FCC 47CFR part 15C
Test Report
For
WDCOCC Occupancy Sensor
WDCOCC-SING

Reference Standard: FCC 47CFR part 15C
Manufacturer: Inotec UK Ltd
For type of equipment and serial number, refer to section 2
Report Number: 06-7466-4-14 Issue 01
Report Produced by: -

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

Certificate of Test 7466-4

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:	WDCOCC Occupancy Sensor
Model Number: Proposed FCC ID:	WDCOCC-SING 2ABOOWDCOCC-SING
Unique Serial Number:	11493A1079
Manufacturer:	Inotec UK Ltd. 3 Read Close, Hockley, Essex. SS5 4LS
Full measurement results are detailed in Report Number:	06-7466-4-14 Issue 01
Test Standards:	FCC 47CFR Part 15.247 effective date **October 1st 2013,** Class DTS Intentional Radiator

NOTE:
The above list is incomplete as only certain tests were performed based upon manufacturer's declarations. For details refer to section 3 of this report.

DEVIATIONS:
Deviations from the standards have been applied. For details refer to section 4.2 of 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 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: 20th May 2014 - 5th June 2014

Test Engineer: Graham Blake
Digitally signed by Graham Blake
DN: CN = Graham Blake, C = GB, O = RN Electronics
Date: 2014.08.05 13:41:45 +01'00'

Approved By:
Radio Approvals Manager
Digitally signed by: Daniel Sims
DN: CN = Daniel Sims C = GB O = RN Electronics Ltd
Date: 2014.08.05 13:40:32 Z

Customer representative:

1 Contents

2 Equipment Under Test (EUT)

2.1 Equipment Specification

Applicant	Inotec UK Ltd. 3 Read Close, Hockley, Essex. SS5 4LS
Manufacturer of EUT	Inotec UK Ltd
Brand name of EUT	WDCOCC Occupancy Sensor
Model Number of EUT	WDCOCC-SING
Serial Number of EUT	11493A1079
Date when equipment was received by RN Electronics	41745
Date of test:	20th May 2014 - 5th June 2014
Visual description of EUT:	Small plastic enclosure with two sensor apertures on one side and slotted air-vents on the other. The unit houses an internal battery compartment and fixed integral antenna.
Main function of the EUT:	Workplace occupancy detection.
Height	18 mm
Width	80 mm
Depth	80 mm
Weight	0.64kg
Voltage	4.5V nominal (3xAAA batteries)
Current required from above voltage source	20mA

2.2 EUT Configurations for testing

General parameters	
EUT Normal use position	Under desktop
Choice of model(s) for type tests	Production prototype
Antenna details	Integral wire colour coded antenna
Antenna port	No
Baseband Data port	No
Highest Signal generated in EUT	922MHz
Lowest Signal generated in EUT	27MHz (crystal)
TX Parameters	
Alignment range – transmitter	922MHz
EUT Declared Modulation Parameters	DSSS
EUT Declared Power level	+10dBm
EUT Declared Signal Bandwidths	500kHz
EUT Declared Channel Spacing's	Single wideband channel
EUT declared Duty Cycle	<1%
Unmodulated carrier available?	Yes
Declared frequency stability	40 PPM

2.3 Functional Description

The WDCOCC occupancy sensor utilizes a PIR and an IR sensor to detect heat and movement of an area / desk. This occupancy data is transmitted on event at 922MHz to a central access point which in turn relays the occupancy information to a central computer system for analysis.

2.4 EUT Modes

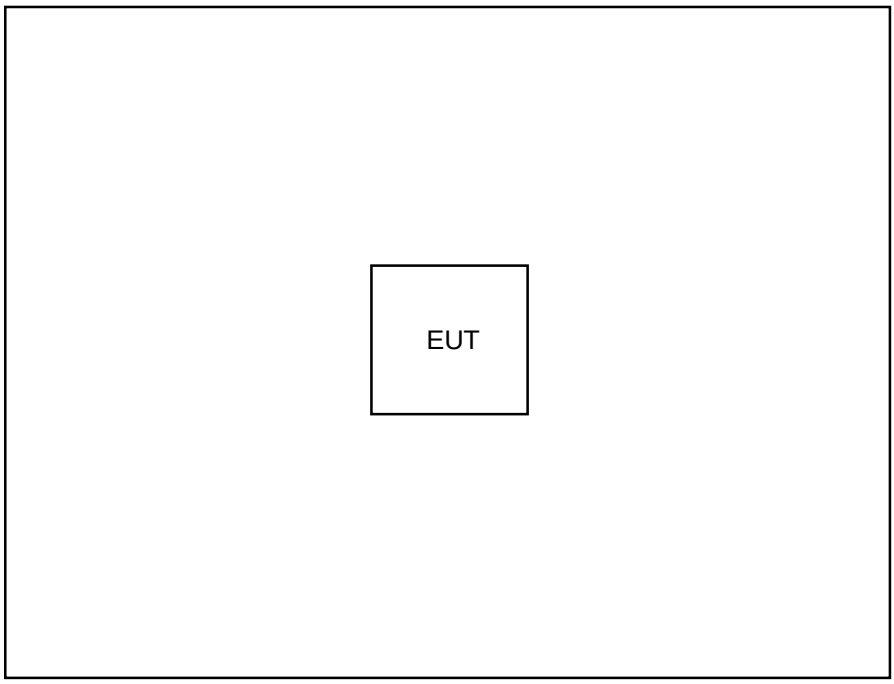
Mode Reference	Description	Used for testing
TX MOD	Continuous transmit at 922MHz with modulation	Yes
Normal operation	Transmitting 'on-event' at 922MHz	Yes

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: 05 August 2014

2.5 Emissions Configuration



The unit was powered from new batteries (3 x AAA type). The unit was configured by the manufacturer to allow permanent transmit of the device at 922MHz upon power up, as stated within section 2.4 of this report. The transmit mode was 100% continuous with system modulation and the power setting was left at the default maximum of +10dBm.

3 Summary of test results

The **WDCOCC Occupancy Sensor** was tested to the following standards: -

FCC 47CFR Part 15.247 (effective date October 1st, 2013);
Class DTS 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	FCC Part 15C §15.207	NOT APPLICABLE[1]
2. Radiated emissions	FCC Part 15C §15.205, §15.209 and §15.247(d)	PASSED
3. Antenna power Conducted emissions	FCC Part 15.111	NOT APPLICABLE[2]
4. Occupied bandwidth	FCC Part 15C §15.215(c), §15.247(a)(2)	PASSED
5. Maximum Peak/Average conducted output power	FCC Part 15C §15.247(b) Peak Average	NOT APPLICABLE[2] NOT APPLICABLE[2]
6. Effective radiated power field strength		PASSED
7. Duty cycle	FCC Part 15C §15.35(c)	NOT APPLICABLE[3]
8. Power Spectral Density	FCC Part 15C §15.247(e)	PASSED
9. Band edge compliance	FCC Part 15C §15.205, §15.209 and §15.247	PASSED
10. FHSS parameters	FCC Part 15C §15.247(a)(1) Dwell time and Number of hopping channels Frequency separation	 NOT APPLICABLE[4] NOT APPLICABLE[4]
11. Frequency stability	ANSI C63.10 §6.8.	NOT APPLICABLE[5]

[1] EUT does not operate from the AC power lines nor contain provisions for operation while connected to AC power lines.
[2] Applies to EUT's with an antenna port. The EUT has an integral antenna only
[3] There is no limit defined in the standard. It was, however, confirmed by observation that the continuous test mode provided was 100% duty.
[4] EUT does not employ FHSS technology.
[5] No limits apply, however the requirement to contain the designated bandwidth of the emission within the specified frequency band includes the frequency stability of the transmitter over expected variations in temperature and supply voltage.

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	FCC 47CFR15	2012	47CFR15
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	KDB558074	2013	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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 Part 15 deviations:
None.

4.3 Tests at Extremes of Temperature & Voltage

Not Required.

4.4 Measurement Uncertainties

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

5 Tests, Methods and Results

5.1 AC power line conducted emissions

NOT APPLICABLE: EUT does not operate from the AC power lines nor contain provisions for operation while connected to AC power lines.

5.2 Radiated emissions

5.2.1 Test Methods

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

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 measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed with new batteries.

The EUT was operated in **TX MOD** mode.

5.2.3 Test Procedure

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

Below 30MHz, measurements were made in a semi-anechoic chamber (pre-scan) with final measurements on an OATS without a ground plane where required. The antenna was placed 1m above the ground. The equipment and the antenna were rotated 360° to record the worst case emissions.

30MHz - 1GHz, measurements were made on a site listed 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. Horn antennas were used at heights where the whole of the EUT was contained within the main beam. The EUT was rotated through 360° to record the worst case emissions. A measurement distance of 3m was used between the test range 1 - 6GHz and a measurement distance of 1.2m was used in the test range 6 – 9.3GHz.

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

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

5.2.4 Test Equipment used

E268, E411, E412, E429**,** TMS81**,** TMS82, TMS933**.**

See Section 10 for more details

5.2.5 Test results

Ambient conditions
Temperature: 22 °C Relative humidity: 41 %

Analyser plots showing Peak values can be found in Section 6.1 of this report.

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

5.2.5.1 Below 30MHz.

Plot references for Low Frequency Radiated emissions measurements (9kHz to 30MHz)

Channel	Parallel Plots	Perpendicular Plots
922MHz	7466-4 Low freq Parallel 150kHz - 30MHz	7466-4 Low freq Perpendicular 150kHz - 30MHz

5.2.5.2 30MHz - 1GHz.

Radio Parameters 1

Band	902-928 MHz
Power level	+10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

Results relating to Radio Parameters 1

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)	Antenna Polarisation	EUT Polarisation
1	869.888	39.0	34.2	-11.8	Horizontal	side
2	882.900	37.6	31.4	-14.6	Horizontal	side
3	651.537	34.1	30.5	-15.5	Horizontal	side
4	869.900	38.5	33.0	-13.0	Vertical	Upright
5	882.843	37.1	31.9	-14.1	Vertical	Upright

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

30 – 300 MHz	Horizontal	7466-4 Rad 1 VHF Horiz
30 – 300 MHz	Vertical	7466-4 Rad 1 VHF Vert
300 – 1000 MHz	Horizontal	7466-4 Rad 1 UHF Horiz
300 – 1000 MHz	Vertical	7466-4 Rad 1 UHF Vert

Note: only plots for the EUT in the position on its side are shown, however, 3 orthogonal planes have been investigated / measured.

5.2.5.3 Above 1GHz.

Radio Parameters 1

Band	902-928 MHz
Power level	+10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

Results relating to Radio Parameters 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
1844	42.8	-31.2	38	-16	Vertical	side
3688	47.3	-26.7	37.2	-16.8	Vertical	side
4610	47.4	-26.6	39.5	-14.5	Vertical	upright
5532	47.5	-26.5	35.8	-18.2	Vertical	side
6454	51.2	-22.8	43.6	-10.4	Vertical	upright
7376	56.9	-17.1	44.8	-9.2	Vertical	side
8298	49.4	-24.6	38.7	-15.3	Vertical	upright
9220	53.3	-20.7	42.9	-11.1	Vertical	upright
1844	40.8	-33.2	35.8	-18.2	Horizontal	side
3688	48.1	-25.9	38	-16	Horizontal	flat
5532	47.1	-26.9	35.3	-18.7	Horizontal	upright

6454	51.9	-22.1	40.3	-13.7	Horizontal	side
7376	57.9	-16.1	50.6	-3.4	Horizontal	side
8298	50.5	-23.5	36.9	-17.1	Horizontal	side
9220	54.3	-19.7	45.5	-8.5	Horizontal	side

Plot reference table

Frequency Range	Antenna Polarisation	Plot reference
1GHz - 3GHz	Horizontal	7466-4 1 - 3 GHz Horiz
1GHz - 3GHz	Vertical	7466-4 1 - 3 GHz Vert
3GHz - 5GHz	Horizontal	7466-4 3 - 5 GHz Horiz
3GHz - 5GHz	Vertical	7466-4 3 - 5 GHz Vert
5GHz - 6GHz	Horizontal	7466-4 5 - 6 GHz Horiz
5GHz - 6GHz	Vertical	7466-4 5 - 6 GHz Vert
6GHz - 7.77GHz	Horizontal	7466-4 6 - 7.77 GHz Horiz
6GHz - 7.77GHz	Vertical	7466-4 6 - 7.77 GHz Vert
7.77GHz -9.3GHz	Horizontal	7466-4 7.77 - 9.3 GHz Horiz
7.77GHz -9.3GHz	Vertical	7466-4 7.77 - 9.3 GHz Vert

Note: only plots for EUT position on its side are shown, however, 3 orthogonal planes have been investigated/measured.

LIMITS:

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

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

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

5.3 Antenna power conducted emissions

NOT APPLICABLE: Applies to EUT's with an antenna port. The EUT has an integral antenna only.

5.4 Occupied bandwidth

5.4.1 Test Methods

Test Requirements**:** FCC Part 15C, Reference (15.215)
Test Method: ANSI C63.10, Reference (6.9)

5.4.2 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 EUT was operated in TX MOD mode.

