



FCC 47CFR part 15C Test Report

**For
Nomad Key
NRT302**

Reference Standard: FCC 47CFR part 15C
Manufacturer: Maynetronics Ltd
For type of equipment and serial number, refer to section 3
Report Number: 09-7226-2-14 Issue 01
Report Produced by: -

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Certificate of Test 7226-2

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:	Nomad Key
Model Number:	NRT302
Proposed FCC ID:	OOANRT302
Unique Serial Number:	8396
Manufacturer:	Maynetronics Ltd. Oak Cottage Ashey Road Ashey Isle of Wight PO33 4BD
Full measurement results are detailed in Report Number:	09-7226-2-14 Issue 01
Test Standards:	FCC 47CFR Part 15.249 effective date October 1st 2013 , Class DXT Intentional Radiator

DEVIATIONS:
None.

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

Date of Test:	29 th July - 29th September 2014
Test Engineer:	
Approved By: Technical Director	
Customer Representative:	

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2 Equipment Under Test (EUT)

2.1 Equipment Specification

Applicant	Maynetronics Ltd. Oak Cottage, Ashey Road, Ashey, Isle of Wight. PO33 4BD	
Manufacturer of EUT	Maynetronics Ltd.	
Brand name of EUT	Nomad Key	
Model Number of EUT	NRT302	
Serial Number of EUT	8396	
Date when equipment was received by RN Electronics	13 th June 2014	
Date of test:	29 th July - 29th September 2014	
Visual description of EUT:	A small plastic enclosure designed to be hand-held. The unit features a membrane type numerical keypad with additional function buttons to navigate the menu system. A backlit LCD screen is recessed into the unit. The unit is powered by two 1.5V AA NiMh rechargeable batteries, and the unit is charged by placing it into a spare bay of the five-way docking / charging station. The docking / charging station is powered using a 110V 60Hz power supply.	
Main function of the EUT:	A portable terminal to allow users to scan RFID tags using the built-in 13.56MHz reader/writer, and to make data entries. The EUT can be polled from a central location for data updates using the 915 MHz radio link.	
Height	120 mm	
Width	170 mm	
Depth	16 mm	
Weight	0.1 kg	
Voltage	2.2 – 15 V DC	
Current required from above voltage source	0.03 A	
EUT supplied PSU:	Manufacturer	EMS Power
	Model number	Model 9090
	Serial number	Not specified
	Input voltage	115 Vac / 230 Vac
	Input current	Not specified
	Output	+/- 12 Vdc, 3 Amp

2.2 EUT Configurations for testing

General parameters	
EUT Normal use position	Hand held
Choice of model(s) for type tests	Production prototype
Antenna details	2 x integral antenna (PCB etched)
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	915 MHz
Lowest Signal generated in EUT	2 MHz
TX Parameters	
Alignment range – transmitter	915 MHz (fixed frequency equipment)
EUT Declared Modulation Parameters	FM
EUT Declared Power level	94dBuV/m @ 3m
EUT Declared Signal Bandwidths	40 kHz
EUT Declared Channel Spacing's	Single channel equipment.
EUT declared Duty Cycle	Not stated
Unmodulated carrier available?	No
Declared frequency stability	10 ppm
RX Parameters	
Alignment range – receiver	915 MHz (fixed frequency equipment)
EUT Declared RX Signal Bandwidth	80 kHz

2.3 Functional Description

The Nomad Key NRT302 incorporates two separate radio modules, a 915 MHz transceiver and a 13.56 MHz RFID reader / writer. In normal operation, the user scans RFID tags with the unit, and makes data entries using the keypad. The EUT can be polled from a central location using the 915 MHz radio link, for data updates.

The manufacturer states that the two radios operate asynchronously, and therefore only one radio will transmit at any point in time. This function is controlled in the EUT's firmware. Both of the EUT's antennas are integral and are etched into the printed circuit board. The unit features a backlit LCD screen to provide the user with status information and a sounder.

2.4 EUT Modes

Mode Reference	Description	Used for testing
TX 13.56 MOD (Docked)	Transmitting for 38ms every 480ms with modulation, On charge (docked) in the docking station	No
TX 13.56 MOD (Undocked)	Transmitting for 38ms every 480ms with modulation, standalone (undocked) configuration	No
TX 13.56 RFID TAG (Docked)	Scanning RFID tag. EUT Transmits a single burst for 85ms, On charge (docked) in the docking station	No
TX 13.56 RFID TAG (Undocked)	Scanning RFID tag. EUT Transmits a single burst for 85ms, standalone (undocked) configuration	No
TX 915 MOD (Docked)	Transmitting continuously at 915 MHz with modulation, On charge (docked) in the docking station	Yes
TX 915 MOD (Undocked)	Transmitting continuously at 915 MHz with modulation, standalone (undocked) configuration	Yes
RX 915 (Docked)	Receiving continuously at 915 MHz, On charge (docked) in the docking station	No
RX 915 (Undocked)	Receiving continuously at 915 MHz standalone (undocked) configuration	No

The Nomad Key NRT302 incorporates two separate radio modules, a 915 MHz transceiver and a 13.56 MHz RFID reader / writer. For the purposes of testing, the EUT was supplied with a docking charger. As the Nomad NRT302 could be used whilst docked in the charger and in a standalone (handheld) configuration, pre-tests were performed in order to determine any worst case modes/configurations for final tests. Refer to specific test results sections (section 5) for details. A special engineering menu was provided on the unit and this allowed the EUT to be set to transmit using either of the two radios. The 915 MHz radio could be set to transmit continuously with modulation, and the 13.56MHz radio could be set to transmit in bursts of 38ms every 480ms.

All modes were verified using a spectrum analyser tuned to the fundamental frequency. The manufacturer has stated that this engineering menu will not be available to the end-user in the final product.

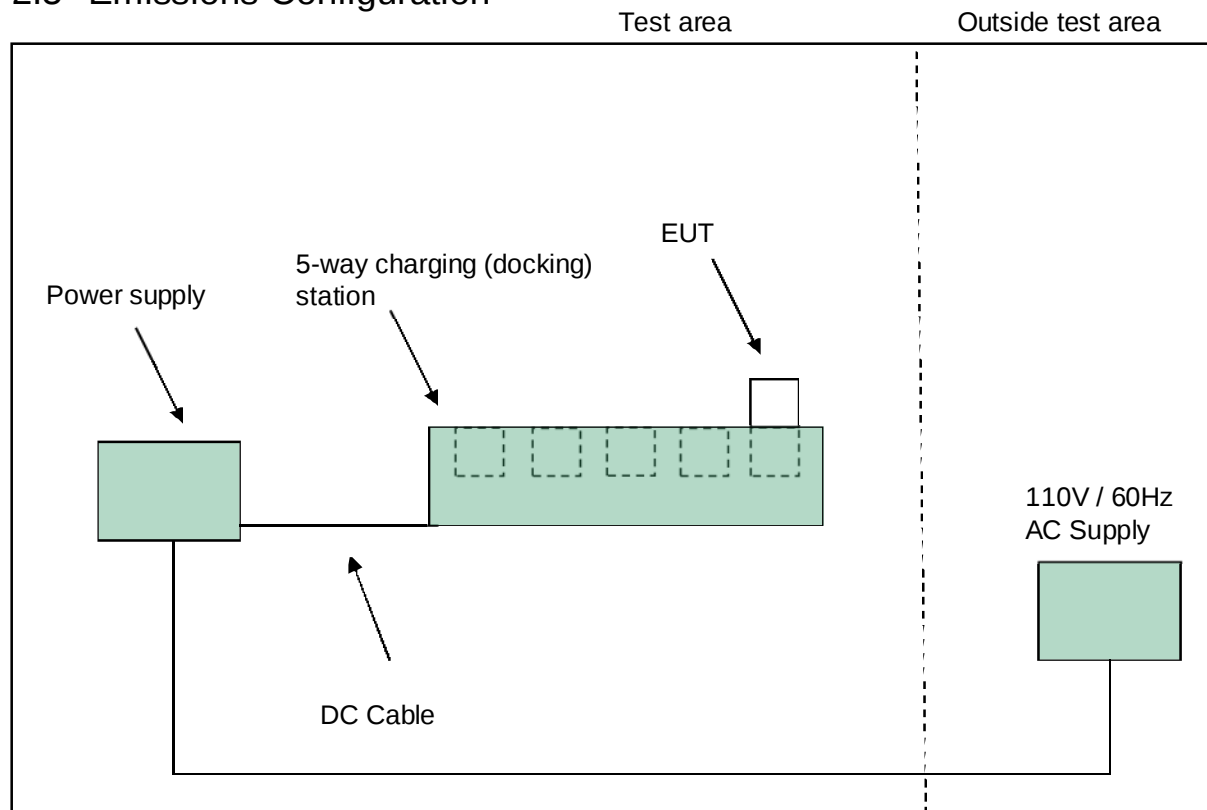
This test report pertains to the 915 MHz radio and as such, **TX 13.56 MHz** modes have not been used for testing. Please refer to RN Electronics test report 09-7226-5-14 Issue 01 for test results for the 13.56 MHz radio.

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: 20 January 2015

2.5 Emissions Configuration



Initially the EUT was pre-tested to establish any worst-case in terms of radiated emissions. The EUT was pre-tested whilst powered from its internal batteries, and also whilst charging on the five-way docking station. Worst case radiated emissions in the range 30-1000MHz were observed when the EUT was on charge in docking bay 2, for all other tests where the docking/charger was used there was no discernible difference in emissions between docking bays.

For AC conducted emissions there was no discernible difference in emissions between any of the five charging bay positions, so for full-test the first bay was used.

For Effective radiated power field strength and occupied bandwidth measurements, the EUT was pre-tested whilst operating on its internal batteries, and also whilst charging in each of the five-way docking station bays. It was found that there was no discernible difference in performance when the EUT was powered using batteries, or when on charge in any of the five charging bays, therefore for ease of test, the EUT was powered using the internal batteries in a stand-alone configuration for full-test.

The charging station was powered using the manufacturer's presented power supply. The power supply was connected to a 110V AC / 60 Hz mains supply positioned outside of the test area.

3 Summary of test results

The **Nomad Key NRT302** was tested to the following standards: -

FCC 47CFR Part 15.249 (effective date October 1st, 2013); Class DXT 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.	PASSED 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 that the TX mode used was 100% constant.

4 Specifications

The tests were performed and operated in accordance with the RN Electronics procedures and the basic standards listed below.

Reference	Standard Number	Year	Description
4.1.1	47CFR15	2013	Federal Communications Commission PART 15 – RADIO FREQUENCY DEVICES
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

R.N. Electronics is accredited as a Conformity Assessment Body (CAB) for Declaration of Conformity (DOC) under parts 15B & 18. Designation Number UK0015. Test Firm Registration number 966349.
Test sites M and OATS are listed with the FCC. Registration Number 293246.

4.1 Deviations

None.

4.2 Measurement Uncertainties

Parameter	Uncertainty
Transmitter Tests	
Occupied bandwidth	$\pm 1.9 \%$
Radiated RF power	$\pm 3.5 \text{ dB}$
Radiated spurious emissions	$<\pm 3.4 \text{ dB}$
AC line conducted emissions	150kHz to 30MHz $\pm 3.6 \text{ dB}$

5 Tests, Methods and Results

5.1 Conducted emissions

5.1.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.207)

Test Method: ANSI C63.10, Reference (6.2)

5.1.2 Configuration of EUT

The Nomad Key NRT302 was placed on a wooden table 0.8m above the ground plane and placed in the charging station. The charging station was powered using the manufacturers presented power supply. The power supply was connected to a LISN via a 1m mains cable, and powered using 110V / 60Hz AC supply.

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

During the initial pre-scan, the EUT was checked in all five charging bays; however there was no discernible difference between bays, so for full test the unit was docked in the first bay. The EUT was operated in **TX 915 MOD (Docked)** 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, E465

See Section 10 for more details.

5.1.5 Test results

Ambient conditions.

Temperature: 25 °C Relative humidity: 47 %

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6.1 of this report.

Plot reference tables

Frequency range	Plot reference
150kHz to 30MHz	7226-2 Cond 1 AC Live 150k-30M Average
150kHz to 30MHz	7226-2 Cond 1 AC Live 150k-30M Quasi-Peak
150kHz to 30MHz	7226-2 Cond 1 AC Neutral 150k-30M Average
150kHz to 30MHz	7226-2 Cond 1 AC Neutral 150k-30M Quasi-Peak

LIMITS:

As drawn on the respective plots.

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

5.2 Intentional radiator field strength

5.2.1 Test Methods

Test Requirements	FCC Part 15C, Reference (15.249 a)
Test Method:	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. Initially the EUT was pre-tested to establish the worst-case in terms of field strength. The EUT was pre-tested whilst operating on its internal batteries, and also whilst charging in each of the five-way docking station bays. It was found that there was no discernible difference in intentional radiator field strength when the EUT was powered using batteries or when on charge in any of the five charging bays. For full-test the EUT was placed on-charge in the end bay of the charger. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was rotated in all three orthogonal planes. The EUT was operated in **TX 915 MOD (Docked)** mode.

5.2.3 Test Procedure

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

Measurements were made in a semi-anechoic chamber. 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 M.

5.2.4 Test Equipment used

E411, E412, TMS933, E570

See Section 10 for more details

5.2.5 Test results

Ambient conditions.

Temperature: 24°C

Relative humidity: 39 %

Pressure: 102 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	94 dBuV/m @ 3m
Channel spacing	Single frequency equipment
Mod scheme	FM
Low channel	915 MHz

Duty Cycle Table relating to Radio Parameters 1

	Single channel
Duty Cycle (%)	100.00
Duty Cycle correction	0.00

Results relating to Radio Parameters 1

	Single channel
Peak Level (dBµV/m)	91.30
Plot reference	7226-2 915 MHz Upright Vert
Antenna Polarisation	Vert
EUT Polarisation	Upright

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: FCC Part 15C, Reference (15.209)

Test Method: 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. Initially the EUT was pre-tested to establish the worst-case in terms of emissions. The EUT was pre-tested whilst operated on its internal batteries, and also whilst charging in each of the five-way docking station bays. Worst case emissions were observed when the EUT was on charge, and located in docking bay 2 position, so for full-test this bay was used. The front edge of the EUT was initially positioned facing the antenna. The EUT was rotated in all three orthogonal planes. The EUT was operated in **TX 915 MOD (Docked)** test mode.

