



Radio Test Report
FCC 47CFR74H
For
En2 Professional Pocket Transmitter - 100mW
En2 TXPH

Reference Standard: FCC 47CFR74H Oct '11
Manufacturer: Audio Limited
For type of equipment and serial number, refer to section 3
Report Number: 04-558-4985-1-12 Issue 02
Supersedes report no. 04-558/4985/1/12
Report Produced by: -

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Certificate of Test 4985/1

The unit noted below has been tested by **R.N. Electronics Limited** and, where appropriate, conforms to the relevant subpart of FCC 47CFR74H. This is a certificate of test only and should not be confused with an equipment authorization. Other standards may also apply.

Equipment:	En2 Professional Pocket Transmitter -100mW
Model Number:	En2 TXPH
Proposed FCC ID:	Not stated
Unique Serial Numbers:	637626-08, 637626-10 & 637626-11
Manufacturer:	Audio Limited Audio House, Progress Road High Wycombe, Buckinghamshire HP12 4JD
Customer Purchase Order Number:	P2787
Full measurement results are detailed in Report Number:	04-558-4985-1-12 Issue 02
Test Standards:	FCC 47CFR74H, Oct 2011 Low Power Auxiliary Station; Class TBT

DEVIATIONS:
None.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Date of Test: 05/Mar/2012 to 05/Apr/2012

Test Engineer:

A handwritten signature in blue ink, appearing to read 'R. N.', is written inside a dashed rectangular box.

Approved By:
Technical Director

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Customer Representative:

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2 Summary of test results

The **En2 Professional Pocket Transmitter -100mW** was tested to the following standards: -

FCC 47CFR74H (Oct 2011); Low Power Auxiliary Station; Class TBT

Any compliance statements are made reliant on the modes of operation as instructed to us by the Manufacturer based on their specific knowledge of the application and functionality of the equipment tested. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard, particularly under different conditions to those during testing. This report relates to the equipment tested as identified by a unique serial number and at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed

Title	Reference	Results
1. RF power output	47CFR2, subpart J	Conducted: PASSED Radiated: PASSED
2. Modulation characteristics	47CFR2, subpart J	Frequency response: see note Modulation limiting: PASSED
3. Occupied bandwidth	47CFR2, subpart J	PASSED
4. Spurious emissions at antenna terminals	47CFR2, subpart J	PASSED
5. Field strength of spurious radiation	47CFR2, subpart J	PASSED
6. Frequency stability	47CFR2, subpart J	PASSED

note. No limits are specified for this test.

This report was printed on: 25 February 2014

3 Equipment Under Test (EUT)

3.1 Equipment general specification

Applicant	Audio Limited Audio House Progress Road High Wycombe Buckinghamshire HP12 4JD
Manufacturer of EUT	Audio Limited
Brand name of EUT	En2 System
Model Number of EUT	En2 TXPH
Proposed FCC ID	Not stated
Serial Numbers of EUT	637626-08, 637626-10 & 637626-11
Date when equipment was received by RN Electronics	5 th March 2012
Date of test:	05/Mar/2012 to 05/Apr/2012
Customer order number:	P2787
Visual description of EUT:	A hand sized silver metallic case with a small rectangular display. The top of the housing incorporates a selector switch, a 5 way microphone / DC input connector and an SMA female co-axial antenna connector. The battery compartment and on/off switch are on the underside.
Main function of the EUT:	A small belt pack Radio-microphone transmitter.
Height	82 mm
Width	63 mm
Depth	20 mm
Weight	0.118 kg
Voltage	1.5V Internal, 6-18V External
Current required from above voltage source	80mA @ 12VDC

3.2 Equipment RF parameters and configurations for testing

Frequency range	Low Band 470-480 MHz, Mid Band 606-631 MHz & High Band 655-698 MHz
Normal use position	Body Worn
Normal test signals	Audio
Declared modulation parameters	FM emission designator: 200KF3E
Declared power level	100mW max and 40mW low. Power is adjustable (either high or low) via user controls in the settings menu.
Declared channel bandwidth	200kHz
Declared frequency stability	35ppm
Antenna details	External. SMA Female, ¼ wave dipole at 0dBd
Highest frequency generated / used	698MHz
Lowest frequency generated / used	11MHz Crystal, 470MHz RF

File name AUDIO LTD.4985-1.DOC

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3.3 Functional description of EUT

A body worn transmitter pack with a small microphone attachment that can relay an audio feed to a receiver unit within the RF range. A suite of three units can be preset to numerous channels within their individual frequency bands. The EUT is intended for professional use only.

3.4 EUT modes

Mode	Description	Used for test
CW	Transmitter on continuously 100% duty cycle, but not modulated.	YES
Modulated	Transmitter on continuously 100% duty cycle transmitting analogue audio.	YES
Preset Frequency Mode	Tuneable to 'Factory-Set' frequencies (32 max)	NO
User Frequency Mode	Tuneable to User 'Saved' frequencies (32 max)	YES
Manual Frequency Mode	Tuneable across full band in 25kHz steps	NO
Low Power Mode	Output power at a minimum setting	YES

Frequencies used for test were:

470.1, 475.0 & 479.9 MHz

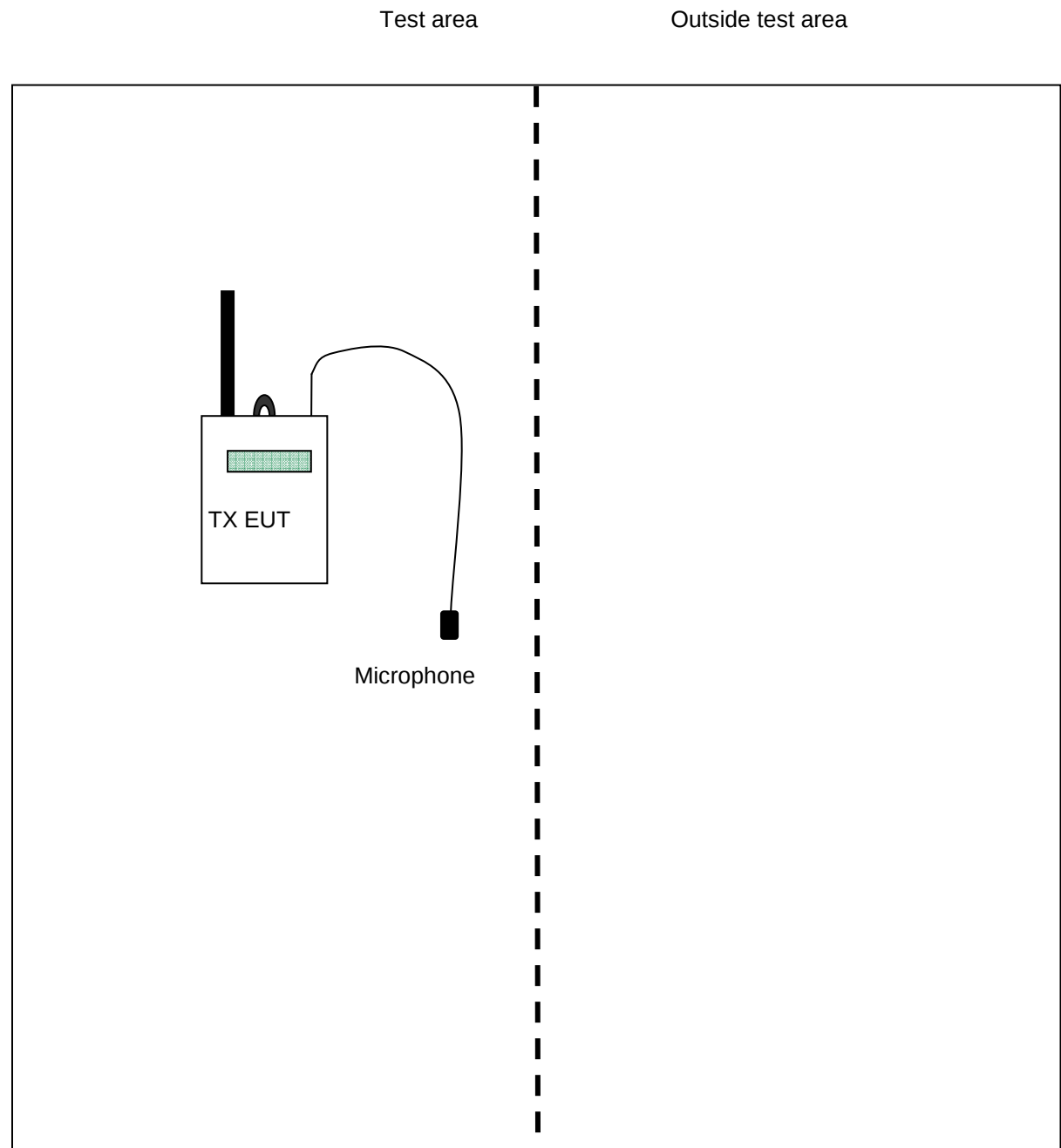
614.1, 622.5 & 630.2 MHz

655.5, 676.5 & 697.5 MHz

Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 10.

Any modifications made to the EUT, whilst under test, can be found in Section 11.

3.5 Emissions Configuration



The EUT was powered via by a new battery, the antenna port was connected to the dedicated antenna supplied and the microphone port was connected to a supplied lapel mic. Channel selection and power levels were via the wheel control and LCD display.

4 Specifications

The tests were performed by RN Electronics Engineer Peter Finley who set up the tests, the test equipment, and operated it in accordance with the **R.N. Electronics Ltd** procedures manual and the relevant standards listed below.

4.1 Relevant standards

Reference	Standard Number	Year	Description
4.1.1	47CFR Part 74, Subpart H	2011	Part 74 – Experimental radio, auxiliary, special broadcast and other program distributional services. Subpart H – Low power auxiliary stations
4.1.2	47CFR Part 2, Subpart J	2011	Part 2 – Frequency allocations and radio treaty matters; General rules and regulations. Subpart J – Equipment authorization procedures.
4.1.3	ITU Rec. SM.329	10 (02/03)	Unwanted emissions in the spurious domain.
4.1.4	TIA-603-C	2004	Land mobile FM or PM communications equipment measurement and performance standards.

4.2 Deviations

None.

4.3 Test site

R.N. Electronics Ltd. sites M and OATS are listed with the FCC. Registration Number 293246

4.4 Tests at Extremes of Temperature & Voltage

The following test conditions were used to simulate testing at nominal or extremes.

Temperature Test Conditions		Voltage Test Conditions	
T amb	+20°C	V nom	+12V dc
T min	-30 °C	V min	+ 6V dc
T max	+50 °C	V max	+18V dc

Extremes of voltage are based on manufacturers declared min / max.

Extremes of temperature are based upon FCC 47CFR2J requirement.

The ambient test conditions of humidity and pressure in the laboratory were as follows:

38 - 46%; 1003 - 1038 mbar.

- ☐ A permanent internal RF port was used for testing.
- ☐ A test fixture was used for testing.
- ☐ A temporary RF port was created for testing.
- ☒ The equipment external RF port was used for testing.

4.5 Measurement Uncertainties

Parameter	Uncertainty	
Transmitter Tests		
Conducted RF power	<± 0.8 dB	9kHz – 18GHz
Radiated RF power	± 3.5 dB	
Occupied bandwidth	± 1.9 %	
Radiated spurious emissions	± 3.5 dB	
Conducted spurious emissions	± 2.6 dB	9kHz – 22GHz
Frequency error	<± 0.1 ppm	

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5 Tests, Methods and Results

5.1 Output power

5.1.1 Conducted power

5.1.1.1 Test Methods

Test Requirements

47CFR Part 2, Subpart J

Test Method:

TIA-603-C

5.1.1.2 Configuration of EUT

The EUT was placed in a temperature controlled chamber and thermal balance was achieved before testing commenced. The EUT was operated in CW mode. Measurements were made at the 50 ohm coaxial transmit port.

5.1.1.3 Test Procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section. The power stated is the maximum power observed from an average power detector.

5.1.1.4 Test results

Ambient conditions.

Temperature: 20-21 °C

Relative humidity: 38 %

Pressure: 1000-1030 mbar

RADIO PARAMETERS.

Rated Power	20dBm
Channel Spacing	NA
Modulation	None

TABLE OF CARRIER POWER LOW BAND 470.1MHz 475.0MHz 479.9MHz

Test Conditions		Carrier Power (dBm)		
		Low	Mid	High
T amb	V nom	19.90	19.81	19.54

TABLE OF CARRIER POWER MID BAND 614.1MHz 622.5MHz 630.2MHz

Test Conditions		Carrier Power (dBm)		
		Low	Mid	High
T amb	V nom	19.1	18.3	18.3

TABLE OF CARRIER POWER HIGH BAND 655.5MHz 676.5MHz 697.5MHz

Test Conditions		Carrier Power (dBm)		
		Low	Mid	High
T amb	V nom	18.95	19.22	19.22

LIMITS: 74.861(e)(1) The power of the unmodulated carrier at the antenna may not exceed:

Frequency	Max. Power
54-72, 76-88 & 174-216 MHz	50mW (17 dBm)
470-608 & 614-698 MHz	250mW (24 dBm)

These results show that the EUT has **PASSED** this test.

5.1.1.5 Test Equipment used

E290, E397

See Section 10 for more details

5.1.2 Intentional radiator field strength

5.1.2.1 Test Methods

Test Requirements	47CFR Part 2, Subpart J
Test Method:	TIA-603-C; Clause 2.2.17.2

5.1.2.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was operated in constant Transmit mode.

5.1.2.2 Test Procedure

Tests were made in accordance with TIA-603-C using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber.

Both the equipment and its antenna were rotated 360° to record the maximised emission.

5.1.2.3 Test results

Test Environment: Test Site M.

Temperature: 14°C

Humidity: 40%

Low Band

Channel	Measured result (dBm)	EUT polarisation	Measurement polarisation
470.1MHz	16.44	V	V
475.0MHz	16.83	V	H
479.9MHz	16.49	V	H

Mid Band

Channel	Measured result (dBm)	EUT polarisation	Measurement polarisation
614.1MHz	13.37	V	H
622.5MHz	13.15	V	H
630.2MHz	13.20	V	H

High Band

Channel	Measured result (dBm)	EUT polarisation	Measurement polarisation
655.5MHz	13.22	V	V
676.5MHz	13.10	V	H
697.5MHz	13.64	V	H

LIMITS:

74.861(e)(1) The power of the unmodulated carrier at the antenna may not exceed:

Frequency	Max. Power
54-72, 76-88 & 174-216 MHz	50mW (17 dBm)
470-608 & 614-698 MHz	250mW (24 dBm)

These results show that the EUT has **PASSED** this test.

5.1.2.4 Test Equipment used

E131, E410, E411, E412, TMS814, TMS933
See Section 10 for more details

5.2 Spurious emissions at antenna terminals

5.2.1 Test Methods

Test Requirements 47CFR Part 2, Subpart J

Test Method: TIA-603-C
ITU-R Rec. SM.329

5.2.2 Configuration of EUT

The EUT was tested on the bench and ambient conditions were monitored.

5.2.3 Test Procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site A. A complete scan of emissions from 25MHz to 7 GHz was made to identify any signals within 20dB of the limits. Any identified spurious signals were measured and plots were taken in the required bandwidths.

5.2.4 Test Results

Ambient conditions.

Temperature: 18-20 °C Relative humidity: 40-41 % Pressure: 1006-1020 mbar

RADIO PARAMETERS

Channel Name	Low Band 470.1MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
940.2	-28.83
1410.3	-38.17
1880.0	-39.67
2350.5	-40.0
3290.7	-38.00
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-201
150kHz to 30MHz	J4985-1-204
30MHz to 1GHz	J4985-1-207
1-2GHz	J4985-1-210
2-3GHz	J4985-1-213
3-4GHz	J4985-1-216
4-5GHz	J4985-1-219

RADIO PARAMETERS

Channel Name	Low Band 475.0MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
950	-31.67
1425	-38.83
1900	-41.17
2375	-39.67
3325	-35.83
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-202
150kHz to 30MHz	J4985-1-205
30MHz to 1GHz	J4985-1-208
1-2GHz	J4985-1-211
2-3GHz	J4985-1-214
3-4GHz	J4985-1-217
4-5GHz	J4985-1-220

RADIO PARAMETERS

Channel Name	Low Band 479.9MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
959.9	-35
1439.7	-38.67
1919.6	-39.17
2399.5	-39.5
3359.3	-34.83
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-203
150kHz to 30MHz	J4985-1-206
30MHz to 1GHz	J4985-1-209
1-2GHz	J4985-1-212
2-3GHz	J4985-1-215
3-4GHz	J4985-1-218
4-5GHz	J4985-1-221

RADIO PARAMETERS

Channel Name	Mid Band 614.1MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
1228.2	-25.50
1842.3	-34.50
2456.4	-38.17
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-231
150kHz to 30MHz	J4985-1-234
30MHz to 1GHz	J4985-1-237
1-2GHz	J4985-1-240
2-3GHz	J4985-1-243
3-4GHz	J4985-1-246
4-5GHz	J4985-1-249
5 to 6.5	J4985-1-252

RADIO PARAMETERS

Channel Name	Mid Band 622.5MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
1245	-25.67
1867.5	-35.0
2490	-39.67
3112.5	-39.0
3735	-40.5
5600	-40.66
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-232
150kHz to 30MHz	J4985-1-235
30MHz to 1GHz	J4985-1-238
1-2GHz	J4985-1-241
2-3GHz	J4985-1-244
3-4GHz	J4985-1-247
4-5GHz	J4985-1-250
5 to 6.5	J4985-1-253

RADIO PARAMETERS

Channel Name	Mid Band 630.2MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
1260.4	-26.17
1890.6	-33.17
2520.8	-38.5
3151	-39.17
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-233
150kHz to 30MHz	J4985-1-236
30MHz to 1GHz	J4985-1-239
1-2GHz	J4985-1-242
2-3GHz	J4985-1-245
3-4GHz	J4985-1-248
4-5GHz	J4985-1-251
5 to 6.5	J4985-1-254

RADIO PARAMETERS

Channel Name	High Band 655.5MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
1311	-30.5
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-261
150kHz to 30MHz	J4985-1-264
30MHz to 1GHz	J4985-1-267
1-2GHz	J4985-1-270
2-3GHz	J4985-1-273
3-4GHz	J4985-1-276
4-5GHz	J4985-1-279
5 to 7	J4985-1-282

RADIO PARAMETERS

Channel Name	High Band 676.5MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
3353	-36.33
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-262
150kHz to 30MHz	J4985-1-265
30MHz to 1GHz	J4985-1-268
1-2GHz	J4985-1-271
2-3GHz	J4985-1-274
3-4GHz	J4985-1-277
4-5GHz	J4985-1-280
5 to 7	J4985-1-283

RADIO PARAMETERS

Channel Name	High Band 697.5MHz
Channel Spacing	NA
Modulation Type	None
Power Level	20dBm

Spurious Frequency (MHz)	Measured Spurious Level (dBm)
1395	-29.0
Frequency Range	Plot Number
9kHz to 150kHz	J4985-1-263
150kHz to 30MHz	J4985-1-266
30MHz to 1GHz	J4985-1-269
1-2GHz	J4985-1-272
2-3GHz	J4985-1-275
3-4GHz	J4985-1-278
4-5GHz	J4985-1-281
5 to 7	J4985-1-284

The plots for this test may be found in section 6.

Graphical Results

Limits:

74.861(e)(6)(iii) On any frequency removed from the operating frequency by more than 250% of the authorized bandwidth it shall be attenuated at least $43 + 10\log$ (mean output power in Watts) dB = -13 dBm.

These results show that the EUT has **PASSED** this test.

5.2.5 Test Equipment used

E342

See Section 10 for more details.

5.3 Field strength of spurious radiations

5.3.1 Test Methods

Test Requirements 47CFR Part 2, Subpart J

Test Method: TIA-603-C
ITU-R Rec. SM.329

5.3.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. Radiated Emissions testing was performed with a new/fully charged battery. The EUT was operated in continuous Transmit mode.

5.3.3 Test Procedure

Tests were made in accordance with the Test Methods noted above using the Test Equipment noted below.

25MHz - 1GHz, measurements were made in an ALSE with a ground plane. The equipment was rotated 360° and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions.

Above 1GHz, measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The EUT was raised and antenna was placed 1.5m above the ground in line with the EUT, which was rotated through 360° to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

5.3.4 Test results

Final tests were performed using Test Sites M & B.

Test Environment:

Temperature: 14-15°C

Humidity: 38-46%

Table of signals measured below 1GHz.

Horizontal

None within 20dB of the Limit to report.

Vertical

None within 20dB of the Limit to report.

Table of signals measured above 1GHz.

Horizontal

None within 20dB of the Limit to report.

Vertical

None within 20dB of the Limit to report.

LIMITS:

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74.861(e)(6)(iii) On any frequency removed from the operating frequency by more than 250% of the authorized bandwidth it shall be attenuated at least $43 + 10\text{Log}$ (mean output power in Watts) dB = -13 dBm.

These results show that the EUT has **PASSED** this test.

5.3.5 Test Equipment used

E136, E266, E268, E289, E342, E410, E411, E412, TMS933
See Section 10 for more details

5.4 Modulation characteristics

5.4.1 Frequency response

5.4.1.1 Test Methods

Test Requirements 47CFR Part 2, Subpart J

Test Method: TIA-603-C

5.4.1.2 Configuration of EUT

The EUT was tested on a bench. Measurements were made at the 50 ohm coaxial transmit port. The EUT was modulated with a CW audio signal applied to the microphone input.

5.4.1.3 Test Procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site A. The constant input approach was used to measure deviation relative to a 1kHz tone from 100Hz to 15kHz.

5.4.1.4 Test Results

Ambient conditions.

Temperature: 20 °C

Relative humidity: 38 %

Pressure: 1020 mbar

RADIO PARAMETERS.

Output Power	+20dBm
Channel Spacing	200kHz
Modulation	FM

LOW BAND

Plot reference	
Low	Audio Frequency Response 470.1 MHz Channel
Mid	Audio Frequency Response 475 MHz Channel
High	Audio Frequency Response 479.9 MHz Channel

MID BAND

Plot reference	
Low	Audio Frequency Response 614.1 MHz Channel
Mid	Audio Frequency Response 622.5 MHz Channel
High	Audio Frequency Response 630.2 MHz Channel

HIGH BAND

Plot reference	
Low	Audio Frequency Response 655.5 MHz Channel
Mid	Audio Frequency Response 676.5 MHz Channel
High	Audio Frequency Response 697.5 MHz Channel

Results for this test are presented graphically, please refer to section 6.

LIMITS:

No Limits Specified for this test.

5.4.1.5 Test Equipment used

E227, TMS49, TMS55

See Section 10 for more details

File name AUDIO LTD.4985-1.DOC

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5.4.2 Modulation limiting

5.4.2.1 Test Methods

Test Requirements 47CFR Part 2, Subpart J

Test Method: TIA-603-C

5.4.2.2 Configuration of EUT

The EUT was tested on a bench. Measurements were made at the 50 ohm coaxial transmit port. The EUT was modulated with a CW audio signal applied to the microphone input.

5.4.2.3 Test Procedure

Tests were made in accordance with the Test Method noted above, with the following exceptions, using the measuring equipment noted in the 'Test Equipment' Section at Site A. The audio frequency was held steady and the audio level increased rather than visa-versa to record the maximum deviation at 300, 1000, 2500, 3000 & 15000Hz.

5.4.2.4 Test Results

Ambient conditions.

Temperature: 20 °C

Relative humidity: 38 %

Pressure: 1020 mbar

RADIO PARAMETERS.

Output Power	+20dBm
Channel Spacing	200kHz
Modulation	FM

LOW BAND

Plot reference	
Low	Modulation Limiting 470.1MHz Channel
Mid	Modulation Limiting 475MHz Channel
High	Modulation Limiting 479.9MHz Channel

MID BAND

Plot reference	
Low	Modulation Limiting 614.1MHz Channel
Mid	Modulation Limiting 622.5MHz Channel
High	Modulation Limiting 630.2MHz Channel

HIGH BAND

Plot reference	
Low	Modulation Limiting 655.5MHz Channel
Mid	Modulation Limiting 676.5MHz Channel
High	Modulation Limiting 697.5MHz Channel

Results for this test are presented graphically, please refer to section 6.

Limits:

74.861(e)(3) A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

These results show that the EUT has **PASSED** this test.

5.4.2.5 Test Equipment used

File name AUDIO LTD.4985-1.DOC

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E227, TMS49, TMS55
See Section 10 for more details

5.5 Occupied bandwidth

5.5.1 Test Methods

Test Requirements

47CFR Part 2, Subpart J

Test Method:

TIA-603-C

5.5.2 Configuration of EUT

The EUT was placed on a bench and ambient conditions were monitored. The audio input was connected to an audio analyser. The EUT was operated in **constant transmit** mode (with the audio gain set to maximum).

5.5.3 Test Procedure

Tests were made in accordance with the Test Method above using the Test Equipment noted below. A 1kHz RBW, 1x VBW, auto sweep time, detector and max hold settings were used.

5.5.4 Test results

Tests were performed using Test Site **A**.

Temperature of test Environment: 18-21°C

Analyser plots for the 99% bandwidth can be found in Section 6.1 of this report.

LOW BAND

Channel	Result (kHz)	Plot reference
Bottom	106.7	J4985-1-108
Middle	110.0	J4985-1-109
Top	115.0	J4985-1-110

MID BAND

Channel	Result (kHz)	Plot reference
Bottom	120.0	J4985-1-102
Middle	123.3	J4985-1-103
Top	130.0	J4985-1-104

HIGH BAND

Channel	Result (kHz)	Plot reference
Bottom	113.3	J4985-1-105
Middle	123.3	J4985-1-106
Top	135.0	J4985-1-107

LIMITS:

74.861(e)(5) The operating bandwidth shall not exceed 200kHz.

These results show that the **EUT** has **PASSED** this test.

5.5.5 Test Equipment used

E269, E342, E361, E479, P243, TMS49, TMS55
See Section 10 for more details.

5.6 Frequency stability

5.6.1 Test Methods

Test Requirements 47CFR Part 2, Subpart J

Test Method: TIA-603-C

5.6.2 Configuration of EUT

The EUT was placed in a temperature controlled chamber and thermal balance was achieved before testing commenced. Measurements were made at the 50 ohm coaxial transmit port. The EUT was placed into a CW mode for purposes of this test.

5.6.3 Test Procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment' Section at Site A. A frequency count was performed on the CW signal. At the upper temperature extreme, the EUT was switched on in the transmit condition for one minute, after which the tests were conducted. At the lower temperature extreme, the EUT was switched on for one minute, after which the tests were conducted. The error was noted as the difference between the nominal and the actual frequency.

5.6.4 Test results

Ambient conditions.

Temperature: 20 °C

Relative humidity: 41 %

Pressure: 1038 mbar

RADIO PARAMETERS.

Rated Power	20dBm
Channel Spacing	NA
Modulation	None

TABLE OF FREQUENCY ERROR

LOW BAND

Test Conditions		Frequency Reading (MHz)		
		Low	Mid	High
T amb	V nom	470.099880	474.999743	479.889494
T amb	V min	470.099869	474.999784	479.899500
T amb	V max	470.099885	474.999802	479.899547
-30C	V nom	470.090954	474.988186	479.884123
-20C	V nom	470.093940	474.995243	479.895370
-10C	V nom	470.097884	474.998971	479.899228
0C	V nom	470.100613	475.000295	479.900148
10C	V nom	470.100877	475.001010	479.900504
30C	V nom	470.100502	475.000503	479.900650
40C	V nom	470.099719	474.999713	479.899699
50C	V nom	470.099475	474.999410	479.899415
Max Frequency Error observed (Hz)		+877 / -9046	+1010 / -4757	+650 / -15877

TABLE OF FREQUENCY ERROR

MID BAND

Test Conditions		Frequency Reading (MHz)		
		Low	Mid	High
T amb	V nom	614.101134	622.500642	630.200768
T amb	V min	614.101141	622.500689	630.200783
T amb	V max	614.101151	622.500711	630.200789
-30C	V nom	614.092261	622.488938	630.183442
-20C	V nom	614.093297	622.495997	630.198049
-10C	V nom	614.092271	622.501777	630.201173
0C	V nom	614.103096	622.503426	630.203630
10C	V nom	614.103506	622.503586	630.203576
30C	V nom	614.100980	622.500800	630.200702
40C	V nom	614.099397	622.499457	630.199517
50C	V nom	614.098404	622.498174	630.198114
Max Frequency Error observed (Hz)		+3506 / -7739	+3586 / -11062	+3576 / -16558

TABLE OF FREQUENCY ERROR

HIGH BAND

Test Conditions		Frequency Reading (MHz)		
		Low	Mid	High
T amb	V nom	655.501356	676.501770	697.501624
T amb	V min	655.501383	676.501646	697.501544
T amb	V max	655.501434	676.501585	697.501481
-30C	V nom	655.495939	676.495582	697.490168
-20C	V nom	655.496476	676.498880	697.499951
-10C	V nom	655.500875	676.501053	697.500422
0C	V nom	655.503507	676.503640	697.503779
10C	V nom	655.503413	676.503536	697.503640
30C	V nom	655.501564	676.501	697.501252
40C	V nom	655.499721	676.499739	697.499752
50C	V nom	655.498748	676.498705	697.498651
Max Frequency Error observed (Hz)		+3507 / -4061	+3640 / -4418	+3779 / -9832

LIMITS:

74.861(e)(4) The frequency tolerance of the transmitter shall be 0.005 %.
e.g. for 470MHz limit is therefore 23.5kHz.

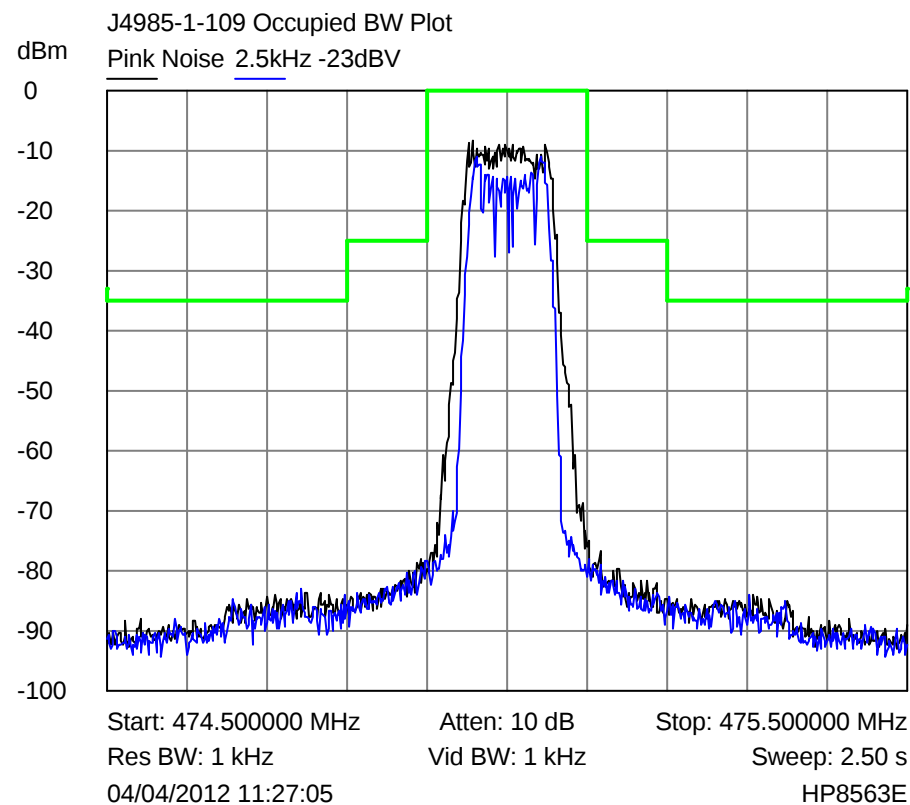
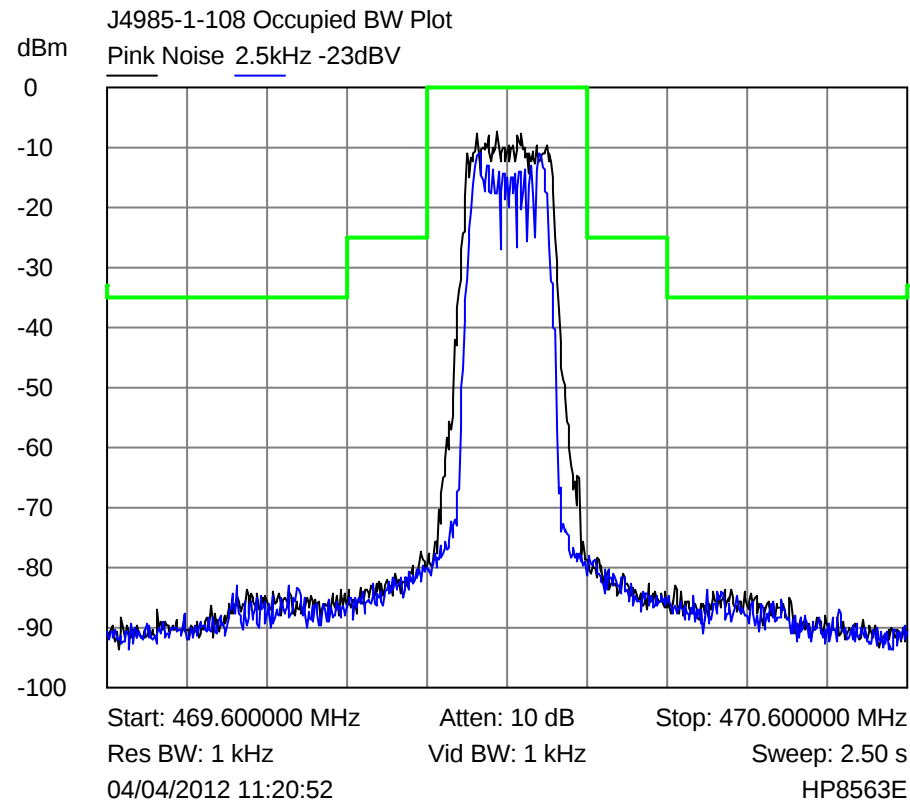
These results show that the EUT has **PASSED** this test.

