Radio Test Report

Salunda Ltd

6870 GW Module

C6

47 CFR Part 15.247 Effective Date 1st October 2021
DTS: Digital Transmission System
Test Date: 6th March 2023 to 10th March 2023
Report Number: 03-13422-2-23 Issue 01

The testing was carried out by RN Electronics Ltd, an independent test house, at their test facility located at:

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This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF communiqué dated April 2017).

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

Certificate of Test 13422-2

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:	6870 GW Module
Model Number:	C6
Unique Serial Number:	1
Applicant:	Salunda Ltd Unit 6 Avonbury Business Park Bicester Oxon OX26 2UA
Proposed FCC ID	2ALTW18016870.
Full measurement results are detailed in Report Number:	03-13422-2-23 Issue 01
Test Standards:	47 CFR Part 15.247 Effective Date 1st October 2021 DTS: Digital Transmission System

NOTE:
Certain tests were not performed based upon applicant's declarations. Certain other requirements are subject to applicant's declaration only and have not been tested/verified. For details refer to section 3 of this report. This report pertains to 2.4 GHz ZigBee operation, for UWB operation please refer to RN report 03-13422-1-23.

DEVIATIONS: No deviations 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: 6th March 2023 to 10th March 2023

Test Engineer:
Chee-Wah Yeung

Chee-Wah Yeung
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Customer Representative:

1 Contents

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Salunda Ltd Unit 6 Avonbury Business Park Bicester Oxon OX26 2UA	
Manufacturer of EUT	Salunda Ltd	
Full Name of EUT	6870 GW Module	
Model Number of EUT	C6	
Serial Number of EUT	1	
Date Received	3rd March 2023	
Date of Test:	6th March 2023 to 10th March 2023	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	2nd May 2023	
Main Function	Provide UWB GW capability	
Information Specification	Height	10 mm
	Width	100 mm
	Depth	100 mm
	Weight	0.2 kg
	Voltage	32-50 V DC
	Current	0.05 A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Wall mounted
Choice of model(s) for type tests	C10
Antenna details	2 x Johanson 2450AT42E0100 PCB mount
Antenna port	N/A - Integral Antenna
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	6.5 GHz
Lowest Signal generated in EUT	12 MHz
Hardware Version (HVIN)	C
Software Version	Android App 1.8
Firmware Version (FVIN)	RF - 5.7, UWB 5.10
Type of Equipment	Multi-Radio
Technology Type	Zigbee
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	2405 - 2480 MHz
EUT Declared Modulation Parameters	O-QPSK
EUT Declared Power level	Not Specified
EUT Declared Signal Bandwidths	2 MHz
EUT Declared Channel Spacing's	5 MHz
EUT Declared Duty Cycle	10%
Unmodulated carrier available?	Yes
Declared frequency stability	Not Specified
RX Parameters	
Alignment range – receiver	2405 - 2480 MHz
EUT Declared RX Signal Bandwidth	500 MHz
Receiver Signal Level (RSL)	Not Specified
Method of Monitoring Receiver BER	Not Specified
FCC Parameters	
FCC Transmitter Class	DTS: Part 15 Digital Transmission System

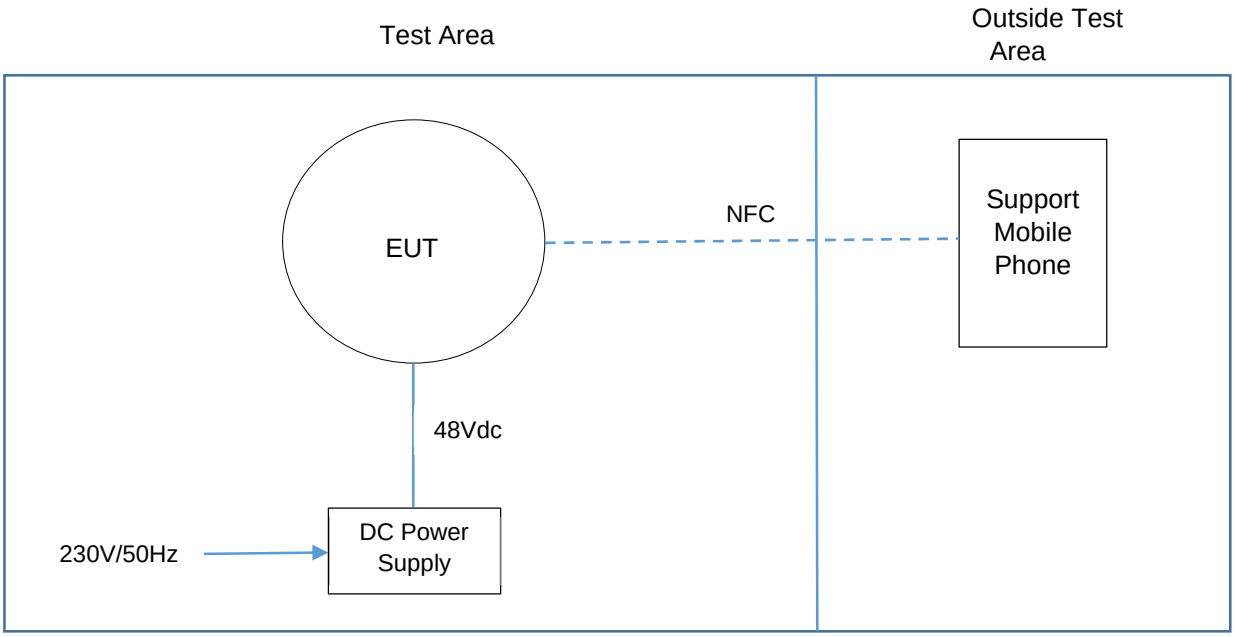
2.3 Functional description

Locates via UWB and sends location back to server, configuration over the 2.4GHz network, can also operate as gateway which responds to request to range. The 6870 GW Module also has NFC (13.56MHz) although the NFC tag is connected to the internal electronics of the EUT, it is a passive tag and does not generate its own electromagnetic field.

2.4 Modes of operation

Mode Reference	Description	Used for testing
Mode 1	Continuous Transmit, PRBS, Channel 11 (2405 MHz), Ant 0	Yes
Mode 2	Continuous Transmit, PRBS, Channel 11 (2405 MHz), Ant 1	Yes
Mode 3	Continuous Transmit, PRBS, Channel 18 (2440 MHz), Ant 0	Yes
Mode 4	Continuous Transmit, PRBS, Channel 18 (2440 MHz), Ant 1	Yes
Mode 5	Continuous Transmit, PRBS, Channel 26 (2480 MHz), Ant 0	Yes
Mode 6	Continuous Transmit, PRBS, Channel 26 (2480 MHz), Ant 1	Yes
Mode 7	Continuous Transmit, 'Send Message Often' mode, Channel 26 (2480 MHz), Ant 1	Yes
Mode 8	Continuous Transmit, 'Send Message Often' mode, Channel 11 (2405 MHz), Ant 1	Yes
Mode 9	Continuous Transmit, PRBS, Channel 11 (2405 MHz), Ant 1 + UWB (Power15.5, UWB Radio 0)	Yes
Mode 10	Continuous Transmit, PRBS, Channel 18 (2440 MHz), Ant 1 + UWB (Power15.5, UWB Radio 0)	Yes
Mode 11	Continuous Transmit, PRBS, Channel 26 (2480 MHz), Ant 1 + UWB (Power15.5, UWB Radio 0)	Yes
Mode 12	Transmitting continuously at 6489 MHz with system modulation. Tested in conjunction with the 2.4 GHz radio transmitting at 2440 MHz.	Yes

2.5 Emissions configuration



The unit was powered from a bench DC power supply. For conducted tests a separate sample was supplied with SMA connectors to Zigbee (2.4GHz) antenna ports 0 & 1. For AC conducted emissions the EUT was connected to a mains powered 48 VDC PSU provide by the applicant. The unit was configured using the support mobile phone, running Salunda NFC Lite engineering software, via NFC which allowed the following parameters to be set: various 2.4GHz modes, channel (11, 18 or 26), Power setting (0-13) and Antenna port (0 or 1). The EMC modes supplied were investigated and the 'PRBS' mode was found to be the worst case mode. The following Low, Mid & High channels were supplied for testing:

Low Channel 11 (2405 MHz) – level 13
Mid Channel 18 (2440 MHz) – level 13
High Channel 26 (2480 MHz) – level 9

The device also had two UWB transceivers in it. Only one could work at a time in conjunction with the ZigBee transmitter. Power settings for the UWB devices were set at Coarse 12.5 and Fine 3, during preliminary scans no discernible difference was noted in emissions between UWB devices in conjunction with the ZigBee channel transmissions. Therefore for full test UWB radio 0 was used. UWB test requirements are covered under RN Report 03-13422-1-23.

2.5.1 Signal leads

Port Name	Cable Type	Connected
PWR A	Unscreened, 4 core (Twisted pair), 2 core	2 cores

3 Summary of test results

The 6870 GW Module, C6 was tested for compliance to the following standard(s) :

47 CFR Part 15.247 Effective Date 1st October 2021
DTS: 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	47 CFR Part 15C Part 15.207	PASSED
2. Radiated emissions 9 - 150 kHz	47 CFR Part 15C Part 15.209	NOT APPLICABLE[5]
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15C Part 15.209	PASSED
4. Radiated emissions 30 MHz -1 GHz	47 CFR Part 15C Part 15.247(d) & 15.209	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Part 15.247(d) & 15.209	PASSED[6]
6. Effective radiated power field strength	47 CFR Part 15C Part 15.247(d)	PASSED
7. Band Edge Compliance	47 CFR Part 15C Part 15.215 & 15.247(d)	PASSED
8. Occupied bandwidth	47 CFR Part 15C Part 15.247(a)(2)/15.215	PASSED
9. Maximum Average conducted output power	47 CFR Part 15C Part 15.247(b3)	NOT APPLICABLE[1]
10. Maximum Peak conducted output power	47 CFR Part 15C Part 15.247(b)(3)	PASSED
11. Maximum Power Spectral Density	47 CFR Part 15C Part 15.247(e)	PASSED
12. Antenna power conducted emissions	47 CFR Part 15C Part 15.247(d)	NOT APPLICABLE[3]
13. Duty cycle	47 CFR Part 15C Part 15.35(c)	NOT APPLICABLE[4]
14. FHSS carrier frequency separation	47 CFR Part 15C Part 15.247(a1)	NOT APPLICABLE[2]
15. Average time of occupancy	47 CFR Part 15C Part 15.247(a)(1)(i)/(ii)/(iii)	NOT APPLICABLE[2]
16. Number of Hop Channels	47 CFR Part 15C Part 15.247(a)(1)(i)/(ii)/(iii)	NOT APPLICABLE[2]

[1] Peak Cond Power was carried out instead.

[2] EUT does not employ FHSS technology.

[3] Applies to EUT's with an antenna port. The EUT has an integral antenna only.

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

[5] Spectrum below 30MHz started at a frequency of 150 kHz up to a frequency of 30 MHz based on the lowest signal generated/used within the equipment as declared by the applicant of 12 MHz.

[6.] Spectrum investigated up to a frequency of 40GHz based on 10 times the highest channel/ signal generated in equipment of 6489 MHz associated with the UWB transmitter.

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	2021	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	KDB 558074 D01 v05r02	2019	Federal Communications Commission Office of Engineering and Technology Laboratory Division; GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

4.2 Deviations

No deviations were applied

4.3 EUT extremes of temperature & voltage

The following nominal and extremes EUT conditions were declared by the manufacturer.

Declared Temperature Conditions		Declared Voltage Conditions	
T nominal	20 °C	V nominal	48V DC
T minimum	-20 °C	V minimum	32V DC
T maximum	60°C	V maximum	50V DC

The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

4.4 Test fixtures

In order to measure RF parameters at temperature extremes, the EUT was tested in a temperature controlled chamber as follows:

A temporary RF port was created for conducted testing.

5 Tests, methods and results

5.1 AC power line conducted emissions

5.1.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 6.2 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.207 [Reference 4.1.1 of this report]

5.1.2 Configuration of EUT

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

Details of the Peripheral and Ancillary Equipment connected for this test are listed in section 10.

In a pre-test the EUT was configured to transmit on each transmitter in turn. It was found that there was no perceivable difference between the two radios and therefore for final test the EUT was assessed with Radio 0 transmitting.

For final test the EUT was operated in mode 12.

5.1.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment listed 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

E150, E035, ZSW1, E624, E411, E465

See Section 9 for more details

5.1.5 Test results

Temperature of test environment	15°C
Humidity of test environment	50%
Pressure of test environment	101 kPa

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Single channel	2440 MHz

Plot refs
13422-1 Cond 1 AC Live 150k-30M Average
13422-1 Cond 1 AC Live 150k-30M Quasi-Peak
13422-1 Cond 1 AC Neutral 150k-30M Average
13422-1 Cond 1 AC Neutral 150k-30M Quasi-Peak

Table of signals measured for Cond 1 AC Live 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.155	47.7	43.4	-22.3	25.2	-30.5
2	0.160	46.6	43.1	-22.4	25.9	-29.6
3	0.204	41.1	37.1	-26.3	20.9	-32.5
4	0.265	36.3	31.7	-29.6	18.8	-32.5
5	0.612	31.0	29.0	-27.0	24.6	-21.4
6	28.298	31.3	28.1	-31.9	21.6	-28.4

Table of signals measured for Cond 1 AC Neutral 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.180	44.0	40.2	-24.3	23.8	-30.7
2	0.203	41.9	37.8	-25.7	21.9	-31.6
3	0.362	37.5	34.4	-24.3	26.5	-22.2
4	0.612	31.1	29.2	-26.8	24.6	-21.4
5	1.654	26.0	23.2	-32.8	15.7	-30.3
6	1.835	31.9	29.8	-26.2	24.9	-21.1

Peak detector “Max held” Analyser plots against the Quasi-Peak / Average limit line(s) can be found in Section 6 of this report./ Only results within 20dB of limits have been reported.

LIMITS:
15.207: as given in the above tables / 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:
UE71 150kHz to 30MHz ±3.4dB

5.2 Radiated emissions 9 - 150 kHz

NOT APPLICABLE: Lowest declared frequency used was 12 MHz

5.3 Radiated emissions 150 kHz - 30 MHz

5.3.1 Test methods

Test Requirements: 47 CFR Part 15C Part 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 Part 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 whilst powered using a DC power supply.

The EUT was operated in Modes 9, 10 and 11.

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 any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was 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 M.

5.3.4 Test equipment

E411, E624, TMS81

See Section 9 for more details

5.3.5 Test results

Temperature of test environment 16°C
Humidity of test environment 49%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Low channel	2405 MHz (CH11)

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
No spurious emissions within 20 dB of limits				

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Mid channel	2440 MHz (CH18)

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
No spurious emissions within 20 dB of limits				

Plot refs
13422-2 Rad 1 150k-30MHz Para
13422-2 Rad 1 150k-30MHz Perp

Band	2400-2483.5 MHz
Power Level	9
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
High channel	2480 MHz (CH26)

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
No spurious emissions within 20 dB of limits				

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

Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report.

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 20/30dB from the level of the fundamental / 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 Part 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 Part 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 whilst powered using a DC power supply.

The EUT was operated in Modes 9, 10 and 11.

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 degrees 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 M.

5.4.4 Test equipment

E411, E624, E743, LPE364

See Section 9 for more details

5.4.5 Test results

Temperature of test environment 16°C
Humidity of test environment 49%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Low channel	2405 MHz (CH11)

Table of signals measured as Channel 18 (Mid Channel).

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Mid channel	2440 MHz (CH18)

Plot refs
13422-2 Rad 1 VHF Vert
13422-2 Rad 1 UHF Vert
13422-2 Rad 1 VHF Horiz
13422-2 Rad 1 UHF Horiz

Table of signals measured for Rad 1 Horizontal Sig List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	30.000	18.2	11.7	-28.3
2	124.269	25.9	20.0	-23.5
3	236.999	24.5	18.8	-27.2
4	265.800	27.4	21.3	-24.7
5	544.410	30.8	24.9	-21.1
6	950.350	36.1	29.1	-16.9

Table of signals measured for Rad 1 Vertical Sig List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	30.000	19.0	13.5	-26.5
2	72.390	29.7	27.4	-12.6
3	125.000	26.9	20.7	-22.8
4	174.990	23.4	18.8	-24.7
5	208.029	29.3	24.2	-19.3
6	208.029	29.6	24.6	-18.9
7	675.850	35.1	27.5	-18.5
8	912.148	35.6	29.8	-16.2

Band	2400-2483.5 MHz
Power Level	9
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
High channel	2480 MHz (CH26)

Table of signals measured as Channel 18 (Mid Channel)

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

No discernible difference was noted in emissions between channel settings (exploratory measurements), therefore final measurements are presented for TX mid channel mode only for these test ranges.

The worst case data rate was found to yield the highest emission amplitudes and has been used for final measurements.

Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid channel plots are shown in this report.

UWB transmitter was also on for these tests.

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 20/30dB from the level of the fundamental / 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 ±6.1dB

5.5 Radiated emissions above 1 GHz

5.5.1 Test methods

Test Requirements:	47 CFR Part 15C Part 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 Part 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 whilst powered using the manufacturer's power supply.

The UWB signal was turned on throughout testing, testing around the UWB signal range were repeated with the UWB signal turned off to ensure no other spurious emissions from the EUT or ZigBee signal were present in this range.

The EUT was operated in Modes 2, 4, 6, 9, 10 and 11.

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 degrees to record the worst case emissions. A measurement distance of 3m was used between the test range 1 - 6GHz, 1.2m was used in the test range 6 - 18GHz and 0.3m was used in the test range 18 - 40GHz.

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

Tests were performed using Test Site B.

5.5.4 Test equipment

E296-2, E330, E428, E429, E520, E642, E755, E856, E904, TMS78, TMS79

See Section 9 for more details

5.5.5 Test results

Temperature of test environment	16°C
Humidity of test environment	56%
Pressure of test environment	999kPa

Setup Table

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Low channel	2405 MHz (CH11)

Table of signals measured as Channel 18 (Mid Channel)

Setup Table

Band	2400-2483.5 MHz
Power Level	13
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Mid channel	2440 MHz (CH18)

Spurious Frequency (MHz)	Measured Peak Level (dBµV/m)	Difference to Peak Limit (dB)	Measured Average Level (dBµV/m)	Difference to Average Limit (dB)	EUT Polarisation	Antenna Polarisation
1437.64	41.87	-32.13	34.67	-19.33	Upright	Vertical
1562.6	37.9	-36.1	31.2	-22.8	Upright	Vertical
9975	47.47	-26.53	35.07	-18.93	Side	Vertical
10000	46.77	-27.23	34.47	-19.53	Upright	Horizontal
12398	51.7	-22.3	39.2	-14.8	Side	Vertical
12399.1	52.2	-21.8	39.2	-14.8	Upright	Horizontal

Plot refs
13422-2 Rad 1 1-2GHz Vert
13422-2 Rad 1 1-2GHz Horiz
13422-2 Rad 1 2-2.7GHz Vert
13422-2 Rad 1 2-2.7GHz Horiz
13422-2 Rad 1 2.7-5GHz Vert
13422-2 Rad 1 2.7-5GHz Horiz
13422-2 Rad 1 5-6GHz Vert
13422-2 Rad 1 5-6GHz Horiz
13422-2 Rad 1 6-7.77GHz Vert
13422-2 Rad 1 6-7.77GHz Horiz
13422-2 Rad 1 7.77-10GHz Vert
13422-2 Rad 1 7.77-10GHz Horiz
13422-2 Rad 1 10-12_4GHz Vert
13422-2 Rad 1 10-12_4GHz Horiz
13422-2 Rad 1 12-15GHz Vert
13422-2 Rad 1 12-15GHz Horiz
13422-2 Rad 1 15-18GHz Vert
13422-2 Rad 1 15-18GHz Horiz
13422-2 Rad 1 18-22GHz Vert
13422-2 Rad 1 18-22GHz Horiz
13422-2 Rad 1 22-25GHz Vert
13422-2 Rad 1 22-25GHz Horiz
13422-2 Rad 1 25-26.5GHz Vert
13422-2 Rad 1 25-26.5GHz Horiz
13422-2 Radiated Emissions 26.5 - 31.5 GHz Ant1 Horiz @0.3m
13422-2 Radiated Emissions 26.5 - 31.5 GHz Ant1 Vert @0.3m
13422-2 Radiated Emissions 31.5 - 35 GHz Ant1 Horiz @0.3m
13422-2 Radiated Emissions 31.5 - 35 GHz Ant1 Vert @0.3m
13422-2 Radiated Emissions 35 - 40 GHz Ant1 Horiz @0.3m
13422-2 Radiated Emissions 35 - 40 GHz Ant1 Vert @0.3m

Setup Table

Band	2400-2483.5 MHz
Power Level	9
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
High channel	2480 MHz (CH26)

Table of signals measured as Channel 18 (Mid Channel)

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

Note: Whilst Low, Mid and High channels were tested, plots are for illustrative purposes only and only Mid

channel plots are shown in this report. The worst case data rate was found to yield the highest emission amplitudes and has been used for final measurements.

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 20/30dB from the level of the fundamental / 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 – 26.5 GHz ±3.9dB, 26.5 – 40 GHz ±3.9dB.

5.6 Effective radiated power field strength

5.6.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.247(d) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.5/6.6 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 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 0.8//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 Modes 1, 2, 3, 4, 5 and 6.

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 B.

5.6.4 Test equipment

E428, E642, E856, E904

See Section 9 for more details

5.6.5 Test results

Temperature of test environment 16°C
Humidity of test environment 54%
Pressure of test environment 999kPa

Band	2400-2483.5 MHz
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4 250 kbps
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	95.47	97.38	96.26
Plot reference	13422-2 Radiated Power Low Ch (CH11 - 2405 MHz) Horizontal Ant 1 UPRIGHT	13422-2 Radiated Power Mid Ch (CH18 - 2440 MHz) Horizontal A1 UPRIGHT	13422-2 Radiated Power High Ch (CH26 - 2480 MHz) Horizontal A1 Power Setting_ 9 FLAT
Antenna Polarisation	Horiz	Horiz	Horiz
EUT Polarisation	Upright	Upright	Flat

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

LIMITS:

The maximum output power in all cases is 30dBm/ 1watt, where 30 dBm = 125.2 dBµV/m@3 m

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 Part 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 Part 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 Modes 1, 2, 3, 4, 5 and 6.

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 B.

