



FCC 47CFR part 15C Test Report For Site Monitoring Unit SMU4

Reference Standard: FCC 47CFR part 15C
Manufacturer: Serco Geografix Ltd
For type of equipment and serial number, refer to section 3
Report Number: 11-7048-4-13 Issue 03
Supersedes report: 11-7048-4-13 Issue 02
Report Produced by: -

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Certificate of Test 7048-4

The unit noted below has been tested by **R.N. Electronics Limited** and, where appropriate, conforms to the relevant subpart of FCC 47CFR Part 15. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	Site Monitoring Unit
Model Number:	SMU4
Proposed FCC ID:	QYM-SMU4
Unique Serial Number:	50039
Manufacturer:	Serco Geografix Ltd Hurricane Way Norwich Norfolk NR6 6EW
Full measurement results are detailed in Report Number:	11-7048-4-13 Issue 03
Test Standards:	FCC 47CFR Part 15.249 effective date October 1st 2012 , Class DXX Intentional Radiator

DEVIATIONS:

Deviations from the standards have been applied; please section 4.1 within this report.

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: 8th August 2013 - 29th November 2013

Test Engineer:

Approved By:
Managing Director

Customer Representative:

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2 Equipment Under Test (EUT)

2.1 Equipment Specification

Applicant	Serco Geografix Ltd Hurricane Way Norwich Norfolk NR6 6EW	
Manufacturer of EUT	Serco Geografix Ltd	
Brand name of EUT	Site Monitoring Unit	
Model Number of EUT	SMU4	
Serial Number of EUT	50039	
Date when equipment was received by RN Electronics	8th July 2013	
Date of test:	8th August 2013 - 29th November 2013	
Visual description of EUT:	A plastic enclosure with membrane type push-buttons on the upper side. A front facing LCD display provides the user with information. A telephone style handset is located in a cradle on the upper side of the EUT. A PSTN cable assembly allows the unit to be connected to a telephone network. A DC socket is provided to power the unit, and to charge the internal backup battery. A mains charger is provided.	
Main function of the EUT:	The equipment is part of an 'Offender Monitoring System'. The unit receives status messages from 'offender tags' and reports any absence of the offender to a central computer system.	
Height	80 mm	
Width	250 mm	
Depth	190 mm	
Weight	1.25	
Voltage	6V - 10V	
Current required from above voltage source	17mA - 250mA depending on mode	
EUT supplied PSU:	Manufacturer	V-Infinity
	Model number	EPSA060200U
	Input voltage	100 – 240 AC 50/60Hz
	Input current	0.4A
	Output Voltage	+6VDC
	Output Current	2 AMP

2.2 EUT Configurations for testing

General parameters	
EUT Normal use position	On top of any suitable flat surface
Antenna details	2 x integral, 1 x integral for GSM
Antenna port	No
Baseband Data port (yes/no)?	Yes
Highest Signal generated in EUT	915.15 MHz
Lowest Signal generated in EUT	32.768 kHz
TX Parameters	
Alignment range – transmitter	902 - 928 MHz
EUT Declared Modulation Parameters	FSK 4800 baud
EUT Declared Power level	-15dBm
EUT Declared Signal Bandwidths	75kHz
EUT Declared Channel Spacing's	Single Channel only
EUT declared Duty Cycle	Not declared
Unmodulated carrier available?	Yes
Declared frequency stability	+/- 10 ppm
RX Parameters	
Alignment range – receiver	902 - 928 MHz
EUT Declared RX Signal Bandwidth	101.6 kHz

2.3 Functional Description

The EUT monitors Personal Identity Devices (PID's) and other related devices, by receiving status messages sent over a radio link at 915.15 MHz. If any unauthorised absences are detected, a central computer system is notified via GSM or PSTN communications networks. The unit is equipped with a handset for phone calls. The unit is powered via mains DC adaptor which also charges the internal battery. An internally-accessible USB socket is provided for debugging and testing purposes only. The settings of the EUT can be modified over the radio link using a dedicated remote control (MID2). The unit contains two separate radios, which for the purposes of testing can be enabled individually.

2.4 EUT Modes

Mode Reference	Description	Used for testing
TX 1	Transmitting continuously (Radio 1)	Yes
TX 2	Transmitting continuously (Radio 2)	Yes

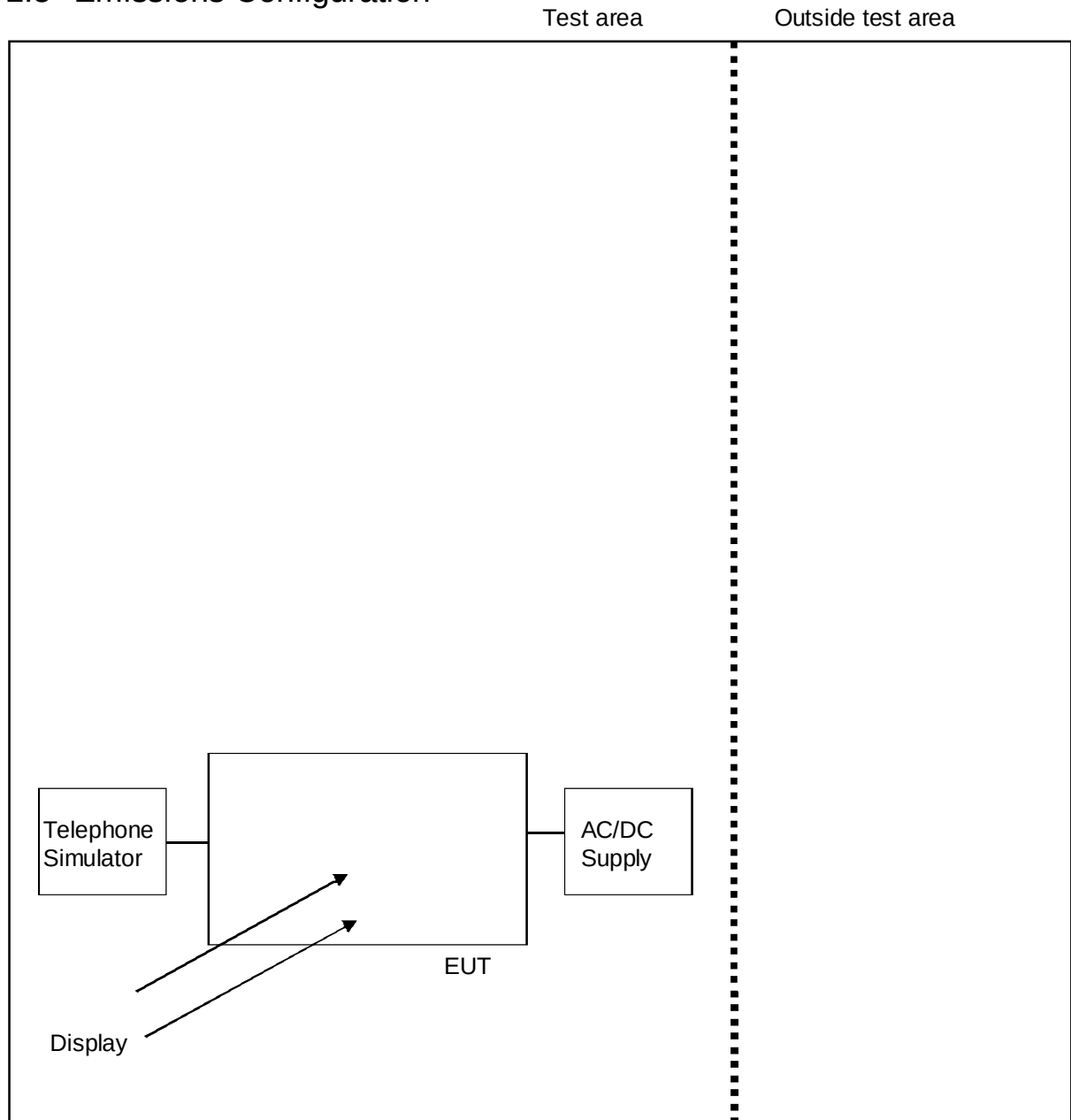
Note: During both the modes above the GSM module was in operation

Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 11.

Any modifications made to the EUT, whilst under test, can be found in Section 12.

This report was printed on: 06 August 2014

2.5 Emissions Configuration



The unit was powered from the dedicated AC/DC adapter. The unit was configured with engineering software to allow permanent transmit on 915.15 MHz. The transmit mode was 100% continuous with FSK modulation. The power level was set to -15dBm by the manufacturer.

For radiated emissions tests the unit was connected to a telephone simulator. The simulator and the AC/DC adapter were placed on to the test table, along with the main enclosure of the EUT.

3 Summary of test results

The **Site Monitoring Unit SMU4** was tested to the following standards: -

FCC 47CFR Part 15.249 (effective date October 1st, 2012); Class DXX Intentional Radiator

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. AC power line conducted emissions	ANSI C63.10 §6.2.	PASSED
2. Intentional radiator field strength	ANSI C63.10 §6.10.	PASSED
3. Radiated emissions	ANSI C63.10 §6.4 – 6.6.	PASSED
4. Frequency stability	ANSI C63.10 §6.8.	NOT APPLICABLE ¹
5. Occupied bandwidth	ANSI C63.10 §6.9.	PASSED
6. Band Edge		PASSED
7. Duty cycle	ANSI C63.10 §7.5.	NOT APPLICABLE ²

¹ EUT is not for fixed, point-to-point operation, therefore no limits are specified.

² No limits apply, however duty cycle check made to verify 100% constant TX modes being used.

4 Specifications

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, ANSI C63.10-2009, FCC Part 15 and those specifications incorporated by reference into 47CFR15 (e.g. ANSI C63.4-2003).

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

4.1 Deviations

ANSI C63-10-2009 deviations:

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

FCC Part 15 deviations:

None.

4.2 Tests at Extremes of Temperature & Voltage

Not required.

4.3 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
Occupied bandwidth	$\pm 1.9 \%$
Radiated RF power	$\pm 3.5 \text{ dB}$
Radiated spurious emissions	30MHz - 1000MHz $\pm 5.1 \text{ dB}$
	1000MHz - 2000MHz $\pm 4.5 \text{ dB}$
	1 – 18 GHz $\pm 3.5 \text{ dB}$
AC line conducted emissions	(For LISN) 150kHz to 30MHz $\pm 3.6 \text{ dB}$

5 Tests, Methods and Results

5.1 AC power line conducted emissions

5.1.1 Test Methods

Test Requirements
Test Method:

FCC Part 15C, Reference (15.207)
ANSI C63.10, Reference (6.2.)

5.1.2 Configuration of EUT

The EUT was placed on a wooden table 0.8m above the ground plane and the dedicated power supply was connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test is listed in section 11.

The EUT was operated in mode TX 2 (radio 2), which was found to be the 'worst case' operating mode.

5.1.3 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted in the 'Test Equipment' section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.
At least 6 signals within 20dB and/or all signals within 10dB of the limit were investigated.

Tests were performed in Test Site F.

5.1.4 Test Equipment used

E150, E035, E410, E411, E412, N439

See Section 10 for more details.

5.1.5 Test results

Ambient conditions.
Temperature: 26 °C Relative humidity: 46 %

Analyser plots for the Quasi-Peak / Average values as applicable can be found in Section 6.1 of this report.

Table of signals measured.

Quasi-Peak and Average Live (DC Power port)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.239	48.5	43.2	-18.9	32.6	-19.5
2	0.318	39.6	29.5	-30.3	27.3	-22.5
3	0.349	36.8	33.1	-25.9	23.7	-25.3
4	0.623	43.5	41.4	-14.6	35.4	-10.6
5	0.676	46.1	44.0	-12.0	37.8	-8.2
6	0.676	46.4	43.8	-12.2	37.9	-8.1
7	8.036	52.6	48.6	-11.4	39.7	-10.3
8	8.130	53.7	48.2	-11.8	39.9	-10.1
9	8.374	54.3	49.3	-10.7	41.1	-8.9
10	8.508	53.9	48.2	-11.8	40.6	-9.4
11	9.703	52.9	49.6	-10.4	41.9	-8.1
12	9.813	52.9	48.9	-11.1	42.5	-7.5

Table of signals measured.

Quasi-Peak and Average Neutral (DC Power port)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.198	53.4	51.2	-12.5	39.6	-14.1
2	0.248	49.1	44.6	-17.2	33.8	-18.0
3	0.277	39.1	34.2	-26.7	24.7	-26.2
4	0.471	44.1	40.8	-15.7	34.3	-12.2
5	0.747	50.6	47.3	-8.7	40.9	-5.1
6	0.878	46.0	43.1	-12.9	36.8	-9.2
7	7.861	51.7	47.1	-12.9	40.3	-9.7
8	8.033	53.7	49.1	-10.9	40.0	-10.0
9	8.314	52.9	48.7	-11.3	41.0	-9.0
10	8.713	53.2	49.8	-10.2	42.0	-8.0
11	9.658	53.9	49.5	-10.5	41.8	-8.2
12	9.950	52.7	48.9	-11.1	41.0	-9.0

Plot reference tables

Frequency range	Plot reference
150kHz to 30MHz	7048-1 Cond 1 AC Live 150k-30M Average
150kHz to 30MHz	7048-1 Cond 1 AC Live 150k-30M Quasi-Peak
150kHz to 30MHz	7048-1 Cond 1 AC Neutral 150k-30M Average
150kHz to 30MHz	7048-1 Cond 1 AC Neutral 150k-30M Quasi-Peak

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

5.2 Intentional radiator field strength

5.2.1 Test Methods

Test Requirements
Test Method:

FCC Part 15C, Reference (15.249 a)
ANSI C63.10, Reference (6.3 / 6.5)

5.2.2 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 rotated in all three orthogonal planes to maximise emissions. Final measurements were taken at 3m. The EUT was operated in TX 1 and TX 2 modes for this test.

5.2.3 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in an OATS. This site is listed with the FCC.

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

Tests were performed using Test Site OATS.

5.2.4 Test Equipment used

TMS903, E226, N439

See Section 10 for more details

5.2.5 Test results

Ambient conditions.

Temperature: 24°C

Relative humidity: 50 %

Pressure: 102 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	-15dBm
Channel spacing	n/a
Mod scheme	FSK
TX1	915.15 MHz (Radio 1)
TX2	915.15 MHz (Radio 2)

Duty Cycle Table relating to Radio Parameters 1

	Low	High
Duty Cycle (%)	100	100
Duty Cycle correction	0	0

Results relating to Radio Parameters 1

	Low	High
QP Level (dBµV/m)	88	86.1
Plot reference	J7048-1 ERP plot (Horiz antenna, EUT Back down	J7048-1 ERP plot (Horiz antenna, EUT Back down

File name SERCO.7048-4 ISS 03.DOCX

The contents of this report, apart from the referenced ANSI C63.4-2003, are beyond the scope of UKAS Testing Laboratory No. 2360 accreditation.

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	Radio 1	Radio 2
Antenna Polarisation	Horiz	Horiz
EUT Polarisation	Back Down	Back Down

Any Analyser plots can be found in Section 6.2 of this report.

LIMITS:

15.249(a) 50 mV/m @ 3m (94 dBµV/m @ 3m).

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

5.3 Radiated emissions

5.3.1 Test Methods

Test Requirements:
Test Method:

FCC Part 15C, Reference (15.209)
ANSI C63.10, Reference (6.4 – 6.6.)

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. The unit was powered from the dedicated AC/DC adapter. The unit was configured with engineering software to allow permanent transmit on 915.15 MHz. The transmit mode was 100% continuous with modulation, and the power level was set to -15dBm as per the manufacturer. The unit was connected to a telephone simulator. The simulator and the AC/DC adapter were placed on to the test table along with the main enclosure of the EUT.

