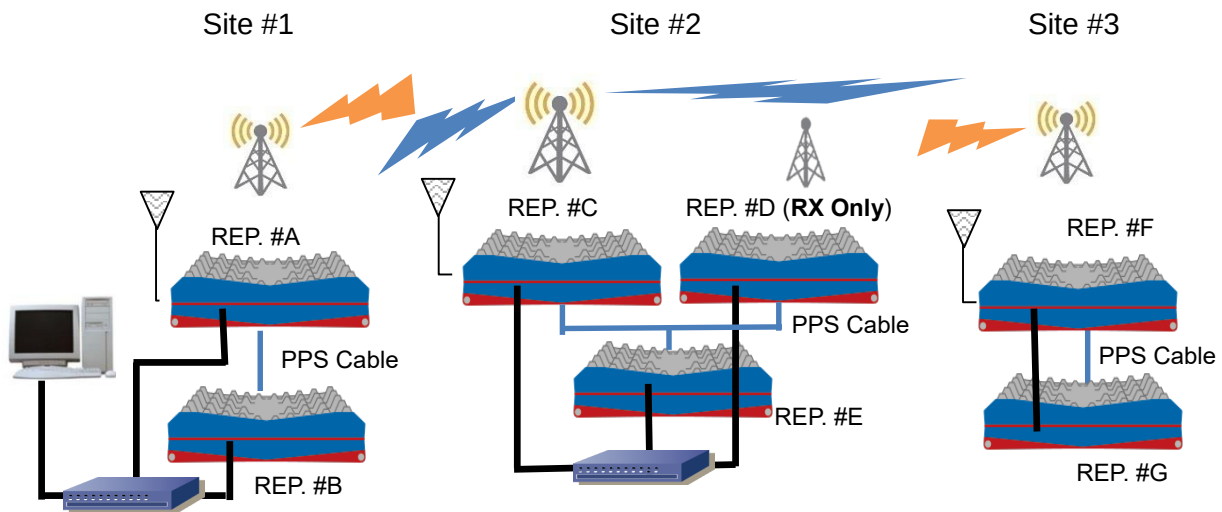
☐ Wired  
☒ DMR RF Link TS A  
☐ DMR RF Link TS B

☒ Station ID (1 ÷ 254) 213  
☐ Use Secure Access Feature  
 Messages Timeout [s] 10

| KAIROS Manager<br>KAIROS –<br>Connection setup | Site #1             |              | Site #2                 |                     | Note                                                                 |
|------------------------------------------------|---------------------|--------------|-------------------------|---------------------|----------------------------------------------------------------------|
|                                                | For RF<br>LINK(DMR) | For Local    | For RF<br>LINK(DM<br>R) | For Local           |                                                                      |
| IP settings                                    | 172.33.91.13        | 172.33.95.13 | <b>172.33.91.13</b>     |                     | When a Site #2 will be connected, enter the RF-LINK Down IP Address. |
| Access Mode                                    | Wired               |              | DMR RF<br>LINK TS A     | DMR RF<br>LINK TS A | Choose DMR RF Link to Access.                                        |
| Station ID (1 to 254)                          | N/A                 |              | 212                     | 213                 | Enter target's Station ID.                                           |
| Message Timeout                                | 4 sec               |              | 10 sec                  |                     | Recommended                                                          |

### 5.2.9. RF Link (DMR) 3Sites

To connect KAIROS via IP by the KAIROS Manager, Administer needs to pay attention for some settings



MultiSite:

Master: REP. #C

Slave: REP. #A, #B, #D, #E, #F and #G

Synchronization:

1<sup>st</sup> Choice: "GPS/GLONASS"

2<sup>nd</sup> Choice: "RF LINK (DMR)"

For RF Link Repeaters

| KAIROS Manager<br><br>KAIROS –<br>Configuration | Site #1       | Site #2       |              | Site #3       | Note        |
|-------------------------------------------------|---------------|---------------|--------------|---------------|-------------|
|                                                 | REP. #A       | REP. #C       | REP. #D      | REP. #F       |             |
| Network Settings                                |               |               |              |               |             |
| IP Settings                                     |               |               |              |               | Unique IP   |
| IP Address                                      | 172.33.91.13  | 172.33.95.14  | 172.33.95.15 | 172.33.92.13  | Address's   |
| Subnet Mask                                     | 255.255.0.0   |               |              |               | Recommended |
| Default Gateway                                 | 172.33.91.254 | 172.33.95.254 |              | 172.33.92.254 |             |
| Main Setup                                      |               |               |              |               |             |
| Identity Data - Station ID                      | 112           | 212           | 213          | 214           | Unique ID's |
| Identity Data – Network ID                      | 160           |               |              |               | Same ID     |
| Identity Data - DMR ID                          | 2112          | 2212          | 2213         | 2312          | Unique ID's |
| GNSS Optional Module                            |               |               |              |               |             |
| Enable GNSS Module if present                   | Checked       | Checked       | None         | Checked       |             |
| Supply Voltage to GNSS                          | Checked       | Checked       | None         | Checked       |             |
| Antenna                                         |               |               |              |               |             |



| KAIROS Manager<br>KAIROS –<br>Configuration | Site #1                       | Site #2                         |                                | Site #3                       | Note    |
|---------------------------------------------|-------------------------------|---------------------------------|--------------------------------|-------------------------------|---------|
|                                             | REP. #A                       | REP. #C                         | REP. #D                        | REP. #F                       |         |
| TRX Operation Modes                         | -                             |                                 |                                |                               |         |
| Operative Mode                              | <b>RF LINK UP<br/>NODE</b>    | <b>RF LINK DOWN NODE</b>        |                                | <b>RF LINK UP<br/>NODE</b>    |         |
| Service                                     | FULL DUPLEX                   |                                 |                                |                               |         |
| Type                                        | SINGLE UNIT                   |                                 |                                |                               |         |
| Enable TRX                                  | Checked                       |                                 | <b>Uncheck</b>                 | Checked                       |         |
| Enabling TX                                 | Checked                       |                                 |                                |                               |         |
| Enabling Main RX                            |                               |                                 |                                |                               |         |
| Channel Table - Channel<br>data editing     |                               |                                 |                                |                               |         |
| TX Frequency [MHz]                          | <b>Freq.#1</b>                | <b>Freq.#2</b>                  | Any                            | <b>Freq.#3</b>                |         |
| RX Frequency [MHz]                          | <b>Freq.#2</b>                | <b>Freq.#1</b>                  | <b>Freq. #3</b>                | <b>Freq.#2</b>                |         |
| Channel Enabled                             | Checked                       |                                 |                                |                               |         |
| ETSI DMR Mode                               | Checked                       |                                 |                                |                               |         |
| Main DMR Color Code                         | RX: 1, TX: 1                  |                                 |                                |                               | Same CC |
| Primary Synchronization                     |                               |                                 |                                |                               |         |
| 1 <sup>st</sup> Choice                      | Internal PPS<br>(GPS/GLONASS) | Internal PPS<br>(GPS/GLONASS)   | <b>External PPS<br/>(Full)</b> | Internal PPS<br>(GPS/GLONASS) |         |
| 2 <sup>nd</sup> Choice                      | <b>RF LINK(DMR)</b>           | <b>Internal Ref(Full)</b>       |                                | <b>RF LINK(DMR)</b>           |         |
| PPS Signal Handling                         |                               |                                 |                                |                               |         |
| -Internal from GPS/GLONASS                  | Automatic/Straight            | Automatic/Straight              | Forced OFF/Straight            | Automatic/Straight            |         |
| -Internal from PTP Device                   | Forced OFF/Straight           | Forced OFF/Straight             | Forced OFF/Straight            | Forced OFF/Straight           |         |
| -External from rear plug                    | Forced ON/Straight            | Forced ON/Straight              | Forced ON/Straight             | Forced ON/Straight            |         |
| PPS to PTP Event                            | Internal Ref                  | Internal Ref                    | Internal Ref                   | Internal Ref                  |         |
| PPS to rear plug                            | Internal Ref                  | <b>Internal Ref</b>             | N/A                            | Internal Ref                  |         |
| RF Sync Source                              | OFF                           | <b>Sync Packets on<br/>TS A</b> | OFF                            | OFF                           |         |
| Base Station Layer<br>Configuration         |                               |                                 |                                |                               |         |
| Display IDLE Packets                        | Checked                       |                                 |                                |                               |         |
| TX:act as...                                | Base Station                  |                                 |                                |                               |         |
| RX:act as...                                | Mobile Station                |                                 |                                |                               |         |
| Hang Timer [30 ms<br>ticks] (0 to 32767)    |                               |                                 |                                |                               |         |

| KAIROS Manager<br>KAIROS –<br>Configuration |                               | Site #1           | Site #2       |                  | Site #3           | Note |
|---------------------------------------------|-------------------------------|-------------------|---------------|------------------|-------------------|------|
|                                             |                               | REP. #A           | REP. #C       | REP. #D          | REP. #F           |      |
|                                             | Private Calls                 | 0                 |               |                  |                   |      |
|                                             | Group Calls                   | 0                 |               |                  |                   |      |
|                                             | Data Response                 | 0                 |               |                  |                   |      |
|                                             | Network Delay [30 ms ticks]   | 2                 | 8             | 2                | 2                 |      |
|                                             | RX Pkts Advance [30 ms ticks] | 6                 | 0             | 6                | 6                 |      |
| Base Station Operating Modes                |                               |                   |               |                  |                   |      |
| Base Station Role                           |                               | LINK UP TO MASTER | <b>MASTER</b> | LINK DWON TO NET | LINK UP TO MASTER |      |
| Stand-Alone                                 |                               | Unchecked         |               |                  |                   |      |
| Master - Preset IP Address                  |                               | N/A               | N/A           | 172.33.95.14     | N/A               |      |
| Voting Delay[ts]                            |                               | None              | 3             | None             |                   |      |

