

Application Note

KAIROS DMR System

November 2019 Update

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1. KAIROS System November 2019 Update

1.1. Overview

This document is described additional functionality by updating KAIROS Firmware which is released on end of November 2019.

1.2. Version information

Product	Supported Version in Release
KAIROS System	Operating System: Linux 2.4.31 Version 01, Build 07 KAIROS Main Firmware Version 1.6.B.1_stable KAIROS DSP Firmware Version 4.5C KAIROS PLD Firmware Version 4.13 Tier III Controller Version 1.0.5.0
KAIROS Manager	KAIROS Manager Version 1.7.9

1.3. Updated Features Quick Reference

The items which have "✓ New" are updated features, only "✓" is an existing feature.

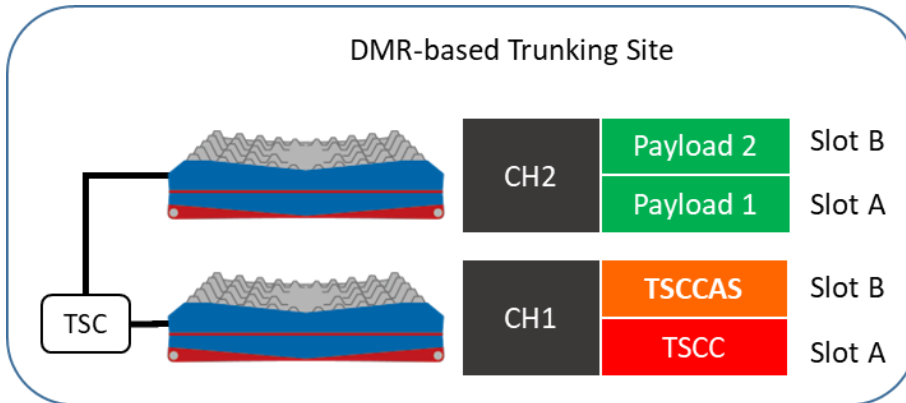
#	Updated Features	S-Trunking	Tier III
1	Unified Single Block Data (USBD)	N/A (Note 1)	✓ New
2	Transmit Interrupt	✓ New	✓ New
3	Power Save	N/A	✓ New
4	Long Data Message/ Transparent/OTAP	✓ New	✓ New
5	Multisite Trunking	✓ New	✓
6	IP Gateway Connection	✓ New	✓

Note 1: The feature will be supported on end of March 2020 update.

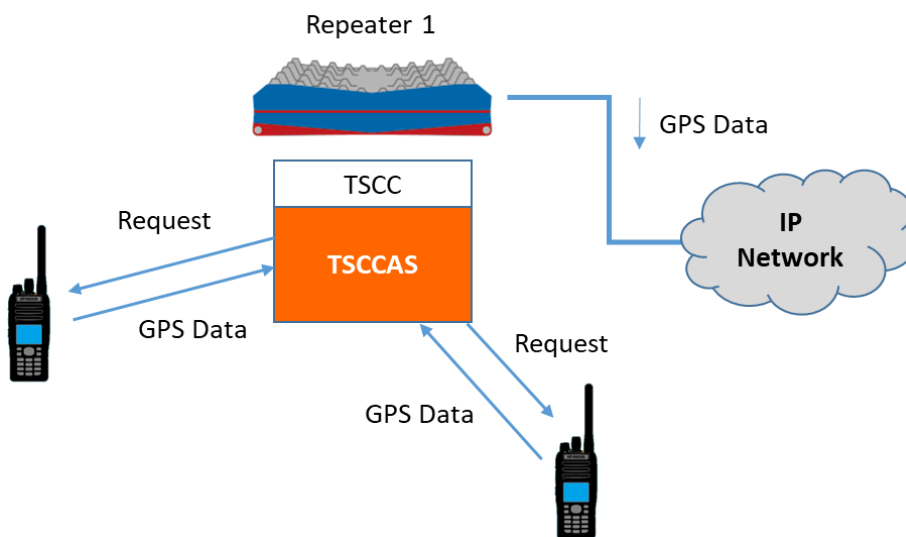
1.3.1. Unified Single Block Data (USBD)

USBD Polling Service enables GPS data to be polled from a Mobile Station.

If a repeater has a Trunk Station Control Channel (TSCC), the other timeslot is able to be set as Trunk Station Control Channel Alternate Slot (TSCCAS).



TSCCAS is used as a dedicated timeslot for GPS polling, and data protocol is USBD Polling Service defined in DMR Standard (ETSI TS 102 361-4).



