

Application Note

DMR Tier III

KAIROS Tier III Trunking

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Revision History

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1 Outline

1.1 Confirmed version information

1. Outline

This document summarizes the basic information necessary to construct Tier 3 Trunking System using KAIROS.

1.1. Confirmed version information

Version of various Software confirmed when editing this material is as follows.

➤ KAIROS Firmware

- OS: Linux 2.4.31 Version 01, Build 07
- KAIROS (Base Station): 1.6.B.1_stable
- DSP: Version 4.5C
- PLD: Version 4.13

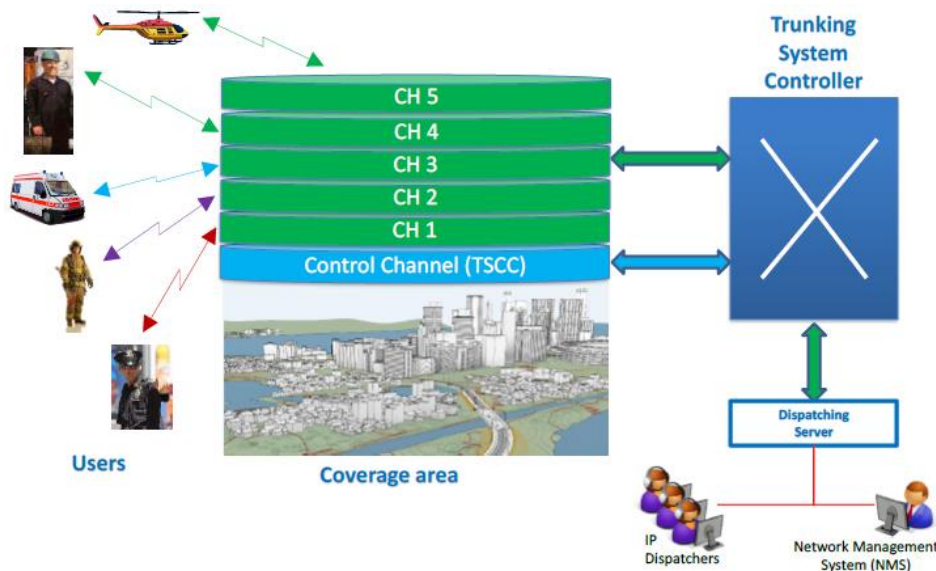
➤ Tier 3 Controller: 1.0.5.0

➤ KAIROS Manager: 1.7.9

2. What's DMR Tier 3 Trunking

In a Tier 3 "Trunked" radio system the number of channels is much lower than the number of potential users, but, the use of channels is optimized while minimizing waiting as the traffic channels are assigned only when needed.

The following picture shows the basic elements of a Tier 3 system.



The system consists of a certain number of channels called traffic channels (Payload/ Traffic channel) and a channel dedicated to the management of the system: the Control Channel (TSCC). The Control Channel is always in transmission and it is controlled by the Tier 3 Controller (TSC - Trunking System Controller in the picture above) which is responsible for regulating the access of the networked terminals allocating the channels as appropriate.

2.1. Overview of KAIROS Tier 3 Trunking

- KAIROS Tier 3 Trunking supports a larger Traffic Capacity with enhanced call function, security, and provides comfortable communication for easier user operation than the Tier 2 Conventional System.
- Multiple applications run on the reliable Linux OS in KAIROS.
- Since KAIROS can install Trunking Site Controller to itself as software, there is no need to separately prepare an industrial server for TSC.
- KAIROS can simplify the system configuration in the site, the number of equipment is small, power consumption is low, heat generation can be suppressed. It also improves reliability in case of failure.
- 16mil types of Unit ID and Group ID are possible.
- The KAIROS Tier 3 Network structure is based on the Distributed controller structure. This architecture reduces processing load on each cell, reduces the required IP bandwidth, and speeds up the communication channel allocation process.
- Combined with Simulcast, KAIROS Tier 3 can build Tier 3 Trunking in a very wide area.
- Migration from Tier 2 to Tier 3 is easy. KAIROS currently in use on Tier 2 can be changed to Tier 3.

2 What's DMR Tier 3 Trunking

2.2 Centralized controller or Distributed controller for TSC redundancy

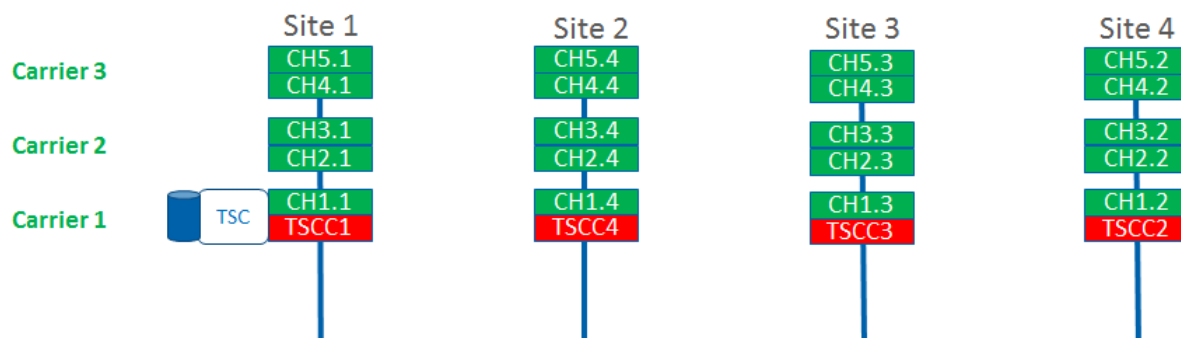
2.2. Centralized controller or Distributed controller for TSC redundancy

This document describes TSC programming information for Centralized controller mode unless specified.

2.2.1. Centralized controller

This is a basic simple Tier3 controller application that a TSC in a system manage traffic for all sites.

Almost of the contents in this manual is written for this “Centralized controller” mode.

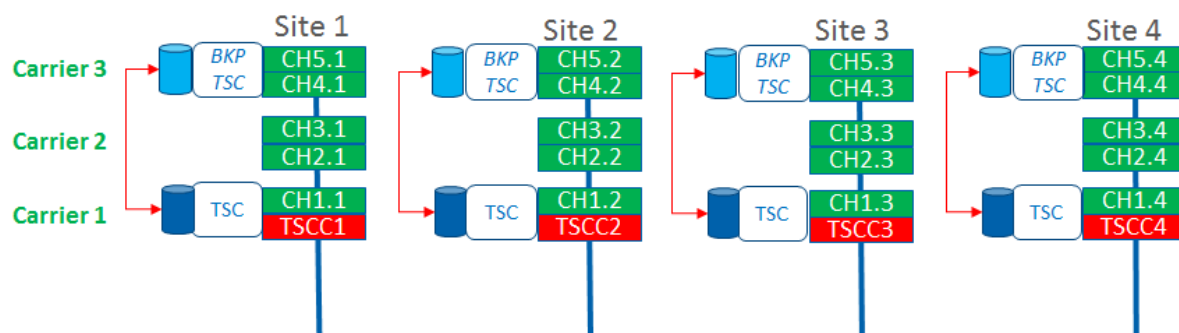


2.2.2. Distributed controller for TSC redundancy

This is a special application for redundancy.

By having plural TSC in a system, it could have redundancy for TSC, but it causes increasing IP traffic and busy communication between TSCs.

Ask JVCKENWOOD before ordering in case you are considering this application.



3 Preparation to use KAIROS for Tier 3

3.1 Make a system configuration diagram

3. Preparation to use KAIROS for Tier 3

Necessary equipment is as follows.

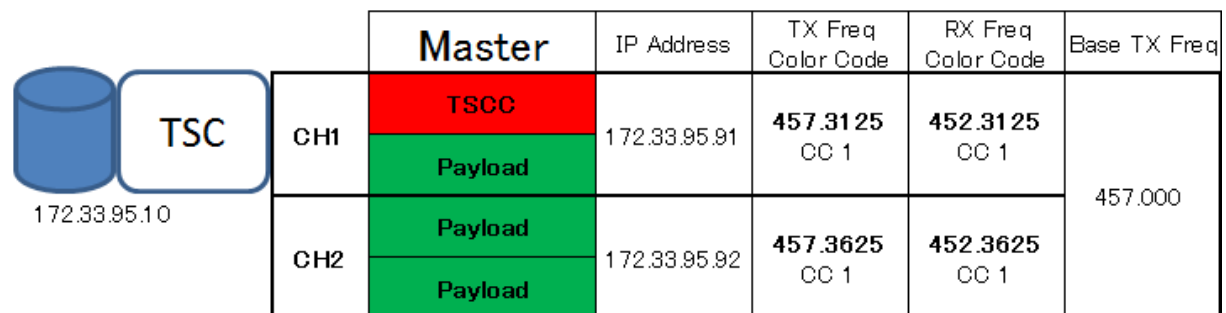
- KAIROS Repeater: One physical channel is set for one KAIROS. A single physical channel can be used for two logical channels. Also, please make sure that all KAIROS Firmware is same version.
- KA-VOC-2: This is an option board that has DMR Vocoder and GPS receiver. Install it in the KAIROS main body.
- Flat Cable: It is for Synchronization between KAIROS in the same site.
- KAIROS Manager: It is a programming software for Windows for frequency setting, color code setting, Tier 2/ Tier 3 switching, Tier 3 Controller writing, and part of Tier 3 setting, etc.
- KAIROS Web: Connect to Web Server in KAIROS by Firefox browser, set up dedicated IP address of Trunking Site Controller (TSC), and start TSC, etc. Firefox is recommended as a browser.
- KAIROS Network Management System (KA-NMS): Connect to Tier 3 Controller in KAIROS by the browser and make detailed setting of Tier 3. Firefox is recommended as a browser.

3.1. Make a system configuration diagram

In order to set up KAIROS Tier 3 Network, it is necessary to input many items to various applications such as KAIROS Manager, KAIROS Web and KA-NMS.

Let's create a system configuration diagram before setting up to reduce mistakes.

[Example]



	Master	IP Address	TX Freq Color Code	RX Freq Color Code	Base TX Freq
CH1	TSCC	172.33.95.91	457.3125 CC 1	452.3125 CC 1	457.000
	Payload				
CH2	Payload	172.33.95.92	457.3625 CC 1	452.3625 CC 1	
	Payload				

3 Preparation to use KAIROS for Tier 3

3.2 Tier 3 License

3.2. Tier 3 License

3.2.1. In case purchasing new KAIROS

Please order Tier 3 license at the same time of ordering KAIROS system.

TSC and NMS license are also needed for a KAIROS that role has TSC. For ordering those licenses, please refer to the AN-20-0002 “Application note KAIROS License Information” for more detail.

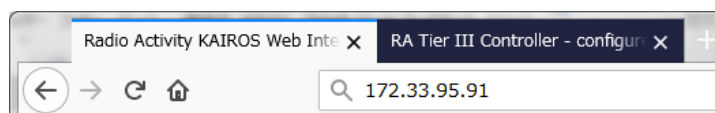
3.2.2. In case changing current KAIROS Tier 2 to Tier 3

Tier 2 KAIROS can be changed to Tier 3. In this case Tier 3 license is required.

TSC and NMS license are also needed for a KAIROS that role has TSC. For ordering those licenses, please refer to the AN-20-0002 “Application note KAIROS License Information” for more detail.

To check the license status, use KAIROS Web.

Enter KAIROS IP Address in Firefox's address bar and press Enter.



Click “Setup” – “Keys” to see the Current license Status.

If the Tier 3 license is Expired, please purchase it and perform Activation.

Current keys status:	
DMR licence	is activated for LIFETIME
Analog licence	is activated for LIFETIME
Tier 3 licence	is activated for LIFETIME
Net Control licence	is activated for LIFETIME
SNMP licence	is activated for LIFETIME
POCSAG licence	is activated for LIFETIME
MTCS licence	is activated for LIFETIME
Simulcast licence	is activated for LIFETIME
P25 licence	is activated for LIFETIME
TX licence	is activated for LIFETIME
SIP licence	is activated for LIFETIME
Amateur Radio Features licence	is activated for LIFETIME
Raw Port licence	is activated for LIFETIME
Audio from web licence	is activated for LIFETIME
VVF Features licence	is activated for LIFETIME
S-Trunking licence	is activated for LIFETIME
1+1 redundancy licence	is activated for LIFETIME
Multi-Site Trunking licence	is activated for LIFETIME
NMS licence	is activated for LIFETIME
TSC licence	is activated for LIFETIME
Number 20 licence	has EXPIRED

Note: Multi-Site Trunking license is required to all of the KAIROS repeater in a multisite system.

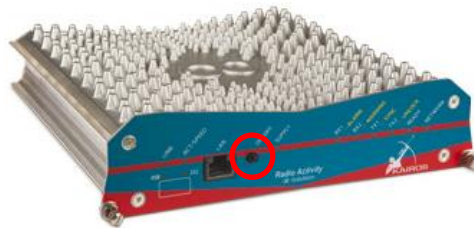
4. Setting

[Important Notice]

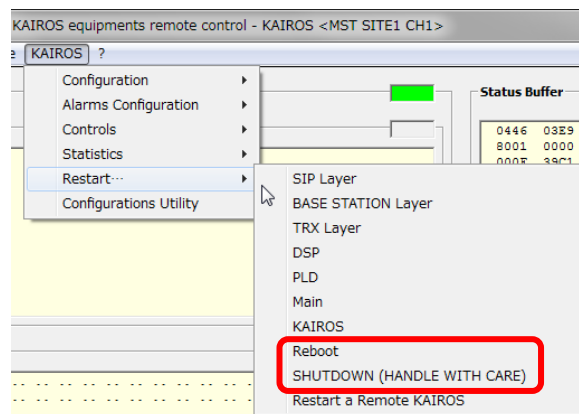
When restarting KAIROS and shutting down, please be sure to operate by the power button operation, KAIROS Manager operation, or KAIROS Web operation.

If it suddenly turns off the power supply and cuts the power supply to KAIROS, it may not start normally the next time.

➤ KAIROS Power button



➤ KAIROS Manager



➤ KAIROS Web



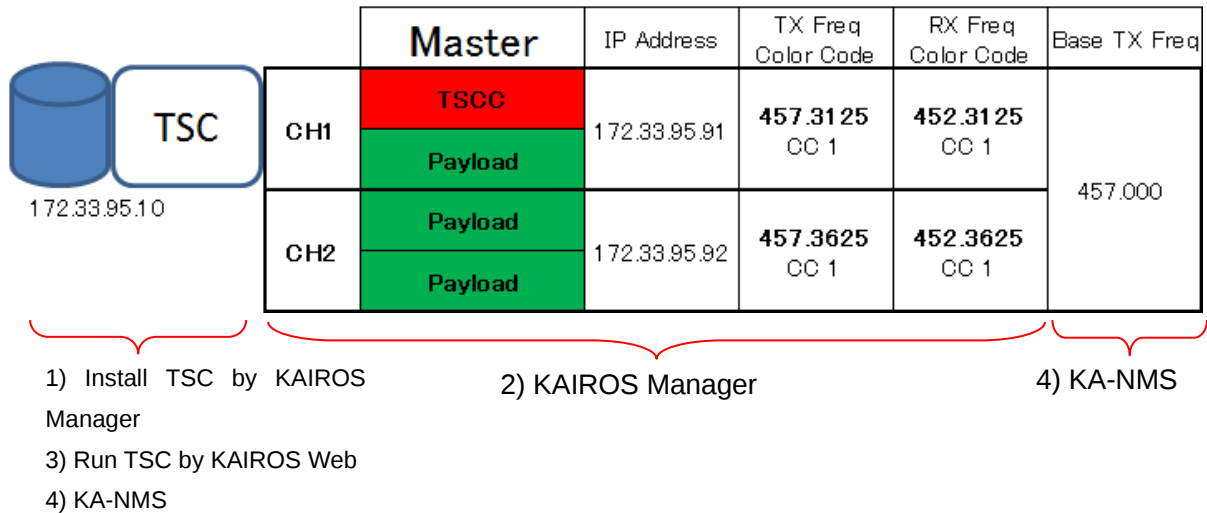
4 Setting

4.1 Basic Setting Procedure

4.1. Basic Setting Procedure

Basically, the setting procedure is as follows.

