ASTRONICS
TEST SYSTEMS

FCT-1391
R8x00 SERIES
COMMUNICATIONS SYSTEM ANALYZER
DMR TIER III OPERATIONAL TESTING USER
GUIDE

For software version 4.6
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Table of Contents

User Guide

List of Figures

User Guide

List of Tables

Page

1   Overview

The purpose of this user guide is to demonstrate the use of the R8000, R8100, R8200, or R8600 communications system analyzer for testing DMR radios configured for Tier III (trunking) operation. The DMR Tier III test mode on the R8x00 is designed to support devices configured to meet the DMR Tier III standard as defined by ETSI TS 102 361-4 v1.11.1 (2021-01) "Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Mobile Radio (DMR) Systems; Part 4: DMR trunking protocol."

Note: *Devices configured for manufacturer specific proprietary modes of operation will NOT work with the Astronics DMR Tier III test mode.*

The testing is performed with the radio in operational (trunking) mode. To accomplish this, the R8x00 mimics the network programmed for the selected radio channel. When the radio is powered up or switched to the selected channel, the device will register with the R8x00 and the R8x00 will be ready to test Transmitter (Tx) and Receiver (Rx) functions. Therefore, UUT testing is performed in the same manner as a device operating on the Tier III network.

The DMR Tier III test mode provides verification of the following operations:

1. Registration of device to network.

    * Confirmation of device programed network model, net ID, site ID, and Color Code (CC).

    * Confirmation of selected base station uplink and downlink frequencies.

2. Identification of radio ID and channel assigned group ID.

3. Tx physical layer measurements (instantaneous and averaged bursts).

    * Power level (dBm)

    * Frequency error (Hz)

    * Symbol deviation (Hz)

    * Frame alignment (micro sec)

    * FSK error (%)

    * Magnitude error (%)

4. Rx device sensitivity while in DMR Tier III operation.

5. Testing of selected call types (both Tx and Rx).

    * Group call

    * Private (simplex) call – hook and no hook

    * Emergency – group and private

    * Ambient (must be allowed in radio configuration)

    * Phone call

6. Send and receive text messages (short message service) in DMR Tier III standard mode only.

7. Test Dynamic Group Number Assignment (DGNA)in devices configured to accept Over-The-Air (OTA) DGNA.

The DMR Tier III test mode is not intended to be broadcast over the air. For accurate measurements and to prevent any network interference, the test technician must have a direct RF connection from the antenna port of the radio to the RF In/Out port of the R8x00.

Note: *When testing a portable or mobile device, only connect the device antenna port to the RF In/Out port of the R8x00. NEVER connect the device antenna port to the R8x00 antenna port or RF Gen Out port.*

The descriptions and figures in this user guide are based on an R8100/R8200/R8600 running software version 4.6 or later and the following option enabled:

DMR Tier III MS (R8-DMR_T3MS)

In some cases, the text will reference the R8100 O&M manual which can be found online at

www. freedomcte.com.

Reference 1)

FCT-1366C – R8100 Series Communications System Analyzer Operation's Manual. Freedom Communication Technologies

The R8000 also fully supports the DMR Tier III test mode and can perform all the same tests and functions as the R8100/R8200/R8600 units, but the user interface is organized differently. Most of the figures in this user guide will be from the R8100 user interface. Periodically, figures from the R8000 will be shown as reference.

2 DMR Tier III (ETSI Digital; Mobile Radio)

The DMR Tier III Test Package option allows testing of subscriber radios compliant with the ETSI Digital Mobile Radio (DMR) Tier III trunked radio transmission protocol. DMR radios use a digital transmission format employing Four-Level Frequency Shift Keying (4FSK) modulation with a channel access method of Time Division Multiple Access (TDMA) technology with two slots per frame. Pressing Test > Test Mode > DMR Tier III MS initiates the DMR Tier III MS test mode. On the R8x00 main display, the Standard Mode Audio Zone and Audio Zone soft keys are replaced by a DMR soft key and DMR specific content (see Figure 1 and Figure 1a). In addition, a variety of displays are available in the Display Zone and a DMR Tier III MS Status display is automatically selected in Meter Zone as a convenience.

Note: *The DMR Tier III test mode on the R8x00 series is designed to support testing user devices configured to meet the DRM Tier III standard as defined by ETSI TS 102 361-4 v1.11.1 (2021-01) "Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Mobile Radio (DMR) Systems; Part 4: DMR trunking protocol."*

Devices must be configured for DMR Tier III operation and NOT a manufacturer specific proprietary mode of operation. For example, the Motorola Capacity Max Advantage system

type will NOT work with the R8x00 series DMR Tier III test mode, but the Capacity Max Open System and Capacity Max Open Radio system types will work.
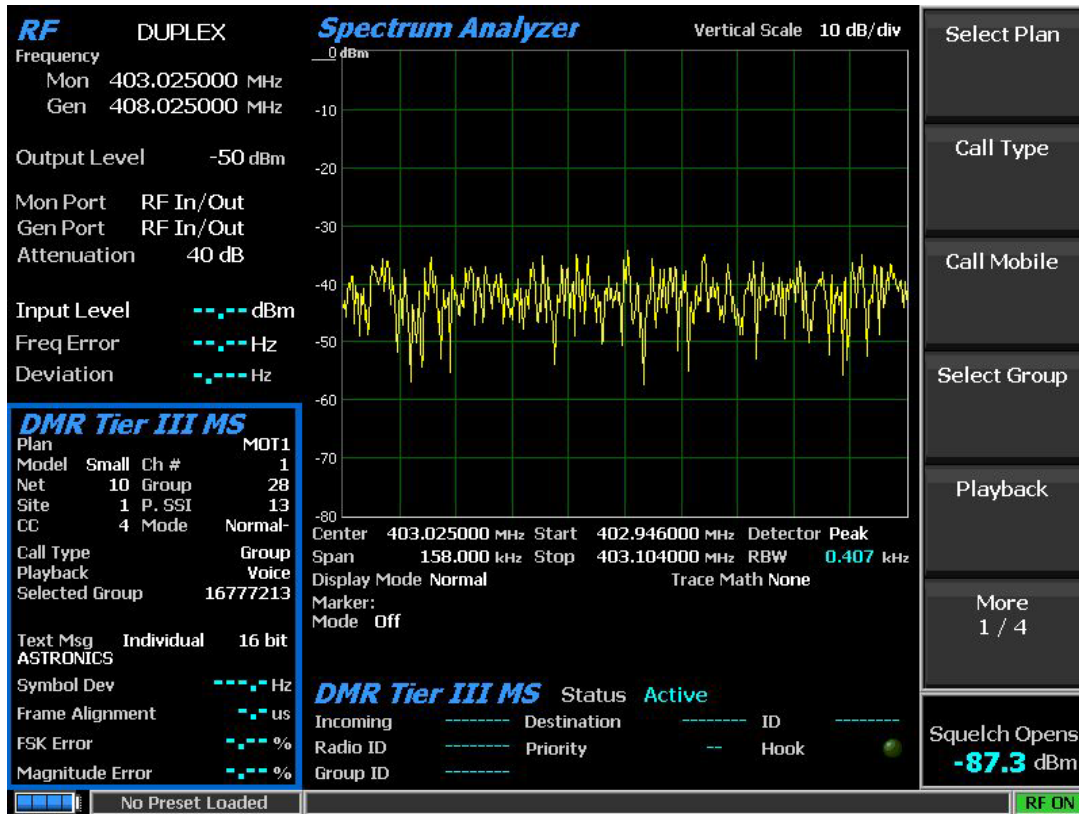
Figure 1 – Main Screen in Duplex Mode After Selecting DMR Tier III MS Test Mode (R8100/R8200/R8600)
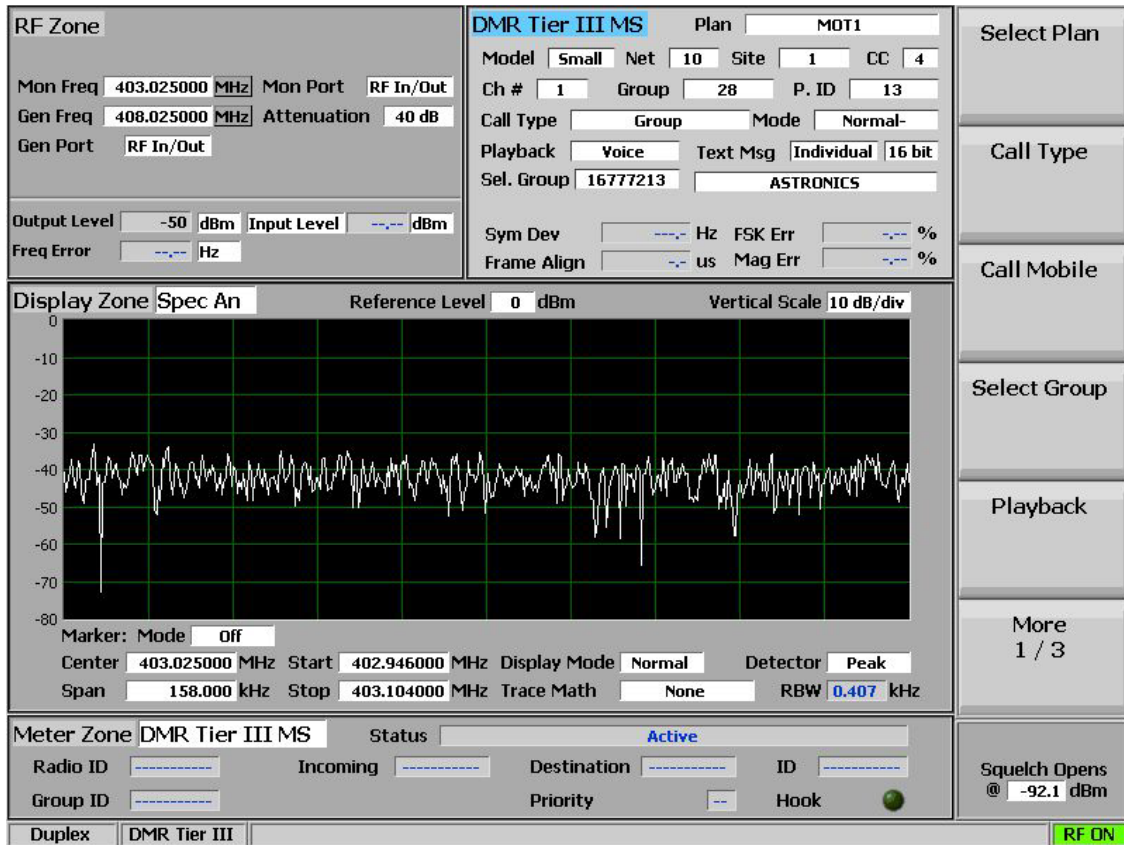
Figure 1a – Main Screen in Duplex Mode After Selecting DMR Tier III MS Test Mode (R8000)

2.1   DMR Transmitter Tests

These tests are performed with the R8x00 in Duplex Mode (see Figure 1 and Figure 1a). While the radio is in transmission, the R8x00 continuously measures the quality of the transmitted 4FSK signal over the 132 symbols (264 bits) that comprise an entire DMR TDMA burst.

The quality measurements are made on each inbound (uplink) data burst as well as each inbound voice burst. Therefore, each inbound voice burst (A to F) of each superframe is measured. The inbound data bursts are measured on the control channel (registration, SDS, DGNA, etc.) as well as on the traffic channel (Push-To-Talk (PTT) release, call clear down, etc.).
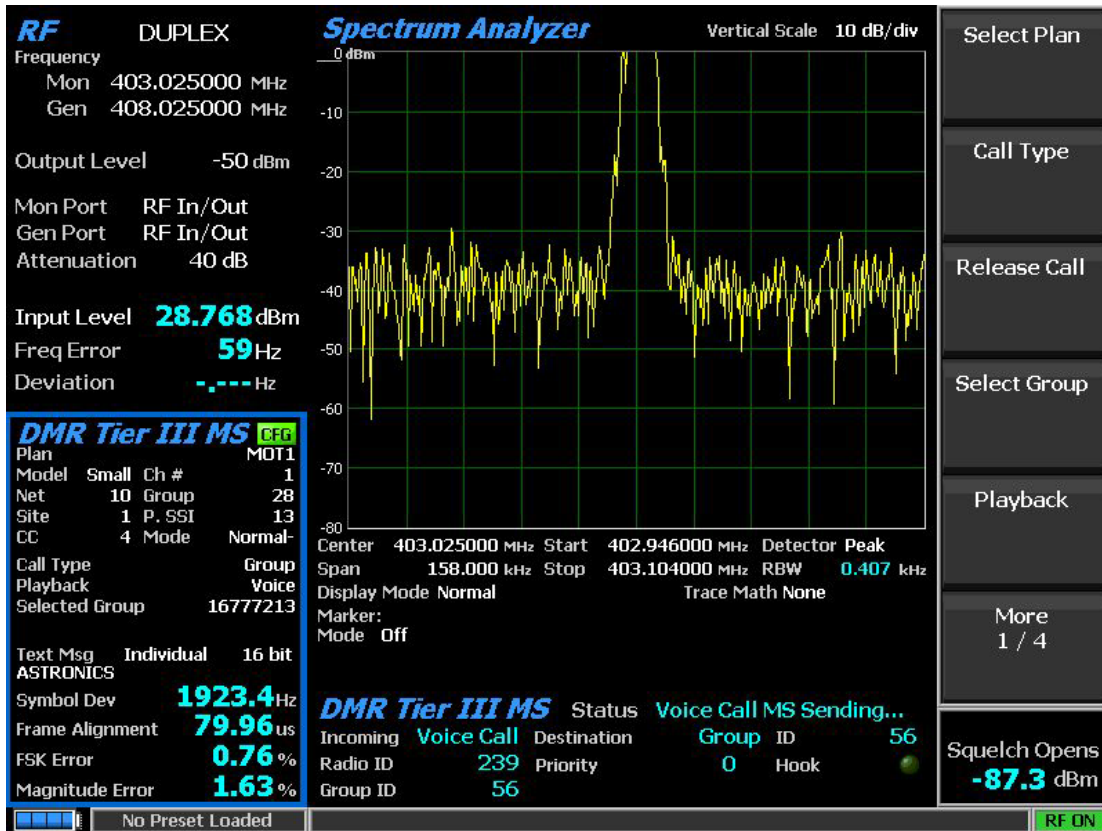
Figure 2 – Zones in Duplex Mode (R8100/R8200/R8600)
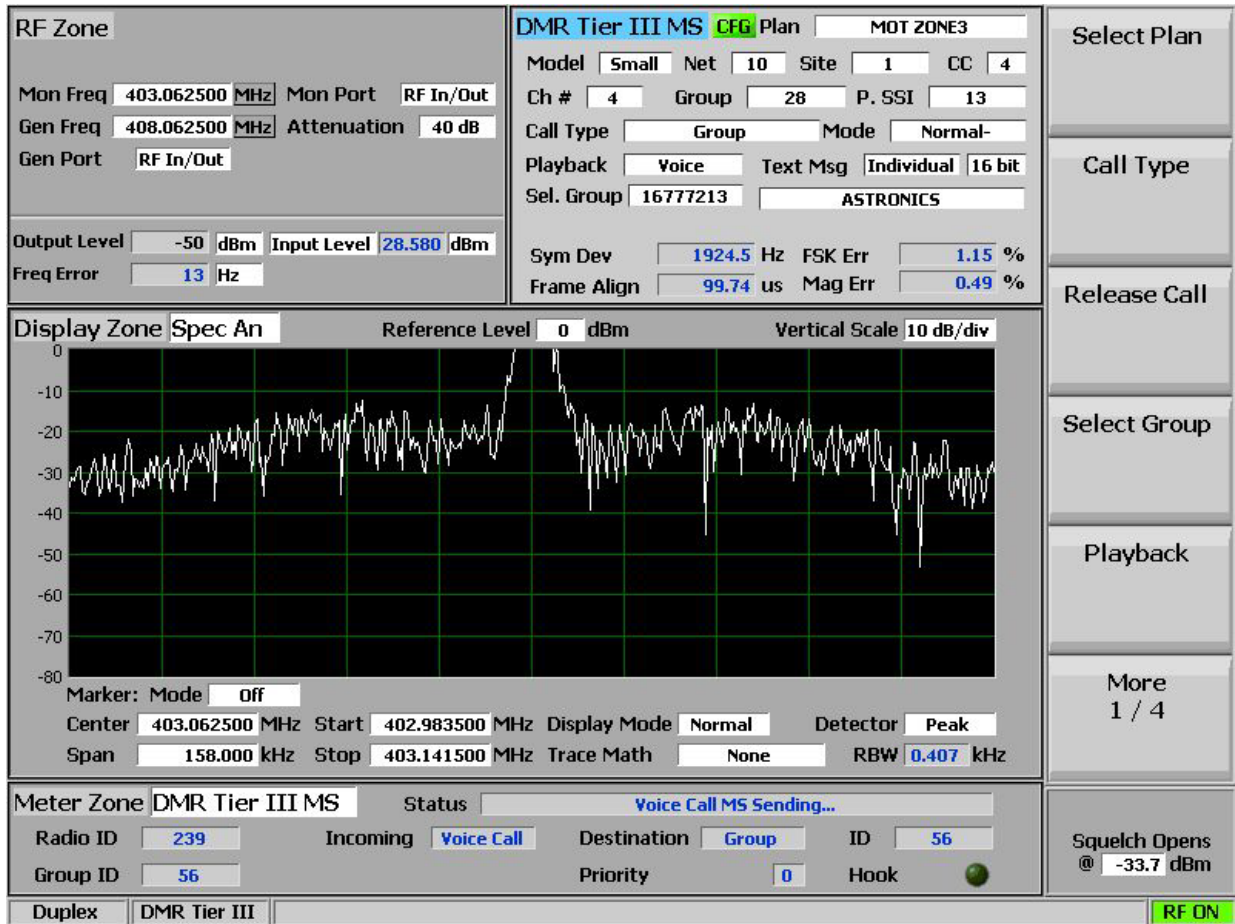
Figure 2a – Zones in Duplex Mode (R8000)

2.1.1 RF Zone

Input Level

Displays the average power in the specified burst of the synchronized TDMA slot of the received signal.

Note: *Although Input Level is used for Squelch, Squelch has no effect on measurement updates.*

Note: *When the RF input power on the RF In/Out port is above +20 dBm (100 mW), the R8x00 uses a broadband power detector for the measurement. The Input Level field in the RF Zone changes to Power Meter to indicate this measurement mode.*

Note: *The TDMA transmission alternates between a used and unused time slot, so the RF Zone field will switch between the two. An unused slot has no power, so the display will flash between Input Level and Power Meter. In this condition, the Input Level reading should be used because null slots can cause the Power Meter indication to read right on or approximately 3 dB less than the power in the used slots.*

Note: *If the switching between two readings is undesirable, changing the Input Source parameter from Auto to Input Level will force the reported reading to Input Level.*

Freq Error

Displays the frequency difference of the received DMR transmission carrier minus the R8x00 Monitor Frequency.

Attenuation

Attenuation in Figure 2 and Figure 2a is not highlighted, which indicates automatic attenuation is disabled, and the user can manually set the attenuation level. When entering DMR Tier III test mode, the default attenuation value is 40 dB. Manual attenuation is preferred for TDMA signals, as automatic attenuation can cause problems. However, automatic attenuation works well for continuous signals.

Note: *For other standard RF Zone settings, see the appropriate sections in the O&M manual. (Reference 1).*

2.1.2   DMR Tier III MS Zone

A portion of the DMR Tier III MS zone displays the network setup the user has configured in the Channel Plan configuration window. The channel plan can be entered for each network programmed on the radio or can be pre-configured and saved to a file for later use.

The following items in the DMR Tier III MS zone display information set in the Channel Plan configuration window, which is explained in detail later.

Each DMR Tier III network is uniquely identified by the following parameters: model type, network ID, site ID, and color code.

The following sections discuss the DMR Tier III MS zone measurement displays.

CFG

When a non-default configuration is in use, a green flag labeled "CFG" is displayed in the DMR Tier III MS zone. Changes to the default configuration should be rare. If testing with a Motorola Capacity Max device, see Appendix 4 – Power User Feature of DMR Tier III Test Mode.

Plan

Displays the name of the saved channel plan in use. If there is no saved channel plan in use, then the field will be dashed (-------------------).

The channel plan is configured under the Channel Plan … soft key settings.

Model

Displays the network model. Network models are identified by one of four size settings: tiny, small, large, and huge.

Note: *The network model selection changes the number of bits available for the Net and Site fields.*

The network model is configured under the Channel Plan … soft key settings.

Net

Displays the network identity. The following lists the net values for each type of model:

>Tiny: value set from 0 to 511

>Small: value set from 0 to 127

>Large: value set from 0 to 15

>Huge: value set from 0 to 3

The network identity is configured under the Channel Plan … soft key settings.

Site

Displays the network site identity. The following lists the site values for each type of model:

>Tiny: value set from 0 to 7

>Small: value set from 0 to 31

>Large: value set from 0 to 255

>Huge: value set from 0 to 1023

The site identity is configured under the Channel Plan … soft key settings.

CC

Displays the four-bit color code (0 to 15) of the synchronized TDMA slot of the received signal transmission. CC is digital ID information equivalent to Continuous Tone Coded Squelch System (CTCSS)/ Private Line (PL) and Continuous Digital Coded Squelch System (CDCSS)/ Digital Private Line (DPL) of analog FM radio systems. Correct CC is required for access to the DMR system.

CC is configured under the Channel Plan … soft key settings.

Ch#

Displays the assigned channel number of uplink/downlink frequencies for the control channel as defined in the radio network configuration for the base station. When the radio is programmed, the user can choose either a fixed channel plan or a flexible channel plan for the device frequencies. The fixed channel plan assigns logical channel numbers calculated from a defined base frequency, from frequency separation between adjacent channels, and from duplex split. The flexible channel plan allows the user to select Tx and Rx frequencies directly for a selected channel number. In either method, the logical channel number for the pair of frequencies in use by the radio for the network control channel must be configured in the channel plan on the R8x00 unit as this will also be used for voice channel testing and will be displayed in the DMR Tier III MS zone.

Note: *The R8x00 does not use the channel number to calculate base station frequencies, but it will supply this value to radios that need it to set the voice frequencies. The actual values of the control channel frequencies must be entered in the channel plan, and the "channel number" defined for the control channel frequencies must also be entered in the channel plan.*

The channel number is configured under the Channel Plan … soft key settings.

Group

Displays the group address. Group address is the default group attached to the R8x00. The Mobile Station (MS) may call this group with a service (talkgroup short data or voice talkgroup call) without having registered this group before. This value is not an individual call ID.

The R8x00 does not list this group ID in the Select Group submenu, but the R8x00 can call the group ID by using the Custom Group ID field to set the same value.

The group address is configured under the Channel Plan … soft key settings.

P. SSI

Displays the private Short Subscriber Identity (SSI) address used as the source ID for individual calls, phone calls, and text messages sent from the R8x00 to the UUT. The MS can also use this ID to call to or send individual text messages.

The private SSI address is configured under the Channel Plan … soft key settings.

Mode

The two base station modes of operation available are normal-aligned and fallback-aligned. Both modes use aligned or offset channel timings.

The difference between normal-aligned and fallback-aligned is that in fallback-aligned mode, the base station loses the backbone connection to the network infrastructure.

The fallback-aligned mode is indicated to the MS because the MS will only reach another MS locally camping in the same BS. MS camping in another BS belonging to the same network will not be reachable. The MS indicates a drop to fallback-aligned mode to the operator on screen or by LED. Normal-aligned indicates the BS has a backbone connection to the network.

BS mode is configured under the Channel Plan … soft key settings.

Call Type

Displays the type of call that will transmit from the R8x00 when the Call Mobile soft key is selected.

The call type is configured in the Call Type soft key drop-down menu.

The following are the available call types:

> Group – Call to selected group number.
>
> Simplex (no Hook) – Call to mobile SSI as private.
>
> Simplex (Hook) – Call to mobile SSI as private, user must accept.
>
> Emergency (Group) – Call to selected group number.
>
> Emergency (Simplex) – Call to mobile SSI.
>
> Ambient – Call to mobile SSI.
>
> Phone Call – Call to mobile using private SSI or phone number as source.
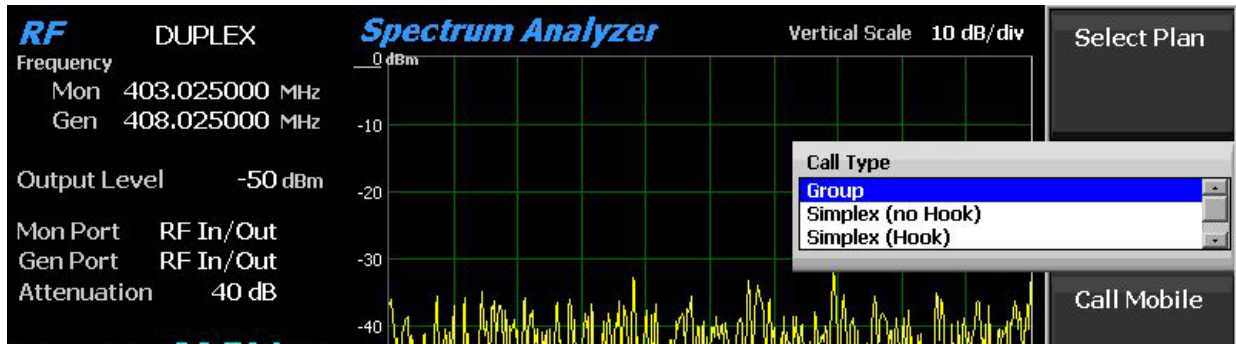
Figure 3 – Call Type

Playback

Displays the selected mode of operation when the R8x00 sends voice data to the UUT.

Playback is configured via the Playback soft key.

The available playback selections are:

Voice – Plays recently recorded voice from radio transmission. If no recorded voice is available, then none will be looped back.

400Hz – Plays continuous 400Hz tone.

800Hz – Plays continuous 800Hz tone.

1 kHz – Plays continuous 1kHz tone.

1.6 kHz – Plays continuous 1.6kHz tone.

2.4 kHz – Plays continuous 2.4kHz tone.

1031 Hz – Plays continuous 1031 Hz tone.

Note: *The 400Hz tone is also used as brief tone divide between "Voice Call Playback" and "Voice Call Hangtime."*
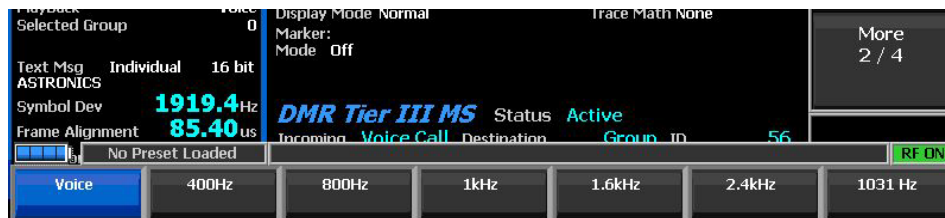
Figure 4 – Playback Selections

Selected Group

Displays the active group number that will be called if the call type is Group or Emergency (Group).

