

Application Note

S-Trunking

- KAIROS

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Revision History

Version	Date of issue	Note
1.00	August-7, 2019	First edition
1.01	June-26, 2020	The revised issuing corrected minor errors.

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1. Outline

This document summarizes the basic information necessary to construct S-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): 1.6.9.0
 - DSP: Version 4.57
 - PLD: Version 4.13
- Trunking System Controller: 1.0.3.0
- KAIROS Manager: 1.7.6

Note: The above version is 1st release for S-Trunking, but Multisite and several features are under developing and not supported yet.

1.2. References

The following referenced documents assist for the present document.

- [1] AN-18-0015: KAIROS Manager Function Manual
- [2] AN-19-0001: DMR Tier III/ KAIROS Tier III Trunking
- [3] AN-19-0006: Application Note IP Gateway KPG 1013GW

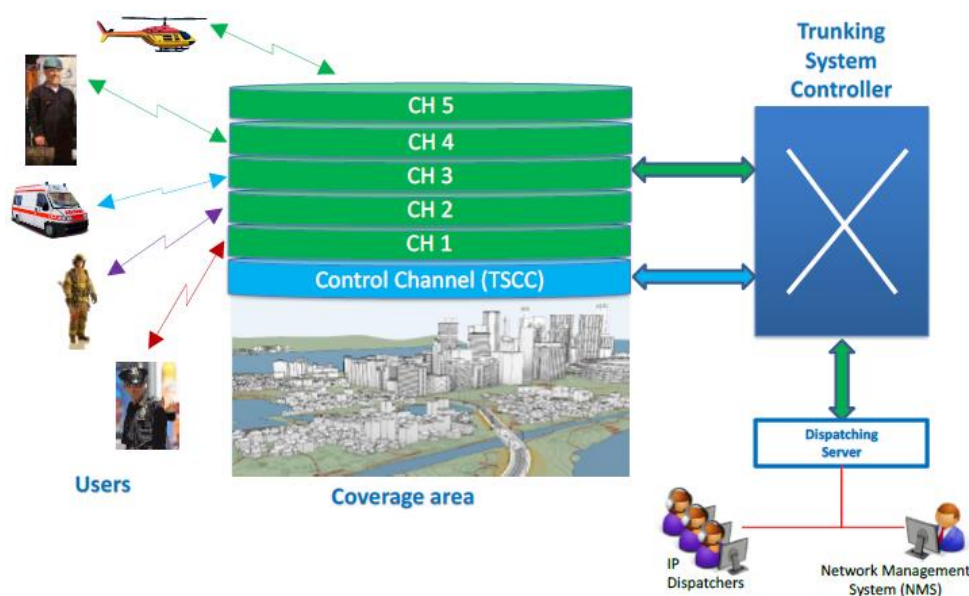
2. Overview

2.1. What's S-Trunking

Presently, we support DMR Tier III Trunking in conformity with ETSI standard. On the other hand, S-Trunking is JVCKENWOOD proprietary DMR-based TDMA Trunking system. This section describes about general differences between DMR Tier III Trunking and S-Trunking.

In a Tier III system, the number of channels may be much lower than the number of potential users, but, the use of channels is optimized as traffic channels which are assigned only when needed. The system consists of certain number of traffic channels (Payload channels) and a channel dedicated to the management of the system: the Control Channel (TSCC). A TSCC is controlled by Trunking System Controller (TSC) which manages an access from users and allocates a Payload channel as appropriate. In the above point, S-Trunking is same as Tier III system.

The following picture shows the basic elements of a Tier III and S-Trunking system.



On the other hand, there are some obvious different points between two.

2.1.1. TSCC Transmission

In a Tier III system, each site has a TSCC which transmits continuously. Therefore, it can provide large-scale and stably communication service to a Subscriber Unit (SU). However, it doesn't conform shared channel licenses for private carriers, a user shares a frequency with another user/agencies, because a site's TSCC exclusively occupies a frequency.

In contrast, S-Trunking conforms shared channel environment, because its TSCC is basically transmitted intermittently (Beacon), please refer the following table and figures. So, we can deploy trunked systems under private carrier licenses.

Table: System specification

	S-Trunking	DMR Tier III Trunking
TSCC transmission	intermittently	continuously

2 Overview

2.1 What's S-Trunking

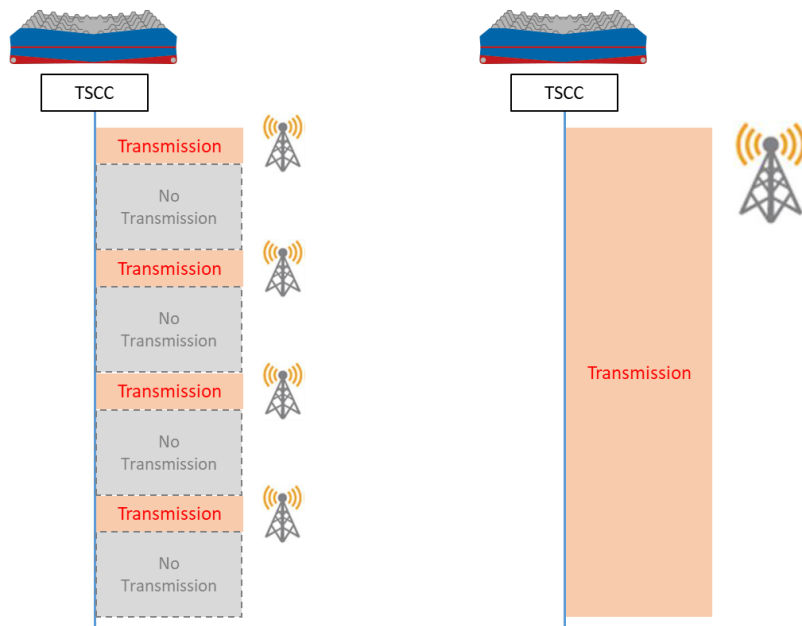
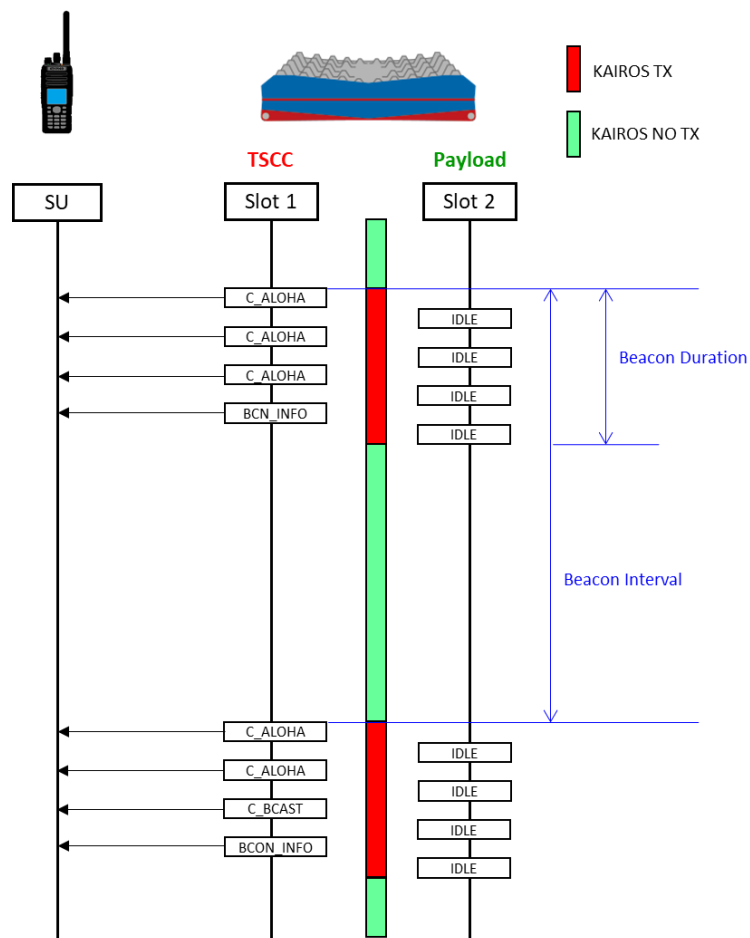


Figure: S-Trunking

Figure: DMR Tier III Trunking

➤ Beacon

An intermittent transmission is in other words Beacon. S-Trunking has some Beacon parameters, Beacon Duration and Beacon Interval, which could be configured



Beacon Duration: 420 to 15240 [ms]
Beacon Interval: 1440 to 121920 [ms]

A Beacon consists of the following DMR-based messages.

Message	Description
C_ALOHA	It contains the basic information of the system to make SUs possible to judge whether to perform registration or roaming.
C_GRANT	It contains the call traffic information to direct SUs to the particular Payload channel.
C_BCAST	Announce/Withdraw TSCC This announcement adds and/or withdraws a TSCC that is active in a Multisite system. Adjacent Site Information It contains adjacent sites information to assist SUs to acquire an appropriate TSCC if it moves out from current TSCC.
BCON_INFO	It is always announced one times on the end of transmission on the TSCC.

2.1.2. Carrier Sense

An S-Trunking system is supposed to be under the shared channel licenses environment. Therefore, sites and SUs basically should conduct carrier sense before transmitting, and they can restrict the transmission to avoid interference with another user/agencies.

In a Tier III system, it assumes that each site and SU can exclusively use designed frequency, and the carrier sense feature is not required.

2.1.3. System Size

An S-Trunking system consists of certain number of Payload channels and a TSCC, and it scales up to 15 sites and 8 repeaters (1 TSCC and 15 Payload) for each site.

A Tier III system is able to provide over a thousand of sites system.

2.1.4. Interoperability

A Tier III system is designed in conformity with ETSI standard, and interoperability is ensured except for “private” features of each manufactures.

S-Trunking is JVCKENWOOD proprietary specifications, therefore, there is not interoperability.