This service is very efficient, allows data to be packaged minimizing, reduces delays between one sending and the other, avoids conflicts and supports large quantities of location updates. In DMR Tier III Trunking, we expect that TSCCAS has a theoretical maximum capacity of 1000 terminals / minute at full rate.

Note: KAIROS doesn't support this feature on the S-Trunking at this moment. Therefore, it can only be used in DMR Tier III Trunking mode until end of March version up.

Recommended Polling interval vs Number of Mobile Station is shown as below;

Polling interval	Number of MS, GPS Polling on	
	TSCC (Slot A) *1	TSCCAS (Slot B)
30 [sec]	Up to 15 [Unit]	Up to 500 [Unit]
60 [sec]	Up to 30 [Unit]	Up to 1000 [Unit]
90 [sec]	Up to 45 [Unit]	Up to 1500 [Unit]
120 [sec]	Up to 60 [Unit]	Up to 2000 [Unit]

*1 Number of MS on TSCC (Slot A) is not a strict number, because it depends on the traffic (How busy TSCC by Voice call or Status message and so on) on the channel.

1.3.1.1. KAIROS Manager setting

Select "TSCCAS" from TS B Role.

In case Multisite Trunking, same setting is needed to all of KAIROS which is working as TSCC.

The screenshot shows the 'DMR Tier III Settings - KAIROS <MST SITE1 CH1>' window. It is divided into 'Static Configuration' and 'Run-Time Data' sections. The 'Tier III Network' section contains various parameters. The 'TS B Role' is highlighted with a red box and is set to 'TSCCAS'. Other parameters include IP Address (172.33.21.101), Model (SMALL), Net (126), Site (0), Par (PAR A+B), TS A Role (TCC PAR A+B), Idle Time (10s), and ETSI Versions Compliance (ETSI Version >= 1.7.1 selected).

1.3.1.2. KA-NMS setting

Select "TSCCAS" from Control Channel Type to allow to use of TSCCAS and inform its status on TSCC.

The screenshot shows the 'Network' configuration window. The 'Control Channel Type' is set to 'TSCCAS', which is highlighted with a red rectangle. Below this, an 'Edit:Control Channel Type' dialog box is open, showing a dropdown menu with 'TSCCAS' selected. The dialog also has an 'Apply' button and a list of options: 'TSCCAS' and 'TSCC'.

Select "USBC CCAS" to use of Polling NMEA in T3 System.

If "UDT" is selected, GPS polling will work on TSCC (Slot A).

"Timeout positioning request polling" defines polling interval. Minimum number is 30 [sec].

The screenshot shows the 'T3 System' configuration window. The 'Polling NMEA' is set to 'USBC CCAS', which is highlighted with a red rectangle. Below this, the 'Timeout positioning request polling' is set to '30', also highlighted with a red rectangle. An 'Edit:Polling NMEA' dialog box is open, showing a dropdown menu with 'USBC CCAS' selected. The dialog also has an 'Apply' button and a list of options: 'USBC CCAS', 'Off', 'UDT', and 'USBD CC'.

1.3.1.3. Mobile Station Setting

Select "Poll" in the GPS setting.

General RX/TX Options Other Options **GPS** Personalities

Protocol: DMR-based Trunking Type Tier III

Base Station

ID Type Group ID

ID 26

GPS Combination

☐ Status

Combination Status Range 0 - 99

☐ Emergency

☐ GPS Report Priority over Group Call

GPS Report with Voice

Report Off

Interval 1 3.6 [s]

GPS Report Mode Poll

AUTO

GPS Report Interval Time [s] 180

☐ GPS Distance Change

Distance 100 Meters

GPS Message Type Full

KPG-D3

1.3.1.4. Quick Check by using KA-NMS – Monitor – Network

GPS information can be seen through Monitor – Network.

RadioActivity Infinite Solutions

Status Monitor Settings

Carrier only Site only Zone only See all

ZONE1

SITE1

CARRIER1

MST SITE1 CH1

CC Ts A CC Ts B

Role: MASTER

IP Addr.: 172.33.21.20

Network: DEMO KW

2 portables

CARRIER2

MST SITE2 CH1

Role: MASTER

IP Addr.: 172.33.21.22

Network: DEMO KW

Terminals on Base Station MST SITE1 CH1

Name	user
DMR Id	1001
BS Id	151199744
Config. Id	9
Last Registration	10:41:36
Last Call	none
Last ACK	10:41:36
Last GPS ACK	10:48:27
GPS latitude	35.508928
GPS longitude	139.556054
GPS speed	0
GPS direction	0
Active groups	26

Turns to gray color here in case of TSCCAS

Click here for more detail.

