

Test Report for the FCC and ISED Testing of an OMED Breath Analyzer to FCC Rule 47CFR 15.247 and ISED RSS-247 for Owlstone Medical Ltd

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Project number: C8445

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Issue	Description						Issue by	Date
1	Copy 1		Copy 2		PDF	√	JB	2 nd April 2024

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Test Report Change History

Issue	Date	Modification Details
1	2 nd April 2024	First Issue
2		
3		
4		
5		
6		
7		
8		
9		
10		

Section 1 Test Location

All testing was performed at;

Eurofins E&E UK	Unit 5
	Speedwell Road
	Castleford
	WF10 5PY
Tel:	01977 731173
Website	http://www.yorkemc.co.uk
UKAS Testing No.	1574

1.1 UKAS Accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Eurofins E&E UK latest accreditation schedule can be found at:

http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

Eurofins E&E UK Castleford Laboratory, is an Accredited facility recognised by the Federal Communications Commission (FCC) for certification testing. The appropriate FCC Designation Number is UK2013, dated 1st March 2021.

Eurofins E&E UK Castleford Laboratory is recognised by ISED for certification testing.

ISED Assigned Code: 22959

CAB Identifier: UK0004

Section 2 Customer Information

Company name	Owlstone Medical Limited
Address	183 Cambridge Science Park
	Milton Road
	Cambridge
	CB4 0GA
	United Kingdom
Contact	David Metcalfe
Email	david.metcalfe@owlstone.co.uk

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

Date received:	8 th March 2024
EUT name:	OMED Breath Analyzer
PMN:	OMED Breath Analyzer
HVIN:	BETA
FCC ID:	2BFTFHMBA-01
IC:	32296-HMBA01
EUT description:	The OMED Breath Analyzer device is used to measure levels of hydrogen and methane in exhaled breath. The information obtained from the device will be used as an aid in the diagnosis of medical conditions such as SIBO and IBS.
Antenna	Integral Antenna: Johanson Technology 2450AT18D0100001 1.5dBi peak gain
Transmission	Digital Transmission System (DTS) Bluetooth Low Energy (BLE)
Modulation schemes	PRBS9
Operating frequency band	2400MHz to 2483.5MHz
No of units tested:	Unit 1: Radiated tests Unit 2: Conducted tests
EUT power:	5V via USB port
Highest internal frequency:	2.480GHz
Mode/s of operation:	Continuous transmit of packetized data at top, middle and bottom channels. Data rates of 1Mbps & 2Mbps. Channels used: 2402MHz, 2440MHz and 2480MHz
Test software:	Test Firmware installed. The test modes were controlled via USB connection to a laptop running nRF connect for Desktop v4.3.0 and Direct Test Mode v2.2.0 control software.
Modifications incorporated during testing:	N/A

Ports and Cables	Cable Length	Screened/ unscreened	Connected to
RF Cable	20cm	Screened	OMED controller PCB

3.2 EUT Photographs

Photographs are supplied separately.

3.3 Configuration of EUT

The apparatus was supplied in one single possible configuration.

BLE Channel Number	Frequency	BLE Channel Number	Frequency
0	2404 MHz	20	2446 MHz
1	2406 MHz	21	2448 MHz
2	2408 MHz	22	2450 MHz
3	2410 MHz	23	2452 MHz
4	2412 MHz	24	2454 MHz
5	2414 MHz	25	2456 MHz
6	2416 MHz	26	2458 MHz
7	2418 MHz	27	2460 MHz
8	2420 MHz	28	2462 MHz
9	2422 MHz	29	2464 MHz
10	2424 MHz	30	2466 MHz
11	2428 MHz	31	2468 MHz
12	2430 MHz	32	2470 MHz
13	2432 MHz	33	2472 MHz
14	2434 MHz	34	2474 MHz
15	2436 MHz	35	2476 MHz
16	2438 MHz	36	2478 MHz
17	2440 MHz	37*	2402 MHz
18	2442 MHz	38*	2426 MHz
19	2444 MHz	39*	2480 MHz

*Advertising channels.

BLE Channelization

3.4 EUT Monitoring/Auxiliary Equipment

Equipment name	Type no.	Serial no
HP Pavilion Laptop	14-ce1507sa	5CD9115NKV

3.5 Monitoring Software

None. The channel required was selected via software prior to the testing.

Section 4 Test Specifications**For USA:**

Regulation / Test Standard	Regulation: Title 47 of the Code of Federal Regulations (CFR) Part 15 (47CFR15) Subpart C – Intentional Radiators Measurement standard: ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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Requirement	FCC Rule Part	Comments	Result Summary
6 dB Bandwidth	FCC § 15.247(a)(2)	Applies	Pass
Maximum peak conducted power	FCC § 15.247(b)(3)	Applies	Pass
Power spectral density	FCC § 15.247(e)	Applies	Pass
Band edge compliance	FCC § 15.247(d)	Applies	Pass
Conducted spurious emissions	FCC § 15.247(d)	Applies	Pass
Transmitter radiated spurious emissions – restricted bands	FCC § 15.247(d) FCC § 15.209	Applies	Pass
AC power line conducted emissions	FCC § 15.207	Applies	Pass

For Canada:

Regulation / Test Standard	RSS-247 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices Issue 3 August 2023 And, RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 5 April 2018 +A1 March 2019 +A2 February 2021
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Requirement	ISED Ragulation	Comments	Results Summary
99% Occupied Bandwidth	RSS-Gen 6.6	Applies	Pass
6 dB Bandwidth	ISED RSS-247 § 5.2	Applies	Pass
Maximum peak conducted power	ISED RSS-247 § 5.4	Applies	Pass
Power spectral density	ISED RSS-247 § 5.2	Applies	Pass
Band edge compliance	ISED RSS-247 § 3.3 and 5.5 RSS-GEN Issue 5 Section 8.10	Applies	Pass
Conducted spurious emissions	ISED RSS-247 § 5.5	Applies	Pass
Transmitter radiated spurious emissions	ISED RSS-GEN § 8.9	Applies	Pass
AC power line conducted emissions	ISED RSS-247 § 3.1	Applies	Pass

4.1 Knowledge Database References

The following KDBs were referenced during the testing.

The latest knowledge database references are available via the FCC KDB website at:

<https://apps.fcc.gov/kdb>

4.1.1 Radiated Emissions (30MHz to 1000MHz)

Publication Number	Keyword	Publication Date
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017

4.1.2 Radiated Emissions (1GHz to 40GHz)

Publication Number	Keyword	Publication Date
414788	Test Site Validation Requirements above 1 GHz.	07/12/2018
414788	Comparison Noise Emitter (CNE), reference noise source, .pdf	07/12/2018
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017
414788	Comparison Noise Emitters (CNE), test equipment, Broadband.pdf	07/12/2018

4.2 Compliance Statement

The OMED Breath Analyzer, as tested, was shown to meet requirements of the standards listed in Section 4 of this report.

Section 5 Spurious Emission Results – Radiated and Conducted

5.1 Test Specification

FCC Rule Part	47CFR 15.247 (d)
Standard	ANSI C63.10:2013
Measurement Uncertainty Radiated tests	The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95% is +/- 5.01dB for the frequency range from 9kHz to 30MHz +/- 6.26dB for the frequency range 30MHz to 1GHz +/- 5.14dB for the frequency range from 1GHz to 6GHz +/- 5.45dB for the frequency range from 6GHz to 18GHz
Measurement Uncertainty Conducted Power tests	± 1.4 dB

5.2 Procedure and Test Software Version

Radiated tests:- 47CFR15.205 and 47CFR15.209

Eurofins E&E UK test procedure (30MHz to 1GHz)	CEP23 Issue 9
Eurofins E&E UK test procedure (1GHz to 40GHz)	CEP64 Issue 10
Test software	RadiMation Version 2016.2.8

Conducted Tests 47CFR 15.247(d)

ANSI C63.10-2013 Clause reference:	11.11.2 and 11.11.3
Test software	N/A

5.3 Radiated Emissions (30MHz to 1GHz)

Radiated electric field emission measurements are applied as defined in 47CFR15.205 and 47CFR15.209.

5.3.1 Limits at 3m

Frequency (MHz)	Electric Field Strength Limit (dBµV/m) at 3m measurement distance
	Quasi Peak
30 - 88	40.0
88 -216	43.5
216 - 960	46.0
960- 1000	54.0

Note: FCC 47 CFR Part 15 Section 15.209 and 15.205 specifies test limits at 3m

Receiver Settings

Receiver Parameters	Setting
Detector Function	Quasi Peak
Start Frequency	30MHz
Stop Frequency	1000MHz
Resolution Bandwidth	120kHz
Video Bandwidth	Auto

5.3.2 Emissions measurements**5.3.3 Date of Test**

13th March 2024

5.3.4 Test Area

LAB 1 (SAC)

5.3.5 Tested by

J Beevers

5.3.6 Test Setup

The EUT was configured in the SAC on an 80cm high polystyrene table.

The measurement was performed with an antenna to EUT separation distance of 3m. The results were maximised in orientation 0-360 degrees and height 1-4m.

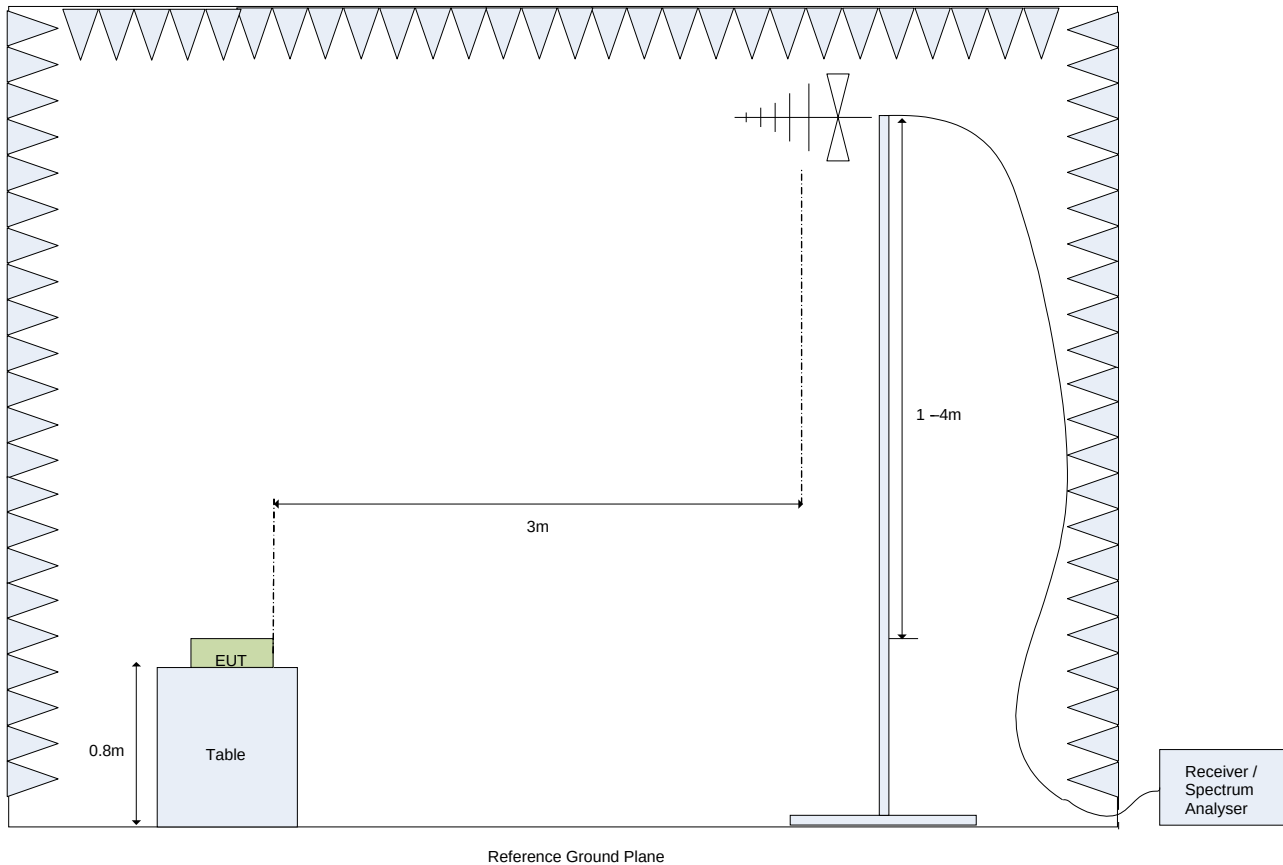


Figure 1 Test Setup for E-Field Measurements from 30MHz to 1GHz

Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.10-2013.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

Operating Mode During testing

During spurious emission testing the equipment under test was set to transmit for each channel bandwidth on the following channels: 2402MHz, 2440MHz and 2480MHz.

The equipment under test was pre-scanned using peak detection when operating on all three channels for each channel bandwidth. Final measurements were performed with the equipment under test operating on 2402MHz with a 1MHz channel bandwidth and 2440MHz with a 2MHz channel bandwidth.

5.3.7 Electric field emissions, 30MHz to 1GHz

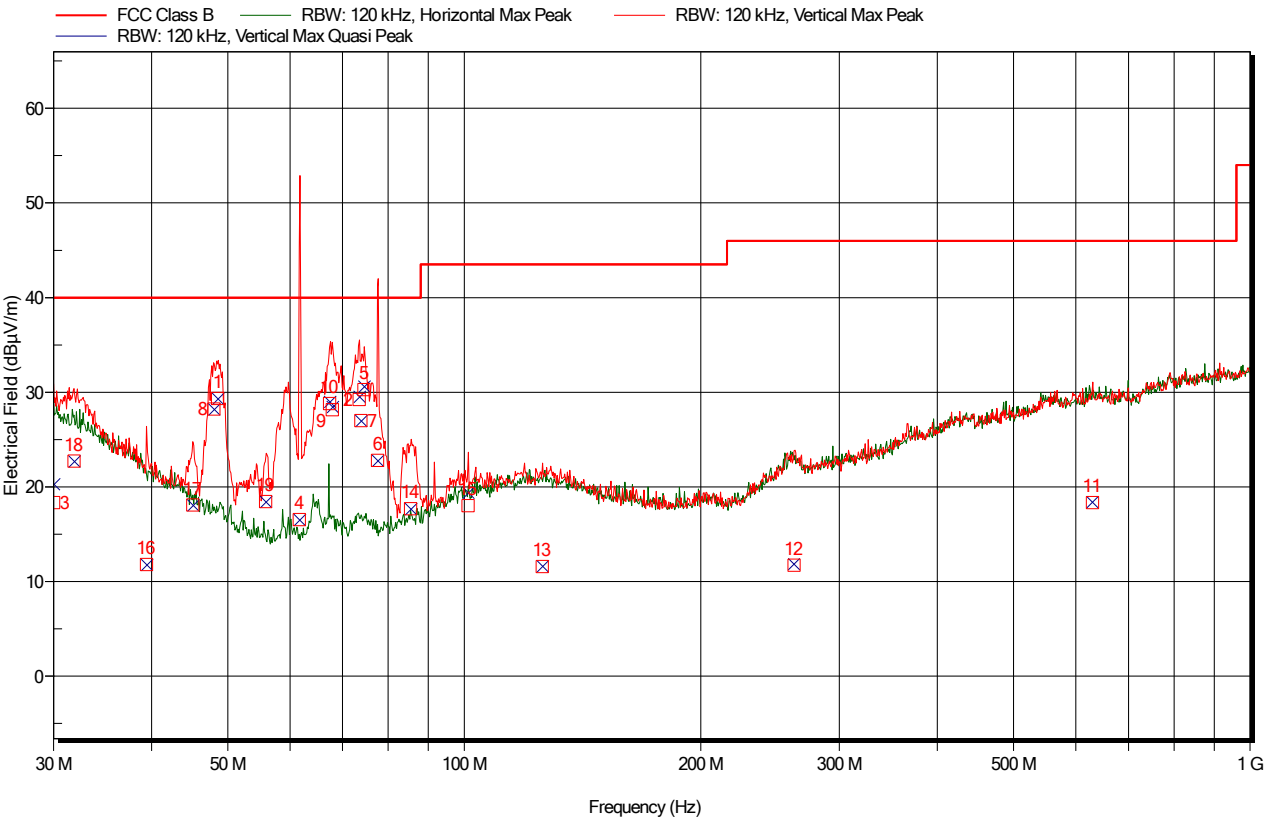


Figure 2 Electric field emissions Plot, 30MHz to 1GHz, 1MHz channel bandwidth, 2402MHz Operation

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height	Polarization
MHz	dBµV/m	dBµV/m	dB		degrees	m	
48.54	29.4	40	-10.6	Pass	360	1.0	Vertical
73.50	29.2	40	-10.8	Pass	290	1.0	Vertical
30.00	18.4	40	-21.6	Pass	265	3.3	Vertical
61.68	16.5	40	-23.5	Pass	265	1.1	Vertical
74.52	30.3	40	-9.7	Pass	255	1.3	Vertical
77.58	22.8	40	-17.2	Pass	135	1.1	Vertical
73.86	27.0	40	-13.0	Pass	45	1.3	Vertical
48.00	28.2	40	-11.8	Pass	15	1.0	Vertical
67.92	28.2	40	-11.8	Pass	45	1.1	Vertical
67.38	28.8	40	-11.2	Pass	355	1.1	Vertical
630.12	18.3	46	-27.7	Pass	220	3.9	Vertical
262.86	11.7	46	-34.3	Pass	85	1.6	Vertical
125.58	11.6	43.5	-31.9	Pass	100	1.1	Vertical
85.44	17.7	40	-22.3	Pass	290	1.3	Vertical
101.10	18.0	43.5	-25.5	Pass	110	1.0	Vertical
39.42	11.8	40	-28.2	Pass	315	1.0	Vertical
45.12	18.1	40	-21.9	Pass	115	1.0	Vertical
31.86	22.7	40	-17.3	Pass	100	1.0	Vertical
55.86	18.5	40	-21.5	Pass	130	1.1	Vertical

Table 1 Electric Field Emissions Peaks, 30MHz to 1GHz. 1MHz channel bandwidth, 2402MHz Operation

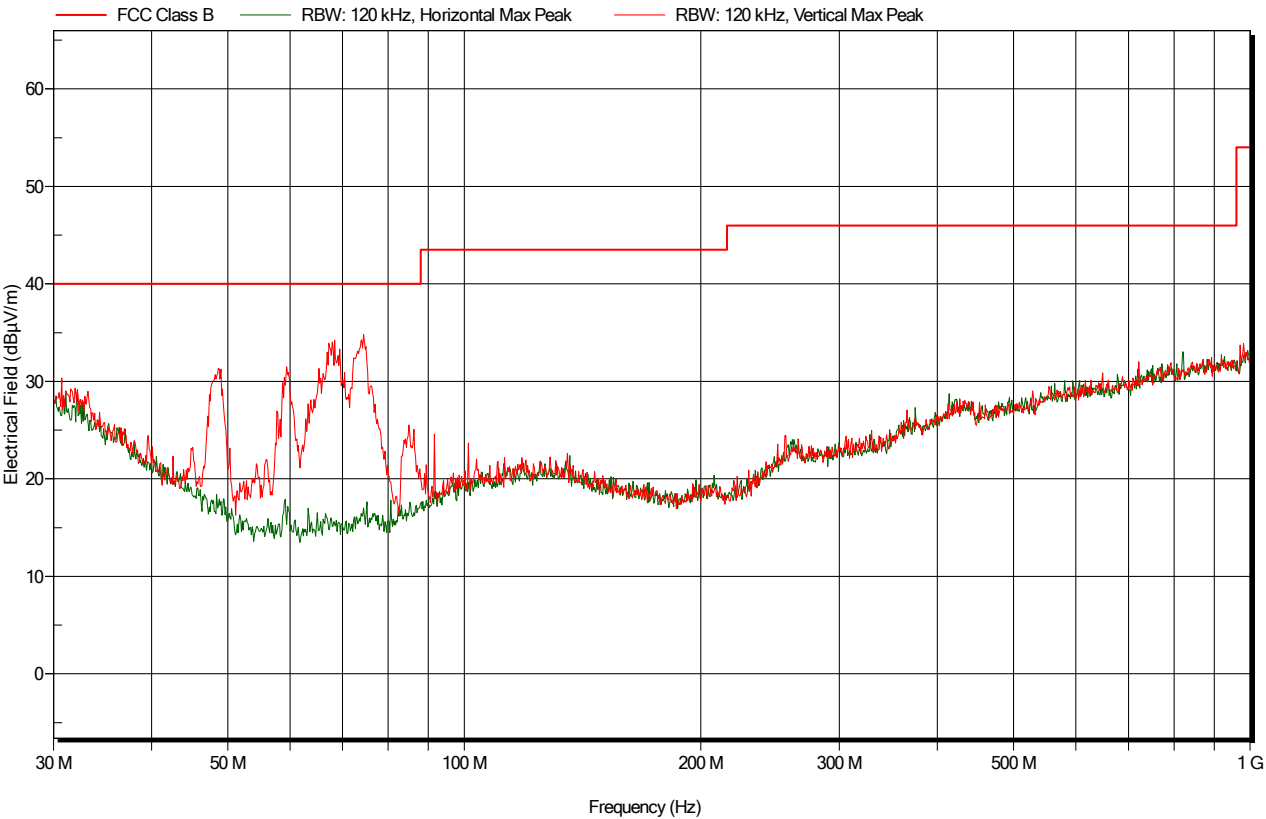


Figure 3 Electric field emissions Plot, 30MHz to 1GHz, 1MHz channel bandwidth, 2440MHz operation - Peak detector scan

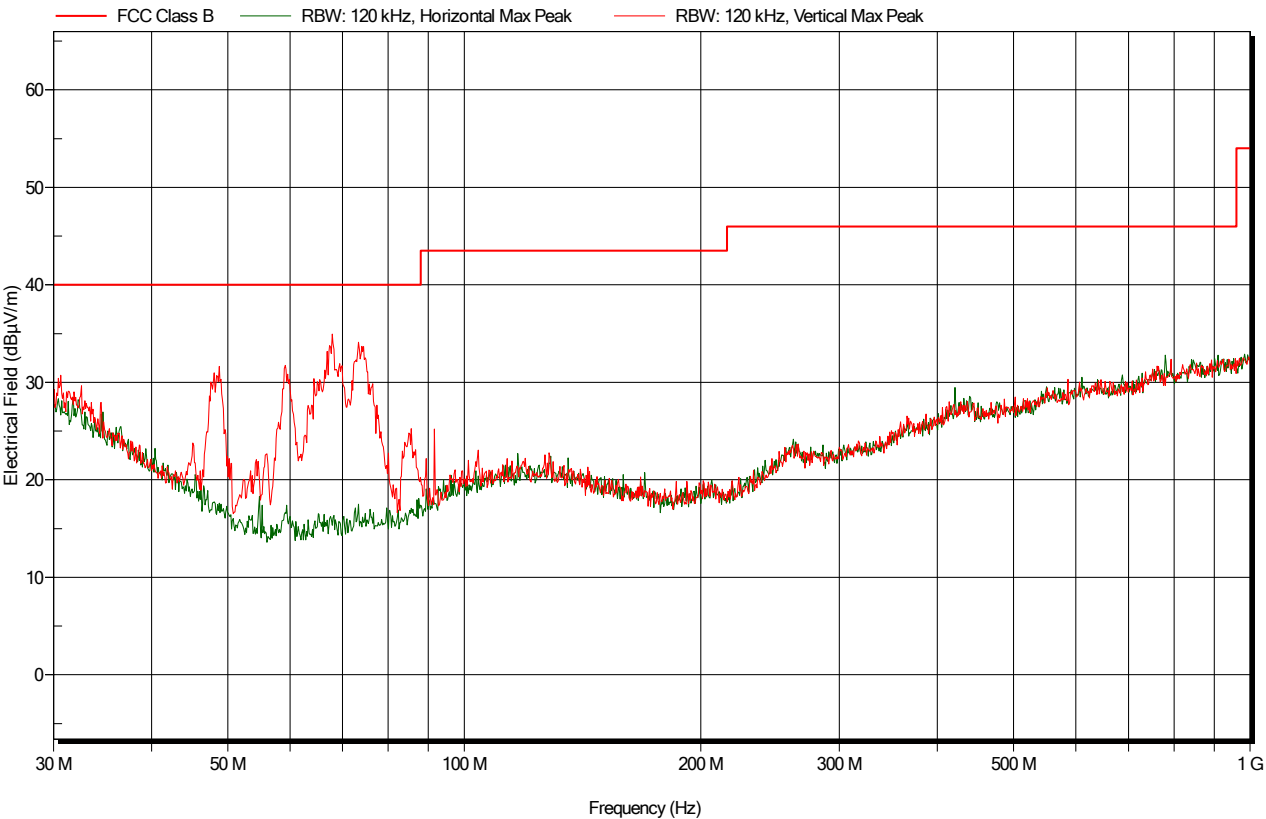


Figure 4 Electric field emissions Plot, 30MHz to 1GHz, 1MHz channel bandwidth, 2480MHz operation - Peak detector scan

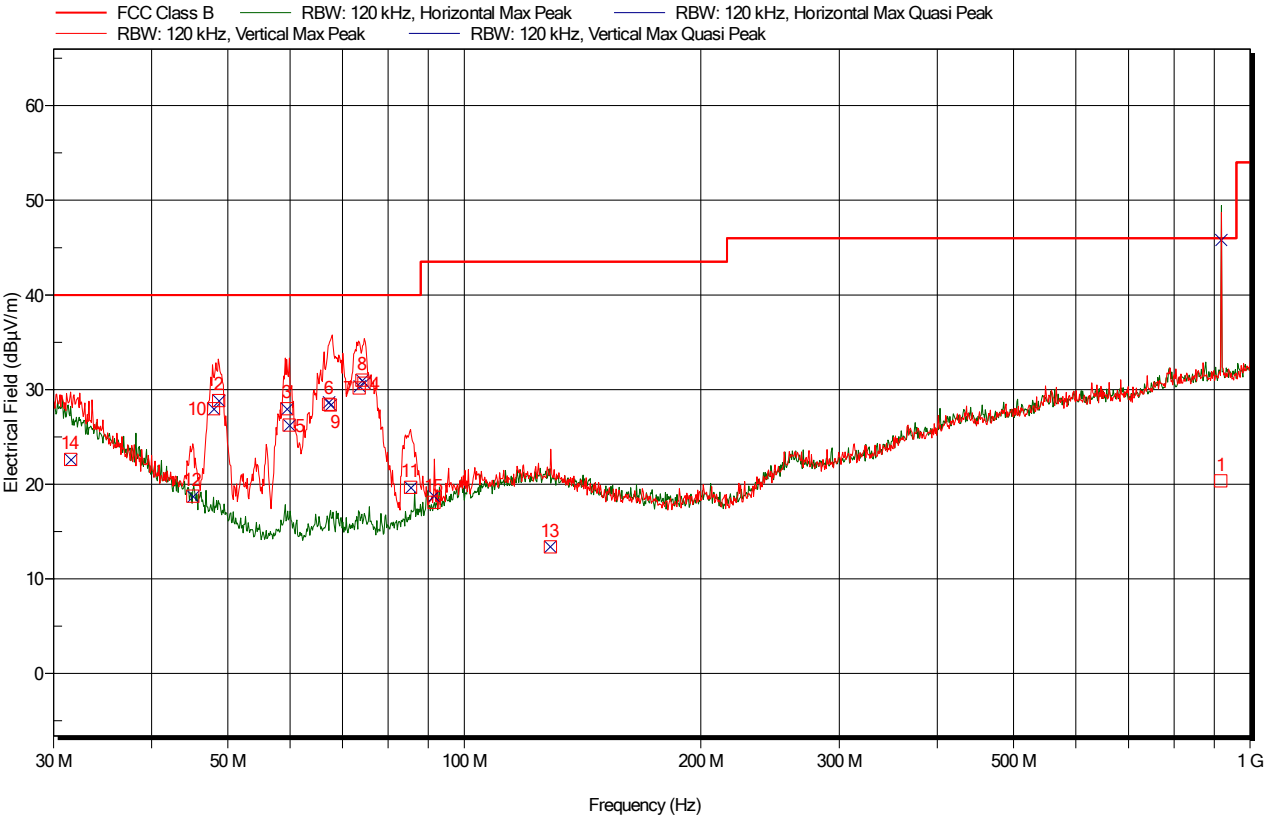


Figure 5 Electric field emissions Plot, 30MHz to 1GHz, 2MHz channel bandwidth, 2440MHz Operation