5.3.3 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. 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.

1 – 6 GHz, measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The EUT was rotated through 360° to record the worst case emissions. A measurement distance of 3m was used.

6 – 10 GHz, measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The EUT was rotated through 360° to record the worst case emissions. A measurement distance of 1.2m was used.

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

Tests were performed using Test Site M and OATS.

5.3.4 Test Equipment used

E411, E412, TMS81, TMS933, E570, E428, TMS82

See Section 10 for more details

5.3.5 Test results

Ambient conditions

Temperature: 24 °C Relative humidity: 39 %

Peak detector "Max held" Analyser plots against the Quasi-Peak / Average limit line(s) and any tables of signals within 20dB of the limit line 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 Below 30MHz.

No significant emissions were observed below 30MHz.

Plot references for Radiated emissions measurements (150kHz - 30MHz)

Channel	Parallel Plots	Perpendicular Plots
915 MHz	7226-2 LF Emissions 150kHz - 3MHz parallel (13.56MHz transmitting)	7226-2 LF Emissions 150kHz - 3MHz perpendicular (13.56MHz transmitting)
915 MHz	7226-2 LF Emissions 3MHz - 30MHz parallel (13.56MHz transmitting)	7226-2 LF Emissions 3MHz - 30MHz perpendicular (13.56MHz transmitting)

5.3.5.2 30MHz - 1GHz.

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

Frequency Range	Antenna Polarisation	Plot reference
30 – 300 MHz	Horizontal	7226-2 Rad 1 VHF Horiz
30 – 300 MHz	Vertical	7226-2 Rad 1 VHF Vert
300 – 1000 MHz	Horizontal	7226-2 Rad 1 UHF Horiz
300 – 1000 MHz	Vertical	7226-2 Rad 1 UHF Vert

Table of signals measured

Horizontal

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP Lim (dB)
1	239.020	35.3	30.2	-15.8
2	277.419	41.9	37.5	-8.5
3	423.570	38.9	33.0	-13.0
4	448.700	36.3	29.5	-16.5
5	451.089	38.1	32.2	-13.8
6	452.800	39.8	33.1	-12.9
7	454.000	37.8	31.9	-14.1
8	460.841	38.3	32.7	-13.3
9	467.160	39.0	32.4	-13.6

Vertical

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP Lim (dB)
1	277.490	36.2	31.3	-14.7
2	411.100	33.7	27.9	-18.1
3	453.029	32.9	26.4	-19.6
4	456.801	34.9	28.7	-17.3
5	464.397	34.8	27.9	-18.1
6	468.010	35.3	28.6	-17.4
7	943.680	37.3	30.9	-15.1

5.3.5.3 Above 1GHz.

Radio Parameters 1

Band	902-928 MHz
Power level	94 dBuV/m @ 3m
Channel spacing	single frequency
Mod scheme	FM
Low channel	915 MHz

Results relating to Radio Parameters 1

Spurious Frequency (MHz)	Measured Peak Level (dBuV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBuV/m)	Difference to Average Limit (dB)	Antenna Polarisation	EUT Polarisation
1829.941	42.6	-31.4	38.7	-15.3	Horizontal	Upright
2744.932	43.8	-30.2	38.3	-15.7	Horizontal	Upright
3167.597	41.2	-32.8	29.4	-24.6	Horizontal	Upright
4574.853	54.5	-19.5	51.9	-2.1	Horizontal	Upright
1248.437	34.7	-39.3	22.5	-31.5	Vertical	Upright
2744.912	42.6	-31.4	36.4	-17.6	Vertical	Upright
4574.853	52.6	-21.4	49.4	-4.6	Vertical	Upright

Plot reference table

Frequency Range	Antenna Polarisation	Plot reference
1 - 2 GHz	Horizontal	7226-2 Rad 1 1-2GHz Horiz
1 - 2 GHz	Vertical	7226-2 Rad 1 1-2GHz Vert
2 - 5 GHz	Horizontal	7226-2 Rad 1 2-5GHz Horiz
2 - 5 GHz	Vertical	7226-2 Rad 1 2-5GHz Vert
5 - 6 GHz	Horizontal	7226-2 Rad 1 5-6GHz Horiz
5 - 6 GHz	Vertical	7226-2 Rad 1 5-6GHz Vert
6 - 10 GHz	Horizontal	7226-2 Rad 1 6 up to10GHz Horiz
6 - 10 GHz	Vertical	7226-2 Rad 1 6 up to10GHz Vert

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 μ V/m @ 3m (-54 dBm).

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

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

5.4 Frequency stability

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

5.5 Occupied bandwidth (20dB)

5.5.1 Test Methods

Test Requirements: FCC Part 15C, Reference (15.215 (c))

Test Method: ANSI C63.10, Reference (6.9)

5.5.2 Configuration of EUT

For occupied bandwidth measurements, the EUT was pre-tested whilst operating on its internal batteries, and also whilst charging in each of the five-way docking station bays. It was found that there was no discernible difference in occupied bandwidth between the two methods. For full-test the EUT was tested whilst charging in the docking station.

The EUT was placed in a chamber and was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was referenced to maximum field strength as measured on an OATS. The EUT was operated in **TX 915 MOD (Docked)** mode.

5.5.3 Test Procedure

Tests were performed using Test Site M.

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 5kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 20dB bandwidth.

5.5.4 Test Equipment used

E411, E412, TMS933

See Section 10 for more details.

5.5.5 Test results

Ambient conditions.

Temperature: 22 °C

Relative humidity: 44 %

Pressure: 102 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	94 dBuV/m @ 3m
Channel spacing	single frequency equipment
Mod scheme	FM
Low channel	915 MHz

Results relating to Radio Parameters 1

	Single channel
20dB BW (MHz)	0.13
Plot reference	7226-2 20dB bandwidth

LIMITS:

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

The result is also presented graphically. Please refer to section 6.4 of this report.

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 and 15.247)

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 EUT was tested whilst charging in the docking station and positioned for maximised emissions. The EUT was operated in **TX 915 MOD (Docked)** mode.

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

E411, E412, TMS933, E570

See Section 10 for more details.

5.6.5 Test results

Ambient conditions.

Temperature: 24 °C

Relative humidity: 39 %

Pressure: 102 kPa

Radio Parameter 1

Band	902-928 MHz
Power level	94 dBuV/m @ 3m
Channel spacing	single frequency equipment
Mod scheme	FM
Low channel	915 MHz

Band Edge Results relating to Radio Parameters 1

	Lower edge	Upper edge
Peak Level (dBuV/m)	32.4	33.3
Plot reference	J7226-2 Band edges 30MHz span	

The result are presented graphically, please refer to section 6.5 for plots.

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. See radiated emissions results section 5.3.

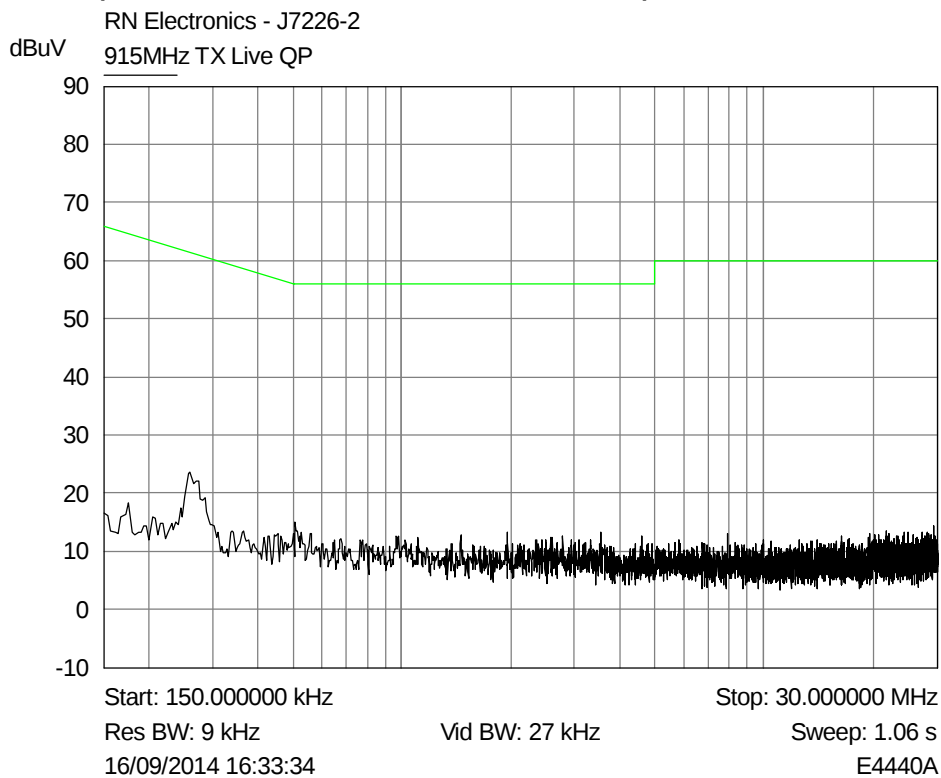
These results show that the **EUT** has **PASSED** this test.

5.7 Duty cycle

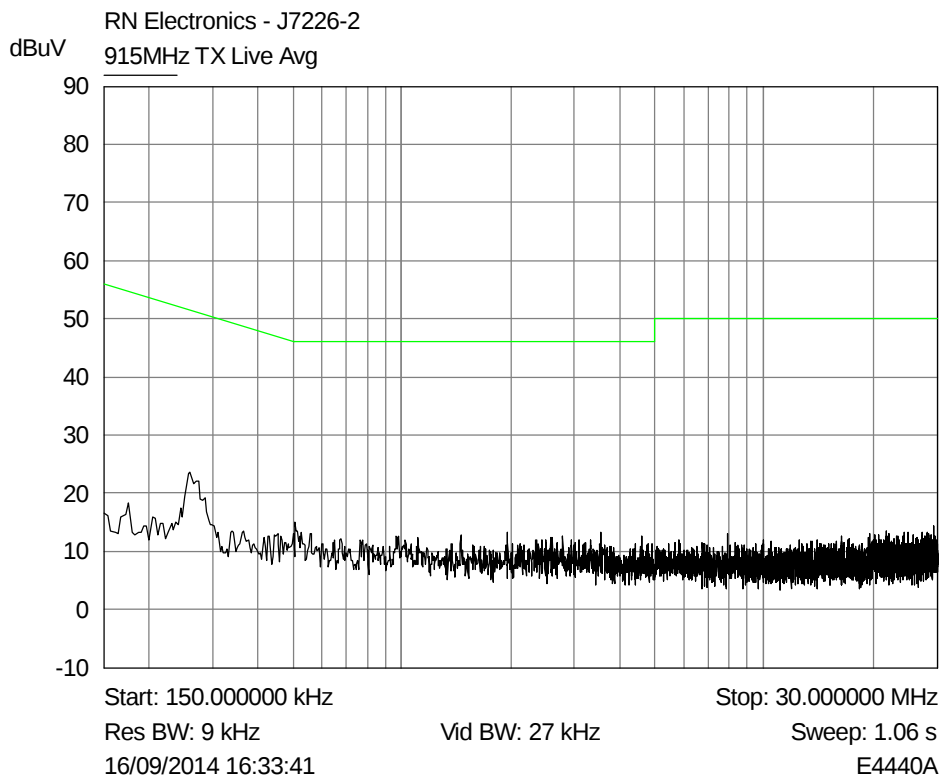
No limits apply, however duty cycle check made to verify that the TX mode used was 100% constant.

6 Plots and Results

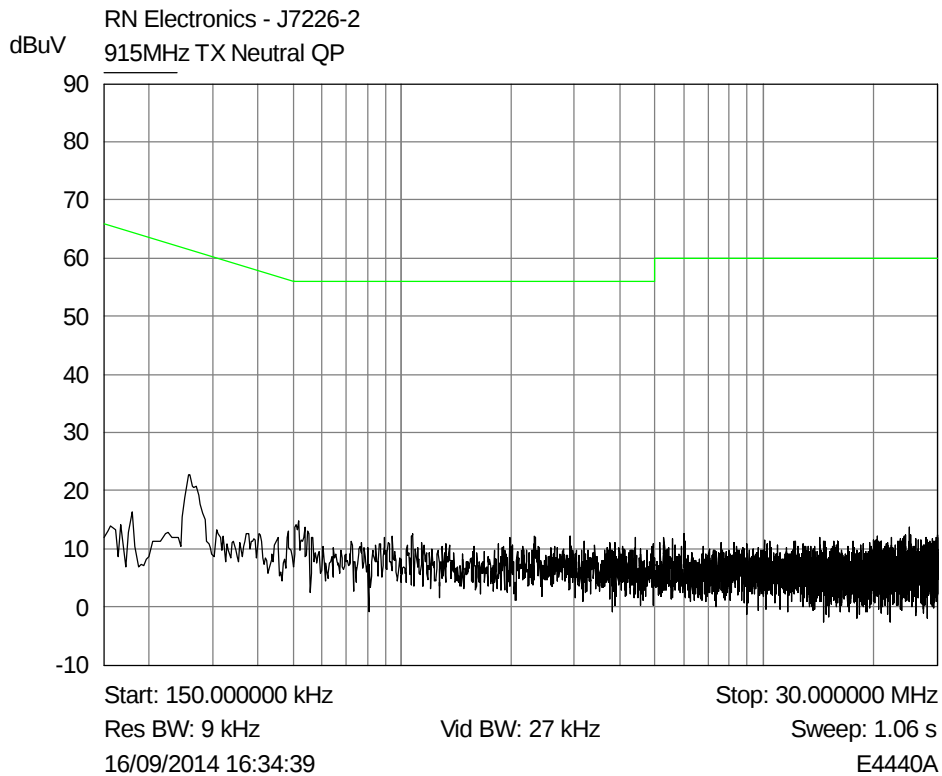
6.1 AC power line conducted emissions plots



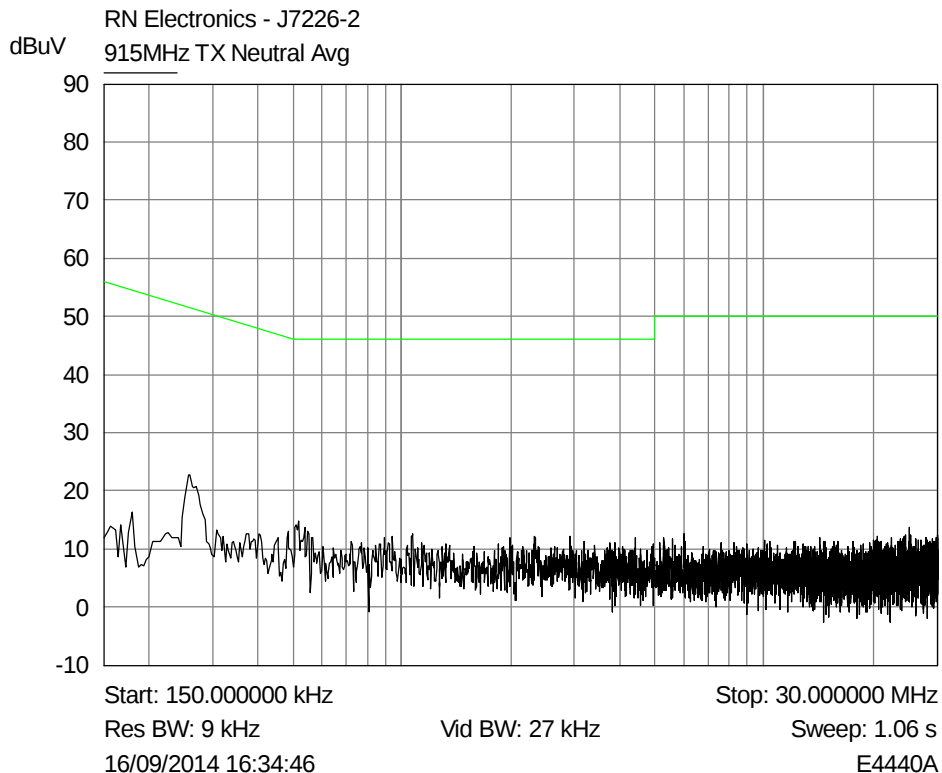
Plot of peak emissions 150kHz - 30MHz on the 915MHz transmitting live terminal against the quasi-peak limit line.



