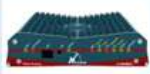


This document covers setup procedure following the Standard Structures.

1. Standard Structure

1.1 Single Repeater

Single Site Tier2 Conventional (Standard Single Site) Order sample: STANDARD SINGLE-SITE

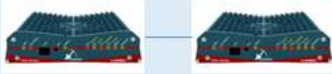


Unit	Role	Mode	Primary Sync	Labor	License	External	Panel
Unit1	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	N/A	KA-RK1v2

No synchronization is required. The most simple, easy solution to expand coverage.

1.2. Single Repeater + Hot Standby Repeater (Option)

Single Site Tier2 Conventional 1+1 Hot Standby (Option) Order sample: STANDARD SINGLE-SITE & 1+1 Hot Standby



Unit	Role	Mode	Primary Sync	Labor	License	External	Panel
Unit1	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	KA-1+1	N/A
Unit2	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	N/A	KA-RK2

Hot Standby repeater is ready for emergency case. KA-1+1 includes a cable to sync physically.

The 2<sup>nd</sup> repeater must have same configuration except Station ID.

1+1 Hot Standby is a strong point of Kairos. TKR-D series do not have any function for redundancy.

1.3. 2sites Roaming System

2 Sites Tier2 Site Roaming (Standard 2sites) Order sample: 2sites STANDARD MULTI-SITE



Unit	Role	Mode	Backup Master	Primary Sync	Second Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal Ref.	Internal Ref.	✓		KA-SETUP	KA-DMR-L	N/A	KA-RK1v2
Unit2	Slave	Broadcaster		Internal PTP	Internal Ref.			KA-SETUP	KA-DMR-L	N/A	KA-RK1v2

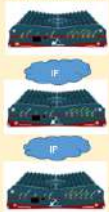
All of voice streaming have to through the Master Repeater. Slave repeater start to repeat the voice streaming locally when the Master Repeater offline.

Beacon Sync is required to realize roaming behavior on subscribers. Kairos has VCTCXO internally. Repeaters on the other sites will use this Master Reference via IP Network for synced Beacon transmitting. PTP algorithm allows this synchronization between Master and Slave.

PTP sync is a strong point of Kairos. The sync quality is better than TKR-D series. Beacon Sync Quality is very important for site roaming subscribers.

1.4. 3sites Roaming System

3 Sites Tier2 Site Roaming with Backup Master (Standard 3sites) Order sample: 3 sites STANDARD MULTI-SITE



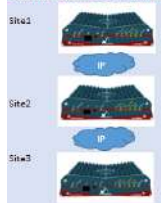
Unit	Role	Mode	Backup Master	Primary Sync	Second Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal Ref.	Internal Ref.	✓		KA-SETUP	KA-DMR-L	N/A	KA-RK1v2
Unit2	Slave	Broadcaster	✓	Internal PTP	Internal Ref.		✓	KA-SETUP	KA-DMR-L	N/A	KA-RK1v2
Unit3	Slave	Broadcaster		Internal PTP	Internal Ref.			KA-SETUP	KA-DMR-L	N/A	KA-RK1v2

Backup Master Repeater is available. A Slave repeater will become Backup Master Repeater. The function of Master Repeater immediately rollover to the Backup Master Repeater. Backup Master Function allows Inter-site call capability between the online sites.

Centralized Voting Structure based on RA simulcast system allows to having wide coverage by RX only site as an option. The Mater selects the best signal between the sites having same RX frequency selected. Backup Master Function covers the weak point of single point system structure.

### 1.5. 3sites Simulcast System

Order sample: 3 sites STANDARD SIMULCAST



Role	Mode	Backup Master	Primary Sync	Secondary Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel			
Unit1	Master	Master	Internal PPS	InternalRef	✓		KA-SETUP	KA-DMR4	KA-SI-T2	KA-GPS	GPS-ANT	KA-RK1V2	
Unit2	Slave	Broadcaster	✓	Internal PPS	Internal PTP		✓	KA-SETUP	KA-DMR4	KA-SI-T2	KA-GPS	GPS-ANT	KA-RK1V2
Unit3	Slave	Broadcaster		Internal PPS	Internal PTP			KA-SETUP	KA-DMR4	KA-SI-T2	KA-GPS	GPS-ANT	KA-RK1V2

The concept is same as 3sites roaming system, however just 1 frequency is required on this system. KA-SI-T2 allows Simulcast Setup on the repeaters. KA-GPS and GPS-ANT for each repeater are mandatory to synchronize the TX timing in a system. PTP connection is still available as a second choice when the GPS connection is broken. DMR Simulcast solution is available now.

### 1.6. IP/RF Link Mixed System

Order sample: 3 sites STANDARD MULTI-SITE & Additional Repeater STANDARD SINGLE-SITE



Role	Mode	Backup Master	Primary Sync	Second Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel	
Unit1	Master	Master	Internal Ref	Internal Ref	✓		KA-SETUP	KA-DMR4	N/A	KA-RK2	
Unit2	Link Down to Net	RF Link Down		Internal PTP	Internal Ref.			KA-SETUP	KA-DMR4	N/A	KA-RK1V2
Unit3	Slave	Broadcaster	✓	Internal PTP	Internal Ref.		✓	KA-SETUP	KA-DMR4	N/A	KA-RK1V2
Unit4	Slave	Broadcaster		Internal PTP	Internal Ref.			KA-SETUP	KA-DMR4	N/A	KA-RK1V2
Unit5	Link Up to Master	RF Link Up		RF Link (DMR)	Internal Ref.	✓		KA-SETUP	KA-DMR4	N/A	KA-RK2

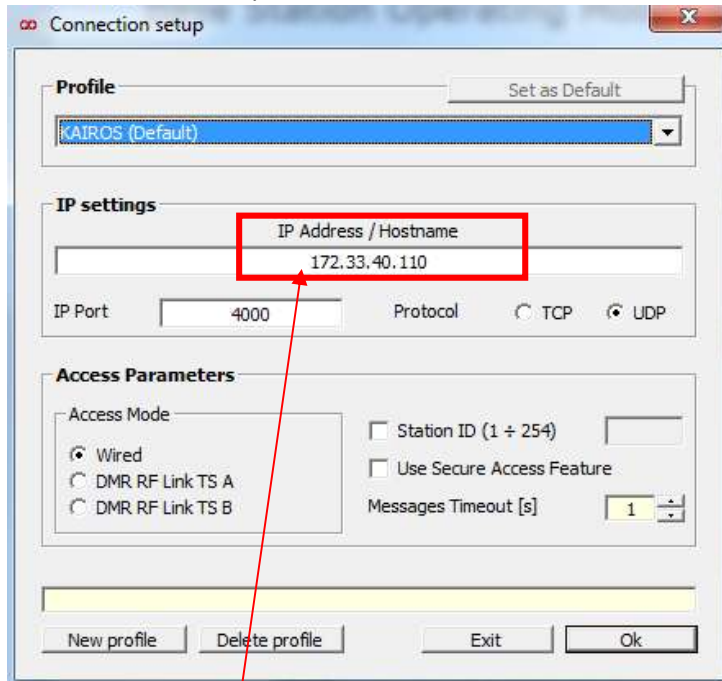
RF Link is available if you cannot provide IP Connection for sites communication. There are no additional license for RF Link Connectivity. You can use RF Link Solution even if it is simulcast system. TKR-D series is not capable to RF Link Connectivity. We can offer this solution to a customer who wants DMR but does not have IP connection between sites.

## 2. Setup Procedure

### 2.0. Common Procedure

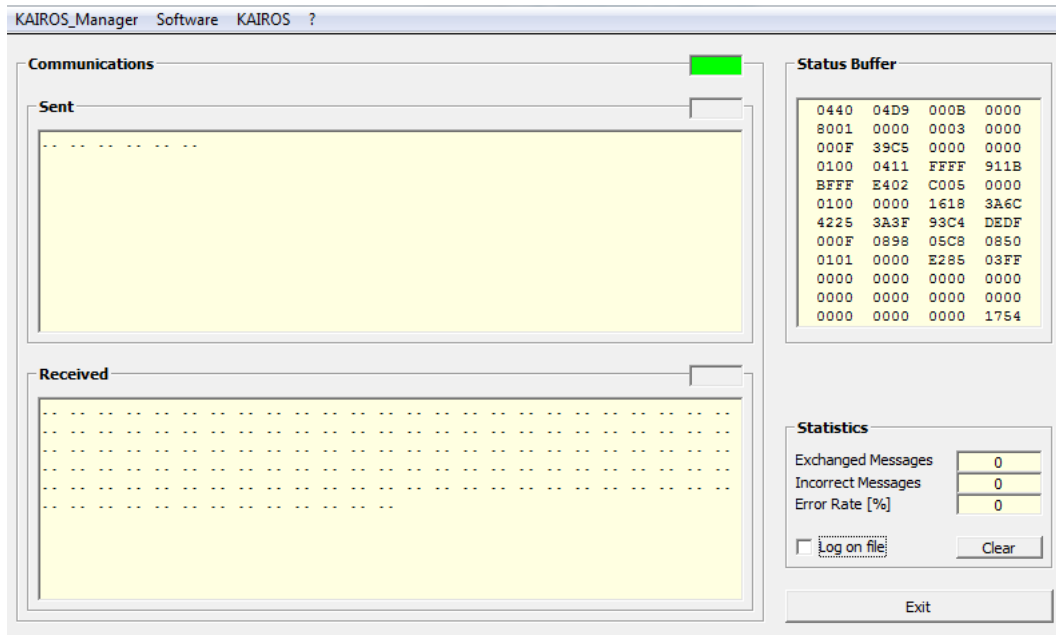
#### a. Open Kairos Manager

##### Connection Setup

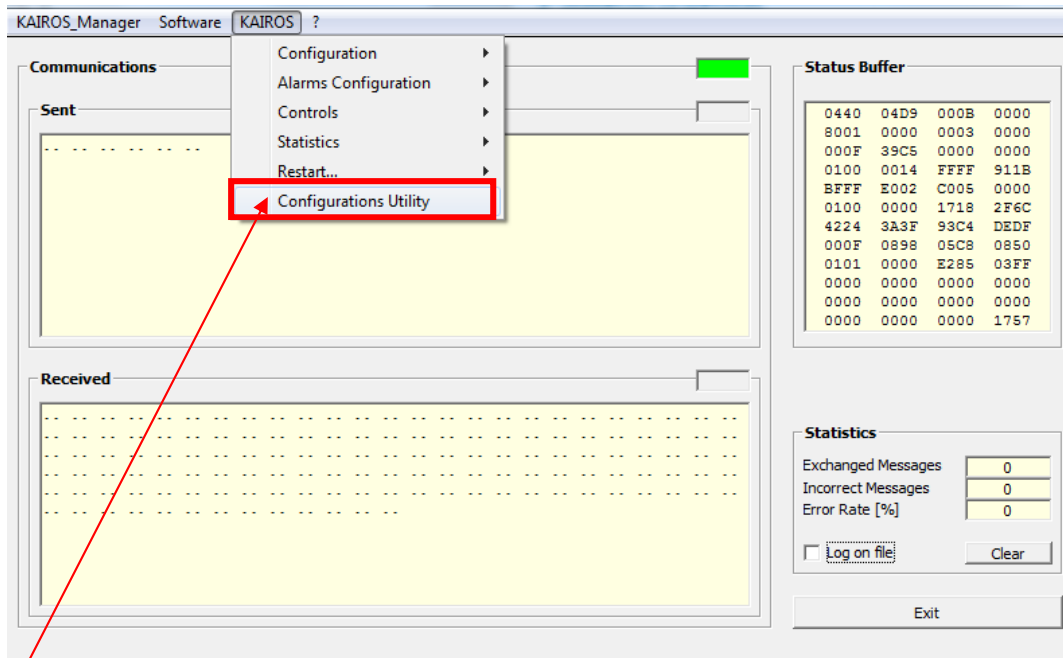


#### b. Connect to the default IP Address attached on the label.

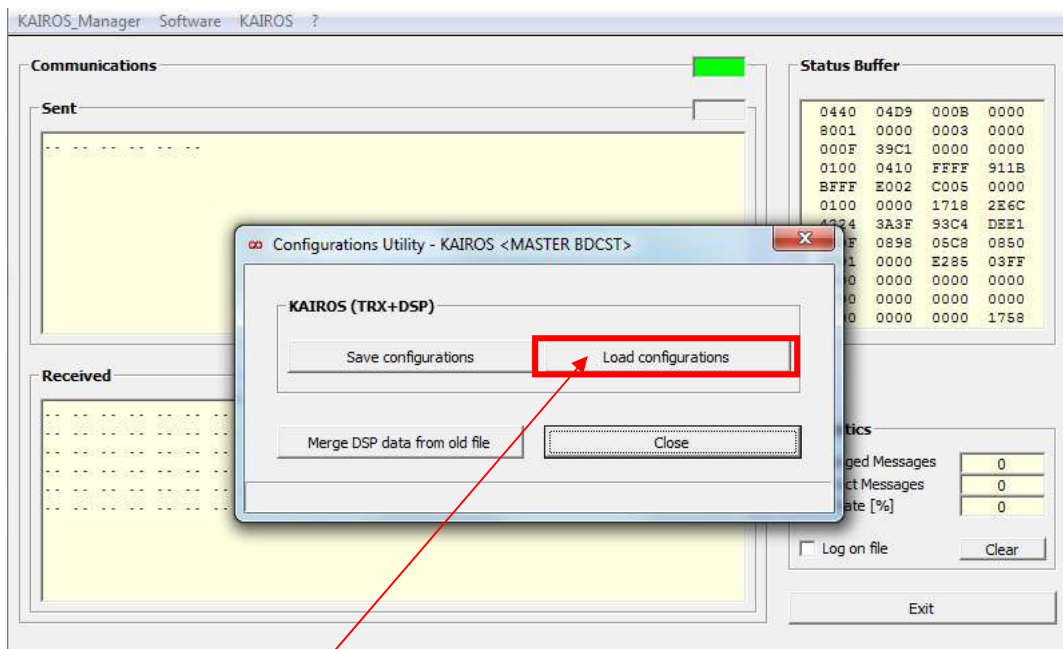
##### Main Menu



#### c. Select Configuration Utility from KAIROS main menu.



Configuration Utility



d. Select Load configuration

### Load Configuration

MST UHF 1.ka	5/25/2018 8:38 AM	KA File	54 KB
SLV UHF 1.ka	5/25/2018 8:48 AM	KA File	54 KB

BDCST MST SITE UHF.ka	7/3/2018 8:43 AM	KA File	54 KB
BDCST SLV SITE UHF.ka	7/3/2018 10:30 AM	KA File	54 KB
DOWNLINK MST SITE UHF.ka	7/2/2018 4:26 PM	KA File	54 KB
UPLINK SLV SITE UHF.ka	7/3/2018 4:50 PM	KA File	54 KB

You can select the default configuration provided by AFCO.

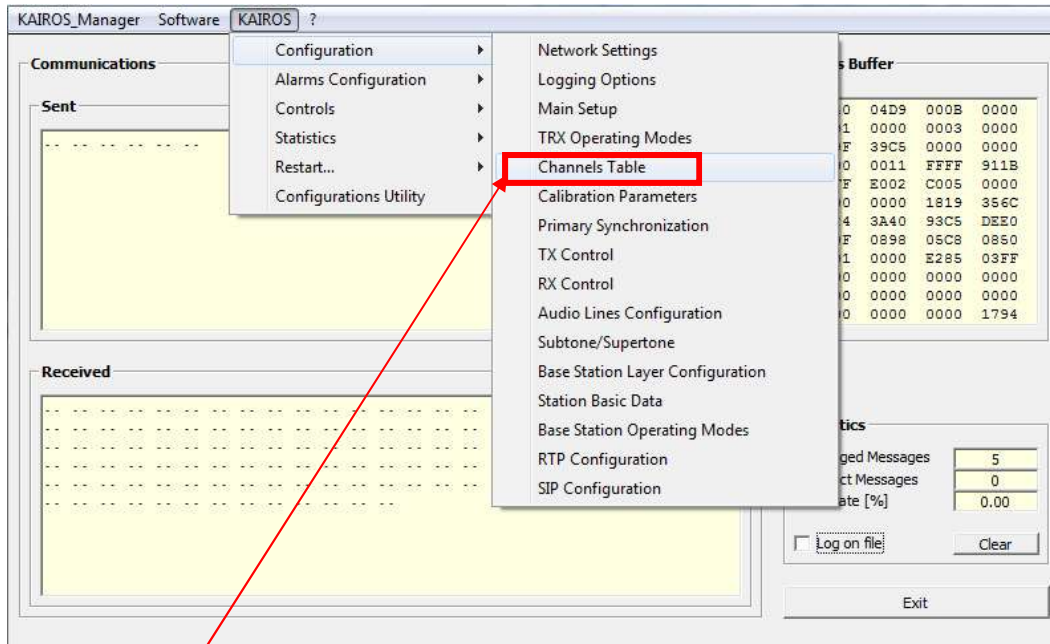
- MST.ka (for Standard IP Link)
- SLV.ka (for Standard IP Link)
- BDCST MST SITE.ka (for Standard RF Link)
- BDCST SLV SITE.ka (for Standard RF Link)
- DOWNLINK MST SITE.ka (for Standard RF Link)
- UPLINK SLV SITE.ka (for Standard RF Link)

e. Select load items

Network Settings	<input type="checkbox"/>	<input type="button" value="Select All"/> <input type="button" value="Deselect All"/> <input type="button" value="Select for Cloning"/> <input type="button" value="OK"/> <input type="button" value="Cancel"/>
Logging Settings	<input checked="" type="checkbox"/>	
Primary Synchronization Settings	<input checked="" type="checkbox"/>	
Main Configuration	<input checked="" type="checkbox"/>	
Alarm Traps Parameters	<input checked="" type="checkbox"/>	
Alarm Events definitions	<input checked="" type="checkbox"/>	
TRX Configuration	<input checked="" type="checkbox"/>	
Channels Table	<input type="checkbox"/>	
Base Station Basic Data	<input checked="" type="checkbox"/>	
Base Station Operating Mode	<input checked="" type="checkbox"/>	
RPT Configuration	<input checked="" type="checkbox"/>	
SIP Configuration	<input checked="" type="checkbox"/>	
DSP Configuration	<input checked="" type="checkbox"/>	

The Default File has own IP Address and the model is KA450 But you can ignore these deleting **Network Setting** and **Channel Table** from the load items.

f. Edit Channel Table



Channel Table

The screenshot shows the 'Channels Table - KAIROS <MST - SIP>' window. The table has 10 columns: Channel 0, Channel 1, Channel 2, Channel 3, Channel 4, Channel 5, Channel 6, Channel 7, and Channel 8. The 'Channel 0' column is highlighted in cyan. A red box highlights the 'Channel 0' header cell, and a red arrow points from this box to the text below.

	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7	Channel 8
Channel Name	Channel 0	Empty Channel	Empty Channel	Empty Channel	Empty Channel	Empty Channel	Empty Channel	Empty Channel	Empty Channel
Channel present	YES	NO	NO	NO	NO	NO	NO	NO	NO
Channel enabled	YES	NO	NO	NO	NO	NO	NO	NO	NO
ANALOG mode	YES	NO	NO	NO	NO	NO	NO	NO	NO
DMR ETSI mode	YES	NO	NO	NO	NO	NO	NO	NO	NO
DMR MotoTRBO mode	YES	NO	NO	NO	NO	NO	NO	NO	NO
Digital P25 mode	NO	NO	NO	NO	NO	NO	NO	NO	NO
PCCSAG mode	NO	NO	NO	NO	NO	NO	NO	NO	NO
Channel Bandwidth [kHz]	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
TX Frequency [MHz]	162.26250	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RX Frequency [MHz]	157.66250	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Simplex Frequency Shift	NO	NO	NO	NO	NO	NO	NO	NO	NO
TX Power [W]	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maximum continuous tx time [s]	0	0	0	0	0	0	0	0	0
Transmit closure delay [ms]	500	500	500	500	500	500	500	500	500
TX DPL Code [oct]	--	--	--	--	--	--	--	--	--
RX DPL Code [oct]	--	--	--	--	--	--	--	--	--
TX TCS Frequency [Hz]	123.0	123.5	123.5	123.5	123.5	123.5	123.5	123.5	123.5
RX TCS Frequency [Hz]	123.0	123.5	123.5	123.5	123.5	123.5	123.5	123.5	123.5
Multitone TCS	NO	NO	NO	NO	NO	NO	NO	NO	NO
Squelch Tail Cutoff on TX	NO	NO	NO	NO	NO	NO	NO	NO	NO
Squelch Tail Cutoff on RX	YES	NO	NO	NO	NO	NO	NO	NO	NO
RX Emergency TCS Frequency [Hz]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RX TCS hold time [ms]	500	500	500	500	500	500	500	500	500
Subtone deviation [Hz]	250	250	250	250	250	250	250	250	250
Supertone Frequency [Hz]	0	0	0	0	0	0	0	0	0
RX Squelch level [dB]	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
RX Squelch Hysteresis [dB]	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
RX DMR Colour Code (main)	5	1	1	1	1	1	1	1	1
TX DMR Colour Code (main)	5	1	1	1	1	1	1	1	1
RX DMR Colour Code (aux)	5	1	1	1	1	1	1	1	1
TX DMR Colour Code (aux)	5	1	1	1	1	1	1	1	1
Downlink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT
Uplink P25 NAC code [hex]	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT	DEFAULT

You can double Click on the Channel Number to edit the detail.