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height	Polarization
MHz	dBµV/m	dBµV/m	dB		degrees	m	
917.28	20.4	46	-25.6	Pass	210	2.5	Horizontal
48.66	28.8	40	-11.2	Pass	345	1.0	Vertical
59.40	28	40	-12	Pass	315	1.0	Vertical
74.52	30.7	40	-9.3	Pass	235	1.4	Vertical
59.82	26.2	40	-13.8	Pass	260	1.0	Vertical
67.20	28.5	40	-11.5	Pass	235	1.7	Vertical
73.50	30.2	40	-9.8	Pass	225	1.3	Vertical
74.10	31	40	-9	Pass	225	1.4	Vertical
67.50	28.4	40	-11.6	Pass	125	1.8	Vertical
47.94	28	40	-12	Pass	360	1.0	Vertical
85.38	19.7	40	-20.3	Pass	220	1.3	Vertical
45.12	18.7	40	-21.3	Pass	40	1.0	Vertical
128.64	13.4	43.5	-30.1	Pass	250	1.0	Vertical
31.56	22.6	40	-17.4	Pass	30	1.0	Vertical
91.50	18.1	43.5	-25.4	Pass	115	1.1	Vertical

Table 2 Electric Field Emissions Peaks, 30MHz to 1GHz. 2MHz channel bandwidth, 2440MHz Operation

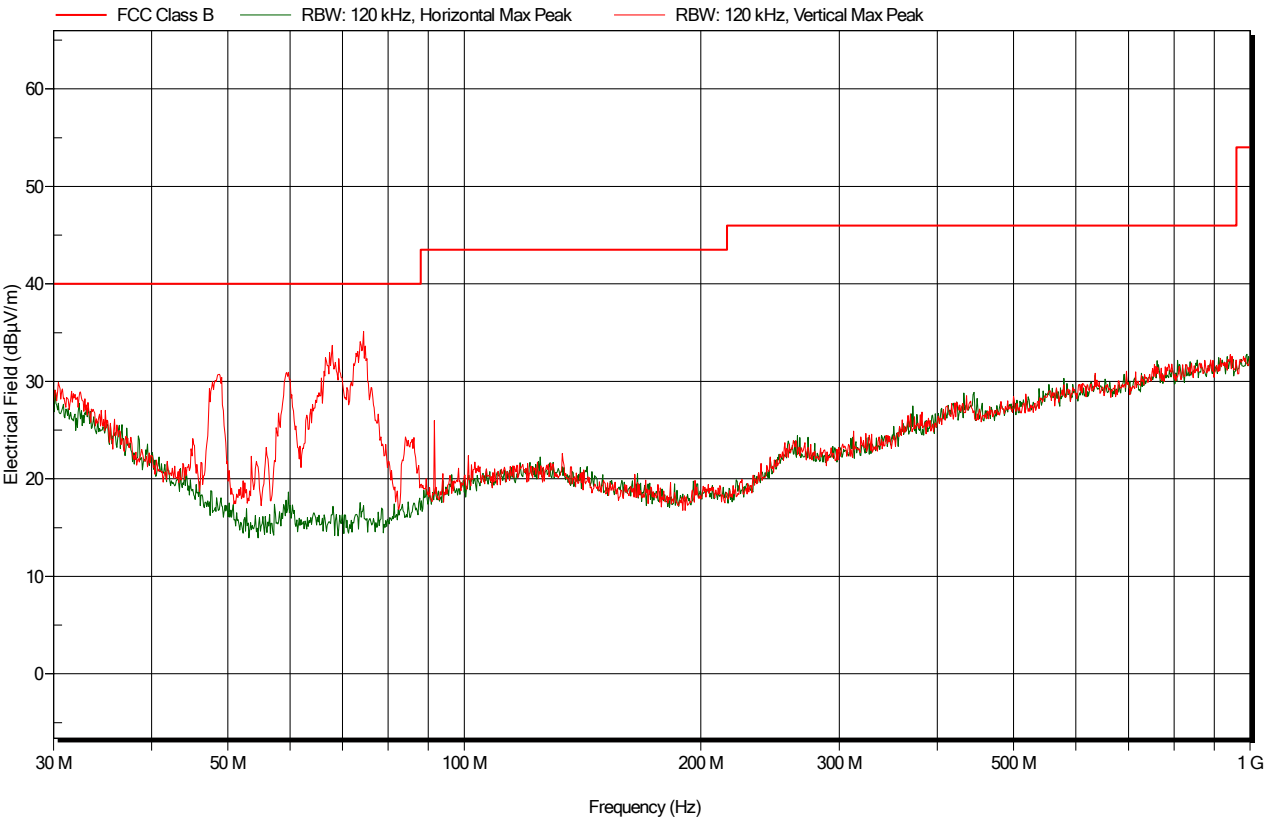


Figure 6 Electric field emissions Plot, 30MHz to 1GHz, 2MHz channel bandwidth, 2402MHz operation - Peak detector scan

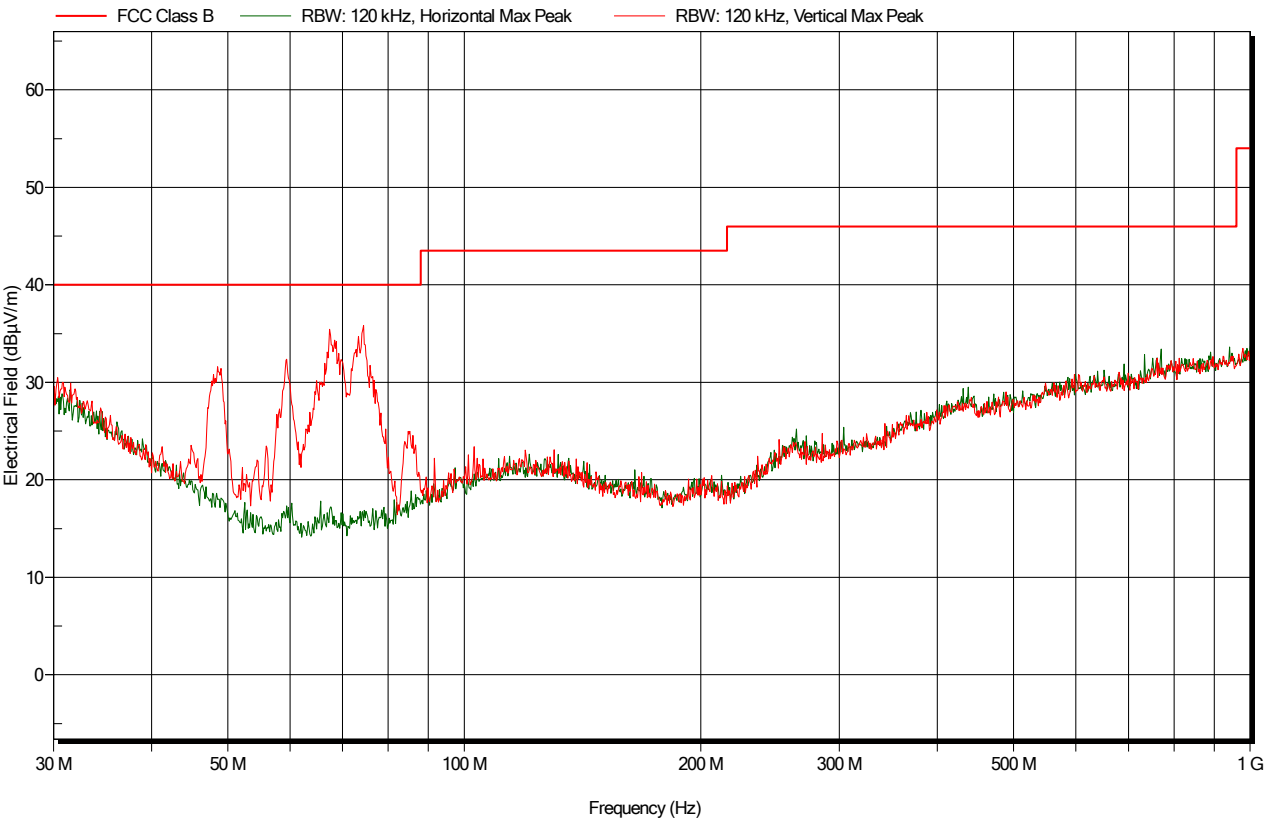


Figure 7 Electric field emissions Plot, 30MHz to 1GHz, 2MHz channel bandwidth, 2480MHz operation - Peak detector scan

5.4 Radiated Emissions (1GHz to 18GHz)

5.4.1 Limits

Frequency (GHz)	Limit (dBµV/m)	Limit (dBµV/m)
	Peak	Average
1-18	74.0	54.0

5.4.2 Receiver Settings

Receiver Parameters	Setting
Detector Function	Average and Peak
Start Frequency	1GHz
Stop Frequency	18GHz
Resolution Bandwidth	1MHz
Video Bandwidth	Auto

5.4.3 Emissions measurements

5.4.4 Date of Test

12th March 2024

5.4.5 Test Area

LAB 1 (SAC)

5.4.6 Tested by

J Beevers

5.4.7 Test Setup

The EUT was configured in the SAC on a 1.5m high table. Exploratory measurements on the EUT were carried out to identify suspect frequencies and worst case orientations, see Section 5.4.8.

The measurement was then performed with an antenna to EUT separation distance of 3m.

The antenna was kept in the “cone of radiation” from the EUT and pointed at the area both in azimuth and elevation using the tilt mechanism on the antenna mast.

The results were maximised in orientation 0-360 degrees and height 1-4m.

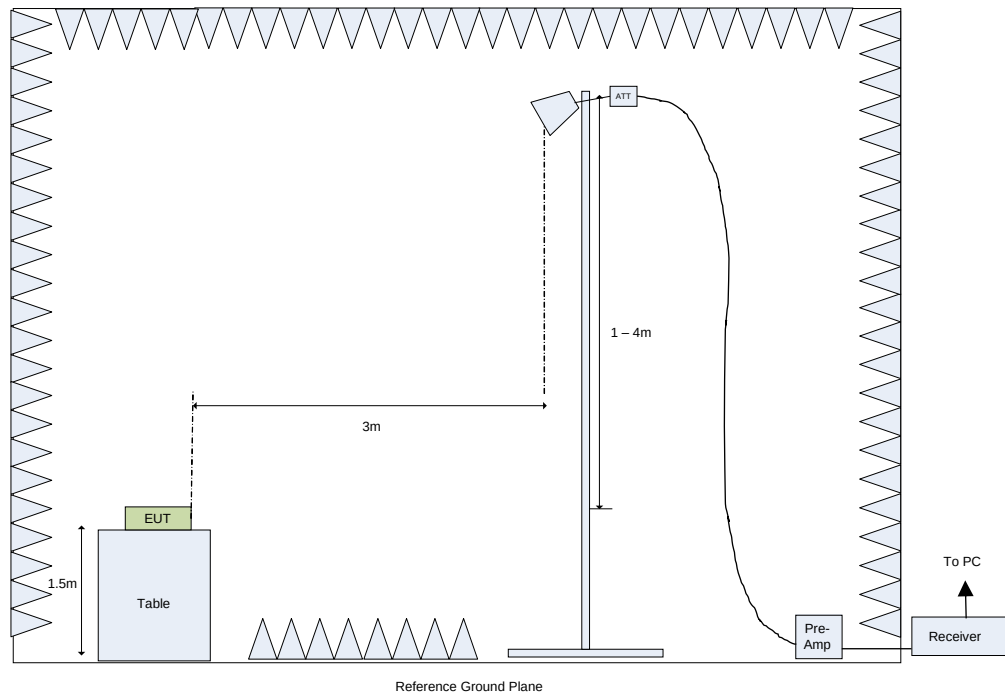


Figure 5.4.7.1: Test Setup for Final E-Field Measurements from 1GHz to 18GHz

Note 1: With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.4-2010.

Note 2: There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

Note 3: On all swept and final measurements made between 1GHz and 18GHz a 2.4GHz Microtronics BRM50702 notch filter was placed in the measurement chain between the antenna and pre-amplifier in order to prevent the artificial generation of harmonics within the pre-amplifier.

5.4.8 Exploratory Radiated Emission Maximization

During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance between the surface of the EUT and the scanning antenna was circa 30cm.

Frequency (GHz)	Mode of operation	EUT face *	Emissions Angle (w.r.t. turntable)	Height	Polarization
1.0196	Transmitting on channel 2402MHz, 1MHz BW	front face	0	1.5	V
2.0175	Transmitting on channel 2402MHz, 1MHz BW	front face	0	1.5	V
4.8038	Transmitting on channel 2402MHz, 1MHz BW	front face	0	1.5	V
1.0196	Transmitting on channel 2440MHz, 1MHz BW	front face	0	1.5	V
1.0791	Transmitting on channel 2440MHz, 1MHz BW	front face	0	1.5	V
2.0566	Transmitting on channel 2440MHz, 1MHz BW	front face	0	1.5	V
4.8803	Transmitting on channel 2440MHz, 1MHz BW	front face	0	1.5	V
1.0196	Transmitting on channel 2480MHz, 1MHz BW	front face	0	1.5	V
1.2814	Transmitting on channel 2480MHz, 1MHz BW	front face	0	1.5	V
2.2249	Transmitting on channel 2480MHz, 1MHz BW	front face	0	1.5	V
2.8641	Transmitting on channel 2480MHz, 1MHz BW	front face	0	1.5	V
4.9602	Transmitting on channel 2480MHz, 1MHz BW	front face	0	1.5	V
1.0196	Transmitting on channel 2402MHz, 2MHz BW	front face	0	1.5	V
1.4004	Transmitting on channel 2402MHz, 2MHz BW	front face	0	1.5	V
2.0192	Transmitting on channel 2402MHz, 2MHz BW	front face	0	1.5	V
2.2113	Transmitting on channel 2402MHz, 2MHz BW	front face	0	1.5	V

4.8055	Transmitting on channel 2402MHz, 2MHz BW	front face	0	1.5	V
1.0791	Transmitting on channel 2440MHz, 2MHz BW	front face	0	1.5	V
1.3953	Transmitting on channel 2440MHz, 2MHz BW	front face	0	1.5	V
2.1841	Transmitting on channel 2440MHz, 2MHz BW	front face	0	1.5	V
4.8820	Transmitting on channel 2440MHz, 2MHz BW	front face	0	1.5	V
1.0196	Transmitting on channel 2480MHz, 2MHz BW	front face	0	1.5	V
1.1403	Transmitting on channel 2480MHz, 2MHz BW	front face	0	1.5	V
4.9602	Transmitting on channel 2480MHz, 2MHz BW	front face	0	1.5	V

Table 3 Frequencies identified during Exploratory Radiated Emission maximization

Note 1: The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction through 360°.

Note 2: With no emissions observed above 5GHz during the exploratory investigation, final measurements were performed up to 10GHz only.

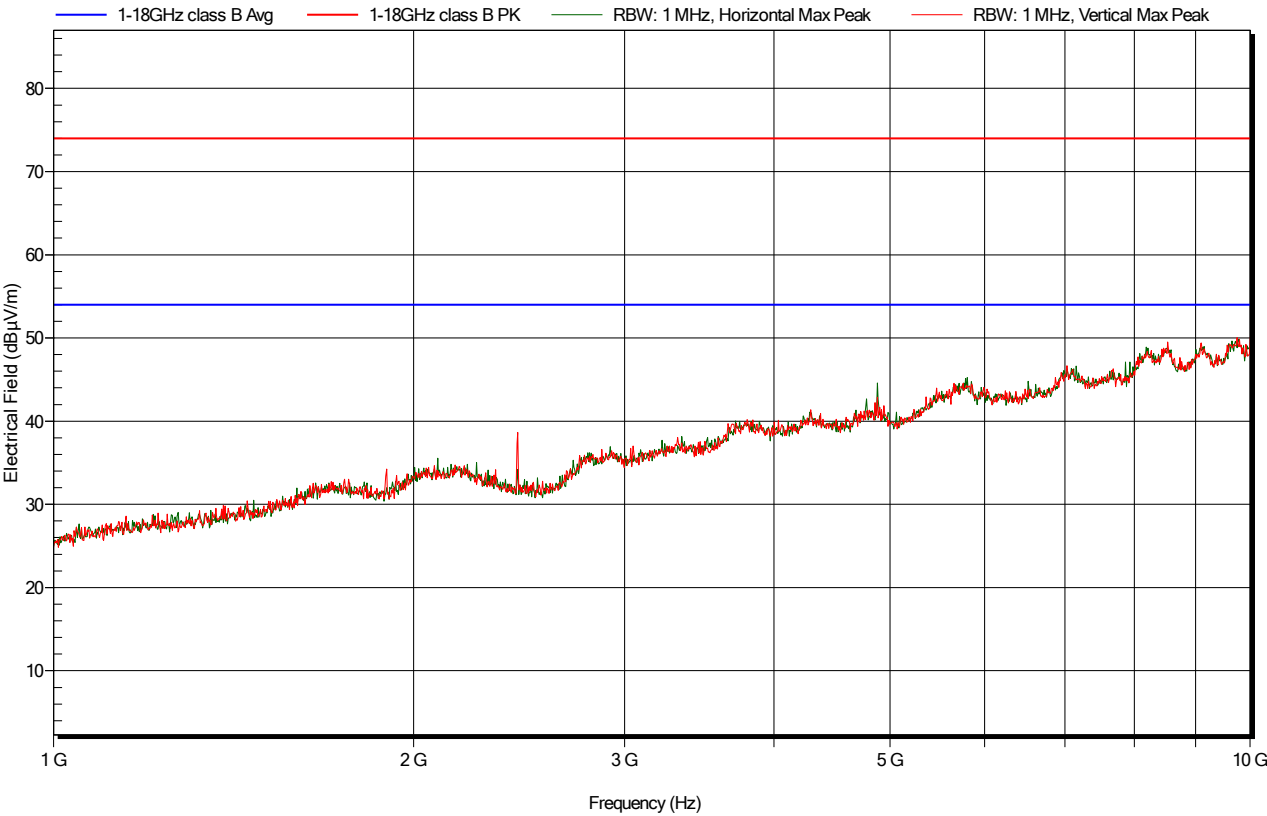


Figure 9 Electric field emissions Plot, 1GHz to 10GHz, 1MHz channel bandwidth, 2440MHz operation - Peak detector scan

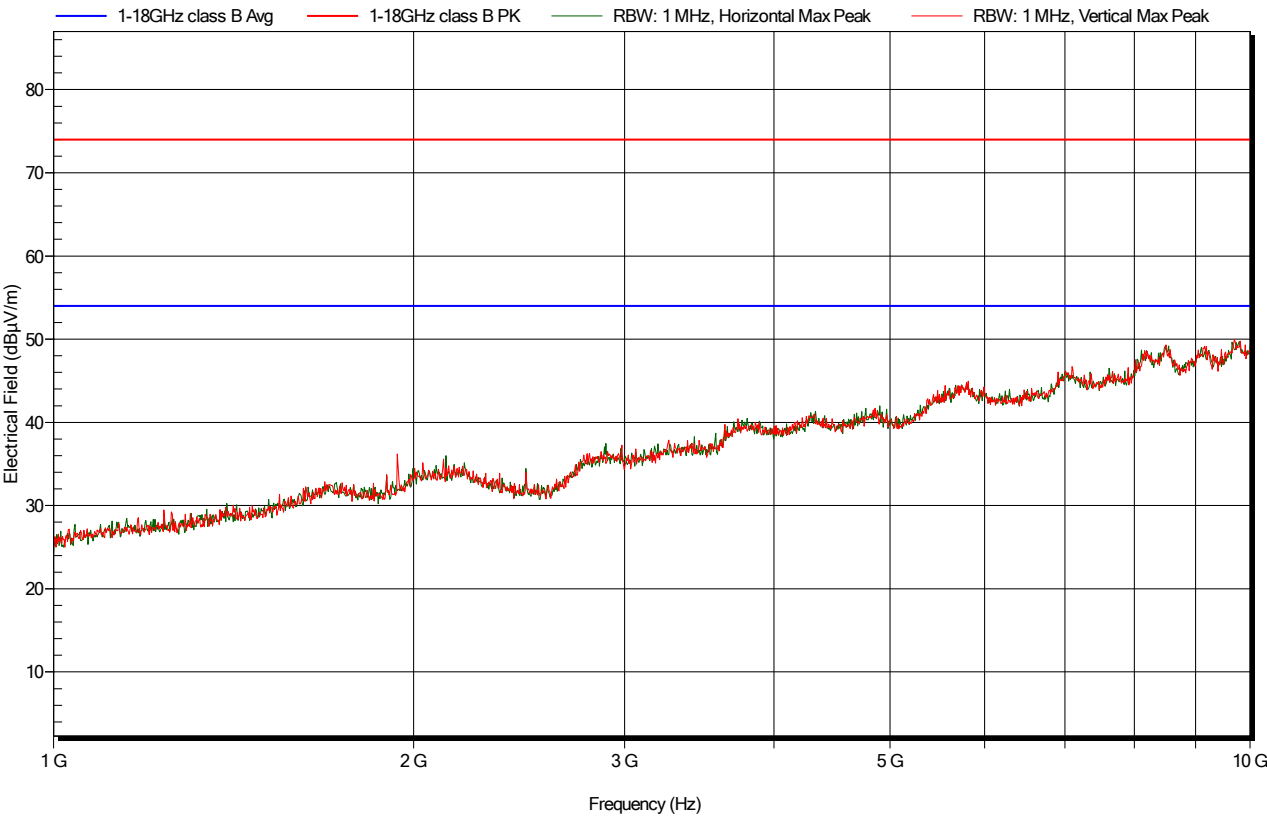


Figure 10 Electric field emissions Plot, 1GHz to 10GHz, 1MHz channel bandwidth, 2480MHz operation - Peak detector scan

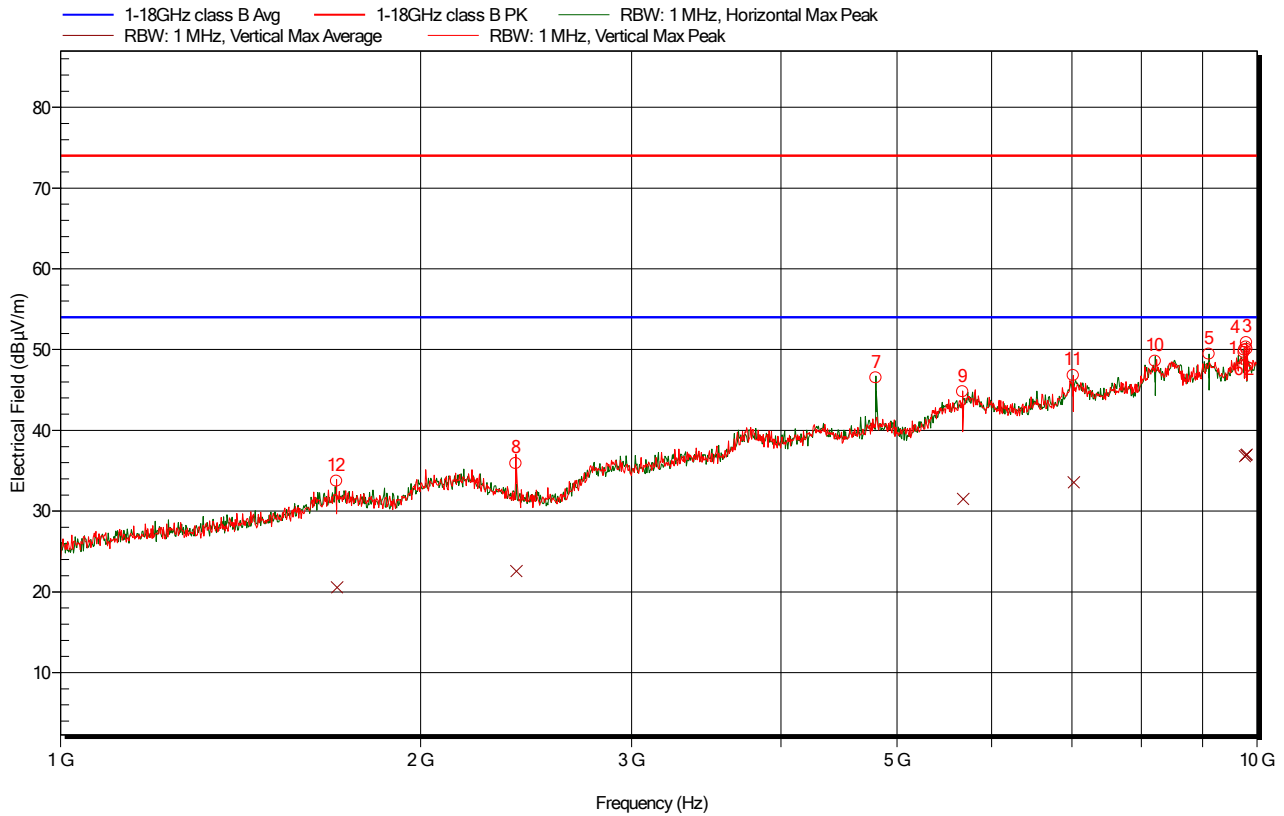


Figure 11 Electric field emissions Plot, 1GHz to 10GHz. 2MHz channel bandwidth, 2402MHz operation

Frequency	Average	Average Limit	Average Difference	Average Status	Angle	Height	Polarization
GHz	dBμV/m	dBμV/m	dB		degrees	m	
9.791	36.91	54	-17.09	Pass	55	3.6	Vertical
9.754	36.83	54	-17.17	Pass	150	2.8	Horizontal
9.802	37.02	54	-16.98	Pass	155	2.5	Vertical
9.799	37.24	54	-16.76	Pass	200	1.6	Horizontal
9.113	35.80	54	-18.20	Pass	280	1.0	Horizontal
9.757	36.86	54	-17.14	Pass	305	2.2	Vertical
4.803	31.98	54	-22.02	Pass	180	1.2	Horizontal
2.402	22.64	54	-31.36	Pass	235	1.7	Vertical
5.675	31.58	54	-22.42	Pass	195	2.9	Vertical
8.218	35.50	54	-18.50	Pass	160	3.6	Horizontal
7.018	33.62	54	-20.38	Pass	310	3.8	Vertical
1.701	20.60	54	-33.40	Pass	210	4.0	Vertical
8.507	36.23	54	-17.77	Pass	20	2.2	Vertical