- 1) Installing Tier 3 Controller by KAIROS Manager (4.2)
- 2) Setting up KAIROS by KAIROS Manager (4.3)
- 3) Run TSC by KAIROS Web (4.4)
- 4) TSC setting by KA-NMS (4.5)



4.2. Install of Tier 3 Controller

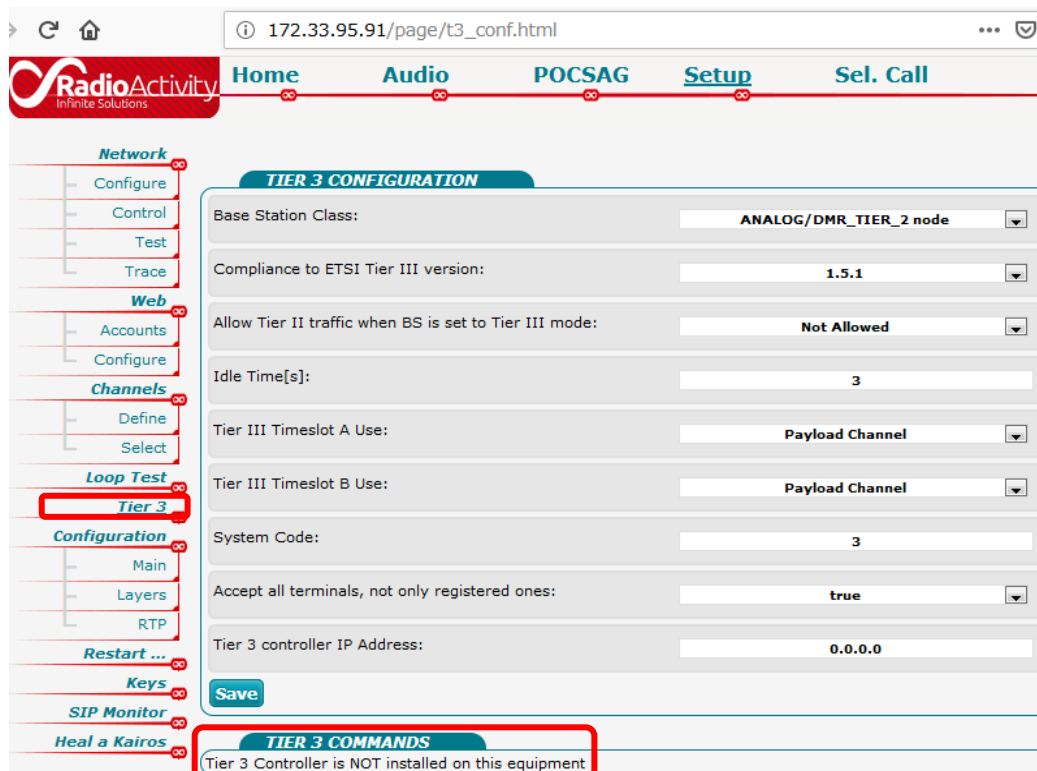
4.2.1. How to confirm the existence of Tier 3 Controller

First decide KAIROS (TSC) to be used as Tier 3 Controller.

Confirm whether Tier 3 Controller is installed in KAIROS or not by the KAIROS Web.

Click Tier 3 from the menu on the left side of KAIROS Web.

The result can be confirmed with TIER 3 COMMANDS at the bottom of the screen.



4 Setting

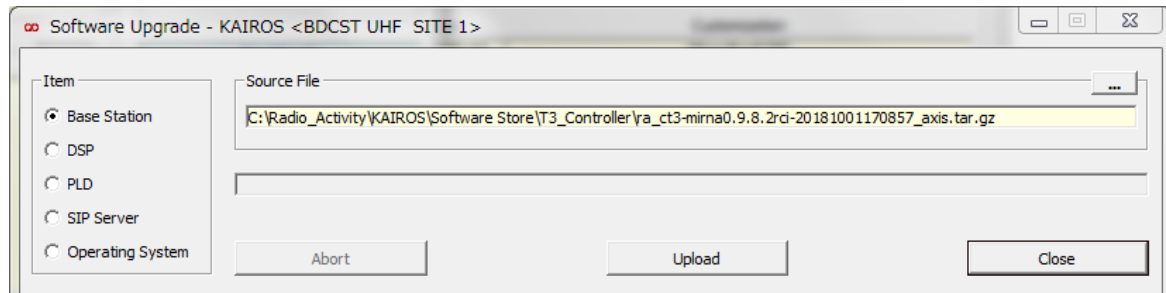
4.2 Install of Tier 3 Controller

4.2.2. Install of Tier 3 Controller

Install of Tier 3 Controller is done by KAIROS Manager.

Select Base Station from Software - Upload.

Select a Source File for the Tier 3 Controller and click Upload.



4.2.3. Confirm installation result of Tier 3 Controller

Make sure Tier 3 Controller is installed in KAIROS on KAIROS Web.

The result is displayed in TIER 3 COMMANDS at the bottom of the KAIROS Web.



4 Setting

4.3 Setting up by KAIROS Manager

4.3. Setting up by KAIROS Manager

4.3.1. Service Class setting

By the KAIROS Manager, set whether to work KAIROS on Tier 2 or Tier 3.

Select "Multiprotocol DMR Tier III Node"

This setting is done for all KAIROS in the network to work as Tier 3.

Not only KAIROS which works as TSC but also KAIROS which roles as Payload requires the same setting.

TRX Operating Modes - KAIROS <RFU 1 MST>

TRX Configuration

Operative mode: MASTER 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
☒ 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

4.3.2. Operative Mode setting

Operative Mode normally selects Master Base Station. The setting target is located in two different places.

This setting has to be done for all of the KAIROS in a network to work as Tier 3.

Not only KAIROS which works as TSC but also KAIROS which roles as Payload requires the same setting as MASTER.

4.3.2.1. TRX Operating Modes - TRX Configuration

TRX Operating Modes - KAIROS <MST SITE1 CH1>

TRX Configuration

Operative mode: MASTER BASE STATION

Service: FULL DUPLEX

Type: SINGLE UNIT

Enabling TRX

☒ 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

Select MASTER BASE STATION in the Operative mode.

Note: All KAIROS repeaters work as the MASTER in Tier 3 System, except Slave KAIROS in Tier 3 Simulcast application.

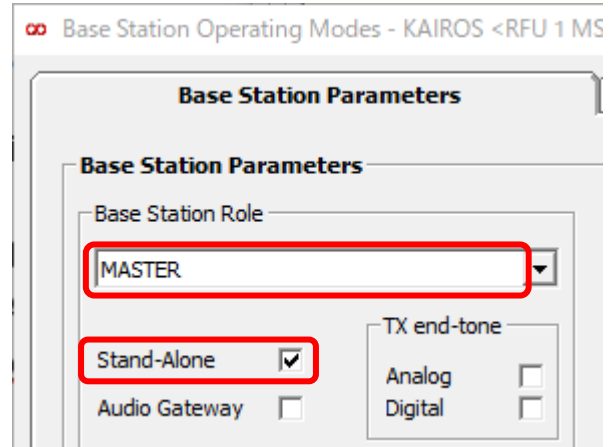
Check PCM 1, PCM 2 in the "Enabling TRX".

4 Setting

4.3 Setting up by KAIROS Manager

4.3.2.2. Base Station Operating Modes - Base Station Parameters

- **Base Station Role:** Select MASTER
- **Stand-Alone:** Check if the system is Single Site, Uncheck if the system is Tier 3 Simulcast or Multi-Site.



Base Station Operating Modes - KAIROS <RFU 1 MS

Base Station Parameters

Base Station Role

MASTER

Stand-Alone ☒

Audio Gateway ☐

TX end-tone

Analog ☐

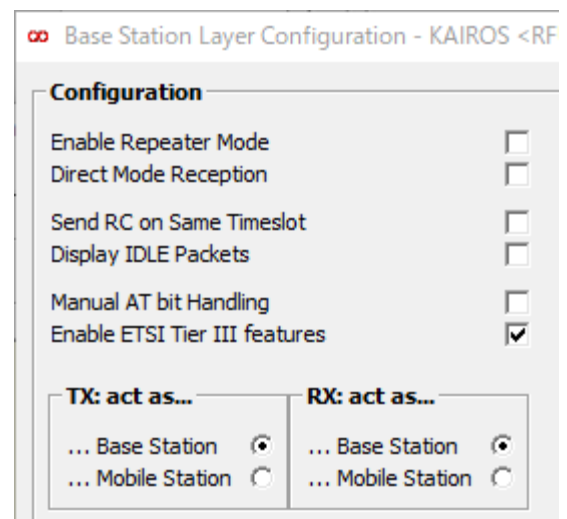
Digital ☐

4.3.3. Base Station Layer Configuration setting

This setting is done for all KAIROS in the network to work as Tier 3.

Not only KAIROS which works as TSC but also KAIROS which roles as Payload requires the same setting.

- **Enable Repeater Mode:** Uncheck
- **Send RC on Same Timeslot:** Check here in case if using Enhanced Encryption, Uncheck with the Firmware 1.6.B.1_stable or later.
- **Manual AT bit handling:** Check here for a KAIROS for TSCC, Uncheck here for a KAIROS for a Payload.
- **Enable ETSI Tier III features:** Check



Base Station Layer Configuration - KAIROS <RF

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 ☒

... Mobile Station ☐

RX: act as...

... Base Station ☒

... Mobile Station ☐

4 Setting

4.3 Setting up by KAIROS Manager

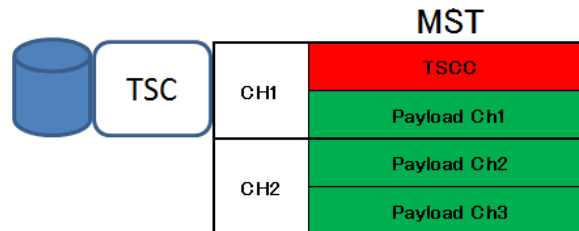
4.3.4. Main setup - Name setting

In the KAIROS Tier 3 network, Name setting is very important.

The Monitor Network of KA-NMS is drawn based on this Name setting as well.

This name setting is done by KAIROS Manager.

For example, when setting up a Single Site like below, set the following names to 2pcs of KAIROS.



∞ Main Setup - KAIROS <RFU 1 MST>	∞ Main Setup - KAIROS <RFU 2 SLV>
Equipment Name MST SITE CH1	Equipment Name MST SITE CH2
Geographic Data Network Name: DEMO KW Zone Name: ZONE 1 Carrier Name: CARRIER 1 Site Name: SITE 1	Geographic Data Network Name: DEMO KW Zone Name: ZONE 1 Carrier Name: CARRIER 2 Site Name: SITE 1

CH1 Repeater CH2 Repeater

- **Equipment Name:** Any name
- **Network Name: Same name**, It must be the same name as the Network name in KA-NMS.
- **Zone Name: Same name**, It is necessary to match this name in all KAIROS managed by the same TSC.
- **Carrier Name: Different name**, Carrier is a radio channel by two Timeslots.
- **Site Name: Same name**, It is necessary to match this name in all KAIROS operated in the same site.

4.3.5. Main setup - Features setting

Features

Run TRX Layer	☒
Run Station Layer	☒
Run RTP Layer	☒
Run SIP Layer	☐

If IP Console is used in a system, RTP communication is required.

- **Run RTP Layer:** Check

[Note] In order to use RTP, the option KA-VOC-2 (DMR Vocoder) is required.

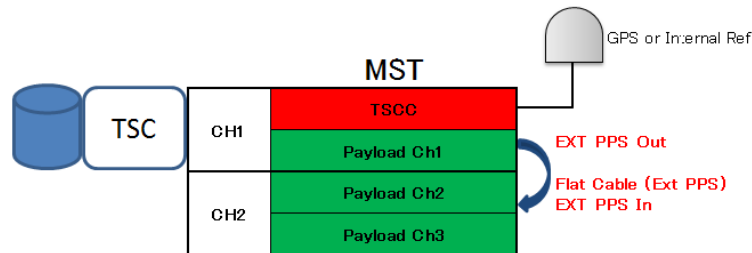
4 Setting

4.3 Setting up by KAIROS Manager

4.3.6. Synchronization

Tier 3 sites usually use multiple KAIROS. Make one KAIROS (usually KAIROS with TSCC) as synchronization Ref. If there are multiple sites, set GPS to Ref and Internal Ref for 1 site only. Other KAIROS receives the synchronization signal from Ref KAIROS as EXT PPS using Flat Cable. By this, multiple KAIROS in the site can be synchronized.

There are several redundancy methods for synchronization, so refer to the KAIROS Manager Function Manual.



Check the synchronization status with Controls - KAIROS Overall Status.

It is no problem if External PPS Signal is locked.

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			

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			

Synchronization Status: CH1 and CH2

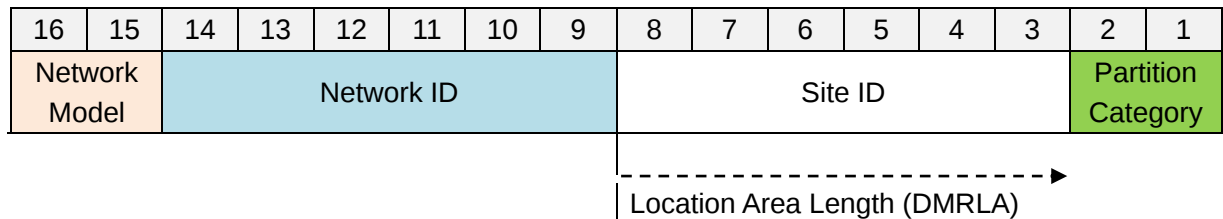
4.3.7. Channel Table setting

Set the Channel Table by KAIROS Manager.

In Single Site, it is necessary to set a different frequency to CH1 (with TSCC) and CH2 (with Payload only).

4.3.8. Explanation of Tier 3 Parameters

- The DMR Tier 3 trunking system has a System Code to identify networks and sites. The System Code is announced from the DMR Tier 3 trunking system. An MS compares it with the own system code and judges whether to perform registration or roaming according to the setting of Coverage Type.
- The System Code consists of the following 16 bits. Depending on the Network Model, the setting range of Network ID, Site ID, Location Area Length (DMRLA) will be changed.

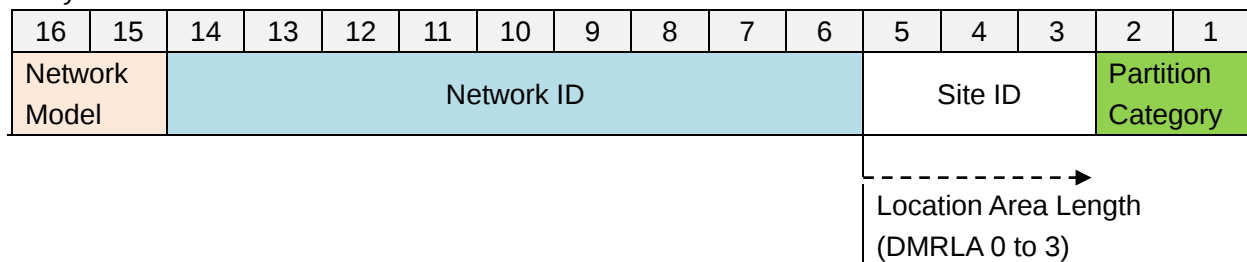


Network Model	Network ID Range	Site ID Range	DMRLA Range	Partition Category
Tiny, 2bit, 00	9bit, 0~511 [ID]	3bit, 0~7 [ID]	0~3 [bit]	2bit A:01 B:10 A+B:11 None:00
Small, 2bit, 01	7bit, 0~127 [ID]	5bit, 0~31 [ID]	0~5 [bit]	
Large, 2bit, 10	4bit, 0~15 [ID]	8bit, 0~255 [ID]	0~8 [bit]	
Huge, 2bit, 11	2bit, 0~3 [ID]	10bit, 0~1023 [ID]	0~10 [bit]	

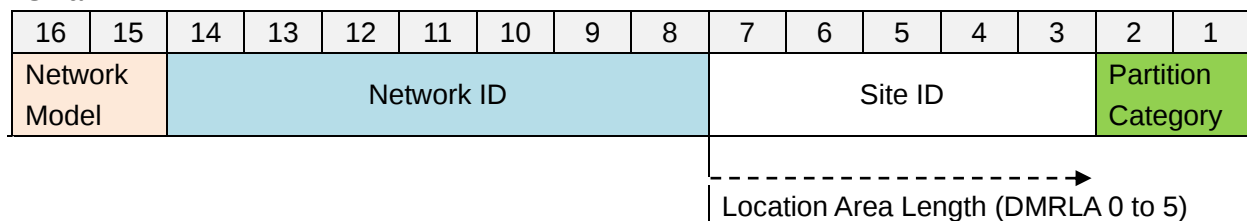
4.3.8.1. Network Model

This parameter indicates the network scale. Depending on the Network Model, the setting range of Network ID and Site ID will be changed.

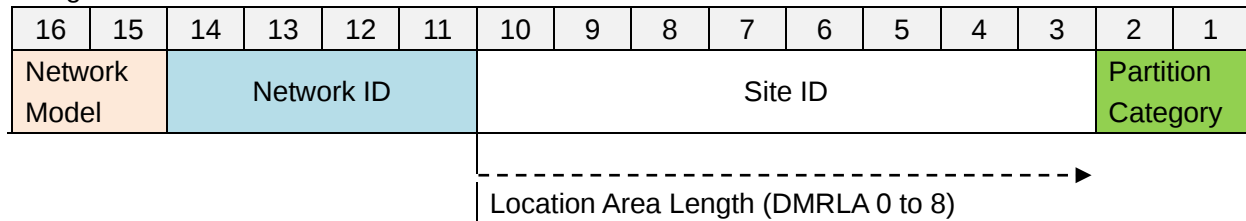
Tiny



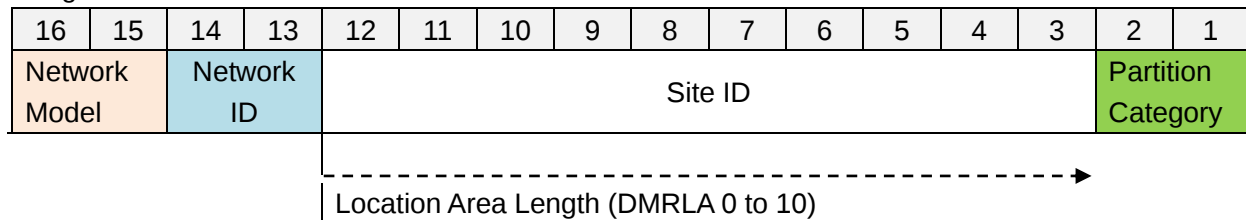
Small



Large



Huge



4.3.8.2. Network ID

Set the Network ID to identify the network.

The setting range of the Network ID depends on the Network Model.