5.7.4 Test equipment

E428, E642, E856, E904

See Section 9 for more details

5.7.5 Test results

Temperature of test environment 16°C
Humidity of test environment 56%
Pressure of test environment 999kPa

Band	2400-2483.5 MHz
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

Restricted Band Edges	Low channel	High channel
Restricted Peak Level measured (dBuV/m)	54.51	66.92
Restricted band edge Peak Plot	13422-2 Restricted BE Channel 11 Power Setting 13 Peak 'Send Message Often' Mode Peak	13422-2 Restricted BE Channel 26 Power Setting 9 Peak 'Send Message Often' Mode Peak
Restricted Average Level measured (dBuV/m)	29.84	50.47
Restricted band edge Average Plot	13422-2 Restricted BE Channel 11 Power Setting 13 Average 'Send Message Often' Mode	13422-2 Restricted BE Channel 26 Power Setting 9 Average 'Send Message Often' Mode

Authorised Band Edges	Low channel	High channel
Authorised Band Edge (dBc) value measured	-47.42	-51.00
Authorised Band Edge Plot	13422-2 Authorised Band Edge Zigbee Channel 11 (2405 MHz) Upright Position Vert Ant 1	13422-2 Authorised Band Edge Zigbee Channel 26 (2480 MHz) Flat Position Horiz Ant 1

Analyser plots for the Band Edge Compliance can be found in Section 6 of this report. These show the 20/30dBc 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 Part 15.247(a)(2) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 11.8 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.247(a)(2) [Reference 4.1.1 of this report]

5.8.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary RF port. The EUT was operated in Modes 1, 2, 3, 4, 5 and 6.

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 M.

5.8.4 Test equipment

E367, E411, E624

See Section 9 for more details

5.8.5 Test results

Temperature of test environment	19°C
Humidity of test environment	47%
Pressure of test environment	102kPa

Band	2400-2483.5 MHz (Antenna 0)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

	Low channel	Mid channel	High channel
6 dB Bandwidth Result (MHz)	1.62	1.604	1.63
Plot for 6 dB Bandwidth Result (MHz)	13422-2 6dB BW CH11 Ant 0	13422-2 6dB BW CH18 Ant 0	13422-2 6dB BW CH26 Ant 0
99 % Bandwidth Result (MHz)	2.37	2.34	2.35
Frequency Error (kHz) (include sign)	-10.247	1.56	-12.93
Operating frequency (MHz)	2405	2440	2480
6 dB FLOW Worst case (MHz)	2404.179753	2439.19956	2479.17207
6 dB FHIGH Worst case (MHz)	2405.799753	2440.80356	2480.80207

Band	2400-2483.5 MHz (Antenna 1)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

	Low channel	Mid channel	High channel
6 dB Bandwidth Result (MHz)	1.63	1.63	1.61
Plot for 6 dB Bandwidth Result (MHz)	13422-2 6dB BW CH11 Ant 1	13422-2 6dB BW CH18 Ant 1	13422-2 6dB BW CH26 Ant 1
99 % Bandwidth Result (MHz)	2.33	2.35	2.35
Frequency Error (kHz) (include sign)	-21.72	6.26	-15.59
Operating frequency (MHz)	2405	2440	2480
6 dB FLOW Worst case (MHz)	2404.16328	2439.19126	2479.17941
6 dB FHIGH Worst case (MHz)	2405.79328	2440.82126	2480.78941

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: Peak conducted power tested instead.

5.10 Maximum Peak conducted output power

5.10.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.247(b)(3) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 11.9 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.247(b)(3) [Reference 4.1.1 of this report]

5.10.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the temporary RF port.

The EUT was set to each mode and test signal in turn (see section 2.4) and highest power levels recorded.

The EUT was operated in Modes 1, 2, 3, 4, 5 and 6 for this test.

5.10.3 Test procedure

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

Peak stated reading is maximum power observed using a spectrum analyser RBW > 6dB BW of the EUT.

Measurements were made on a test bench in site M.

5.10.4 Test equipment

E367, E411, E624

See Section 9 for more details

5.10.5 Test results

Temperature of test environment 19°C
Humidity of test environment 47%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz (Antenna 0)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

Nominal voltage result (dBm)	9.97	9.93	3.70
Plot reference	13422-2 Max Pk Conducted O_P Power Channel 11 (2405 MHz) Ant 0	13422-2 Max Pk Conducted O_P Power Channel 18 (2440 MHz) Ant 0	13422-2 Max Pk Conducted O_P Power Channel 26 (2480 MHz) Ant 0
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	9.97	9.93	3.70
Margin to Limit (dB)	-20.03	-20.07	-26.30
Result in (W)	0.010	0.010	0.002

Band	2400-2483.5 MHz (Antenna 1)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

Nominal voltage result (dBm)	9.22	10.09	5.25
Plot reference	13422-2 Max Pk Conducted O_P Power Channel 11 (2405 MHz) Ant 1	13422-2 Max Pk Conducted O_P Power Channel 18 (2440 MHz) Ant 1	13422-2 Max Pk Conducted O_P Power Channel 26 (2480 MHz) Ant 1
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	9.22	10.09	5.25
Margin to Limit (dB)	-20.78	-19.91	-24.75
Result in (W)	0.008	0.010	0.003

LIMITS:
15.247(b)(3)
For systems using digital modulation in the 902-928, 2400-2483.5 or 5725-5850 MHz bands 1 Watt.

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 Part 15.247(e) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 11.10 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.247(e) [Reference 4.1.1 of this report]

5.11.2 Configuration of EUT

The EUT was configured as for the peak conducted test. The EUT was operated in Modes 1, 2, 3, 4, 5 and 6 for this test.

5.11.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. Measurements & plots were taken with the span set to 1.5 times the measured DTS bandwidth for each modulation scheme setting.

Tests were performed using Test Site M.

5.11.4 Test equipment

E367, E411, E624

See Section 9 for more details

5.11.5 Test results

Temperature of test environment 19°C
Humidity of test environment 47%
Pressure of test environment 102kPa

Band	2400-2483.5 MHz (Antenna 0)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

	Low channel	Mid channel	High channel
Antenna Gain (dBi)	-1	-1	-1
Duty Cycle (%)	100	100	100
PSD (dBm/3 kHz)	-5.73	-5.81	-11.8
Plot reference	13422-2 Max PSD Channel 11 (2405 MHz) Ant 0	13422-2 Max PSD Channel 18 (2440 MHz) Ant 0	13422-2 Max PSD Channel 26 (2480 MHz) Ant 0

Band	2400-2483.5 MHz (Antenna 1)
Power Level	13 for Low and Mid, 9 for High
Channel Spacing	5 MHz
Mod Scheme	802.15.4
Low channel	2405 MHz (CH11)
Mid channel	2440 MHz (CH18)
High channel	2480 MHz (CH26)

	Low channel	Mid channel	High channel
Antenna Gain (dBi)	-1	-1	-1
Duty Cycle (%)	100	100	100
PSD (dBm/3 kHz)	-6.64	-5.63	-10.33

Plot reference	13422-2 Max PSD Channel 11 (2405 MHz) Ant 1	13422-2 Max PSD Channel 18 (2440 MHz) Ant 1	13422-2 Max PSD Channel 26 (2480 MHz) Ant 1

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 EUT has an integral antenna only / The EUT was tested for radiated emissions with its dedicated antenna in position.

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 at 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

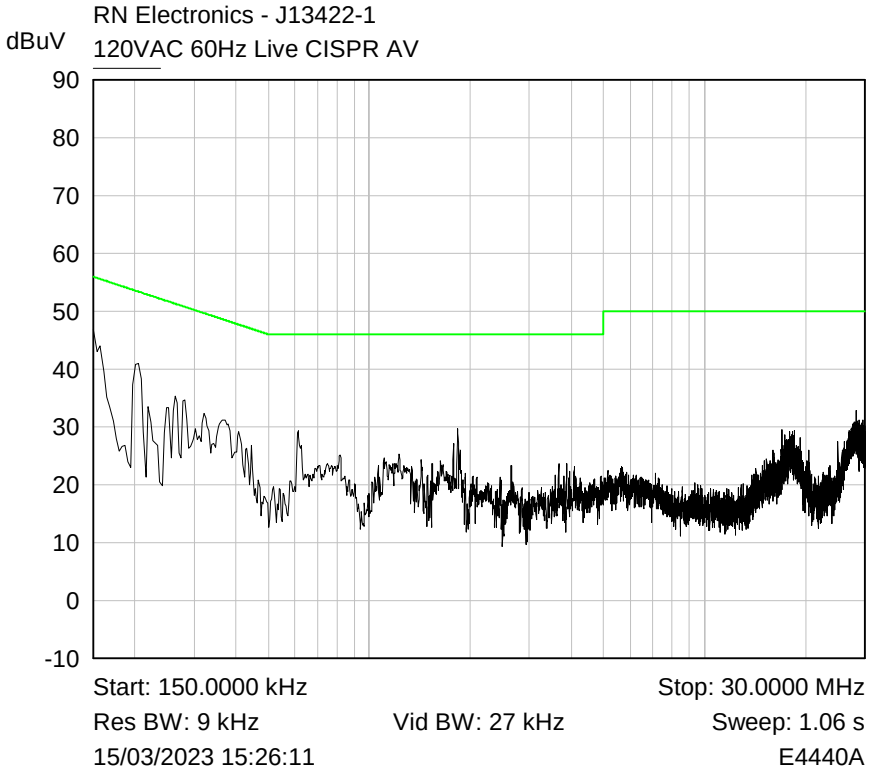
5.16 Number of Hop Channels

NOT APPLICABLE: EUT does not employ FHSS technology

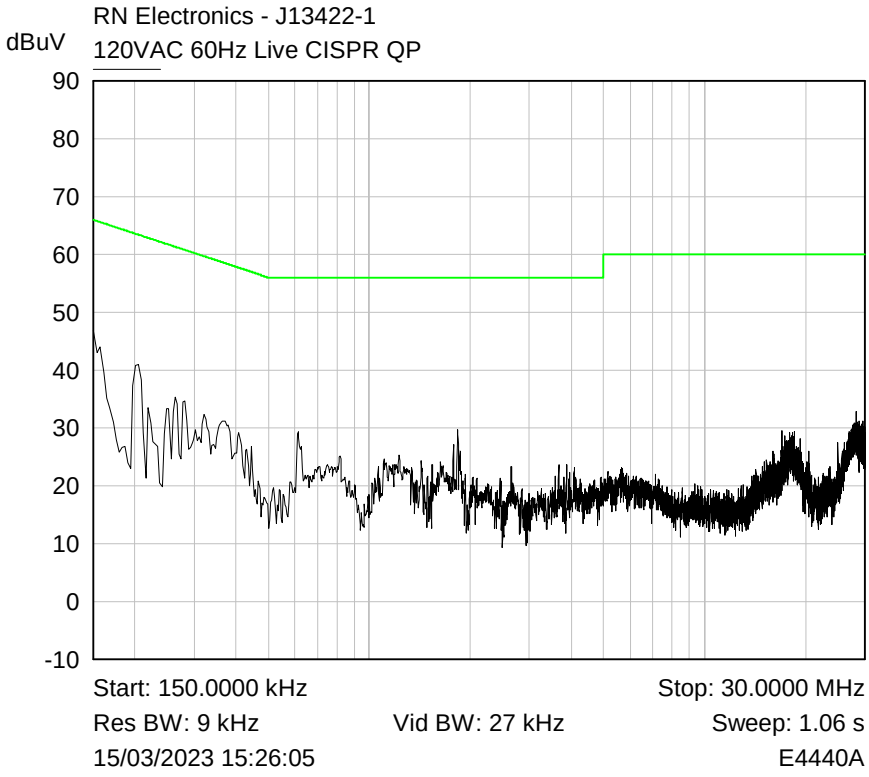
6 Plots/Graphic

6.1 AC power line conducted emissions

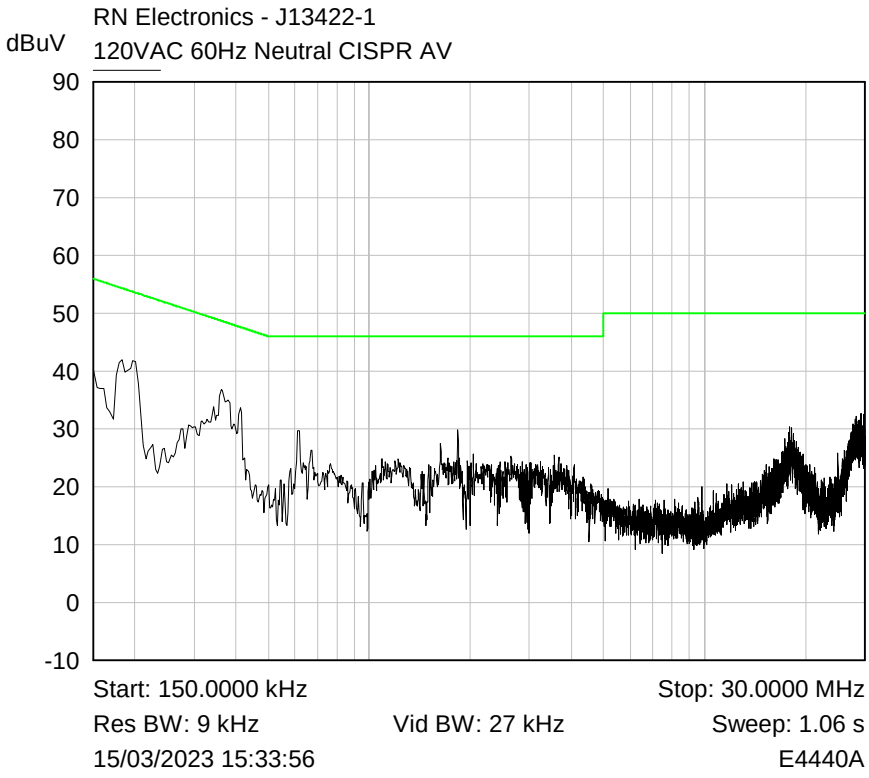
RF Parameters: Band 2400-2483.5 MHz, Power 13 dBm, Channel Spacing 5MHz Single Channel, Modulation 802.15.4 250 kbps, Channel 2440 MHz



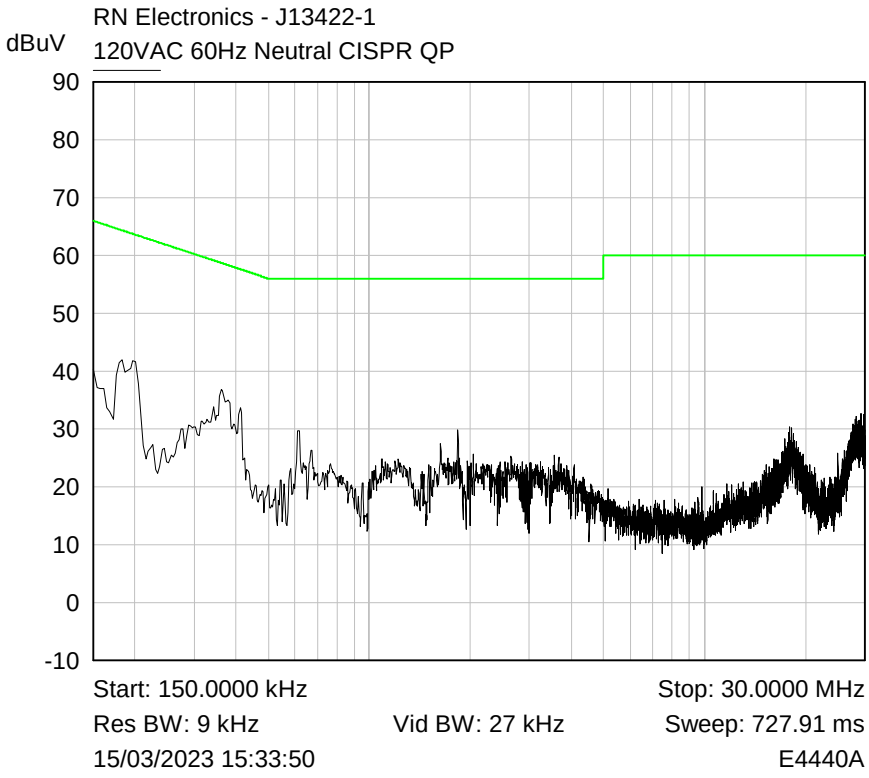
Plot of Live150k-30M Average



Plot of Live150k-30M Quasi-Peak



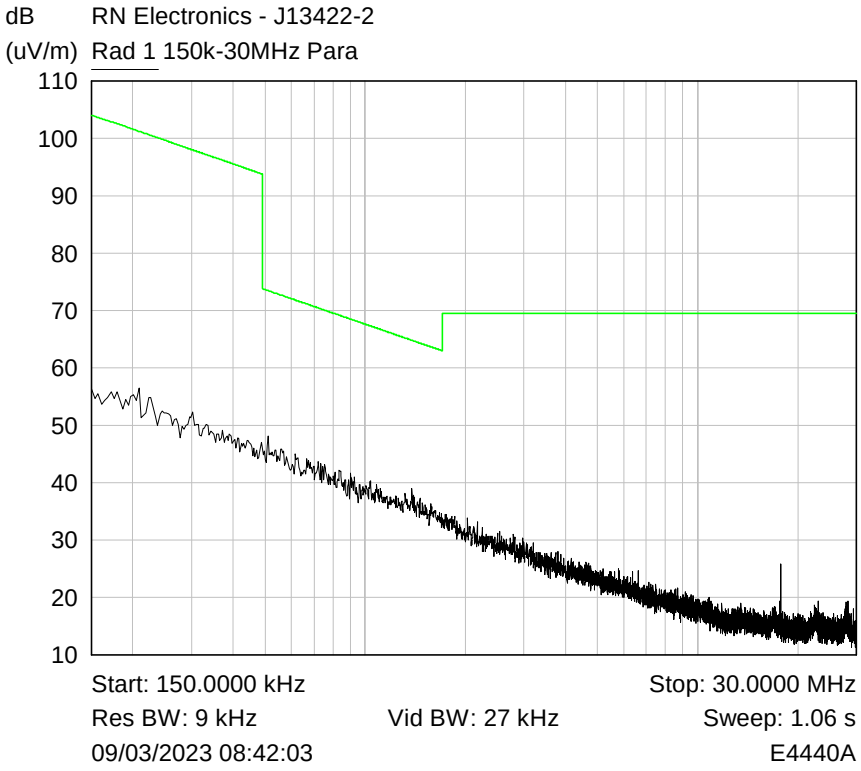
Plot of Neutral150k-30M Average



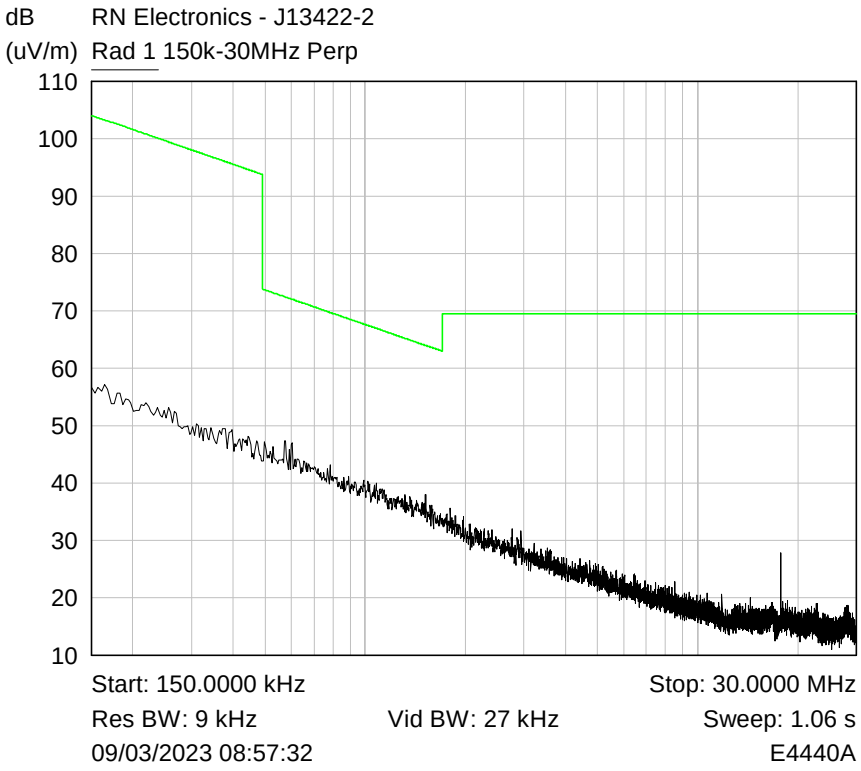
Plot of Neutral150k-30M Quasi-Peak

6.2 Radiated emissions 150 kHz – 30 MHz

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2405 MHz (CH11)