5.6.5 Test Equipment used

E227, E342, L264, TMS38
See Section 10 for more details

6 Plots and Results

6.1 Spectrum (occupied bandwidth and attenuation) plots

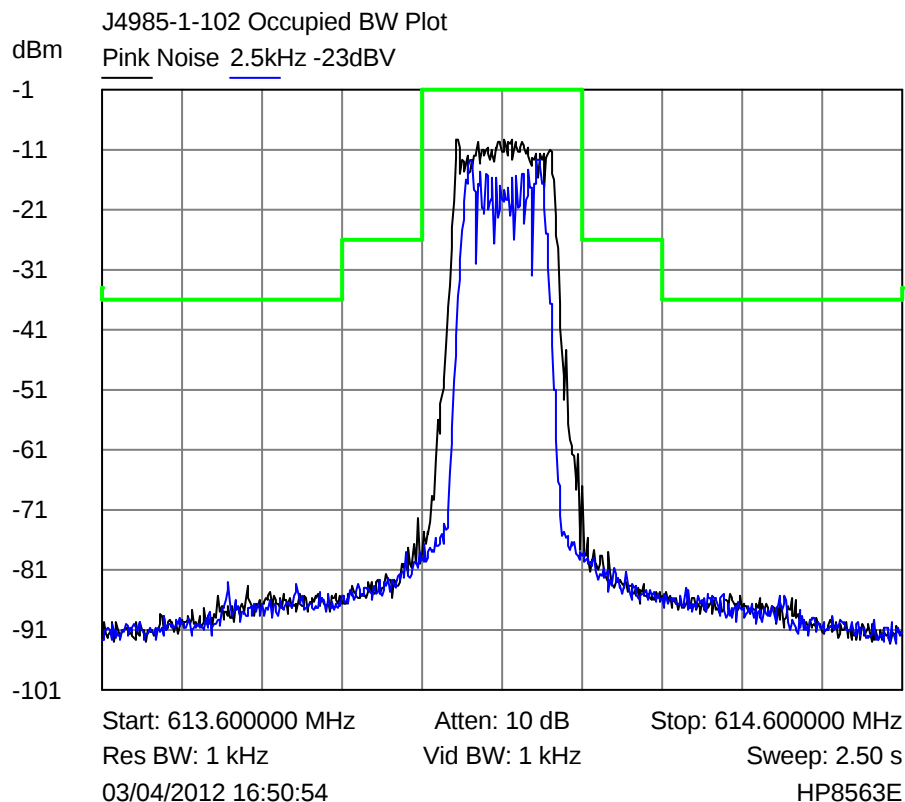
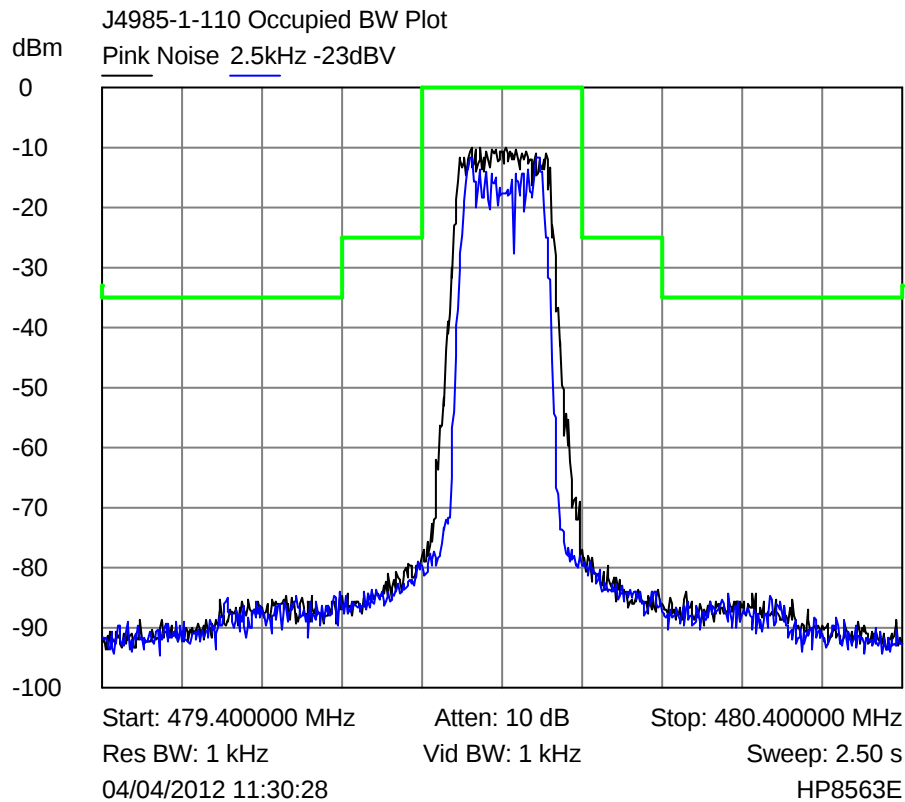


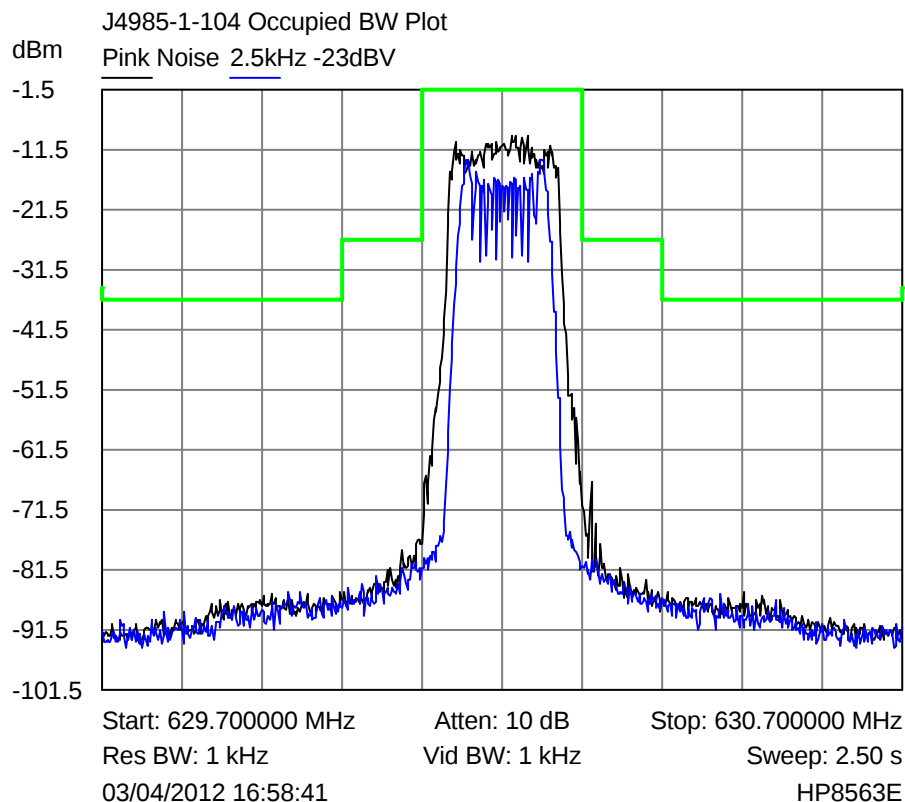
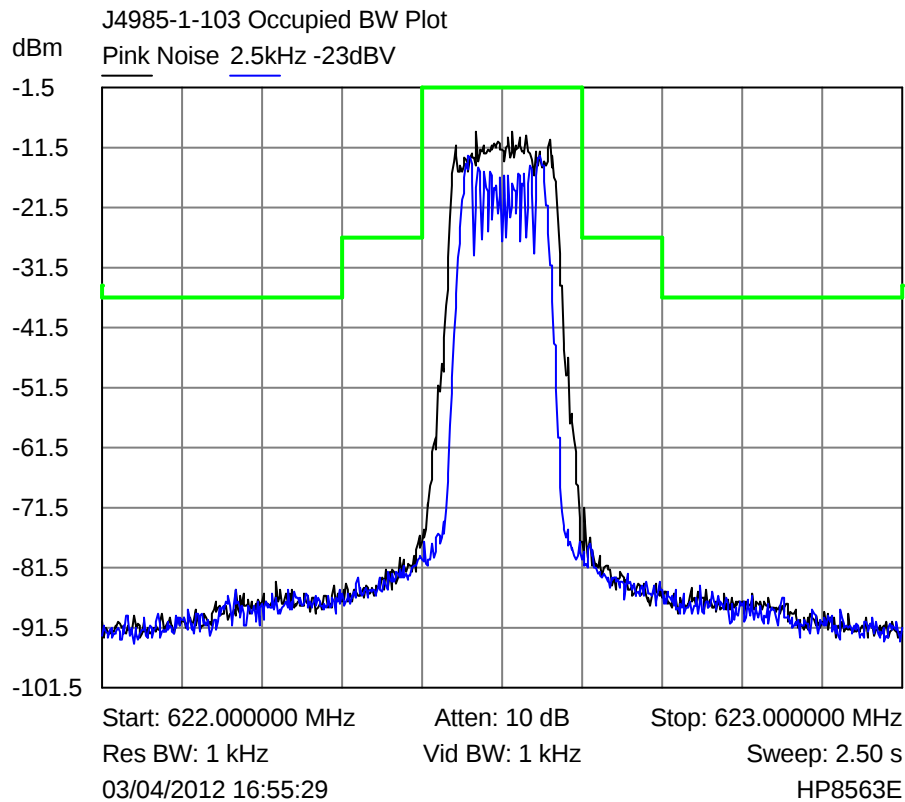
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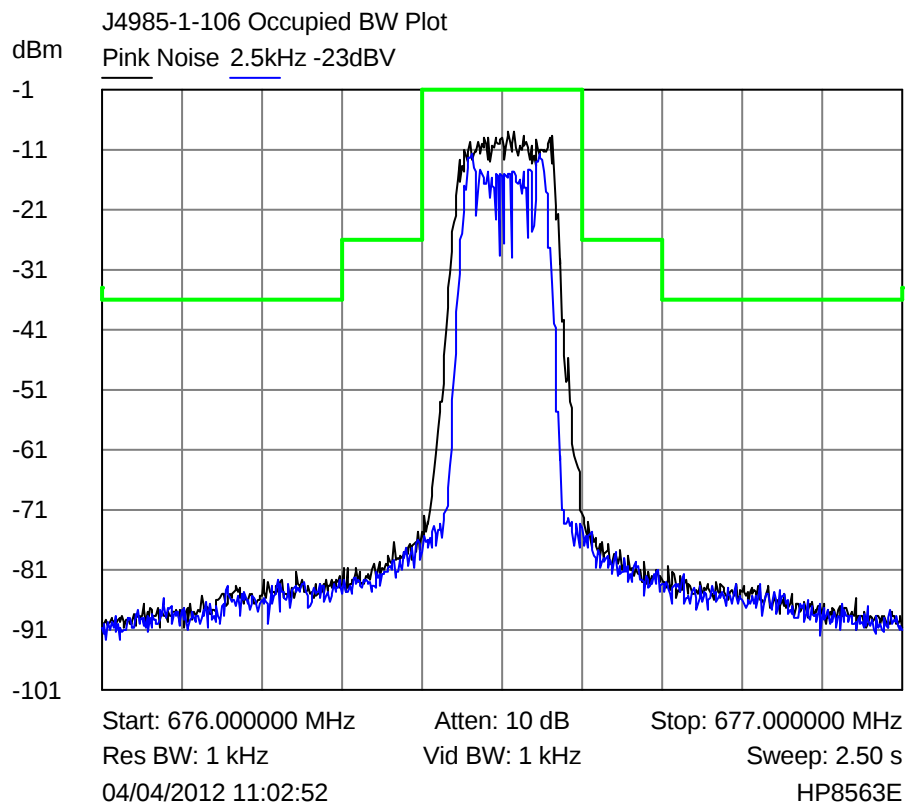
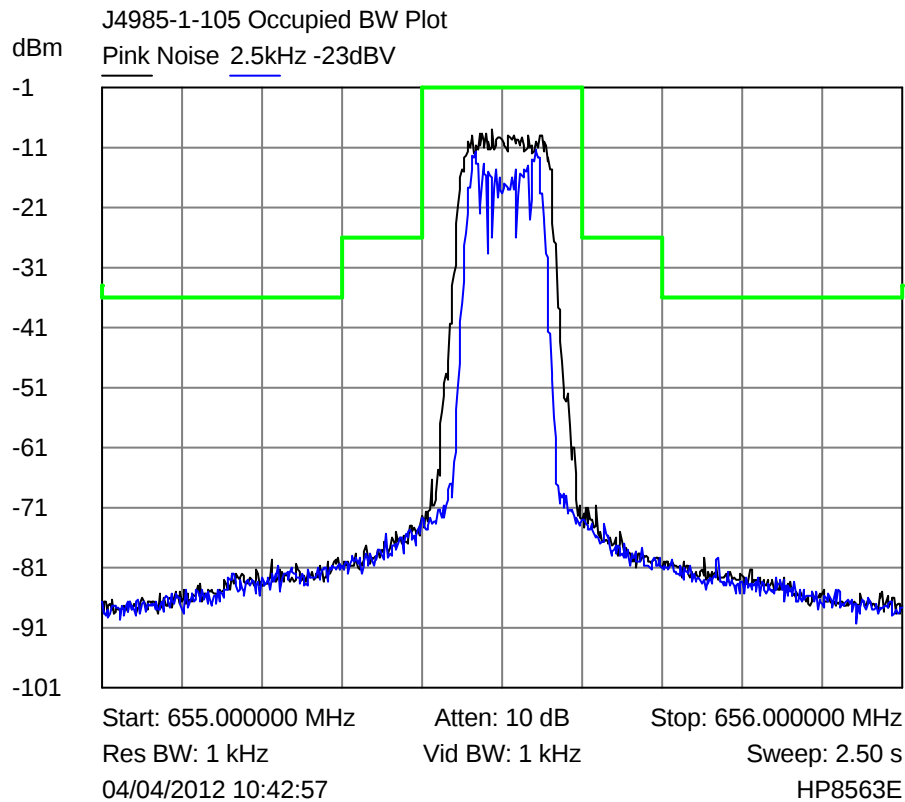
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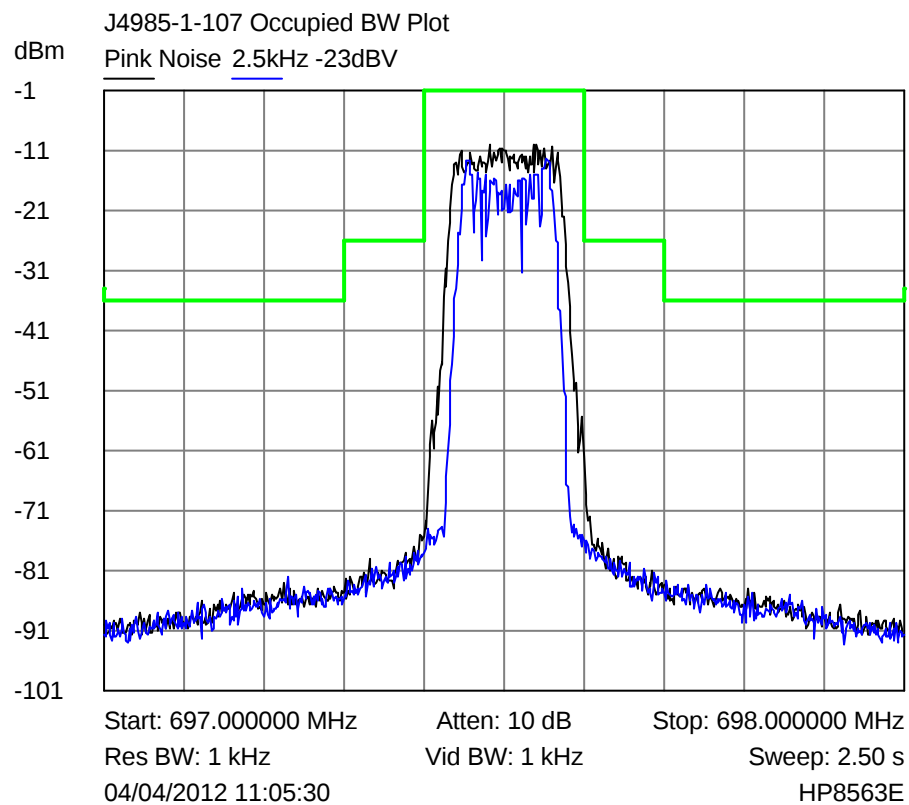
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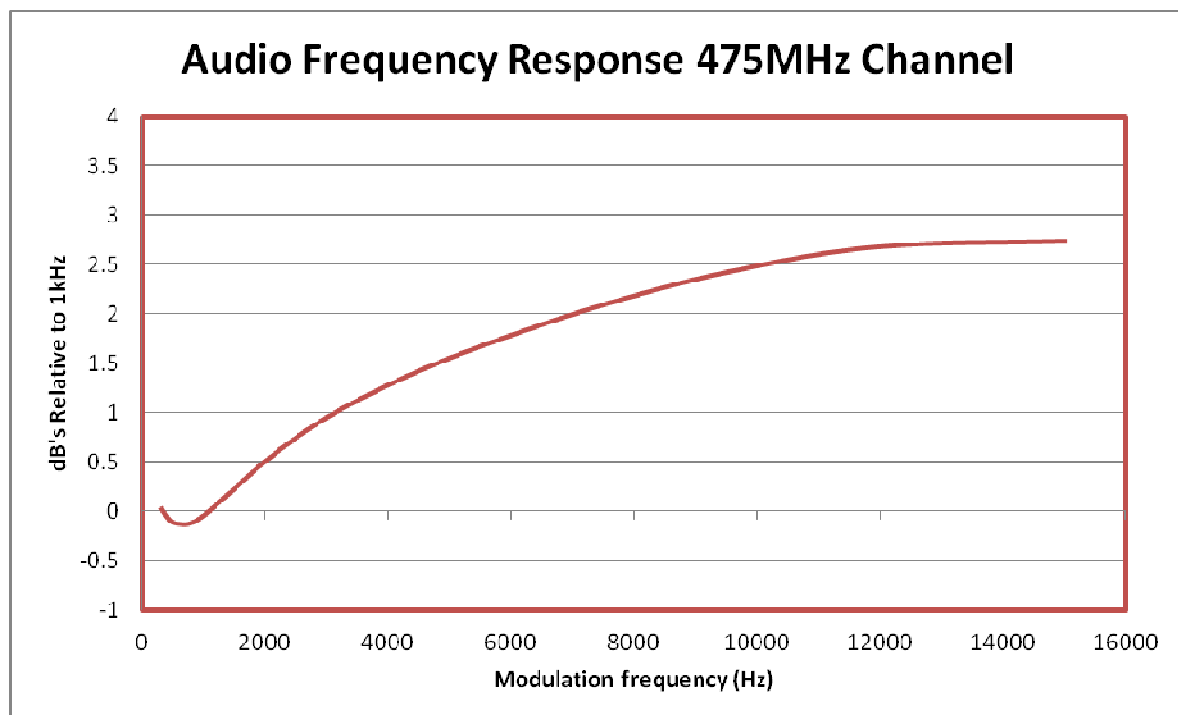
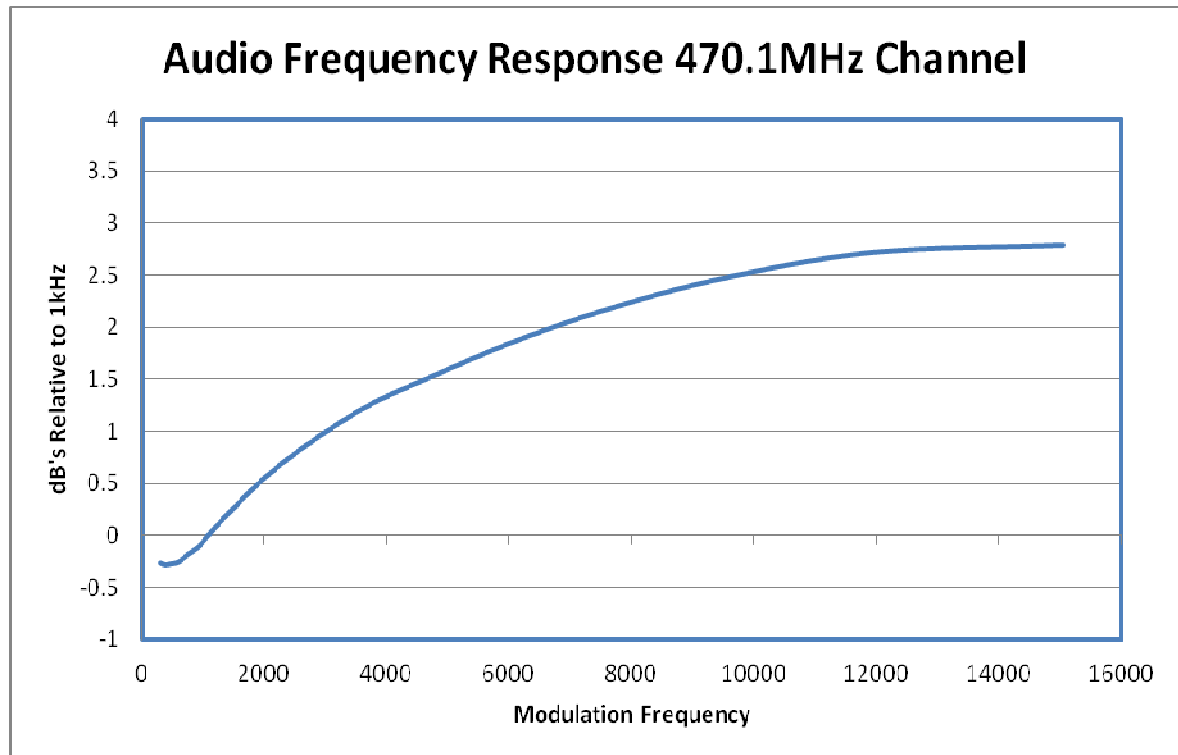


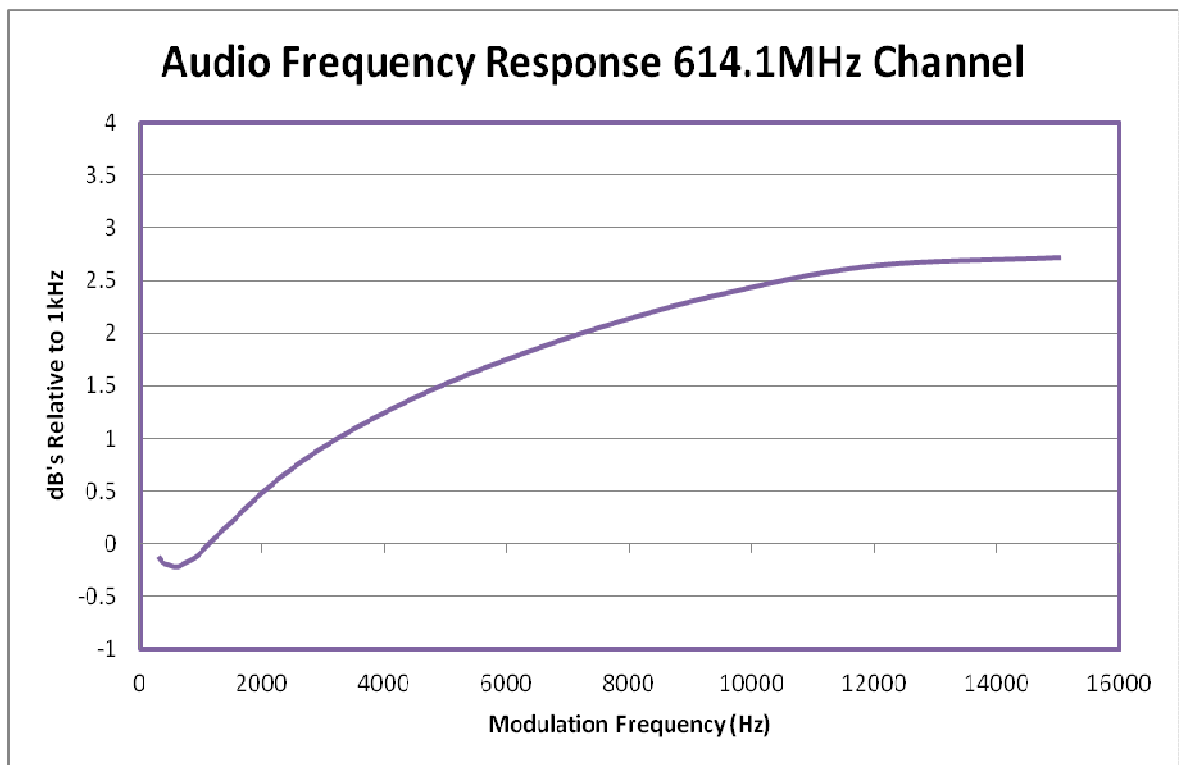
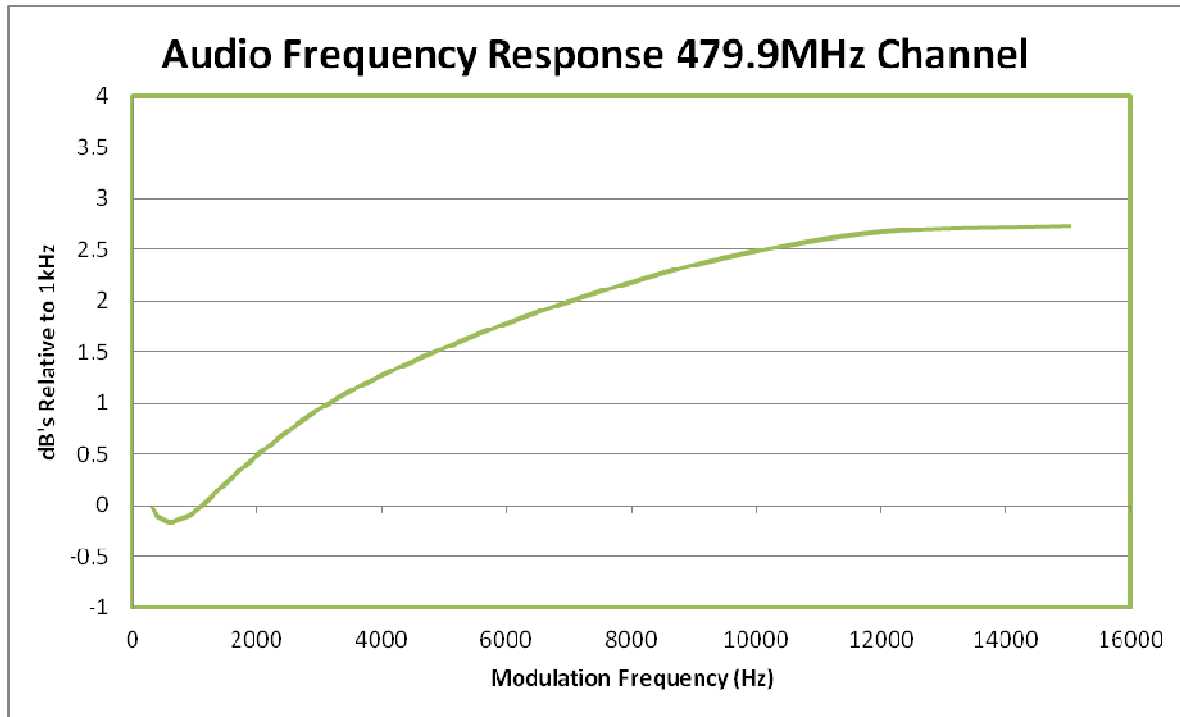


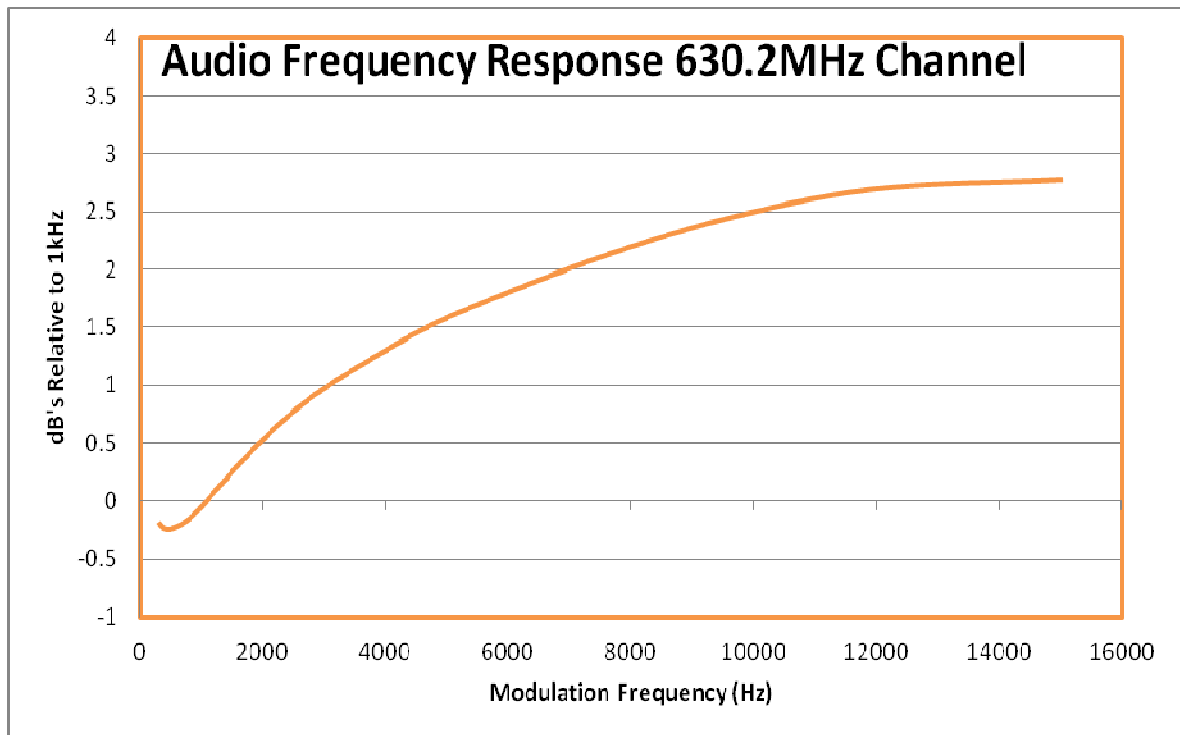
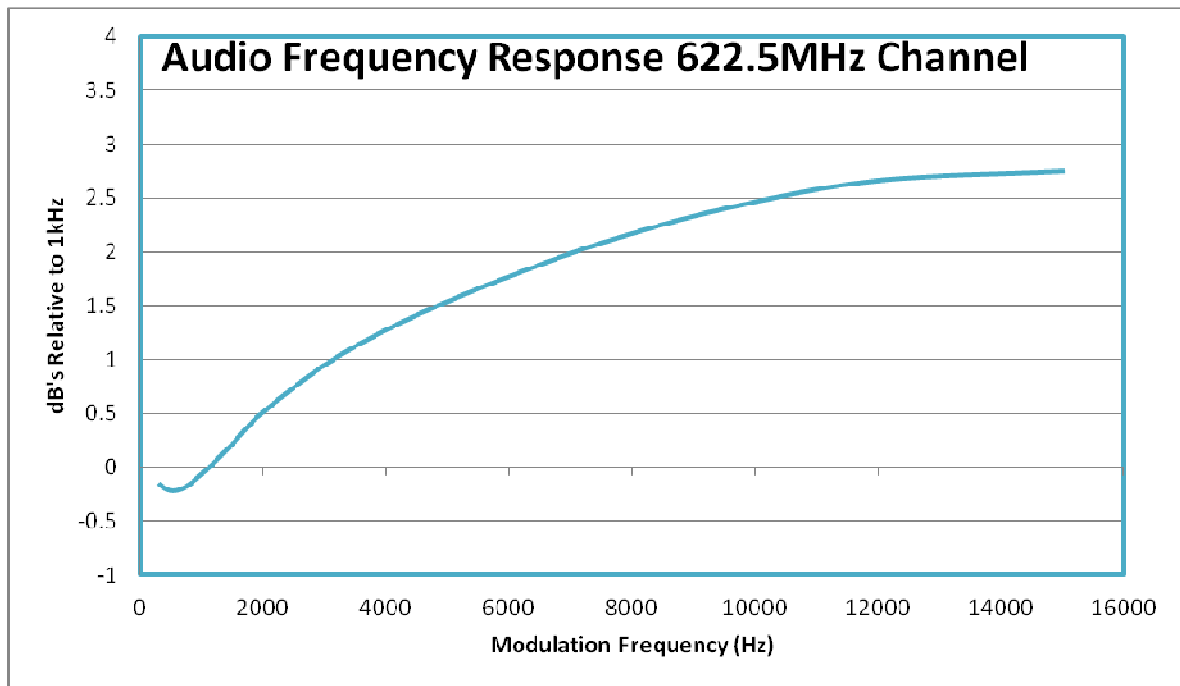


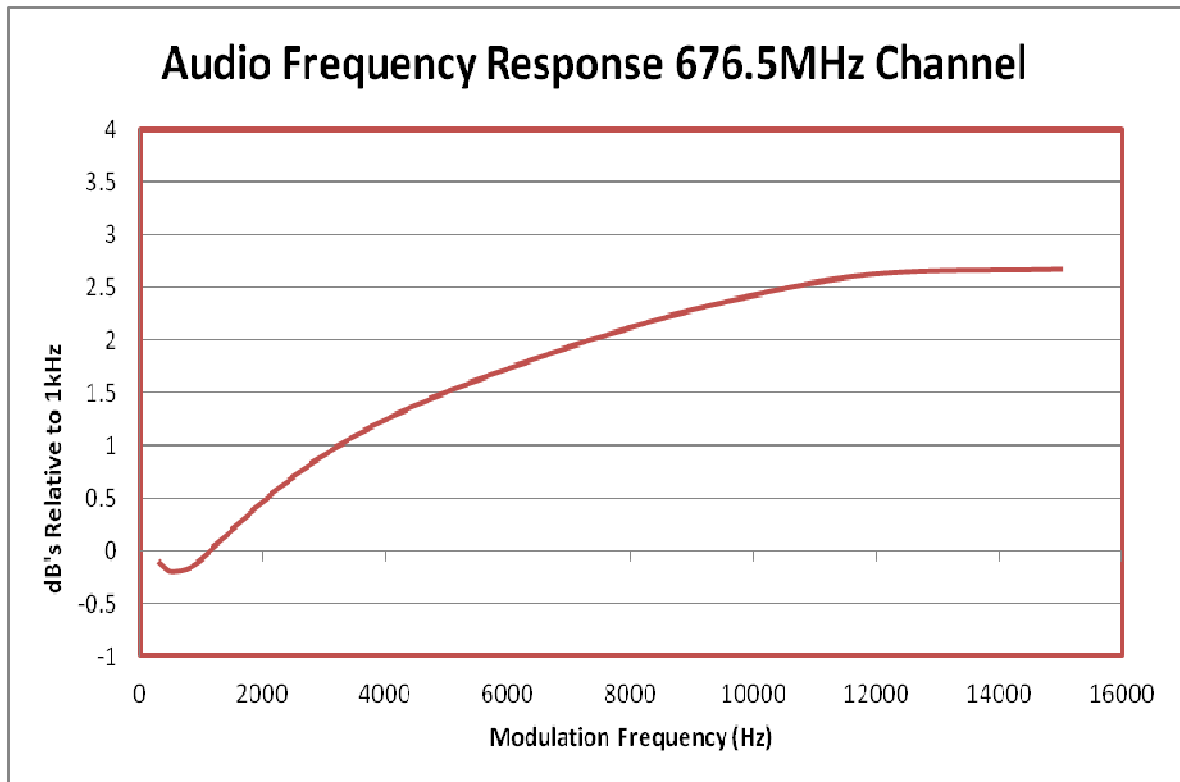
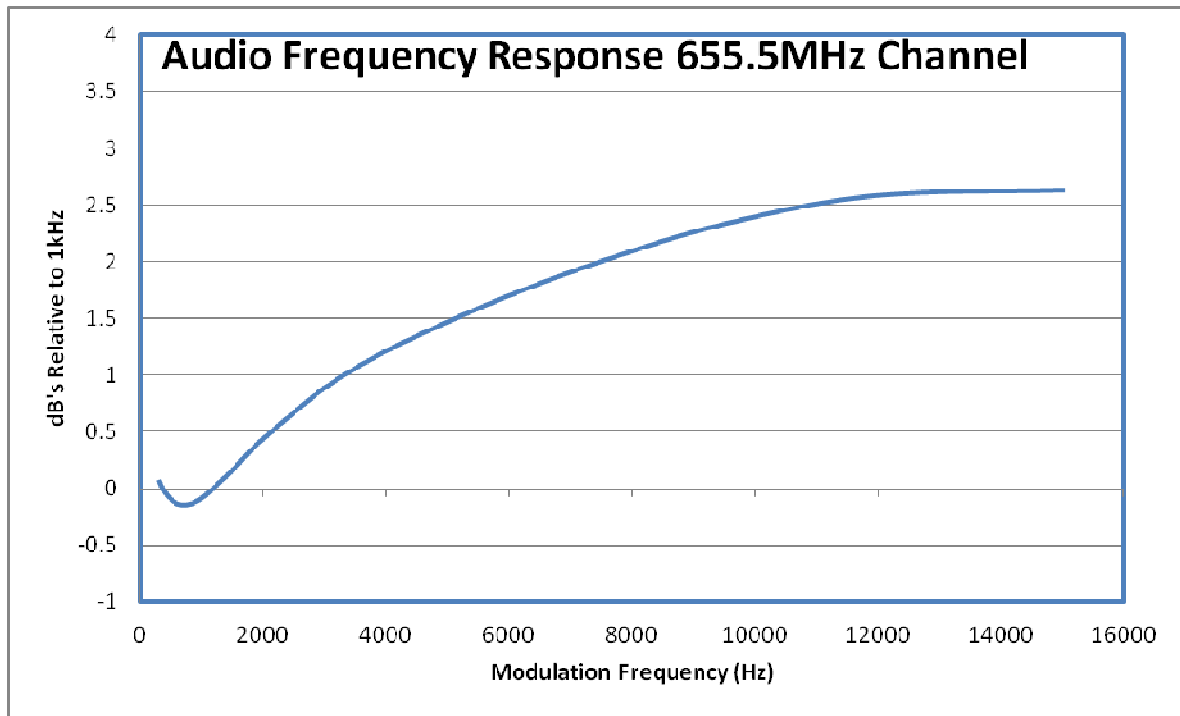