4.3.8.3. Site ID

Set the Site ID to identify the Site.

The setting range of the Site ID depends on the Network Model.

4.3.8.4. Location Area Length (DMRLA)

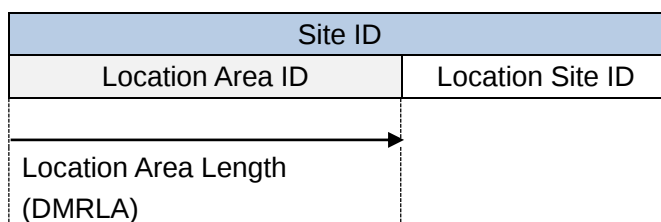
This sets the setting range (number of bits) of the Location Area ID.

The setting range of the DMRLA depends on the Network Model.

4.3.8.5. Location Area ID

This sets the ID that identifies the group of sites. It can be configured with a Location Area ID.

For the bit area of Site ID, the range determined by the Location Area Length (DMRLA) can be set as the Location Area ID.



4.3.8.6. Location Site ID

In the Bit area of Site ID, the part excluding the Location Area ID is used as the Location Site ID.

[Note]

KAIROS does not have a setting called Location Area ID and Location Site ID, and it is set with Site ID and DMRLA.

For example, Let's consider the case below.

Network Model=Small, DMRLA=3, Location Area ID=3, Location Site ID=2

Since "Site ID= 5 bits" and "DMRLA= 3 bits",

Location Area ID becomes "3 bits"

Location Site ID becomes "2 bits"

Small

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Network Model		Network ID								Site ID					Partition Category

Location Area Length (DMRLA)

Since Location Area ID is 3 [dec] = 010 [bin],

Location Site ID is 2 [dec] = 10 [bin]

Site ID becomes 01010 [bin] = 10 [dec]

Site ID				
Location Area ID			Location Site ID	
0	1	0	1	0

Location Area Length (DMRLA=3)

4.3.8.7. Partition Category

For a site with many MS, you can create two (A/ B) groups to distribute access.

The last 2 bytes of System Code is the Partition Category.

Tiny

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Network Model		Network ID										Site ID		Partition Category	

PAR A: Accept terminals that have Partition Category = A. (last 2bits=01)

PAR B: Accept terminals that have Partition Category = B. (last 2bits=10)

PAR A+B: Accept terminals that have Partition Category = both A and B (last 2bits=11)

4 Setting

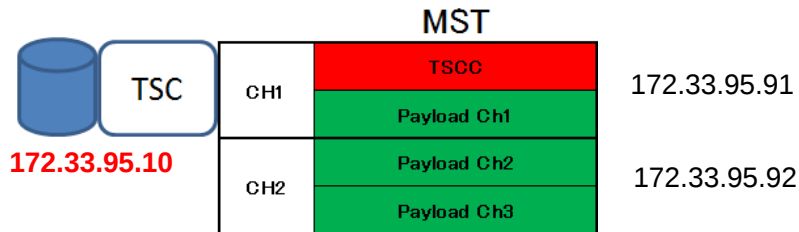
4.3 Setting up by KAIROS Manager

4.3.9. Tier 3 Parameters setting

This section explains how to set Tier 3 Parameters for KAIROS.

This is a common setting for all KAIROS in the same site.

Give another IP address for TSC to KAIROS installed with Tier 3 Controller.



Base Station Operating Modes - Tier III Parameters

Tier III Parameters

Static Configuration

Tier III Controller ☒

IP Address

Run-Time Data

IP Address

Tier III Network

Model

Net (0 ÷ 127)

Site (0 ÷ 31)

Par

TS A Role

TS B Role

Idle Time [s]

Accept not registered terminals ☐

C-syscode [hex]

Net-Site [hex]

Allow Tier II traffic ☐ TS A ☐ TS B ☐

Control Channel Mode

Inactive Timer [ms]

JVCKENWOOD S-Trunking Timing

Interval [ms]

Active [ms]

ETSI Versions Compliance

- **Tier III Controller:** Check
- **IP Address:** Set the IP Address of the TSC. Set KAIROS of CH2 as well.
- **Model:** Choose one from HUGE, LARGE, SMALL, or TINY.
- **Net:** Enter Network ID.
- **Site:** Enter Site ID.
- **Par:** Choose Partition Category.
- **TS A Role:** Choose role of Time Slot A.
- **TS B Role:** Choose role of Time Slot B.
- **Idle Time [s]:** After Uplink disappeared, it is the time that TSCC keeps grant state and assign Payload Ch. In case of Massage Trunk, if you shorten this time, Payload Channel will be released as soon as the Uplink is stopped.
- **Accept not registered terminals:** Uncheck
- **C-syscode [hex]:** It shows System Code in [hex].
- **Net-Site:** It shows Net-Site in [hex].
- **Allow Tier II traffic:** Uncheck both.
- **Control Channel Mode:** Choose "Standard".
- **Inactive Timer [ms]:** It is for S-Trunking.
- **JVCKENWOOD S-Trunking Timing:** It is for S-Trunking.
- **ETSI Versions Compliance:** Choose 1.7.1

4.3.10. Other recommended settings

4.3.10.1. Disable all check box in the Logging Options. (Mandatory)

This Options are only for Radio Activity factory's engineer.

If a KAIROS has Logging Options by checking some of them, it might cause slow system working.

Make sure the settings are all unchecked as the figure below.

Logging Options - KAIROS <RFU 1 MST>

User Messages	Secure Access Messages
Log Facility: USER	Log Facility: SECURITY (SYS3)
Allowed Messages Level	
DEBUG ☐	DEBUG ☐
INFORMATIONAL ☐	INFORMATIONAL ☐
NOTICE ☐	NOTICE ☐
WARNING ☐	WARNING ☐
ERRORS ☐	ERRORS ☐
CRITICAL ☐	CRITICAL ☐
ALERT ☐	ALERT ☐
EMERGENCY ☐	EMERGENCY ☐
Remote Syslog Server ☐	
IP Address:	IP Address:
IP Port: 514	IP Port: 514
Read	Write
Close	

4.4. Setting by KAIROS Web

4.4.1. Run Tier 3 Controller

Install Tier 3 Controller (See [4.2](#)).

Click "Start/ Restart Tier 3 Controller" to Run TSC.

Tier 3 Controller will run in a few minutes.



The version of Tier 3 Controller installed can be seen here.

TS IP Address never show here when the KAIROS is installed TSC first time.

Just proceed to the next page. (See [4.5](#)).

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

4.5. Setting of Tier 3 Controller by KA-NMS

KAIROS Network Management System (KA-NMS) is a Web tool which uses a browser (Firefox) for setting up TSC. KA-NMS is similar to KAIROS Web Interface, but it is another setup tool called KA-NMS.

Open the KA-NMS by adding the Port Number after the IP address.

In addition, there is no KA-MNS setting for Payload KAIROS (KAIROS without TSC). (Because of no TSC)

4.5.1. TSC IP Address setting

TSC owes an important role to manage Traffic in Tier 3 Trunking site.

To set the IP Address for the TSC, enter the following in the address bar of Firefox and press Enter.

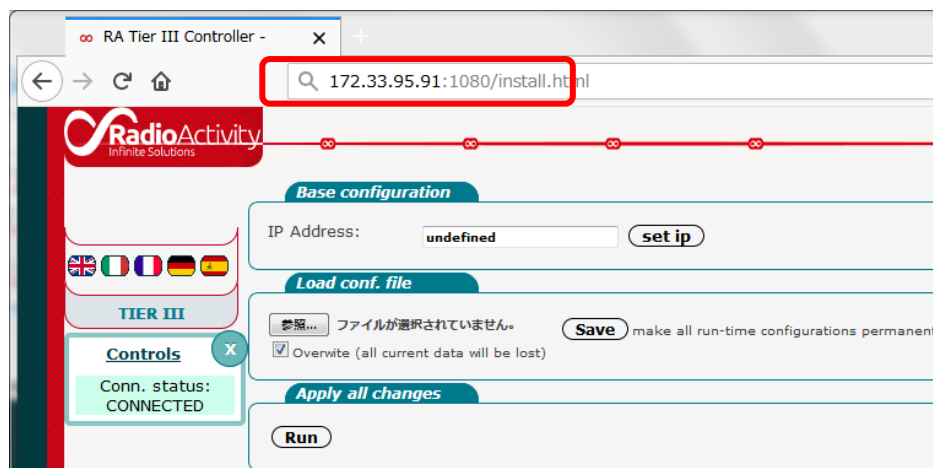
Set a new independent IP address for the TSC. The TSC IP Address is the same IP Address as set in Section 4.3.9.

In addition, set TSC's IP Address to KAIROS of Payload Channel. This is done in 4.3.9.

To set the TSC IP Address, add Port Number **":1080/install.html"** to KAIROS IP Address.

Enter the following in the Firefox address bar and press Enter.

[KAIROS IP Address]:**1080/install.html**



Enter the IP Address of TSC in "IP Address" and click "set ip".

Then click "Run". After about 10 seconds the browser will refresh.



Now, TSC has been given IP address and started TSC role.

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

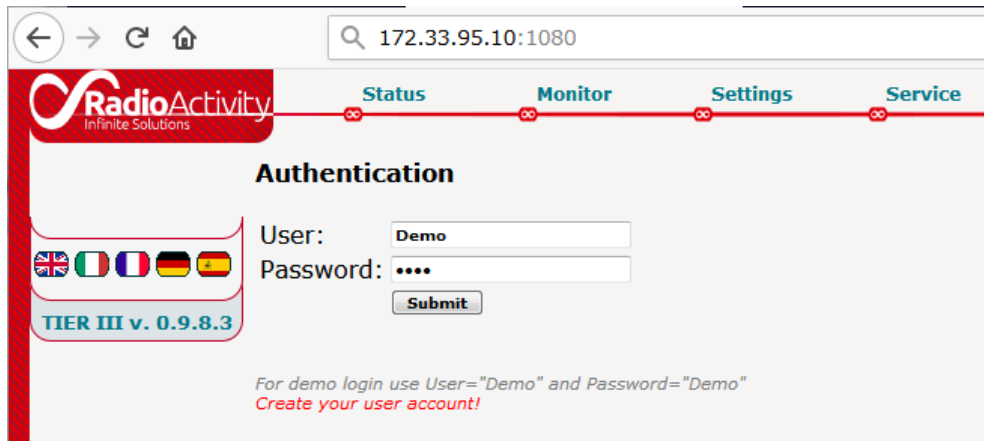
4.5.2. How to open KAIROS Network Management System (KA-NMS)

To open the TSC for setting, add Port Number "":1080" to KAIROS IP Address.

Enter the following in the Firefox address bar and press Enter.

[KAIROS IP Address]:1080

Enter User = "Demo", Password = "Demo" and click "Submit".



4.5.3. Settings

By clicking "Settings", following screen will be displayed.



4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS



- **Mobile Station:** Allows to add DMR portables and configure their rights.
- **Call Groups:** Allows to add Groups and configure their rights.
- **External Servers:** Allows to set interfaces towards external server such as alarm server, SNMP server, dispatching servers.
- **System:** Allows to set different parameters and choose different options related to the Tier 3 protocol.
- **Network:** Allows to add a new Tier 3 DMR network and edit the parameters of existent Tier 3 DMR network.
- **Controller:** This is a setting for “Distributed Controller” for TSC redundancy. (For more detail, Refer to the AN-19-0008_DMR_Tier3_TSC_Redundancy_V100)
- **Trunk Station:** This is a setting for “Distributed Controller” for TSC redundancy. (For more detail, Refer to the AN-19-0008_DMR_Tier3_TSC_Redundancy_V100)
- **Gateways:** Allows to add Gateways.
- **[T]TT:** It has not been developed yet.
- **Users:** Allows to add new users to Administrators

- **Maintenance:** Allows to manage configurations and perform the restart of the Tier 3 controller.
- **Logout:** allows to logout from the current session of KA-NMS

4.5.3.1. Network

By using this information, MS can roam between networked sites, enabling a wide range of system operations such as communication between different sites. In addition, the Network setting is necessary information for MS to perform Registration properly.

To create a new Network, click "Add Network" in the small "Filter" window that appears on the bottom left of the screen.

Make the same settings as Tier 3 Parameters set in KAIROS Manager. (See [4.3.9](#))

Make sure that hex value of System Code matches C-syscode [hex] in KAIROS Manager. (See [4.3.9](#))

C-syscode [hex]	4503
Net-Site [hex]	0140

A screenshot of the KA-NMS interface. On the left, a 'Filter' window is open, showing 'Conn. status: CONNECTED' and an 'Add Network' button highlighted with a red rectangle. On the right, the 'Edit' window for a network is shown. It has tabs for 'This Network', 'Add Network', and 'Delete Network'. The 'Add Network' tab is active. The 'Data to be edited' section contains the following fields: Name (DEMO KW), ColorCode (1), Model (Small), Net (10), Site (0), Par (checked for A and B), DmrLa (5), Backoff (8), System Code (17667, with a red rectangle around it and a note 'hex:4503'), and Base Tx Frequency (457000000). A 'Save' button is at the bottom.

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

Name	DEMO KW
ColorCode	1
Model	Small
Net	10
Site	0
Par	☒ A ☒ B
DmrLa	5
Backoff	8
System Code	17667 0100010100000011 hex:4503
Base Tx Frequency	457000000

➤ **Net:** this is the network identifier of the trunked system. Each DMR Tier 3 network composing a single Tier 3 infrastructure should have its own Network ID. Since the number of bits representing the Net ID + Site ID is fixed (12 bit), thus the higher is the number of sites for each network the lower is the number of independent trunked network you may have in your system.

➤ **Site:** This field is the Site identifier. Each site inside a network should have its own site ID

➤ **Par:** This field is used to split the fleet of portables into independent groups. It is used for example in case there are two different control channels (TSCC) and we need to force a group of portables to use the first control channel and the other group to use the second control channel. This feature should be set also on portables. Portables set to use PAR A+B can use both the control channels.

➤ **DmrLa:** This field specifies the length, expressed as the number of bits, of the C_SYS_AREA field which is used to identify the coverage of the area of a DMR Tier 3 Network. The coverage area is divided into a number of location areas (DmrLa): a DmrLa corresponds to a single radio site or a small number of radio sites.

➤ **Backoff:** This parameter specifies the Backoff number. When either the DMR portable's random access request on the control channel fails or any answer to a random request is received, the mobile radio will try to access again to the control channel after a variable amount of time randomly chosen from in the interval between [0 to Backoff * 30] ms in order to avoid collision of access from the portable.

➤ **System Code:** once the Model, Net, Site Par and DmrLa have been set the Network Management System computes the System Identity Code and displays it in this box. Be sure that the same System Identity Code is identical to the one set on portables otherwise the registration procedure will not succeed.

➤ **Base Tx Frequency:** in order to assign payload channels to requesting radios both the trunking controller and mobile portables need a way to identify the carrier. The controller can send this information to mobile portables either specifying directly the physical channel number (that is the frequency of the carrier of the payload channel) or specifying the logical channel number. If the latter method is used then the logical channel number is computed by both of the parties in the following way:

$$f_{Base}[MHz] + (LogicalCH - 1) * f_{ChSpacing}[MHz] / 1000$$

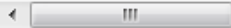
Please, consider you need to specify a Base Tx Frequency for each network.

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

4.5.3.2. System

4.5.3.2.1. Audio/Data Call

<u>Audio/Data Call</u>	
Trunking Method	Message
Trunking_Method_Force	None
Timeout Audio Call Setup	30
Timeout Audio Call	600
Timeout Late Entry	1
Audio Call Setup Type	OACSU
Force As Configured in Call Setup	None
Ind. Audio Call Setup Speedup	On
Channel P_Protect	Start payload use
Channel P_Protect Timeout	5
Channel P_Protect Number	250
Channel P_Clear Number	3
Timeout Audio Call Setup QACK	3
Audio Call Group Zone	All network zone
Audio Call Group Mode	Fast Start Mode
Rights AudioData	None
TX Interrupt	Deny
Talkgroup Call Collision	Wait Late Entry
Payload Check	Check payload after reservati 

In order to set up a voice call on a DMR Tier 3 system a subscriber presses the PTT on its mobile radio, then the mobile transmits a call request to the system using the control channel (TSCC). The Tier 3 controller sends, on the control channel, a Channel Grant message to the calling portable and to the called portable (or the target group of subscribers). All the mobile portables involved in the call then turn on the traffic channel assigned by the controller.