## Channel Data Edit

Channels data editing - KAIROS <MST - SIP>

Channel 0 | Channel 1 | Channel 2 | Channel 3 | Channel 4 | Channel 5 | Channel 6

Channel Name: Channel 0

Channel Spacing [KHz]: 12.5

TX Frequency [MHz]: 162.262500

RX Frequency [MHz]: 157.662500

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

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:

Save Channel Data | Cancel

Modify the **TX/RX Frequency** and the **operation mode** following the customer's requirement. You can select ANALOG/ETSI DMR/P25 at one time. MotoTRBO DMR mode is for compatibility of Motorola subscribers.

## CC Edit

Channel 0 | Channel 1 | Channel 2 | Channel 3 | Channel 4 | Channel 5 | Channel 6 | Channel 7 | Channel 8 | Channel 9 | Channel 10 | Char < >

Channel Name: Channel 0

Channel Spacing [KHz]: 12.5

TX Frequency [MHz]: 453.150000

RX Frequency [MHz]: 463.150000

TX Power [W]: 1.0

Max Continuous TX [s]: 0

TX Cutoff Delay [ms]: 550

RX Squelch level [dB]: 20.0

RX Squelch Hysteresis [dB]: 6.0

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:

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

P25 TX NAC:  Default  Any  Open ---> 585

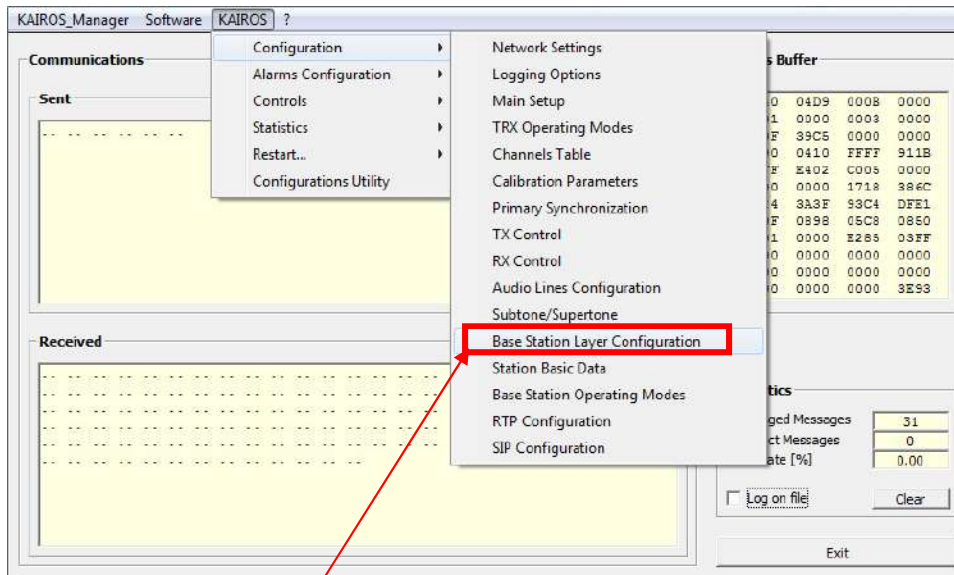
P25 RX NAC:  Default  Any  Open ---> 585

Main DMR Color Code: RX 5 TX 5

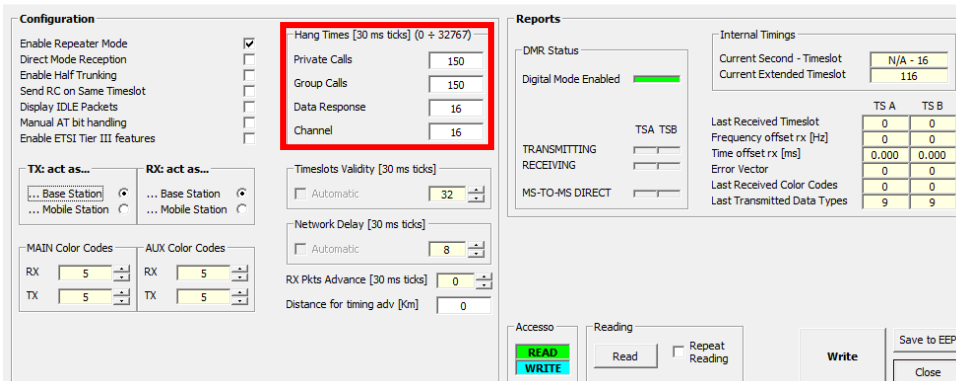
Aux DMR Color Code: RX 5 TX 5

You can modify **CC** for Tx and Rx both.

g. Edit Base Layer Configuration.



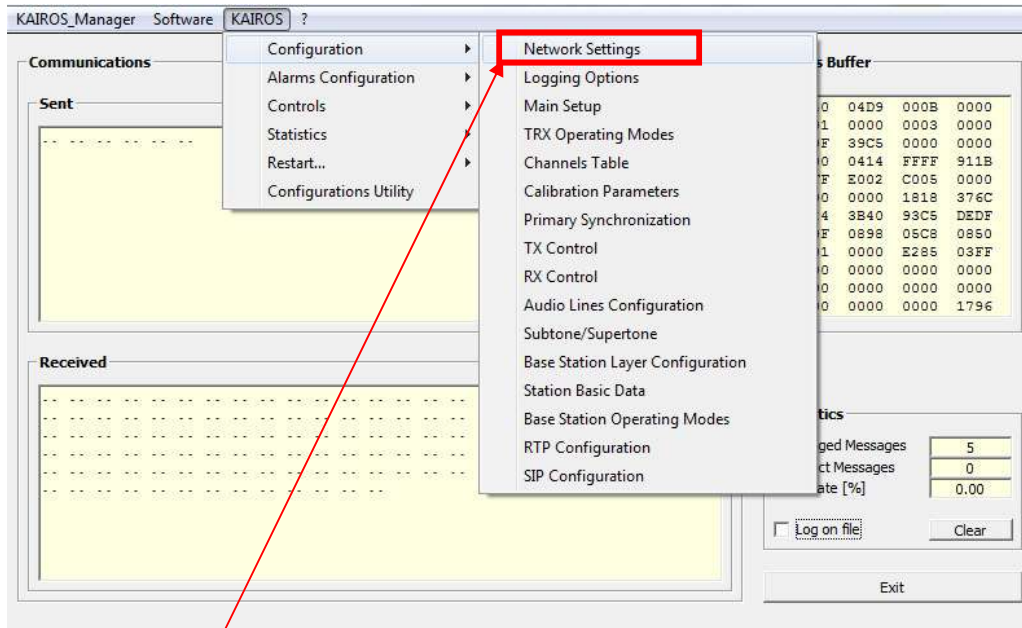
Base Layer Configuration



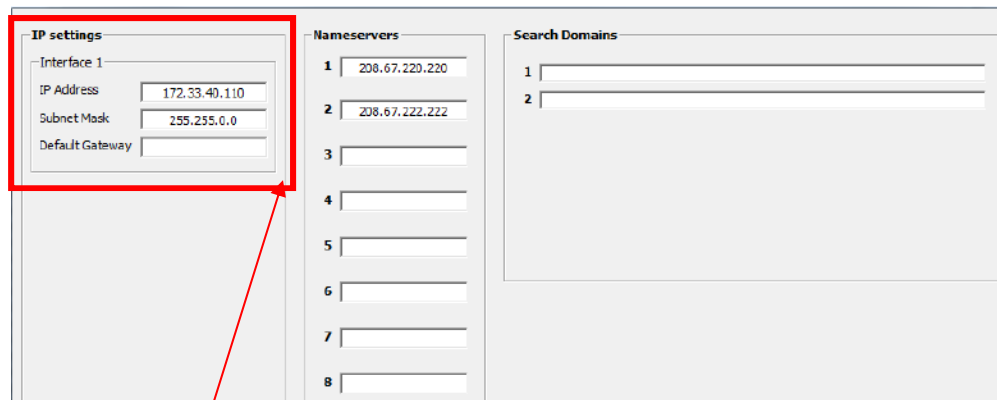
You can modify each Hand Timer. The step is 30[ms] based on DMR frame rate. And basically all repeaters in system will have same value.



## h. Edit IP setting

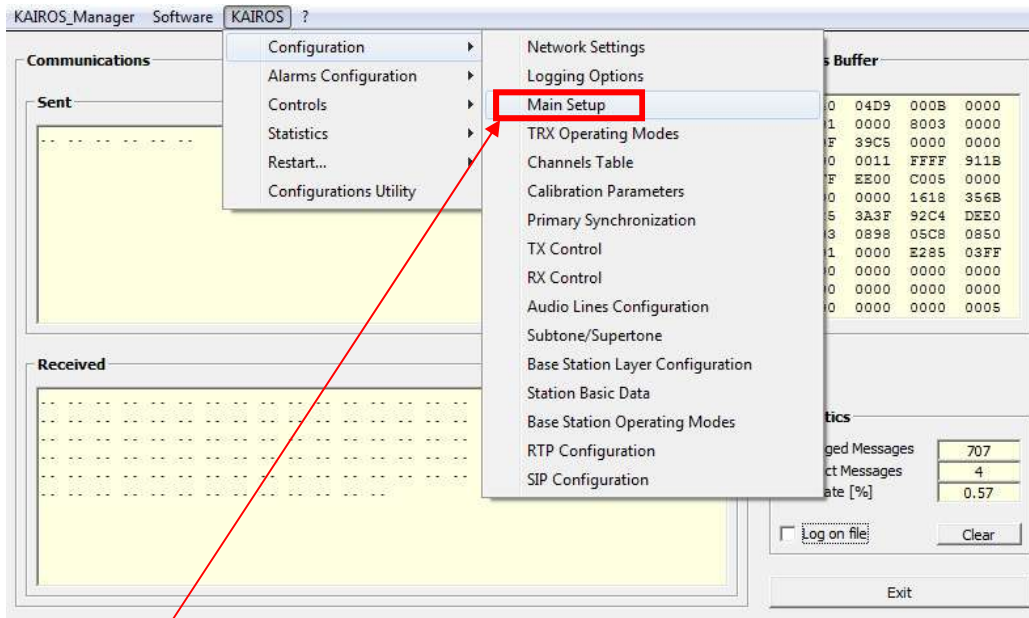


### Network Setting

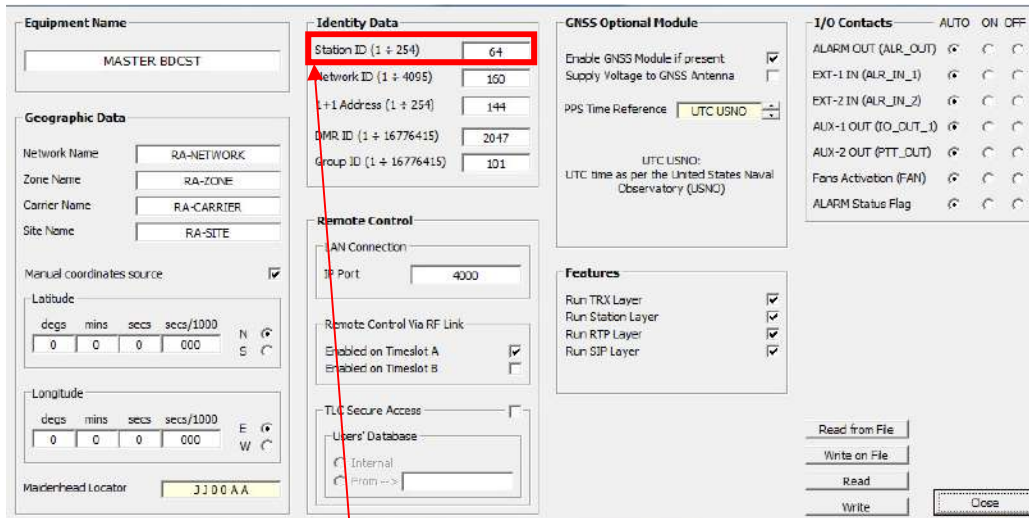


You can edit the **IP Address** following customer requirement. Please use modified IP Address to login to Kairos Manager from next time.

i. Edit Repeater ID



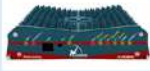
**Main Setup**



You must setup the **Station ID** for each repeater in the network separately.

## 2.1. Single Repeater

Single Site Tier2 Conventional (Standard Single Site) Order sample: **STANDARD SINGLE-SITE**

Site1 

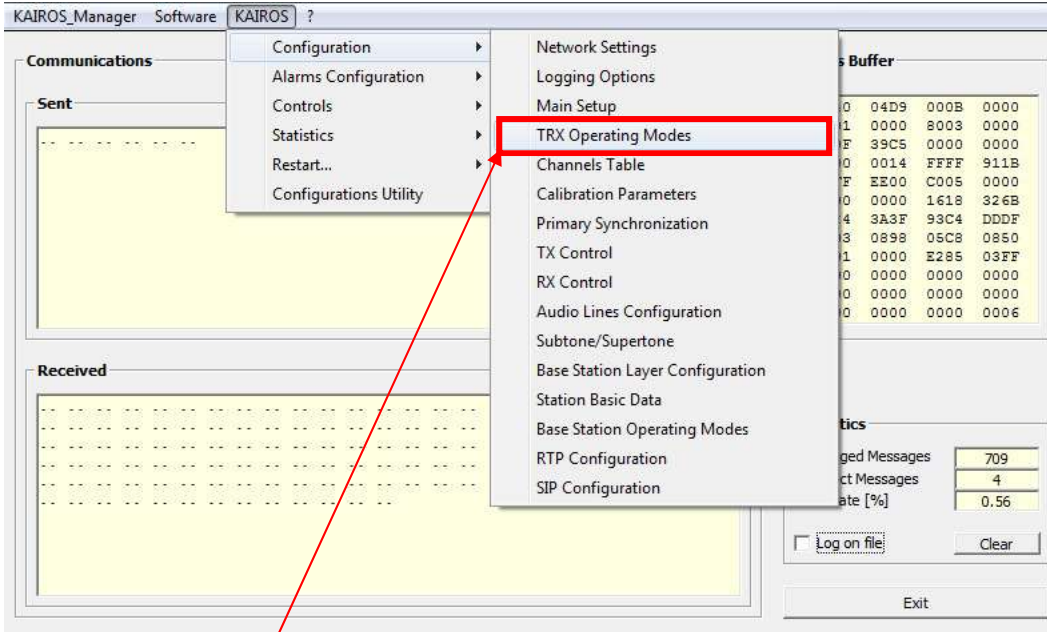
	Role	Mode	Sync Master	Labor	License	External	Panel
Unit1	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	N/A	KA-RK1v2

### Site1

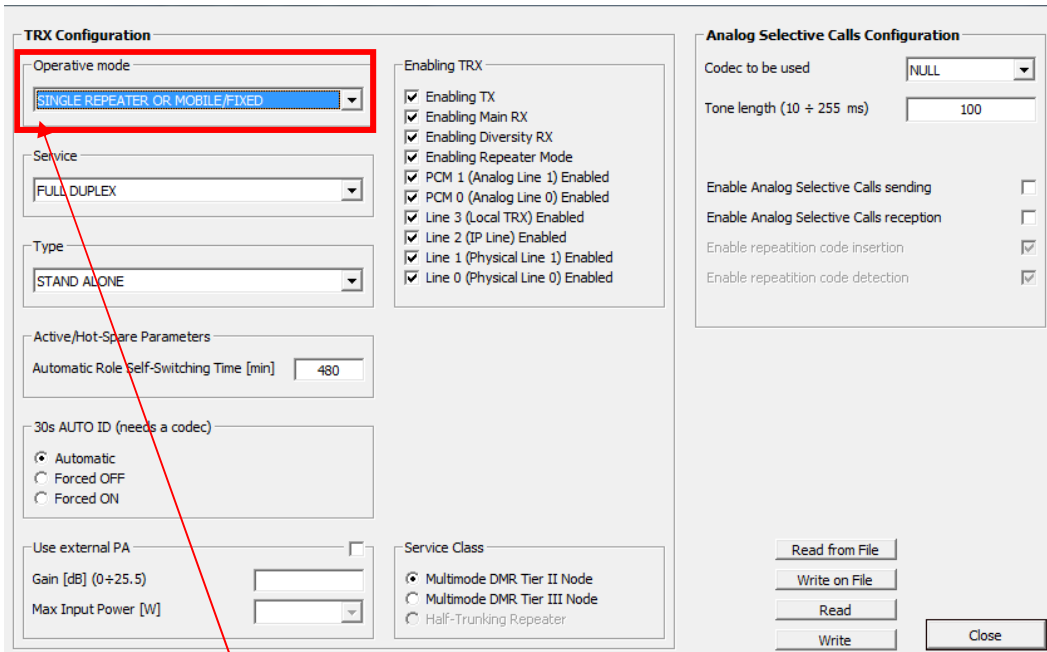
Unit1: Master Repeater

A. Single Repeater Setup

- a. Read (Open) default setting from Kairos following common procedure.  
All stocks of Kairos already done the Single Repeater Setup by Radio Activity. Load Configuration is not required.
- b. Modify the same items following common procedure.
- c. Modify TRX Mode.

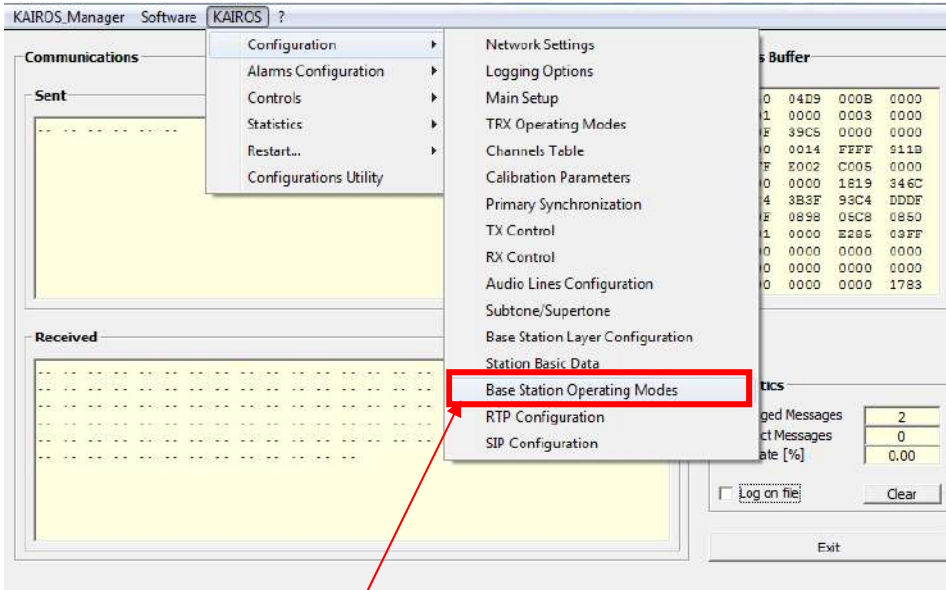


**TRX Operation Mode**

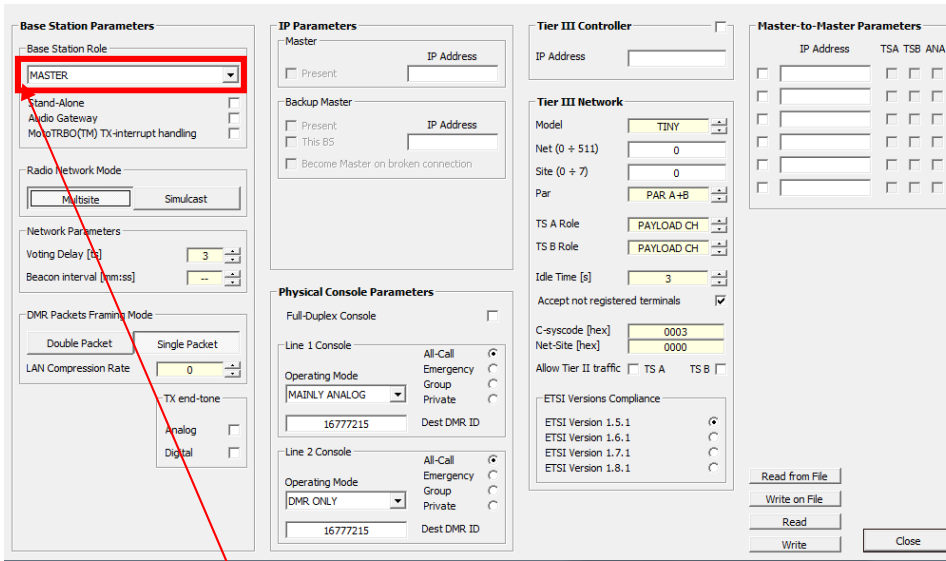


Operation Mode is **SINGLE REPEATER OR MOBILE, FIXED**

d. Modify Base Station Operation Role.