The EUT was operated in both TX 1 and TX 2 modes.

5.3.3 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

30MHz - 1GHz, pre-scans were made in a semi anechoic chamber, followed by final measurements on a site registered with the FCC. 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.

Tests were performed using Test Site M, B and OATS.

5.3.4 Test Equipment used

TMS82, TMS933, E410, E411, E412, E428, E533, E534, E535, N439

See Section 10 for more details

5.3.5 Test results

Ambient conditions:

Temperature: 23-25 °C Relative humidity: 50-59 %

Analysers plots for the Quasi-Peak / Average values as applicable can be found in Section 6.3 of this report.

Note: EUT tested in a continuous transmit mode for ease of test

5.3.5.1 30MHz - 1GHz.

Plot references for Radiated emissions measurements (30-1000MHz)

Frequency Range	Antenna Polarisation	Plot reference
30 – 300 MHz	Horizontal	7048-1 Rad 1 VHF Horiz
30 – 300 MHz	Vertical	7048-1 Rad 1 VHF Vert
300 – 1000 MHz	Horizontal	7048-1 Rad 1 UHF Horiz
300 – 1000 MHz	Vertical	7048-1 Rad 1 UHF Vert
30 – 300 MHz	Horizontal	7048-1 Rad 2 VHF Horiz
30 – 300 MHz	Vertical	7048-1 Rad 2 VHF Vert
300 – 1000 MHz	Horizontal	7048-1 Rad 2 UHF Horiz
300 – 1000 MHz	Vertical	7048-1 Rad 2 UHF Vert

Table of signals measured

Horizontal top six signals TX1 Radio 1

Frequency	QP(dBµV/m)	Difference to QP Limit (dB)	Peak (dBµV/m)
50.300	11.5	-28.5	25.3
65.540	26.0	-14.0	30.4
77.000	24.7	-15.3	29.1
152.000	25.1	-18.4	28.5
170.600	13.1	-30.4	21.0
285.200	16.2	-27.3	23.1

Vertical top six signals TX1 Radio 1

Frequency	QP(dBµV/m)	Difference to QP Limit (dB)	Peak (dBµV/m)
54.010	34.8	-5.2	37.5
65.560	37.7	-2.3	40.8
164.300	32.0	-11.5	36.5
179.900	27.6	-16.9	30.5

Horizontal top six signals TX2 Radio 2

Frequency	QP(dBµV/m)	Difference to QP Limit (dB)	Peak (dBµV/m)
85.181	13.9	-26.1	18.8
152.000	28.0	-15.5	30.6
197.994	20.0	-23.5	25.1
285.613	23.6	-22.4	27.8
303.420	16.8	-29.2	23.5

Vertical top six signals TX2 Radio 2

Frequency	QP(dBμV/m)	Difference to QP Limit (dB)	Peak (dBμV/m)
30.720	26.8	-13.2	32.4
46.430	27.3	-12.7	32.8
48.010	31.7	-8.3	35.0
65.547	37.4	-2.6	40.2
67.950	24.1	-15.9	29.4
158.000	29.0	-14.5	31.5

5.3.5.2 Above 1GHz.

Band	902-928 MHz
Power level	-15dBm
Channel spacing	NA Single Channel
Mod scheme	FSK
Bottom channel	915.15 MHz (radio 1)

Results relating to TX1 (Radio 1)

Spurious Frequency (MHz)	Measured Peak Level (dBμV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBμV/m)	Difference to Average Limit (dB)	Antenna Polarisation	EUT Polarisation
5490.9	46.22	-27.78	38.58	-15.42	Horizontal	End down

Band	902-928 MHz
Power level	-15dBm
Channel spacing	NA Single Channel
Mod scheme	FSK
Bottom channel	915.15 MHz (radio 2)

Results relating to TX2 (Radio 2)

Spurious Frequency (MHz)	Measured Peak Level (dBμV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBμV/m)	Difference to Average Limit (dB)	Antenna Polarisation	EUT Polarisation
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No emissions were observed within 20dB of limits over 1GHz for the TX2 (Radio 2)

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.

15.249(a) harmonics must not exceed 500 mV/m (54 dB μV/m @ 3m).

15.249(d) other emissions, outside the intentional band, must be attenuated by at least 50dB from the level of the fundamental / meet the general limits of 15.209.

n.b. the general limits of 15.209 are as drawn on the respective plots in section 6.3.

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

5.4 Frequency stability

NOT APPLICABLE: EUT is not for fixed, point-to-point operation, therefore no limits are specified.

5.5 Occupied bandwidth

5.5.1 Test Methods

Test Requirements:
Test Method:

FCC Part 15C, Reference (15.215)
ANSI C63.10, Reference (6.9)

5.5.2 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. The unit was powered from the dedicated AC/DC adapter. The unit was configured with engineering software to allow permanent transmit on 915.15 MHz. The transmit mode was 100% continuous with modulation, and the power level was set to -15dBm. The unit was connected to a telephone simulator. The simulator and the AC/DC adapter were placed on to the test table along with the main enclosure of the EUT. The EUT was operated in TX 1 and TX 2 modes.

5.5.3 Test Procedure

Tests were performed using Test Site OATS.

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 10kHz RBW, 30kHz VBW, auto sweep time and max hold settings were used for the 20dB bandwidth.

5.5.4 Test Equipment used

E226, TMS903, N439

See Section 10 for more details.

5.5.5 Test results

Ambient conditions.

Temperature: 24 °C

Relative humidity: 50 %

Pressure: 102 kPa

Analyser plots for the 20dB bandwidth can be found in Section 6.4 of this report.

Radio Parameter 1

Band	902-928 MHz
Power level	-15dBm
Channel spacing	n/a
Mod scheme	FSK
TX1	915.15 MHz Radio 1
TX2	915.15 MHz Radio 2

Results relating to Radio Parameters 1

	Radio 1	Radio 2
20dB BW (kHz)	102.4	99.86
Plot reference	J7048-1 20 dB BW plot (Horiz antenna, EUT back down) Radio 1	J7048-1 20 dB BW plot (Horiz antenna, EUT back down) Radio 2

LIMITS:

15.215(c) the 20dB bandwidth of the emission must be contained within the designated frequency band.

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

5.6 Band Edge

5.6.1 Test Methods

Test Requirements:	FCC Part 15C, Reference (15.215)
Test Method:	FCC Part 15C, Reference (15.215) ANSI C63.10-2009, Reference clause 6.9.3

5.6.2 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. The unit was powered from the dedicated AC/DC adapter. The unit was configured with engineering software to allow permanent transmit on 915.15 MHz. The transmit mode was 100% continuous with modulation, and the power level was set to -15dBm. The unit was connected to a telephone simulator. The simulator and the AC/DC adapter were placed on to the test table along with the main enclosure of the EUT. The EUT was operated in TX 1 and TX 2 modes.

5.6.3 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The emission from the EUT was maximised before taking the plots.

Tests were performed using Test Site M.

5.6.4 Test Equipment used

E410, E411, E412, TMS933

See Section 10 for more details.

5.6.5 Test results

Temperature: 23-25 °C Relative humidity: 50-59 %

Please refer to the UHF plots in section 6.3. & bandwidth plots shown in section 6.4.

LIMITS:

The restricted band edges closest to the EUT frequency of 902-928MHz are 614 & 960MHz.

The wanted emissions should remain within the designated frequency band.

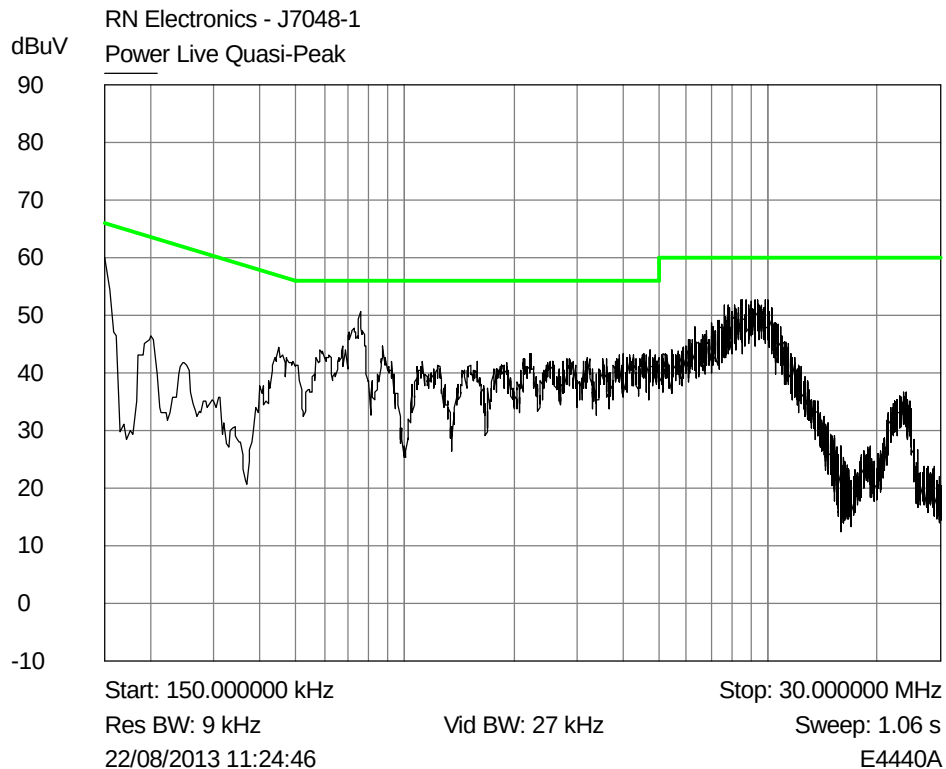
These results show that the EUT has **PASSED** this test.

5.7 Duty cycle

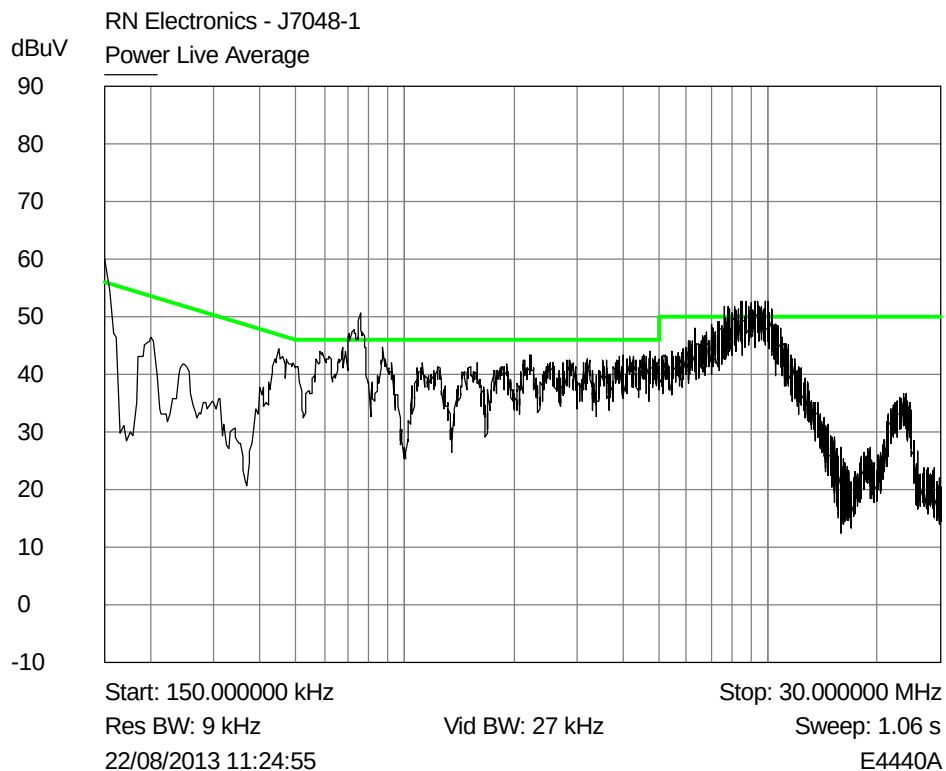
No limits apply, however duty cycle check made to verify 100% constant TX modes being used.

6 Plots and Results

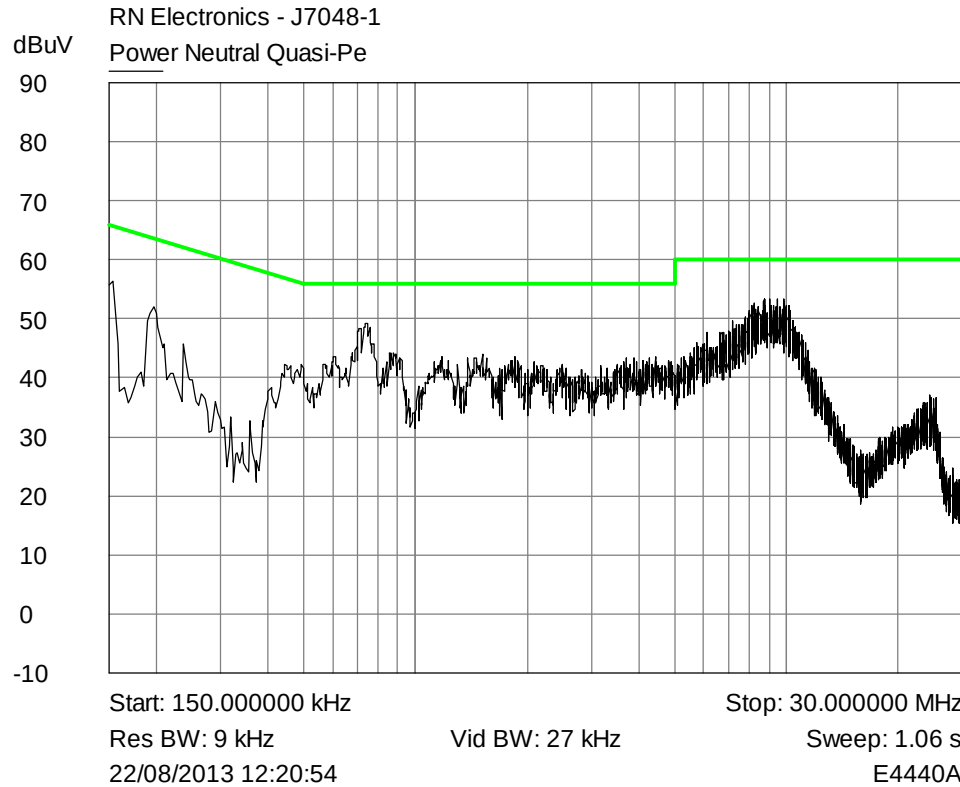
6.1 AC power line conducted emissions plots



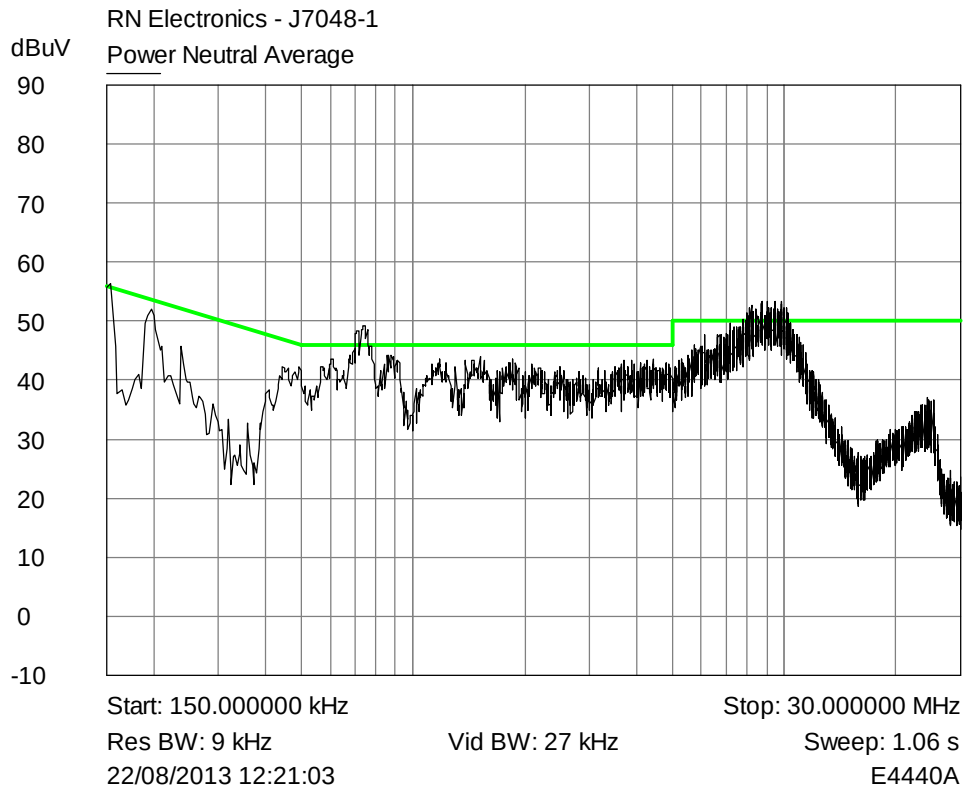
Plot of peak emissions 150kHz - 30MHz on the AC/DC Power port live terminal against the quasi-peak limit line.