Table 5 Electric Field Emissions Peaks, 1GHz to 10GHz – 2MHz channel bandwidth, 2402MHz operation

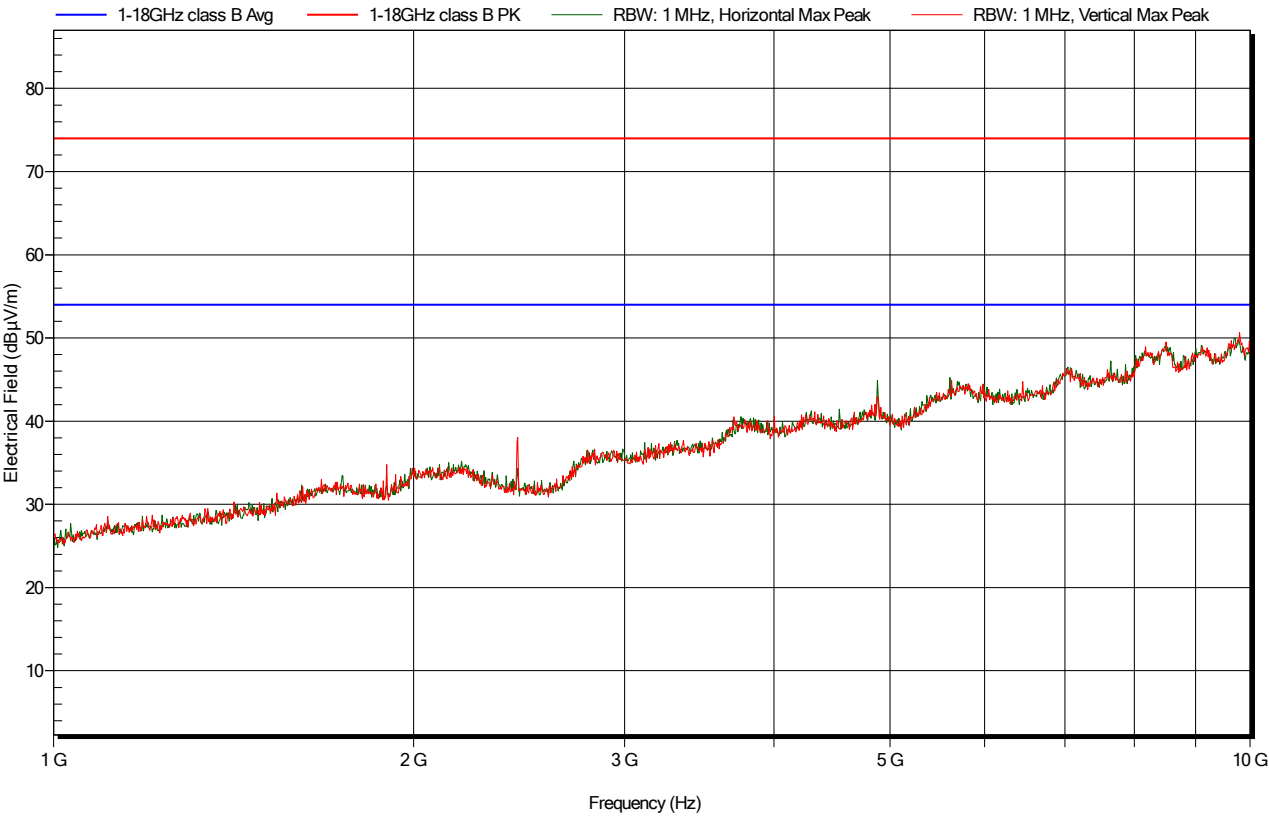


Figure 12 Electric field emissions Plot, 1GHz to 10GHz, 2MHz channel bandwidth, 2440MHz operation - Peak detector scan

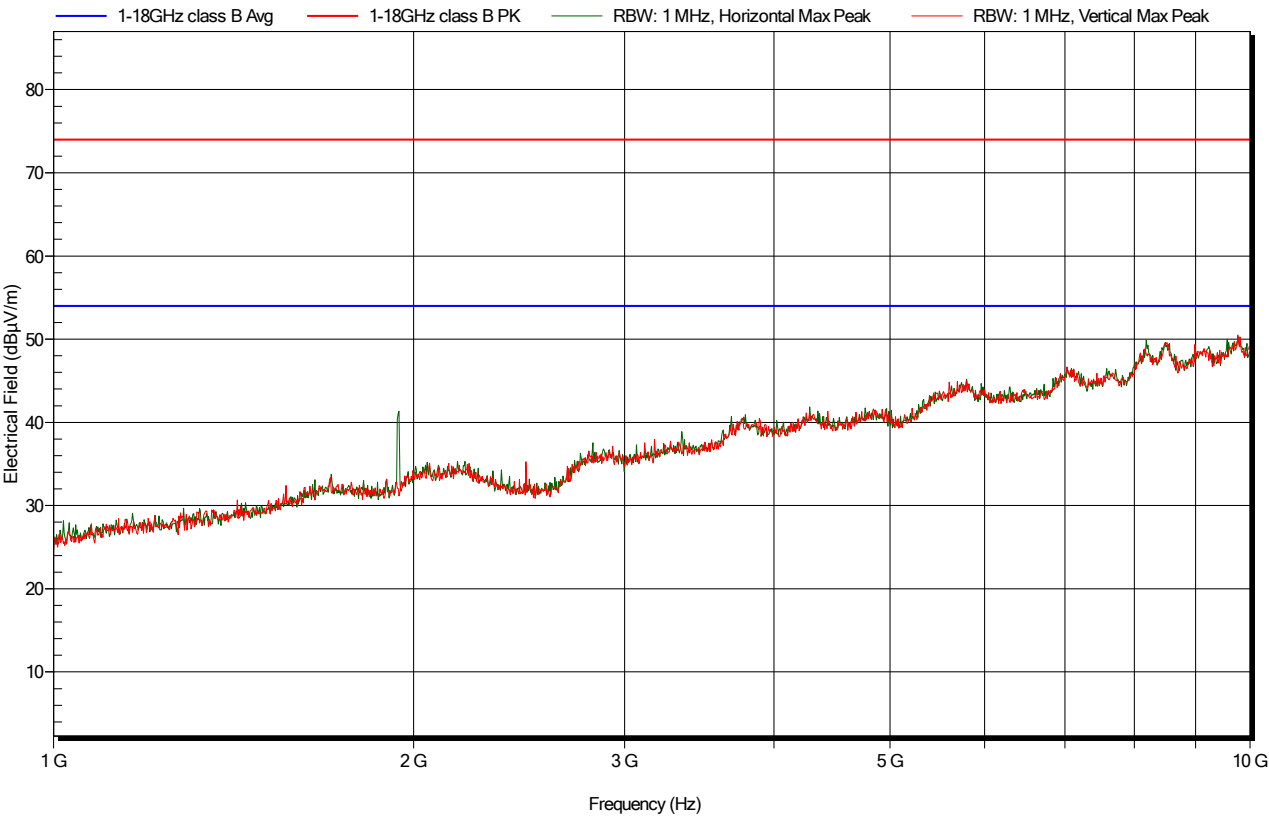


Figure 13 Electric field emissions Plot, 1GHz to 10GHz, 2MHz channel bandwidth, 2480MHz operation - Peak detector scan

5.4.10 Example field strength calculation

The total average corrections are shown in the above table. This correction figure consists of Preamplifier gain (PG), Antenna factor (AF); and Cable loss (CL), and where necessary distance extrapolation factor (dB).

Field strength (FS) is calculated as follows:

$$\text{FS (dB}\mu\text{V/m)} = \text{Indicated Signal Level (dB}\mu\text{V)} - \text{PG (dB)} + \text{AF (dB)} + \text{CL (dB)}$$

5.4.11 Sample Data

From Figure 11 and table 5. The Average level at 8.507GHz is calculated as follows:

$$\text{FS (dB}\mu\text{V/m)} = 42.01(\text{dB}\mu\text{V/m}) - 54.01(\text{dB}) + 42.13(\text{dB/m}) + 6.10(\text{dB}) = 36.23\text{dB}\mu\text{V/m}$$

5.5 Radiated Emissions (18GHz to 25GHz)**5.5.1 Limits**

Frequency (GHz)	Limit (dBµV/m)	Limit (dBµV/m)
	Peak	Average
18-25	74.0	54.0

5.5.2 Receiver Settings

Receiver Parameters	Setting
Detector Function	Average and Peak
Start Frequency	18GHz
Stop Frequency	25GHz
Resolution Bandwidth	1MHz
Video Bandwidth	Auto

5.5.3 Emissions measurements**5.5.4 Date of Test**12th March 2024**5.5.5 Test Area**

LAB 1 (SAC)

5.5.6 Tested by

J Beevers

5.5.7 Test Setup

This is the same as for the 1-18GHz range for final measurements, except with a measurement distance of 1m.

5.5.8 Exploratory Radiated Emission Maximization

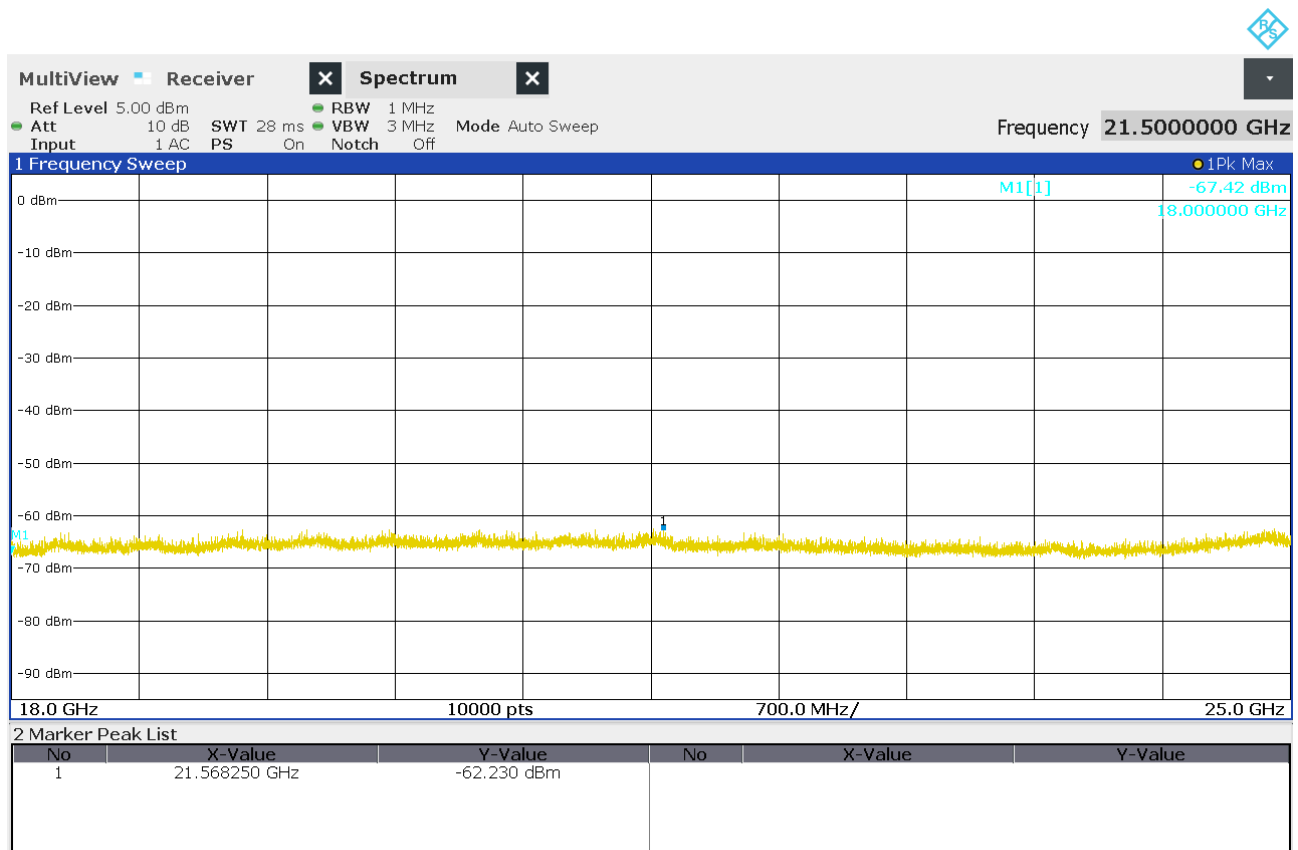
During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance between the surface of the EUT and the scanning antenna was circa 30cm.

Frequency (GHz)	Mode of operation	EUT face *	Emissions Angle (w.r.t. turntable)	Height	Polarization
-	Tx on channels 2402MHz, 2440MHz and 2480MHz.	-	-	-	-

Table 6 Frequencies identified during Exploratory Radiated Emission maximization

Note 1: The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction through 360°.

Note 2: No emissions were identified for further investigation above 18GHz.

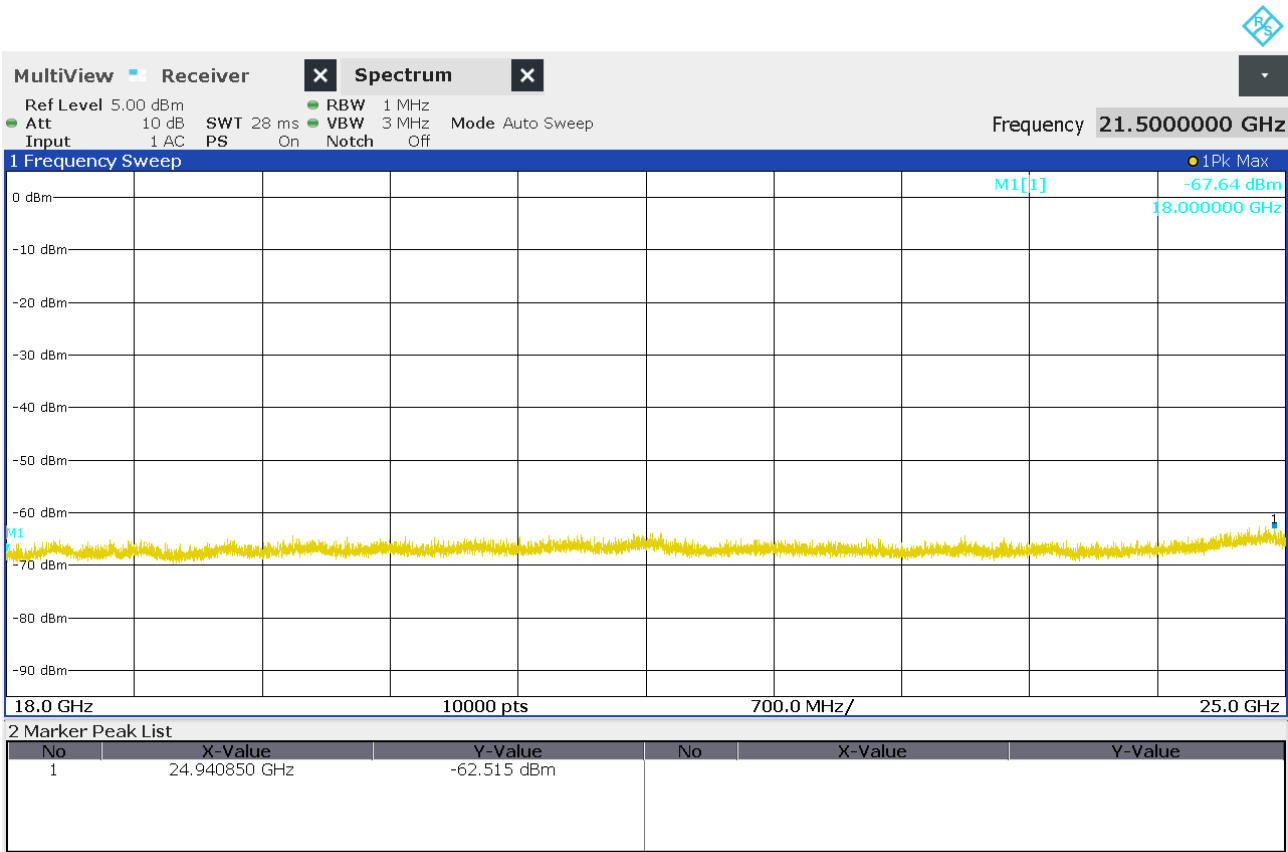


06:07:24 PM 03/11/2024

Figure 14 – Manual investigation – 1MHz channel bandwidth, channel 2402MHz

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06:05:24 PM 03/11/2024

Figure 15 – Manual investigation – 1MHz channel bandwidth, channel 2440MHz



06:09:22 PM 03/11/2024

Figure 16 – Manual investigation – 1MHz channel bandwidth, channel 2480MHz

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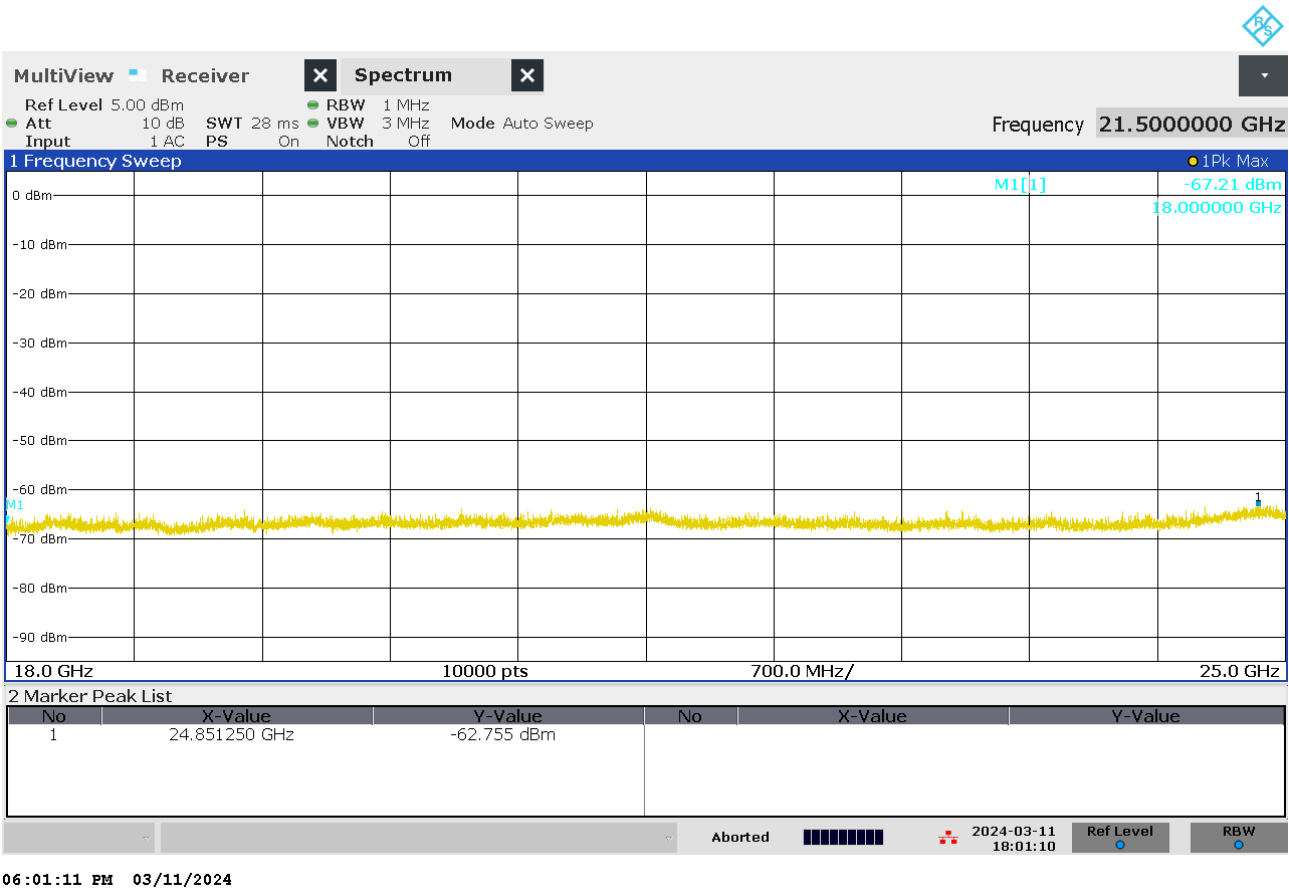


Figure 17 – Manual investigation – 2MHz channel bandwidth, channel 2402MHz

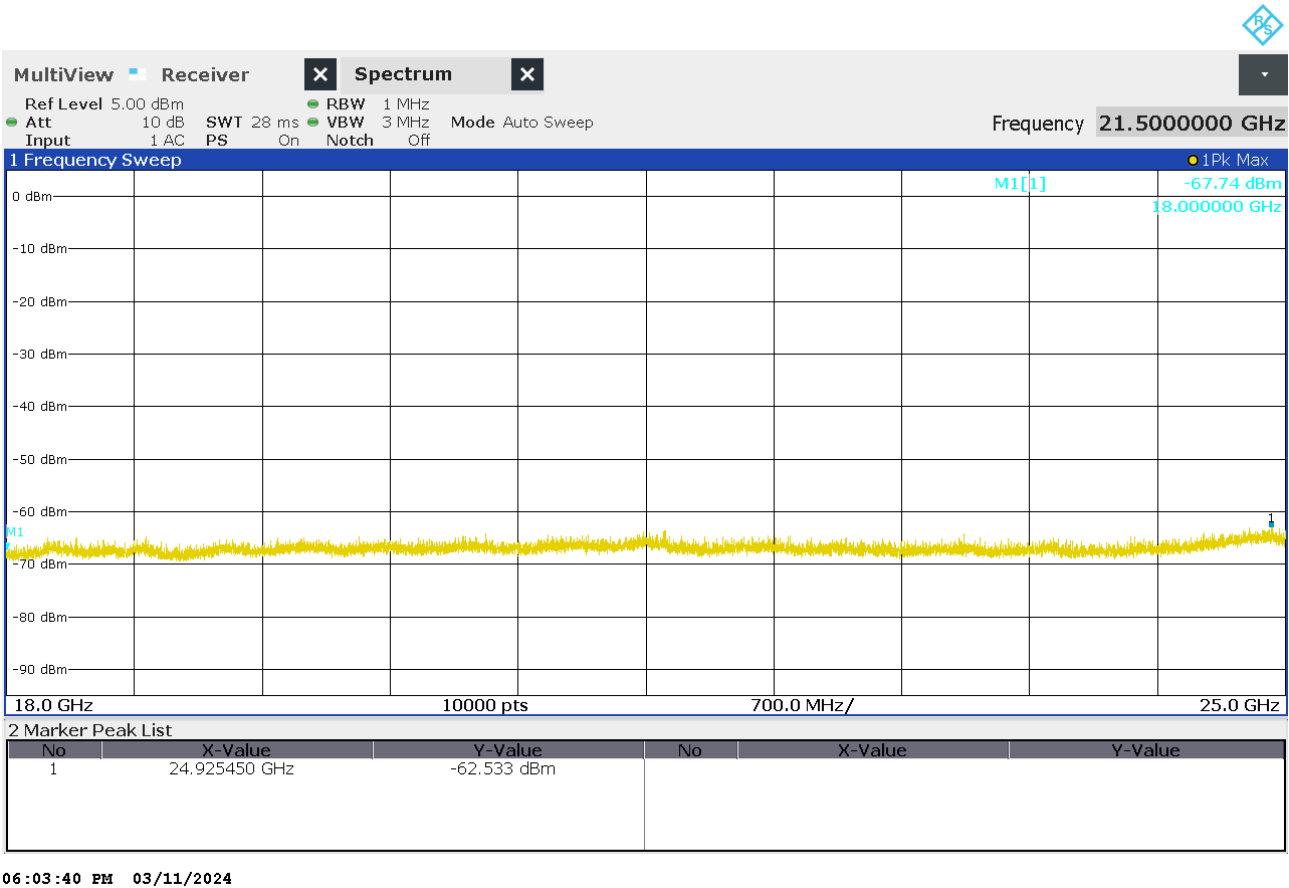


Figure 18 – Manual investigation – 2MHz channel bandwidth, channel 2440MHz

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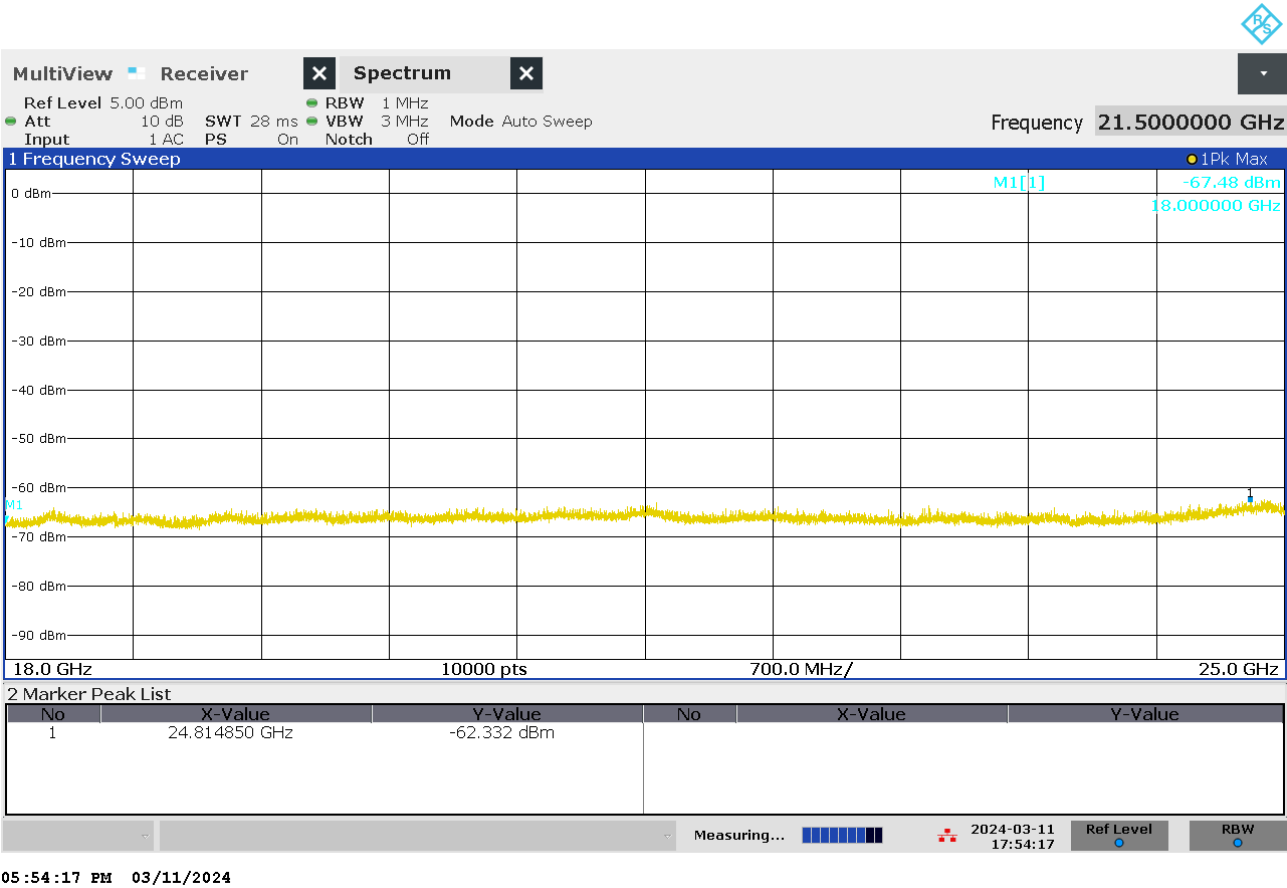


Figure 19 – Manual investigation – 2MHz channel bandwidth, channel 2480MHz

5.6 Conducted Spurious Emissions 30MHz to 25GHz**5.6.1 Limits**

Frequency (MHz)	Limit, 47CFR 15.247(d)
	Peak
30 – 25000	-20dBc

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.11.2

Receiver Parameters	Setting
Detector Function	Peak
Start Frequency	30MHz
Stop Frequency	25000MHz
Resolution Bandwidth	100kHz
Video Bandwidth	300kHz
Sweep rate	Auto couple
Trace mode	Max hold

5.6.2 Emissions measurements**5.6.3 Date of Test**

21st March 2024

5.6.4 Test Area

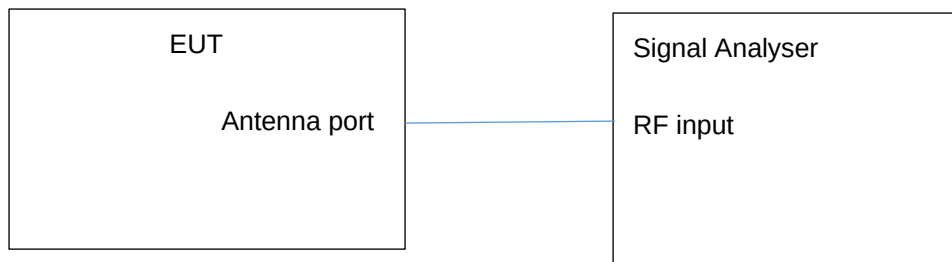
LAB 5

5.6.5 Tested by

J Beevers

5.6.6 Test Setup

The antenna port was connected directly to the signal analyser.



