FCC 47CFR part 2 and part 74H
Test Report
For
En2 Professional Plug-on Transmitter
En2 PTXH

Reference Standard: FCC 47CFR part 2 and part 74H
Manufacturer: Audio Limited
For type of equipment and serial number, refer to section 3
Report Number: 06-6833-3-13 Issue 01
Report Produced by: -

R.N. Electronics Ltd.
1 Arnolds Court
Arnolds Farm Lane
Mountnessing
Essex
CM13 1UT
U.K.

www.RNelectronics.com

Telephone +44 (0) 1277 352219
Email sales@RNelectronics.com

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Arnolds Court, Arnolds Farm Lane, Mountnessing, Brentwood Essex, CM13 1UT

Certificate of Test 6833-3

The unit noted below has been tested by **R.N. Electronics Limited** and, where appropriate, conforms to the relevant subpart of FCC 47CFR part 2 and part 74H. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	En2 Professional Plug-on Transmitter
Model Number:	En2 PTXH
Proposed FCC ID:	Not stated
Unique Serial Number:	S/N 000001-06 (EUT 'A') 470-526 MHz S/N 000001-08 (EUT 'B') 542-608 MHz S/N 000001-05 (EUT 'C') 614-698 MHz
Manufacturer:	Audio Limited Audio House Progress Road High Wycombe Buckinghamshire HP12 4JD United Kingdom
Full measurement results are detailed in Report Number:	06-6833-3-13 Issue 01
Test Standards:	FCC 47CFR part 2 and part 74H effective date **October 1st 2012,** Class Low Power Auxiliary Stations

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 Directive, 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:	14th June 2013 – 18th June 2013
Test Engineer:	Graham Blake Digitally signed by Graham Blake DN: CN = Graham Blake, C = GB, O = RN Electronics Date: 2013.12.13 09:49:27 Z
Approved By:	Roger Ray
Customer Representative:	

1 Contents

2 Equipment Under Test (EUT)

2.1 Equipment Specification

Applicant	Audio Limited Audio House Progress Road High Wycombe Buckinghamshire HP12 4JD United Kingdom
Manufacturer of EUT	Audio Limited
Brand name of EUT	En2 Professional Plug-on Transmitter
Model Number of EUT	En2 PTXH
Serial Number of EUT	000001-06 000001-08 000001-05
Date when equipment was received by RN Electronics	3rd June 2013
Date of test:	14th June 2013 – 18th June 2013
Visual description of EUT:	Small plastic enclosure, with a 3-pin female XLR connector at one end, and a battery compartment at the other. In the front face of the unit, a display screen is housed, and there are two multi-function switches to enable control of the unit.
Main function of the EUT:	Professional microphone plug-on radio transmitter.
Height	118 mm
Width	37 mm
Depth	39 mm
Voltage	2.7 VDC
Current required from above voltage source	224 mA

2.2 EUT Configurations for testing

General parameters	
EUT Normal use position	Hand-held
Antenna details	Uses the body of a professional microphone
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	698 MHz
Lowest Signal generated in EUT	11 MHz
TX Parameters	
Alignment range – transmitter	470 – 698 MHz
EUT Declared Modulation Parameters	FM
EUT Declared Power level	40mW
EUT Declared Signal Bandwidths	200 kHz
EUT Declared Channel Spacing's	Not declared
EUT declared Duty Cycle	100 %
Unmodulated carrier available?	Yes
Declared frequency stability	+/- 10 ppm
Audio Parameters – TX	
Max Audio input level	+10dBV
Audio input limiting threshold	-35dBV
Max Deviation (kHz)	+/- 45 kHz
Lowest audio mod frequency	50 Hz
Pre-Emphasis used	100 us

2.3 Functional Description

A battery-powered audio transmitter, designed to be connected to a professional microphone body via an XLR connector. The unit has controls to allow the user to change the transmitting frequency and to change the audio characteristics via a menu system. This information is displayed via the built-in display screen. In normal use, the transmitter utilizes the body of the connected microphone as the antenna.

2.4 EUT Modes

Mode Reference	Description	Used for testing
CW	Transmitting without audio modulation	Yes
MOD	Transmitting with audio modulation	Yes

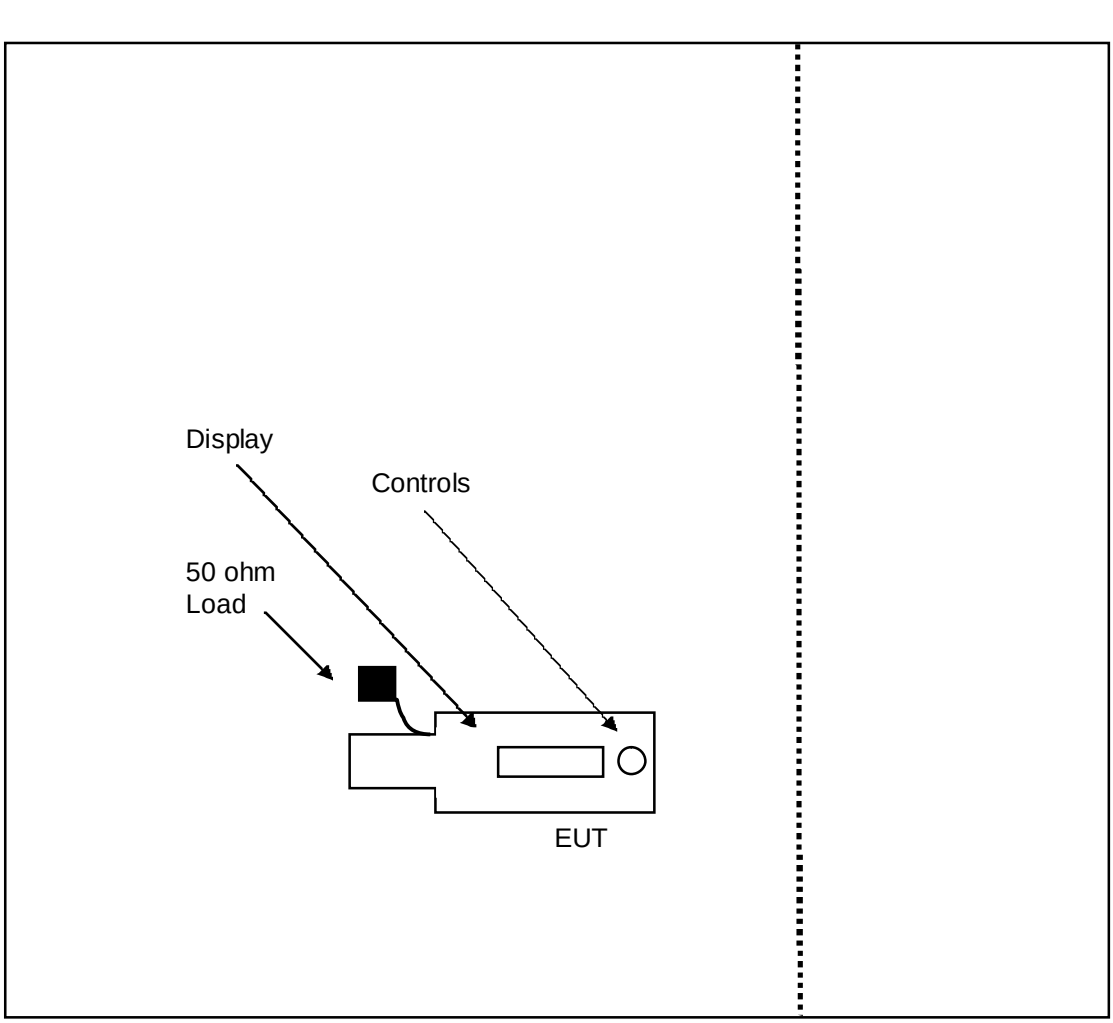
For testing purposes, the manufacturer supplied three units to encompass the entire family product operating frequency range of 470 MHz – 698 MHz. The manufacturer modified the test units by soldering a short SMA cable-assembly directly to the output of the EUT's power-amplifier circuit.

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.

This report was printed on: 12 December 2013

2.5 Emissions Configuration



In normal use the EUT connects to the body of a professional audio microphone, to allow for wireless transmission. The plug-in transmitter utilises the body of the microphone as the antenna. For testing purposes, the manufacturer supplied three units to encompass the entire product family operating frequency range of 470 MHz – 698 MHz. The manufacturer modified the test units by soldering a short SMA cable-assembly directly to the output of the EUT's power-amplifier circuit.

For radiated tests, a 50 ohm load was connected to the SMA connector of each test unit, and a new set of batteries were installed.

For conducted emissions tests the SMA port was unit was connected to a spectrum analyser using attenuation to protect the analysers input. The units were powered using a new set of batteries.

3 Summary of test results

The En2 Professional Plug-on Transmitter En2 PTXH was tested to the following standards: -

FCC 47CFR part 2 and part 74H (effective date October 1st, 2012);
Class: Low Power Auxiliary Stations

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.

Title	Reference	Results
1. Radiated emissions	FCC 47CFR §2.1053	PASSED
2. Antenna power Conducted emissions	FCC 47CFR §2.1051	PASSED
3. Occupied bandwidth	FCC 47CFR §2.1049	PASSED
4. Maximum Peak conducted output power		Not applicable
5. Maximum Average conducted output power	FCC 47CFR 2.1046	PASSED
6. Frequency stability	FCC 47CFR §2.1055	PASSED
7. Modulation limiting	FCC 47CFR §2.1047	PASSED
8. Audio frequency response	FCC 47CFR §2.1047	PASSED

4 Specifications

4.1 Relevant Standards

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

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

Reference	Standard Number	Year	Description
4.1.1	47CFR Part 2	2012	Federal Communications Commission PART 2 – Frequency Allocations and Radio Treaty Matters
4.1.2	ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices
4.1.3	ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
4.1.4	TIA-603-C	2004	TIA STANDARD Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards

4.2 Deviations

ANSI C63-10-2009 deviations:
The reference standard ANSI C63.4-2003 was used, not the latest ANSI C63.4-2009

FCC 47CFR deviations:

None

4.3 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	2.7 VDC
T cold	-30 °C	V min	2 VDC
T hot	50 °C	V max	3.1 VDC

Extremes of voltage are based on the manufacturer's declarations. Extremes of temperature are based upon portable use. The ambient test conditions of humidity and pressure in the laboratory were as follows: Relative humidity 45 % 102 kPa.

N.b. for certain tests referenced to antenna port:

☐ 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.

4.4 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
RF frequency	<± 0.7 ppm
Conducted RF power	<± 1.0 dB
Occupied bandwidth	± 1.9 %
Radiated spurious emissions	30MHz - 1000MHz ±5.1dB 1000MHz - 2000MHz ±4.5dB 1 – 18 GHz ±3.5dB
Conducted spurious emissions	± 2.8 dB

5 Tests, Methods and Results

5.1 Radiated emissions

5.1.1 Test Methods

Test Requirements:	FCC 47CFR § 74.861 (e) (6) (3)
Test Method:	FCC 47CFR §2.1053 TIA-603

5.1.2 Configuration of EUT

The EUT was tested in an ALSE and ambient conditions were monitored. Three orthogonal planes were examined. The EUT was operated in CW mode for this test. A 50ohm load was connected to the RF output port.

5.1.3 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 B. Peak field strength from the EUT was maximised by rotating it 360 degrees.

25MHz - 1GHz.
The measuring antenna was scanned 1 - 4m in both Horizontal and Vertical polarisations. Substitution method was performed using tuned dipoles and a calibrated bi-conical antenna.

1GHz – 6GHz.
The measuring antenna was used in both Horizontal and Vertical polarisations. Substitution method was performed using standard gain horn antennas.

5.1.4 Test Equipment used

E007-2, E266, E268, E327, E342, E428, TMS814, TMS815, TMS82, E451, E433

See Section 10 for more details

5.1.5 Test results

Ambient conditions.
Temperature: 22°C Relative humidity: 46% Pressure: 101kPa

Band	470-526 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Bottom channel	470.1 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
753.7	-59.5	-46.5	Horizontal	Side
2350.5	-55.5	-42.5	Vertical	Flat
2820.6	-51.1	-38.1	Vertical	Flat
3290.7	-36.8	-23.8	Horizontal	Flat
3760.8	-47	-34	Horizontal	Flat
4230.9	-40.2	-27.2	Horizontal	Flat

Band	470-526 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Middle channel 1	526.0 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
1578	-58.03	-45.03	Horizontal	Flat
2104	-47.1	-34.1	Vertical	Flat
2630	-54.3	-41.3	Horizontal	Flat
3156	-41	-28	Vertical	Flat
3682	-46.7	-33.7	Vertical	Flat
4208	-42	-29	Horizontal	Flat
5260	-46.7	-33.7	Horizontal	Flat

Band	542-608 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Top channel	607.9 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
1215.8	-49.1	-36.1	Vertical	Flat
1823.7	-55.8	-42.8	Vertical	Flat
2431.6	-53	-40	Vertical	Flat
3039.5	-50.2	-37.2	Vertical	Flat
3647.4	-41.4	-28.4	Vertical	Flat
4255.3	-45.1	-32.1	Vertical	Flat
4863.2	-46.4	-33.4	Vertical	Flat
5471.1	-45	-32	Vertical	Flat

Band	614-698 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Bottom channel	614.1 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
1842.3	-48	-35	Horizontal	Flat
2456.4	-46.5	-33.5	Horizontal	Flat
3070.5	-48.5	-35.5	Horizontal	Flat
3684.6	-45.5	-32.5	Vertical	Flat
4298.7	-43.3	-30.3	Horizontal	Flat
4912.8	-46.6	-33.6	Horizontal	Flat
5526.9	-51.4	-38.4	Horizontal	Flat
6755.1	-60.5	-47.5	Horizontal	Flat

Band	614-698 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Bottom channel	656.025 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
468	-53.6	-40.6	Horizontal	Flat
1968.075	-47.3	-34.3	Horizontal	Side
2624.1	-53.2	-40.2	Horizontal	Flat
3280.125	-41.9	-28.9	Horizontal	Flat
3936.15	-42.5	-29.5	Horizontal	Flat
4592.175	-45.4	-32.4	Vertical	Flat
6560.25	-53	-40	Vertical	Flat

Band	614-698 MHz
Power level	44 mW
Channel spacing	n/a
Mod scheme	FM
Bottom channel	697.9 MHz

Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Difference to Limit (dB)	Antenna Polarisation	EUT Polarisation
2093.7	-52	-39	Horizontal	Side
3489.5	-40.7	-27.7	Horizontal	Flat
4187.4	-43.1	-30.1	Horizontal	Flat
4885.3	-41.2	-28.2	Horizontal	Flat
5583.2	-43.7	-30.7	Vertical	Flat
6281.1	-52.1	-39.1	Vertical	Flat
6979	-53.4	-40.4	Vertical	Flat

LIMITS:

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth:
at least 43+10log10 (mean output power in watts) dB = -13dBm.

