

R8000 SERIES COMMUNICATIONS SYSTEM ANALYZER

AUTOTUNE USER GUIDE

Kenwood NX Portable Radios Kenwood NX Mobile Radios

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FCT-1375D

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1. Introduction

The Freedom Communication Technologies 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 Kenwood NX Portable and NX Mobile radios.

Please refer to the R8000 Series Communications System Analyzer Owner's Manual (FCT-1365) for an overview and basic operating instructions for AutoTune itself.

2.1. Supported Models

The following Kenwood NX series models are supported:

- NX-200[G|S]
- NX-210[G]
- NX-300[G|S]
- NX-320
- NX-410
- NX-411
- NX-700[H]
- NX-706
- NX-800[H]
- NX-806
- NX-820[H|HG]
- NX-900
- NX-901

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 approximately 630 mVrms for Kenwood NX Portable and 2.83 Vrms for Kenwood NX Mobile radios across a 4 Ω speaker.

4. Kenwood NX Portable Radio Test Setup

In order to perform the test and alignment procedures, the NX 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.

4.1. NX Portable Test Setup

Refer to the diagram below for the proper test setup. Note that the correct setting for each test set switch is listed in TEST SET SETTINGS.

Note: Approved USB to serial adapters for connecting the R8000 analyzer to the Kenwood NX series radio under test include any adapters which utilize an FTDI FT232_USB to serial UART interface. See http://www.ftdichip.com/Products/ICs/FT232R.htm for more detail.

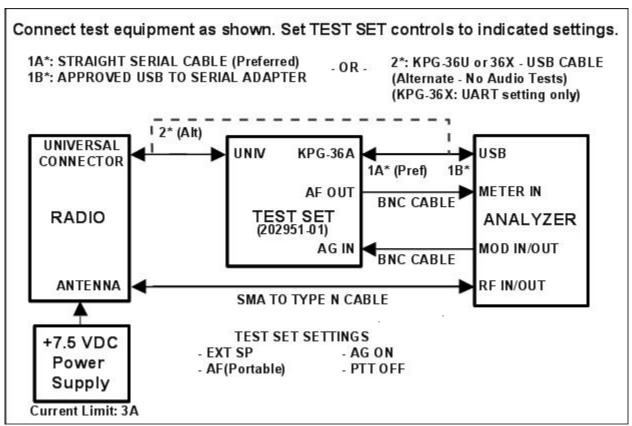


Figure 4-1. NX Portable Test Setup Diagram with 202951-01 Test Set.

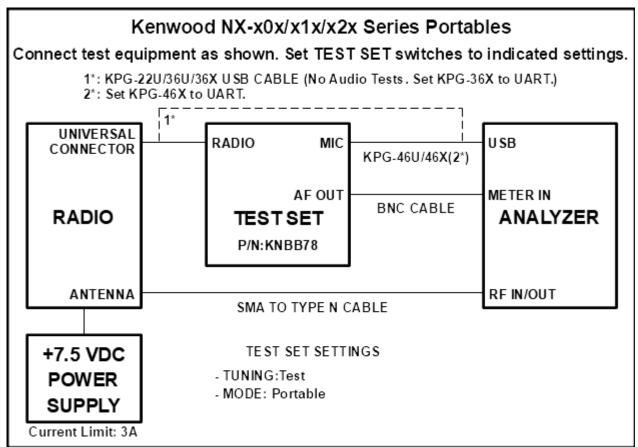


Figure 4-2. NX Portable Test Setup Diagram with KNBB78 Test Set.

4.2. Kenwood NX Portable USB Cables

R8000 system software version 3.1.0.0 and later supports Kenwood USB cables for testing NX portables. When a Kenwood USB cable connects the Radio directly to the Analyzer, the Test Set is bypassed as shown. The Kenwood USB cables do not route radio audio signals. Therefore, the following tests cannot be run when using a Kenwood USB cable:

- TX VOX
- RX Sensitivity
- RX Squelch
- RX RSSI

When a Kenwood NX Portable is selected as the radio to be tested, a new display group appears below the Activity Group (Test Only, Test and Align). This new group displays the current selection for the NX radio interface cable - either Serial, or USB. Use the "Serial or USB Cable" softkey on the right side of the screen to select the cable being used. The list of tests available will update depending on the selection of the cable and the test Activity.

Note: When using the KPG-36X cable, the switch on the cable must be set to "UART" in order for the Analyzer to communicate with the radio. The cable selection on the Analyzer must still be set to "USB", because the audio tests are not supported when using either the 36U or 36X cables.

5. Kenwood NX 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 radio service manual.

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

5.1. Assist Voltage

5.1.1. Alignment

The radio is placed into Test Mode and its VCO lock voltage is adjusted at several RX and TX Test Frequency points. The new softpot values for the voltages are then programmed into the radio.

Name	Description
Result	Pass or Fail. Pass as long as no radio error detected.
Softpot	Radio softpot after alignment

Table 5-1. Reference Frequency alignment results

5.1.2. Test

There is no Assist Voltage test.

5.2. Reference Frequency

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	FM	-30 dBm

Table 5-2. Analyzer Configuration for Reference Frequency

5.2.1. 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. Pass as long as no radio error returned
Frequency	Test Frequency
New Softpot	Radio softpot after alignment
Temp (23 - 27° C)	Internal radio temperature, in Celsius. Ideal temperature is
	between 23 and 27 degrees Celsius.

Table 5-3. Reference Frequency alignment results

5.2.2. 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
Temp (23 - 27° C)	Internal radio temperature, in Celsius. Ideal temperature is
	between 23 and 27 degrees Celsius.

Table 5-4. Reference Frequency test results

5.3. TX Power

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

Table 5-5. Analyzer Configuration for TX Power

5.3.1. Alignment

The TX Power Out alignment aligns the power output level of the radio at both High and Low power levels. The radio is placed into Test Mode and commanded to transmit at the first Test Frequency and the High power setting. For each test frequency, the output level is measured and then adjusted until near to a band-specific output level defined by the respective Kenwood NX Portable radio service manuals.

Model	High Power Limits(W)	Low Power Limits(W)
NX-410 (800 MHz)	2.8 - 3.2	0.9 - 1.1
NX-411 (900 MHz)	2.3 - 2.7	0.9 - 1.1
All other models	4.8 - 5.2	0.7 - 0.9

Table 5-6. Kenwood NX Portable specified target power

This process is repeated for the Low Power setting. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within manufacturer limits
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot after alignment

Table 5-7. TX Power alignment results

5.3.2. 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 High Power and Low 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
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Softpot	Radio softpot which yields Power Out

Table 5-8. TX Power test results

5.4. TX Modulation

The TX Modulation alignment and test includes both TX Balance alignment/test as well as TX Maximum Deviation alignment/test.

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

Table 5-9. Analyzer Configuration for Modulation Balance test, alignment

5.4.1. TX Balance Alignment

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio softpot is adjusted until the deviation difference between the first and second tones is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

The Variance is calculated as:
$$Variance(\%) = \left(\frac{Deviation_{LOW} - Deviation_{HIGH}}{Deviation_{LOW} *100}\right)$$

Name	Description		
Result	Pass or Fail. Calculated difference between Low and High tone		
	deviation less than or equal to Dev Ratio.		
Frequency	Test Frequency		
Variance	Calculated difference, in %, between Low and High tone deviation		
Max Limit	Maximum passable % difference (inclusive) between low and high		
	tone deviation.		
Old Softpot	Original radio softpot setting		
New Softpot	Radio softpot setting after alignment		

Table 5-10. TX Balance alignment results

5.4.2. TX Balance Test

The radio is placed into Test Mode at the first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The percent difference is compared against test limits and written to the log file. This test is performed for each remaining TX Test Frequency.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Low Tone	Measured low tone deviation level.
High Tone	Measured high tone deviation level.
Variance	Calculated difference, in %, between Low and High tone deviation
Max Limit	Maximum passable deviation (inclusive)
Softpot	Radio softpot which yields Variance

Table 5-11. TX Balance test results

5.4.3. TX Maximum Deviation Alignment

The radio is placed into Test Mode at low power at the first bandwidth, first TX Test Frequency and commanded to transmit. The radio generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio softpot is adjusted until the deviation is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

Name	Description		
Result	Pass or Fail. Calculated difference between Low and High tone		
	deviation less than or equal to Dev Ratio.		
Frequency	Test Frequency		
Deviation	Measured maximum deviation level		
Min Limit	Minimum passable deviation level		
Max Limit	Maximum passable deviation level		
Old Softpot	Original radio softpot setting		
New Softpot	Radio softpot setting after alignment		