## For local Repeaters

| KAIROS Manager<br>KAIROS –<br>Configuration |                 | Site #1            | Site #2       | Site #3       | Note                |
|---------------------------------------------|-----------------|--------------------|---------------|---------------|---------------------|
|                                             |                 | REP. #B            | REP. #E       | REP. #G       |                     |
| Network Settings                            |                 |                    |               |               |                     |
| IP Settings                                 | IP Address      | 172.33.91.14       | 172.33.95.16  | 172.33.92.14  | Unique IP Address's |
|                                             | Subnet Mask     | 255.255.0.0        |               |               | Recommended         |
|                                             | Default Gateway | 172.33.91.254      | 172.33.95.254 | 172.33.92.254 |                     |
|                                             |                 |                    |               |               |                     |
| Main Setup                                  |                 |                    |               |               |                     |
| Identity Data - Station ID                  |                 | 113                | 214           | 214           | Unique ID's         |
| Identity Data – Network ID                  |                 | 160                |               |               | Same ID             |
| Identity Data - DMR ID                      |                 | 2113               | 2214          | 2313          | Unique ID's         |
| TRX Operation Modes                         |                 |                    |               |               |                     |
| Operative Mode                              |                 | SLAVE BASE STATION |               |               |                     |
| Service                                     |                 | FULL DUPLEX        |               |               |                     |
| Type                                        |                 | SINGLE UNIT        |               |               |                     |

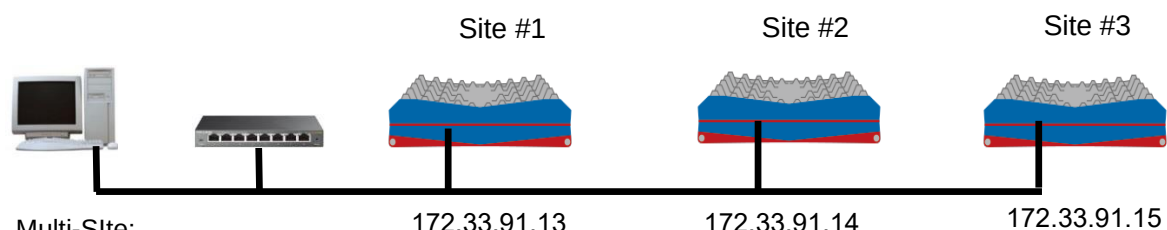
| KAIROS Manager<br>KAIROS –<br>Configuration                                                                                                                         |         | Site #1<br>REP. #B                                                                             | Site #2<br>REP. #E | Site #3<br>REP. #G | Note    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------|--------------------|--------------------|---------|
| Enable TRX<br>Enabling TX<br>Enabling Main RX                                                                                                                       |         |                                                                                                |                    |                    |         |
|                                                                                                                                                                     | Checked |                                                                                                |                    |                    |         |
|                                                                                                                                                                     | Checked |                                                                                                |                    |                    |         |
| Channel Table - Channel data editing                                                                                                                                |         |                                                                                                |                    |                    |         |
| TX Frequency [MHz]                                                                                                                                                  |         | Freq.#4                                                                                        | Freq.#6            | Freq.#8            |         |
| RX Frequency [MHz]                                                                                                                                                  |         | Freq.#5                                                                                        | Freq.#7            | Freq.#9            |         |
| Channel Enabled                                                                                                                                                     |         | Checked                                                                                        |                    |                    |         |
| ETSI DMR Mode                                                                                                                                                       |         | Checked                                                                                        |                    |                    |         |
| Main DMR Color Code                                                                                                                                                 |         | RX: 1, TX: 1                                                                                   |                    |                    | Same CC |
| Primary Synchronization                                                                                                                                             |         |                                                                                                |                    |                    |         |
| 1 <sup>st</sup> Choice                                                                                                                                              |         | External PPS (Full)                                                                            |                    |                    |         |
| PPS Signal Handling<br>-Internal from GPS/GLONASS<br>-Internal from PTP Device<br>-External from rea plug<br>PPS to PTP Event<br>PPS to rear plug<br>RF Sync Source |         | Forced OFF/Straight<br>Forced OFF/Straight<br>Forced ON/Straight<br>Internal Ref<br>N/A<br>OFF |                    |                    |         |
| Base Station Layer Configuration                                                                                                                                    |         |                                                                                                |                    |                    |         |
| TX:act as...                                                                                                                                                        |         | Base Station                                                                                   |                    |                    |         |
| RX:act as...                                                                                                                                                        |         | Base Station                                                                                   |                    |                    |         |
| Hang Timer [30 ms ticks] (0 to 32767)                                                                                                                               |         |                                                                                                |                    |                    |         |
| Private Calls<br>Group Calls<br>Data Response                                                                                                                       |         | 0                                                                                              |                    |                    |         |
| Channel                                                                                                                                                             |         | 100                                                                                            |                    |                    |         |
| Network Delay [30 ms ticks]                                                                                                                                         |         | 8                                                                                              | 8                  | 8                  |         |
| RX Pkts Advance [30 ms ticks]                                                                                                                                       |         | 0                                                                                              | 0                  | 0                  |         |
| Base Station Operating                                                                                                                                              |         |                                                                                                |                    |                    |         |

| KAIROS Manager<br>KAIROS –<br>Configuration | Site #1      | Site #2      | Site #3      | Note |
|---------------------------------------------|--------------|--------------|--------------|------|
|                                             | REP. #B      | REP. #E      | REP. #G      |      |
| Modes                                       |              |              |              |      |
| Base Station Role                           | BROADCASTER  |              |              |      |
| Stand-Alone                                 | Unchecked    |              |              |      |
| IP parameters                               |              |              |              |      |
| Master -<br>Preset IP Address               | 172.33.91.13 | 172.33.95.14 | 172.33.92.13 |      |
| Voting Delay[ts]                            | None         |              |              |      |

## 5.3. Redundancy

### 5.3.1. Backup Master (Multi-site & PTP)

This is 3Site Multi-site with PTP and Backup Master. Below configuration allows keeping system operation even if site1 and site2 have failure.



Site #1: Master

Site #2: **Backup Master**

Site #3: Slave

TX: 153.2 MHz

RX: 148.6MHz

Color Code: 1

TX: 154.4 MHz

RX: 149.8MHz

Color Code: 1

TX: 155.9 MHz

RX: 150.3MHz

Color Code: 1

Synchronization:

Site #1: **PTP Backup Master**

Site #2: PTP Master

Site #3: PTP Slave

| KAIROS Manager<br>KAIROS – Configuration |  | Site #1                  | Site #2            | Site3        | Note        |
|------------------------------------------|--|--------------------------|--------------------|--------------|-------------|
| Network Settings                         |  |                          |                    |              |             |
| IP Settings                              |  |                          |                    |              |             |
| IP Address:                              |  | 172.33.91.13             | 172.33.91.14       | 172.33.91.15 |             |
|                                          |  | Subnet Mask: 255.255.0.0 |                    |              | Recommended |
| Main Setup                               |  |                          |                    |              |             |
| Identity Data - Station ID               |  | 112                      | 212                | 214          | Unique ID's |
| Identity Data – Network ID               |  | 160                      |                    |              | Same ID     |
| Identity Data - DMR ID                   |  | 2112                     | 2212               | 2314         | Unique ID's |
| TRX Operation Modes                      |  |                          |                    |              |             |
| Operative Mode                           |  | Master Base Station      | Slave Base Station |              |             |
| Service                                  |  | FULL DUPLEX              |                    |              |             |
| Type                                     |  | SINGLE UNIT              |                    |              |             |
| Enable TRX                               |  |                          |                    |              |             |
| Enabling TX                              |  | Checked                  |                    |              |             |
| Enabling Main RX                         |  | Checked                  |                    |              |             |
| Line2 (IP Line) Enabled                  |  | Checked                  |                    |              |             |