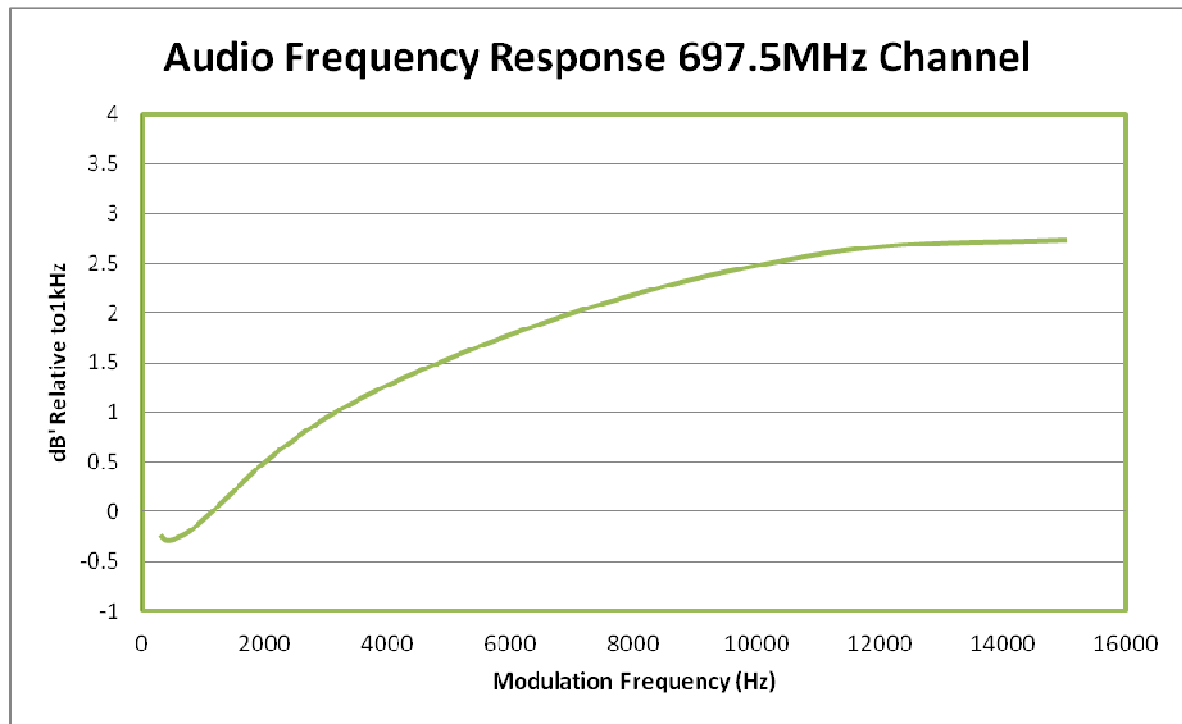
6.2 Audio frequency plots



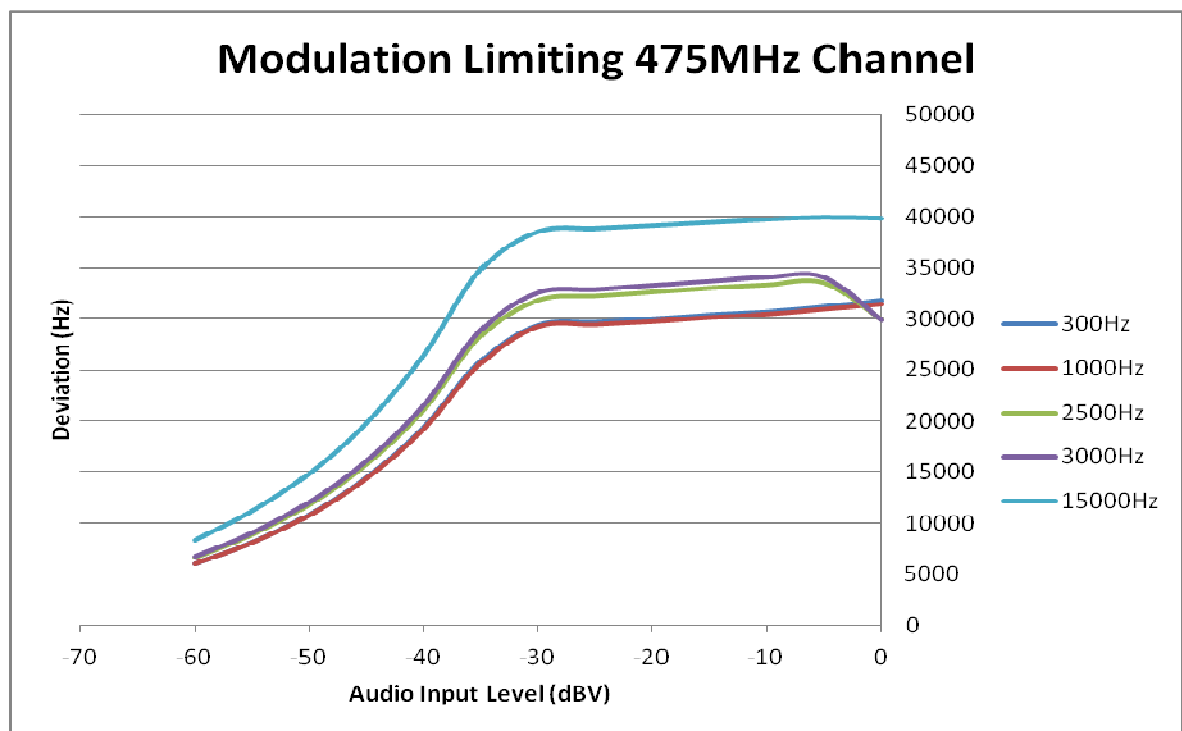
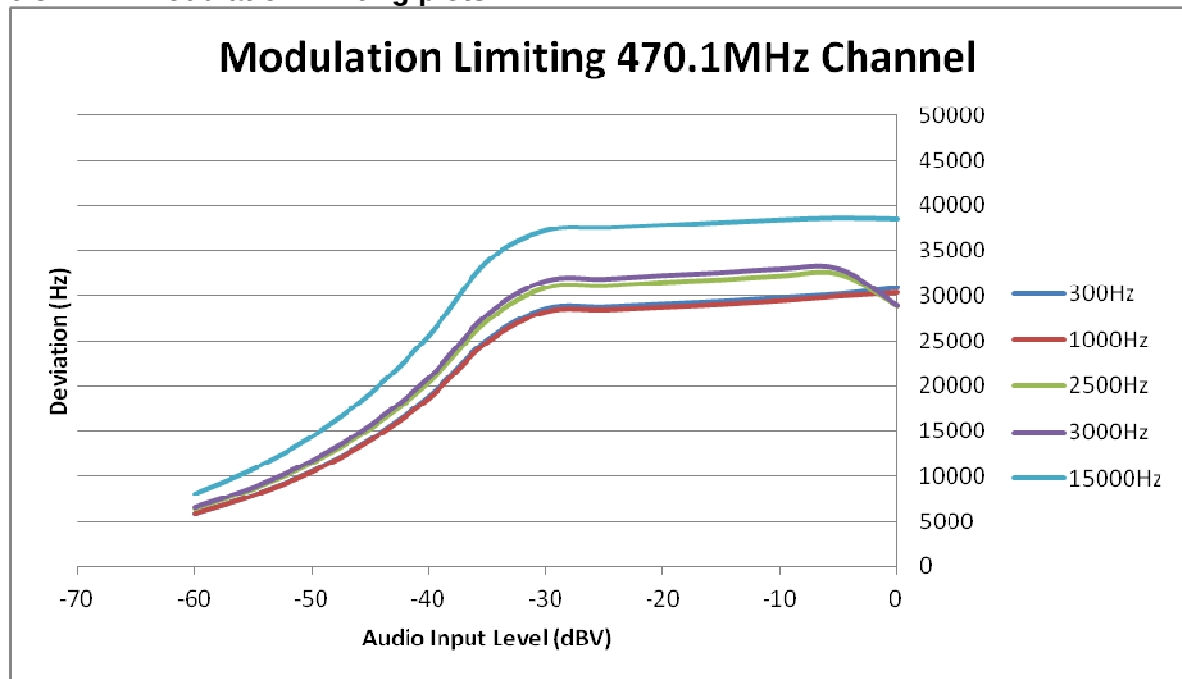


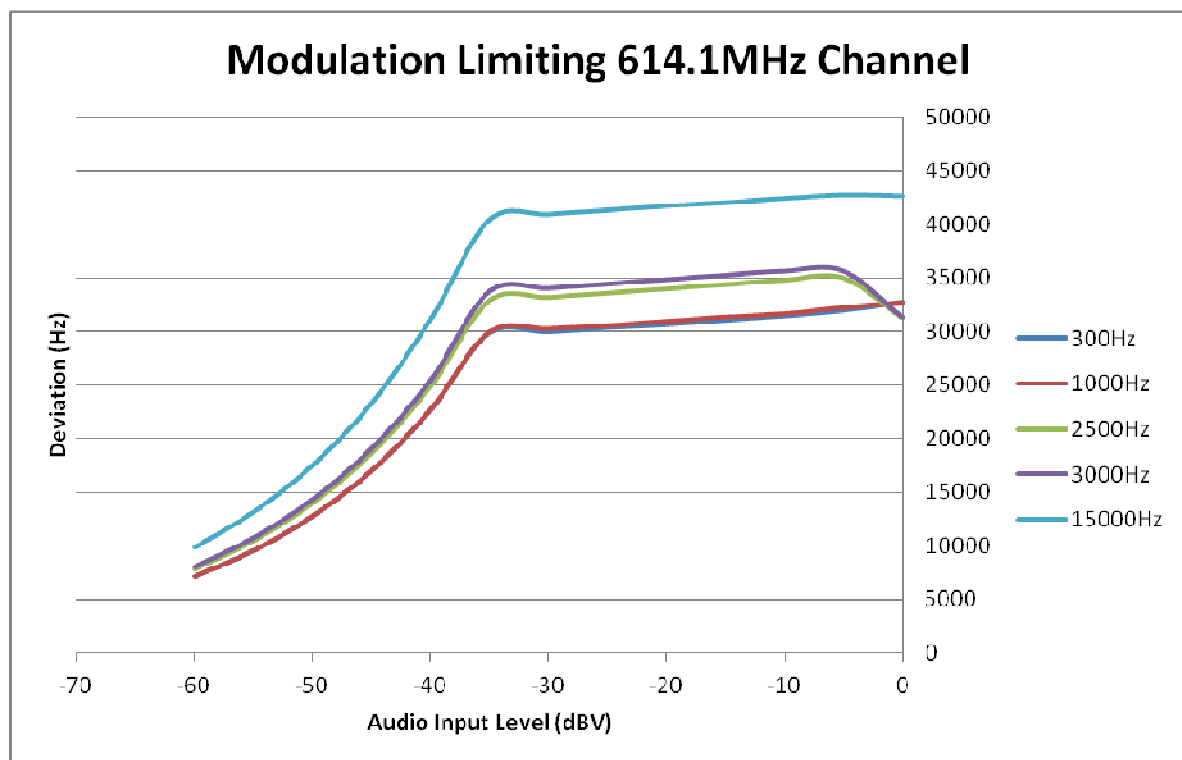
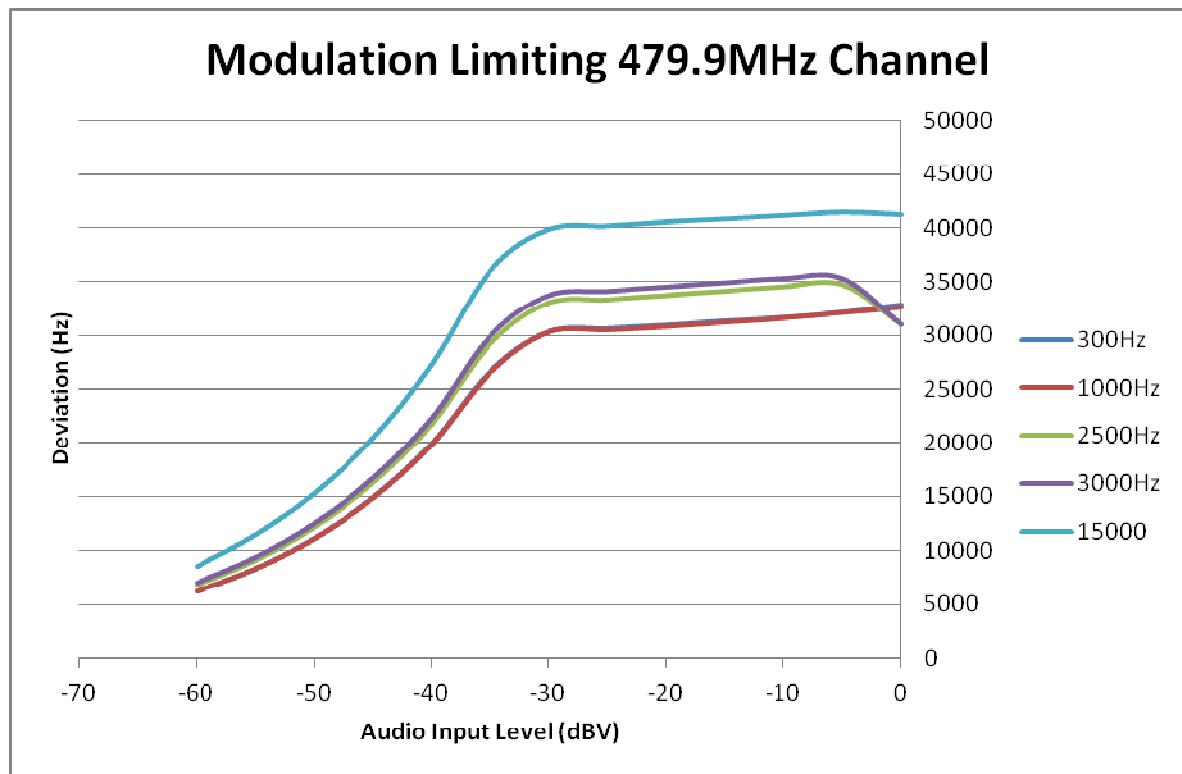


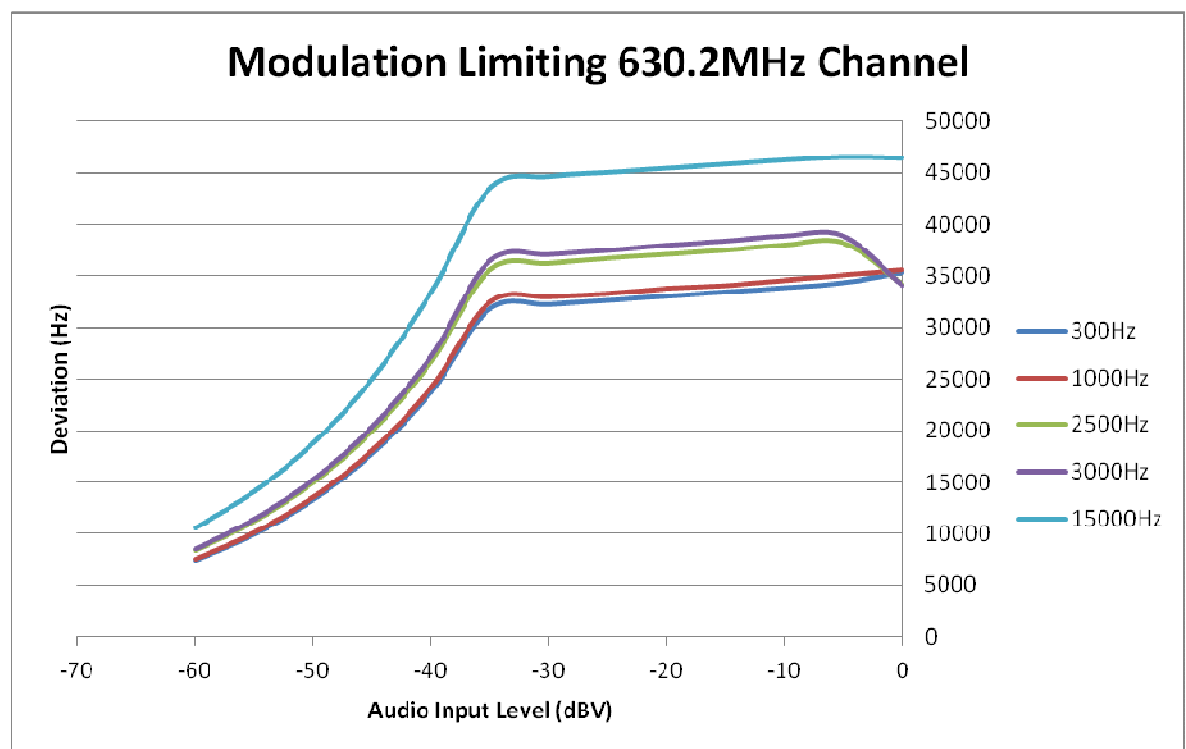
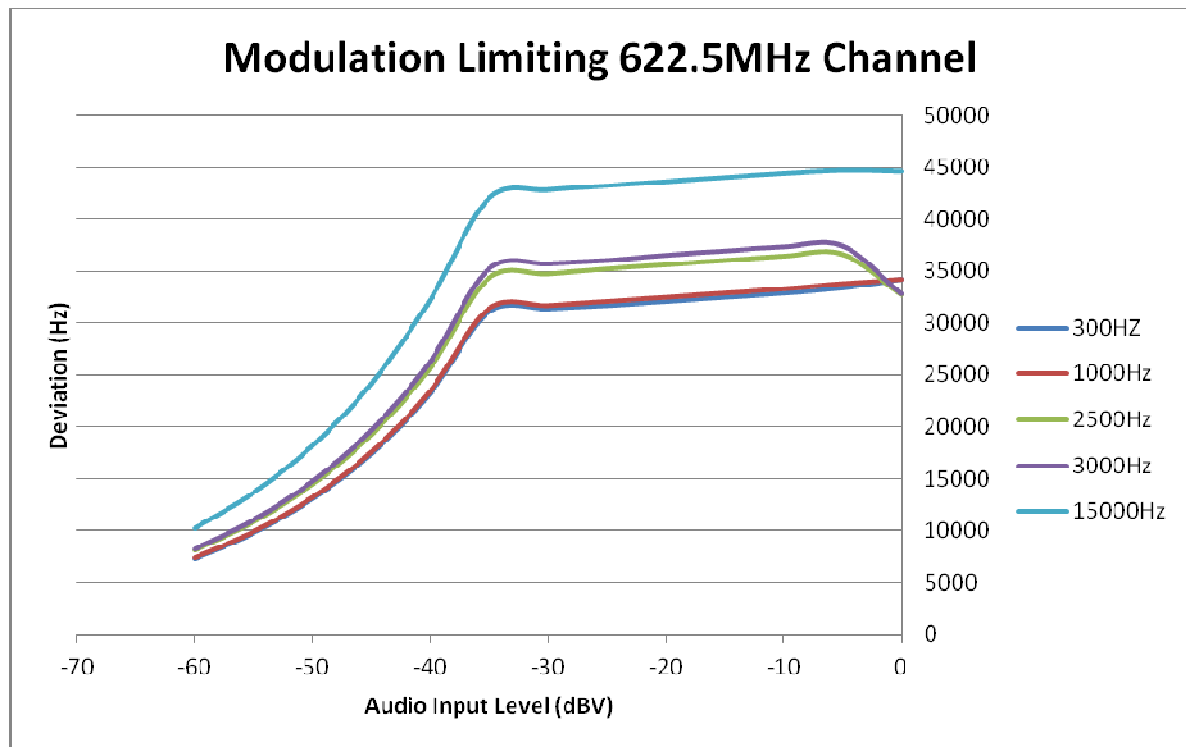


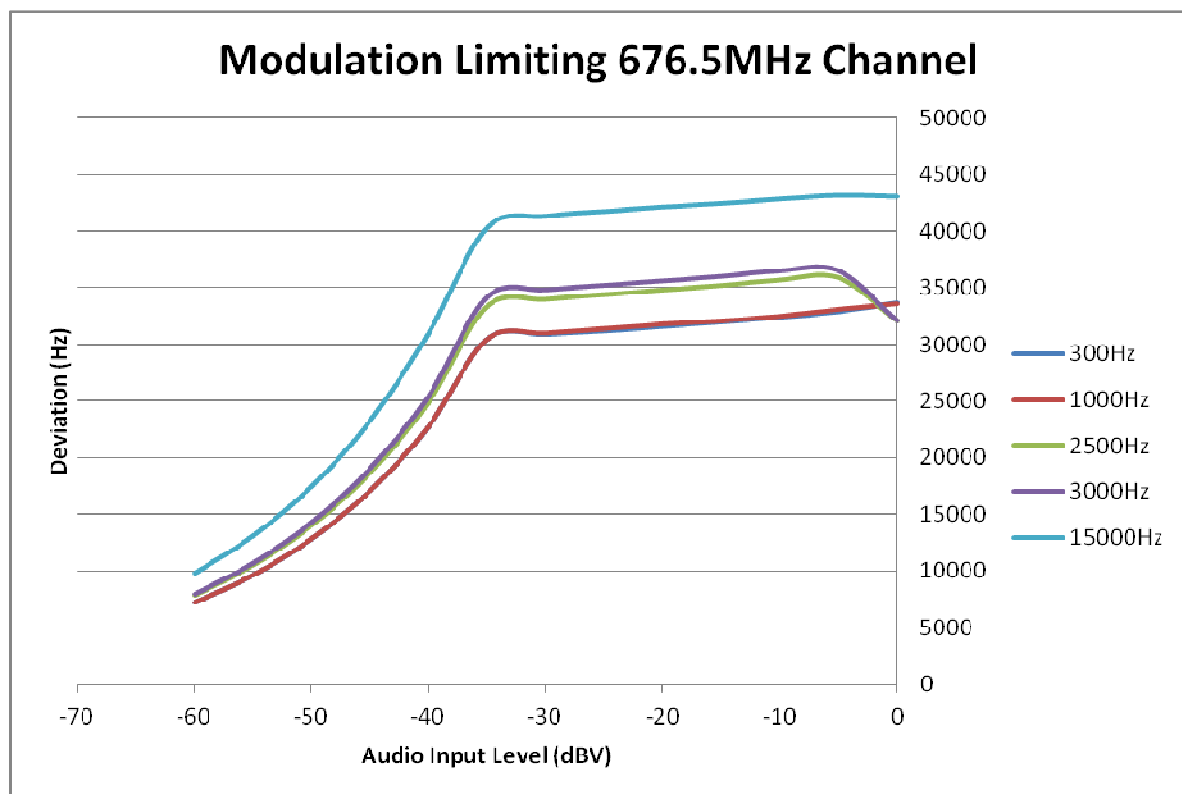
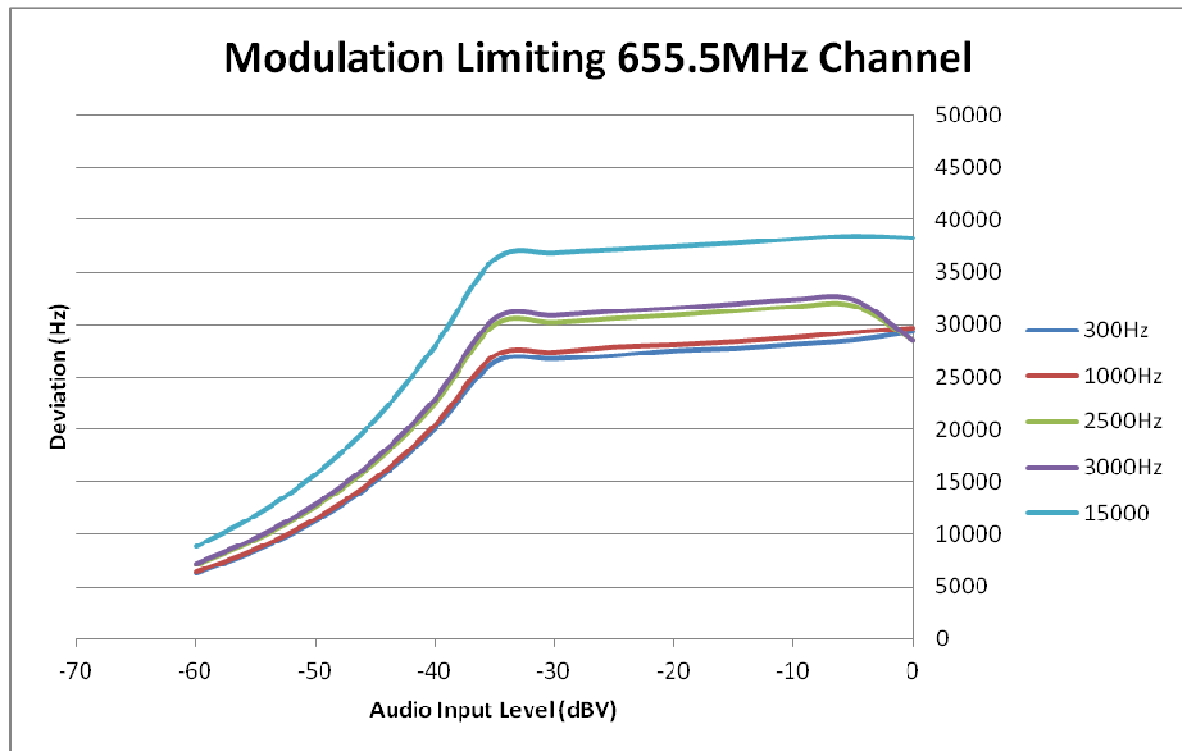


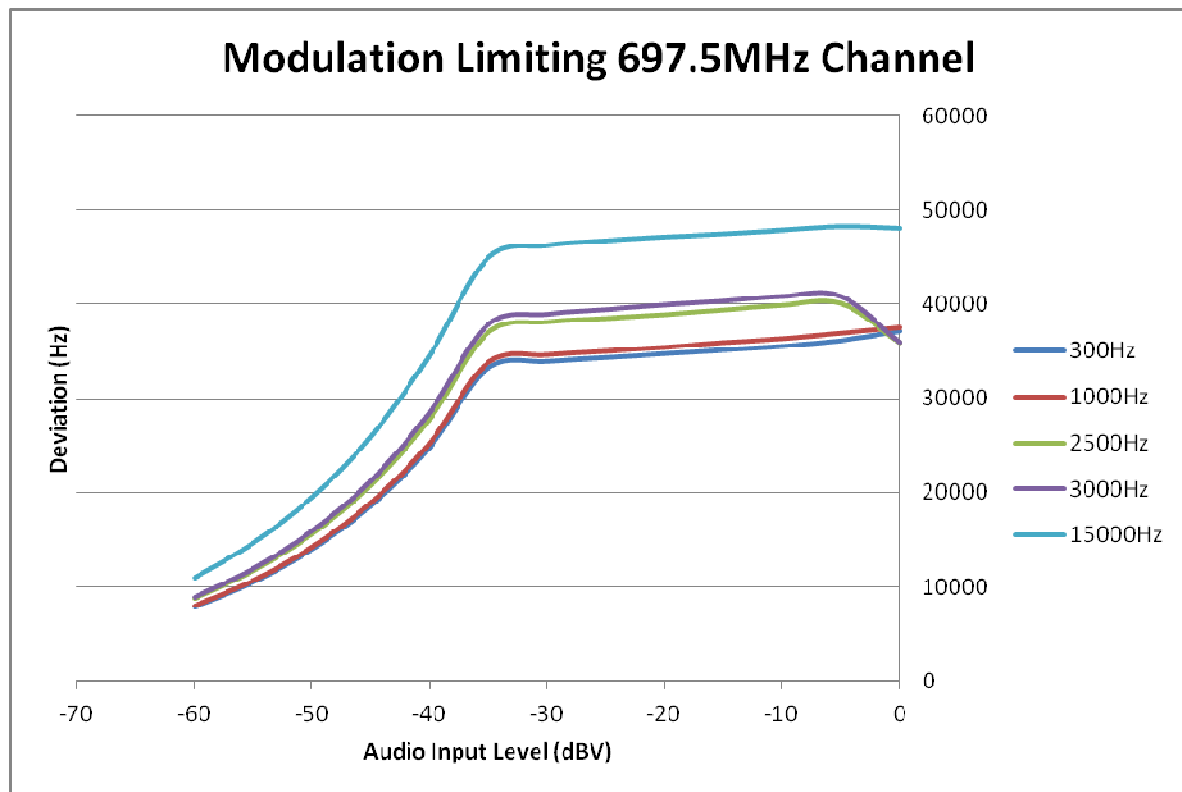
6.3 Modulation limiting plots



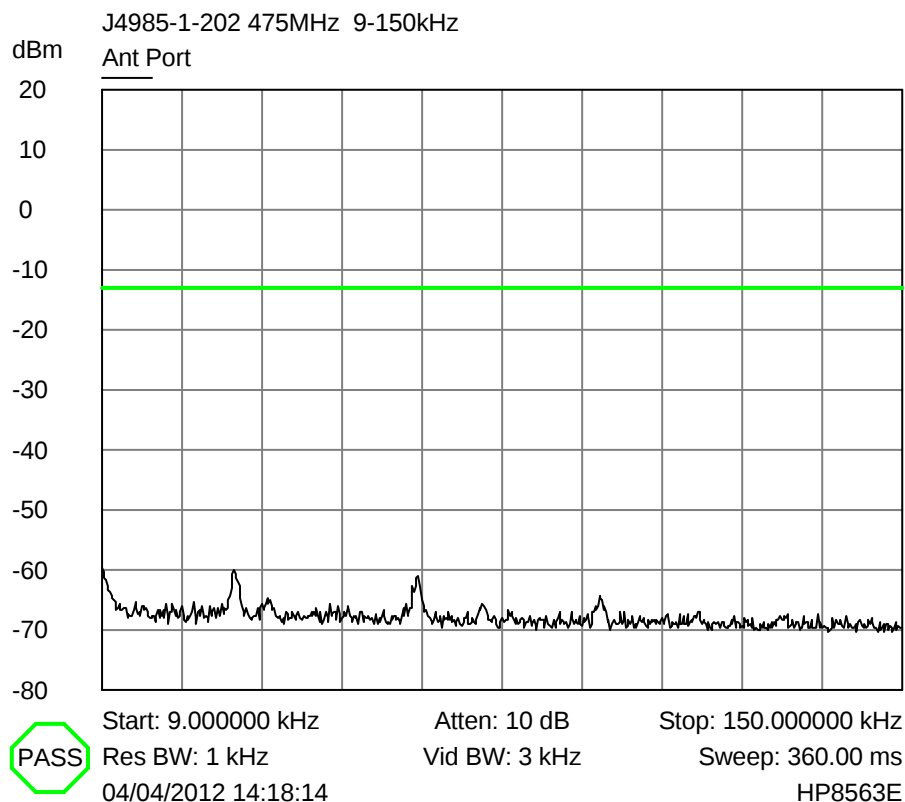
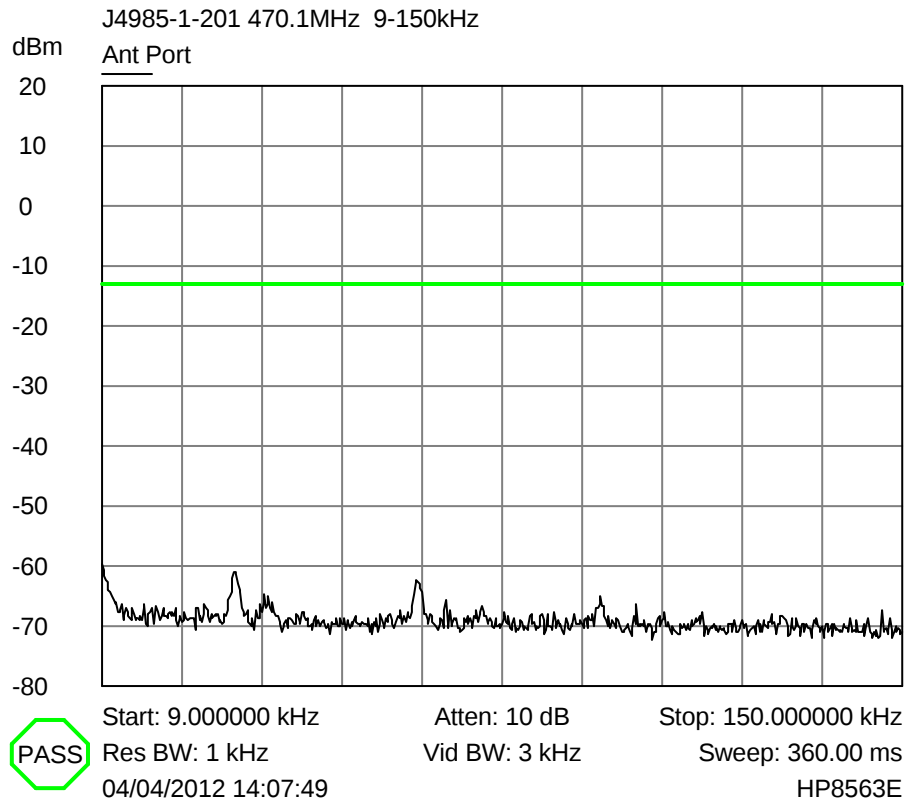