Plot of peak emissions 150kHz - 30MHz on the AC/DC Power port live terminal against the average limit line.



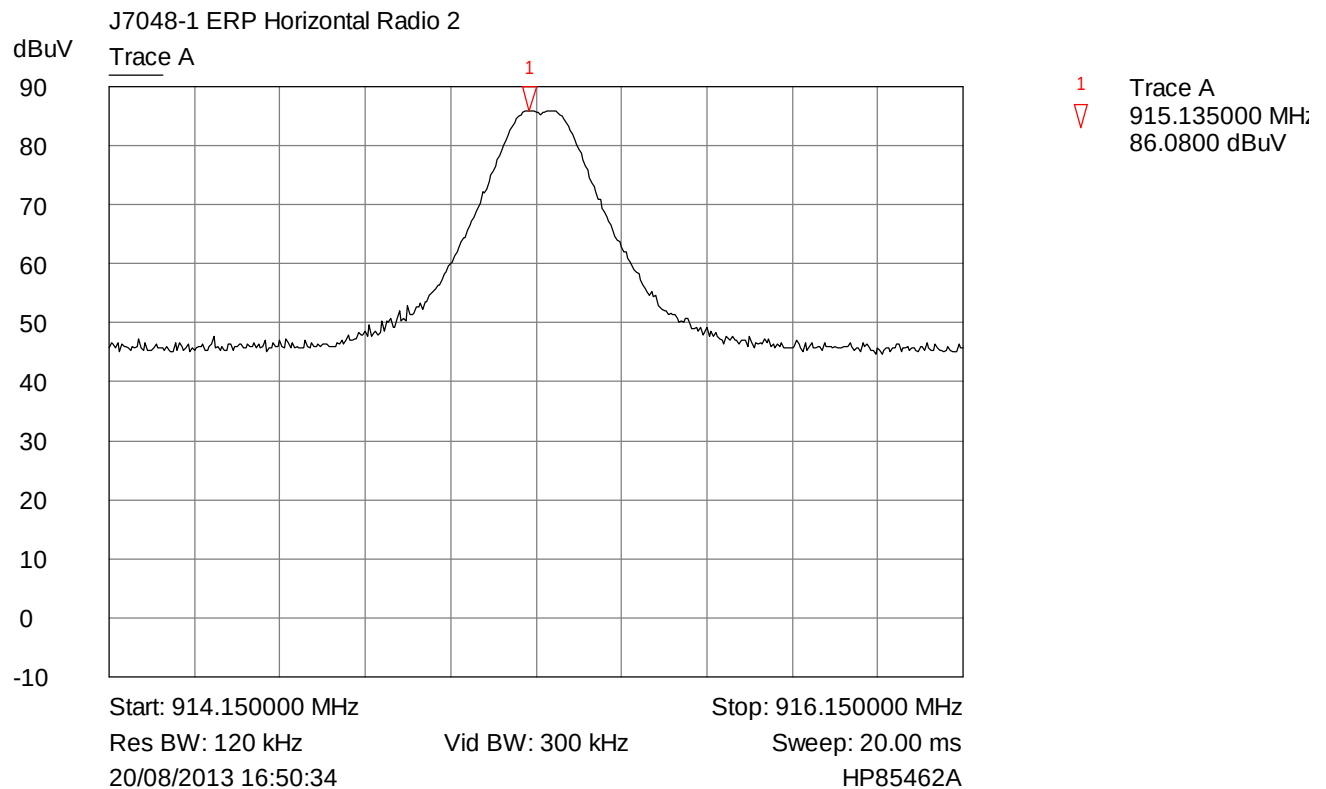
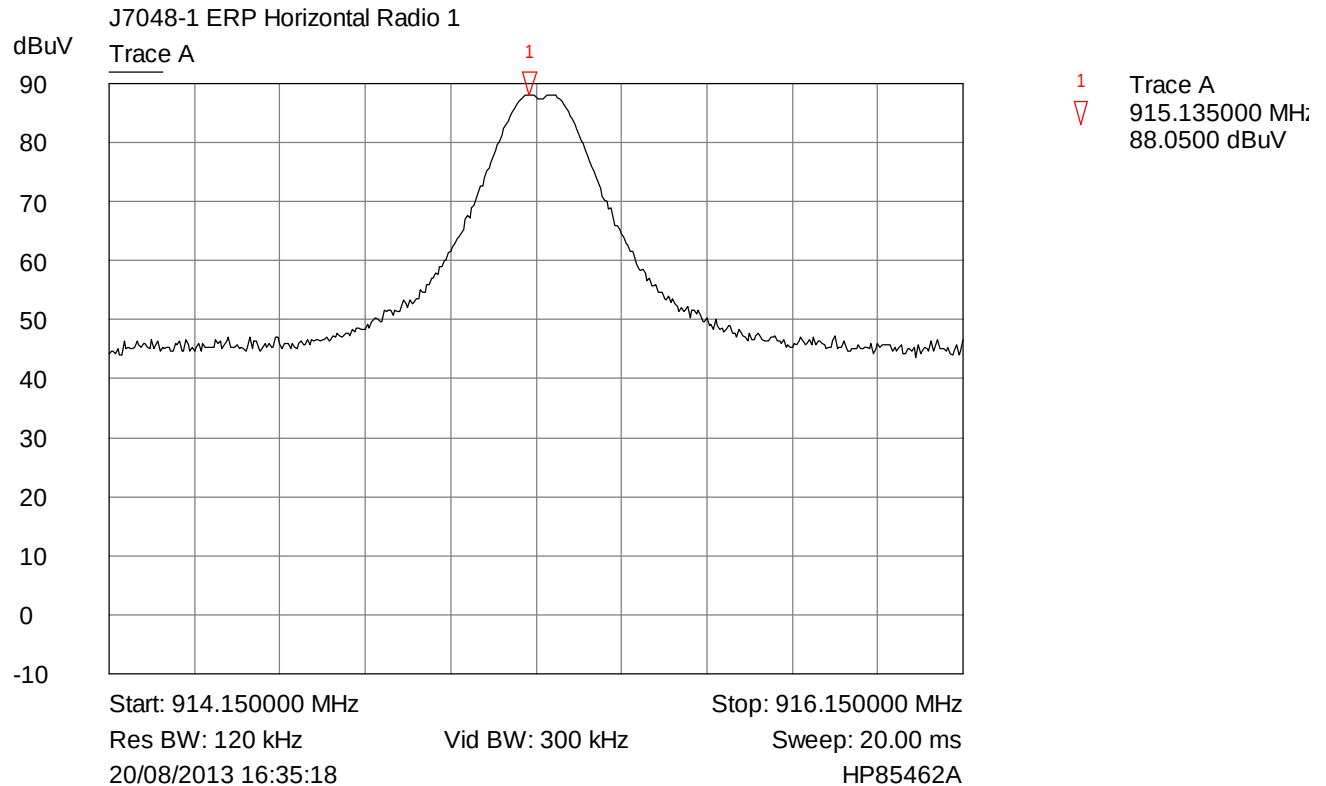
Plot of peak emissions 150kHz - 30MHz on the AC/DC Power port neutral terminal against the quasi-peak limit line.



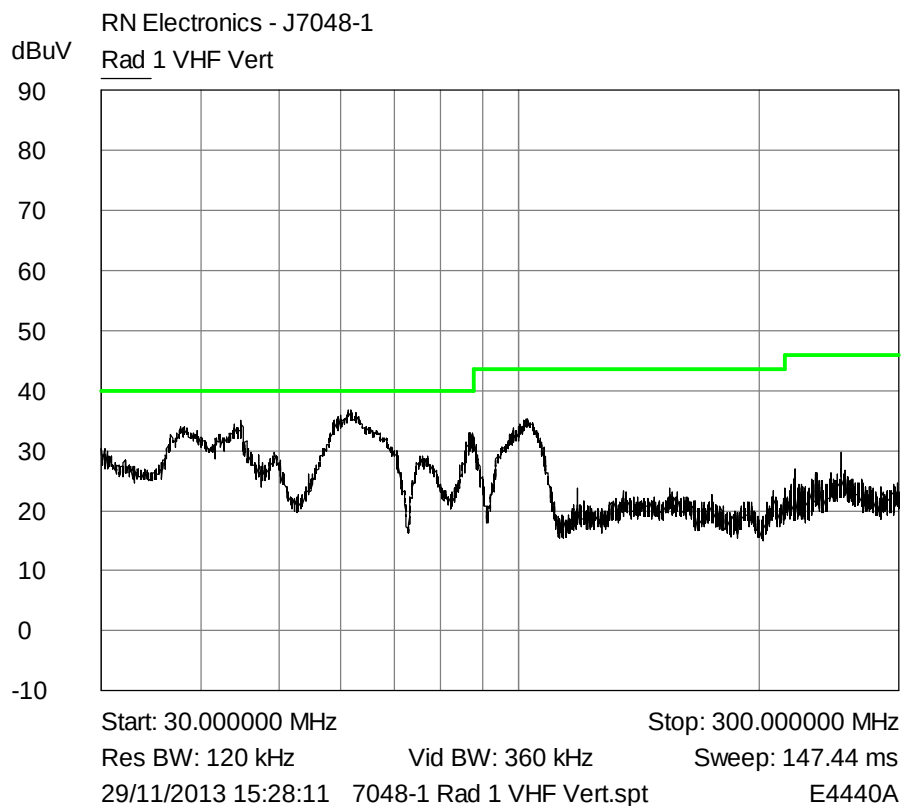
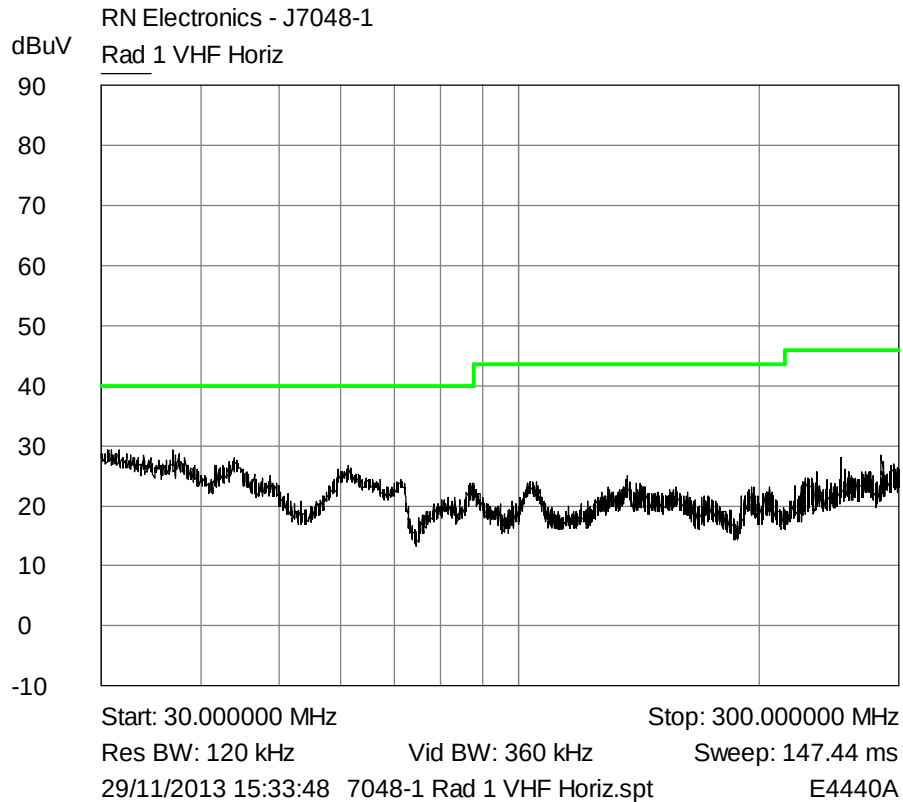
Plot of peak emissions 150kHz - 30MHz on the AC/DC Power port neutral terminal against the average limit line.