1.3.1.5. Quick Check by using KA-NMS – Monitor – Mobile Positioning

You may test GPS polling status without KAS-20, by mini AVL function in KA-NMS.

The screenshot shows the KA-NMS Monitor interface. The 'Monitor' tab is selected. On the left sidebar, 'Mobile Positioning' is highlighted. The main area displays a table titled 'Mobile station positioning' with the following data:

Time (UTC)	Name[DMR Id]	Latitude	Longitude	Speed	Direction
Wed Nov 27 17:15:17 2019	user[1003]	35.509679	139.556376	0	0
Wed Nov 27 17:14:59 2019	user[1001]	35.508907	139.556311	0	0
Wed Nov 27 17:14:58 2019	user[1002]	35.509368	139.556258	0	0

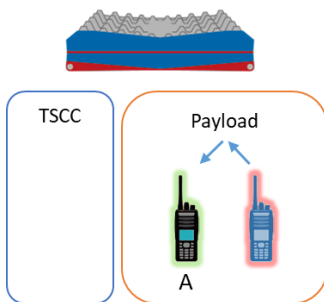
A 'Map' button is visible below the table.

By clicking “Map” button, Mobile Stations are mapped on KA-NMS.

The screenshot shows the KA-NMS Monitor interface with the 'Map' button clicked. The main area displays a map of the Yokohama area with three mobile stations marked by colored pins (1001, 1002, 1003). The map includes labels for various locations such as 鶴見川, 白山公園, and 鶴見川. The left sidebar shows the 'Mobile Positioning' tab selected, and the 'Controls' section indicates 'Conn. status: CONNECTED'.

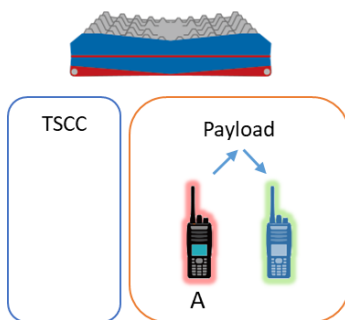
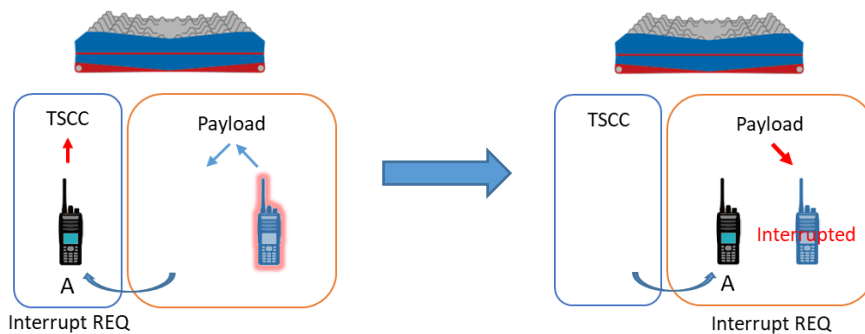
1.3.2. Transmit Interrupt

1.3.2.1. Transmit Interrupt Basic operation



At first, Mobile Station-A is on Payload and involves voice call. In this case, it can't transmit a voice call while the other MS transmits.

In the next, when MS-A uses Transmit Interrupt, it temporarily moves TSCC and transmits an interrupt request. If the TSCC accepts the request, MS-A is back to Payload soon. After that, interrupt request is sent on Payload downlink and the other MS may stop transmitting.



Finally, SU-A is able to transmit a voice call on current Payload channel.

1.3.2.2. Transmit Interrupt Mode

#	TX Interrupt	Description
1	Low Priority Mode	Same as ETSI mode
2	Deny	TSCC doesn't accept TX Interrupt request.
3	ETSI Mode	Interrupt request will be sent on the Payload Channel. If an MS enable Interrupt Decode, it will be interrupted.
4	High Priority Mode	Interrupt command can be sent regardless the MS Call Interrupt Decode setting.

1.3.2.3. KA-NMS setting

Select TX Interrupt Mode from System – Audio/Data Call in KA-NMS.

The screenshot shows the 'System' configuration page in KA-NMS. Under the 'Audio/Data Call' section, the 'TX Interrupt' setting is highlighted with a red box and is set to 'ETSI Mode'. Below this, the 'Edit:TX Interrupt' section is visible, showing a dropdown menu with the following options: 'ETSI Mode', 'Deny', 'Low Priority Mode', and 'High Priority Mode'. The 'ETSI Mode' option is currently selected.