2.1.5. Simulcast

Simulcast is not supported in an S-Trunking system.

2 Overview

2.1 What's S-Trunking

2.1.6. Features Comparison

At the 1st Release of S-Trunking, there are several unsupported features.

Features		S-Trunking		DMR Tier III
		1st Release July 2019	2nd Release September 2019	
System				
Limited size	Sites for the entire system	Single Site only	Network Model Tiny: 7 Small: 15 Large: 15 Huge: 15	Network Model Tiny: 7 Small: 31 Large: 255 Huge: 1023
	Channels per site	6 KAIROS (12 slots)	8 KAIROS (16 slots)	TBD
	GPS capacity per site	N/A	300	1000
Simulcast		N/A	N/A	✓
Fixed Channel Plan		✓	✓	✓
Trunking Type (Message/ Transmission/ Quasi-Transmission)		Transmission Only	✓	✓
Call Type				
Group Call/ Individual Call/ Broadcast Call/ All Call		✓	✓	✓
Status Message/ Emergency Status Message		✓	✓	✓
Radio Check (Status Polling)		N/A	✓	✓
Short Data Message		✓	✓	✓
GPS Data Message		N/A	✓	✓
GPS Data Polling		N/A	✓	✓
Long Data Message/ Transparent		N/A	✓	✓
OTAP (Over-the-Air Programing)		N/A	✓	✓
Priority Call		N/A	✓	✓
Emergency Call		✓	✓	✓
Emergency Alarm		✓	✓	✓
Stun/ Revive/ Kill		N/A	✓	✓
Remote Monitor (Ambient Listening)		N/A	✓	✓
Transmit Interrupt		N/A	✓	✓
Late Entry		✓	✓	✓
Trunking Features				
Registration/ De-Registration		✓	✓	✓
Power Save		N/A (See Note)	N/A (See Note)	✓
Authentication		✓	✓	✓
Group Subscription		✓	✓	✓
Adjacent Site Information		N/A	✓	✓
Other				
Continuous Wave Identification (CW ID)		✓	✓	✓
Cross-busy (Carrier Sense)		External Input only	✓	N/A

Note: In the case of S-Trunking, a Subscriber Unit (SU) executes "Power Save" feature on a stand-alone.

2.2. Overview of KAIROS S-Trunking

- KAIROS S-Trunking supports a larger Traffic Capacity with enhanced call function, security, and provides comfortable communication for easier user operation than the DMR Tier II Conventional system.
- Multiple applications run on the reliable Linux OS in KAIROS.
- Since KAIROS can install Trunking System Controller (TSC) to itself as software, there is no need to separately prepare an industrial server for TSC.
- KAIROS can simplify the system configuration in a site, the number of equipment is small, power consumption is low, and heat generation can be suppressed. It also improves reliability in case of failure.
- 16 million types of Unit ID and Group ID are possible.
- The KAIROS S-Trunking 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.
- Migration from DMR Tier II to S-Trunking is easy. KAIROS currently in use on DMR Tier II can be changed to S-Trunking.
- KAIROS conduct carrier sense before transmitting, and it can restrict the transmission to avoid interference with another user/agencies under shared licenses environment.

3. Preparation to use KAIROS for S-Trunking

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 a DMR Vocoder. Please 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 frequency setting, color code setting, Trunking System Controller (TSC) software writing, etc.
- KAIROS Web Interface: Connect to Web Server in KAIROS a web browser to set up dedicated IP address of TSC and start TSC, etc.
- KAIROS Network Management System (KA-NMS): Connect to TSC in KAIROS by a web browser to make detail setting of S-Trunking.

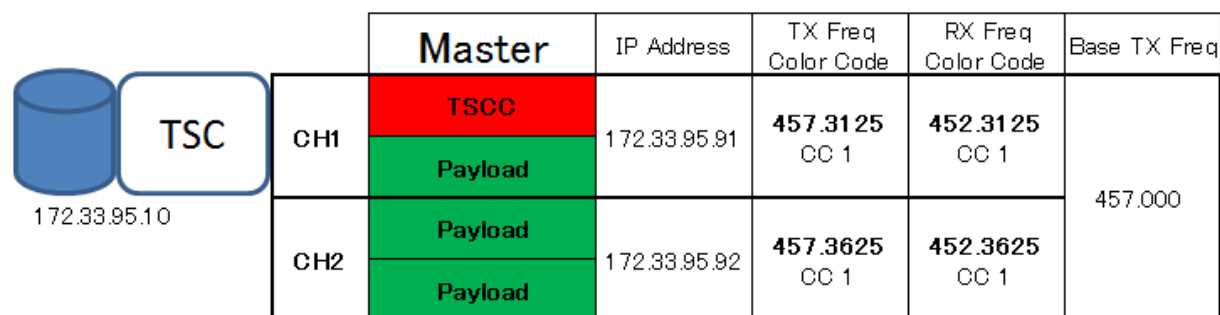
Note: Firefox is recommended as a web browser.

3.1. Make a system configuration diagram

In order to set up KAIROS S-Trunking Network, it is necessary to input many items to various applications such as KAIROS Manager, KAIROS Web Interface 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				

3.2. S-Trunking License

When operating S-Trunking system, it is necessary to activate software licenses for KAIROS.

➤ Mandatory licenses

Following is required for each KAIROS.

DMR license

S-Trunking license

➤ Optional licenses

Following is required for each KAIROS to operate in multisite system.

Multi-Site Trunking license

3.2.1. In case purchasing new KAIROS

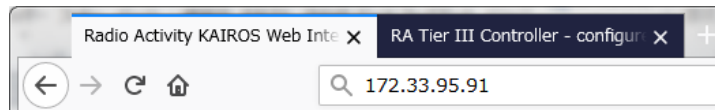
Please order DMR and S-Trunking license at the same time as ordering KAIROS, and if multisite system is required, please order Multi-Site Trunking license in combination.

3.2.2. In case changing current KAIROS Tier II to S-Trunking

Tier II KAIROS can be changed to S-Trunking. In this case S-Trunking license is required.

To check the license, use KAIROS Web Interface.

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



Click Setup - Keys to see the Current Keys Status.

If S-Trunking license is "EXPIRED", please purchase additional license and perform Activation.

If multisite is required, please purchase and activation Multi-Site Trunking license in combination.

3.2.3. In case changing current KAIROS Tier III to S-Trunking

Tier III KAIROS can be changed to S-Trunking. In this case S-Trunking license is required and it needs to make Tier III license to be expired.

To check the license, use KAIROS Web Interface as well as "3.2.2 In case changing current KAIROS Tier II to S-Trunking".

Please order S-Trunking license to be activated and Tier III license to be expired.

Important Note: In presently software version, a KAIROS which has Tier III license doesn't work as an S-Trunking channel even if S-Trunking license is activated. This limitation will be improved in the feature update.

3 Preparation to use KAIROS for S-Trunking

3.2 S-Trunking License

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	has EXPIRED
Raw Port licence	has EXPIRED
Audio from web licence	is activated for LIFETIME
VVF Features licence	has EXPIRED
S-Trunking licence	has EXPIRED
1+1 redundancy licence	is activated for LIFETIME
Multi-Site Trunking licence	has EXPIRED
NMS licence	is activated for LIFETIME
TSC licence	is activated for LIFETIME
Number 20 licence	has EXPIRED
Number 21 licence	has EXPIRED
Number 22 licence	has EXPIRED
Number 23 licence	has EXPIRED
Number 24 licence	has EXPIRED
Number 25 licence	has EXPIRED
Number 26 licence	has EXPIRED
Number 27 licence	has EXPIRED
Number 28 licence	has EXPIRED
Number 29 licence	has EXPIRED
Number 30 licence	has EXPIRED
Region	World Wide

4. Setting

[Important Notice]

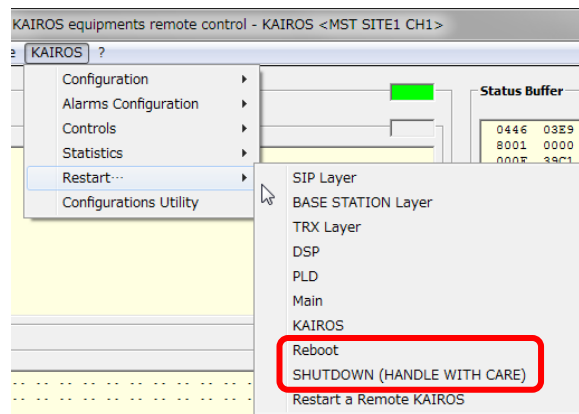
When restarting KAIROS and shutting down, please be sure to operate by the power button, KAIROS Manager, or KAIROS Web operation.

