

R8000 Series Communications System Analyzer

AUTOTUNE USER GUIDE

Kenwood NX Portable Kenwood NX Mobile

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CG-1375 Rev. B

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1. Introduction

The Freedom Communication Technologies R8000 Series Communications System Analyzer AutoTune™ (hereafter "AutoTune") is designed to provide an automated test and alignment solution for supported two-way radios.

2. Scope

This document is intended to provide 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 (CG-1365) for an overview and basic operating instructions for AutoTune itself.

3. Conventions

Rated Audio. Approx. 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 OR Prolific Technology Inc. PL-2303 USB to serial controller interface. See <u>http://www.ftdichip.com/Products/ICs/FT232R.htm</u> or <u>http://www.prolific.com.tw/US/ShowProduct.aspx?pcid=41</u> for more detail.





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. Peteronce Frequency alignment results	

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 5.0. Another an Confirmation for Defense of Freeman and				

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.

Description
Pass or Fail. Power Out within manufacturer limits
Test Frequency
Measured radio output level
Minimum Limit (inclusive) for Power Out
Maximum Limit (inclusive) for Power Out
Original radio softpot setting
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 \pm Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the \pm 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 \pm 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 \pm 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 \pm 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 of 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 \pm Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the \pm 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
TILL FAR TV/VOV	

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
T-LL F AA DV A	

 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	Model- specific
			kHz	

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).

Description
Pass or Fail. Pass unless radio error detected.
Test Frequency
Analyzer output level used to generate squelch level. Same as 12dB
SINAD level in previous step on this section.
Original radio softpot setting
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 5.00, DV DCCL same it initia moulto		

 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 OR Prolific Technology Inc. PL-2303 USB to serial controller interface. See <u>http://www.ftdichip.com/Products/ICs/FT232R.htm</u> or <u>http://www.prolific.com.tw/US/ShowProduct.aspx?pcid=41</u> for more detail.





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	

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 7.9. Analyzar Configuration for Deference Francesory				

 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
Toble 7.5. Analyzer Configuration for TV Dower				

 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 7.0 Ana	luman Canfinunati	an far TV Madulation	test allowment	

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 \pm Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the \pm 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 \pm 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 \pm 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 \pm 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 \pm Peak/2-averaged deviation of this tone is measured with the analyzer. The radio then generates a High modulation tone and the \pm 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:	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 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 Se	ansitivity (Analog) test results

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
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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).

ss or Fail. Pass unless radio error detected.
st Frequency
alyzer output level used to generate squelch level. Same as 12dB
NAD level in previous step on this section.
iginal radio softpot setting
ndio 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:	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 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: freedomcte.com/service-support/

8.2. Sales

Telephone/Fax: 844.903.7333 Email: sales@freedomcte.com Web: 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 (CG-1365) for modification instructions.

The following tables list the default test limits for each Kenwood NX Series radio model supported by AutoTune.

Kenwood NX Series AutoTune™ User Guide

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
		TV Davies List NV 2000	Viax = 5.2 VV
		TX Power High NX-3005	Max = 5.2 W
		TX Power High NX-410	Min = 2.8 W
		TXT Ower High TXX 410	Max = 3.2 W
		TX Power High NX-411	Min = 2.3 W
		iver ower night over the	Max= 2.7 W
5.3	TX Power Low	TX Power High NX-200	Min= 0.7 W
			Max= 0.9 W
		TX Power High NX-200S	Min= 0.7 W
		Ũ	Max= 0.9 W
		TX Power High NX-210	Min= 0.7 W
			Max= 0.9 W
		TX Power High NX-300	Min= 0.7 W
			Max= 0.9 W
		TX Power High NX-300S	Min= 0.7 W
			Max= 0.9 W
		TX Power High NX-410	Min= 0.9 W
			Max= 1.1 W
		TX Power High NX-411	Mox = 1.1 M
54	TX Modulation	TX Modulation Balance	Min = 1.0%
5.4			$M_{2X} = 1.0\%$
54	TX Modulation	TX Maximum Deviation (Wide5k)	Min-3200 Hz
5.4		TX Maximum Deviation (Wideok)	Max=5000 Hz
		TX Maximum Deviation (Wide5k) NX-	Min=3500 Hz
		410	Max=5000 Hz
		TX Maximum Deviation (Wide4k)	Min=2500 Hz
			Max=4000 Hz
		TX Maximum Deviation (Narrow)	Min=1600 Hz
			Max=2500 Hz
		TX Maximum Deviation (Narrow) NX-	Min=1700 Hz
		410	Max=2500 Hz
		TX Maximum Deviation (Narrow) NX-	Min=1700 Hz
		411	Max=2500 Hz
		TX Maximum Deviation (NXDN	Min=2750 Hz
		Narrow)	Max=3362 Hz
		IX Maximum Deviation (NXDN Very	Min=1203 Hz
<u> </u>			IVIAX=14/1 HZ
5.5			
		OT Deviation (Wide 4k)	
			Max-800 Hz
		OT Deviation (Narrow)	Міал-000 ПZ