Table 5-12. TX Maximum Deviation alignment results

5.4.4. TX Maximum Deviation Test

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The radio generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. This test is performed for 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
Softpot	Radio softpot which yields Deviation

Table 5-13. TX Maximum Deviation test results

5.5. TX Signaling

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

Table 5-14. Analyzer Configuration for TX Signaling test, alignment

5.5.1. TX Signaling Alignment

The radio is placed into Test Mode at low power at the first bandwidth and first TX Test Frequency and commanded to transmit. The radio modulates the Test Frequency using the modulation types in Table 5-15 in sequence. The ±Peak/2-averaged modulation deviation is measured with the analyzer. The radio softpot is adjusted until the deviation is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

Modulation	Description
QT	Quiet Talk
DQT	Digital Quiet Talk
LTR	Logic Trunked Radio
DTMF	Dual-tone multi-frequency
Single Tone	Single modulation frequency
MSK	Minimum-shift keying
CWID	Continuous Wave Identification

Table 5-15. TX Signaling modulation types

Name	Description		
Result	Pass or Fail. Calculated difference between Low and High tone		
	deviation less than or equal to Dev Ratio.		
Frequency	Test Frequency		
Deviation	Measured modulation deviation level		
Min Limit	Minimum passable deviation (inclusive)		
Max Limit	Maximum passable deviation (inclusive)		
Old Softpot	Original radio softpot setting		
New Softpot	Radio softpot setting after alignment		

Table 5-16. TX Signaling alignment results

5.5.2. TX Signaling Test

The radio is placed into Test Mode at the first bandwidth and first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The deviation is compared against test limits and written to the log file. This test is performed for each remaining TX Test Frequency.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Deviation	Measured modulation deviation level
Min Limit	Minimum passable deviation (inclusive)
Max Limit	Maximum passable deviation (inclusive)
Softpot	Radio softpot which yields Deviation

Table 5-17. TX Signaling test results

5.6. TX VOX

NOTE: The TX VOX alignment is only applicable to NX Portable radios.

Mode	Audio Frequency	Amplitude
VOX1	1 kHz	45 mV _{RMS} (64 mV _{pk})
VOX10	1 kHz	3 mV _{RMS} (4 mV _{pk})

Table 5-18. Analyzer Configuration for TX VOX1/10 alignment

5.6.1. TX VOX Alignment

The radio is placed into Test Mode. The VOX sensitivity is measured for both VOX 1 and VOX 10 levels. New VOX1 and VOX 10 levels are set using these sensitivity measurements. The results for each VOX level are written to the log file.

Name	Description
Result	Pass or Fail. Pass unless a radio error occurs.
VOX1 Softpot	New programmed softpot based on VOX1 sensitivity level
Audio Voltage	VOX1 audio voltage level
VOX10 Softpot	New programmed softpot based on VOX10 sensitivity level
Audio Voltage	VOX10 audio voltage level

Table 5-19. TX VOX1/10 alignment results

5.6.2. TX VOX Test

There is no TX VOX test.

5.7. RX Sensitivity

NOTE: This test requires an analyzer with NXDN test mode (R8-NXDN or R8-NXDNTYPC option) capability.

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog:	Model-
			Wide(5k): 1 kHz @ 3 kHz	specific
			Wide(4k): 1 kHz @ 2.4 kHz	
			Narrow: 1 kHz @ 1.5 kHz	
			Digital:	
			FSW+PN9 test pattern	

Table 5-20. Analyzer Configuration for RX Sensitivity test

5.7.1. Alignment

Alignment not currently available.

5.7.2. Test (Analog)

The analyzer is setup by applying the Modulation signal in Table 5-20 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 5-21. RX Sensitivity test results

5.7.3. Test (Digital)

The analyzer is setup by applying the Modulation signal in Table 5-20 to the radio. 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's BER level measures about 3%. 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
3% BER	Analyzer output level at which the radio Bit Error Rate (BER) level measures about 3%
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass

Table 5-22. RX Sensitivity test results

5.8. RX Squelch

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog: Wide(5k): 1 kHz @ 3 kHz Wide(4k): 1 kHz @ 2.4 kHz Narrow: 1 kHz @ 1.5 kHz Digital: Very Narrow: 0.4 kHz @ 1.1 kHz	Model- specific

Table 5-23. Analyzer Configuration for RX Squelch test

5.8.1. Alignment

The analyzer is setup by applying the Modulation signal in Table 5-23 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. Pass if 12 dB 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 5-24. RX Squelch sensitivity results

The analyzer is then setup by applying the Modulation signal in Table 5-23 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and then written to radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Pass unless radio error detected.
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 5-25. RX Squelch alignment results

The analyzer is then setup by applying the Modulation signal in Table 5-23 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 5-26. RX Squelch alignment results

5.8.2. Test

The analyzer is setup by applying the Modulation signal in Table 5-23 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. Pass if 12 dB 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 5-27. RX Squelch sensitivity test results

The analyzer is then setup by applying the Modulation signal in Table 5-23 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 5-28. RX Squelch test results

5.9. RX RSSI

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog:	Model-
			Wide(5k): 1 kHz @ 3 kHz	specific
			Wide(4k): 1 kHz @ 2.4 kHz	•
			Narrow: 1 kHz @ 1.5 kHz	
			Digital:	
			Narrow: 1 kHz @ 3 kHz	
			Very Narrow: 1 kHz @ 1.1 kHz	

Table 5-29. Analyzer Configuration for RX RSSI test

5.9.1. Alignment

Note: This alignment depends upon the 12 dB SINAD output levels discovered in either the RX Sensitivity or RX Squelch sections. If either of these two items are run prior to RX RSSI alignment, the 12 dB SINAD output level points are reused. If neither RX Sensitivity nor RX Squelch is run prior to RX RSSI alignment, then the 12 dB SINAD test parts of RX Sensitivity are performed. See the RX Sensitivity section for details on how the 12 dB SINAD output level points are generated.

The analyzer is setup by applying the appropriate Modulation signal in Table 5-29 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 plus a fixed offset. The radio RSSI level is requested from and then applied to the radio. The final results are written to the log file. This process is repeated for each bandwidth, each RX Test Frequency, and each RSSI type (Reference, Low, and High).

Name	Description
Result	Pass or Fail. Pass if 12 dB SINAD level within Max Limit
Frequency	Test Frequency
Output Level	Analyzer output level at which the radio SINAD level measures about
	12 dB, plus a fixed offset for RSSI measurements
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 5-30. RX RSSI sensitivity results

The analyzer is then setup by applying the appropriate Modulation signal in Table 5-29 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and then written to radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Pass unless radio error detected.
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 5-31. RX Squelch alignment results

The analyzer is then setup by applying the appropriate Modulation signal in Table 5-29 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 5-32. RX Squelch alignment results

5.9.2. Test

No test is currently available.

6. Kenwood NX Mobile Radio Test Setup

In order to perform the test and alignment procedures, the NX Mobile 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 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.

6.1. NX Mobile Test Setup

Refer to the diagram below for the proper test setup.

Note: Approved USB to serial adapters for connecting the R8000 analyzer to the Kenwood NX series radio under test include any adapters which utilize an FTDI FT232_USB to serial UART interface. See

http://www.ftdichip.com/Products/ICs/FT232R.htm for more detail.

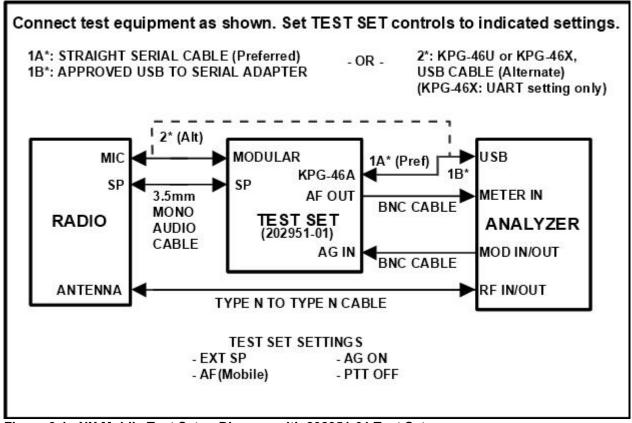


Figure 6-1. NX Mobile Test Setup Diagram with 202951-01 Test Set.

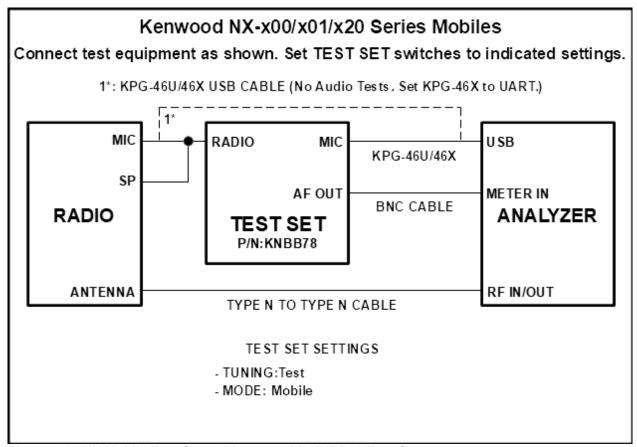


Figure 6-2. NX Mobile Test Setup Diagram with KNBB78 Test Set.

