Radio Test Report

Sound Devices LLC

A20-SuperNexus

28303

47 CFR Part 15.247 Effective Date 1st October 2023
DSS: Part 15 Spread Spectrum Transmitter
Test Date: 9th April 2024 to 15th April 2024
Report Number: 04-14508-6-24 Issue 01

The testing was carried out by Kiwa Electrical Compliance, 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 14508-6

The equipment noted below has been fully tested by Kiwa Electrical Compliance 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:	A20-SuperNexus
Model Number:	28303
Unique Serial Number:	VZ0224036000 (AC Conducted emissions only) VZ0224036004 (all other tests)
Applicant:	Sound Devices LLC PO BOX 576 E7556 State Road 23 and 33 Reedsburg, Wisconsin 53959 USA
Proposed FCC ID	2AKLX-28303
Full measurement results are detailed in Report Number:	04-14508-6-24 Issue 01
Test Standards:	47 CFR Part 15.247 Effective Date 1st October 2023 DSS: Part 15 Spread Spectrum Transmitter

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 proprietary 2.4 GHz FHSS operation only.

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: 9th April 2024 to 15th April 2024

Test Engineer:
Graham Blake

Graham Blake
Digitally signed by: Graham Blake
DN: CN = Graham Blake email = graham.blake@kiwa.com C = GB OU = Kiwa Electrical Compliance
Date: 2024.07.17 12:54:39 Z

Approved By:
Radio Approvals Manager

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Date: 2024.07.17 12:41:19 Z

Customer Representative:

1 Contents

2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Sound Devices LLC PO BOX 576 E7556 State Road 23 and 33 Reedsburg Wisconsin 53959 USA	
Manufacturer of EUT	Sound Devices LLC	
Full Name of EUT	A20-SuperNexus	
Model Number of EUT	28303	
Serial Number of EUT	VZ0224036000 (AC Conducted emissions only) VZ0224036004 (all other tests)	
Date Received	2nd April 2024	
Date of Test:	9th April 2024 to 15th April 2024	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	17th July 2024	
Main Function	Multi-Channel Wireless Microphone Receiver	
Information Specification	Height	42 mm
	Width	446 mm
	Depth	310 mm
	Weight	4 kg
	Voltage	10-18 VDC
	Current	5A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Rack Mounted
Choice of model(s) for type tests	Engineering production sample
Antenna details	External
Antenna port	External
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2481.6 MHz
Lowest Signal generated in EUT	4 MHz
Hardware Version (HVIN)	28303
Software Version	Not Applicable
Firmware Version (FVIN)	v0.01
Type of Equipment	Multi Radio.
Technology Type	FHSS
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	2400.8 - 2481.6 MHz
EUT Declared Modulation Parameters	FHSS
EUT Declared Power level	<10dBm
EUT Declared Signal Bandwidths	203 kHz
EUT Declared Channel Spacing's	400 kHz
EUT Declared Duty Cycle	15 - 20% Maximum
Unmodulated carrier available?	No
Declared frequency stability	Not declared
RX Parameters	
Alignment range – receiver	2400.8 - 2481.6 MHz
EUT Declared RX Signal Bandwidth	203 kHz
FCC Parameters	
FCC Transmitter Class	DSS: Part 15 Spread Spectrum Transmitter

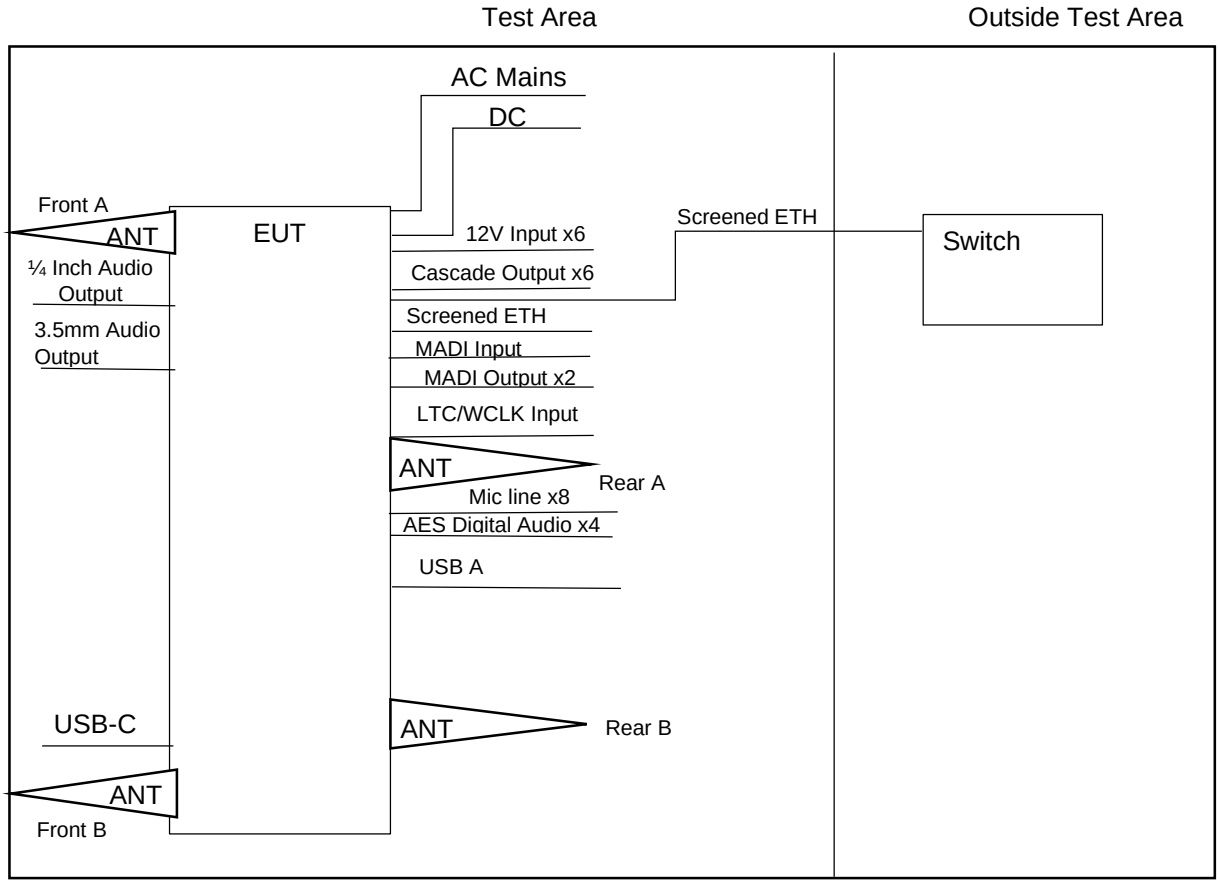
2.3 Functional description

The A20-SuperNexus is a professional 32-channel digital wireless microphone receiver intended for PSME (Professional Programme Making and Special Events) applications. It is compatible with A10-TX, A20-MINI, and A20-TX wireless microphone transmitters from Sound Devices. It has a very wide tuning range of 169-1525 MHz for accessing new wireless microphone spectrum allocations in Europe, Asia, Japan, United States and Canada. The receiver is intended for 19-inch rack mounting, and measures 1.75 inches (1U) in height. It includes Dante and Ethernet interfaces; USB-C, USB-A; x32 AES outputs; x32 Mic/Line analogue inputs; x3 MADI interfaces; x3 BNC diversity antenna inputs with 12V antenna powering and support for Smart antennas; antenna cascade outputs for looping through to other receivers; long-range proprietary 2.4 GHz wireless back-link ("NexLink") and Bluetooth LE for remote control of microphone transmitters; ¼-inch and 3.5 mm headphone jacks; OLED touchscreens and a built-in web server for setup, control, and monitoring via phone, tablet, or computer. The receiver is powered from 10-18V DC, or 100-240V AC mains, it will also support PoE+ powered peripherals from Sound Devices.

2.4 Modes of operation

Mode Reference	Description	Used for testing
TX LOW	Transmitting continuously at 2400.8 MHz with system modulation.	Yes
TX MID	Transmitting continuously at 2440.8 MHz with system modulation.	Yes
TX HIGH	Transmitting continuously at 2481.6 MHz with system modulation.	Yes
TX HOPPING	Transmitting whilst hopping across all channels with system modulation.	Yes

2.5 Emissions configuration



The EUT is primarily be powered from 120VAC 60Hz via the customers supplied mains lead but it also has a back power option via a 5 pin DC port at 12VDC. In an emissions pre-test the EUT was powered using each method to establish worst-case. For final test radiated emissions was performed using the 120VAC mains port.

The +12V inputs were terminated with a 60 Ohm DC loads, the Cascade outputs were terminated with 50 Ohm RF loads, the USB was unterminated, one Ethernet port was connected to a network switch, the MADI inputs and outputs were terminated with 75 Ohm loads, the LTC/WCLK Input was terminated with 75 Ohm load, the AES ports were terminated with 110 Ohm loads, the Mic/Line Analogue Audio ports were terminated with 600 Ohm loads, the 3.5 mm audio output was terminated with an 100 Ohm load and the ¼ Inch audio output was terminated with an 100 Ohm load.

For AC conducted emissions the EUT was tested powered from a 1 meter mains lead to test the AC port. To Test the DC port, the EUT was powered via a typical off the shelf AC/DC adaptor, detail of this can be found in section 10.2 of this report.

Prior to test the EUT was configured with engineering menus to allow permanent transmit modes of device on the top, middle and bottom channels as stated within section 2.4 of this report. The transmit test modes were set using the engineering mode provided within the unit. The transmit mode was 100% continuous. The power settings for each channel were as stated below:-

Low Channel (2400.8 MHz) = Power Setting:29 (Declared Maximum)
Mid Channel (2440.8 MHz) = Power Setting:29 (Declared Maximum)
High Channel (2481.6 MHz) = Power Setting:29 (Declared Maximum)

The EUT has 4 RF ports. The engineering firmware allowed only one RF port to be selected at any one time. Where appropriate all ports have been assessed. For radiated emissions tests a pre-test was performed to determine the worst-case port. There was no perceivable difference between the ports and therefore for full test the RF port with the highest output power was used (Port Rear B).

For FHSS tests, a companion unit was provided by the applicant which was used to establish a communications link with the EUT. Once paired with the EUT the test unit was configured into hopping mode. Once frequency hopping was established between the units, measurements were made directly at the EUTs RF port.

Port Name	Cable Type	Connected
AC Mains	3 Core	Yes
DC	2 Core	Yes
Antenna Front A	SMA Coax	Yes
Antenna Front B	SMA Coax	Yes
Antenna Rear A	SMA Coax	Yes
Antenna Rear B	SMA Coax	Yes
A1+12V Input	BNC 50 Ohm Coax	Yes
A2+12V Input	BNC 50 Ohm Coax	Yes
A3+12V Input	BNC 50 Ohm Coax	Yes
B1+12V Input	BNC 50 Ohm Coax	Yes
B2+12V Input	BNC 50 Ohm Coax	Yes
B3+12V Input	BNC 50 Ohm Coax	Yes
A1 Cascade Output	BNC 50 Ohm Coax	Yes
A2 Cascade Output	BNC 50 Ohm Coax	Yes
A3 Cascade Output	BNC 50 Ohm Coax	Yes
B1 Cascade Output	BNC 50 Ohm Coax	Yes
B2 Cascade Output	BNC 50 Ohm Coax	Yes
B3 Cascade Output	BNC 50 Ohm Coax	Yes
Eth 1 POE Output	Screened	Yes
Eth 2	Screened	Yes
Optical 1	Fibre	No
Optical 2	Fibre	No
MADI Input	BNC 75 Ohm Coax	Yes
MADI Output 1	BNC 75 Ohm Coax	Yes
MADI Output 2	BNC 75 Ohm Coax	Yes
LTC/WCLK Input	BNC 75 Ohm Coax	Yes
AES 1-8 Digital Audio	Eth	Yes
AES 9-16 Digital Audio	Eth	Yes
AES 17-24 Digital Audio	Eth	Yes
AES 25-32 Digital Audio	Eth	Yes
Mic/Line 1-4 Analogue Audio	Eth	Yes
Mic/Line 5-8 Analogue Audio	Eth	Yes
Mic/Line 9-12 Analogue Audio	Eth	Yes
Mic/Line 13-16 Analogue Audio	Eth	Yes
Mic/Line 17-20 Analogue Audio	Eth	Yes
Mic/Line 21-24 Analogue Audio	Eth	Yes
Mic/Line 25-28 Analogue Audio	Eth	Yes
Mic/Line 29-32 Analogue Audio	Eth	Yes
3.5 mm audio output	Audio Lead	Yes
¼ Inch audio output	Audio Lead	Yes
USB-A	USB	Yes
USB-C	USB	Yes
USB-A	For Engineering use only	No

3 Summary of test results

The A20-SuperNexus was tested for compliance to the following standard:

47 CFR Part 15.247 Effective Date 1st October 2023
DSS: Part 15 Spread Spectrum Transmitter

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	PASSED
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[1]
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)(1)	PASSED
9. Maximum Average conducted output power	47 CFR Part 15C Part 15.247(b3)	NOT APPLICABLE[5]
10. Maximum Peak conducted output power	47 CFR Part 15C Part 15.247(b)(1)	PASSED
11. Maximum Power Spectral Density	47 CFR Part 15C Part 15.247(e)	NOT APPLICABLE[4]
12. Antenna power conducted emissions	47 CFR Part 15C Part 15.247(d)	NOT APPLICABLE[2]
13. Duty cycle	47 CFR Part 15C Part 15.35(c)	NOT APPLICABLE[3]
14. FHSS carrier frequency separation	47 CFR Part 15C Part 15.247(a1)	PASSED
15. Average time of occupancy	47 CFR Part 15C Part 15.247(a)(iii)	PASSED
16. Number of Hop Channels	47 CFR Part 15C Part 15.247(a)(iii)	PASSED

[1] Spectrum investigated up to a frequency of 25GHz based on 10 times the highest channel/ signal generated in equipment of 2481.6MHz.

[2] The EUT was tested for radiated emissions with its dedicated antenna in position.

[3] No limits apply.

[4] EUT uses FHSS technology and is therefore not applicable to this test.

[5] Peak conducted power has been measured instead.

4 Specifications

The tests were performed and operated in accordance with Kiwa Electrical Compliance procedures and the relevant standards listed below.

4.1 Relevant standards

Ref.	Standard Number	Version	Description
4.1.1	47 CFR Part 15C	2023	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.

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 placed on a wooden table 0.8m above the ground plane and 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.

Initially the EUT was tested whilst powered using a mains power source. The test was repeated with the EUT powered using an external DC power supply.

In a pre-test all modes were evaluated to determine worst-case, however there was no discernible difference between modes and therefore for final test TX Mid mode was used.

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, TMS937, TMS938

See Section 9 for more details

5.1.5 Test results

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

Mains powered

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

Plot refs
14508-6 Cond 1 AC Live 150k-30M Average
14508-6 Cond 1 AC Live 150k-30M Quasi-Peak
14508-6 Cond 1 AC Neutral 150k-30M Average
14508-6 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	0.224	45.7	44.8	-17.9	35.9	-16.8
2	0.266	49.4	48.6	-12.6	39.8	-11.4
3	0.334	43.2	41.7	-17.7	31.5	-17.9
4	0.442	51.1	49.2	-7.8	39.6	-7.4
5	0.619	42.3	40.8	-15.2	29.4	-16.6
6	0.794	36.3	34.5	-21.5	22.3	-23.7
7	0.796	36.4	34.4	-21.6	22.5	-23.5

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	0.219	45.9	44.7	-18.2	35.5	-17.4
2	0.268	50.0	48.7	-12.5	39.3	-11.9
3	0.328	43.6	41.8	-17.7	30.3	-19.2
4	0.450	50.3	48.6	-8.3	40.4	-6.5
5	0.608	44.7	41.7	-14.3	31.6	-14.4
6	0.774	37.4	35.0	-21.0	24.5	-21.5

DC Powered

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

Plot refs
14508-6 Cond 2 AC Live 150k-30M Average
14508-6 Cond 2 AC Live 150k-30M Quasi-Peak
14508-6 Cond 2 AC Neutral 150k-30M Average
14508-6 Cond 2 AC Neutral 150k-30M Quasi-Peak

Table of signals measured for Cond 1 DC Positive 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.169	46.4	39.3	-25.7	15.6	-39.4
2	0.175	45.6	38.7	-26.0	15.0	-39.7
3	0.190	44.7	37.6	-26.4	14.1	-39.9
4	0.298	42.1	35.2	-25.1	12.8	-37.5
5	0.354	40.2	33.7	-25.2	12.0	-36.9
6	0.641	41.8	34.9	-21.1	9.3	-36.7

Table of signals measured for Cond 1 DC Negative 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.173	46.5	39.5	-25.3	15.3	-39.5
2	0.197	44.9	38.0	-25.7	14.0	-39.7
3	0.337	42.8	36.9	-22.4	14.2	-35.1
4	0.617	41.5	34.6	-21.4	10.1	-35.9
5	0.698	38.5	31.5	-24.5	8.4	-37.6
6	0.738	35.5	28.6	-27.4	7.3	-38.7

No discernible difference was noted in emissions between channels (exploratory measurements); therefore the final measurements are presented for TX mid channel mode only.

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.

Note: The manufacturer has stated that the EUT is generally a mains powered product, however provision has been made to allow for a battery to be connected to the DC port as a backup supply. The EUT has also been tested whilst powered using the DC port along with a 12V 10 Amp power supply.

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

5.2.1 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]

5.2.2 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 assessed in its normal use position. Radiated Emissions testing was performed whilst powered using a 120VAC 60Hz power source. In a pre-test all modes were evaluated to determine worst-case, however there was no discernible difference between modes and therefore for final test TX Mid mode was used.

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 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.

5.2.4 Test equipment

TMS81, ZSW1, E624, E411

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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

Plot refs
14508-6 Rad 1 9k-150kHz Para
14508-6 Rad 1 9k-150kHz Perp

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

No emissions were 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 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

5.3 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 assessed in its normal use position. Radiated Emissions testing was performed whilst powered using a 120VAC 60Hz power source. In a pre-test all modes were evaluated to determine worst-case, however there was no discernible difference between modes and therefore for final test TX Mid mode was used.

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

TMS81, ZSW1, E624, E411

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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

Plot refs
14508-6 Rad 1 150k-30MHz Para
14508-6 Rad 1 150k-30MHz Perp

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

No emissions were 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 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 assessed in its normal use position. Radiated Emissions testing was performed whilst powered using a 120VAC 60Hz power source. In a pre-test all modes were evaluated to determine worst-case, however there was no discernible difference between modes and therefore for final test TX Mid mode was used.

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

LPE364, E743, NSA-M, ZSW1, E624, E411

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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

Plot refs
14508-6 Rad 1 VHF Horiz
14508-6 Rad 1 VHF Vert
14508-6 Rad 1 UHF Horiz
14508-6 Rad 1 UHF Vert

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	99.999	31.4	28.8	-14.7
2	124.999	31.2	28.2	-15.3
3	140.878	33.6	28.7	-14.8
4	151.706	26.3	20.2	-23.3
5	199.999	27.6	25.1	-18.4
6	500.002	40.3	38.1	-7.9
7	625.008	37.3	33.3	-12.7
8	875.008	36.7	33.0	-13.0

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	44.544	27.4	23.5	-16.5
2	47.617	24.3	19.8	-20.2
3	56.832	23.7	21.0	-19.0
4	99.999	34.8	33.6	-9.9
5	124.999	32.0	29.8	-13.7
6	141.013	29.0	23.7	-19.8
7	199.999	25.1	21.1	-22.4
8	500.001	37.0	33.3	-12.7
9	625.002	39.3	36.4	-9.6

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.

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 assessed in its normal use position. Radiated Emissions testing was performed whilst powered using a 120VAC 60Hz power source. In a pre-test all modes were evaluated to determine worst-case, however there was no discernible difference between modes and therefore for final test TX Mid mode was used.

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 - 25GHz.

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

Tests were performed using Test Site M and B.

5.5.4 Test equipment

E136, E411, E428, E624, E642, E856, TMS78, TMS79, TMS82

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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Mid channel	2440.8 MHz

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
2500	46.6	-27.4	40.9	-13.1	Normal use	Horizontal
16120	45.9	-28.1	39.8	-14.2	Normal use	Vertical

Plots
14508-6 Rad 1 1-2GHz Horiz
14508-6 Rad 1 1-2GHz Vert
14508-6 Rad 1 2-2.7GHz Horiz
14508-6 Rad 1 2-2.7GHz Vert
14508-6 Rad 1 2.7-5.15GHz Horiz
14508-6 Rad 1 2.7-5.15GHz Vert
14508-6 Rad 1 5.15-6GHz Horiz
14508-6 Rad 1 5.15-6GHz Vert
14508-6 Rad 1 6upto7.77GHz Horiz
14508-6 Rad 1 6upto7.77GHz Vert
14508-6 Rad 1 7.77upto10GHz Horiz
14508-6 Rad 1 7.77upto10GHz Vert
14508-6 Rad 1 10upto12_5GHz Horiz
14508-6 Rad 1 10upto12_5GHz Vert
14508-6 Rad 1 12.5-15GHz Horiz
14508-6 Rad 1 12.5-15GHz Vert
14508-6 Rad 1 15-18GHz Horiz
14508-6 Rad 1 15-18GHz Vert
14508-6 Rad 1 18-22GHz Horiz
14508-6 Rad 1 18-22GHz Vert
14508-6 Rad 1 22-25GHz Horiz
14508-6 Rad 1 22-25GHz Vert

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.

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 – 25 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 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 assessed in its normal use position.

The EUT was operated in TX LOW, TX MID and TX HIGH 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 M.

5.6.4 Test equipment

E136, E313, E411, E624, TMS82

See Section 9 for more details

5.6.5 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	Setting 29 (Front A)
Channel Spacing	400 kHz
Mod Scheme	FHSS MHz
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	102.4	99.1	101.7
Plot reference	14508-6 ERP Front A LOW HORIZ	14508-6 ERP Front A MID Vert	14508-6 ERP Front A HIGH Vert
Antenna Polarisation	Horiz	Vert	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Setting 29 (Front B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	98.5	97.0	102.2
Plot reference	14508-6 ERP Front B LOW HORIZ	14508-6 ERP Front B MID HORIZ	14508-6 ERP Front B HIGH Vert
Antenna Polarisation	Horiz	Horiz	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	100.8	99.8	102.2
Plot reference	14508-6 ERP Rear A LOW VERT	14508-6 ERP Rear A MID Vert	14508-6 ERP Rear A HIGH Vert
Antenna Polarisation	Vert	Vert	Vert
EUT Polarisation	Upright	Upright	Upright

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
Peak Level (dBµV/m)	104.2	102.4	102.6
Plot reference	14508-6 ERP Rear B LOW Vert	14508-6 ERP Rear B MID Vert	14508-6 ERP Rear B HIGH Vert
Antenna Polarisation	Vert	Vert	Vert
EUT Polarisation	Upright	Upright	Upright

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

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

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 TX LOW, TX HIGH and TX HOPPING modes.

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. Due to the influence of high in-band signals when using the specified resolution bandwidth the Marker Delta method was employed for the restricted band edge tests as per ANSI C63.10 Clause 6.10.6.

Tests were performed using Test Site M.

5.7.4 Test equipment

E136, E411, E624, TMS82

See Section 9 for more details

5.7.5 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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
High channel	2481.6 MHz

Restricted Band Edges	Low channel	High channel
Restricted Peak Level measured (dBuV/m)	40.0	60.8
Restricted band edge Peak Plot	Restricted Band Edge Rear B LOW	Restricted Band Edge Rear B HIGH PK
Restricted Average Level measured (dBuV/m)	Peak complies with average limit	53.5
Restricted band edge Average Plot	Not applicable	Restricted Band Edge Rear B HIGH 3 Restricted Band Edge Rear B HIGH 2

Authorised Band Edges	Low channel	High channel
Authorised Band Edge (dBc) value measured	51.8	59
Authorised Band Edge Plot	Authorised Band Edge Rear B LOW	Authorised Band Edge Rear B HIGH
Authorised Band Edge (dBc) Hopping value measured	41.6	56.9
Authorised Band Edge Hopping Plot	Authorised Band Edge Rear B Hopping LOW	Authorised Band Edge Rear B Hopping HIGH

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.

Delta Marker method used due to the influence of high in band signal at band edge.

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)(1)(i)
Test Method:	ANSI C63.10 Clause 6.9 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.215(c)/ 15.247(a)(1)(i) [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 RF port. The EUT was operated in TX LOW, TX MID and TX HIGH modes.

5.8.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 6kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 20dB bandwidth.

Tests were performed using Test Site A.

5.8.4 Test equipment

E301, E517, E755

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	Setting 29 (Front A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.2322	0.2331	0.2315
Plot for 20 dB Bandwidth Result	14508-6 OBW Front A LOW	14508-6 OBW Front A MID	14508-6 OBW Front A HIGH
99 % Bandwidth Result (MHz)	0.2088	0.209	0.209
Frequency Error (kHz)	0.141	0.394	0.325
Operating frequency (MHz)	2400.8	2440.8	2481.6
20 dB FLOW Worst case (MHz)	2400.684	2440.684	2481.484
20 dB FHIGH Worst case (MHz)	2400.916	2440.917	2481.716

Band	2400-2483.5 MHz
Power Level	Setting 29 (Front B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.2338	0.2352	0.2333
Plot for 20 dB Bandwidth Result	14508-6 OBW Front B LOW	14508-6 OBW Front B MID	14508-6 OBW Front B HIGH
99 % Bandwidth Result (MHz)	0.2088	0.2092	0.2086
Frequency Error (kHz)	0.289	0.604	0.265
Operating frequency (MHz)	2400.8	2440.8	2481.6
20 dB FLOW Worst case (MHz)	2400.683	2440.684	2481.484
20 dB FHIGH Worst case (MHz)	2400.917	2440.917	2481.717

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.2335	0.2335	0.2313
Plot for 20 dB Bandwidth Result	14508-6 OBW Rear A LOW	14508-6 OBW Rear A MID	14508-6 OBW Rear A HIGH
99 % Bandwidth Result (MHz)	0.2088	0.2087	0.2091
Frequency Error (kHz)	0.473	0.341	0.501
Operating frequency (MHz)	2400.8	2440.8	2481.6
20 dB FLOW Worst case (MHz)	2400.683	2440.684	2481.485
20 dB FHIGH Worst case (MHz)	2400.917	2440.917	2481.716

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

	Low channel	Mid channel	High channel
20 dB Bandwidth Result (MHz)	0.2326	0.233	0.2349
Plot for 20 dB Bandwidth Result	14508-6 OBW Rear B LOW	14508-6 OBW Rear B MID	14508-6 OBW Rear B HIGH
99 % Bandwidth Result (MHz)	0.2087	0.2088	0.2088
Frequency Error (kHz)	0.311	0.467	0.348
Operating frequency (MHz)	2400.8	2440.8	2481.6
20 dB FLOW Worst case (MHz)	2400.684	2440.684	2481.484
20 dB FHIGH Worst case (MHz)	2400.917	2440.915	2481.717

Analyser plots for the 20dB bandwidth can be found in Section 6 of this report.

LIMITS:
15.215(c) The 20dB bandwidth of the emission must be contained within the designated frequency band.
15.247(a)(1)(i) The maximum allowed 20dB bandwidth of the hopping channel is 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 has been measured instead.

5.10 Maximum Peak conducted output power

5.10.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.247(b)(1) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.247(b)(1) [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 RF ports.
The EUT was operated in TX LOW, TX MID and TX HIGH modes 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 > 20dB BW of the EUT.

Measurements were made on a test bench in site A.

5.10.4 Test equipment

E301, E517, E755

See Section 9 for more details

5.10.5 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	Setting 29 (Front A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

Nominal voltage result (dBm)	4.95	3.72	6.05
Single port Plot reference	14508-6 Peak conducted power - Port Front A LOW	14508-6 Peak conducted power - Port Front A MID	14508-6 Peak conducted power - Port Front A HIGH
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	4.95	3.72	6.05
Margin to Limit (dB)	-25.05	-26.28	-23.95
Result in (W)	0.003	0.002	0.004

Band	2400-2483.5 MHz
Power Level	Setting 29 (Front B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

Nominal voltage result (dBm)	5.26	3.89	6.24
Single port Plot reference	14508-6 Peak conducted power - Port Front B LOW	14508-6 Peak conducted power - Port Front B MID	14508-6 Peak conducted power - Port Front B HIGH
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	5.26	3.89	6.24
Margin to Limit (dB)	-24.74	-26.11	-23.76
Result in (W)	0.003	0.002	0.004

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

Nominal voltage result (dBm)	6.32	5.51	7.25
Single port Plot reference	14508-6 Peak conducted power - Port Rear A LOW	14508-6 Peak conducted power - Port Rear A MID	14508-6 Peak conducted power - Port Rear A HIGH
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.32	5.51	7.25
Margin to Limit (dB)	-23.68	-24.49	-22.75
Result in (W)	0.004	0.004	0.005

Band	2400-2483.5 MHz
Power Level	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz
Mid channel	2440.8 MHz
High channel	2481.6 MHz

Nominal voltage result (dBm)	6.42	5.71	7.24
Single port Plot reference	14508-6 Peak conducted power - Port Rear B LOW	14508-6 Peak conducted power - Port Rear B MID	14508-6 Peak conducted power - Port Rear B HIGH
Limit in dBm	30.00	30.00	30.00
Maximum result (dBm)	6.42	5.71	7.24
Margin to Limit (dB)	-23.58	-24.29	-22.76
Result in (W)	0.004	0.004	0.005

LIMITS:
15.247(b)(1)
For FHSS operating 2400-2483.5 MHz employing at least 75 channels 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

NOT APPLICABLE: EUT uses FHSS technology and is therefore not applicable to this test.

5.12 Antenna power conducted emissions

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NOT APPLICABLE: The EUT was tested for radiated emissions with its dedicated antenna in position.

5.13 Duty cycle

NOT APPLICABLE: No limits apply.

5.14 FHSS carrier frequency separation

5.14.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.247(a1) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 7.8 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.247(a1) [Reference 4.1.1 of this report]

5.14.2 Configuration of EUT

The EUT was tested on the bench and ambient conditions were monitored. The EUT was operated in TX HOPPING mode.

5.14.3 Test procedure

Tests were made using the measuring equipment listed in the 'Test Equipment' Section. With the EUT hopping, a span was set on the spectrum analyser to show two adjacent channel peaks. The analyser was set to Peak detector and a max held trace, the trace was allowed enough sweeps to stabilise.

Tests were performed in test site A.

5.14.4 Test equipment

E301, E517, E755

See Section 9 for more details

5.14.5 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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Channel	Hopping

	Low channel
Separation (kHz)	400
Plot of Separation (kHz)	14508-6 Channel Separation - Hopping

Analyser plots for the carrier separation can be found in Section 6 of this report

LIMITS:
FHSS shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

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 %

5.15 Average time of occupancy

5.15.1 Test methods

Test Requirements:	47 CFR Part 15C Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]
Test Method:	ANSI C63.10 Clause 7.8 [Reference 4.1.2 of this report]
Limits:	47 CFR Part 15C Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]

5.15.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the RF port. Ambient conditions were monitored. The EUT was operated in TX HOPPING mode for this test.

5.15.3 Test procedure

Tests were made using the measuring equipment listed in the 'Test Equipment' Section. The EUT was set into hopping mode. A spectrum analyser was set to zero span and a suitable sweep was used. Accumulated TX time was then calculated from the captured data using markers. The test was repeated several times to ensure compliance was met. The worst-case result has been recorded in this report.

Tests were performed in test site A.

5.15.4 Test equipment

E301, E755

See Section 9 for more details

5.15.5 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	Setting 29 (Rear A)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Channel	Hopping

Maximum accumulated occupation period	387.2 milliseconds
Observation period (number of hopping channels x 0.4 seconds)	78.8 seconds
Period time (s)	14508-6 Occupancy plot 1

An analyser plot showing maximum occupation time can be found in Section 6 of this report.

LIMITS:
FHSS operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

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:
2.57 ms

5.16 Number of Hop Channels

5.16.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 7.8 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.247(a)(1)(iii) [Reference 4.1.1 of this report]

5.16.2 Configuration of EUT

The EUT was measured on a bench using a spectrum analyser connected to the RF port. Ambient conditions were monitored. The EUT was operated in TX HOPPING mode for this test.

5.16.3 Test procedure

Tests were made using the measuring equipment noted in the 'Test Equipment' Section at Site A. With the EUT hopping, a suitable span was set on the spectrum analyser to show clearly over a range of plots the number of channels being used by the EUT. The analyser was set to Peak detector and max held and the trace was allowed to stabilise for each plot.