Selected group is configured under the Select Group soft key settings.
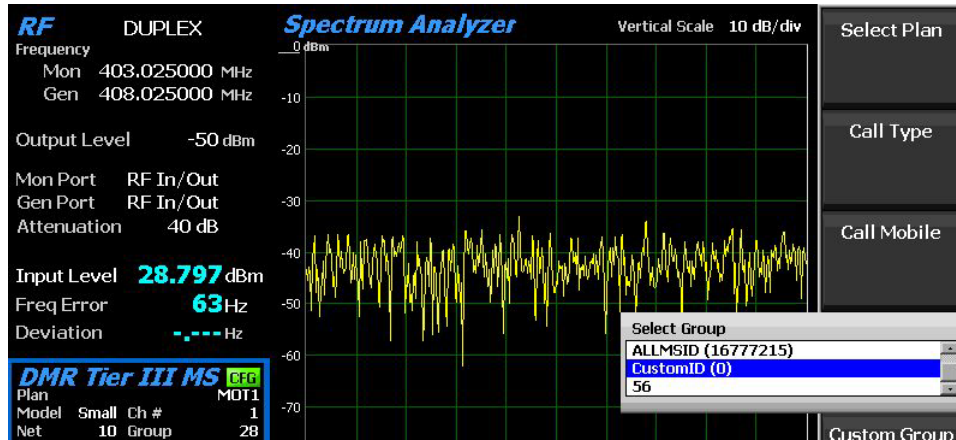
Figure 5 – Selected Group

Text Msg

Displays the current message type, text message format, and the text message that will be sent from the R8x00 to the UUT when the Send Message soft key is selected.

The balance of reported information in the DMR Tier III MS zone are physical layer measurements made while the UUT is transmitting. The following measurements are actively updated while the radio is in Tx operation, but will freeze at the last reported values when radio transmission stops.

Symbol Deviation

Displays the symbol deviation estimated by averaging the normalized frequency deviations at symbol times. The normalized frequency deviation is computed as the ratio of the actual frequency measurement at a given symbol or deviation state to the corresponding symbol value.

For verification, the technician should obtain proper symbol deviation from the manufacturer specifications for the radio under test. The nominal value based on the ETSI Digital Mobile Radio standard is 1944 Hz.

Frame Alignment

When in trunking operation, the radio synchronizes its transmission to the BS transmission in time and frequency, so the radio timing depends on the BS. Frame alignment allows the operator to see the timing of the radio in dependency to the BS transmission. This time offset between the downlink and uplink sync pattern as measured by the R8x00 is called frame alignment. In other words, the frame alignment specifies the time offset between BS transmission and MS transmission and reflects the MS capability to synchronize in time. Measuring frame alignment is important in trunking because if the MS transmits too early or too late, it may disturb the time slot boundaries, and this disturbs another MS transmitting in the next time slot. These timeslot boundaries are also specifying the limits. There is a 2.5 ms guard period between consecutive time slots. The MS should not exceed that.

The frame alignment measurement unit is microSeconds (µS).

FSK Error

Displays the root mean squared (rms) spread in percentage error as computed from the measured symbols to the calculated symbol deviation measurement in the specified burst of the synchronized TDMA slot of the received signal.

Magnitude Error

Displays the average envelope magnitude over the burst interval subtracted from the envelope magnitude of the sample at the decision point in percentage.

2.1.3 DMR Tier III MS Zone Soft Keys

The following sections describe the DMR Tier III soft keys.

Select Plan

Provides a drop-down list of prebuilt channel plans that are already saved on the UUT. Selecting one of the available plans will immediately load that plan and reconfigure the mimic network to operate using the selected plan.

Call Type

Opens a drop-down menu with a list of calls that can be initiated from the R8x00 to the UUT.

The following are the available call types:

> Group – Call to selected group number.
>
> Simplex (no Hook) – Call to mobile SSI as private.
>
> Simplex (Hook) – Call to mobile SSI as private, user must accept.
>
> Emergency (Group) – Call to selected group number.
>
> Emergency (Simplex) – Call to mobile SSI.
>
> Ambient – Call to mobile SSI.
>
> Phone Call – Call to mobile using private SSI or phone number as source.

Call Mobile

Selecting this item immediately initiates a call based on the Call Type selection.

Select Group

Opens a drop-down menu with a list of group IDs that can be selected for a Group call type.

Note: *Only visible when the call type is Group.*

Custom Group ID

The user can input a group ID value here and then when the Call Mobile soft key is pressed, the R8x00 will send a call to the set group ID.

Note: *Only visible when the selected group is "CustomID(#)."*

Phone Number

Selecting this item will open a data entry field to enter the source phone number when a Phone Call is initiated at the R8x00.

The number is used for calls initiated by the R8x00 to the UUT and for calls initiated by the UUT to the R8x00. When placing a Phone Call at the UUT, the number being called must be set in the Phone Number field to allow the call to be accepted and completed by the R8x00.

Note: *Only visible when the call type is Phone Call.*

Phone Call Type

Opens a drop-down menu to set the type of phone call that will be placed when Phone Call is selected as the call type. The UUT must be configured to receive the selected type of phone call.

The available Phone Call Type menu choices are:

- PSTN
- Line
- PABX
- Dispatcher

A phone call simulates a voice call to or from a terminal of a Public Switched Telephone Network (PSTN) or Private Automatic Branch eXchange (PABX) network. The network is connected via a gateway to the DMR network. If the mobile initiates a phone call, then it addresses the PSTN- or PABX- terminal.

The DMR TIERIII test mode accepts the phone call if the PSTN- or PABX network address sent by the mobile matches the "Phone Number" configured by user.

The test mode also always accepts calls to the Private SSI set in the Channel plan and to the dispatcher gateway.

Normally, calls must be 4 characters or more.

See ETSI TS 102 361-4 V1.11.1 Chapter E.3.7. "Calls to Line Connected Destinations" for more information on destination addresses.

Note: *Phone Call Type is only visible when the call type is Phone Call.*

Playback

Selecting this item will open selection of options for voice call payload to radio.

Note: *This selection can be changed while a call is active.*

The available selections are:

> Voice – plays recently recorded voice from radio transmission. If no recorded voice is available, then none will be looped back.

> 400Hz – plays continuous 400Hz tone

> 800Hz – plays continuous 800Hz tone

> 1 kHz – plays continuous 1kHz tone

> 1.6 kHz – plays continuous 1.6kHz tone

> 2.4 kHz – plays continuous 2.4kHz tone

> 1031 Hz – plays continuous 1031Hz tone

Note: *The 400Hz tone is also used as brief tone divide between "Voice Call Playback" and "Voice Call Hangtime."*

Message Type

This parameter has a drop-down menu with the choice of "Status" or "Text" message to be sent to the UUT.

Text message sends a user settable string to UUT.

Status message sends a numeric value to UUT. This may show up on the UUT as a notification.

Based on message type selection, additional soft keys will be available.

Message Destination

This parameter provides a drop-down selection of "Individual" or "Group."

When "Individual" is selected, the message will be sent to the Radio ID that is currently registered.

When "Group" is selected, the message will be sent to the "Group" ID selected under the Select Group soft key drop-down menu.

Note: *Messages cannot be sent to the default All Call groups. Ensure a valid Group ID is selected.*

Text Message

Text Message is a field that allows the user to create a message to send to the UUT. The message is pre-loaded with a default of "ASTRONICS," but this can be replaced by a user defined message.

Note: *Only visible when the message type is "Text."*

Save the setup as a preset to keep a user defined message.
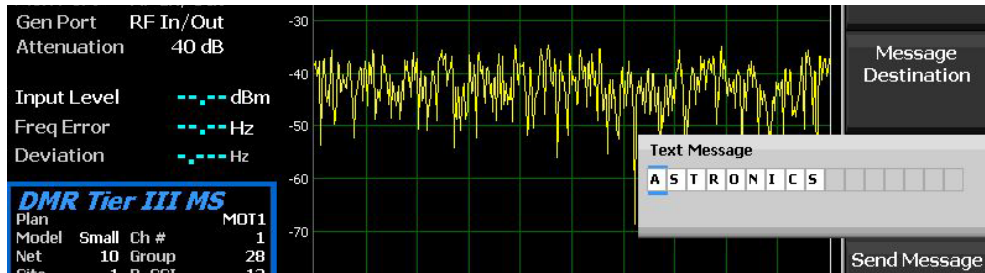
Figure 6 – Text Message

Status Message

This parameter sets a numeric value to send to the UUT. The value can be set from 0 to 99.

Note: *Only visible when the message type is "Status."*

Send Message

Sends wither a text message or status message. When the Send Message soft key is selected, the R8x00 will transmit the current "message type" message to the UUT.

Text Message Format

Figure 7 – Text Message Format

Selects the choice of text messages as 8 bit or 16 bit. 16 bit is the recommended format and is the default.

Note: *Only visible when the message type is "Text."*

Channel Plan Configuration

Selecting the Channel Plan … soft key opens the Channel Plan configuration window (see Figure 8 and Figure 8a).
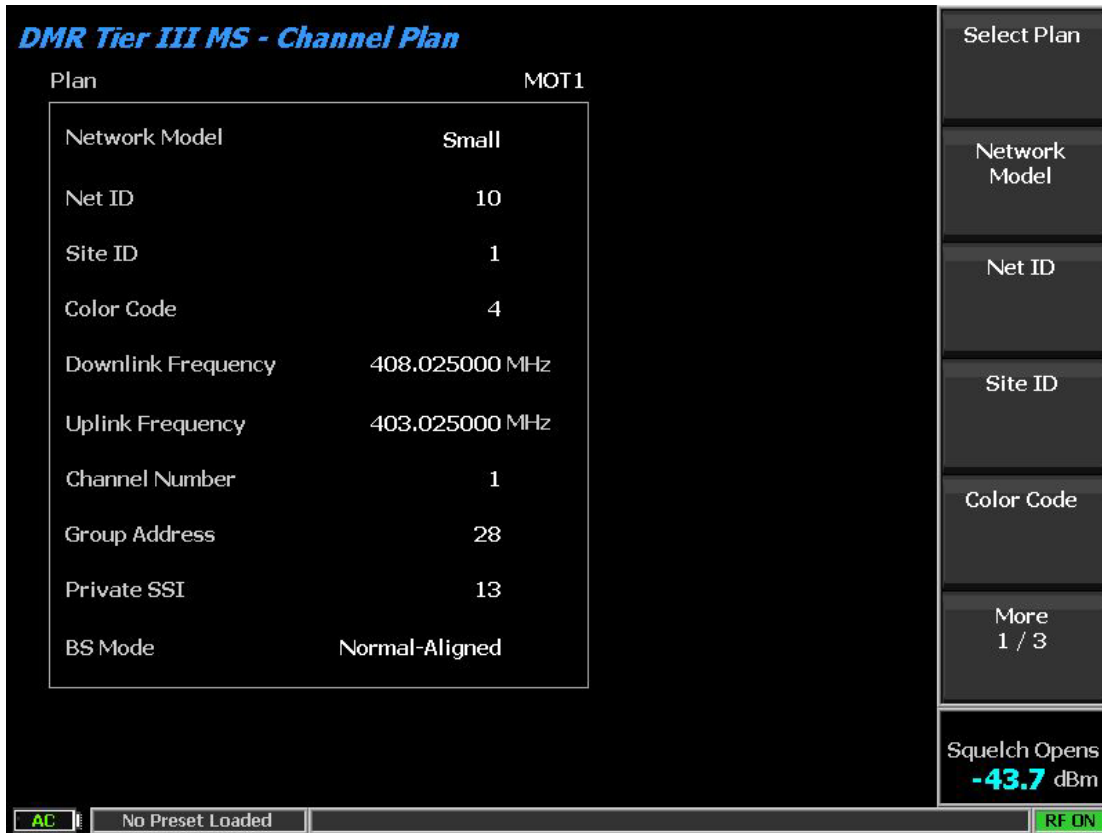
Figure 8 – Channel Plan Configuration Window (R8100/R8200/R8600)
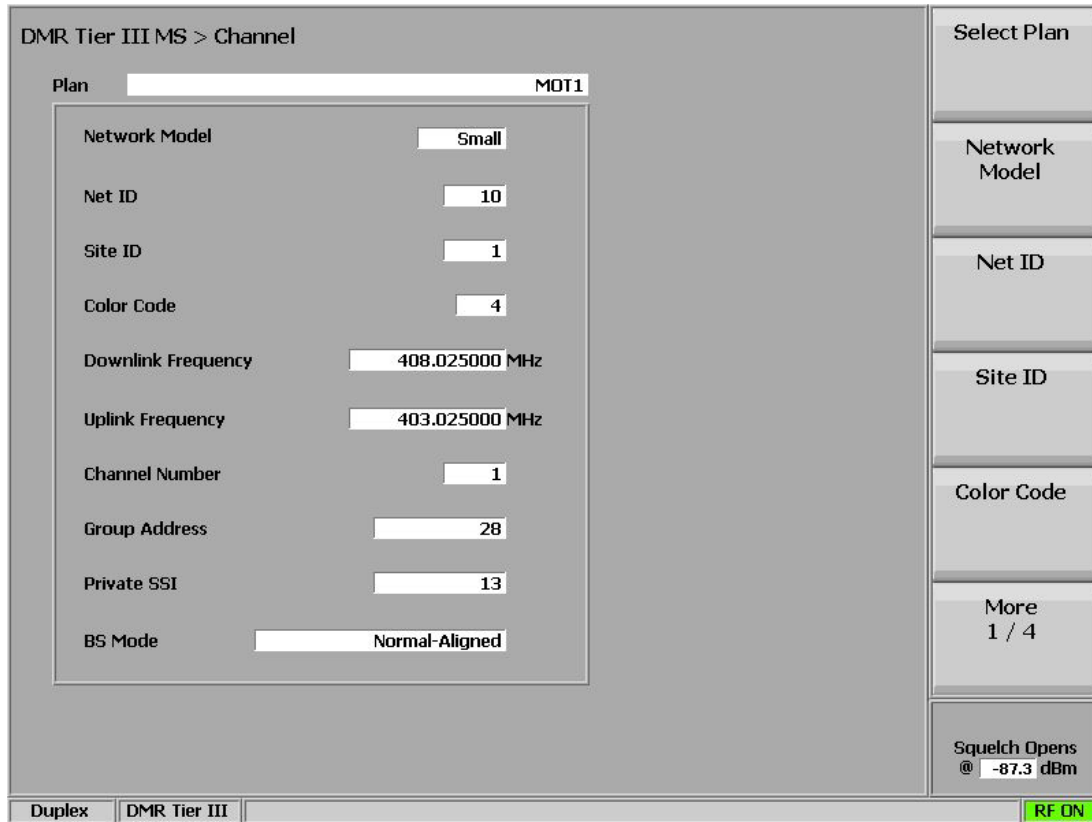
Figure 8a – Channel Plan Configuration Window (R8000)

The Channel Plan configuration window is used to configure the network settings required to match the live network settings that the UUT is programed to operate on.

The following sections describe the Channel Plan … soft keys:

Select Plan (Channel Plan Submenu)

Provides a drop-down list of prebuilt channel plans saved on the UUT. Selecting one of the available plans will immediately load that plan and reconfigure the mimic network to operate using the selected plan.

Network Model (Channel Plan Submenu)

Network models are identified by one of four size settings: tiny, small, large, and huge.

Note: *The Network Model selection changes the number of bits available for Net ID and Site ID.*

Net ID (Channel Plan Submenu)

Network identity. The following lists the net ID values for each type of model:

        Tiny: value set from 0 to 511

        Small: value set from 0 to 127

        Large: value set from 0 to 15

        Huge: value set from 0 to 3

Site ID (Channel Plan Submenu)

A particular site within a network. The following lists the site ID values for each type of model:

        Tiny: value set from 0 to 7

        Small: value set from 0 to 31

        Large: value set from 0 to 255

        Huge: value set from 0 to 1023

Color Code (Channel Plan Submenu)

This field displays the four-bit color code (0 to 15) of the synchronized TDMA slot of the received signal transmission. CC is digital ID information equivalent to CTCSS/PL and CDCSS/DPL of analog FM radio systems. Correct CC is required for user access to the DMR system.

Downlink Frequency (Channel Plan Submenu)

Downlink frequency is the base station or repeater transmission frequency value that the radio test channel is configured to receive the control channel on. BS to MS frequency in MHz.

Uplink Frequency (Channel Plan Submenu)

Uplink frequency is the base station or repeater receiver frequency value that the radio test channel is configured to transmit the control channel on. MS to BS frequency in MHz.

Channel Number (Channel Plan Submenu)

Displays the channel number (as defined in the UUT) of uplink and downlink frequencies for the control channel in the network configuration. The radio channel can be configured as either a fixed channel plan or a flexible channel plan for the device frequencies. In either method, Channel Number sets the logical channel number for the pair of frequencies in use by the radio for voice channel operation. The R8x00 will use the same frequencies for both the control channel and the voice channel. Therefore, the logical channel number must be the same number assigned for the control channel in the radio under test.

Group Address (Channel Plan Submenu)

Group address is the default group attached in the DLL. The MS may call this group with a service (talkgroup short data or voice talkgroup call) without having registered this group before. This value is NOT an individual call ID.

Group address is set in the Channel Plan configuration window.

Private SSI (Channel Plan Submenu)

The Private SSI address is the ID used as the source ID for individual calls, phone calls, and text messages sent from the R8x00 to the UUT. The MS can also use this ID to call to or to send individual text messages.

Private SSI is set in the Channel Plan configuration window.

BS Mode (Channel Plan Submenu)

The two base station modes of operation available are normal-aligned and fallback-aligned. Both modes use aligned or offset channel timings.

The difference between normal-aligned and fallback-aligned is that in fallback-aligned mode, the base station loses the backbone connection to the network infrastructure.

The fallback-aligned mode is indicated to the MS because the MS will only reach another MS locally camping in the same BS. MS camping in another BS belonging to the same network will not be reachable. The MS indicates this condition to the operator on screen or by LED. Normal-aligned indicates the BS has a backbone connection to the network.

Save Plan As (Channel Plan Submenu)

This selection opens an edit window for the user to type in a name for the currently configured channel plan and to save to local memory.

Save As Selected Plan (Channel Plan Submenu)

Saves the currently configured channel plan to local memory, overwriting the currently selected plan name.

Delete Plan (Channel Plan Submenu)

Opens the current list of available channel plans in local memory. The user can then select a plan to delete from the list.

Import Plan (Channel Plan Submenu)

Visible when a USB drive is connected to an R8x00 USB port and a set of channel plans are available on the USB drive. The soft key opens the current list of available channel plans on the USB drive that can be imported to the local memory, either one at time or all at once.

Export Plan (Channel Plan Submenu)

Visible when a USB drive is connected to an R8x00 USB port. The soft key opens the current list of available channel plans in local memory that can be exported to the USB drive, either one at time or all at once.

DGNA …

DGNA is a method to add groups to the radio over the air. There are two different methods to accomplish this and not all radio manufactures support DGNA.

The two methods are:

1) DGNA Address Mode

    a. The mode permits up to fifteen 24-bit dynamic talkgroup addresses to be assigned.

    b. Currently supported by Tait radios.

2) DGNA Alias Mode

    a. This mode permits one 24-bit dynamic talkgroup address and an associated alias text string of up to 21 unicode characters.

    b. Currently supported by Motorola (**Note:** *Use Address Type "Device" for Moto*).

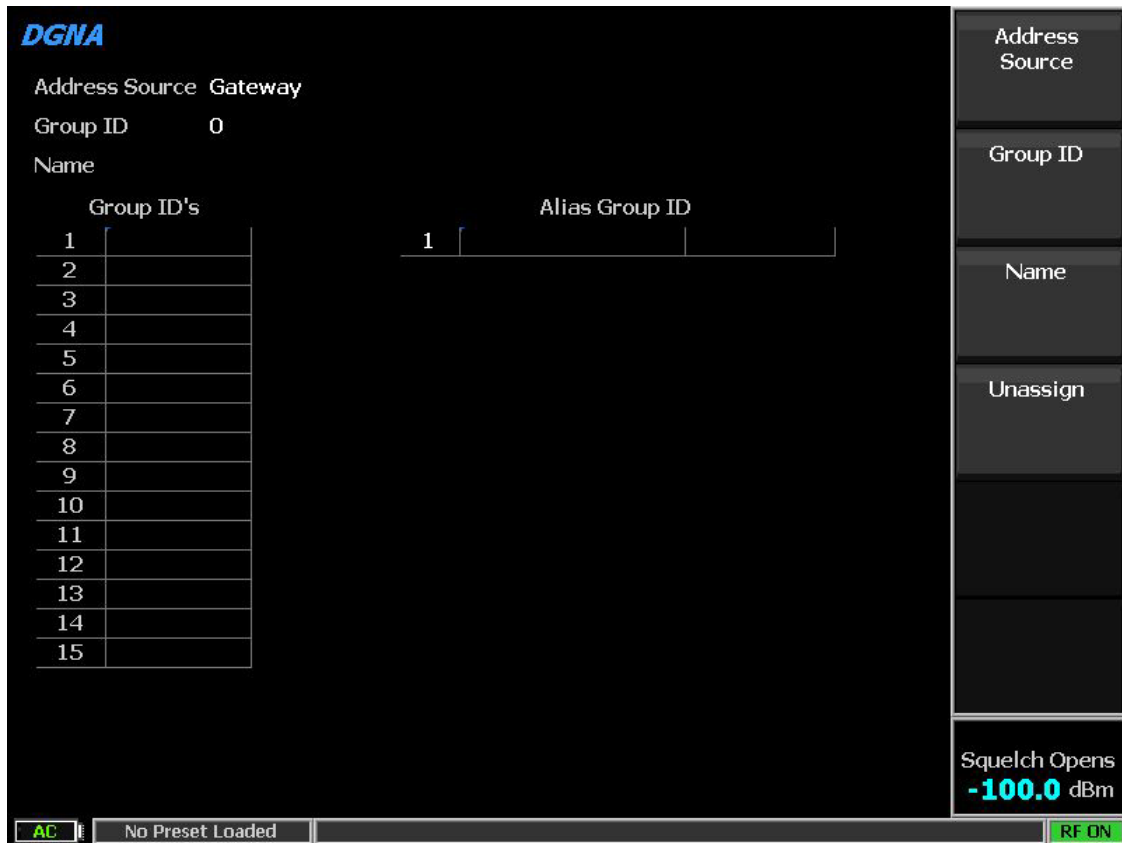Selecting the DGNA … soft key opens the DGNA configuration window (see Figure 9 and Figure 9a).

Figure 9 – DGNA Configuration Window (R8100/R8200/R8600)

Figure 9a – DGNA Configuration Window (R8000)

Depending on which method of DGNA is available for the radio, the available soft keys are used differently. The following sections describe the available soft keys:

Address Source (DGNA Submenu)

Used to select Gateway or Device as the source ID for the DGAN command sent to the UUT.

Note: *For Motorola Devices, Address Source must be set to "Device" for DGNA to operate.*

Group ID (DGNA Submenu)

Sets a group ID number. This value is used for both Address Mode and Alias Mode. Once a value is entered, the Assign soft key is displayed.

Name (DGNA Submenu)

Sets the alias name for the Alias Mode only. If a name is entered in this field, then when the Assign key is selected, the R8x00 will send a command to set the Alias Group SSI. If no name is configured, then the Assign key will send the value to the Address Group SSI list.

Assign (DGNA Submenu)

Selecting the Assign soft key causes the R8x00 to send a dynamic group ID to the UUT. The mode of send value will depend on use of *Name* above. If a name is entered, then the Alias Group SSI will be sent. If no name value is entered, then an address Group ID will be sent.

Unassign (DGNA Submenu)

This soft key is displayed after a dynamic ID is assigned. Using the Unassign soft key will remove the dynamic address from the UUT.

When the UUT supports the DGNA Address Mode, then use ONLY the Group SSI key to enter a desired use value. When the value is entered, an Assign soft key will appear that when pressed, will move the value to the column of assigned groups and transmit the group ID to the radio. Later entering the same value at Group SSI will bring up an Unassign soft key to remove a value.

When the UUT supports the DGNA Alias Mode, first use the Name soft key to create an alias name that is placed into the Name slot of the Alias Group SSI. Then use the Group SSI key to assign a group number. Once number is created, the Assign soft key will appear. Select the Assign soft key to send the alias name and group number to the radio.

The value can be removed by setting Group SSI to same value and selecting the Unassign soft key.

Radio Test …

Opens a GUI menu with access to two built-in test features and a test results page that can be output to a USB storage device.

Select Display

Opens the Tx Test, Rx Test, or Test Results windows.

The Tx Test window is seen in Figure 10 and Figure 10a.

Figure 10 – Tx Test (R8100/R8200/R8600)

Figure 10a – Tx Test (R8000)

Tx Test places an Ambient Call to the UUT to start radio transmission. Once the UUT is transmitting, the test mode will average the measurement results for the configured number of burst samples. The default is 100 burst samples.

Note: *The R8x00 uses an Ambient Call to attempt to start radio transmission. If "Ambient" or "Remote Monitor" is not enabled for the UUT, the user can also press and hold the PTT button on the radio after the Tx Test > On soft keys are selected. **Important:** When using the manual PTT for the test, the user must hold the PTT button on the radio until the total number of burst samples is reached on screen.*

The Rx Test window is seen in Figure 11 and Figure 11a.
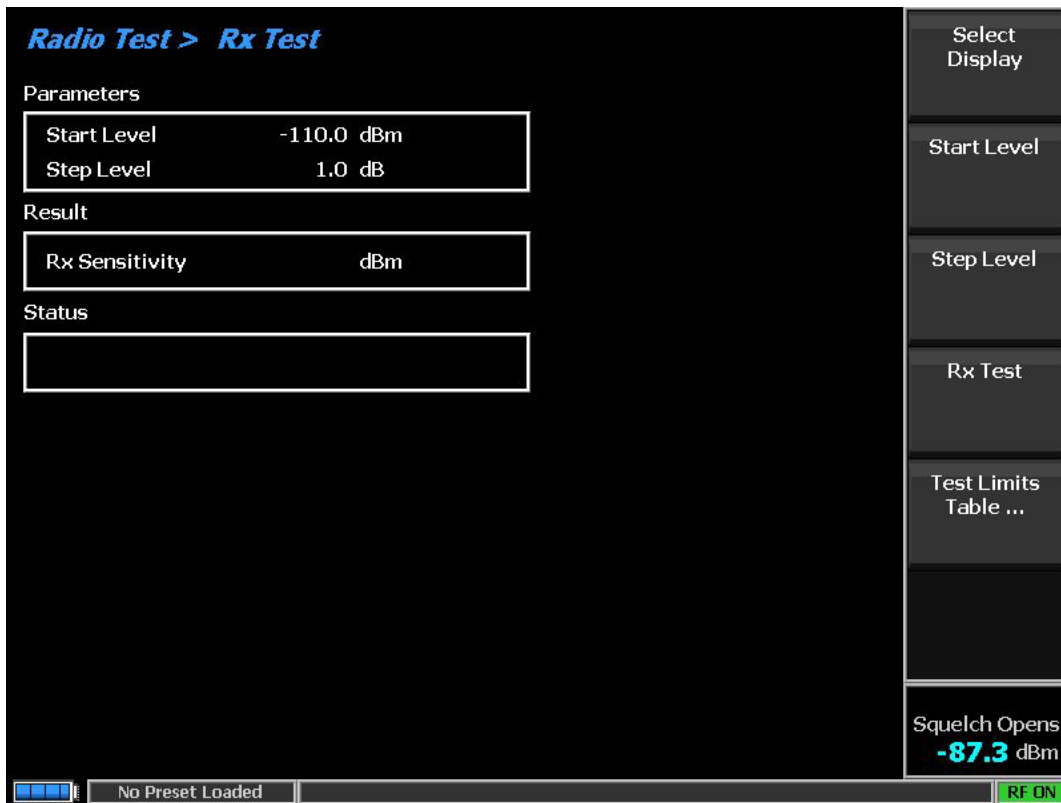
Figure 11 – Rx Test (R8100/R8200/R8600)

Figure 11a – Rx Test (R8000)

Rx Test measures UUT sensitivity. When the Rx test is started, the R8x00 sends paging messages to the UUT while adjusting the output power down in the defined step levels. Each time the UUT responds to the R8x00, the test will take one step lower. When the radio no longer responds, the Rx Test window will show the last good transmission level.