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

5.2 Antenna power conducted emissions

5.2.1 Test Methods

Test Requirements**:**	FCC 47CFR § 74.861 (e) (6) (3)
Test Method:	FCC 47CFR § 2.1051

5.2.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial RF port. The EUT was operated in MOD mode for this test.

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 the lowest frequency generated/ used within the equipment up to 10 times the highest frequency generated/ used was made, to identify any signals within 20dB of the limits. Any identified spurious signals were measured in the required bandwidths.

5.2.4 Test Equipment

E131, TMS55, E451, E227, TMS48, E433

See Section 10 for more details

5.2.5 Test Results

Ambient conditions.
Temperature: 20 °C Relative humidity: 52 % Pressure: 101 kPa

For testing purposes, the manufacturer supplied three units to encompass the entire family product operating frequency range of 470 MHz – 698 MHz. Conducted emissions measurements were made at a selection of frequencies across this range. The measurements were made at:

470.1MHz and 526.0 MHz	(unit 'A')
607.9 MHz	(unit 'B')
614.1 MHz, 656.025 MHz and 697.9 MHz	(unit 'C')

No significant emissions were observed during the measurements, and so as to reduce the size of this report, only the worst-case plots for frequency (656.025 MHz) have been included in section 6.1. These plots are representative for the entire frequency range.

LIMITS:

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth:
at least 43+10log10 (mean output power in watts) dB = -13dBm.

The limit lines are displayed on the plots in section 6.1

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

5.3 Occupied bandwidth

5.3.1 Test Methods

Test Requirements**:**	FCC 47CFR § 74.861 (e) (5)
Test Method:	FCC 47CFR § 2.1049

5.3.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the coaxial RF port. The EUT was modulated by an appropriate audio signal to be representative of the type of service in which used i.e. 85% @ 15 kHz. The EUT was operated in MOD mode for this test.

5.3.3 Test Procedure

Tests were performed using Test Site A.

Tests were made in accordance with FCC 47CFR part 2 using the measuring equipment noted below. The 99% bandwidth measurement function of the analyser was used. A 3kHz RBW and a 10kHz VBW, auto sweep time and max hold settings were used for the 99% bandwidth.

5.3.4 Test Equipment used

E227, TMS55, E451, TMS48

See Section 10 for more details.

5.3.5 Test results

Ambient conditions.
Temperature: 20 °C Relative humidity: 52 % Pressure: 101 kPa

Analyser plots for the 99% bandwidth can be found in Section 6.2 of this report.

Band	470-698 MHz	470-698 MHz	470-698 MHz	470-698 MHz	470-698 MHz	470-698 MHz
Power level	40 mW	40 mW	40 mW	40 mW	40 mW	40 mW
Channel spacing	n/a	n/a	n/a	n/a	n/a	n/a
Mod scheme	FM	FM	FM	FM	FM	FM
Frequency	470.1 MHz	526 MHz	607.9 MHz	614.1 MHz	656 MHz	697.9 MHz

99% BW (MHz)	**0.105**	**0.1035**	**0.099**	**0.093**	**0.096**	**0.1035**
Plot reference	OBW Plot-003.spt	OBW Plot-002.spt	OBW Plot-001.spt	OBW Plot-005.spt	OBW Plot-006.spt	OBW Plot-004.spt

LIMITS:

The operating bandwidth shall not exceed 200 kHz.

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

5.4 Maximum Peak conducted output power

Not applicable

5.5 Maximum Average conducted output power

5.5.1 Test Methods

Test Requirements	FCC 47CFR § 74.861 (e) (1) (ii)
Test Method:	FCC 47CFR § 2.1046

5.5.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial RF port. The EUT was modulated with a 2.5 kHz audio tone with an amplitude of 0dBV.

The power was measured at a selection of frequencies across the entire product family frequency range.

5.5.3 Test Procedure

Tests were made in accordance with FCC 47CFR part 2 using the measuring equipment noted below.

Power meter reading stated is maximum power observed using an average power head.

Measurements were made in test site A.

5.5.4 Test Equipment used

E227, E290, E397, TMS48, TMS55

See Section 10 for more details

5.5.5 Test results

Ambient conditions.
Temperature: 18 °C Relative humidity: 50 % Pressure: 102 kPa

Band	470 - 526 MHz
Power level	40 mW
EUT	A
Mod scheme	FM
Low channel	470.1 MHz
High channel	526 MHz

Test conditions: Temp Ambient, Volts Nominal	**Carrier Power (mW)**	
	Low	**High**
	36.81	33.88
Maximum TX Power observed (mW)	36.81	
Variation in TX power observed (dB)	-8.32 / -8.68	

Temp Ambient Volts Nominal		
	Low	**High**
measured dBm	15.66	15.3
mW	36.8	33.9

Band	542 - 608 MHz
Power level	40 mW
EUT	B
Mod scheme	FM
High channel	607.9 MHz

Test conditions: Temp Ambient, Volts Nominal	**Carrier Power (mW)**
	High
	36.90
Maximum TX Power observed (mW)	36.90

Temp Ambient Volts Nominal	
	High
measured dBm	15.67
mW	36.9

Band	614 - 698 MHz
Power level	40 mW
EUT	C
Mod scheme	FM
Low channel	614.1 MHz
Mid channel	656.025 MHz
Top channel	697.9 MHz

Test conditions: Temp Ambient, Volts Nominal	**Carrier Power (mW)**		
	Low	**Mid**	**High**
	35.56	36.81	39.63
Maximum TX Power observed (mW)	39.63		
Variation in TX power observed (dB)	-8 / -8.47		

Temp Ambient Volts Nominal			
	Low	**Mid**	**High**
measured dBm	15.51	15.66	15.98
mW	35.6	36.8	39.6

LIMITS:

For 470–608 and 614–698 MHz bands 250 mW.

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

5.6 Frequency stability

5.6.1 Test Methods

Test Requirements FCC 47CFR § 74.861 (e) (4)
Test Method: FCC 47CFR § 2.1055

5.6.2 Configuration of EUT

The EUT was placed in a temperature controlled chamber. The EUT emissions were observed by connecting a spectrum analyser to the RF port. The EUT was operated in CW mode for this test.

5.6.3 Test Procedure

Tests were made in accordance with FCC Part 2 using the measuring equipment noted below.

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

5.6.4 Test Equipment used

E003, E227, E434, P266

See Section 10 for more details

Test results

Ambient conditions.
Temperature: 20 °C Relative humidity: 45 % Pressure: 103 kPa

EUT	A
Power level	40 mW
Channel spacing	Not applicable
Mod scheme	FM
Low channel	470.1 MHz
Mid channel	526.0 MHz

Temp (°C)	Voltage (V)	Low channel (MHz)	Mid channel (MHz)
-30	**2.7**	470.100357	526.000822
-20	**2.7**	470.102319	526.002542
-10	**2.7**	470.101881	526.002270
0	**2.7**	470.102414	526.002705
10	**2.7**	470.102373	526.002610
20	**2**	470.101229	526.001410
20	**2.7**	470.101045	526.002093
20	**3.1**	470.101259	526.001380
30	**2.7**	470.101045	526.001139
40	**2.7**	470.100204	526.000282
50	**2.7**	470.099783	525.999753
Frequency Error Limit (Hz) ±		23505	26300
Max Frequency Error per chan (Hz)		2414 / -217	2705 / -247
Max Frequency Error observed (Hz)		+2705 / -247	

EUT	B
Power level	40 mW
Channel spacing	Not applicable
Mod scheme	FM
Low channel	607.9 MHz

Temp (°C)	Voltage (V)	Low channel (MHz)
-30	**2.7**	607.900214
-20	**2.7**	607.901918
-10	**2.7**	607.902092
0	**2.7**	607.902605
10	**2.7**	607.902477
20	**2**	607.901624
20	**2.7**	607.901911
20	**3.1**	607.901684
30	**2.7**	607.901167
40	**2.7**	607.900212
50	**2.7**	607.899581
Frequency Error Limit (Hz) ±		30395
Max Frequency Error per chan (Hz)		2605 / -419
Max Frequency Error observed (Hz)		+2605 / -419

EUT	C
Power level	40 mW
Channel spacing	Not applicable
Mod scheme	FM
Low channel	614.1 MHz
Mid channel	656.025 MHz
High channel	697.9 MHz

Temp (°C)	Voltage (V)	Low channel (MHz)	Mid channel (MHz)	High channel (MHz)
-30	**2.7**	614.101930	656.027743	697.903160
-20	**2.7**	614.102639	656.027581	697.902280
-10	**2.7**	614.102826	656.028129	697.903368
0	**2.7**	614.102940	656.028179	697.903401
10	**2.7**	614.102637	656.027754	697.902873
20	**2**	614.101240	656.026210	697.901040
20	**2.7**	614.101295	656.026378	697.901493
20	**3.1**	614.101280	656.026180	697.901050
30	**2.7**	614.100565	656.025469	697.899940
40	**2.7**	614.098760	656.023821	697.898930
50	**2.7**	614.097720	656.022547	697.891366
Frequency Error Limit (Hz) ±		30705	32802	34895
Max Frequency Error per chan (Hz)		2940 / -2280	3179 / -2453	3401 / -8634
Max Frequency Error observed (Hz)		+3401 / -8634		

LIMITS: Frequency tolerance of the transmitter shall be 0.005 percent.

The frequency error limit is shown in the tables.

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

5.7 Modulation Limiting

5.7.1 Test Methods

Test Requirements FCC 47CFR § 74.861 (e) (3)
Test Method: FCC 47CFR § 2.1047

5.7.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the 50 ohm coaxial RF port using a modulation analyser. The EUT was operated in MOD mode for this test.

5.7.3 Test Procedure

Tests were made in accordance with FCC Part 2 using the measuring equipment noted below.

Tests were performed using Test Site A.

5.7.4 Test Equipment used

E227, TMS48, TMS55

See Section 10 for more details

5.7.5 Test results

Ambient conditions.
Temperature: 20 °C Relative humidity: 52 % Pressure: 101 kPa

The results are presented graphically, Please refer to section 6.3.

LIMITS: +/- 75 kHz

The limits are shown on the graphs.

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

5.8 Audio frequency response

5.8.1 Test Methods

Test Requirements	FCC 47CFR § 2.1047
Test Method:	FCC 47CFR § 2.1047

5.8.2 Configuration of EUT

The EUT was operated on a test bench. Measurements were made at the coaxial RF port using a modulation analyser. The EUT was modulated with an audio signal with an amplitude sufficient to achieve 20% of the 75 kHz deviation limit. This level was representative of the type of service in which used.

5.8.3 Test Procedure

Tests were made in accordance with FCC Part 2 using the measuring equipment noted below.

Tests were performed using Test Site A.

5.8.4 Test Equipment used

E227, TMS48, TMS55

See Section 10 for more details

5.8.5 Test results

Ambient conditions.
Temperature: 20°C Relative humidity: 52 % Pressure: 101 kPa

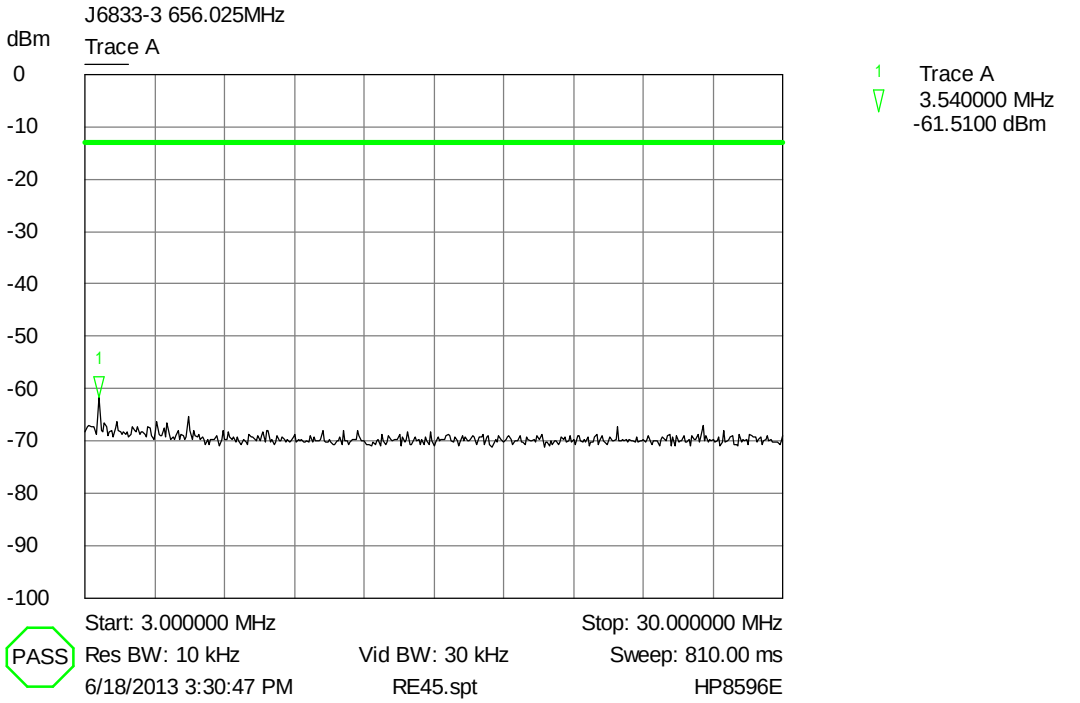
The results are presented graphically, Please refer to section 6.4.

