ASTRONICS
TEST SYSTEMS

R8000 SERIES
COMMUNICATIONS SYSTEM ANALYZER

AUTOTUNE USER GUIDE

Harris XG-75 Portable
Harris XG-75 Mobile

Astronics Test Systems
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1. Introduction

The Astronics Test Systems R8000 Series Communications System Analyzer AutoTune™ (hereafter “AutoTune”) provides an automated test and alignment solution for supported two-way radios.

2. Scope

This document includes information regarding the tests and alignments performed for supported radios by AutoTune. This document is restricted to radio-specific information for Harris XG-75 Portable and XG-75 Mobile series radios.

Please refer to the R8100 Series Communications System Analyzer Owner’s Manual (FCT-1382) for an overview and basic operating instructions for AutoTune itself.

3. Conventions

3.1. PPM

“ppm” is “parts per million”. This specification is generally limited to frequency-related measurements. If the frequency units are in MHz, then the ppm specification is in Hz. For example, a 169.075 MHz frequency with a ±1.5 ppm specification is allowed to vary by 1.5 * 169.075 MHz, or about ±254 Hz.

3.2. Rated Audio

Rated audio voltage target is **2 V_{RMS}** for portable models and **7.745 V_{RMS}** for mobile models.

4. Important Notes

4.1. Required firmware

All Harris XG-75 series radios must be running **XGP** or **XLP** firmware for AutoTune to successfully service them. Older ECP firmware is not currently supported. Contact Harris Technical Assistance Center (TAC) for information on acquiring XGP firmware.

4.2. Conventional channel selection

The radio must have a conventional channel selected before AutoTune servicing begins. A trunked channel if selected is known to cause radio communication initialization failures.

4.3. Supported models

The following Harris XG-75 series models are supported by AutoTune:

- P7300
- XG-75
- XG-75P
- XG-75Pe
- M7300
- XG-75M

4.4. Required Options

Option Name	Reason
Harris XG-75 (R8-AT_XG75)	Harris XG-75 AutoTune
P25 Conventional Test Mode (R8-P25)	Used to perform P25 Rx BER (C4FM) tests.
P25 Phase 2 Test Mode (R8-P25_II)	Used to perform P25 Rx BER (TDMA) tests.

Table 1. Required R8x00 options for AutoTune for Harris XG-75 series radios.

5. Harris XG-75 Portable Radio Test Setup

Before servicing a radio with AutoTune, ensure the analyzer is running the current system software version. Each system version release contains issue resolutions and/or new/enhanced features.

- On the analyzer, navigate to Settings > About… Note the System version shown.
- Browse to the Astronics Test Systems software upgrades webpage: https://freedomcte.com/upgrades/
- If the first Current System Version shown on the webpage is more recent than the analyzer System version, follow the webpage instructions to download and apply the current system version software to your analyzer.

To perform test and alignment procedures, the XG-75 Portable radio must be connected to the R8000 Communications System Analyzer as shown in the figure below.

Make certain that the radio under test is configured as described in the corresponding diagram **before** attempting to perform an alignment or test. Failure to do so may result in poor radio performance and/or damage to the analyzer or radio equipment under test.

5.1. Cable Sweep

Every RF cable connected between a radio under test and the analyzer attenuates the signal propagating through it. The amount of attenuation varies by several factors such as operating frequency, cable length, and cable type. Ensuring this attenuation is accounted for by the analyzer is important to the accuracy of several tests and alignments, primarily power tests.

Sweep the RF cable used between the Radio and Analyzer, label the RF cable with the stored cable sweep name, and enable the Cable Sweep feature in the analyzer System, System Settings… menu. Refer to Application Note FCT-1017 *Utilizing Cable Sweep* for instructions on how to perform a cable sweep.

5.2. Test Hardware

Test Aid	Recommended part	Description
USB radio programming cable	Astronics part# TTL-232RG-VSW3V3-WE_M	USB to TTL cable for programming and servicing radio.
Variable DC power supply	Astron VS-50M	DC power supply with sufficient current sourcing capacity.
Battery eliminator	Harris part# BT-023406-015	Interfaces portable radio to DC power supply.
RF test cable (Type N to BNC)	Megaphase RF Orange series	Shielded RF cable with low loss.
Antenna adapter	Harris part# 19B801496G2	RF adapter for radio antenna to BNC connector.
Reference cable	Pomona 5697	BNC cable for sweeping RF test cable.
6 dB attenuator	Mini-Circuits 15542	Attenuator for reducing Reference cable VSWR.
Audio cables	Pomona 5697	Connects analyzer and portable test set for audio signals.
Portable test box	Harris MATQ-03424 Test Box	Routes signals between radio and analyzer for Rx audio and microphone tests and for data communication.
Audio test cable	Harris part# CA-023407-002	Routes signal between radio and Portable Test Box for Rx audio and data communication.

Table 2. Portable Test Hardware Table

5.2.1. Battery Eliminator

Battery eliminators interface portable radios to DC power supplies. They're needed because batteries cannot produce consistent voltage/current when the radio is keyed for extended time periods, as it will be during an alignment. Attempting to use even a nominally good battery will eventually result in power alignment failures. A battery eliminator should always be used while performing portable radio alignments and tests with AutoTune to achieve consistent alignment performance.

For XG-75 Portable radio models, use the following Harris battery eliminator part. For more information, refer to the applicable Harris radio maintenance manual.

- Part Number: BT-023406-015

5.3. XG-75 Portable Test Setup

Refer to the diagram below for the proper test setup. Note that the Test Box Device # knob should be set to position **7** as shown.

Note: Parts numbers shown in the diagram are available from Astronics Test Systems.

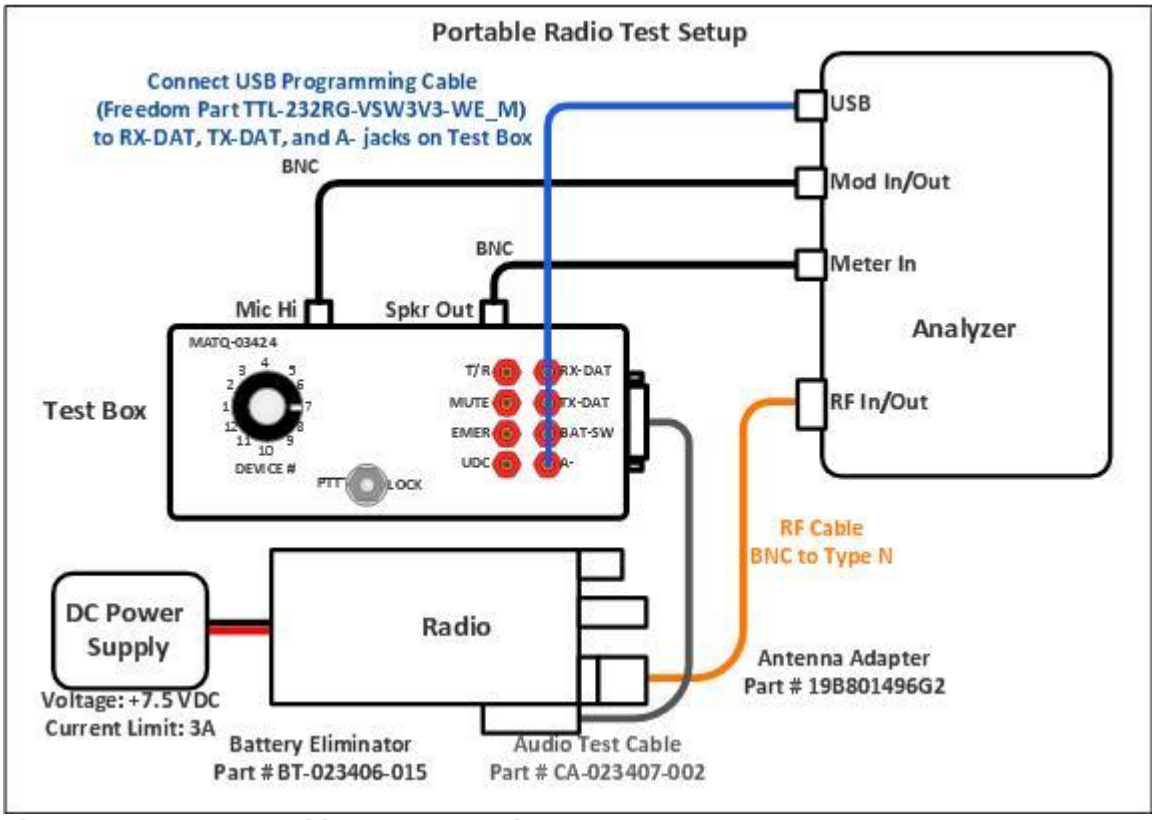

Figure 5-1. XG-75 Portable Test Setup Diagram

6. Harris XG-75 Portable Alignment and Test Descriptions

Note: Throughout this section are references to Test Frequency. Test Frequencies are band- and mode -specific. A table of the frequencies used by each band may be found in the respective Harris radio service manual.

Note: All analyzer Mode settings are Standard unless otherwise indicated.