5.4.3 Test Procedure

Tests were performed using Test Site M. The EUT was set in its maximised field strength position.
Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 100kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 6dB bandwidth.

5.4.4 Test Equipment used

E411, E412, TMS933

See Section 10 for more details.

5.4.5 Test results

Ambient conditions.
Temperature: 22 °C Relative humidity: 42 % Pressure: 101 kPa

Analyser plots for the 6dB bandwidth can be found in Section 6.4 of this report.

Radio Parameter 1

Band	902-928 MHz
Power level	10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

Results relating to Radio Parameters 1

	Low
6dB BW (MHz)	583.6kHz
Plot reference	7466-4 BW Horiz Flat

LIMITS:

15.247(a)(2) The minimum 6dB bandwidth shall be at least 500kHz.

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

5.5 Maximum Peak conducted output power

NOT APPLICABLE: Applies to EUT's with an antenna port. The EUT has an integral antenna only.

5.6 Maximum Average conducted output power

NOT APPLICABLE: Applies to EUT's with an antenna port. The EUT has an integral antenna only.

5.7 Effective radiated power field strength

5.7.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.247)
Test Method: ANSI C63.10 Reference (6.3.1)

5.7.2 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 through 360° in all three orthogonal plane positions to maximise emissions. Final measurements were taken at 3m. The EUT was operated in TX MOD mode for this test.

5.7.3 Test Procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment noted in the 'Test Equipment used' section at Site M. The power stated is Peak field strength.

5.7.4 Test Equipment used

E411, E412, TMS933

See Section 9 for more details

5.7.5 Test results

Ambient conditions.
Temperature: 22°C Relative humidity: 41 % Pressure: 101 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

Duty Cycle Table relating to Radio Parameters 1

	Low
Duty Cycle (%)	100.00
Duty Cycle correction	0.00

Results relating to Radio Parameters 1

	Low
Peak Level (dBµV/m)	103
Plot reference	7466-4 Radiated power Horiz flat
Antenna Polarisation	Horiz
EUT Polarisation	Flat

LIMITS:

The maximum output power in all cases is 30dBm / 1watt.

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

5.8 Duty cycle

NOT APPLICABLE: There is no limit defined in the standard. It was, however, confirmed by observation that the continuous test mode provided was 100% duty.

5.9 Maximum Power Spectral Density

5.9.1 Test Methods

Test Requirements**:** FCC Part 15C, Reference (15.247)
Test Method: KDB558074, PSD Option 1

5.9.2 Configuration of EUT

The EUT was configured as for the peak radiated field strength test. The EUT was operated in TX MOD mode for this test.

5.9.3 Test Procedure

Tests were performed using Test Site M**.**
Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The emission from the EUT was maximised before taking any plots. PEP was recorded in the required span and bandwidth. Once the peak was found, Measurements & plots were taken with the span set to 1.5 times the measured DTS bandwidth utilising a 3kHz RBW.

5.9.4 Test Equipment used

E412, E411, TMS933

See Section 10 for more details.

5.9.5 Test results

Ambient conditions.
Temperature: 22°C Relative humidity: 41% Pressure: 101kPa

Radio Parameter 1

Band	902-928 MHz
Power level	10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

	Low
Plot reference	7466-4 PSD maximised Horiz Flat
Result (dBm)/3kHz	-4.43

Note: Highest power recorded was with EUT in a flat position and with a horizontal measuring antenna.

LIMITS:
15.247(e) +8dBm/3kHz.

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

5.10 Band Edge Compliance

5.10.1 Test Methods

Test Requirements: FCC Part 15C, Reference (15.215 and 15.247)
Test Method: ANSI C63.10-2009, Reference clause 6.9.3

5.10.2 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 EUT was operated in TX MOD mode.

5.10.3 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**.

5.10.4 Test Equipment used

TMS933, E411, E412

See Section 10 for more details.

5.10.5 Test results

Ambient conditions.
Temperature: 22 °C Relative humidity: 41 % Pressure: 101 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	10 dBm
Channel spacing	single channel
Mod scheme	DSSS 500kbps
Low channel	922 MHz

Restricted Band Edge Results relating to Radio Parameters 1

Band Edge Results relating to Radio Parameters 1

	Low & high
Plot reference	7466-4 Band edge 902 - 928 MHz

The band edge readings were performed with a peak detector (max held plot) and with the EUT set in a constant 100% transmit state.
Analyser plots for the Band Edge Compliance can be found in Section 6.3 of this report. These show the 20dBc requirement of 15.247(d)

The restricted band edges closest to the EUT frequency of 902-928MHz are 614 & 960MHz. Further wider span plots have been taken to show the fact that there are no spurious emissions above the restricted limits of 15.209.

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

5.11 FHSS Parameters

NOT APPLICABLE: EUT does not employ FHSS technology.

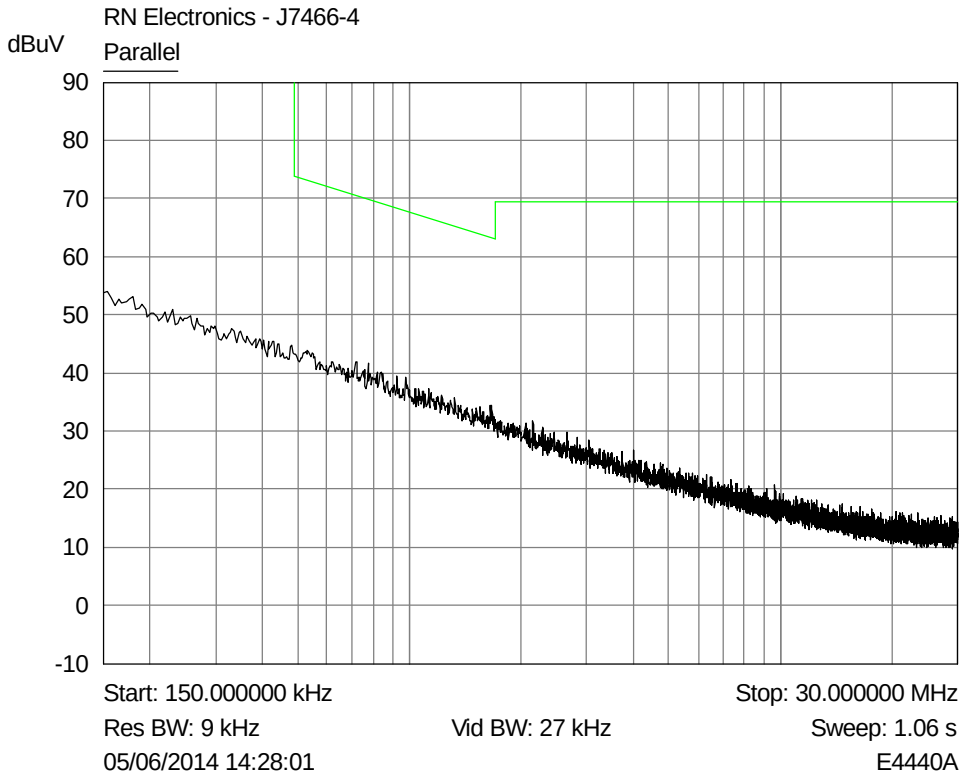
5.12 Frequency stability

NOT APPLICABLE: No limits apply, however the requirement to contain the designated bandwidth of the emission within the specified frequency band includes the frequency stability of the transmitter over expected variations in temperature and supply voltage.