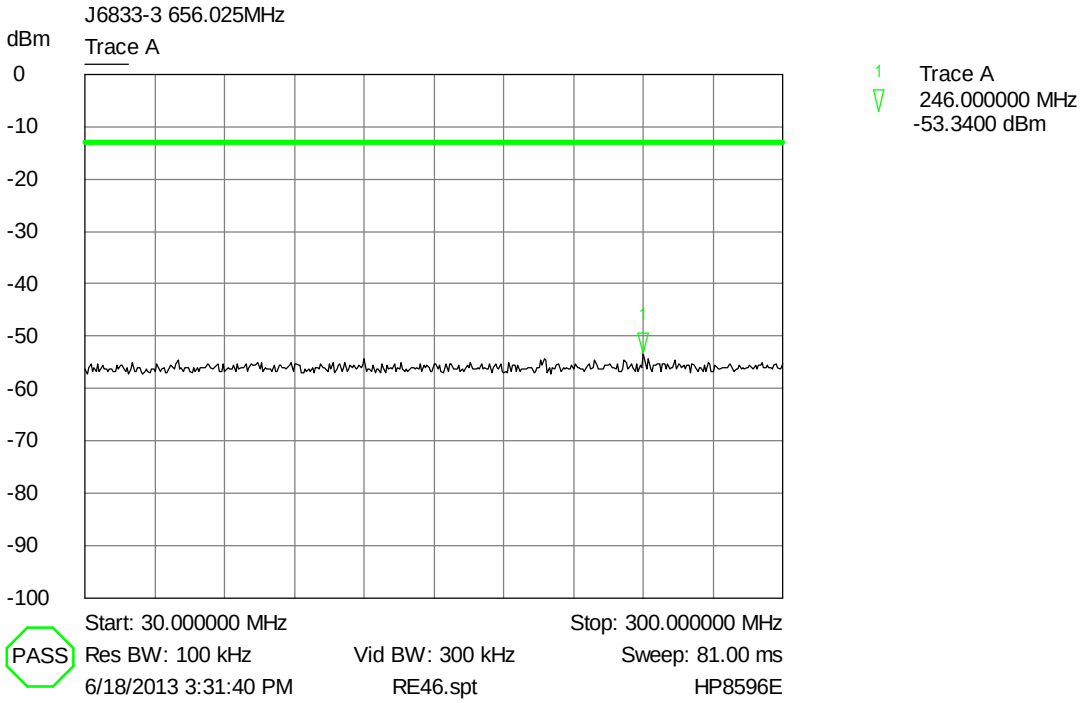
LIMITS: No limits specified

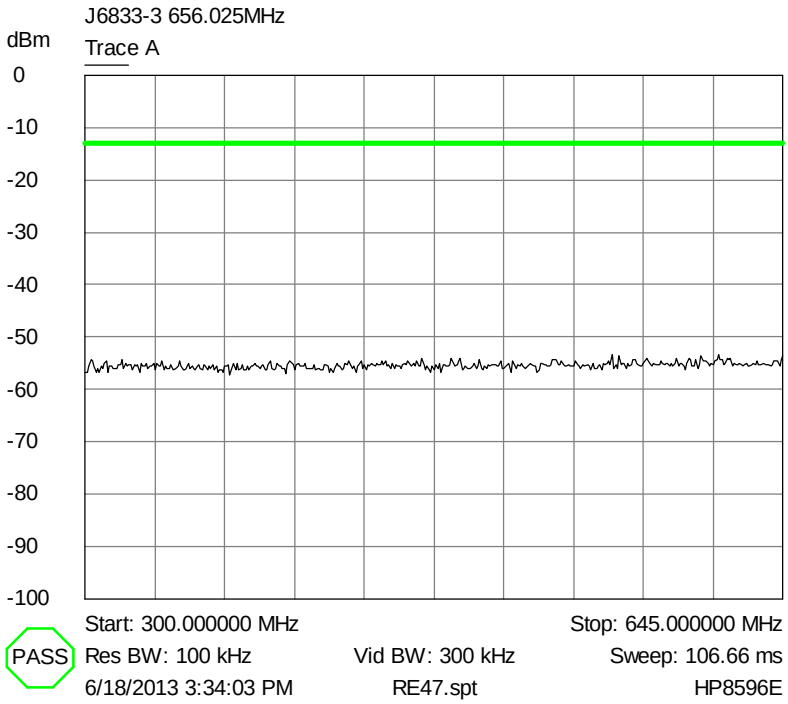
These results show that the EUT has **PASSED** this test.

