Radio Test Report

Audio Ltd.

Digital Radio Microphone Pocket Transmitter

TX1010

47 CFR Part 15.247
Effective Date 1st October 2014
DTS: Part 15 Digital Transmission System

Test Date: 9th - 14th September 2015
Report Number: 09-8242-5-15 Issue 02

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Certificate of Test 8242-5

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

Equipment:	Digital Radio Microphone Pocket Transmitter
Model Number:	TX1010
Unique Serial Number:	D064900-11
Manufacturer:	Audio Ltd Audio House, Progress Road High Wycombe Buckinghamshire HP12 4JD
Full measurement results are detailed in Report Number:	09-8242-5-15 Issue 02
Test Standards:	47 CFR Part 15.247 Effective Date 1st October 2014 DTS: Part 15 Digital Transmission System

NOTE:
Certain tests were not performed based upon manufacturer's declarations. Certain other requirements are subject to manufacturer declaration only and have not been tested/verified. For details refer to section 3 of this report.
This test report is for the Bluetooth radio parameters only, please see RN report 09-8242-3-15 for UHF radio parameters results.

DEVIATIONS:
No deviations from the standard have been applied.

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: 9th - 14th September 2015

Test Engineer: Digitally signed by: Graham Blake
DN: CN = Graham Blake C = GB O = RN Electronics Ltd
Date: 2016.09.09 11:20:34 +01'00'

Approved By:
Radio Approvals Manager: Digitally signed by: Daniel Sims
DN: CN = Daniel Sims C = GB O = RN Electronics Ltd
Date: 2016.09.09 09:20:57 Z

Customer Representative:

1 Contents

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Audio Ltd Audio House Progress Road High Wycombe Buckinghamshire HP12 4JD	
Manufacturer of EUT	Audio Ltd	
Brand name of EUT	Digital Radio Microphone Pocket Transmitter	
Model Number of EUT	TX1010	
Serial Number of EUT	D064900-11	
Date Received	20th August 2015	
Date of Test:	9th - 14th September 2015	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Created	3rd November 2015	
Visual Description	The TX1010 transmitter is built from milled, high grade aluminium and the units' power is provided by two 1.5V AA batteries housed in a hinged, lockable compartment. There's a built-in SD card reader which can be used to update the system's firmware and capture the live audio stream. The unit is controlled using the three push-buttons; this allows the user to navigate the menu system. The power switch is situated under the lockable flap. The EUTs' Bluetooth antenna is integral. The whip antenna (for UHF radio) is connected via the units' SMA antenna port. In normal use a lapel microphone is connected via a 3-pin Lemo connector.	
Main Function	Pocket microphone UHF radio transmitter with Bluetooth (low energy) functionality.	
Information Specification	Height	124 mm
	Width	68 mm
	Depth	18 mm
	Weight	0.18 kg
	Voltage	2 - 3 VDC
	Current	0.5 Amp @ 2.5 VDC

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Pocket (Body-worn)
Choice of model(s) for type tests	Production prototype
Antenna details	Integral antenna Bluetooth UHF SMA whip antenna
Antenna port	No (Bluetooth LE), Yes (UHF Transmitter)
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2480 MHz
Lowest Signal generated in EUT	10 MHz
TX Parameters	
Alignment range – transmitter	2402 MHz - 2480 MHz
EUT Declared Modulation Parameters	BLE Protocol
EUT Declared Power level	1 mW (0 dBm Conducted power)
EUT Declared Signal Bandwidths	2 MHz
EUT Declared Channel Spacing's	2 MHz
Unmodulated carrier available?	No
Declared frequency stability	Not stated
RX Parameters	
Alignment range – receiver	2402 MHz - 2480 MHz
EUT Declared RX Signal Bandwidth	2 MHz
SRD Parameters	
SRD/Receiver Category	DTS: Part 15 Digital Transmission System

Note: This test report is for the Bluetooth radio parameters only; please see RN report 09-8242-3-15 for UHF radio parameters results.

2.3 Functional description

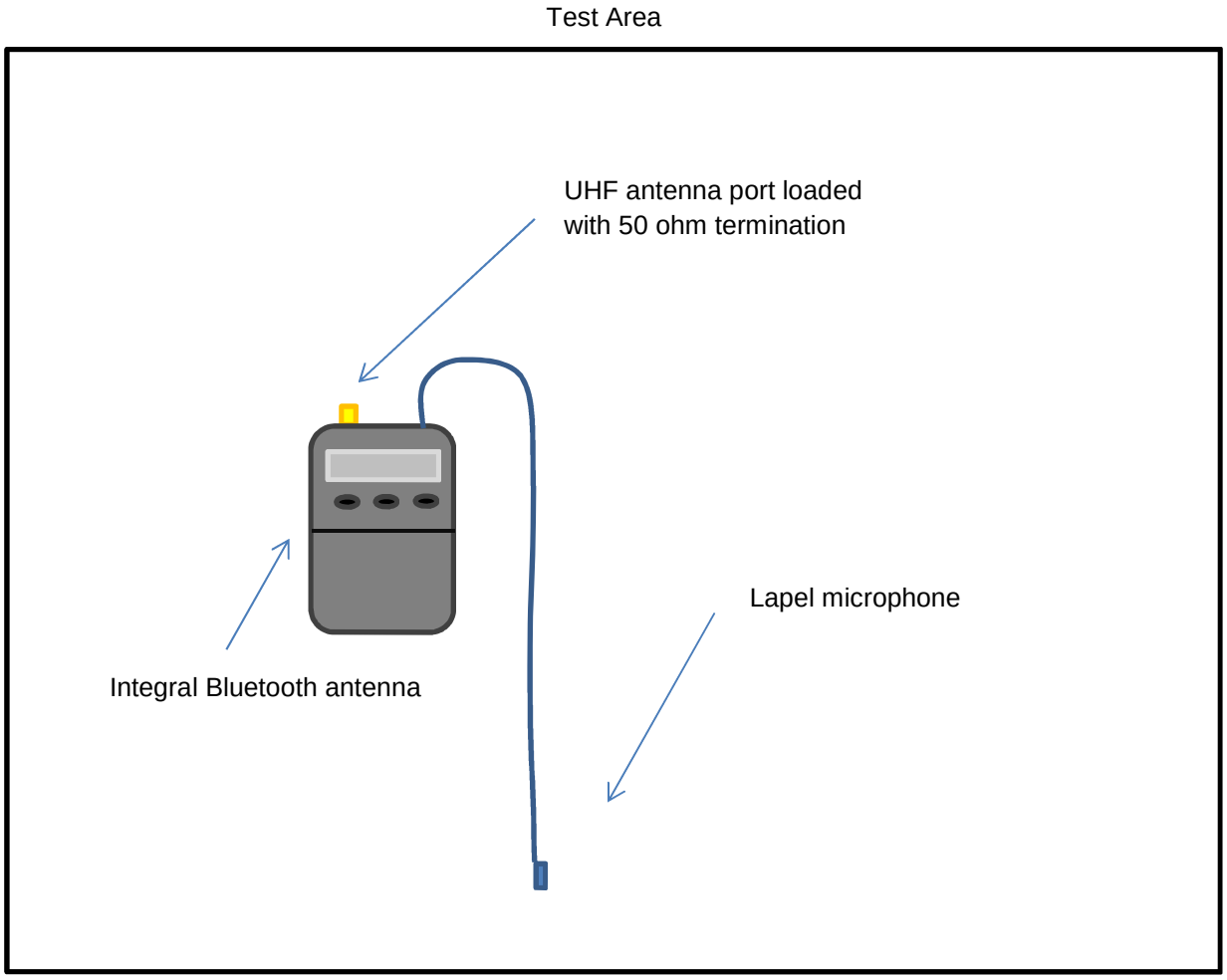
The EUT is a UHF digital radio transmitter which transmits audio over the frequency range of 470.2 MHz - 693.8 MHz (limited to 607.4 MHz for FCC). The EUT incorporates a Bluetooth (Low energy) transceiver which allows remote control of the equipment using a Smartphone or Tablet PC and a dedicated application. Within the product range there are different production builds, each covering a segment of the overall switching range of the UHF transmitter.

2.4 Modes of operation

Mode Reference	Description	Used for testing
TX 2402 MOD	Transmitting continuous data packets 2402 MHz	Yes
TX 2442 MOD	Transmitting continuous data packets 2442 MHz	Yes
TX 2480 MOD	Transmitting continuous data packets 2480 MHz	Yes
RX 2402	The EUT is receiving at 2402 MHz	No
RX 2442	The EUT is receiving at 2442 MHz	No
RX 2480	The EUT is receiving at 2480 MHz	No
TX HOPPING	The EUT is hopping over the frequencies 2402 MHz, 2426 MHz and 2480 MHz ('advertising' transmission protocol)	Yes
TX 470.2	Transmitting at 470.2 MHz (UHF Radio)	No
TX 509	Transmitting at 509 MHz (UHF Radio)	No
TX 547.8	Transmitting at 547.8 MHz (UHF Radio)	No
TX 518.2	Transmitting at 518.2 MHz (UHF Radio)	No
TX 563	Transmitting at 563 MHz (UHF Radio)	No
TX 607.4	Transmitting at 607.4 MHz (UHF Radio)	No

Note: This test report is for the Bluetooth radio parameters only; however, as the UHF transmitter is permanently on in normal operation, the BLE transmitter was tested with the UHF transmitter in operation. Please see RN report 09-8242-3-15 for UHF radio parameters results.

2.5 Emissions configuration



The unit was powered from a new set of batteries. The EUTs UHF antenna was removed and the antenna port was connected to a 50 ohm load. A lapel microphone was connected to the EUTs' microphone port. During a pre-test, the EUTs UHF transmitter was tuned across its switching range to establish whether any emissions due to mixing products of the two separate transmitters occurred, however no difference in emissions were observed and therefore for full test the UHF transmitter was set to mid channel.
The EUT was supplied with engineering firmware which allowed control of the EUTs Bluetooth (low energy) radio. The Bluetooth transmit mode was 100% with normal modulation and the power settings for each channel were as stated below:

Low channel (2402 MHz) = Level 1 mW (0 dBm)
Mid channel (2442 MHz) = Level 1 mW (0 dBm)
High channel (2480 MHz) = Level 1 mW (0 dBm)

For conducted power tests the EUT was tested on a bench out of its enclosure to allow a temporary RF lead to be soldered to the antenna port.

Note: During ERP tests, the measured radiated power was found to be much lower than anticipated. This was due to the integral Bluetooth antenna being mounted inside the EUTs machined aluminium enclosure, which limited the radiated power. This was verified with the manufacturer at the time of test.

2.5.1 Signal leads

Port Name	Cable Type	Connected
Antenna	Whip antenna	No*
Microphone	Custom	Yes

*This test report pertains to the EUTs' Bluetooth (BLE) operation and therefore during the tests covered in this test report the UHF whip antenna was removed and terminated with a 50 ohm load.

3 Summary of test results

The Digital Radio Microphone Pocket Transmitter, TX1010 was tested for compliance to the following standard:

47 CFR Part 15.247
Effective Date 1st October 2014
DTS: Part 15 Digital Transmission System

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. 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 or the essential requirements of the directive, particularly under different conditions to those during testing. 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%.

Title	References	Results
Transmitter Tests		
1. AC power line conducted emissions	-	NOT APPLICABLE[1]
2. Radiated emissions 9 kHz - 150 kHz	47 CFR Part 15C Clause 15.209	PASSED
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15C Clause 15.209	PASSED
4. Radiated emissions 30 MHz -1 GHz	47 CFR Part 15C Clause 15.247(d) & 15.209	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Clause 15.247(d) & 15.209	PASSED
6. Effective radiated power field strength	47 CFR Part 15C Clause 15.247(d)	PASSED
7. Band Edge Compliance	47 CFR Part 15C Clause 15.215 & 15.247(d)	PASSED
8. Occupied bandwidth	47 CFR Part 15C Clause 5.247(a)(2) 15.215	PASSED
9. Maximum Average conducted output power	-	NOT APPLICABLE[5]
10. Maximum Peak conducted output power	-	PASSED
11. Maximum Power Spectral Density	47 CFR Part 15C Clause 15.247(e)	PASSED
12. Antenna power conducted emissions	-	NOT APPLICABLE[2]
13. Duty cycle	-	NOT APPLICABLE[3]
14. FHSS carrier frequency separation	-	NOT APPLICABLE[4]
15. Average time of occupancy	-	NOT APPLICABLE[4]
16. Number of Hop Channels	-	NOT APPLICABLE[4]

[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 EUTs' Bluetooth radio has an integral antenna only. Radiated emissions have been performed with the integral antenna in place.

[3] No limits apply, however duty cycle measurement performed to verify any possible correction factors for average emissions. EUT Duty was confirmed as operating in a 100% constant transmit state for tests.

[4] EUT does not employ FHSS technology.

[5] PK conducted power measured instead.

4 Specifications

The tests were performed and operated in accordance with R.N. Electronics Ltd procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	47 CFR Part 15C	2014	Federal Communications Commission PART 15 – RADIO FREQUENCY DEVICES
4.1.2	ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
4.1.3	ANSI C63.4	2014	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	DA 00-705	2000	PUBLIC NOTICE Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
4.1.5	KDB 558074 D01 v03r03	2013	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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

4.2 Deviations

No deviations from the standards have been applied.

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 9 kHz - 150 kHz

5.2.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.209/15.247(d) [Reference 4.1.1 of this report]

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 a new set of batteries.

The EUT was operated in **TX 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.
Note: The UHF transmitter was also in operation on its middle channel, however regardless of UHF channel setting no difference in emissions were observed with the BLE transmitter operating on any of the tested channels.

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 (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 degrees 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 H and OATS.

5.2.4 Test equipment

E533, E534, E535, TMS81, TMS45

See Section 9 for more details

5.2.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Mid channel	2442 MHz

Plot refs
8242-5 9kHz – 150kHz Band A Unit Parallel
8242-5 9kHz – 150kHz Band A Unit Perpendicular

Peak detector “Max held” Analyser plots against the Quasi-Peak limit line can be found in Section 6 of this report.

Note: There was no significant difference between top, middle and bottom channels, and therefore to limit the size of this test report only middle channel plots have been included.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20dB from the level of the fundamental or meet the general limits of 15.209.

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

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
9kHz – 30MHz ±3.9dB

5.3 Radiated emissions 150 kHz – 30 MHz

5.3.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.4 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.209/15.247(d) [Reference 4.1.1 of this report]

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 EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed with a new set of batteries.

The EUT was operated in **TX 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.
Note: The UHF transmitter was also in operation on its middle channel, however regardless of UHF channel setting no difference in emissions were observed with the BLE transmitter operating on any of the tested channels.

5.3.3 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 (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 degrees 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 H and OATS.

5.3.4 Test equipment

E533, E534, E535, TMS81, TMS45

See Section 9 for more details

5.3.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Mid channel	2442 MHz

Plot refs
8242-5 150 kHz – 30 MHz Band A Unit Parallel
8242-5 150 kHz – 30 MHz Band A Unit Perpendicular

Peak detector “Max held” Analyser plots against the Quasi-Peak limit lines can be found in Section 6 of this report.

Note: There was no significant difference between top, middle and bottom channels, and therefore to limit the size of this test report only middle channel plots have been included.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20dB from the level of the fundamental or meet the general limits of 15.209.

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

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
9kHz – 30MHz ±3.9dB

5.4 Radiated emissions 30 MHz -1 GHz

5.4.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.247(d) & 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.5 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.209/15.247(d) [Reference 4.1.1 of this report]

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 rotated in all three orthogonal planes. Radiated Emissions testing was performed with a new set of batteries.

The EUT was operated in **TX 2402 MOD, TX 2442 MOD** and **TX 2480 MOD** modes.
Note: The UHF transmitter was also in operation on its middle channel, however regardless of UHF channel setting no difference in emissions were observed with the BLE transmitter operating on any of the tested channels.

5.4.3 Test procedure

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

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

Tests were performed using Test Site H.

5.4.4 Test equipment

E533, E534, E535, LPE364, TMS45

See Section 9 for more details

5.4.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Mid channel	2442 MHz

Plot refs
8242-5 Rad 1 VHF Horiz
8242-5 Rad 1 VHF Vert
8242-5 Rad 1 UHF Horiz
8242-5 Rad 1 UHF Vert

Peak detector “Max held” Analyser plots against the Quasi-Peak limit lines can be found in Section 6 of this report.

Note: There was no significant difference between top, middle and bottom channels, and therefore to limit the size of this test report only middle channel plots have been included.

No emissions observed within 20dB of limits.

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20dB from the level of the fundamental or meet the general limits of 15.209.
The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
30MHz - 1000MHz ±5.1dB

5.5 Radiated emissions above 1 GHz

5.5.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.247(d) & 15.209 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.247(d) & 15.209 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was placed on a 1.5 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 a new set of batteries.

The EUT was operated in **TX 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.
Note: The UHF transmitter was also in operation on its middle channel, however regardless of UHF channel setting no difference in emissions were observed with the BLE transmitter operating on any of the tested channels.

5.5.3 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 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 1.2m was used in the test range 6 – 25GHz

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

Tests were performed using Test Site H.

5.5.4 Test equipment

TMS78, TMS79, TMS82, E268, E533, E534, E535, LPE333, LPE261

See Section 9 for more details

5.5.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Setup Table

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

Frequency range	Antenna Polarisation	EUT Polarisation	Plot Reference
1 – 2 GHz	Vertical	Vertical	8128-4 Rad 1 1-2GHz Vert
2 – 5 GHz	Vertical	Vertical	8128-4 Rad 1 2-5GHz Vert
5 – 6 GHz	Vertical	Vertical	8128-4 Rad 1 5-6GHz Vert
6 – 9 GHz	Vertical	Vertical	8128-4 Rad 1 6-9GHz Vert
9 – 12.5 GHz	Vertical	Vertical	8128-4 Rad 1 9-12.5GHz Vert
12.5 – 15 GHz	Vertical	Vertical	8128-4 Rad 1 12.5-15GHz Vert
15 – 18 GHz	Vertical	Vertical	8128-4 Rad 1 15-18GHz Vert
18 – 21 GHz	Vertical	Vertical	8128-4 Rad 1 18-21GHz Vert
21 – 23 GHz	Vertical	Vertical	8128-4 Rad 1 21-23GHz Vert
23 – 25 GHz	Vertical	Vertical	8128-4 Rad 1 23-25GHz Vert
1 – 2 GHz	Horizontal	Vertical	8128-4 Rad 1 1-2GHz Horiz
2 – 5 GHz	Horizontal	Vertical	8128-4 Rad 1 2-5GHz Horiz
5 – 6 GHz	Horizontal	Vertical	8128-4 Rad 1 5-6GHz Horiz
6 – 9 GHz	Horizontal	Vertical	8128-4 Rad 1 6-9GHz Horiz
9 – 12.5 GHz	Horizontal	Vertical	8128-4 Rad 1 9-12.5GHz Horiz
12.5 – 15 GHz	Horizontal	Vertical	8128-4 Rad 1 12.5-15GHz Horiz
15 – 18 GHz	Horizontal	Vertical	8128-4 Rad 1 15-18GHz Horiz
18 – 21 GHz	Horizontal	Vertical	8128-4 Rad 1 18-21GHz Horiz
21 – 23 GHz	Horizontal	Vertical	8128-4 Rad 1 21-23GHz Horiz
23 – 25 GHz	Horizontal	Vertical	8128-4 Rad 1 23-25GHz Horiz

Peak detector “Max held” Analyser plots against the average limit line can be found in Section 6 of this report.