5.16.4 Test equipment

E301, E517, E755

See Section 9 for more details

5.16.5 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	Setting 29 (Rear B)
Channel Spacing	400 kHz
Mod Scheme	FHSS
Low channel	2400.8 MHz

No of hopping Channels	197
Minimum No. Required number by specification	15
Plot of Hopping Channels 1-47	14508-6 Number of hopping channels - Plot 1
Plot of Hopping Channels 48-96	14508-6 Number of hopping channels - Plot 2
Plot of Hopping Channels 97-146	14508-6 Number of hopping channels - Plot 3
Plot of Hopping Channels 147-197	14508-6 Number of hopping channels - Plot 4

Note: Applicant declares that 6 channels are missing from the hopping sequence.

Analyser plots showing the number of hopping channels can be found in Section 6 of this report.

LIMITS:
FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

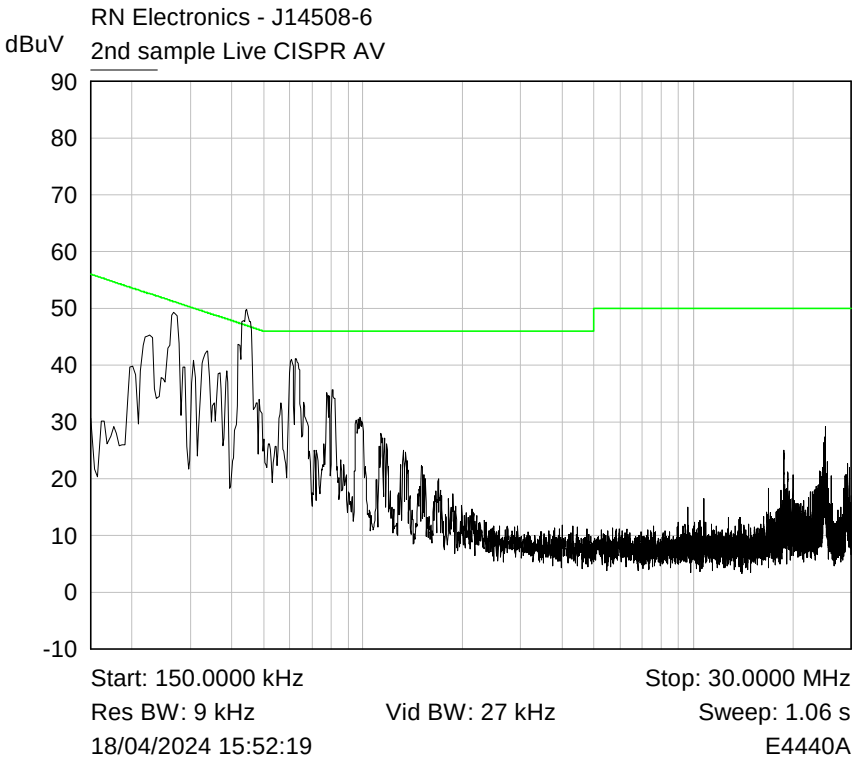
These results show that the EUT has PASSED this test.

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

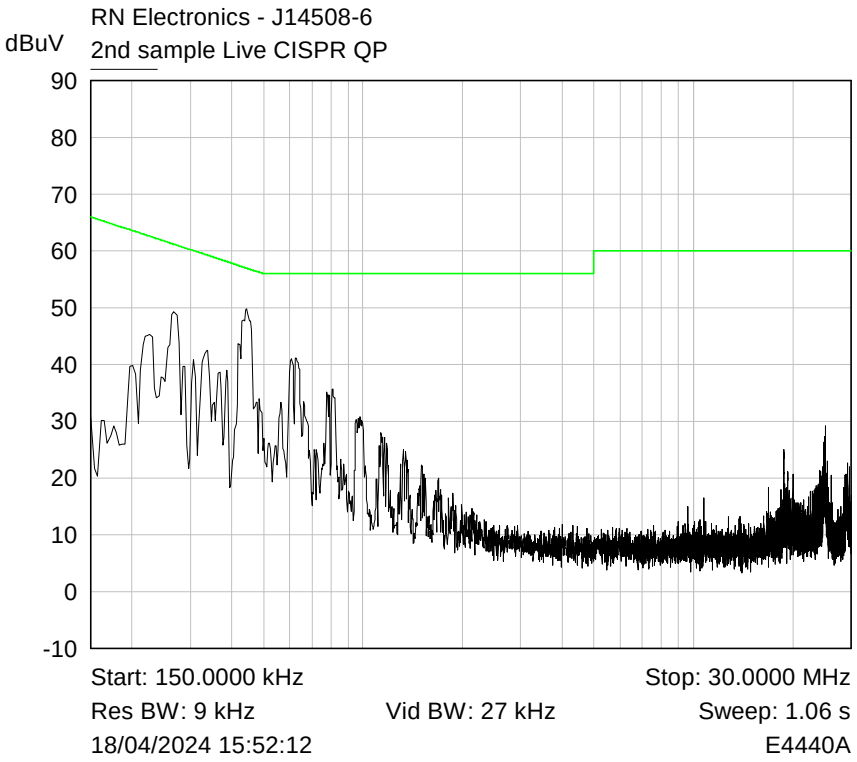
6 Plots/Graphical results

6.1 AC power line conducted emissions

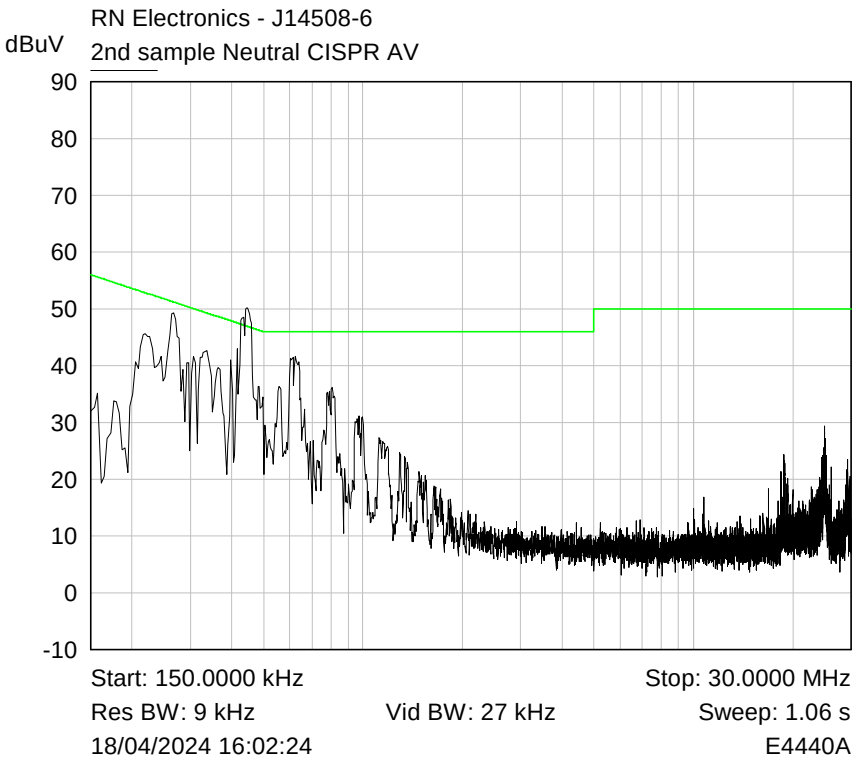
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



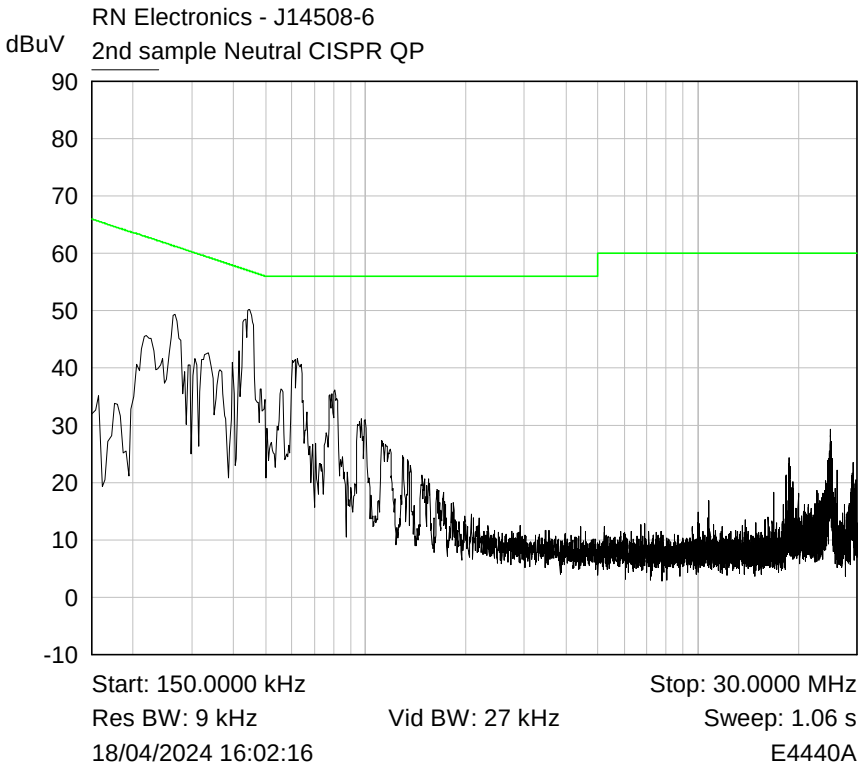
Plot of Live150k-30M Average



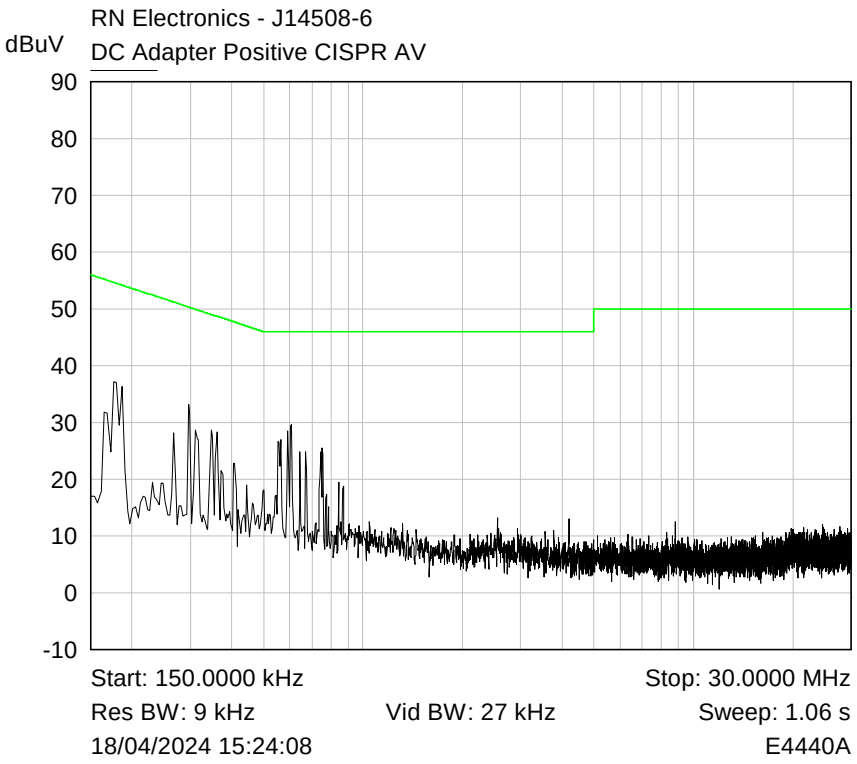
Plot of Live150k-30M Quasi-Peak



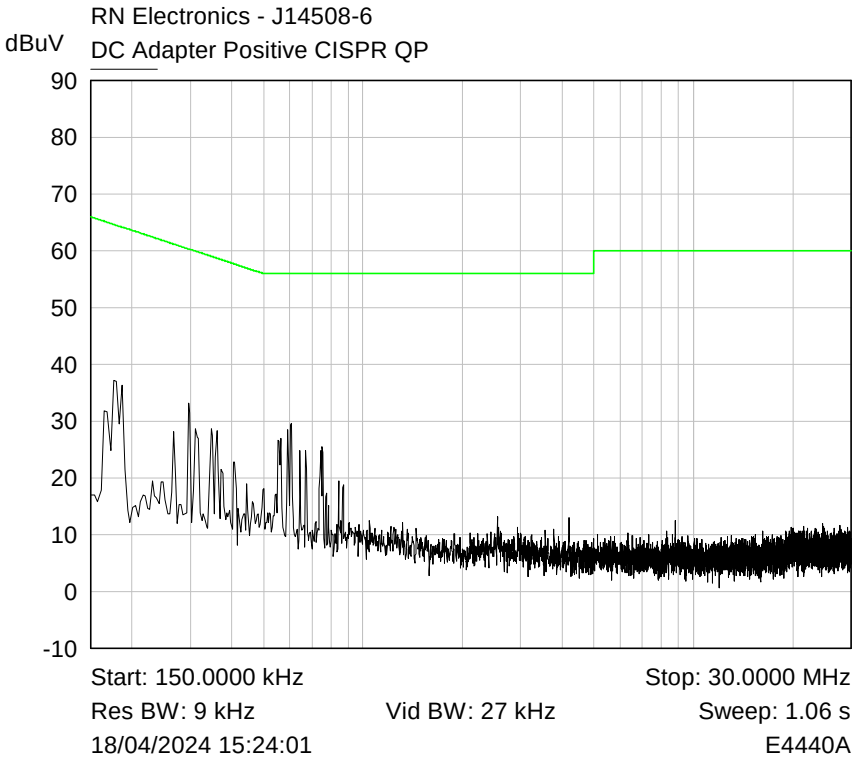
Plot of Neutral150k-30M Average



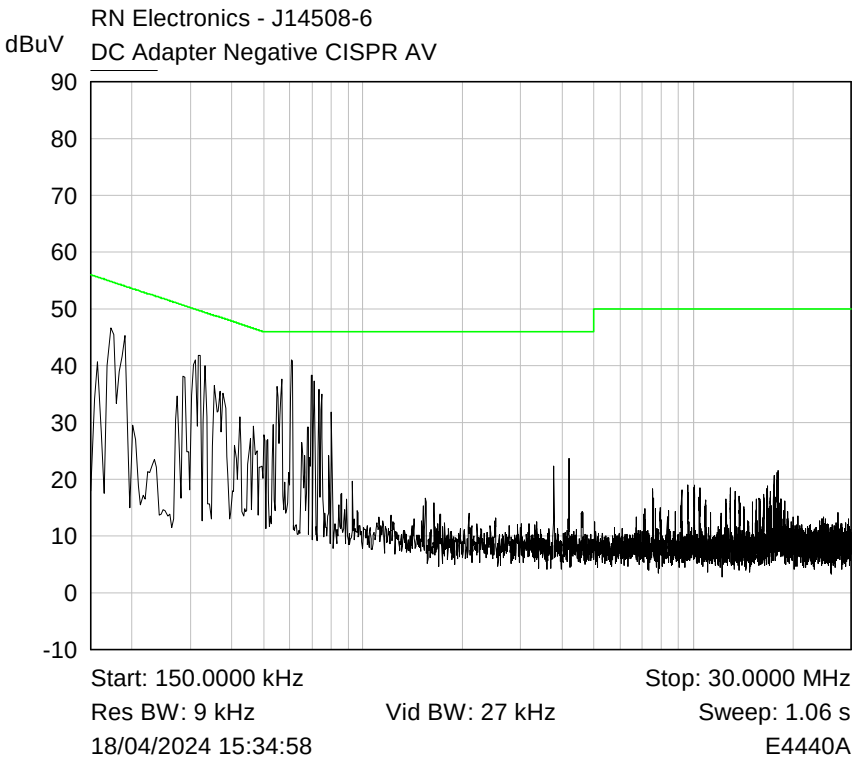
Plot of Neutral150k-30M Quasi-Peak



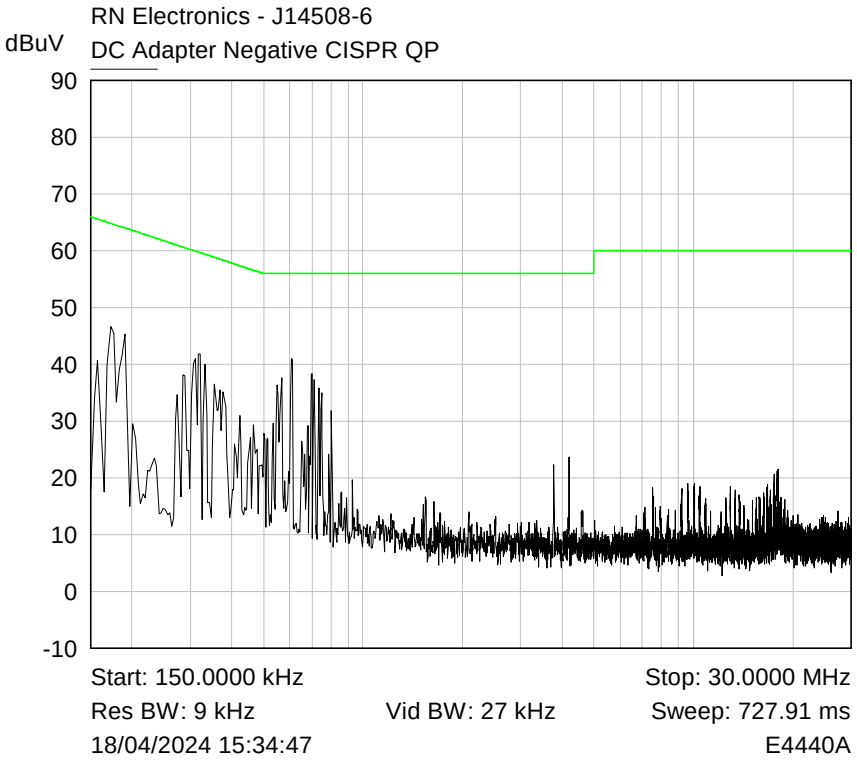
Plot of DC Positive 150k-30M Average



Plot of DC Positive 150k-30M Quasi-Peak



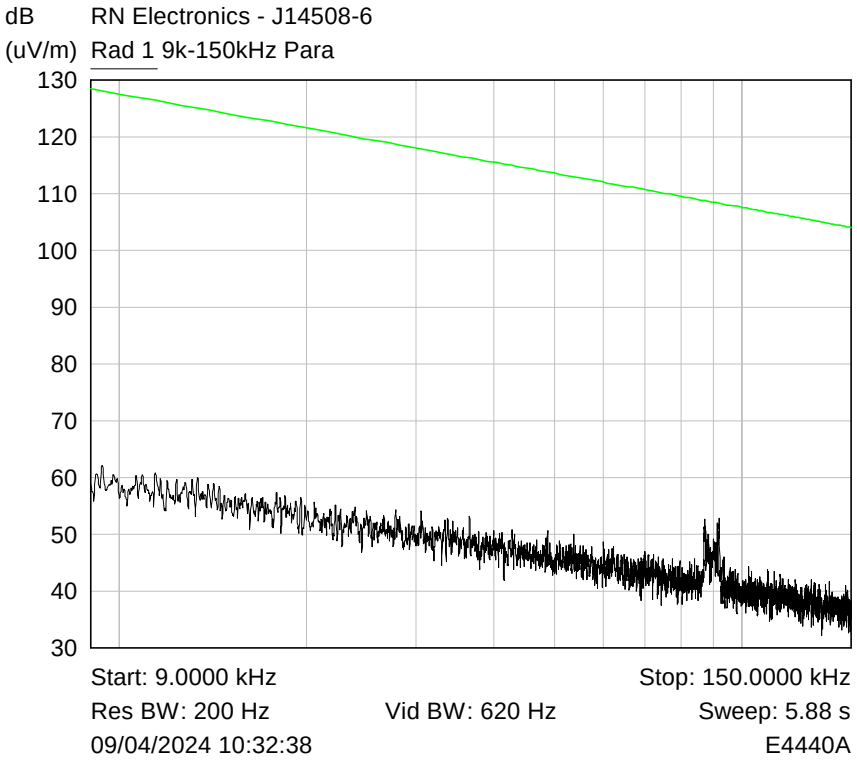
Plot of DC Negative 150k-30M Average



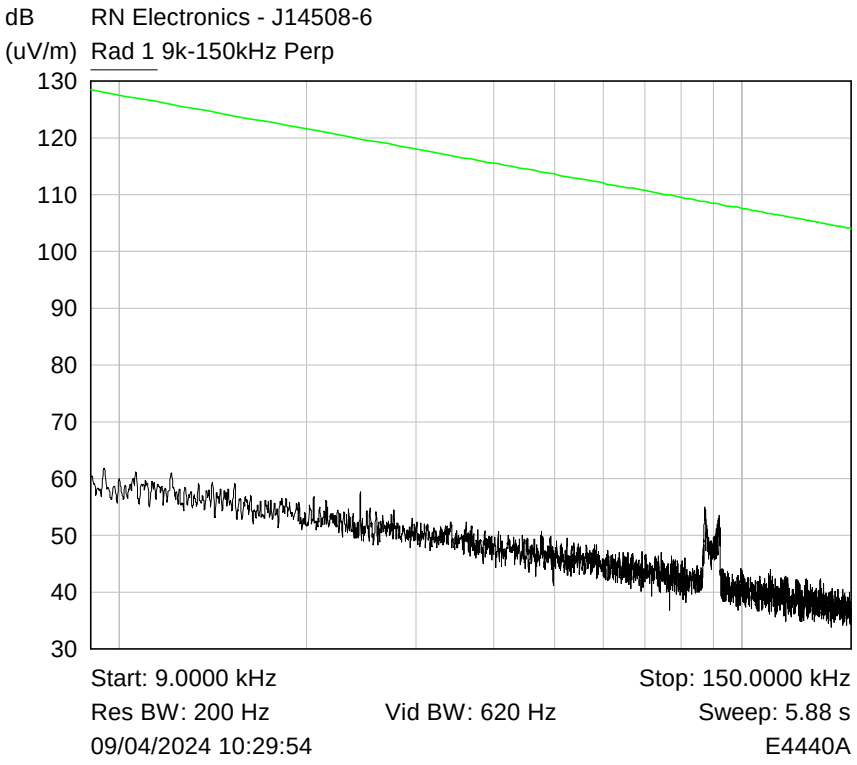
Plot of DC Negative 150k-30M Quasi-Peak

6.2 Radiated emissions 9 - 150 kHz

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



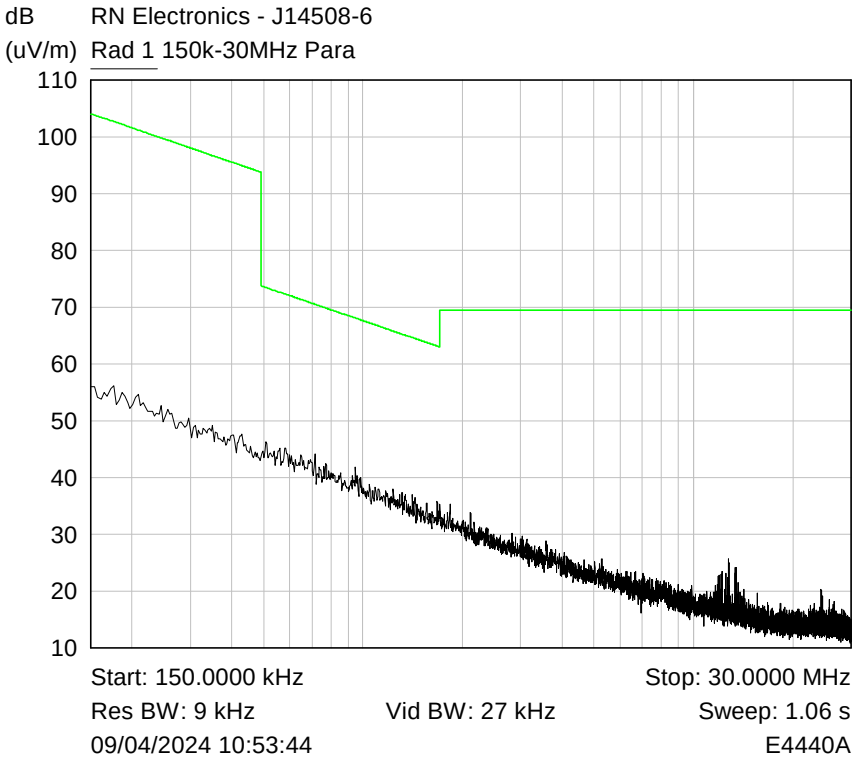
Plot of 9k-150kHz Parallel



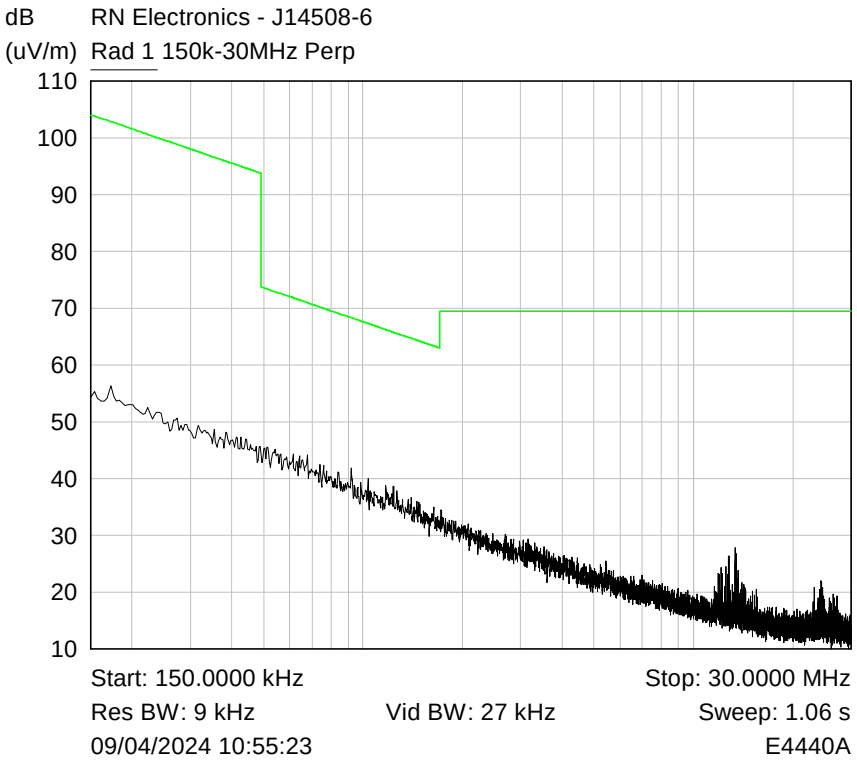
Plot of 9k-150kHz Perpendicular

6.3 Radiated emissions 150 kHz - 30 MHz

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



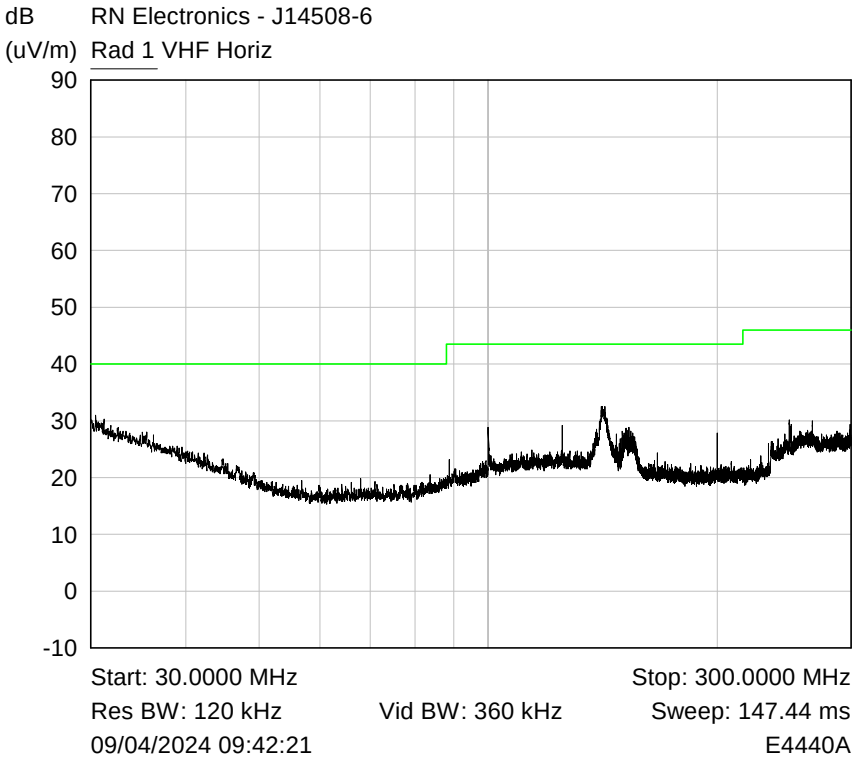
Plot of 150kHz-30MHz Parallel



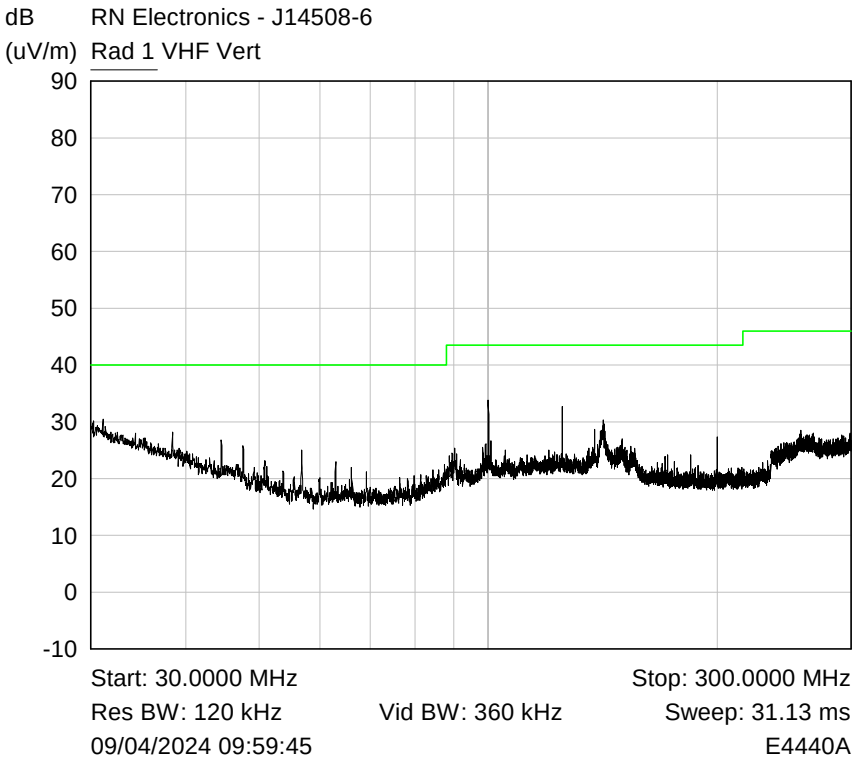
Plot of 150kHz-30MHz Perpendicular

6.4 Radiated emissions 30 MHz -1 GHz

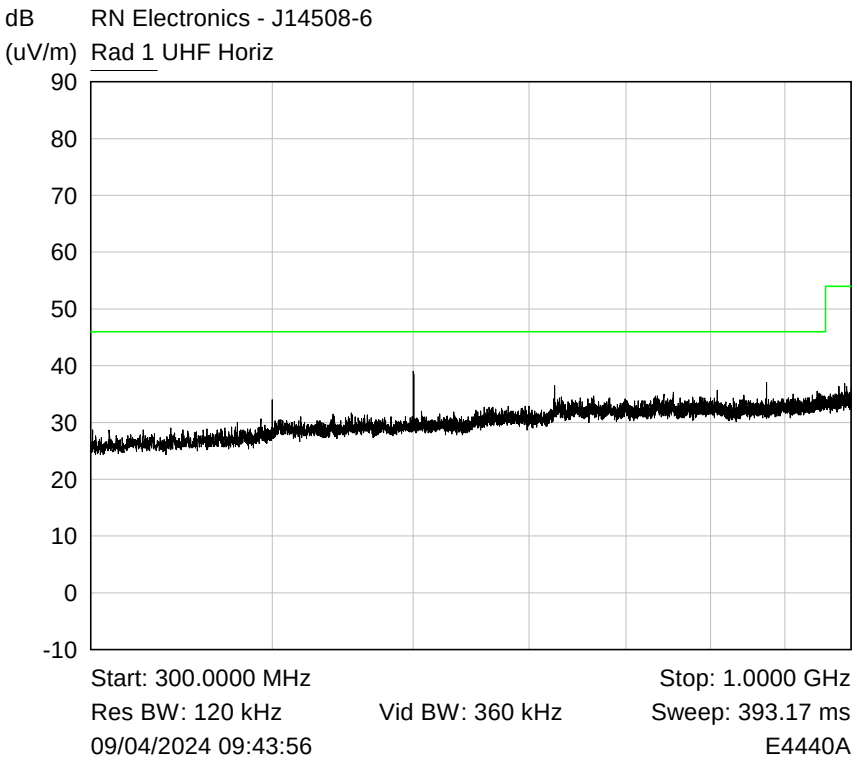
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



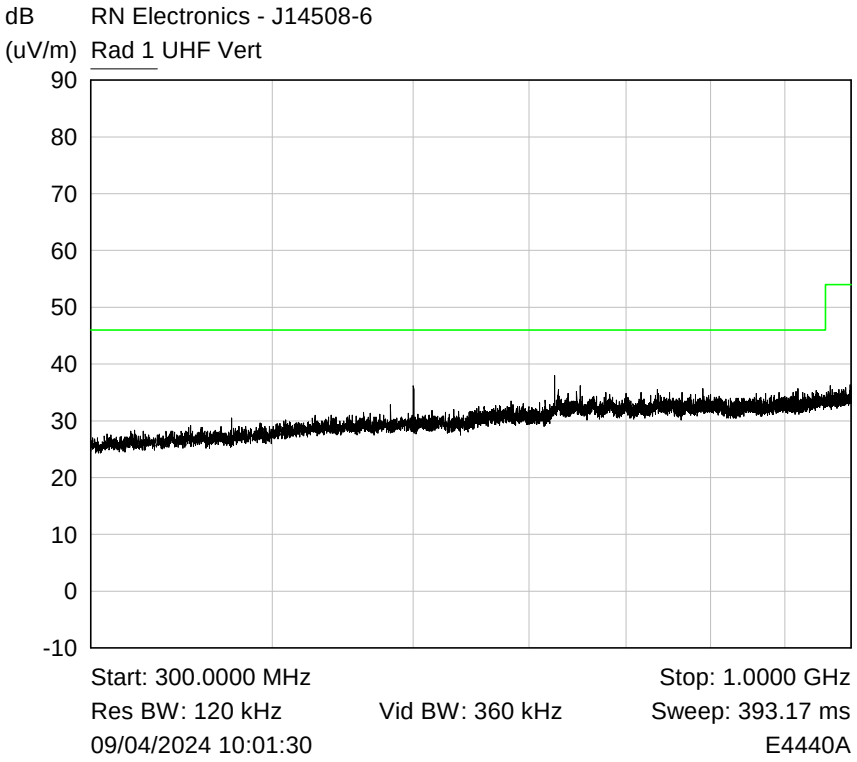
Plot of Peak emissions for VHF Horizontal against the QP limit line.