Trunking Method	Allows to choose the trunking method of the radio network: ➤ Message Trunking mode: A voice call always starts with a request sent by portable on TSCC. The traffic channel is allocated for all the duration of the call and must be explicitly released by user. ➤ Transmission Trunking mode: A new traffic channel request is sent on the TSCC by the portable each time the PTT is sent. ➤ Quasi Transmission Trunking mode: A new traffic channel request is sent on TSCC by the portable after a Hang time has elapsed.
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4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

Trunking_Method_Force	➤ Use Transmission Method for Data Call: This selection is available when "Message Trunking mode" is selected. ➤ Use Message Method for Data Call: This selection is available when "Transmission Trunking mode" is selected.
Timeout Audio Call Setup [s]	This is the maximum amount of time tolerated by the system from the call request to call establishment (Channel Grant).
Timeout Audio Call	This is the maximum amount of time a call can stay on air before being terminated by the system. Set 0 to disable this feature.
Timeout Late Entry	Minimum time between two consecutive Channel Grant packets. A variable number of Channel Grant signaling packet is sent on control channel to advise a Talkgroup call is active. In this way a radio can join a voice talkgroup call also if it was not on the control channel at the time of call initiation. By setting 0 only one channel grant is transmitted by the Controller (pay attention because portables which do not receive the Ch Grant will not be able to join the group call).
Audio_Call_Setup_Type	Allows to choose how individual audio calls are managed by the system: ➤ OACSU (off the air call setup) ➤ FOACSU (full off the air call setup) ➤ Unconfirmed (Not supported by KENWOOD radios)
Force As Configured in Call Setup	➤ Ind call Type as Caller: FOACSU / OACSU can be set for each calling Mobile Station. After enabling this "Ind call Type as Caller", set FOACSU or OACSU for the sending Mobile Station in "Mobile Stations-> Sent Call type". ➤ Ind call Type as Called: FOACSU / OACSU can be set for each called Mobile Station. After enabling this "Ind call Type as Called", set FOACSU or OACSU for the receiving Mobile Station in "Mobile Stations-> Sent Call type". ➤ Ind call Priority as caller: A priority of Individual call can be set for each caller Mobile Station. After enabling this "Ind call Priority as Caller", set Priority for the Caller Mobile Station in "Mobile Stations-> Sent Priority". ➤ Ind call Priority as called: A priority of Individual call can be set for each called Mobile Station. After enabling this "Ind call Priority as Called", set Priority for the Caller Mobile Station in "Mobile Stations-> Received Priority". ➤ Grp Call Priority as called: A priority of Group call can be set for each called Group ID. After enabling this "Grp call Priority as Called", set Priority for the Caller Group ID in "Mobile Stations-> Call Groups".
Ind. Audio Call Setup Speedup	On: TSC reserves PCH before confirm availability of called MS. Off: TSC reserves PCH after confirm availability of called MS to improve PCH efficiency.

Channel P_Protect	Selection cases to send P_Protect packet on payload channels. P_Protect is a message on the Payload channel which contains the available ID for the communication on it. If a Mobile Station receives the P_Protect message which is not related to it, the MS returns to TSCC immediately. ➤ Start payload use : Check here always Select whether to send a P_PROTECT packet when PCH assignment is completed. ➤ Payload in use : Uncheck (N/A) Select whether to send a P_PROTECT packet while Hang Time is being on the PCH. ➤ End Voice (alt.LCT) : Uncheck (N/A) Select whether to send P_PROTECT packet on PCH after releasing Mobile Station's PTT. ➤ Free payload : Uncheck (N/A) Select whether to send a P_PROTECT packet instead of an Idle packet on the reverse slot when it is free.
Channel P_Protect Timeout	Not available. Minimum Time in seconds between two P_Protect messages when sent periodically.
Channel P_Protect Number	Number of P_Protect message to send as sequence. e.g. 250 is around 15 seconds.
Channel_P_Clear Number	Number of P_CLEAR packets sent on the traffic channel before releasing it.
Timeout Audio Call Setup QACK	This is the maximum amount of time the system waits after receiving a call request before queuing the call in case it does not receive any answer.
Audio Call Group Zone	Allows to choose which zones should receive a incoming group call: ➤ Configured Zone Table: The group call is established only in the list of zones configured on NMS, ➤ Mobile Subscribers selection position: The group call is established only in the zones where portables subscribed to that group are present, ➤ Caller Zone: The group call is established only in the same zone it was originated, ➤ All network zone: The group call is established in all the zones of the Tier 3 network
Audio Call Group Mode	Select the group call setup mode in case of Multisite group call: ➤ Fast Start mode: a Multi-Site Talkgroup voice call is set up in all the destination sites where at least one traffic channel is available and it is set up on each busy site as soon as a traffic channel becomes available. ➤ All Start mode: a Multi-Site Talkgroup voice call is queued if at least at one of the destination sites there is not any traffic channel available. The call is set up only when all destination sites have a traffic channel available.
Rights Audio Data	Allows to set the rights of a communication: ➤ Table: Uncheck here. Not available ➤ User: Follows by setting in Mobile Stations. See 4.5.3.3. ➤ Group: Uncheck here. Not available

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

TX Interrupt	➤ Deny : The System denies TX Interrupt request. ➤ Low Priority Mode : The System accepts TX Interrupt request only Emergency call. ➤ ETSI Mode : The System accepts TX Interrupt request only Emergency call. (Same as Low Priority Mode) ➤ High Priority Mode : The System accepts TX Interrupt request and force interrupt MS whatever its settings.
Talkgroup Call Collision	➤ Wait Late Entry : In case two Mobile Stations start the same Group ID of "Group call" at the almost same timing, TSCC never sends back "NACK" to the one which starts call a bit late. If a Mobile Station can move to the Payload channel by grant message which is not granted to the one can use this setting. The loser one will move to the Payload channel by Late Entry. ➤ Deny : Select this for NX-3000/5000 Series. In case two Mobile Stations start the same Group ID of "Group call" at the almost same timing, TSCC sends back "NACK" to the one which starts call a bit late. The loser one will move to the Payload channel by Late Entry.
Payload Check	➤ Check payload after reservation: Check ➤ Use BS periodic cross-busy check: Uncheck here. Not available

4.5.3.2.2. Network

Network	
Network Type	Multisite Multifrequen III
Control channel Mode	Dedicated
Control channel Aloha	On
Control Channel Type	TSCC
Control Channel Source	BS
Control Channel Switch	Never
Control Channel Switch Time	
Authentication	None
Authentication Timeout	0
Power Save	None

Network Type	Allows to choose one of the following network topologies: ➤ Multisite Multifrequency: Each site is related to one or more carriers and can have its TSCC. ➤ Simulcast/Single site: It is a Tier 3 simulcast network. While Tier 2 Simulcast network is composed a single carrier master and slaves repeaters, in a Tier 3 Simulcast network the master is a group of master repeaters (TSCC+Payload Channel) and a group of slave repeaters. ➤ Mixed: This solution mixes both the first and the second case.
Control Channel Mode	Allows to choose the Control Channel Mode: ➤ Dedicated: control channel is always on air, keeps transmitting ALOHA. ➤ Non Dedicated: control channel can be converted to traffic channel if needed. ➤ Shared Spectrum:
Control Channel Aloha	Allows to choose whether ALOHA signaling packets should be sent on control channel. By default it is set to yes.
Control Channel Type	A physical channel may support both a Trunk Station Control Channel (TSCC) on one logical channel and a Trunk Station Control Channel Alternate Slot (TSCCAS) on the other logical channel. Allows to choose the control channel type, which can be: ➤ TSCC: Trunk Station Control Channel ➤ TSCCAS: The TSCCAS provides a USBD polling and data transfer facility.
Control Channel Source	Allows to choose if the control channel configurations are acquired by reading repeater's configurations or by reading the NMS configurations. ➤ BS: Select this. ➤ TS: Don't select this. Not available.

Control Channel Switch	Allows to choose which conditions can cause the control channel to switch to another carrier/timeslot: ➤ Never: Select here. ➤ Auto: Don't select here. Not available. ➤ Fault: Don't select here. Not available.
Control Channel Switch Time	Allows to set the minimum timelife of Control Channel before switch in seconds.
Authentication	➤ None ➤ Registration : Select this in case of using Authentication. ➤ Call Setup: Don't select here. Not available. ➤ Periodic: Don't select here. Not available. ➤ Stun/Revive: Don't select here. Not available. ➤ Kill: Don't select here. Not available.
Authentication Timeout	It can be entered some number (0: infinity) in case "Periodic" is selected in Authentication.
Power Save	If a Tier 3 system is designed to use power save select some value from here, in this case same setting in Mobile Station is also required. ➤ None ; This is a best selection to have quick response for traffics. ➤ 1:2 ; The System supports Power Save for a Mobile Station that enables "Power Save (Short)". ➤ 1:4 ; The System supports Power Save for a Mobile Station that enables "Power Save (Medium)". ➤ 1:8 ; The System supports Power Save for a Mobile Station that enables "Power Save (Long)". ➤ 1:16 ; This is a reserved selection, don't select it. ➤ 1:32 ; This is a reserved selection, don't select it. ➤ 1:64 ; This is a reserved selection, don't select it. ➤ 1:128 ; This is a reserved selection, don't select it.

4.5.3.2.3. Registration

<u>Registration</u>	
Timeout Inactivity	3600
Timeout Delete	10
Procedure	Standard
Options	Single Talk-group Att Talk-group List Subsc III
Rights	MS Account

Timeout Inactivity	Maximum amount of inactivity time in seconds before de-registering a portable.
Timeout Delete	Timeout after a terminal contact loss before it's data will be deleted
Procedure	Allows to choose the registration procedure: ➤ Automatic: When a Mobile Station starts call but the controller has not registered it yet (due to restarted TSC and so on), register it immediately then allow call request. ➤ Standard: When a Mobile Station starts call but the controller has not registered it yet (due to restarted TSC and so on), MS will be failed to start call. The MS can be registered after that. ➤ No Requested: The Controller never manages MS registration information.
Options	Allows to choose following options: ➤ Single Talk-group Attachment: Allows Mobile Station Group subscription for one Group ID. ➤ Talk-group List Subscription: Allows Mobile Station Group subscription for more than 2 Group IDs. ➤ Mass Registration Packet: The system sends a Registration request to all Mobile Stations after restart TSC automatically.
Rights	Allows to choose where to check radio rights during Registration Process with following options: ➤ MS Account: Check here ➤ Rights Table: Don't select here. Not available.

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

4.5.3.2.4. T3 System

<u>T3 System</u>	
Etsi Compliance	1.8.1
Announce Adjacent Site	On
Announce Logical Physical Channel	Off
Announce TSCC	Off
Announce_Time	Off
Polling NMEA	UDT
Timeout positioning request polling	600
Access_Control	On
Advance Message	Off
Networks Separation	Off
TS Topology	Distributed
TS Operation	TS Logic
TS Priority	None
Demo Rights	None
Flooding Filter	Medium

Etsi Compliance	Allows to choose which version of ETSI standard to be compliant with: ➤ 1.8.1 ➤ 1.5.1 ➤ 1.6.1 ➤ 1.7.1 Select 1.8.1 normally.
Announce Adjacent Site	Enables transmission of adjacent site announcement packets. This packets announce information about the TSCCs in use on radio sites close to this TSCC to assist MS to acquire an appropriate TSCC if the MS moves out of radio contact with the current TSCC (could be used to make the portable choosing a particular control channel out of other possible control channels). By default this feature is disabled.
Announce Logical Physical Channel	Enables transmission of PDU containing a Logical/ Physical channel association. This PDU announces a logical to physical channel relationship. The PDU defines the physical transmitter and receiver frequencies to be assigned to a logical channel
Announce TSCC	This announcement adds and/or withdraws a TSCC radio channel that is active in a wide area system. MSs shall add/ withdraw the logical channel (s) to/ from their Short Hunt list of physical channels to hunt.
Announce Time	Off or On. Select Off. NX-3000/5000 series are not available for the setting "On".

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4.5 Setting of Tier 3 Controller by KA-NMS

Polling NMEA	Set NMEA automatic polling request (ON/ OFF). ➤ UDT: Allow send GPS data from MS on TSCC (TS A) with UDT format. ➤ Off ➤ USB D CC: Allow send GPS data from MS on TSCC (TS A) with USB D format. Do not use this selection normally. ➤ USB D CCAS: Allow send GPS data from MS on TSCCAS (TS B) with USB D format.
Access Control	Check the IP address of external Server in case of inbound IP packets.
Advance Message	Allows advance sending of important messages
Networks Separation	Allows to keep separate users from different networks.
TS Topology	➤ Distributed; is a selection for the Distributed Controller mode for TSC redundancy. ➤ Centralized; is a selection for the Centralized Controller mode for single TSC. Select this for a simple system.
TS Operation	➤ TS Logic; is a selection for the Distributed Controller mode for TSC redundancy. ➤ BS Status; is a selection for the Centralized Controller mode for single TSC. Select this for a simple system.
TS Priority	➤ Use High Priority : Set the Microprocessor priority to the controller than the base station.
Demo Rights	➤ Don't check rights in call setup; Uncheck here in actual usage, If check here TSC doesn't check "Call Groups Table" to setup call.
Flooding Filter	If the same call happens very often this setting can set the level of sending "NACK". ➤ Medium : Select this normally ➤ Low : Recommended to select this in S-Trunking. ➤ High : Send "Failed" more frequently.

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4.5 Setting of Tier 3 Controller by KA-NMS

4.5.3.2.5 Short data message

<u>Short data message</u>	
SDM Timeout	0
SDM Format	UTF-16BE (16 bit)
SDM TS Timeout	1800
SDM Multisite	Group
SDM CutTail	0

SDM Timeout	Enter 0. Not available.
SDM Format	➤ UTF-16BE (16 bit): Select this normally. ➤ Forward Received: It forwards received data. Don't use this normally. ➤ ISO-646 (7 bit): Don't select this. Not available. ➤ ISO-8859 (8 bit): Don't select this. Not available.
SDM TS Timeout	Don't select this. Not available.
SDM Multisite	➤ Individual: Don't select this. Not available. ➤ Group: Select this normally.
SDM CutTail	Don't select this. Not available.

4.5.3.2.6 S-Trunking

<u>S-Trunking</u>	
S-Trunking Mode	Off

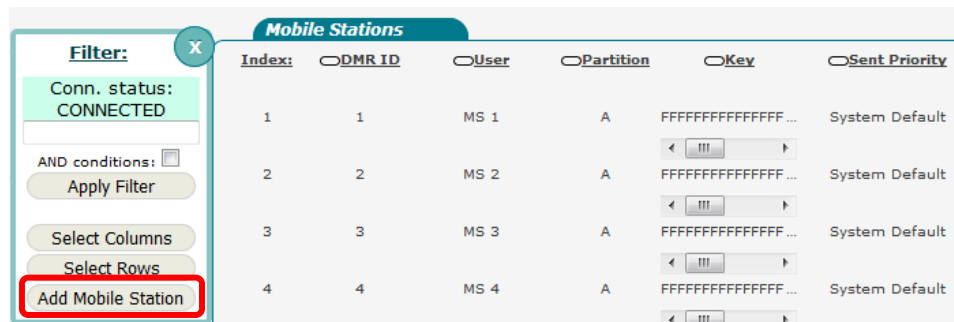
S-Trunking Mode	➤ Off: This selection must be Off for Tier 3 system. ➤ Kenwood proprietary S-Trunking Network: Select this if the system is S-Trunking.
-----------------	---

4 Setting

4.5 Setting of Tier 3 Controller by KA-NMS

4.5.3.3. Mobile Stations

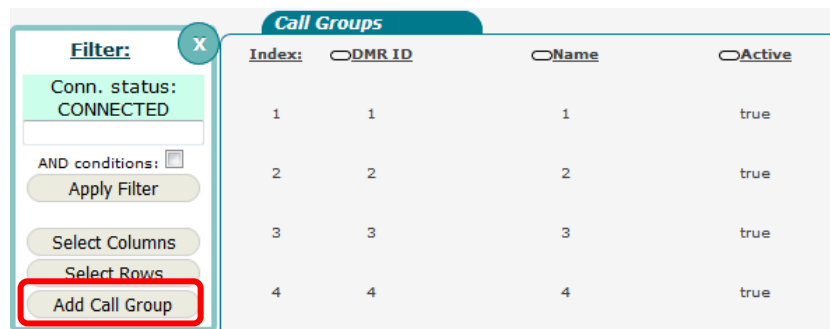
This box allows you to add a new Mobile station to the network. You need to click on Add Mobile Station on the box on the bottom left of the page:



DMR ID	DMR identity of the subscriber radios (portable and/or mobiles)
User	It is a text label to identify the mobile (alias).
Partition	Allows to set which fleet's partition this portable belongs to in case of a system operating with two control channels. If a site operates with multiple control channels it is possible to make a mobile working only on partition A, only partition B or on both partitions A+B
Key	It allows setting of Authentication key. It must match the key programmed in the subscriber radio.
Sent Priority	Allows to set the Forced Priority of a Call ➤ System Default ➤ Without Priority ➤ Low Priority ➤ Medium priority ➤ High Priority
Receive Priority	Allows to set the Forced Priority of a Call Received ➤ System Default ➤ Without Priority ➤ Low Priority ➤ Medium priority ➤ High Priority
Individual Audio Call rights	Allows to set the rights to make and receive individual audio call ➤ None ➤ Send ➤ Receive ➤ Send and Receive

4.5.3.4. Call Groups

This box allows you to add a new DMR Call Group to the network. You need to click on Add Call Group on the box on the bottom left of the page:



DMR ID	DMR ID of the radio Talk-group “ALL Call” can be added in here with DMR ID “16777215”
Name	Short Name of the Radio Talk-group
Active	Allows to define is group is active or not in the system
Description	Textual identifier to recognize the network
Received priority	Allows to set the Forced Priority of a Call Received ➤ System Default ➤ Without Priority ➤ Low Priority ➤ Medium priority ➤ High Priority If a Call Group is given higher priority, it lines up on top of the Queuing list while all Payload is busy.
Time of last change	Time-stamp for the last changes

After setting up until here, MS can perform Registration, making a Group Call and so on.

The settings will be lost when the KAIROS power is turned on again, so be sure to save it. Refer to Chapter 6 for the saving method.