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

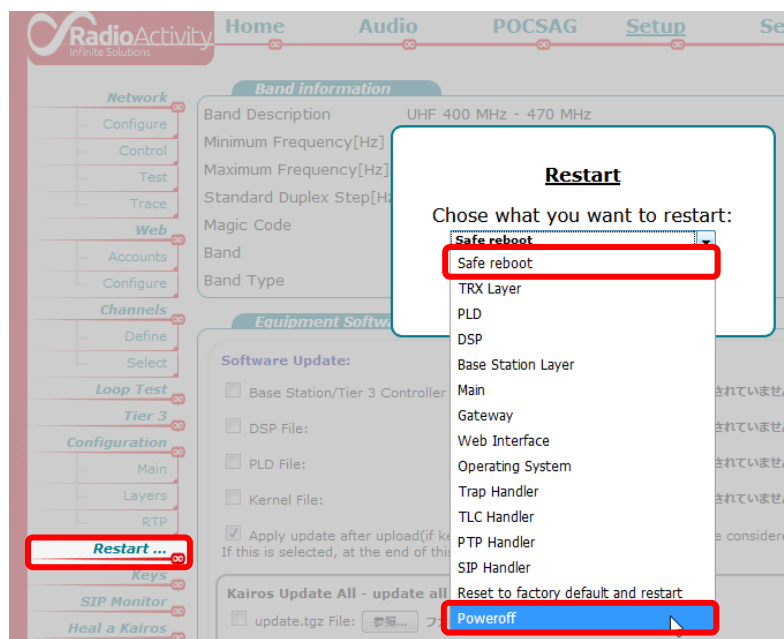
➤ KAIROS Power button



➤ KAIROS Manager



➤ KAIROS Web



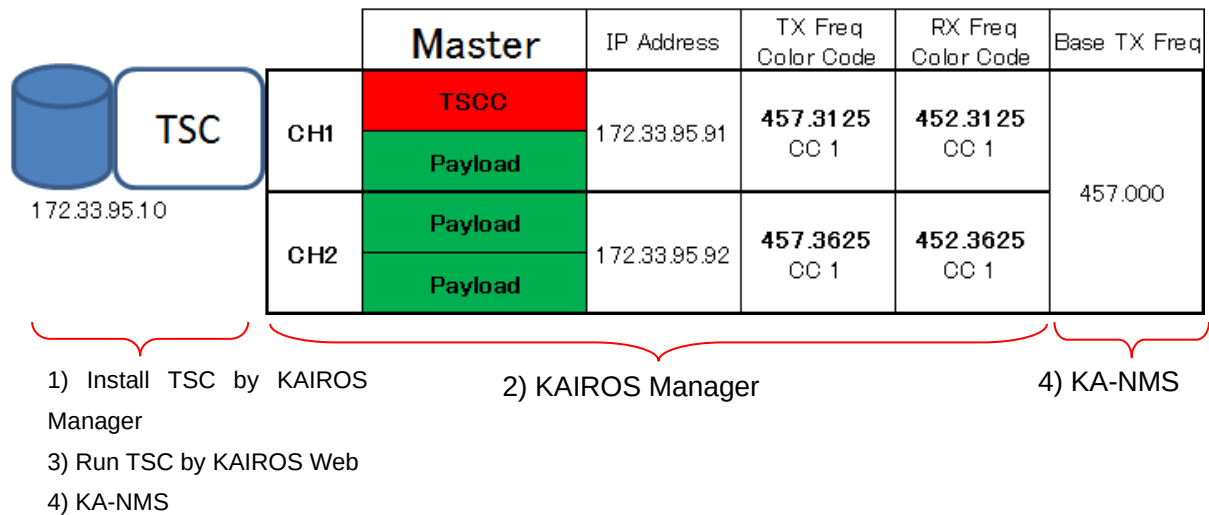
4 Setting

4.1 Basic Setting Procedure

4.1. Basic Setting Procedure

Basically, the setting procedure is as follows.

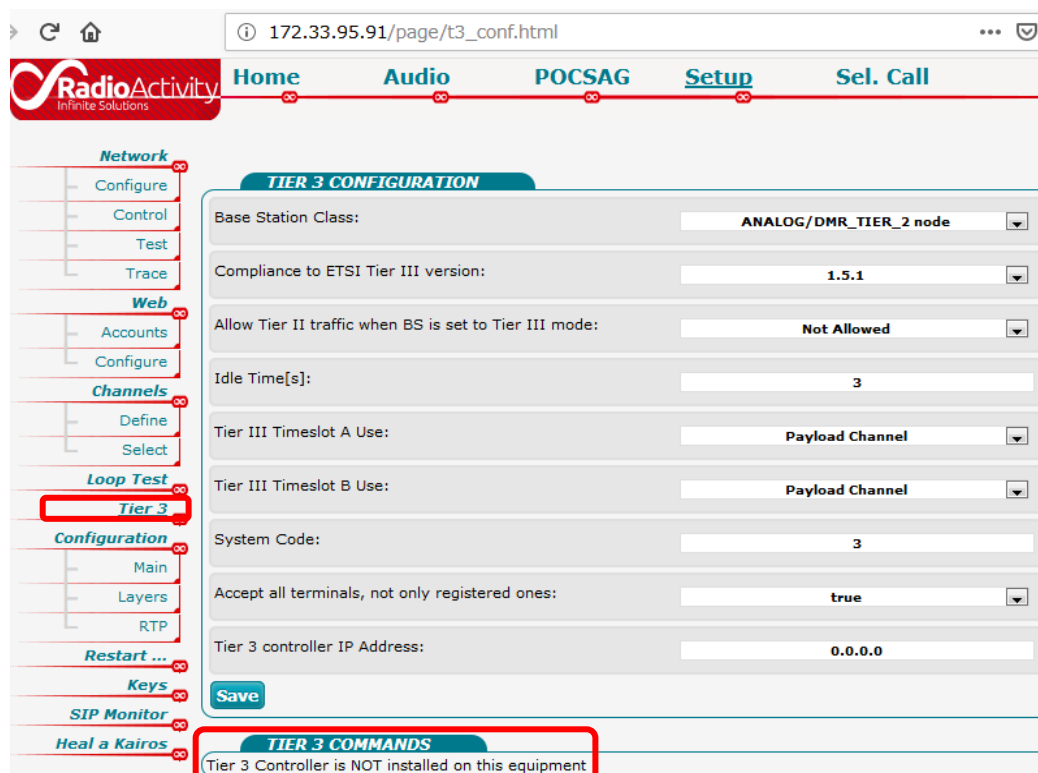
- 1) Installing Trunking System Controller (TSC) by KAIROS Manager (4.2)
- 2) Setting up KAIROS by KAIROS Manager (4.3)
- 3) Run TSC by KAIROS Web (4.4)
- 4) TSC setting by KA-NMS (4.5)



4.2. Install of Trunking System Controller (TSC)

4.2.1. How to confirm the existence of Trunking System Controller (TSC)

First decide the KAIROS to be used as TSC. Confirm whether it is installed in the 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

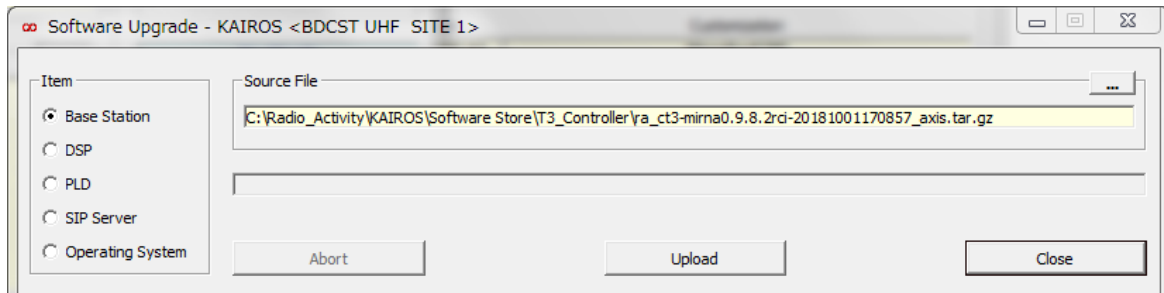
4.2 Install of Trunking System Controller (TSC)

4.2.2. Install of TSC software

Install of TSC software is done by KAIROS Manager.

[1] Select Base Station from Software Upgrade.

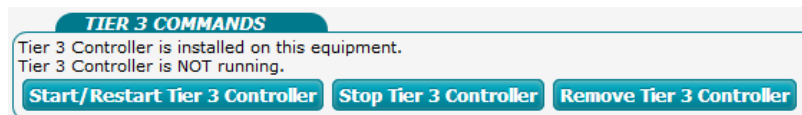
[2] Select a Source File for the TSC (.gz) and click Upload.



4.2.3. Confirm installation result of TSC

Make sure TSC is installed in KAIROS on KAIROS Web.

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



Note: Though it may describe the status of “Tier 3 Controller”, it is same thing as TSC status.

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 Conventional or Trunking.

Select “Multiprotocol DMR Tier III Node” from KAIROS - Configuration - TRX Operating Modes - Service Class.

TRX Operating Modes - KAIROS <STRK SITE CH1>

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

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

Working Channel Handling

☐ Enable Changing from I/O

☐ Enable Changing from Network

☐ Enable Changing from Audio Tones

☐ Enable Changing from Selective Call

Codec to be used: NULL

Prefix to be used: 0000

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

Read from File

Write on File

Read

Write

Close

This setting should be done for all KAIROS in the network to work as S-Trunking. Not only KAIROS which works as TSCC (control channel) but also KAIROS which roles as Payload (traffic channel) requires the same setting.

4 Setting

4.3 Setting up by KAIROS Manager

4.3.2. Operative Mode setting

Operative Mode normally selects Master Base Station. The setting target is located in two places. This setting is done for all KAIROS in the network to work as S-Trunking. Not only KAIROS which works as TSCC but also KAIROS which roles as Payload requires the same setting as MASTER.

4.3.2.1. TRX Operating Modes - TRX Configuration

- Select “MASTER BASE STATION” for Operative mode
- Check “PCM 1” and “PCM 2” in Enabling TRX.

(KAIROS > Configuration > TRX Operating Modes)

4.3.2.2. Base Station Operating Modes - Base Station Parameters

- Select “MASTER” for Base Station Role
- Check “Stand-Alone”

(KAIROS > Configuration > Base Station Operating Modes)

4 Setting

4.3 Setting up by KAIROS Manager

4.3.3. Base Station Layer Configuration setting

This setting is done for all KAIROS in the network to work as S-Trunking. Not only KAIROS which works as TSCC but also KAIROS which roles as Payload requires the same setting.

