Radio Test Report

Eptura Inc.
Meeting Room Screen
Room V3.0

47 CFR Part 15.209 Effective Date 1st October 2023
DXX: Part 15 Low Power Communication Device Transmitter
Test Date: 10th January 2024 to 2nd February 2024
Report Number: 02-14529-8-24 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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Certificate of Test 14529-8

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:	Meeting Room Screen
Model Number:	Room V3.0
Unique Serial Number:	201702R01245000134A. 201702R01235000115A (for AC powerline conducted emissions)
Applicant:	Eptura Inc. 950 East Paces Ferry Road NE, Suite 800 Atlanta GA 30326 USA
Proposed FCC ID	2BGPFV3ROOMSCREEN
Full measurement results are detailed in Report Number:	02-14529-8-24 Issue 01
Test Standards:	47 CFR Part 15.209 Effective Date 1st October 2023 DXX: Part 15 Low Power Communication Device 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 the 125 kHz RFID functionality of the device 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:	10th January 2024 to 2nd February 2024
Test Engineer: Chee-Wah Yeung	Chee-Wah Yeung Digitally signed by: Chee-Wah Yeung DN: CN = Chee-Wah Yeung email = chee-wah.yeung@kiwa.com C = GB OU = Kiwa Electrical Compliance Date: 2024.06.07 11:08:08 Z
Approved By: Radio Approvals Manager	Digitally signed by: Daniel Sims DN: CN = Daniel Sims email = Daniel.Sims@kiwa.com C = GB O = Kiwa Electrical Compliance - Brentwood Date: 2024.06.07 09:38:49 Z
Customer Representative:	

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2 Equipment under test (EUT)

2.1 Equipment specification

Applicant	Eptura Inc. 950 East Paces Ferry Road NE, Suite 800 Atlanta, GA 30326 USA	
Manufacturer of EUT	Eptura Inc.	
Full Name of EUT	Meeting Room Screen	
Model Number of EUT	Room V3.0	
Serial Number of EUT	201702R01245000134A, 201702R01235000115A (for AC powerline conducted emissions)	
Date Received	3rd January 2024	
Date of Test:	10th January 2024 to 2nd February 2024	
Purpose of Test	To demonstrate design compliance to the relevant rules of Chapter 47 of the Code of Federal Regulations.	
Date Report Issued	15th February 2024	
Main Function	Meeting room touch screen device	
Information Specification	Height	182 mm
	Width	247 mm
	Depth	30 mm
	Weight	798 g
	Voltage	Not Specified
	Current	Not Specified
EUT Supplied PSU	Manufacturer	KSPower
	Model number	KS39DU-1200300CB
	Serial number	E1-20230603006
	Input voltage	100-240 V 50/60 Hz
	Input current	2.0 A
	Output	12 Vdc, 3.0 A

2.2 Configurations for testing

General Parameters	
EUT Normal use position	Wall mount/kiosk mount
Choice of model(s) for type tests	Room V3.0
Antenna details	2 internal antennas: -Wi-Fi/ BT (Gain: 2 dBi) -RFID 125 kHz & 13.56 MHz (Gain: 0 dBi)
Antenna port	No
Baseband Data port (yes/no)?	No
Highest Signal generated in EUT	2480 MHz
Lowest Signal generated in EUT	10 kHz
Hardware Version (HVIN)	1.1
Software Version	Settings App: V2.0.40 HAL App: 1.6.22 Room App: 3.0.0.1
Firmware Version (FVIN)	11.24.01.24
Type of Equipment	Standalone
Technology Type	RFID (125 kHz & 13.56 MHz) / Wi-Fi / BT
Geo-location (yes/no)	No
TX Parameters	
Alignment range – transmitter	125 kHz
EUT Declared Modulation Parameters	Not Specified
EUT Declared Power level	Not Specified
EUT Declared Signal Bandwidths	Not Specified
EUT Declared Channel Spacing's	Not Channelized
EUT Declared Duty Cycle	Not Specified
Unmodulated carrier available?	No
Declared frequency stability	Not Specified
RX Parameters	
Alignment range – receiver	125 kHz
EUT Declared RX Signal Bandwidth	Not Specified
Receiver Signal Level (RSL)	Not Specified
Method of Monitoring Receiver BER	Not Specified
FCC Parameters	
FCC Transmitter Class	DXX: Part 15 Low Power Communication Device Transmitter

2.3 Functional description

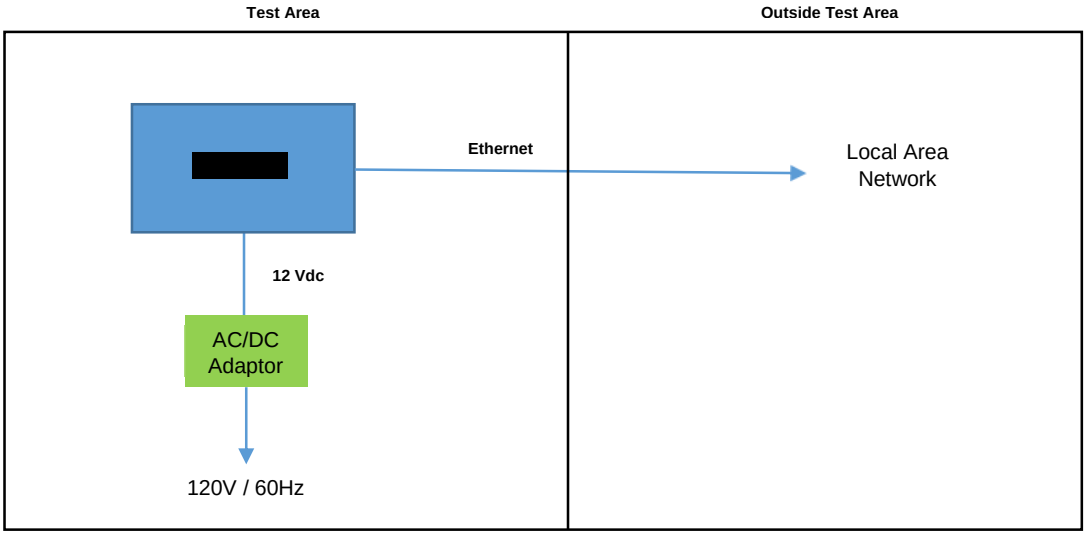
The V3 is a Wall Mounted Android Touch Screen Terminal in an ABS/PC plastic housing with 10.1” 1280x800 dot IPS TFT LCD and multitouch projected capacitive touch screen with toughened glass. It has an internal 2.4GHz Wi-Fi/BT module and an internal RFID Card Reader operating at both 13.56MHz and 125kHz. The low voltage directive compliant V3 is powered by POE via the RJ45 LAN port (with option of 12Vdc jack plug power input when Wi-Fi is used not LAN). Its average power consumption is 7W. A metal plate covers I/O ports, with only the RJ45 LAN and DC ports exposed for use. There is a diffused LED light guide to denote unit availability status.

2.4 Modes of operation

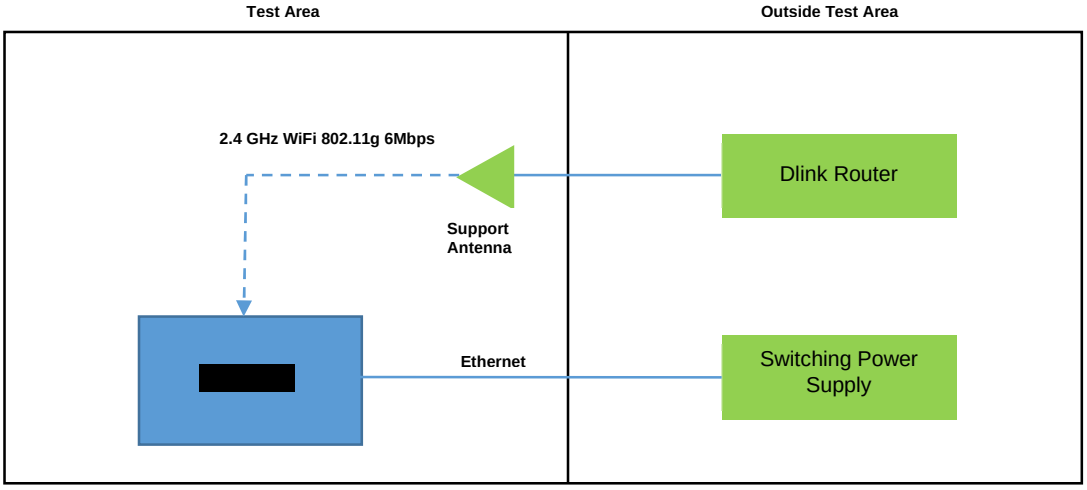
Mode Reference	Description	Used for testing
Mode 1	Repeatedly Transmitting 125 kHz & 13.56 MHz RFID (125 kHz Card presented) and data via 2.4 GHz WiFI CH6 (2437 MHz) 802.11g 6Mbps	Yes
Mode 2	Repeatedly Transmitting 125 kHz & 13.56 MHz RFID (125 kHz Card not presented) and data via 2.4 GHz WiFI CH6 (2437 MHz) 802.11g 6Mbps	Yes
Mode 3	Repeatedly Transmitting 125kHz & 13.56MHz RFID (125 kHz Card) PoE with Ethernet to KEC Network playing Video via YouTube	Yes
Mode 4	Repeatedly Transmitting 125kHz & 13.56MHz RFID (125 kHz Card) AC/DC Adaptor with Ethernet to KEC Network playing Video via YouTube	Yes

2.5 Emissions configuration

2.5.1 AC/DC Adaptor Emissions configuration



2.5.2 PoE Emissions configuration



The EUT could be powered 2 ways 'PoE' or using the supplied 'AC/DC Adaptor'. The AC/DC Adaptor supplied 12 Vdc to the EUT and when used during testing the Ethernet port was connect to the LAN.

Two RFID card were provided for testing. The 'Haltest' App was opened and 'Loop Test' started and with card presented and not-present initially. The 'HID iCLASS DG' card (Card 2) had higher emissions then the other 13.56 MHz card (Plane – Card 1) and without card and was therefore used during emissions testing. The EUT also had 125 kHz RFID, the 125 kHz and 13.56 MHz was repeatedly transmitting even in the absence of their respective RFID cards. When the card(s) were present the amplitude and duty cycle of the signals changed.

The 'YouTube' App was also running during testing with a video streaming. When testing with the AC/DC Adaptor configuration it was streaming via direct connection to LAN and for the PoE configuration in the chamber it was streaming via Wi-Fi to router outside of the chamber. The Wi-Fi was set to the middle channel (2437 MHz) 802.11g 6Mbps which was worst case.

2.5.3 Signal leads

Port Name	Cable Type	Connected
DC Power	2 core, Unscreened	Yes
Ethernet (PoE)	8 core, Unscreened	Yes

3 Summary of test results

The Room V3.0 was tested for compliance to the following standard(s):

47 CFR Part 15.209
Effective Date 1st October 2023
DXX: Part 15 Low Power Communication Device 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 & 15.33(a)	PASSED
3. Radiated emissions 150 kHz - 30 MHz	47 CFR Part 15C Part 15.209 & 15.33(a)	PASSED
4. Radiated emissions 30 MHz -1 GHz	47 CFR Part 15C Part 15.209	PASSED
5. Radiated emissions above 1 GHz	47 CFR Part 15C Part 15.209 & 15.33(a)	PASSED[1]
6. Intentional radiator field strength	47 CFR Part 15C Part 15.209	PASSED
7. Band edge compliance	47 CFR Part 15C Part 15.205	NOT APPLICABLE[2]
8. Occupied bandwidth	47 CFR Part 15C Part 15.215(c)	PASSED
9. Duty Cycle	47 CFR Part 15C Part 15.35	PASSED
10. Duty Cycle	47 CFR Part 15C Part 15.35	PASSED

[1] Frequency range investigated up to 25 GHz based on ten times the highest frequency internally generated of 2480 MHz.
[2] There are no additional requirements for ‘Band Edge Compliance’ for 125 kHz RFID other than those specified in 47 CFR Part 15C Part 15.209.

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

4.2 Deviations

No deviations were applied.

4.3 Tests at extremes of temperature & voltage

The following test conditions were used to simulate testing at nominal or extremes.

Temperature Test Conditions		Voltage Test Conditions	
T nominal	20 °C	V nominal	12V DC
T minimum	-20 °C	V minimum	10.2V DC
T maximum	50 °C	V maximum	13.8V DC

Extremes of voltage are based on nominal +/-15%.
The ambient test conditions of humidity and pressure in the laboratory were as specified in each specific test section within this report

4.4 Test fixtures

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

A test fixture was used for testing.

5 Tests, methods and results

5.1 AC power line conducted emissions

5.1.1 Test methods

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

5.1.2 Configuration of EUT

The EUT was 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.

The EUT was operated in Mode 3 and Mode 4.

5.1.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.

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

Tests were performed in Test Site H.

5.1.4 Test equipment

E642, F238, LPE222

See Section 9 for more details

5.1.5 Test results

Temperature of test environment 16°C
Humidity of test environment 57%
Pressure of test environment 100kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	RFID

Plot refs
14529-8 Cond 1 AC Live 150k-30M Average
14529-8 Cond 1 AC Live 150k-30M Quasi-Peak
14529-8 Cond 1 AC Neutral 150k-30M Average
14529-8 Cond 1 AC Neutral 150k-30M Quasi-Peak

Single channel	125 kHz
Power Level	AC/DC Adaptor
Channel Spacing	Non Channelized
Mod Scheme	RFID

Plot refs
14529-8 Cond 2 AC Live 150k-30M Average
14529-8 Cond 2 AC Live 150k-30M Quasi-Peak
14529-8 Cond 2 AC Neutral 150k-30M Average
14529-8 Cond 2 AC Neutral 150k-30M Quasi-Peak

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

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.176	47.9	45.3	-19.4	41.3	-13.4
2	0.528	44.1	42.8	-13.2	31.4	-14.6
3	0.617	39.9	38.8	-17.2	31.3	-14.7
4	0.705	42.2	40.6	-15.4	36.5	-9.5
5	16.228	41.3	39.5	-20.5	33.0	-17.0
6	18.425	41.7	39.6	-20.4	35.3	-14.7
7	20.258	49.2	47.5	-12.5	44.7	-5.3
8	26.348	50.4	49.6	-10.4	44.5	-5.5
9	29.402	51.9	50.6	-9.4	47.0	-3.0

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

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.176	48.2	46.3	-18.4	42.2	-12.5
2	0.528	47.5	44.7	-11.3	33.1	-12.9
3	0.704	42.9	41.8	-14.2	36.9	-9.1
4	14.031	40.0	38.3	-21.7	33.5	-16.5
5	16.228	42.5	39.8	-20.2	35.9	-14.1
6	18.424	42.1	40.2	-19.8	35.9	-14.1
7	19.709	42.8	43.8	-16.2	40.5	-9.5
8	20.381	47.8	47.0	-13.0	44.4	-5.6
9	20.808	50.6	49.3	-10.7	45.3	-4.7
10	25.679	51.0	50.6	-9.4	47.3	-2.7
11	28.734	51.7	50.3	-9.7	45.2	-4.8

Table of signals measured for Cond 2 AC Live 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	9.771	37.0	34.5	-25.5	28.8	-21.2

Table of signals measured for Cond 2 AC Neutral 150k-30M

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP -Lim (dB)	AV Amp (dBuV)	AV -Lim (dB)
1	0.452	38.0	35.2	-21.6	26.9	-19.9
2	9.308	39.9	36.6	-23.4	30.7	-19.3

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.

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: UE70 9kHz to 150kHz ±3.76dB, 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 & 15.33(a) [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 [Reference 4.1.1 of this report]

5.2.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Following investigation there did not appear to be any difference when EUT was powered by PoE or using the supplied AC/DC Adaptor, therefore the EUT was operated in Mode 1.

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

E411, E624, TMS81, ZSW1

See Section 9 for more details

5.2.5 Test results

Temperature of test environment	16°C
Humidity of test environment	61%
Pressure of test environment	101kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	With Card

Plot refs
14529-8 Rad 1 9k-150kHz Para
14529-8 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.

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

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

These 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 & 15.33(a) [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 [Reference 4.1.1 of this report]

5.3.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Following investigation there did not appear to be any difference when EUT was powered by PoE or using the supplied AC/DC Adaptor, therefore the EUT was operated in Mode 1.

5.3.3 Test procedure

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

Measurements were made in a semi-anechoic chamber (pre-scan) with any final measurements required performed on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees to record the worst case emissions.

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

Tests were performed using Test Site M.

5.3.4 Test equipment

E411, E624, TMS81, ZSW1

See Section 9 for more details

5.3.5 Test results

Temperature of test environment	16°C
Humidity of test environment	61%
Pressure of test environment	101kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	With Card

Plot refs
14529-8 Rad 1 150k-30MHz Para
14529-8 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.

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

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

These 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 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.5 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Clause 15.209 [Reference 4.1.1 of this report]

5.4.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Following investigation there did not appear to be any difference when EUT was powered by PoE or using the supplied AC/DC Adaptor, therefore the EUT was operated in Mode 1.

5.4.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The equipment was rotated 360 degrees and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions.

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

Tests were performed using Test Site M.

5.4.4 Test equipment

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

See Section 9 for more details

5.4.5 Test results

Temperature of test environment 16°C
Humidity of test environment 67%
Pressure of test environment 102kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	With Card

Plot refs
14529-8 Rad 1 VHF Horiz
14529-8 Rad 1 VHF Vert
14529-8 Rad 1 UHF Horiz
14529-8 Rad 1 UHF Vert

Table of signals measured for Horizontal Signal List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	51.450	30.4	24.3	-15.7
2	72.004	24.4	20.4	-19.6
3	125.004	29.5	25.7	-17.8
4	192.102	31.9	24.1	-19.4
5	204.041	33.6	27.0	-16.5
6	216.029	33.1	26.4	-19.6
7	226.774	35.3	31.8	-14.2
8	250.005	32.7	28.6	-17.4
9	375.013	42.5	41.0	-5.0
10	468.006	38.2	31.6	-14.4
11	479.973	38.3	31.3	-14.7

12	492.027	37.9	31.2	-14.8
13	499.997	35.9	31.7	-14.3
14	504.062	36.1	27.4	-18.6
15	529.143	37.3	34.1	-11.9
16	576.075	37.7	29.6	-16.4
17	588.075	37.1	28.8	-17.2
18	604.690	34.7	28.9	-17.1
19	612.223	33.4	27.6	-18.4
20	624.994	40.6	37.4	-8.6
21	646.997	36.0	29.6	-16.4
22	651.512	39.2	34.0	-12.0
23	720.740	35.7	29.3	-16.7
24	750.017	40.9	36.2	-9.8
25	755.917	42.7	39.6	-6.4
26	854.889	36.5	30.6	-15.4
27	874.992	46.3	44.1	-1.9

Table of signals measured for Vertical Signal List

Signal No.	Freq (MHz)	Peak Amp (dBuV/m)	QP Amp (dBuV/m)	QP -Lim (dB)
1	67.794	41.1	36.9	-3.1
2	70.450	38.5	33.4	-6.6
3	71.833	40.9	36.1	-3.9
4	72.912	37.5	32.0	-8.0
5	75.591	41.0	36.1	-3.9
6	77.530	37.1	31.7	-8.3
7	79.509	35.8	29.8	-10.2
8	81.445	36.1	30.4	-9.6
9	84.052	35.2	30.6	-9.4
10	87.590	33.6	28.8	-11.2
11	94.884	32.0	25.7	-17.8
12	99.984	35.0	29.2	-14.3
13	102.943	37.3	30.7	-12.8
14	105.402	34.1	28.8	-14.7
15	109.104	35.6	29.4	-14.1
16	121.721	31.5	25.2	-18.3
17	144.002	34.1	27.4	-16.1
18	151.184	43.6	38.6	-4.9
19	156.004	37.1	30.4	-13.1
20	168.074	39.9	34.0	-9.5
21	176.155	31.2	25.3	-18.2
22	179.999	42.5	37.2	-6.3
23	189.827	37.0	32.9	-10.6
24	191.993	46.3	40.7	-2.8
25	199.313	35.3	30.2	-13.3
26	203.962	44.7	38.6	-4.9
27	211.646	34.3	27.8	-15.7
28	215.989	41.4	35.1	-8.4
29	222.911	31.8	26.8	-19.2
30	226.772	40.1	36.7	-9.3
31	228.143	33.6	26.8	-19.2
32	240.061	34.1	26.8	-19.2
33	250.013	32.9	28.6	-17.4
34	375.007	35.0	31.7	-14.3

35	604.740	39.0	35.1	-10.9
36	625.013	42.6	40.3	-5.7
37	651.536	40.2	34.6	-11.4
38	680.322	37.9	33.9	-12.1
39	750.016	40.4	36.6	-9.4
40	755.919	41.9	38.0	-8.0
41	859.591	36.9	30.6	-15.4
42	875.017	37.9	32.9	-13.1
43	933.251	37.9	32.0	-14.0
44	957.396	37.2	31.8	-14.2

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

LIMITS:

15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.231(b)/(e) limits are applicable elsewhere, although 15.209 limits may be used where these allow a higher field strength.

n.b. 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 15.209 & 15.33(a) [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 15.209 [Reference 4.1.1 of this report]

5.5.2 Configuration of EUT

The EUT was placed on a 1.5 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Following investigation there did not appear to be any difference when EUT was powered by PoE or using the supplied AC/DC Adaptor, therefore the EUT was operated in Mode 1.