5.6.7 Test Results

The results of the conducted spurious emissions are stated below and by the signal analyser images.

All disturbances detected were > 20dB below the carrier.

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5.6.8 Antenna port conducted emissions, 30MHz to 25GHz

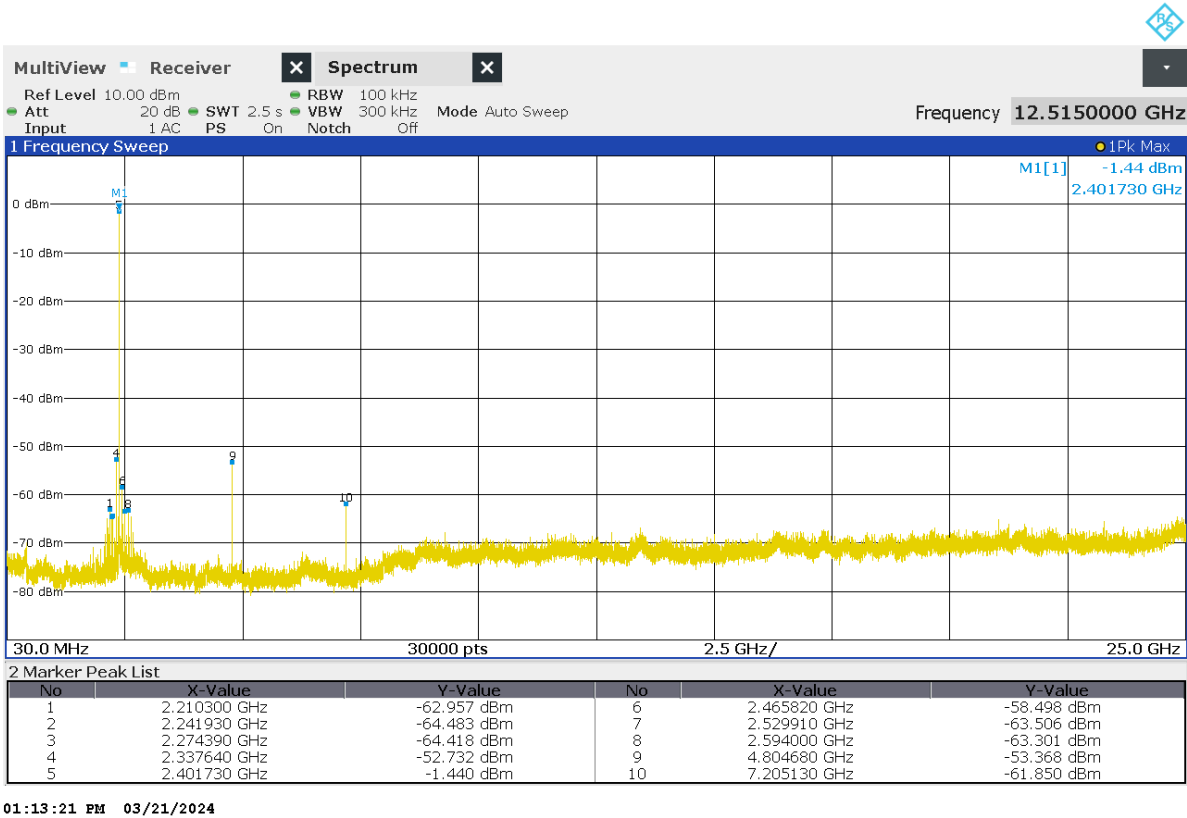


Figure 20 Conducted emissions 30MHz to 25GHz. 1MHz channel bandwidth, channel 2402MHz.

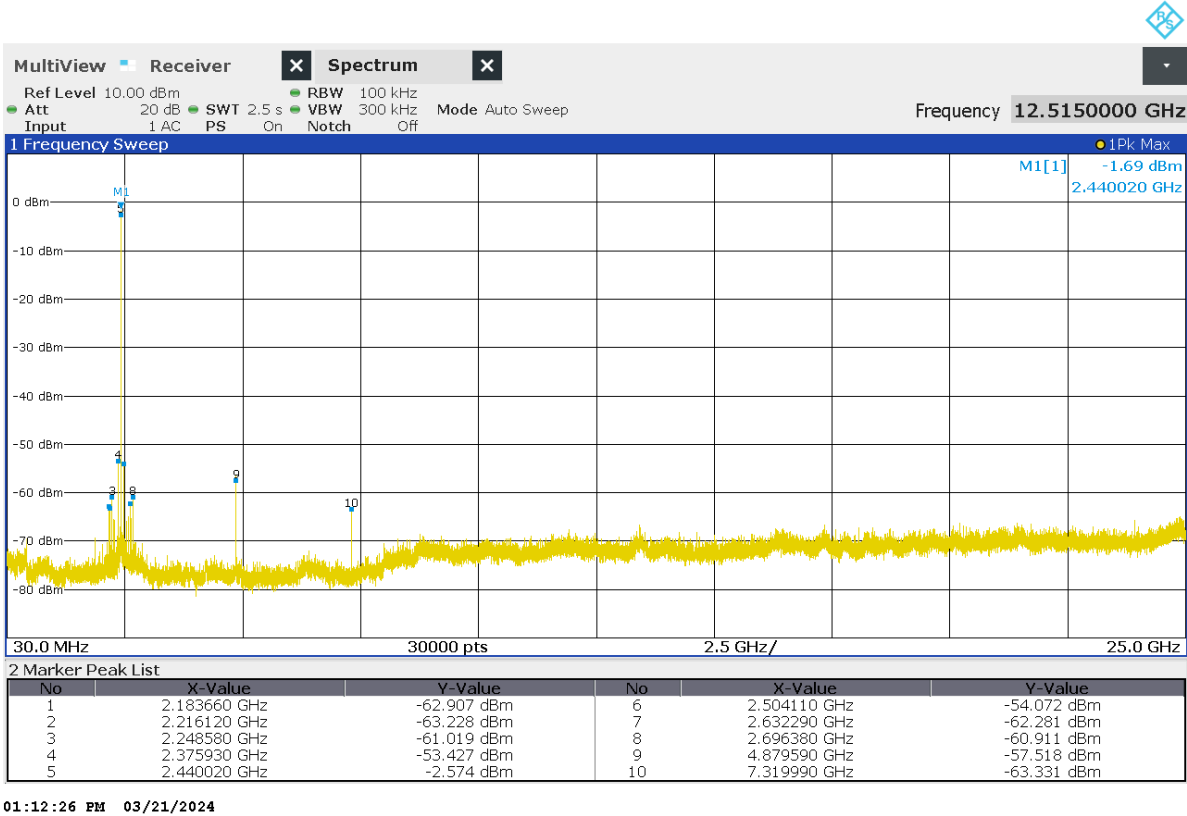


Figure 21 Conducted emissions 30MHz to 25GHz. 1MHz channel bandwidth, channel 2440MHz.

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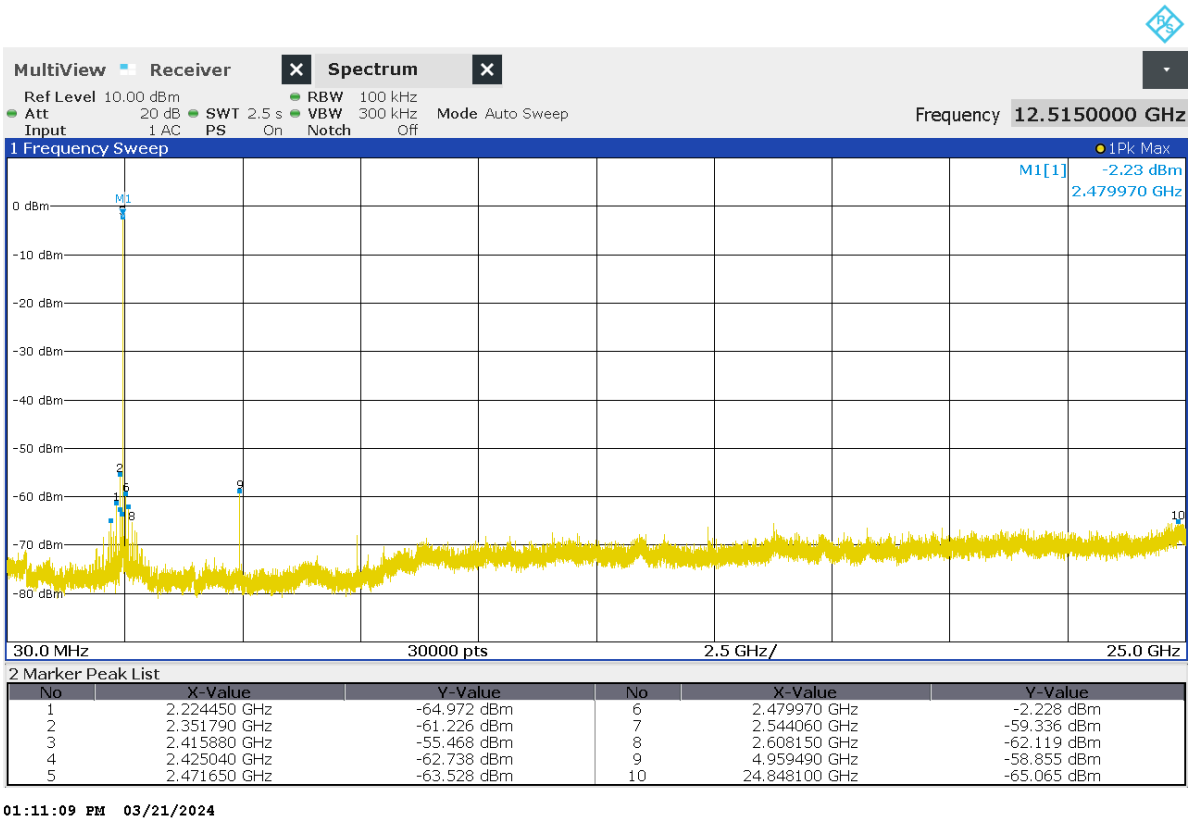


Figure 22 Conducted emissions 30MHz to 25GHz. 1MHz channel bandwidth, channel 2480MHz.

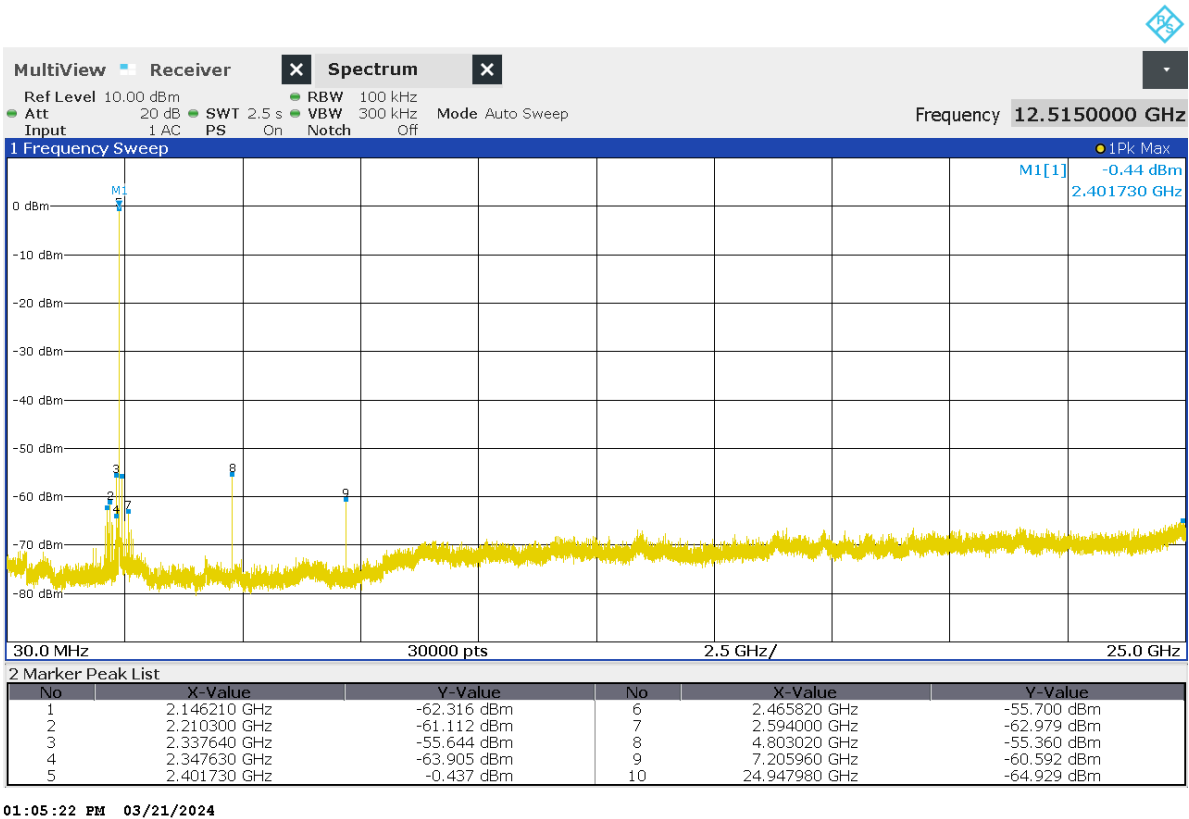


Figure 23 Conducted emissions 30MHz to 25GHz. 2MHz channel bandwidth, channel 2402MHz.

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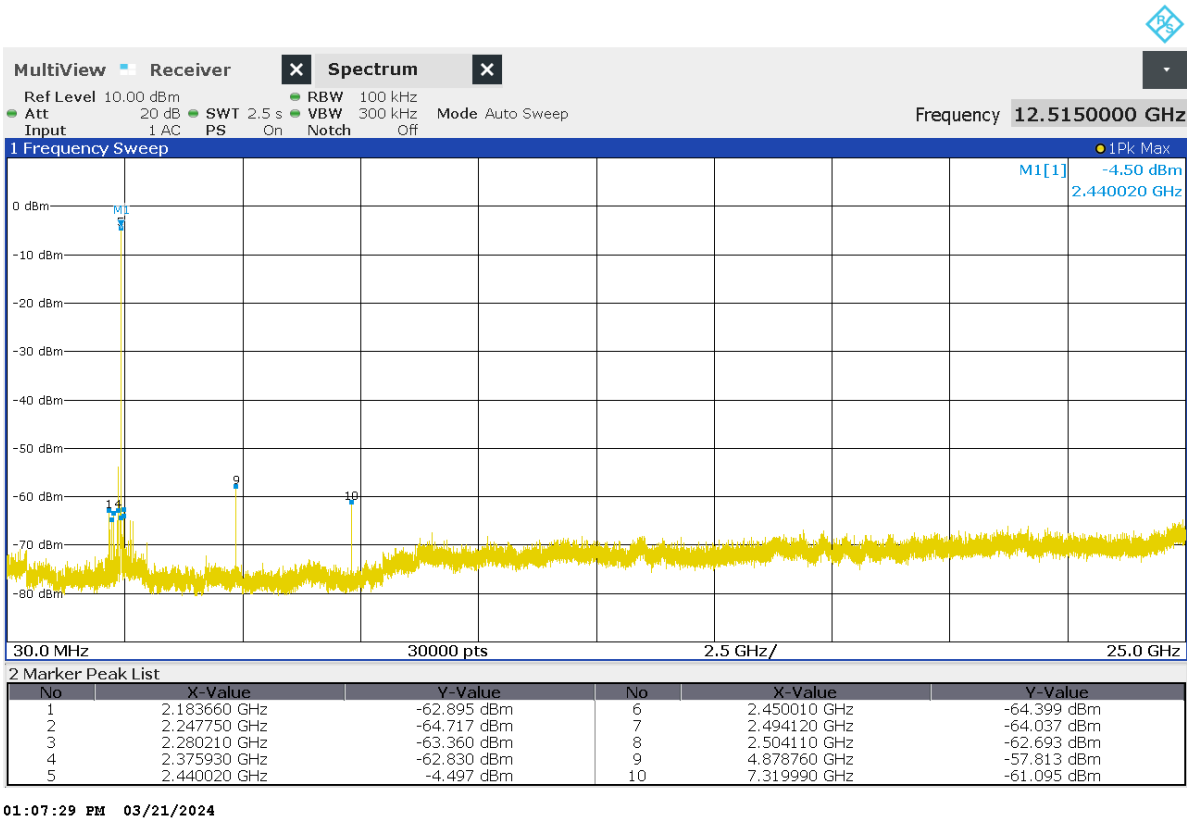


Figure 24 Conducted emissions 30MHz to 25GHz. 2MHz channel bandwidth, channel 2440MHz.

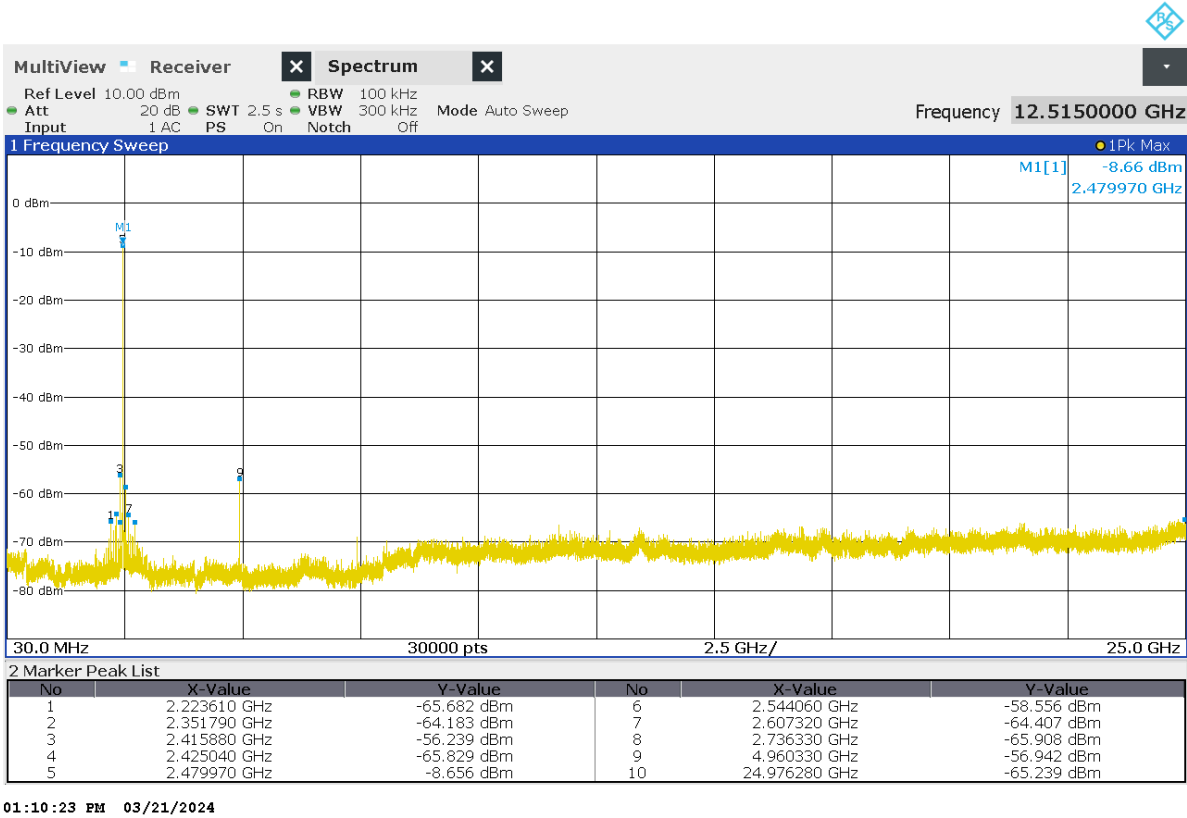


Figure 25 Conducted emissions 30MHz to 25GHz. 2MHz channel bandwidth, channel 2480MHz.

Section 6 6dB Bandwidth and 99% Occupied Bandwidth

6.1 Test Specification

FCC Rule Part	46CFR 15.247 (b)(2)
Standard	ANSI C63.10:2013
Measurement Uncertainty Frequency tests	$\pm 9 \times 10^{-8}$

6.2 Procedure and Test Software Version

Conducted Tests

ANSI C63.10-2013 Clause reference:	11.9.1.1 (RBW>DTS bandwidth)
Test software	N/A

Frequency (MHz)	Limit, 47CFR 15.247(a)(2) 6dB bandwidth
	Peak
2400MHz to 2483.5MHz	At least 500kHz

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.8.1

Receiver Parameters	Settings	
	6dB Bandwidth	99% OBW
Detector Function	Peak	Peak
Span	4/6MHz	4/8MHz
Resolution Bandwidth	100kHz	30kHz
Video Bandwidth	300kHz	100kHz
Sweep rate	Auto couple	Auto couple
Trace mode	Max hold	Max hold

6.2.1 Emissions measurements

6.2.2 Date of Test

21st March 2024

6.2.3 Test Area

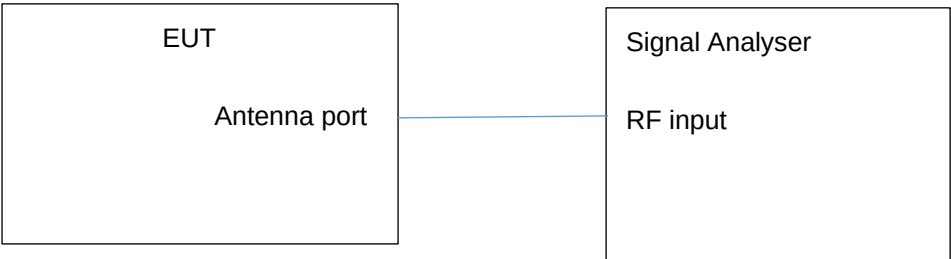
LAB 5

6.2.4 Tested by

J Beevers

6.2.5 Test Setup

The antenna port was connected directly to the signal analyser.



6.2.6 Test Results

The results of the 6dB bandwidth measurements are stated in the table below and by the signal analyser images.