6.2. Kenwood NX Mobile USB Cables

R8000 system software version 3.1.0.0 and later supports Kenwood KPG-46U and KPG-46X USB cables for testing NX mobiles. When using a Kenwood USB cable with the 202951-01 Test Set, a 3.5mm mono audio cable is still used for routing audio signals. Unlike the NX Portable, when used with the 202951-01 Test Set a NX Mobile radio with the USB cable can still run all tests.

When using a Kenwood USB cable without a Test Set, radio audio signals cannot be routed to the Analyzer for measurement. The Kenwood USB cables do not route radio audio signals. The following tests cannot be run when using only a Kenwood USB cable (KPG-46U/46X) to connect the Radio directly to the Analyzer:

- RX Sensitivity
- RX Squelch
- RX RSSI

Note: When using the KPG-46X cable, the switch on the cable must be set to "UART" in order for the Analyzer to communicate with the radio.

7. Kenwood NX 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.

7.1. Assist Voltage

7.1.1. Alignment

The radio is placed into Test Mode and its VCO lock voltage is adjusted at several RX and TX Test Frequency points. The new softpot values for the voltages are then programmed into the radio.

Name	Description
Result	Pass or Fail. Pass as long as no radio error detected.
Softpot	Radio softpot after alignment

Table 7-1. Reference Frequency alignment results

7.1.2. Test

There is no Assist Voltage test.

7.2. Frequency

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	FM	-30 dBm

Table 7-2. Analyzer Configuration for Reference Frequency

7.2.1. 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. Pass as long as no radio error returned
Frequency	Test Frequency
New Softpot	Radio softpot after alignment
Temp (23 - 27° C)	Internal radio temperature, in Celsius. Ideal temperature is
	between 23 and 27 degrees Celsius.

Table 7-3. Reference Frequency alignment results

7.2.2. 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
Temp (23 - 27° C)	Internal radio temperature, in Celsius. Ideal temperature is
	between 23 and 27 degrees Celsius.

Table 7-4. Reference Frequency test results

7.3. TX Power

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

Table 7-5. Analyzer Configuration for TX Power

The TX Power alignment aligns both the power output level limit and power output level of the radio at both High and Low power levels.

7.3.1. TX Power Limit Alignment

The radio is placed into Test Mode and commanded to transmit at the first Test Frequency and the High Transmit Power Limit setting. For each test frequency, the output level is measured and then adjusted until near to a band-specific output level defined by the respective Kenwood NX Mobile radio service manuals.

This process is repeated for the Low Transmit Power Limit setting. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within manufacturer limits
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot after alignment

Table 7-6. TX Power Limit alignment results

7.3.2. TX Power Alignment

The radio is placed into Test Mode and commanded to transmit at the first Test Frequency and the High Transmit Power setting. For each test frequency, the output level is measured and then adjusted until near to a band-specific output level defined by the respective Kenwood NX Mobile radio service manuals.

This process is repeated for the Low Transmit Power setting. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within manufacturer limits
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot after alignment

Table 7-7. TX Power alignment results

7.3.3. 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 High Transmit Power and Low Transmit 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
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out
Softpot	Radio softpot which yields Power Out

Table 7-8. TX Power test results

7.4. TX Modulation

The TX Modulation alignment and test includes both TX Balance alignment/test as well as TX Maximum Deviation alignment/test.

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

Table 7-9. Analyzer Configuration for TX Modulation test, alignment

7.4.1. TX Balance Alignment

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio softpot is adjusted until the deviation difference between the first and second tones is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

The Variance is calculated as:
$$Variance(\%) = \left(\frac{Deviation_{LOW} - Deviation_{HIGH}}{Deviation_{LOW} *100}\right)$$

Name	Description
Result	Pass or Fail. Calculated difference between Low and High tone
	deviation less than or equal to Dev Ratio.
Frequency	Test Frequency
Variance	Calculated difference, in %, between Low and High tone deviation
Max Limit	Maximum passable % difference (inclusive) between low and high
	tone deviation.
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 7-10. TX Balance alignment results

7.4.2. TX Balance Test

The radio is placed into Test Mode at the first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The percent difference is compared against test limits and written to the log file. This test is performed for each remaining TX Test Frequency.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Low Tone	Measured low tone deviation level.
High Tone	Measured high tone deviation level.
Variance	Calculated difference, in %, between Low and High tone deviation
Max Limit	Maximum passable deviation (inclusive)
Softpot	Radio softpot which yields Variance

Table 7-11. TX Balance test results

7.4.3. TX Maximum Deviation Alignment

The radio is placed into Test Mode at low power at the first bandwidth, first TX Test Frequency and commanded to transmit. The radio generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio softpot is adjusted until the deviation is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

Name	Description
Result	Pass or Fail. Calculated difference between Low and High tone
	deviation less than or equal to Dev Ratio.
Frequency	Test Frequency
Deviation	Measured maximum deviation level
Min Limit	Minimum passable deviation level
Max Limit	Maximum passable deviation level
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 7-12. TX Maximum Deviation alignment results

7.4.4. TX Maximum Deviation Test

The radio is placed into Test Mode at low power at the first TX Test Frequency and commanded to transmit. The radio generates a modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. This test is performed for 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
Softpot	Radio softpot which yields Deviation

Table 7-13. TX Maximum Deviation test results

7.5. TX Signaling

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

Table 7-14. Analyzer Configuration for TX Signaling test, alignment

7.5.1. TX Signaling Alignment

The radio is placed into Test Mode at low power at the first bandwidth and first TX Test Frequency and commanded to transmit. The radio modulates the Test Frequency using the modulation types in Table 7-15 in sequence. The ±Peak/2-averaged modulation deviation is measured with the analyzer. The radio softpot is adjusted until the deviation is within test limits. This adjustment is performed for each TX Test Frequency. The results for each TX Test Frequency are written to the log file.

Modulation	Description
QT	Quiet Talk
DQT	Digital Quiet Talk
LTR	Logic Trunked Radio
DTMF	Dual-tone multi-frequency
Single Tone	Single modulation frequency
MSK	Minimum-shift keying
CWID	Continuous Wave Identification

Table 7-15. TX Signaling modulation types

Name	Description
Result	Pass or Fail. Calculated difference between Low and High tone
	deviation less than or equal to Dev Ratio.
Frequency	Test Frequency
Deviation	Measured modulation deviation level
Min Limit	Minimum passable deviation (inclusive)
Max Limit	Maximum passable deviation (inclusive)
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 7-16. TX Signaling alignment results

7.5.2. TX Signaling Test

The radio is placed into Test Mode at the first bandwidth and first TX Test Frequency and commanded to transmit. The radio generates a Low modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the ±Peak/2-averaged deviation of this tone is measured with the analyzer. The deviation is compared against test limits and written to the log file. This test is performed for each remaining TX Test Frequency.

Name	Description
Result	Pass or Fail. Deviation is less than or equal to Max Limit.
Frequency	Test Frequency
Deviation	Measured modulation deviation level
Min Limit	Minimum passable deviation (inclusive)
Max Limit	Maximum passable deviation (inclusive)
Softpot	Radio softpot which yields Deviation

Table 7-17. TX Signaling test results

7.6. RX Sensitivity

NOTE: This test requires an analyzer with NXDN test mode (R8-NXDN or R8-NXDNTYPC option) capability.

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog: Wide(5k): 1 kHz @ 3 kHz Wide(4k): 1 kHz @ 2.4 kHz Narrow: 1 kHz @ 1.5 kHz Digital: FSW+PN9 test pattern	Model- specific

Table 7-18. Analyzer Configuration for RX Sensitivity test

7.6.1. Alignment

Alignment not currently available.