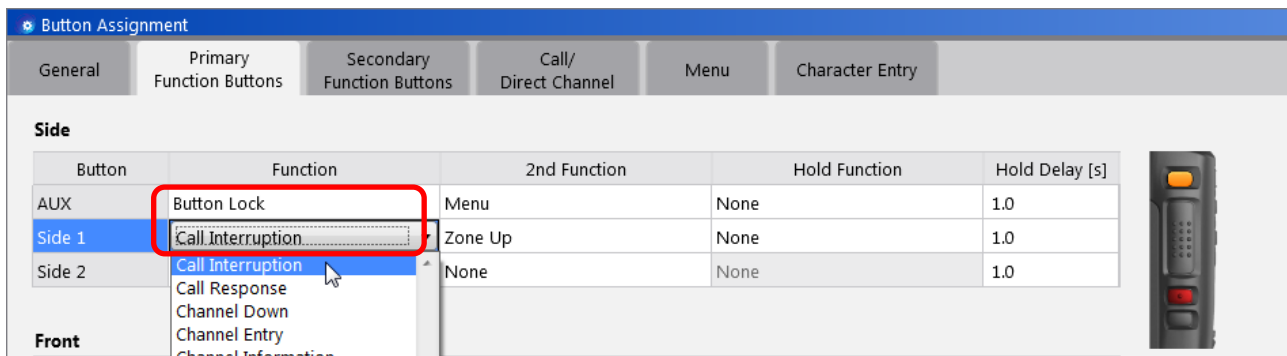
1.3.2.4. Mobile Station Setting

In order to send Transmit Interrupt from Mobile Station, following setting is required;

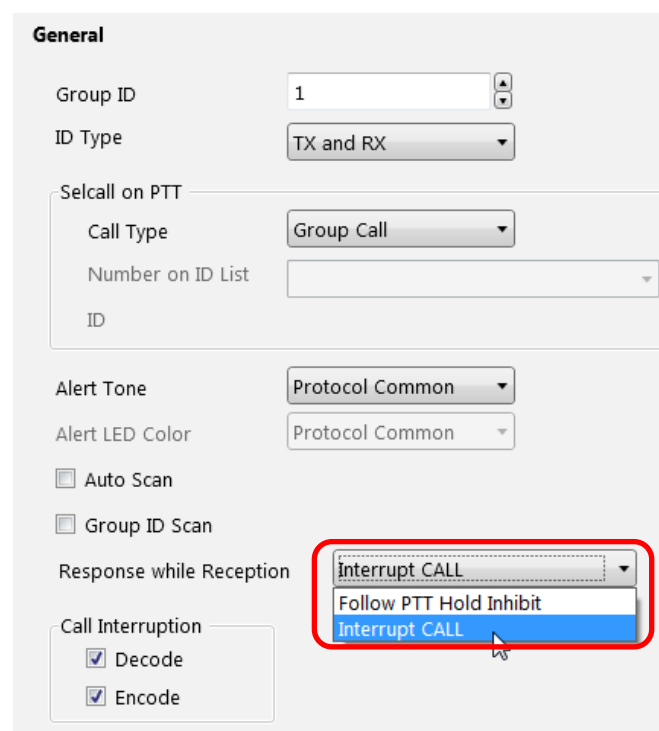
- Check “Decode” and/or “Encode” of Call Interruption in the Personalities.

The screenshot shows the 'General' settings page for a Mobile Station. The 'Call Interruption' section is highlighted with a red box, showing two checked options: 'Decode' and 'Encode'. The 'Response while Reception' dropdown menu is open, showing the following options: 'Interrupt CALL', 'Follow PTT Hold Inhibit', and 'Interrupt CALL'. The 'Interrupt CALL' option is currently selected.

- Assign "Call Interruption" to a side button or front button.



- Or set "Interrupt CALL" in the Personalities.



1.3.3. Power Save

In order to improve long battery life for the mobile stations, KAIROS Tier III supports "Power Save".

For an MS to activate power save, it registers with the TSCC. In the registration service request, the MS may ask for power save it wishes to employ by sending a parameter.