Plot of peak emissions 150kHz - 30MHz on the 915MHz transmitting live terminal against the average limit line.

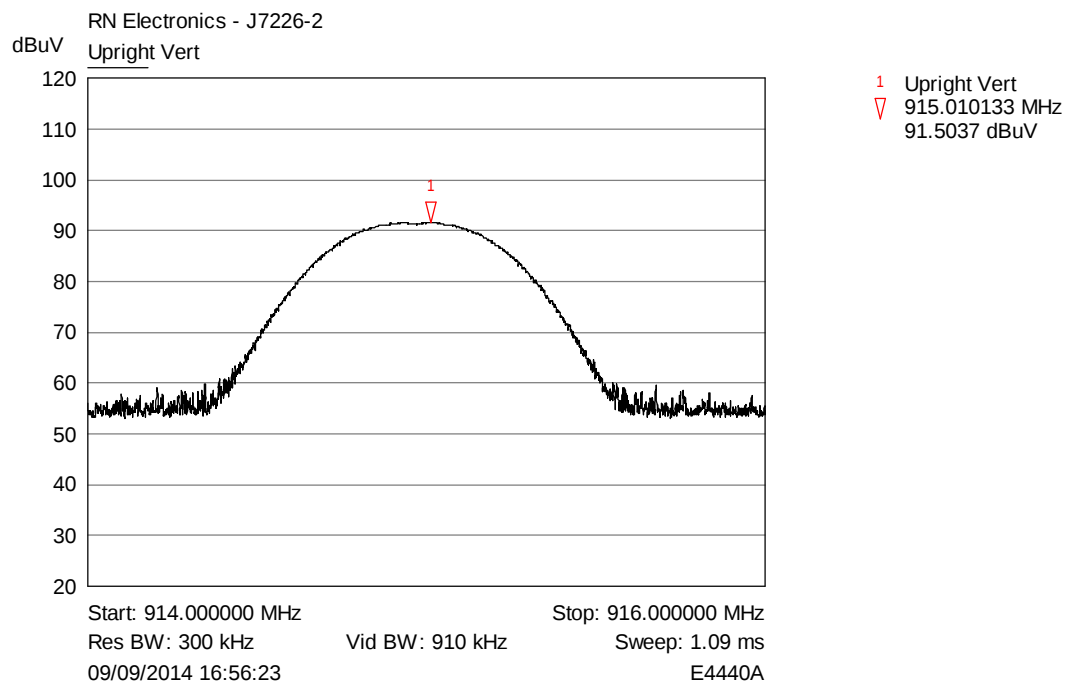


Plot of peak emissions 150kHz - 30MHz on the 915MHz transmitting neutral terminal against the quasi-peak limit line.



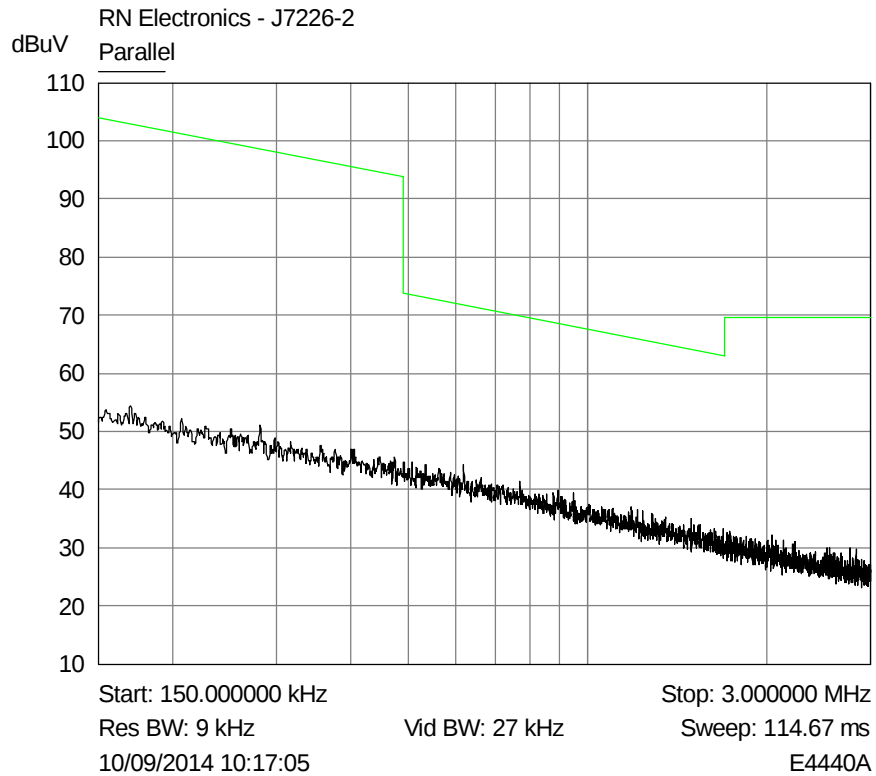
Plot of peak emissions 150kHz - 30MHz on the 915MHz transmitting neutral terminal against the average limit line.

6.2 Intentional radiator field strength plots

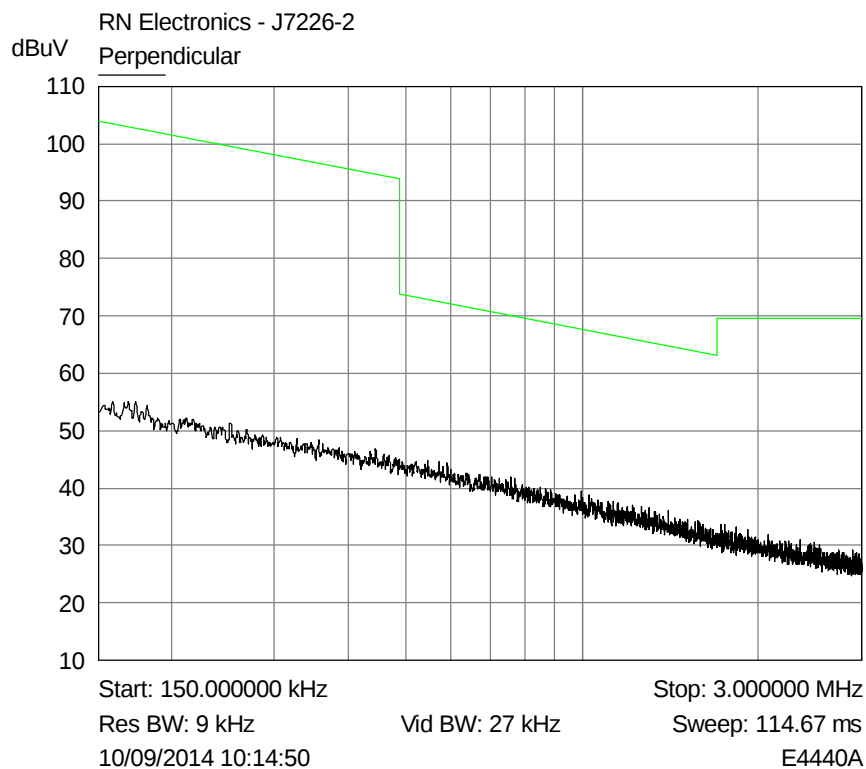


Plot for Band 902-928 MHz, Power 94 dBuV, and FM Modulation.

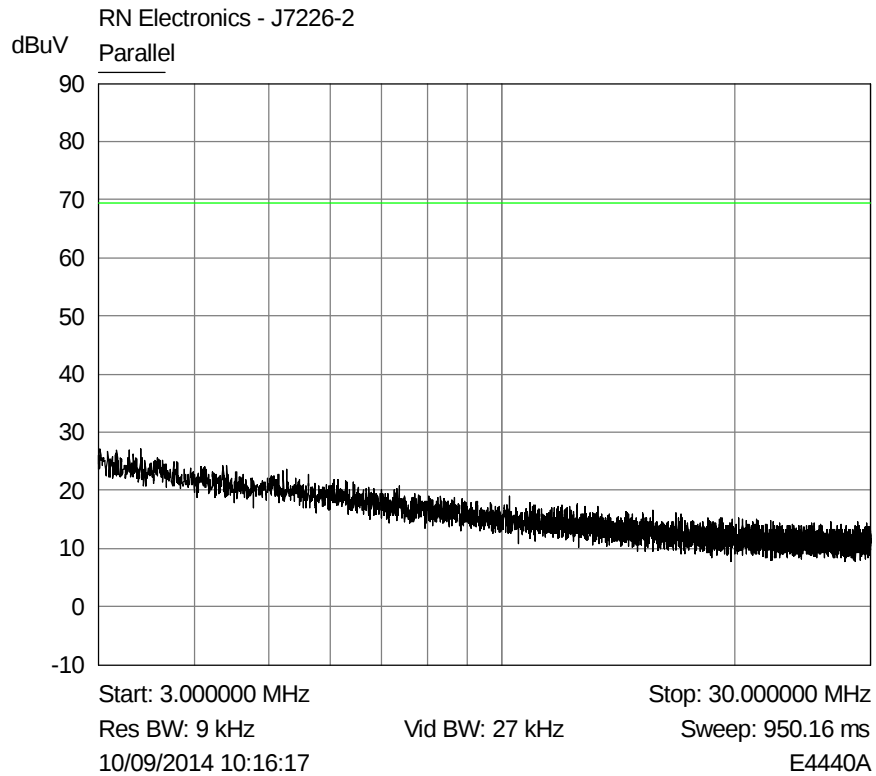
6.3 Radiated emissions plots



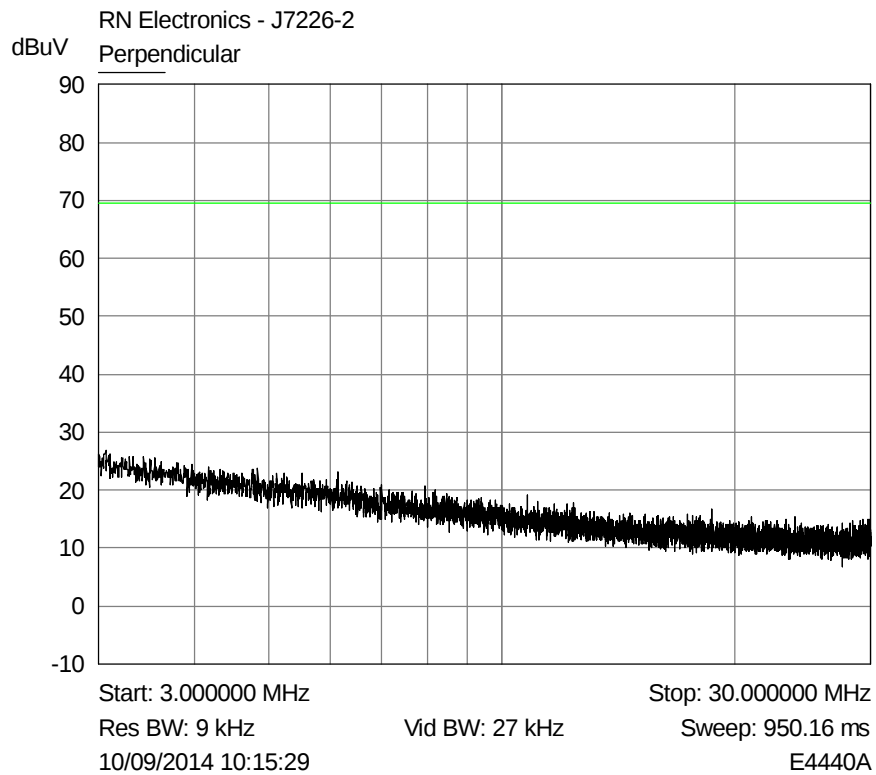
915 MHz Transmitting – 150kHz – 3MHz Parallel Plot