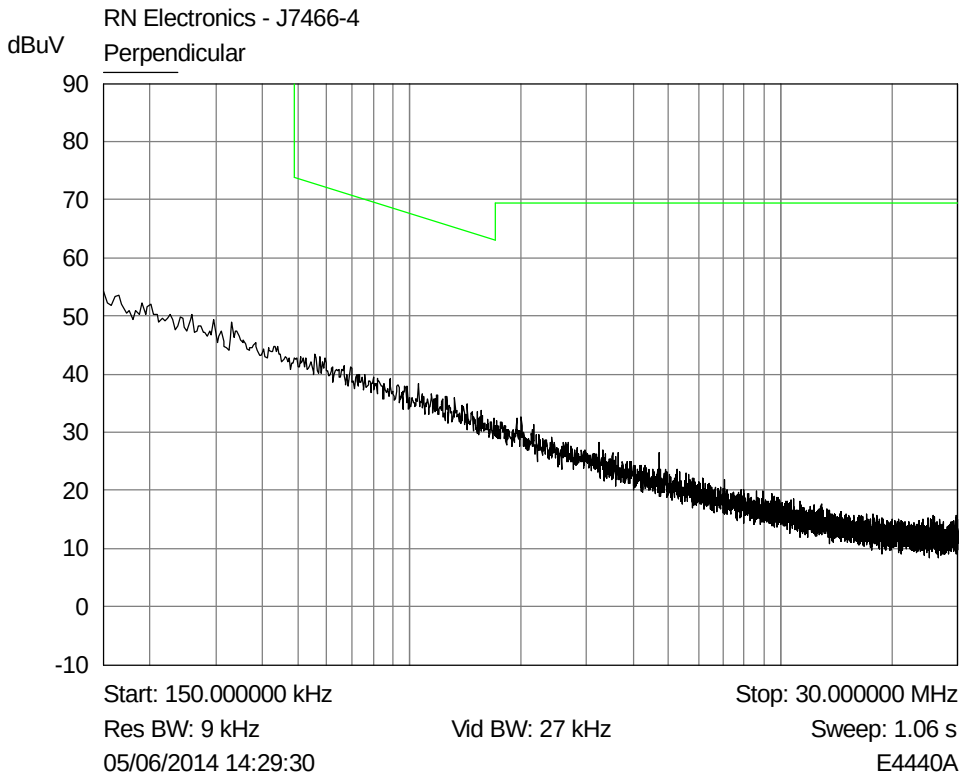
6 Plots and Results

6.1 Radiated emissions plots

6.1.1 Low frequency radiated emissions plots

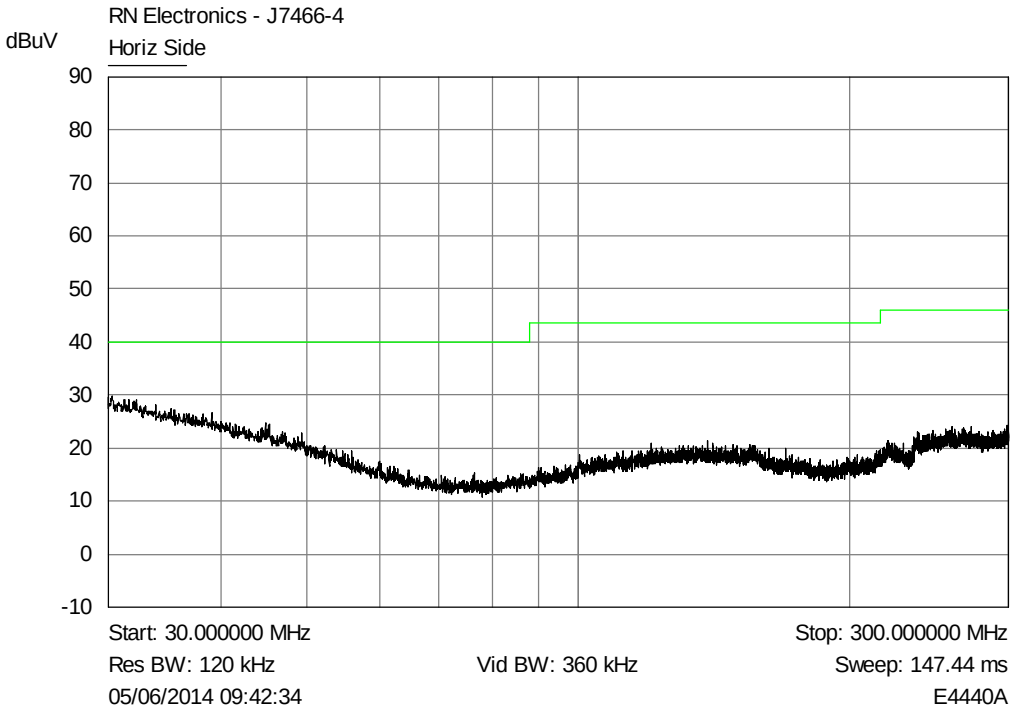


Parallel Plot

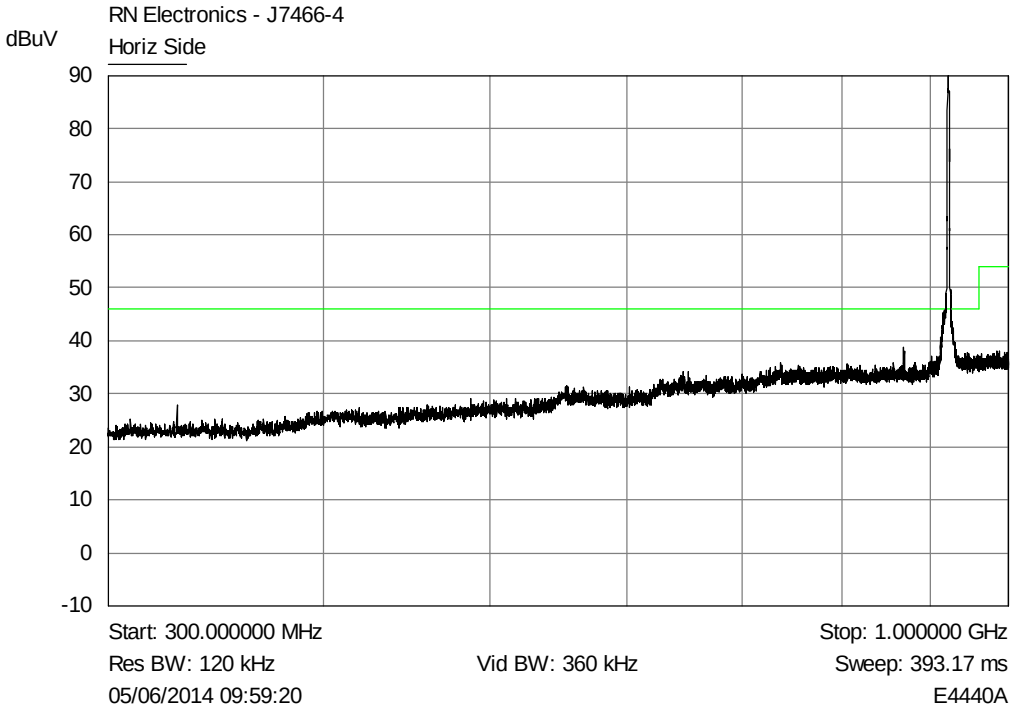


Perpendicular Plot

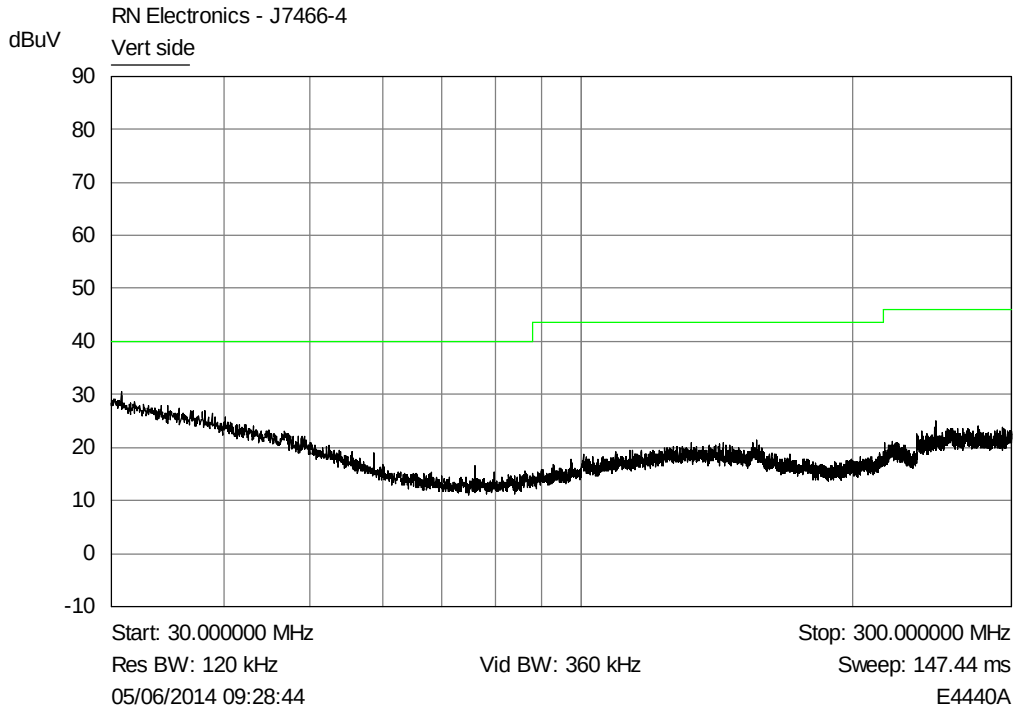
6.1.2 Radiated emissions - 30MHz - 1GHz



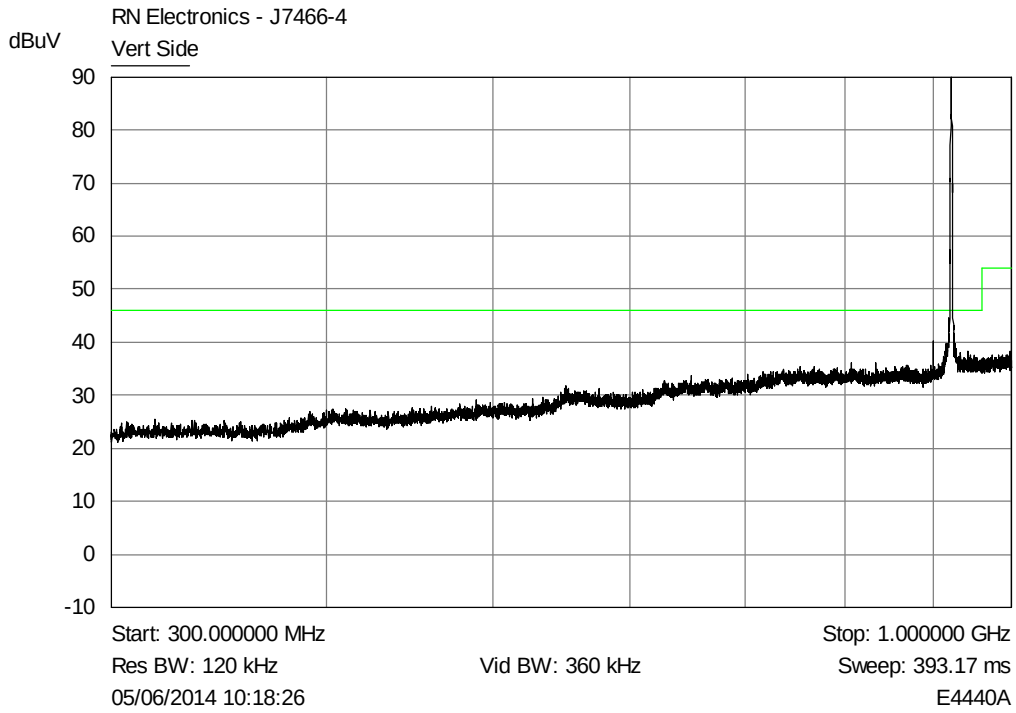
EUT Side – Measuring antenna Horizontal VHF



EUT Side – Measuring antenna Horizontal UHF



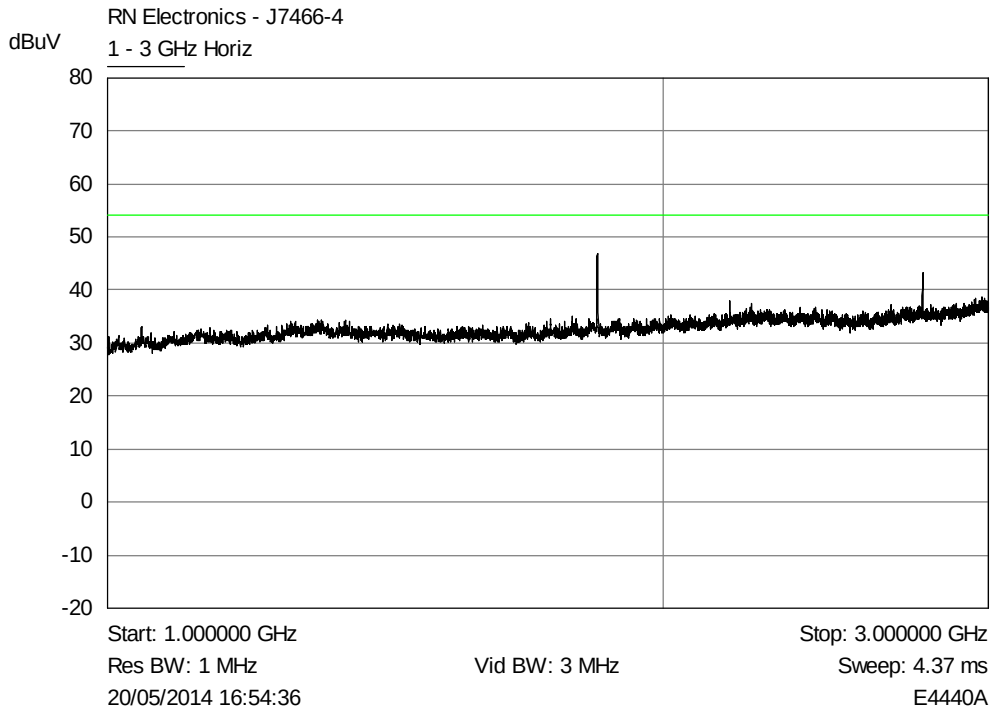
EUT Side – Measuring antenna Vertical VHF

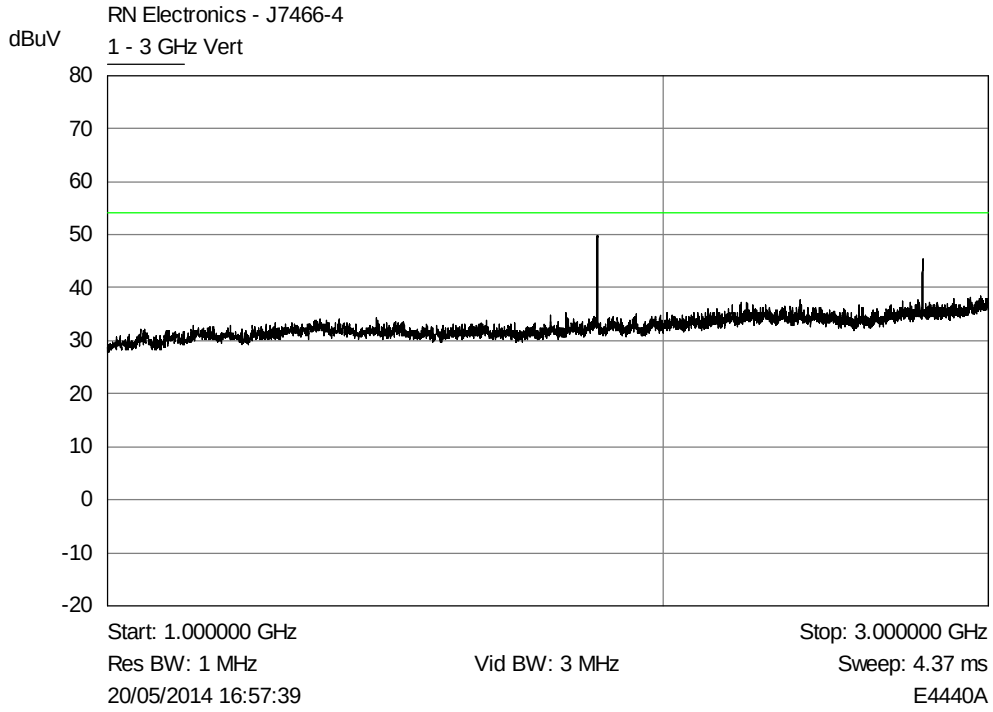


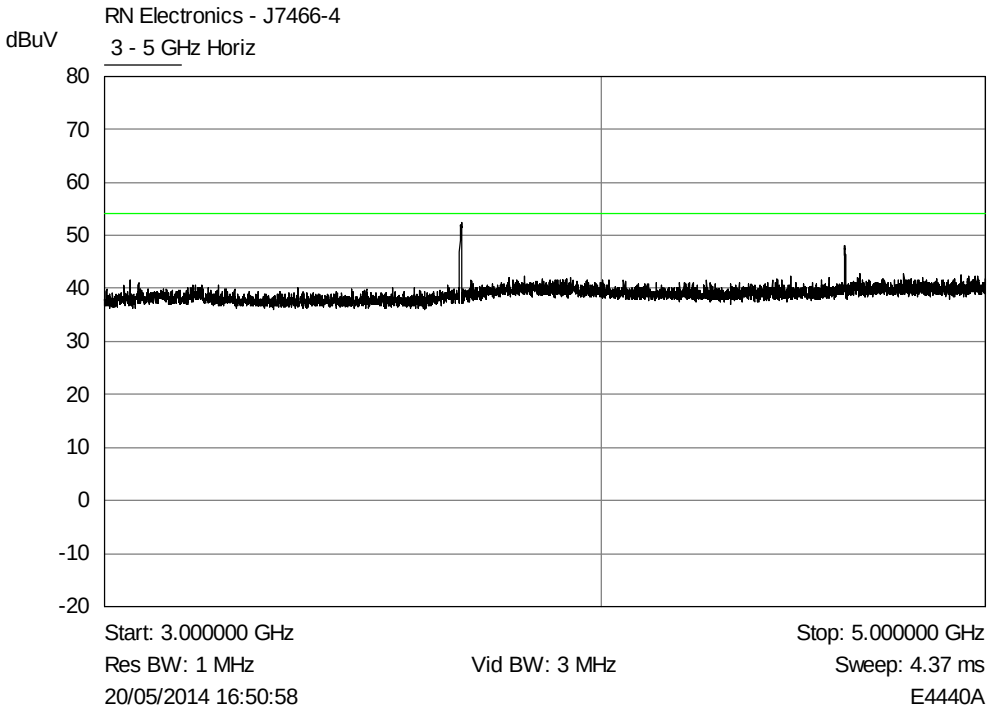
EUT Side – Measuring antenna Vertical UHF