| KAIROS Manager<br>KAIROS – Configuration |                                           | Site #1                                                                                        | Site #2      | Site3        | Note                                 |
|------------------------------------------|-------------------------------------------|------------------------------------------------------------------------------------------------|--------------|--------------|--------------------------------------|
| Channel Table - Channel data editing     |                                           |                                                                                                |              |              |                                      |
|                                          | TX Frequency [MHz]                        | 153.200000                                                                                     | 154.400000   | 155.900000   |                                      |
|                                          | RX Frequency [MHz]                        | 148.600000                                                                                     | 149.800000   | 150.300000   |                                      |
|                                          | Channel Enabled                           | Checked                                                                                        |              |              |                                      |
|                                          | ETSI DMR Mode                             | Checked                                                                                        |              |              |                                      |
|                                          | Main DMR Color Code                       | RX: 1, TX: 1                                                                                   |              |              |                                      |
| Primary Synchronization                  |                                           |                                                                                                |              |              |                                      |
|                                          | 1 <sup>st</sup> Choice                    | Internal PTP                                                                                   |              |              |                                      |
|                                          | Internal PTP Handling - Role              | Backup Master                                                                                  | Master       | Slave        |                                      |
|                                          | Domain                                    | 0                                                                                              |              |              | Same number                          |
|                                          | Max Slave Groups                          | 2                                                                                              |              |              | Same Number                          |
|                                          | Slave Group Membership                    | 1                                                                                              | 0            | 2            | Master :<br>always zero              |
|                                          | Internal PTP Handling – PTP IP Parameters |                                                                                                |              |              | The Slave needs the Mater IP Address |
|                                          | Master PTP Address                        | 172.33.91.14                                                                                   |              |              |                                      |
|                                          | Backup Mst IP Address                     | 172.33.91.13                                                                                   |              |              |                                      |
|                                          | PPS Signal Handling                       |                                                                                                |              |              |                                      |
|                                          | - Internal from GPS/GLONASS               | Forced OFF /Straight<br>Automatic/Straight<br>Forced OFF/Straight<br>Internal Ref<br>insulated |              |              |                                      |
|                                          | -Internal from PTP Device                 |                                                                                                |              |              |                                      |
|                                          | -External from rea plug                   |                                                                                                |              |              |                                      |
|                                          | PPS to PTP Event                          |                                                                                                |              |              |                                      |
|                                          | PPS to rear plug                          |                                                                                                |              |              |                                      |
| Base Station Layer Configuration         |                                           |                                                                                                |              |              |                                      |
|                                          | Network Delay [30 ms] ticks               | 6                                                                                              |              |              |                                      |
| Base Station Operating Modes             |                                           |                                                                                                |              |              |                                      |
|                                          | Base Station Role                         | MASTER                                                                                         | BROADCASTER  |              |                                      |
|                                          | Stand-Alone                               | Unchecked                                                                                      |              |              |                                      |
|                                          | IP Parameters                             |                                                                                                |              |              |                                      |
|                                          | Master Present IP Address                 | N/A                                                                                            | 172.33.91.13 | 172.33.91.13 |                                      |

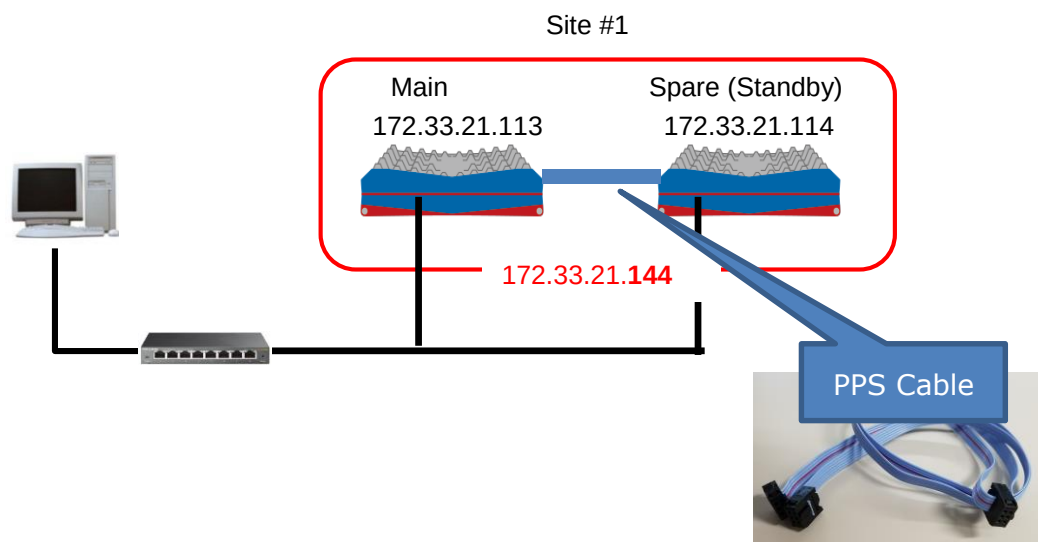
| KAIROS Manager<br>KAIROS – Configuration |                                                                                           | Site #1 | Site #2                              | Site3                                         | Note |
|------------------------------------------|-------------------------------------------------------------------------------------------|---------|--------------------------------------|-----------------------------------------------|------|
|                                          | Backup Master<br>Preset<br>This BS<br>IP Address<br>Become Master on<br>broken connection | N/A     | Checked<br>Checked<br>N/A<br>Checked | Checked<br>Uncheck<br>172.33.91.14<br>Checked |      |
|                                          | Stand-Alone                                                                               |         | Unchecked                            |                                               |      |
|                                          | Network Parameters                                                                        |         |                                      |                                               |      |
|                                          | Voting Delay [ts]                                                                         | 3       | None                                 |                                               |      |

### 5.3.2. 1+1 Redundancy

As site redundancy, introduce single site configuration with 1+1 Hot/Standby.

Note:

It requires 1+1 Redundancy license. And PPS-Cable connection also be required.



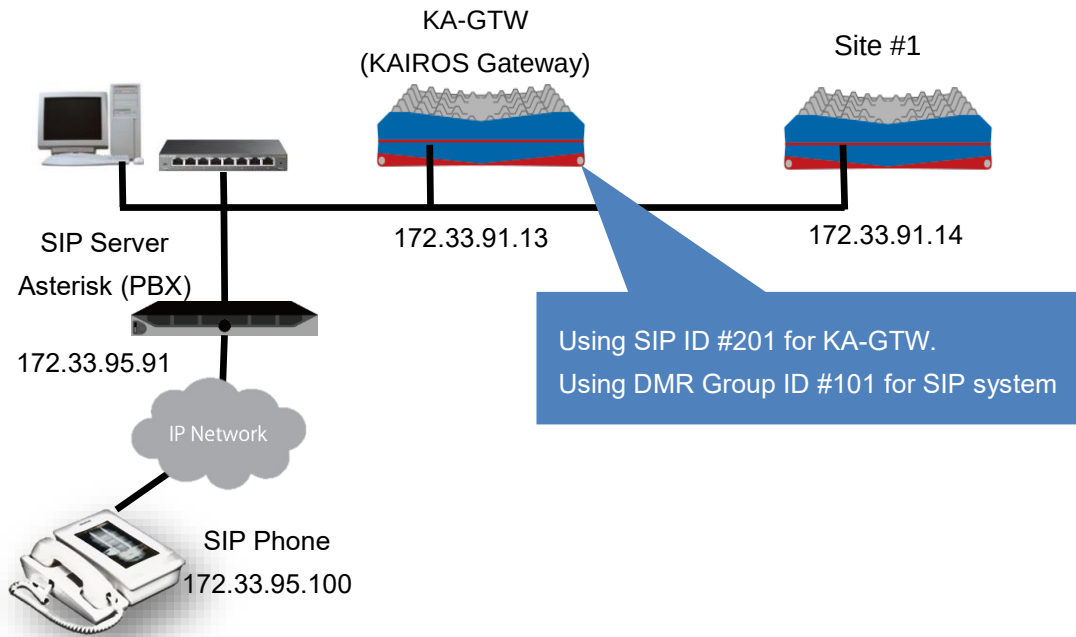
| KAIROS Manager<br>KAIROS – Configuration | Site #1                         |                              | Note                                                                 |
|------------------------------------------|---------------------------------|------------------------------|----------------------------------------------------------------------|
|                                          | Main                            | Spare                        |                                                                      |
| Network Settings                         |                                 |                              |                                                                      |
| IP Settings                              | IP Address:<br>172.33.91.113    | IP Address:<br>172.33.91.114 |                                                                      |
|                                          | Subnet Mask: 255.255.0.0        |                              | Recommended                                                          |
| Main Setup                               |                                 |                              |                                                                      |
| Identity Data - Station ID               | 112                             | 113                          | Some ID's                                                            |
| Identity Data – Network ID               | 160                             |                              | Same ID                                                              |
| <b>Identity Data – 1+1 Address</b>       | <b>144</b>                      |                              | <b>This Site's alias IP Address is configured as "172.33.21.144"</b> |
| Identity Data - DMR ID                   | 2112                            | 2113                         | Unique ID's                                                          |
| TRX Operation Modes                      |                                 |                              |                                                                      |
| Operative Mode                           | SINGLE REPEATER OR MOBILE/FIXED |                              |                                                                      |
| Service                                  | FULL DUPLEX                     |                              |                                                                      |
| Type                                     | <b>1+1 ACTIVE NODE</b>          | <b>1+1 HOT SPARE NODE</b>    |                                                                      |
| Enable TRX                               |                                 |                              |                                                                      |
| Enabling TX                              | Checked                         |                              |                                                                      |
| Enabling Main RX                         | Checked                         |                              |                                                                      |
| Line2 (IP Line) Enabled                  | Checked                         |                              |                                                                      |