Note: There was no significant difference between top, middle and bottom channels, and therefore to limit the size of this test report only middle channel plots have been included.

No emissions observed within 20dB of limits.

LIMITS:
15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.247(d) other emissions, outside the intentional band, must be attenuated by at least 20dB from the level of the fundamental or meet the general limits of 15.209.
The general limits of 15.209 are as drawn on the respective plots.

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
1 – 18 GHz ±3.5dB
18 – 25 GHz ±3.9dB

5.6 Effective radiated power field strength

5.6.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.247(d) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.6 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.247(d) & 15.209(a) [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

The EUT was placed on a 1.5 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 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.

5.6.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment used' section. The power stated is Peak field strength. Tests were performed in test site H.

5.6.4 Test equipment

LPE261, LPE333, E533, E534, E535

See Section 9 for more details

5.6.5 Test results

Temperature of test environment	23°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

	Low	Mid	High
Duty Cycle (%)	100.00	100.00	100.00
Duty Cycle correction	0.00	0.00	0.00

	Low	Mid	High
Peak Level (dBµV/m)	57.3	55.7	56.2
Peak Level converted (dBm)	-49.7	-51.3	-50.8
Plot reference	8242-5 Radiated power, 2402 MHz Vert	8242-5 Radiated power, 2442 MHz Vert	8242-5 Radiated power, 2480 MHz Horiz
Antenna Polarisation	Vert	Vert	Horiz
EUT Polarisation	Upright	Upright	Upright

Analyser plots can be found in Section 6 of this report.

Note: During ERP tests, the measured radiated power was found to be much lower than anticipated. This was due to the integral Bluetooth antenna mounted inside the EUTs machined aluminium enclosure, which limited the radiated power.

LIMITS:
The maximum output power in all cases is 1watt (30dBm).

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 3.9 dB

5.7 Band Edge Compliance

5.7.1 Test methods

Test Requirements:	47 CFR Part 15C Clause 15.215 & 15.247(d) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.10 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Clause 15.209(a) & 15.247(d) [Reference 4.1.1 of this report]

5.7.2 Configuration of EUT

The EUT was placed on a 1.5 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 HOPPING** mode.

5.7.3 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 H.

5.7.4 Test equipment

LPE333, LPE261, E535, E534

See Section 9 for more details

5.7.5 Test results

Temperature of test environment	22°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

	Low Channel	High Channel
AV Level (dBµV/m)	26.3	26.3
Restricted Band Edge Plot (AVG) ref	J8242-5 Restricted Band edge lower AVG	J8242- Restricted Band edge upper AVG
Peak Level (dBµV/m)	37.7	37.2
Restricted Band Edge Plot (PK) ref	J8242-5 Restricted Band edge lower PK	J8242- Restricted Band edge upper PK

	Low Channel	High Channel
Peak Plot reference	J8242-5 Band edge PK lower	J8242-5 Band edge PK upper

Analyser plots for the Band Edge Compliance can be found in Section 6 of this report. These show the 20 dBc requirement of 15.247(d) are met at the band edges of 2400 and 2483.5 MHz. Restricted band edge plots are also shown in section 6.

The tables list the field strengths observed in the adjacent restricted bands, which are required to meet the tighter 15.209 limits.

LIMITS:
AV = 54dBuV/m at band edges
PK = 74dBuV/m at band edges

The restricted band edges closest to the EUT frequency of 2400-2483.5MHz are 2390 & 2483.5MHz.

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.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 3.9 dB

5.8 Occupied bandwidth

5.8.1 Test methods

Test Requirements: 47 CFR Part 15C Clause 15.247(a)(2) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.9 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Clause 15.247(a)(2) [Reference 4.1.1 of this report]

5.8.2 Configuration of EUT

The EUT was placed on a 1.5 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 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.

5.8.3 Test procedure

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. Tests were performed using Test Site H.

5.8.4 Test equipment

E534, E535, LPE261, LPE333

See Section 9 for more details

5.8.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

	Low	Mid	High
6dB Bandwidth (MHz)	0.6828	0.6941	0.6833
Plot reference	8242-5 2402 MHz	8242-5 2442 MHz	8242-5 2480 MHz OBW

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

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

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1.9 %

5.9 Maximum Average conducted output power

NOT APPLICABLE: PK conducted power measured instead.

5.10 Maximum Peak conducted output power

5.10.1 Test methods

Test Requirements: 47 CFR Part 15C Clause 15.247(b) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 11.9.1.3 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Clause 15.247(b)(3) [Reference 4.1.1 of this report]

5.10.2 Configuration of EUT

The EUT was tested on a bench, connected to a PK power meter. The EUT was operated in **TX 2402 MOD**, **TX 2442 MOD** and **TX 2480 MOD** modes.

5.10.3 Test procedure

Tests were made in accordance with the Test Method noted above using the measuring equipment listed in the 'Test Equipment used' section. The power stated is Peak conducted power. Tests were performed in test site A.

5.10.4 Test equipment

E611, E533, E534, E535

See Section 9 for more details

5.10.5 Test results

Temperature of test environment	21°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

	Low	Mid	High
Duty Cycle (%)	100.00	100.00	100.00

	Low	Mid	High
Peak Level measured (dBm)	-7.7	-7.2	-7.0

Note: During conducted tests the power was found to be a little low than declared, The EUT was confirmed as being set to maximum power and the results were confirmed as acceptable to Audio Ltd.

LIMITS:
The maximum output power in all cases is 1watt (30dBm).

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 1.0 dB

5.11 Maximum Power Spectral Density

5.11.1 Test methods

Test Requirements: 47 CFR Part 15C Clause 15.247(e) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 11.10.2 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Clause 15.247(e) [Reference 4.1.1 of this report]

5.11.2 Configuration of EUT

The EUT was tested on a bench. The EUT was operated in **TX 2402 MOD, TX 2442 MOD** and **TX 2480 MOD** modes for this test.

5.11.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. PEP was recorded in the required span and bandwidth. Measurements and plots were taken with the span set to 1.5 times the measured DTS bandwidth. Tests were performed using Test Site H.

5.11.4 Test equipment

E535, E534

See Section 9 for more details

5.11.5 Test results

Temperature of test environment	20°C
Humidity of test environment	50%
Pressure of test environment	101kPa

Band	2400-2483.5 MHz
Power Level	1 mW
Channel Spacing	2 MHz
Mod Scheme	BLE Protocol
Low channel	2402 MHz
Mid channel	2442 MHz
High channel	2480 MHz

	Low	Mid	High
Duty Cycle (%)	100	100	100
dBm per 3 kHz RBW	-26.6	-19.8	-22.5
Plot reference	8242-5 PSD 2402 MHz 3 kHz	8242-5 PSD 2442 MHz 3 kHz	8242-5 PSD 2480 MHz 3 kHz

Any Analyser plots can be found in Section 6 of this report.

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

These results show that the EUT has PASSED this test.

The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
<± 2 dB

5.12 Antenna power conducted emissions

NOT APPLICABLE: Applies to EUT's with an antenna port. The EUTs' Bluetooth radio has an integral antenna only. Radiated emissions have been performed with the integral antenna in place.

5.13 Duty cycle

NOT APPLICABLE: No limits apply, however duty cycle measurement performed to verify any possible correction factors for average emissions. EUT Duty was confirmed as operating in a 100% constant transmit state for tests.

5.14 FHSS carrier frequency separation

NOT APPLICABLE: EUT does not employ FHSS technology.

5.15 Average time of occupancy

NOT APPLICABLE: EUT does not employ FHSS technology.

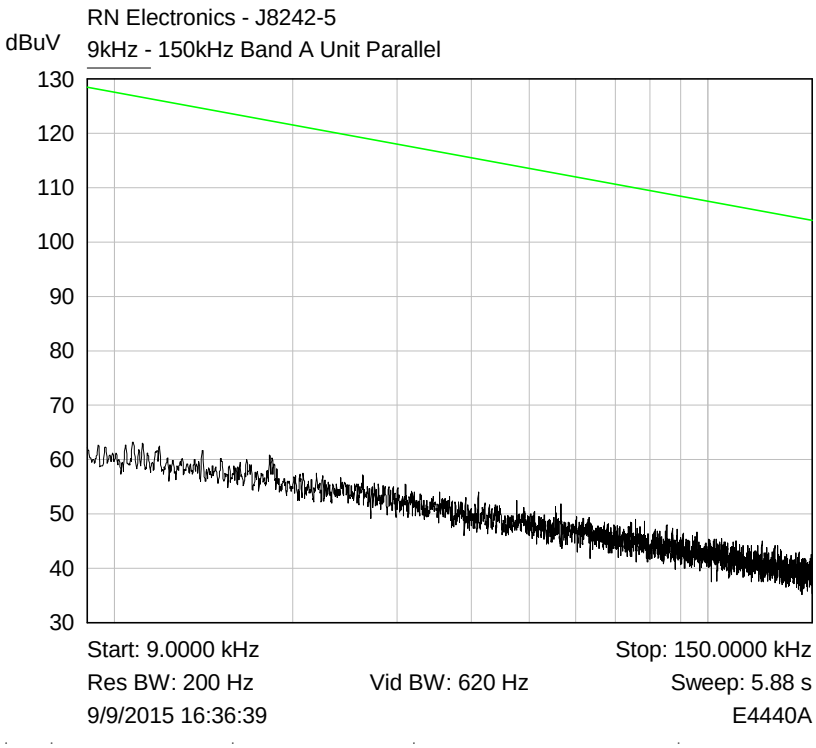
5.16 Number of Hop Channels

NOT APPLICABLE: EUT does not employ FHSS technology.