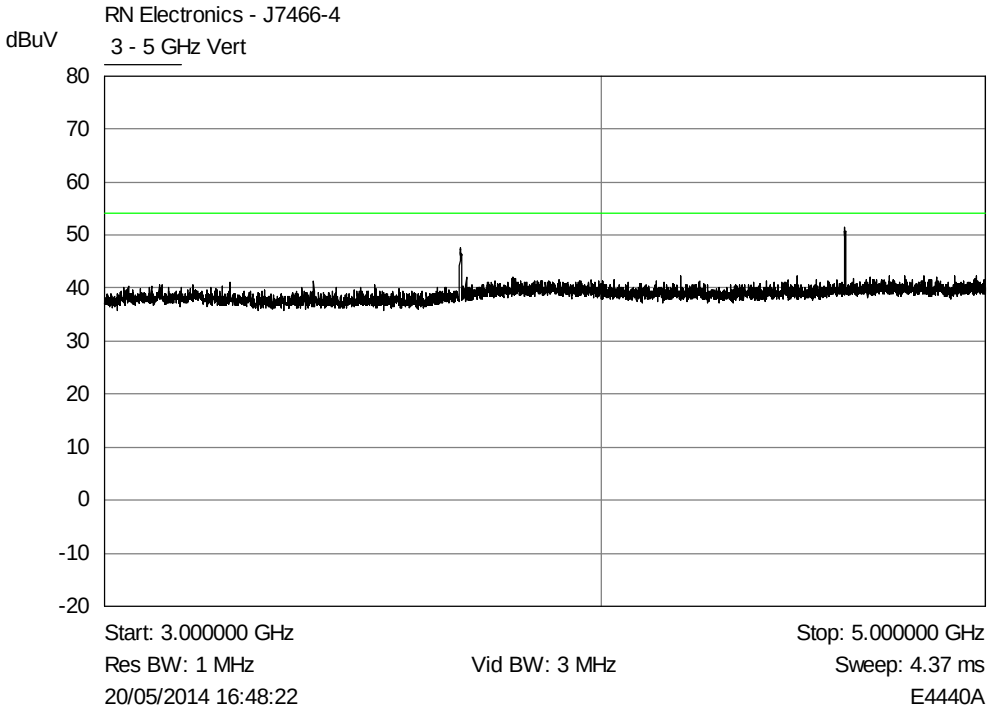
Note: Whilst all 3 orthogonal EUT planes have been tested and measured, only plots for EUT on its side have been included within the report as worst case.

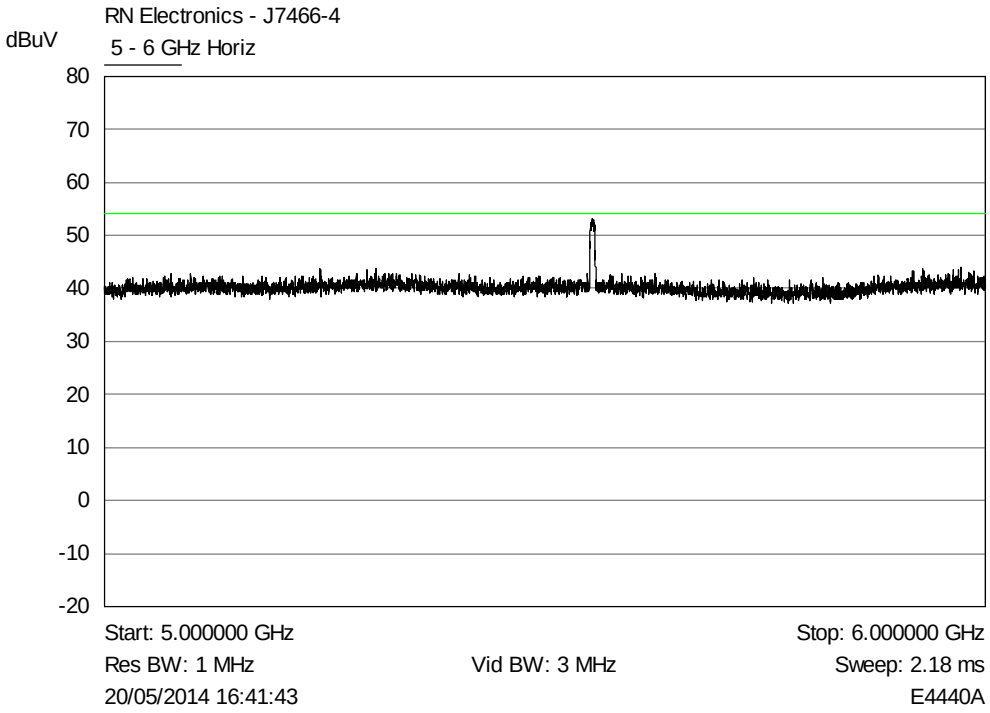
6.1.3 Radiated emissions Plots above 1GHz

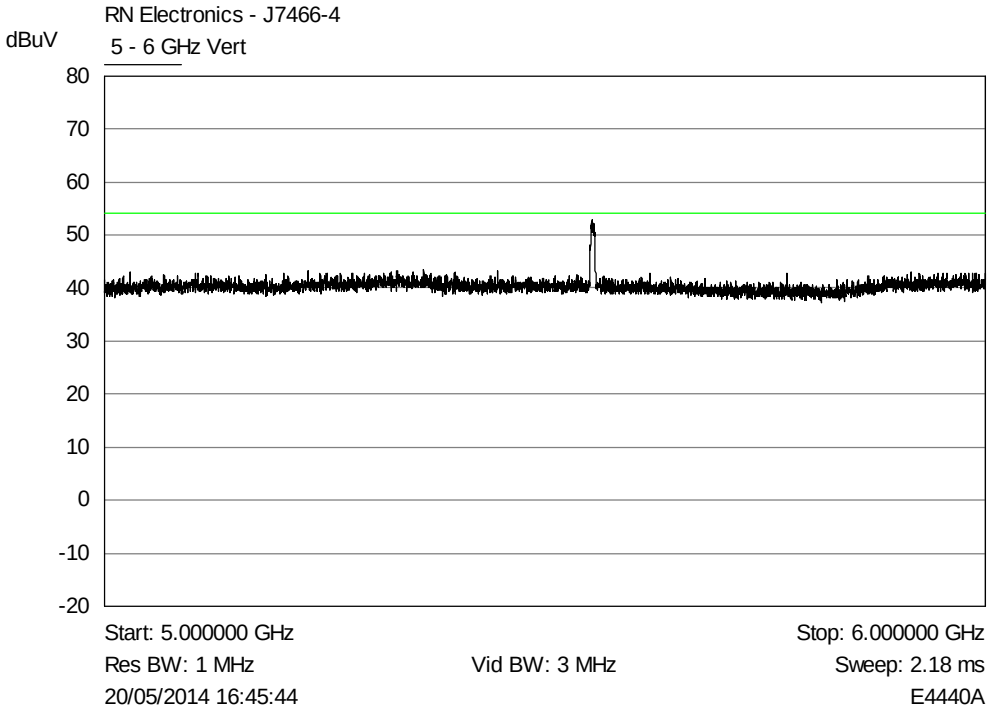


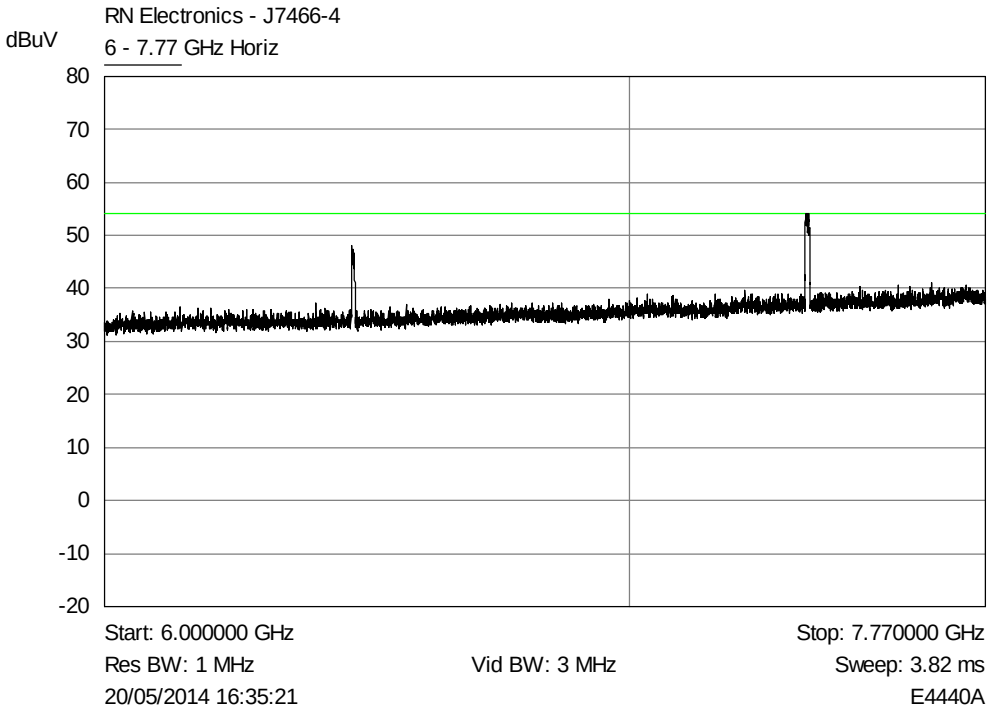


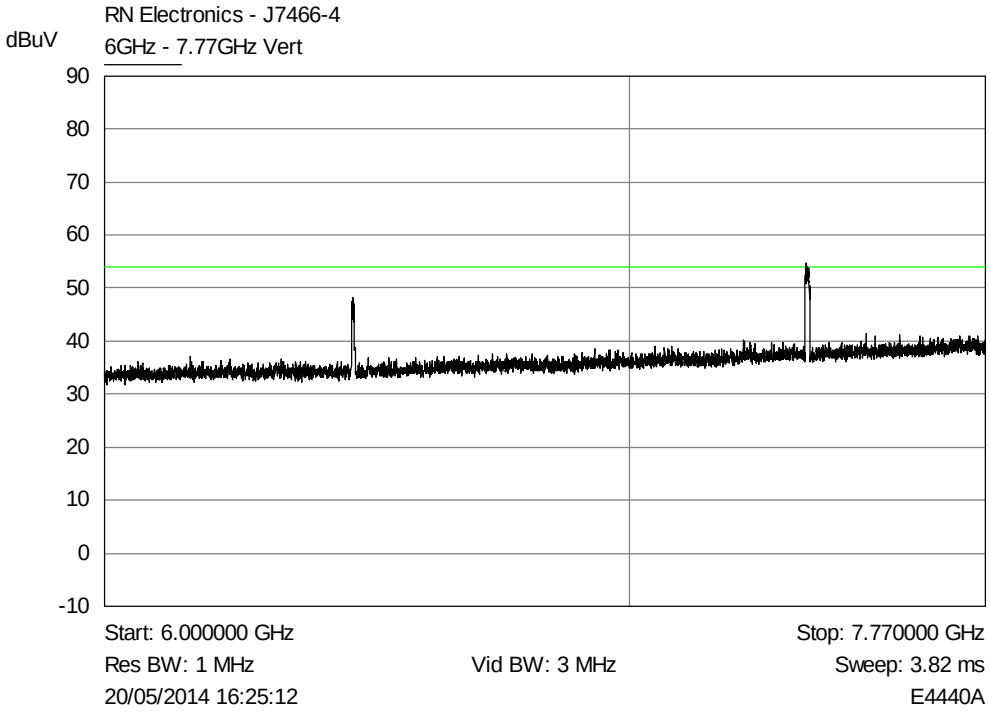

RN Electronics - J7466-4
dBuV
3 - 5 GHz Horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 3.000000 GHz
Stop: 5.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.37 ms
20/05/2014 16:50:58
E4440A

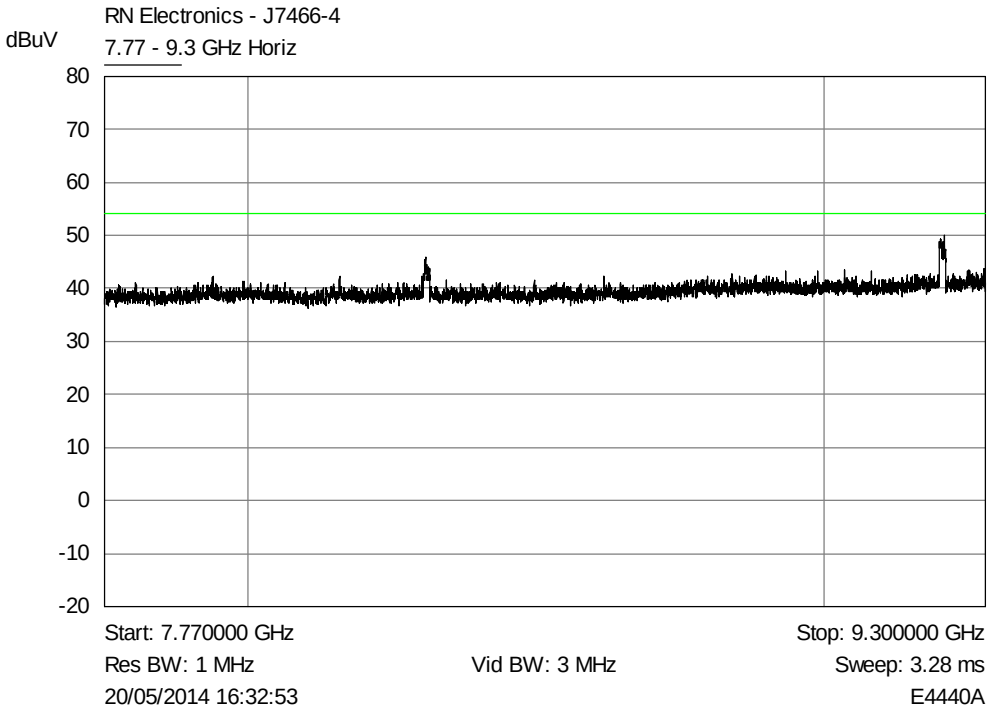

RN Electronics - J7466-4
dBuV
3 - 5 GHz Vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 3.000000 GHz
Stop: 5.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.37 ms
20/05/2014 16:48:22
E4440A