6.1. Reference Oscillator

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	30 dB

Table 3. Analyzer Configuration for Reference Frequency

6.1.1. Alignment

The radio is placed into Test Mode at a Tx Test Frequency and commanded to transmit. Using a best linear fit algorithm, two frequency error measurements are taken at two different radio softpot values. These frequency error measurements are used to calculate the softpot value which minimizes frequency error. After programming this new softpot value into the radio, the radio softpot is fine tuned until minimum frequency error is detected. The frequency error is compared against test limits and the final results written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error alignment
Max Limit	Maximum Limit (inclusive) for frequency error alignment
Old Softpot	Radio softpot before alignment
New Softpot	Radio softpot after alignment

Table 4. Reference Frequency alignment results

6.1.2. Test

The radio is placed into Test Mode at a Tx Test Frequency and commanded to transmit. The frequency error is measured by the analyzer and compared to test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error
Max Limit	Maximum Limit (inclusive) for frequency error
Softpot	Radio softpot producing the Freq Error

Table 5. Reference Frequency test results

6.2. TX Power

Note: For more information on Power Control and Power Sense softpots, see Harris radio maintenance manuals.

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	30 dB

Table 6. Analyzer Configuration for TX Power

6.2.1. Alignment

The TX Power alignment aligns the power output level of the radio at Low, Mid, and High power levels. The radio is placed into Test Mode and commanded to transmit at the first Test Frequency and the Low, Mid, and High power settings in turn. For each test frequency, the output level is measured and then adjusted until near to a band-specific output level defined by the respective Harris XG-75 Portable radio service manuals. See APPENDIX A for test limits used.

Name	Description
Result	Pass or Fail. Power Out within manufacturer limits
Power Level	Power setting under alignment (Low, Mid, High)
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Old Pwr Cntl	Original radio Power Control softpot setting before alignment.
New Pwr Cntl	Radio Power Control softpot setting after alignment.
Old Pwr Sens	Radio Power Sense softpot setting before alignment.
New Pwr Sens	Radio Power Sense softpot setting after alignment.

Table 7. TX Power alignment results

6.2.2. Test

The radio is placed into Test Mode and commanded to transmit. Beginning at the first Tx Test Frequency, the output level is measured at each TX Test Frequency, for Low, Mid, and High Power, and compared against test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within Max Limit, Min Limit
Power Level	Power setting under test (Low, Mid, High)
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Power Control	Radio Power Control softpot setting which yields Power Out
Power Sense	Radio Power Sense softpot setting which yields Power Out

Table 8. TX Power test results

6.3. FM Deviation

The FM Deviation test measures the “compensation factors used to maintain consistent modulation characteristics across the radio’s bandsplit.”

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 9. Analyzer Configuration for FM Deviation test

6.3.1. FM Deviation Test

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. This test is performed for each bandwidth mode (Wideband, NPSPAC (if applicable), and Narrowband) and each Tx Test Frequency. The test results for each Tx Test Frequency are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Deviation	Measured maximum deviation level
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 10. FM Deviation test results

6.4. Channel Guard Deviation and DCG Scalar Test

The Channel Guard Deviation and DCG Scalar test measures the “compensation factors used to maintain consistent modulation characteristics for Tone and Digital Channel Guard operation.”

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 11. Analyzer Configuration for Channel Guard Deviation and DCG Scalar test

6.4.1. Channel Guard Deviation and DCG Scalar Test

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. This test is performed for each bandwidth mode (Wideband TCG, NPSPAC TCG (if applicable), Narrowband TCG, and Wideband DCG) and each Tx Test Frequency. The test results for each Tx Test Frequency are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Deviation	Measured deviation level
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 12. Channel Guard Deviation and DCG Scalar test results

6.5. C4FM Deviation Test

The C4FM Deviation test measures the compensation factors used to maintain consistent modulation characteristics for C4FM digital operation.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	Pwr-Weight

Table 13. Analyzer Configuration for C4FM Deviation test

6.5.1. C4FM Deviation Test

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the Power-Weight-averaged deviation of this tone is measured with the analyzer. This test is performed for the C4FM bandwidth mode and each Tx Test Frequency. The test results for each Tx Test Frequency are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Deviation	Measured C4FM deviation level
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 14. C4FM Deviation test results

6.6. P25 Phase 1 Tx Modulation (C4FM) Test

The P25 Phase 1 Tx Modulation (C4FM) test measures the radio's P25 Phase 1 C4FM modulation level at a specific test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	Peak Avg

Table 15. Analyzer Configuration for P25 Phase 1 Tx Modulation (C4FM) test

6.6.1. P25 Phase 1 Tx Modulation (C4FM) Test

The radio is placed into Test Mode at low power at the last Tx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the Peak-averaged deviation of this tone is measured with the analyzer. This test is performed at a single Tx Test Frequency. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Measured Dev	Measured P25 Phase 1 C4FM deviation
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 16. P25 Phase 1 Tx Modulation (C4FM) test results

6.7. P25 Phase 2 Tx Modulation (TDMA) Test

The P25 Phase 2 Tx Modulation (TDMA) test measures the radio's P25 Phase 2 TDMA modulation level at a specific test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 17. Analyzer Configuration for P25 Phase 2 Tx Modulation (TDMA) test

6.7.1. P25 Phase 2 Tx Modulation (TDMA) Test

The radio is placed into Test Mode at low power at the last Tx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the +/-Peak / 2-averaged deviation of this tone is measured with the analyzer. This test is performed at a single Tx Test Frequency. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Measured Dev	Measured P25 Phase 2 TDMA deviation
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 18. P25 Phase 2 Tx Modulation (TDMA) test results

6.8. TX Audio Sensitivity and Distortion

Tx Audio Sensitivity and Distortion test verifies the transmitter audio distortion is at an appropriate level.

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	30 dB

Table 19. Analyzer Configuration for TX Audio Sensitivity and Distortion test

6.8.1. TX Audio Sensitivity and Distortion Test

The radio is placed into Test Mode at Wide bandwidth and highest Tx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the audio distortion of the radio's modulated signal is measured with the analyzer. The distortion is compared against test limits and written to the log file.

Name	Description
Result	Pass or Fail. Distortion is less than or equal to Max Limit.
Frequency	Test Frequency
Audio Level	Audio tone voltage level generated by the analyzer
Distortion	Measured distortion percentage
Max Limit	Maximum passable deviation (inclusive)

Table 20. Tx Audio Sensitivity and Distortion test results

6.9. Rx Audio Level and Distortion

Rx Audio Level and Distortion test verifies the receiver audio amplitude and distortion are at appropriate levels.

RF Control	Port	Frequency	Modulation	Output
Generate	RF IN/OUT	Test Frequency	FM	-47 dBm

Table 21. Analyzer Configuration for Rx Audio Level and Distortion test

6.9.1. RX Audio Level and Distortion Test

The radio is placed into Test Mode at Wide bandwidth and lowest Rx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the audio voltage and distortion of the radio's demodulated signal is measured with the analyzer. Both the audio level and the distortion are compared against test limits and written to the log file.

Name	Description
Result	Pass or Fail. Distortion is less than or equal to Max Limit.
Frequency	Test Frequency
Min Limit	Minimum audio voltage level required to pass the test
Max Volume	Audio volume level generated by the radio at max volume setting
Mid Vol Dist	Measured distortion percentage at mid volume setting
Max Limit	Maximum passable distortion (inclusive)

Table 22. Rx Audio Level and Distortion test results

6.10. Squelch Open and Close

Squelch Open and Close alignment verifies and modifies as necessary the squelch hysteresis so stronger RF signals are correctly received and weaker RF signals are correctly blocked.

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Bandwidth- and frequency-specific	Model-specific

Table 23. Analyzer Configuration for Squelch Open and Close alignment, test

6.10.1. Alignment

For each bandwidth mode (Narrowband, Wideband, NPSPAC, C4FM) and for each test frequency, the analyzer is setup to use the bandwidth- and test frequency-specific RF bandwidth and Fixed 1 kHz levels. The radio volume is then adjusted for Rated Audio. The radio is placed into Test Mode and the analyzer output level adjusted to -130 dBm. The analyzer output level is slowly increased until the radio unsquelches. The output level is then lowered until radio again squelches. SINAD is measured at the unsquelch point and the output levels between the unsquelch point and the squelch point are compared against test limits. If outside test limits, applicable softpots are updated and the alignment process is repeated. Once measurements are within test limits, the final results are written to the log file. This process is repeated for each bandwidth and each test frequency. Results are recorded to test log file.

Name	Description
Result	Pass or Fail. Pass if alignment completes within valid softpot range.
Frequency	Test Frequency
Min Sql Open	Minimum SINAD level at which unsquelch should occur
Open SINAD	SINAD level at which squelch opens
Max Sql Open	Maximum SINAD level at which unsquelch should occur
Min Hyst	Minimum hysteresis between squelch open output level and squelch close output level
Hysteresis	Difference between squelch open output level and squelch close output level
Max Hyst	Maximum hysteresis between squelch open output level and squelch close output level
Open Softpot	Radio softpot governing Squelch Open level.
Close Softpot	Radio softpot governing Squelch Close level.

Table 24. Squelch Open and Close alignment results

6.10.2. Test

For each bandwidth mode (Narrowband, Wideband, NPSPAC, C4FM) and for each test frequency, the analyzer is setup to use the bandwidth- and test frequency-specific RF bandwidth and Fixed 1 kHz levels. The radio volume is then adjusted for Rated Audio.