Channel bandwidth (MHz)	Channel (MHz)	99% Occupied Bandwidth (MHz)	Measured 6dB bandwidth (kHz)	Minimum requirement (kHz)	Figure	Result
1	2402.0	1.0522	777.6	500.0	26 & 32	Pass
1	2440.0	1.0595	735.2	500.0	27 & 33	Pass
1	2480.0	1.0497	656.6	500.0	28 & 34	Pass
2	2402.0	2.0943	1218.0	500.0	29 & 35	Pass
2	2440.0	2.0948	1098.3	500.0	30 & 36	Pass
2	2480.0	2.0862	1203.0	500.0	31 & 37	Pass

Table 7 Bandwidth Measurements

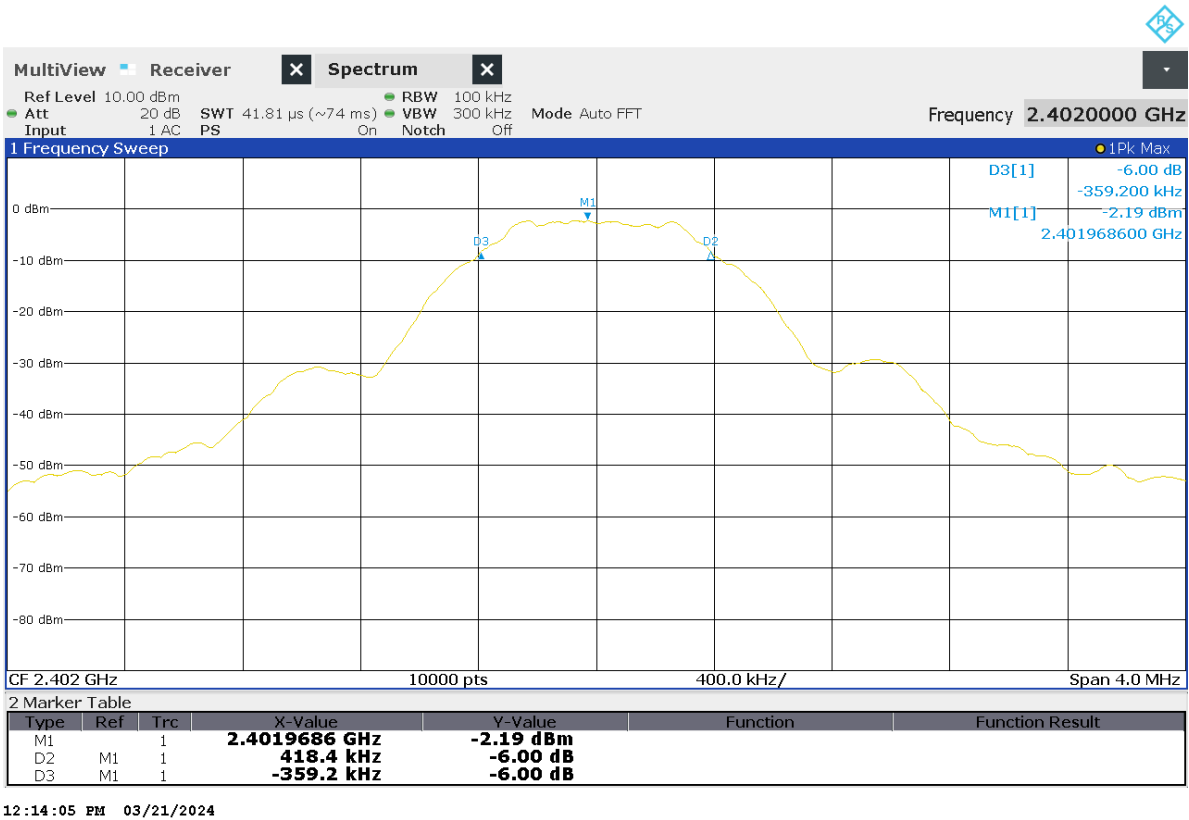


Figure 26 Bandwidth at 6dB Point. 1MHz channel bandwidth, channel 2402MHz

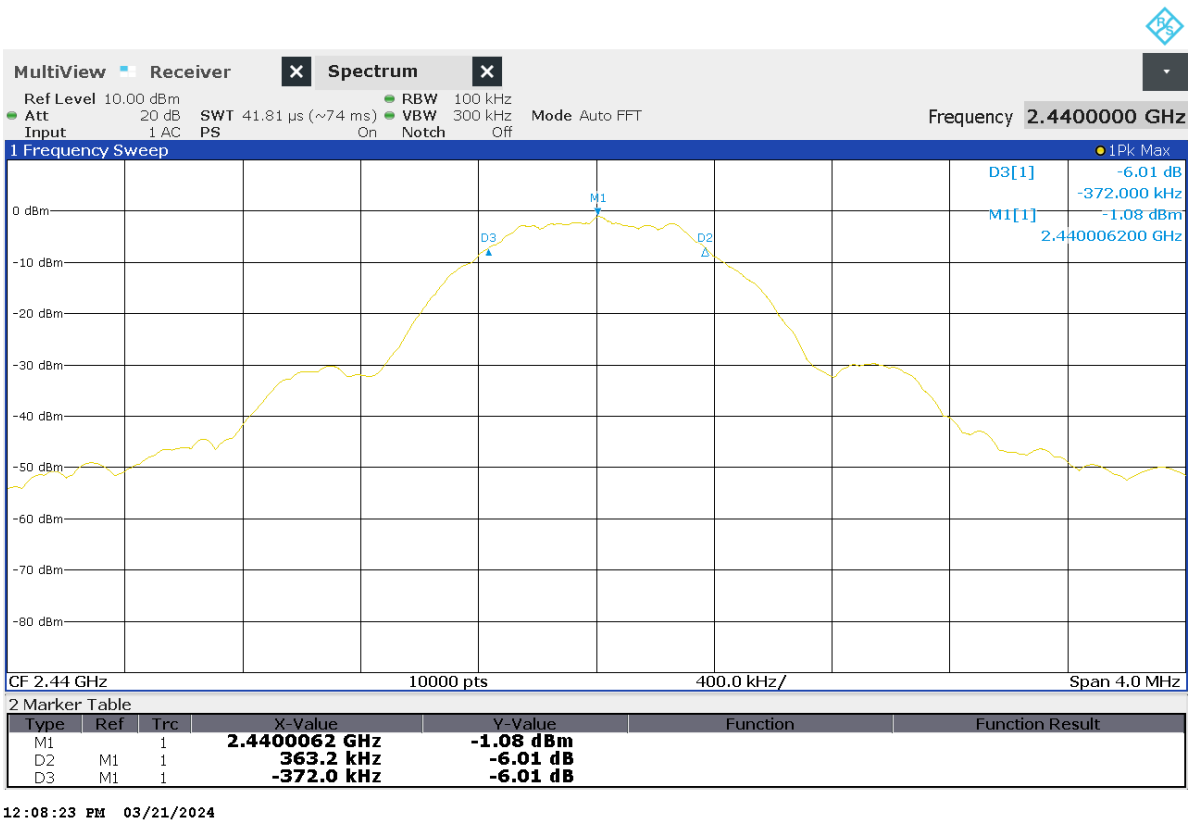


Figure 27 Bandwidth at 6dB Point. 1MHz channel bandwidth, channel 2440MHz

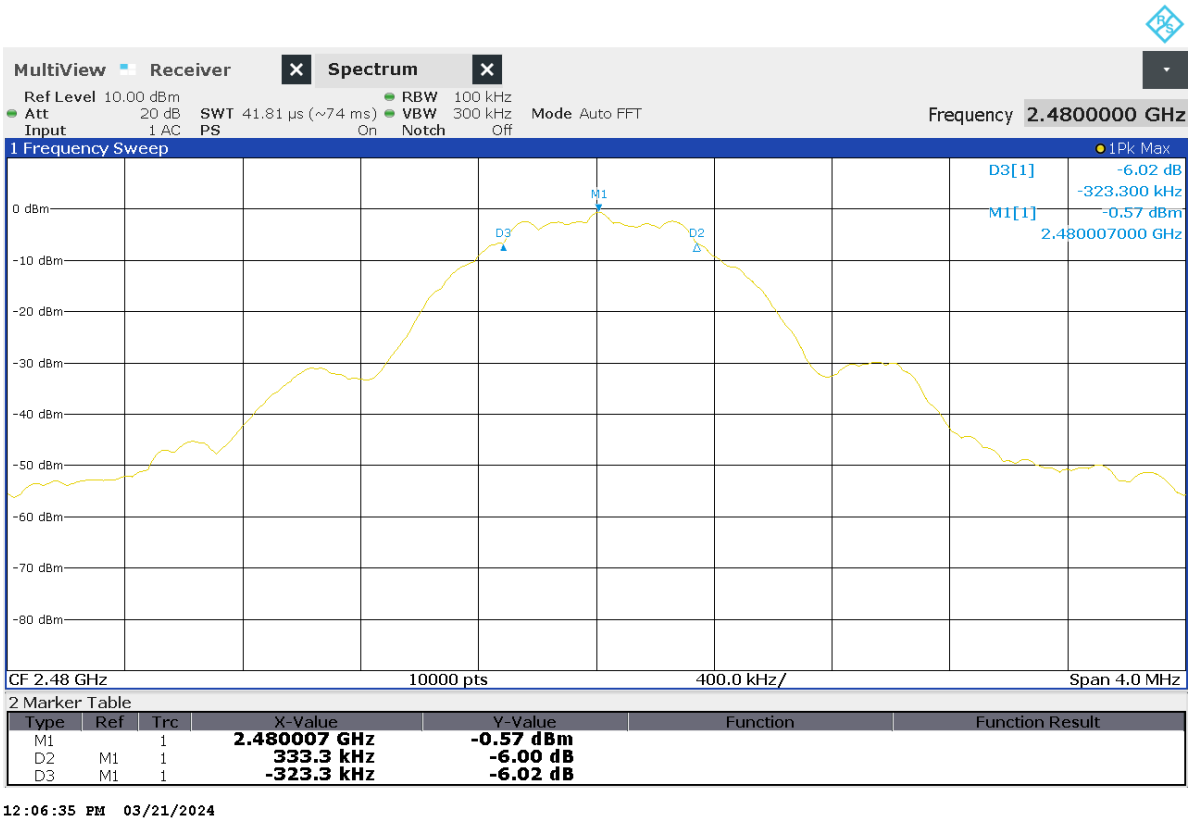


Figure 28 Bandwidth at 6dB Point. 1MHz channel bandwidth, channel 2480MHz

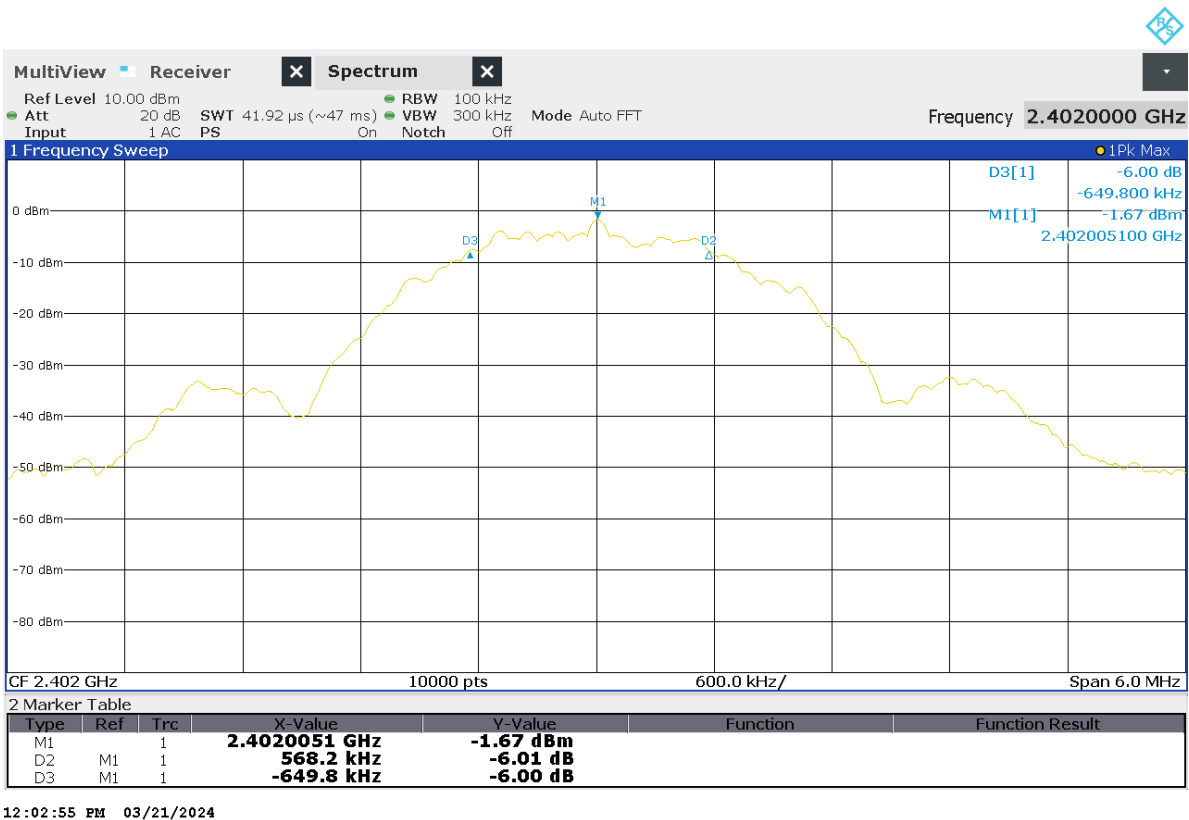


Figure 29 Bandwidth at 6dB Point. 2MHz channel bandwidth, channel 2402MHz

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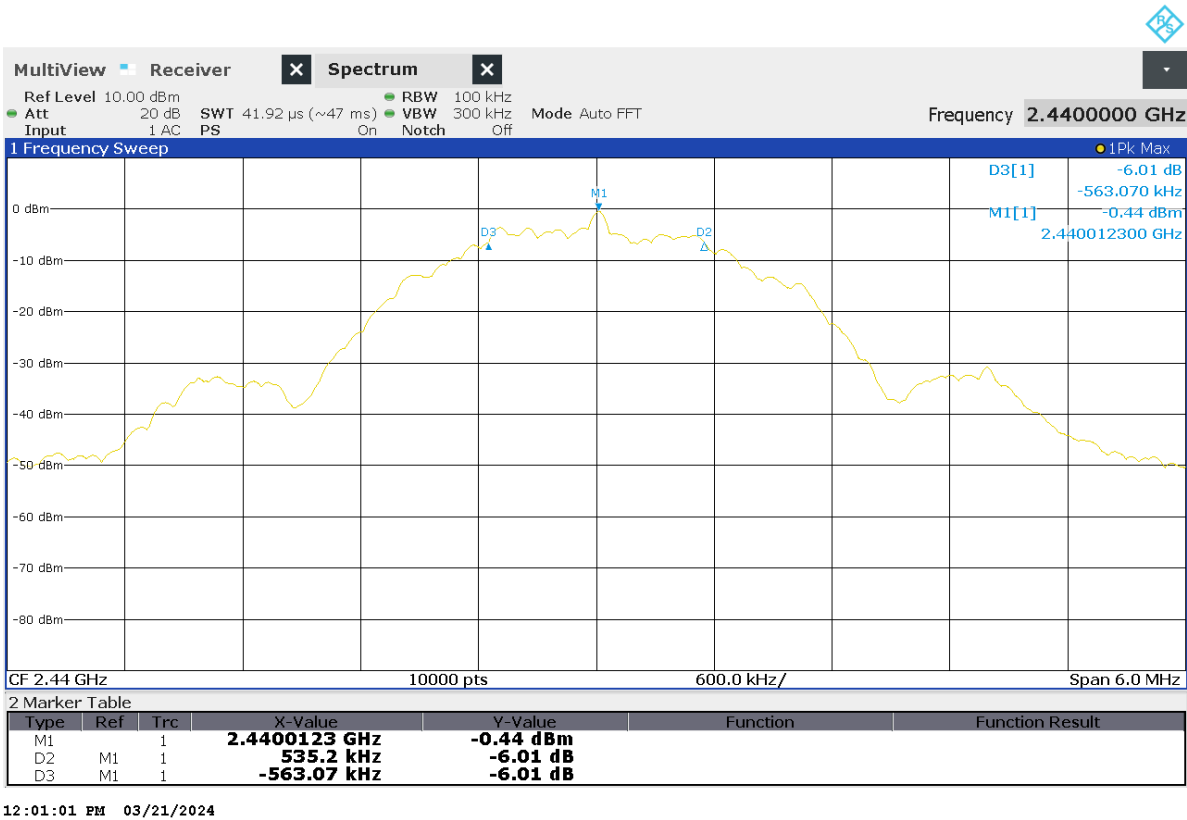


Figure 30 Bandwidth at 6dB Point. 2MHz channel bandwidth, channel 2440MHz

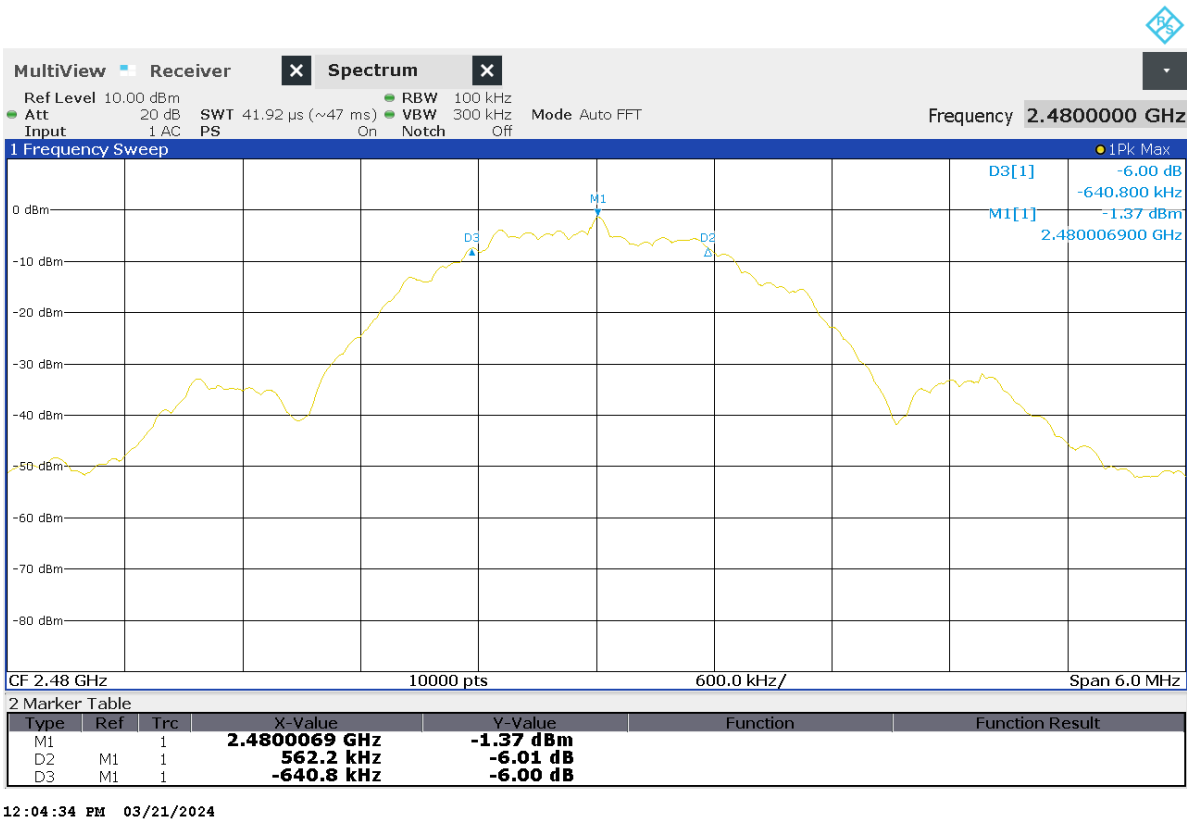


Figure 31 Bandwidth at 6dB Point. 2MHz channel bandwidth, channel 2480MHz



Figure 32 99% Occupied Bandwidth. 1MHz channel bandwidth, channel 2402MHz



Figure 33 99% Occupied Bandwidth. 1MHz channel bandwidth, channel 2440MHz



Figure 34 99% Occupied Bandwidth. 1MHz channel bandwidth, channel 2480MHz

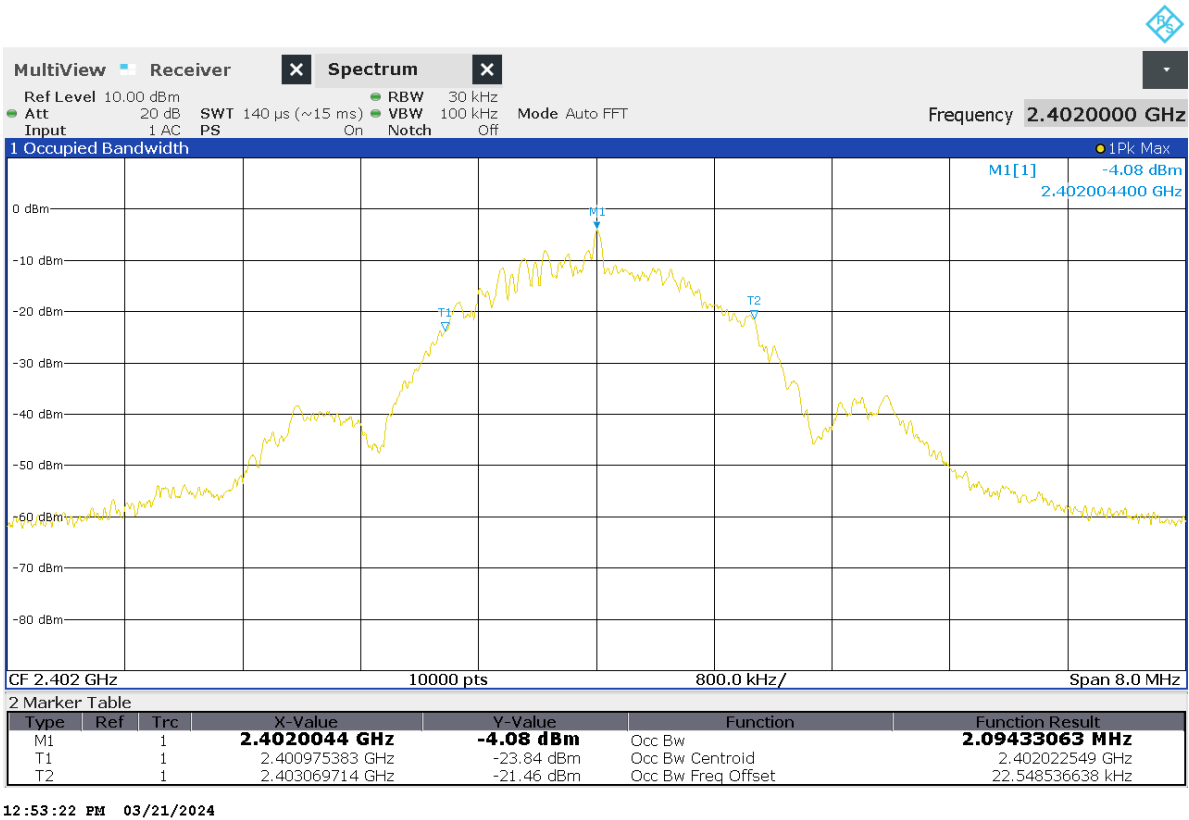


Figure 35 99% Occupied Bandwidth. 2MHz channel bandwidth, channel 2402MHz

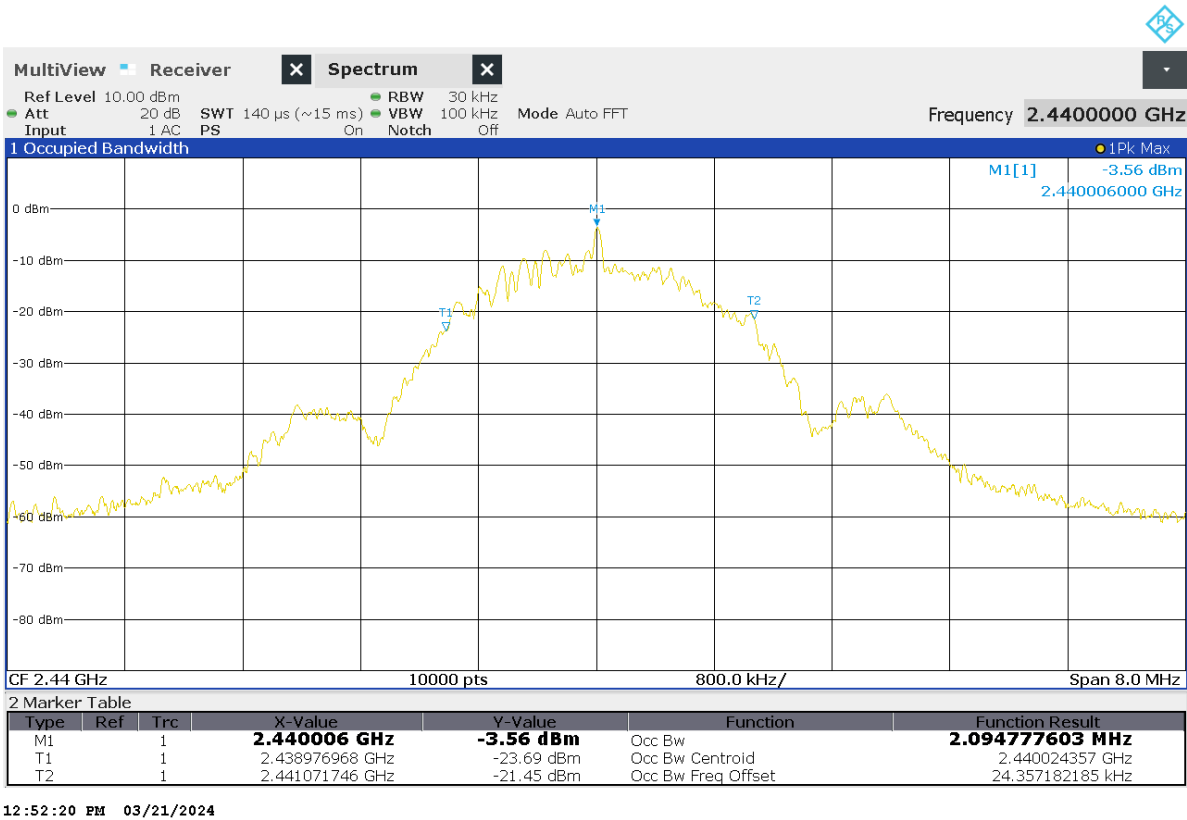


Figure 36 99% Occupied Bandwidth. 2MHz channel bandwidth, channel 2440MHz

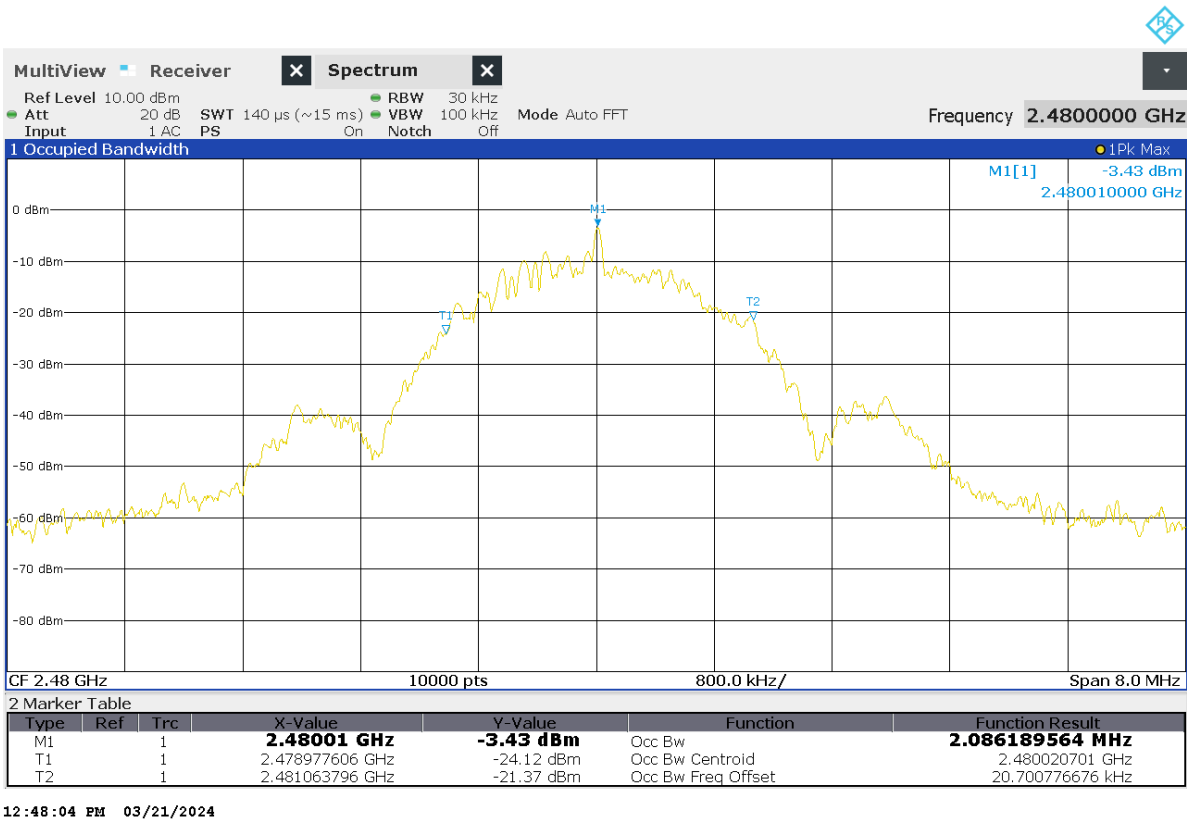


Figure 37 99% Occupied Bandwidth. 2MHz channel bandwidth, channel 2480MHz

Section 7 Peak Output Power

7.1 Test Specification

FCC Rule Part	46CFR 15.247 (b)(3)
Standard	ANSI C63.10:2013
Measurement Uncertainty Conducted Power tests	±1.4dB

7.2 Procedure and Test Software Version

Conducted Tests

ANSi C63.10-2013 Clause reference:	11.9.1.1 (RBS>DTS bandwidth)
Test software	N/A

Frequency (MHz)	Limit, 47CFR 15.247(b)(2)
	Peak
2400MHz to 2483.5MHz	1 watt

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.11.2

Receiver Parameters	Setting
Detector Function	Peak
Span	10MHz
Resolution Bandwidth	2MHz
Video Bandwidth	10MHz
Sweep rate	Auto couple
Trace mode	Max hold

7.2.1 Emissions measurements

7.2.2 Date of Test

21st March 2024

7.2.3 Test Area

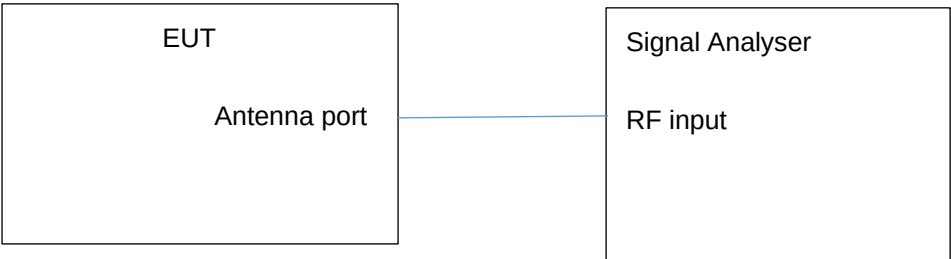
LAB 5

7.2.4 Tested by

J Beevers

7.2.5 Test Setup

The antenna port was connected directly to the signal analyser.