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



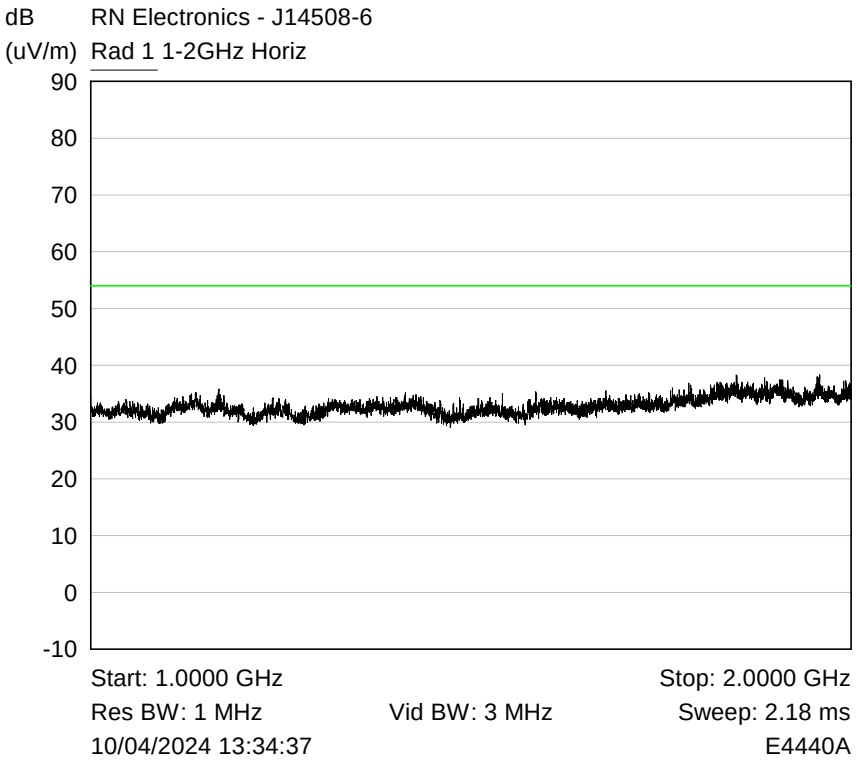
Plot of Peak emissions for UHF Horizontal against the QP limit line.

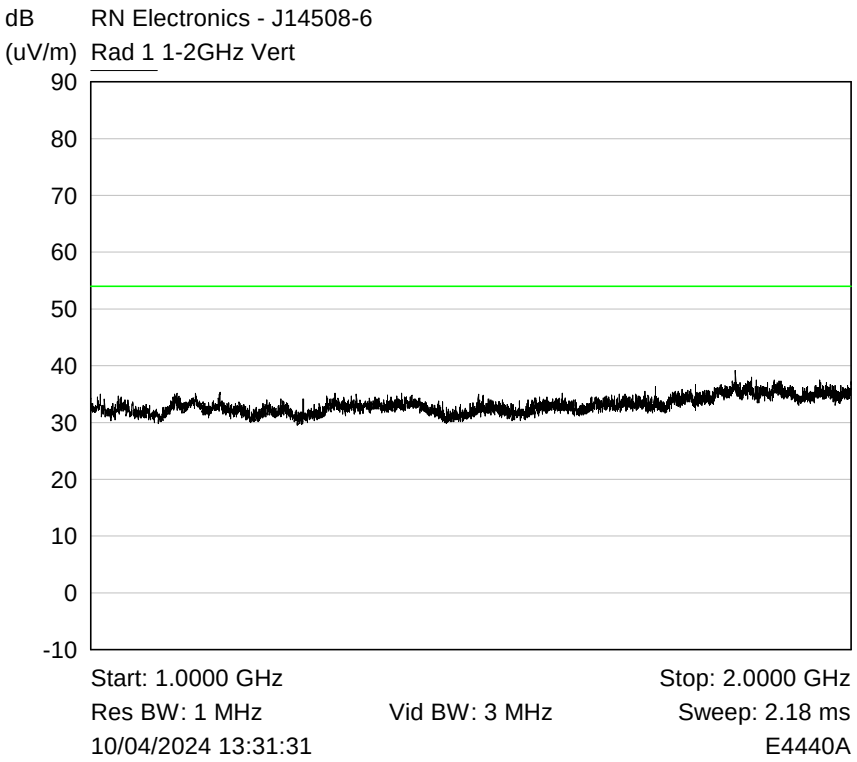


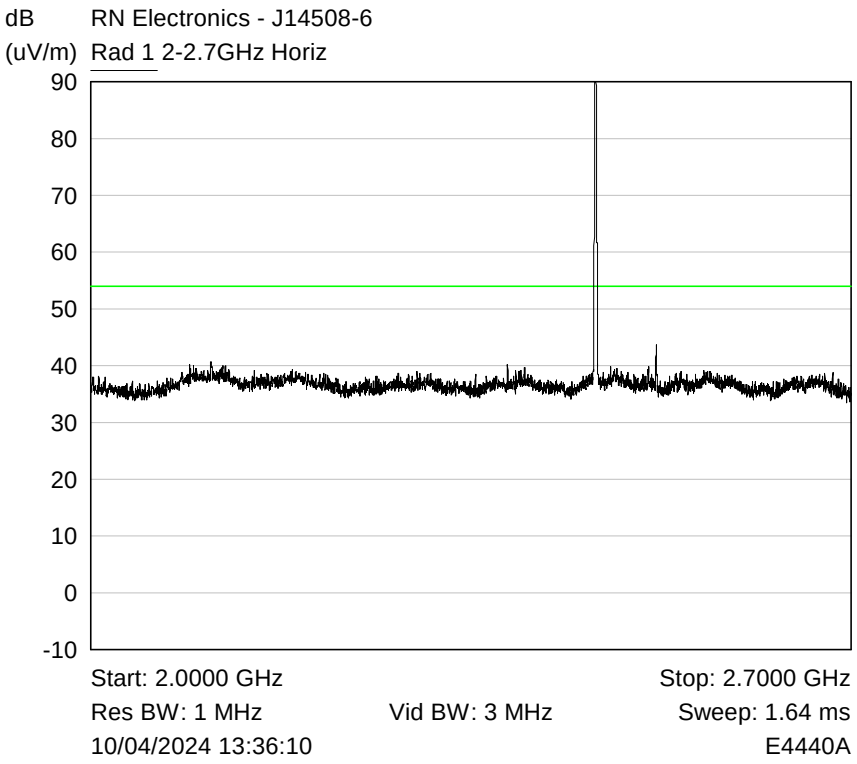
Plot of Peak emissions for UHF Vertical against the QP limit line.

6.5 Radiated emissions above 1 GHz

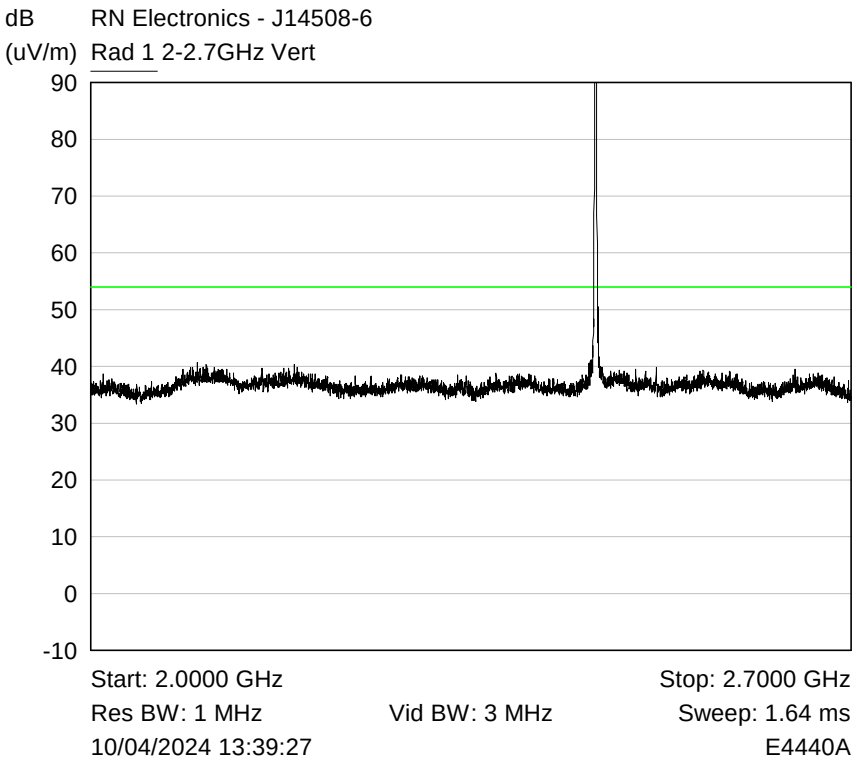
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



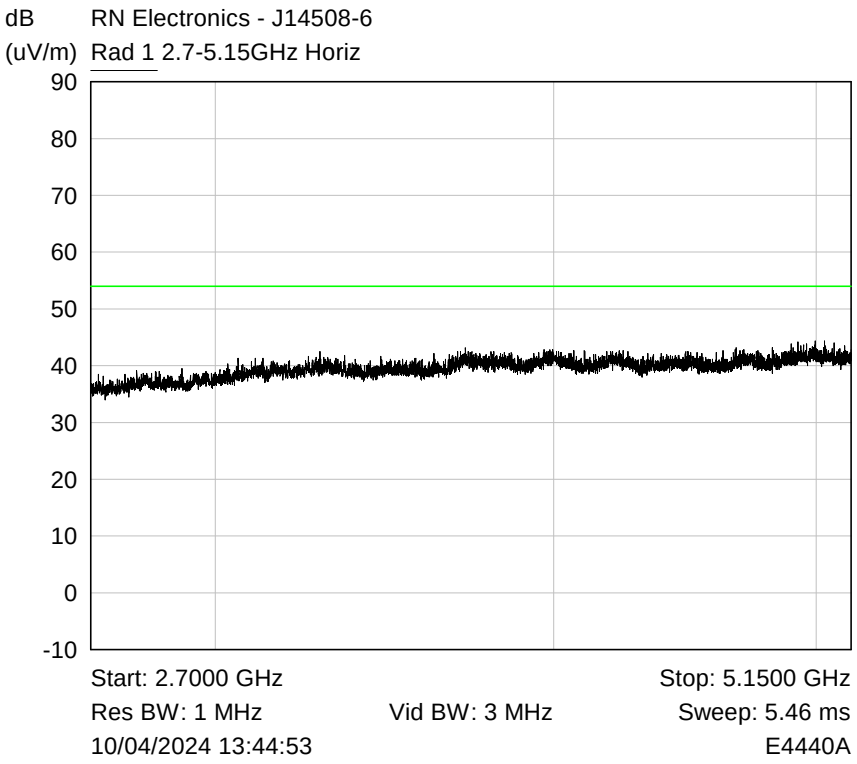


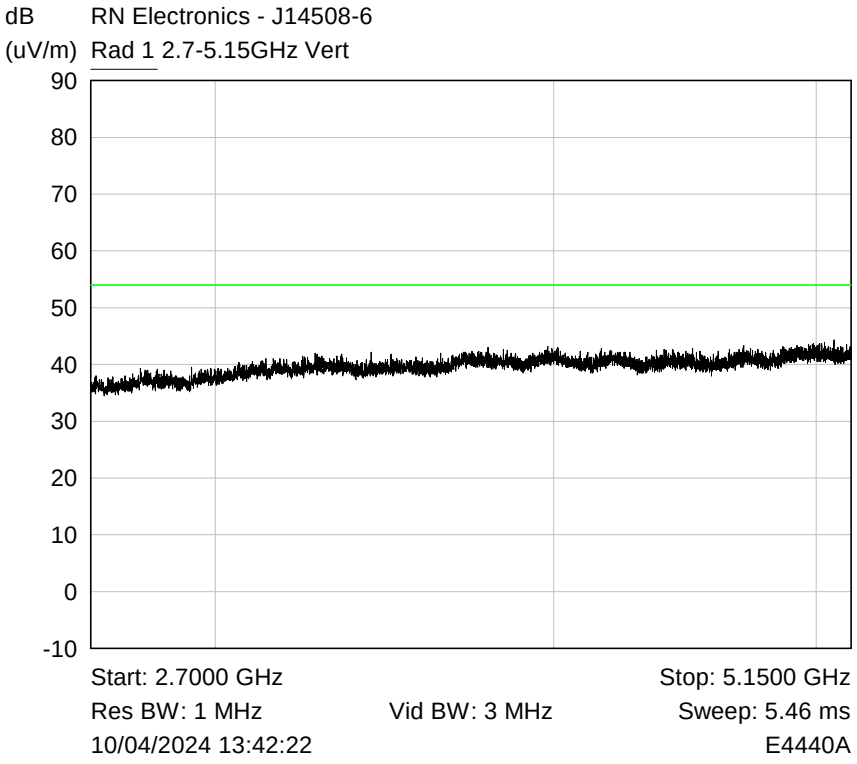


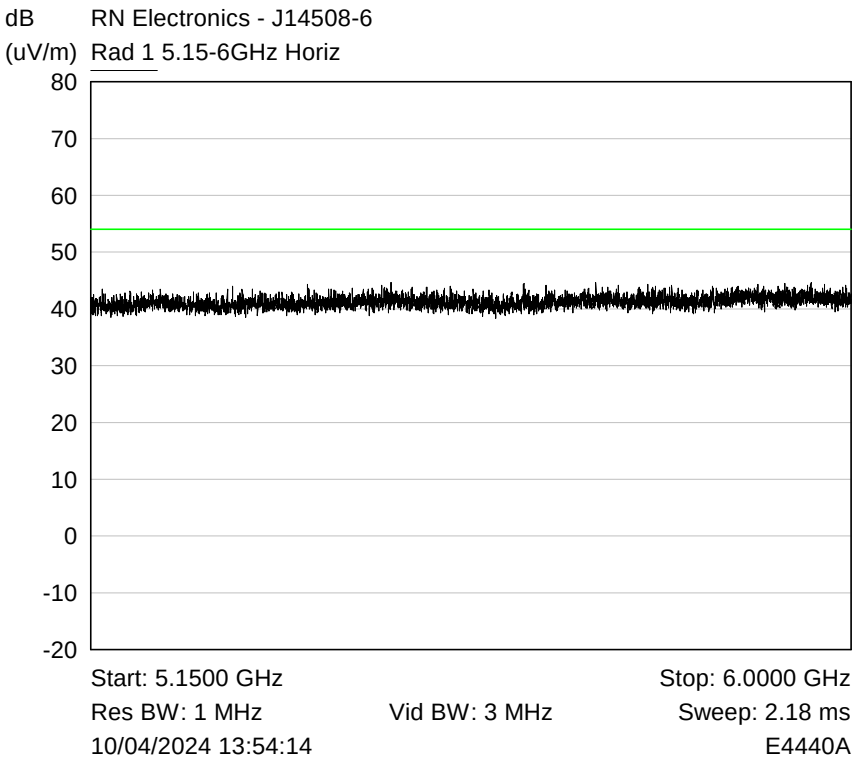
The signal that exceeds the limit line is the intentional transmit carrier at 2440.8 MHz

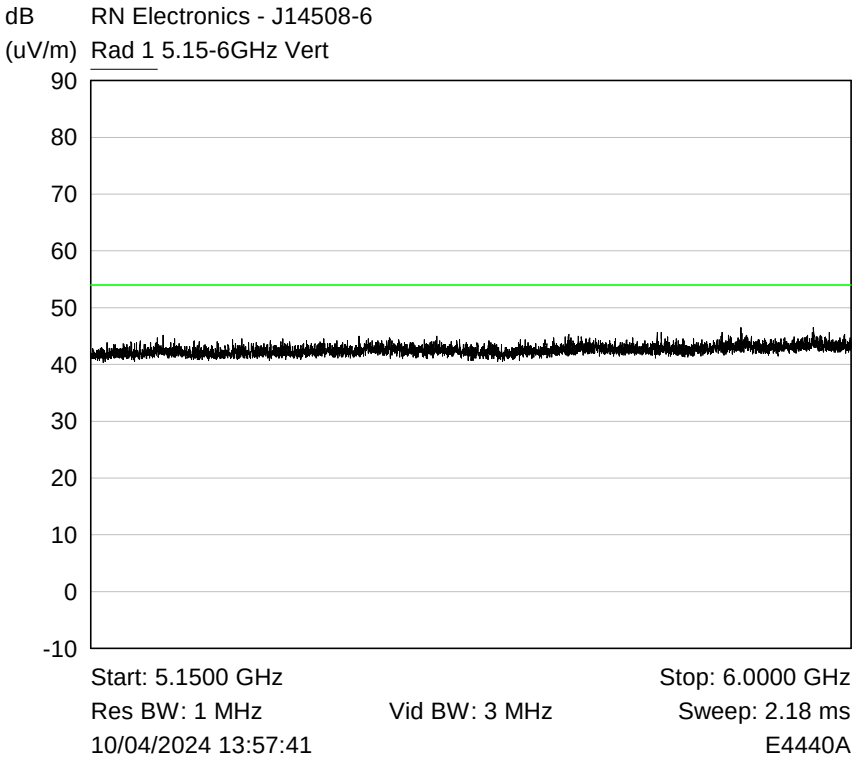


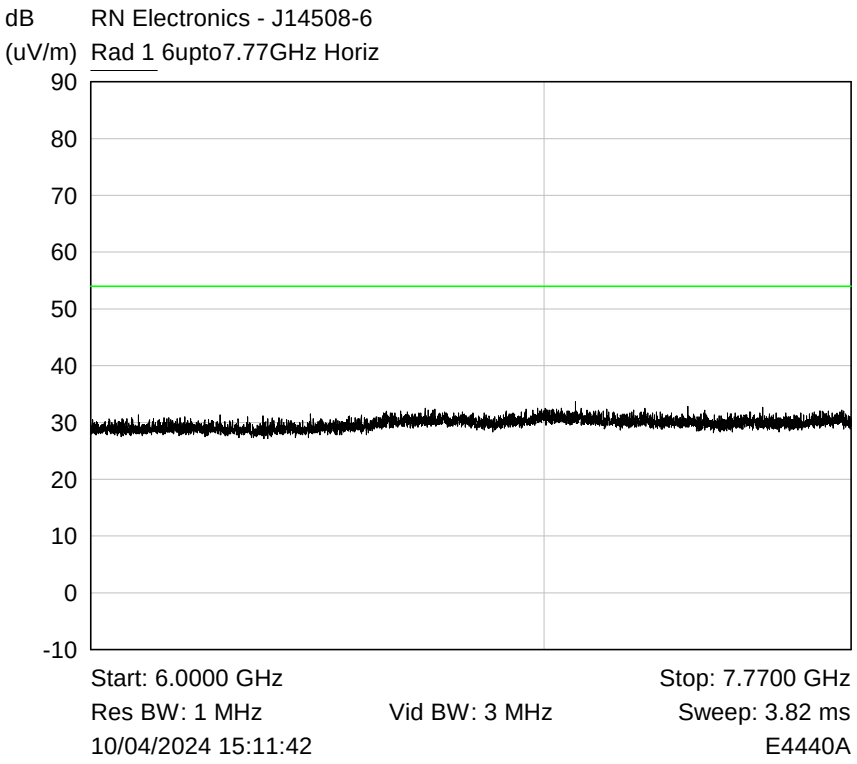
The signal that exceeds the limit line is the intentional transmit carrier at 2440.8 MHz

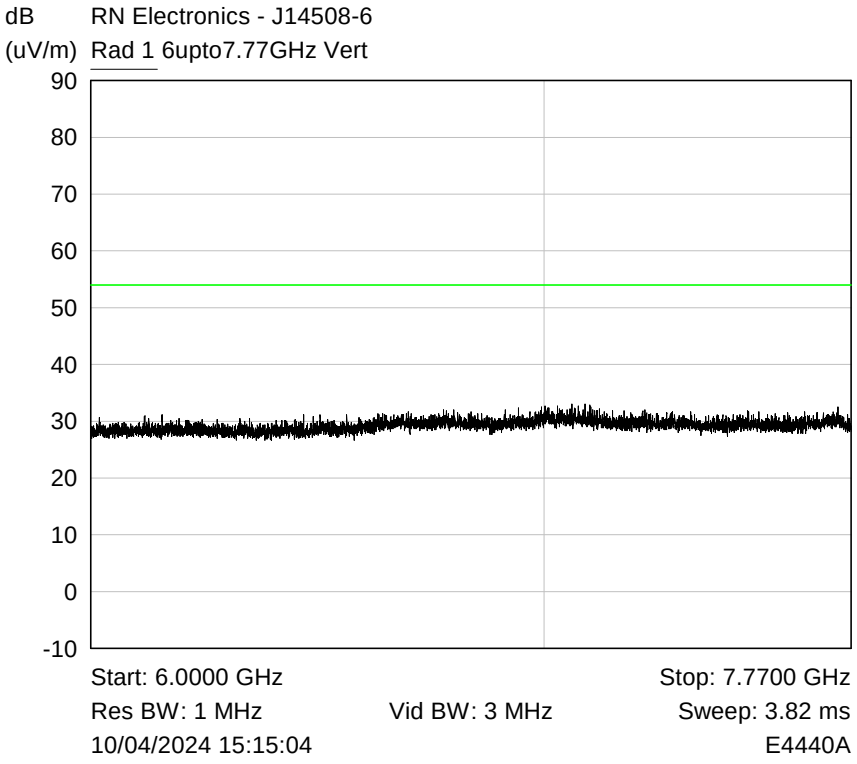

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 2.7-5.15GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.7000 GHz
Stop: 5.1500 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.46 ms
10/04/2024 13:44:53
E4440A

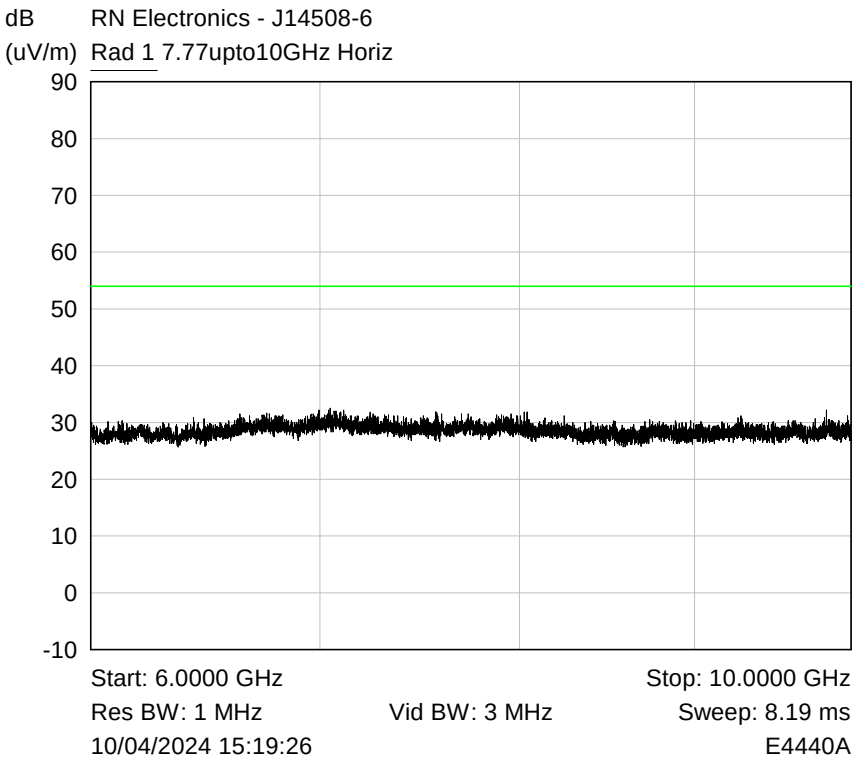

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 2.7-5.15GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.7000 GHz
Stop: 5.1500 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.46 ms
10/04/2024 13:42:22
E4440A

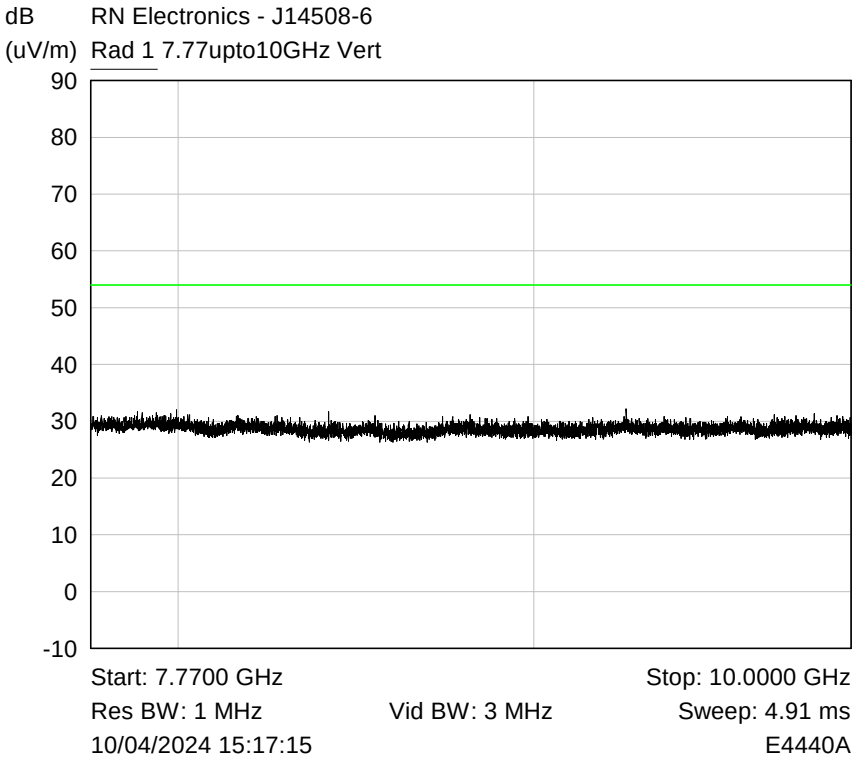


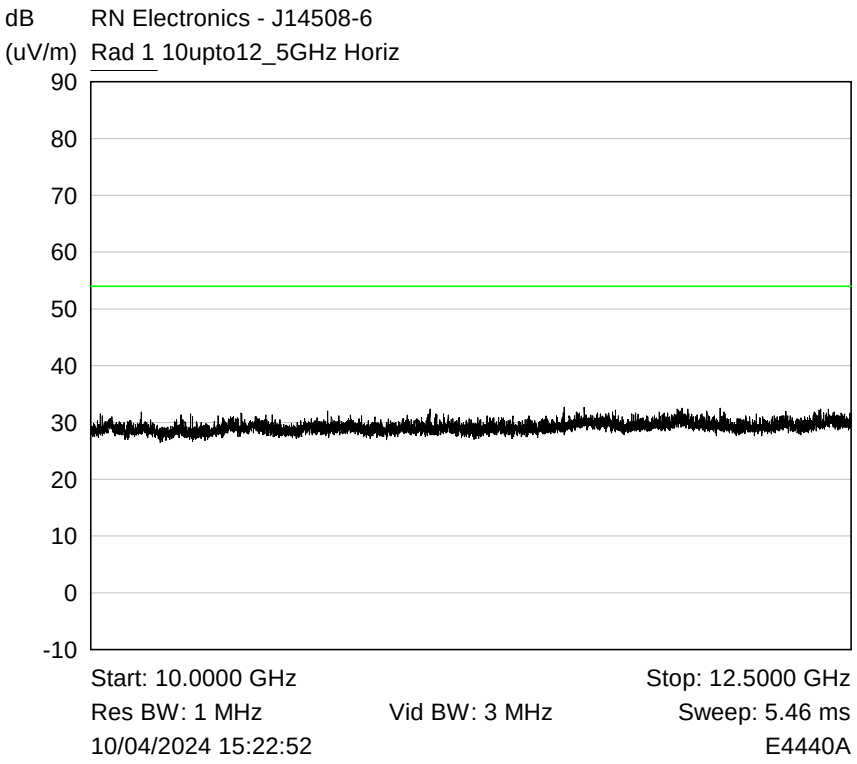


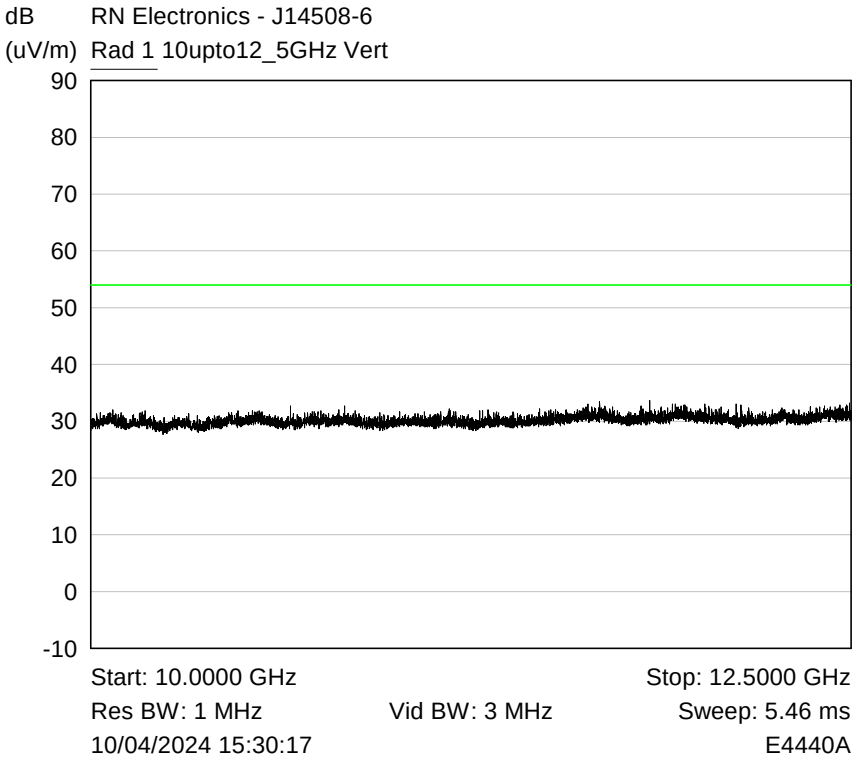

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 6upto7.77GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.0000 GHz
Stop: 7.7700 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
10/04/2024 15:11:42
E4440A