The radio is placed into Test Mode and the analyzer output level adjusted to -130 dBm. The analyzer output level is slowly increased until the radio unsquelches. The output level is then lowered until radio again squelches. SINAD is measured at the unsquelch point and the output levels between the unsquelch point and the squelch point are compared against test limits. If outside test limits, up to two measurement attempts are made to verify failure. Final results are written to the log file. This process is repeated for each bandwidth and each test frequency.

Name	Description
Result	Pass or Fail. Pass if alignment completes within valid softpot range.
Frequency	Test Frequency
Min Hyst	Minimum hysteresis between squelch open output level and squelch close output level
Hysteresis	Difference between squelch open output level and squelch close output level
Max Hyst	Maximum hysteresis between squelch open output level and squelch close output level
Open Softpot	Radio softpot governing Squelch Open level.
Close Softpot	Radio softpot governing Squelch Close level.

Table 25. Squelch Open and Close test results

6.11. RSSI

RSSI alignment and test verifies that varying levels of RF input power are accurately measured by the radio's receive signal strength indicator.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Freq	None	Various

Table 26. Analyzer Configuration for RSSI alignment, test

6.11.1. Alignment

The radio is placed into Test Mode at the first RX Test Frequency. The output level of the analyzer is then adjusted to match the current RSSI output level. The radio RSSI level is requested and then the corresponding softpot applied to the radio. The final results are written to the log file. This process is repeated for each Rx Test Frequency and each RSSI level (Weak, Medium, and High).

Name	Description
Result	Pass or Fail. Pass if radio RSSI within target +/- tolerance
Frequency	Test Frequency
Weak Level +/-Tolerance	Measured Radio RSSI at weak input level
Weak Softpot	RSSI softpot associated with weak level
Medium Level +/-Tolerance	Measured Radio RSSI medium input level
Med Softpot	RSSI softpot associated with medium level
Strong Level +/-Tolerance	Measured Radio RSSI strong input level
Strong Softpot	RSSI softpot associated with strong level

Table 27. RSSI alignment results

6.11.2. Test

The radio is placed into Test Mode at the first RX Test Frequency. The output level of the analyzer is then adjusted to match the current RSSI output level. The radio RSSI level is requested from the radio. The final results are written to the log file. This process is repeated for each Rx Test Frequency and each RSSI level (Weak, Medium, and High). Test report format is identical to RSSI alignment.

6.12. RX Sensitivity (SINAD)

Rx Sensitivity (SINAD) test verifies the receiver analog audio sensitivity is at an appropriate level.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Freq	1 kHz @ 3 kHz	-60 dBm

Table 28. Analyzer Configuration for RX Sensitivity test

6.12.1. Test

The analyzer is setup by applying the Modulation signal in Table 28 to the radio and then adjusting radio volume for Rated Audio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The output level of the analyzer is then adjusted until the radio audio signal's SINAD level measures about 12 dB. The current analyzer output level is then compared against test limits. The final results are written to the log file. This process is repeated for each bandwidth and each RX Test Frequency.

Name	Description
Result	Pass or Fail. Sensitivity (SINAD) level within Max Limit
Frequency	Test Frequency
12dB SINAD	Analyzer output level at which the radio SINAD level measures about 12 dB
Max Limit	Maximum Limit (inclusive) for RX Sensitivity to Pass

Table 29. RX Sensitivity test results

6.13. P25 Phase 1 Rx Sensitivity (C4FM) Test

The P25 Phase 1 Rx Sensitivity (C4FM) test measures the radio's P25 Phase 1 C4FM sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	C4FM	-116 dBm

Table 30. Analyzer Configuration for P25 Phase 1 Rx Sensitivity (C4FM) test

6.13.1. Test

The analyzer is setup by applying the Modulation signal in Table 30 to the radio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The radio's reported BER level is measured and compared against test limits. The final results are written to the log file. This process is repeated for each Test Frequency.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass
Min Limit	Minimum Limit (exclusive) for Sensitivity (SINAD) to Pass

Table 31. P25 Phase 1 Rx Sensitivity (C4FM) test results

6.14. P25 Phase 2 Rx Sensitivity (TDMA) Test

The P25 Phase 2 Rx Sensitivity (TDMA) test measures the radio's P25 Phase 2 TDMA sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	TDMA	-116 dBm

Table 32. Analyzer Configuration for P25 Phase 2 Rx Sensitivity (TDMA) test

6.14.1. Test

The analyzer is setup by applying the Modulation signal in Table 32 to the radio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The radio's reported BER level is measured and compared against test limits. The final results are written to the log file. This process is repeated for each Test Frequency.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass
Min Limit	Minimum Limit (exclusive) for Sensitivity (SINAD) to Pass

Table 33. P25 Phase 2 Rx Sensitivity (TDMA) test results

6.15. Rx IF Bandwidth – Signal Displacement Bandwidth Test

The Rx IF Bandwidth – Signal Displacement Bandwidth test verifies the receiver adjacent channel selectivity is at an appropriate level.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	1 kHz @ 3 kHz	-60 dBm

Table 34. Analyzer Configuration for Rx IF Bandwidth – Signal Displacement Bandwidth test

6.15.1. Test

The analyzer is setup by applying the Modulation signal in Table 34 to the radio. The radio is placed into Test Mode at the last RX Test Frequency. Radio volume control is set for mid-range. Adjust the output level until 12 dB SINAD is reached. Increase analyzer output level by 6 dBm. Slowly increase analyzer generate frequency until measured SINAD drops back to 12 dB. Starting from center frequency, slowly decrease analyzer generate frequency until measured SINAD drops back to 12 dB. Compare against test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
12dB SINAD	Analyzer output level at which the radio SINAD level measures about 12 dB
Min Limit	Minimum Limit (inclusive) for Rx IF Bandwidth to Pass
Sig Disp BW	Measured signal displacement bandwidth
Min Limit	Minimum Limit (inclusive) for Rx IF Bandwidth to Pass

Table 35. Rx IF Bandwidth – Signal Displacement Bandwidth test results

7. Harris XG-75 Mobile Radio Test Setup

Before servicing a radio with AutoTune, ensure the analyzer is running the current system software version. Each system version release contains issue resolutions and/or new/enhanced features.

- On the analyzer, navigate to Settings > About… Note the System version shown.
- Browse to the Astronics Test Systems software upgrades webpage: https://freedomcte.com/upgrades/
- If the first Current System Version shown on the webpage is more recent than the analyzer System version, follow the webpage instructions to download and apply the current system version software to your analyzer.

To perform test and alignment procedures, the XG-75 Mobile radio must be connected to the R8000 Communications System Analyzer as shown in the figures below.

Make certain that the radio under test is configured as described in the corresponding diagram **before** attempting to perform the indicated alignment or test. Failure to do so may result in poor radio performance and/or damage to the analyzer or radio equipment under test.

7.1. Cable Sweep

Every RF cable connected between a radio under test and the analyzer attenuates the signal propagating through it. The amount of attenuation varies by several factors such as operating frequency, cable length, and cable type. Ensuring this attenuation is accounted for by the analyzer is important to the accuracy of several tests and alignments, primarily power tests.

Sweep the RF cable used between the Radio and Analyzer, label the RF cable with the stored cable sweep name, and enable the Cable Sweep feature in the analyzer System, System Settings… menu. Refer to Application Note FCT-1017 *Utilizing Cable Sweep* for instructions on how to perform a cable sweep.

7.2. Test Hardware

Test Aid	Recommended part	Description
USB radio programming cable	Astronics part# BCM676/MXT100	USB to serial adapter cable for programming and servicing radio.
Variable DC power supply	Astron VS-50M	DC power supply with sufficient current sourcing capacity.
RF test cable (Type N to TNC)	Megaphase RF Orange series	Shielded RF cable with low loss.
Reference cable	Pomona 5697	BNC cable for sweeping RF test cable.
6 dB attenuator	Mini-Circuits 15542	Attenuator for reducing Reference cable VSWR.
Audio cables	Pomona 5697	Connects analyzer and mobile speaker load for routing recovered audio signals.
Speaker load	Astronics part # 202161-02	Simulates speaker load for mobile recovered audio tests.
Speaker cable	Harris part # 14002-0174-07	Routes recovered audio from mobile to speaker load
Modified microphone cable	Astronics part #MC-101616-041_M	Routes simulated microphone audio from analyzer to mobile MIC port.
CAN cable (remote mount only)	Harris part# CA-009562-001	Connects mobile transceiver to remote mount control head.

Table 36. Portable Test Hardware Table

7.3. XG-75 Mobile Test Setup

Refer to the diagrams below for proper test setup.