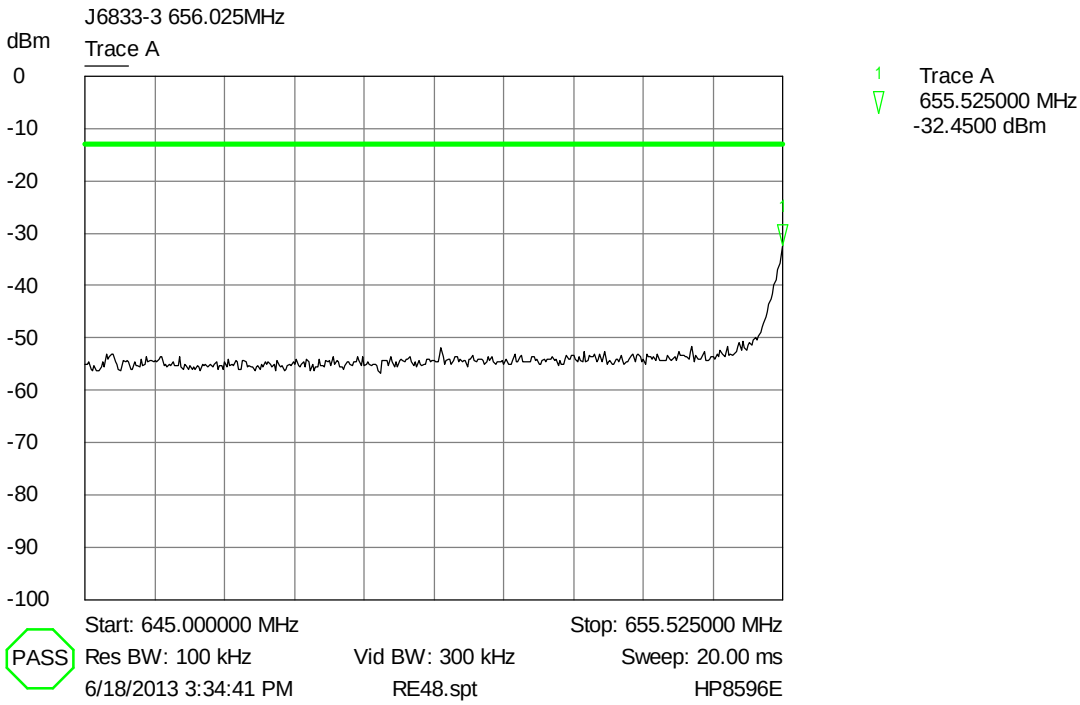
6 Plots and Results

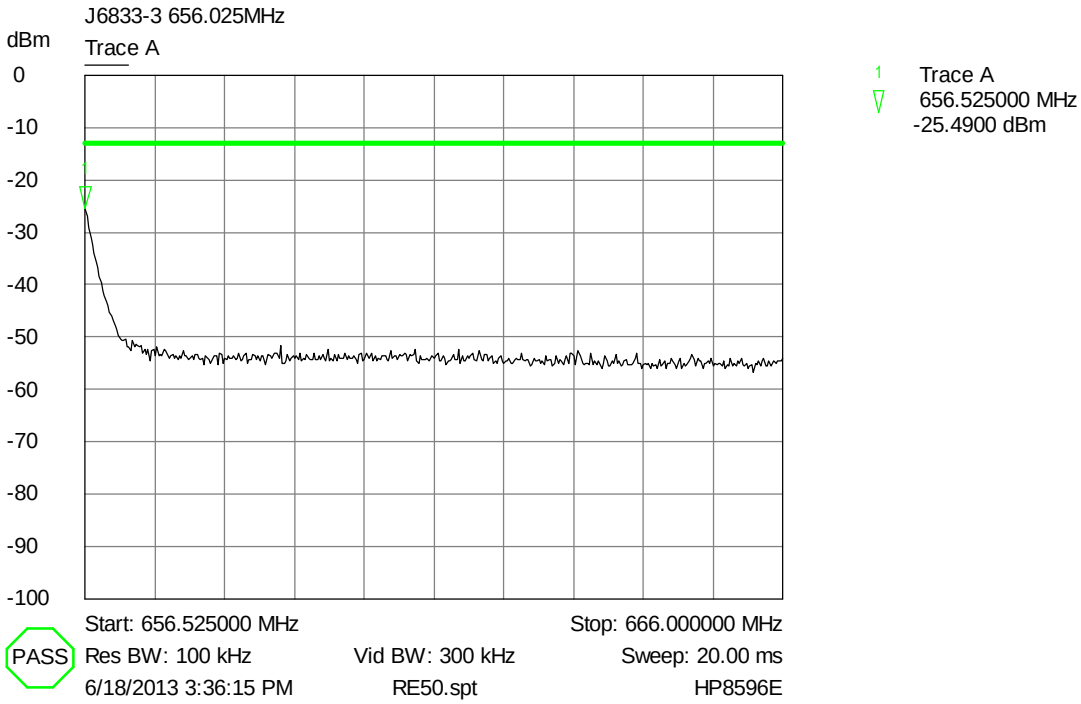
6.1 Antenna power conducted plots

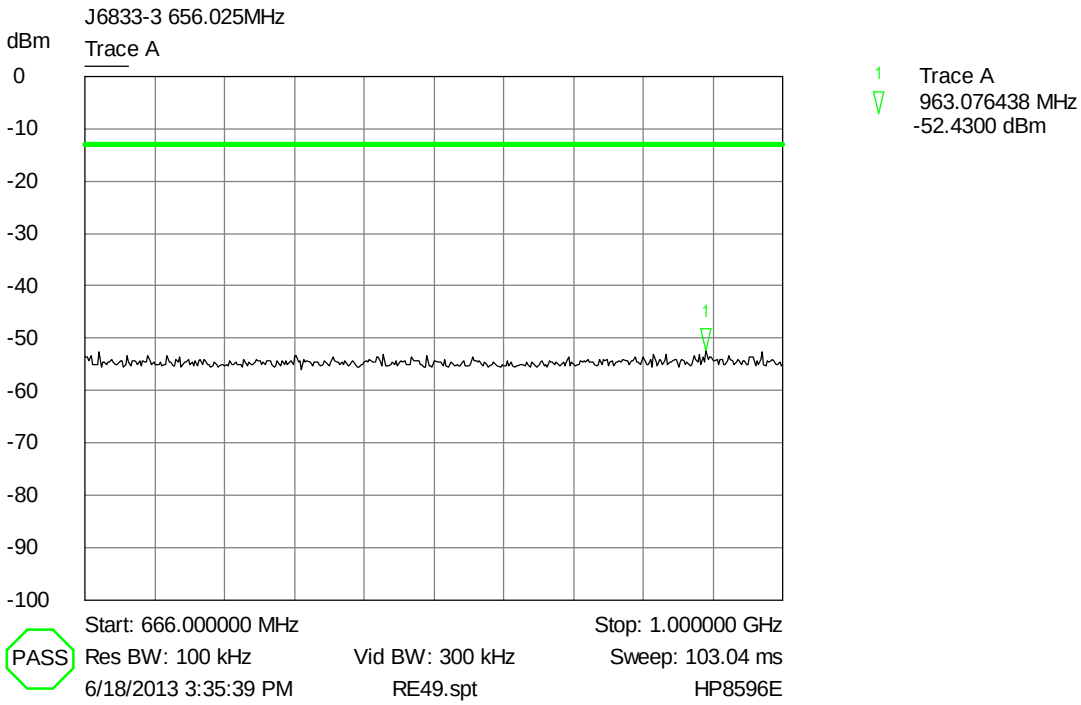


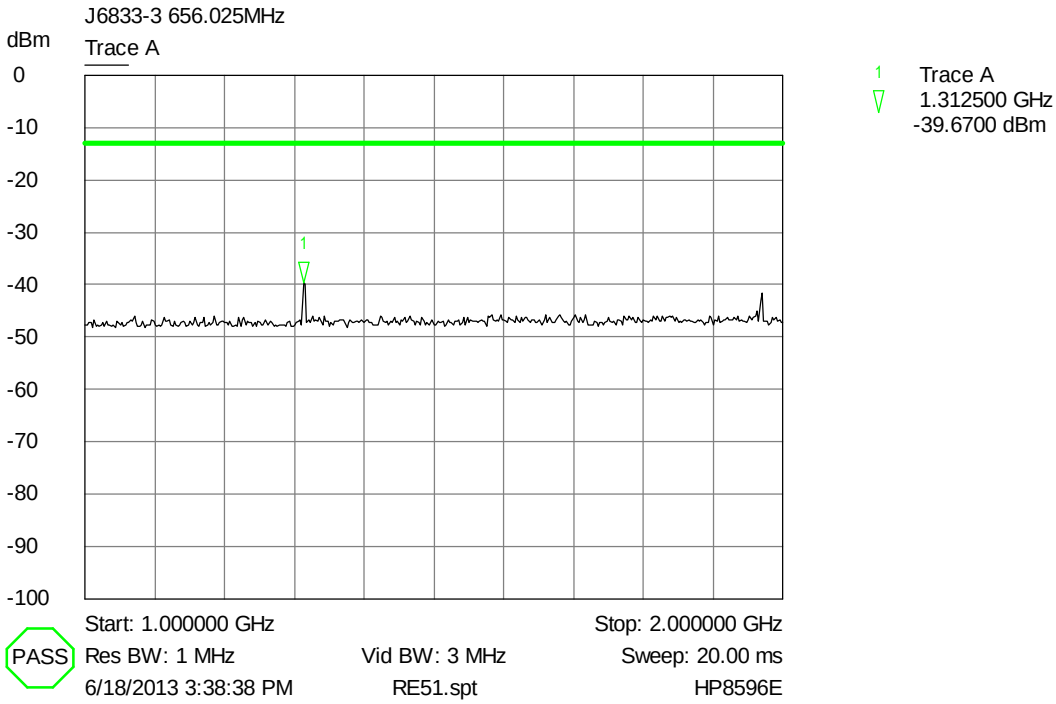


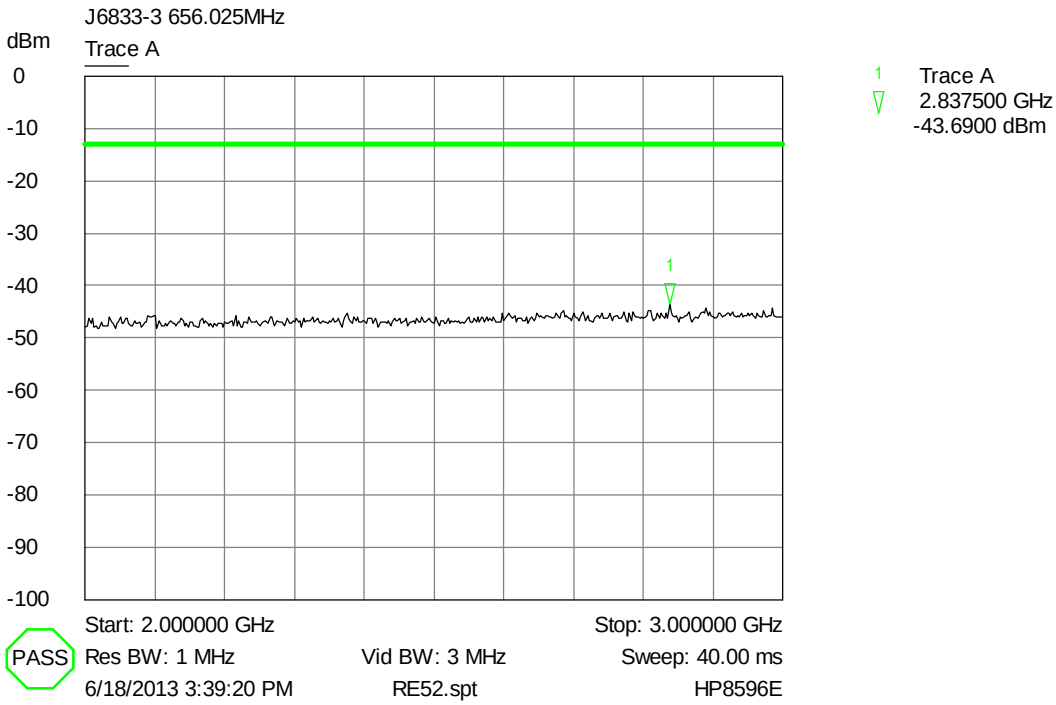

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Start: 300.000000 MHz
Stop: 645.000000 MHz
PASS
Res BW: 100 kHz
Vid BW: 300 kHz
Sweep: 106.66 ms
6/18/2013 3:34:03 PM
RE47.spt
HP8596E

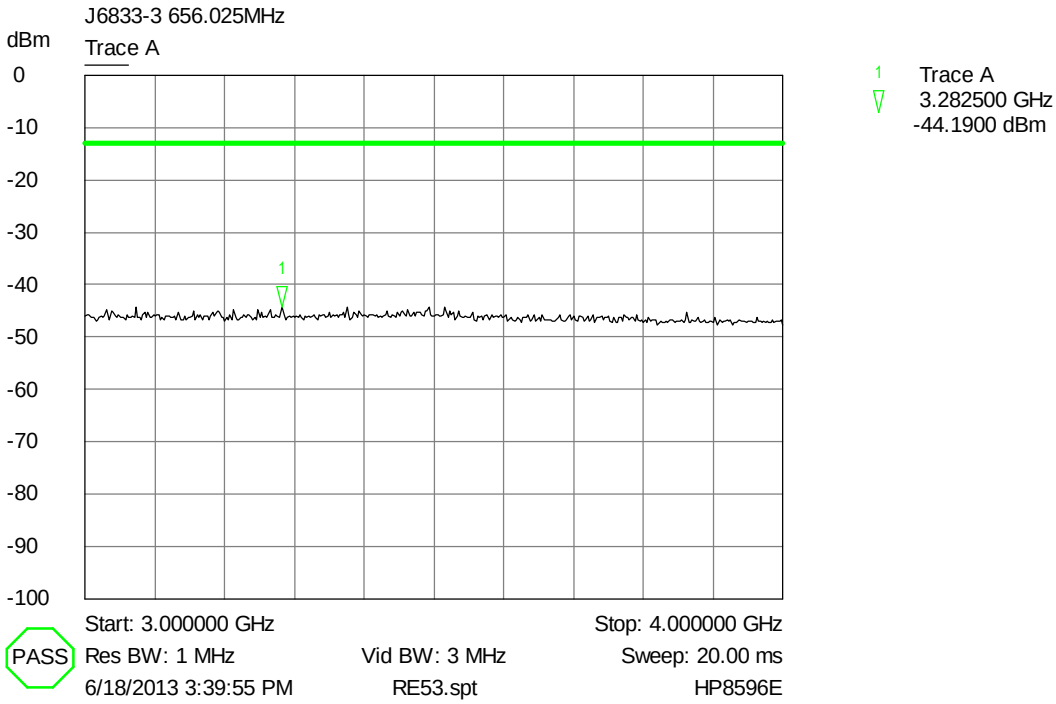

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
655.525000 MHz
-32.4500 dBm
Start: 645.000000 MHz
Stop: 655.525000 MHz
PASS
Res BW: 100 kHz
Vid BW: 300 kHz
Sweep: 20.00 ms
6/18/2013 3:34:41 PM
RE48.spt
HP8596E

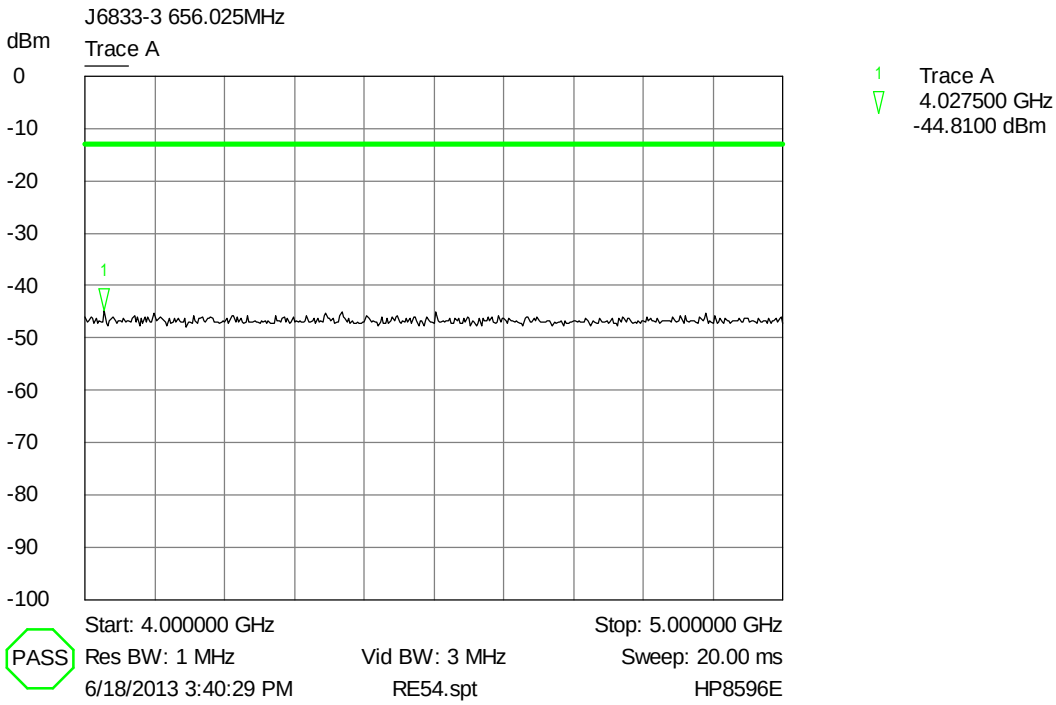

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
656.525000 MHz
-25.4900 dBm
Start: 656.525000 MHz
Stop: 666.000000 MHz
PASS
Res BW: 100 kHz
Vid BW: 300 kHz
Sweep: 20.00 ms
6/18/2013 3:36:15 PM
RE50.spt
HP8596E

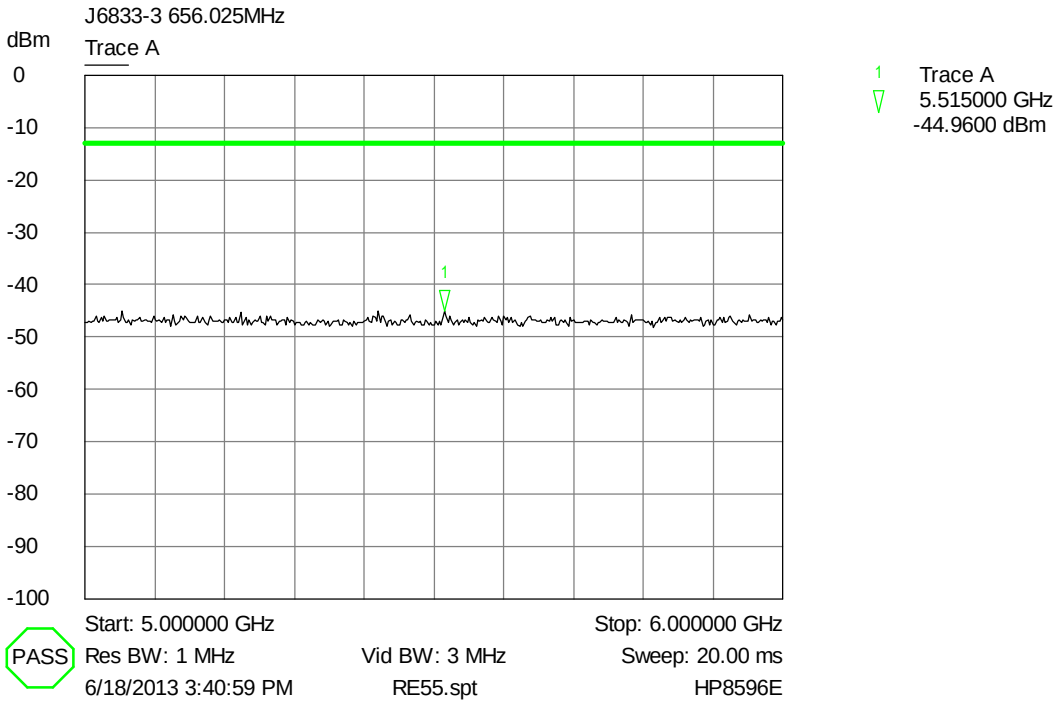

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
963.076438 MHz
-52.4300 dBm
Start: 666.000000 MHz
Stop: 1.000000 GHz
PASS
Res BW: 100 kHz
Vid BW: 300 kHz
Sweep: 103.04 ms
6/18/2013 3:35:39 PM
RE49.spt
HP8596E

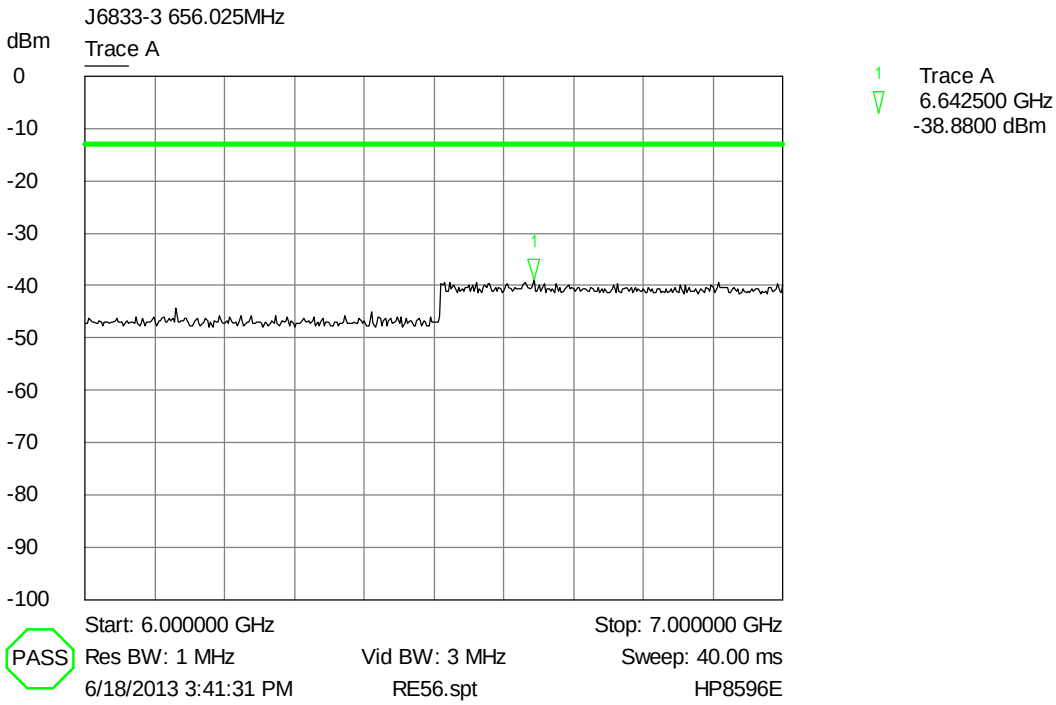

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
1.312500 GHz
-39.6700 dBm
Start: 1.000000 GHz
Stop: 2.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 20.00 ms
6/18/2013 3:38:38 PM
RE51.spt
HP8596E


J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
2.837500 GHz
-43.6900 dBm
Start: 2.000000 GHz
Stop: 3.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 40.00 ms
6/18/2013 3:39:20 PM
RE52.spt
HP8596E