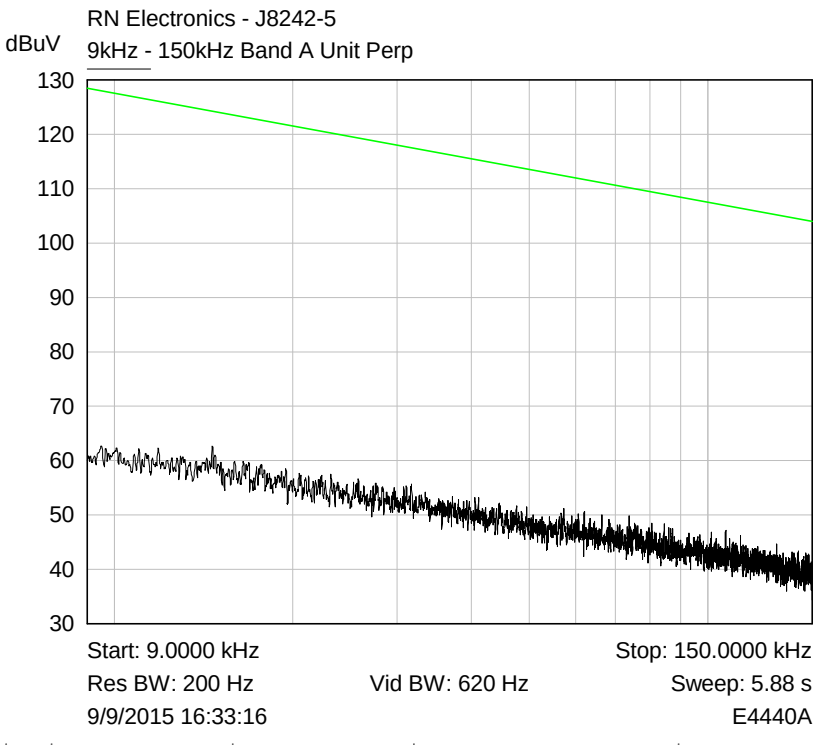
6 Plots/Graphical results

6.1 Radiated emissions 9 kHz – 150 kHz

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



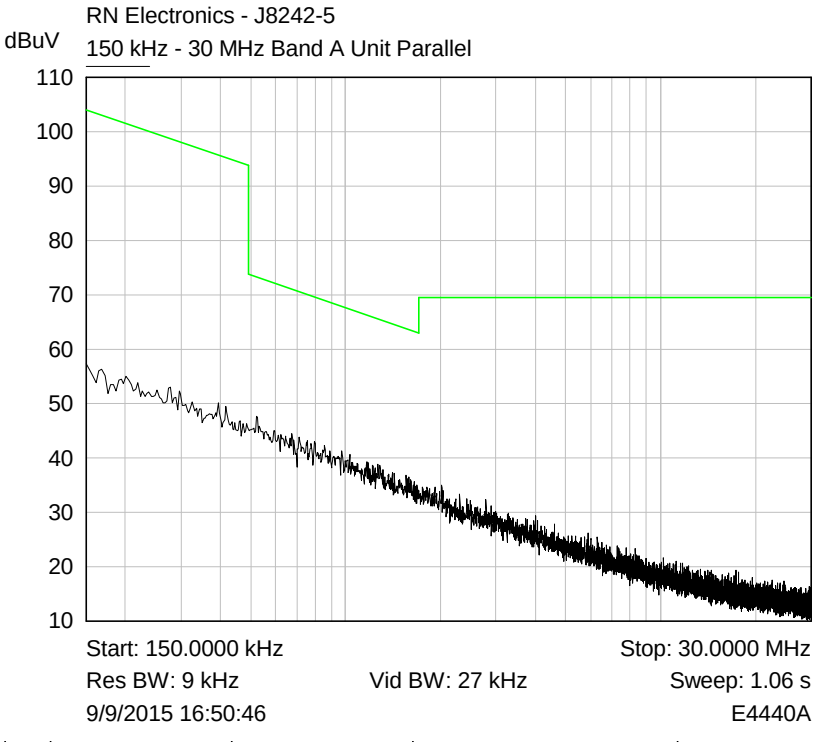
Plot of 9-150kHz Parallel



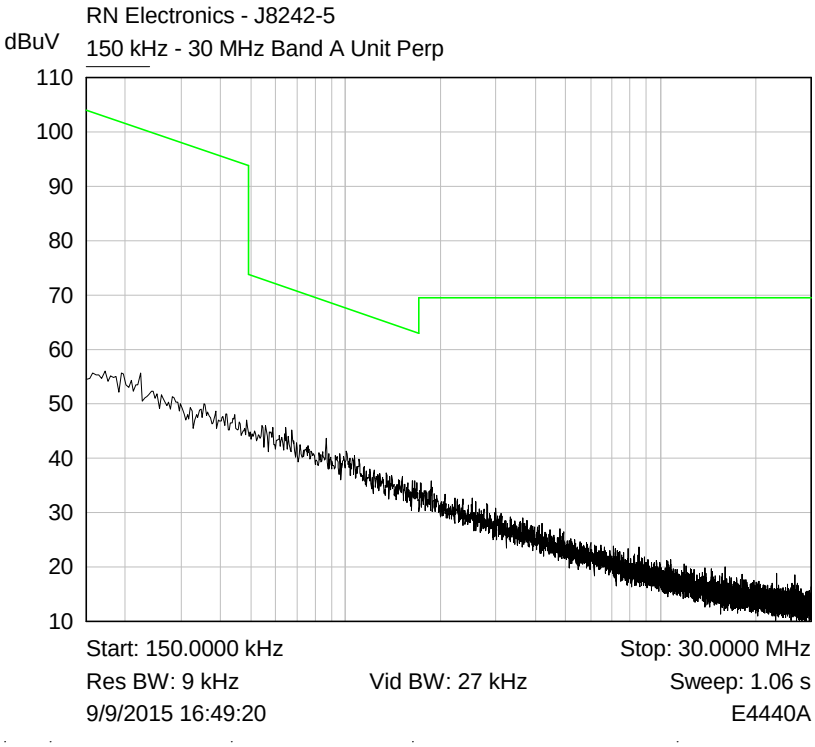
Plot of 9-150kHz Perpendicular

6.2 Radiated emissions 150 kHz – 30 MHz

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



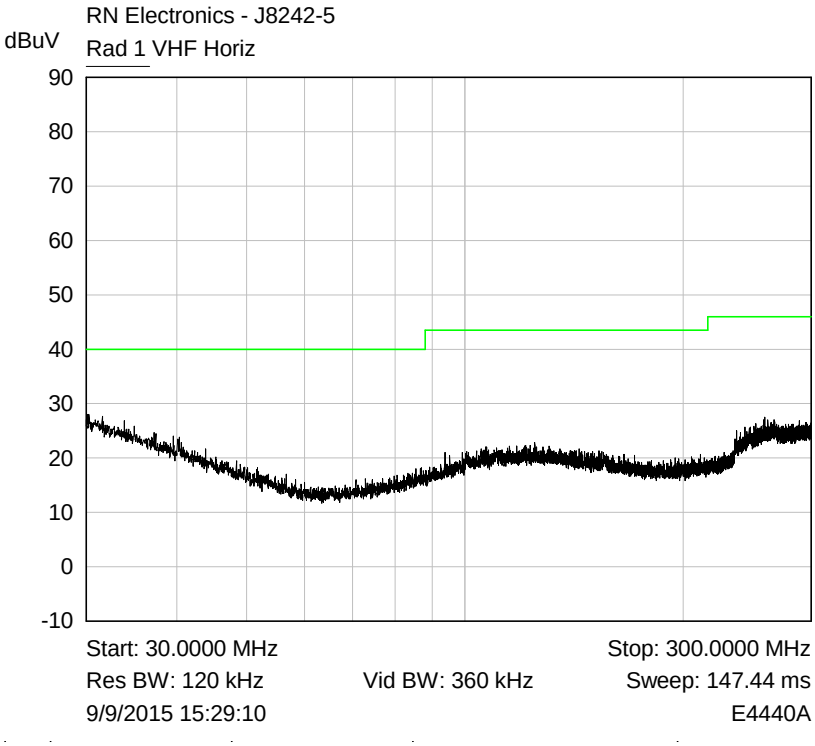
Plot of 150k-30MHz Parallel



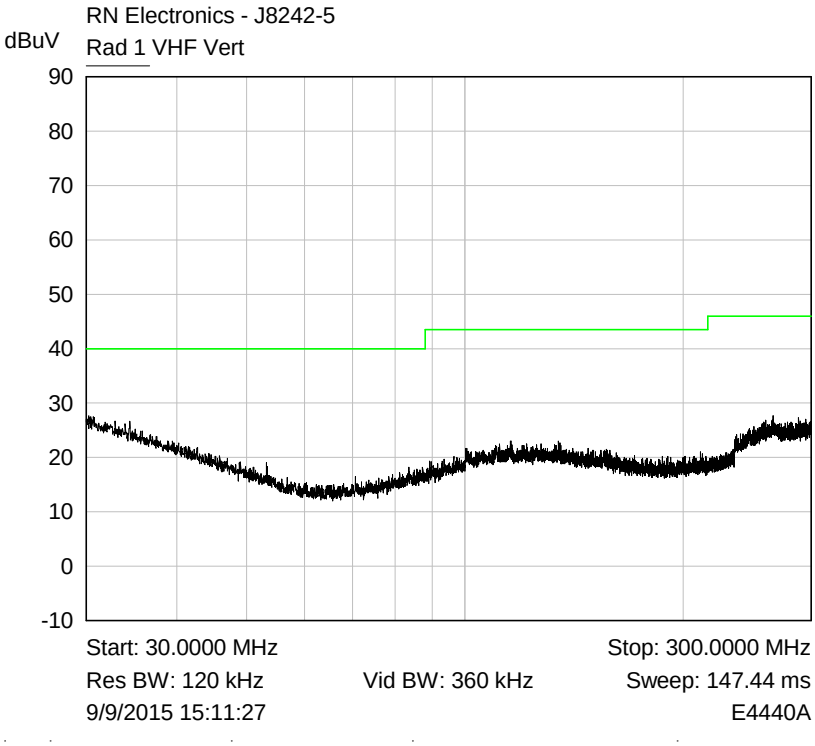
Plot of 150k-30MHz Perpendicular

6.3 Radiated emissions 30 MHz -1 GHz

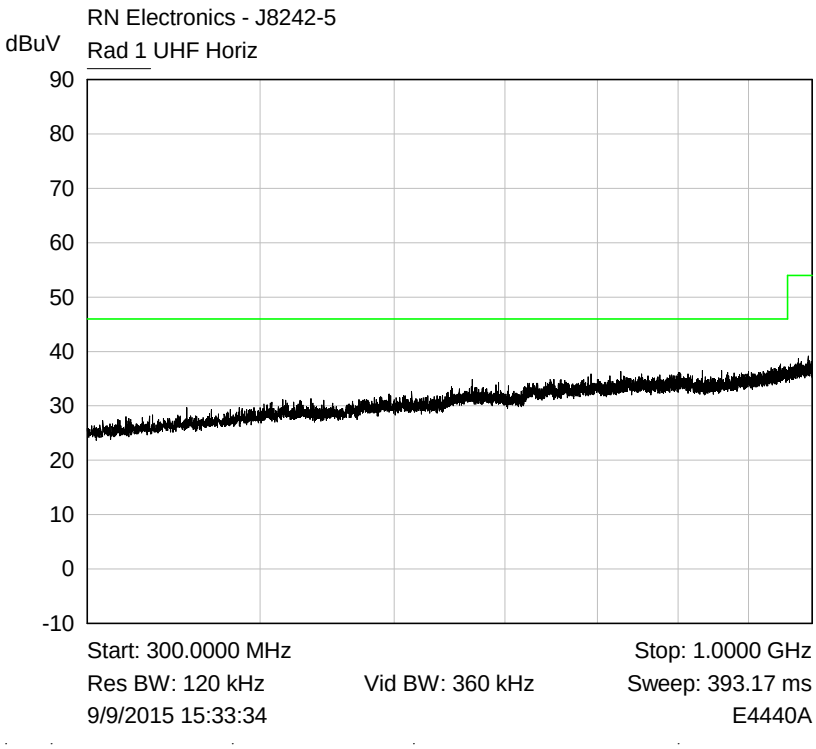
RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



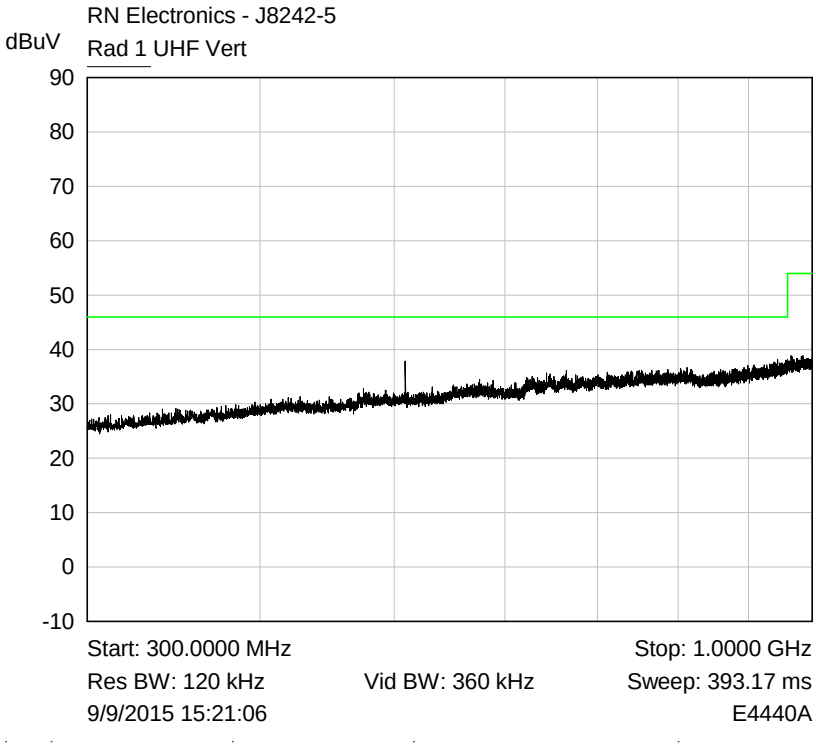
Plot of Peak emissions for VHF Horizontal against the QP limit line.



Plot of Peak emissions for VHF Vertical against the QP limit line.



Plot of Peak emissions for UHF Horizontal against the QP limit line.

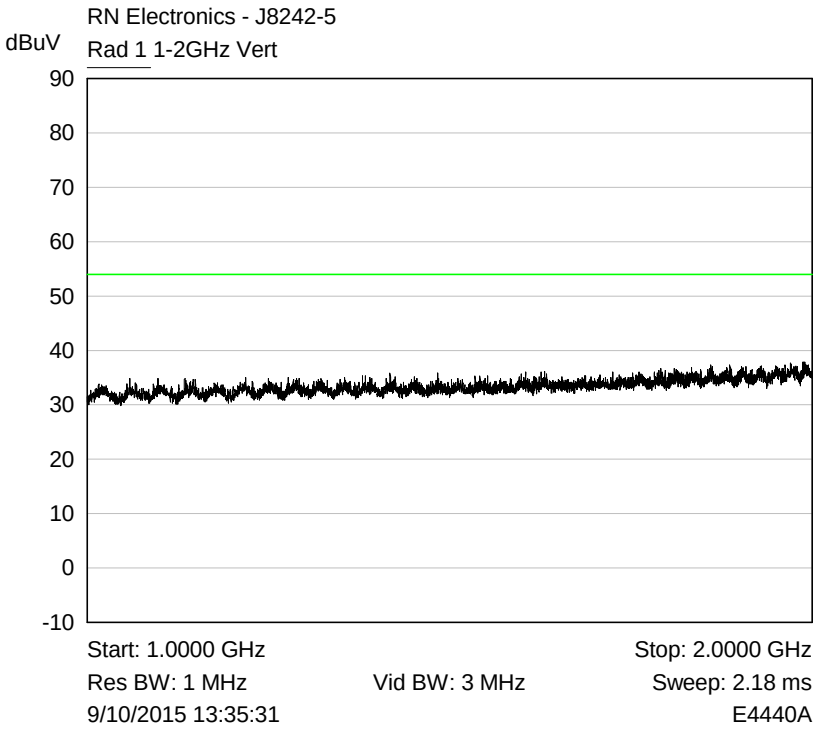


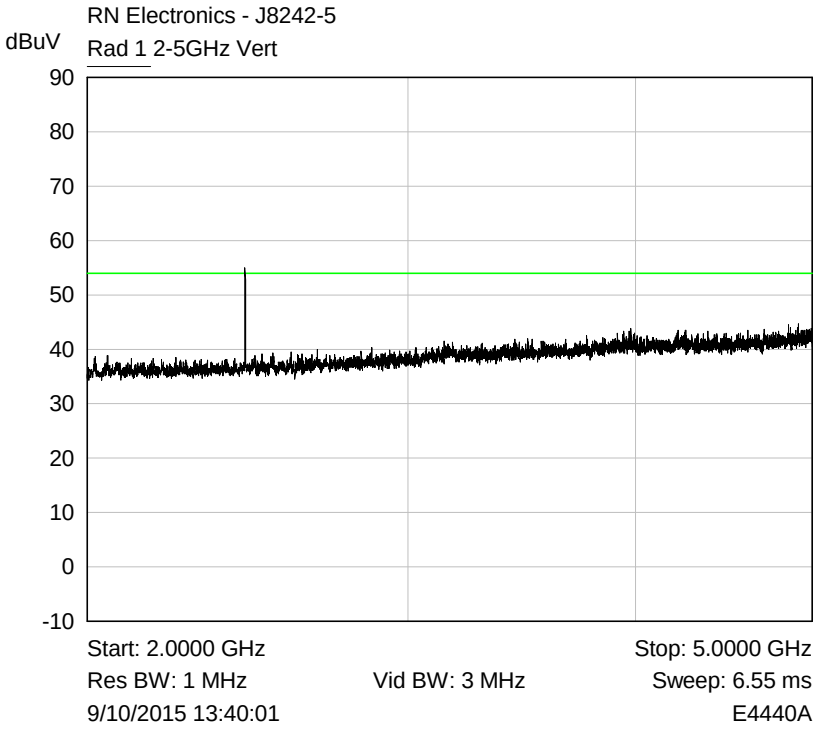
Plot of Peak emissions for UHF Vertical against the QP limit line.
Note: signal observed is UHF fundamental breakthrough.

6.4 Radiated emissions above 1 GHz

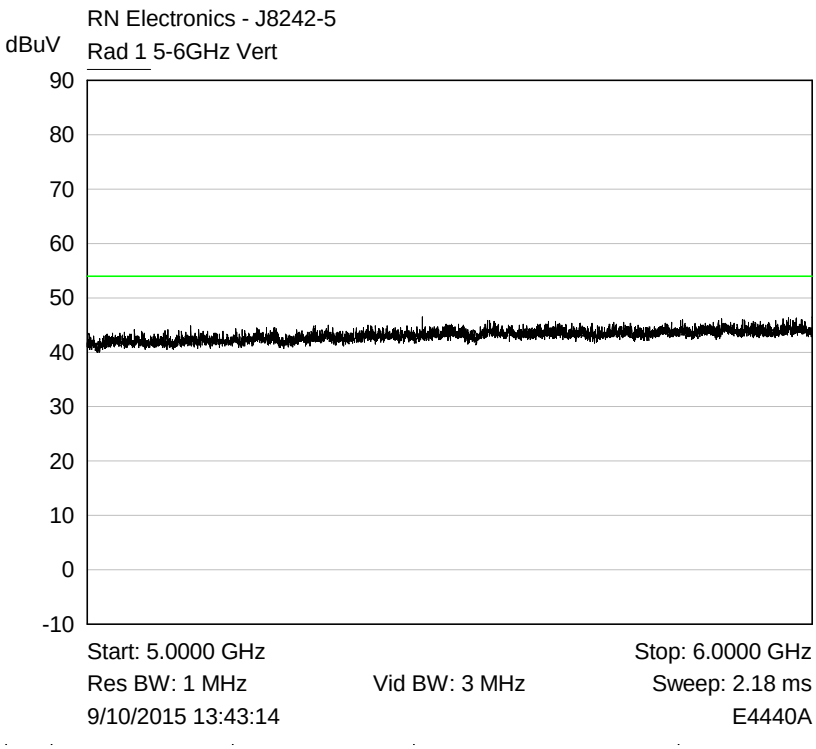
RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz

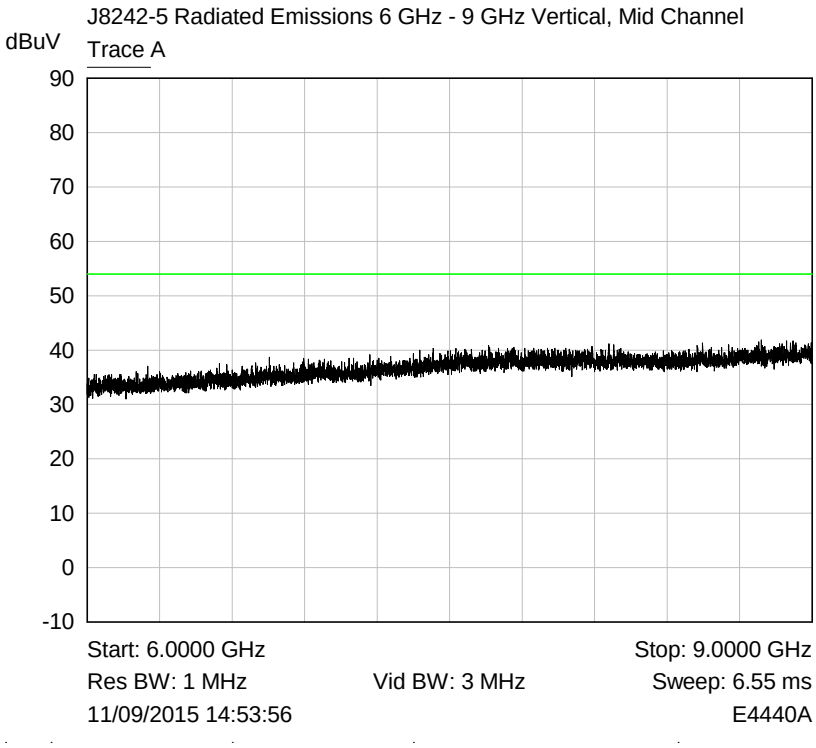
Note: All plots above 1GHz show a pk max held plot against the average limit line as worst case, where signals were found the appropriate measurement detectors were used during measurements.

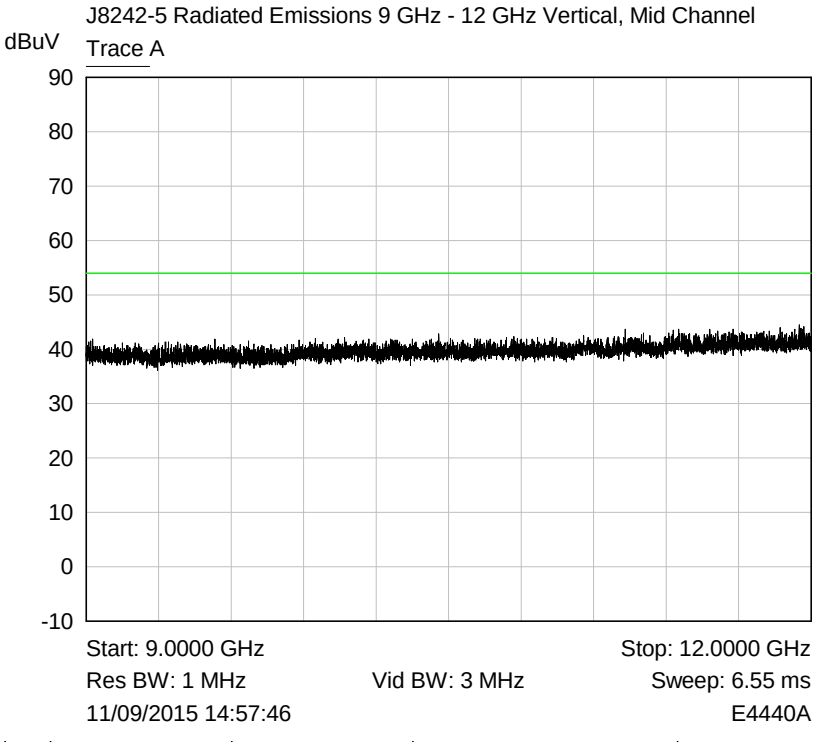


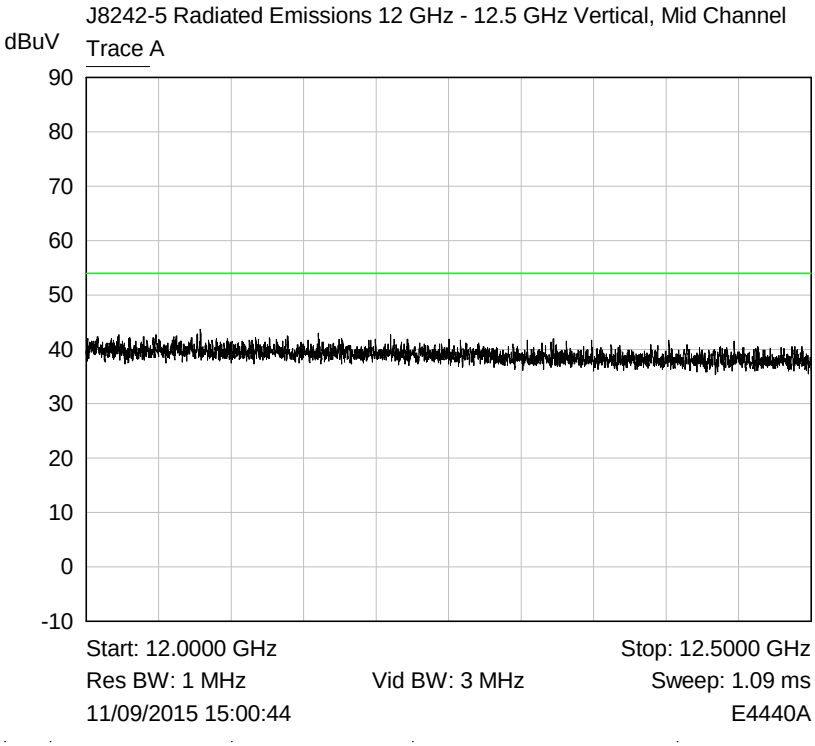


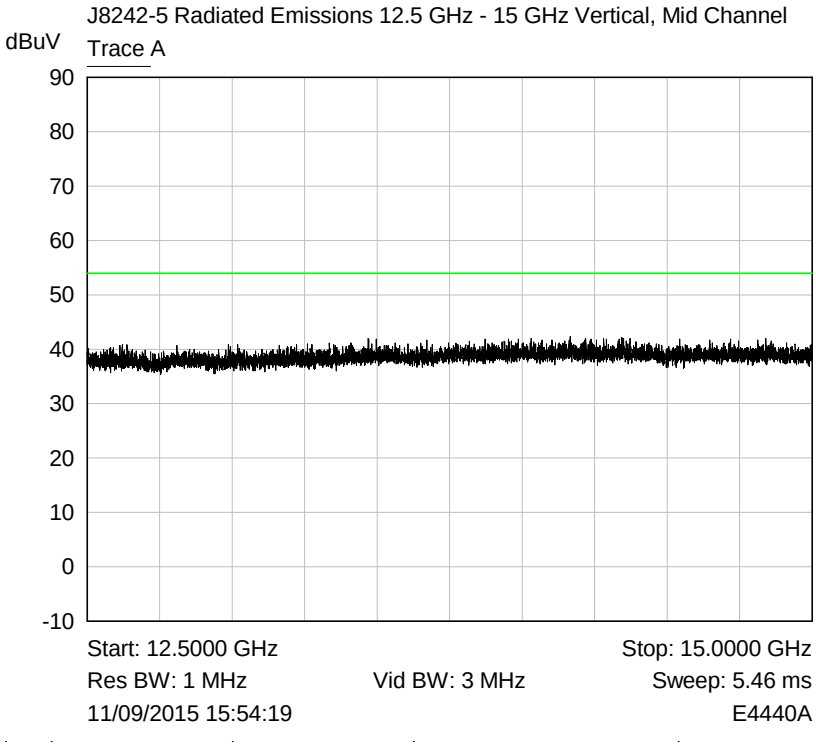
Note: Plot shows the fundamental BT frequency of the EUT