- Enable Repeater Mode: Uncheck
- Manual AT bit handling: Check
- Enable ETSI Tier III features: Check
- Hung Times > Channel: 0

Base Station Layer Configuration - KAIROS <STRK SITE 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... **RX: act as...**

... Base Station ☒ ... Base Station ☒

... Mobile Station ☐ ... Mobile Station ☐

MAIN Color Codes **AUX Color Codes**

RX 1 RX 1

TX 1 TX 1

Hang Times [30 ms ticks] (0 - 32767)

Private Calls 1000

Group Calls 1000

Data Response 1000

Channel 0

Timeslots Validity [30 ms ticks]

☐ Automatic 32

Network Delay [30 ms ticks]

☐ Automatic 6

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

Accesso **Reading**

READ WRITE Read ☐ Re

(KAIROS > Configuration > Base Station Layer Configuration)

4.3.3.1. Hang Times

Set Hang Times for each calls. This could be set for all KAIROS in the network individually.

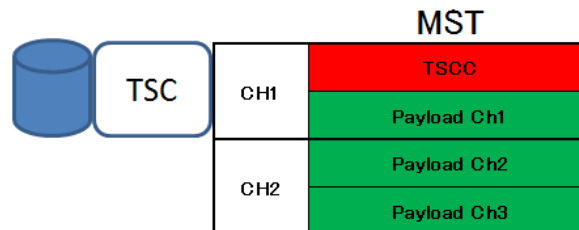
- Private Calls: Hang time after Individual Call.
- Group Calls: Hang time after Group Call.
- Data Response: Hang time after Data TX.
- Channel: Set to '0'. (It is additional Hang time follows by Private/ Group/ Data.)

4.3.4. Main Setup setting

4.3.4.1. Name Setting

In the KAIROS S-Trunking 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 <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 <MST SITE 1 CH 2>

Equipment Name

MST SITE 1 CH 2

Geographic Data

Network Name: DEMO KW

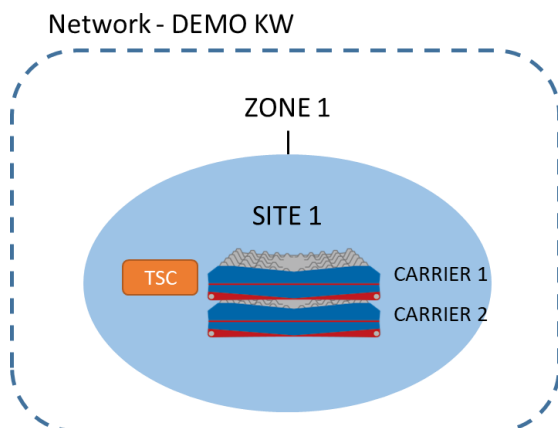
Zone Name: ZONE 1

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 operated in the same zone.
- Carrier Name: Different name, Carrier is a radio channel by two Timeslots, it should be different name in each KAIROS in the same site.
- Site Name: Same name, it is necessary to match this name in all KAIROS operated in the same site.



4 Setting

4.3 Setting up by KAIROS Manager

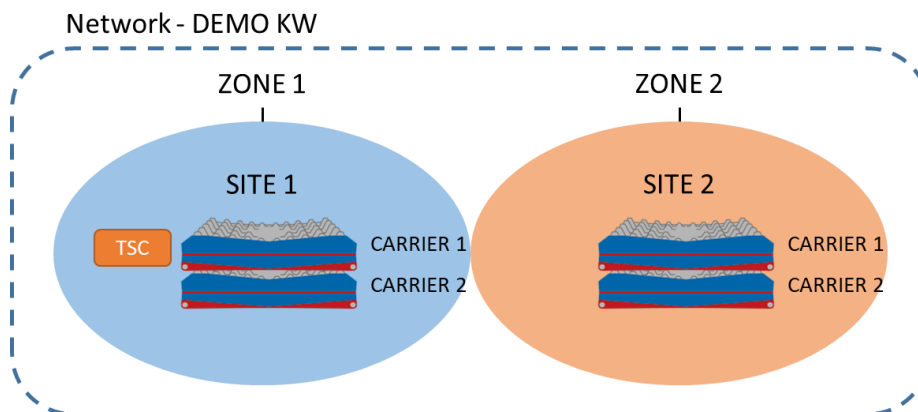
For other example, when setting up a Multisite (2 sites and 2 carriers in each site), set the following names to 4pcs of KAIROS.

Equipment Name	Geographic Data
MST SITE1 CH1	Network Name: DEMO KW Zone Name: ZONE1 Carrier Name: CARRIER1 Site Name: SITE1
MST SITE1 CH2	Network Name: DEMO KW Zone Name: ZONE1 Carrier Name: CARRIER2 Site Name: SITE1
MST SITE2 CH1	Network Name: DEMO KW Zone Name: ZONE2 Carrier Name: CARRIER1 Site Name: SITE2
MST SITE2 CH2	Network Name: DEMO KW Zone Name: ZONE2 Carrier Name: CARRIER2 Site Name: SITE2

Site1 CH1 Repeater Site1 CH2 Repeater

Site2 CH1 Repeater Site2 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: It is necessary to match this name in all KAIROS operated in the same zone.
- Carrier Name: It must be different name in each KAIROS in the same site.
- Site Name: It is necessary to match this name in all KAIROS operated in the same site.



4.3.4.2. Features

When using IP Console, RTP communication is required.

Run RTP Layer: Check

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

Note: About using IP Console, refer “AN-19-0006: Application Note IP Gateway KPG 1013GW”.

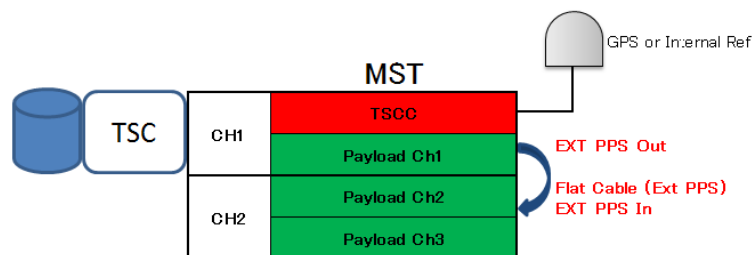
4.3.5. Synchronization

S-Trunking sites usually use multiple KAIROS. So, synchronization of each KAIROS is required to operate an S-Trunking system correctly.

At first, make one KAIROS (usually KAIROS with TSCC) to be a synchronization reference (Ref). If there are multiple sites, we recommend to make one Ref KAIROS in each site and set “Internal PPS (GPS/ GLONASS)” to all of them. In case of single site, setting “Internal Ref” to Ref KAIROS is also OK.

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 “AN-18-0015: 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 Setting

4.3 Setting up by KAIROS Manager

4.3.6. 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).

CH1 (with TSCC)

	Channel 0	Channel 1	Channel 2	Channel 3
Channel Name	Channel 0	Channel 1	Empty Channel	Empty Channel
Channel present	YES	YES	NO	NO
Channel enabled	YES	YES	NO	NO
ANALOG mode	YES	NO	NO	NO
DMR ETSI mode	YES	YES	NO	NO
DMR MotoTRBO mode	YES	YES	NO	NO
Digital P25 mode	NO	NO	NO	NO
POCSAG mode	NO	NO	NO	NO
Channel Spacing [kHz]	12.5	12.5	12.5	12.5
TX Frequency [MHz]	459.31250	459.36250	0.00000	0.00000
RX Frequency [MHz]	454.31250	454.36250	0.00000	0.00000
Simplex Frequency Shift	NO	NO	NO	NO
TX Power [W]	1.0	1.0	0.0	0.0
Maximum continuous tx time [s]	0	0	0	0
Transm. closure delay [ms]	500	500	500	500
TX DPL Code [oct]	--	--	--	--
RX DPL Code [oct]	--	--	--	--
TX TCS Frequency [Hz]	123.0	123.0	123.5	123.5
RX TCS Frequency [Hz]	123.0	123.0	123.5	123.5
Multitone TCS	NO	NO	NO	NO
Squelch Tail Cutoff on TX	NO	NO	NO	NO
Squelch Tail Cutoff on RX	YES	YES	NO	NO
RX Emergency TCS Frequency [Hz]	0.0	0.0	0.0	0.0
RX TCS hold time [ms]	500	500	500	500
Subtone deviation [Hz]	250	250	250	250
Supertone Frequency [Hz]	0	0	0	0
RX Squelch level [dB]	20.0	20.0	20.0	20.0
RX Squelch Hysteresis [dB]	6.0	6.0	6.0	6.0
RX DMR Colour Code (main)	1	1	1	1
TX DMR Colour Code (main)	1	1	1	1
RX DMR Colour Code (aux)	1	1	1	1
TX DMR Colour Code (aux)	1	1	1	1
Downlink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT
Uplink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT

CH2 (with Payload)

	Channel 0	Channel 1	Channel 2	Channel 3
Channel Name	Channel 0	Channel 1	Empty Channel	Empty Channel
Channel present	YES	YES	NO	NO
Channel enabled	YES	YES	NO	NO
ANALOG mode	YES	YES	NO	NO
DMR ETSI mode	YES	YES	NO	NO
DMR MotoTRBO mode	YES	YES	NO	NO
Digital P25 mode	NO	NO	NO	NO
POCSAG mode	NO	NO	NO	NO
Channel Spacing [kHz]	12.5	12.5	12.5	12.5
TX Frequency [MHz]	459.31250	459.36250	0.00000	0.00000
RX Frequency [MHz]	454.31250	454.36250	0.00000	0.00000
Simplex Frequency Shift	NO	NO	NO	NO
TX Power [W]	1.0	4.0	0.0	0.0
Maximum continuous tx time [s]	0	0	0	0
Transm. closure delay [ms]	500	500	500	500
TX DPL Code [oct]	--	--	--	--
RX DPL Code [oct]	--	--	--	--
TX TCS Frequency [Hz]	123.0	123.0	123.5	123.5
RX TCS Frequency [Hz]	123.0	123.0	123.5	123.5
Multitone TCS	NO	NO	NO	NO
Squelch Tail Cutoff on TX	NO	NO	NO	NO
Squelch Tail Cutoff on RX	YES	YES	NO	NO
RX Emergency TCS Frequency [Hz]	0.0	0.0	0.0	0.0
RX TCS hold time [ms]	500	500	500	500
Subtone deviation [Hz]	250	250	250	250
Supertone Frequency [Hz]	0	0	0	0
RX Squelch level [dB]	20.0	20.0	20.0	20.0
RX Squelch Hysteresis [dB]	6.0	6.0	6.0	6.0
RX DMR Colour Code (main)	1	1	1	1
TX DMR Colour Code (main)	1	1	1	1
RX DMR Colour Code (aux)	1	1	1	1
TX DMR Colour Code (aux)	1	1	1	1
Downlink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT
Uplink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT

(KAIROS > Configuration > Channel Table)

4.3.6.1. Channels data editing

- Channel Enabled: Check
- Analog Mode: Check here in case if using Analog CW ID
- ETSI DMR Mode: Check
- Main DMR Color Code: It must be same value both RX and TX, and for TSCC and Payload.