**Base Station Operation Mode**




Base Station Role is **MASTER**

## 2.2. Single Repeater + Hot Standby Repeater

Single Site Tier2 Conventional 1+1 Hot Standby (Option) Order sample: STANDARD SINGLE-SITE & 1+1 Hot Standby

Site1



	Role	Mode	Primary Sync	Labor	License	External	Panel
Unit1	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	N/A	KA-RK2
Unit2	Master	Single Repeater	N/A	KA-SETUP	KA-DMR-L	N/A	

### Site1

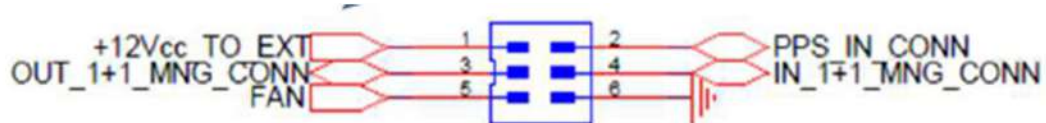
Unit1: Master Repeater

Unit2: Standby Repeater for Unit1

Sync Cable is required to tie the 2 repeaters for redundancy.

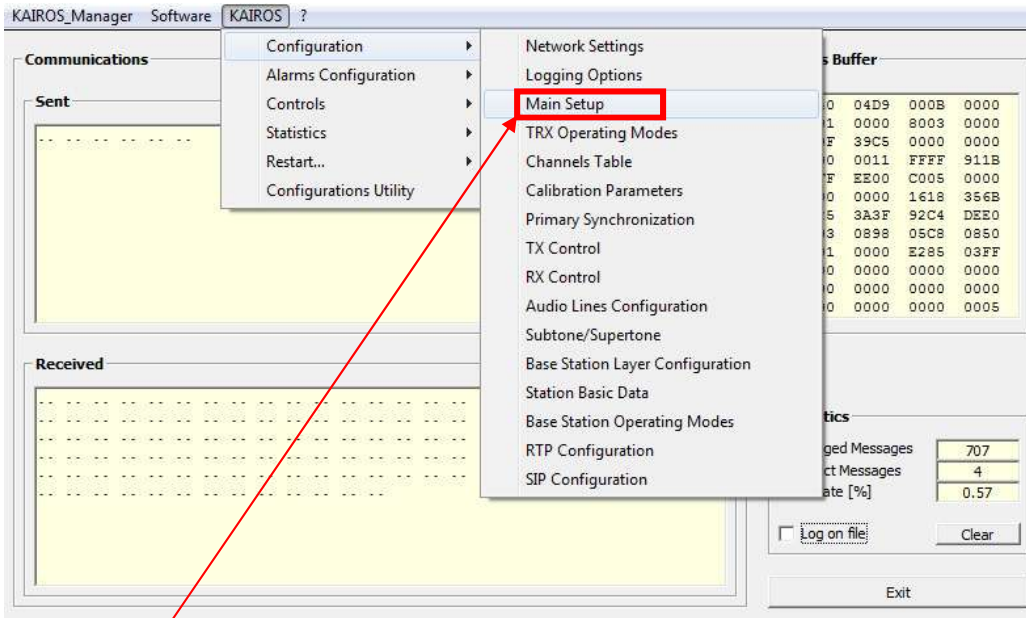


This cable can be provided when the customer purchased KA-1+1 option.

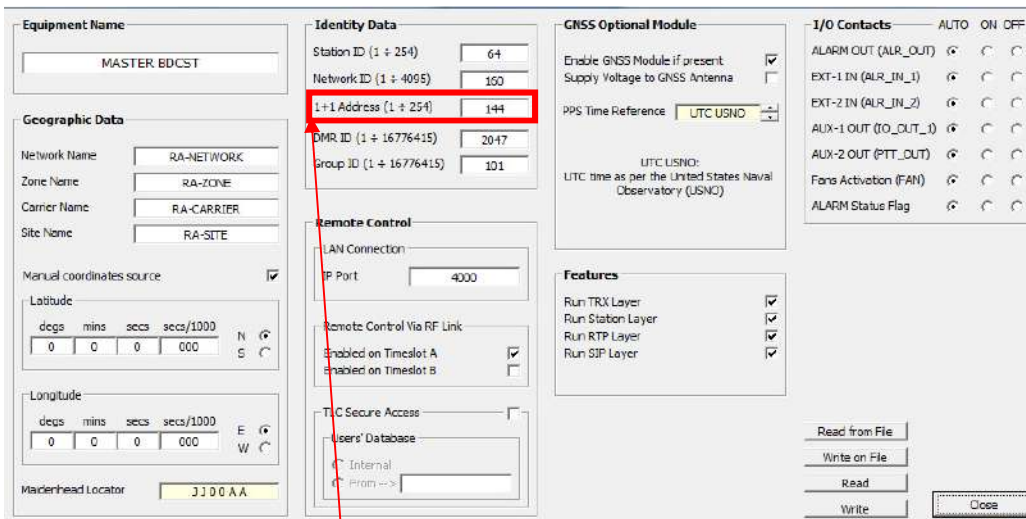


A. Primary Repeater Setup

- a. Modify the same items following Single Repeater Setup.
- b. Edit Main Setup.

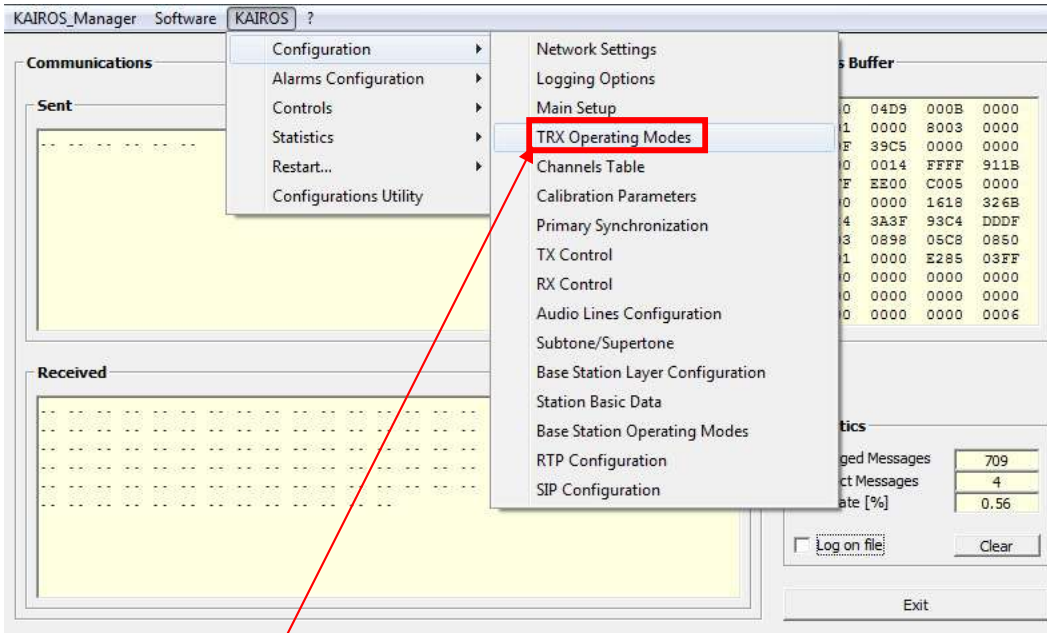


**Main Setup**

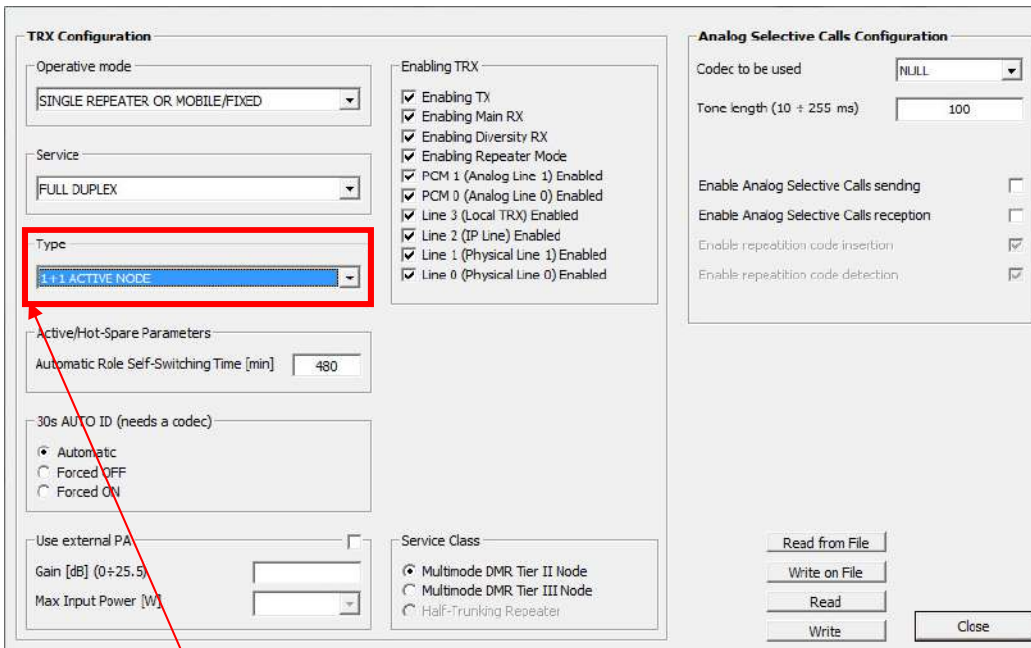


You can modify **1+1 Address** which works on active repeater between the 2repeater. This address must be used on last 3digit following his network address. In this case scenario, it is 172.33.40.144.

c. Edit TRX Operation Modes.



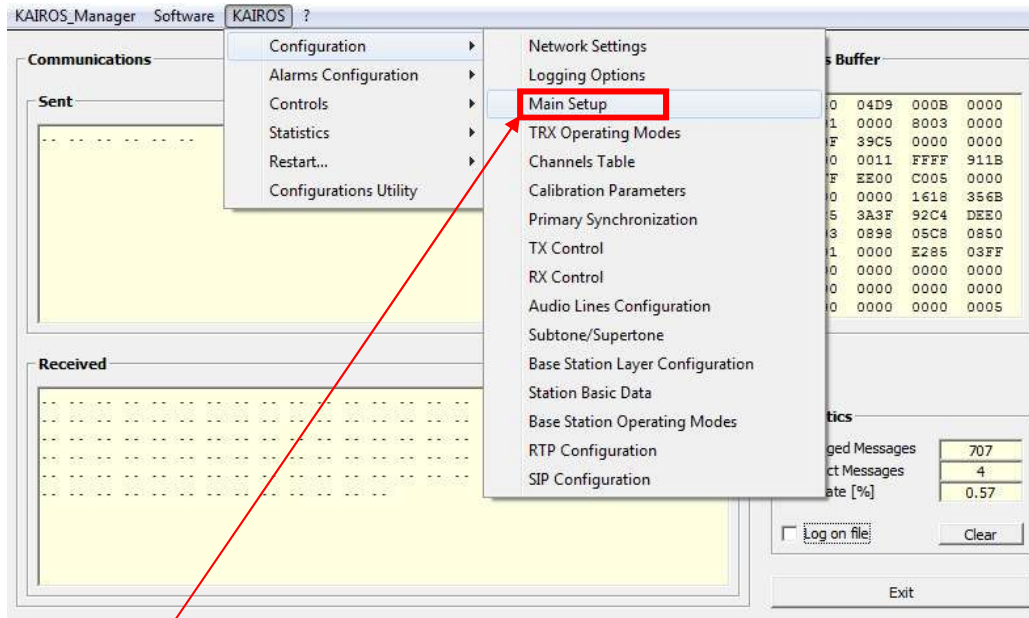
**TRX Operation Modes**



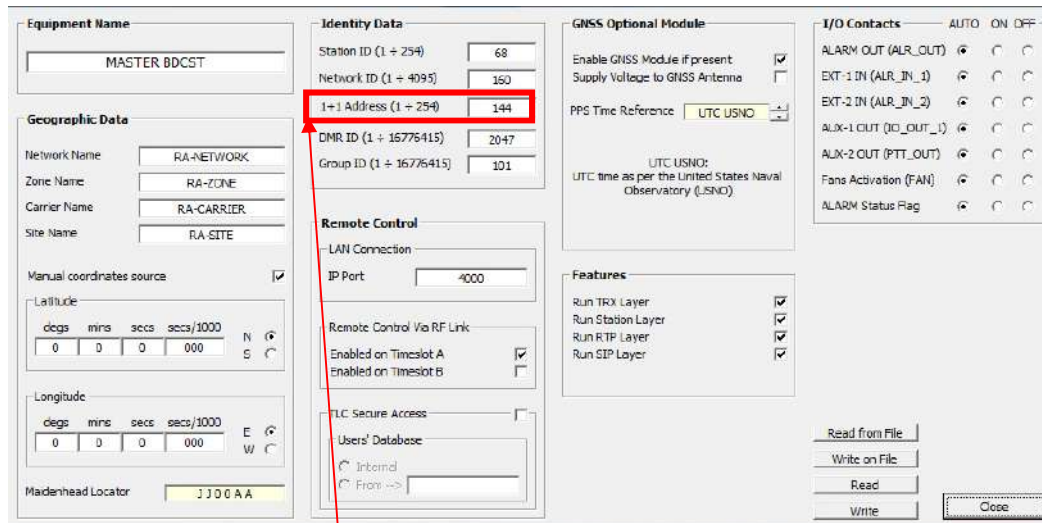
You must select **1+1 ACTIVE NODE** on the primary repeater.



- B. Secondary Repeater Setup
  - a. Modify the same items following Single Repeater Setup.
  - b. Edit Main Setup.

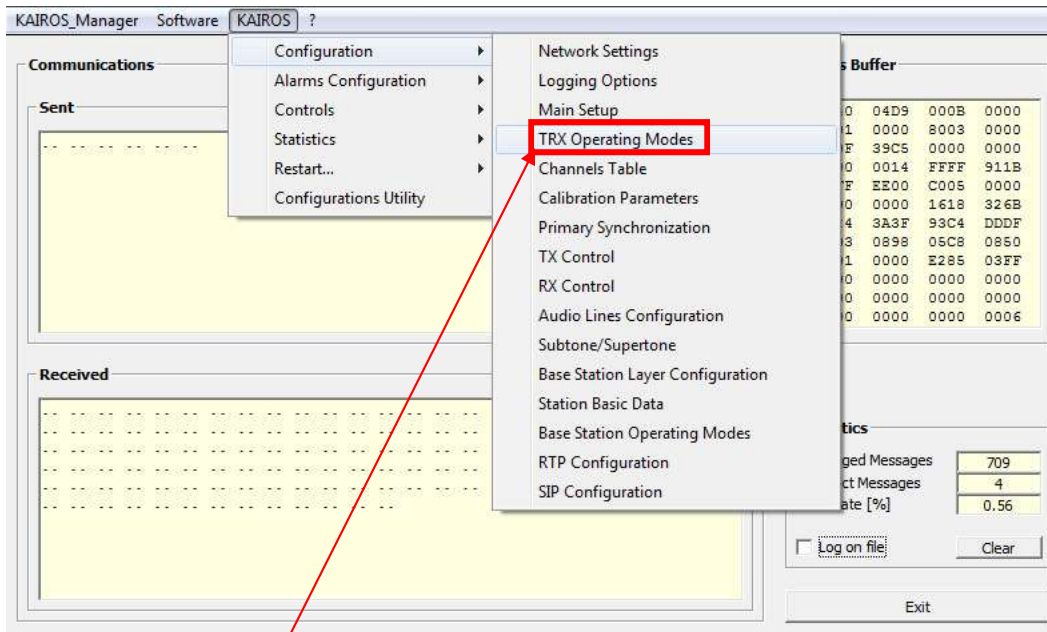


**Main Setup**

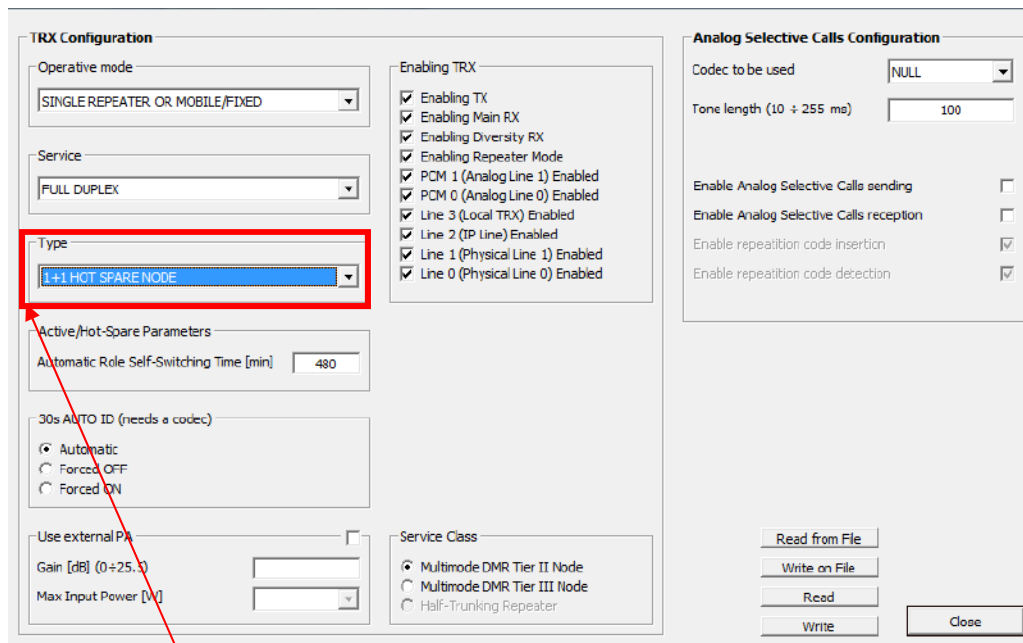


You can modify **1+1 Address** which works on active repeater between the 2 repeaters. This address must be used on last 3digit following his network address. In this case scenario, it is 172.33.40.144. This address has to be same as the Primary Repeater Setup.

c. Edit TRX Operation Modes.

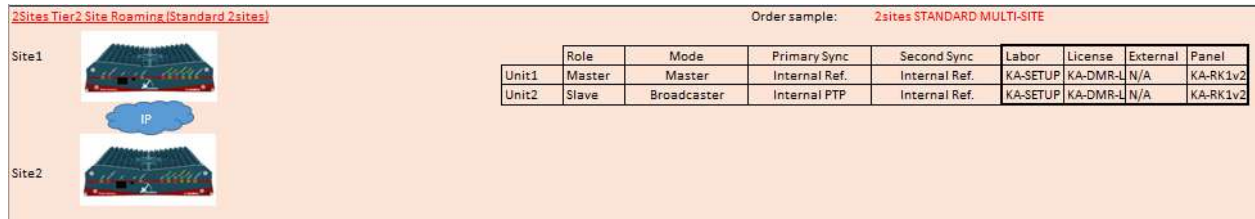


**TRX Operation Modes**



You must select **1+1 HOT SPARE NODE** on the secondary repeater.