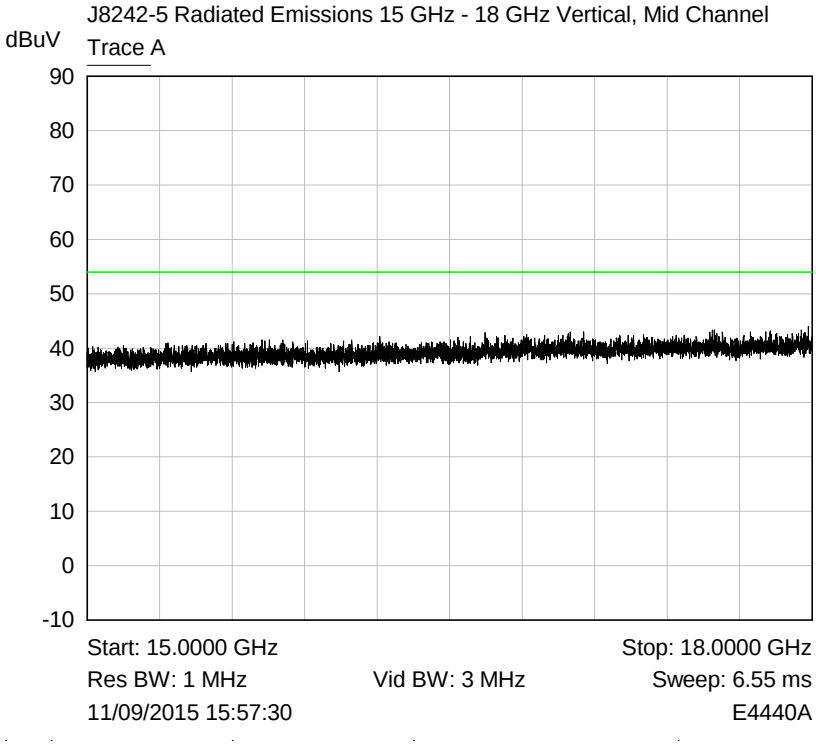


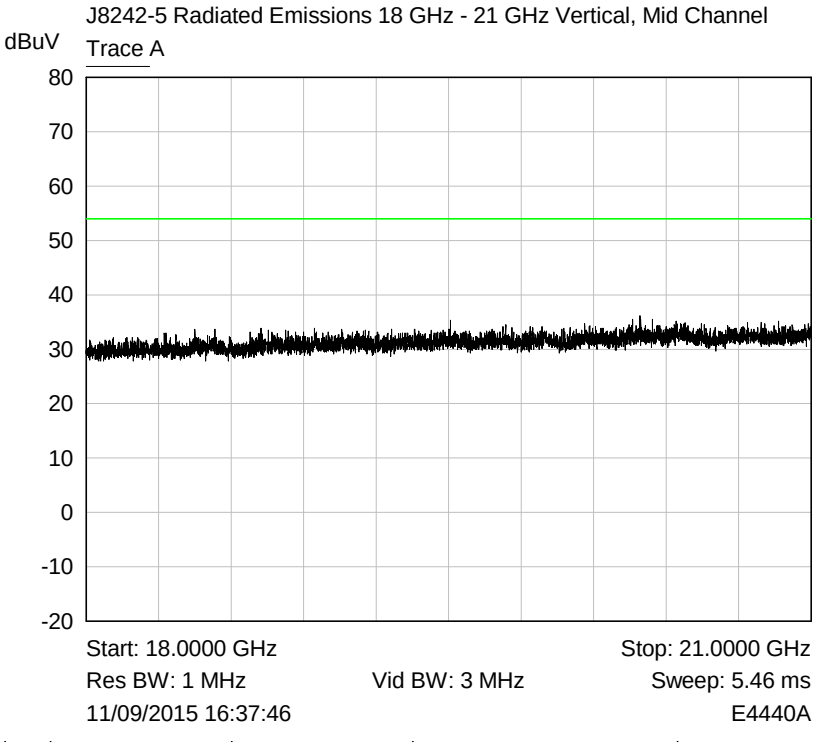


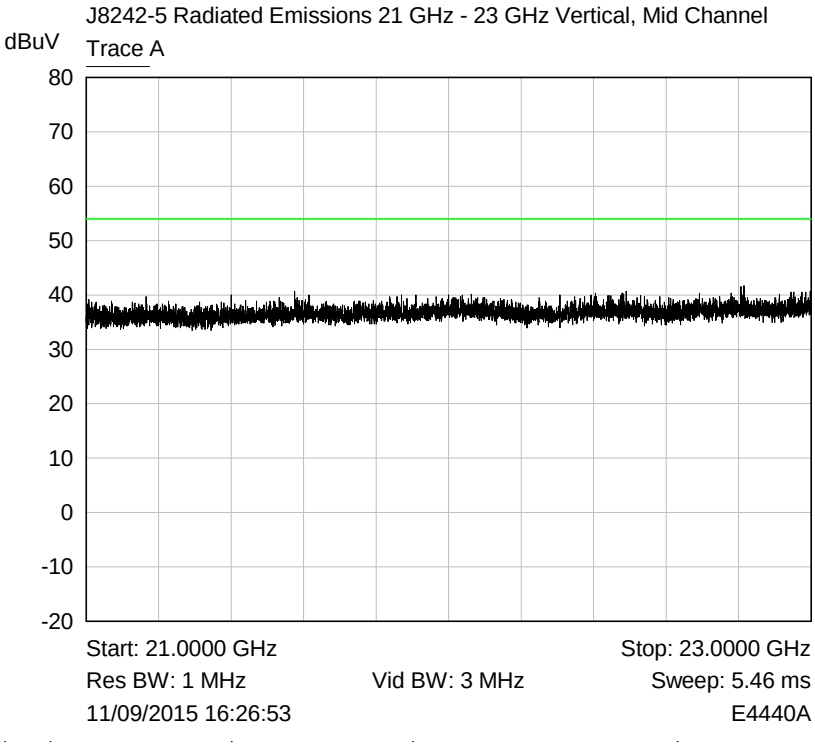


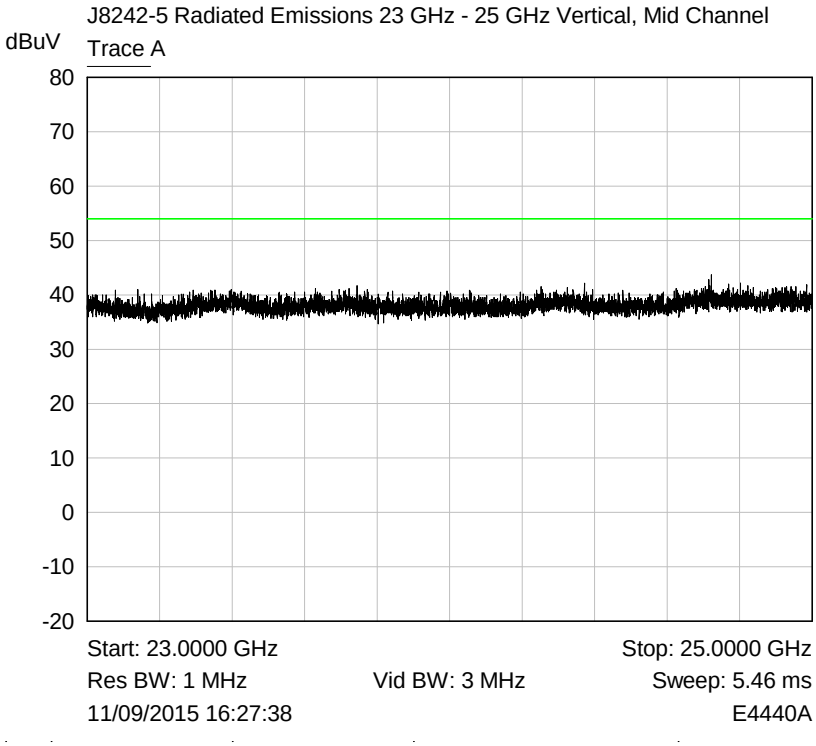


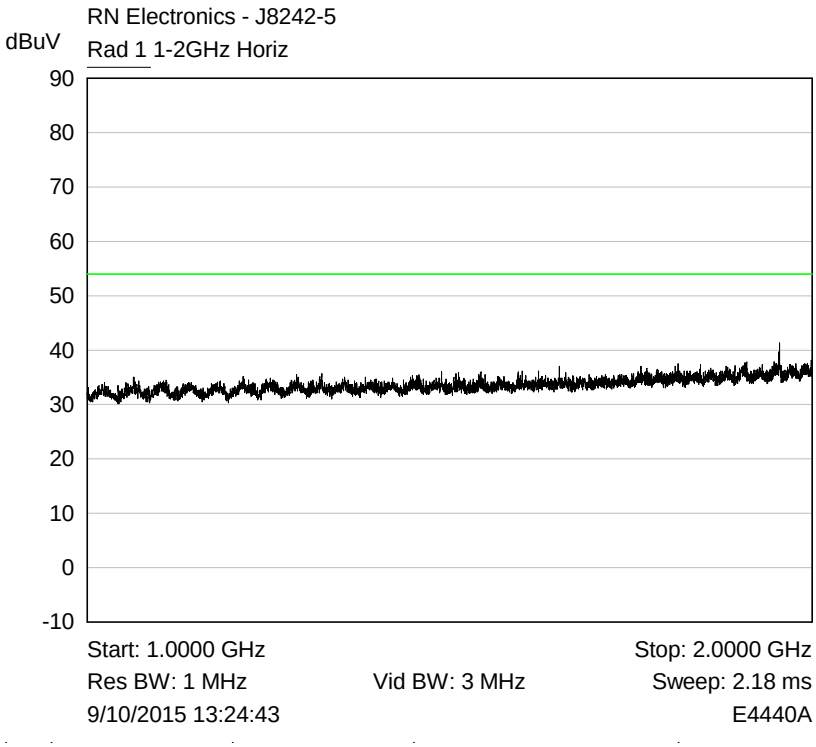


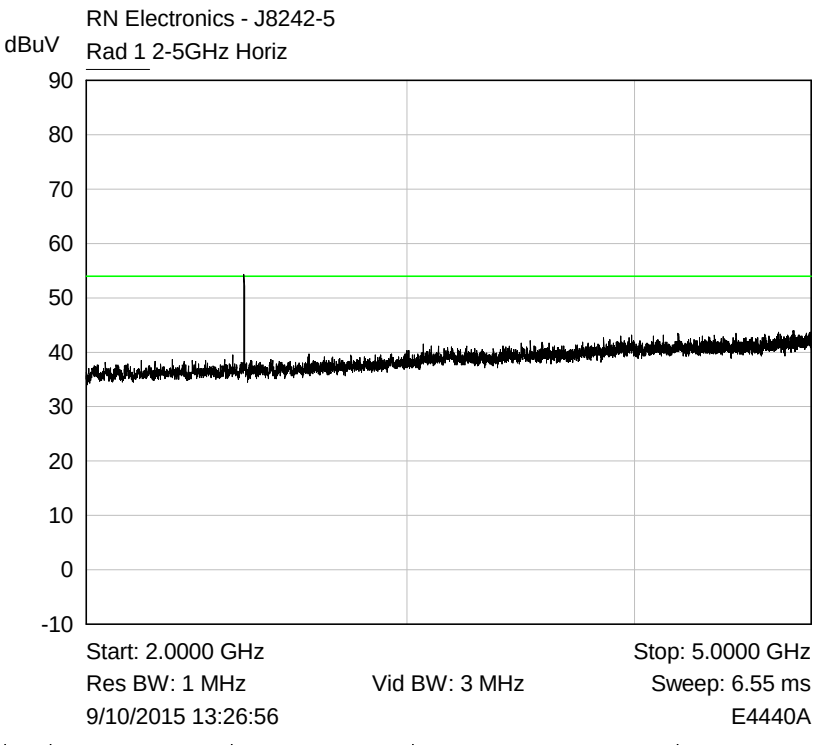




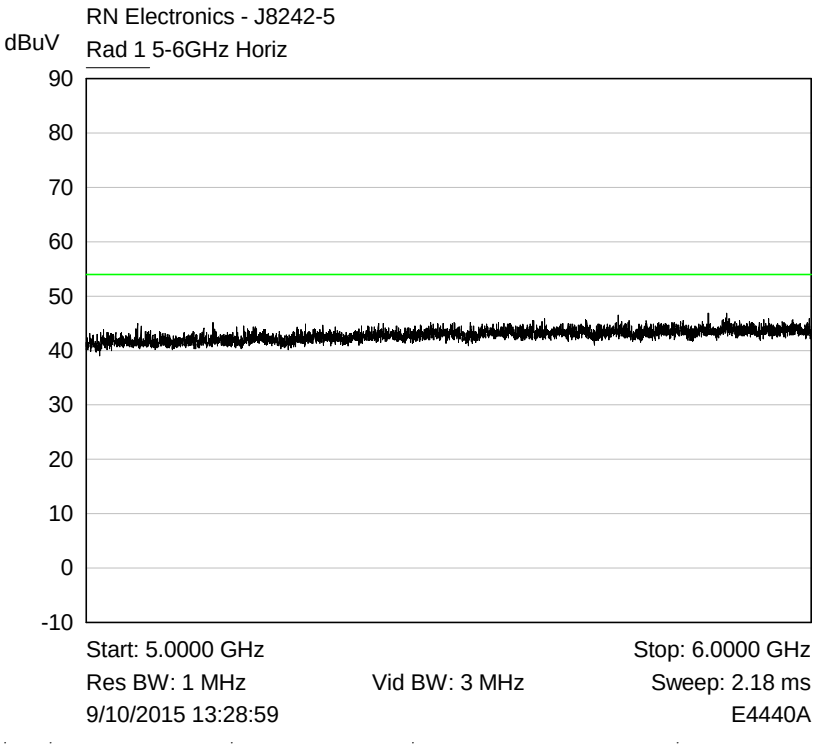


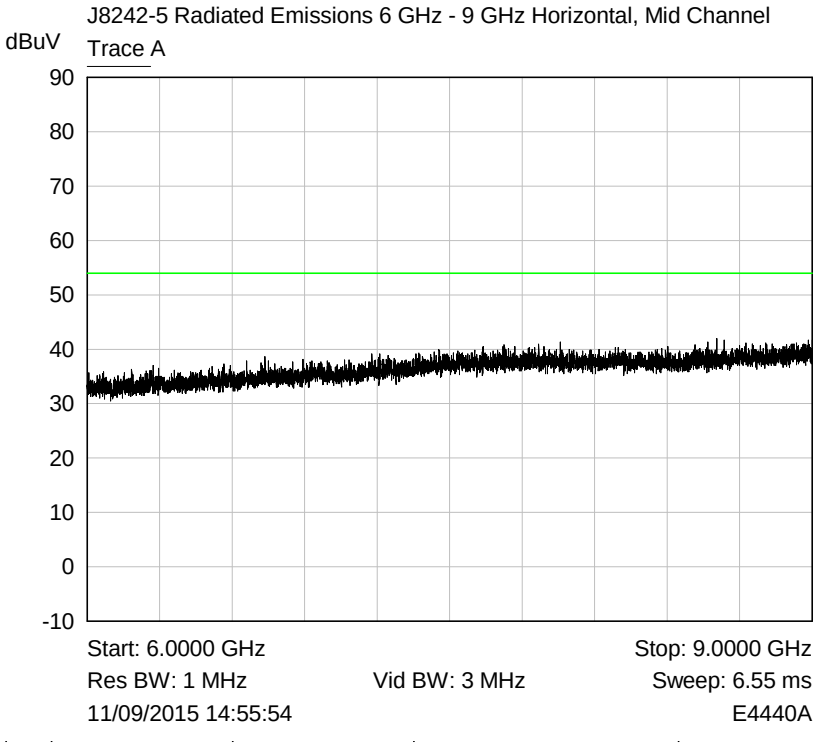


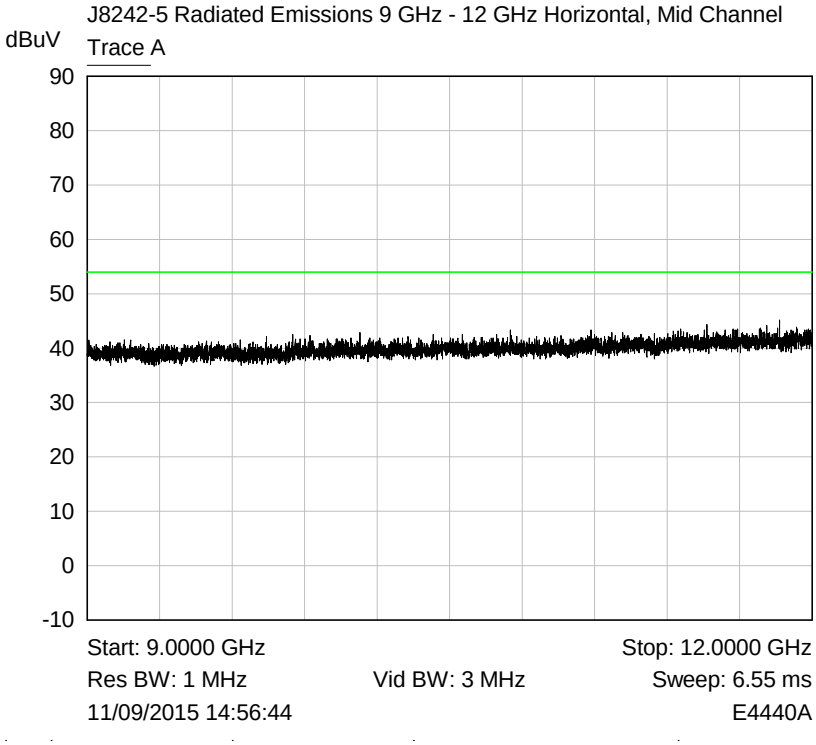




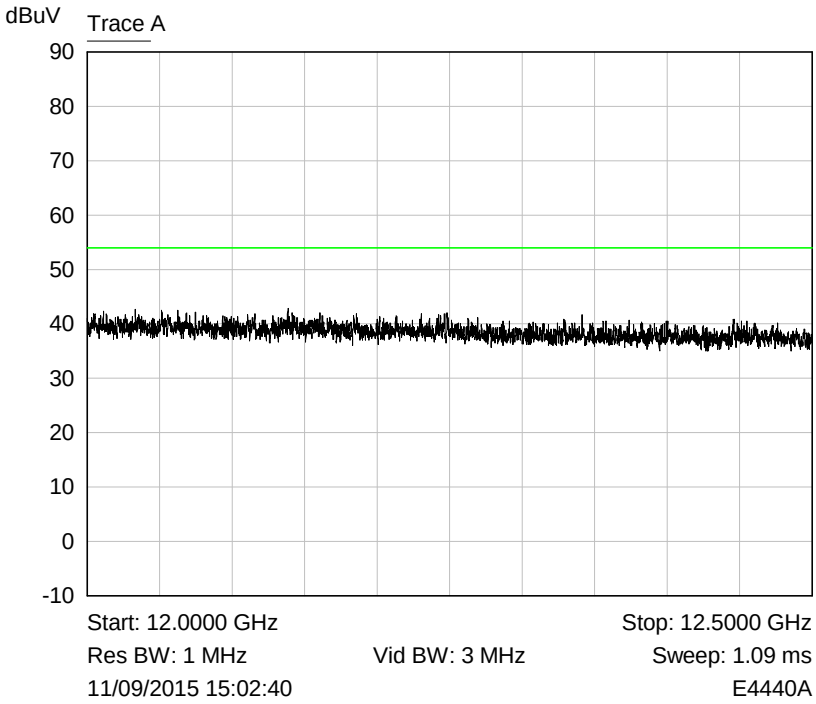
Plot shows the fundamental frequency of the EUT