7.2.6 Test Result

The results of the peak output power measurements are stated in the table below and by the signal analyser images.

Channel bandwidth (MHz)	Channel (MHz)	Peak Power (dBm)	Peak Power (Watts)	Limit (Watts)	Figure
1	2402.0	-0.13	0.00097	1	38
1	2440.0	0.05	0.00101	1	39
1	2480.0	-0.10	0.00098	1	40
2	2402.0	-0.19	0.00096	1	41
2	2440.0	-0.05	0.00099	1	42
2	2480.0	-0.13	0.00097	1	43

Table 8 Peak Output Power Measurements

The MAX antenna gain is 1.50 dBi, MAX EIRP=MAX peak power *MAX antenna gain=0.05+1.50=1.55 dBm, The Max EIRP is 1.55 dBm (0.0014W) and does not exceed 4W, which meets the EIRP requirement of RSS-247 section 5.4.

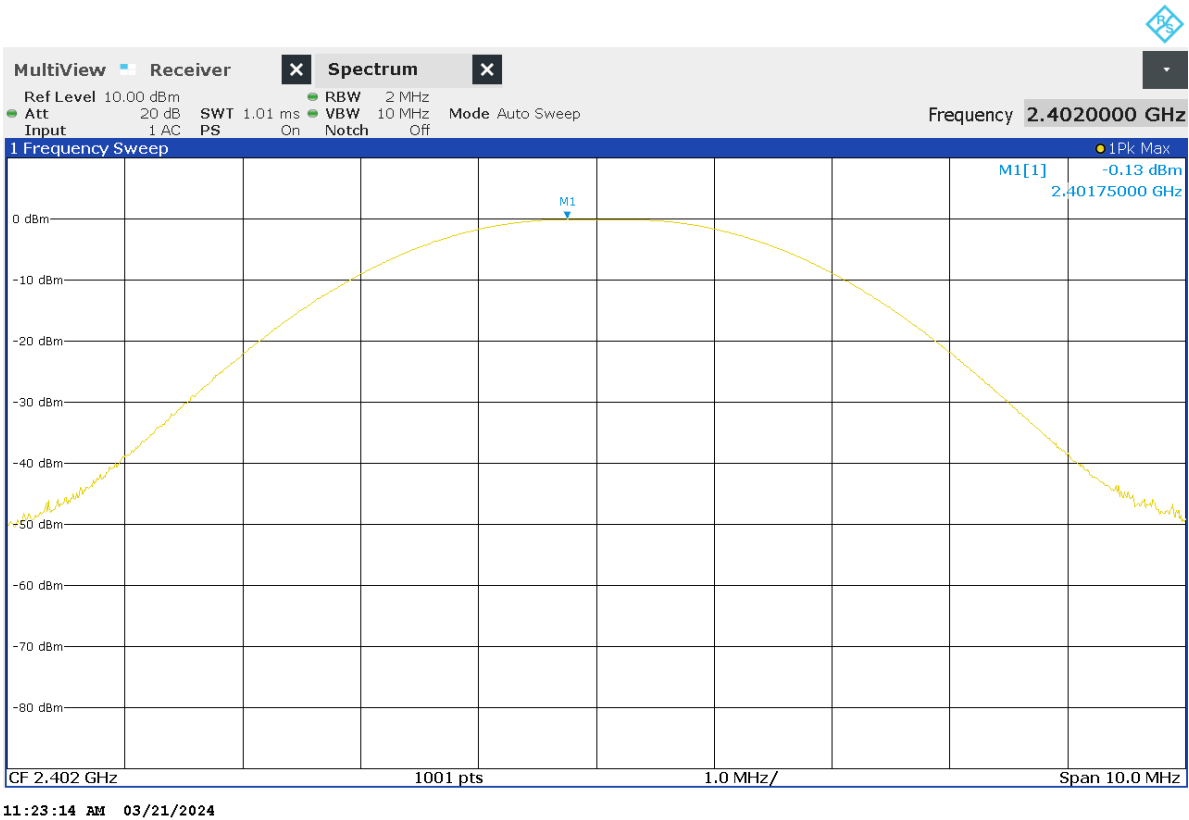


Figure 38 Peak output power, 1MHz channel bandwidth, channel 2402MHz

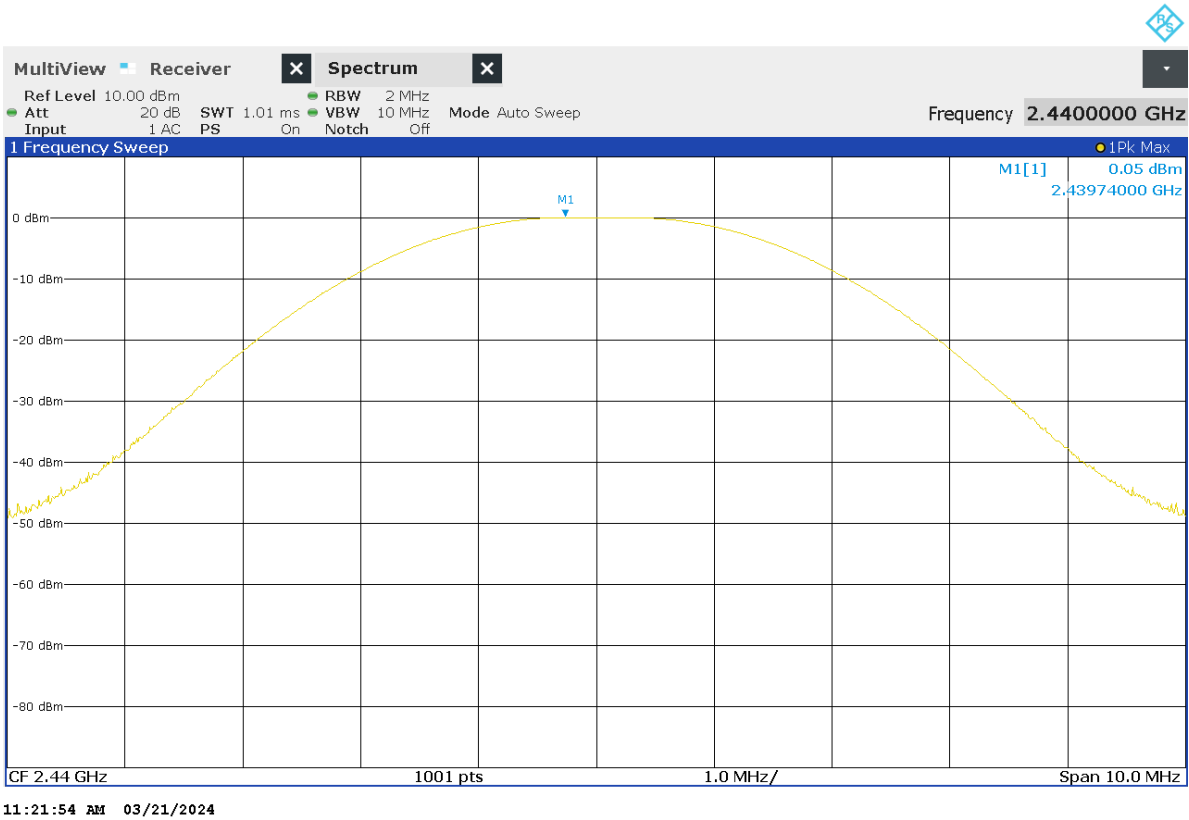


Figure 39 Peak output power, 1MHz channel bandwidth, channel 2440MHz

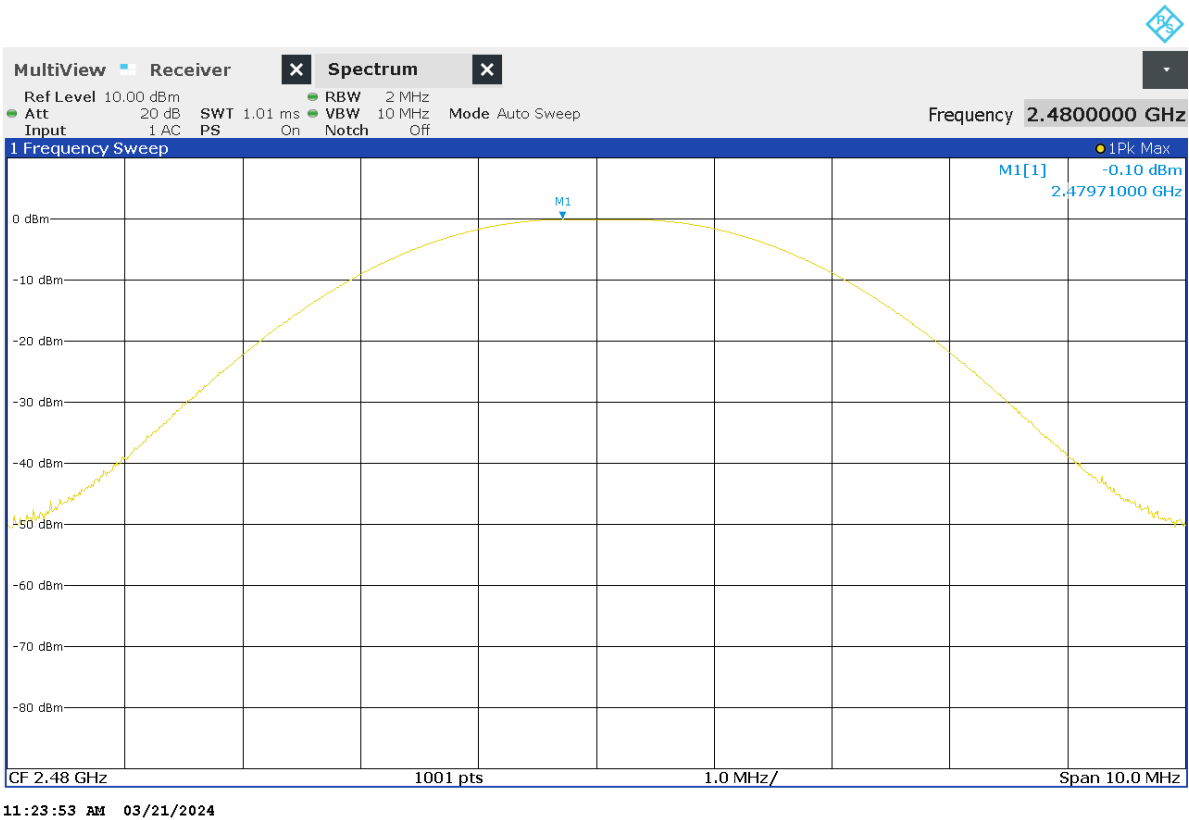


Figure 40 Peak output power, 1MHz channel bandwidth, channel 2480MHz

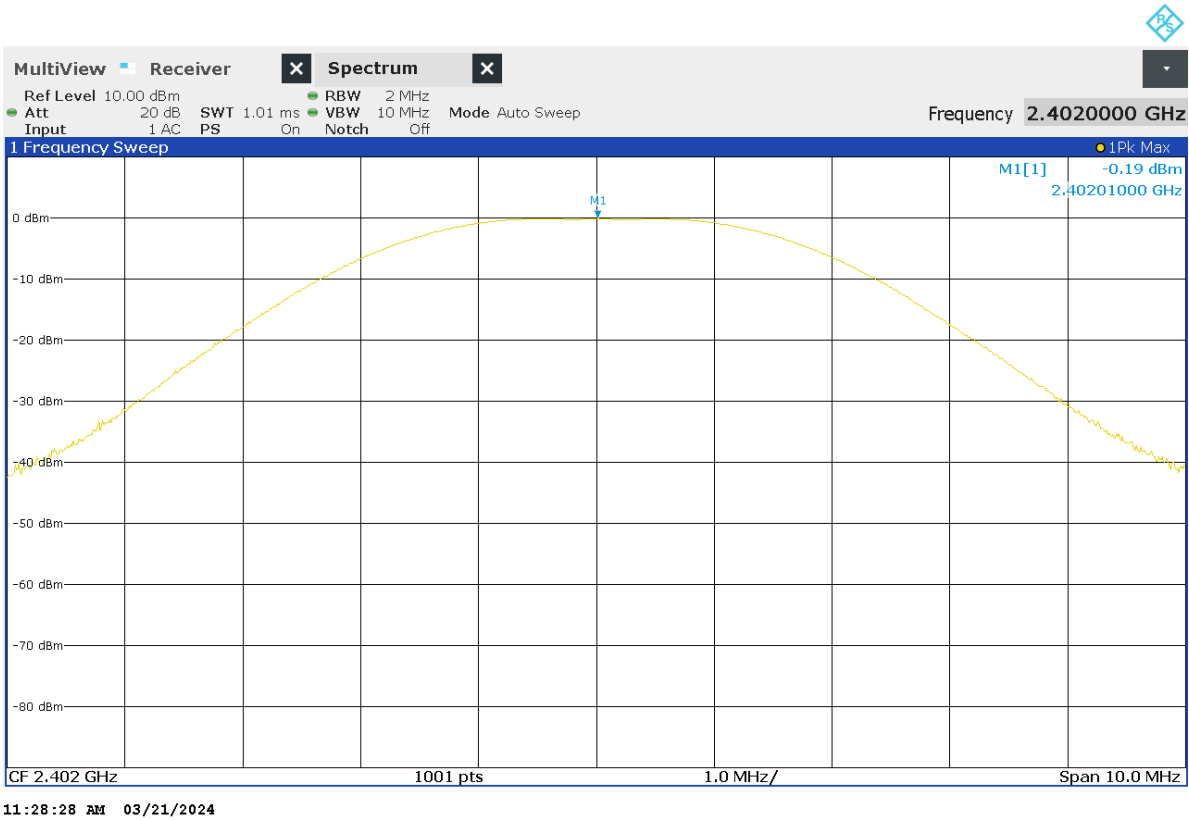


Figure 41 Peak output power, 2MHz channel bandwidth, channel 2402MHz

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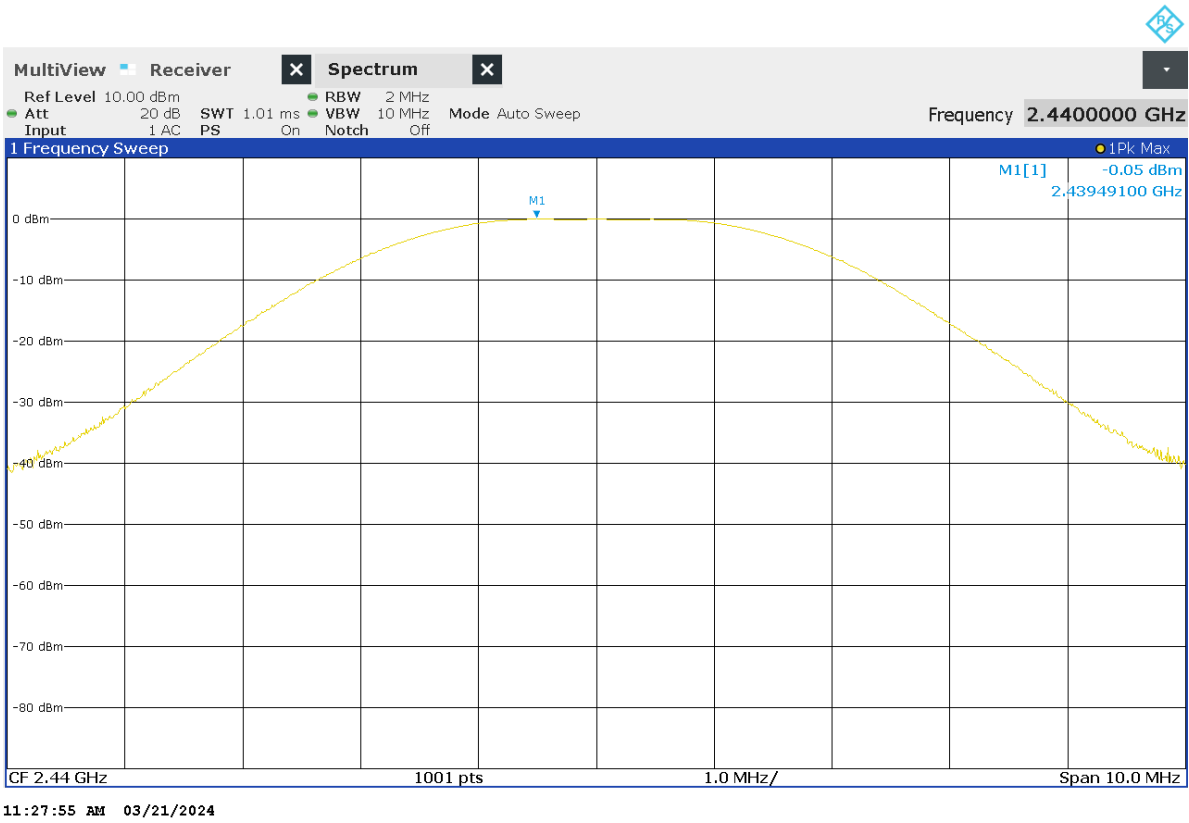


Figure 42 Peak output power, 2MHz channel bandwidth, channel 2440MHz

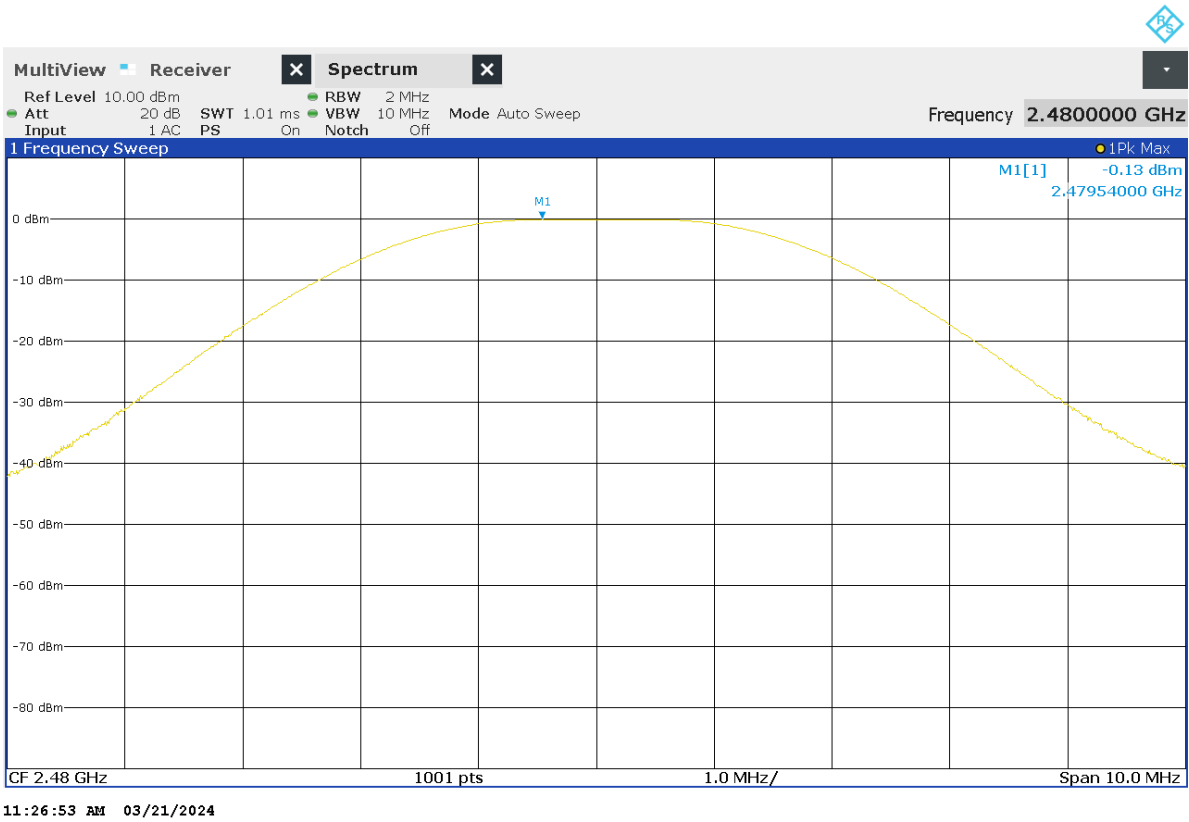


Figure 43 Peak output power, 2MHz channel bandwidth, channel 2480MHz

Section 8 Power Spectral Density

8.1 Test Specification

FCC Rule Part	46CFR 15.247 (e)
Standard	ANSI C63.10:2013
Measurement Uncertainty Conducted Power tests	±1.4dB

8.2 Procedure and Test Software Version

Conducted Tests

ANSi C63.10-2013 Clause reference:	Clause 11.10.2
Test software	N/A

Frequency (MHz)	Limit, 47CFR 15.247(e)
	Peak
2400MHz to 2483.5MHz	<8dBm in any 3kHz band during any time interval of complete transmission

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 11.10.2

Receiver Parameters	Setting
Detector Function	Peak
Span	1.5 x DTS bandwidth
Resolution Bandwidth	3kHz ≤RBW ≤100kHz
Video Bandwidth	3 x RBW
Sweep rate	Auto couple
Trace mode	Max hold

8.2.1 Emissions measurements

8.2.2 Date of Test

21st March 2024

8.2.3 Test Area

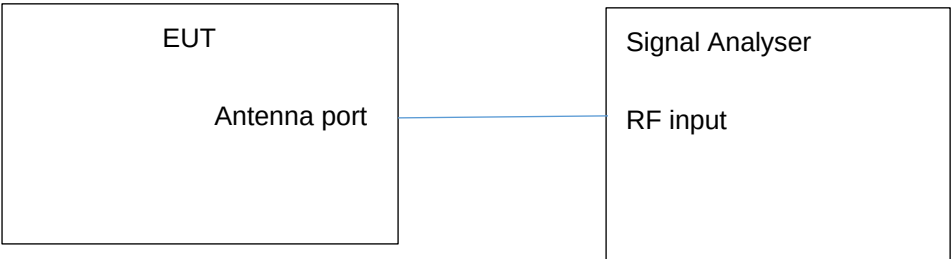
LAB 5

8.2.4 Tested by

J Beevers

8.2.5 Test Setup

The antenna port was connected directly to the signal analyser.