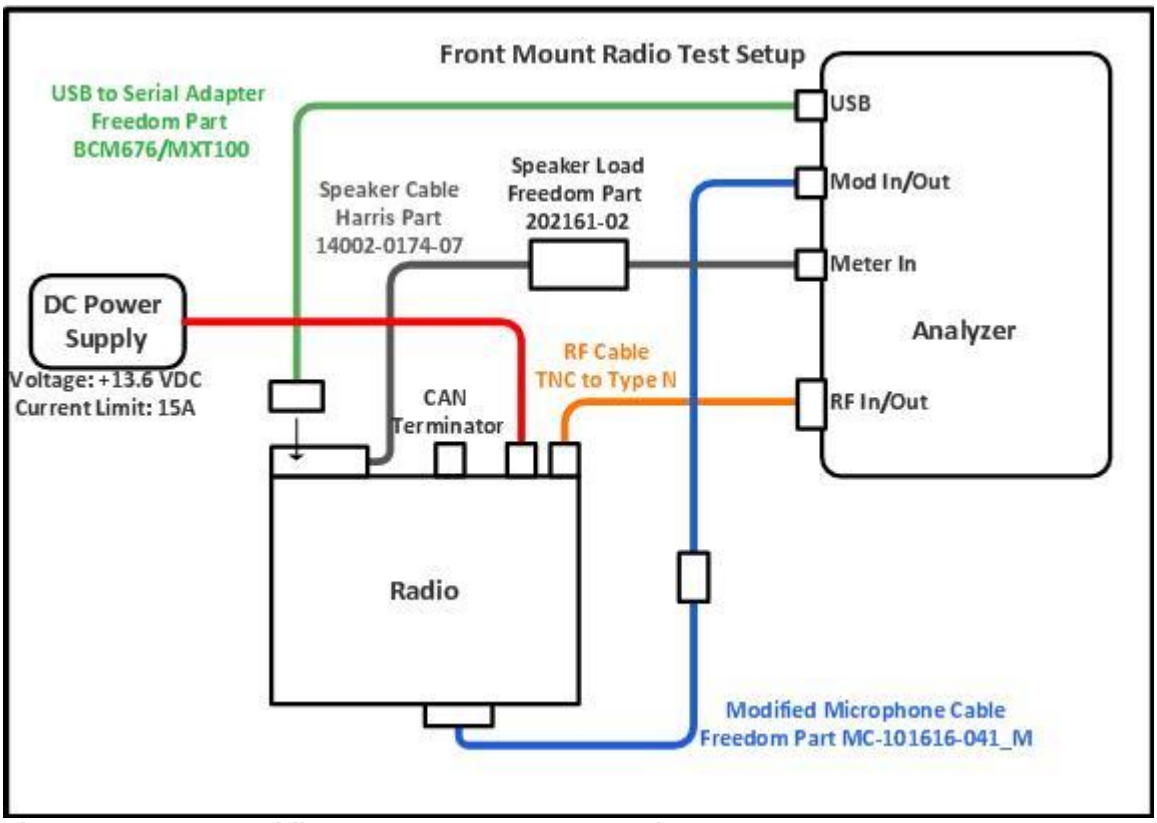

Figure 7-1. XG-75 Mobile Front Mount Test Setup Diagram

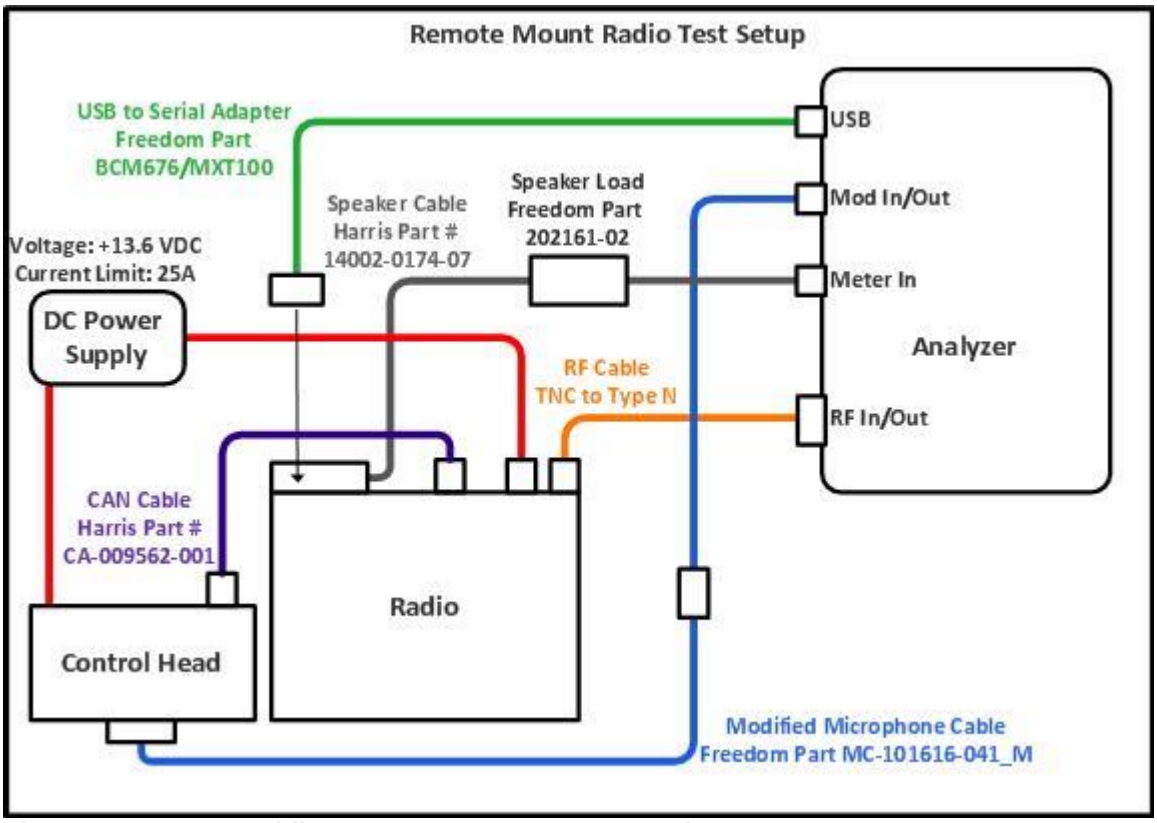

Figure 7-2. XG-75 Mobile Remote Mount Test Setup Diagram

8. Harris XG-75 Mobile Alignment and Test Descriptions

Note: Throughout this section are references to Test Frequency that are band- and mode -specific. A table of the frequencies used by each band may be found in the respective radio service manual.

Note: All analyzer Mode settings are Standard unless otherwise indicated.

8.1. Reference Frequency

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	30 dB

Table 37. Analyzer Configuration for Reference Frequency

8.1.1. Alignment

The radio is placed into Test Mode at a Tx Test Frequency and commanded to transmit. Using a best linear fit algorithm, two frequency error measurements are taken at two different radio softpot values. These frequency error measurements are used to calculate the softpot value which minimizes frequency error. After programming this new softpot value into the radio, the radio softpot is fine tuned until minimum frequency error is detected. The frequency error is compared against test limits and the final results written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error alignment
Max Limit	Maximum Limit (inclusive) for frequency error alignment
Old Softpot	Radio softpot before alignment
New Softpot	Radio softpot after alignment

Table 38. Reference Frequency alignment results

8.1.2. Test

The radio is placed into Test Mode at a Tx Test Frequency and commanded to transmit. The frequency error is measured by the analyzer and compared to test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error
Max Limit	Maximum Limit (inclusive) for frequency error
Softpot	Radio softpot producing the Freq Error

Table 39. Reference Frequency test results

8.2. TX Power

Note: For more information on Power Control and Power Sense softpots, see Harris radio maintenance manuals.

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	40 dB

Table 40. Analyzer Configuration for TX Power

8.2.1. Alignment

The TX Power alignment aligns the power output level of the radio at Low, Mid, and High power levels. The radio is placed into Test Mode and commanded to transmit at the first Test Frequency and the Low, Mid, and High power settings in turn. For each test frequency, the output level is measured and then adjusted until near to a band-specific output level defined by the respective Harris XG-75 Mobile radio service manuals. See APPENDIX A for test limits used.

Name	Description
Result	Pass or Fail. Power Out within manufacturer limits
Power Level	Power setting under alignment (Low, Mid, High)
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Old Pwr Cntl	Original radio Power Control softpot setting before alignment.
New Pwr Cntl	Radio Power Control softpot setting after alignment.
Old Pwr Sens	Radio Power Sense softpot setting before alignment.
New Pwr Sens	Radio Power Sense softpot setting after alignment.

Table 41. TX Power alignment results

8.2.2. Test

The radio is placed into Test Mode and commanded to transmit. Beginning at the first Tx Test Frequency, the output level is measured at each TX Test Frequency, for Low, Mid, and High Power, and compared against test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within Max Limit, Min Limit
Power Level	Power setting under test (Low, Mid, High)
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Power Control	Radio Power Control softpot setting which yields Power Out
Power Sense	Radio Power Sense softpot setting which yields Power Out

Table 42. TX Power test results

8.3. Tx Modulation Limit

The Tx Modulation Limit test measures the radio's maximum modulation level at a specific test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 43. Analyzer Configuration for Tx Modulation Limit test

8.3.1. Tx Modulation Limit Test

The radio is placed into Test Mode at low power at the last TX Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the ±Peak / 2-averaged deviation of this tone is measured with the analyzer. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Deviation	Measured maximum deviation level
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 44. Tx Modulation Limit test results

8.4. P25 Phase 1 Tx Modulation (C4FM) Test

The P25 Phase 1 Tx Modulation (C4FM) test measures the radio's P25 Phase 1 C4FM modulation level at a specific test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	Peak Avg

Table 45. Analyzer Configuration for P25 Phase 1 Tx Modulation (C4FM) test

8.4.1. P25 Phase 1 Tx Modulation (C4FM) Test

The radio is placed into Test Mode at low power at the last Tx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the Peak-averaged deviation of this tone is measured with the analyzer. This test is performed at a single Tx Test Frequency. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Measured Dev	Measured P25 Phase 1 C4FM deviation
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 46. P25 Phase 1 Tx Modulation (C4FM) test results

8.5. P25 Phase 2 Tx Modulation (TDMA) Test

The P25 Phase 2 Tx Modulation (TDMA) test measures the radio's P25 Phase 2 TDMA modulation level at a specific test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 47. Analyzer Configuration for P25 Phase 2 Tx Modulation (TDMA) test

8.5.1. P25 Phase 2 Tx Modulation (TDMA) Test

The radio is placed into Test Mode at low power at the last Tx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the +/-Peak / 2-averaged deviation of this tone is measured with the analyzer. This test is performed at a single Tx Test Frequency. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Measured Dev	Measured P25 Phase 2 TDMA deviation
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level

Table 48. P25 Phase 2 Tx Modulation (TDMA) test results

8.6. Rx Audio Level and Distortion

Rx Audio Level and Distortion test verifies the receiver audio amplitude and distortion are at appropriate levels.