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. The EUT was raised and antenna was placed 1.5m above the ground in line with the EUT, which was rotated through 360 degrees to record the worst case emissions. A measurement distance of 3m was used between the test range 1GHz - 6GHz, 1.2m was used in the test range 6-18GHz and 0.3m was used in the test range 18-25GHz. Tests were performed in Test Site B.

5.5.4 Test equipment

E412, E428, E429, E856, E904, E972, TMS78, TMS79

See Section 9 for more details

5.5.5 Test results

Temperature of test environment 16°C
Humidity of test environment 69%
Pressure of test environment 104kPa

Setup Table

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	RFID

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
1124.99	45.1	-28.9	39.3	-14.7	Upright	Horizontal
1360.674	51.2	-22.8	38.2	-15.8	Upright	Vertical
1436.241	47.4	-26.6	34.8	-19.2	Upright	Horizontal
1436.247	55.1	-18.9	43.2	-10.8	Upright	Vertical
1511.841	50	-24	41.6	-12.4	Upright	Vertical
1511.847	49.1	-24.9	35.7	-18.3	Upright	Horizontal
1587.431	43.5	-30.5	35.7	-18.3	Upright	Horizontal
1587.431	46.5	-27.5	36.4	-17.6	Upright	Vertical
1663.024	47	-27	37.9	-16.1	Upright	Horizontal
1663.024	53.2	-20.8	47.5	-6.5	Upright	Vertical
3888.063	49.04	-24.96	37.14	-16.86	Upright	Horizontal
3888.162	47.84	-26.16	35.24	-18.76	Upright	Vertical
11755.096	50.12	-23.88	37.22	-16.78	Upright	Horizontal
12128.398	48.11	-25.89	36.41	-17.59	Upright	Vertical
12271.995	50.17	-23.83	37.37	-16.63	Upright	Horizontal

Plots
14529-6 Rad 1 1-2GHz Horiz
14529-6 Rad 1 1-2GHz Vert
14529-6 Rad 1 2-3GHz Horiz
14529-6 Rad 1 2-3GHz Vert
14529-6 Rad 1 3-5GHz Horiz
14529-6 Rad 1 3-5GHz Vert
14529-6 Rad 1 5-6GHz Horiz
14529-6 Rad 1 5-6GHz Vert
14529-6 Rad 1 6-7.77GHz Horiz
14529-6 Rad 1 6-7.77GHz Vert
14529-6 Rad 1 7.77-10GHz Horiz
14529-6 Rad 1 7.77-10GHz Vert
14529-6 Rad 1 10-12_4GHz Horiz
14529-6 Rad 1 10-12_4GHz Vert
14529-6 Rad 1 12-15GHz Horiz
14529-6 Rad 1 12-15GHz Vert
14529-6 Rad 1 15-18GHz Horiz
14529-6 Rad 1 15-18GHz Vert
14529-6 Rad 1 18-22GHz Horiz
14529-6 Rad 1 18-22GHz Vert
14529-6 Rad 1 22-25GHz Horiz
14529-6 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: The client requested worst case channel from WiFi module report to be tested which was Mid channel (2437 MHz) were tested, plots are for illustrative purposes only in this report.

LIMITS:
15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector.
15.231(b)/(e) limits are applicable elsewhere, although 15.209 limits may be used where these allow a higher field strength.

n.b. 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 Intentional radiator field strength

5.6.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.209 [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.5/6.6 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.209 & 15.35 [Reference 4.1.1 of this report]

5.6.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was rotated in all three orthogonal planes. The EUT was operated in Mode 1.

5.6.3 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. The antenna was placed 1m above the ground. The equipment was rotated 360 degrees and emissions maximised to record the worst case emissions.

Measurements were made at Site M and OATS.

5.6.4 Test equipment

E411, E624, TMS81, ZSW1

See Section 9 for more details.

5.6.5 Test results

Temperature of test environment 16°C
Humidity of test environment 61%
Pressure of test environment 101kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	RFID

	Single channel
Peak Level (dBµV/m) @ 3 m distance	54.67
Plot reference	14529-8 Radiated H-Field 125 kHz
Antenna Polarisation	Perpendicular
EUT Polarisation	Upright

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

LIMITS:

15.209 limit is 2400/F(kHz) µV/m @ 300 m.
F = 125 kHz.
2400/125 = 19.2 µV/m @ 300 m.
19.2 µV/m = 25.67 dBµV/m @ 300 m.

The 3 m measurement can be extrapolated to 300 m as specified in 15.31(f)(2) by subtracting 40 dB/decade to give: -
54.67-80 = -25.33 dBµV/m @ 300 m.
These results show that the EUT has PASSED this test.

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

5.7 Band edge compliance

NOT APPLICABLE: There are no additional requirements for ‘Band Edge Compliance’ for 125 kHz RFID other than those specified in 47 CFR Part 15C Part 15.209.

5.8 Occupied bandwidth

5.8.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.215(c) [Reference 4.1.1 of this report]
Test Method: ANSI C63.10 Clause 6.9 [Reference 4.1.2 of this report]
Limits: 47 CFR Part 15C Part 15.215(c) [Reference 4.1.1 of this report]

5.8.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in Mode 1 and Mode 2.

5.8.3 Test procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 120kHz RBW, 3x VBW, auto sweep time and max hold settings were used for the 20 dB bandwidth.

Tests were performed using Test Site M.

5.8.4 Test equipment

E411, E624, TMS81, ZSW1

See Section 9 for more details

5.8.5 Test results

Temperature of test environment 16°C
Humidity of test environment 61%
Pressure of test environment 101kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	RFID (with Card)

	Single channel
20 dB Bandwidth (Hz) Nominal Temp & Volts	308.399
Plot for 20 dB Bandwidth (MHz) Nominal Temp & Volts	14529-8 20dB BW with 125 kHz Card_RBW 50 Hz

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	RFID (Without Card)

	Single channel
20 dB Bandwidth (Hz) Nominal Temp & Volts	456.879
Plot for 20 dB Bandwidth (MHz) Nominal Temp & Volts	14529-8 20dB BW without 125 kHz Card_RBW 50 Hz

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

LIMITS:
15.215(c) it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

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 Duty Cycle

5.9.1 Test methods

Test Requirements: 47 CFR Part 15C Part 15.35 [Reference 4.1.1 of this report]
Test Method: See 5.9.3 of this report
Limits: 47 CFR Part 15C Part 15.35 [Reference 4.1.1 of this report]

5.9.2 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in Mode 1.

5.9.3 Test procedure

A zero span was set on the analyser with the frequency set to the fundamental frequency of the EUT. Suitable triggering was also set and the TX on time and repetition times were evaluated and plotted. Tests were performed using Test Site M.

5.9.4 Test equipment

E411, E624, TMS81, ZSW1

See Section 9 for more details

5.9.5 Test results

Temperature of test environment 16°C
Humidity of test environment 61%
Pressure of test environment 101kPa

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	With Card RFID

	Single channel
TX on time (ms)	884.57
TX on Plot filename	14529-8 Duty Cycle 125 kHz with card
TX repetition time (s)	0.898607
Calculated TX Duty cycle (%)	98.437503

Single channel	125 kHz
Power Level	PoE
Channel Spacing	Non Channelized
Mod Scheme	without Card RFID

	Single channel
TX on time (mS)	446.25
TX on Plot filename	14529-8 Duty Cycle 125 kHz without card
TX repetition time (S)	1.4554
Calculated TX Duty cycle (%)	30.661749

Analyser plots for the dwell time and duty cycle can be found in Section 6 of this report.

LIMITS:

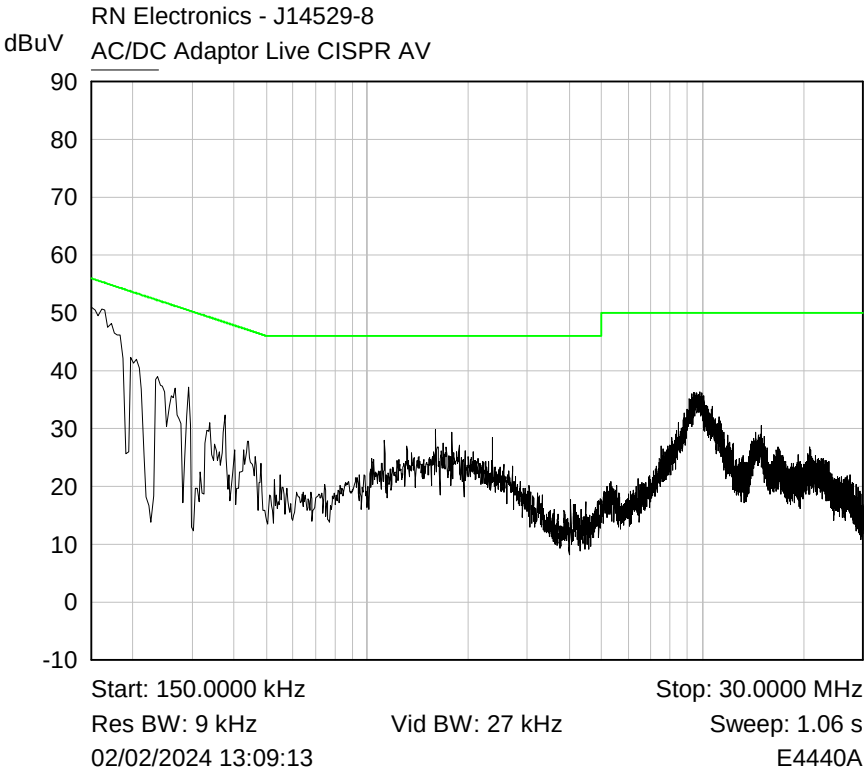
No Limits apply, however, when using an average detector duty cycle correction is allowed per 15.35.

These results show that the EUT has PASSED this test.

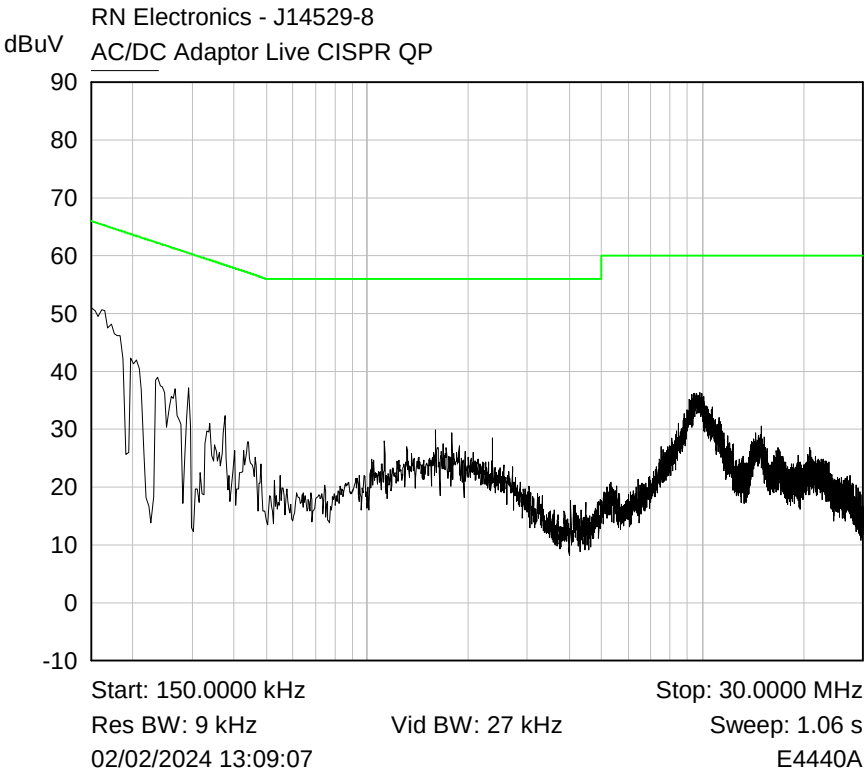
The uncertainty gives a 95% confidence interval in the measurement. Expanded uncertainty (K=2) is as follows:
2.57 ms

6 Plots/Graphical results

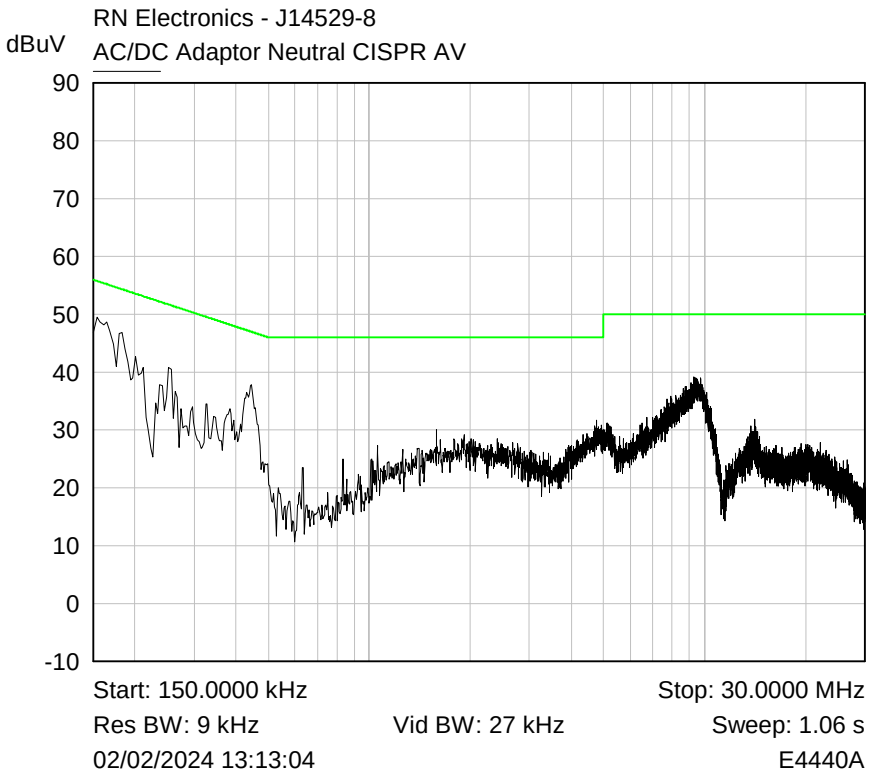
6.1 AC powerline conducted emission



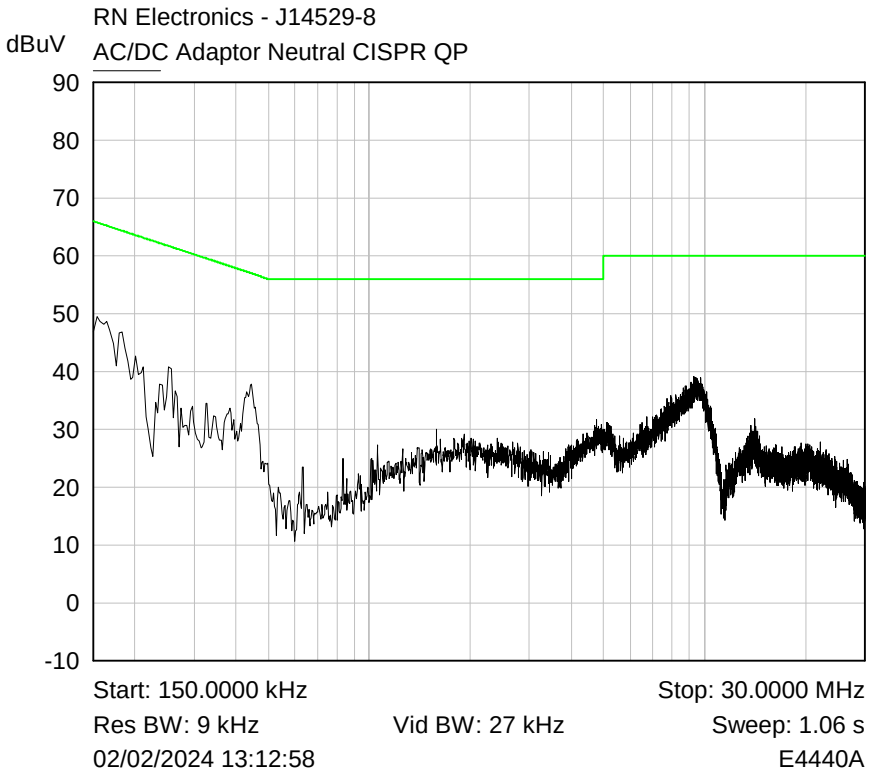
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.



Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.

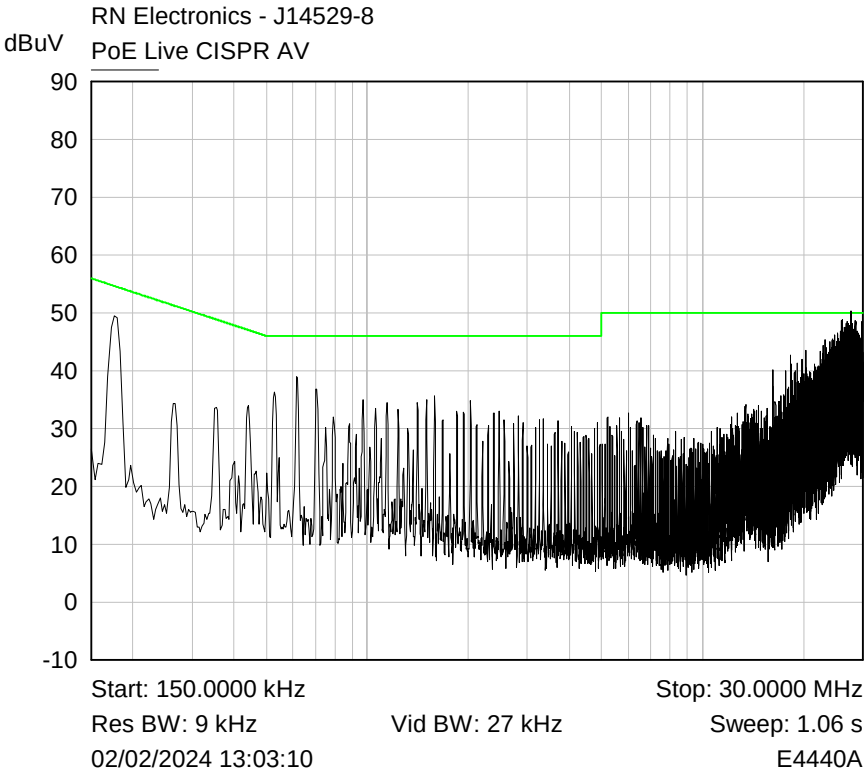


Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.