6.4 Antenna port spurious emission plots

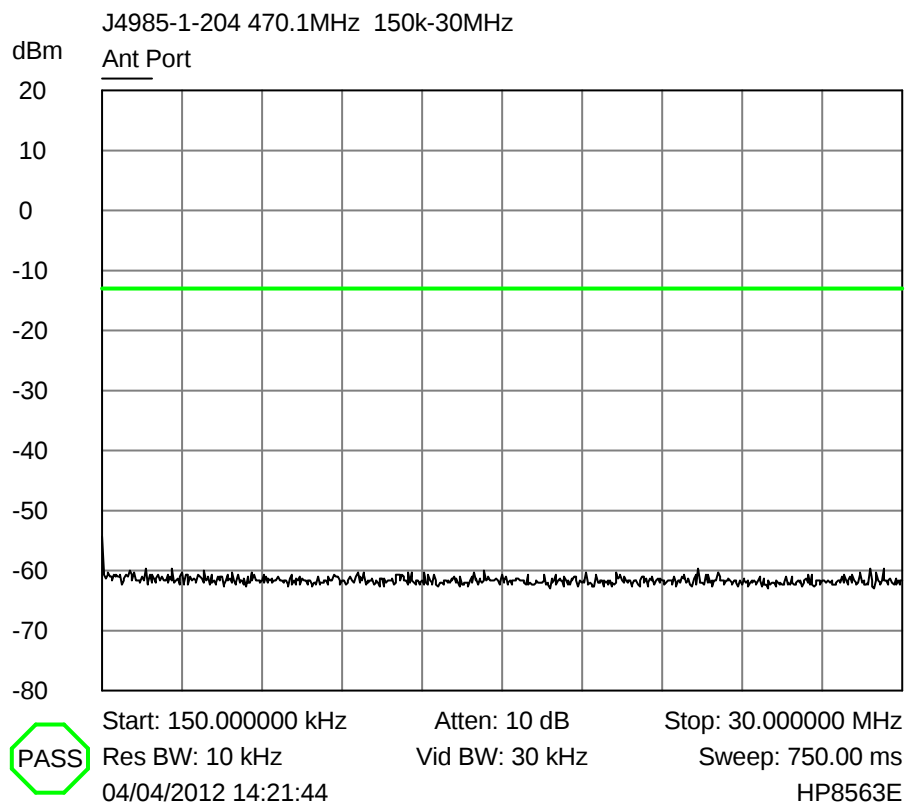
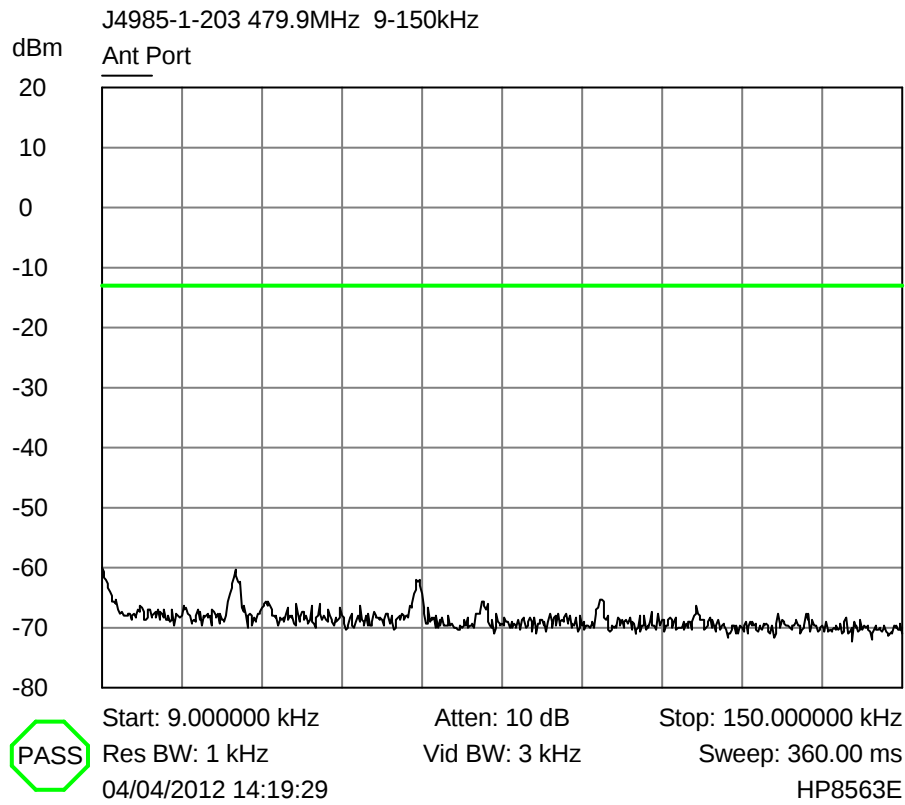


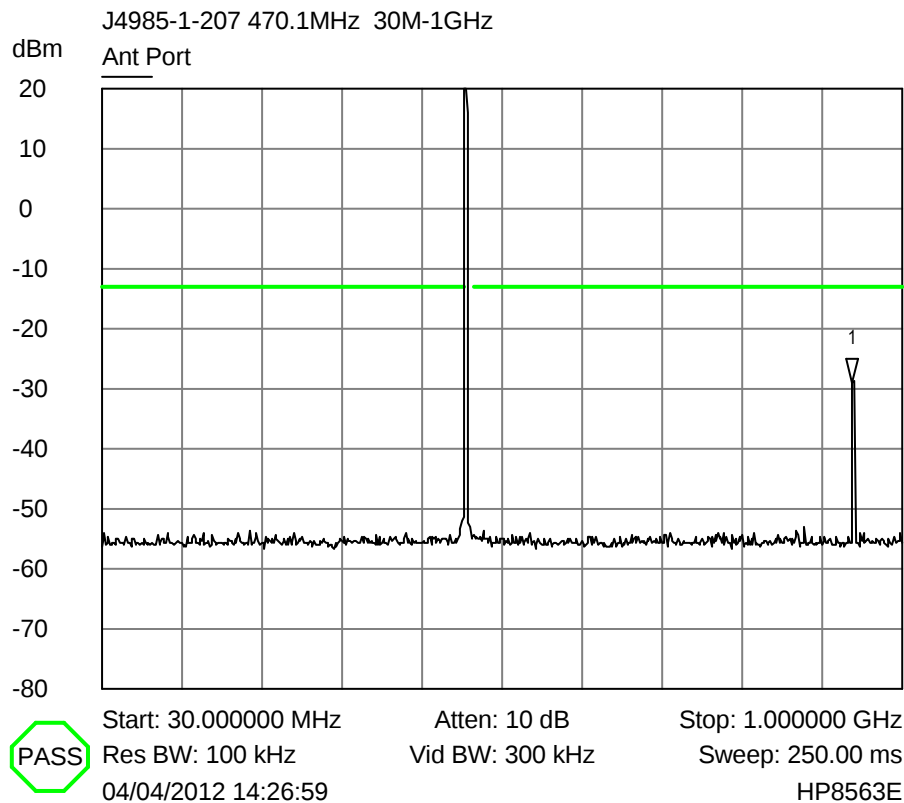
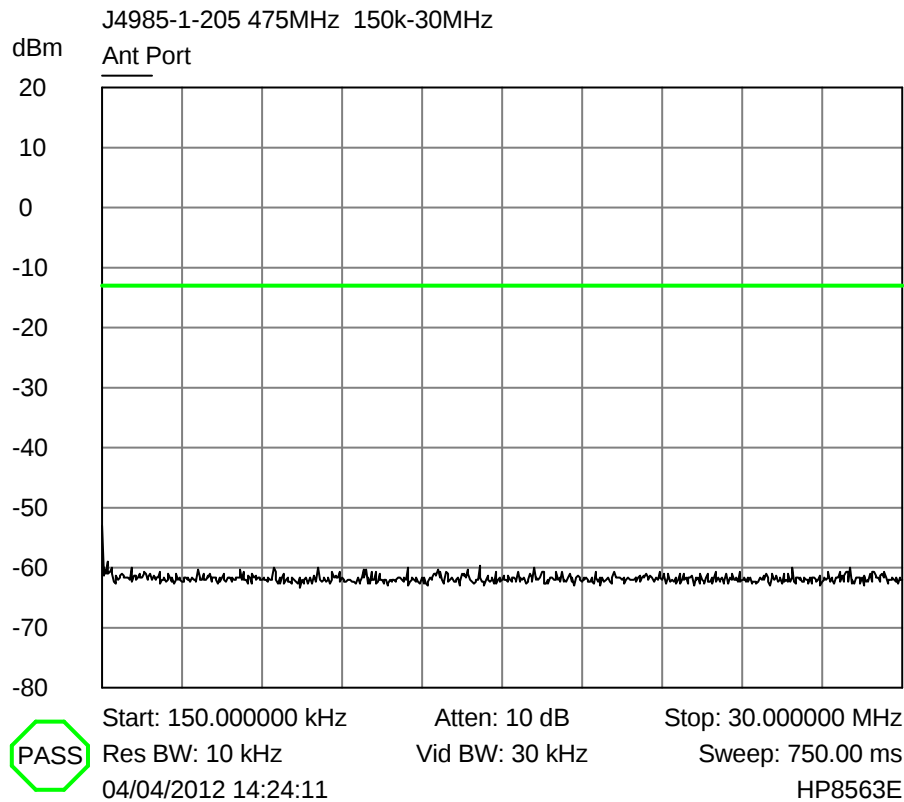
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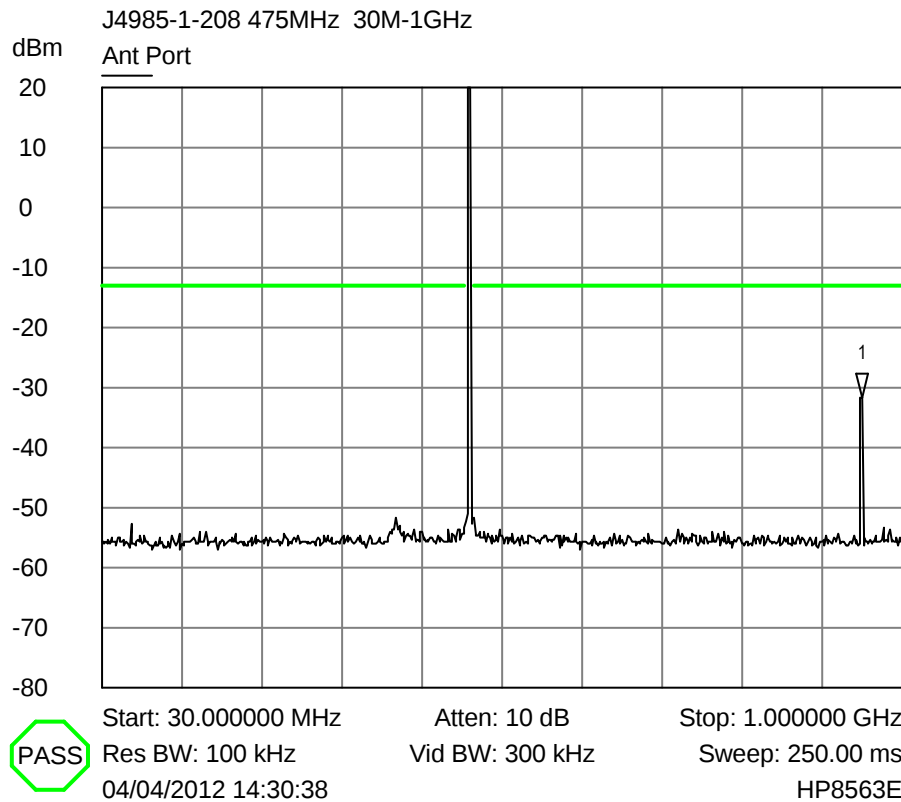
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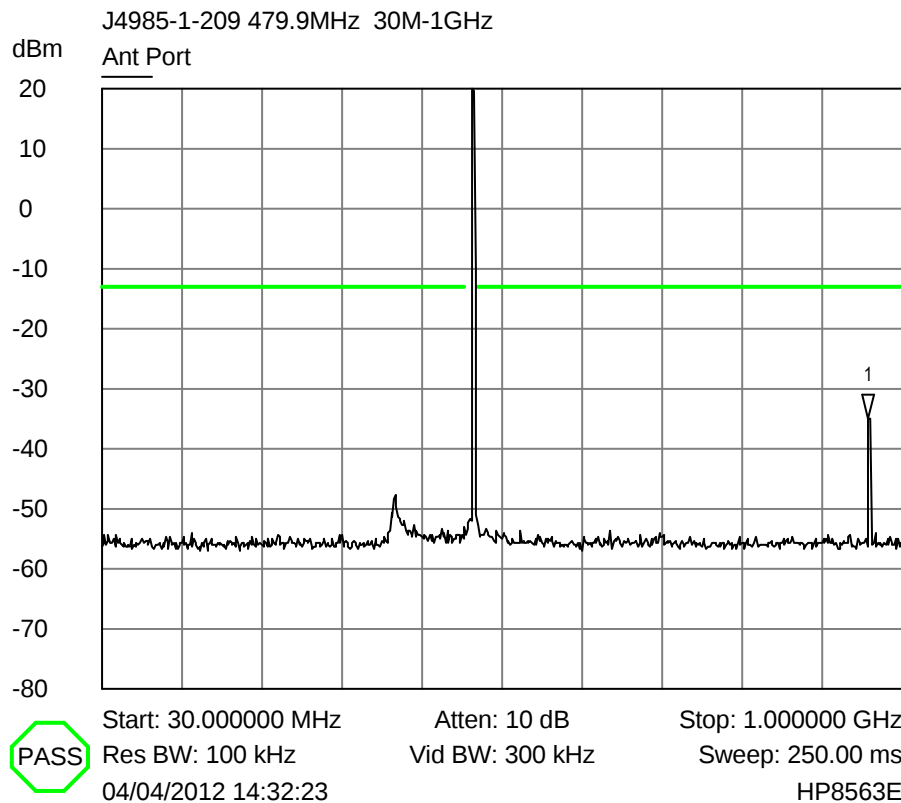




1 Ant Port
▽ 940.18333 MHz
-29.0000 dBm



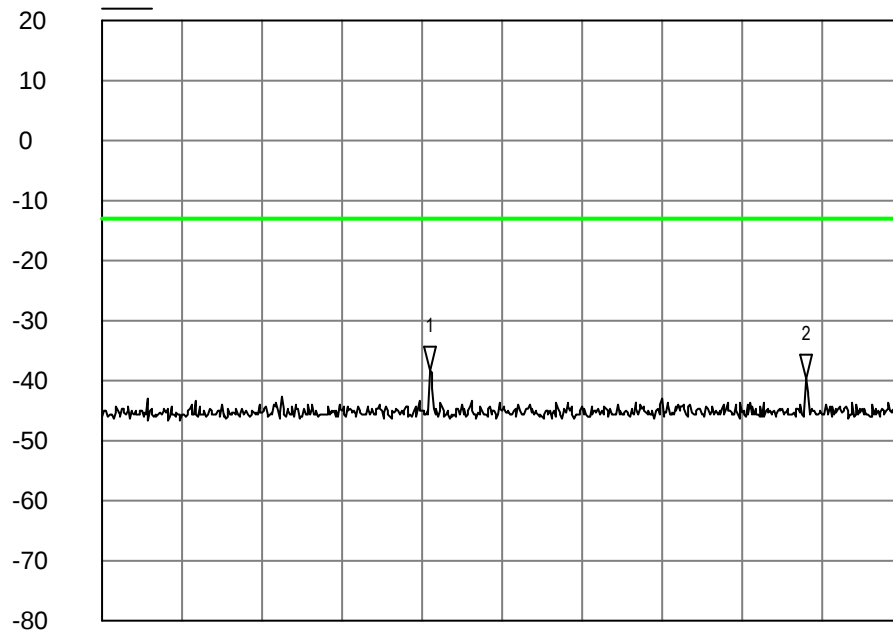
1 Ant Port
▽ 951.500000 MHz
-31.6600 dBm



1 Ant Port
▽ 959.583333 MHz
-35.0000 dBm

J4985-1-210 470.1MHz 1-2GHz

Ant Port



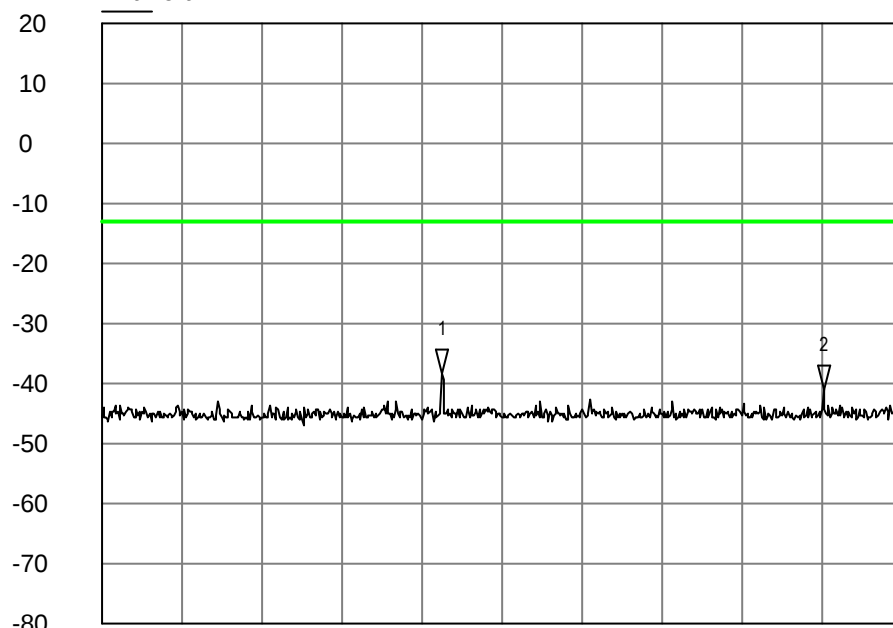
- 1 Ant Port
▽ 1.410000 GHz
-38.1700 dBm
- 2 Ant Port
▽ 1.880000 GHz
-39.6700 dBm

PASS

Start: 1.000000 GHz Atten: 10 dB Stop: 2.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
04/04/2012 14:45:36 HP8563E

J4985-1-211 475MHz 1-2GHz

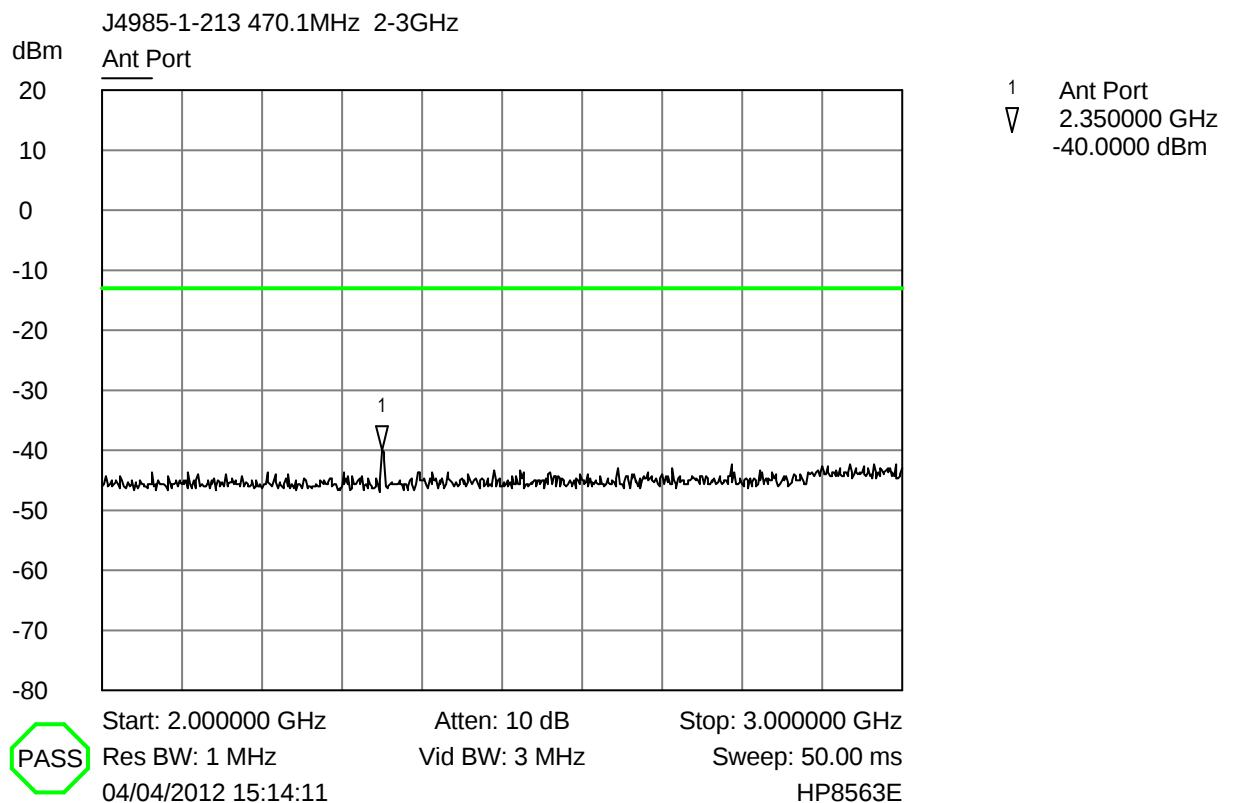
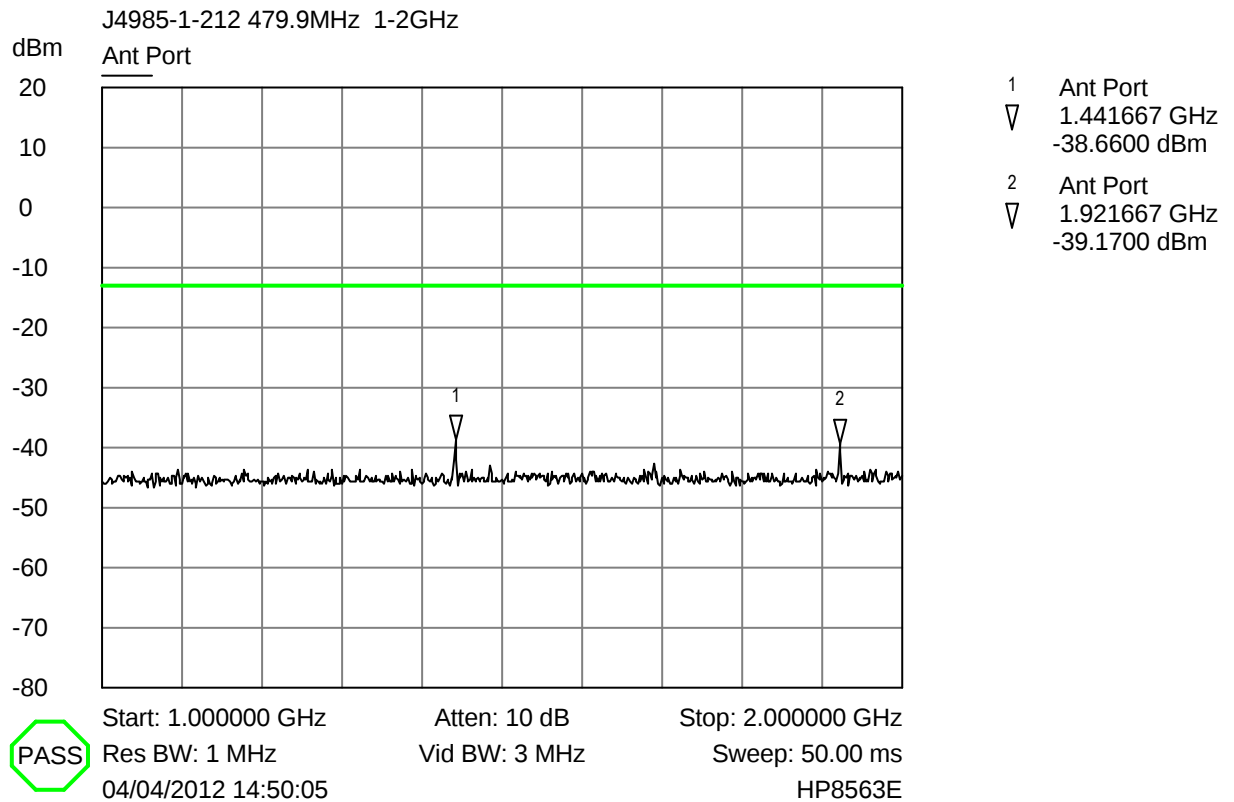
Ant Port



- 1 Ant Port
▽ 1.425000 GHz
-38.3300 dBm
- 2 Ant Port
▽ 1.901667 GHz
-41.1600 dBm

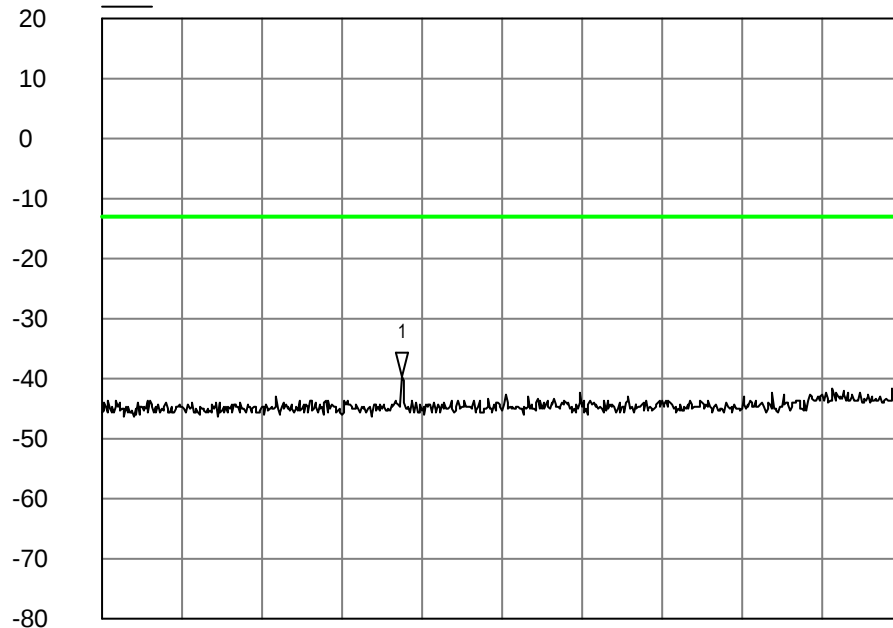
PASS

Start: 1.000000 GHz Atten: 10 dB Stop: 2.000000 GHz
Res BW: 1 MHz Vid BW: 3 MHz Sweep: 50.00 ms
04/04/2012 14:48:33 HP8563E



J4985-1-214 475MHz 2-3GHz

dBm
Ant Port



1
▽ Ant Port
2.375000 GHz
-39.6700 dBm

PASS

Start: 2.000000 GHz

Atten: 10 dB

Stop: 3.000000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

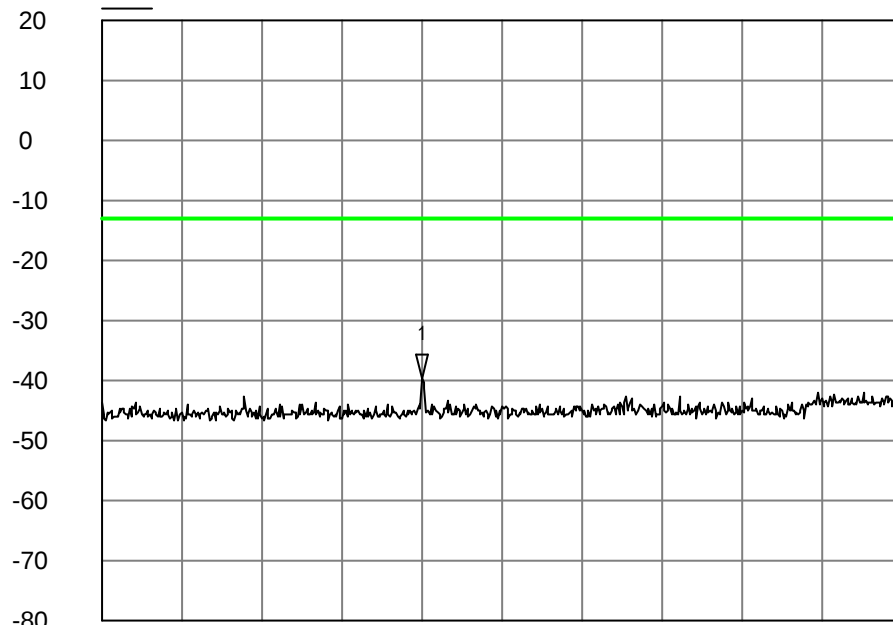
Sweep: 50.00 ms

04/04/2012 15:18:40

HP8563E

J4985-1-215 479.9MHz 2-3GHz

dBm
Ant Port



1
▽ Ant Port
2.400000 GHz
-39.5000 dBm

PASS

Start: 2.000000 GHz

Atten: 10 dB

Stop: 3.000000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

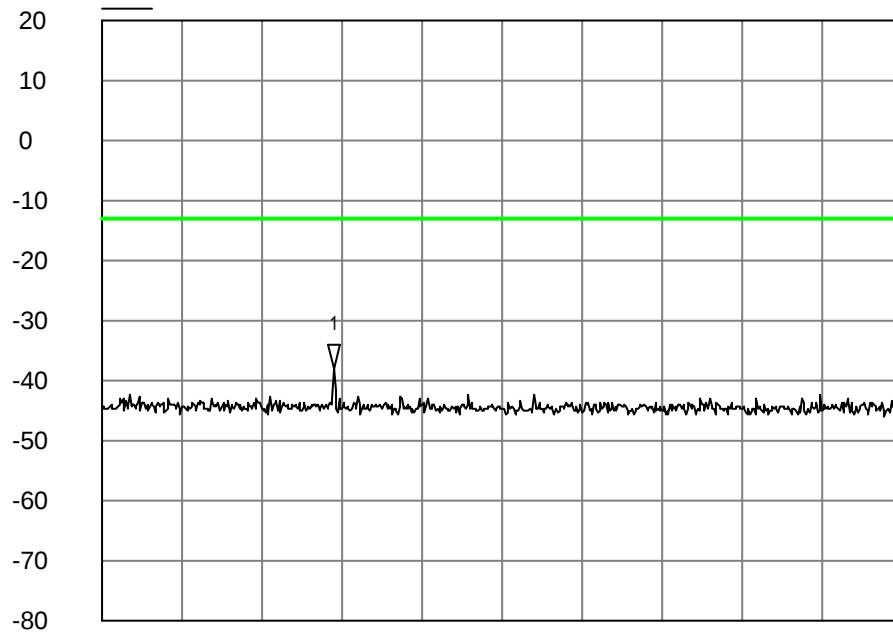
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04/04/2012 15:22:52

HP8563E

J4985-1-216 470.1MHz 3-4GHz

Ant Port



1 Ant Port
3.290000 GHz
-38.0000 dBm

PASS

Start: 3.000000 GHz

Atten: 10 dB

Stop: 4.000000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

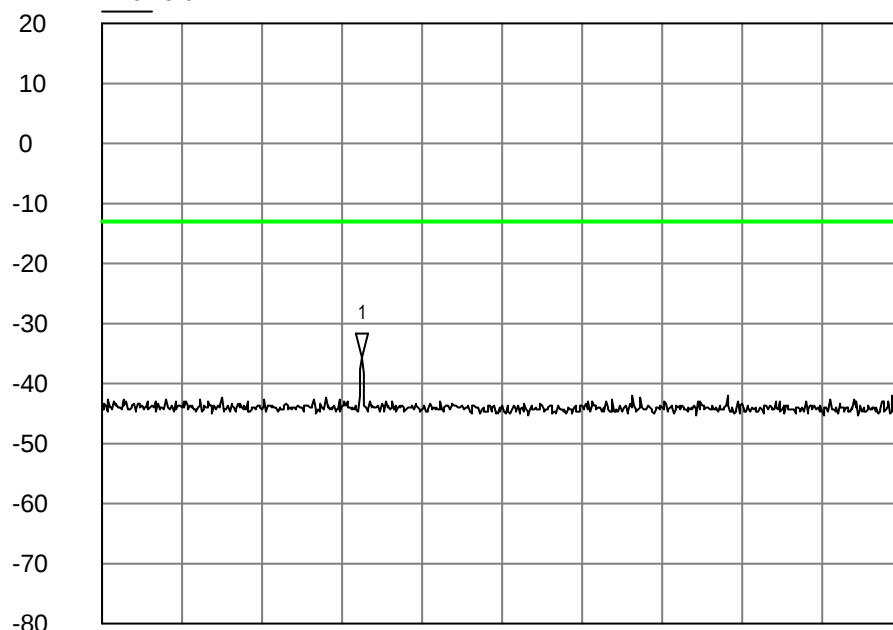
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04/04/2012 15:30:27