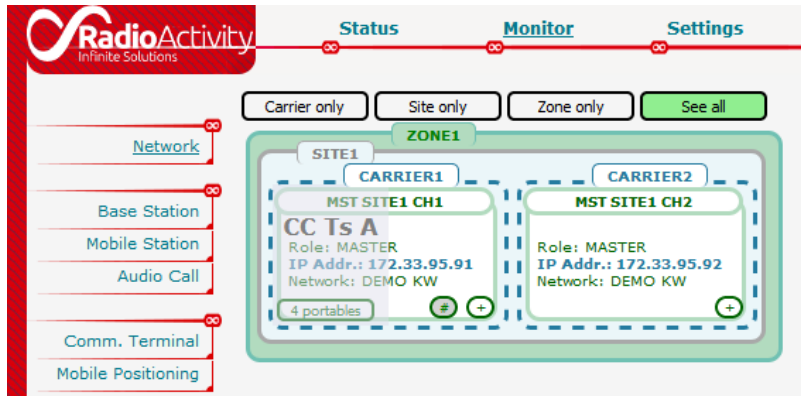
5. Monitor Function

It allows to monitor the Tier 3 network. It is possible to customize the view according to different parameters. The figure below shows a general view of the monitoring system:

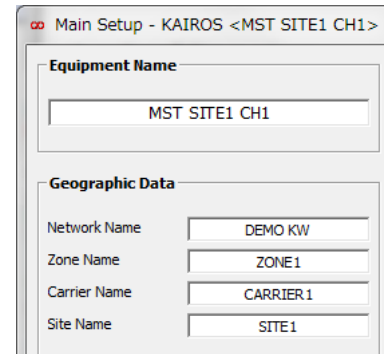
5.1. Network

It allows to monitor all the Tier 3 networks of the system.

Using the name setting by KAIROS Manager, KA-NMS shows the system configuration.



KA-NMS - Monitor - Network



KAIROS Manager - Main Setup

5.2. Base Station

It allows to monitor all repeaters of the system.

Base Station										
ID BS	Name	Carrier	Site	Zone	Net	IP Addr.	TX Freq.	RX Freq.	Contact	
138499888	MST SITE1 CH2	CARRIER2	SITE1	ZONE1	DEMO KW	172.33.95.92	457362500	447362500	04:14.42	
138492560	MST SITE1 CH1	CARRIER1	SITE1	ZONE1	DEMO KW	172.33.95.91	457312500	447312500	04:14.27	

5.3. Mobile Station

It allows to monitor which mobiles are currently registered to one of the monitored systems.

Mobile Station							
ID DMR	Name	Registration	Last Call	Last Call Length	Contact	GPS	
21	NX-3320	03:43.58	01:34.28	20	03:43.58		
39	NX-5300_39	01:34.13	00:00.00	0	03:34.39		
41	NX-5300_41	04:15.54	00:00.00	0	04:15.54		

5 Monitor Function

5.4 Audio Call

5.4. Audio Call

It allows to listen ongoing communications and to start a new one.

Calls queue

Thu Nov 29 13:19:43 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status channelok priority: 0 options als	
channels: MST SITE1 CH1 CARRIER1 ts B ;				X
Thu Nov 29 13:19:40 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status channelok priority: 0 options als	
channels: MST SITE1 CH1 CARRIER1 ts B ;				X

Active Calls

Thu Nov 29 13:18:54 2018	caller: NX-3320 (21) ind	called: 31 (31) grp	status grant priority: 0 options	
channels: MST SITE1 CH2 CARRIER2 ts B ;				X

Registrations

13:19:07:Registered terminal 39
13:18:41:Registered terminal 39
13:17:25:Registered terminal 41
13:17:25:Registered terminal 21

Calls Log

Thu Nov 29 13:19:43 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status channelok priority: 0 options als	
channels: MST SITE1 CH1 CARRIER1 ts B ;				
Thu Nov 29 13:19:40 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status channelok priority: 0 options als	
channels: MST SITE1 CH1 CARRIER1 ts B ;				
Thu Nov 29 13:18:54 2018	caller: NX-3320 (21) ind	called: 31 (31) grp	status grant priority: 0 options	
channels: MST SITE1 CH2 CARRIER2 ts B ;				
Thu Nov 29 13:18:54 2018	caller: NX-3320 (21) ind	called: 31 (31) grp	status grant priority: 0 options	
channels: MST SITE1 CH2 CARRIER2 ts B ;				
Thu Nov 29 13:18:50 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status callend priority: 0 options als	channels:
Thu Nov 29 13:18:40 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status dstrecvf priority: 0 options als	channels:
Thu Nov 29 13:18:41 2018	caller: NX-3320 (21) ind	called: 31 (31) grp	status callend priority: 0 options	channels:
Thu Nov 29 13:18:39 2018	caller: NX-5300_39 (39) ind	called: NX-5300_39 (39) ind	status callend priority: 0 options als	channels:

5 Monitor Function

5.5 Comm. Terminal

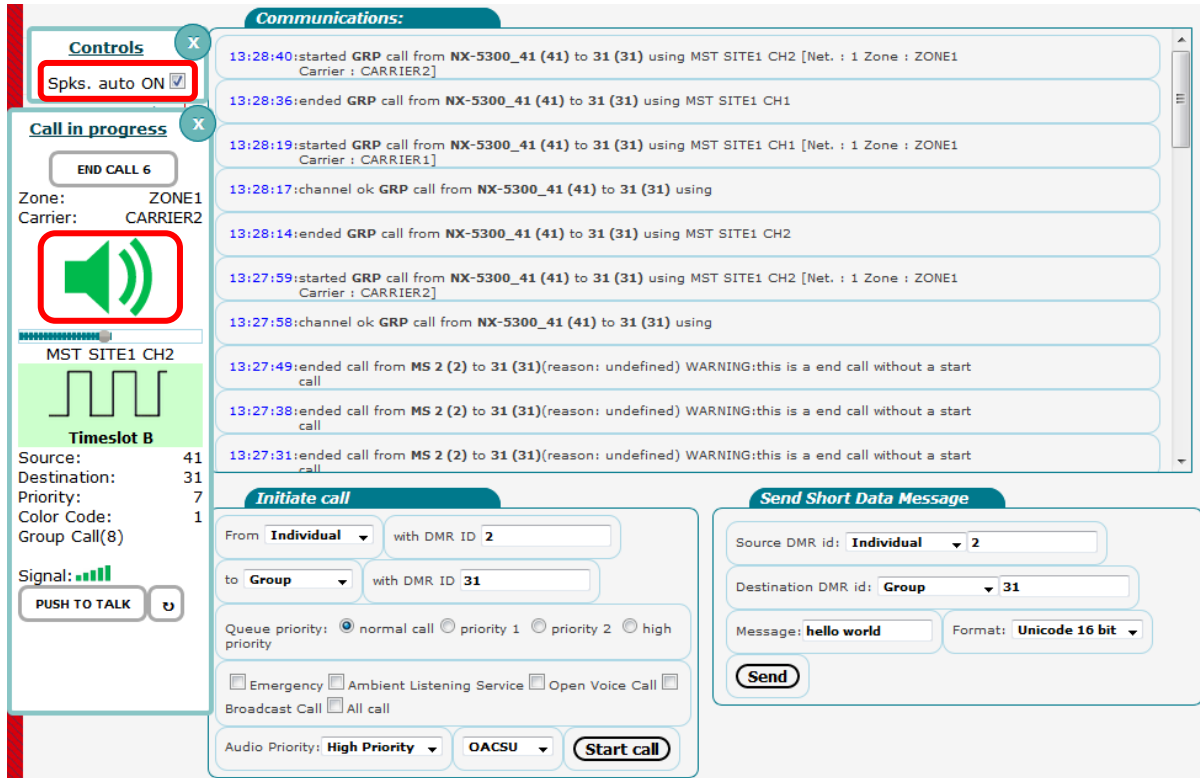
5.5. Comm. Terminal

It allows to monitor ongoing communications.

Check "Spks. auto ON" to hear the receiving sound with PC Speaker.

By clicking Speaker Icon  , receiving sound outputs as well.

Besides displaying Communications Log, it is also possible to test Voice Call and Short Data Message.



The screenshot displays the Comm. Terminal interface with several sections:

- Controls:** Includes a checkbox for "Spks. auto ON" (checked) and a speaker icon.
- Call in progress:** Shows a "Call in progress" status with a "END CALL 6" button. Below it, a waveform graph is labeled "MST SITE1 CH2" and "Timeslot B". Source: 41, Destination: 31, Priority: 7, Color Code: 1, Group Call(8). A "PUSH TO TALK" button is also present.
- Communications:** A log of communications events, including started and ended GRP calls and channel ok messages.
- Initiate call:** A section for starting a call with fields for "From" (Individual), "to" (Group), and "Queue priority" (normal call, priority 1, priority 2, high priority). It also includes checkboxes for "Emergency", "Ambient Listening Service", "Open Voice Call", and "Broadcast Call". A "Start call" button is at the bottom.
- Send Short Data Message:** A section for sending a short data message with fields for "Source DMR id" (Individual), "Destination DMR id" (Group), "Message" (hello world), and "Format" (Unicode 16 bit). A "Send" button is at the bottom.

5 Monitor Function

5.6 Status

5.6. Status

This box provides a general view of the Tier 3 infrastructure. It allows to see all the network belonging to this infrastructure, all the sites belonging to each network and each carrier.

System Network

Trunk Controllers

Controller	Ip_In	Ip_Out
	172.33.95.10	172.33.95.10

Managed System Networks

Name	Color Code	Sys Model	Sys Net	Sys Site	Sys Par	DmrLa	Backoff	SysCode	Base Frequency	Update
DEMO KW	1	Small (1)	0x0a	00	0x03	0x05	0x08	17667	457000000	

Network Topology Elements

Site Name	Update	Carrier Name	Update	Zone Name	Update
SITE1	02:16.48	CARRIER1	02:16.48	ZONE1	02:16.48
		CARRIER2	02:17.01		

Base Station

ID BS	Name	Carrier	Site	Zone	Net	IP Addr.	TX Freq.	RX Freq.	Contact
138492560	MST SITE1 CH1	CARRIER1	SITE1	ZONE1	DEMO KW	172.33.95.91	457312500	447312500	04:12.12
138499888	MST SITE1 CH2	CARRIER2	SITE1	ZONE1	DEMO KW	172.33.95.92	457362500	447362500	04:12.15

Find in *

rows: 15 - 50 - 100

DMR Gateway

ID DGW	ID DMR	Name	ID BS	IP Addr.	TsA Fitpeer	TsB Fitpeer	Contact
--------	--------	------	-------	----------	-------------	-------------	---------

Find in *

rows: 15 - 50 - 100

Mobile Station

ID DMR	Name	Registration	Last Call	Last Call Length	Contact	GPS
1	Moto	02:46.52	04:08.47	4	04:08.47	
41	NX-5300_41	04:08.17	04:09.46	2	04:09.46	

Find in *

rows: 15 - 50 - 100

Audio Call

Call On Air

Caller	Called	Call Type	Request	Start	Channel
--------	--------	-----------	---------	-------	---------

Find in *

rows: 15 - 50 - 100

Call Queue

Caller	Called	Call Type	Request
--------	--------	-----------	---------

Find in *

rows: 15 - 50 - 100

6. Maintenance

This menu allows you to manage configurations of the Tier 3 controller.

The screenshot shows a web interface for the Maintenance menu. It is divided into three main sections, each with a blue header bar:

- Operations:** Contains four buttons:
 - Save**: make all run-time configurations permanent
 - Load**: apply to run-time environment the last saved configurations
 - Hot reload**: Restart all software without loss of runtime data
 - Restart**: Restart all software, deleting all not saved data
- From/to your device:** Contains one button:
 - Save File**: save to local storage a file with all run-time configurations
 Below this is the text "Load configurations from file:" followed by an **Upload** button and a checked checkbox labeled "Overwrite (all current data will be lost)".
- Update:** Contains one button:
 - Distribute**: Clone the controller or only the configuration on an other equipment
 Below this is the text "Select update file:" followed by an **Upload** button and a button labeled **Upload Update file**.

- **Save:** If you change the setting, just write it in the run-time area temporarily and it will be lost when restart unless you save it. If you want to apply the setting when restart, you need to click "Save" to save it to EEPROM in the KAIROS.
- **Load:** Click to discard temporary run-time settings and load settings from EEPROM in the KAIROS.
- **Hot reload:** Temporarily changed data is temporarily written in the run-time area and disappears when restart, but "Hot reload" can restart without losing run-time data.
- **Restart:** Restart TSC. Run-time data will be lost.
- **Save File:** Click to save TSC settings as a file. The file is saved in the Download folder in your PC as "configurations.json". To keep the file rename it after saved.
- **Upload (Load configuration from file):** When loading the "json" setting data, select the file here.
- **Distribute:** If there are multiple TSC in a Network, click here if you want to clone the current TSC setting to another TSC.

7. Service

Network Overall Status							
NAME	ROLE	IP	CARRIER	SITE	ZONE	NETWORK	TX CHANN
MST SITE1 CH1	Master	172.33.95.91	CARRIER1	SITE1	ZONE1	1	26
SLV SITE1 CH1	Slave	172.33.95.92	CARRIER1	SITE2	ZONE1	1	26
MST SITE1 CH2	Master	172.33.70.13	CARRIER1	SITE1	ZONE2	1	34

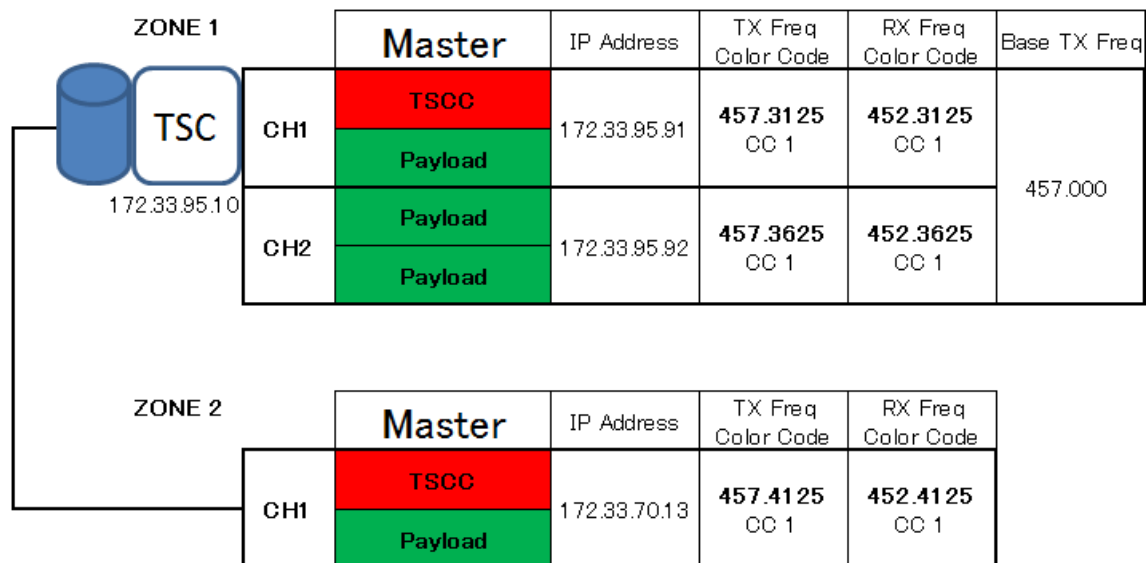
NOS: Network Overall Status. It is a way for seeing and setting up the parameters of the entire system by the same single connection.

8. Application Example

8.1. Multisite Multi-Frequency

Let's try to set the 2 Site configuration as shown below.

In the case of a small multisite, it is possible to manage multiple sites by one TSC.



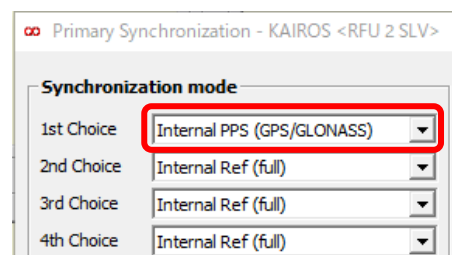
8.1.1. ZONE 1 Repeater setting

Set as described in Chapter 4.

8.1.2. ZONE 2 Repeater Setting

1. Synchronization mode: Even in a Multisite Multi-Frequency system, it is recommended to use GPS synchronization between sites because the KAIROS is designed based on synchronization technology for simulcast.

PTP Synchronization is also possible but the IP network must be stable (good quality) like in a lab test.

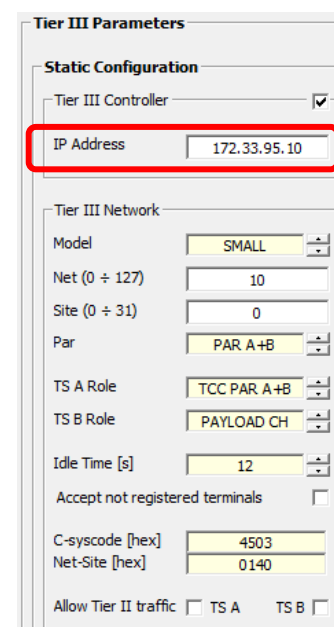


2. Channel Table: Since it is Multisite Multi-Frequency, set the TX/ RX frequency to be different between ZONE 1 and ZONE 2.

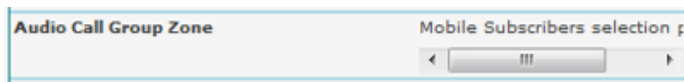
3. Set Tier 3 Parameters

For Tier 3 Controller IP Address, enter the IP Address of TSC in ZONE 1.