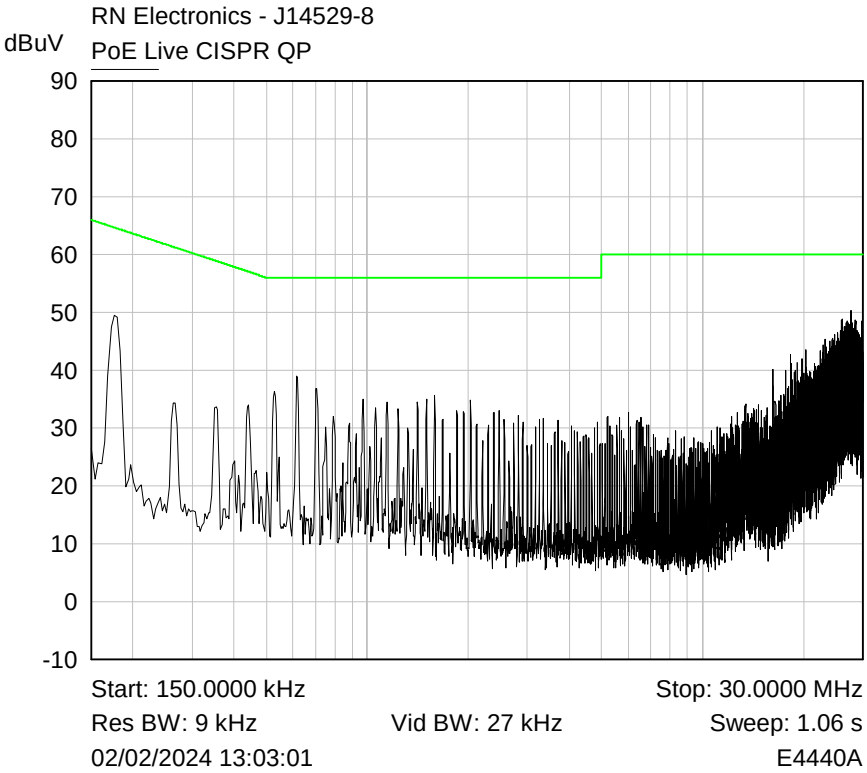


Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

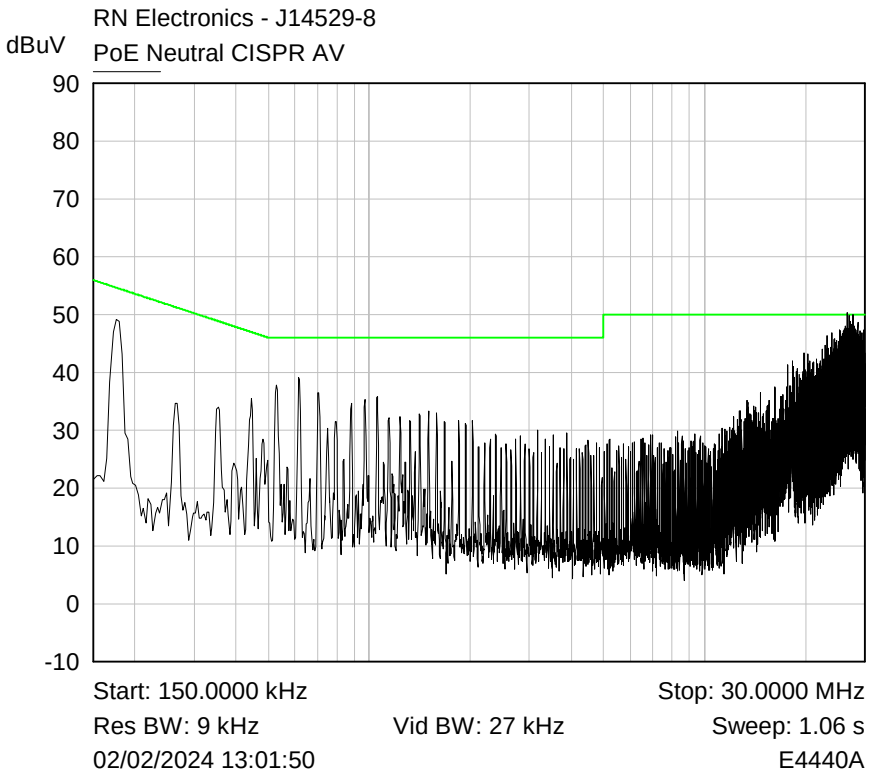
6.2 PoE conducted emission



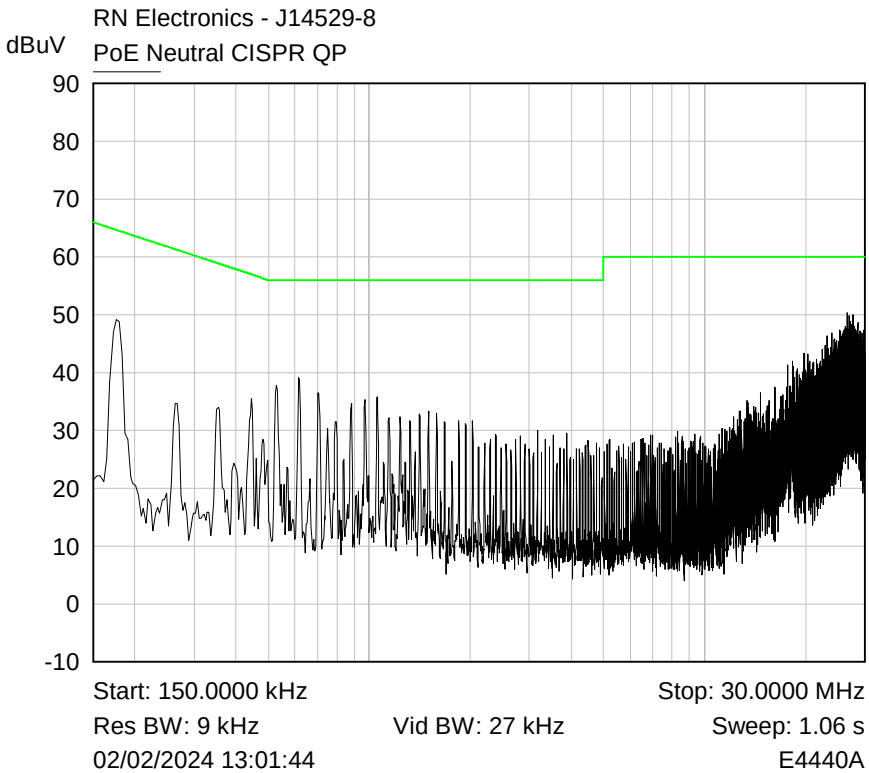
Peak emissions 150 kHz - 30 MHz on the live terminal against the average limit line.



Peak emissions 150 kHz - 30 MHz on the live terminal against the quasi-peak limit line.



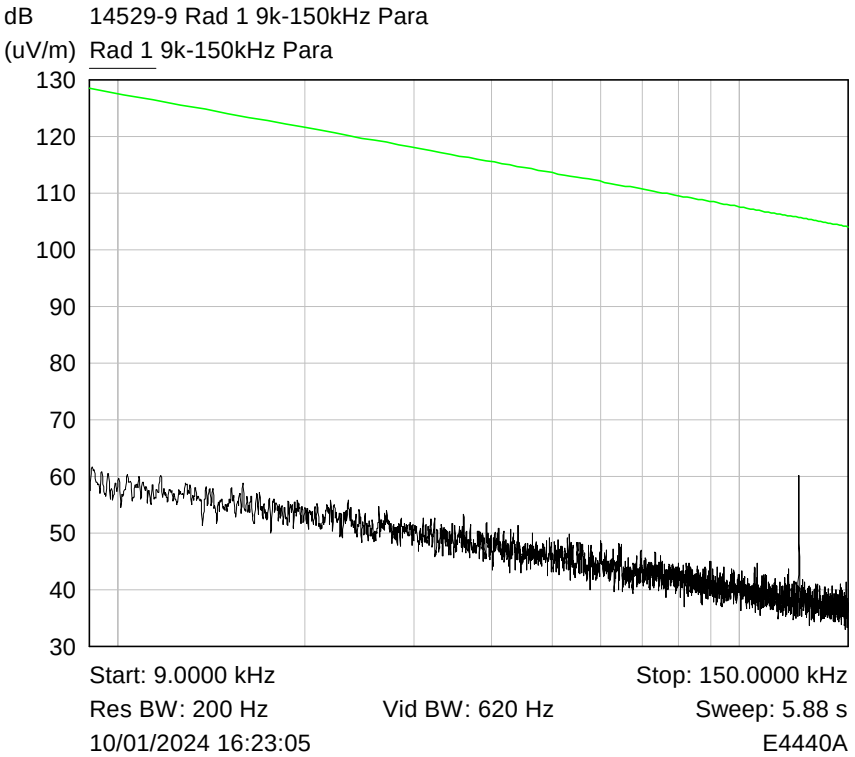
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the average limit line.



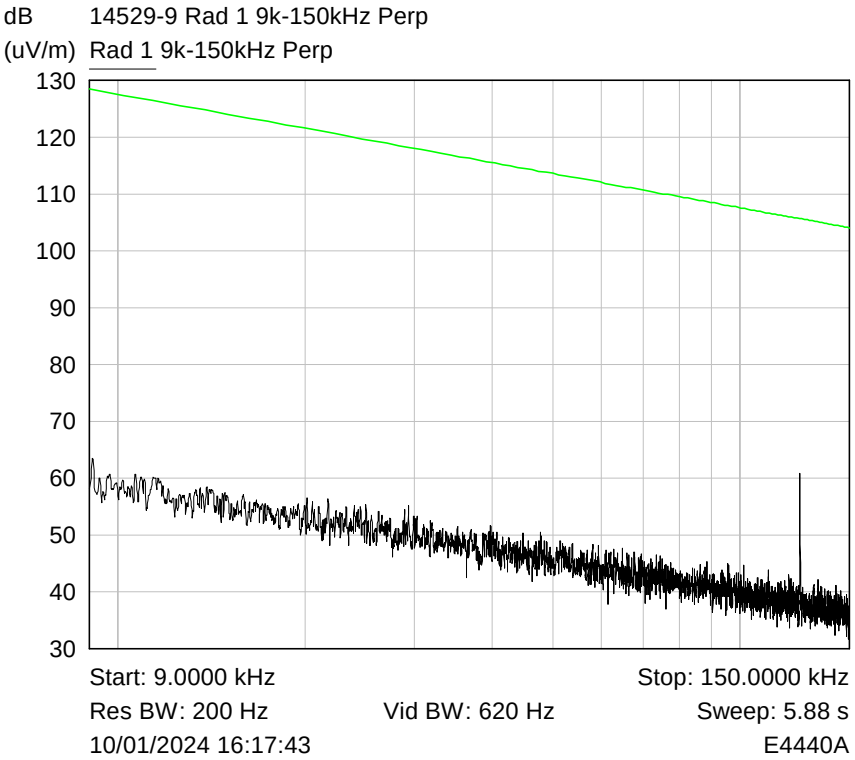
Peak emissions 150 kHz - 30 MHz on the neutral terminal against the quasi-peak limit line.

6.3 TX Unwanted radiated emissions 9-150kHz

RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation with 125 kHz Card Present, Channel 125 kHz



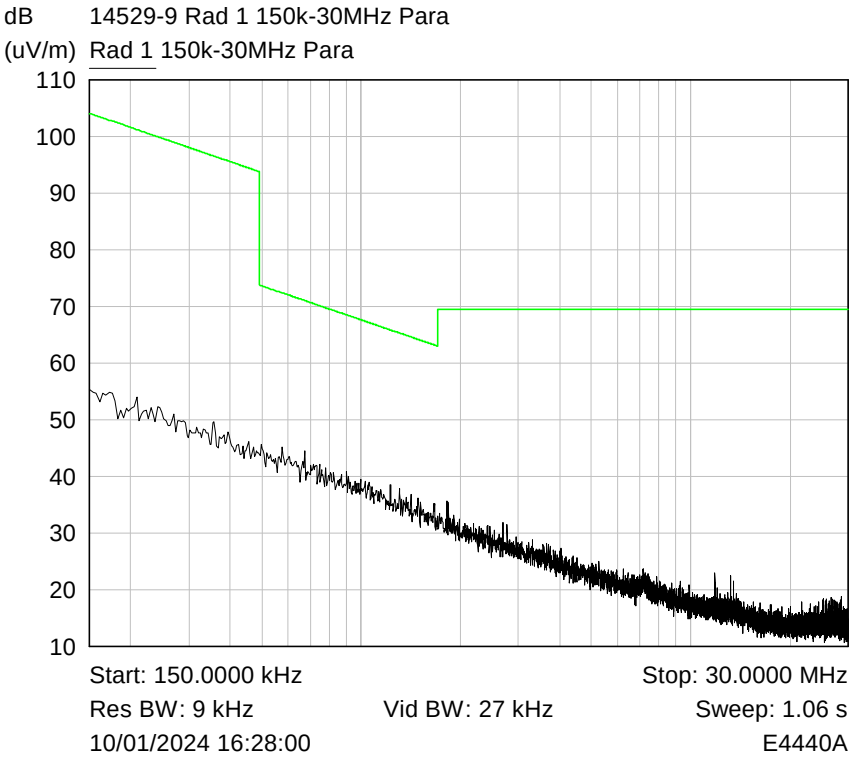
Plot of 9k-150kHz Parallel
Note: Signal on plot is 125 kHz intentional transmission



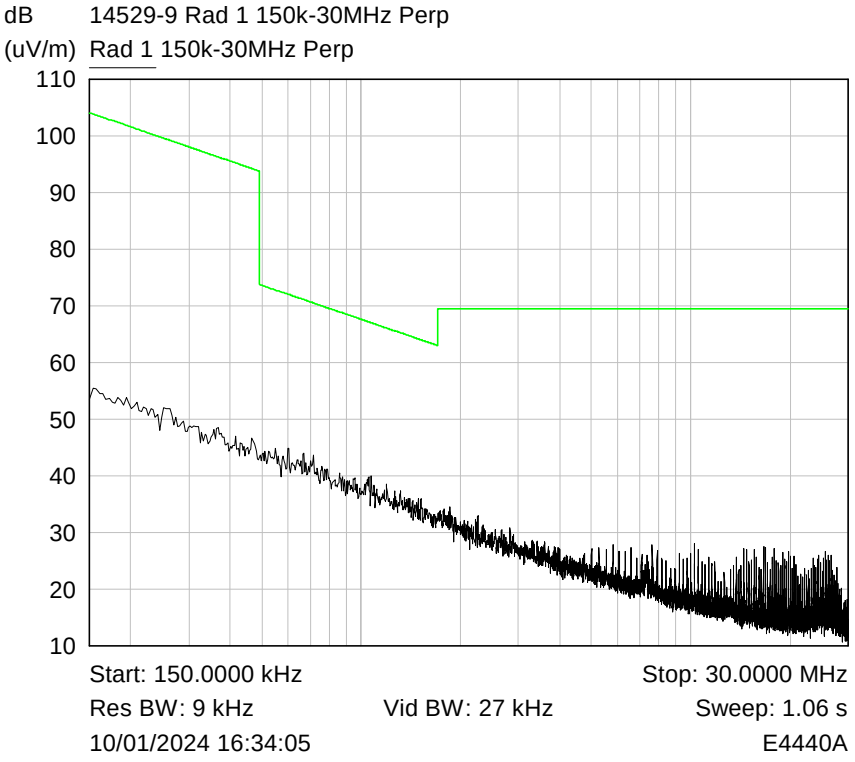
Plot of 9k-150kHz Perpendicular
Note: Signal on plot is 125 kHz intentional transmission

6.4 TX Unwanted radiated emissions 150kHz-30MHz

RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation with 125 kHz Card Present, Channel 125 kHz



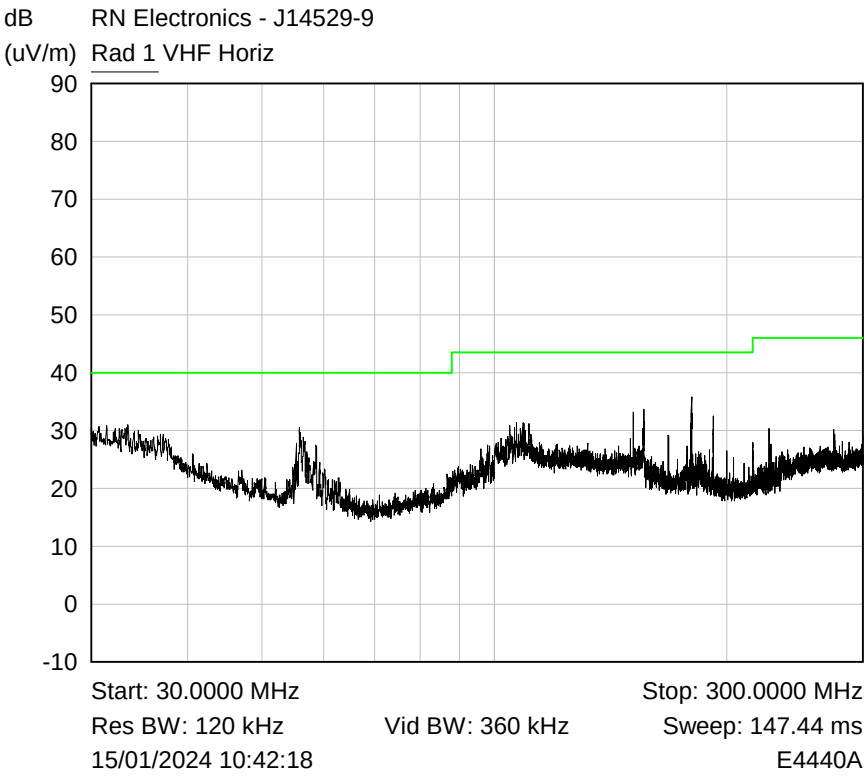
Plot of 150kHz-30MHz Parallel



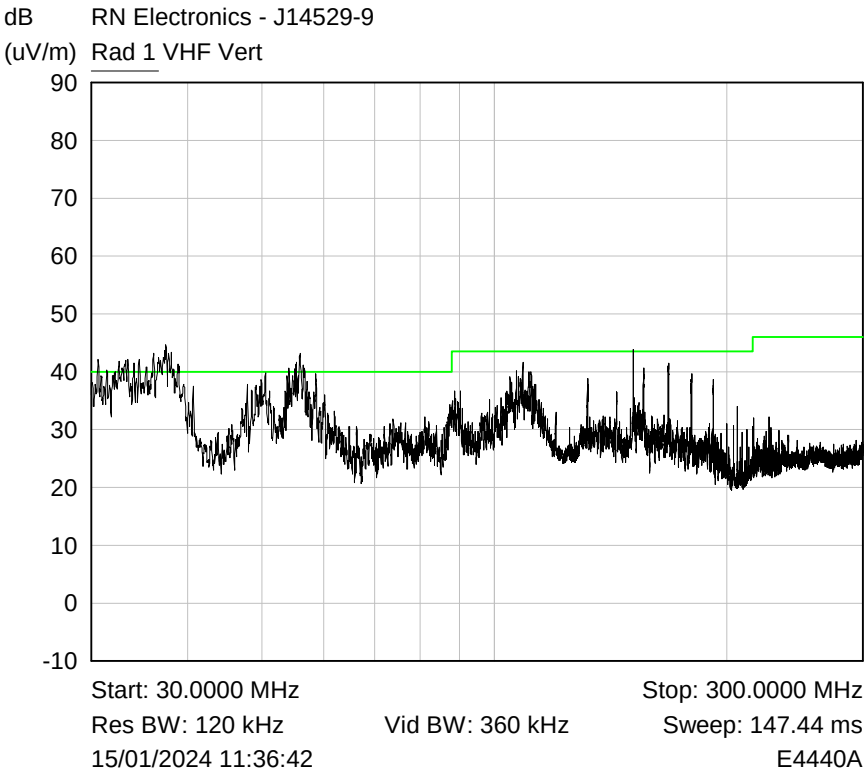
Plot of 150kHz-30MHz Perpendicular

6.5 Radiated emissions 30 MHz-1 GHz

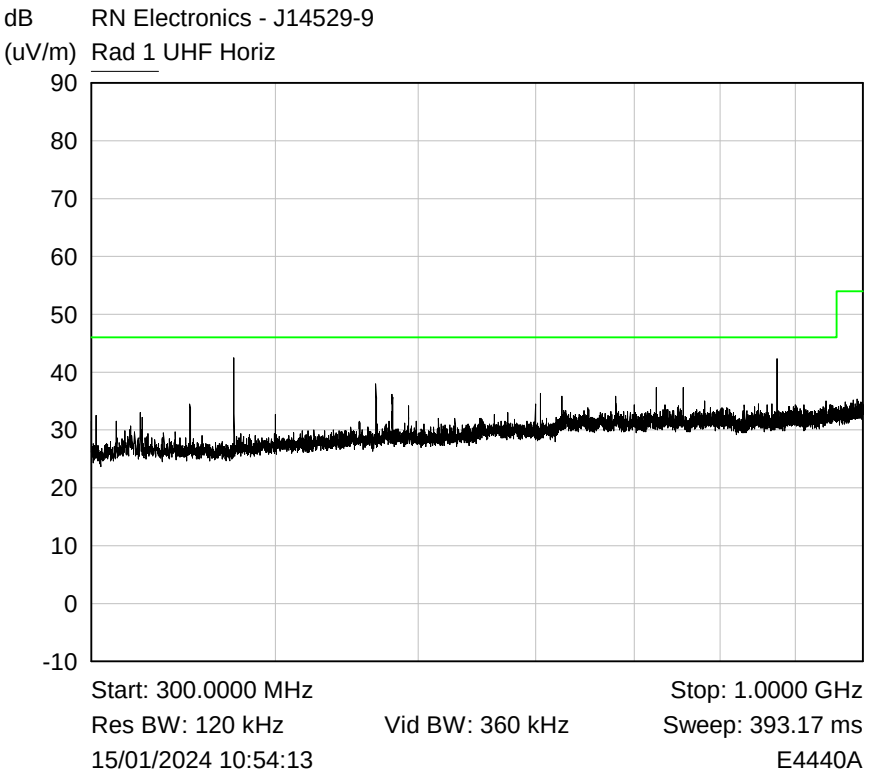
RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation RFID, Channel 125 kHz



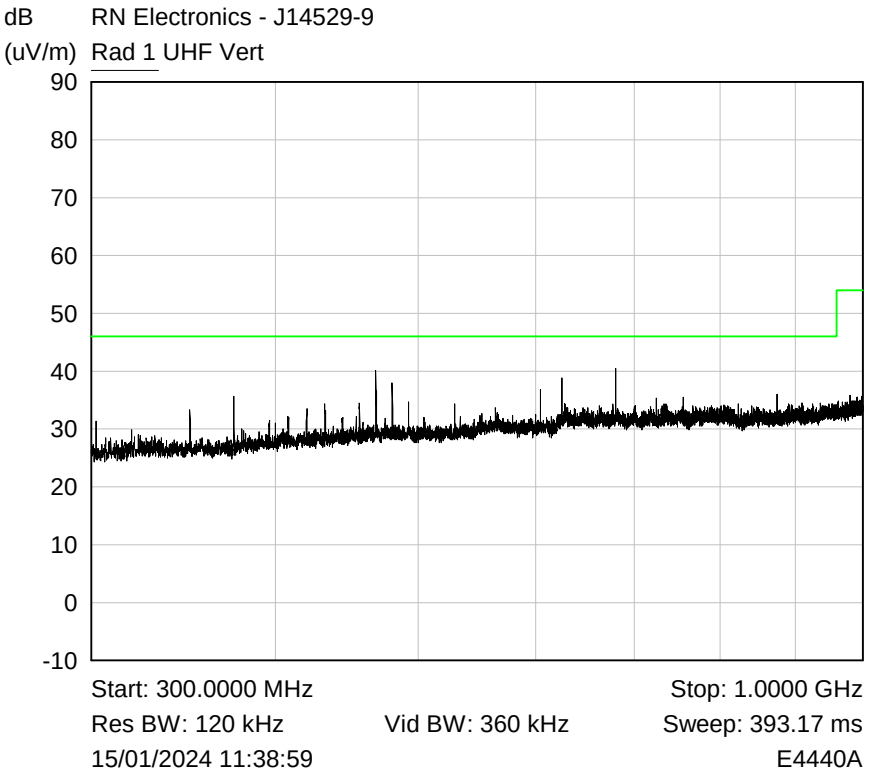
Plot of Peak emissions for VHF Horizontal against the QP limit line.