RF Control	Port	Frequency	Modulation	Output
Generate	RF IN/OUT	Test Frequency	FM	-47 dBm

Table 49. Analyzer Configuration for Rx Audio Level and Distortion test

8.6.1. RX Audio Level and Distortion Test

The radio is placed into Test Mode at Wide bandwidth and lowest Rx Test Frequency and commanded to transmit. The analyzer generates a modulation tone and the audio voltage and distortion of the radio's demodulated signal is measured with the analyzer. Both the audio level and the distortion are compared against test limits and written to the log file.

Name	Description
Result	Pass or Fail. Distortion is less than or equal to Max Limit.
Frequency	Test Frequency
Min Limit	Minimum audio voltage level required to pass the test
Max Volume	Audio volume level generated by the radio at max volume setting
Mid Vol Dist	Measured distortion percentage at mid volume setting
Max Limit	Maximum passable distortion (inclusive)

Table 50. Rx Audio Level and Distortion test results

8.7. RSSI

RSSI alignment and test verifies that varying levels of RF input power are accurately measured by the radio's receive signal strength indicator.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Freq	None	Various

Table 51. Analyzer Configuration for RSSI alignment, test

8.7.1. Alignment

The radio is placed into Test Mode at the first RX Test Frequency. The output level of the analyzer is then adjusted to match the current RSSI output level. The radio RSSI level is requested and then the corresponding softpot applied to the radio. The final results are written to the log file. This process is repeated for each Rx Test Frequency and each RSSI level (Weak, Medium, and High).

Name	Description
Result	Pass or Fail. Pass if radio RSSI within target +/- tolerance
Frequency	Test Frequency
Weak Level +/-Tolerance	Measured Radio RSSI at weak input level
Weak Softpot	RSSI softpot associated with weak level
Medium Level +/-Tolerance	Measured Radio RSSI medium input level
Med Softpot	RSSI softpot associated with medium level
Strong Level +/-Tolerance	Measured Radio RSSI strong input level
Strong Softpot	RSSI softpot associated with strong level

Table 52. RSSI alignment results

8.7.2. Test

The radio is placed into Test Mode at the first RX Test Frequency. The output level of the analyzer is then adjusted to match the current RSSI output level. The radio RSSI level is requested from the radio. The final results are written to the log file. This process is repeated for each Rx Test Frequency and each RSSI level (Weak, Medium, and High). Test report format is identical to RSSI alignment.

8.8. RX Sensitivity (SINAD)

Rx Sensitivity (SINAD) test verifies the receiver analog audio sensitivity is at an appropriate level.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Freq	1 kHz @ 3 kHz	-60 dBm

Table 53. Analyzer Configuration for RX Sensitivity test

8.8.1. Test

The analyzer is setup by applying the Modulation signal in Table 28 to the radio and then adjusting radio volume for Rated Audio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The output level of the analyzer is then adjusted until the radio audio signal's SINAD level measures about 12 dB. The current analyzer output level is then compared against test limits. The final results are written to the log file. This process is repeated for each bandwidth and each RX Test Frequency.

Name	Description
Result	Pass or Fail. Sensitivity (SINAD) level within Max Limit
Frequency	Test Frequency
12dB SINAD	Analyzer output level at which the radio SINAD level measures about 12 dB
Max Limit	Maximum Limit (inclusive) for RX Sensitivity to Pass

Table 54. RX Sensitivity test results

8.9. Squelch Open and Close

Squelch Open and Close alignment verifies and modifies as necessary the squelch hysteresis so stronger RF signals are correctly received and weaker RF signals are correctly blocked.

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Bandwidth- and frequency-specific	Model-specific

Table 55. Analyzer Configuration for Squelch Open and Close alignment, test

8.9.1. Alignment

For each bandwidth mode (Narrowband, Wideband, NPSPAC, C4FM) and for each test frequency, the analyzer is setup to use the bandwidth- and test frequency-specific RF bandwidth and Fixed 1 kHz levels. The radio volume is then adjusted for Rated Audio. The radio is placed into Test Mode and the analyzer output level adjusted to -130 dBm. The analyzer output level is slowly increased until the radio unsquelches. The output level is then lowered until radio again squelches. SINAD is measured at the unsquelch point and the output levels between the unsquelch point and the squelch point are compared against test limits. If outside test limits, applicable softpots are updated and the alignment process is repeated. Once measurements are within test limits, the final results are written to the log file. This process is repeated for each bandwidth and each test frequency. Results are recorded to test log file.

Name	Description
Result	Pass or Fail. Pass if alignment completes within valid softpot range.
Frequency	Test Frequency
Min Sql Open	Minimum SINAD level at which unsquelch should occur
Open SINAD	SINAD level at which squelch opens
Max Sql Open	Maximum SINAD level at which unsquelch should occur
Min Hyst	Minimum hysteresis between squelch open output level and squelch close output level
Hysteresis	Difference between squelch open output level and squelch close output level
Max Hyst	Maximum hysteresis between squelch open output level and squelch close output level
Open Softpot	Radio softpot governing Squelch Open level.
Close Softpot	Radio softpot governing Squelch Close level.

Table 56. Squelch Open and Close alignment results

8.9.2. Test

For each bandwidth mode (Narrowband, Wideband, NPSPAC, C4FM) and for each test frequency, the analyzer is setup to use the bandwidth- and test frequency-specific RF bandwidth and Fixed 1 kHz levels. The radio volume is then adjusted for Rated Audio.

The radio is placed into Test Mode and the analyzer output level adjusted to -130 dBm. The analyzer output level is slowly increased until the radio unsquelches. The output level is then lowered until radio again squelches. SINAD is measured at the unsquelch point and the output levels between the unsquelch point and the squelch point are compared against test limits. If outside test limits, up to two measurement attempts are made to verify failure. Final results are written to the log file. This process is repeated for each bandwidth and each test frequency.

Name	Description
Result	Pass or Fail. Pass if alignment completes within valid softpot range.
Frequency	Test Frequency
Min Hyst	Minimum hysteresis between squelch open output level and squelch close output level
Hysteresis	Difference between squelch open output level and squelch close output level
Max Hyst	Maximum hysteresis between squelch open output level and squelch close output level
Open Softpot	Radio softpot governing Squelch Open level.
Close Softpot	Radio softpot governing Squelch Close level.

Table 57. Squelch Open and Close test results

8.10. P25 Phase 1 Rx Sensitivity (C4FM) Test

The P25 Phase 1 Rx Sensitivity (C4FM) test measures the radio's P25 Phase 1 C4FM sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	C4FM	-116 dBm

Table 58. Analyzer Configuration for P25 Phase 1 Rx Sensitivity (C4FM) test

8.10.1. Test

The analyzer is setup by applying the Modulation signal in Table 30 to the radio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The radio's reported BER level is measured and compared against test limits. The final results are written to the log file. This process is repeated for each Test Frequency.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass
Min Limit	Minimum Limit (exclusive) for Sensitivity (SINAD) to Pass

Table 59. P25 Phase 1 Rx Sensitivity (C4FM) test results

8.11. P25 Phase 2 Rx Sensitivity (TDMA) Test

The P25 Phase 2 Rx Sensitivity (TDMA) test measures the radio's P25 Phase 2 TDMA sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	TDMA	-116 dBm

Table 60. Analyzer Configuration for P25 Phase 2 Rx Sensitivity (TDMA) test

8.11.1. Test

The analyzer is setup by applying the Modulation signal in Table 32 to the radio. The radio is placed into Test Mode at the first bandwidth and first RX Test Frequency. The radio's reported BER level is measured and compared against test limits. The final results are written to the log file. This process is repeated for each Test Frequency.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass
Min Limit	Minimum Limit (exclusive) for Sensitivity (SINAD) to Pass

Table 61. P25 Phase 2 Rx Sensitivity (TDMA) test results

8.12. Basic Troubleshooting

Symptom	Possible Cause	Possible Solution
Analyzer consistently fails to communicate with radio	• Radio not running XGP firmware	• AutoTune only supports test and alignment on XG-75 series radios running XGP firmware. Older ECP firmware is not supported.
	• Tx/Rx data signals in floating state (XG-75 Portable only)	• Reset (disconnect/reconnect) ground pin (A-) of radio programming cable to Harris Test Box.
	• Unsupported USB to serial adapter (mobiles only)	• Approved USB to serial adapters for connecting the R8000 analyzer to the Harris XG-75 Mobile series radio under test include any adapters which utilize an FTDI FT232_USB to serial UART interface OR Prolific Technology Inc. PL-2303 USB to serial controller interface. See www.ftdichip.com or www.prolific.com.tw for more detail.
	• Radio on a trunking channel	• Change radio channel to a conventional channel. Trunking channel mode can prevent AutoTune from placing radio into test mode.
Analyzer occasionally fails to communicate with radio	• USB hub in use	• USB hubs are known to occasionally prevent or drop radio communication. Connect the radio programming cable directly to an analyzer USB port.