			1 4 5 9 1 1
			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
			Max=1130 Hz
		LTR Deviation (Narrow)	Min=500 Hz
			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
			Max=2900 Hz
		MSK Deviation (Narrow)	Min=1000 Hz
			Max=2000 Hz
		CWID Deviation (NXDN Very Narrow)	Min=750 Hz
			Max=1250 Hz
5.6	TX VOX	VOX1	Max=45 mVrms
		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
		Sensitivity (Wide5k) NX-200 C	Max=-116 dBm
		Sensitivity (Wide5k) NX-200S	Max=-116 dBm
		Sensitivity (Wide5k) NX-300 K	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	Max=-116 dBm
		Sensitivity (Wide5k) NX-300 C	Max=-116 dBm

	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-	Max= 117 dBm Max=-119 dBm
	200 K	
		Mov- 110 dPm
	Sensitivity (NXI)N Verv Narrow) NX-	
	Sensitivity (NXDN Very Narrow) NX- 200 K2	wax=-119 ubiii
	Sensitivity (NXDN Very Narrow) NX- 200 K2 Sensitivity (NXDN Very Narrow) NX-	Max=-119 dBm
	Sensitivity (NXDN Very Narrow) NX- 200 K2 Sensitivity (NXDN Very Narrow) NX- 210 K2	Max=-119 dBm Max=-119 dBm

		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
		Squelch Tight	Min=-15
			Max=15

Table A-1. Default Kenwood NX Portable Limits

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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
			Max=31.0 W
		TX Power Limit High NX-800 K2	Min=30.0 W
			Max=36.0 W
		TX Power Limit High NX-800H K Low	Min=45.0 W
			Max=51.0 W
		IX Power Limit High NX-800H K High	Min=40.0 W
		TV Devee Limit Link NV 00011K Link	Max=46.0 W
		IX Power Limit High NX-800H K High	Win=35.0 W
		TX Dower Limit High NX 800H K2	Min 45.0 W
			$M_{0} = 45.0 \text{ W}$
		TX Power Limit High NX-800H K3	Min-45.0 W
			Max = 51.0 W
		TX Power Limit High NX-900	Min=17.0 W
			Max=18.0 W
		TX Power Limit High NX-901	Min=16.0 W
			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
			Max=26.0 W
		TX Power Limit Low NX-800H K2	Min=24.0 W
			Max=26.0 W
		TX Power Limit Low NX-800H K3	Min=24.0 W
			Max=26.0 W
		TX Power Limit Low NX-900	Min=7.0 W

			Max=8.0 W
		TX Power Limit Low NX-901	Min=7.0 W
			Max=8.0 W
	TX Power High	TX Power High NX-700 C	Min=24.0 W
			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
		5 5	Max=36.0 W
		TX Power High NX-800H K2	Min=44.0 W
		C C	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