Start Level

Sets the power output level that Rx test will start at. Default is -110.0 dBm.

Step Level

Sets the power amount the test will step down at each iteration. Default is 1.0 dB.

Rx Test

Select Rx Test and press the On key to start testing.

Use the Select Display soft key to navigate to the Test Results window (see Figure 12).
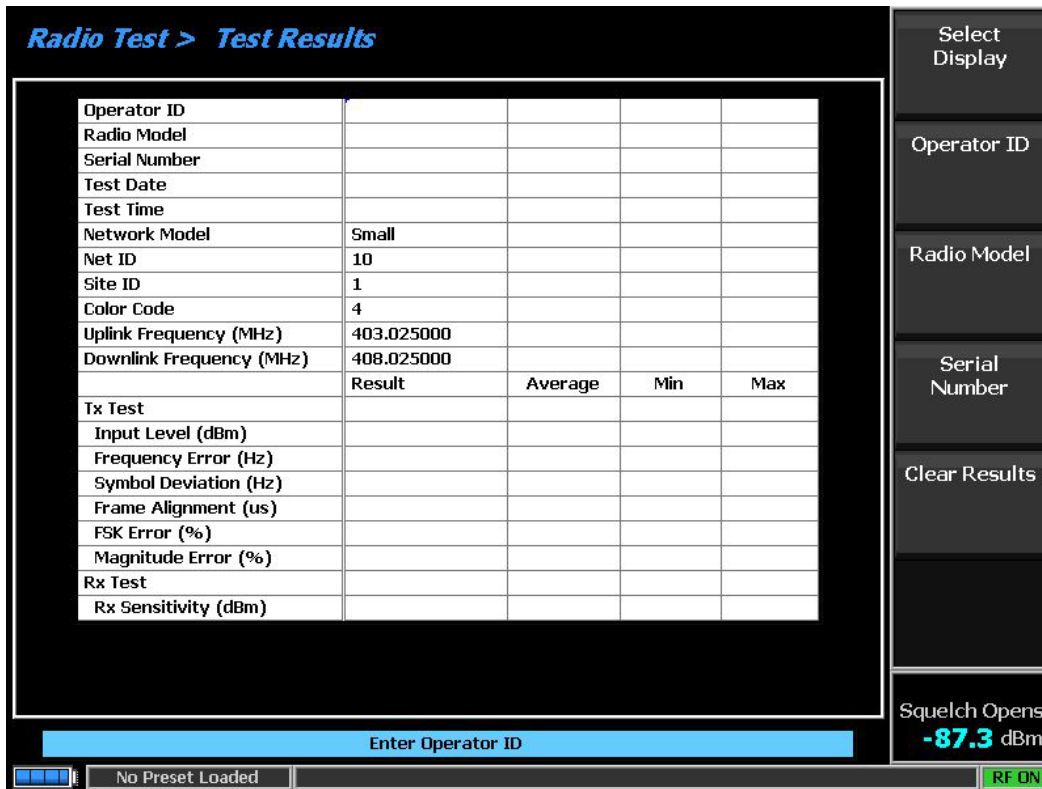
Figure 12 – Test Results (R8100/R8200/R8600)
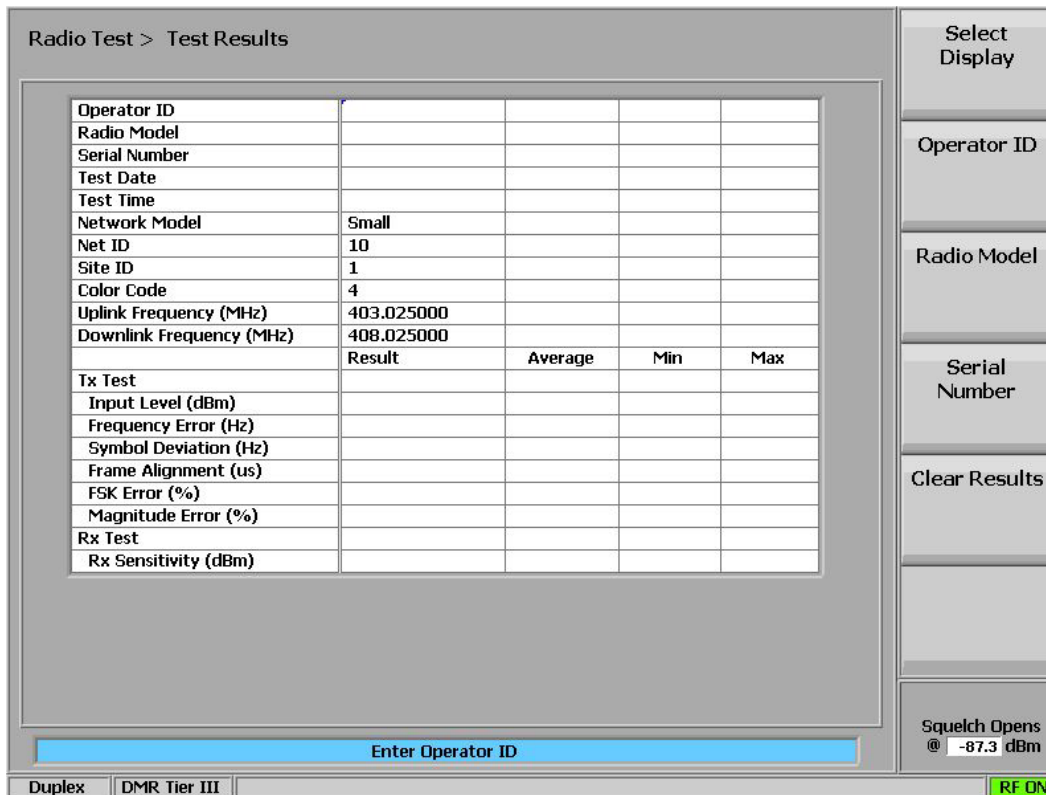
Figure 12a – Test Results (R8000)

The Test Results window collects the measurements made while executing the Tx test and Rx test. The information is arranged in a tabular format with open entries for the following inputs from the user. When the USB drive is connected to the R8x00, the User will be prompted to enter the missing information. Only after values are entered in Operator ID, Radio Model and Serial Number fields will the user be able to export the results to the USB drive.

Operator ID

Name or ID information representing the technician performing the test.

Radio Model

Can be actual model number or combination of manufacturer and model number.

Serial Number

UUT serial number.

Clear Results

Erases all displayed measurements.

Export Results

This soft key is only visible after all fields have values and a USB drive is connected. When selected, the system will output two files to the USB drive. These files will be named based on the radio model, serial number, date, and time and will be located on the USB drive at ASTRONICS\DMRTier3\TestResults. One file will be a .csv text file of the data in the Test Results screen. The other file will be a bit map image of the Test Results screen only (no soft keys).

Test Limits Table …

Opens the Test Limits Table window that is used to set limits for both the test results report and the Bar Chart window found in the Display Zone.

See Figure 13 for an example of the Test Limits window.
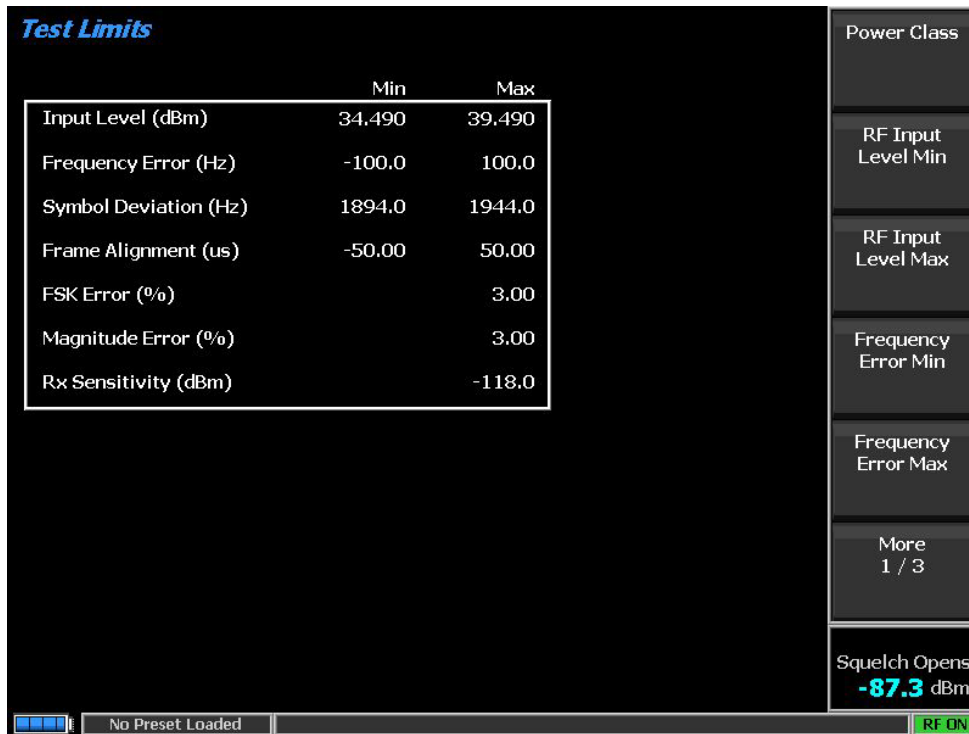
Figure 13 – Test Limits

See the following sections for the available test limit settings:

Power Class (Test Limits Table Submenu)

Selection of power classes as defined by the DMR standard.

The following class levels are available:

> 1W, 5W, 10W, 25W and 40W.

Use of this value will adjust the RF Input Level Min and RF Input Level Max fields to the values defined in the standards document.

RF Input Level Min and Max (Test Limits Table Submenu)

Resolution 0.1 dBm. Can be set by selection of Power Class or can be manually entered here.

Frequency Error Min and Max (Test Limits Table Submenu)

Resolution 0.1 Hz.

Symbol Deviation Min and Max (Test Limits Table Submenu)

Resolution to 1 Hz.

Frame Alignment Min and Max (Test Limits Table Submenu)

Resolution to 0.001 μs.

FSK Error (Test Limits Table Submenu)

Resolution to 0.01 %.

Magnitude Error (Test Limits Table Submenu)

Resolution to 0.01 %.

Rx Sensitivity (Test Limits Table Submenu)

Resolution to 0.1 dBm.

2.1.4   Display Zone

Select Display (Display Zone Submenu)

While in Duplex Mode the following Display Zones are available and active:

- Spectrum Analyzer
- Eye Diagram
- Power Profile
- Distribution Plot
- Analysis Details
- Bar Charts
- Transaction Details

Each of these displays show information about the RF signal being received by the R8x00. See the following sections for examples of each window.
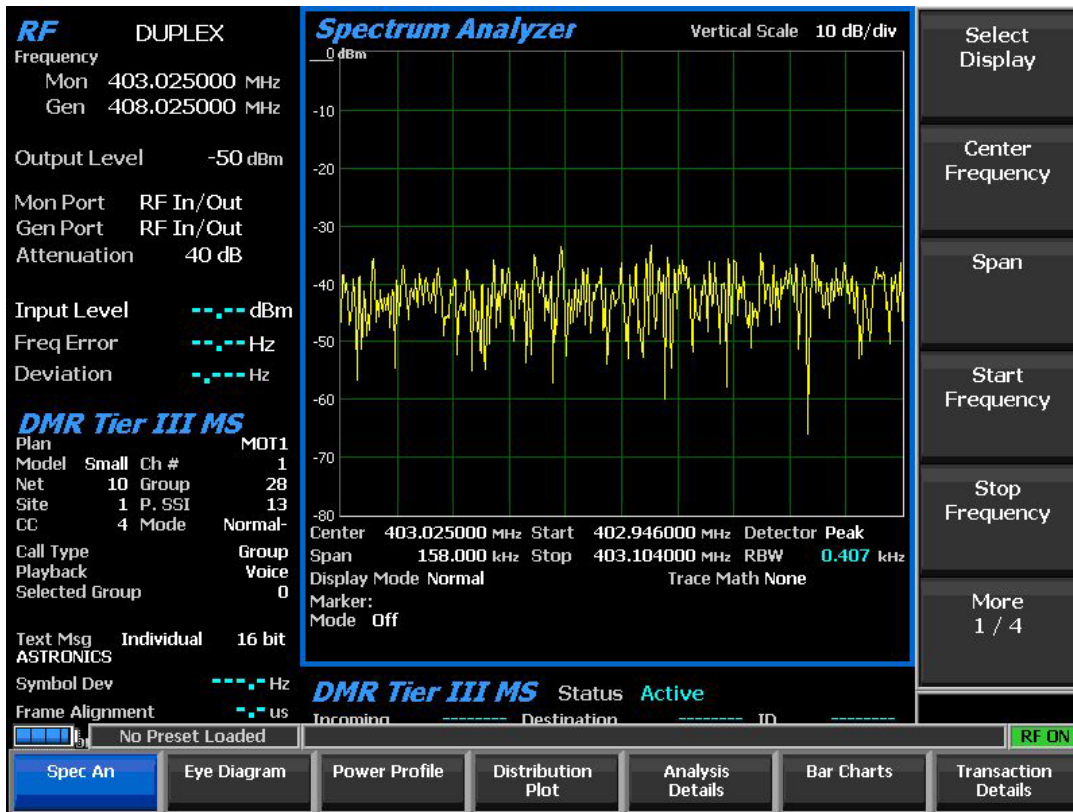
Figure 14 – Display Zone Selections and Spectrum Analyzer
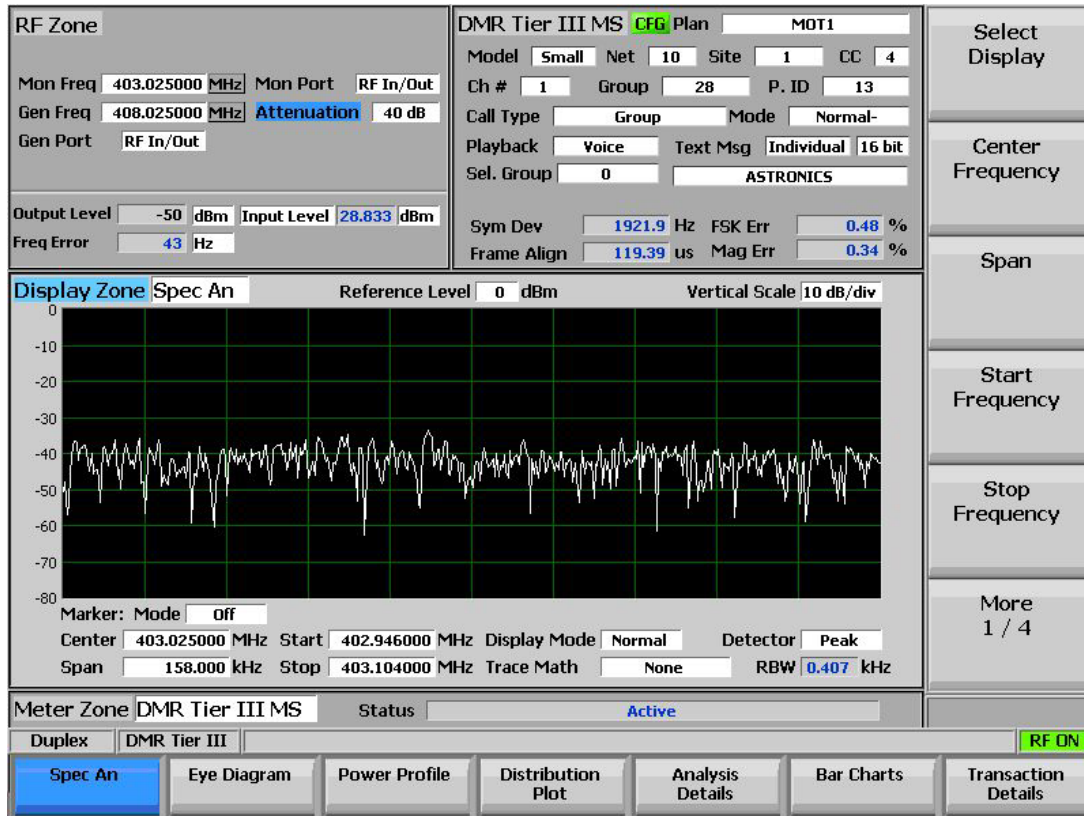
Figure 14a – Display Zone Selections and Spectrum Analyzer (R8000)

Spectrum Analyzer (Display Zone Selection)

See the full O&M (Reference 1) for details on standard controls of the spectrum analyzer.

Eye Diagram (Display Zone Selection)

The Eye Diagram provides a visual representation of the frequency shifts from one symbol to the next where time is displayed on X-axis and deviations on the Y-axis.

The Display Mode field switches the display between Normal and Fade Away.

There is a significant delay when switching to Fade Away to fill in buffer.

Figure 15 – Eye Diagram (R8100/R8200/R8600)

Figure 15a – Eye Diagram (R8000)

Power Profile (Display Zone Selection)

The power profile display provides a power versus time plot of the transmitter for voice slot only. The scaling and position of the vertical power axis can be adjusted to inspect greater range or detail. Display functions and markers are available for advanced analysis. It is not possible to "see" the empty slot as this test mode is focused on radio Tx only.

Note: *See the Technical Specification: ETSI TS 102 361-1 Electromagnetic compatibility and Radio spectrum Matters (ERM); Digital Mobile Radio (DMR) Systems; Part 1: "DMR Air Interface (AI) protocol," Burst timing.*
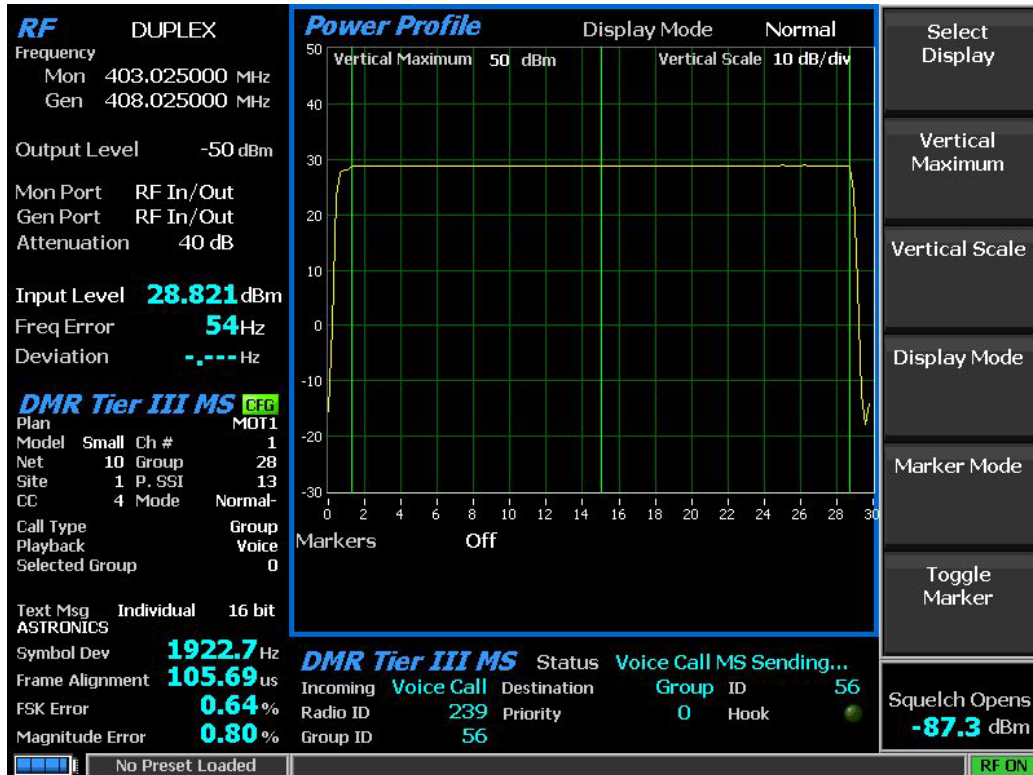
Figure 16 – Power Profile

Vertical Maximum (Power Profile Submenu)

This key adjusts the maximum level for the vertical scale of the display (top line) from -120 dBm to +60 dBm in 1 dB increments.

Vertical Scale (Power Profile Submenu)

This key selects the vertical scale resolution for the display's major grid lines from 1 dB/div to 10 dB/div via a horizontal soft key list.

Display Mode (Power Profile Submenu)

This soft key selects the display presentation with the following horizontal menu choices:

Normal selection allows the display to update continuously.

Freeze selection provides a snapshot of the current display indication and stops additional updates.

Max Hold selection allows the display to retain the highest peak signal amplitudes measured during successive sweeps.

Average selection displays signal amplitudes as a rolling average of the peak amplitudes measured on each successive sweep. The average consists of one to five sweeps, shown beside the Mode indication.

Marker Mode (Power Profile Submenu)

This key provides display marker control via a horizontal soft key menu. Markers can be turned off or on with a choice of numeric readout for the signal measurements. "Absolute" provides actual peak readings while "Delta" measures the relative difference of both power and time between the markers. "Delta dBm" is a line marker that shows difference in power only.

Toggle Marker (Power Profile Submenu)

This key cycles through the available markers to select the active one (yellow) for positional adjustment on the display. The active marker is moved using the Left/Right (◄►) cursor control buttons.

Distribution Plot (Display Zone Selection)

The Distribution Plot depicts the spread of symbols over time about each center. There are no controls for the distribution plot.
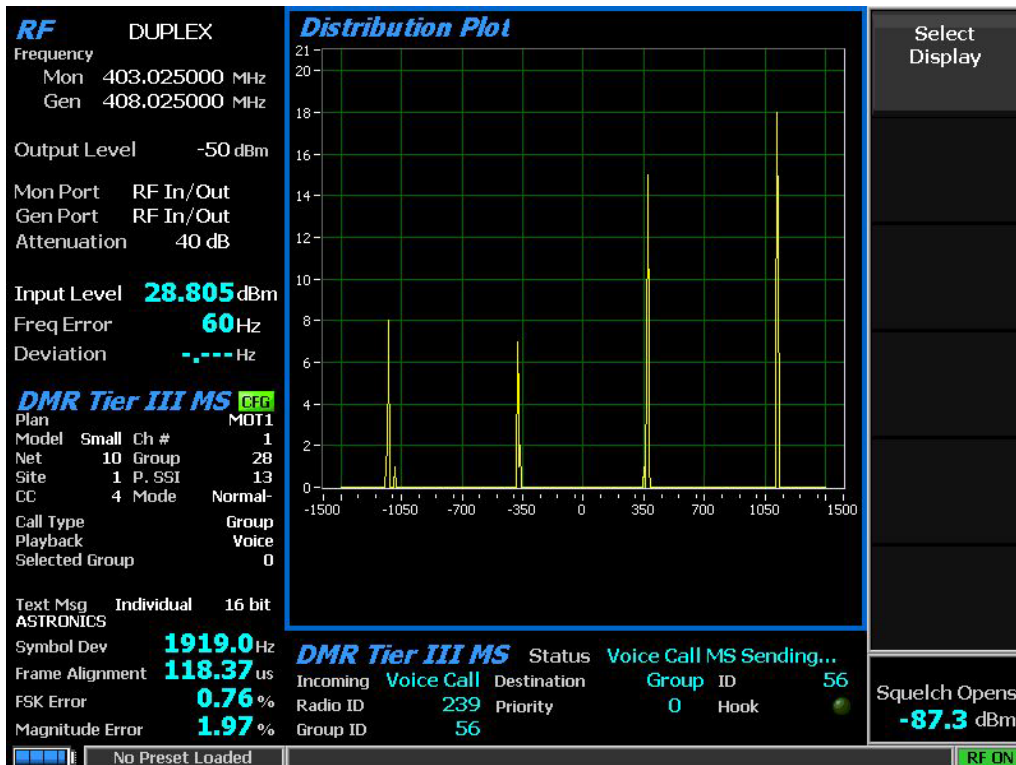
Figure 17 – Distribution Plot
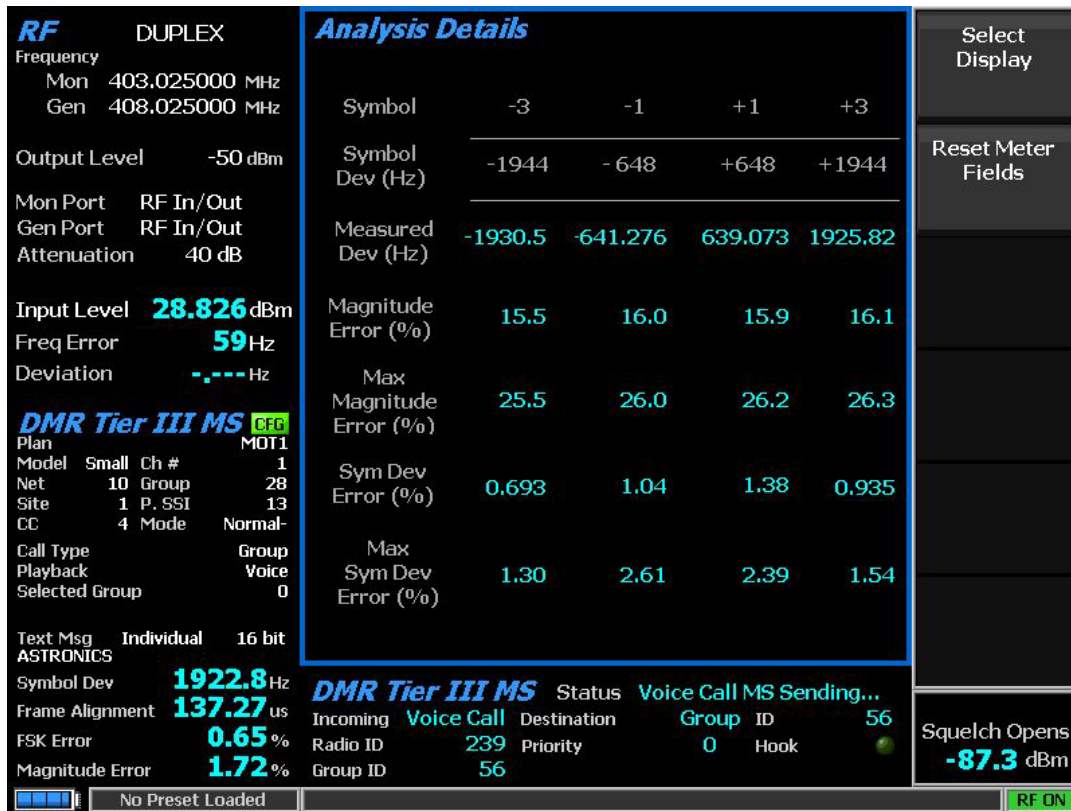
Figure 18 – Analysis Details

Analysis Details (Display Zone Selection)

Analysis Details displays the measured deviation points for each data symbol and the Magnitude error for each data symbol.

The nominal deviation points for each data symbol are provided on the screen as reference.