1.3.3.1. Power Save setting table

KA-NMS Setting	NX Radios setting	MS Receiving rate	Receiving On time	Receiving Off time
N/A	OFF	1/1	Always	None
1:2	Short	1/2	480 ms	480 ms
1:4	Medium	1/4	480 ms	1440 ms
1:8	Long	1/8	480 ms	3360 ms

1.3.3.2. Battery Life in DMR Tier III Trunking

NX-3000 Series

[h]

Battery Saver	KNB-55L 1480mAh		KNB-57L 2000mAh		KNB-79LC 2860mAh*1	
	Hi Power	Lo Power	Hi Power	Lo Power	Hi Power	Lo Power
OFF	7.2	8.3	10.1	11.6	12.4	14.2
Short	8.9	10.7	12.5	14.9	15.4	18.3
Medium	10.4	12.8	14.6	17.9	17.9	22.0
Long	11.2	14.0	15.6	19.5	19.2	24.0

NX-5000 Series

[h]

Battery Saver	KNB-L1 2000mAh		KNB-L2 2600mAh		KNB-L3 3400mAh	
	Hi Power	Lo Power	Hi Power	Lo Power	Hi Power	Lo Power
OFF	10.6	11.9	13.8	15.4	18.1	20.2
Short	12.2	13.9	15.9	18.0	20.7	23.6
Medium	13.5	15.6	17.5	20.2	22.9	26.5
Long	14.2	16.6	18.5	21.5	24.2	28.2

Conditions are;

TX-RX-Standby duty: 5-5-90

LCD Backlight: Off

Bluetooth: Off

ANR: Standard

Ext. SP/MIC: None

Option Board: None (NX-5000)

AF Output while receiving: 500mW

Mandown Detection: Off

GPS: Off

*1 Charged by KSC-25S/25LS

MicroSD: None (NX-5000)

1.3.3.3. KA-NMS Setting

Check "Single Talk-group Attachment" in Procedure – Options.

The image shows two overlapping windows from the KA-NMS interface. The 'Registration' window on the left has a table with the following data:

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

The 'Edit:Options' window on the right is titled 'Radio Registration Options Selection' and contains the following options:

- ☒ Single Talk-group Attachment
- ☒ Talk-group List Subscription
- ☐ Mass Registration Packet

An 'Apply' button is located at the bottom right of the 'Edit:Options' window.

Check Power Save Option from "1:2" or "1:4" or "1:8".

"1:16" and bigger are reserved selections. NX Radios don't have such selection so do not use them.

The image shows two overlapping windows from the KA-NMS interface. The 'Network' window on the left has a table with the following data:

Network	
Network Type	Multisite Multifrequen
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	1:2 1:4 1:8

The 'Edit:Power Save' window on the right is titled 'Power Save option' and contains the following options:

- ☒ 1:2
- ☒ 1:4
- ☒ 1:8
- ☐ 1:16
- ☐ 1:32
- ☐ 1:64
- ☐ 1:128

An 'Apply' button is located at the bottom right of the 'Edit:Power Save' window.

1.3.3.4. Mobile Station Setting

Enable "Group Subscription" in Trunking Network.

If without Group Subscription, Receiving MS cannot receive Grant message while it is sleeping.

The screenshot shows the 'System' configuration tab. The 'General' tab is selected. The 'System' section contains the following settings:

- Network Model: Small
- Network ID: 126
- Location Area Length (DMRLA): 3
- Location Area ID: 0
- Location Site ID: 0
- Site ID: 0
- Coverage Type: Intra-Network
- System Code (bin): 01 111110 000 00 xx
- Lowest Frequency Number: 1
- Highest Frequency Number: 480
- ☒ Group Subscription (highlighted with a red rectangle)

Select Battery Saver setting. (See the Table 1.3.3.1)

Longer setting can save battery consuming more, but it may cause slow Grant on calling Mobile Station.

The screenshot shows the 'RX/TX Options' configuration tab. The 'General' tab is selected. The 'RX Options' section contains the following settings:

- Protocol: DMR-based Trunking
- Type: I
- ☐ Secure Indicator
- Remote Monitor
 - ☐ Remote Monitor
 - Timer [s]: 10
 - Display: On
- FOACSU
 - ☒ FOACSU
 - ☐ Suppress Emergency Call
- Late Entry Cancel Time [s]: Off
- Battery Saver: Short (highlighted with a red rectangle)

1.3.4. Long Data Message/ Transparent/OTAP

Until October 2019, KAIROS System supported Long Data, Transparent in Tier II only.

From new version, November 2019 update, it supports S-Trunking and Tier III as well.