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



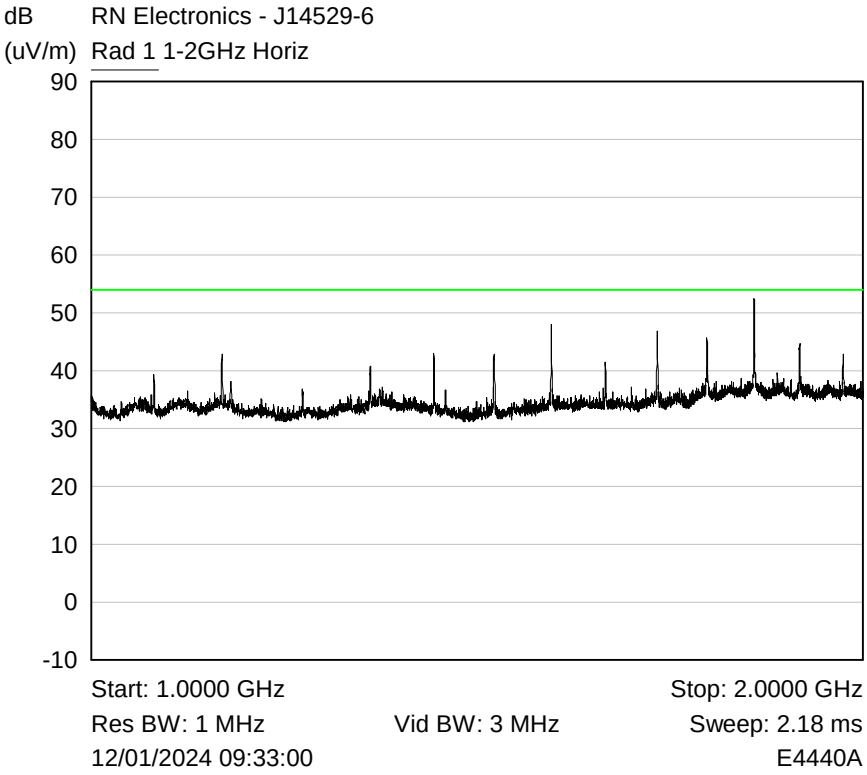
Plot of Peak emissions for UHF Horizontal against the QP limit line.

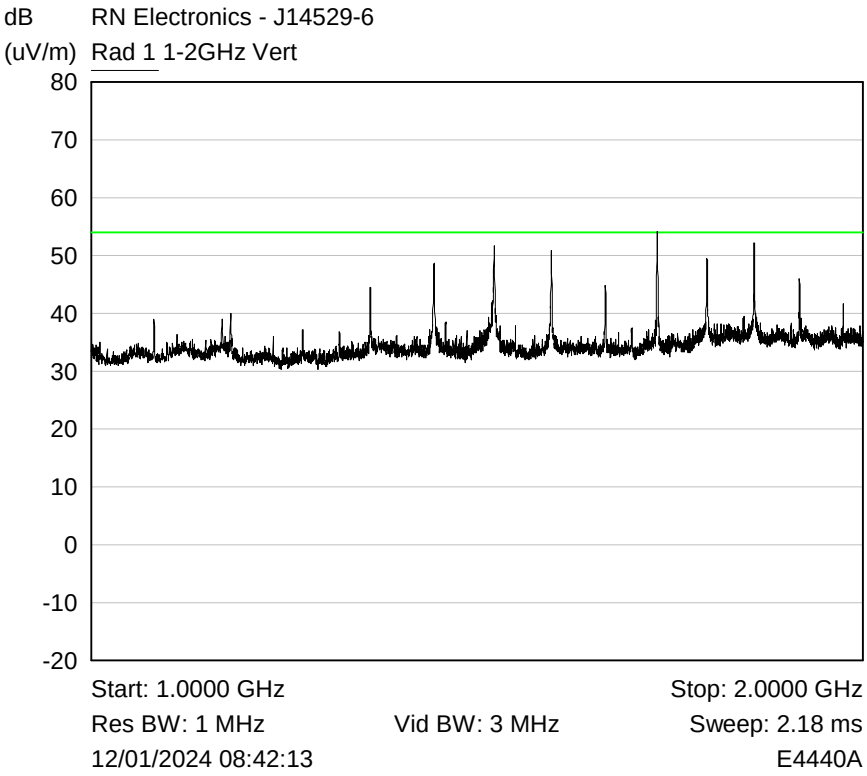


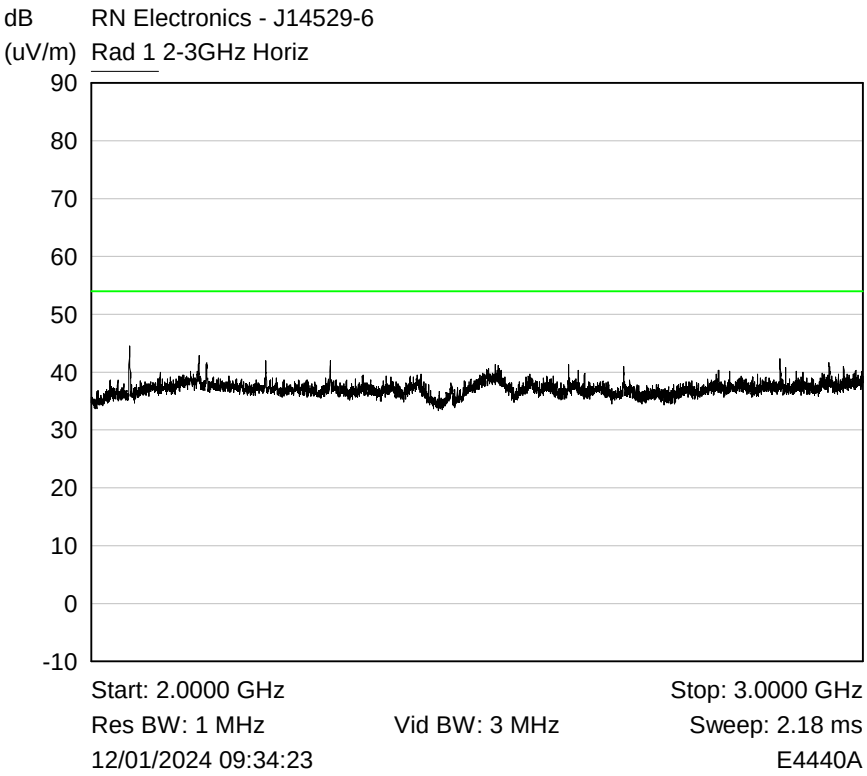
Plot of Peak emissions for UHF Vertical against the QP limit line.

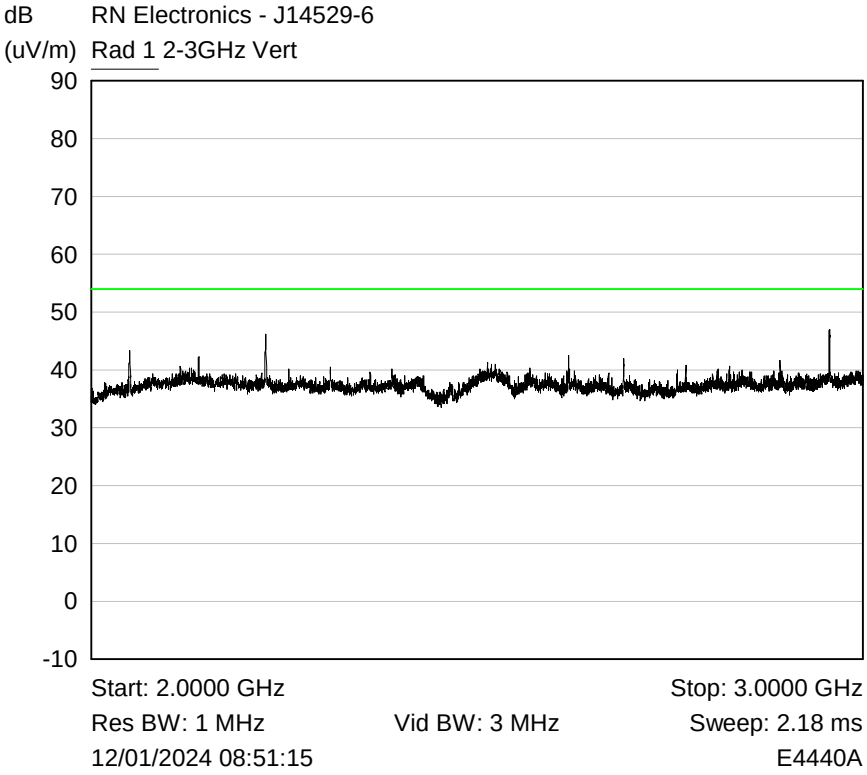
6.6 Radiated emissions above 1 GHz

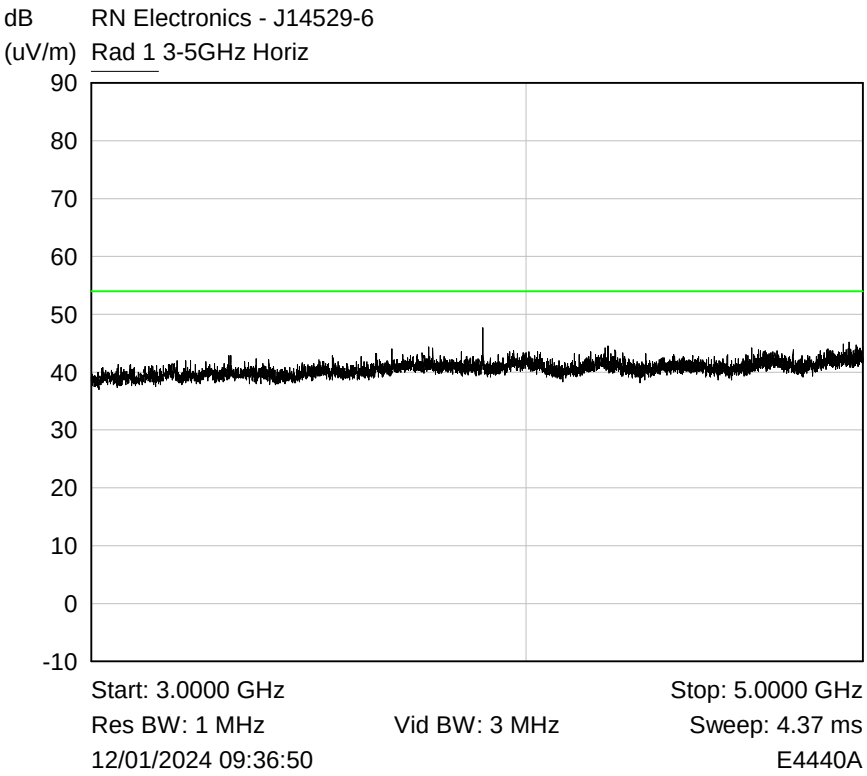
RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation RFID, Channel 125 kHz

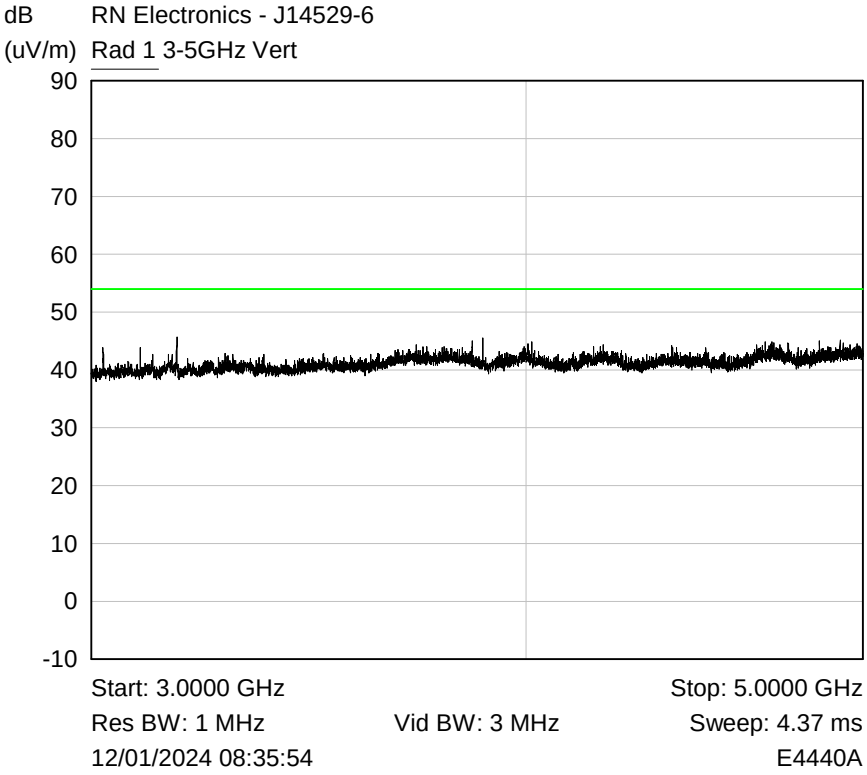


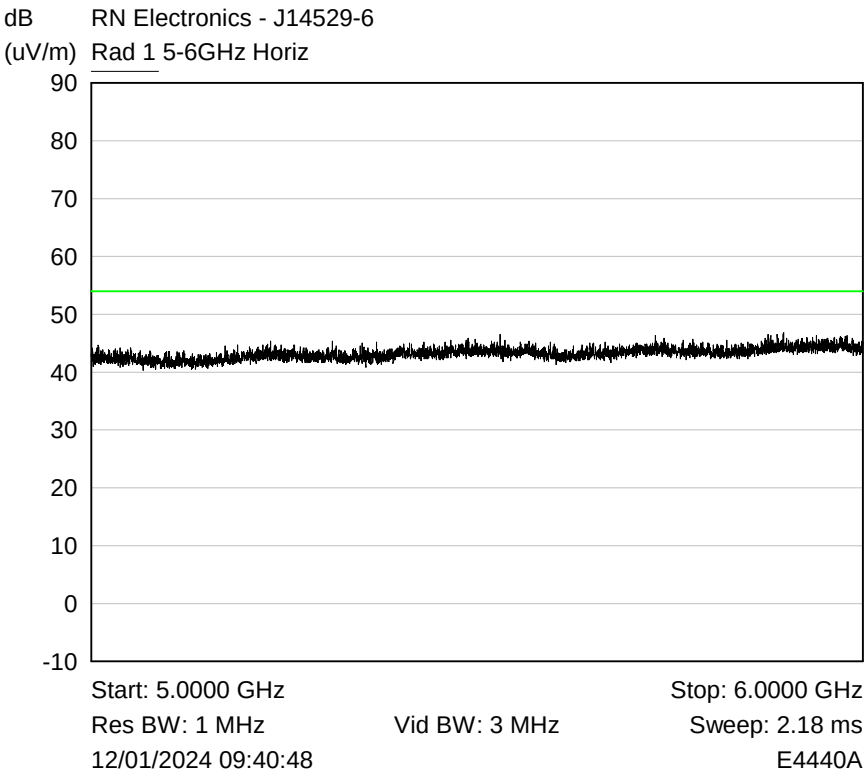


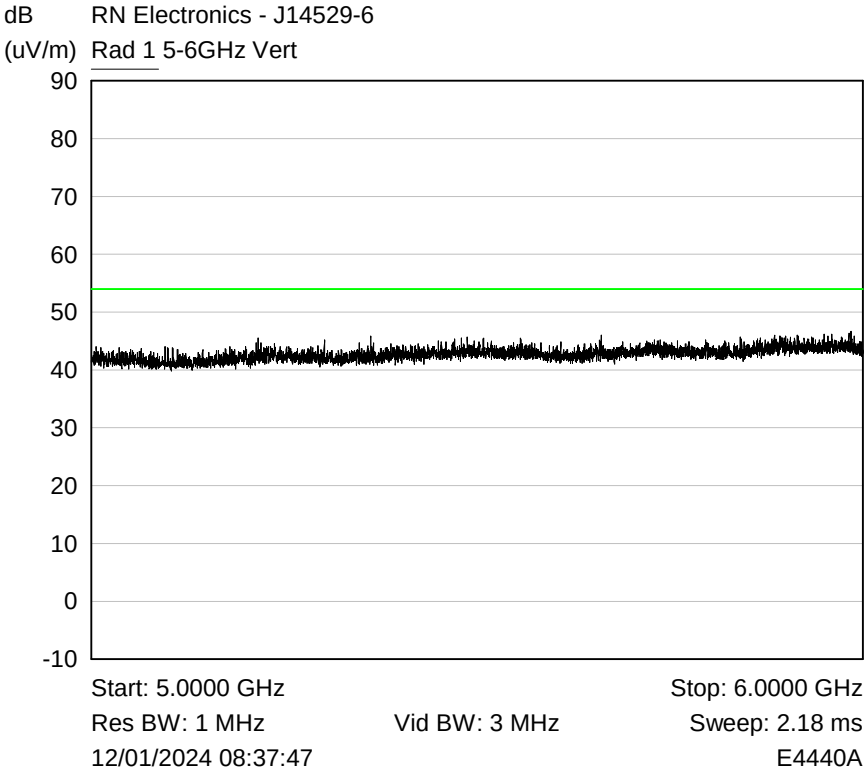

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 2-3GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.0000 GHz
Stop: 3.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
12/01/2024 09:34:23
E4440A

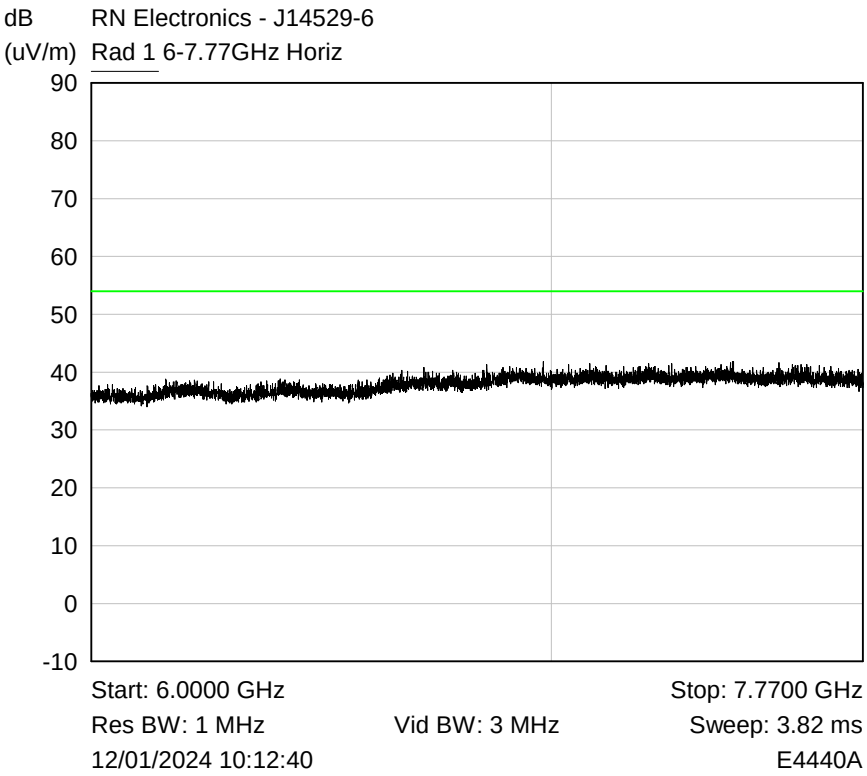

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 2-3GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 2.0000 GHz
Stop: 3.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
12/01/2024 08:51:15
E4440A

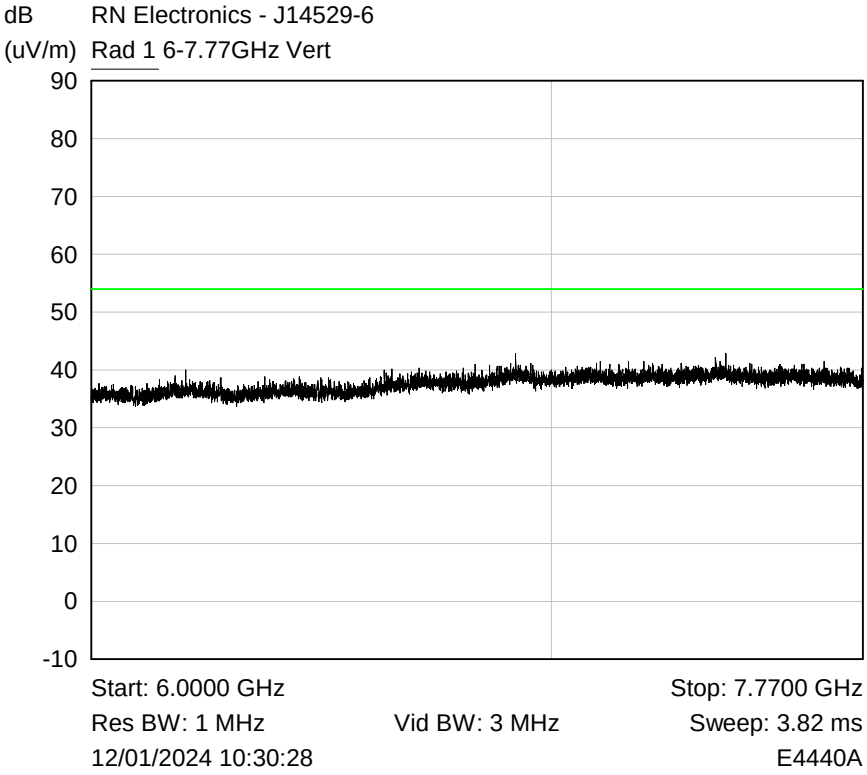

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 3-5GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 3.0000 GHz
Stop: 5.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.37 ms
12/01/2024 09:36:50
E4440A