| KAIROS Manager<br>KAIROS – Configuration | Site #1      |       | Note            |
|------------------------------------------|--------------|-------|-----------------|
|                                          | Main         | Spare |                 |
| Primary Synchronization                  |              |       |                 |
|                                          |              |       |                 |
| Channel Table - Channel data editing     |              |       |                 |
| TX Frequency [MHz]                       | 153.200000   |       | Some Frequency. |
| RX Frequency [MHz]                       | 148.600000   |       | Some Frequency. |
| Channel Enabled                          | Checked      |       |                 |
| ETSI DMR Mode                            | Checked      |       |                 |
| Main DMR Color Code                      | RX: 1, TX: 1 |       |                 |
| Base Station Operating Modes             |              |       |                 |
| Base Station Role                        | MASTER       |       |                 |
| IP Parameters                            | N/A          |       |                 |
| Stand-Alone                              | Checked      |       |                 |

## 5.4. KAIROS IP Gateway for the SIP Phone System

This is basic single site with Kairos gateway configuration. To connect KAIROS via IP by the KAIROS Manager, Administer needs to pay attention for some settings



| KAIROS Manager<br>KAIROS – Configuration | KA-GTW<br>(KAIROS Gateway)  | Site #1                     | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.91.14 |             |
|                                          | Subnet Mask: 255.255.0.0    |                             | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 212                         | 112                         | Unique ID's |
| Identity Data – Network ID               | 160                         |                             | Some ID's   |
| Identity Data - DMR ID                   | 2212                        | 2112                        | Unique ID's |
| Features                                 |                             |                             |             |
| RUN SIP Layer                            | Checked                     | None                        |             |
| Run RTP Layer"                           | Checked                     | None                        |             |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | Slave Base Station          | Master Base Station         |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | None                        | Checked                     |             |
| Enabling Main RX                         | None                        | Checked                     |             |
| Line2 (IP Line) Enabled                  | Checked                     | Checked                     |             |

| KAIROS Manager<br>KAIROS – Configuration  | KA-GTW<br>(KAIROS Gateway)         | Site #1    | Note                                    |
|-------------------------------------------|------------------------------------|------------|-----------------------------------------|
| Channel Table - Channel data editing      |                                    |            |                                         |
| TX Frequency [MHz]                        | None                               | 153.200000 |                                         |
| RX Frequency [MHz]                        | None                               | 148.600000 |                                         |
| Channel Enabled                           | None                               | Checked    |                                         |
| ETSI DMR Mode                             | Checked                            |            |                                         |
| Main DMR Color Code                       | RX: 1, TX: 1                       |            |                                         |
| Primary Synchronization                   |                                    |            |                                         |
| 1st Choice                                | Internal PTP                       |            |                                         |
| Internal PTP Handling -Role               | Slave                              | Master     |                                         |
| Domain                                    | 0                                  |            |                                         |
| Max Slave Groups                          | 1                                  |            |                                         |
| Slave Group Membership                    | 1                                  | 0          |                                         |
| Internal PTP Handling – PTP IP Parameters | Master IP Address:<br>172.33.91.14 | None       |                                         |
| Basic Station Layer Configuration         |                                    |            |                                         |
| Network Delay [30ms] ticks                | 6                                  |            | Same                                    |
| Base Station Operating Modes              |                                    |            |                                         |
| Base Station Role                         | BROADCASTER                        | MASTER     |                                         |
| Stand-Alone                               | Unchecked                          |            |                                         |
| IP Parameters                             |                                    |            |                                         |
| Preset IP Address                         | 172.33.91.14                       | N/A        |                                         |
| RTP Configuration                         |                                    |            |                                         |
| TS A Channel Parameters<br>Channel Enable | Checked                            | None       |                                         |
| TS B Channel Parameters<br>Channel Enable | Checked                            | None       |                                         |
| SIP Configuration                         |                                    |            |                                         |
| DMR TS A                                  |                                    | None       | Using TS A                              |
| <b>Account Parameters</b>                 |                                    |            |                                         |
| - Account Enabled                         | Checked                            |            |                                         |
| -Perform SIP REGISTER Procedure           | Checked                            |            |                                         |
| -Channel used for                         | Voice                              |            |                                         |
| -Don't delete Main Numeric Prefix on Dial | Uncheck                            |            |                                         |
| -Account Name                             | DMR TS A                           |            |                                         |
| -SIP User ID                              | 201                                |            |                                         |
| -SIP Authentication ID                    | 201                                |            |                                         |
|                                           |                                    |            | Enter information's from the SIP Server |

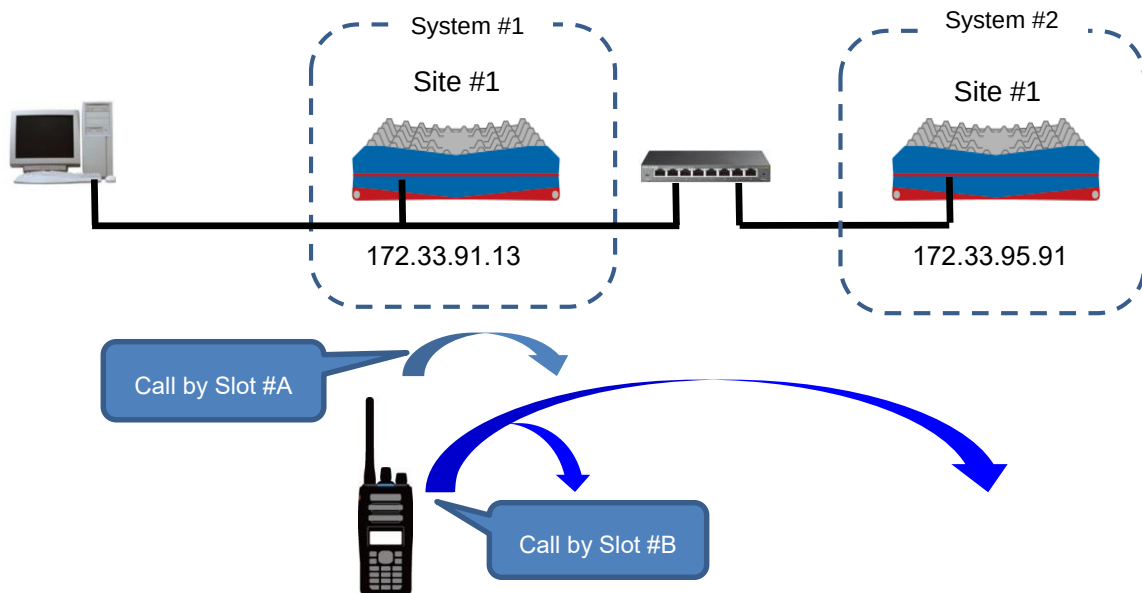
| KAIROS Manager<br>KAIROS – Configuration |                                                                                                                                                                                                 | KA-GTW<br>(KAIROS Gateway)                                                                                   | Site #1 | Note |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------|------|
|                                          | -SIP Password<br>-Hang Sequence Time Window<br><br><b>SIP Server</b><br>-IP Address<br>-Server IP Port<br>-Local IP Port<br>-Protocol<br><b>AIR Calls from SIP</b><br>-ID to call<br>-Call Mode | Blank<br><br>5<br><br><b>172.33.95.91</b><br><b>#5060</b><br><b>#5061</b><br><b>UDP</b><br><br>#101<br>Group |         |      |
|                                          | <b>SIP call from AIR</b><br><b>-Dual Mode</b><br><br><b>-Main Numeric Prefix on DMR Call Alerts</b>                                                                                             | Call alert to<br>Numeric Prefix +<br>SIP Number<br>'99'                                                      |         |      |

Refer application note for start a call and terminate a call procedure.