## 2.3.2sites Roaming System



### Site1

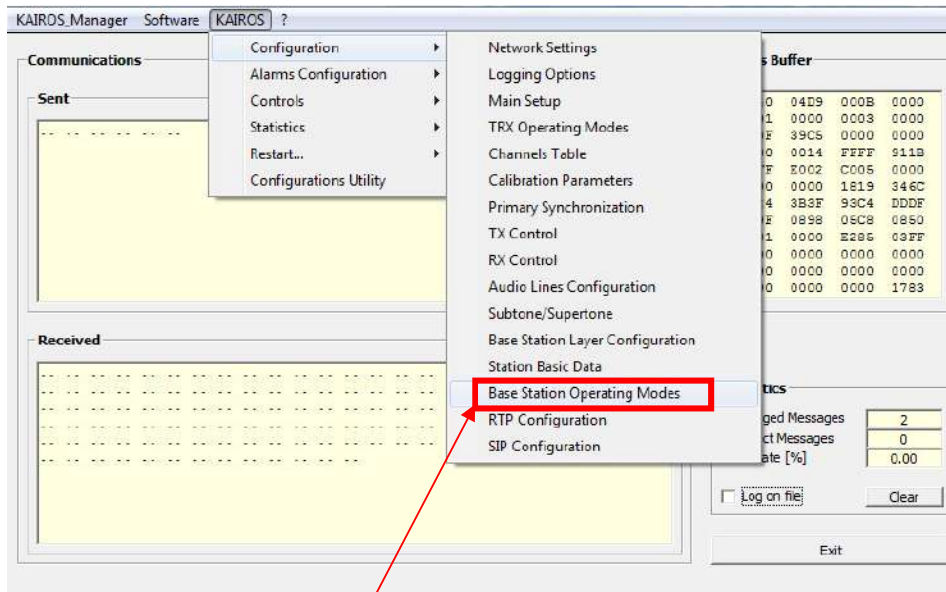
Unit1: Master Repeater

### Site2

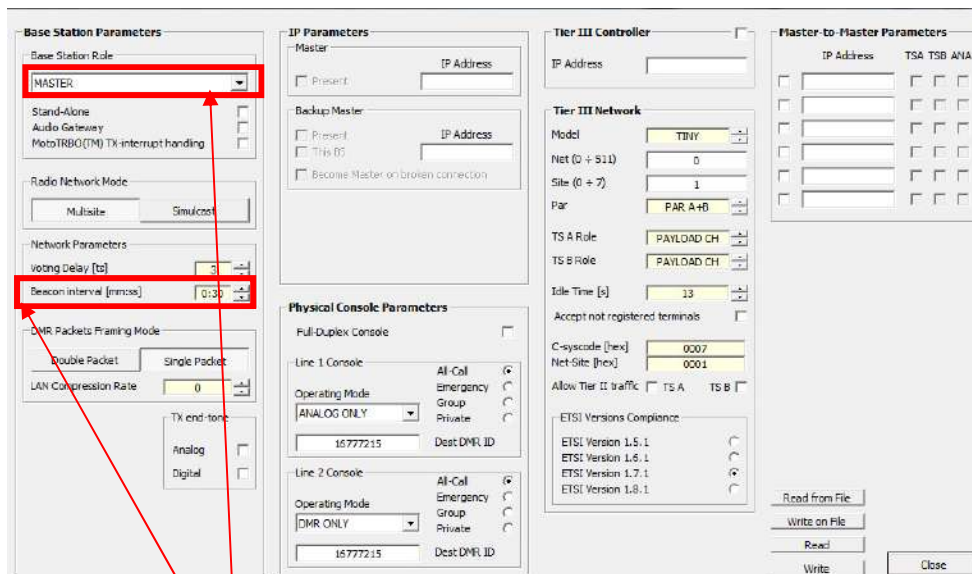
Unit2: Slave Repeater

A. Master Repeater Setup

- a. Open "MST.ka" following common procedure.
- b. Modify the same items following common procedure.
- c. Select Base Station Operation Mode.



**Base Station Operation Mode**

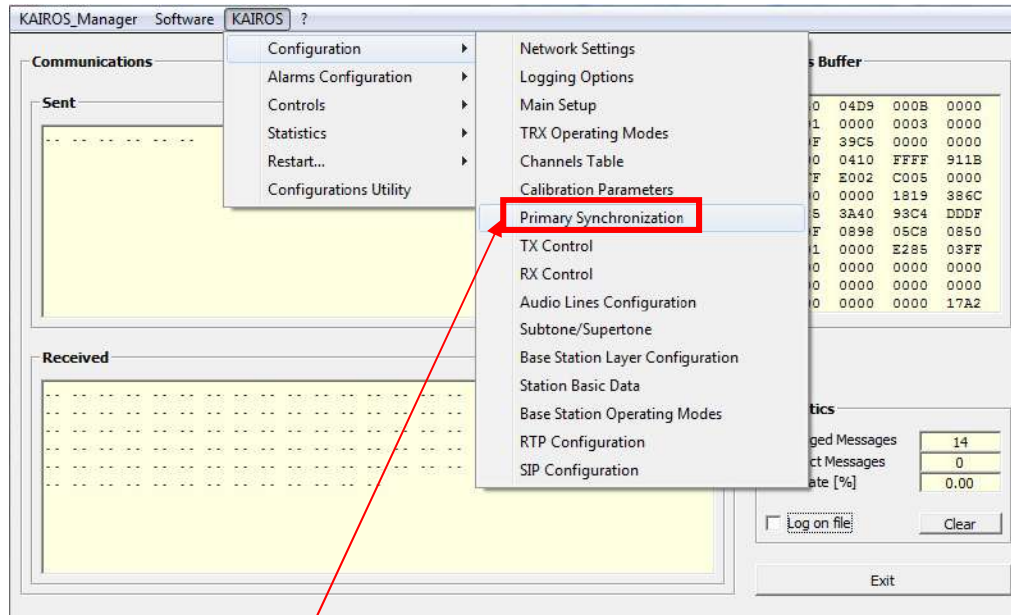


You can modify **Beacon Interval**

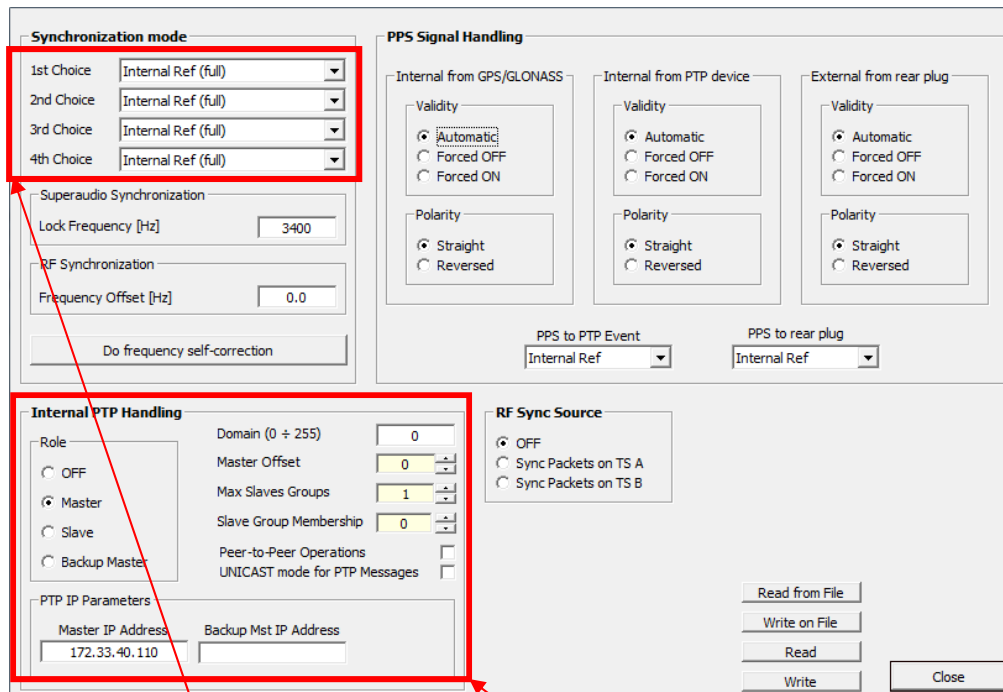
- d. Modify Base Station Role.

Base Station Role is **MASTER**

e. Select Primary Synchronization



**Primary Synchronization**



You can modify **Synchronization Mode** and **Internal PTP Handling Mode**. You can separate the PTP master repeater and the Master Repeater as a role. It depends on the position on the rack or the network position in the system. In this case scenario, there is no external reference and the Master Repeater will provide his Internal Ref. (VCTCXO) to Slave Repeater. The 1<sup>st</sup> choice must be Internal Ref (full) and the role of PTP Handling must be Master.

## Internal PTP Handling

**Internal PTP Handling**

Role

OFF

Master

Slave

Backup Master

Domain (0 + 255)

Master Offset

**Max Slaves Groups**

Slave Group Membership

Peer-to-Peer Operations

UNICAST mode for PTP Messages

PTP IP Parameters

Master IP Address

Backup Mst IP Address

The PTP Slave follows PTP Master as his timing of any transmitting.

You can modify the **Max Slaves Group Number** which is the maximum number of direction from the PTP Master who provides the PTP signal. In 2sites case, you can select "1" because there is just 1Slave Repeater. Slave Group Membership must be 0 on the PTP Master.

## f. Modify TRX Operation Mode

KAIROS\_Manager Software KAIROS ?

Communications

Configuration

Alarms Configuration

Controls

Statistics

Restart...

Configurations Utility

Network Settings

Logging Options

Main Setup

**TRX Operating Modes**

Channels Table

Calibration Parameters

Primary Synchronization

TX Control

RX Control

Audio Lines Configuration

Subtone/Supertone

Base Station Layer Configuration

Station Basic Data

Base Station Operating Modes

RTP Configuration

SIP Configuration

Sent

Received

Statistics

Logged Messages

Act Messages

Rate [%]

Log on file!

**TRX Operation Mode**

**TRX Configuration**

Operative mode  
MASTER BASE STATION

Service  
FULL DUPLEX

Type  
STAND ALONE

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

Service Class

- Multimode DMR Tier II Node
- Multimode DMR Tier III Node
- Half-Trunking Repeater

**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

Read from File

Write on File

Read

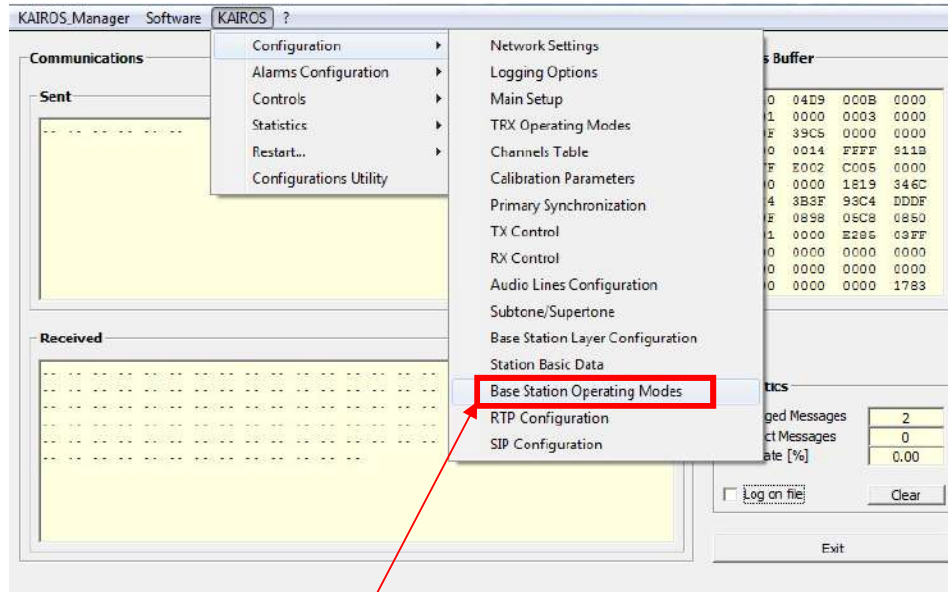
Write

Close

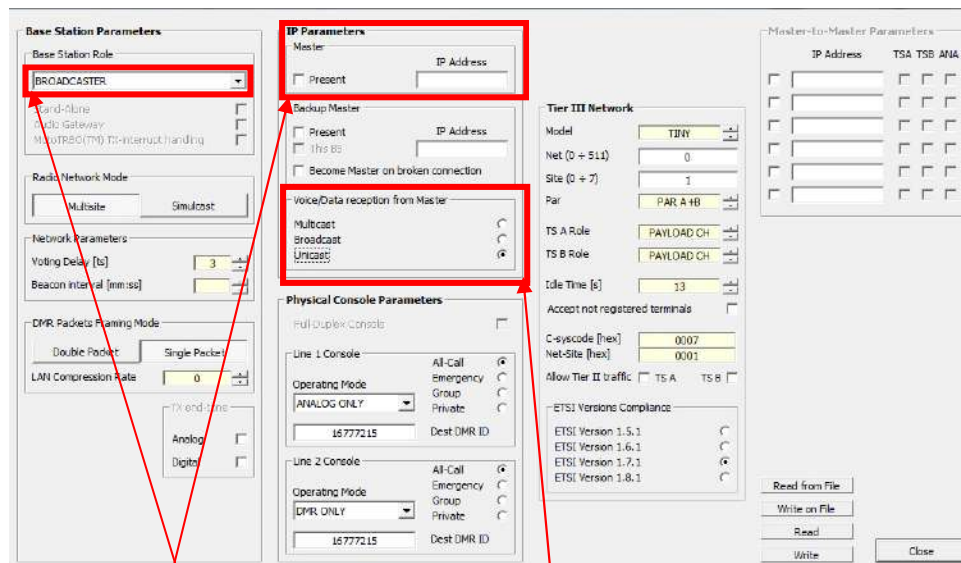
Operation Mode is MASTER BASE STATION

B. Slave Repeater Setup

- a. Open "SLV.ka" following common procedure.
- b. Modify the same items following common procedure.
- c. Select Base Station Operation Mode.



**Base Station Operation Mode**



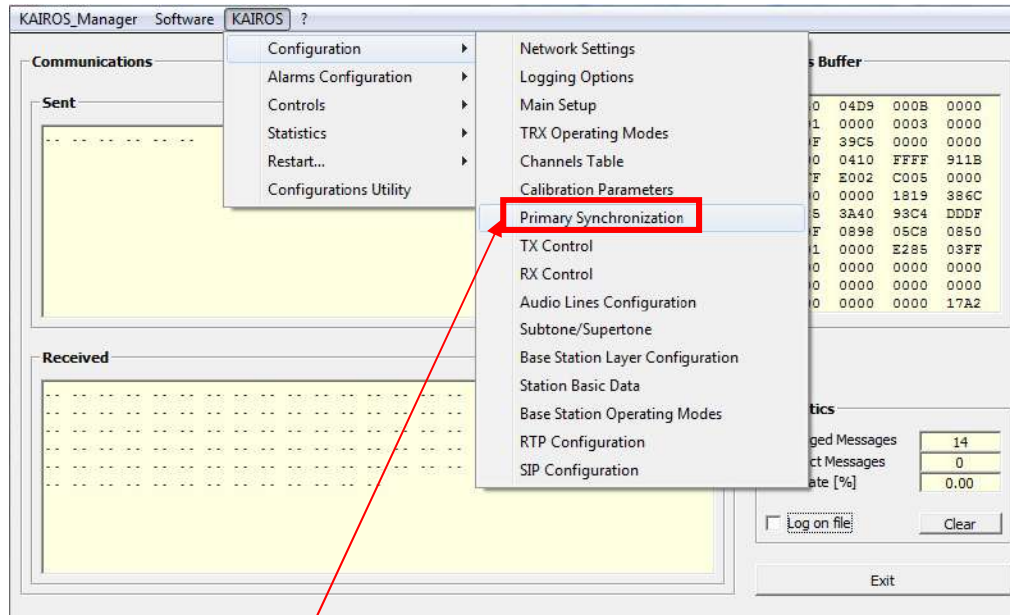
You can edit **Master Repeater IP Address** and **Data Reception Method** following customer requirement. Beacon Interval is Blank because all Slave Repeater follows Master Beacon timing.

- d. Modify Base Station Role

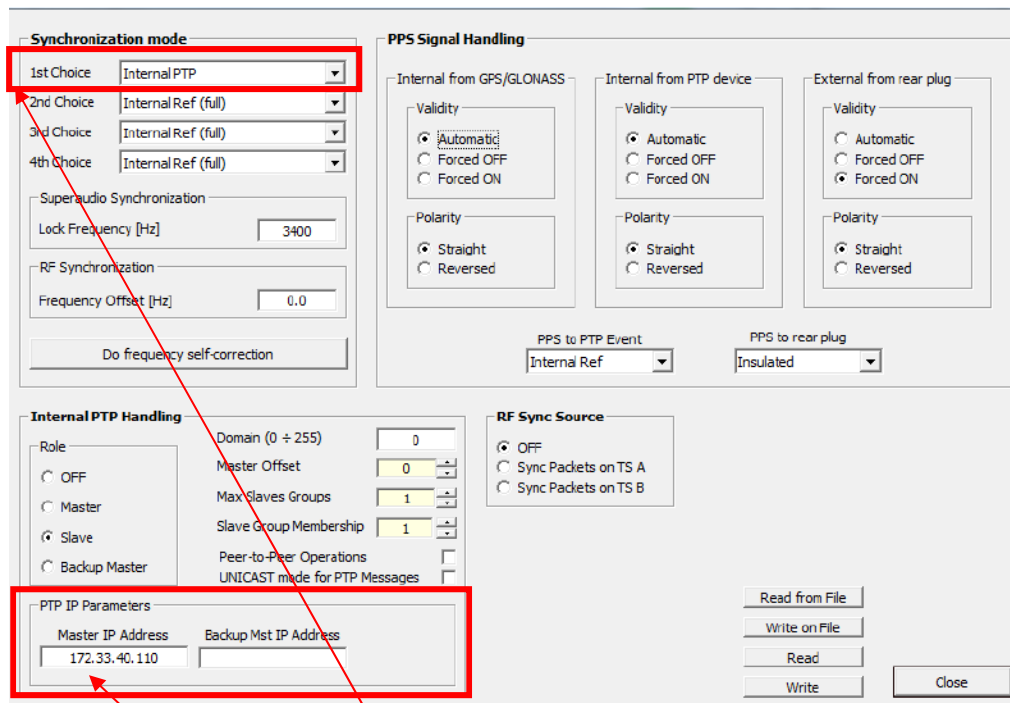
Base Station Role is **BROADCASTER**



e. Select Primary Synchronization



**Primary Synchronization**



In this case scenario, the Master Repeater will provide his Internal Ref. (VCTCXO) to Slave Repeater. The 1<sup>st</sup> choice must be **Internal PTP** and the role of PTP Handling must be Slave. And you must edit **PTP Master IP Address** to get the PTP signal from the Master.

## Internal PTP Handling

**Internal PTP Handling**

Role

OFF

Master

Slave

Backup Master

Domain (0 ÷ 255)

Master Offset

Max Slaves Groups

Slave Group Membership

Peer-to-Peer Operations

UNICAST mode for PTP Messages

PTP IP Parameters

Master IP Address

Backup Mst IP Address

The PTP Slave follows PTP Master as his timing of any transmitting.

You can modify the Max Slaves Group/Number even if it is on the PTP Slave because some PTP Slave becomes Slave Group Master. But it is kind of an option for complicated site structure. In this case scenario, I simply suggest Max Slaves Groups on PTP Slave is "1" because there is just 1 slave repeater. Basically this number should be the number of Slaves.

Slave Group Membership must not be 0 on the PTP Slave. Each PTP Slave should have different number except the case of a Slave under Slave PTP Master.

## f. Modify TRX Operation Mode

KAIROS\_Manager Software KAIROS ?