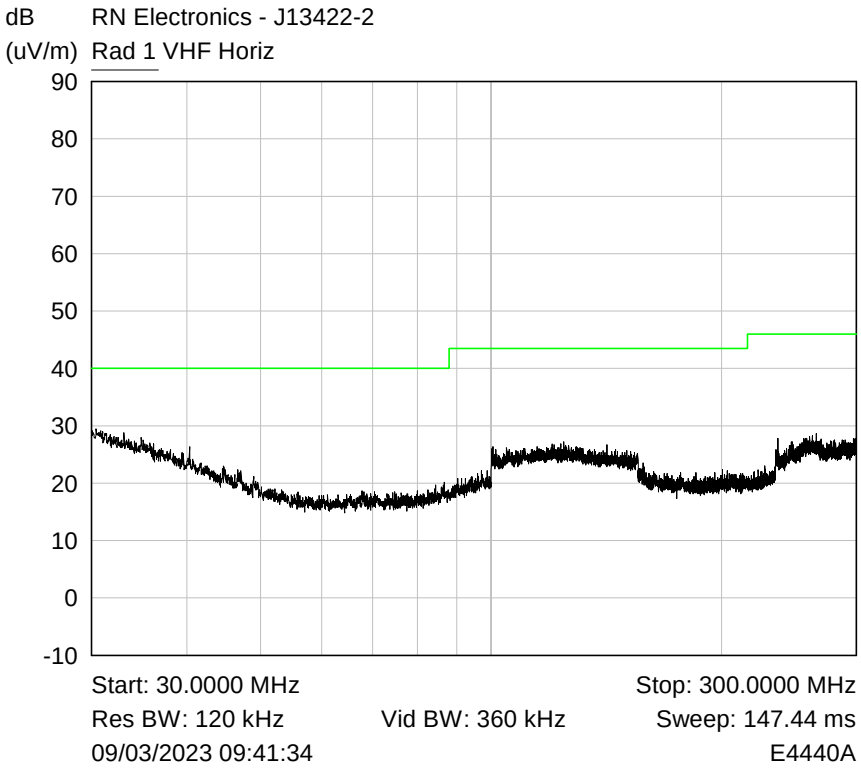
Plot of 150kHz-30MHz Parallel



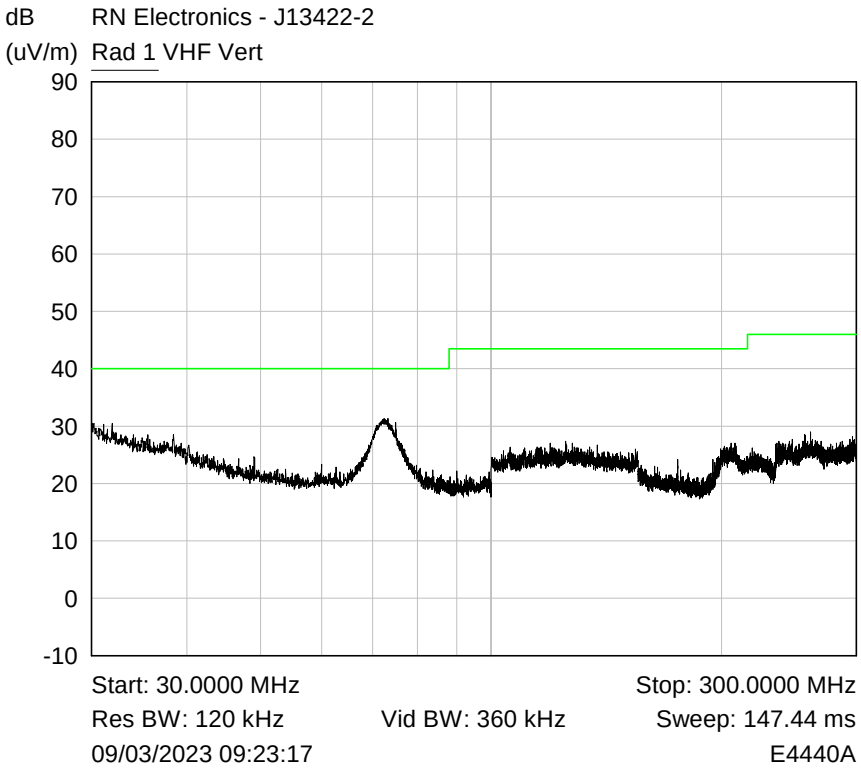
Plot of 150kHz-30MHz Perpendicular

6.3 Radiated emissions 30 MHz -1 GHz

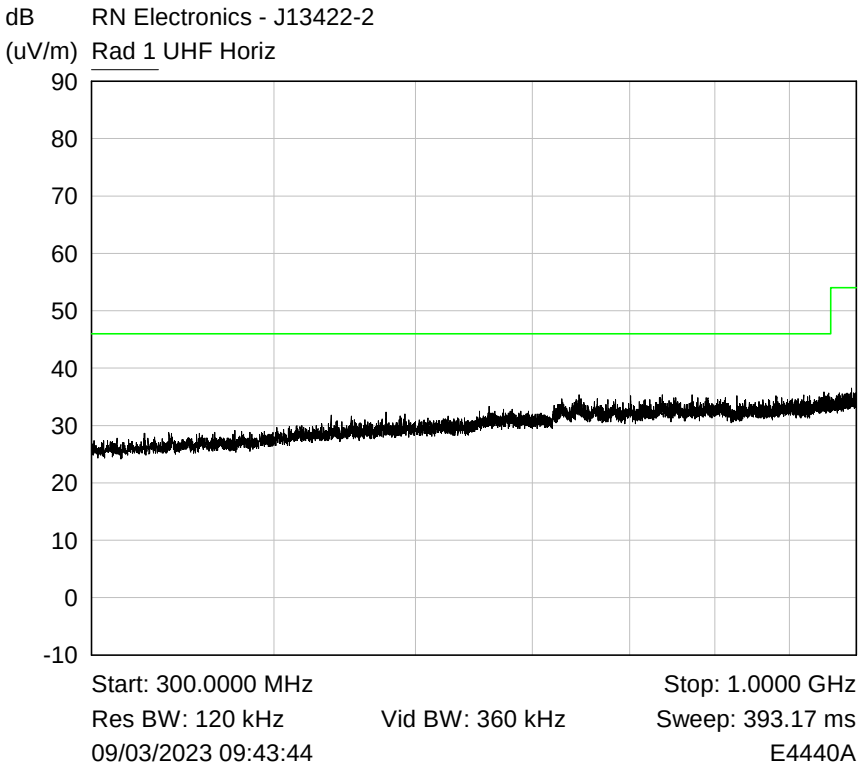
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2405 MHz (CH11)



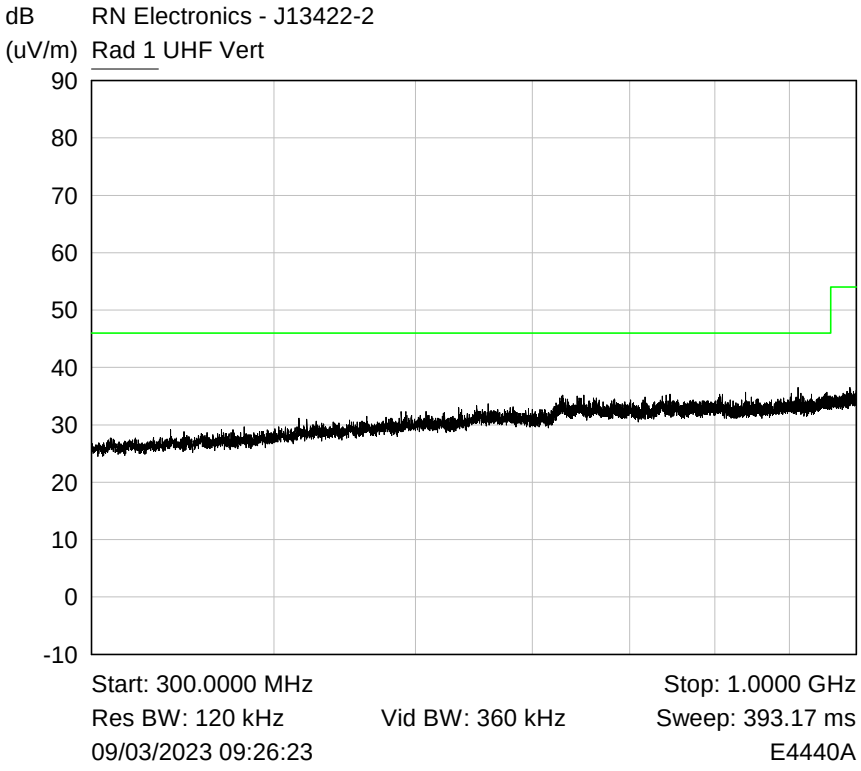
Plot of Peak emissions for VHF Horizontal against the QP limit line.



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



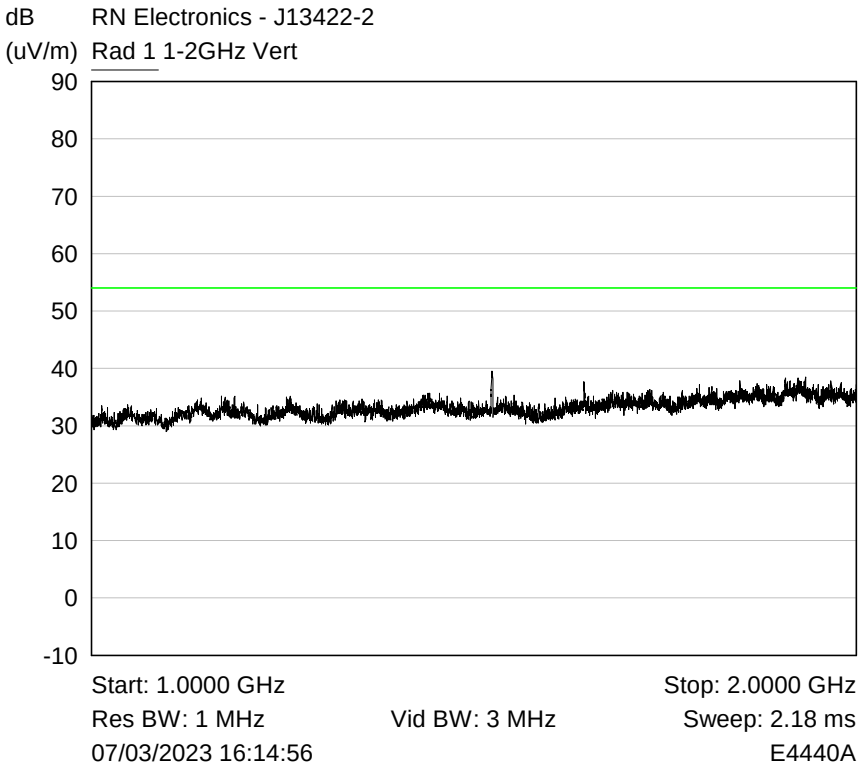
Plot of Peak emissions for UHF Horizontal against the QP limit line.

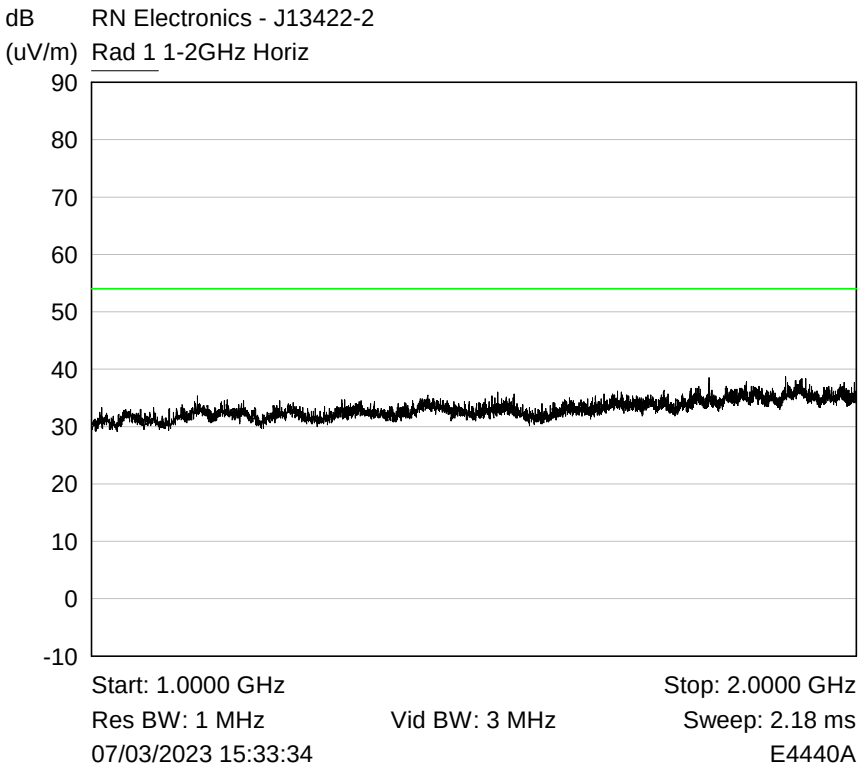


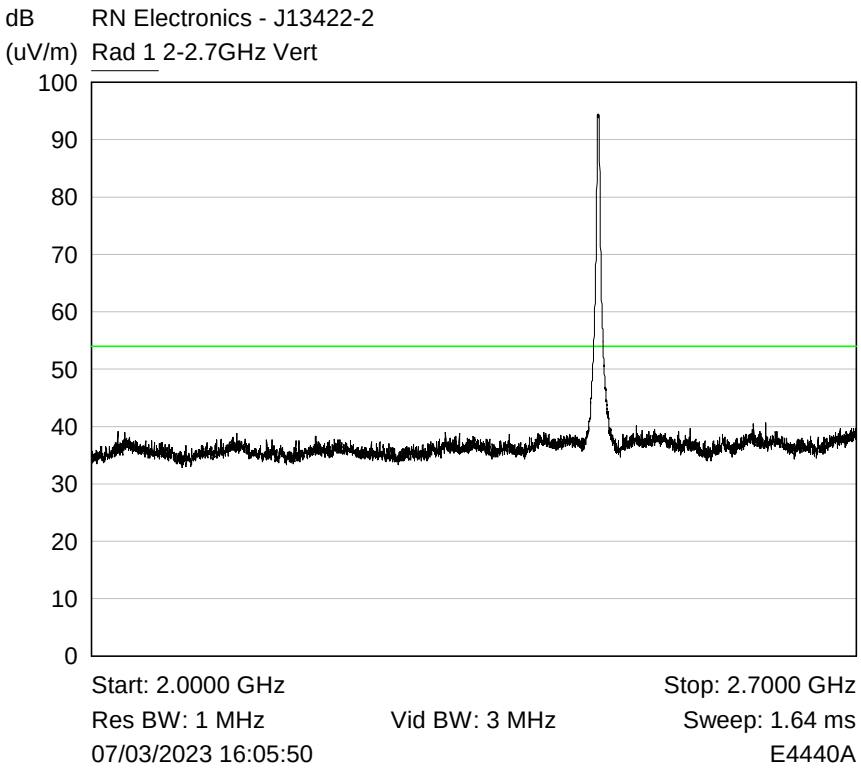
Plot of Peak emissions for UHF Vertical against the QP limit line.

6.4 Radiated emissions above 1 GHz

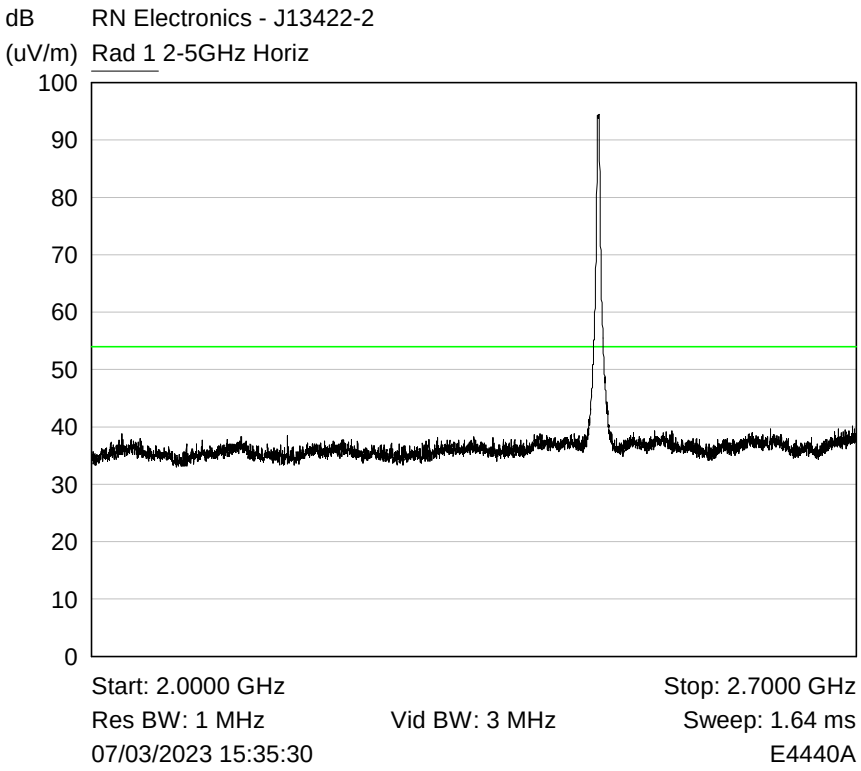
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2440 MHz (CH18)



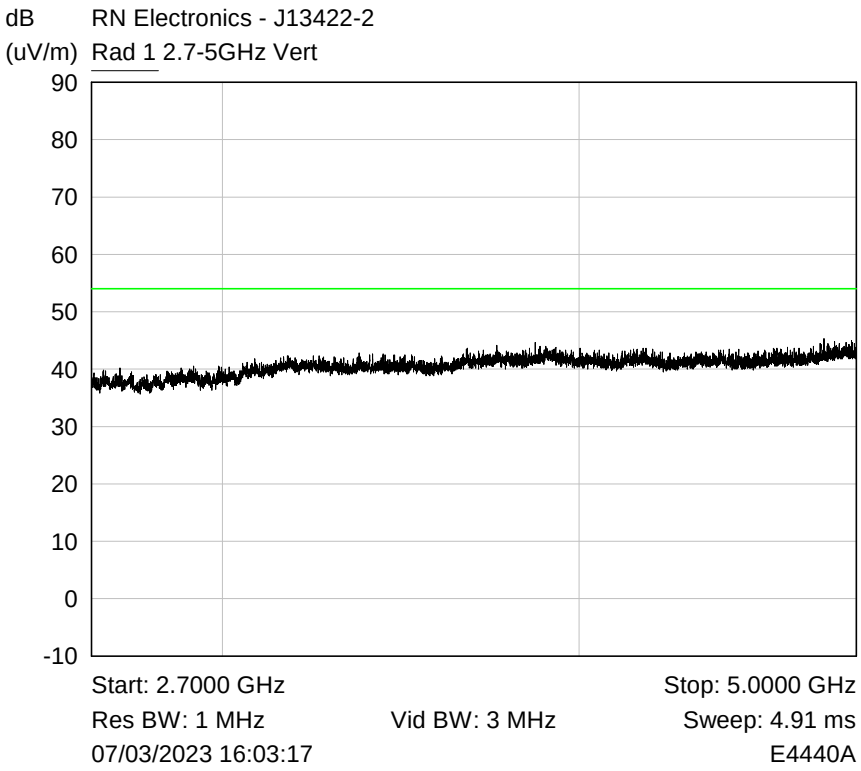


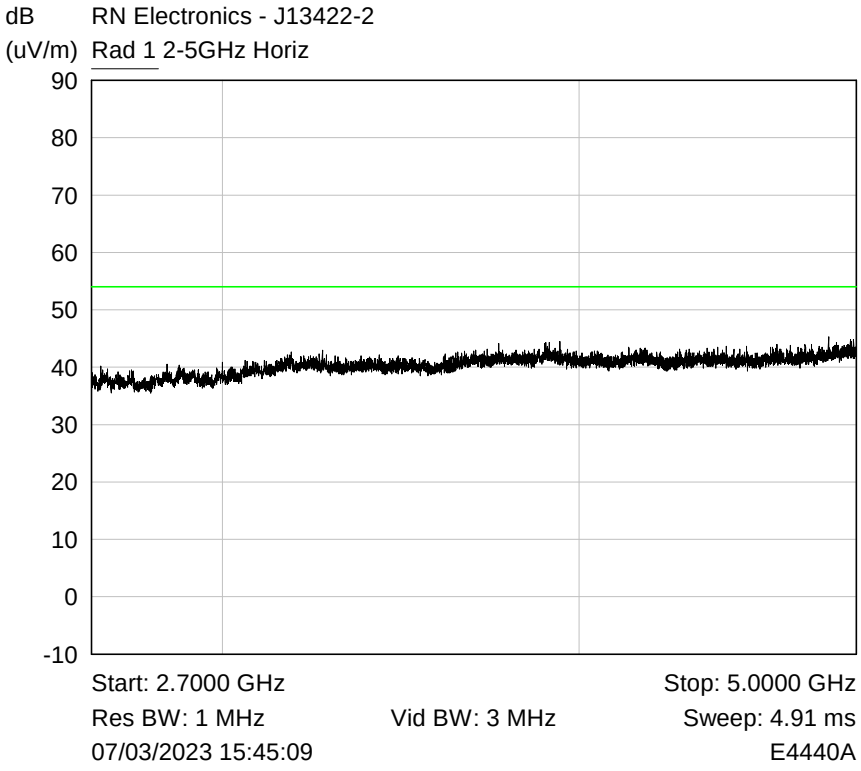


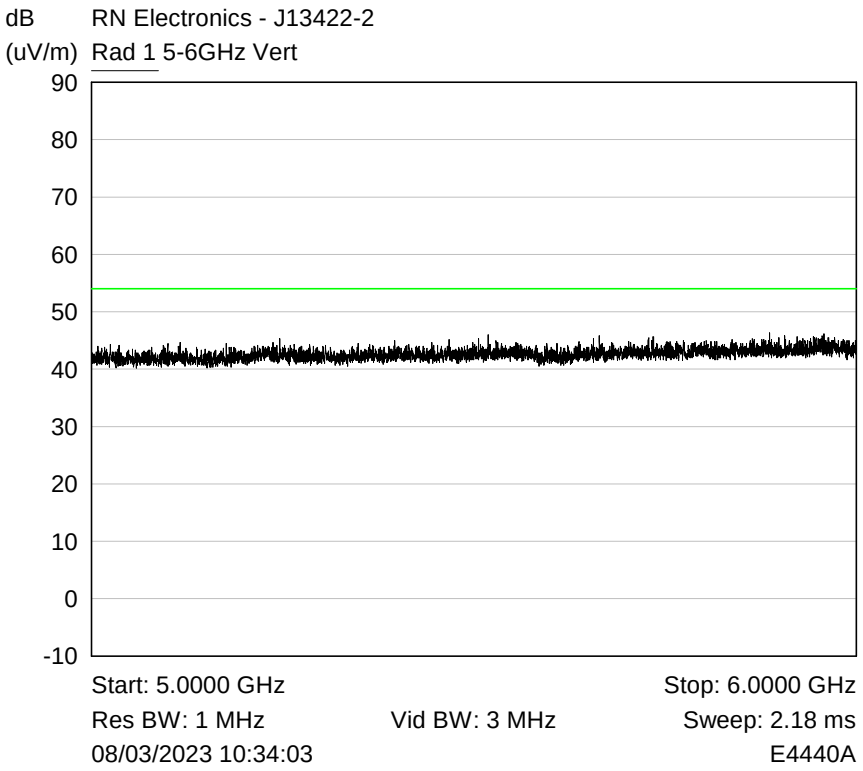
Note: fundamental shown on plot.



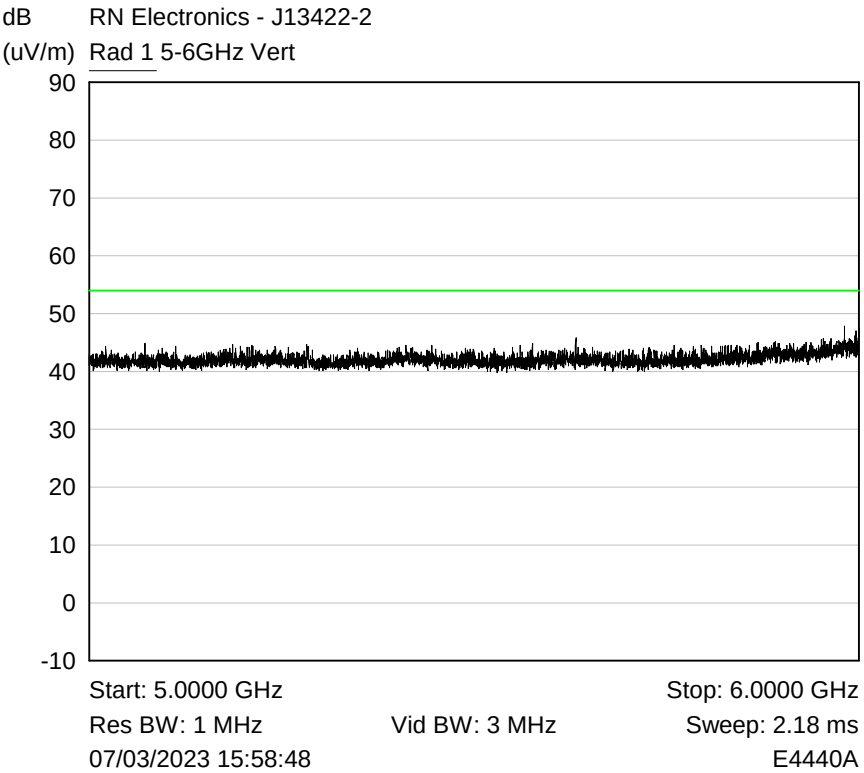
Note: fundamental shown on plot.