HP8563E

J4985-1-217 475MHz 3-4GHz

Ant Port



1 Ant Port
3.325000 GHz
-35.8300 dBm

PASS

Start: 3.000000 GHz

Atten: 10 dB

Stop: 4.000000 GHz

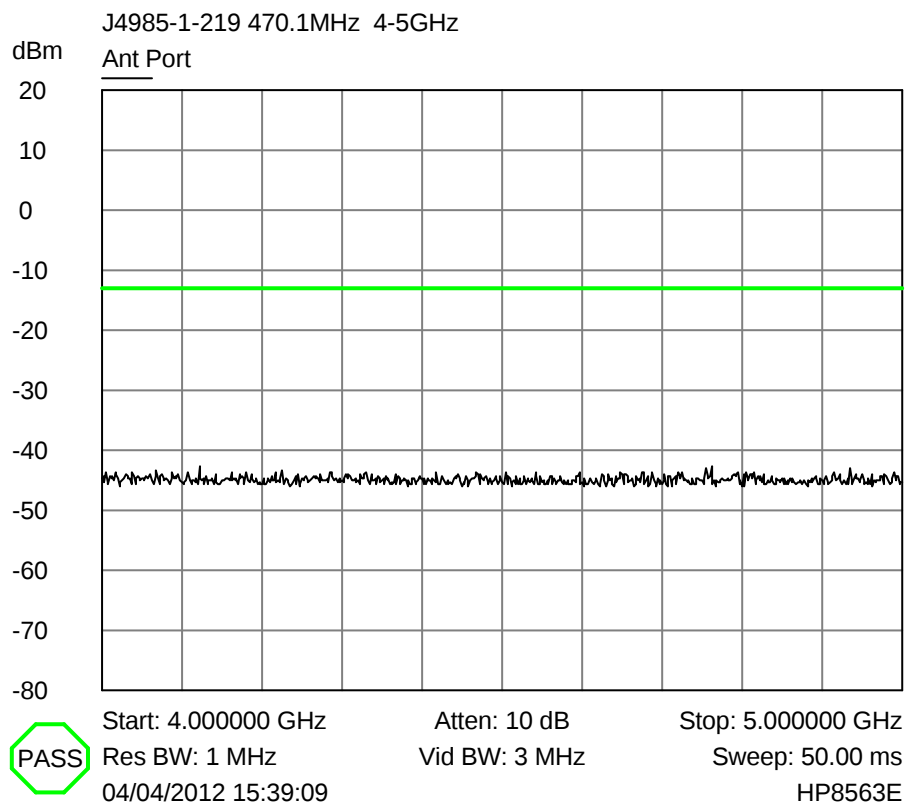
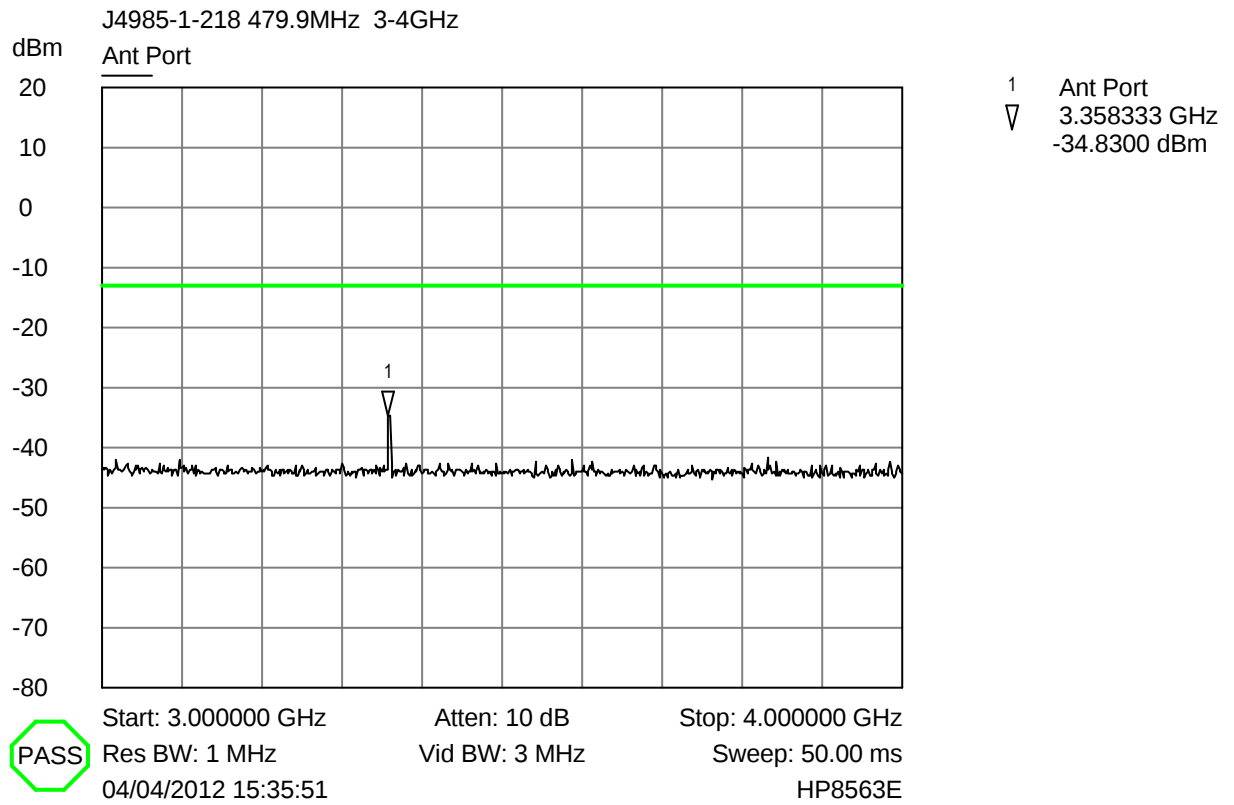
Res BW: 1 MHz

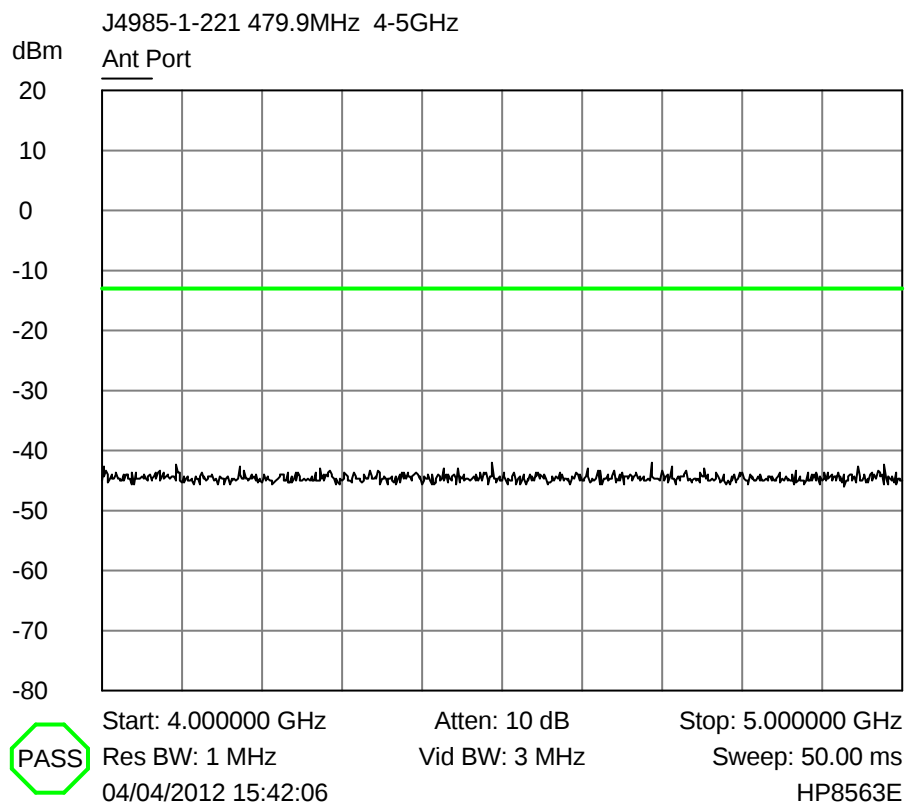
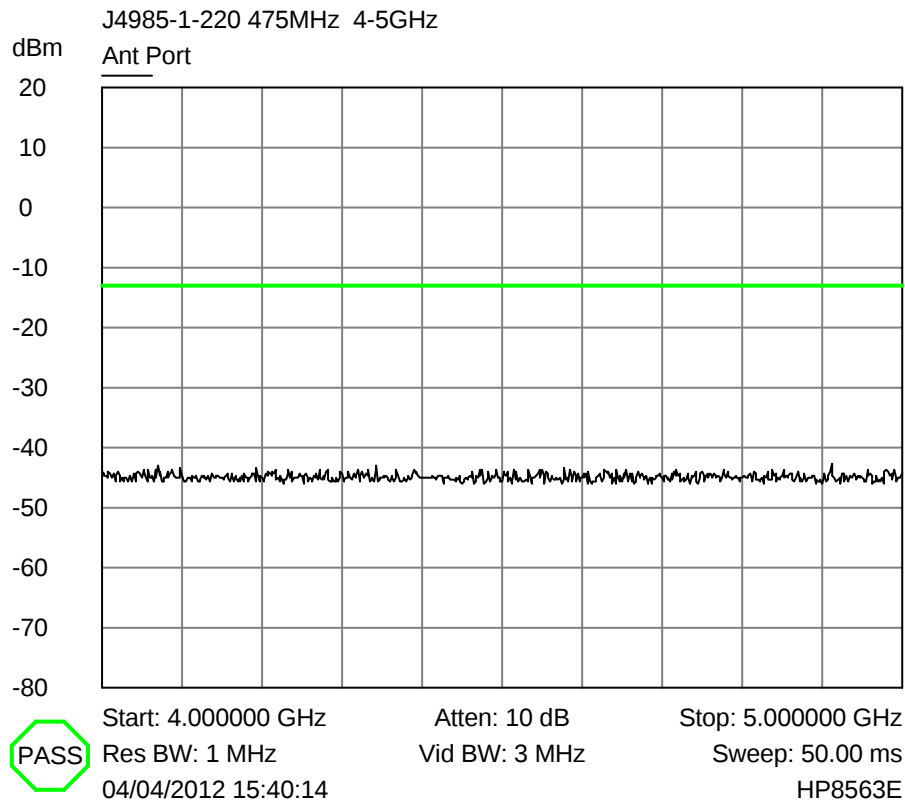
Vid BW: 3 MHz

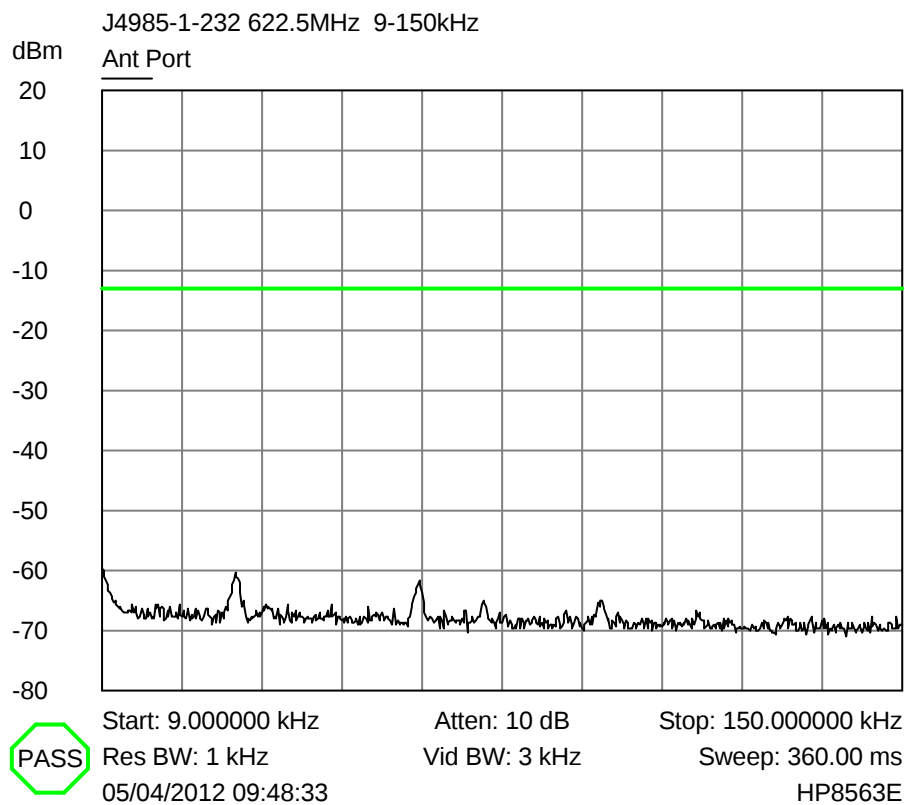
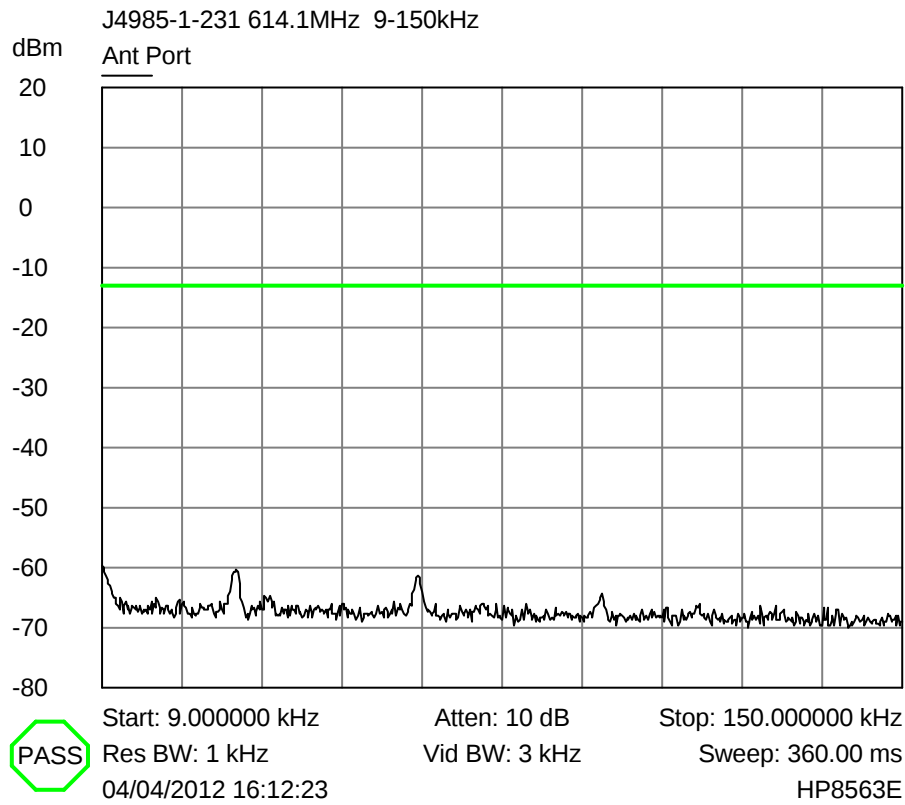
Sweep: 50.00 ms

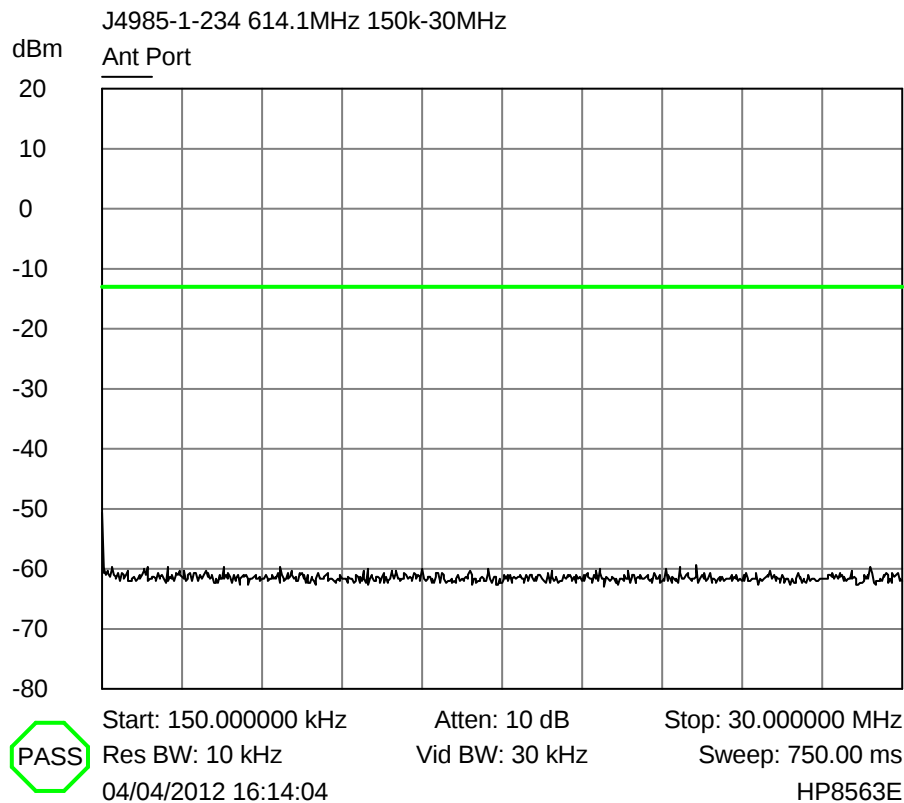
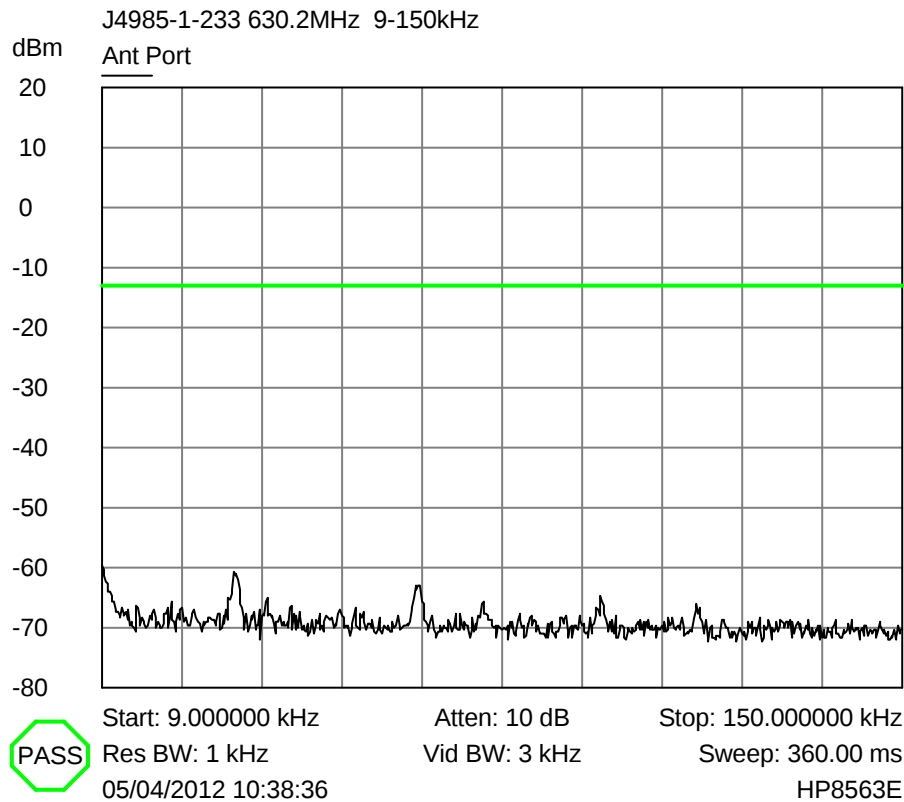
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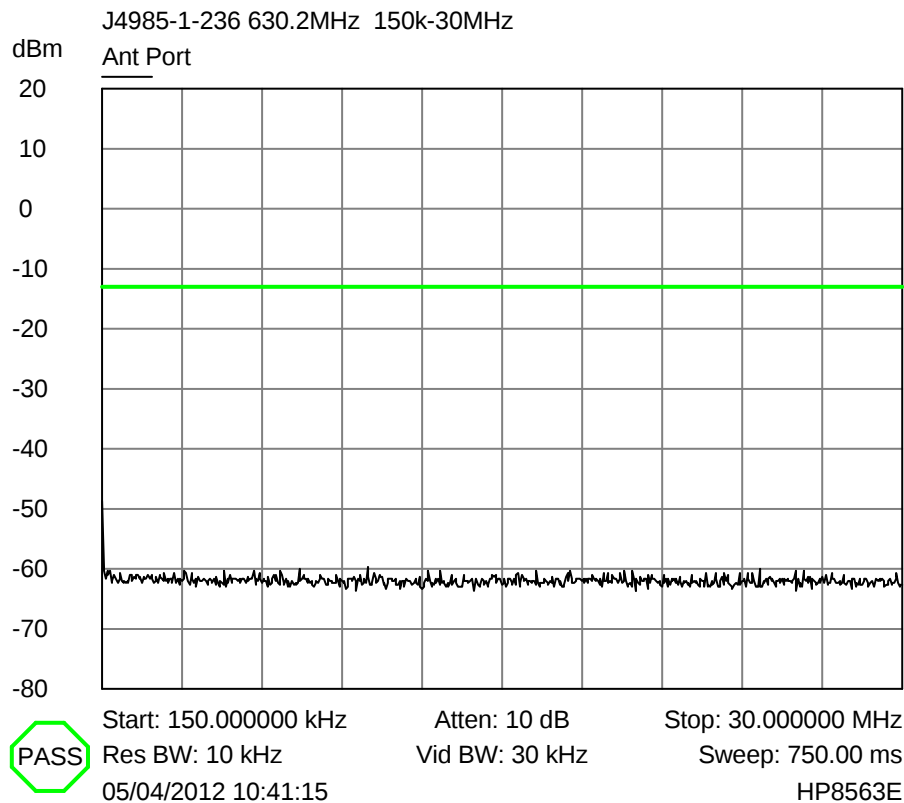
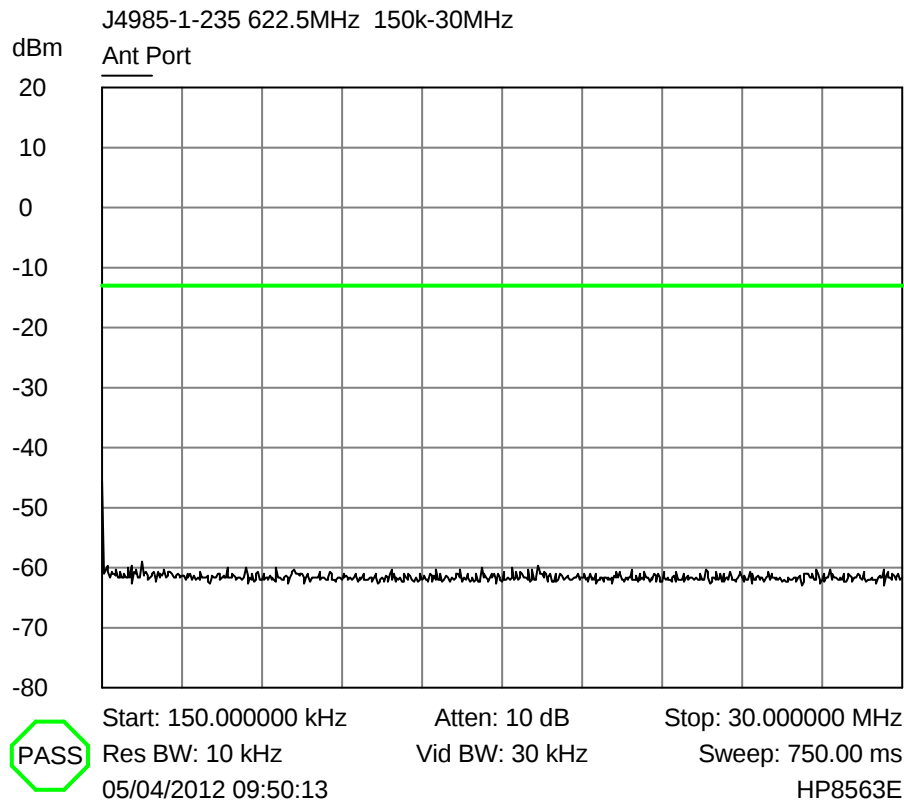
HP8563E

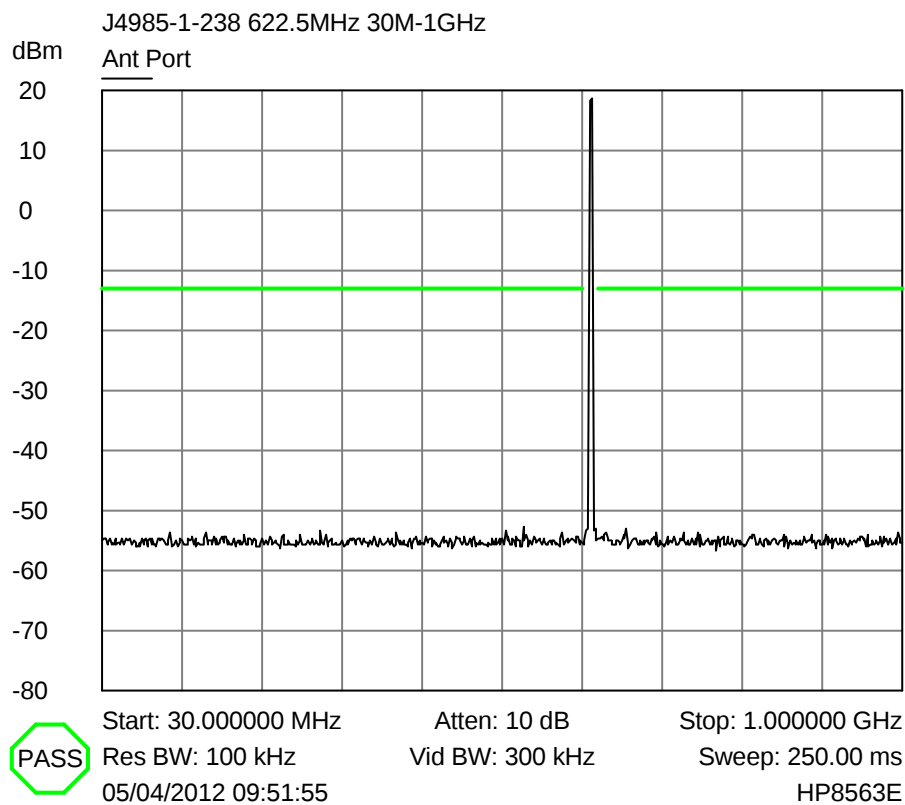
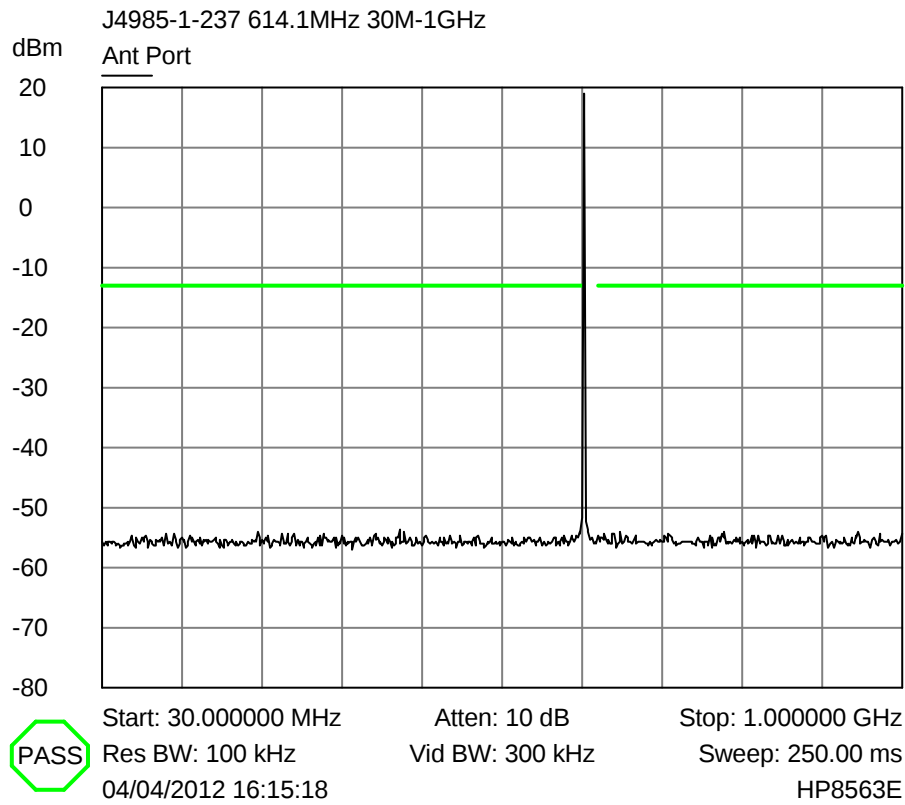


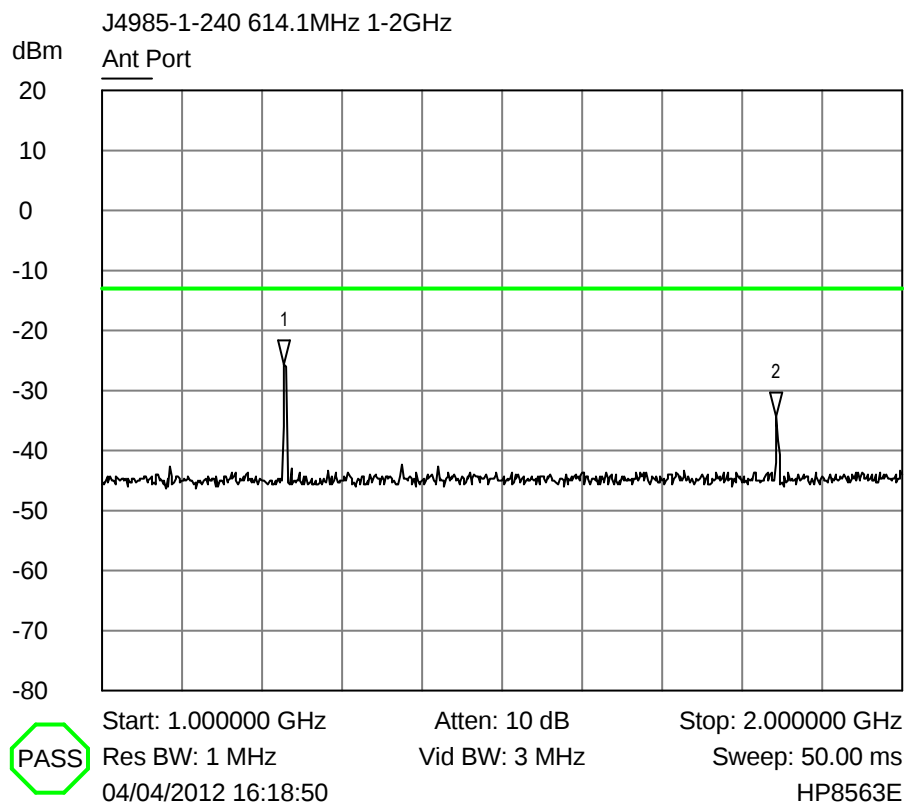
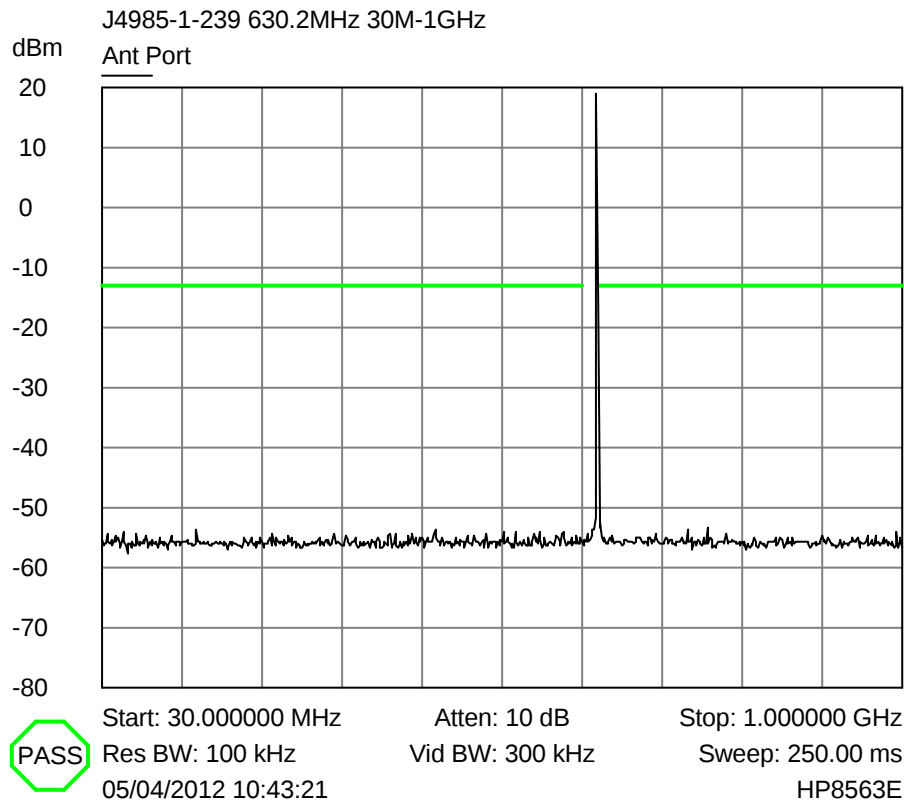




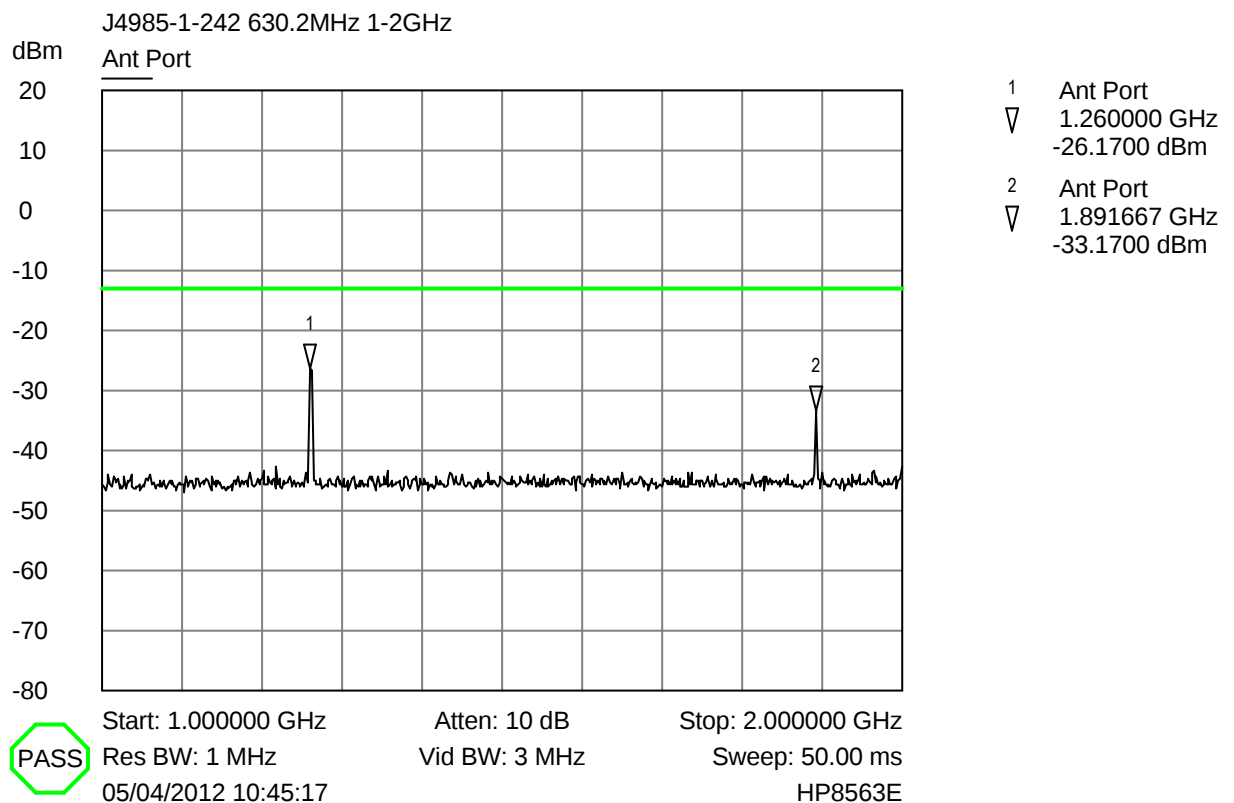
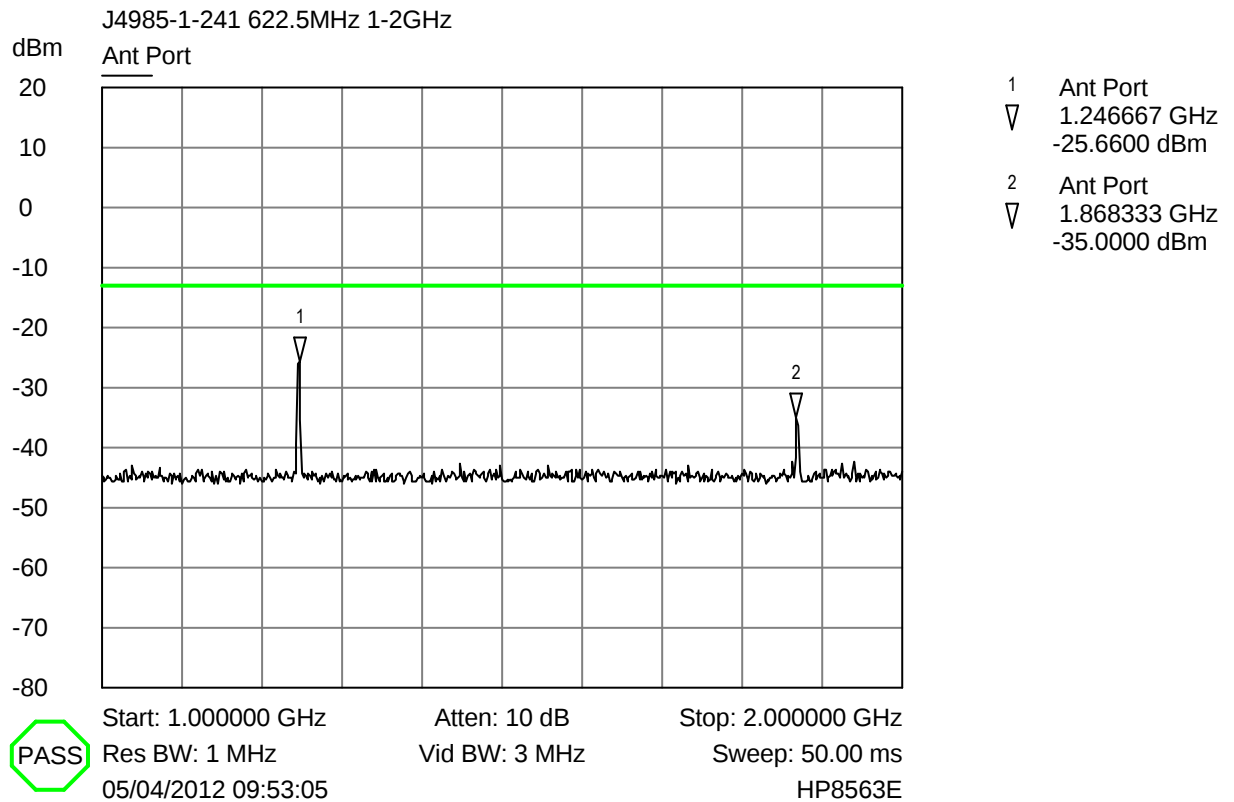