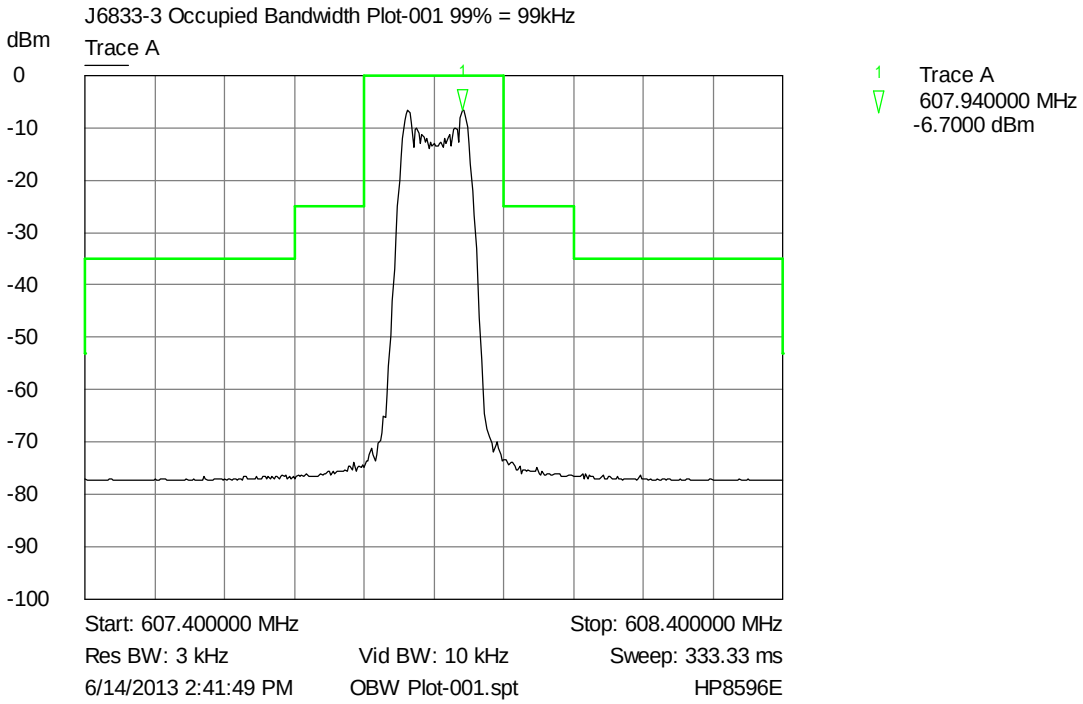

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
3.282500 GHz
-44.1900 dBm
Start: 3.000000 GHz
Stop: 4.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 20.00 ms
6/18/2013 3:39:55 PM
RE53.spt
HP8596E

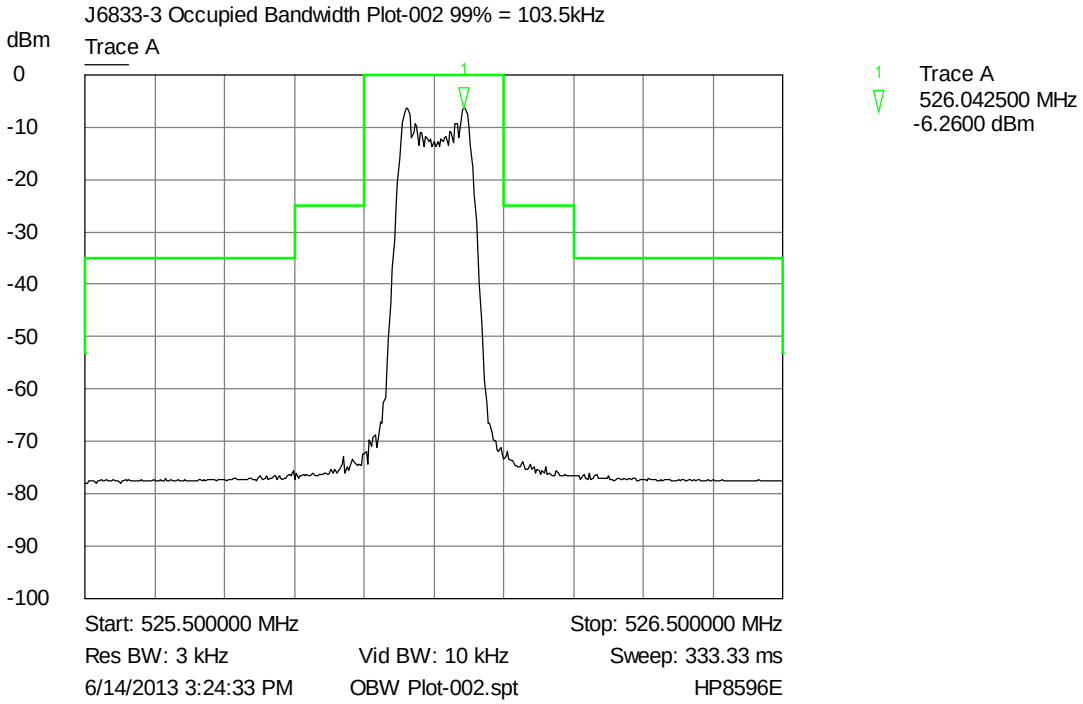

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
4.027500 GHz
-44.8100 dBm
Start: 4.000000 GHz
Stop: 5.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 20.00 ms
6/18/2013 3:40:29 PM
RE54.spt
HP8596E


J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
5.515000 GHz
-44.9600 dBm
Start: 5.000000 GHz
Stop: 6.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 20.00 ms
6/18/2013 3:40:59 PM
RE55.spt
HP8596E

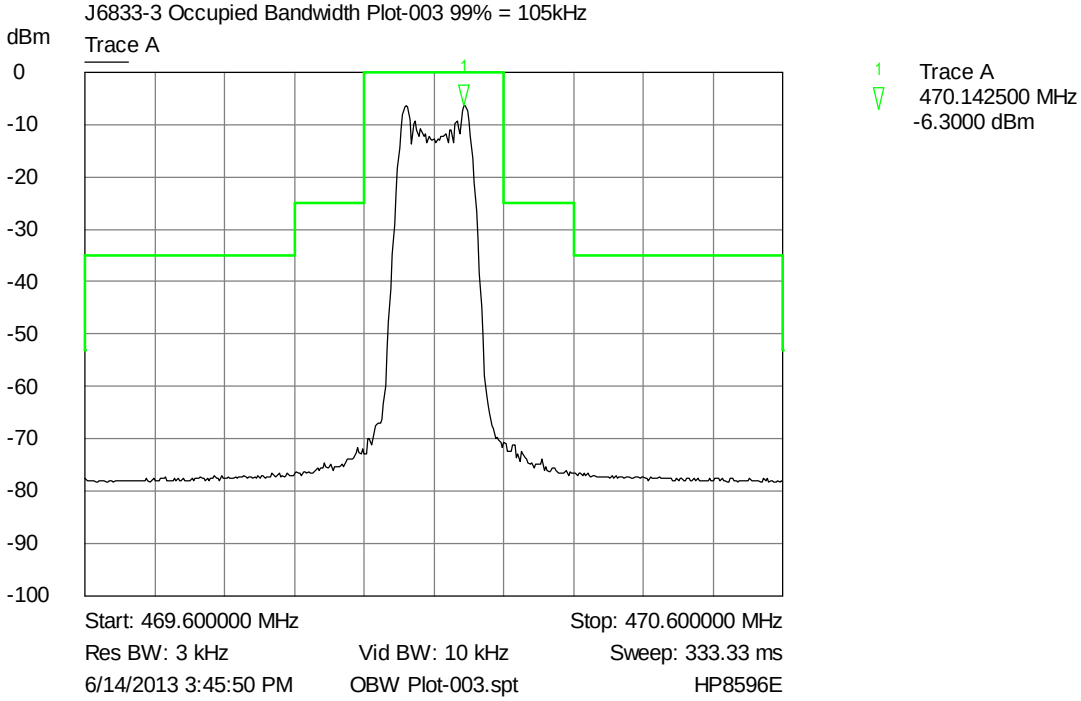

J6833-3 656.025MHz
dBm
Trace A
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1
Trace A
6.642500 GHz
-38.8800 dBm
Start: 6.000000 GHz
Stop: 7.000000 GHz
PASS
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 40.00 ms
6/18/2013 3:41:31 PM
RE56.spt
HP8596E

6.2 99% occupied bandwidth plots

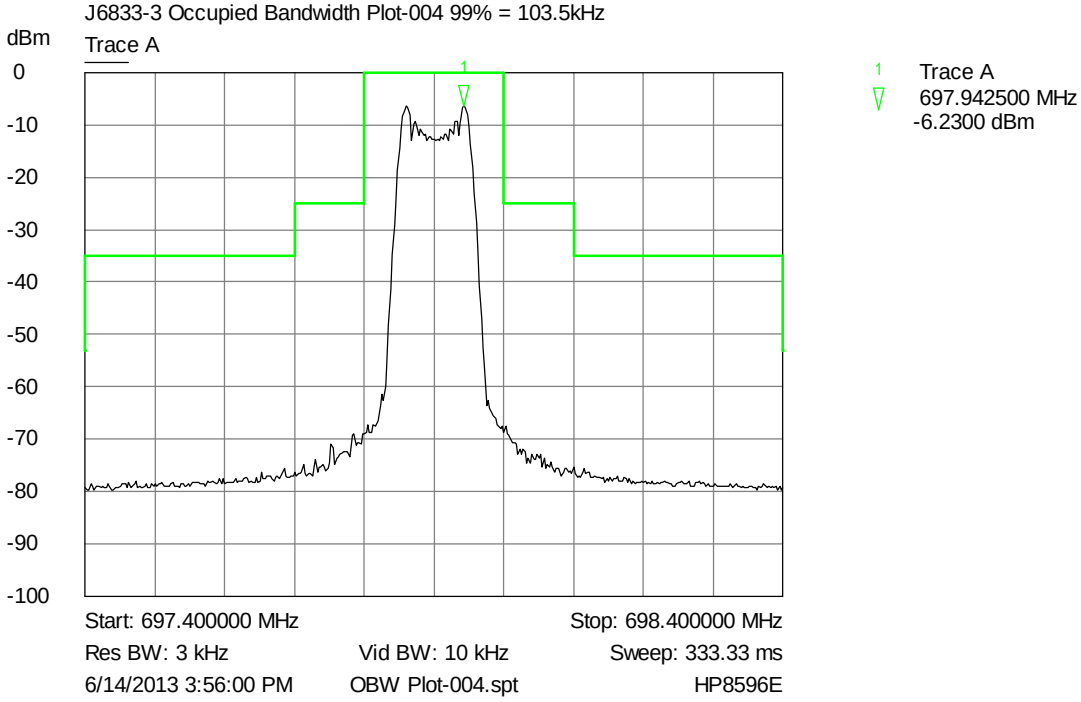




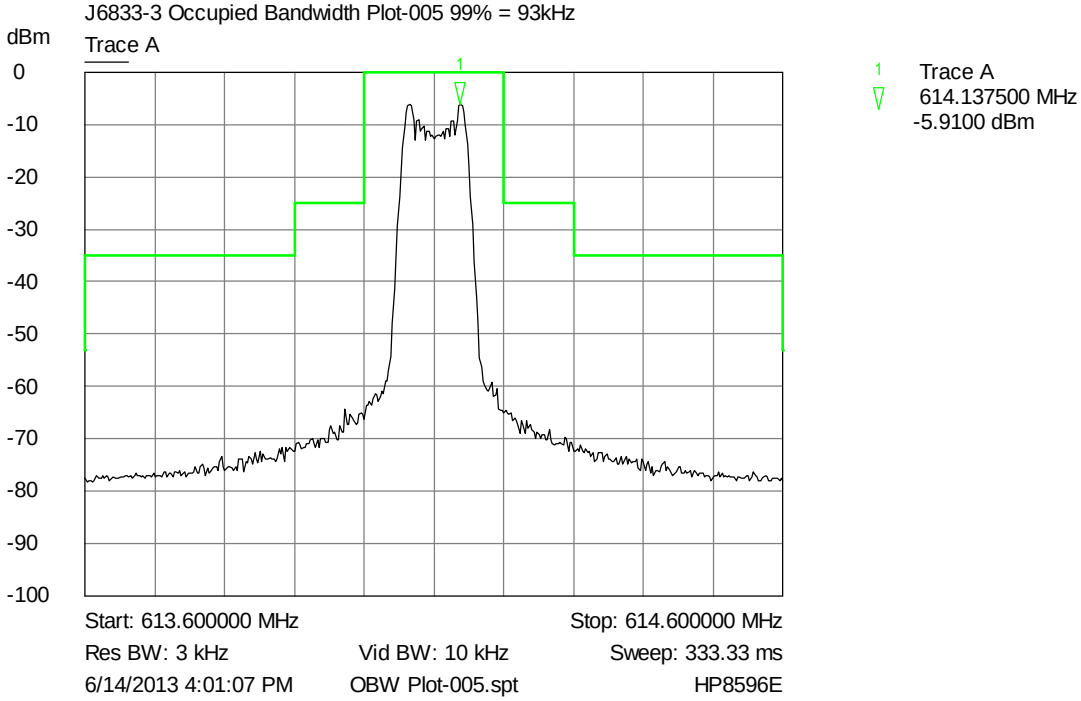
J6833-3 Occupied Bandwidth Plot-003 99% = 105kHz