7.6.2. Test (Analog)

The analyzer is setup by applying the Modulation signal in Table 7-18 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 7-19. RX Sensitivity (Analog) test results

7.6.3. Test (Digital)

The analyzer is setup by applying the Modulation signal in Table 7-18 to the radio. 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's BER level measures about 3%. 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
3% BER	Analyzer output level at which the radio Bit Error Rate (BER) level measures about 3%
Max Limit	Maximum Limit (inclusive) for Sensitivity (SINAD) to Pass

Table 7-20. RX Sensitivity (Digital) test results

7.7. RX Squelch

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog:	Model-
			Wide(5k): 1 kHz @ 3 kHz	specific
			Wide(4k): 1 kHz @ 2.4 kHz	
			Narrow: 1 kHz @ 1.5 kHz	
			Digital:	
			Narrow: 1 kHz @ 3 kHz	
			Very Narrow: 1 kHz @ 1.5 kHz	

Table 7-21. Analyzer Configuration for RX Squelch test

7.7.1. Alignment

The analyzer is setup by applying the Modulation signal in Table 7-21 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. Pass if 12 dB 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 7-22. RX Squelch sensitivity results

The analyzer is then setup by applying the Modulation signal in Table 7-21 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and then written to radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Pass unless radio error detected.
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Old Softpot	Original radio softpot setting
New Softpot	Radio softpot setting after alignment

Table 7-23. RX Squelch alignment results

The analyzer is then setup by applying the Modulation signal in Table 7-21 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 7-24. RX Squelch alignment results

7.7.2. Test

The analyzer is setup by applying the Modulation signal in Table 7-21 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. Pass if 12 dB 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 7-25. RX Squelch sensitivity test results

The analyzer is then setup by applying the Modulation signal in Table 5-23 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 7-26. RX Squelch test results

7.8. RX RSSI

RF Control	Port	Frequency	Modulation	Level
Generate	RF IN/OUT	Test Freq	Analog: Wide(5k): 1 kHz @ 3 kHz	Model- specific
			Wide(4k): 1 kHz @ 2.4 kHz	эрссто
			Narrow: 1 kHz @ 1.5 kHz Digital:	
			Narrow: 1 kHz @ 3 kHz	
			Very Narrow: 1 kHz @ 1.1 kHz	

Table 7-27. Analyzer Configuration for RX RSSI test

7.8.1. Alignment

Note: This alignment depends upon the 12 dB SINAD output levels discovered in either the RX Sensitivity or RX Squelch sections. If either of these two items are run prior to RX RSSI alignment, the 12 dB SINAD output level points are reused. If neither RX Sensitivity nor RX Squelch is run prior to RX RSSI alignment, then the 12 dB SINAD test parts of RX Sensitivity are performed. See the RX Sensitivity section for details on how the 12 dB SINAD output level points are generated.

The analyzer is setup by applying the appropriate Modulation signal in Table 7-27 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 plus a fixed offset. The radio RSSI level is requested from and then applied to the radio. The final results are written to the log file. This process is repeated for each bandwidth, each RX Test Frequency, and each RSSI type (Reference, Low, and High).

Name	Description	
Result	Pass or Fail. Pass if 12 dB SINAD level within Max Limit	
Frequency	Test Frequency	
Output Level	Analyzer output level at which the radio SINAD level measures about	
	12 dB, plus a fixed offset for RSSI measurements	
Old Softpot	Original radio softpot setting	
New Softpot	Radio softpot setting after alignment	

Table 7-28. RX RSSI sensitivity results

The analyzer is then setup by applying the appropriate Modulation signal in Table 7-27 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and then written to radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description	
Result	Pass or Fail. Pass unless radio error detected.	
Frequency	Test Frequency	
Output Level	Analyzer output level used to generate squelch level. Same as 12dB	
	SINAD level in previous step on this section.	
Old Softpot	Original radio softpot setting	
New Softpot	Radio softpot setting after alignment	

Table 7-29. RX RSSI alignment results

The analyzer is then setup by applying the appropriate Modulation signal in Table 7-27 to the radio. 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 to the 12 dB output level achieved in the previous step in this section. The radio squelch level is requested and compared to the current squelch level programmed into the radio. The final results are written to the log file. This process is repeated for each bandwidth, RX Test Frequency, and both squelch types (Open and Tight).

Name	Description
Result	Pass or Fail. Difference within Max Limit, Min Limit
Frequency	Test Frequency
Output Level	Analyzer output level used to generate squelch level. Same as 12dB
	SINAD level in previous step on this section.
Softpot	Current programmed squelch softpot value
Squelch Level	Measured radio squelch level
Min Limit	Minimum Limit (inclusive) for RX Squelch to Pass
Difference	Difference between Softpot and Squelch Level
Max Limit	Maximum Limit (inclusive) for RX Squelch to Pass

Table 7-30. RX RSSI alignment results

7.8.2. Test

7.9. No test is currently available.

Basic Troubleshooting

Symptom	Possible Cause	Possible Solution
Analyzer consistently fails to communicate with radio	Incorrect KPG- 144AT port connection	 Verify programming cable is connected to the correct KPG- 144AT test set serial connector. See the respective radio test setup sections for more information.
RX Sensitivity test consistently fails one or more points.	Sensitivity needs alignment	 Using the KPG-111D software, perform a manual Sensitivity alignment.

Table 7-31. Kenwood NX Series Troubleshooting Chart

8. Support Information

8.1. Technical Support

Telephone/Fax: 844.903.7333 Email: service@freedomcte.com Web: http://freedomcte.com/support/

8.2. Sales

Telephone/Fax: 844.903.7333 Email: sales@freedomcte.com Web: http://freedomcte.com/sales/

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 Kenwood NX Series radio model supported by AutoTune.

Section	Test Name	Limit	Default Value
5.1	Frequency	Frequency	Min= -1 ppm
	, ,		Max= 1 ppm
5.3	TX Power High	TX Power High NX-200	Min = 4.8 W
			Max = 5.2 W
		TX Power High NX-200S	Min = 4.8 W
			Max = 5.2 W
		TX Power High NX-210	Min = 4.8 W
			Max = 5.2 W
		TX Power High NX-300	Min = 4.8 W
			Max = 5.2 W
		TX Power High NX-300S	Min = 4.8 W
			Max = 5.2 W
		TX Power High NX-410	Min = 2.8 W
		TVD III I NV 444	Max = 3.2 W
		TX Power High NX-411	Min= 2.3 W
F 2	TV Dawer Law	TV Davier High NV 200	Max= 2.7 W
5.3	TX Power Low	TX Power High NX-200	Min= 0.7 W
		TX Power High NX-200S	Max= 0.9 W Min= 0.7 W
		TA Power High NA-2005	Max= 0.9 W
		TX Power High NX-210	Min= 0.7 W
		TA Power High NA-210	Max= 0.9 W
		TX Power High NX-300	Min= 0.7 W
		TX Fower High NX-300	Max= 0.9 W
		TX Power High NX-300S	Min= 0.7 W
		TXT OWEI Flight 14X 0000	Max= 0.9 W
		TX Power High NX-410	Min= 0.9 W
		gg	Max= 1.1 W
		TX Power High NX-411	Min= 0.9 W
			Max= 1.1 W
5.4	TX Modulation	TX Modulation Balance	Min = -1.0%
			Max = 1.0%
5.4	TX Modulation	TX Maximum Deviation (Wide5k)	Min=3200 Hz
			Max=5000 Hz
		TX Maximum Deviation (Wide5k) NX-	Min=3500 Hz
		410	Max=5000 Hz
		TX Maximum Deviation (Wide4k)	Min=2500 Hz
		T/// 1	Max=4000 Hz
		TX Maximum Deviation (Narrow)	Min=1600 Hz
		TV Manipular Daviation (Norman) NIV	Max=2500 Hz
		TX Maximum Deviation (Narrow) NX-	Min=1700 Hz
		410 TV Maximum Daviation (Narrow) NV	Max=2500 Hz
		TX Maximum Deviation (Narrow) NX-411	Min=1700 Hz Max=2500 Hz
		TX Maximum Deviation (NXDN	Min=2750 Hz
		Narrow)	Max=3362 Hz
		TX Maximum Deviation (NXDN Very	Min=1203 Hz
		Narrow)	Max=1471 Hz
5.5	TX Signaling	QT Deviation (Wide5k)	Min=500 Hz
5.5	17. Signaining	Q Doriation (Widoon)	Max=1000 Hz
		QT Deviation (Wide4k)	Min=400 Hz
		Q i Dovidson (Widorit)	Max=800 Hz
		QT Deviation (Narrow)	Min=250 Hz
	J	Q i Deviation (Narrow)	IVIII1-ZOU HZ