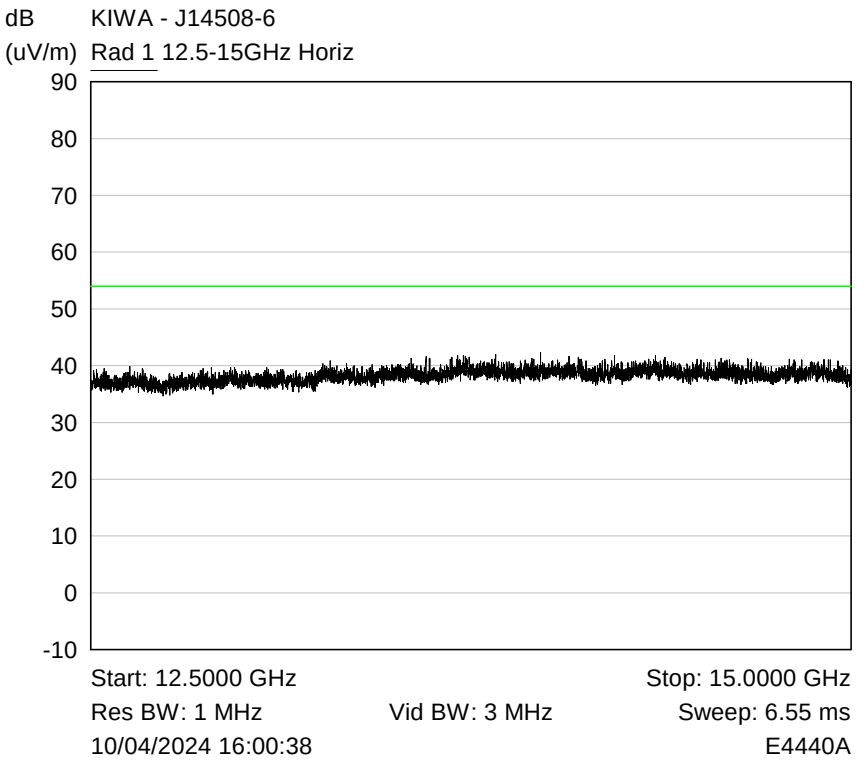

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 6upto7.77GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.0000 GHz
Stop: 7.7700 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
10/04/2024 15:15:04
E4440A

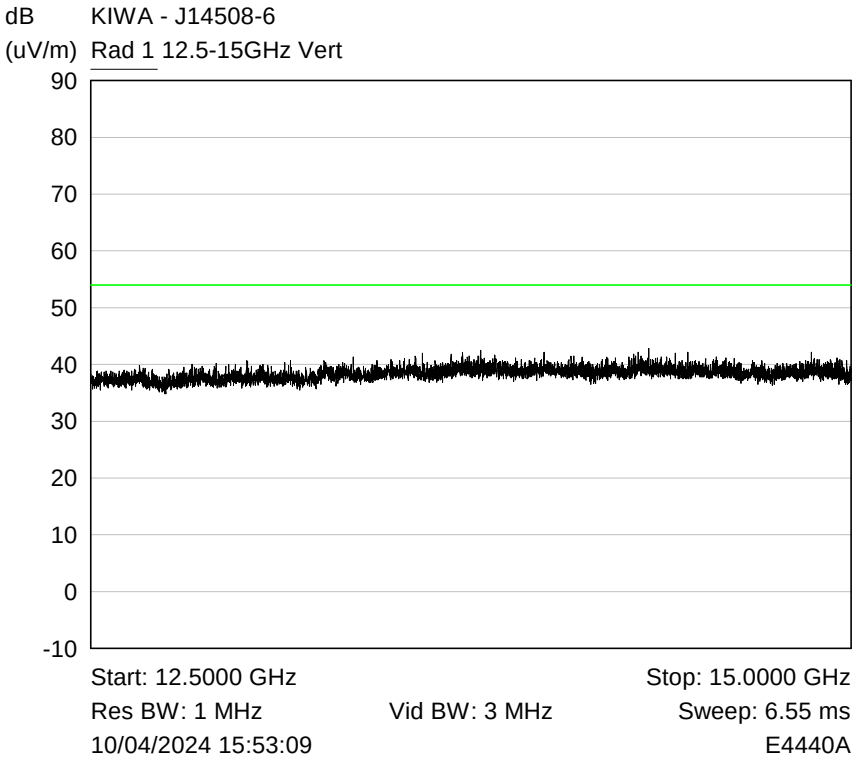

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 7.77upto10GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.0000 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 8.19 ms
10/04/2024 15:19:26
E4440A

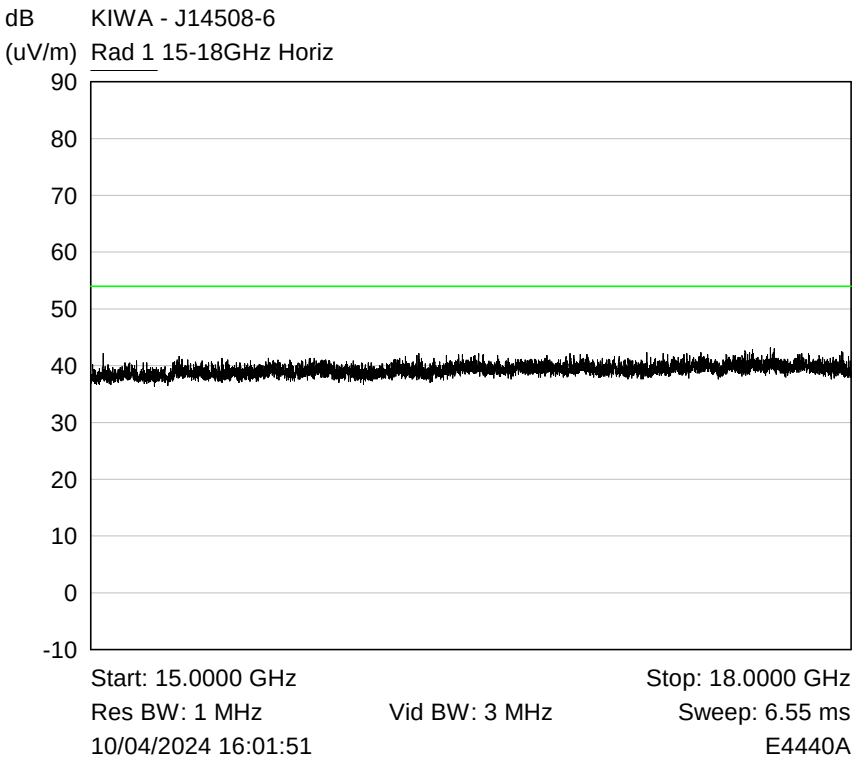

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 7.77upto10GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 7.7700 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
10/04/2024 15:17:15
E4440A

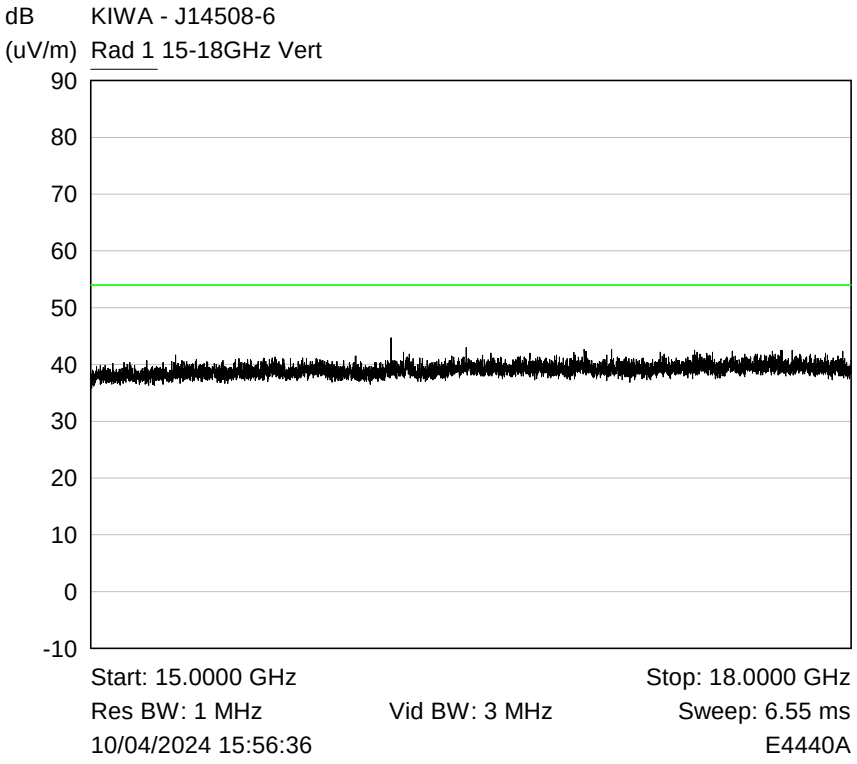

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 10upto12_5GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.5000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.46 ms
10/04/2024 15:22:52
E4440A

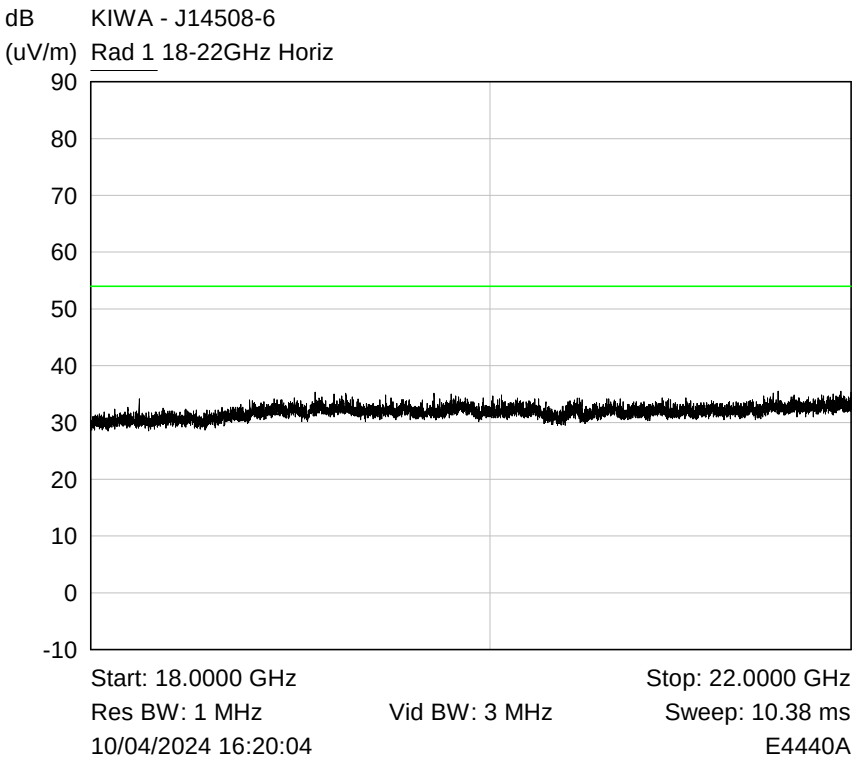

dB
(uV/m)
RN Electronics - J14508-6
Rad 1 10upto12_5GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.5000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 5.46 ms
10/04/2024 15:30:17
E4440A

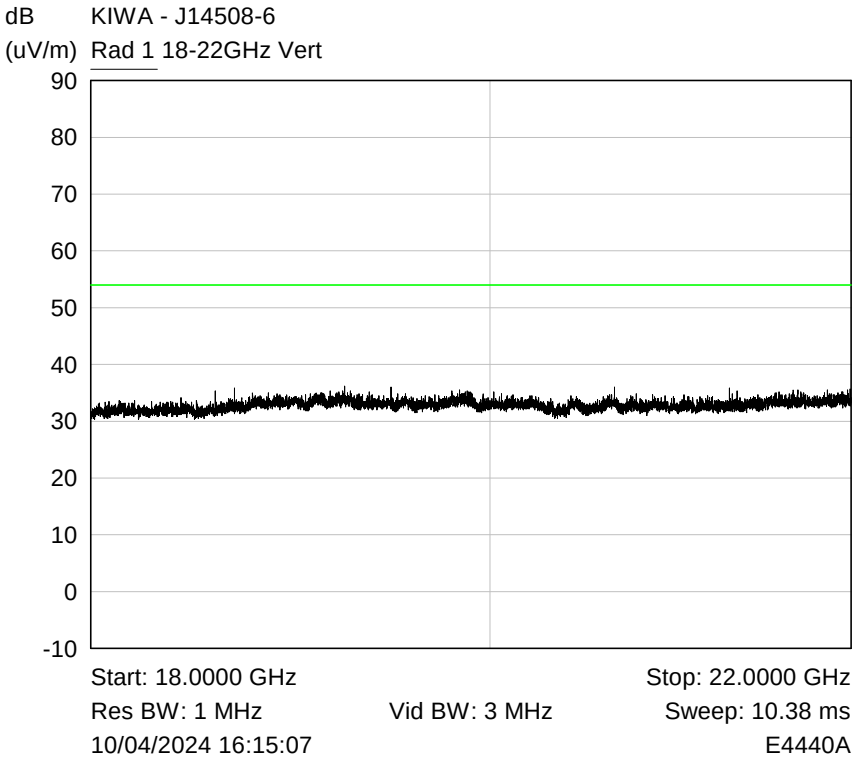

dB
(uV/m)
KIWA - J14508-6
Rad 1 12.5-15GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.5000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
10/04/2024 16:00:38
E4440A

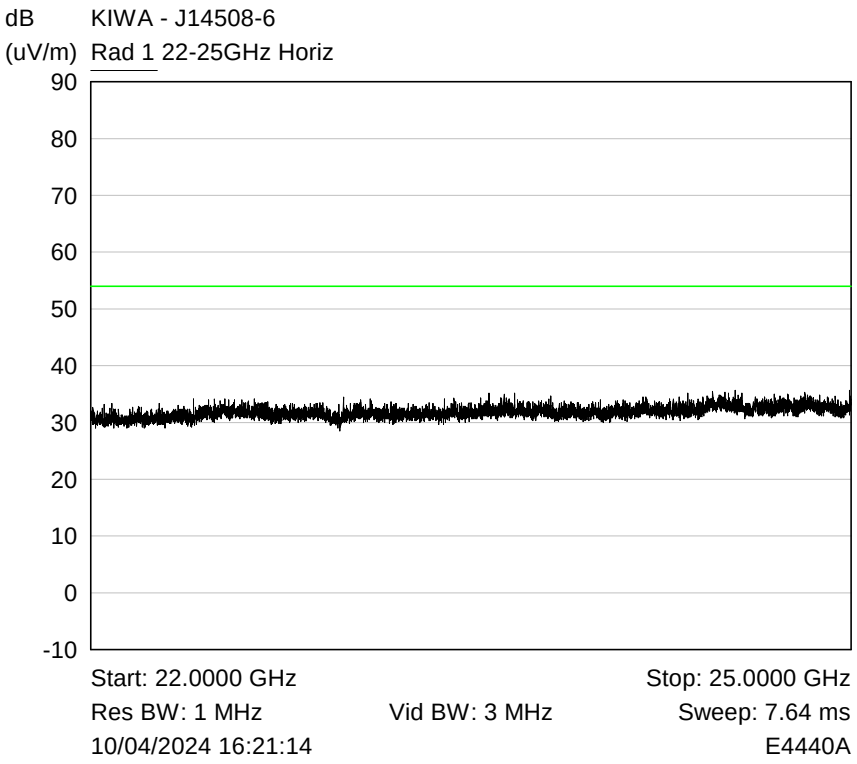

dB
(uV/m)
KIWA - J14508-6
Rad 1 12.5-15GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.5000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
10/04/2024 15:53:09
E4440A

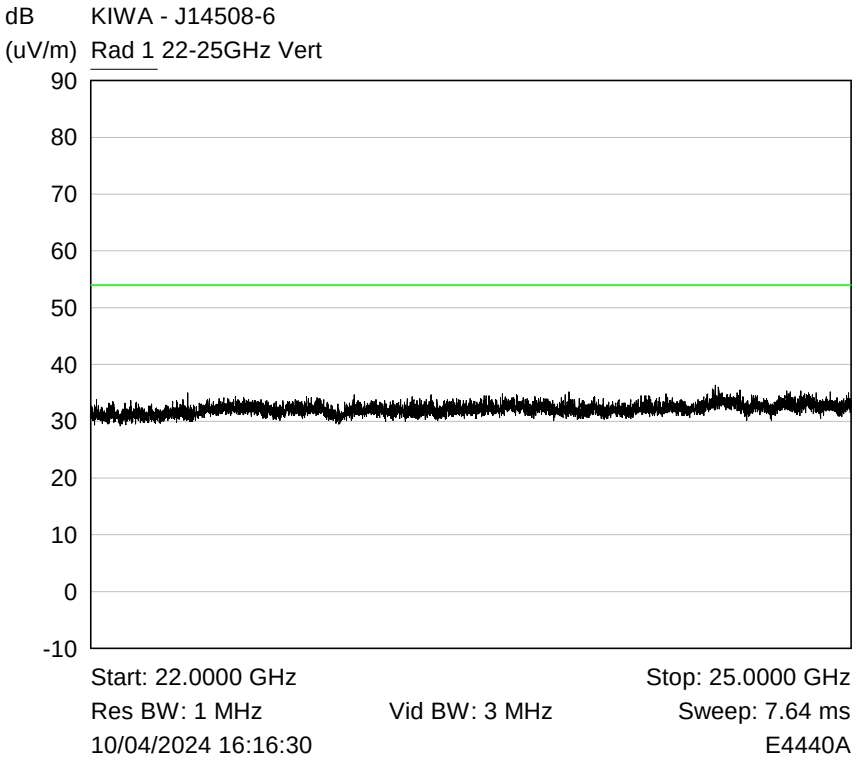

dB
(uV/m)
KIWA - J14508-6
Rad 1 15-18GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 15.0000 GHz
Stop: 18.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
10/04/2024 16:01:51
E4440A


dB
(uV/m)
KIWA - J14508-6
Rad 1 15-18GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 15.0000 GHz
Stop: 18.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
10/04/2024 15:56:36
E4440A


dB
(uV/m)
KIWA - J14508-6
Rad 1 18-22GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 18.0000 GHz
Stop: 22.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 10.38 ms
10/04/2024 16:20:04
E4440A

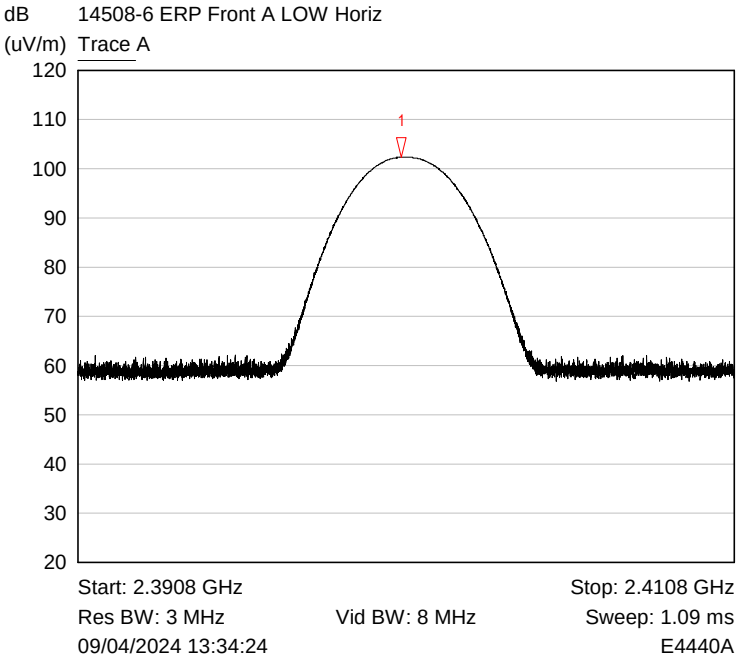

dB
(uV/m)
KIWA - J14508-6
Rad 1 18-22GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 18.0000 GHz
Stop: 22.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 10.38 ms
10/04/2024 16:15:07
E4440A


dB
(uV/m)
KIWA - J14508-6
Rad 1 22-25GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 22.0000 GHz
Stop: 25.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 7.64 ms
10/04/2024 16:21:14
E4440A


dB
(uV/m)
KIWA - J14508-6
Rad 1 22-25GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 22.0000 GHz
Stop: 25.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 7.64 ms
10/04/2024 16:16:30
E4440A

6.6 Effective radiated power field strength

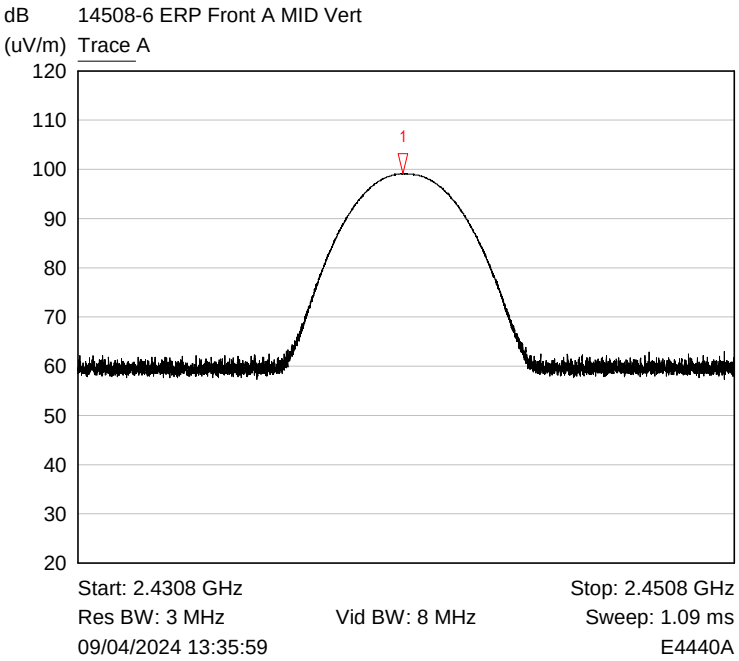
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4006 GHz	102.35 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

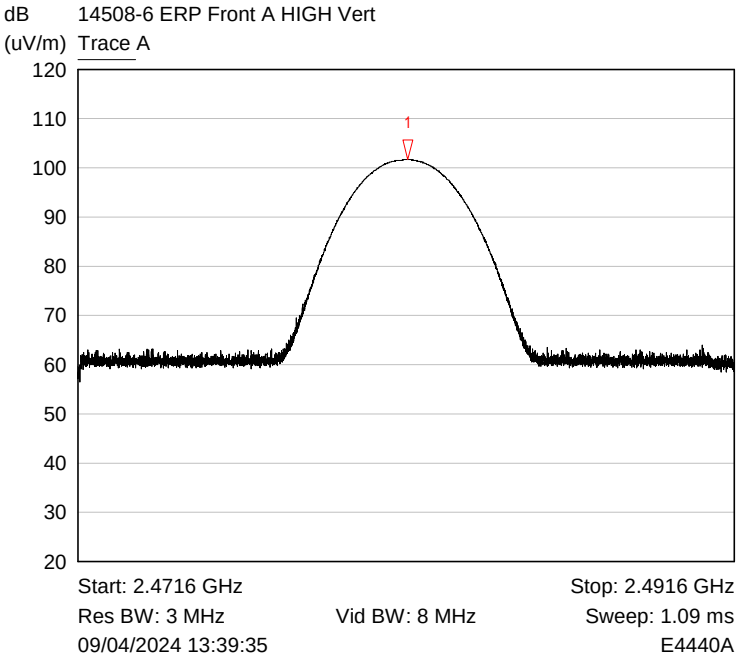
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	99.12 dB(uV/m)	

Plot of Vert polarisation and EUT in Upright position

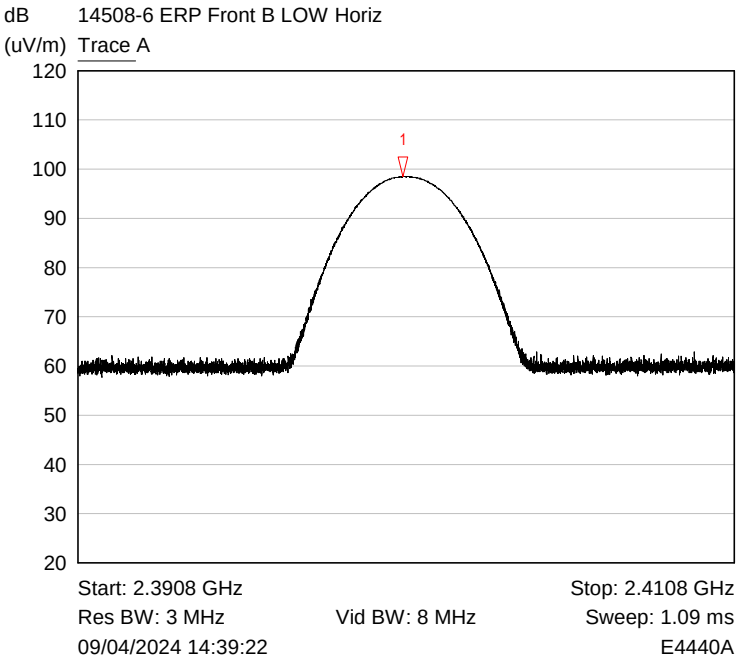
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4816 GHz	101.67 dB(uV/m)	

Plot of Vert polarisation and EUT in Upright position

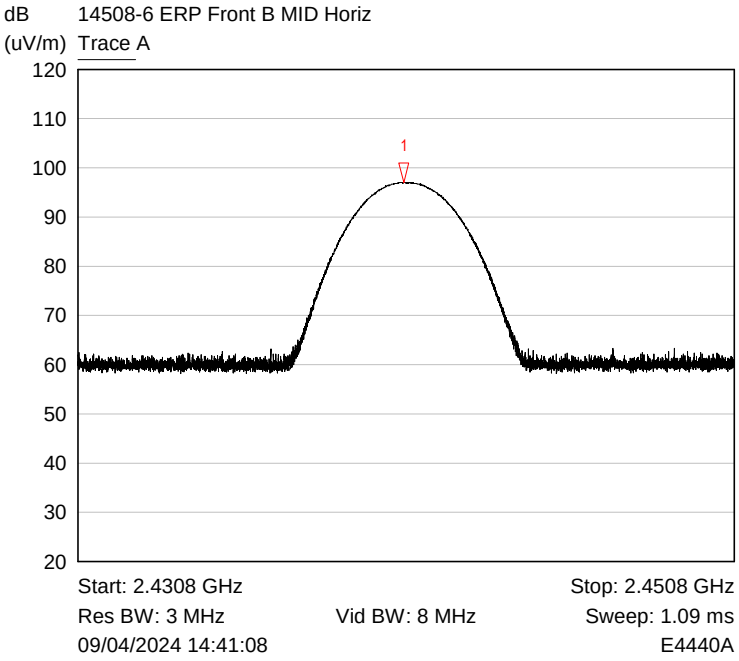
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4007 GHz	98.45 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

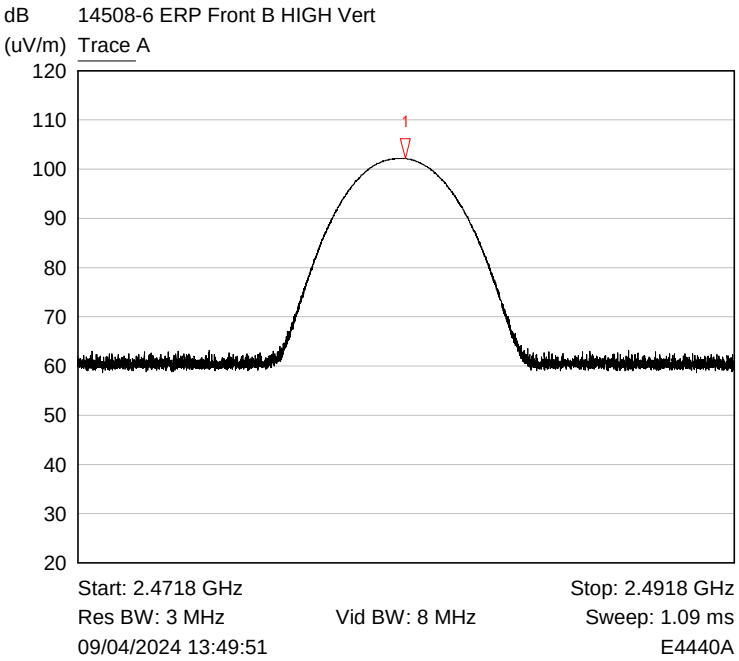
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	97.01 dB(uV/m)	

Plot of Horiz polarisation and EUT in Upright position

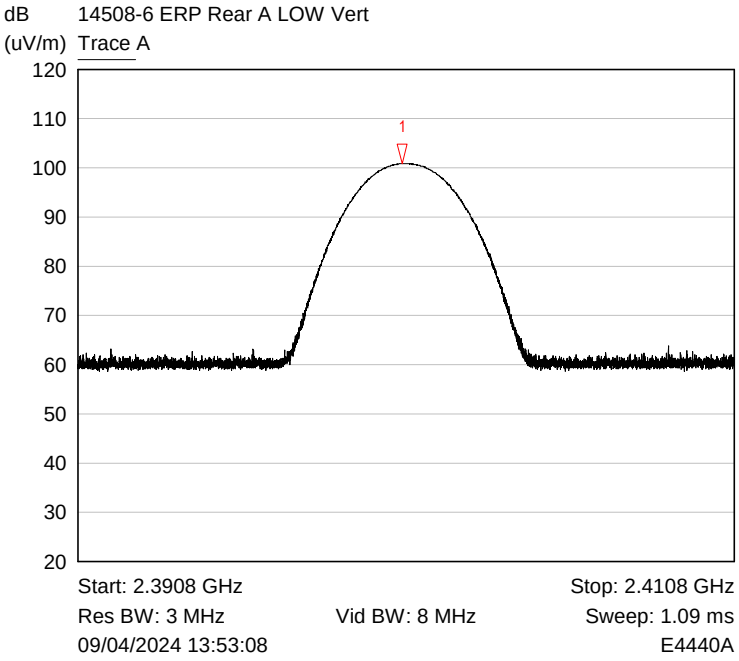
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4818 GHz	102.15 dB(uV/m)	

Plot of Vert polarisation and EUT in Upright position

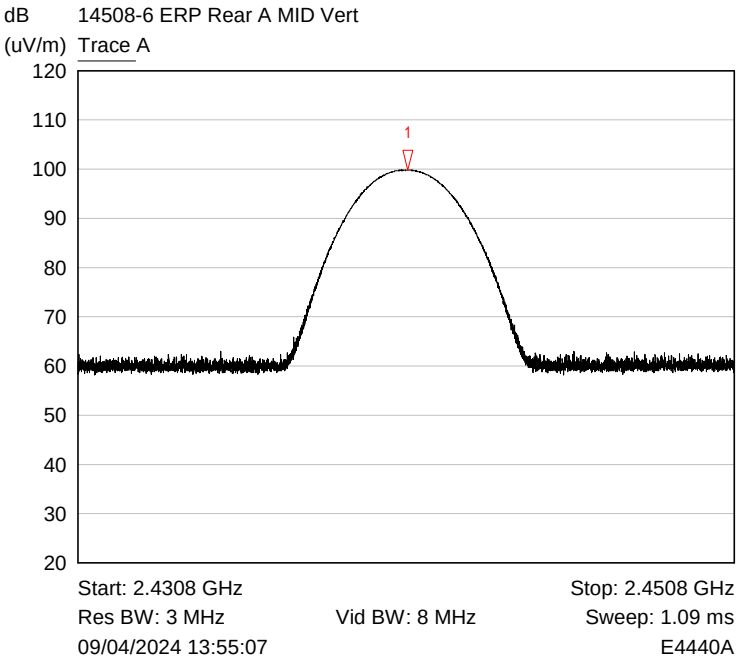
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4007 GHz	100.84 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

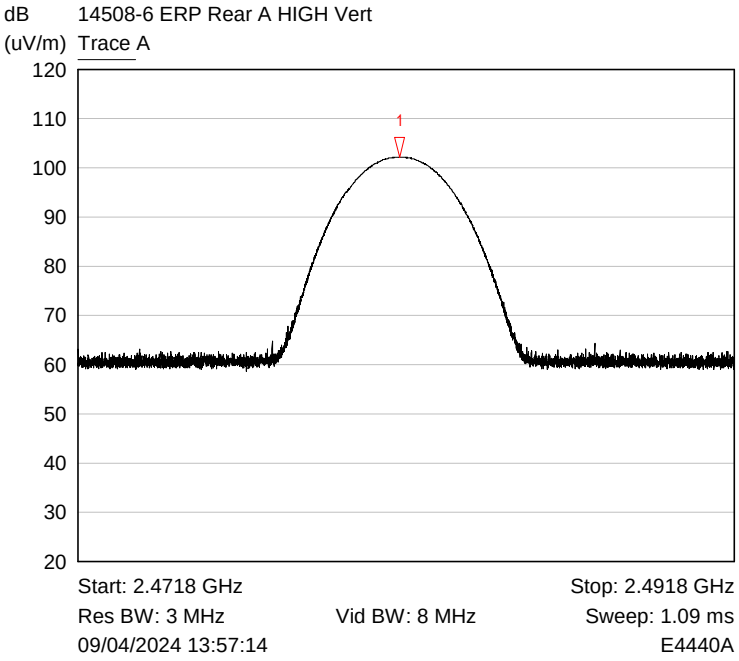
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4408 GHz	99.83 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