Reset Meter Fields (Analysis Details Submenu)

Select this soft key to clear all values on Analysis Details screen and restart averaging.
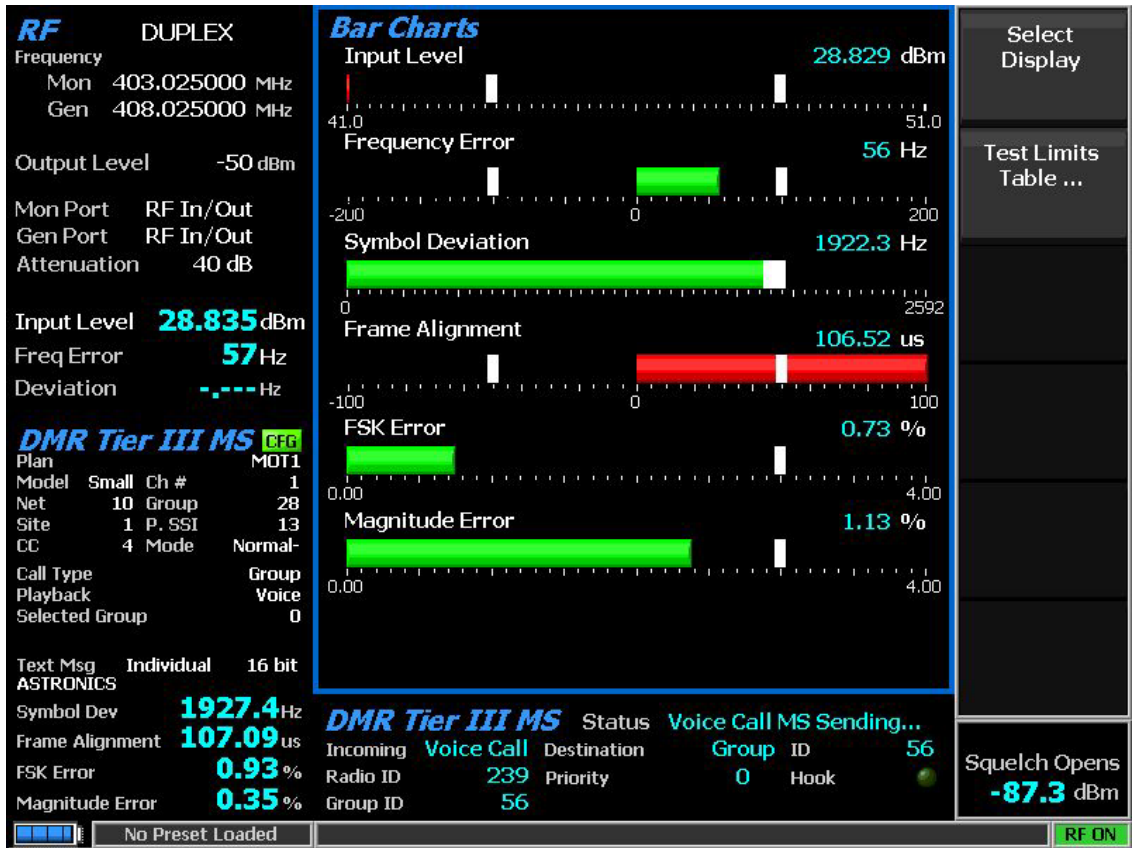
Figure 19 – Bar Charts

Bar Charts (Display Zone Selection)

Displays a bar graph representation of the measurements found in the DMR Tier III MS zone. The bars are color coded to represent pass or fail based on the test limit settings found in the Test Limits Table… soft key.

Transaction Details (Display Zone Selection)

Transaction Details provides a log of radio to R8x00 communication transaction.

Note: *While the Transaction Log zone is selected (Highlighted with Blue border) the arrow keys or rotary knob can be used to scroll up or down in log.*
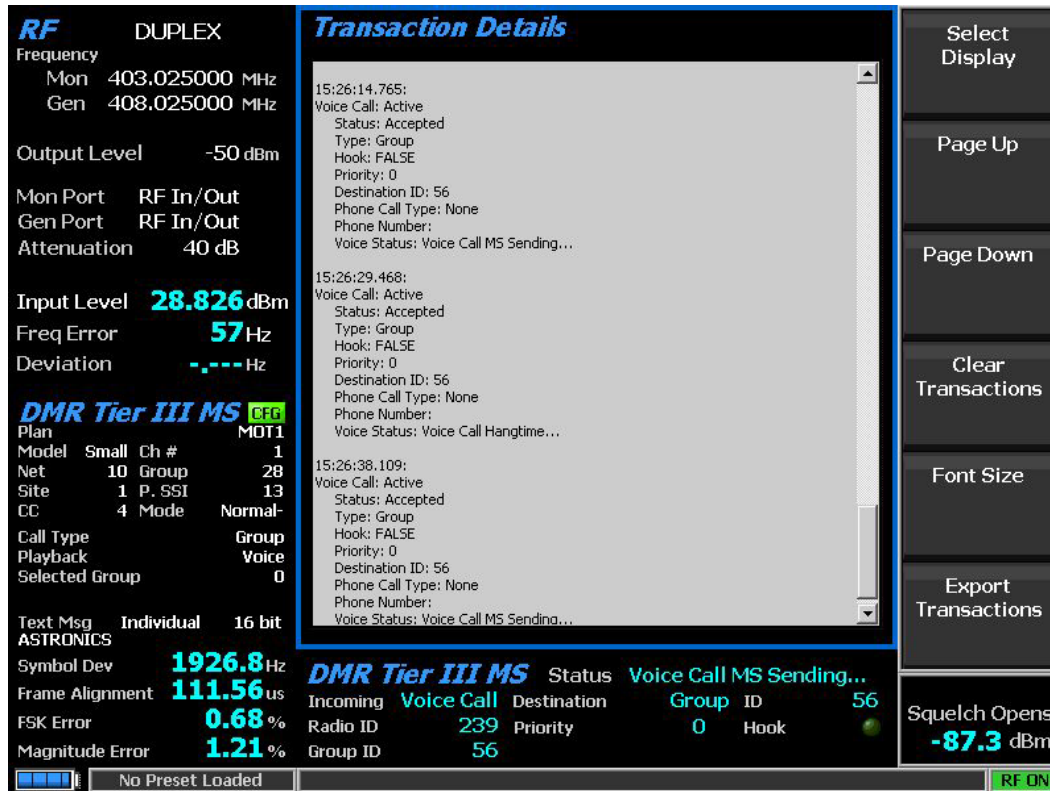
Figure 20 – Transaction Details

Page Up (Transaction Details Submenu)

The arrow keys or knob can be used to move up in the transaction log. For faster movement use the Page up soft key.

Page Down (Transaction Details Submenu)

Arrow keys or knob can be used to move down in the transaction log. For faster movement use the Page Down soft key. Also new information entering the Transaction Log will cause the log to move to the bottom.

Clear Transactions (Transaction Details Submenu)

On execution of this soft key the current visible log is deleted.

Note: *No log is saved over a power outage.*

Font Size (Transaction Details Submenu)

Allows the user to change font size of the displayed transaction log.

Range from 13 to 20.

Export Transactions (Transaction Details Submenu)

Only available when a USB drive is installed. The transaction log can be saved to a USB drive as text file.

2.1.5   Meter Zone

Select Meter (Meter Zone Submenu)

Under Select Meter, the user will find the Constellation and DMR Tier III MS meters. By default, the DMR Tier III MS meter will be shown in DMR Tier III mode. See Meter Zone in O&M manual (Reference 1) for standard selections and see the following sections for custom selections.

Constellation (Meter Zone Selection)

The Constellation display provides a visual representation of overall transmitter operation (see Figure 21). DMR radios broadcast voice and data using four frequency shift deviations of the carrier to represent symbols containing two data bits. Four red tick marks on the display represent the expected locations for the deviation states when the radio is transmitting data bit symbols using the modulation. White tick marks show the actual deviation measurement at symbol decision times. A tighter grouping around the red tick marks indicates more accurate transmitter performance.
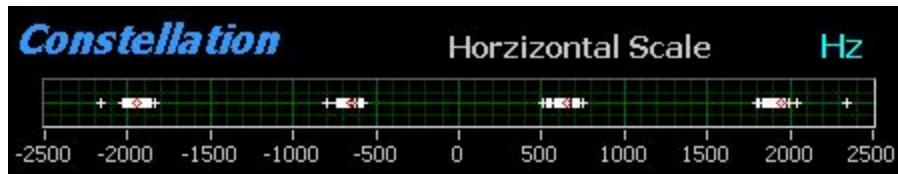
Figure 21 – Constellation Meter in Meter Zone

The nominal deviation points for each data symbol are as follows:

Bits	Symbol	Deviation
01	+3	+1944 Hz
00	+1	+648 Hz
10	-1	-648 Hz
11	-3	-1944 Hz

Table 1 DMR Symbols

DMR Tier III MS (Meter Zone Selection)

The DMR Tier III MS meter display provides information about status of current UUT operations. When the MS registers with the DMR Tier III test mode, the Radio ID and Group ID for the registering channel is shown on left side of meter. The ID on right side is the destination ID last used for last call or message. The lower section of the meter displays detail about last call or message. Figure 22 shows examples of data shown on DMR Tier III Meter Zone.

Figure 22 – DMR Tier III Meter Zone Examples

2.1.6 Live MS Channel Testing

The DMR Tier III MS test mode (R8-DMR_T3MS) expands beyond the standard DMR test mode to support direct interaction with a user device configured for DMR Tier III (trunking) operation based on ETSI standard.

Normally a DMR radio is tested in Tier II mode using the manufacturer's test software to place the device into a test mode. This approach allows full test and alignment of the UUT hardware but does not test the radio in operational mode.

The Astronics DMR Tier III MS test mode configures the R8x00 to transmit a trunking control channel and allows the UUT to register to the network just like it does on a live network. The R8x00 will then allow the user to perform standard measurements on the UUT transmission and verify call operations.

Measurements made by the R8x00 on the UUT transmission include:

- Power level

- Frequency error

- Symbol deviation

- Frame alignment

- FSK error

- Magnitude error

After the radio is registered to the R8x00, the technician can verify operation of various call types, send and receive text messages, and perform an Rx test that steps through the R8x00 power output to determine UUT Rx sensitivity.

Testing a DMR Tier III radio while it is in active operation is often referred to as live testing. Live testing is NOT intended to be OTA. For proper power measurements and to prevent any

interference with an active DMR Tier III network, connect the antenna port of the UUT to the RF In/Out port of the R8x00 with an RF cable. For accurate power measurement results, it is recommended that either RF Level Offset be enabled and an RF In/Out value is set for the cable, or Cable Sweep be enabled and a cable sweep file is generated for the cable. Do NOT use both Cable Sweep and RF Level Offset at same time.

The DMR Tier III test mode uses duplex operation to generate an active trunking control channel and to monitor for responses from the UUT. When the DMR Tier III MS test mode is selected, the R8x00 will enter duplex mode and will NOT allow the user to switch out of duplex.

Configuring the Live DMR Tier III Test

When the DMR Tier III MS (R8-DMR_T3MS) option is enabled, there will be a separate test mode available exclusively for Tier III testing.

To start the DMR Tier III test mode, use the following procedure:

1. Press the blue TEST button.

2. Select the Test Mode soft key.

3. Select the DMR Tier III MS … soft key.

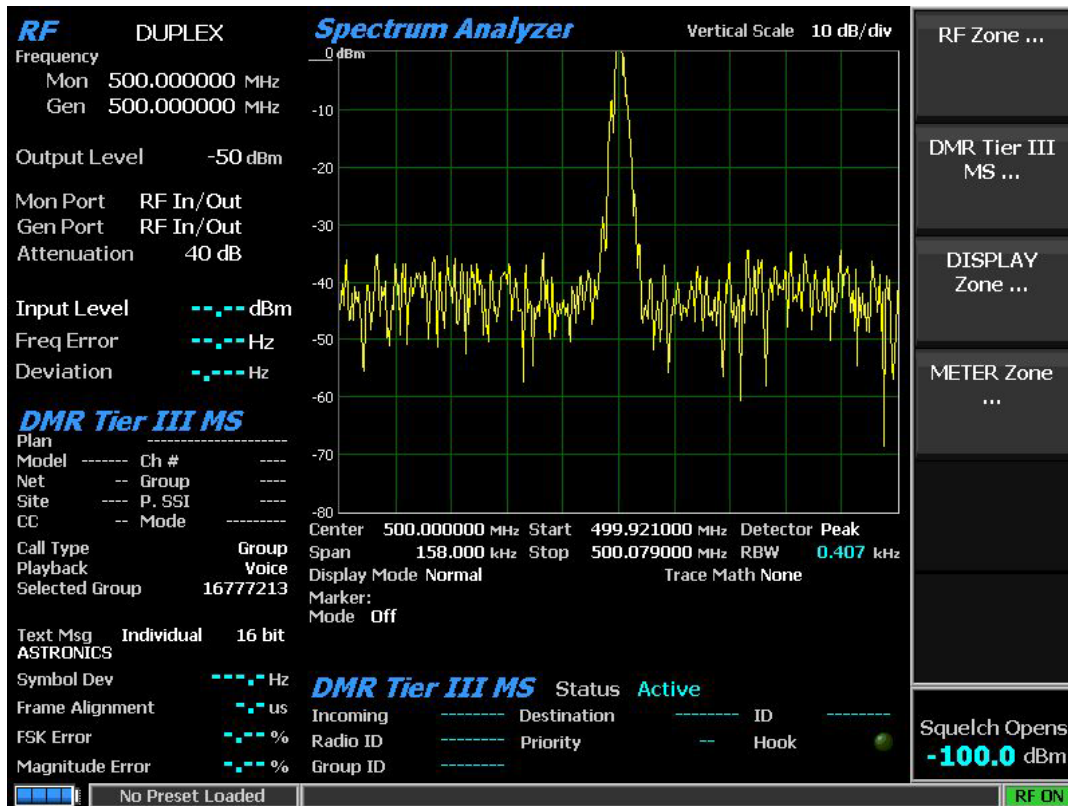The R8x00 will switch to DMR Tier III MS test mode (see Figure 23).

Figure 23 – DMR Tier III MS Test Mode

Before any testing can be performed, the UUT must register with the DMR Tier III test mode.

To accomplish this, the first step is to the configure the channel plan for the channel in use on the UUT.

The following list of parameters the MUST be set correctly for live DMR Tier III testing to work. If the UUT will not register to the R8x00, then check this list of items to verify all are properly set:

- R8x00 is in Duplex Mode.

- Mon port is set to RF I/O.

- Gen port is set to RF I/O.

- Attenuation is NOT on automatic and is set to a value between 20 dB and 40 dB. The default value is 40 dB.

- All unique network parameters (model, net ID, site ID, and CC) are correctly set.

- Network BS Tx (downlink) frequency, BS Rx (uplink) frequency, and channel number are correctly set.

- A channel plan is set in the Channel Plan Configuration window.

- The UUT is on the correct zone/channel for the channel plan loaded.

Confirm you have all network parameters and uplink/downlink frequencies for the channel to be tested. This information can be obtained from the Network Coordinator of the system, or by using the appropriate manufacturer software to read the information from the UUT.

Even though DMR is a standards-based radio protocol, each radio manufacturer has the leeway to add non-standard extensions to the protocol. In some cases, the extensions may be to enhance functionality or may be to make the operation of devices incompatible with the standard. Astronics has not incorporated manufacturer specific proprietary features into this test mode. To successfully test a device with the Astronics DMR Tier III test mode, the device channels used in testing must be configured for DMR Tier III compliant operation. The attached appendices identify the settings needed to allow compliant testing.

See Appendix 1 for notes on programing Motorola Capacity Max for DMR Tier III Standards Compliance.

> **Note:** *The Astronics DMR Tier III test mode is NOT designed to test a "Capacity Max Advantage" network channel. If the primary operation Network is "Advantage," a second Network (Open Radio) would have to be created on the UUT to allow DMR Tier III testing.*

To test a Motorola Capacity Max radio, the network for the selected test channel must be configured as "*Capacity Max Open Radio*" or "*Capacity Max Open System.*"

See Appendix 2 for notes on programing Kenwood for DMR Tier III Standards Compliance.

See Appendix 3 for notes on programing Tait DMR Tier III Standards Compliance.

Example of DMR Tier III Testing

The following information will be used as an example of testing a DMR Tier III device:

Network Model type: Small

Net ID: 10

Site ID: 1

Color Code: 4

Downlink frequency: 408.025000 MHz

Uplink frequency: 403.025000 MHz

Channel #: 1

This is the information necessary to configure the channel plan.

Configure the Channel Plan

To configure the channel plan, use the following procedure:

1. Navigate to the DMR Tier III MS zone.
2. Select the Channel Plan … soft key to open the Channel Plan window.
3. Set Network Model to Small
4. Set Net ID to 10
5. Set Site ID to 1
6. Set Color Code to 4
7. Set Downlink Freq to 408.025
8. Set Uplink Freq to 403.025
9. Set Channel # to 1
10. Set Group Address to 28
11. Set Private SSI to 13
12. Set BS Mode to Normal Aligned
13. Save the plan as TEST 1. The indication at the top of the Channel Plan window will display the TEST 1 plan name (see Figure 24).
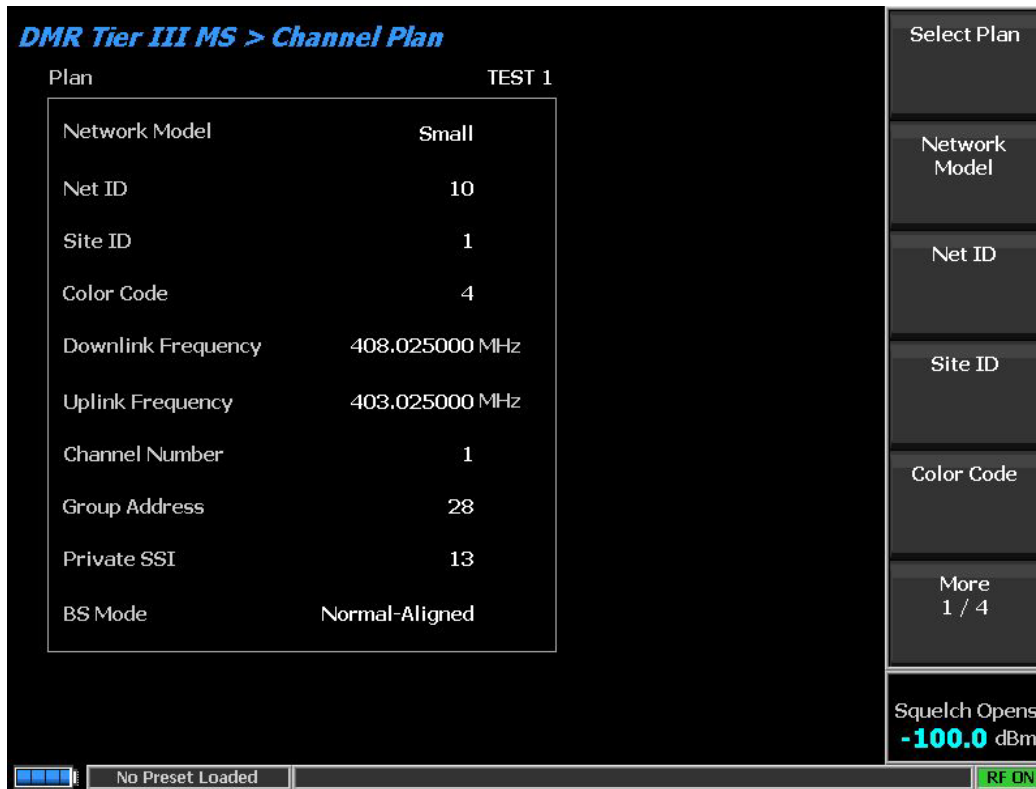
Figure 24 – TEST 1 Channel Plan

14. Press the Esc key to return to the main GUI screen.

15. Power up UUT. If radio is already set for proper zone/channel testing, the device should register to test mode (see Figure 25).

16. If the radio indicates "out of range" or "no network," switch to the proper zone and channel configured for network use.

17. If the "out of range" or "no network" indication continues, verify all network parameters are correct.

User Guide
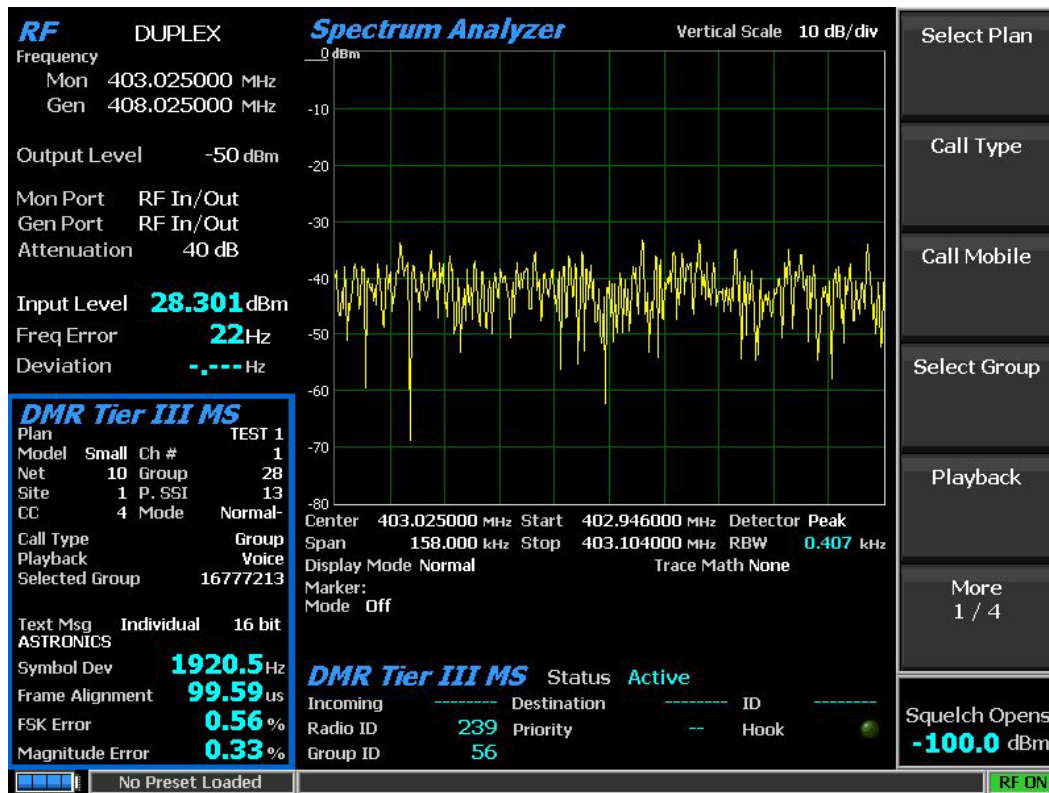
Figure 25 – Registration of Radio is Complete

18. When registration is complete, the Meter Zone will display a Radio ID value. In this example, the value is 239.

19. Also, note that this channel has an assigned group ID of 56.

20. If the test channel has a Private ID or an All Call ID, then no group ID is sent to the network and the group ID would remain 0.

21. Once the UUT is registered, it is possible to place a Group call from the radio to the R8x00 or from the R8x00 to the radio.

Initiate Group Call from UUT

To initiate a Group call from the UUT, use the following procedure:

1. Press the PTT button on the radio to send a Group call to the R8x00 (see Figure 26).
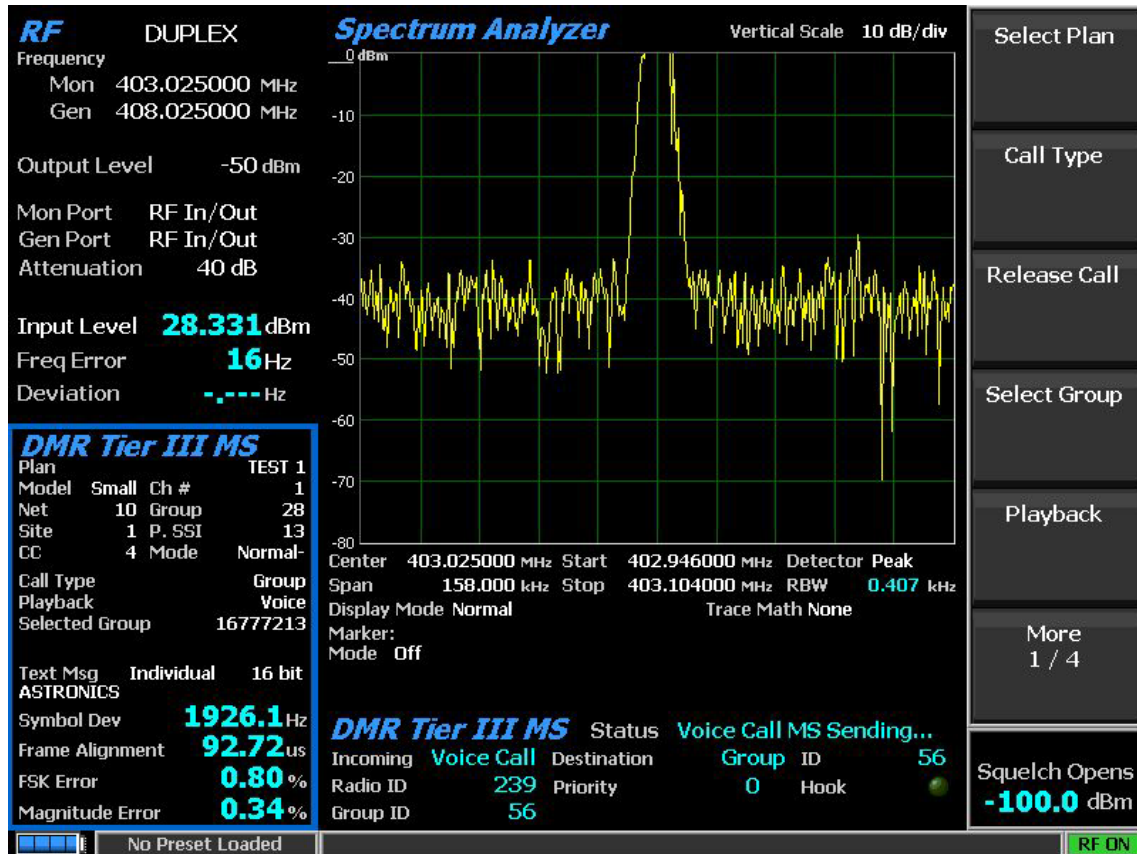
Figure 26 – Group Call Initiated from Radio

Note: *The status in the Meter Zone is "Voice Call MS sending ..." and the group ID is 56. This means the call is made to ID 56.*

2. While the PTT button on the radio is pressed, the measurements in DMR Tier III MS zone will update.

3. It is possible to switch to the Display zone and use the Select Display soft key to switch between the Spectrum Analyzer, Eye Diagram, Power Profile, Distribution Plot, Analysis Details, Bar Charts, or Transaction Details as desired.

4. Release the PTT button.

5. The Meter Zone status will change to "Voice Call Hangtime…."

6. During "Voice Call Hangtime…," there is no transmission back to the UUT. Wait for a brief period and the radio will automatically release the call when the radio hangtime timer expires. The call can also be released by selecting "Release Call" in the DMR Tier III MS zone.