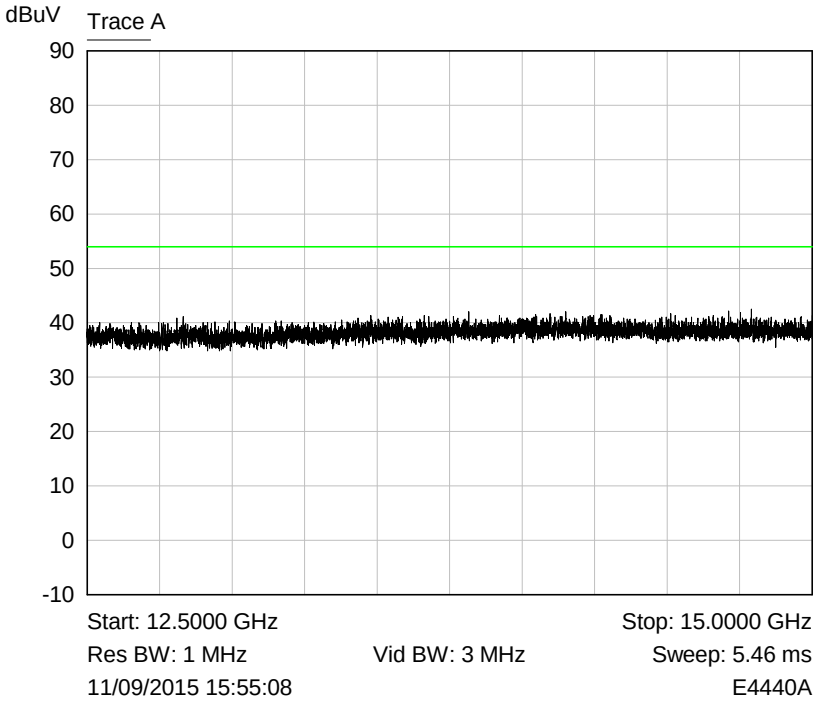


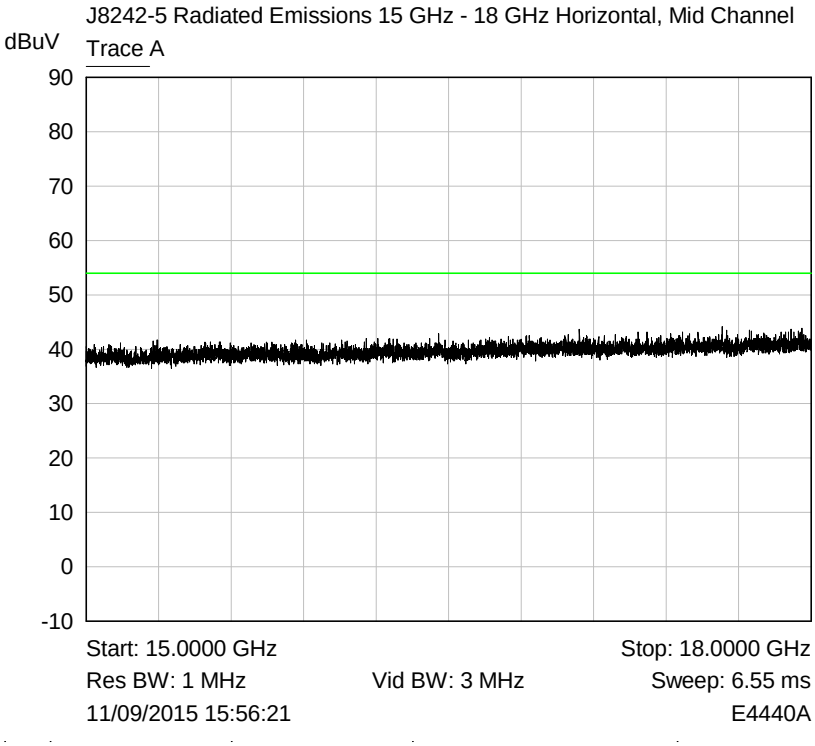


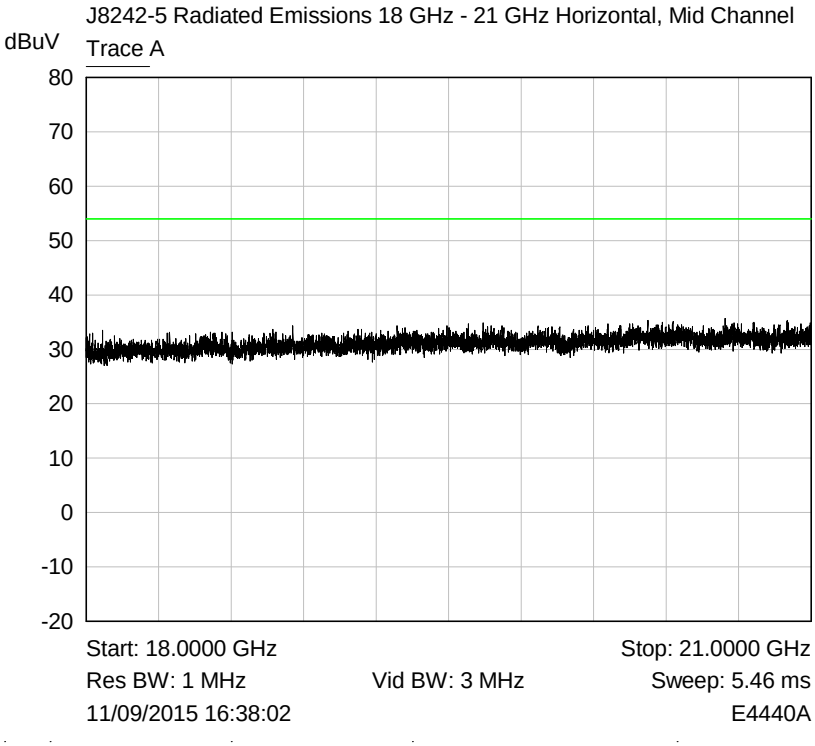
J8242-5 Radiated Emissions 12 GHz - 12.5 GHz Horizontal, Mid Channel

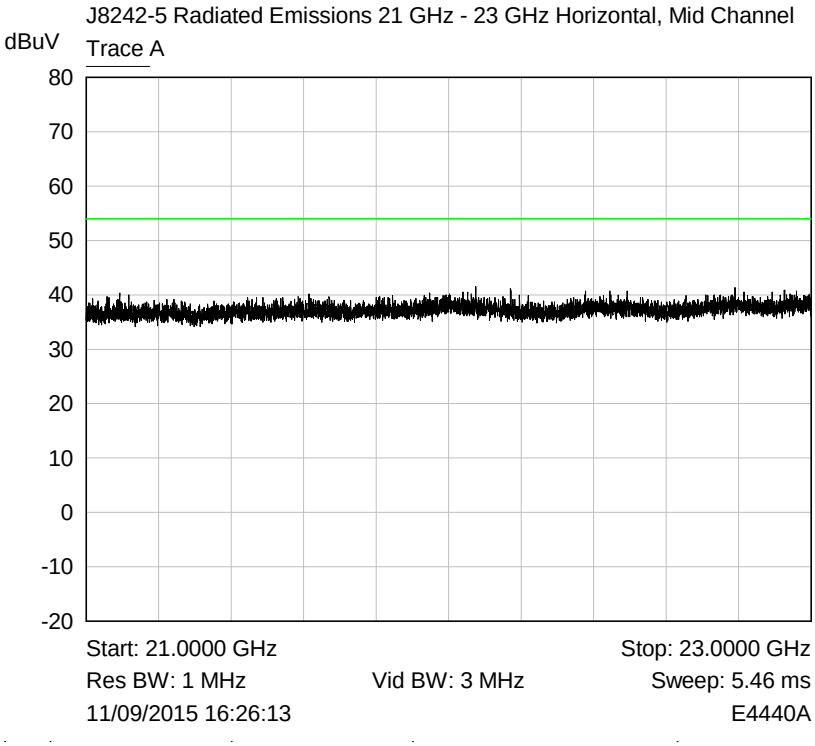


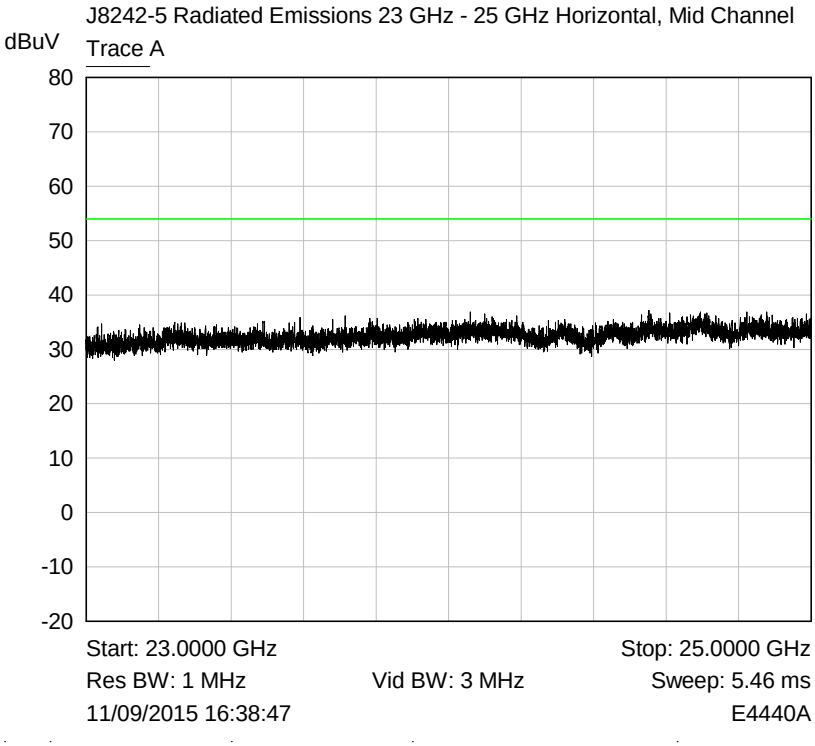
J8242-5 Radiated Emissions 12.5 GHz - 15 GHz Horizontal, Mid Channel





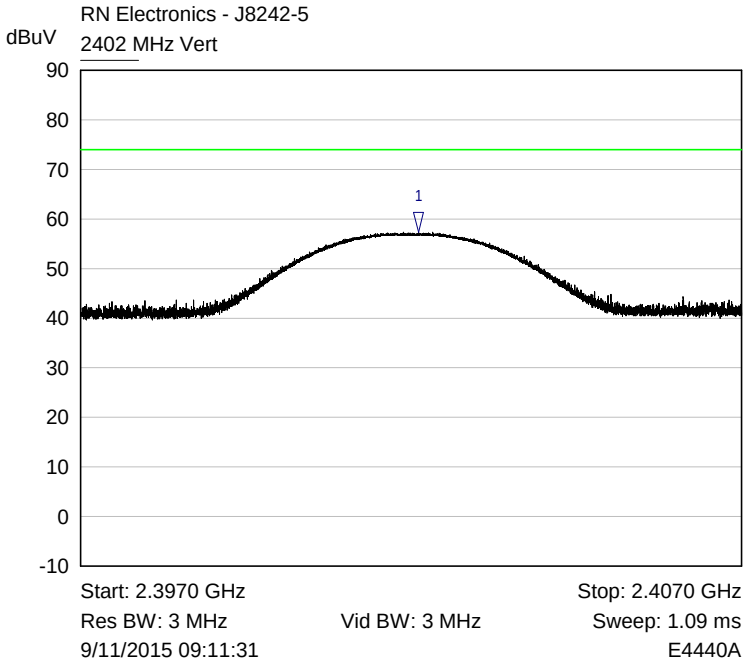






6.5 Effective radiated power field strength

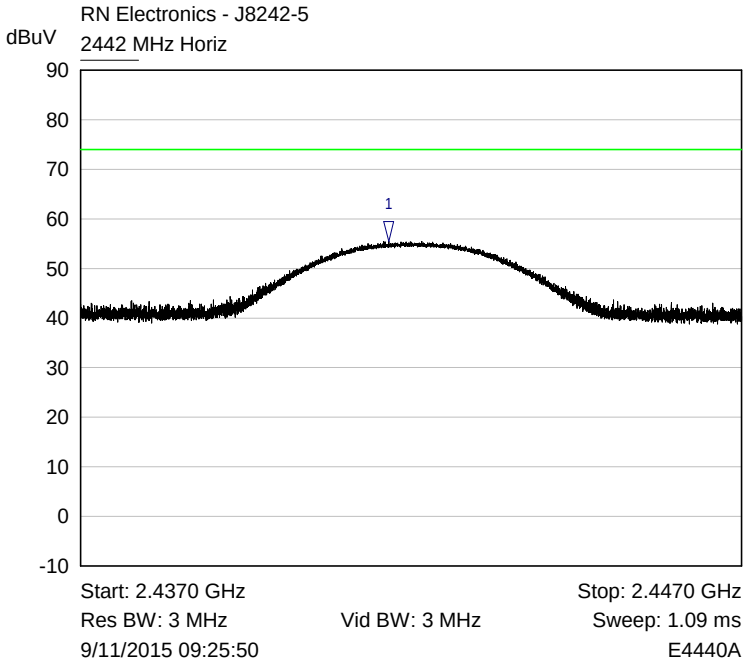
RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2402 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	2402 MHz Vert	2.4021 GHz	57.31 dBuV	

Plot of Vert polarisation and EUT in Upright position

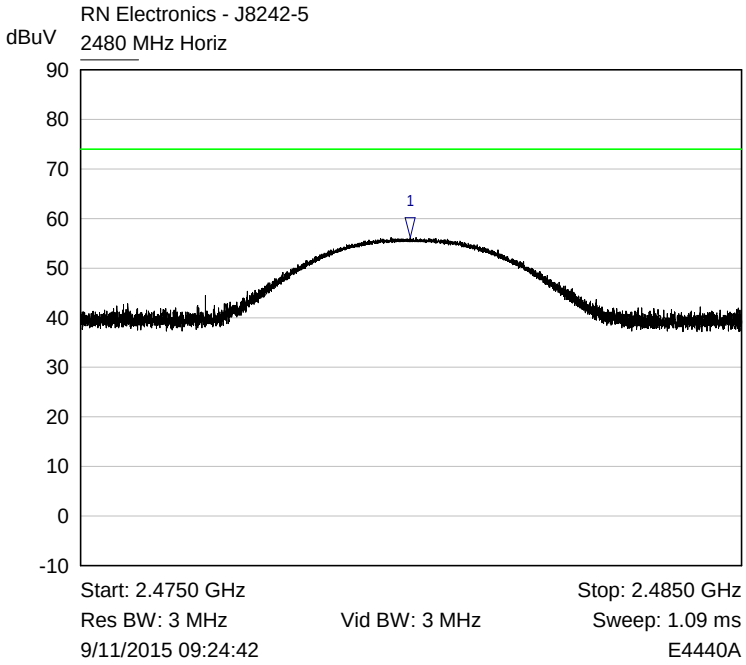
RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	2442 MHz Horiz	2.4417 GHz	55.54 dBuV	