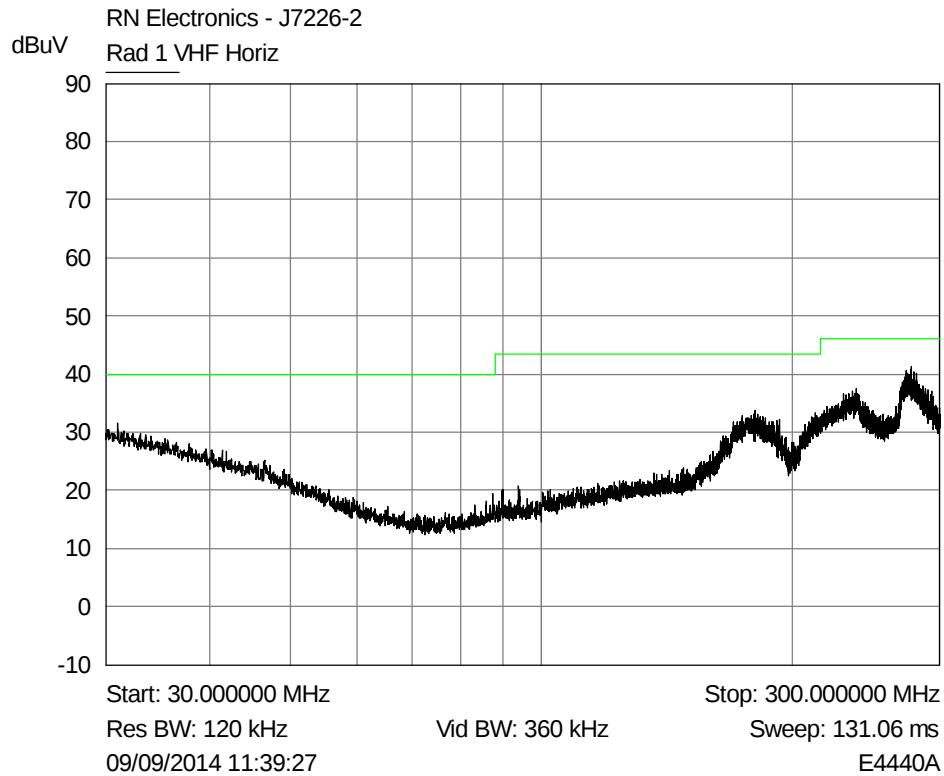
915 MHz Transmitting – 150kHz – 3MHz Perpendicular Plot



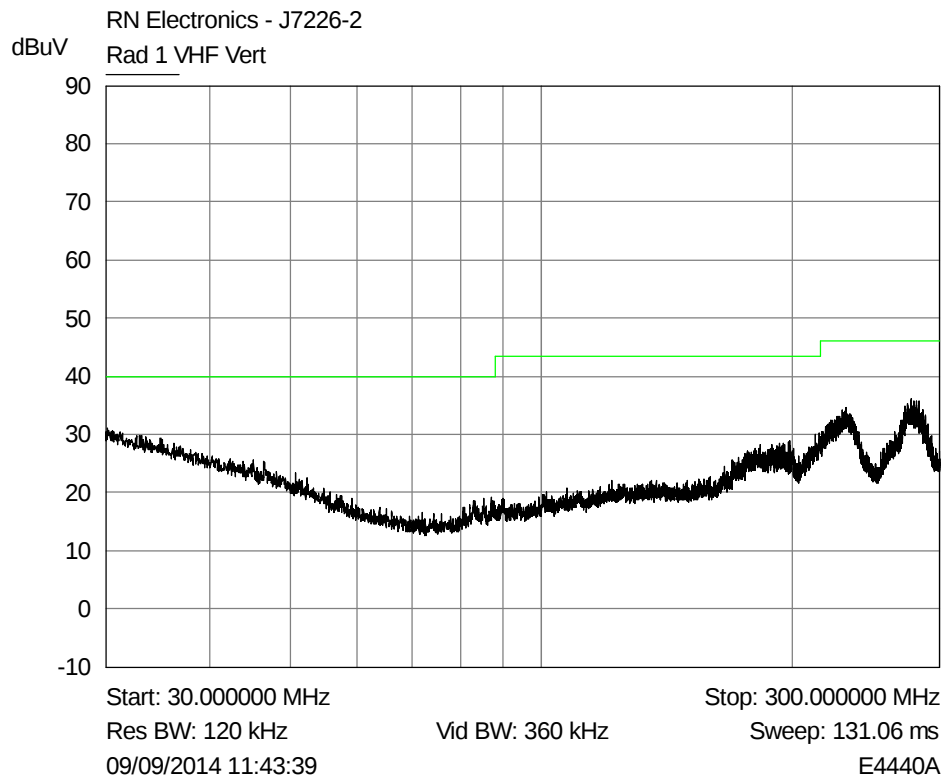
915 MHz Transmitting – 3MHz – 30MHz Parallel Plot



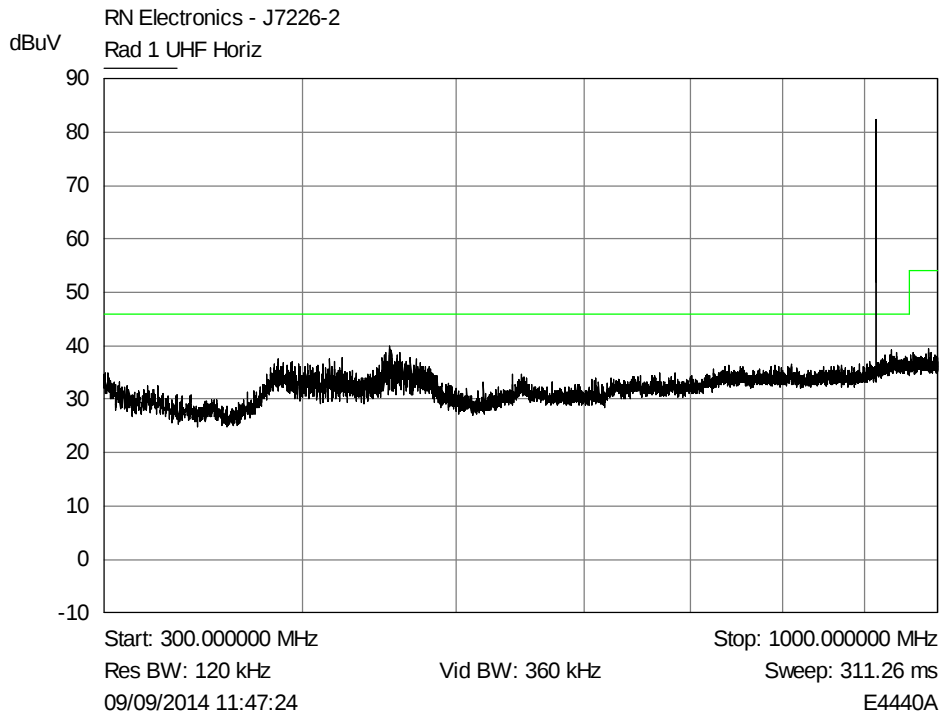
915 MHz Transmitting – 3MHz – 30MHz Perpendicular Plot



Plot of peak horizontal emissions 30MHz - 300MHz against the quasi-peak limit line.

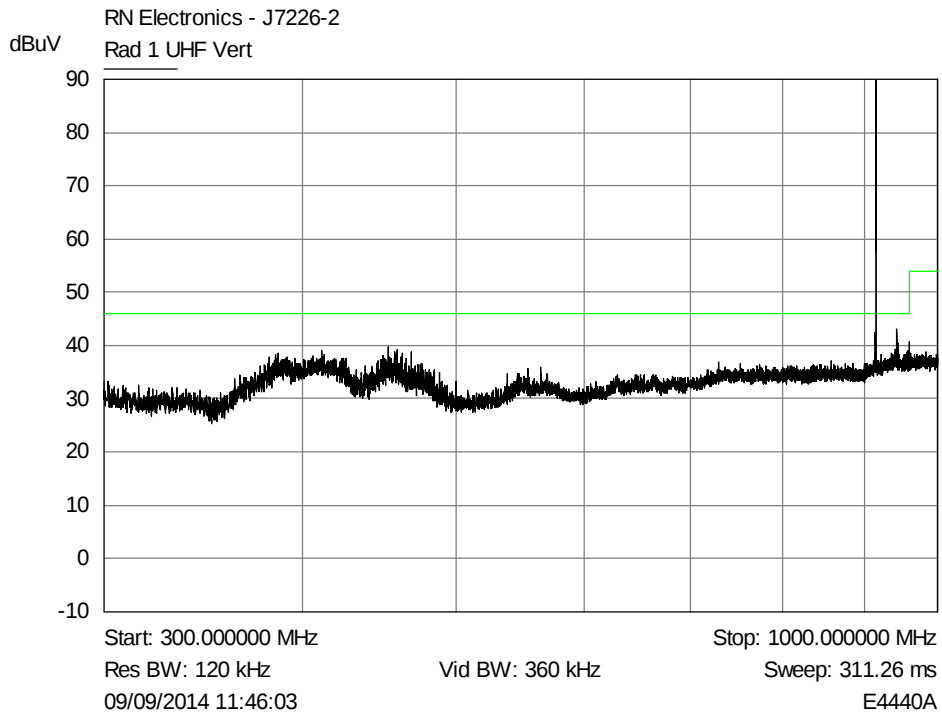


Plot of peak vertical emissions 30MHz - 300MHz against the quasi-peak limit line.



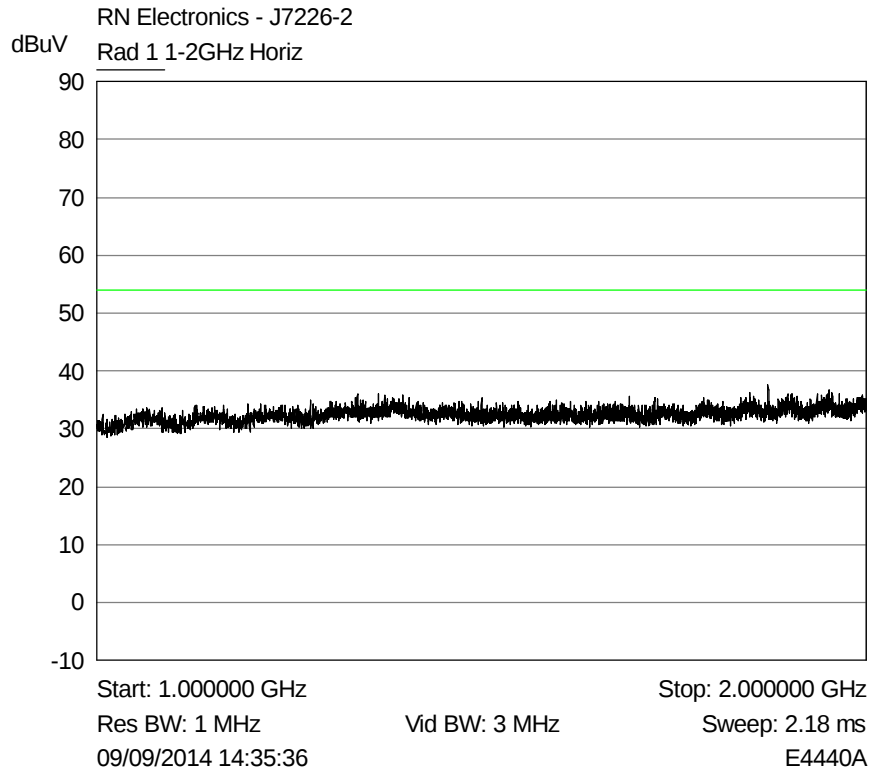
Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line.

Note: Plot shows the EUT's fundamental frequency at 915MHz.

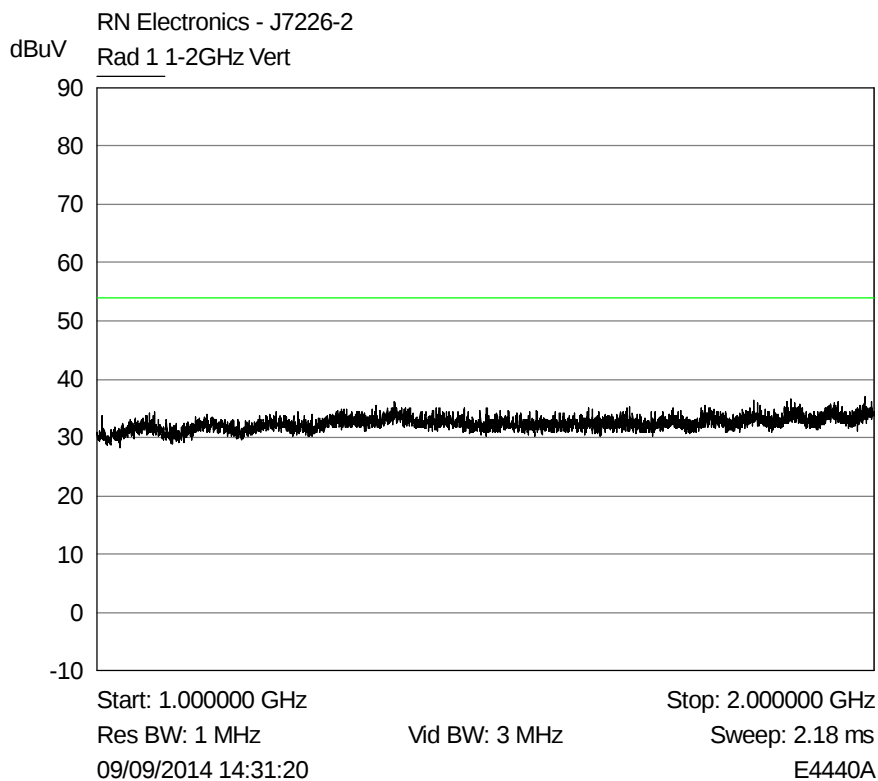


Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

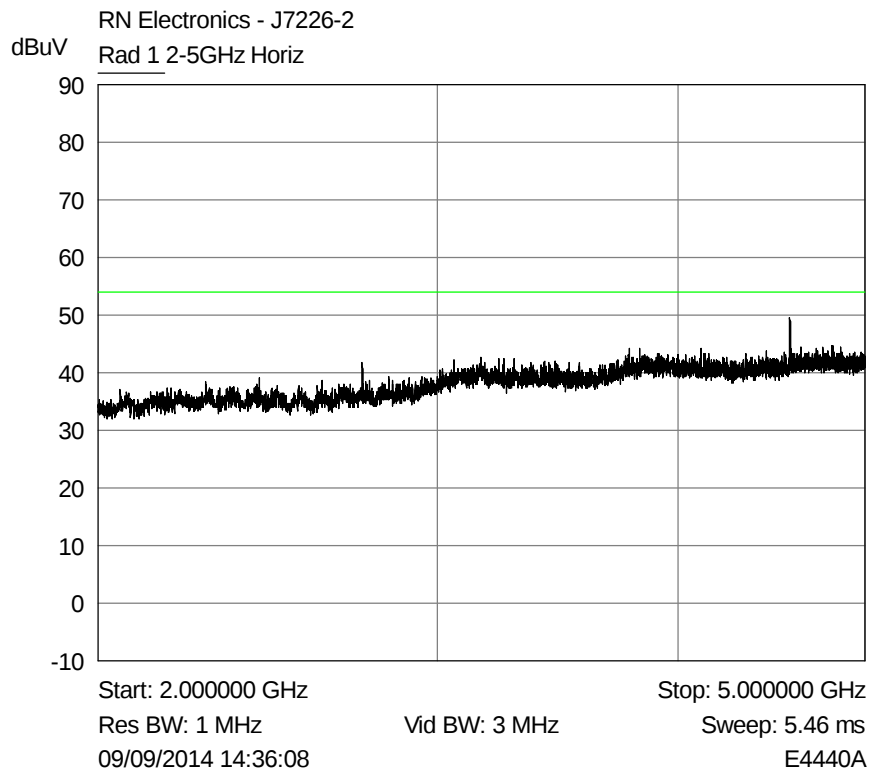
Note: Plot shows the EUT's fundamental frequency at 915MHz.