## 5.5. Multi System

### 5.5.1. Muster to Master

Kairos is able to connect different systems. It is possible to assign Slot A for own system call and Slot B for other system call.



| KAIROS Manager<br>KAIROS – Configuration | System#1<br>Site #1         | System #2<br>Site #1        | Note        |
|------------------------------------------|-----------------------------|-----------------------------|-------------|
| Network Settings                         |                             |                             |             |
| IP Settings                              | IP Address:<br>172.33.91.13 | IP Address:<br>172.33.95.91 |             |
|                                          | Subnet Mask:<br>255.255.0.0 | Subnet Mask:<br>255.255.0.0 | Recommended |
| Main Setup                               |                             |                             |             |
| Identity Data - Station ID               | 212                         | 213                         | Unique ID's |
| Identity Data – Network ID               | 160                         | 161                         | Unique ID's |
| Identity Data - DMR ID                   | 2212                        | 2213                        | Unique ID's |
| TRX Operation Modes                      |                             |                             |             |
| Operative Mode                           | MASTER BASE STATION         |                             |             |
| Service                                  | FULL DUPLEX                 |                             |             |
| Type                                     | SINGLE UNIT                 |                             |             |
| Enable TRX                               |                             |                             |             |
| Enabling TX                              | Checked                     | Checked                     |             |
| Enabling Main RX                         | Checked                     | Checked                     |             |
| Line2 (IP Line) Enabled                  | Checked                     | Checked                     |             |

| KAIROS Manager<br>KAIROS – Configuration | System#1<br>Site #1 | System #2<br>Site #1 | Note                                                                                                                                                         |
|------------------------------------------|---------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Channel Table - Channel data editing     |                     |                      |                                                                                                                                                              |
| TX Frequency [MHz]                       | 153.200000          | 157.400000           |                                                                                                                                                              |
| RX Frequency [MHz]                       | 148.600000          | 152.800000           |                                                                                                                                                              |
| Channel Enabled                          | Checked             | Checked              |                                                                                                                                                              |
| ETSI DMR Mode                            | Checked             | Checked              |                                                                                                                                                              |
| Main DMR Color Code                      | RX: 1, TX: 1        | RX: 1, TX: 1         |                                                                                                                                                              |
| Base Station Operating Modes             |                     |                      |                                                                                                                                                              |
| Base Station Role                        | MASTER              | MASTER               |                                                                                                                                                              |
| Stand-Alone                              | Checked             | Checked              |                                                                                                                                                              |
| <b>Master-to-Master Parameters</b>       |                     |                      |                                                                                                                                                              |
| Static Routers                           |                     |                      |                                                                                                                                                              |
| IP Address                               | 172.33.95.91        | 172.33.91.13         | 1 <sup>st</sup> ∴ Slot #A can call an inter-site call in own system.<br><br>2 <sup>nd</sup> : Slot #B can call make a master-to-master call over own system. |
| TSA                                      | <b>Uncheck</b>      | <b>Uncheck</b>       |                                                                                                                                                              |
| TSB                                      | <b>Check</b>        | <b>Check</b>         |                                                                                                                                                              |
| ANA                                      | None                | None                 |                                                                                                                                                              |

Note:

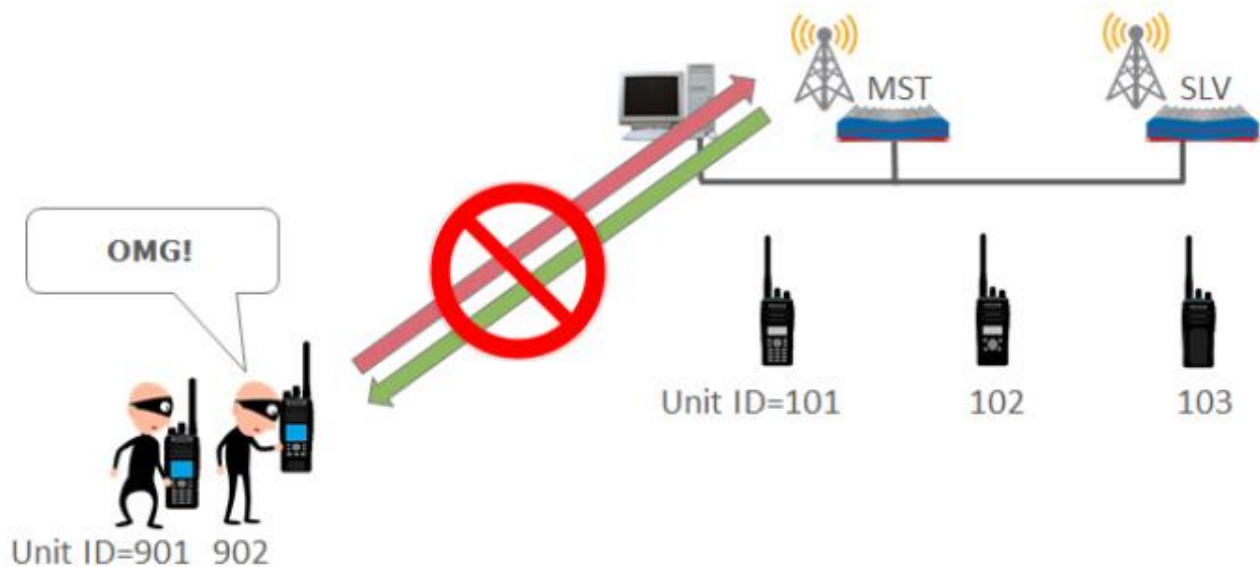
It is impossible to use for Simulcast.

## 5.6. Security

### 5.6.1. Tier II Access Control Lists

KAIROS Repeaters can block an access from unknown Unit ID by "Tier II Access Control Lists".

- (1) Channel Frequency: 150.xxx MHz
- (2) Color Code: 1
- (3) Unit ID Range: 101 ~ 103



Note: No special license is required for this feature except DMR license.

To Enable DMR Tier II Access Control Lists, check "Enable ACL" first, and then enter unit ID range which the KAIROS permit an access. "Allowed DMR IDs" can be set different Unit ID per repeater. This feature applies not only for a voice call but also for a data message.

Tier II Access Control Lists - KAIROS <MST SITE1 CH1>

| #  | Lower ID | Upper ID | #  | Lower ID | Upper ID | #  | Lower ID | Upper ID | #  | Lower ID | Upper ID |
|----|----------|----------|----|----------|----------|----|----------|----------|----|----------|----------|
| 0  | 101      | 103      | 16 |          |          | 32 |          |          | 48 |          |          |
| 1  |          |          | 17 |          |          | 33 |          |          | 49 |          |          |
| 2  |          |          | 18 |          |          | 34 |          |          | 50 |          |          |
| 3  |          |          | 19 |          |          | 35 |          |          | 51 |          |          |
| 4  |          |          | 20 |          |          | 36 |          |          | 52 |          |          |
| 5  |          |          | 21 |          |          | 37 |          |          | 53 |          |          |
| 6  |          |          | 22 |          |          | 38 |          |          | 54 |          |          |
| 7  |          |          | 23 |          |          | 39 |          |          | 55 |          |          |
| 8  |          |          | 24 |          |          | 40 |          |          | 56 |          |          |
| 9  |          |          | 25 |          |          | 41 |          |          | 57 |          |          |
| 10 |          |          | 26 |          |          | 42 |          |          | 58 |          |          |
| 11 |          |          | 27 |          |          | 43 |          |          | 59 |          |          |
| 12 |          |          | 28 |          |          | 44 |          |          | 60 |          |          |
| 13 |          |          | 29 |          |          | 45 |          |          | 61 |          |          |
| 14 |          |          | 30 |          |          | 46 |          |          | 62 |          |          |
| 15 |          |          | 31 |          |          | 47 |          |          | 63 |          |          |