8.2.6 Test Results

Channel bandwidth (MHz)	Channel (MHz)	Power in 3kHz RBW (dBm)	Limit (dBm)	Figure	Result
1	2402	-15.52	8.0	44	Pass
1	2440	-15.49	8.0	45	Pass
1	2480	-15.64	8.0	46	Pass
2	2402	-17.89	8.0	47	Pass
2	2440	-17.70	8.0	48	Pass
2	2480	-17.91	8.0	49	Pass

Table 9 Peak Spectral Density Measurements

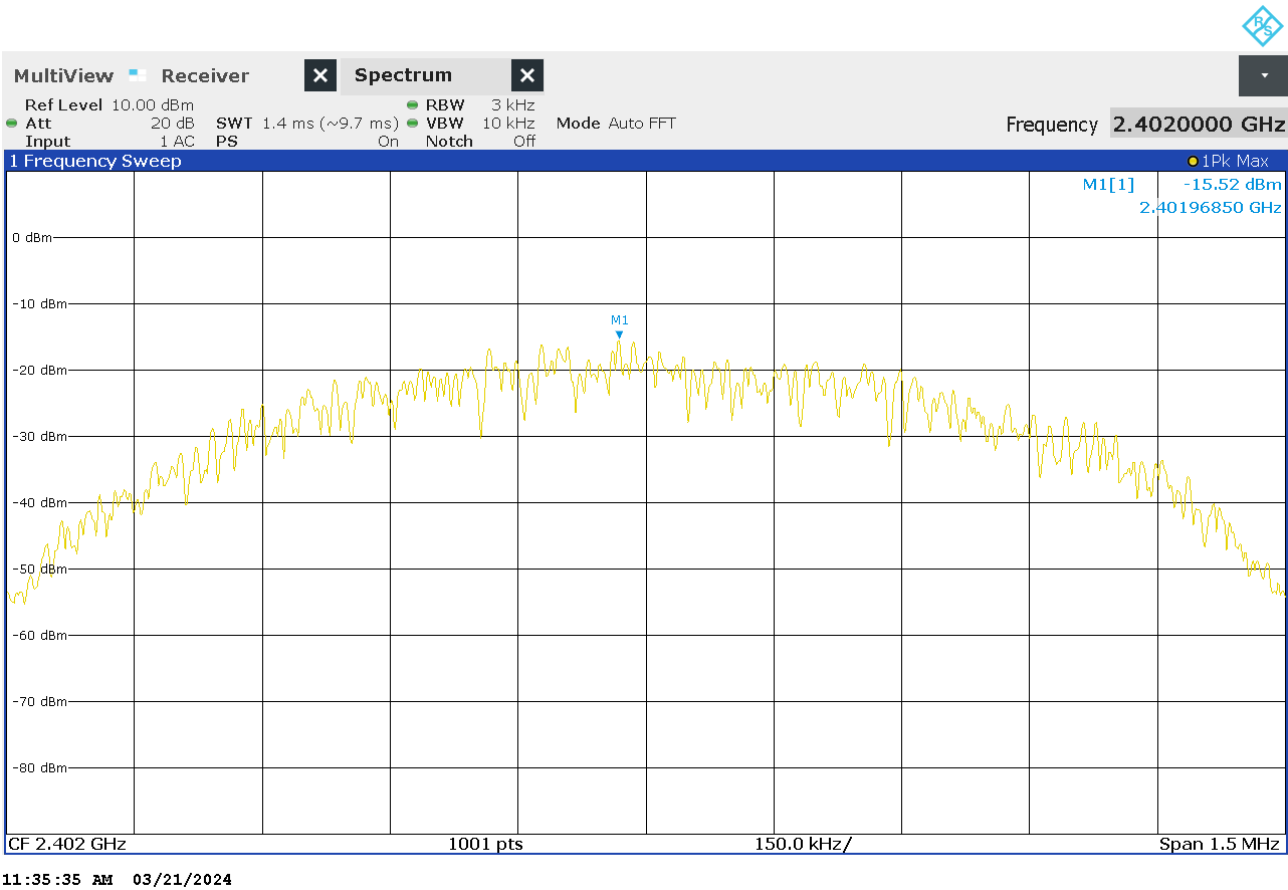


Figure 44 Power spectral density, 1MHz channel bandwidth, channel 2402MHz

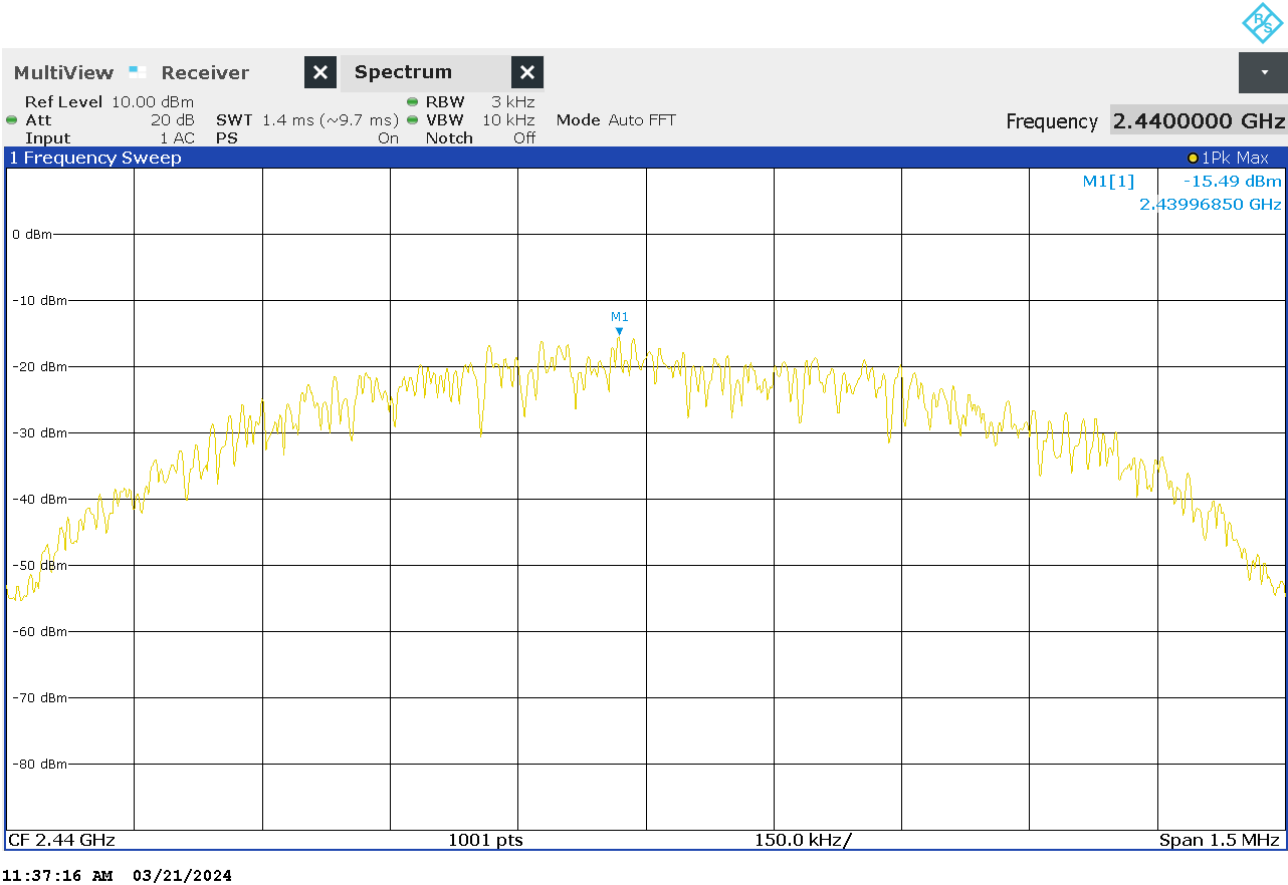


Figure 45 Power spectral density, 1MHz channel bandwidth, channel 2440MHz

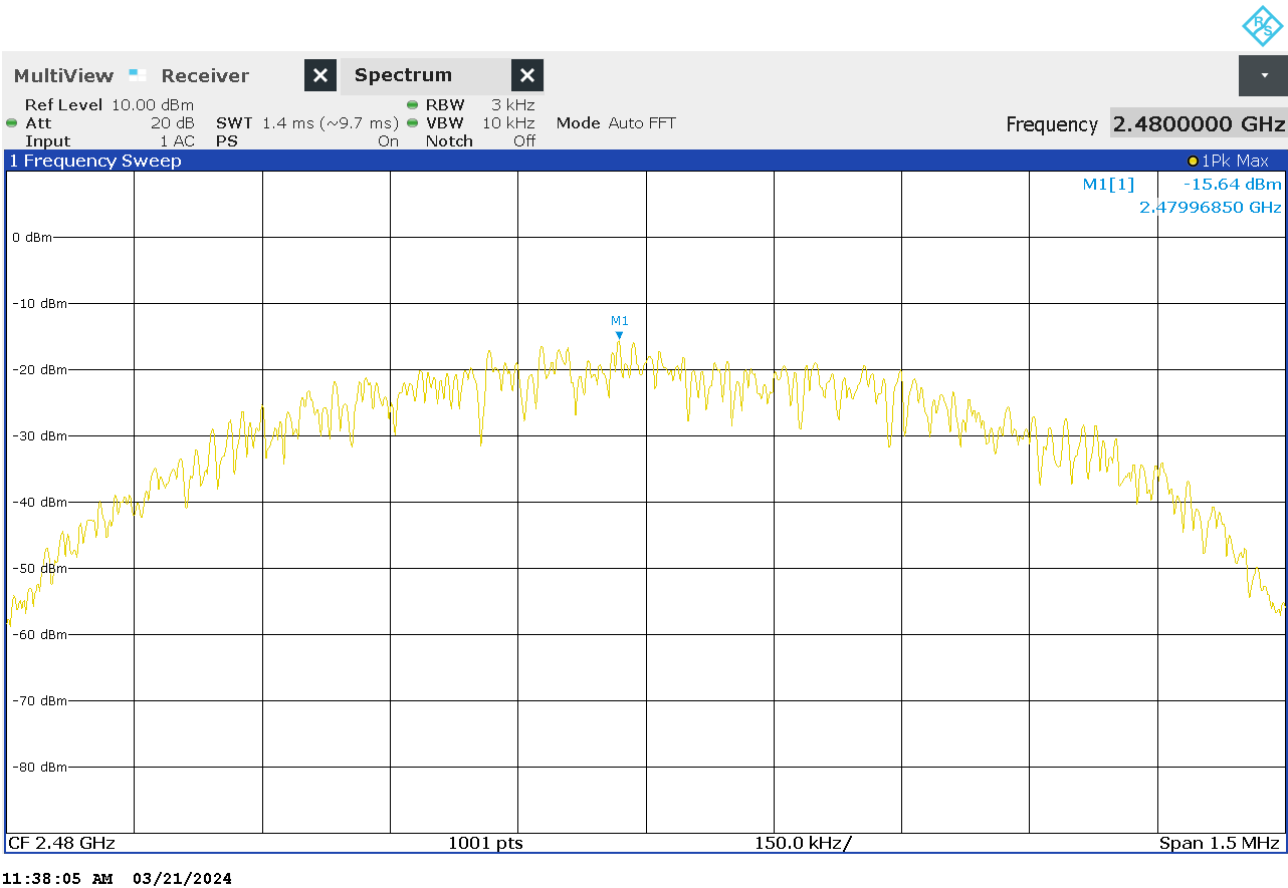
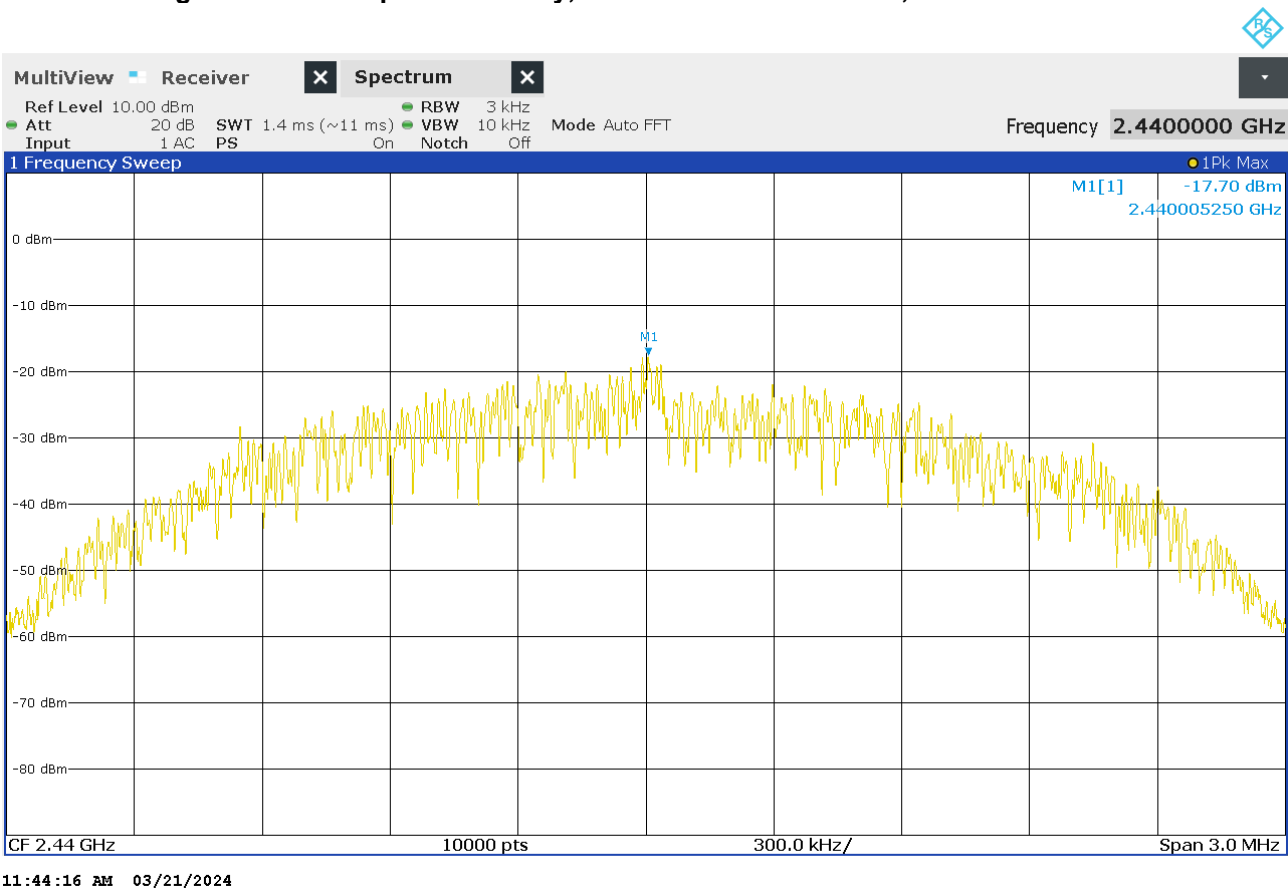
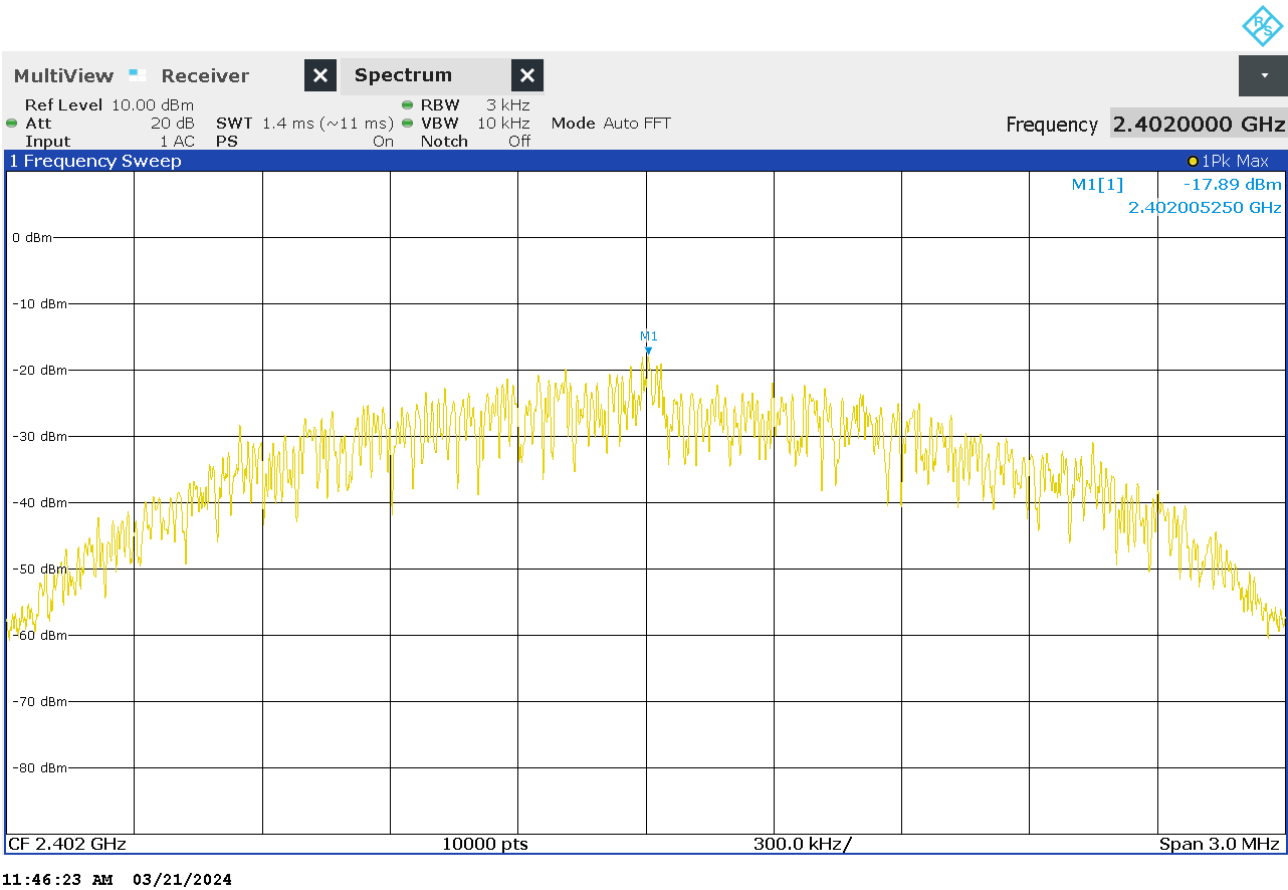


Figure 46 Power spectral density, 1MHz channel bandwidth, channel 2480MHz



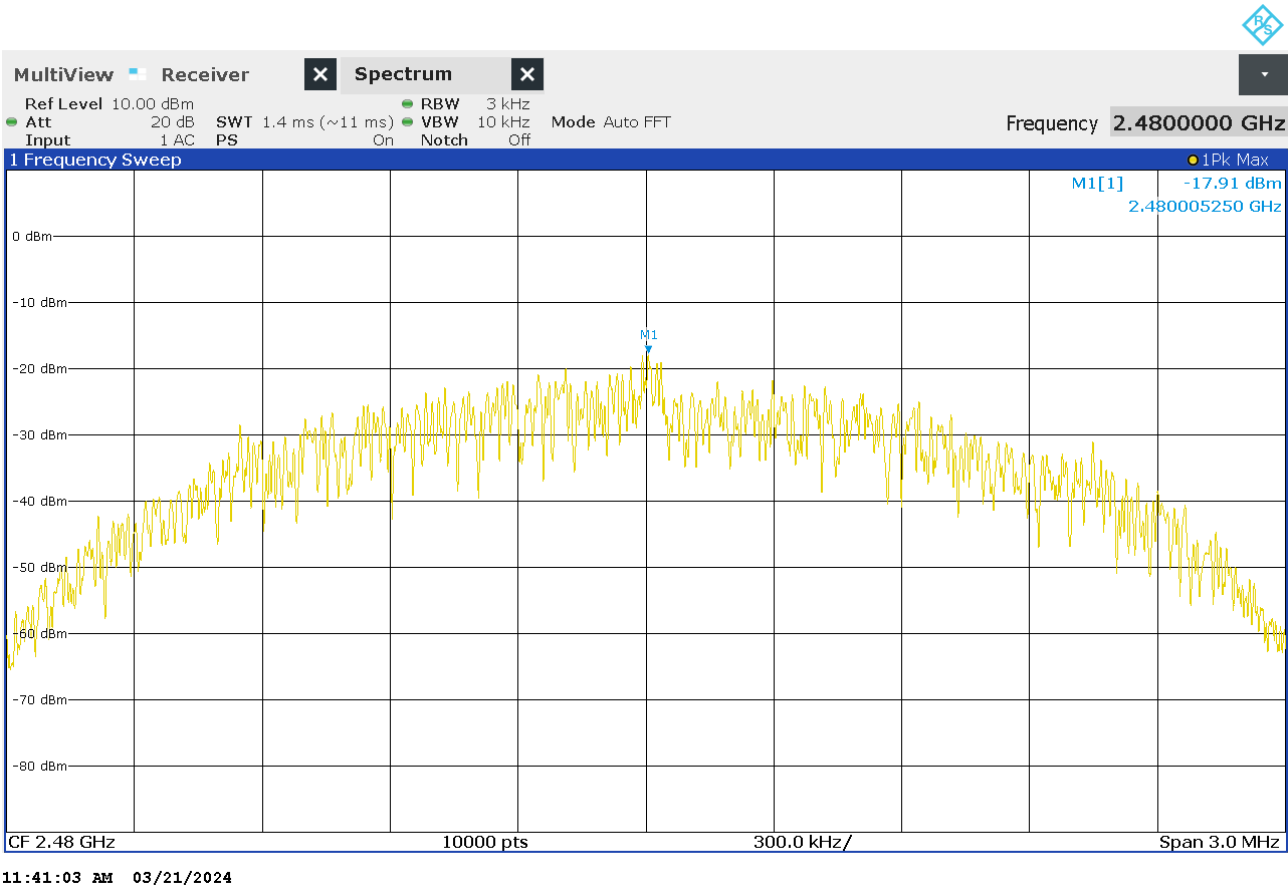


Figure 49 Power spectral density, 2MHz channel bandwidth, channel 2480MHz

Section 9 Band Edge Compliance

9.1 Test Specification

FCC Rule Part	46CFR 15.205 and 47CFR15.209
Standard	ANSI C63.10:2013
Measurement Uncertainty Radiated tests	The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95% is $\pm 5.14\text{dB}$ for the frequency range from 1GHz to 6GHz

9.2 Procedure and Test Software Version

Conducted Tests

ANSi C63.10-2013 Clause reference:	Clause 6.10.4 Authorised band-edge measurements
Test software	N/A

Frequency (MHz)	Limit, 47CFR 15.247(e)
	Peak
2400MHz to 2483.5MHz	Measured signal at the band edge must be below the radiated emission limits of 47CFR15.209

Spectrum analyser settings as specified by ANSI C63.10-2013 Clause 6.10.5 "Restricted band-edge measurements"

Receiver Parameters	Setting
Detector Function	Peak
Span	As necessary
Resolution Bandwidth	1MHz
Video Bandwidth	3 x RBW
Sweep rate	Auto couple
Trace mode	Max hold

9.2.1 Emissions measurements**9.2.2 Date of Test**

12th March 2024

9.2.3 Test Area

LAB 1

9.2.4 Tested by

J Beevers

9.2.5 Test Setup

The test setup was identical to radiated emissions testing 1-18GHz.

9.2.6 Test Results

Results are presented in two formats:

Tabular results of measurements at the band edges. Manual measurements were performed to measure the maximum value of signal at the band edge. The tabular data includes the following:

1. Polarity of the measurement antenna
2. Frequency at the band edge
3. Amplitude of signal at the input of the test receiver
4. Pre-amplifier gain
5. Cable loss
6. Antenna factor
7. Resultant Electric field strength = 3-4+5+6

Spectrum analyser screen displays are also included. Please note that the screen displays do not include losses or antenna factor.

Tabular Data, 1MHz channel bandwidth

The following radiated measurements were made at the band edges:

Upper band edge

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2483.5	65.2	54.0	3.1	29.9	44.1	74	29.9
V	2483.5	63.6	54.0	3.1	29.9	42.5	74	31.5

Table 10 1MHz channel bandwidth, Channel 2480MHz, Peak detector measurements

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2483.5	47.2	54.0	3.1	29.9	28.1	54	25.9
V	2483.5	48.1	54.0	3.1	29.9	27.0	54	27.0

Table 11 1MHz channel bandwidth, Channel 2480MHz, average detector measurements**Lower band edge**

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2400	71.0	54.0	3.0	29.7	49.7	74	24.3
V	2400	66.9	54.0	3.0	29.7	45.6	74	28.4

Table 12 1MHz channel bandwidth, Channel 2402MHz Peak detector measurements

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2400	55.7	54.0	3.0	29.7	34.4	54	19.6
V	2400	52.0	54.0	3.0	29.7	30.7	54	23.3

Table 13 1MHz channel bandwidth, Channel 2402MHz average detector measurements

Tabular Data, 2MHz channel bandwidth

The following radiated measurements were made at the band edges:

Upper band edge

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2483.5	74.1	54.0	3.1	29.9	53.0	74	21.0
V	2483.5	75.3	54.0	3.1	29.9	54.2	74	19.8

Table 14 2MHz channel bandwidth, Channel 2480MHz, Peak detector measurements

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2483.5	53.7	54.0	3.1	29.9	32.6	54	21.4
V	2483.5	54.6	54.0	3.1	29.9	33.5	54	20.5

Table 15 2MHz channel bandwidth, Channel 2480MHz, average detector measurements**Lower band edge**

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2400	88.1	54.0	3.0	29.7	66.8	74	7.2
V	2400	90.7	54.0	3.0	29.7	69.4	74	4.6

Table 16 2MHz channel bandwidth, Channel 2402MHz Peak detector measurements

Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2400	68.0	54.0	3.0	29.7	46.7	54	7.3
V	2400	70.5	54.0	3.0	29.7	49.2	54	4.8

Table 17 2MHz channel bandwidth, Channel 2402MHz average detector measurements

Spectrum analyser displays 1MHz channel bandwidth

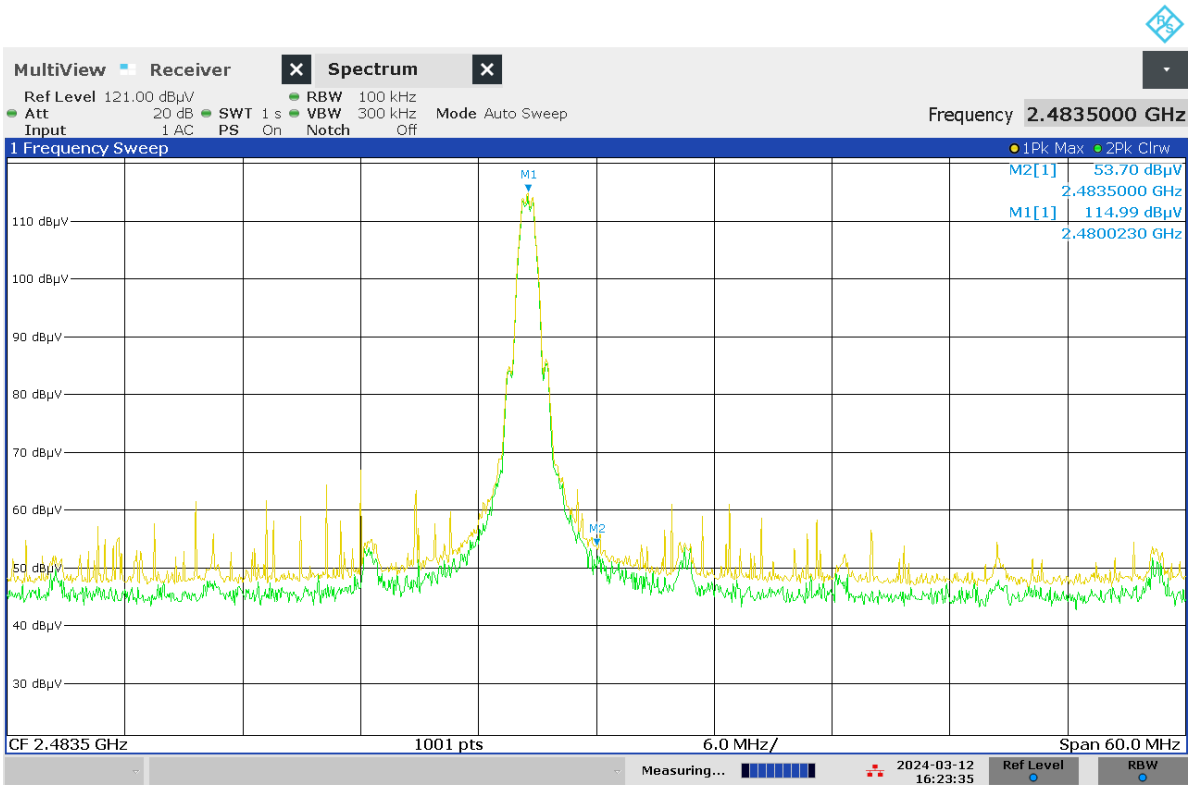


Figure 50 1MHz channel bandwidth, Band Edge Measurement – upper band edge - horizontal polarity