Note: *The ability to release a call at the radio will vary depending on the call type and manufacturer. In general, private calls can be released at device. However, in general, Group calls cannot be released at the device as it would close the call for ALL participants. If you are the initiator of the Group call, you may be able to release the call at the device, but this is manufacturer dependent. If the call cannot be released at device, then close the call at the R8x00 or allow the call to close after hangtime expiration.*

Note: *For Motorola Capacity Max users: if the UUT appears to make first call fine and on the next attempt, the radio reports "Registering" and continues to report "Registering" with each call attempt until it suddenly works again, this is an indication that a custom DMR Tier III configuration file change is needed for the user device to operate smoothly with the test mode. See Appendix 4 for help or contact Astronics Technical Support.*

Initiate Call from the R8x00

To initiate a call from the R8x00, use the following procedure:

1. Navigate to the DMR Tier III MS zone.

2. Press the Select Group soft key.

3. A drop-down list will appear (see Figure 27). This list will display the available groups that can be selected for called. Normally there will be three "all call" groups, the choice of a CustomID (#), and the group ID sent from radio during registration.

4. Select one of the available IDs by pressing the up or down arrows and press the Enter key. 56 is selected in this example.
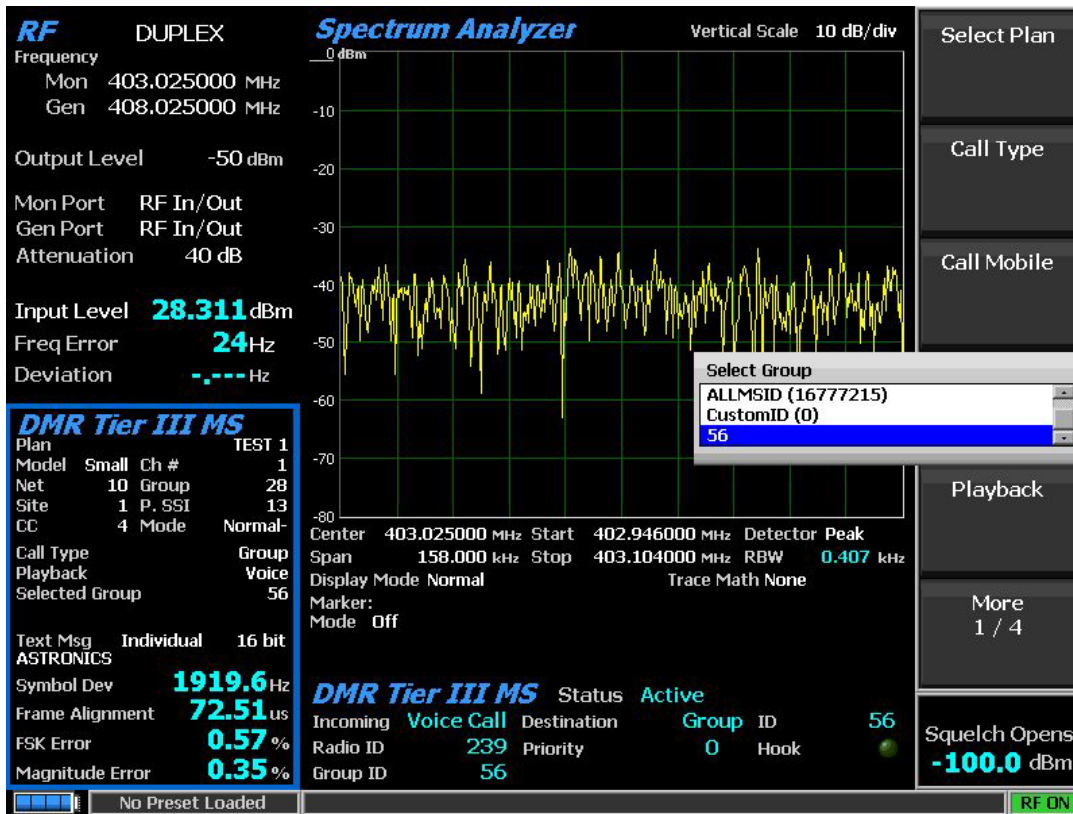
Figure 27 – Select Group Options

5. Select the Call Type soft key. A drop-down list will appear.

6. Select Group and press the Enter key.

7. Press the Call Mobile soft key. The radio will immediately start the call.

8. When the Meter Zone status is "Voice Call Hangtime…," press the PTT button on the radio and say a message.

9. When the PTT button is released, the R8x00 will broadcast back the user's voice back to the radio.

10. The Voice Loopback selection will allow user to switch from "voice" to a list of built-in tones. When a tone is selected the tone will stay on continually (NO hangtime) until the user switches to voice or releases the call.

11. The user cannot release the Group call from the radio, it must be terminated by selecting the Release Call soft key in the DMR Tier III MS zone. The UUT is not allowed to release a call from a received Group call as that would kill the call for all users.

Multiple call types are available for selection:

Group – Call to selected group number.

This can be one of the All Call IDs or the registered group number ID.

This call can also be to "CustomID(#)," which when selected, displays the Custom Group ID soft key where the user can manually enter a Group ID for R8x00 to call to.

When the All Call ID is used, the UUT is not allowed to transmit.

Note: *Call must be released at the R8x00.*

Simplex (no Hook) – Call to Radio ID as Private.

This call is made to the Radio ID value.

The UUT will automatically answer the call.

The call can be released at the UUT or R8x00.

Simplex (Hook) – Call to Radio ID as Private.

This call is made to the Radio ID value.

User must accept (answer) the call at the UUT.

The call can be released at the UUT or R8x00.

Emergency (Group) – Call to selected Group number.

This can be one of the All Call IDs or the registered group number ID.

When the All Call ID is used, the UUT is not allowed to transmit.

Note: *Call must be released at the R8x00.*

Emergency (Simplex) – Call to Radio ID.

The UUT will automatically answer the call.

The call can be released at the UUT or R8x00.

Ambient – Call request to Radio ID for continuous transmit.

This call will only operate if the UUT is configured to support "Ambient" or "Remote Monitor."

This type of call normally has a built-in timeout that is configurable in software.

For testing, it is recommended that Ambient timeout be set to 60 seconds to support the Tx test.

Phone Call – Place a phone call to Radio ID Mobile SSI.

Selecting this call type opens two additional parameters for edit: Phone Call Type and Phone Call Number.

The default call type is PSTN and if no call number is entered, the private SSI will be used for the source call number.

The call can be released at the UUT or R8x00.

Note*: If the radio registers, but the radio signal disappears on the Spectrum Analyzer screen and the call fails, it is possible the channel number is not correctly set for testing. The channel*

number assigned to the base station control channel frequencies must be set as the channel number in the DMR Tier III test mode.

Power Down Radio

When the UUT is powered down, the UUT will unregister from the network.

The Radio ID and Group ID fields will switch to 0 (zero).

Send and Receive Text Messages

Sending text messages to or from the UUT requires the radio channel to be configured for text message operation and for the text message be set up as DMR Tier III compliant using the control channel for data transfer.

Note: *Manufactures provided both the Tier III standard and non-standard or proprietary approaches*.

For the **Motorola Capacity Max** radios – **SEE APPENDEX 1**

> Capacity Max Systems/ "named system"/ General / Text Message Type = DMR Tier 3 IOP
>
> General/ Text Messages/ Max Length of Message Sent = Short
>
> Text message will NOT work with R8x00 if "Text Message Type" is set to "DMR Standard" or "Proprietary."

For **Kenwood DMR Tier III** radios – **SEE APPENDEX 2**

> At time of testing the KPG-D1N software did not designate a Text Message Type for DMR Tier III Turning networks. Testing "Text Messages" with Kenwood NX-5300 portable worked with R8200 DMR tier III test mode. So, default Text message support works.
>
> **Note:** *The KPG-D1N does show a selection of "DMR Message Type" choses of "DMR Standard" or "KENWOOD-defined data" in the DMR Conv configuration only.*

For **Tait DMR Tier III** radios – **SEE APPENDEX 3**

> Trunked Features/Fleet Settings/Fleet Parameters/Group Affiliation = "DMR Standard."
>
> Trunked Features/Radio Unit/Data Parameters/Outgoing Text Format = "Unicode UTF-16BE."

To send or receive a text message, use the following procedure:

1. Configure the channel plan for the test channel and ensure the UUT is registered. See the Configure the Channel Plan section.

2. Verify the UUT registered by checking that the proper mobile SSI and group SSI are populated in the DMR Tier III Meter zone (see Figure 28).

Figure 28 – DMR Tier III Meter Zone After Registration

3. Set the Message Type field to Text and the Text Message Format field to 16 bit (see Figure 29).
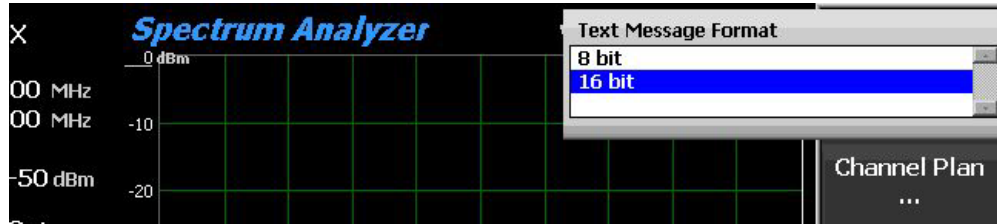

Figure 29 – Setting Text Message Format

4. If desired, change the set text message to a string for UUT transmission. The default value is "Astronics" (see Figure 30).
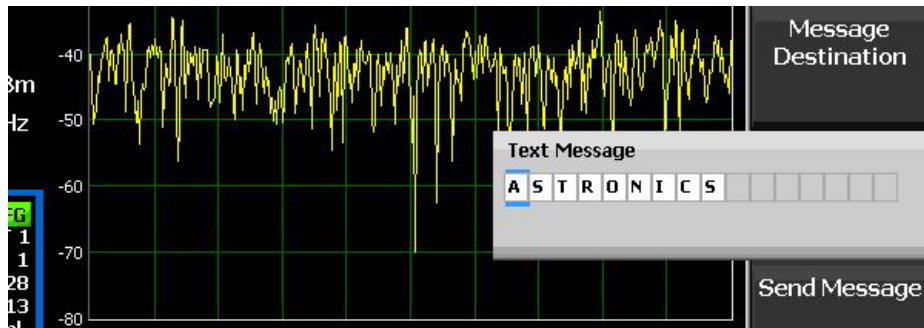

Figure 30 – Default Text Message

5. Press the Send Message soft key. The R8x00 will transmit the text message to the UUT.

6. The UUT will indicate by a beep or a visual on screen that a text message has been sent.

7. Check the UUT messages to find the "Astronics" text or user supplied message if changed.

8. The source ID of the message will be the private SSI configured in the channel plan.

9. From the radio, reply to the received message or send a new message to the R8x00.

10. When the text message is received by the R8x00, it will be shown in the DMR Tier III Meter zone. See the example "Astronics" in Figure 31.

Figure 31 – Text Message Received on R8x00

Also, note that the Meter zone indicates the incoming signal is Message, the type of message is Individual, and the destination ID is 13.

Radio Test…

The mobile device test allows the technician to quickly collect both physical layer characteristics of the UUT transmission as well as determine UUT receiver sensitivity.

From the DMR Tier III MS zone, select the Radio Test … soft key to open the Radio Test … submenu.

Figure 32 – Radio Test … Selection
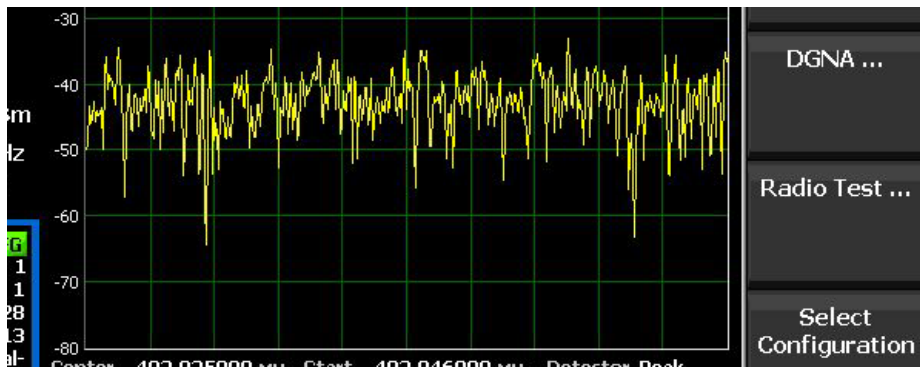
The Tx Test window opens which is designed to average physical layer measurements over a specified number of Tx bursts.

The Burst Samples soft key allows the user to set the number of Tx bursts to average over. The default is 100 (see Figure 33).
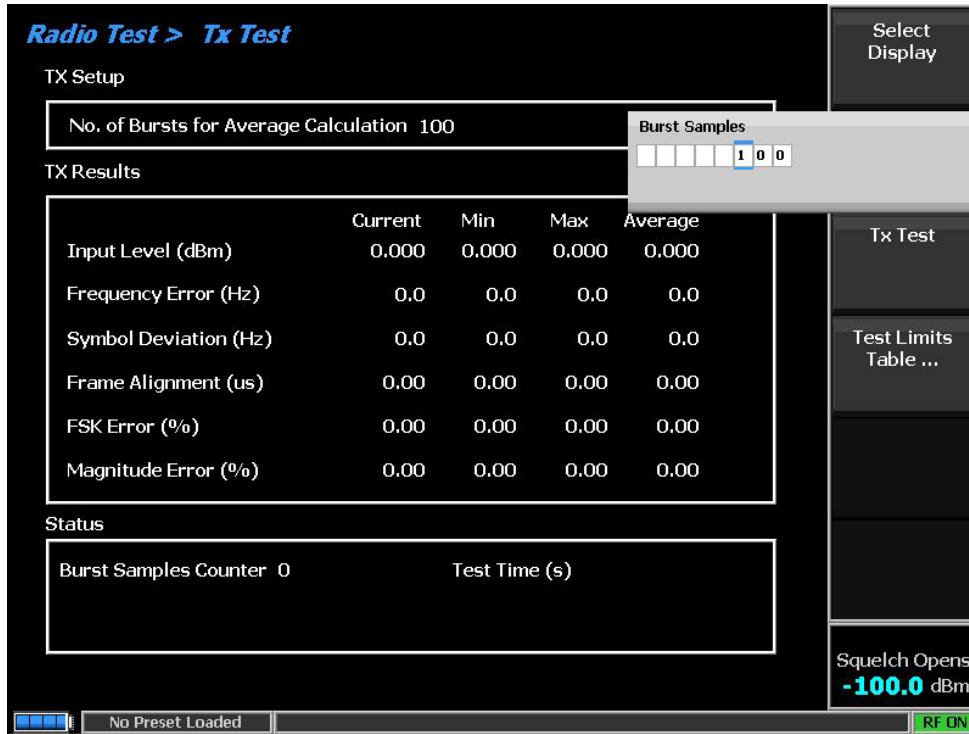
Figure 33 – Tx Test Burst Samples

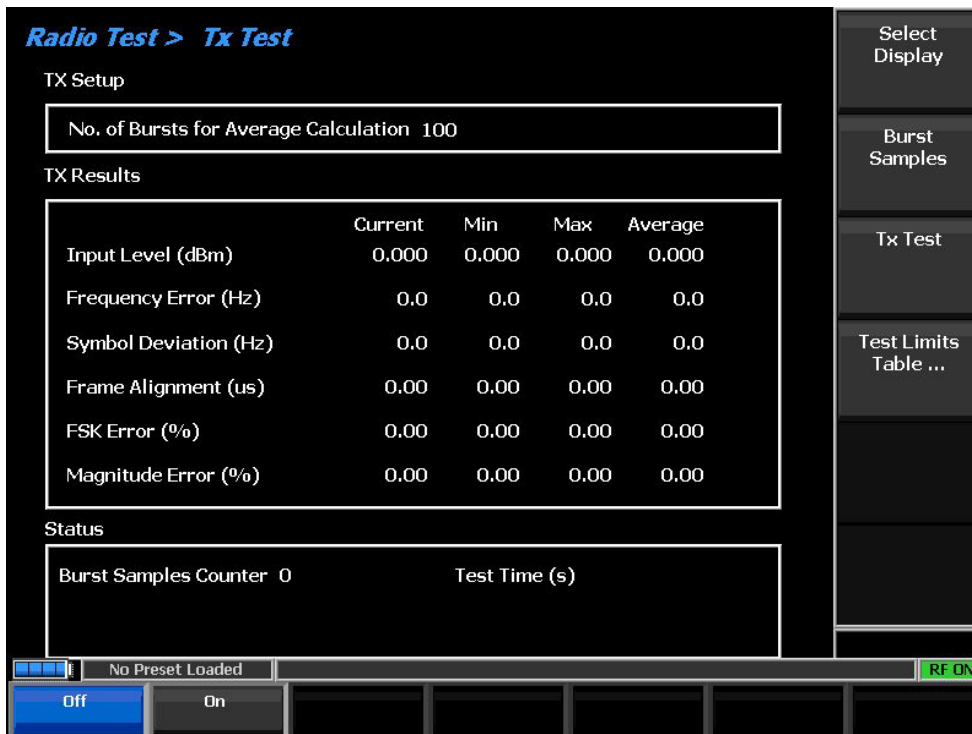To start the testing, select the Tx Test and On soft keys (see Figure 34).

Figure 34 – Select Tx Test

The Tx test mode will send an Ambient Call request to the radio to cause the UUT to start transmitting.

The Burst Samples Counter field will start a counter as each burst is measured and will continue until the counter reaches the selected number of samples.

For the Ambient Call to operate, the radio needs to have "Ambient" or "Remote Monitoring" enabled for the test channel. If this is not enabled, it is still possible to perform the test.

If "Ambient" or "Remote Monitoring" are not enabled for the test channel, perform the Tx test in following manner:

1. Select the Tx Test and On soft keys.

   The test mode will start and hold waiting for the radio transmission.

2. Press and hold the PTT button on the radio until the Burst Samples Counter reaches the number of burst samples and stops counting.

3. Release the PTT button.

Note: *If PTT button is released early, the up counter will continue the count to max, but averages will be the last valid reading over and over.*

See Figure 35 for an example of the Tx Test results.
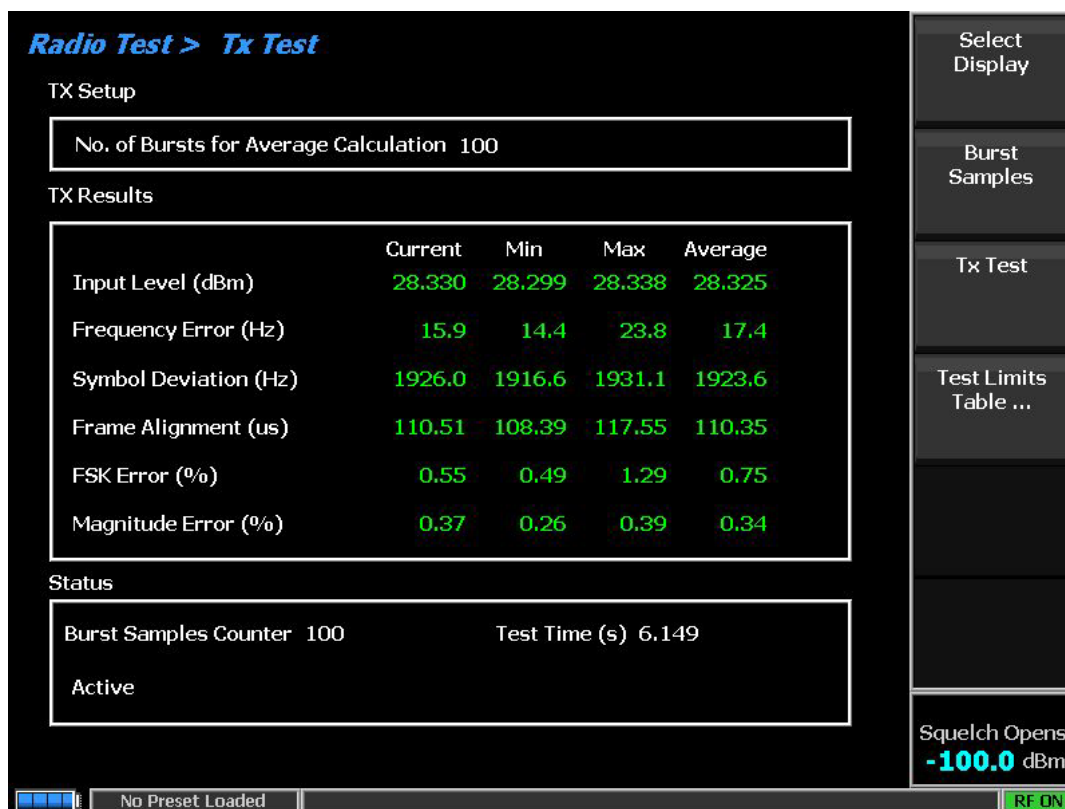
Figure 35 – Tx Test Results with Samples of 100

Press the Select Display and Rx Test soft keys to switch to the receiver sensitivity testing (see Figure 36).
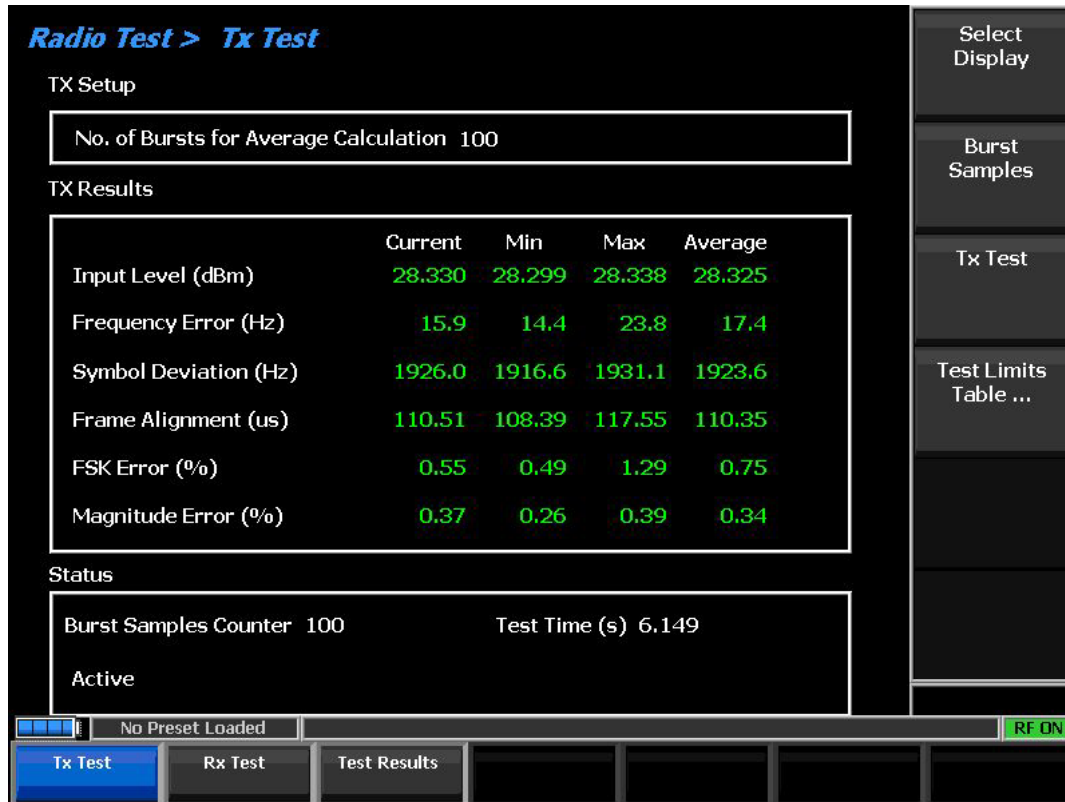
Figure 36 – Switch Between Tx Test and Rx Test

The Rx test will measure receiver sensitivity by sending a paging message to the UUT while lowering output power. When the UUT stops replying to the R8x00, the last valid power level is the Rx sensitivity.

The Rx test has two user settable parameters: Start Level and Step Level. The Start Level parameter sets the heist level the testing will begin at, and the Step Level parameter determines the step size used for each step down.
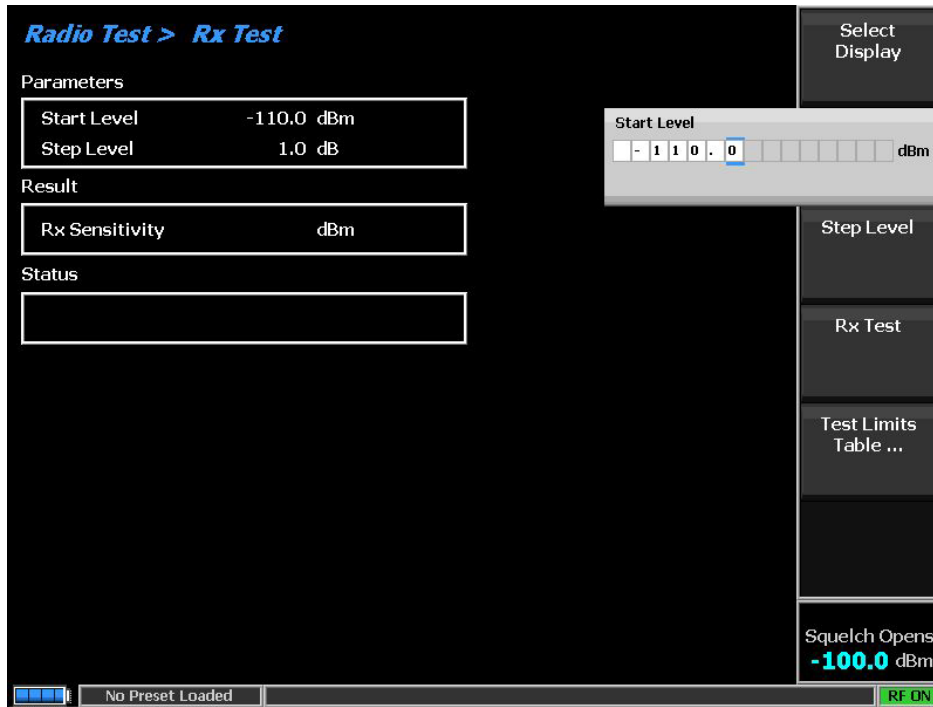
Figure 37 – Setting Start Level for the Rx Test

Figure 38 – Setting Step Level for Rx Test

Setting Start Level too high or Step Level too small will cause the overall test time to increase.

Select the Rx Test and On soft keys to start the receiver sensitivity testing.

The R8x00 will start the test and continue to lower output power until the radio no longer responds.

See Figure 39 for an example of the Rx Test results.