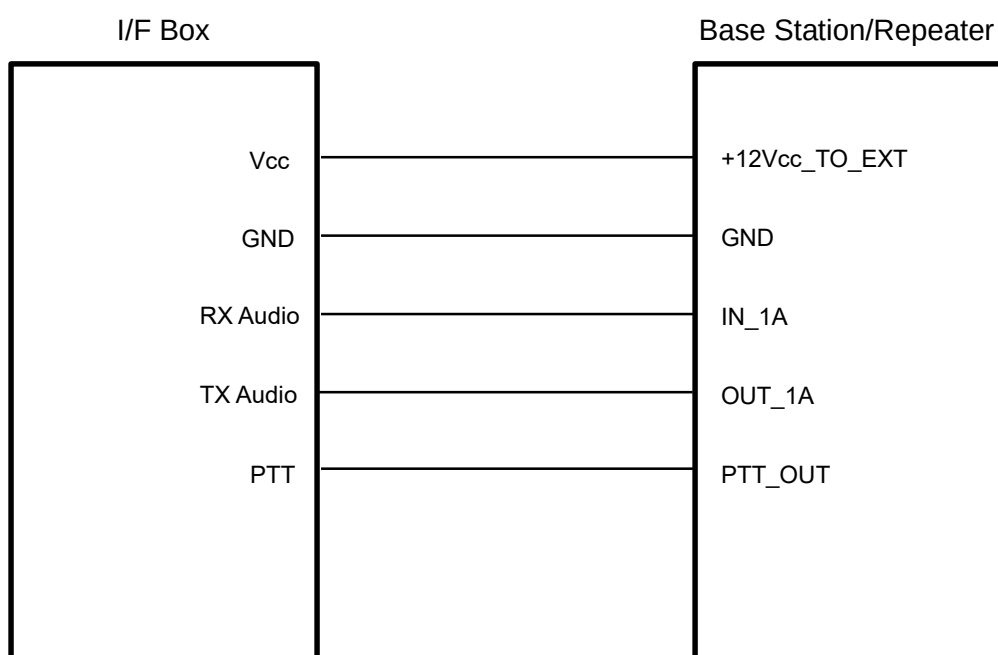
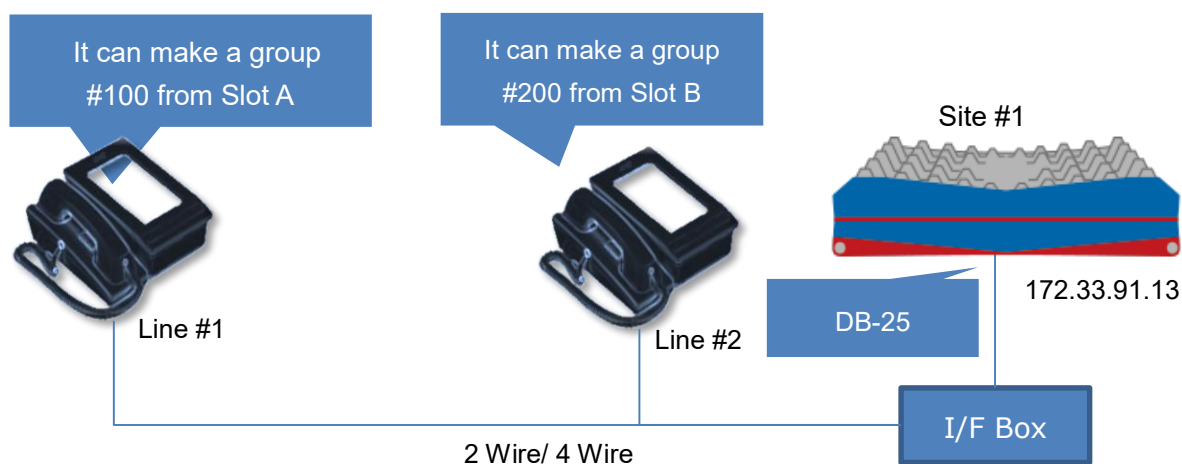
**Enable ACL** ☒

Read from File  
Write on File  
Read  
Write  
Close

| # | Lower ID | Upper ID |
|---|----------|----------|
| 0 | 101      | 103      |

## 5.7. KAIROS Physical Console

This is most basic single site structure with Physical Console. To connect KAIROS via IP by the KAIROS Manager, Administer needs to pay attention for some settings.





| KAIROS Manager<br>KAIROS – Configuration | Site #1                                | Note         |
|------------------------------------------|----------------------------------------|--------------|
| Network Settings                         |                                        |              |
| IP Settings                              | 172.33.91.13                           |              |
| Main Setup                               |                                        |              |
| Identity Data                            | -                                      | Unique ID's  |
| - Station ID                             | 112                                    |              |
| - Network ID                             | 160                                    |              |
| - DMR ID                                 | 2112                                   |              |
| TRX Operation Modes                      |                                        |              |
| Operative Mode                           | <b>SINGLE REPEATER OR MOBILE/FIXED</b> |              |
| Service                                  | FULL DUPLEX                            |              |
| Type                                     | SINGLE UNIT                            |              |
| Enable TRX                               |                                        |              |
| Enabling TX                              | Checked                                |              |
| Enabling Main RX                         | Checked                                |              |
| Channel Table -<br>Channel data editing  |                                        |              |
| TX Frequency [MHz]                       | 153.200000                             |              |
| RX Frequency [MHz]                       | 148.600000                             |              |
| Channel Enabled                          | Checked                                |              |
| ETSI DMR Mode                            | Checked                                |              |
| Main DMR Color Code                      | RX: 1, TX: 1                           |              |
| Base Station Operating Modes             |                                        |              |
| Base Station Role                        | " Master "                             |              |
| Stand-Alone                              | <b>Checked</b>                         |              |
| Physical Console Parameters              |                                        |              |
| Full-Duplex Console                      | <b>Checked</b>                         |              |
| Line 1 Console                           |                                        | Using Slot A |
| Operating Mode                           | <b>'DMR only' or 'MAINLY DMR'</b>      |              |
| Dest. DMR ID                             | <b>#100</b>                            |              |
| All Call/Emergency/Group/Private         | <b>Group</b>                           |              |
| Reply to incoming communication          | Checked                                |              |
| Line 2 Console                           |                                        | Using Slot B |
| Operating Mode                           | <b>'DMR only' or 'MAINLY DMR'</b>      |              |
| Dest. DMR ID                             | <b>#200</b>                            |              |
| All Call/Emergency/Group/Private         | <b>Group</b>                           |              |
| Reply to incoming communication          | Checked                                |              |

Refer I/O Port session for Physical Console connection.

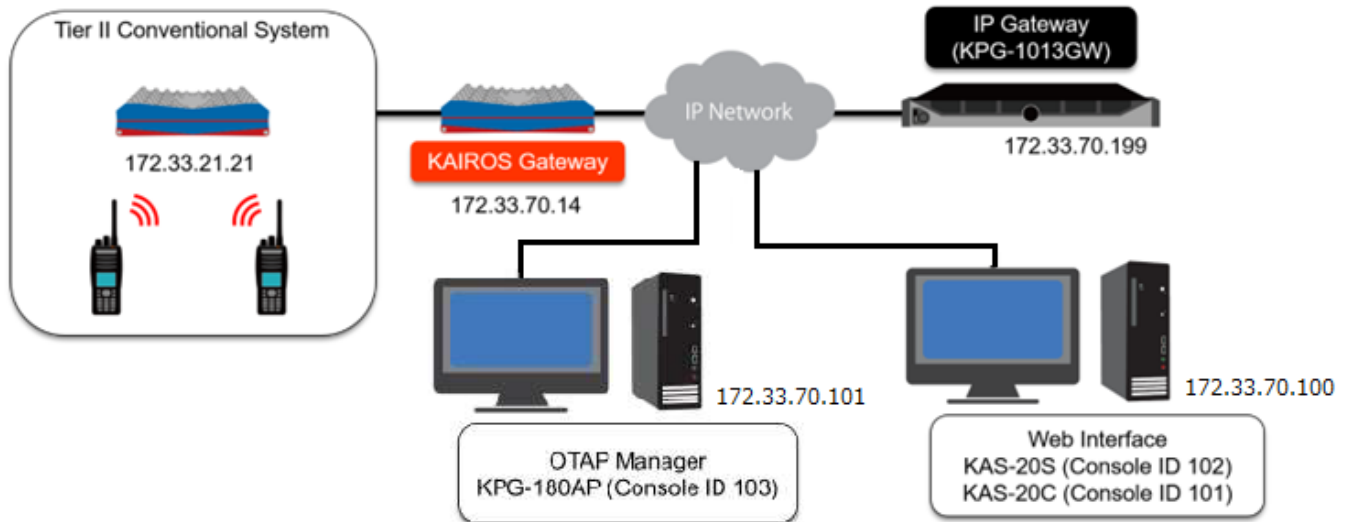
Note:

Kairos doesn't have any function to connect a Console (Pathing). Pathing must be done before connecting with Kairos.

## 5.8. KAIROS IP Gateway for the KAS-20 and the KPG-180AP

This section describes how to set system configuration with IP Gateway, DMR Tier II Conventional System, one KAS-20 Dispatch Console and KPG-180AP OTAP Manager. KAS-20 and KPG-180AP are used Version 3.00.

The following flow is for building the model case. Please refer "AN-19-0013 KAIROS DMR System\_ver1.11" how to configure DMR Tier II Conventional System.