Tx Power aligns power output levels lower than expected.	• RF Level Offset not enabled	• Enable Settings > System Settings… > RF Level Offset. Change RF In/Out offset value to correspond with the RF cable in use and the radio's operating band. For example, if 0.5 dB of loss expected, enter "-0.5 dB" as the RF In/Out offset value. Cable losses are entered as negative values.
Squelch Open and Close test fails one or more points. Can occur even after Squelch Open and Close alignment has just been performed.	• Squelch Open and Close sensitivity	• Repeat the Squelch Open and Close test. The variable nature of the unsquelch/squelch process during the Squelch Open and Close test sometimes makes test consistency irregular.

Table 62. Harris XG-75 Series Troubleshooting Chart

9. Support Information

9.1. Technical Support

Document Library:	freedomcte.com/library/
Video Library:	freedomcte.com/videos/
Phone:	903.985.8999
Email:	Freedom.TechnicalSupport@astronics.com

9.2. Sales

Phone:	903.985.8999
Email:	LMRSales@astronics.com

APPENDIX A. Test Limits

The factory limits contain the default limits as defined by the radio manufacturer and generally should not be modified. However, if extenuating circumstances cause a need to modify the limits this is accommodated by AutoTune. Refer to the R8000 Series Communications System Analyzer Owner's Manual (FCT-1365) for modification instructions.

The following tables list the default test limits for each Harris XG-75 Portable and XG-75 Mobile radio model supported by AutoTune.

Section	Test Name	Limit	Default Value
6.1	Reference Oscillator	Reference Oscillator Align	Min= -0.15 ppm Max= 0.15 ppm
		Reference Oscillator Test	Min= -1.5 ppm Max= 1.5 ppm
		Reference Oscillator Test 700/800MHz Pe	Min= -0.6 ppm Max= 0.6 ppm
6.2.1	TX Power (Align)	TX Power Align VHF Low	Min = 0.49 W Max = 0.51 W
		TX Power Align UHF-L(5W) Low	Min = 0.49 W Max = 0.51 W
		TX Power Align UHF-L(100mW) Low	Min = 0.02 W Max = 0.02 W
		TX Power Align UHF-H Low	Min = 0.49 W Max = 0.51 W
		TX Power Align 700/800MHz Low	Min = 0.49 W Max = 0.51 W
		TX Power Align VHF Mid	Min = 2.97 W Max = 3.03 W
		TX Power Align UHF-L(5W) Mid	Min= 1.98 W Max= 2.02 W
		TX Power Align UHF-H Mid	Min=1.98 W Max=2.02 W
		TX Power Align 700/800MHz Mid	Min=1.58 W Max=1.62 W
		TX Power Align VHF High	Min=5.93 W Max=6.07 W
		TX Power Align UHF-L(5W) High	Min=4.94 W Max=5.06 W
		TX Power Align UHF-L(100mW) High	Min=0.09 W Max=0.10 W
		TX Power Align UHF-H High	Min=4.94 W Max=5.06 W
		TX Power Align 700MHz High	Min=2.82 W Max=2.88 W
		TX Power Align 800MHz High	Min=3.16 W Max=3.24 W
6.2.2	TX Power (Test)	TX Power Test VHF Low	Min= 0.44 W Max= 0.56 W
		TX Power Test UHF-L(5W) Low	Min= 0.44 W Max= 0.56 W
		TX Power Test UHF-L(100mW) Low	Min= 0.09 W Max= 0.11 W
		TX Power Test UHF-H Low	Min= 0.44 W Max= 0.56 W
		TX Power Test 700/800MHz Low	Min= 0.44 W Max= 0.56 W
		TX Power Test VHF Mid	Min= 2.7 W Max= 3.3 W
		TX Power Test UHF-L(5W) Mid	Min= 1.8 W Max= 2.2 W
		TX Power Test UHF-H Mid	Min= 1.8 W Max= 2.2 W
		TX Power Test 700/800MHz Mid	Min= 1.4 W

			Max= 1.8 W
		TX Power Test VHF High	Min= 5.3 W Max= 6.7 W
		TX Power Test UHF-L(5W) High	Min= 4.4 W Max= 5.6 W
		TX Power Test UHF-L(100mW) High	Min= 0.09 W Max= 0.11 W
		TX Power Test UHF-H High	Min= 4.4 W Max= 5.6 W
		TX Power Test 700MHz High	Min= 2.5 W Max= 3.2 W
		TX Power Test 800MHz High	Min= 2.8 W Max= 3.6 W
6.3	FM Deviation	FM Deviation Narrow	Min = 2.15 kHz Max = 2.35 kHz
		FM Deviation Wide	Min=4.1 kHz Max=4.5 kHz
		FM Deviation 700/800MHz NPSPAC	Min=3.5 kHz Max=3.7 kHz
		FM Deviation 700/800MHz Wide	Min=4.3 kHz Max=4.7 kHz
		FM Deviation 700/800MHz Narrow	Min=2.15 kHz Max=2.35 kHz
6.4	Channel Guard Deviation and DCG Scalar Test	CG Deviation Wideband TCG	Min=500 Hz Max=1000 Hz
		CG Deviation NPSPAC	Min=400 Hz Max=800 Hz
		CG Deviation Narrowband TCG	Min=350 Hz Max=500 Hz
		CG Deviation Wideband DCG	Min=350 Hz Max=500 Hz
6.5	C4FM Deviation Test	Data C4FM Deviation Wideband 9600	Min=2.900 kHz Max=3.100 kHz
		Data C4FM Deviation C4FM	Min=2.626 kHz Max=3.026 kHz
		Data C4FM Deviation Narrowband 4800	Min=2.300 kHz Max=2.500 kHz
		Data C4FM Deviation Narrowband 9600	Min=2.300 kHz Max=2.500 kHz
6.6	P25 Phase 1 Tx Modulation (C4FM) Test	P25 Phase1 Tx Modulation C4FM	Min=2.540 kHz Max=3.120 kHz
6.7	P25 Phase 2 Tx Modulation (TDMA) Test	P25 Phase2 Tx Modulation TDMA	Min=2.995 kHz Max=3.310 kHz
6.8	TX Audio Sensitivity and Distortion	Tx Audio Distortion	Max=3%
		Tx Audio Level	Max=14 mV
6.9	Rx Audio Level and Distortion	Rx Audio Distortion	Max=3%
		Rx Audio Voltage	Max=2 V_{RMS}
6.10	Squelch Open and Close	Squelch Hysteresis	Max=5 dB Min=2 dB
		Squelch Open SINAD Align	Max=9.5 dB Min=5.0 dB
		Squelch Open SINAD Test	Max=9.5 dB

			Min=5.0 dB
		Squelch Open Output Level	Min=-130 dBm
6.11	RSSI	XG RSSI Deviation Tolerance	Max=2 dBm
6.12	RX Sensitivity (SINAD)	SINAD	Max=-119 dBm
		Audio Distortion	Max=0 %
6.13	P25 Phase 1 Rx Sensitivity (C4FM) Test	P25 Phase1 Rx Sensitivity C4FM	Min=0 % Max=5 %
6.14	P25 Phase 2 Rx Sensitivity (TDMA) Test	P25 Phase2 Rx Sensitivity TDMA	Min=0 % Max=5 %
6.15	Rx IF Bandwidth – Signal Displacement Bandwidth Test	Rx IF Selectivity	Max=7 kHz Min=2 kHz