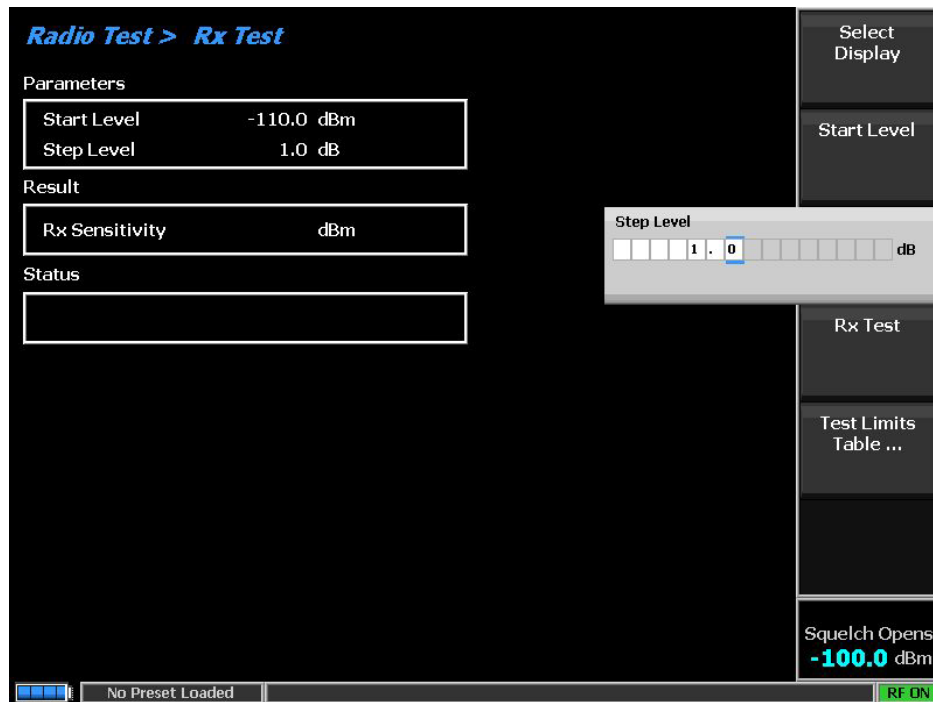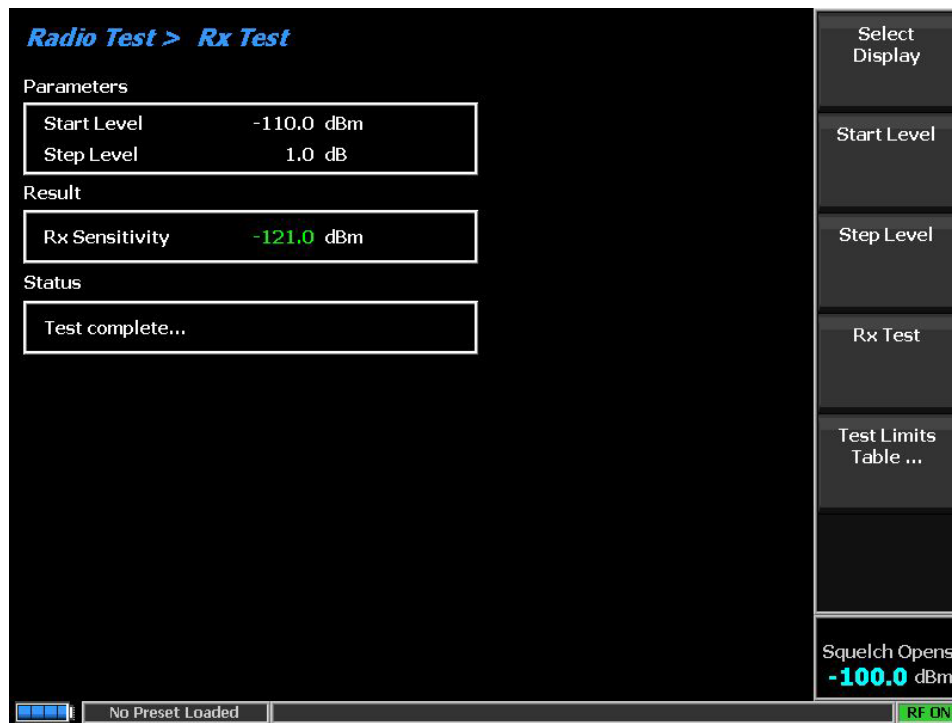Figure 39 – Completion of Rx Test

Press the Select Display and Test Results soft keys, to open the combined test results window (see Figure 40).

	Result	Average	Min	Max
Operator ID				
Radio Model				
Serial Number				
Test Date	1/29/2024			
Test Time	9:08 PM			
Network Model	Small			
Net ID	10			
Site ID	1			
Color Code	4			
Uplink Frequency (MHz)	403.025000			
Downlink Frequency (MHz)	408.025000			
Tx Test				
Input Level (dBm)	PASS	28.325	27.500	32.500
Frequency Error (Hz)	PASS	17.4	-100.0	100.0
Symbol Deviation (Hz)	PASS	1923.6	1894.0	1944.0
Frame Alignment (us)	PASS	110.35	-150.00	150.00
FSK Error (%)	PASS	0.75	0.00	3.00
Magnitude Error (%)	PASS	0.34	0.00	3.00
Rx Test				
Rx Sensitivity (dBm)	PASS	-121.00	-130.00	-118.00

Radio Test > Test Results

Select Display — Operator ID — Radio Model — Serial Number — Clear Results

Squelch Opens **-100.0** dBm
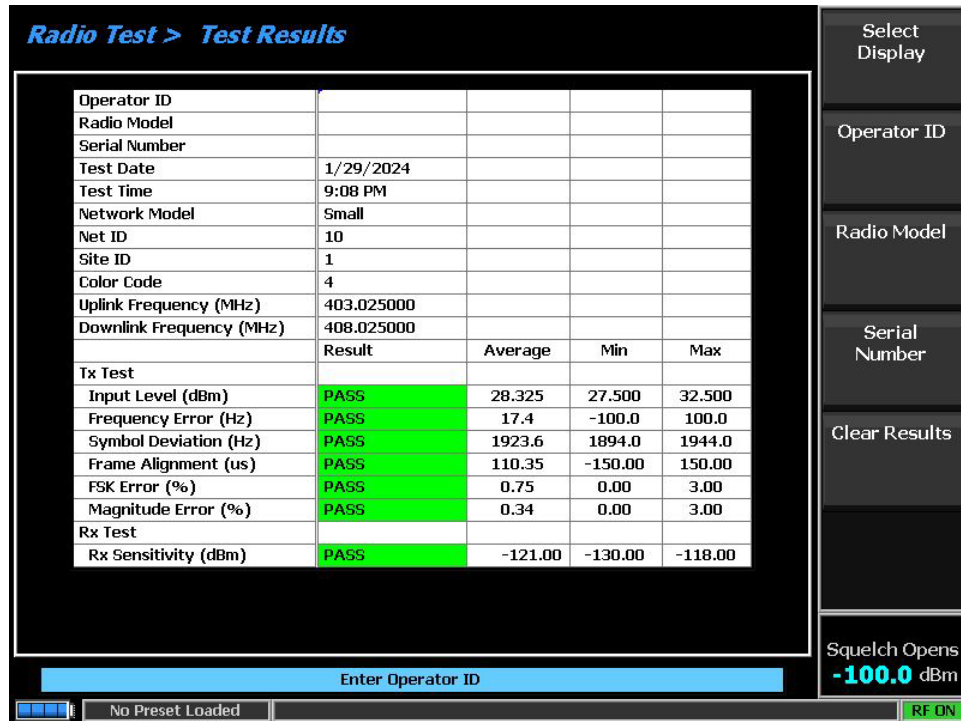
Enter Operator ID

No Preset Loaded — RF ON

Figure 40 – Combined Results of Tx and Rx Testing

Before the test results can be output to the USB drive, the user must enter the following information:

- Operator ID

- Radio Model

- Serial Number

When the values are entered and a USB drive is plugged into the R8x00, the Export Results soft key will be visible (see Figure 41).
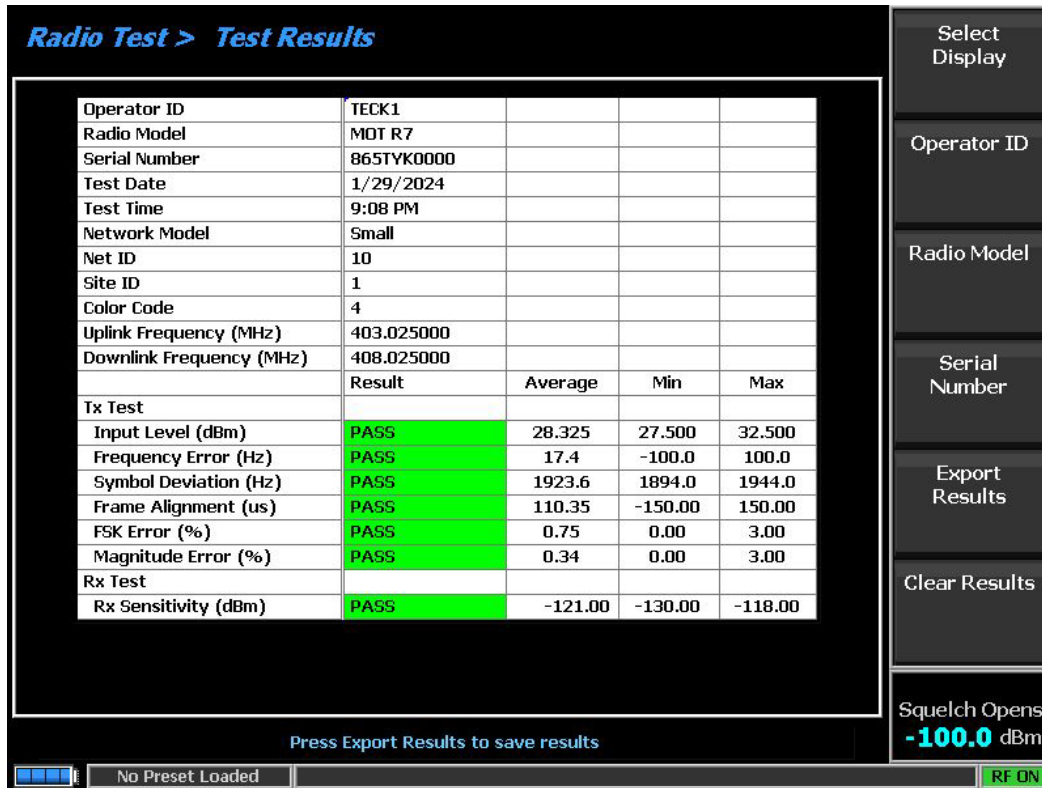

Figure 41 – Ready to Export Results

Press the Export Results soft key to output the two files to the USB drive.

The files will be located on the USB drive at ASTRONICS\DMRTier3\TestResults

One file will be a bit map image that matches the format on screen (results only, no soft keys).

The second file will be the data in a comma delimited file format.

Both files will be named using the information entered by user in the Test Results window.

The file name = Radio ModelSerial NumberDate_Time

2.2 Conclusion

This user guide described the available capabilities of the Freedom R8x00 DMR Tier III test mode and detailed a use case of testing a DMR Tier III MS while in operational mode.

Appendix 1 – Notes on Programing Motorola Capacity Max for DMR Tier III Standards Compliance

Note: *The following figures are from the Motorola RM Configuration Client programing software and are Copyrighted by Motorola Solutions Inc.*

The following sections are examples of the network configuration information required to allow radios to operate in DMR Tier III test mode as defined by the standards for maximum interoperability.

In addition to having the Motorola Capacity Max device (or test network channel) configured for DMR Tier III compliant operation, it is also important to modify the test mode configuration file for best operation with the Motorola device. See Appendix 4 – Power User Feature of DMR Tier III Test Mode: Modifying Configuration Files.

Motorola Capacity Max Radio (Motorola RM Configuration Client)

To test a Motorola Capacity Max radio, the network for selected test channel must be configured as "Capacity Max Open Radio" or "Capacity Max Open System."

Note: *The "Capacity Max Open Radio" system type is the most compliant to the DMR Tier standards and is recommended for network operation where a mix of DMR Tier III radios will be deployed. The Capacity Max Open System also supports DMR Tier III standards and can be tested with the R8x00 DMR Tier III test mode.*

Note: *The Astronics DMR Tier III test mode is NOT designed to test a "Capacity Max Advantage" network channel. If the primary operation network is "Capacity Max Advantage," a second network (open radio) would need to be created on the UUT to allow DMR Tier III testing.*

Note: *The following figures are from Motorola Radio Management.*

Capacity Max Open Radio Example

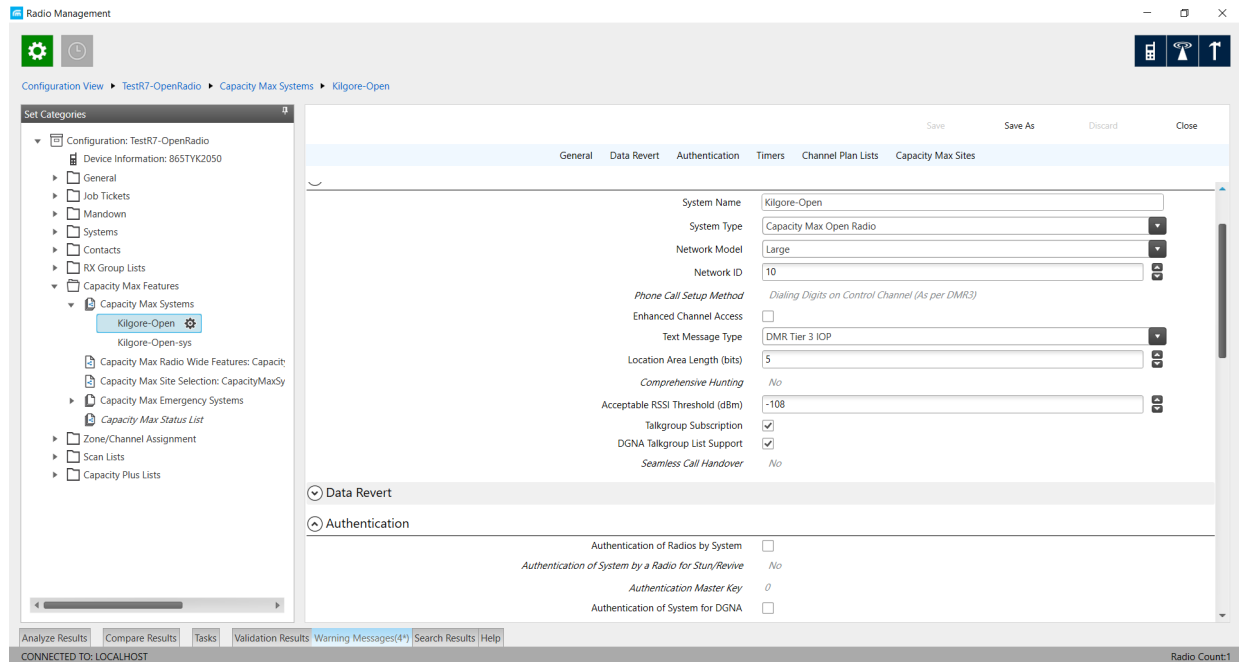The following information is necessary to configure the channel plan on the R8x00.

Figure 42 – Configure System Type and Network Information

Note: *System type is "Open Radio."*
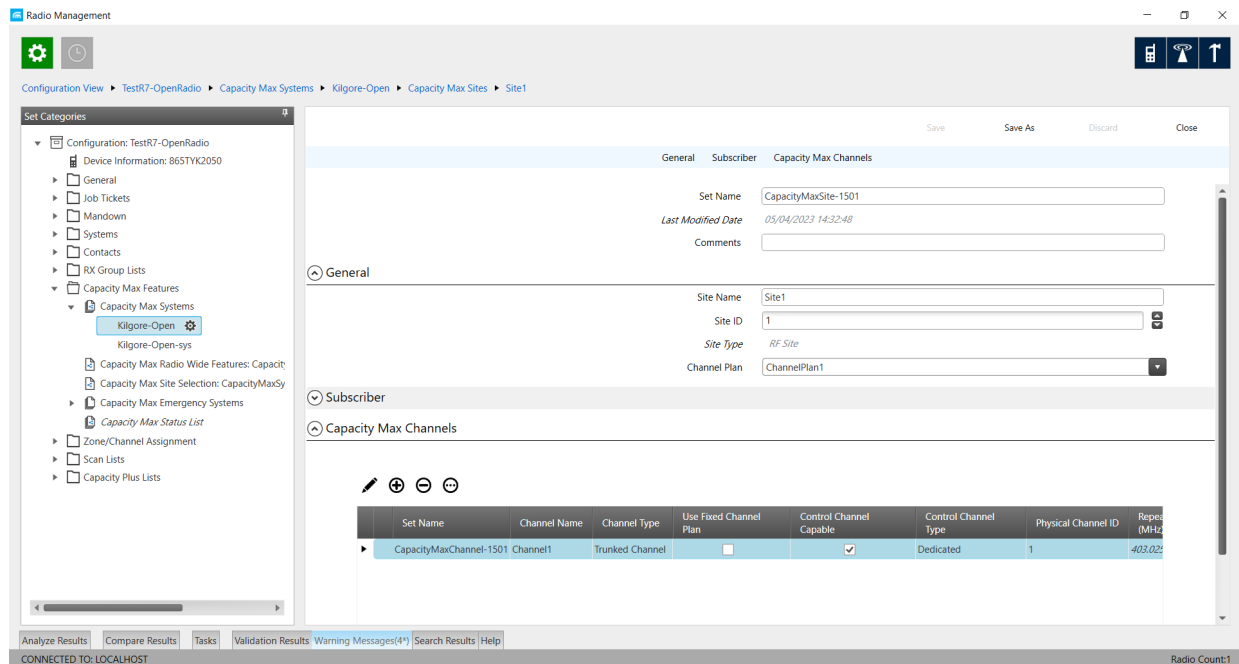
Network Model: Large

Network ID: 10

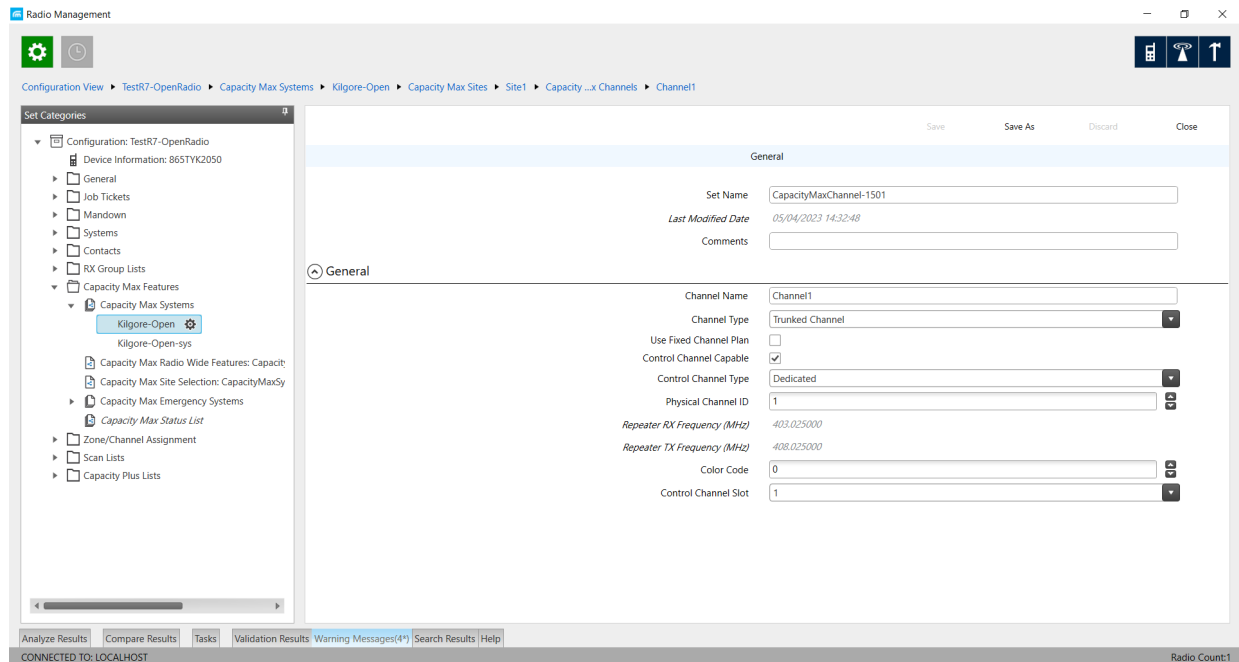Figure 43 – Configure Site ID and Channel

Site ID: 1

Figure 44 – Identify Base Station Frequencies

Color Code: 0

Repeater TX Frequency: 408.025000 MHz

Note: *The Repeater TX Frequency is the value that must be assigned to Downlink Frequency in the R8x00 channel plan.*

Repeater RX Frequency: 403.025000 MHz

Note: *The Repeater RX Frequency is the value that must be assigned to Uplink Frequency in the R8x00 channel plan.*

Physical Channel ID: 1

Note: *The Physical Channel ID is the value that must be assigned to the Channel Number in the R8x00 channel plan.*

Note: *The frequency values are used in the control channel, but the Channel Number is transmitted to the radio for the voice channel access. The voice channel MUST match the control channel frequencies.*

assigned channel number of uplink/downlink frequencies for the control channel

Configuring DGNA on Motorola Capacity Max Open Radio

Each Subscriber Unit (SU) has an enable DGNA function in the Subscriber Access Control (SAC).

In Radio Management (RM), click on Actions and navigate to Manage > Capacity Max Systems Server Data.

A menu will display a list of available Capacity Max Systems. In Figure 45, Open Radio is selected.

Select the view by Subscriber Access Control radio button then scroll through the available data to find DGNA Rx or Receive DGNA and select the checkbox.
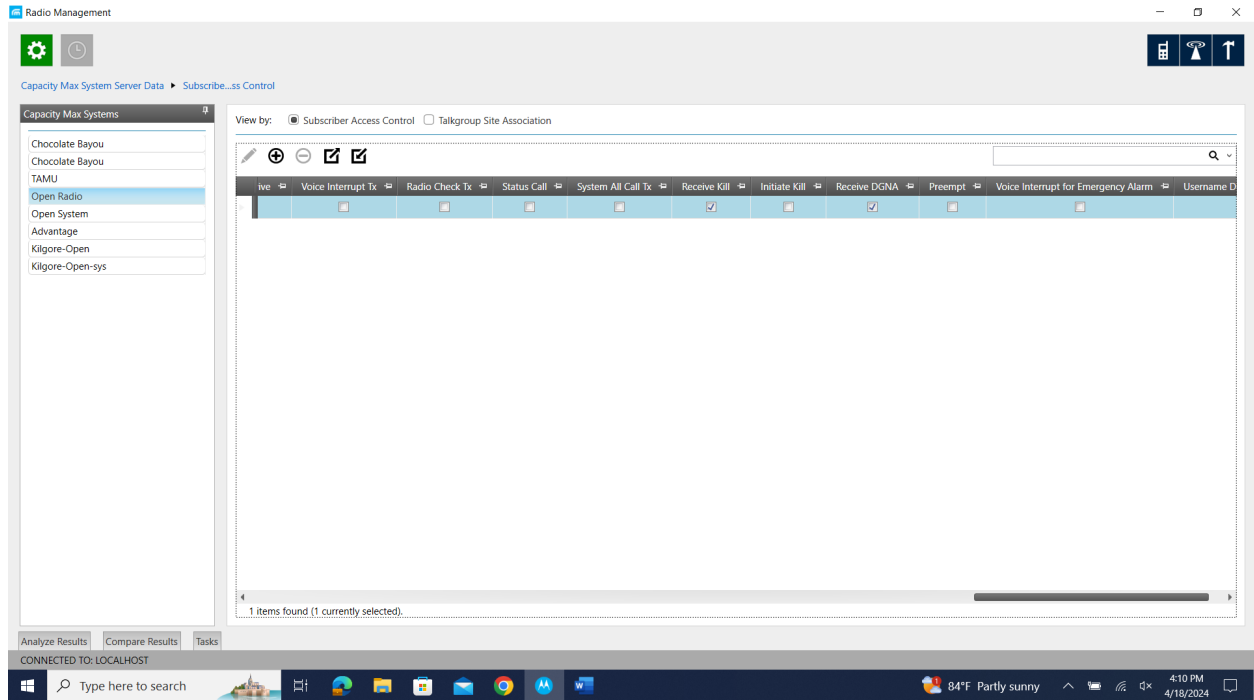

Figure 45 – Enable DGNA in Capacity Max System

Appendix 2 – Notes on Programing Kenwood for DMR Tier III Standards Compliance

Note: The f*ollowing figures are from the KPG-D1N radio programing software and are Copyrighted by JVCKENWOOD Corporation.*

The following section is an example of network configuration information required to allow radios to operate in DMR Tier III mode as defined by the standards for maximum interoperability.

Kenwood Radios with DMR Tier III Trunking Option

To test a Kenwood radio, the DMR option must be "on"" and the DMR Tier III Trunking must be selected.

To configure the DMR network, use the following procedure:

1. Setup the trunked channel plan.

    Available trunked channel plans can be fixed or flexible as needed.

2. Program the UUT to match the desired network information.

    For example, the network system information in Figure 46 is defined as:

    Model: Huge

    Network ID: 3
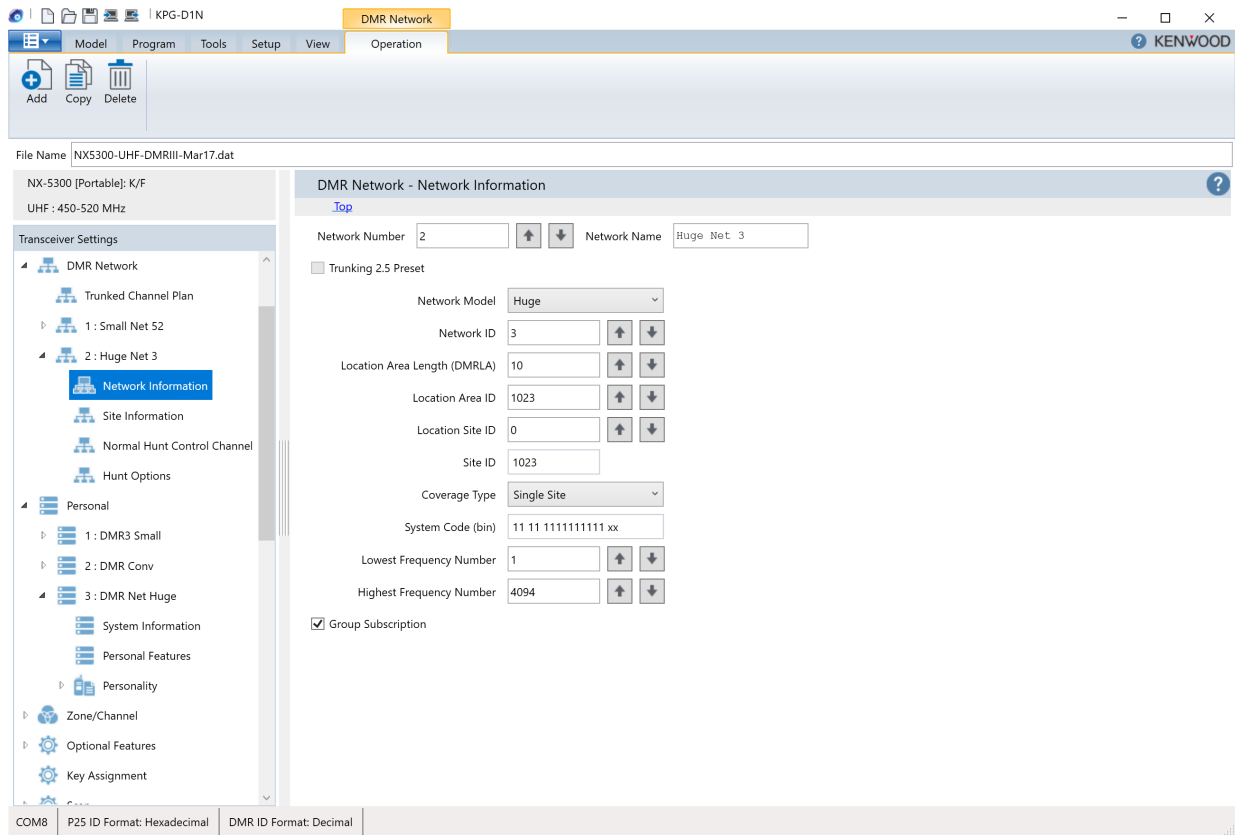
    Site ID: 1023

    Color Code: 9

Figure 46 – Configure Kenwood Network Information

3. Note that the Coverage Type is set to "Single Site." In this setting, all network values are settable. If Coverage Type is set to "Intra-Location Area" or "Intra-Network," then fewer settable values will be available.