### 5.8.1. RTP Configuration

RTP Configuration - KAIROS <SITE1 CH1>

| TS A Channel Parameters                                 | TS B Channel Parameters                                | ANALOG Channel Parameters                              |
|---------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|
| Channel Enabled <input checked="" type="checkbox"/>     | Channel Enabled <input checked="" type="checkbox"/>    | Channel Enabled <input type="checkbox"/>               |
| Send Data <input checked="" type="checkbox"/>           | Send Data <input checked="" type="checkbox"/>          | Send Data <input checked="" type="checkbox"/>          |
| Send RTP Extension <input checked="" type="checkbox"/>  | Send RTP Extension <input checked="" type="checkbox"/> | Send RTP Extension <input checked="" type="checkbox"/> |
| Send Local Echo <input checked="" type="checkbox"/> (1) | Send Local Echo <input checked="" type="checkbox"/>    | Send Local Echo <input checked="" type="checkbox"/>    |
| Raw Data Exchange <input type="checkbox"/>              | Raw Data Exchange <input type="checkbox"/>             | Raw Data Exchange <input type="checkbox"/>             |
| Symmetric RTP <input type="checkbox"/>                  | Symmetric RTP <input type="checkbox"/>                 | Symmetric RTP <input type="checkbox"/>                 |
| Voice Codec: DMRAI (2)                                  | Voice Codec: DMRAI                                     | Voice Codec: U_LAW                                     |
| Buffering [ms]: 180                                     | Buffering [ms]: 180                                    | Buffering [ms]: 180                                    |
| <b>Voice IP Ports</b>                                   | <b>Voice IP Ports</b>                                  | <b>Voice IP Ports</b>                                  |
| From Console (RX): 40000                                | From Console (RX): 40010                               | From Console (RX): 40020                               |
| To Console (TX): 50000                                  | To Console (TX): 50001                                 | To Console (TX): 40120                                 |
| <b>Data IP Ports</b>                                    | <b>Data IP Ports</b>                                   | <b>Data IP Ports</b>                                   |
| From Console (RX): 40200                                | From Console (RX): 40210                               | From Console (RX): 40220                               |
| To Console (TX): 50000                                  | To Console (TX): 50001                                 | To Console (TX): 40320                                 |

Console IP Address: 172.33.70.199 (3)

Use OLD Equipment-ID Format ☐

Use FIXED timestamp on Header ☐

Read from File Write on File Read Write Close

- (1) Enable "Send Local Echo".
- (2) Voice Codec sets to "DMRAI".
- (3) Console IP Address is set the IP Address for IP Gateway. It's "172.33.70.199".

### 5.8.2. Main Setup

Main Setup - KAIROS <MST Site1 CH1>

**Equipment Name**  
MST Site1 CH1

**Geographic Data**  
Network Name: Demo\_UHF  
Zone Name: ZONE1  
Carrier Name: Carrier1  
Site Name: SITE1  
Manual coordinates source: ☒  
Latitude: 0 0 0 000 N S  
Longitude: 0 0 0 000 E W  
Maidenhead Locator: J300AA

**Identity Data**  
Station ID (1 € 254): 112  
Network ID (1 € 4095): 160  
1+1 Address (1 € 254): 185  
DMR ID (1 € 16776415): 2112  
Group ID (1 € 16776415): 128

**Remote Control**  
LAN Connection  
IP Port: 4000  
Remote Control Via RF Link  
Enabled on Timeslot A: ☐  
Enabled on Timeslot B: ☐  
TLC Secure Access: ☐  
Users' Database  
☐ Internal  
☐ From →

**GNSS Optional Module**  
Enable GNSS Module if present: ☐  
Supply Voltage to GNSS Antenna: ☐  
PPS Time Reference: UTC USNO  
UTC USNO:  
UTC time as per the United States Naval Observatory (USNO)

**I/O Contacts** AUTO ON OFF  
ALARM OUT (ALR\_OUT) ☐ ☐ ☐  
EXT-1 IN (ALR\_IN\_1) ☐ ☐ ☐  
EXT-2 IN (ALR\_IN\_2) ☐ ☐ ☐  
AUX-1 OUT (IO\_OUT\_1) ☐ ☐ ☐  
AUX-2 OUT (PTT\_OUT) ☐ ☐ ☐  
Fons Activation (FAN) ☐ ☐ ☐  
ALARM Status Flag ☐ ☐ ☐

**Features**  
Run TRX Layer: ☒  
Run Station Layer: ☒  
Run RTP Layer: ☒  
Run SIP Layer: ☐

Read from File  
Write on File  
Read  
Write  
Close

- (4) Enable "Run RTP Layer". RTP layer should be activated only if RTP interface is used.

### 5.8.3. Base Station Layer Configuration

This setting is not for KAIROS Gateway but for other repeaters. KAIROS Repeater needs to set "Data Response" if it handles long data message.

Base Station Layer Configuration - KAIROS <T2 IPGW SITE1 CH1>

**Configuration**  
Enable Repeater Mode: ☐  
Direct Mode Reception: ☐  
Send RC on Same Timeslot: ☐  
Display IDLE Packets: ☐  
Manual AT bit Handling: ☐  
Enable ETSI Tier III features: ☐  
TX: act as... Base Station  
RX: act as... Base Station  
MAIN Color Codes: RX 1 TX 1  
AUX Color Codes: RX 1 TX 1

Hang Times [30 ms ticks] (0 ÷ 32767)  
Private Calls: 100  
Group Calls: 100  
Data Response: 1000  
Channel: 100  
Timeslots Validity [30 ms ticks]  
Automatic: 32  
Network Delay [30 ms ticks]  
Automatic: 4  
RX Pkts Advance [30 ms ticks]: 0  
Distance for timing adv [km]: 0

**Reports**  
DMR Status  
Digital Mode Enabled: ☒  
TSA TSB  
TRANSMITTING: ☐  
RECEIVING: ☐  
MS-TO-MS DIRECT: ☐  
Internal Timings  
Current Second/Timeslot: 80  
Current Extended Timeslot: 280  
Last Received Timeslot: 38  
Frequency offset rx [Hz]: -4  
Time offset rx [ms]: -0.042  
Error Vector: 169  
Last Received Color Codes: 1  
Last Transmitted Data Types: 9

Reading  
Read  
Repeat Reading  
Write  
Save to EEPROM  
Close

- (5) Set "Data Response" to 1000.

### 5.8.4. TRX Operating Modes

TRX Operating Modes - KAIROS <Site2 Broadcaster>

**TRX Configuration**

Operative mode: SLAVE BASE STATION

Service: FULL DUPLEX

Type: SINGLE UNIT

Active/Hot-Spare Parameters

Automatic Role Self-Switching Time [min]: 480

30s AUTO ID (needs a codec)

☒ Automatic  
☐ Forced OFF  
☐ Forced ON

Use external PA: ☐

Gain [dB] (0÷25.5):

Max Input Power [W]:

**Enabling TRX**

☒ Enabling TX  
☒ Enabling Main RX  
☒ Enabling Diversity RX  
☐ Enabling Repeater Mode  
☒ PCM 1 (Analog Line 1) Enabled (6)  
☒ PCM 0 (Analog Line 0) Enabled  
☒ Line 3 (Local TRX) Enabled  
☒ Line 2 (IP Line) Enabled  
☒ Line 1 (Physical Line 1) Enabled  
☒ Line 0 (Physical Line 0) Enabled

**Analog Selective Calls Configuration**

Codec to be used: NULL

Tone length (10 € 255 ms): 100

Enable Analog Selective Calls sending: ☐  
Enable Analog Selective Calls reception: ☐  
Enable repetition code insertion: ☒  
Enable repetition code detection: ☒

**Service Class**

☒ Multiprotocol DMR Tier II Node  
☐ Multiprotocol DMR Tier III Node

**SRT-DL Feature**

Role inside the Cell: DISABLED

Auto ID Gallery: ☐

Read from File  
Write on File  
Read  
Write  
Close

- (6) To send Audio by RTP on IP network, enable "PCM 1(Analog Line 1)" and "PCM 0 (Analog Line 0)". PCM 1 is for TSB, and PCM 0 is for TSA.

## 6. Appendix

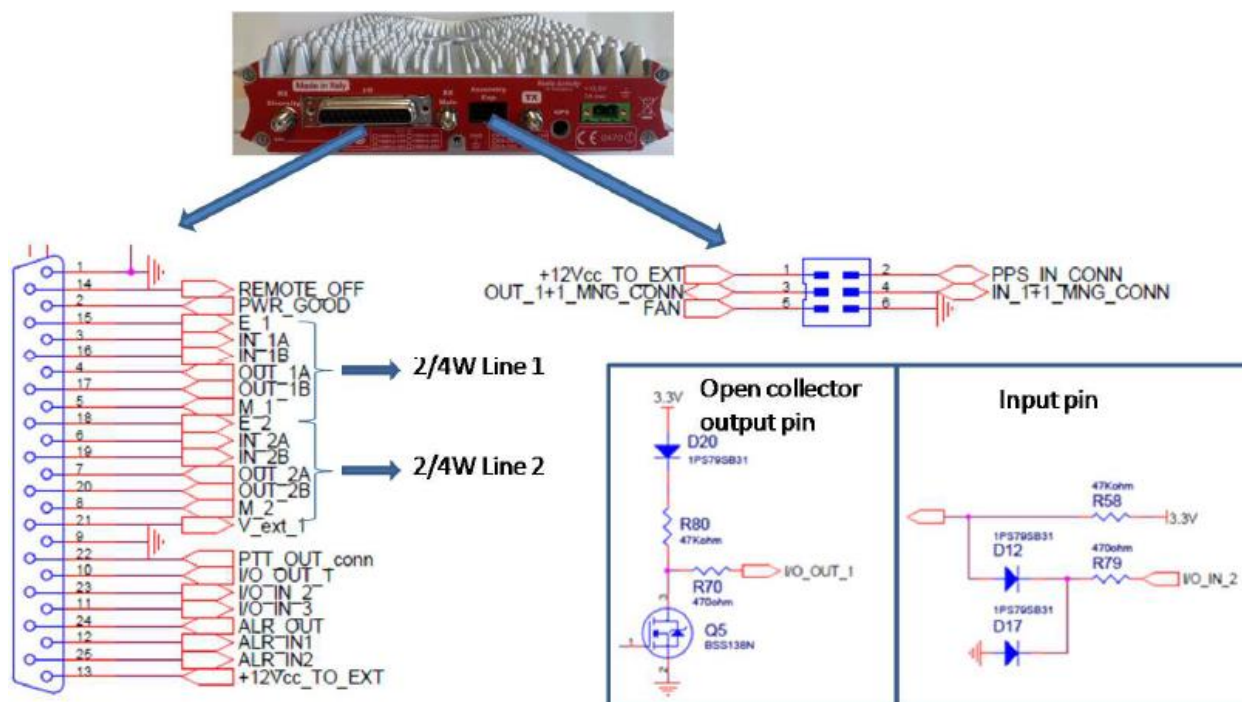
### 6.1. IP Discover

When KAIROS is placed in field or coming back from a site, maybe a problem to connect to it if the IP address is unknown. A simple way to discover the IP is switching on KAIROS with the following procedure.