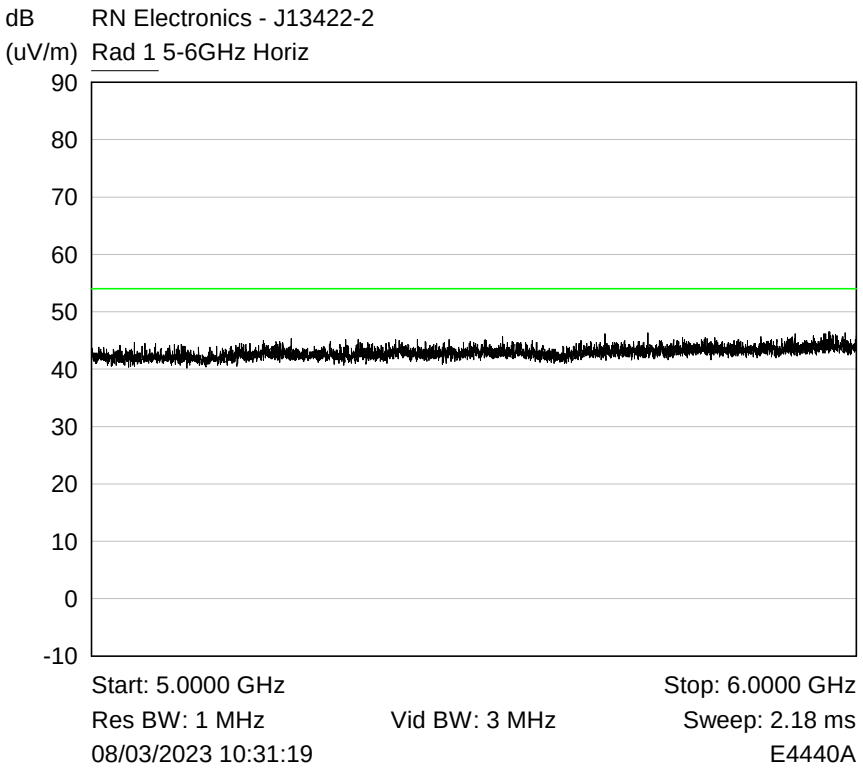




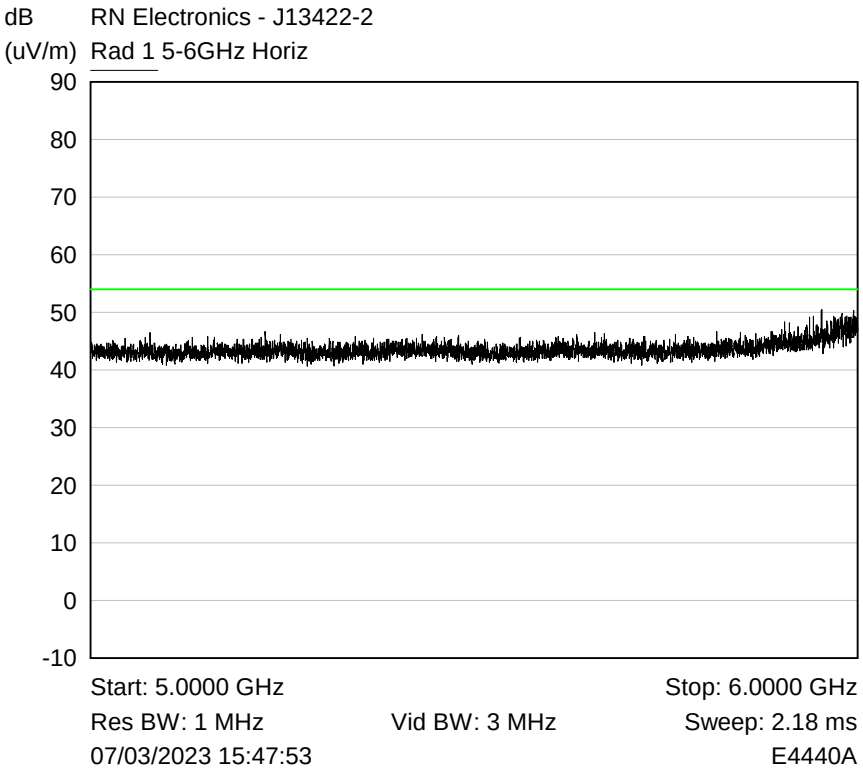
ZigBee turned On / UWB turned Off



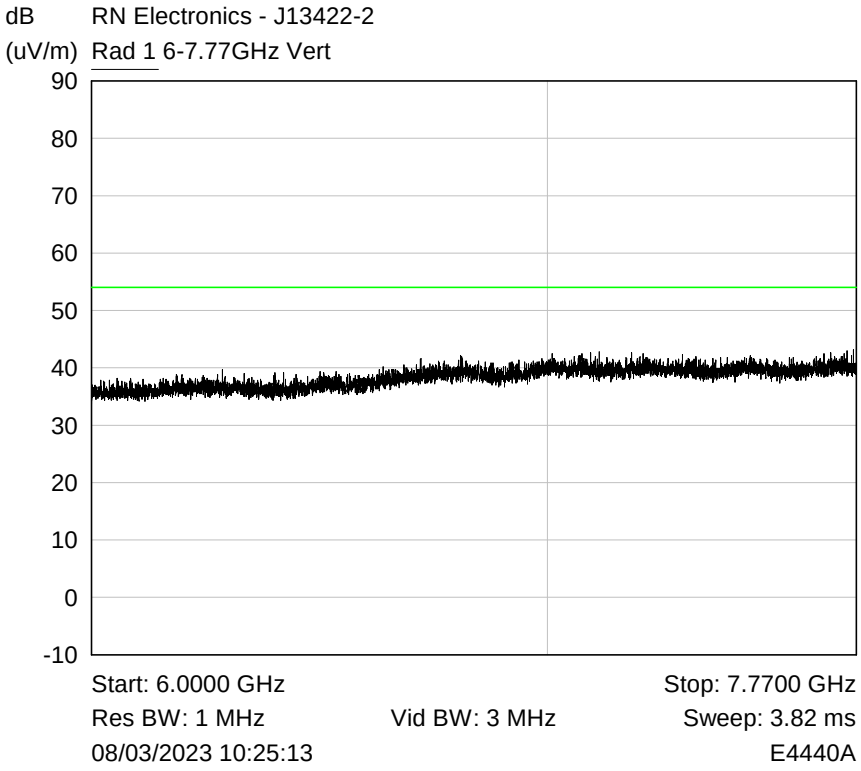
ZigBee turned On / UWB turned On



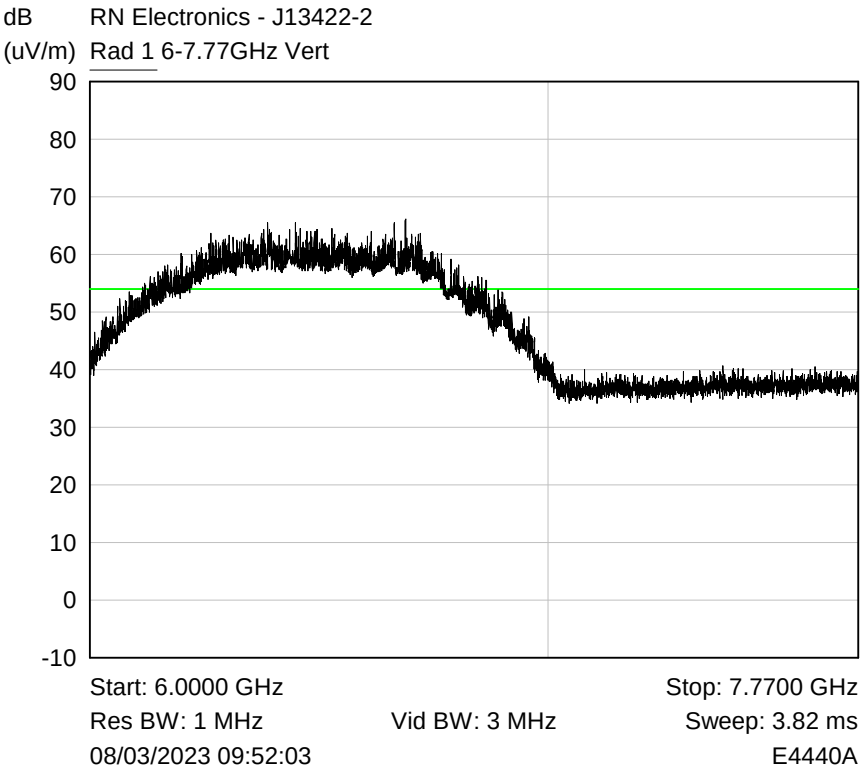
ZigBee turned On / UWB turned Off



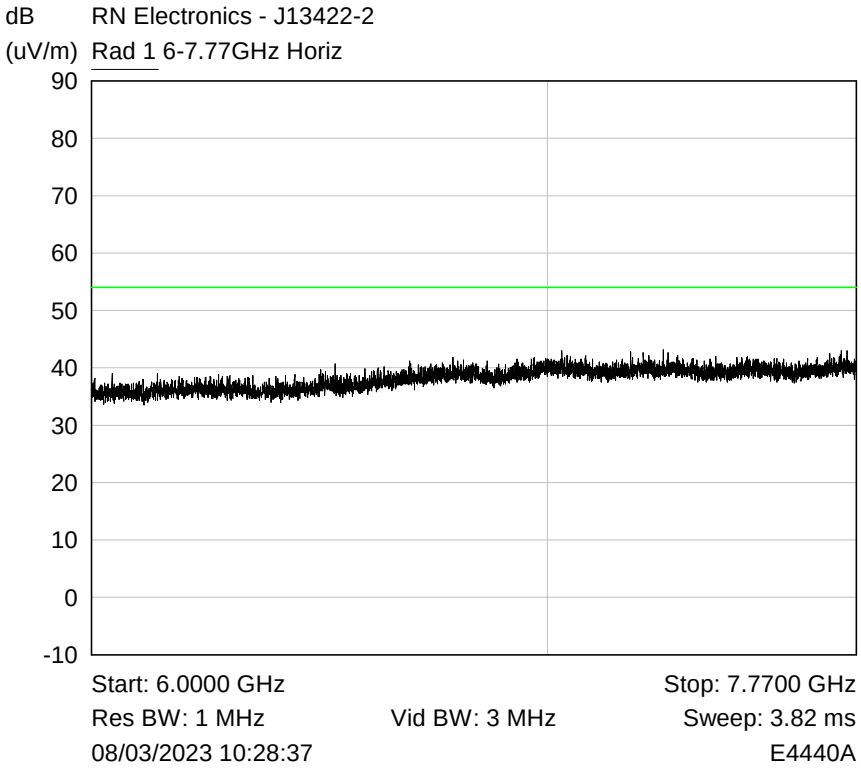
ZigBee turned On / UWB turned On
(emission observed is associated with UWB fundamental)



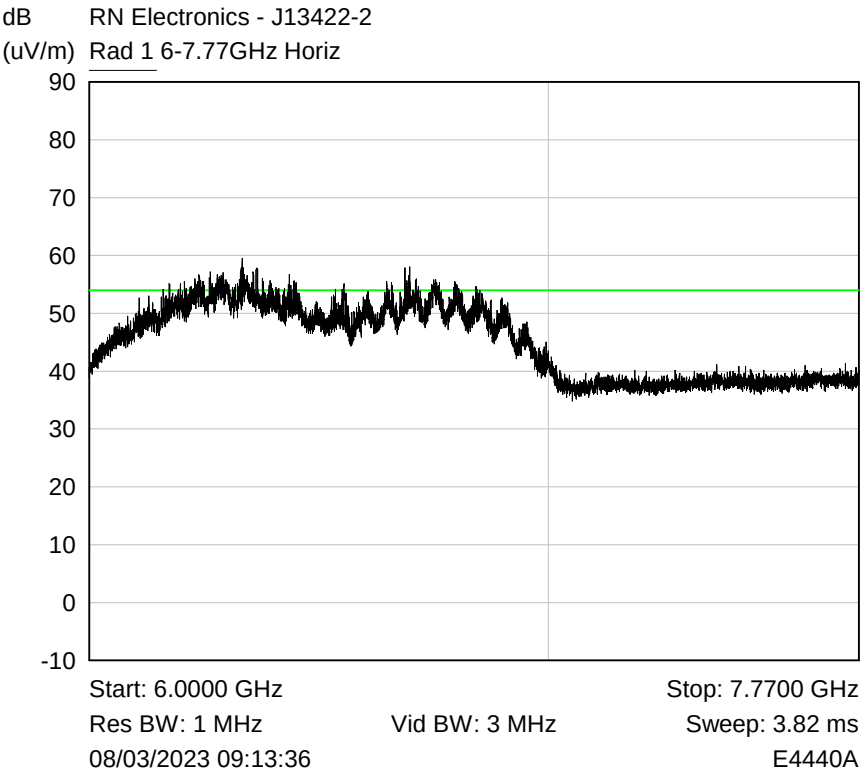
ZigBee turned On / UWB turned Off



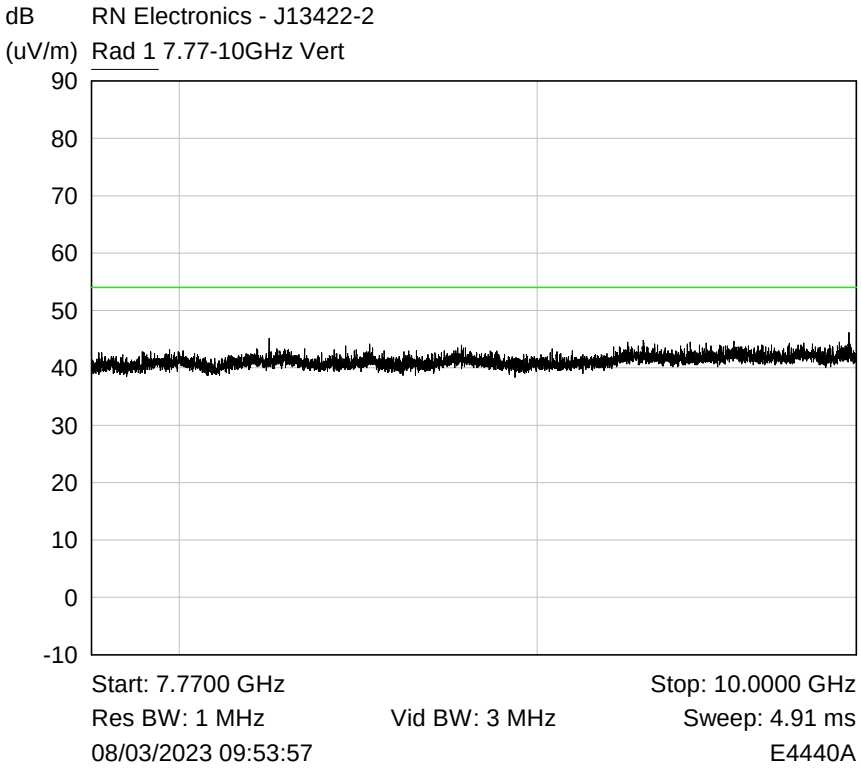
ZigBee turned On / UWB turned On
(emission observed is associated with UWB fundamental, Peak detector, Max held)

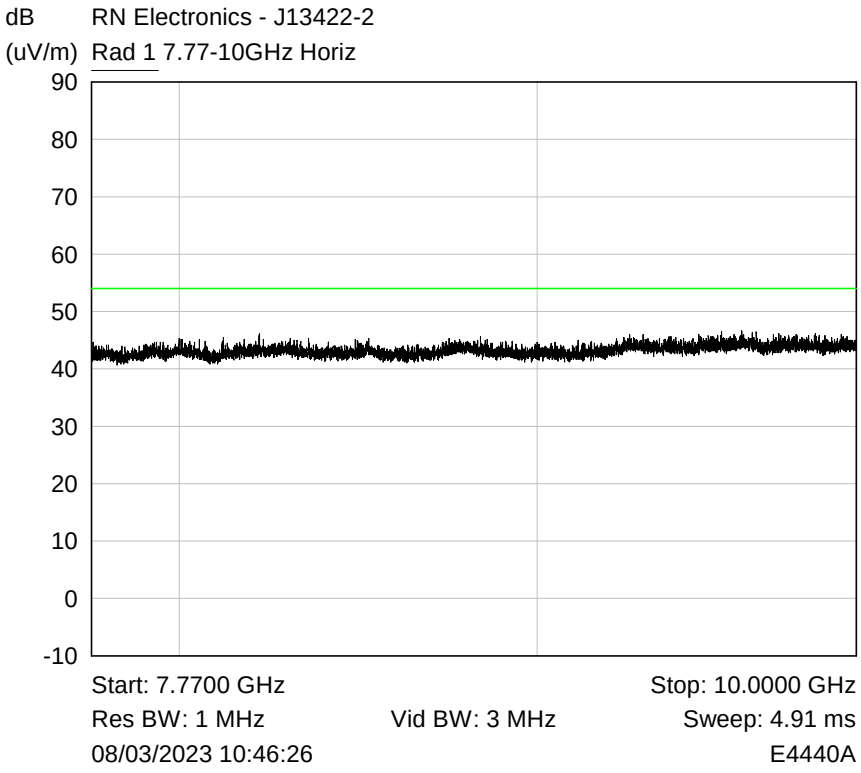


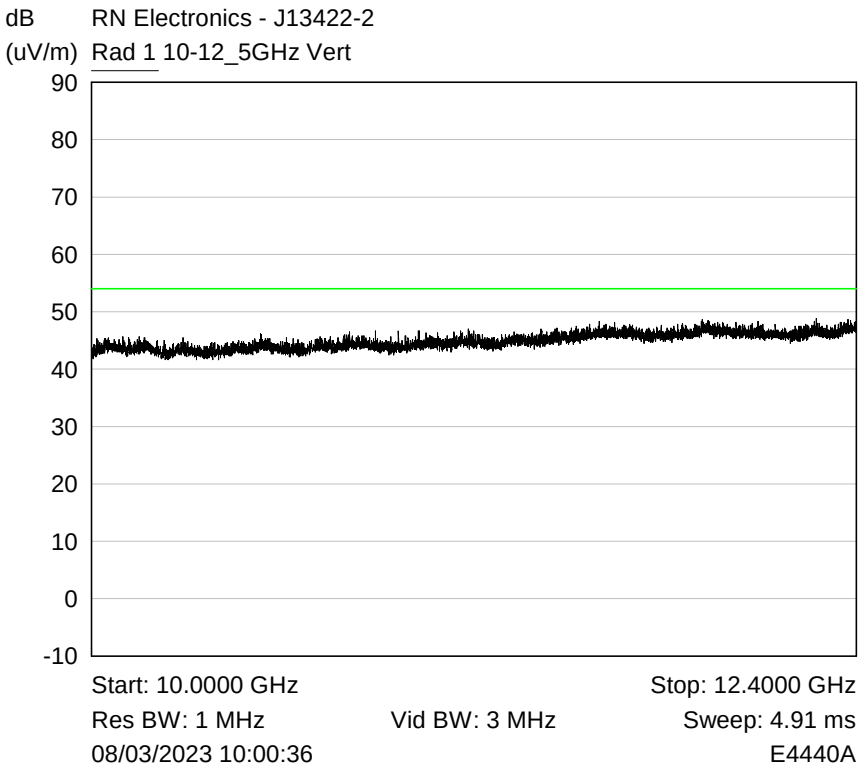
ZigBee turned On / UWB turned Off

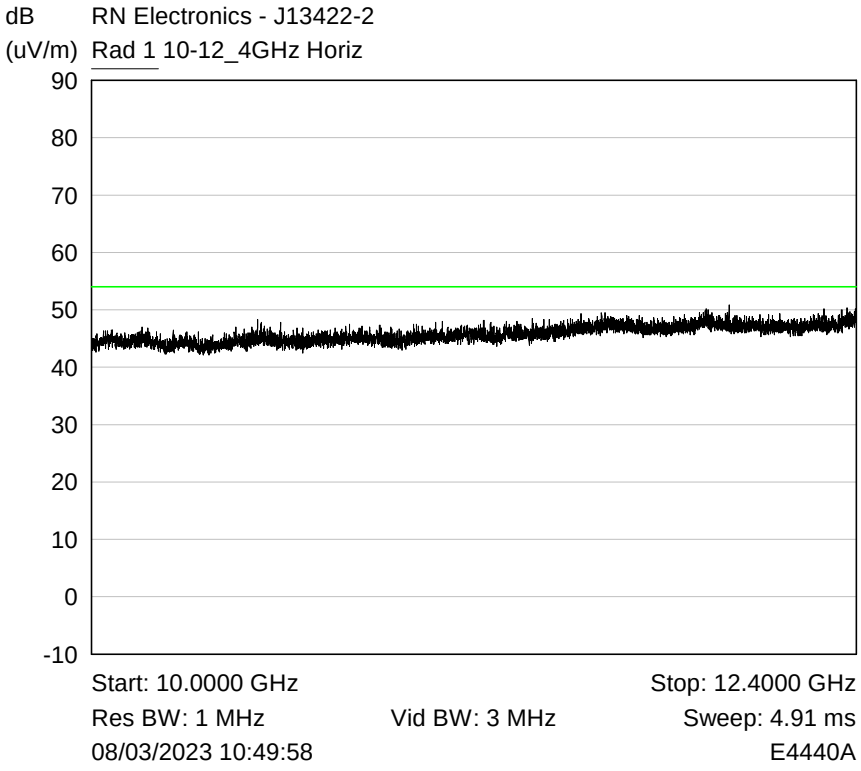


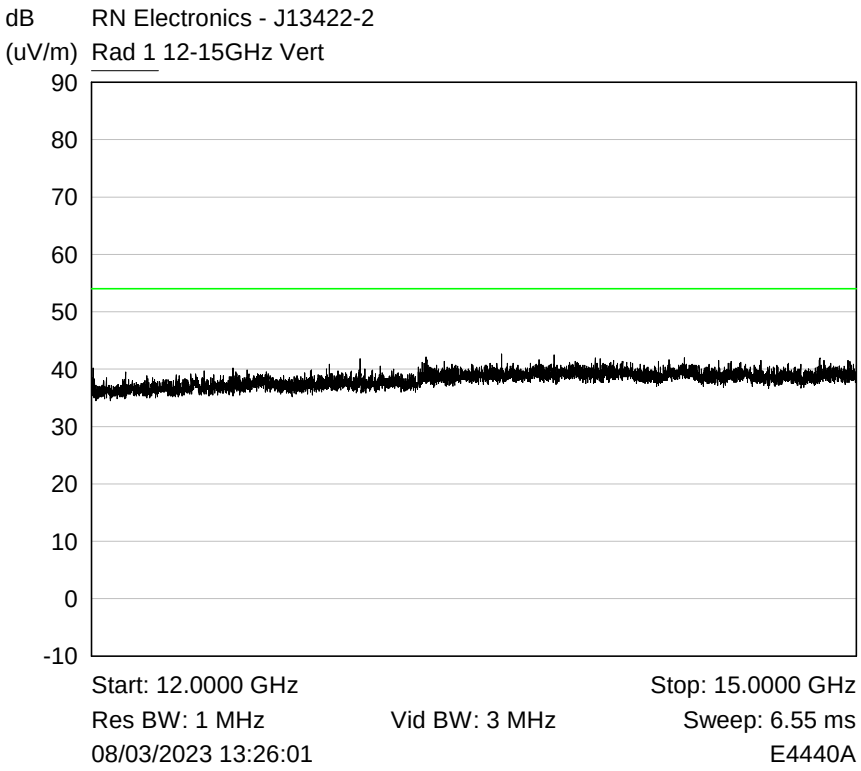
ZigBee turned On / UWB turned On
(emission observed is associated with UWB fundamental, Peak detector, Max held)