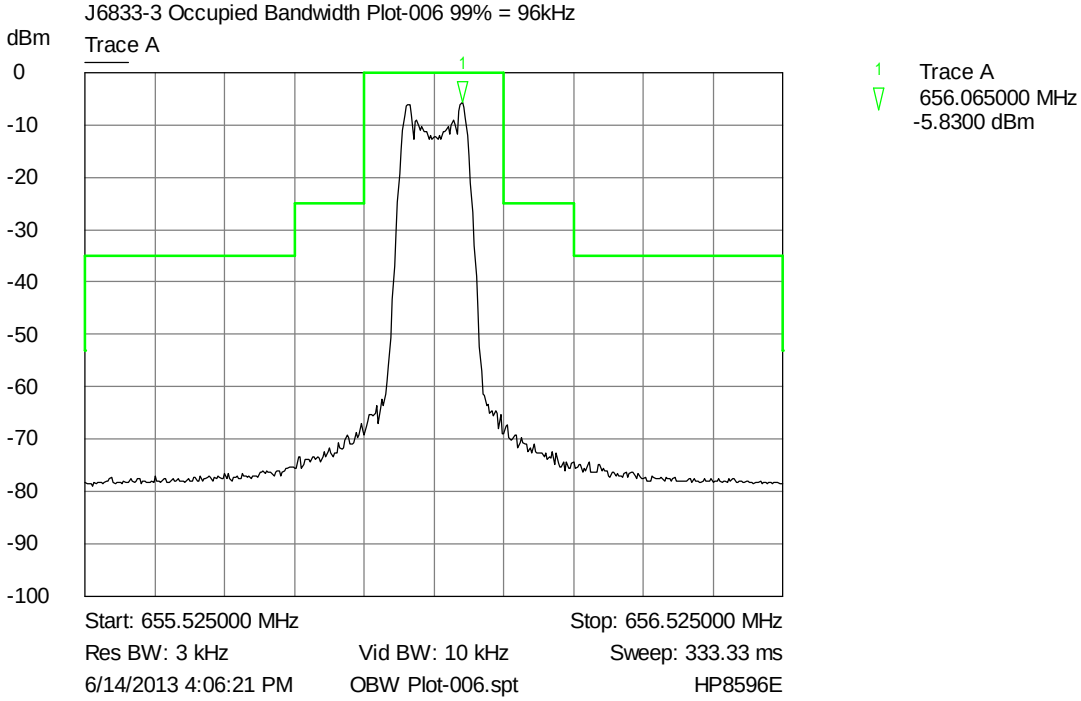
J6833-3 Occupied Bandwidth Plot-004 99% = 103.5kHz



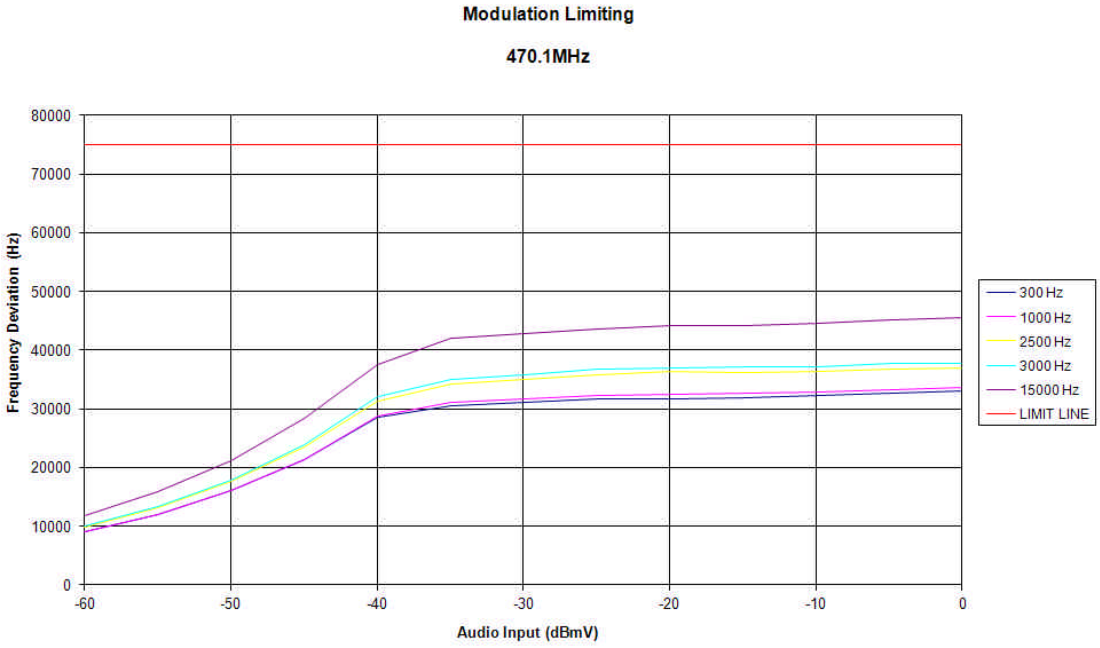
J6833-3 Occupied Bandwidth Plot-005 99% = 93kHz