4. Other settings are the same as for CH1 Repeater of ZONE 1.



5. Set "Audio Call Group Zone" in Audio/Data Call



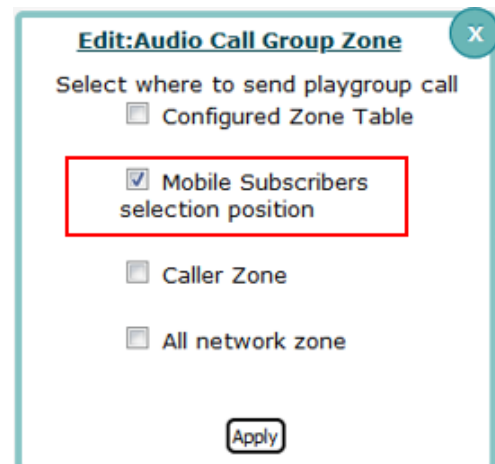
Configured Zone Table: Uncheck always

Mobile Subscribers selection position: In order to improve site efficiency, by checking "Mobile Subscribers selection position", the system can work as "Dynamic Allocation Group Call".

Uncheck other selections.

Check "Group Subscription" in KPG-D1/D3 also needed.

*Dynamic Allocation Group Call: a site that is not registered by any MS, which doesn't enable Group Subscription, doesn't transmit.



Caller Zone: A site never forward a Voice/Data to other site, as disable inter-site call. Uncheck other selections.

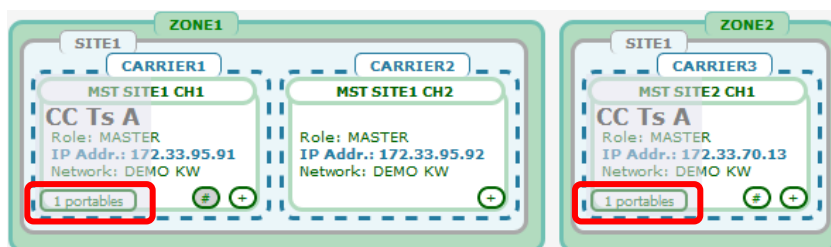
All network zone: All sites will transmit even no Mobile Station under a site. Uncheck other selections.

6. System configuration is end. After Saving, restart both ZONE 1 and ZONE 2 Site.

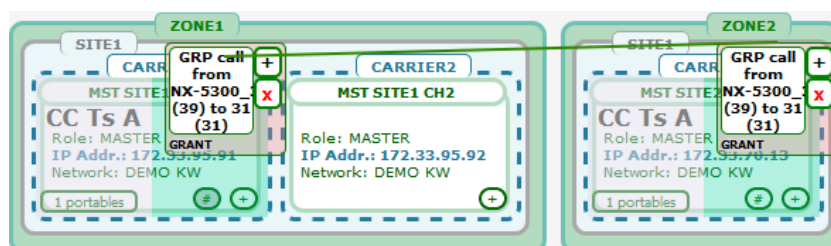
7. Hunt setting in MS to hunt ZONE2 also required.

8.1.3. Monitor-Network

When setting is completed and confirmed by KA-NMS Monitor-Network, it is displayed as follows.



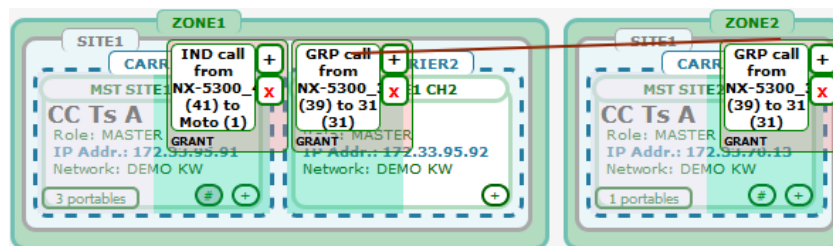
In the above figure, MS is registering to each site.



In the above figure, MS is calling between different sites.

8 Application Example

8.1 Multisite Multi-Frequency



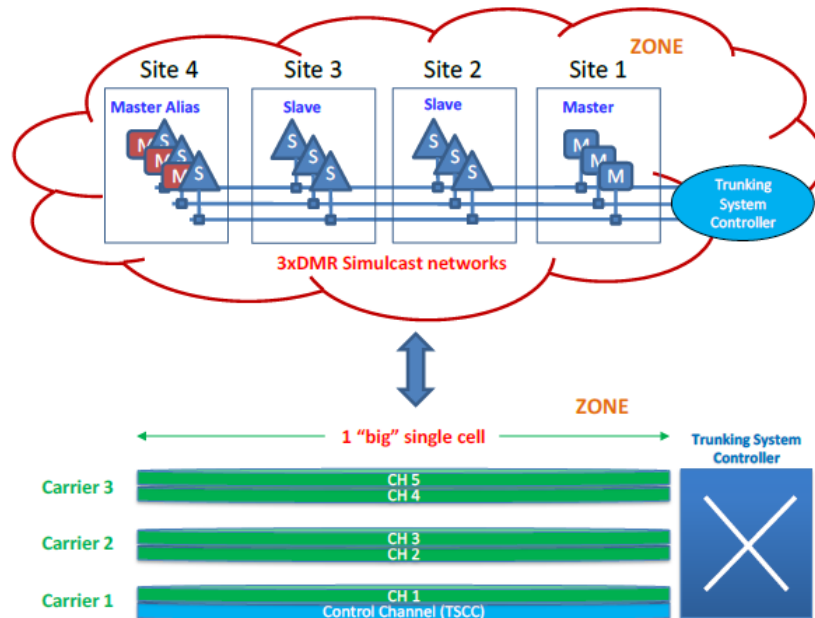
In the above figure, MS is calling between different sites, and Individual Call in ZONE 1.

8.2. Tier 3 with Simulcast

8.2.1. Network Architectures with simulcast cells

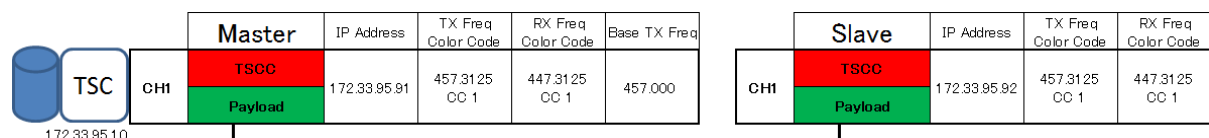
In the following picture, you can see a diagram of a Tier 3 network on 4 sites, realized with 3 simulcast Carriers. Three carriers are drawn with three lines.

As Simulcast can be thought as one Big cell, it can be thought as a Single Tier 3 Trunking site with a large coverage area.



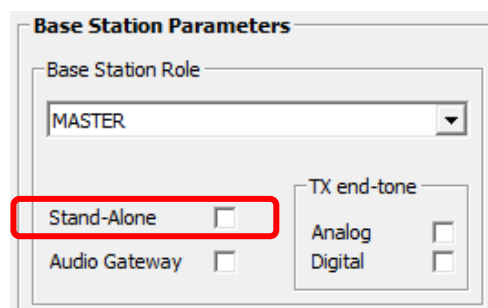
8.2.2. Setting example for Single Tier 3 with Simulcast

Let's set the simplest configuration as shown below.



[Note] Simulcast License is required.

8.2.2.1. Master Repeater setting

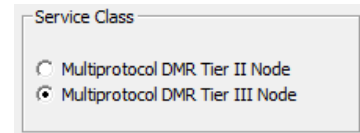


1. Simulcast needs to be synchronized with the Slave. Recommended synchronization is GPS, but PTP synchronization also can be used. For Test in your Lab, PPS synchronization by Flat Cable is convenient. For details of synchronization, please refer to KAIROS Manager Function Manual.
2. Stand-Alone: Uncheck
It is not Stand-Alone so check it.

For other setting items, refer to Chapter 4.

8.2.2.2. Slave Repeater setting

1. Simulcast needs to be synchronized with the Master. Please perform Synchronization setting.
2. Frequency, Color Code to the same as MASTER Repeater.
3. Service Class: Select Multiprotocol DMR Tier III Node.

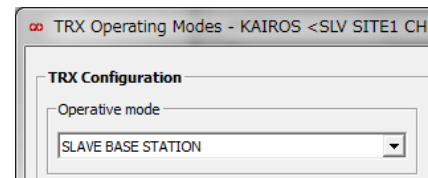


Service Class

☐ Multiprotocol DMR Tier II Node

☒ Multiprotocol DMR Tier III Node

4. TRX Operating Modes - Operative mode: Select SLAVE BASE STATION.



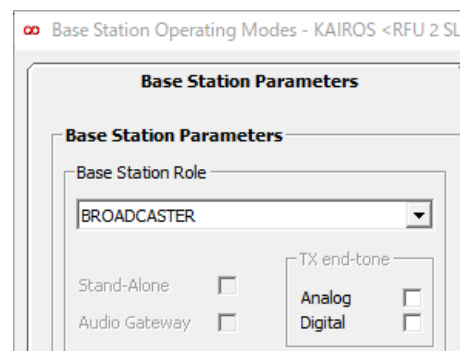
TRX Operating Modes - KAIROS <SLV SITE1 CH>

TRX Configuration

Operative mode

SLAVE BASE STATION

5. Base Station Operating Modes - Base Station Role: Select BROADCASTER.



Base Station Operating Modes - KAIROS <RFU 2 SL>

Base Station Parameters

Base Station Role

BROADCASTER

Stand-Alone ☐

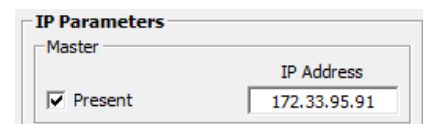
Audio Gateway ☐

TX end-tone

Analog ☐

Digital ☐

6. Enter Master IP Address for Voting.



IP Parameters

Master

☒ Present

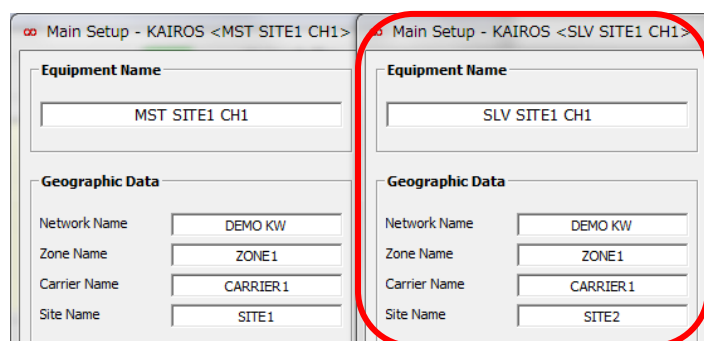
IP Address

172.33.95.91

7. Set Name (Geographic Data)

Equipment Name: Any name
Network Name: Same as MST
Zone Name: Same as MST
Carrier Name: Same as MST
Site Name: Different name.

[Note] It is very important to make the Site Name different from the MST Site.



Main Setup - KAIROS <MST SITE1 CH1>

Equipment Name

MST SITE1 CH1

Geographic Data

Network Name DEMO KW

Zone Name ZONE1

Carrier Name CARRIER1

Site Name SITE1

Main Setup - KAIROS <SLV SITE1 CH1>

Equipment Name

SLV SITE1 CH1

Geographic Data

Network Name DEMO KW

Zone Name ZONE1

Carrier Name CARRIER1

Site Name SITE2

MST Repeater

SLV Repeater

8 Application Example

8.2 Tier 3 with Simulcast

8. Tier 3 Parameters setting

Tier III Parameters

Static Configuration

Tier III Controller ☒

IP Address 172.33.95.10

Tier III Network

Model SMALL

Net (0 ÷ 127) 10

Site (0 ÷ 31) 0

Par PAR A+B

TS A Role TCC PAR A+B

TS B Role PAYLOAD CH

Idle Time [s] 10

Accept not registered terminals ☐

C-syscode [hex] 4503

Net-Site [hex] 0140

Allow Tier II traffic ☐ TS A ☐ TS B ☐

Tier 3 Parameter setting is same as MASTER Repeater.
Be careful not to mistake the IP address of Tier III Controller.

[Note] Do not install Tier III Controller in Slave Repeater.

9. Setting by KA-NMS

Network Type: Select "Simulcast" for the Network Type in Settings - System - Network.

Network

Network Type Simulcast

Control channel Mode Dedicated

Control channel Aloha On

Edit:Network Type

Type of radio network topology: Simulcast

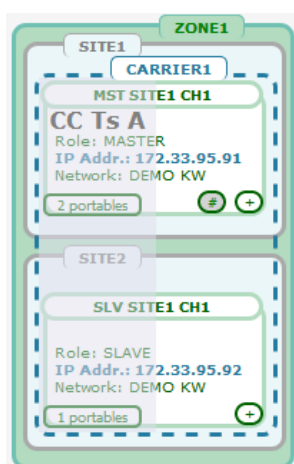
Apply Simulcast

Multisite Multifrequency

Mixed

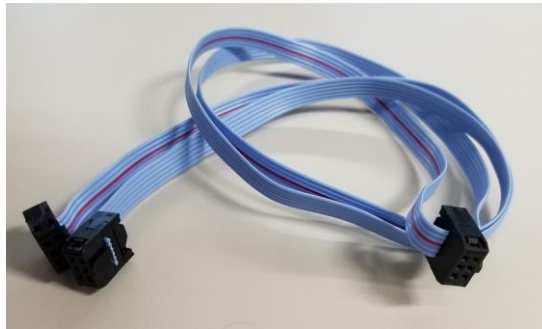
10. System configuration is end. Restart both KAIROS for ZONE 1 and ZONE 2 Site.

When setting is completed and confirmed by KA-NMS Monitor-Network, it is displayed as follows.



9. General

The purpose of this Instruction is to create the synchronization cable used to provide a one pulse per second synchronization source between multiple repeaters at a site.



9.1. Equipment & Materials

Diagonal cutters (1/2 inch or larger, to cut ribbon cable)

Tape measure or suitable substitute graduated in millimeters (to measure cable length)

Following materials:

No	Parts Number (Mouser)	Description	Qty per one cable	Order from	Remarks
1	382-0214	IDC Crimp Tool	1	Local Vender (Mouser)	
2	517-3365/06-100	3M Ribbon Cable	Varies		
3	517-3863-6605	6 conductor connector kit	Varies		

9.2. Instructions

Section 1: Crimp tool preparation

Section 2: Introduction to the 3M IDC connector

Section 3: How to determine cable length

Section 4: Fabricate cable

Section 5: Notes on finished product

Section 1: Crimp tool preparation

1. Prepare the crimp tool by inserting the yellow die into the tool as shown in photo 1.



Photo 1

2. Place the mold in the tool such that the tab on the mold seats against the channel in the tool. The mold will stay in place, but not securely, care is required to assure the mold is seated properly before each use. The correct orientation is shown in photo 2.



Photo 2

Section 2: Introduction to the 3M IDC connector

Shown in photo 3 are two connectors, at the top, with arrows, is a connector showing the “front side” and the bottom row is a connector showing the “back side”. Note that the ‘front side’ has locating tabs (yellow arrows) on all three parts. The three parts of the connector must be assembled with the tabs all oriented in the same direction - that is, the connectors must be assembled and crimped while oriented as shown, for the connector to be reliable.

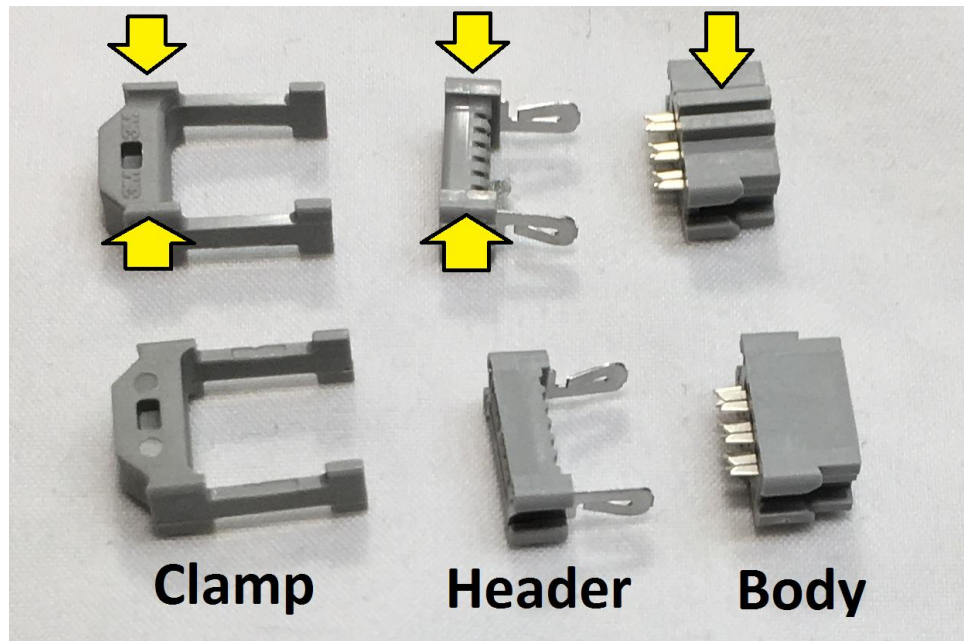


Photo 3

Note how it is easy to determine “front” or “back”, as the “back side” of each part is smooth with no locating tabs.

Section 3: How to determine cable length

The cable will have at least two connectors, spaced 200 mm apart, there must be 12.5 mm of cable extending past the connectors on the ends, to provide for strain relief. Starting with 12.5 mm on each end, we have 25 mm + 200 mm for the first two repeaters and an additional 200 mm for each additional repeater. The cable lengths are shown below:

Number of Repeaters	Length
2	225mm
3	425mm
4	625mm
5	825mm
6	1025mm

Cable length tolerances

Total length of the cable must be within 10 mm.