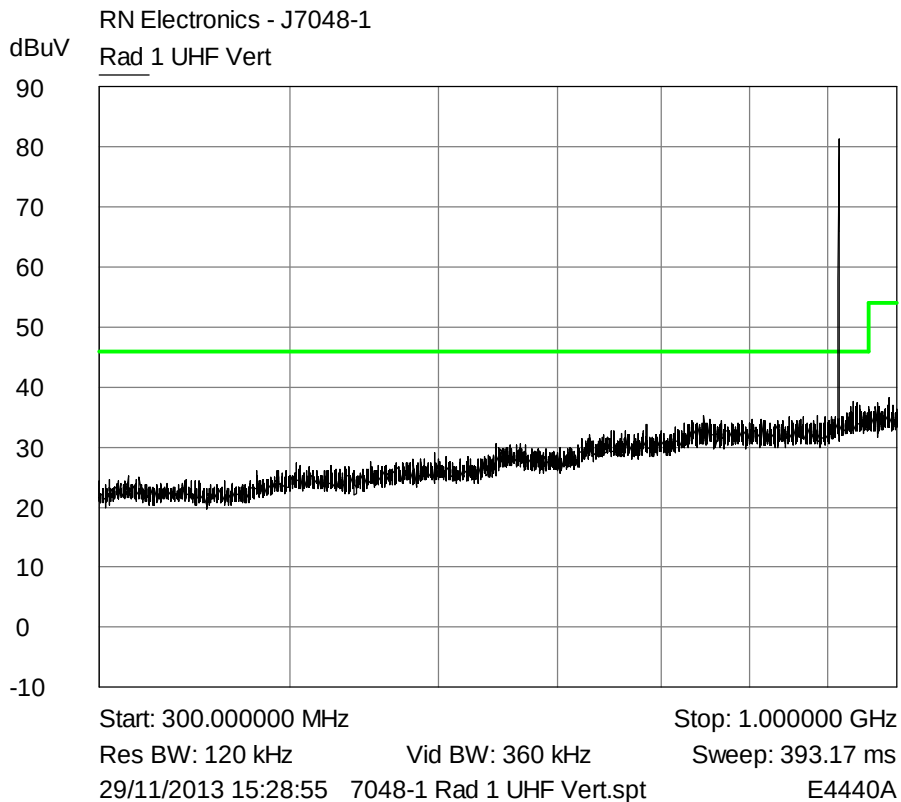
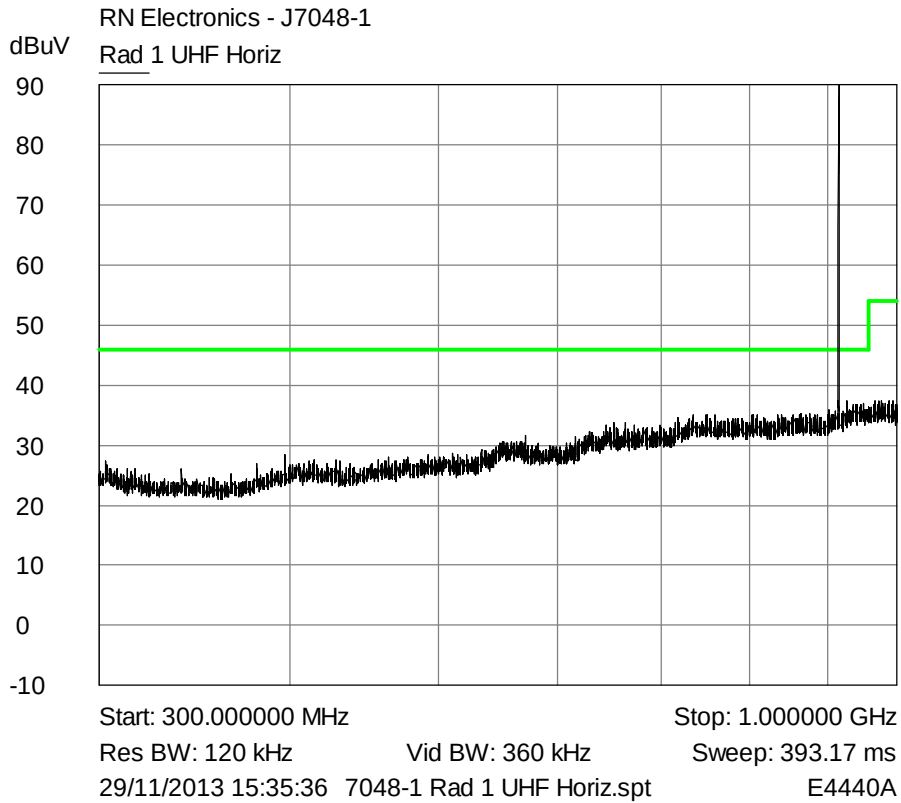
6.2 Intentional radiator field strength plots

6.2.1 Plots for Band 902-928 MHz, Power 7 dBm, single channel , and Modulation FSK

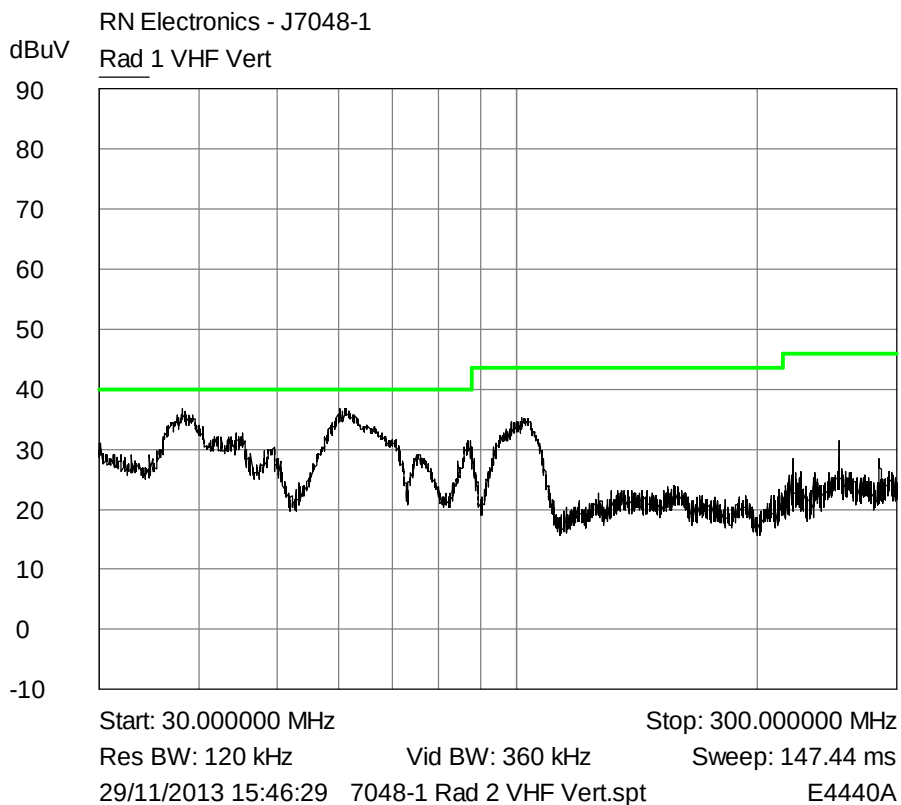
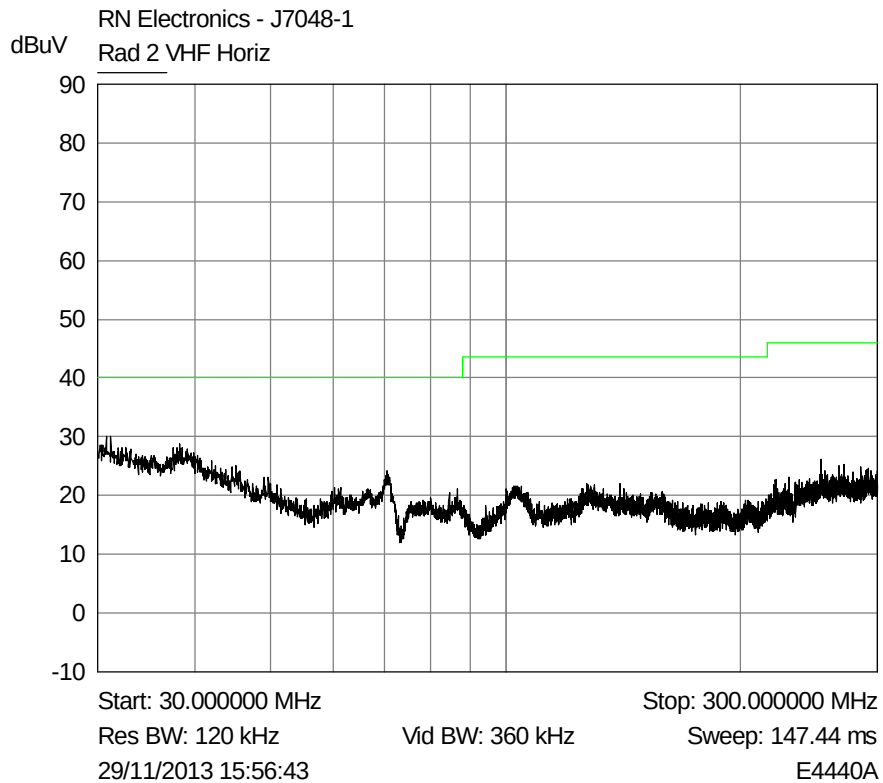


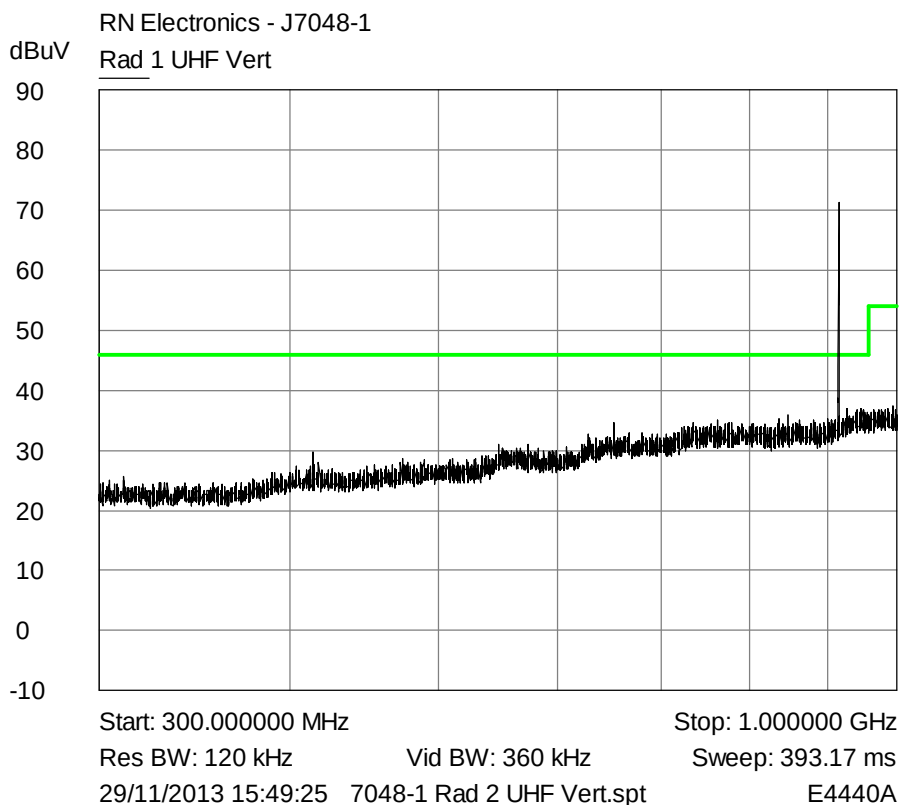
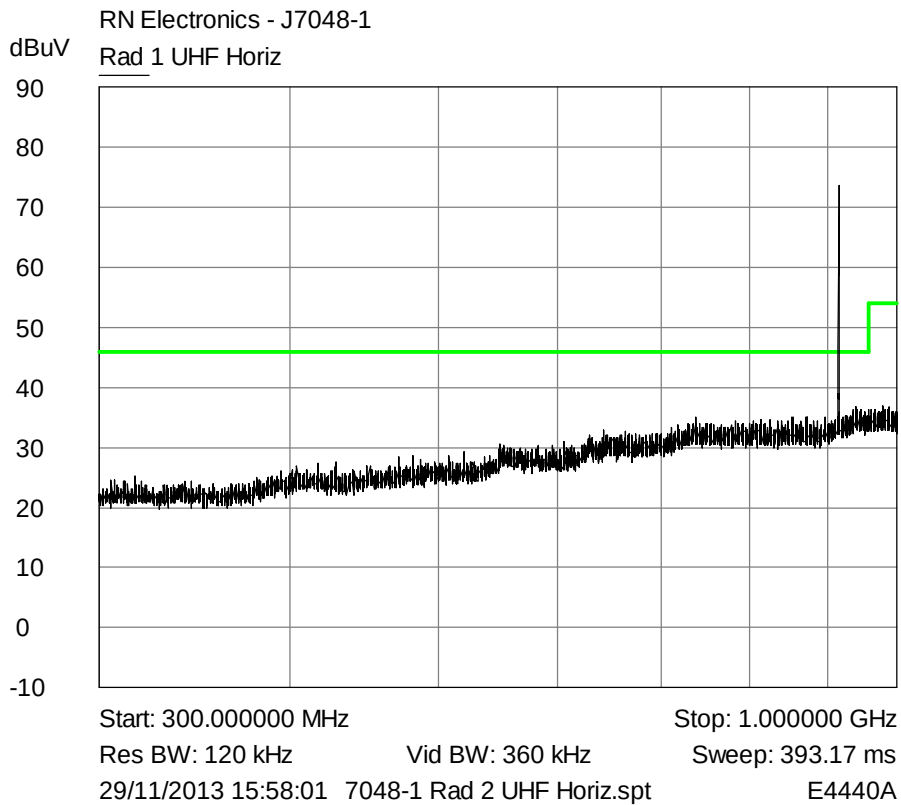
6.3 Radiated emissions plots



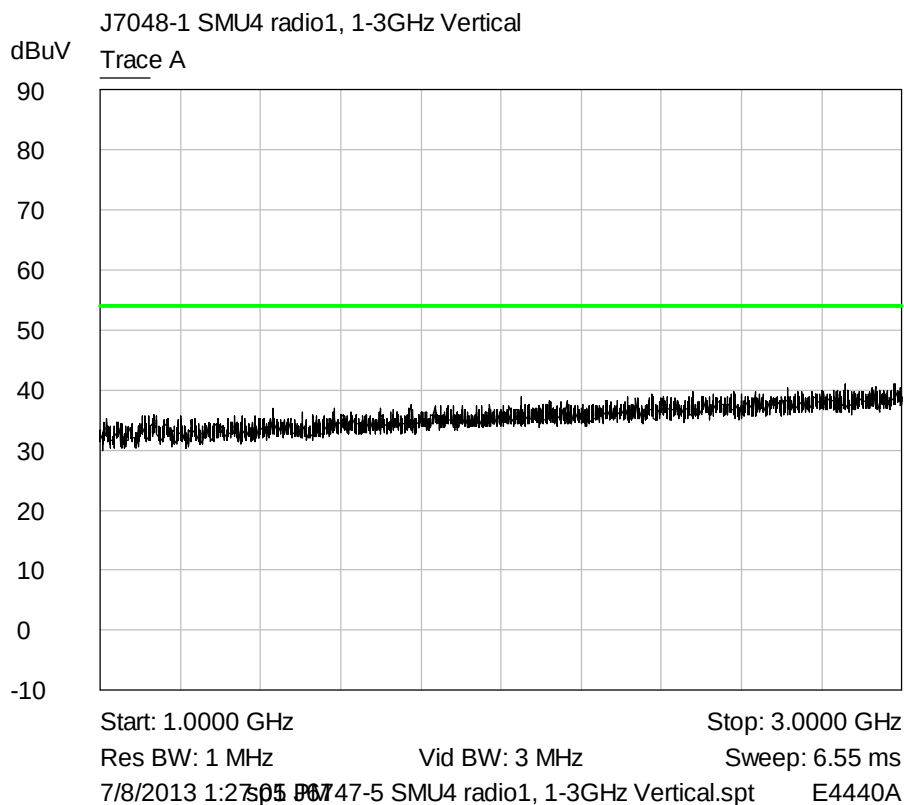
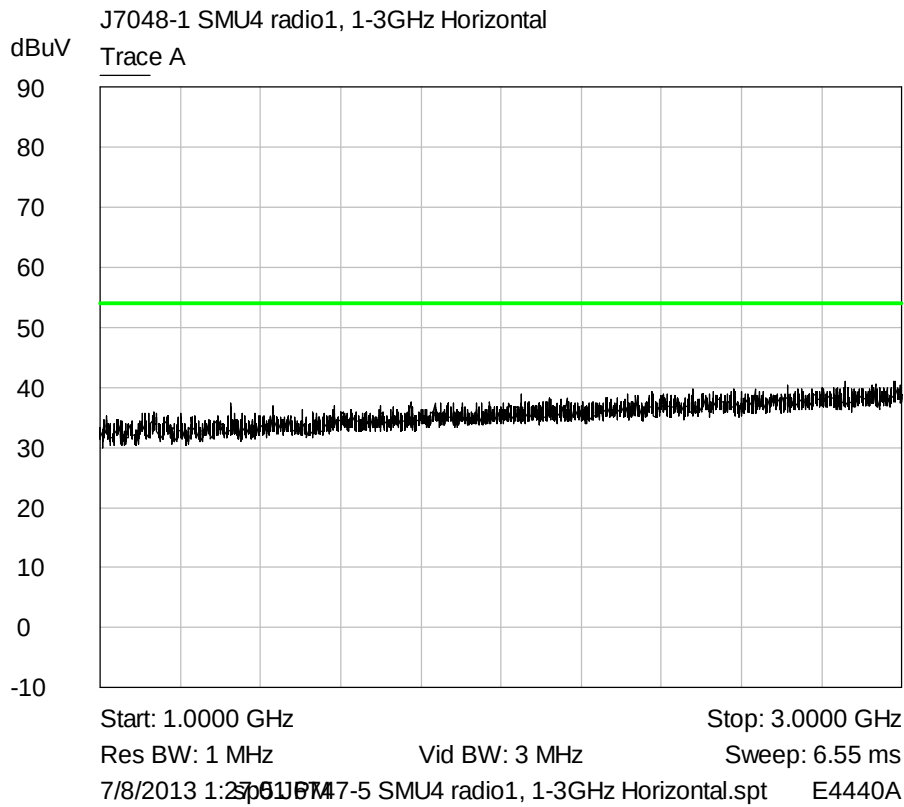