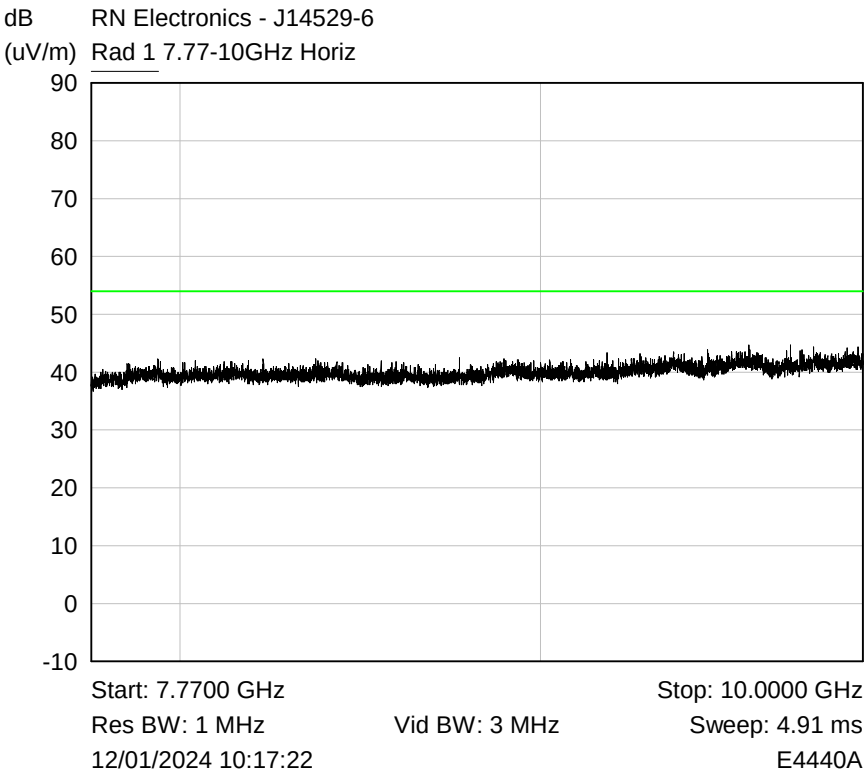

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 3-5GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 3.0000 GHz
Stop: 5.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.37 ms
12/01/2024 08:35:54
E4440A

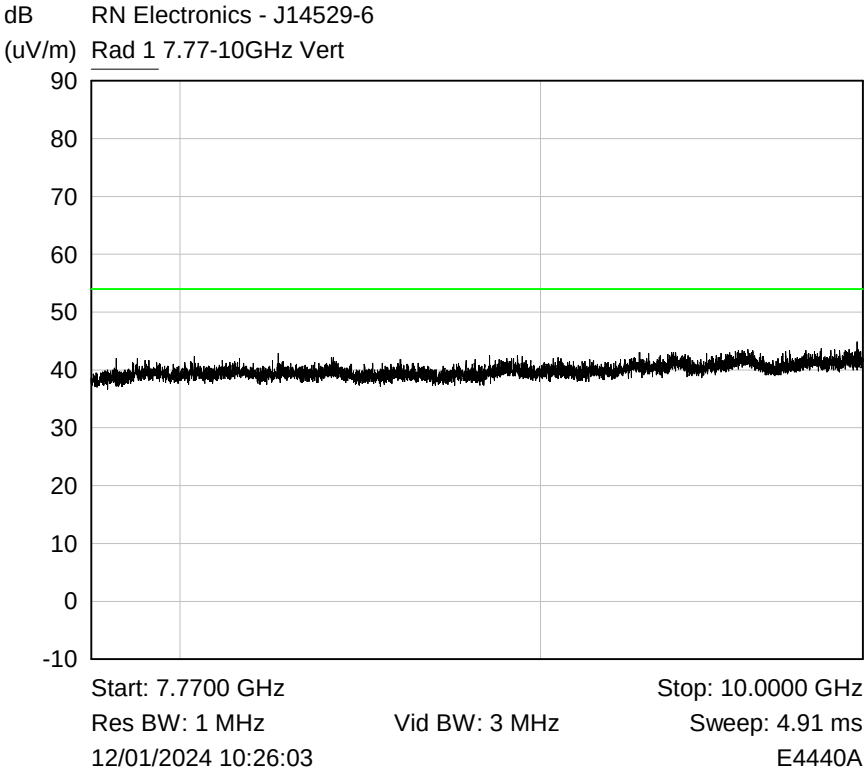

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 5-6GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 5.0000 GHz
Stop: 6.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
12/01/2024 09:40:48
E4440A

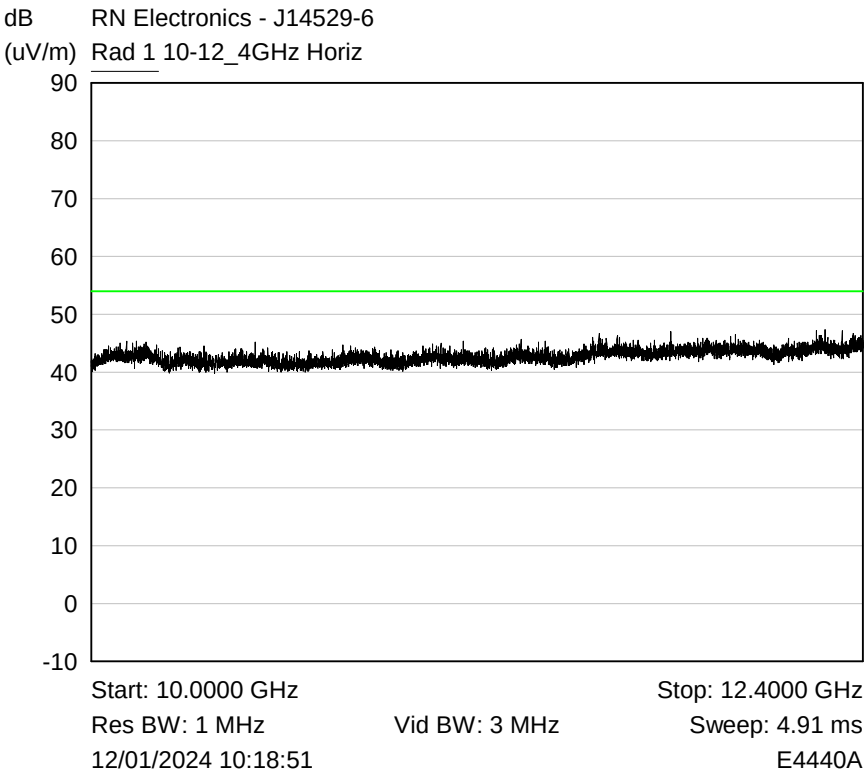

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 5-6GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 5.0000 GHz
Stop: 6.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 2.18 ms
12/01/2024 08:37:47
E4440A

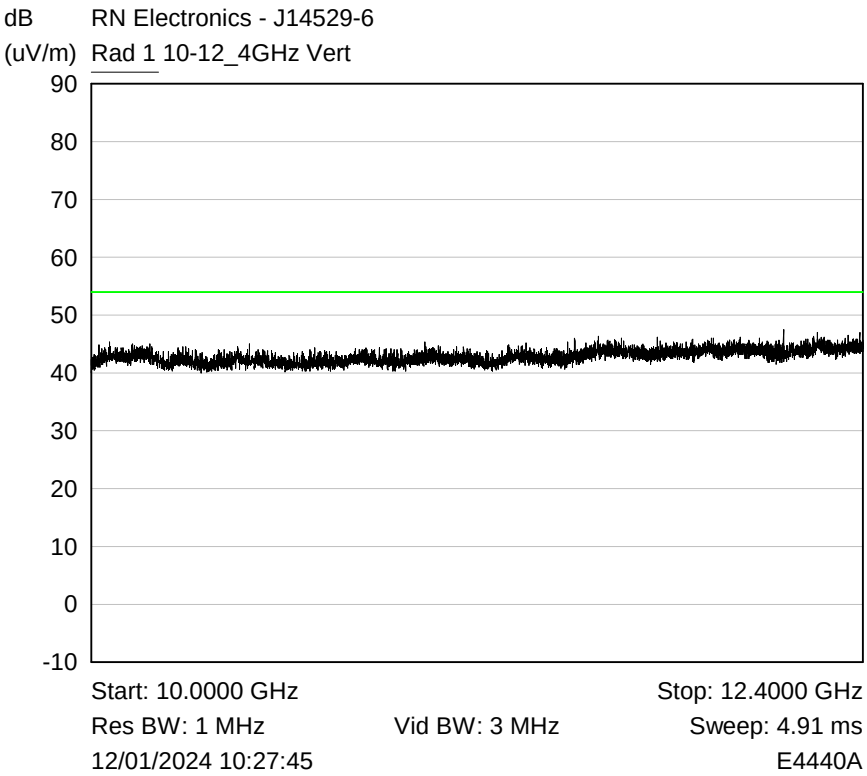

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 6-7.77GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.0000 GHz
Stop: 7.7700 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
12/01/2024 10:12:40
E4440A

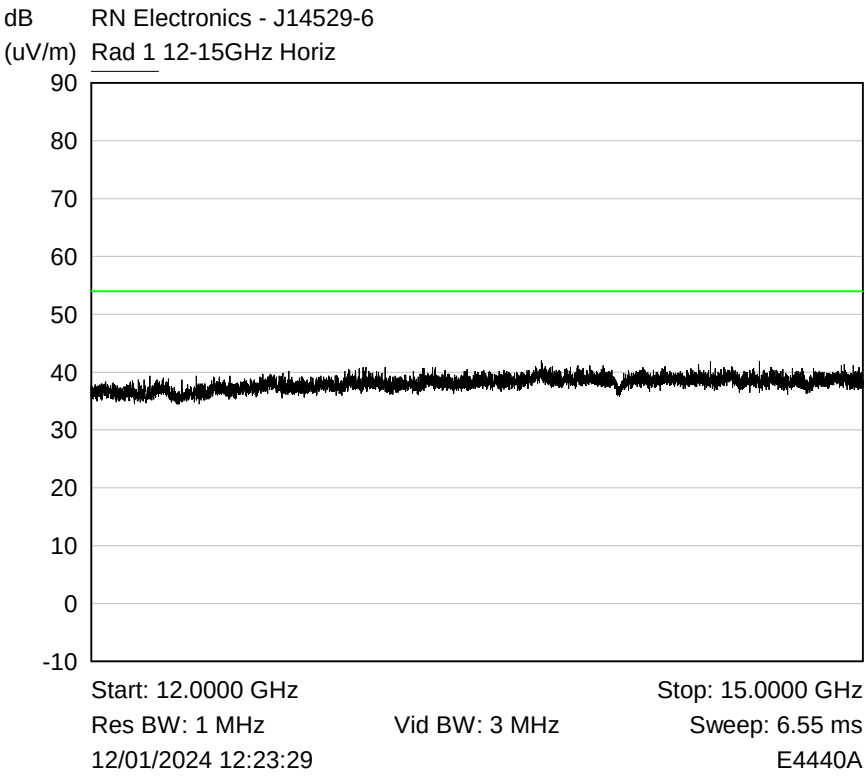

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 6-7.77GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 6.0000 GHz
Stop: 7.7700 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 3.82 ms
12/01/2024 10:30:28
E4440A

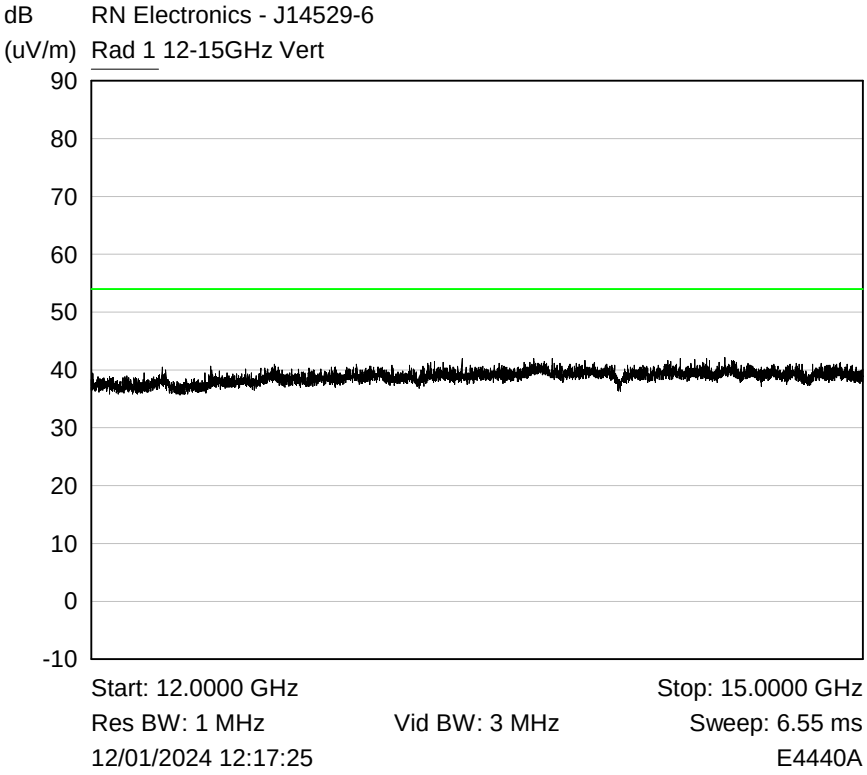

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 7.77-10GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 7.7700 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
12/01/2024 10:17:22
E4440A

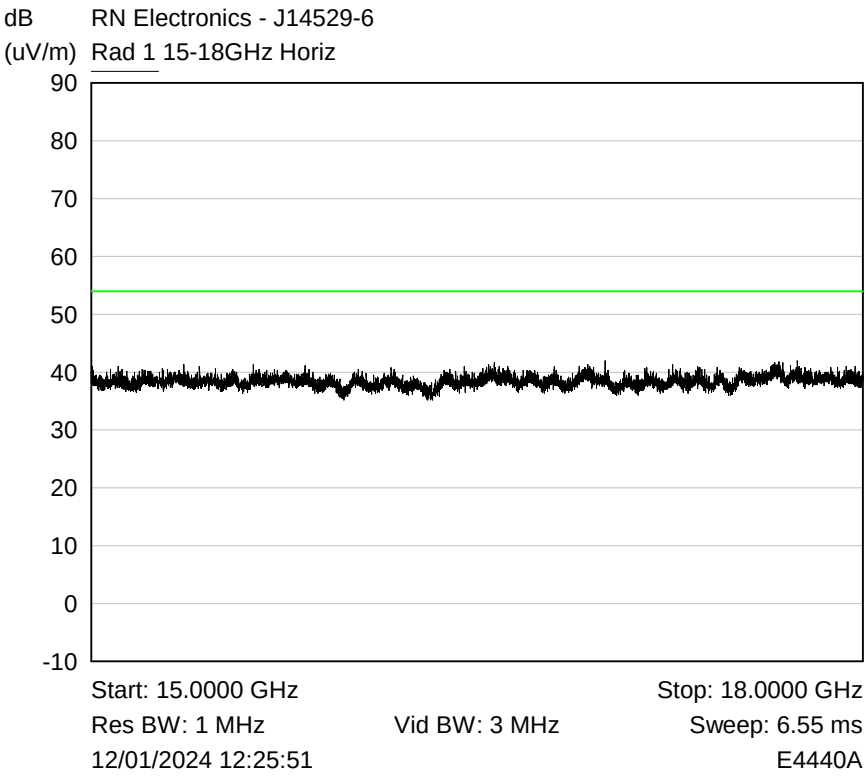

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 7.77-10GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 7.7700 GHz
Stop: 10.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
12/01/2024 10:26:03
E4440A

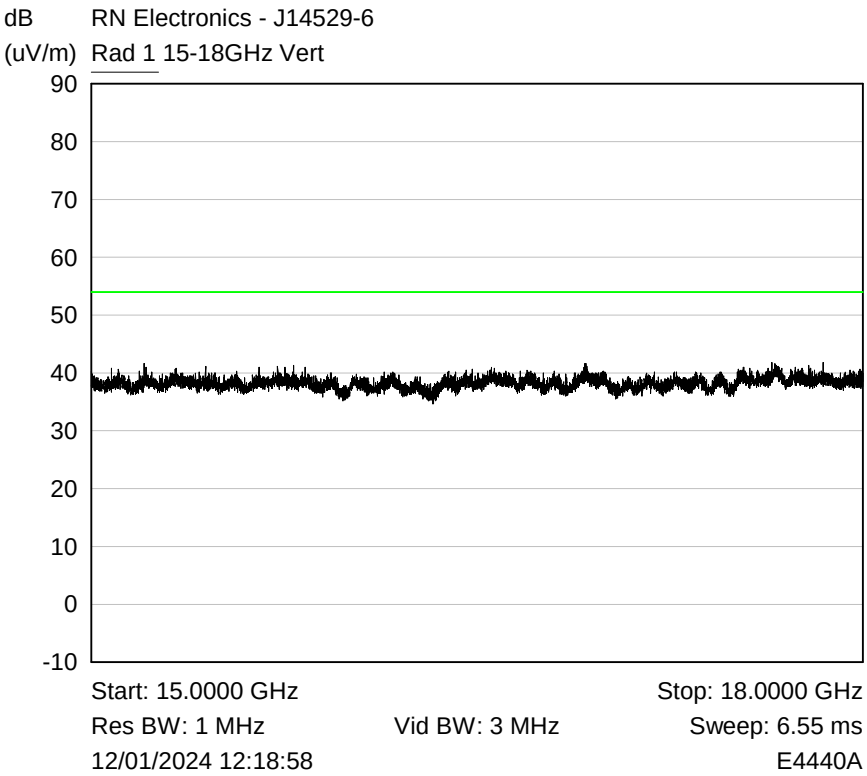

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 10-12_4GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.4000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
12/01/2024 10:18:51
E4440A

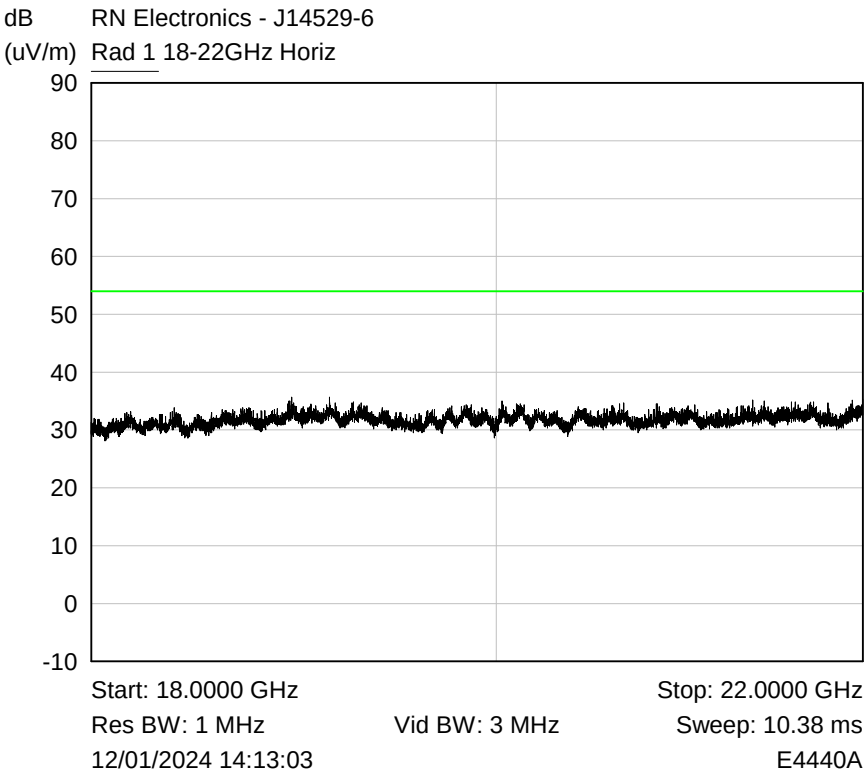

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 10-12_4GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 10.0000 GHz
Stop: 12.4000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 4.91 ms
12/01/2024 10:27:45
E4440A