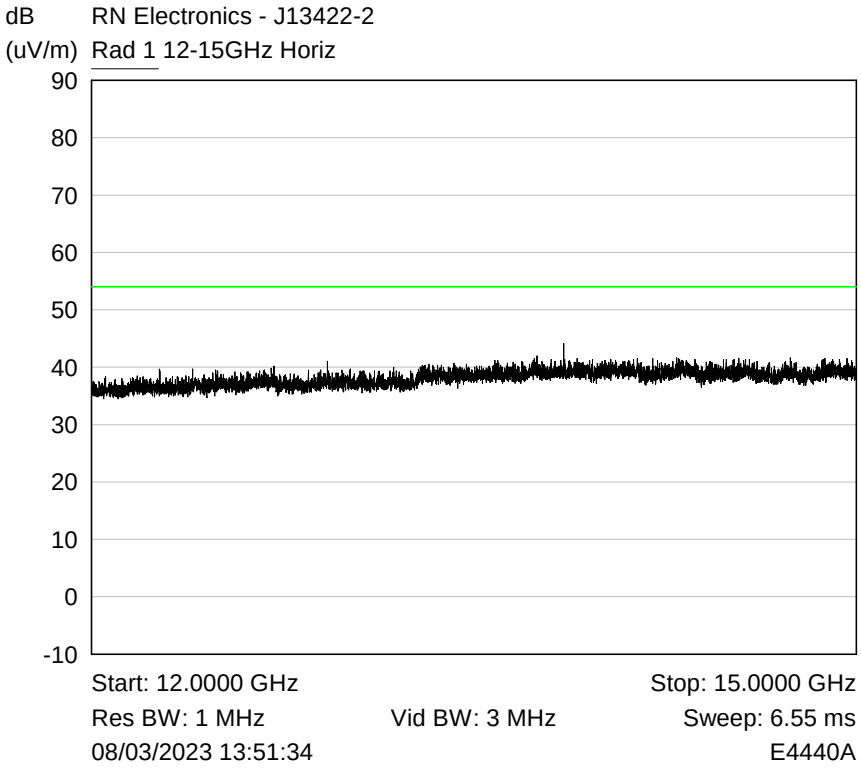

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 7.77-10GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 7.7700 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
08/03/2023 09:53:57
E4440A

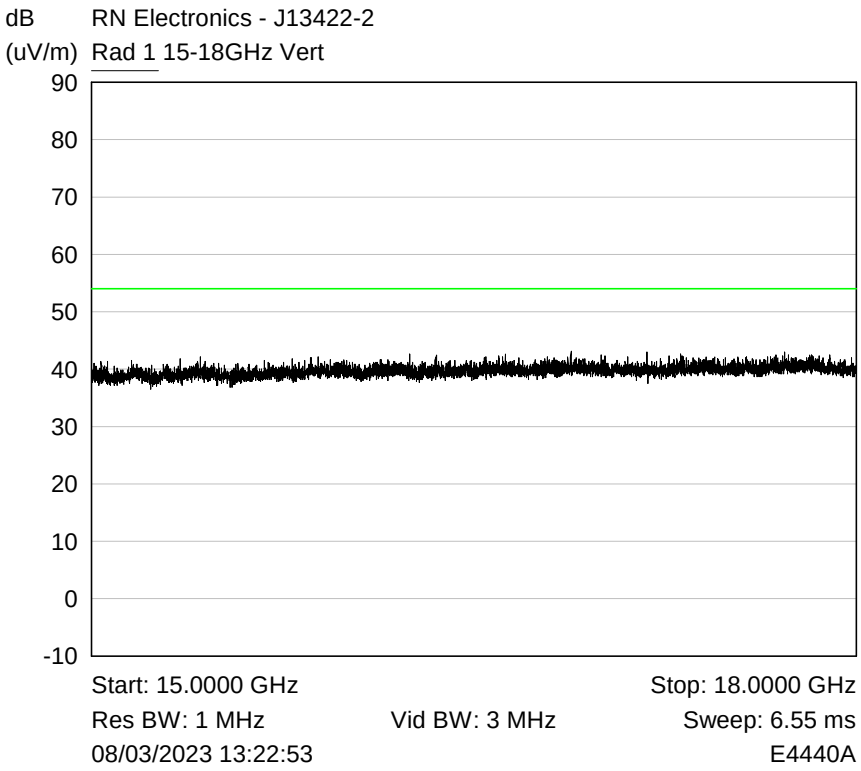

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 7.77-10GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 7.7700 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
08/03/2023 10:46:26
E4440A

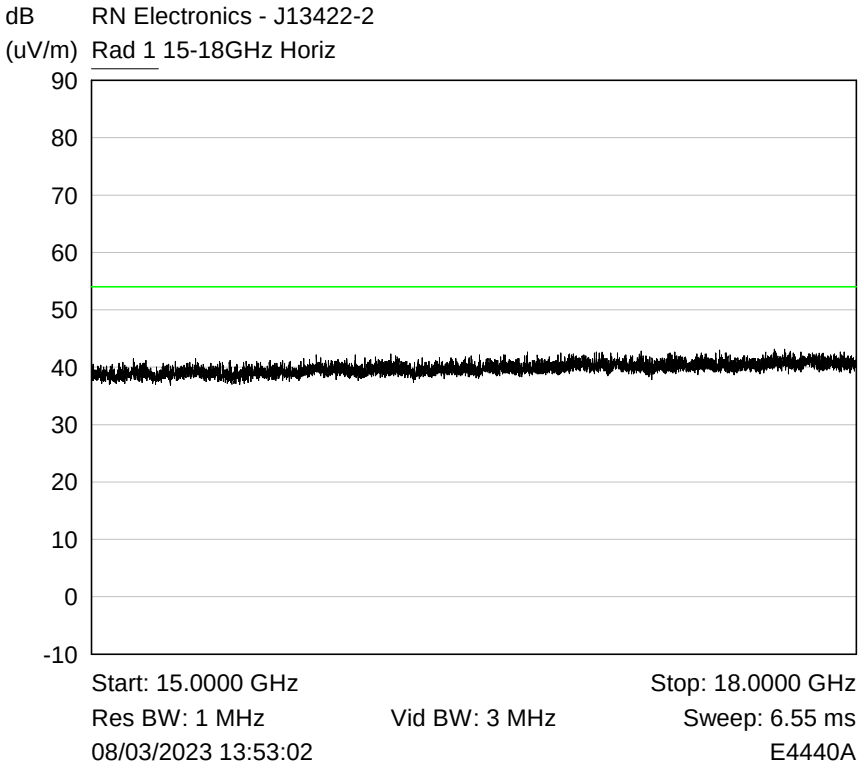

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 10-12_5GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.4000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
08/03/2023 10:00:36
E4440A

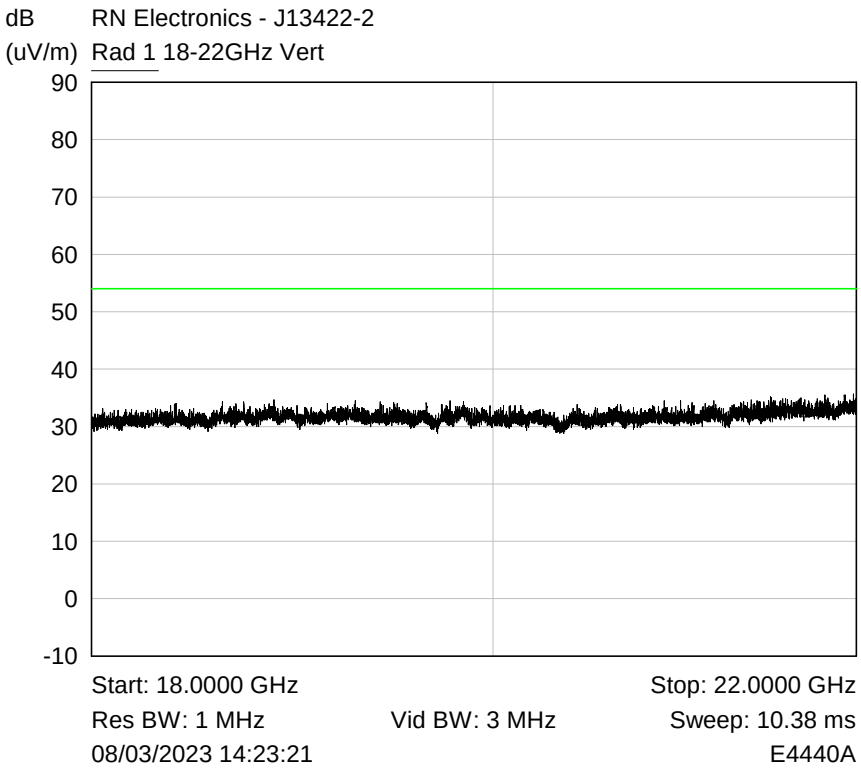

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 10-12_4GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.4000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
08/03/2023 10:49:58
E4440A

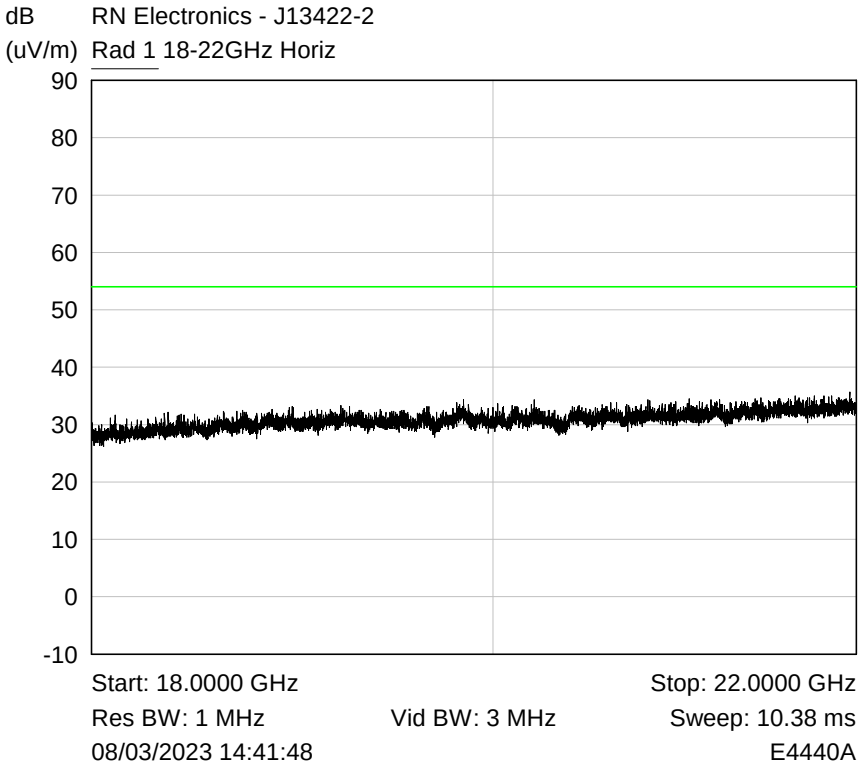

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 12-15GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.0000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
08/03/2023 13:26:01
E4440A

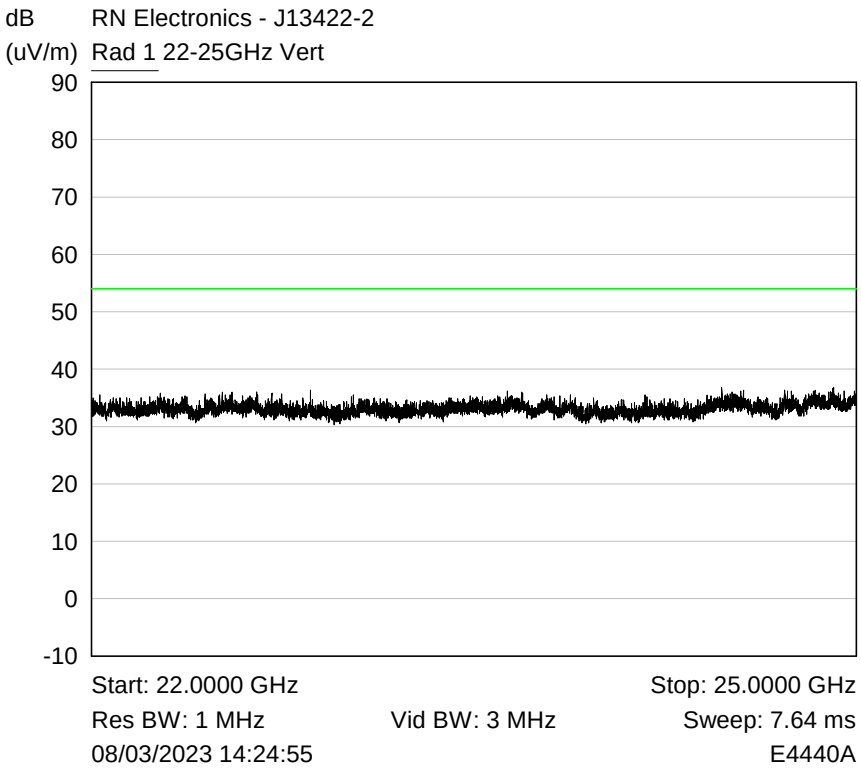

dB
(uV/m)
RN Electronics - J13422-2
Rad 1 12-15GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.0000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
08/03/2023 13:51:34
E4440A