Table A-1. Default Harris XG-75 Portable Limits

Section	Test Name	Limit	Default Value
8.1	Reference Oscillator	Reference Oscillator Align VHF	Min= -10 Hz Max= 10 Hz
		Reference Oscillator Align 350MHz	Min= -10 Hz Max= 10 Hz
		Reference Oscillator Align UHF-L	Min= -10 Hz Max= 10 Hz
		Reference Oscillator Align UHF-H	Min= -10 Hz Max= 10 Hz
		Reference Oscillator Align 700/800MHz	Min= -10 Hz Max= 10 Hz
		Reference Oscillator Test	Min= -1.5 ppm Max= 1.5 ppm
8.2.1	TX Power (Align)	TX Power Align VHF(50W) Low	Min = 9.4 W Max = 10.6 W
		TX Power Align VHF(100W) Low	Min = 47.2 W Max = 53.0 W
		TX Power Align 350MHz Low	Min = 7.5 W Max = 8.5 W
		TX Power Align UHF-L Low	Min = 8.2 W Max = 9.2 W
		TX Power Align UHF-H Low	Min = 8.2 W Max = 9.2 W
		TX Power Align 700MHz Low	Min = 1.55 W Max = 1.75 W
		TX Power Align 800MHz Low	Min= 5.2 W Max= 5.6 W
		TX Power Align VHF(50W) Mid	Min=18.9 W Max=21.2 W
		TX Power Align VHF(100W) Mid	Min=76.0 W Max=85.0 W
		TX Power Align 350MHz Mid	Min=18.9 W Max=21.2 W
		TX Power Align UHF-L Mid	Min=22.0 W Max=22.8 W
		TX Power Align UHF-H Mid	Min=22.0 W Max=22.8 W
		TX Power Align 700MHz Mid	Min=16.1 W Max=16.9 W
		TX Power Align 800MHz Mid	Min=16.1 W Max=16.9 W
		TX Power Align VHF(50W) High	Min=47.2 W Max=53.0 W
		TX Power Align VHF(100W) High	Min=103.8 W Max=116.5 W
		TX Power Align 350MHz High	Min=37.8 W Max=42.4 W
		TX Power Align UHF-L High	Min=53.0 W Max=55.0 W
		TX Power Align UHF-H High	Min=53.0 W Max=55.0 W
		TX Power Align 700MHz High	Min=36.6 W Max=37.4 W
		TX Power Align 800MHz High	Min=36.1 W

			Max=36.9 W
8.2.2	TX Power (Test)	TX Power Test VHF(50W) Low	Min = 8.9 W Max = 11.2 W
		TX Power Test VHF(100W) Low	Min = 44.5 W Max = 56.1 W
		TX Power Test 350MHz Low	Min = 7.1 W Max = 9.0 W
		TX Power Test UHF-L Low	Min = 7.8 W Max = 9.8 W
		TX Power Test UHF-H Low	Min = 7.8 W Max = 9.8 W
		TX Power Test 700MHz Low	Min = 1.47 W Max = 1.85 W
		TX Power Test 800MHz Low	Min= 4.8 W Max= 6.1 W
		TX Power Test VHF(50W) Mid	Min=18.9 W Max=21.2 W
		TX Power Test VHF(100W) Mid	Min=76.0 W Max=85.0 W
		TX Power Test 350MHz Mid	Min=18.9 W Max=21.2 W
		TX Power Test UHF-L Mid	Min=21.1 W Max=23.7 W
		TX Power Test UHF-H Mid	Min=21.1 W Max=23.7 W
		TX Power Test 700MHz Mid	Min=14.7 W Max=18.5 W
		TX Power Test 800MHz Mid	Min=14.7 W Max=18.5 W
		TX Power Test VHF(50W) High	Min=47.2 W Max=53.0 W
		TX Power Test VHF(100W) High	Min=103.8 W Max=116.4 W
		TX Power Test 350MHz High	Min=37.7 W Max=42.4 W
		TX Power Test UHF-L High	Min=51.0 W Max=57.2 W
		TX Power Test UHF-H High	Min=51.0 W Max=57.2 W
		TX Power Test 700MHz High	Min=34.9 W Max=39.2 W
		TX Power Test 800MHz High	Min=34.5 W Max=38.7 W
8.3	Tx Modulation Limit	Tx Modulation Limit Narrowband	Min = 2.15 kHz Max = 2.35 kHz
		Tx Modulation Limit Wideband	Min=4.3 kHz Max=4.7 kHz
		Tx Modulation Limit 700/800MHz Wideband	Min=4.3 kHz Max=5.0 kHz
8.4	P25 Phase 1 Tx Modulation (C4FM) Test	P25 Phase1 Tx Modulation C4FM	Min=2.540 kHz Max=3.120 kHz
8.5	P25 Phase 2 Tx Modulation (TDMA)	P25 Phase2 Tx Modulation TDMA	Min=2.995 kHz Max=3.310 kHz

	Test		
8.6	Rx Audio Level and Distortion	Rx Audio Distortion	Max=5 %
		Rx Audio Voltage	Max=7.745 V_{RMS}
8.9	Squelch Open and Close	Squelch Hysteresis	Max=6 dB Min=2 dB
		Squelch Open SINAD Align	Max=12 dB Min=8 dB
		Squelch Open SINAD Test	Max=12 dB Min=8 dB
		Squelch Open Output Level	Min=-130 dBm
8.7	RSSI	XG RSSI Deviation Tolerance	Max=2 dBm
8.8	RX Sensitivity (SINAD)	SINAD VHF	Max=-119 dBm
		SINAD 350MHz	Max=-119 dBm
		SINAD UHF1	Max=-119 dBm
		SINAD UHF2	Max=-119 dBm
		SINAD 700MHz	Max=-119 dBm
		SINAD 800MHz	Max=-118 dBm
		Audio Distortion	Max=0 %
8.10	P25 Phase 1 Rx Sensitivity (C4FM) Test	P25 Phase1 Rx Sensitivity C4FM	Min=0 % Max=5 %
8.11	P25 Phase 2 Rx Sensitivity (TDMA) Test	P25 Phase2 Rx Sensitivity TDMA	Min=0 % Max=5 %

Table A-2. Default Harris XG-75 Mobile Limits

APPENDIX B. Sample Test Result Report

Note: Results shown below are representative of actual results. Actual results and report format may vary.

```
================================================================================
                              Test Result Report
================================================================================
Model #:  XG-75Pe:system                Date/Time:     7/27/2016 3:06 PM
Serial #: A40207000244                  Operator ID:   M

Info: FLASH Version: XGP R05C05

Reference Oscillator Align
==========================
Result    Frequency      Freq Error     Min Limit      Max Limit      Old Softpot    New Softpot
------    ---------      ----------     ---------      ---------      -----------    -----------
Pass      860.987 MHz    33 Hz          -129 Hz        129 Hz         187            188

TX Power Align - 860.987500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.49 W         0.49 W         0.51 W         0              655            0              817
Pass      Mid            1.59 W         1.58 W         1.62 W         0              943            0              1425
Pass      High           3.22 W         3.16 W         3.24 W         0              1375           0              2027

TX Power Align - 857.687500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.49 W         0.49 W         0.51 W         692            648            803            816
Pass      Mid            1.60 W         1.58 W         1.62 W         1026           937            1409           1430
Pass      High           3.19 W         3.16 W         3.24 W         1165           1349           1609           2011

TX Power Align - 854.312500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.51 W         0.49 W         0.51 W         0              655            0              793
Pass      Mid            1.60 W         1.58 W         1.62 W         0              943            0              1425
Pass      High           3.22 W         3.16 W         3.24 W         0              1375           0              2015

TX Power Align - 851.012500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.51 W         0.49 W         0.51 W         706            661            808            830
Pass      Mid            1.61 W         1.58 W         1.62 W         1052           954            1413           1424
Pass      High           3.16 W         3.16 W         3.24 W         1190           1371           1611           1990

TX Power Align - 815.987500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         0              671            0              784
Pass      Mid            1.59 W         1.58 W         1.62 W         0              983            0              1358
Pass      High           3.19 W         3.16 W         3.24 W         0              1471           0              1923

TX Power Align - 812.687500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         694            630            802            786
Pass      Mid            1.60 W         1.58 W         1.62 W         1032           911            1401           1325
Pass      High           3.21 W         3.16 W         3.24 W         1174           1335           1599           1913

TX Power Align - 809.312500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         0              615            0              782
Pass      Mid            1.61 W         1.58 W         1.62 W         0              887            0              1320
Pass      High           3.20 W         3.16 W         3.24 W         0              1279           0              1902

TX Power Align - 806.012500 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         681            638            794            772
Pass      Mid            1.58 W         1.58 W         1.62 W         1022           927            1408           1298
Pass      High           3.17 W         3.16 W         3.24 W         1159           1342           1596           1883

TX Power Align - 804.993750 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         0              631            0              735
Pass      Mid            1.62 W         1.58 W         1.62 W         0              927            0              1352
Pass      High           2.87 W         2.82 W         2.88 W         0              1215           0              1752

TX Power Align - 803.256250 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.51 W         0.49 W         0.51 W         697            654            750            781
Pass      Mid            1.62 W         1.58 W         1.62 W         1055           956            1328           1344
Pass      High           2.85 W         2.82 W         2.88 W         1186           1253           1512           1775

TX Power Align - 802.906250 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         0              655            0              738
Pass      Mid            1.58 W         1.58 W         1.62 W         0              959            0              1327
Pass      High           2.87 W         2.82 W         2.88 W         0              1279           0              1784

TX Power Align - 800.506250 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         712            667            749            769
Pass      Mid            1.58 W         1.58 W         1.62 W         1084           983            1326           1324
Pass      High           2.87 W         2.82 W         2.88 W         1221           1311           1511           1774

TX Power Align - 798.756250 MHz
================================
Result    Power Level    Power Out      Min Limit      Max Limit      Old Pwr Cntl   New Pwr Cntl   Old Pwr Sens   New Pwr Sens
------    -----------    ---------      ---------      ---------      ------------   ------------   ------------   ------------
Pass      Low            0.50 W         0.49 W         0.51 W         0              663            0              771
Pass      Mid            1.59 W         1.58 W         1.62 W         0              975            0              1324
Pass      High           2.84 W         2.82 W         2.88 W         0              1295           0              1733

TX Power Align - 798.006250 MHz
```