Plot of Horiz polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2480 MHz

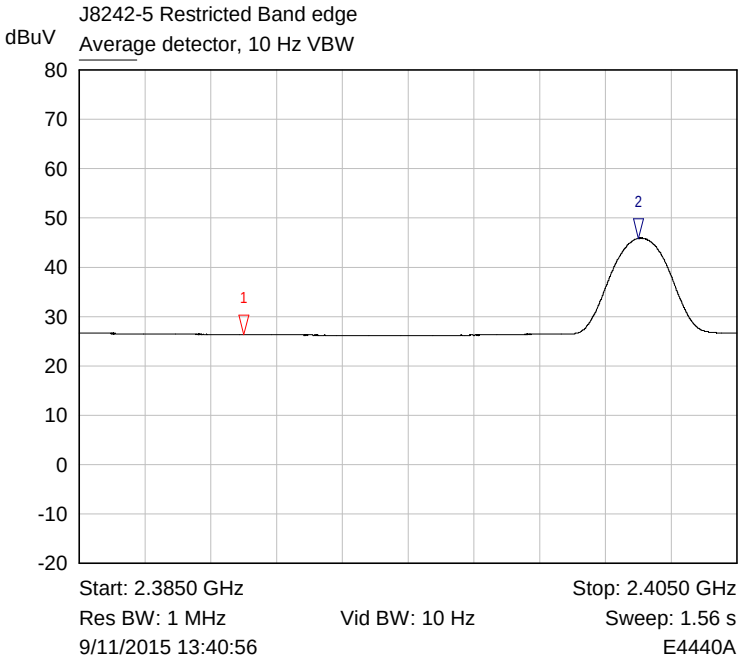


Mkr	Trace	X-Axis	Value	Notes
1 ▽	2480 MHz Horiz	2.4800 GHz	56.20 dBuV	

Plot of Horiz polarisation and EUT in Upright position

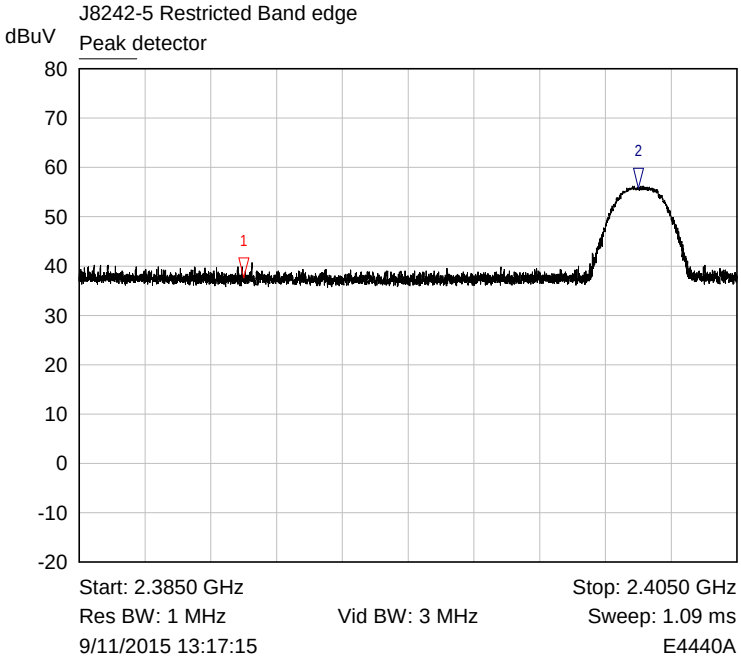
6.6 Band Edge Compliance

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2402 MHz



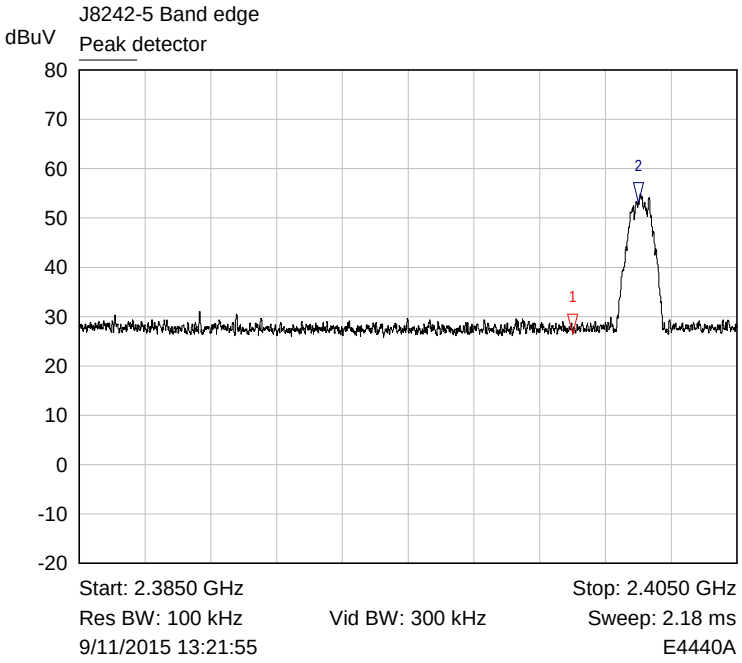
Mkr	Trace	X-Axis	Value	Notes
1	Average detector, 10 Hz VBW	2.3900 GHz	26.33 dBuV	
2	Average detector, 10 Hz VBW	2.4020 GHz	45.87 dBuV	

Restricted Band edge - Average Plot



Mkr	Trace	X-Axis	Value	Notes
1	Peak detector	2.3900 GHz	37.65 dBuV	
2	Peak detector	2.4020 GHz	55.83 dBuV	

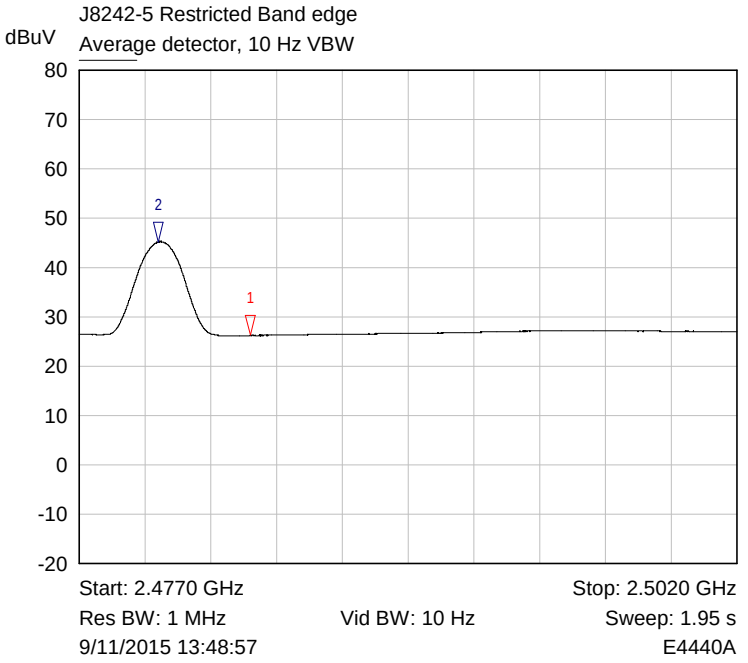
Restricted band edge - Peak Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak detector	2.4000 GHz	26.54 dBuV	
2 ▽	Peak detector	2.4020 GHz	53.08 dBuV	

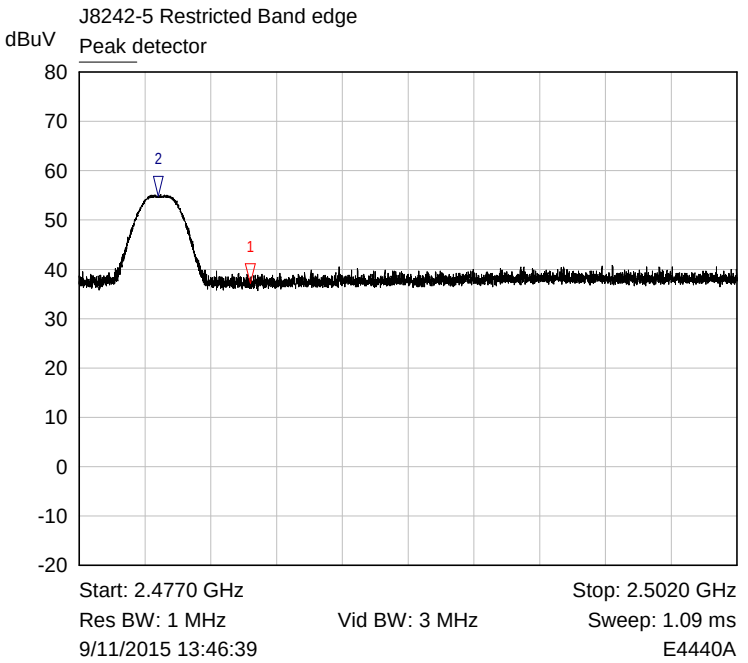
Band edge - Peak Plot

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2480 MHz



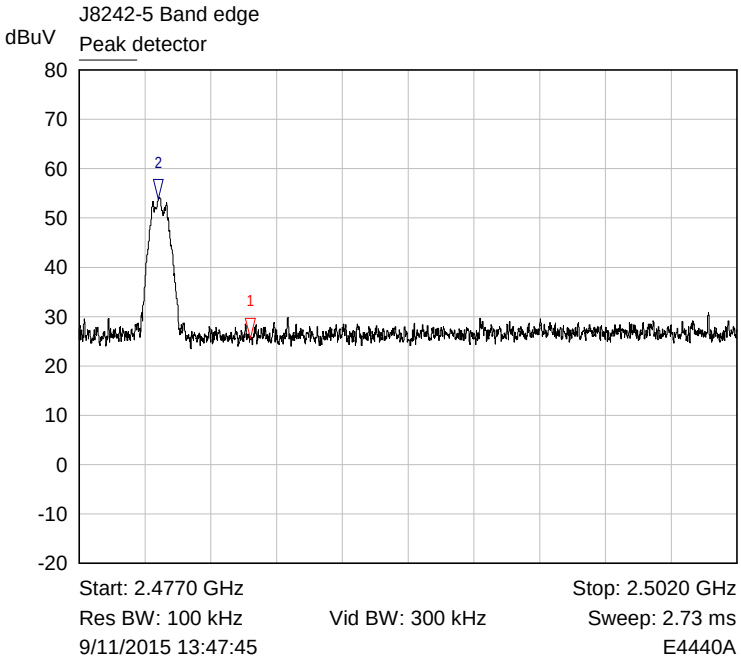
Mkr	Trace	X-Axis	Value	Notes
1	Average detector, 10 Hz VBW	2.4835 GHz	26.25 dBuV	
2	Average detector, 10 Hz VBW	2.4800 GHz	45.19 dBuV	

Restricted band edge - Average Plot



Mkr	Trace	X-Axis	Value	Notes
1	Peak detector	2.4835 GHz	37.16 dBuV	
2	Peak detector	2.4800 GHz	54.76 dBuV	

Restricted band edge - Peak Plot

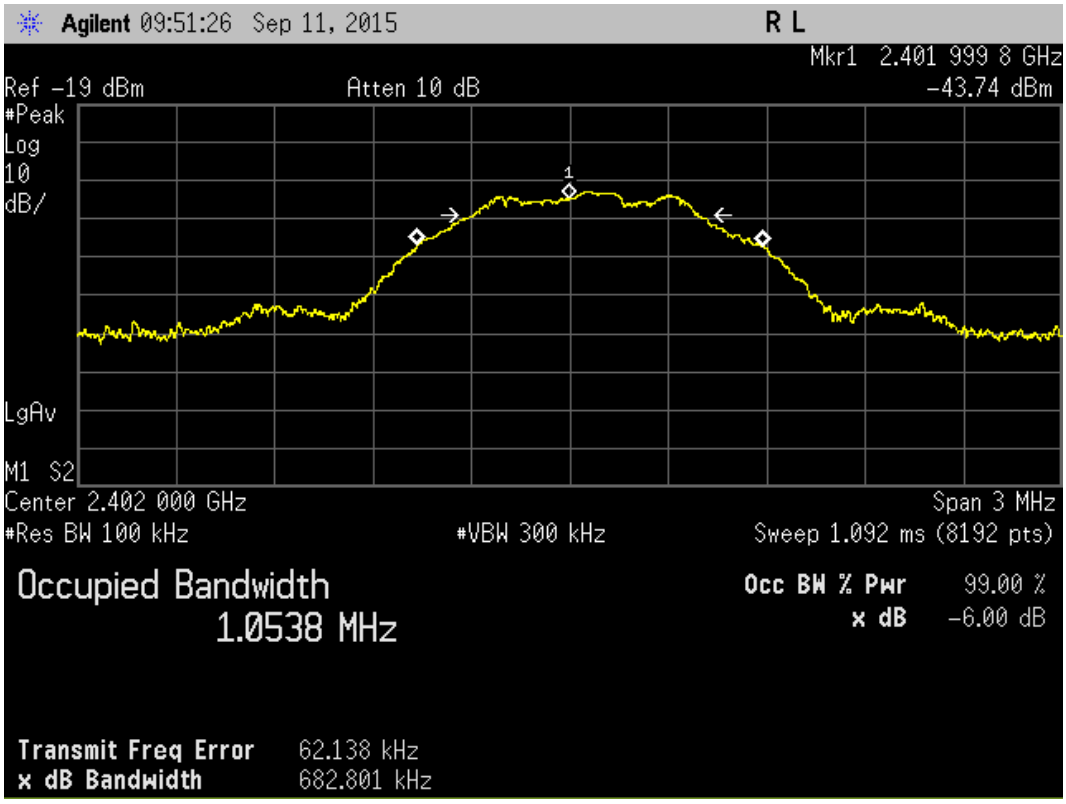


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Peak detector	2.4835 GHz	25.75 dBuV	
2 ▽	Peak detector	2.4800 GHz	53.85 dBuV	

Band edge - Peak Plot

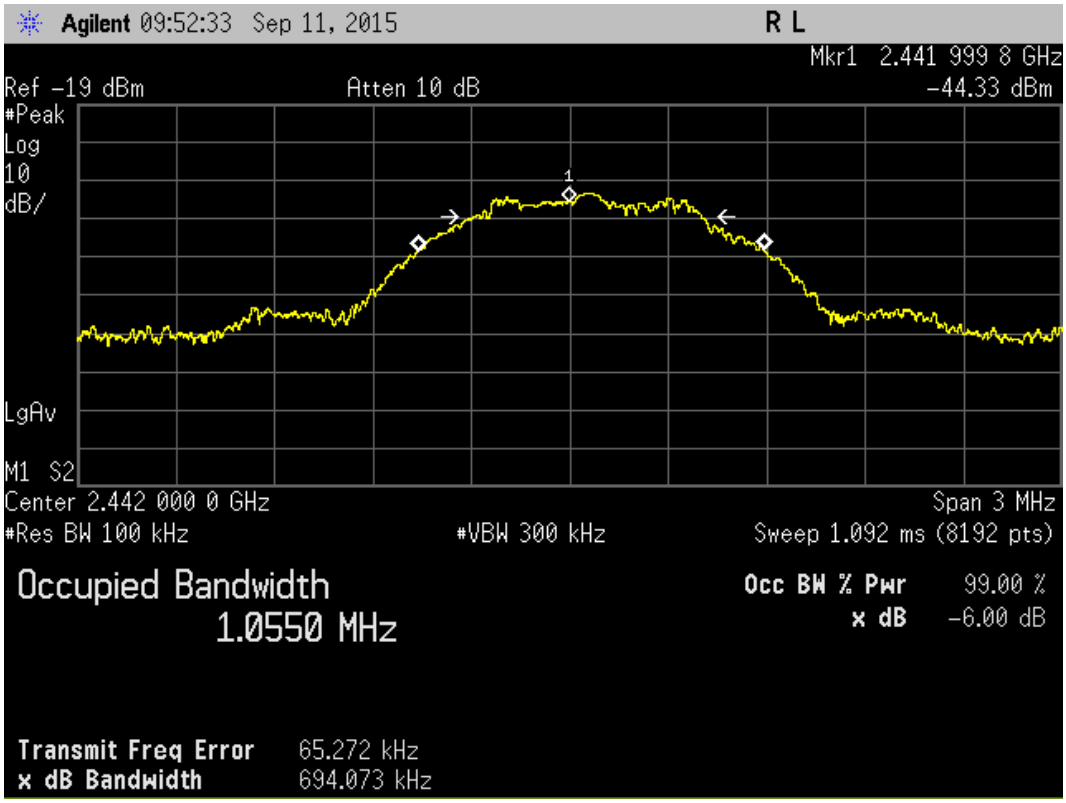
6.7 Occupied bandwidth

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2402 MHz



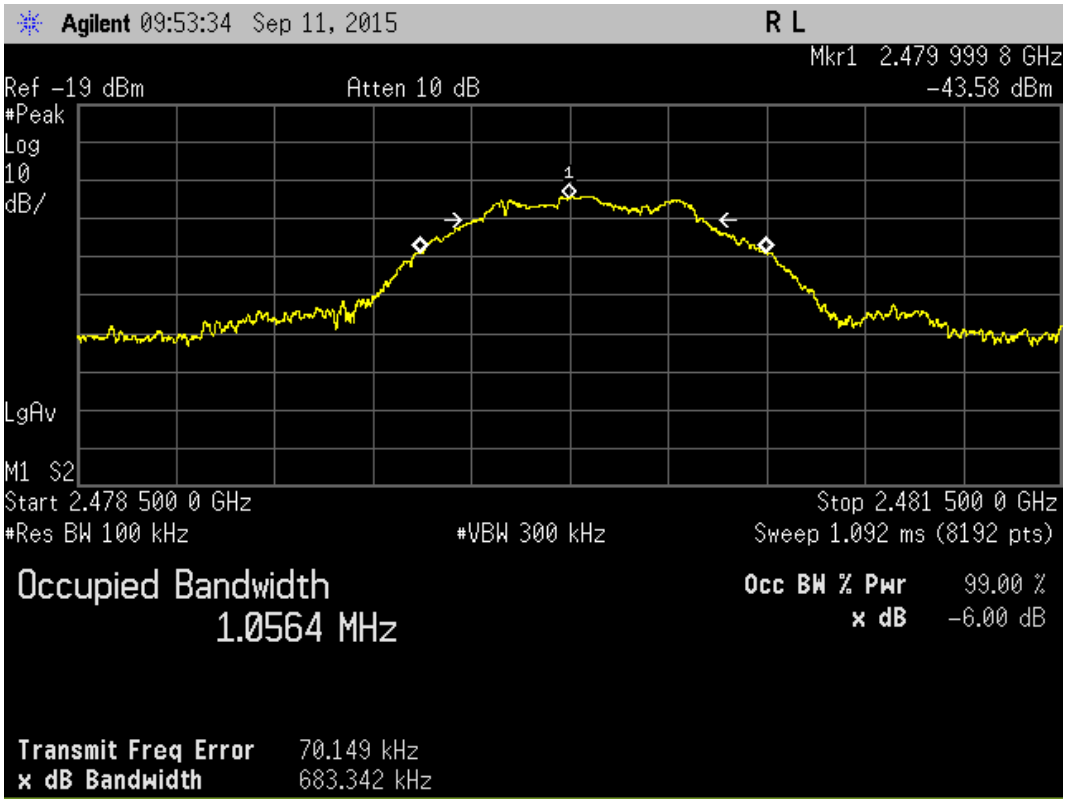
Plot for 6dB Bandwidth (kHz)

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



Plot for 6dB Bandwidth (kHz)

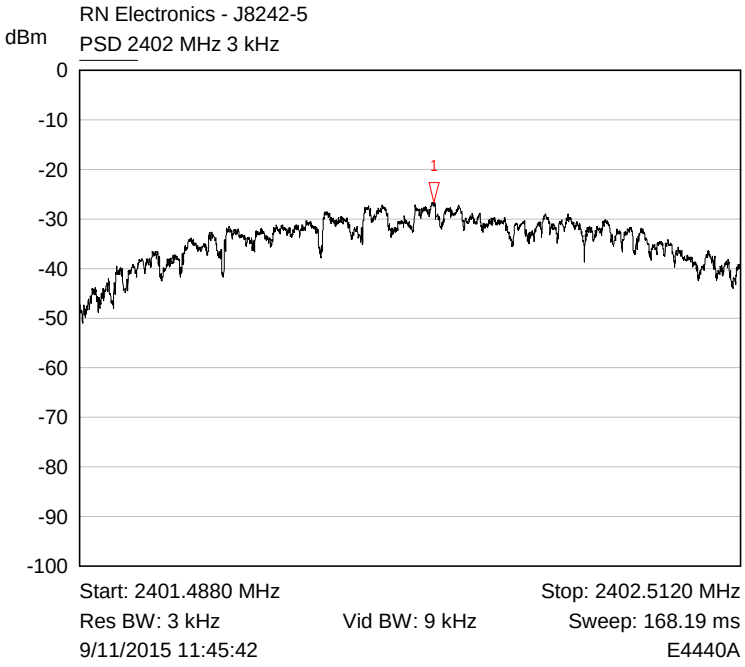
RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2480 MHz



Plot for 6dB Bandwidth (kHz)