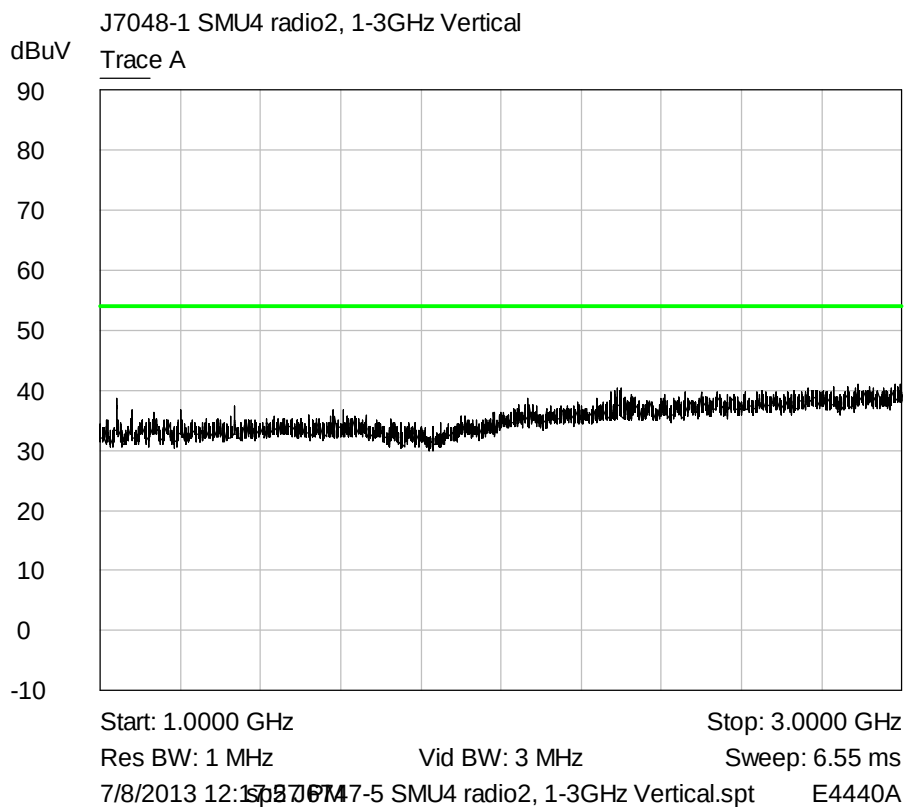
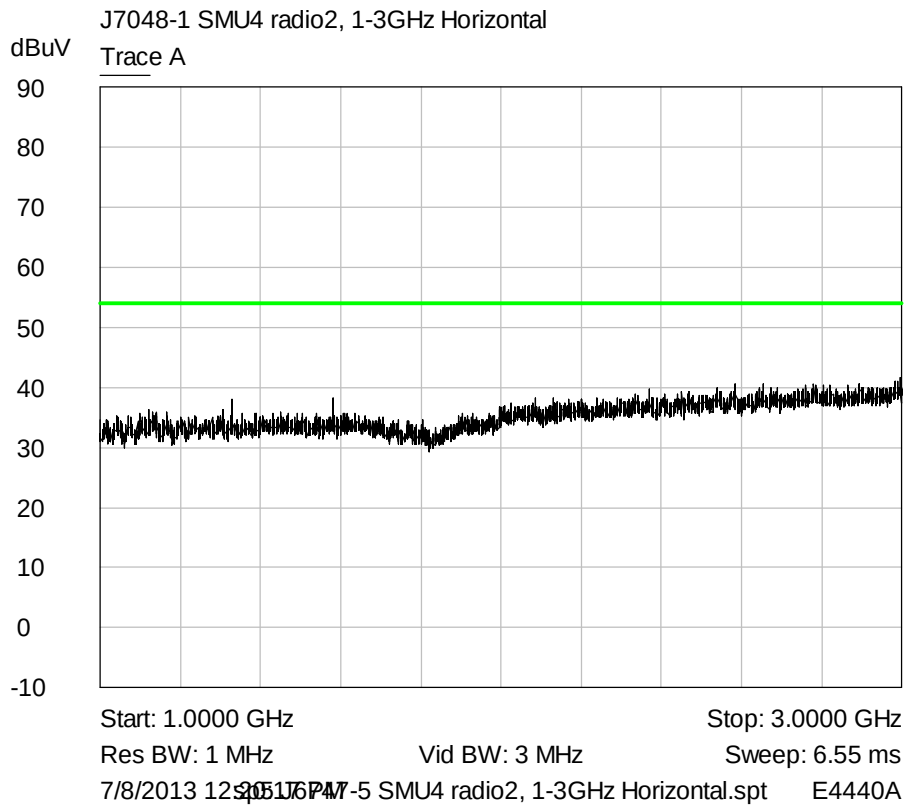
Note: The plots show the fundamental frequency at 915.15 MHz.

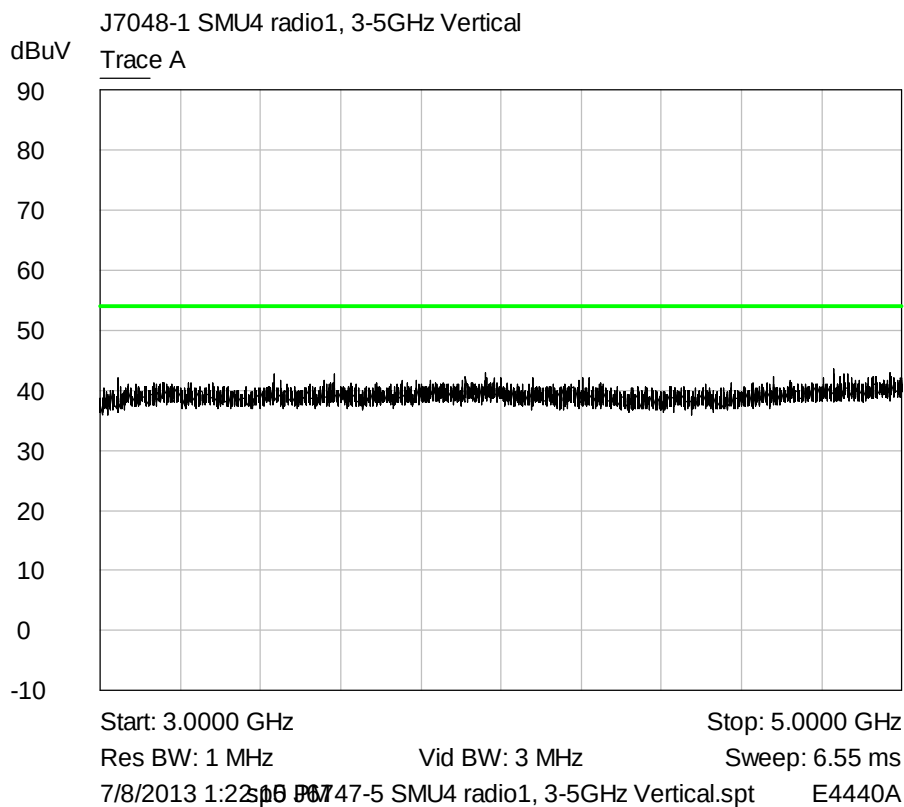
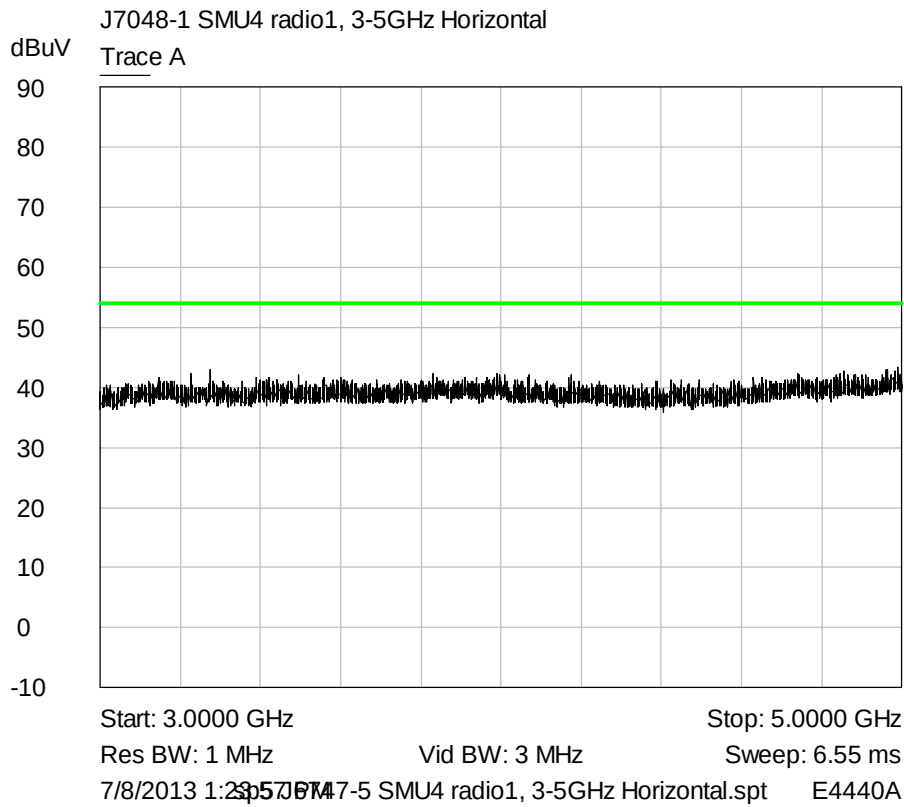


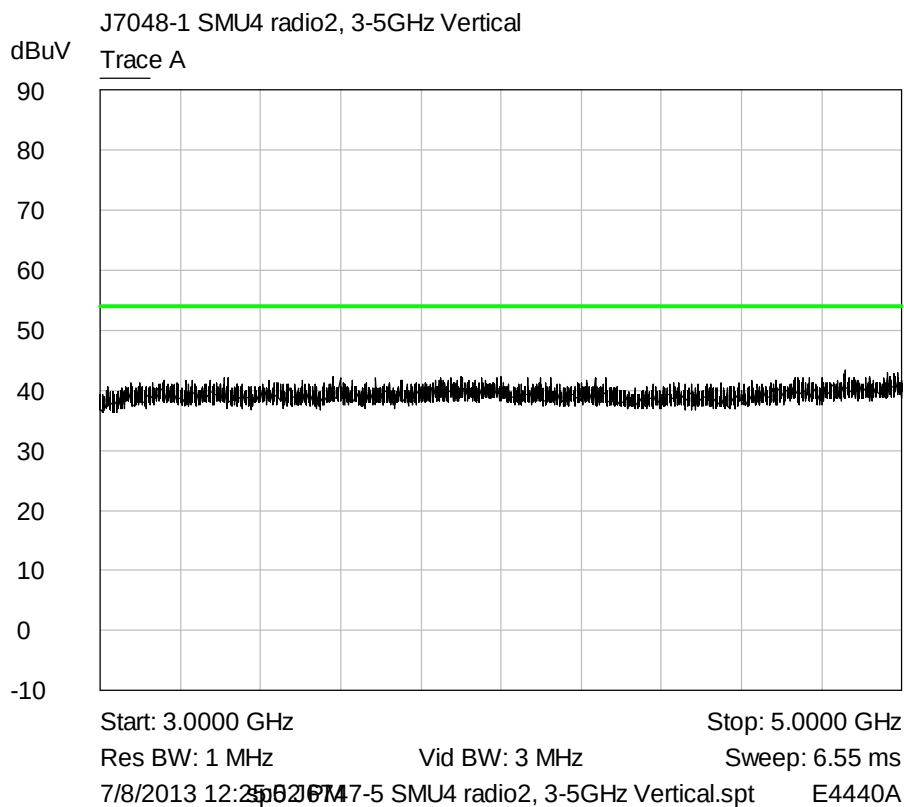
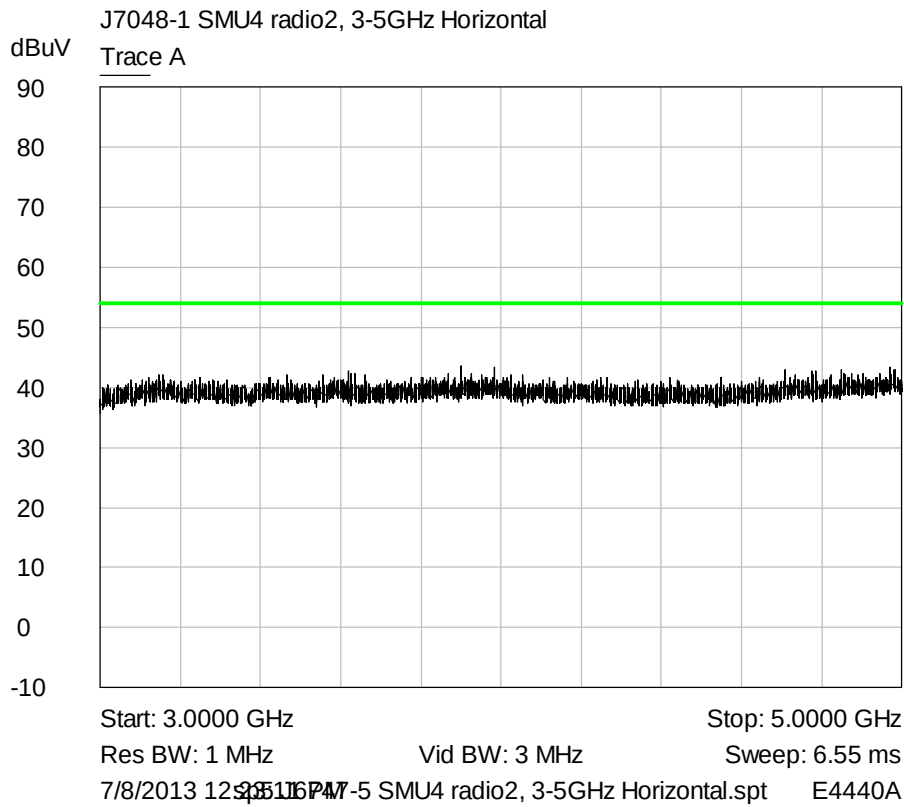