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			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
		LIR Deviation (Wide5k)	Min=750 Hz
		LTD Deviction (Mide Al.)	Max=1250 Hz
		LIR Deviation (Wide4k)	
		LTP Doviction (Norrow)	Min_500 Hz
		DTME Deviation (Wide5k)	Min_2500 Hz
			Max=3500 Hz
		DTME Deviation (Wide4k)	Min-1900 Hz
			Max=2900 Hz
		DTMF Deviation (Narrow)	Min=1000 Hz
			Max=2000 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
			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			
Model #: Serial #:	=====================================		Date/Time: Operator ID:	8/11/2008 10:1 1	======= 4 РМ	
Comments:						
Rx Assist	Voltage (Low) - 851.100 MHz	_			
Result	Softpot		=			
Pass	1556					
Rx Assist	Voltage (High) - 869.900 мн	Z ==			
Result	Softpot					
Pass	2468					
Tx Assist	Voltage (Low) - 806.000 MHz	=			
Result	Softpot					
Pass	2172					
Tx Assist	Voltage (High) - 825.000 мн	Z ==			
Result	Softpot					
Pass	3044					
Tx Assist	Voltage (Low	for TA mode) -	851.000 MHz			
Result	Softpot					
Pass	2189					
Tx Assist	Voltage (High	for TA mode)	- 870.000 MHz			
Result	Softpot					
Pass	2840					
Frequency	Align					
Result	Frequency	New Softpot	Temp (23 - 27°	c)		
Pass	851.050 MHz	2178	25.8 C			
Frequency	Test					
Result	====== Frequency	Freq Error	Min Limit	Max Limit	Temp (23 - 27°	C)
Pass	 851.050 мнz	0.06 ppm	-1.00 ppm	1.00 ppm	25.8 C	
High Tran	smit Power Alig	n				
Result	Frequency	Power Out	Min Limit	Max Limit	Old Softpot	New Softpot
Pass	806.000 MHz	2.8 W	2.8 W	3.2 W	373	413
Pass	825.000 MHZ 851.000 MHZ	3.1 W	2.8 W	3.2 W 3.2 W	420	400
Low Trans	mit Power Align	2.5 ₩	2.0 W	5.2 W	727	507
Result	Frequency	= Power Out	Min Limit	Max Limit	Old Softpot	New Softpot
Pass	806.000 MHz	1.0 W	0.9 W	1.1 W	254	274
Pass Pass	825.000 MHz 851.000 MHz	1.0 W 1.0 W	0.9 W 0.9 W	1.1 W 1.1 W	246 276	266 256
Pass	870.000 MHz	1.0 W	0.9 W	1.1 W	282	252
Tx Balanc	e Align =======					
Result	Frequency	Variance	Max Limit	Old Softpot	New Softpot	
Pass	806.0000 MHz	-0.7 %	+/-1.0 %	60 61	60 61	
Pass	851.0000 MHz	0.4 %	+/-1.0 %	67	67	
TX Maximu	m Deviation Ali	gn Analog Wide	5k	05	05	
Result	Frequency	Deviation	==== Min Limit	Max Limit	Old Softpot	New Softpot
 Pass	 806.000 мнz	 3992 нz	 3200 нz	 5000 нz	 482	482
Pass Pass	825.000 MHz 851.000 MHz	4073 Hz 4098 Hz	3200 Hz 3200 Hz	5000 Hz 5000 Hz	498 498	498 498
Pass	870.000 MHz	4113 Hz	3200 Hz	5000 Hz	498	498
TX Maximu	m Deviation Ali	gn Analog Wide	4k ====			
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	806.000 мнz 825.000 мнz	3191 Hz 3064 Hz	2500 Hz 2500 Hz	4000 Hz 4000 Hz	482 466	482 466
Pass Pass	851.000 MHz 870.000 MHz	3072 Hz 3088 Hz	2500 Hz 2500 Hz	4000 Hz 4000 Hz	466 466	466 466