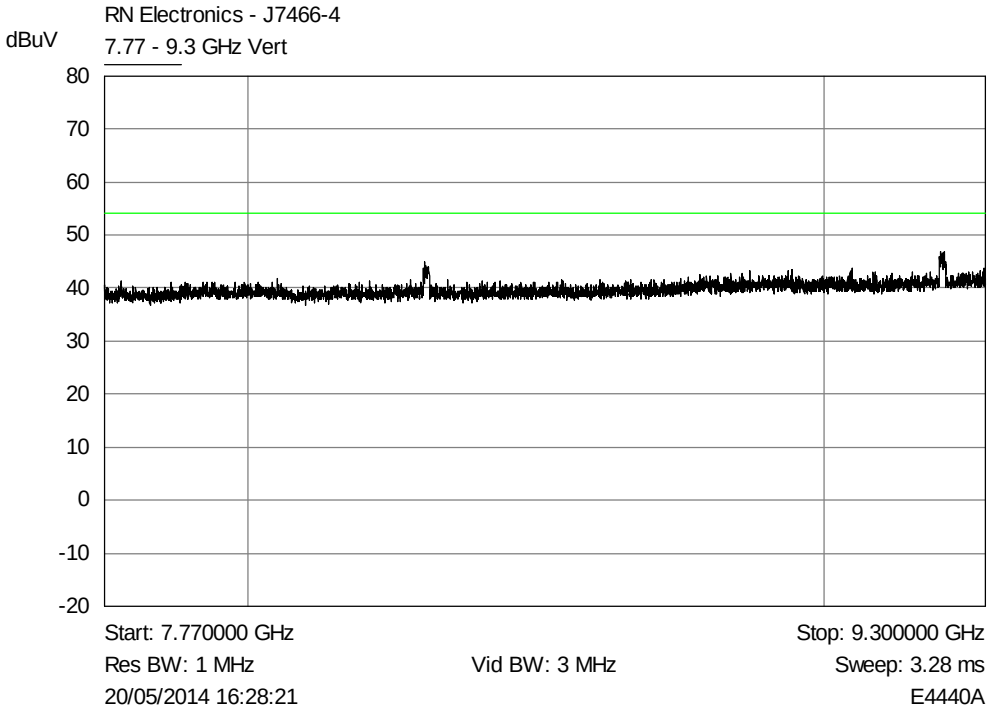

RN Electronics - J7466-4
dBuV
5 - 6 GHz Horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 5.000000 GHz
Stop: 6.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
20/05/2014 16:41:43
E4440A


RN Electronics - J7466-4
dBuV
5 - 6 GHz Vert
80
70
60
50
40
30
20
10
0
-10
-20
Start: 5.000000 GHz
Stop: 6.000000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
20/05/2014 16:45:44
E4440A


RN Electronics - J7466-4
dBuV
6 - 7.77 GHz Horiz
80
70
60
50
40
30
20
10
0
-10
-20
Start: 6.000000 GHz
Stop: 7.770000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
20/05/2014 16:35:21
E4440A


RN Electronics - J7466-4
dBuV
6GHz - 7.77GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.000000 GHz
Stop: 7.770000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
20/05/2014 16:25:12
E4440A

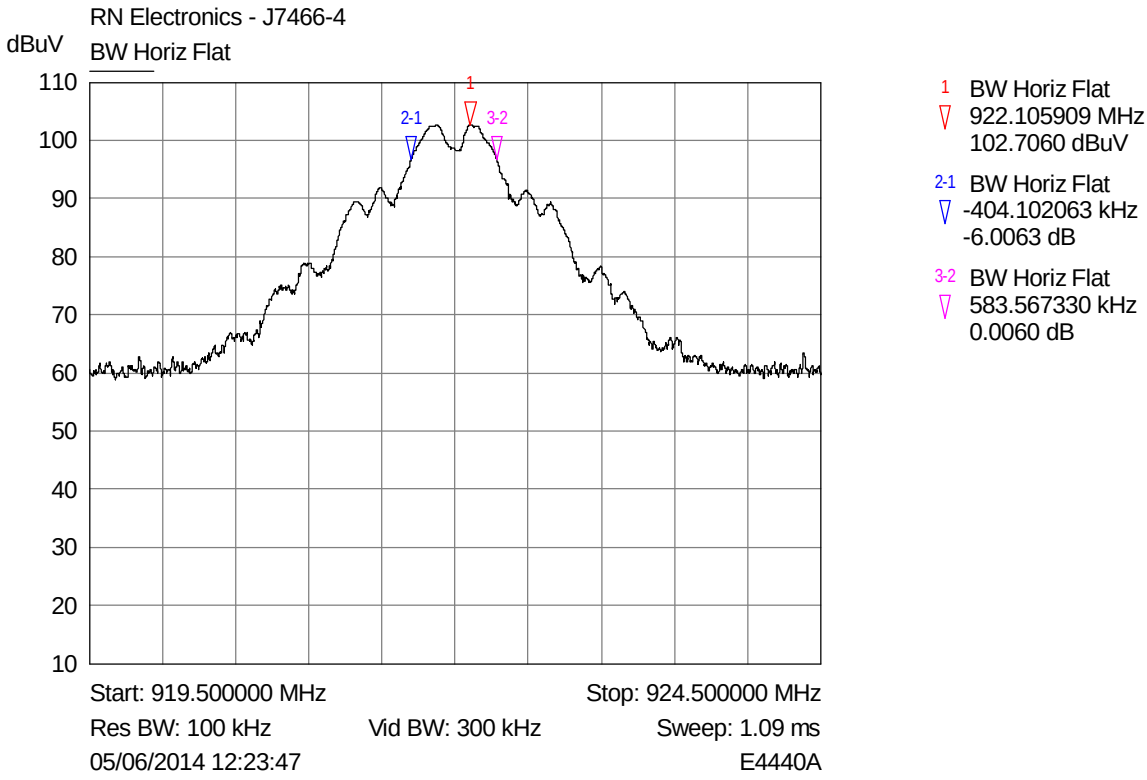




Note: Whilst all 3 orthogonal EUT planes have been tested and measured, only plots for EUT on its side have been included within the report as worst case.

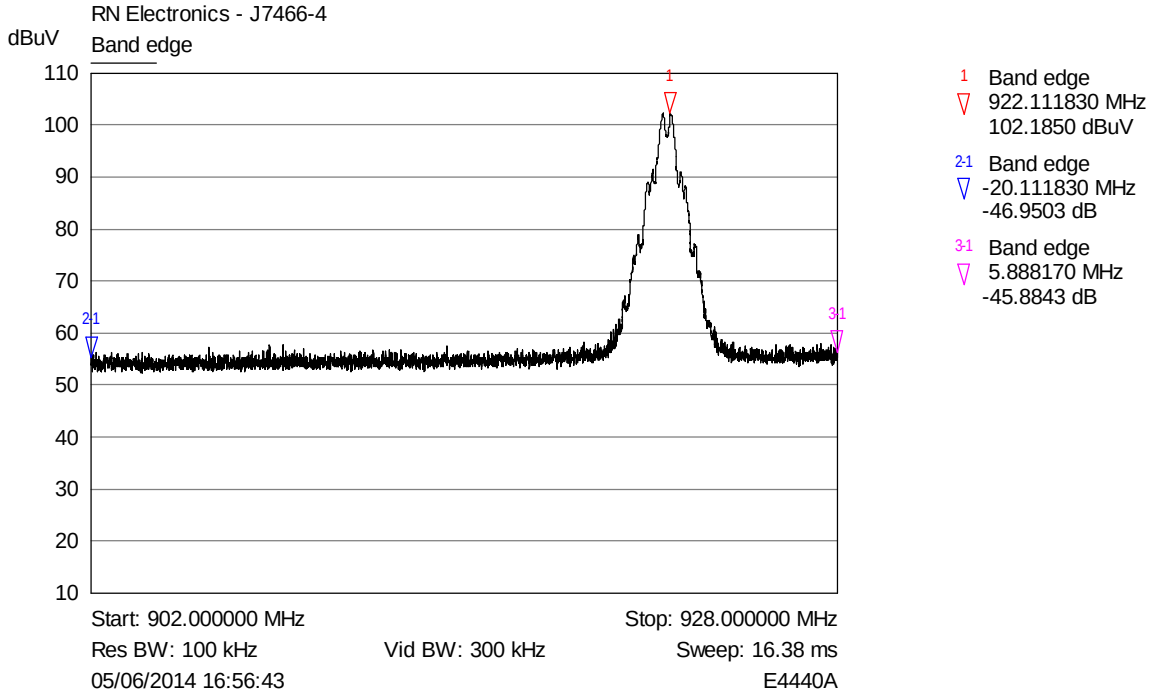
6.2 6dB Bandwidth

6.2.1 Plots for Band 902-928 MHz, Power 10 dBm, Spacing single channel, and Modulation DSSS 500kbps



6.3 Band edge compliance plots

6.3.1 Plots for Band 902-928 MHz, Power 10 dBm, Spacing single channel, and Modulation DSSS 500kbps

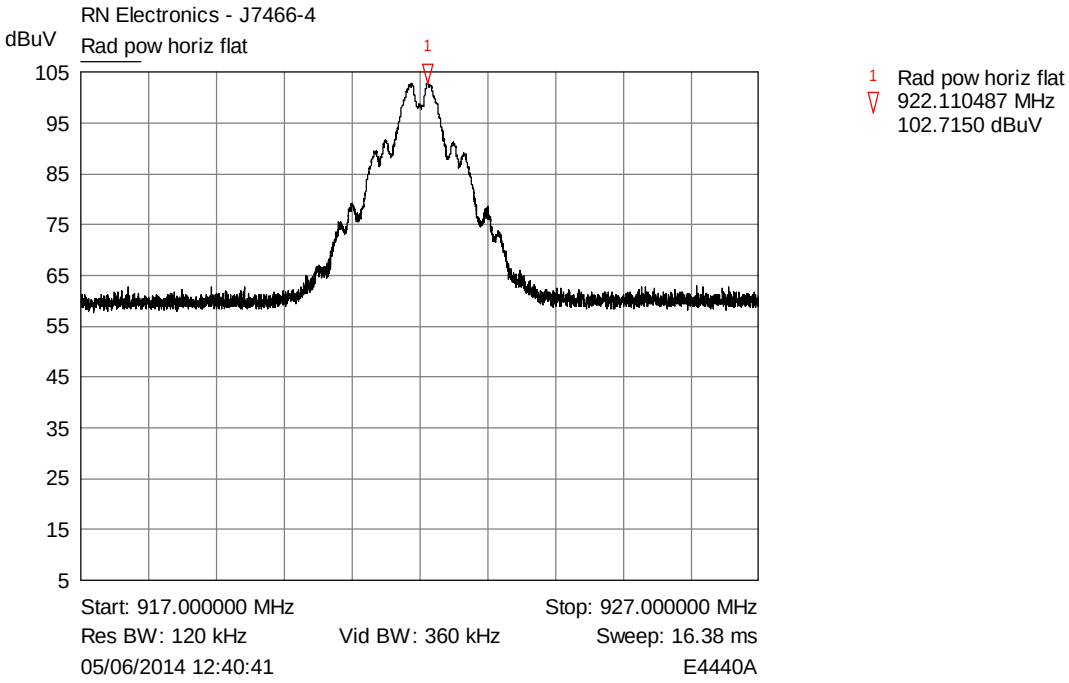


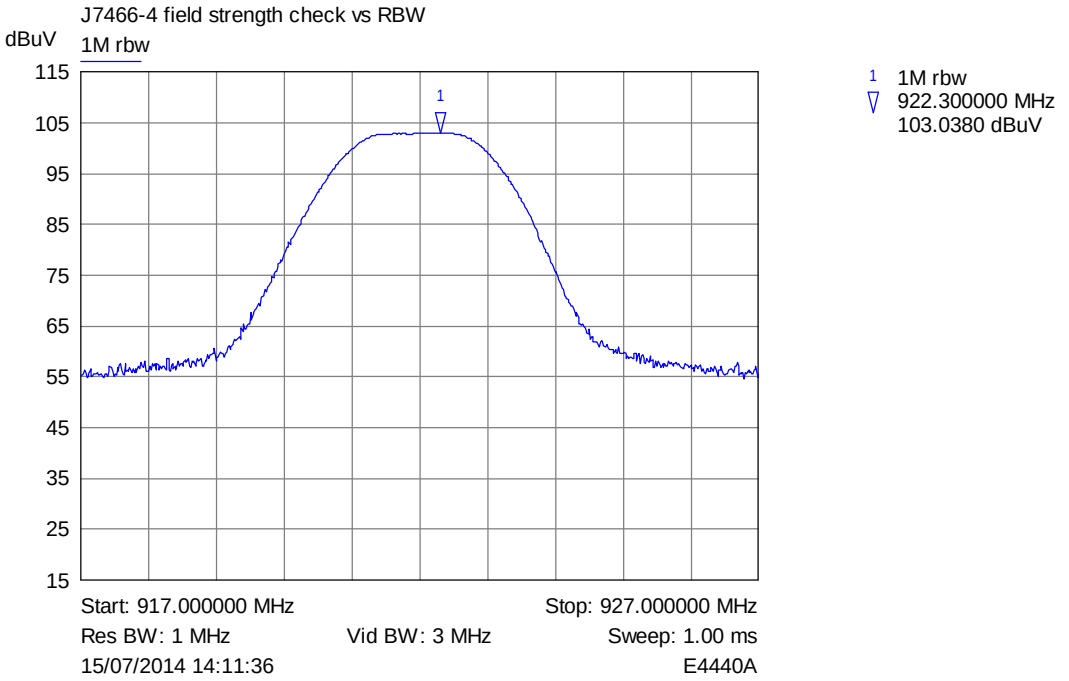
Note: Refer to radiated plots for wider span evidence of restricted band frequency points of 614 & 960 MHz.