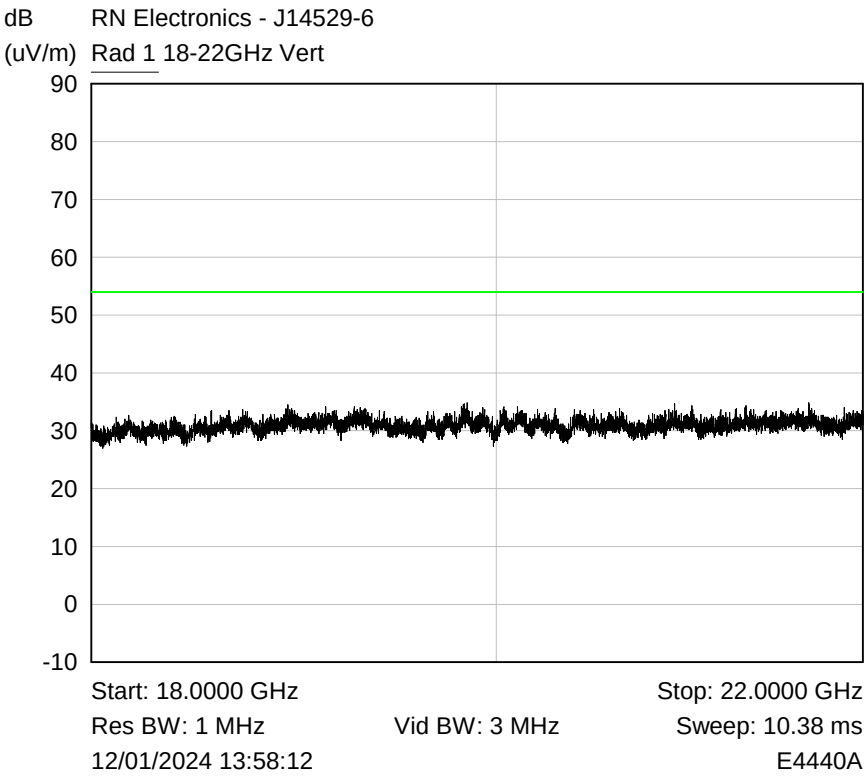

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 12-15GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.0000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
12/01/2024 12:23:29
E4440A

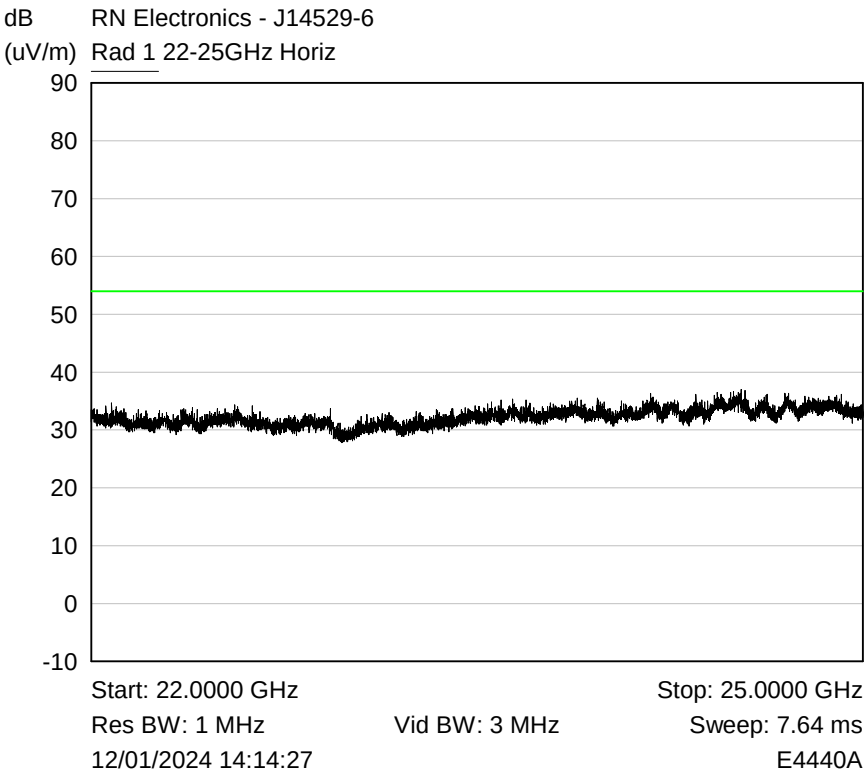

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 12-15GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 12.0000 GHz
Stop: 15.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
12/01/2024 12:17:25
E4440A

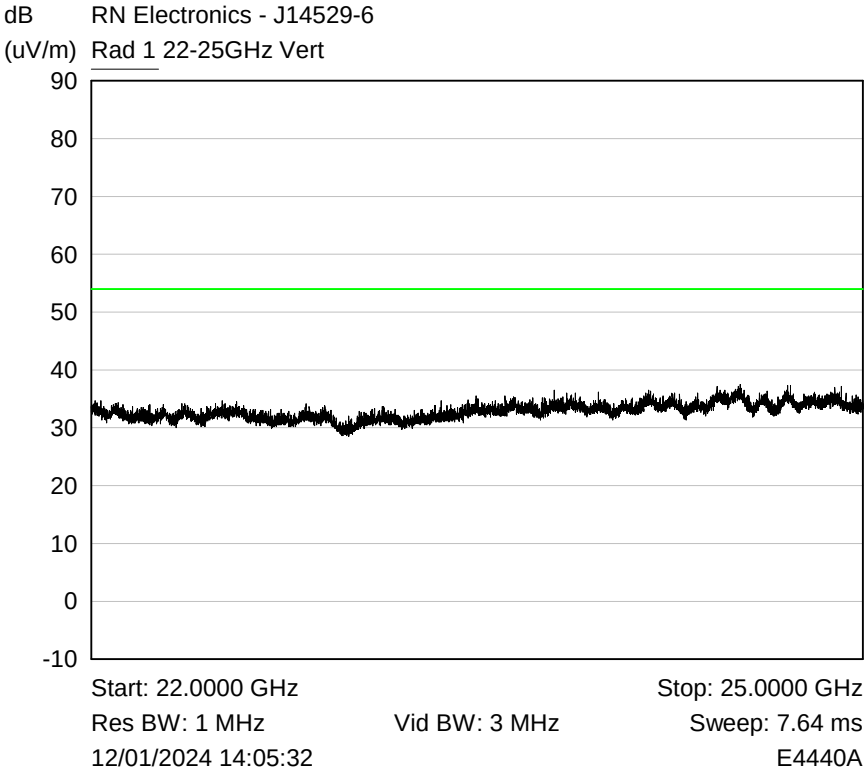

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 15-18GHz Horiz
90
80
70
60
50
40
30
20
10
0
-10
Start: 15.0000 GHz
Stop: 18.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 6.55 ms
12/01/2024 12:25:51
E4440A


dB
(uV/m)
RN Electronics - J14529-6
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
12/01/2024 12:18:58
E4440A


dB
(uV/m)
RN Electronics - J14529-6
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
12/01/2024 14:13:03
E4440A

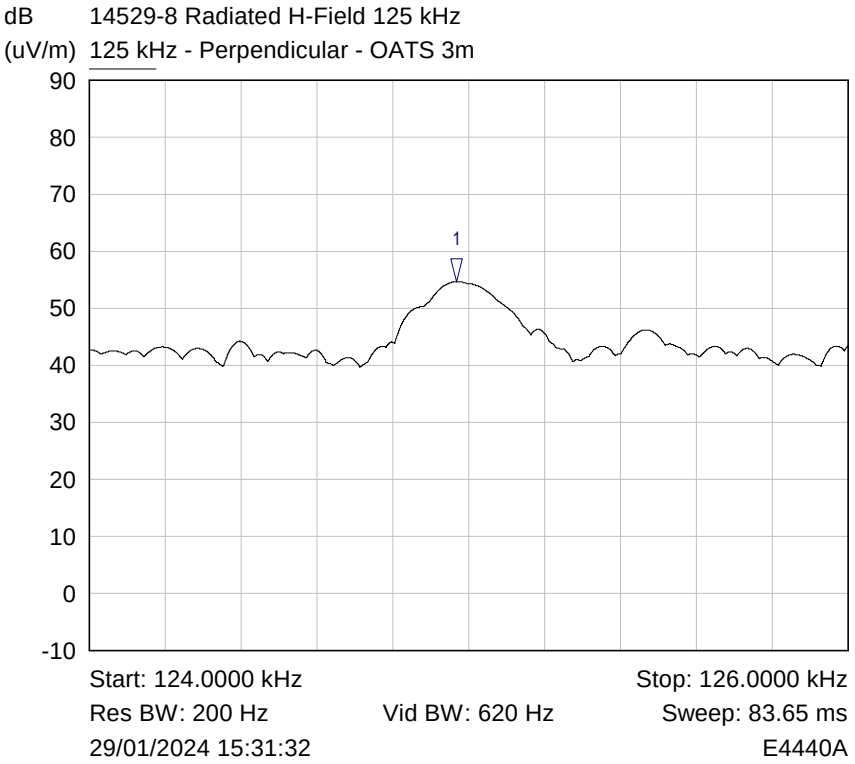

dB
(uV/m)
RN Electronics - J14529-6
Rad 1 18-22GHz Vert
90
80
70
60
50
40
30
20
10
0
-10
Start: 18.0000 GHz
Stop: 22.0000 GHz
Res BW: 1 MHz
Vid BW: 3 MHz
Sweep: 10.38 ms
12/01/2024 13:58:12
E4440A


dB
(uV/m)
RN Electronics - J14529-6
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
12/01/2024 14:14:27
E4440A


dB
(uV/m)
RN Electronics - J14529-6
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
12/01/2024 14:05:32
E4440A

6.7 Intentional radiator field strength

RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation RFID (with Card), Channel 125 kHz

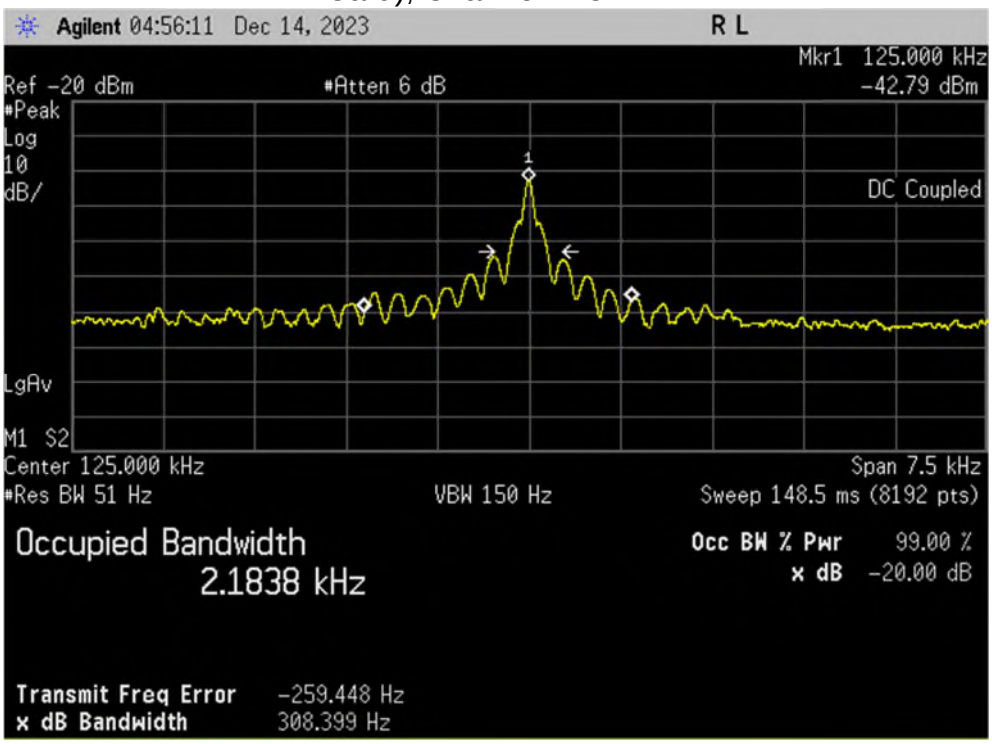


Mkr	Trace	X-Axis	Value	Notes
1 ▽	125 kHz - Perpendicular - OATS 3m	124.9682 kHz	54.67 dB(uV/m)	

Maximised field strength plot reference at 3 metre distance

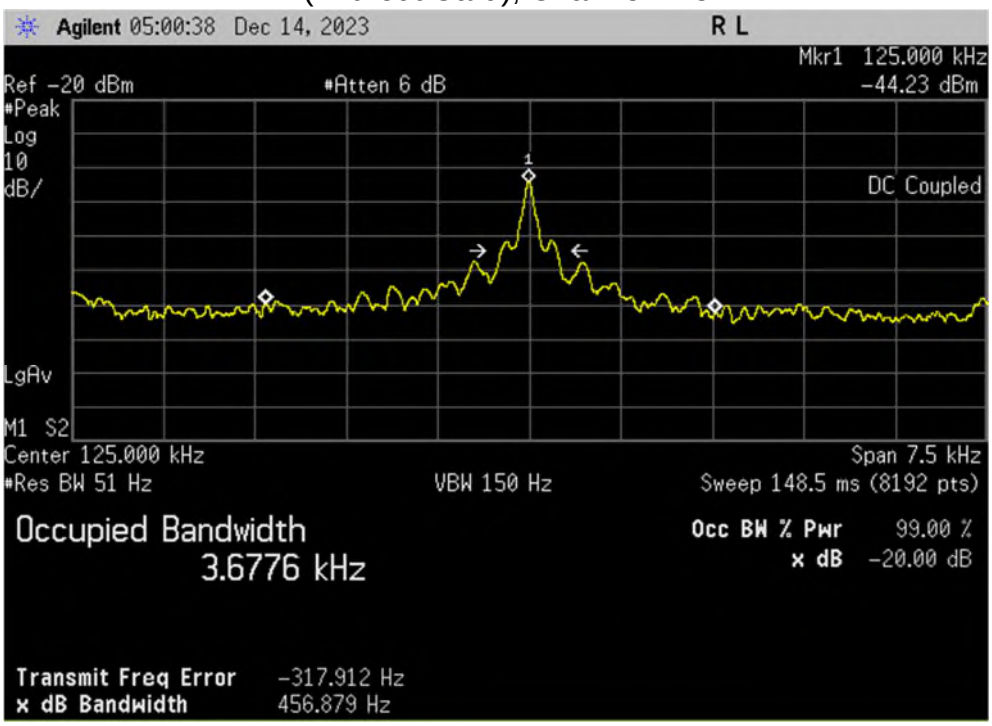
6.8 Occupied bandwidth

RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation RFID (with Card), Channel 125 kHz



Plot for 20 dB Bandwidth (Hz) Nominal Temp & Volts

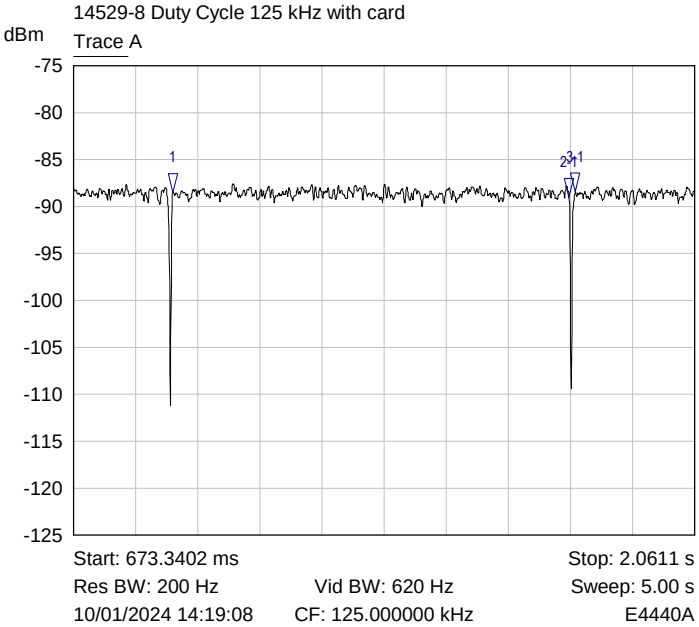
RF Parameters: Band - kHz, Power PoE, Channel Spacing Non Channelized, Modulation RFID (Without Card), Channel 125 kHz



Plot for 20 dB Bandwidth (Hz) Nominal Temp & Volts

6.9 Duty Cycle

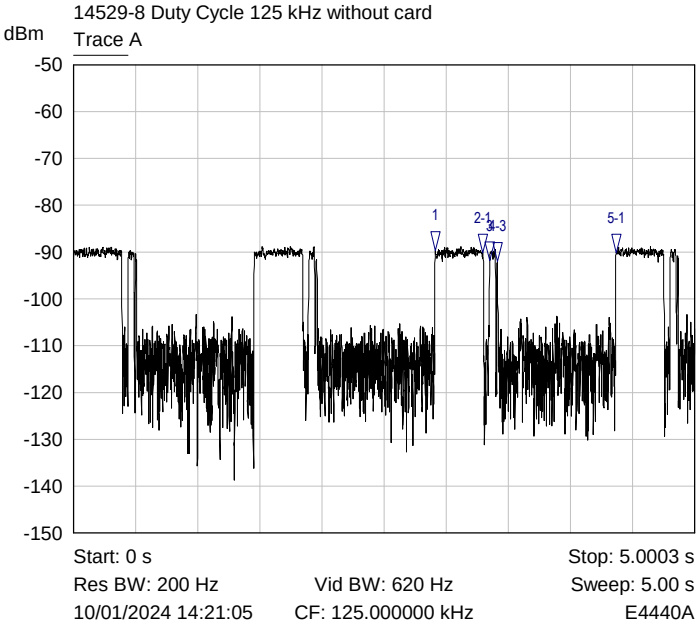
RF Parameters: Power PoE, Channel Spacing Non Channelized, Modulation With Card RFID



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	896.1651 ms	-88.47 dBm	
2-1	Trace A	884.5662 ms	-0.51 dB	
3-1	Trace A	898.6069 ms	0.03 dB	

TX on time (mS)

RF Parameters: Band 119-140 kHz, Power PoE, Channel Spacing Non Channelized, Modulation without Card RFID



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.9125 s	-89.64 dBm	
2-1	Trace A	382.1521 ms	-0.55 dB	
3	Trace A	3.3484 s	-91.79 dBm	
4-3	Trace A	64.0990 ms	-0.27 dB	
5-1	Trace A	1.4554 s	-0.50 dB	

TX on time (mS)

7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

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

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

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

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

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

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

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

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

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

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

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

7.2 Explanation of limit line calculations for radiated measurements

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

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

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

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

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

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

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

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

Equation 21: $E_{Linear} = 10^{((E_{log}-120)/20)}$
And therefore equation 21 transposed is: $E_{Log} = 20xLog(E_{Linear}) +120$
Where:
E_{Linear} is the field strength of the emission in V/m
E_{Log} is the field strength of the emissions in dBµV/m

Equation 22: $EIRP = E_{Meas} + 20log(d_{Meas}) -104.7$
Where:
EIRP is equivalent isotropically radiated power in dBm
E_{Meas} is the field strength of the emission at the measurement distance in dBµV/m
d_{Meas} is the measurement distance in metres

Equation 25: $PD = EIRP_{Linear} / 4\pi d^2$
And therefore equation 25 transposed is: $EIRP_{Linear} = PD \times 4\pi d^2$
Where:
PD is the power density at distance specified by the limit, in W/m^2
$EIRP_{Linear}$ is the equivalent isotropically radiated power in Watts
d is the distance at which the power density limit is specified in metres

Equation 26: $PD = E^2_{Speclimit} / 377$
And therefore equation 26 transposed is: $E_{Spec\ limit} = \sqrt{(PD \times 377)}$
Where:
PD is the power density at distance specified by the limit, in W/m^2
$E_{spec\ limit}$ is the field strength at the distance specified by the limit in V/m

Example:
Radiated spurious emissions limit at 3metres of $90pW/cm^2$.
$90pW/cm^2 \times 100^2 = 0.9\ \mu W/m^2$ = (EIRP Linear)

Equation 25 transposed: $0.9 \times 10^{-6} \times 4 \times \pi \times 3^2 = 0.0001017876$ W
And
Equation 26 transposed: $E_{Spec\ limit} = \sqrt{(0.9x10^{-6} \times 377)} = 0.01842$ V/m.
And
Equation 21 transposed: $E_{Log} = 20Log(0.01842) +120 = 85.3dB\mu V/m$ @ 3m.