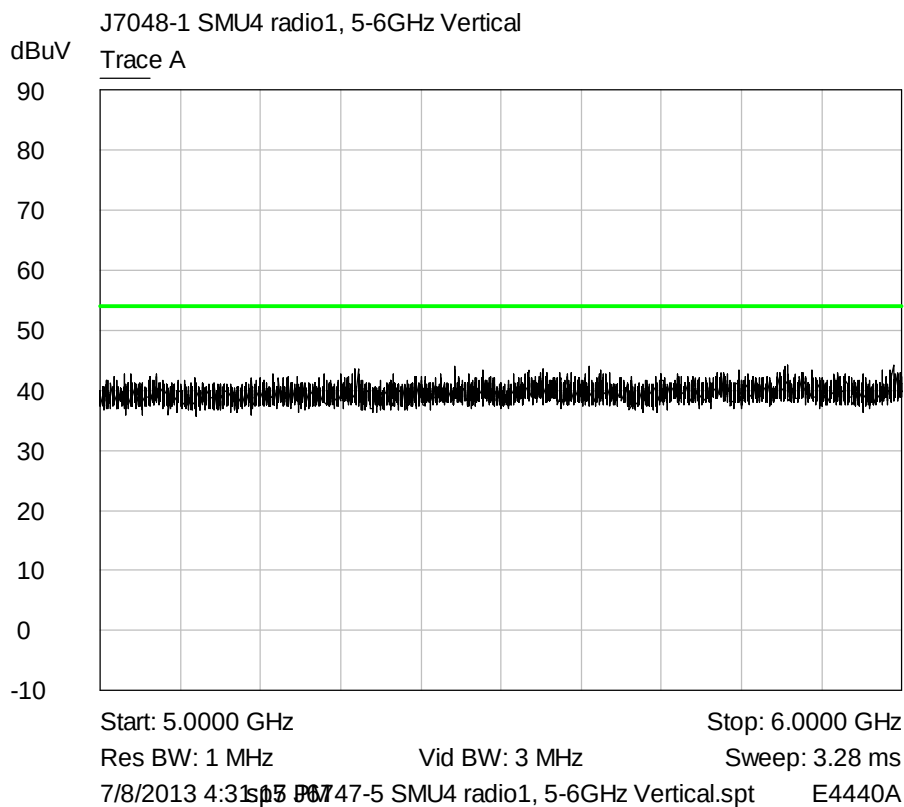
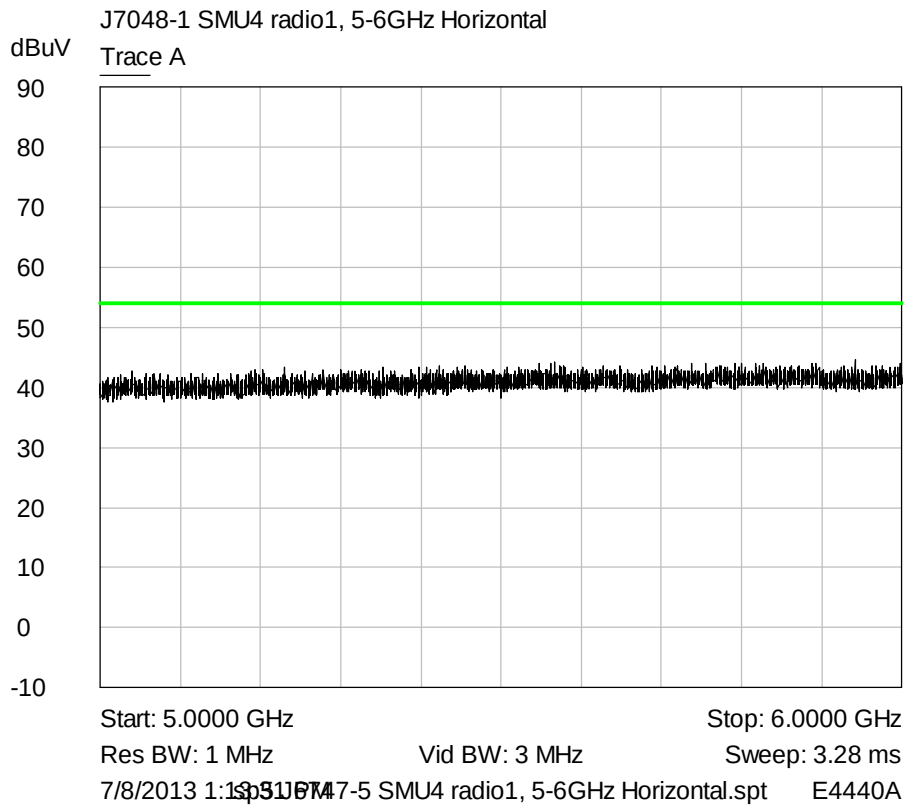
Note: The plots show the fundamental frequency at 915.15 MHz.

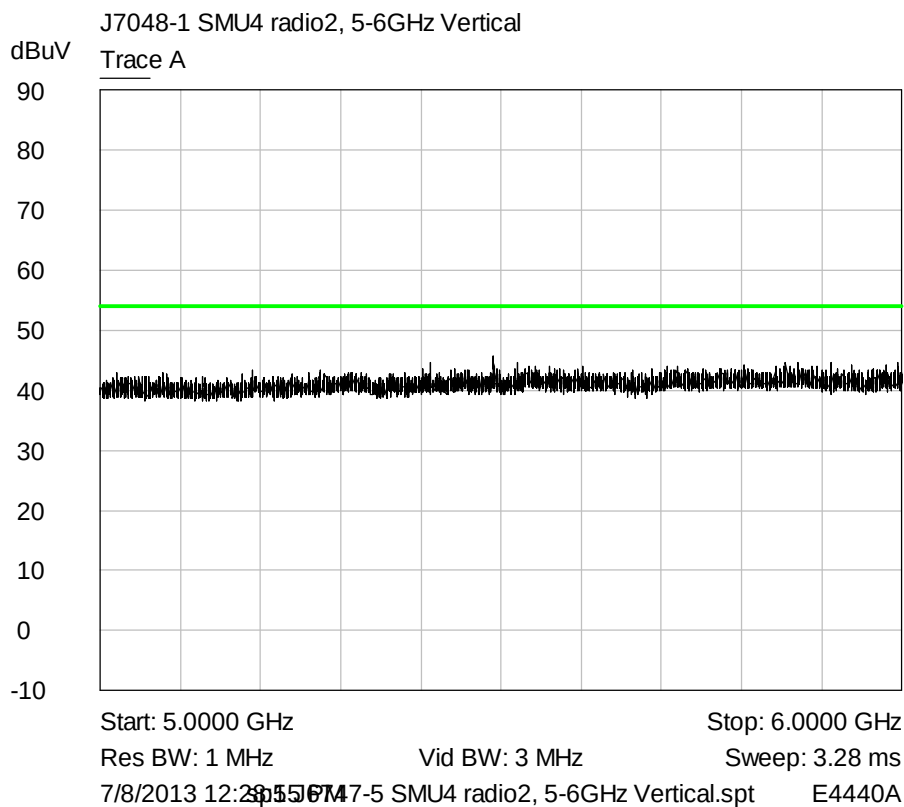
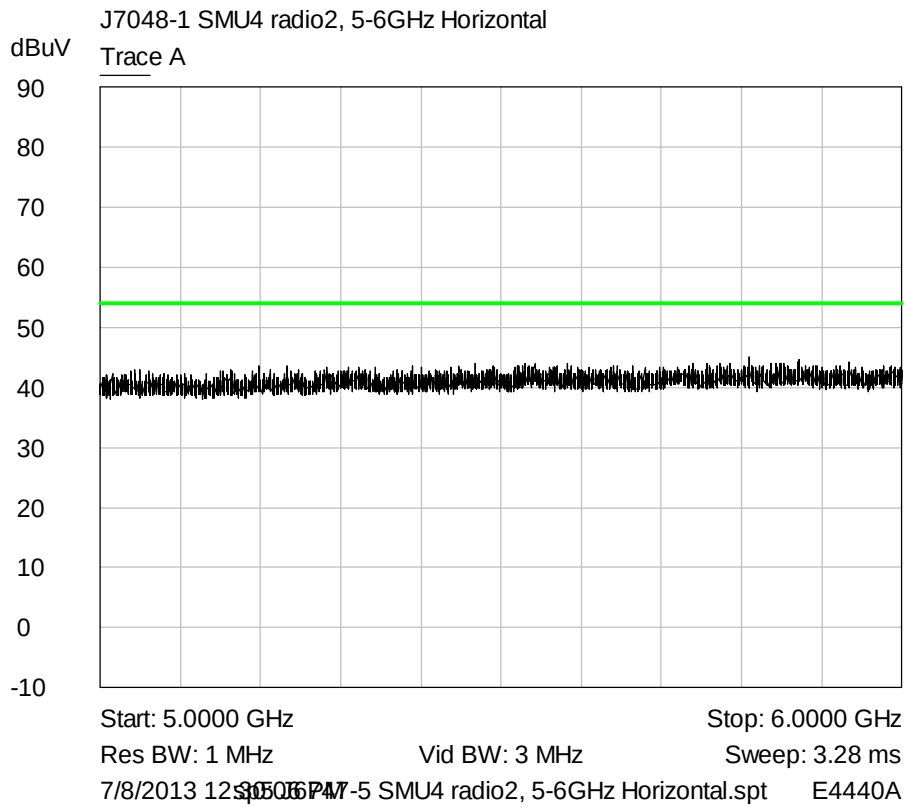


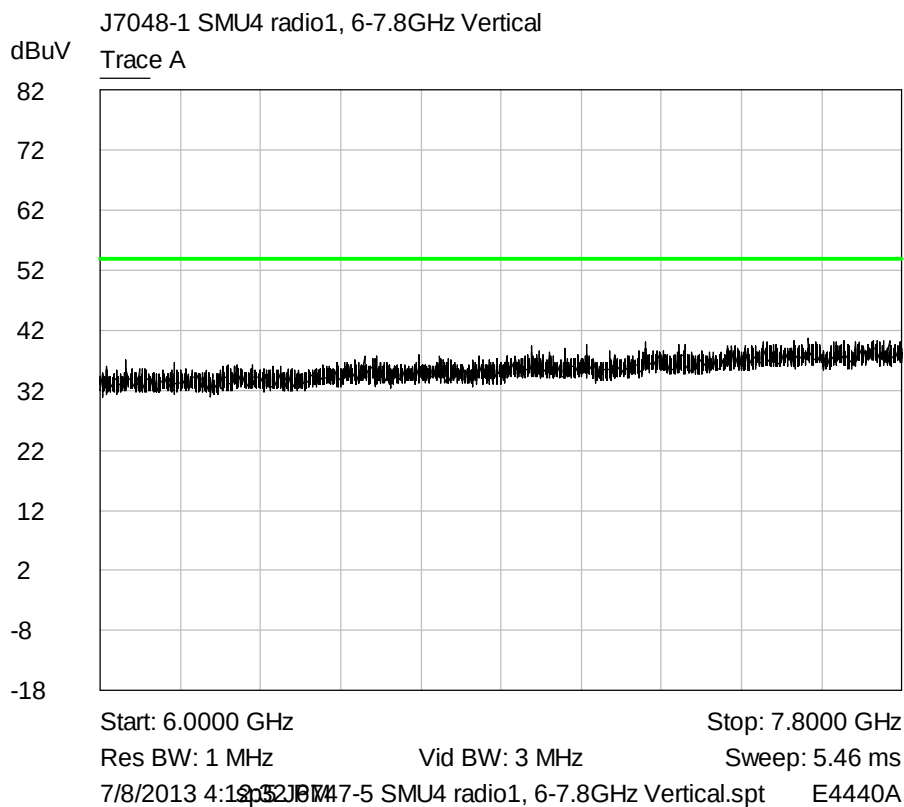
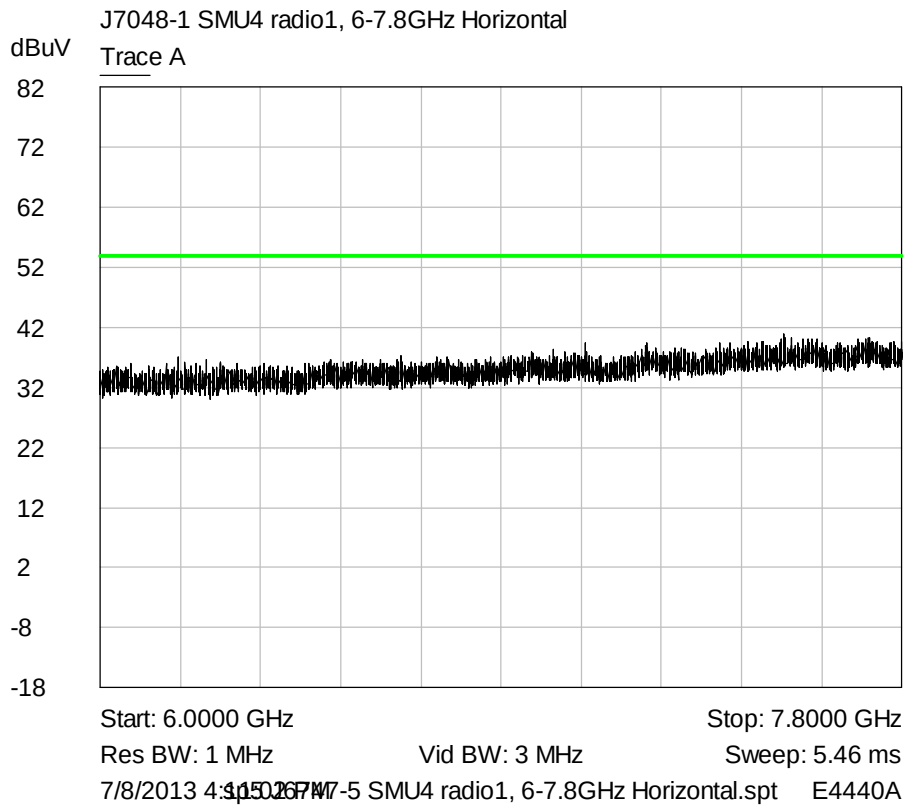


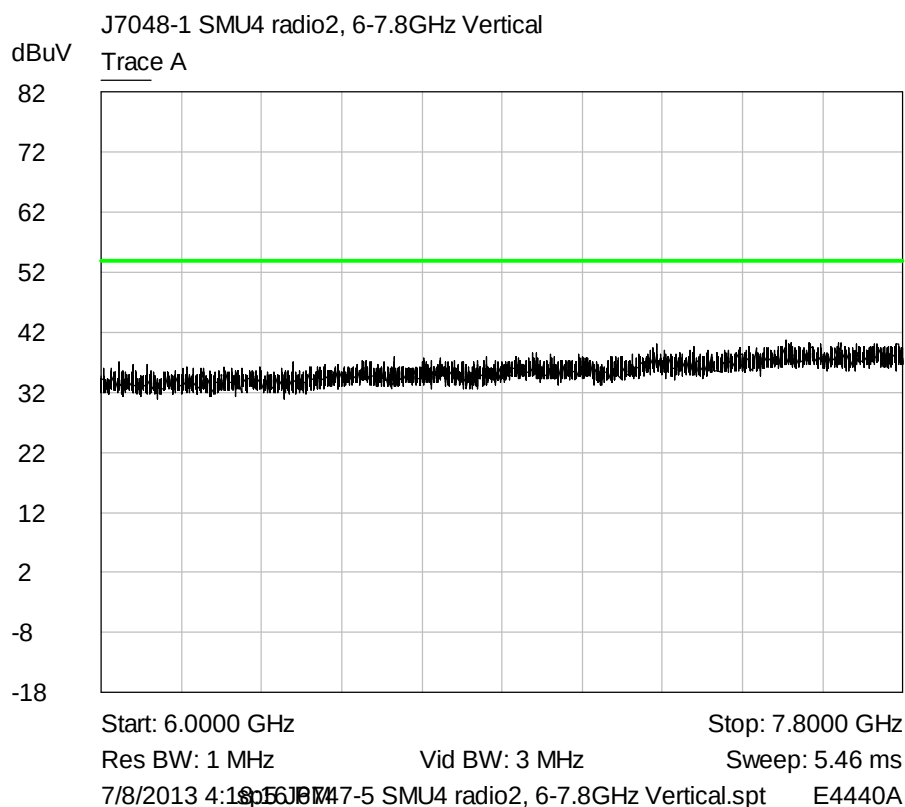
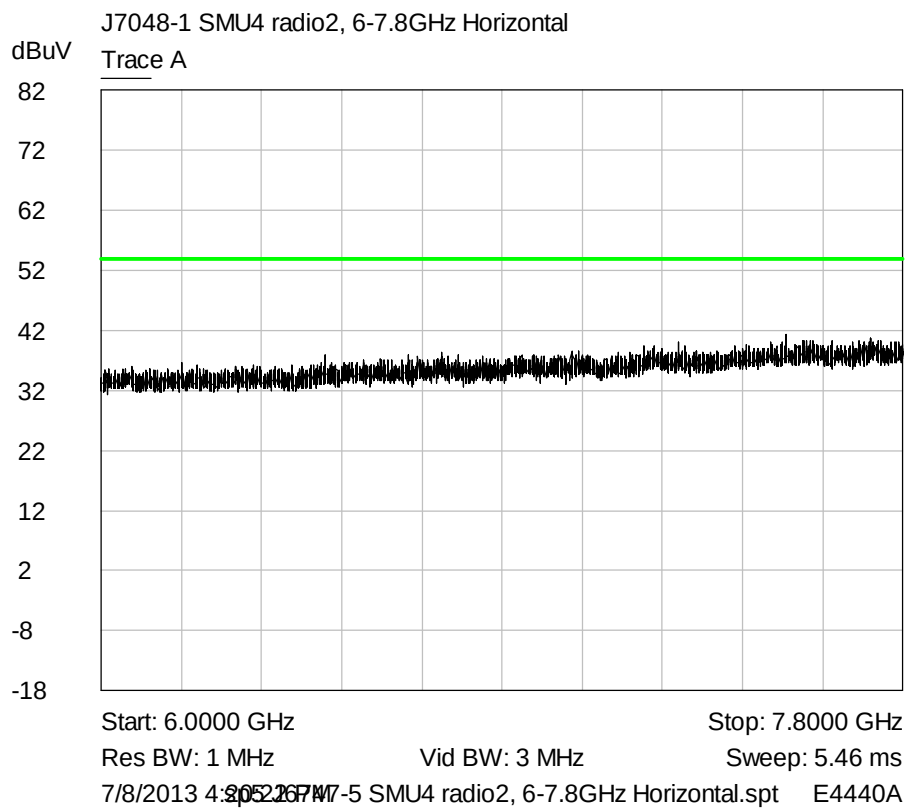