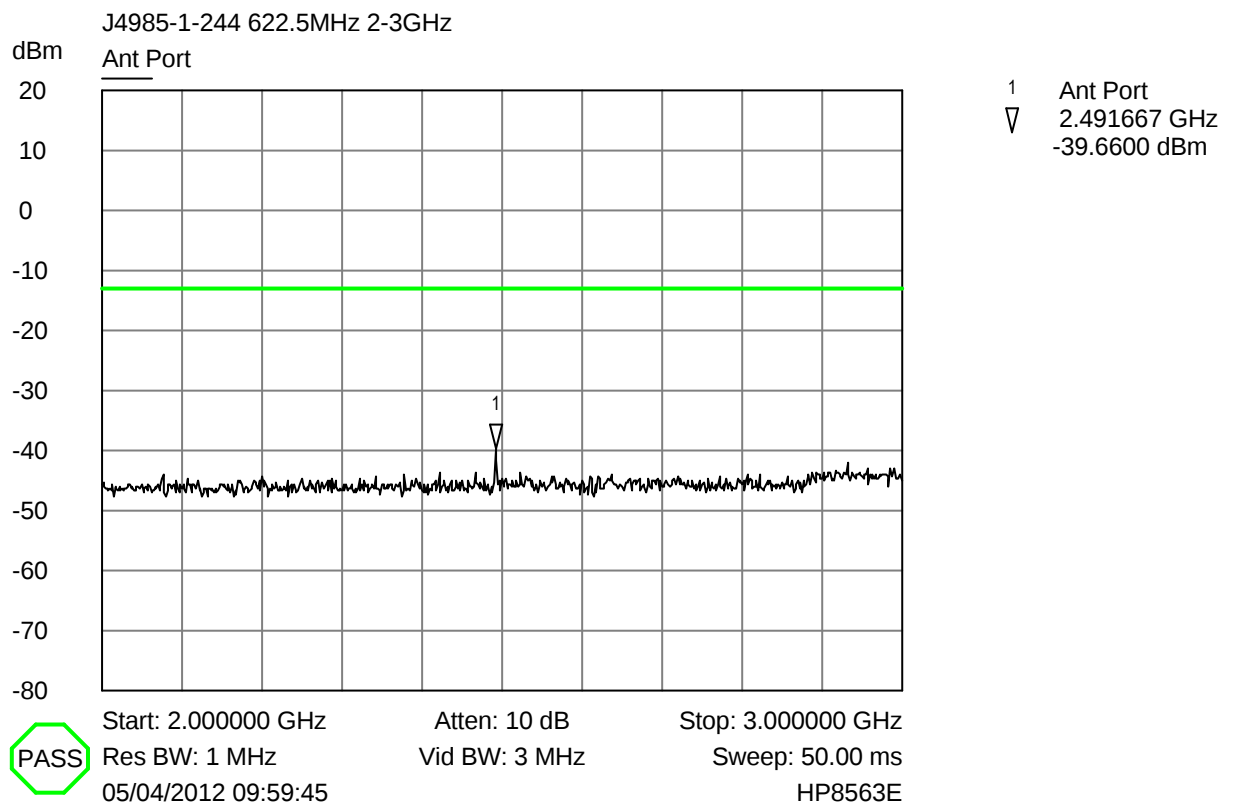
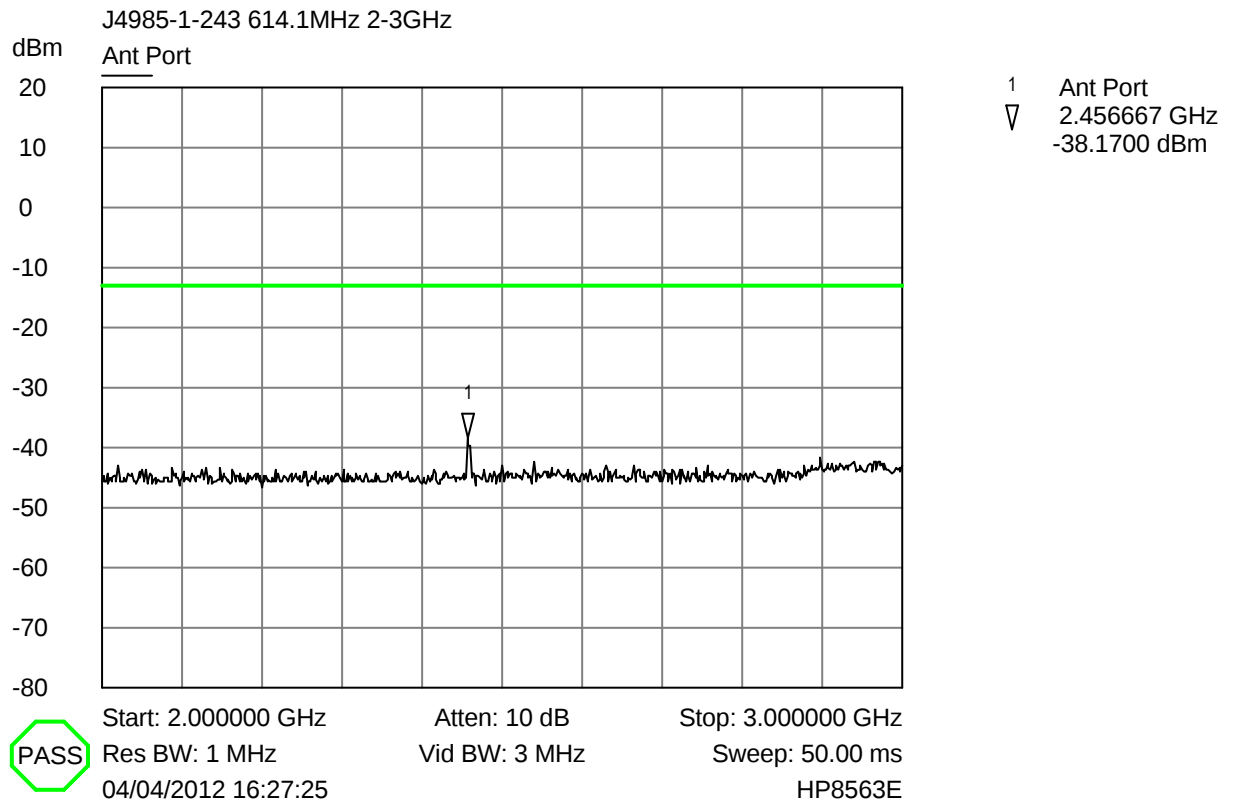






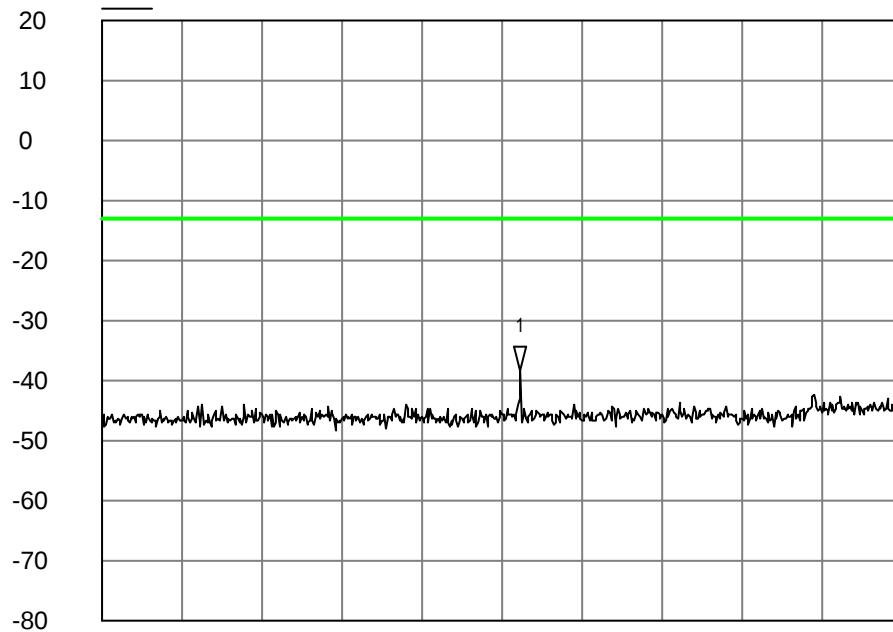
- 1 Ant Port
▽ 1.228333 GHz
-25.5000 dBm
- 2 Ant Port
▽ 1.843333 GHz
-34.5000 dBm





J4985-1-245 630.2MHz 2-3GHz

Ant Port



1 Ant Port
2.523333 GHz
-38.5000 dBm

PASS

Start: 2.000000 GHz

Atten: 10 dB

Stop: 3.000000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

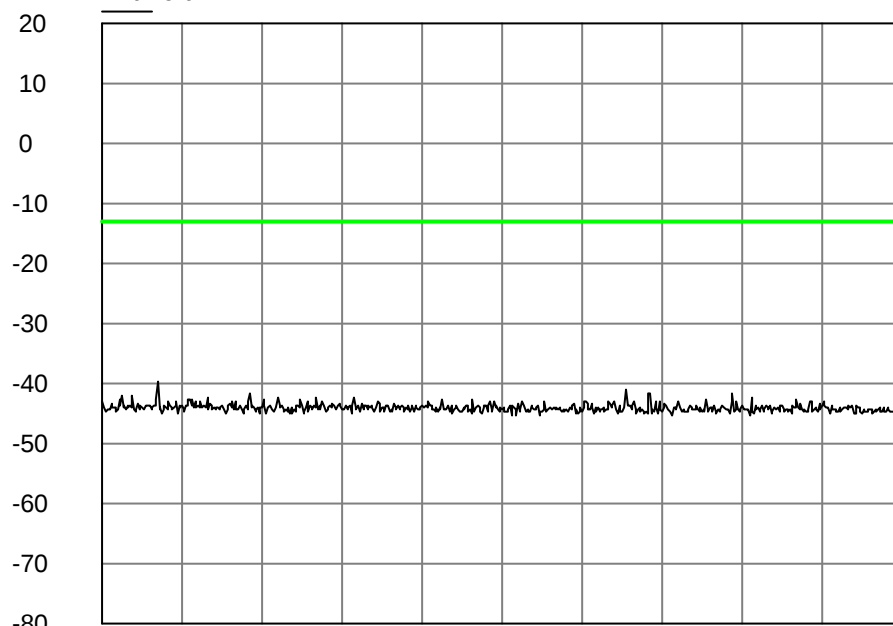
Sweep: 50.00 ms

05/04/2012 10:58:30

HP8563E

J4985-1-246 614.1MHz 3-4GHz

Ant Port



PASS

Start: 3.000000 GHz

Atten: 10 dB

Stop: 4.000000 GHz

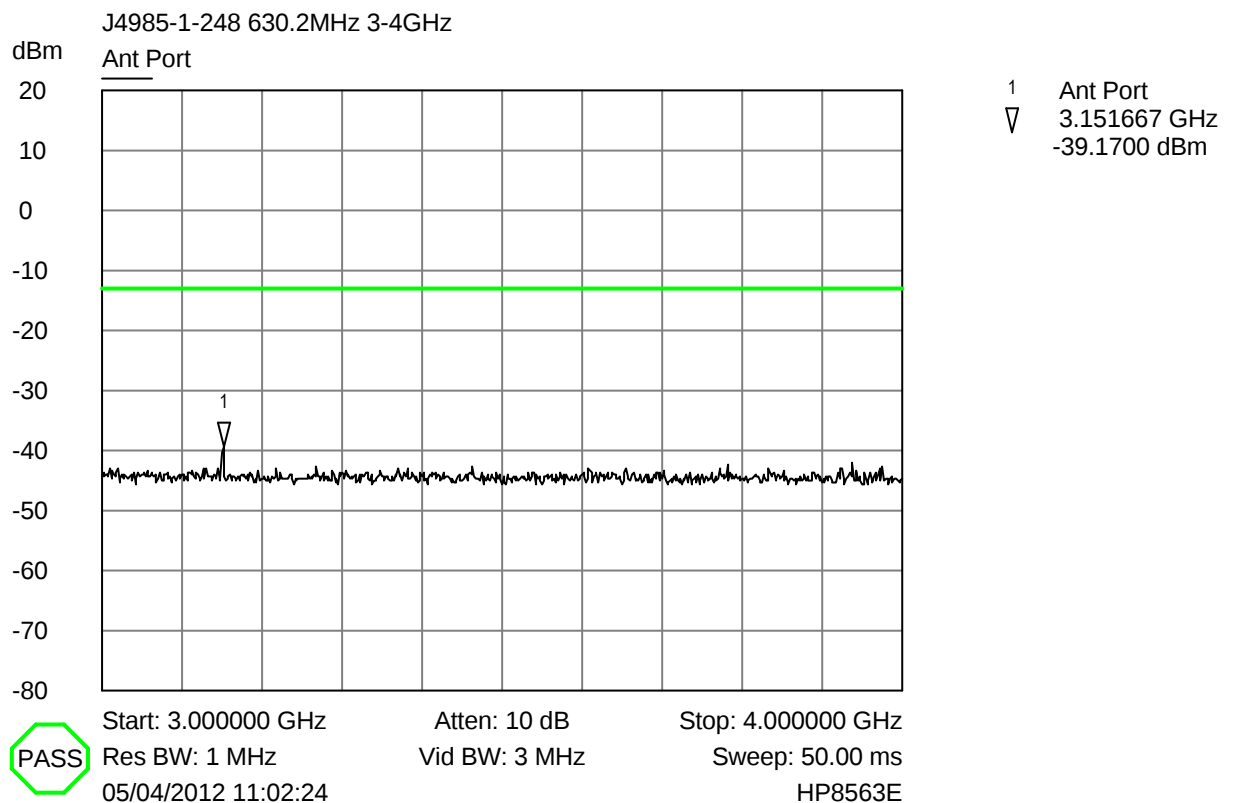
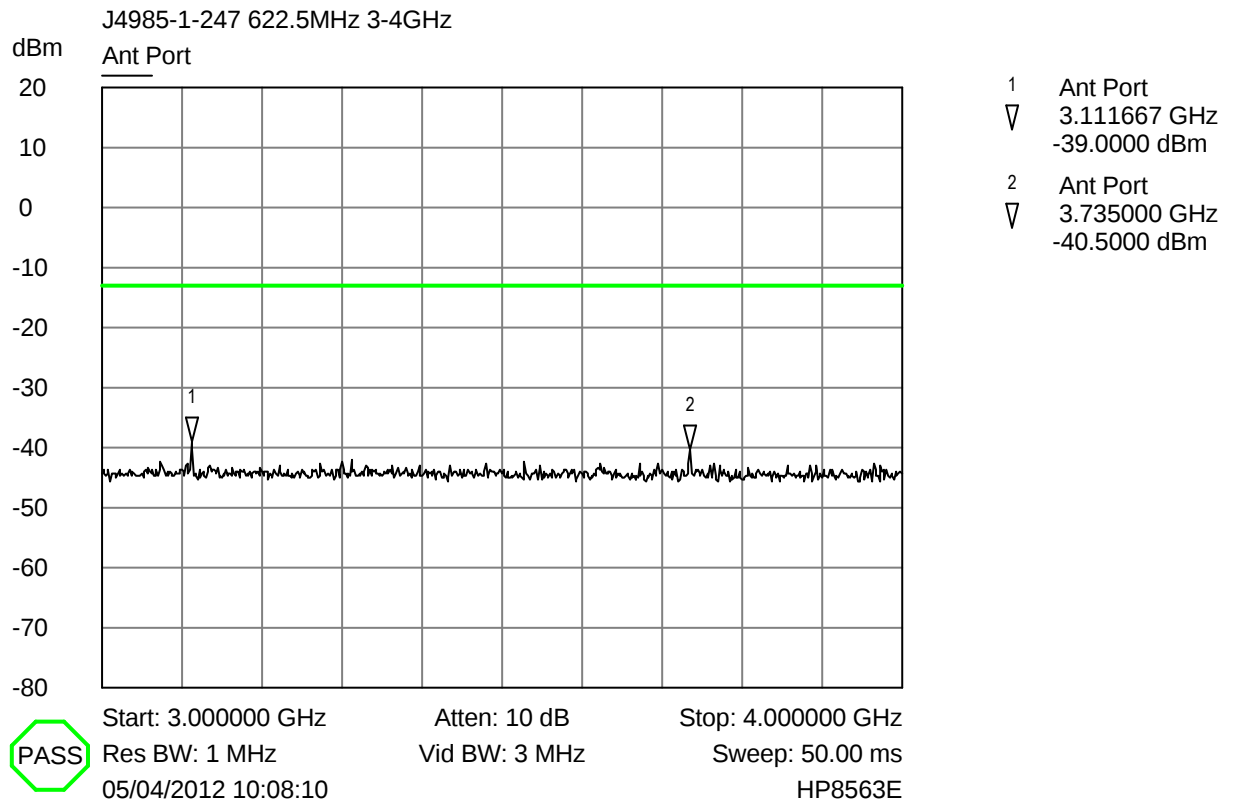
Res BW: 1 MHz

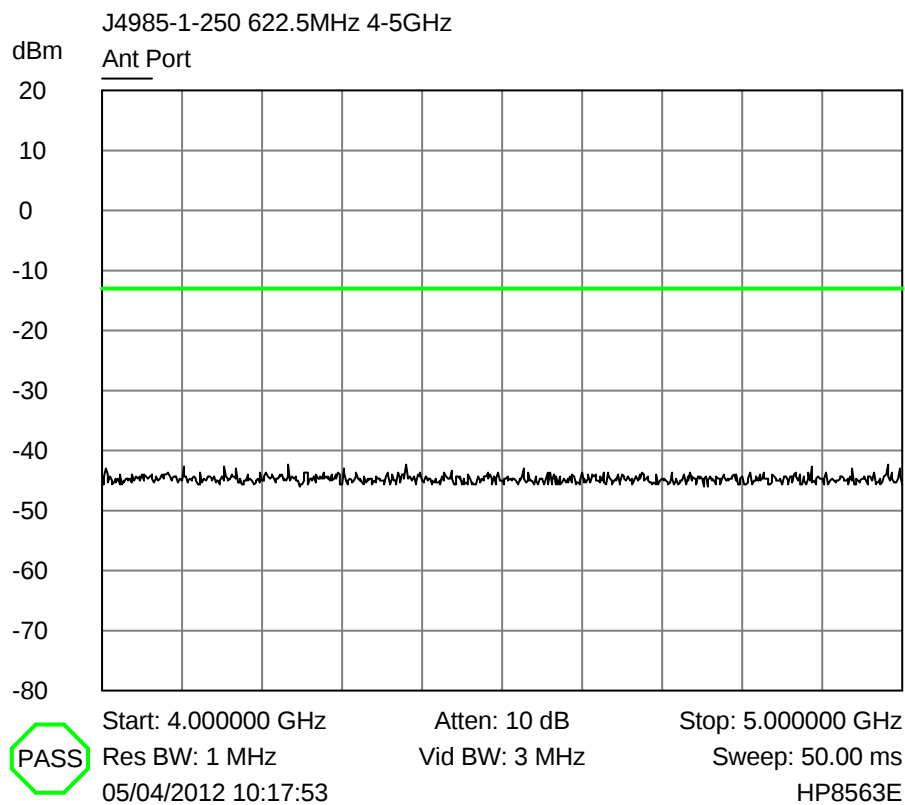
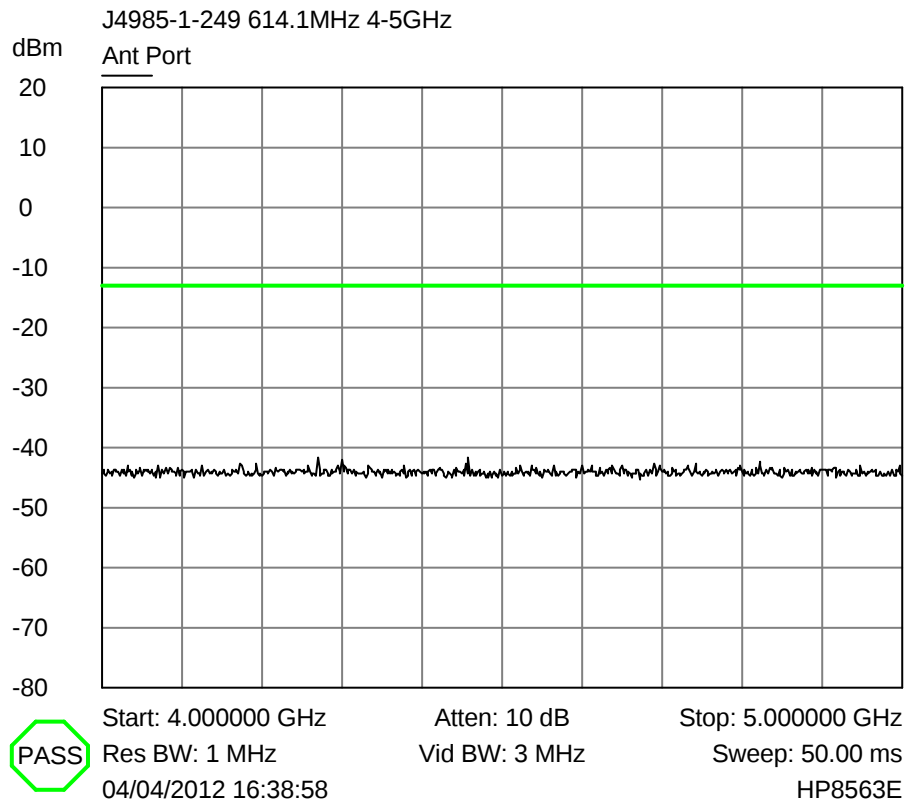
Vid BW: 3 MHz

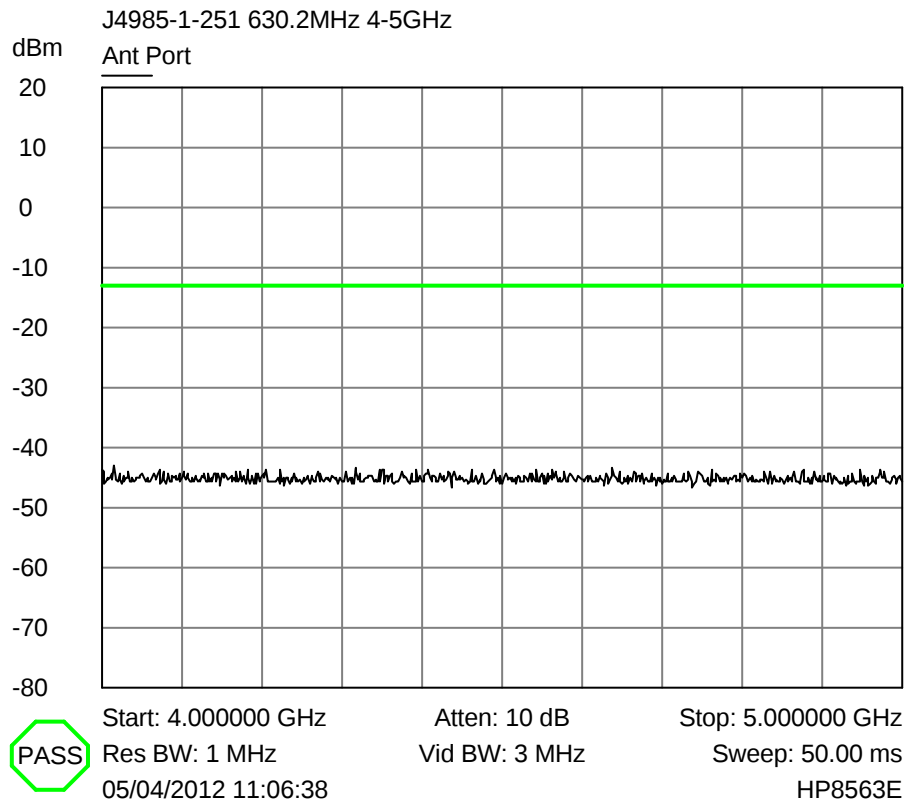
Sweep: 50.00 ms

04/04/2012 16:34:58

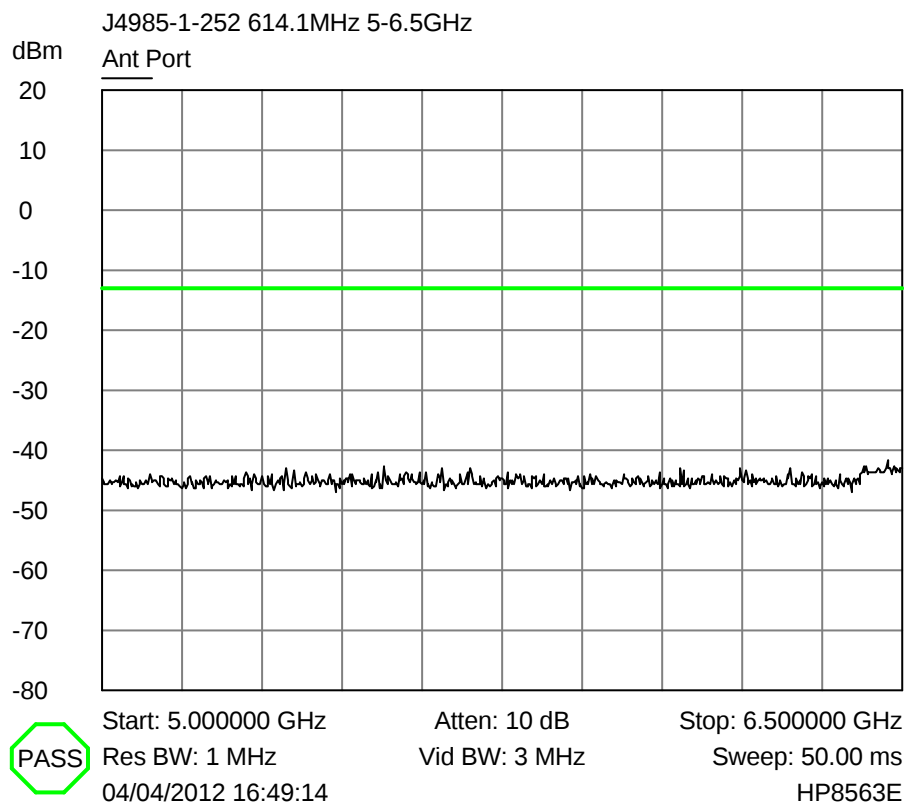
HP8563E

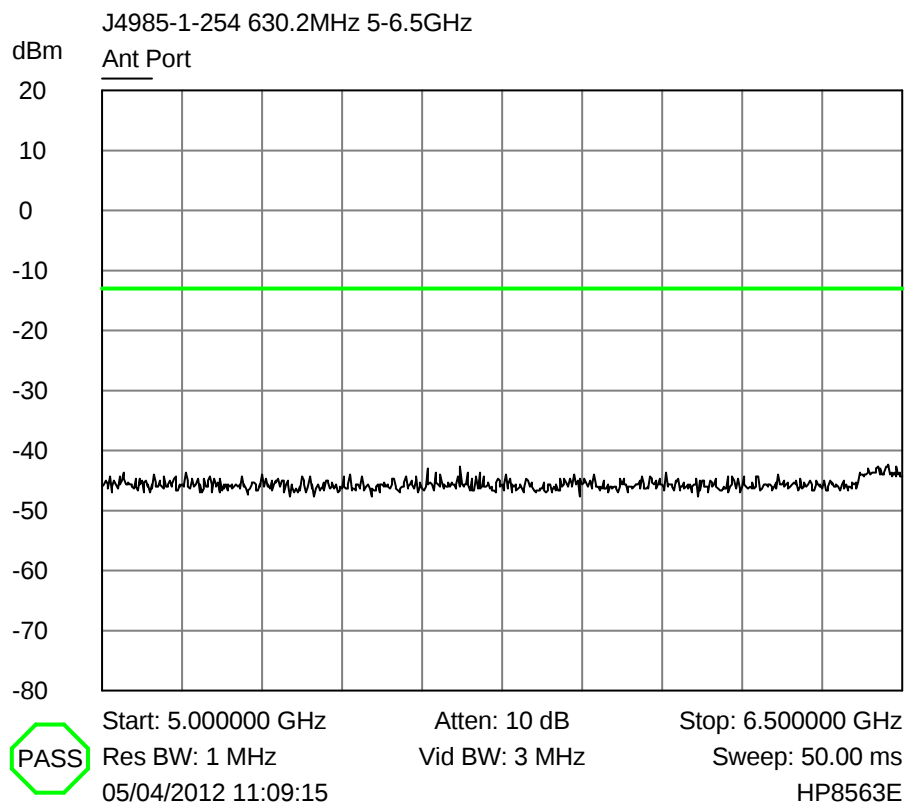
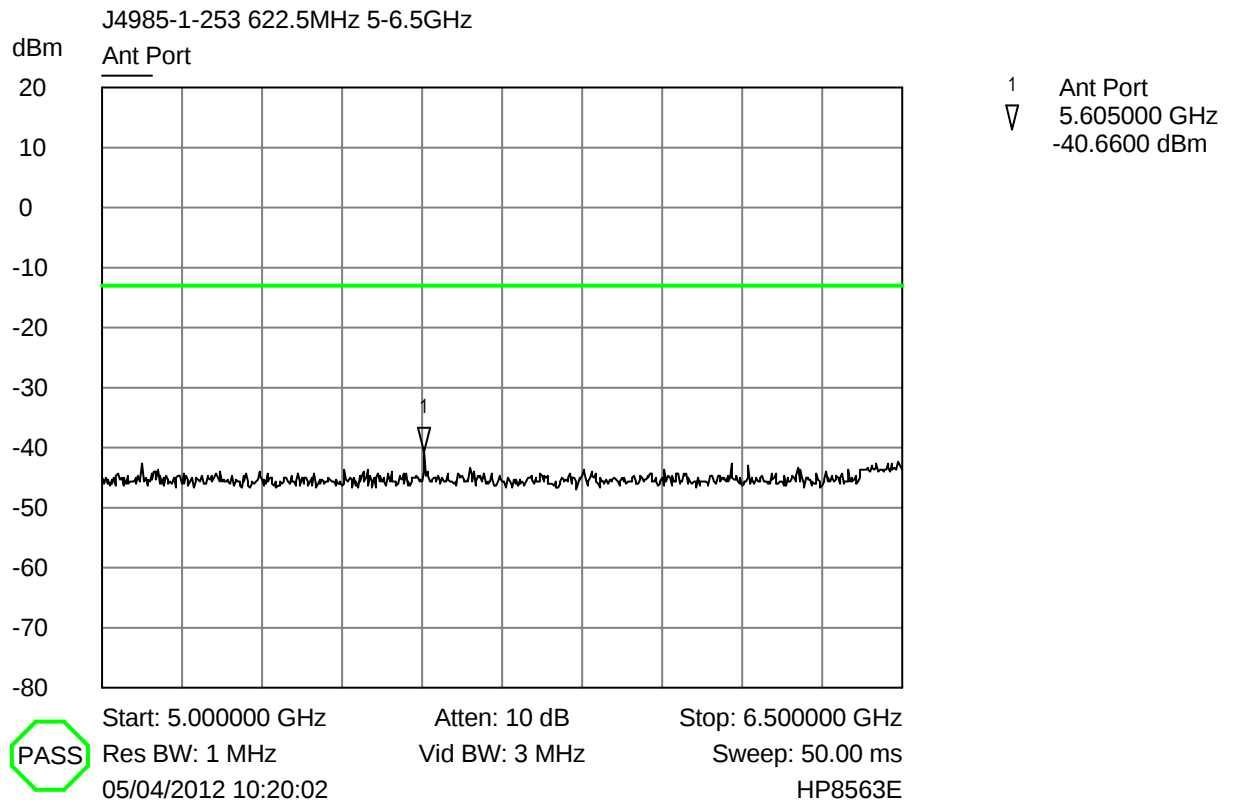