TX Maximum Deviation Align Analog Narrow

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Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	806.000 MHz	1977 Hz 2010 нz	1700 Hz	2500 Hz	482	482				
Pass	851.000 MHZ 870.000 MHZ	2030 HZ 2038 HZ	1700 HZ 1700 HZ 1700 HZ	2500 HZ 2500 HZ 2500 HZ	498 498	498 498				
TX Maximu	TX Maximum Deviation Alian NXDN Narrow									
======= Result	Frequency	Deviation	≔ Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	806.000 MHz	2964 Hz	2750 Hz	3362 нz	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	Erequency	Deviation	====== Min Limit	Max Limit	old softpot	New Softnot				
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				
QT Deviat	ion (Wide5k) Al	ign ====								
Result	Frequency	Deviation	Min Limit	Max Limit	old Softpot	New Softpot				
Pass Pass	825.000 MHZ 870.000 MHZ	780 HZ 782 HZ	500 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				
QT Deviat	ion (Narrow) Al	ign								
======== Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	825.000 MHz	346 Hz	250 Hz	450 Hz	520	520				
Pass	870.000 MHz	340 Hz	250 Hz	450 Hz	500	500				
DQI Devia ====================================	Erequency	Deviation	Min Limit	May Limit	old softpot	New Softnot				
Pass	825 000 MHz	673 Hz	500 HZ	1000 HZ	415	415				
Pass	870.000 MHz	679 Hz	500 HZ	1000 HZ	415	415				
DQT Devia	tion (Wide4k) A =======	lign =====								
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass Pass	825.000 MHz 870.000 MHz	540 Hz 546 Hz	400 Hz 400 Hz	800 Hz 800 Hz	447 447	447 447				
DQT Devia	tion (Narrow) A	lign								
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	tion (Wide5k) A	lign								
======= Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	825.000 MHz	926 Hz	750 Hz	1250 Hz	465	465				
Pass	870.000 MHz	939 Hz	750 Hz	1250 Hz	465	465				
EIR Devia	Eroguoncy	Doviation	Min Limit	May Limit	old softpot	Now Softpot				
	825 000 MHZ			1130 Hz	620	620				
Pass	870.000 MHz	897 Hz	670 Hz	1130 Hz	594	594				
LTR Devia	tion (Narrow) A	lign								
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass Pass	825.000 MHz 870.000 MHz	691 Hz 695 Hz	500 Hz 500 Hz	1000 Hz 1000 Hz	465 465	465 465				
DTMF Devi	ation (Wide5k)	Align								
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	825.000 MHz	2276 Hz	2000 Hz 2000 Hz	3000 HZ	508 508	508 508				
DTMF Devi	ation (Wide4k)	Alian	2000 112	5000 112	500	500				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot				
Pass	825.000 MHz	 1924 Hz	1600 Hz	2500 нг	572	572				
Pass	870.000 MHz	1919 Hz	1600 Hz	2500 Hz	572	572				
DTMF Devi	ation (Narrow)	Align ======	uda i di ti			No. 6 6				
Result	Frequency	Deviation	MIN LIMIT	Max Limit	010 Softpot	New Softpot				
Pass Pass	870.000 MHZ	1195 HZ 1193 HZ	950 HZ 950 HZ	1600 HZ	540 540	540 540				