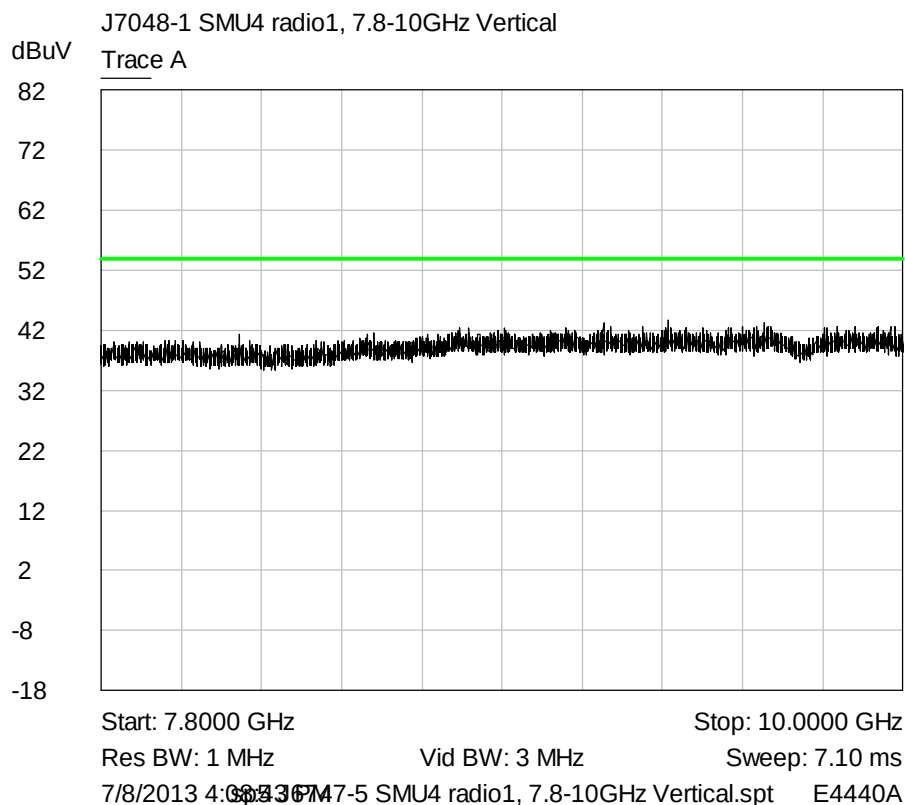
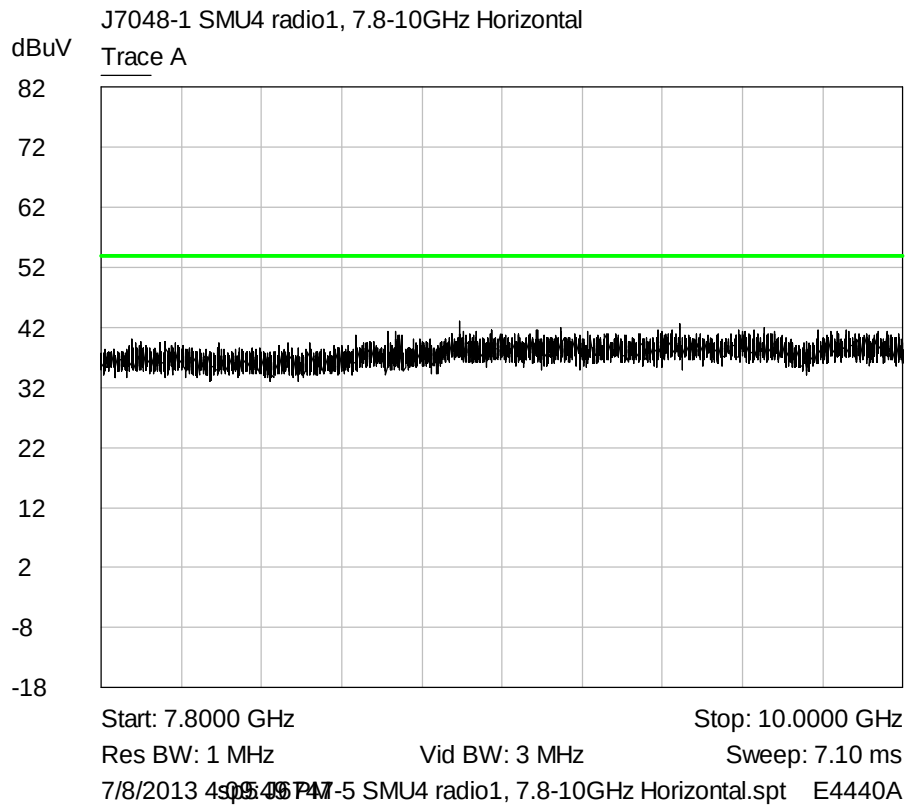


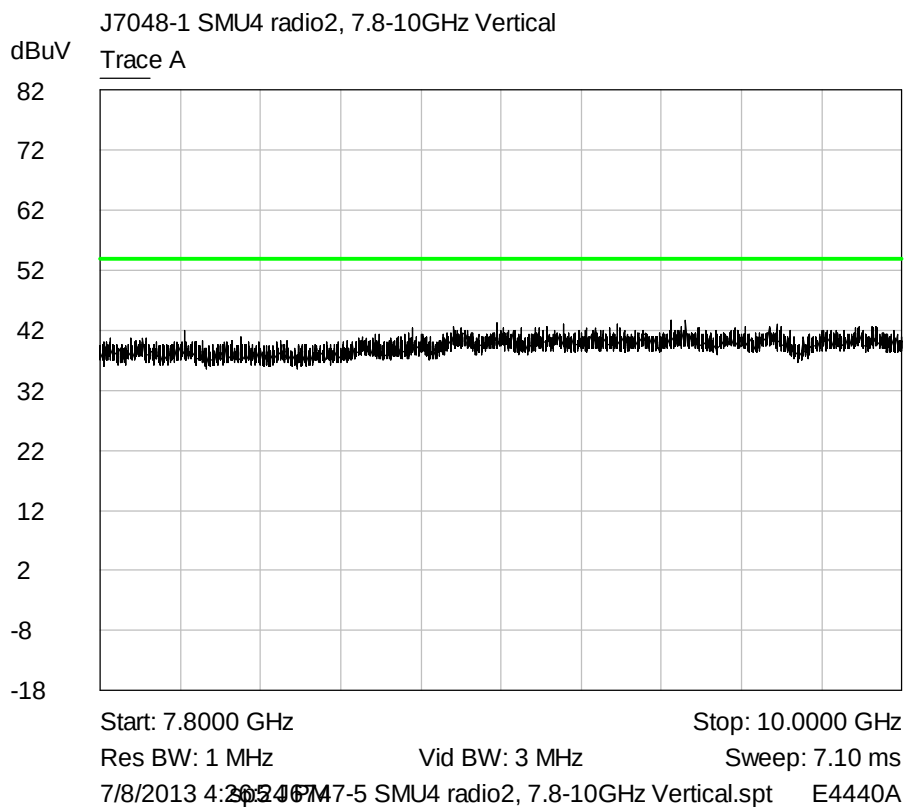
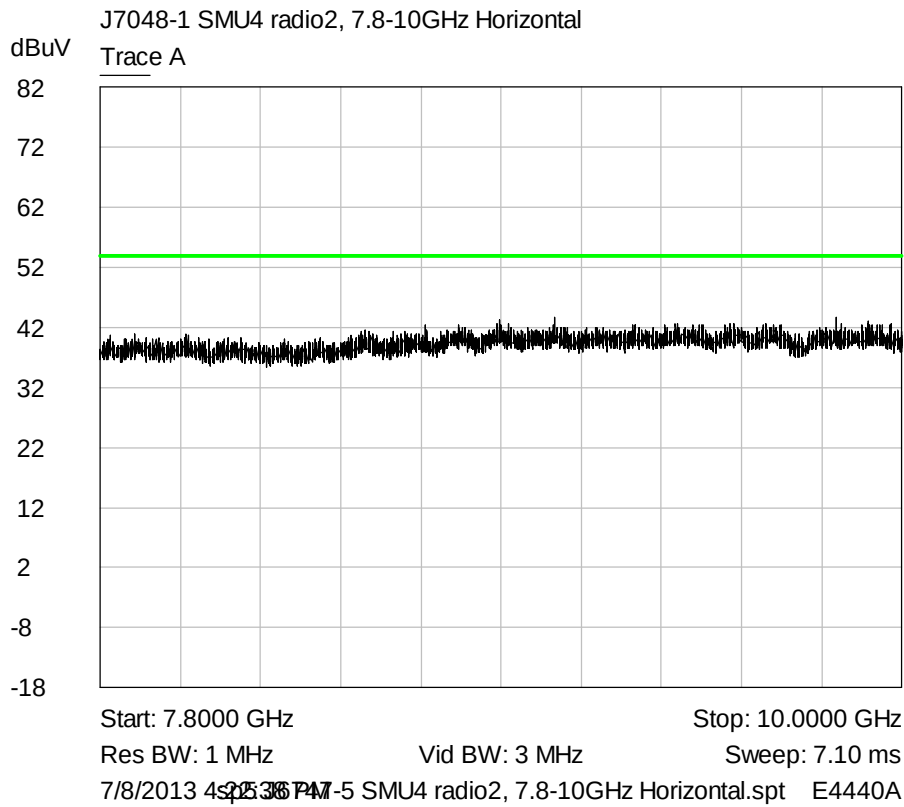