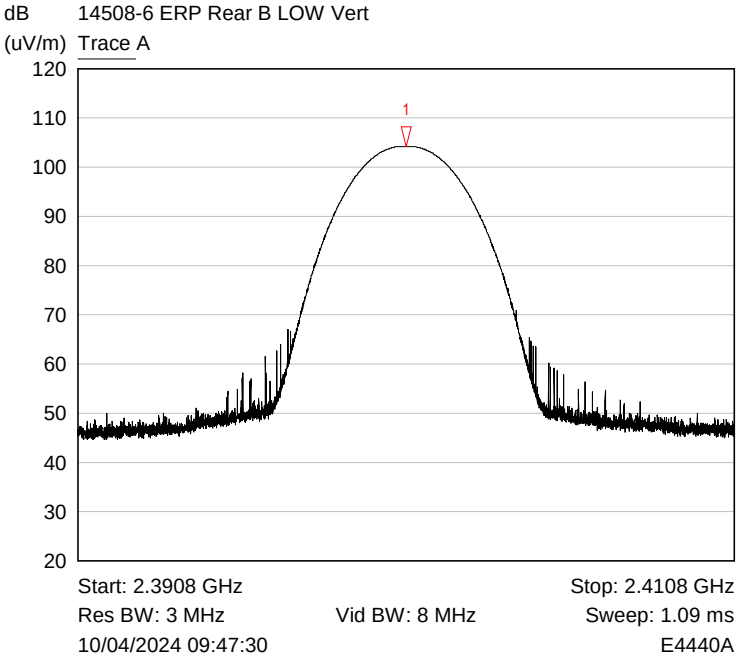
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4816 GHz	102.19 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

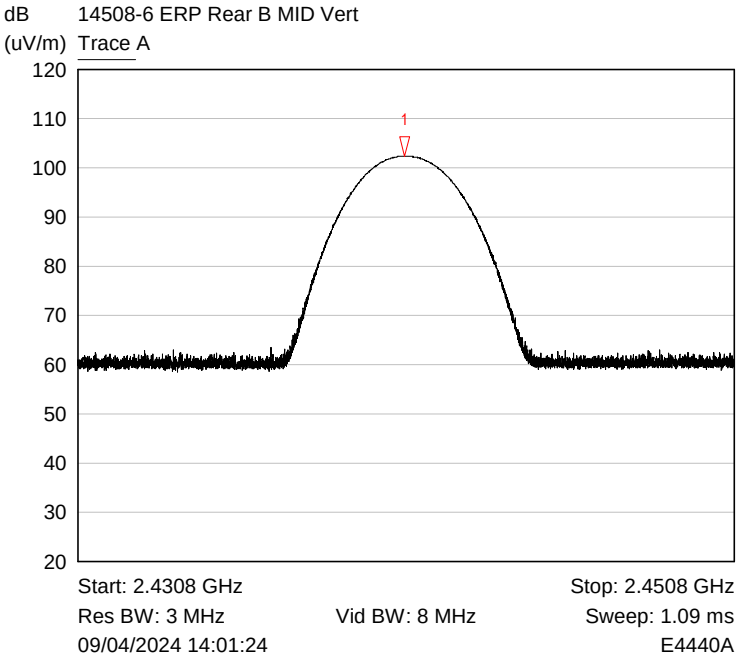
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4008 GHz	104.23 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

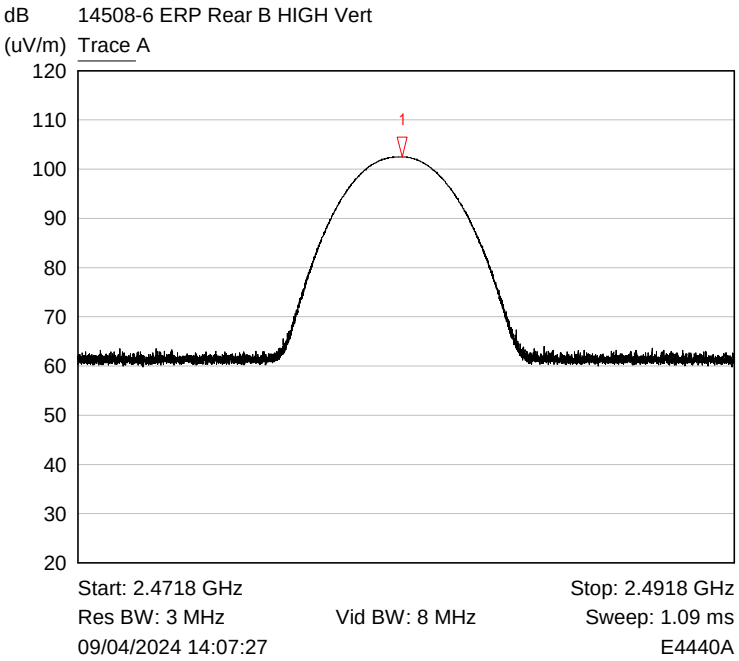
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	102.38 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz

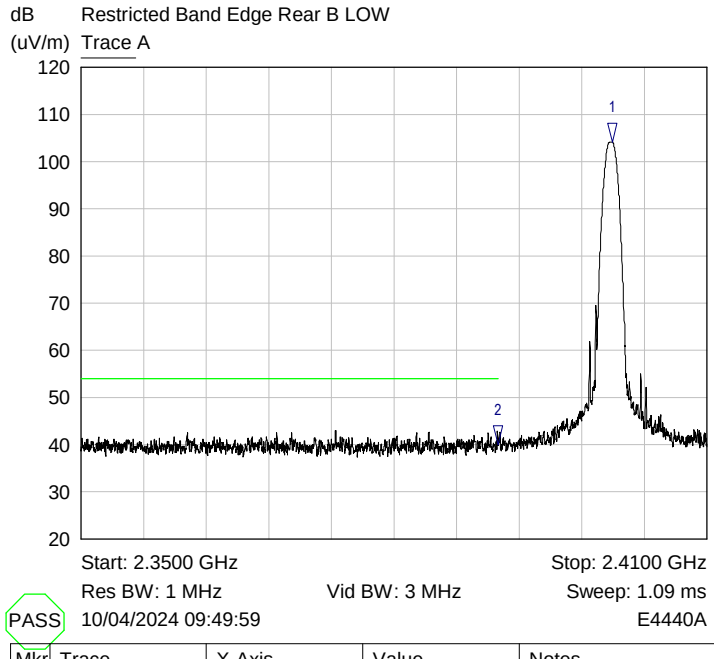


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	102.55 dB(uV/m)	

Plot ref of Vert polarisation and EUT in Upright position

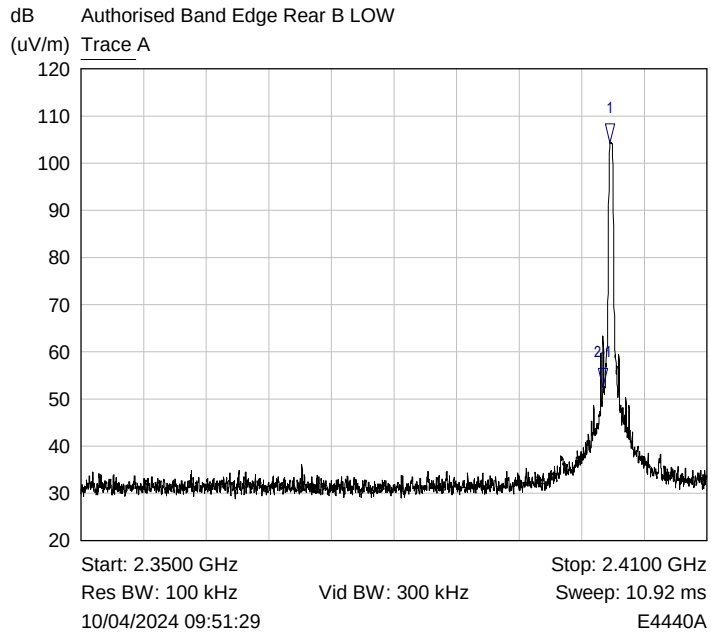
6.7 Band Edge Compliance

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 Mkz, Modulation FHSS, Channel 2400.8 MHz



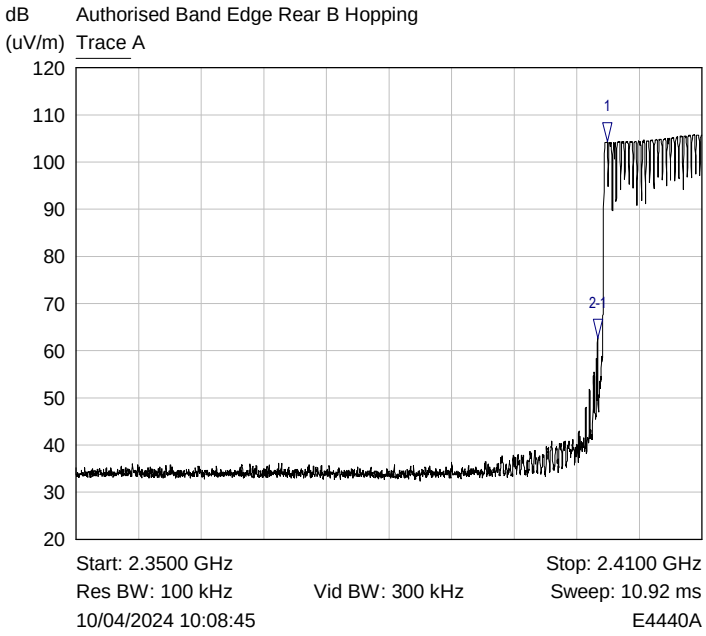
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4009 GHz	104.21 dB(uV/m)	
2	Trace A	2.3900 GHz	40.04 dB(uV/m)	

Restricted band edge Peak Plot



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4007 GHz	104.29 dB(uV/m)	
2-1	Trace A	2.4000 GHz	-51.79 dB	

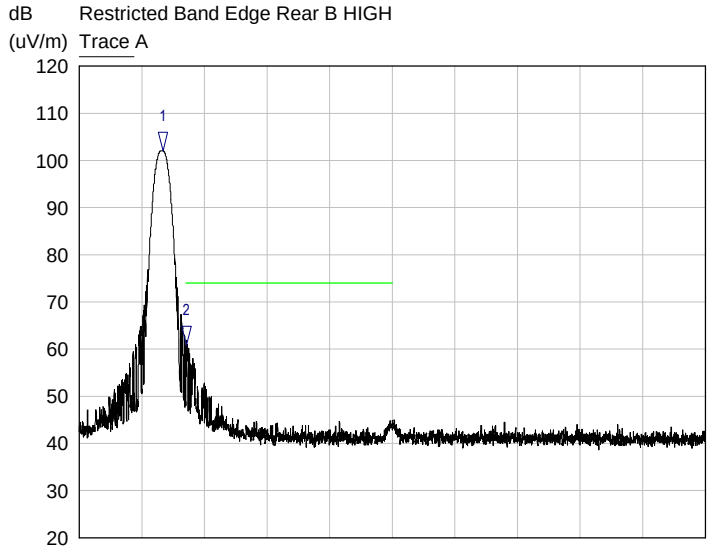
Authorised Band Edge Plot



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4009 GHz	104.26 dB(uV/m)	
2-1	Trace A	2.4000 GHz	-41.62 dB	

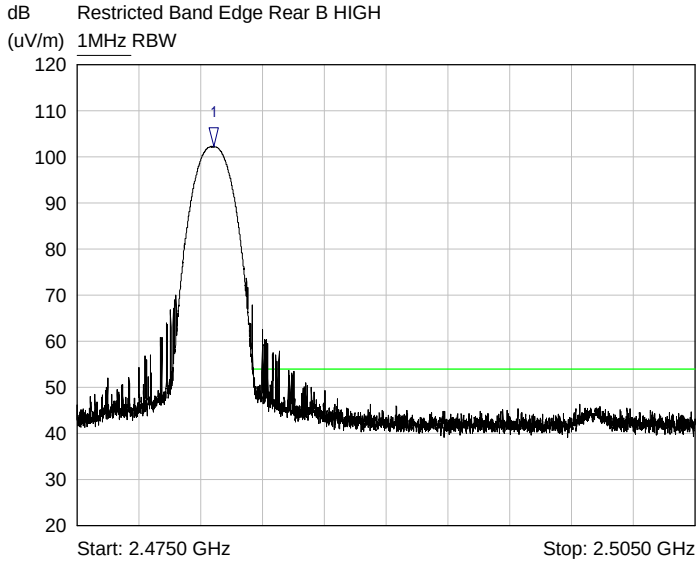
Authorised Band Edge hop Plot

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



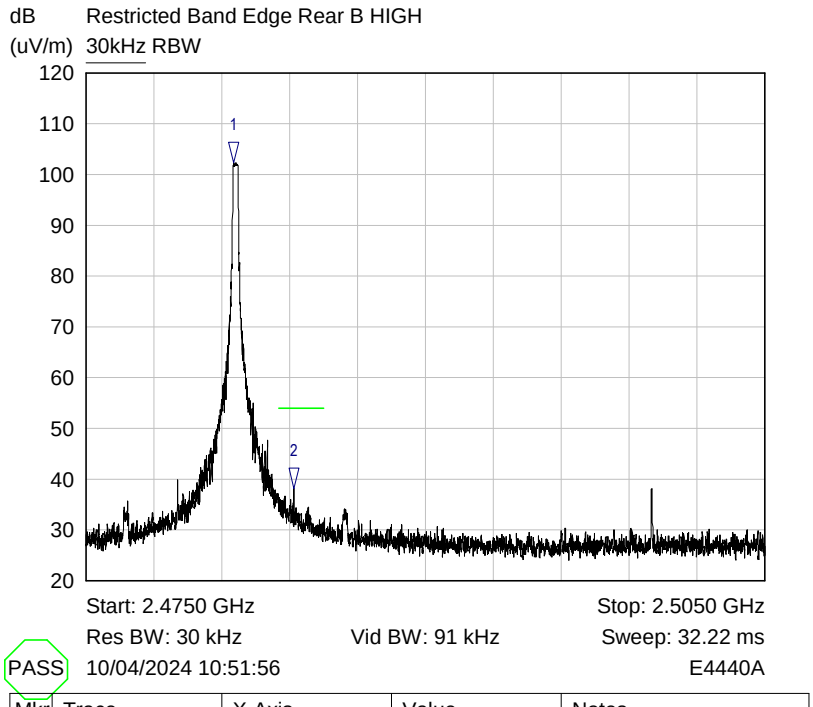
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	102.07 dB(uV/m)	
2 ▽	Trace A	2.4836 GHz	60.78 dB(uV/m)	MKR Delta 102.07- 63.66 = 38.41 dBuV/m@3r

Restricted band edge Peak Plot



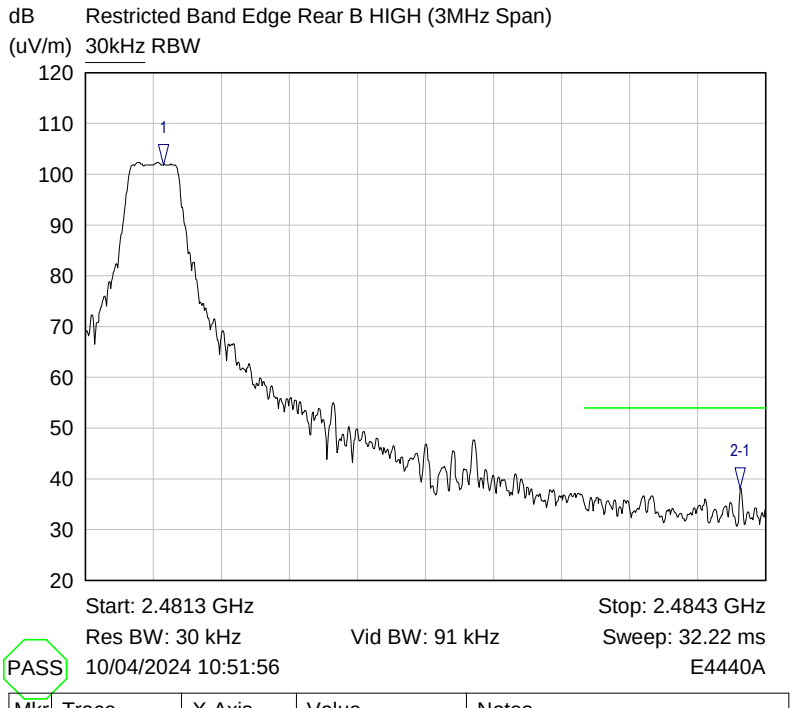
Mkr	Trace	X-Axis	Value	Notes
1 ▽	1MHz RBW	2.4816 GHz	102.38 dB(uV/m)	MKR Delta method required

Restricted band edge Average Plot (requires Delta Marker method to be applied)



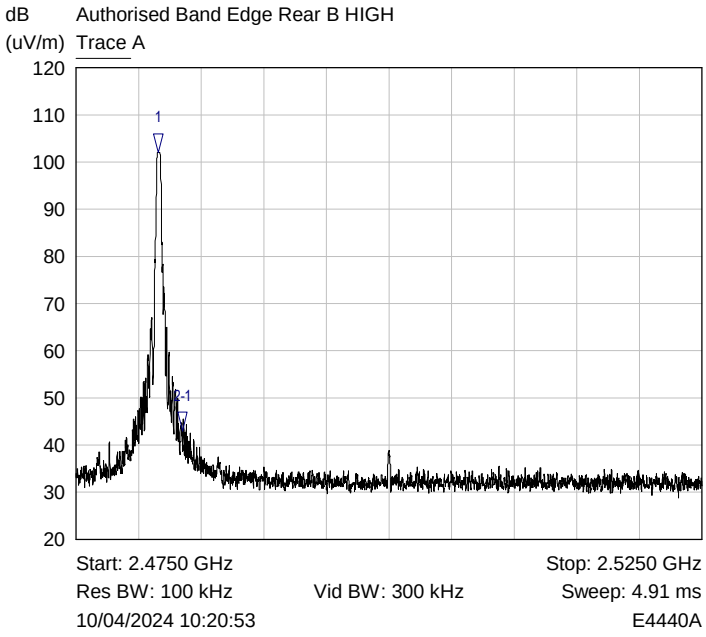
Mkr	Trace	X-Axis	Value	Notes
1 ▽	30kHz RBW	2.4815 GHz	102.38 dB(uV/m)	
2 ▽	30kHz RBW	2.4842 GHz	38.24 dB(uV/m)	

Restricted band edge Peak Plot (Reduced RBW as per ANSI C63.10 6.10.6) Marker Delta method
Limit line frequencies 2483.5 – 2485.5 MHz



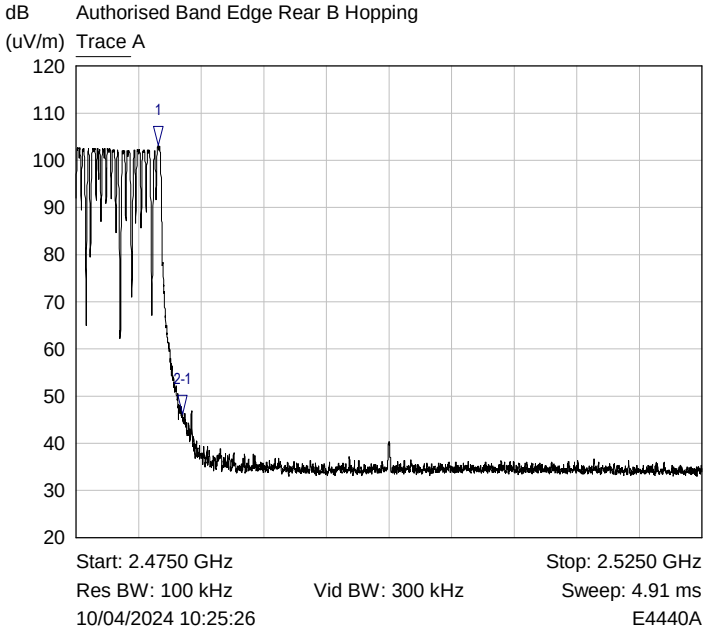
Mkr	Trace	X-Axis	Value	Notes
1 ▽	30kHz RBW	2.4816 GHz	101.90 dB(uV/m)	
2-1 ▽	30kHz RBW	2.4842 GHz	-63.66 dB	value to use for MKR Delta method

Reduced RBW 30kHz and 1% span as per ANSI C63.10 6.10.6) Marker Delta method



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4815 GHz	102.05 dB(uV/m)	
2-1	Trace A	2.4835 GHz	-59.04 dB	

Authorised Band Edge Plot

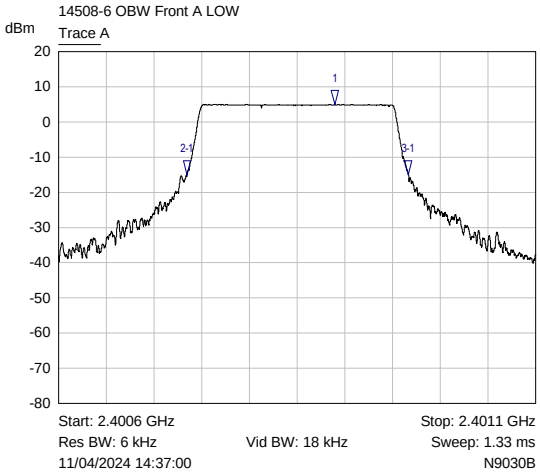


Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4816 GHz	103.12 dB(uV/m)	
2-1	Trace A	2.4835 GHz	-56.92 dB	

Authorised Band Edge hop Plot

6.8 Occupied bandwidth

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



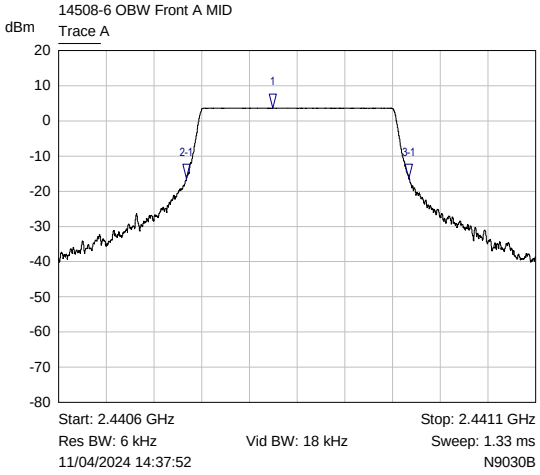
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4008 GHz	5.00 dBm	
2-1	Trace A	-154.7683 kHz	-20.00 dB	
3-1	Trace A	77.4188 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.79 kHz
Power in Occupied Bandwidth	19.88 dBm
Transmit Freq Error	141.55 Hz
-20.00 dB Bandwidth	232.19 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



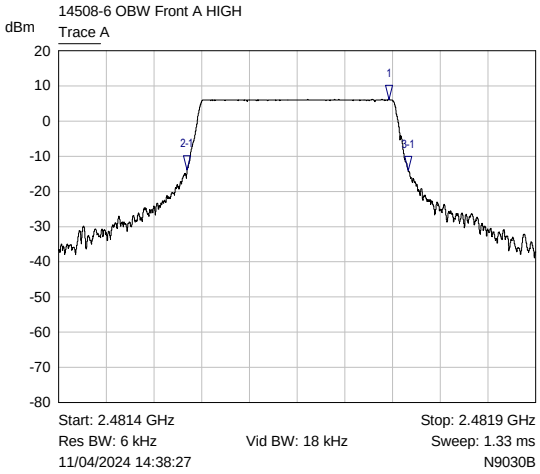
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4408 GHz	3.68 dBm	
2-1	Trace A	-90.5658 kHz	-20.00 dB	
3-1	Trace A	142.5139 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.97 kHz
Power in Occupied Bandwidth	18.61 dBm
Transmit Freq Error	393.35 Hz
-20.00 dB Bandwidth	233.08 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



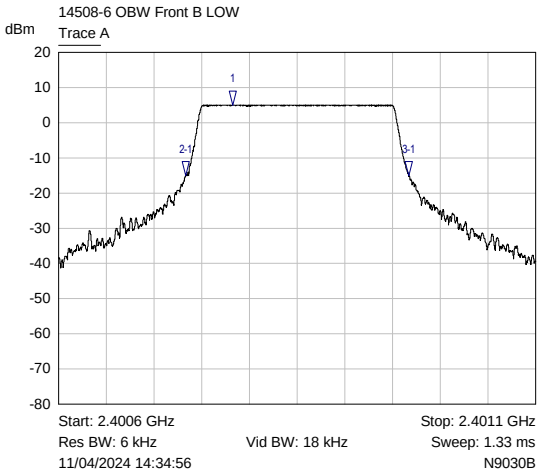
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4817 GHz	6.12 dBm	
2-1	Trace A	-211.5447 kHz	-20.00 dB	
3-1	Trace A	19.9796 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	209.01 kHz
Power in Occupied Bandwidth	21.01 dBm
Transmit Freq Error	324.72 Hz
-20.00 dB Bandwidth	231.52 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



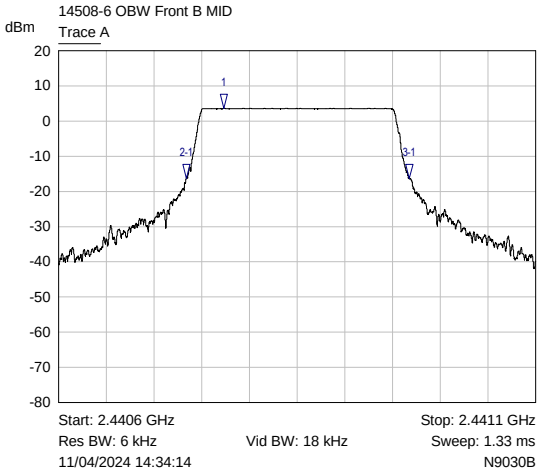
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4007 GHz	5.02 dBm	
2-1	Trace A	-49.2545 kHz	-20.00 dB	
3-1	Trace A	184.5436 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.79 kHz
Power in Occupied Bandwidth	19.93 dBm
Transmit Freq Error	289.21 Hz
-20.00 dB Bandwidth	233.80 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



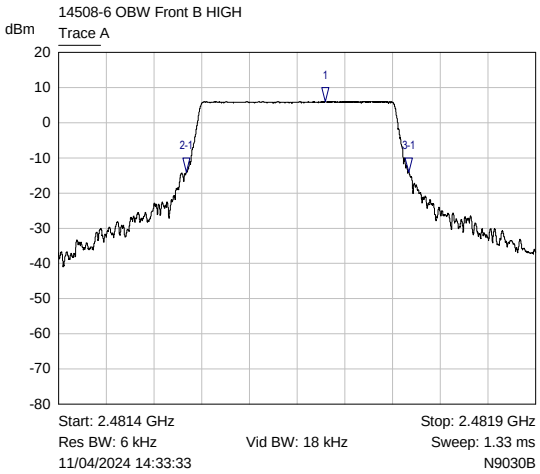
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4407 GHz	3.63 dBm	
2-1	Trace A	-39.6647 kHz	-20.00 dB	
3-1	Trace A	194.0460 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	209.17 kHz
Power in Occupied Bandwidth	18.56 dBm
Transmit Freq Error	604.18 Hz
-20.00 dB Bandwidth	235.16 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



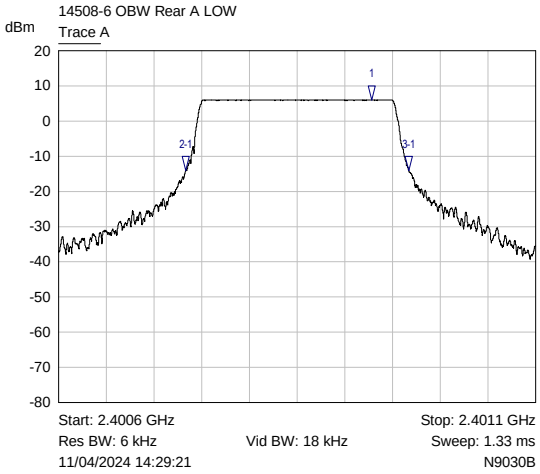
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4816 GHz	5.99 dBm	
2-1	Trace A	-145.6616 kHz	-20.00 dB	
3-1	Trace A	87.6214 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.60 kHz
Power in Occupied Bandwidth	20.89 dBm
Transmit Freq Error	264.71 Hz
-20.00 dB Bandwidth	233.28 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



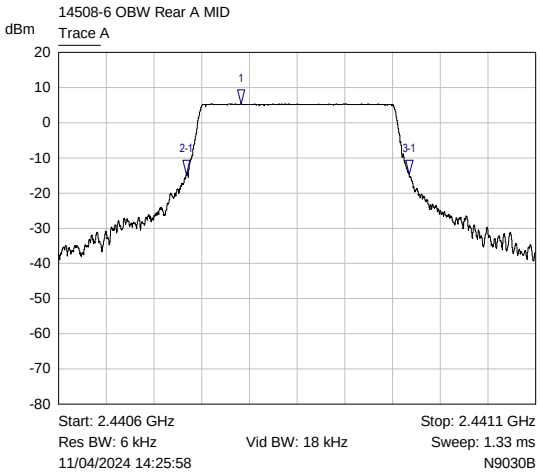
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4009 GHz	6.06 dBm	
2-1	Trace A	-194.9528 kHz	-20.00 dB	
3-1	Trace A	38.5441 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.80 kHz
Power in Occupied Bandwidth	20.98 dBm
Transmit Freq Error	437.03 Hz
-20.00 dB Bandwidth	233.50 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



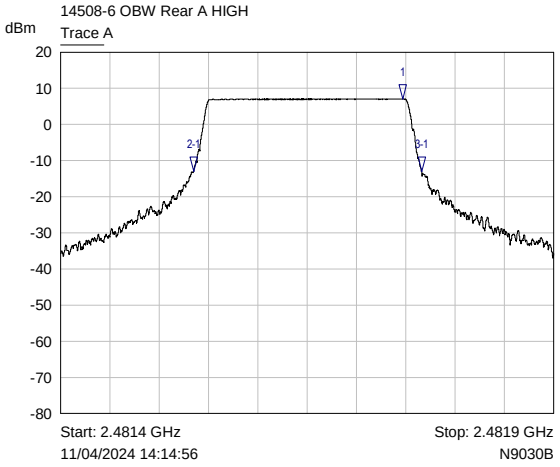
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4407 GHz	5.29 dBm	
2-1	Trace A	-57.5894 kHz	-20.00 dB	
3-1	Trace A	175.8893 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.73 kHz
Power in Occupied Bandwidth	20.20 dBm
Transmit Freq Error	341.04 Hz
-20.00 dB Bandwidth	233.48 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



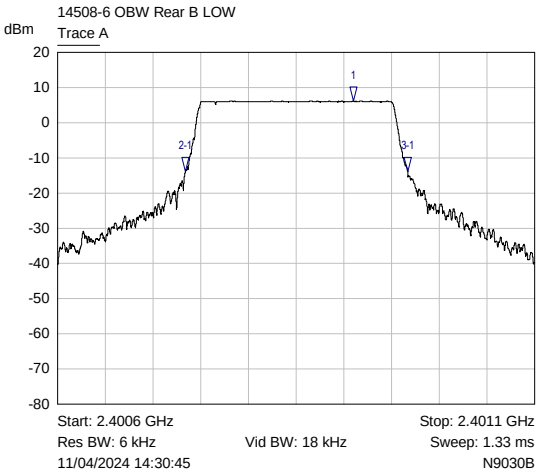
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4817 GHz	7.01 dBm	
2-1	Trace A	-212.1523 kHz	-20.00 dB	
3-1	Trace A	19.0956 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	209.07 kHz
Power in Occupied Bandwidth	21.94 dBm
Transmit Freq Error	500.95 Hz
-20.00 dB Bandwidth	231.25 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



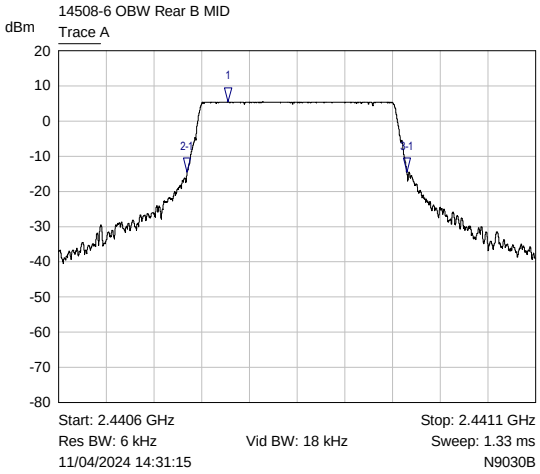
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4009 GHz	6.15 dBm	
2-1	Trace A	-175.9204 kHz	-20.00 dB	
3-1	Trace A	56.7199 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.65 kHz
Power in Occupied Bandwidth	21.06 dBm
Transmit Freq Error	310.86 Hz
-20.00 dB Bandwidth	232.64 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