1. Switch off the equipment.
2. At equipment switched off, press the on/off button for at least 4 sec (all Radio LED will be orange), until the Radio LED start to flash orange slowly.
3. Release the on/off button => the Radio LED start to flash green fast.
4. Press again the on/off button within 4 seconds => the equipment goes in "IP discover status"
5. KAIROS performs all the setup procedure, but its IP becomes: 172.33.16.140/16; during this status the Radio Led flash orange every 2 seconds to advise that the equipment is in a maintenance status.
6. Connect the setup tool to 172.33.16.140/16 address to see/change the IP currently in use in the equipment.
7. At the end of the procedure switch off the equipment pressing the on/off button for at least 2 sec as usual.

At the next power on, the equipment will assume the last IP saved.

## 6.2. I/O Port



### DB25 Connector

| Pin No. | Signal Name | I/O | Signal Type | Description                                               | Spec                   | Typ.      | Remarks                      |
|---------|-------------|-----|-------------|-----------------------------------------------------------|------------------------|-----------|------------------------------|
| 1       | GND         | -   | GND         | GND                                                       | -                      | -         | -                            |
| 2       | PWR_GOOD    | O   | Digital     | Power On Output                                           | H: Not Good<br>L: OK   | 3.3V<br>0 | Open Collector Output Pin.   |
| 3       | IN_1A       | I   | Analog      | Audio Input for Analog (PM)<br>Audio Input for DMR TS1    | Around 1V p-p          | 1 Vp-p    | For DMR need Vocoder option. |
| 4       | OUT_1A      | O   | Analog      | Audio Output for Analog (PM)<br>Audio Output for DMR TS1  |                        | 480mV     | For DMR need Vocoder option. |
| 5       | M_1         | O   | Digital     | Squelch Control for Analog<br>Squelch Control for DMR TS1 | H: Not Busy<br>L: Busy | 3.3V<br>0 |                              |
| 6       | IN_2A       | I   | Analog      | Audio Input for Analog (FM)<br>Audio Input for DMR TS2    | Around 1V p-p          | 1 Vp-p    | For DMR need Vocoder option. |
| 7       | OUT_2A      | O   | Analog      | Audio Output for Analog (FM)<br>Audio Output for DMR TS2  |                        | 1V        | For DMR need Vocoder option. |
| 8       | M_2         | O   | Digital     | Squelch Control for Analog<br>Squelch Control for DMR TS2 | H: Not Busy<br>L: Busy | 3.3V<br>0 | Open Collector Output Pin.   |
| 9       | GND         | -   | GND         | GND                                                       | -                      | -         | -                            |

## 6. Appendix      6.2. I/O Port

|    |                   |   |         |                                                                                                                                              |                                                 |           |                                              |
|----|-------------------|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------|----------------------------------------------|
| 10 | IO_OUT_1          | O | Digital | AUX Output1                                                                                                                                  | H: Not Active<br>L: Active                      | 3.3V<br>0 | Open Collector<br>Output Pin.                |
| 11 | IO_IN_3           | I | Digital | AUX Input3                                                                                                                                   | H: External Device OFF<br>L: External Device ON | 3.3V<br>0 |                                              |
| 12 | ALR_IN1           | I | Digital | Alarm Input1                                                                                                                                 | H: Alarm OFF<br>L: Alarm ON                     | 3.3V<br>0 |                                              |
| 13 | +12Vcc_TO_<br>EXT | O | Analog  | Power Supply for<br>General Purpose External<br>Device                                                                                       | -                                               | Vcc V     | Max 400mA.                                   |
| 14 | REMOTE_O<br>NOFF  | I | Digital | Power On/ Off Control                                                                                                                        | H (250msec): Power ON<br>L (3sec): Power OFF    | 3.3V<br>0 |                                              |
| 15 | E_1               | I | Digital | External PTT Switch1                                                                                                                         | H: External PTT OFF<br>L: External PTT ON       | 3.3V<br>0 |                                              |
| 16 | IN_1B             | I | Analog  | Audio Input for Analog (PM)<br>Audio Input for DMR TS1                                                                                       | Around 1V p-p                                   | 1 Vp-p    | For DMR need<br>Vocoder option.              |
| 17 | OUT_1B            | O | Analog  | Audio Output for Analog (PM)<br>Audio Output for DMR TS1                                                                                     |                                                 | 480mV     | For DMR need<br>Vocoder option.              |
| 18 | E_2               | I | Digital | External PTT Switch2                                                                                                                         | H: External PTT OFF<br>L: External PTT ON       | 3.3V<br>0 |                                              |
| 19 | IN_2B             | I | Analog  | Audio Input for Analog (FM)<br>Audio Input for DMR TS2                                                                                       | Around 1V p-p                                   | 1 Vp-p    | For DMR need<br>Vocoder option.              |
| 20 | OUT_2B            | O | Analog  | Audio Output for Analog (FM)<br>Audio Output for DMR TS2                                                                                     |                                                 | 1V        | For DMR need<br>Vocoder option.              |
| 21 | V_ext_1           | I | Analog  | Not isolated inputs for voltage<br>sensing.<br>ADC port form Analog to Digital.<br>It can be used by Net Control<br>software at this moment. |                                                 | 0 to 20 V | 10k Ohm / 0 to<br>20V referred to<br>ground. |
| 22 | PTT_OUT           | O | Digital | PTT Output                                                                                                                                   | H: Not Active<br>L: Active                      | 3.3V<br>0 | Open Collector<br>Output Pin.                |
| 23 | IO_IN_2           | I | Digital | AUX Input2                                                                                                                                   | H: External Device OFF<br>L: External Device ON | 3.3V<br>0 |                                              |
| 24 | ALR_OUT           | O | Digital | Alarm Output                                                                                                                                 | H: Alarm OFF<br>L: Alarm ON                     | 3.3V<br>0 | Open Collector<br>Output Pin.                |
| 25 | ALR_IN2           | I | Digital | Alarm Input2                                                                                                                                 | H: Alarm OFF<br>L: Alarm ON                     | 3.3V<br>0 |                                              |



## 6pin Connector for flat cable

| Pin No. | Signal Name      | I/O | Signal Type | Description                                                                                                                                                                                                                                                                                                                                                                                                                         | Typ.      | Remarks |
|---------|------------------|-----|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|
| 1       | +12V             | O   | DC          | This pin provides 13.2V, limited at 400mA, to supply a general purpose external device                                                                                                                                                                                                                                                                                                                                              | 13.2V     |         |
| 2       | PPS_IN_CONN      | I/O | Digital     | This pin supports an external PPS signal or can share the internal PPS (from GPS receiver or from the PTP or from other sourced synch). As described previously, a bus connection between different co-located KAIROS realizes a multiple GPS reception with automatic backup. This pin can also be configured to accept an external synchronous clock or an external pulse per second signal. Contact Factory for further details. | 3.3V<br>0 |         |
| 3       | OUT_1+1_MNG_CONN | O   | Digital     | These pins support a simple protocol to allow two KAIROS to functioning as 1+1 (main and spare) redundancy equipment.                                                                                                                                                                                                                                                                                                               | 3.3V<br>0 |         |
| 4       | IN_1+1_MNG_CONN  | I   | Digital     | These pins support a simple protocol to allow two KAIROS to functioning as 1+1 (main and spare) redundancy equipment.                                                                                                                                                                                                                                                                                                               | 3.3V<br>0 |         |
| 5       | FAN              | O   | Digital     | It is closed to GND when the temperature of the internal RF power amplifier rises above the threshold (typ 65°C). It can be used to switch on cooling fans in a cabinet.                                                                                                                                                                                                                                                            | 3.3V<br>0 |         |
| 6       | GND              | I   | Analog      | GND terminal                                                                                                                                                                                                                                                                                                                                                                                                                        | 0V        |         |