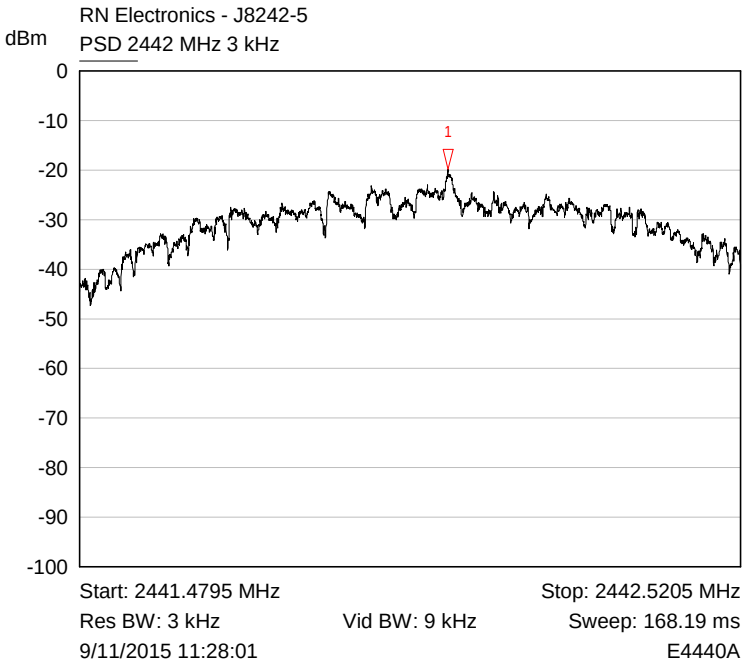
6.8 Maximum Power Spectral Density

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2402 MHz



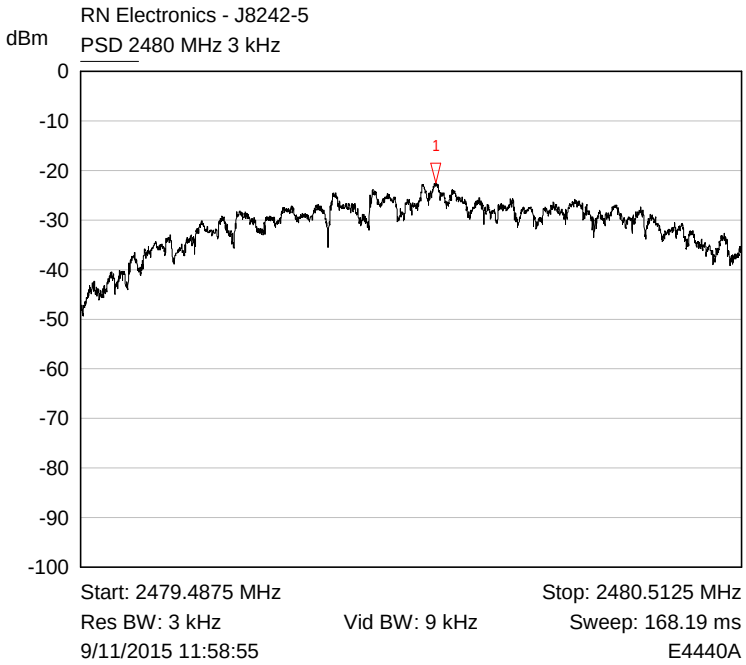
Mkr	Trace	X-Axis	Value	Notes
1 ▽	PSD 2402 MHz 3 kHz	2402.0375 MHz	-26.60 dBm	

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2442 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	PSD 2442 MHz 3 kHz	2442.0596 MHz	-19.80 dBm	

RF Parameters: Band 2400-2483.5 MHz, Power 1 mW, Channel Spacing 2 MHz, Modulation BLE Protocol, Channel 2480 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	PSD 2480 MHz 3 kHz	2480.0378 MHz	-22.50 dBm	

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/m)	Pk – Lim 1 (dB)	QP Amp (dBuV/m)	QP – Lim1 (dB)	Av Amp (dBuV/m)	Av – Lim1 (dB)
1	12345	54.9	-10.5	48	-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/m) 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/m) 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/m) 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).