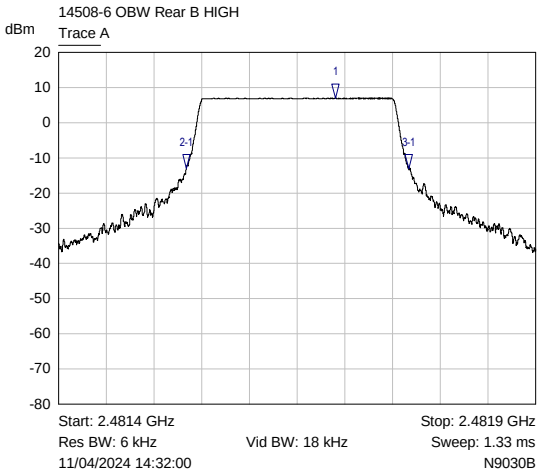
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4407 GHz	5.43 dBm	
2-1	Trace A	-43.0116 kHz	-20.00 dB	
3-1	Trace A	187.4593 kHz	-20.00 dB	

Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.80 kHz
Power in Occupied Bandwidth	20.32 dBm
Transmit Freq Error	466.98 Hz
-20.00 dB Bandwidth	232.95 kHz

Plot for 20 dB Bandwidth Result

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4816 GHz	6.99 dBm	
2-1	Trace A	-156.2010 kHz	-20.00 dB	
3-1	Trace A	77.1049 kHz	-20.00 dB	

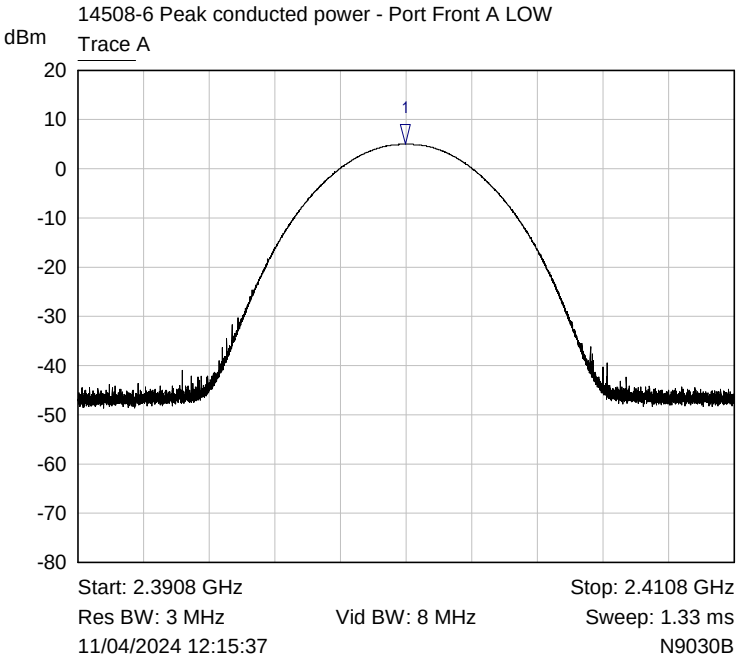
Trace A

Measurement Parameter	Value
99% Occupied Bandwidth	208.80 kHz
Power in Occupied Bandwidth	21.92 dBm
Transmit Freq Error	348.15 Hz
-20.00 dB Bandwidth	234.89 kHz

Plot for 20 dB Bandwidth Result

6.9 Maximum Peak conducted output power

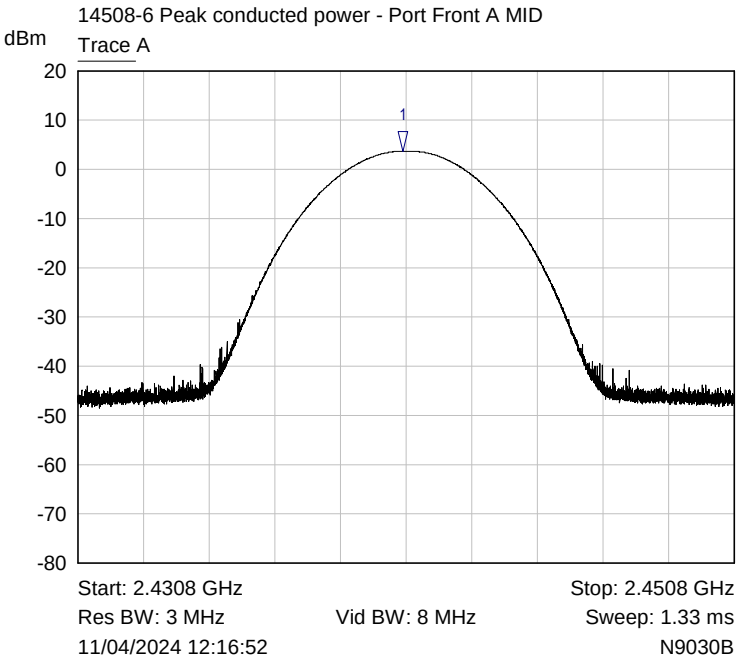
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4008 GHz	4.95 dBm	

Single port Plot reference

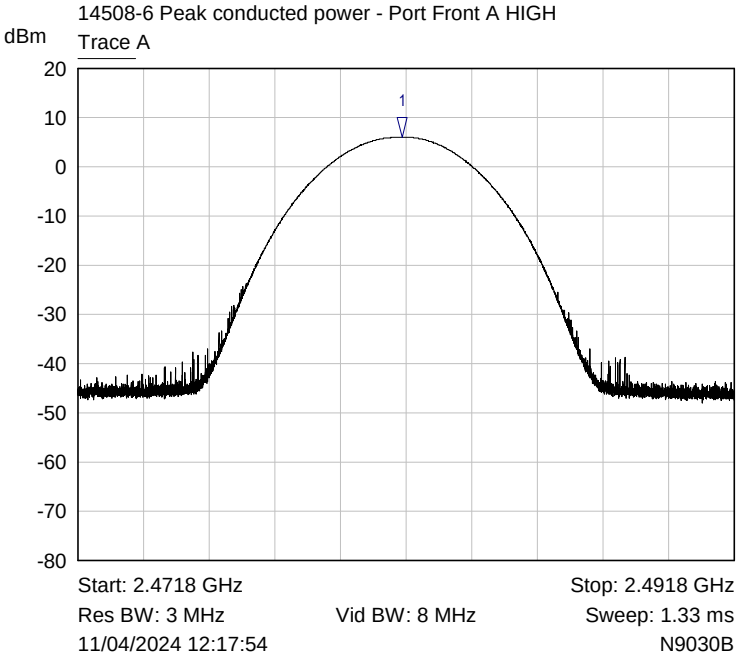
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	3.72 dBm	

Single port Plot reference

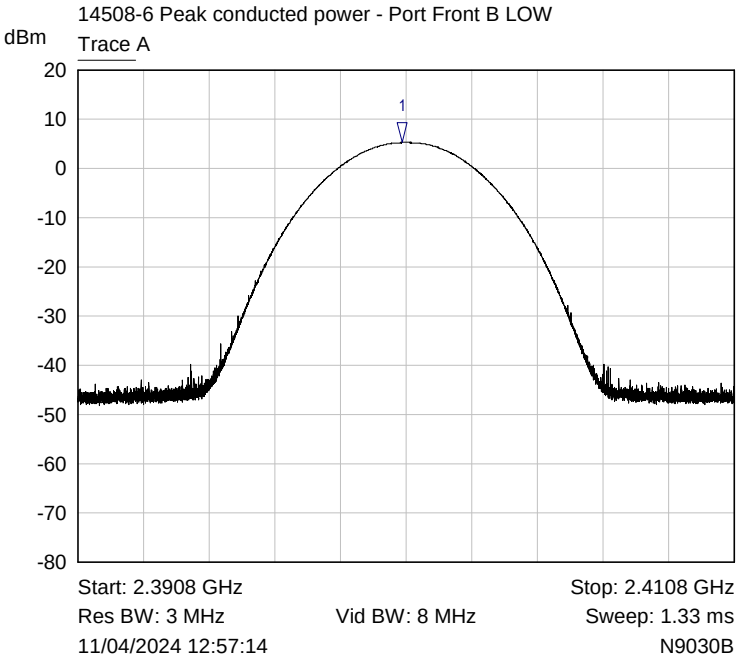
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	6.05 dBm	

Single port Plot reference

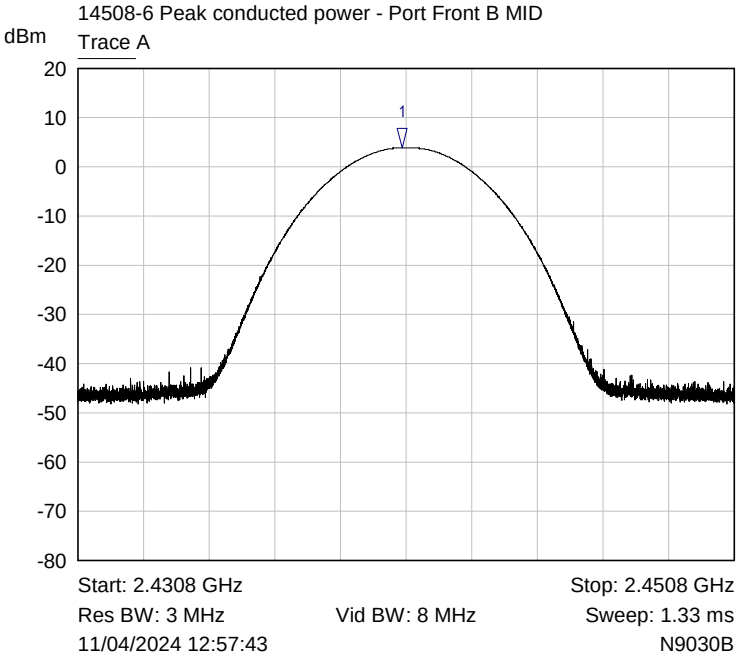
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4007 GHz	5.26 dBm	

Single port Plot reference

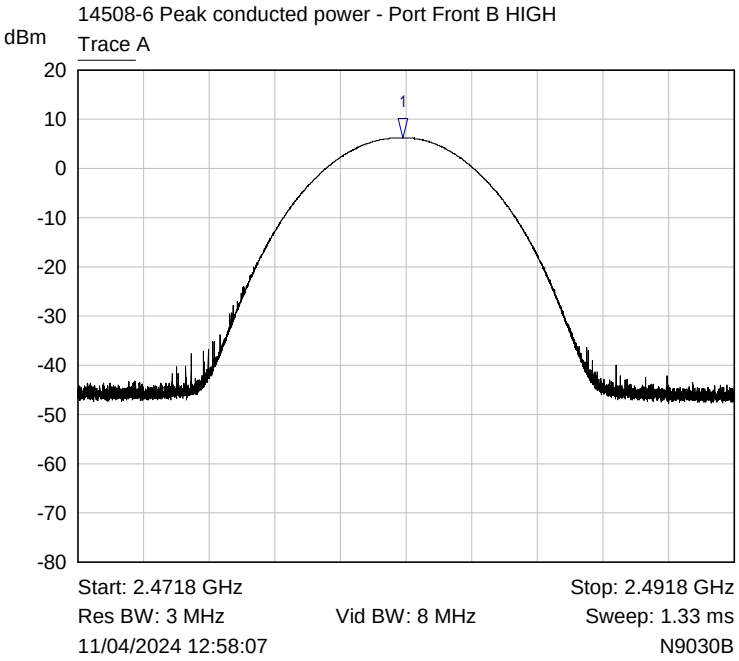
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	3.89 dBm	

Single port Plot reference

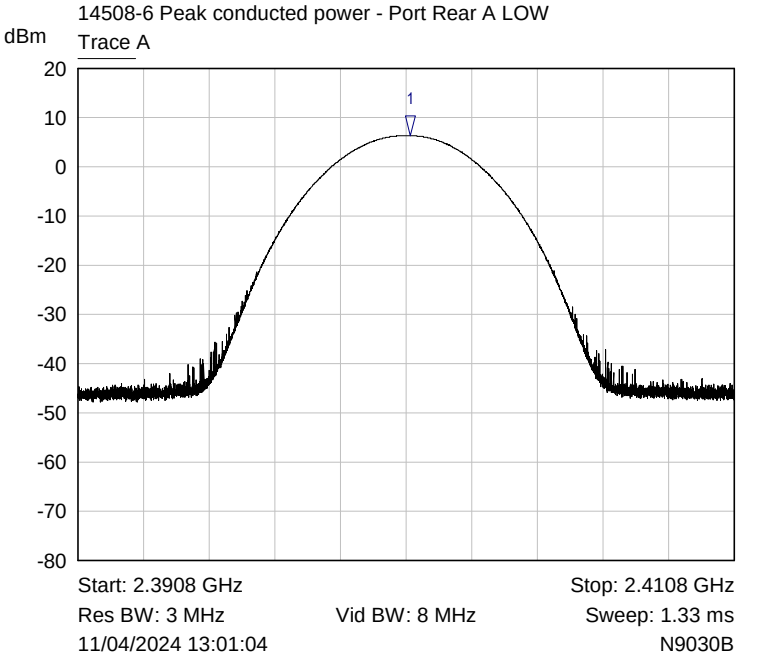
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	6.24 dBm	

Single port Plot reference

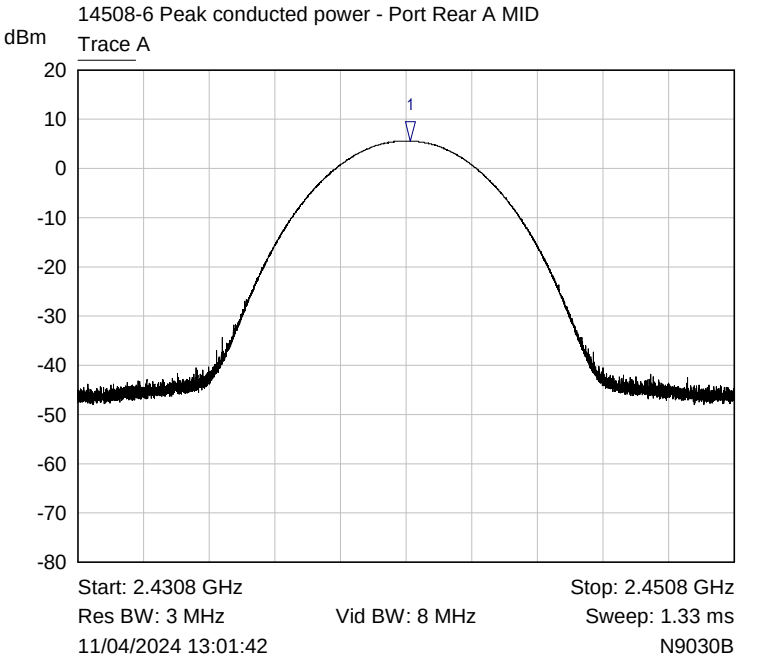
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4009 GHz	6.32 dBm	

Single port Plot reference

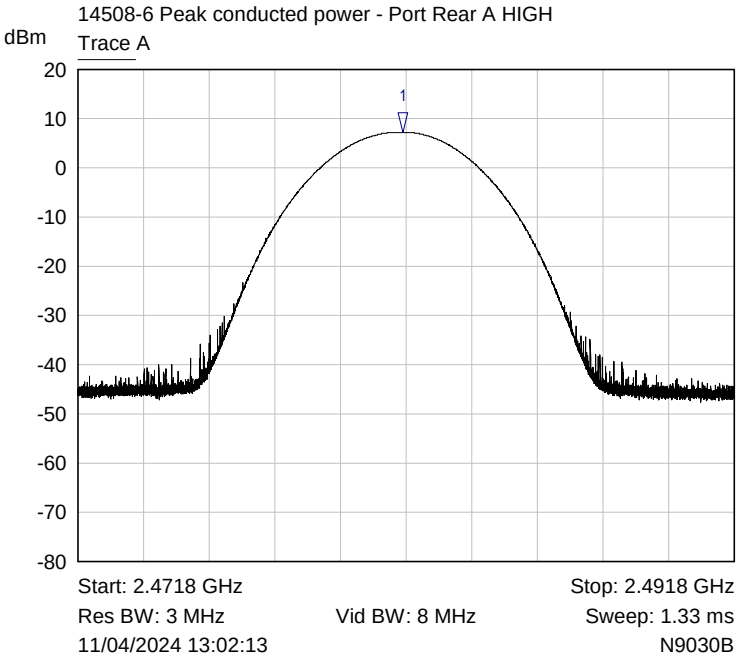
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4409 GHz	5.51 dBm	

Single port Plot reference

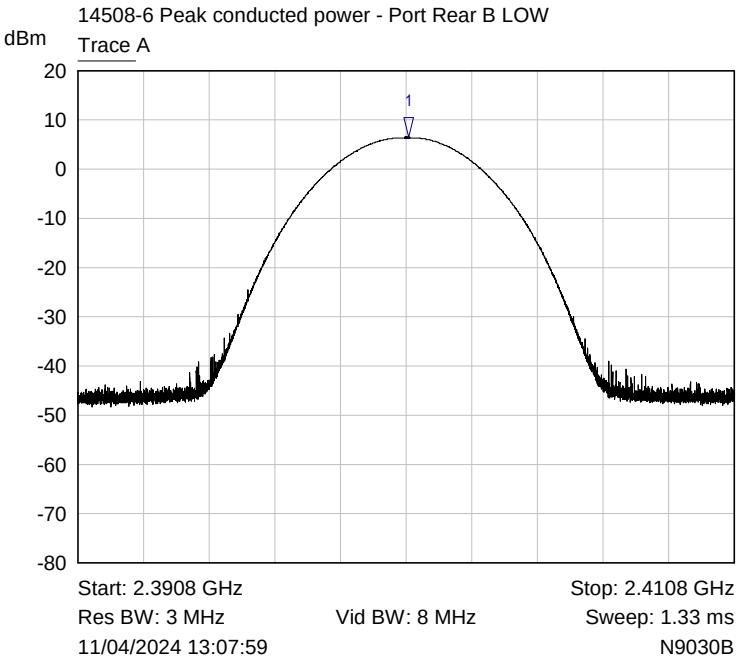
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	7.25 dBm	

Single port Plot reference

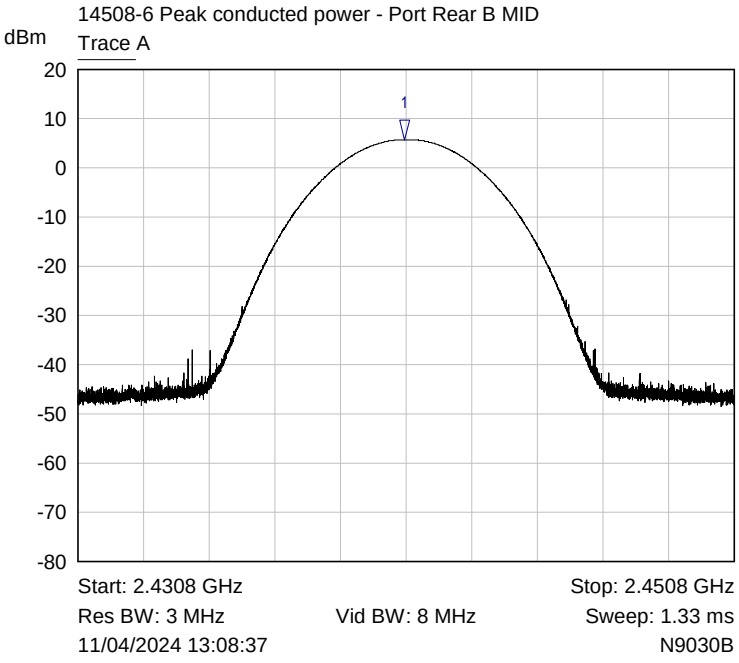
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4009 GHz	6.42 dBm	

Single port Plot reference

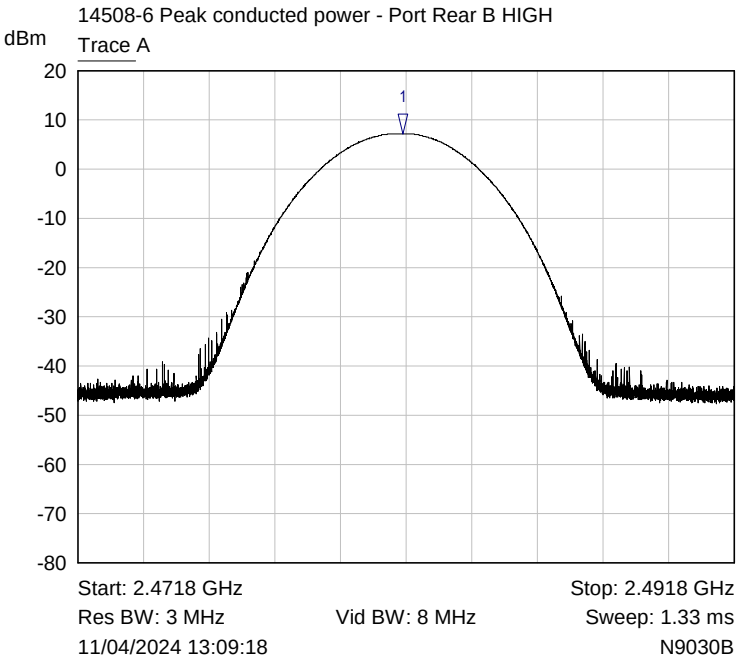
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2440.8 MHz



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4407 GHz	5.71 dBm	

Single port Plot reference

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Rear B), Channel Spacing 400 kHz, Modulation FHSS, Channel 2481.6 MHz

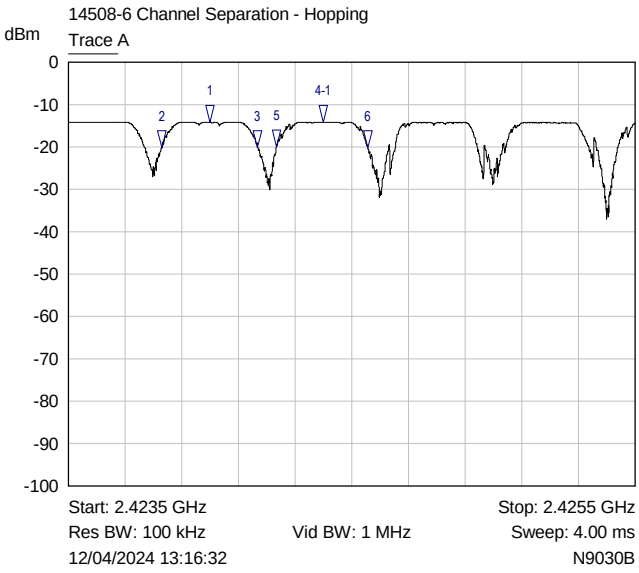


Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4817 GHz	7.24 dBm	

Single port Plot reference

6.10 FHSS carrier frequency separation

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS

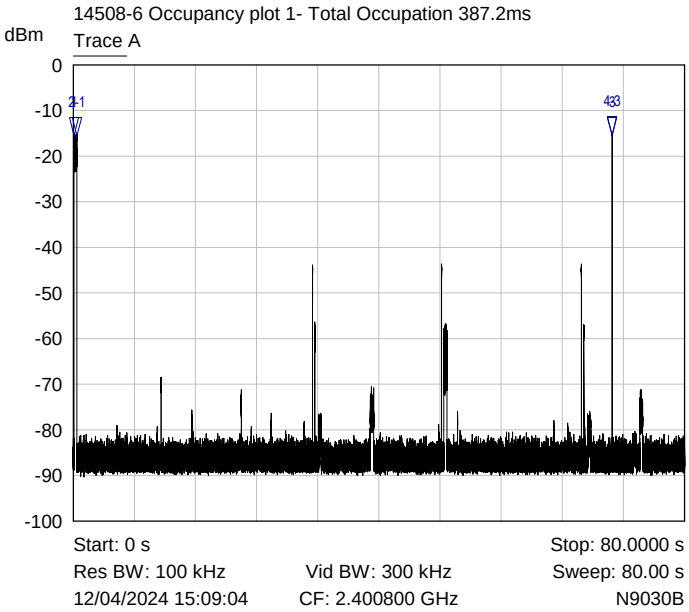


Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4240 GHz	-14.18 dBm	
2	Trace A	2.4238 GHz	-20.13 dBm	
3	Trace A	2.4242 GHz	-20.13 dBm	
4-1	Trace A	400.0000 kHz	0.01 dB	Channel Separation
5	Trace A	2.4242 GHz	-20.13 dBm	
6	Trace A	2.4246 GHz	-20.13 dBm	

Plot of Separation (kHz)

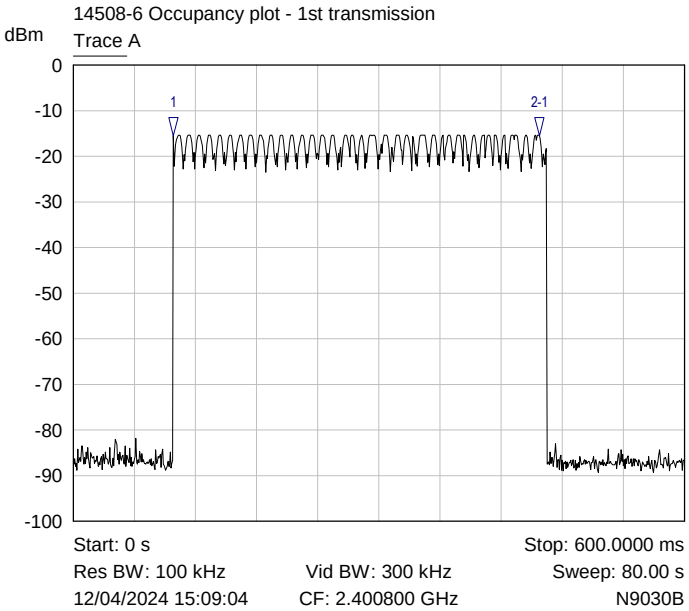
6.11 Average time of occupancy

RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz

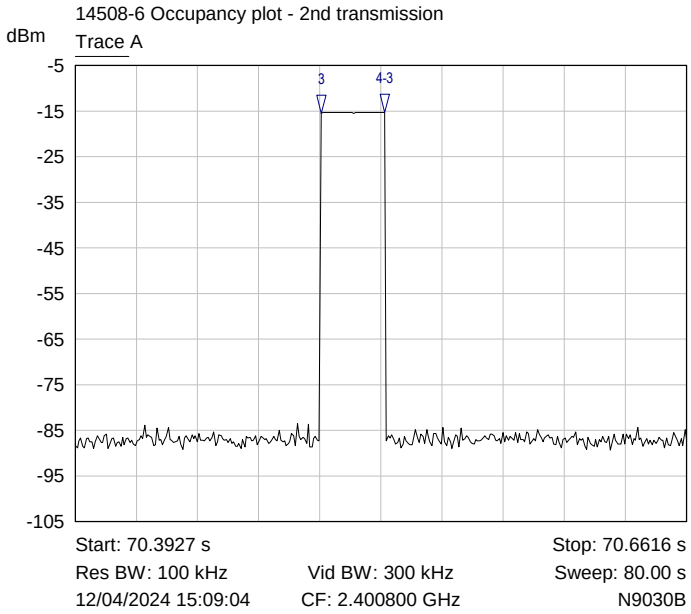


Mkr	Trace	X-Axis	Value	Notes
1	Trace A	98.4000 ms	-15.48 dBm	
2-1	Trace A	359.2000 ms	0.00 dB	1st Transmission
3	Trace A	70.5008 s	-15.44 dBm	
4-3	Trace A	28.0000 ms	0.16 dB	2nd Transmission

Period time (s)



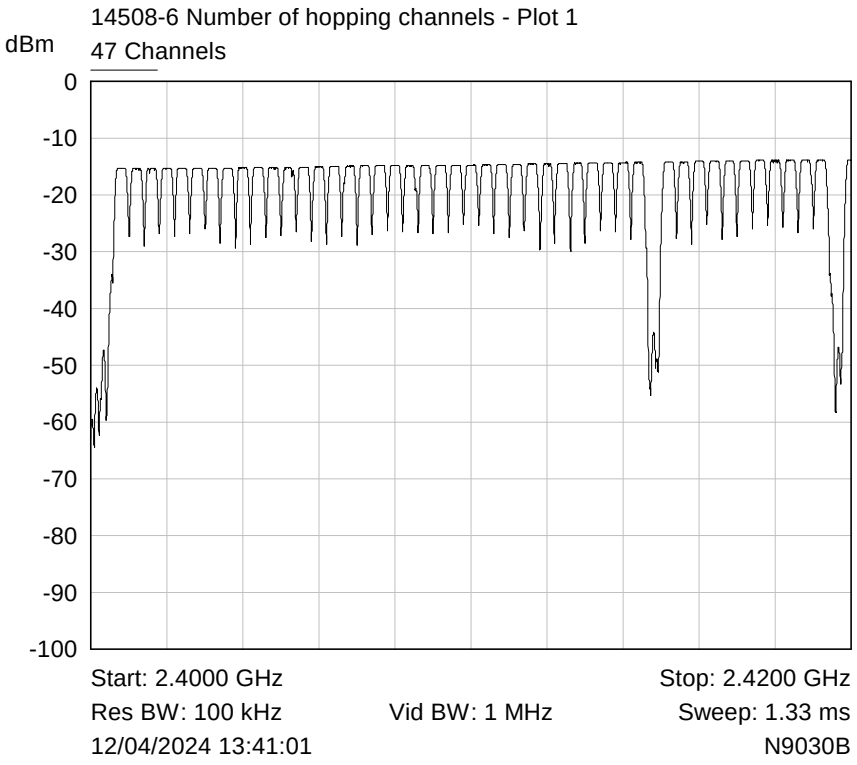
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	98.4000 ms	-15.48 dBm	
2-1	Trace A	359.2000 ms	0.00 dB	1st Transmission



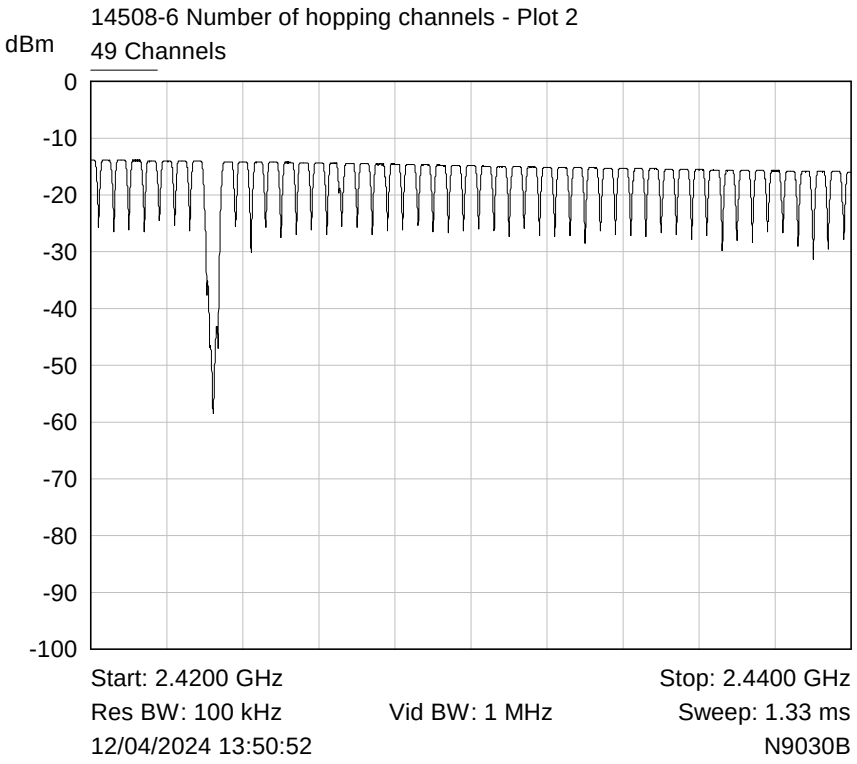
Mkr	Trace	X-Axis	Value	Notes
3	Trace A	70.5008 s	-15.44 dBm	
4-3	Trace A	28.0000 ms	0.16 dB	