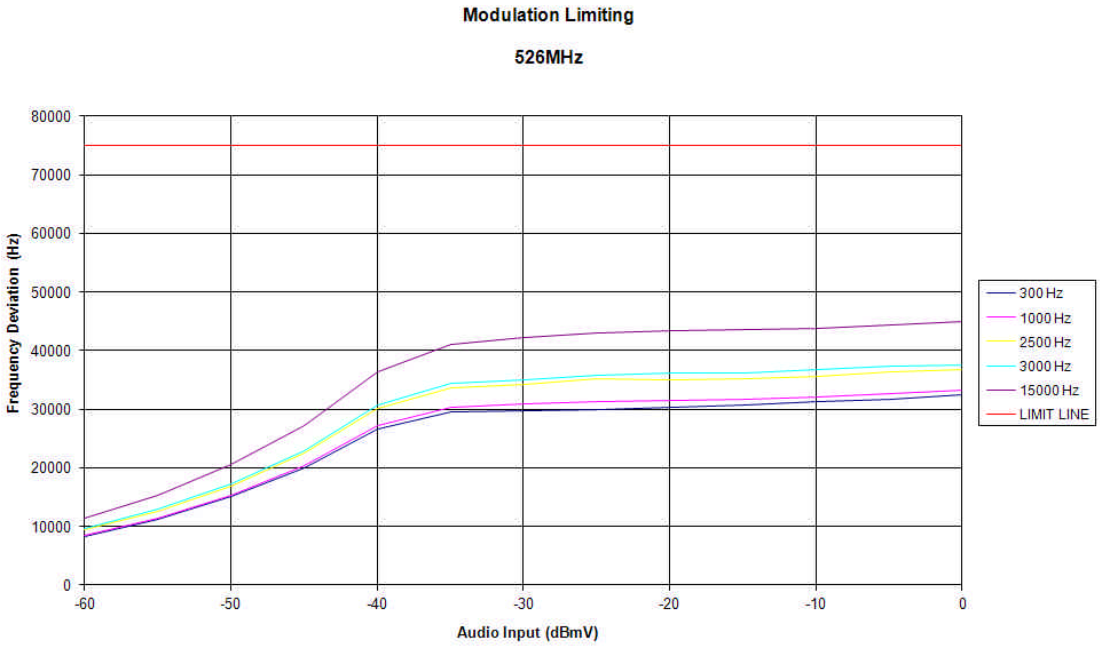


J6833-3 Occupied Bandwidth Plot-006 99% = 96kHz



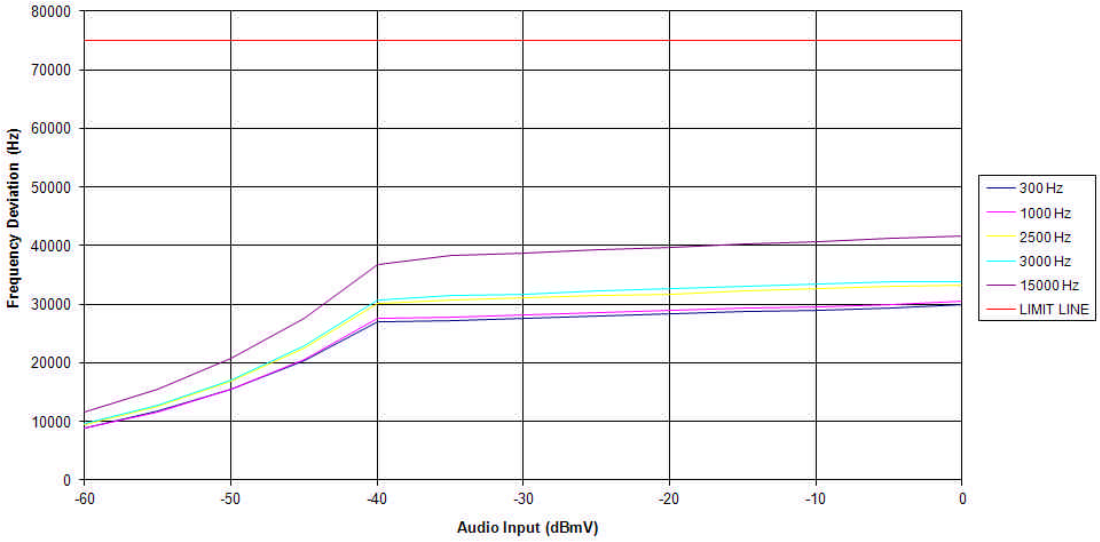
6.3 Modulation limiting plots





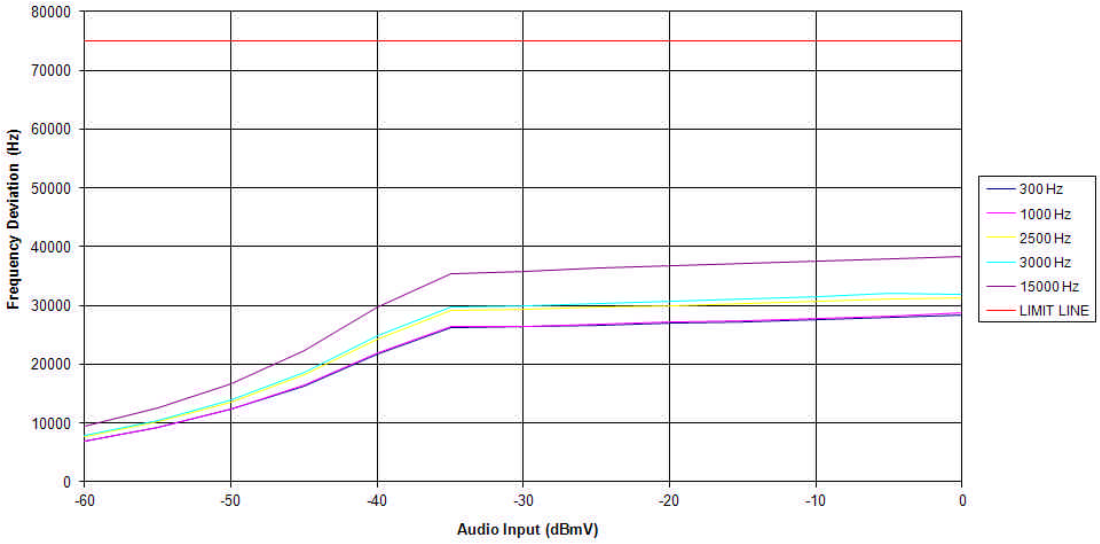
Modulation Limiting

607.9MHz



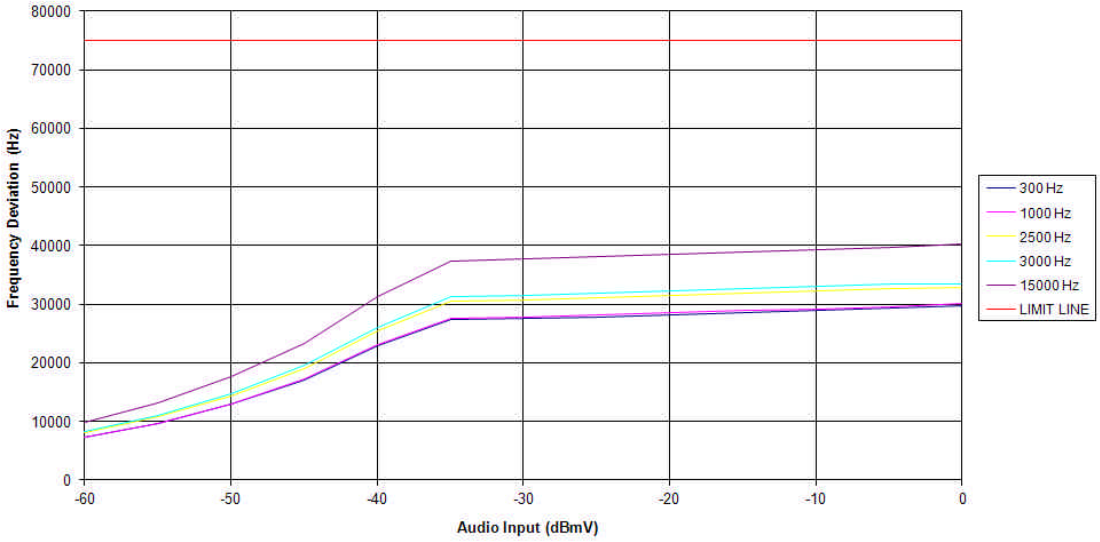
Modulation Limiting

614.1MHz



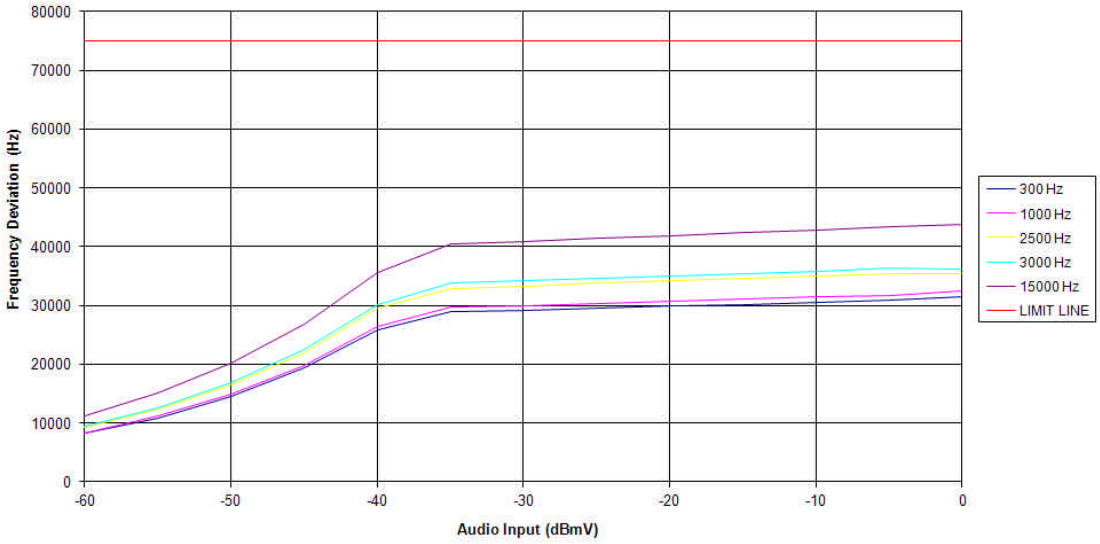
Modulation Limiting

656.025MHz

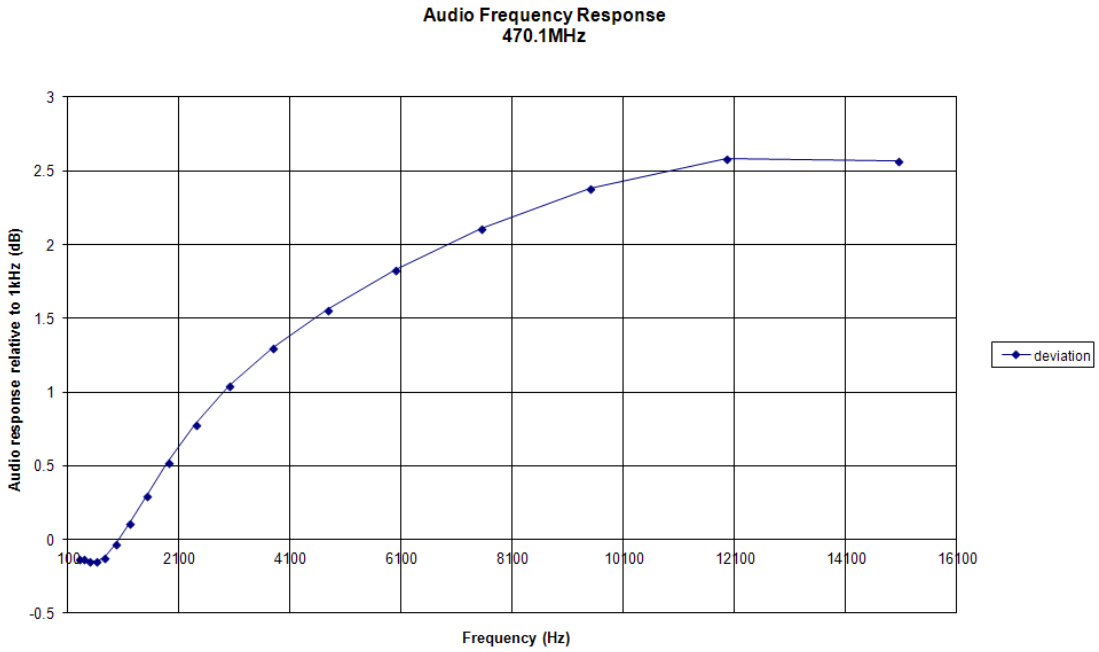


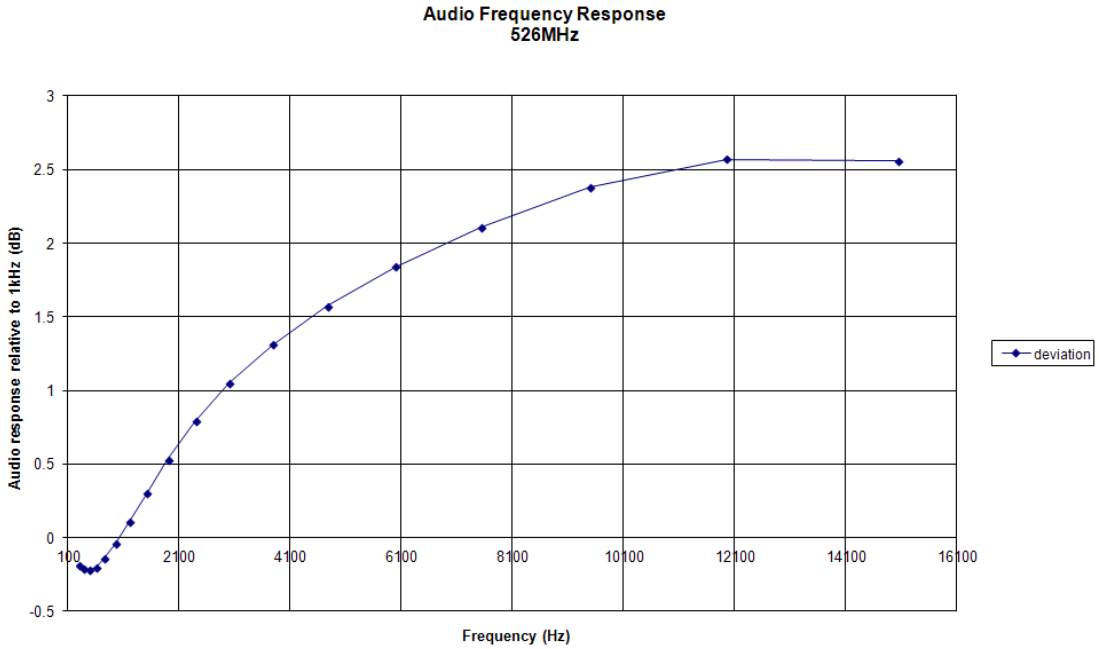
Modulation Limiting

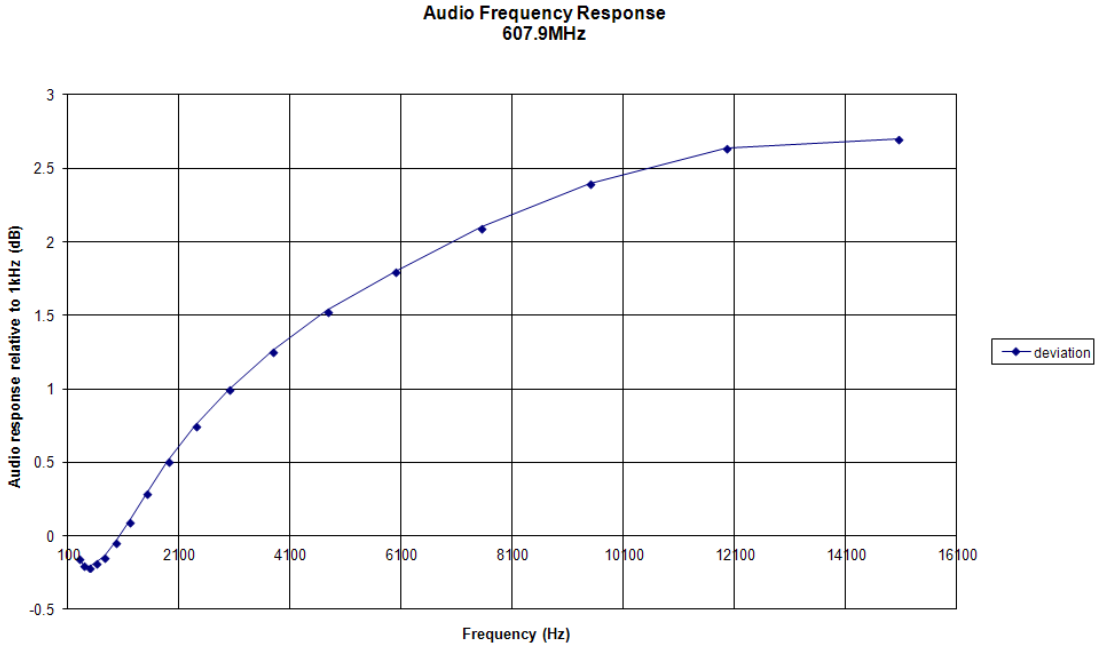
697.9MHz

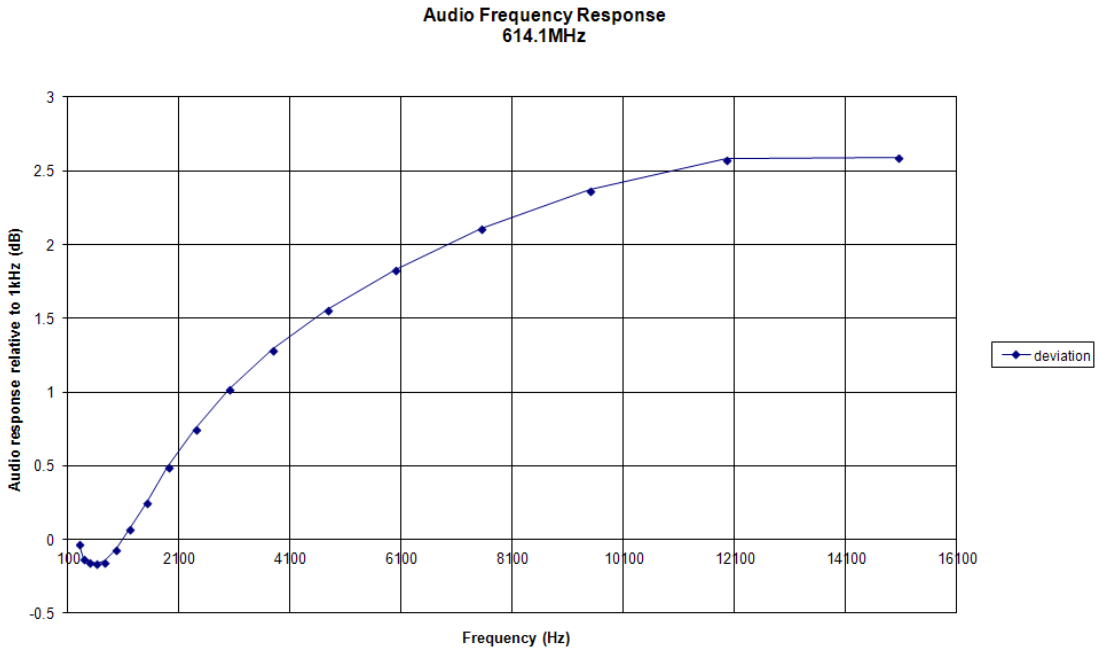


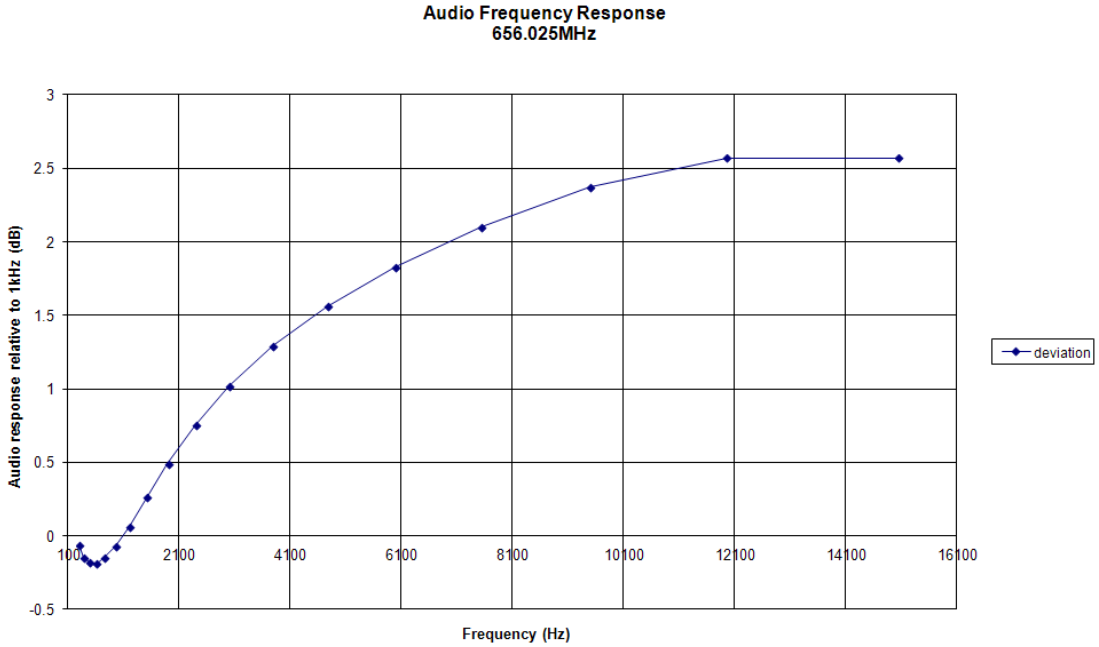
6.4 Audio frequency response plots

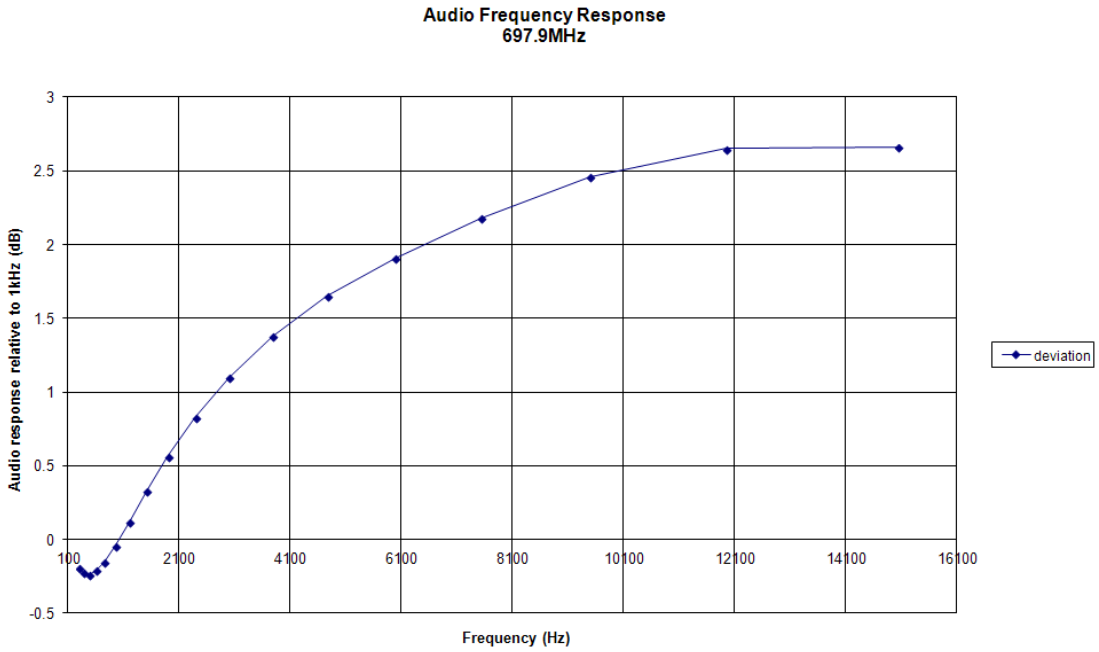





Audio Frequency Response
607.9MHz
Audio response relative to 1kHz (dB)
3
2.5
2
1.5
1
0.5
0
-0.5
100
2100
4100
6100
8100
10100
12100
14100
16100
Frequency (Hz)
deviation