Band Edge

6.4 Effective radiated power field strength

6.4.1 Plots for Band 902-928 MHz, Power 10 dBm, Spacing single channel, and Modulation DSSS 500kbps

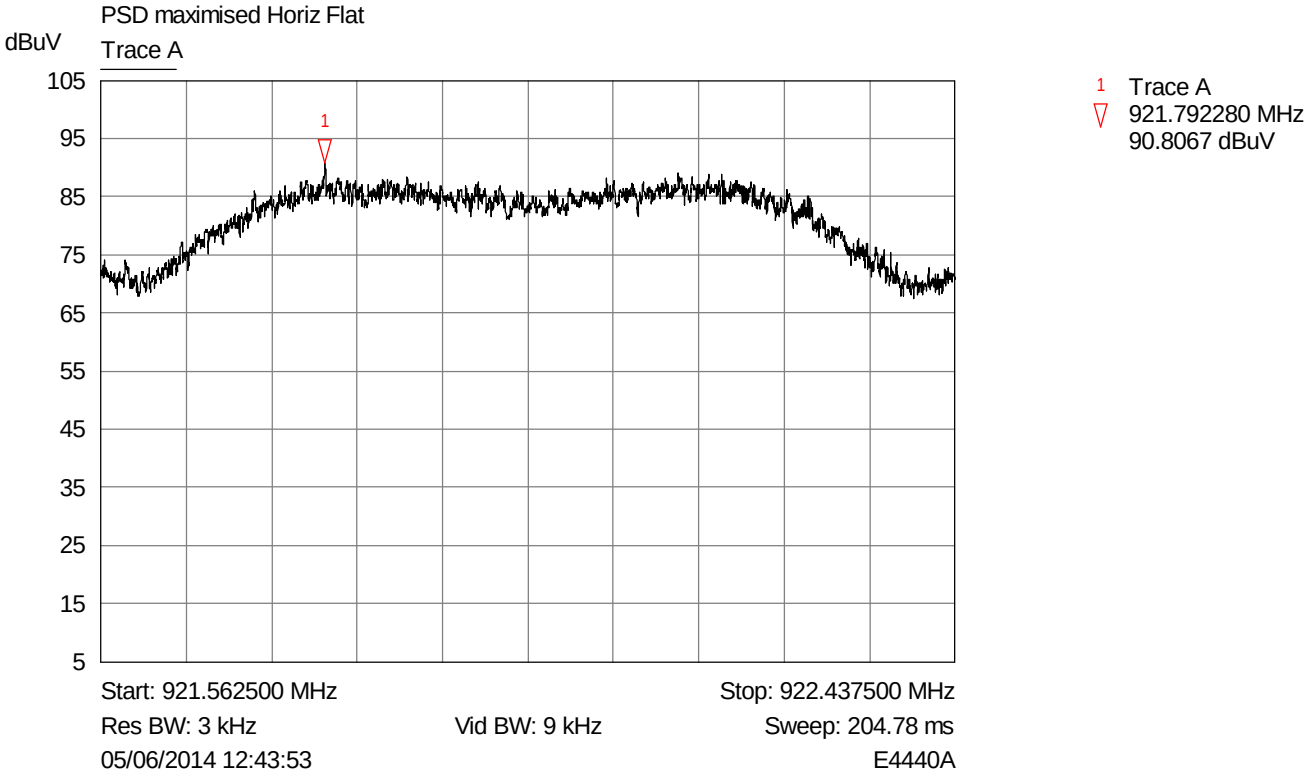




922MHz channel

6.5 Power spectral density plots

6.5.1 Plots for Band 902-928 MHz, Power 10 dBm, Spacing single channel, and Modulation DSSS 500kbps



Low channel

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

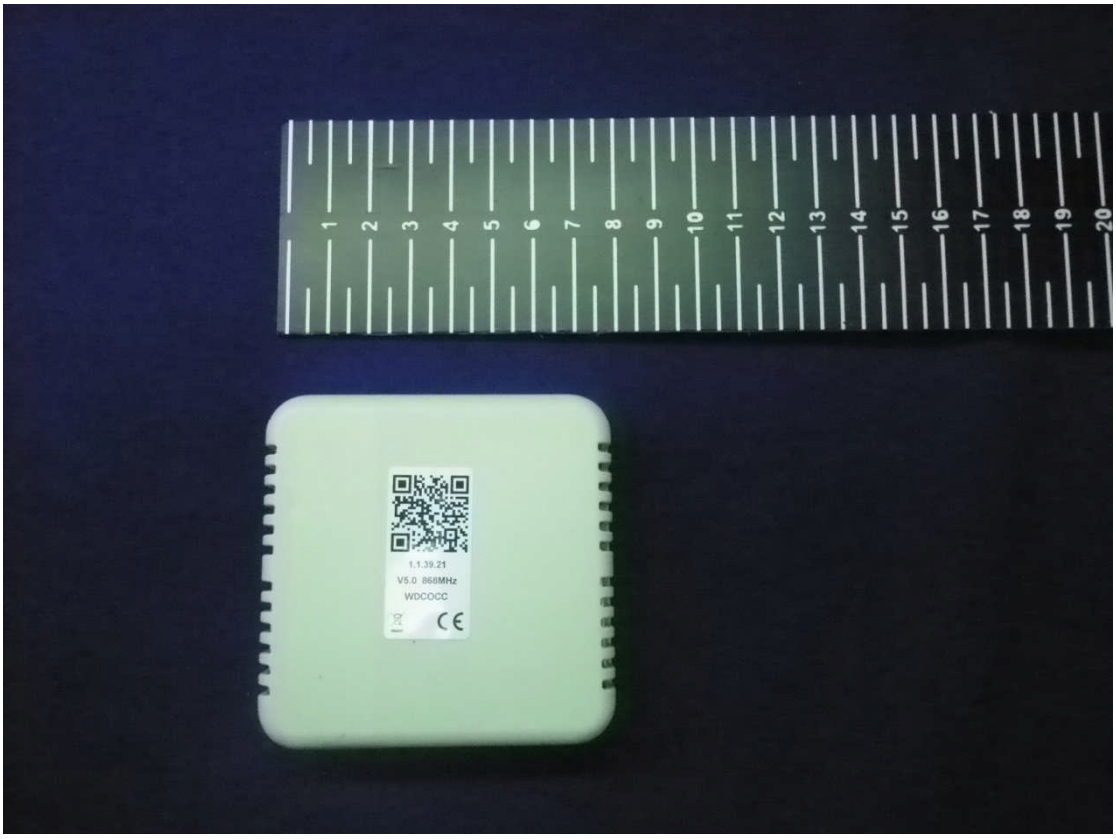
The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to 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

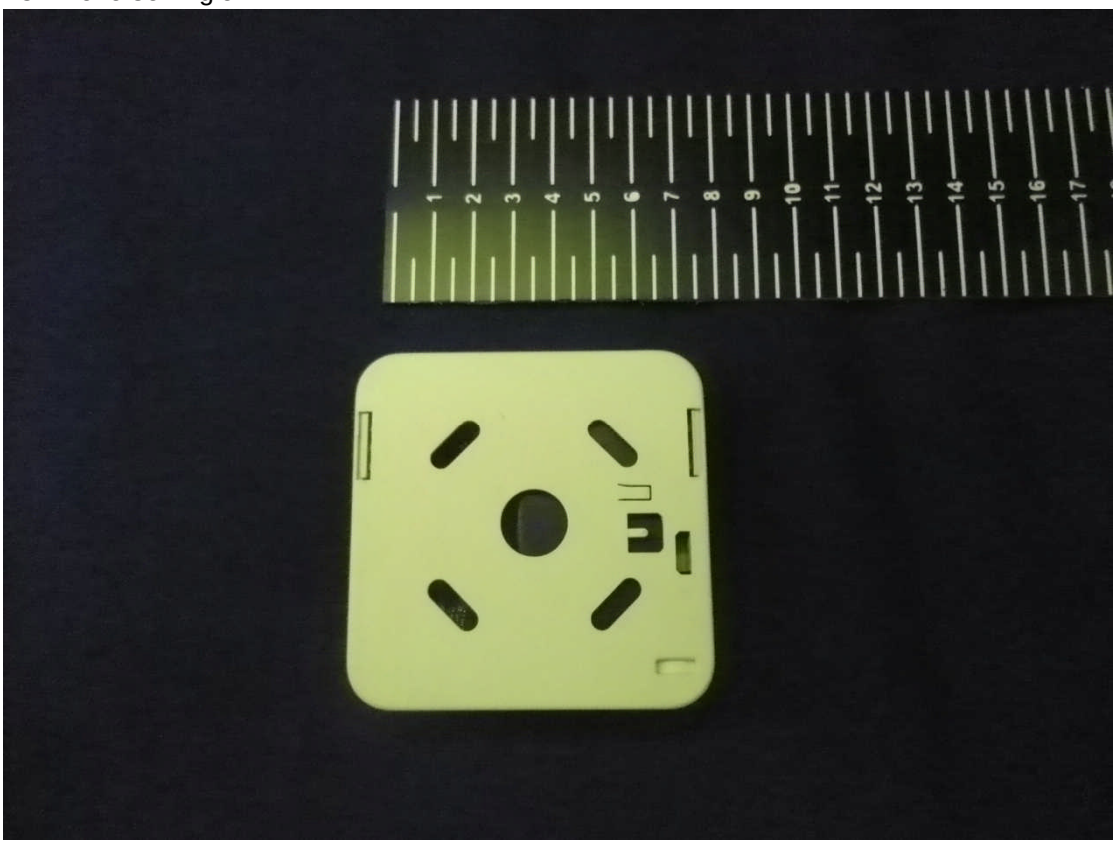
(c) limit of 30 µV/m at 30m, but below 30MHz, equates to 20.log(30) + 40.log(30/3) = 69.5 dBµV/m at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8 Photographs