MSK Devia	ation (Wide5k) /	Align				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass Pass	825.000 MHz 870.000 MHz	2956 Hz 2766 Hz	2500 Hz 2500 Hz	3500 Hz 3500 Hz	513 481	513 481
MSK Devia	ation (Wide4k)	Align				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	825.000 MHz 870.000 MHz	2218 Hz 2206 Hz	1900 Hz 1900 Hz	2900 Hz 2900 Hz	513 513	513 513
MSK Devia	ation (Narrow)	Align				
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass Pass	825.000 MHz 870.000 MHz	1447 Hz 1442 Hz	1000 Hz 1000 Hz	2000 HZ 2000 HZ	513 513	513 513
CWID Dev	iation (NXDN Ve	ry Narrow) Align) ==			
Result	Frequency	Deviation	Min Limit	Max Limit	Old Softpot	New Softpot
Pass	806.050 MHz	1017 Hz	750 Hz	1250 Hz	376	376
TX VOX						
Result	VOX1 Softpot	Audio Voltage	VOX10 Softpot	Audio Voltage		
Pass	190	64.000 mvpk	30	4.000 mvpk		
Rx Sensit	tivity Test Ana	log Wide 5k				
Result	Frequency	12dB SINAD	Max Limit			
Pass	851.0500 MHz	-120.6 dBm	-117.0 dBm			
Pass Pass	869.9500 MHZ	-121.3 dBm -119.9 dBm	-117.0 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	-121.U dBm	-117.0 dBm			
KX Sensit	Tivity Test Ana	10g W10e 4k	Max 1 dans			
кesult 	Frequency	120B SINAD	Max Limit			
Pass Pass	851.0500 MHz 860.0500 MHz	-120.3 dBm -121.0 dBm	-117.0 dBm -117.0 dBm			
Pass Pass	869.9500 MHz 851.5500 MHz	-119.5 dBm -120.1 dBm	-117.0 dBm -117.0 dBm			
Pass Pass	860.5500 MHz 869.4500 MHz	-121.1 dBm -120.6 dBm	-117.0 dBm -117.0 dBm			
Rx Sensit	tivity Test Ana	log Narrow				
Result	Frequency	12dB SINAD	Max Limit			
Pass	 851.0500 мнz	-119.7 dBm	-117.0 dBm			
Pass Pass	860.0500 MHz 869.9500 MHz	-120.3 dBm -119.0 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			
Rx Digita	al Sensitivity ⁻	Test NXDN Narrow	/ ===			
Result	Frequency	3% BER	Max Limit			
Pass Pass	851.0500 MHz 860.0500 MHz	-119.7 dBm -120.3 dBm	-117.0 dBm -117.0 dBm			
Pass	869.9500 MHz 851.5500 MHz	-119.0 dBm -118.8 dBm	-117.0 dBm -117.0 dBm			
Pass	860.5500 MHZ	-120.6 dBm	-117.0 dBm -117.0 dBm			
Rx Dini+-	al Sensitivity -	Test NYDN Verv N	larrow			
Result	Frequency	3% BFR	======= Max imi+			
Pass	 851 0500 мш -	 -122 4 dBm				
Pass	860.0500 MHZ	-123.0 dBm	-119.0 dBm			
Pass	851.5500 MHZ	-122.7 dBm	-119.0 dBm			
Pass	869.4500 MHZ	-122.9 dBm -122.8 dBm	-119.0 dBm			
Rx Sensit	tivity Test Ana	log Wide 5k				
Result	Frequency	12db SINAD	Max Limit			
Pass	851.1000 MHz	-120.4 dBm	-117.0 dBm			
Pass Pass	859.9000 MHz 869.9000 MHz	-121.2 dBm -120.0 dBm	-117.0 dBm -117.0 dBm			
Rx Sensit	tivity Test Ana	log Wide 4k				
======== Result	Frequency	12db SINAD	Max Limit			
Pass	851.1000 MHz	-120.4 dBm	-117.0 dBm			
Pass Pass	859.9000 MHz 869.9000 MHz	-120.6 dBm -120.0 dBm	-117.0 dВm -117.0 dВm			
Rx Sensit	tivity Test Ana	log Narrow				
Result	Frequency	12db SINAD	Max Limit			
	-					