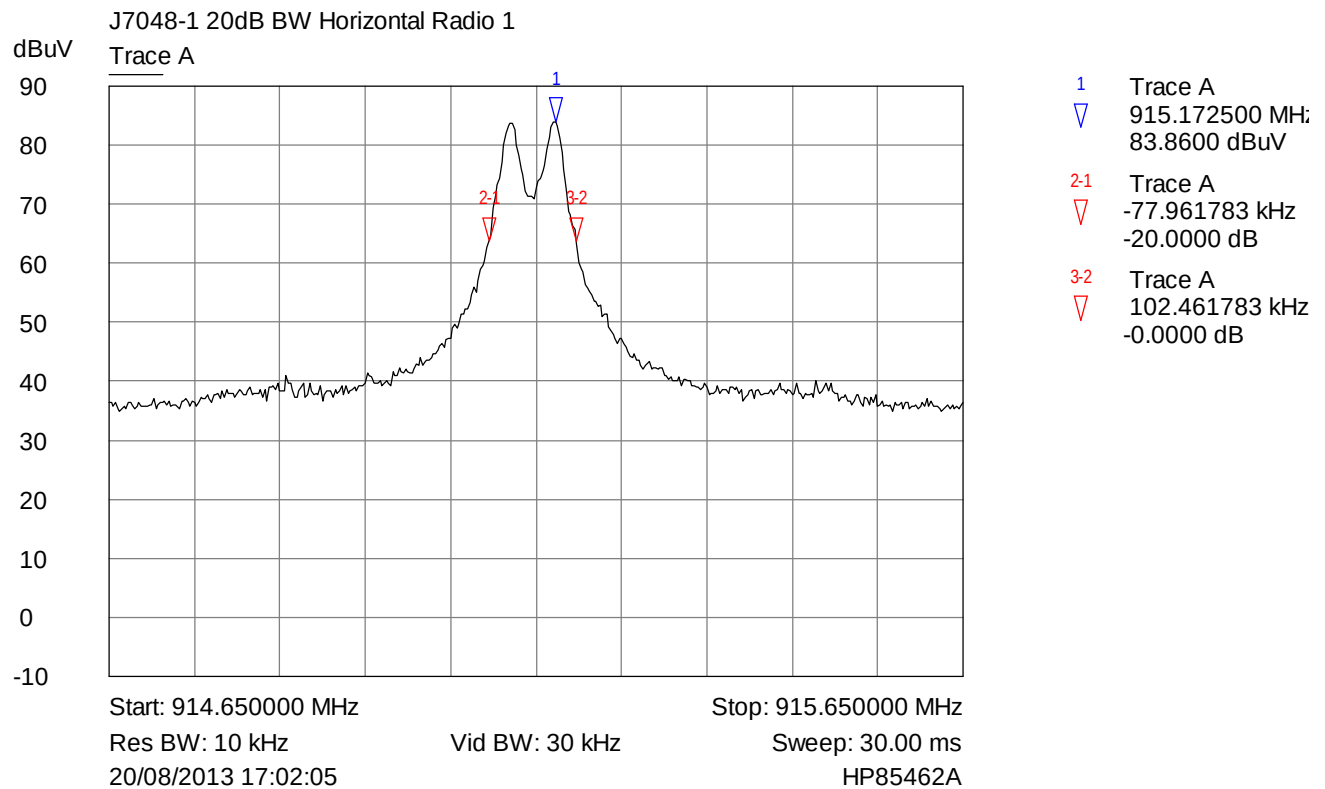




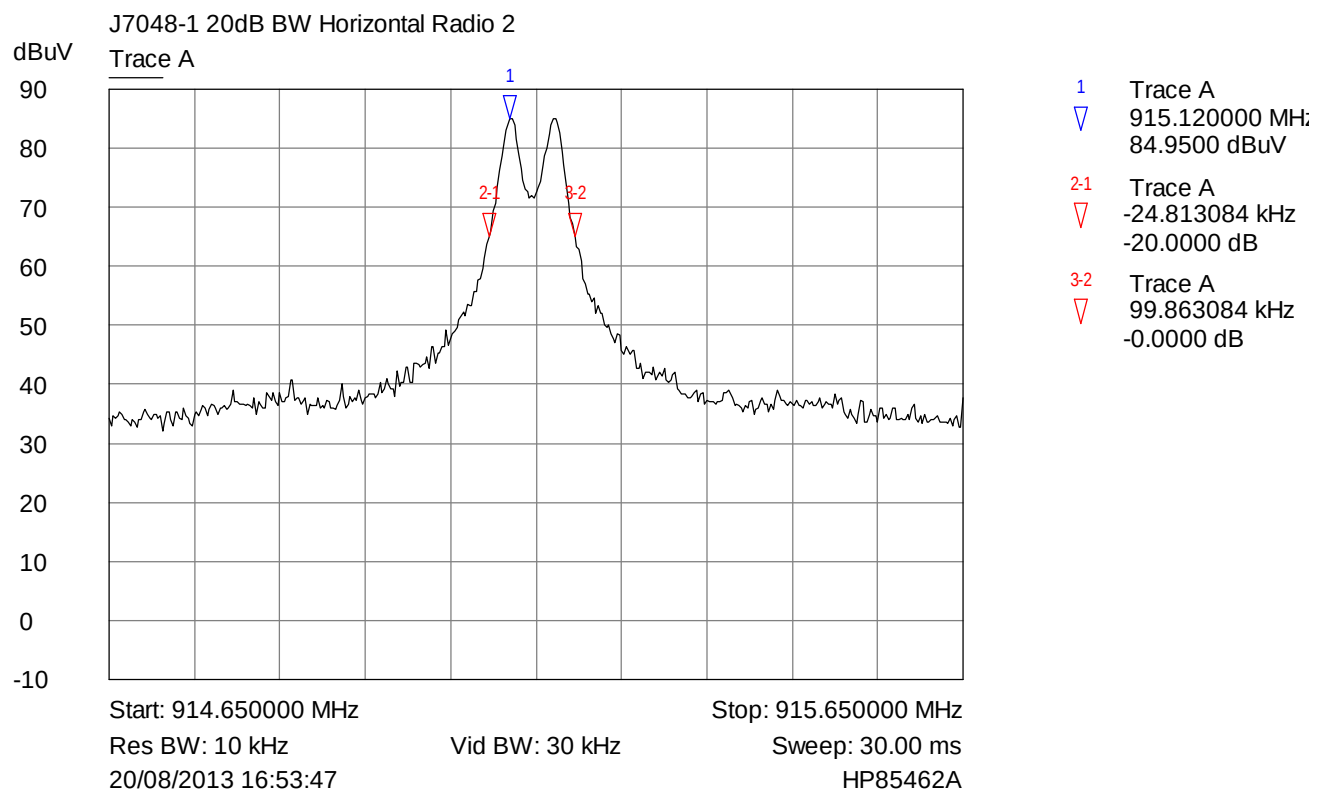


6.4 20dB bandwidth plots

6.4.1 Plots for Band 902-928 MHz with FSK Modulation



TX 1 (Radio 1)



TX2 (Radio 2)

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 (dB μ V)	Pk – Lim 1 (dB)	QP Amp (dB μ V)	QP - Lim1 (dB)	Av Amp (dB μ V)	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 (dB μ V) is the level of received signal that was measured in dB above 1 μ V 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 (dB μ V) is the level of received signal that was measured in dB above 1 μ V 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 (dB μ V) is the level of received signal that was measured in dB above 1 μ V 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.

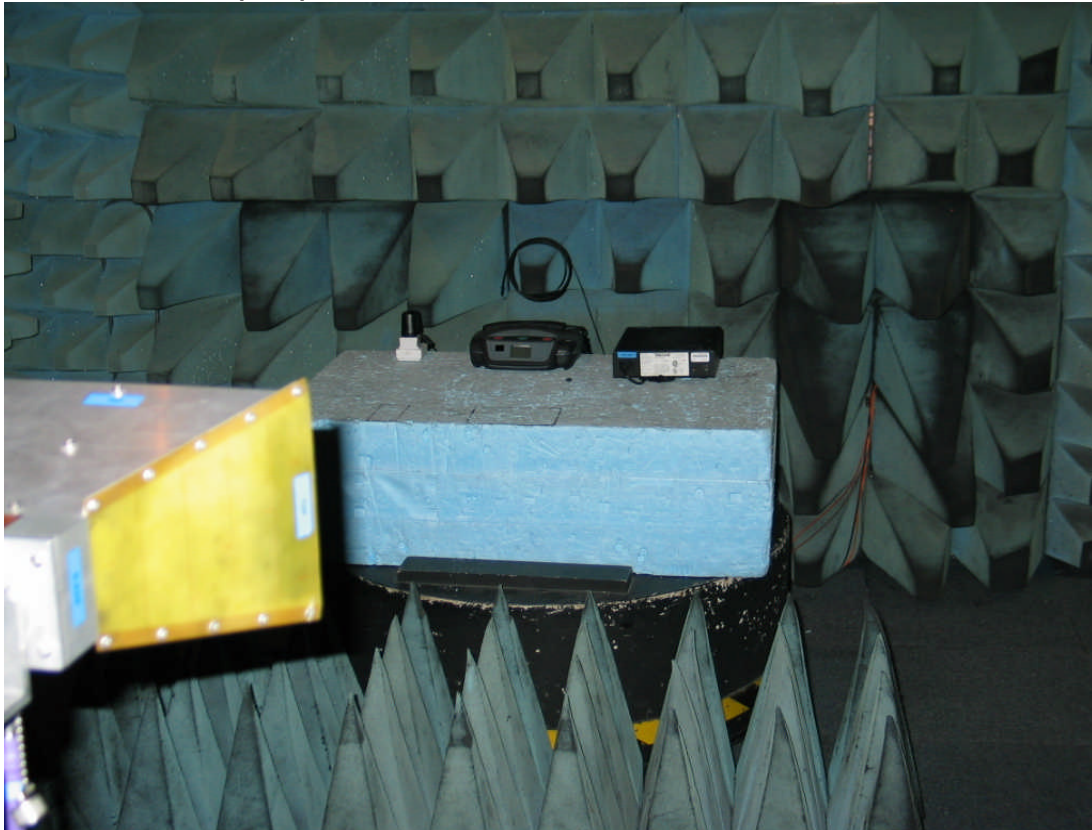
7.2 Explanation of limit line calculations for radiated measurements

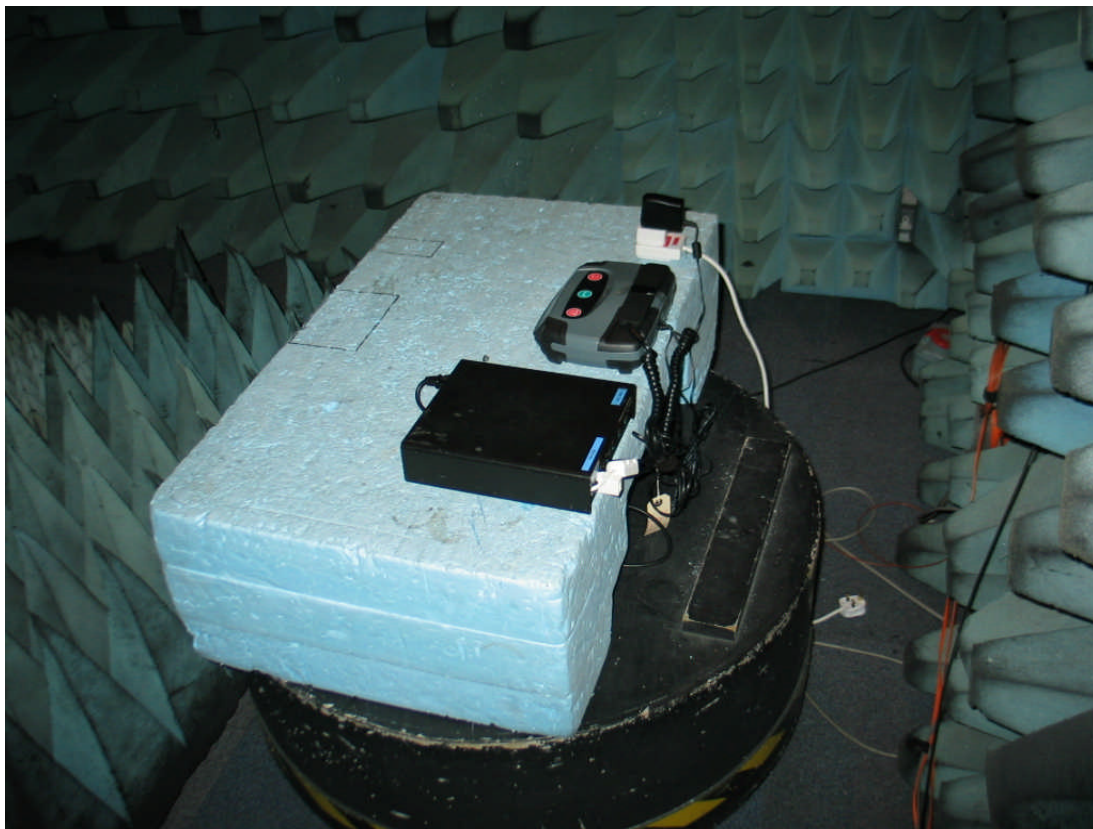
The limits given in the test standard are normally expressed as absolute values (e.g. in $\mu\text{V/m}$ at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in $\text{dB}\mu\text{V/m}$ referenced to the measuring instrument inputs. RN Electronics 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 $500 \mu\text{V/m}$ equates to $20.\log(500) = 54 \text{ dB } \mu\text{V/m}$.
- (b) limit of $300 \mu\text{V/m}$ at 10m equates to $20.\log(300 \cdot 10/3) = 60 \text{ dB } \mu\text{V/m}$ at 3m
- (c) limit of $30 \mu\text{V/m}$ at 30m, but below 30MHz, equates to $20.\log(30) + 40.\log(30/3) = 69.5 \text{ dB}\mu\text{V/m}$ at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8 Photographs

8.1 Test set-up, spurious emissions





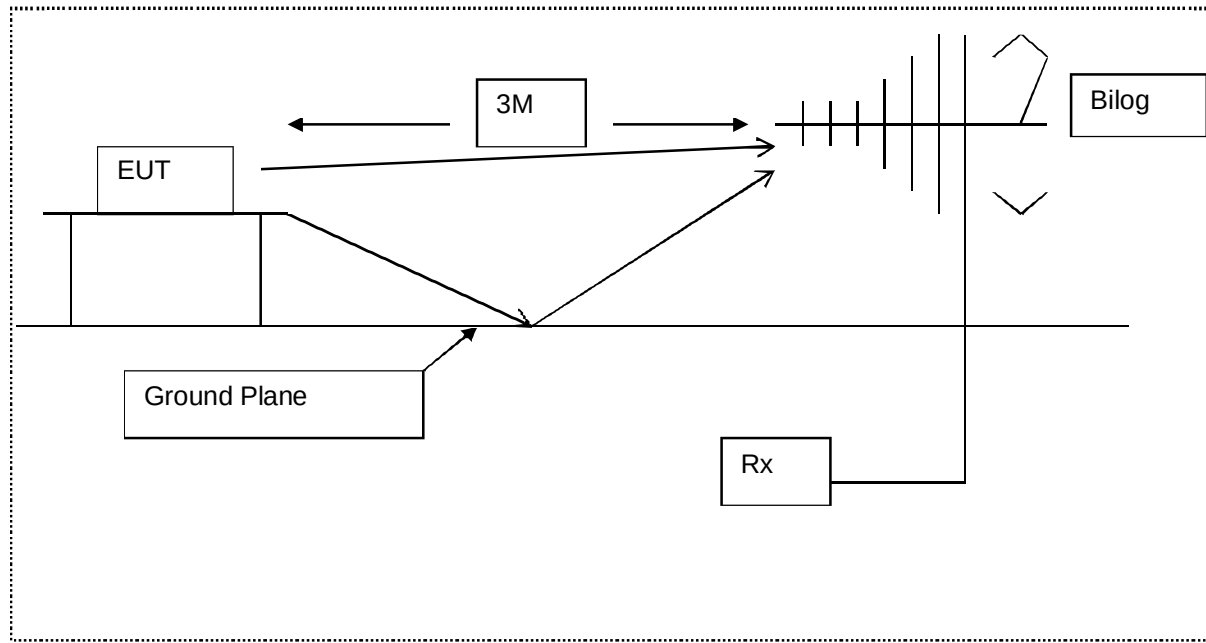


Diagram of the radiated emissions test setup.

Photograph of the EUT as viewed from screened room (conducted emissions)



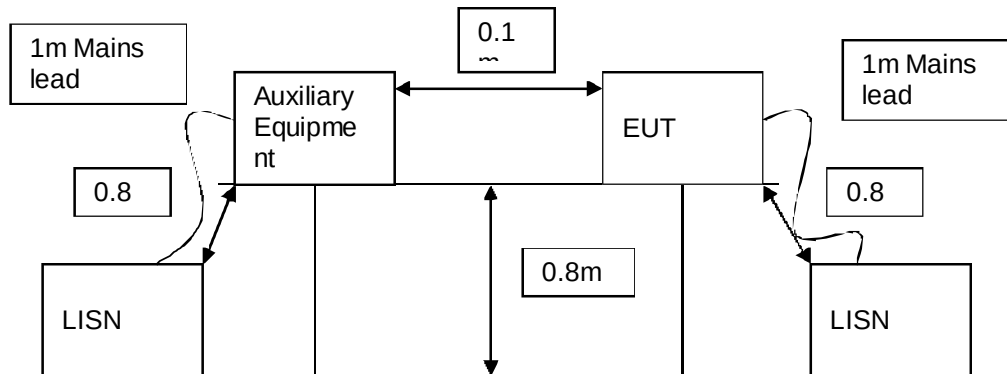


Diagram of the conducted emissions test setup.

8.2 Identifying Photograph of the EUT



9 Signal Leads

Port Name	Cable Type
AC/DC brick	AC plug to two core DC lead
DC power input	2 core JST connector
PSTN	2 core RJ11 connector
Handset	6-core RJ11 connector (coiled lead)

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.

RN No.	Model	Description	Manufacturer	Calibration date	Cal period
E035	HP11947A	Transient Limiter + 10dB Atten.	Hewlett Packard	19-Aug-13*	6 months
E150	MN2050	LISN 13A	Chase	03-Oct-13*	12 months
E226	8546A	EMI Receiver	Hewlett Packard	18-Jun-13	12 months
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	26-Oct-11	36 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	18-Oct-13*	12 months
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	18-Oct-13*	12 months
E428	HF906	1-18 GHz Horn Antenna	Rhode & Schwarz	25-Nov-11	36 months
E465	PCR2000LA	AC Power Supply	KIKUSUI	09-May-13	12 months
E533	N5182A	6 GHz MXG Signal Generator	Agilent Technologies	26-Feb-13	36 months
E534	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	22-Feb-13	36 months
E535	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	22-Feb-13	36 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	26-Nov-13*	12 months
TMS903	CBL6111A	Bilog Antenna 30MHz - 1GHz	Chase	04-Jun-13	36 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.

11 Auxiliary equipment

11.1 Customer supplied Equipment

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

Item No.	Model No.	Description	Manufacturer	Serial No.
1	COMPAQ NC6400	Laptop PC	HP	CND6512VJ3

11.2 Supplied by RN Electronics Limited

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

Item No.	Model No.	Description	Manufacturer	Serial No.
1	TLS-5A-01	Telephone line simulator	Teltone	7880

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

No modifications were made before test by RN Electronics Ltd.

12.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

13 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.

14 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

15 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	kPa	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