Communications

Sent

Received

Configuration

- Configuration
- Alarms Configuration
- Controls
- Statistics
- Restart...
- Configurations Utility

TRX Operating Modes

Channels Table

Calibration Parameters

Primary Synchronization

TX Control

RX Control

Audio Lines Configuration

Subtone/Supertone

Base Station Layer Configuration

Station Basic Data

Base Station Operating Modes

RTP Configuration

SIP Configuration

Statistics

Logged Messages 709

Act Messages 4

Rate [%] 0.56

Log on file Clear

Exit

TRX Operation Mode

**TRX Configuration**

Operative mode  
SLAVE BASE STATION

Service  
FULL DUPLEX

Type  
STAND ALONE

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

Service Class  
 Multimode DMR Tier II Node  
 Multimode DMR Tier III Node  
 Half-Trunking Repeater

**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

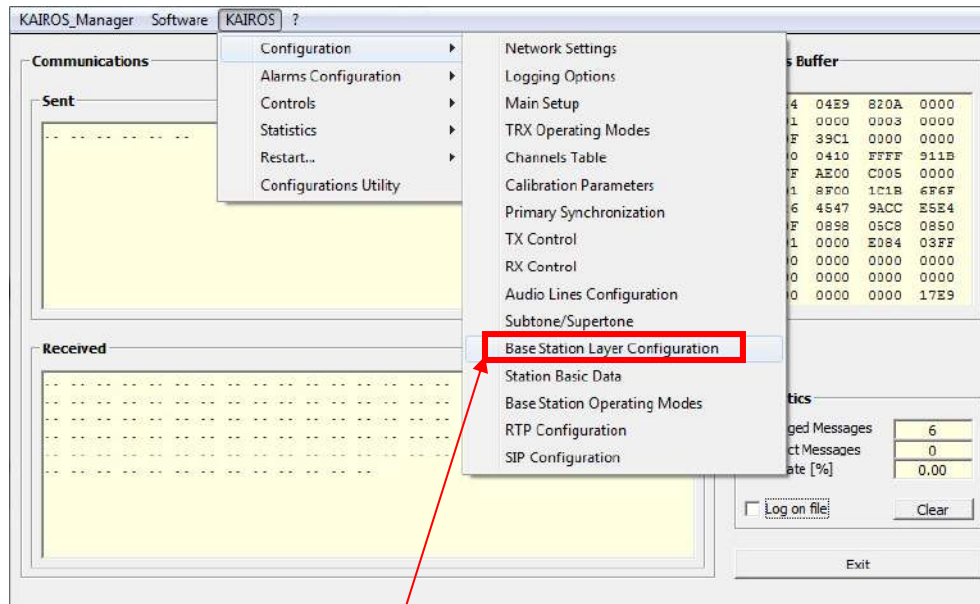
Enable repetition code detection

Read from File  
Write on File  
Read  
Write  
Close

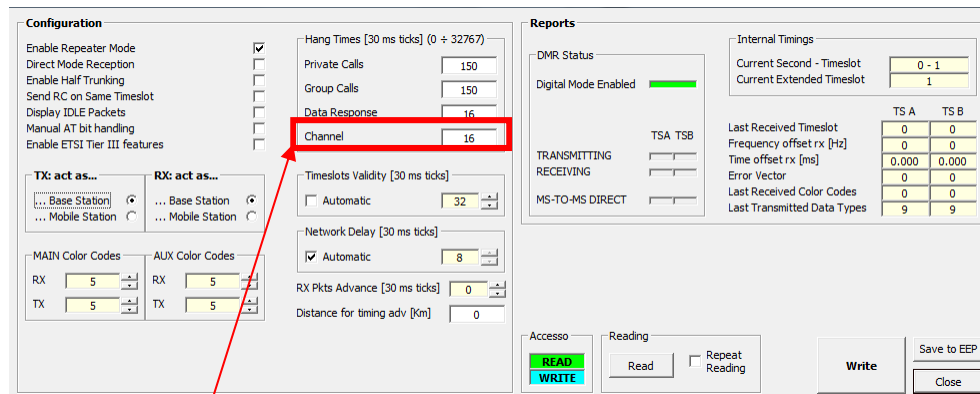
Operation Mode is SLAVE BASE STATION.

### C. Beacon Duration Time (Common Setup)

#### a. Select Base Station Layer Configuration.



#### Base Station Layer Configuration



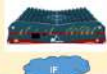
You can modify **Channel Hang Time** it affect Beacon Duration Time. You must modify this value to each repeaters and it must be same value for expected site roaming behavior on subscriber units.

This affect for voice and data transmission. Channel Hang Time does not allow any interruption from subscriber units which use Busy System Lockout during the timer. I do not recommend to setup long duration for this setting.

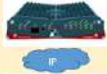
## 2.4.3sites Roaming System

3 Sites Tier 2 Site Roaming with Backup Master (Standard 3 Sites) Order sample: 3 sites STANDARD MULTI-SITE


Site1



Site2



Site3



	Role	Mode	Backup Master	Primary Sync	Second Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal Ref.	Internal Ref.	✓		CA-SETUP	CA-DMR-1	N/A	CA-RK1v2
Unit2	Slave	Broadcaster	✓	Internal PTP	Internal Ref.		✓	CA-SETUP	CA-DMR-1	N/A	CA-RK1v2
Unit3	Slave	Broadcaster		Internal PTP	Internal Ref.			CA-SETUP	CA-DMR-1	N/A	CA-RK1v2

### Site1

Unit1: Master Repeater

### Site2

Unit2: Backup Master Repeater

### Site3

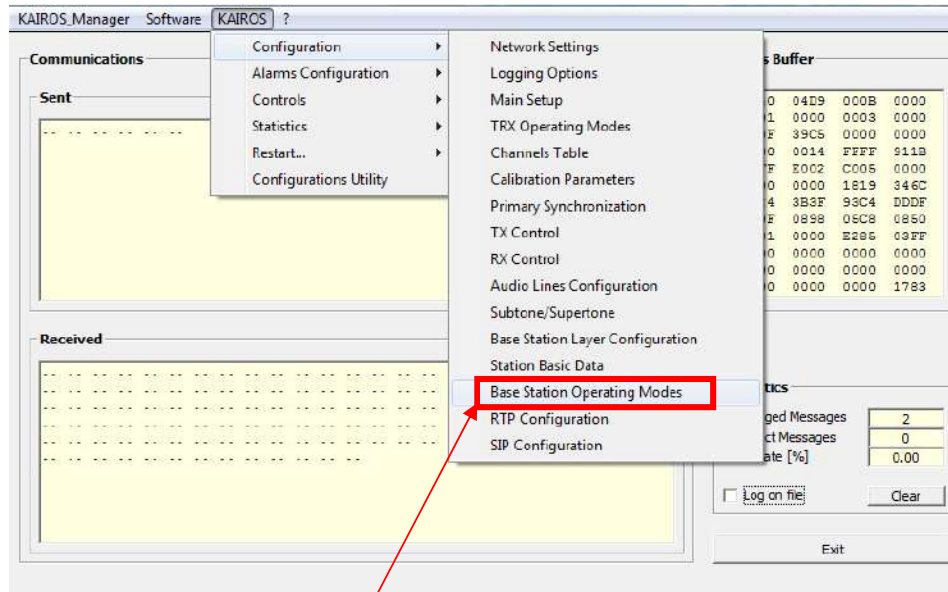
Unit3: Slave Repeater

A. Master Repeater Setup

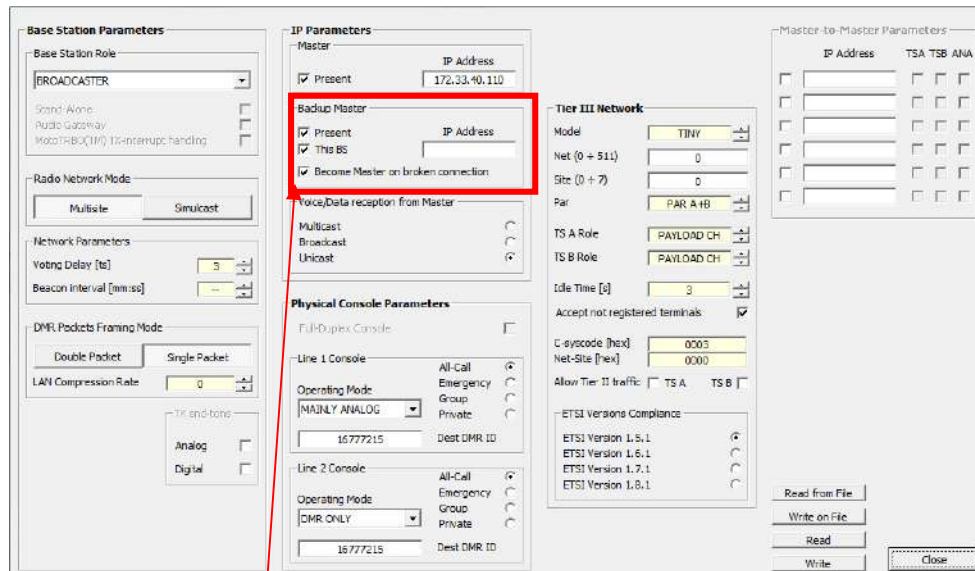
- a. Modify the same items following procedure 2.3. (Master Repeater Setup)

B. Backup Master Repeater Setup

- a. Pick a Slave Repeater for Backup Master Repeater.
- b. Modify the same items following procedure 2.3. (Slave Repeater Setup)
- c. Select Base Station Operation Mode.

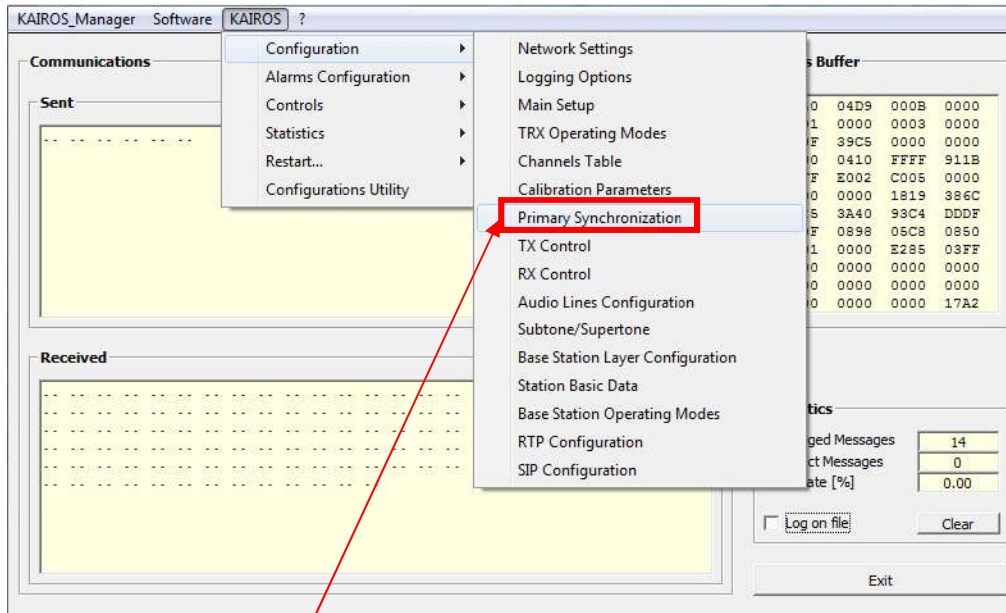


**Base Station Operation Mode**

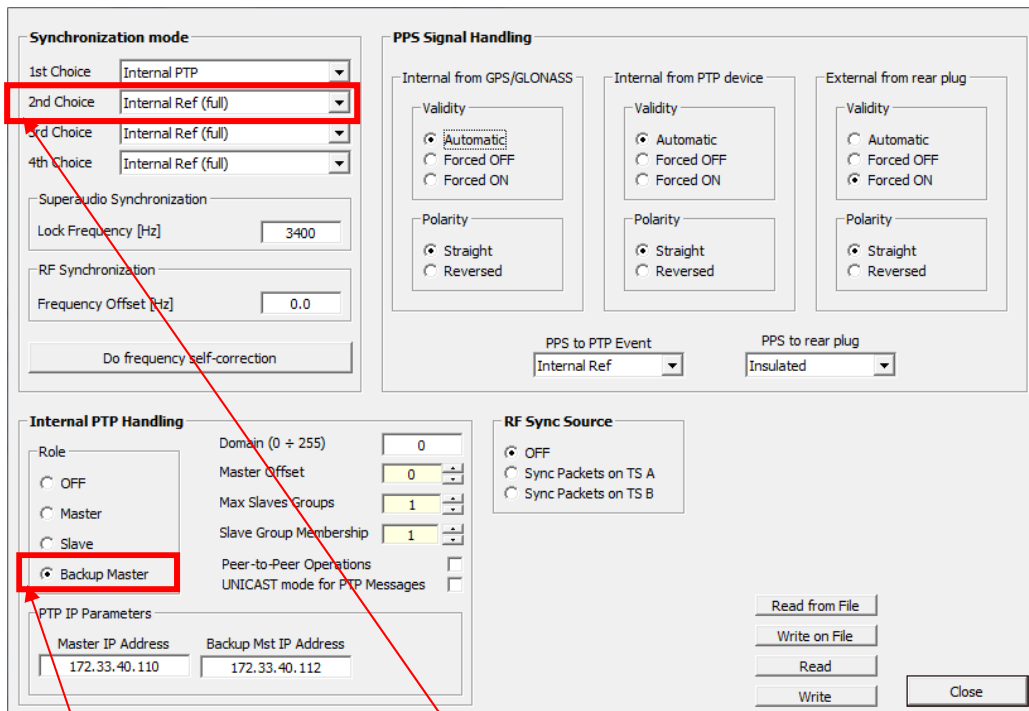


You must all check in **Backup Master setup**.

d. Select Primary Synchronization



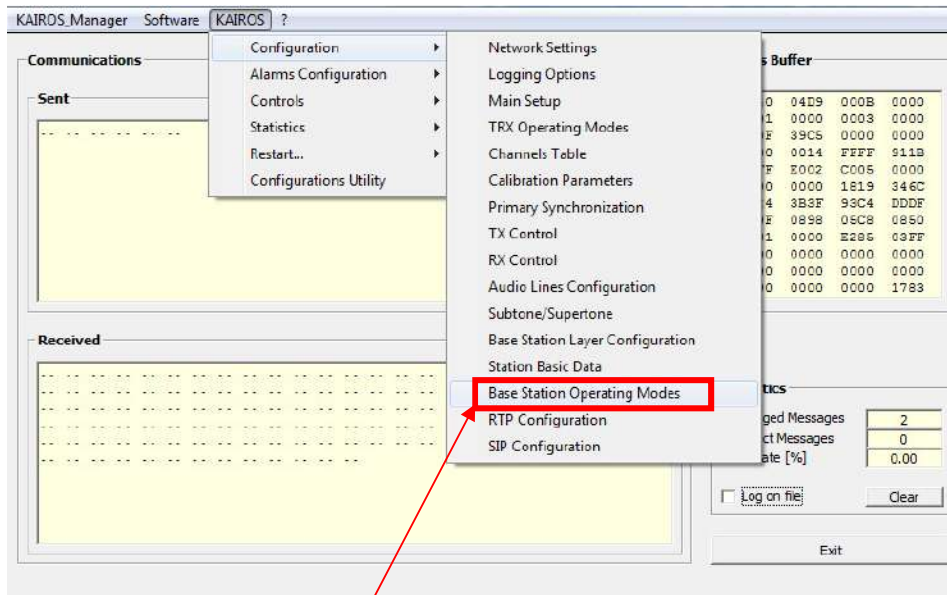
**Primary Synchronization**



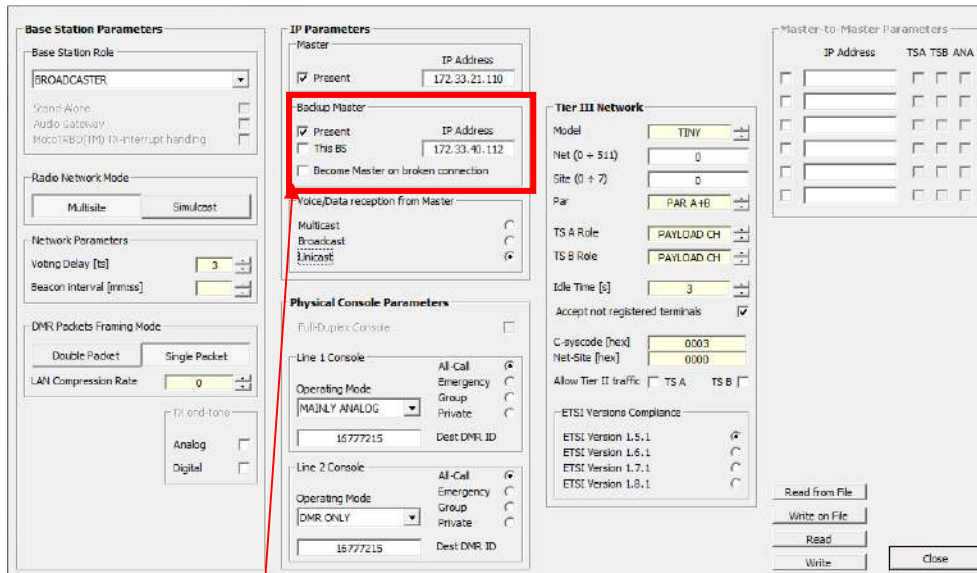
In this case scenario, this Slave Repeater becomes Master Repeater when the Primary Master Repeater offline. The 2<sup>nd</sup> choice must be **Internal Ref. (full)** and the role of PTP Handling must be **Backup Master**.

C. Slave Repeater Setup

- a. Modify the same items following procedure 2.3. (Slave Repeater Setup)
- b. Select Base Station Operation Mode.



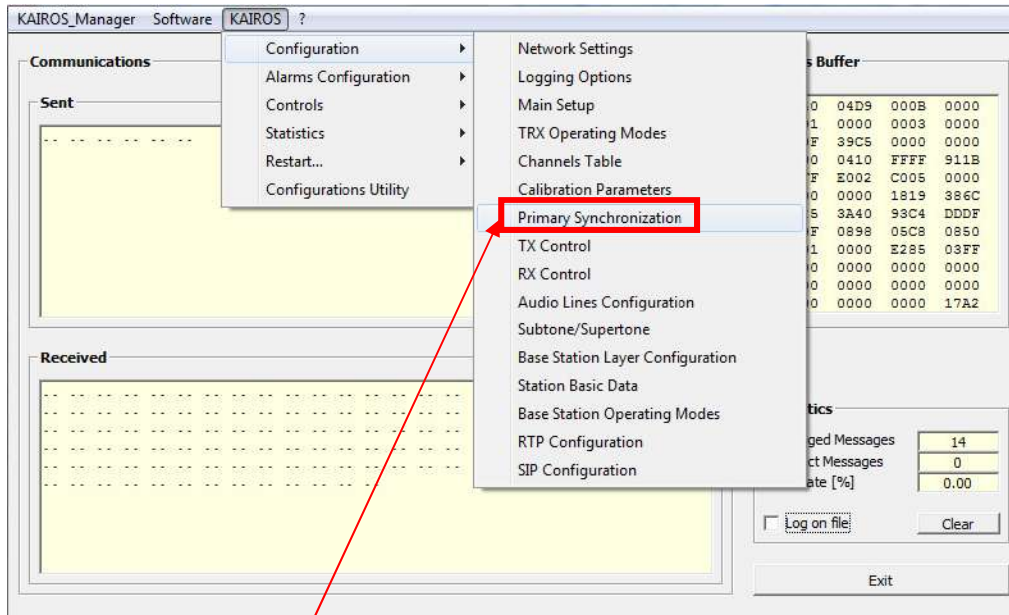
**Base Station Operation Mode**



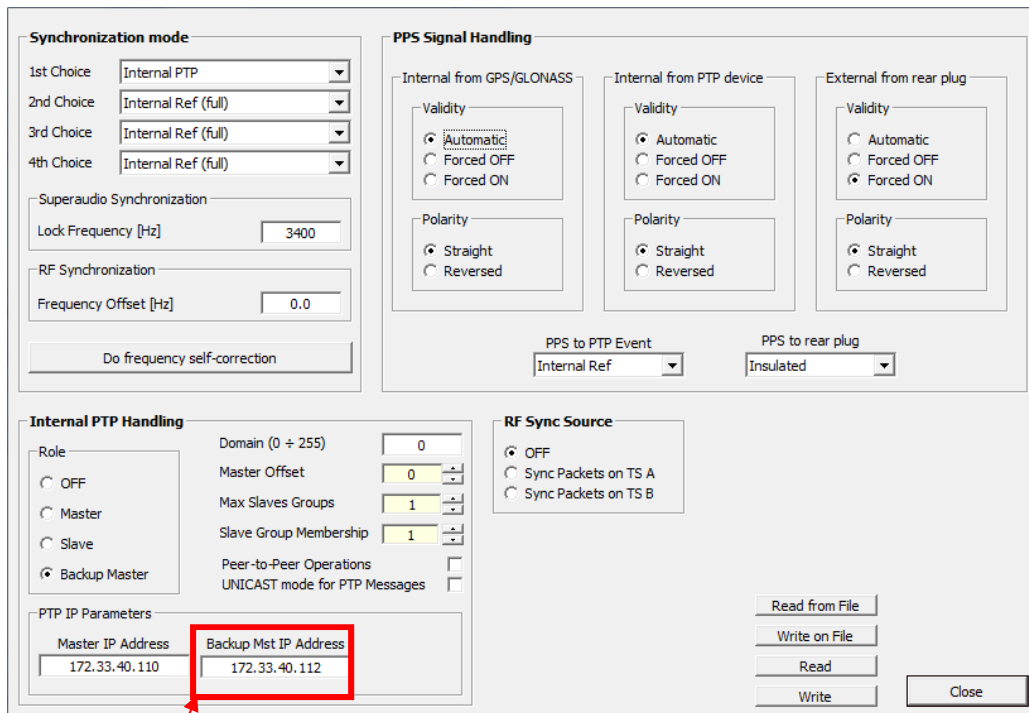
You must edit **Backup Master IP Address.**



c. Select Primary Synchronization



**Primary Synchronization**



You must edit **Backup Master Repeater IP Address** on all of Slave Repeaters.