			M 450 II-
		DOT Davishing (Mida 51)	Max=450 Hz
		DQT Deviation (Wide5k)	Min=500 Hz
		DOT Deviation (Mide 4k)	Max=1000 Hz
		DQT Deviation (Wide4k)	Min=400 Hz Max=800 Hz
		DQT Deviation (Narrow)	Min=250 Hz
		DQ1 Deviation (Namow)	Max=450 Hz
		LTR Deviation (Wide5k)	Min=750 Hz
		LTR Deviation (widesk)	Max=1250 Hz
		LTR Deviation (Wide4k)	Min=670 Hz
		ETT Deviation (Wide-it)	Max=1130 Hz
		LTR Deviation (Narrow)	Min=500 Hz
		Ziii Banatan (itanaw)	Max=1000 Hz
		DTMF Deviation (Wide5k)	Min=2000 Hz
			Max=3000 Hz
		DTMF Deviation (Wide4k)	Min=1600 Hz
		,	Max=2400 Hz
		DTMF Deviation (Wide4k) NX-410	Min=1600 Hz
		,	Max=2500 Hz
		DTMF Deviation (Narrow)	Min=950 Hz
			Max=1600 Hz
		Single Tone Deviation (Wide5k)	Min=2500 Hz
			Max=3500 Hz
		Single Tone Deviation (Wide4k)	Min=1900 Hz
			Max=2900 Hz
		Single Tone Deviation (Narrow)	Min=1000 Hz
			Max=2000 Hz
		MSK Deviation (Wide5k)	Min=2500 Hz
			Max=3500 Hz
		MSK Deviation (Wide4k)	Min=1900 Hz
		11017 5 1111 (31	Max=2900 Hz
		MSK Deviation (Narrow)	Min=1000 Hz
		CIAIR B : (: (AN/BALL)	Max=2000 Hz
		CWID Deviation (NXDN Very Narrow)	Min=750 Hz
F 6	TYVOY	VOV1	Max=1250 Hz
5.6	TX VOX	VOX1	Max=45 mVrms
F 7	DV Consider (Analon)	VOX10	Max=3 mVrms
5.7	RX Sensitivity(Analog)	Sensitivity (Wide5k) NX-200 K	Max=-117 dBm
		Sensitivity (Wide5k) NX-200 K2	Max=-117 dBm
		Sensitivity (Wide5k) NX-210 K2	Max=-117 dBm
		Sensitivity (Wide5k) NX-200 E	Max=-116 dBm
		Sensitivity (Wide5k) NX-200 E3	Max=-116 dBm Max=-116 dBm
		Sensitivity (Wide5k) NX-200 C	
		Sensitivity (Wide5k) NX-200S Sensitivity (Wide5k) NX-300 K	Max=-116 dBm
			Max=-117 dBm
		Sensitivity (Wide5k) NX-300 K2	Max=-117 dBm
		Sensitivity (Wide5k) NX-300 K3	Max=-117 dBm
		Sensitivity (Wide5k) NX-300 K4	Max=-117 dBm
		Sensitivity (Wide5k) NX-300 K5	Max=-117 dBm
		Sensitivity (Wide5k) NX-300 K6	Max=-117 dBm
		Sensitivity (Wide5k) NX-300 E	Max=-116 dBm
		Sensitivity (Wide5k) NX-300S Sensitivity (Wide5k) NX-300 C	Max=-116 dBm Max=-116 dBm
1		Denominal (Angeor) INV-200 C	I IVIAX I TO UDITI

		T	T
		Sensitivity (Wide5k) NX-410 K2	Max=-117 dBm
		Sensitivity (Wide4k) NX-200 E	Max=-116 dBm
		Sensitivity (Wide4k) NX-200 E3	Max=-116 dBm
		Sensitivity (Wide4k) NX-200S	Max=-116 dBm
		Sensitivity (Wide4k) NX-300 E	Max=-116 dBm
		Sensitivity (Wide4k) NX-300 E4	Max=-116 dBm
		Sensitivity (Wide4k) NX-300S	Max=-116 dBm
		Sensitivity (Wide4k) NX-410 K2	Max=-117 dBm
		Sensitivity (Narrow) NX-200 K	Max=-117 dBm
		Sensitivity (Narrow) NX-200 K2	Max=-117 dBm
		Sensitivity (Narrow) NX-210 K2	Max=-117 dBm
		Sensitivity (Narrow) NX-200 E	Max=-116 dBm
		Sensitivity (Narrow) NX-200 E3	Max=-116 dBm
		Sensitivity (Narrow) NX-200 C	Max=-116 dBm
		Sensitivity (Narrow) NX-200S	Max=-116 dBm
		Sensitivity (Narrow) NX-300 K	Max=-117 dBm
		Sensitivity (Narrow) NX-300 K2	Max=-117 dBm
		Sensitivity (Narrow) NX-300 K3	Max=-117 dBm
		Sensitivity (Narrow) NX-300 K4	Max=-117 dBm
		Sensitivity (Narrow) NX-300 K5	Max=-117 dBm
		Sensitivity (Narrow) NX-300 K6	Max=-117 dBm
		Sensitivity (Narrow) NX-300 E	Max=-116 dBm
		Sensitivity (Narrow) NX-300 E4	Max=-116 dBm
		Sensitivity (Narrow) NX-300S	Max=-116 dBm
		Sensitivity (Narrow) NX-300 C	Max=-116 dBm
		Sensitivity (Narrow) NX-410 K2	Max=-117 dBm
		Sensitivity (Narrow) NX-411 K2	Max=-117 dBm
	RX Sensitivity(Digital)	Sensitivity (NXDN Narrow) NX-200 K	Max=-117 dBm
	, ,	Sensitivity (NXDN Narrow) NX-200 K2	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-210 K2	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-200 E	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-200 E3	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-200 C	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-200S	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-300 K	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 K2	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 K3	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 K4	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 K5	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 K6	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-300 E	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-300 E4	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-300S	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-300 C	Max=-112 dBm
		Sensitivity (NXDN Narrow) NX-410 K2	Max=-117 dBm
		Sensitivity (NXDN Narrow) NX-411 K2	Max=-117 dBm
		Sensitivity (NXDN Very Narrow) NX- 200 K	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX- 200 K2	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX- 210 K2	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-	Max=-116 dBm
L	1		

		200 E	
		Sensitivity (NXDN Very Narrow) NX-200 E3	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX- 200 C	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX-200S	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX- 300 K	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX- 300 K2	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-300 K3	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-300 K4	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-300 K5	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-300 K6	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX- 300 E	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX-300 E4	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX-300S	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX- 300 C	Max=-116 dBm
		Sensitivity (NXDN Very Narrow) NX-410 K2	Max=-119 dBm
		Sensitivity (NXDN Very Narrow) NX-411 K2	Max=-119 dBm
5.8	RX Squelch	Squelch Open	Min=-15 Max=15
	1 Default Kanwood NV	Squelch Tight	Min=-15 Max=15

Table A-1. Default Kenwood NX Portable Limits

Section	Test Name	Limit	Default Value
7.2	Frequency	Frequency	Min= -1 ppm
			Max= 1 ppm
7.3	TX Power Limit High	TX Power Limit High NX-700 C	Min=25.0 W
			Max=31.0 W
		TX Power Limit High NX-700 E	Min=25.0 W
			Max=31.0 W
		TX Power Limit High NX-700 K	Min=30.0 W
			Max=36.0 W
		TX Power Limit High NX-700H K	Min=50.0 W
			Max=56.0 W
		TX Power Limit High NX-800 E	Min=25.0 W
			Max=31.0 W
		TX Power Limit High NX-800 K Low	Min=30.0 W
			Max=36.0 W
		TX Power Limit High NX-800 K High'	Min=25.0 W
		TV D 1: '(11' 1 N)V 000 1/0	Max=31.0 W
		TX Power Limit High NX-800 K2	Min=30.0 W
		TV David Livit III at NIV 00011171	Max=36.0 W
		TX Power Limit High NX-800H K Low	Min=45.0 W
		TV Davier Limit High NV 00011 K High	Max=51.0 W
		TX Power Limit High NX-800H K High'	Min=40.0 W Max=46.0 W
		TX Power Limit High NX-800H K High	Min=35.0 W
		1 A Power Limit High NA-600H K High	Max=41.0 W
		TX Power Limit High NX-800H K2	Min=45.0 W
		TA Fower Limit High NA-60011 R2	Max=51.0 W
		TX Power Limit High NX-800H K3	Min=45.0 W
		TX T GWCT EITHE THIGH TVX-00011 RG	Max=51.0 W
		TX Power Limit High NX-900	Min=17.0 W
		17th and Emilian India	Max=18.0 W
		TX Power Limit High NX-901	Min=16.0 W
		1711 21131 <u>2</u> 111111 11g11 11 11 1 2 2	Max=17.0 W
	TX Power Limit Low	TX Power Limit Low NX-700 C	Min=9.0 W
			Max=11.0 W
		TX Power Limit Low NX-700 E	Min=9.0 W
			Max=11.0 W
		TX Power Limit Low NX-700 K	Min=14.0 W
			Max=16.0 W
		TX Power Limit Low NX-700H K	Min=24.0 W
			Max=26.0 W
		TX Power Limit Low NX-800 E	Min=9.0 W
			Max=11.0 W
		TX Power Limit Low NX-800 K	Min=14.0 W
			Max=16.0 W
		TX Power Limit Low NX-800 K2	Min=14.0 W
			Max=16.0 W
		TX Power Limit Low NX-800H K	Min=24.0 W
		TV D	Max=26.0 W
		TX Power Limit Low NX-800H K2	Min=24.0 W
		TV Damar Lin it Laure NV 0001110	Max=26.0 W
		TX Power Limit Low NX-800H K3	Min=24.0 W
		TV Danier Line it Laure NIV 000	Max=26.0 W
		TX Power Limit Low NX-900	Min=7.0 W