Channel Name: Channel 0

TRX Channel Spacing [kHz]: 12.5

TX Frequency [MHz]: 459.312500

RX Frequency [MHz]: 454.312500

TX Power [W]: 1.0

Max Continuous TX [s]: 0

TX Cutoff Delay [ms]: 500

RX Squelch level [dB]: 20.0

RX Squelch Hysteresis [dB]: 6.0

Main TX Subtone: TCS Freq. [Hz] 123.0

Main RX Subtone: TCS Freq. [Hz] 123.0

Uplink Emerg. Subtone [Hz]: 0.0

TCS Hold on RX [ms]: 500

Subtone Deviation [Hz]: 250

Superaudio Frequency [Hz]: 0

Channel Present: ☒

Channel Enabled: ☒

Simplex Shift: ☒

ANALOG Mode: ☒

ETSI DMR Mode: ☒

MotoTRBO (TM) DMR Mode: ☒

P25 Digital Mode: ☒

POCSAG Mode: ☒

Squelch Tail Cutoff on TX: ☒

Squelch Tail Cutoff on RX: ☒

Multitone TCS: ☒

P25 TX NAC: Default

P25 RX NAC: Default

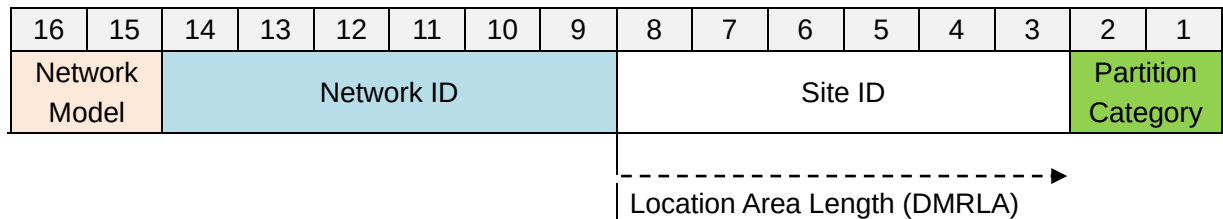
Main DMR Color Code: RX 1 TX 1

Aux DMR Color Code: RX 1 TX 1

Buttons: Save Channel Data, Cancel, Close

4.3.7. Explanation of S-Trunking Parameters

- The S-Trunking system has a System Code to identify networks and sites. The System Code is announced from the S-Trunking system. A Subscriber Unit (SU) 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 and Location Area Length (DMRLA) will be changed.

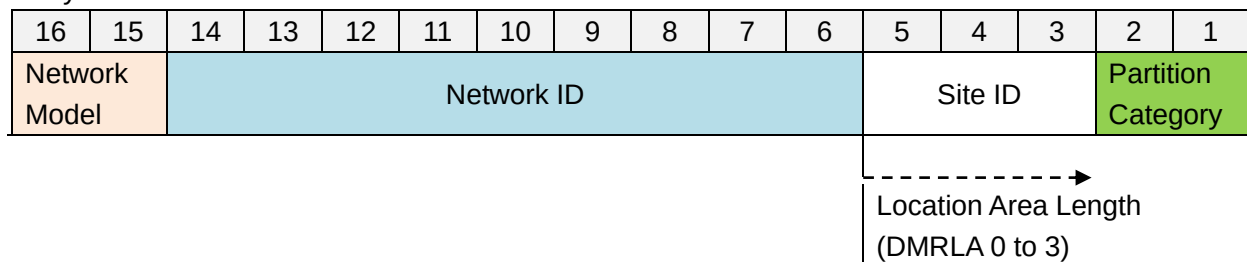


Network Model	Network ID Range	Site ID Range	DMRLA Range	Partition Category
Tiny, 2bit, 00	9bit, 0~511 [ID]	3bit, 0~7 [ID]	0~3 [bit]	2bit A: 01 B: 10 A+B: 11 None: 00
Small, 2bit, 01	7bit, 0~127 [ID]	5bit, 0~31 [ID]	0~5 [bit]	
Large, 2bit, 10	4bit, 0~15 [ID]	8bit, 0~255 [ID]	0~8 [bit]	
Huge, 2bit, 11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

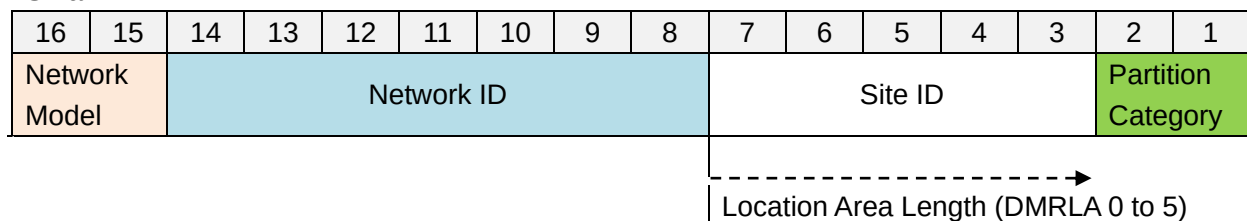
4.3.7.1. Network Model

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

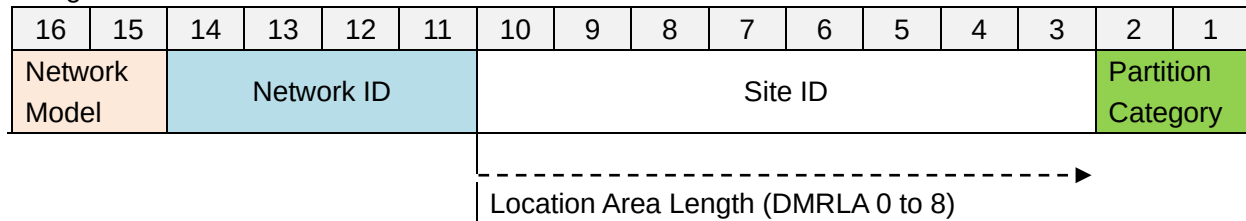
Tiny



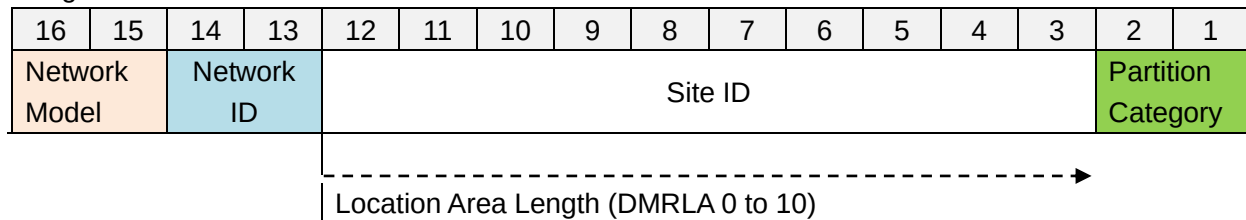
Small



Large



Huge



4.3.7.2. Network ID

Set the Network ID to identify the network.

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

4.3.7.3. Site ID

Set the Site ID to identify the Site.

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

4.3.7.4. Location Area Length (DMRLA)

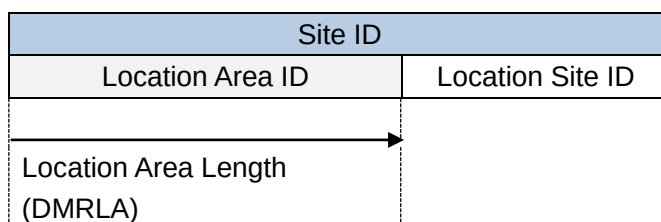
This sets the setting range (number of bits) of the Location Area ID.

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

4.3.7.5. 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.



4.3.7.6. 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)

4.3.7.7. Partition Category

For a site with many SU, 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 2bytes = 01)

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

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

4 Setting

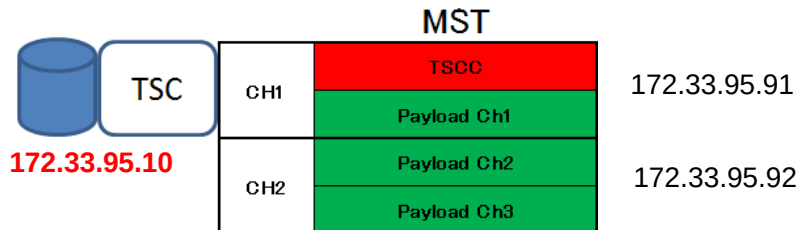
4.3 Setting up by KAIROS Manager

4.3.8. Tier III (S-Trunking) Parameters setting

This section explains how to set S-Trunking Parameters for KAIROS.

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

Give another IP address for Trunking System Controller (TSC) to KAIROS.