## 2.5.3sites Simulcast System

3 Sites Simulcast 3 sites Conventional with Backup Master Standard 3 sites Simulcast

Order example: 3 sites STANDARD SIMULCAST

Site	Mode	Backup Master	Primary Sync	Secondary Sync	PTP Master	PTP Backup Master	Label	License	Internal	Panel
Unit1	Master	Master	Internal PPS	Internal PTP	✓		KA-SETUP	KA-DMR-1   KA-SLT2	KA-GPS	GPS-ANT   KA-RK1-V2
Unit2	Slave	Broadcaster	✓	Internal PPS	Internal PTP		KA-SETUP	KA-DMR-1   KA-SLT2	KA-GPS	GPS-ANT   KA-RK1-V2
Unit3	Slave	Broadcaster		Internal PPS	Internal PTP		KA-SETUP	KA-DMR-1   KA-SLT2	KA-GPS	GPS-ANT   KA-RK1-V2

### Site1

Unit1: Master Repeater

### Site2

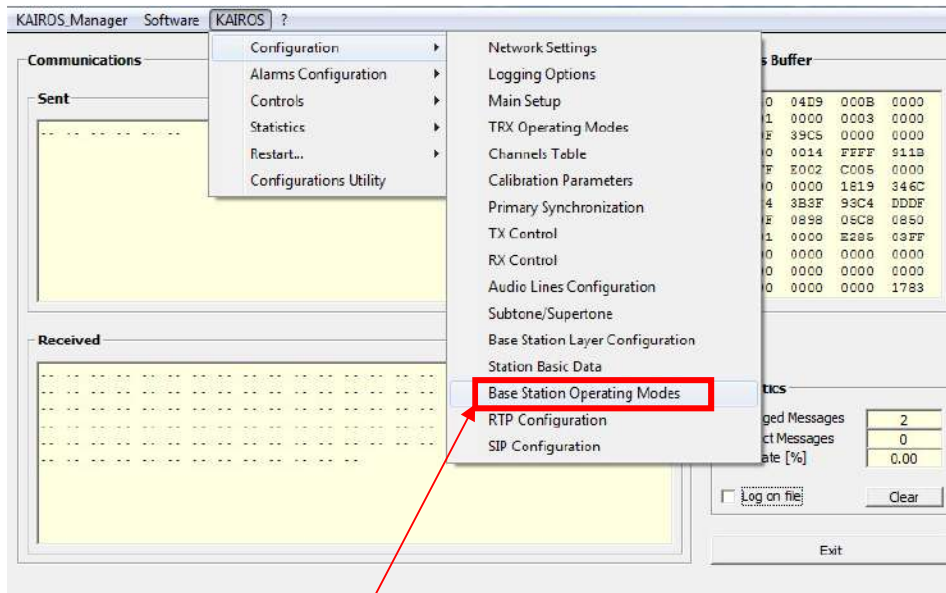
Unit2: Backup Master Repeater

### Site3

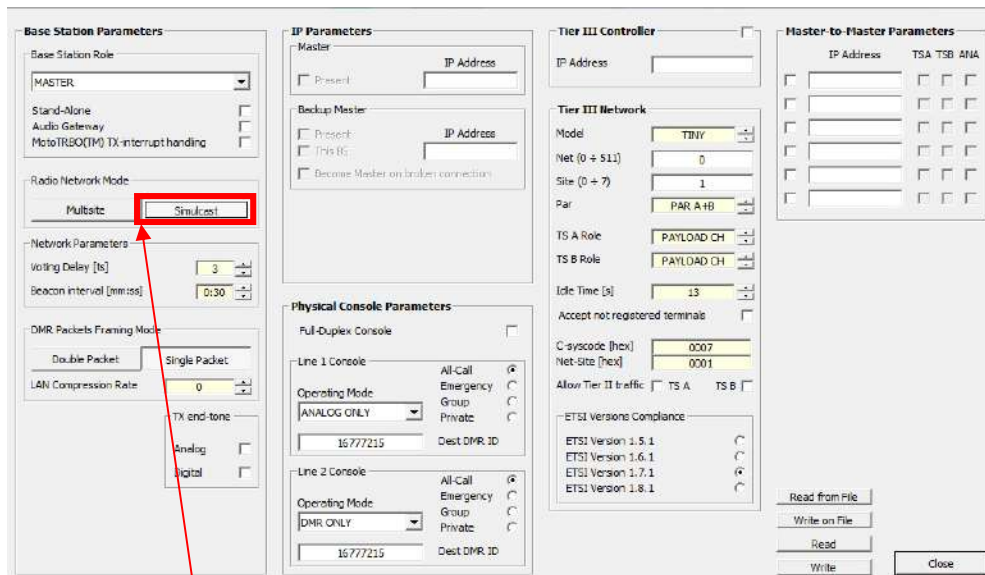
Unit3: Slave Repeater

A. Simulcast Repeater Setup

- a. Modify the same items following procedure 2.4. (for each repeater role)
- b. Select Base Station Operation Mode.

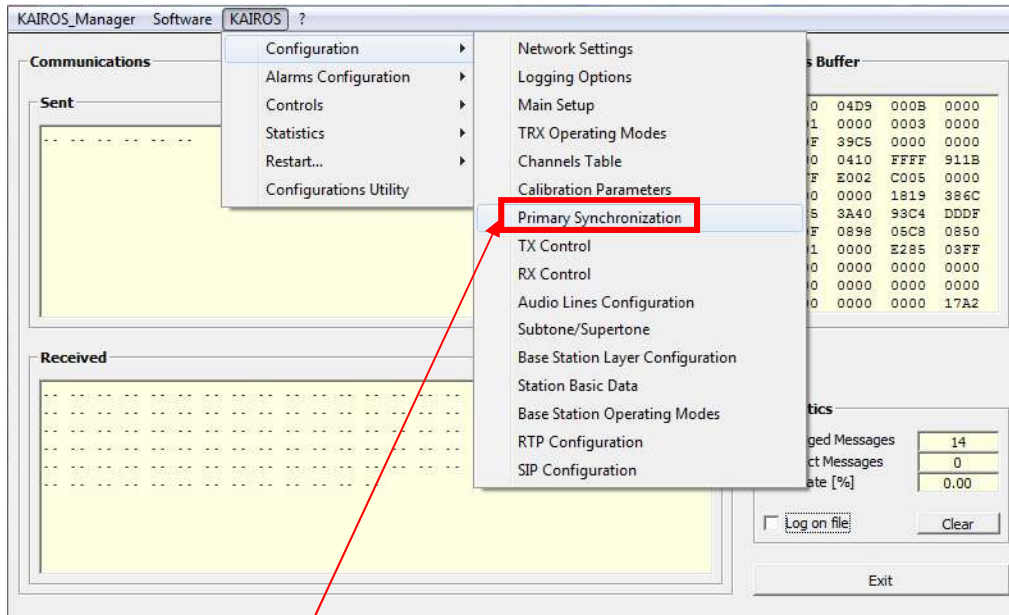


**Base Station Operation Mode**

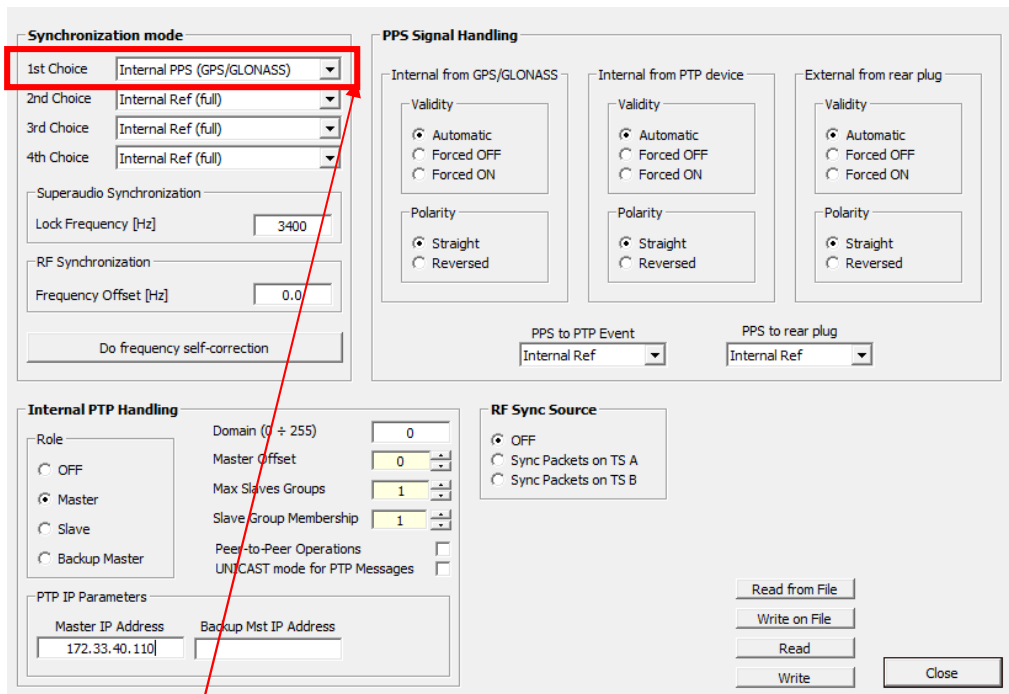


You must select **Simulcast Mode** Beacon Interval Time is not available when you select Simulcast.

c. Select Primary Synchronization.



**Primary Synchronization**



You must select **Internal PPS** for 1<sup>st</sup> Choice.

## 2.6. IP/RF Link Mixed System

### Case1



### Site1

Unit1: Master Repeater

Unit2: RF Down Link Repeater on Master Site

### Site2

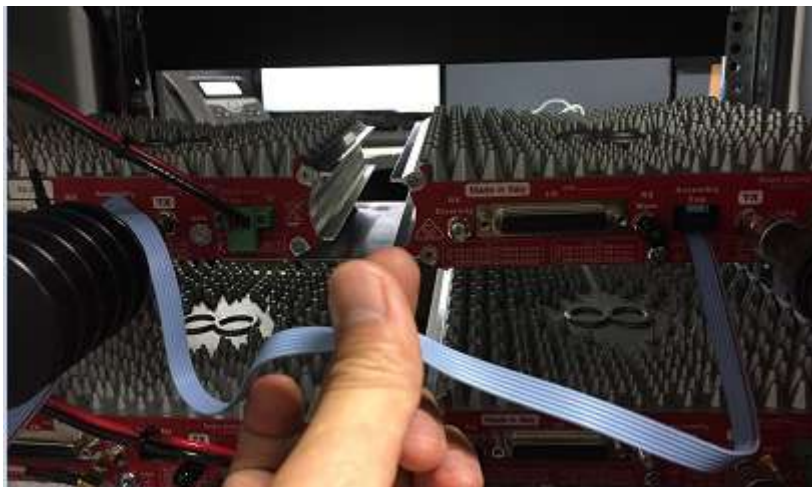
Unit3: Backup Master Repeater

### Site3

Unit4: Broadcaster on Slave Site

Unit5: RF Up Link Repeater on Slave Site

- These 2 repeaters have to be connected by PPS cable.



A. Master Repeater Setup

- a. Select BDCST MST SITE.ka.
- b. Modify the same items following procedure 2.4. (Master Repeater Setup)

B. Backup Master Repeater Setup

- a. Select BDCST SLV SITE.ka.
- b. Modify the same items following procedure 2.4. (Backup Master Repeater Setup)

C. RF Down Link Repeater on Master Site Setup

- a. Select DOWNLINK MST SITE.ka.
- b. Modify the same items following procedure 2.4. (Slave Repeater Setup)
- c. Modify Base Station Role

The screenshot shows the 'Base Station Parameters' configuration window. The 'Base Station Role' dropdown menu is highlighted with a red box and contains the text 'LINK DOWN TO NET'. A red arrow points from this box to the text 'Base Station Role is LINK DOWN TO NET' below the screenshot.

Base Station Role is **LINK DOWN TO NET**

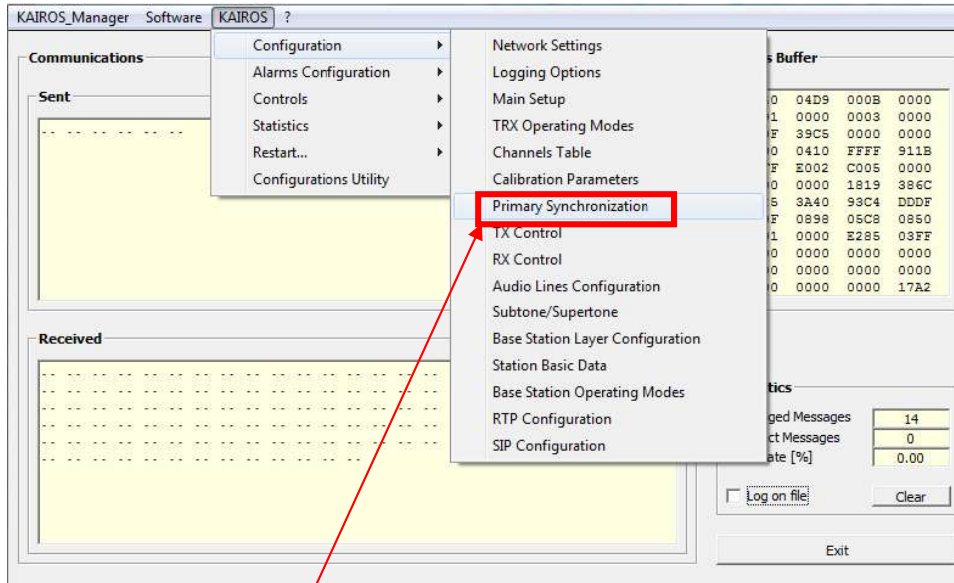
d. Modify TRX Operation Mode

The screenshot shows the 'TRX Configuration' window. The 'Operative mode' dropdown menu is highlighted with a red box and contains the text 'RF LINK-DOWN NODE'. A red arrow points from this box to the text 'Operation Mode is RF LINK-DOWN NODE' below the screenshot.

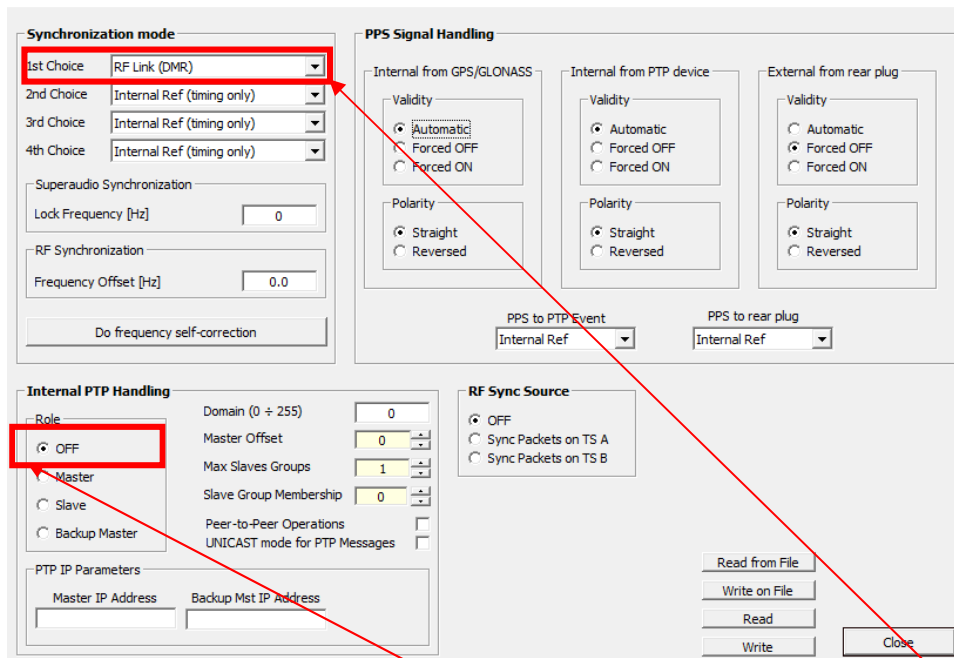
Operation Mode is **RF LINK-DOWN NODE**

D. RF Up Link Repeater on Slave Site Setup

- a. Select UPLINK SLV SITE.ka.
- b. Modify the same items following common procedure.
- c. Select Primary Synchronization



**Primary Synchronization**



The synchronization source is RF Link Down Repeater. So the 1<sup>st</sup> choice must be **RF Link** (DMR) and the role of PTP Handling must be **OFF** because this repeater will provide PPS signal by a cable backside.





d. Modify Base Station Role

The screenshot shows the 'Base Station Parameters' configuration window. The 'Base Station Role' dropdown menu is highlighted with a red box and contains the text 'LINK UP TO MASTER'. A red arrow points from this box to the caption below. Other visible sections include 'IP Parameters', 'Physical Console Parameters', 'Tier III Network', and 'Master-to-Master Parameters'.

Base Station Role is **LINK DOWN TO MASTER.**

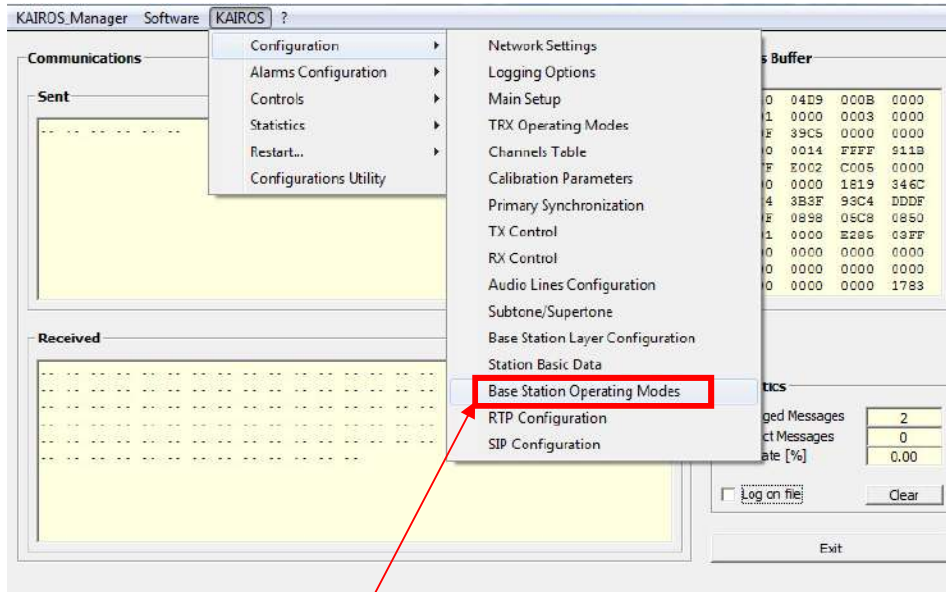
e. Modify TRX Operation Mode

The screenshot shows the 'TRX Configuration' window. The 'Operative mode' dropdown menu is highlighted with a red box and contains the text 'RF LINK-UP NODE'. A red arrow points from this box to the caption below. Other visible sections include 'Enabling TRX', 'Analog Selective Calls Configuration', and 'Service Class'.