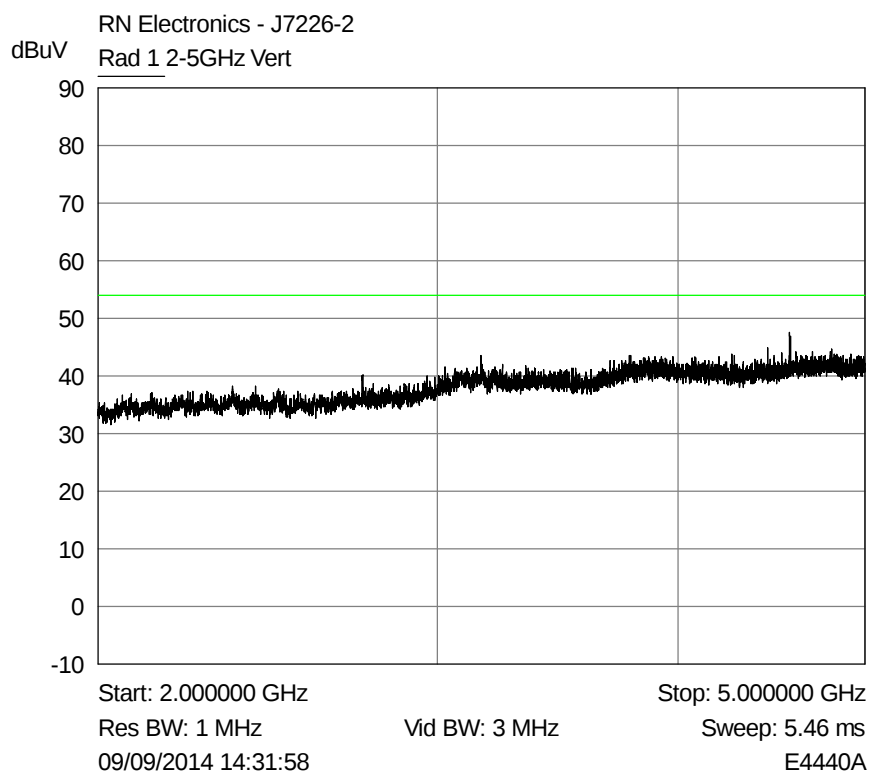
Plot of peak horizontal emissions 1GHz - 2GHz against average limit line.



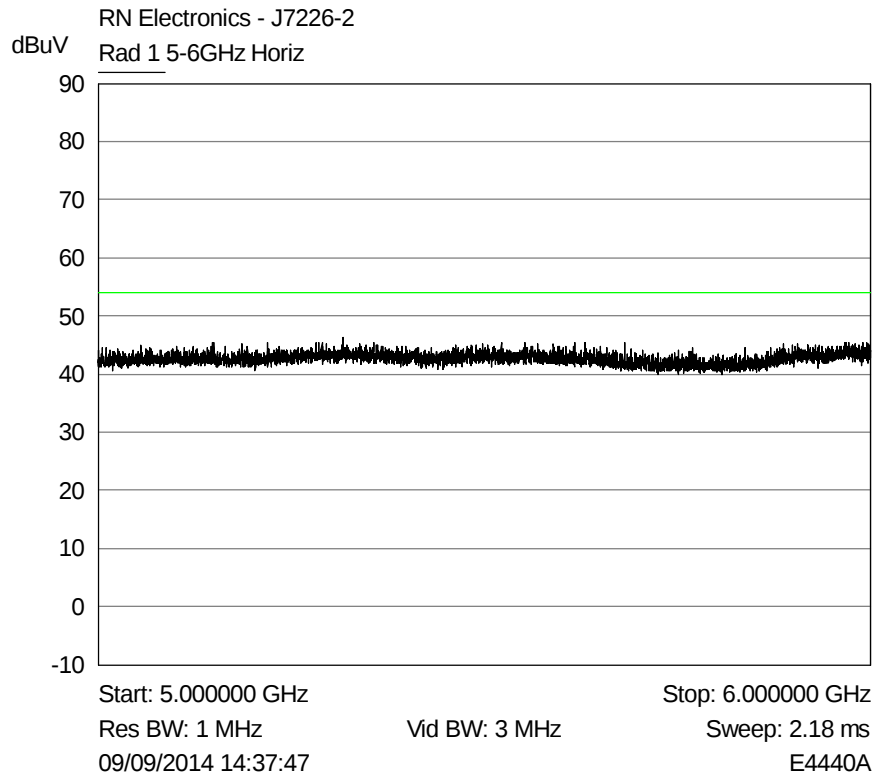
Plot of peak vertical emissions 1GHz - 2GHz against the average limit line.



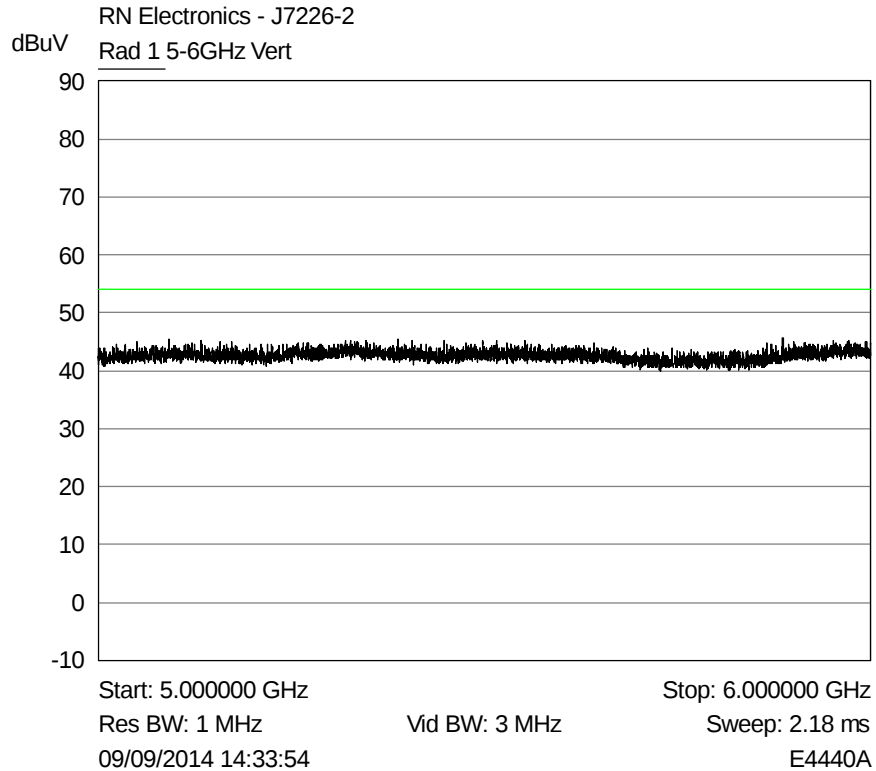
Plot of peak horizontal emissions 2GHz - 5GHz against the average limit line.



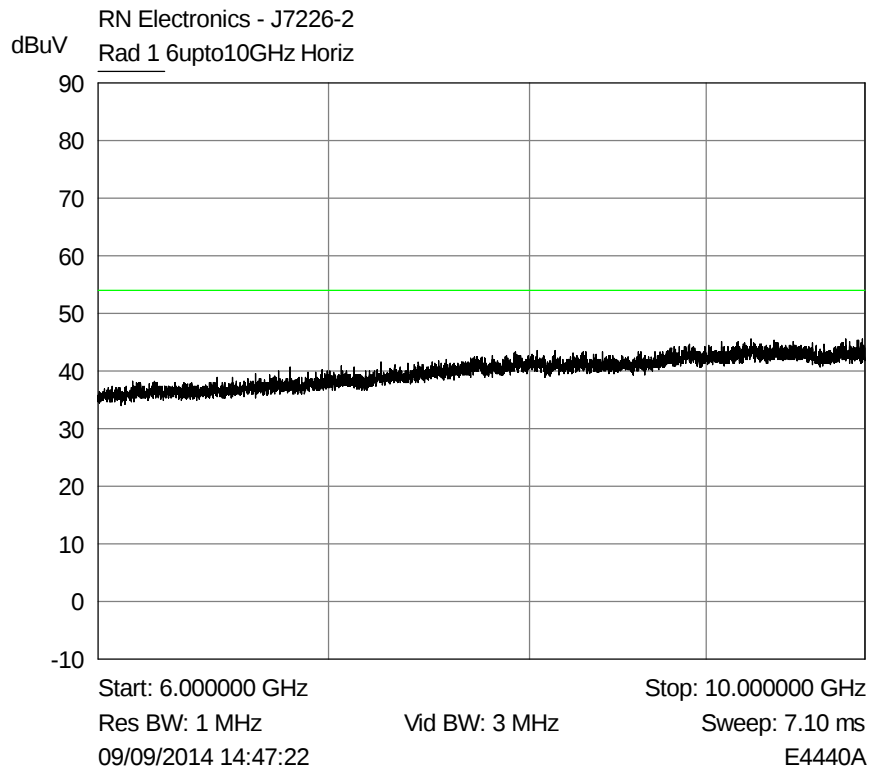
Plot of peak vertical emissions 2GHz - 5GHz against the average limit line.



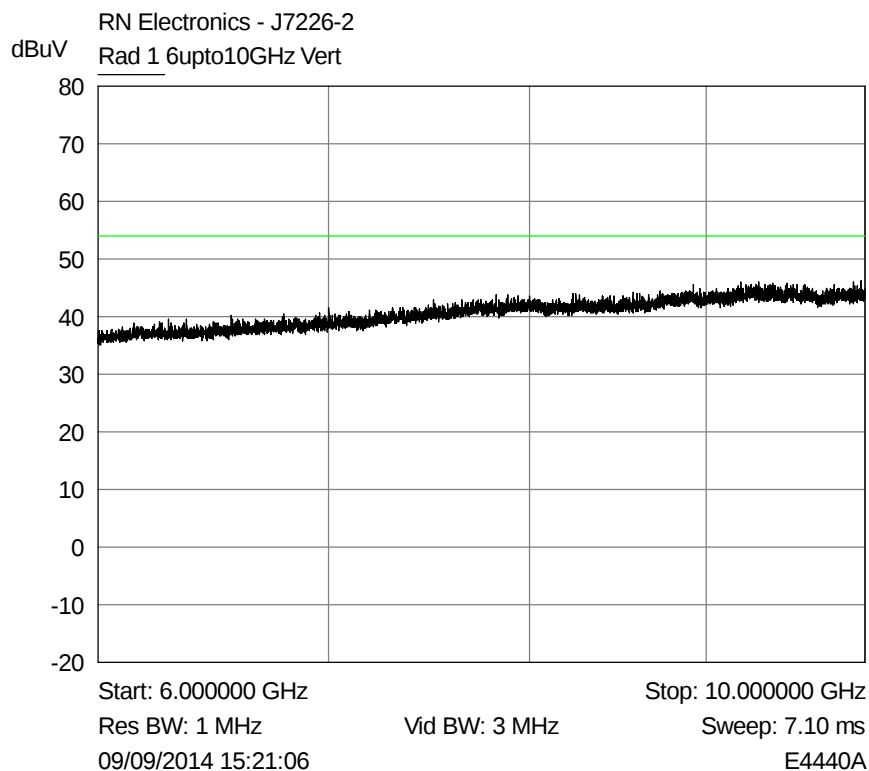
Plot of peak horizontal emissions 5GHz - 6GHz against the average limit line.



Plot of peak vertical emissions 5GHz - 6GHz against the average limit line.

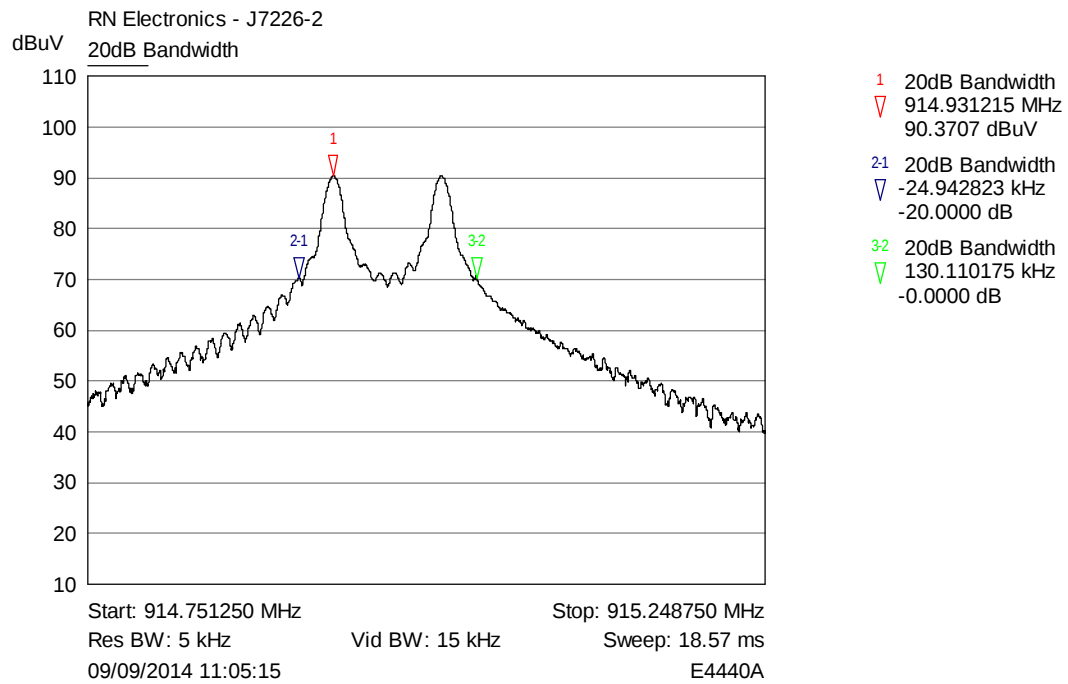


Plot of peak horizontal emissions 6GHz - 10GHz against the average limit line.