Pass 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				
Squelch	Open Analog Wide	5k Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-120.4 dBm -121.2 dBm -120.0 dBm	104 99 103	106 98 105			
Squelch	Open Analog Wide	4k Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-120.4 dBm -120.6 dBm -120.0 dBm	118 119 117	119 130 117			
Squelch	Open Analog Narr	ow Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-119.7 dBm -120.0 dBm -119.3 dBm	82 79 84	79 86 82			
Squelch	Open NXDN Very N	arrow Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass	851.1000 MHz	-123.7 dBm	197	189			
Pass Pass	859.9000 MHz 869.9000 MHz	-124.0 dBm -123.3 dBm	196 196	198 180			
Sque]ch	Tight Analog Wid	e 5k Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass	851.1000 MHz	-115.4 dBm	217	219			
Pass Pass	859.9000 MHz 869.9000 MHz	-116.2 dBm -115.0 dBm	216 217	218 221			
Squelch	Tight Analog Wid	e 4k Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass	851.1000 MHz	-115.4 dBm	231	230			
Pass Pass	869.9000 MHZ 869.9000 MHZ	-115.6 dBm -115.0 dBm	231 228	235 233			
Squelch	Tight Analog Nar	row Align					
Result	Frequency	Output Level	Old Softpot	New Softpot			
Pass Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-114.7 dBm -115.0 dBm -114.3 dBm	202 191 200	200 204 200			
Squelch	Open Analog Wide	5k Test					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass	851.1000 MHz	-120.4 dBm	106	102	-15	-4	15
Fail	869.9000 MHZ 869.9000 MHZ	-121.2 dBm -120.0 dBm	98 105	96 83	-15	-22	15
Squelch	Open Analog Wide	4k Test					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass	851.1000 MHz	-120.4 dBm	119 130	122	-15	3	15 15
Pass	869.9000 MHZ	-120.0 dBm	117	118	-15	1	15
Squelch	Open Analog Narr	ow Test =======					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-119.7 dBm -120.0 dBm -119.3 dBm	79 86 82	82 86 77	-15 -15 -15	3 0 -5	15 15 15
Squelch	Tight Analog Wid	e 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	15 15
Pass	869.9000 MHZ	-115.0 dBm	221	206	-15	-15	15
Squelch	Tight Analog Wid	e 4k Test ======					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass	851.1000 MHz 859.9000 мнт	-115.4 dBm -115.6 dBm	230 235	231 235	-15 -15	1	15 15
Pass	869.9000 MHz	-115.0 dBm	233	224	-15	-9	15
Squelch	Tight Analog Nar	row Test					
Result	Frequency	Output Level	Softpot	Squlech Level	Min Limit	Difference	Max Limit
Pass Pass	851.1000 MHz 859.9000 мн г	-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	rence Analog Wid	de 5k Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-123.4 dBm -124.2 dBm -123.0 dBm	13 13 16	14 16 16
RSSI Refer	rence Analog Wid	de 4k Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-123.4 dBm -123.6 dBm -123.0 dBm	15 13 15	13 17 18
RSSI Refer	rence Analog Na	rrow Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-122.7 dBm -123.0 dBm -122.3 dBm	16 16 16	17 15 19
RSSI Refer	ence NXDN Very	Narrow Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-122.7 dBm -123.0 dBm -122.3 dBm	16 16 17	17 17 19
RSSI LOW A	Analog Wide 5k A	Align ======		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm -118.0 dBm	25 28 27	23 30 25
RSSI LOW A	Analog Wide 4k A	Align ======		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm -118.0 dBm	25 27 24	23 30 24
RSSI LOW A	Analog Narrow A	lign =====		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm -118.0 dBm	25 27 27	27 29 29
RSSI LOW	NXDN Very Narrow	v Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-118.0 dBm -118.0 dBm -118.0 dBm	25 27 28	27 24 26
RSSI High	Analog Wide 5k	Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-80.0 dBm -80.0 dBm -80.0 dBm	96 130 170	171 173 131
RSSI High	Analog Wide 4k	Align		
Result	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass	851.1000 MHz 859.9000 MHz 869.9000 MHz	-80.0 dBm -80.0 dBm -80.0 dBm	167 170 170	130 173 172
RSSI High	Analog Narrow A	Align ======		
Result				
	Frequency	Output Level	Old Softpot	New Softpot
Pass Pass Pass Pass	Frequency 851.1000 MHz 859.9000 MHz 869.9000 MHz	Output Level -80.0 dBm -80.0 dBm -80.0 dBm	old softpot 167 100 170	New Softpot 170 173 100
Pass Pass Pass RSSI High	Frequency 851.1000 MHz 859.9000 MHz 869.9000 MHz NXDN Very Narro	Output Level -80.0 dBm -80.0 dBm -80.0 dBm ow Align	old softpot 167 100 170	New Softpot 170 173 100
Pass Pass Pass RSSI High Result	Frequency S51.1000 MHz 859.9000 MHz 869.9000 MHz NXDN Very Narro Frequency	Output Level -80.0 dBm -80.0 dBm -80.0 dBm -80.0 dBm ow Align 	old Softpot 167 100 170 0ld Softpot	New Softpot 170 173 100 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 KPG-144AT 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 OR Prolific Technology Inc. PL-2303 USB to serial controller interface. See http://www.ftdichip.com/Products/ICs/FT232R.htm or

http://www.prolific.com.tw/US/ShowProduct.aspx?pcid=41 for more detail.

APPENDIX D. Revision History

Original Release – Rev A	L. Shirey	6/5/14	M. Mullins	6/5/14	<u>14065</u>
Rev. No/change	Revised By	Date	Approved By	Date	ECO#