4.3.8.1. Base Station Operating Modes - Tier III Parameters

DMR Tier III Settings - KAIROS <MST SITE1 CH1>

Tier III Parameters

Static Configuration	Run-Time Data
Tier III Controller ☒ IP Address: 172.33.95.90	☒ 172.33.95.90
Tier III Network Model: SMALL Net (0 € 127): 126 Site (0 € 31): 30 Par: PAR A+B TS A Role: TCC PAR A+B TS B Role: PAYLOAD CH Idle Time [s]: 3 Accept not registered terminals: ☐ C-syscode [hex]: 7F7B Net-Site [hex]: 0FDE Allow Tier II traffic: ☐ TS A ☐ TS B	☒ SMALL 126 30 PAR A+B TCC PAR A+B PAYLOAD CH 3 ☐ 7F7B 0FDE ☐ TS A ☐ TS B
ETSI Versions Compliance ETSI Version <= 1.5.1: ☐ ETSI Version == 1.6.1: ☐ ETSI Version >= 1.7.1: ☒	☐ ☐ ☒
Discontinuous Control Channel Disabled: ☐ ETSI Shared Spectrum: ☐ JVCKENWOOD S-Trunking: ☒ Inactive Timer [ms]: 6000 STRK Interval [ms]: 2400 STRK Active [ms]: 480	☐ ☐ ☒ 6000 2400 480

--- Tier III Controller ---

Tier III Controller: Check

IP Address: Set the IP Address of the TSC. Set KAIROS of CH2 as well.

--- Tier III Network ---

Model: Choose Network Model

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 Message 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.

--- ETSI Version Compliance ---

ETSI Versions Compliance: Choose 1.7.1

--- Discontinuous Control Channel ---

Discontinuous Control Channel: Choose JVCKENWOOD S-Trunking.

Inactive Timer: It is the time that TSCC keeps transmission after Uplink disappeared. When the timer is expired, TSCC resumes intermittent operation.

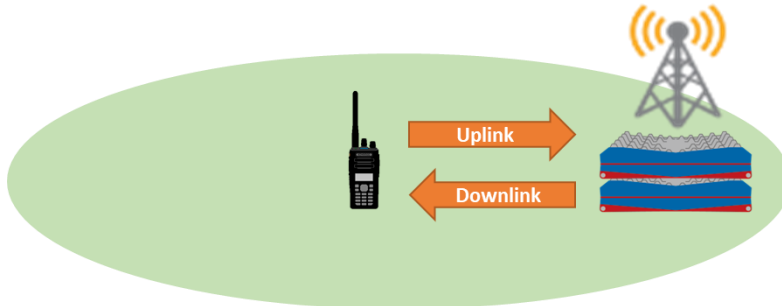
STRK Interval: Set "S-Trunking Beacon Interval time" that value is shorter than the "Beacon Interval Time" in the Mobile station.

STRK Active: Set "S-Trunking Beacon Duration time".

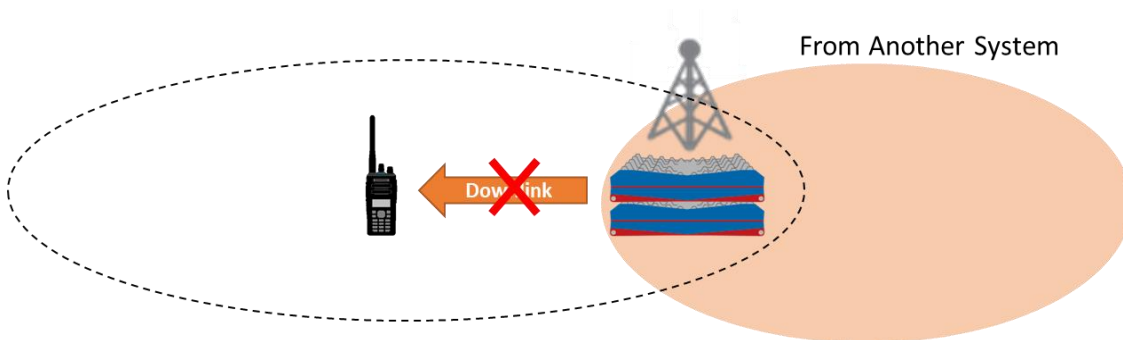
4.3.9. Cross-busy

The Cross-busy is a carrier sense features to avoid interference with another user/ agencies under shared channel licenses environment.

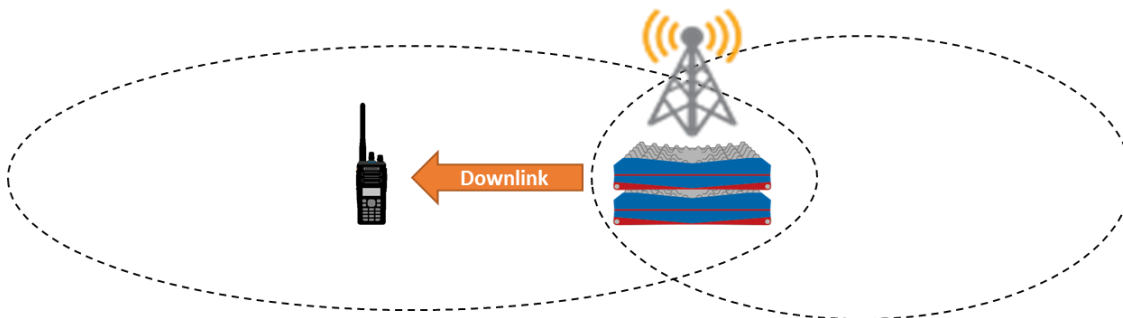
- If a KAIROS detects a conforming carrier (like an uplink from SU), it is able to transmit downlink.



- If a KAIROS detects a non-conforming carrier (from another system/users), downlink transmission is restricted.



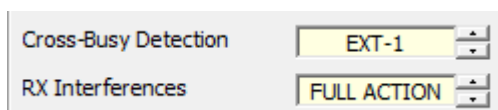
- If a KAIROS doesn't detect any carrier busy, it is able to transmit downlink.



4.3.9.1. Cross-busy Input (Internal)

It is a KAIROS's internal operation to check a RX frequency and restrict an own transmitting. KAIROS judges a shared carrier is busy when it detects non-conforming signal on RX frequency. This feature can be set by **KAIROS Manager**.

Select **FULL ACTION** from the RX Interferences.

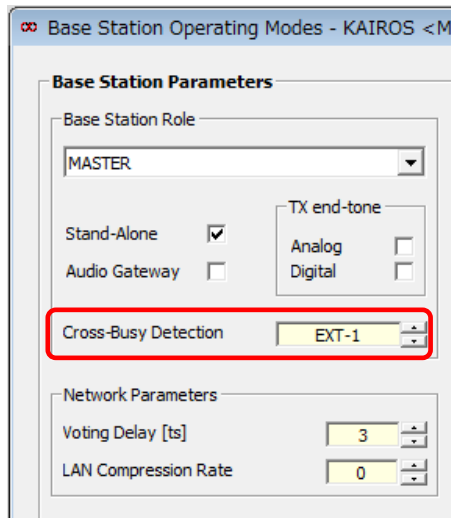


4 Setting

4.3 Setting up by KAIROS Manager

4.3.9.2. Cross-busy Input (External)

It is a detection feature of TX frequency busy by using an external device.



Base Station Operating Modes - Cross-busy Detection:

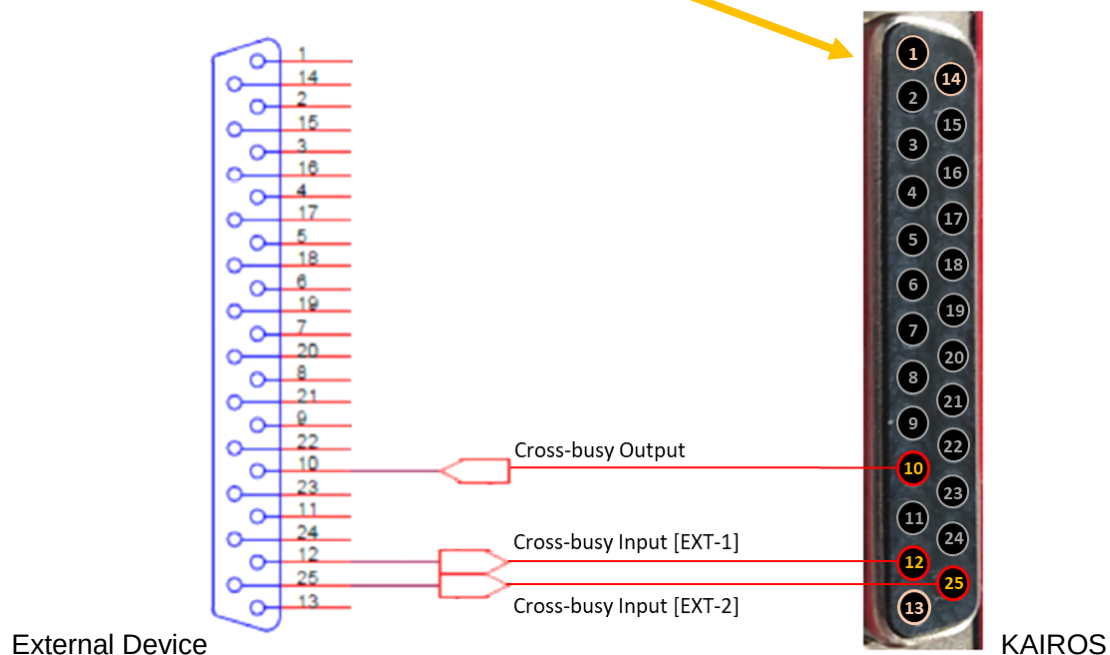
- Disable: Cross-busy detection doesn't work.
- EXT-1: Pin12 of DB25 connector becomes Cross-busy Input.
- EXT-2: Pin25 of DB25 connector becomes Cross-busy Input.

Connect an external device which is able to detect a shared carrier busy to a Cross-busy Input pin. During an external device makes a Cross-busy Input pin to active, a KAIROS restricts an own transmitting.