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.50 W	0.49 W	0.51 W	722	654	749	733
Pass	Mid	1.60 W	1.58 W	1.62 W	1111	968	1336	1295
Pass	High	2.82 W	2.82 W	2.88 W	1249	1271	1522	1756

TX Power Align - 774.993750 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.51 W	0.49 W	0.51 W	0	671	0	767
Pass	Mid	1.59 W	1.58 W	1.62 W	0	991	0	1301
Pass	High	2.86 W	2.82 W	2.88 W	0	1327	0	1743

TX Power Align - 774.006250 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.50 W	0.49 W	0.51 W	760	677	761	758
Pass	Mid	1.60 W	1.58 W	1.62 W	1158	1014	1323	1305
Pass	High	2.88 W	2.82 W	2.88 W	1301	1368	1498	1749

TX Power Align - 773.406250 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.51 W	0.49 W	0.51 W	0	687	0	725
Pass	Mid	1.62 W	1.58 W	1.62 W	0	1039	0	1315
Pass	High	2.84 W	2.82 W	2.88 W	0	1375	0	1698

TX Power Align - 771.006250 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.51 W	0.49 W	0.51 W	759	712	748	758
Pass	Mid	1.62 W	1.58 W	1.62 W	1180	1088	1329	1314
Pass	High	2.86 W	2.82 W	2.88 W	1326	1456	1502	1739

TX Power Align - 769.993750 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.50 W	0.49 W	0.51 W	0	719	0	757
Pass	Mid	1.62 W	1.58 W	1.62 W	0	1103	0	1311
Pass	High	2.86 W	2.82 W	2.88 W	0	1471	0	1733

TX Power Align - 768.006250 MHz

Result	Power Level	Power Out	Min Limit	Max Limit	Old Pwr Cntl	New Pwr Cntl	Old Pwr Sens	New Pwr Sens
Pass	Low	0.50 W	0.49 W	0.51 W	765	718	753	716
Pass	Mid	1.62 W	1.58 W	1.62 W	1187	1112	1327	1313
Pass	High	2.85 W	2.82 W	2.88 W	1331	1482	1497	1708

FM Deviation Test Wide

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	860.9875 MHz	4.5 kHz	4.3 kHz	4.7 kHz
Pass	857.6875 MHz	4.5 kHz	4.3 kHz	4.7 kHz
Pass	854.3125 MHz	4.4 kHz	4.3 kHz	4.7 kHz
Pass	851.0125 MHz	4.5 kHz	4.3 kHz	4.7 kHz
Pass	815.9875 MHz	4.4 kHz	4.3 kHz	4.7 kHz
Pass	812.6875 MHz	4.5 kHz	4.3 kHz	4.7 kHz
Pass	809.3125 MHz	4.5 kHz	4.3 kHz	4.7 kHz

FM Deviation Test NPSPAC

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	806.0125 MHz	3.6 kHz	3.5 kHz	3.7 kHz

FM Deviation Test Narrow

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	804.9937 MHz	2.18 kHz	2.15 kHz	2.35 kHz
Pass	803.2563 MHz	2.23 kHz	2.15 kHz	2.35 kHz
Pass	802.9062 MHz	2.20 kHz	2.15 kHz	2.35 kHz
Pass	800.5063 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	798.7563 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	798.0063 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	774.9937 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	774.0063 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	773.4062 MHz	2.21 kHz	2.15 kHz	2.35 kHz
Pass	771.0063 MHz	2.19 kHz	2.15 kHz	2.35 kHz
Pass	769.9937 MHz	2.18 kHz	2.15 kHz	2.35 kHz
Pass	768.0063 MHz	2.21 kHz	2.15 kHz	2.35 kHz

Channel Guard Deviation Test - Wideband TCG

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	860.987500 MHz	709 Hz	500 Hz	1000 Hz
Pass	851.012500 MHz	709 Hz	500 Hz	1000 Hz
Pass	815.987500 MHz	710 Hz	500 Hz	1000 Hz

Channel Guard Deviation Test - NPSPAC

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	806.012500 MHz	569 Hz	400 Hz	800 Hz

Channel Guard Deviation Test - Narrowband TCG

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	804.993750 MHz	357 Hz	350 Hz	500 Hz
Pass	768.006250 MHz	355 Hz	350 Hz	500 Hz

Channel Guard Deviation Test - Wideband DCG

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	860.987500 MHz	676 Hz	350 Hz	850 Hz

C4FM Deviation Test

Result	Frequency	Deviation	Min Limit	Max Limit
Pass	860.987500 MHz	2.817 Hz	2.626 Hz	3.026 Hz

P25 Phase 1 Tx Modulation C4FM

Result	Test Frequency	Measured Dev	Min Limit	Max Limit
Pass	860.9875 MHz	2.805 kHz	2.540 kHz	3.120 kHz

P25 Phase 2 Tx Modulation TDMA

Result	Test Frequency	Measured Dev	Min Limit	Max Limit
Pass	860.9875 MHz	3.174 kHz	2.995 kHz	3.310 kHz

Tx Audio Distortion

Result	Frequency	Audio Level	Distortion	Max Limit
Pass	860.9875 MHz	10 mV	2.8 %	3.0 %

Rx Audio Level and Distortion

Result	Frequency	Min Limit	Max Volume	Mid Vol Dist	Max Limit
Pass	768.006250 MHz	2.0 Vrms	3.3 Vrms	1.1 %	3.0 %

RSSI Align

Result	Frequency	-110 +/-2 dBm	Weak Softpot	-85 +/-2 dBm	Med Softpot	-60 +/-2 dBm	Strong Softpot
Pass	860.9875 MHz	-108.5 dBm	508	-85.6 dBm	1404	-59.5 dBm	2236
Pass	851.0125 MHz	-111.2 dBm	584	-85.0 dBm	1404	-60.0 dBm	2238
Pass	774.9937 MHz	-109.1 dBm	577	-84.4 dBm	1430	-60.0 dBm	2282
Pass	771.0063 MHz	-109.7 dBm	574	-85.0 dBm	1434	-59.5 dBm	2256
Pass	768.0063 MHz	-110.2 dBm	596	-85.0 dBm	1442	-60.4 dBm	2277

Rx Sensitivity (SINAD) Test

Result	Frequency	12dB SINAD	Max Limit
Pass	768.006250 MHz	-120.2 dBm	-119.0 dBm
Pass	771.006250 MHz	-120.2 dBm	-119.0 dBm
Pass	774.993750 MHz	-120.8 dBm	-119.0 dBm
Pass	851.012500 MHz	-119.8 dBm	-119.0 dBm
Pass	860.987500 MHz	-120.1 dBm	-119.0 dBm

Squelch Open and Close Align - Narrow

Result	Frequency	Min Sql Open	Open SINAD	Max Sql Open	Min Hyst	Hysteresis	Max Hyst	Open Softpot	Close Softpot
Pass	771.00625 MHz	5 dB	9 dB	10 dB	2 dB	4 dB	5 dB	720	1500

Squelch Open and Close Align - Wide

Result	Frequency	Min Sql Open	Open SINAD	Max Sql Open	Min Hyst	Hysteresis	Max Hyst	Open Softpot	Close Softpot
Pass	860.98750 MHz	5 dB	8 dB	10 dB	2 dB	2 dB	5 dB	1850	2550

Squelch Open and Close Align - NPSPAC

Result	Frequency	Min Sql Open	Open SINAD	Max Sql Open	Min Hyst	Hysteresis	Max Hyst	Open Softpot	Close Softpot
Pass	851.01250 MHz	5 dB	9 dB	10 dB	2 dB	2 dB	5 dB	1400	2250

P25 Phase1 Rx Sensitivity C4FM

Result	Frequency	BER	Max Limit	Min Limit
Pass	768.0063 MHz	1.366 %	5.0 %	0.000 %
Pass	771.0063 MHz	1.490 %	5.0 %	0.000 %
Pass	774.9937 MHz	1.146 %	5.0 %	0.000 %
Pass	851.0125 MHz	1.760 %	5.0 %	0.000 %
Pass	860.9875 MHz	1.609 %	5.0 %	0.000 %

P25 Phase2 Rx Sensitivity TDMA

Result	Frequency	BER	Max Limit	Min Limit
Pass	768.0063 MHz	0.308 %	5.0 %	0.000 %
Pass	771.0063 MHz	0.329 %	5.0 %	0.000 %
Pass	774.9937 MHz	0.275 %	5.0 %	0.000 %
Pass	851.0125 MHz	0.516 %	5.0 %	0.000 %
Pass	860.9875 MHz	0.587 %	5.0 %	0.000 %

Rx IF Bandwidth

Result	Frequency	12 dB SINAD	Min Limit	Sig Disp BW	Max Limit
Pass	860.9875 MHz	-120.1 dB	2 kHz	3.00 kHz	7 kHz

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APP Version 2.0.0.108

Figure B-1. Sample Test Result Report

APPENDIX C. Revision History

B – Options, cable sweep, H/W	M. Mullins	M. Hammer	5/1/24	0440
A – Original Release	M. Mullins	W. Black	11/11/2016	0089
Revision – Change	Requested By	Approved By	Rel. Date	ECO#