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		Max=8.0 W
	TX Power Limit Low NX-901	Min=7.0 W
TV D	TV D	Max=8.0 W
TX Power High	TX Power High NX-700 C	Min=24.0 W
	TV D	Max=26.0 W
	TX Power High NX-700 E	Min=24.0 W
		Max=26.0 W
	TX Power High NX-700 K	Min=29.0 W
		Max=31.0 W
	TX Power High NX-700H K	Min=49.0 W
		Max=51.0 W
	TX Power High NX-800 E	Min=24.0 W
		Max=26.0 W
	TX Power High NX-800 K Low	Min=29.0 W
		Max=31.0 W
	TX Power High NX-800 K High'	Min=24.0 W
		Max=26.0 W
	TX Power High NX-800 K2	Min=29.0 W
		Max=31.0 W
	TX Power High NX-800H K Low	Min=44.0 W
		Max=46.0 W
	TX Power High NX-800H K High'	Min=39.0 W
		Max=41.0 W
	TX Power High NX-800H K High	Min=34.0 W
		Max=36.0 W
	TX Power High NX-800H K2	Min=44.0 W
		Max=46.0 W
	TX Power High NX-800H K3	Min=44.0 W
		Max=46.0 W
	TX Power High NX-900	Min=14.0 W
		Max=16.0 W
	TX Power High NX-901	Min=14.0 W
		Max=16.0 W
TX Power Low	TX Power Low NX-700 C	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-700 E	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-700 K	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-700H K	Min=9.0 W
		Max=11.0 W
	TX Power Low NX-800 E	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-800 K	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-800 K2	Min=4.5 W
		Max=5.5 W
	TX Power Low NX-800H K	Min=9.0 W
		Max=11.0 W
	TX Power Low NX-800H K2	Min=9.0 W
		Max=11.0 W
	TX Power Low NX-800H K3	Min=9.0 W
		Max=11.0 W
	TX Power Low NX-900	Min=4.0 W
•		•

			Max=6.0 W
		TX Power Low NX-901	Min=4.0 W
			Max=6.0 W
7.4	TX Modulation Balance	TX Modulation Balance	Min = -1.0%
			Max = 1.0%
7.4	TX Maximum Deviation	TX Maximum Deviation (Wide5k)	Min=3900 Hz
		,	Max=4500 Hz
		TX Maximum Deviation (Wide4k) NX-	Min=3120 Hz
		700	Max=3600 Hz
		TX Maximum Deviation (Wide4k) NX-	Min=3120 Hz
		800	Max=3600 Hz
		TX Maximum Deviation (Wide4k) NX-	Min=2500 Hz
		900	Max=4000 Hz
		TX Maximum Deviation (Narrow)	Min=1950 Hz
		,	Max=2250 Hz
		TX Maximum Deviation (NXDN	Min=2750 Hz
		Narrow)	Max=3362 Hz
		TX Maximum Deviation (NXDN	Min=2750 Hz
		Narrow) NX-900	Max=3200 Hz
		TX Maximum Deviation (NXDN	Min=2750 Hz
		Narrow) NX-901	Max=3200 Hz
		TX Maximum Deviation (NXDN Very	Min=1203 Hz
		Narrow)	Max=1471 Hz
7.5	TX Signaling	QT Deviation (Wide5k)	Min=500 Hz
		·	Max=1000 Hz
		QT Deviation (Wide4k)	Min=400 Hz
		,	Max=800 Hz
		QT Deviation (Narrow)	Min=250 Hz
		·	Max=450 Hz
		DQT Deviation (Wide5k)	Min=500 Hz
			Max=1000 Hz
		DQT Deviation (Wide4k)	Min=400 Hz
			Max=800 Hz
		DQT Deviation (Narrow)	Min=250 Hz
			Max=450 Hz
		LTR Deviation (Wide5k)	Min=750 Hz
			Max=1250 Hz
		LTR Deviation (Wide4k)	Min=670 Hz
		1777	Max=1130 Hz
		LTR Deviation (Narrow)	Min=500 Hz
			Max=1000 Hz
		DTMF Deviation (Wide5k)	Min=2500 Hz
		DTME Davistics (MELLAL)	Max=3500 Hz
		DTMF Deviation (Wide4k)	Min=1900 Hz
		DTME Deviction (Norman)	Max=2900 Hz
		DTMF Deviation (Narrow)	Min=1000 Hz
		Cingle Tage Deviation (MEd.Fl.)	Max=2000 Hz
		Single Tone Deviation (Wide5k)	Min=2500 Hz
		Single Tone Deviation (Wide4k)	Max=3500 Hz
		Single Tone Deviation (Wide4k)	Min=1900 Hz
		Single Tone Deviation (Narrow)	Max=2900 Hz
		Single Tone Deviation (Narrow)	Min=1000 Hz
		MSK Deviation (Wide5k)	Max=2000 Hz
		INION Deviation (Mideok)	Min=2500 Hz

			Max=3500 Hz
		MSK Deviation (Wide4k)	Min=1900 Hz
			Max=2900 Hz
		MSK Deviation (Narrow)	Min=1000 Hz
			Max=2000 Hz
		CWID Deviation (NXDN Very Narrow)	Min=750 Hz
			Max=1250 Hz
7.6	RX Sensitivity(Analog)	All bandwidths	Max=-117 dBm
	RX Sensitivity(Digital)	Sensitivity (NXDN Narrow)	Max=-115 dBm
		Sensitivity (NXDN Very Narrow)	Max=-119 dBm
7.7	RX Squelch	Squelch Open	Min=-15
			Max=15
		Squelch Tight	Min=-15
			Max=15

Table A-2. Default Kenwood NX Mobile Limits

APPENDIX B. Sample Test Result Report

	========	Test Re	sult Report			
	NX-410:K2 B1200043		Date/Time: Operator ID:	8/11/2016 10:1 1	======= 4 РМ	
Comments:						
Rx Assist	Voltage (Low)) - 851.100 MHz	_			
Result	Softpot		=			
Pass	1556					
Rx Assist	Voltage (ніgh) - 869.900 мн	z ==			
Result	Softpot 					
Pass	2468					
=======	Voltage (Low)) - 806.000 MHz	=			
Result						
Pass Tx Assist	2172 Voltage (High) - 825.000 MH	z			
Result			==			
Pass	3044					
	Voltage (Low	for TA mode) -	851.000 MHz			
Result	Softpot					
Pass	2189					
Tx Assist	Voltage (High	for TA mode)	- 870.000 MHz			
Result						
Pass	2840					
Frequency						
Result	Frequency	New Softpot	Temp (23 - 27°	c)		
	851.050 MHz	2178	25.8 C			
Frequency						
Result	Frequency	Freq Error	Min Limit	Max Limit	Temp (23 - 27°	c)
Pass	851.050 MHz	0.06 ppm	-1.00 ppm	1.00 ppm	25.8 C	
========	smit Power Alig	==				
Result	Frequency	Power Out	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	806.000 MHz 825.000 MHz	2.8 W 3.1 W	2.8 W 2.8 W	3.2 W 3.2 W	373 376	413 416
Pass Pass	806.000 MHz 825.000 MHz 851.000 MHz 870.000 MHz	3.1 W 2.9 W	2.8 W 2.8 W	3.2 W 3.2 W	420 427	400 387
	mit Power Align					
Result	Frequency	Power Out	Min Limit	Max Limit	Old Softpot	New Softpot
			0.9 W	1.1 W	254	274
Pass Pass	806.000 MHz 825.000 MHz 851.000 MHz 870.000 MHz	1.0 W 1.0 W	0.9 W 0.9 W	1.1 W 1.1 W	246 276	266 256
_		1.0 W	0.9 W	1.1 W	282	252
Tx Balance ======== Result		Variance	Max Limit	Old Softpot	New Softpot	
Pass	Frequency 806.0000 MHz	 -0.7 %	+/-1.0 %	60	60	
Pass Pass Pass	825.0000 MHz 825.0000 MHz 851.0000 MHz	0.4 % 0.4 %	+/-1.0 % +/-1.0 % +/-1.0 %	61 67	61 67	
Pass	870.0000 MHz	0.4 %	+/-1.0 %	69	69	
	m Deviation Ali		====			
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	806.000 MHz 825.000 MHz	3992 Hz 4073 Hz	3200 Hz 3200 Hz	5000 Hz 5000 Hz	482 498	482 498
Pass Pass	851.000 MHz 870.000 MHz	4098 Hz 4113 Hz	3200 Hz 3200 Hz	5000 Hz 5000 Hz	498 498	498 498
TX Maximum	m Deviation Ali	gn Analog Wide	4k			
Result	Frequency	Deviation	==== Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	806.000 MHz 825.000 MHz	3191 Hz 3064 Hz	2500 Hz 2500 Hz	4000 Hz 4000 Hz	482 466	482 466
Pass Pass Pass	851.000 MHZ 851.000 MHZ 870.000 MHZ	3072 Hz 3088 Hz	2500 Hz 2500 Hz 2500 Hz	4000 HZ 4000 HZ 4000 HZ	466 466	466 466
	m Deviation Ali			.3002	. 30	.00

Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	806.000 MHz	1977 Hz	1700 Hz	2500 Hz	482	482			
Pass Pass	825.000 MHz 851.000 MHz	2010 Hz 2030 Hz	1700 Hz 1700 Hz	2500 Hz 2500 Hz	498 498	498 498			
Pass 870.000 MHz 2038 Hz 1700 Hz 2500 Hz 498 498 TX Maximum Deviation Align NXDN Narrow									
Result			≔ Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	806.000 MHz	2964 Hz	2750 Hz	3362 Hz	501	501			
Pass Pass	825.000 MHz 851.000 MHz	2928 Hz 2935 Hz	2750 Hz 2750 Hz	3362 Hz 3362 Hz	501 501	501 501			
Pass	870.000 MHz	2945 Hz	2750 Hz	3362 Hz	501	501			
Result	IM Deviation Ali ====================================	gn NXDN very Na ========= Deviation	rrow ====== Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	806.000 MHz	1291 Hz	1203 Hz	1471 Hz	501	501			
Pass Pass	825.000 MHz 851.000 MHz	1275 Hz 1286 Hz	1203 Hz 1203 Hz	1471 Hz 1471 Hz	501 501	501 501			
Pass .	870.000 MHz	1289 Hz	1203 Hz	1471 Hz	501	501			
=======		====			014 5-5	N			
Result	Frequency	Deviation 760 Hz	Min Limit 500 Hz	Max Limit 1000 Hz	Old Softpot 539	New Softpot 539			
Pass Pass	825.000 MHz 870.000 MHz	780 HZ 782 HZ	500 HZ	1000 HZ 1000 HZ	539	539			
QT Deviat	ion (Wide4k) Al	ign ====							
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	568 Hz 579 Hz	400 Hz 400 Hz	800 Hz 800 Hz	533 533	533 533			
	ion (Narrow) Al								
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	346 Hz 340 Hz	250 Hz 250 Hz	450 Hz 450 Hz	520 500	520 500			
	tion (Wide5k) A		230 HZ	430 HZ	300	300			
Result		Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	825.000 MHz	673 Hz	500 Hz	1000 Hz	415	415			
Pass	870.000 MHz	679 Hz	500 Hz	1000 Hz	415	415			
========	ition (Wide4k) A			May I dude	014 505+00+	Now Coffman			
Result	Frequency	Deviation 540 Hz	Min Limit 400 Hz	Max Limit 800 Hz	Old Softpot 447	New Softpot 447			
Pass Pass	825.000 MHz 870.000 MHz	546 Hz	400 HZ 400 HZ	800 HZ 800 HZ	447	447			
DQT Devia	tion (Narrow) A	align =====							
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	306 Hz 313 Hz	250 Hz 250 Hz	450 Hz 450 Hz	415 415	415 415			
LTR Devia	ution (Wide5k) A	lign							
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	926 Hz 939 Hz	750 Hz 750 Hz	1250 Hz 1250 Hz	465 465	465 465			
	ıtion (Wide4k) A								
Result	Frequency	===== Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	825.000 MHz	922 Hz 897 Hz	670 Hz	1130 Hz	620	620			
Pass	870.000 MHz ution (Narrow) A		670 Hz	1130 Hz	594	594			
Result		===== Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	825.000 MHz	691 Hz	500 Hz	1000 Hz	465	465			
Pass	870.000 MHz	695 Hz	500 Hz	1000 Hz	465	465			
=======					-7.1 - 6				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	2276 Hz 2272 Hz	2000 Hz 2000 Hz	3000 Hz 3000 Hz	508 508	508 508			
DTMF Devi	ation (Wide4k)	Align ======							
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass Pass	825.000 MHz 870.000 MHz	1924 Hz 1919 Hz	1600 Hz 1600 Hz	2500 Hz 2500 Hz	572 572	572 572			
	ation (Narrow)	Align							
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot			
Pass	825.000 MHz	1195 Hz	950 Hz	1600 Hz	540 540	540 540			
Pass	870.000 MHz	1193 Hz	950 Hz	1600 Hz	J#U	J 4 0			

Result	Frequency		Min Limit	Max Limit	Old Softpot	New Softpot
Pass	825.000 MHz 870.000 MHz	2956 нz 2766 нz	2500 Hz 2500 Hz	3500 Hz 3500 Hz	513 481	513 481
Pass MSK Devi	ation (Wide4k)		2300 H2	3300 HZ	401	401
		======	Min Limit	Max Limit	Old Softpot	New Softpo
 Pass	825.000 MHz	2218 Hz	1900 Hz	2900 Hz	513	513
Pass	870.000 MHz	2206 Hz	1900 Hz	2900 Hz	513	513
	ation (Narrow)			May I duda	014 505+00+	Now Coftma
Result	Frequency 825.000 MHz		Min Limit 1000 Hz	Max Limit 2000 Hz	Old Softpot 513	New Softpo 513
Pass Pass	870.000 MHZ		1000 HZ 1000 HZ	2000 HZ 2000 HZ	513	513
		ry Narrow) Aligr				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpo
Pass	806.050 MHz	1017 Hz	750 Hz	1250 Hz	376	376
TX VOX	vov1 sefere	dåv-3+	vov10 c-f	Audda walkana		
Result	VOX1 Softpot 190	64.000 mvpk	VOX10 Softpot			
Pass Pv Sanci	tivity Test Ana		30	4.000 m∨pk		
			Max Limit			
Pass						
Pass Pass	869.9500 MHz	-120.6 dBm -121.3 dBm -119.9 dBm	-117.0 dBm			
Pass Pass	851.5500 MHz 860.5500 MHz	-120.1 dBm -121.2 dBm	-117.0 dBm -117.0 dBm			
Pass	869.4500 MHz		-117.0 dBm			
	tivity Test Ana		Max Limit			
Pass		-120.3 dBm	-117.0 dBm			
Pass Pass	860.0500 MHz		-117.0 dBm -117.0 dBm			
Pass Pass	851.5500 MHz	-120.1 dBm -121.1 dBm				
Pass .	869.4500 MHz		-117.0 dBm			
	tivity Test Ana		May Limit			
Result Pass	851.0500 MHz	12dB SINAD	Max Limit -117.0 dBm			
Pass Pass	860.0500 MHZ 869.9500 MHZ	-120.3 dBm	-117.0 dBm -117.0 dBm			
Pass Pass	851.5500 MHz 860.5500 MHz	-119.6 dBm -120.3 dBm	-117.0 dBm -117.0 dBm			
Pass	869.4500 MHz	-120.0 dBm	-117.0 dBm			
		Test NXDN Narrov	===			
Result	Frequency 851.0500 MHz		Max Limit			
Pass Pass Pass	860.0500 MHz	-119.7 dBm -120.3 dBm -119.0 dBm	-117.0 dBm -117.0 dBm -117.0 dBm			
Pass Pass	851.5500 MHz 860.5500 MHz	-118.8 dBm -120.6 dBm	-117.0 dBm -117.0 dBm			
Pass	869.4500 MHz	-120.2 dBm	-117.0 dBm			
=======		Test NXDN Very N				
Result	Frequency	3% BER	Max Limit			
Pass Pass	851.0500 MHz 860.0500 MHz	-122.4 dBm -123.0 dBm	-119.0 dBm -119.0 dBm			
Pass Pass	869.9500 MHZ 851.5500 MHZ	-120.8 dBm -122.7 dBm	-119.0 dBm -119.0 dBm			
Pass Pass	860.5500 MHz 869.4500 MHz	-122.9 dBm -122.8 dBm	-119.0 dBm -119.0 dBm			
	tivity Test Ana					
Result	Frequency	12dB SINAD	Max Limit			
Pass Pass	851.1000 MHz 859.9000 MHz	-120.4 dBm -121.2 dBm	-117.0 dBm -117.0 dBm			
Pass	869.9000 MHz	-120.0 dBm	-117.0 dBm			
	tivity Test Ana		May I imit			
Result Pass	Frequency 851.1000 MHz	12dB SINAD -120.4 dBm	Max Limit -117.0 dBm			
Pass Pass Pass	859.9000 MHZ 869.9000 MHZ	-120.4 dBm -120.6 dBm -120.0 dBm	-117.0 dBm -117.0 dBm -117.0 dBm			
	tivity Test Ana		III.O UDIII			
	Frequency		Max Limit			
	,,					

Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	 -119.7 dBm -120.0 dBm -119.3 dBm	 -117.0 dBm -117.0 dBm -117.0 dBm				
	Open Analog Wide						
Result		_	Old Softpot	New Softpot			
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz		104 99 103	106 98 105			
	Open Analog Wide						
Result			Old Softpot	New Softpot			
Pass Pass	851.1000 MHz 859.9000 MHz	-120.4 dBm -120.6 dBm	118 119	119 130			
Pass	869.9000 MHZ	-120.0 dBm	117	117			
	Open Analog Narr						
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass Pass	851.1000 MHz 859.9000 MHz	-119.7 dBm -120.0 dBm	82 79	79 86			
Pass	869.9000 MHz	-119.3 dBm	84	82			
	Open NXDN Very N						
Result			Old Softpot	New Softpot			
Pass Pass	851.1000 MHz 859.9000 MHz	-124.0 dBm	197 196	189 198			
Pass	869.9000 MHz	-123.3 dBm	196	180			
	Tight Analog Wic		Old Softpot	Now Softnot			
Pass	Frequency 851.1000 MHz		217	New Softpot 219			
Pass Pass	859.9000 MHz 869.9000 MHz	-115.4 dBm -116.2 dBm -115.0 dBm	217 216 217	218 221			
	Tight Analog Wid		217	221			
			Old Softpot	New Softpot			
Pass				230			
Pass Pass	859.9000 MHz 869.9000 MHz	-115.6 dBm -115.0 dBm	231 228	235 233			
	Tight Analog Nar						
Result		Output Level		New Softpot			
Pass	851.1000 MHz		202	200			
Pass Pass	859.9000 MHz 869.9000 MHz	-115.0 dBm -114.3 dBm	191 200	204 200			
	Open Analog Wide						
Result			Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass	851.1000 MHz 859.9000 MHz		106 98	102 96	-15 -15	-4 -2	15 15
Fail	869.9000 MHz	-120.0 dBm	105	83	-15	-22	15
	Open Analog Wide						
Result		Output Level	Softpot 		Min Limit		Max Limit
Pass Pass	851.1000 MHz 859.9000 MHz	-120.6 dBm	119 130	122 129	-15 -15	3 -1	15 15
Pass	869.9000 MHz	-120.0 dBm	117	118	-15	1	15
	Open Analog Narr		Saftmat	Carriagh Laval		Difference	May 1 dude
Result Pass	Frequency 851.1000 MHz	Output Level 	Softpot 79	Squlech Level 82	Min Limit -15	3	Max Limit 15
Pass Pass	859.9000 MHz 869.9000 MHz	-119.7 dBm -120.0 dBm -119.3 dBm	86 82	86 77	-15 -15 -15	0 -5	15 15 15
Squelch	Tight Analog Wic	de 5k Test					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass	851.1000 MHz	-115.4 dBm	219	218	-15	-1 -1	15
Pass Pass	859.9000 MHz 869.9000 MHz	-116.2 dBm -115.0 dBm	218 221	215 206	-15 -15	-3 -15	15 15
Squelch	Tight Analog Wid	de 4k Test					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass	851.1000 MHz 859.9000 MHz	-115.4 dBm -115.6 dBm	230 235	231 235	-15 -15	1 0	15 15
Pass	869.9000 MHz	-115.0 dBm	233	224	-15	-9	15
	Tight Analog Nar		_				
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass	851.1000 MHz 859.9000 MHz	-114.7 dBm -115.0 dBm	200 204	199 204	-15 -15	-1 0	15 15
Pass	869.9000 MHz	-114.3 dBm	200	194	-15	-6	15

RSSI Refe	erence Analog Wi	de 5k Align		
Result	Frequency	Output Level	Old Softpot	
Pass	851.1000 MHz 859.9000 MHz		13	14
Pass Pass	869.9000 MHZ 869.9000 MHZ	-124.2 dBm -123.0 dBm	13 16	16 16
	erence Analog Wi			
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-123.4 dBm -123.6 dBm	15 13	13 17
Pass			15	18
=======	erence Analog Na =========	=========	-11 - 6	
	Frequency	Output Level		
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-122.7 dBm -123.0 dBm	16 16 16	17 15 19
_	erence NXDN Very		10	19
=======			Old Softpot	New Softpot
Pass	851.1000 MHz	-122.7 dBm	16	17
Pass Pass	Frequency 851.1000 MHz 859.9000 MHz 869.9000 MHz	-123.0 dBm -122.3 dBm	16 17	17 19
	Analog Wide 5k			
Result	Frequency	Output Level	Old Softpot	
Pass	851.1000 MHz 859.9000 MHz	-118.0 dBm	25	23
Pass Pass	859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm	28 27	30 25
	Analog Wide 4k			
	Frequency		Old Softpot	New Softpot
Pass	851.1000 MHz	-118.0 dBm -118.0 dBm	25	23
Pass Pass	859.9000 MHZ 869.9000 MHZ	-118.0 dBm -118.0 dBm	27 24	30 24
	Analog Narrow A			
			Old Softpot	New Softpot
Pass Pass	851.1000 MHz 859.9000 MHz	-118.0 dBm	25 27	27 29
Pass	869.9000 MHz	Output Level 	27	29
	NXDN Very Narro	ow Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass	Frequency 851.1000 MHz 859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm	25 27	27 24
Pass			28	26
=======	n Analog Wide 5k		Old Softmot	Now Softnot
Pass	Frequency 851.1000 MHz 859.9000 MHz 869.9000 MHz		01d Softpot 96	New Softpot 171
Pass Pass Pass	859.9000 MHZ 869.9000 MHZ	-80.0 dBm -80.0 dBm	130 170	171 173 131
	n Analog Wide 4k		2.0	131
Result		Output Level	Old Softpot	New Softpot
Pass				130
Pass Pass	859.9000 MHz 869.9000 MHz	-80.0 dBm -80.0 dBm -80.0 dBm	170 170	173 172
=======	n Analog Narrow			
Result	Frequency	Output Level	Old Softpot	New Softpot
	851.1000 MHz	-80.0 dBm	167	170
Pass Pass	859.9000 MHZ	-80.0 dRm	T00	1/3
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-80.0 dBm -80.0 dBm	170	173 100
Pass Pass Pass RSSI High	n NXDN Very Narr	ow Align		100
Pass Pass Pass RSSI High	NXDN Very Narr	row Align ======== Output Level	Old Softnot	New Softpot
Pass Pass Pass RSSI High	n NXDN Very Narr	row Align ======== Output Level	Old Softnot	100 New Softpot

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Figure B-1. Sample Test Result Report

APPENDIX C. Alternate Test Set

A custom test set jig may be constructed for performing AutoTune tests and alignments in place of the 202951-01 Test Set supplied by Freedom Communication Technologies. For required programming cable and audio connections, please see the radio service manual for the model under test.

For Kenwood NX Portable radios, a custom test jig interface requires the Kenwood KPG-36 or KPG-36A interface cable modified to tap into the audio wires.

For Kenwood NX Mobile radios, a custom test jig interface requires the Kenwood adapter cable E30-3383-05, which brings out the audio wires used for injecting audio into the transceiver.

Refer to Figure 4-1. NX Portable Test Setup Diagram and/or Figure 6-1. NX Mobile Test Setup Diagram for general connector information.

Note: Approved USB to serial adapters for connecting the R8000 analyzer to the Kenwood NX series radio under test include any adapters which utilize an FTDI FT232_USB to serial UART interface. See http://www.ftdichip.com/Products/ICs/FT232R.htm for more detail.

APPENDIX D. Revision History

D- Auto Tune User Guide	M. Mullins	M. Humphries	1/21/21	0331
C – Kenwood USB Cables	T.John	M.Humphries	3/12/18	<u>0177</u> *
B – from CG1375A	S.HiII	M.Mullins	6/30/15	-
Revision – Change	Requested By	Approved By	Rel. Date	ECO#