8 Photographs

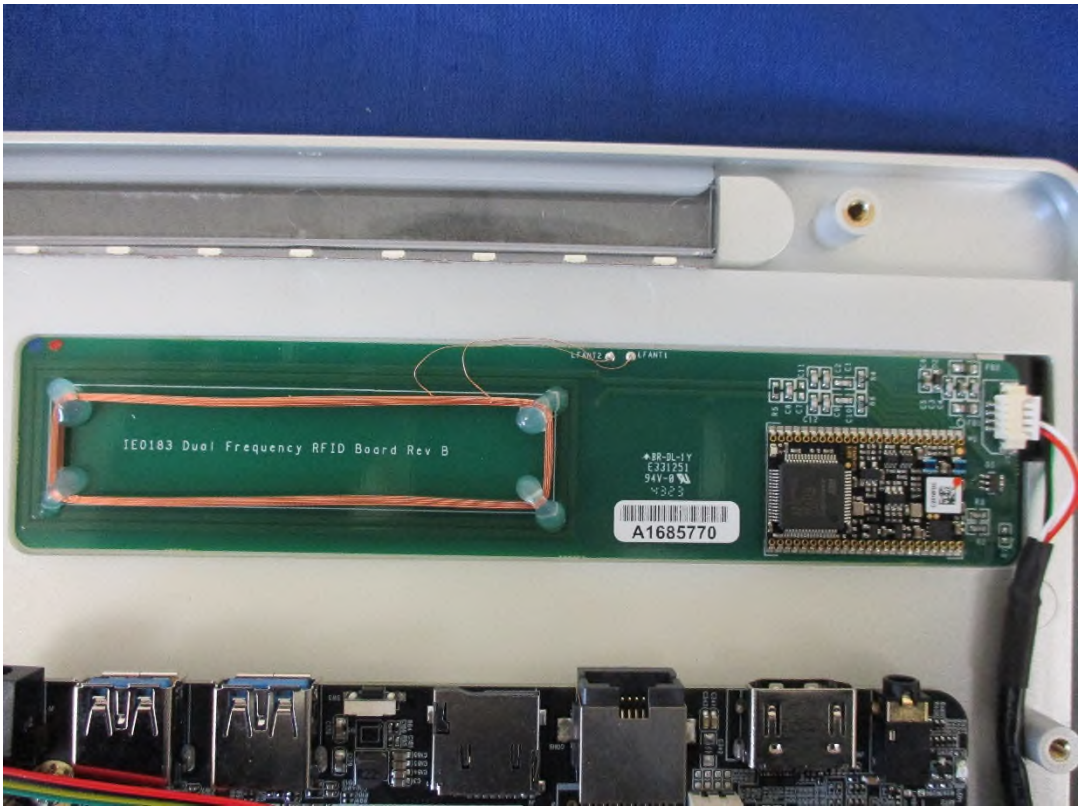
8.1 EUT Front View

8.2 EUT Reverse Angle

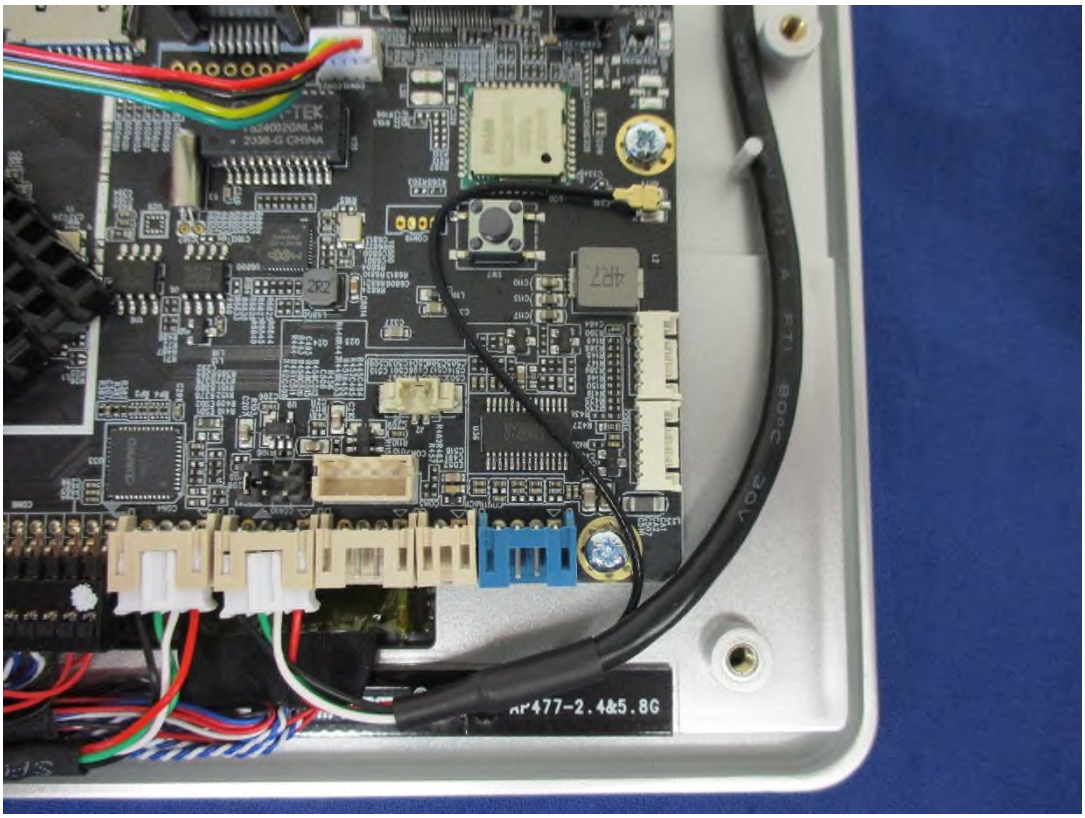
8.3 EUT Left side View

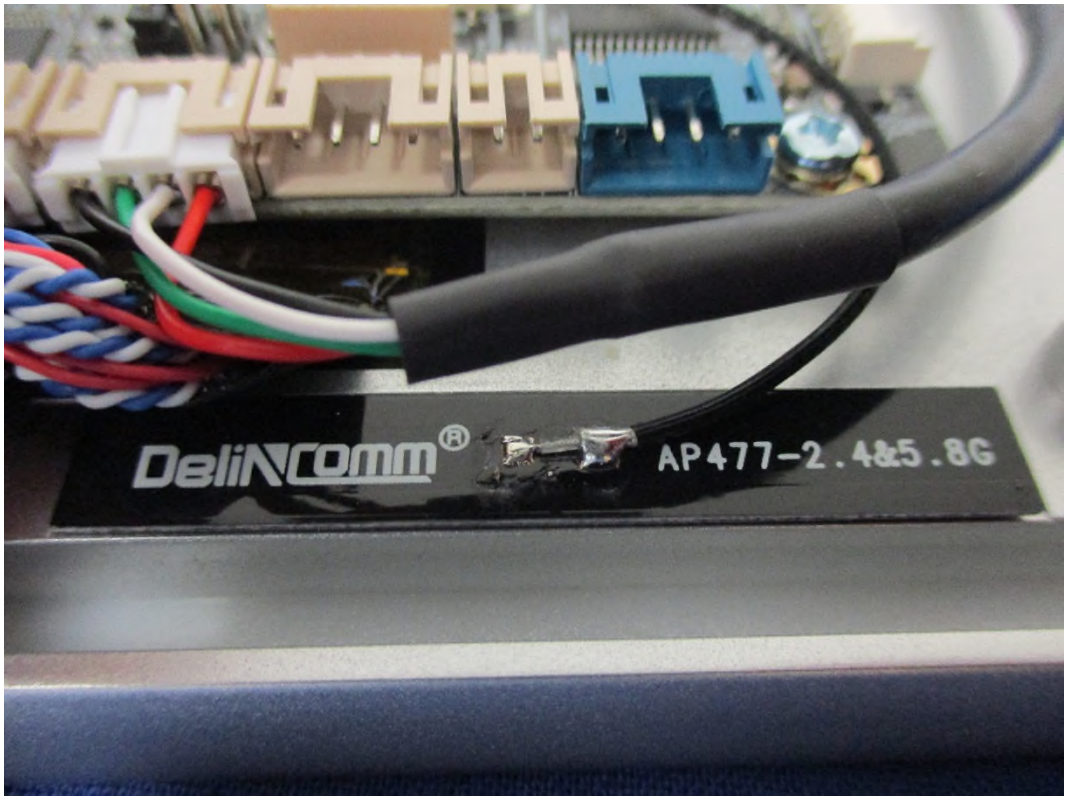
8.4 EUT Right side View

8.5 EUT Antenna Port



125 kHz & 13.56 MHz Antenna

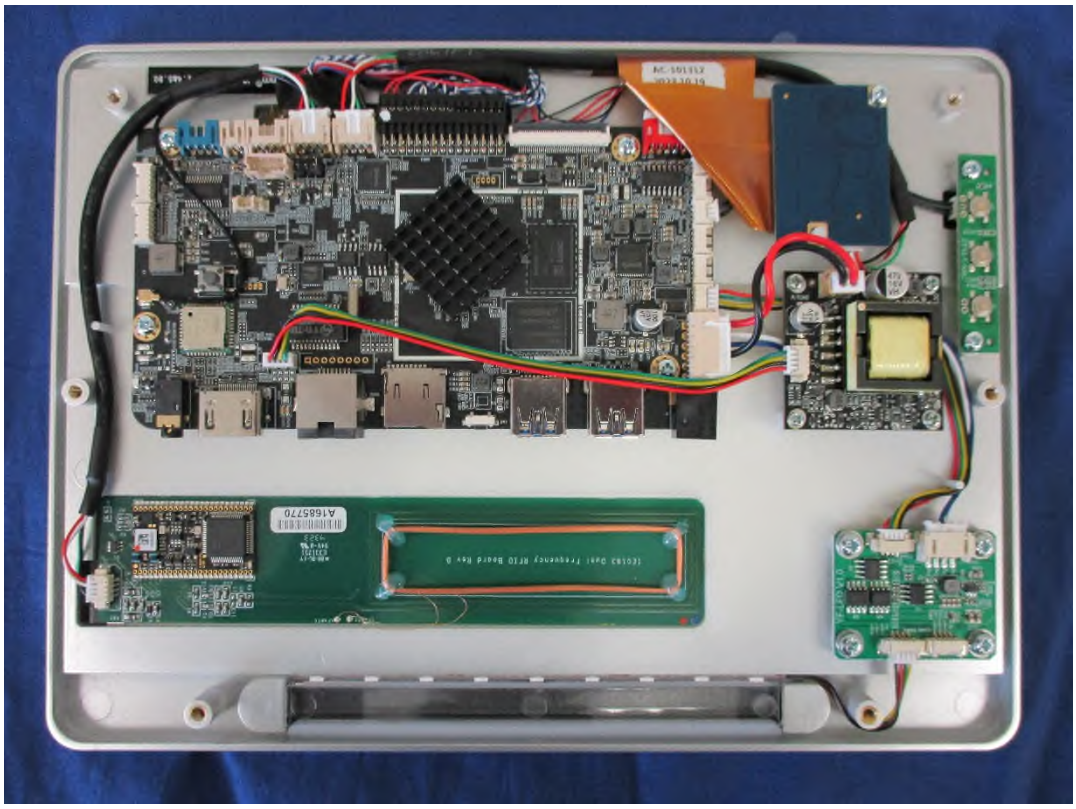


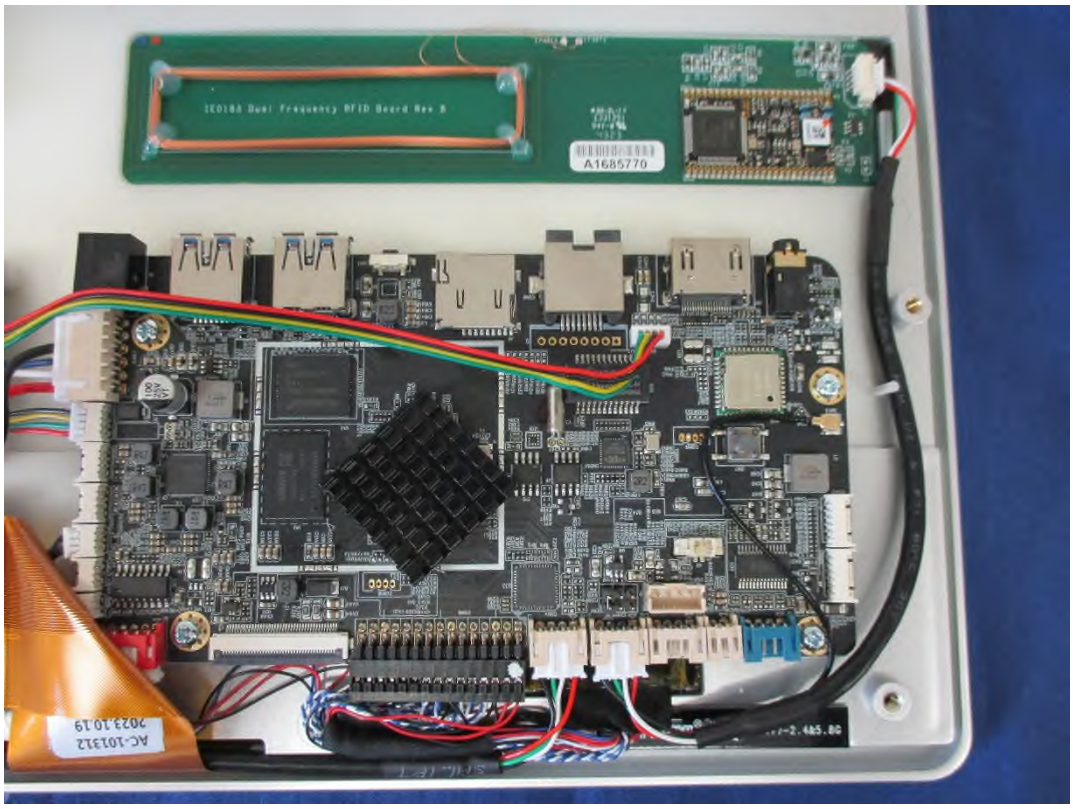


2.4 GHz Antenna

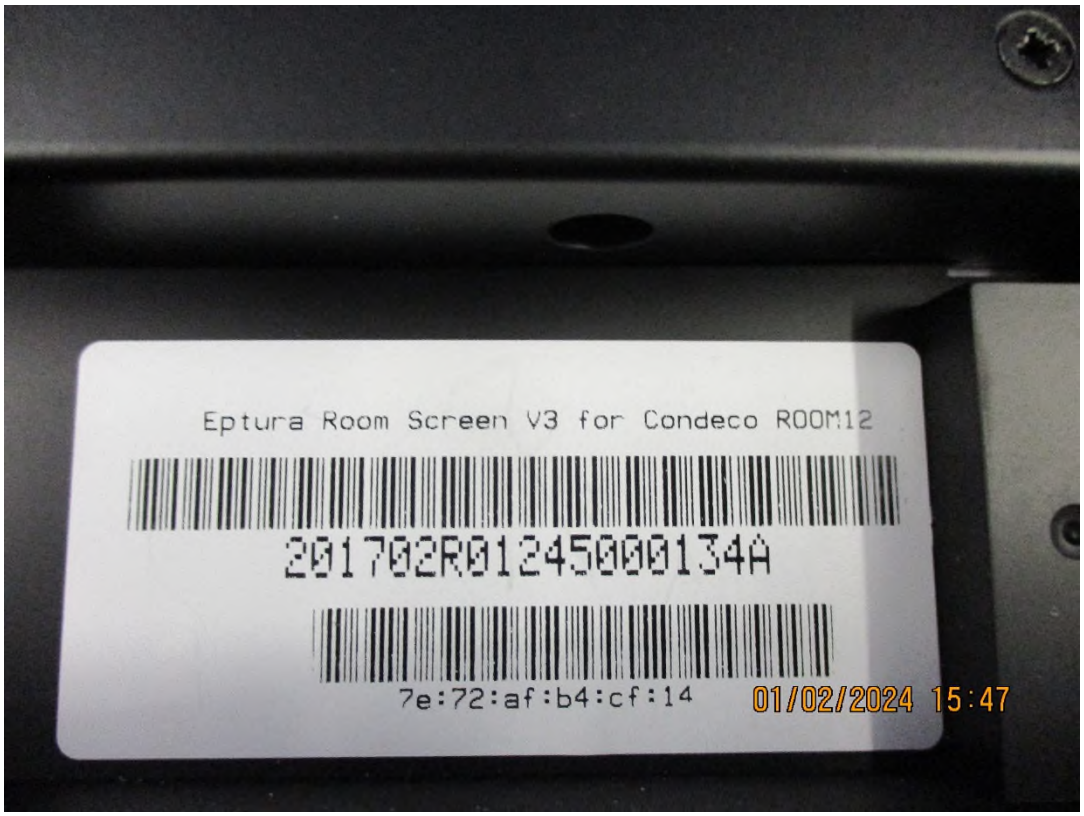
8.6 EUT Display & Controls

8.7 EUT Internal photos



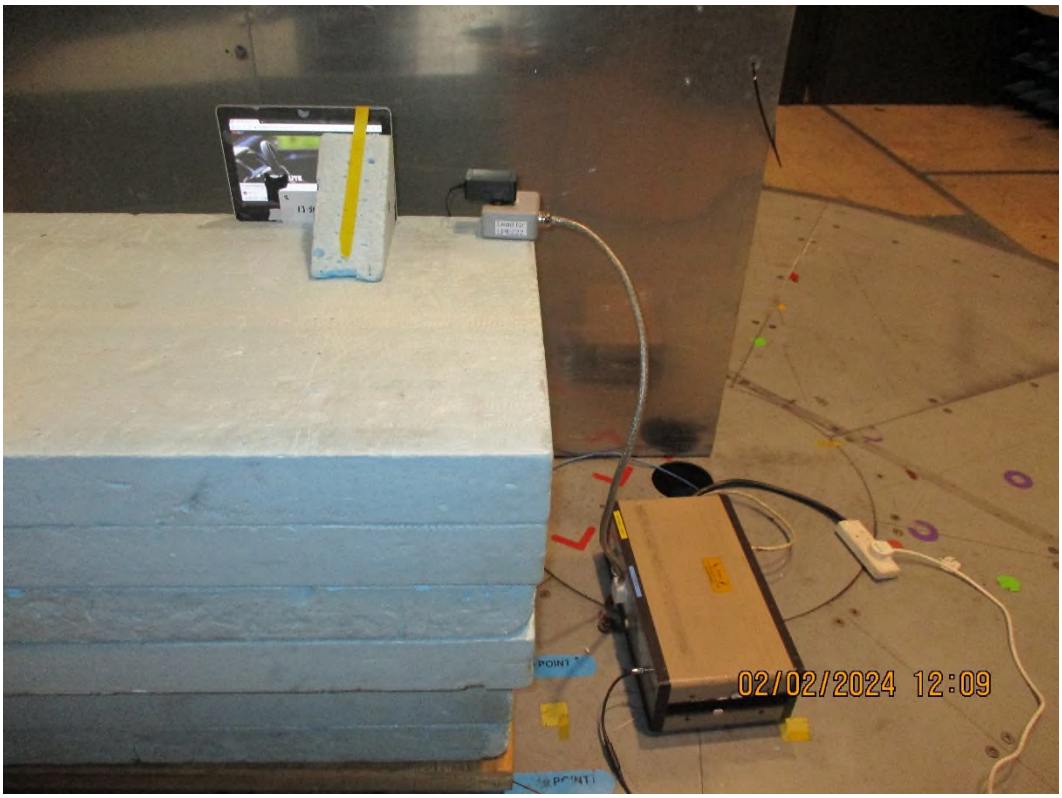


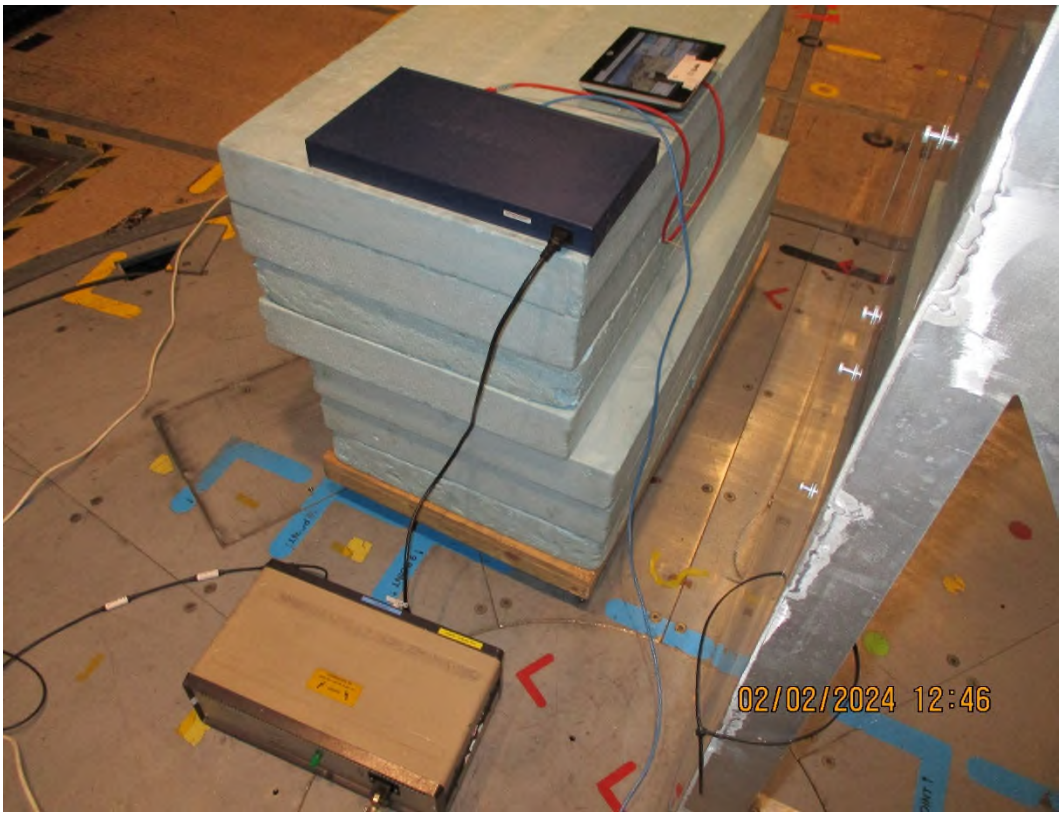
8.8 EUT ID Label



8.9 EUT Chassis

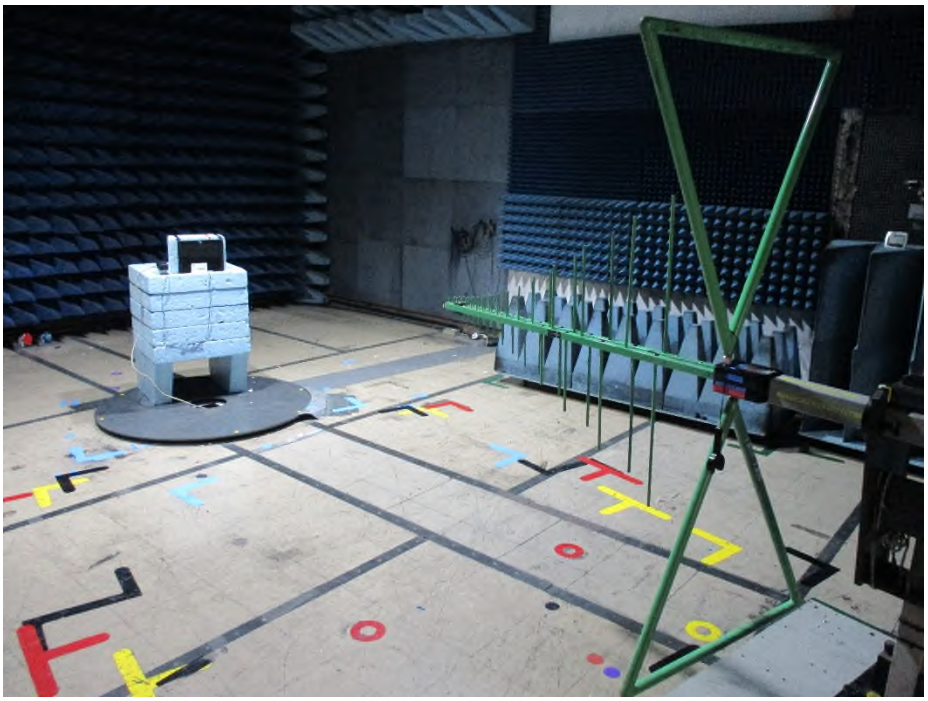
8.10 AC Power line and PoE conducted emissions