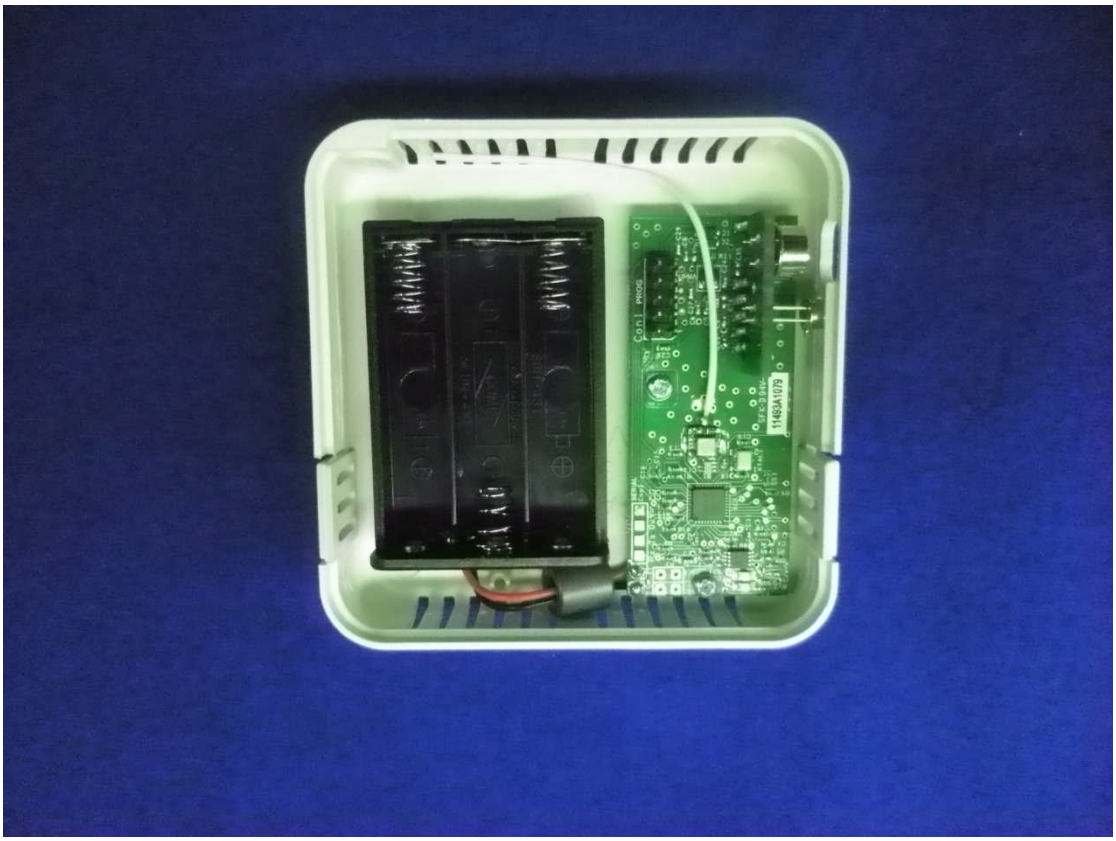
8.1 EUT Front View

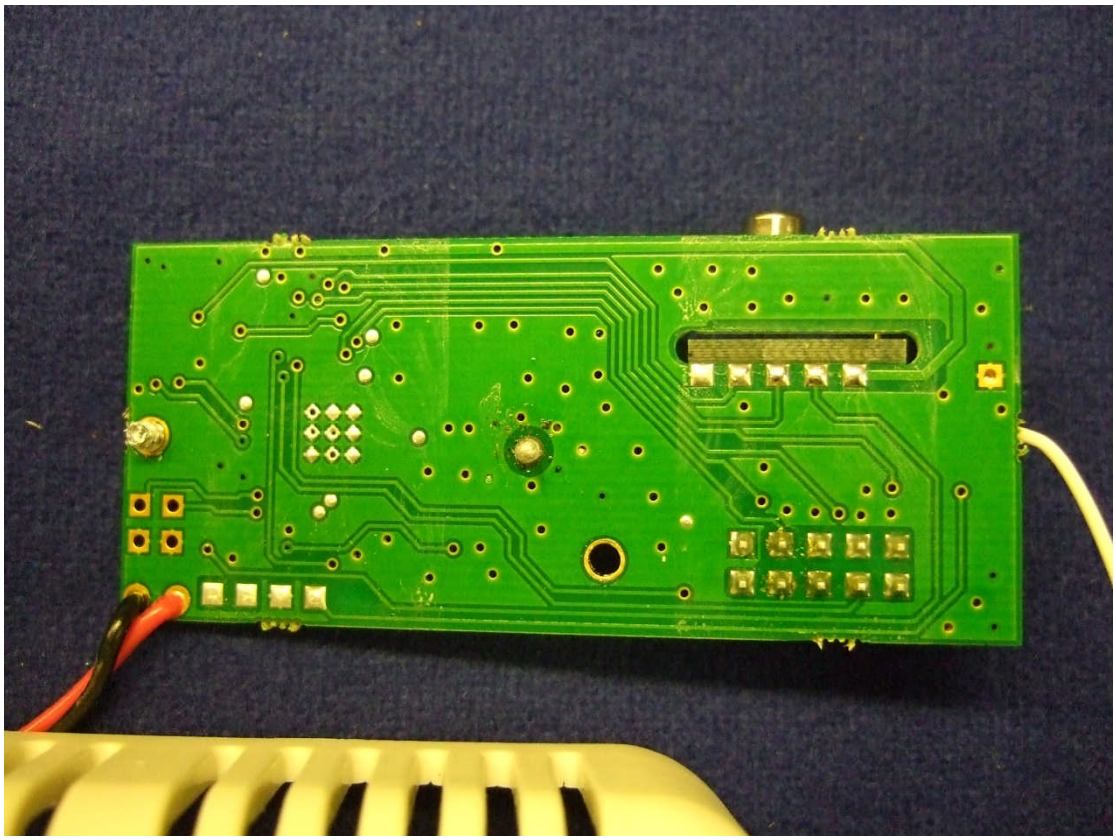


EUT Reverse Angle



8.2 EUT Internal Construction

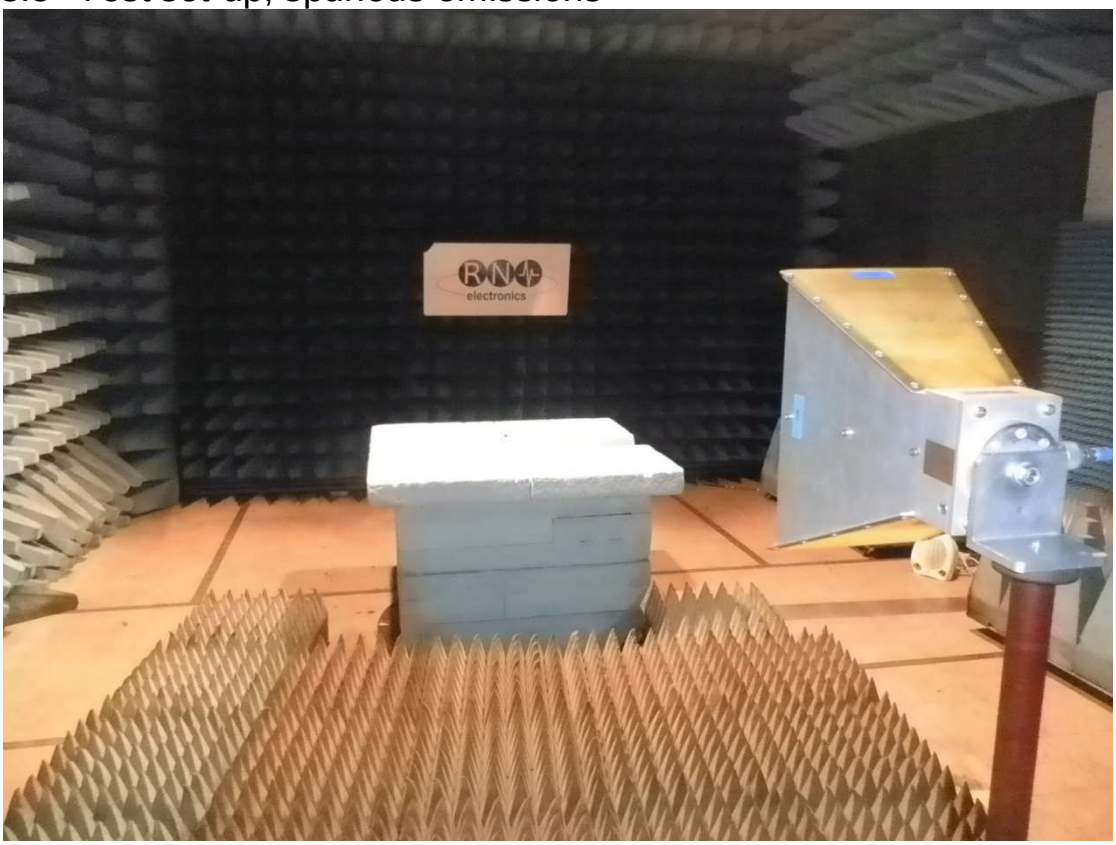


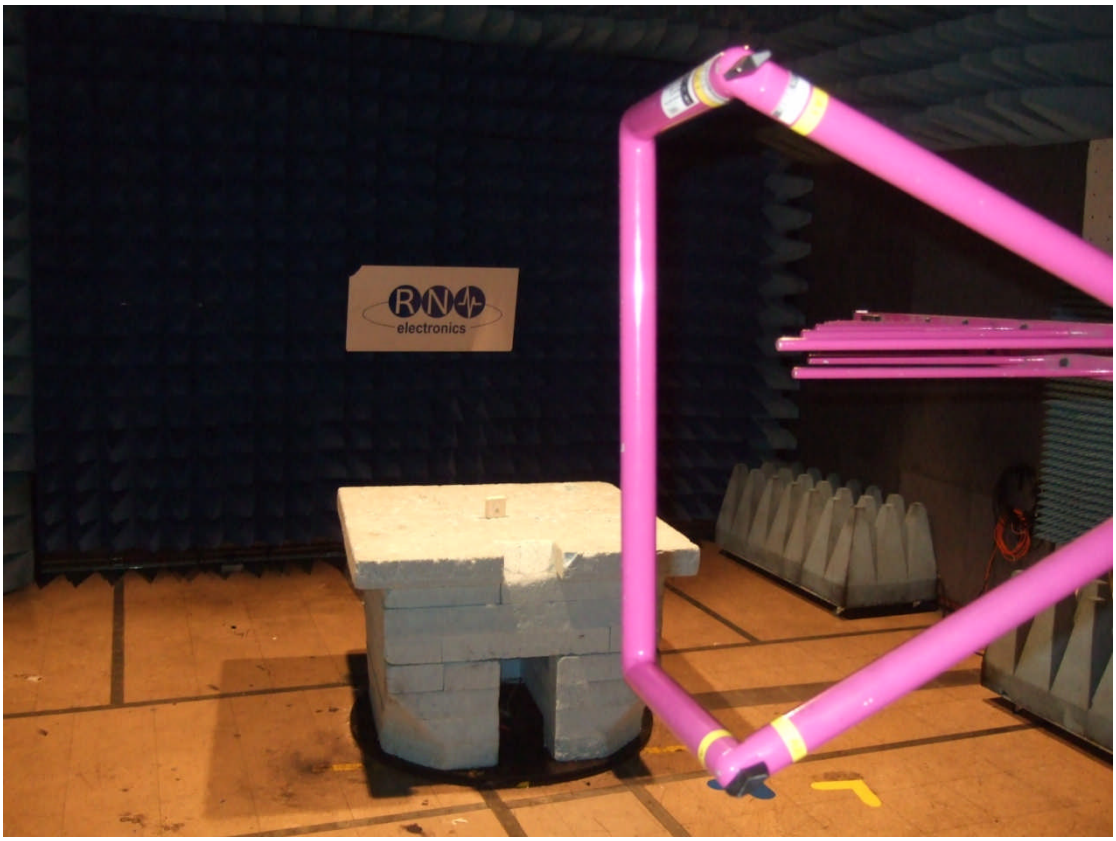


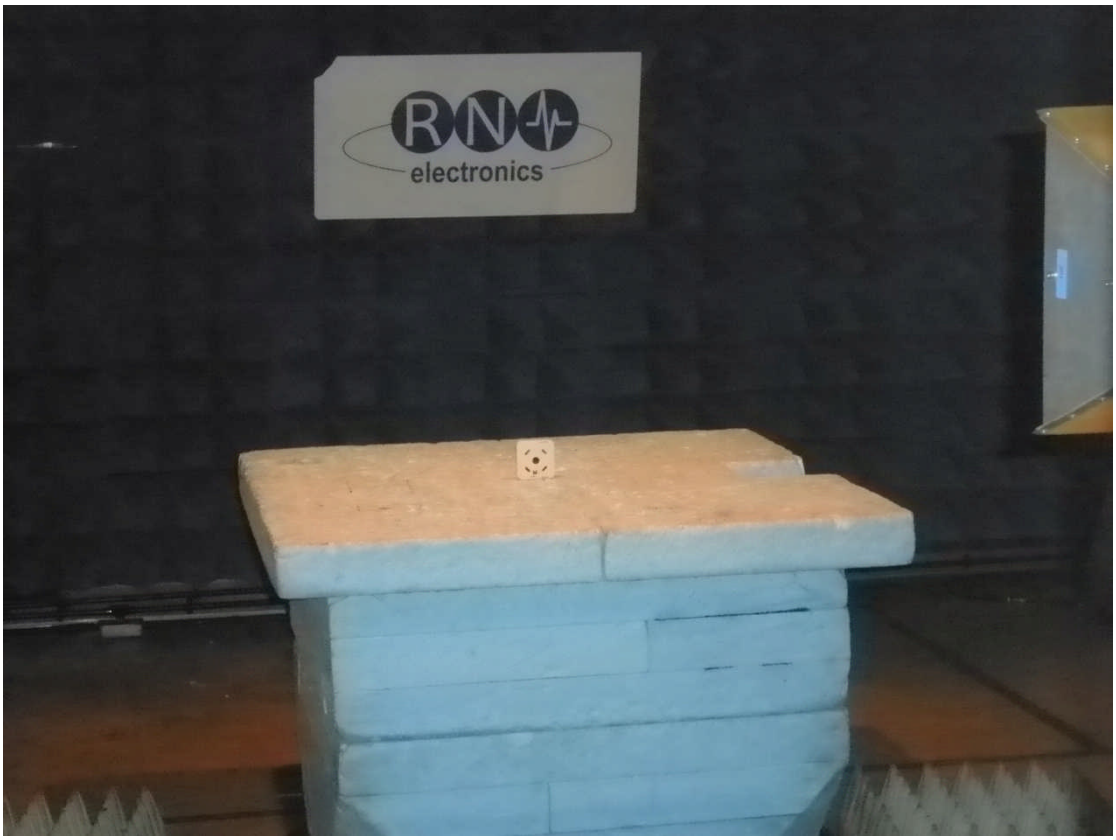
8.3 EUT Integral Antenna

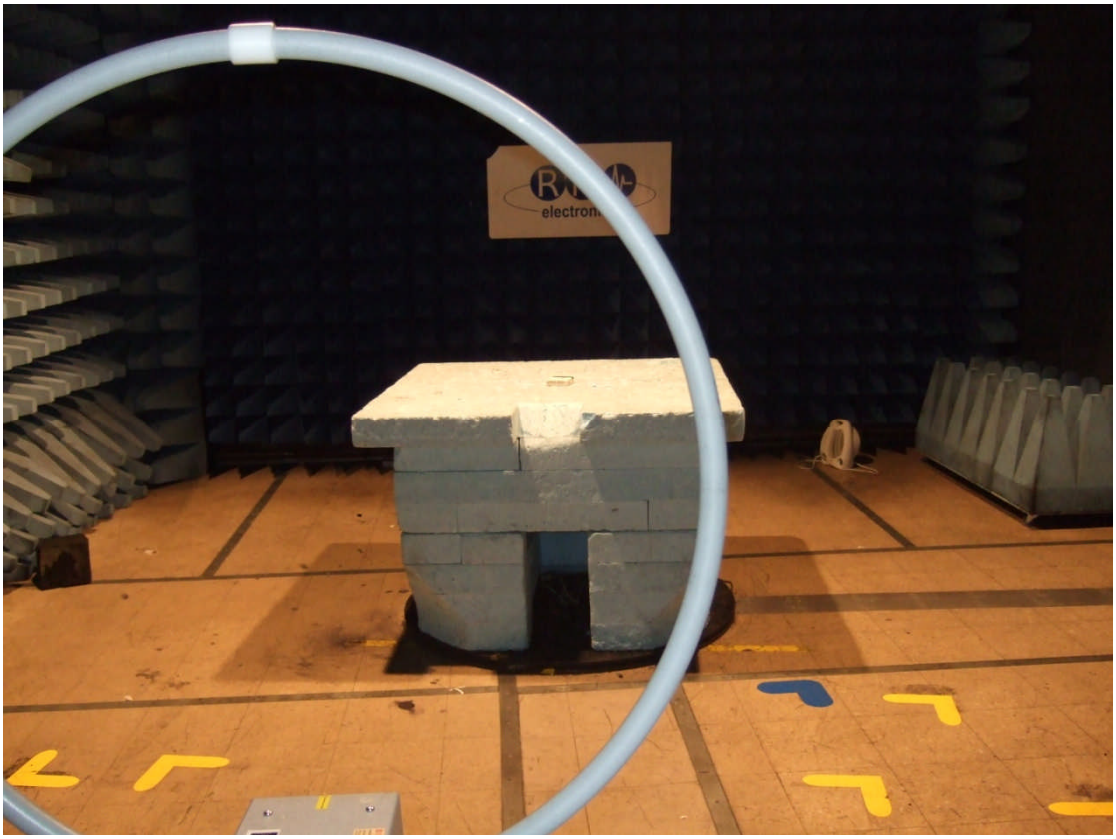
8.4 EUT Identification Label

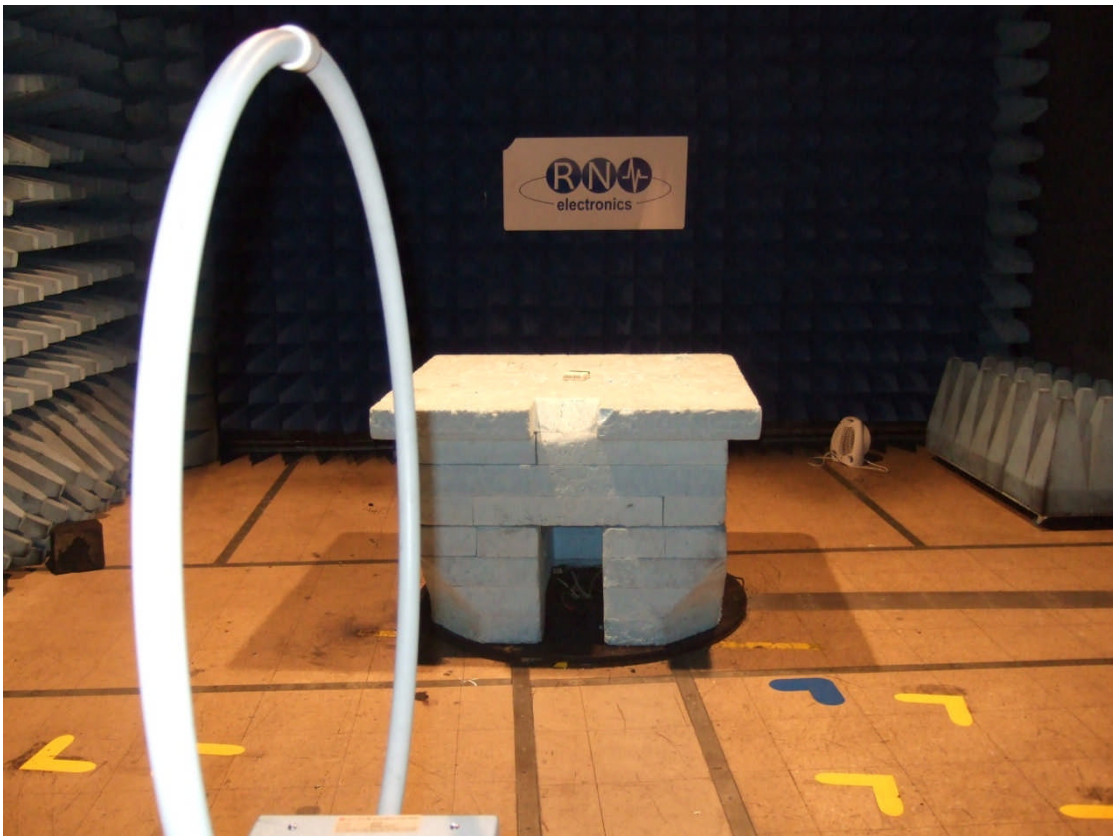
8.5 Test set-up, spurious emissions






RN
electronics




RN
electronics

8.6 Diagrams

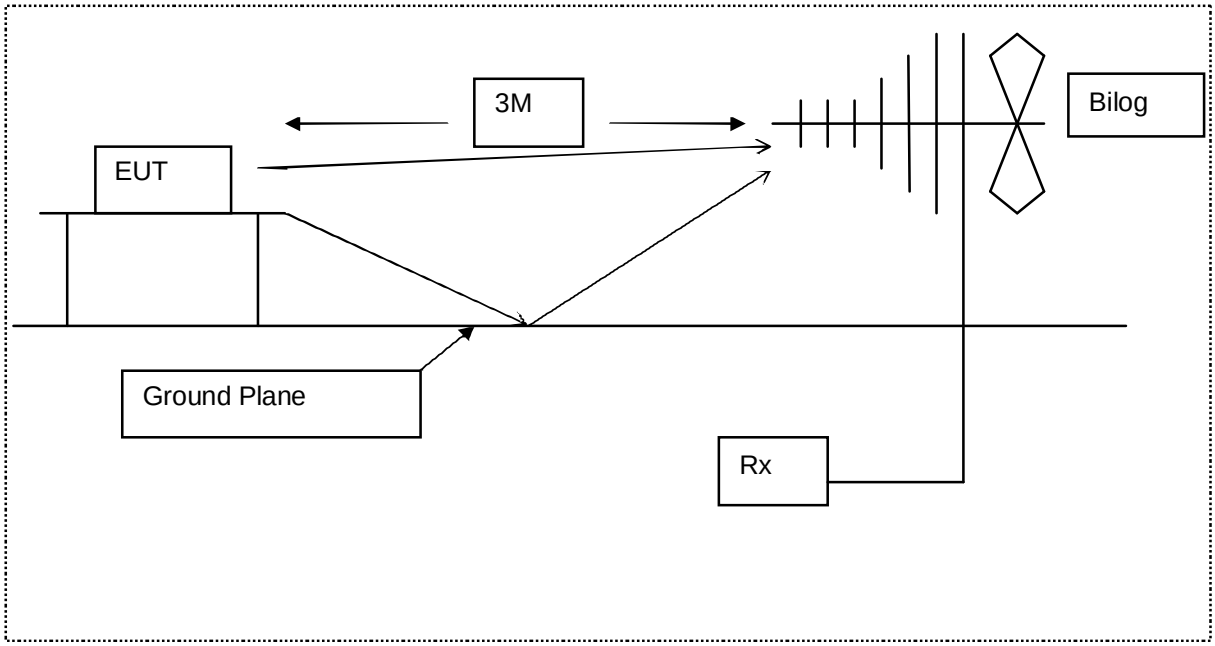


Diagram of the radiated emissions test setup.

9 Signal Leads

No signal leads were connected to EUT during test.

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
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	29-Apr-14	24 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	21-Jan-14	12 months
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	21-Jan-14	24 months
E429	-	5 Switch Filter Box 0.91 GHz - 16.3 GHz	RN Electronics	23-Jan-14	12 months
TMS81	6502	Active Loop Antenna	EMCO	24-Oct-12	24 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	26-Nov-13	12 months