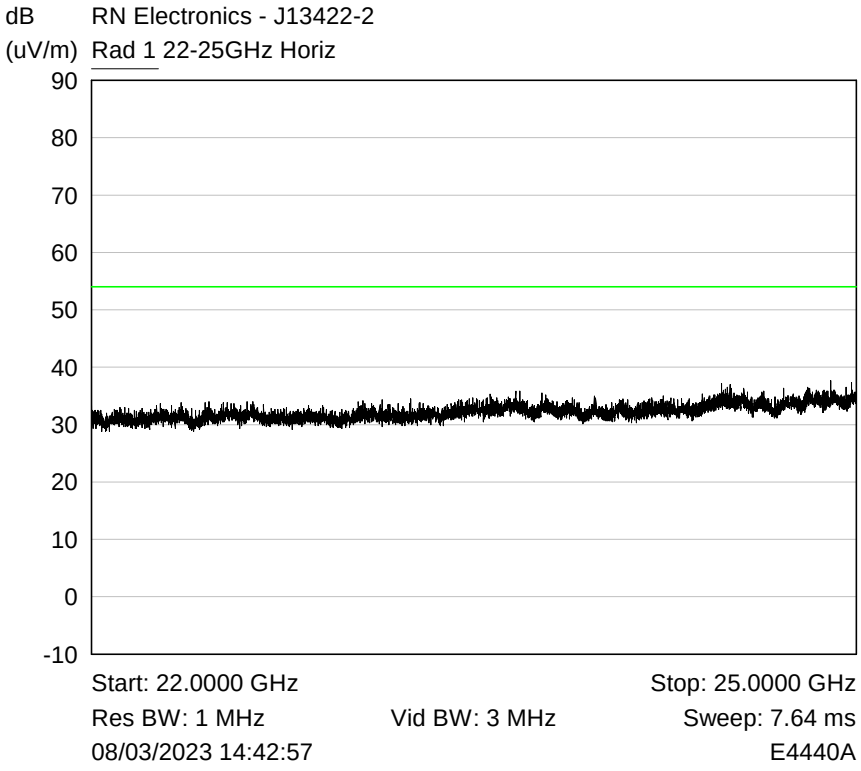


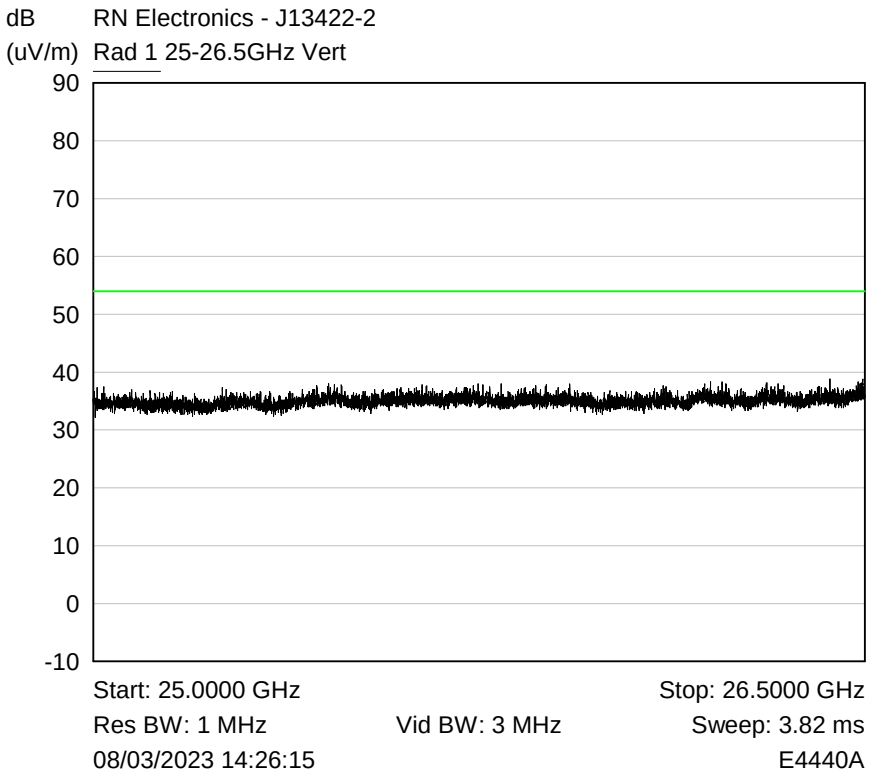


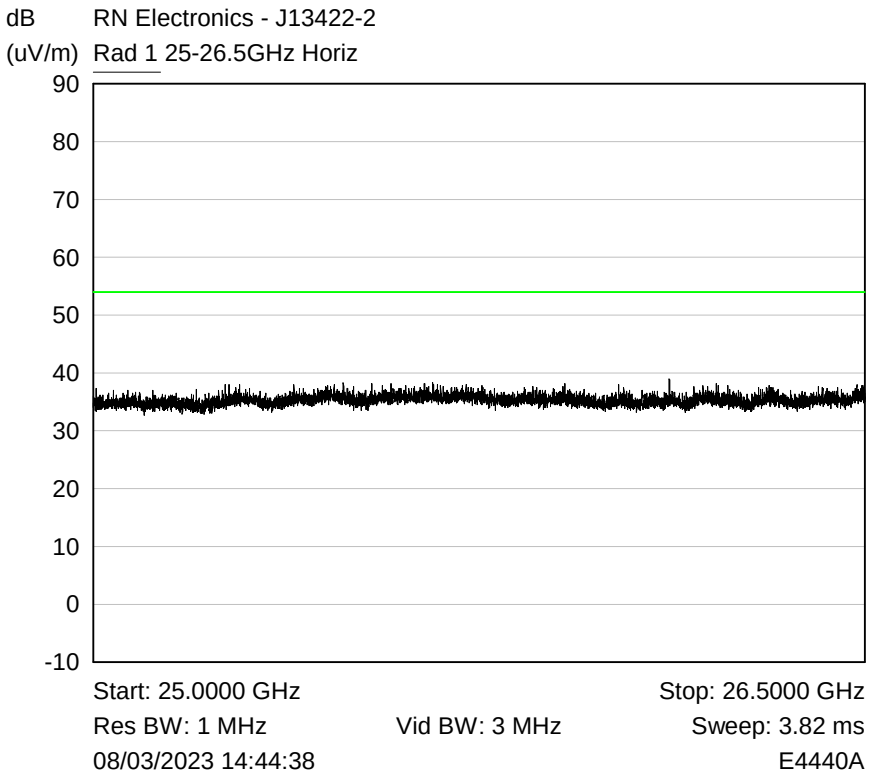


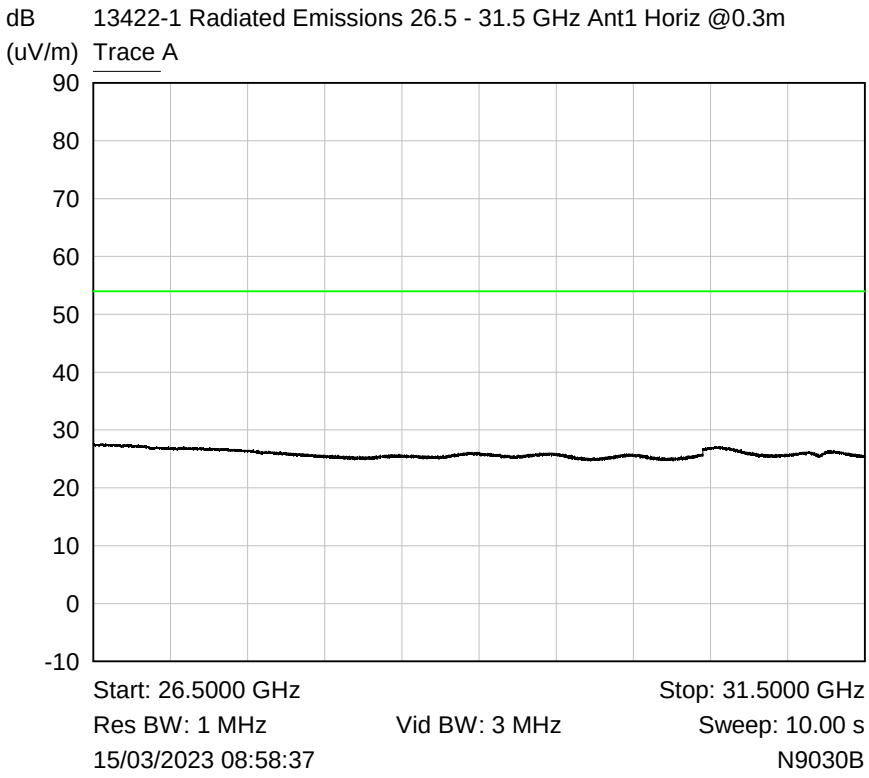


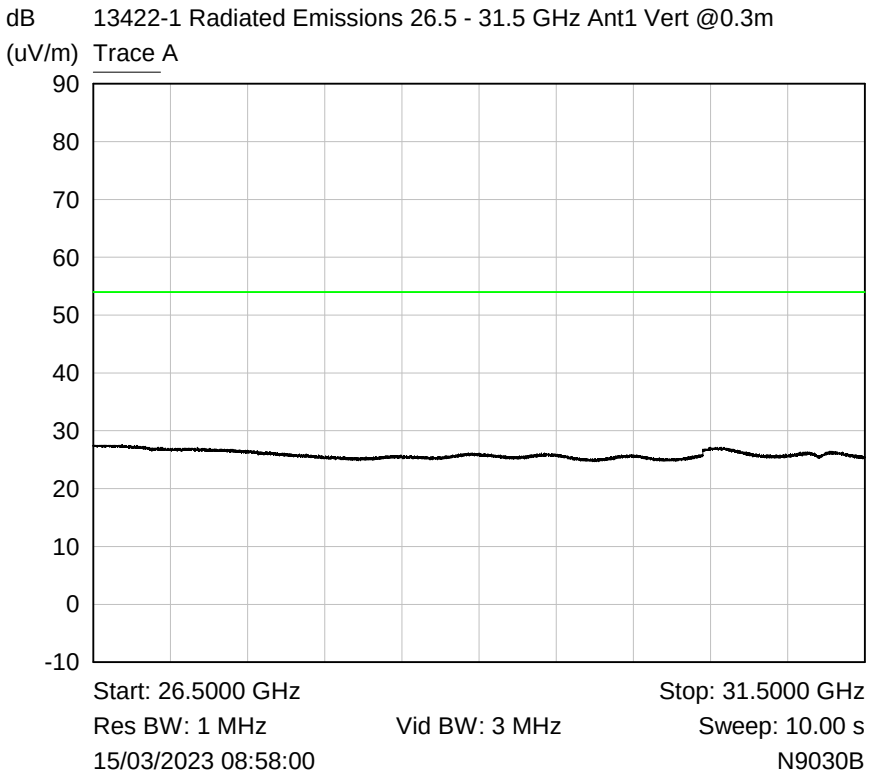


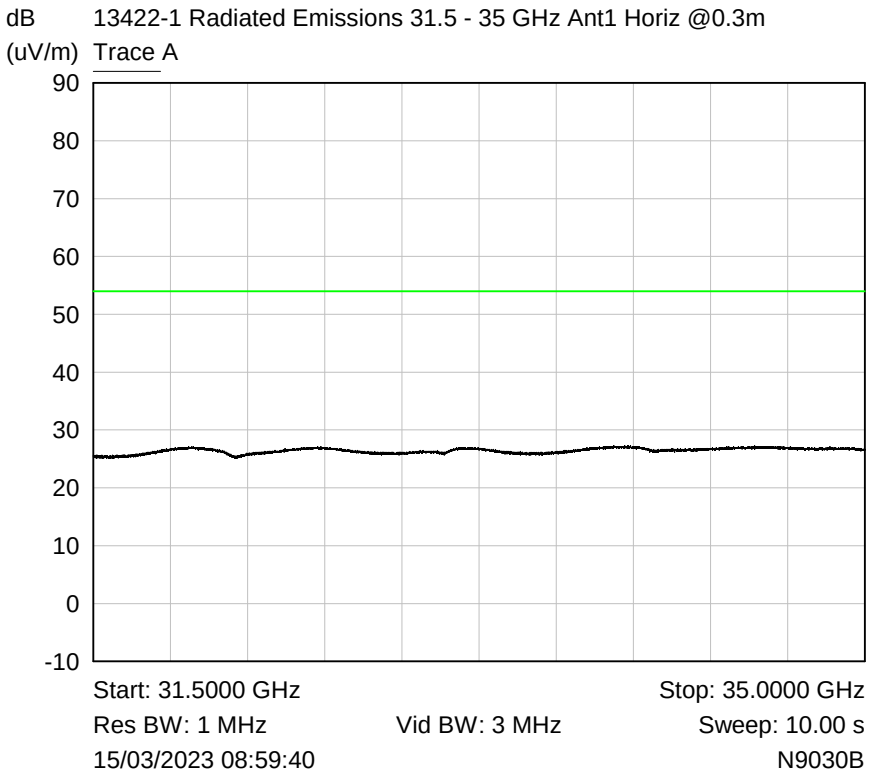


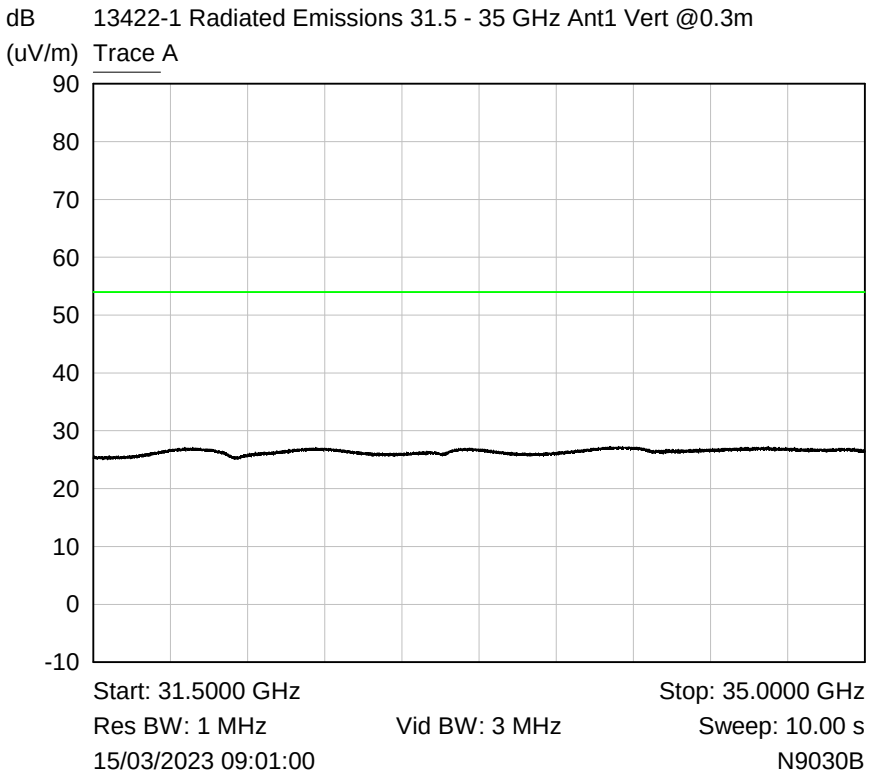


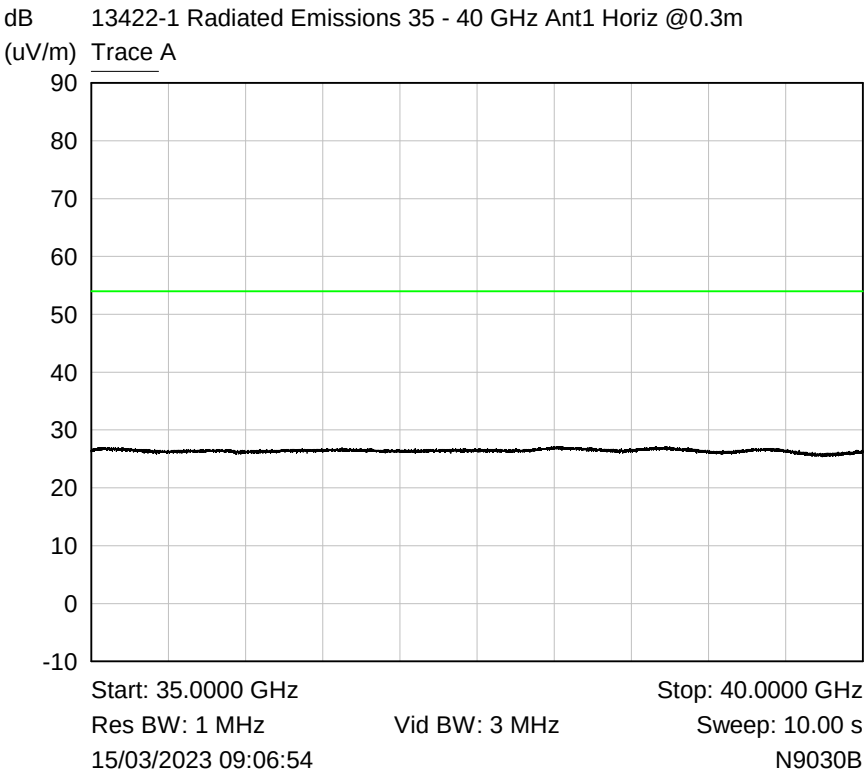






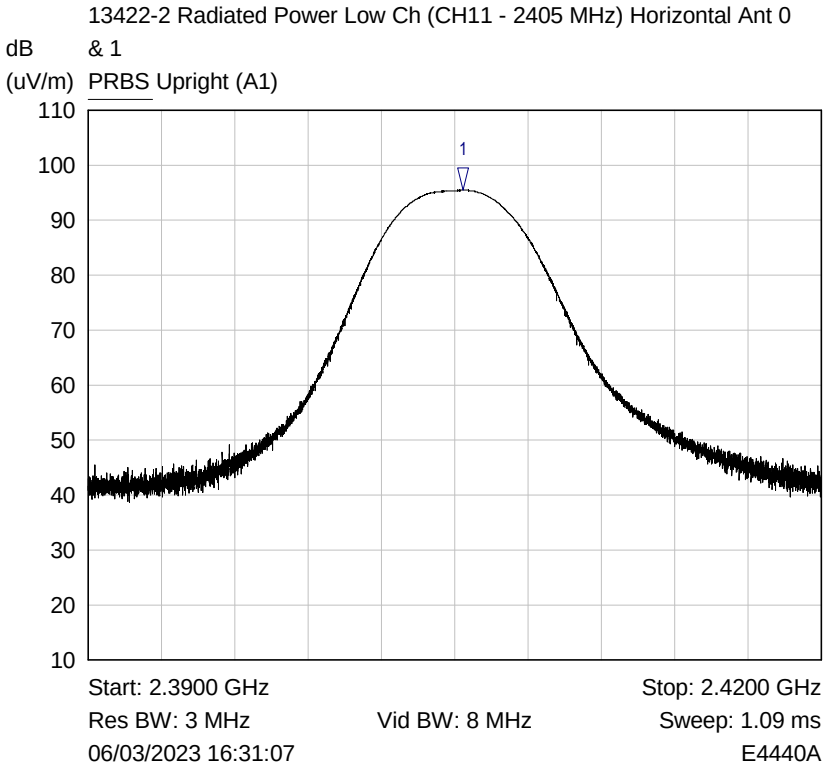





dB
(uV/m)
13422-1 Radiated Emissions 35 - 40 GHz Ant1 Horiz @0.3m
Trace A
90
80
70
60
50
40
30
20
10
0
-10
Start: 35.0000 GHz
Stop: 40.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 10.00 s
15/03/2023 09:06:54
N9030B

6.5 Effective radiated power field strength

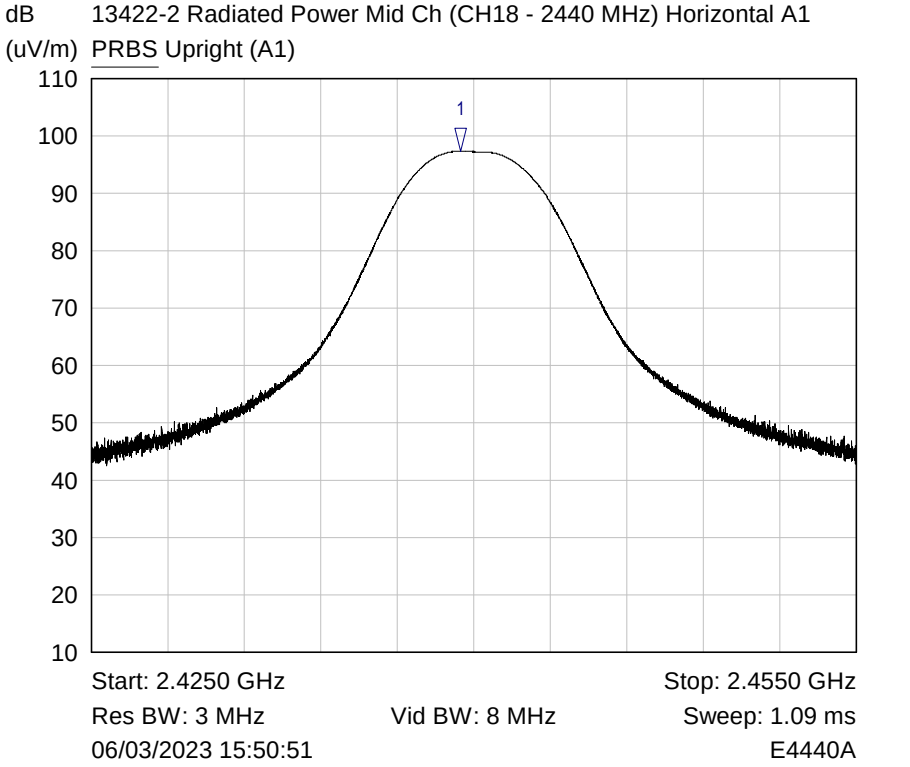
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2405 MHz (CH11)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	PRBS Upright (A1)	2.4053 GHz	95.47 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

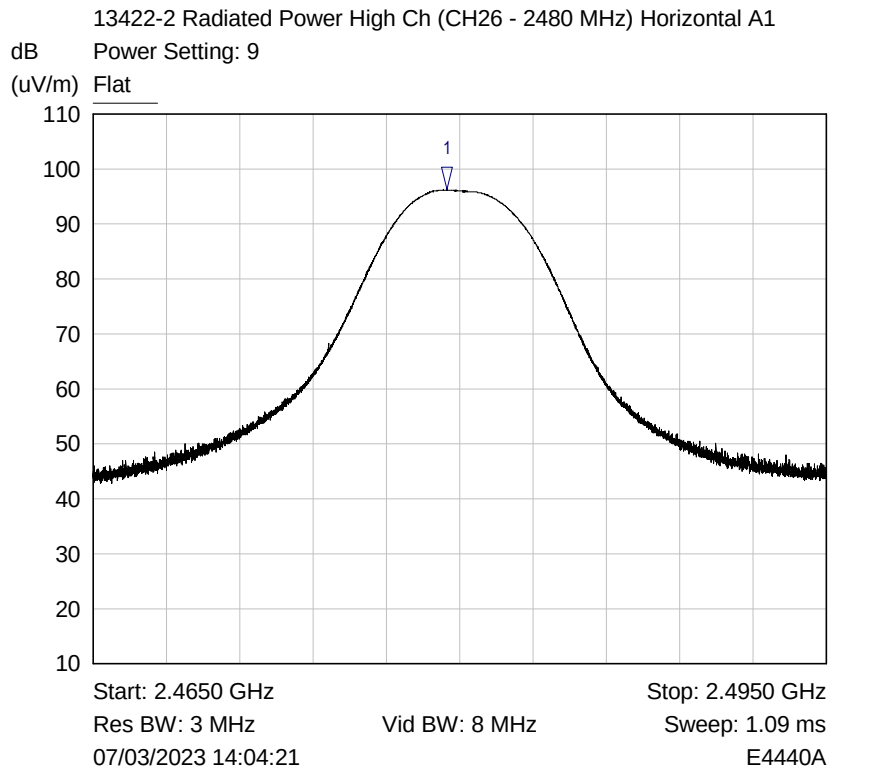
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2440 MHz (CH18)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	PRBS Upright (A1)	2.4395 GHz	97.38 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4 250 kbps, Channel 2480 MHz (CH26)

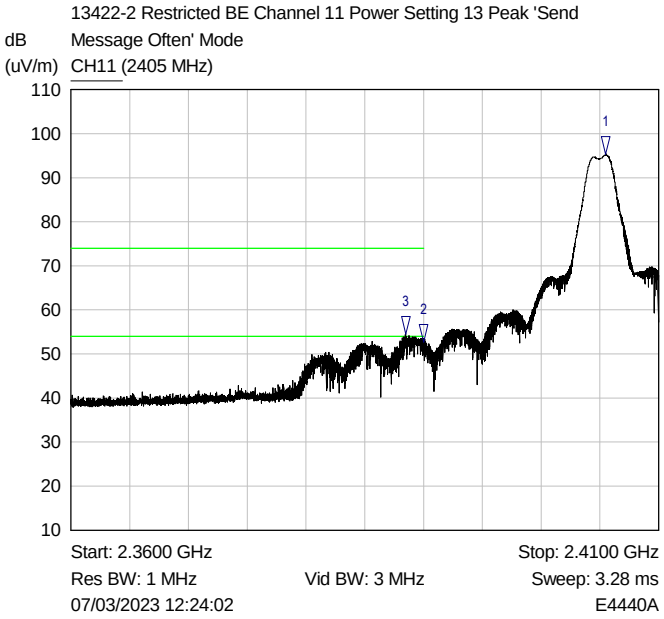


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Flat	2.4795 GHz	96.26 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

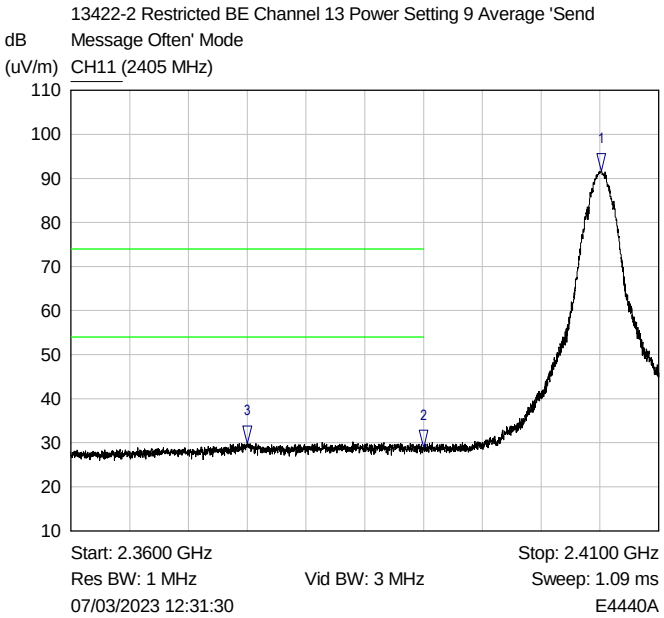
6.6 Band Edge Compliance

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2405 MHz (CH11)



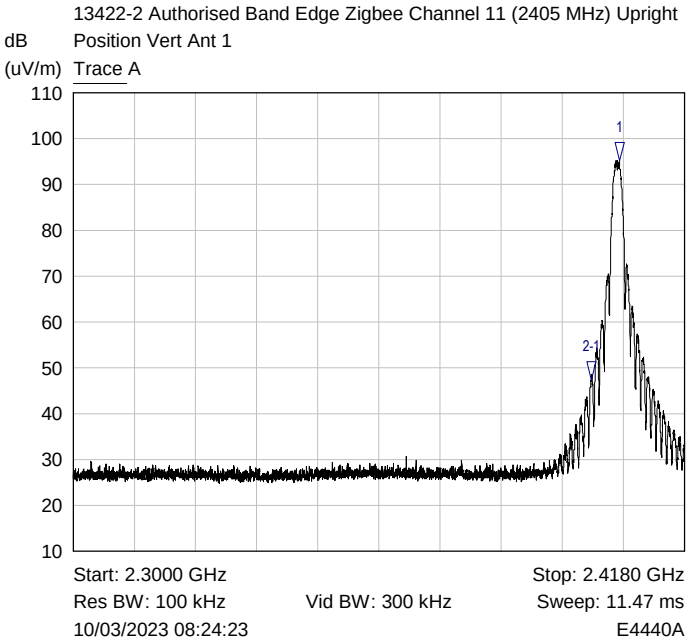
Mkr	Trace	X-Axis	Value	Notes
1	CH11 (2405 MHz)	2.4055 GHz	95.26 dB(uV/m)	
2	CH11 (2405 MHz)	2.3900 GHz	52.75 dB(uV/m)	
3	CH11 (2405 MHz)	2.3885 GHz	54.51 dB(uV/m)	

Restricted band edge Peak Plot



Mkr	Trace	X-Axis	Value	Notes
1	CH11 (2405 MHz)	2.4051 GHz	91.63 dB(uV/m)	
2	CH11 (2405 MHz)	2.3900 GHz	28.80 dB(uV/m)	
3	CH11 (2405 MHz)	2.3750 GHz	29.84 dB(uV/m)	

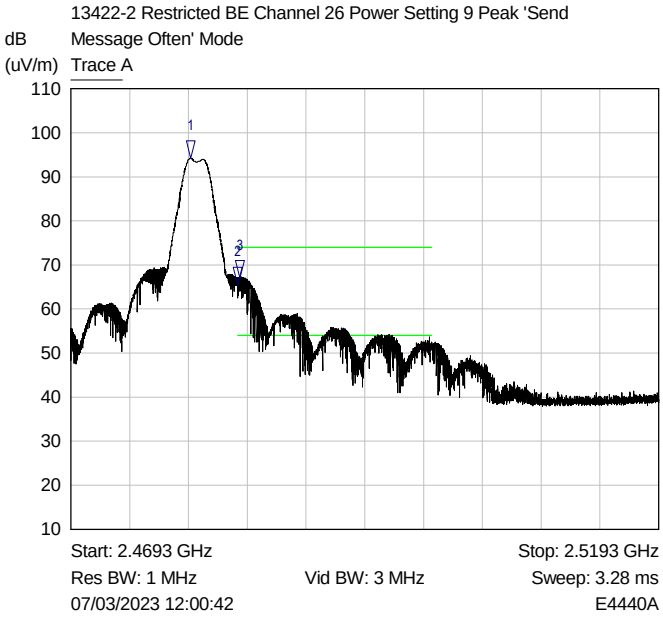
Restricted band edge Average Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4055 GHz	95.24 dB(uV/m)	
2-1 ▽	Trace A	2.4000 GHz	-47.82 dB	