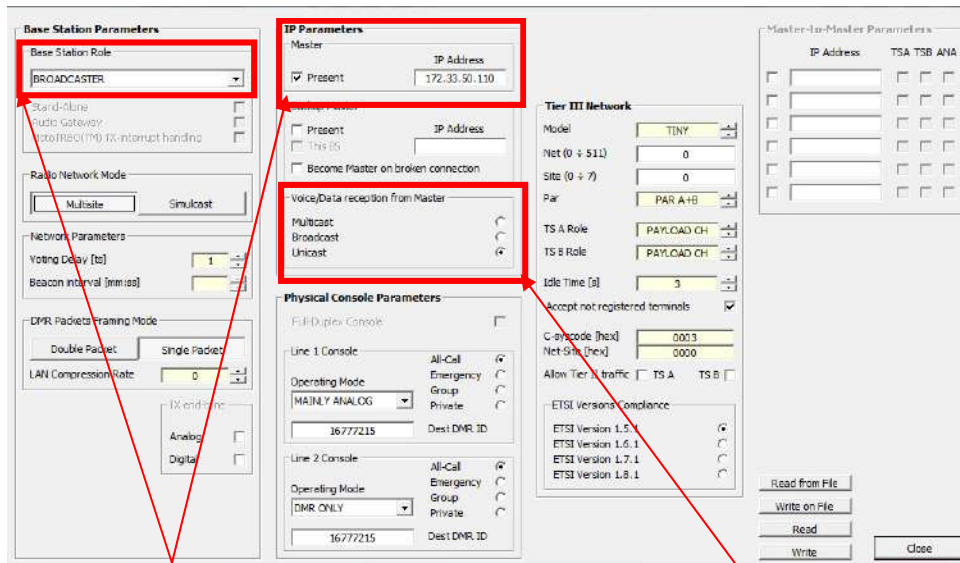
Operation Mode is **RF LINK-UP NODE.**

E. Broadcaster on Slave Site Setup

- a. Select BDCST SLV SITE.ka.
- b. Modify the same items following common procedure.
- c. Select Base Station Operation Mode.



**Base Station Operation Mode**

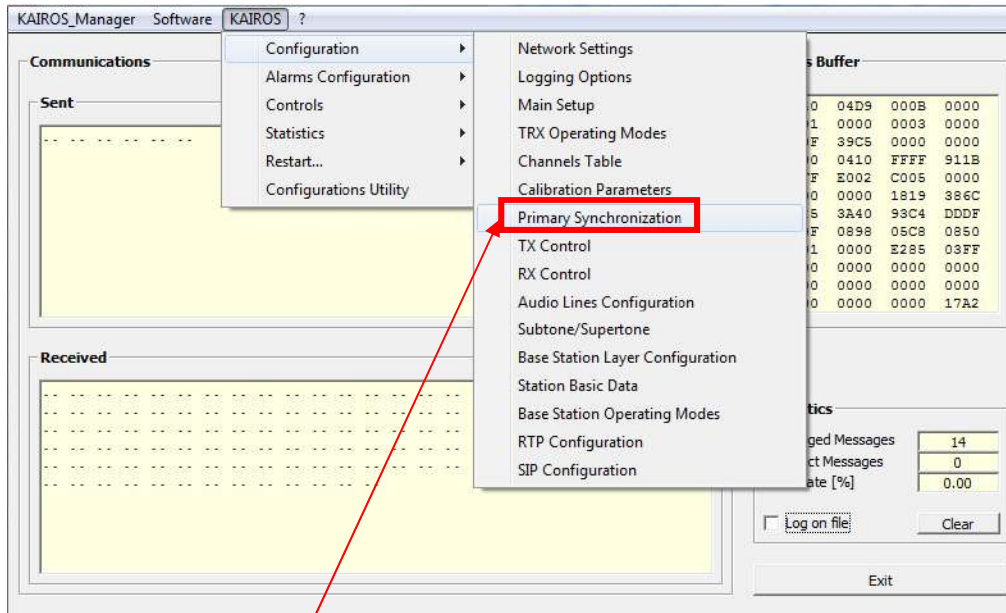


You can edit **Master Repeater IP Address** in this island site and **Data Reception Method** following customer requirement. Beacon Interval is Blank because all Slave Repeater follows Master Beacon timing.

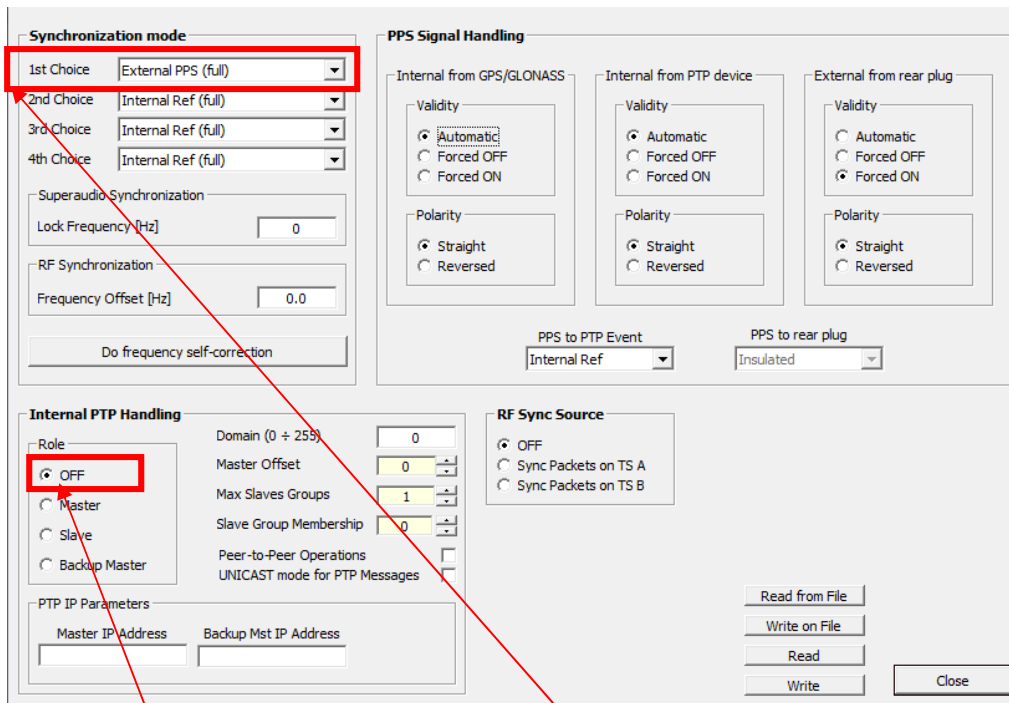
- d. Modify Base Station Role

Base Station Role is **BROADCASTER**

e. Select Primary Synchronization



**Primary Synchronization**



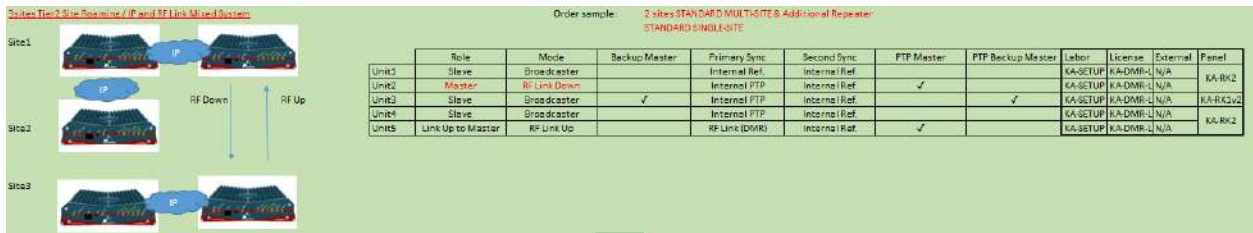
In this case scenario, the Master Repeater in this island site will provide PPS signal following the RF Link Synchronization. The 1<sup>st</sup> choice must be **External PPS(full)** and the role of PTP Handling must be **Off**.

f. Modify TRX Operation Mode

The image shows a software configuration window titled "TRX Configuration" and "Analog Selective Calls Configuration". In the "TRX Configuration" section, the "Operative mode" dropdown menu is highlighted with a red box and contains the text "SLAVE BASE STATION". A red arrow points from this dropdown to the text "Operation Mode is SLAVE BASE STATION" located below the dialog. Other settings in the "TRX Configuration" section include "Service" set to "FULL DUPLEX", "Type" set to "STAND ALONE", "Automatic Role Self-Switching Time [min]" set to "0", "30s AUTO ID" set to "Automatic", "Use external PA" unchecked, "Gain [dB]" and "Max Input Power [W]" input fields, and "Service Class" set to "Multimode DMR Tier II Node". The "Enabling TRX" section has several checked options: "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", and "Line 0 (Physical Line 0) Enabled". The "Analog Selective Calls Configuration" section includes "Codec to be used" set to "NULL", "Tone length (10 ÷ 255 ms)" set to "10", and checkboxes for "Enable Analog Selective Calls sending" (unchecked), "Enable Analog Selective Calls reception" (unchecked), "Enable repetition code insertion" (checked), and "Enable repetition code detection" (checked). At the bottom right of the dialog are buttons for "Read from File", "Write on File", "Read", "Write", and "Close".

Operation Mode is **SLAVE BASE STATION**

## Case2



### Site1

Unit1: Broadcaster on Master Site

Unit2: Master / RF Down Link Repeater on Master Site

### Site2

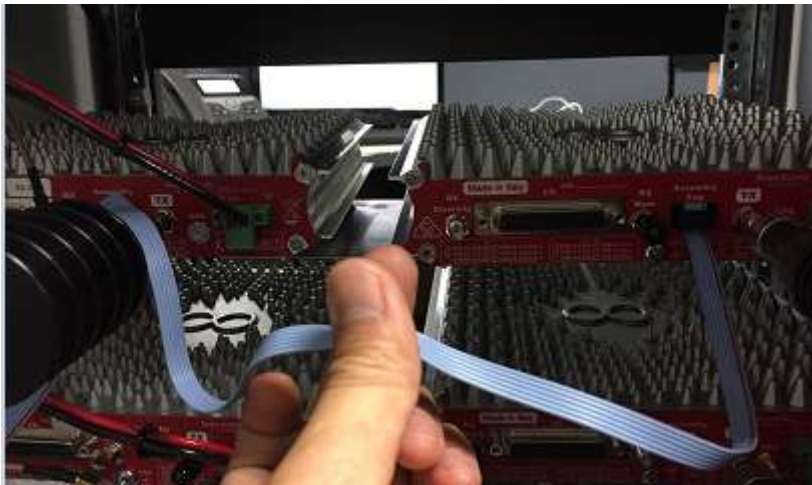
Unit3: Backup Master Repeater

### Site3

Unit4: Broadcaster on Slave Site

Unit5: RF Up Link Repeater on Slave Site

- These 2 repeaters have to be connected by PPS cable.



A. Broadcaster on Master Site Setup

- a. Select BDCST MST SITE.ka.
- b. Modify the same items following procedure 2.4. (Slave Repeater Setup)

B. Master / RF Down Link Repeater on Master Site Setup

- a. Select DOWNLINK MST SITE.ka.
- b. Modify the same items following procedure 2.4. (Master Repeater Setup)
- c. Modify Base Station Role

The screenshot shows the 'Base Station Parameters' configuration window. The 'Base Station Role' dropdown menu is highlighted with a red box and contains the text 'MASTER'. A red arrow points from this box to the text 'Base Station Role is MASTER' below the screenshot. Other visible settings include 'Stand-Alone', 'Radio Network Mode' (Multisite/Simulcast), 'Network Parameters' (Voting Delay, Beacon Interval), 'DMR Pockets Framing Mode' (Double Packet/Single Packet), 'IP Parameters' (Master/Backup Master), 'Tier III Controller' (IP Address, Network), 'Physical Console Parameters' (Line 1/2 Console), and 'Master-to-Master Parameters' (IP Address, TSA, TSB, ANA).

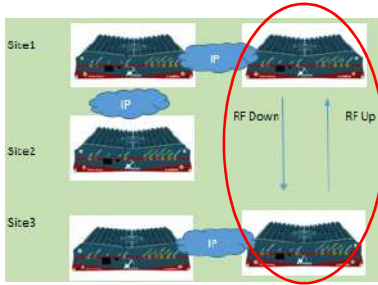
Base Station Role is **MASTER**

d. Modify TRX Operation Mode

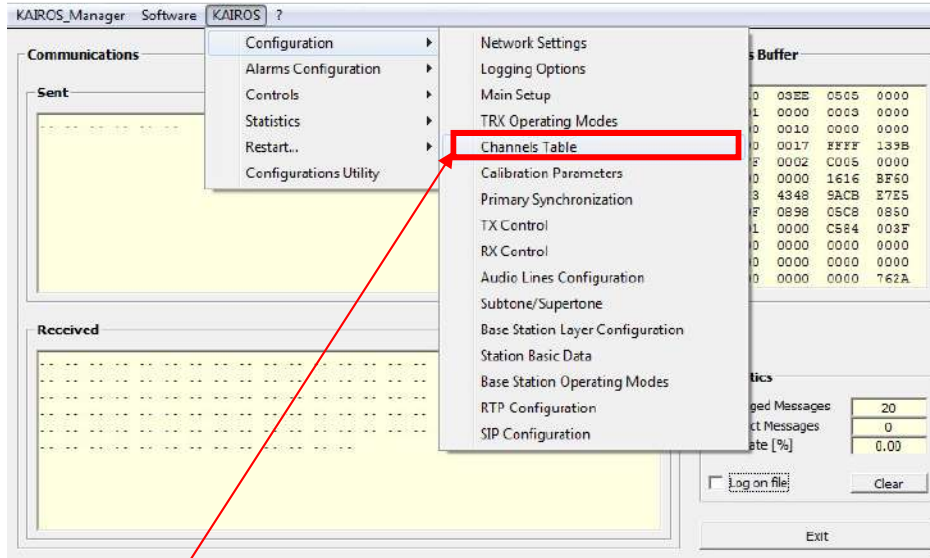
The screenshot shows the 'TRX Configuration' window. The 'Operative mode' dropdown menu is highlighted with a red box and contains the text 'RF LINK-DOWN NODE'. A red arrow points from this box to the text 'Operation Mode is RF LINK-DOWN NODE' below the screenshot. Other visible settings include 'Service' (FULL DUPLEX), 'Type' (STAND ALONE), 'Active/Hot-Share Parameters' (Automatic Role Self-Switching Time), '30s AUTO ID' (Automatic/Forced OFF/Forced ON), 'Use external PA' (Gain, Max Input Power), 'Enabling TRX' (checkboxes for TX, RX, Repeater Mode, PCM, Lines), and 'Analog Selective Calls Configuration' (Codec, Tone length, checkboxes for sending/reception and repetition code).

Operation Mode is **RF LINK-DOWN NODE**

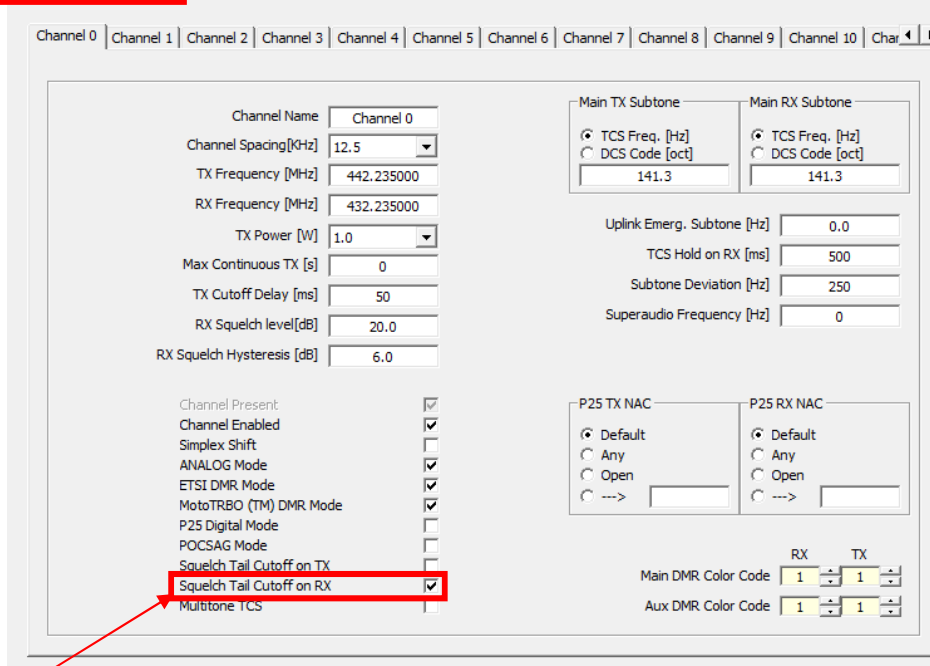
## Common Procedure on RF Linked Repeater



### a. Select Channel Table



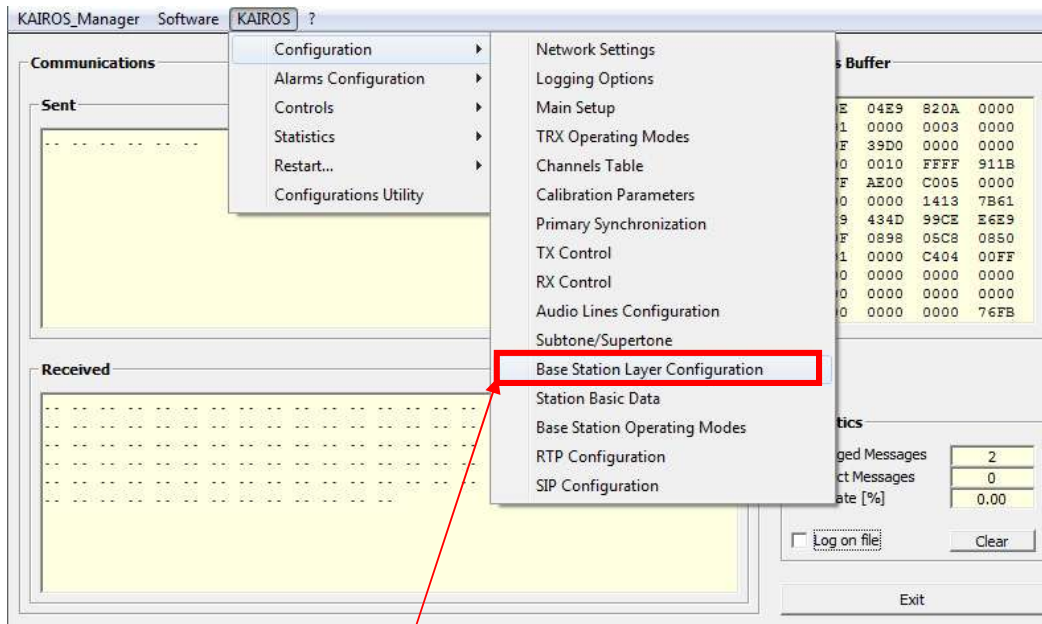
**Channel Table**



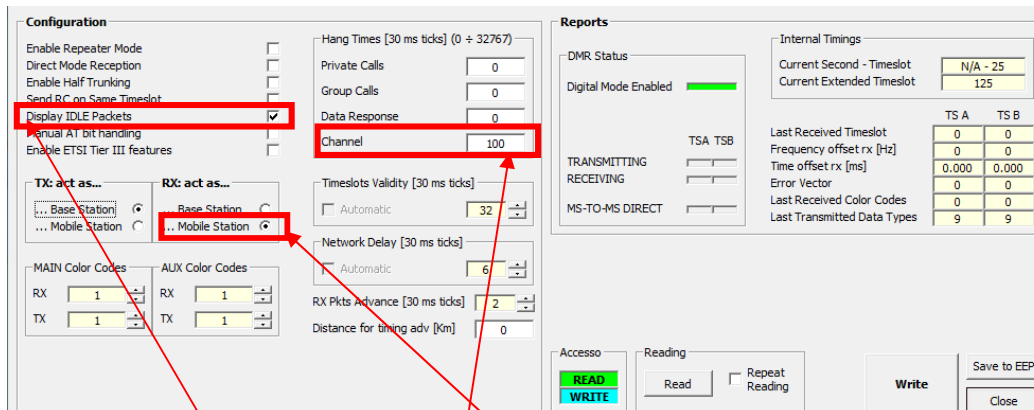
**Squelch Tail Cutoff on RX** must be checked on RF Linked Kairos.



b. Select Base Station Layer Configuration



**Base Station Layer Configuration**



You must enable **Display IDLE Packet** on RF Linked Kairos.