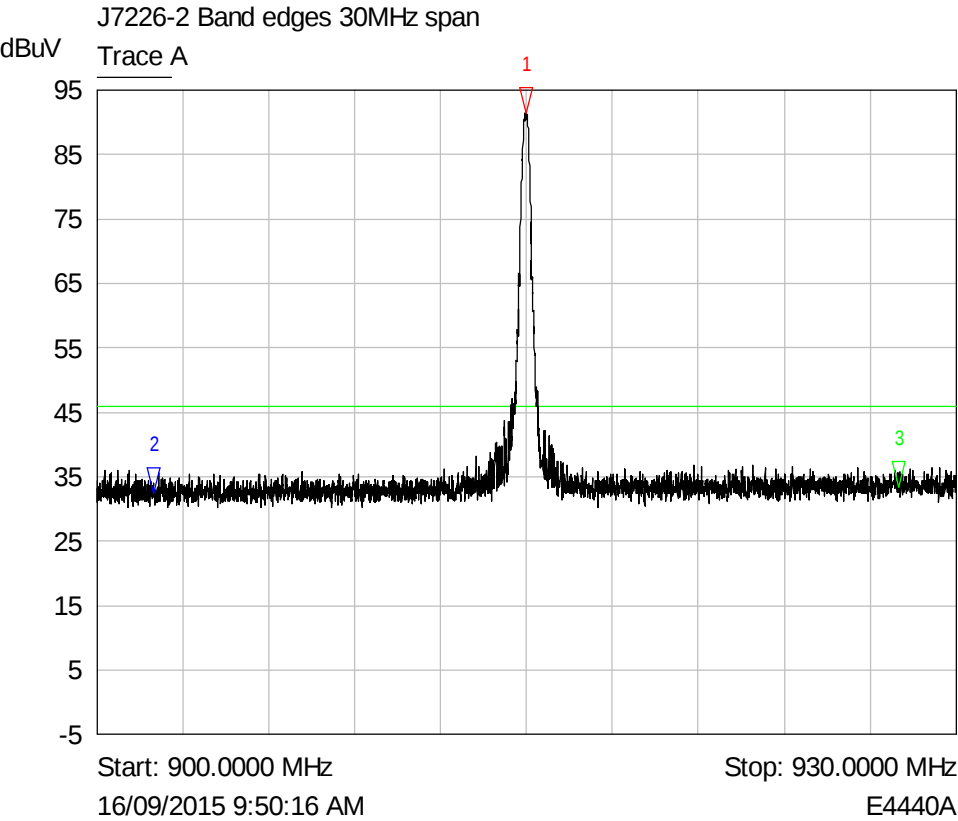
Plot of peak vertical emissions 6GHz - 10GHz against the average limit line.

6.4 20dB bandwidth plot



Plots for Band 902-928 MHz, Power 94 dBuV/m @ 3m and FM Modulation.

6.5 Band edge compliance plots



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	915.0092 MHz	91.28 dBuV	
2 ▽	Trace A	901.9998 MHz	32.38 dBuV	
3 ▽	Trace A	928.0002 MHz	33.33 dBuV	

Plots for Band 902-928 MHz, Power 94 dBuV/m @ 3m and FM Modulation.

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 μ V/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dB μ 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 μ V/m equates to $20.\log(500) = 54$ dB μ V/m.
- (b) limit of 300 μ V/m at 10m equates to $20.\log(300 \cdot 10/3) = 60$ dB μ V/m at 3m

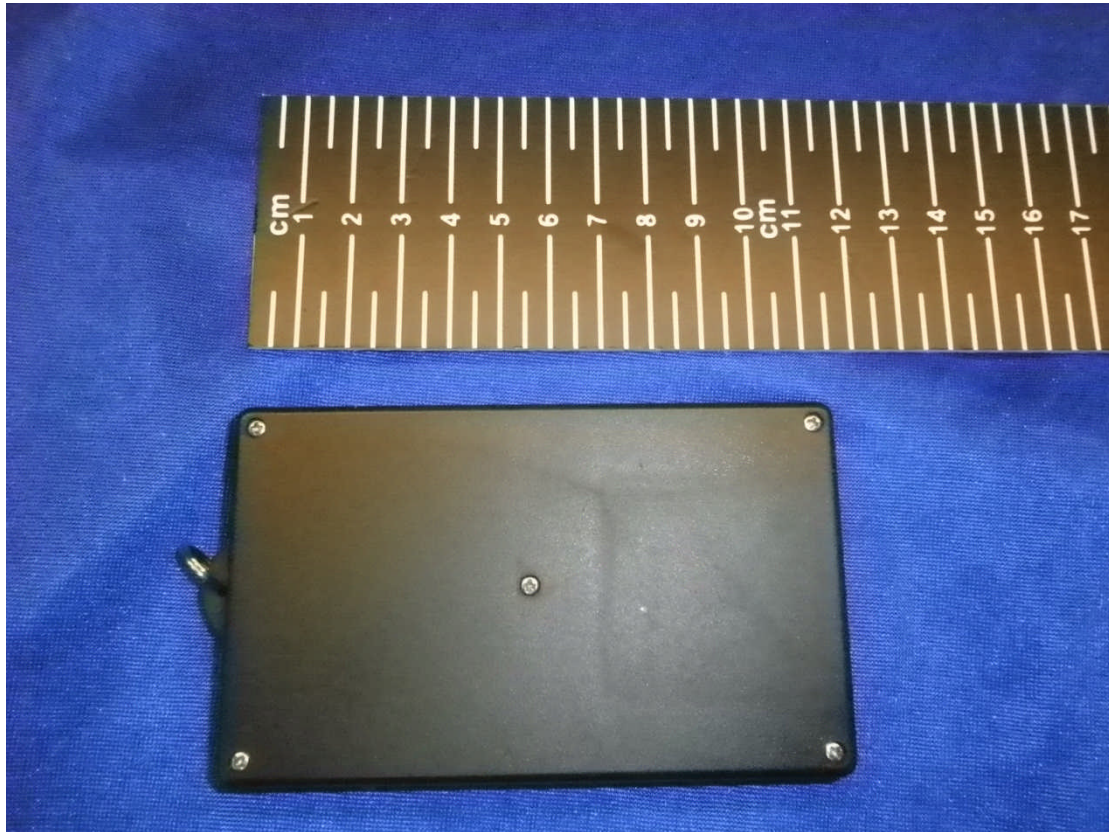
- (c) limit of 30 $\mu\text{V}/\text{m}$ at 30m, but below 30MHz, equates to $20.\log(30) + 40.\log(30/3) = 69.5 \text{ dB}\mu\text{V}/\text{m}$ at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8 Photographs

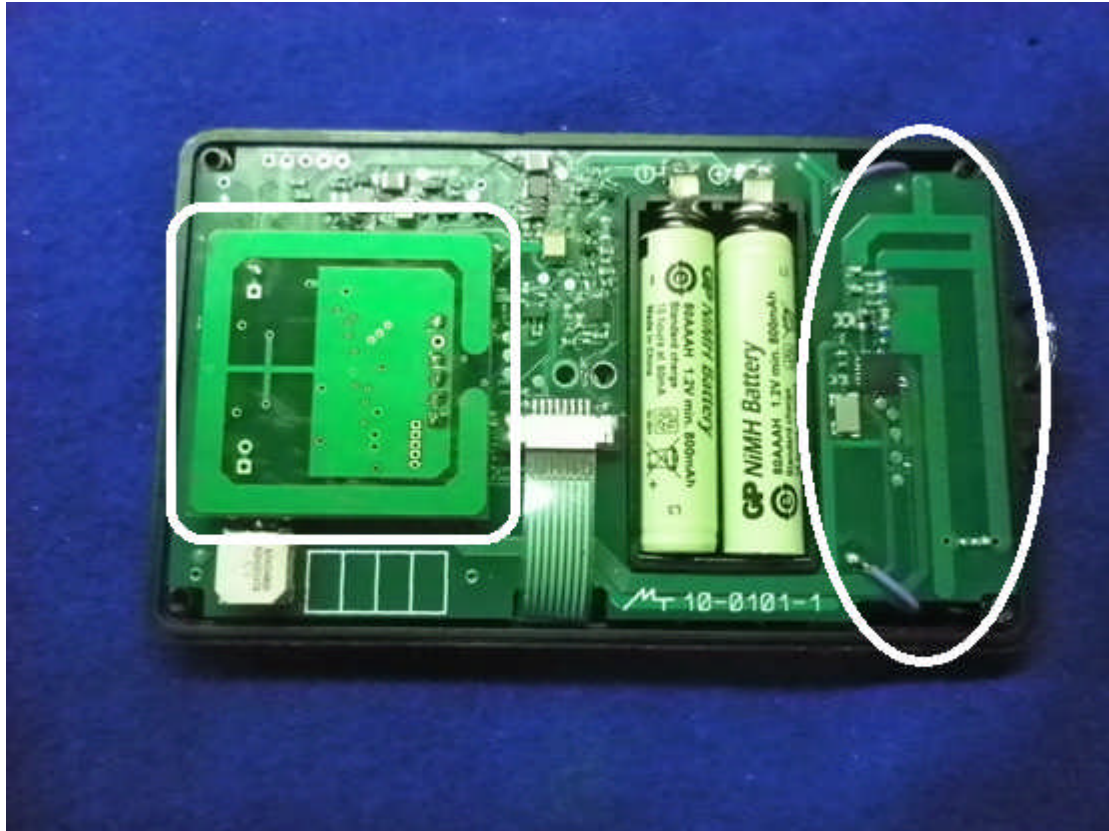
8.1 EUT Front view



8.2 EUT rear view



8.3 EUT antenna / RF connector port

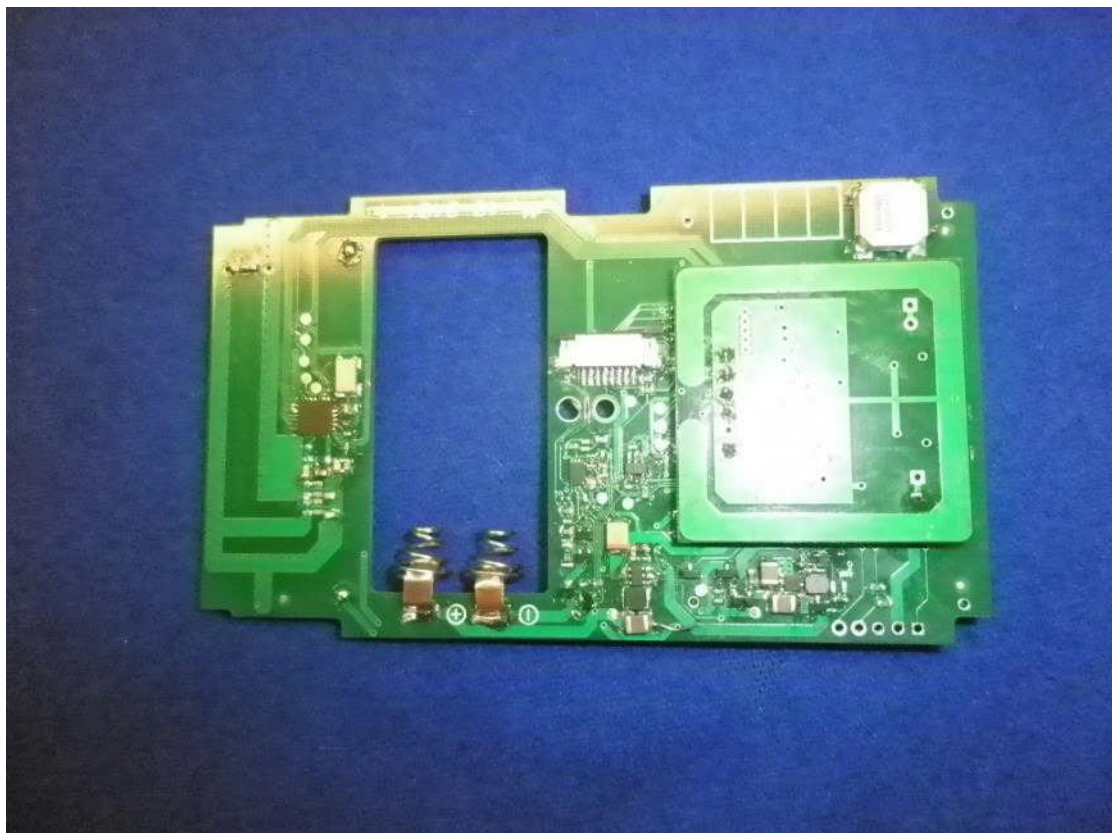
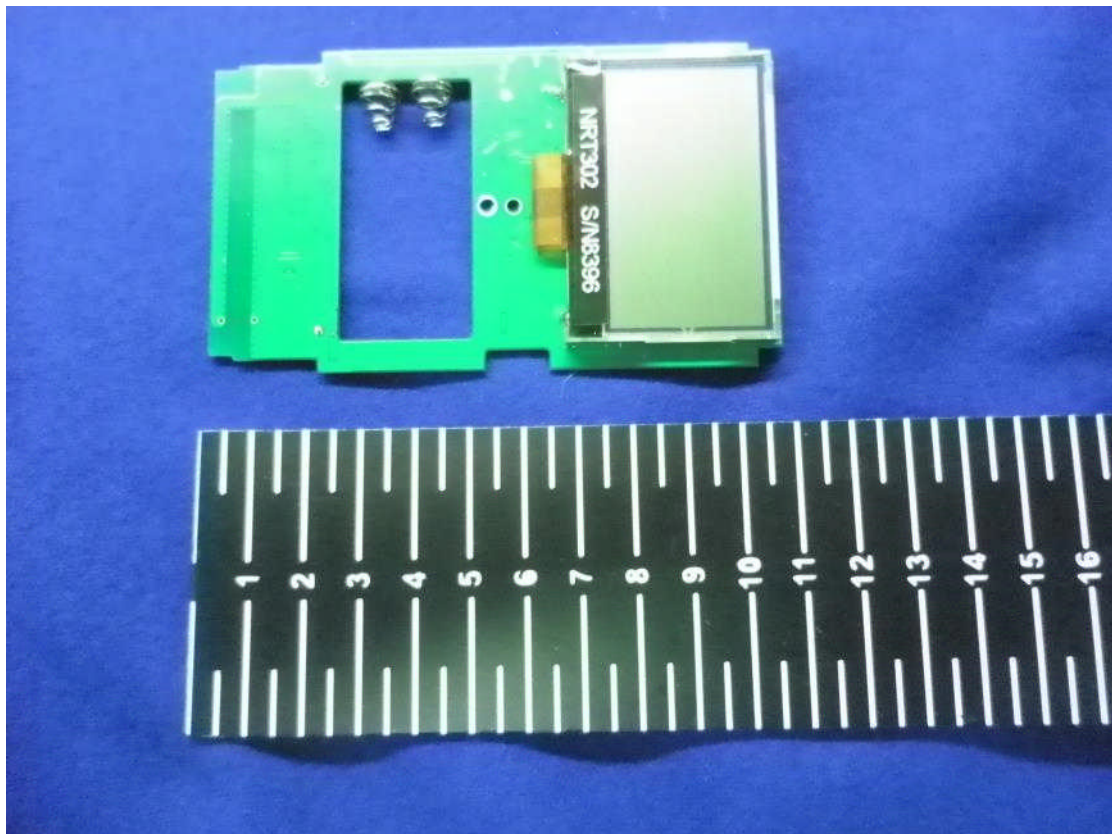


Photograph shows the two integral antennas etched into the PCB's. The 13.56 MHz RFID reader / writer shown on the left, and the 915 MHz transceiver shown on the right.