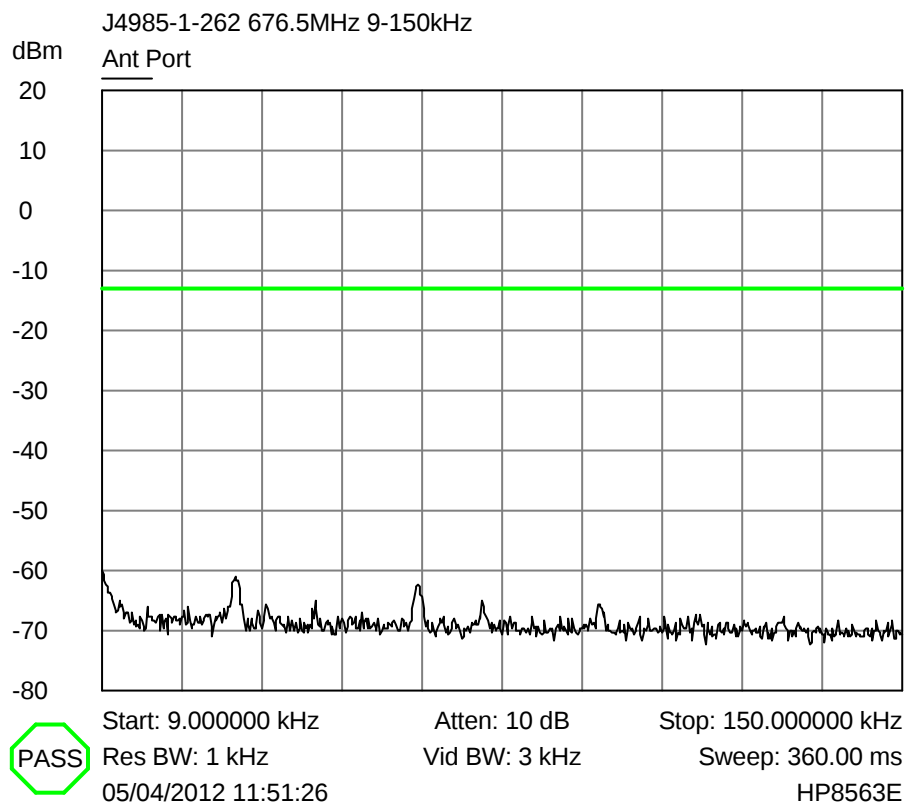
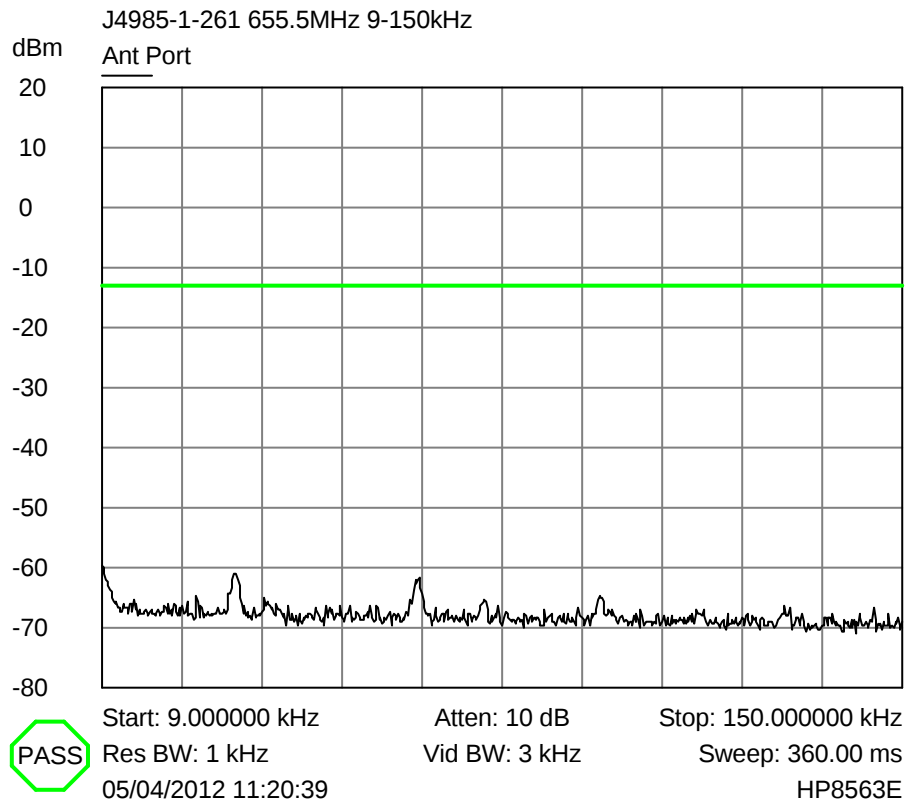


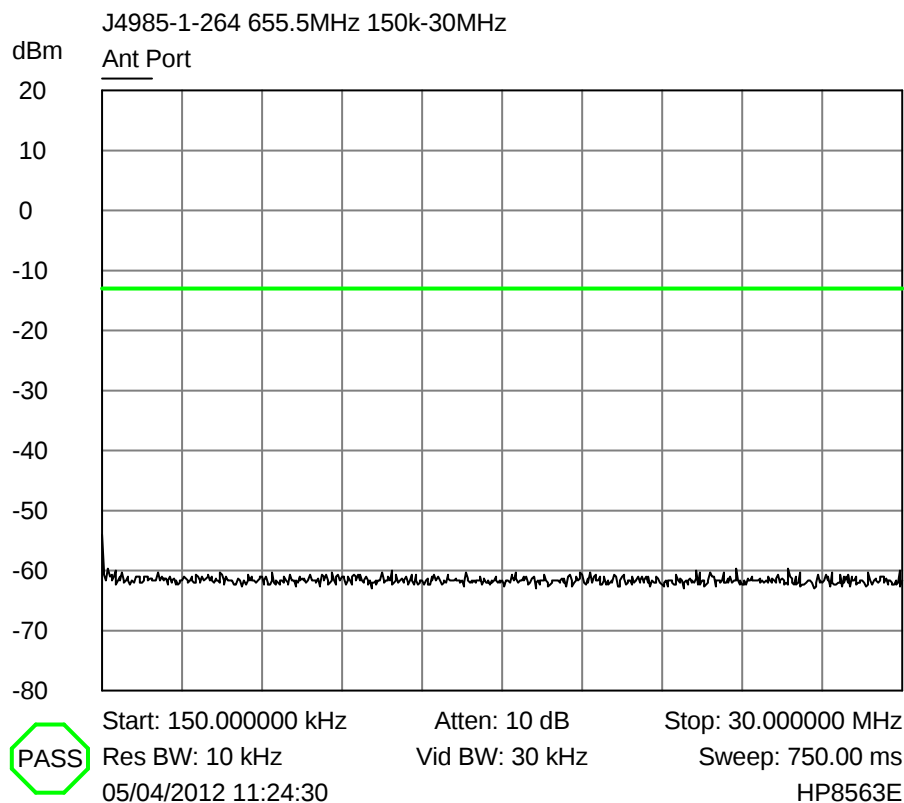
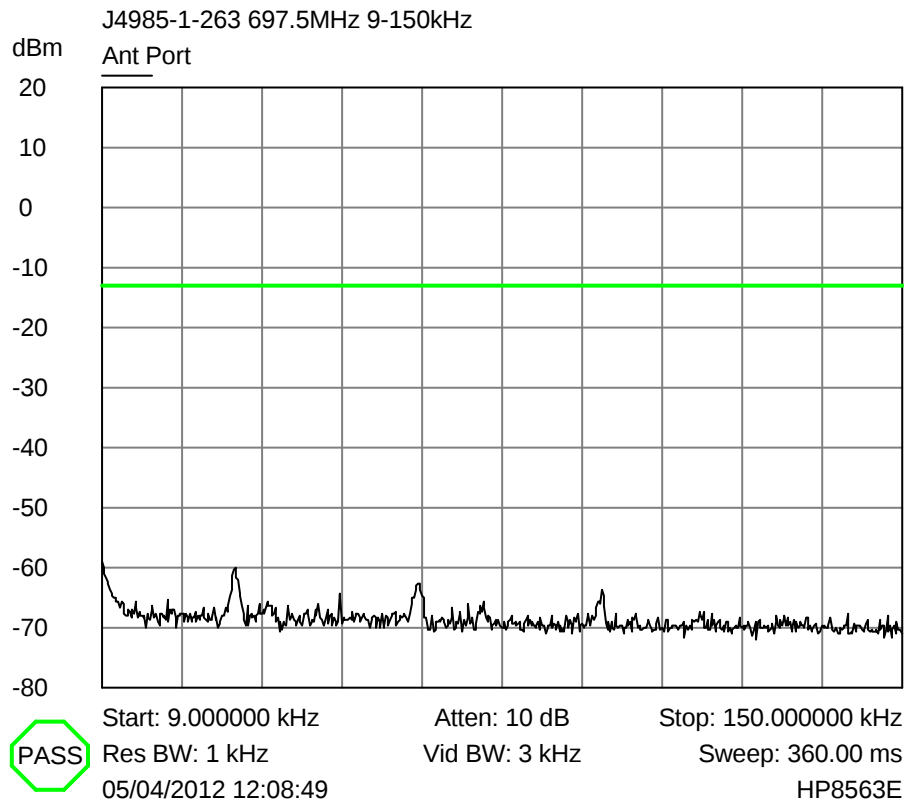


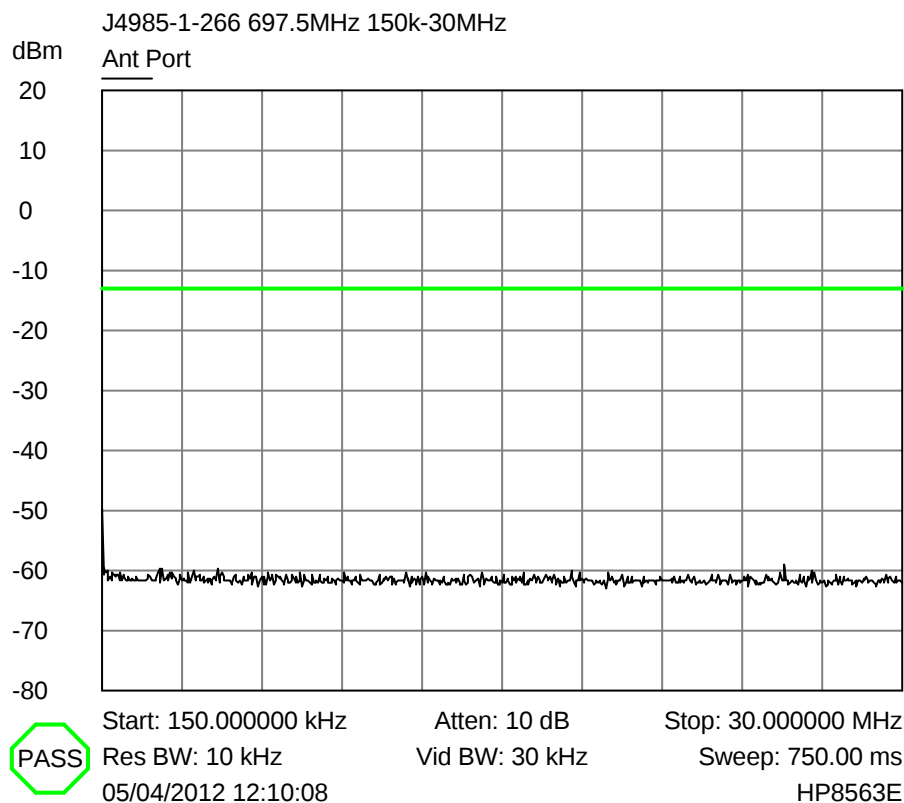
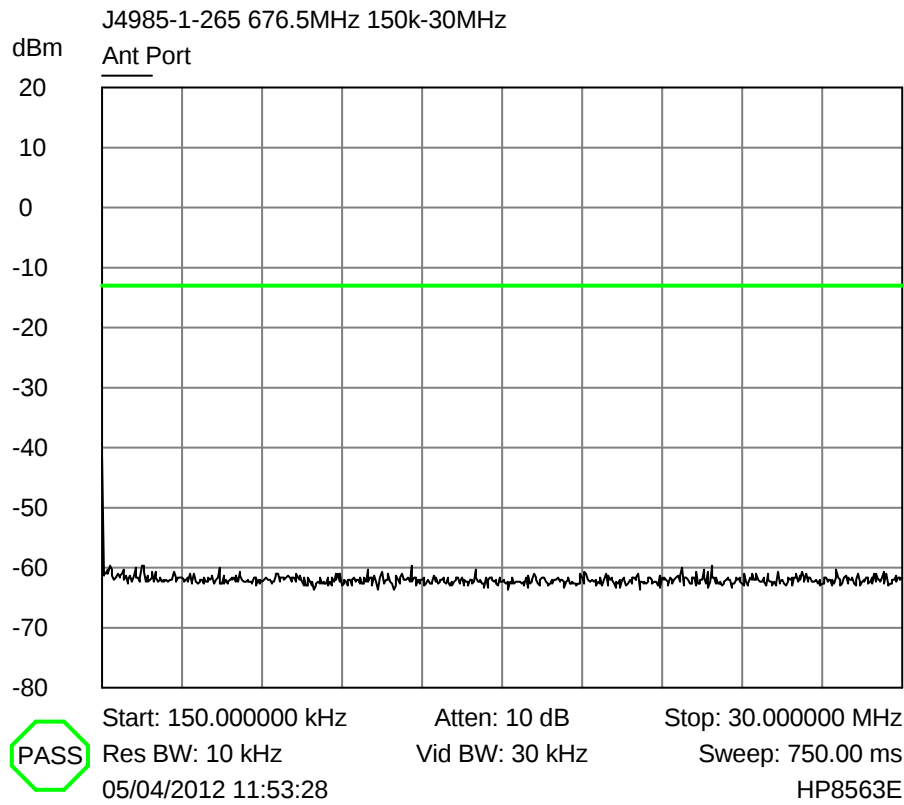
Insert Test

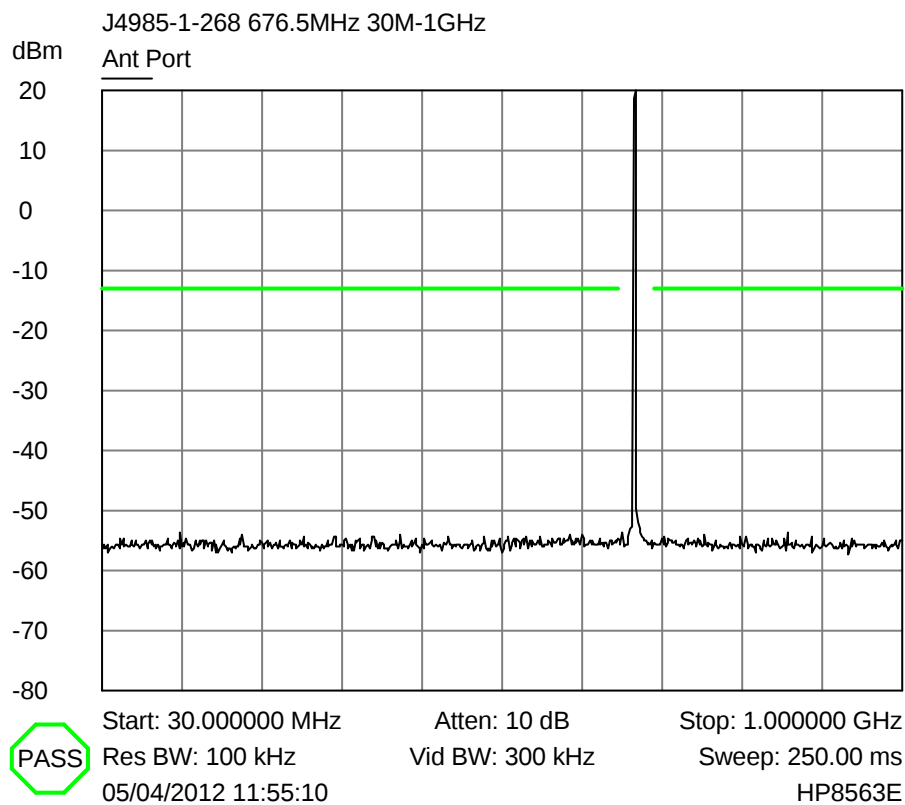
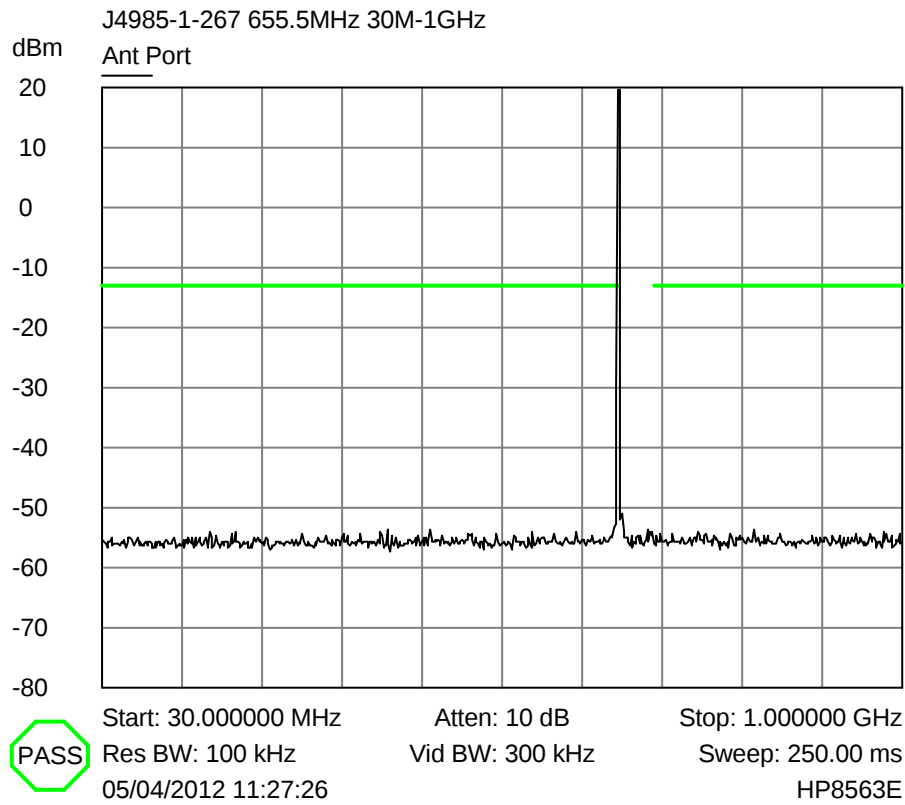


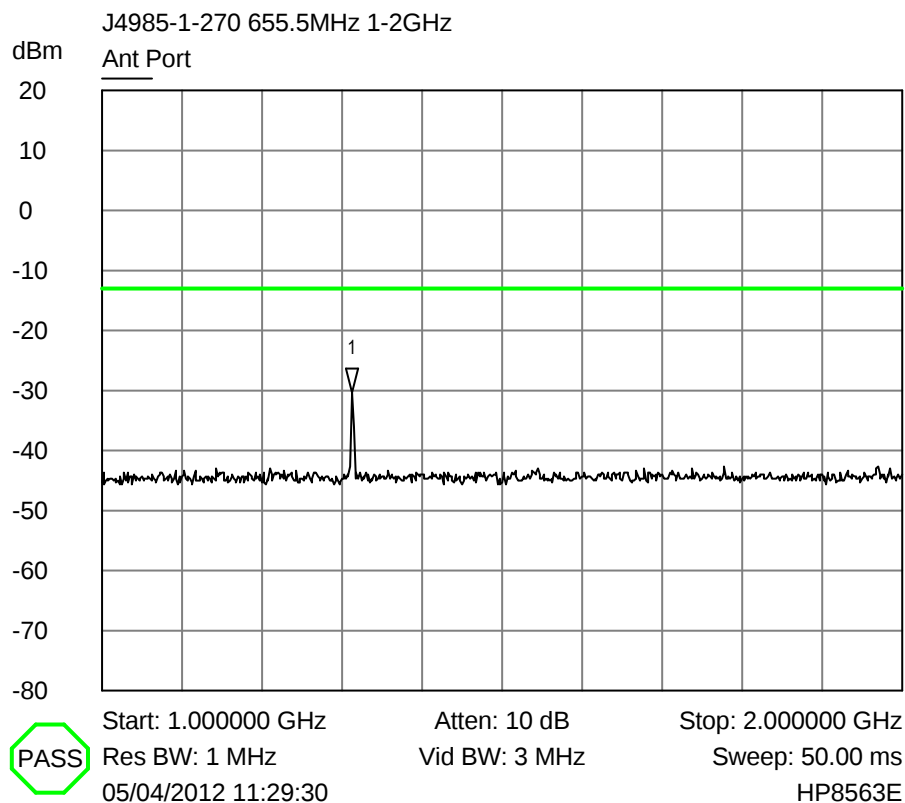
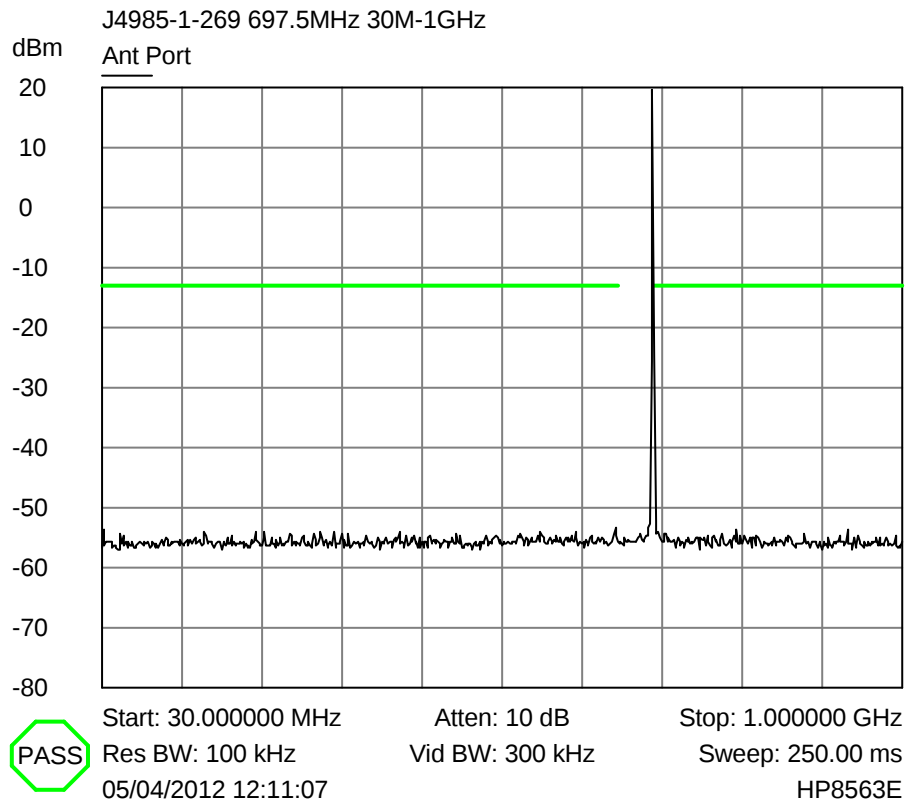








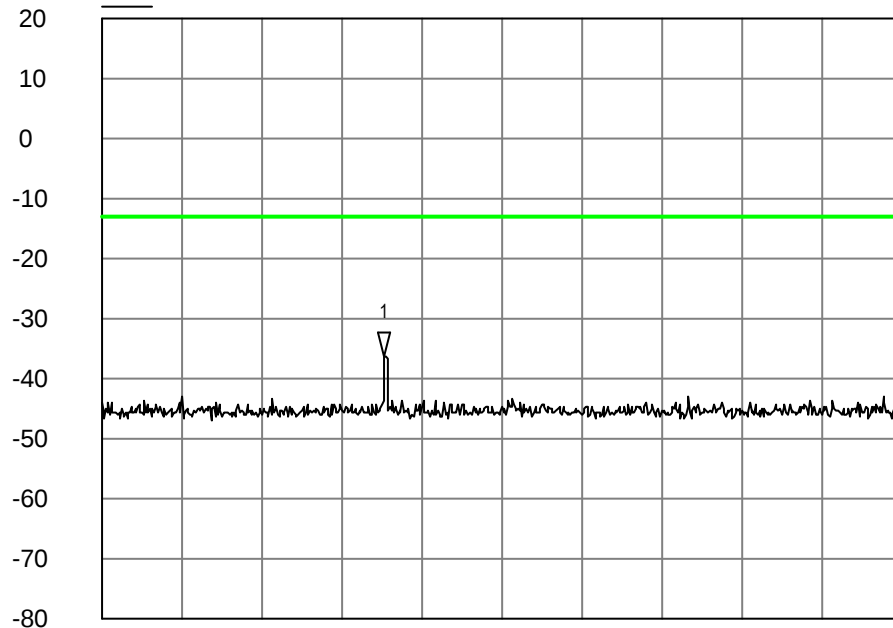




1 Ant Port
▽ 1.313333 GHz
-30.5000 dBm

J4985-1-271 676.5MHz 1-2GHz

dBm
Ant Port



1
▽ Ant Port
1.353333 GHz
-36.3300 dBm

PASS

Start: 1.000000 GHz

Atten: 10 dB

Stop: 2.000000 GHz

Res BW: 1 MHz

Vid BW: 3 MHz

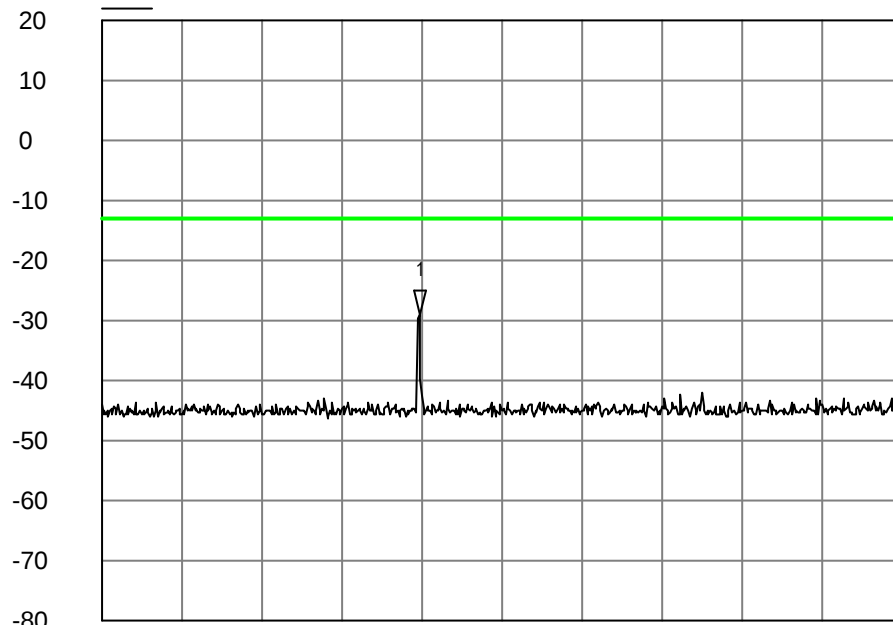
Sweep: 50.00 ms

05/04/2012 11:57:36

HP8563E

J4985-1-272 697.5MHz 1-2GHz

dBm
Ant Port



1
▽ Ant Port
1.396667 GHz
-29.0000 dBm

PASS

Start: 1.000000 GHz

Atten: 10 dB

Stop: 2.000000 GHz

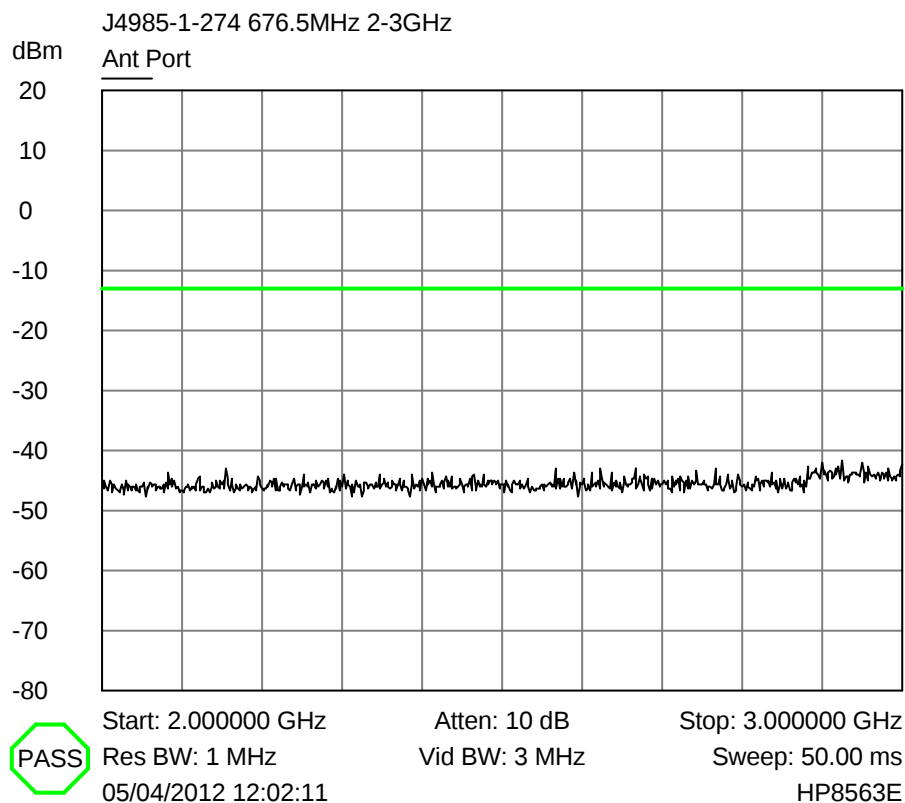
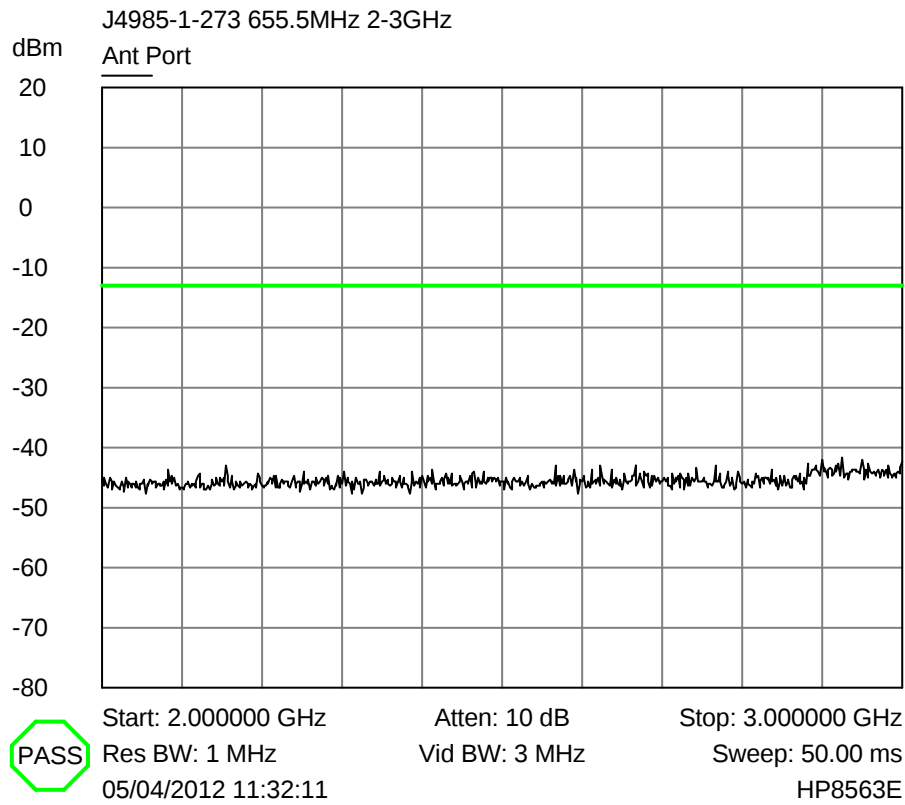
Res BW: 1 MHz

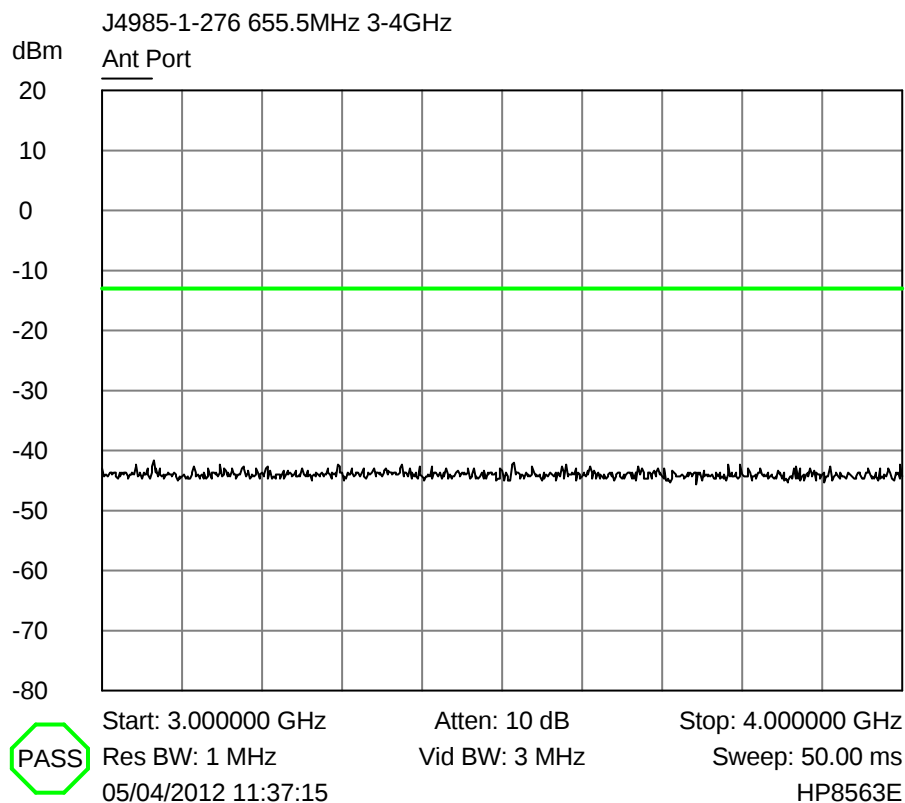
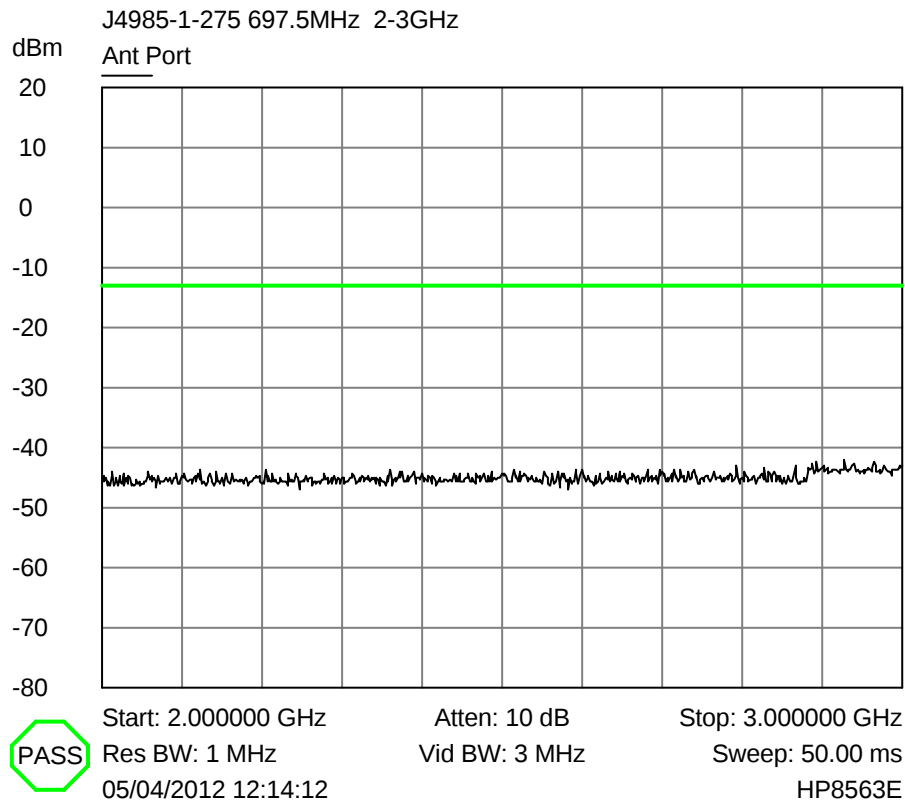
Vid BW: 3 MHz