6.12 Number of Hop Channels

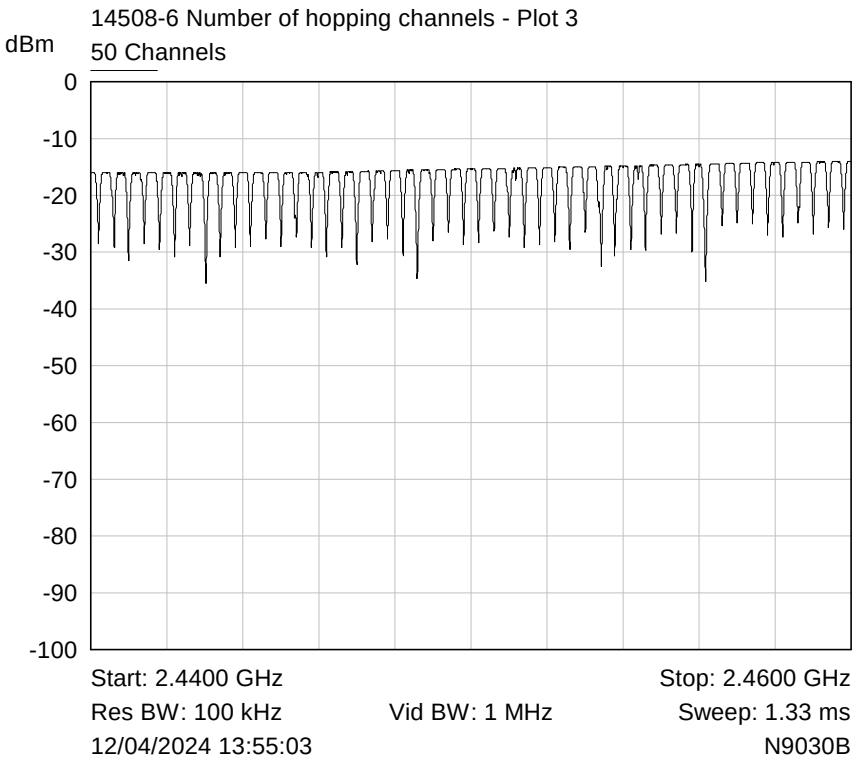
RF Parameters: Band 2400-2483.5 MHz, Power Setting 29 (Front A), Channel Spacing 400 kHz, Modulation FHSS, Channel 2400.8 MHz



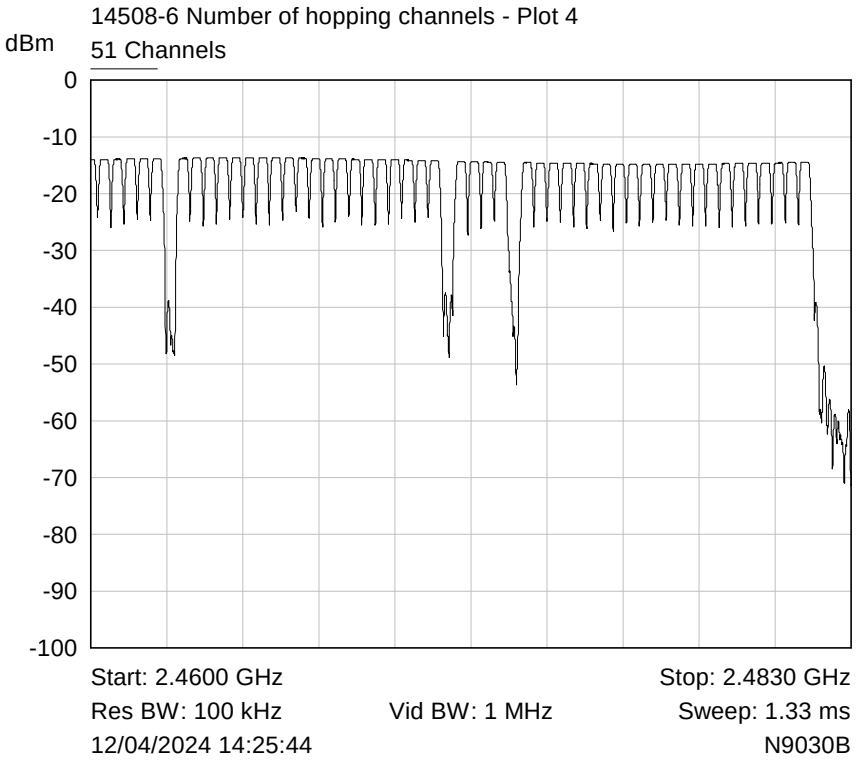
Plot of Hopping Channels 1-47



Plot of Hopping Channels 48-96



Plot of Hopping Channels 97-146



Plot of Hopping Channels 147-197

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. Kiwa Electrical Compliance 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

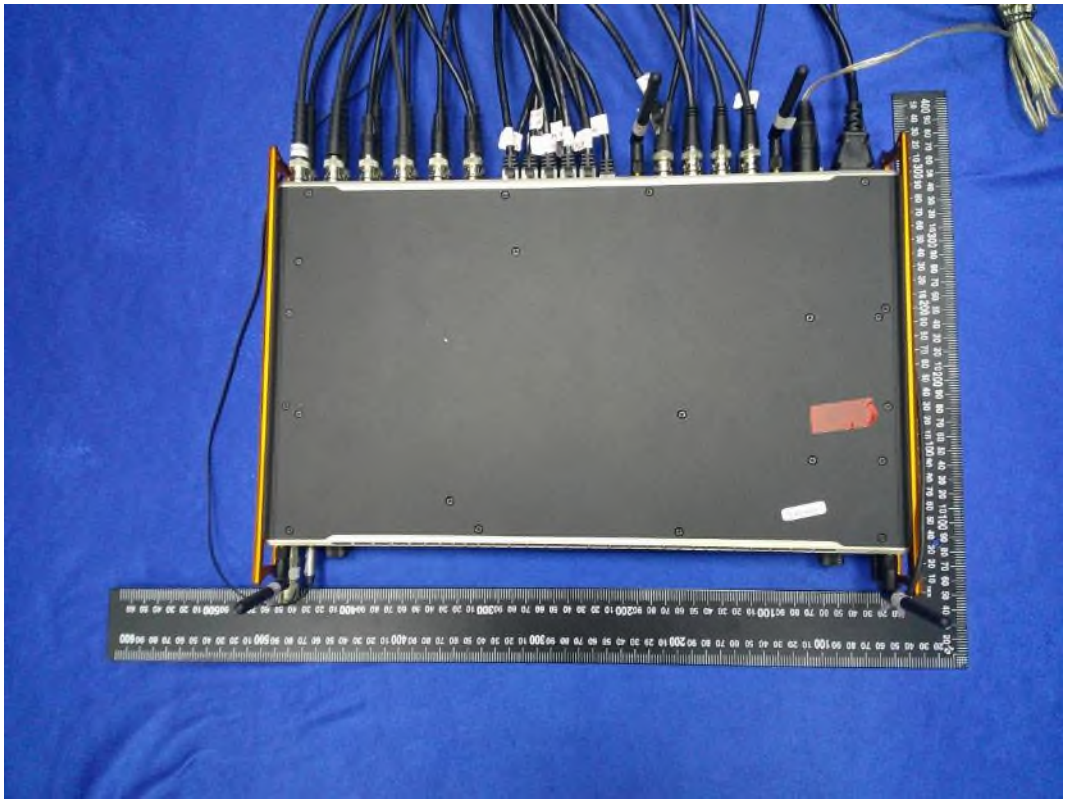
Equation 26 transposed: $E_{Spec\ limit} = \sqrt{(0.9x10^{-6} \times 377)} = 0.01842$ V/m.

And

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

8 Photographs

8.1 EUT Front View



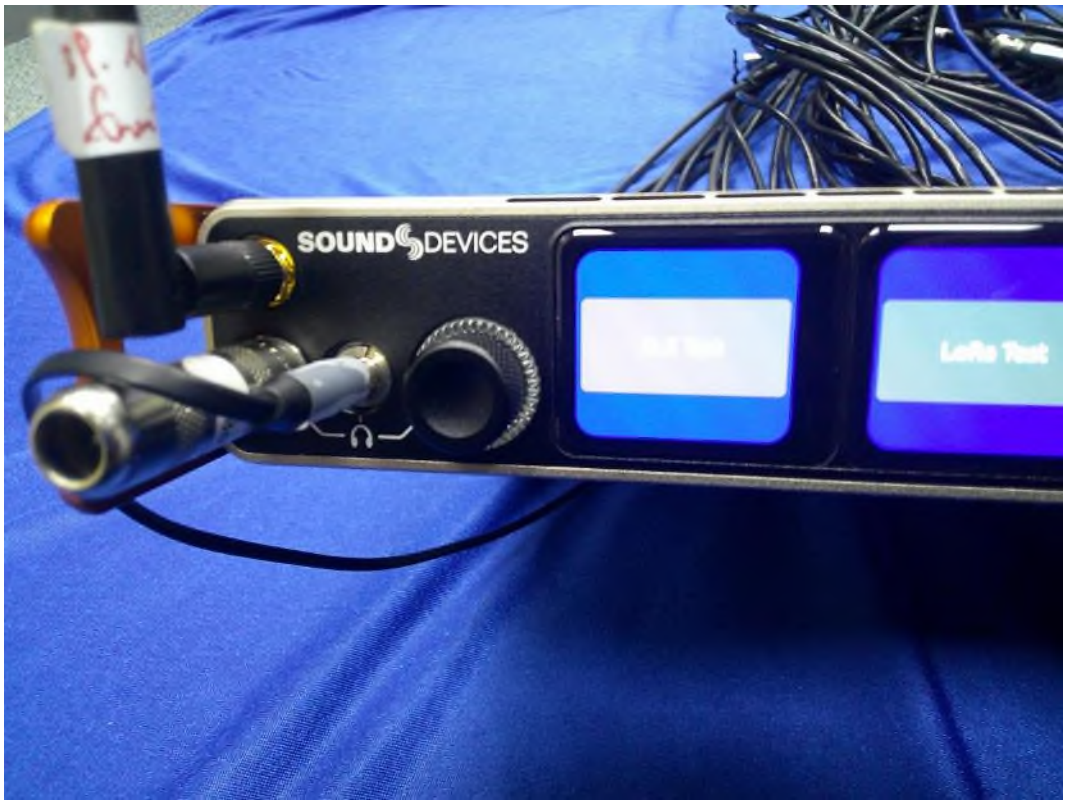
8.2 EUT Reverse Angle

8.3 EUT Left side View

8.4 EUT Right side View

8.5 EUT Antenna

8.6 EUT Display & Controls

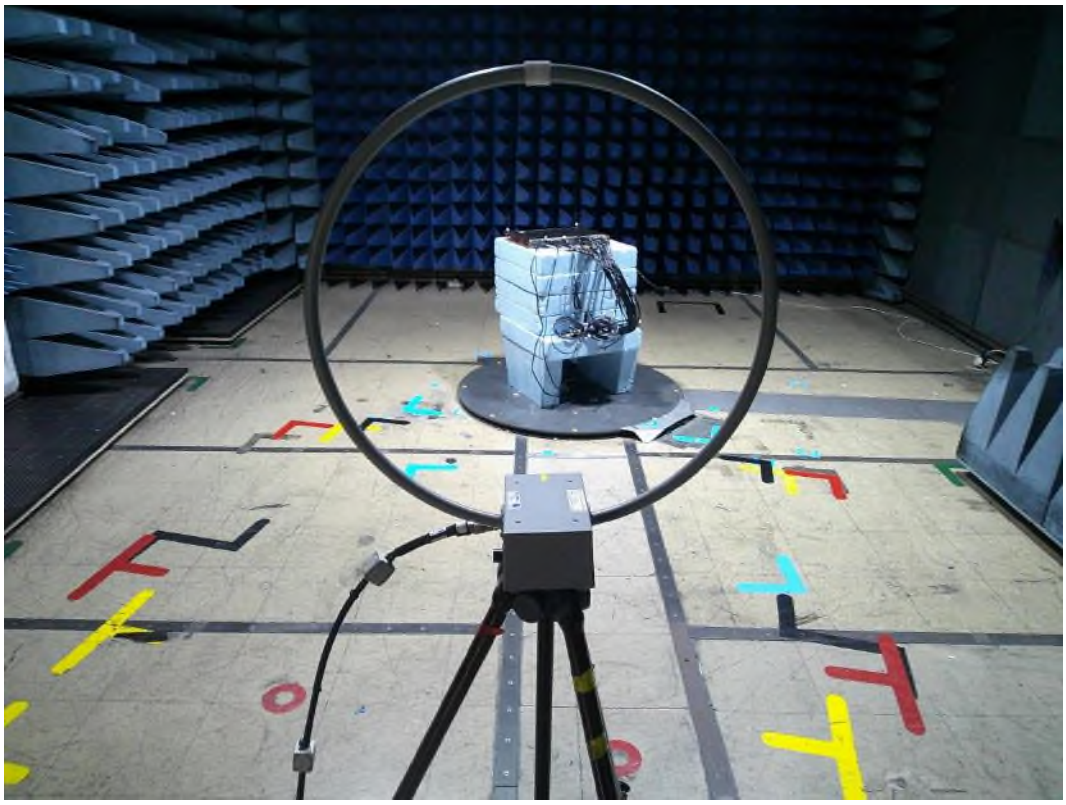


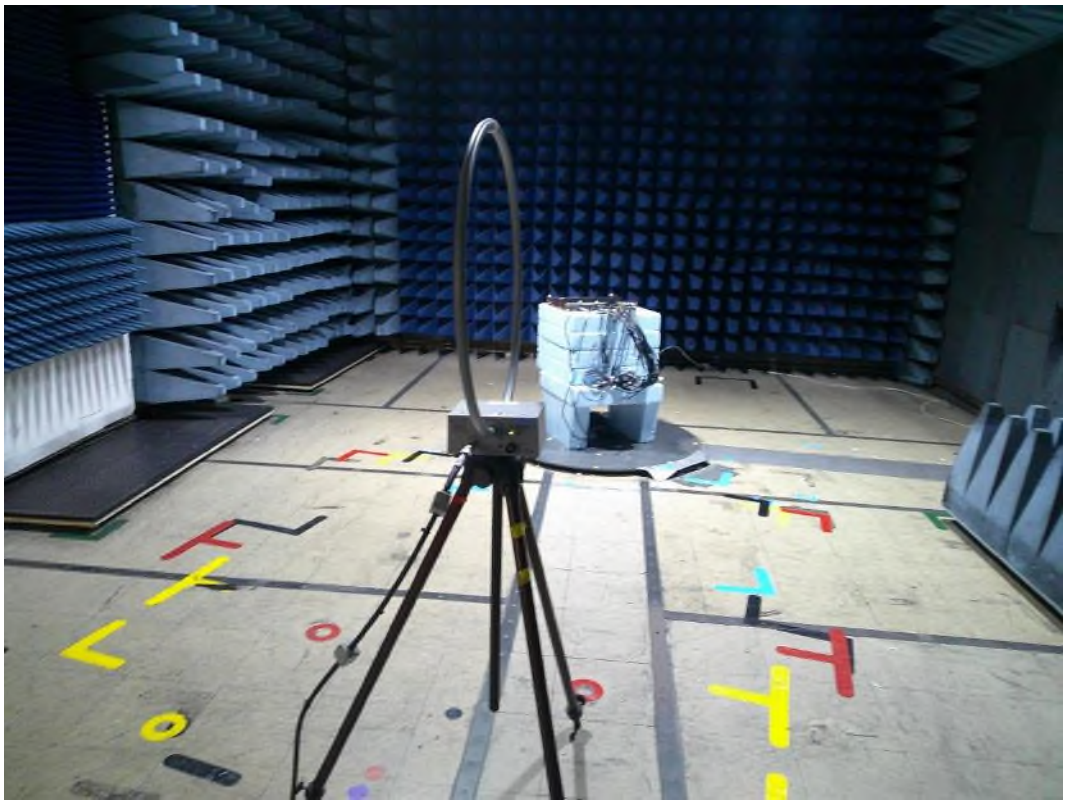
8.7 EUT Internal photos

Due to the complexity of the EUT no internal photograph were taken.