4.3.9.3. Cross-busy Output

During a KAIROS transmitting, the Cross-busy output pin (DB25 Pin10) is active to inform an external device that a shared carrier is busy. Any particular setting is not required for this feature.

4.3.9.4. DB25 Connector for Cross-busy



➤ Pin12 (input): Cross-busy Input [EXT-1]

Low: Active

High: Inactive

➤ Pin25 (input): Cross-busy Input [EXT-2]

Low: Active

High: Inactive

➤ Pin10 (output): Cross-busy Output

Low: Active

High: Inactive

Note: Refer to the “AN-18-0015: KAIROS Manager Function Manual” if you need a detail of DB25 Connector.

4.3.10. Logging Options setting

Logging options are debugging features for engineers. So, set the all of checkbox to uncheck.

The screenshot shows a window titled "Logging Options - KAIROS <STRK SITE CH1>". It contains two main sections: "User Messages" and "Secure Access Messages".

User Messages Section:

- Log Facility: **USER** (dropdown)
- Allowed Messages Level:
 - DEBUG ☐
 - INFORMATIONAL ☐
 - NOTICE ☐
 - WARNING ☐
 - ERRORS ☐
 - CRITICAL ☐
 - ALERT ☐
 - EMERGENCY ☐
- Remote Syslog Server ☐
 - IP Address:
 - IP Port: **514** (text box)

Secure Access Messages Section:

- Log Facility: **SECURITY (SYS3)** (dropdown)
- Allowed Messages Level:
 - DEBUG ☐
 - INFORMATIONAL ☐
 - NOTICE ☐
 - WARNING ☐
 - ERRORS ☐
 - CRITICAL ☐
 - ALERT ☐
 - EMERGENCY ☐
- Remote Syslog Server ☐
 - IP Address:
 - IP Port: **514** (text box)

At the bottom of the window are three buttons: "Read", "Write", and "Close".

4.4. Setting by KAIROS Web

4.4.1. Run Trunking System Controller (TSC)

Install TSC software (See 4.2 Install of Trunking System Controller (TSC)).

Click “Start/ Restart Tier 3 Controller” to start TSC. After that it will run in a few minutes.



The version of TSC installed can be checked here.

Note: Though it may describe the status of “Tier 3 Controller”, it is same thing as TSC status.

4.5. Setting of Trunking System Controller (TSC) 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.

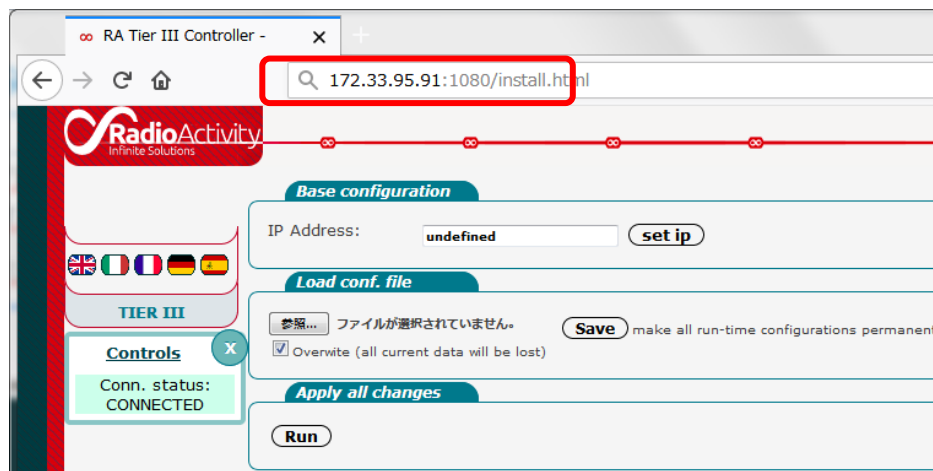
4.5.1. TSC IP Address setting

TSC owes an important role to manage Traffic in S-Trunking site.

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



Note: If you use an IP Address of No TSC KAIROS, the above screen would not be seen.

Set a new independent IP address for the TSC. It must be the same IP Address as set in Section “4.3.8 Tier III (S-Trunking) Parameters setting”.

Enter “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 Trunking System Controller (TSC) 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 TSC’s IP Address.

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

[TSC’s IP Address]:1080

Enter User = “Demo”, Password = “Demo” and click “Submit”.

RadioActivity
Infinite Solutions

Status Monitor Settings Service

Authentication

User: Demo
Password:
Submit

TIER III v. 0.9.8.3

For demo login use User="Demo" and Password="Demo"
Create your user account!

4.5.3. Settings

When you open “Settings”, the following screen is displayed.

RadioActivity
Infinite Solutions

Status Monitor Settings Service

Network

Index	Name	ColorCode	Model	Net	Site	Par
1	DEMO KW	1	Small	10	0	[A B]

Mobile Stations
Call Groups
External Servers
System
Network
Controller
Trunk Station
Gateways
[T]TT
Users
Maintenance
Logout

TIER III v. 0.9.8.2
IP HW 172.33.95.91
IP TS 172.33.95.10

Filter: X
Conn. status: CONNECTED
AND conditions: ☐
Apply Filter
Select Columns
Select Rows
Add Network

4 Setting

4.5 Setting of Trunking System Controller (TSC) by KA-NMS



- Mobile Station: Allows to add Subscriber Unit (SU) 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 server.
- System: Allows to set different parameters and choose different options related to the DMR-based protocol.
- Network: Allows to add a new S-Trunking network and edit the parameters of an existent network.
- Controller: It has not been developed yet.
- Trunk Station: It has not been developed yet.
- Gateways: Allows to add Gateways.
- [T]TT: It has not been developed yet.
- Users: Allows to add new users to System Administrators
- Maintenance: Allows to manage configurations and perform the restart of the TSC.
- Logout: allows to logout from the current session of KA-NMS

4.5.3.1. Network

By using this information, SUs 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 SUs 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 III (S-Trunking) Parameters set in KAIROS Manager. (See 4.3.8)

A screenshot of the KA-NMS 'Edit' window for a network configuration. The window has a title bar with 'Edit:' and a close button. Below the title bar are three buttons: 'This Network' (highlighted in green), 'Add Network', and 'Delete Network'. The main area is titled 'Data to be edited:' and contains several fields: 'Name' (DEMO KW), 'ColorCode' (1), 'Model' (Small), 'Net' (10), 'Site' (0), 'Par' (two checkboxes labeled A and B), 'DmrLa' (5), 'Backoff' (8), 'System Code' (17667, with a red box around it showing a binary representation 0100010100000011 and hex:4503), and 'Base Tx Frequency' (457000000). A 'Save' button is at the bottom. On the left side of the main window, there is a 'Filter:' panel with a close button. It contains a 'Conn. status: CONNECTED' dropdown, an 'AND conditions:' checkbox, an 'Apply Filter' button, and three buttons: 'Select Columns', 'Select Rows', and 'Add Network' (highlighted with a red box).

4 Setting

4.5 Setting of Trunking System Controller (TSC) by KA-NMS

Make sure that hex value of System Code matches C-syscode [hex] in KAIROS Manager. (See 4.3.8)

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

Name	DEMO KW
ColorCode	1
Model	Small
Net	10
Site	0
Par	☒ A ☒ B
DmrLa	5
Backoff	8
System Code	17667 01000101000000 hex:4503
Base Tx Frequency	457000000

- Net: this is the network identifier of the trunking system. Each S-Trunking network composing a single 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 SUs 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 SUs to use the first control channel and the other group to use the second control channel. This feature should be set also on SUs. If SUs set to use PAR A+B, they can use both the control channels.
- DmrLa: This field specifies the length, expressed as the number of bits, of the Location Area field which is used to identify the coverage of the area of an S-Trunking Network. The coverage area is divided into a number of location areas (DmrLas): 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 SU's random access request on the control channel fails or any answer to a random request is not received, the SU 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 other SUs.
- System Code: Once the "Model", "Net", "Site", "Par" and "DmrLa" have been set, KA-NMS 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 SUs otherwise the registration procedure will not succeed.
- Base Tx Frequency: In order to assign payload channels to requesting SUs, both the trunking controller and SUs need a way to identify the carrier. The controller can send this information to SUs 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 Trunking System Controller (TSC) by KA-NMS

4.5.3.2. System

4.5.3.2.1. Audio/Data Call

<u>Audio/Data Call</u>	
Trunking Method	Transmission
Trunking_Method_Force	None
Timeout Audio Call Setup	30
Timeout Audio Call	300
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	All Start Mode
Rights AudioData	None
Talkgroup Call Collision	Wait Late Entry
Payload Check	Check payload after reservati 

In order to set up a voice call on an S-Trunking system, a subscriber presses the PTT, then the Subscriber Unit (SU) transmits a call request to the system using the control channel (TSCC). The Trunking System Controller (TSC) sends, on the control channel, a Channel Grant message to the calling SU and to the called SU (or the target group of subscribers). All the SUs involved in the call then turn on the traffic channel (Payload) assigned by the controller.

Trunking Method	Allows to choose a trunking method of the radio network: ➤ Message Trunking mode: A voice call always starts with a request sent by SU on TSCC. The Payload channel is allocated for all the duration of the call and must be explicitly released by user. ➤ Transmission Trunking mode: A new call request is sent on the TSCC by the SU each time the PTT is sent. ➤ Quasi Transmission Trunking mode: A new call request is sent on TSCC by the SU after a Hang time has elapsed.
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 SU 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 a SU 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
Channel P_Protect	TBD (will be explained in the next update)
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 an incoming group call: ➤ Configured Zone Table: The group call is established only in the list of zones configured on KA-NMS. ➤ Mobile Subscribers selection position: The group call is established only in the zones where SUs 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 S-Trunking network
Audio_Call_Group_Mode	Select the group call setup mode in case of Multisite group call: ➤ 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. ➤ 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.