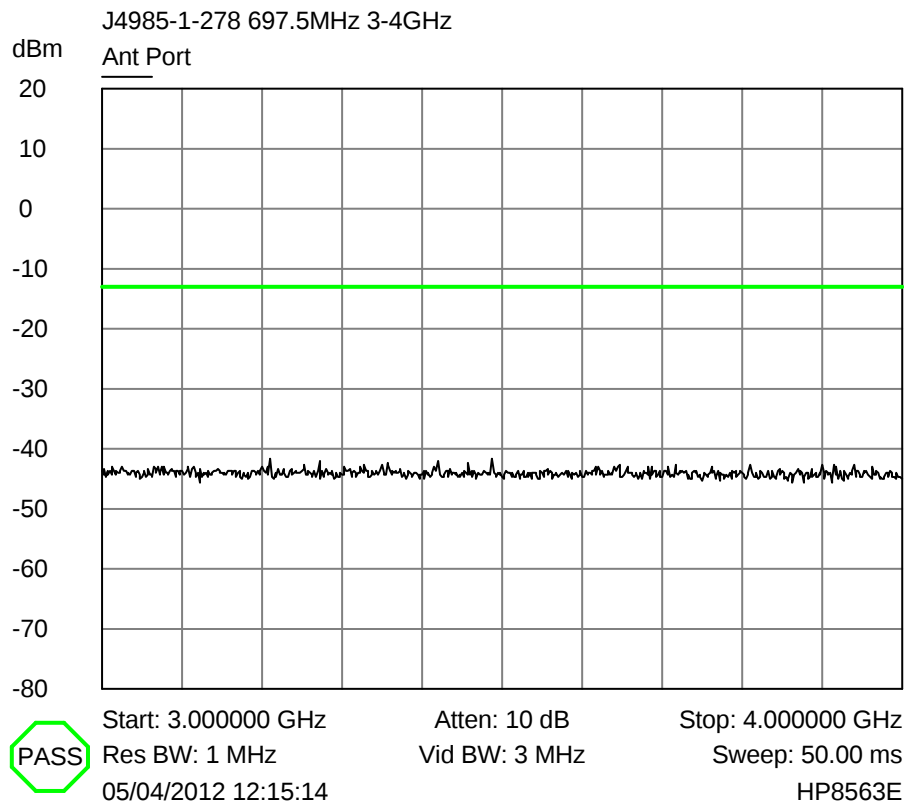
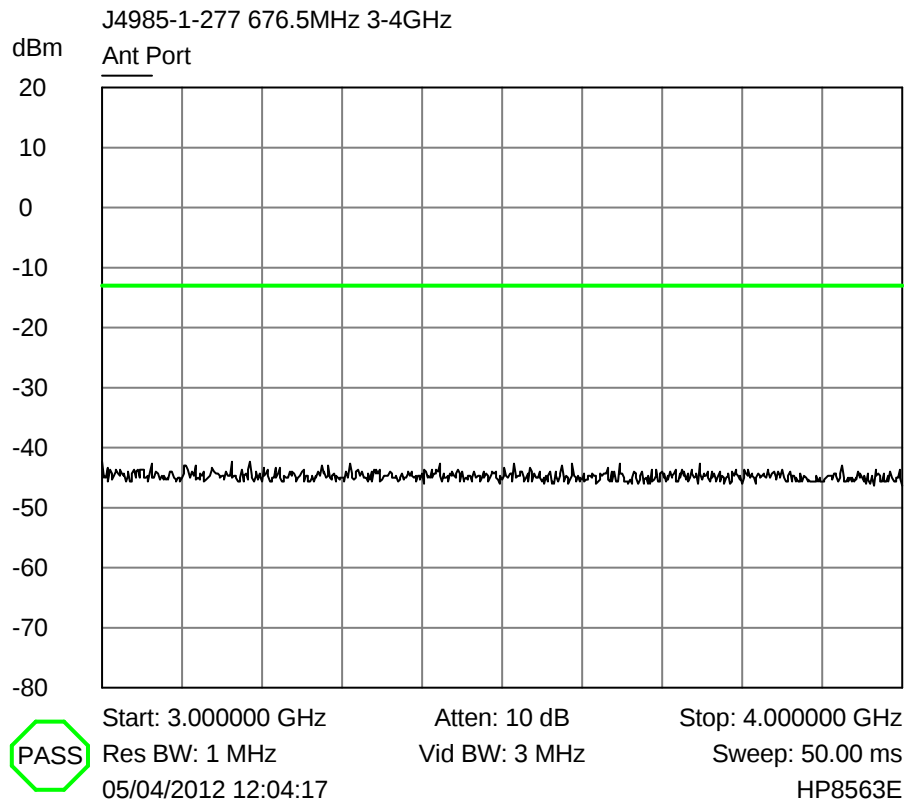
Sweep: 50.00 ms

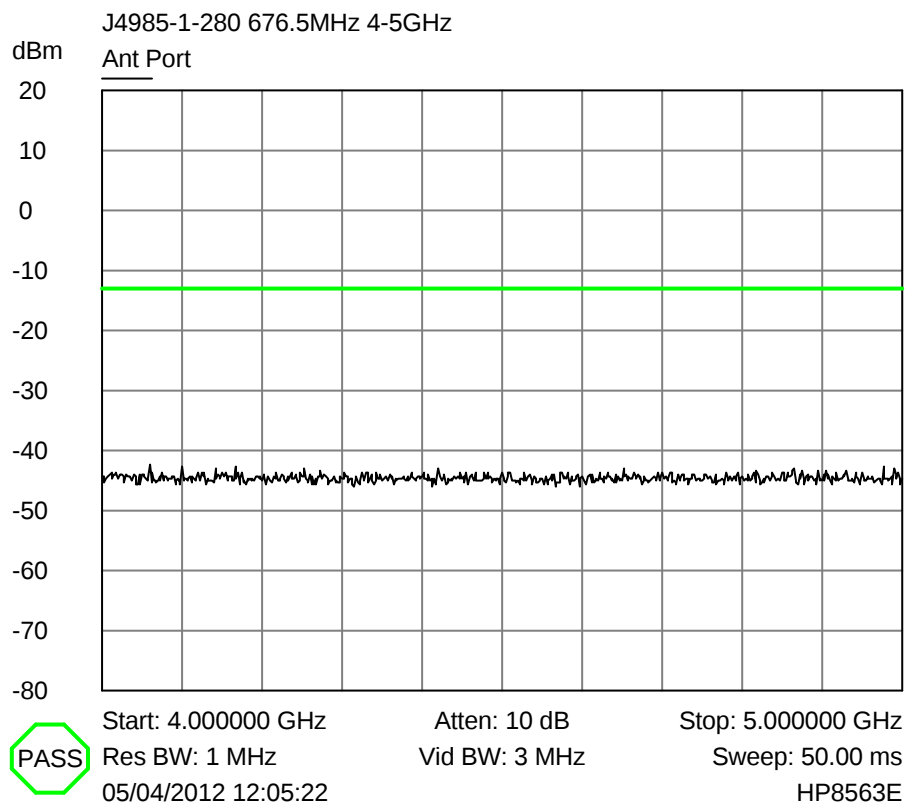
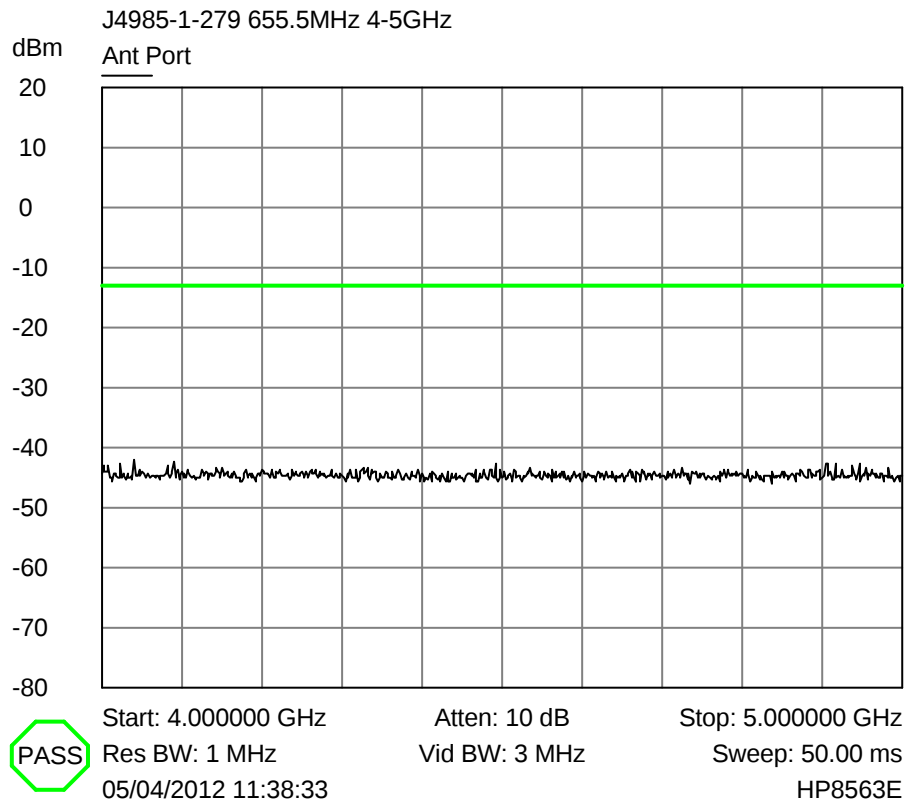
05/04/2012 12:12:21

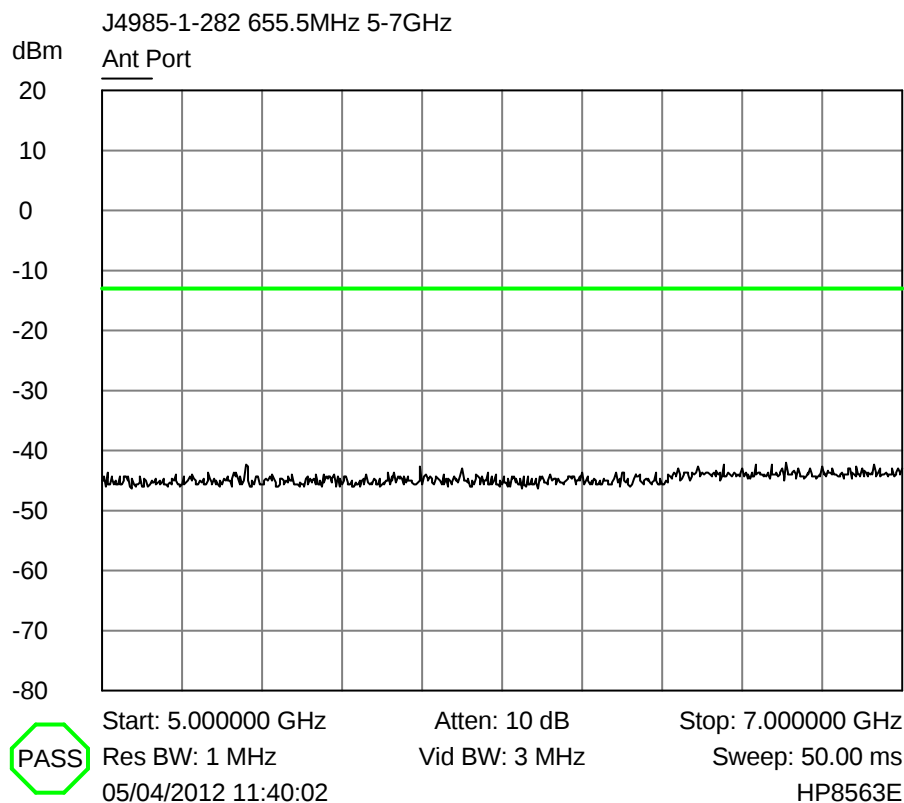
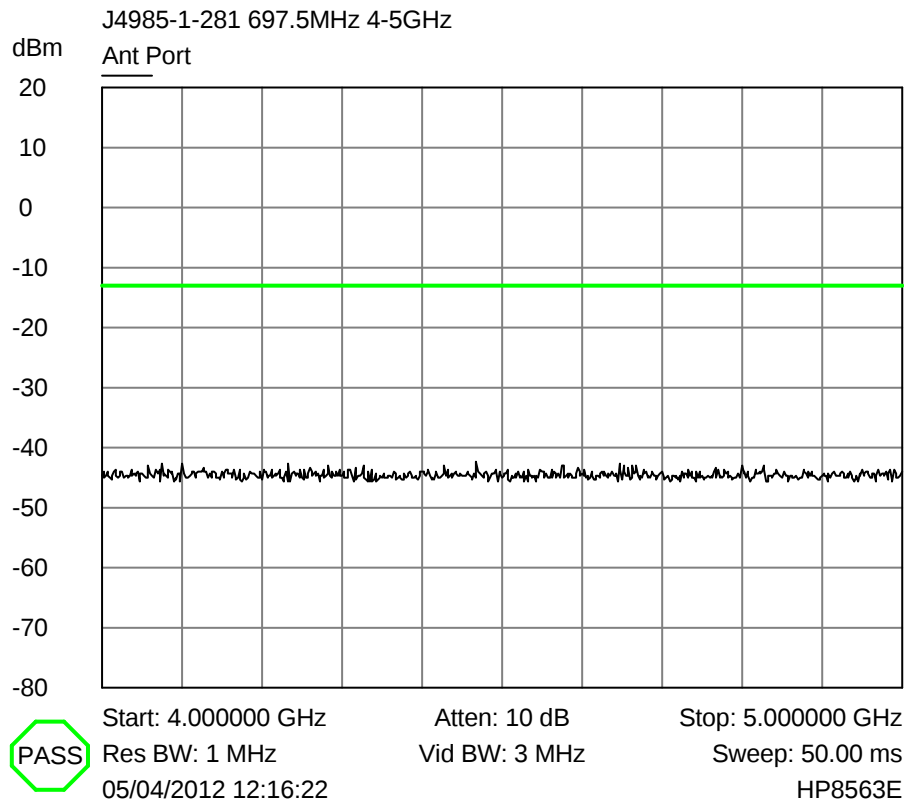
HP8563E

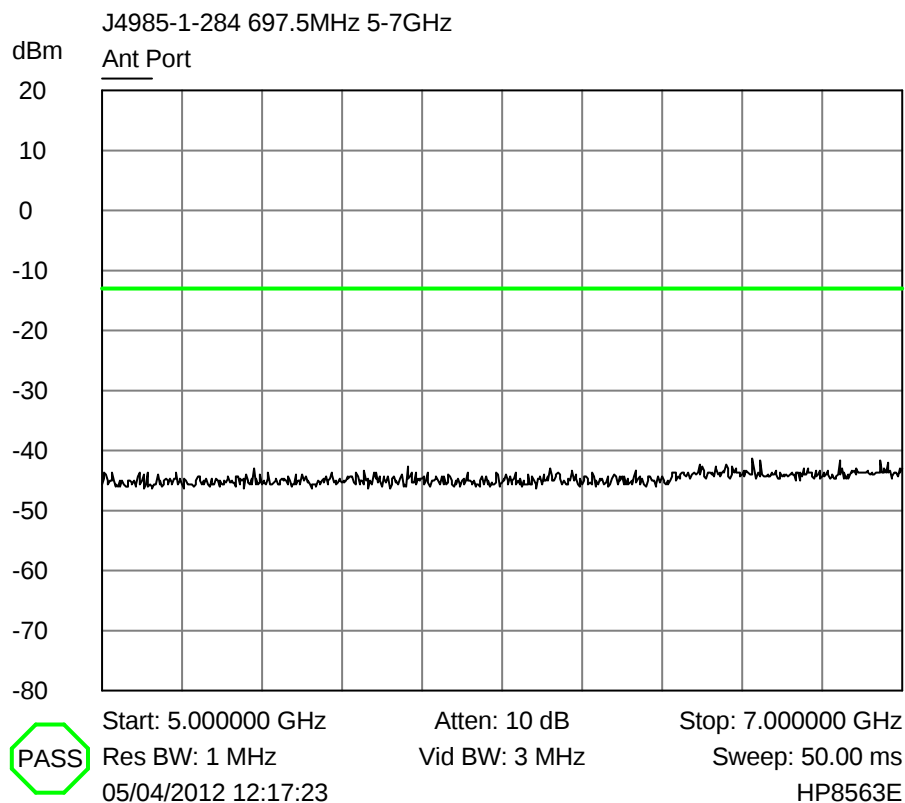
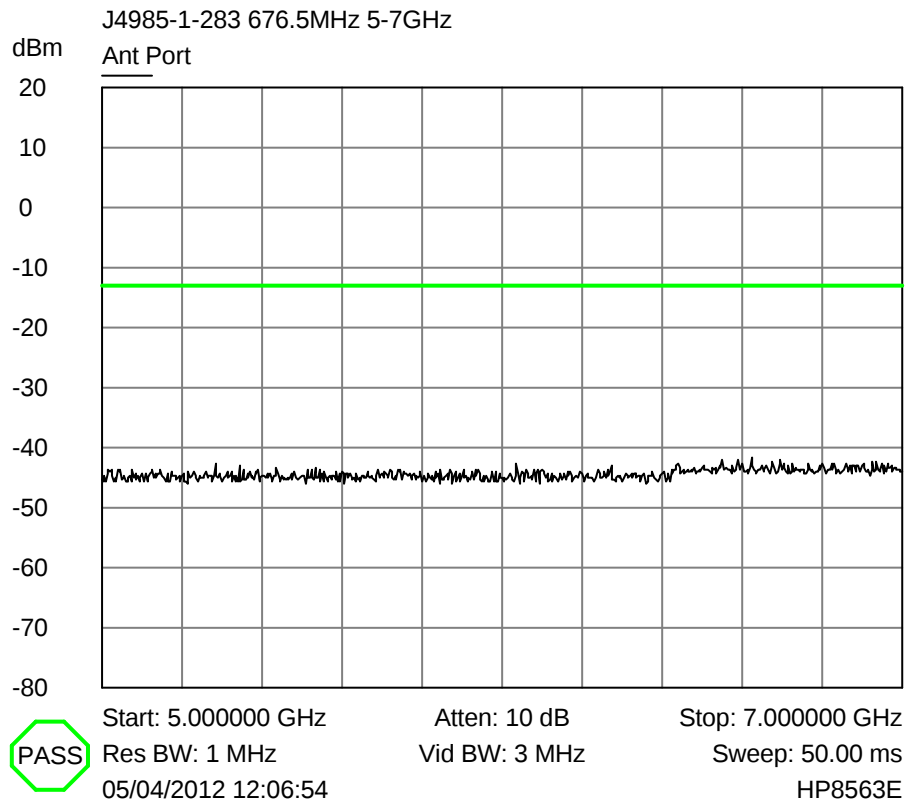








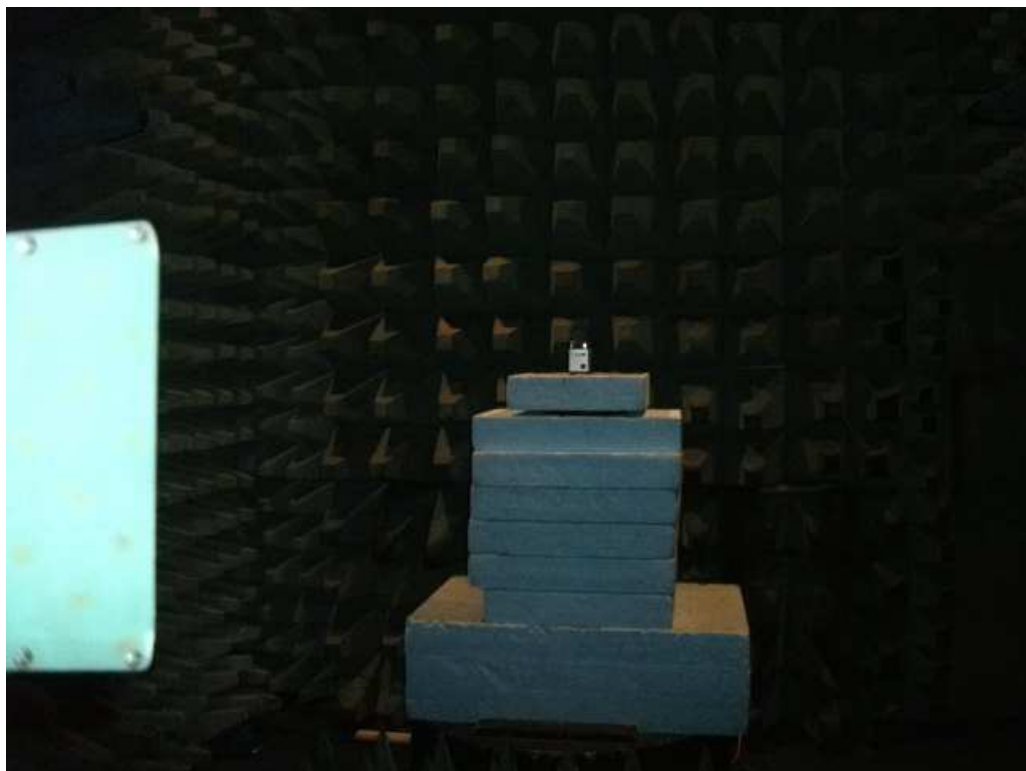




7 Explanation of Table of Signals Measured

None Required for this Standard.

8 Photographs



**Photograph of the EUT as viewed from in front of
the antenna, site M & B.**

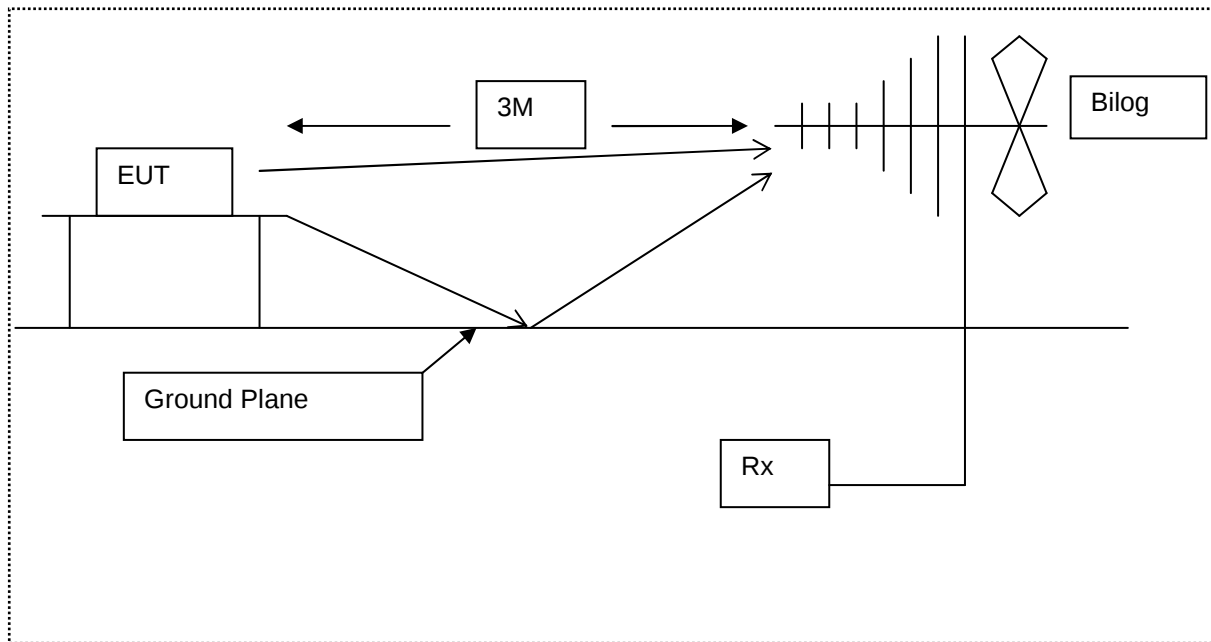


Diagram of the radiated emissions test setup.



Identifying Photographs of the EUT



File name AUDIO LTD.4985-1.DOC

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Control, Antenna and Audio Inputs



Display



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Casing and Internal PCB's



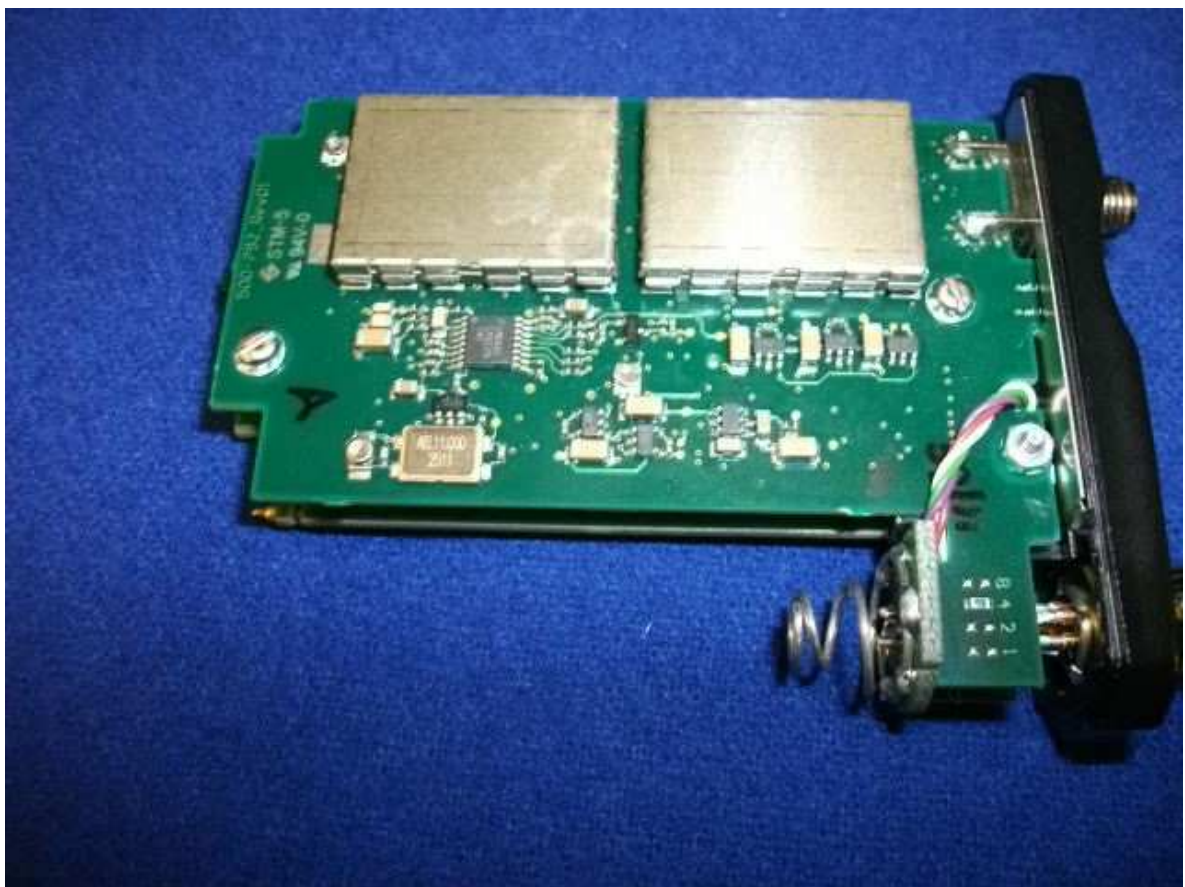
Internal Photographs of the EUT

File name AUDIO LTD.4985-1.DOC

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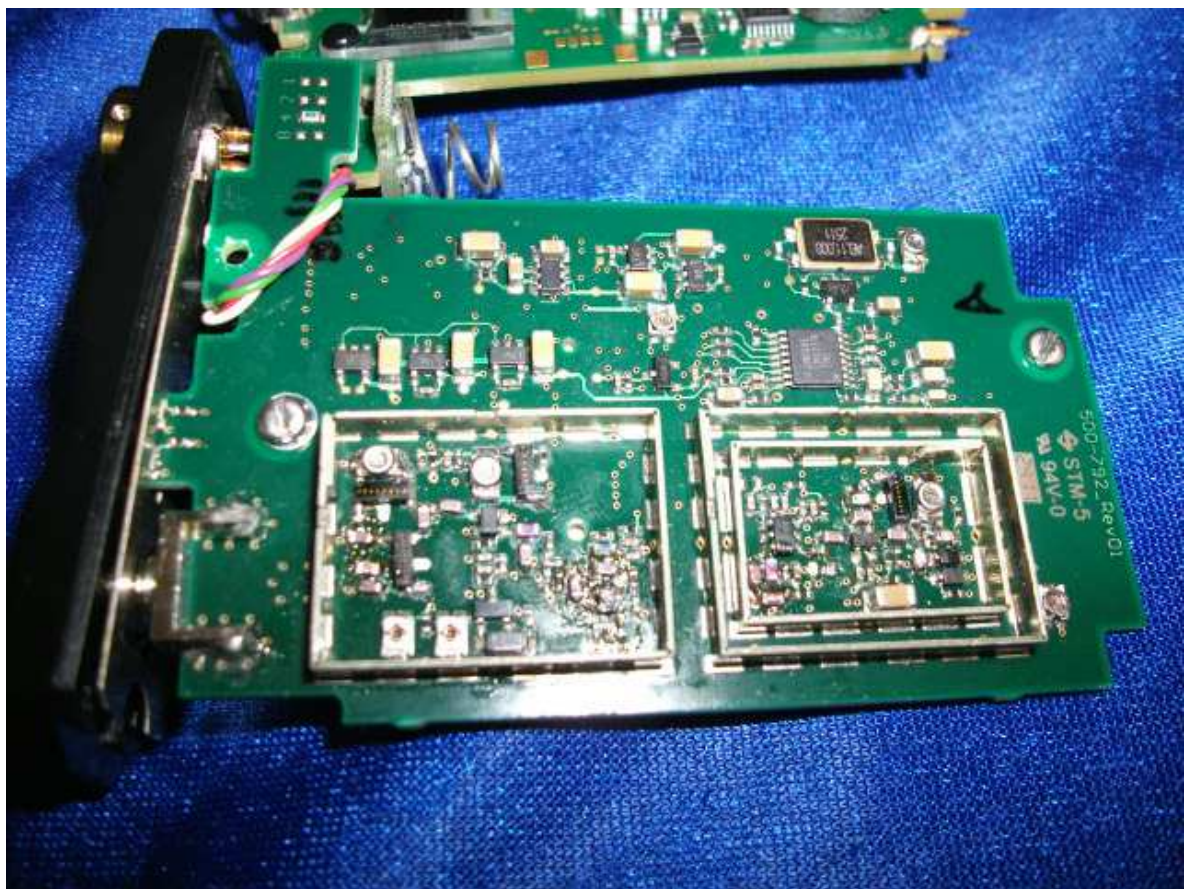


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9 Signal Leads

Port Name	Cable Type
Antenna	SMA
Audio & Power I/P	3 core screened coax

10 Test Equipment Calibration list

The following table lists the test equipment used, last calibration date and calibration interval. All test equipment used has been maintained within the calibration requirements of **R.N. Electronics Ltd.** test facility quality system. Calibration intervals are regularly reviewed dependent on equipment manufacturer's recommendations and actual usage of the equipment.

RNNo	Model	Description	Manufacturer	Date Calibrated	Period
E131	ESG-3000A	Signal Generator	Hewlett Packard	09-Nov-10	24
E136	3105	Horn Antenna	EMCO	N/A	0
E227	6632A	System DC Power Supply	Hewlett Packard	26-Jan-12	12
E266	2032	5.4GHz Signal Generator	Marconi Instruments	28-Jun-12	24
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	14-Apr-11	60
E269	-	CCIR 559-2 Filter	RA	25-Oct-11	12
E289	8449B	22-40GHZ H40 Block Down Converter	HP	20-Dec-11	12
E290	6914	Power Sensor	Marconi Instruments	23-Aug-11	24
E342	8563E	Spectrum Analyser 26.5 GHz	HP	29-Mar-11	24
E361	EF5-05	Audio Filter	Fern Developments	-	-
E397	6960B	RF Power Meter	Marconi Instruments	16-Jul-11	24
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	26-Oct-11	12
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	26-Oct-11	12
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	26-Oct-11	12
E479	3750	Variable Electronic Filter	Krohn-Hite	-	-
L264	DT75	Digital Thermometer	Instrotech Ltd	13-Jul-10	24
P243	RG-1	Noise Generator 0-100KHz	Wandel & Goltermann	04-Apr-12*	12
TMS38	VMT04/140	Environmental Oven	Heraeus Votsch	-	-
TMS49	8901B	Modulation Analyser	Hewlett Packard	17-Sep-10	24
TMS55	8903B	Audio Analyser	Hewlett Packard	19-Mar-12*	24
TMS814	MP627A	Doublet Antenna 200-1700 MHz	Anritsu Electric Co Ltd	08-Feb-12	24
TMS933	CBL6141A	Bilog Antenna 30MHz - 2GHz	York EMC	09-Sep-10	36

* Calibration was performed prior to test for these items.

11 Auxiliary equipment

11.1 Auxiliary equipment supplied by Audio Limited.

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

None.

11.2 Auxiliary equipment supplied by RN Electronics Limited

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

None.

12 Modifications

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

12.1 Modifications before test

There were no modifications made by R.N. Electronics Ltd before testing commenced.

12.2 Modifications during test

There were no modifications made by R.N. Electronics Ltd during testing.

13 Description of Test Sites

Site A	Radio / Calibration Laboratory and anechoic chamber
Site B	Semi-anechoic chamber
Site B1	Control Room for Site B
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions) VCCI Registration No. C-2823
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 293246
Site Q	Fully-anechoic chamber
Site OATS	3m and 10m Open Area Test Site FCC Registration No. 293246 IC Registration No. 5612A-1 VCCI Registration No. R-2580
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

14 Abbreviations and Units

%	Percent	Hz	Hertz
μV	microVolts	IF	Intermediate Frequency
μW	microWatts	kHz	kiloHertz
AC	Alternating Current	LO	Local Oscillator
ALSE	Absorber Lined Screened Enclosure	mA	milliAmps
AM	Amplitude Modulation	max	maximum
Amb	Ambient	mbar	milliBars
ANSI	American National Standards Institute	MHz	MegaHertz
°C	Degrees Celsius	min	minimum
CFR	Code of Federal Regulations	mm	milliMetres
CS	Channel Spacing	ms	milliSeconds
CW	Continuous Wave	mW	milliWatts
dB	decibels	NA	Not Applicable
dBμV	decibels relative to 1μV	nom	Nominal
dBc	decibels relative to Carrier	nW	nanoWatt
dBm	decibels relative to 1mW	OATS	Open Area Test Site
DC	Direct Current	OFDM	Orthogonal Frequency Division Multiplexing
EIRP	Equivalent Isotropic Radiated Power	ppm	Parts per million
ERP	Effective Radiated Power	QAM	Quadrature Amplitude Modulation
EUT	Equipment Under Test	QPSK	Quadrature Phase Shift Keying
FCC	Federal Communications Commission	Ref	Reference
FM	Frequency Modulation	RF	Radio Frequency
FSK	Frequency Shift Keying	RTP	Room Temperature and Pressure
g	Grams	s	Seconds
GHz	GigaHertz	Tx	Transmitter
		V	Volts