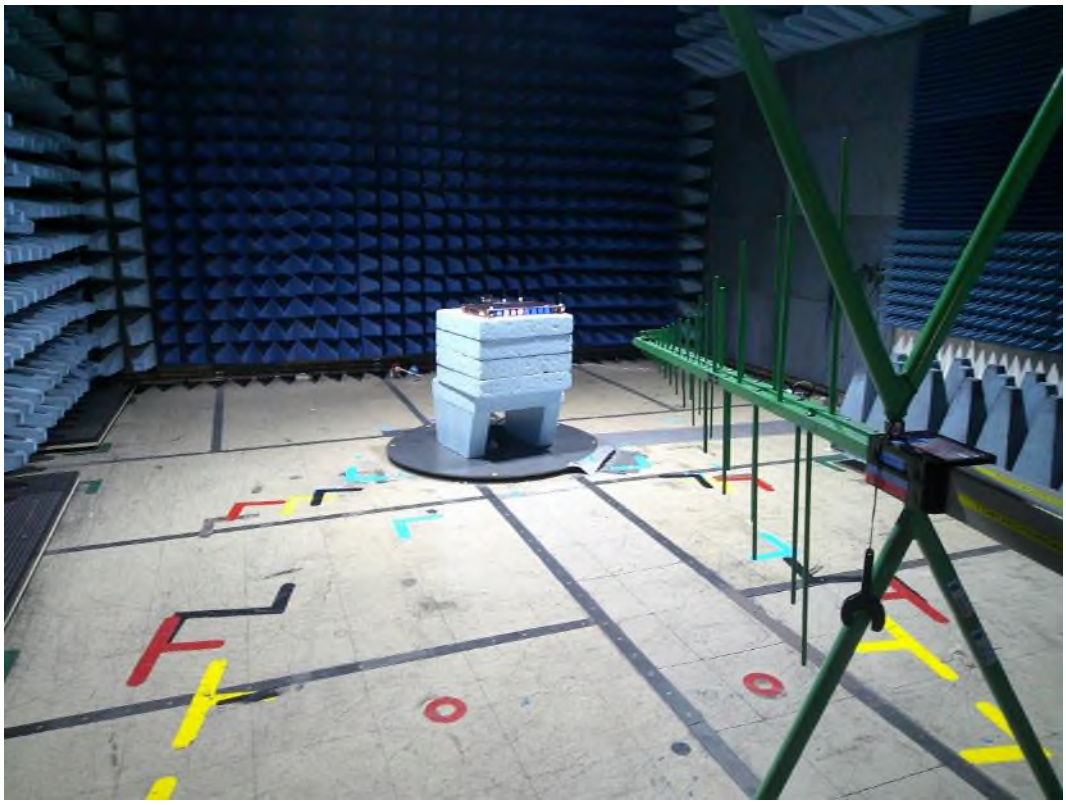
8.8 EUT ID Label

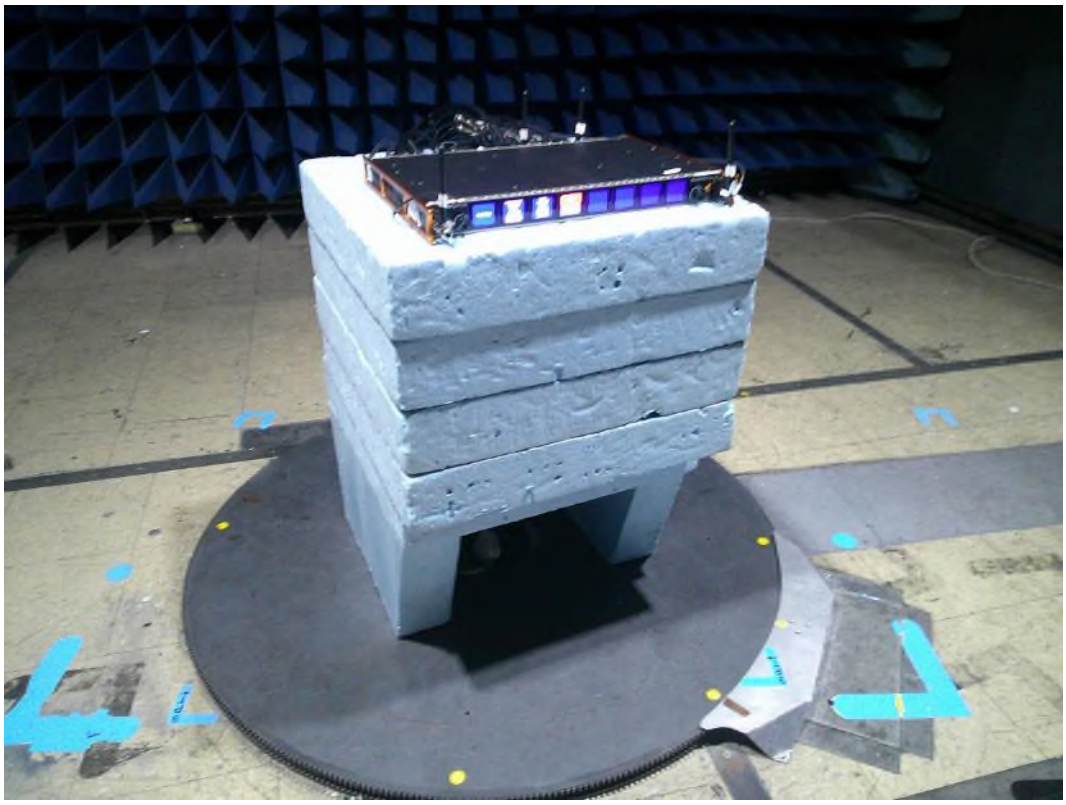
8.9 Radiated emissions 150 kHz - 30 MHz

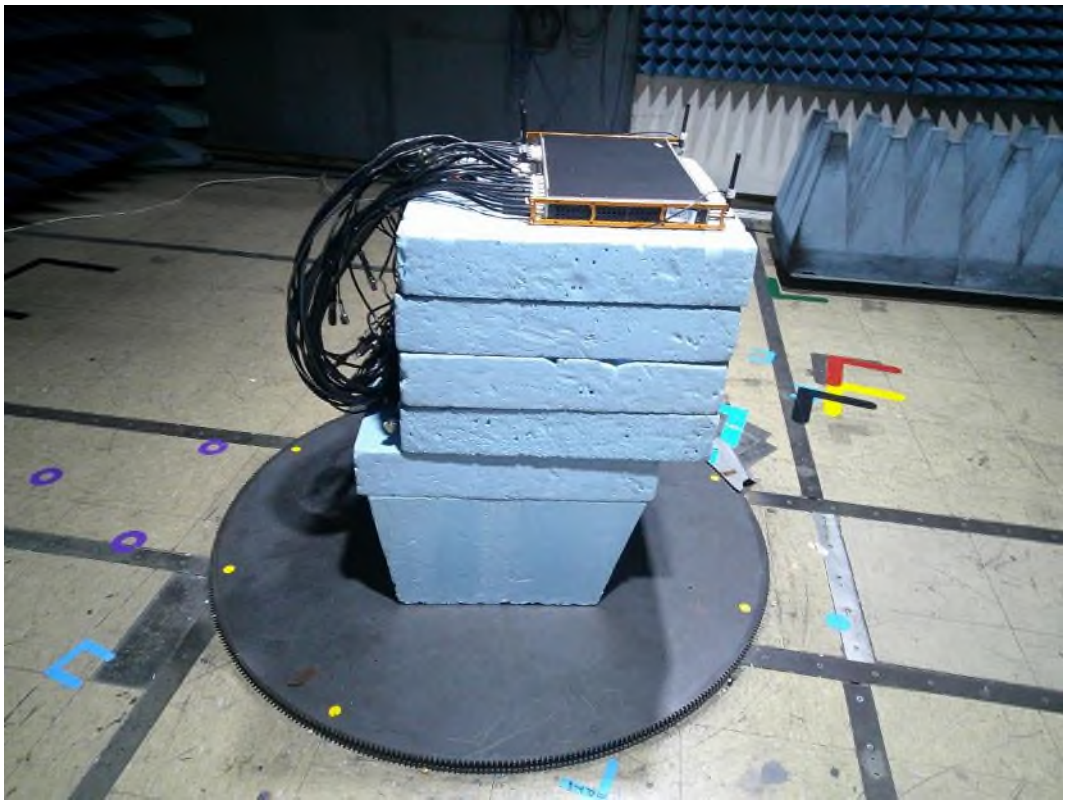


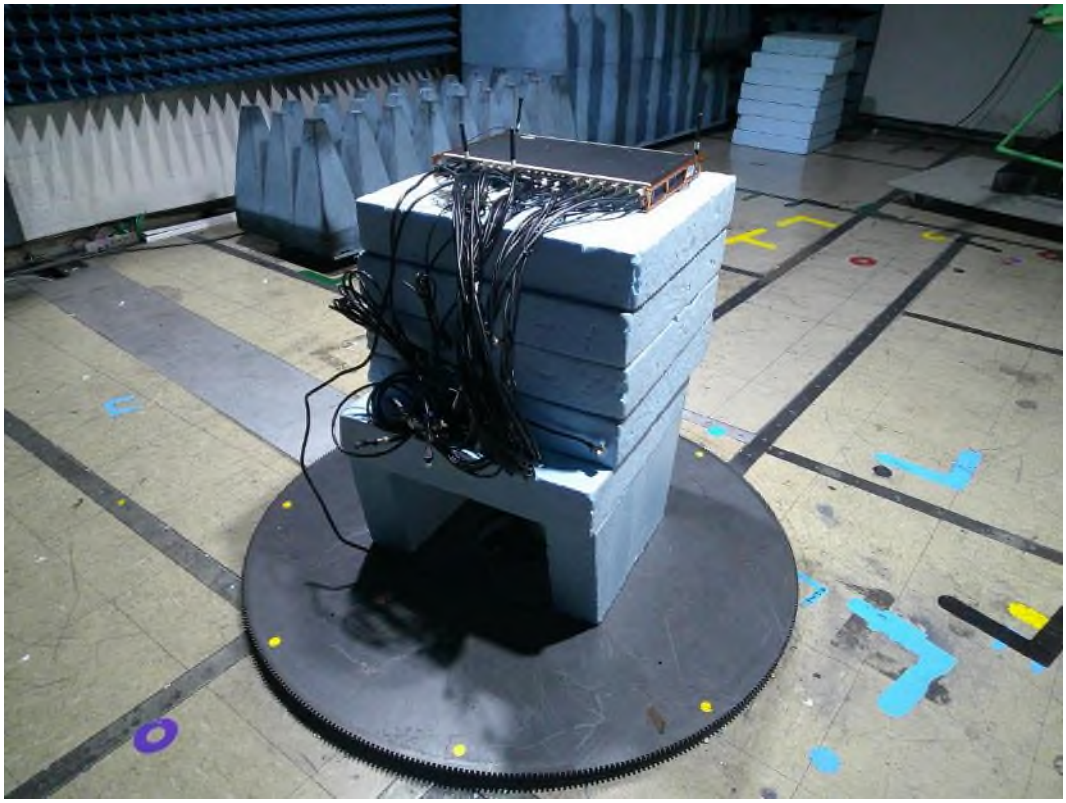


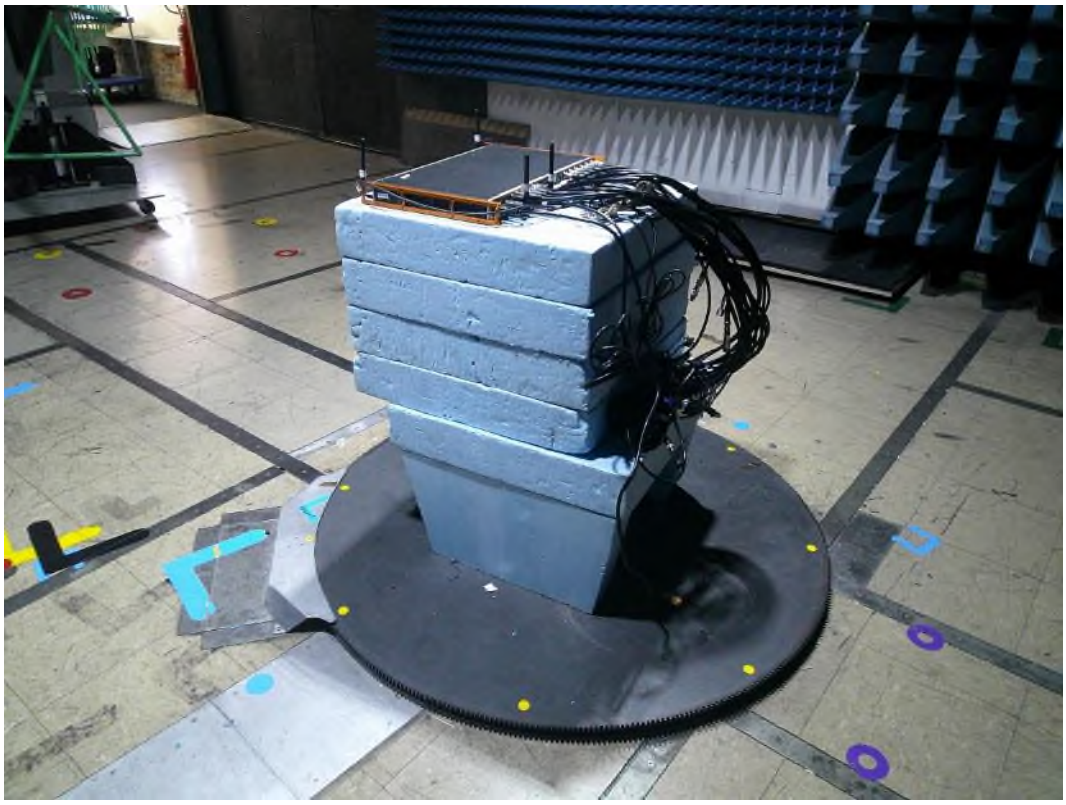
8.10 Radiated emissions 30 MHz -1 GHz

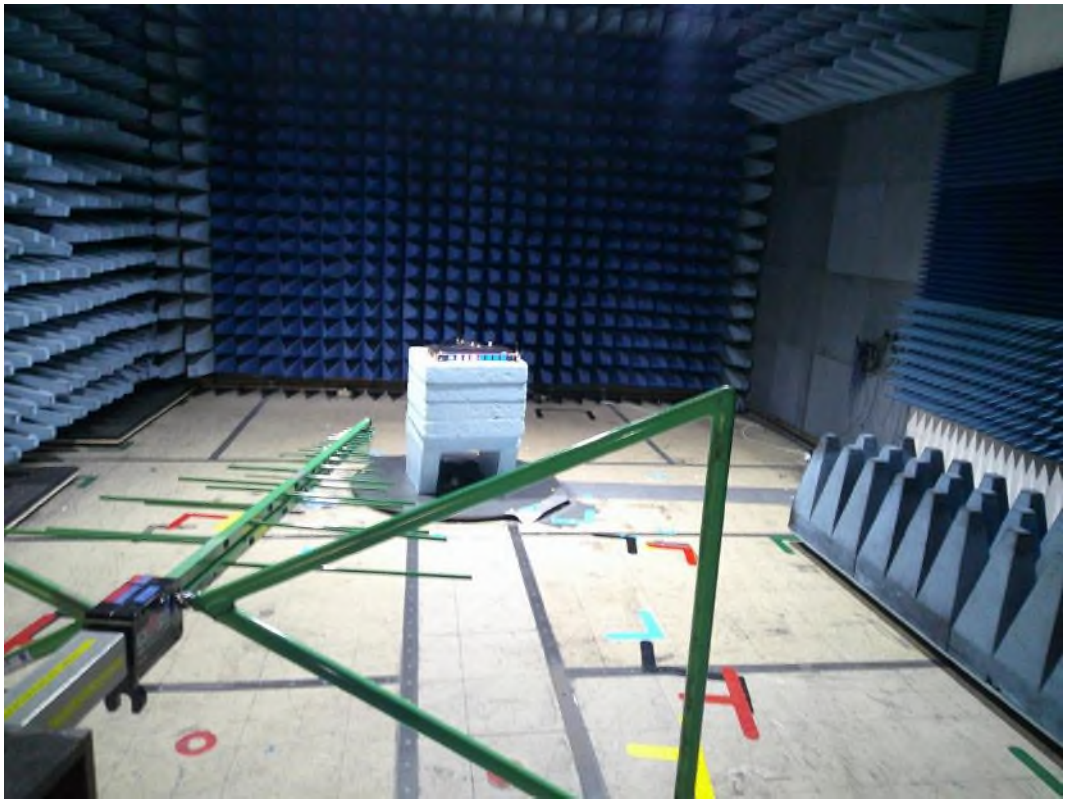




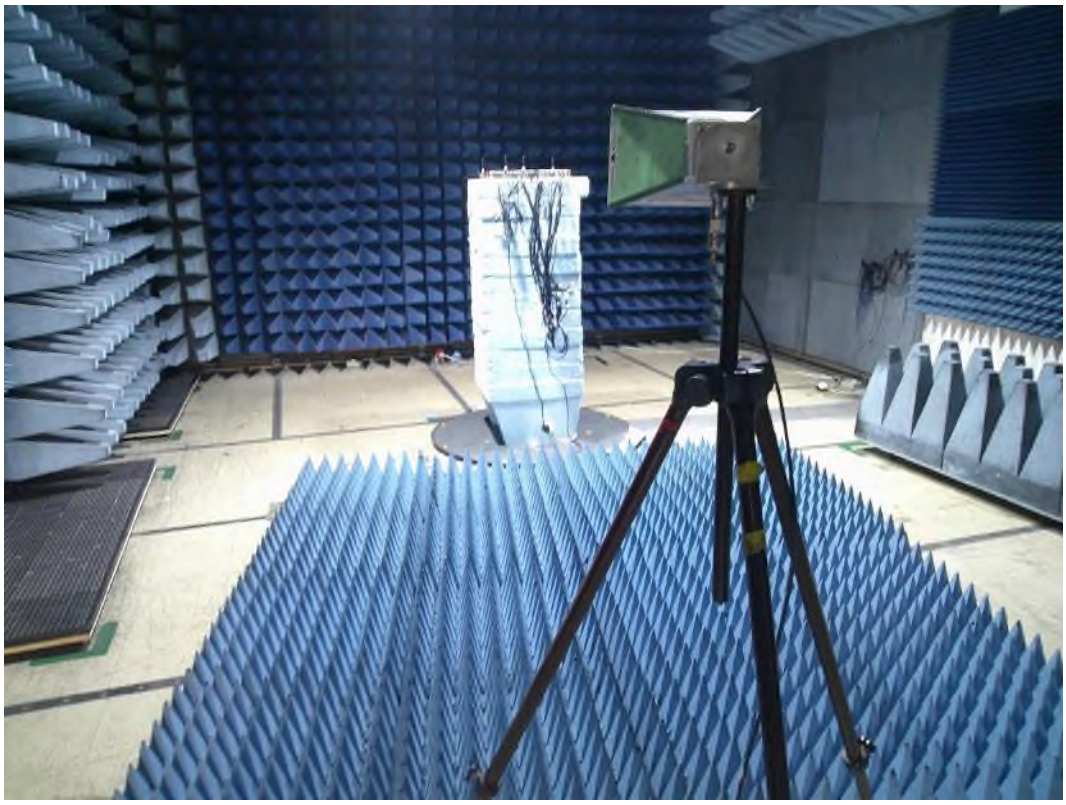


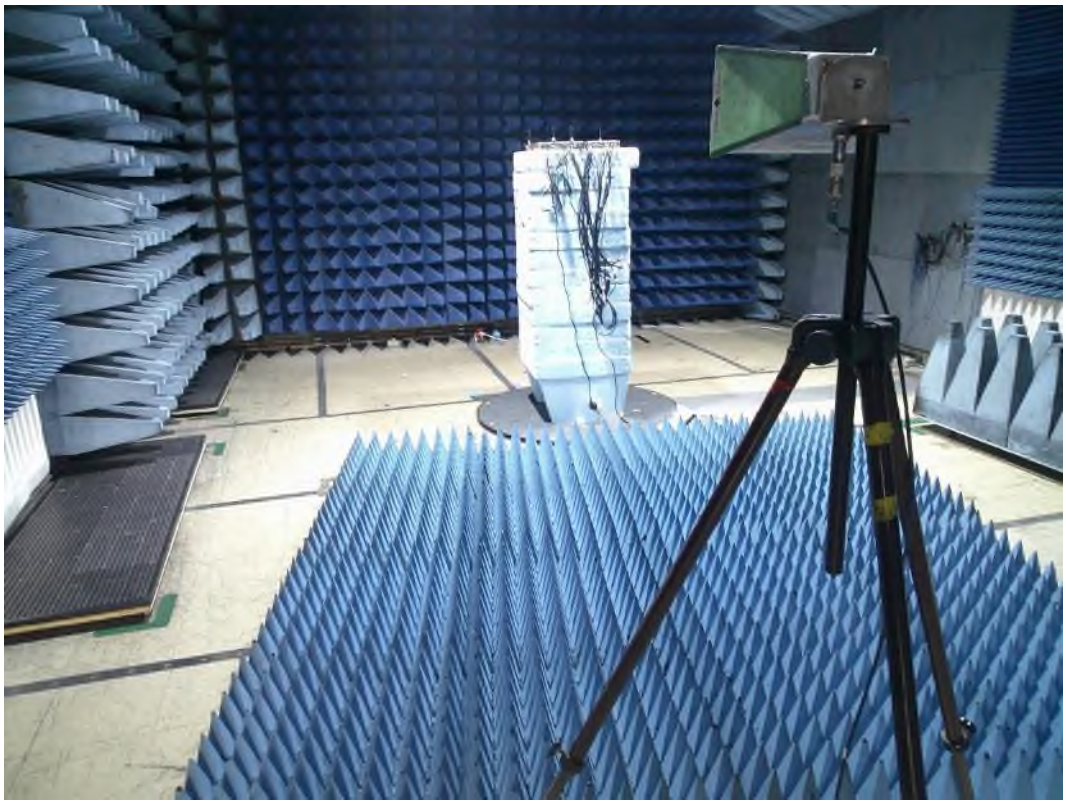


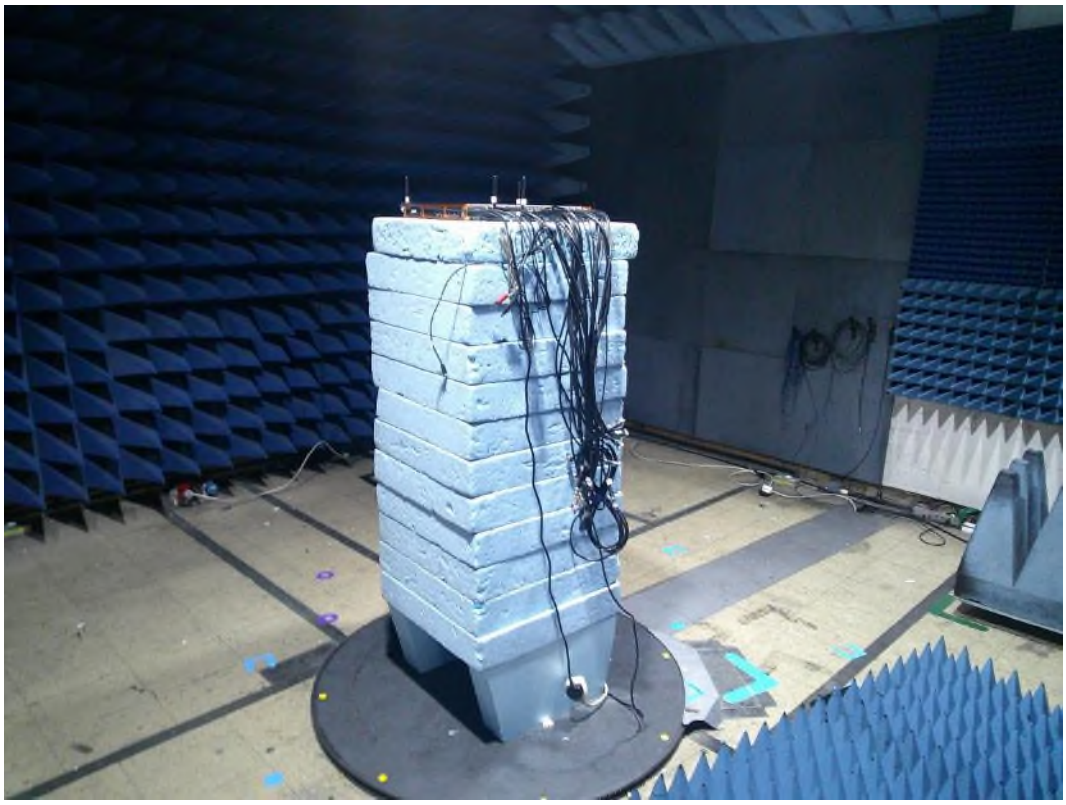


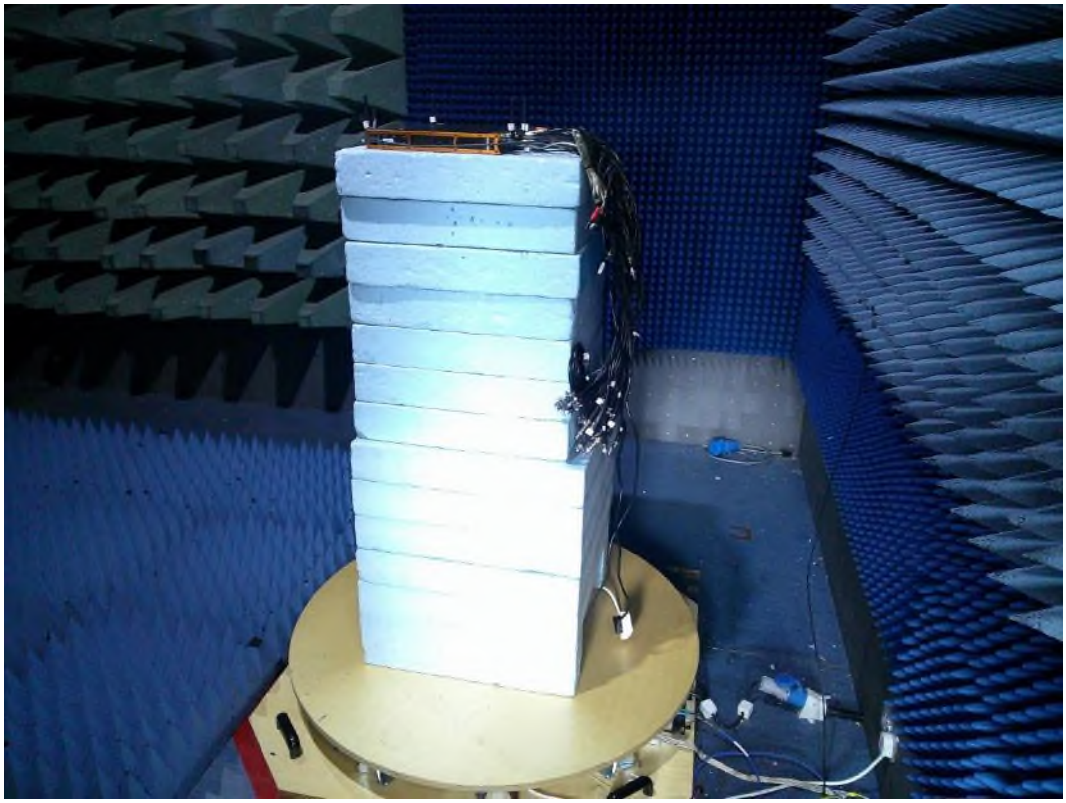


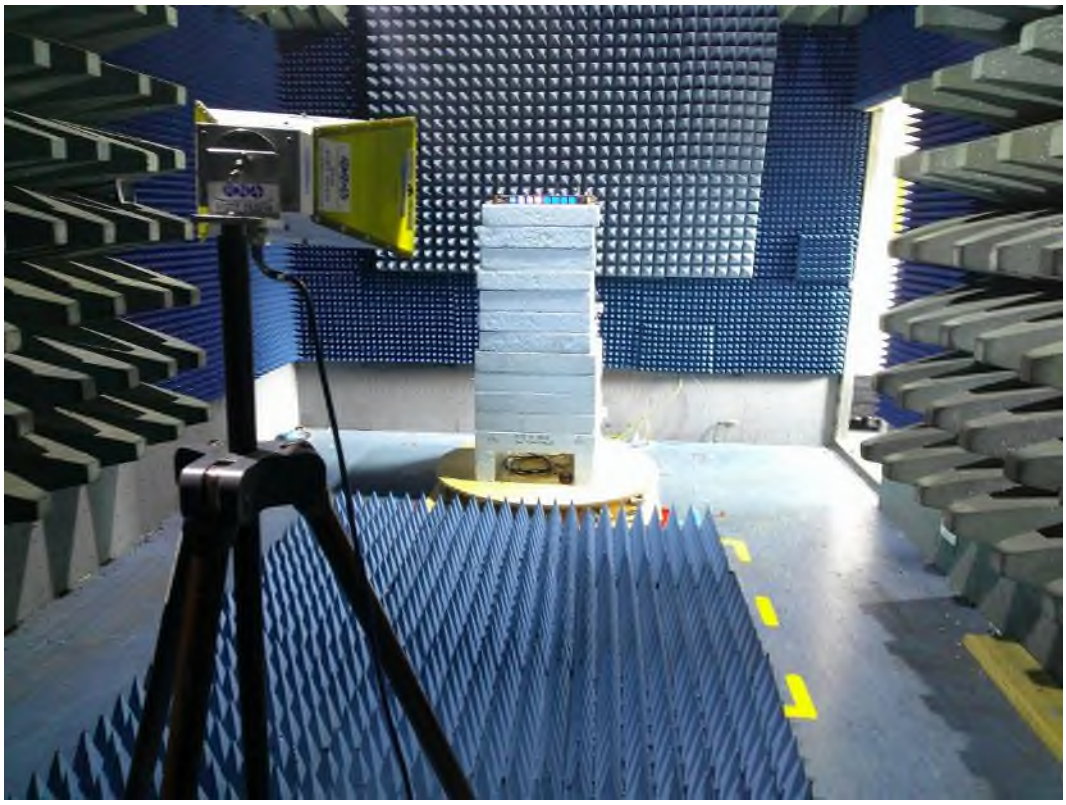
8.11 Radiated emissions above 1 GHz

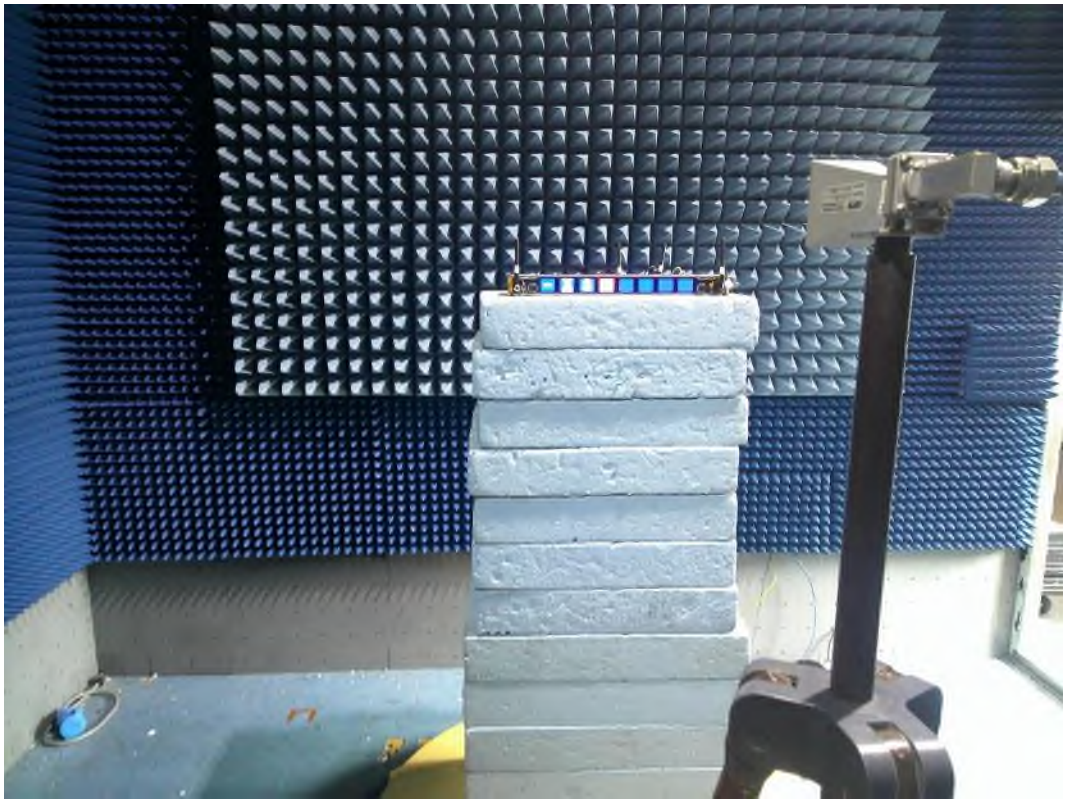


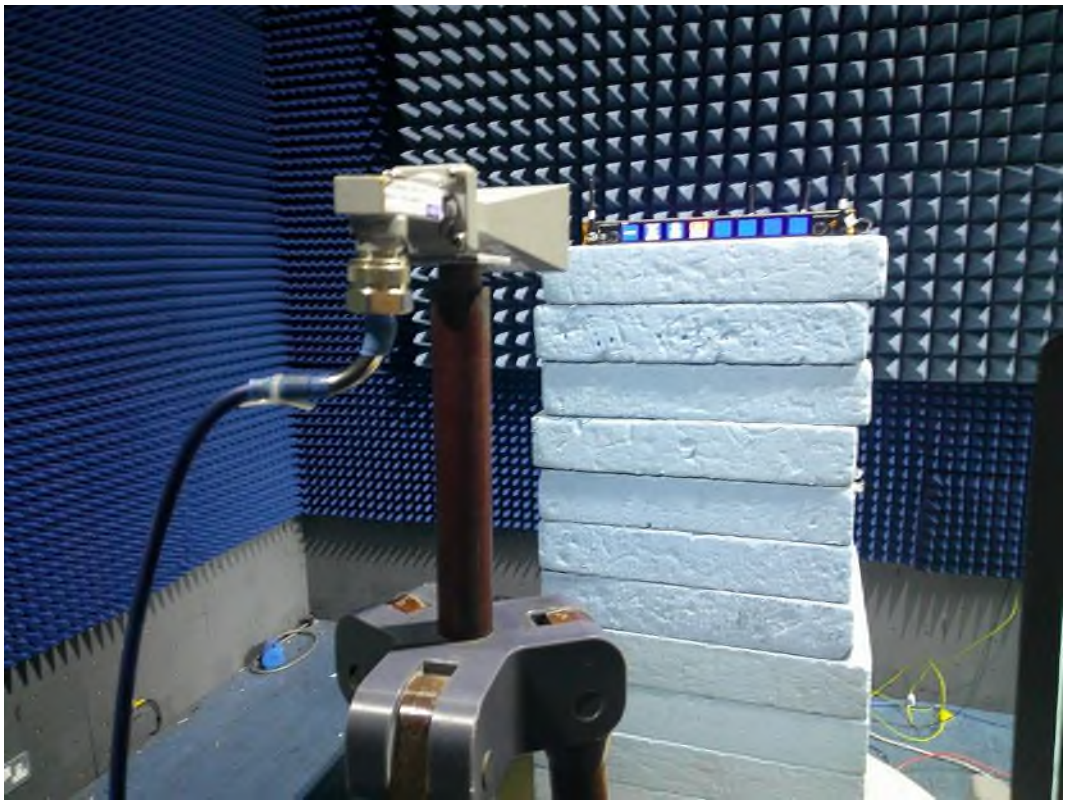


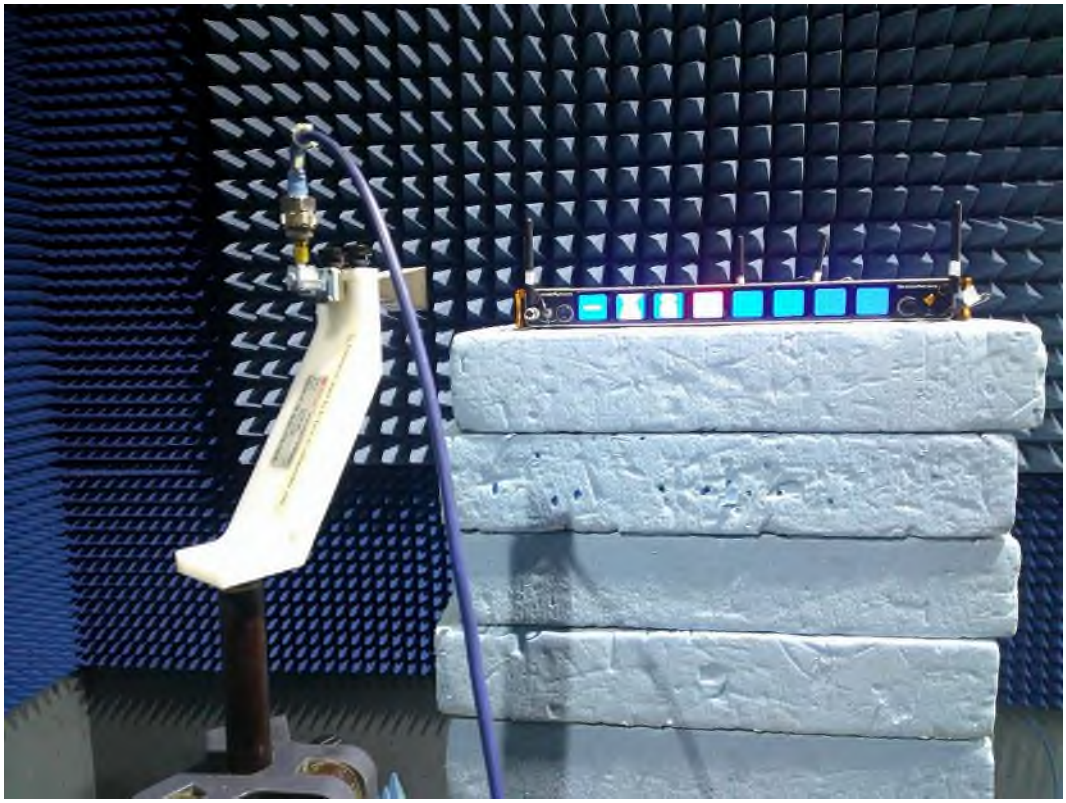




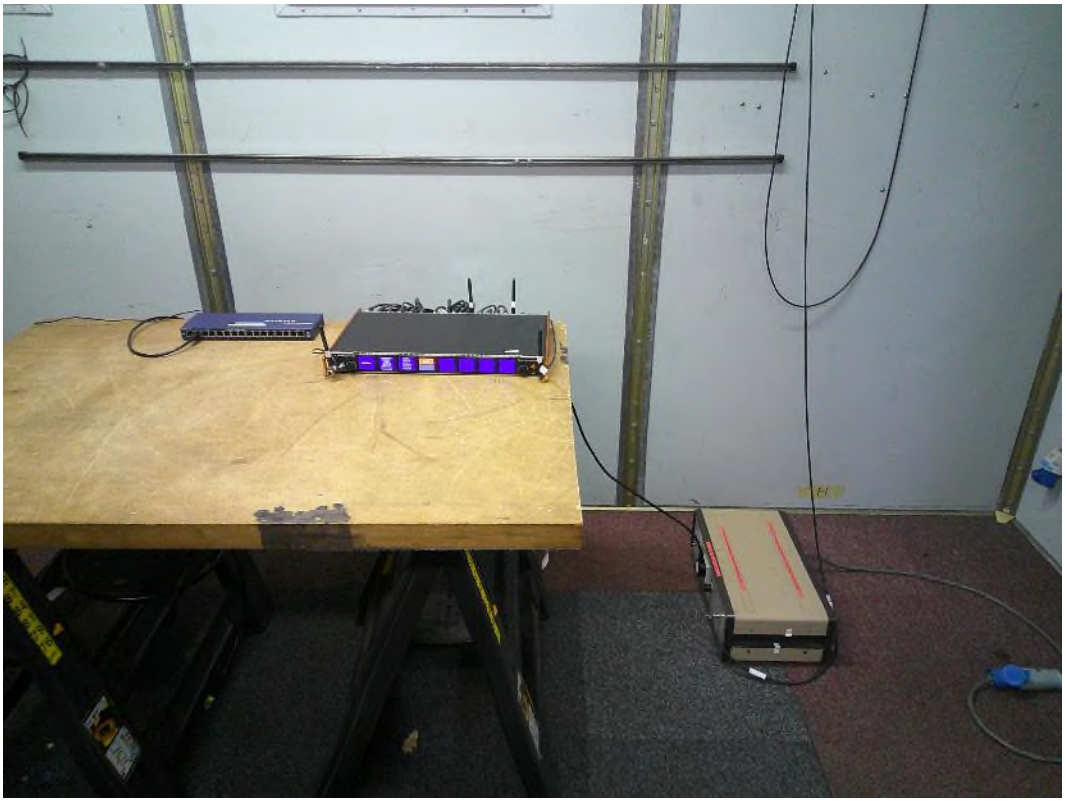








8.12 AC Conducted emissions



EUT powered using a 120VAC 60Hz power source

EUT powered via DC port using a bench power supply

8.13 Radiated emission diagrams

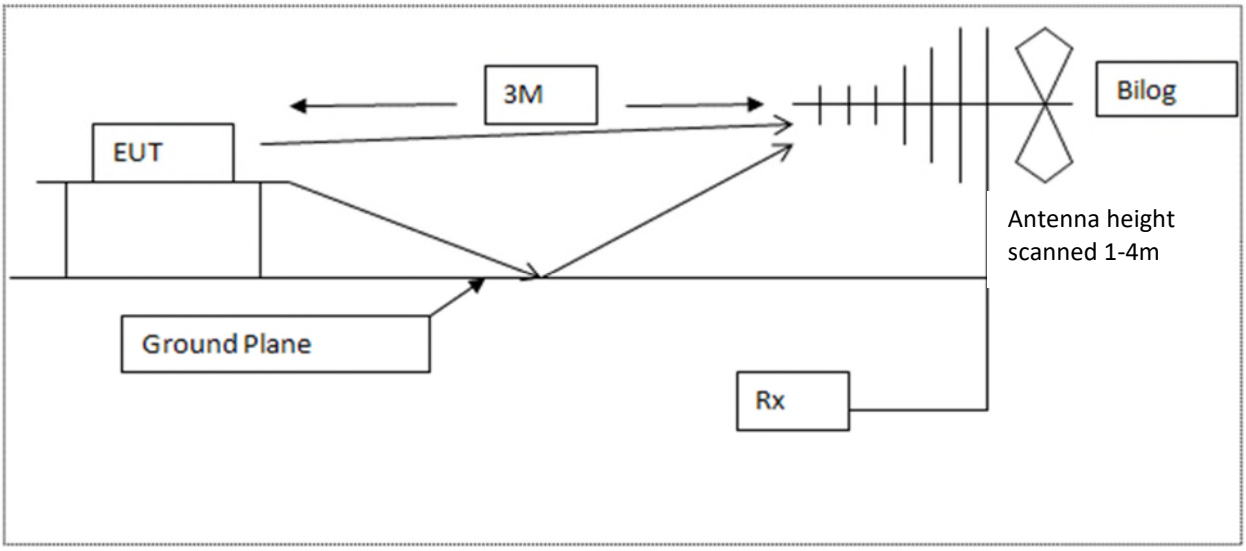


Diagram of the radiated emissions test setup 30 - 1000 MHz

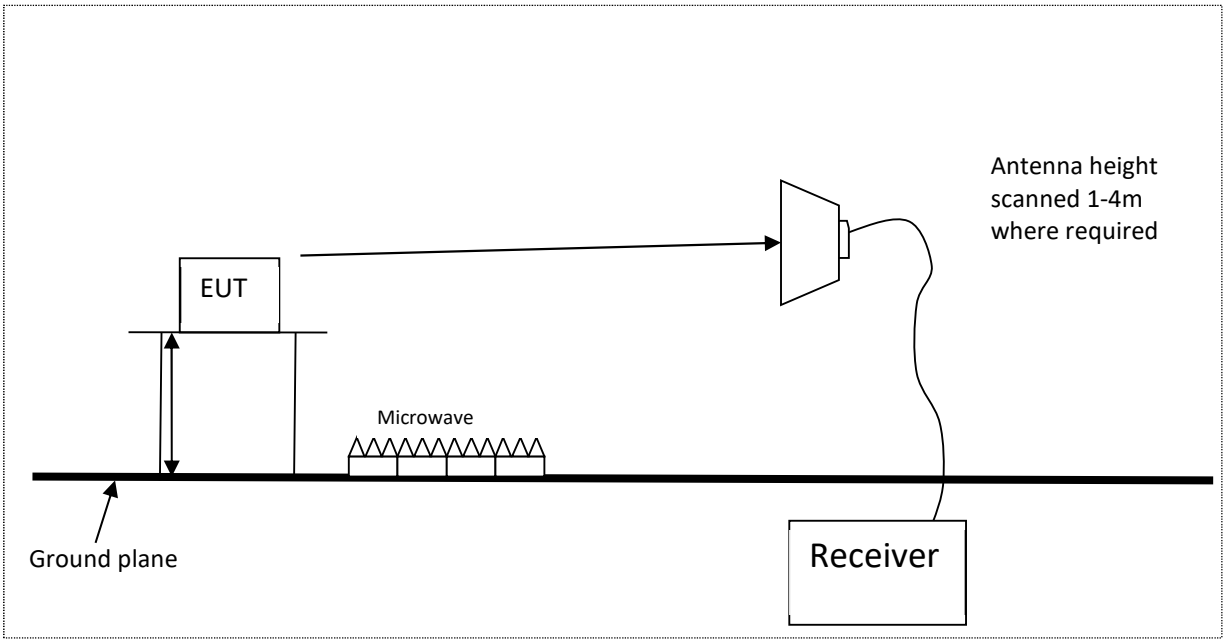


Diagram of the radiated emissions test setup above 1GHz

8.14 AC powerline conducted emission diagram

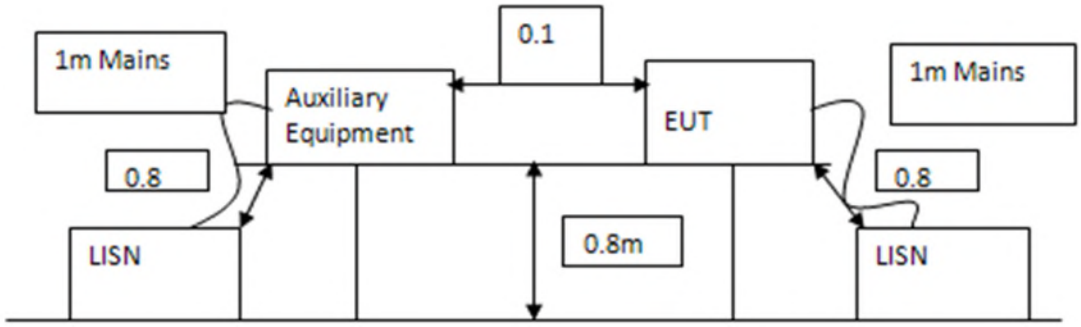


Diagram of the AC conducted emissions test setup

9 Test equipment calibration list

The following is a list of the test equipment used by Kiwa Electrical Compliance 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	03-Jan-2024	12 months
E136	3105	Horn Antenna 1 - 12.5 GHz	EMCO	#15-May-2024	12 months
E150	MN2050	LISN 13A	Chase	03-May-2023	12 months
E301	8493C	Attenuator 20dB 26.5GHz	Hewlett Packard	09-Apr-2024	12 months
E313	777C	Attenuator 30dB	Narda	27-Oct-2023	12 months
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	05-Jul-2023	12 months
E428	HF906	Horn Antenna 1 - 18 GHz	Rohde & Schwarz	23-May-2023	36 months
E517	E4421B	Signal Generator 250 kHz - 3 GHz	Hewlett Packard	18-Sep-2023	12 months
E624	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	06-Jul-2023	24 months
E642	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	20-Feb-2024	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	22-Feb-2024	12 months
E755	N9030B	PXA Signal Analyser 3 Hz to 50 GHz	Keysight Technologies	14-Aug-2023	12 months
E856	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	22-Mar-2024	12 months
LPE364	CBL6112A	Antenna BiLog 30MHz - 2GHz	Chase Electronics Ltd	28-Mar-2022	36 months
NSA-M	NSA - M	NSA - Site M	RN Electronics	29-Nov-2021	36 months
TMS78	3160-08	Horn Std Gain 12.4 - 18 GHz	ETS Systems	05-Oct-2023	12 months
TMS79	3160-09	Horn Std Gain 18 - 26.5 GHz	ETS Systems	23-May-2023	12 months
TMS81	6502	Antenna Active Loop	EMCO	17-Aug-2023	24 months
TMS82	8449B	Pre-Amplifier 1GHz - 26.5GHz	Agilent Technologies	08-Jan-2024	12 months
TMS937	CCN1000	Mains Flicker	Schaffner	31-Aug-2022	24 months
TMS938	NSG1007	AC Power Source 3kVA	Schaffner	31-Aug-2022	24 months
ZSW1	V2.5.2	Measurement Software Suite	RN Electronics	Not applicable	

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	A20-Mini	Audio Transmitter	Sound Devices LLC	GE0822350072

10.2 Kiwa Electrical Compliance supplied equipment

KEC No.	Model No.	Description	Manufacturer	Serial No
E465	PCR2000LA	AC Power Source 2kVA	Kikusui	HJ000995
N450	EN106TP	6 Port Ethernet Hub	Netgear	ENT6006298
P274	TPS2000	PSU 15V 10A	TOPWARD ELECTRIC INSTRUMENTS	920243

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 Kiwa Electrical Compliance.

11.2 Modifications during test

No modifications were made during test by Kiwa Electrical Compliance.

12 Description of test sites

Site A Radio Laboratory and Anechoic Chamber

Site B Semi-Anechoic Chamber and Control Room
FCC Registration No. 654321, 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. 654321, 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. 654321, 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. 654321, ISED Registration No. 5612A-1

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

CAB identifier as issued by Innovation, Science and Economic Development Canada is UK0002
CAB identifier as issued by FCC is UK2015

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	Resolution 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 Repetition Frequency	VSAT	Very Small Aperture Terminal
PSD	Power Spectral Density	W	Watts
PSU	Power Supply Unit		

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