   Note: The Location Area Length (DMRLA) is configured based on Network Model.

   Tiny: 0 to 3

   Small: 0 to 5

   Large: 0 to 8

   Huge: 0 to 10

   Normally Tiny is set to 3 and others are set to 5.

4. Select Group Subscription to send the group ID when the radio registers to the R8x00 DMR Tier III test mode.
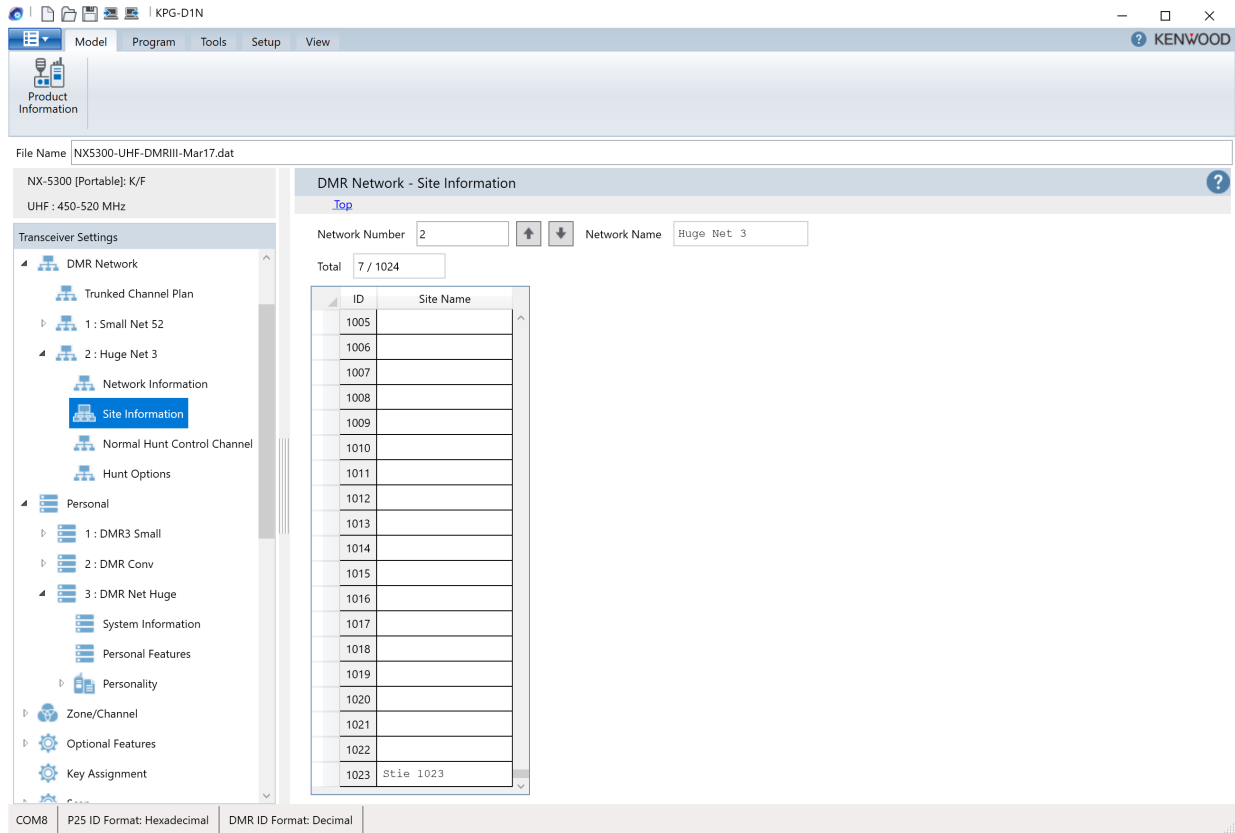
Figure 47 – Configure Kenwood Site Information

5. Give the site ID value a name in the Site Information screen. If no name is given, the radio may not recognize the site ID.

6. Set the color code in the Normal Hunt Control Channel screen.

7. The Normal Hunt Control Channel screen also lists the frequencies of the control channel and the frequency number.

   A. RX Frequency is Downlink Frequency in the R8x00 channel plan.

   B. TX Frequency is Uplink Frequency in the R8x00 channel plan.

   C. Frequency No is Channel Number in the R8x00 channel plan.
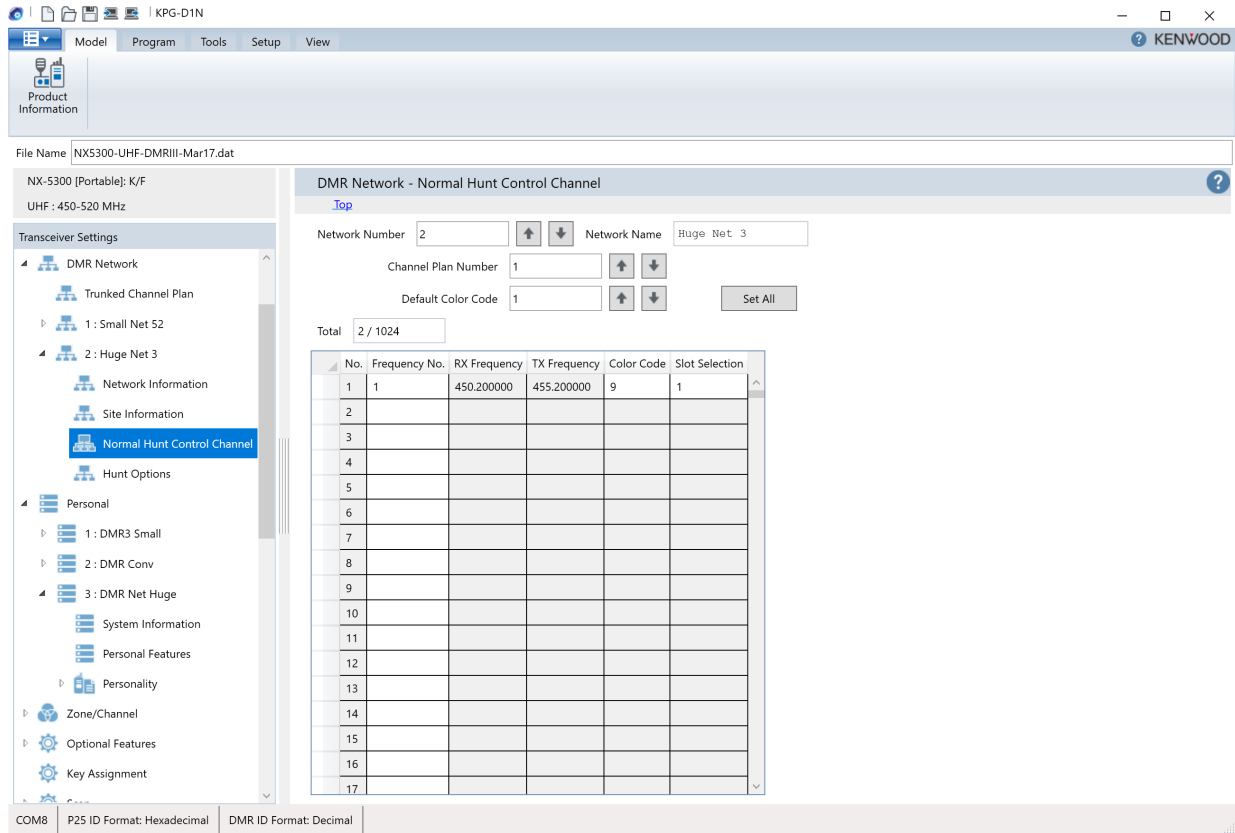
Figure 48 – Configure Kenwood Normal Hunt Control Channel

8. In the Personal screen, define additional system information for the system number built in the DMR network.
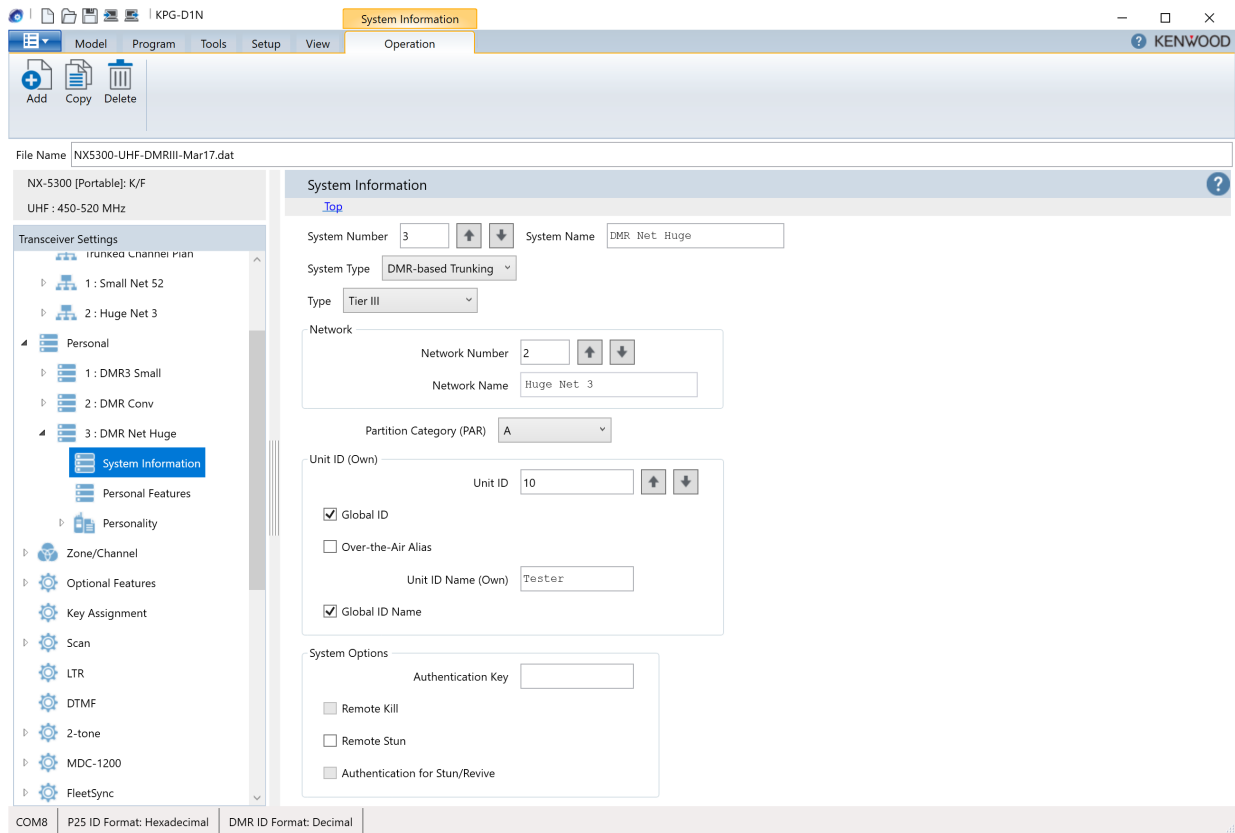
Figure 49 – Configure Kenwood System Information

9. Select System Type as "DMR-based Trunking" and the Type as "Tier III".

10. Unit ID sets the ID of the radio itself. This ID is used for non-group calls placed from the R8x00 and will show up as Mobile SSI in the DMR Tier III status meter.

11. In the Personal Features screen, select the Remote Monitor checkbox and set Remote Monitor Timer to 10 seconds or greater. In this example, the remote monitor timer is set to 60 seconds.
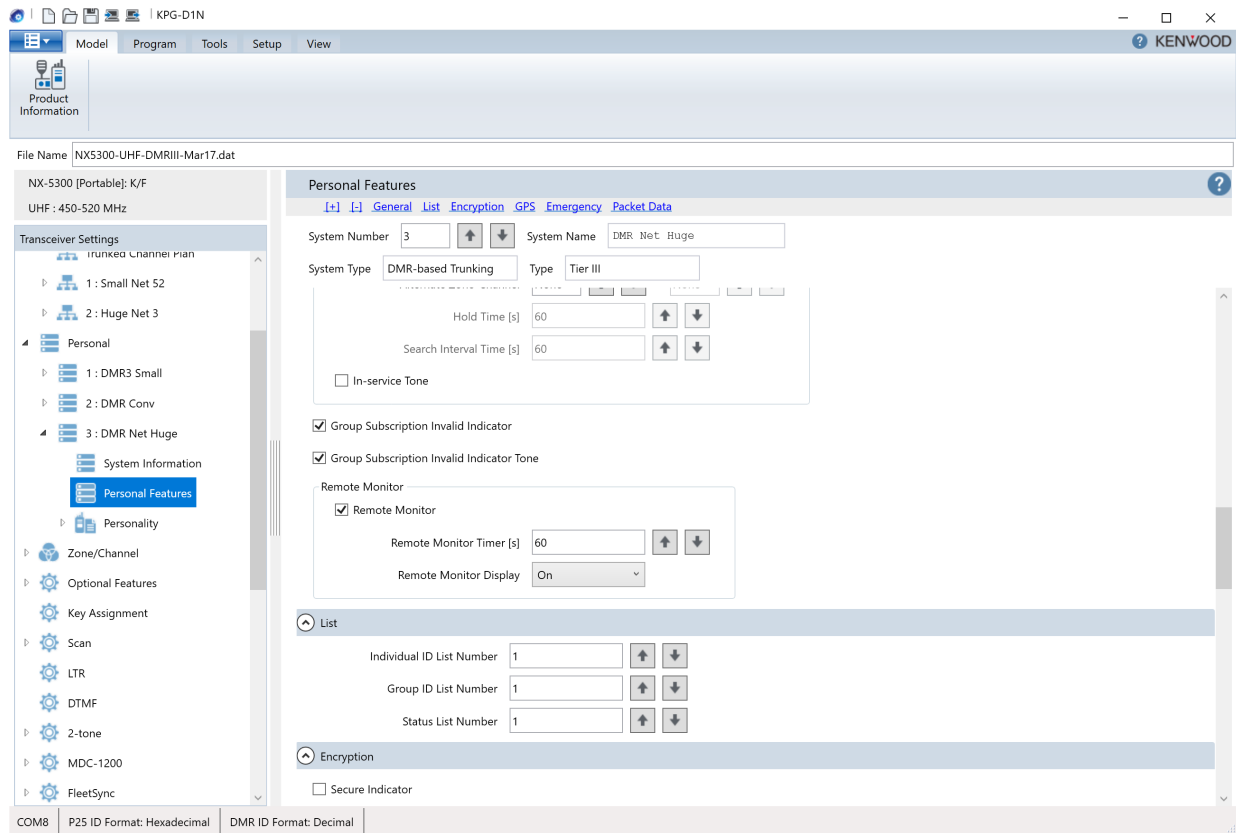
Figure 50 – Configure Kenwood Personal Features

This setting will allow the DMR Tier III test mode to use the Ambient call from the R8x00. The Ambient call is also used in MS Test> Tx Test mode data collection.

Configure the Group IDs under the Personal and Personality screens.

Figure 51 – Configure Kenwood Personality

In this example, a Group ID of 6000 is set for Personality No. 1. This personality will then be selected in the Zone/Channel Information screen (see Figure 52).

Figure 52 – Configure Kenwood Zones

At the time of this user guide development, the Kenwood radios do NOT support DGNA functionality, so there is no description on how to configure DGNA operation in Kenwood radios.

Appendix 3 – Notes on Programing Tait DMR Tier III Standards Compliance

The Tait radio is programed using the DMR and MPT Terminals programming application.

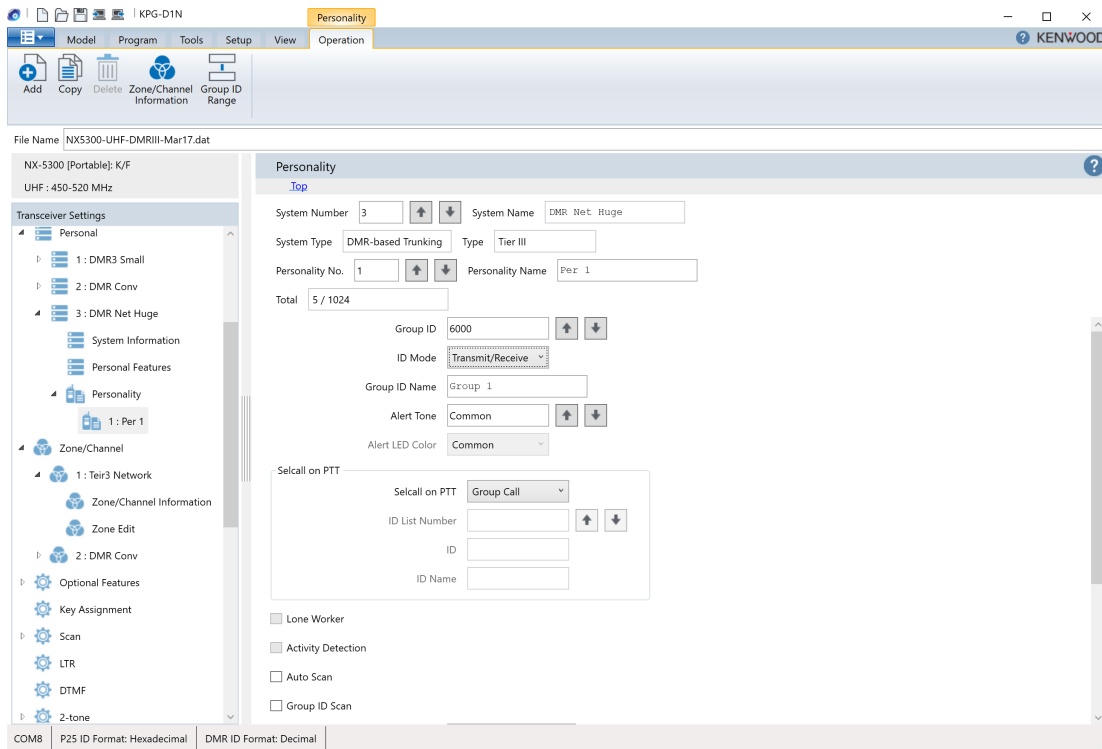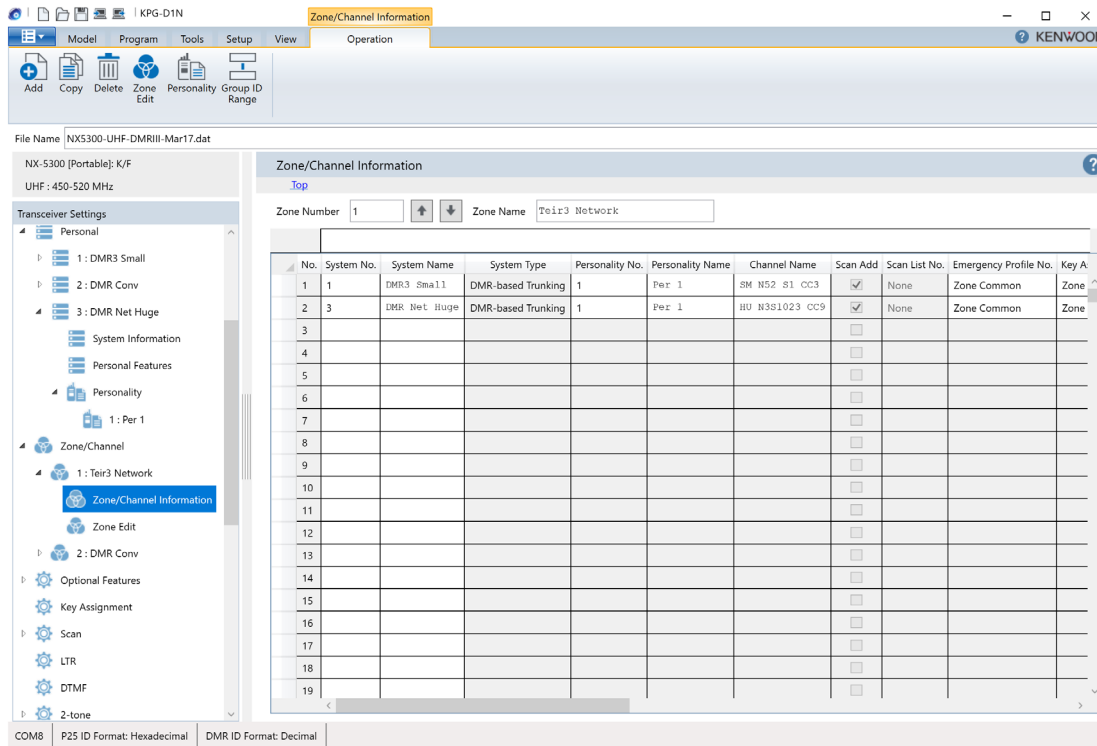The following figures are from Tait Programing Application and are Copyright by Tait International Limited.

The following sections are examples of network configuration information required to allow radios to operate in DMR Tier III mode as defined by the standards for maximum interoperability.

According to the Tait help:

When programming trunked settings, possible entries and availability of certain features often depend upon settings in other forms. The order in which the screen data is entered is important. The recommended sequence for changing radio settings is:

1. Network Settings: NetworkA conventional network is a set of self-contained information, that conventional channels are added to. Trunked networks contain trunked parameters used to communicate with the trunking system controller. The radio supports up to four separate trunked networks. data should be changed first.

2. Fleet Settings: With the network data added, add or change values to the fleet settings.

3. Radio Settings: After editing fleet settings, the data can be altered in the other forms under Radio Unit, Radio Calls, and Customize Radio.
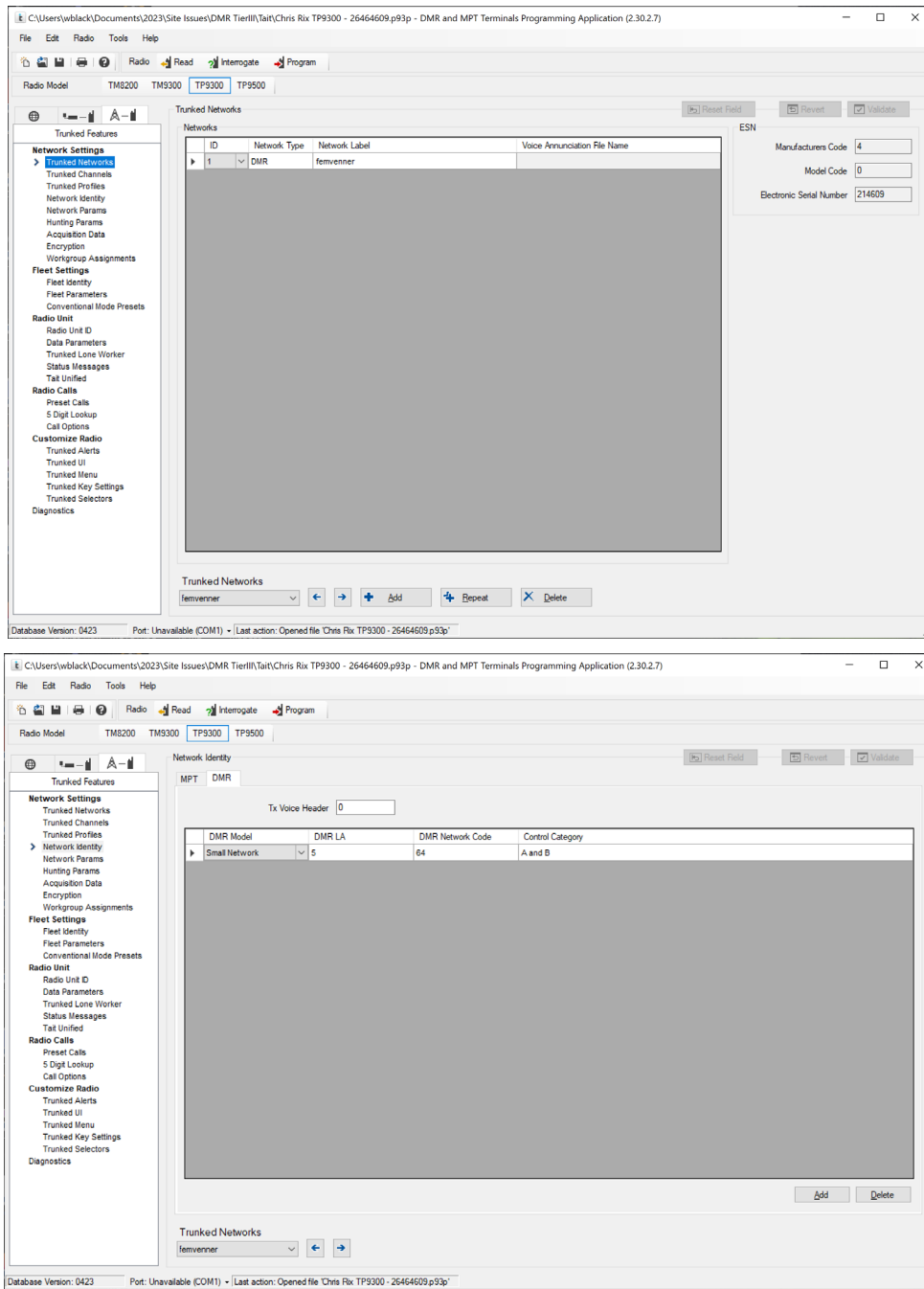
Figure 53 – Tait Network Settings Examples
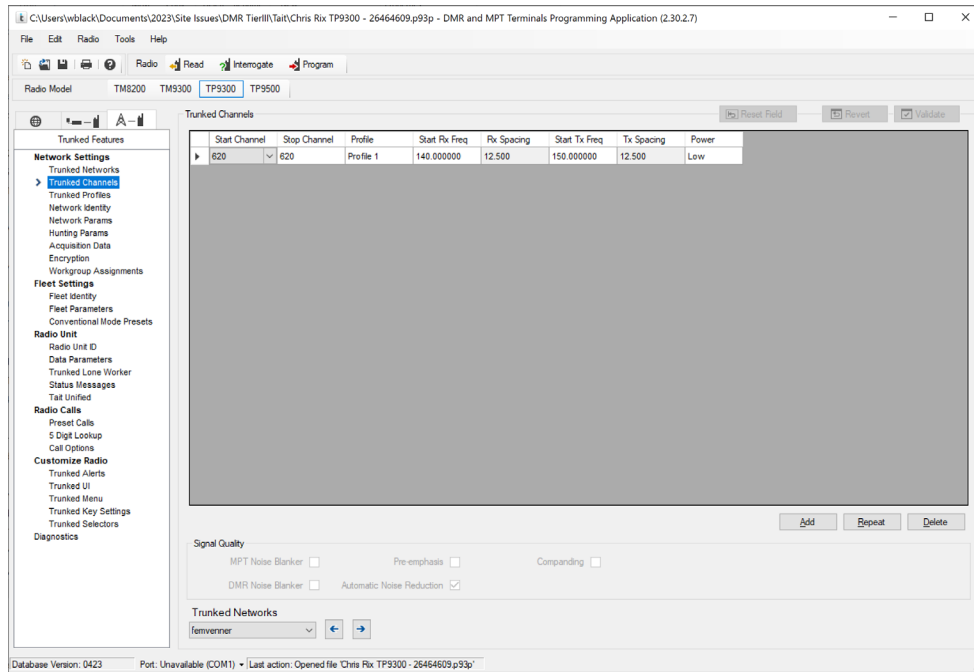
Figure 54 – Tait Trunked Channel Plan