8.11 Radiated emissions 9 kHz – 30 MHz

8.12 Radiated emissions 30 – 1000 MHz

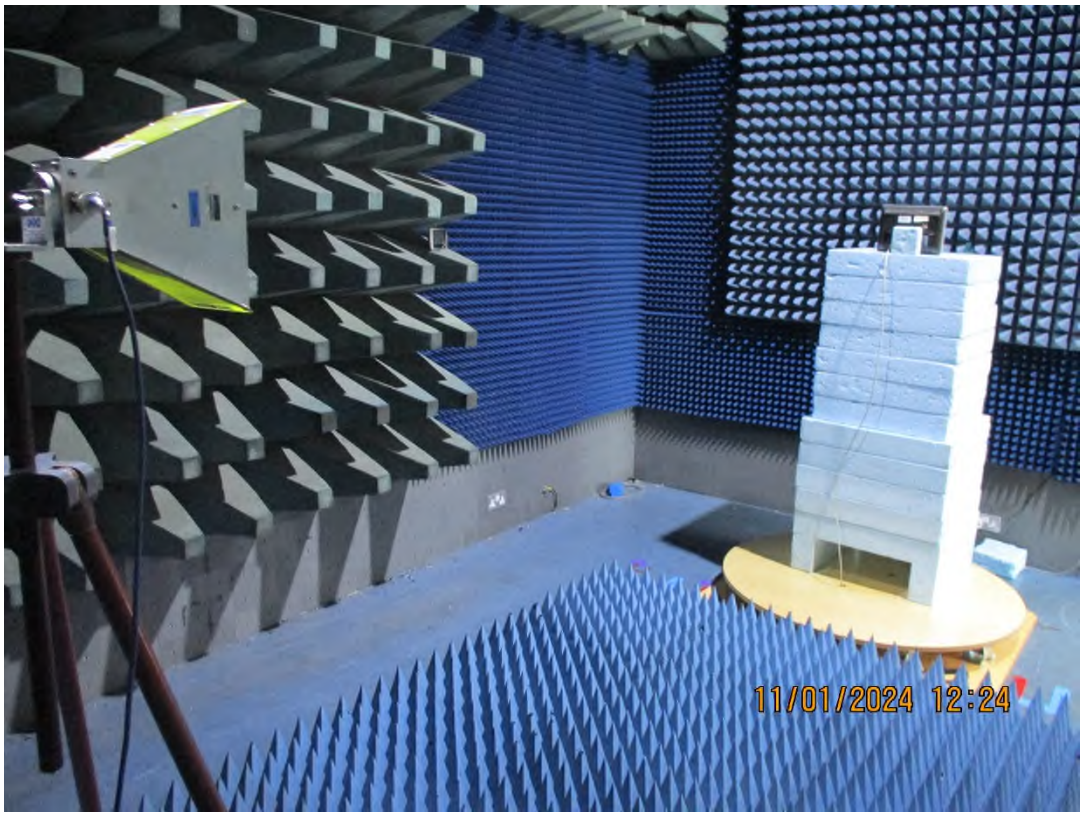


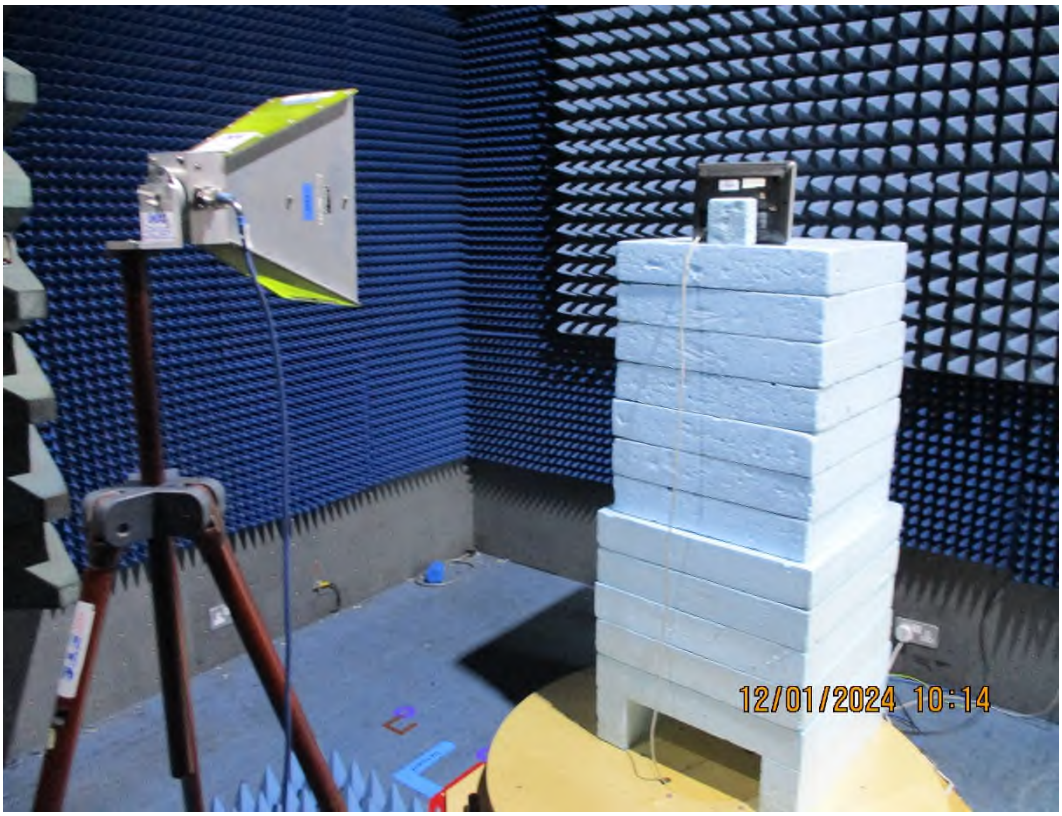
Upright Position

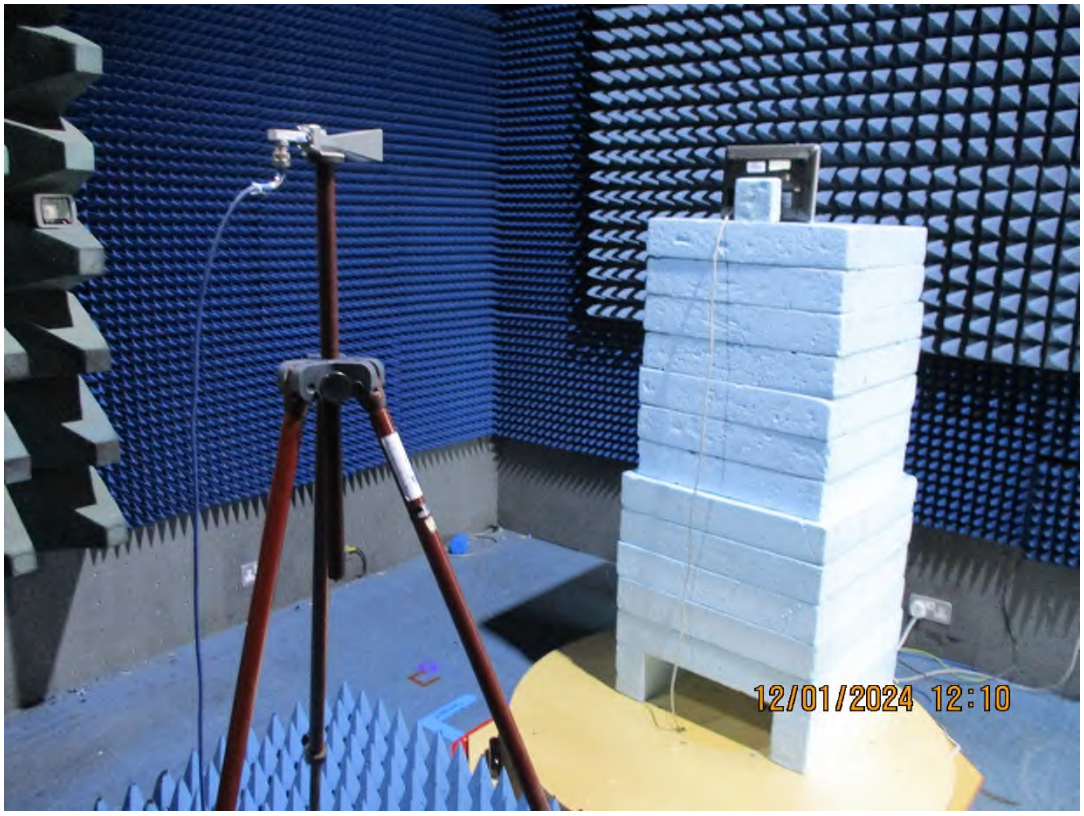
Side Position

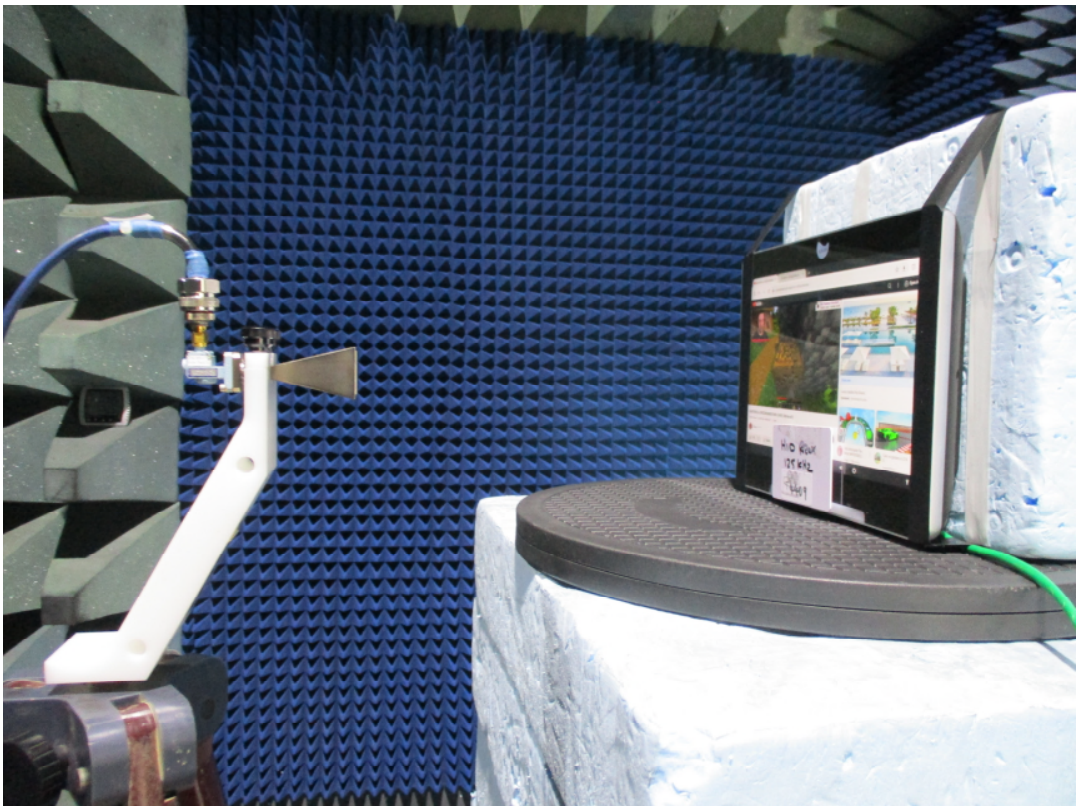
Flat Position

8.13 Radiated emissions above 1 GHz






12/01/2024 12:10



8.14 Radiated emission diagrams

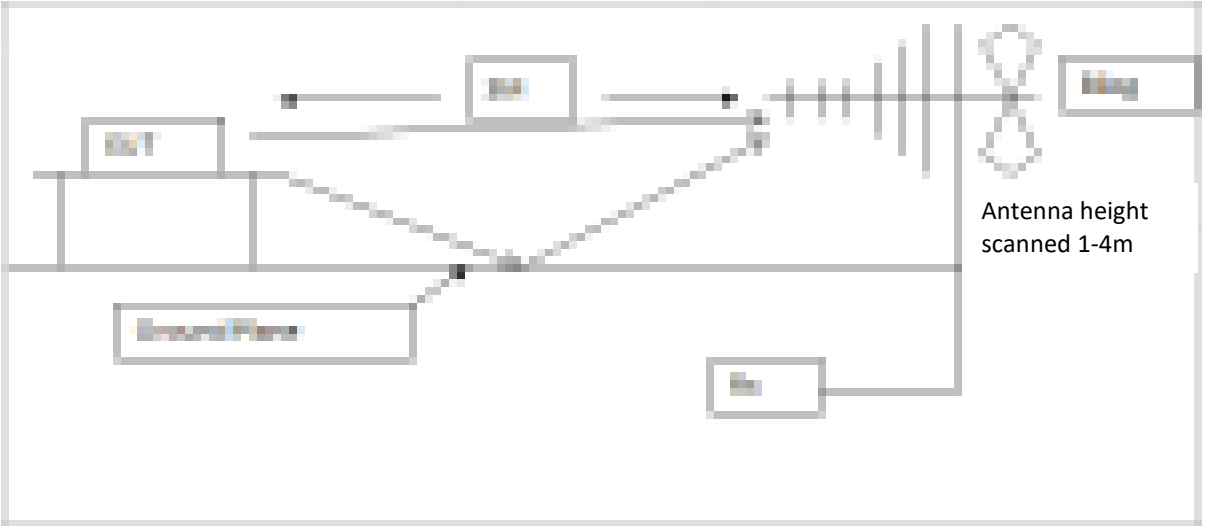


Diagram of the radiated emissions test setup 30 - 1000 MHz

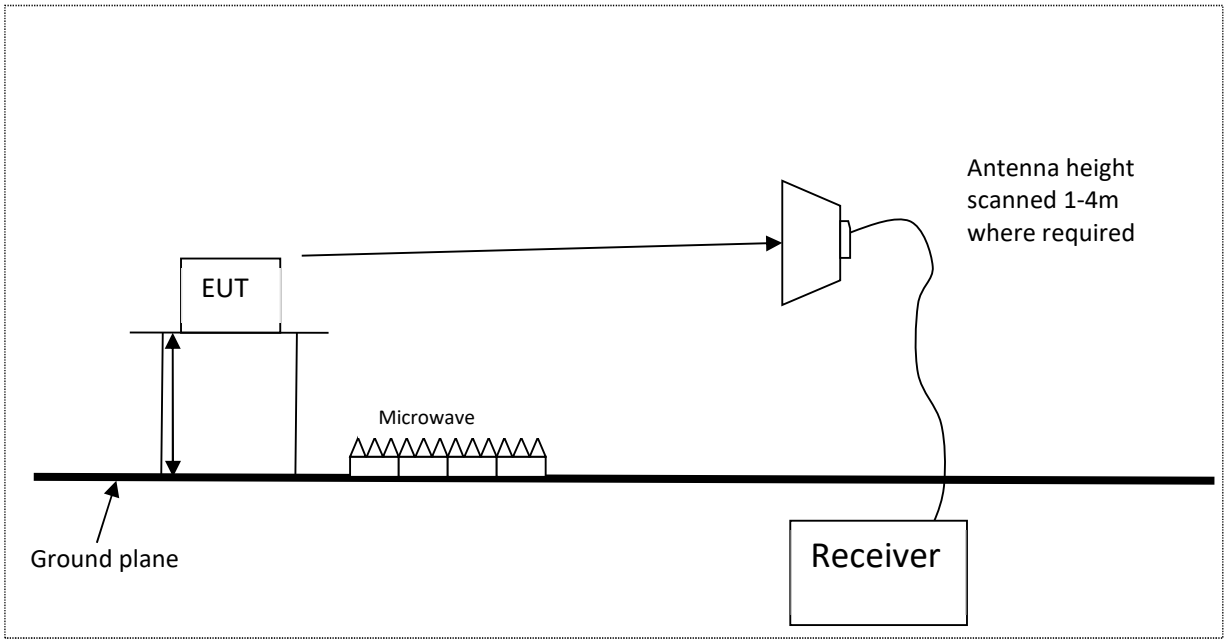


Diagram of the radiated emissions test setup above 1GHz

8.15 AC powerline conducted emission diagram

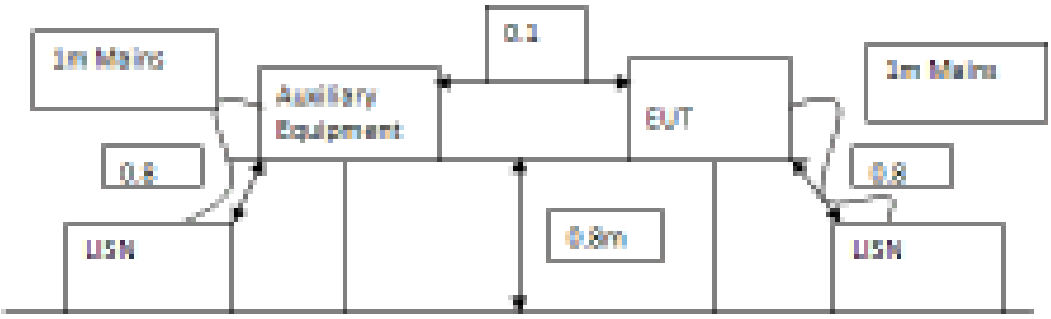


Diagram of the AC conducted emissions test setup

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
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	05-Jul-2023	12 months
E412	E4440A	PSA 3 Hz - 26.5 GHz	Agilent Technologies	22-Sep-2023	24 months
E428	HF906	Horn Antenna 1 - 18 GHz	Rohde & Schwarz	23-May-2023	36 months
E429	-	Filter Box 5 Switch Filters 0.91 GHz - 16.3 GHz	RN Electronics	21-Aug-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	24-Nov-2023	24 months
E743	2017 4/2dB	Attenuator 4/2dB 30-1000MHz	RN Electronics	15-Mar-2023	12 months
E856	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	24-Nov-2023	12 months
E904	5086-7805	Pre-Amplifier 1GHz - 26.5GHz	Hewlett Packard	03-May-2023	12 months
E972	WRCGV10	Filter Band Reject 2400 to 2483.5 MHz	Wainwright Instruments	03-Apr-2023	12 months
F238	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	23-Aug-2023	12 months
LPE222	MN2050	LISN Artificial Mains Network	Chase	15-May-2023	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
ZSW1	V2.5.2	Measurement Software Suite	RN Electronics	Not Applicable	

10 Auxiliary and peripheral equipment

10.1 Customer supplied equipment

Item No.	Model No.	Description	Manufacturer	Serial No.
1	PSA16U-480(POR)	Switch Power Supply	Phihong	P04805817B1

10.2 Kiwa Electrical Compliance supplied equipment

RN No.	Model No.	Description	Manufacturer	Serial No
N473	DIR-855	Wireless N Quadband Gigabit Router	D-Link	F3RR29B003035
None	FS728TP	24 port PoE smart switch	Netgear	0026F2905125

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. 293246, ISED Registration No. 5612A-4

Site C Transient Laboratory

Site D Screened Room (Conducted Immunity)

Site E Screened Room (Control Room for Site D)

Site F Screened Room (Conducted Emissions)

Site G Screened Room (Control Room for Site H)

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

Site J Transient Laboratory

Site K Screened Room (Control Room for Site M)

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

Site N Radio Laboratory

Site Q Fully-Anechoic Chamber

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

Site R Screened Room (Conducted Immunity)

Site S Safety Laboratory

Site T Transient Laboratory

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

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