- End connectors must be installed 12.5 mm from each end with a tolerance of +/- 2 mm.
- Connectors not on either end of the cable (in a cable of more than two connectors) must be placed 200 mm from adjacent connectors, with a tolerance of +/- 5 mm.

Section 4: Fabricate cable

There are only a few steps in assembling a connector and crimping it to the cable. The connectors at each end of the cable are installed first.

1. You will need the three pieces of the connector, set the Clamp aside.
 - a. See photo 3 to identify “header”, “body” and “clamp”.
2. Orient the connector as shown in photo 4 using only the header and body. Mate the two parts as shown by guiding the header’s metal tabs into the channels on the body.

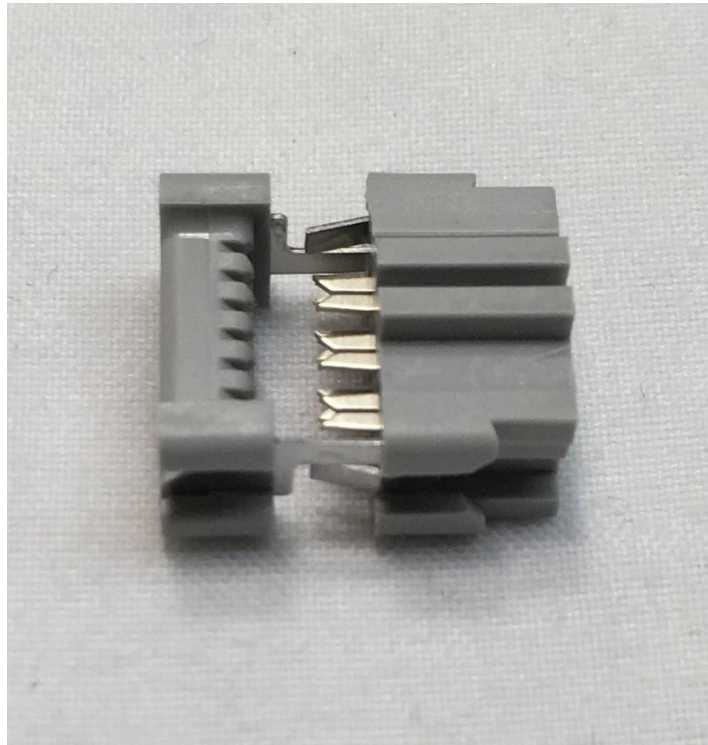


Photo 4

3. Pass the cable thru the opening between the two parts as shown in photo 5; provide 12.5 mm of cable past the connector, as shown. Note that the colored conductor is at the 'top' and on the 'right side' as viewed from the 'front' side of the connector. (See text of section 2, and photo 3.)

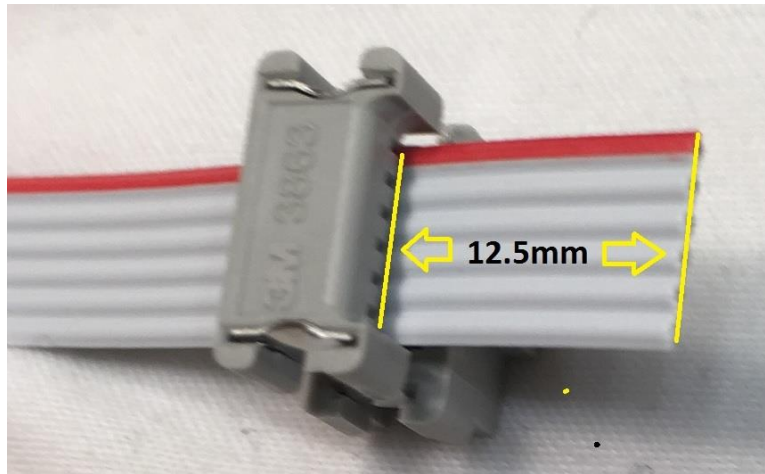


Photo 5

4. Verify that the pins are seated on the conductors (there are six pins and six conductors; you can see three at a time from either side). See photo 6.

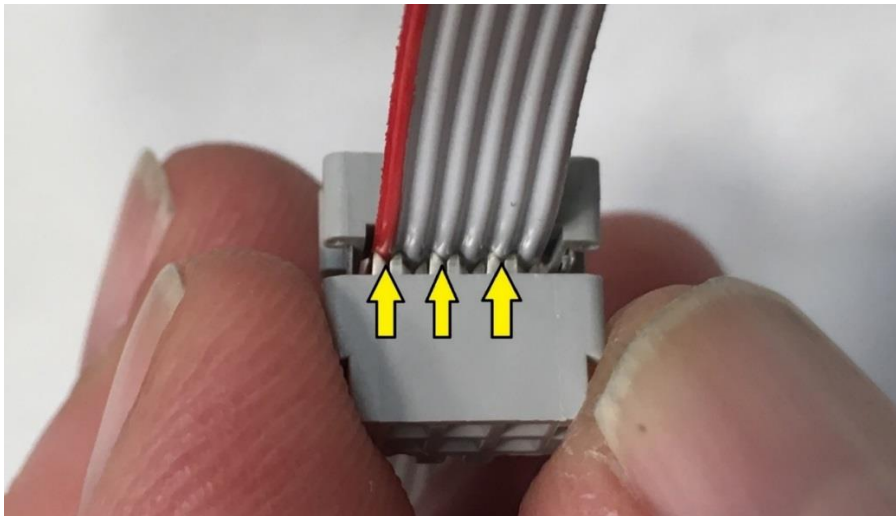


Photo 6

Verify that the metal tabs of the header are in the slots on the body. (Only one tab is visible, see photo 7.)



Photo 7

5. The assembly is now ready for crimping. Place the connector carefully in the crimp tool die as shown in photo 8, note that the connector is centered in the die to provide an even pressure.



Photo 8

6. Once crimped, the header's metal tabs must be fully inserted into the body and header must be pressed together tightly as shown in photo 9. The metal tabs must lock in place (indicated with yellow arrow, photo 9). There is another metal tab, not visible in the photo, on the other side of the connector.

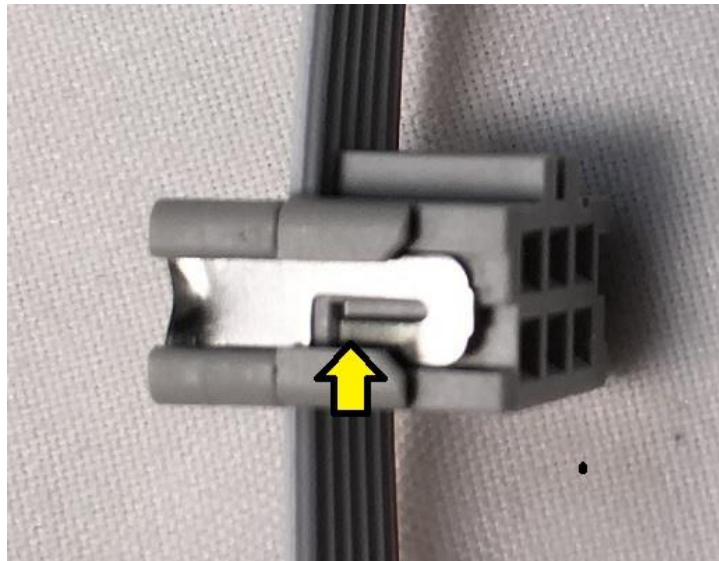


Photo 9

7. See photo 10, observe that the conductors are in the channels provided for them (yellow arrows).

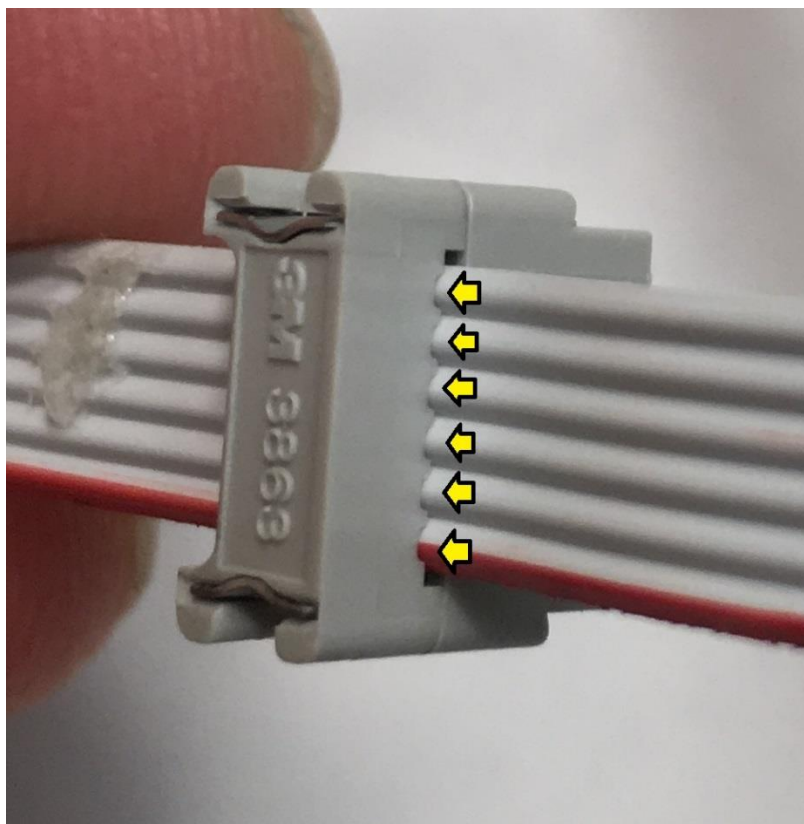


Photo 10

8. Place the clamp over the header, paying attention that the locator tabs are pointing in the right direction as per photo 3 and as shown in photo 11.

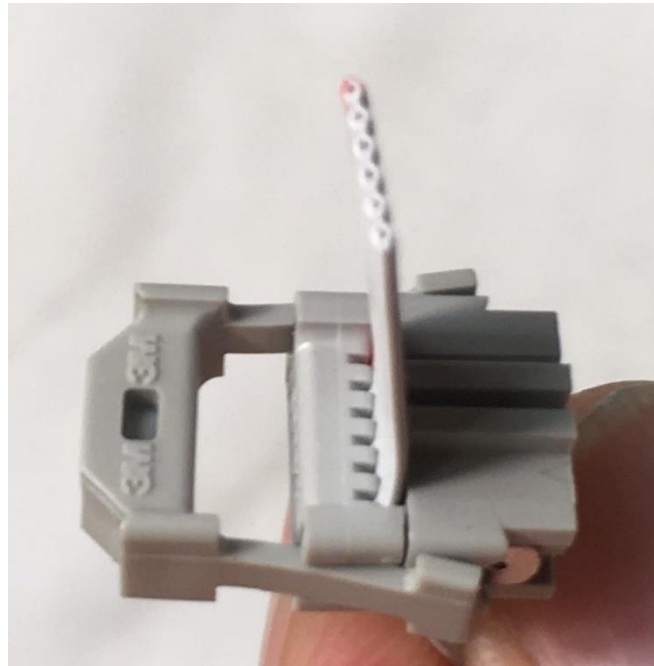


Photo 11

9. Curl the end of the cable under the clamp as shown in Photo 12.

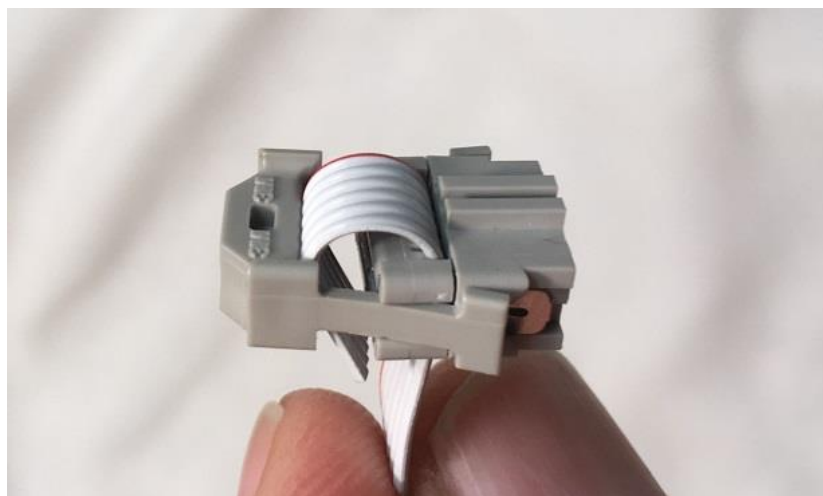


Photo 12

10. Press the clamp onto the header and body as shown in photo 13. (Use of the crimp tool can be helpful for this step but is optional.)

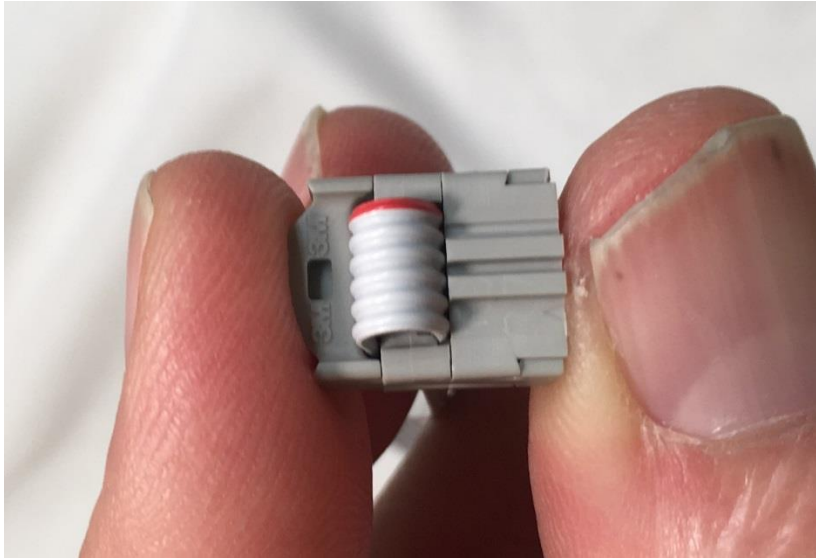


Photo 13

11. Verify that the locking tabs of the header are in place, locking the clamp to the body. (yellow arrows in photo 14.) Press the tabs into place if they do not seat themselves.

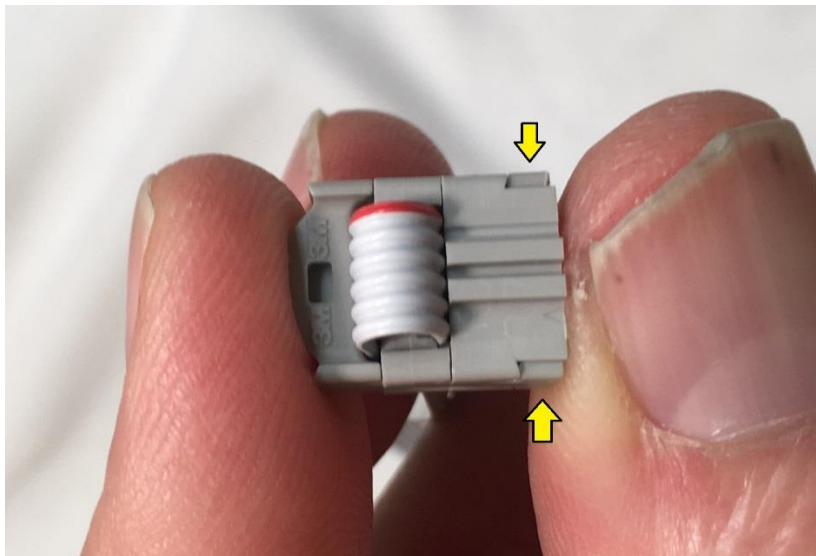


Photo 14

Proceed to “Connectors mid-span on the cable” below for cables with more than two connectors. In cases of cables with only two connectors, go to Section 5.

Connectors mid-span on the cable

12. Place connectors every 200 mm along the cable. (For example: With a three repeater cable, place one connector at the midpoint.) Place the Header and body on the cable as shown in photo 15. The connector and red strip on the cable must be oriented as shown, as all connectors must face “the same way” on the cable. (The yellow arrow points to the red striped conductor.) See also, photo 25 in **Section 5**.