The Trunked Channels screen displays the channel number and frequencies. This screen and the Hunting Params screen set the control channel freqiences and channel number set in the R8x00 channel plan. In this example, Start TX Freq is equal to Uplink Frequency in the R8x00 channel plan and Start TX Freq is equal to Downlink Frequency in the R8x00 channel plan. This is due to both the Start Channel and Stop Channel values being 620. The value of 620 is also used for the Hunting channel number and will be the channel number set in the R8x00 channel plan.
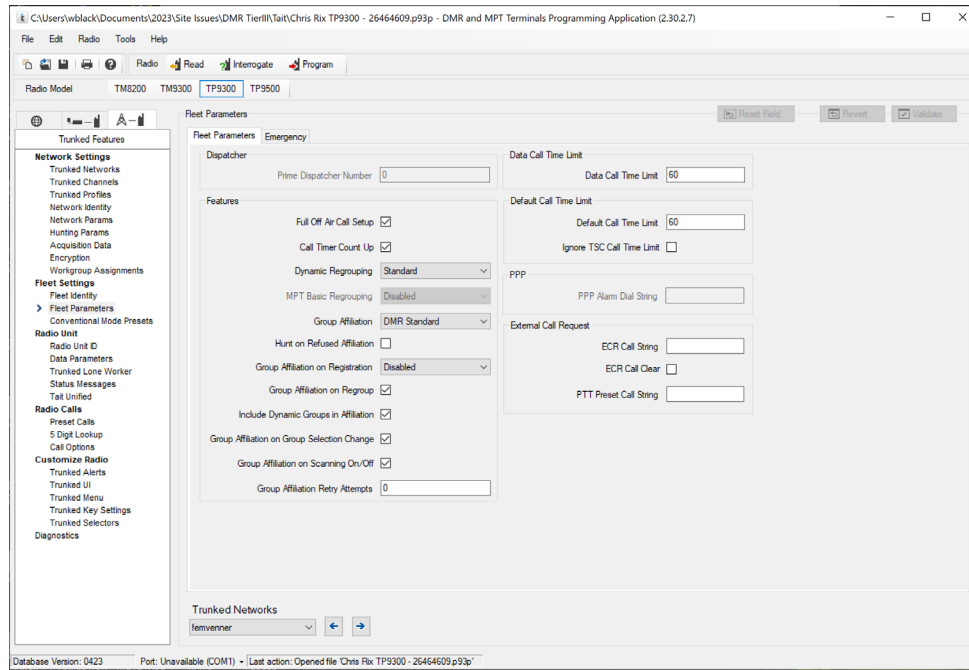
Figure 55 – Tait Fleet Settings Examples
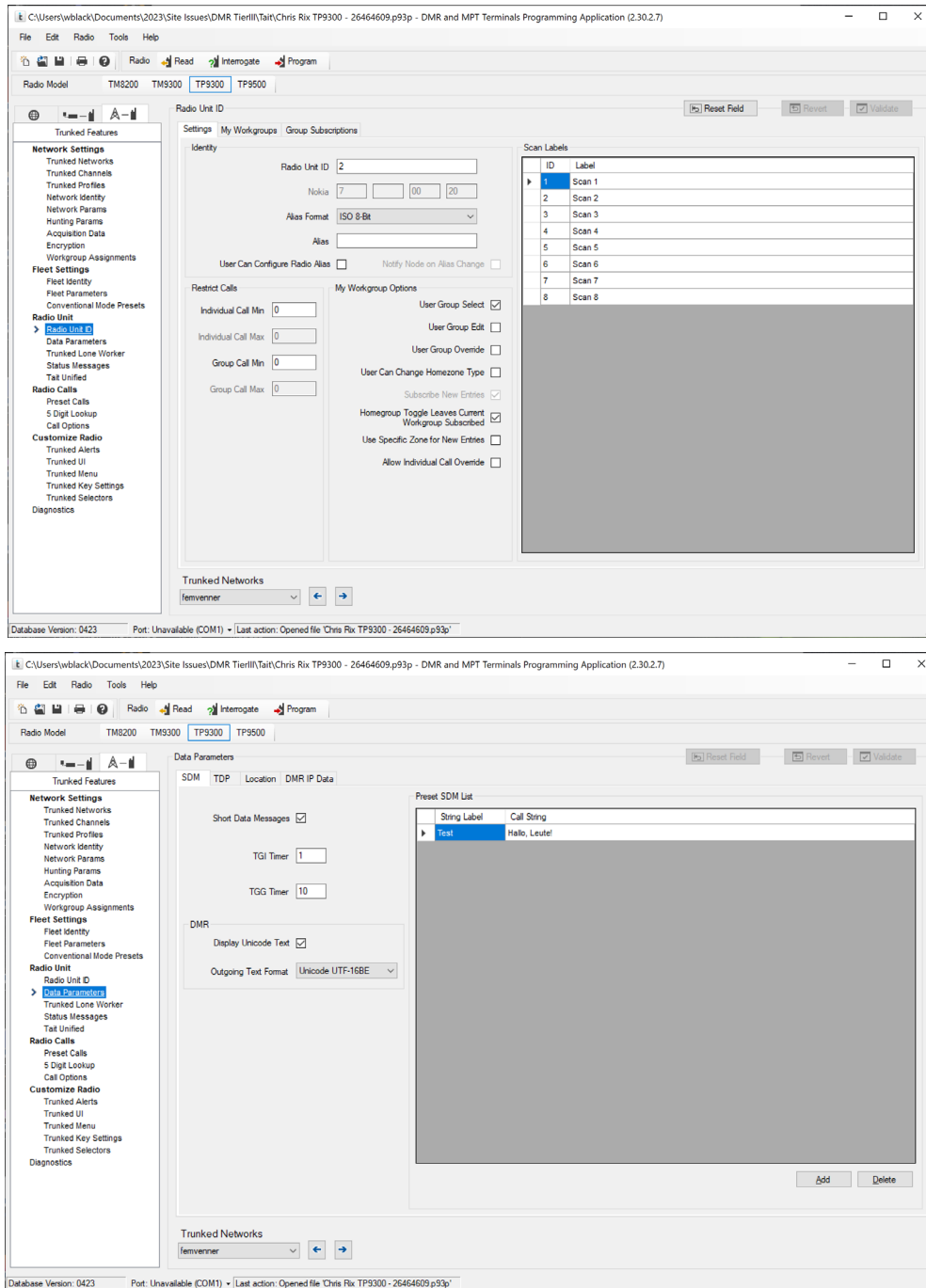
Figure 56 – Tait Radio Settings Examples

Appendix 4 – Power User Feature of DMR Tier III Test Mode

Configuration Files

There is a text-based configuration file that controls various characteristics of the physical layer interface between the R8x00 and the UUT. This file is installed with default values that should not be changed by users unless directed by Astronics support personnel.

The configuration file is set with defaults that have been tested with Kenwood, Motorola, and Tait DMR Tier III radios and found to operate properly. The idea behind this file is to allow changes to test mode operation as future needs require it without always having to release a new software version.

When testing Motorola Capacity Max devices (in Open radio or Open system mode) there is one value that must be updated to improve the testing experience. The value is called [C_BCAST_Mass_Req]. This value represents Broadcast Mass Registration (MassReg). See ETSI TS 102 361-4, Chapter 6.4.5 for details. This value is a method to force all user devices on the network to re-register if needed. To minimize the congestion that could occur during the re-registration process, a window time is provided within which each device selects its own random time to re-register. As there is only one device being tested by the R8x00, congestion is not an issue. The MassReg command would only be used in a live system when something has gone wrong within network and a restart is needed. It is used in the R8x00 to force the MS to periodically verify it is still connected to the R8x00.

The default "MassReg" configuration item found in file is as follows:

> [C_BCAST_Mass_Req]
>
> Send_Option;1;"{BOOL:0,1}";"<flag> : 0=Do not send,1=Send as CSBK"
>
> Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"
>
> Reg_Window;9;"{INT:0 to 15}";"<table>: See ETSI TS 102 361-4, Chapter 7.2.19.5.1"
>
> **Note:** The Reg_Window is set to "9," which equates to a time window of 300 seconds. See ETSI TS 102 361-4, Chapter 6.4.5.1

That means the MS should re-register within 5 minutes after receipt of request.

The interpretation of how a radio operates until re-registration is not defined in the standard and is left to the manufacturer. Tait and Kenwood radios continue to Tx and Rx as though the radio is already registered to network, and then re-register before the window timeout. Motorola devices stop all operations of Tx and Rx until the re-registration is completed within the designated window.

Note: The maximum registration window selection is 200,000 seconds (55.5 hours).

For users selecting the Moto PTT, the device will be registered, able to make one call, and then it will no longer Tx or Rx calls. Pressing the PTT button on the radio will result in a "Registering" message that appear for a few minutes. This behavior makes manual testing very difficulat as user must wait for timeout to complete before next call can complete. To stop this behavior, it is recommended to change the Reg_Window from "9" to "0," where "0" represents "Cancel Mass Reg." For example:

[C_BCAST_Mass_Req]

Send_Option;1;"{BOOL:0,1}";"<flag> : 0=Do not send,1=Send as CSBK"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Reg_Window;0;"{INT:0 to 15}";"<table>: See ETSI TS 102 361-4, Chapter 7.2.19.5.1"

This setting will also work for all radio manufactures.

Modifying Configuration Files

To modify the configuration file, a copy of the default file is needed.

Contact customer support for a default file (or a file modified for Motorola operation).

A clean "default" file is available from the R8x00 using following method:

1. Plug a USB drive into the R8x00.

2. Navigate to the DMR Tier III MS test mode.

3. Press the DMR Tier III MS… soft key or press the number "4" key to jump into the DMR Tier III MS zone.

4. Press the Shift key and then the Bksp key in that order.

5. There will be NO indication on the front panel of R8x00 that anything has happened.

6. Remove the USB drive and connect to a PC.

7. Open the file directory and look for the "defaultCFG.csv" file located at \ASTRONICS\DMRTier3\Config.

This is a copy of the configuration text file that can be used for modification.

Note: *The file has a .csv extension, but it is recommended that it be opened in Notepad for editing and NOT in Excel.*

Open the file in Notepad and make the desired value change. Do not change or move anything other than the specific values. Leave all lines in the same order.

Save the file to a new name and do not change the extension. Save the file in the same location on USB drive. For example, D:\ASTRONICS\DMRTier3\Config\ MOTO-CFG.csv.

While in the DMR Tier III test mode, plug the USB with updated configuration back into the R8x00.

In the DMR Tier III MS zone soft key menu, a new Import Configuration soft key will appear.

Select the Import Configuration soft key and select the modified configuration file for import and press the Enter key.
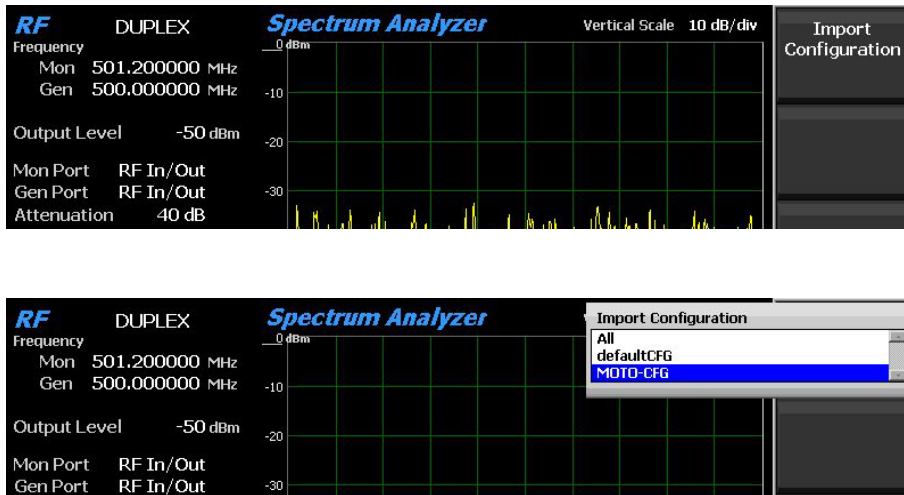
Figure 57 – Import Configuration

With a new configuration file in the unit, two additional soft keys will be available for use: Select Configuration and Delete Configuration.
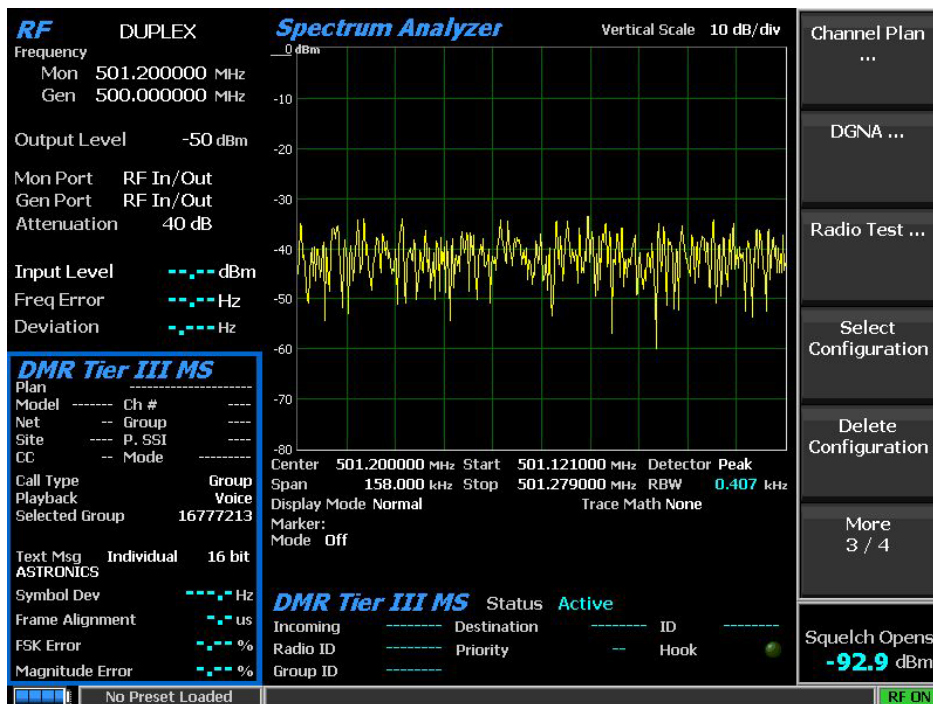

Figure 58 – Select Configuration and Delete Configuration Soft Keys

When the non-default configuration is in use, a green flag labeled "CFG" will appear in the DMR Tier III MS zone.
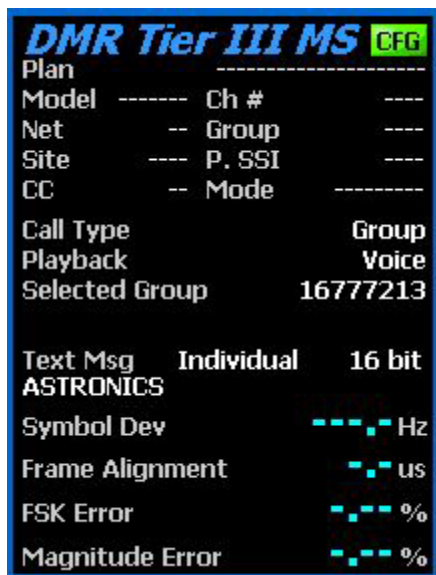
Figure 59 – DMR Tier III Zone with Configuration Loaded

When the R8x00 is booted to system defaults, the DRM Tier III test mode will always start with the default configuration file. The user must select a different configuration file to use one. If it is desirable to boot to a pre-selected channel plan and configuration file, then the desired setup should be saved as a preset.

List of Configuration Settings

For reference, all configuration items found in the configuration file are listed below along with default settings.

If more information is desired for settings, see the references to the standards documents located after the variable names listed below.

Note: *The items that have term "Dangerous" following them indicate that the Astronics development team strongly recommends this value should stay at its default value. If the term "Unsupported" is used, that means the values have been included for future use, but are not actively supported by the DMR Tier III test mode.*

=======

[ALOHA]

Version;4;"{INT:0 to 4}";"<number>: See ETSI TS 102 361-4, Chapter 7.2.32"

Mask;0;"{INT:0 to 24}";"<number>: Dangerous: See ETSI TS 102 361-4, Chapter 7.2.1"

MsAdress;0;"{INT:0 to 16776895}";"<number>: Dangerous: See ETSI TS 102 361-4, Table 7.19: C_ALOHA PDU"

ServiceFunction;0;"{INT:0 to 3}";"<number>: Dangerous: See ETSI TS 102 361-4, Chapter 7.2.2"

Par;3;"{INT:0 to 3}";"<number>: Dangerous: See ETSI TS 102 361-4, Chapter 6.3.2.2.1.4"

TSCCAS;0;"{BOOL:0,1}";"<number>: Unsupported yet: See ETSI TS 102 361-4, Chapter 7.1.1.1.4"

[C_BCAST_CallTimer_Parms]

Send_Option;1;"{BOOL:0,1}";"<flag> : 0=Do not send,1=Send as CSBK"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

T_EMERG_TIMER;32;"{INT:1 to 511}";"<table> : (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A, Table A.2: Call Timer Tokens T_EMERG_TIMER"

T_MS_MS_TIMER;108;"{INT:1 to 4095}";"<table> : (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A, Table A.4: Call Timer Tokens T_MS-MS_TIMER"

T_MS_LINE_TIMER;108;"{INT:1 to 4095}";"<table> : (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A, Table A.5: Call Timer Tokens T_MS-LINE_TIMER"

T_PACKET_TIMER;12;"{INT:1 to 31}";"<table> : (overwrites R8 parameter ulVoiceCallTimeOut) Unsupported yet: See ETSI TS 102 361-4 Annex A, Table A.3: Call Timer Tokens T_PACKET_TIMER"

[C_BCAST_Mass_Req]

Send_Option;1;"{BOOL:0,1}";"<flag> : 0=Do not send,1=Send as CSBK"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Reg_Window;9;"{INT:0 to 15}";"<table>: See ETSI TS 102 361-4, Chapter 7.2.19.5.1"

[C_BCAST_Chan_Freq]

Send_Option;1;"{INT:0 to 2}";"<number>: 0=Do not send,1=Send as CSBK, 2=Send as MBC(BC_AP)"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

[C_BCAST_Gen_Site_Params]

Send_Option;1;"{BOOL:0,1}";"<flag >: 0=Do not send,1=Send as CSBK"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Reg_Tg_Subscription;0;"{BOOL:0,1}";"<number>: See ETSI TS 102 361-4, Chapter 7.2.41"

[C_BCAST_Local_Time]

Send_Option;0;"{BOOL:0,1}";"<number>: 0=Do not send,1=Send as CSBK"

Send_Periode;500;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Ntp_Periode;0;"{INT:0,30 to 86400}";"<seconds>: 0=Do not use NTP server for time synchronization, otherwise time synchronization every N seconds"

Ntp_Server;;"{String:max 47 chars}";"<String> : Empty for no server, else IPv4, [IPv6] or name like 'pool.ntp.org', add ':port' if necessary."

TZ;;"{String:max 23 chars}";"<String> : Empty use host for local time, else set time zone in the format of the environment variable TZ, e.g. 'GST-1GDT'."

[C_BCAST_Manufacturer_Specific_1]

Send_Option;0;"{INT:0 to 2}";"<number>: 0=Do not send,1=Send as CSBK(96Bits), 2=Send as MBC(192Bits)"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Data;0x000000000000000000000000;"{HEX:0-9,A-F:96 or 192 bits}";"<binary>: Data in hexadecimal format"

[C_BCAST_Manufacturer_Specific_2]

Send_Option;0;"{INT:0 to 2}";"<number>: 0=Do not send,1=Send as CSBK(96Bits), 2=Send as MBC(192Bits)"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Data;0x000000000000000000000000;"{HEX:0-9,A-F:96 or 192 bits}";"<binary>: Data in hexadecimal format"

[C_BCAST_Manufacturer_Specific_3]

Send_Option;0;"{INT:0 to 2}";"<number>: 0=Do not send,1=Send as CSBK(96Bits), 2=Send as MBC(192Bits)"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Data;0x000000000000000000000000;"{HEX:0-9,A-F:96 or 192 bits}";"<binary>: Data in hexadecimal format"

[C_BCAST_Manufacturer_Specific_4]

Send_Option;0;"{INT:0 to 2}";"<number>: 0=Do not send,1=Send as CSBK(96Bits), 2=Send as MBC(192Bits)"

Send_Periode;166;"{INT:8 to 1000}";"<frames>: Send in every N frames"

Data;0x000000000000000000000000;"{HEX:0-9,A-F:96 or 192 bits}";"<binary>: Data in hexadecimal format"

[Timer]

TV_Item;0;"{INT:0,10 to 60}";"<seconds>: (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A, set 0 for unlimited, in other case SwiMi will send PTT de-key"

TV_Hangtime;30;"{INT:1 to 60}";"<seconds>: (overwrites R8 parameter ulVoiceCallHangTime) See ETSI TS 102 361-4 Annex A"

TV_Inactive;5;"{INT:1 to 60}";"<seconds>: See ETSI TS 102 361-4 Annex A, In seconds a MS does not send voice data until PTT de-keying"

PV_Hangtime;30;"{INT:1 to 60}";"<seconds>: (overwrites R8 parameter ulVoiceCallHangTime) Like TV_Hangtime but for private calls"

T_AnswerCall;2;"{INT:2 to 60}";"<seconds>: See ETSI TS 102 361-4 Annex A, If T_CALL_SETUP_PHASE is enabled it is used as maximum time for a periodic C_AHOY, otherwise cancel call if timer fires"

T_Pending;2;"{INT:2 to 60}";"<seconds>: See ETSI TS 102 361-4 Annex A, If T_CALL_SETUP_PHASE is enabled it is used as maximum time for a periodic C_AHOY, otherwise cancel call if timer fires"

T_ALS_REQUEST_LIFE_SPAN;1;"{INT:1 to 10}";"<seconds>: See ETSI TS 102 361-4 Annex A"

TP_Timer;4;"{INT:4 to 60}";"<seconds>: See ETSI TS 102 361-4 Annex A, If T_CALL_SETUP_PHASE is enabled it is used as maximum time for a periodic C_WACK, otherwise cancel call if timer fires"

TNP_Timer;2;"{INT:2 to 60}";"<seconds>: See ETSI TS 102 361-4 Annex A, If T_CALL_SETUP_PHASE is enabled it is used as maximum time for a periodic C_WACK, otherwise cancel call if timer fires"

T_ALS;60;"{INT:10 to 300}";"<seconds>: (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A"

T_ALS_E;60;"{INT:10 to 14400}";"<seconds>: (overwrites R8 parameter ulVoiceCallTimeOut) See ETSI TS 102 361-4 Annex A"

T_CALL_SETUP_PHASE;30;"{INT:0,2 to 60}";"<seconds>: 0=Disabled, otherwise synchronization of TP_Timer and T_AnswerCall/T_Pending by sending of C_WACK/C_AHOY to MS until end of this timer"

T_Call_Device_Ring_Time;3;"{INT:1 to 59}";"<seconds>: P2P call (FOACSU) to R8 device, ring time before accepting the call."

T_Call_Late_Entry;4;"{INT:0 to 10}";"<seconds>: 0=Do not send Late-Entry on TSCC, else every N seconds"

T_Call_Replay_HangTime;2;"{INT:1 to 10}";"<seconds>: (Used for R8 parameter ul*SpeechTxStatus=4) Hangtime between repeated recorded voice data"

T_CmdReg_MassReq;2;"{INT:1 to 10}";"<seconds>: Time out for command registration, see also CmdReg_Retries"

[Constants]

Call_Ahoy_Retry;3;"{INT:1 to 6}";"<retry> : How often retry to send the AHOY to called MS"

Call_Udt_Retry;3;"{INT:1 to 6}";"<retry>   : How often retry to send UDT (BCD/Supplementary-Data+Payload) while call-setup"

Call_Header_Nr;1;"{INT:0 to 6}";"<repeat> : How often repeat VOICE-LC-HEADER (0=Not repeated)"

Call_Terminator_Nr;4;"{INT:1 to 6}";"<repeat> : How often send TERMINATOR-LC until fall back to P_PROTECT"

Call_Clear_Nr;4;"{INT:1 to 6}";"<repeat> : How often send P_CLEAR"

Call_PTT_DeKey_Retry;3;"{INT:1 to 6}";"<retry> : How often send ceased/release command in reverse channel for voice payload PTT"

Call_PTT_DeKey_Extra;5;"{INT:1 to 60}";"<seconds>: Extra seconds if the Mobile TV_Item, T_MS-MS_TIMER, T_MS-Line_TIMER or T_EMERG_TIMER is not observed before SwiMi initiates PTT de-keying."

Sds_Ahoy_Retry;3;"{INT:1 to 6}";"<retry> : How many times to try to send C_AHOY(status SDS) to MS"

Sds_Udt_Retry;3;"{INT:1 to 6}";"<retry>   : How many times to try to send UDT (payload SDS) to MS"

Sds_Group_Repeat;1;"{INT:1 to 6}";"<repeat> : How often an SDS is sent to a group again"

Page_Request_Retries;3;"{INT:1 to 6}";"<retry> : How many times to try a paging request"

CmdReg_Retries;3;"{INT:1 to 6}";"<retry> : How many times to try a command registration, see also CmdReg_TimeOut"

Dgna_Udt_Retry;3;"{INT:1 to 6}";"<retry> : How many times to try to send UDT DGNA request to MS"

[VoicePattern_1]

VoiceNumber;0;"{INT:0,9 to 14}";"<number>: 0=No voice pattern, 9-13=Replace predefined test tune, 14=Default for the data that does not replace the predefined."

VoiceData;0x000000000000000000000000000000000000000000000000000000;"{HEX:0-9,A-F:216 bits}";"<binary>: Data in hexadecimal format"

[BehaviouralPatterns]

Call_Grant_Type;1;"{INT:1 to 2}";"<flag> : 1=Send as CSBK, 2=Send as MBC(CG_AP)"

Call_Bcd_Request;2;"{INT:0 to 2}";"<number>: Send phone call as 0=AHOY+BCD <UDT:Response Requested (A)>, 1=AHOY+BCD <UDT:Response NOT Requested (A)>, 2=BCD<UDT:Response Requested (A)>"

Call_HangTime_Type;0;"{INT:0 to 1}";"<flag> : 0=Use P_PROTECT in hang time, 1=Force voice terminater instead of P_PROTECT"

Call_ReverseCh_Crc;0;"{INT:0 to 3}";"<number>: 0=By ALOHA element 'Version', 1=Force with Mask (Beginning with: ETSI TS 102 361-1 V2.5.1), 2=Force without mask (Previous: ETSI TS 102 361-1 V2.5.1), 3=Force unprotected: Until ETSI TS 102 361-4 V1.6.1"

Call_ReverseCh_SF_Repeat;0;"{INT:0 to 6}";"<number>: 0=Send once in Super Frame slot F, 1-6=If TSCC, IDLE or Data-CH: Number of continuous repetitions. For voice CH as only in frame F."

Tscc_Delayed_Ms_Sending;1;"{INT:0 to 1}";"<flag> : 0=false, 1=Tolerate Mobile does not transmit in the first granted slot, but in the second!"

Tscc_CmdReq_Sending;1;"{INT:0 to 2}";"<number>: 0=Cancel-MassReg(ADRNULL)+Short-term-MassReg(MS),1=Cancel-MassReg(MS)+Short-term-MassReg(MS),2=Short-term-MassReg(MS)"

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This is the end of the configuration items reference list.