Audio Frequency Response
614.1MHz
Audio response relative to 1kHz (dB)
3
2.5
2
1.5
1
0.5
0
-0.5
100
2100
4100
6100
8100
10100
12100
14100
16100
Frequency (Hz)
deviation


Audio Frequency Response
656.025MHz
Audio response relative to 1kHz (dB)
3
2.5
2
1.5
1
0.5
0
-0.5
100
2100
4100
6100
8100
10100
12100
14100
16100
Frequency (Hz)
deviation


Audio Frequency Response
697.9MHz
Audio response relative to 1kHz (dB)
3
2.5
2
1.5
1
0.5
0
-0.5
100
2100
4100
6100
8100
10100
12100
14100
16100
Frequency (Hz)
deviation

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48.0	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in µV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBµV/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

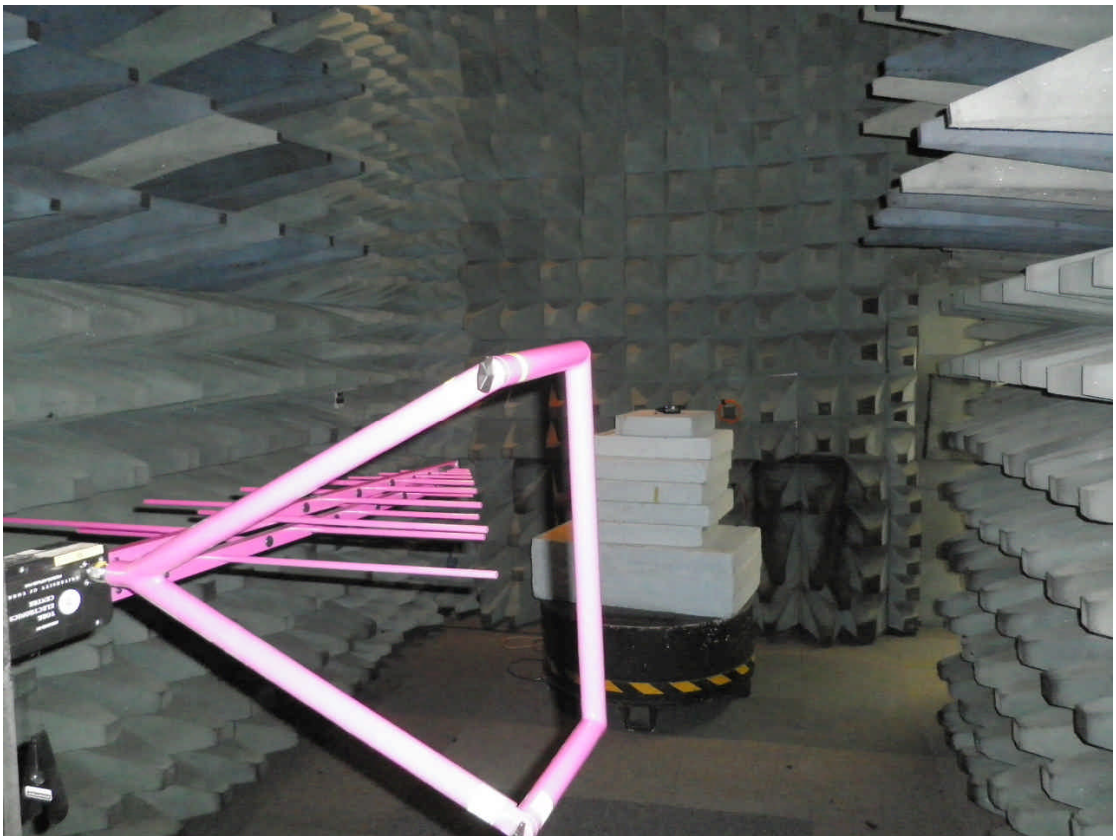
(a) limit of 500 µV/m equates to 20.log (500) = 54 dB µV/m.

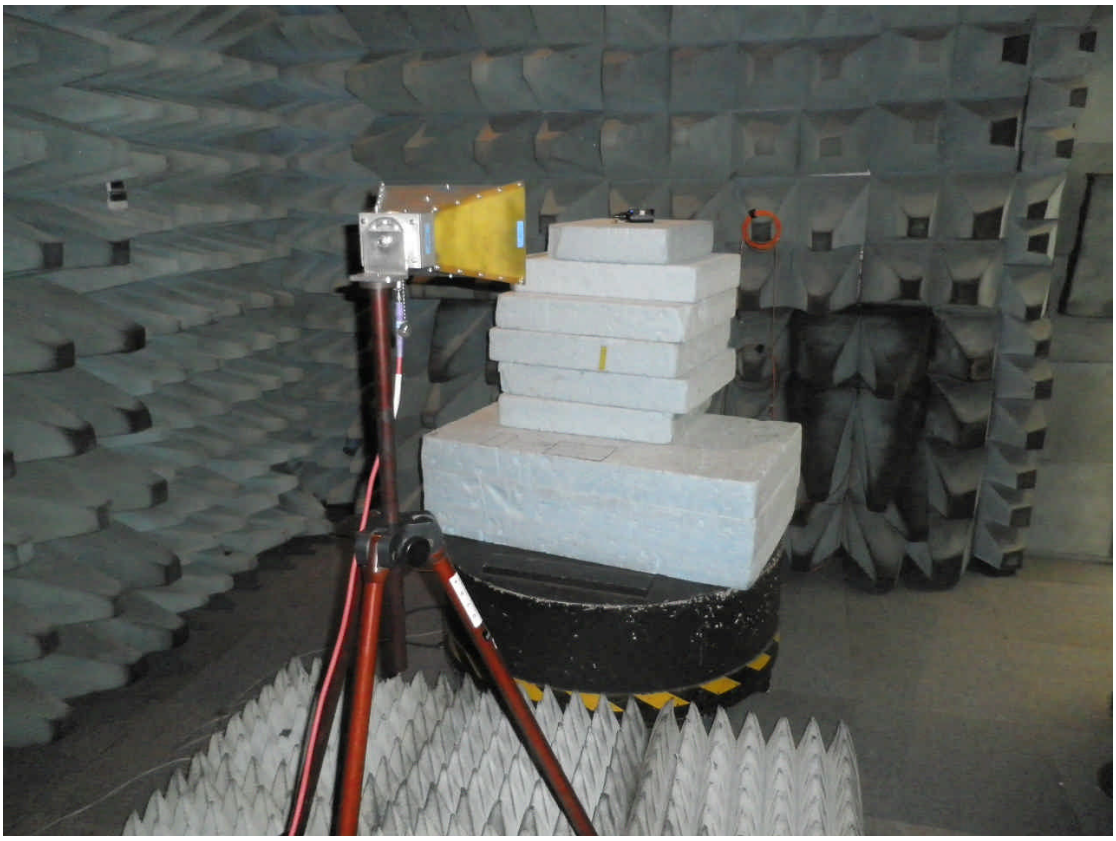
(b) limit of 300 µV/m at 10m equates to 20.log (300 . 10/3) = 60 dB µV/m at 3m

(c) limit of 30 µV/m at 30m, but below 30MHz, equates to 20.log(30) + 40.log(30/3) = 69.5 dBµV/m at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8 Photographs

Identifying photograph of the EUT.





Photographs of the EUT as viewed from in site B.

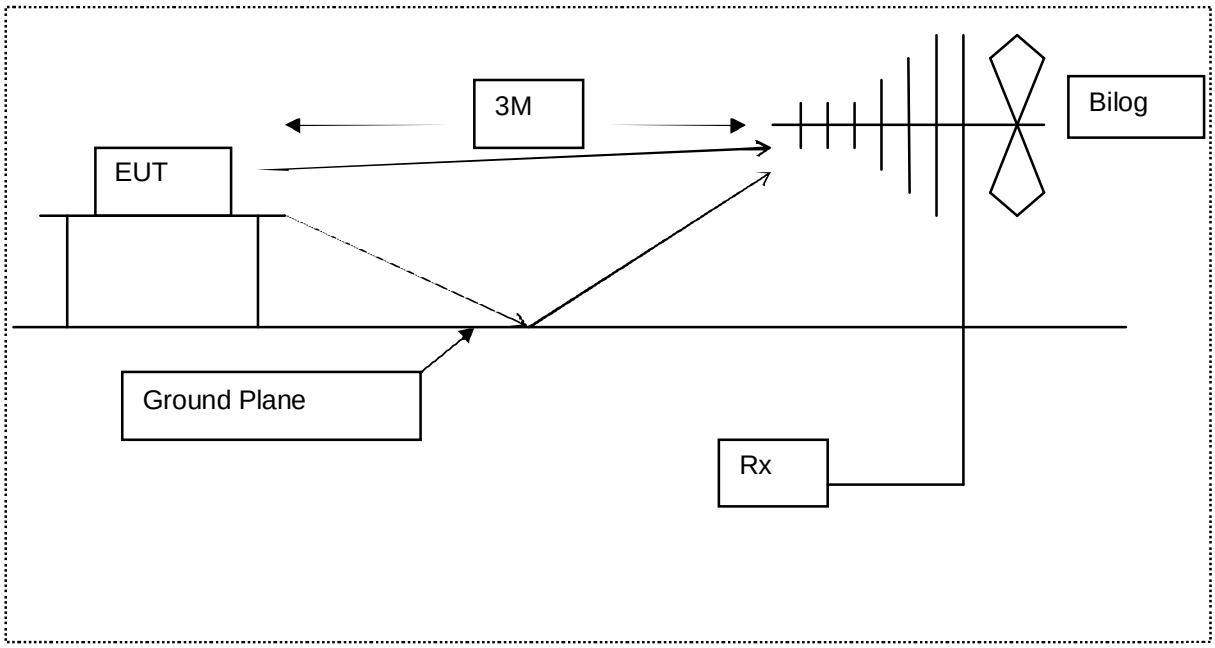


Diagram of the radiated emissions test setup.

9 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.

RN No.	Model	Description	Manufacturer	Calibration date	Cal period
E003	HP8593E	Spectrum Analyser	Hewlett Packard	21-Nov-12	24 months
E007-2	VHA9103	Bi-con Antenna	Schwarzbeck	14-Feb-11	36 months
E131	ESG-3000A	Signal Generator	Hewlett Packard	02-Jan-13	24 months
E227	6632A	System DC Power Supply	Hewlett Packard	25-Jan-13	12 months
E266	2032	5.4GHz Signal Generator	Marconi Instruments	28-Jun-12	24 months
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	14-Apr-13	24 months
E290	6914	Power Sensor	Marconi Instruments	19-Sep-13*	24 months
E327	CBL6141A	Bi-log Antenna	Schaffner	01-May-12	24 months
E342	8563E	Spectrum Analyser 26.5 GHz	HP	28-May-13	24 months
E397	6960B	RF Power Meter	Marconi Instruments	31-Jul-13*	24 months
E428	HF906	1-18 GHz Horn Antenna	Rhode & Schwarz	25-Nov-11	36 months
E433	MG3693A	Signal Generator 30GHz	Anritsu	20-Apr-12	24 months
E451	HP 8596E	Spectrum Analyzer 9 kHz - 12.8 GHz	HP	25-Jun-13	24 months
L264	DT75	Digital Thermometer	Instrotech Ltd	20-Sep-12	24 months
P266	9480	Distribution System	Racal Instruments Ltd	03-Jan-12	12 months
TMS48	8901B	Modulation Analyser	Hewlett Packard	20-Mar-12	24 months
TMS55	8903B	Audio Analyser	Hewlett Packard	19-Mar-12	24 months
TMS80	206-3722	Digital Thermometer & K Probe	RS Components Ltd	31-Oct-13*	12 months
TMS814	MP627A	Doublet Antenna 200-1700 MHz	Anritsu Electric Co Ltd	29-Oct-13*	12 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	26-Nov-13*	12 months

*The equipment listed above was 'in calibration' at the time of test. The equipment has since been recalibrated prior to the generation of this report.

10 Auxiliary equipment

10.1 Customer supplied Equipment

No customer supplied equipment was used.

10.2 Supplied by RN Electronics Limited

No Auxiliary equipment was used.

11 Modifications

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

11.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

11.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

12 Compliance information

Products subject to the Declaration of Conformity procedure are required to be supplied with a compliance information statement. A copy of this statement may be included here:

Certified equipment - DoC not required.

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 (AC power line conducted Emissions) VCCI Registration No. C-2823
Site G	Screened Room (Control Room for Site H)
Site H	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 823977
Site J	Screened Room
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
		max	maximum
AM	Amplitude Modulation	kPa	milliBars
Amb	Ambient	MHz	MegaHertz
ANSI	American National Standards Institute	min	minimum
		mm	milliMetres
ºC	Degrees Celsius	ms	milliSeconds
CFR	Code of Federal Regulations	mW	milliWatts
		NA	Not Applicable
CS	Channel Spacing	nom	Nominal
CW	Continuous Wave	nW	nanoWatt
dB	deciBels	OATS	Open Area Test Site
dBµV	deciBels relative to 1µV	OFDM	Orthogonal Frequency Division Multiplexing
dBc	deciBels relative to Carrier		
dBm	deciBels relative to 1mW	ppm	Parts per million
DC	Direct Current	QAM	Quadrature Amplitude Modulation
EIRP	Equivalent Isotropic Radiated Power	QPSK	Quadrature Phase Shift Keying
ERP	Effective Radiated Power		
EUT	Equipment Under Test	Ref	Reference
FCC	Federal Communications Commission	RF	Radio Frequency
		RTP	Room Temperature and Pressure
FM	Frequency Modulation		
FSK	Frequency Shift Keying	s	Seconds
g	Grams	Tx	Transmitter
GHz	GigaHertz	V	Volts