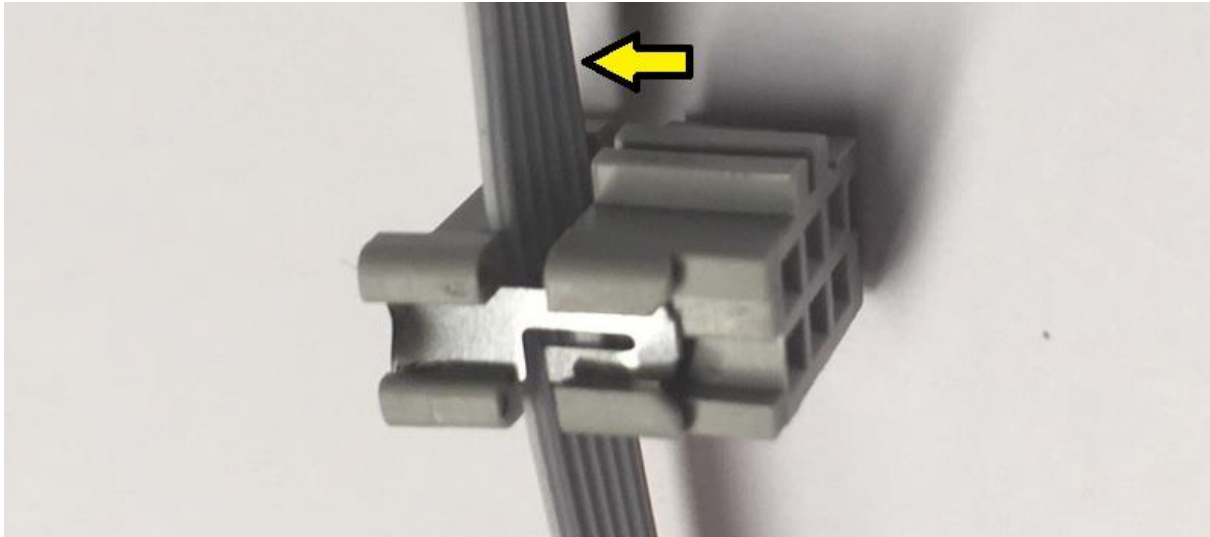


Photo 15

13. Verify that the pins are seated on the conductors as shown in photo 16.

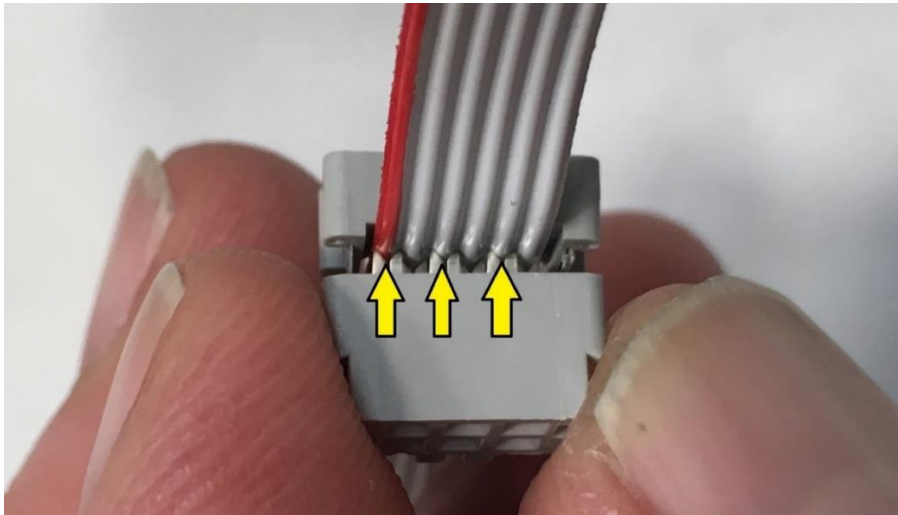


Photo 16

14. Verify that the metal tabs of the header are in the slots on the body. (Only one tab is visible, see photo 17.)

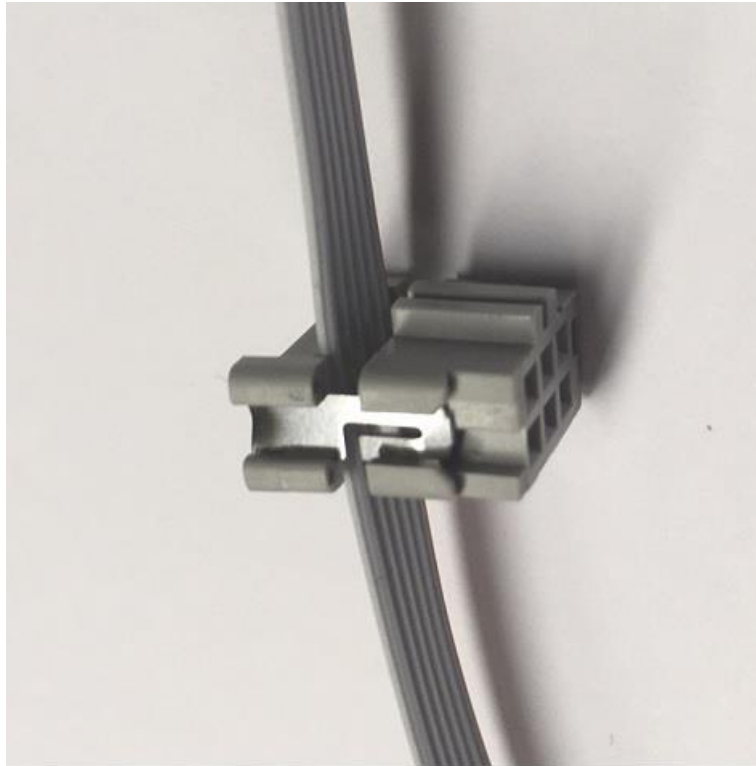


Photo 17

15. The assembly is now ready for crimping. Place the connector carefully in the crimp tool die as shown in photo 18, note that the connector is centered in the die to provide an even pressure.



Photo 18

16. Once crimped, the header's metal tabs must be fully inserted into the channels on the body, as locked into place (yellow arrow) as shown in photo 19.

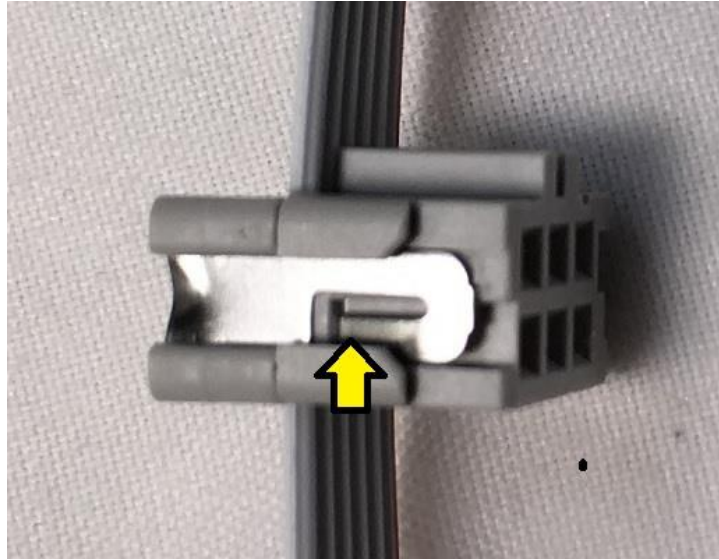


Photo 19

17. See photo 20, observe that the conductors are in the channels provided for them (yellow arrows).

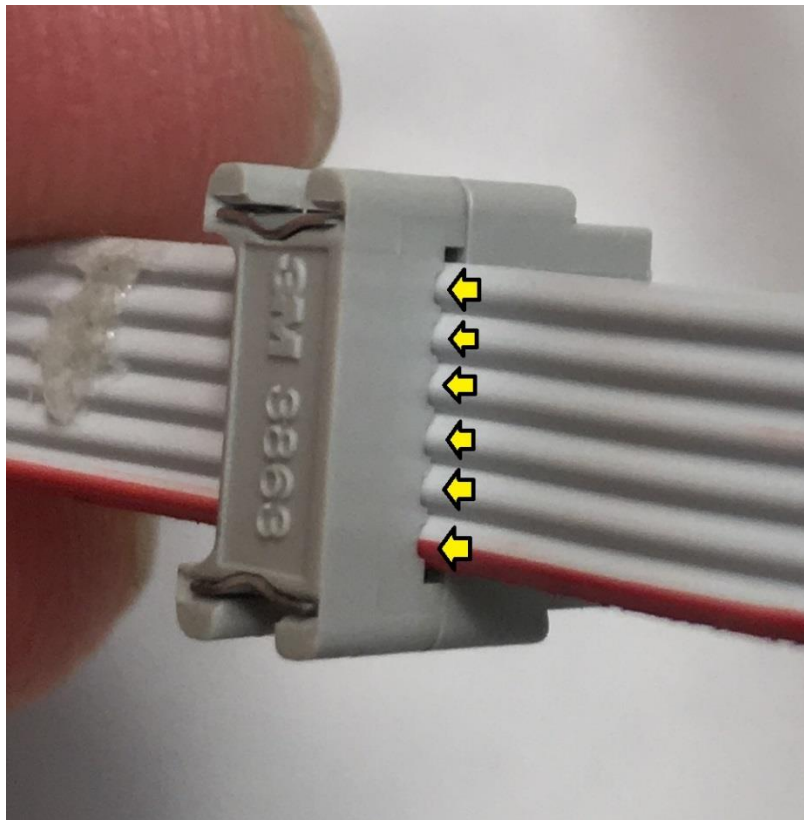


Photo 20

18. Place the clamp over the header, paying attention that the locator tabs are pointing in the right direction as per photo 3 and as shown in photo 21.

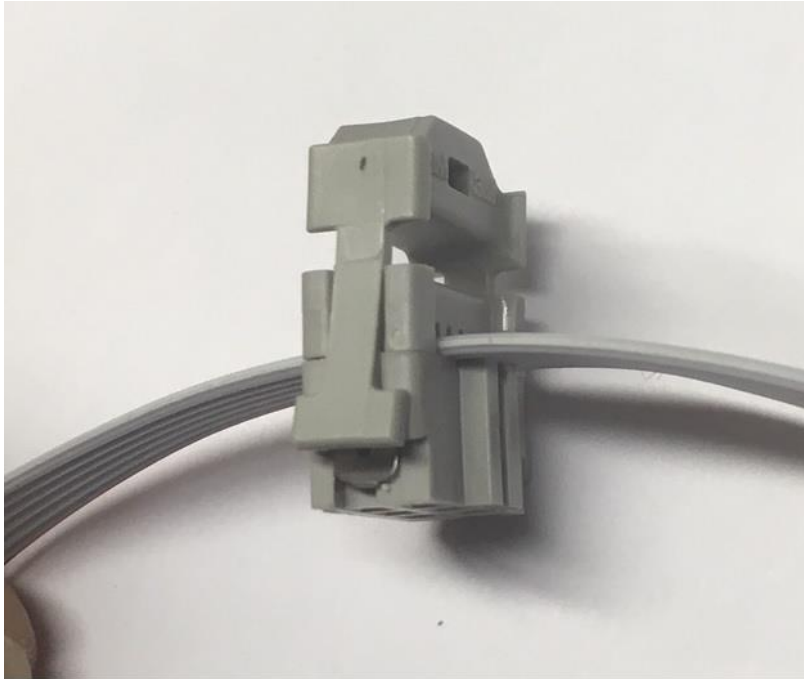


Photo 21

19. Press the clamp onto the header and body as shown in photo 22. (Use of the crimp tool can be helpful for this step but is optional.)

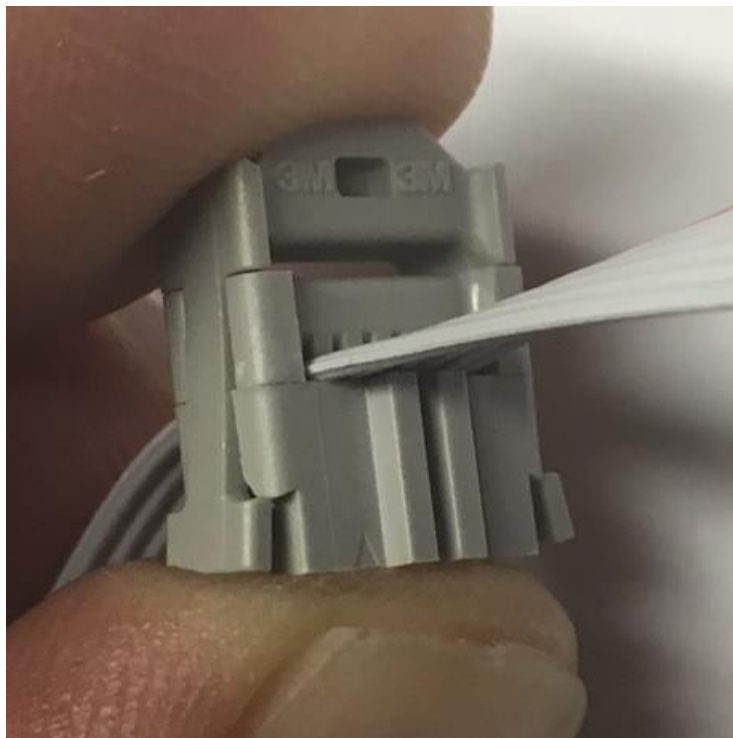


Photo 22

20. Verify that the locking tabs of the header are in place, locking the clamp to the body (yellow arrows in photo 23.)

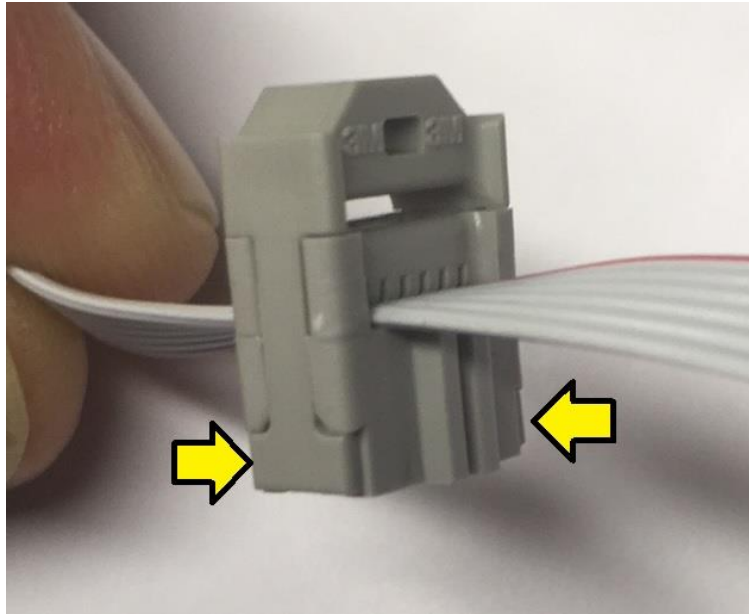


Photo 23

21. After installing all connectors on the cable, proceed to section 5.

Section 5: Notes on finished product

A two connector-version of the finished product shows the strain relief loop in the cable at the connector on each end (yellow arrows), see photo 24.

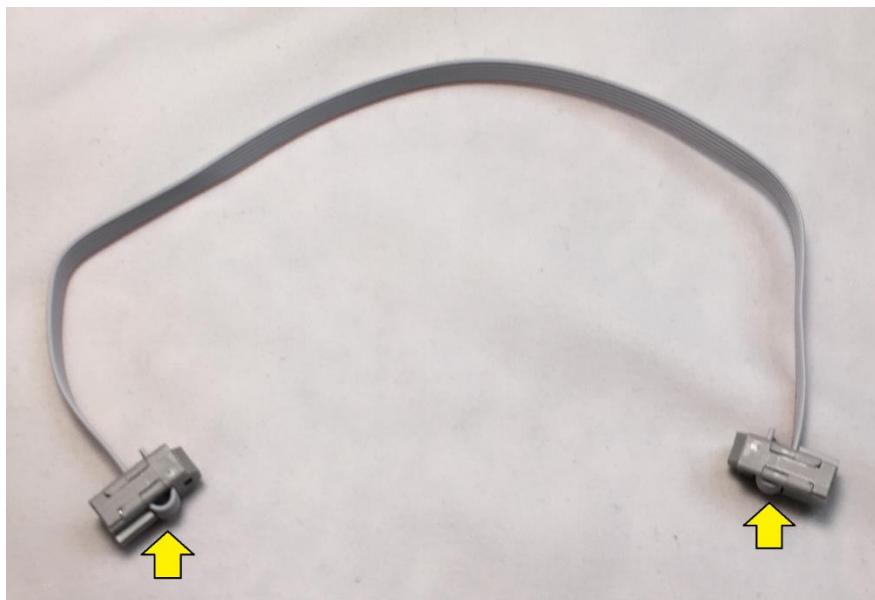


Photo 24

Note also that the orientation tabs on each connector (yellow arrows) point in the same direction with the striped conductor on the ribbon cable oriented as shown (red arrow). See photo 25.

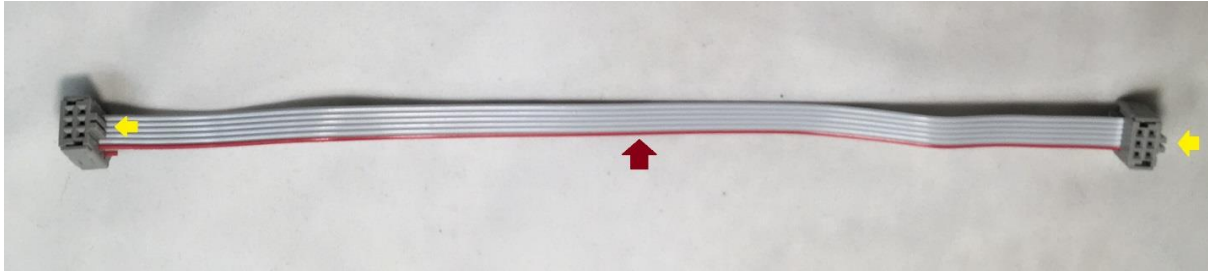


Photo 25

Place of purchase

6 pin connectors

<https://www.mouser.com/ProductDetail/Wurth-Electronics/61200623021?qs=sGAEpiMZZMu0%252bmZx5g6tFLzTkNWwy5q0L1QMKS2ZGh4%3d>

26 conductor flat cable

<https://www.mouser.com/ProductDetail/Amphenol-Spectra-Strip/135-2801-026?qs=sGAEpiMZZMsJiFh04Lj2rvezlru2hL8PIDffV7ceKF0%3d>

crimp tool

<https://www.mouser.it/ProductDetail/Eagle-Plastic-Devices/382-0214?qs=sGAEpiMZZMuHCD5%252fnvq3PoyN19q2rZAQQHgo9ftK1N4%3d>