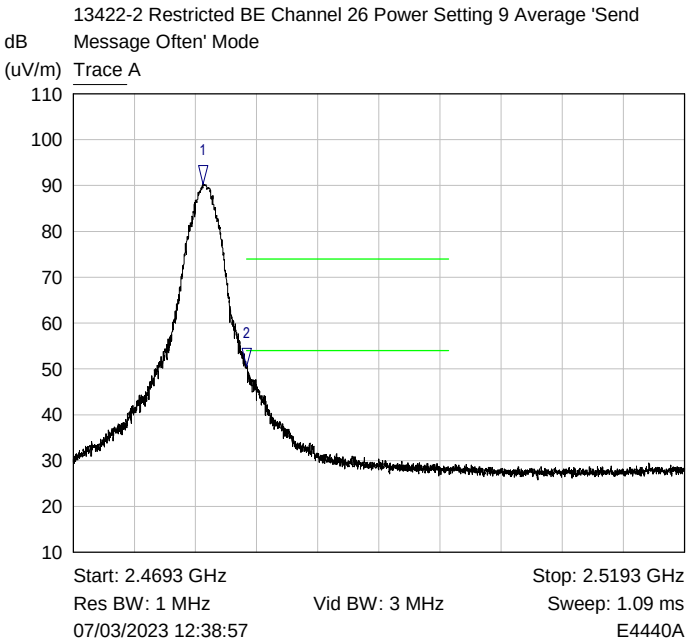
Authorised Band Edge Plot

RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2480 MHz (CH26)



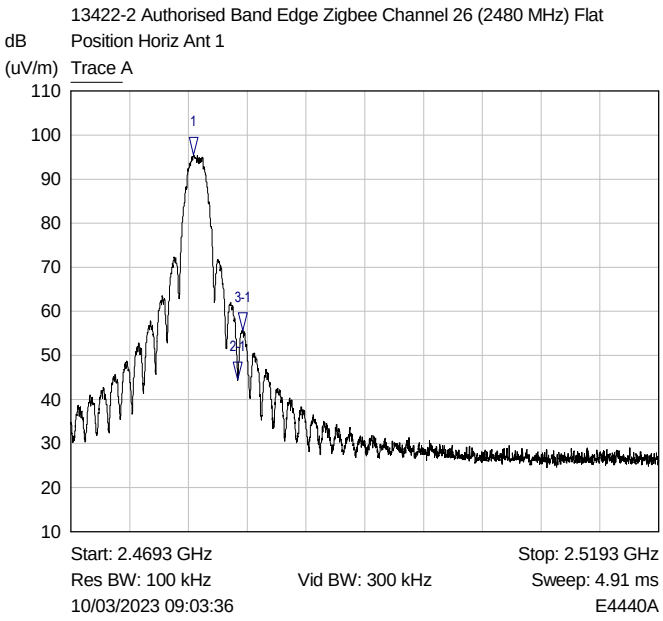
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4795 GHz	94.20 dB(uV/m)	
2 ▽	Trace A	2.4835 GHz	65.51 dB(uV/m)	
3 ▽	Trace A	2.4837 GHz	66.92 dB(uV/m)	

Restricted band edge Peak Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4799 GHz	90.28 dB(uV/m)	
2 ▽	Trace A	2.4835 GHz	50.47 dB(uV/m)	

Restricted band edge Average Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4797 GHz	95.50 dB(uV/m)	
2-1 ▽	Trace A	2.4835 GHz	-51.00 dB	
3-1 ▽	Trace A	2.4839 GHz	-39.83 dB	

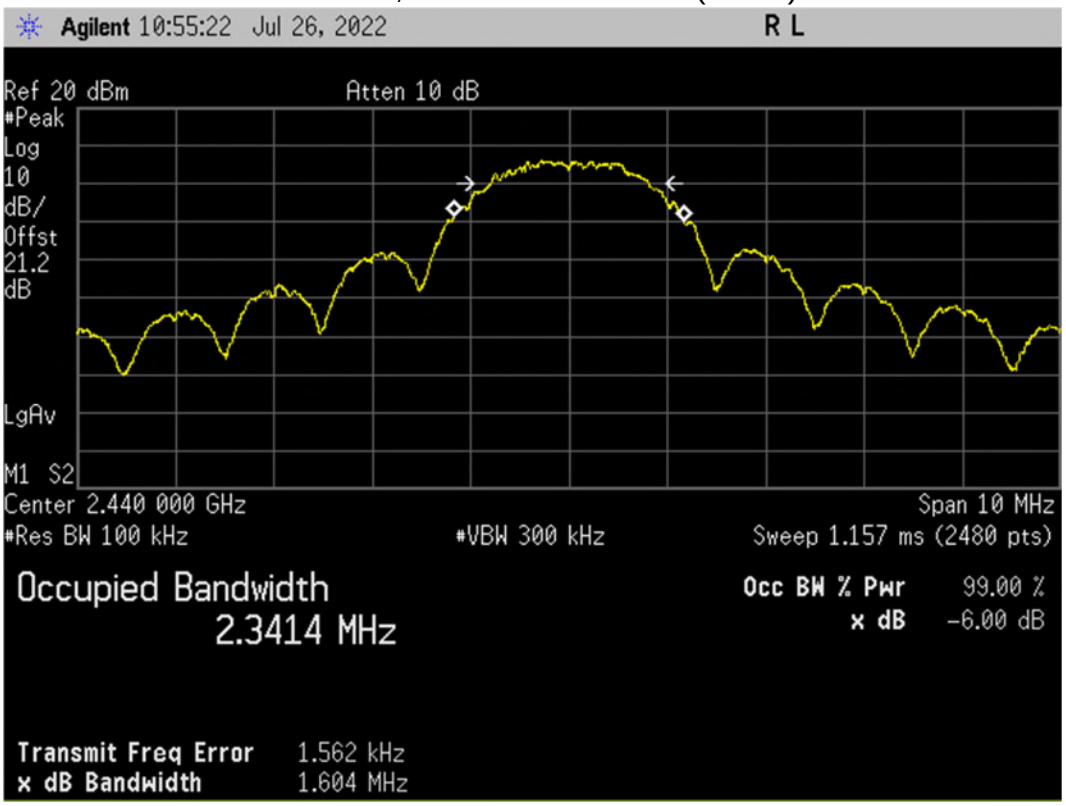
Authorised Band Edge Plot

6.7 Occupied bandwidth

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2405 MHz (CH11)

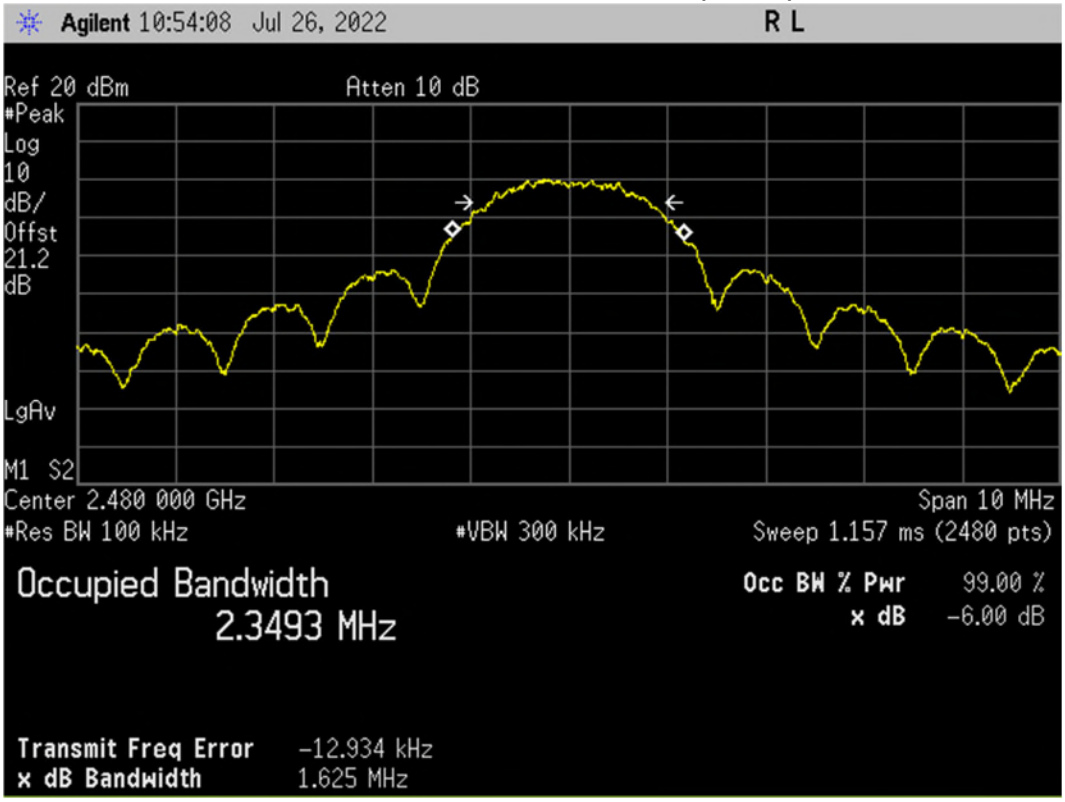
Plot for 6 dB Bandwidth Result (MHz)

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2440 MHz (CH18)



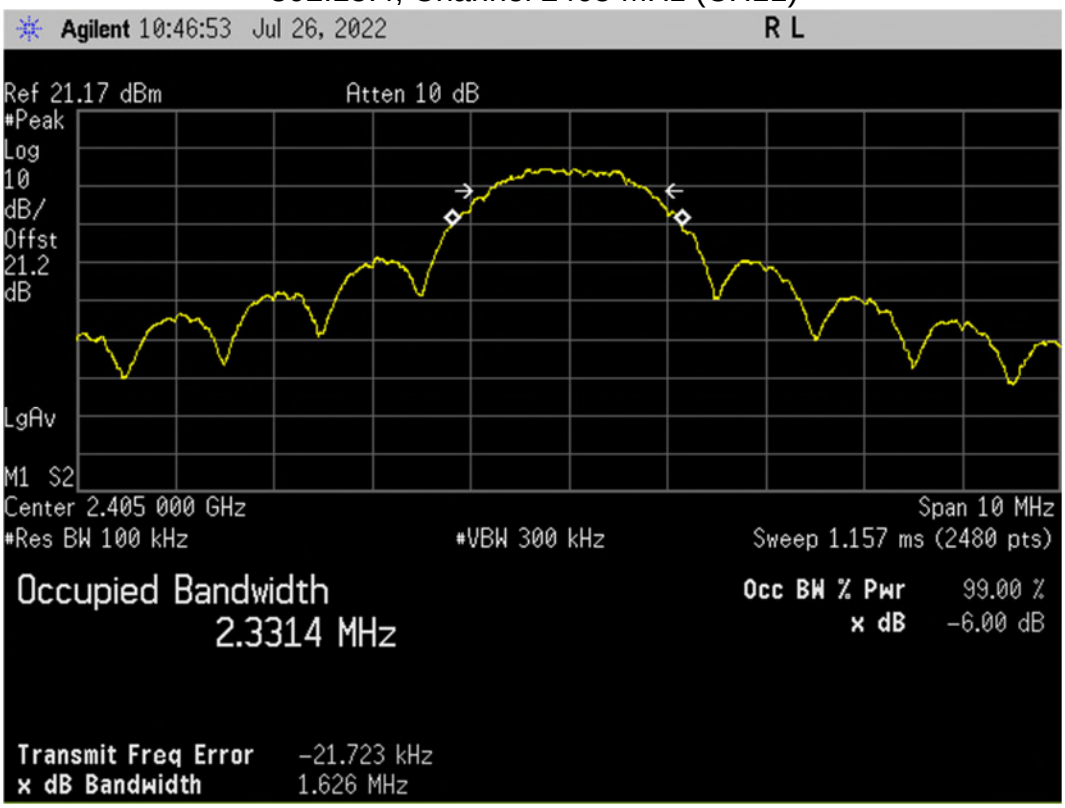
Plot for 6 dB Bandwidth Result (MHz)

RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2480 MHz (CH26)



Plot for 6 dB Bandwidth Result (MHz)

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2405 MHz (CH11)

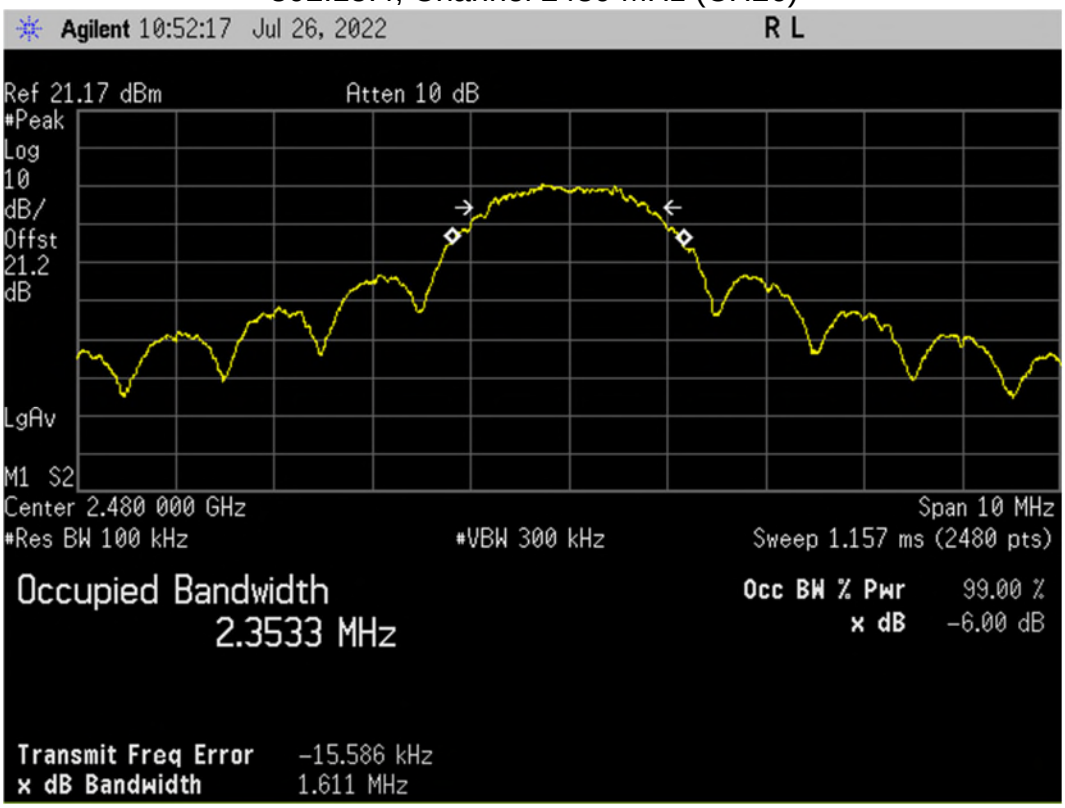


Plot for 6 dB Bandwidth Result (MHz)

RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2440 MHz (CH18)

Plot for 6 dB Bandwidth Result (MHz)

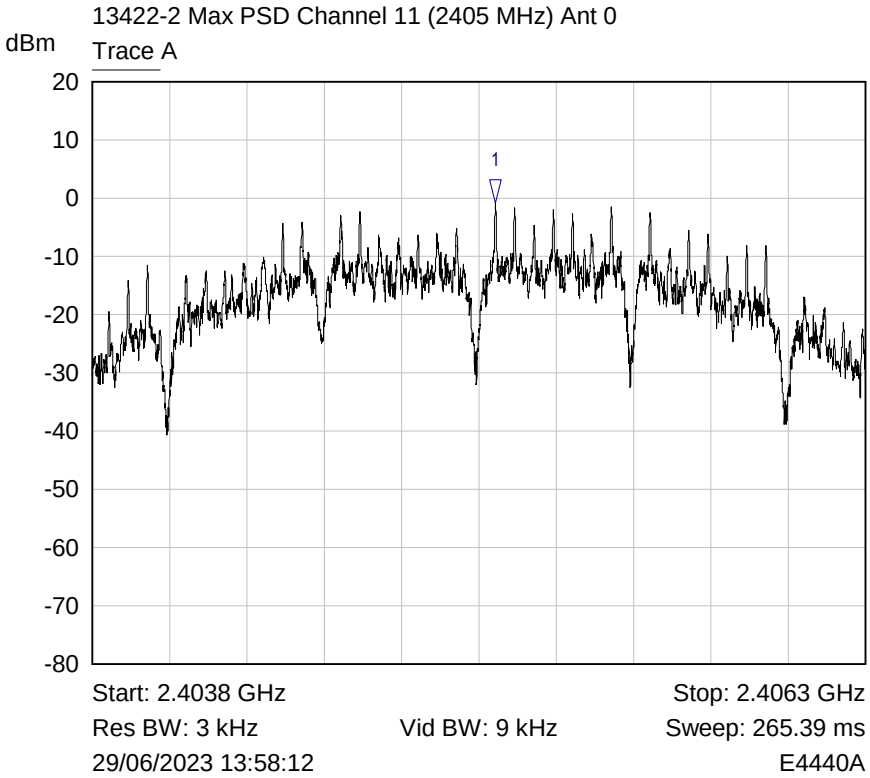
RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2480 MHz (CH26)



Plot for 6 dB Bandwidth Result (MHz)

6.8 Maximum Power Spectral Density

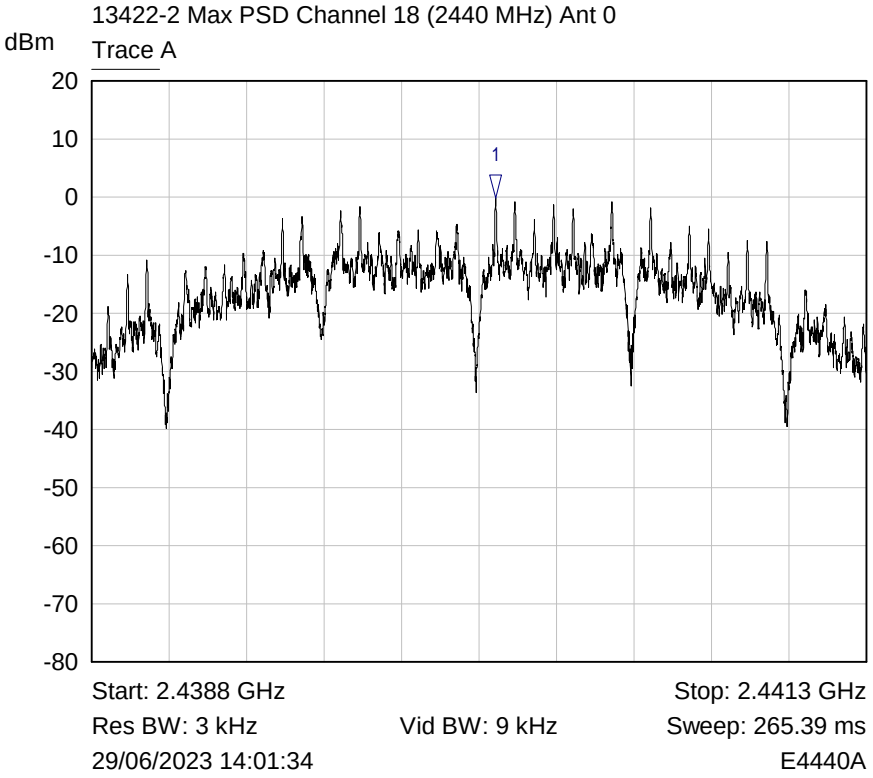
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2405 MHz (CH11)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4051 GHz	-0.88 dBm	

Plot of PSD on Channel 11 (Antenna Port 0)

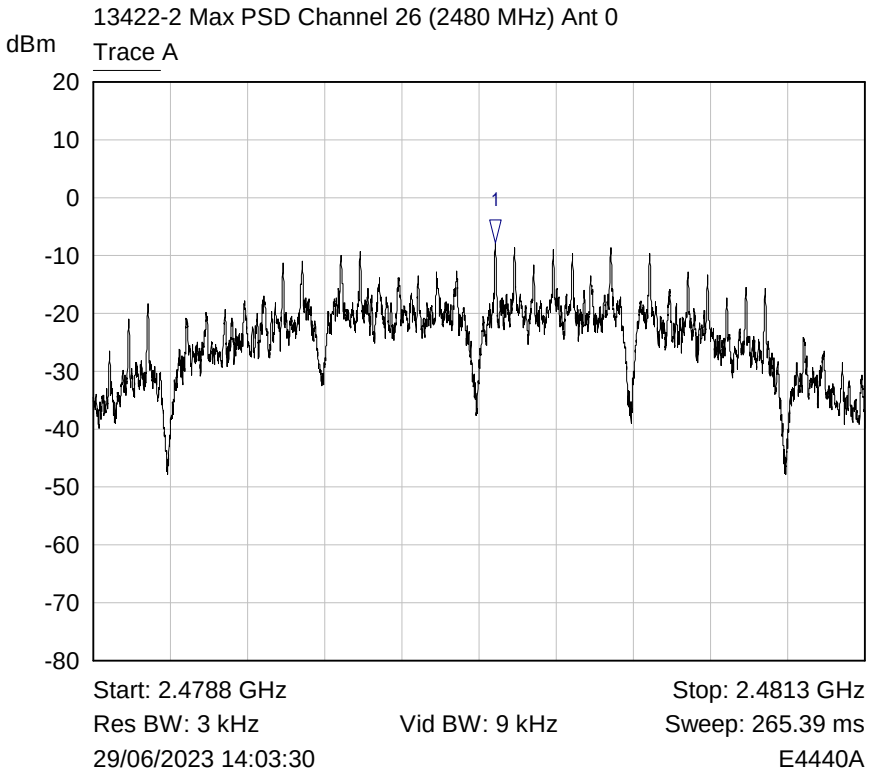
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2440 MHz (CH18)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4401 GHz	-0.12 dBm	

Plot of PSD on Channel 18 (Antenna Port 0)