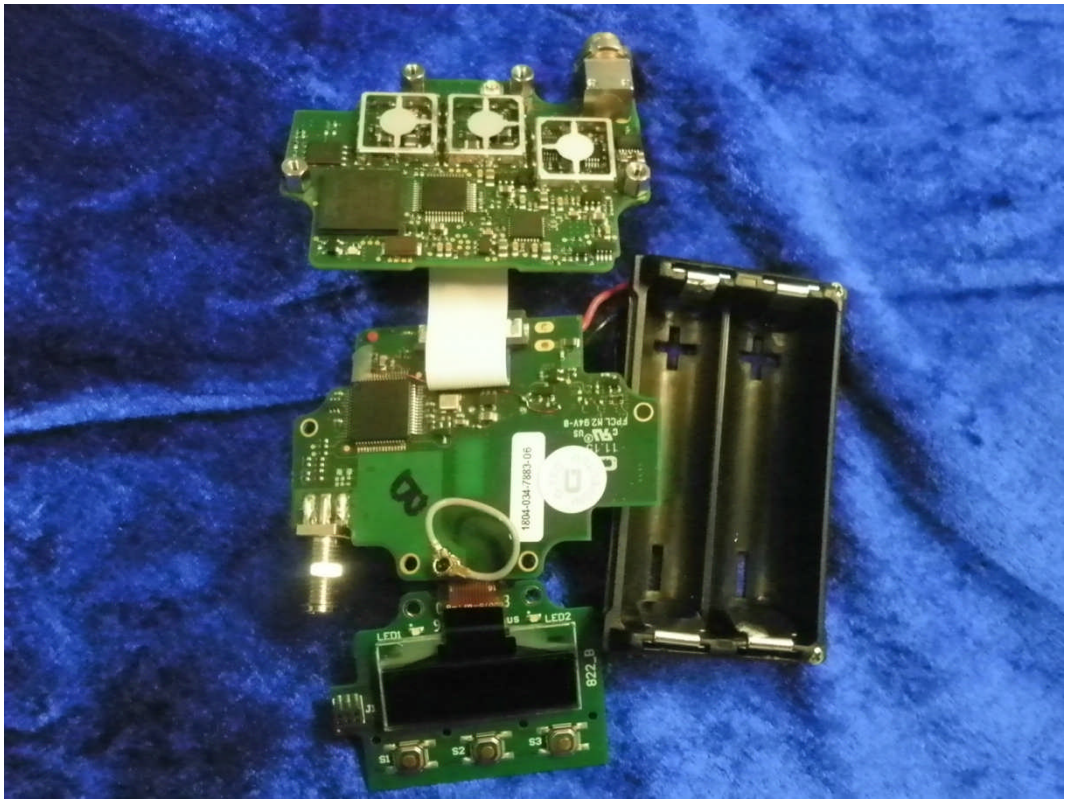
8 Photographs

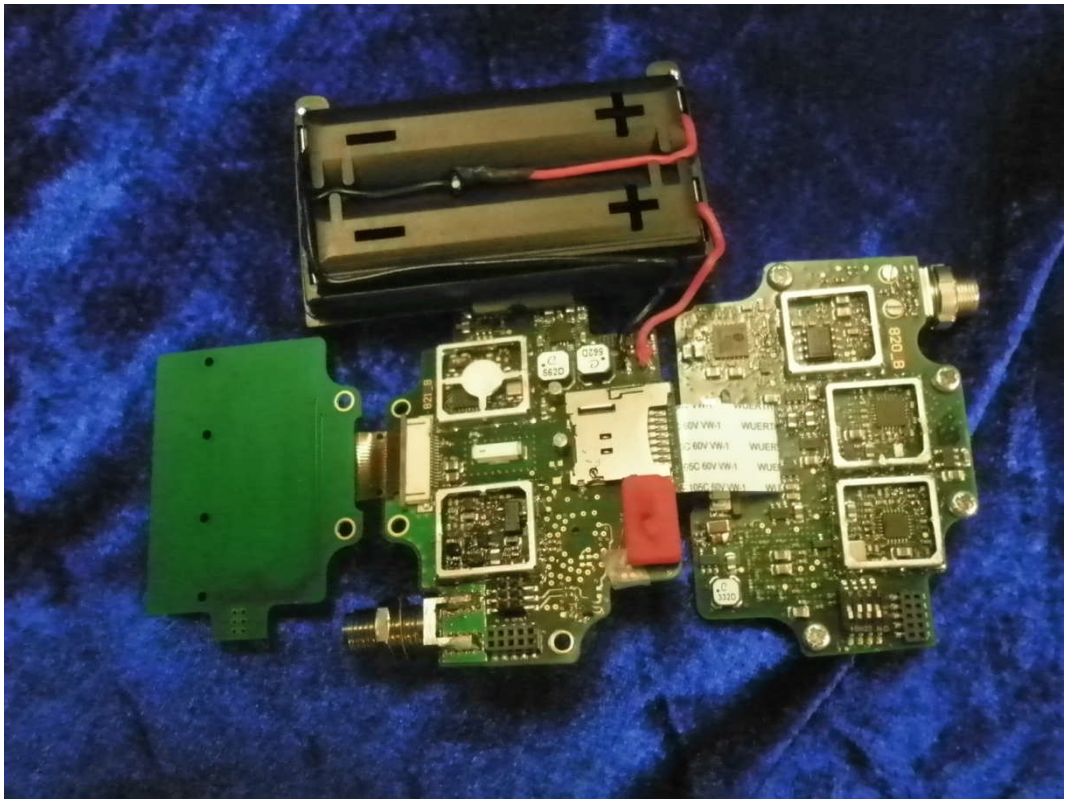
8.1 EUT Front View

8.2 EUT Reverse Angle

8.3 EUT Display & Controls

8.4 EUT Internal photos



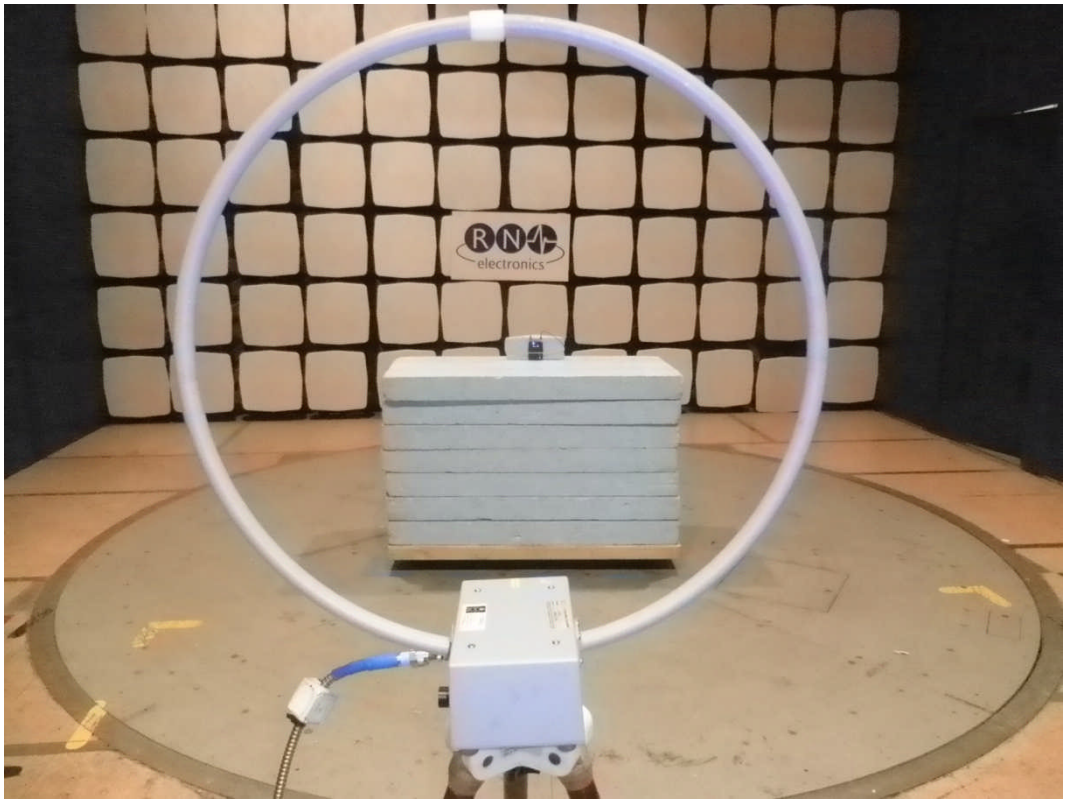


8.5 EUT ID Label

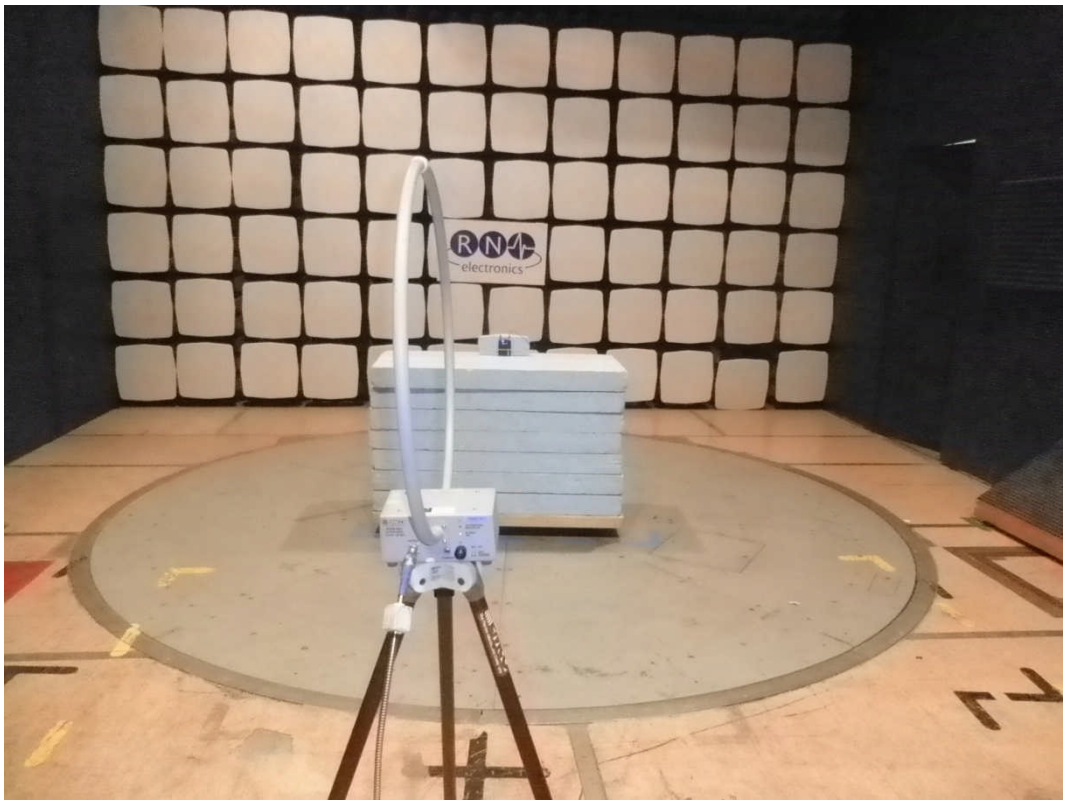
8.6 Radiated emissions 150 kHz – 30 MHz

Site OATS

Site OATS

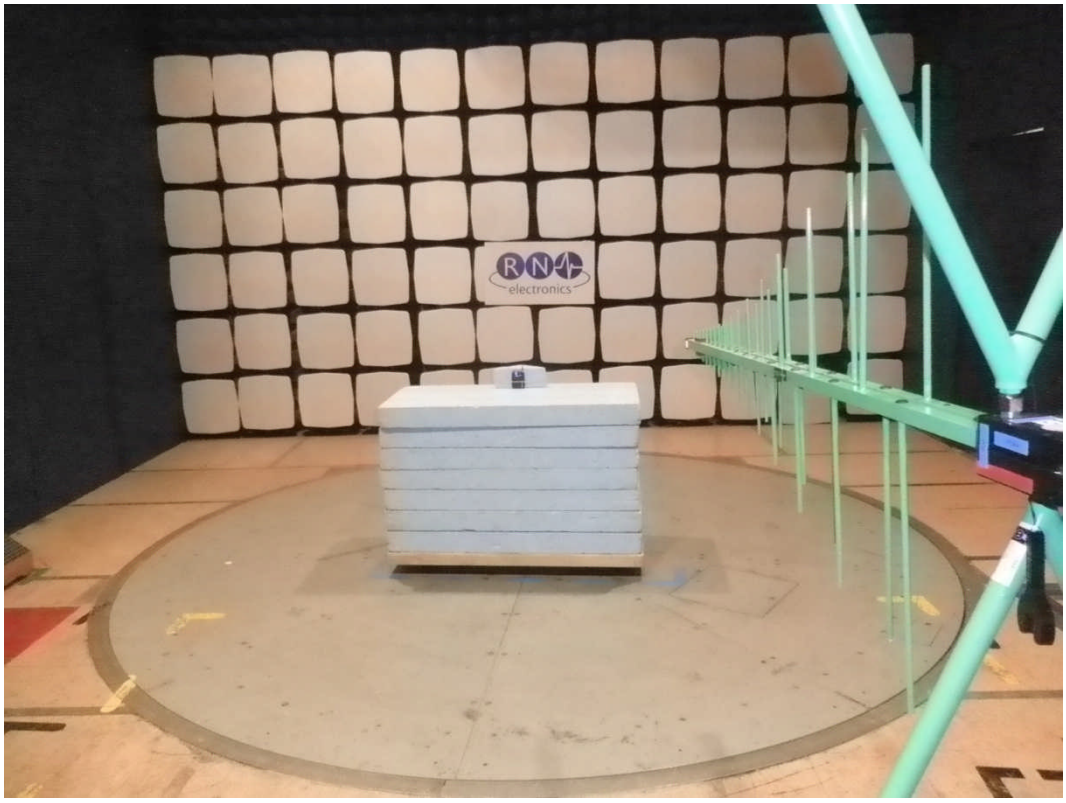


Site H

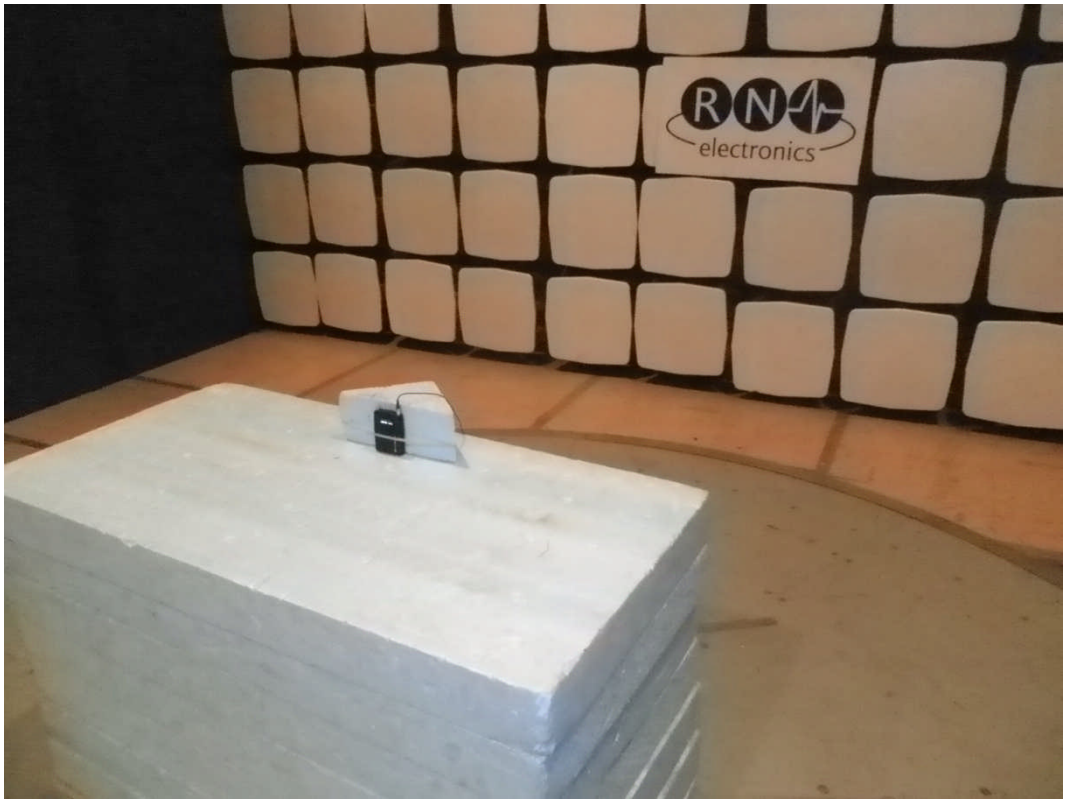


Site H

8.7 Radiated emissions 30 MHz -1 GHz

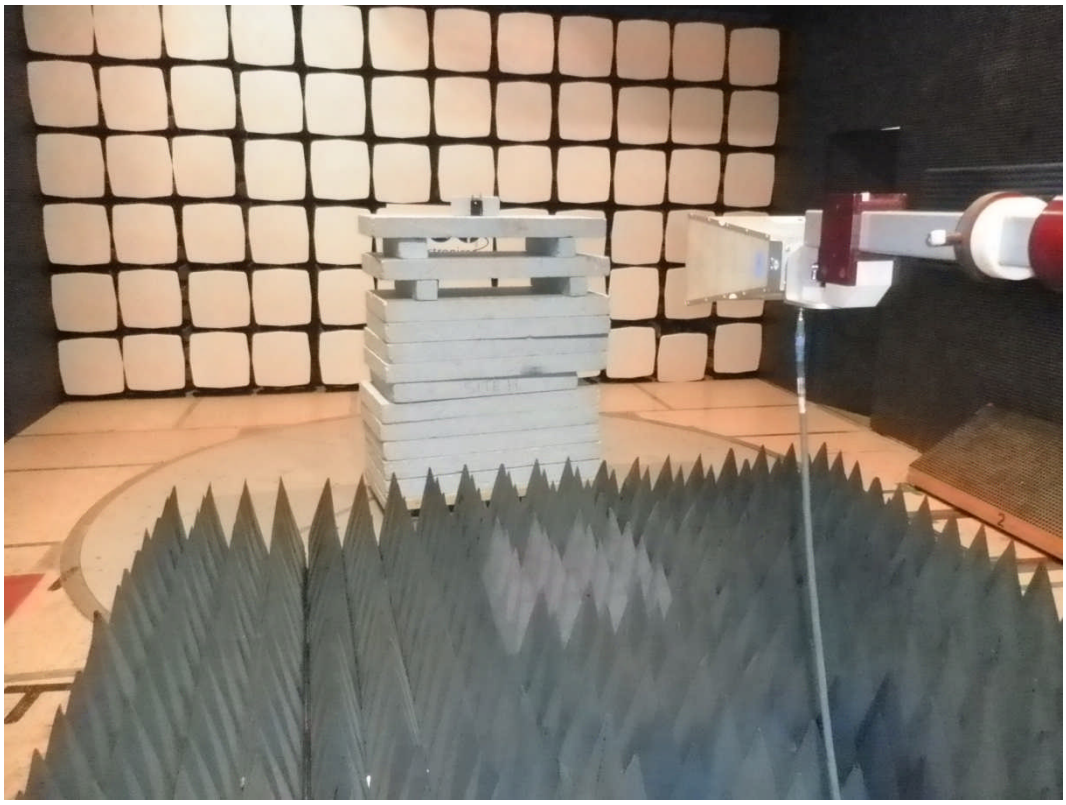


Site H

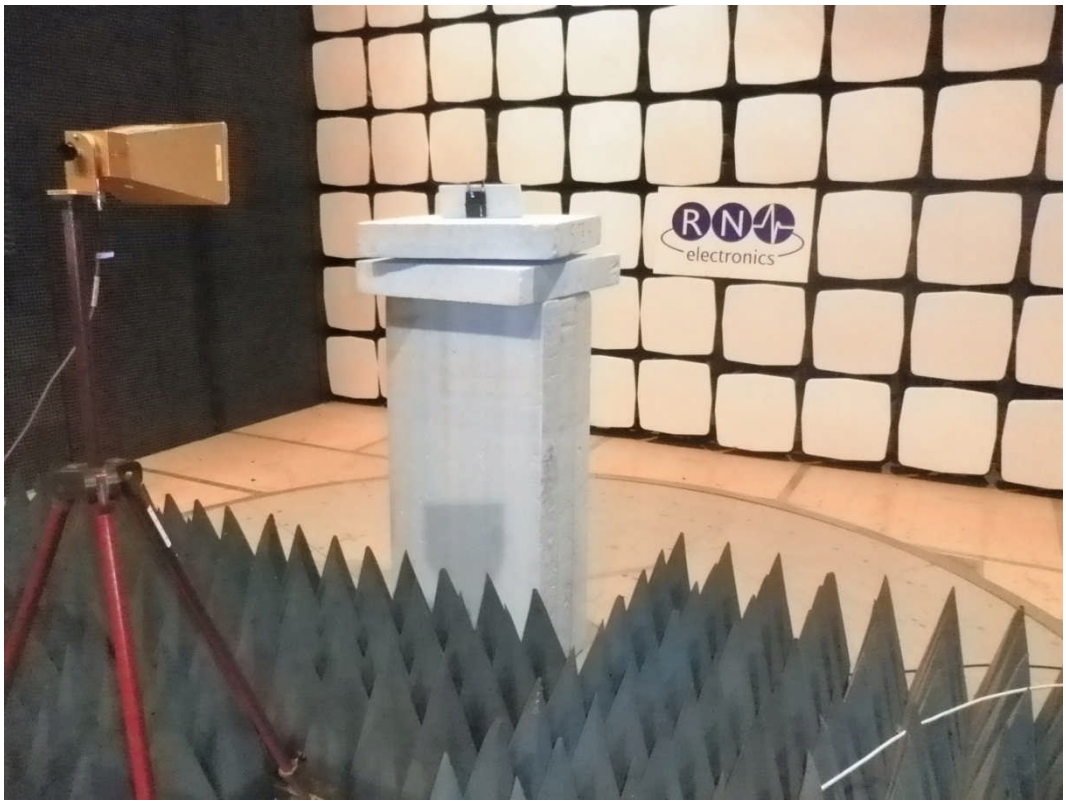


Site H

8.8 Radiated emissions above 1 GHz

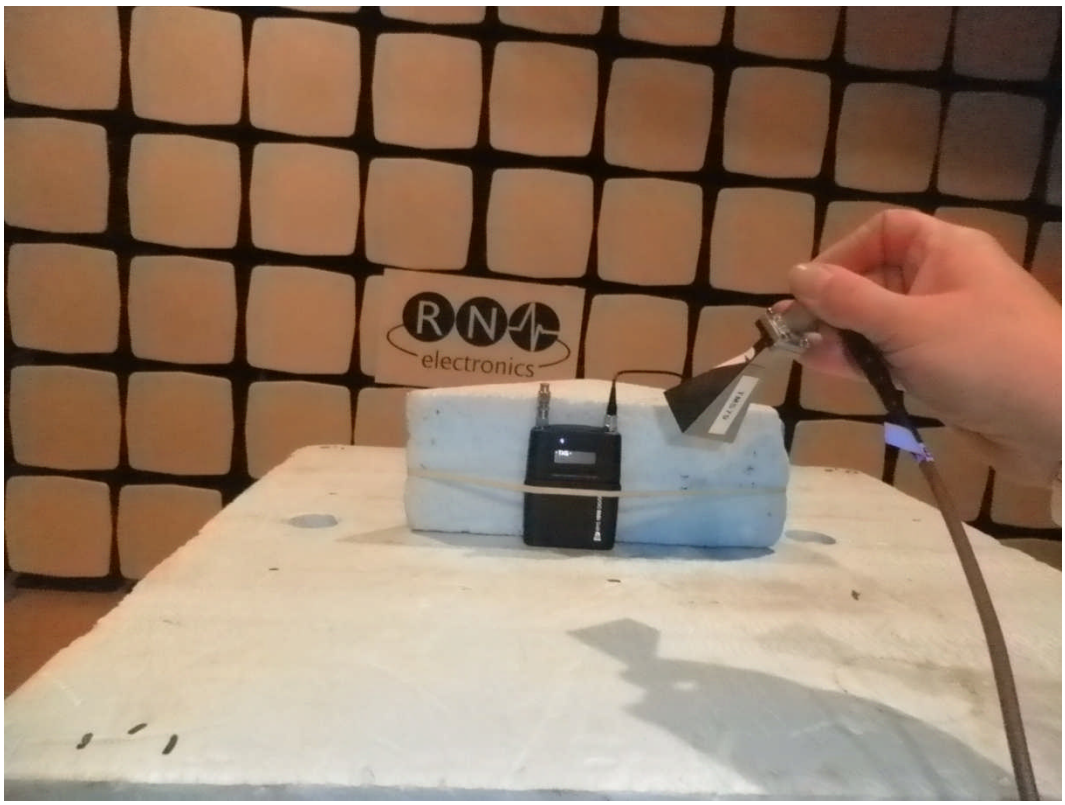


Site H



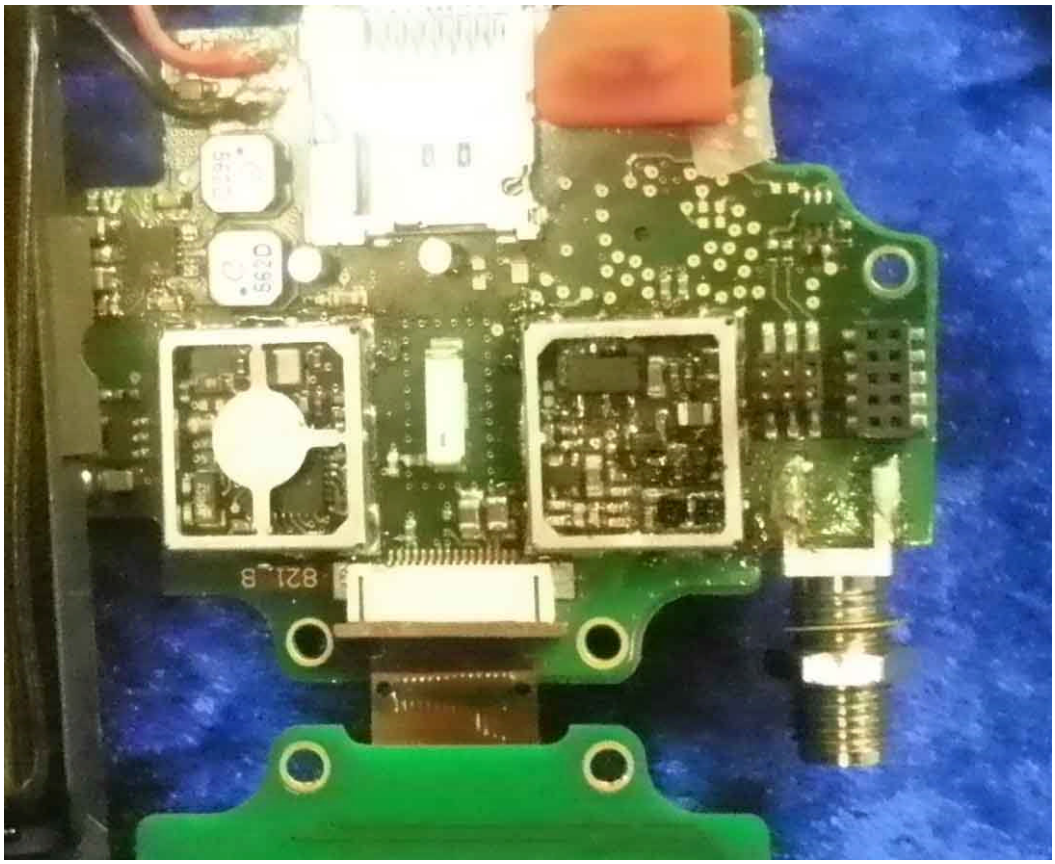
Site H

Site H



Site H

8.9 Antenna



8.10 Radiated emission diagram

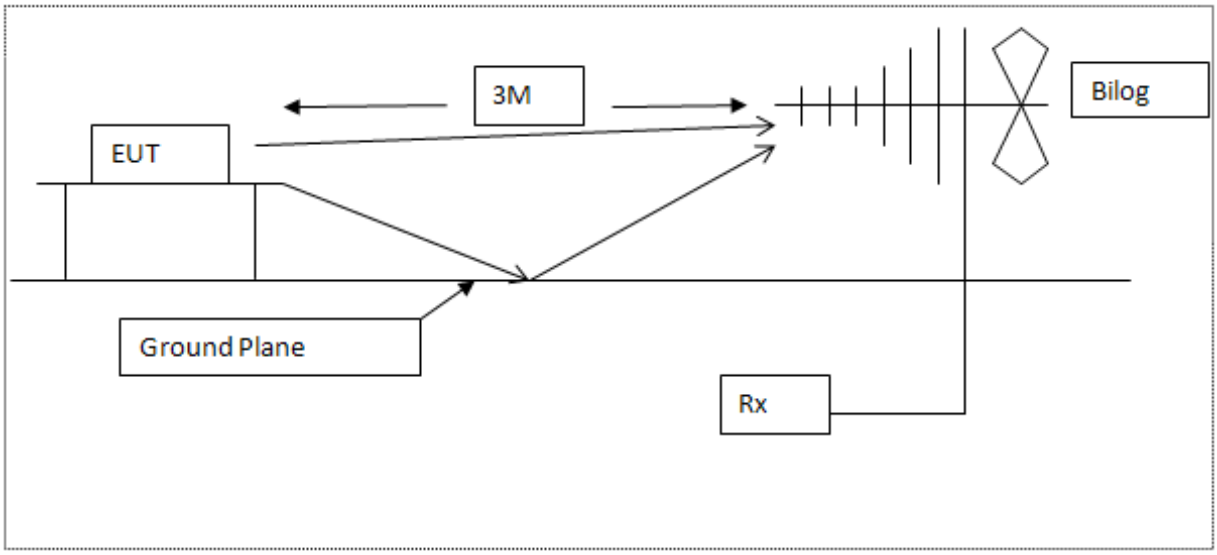


Diagram of the radiated emissions test setup 30 – 1000 MHz

9 Test equipment calibration list

The following is a list of the test equipment used by R.N. Electronics Ltd to test the unit detailed within this report. In line with our procedures, the equipment was within calibration for the period during which testing was carried out.

RN No.	Model No.	Description	Manufacturer	Calibration date	Cal period
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	08-Apr-2015	24 months
E533	N5182A	6 GHz MXG Signal Generator	Agilent Technologies	26-Feb-2013	36 months
E534	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	26-Feb-2015	24 months
E535	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	26-Jan-2015	12 months
E611	RPR3006W	USB RF power Sensor 10MHz - 6GHz	Dare Instruments	06-Mar-2015	12 months
LPE261	3115	1-18GHz Horn	EMCO	18-Feb-2014	24 months
LPE333	8449B	Pre-amplifier 1GHz - 26.5GHz	HP	29-Jan-2015	24 months
LPE364	CBL6112A	30MHz - 2GHz Bilog Antenna	Chase Electronics Ltd	02-Dec-2013	24 months
TMS45	Model1	Attenuator	Weinschel	07-Jul-2015	12 months
TMS78	3160-08	Std Gain Horn Antenna 12.4-18 GHz	ETS Systems	05-Jun-2015	12 months
TMS79	3160-09	Std Gain Horn Antenna 18-26.5 GHz	ETS Systems	05-Jun-2015	12 months
TMS81	6502	Active Loop Antenna	EMCO	27-Apr-2015	24 months
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	10-Dec-2014	12 months

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

No customer equipment was supplied.

10.2 RN Electronics supplied equipment

No RN Electronics Ltd supplied equipment was used.

11 Condition of the equipment tested

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

11.1 Modifications before test

No modifications were made before test by RN Electronics Ltd.

11.2 Modifications during test

No modifications were made during test by RN Electronics Ltd.

12 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 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

13 Abbreviations and units

%	Percent	LBT	Listen Before Talk
µA/m	microAmps per metre	LO	Local Oscillator
µV	microVolts	mA	milliAmps
µW	microWatts	max	maximum
AC	Alternating Current	kPa	Kilopascal
ALSE	Absorber Lined Screened Enclosure	Mbit/s	MegaBits per second
AM	Amplitude Modulation	MHz	MegaHertz
Amb	Ambient	mic	Microphone
ATPC	Automatic Transmit Power Control	min	minimum
BER	Bit Error Rate	mm	milliMetres
ºC	Degrees Celsius	ms	milliSeconds
C/I	Carrier / Interferer	mW	milliWatts
CEPT	European Conference of Postal and Telecommunications Administrations	NA	Not Applicable
COFDM	Coherent OFDM	nom	Nominal
CS	Channel Spacing	nW	nanoWatt
CW	Continuous Wave	OATS	Open Area Test Site
dB	deciBels	OFDM	Orthogonal Frequency Division Multiplexing
dBµA/m	deciBels relative to 1µA/m	ppm	Parts per million
dBµV	deciBels relative to 1µV	PRBS	Pseudo Random Bit Sequence
dBc	deciBels relative to Carrier	QAM	Quadrature Amplitude Modulation
dBm	deciBels relative to 1mW	QPSK	Quadrature Phase Shift Keying
DC	Direct Current	R&TTE	Radio and Telecommunication Terminal Equipment
DTA	Digital Transmission Analyser	Ref	Reference
EIRP	Equivalent Isotropic Radiated Power	RF	Radio Frequency
ERP	Effective Radiated Power	RFC	Remote Frequency Control
EU	European Union	RSL	Received Signal Level
EUT	Equipment Under Test	RTP	Room Temperature and Pressure
FM	Frequency Modulation	RTPC	Remote Transmit Power Control
FSK	Frequency Shift Keying	Rx	Receiver
g	Grams	s	Seconds
GHz	GigaHertz	SINAD	Signal to Noise And Distortion
Hz	Hertz	Tx	Transmitter
IF	Intermediate Frequency	V	Volts
kHz	kiloHertz		