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4.5 Setting of Trunking System Controller (TSC) by KA-NMS

Rights Audio Data	Allows to set the rights of a communication: ➤ Table: It has not been developed yet. ➤ User: It works depending on “Settings->Mobile Stations” of each user. ● Individual Audio Call Rights ● Individual Audio Call Rights ● Individual Short Data Call Rights ● Individual Gateway Call Rights ➤ Group: It has not been developed yet.
Payload Check	➤ Check payload after reservation: Recommend to check. ➤ Use BS periodic Cross-busy check: Allows to set Cross-busy enabled by internal operation: detecting a RX frequency busy. It can be used in combination with external operation: “Cross-busy Input (4.3.9.2)”.

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: ➤ Simulcast/Single Site: For a single site. Simulcast is not supported with S-trunking. ➤ Multisite: Each site is related to one or more carriers and can have its TSCC. ➤ Mixed: It is not necessary to select this.
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: It has not been developed yet.
Control Channel Aloha	Allows to choose whether ALOHA signaling packets should be sent on control channel. By default it is set to yes.

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4.5 Setting of Trunking System Controller (TSC) by KA-NMS

Control Channel Type	Allows to choose the control channel type, which can be: ➤ TSCC: The control channel doesn't announce that the alternate slot of it can be used for GPS (USBD) polling and transfer. ➤ TSCCAS: The control channel announce that the alternate slot of it can be used for GPS (USBD) polling and transfer.
Control Channel Source	Allows to choose if the control channel configurations are acquired by reading repeater's configurations or by reading the KA-NMS configurations.
Control Channel Switch	Allows to choose which conditions can cause the control channel to switch to another carrier/ timeslot: ➤ Never: The Control Channel is fixed and never switch. ➤ Auto: It has not been developed yet. ➤ Fault: It has not been developed yet.
Authentication	Allows to choose when the authentication of SU is required. ➤ Registration: In a registration sequence ➤ Call Setup: In a call setup sequence ➤ Periodic: A certain of period time is expired ➤ Stun/Revive: Receiving Stun or Revive request. ➤ Kill: Receiving Kill request.
Power Save	It should be select "None".

4.5.3.2.3. Registration

Registration	
Timeout Inactivity	3600
Timeout Delete	10
Procedure	Standard
Options	Single Talk-group Att Talk-group List Subsc Mass Registration Packet
Rights	MS Account

Timeout Inactivity	Maximum amount of inactivity time in seconds before de-registering a SU.
Timeout Delete	Timeout after a SU contact loss before its data will be deleted.
Procedure	Allows to choose the registration procedure: ➤ Standard registration ➤ Automatic ➤ No registration needed
Options	Allows to choose following options: ➤ Single Talk-group Attachment ➤ Talk-group List Subscription ➤ Mass Registration Packet
Rights	Allows to choose where to check a SU rights during Registration Process with following options: ➤ MS Account ➤ Rights Table

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4.5 Setting of Trunking System Controller (TSC) by KA-NMS

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4.5 Setting of Trunking System Controller (TSC) by KA-NMS

4.5.3.2.4. T3 System

T3 System	
Etsi Compliance	1.8.1
Announce Adjacent Site	Off
Announce Logical Physical Channel	Off
Announce TSCC	Off
Announce_Time	Off
Polling NMEA	UDT
Timeout positioning request polling	600
Access_Control	On
Advance Message	On
Networks Separation	On
TS Topology	Centralized
TS Operation	BS Status
TS Priority	Use High Priority
Demo Rights	Don't check rights in call setu

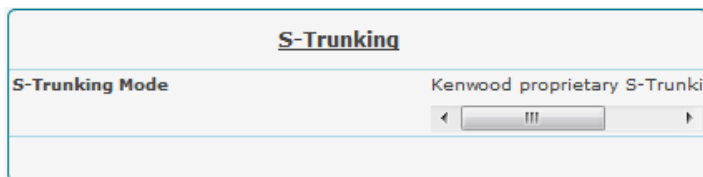
Etsi_Compliance	Allows to choose which version of ETSI standard to be compliant with: ➤ 1.5.1 ➤ 1.6.1 ➤ 1.7.1 ➤ 1.8.1 Same setting for MS should be same.
Announce Adjacent Site	Enables transmission of adjacent site announcement packets. This packets announce information about the TSCCs in use on radio sites close to this TSCC to assist SU to acquire an appropriate TSCC if the SU moves out of radio contact with the current TSCC (could be used to make the SU 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. SUs shall add/ withdraw the logical channel (s) to/ from their Short Hunt list of physical channels to hunt.
Announce_Time	TBD (will be explained in the next update)

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4.5 Setting of Trunking System Controller (TSC) by KA-NMS

Polling NMEA	Allows to set NMEA automatic polling request. ➤ Off: Cyclic polling requests is off. ➤ UDT: UDT format GPS polling is run. ➤ USB D CC: USB D format GPS polling is run on the TSCC. ➤ USB D CCAS: USB D format GPS polling is run on the alternate slot of TSCC (TSCCAS).
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	Allows to choose the managing type of TSC. ➤ Centralized: One TSC in one system. ➤ Distributed: Multi TSC in one system. (It has not been developed yet.)
TS Operation	Allows to choose the activation logic of TSC. ➤ BS Station: TSC restarts according to the KAIROS main unit reboot. ➤ TS Logic: TSC works regardless of the KAIROS main unit reboot.
TS Priority	Allows to give high priority to embedded controller.
Demo Rights	Allows to remove rights check in call setup.

4.5.3.2.5. S-Trunking



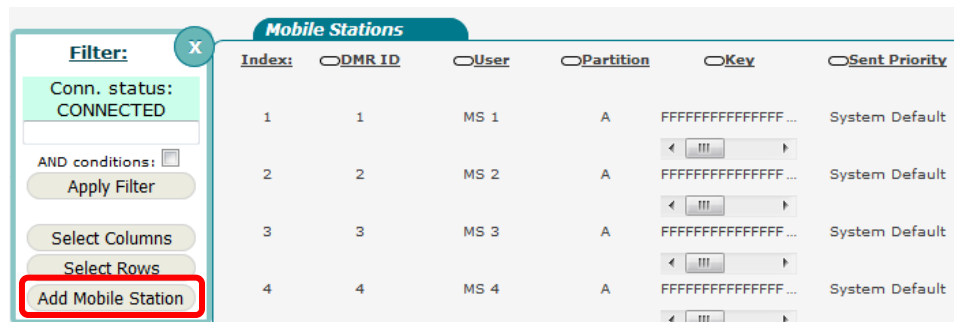
S-Trunking Mode	Allows to use Kenwood proprietary S-Trunking compliance mode. Set to check to run the S-Trunking system.
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4 Setting

4.5 Setting of Trunking System Controller (TSC) by KA-NMS

4.5.3.3. Mobile Stations

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

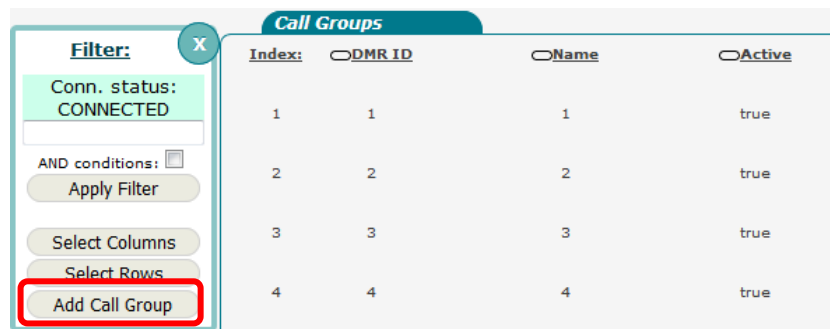


DMR ID	DMR identity of the SUs (portables and/ or mobiles).
User	It is a text label to identify the SU (alias).
Partition	Allows to set which fleet partition the SU belongs to in case of a system operating with two control channels. If a site operates with multiple control channels it is possible to make a SU 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 SU.
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
Individual Data Call rights	Allows to set the rights to make and receive individual data call. ➤ None ➤ Send ➤ Receive ➤ Send and Receive

Individual Short Data Call rights	Allows to set the rights to make and receive individual short data call. ➤ None ➤ Send ➤ Receive ➤ Send and Receive
Gateway Call rights	Allows to set the rights to make and receive gateway call. ➤ None ➤ Send ➤ Receive ➤ Send and Receive
Sent Call Type	Allows to set how individual audio calls making are managed by the SU: ➤ Default (same as system default) ➤ Unconfirmed ➤ OACSU (off the air call setup) ➤ FOACSU (full off the air call setup)
Receive Call Type	Allows to set how individual audio calls receiving are managed by the SU: ➤ Default (same as system default) ➤ Unconfirmed ➤ OACSU (off the air call setup) ➤ FOACSU (full off the air call setup)
Active	Allows to define the SU is active or not in the system.

4.5.3.4. Call Groups

This box allows you to add a new 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	ID of the Talk-group.
Name	Short Name of the Talk-group.
Active	Allows to define the Talk-group is active or not in the system.
Description	Textual identifier to recognize the network.
Receive priority	Allows to set the Forced Priority of a Call Received ➤ System Default ➤ Without Priority ➤ Low Priority ➤ Medium priority ➤ High Priority
Time of last change	Time-stamp of the last changes

After setting up until here, a SU can perform Registration, 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 of “AN-19-0001: DMR Tier III/ KAIROS Tier III Trunking” for the saving method.

5. Monitor Function

It allows to monitor the S-Trunking network. It is possible to customize the view according to different parameters. These options are same as DMR Tier III, so refer “AN-19-0001: DMR Tier III/ KAIROS Tier III Trunking”.

6. Service

These options are same as DMR Tier III, so refer “AN-19-0001: DMR Tier III/ KAIROS Tier III Trunking”.