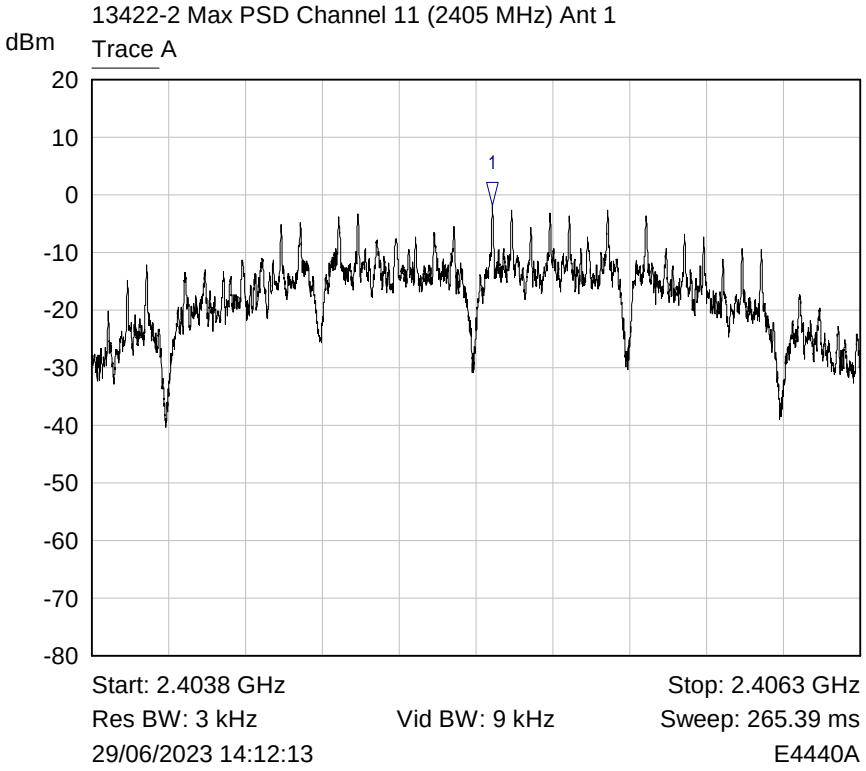
RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2480 MHz (CH26)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4801 GHz	-7.83 dBm	

Plot of PSD on Channel 26 (Antenna Port 0)

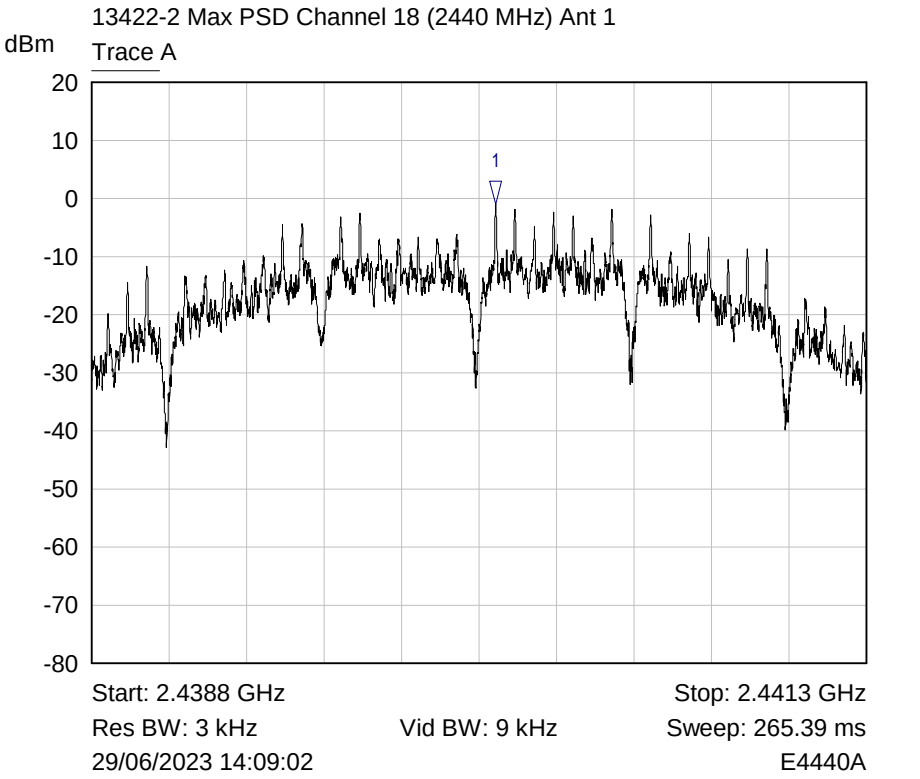
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2405 MHz (CH11)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4051 GHz	-1.85 dBm	

Plot of PSD on Channel 11 (Antenna Port 1)

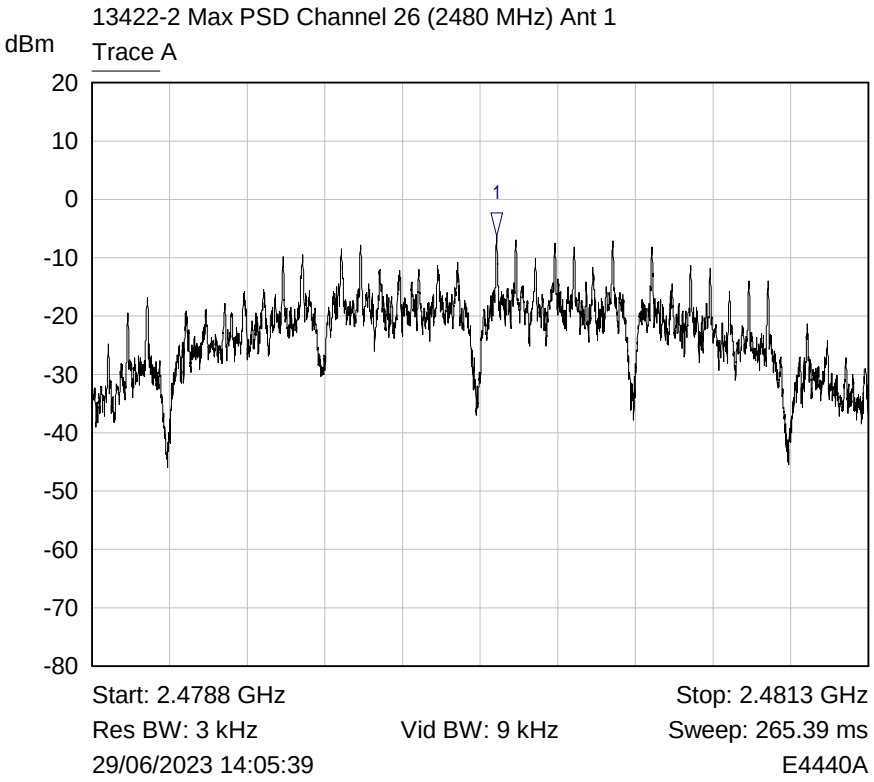
RF Parameters: Band 2400-2483.5 MHz, Power 13, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2440 MHz (CH18)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4401 GHz	-1.07 dBm	

Plot of PSD on Channel 18 (Antenna Port 1)

RF Parameters: Band 2400-2483.5 MHz, Power 9, Channel Spacing 5 MHz, Modulation 802.15.4, Channel 2480 MHz (CH26)



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4801 GHz	-6.35 dBm	

Plot of PSD on Channel 26 (Antenna Port 1)

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

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

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48	-12.6	37.6	-14.4

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

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

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

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

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

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

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

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

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

7.2 Explanation of limit line calculations for radiated measurements

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

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

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

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

The measurement receiver used for emissions testing, performs the field strength (FS) calculations automatically. The receiver combines the signal amplitude (RA), Antenna Factor (AF) and Cable Loss (CL) factors for the frequency to be measured.

Example calculation: - FS = RA + AF + CL.

Receiver amplitude (RA)	Antenna factor (3m) (AF)	Cable loss (CL)	Field strength result (3m) (FS)
20dBuV	25 dB	3 dB	48dBuV/m

Additional calculation examples per ANSI C63.10 clause 9.4 – 9.6 equations 21, 22, 25 & 26:

Equation 21: $E_{Linear} = 10^{((E_{log}-120)/20)}$

And therefore equation 21 transposed is: $E_{Log} = 20xLog(E_{Linear}) +120$

Where:

E_{Linear} is the field strength of the emission in V/m

E_{Log} is the field strength of the emissions in dBµV/m

Equation 22: $EIRP = E_{Meas} + 20log(d_{Meas}) -104.7$

Where:

EIRP is equivalent isotropically radiated power in dBm

E_{Meas} is the field strength of the emission at the measurement distance in dBµV/m

d_{Meas} is the measurement distance in metres

Equation 25: $PD = EIRP_{Linear} / 4\pi d^2$

And therefore equation 25 transposed is: $EIRP_{Linear} = PD \times 4\pi d^2$

Where:

PD is the power density at distance specified by the limit, in W/m^2

$EIRP_{Linear}$ is the equivalent isotropically radiated power in Watts

d is the distance at which the power density limit is specified in metres

Equation 26: $PD = E^2_{Speclimit} / 377$

And therefore equation 26 transposed is: $E_{Spec\ limit} = \sqrt{(PD \times 377)}$

Where:

PD is the power density at distance specified by the limit, in W/m^2

$E_{spec\ limit}$ is the field strength at the distance specified by the limit in V/m

Example:

Radiated spurious emissions limit at 3metres of $90pW/cm^{2.}$

$90pW/cm^2 \times 100^2 = 0.9\ \mu W/m^2$ = (EIRP Linear)

Equation 25 transposed: $0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876$ W

And

Equation 26 transposed: $E_{Spec\ limit} = \sqrt{(0.9 \times 10^{-6} \times 377)} = 0.01842$ V/m.

And

Equation 21 transposed: $E_{Log} = 20Log(0.01842) + 120 = 85.3dB\mu V/m$ @ 3m.

8 Photographs

No photos included due to confidentiality requested by client towards FCC certification.

8.1 Radiated emission diagrams

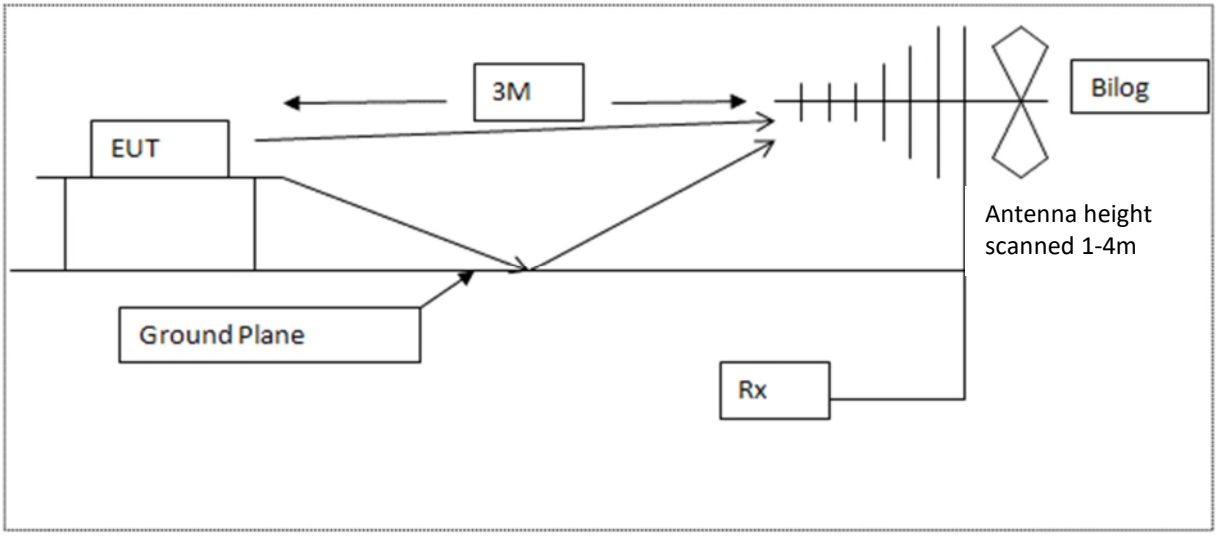


Diagram of the radiated emissions test setup 30 - 1000 MHz

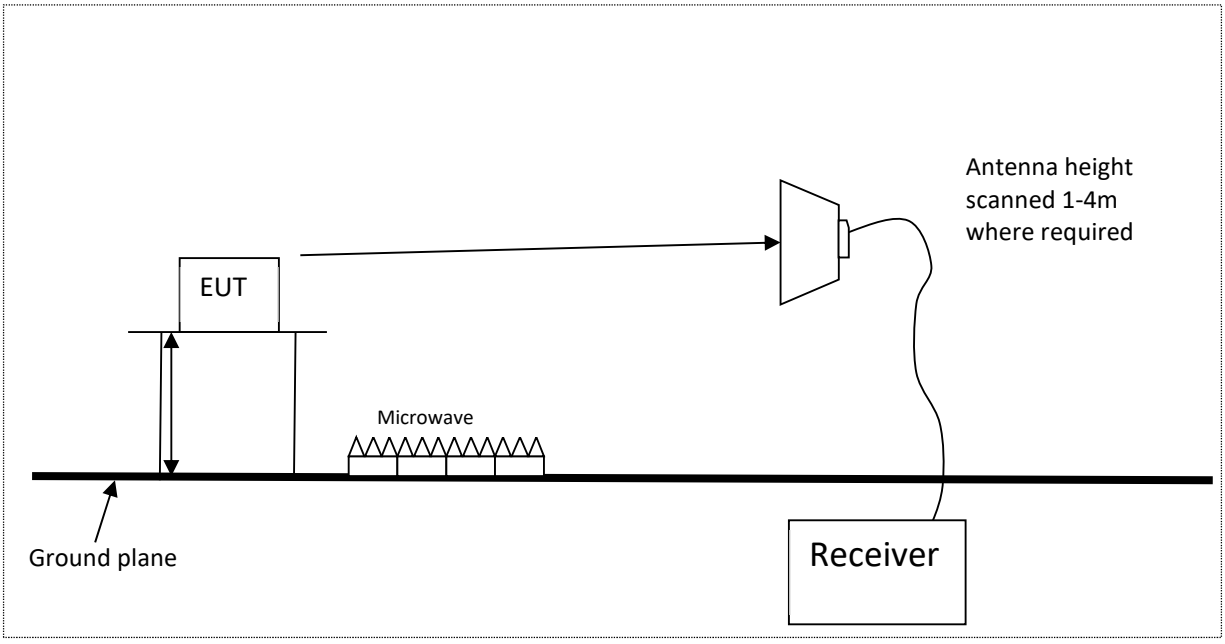
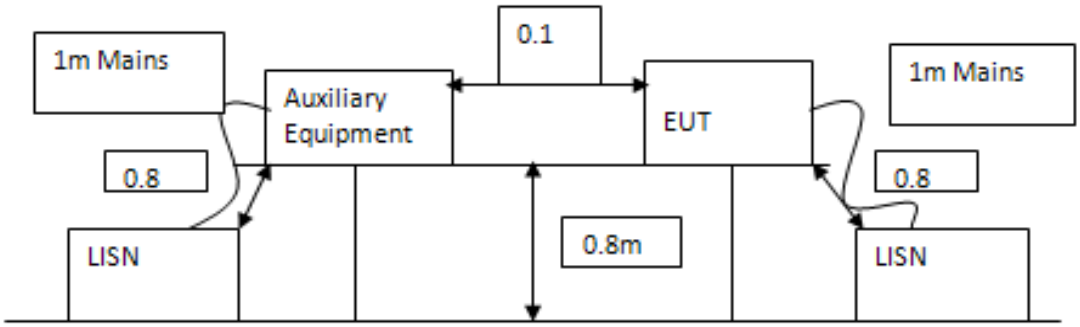


Diagram of the radiated emissions test setup above 1GHz

8.2 AC powerline conducted emission diagram



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
E035	11947A	Transient Limiter 9kHz - 200MHz	Hewlett Packard	16-Dec-2022	12 months
E150	MN2050	LISN 13A	Chase	25-Apr-2022	12 months
E296-2	11970A	Harmonic Mixer 26.5-40GHz	Hewlett Packard	27-Jun-2022	12 months
E330	2224-20	Horn Antenna 26.5-40GHz	Flann (FMI)	22-Apr-2022	12 months
E367	6534/4	Attenuator 20dB 18GHz	Marconi Instruments	09-Nov-2022	12 months
E411	N9039A	9kHz - 1GHz RF Filter Section	Agilent Technologies	07-Jul-2022	12 months
E428	HF906	Horn Antenna 1 - 18 GHz	Rohde & Schwarz	02-Apr-2022	12 months
E429	-	Filter Box 5 Switch Filters 0.91 GHz - 16.3 GHz	RN Electronics	23-Aug-2022	12 months
E520	MD4A	Diplexor IF DC-2.5GHz, LO 5-20GHz	Pacific Millimeter Products	#15-Mar-2023	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	06-Jul-2022	24 months
E642	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	06-Dec-2022	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	10-Mar-2022	12 months
E755	N9030B	PXA Signal Analyser 3 Hz to 50 GHz	Keysight Technologies	03-Aug-2022	12 months
E856	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	06-Dec-2022	12 months
E904	5086-7805	Pre-Amplifier 1GHz - 26.5GHz	Hewlett Packard	#03-May 2023	12 months
LPE364	CBL6112A	Antenna BiLog 30MHz - 2GHz	Chase Electronics Ltd	28-Mar-2022	24 months
TMS78	3160-08	Horn Std Gain 12.4 - 18 GHz	ETS Systems	30-Sep-2022	12 months
TMS79	3160-09	Horn Std Gain 18 - 26.5 GHz	ETS Systems	25-May-2022	12 months
TMS81	6502	Antenna Active Loop	EMCO	22-Jul-2021	24 months

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

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	XT2173-3	Mobile Phone	Motorola	ZY22FCH44T

10.2 RN Electronics supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
P168	LT30-2	DC Power Supply	Farnell	None

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

The power setting for channel 26 only was reduced, from power setting 13 to 9, due to Peak Conducted RF Power test failure. All tests were carried out with the power settings stated in section 2.5 of this report.

12 Description of test sites

Site A Radio Laboratory and Anechoic Chamber

Site B Semi-Anechoic Chamber and Control Room
FCC Registration No. 293246, ISED Registration No. 5612A-4

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)

Site G Screened Room (Control Room for Site H)

Site H 3m Semi-Anechoic Chamber (indoor OATS)
FCC Registration No. 293246, ISED Registration No. 5612A-2, VCCI Registration No. 4065

Site J Transient Laboratory

Site K Screened Room (Control Room for Site M)

Site M 3m Semi-Anechoic Chamber (indoor OATS)
FCC Registration No. 293246, ISED Registration No. 5612A-3

Site N Radio Laboratory

Site Q Fully-Anechoic Chamber

Site OATS 3m and 10m Open Area Test Site
FCC Registration No. 293246, ISED Registration No. 5612A-1

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

RN Electronics CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002
RN Electronics CAB identifier as issued by FCC is UK0015

13 Abbreviations and units

%	Percent
λ	Wavelength
µA/m	microAmps per metre
µV	microVolts
µW	microWatts
AC	Alternating Current
ACK	ACKnowledgement
ACP	Adjacent Channel Power
AFA	Adaptive Frequency Agility
ALSE	Absorber Lined Screened Enclosure
AM	Amplitude Modulation
Amb	Ambient
ANSI	American National Standards Institute
ATPC	Automatic Transmit Power Control
AVG	Average
AWGN	Additive White Gaussian Noise
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BT	BlueTooth
BLE	BlueTooth Low Energy
BW	Bandwidth
ºC	Degrees Celsius
C/I	Carrier / Interferer
CAC	Channel Availability Check
CCA	Clear Channel Assessment
CEPT	European Conference of Postal and Telecommunications Administrations
CFR	Code of Federal Regulations
CISPR	Comité International Spécial des Perturbations Radioélectriques
cm	centimetre
COFDM	Coherent OFDM
COT	Channel Occupancy Time
CS	Channel Spacing
CW	Continuous Wave
DAA	Detect And Avoid
dB	deciBels
dBµA/m	deciBels relative to 1µA/m
dBµV	deciBels relative to 1µV
dBµV/m	deciBels relative to 1µV/m
dBc	deciBels relative to Carrier
dBd	deciBels relative to dipole gain
dBi	deciBels relative to isotropic gain
dBm	deciBels relative to 1mW
dBr	deciBels relative to a maximum value
dBW	deciBels relative to 1W
DC	Direct Current
DFS	Dynamic Frequency Selection
DMO	Dynamic Modulation Order
DSSS	Direct Sequence Spread Spectrum
DTA	Digital Transmission Analyser
EIRP	Equivalent Isotropic Radiated Power
emf	electromotive force
ERC	European Radiocommunications Committee
ERP	Effective Radiated Power
ETSI	European Telecommunications Standards Institute
EU	European Union
EUT	Equipment Under Test
FCC	Federal Communications Commission
FER	Frame Error Rate
FHSS	Frequency Hopping Spread Spectrum
FM	Frequency Modulation
FSK	Frequency Shift Keying
FSS	Fixed Satellite Service
g	Grams
GHz	GigaHertz
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
ISED	Innovation Science and Economic Development
ITU	International Telecommunications Union
KDB	Knowledge DataBase

kg	kilogram	pW	picoWatts
kHz	kiloHertz	QAM	Quadrature Amplitude Modulation
kPa	Kilopascal	QP	Quasi Peak
LBT	Listen Before Talk	QPSK	Quadrature Phase Shift Keying
LISN	Line Impedance Stabilisation Network	RBW	Resoution Band Width
LNA	Low Noise Amplifier	RED	Radio Equipment Directive
LNB	Low Noise Block	R&TTE	Radio and Telecommunication Terminal Equipment
LO	Local Oscillator	Ref	Reference
m	metre	RF	Radio Frequency
mA	milliAmps	RFC	Remote Frequency Control
max	maximum	RFID	Radio Frequency IDentification
Mbit/s	MegaBits per second	RLAN	Radio Local Area Network
MCS	Modulation and Coding Scheme	RMS	Root Mean Square
MHz	MegaHertz	RNSS	Radio Navigation Satellite Service
mic	Microphone	RSL	Received Signal Level
MIMO	Multiple Input, Multiple Output	RSSI	Received Signal Strength Indicator
min	minimum	RTP	Room Temperature and Pressure
mm	millimetres	RTPC	Remote Transmit Power Control
ms	milliseconds	Rx	Receiver
mW	milliWatts	s	Seconds
NA	Not Applicable	SINAD	Signal to Noise And Distortion
NFC	Near Field Communications	SRD	Short Range Device
nom	Nominal	Tx	Transmitter
nW	nanoWatt	UKAS	United Kingdom Accreditation Service
OATS	Open Area Test Site	UKCA	United Kingdom Conformity Assessed
OBW	Occupied Band Width	UKRER	United Kingdom Radio Equipment Regulations
OCW	Occupied Channel Width	UHF	Ultra High Frequency
OFDM	Orthogonal Frequency Division Multiplexing	U-NII	Unlicensed National Information Infrastructure
OOB	Out Of Band	USB	Universal Serial Bus
ppm	Parts per million	UWB	Ultra Wide Band
PER	Packet Error Rate	V	Volts
PK	Peak	V/m	Volts per metre
PMR	Private Mobile Radio	VBW	Video Band Width
PRBS	Pseudo Random Bit Sequence	VHF	Very High Frequency
PRF	Pulse Repitition Frequency	VSAT	Very Small Aperture Terminal
PSD	Power Spectral Density	W	Watts
PSU	Power Supply Unit		

====== END OF TEST REPORT ======