Basically TX/RX acts are set to Base Station. But **Mobile Station** must be checked for RX acts on RF Linked Kairos.

Channel Hang Timer must be set to **100 (3000ms)** to have enough synchronization.

### 3. Additional Information

#### 3.1. Add Hot Standby Repeater

2 Sites Tier 2 Site Redundancy / 1+1 Hot Standby (Recommended)

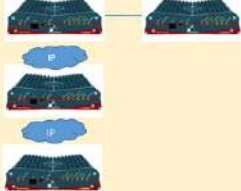
Order sample: STANDARD SINGLE-SITE & 1+1 Hot Standby  
STANDARD SINGLE-SITE



Unit	Role	Mode	Backup Master	Primary Sync	Secondary Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal Ref	Internal Ref			KA-SETUP	KA-DMR-1	KA-1+1	KA-RK2
Unit2	Master	Master		Internal Ref	Internal Ref			KA-SETUP	KA-DMR-1	N/A	N/A
Unit3	Slave	Broadcaster		Internal PTP	Internal Ref	✓		KA-SETUP	KA-DMR-1	N/A	KA-RK1v2

3 Sites Tier 2 Site Redundancy with Backup Master / 1+1 Hot Standby (Recommended)

Order sample: STANDARD SINGLE-SITE & 1+1 Hot Standby  
3 Sites STANDARD MULTI-SITE



Unit	Role	Mode	Backup Master	Primary Sync	Secondary Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal Ref	Internal Ref			KA-SETUP	KA-DMR-1	KA-1+1	KA-RK2
Unit2	Master	Master		Internal Ref	Internal Ref			KA-SETUP	KA-DMR-1	N/A	N/A
Unit3	Slave	Broadcaster	✓	Internal PTP	Internal Ref	✓		KA-SETUP	KA-DMR-1	N/A	KA-RK1v2
Unit4	Slave	Broadcaster		Internal PTP	Internal Ref		✓	KA-SETUP	KA-DMR-1	N/A	KA-RK1v2

3 Sites Simulcast Tier 2 Conventional with Backup Master / 1+1 Hot Standby for Master (Recommended)

Order sample: STANDARD SIMULCAST & 1+1 Hot Standby  
2 sites STANDARD SIMULCAST



Unit	Role	Mode	Backup Master	Primary Sync	Secondary Sync	PTP Master	PTP Backup Master	Labor	License	External	Panel
Unit1	Master	Master		Internal PTP	Internal Ref			KA-SETUP	KA-DMR-1 KA-S-PT2	KA-1+1	KA-GPS GPS-ANT KA-RK2
Unit2	Master	Master		Internal PTP	Internal Ref			KA-SETUP	KA-DMR-1 KA-S-PT2	N/A	KA-GPS GPS-ANT KA-RK2
Unit3	Slave	Broadcaster	✓	Internal PTP	Internal PTP	✓		KA-SETUP	KA-DMR-1 KA-S-PT2	N/A	KA-GPS GPS-ANT KA-RK3v2
Unit4	Slave	Broadcaster		Internal PTP	Internal PTP		✓	KA-SETUP	KA-DMR-1 KA-S-PT2	N/A	KA-GPS GPS-ANT KA-RK3v2

When you add Hot Standby Repeater into system, you must consider which repeater can be redundant. Above picture is a recommended structure with hot standby repeater.

Kairos System must have Master Voting Repeater and Master PTP Repeater when you will use PTP sync between sites. Then you can have Backup Repeater for both function. **But Hot Standby Repeater is not available to PTP Master function.**

Here is the case of lost repeaters.

Lost Repeater	System Behavior
Voting Master Repeater	No Intersite Call in the system.
PTP Master Repeater	No synchronization between sites.

Voting Master is the most important repeater in the system. The system will continue to work without PTP Master Repeater. To having Backup Voting Master Repeater, you must setup PTP Master to a Voting Slave Repeater. And you can add a PTP Backup Repeater into over 3sites system in this case scenario.

You can follow the setup procedure 2.2 when you add Hot Standby Repeater into system. But please consider which repeater will have Voting Master or PTP Master.

### 3.2. Appendix A

The reason why we have default data file for some case is the Kairos Manager has too much detailed setup items.

I picked the important setting on each display. You have to take care this portion based on the structure which customer requested but you do not need to take care in case standard structure case which I mentioned on this document.

#### Base Station Operating Mode

**Voting Delay:** This is a parameter for Voting Master Repeater when the voter repeat voice/data streaming to Broadcaster Repeaters. Please check Appendix B to see the parameter example.

The screenshot displays the Kairos Manager configuration interface, organized into several panels:

- Base Station Parameters:** Includes Base Station Role (MASTER), Radio Network Mode (Multiste/Simulcast), Network Parameters (Voting Delay [ts] set to 3, Beacon interval [mm:ss] set to 0:30), and DMR Packets Framing Mode (Double Packet/Single Packet).
- IP Parameters:** Configures IP addresses for Master and Backup Master.
- Physical Console Parameters:** Configures console settings for Line 1 and Line 2, including Operating Mode (ANALOG ONLY/DMR DNLY) and Dest DMR ID (16777215).
- Tier III Controller:** Configures IP Address and other controller-specific parameters.
- Tier III Network:** Configures Model (TINY), Net (0 ÷ 511), Site (0 ÷ 7), Par (PAR A+B), TS A Role, TS B Role, Idle Time [s], and Accept not registered terminals.
- Master-to-Master Parameters:** Configures IP Address, TSA, TSB, and ANA for multiple instances.

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

## Base Station Layer Configuration

**Network Delay/Rx Packets Advance:** There are parameters for all repeaters to have synchronized transmit timing. Please check Appendix B to see the parameter example.

**Distance for timing adv:** You must setup this parameter for RF Linked System even if it is simulcast system to having synchronized transmit timing. Please modified following site location.

**Configuration**

Enable Repeater Mode   
Direct Mode Reception   
Enable Half Trunking   
Send RC on Same Timeslot   
Display IDLE Packets   
Manual AT bit handling   
Enable ETSI Tier III features

Hang Times [30 ms ticks] (0 ÷ 32767)  
Private Calls 150  
Group Calls 150  
Data Response 16  
Channel 16

Timeslots Validity [30 ms ticks]  
 Automatic 32

TX: act as... RX: act as...  
... Base Station ... Base Station  
... Mobile Station ... Mobile Station

MAIN Color Codes AUX Color Codes  
RX 5 RX 5  
TX 5 TX 5

Network Delay [30 ms ticks]  
 Automatic 8

RX Pkts Advance [30 ms ticks] 0

Distance for timing adv [Km] 0

**Reports**

DMR Status  
Digital Mode Enabled

Internal Timings  
Current Second - Timeslot N/A - 16  
Current Extended Timeslot 116

	TS A	TS B
Last Received Timeslot	0	0
Frequency offset rx [Hz]	0	0
Time offset rx [ms]	0.000	0.000
Error Vector	0	0
Last Received Color Codes	0	0
Last Transmitted Data Types	9	9

Accesso Reading  
**READ**  Repeat Reading  
**WRITE**

**Write** Save to EEP  
Close

## TX Control

**HP filter:** These parameters are for RF Linked System. Based on Kairos structure, you have to have fixed value for RF Linked system. But you do not need to take care these because the base default date file for RF Link will cover this parameters.

**TX Configuration**

HP filter  Notch

Delay  
Dis ms, μs  
Null km  
Ena km

Modulation FM PM

TCS/DPL encoder

**Parameters of transmission**  
Nominal deviation [Hz] 1500  
Supertone tone [Hz] 0  
 Max Cont. Tx [s]  
 Hold Time [ms] 550  
 Enable Tx end tone  
Chan Bandwidth 12,5 kHz

**TX Measures**  
Current Deviation [Hz] 0  
Limiter (dB) 0.0

Access  
**READ**  
**WRITE**

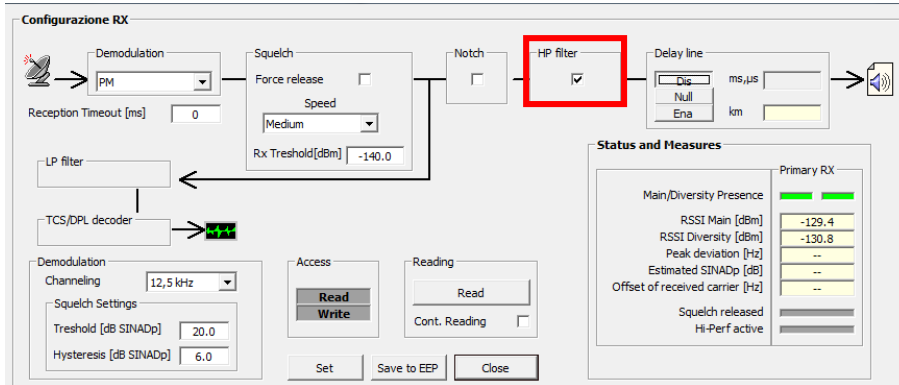
**TX Module Status**  
Limiter On

Reading  
Read  
 Repeat Reading  
Exit

Save to EEP  
Set

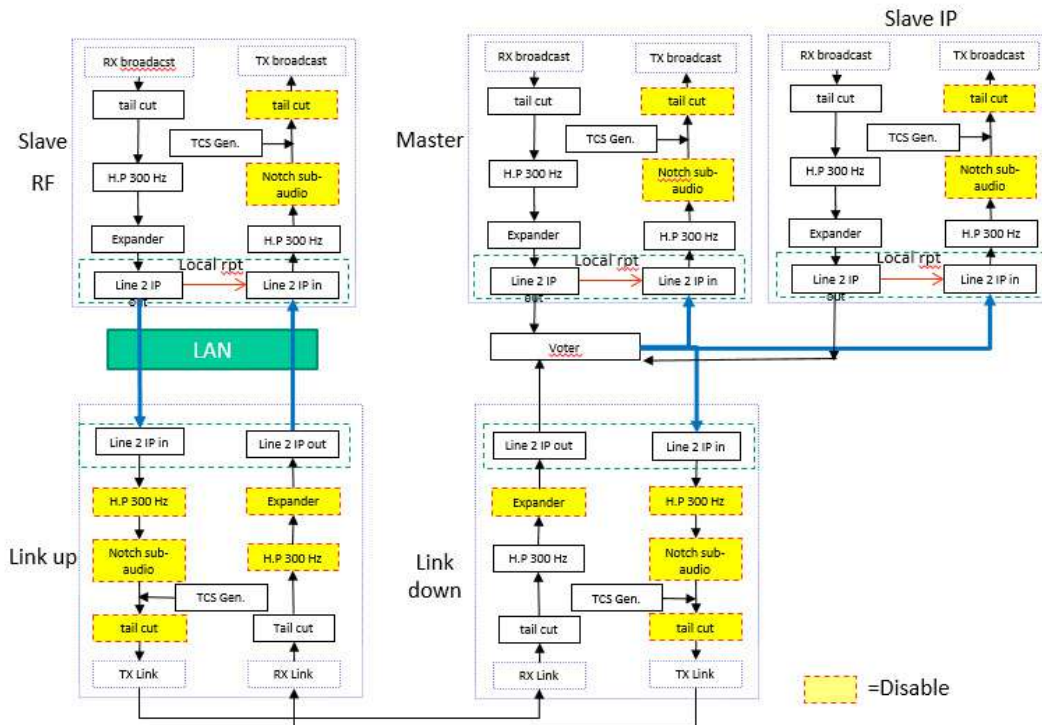
## RX Control

**HP filter:** These parameters are for RF Linked System. Based on Kairos structure, you have to have fixed value for RF Linked system. But you do not need to take care these because the base default date file for RF Link will cover this parameters.



Below Picture is provided by Radio Activity. You must follow this structure.

## Percorsi audio analogici rete SAT+MST "MIXED" KAIROS

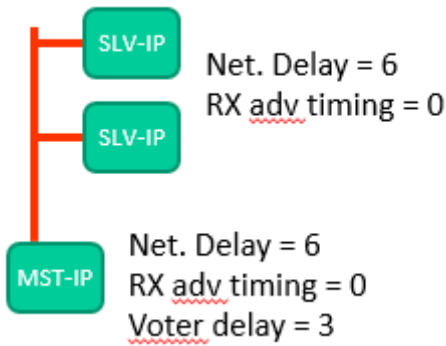


### 3.3. Appendix B

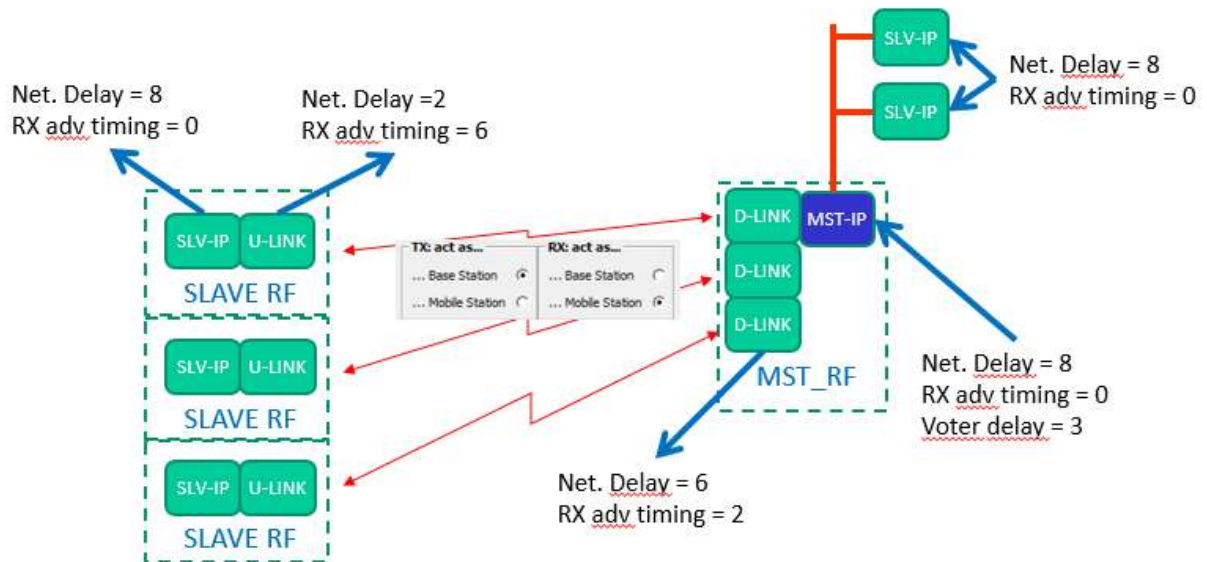
You must modify some parameters from default data file to having the system works correctly based on the system structure if the customer's requirement was out of this document.

#### Standard Structure which this document covered

##### - 2level IP Linked System

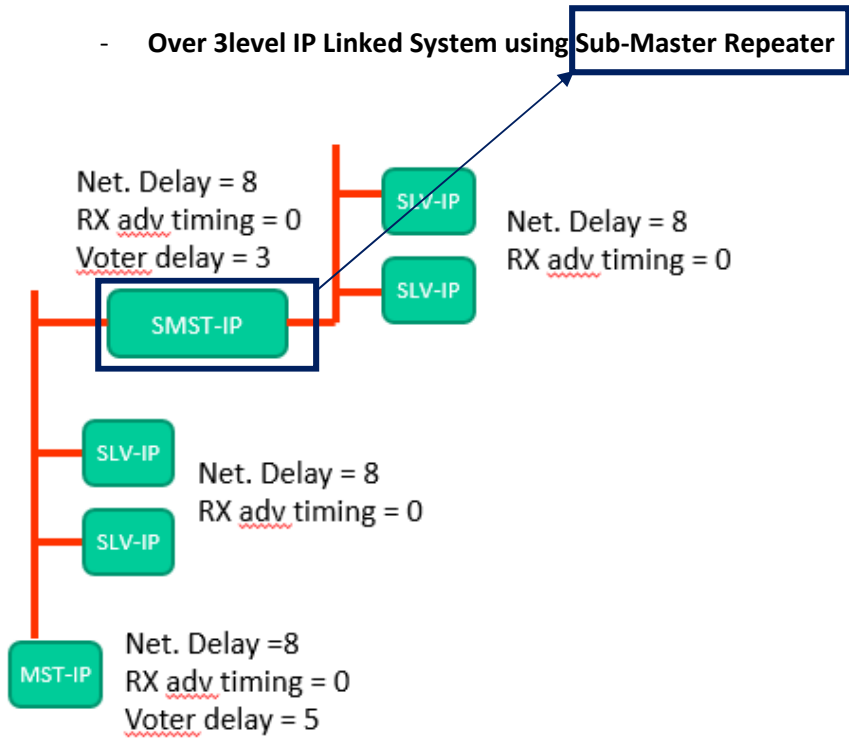


##### - 2level IP and RF Linked Mixed System



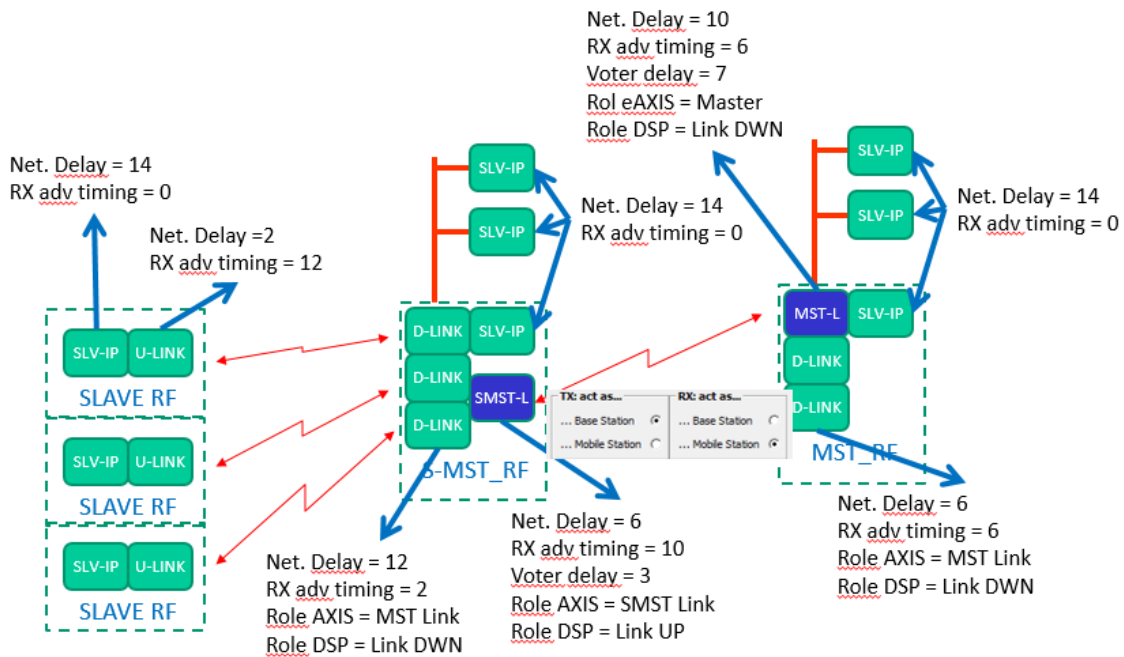
Optional Structure which this document did not cover

We must consider the system and network design following Radio Activity Team when we sale these optional System Structure.



\*Sub-Master is one of role on Kairos.

**Over 3level IP and RF Linked Mixed System using Sub-Master Repeater**



- Pipeline RF Linked System