TMS933	CBL6141 A	Bilog Antenna 30MHz - 2GHz	York EMC	09-Sep-12	36 months

11 Auxiliary equipment

11.1 Customer supplied Equipment

No customer supplied equipment was used

11.2 Supplied by RN Electronics Limited

No RN Electronics supplied equipment was used

12 Modifications

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

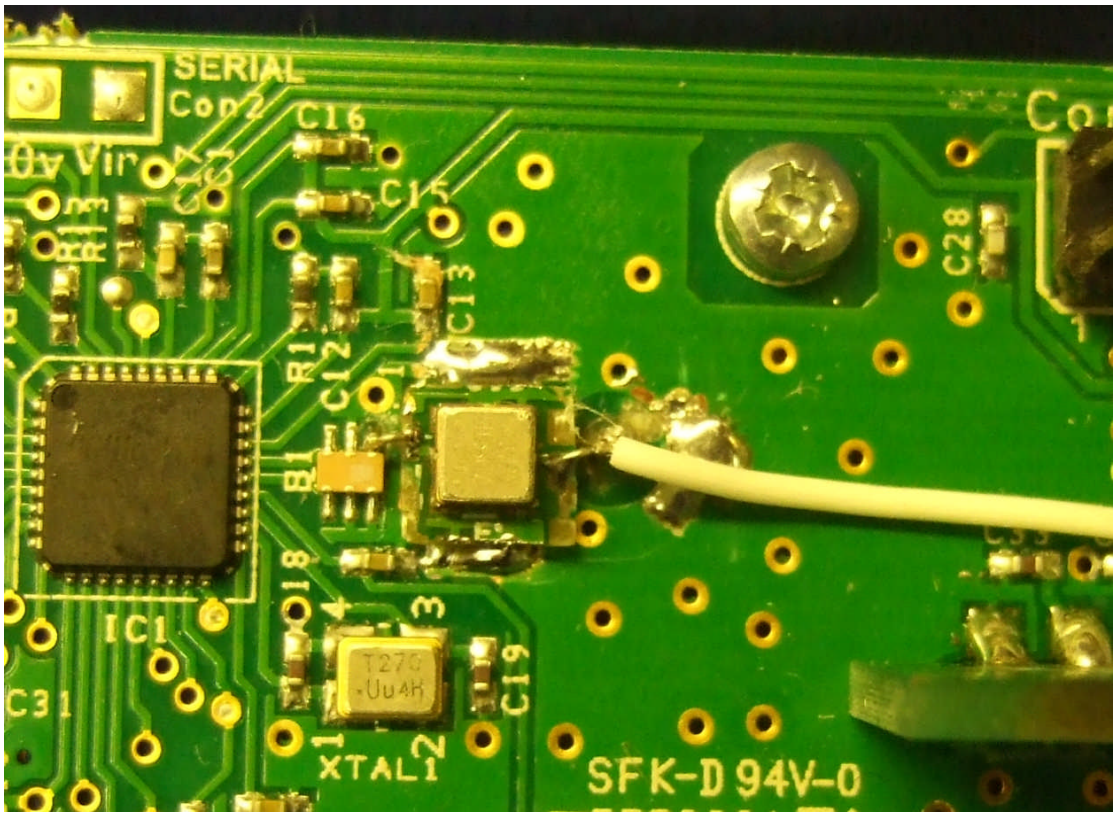
12.1 Table of modifications

No modifications were made before test by RN Electronics Ltd.

12.2 Modifications before test

In order for the EUT to comply with the spurious emissions requirements in the 30-1000MHz range the following modification was implemented by an Inotec representative before full tests began:-

RF SAW filter fitted to EUT on small PCB soldered to main board. See picture 1 below:
Part number: B39921B3588U410
Manufacturer: EPCOS



12.3 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 (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

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
		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