8.4 EUT Display / Controls

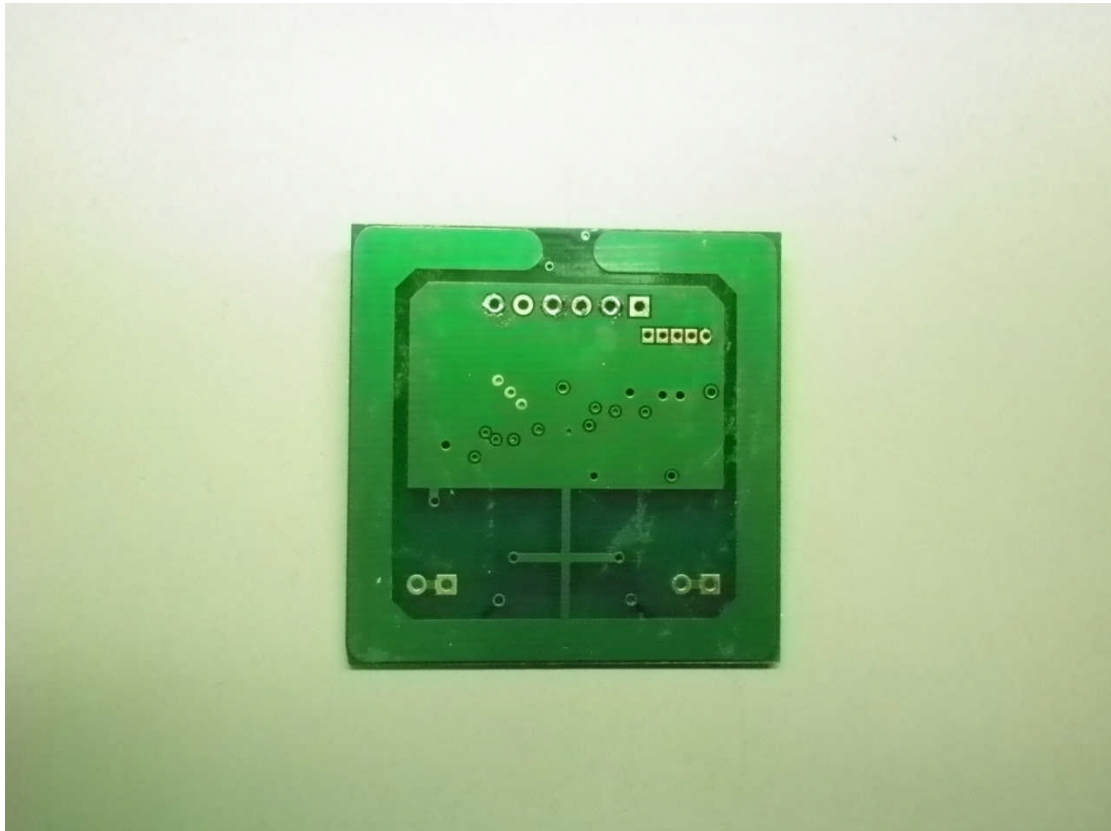


8.5 EUT internal construction

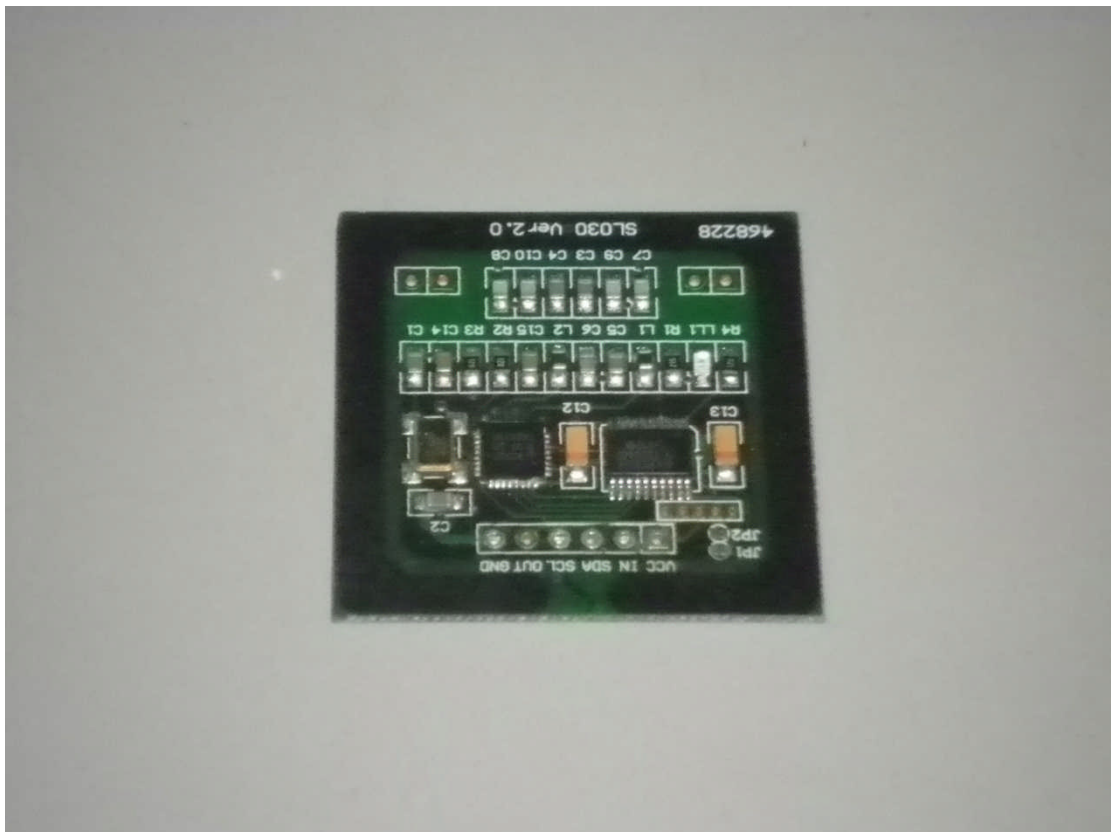




Photograph shows the main NRT302 PCB with the RFID reader / writer module removed.

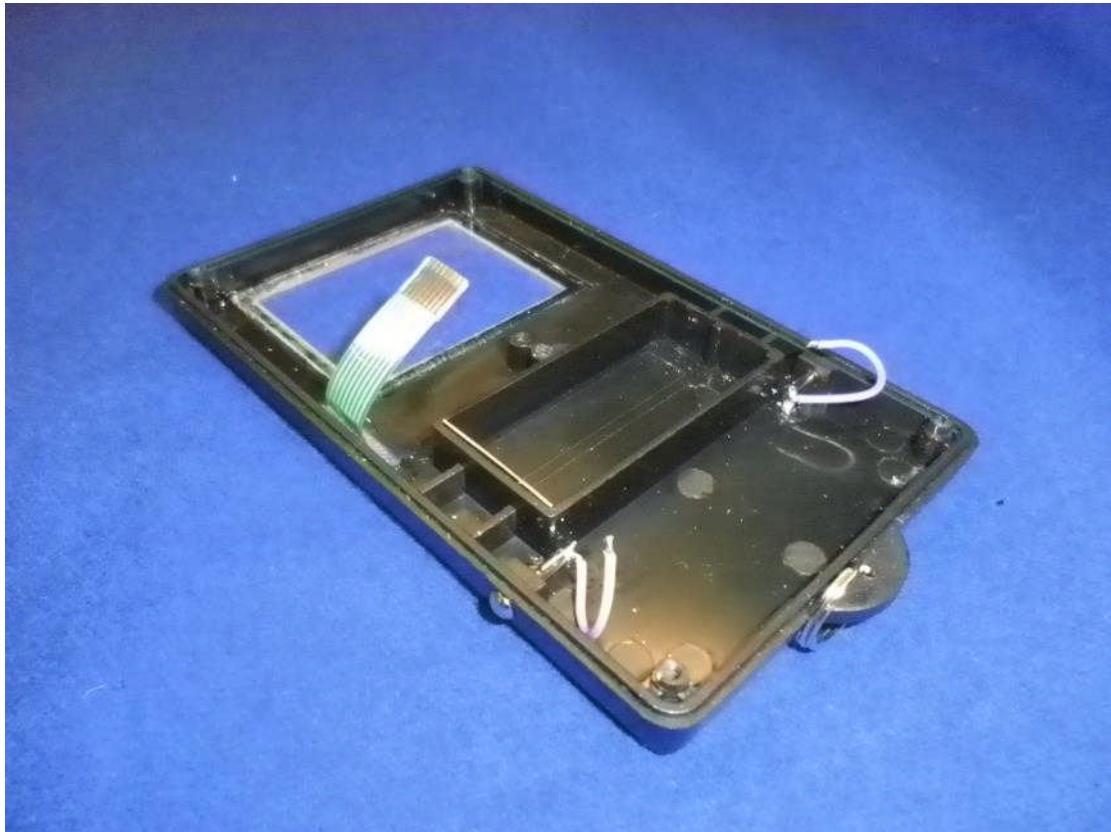


Photograph shows the RFID reader / writer module.



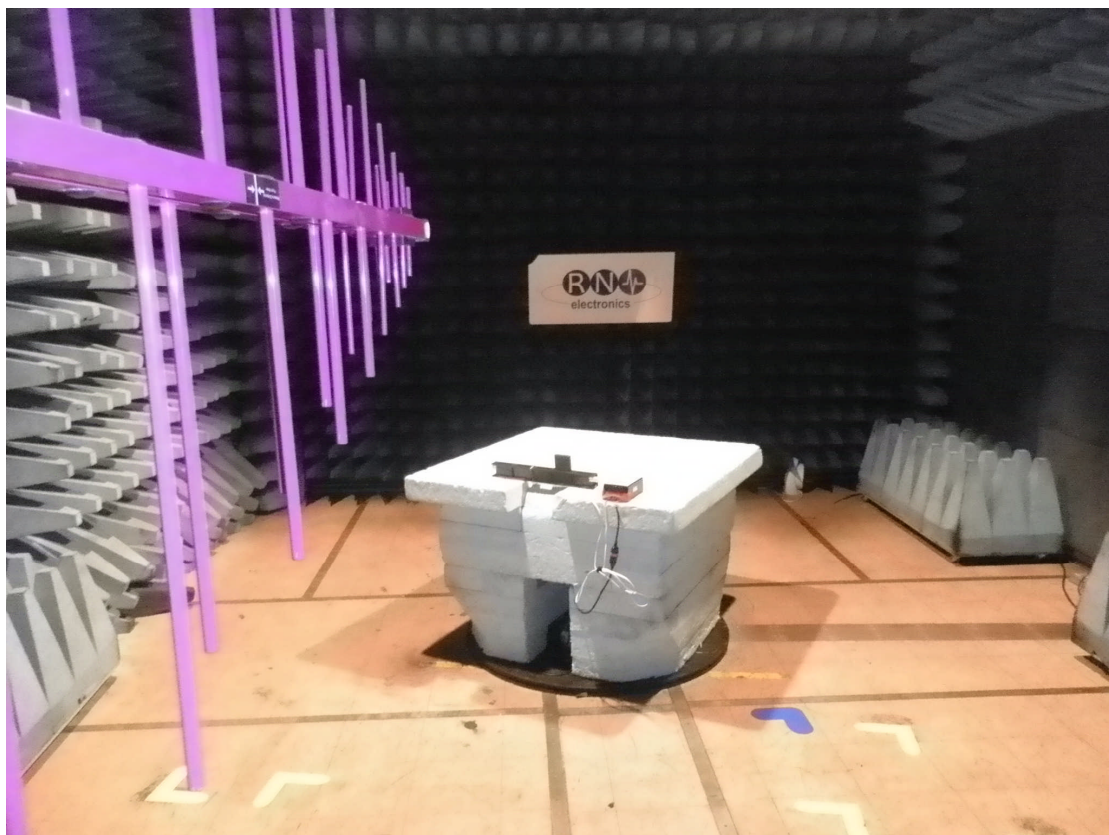
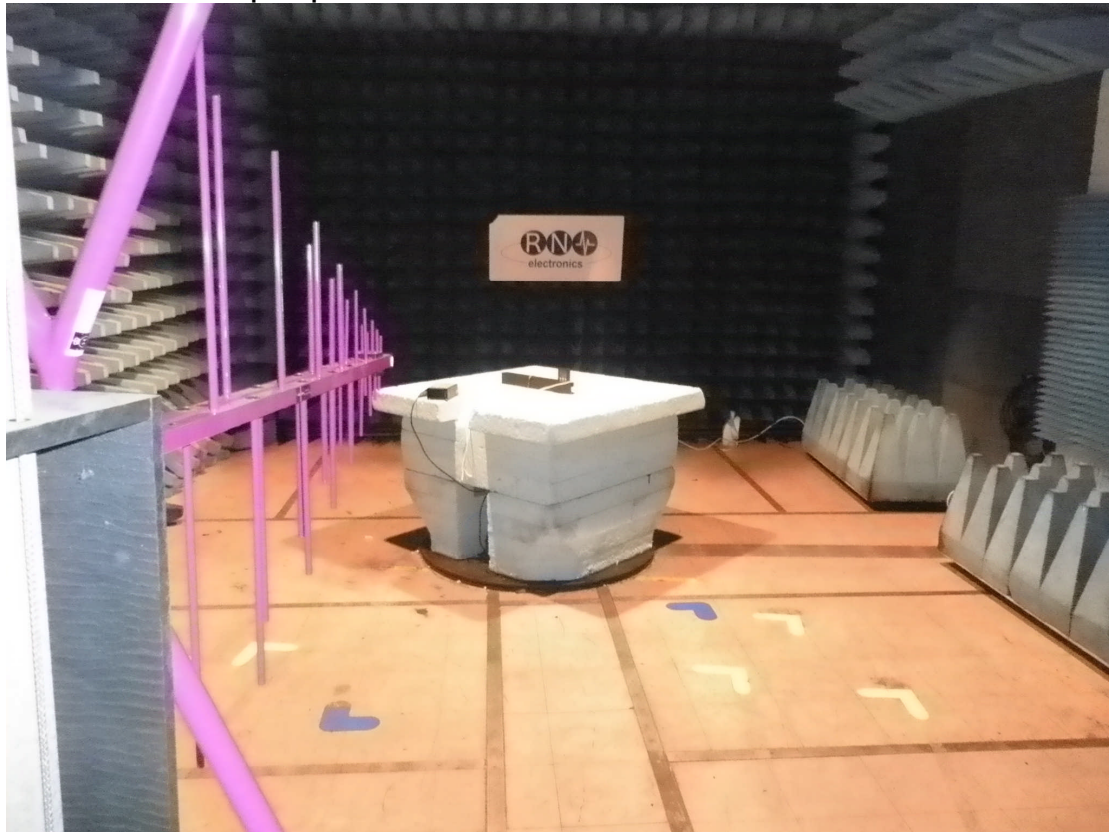
Photograph shows the RFID reader / writer module.