System	Until October 2019	November 2019 onwards
DMR Tier III	Not Supported Long Data, Transparent and OTAP	Supported Long Data, Transparent and OTAP
S-Trunking	Not Supported Long Data, Transparent and OTAP	
DMR Tier II	Supported Long Data, Transparent Not supported OTAP	

1.3.5. Multisite Trunking (S-Trunking)

In S-Trunking service, only **Single site** has been supported until now.

From this release, S-Trunking in **Multisite** (up to 15 sites) is supported.

For the setting of KAIROS and KA-NMS, please refer to another Application Note AN-19-0005 "KAIROS S-Trunking".

1.3.5.1. Required Licences

Multi-Site Trunking Licence (**KWD-KA10MST**) is required.

Licences for Each Repeaters				TSC		Non-TSC	
● S-Trunking ● Multi-Site							
DMR	Tier 3	Simulcast	Multi-Site Trunking	S-Trunking	NMS	TSC	
required	Expired (see note)	n/a	required	required	n/a	n/a	

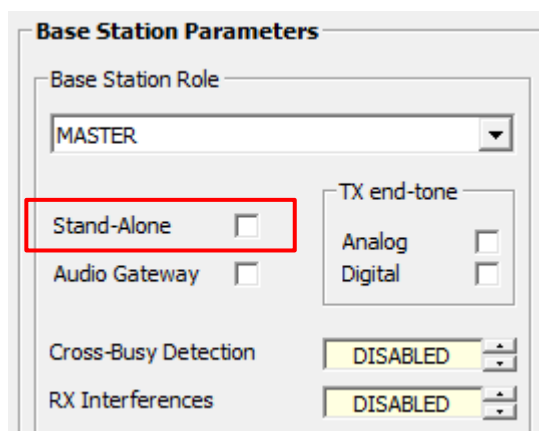
Note: In case the System is S-Trunking, "Tier 3" Licence must not be activated.

Current keys status:	
DMR licence	is activated for LIFETIME
Analog licence	is activated for LIFETIME
Tier 3 licence	has EXPIRED
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	has EXPIRED
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
VVE Features licence	has EXPIRED
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	has EXPIRED
TSC licence	has EXPIRED
Number 20 licence	has EXPIRED

Current License Status in KAIROS Web – Keys.

1.3.5.2. Programming

Since multisite is not a “Stand-Alone”, so this item must be Uncheck in KAIROS Manager



Base Station Parameters

Base Station Role
MASTER

Stand-Alone ☐

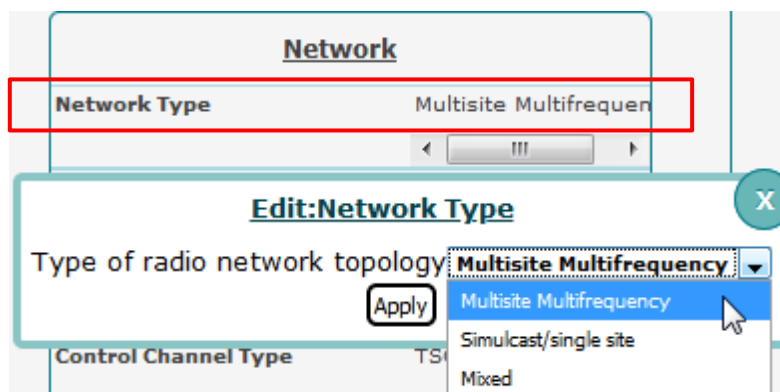
Audio Gateway ☐

Cross-Busy Detection **DISABLED**

RX Interferences **DISABLED**

TX end-tone
Analog ☐
Digital ☐

Select “Multisite Multi-frequency” in KA-NMS – System – Network.



Network

Network Type Multisite Multifrequency

Edit:Network Type

Type of radio network topology: **Multisite Multifrequency**

Apply

Control Channel Type TS1

Multisite Multifrequency
Simulcast/single site
Mixed

For the other setting of KAIROS and KA-NMS, please refer to another Application Note AN-19-0005 “KAIROS S-Trunking”.

1.3.6. IP Gateway Connection

Until October 2019, KAIROS System supported IP-Gateway in Tier III only.

From new version, November 2019 update, it supports S-Trunking and Tier II as well.

Another Application Note AN-19-0013 “Application Note IP Gateway KPG-1013GW” has been issued. Please refer to it for more detail.

System	Until October 2019	November 2019 onwards
DMR Tier III	Supported IP-Gateway	Support IP-Gateway
S-Trunking	Not Supported	
DMR Tier II	Not Supported	