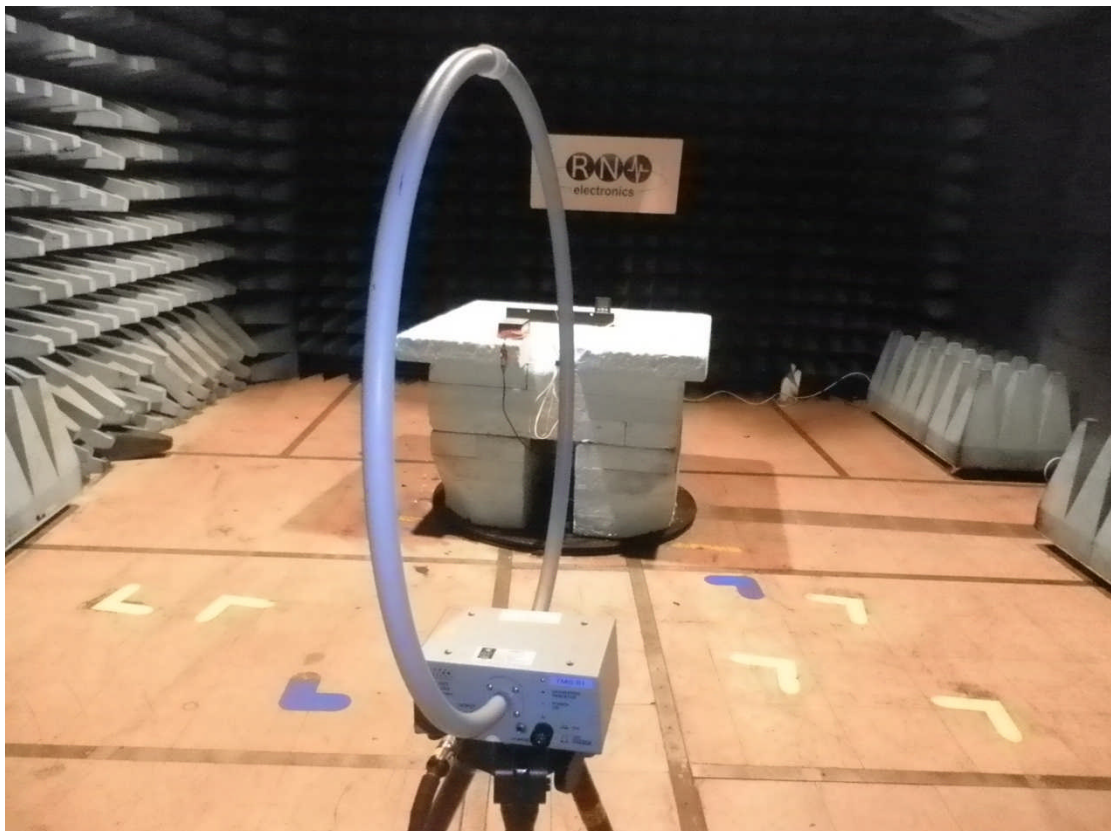
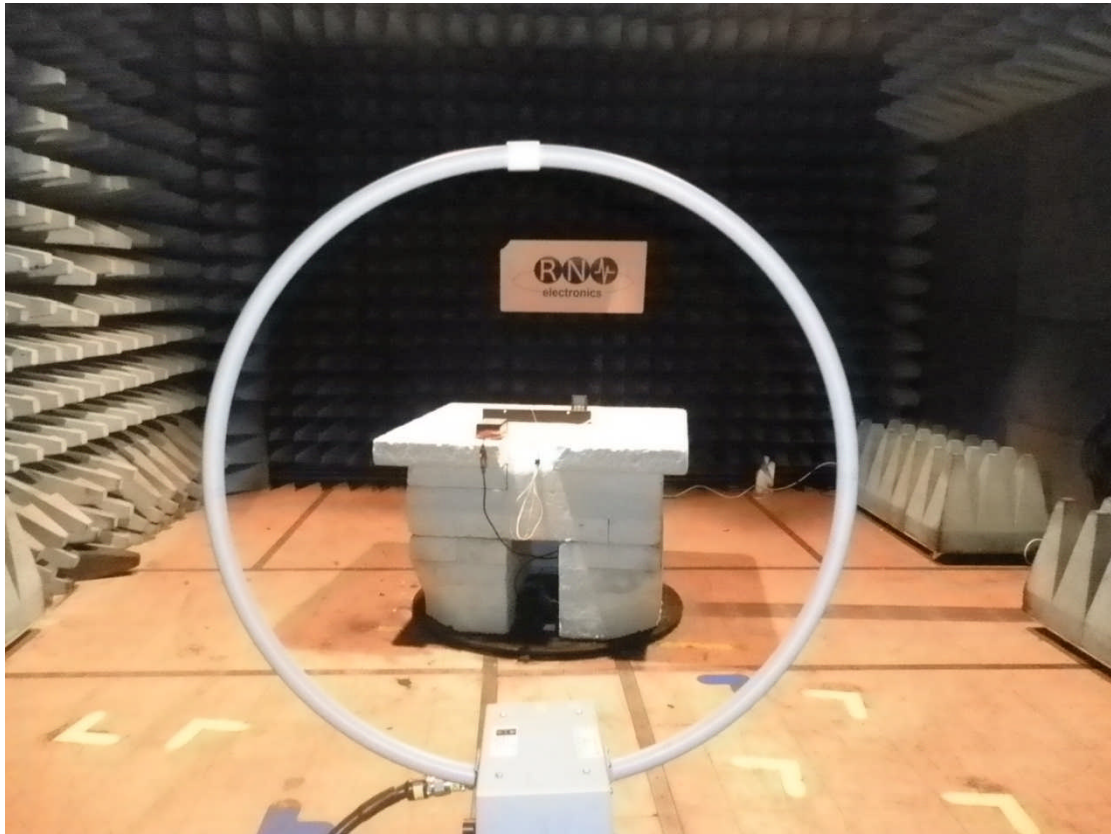
8.6 EUT Chassis





8.7 Test set-up, spurious emissions







8.8 Test set-up, AC power line conducted emissions



8.9 Test set-up diagrams

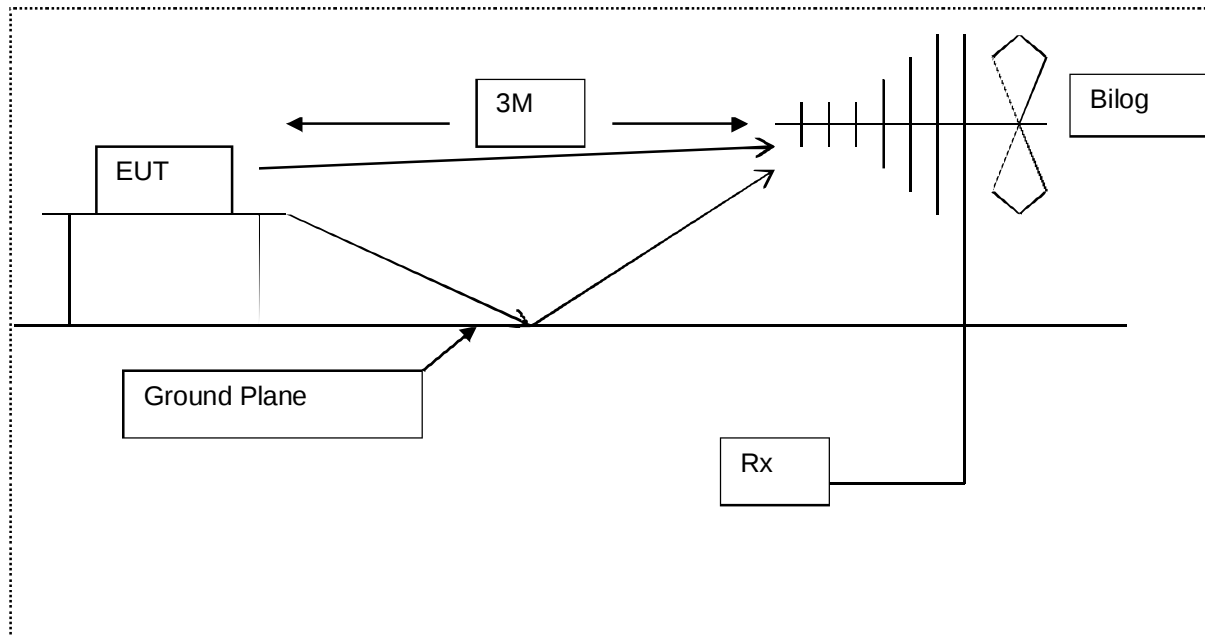


Diagram of the radiated emissions 30-1000 MHz test setup.

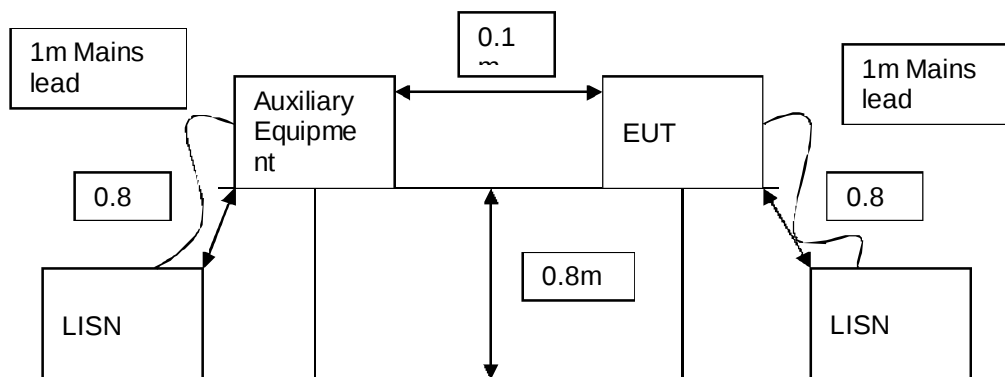


Diagram of the conducted emissions test setup.

9 Signal Leads

Port Name	Cable Type	Connected
Mains	3 Core	Yes

Note: This lead was the supply lead to the charger / docking station and as such was connected to the EUT via the docking station for “Docked” mode tests only.

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	*15-Dec-14	6 months
E150	MN2050	LISN 13A	Chase	*06-Oct-14	12 months
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	*28-Oct-14	36 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
E428	HF906	1-18 GHz Horn Antenna	Rhode & Schwarz	28-Jan-14	24 months
E570	K050120400F	3 Phase Power Supply	Harmer & Simmons	*5-Jan-15	12 months
E465	PCR2000LA	AC Power Supply	KIKUSUI	08-May-14	12 months
TMS81	6502	Active loop antenna	EMCO	*10-Dec-14	24 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	*10-Dec-14	12 months
TMS933	CBL6141A	Bilog Antenna 30MHz - 2GHz	York EMC	*29-Sep-14	24 months

* Equipment was within calibration dates for tests and has been re-calibrated since or during date of tests.

11 Auxiliary equipment

11.1 Customer supplied Equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	Unknown	Charging / docking station	Maynetronics	Unknown
2	9090	Unregulated power supply	EMS Power	986723

11.2 Supplied by RN Electronics Limited

No auxiliary equipment was supplied by RN Electronics

12 Modifications

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

12.1 Table of modifications

Test	Modification	Time of modification
Intentional radiator field strength	Manufacturers' power level set to 'level 10'. This was the first test performed.	During testing

12.2 Modifications before test

No modifications were made before test by RN Electronics Ltd.

12.3 Modifications during test

For test purposes, the manufacturer supplied a test unit programmed with 'engineering firmware' that allowed the RF power to be adjusted. During the Intentional radiator field strength test, the RF output power was set to a level below the power limit. The power level was set with guidance provided by the manufacturer to allow for variation due to manufacturing tolerances. The manufacturer states that the final production firmware will not allow the user to change the RF power level.

A power level of '10' was selected since this gave a level of 91.3dBuV/m at 3m, where the standard states a maximum power level of 94dBuV/m at 3m.

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 G	Screened Room (Control Room for Site H)
Site H	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 293246 IC Registration No. 5612A-2
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	kilopascals
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