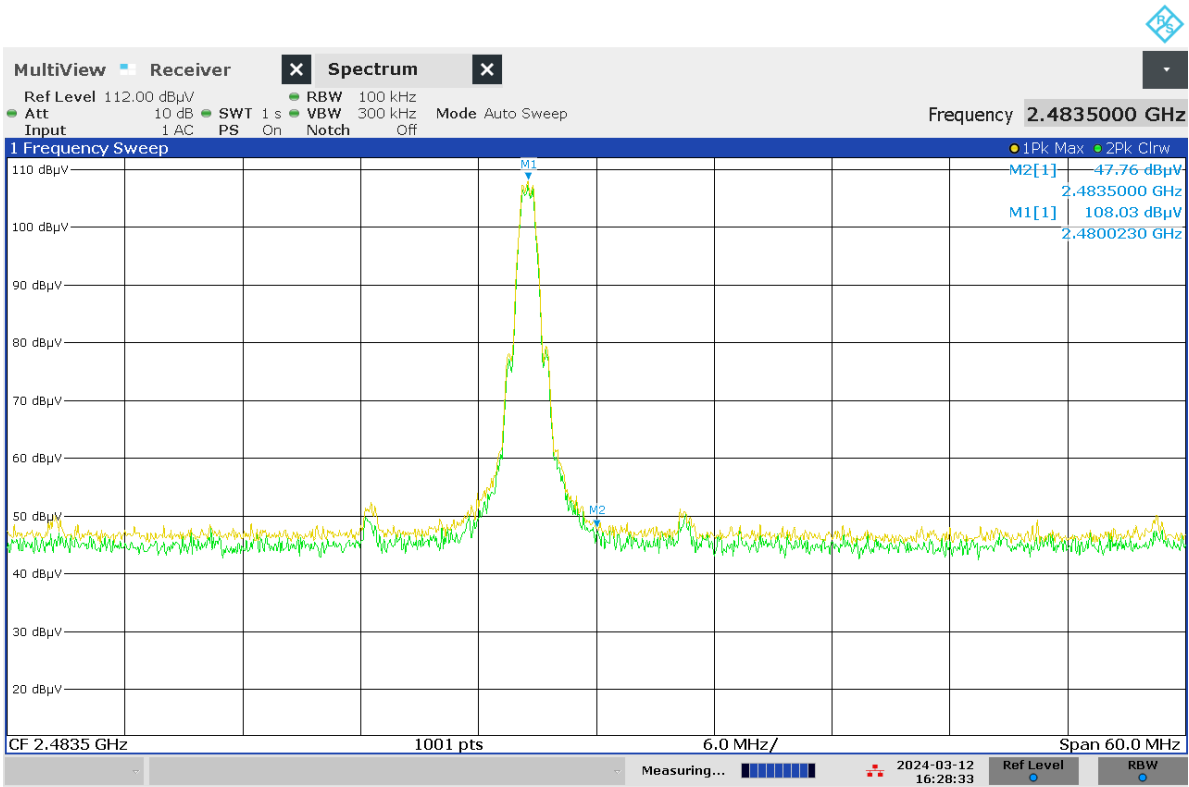


Figure 51 1MHz channel bandwidth, Band Edge Measurement – upper band edge - vertical polarity

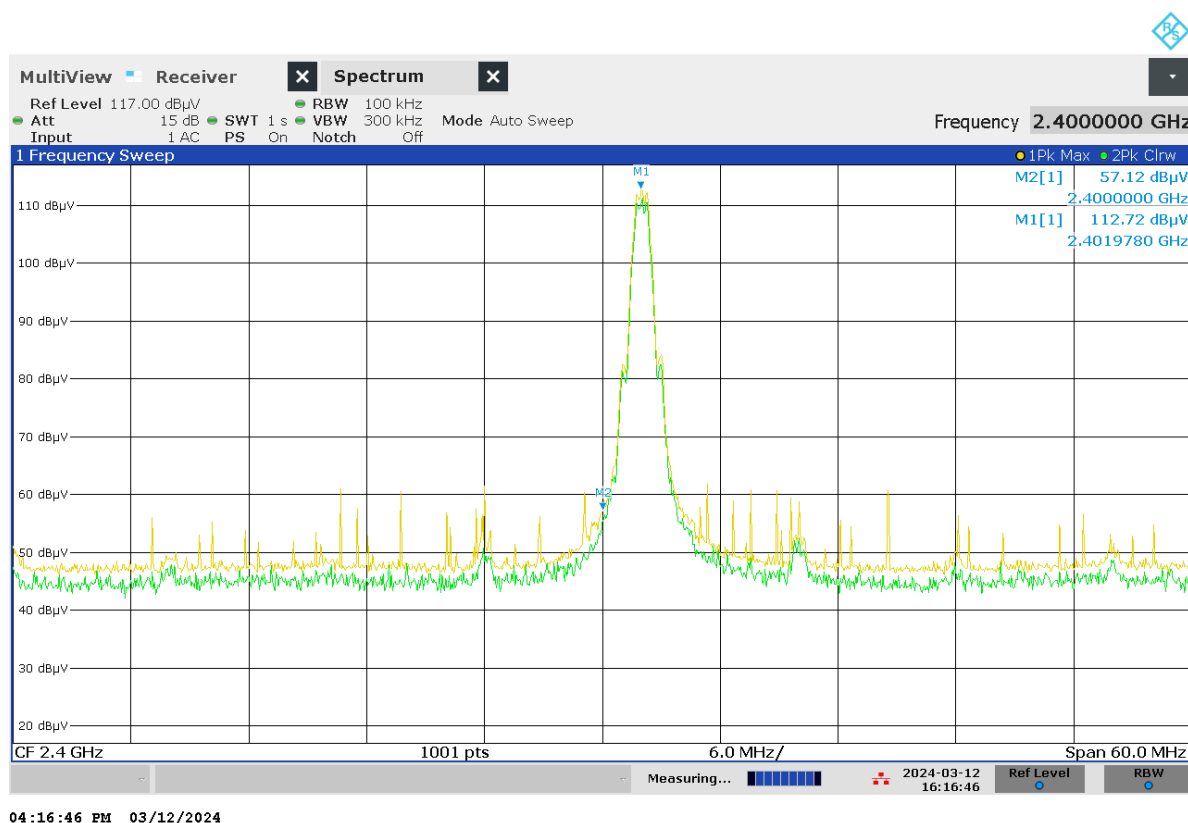


Figure 52 1MHz channel bandwidth, Band Edge Measurement – lower band edge - horizontal polarity

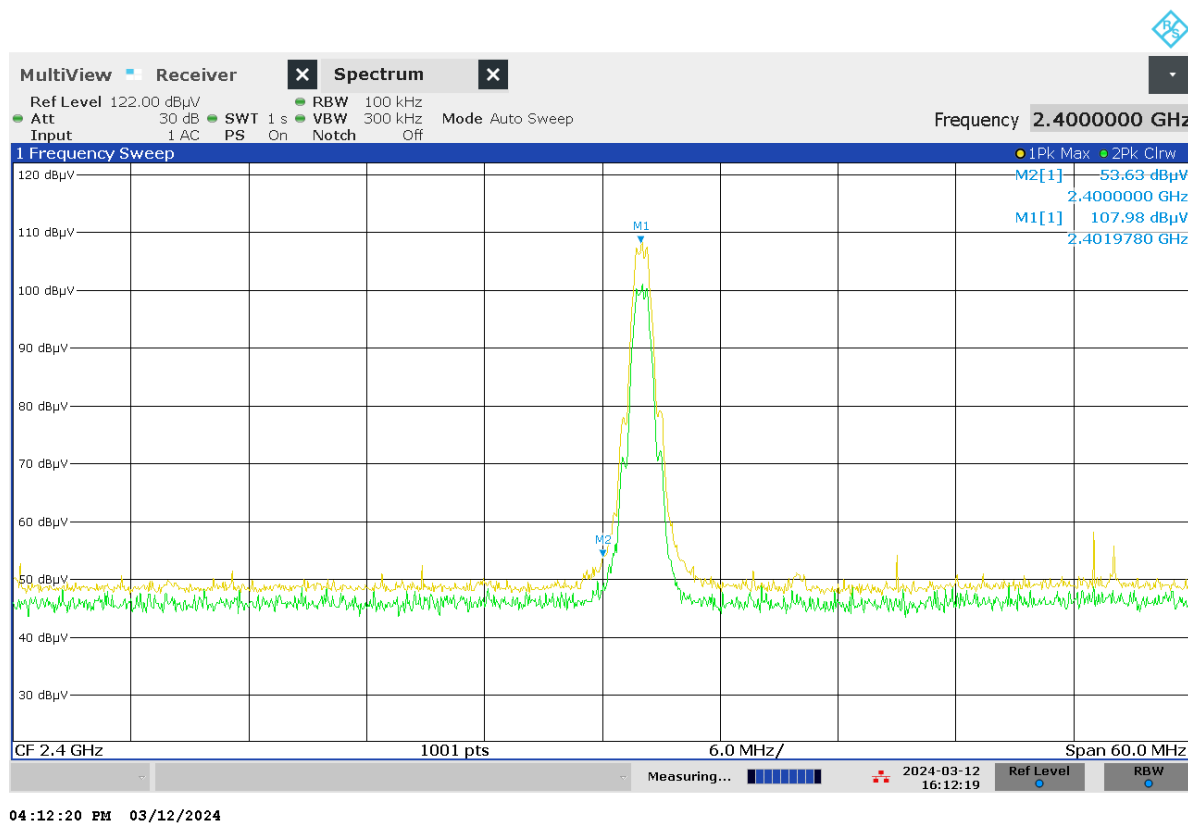


Figure 53 1MHz channel bandwidth, Band Edge Measurement – lower band edge - vertical polarity

Spectrum analyser displays 2MHz channel bandwidth

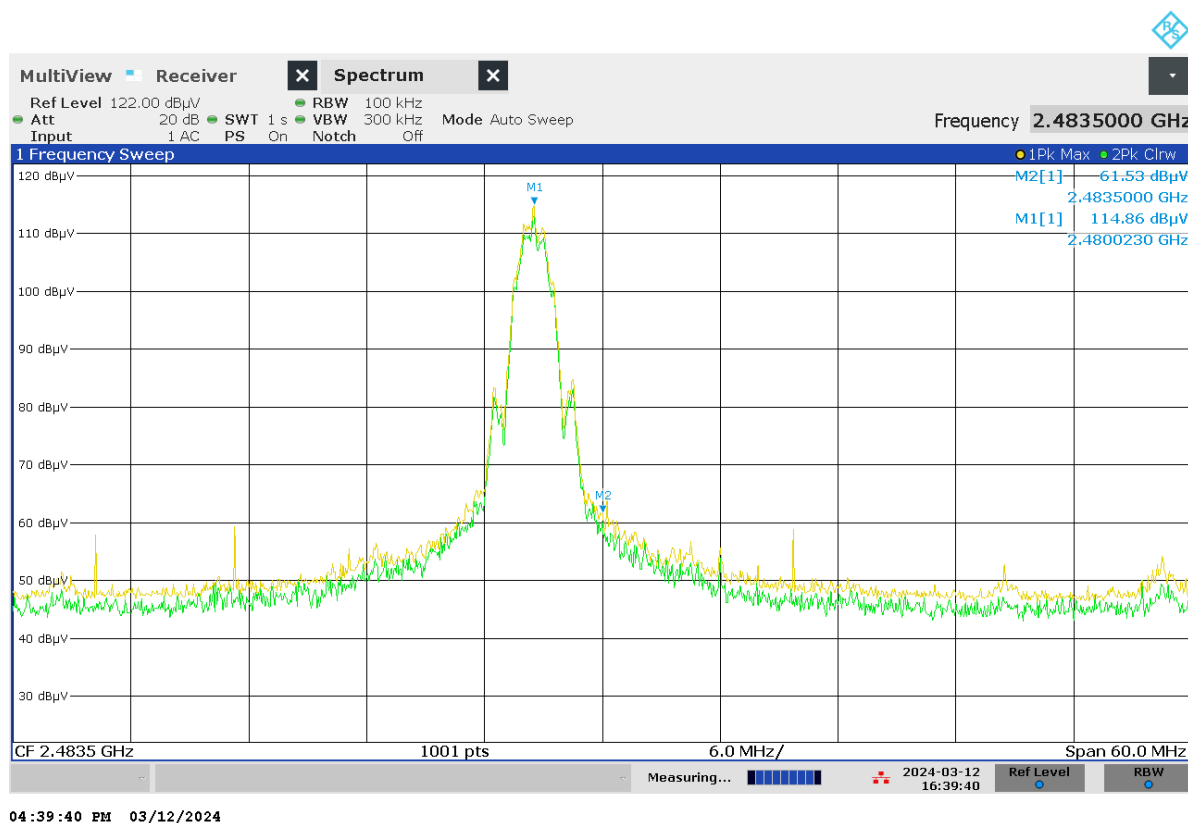


Figure 54 2MHz channel bandwidth, Band Edge Measurement – upper band edge - horizontal polarity

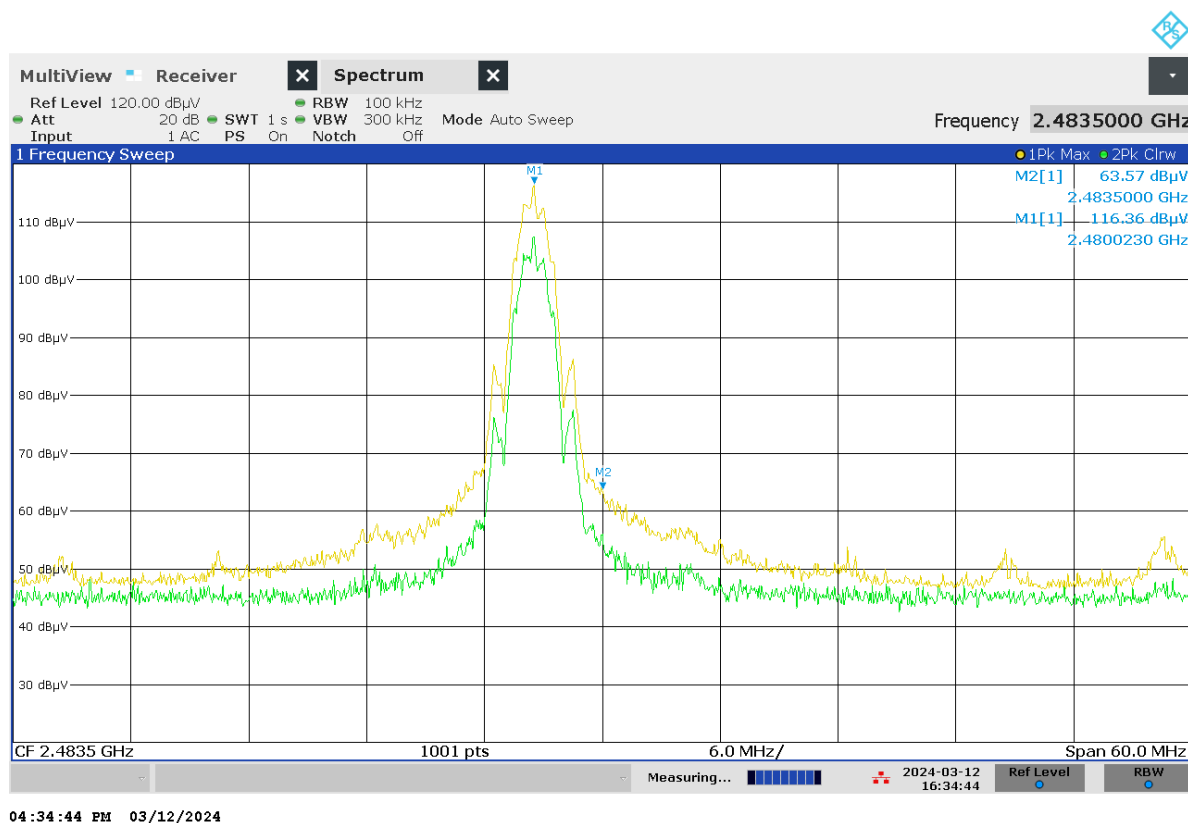


Figure 55 2MHz channel bandwidth, Band Edge Measurement – upper band edge - vertical polarity

Date: 2nd April 2024

Report Number: C15488TR1

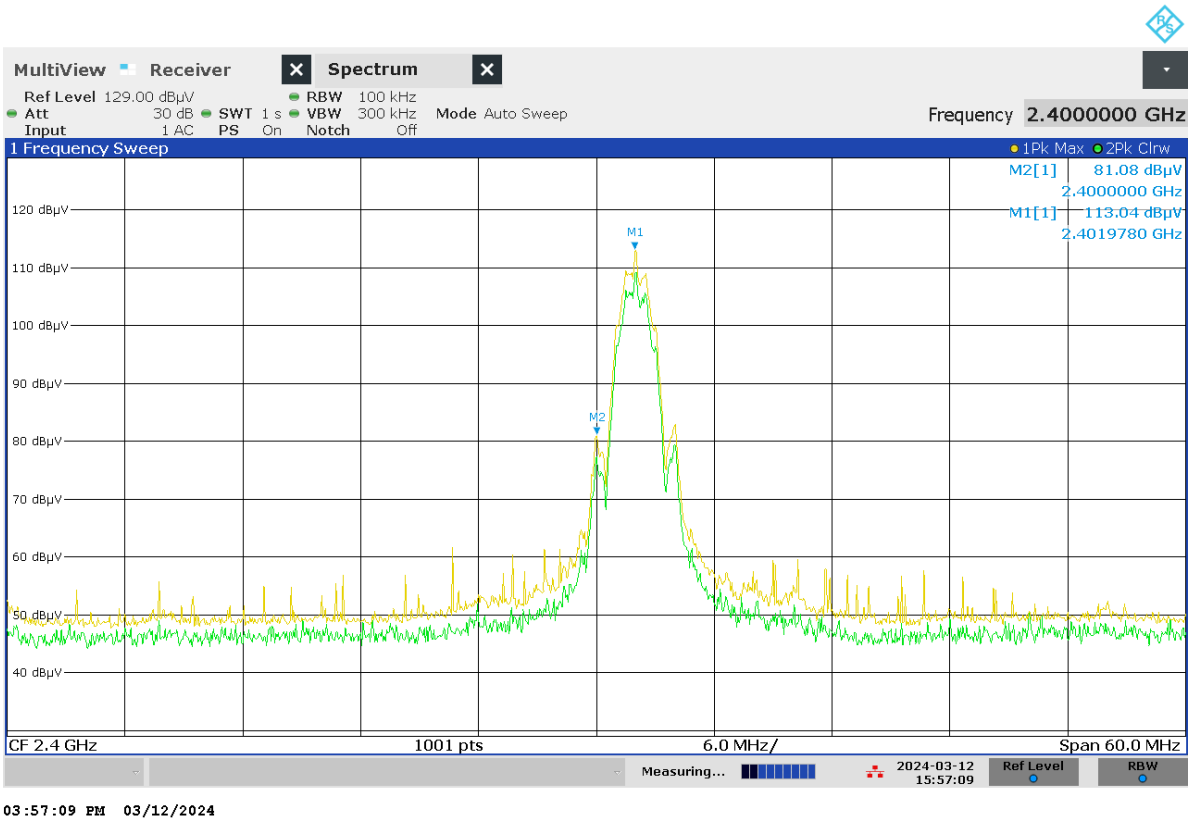


Figure 56 2MHz channel bandwidth, Band Edge Measurement – lower band edge - horizontal polarity

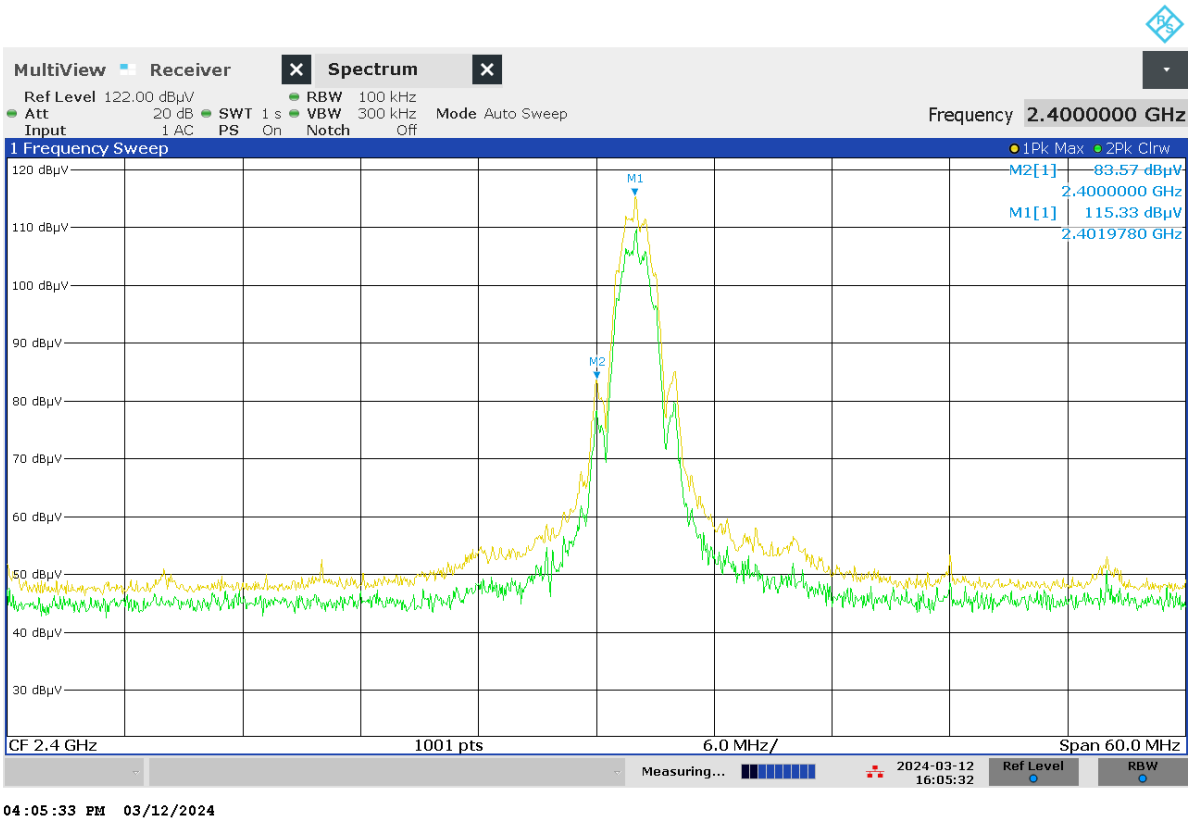


Figure 57 2MHz channel bandwidth, Band Edge Measurement – lower band edge - vertical polarity

Section 10 AC Mains Conducted Emissions

10.1 Test Specification

FCC Rule Part	46CFR 15.207
Standard	ANSI C63.10:2013
Measurement Uncertainty	The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 % is $\pm 3.44\text{dB}$

10.2 Power Line Emission Limits

Frequency (MHz)	Class B (dB μ V)	
	Quasi Peak	Average
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5.0	56.0	46.0
5.0 - 30	60.0	50.0

Note: * The limit decreases linearly with the logarithm of the frequency in the range

10.3 Receiver Settings

Receiver Parameters	Setting
Detector Function	Quasi Peak and Average
Start Frequency	150kHz
Stop Frequency	30MHz
Resolution Bandwidth	10kHz
Video Bandwidth	Auto

10.4 Procedure and Test Software Version

Eurofins E&E UK test procedure	CEP19 Issue 10
Test software	RadiMation Version 2016.1.6

10.4.1 Date of Test25th March 2024**10.4.2 Test Area**

LAB 2

10.4.3 Tested by

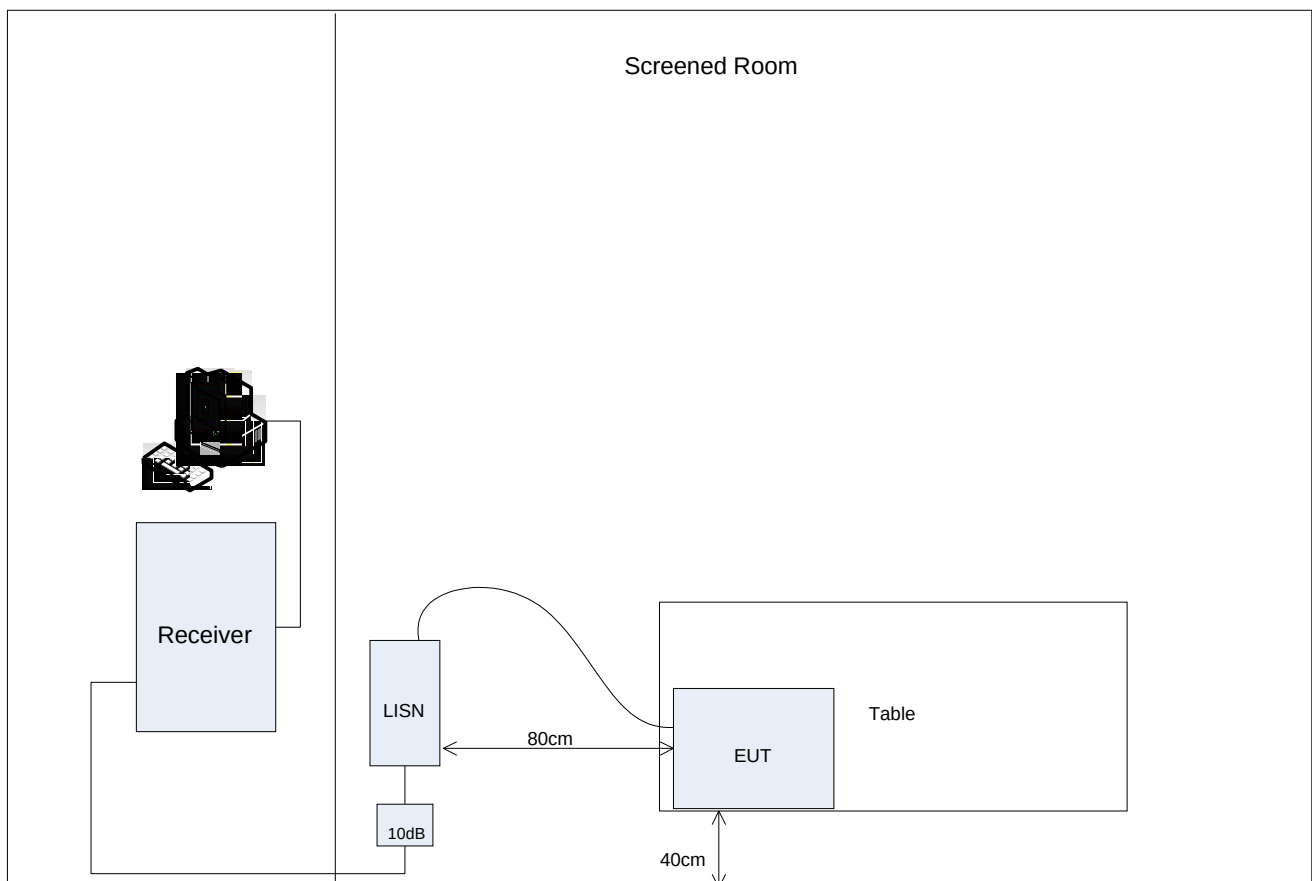
J Beevers

10.4.4 Test Setup

This test was applied to the EUT's Live and Neutral lines. The EUT was configured in the screened room on an 80cm high table was positioned 40cm from the room wall.

A calibrated mains extension lead was used to ensure a known impedance was presented to the EUT

The EUT was then powered from the mains supply via a Line Impedance Stabilisation Network (LISN).



10.5 Test Results

This section contains graphical and tabulated data. The following data is presented

Channel Bandwidth (MHz)	Channel (MHz)	Conductor	Result summary
1	2402	Live	Pass
1	2402	Neutral	Pass
1	2440	Live	Pass
1	2440	Neutral	Pass
1	2480	Live	Pass
1	2480	Neutral	Pass
2	2402	Live	Pass
2	2402	Neutral	Pass
2	2440	Live	Pass
2	2440	Neutral	Pass
2	2480	Live	Pass
2	2480	Neutral	Pass

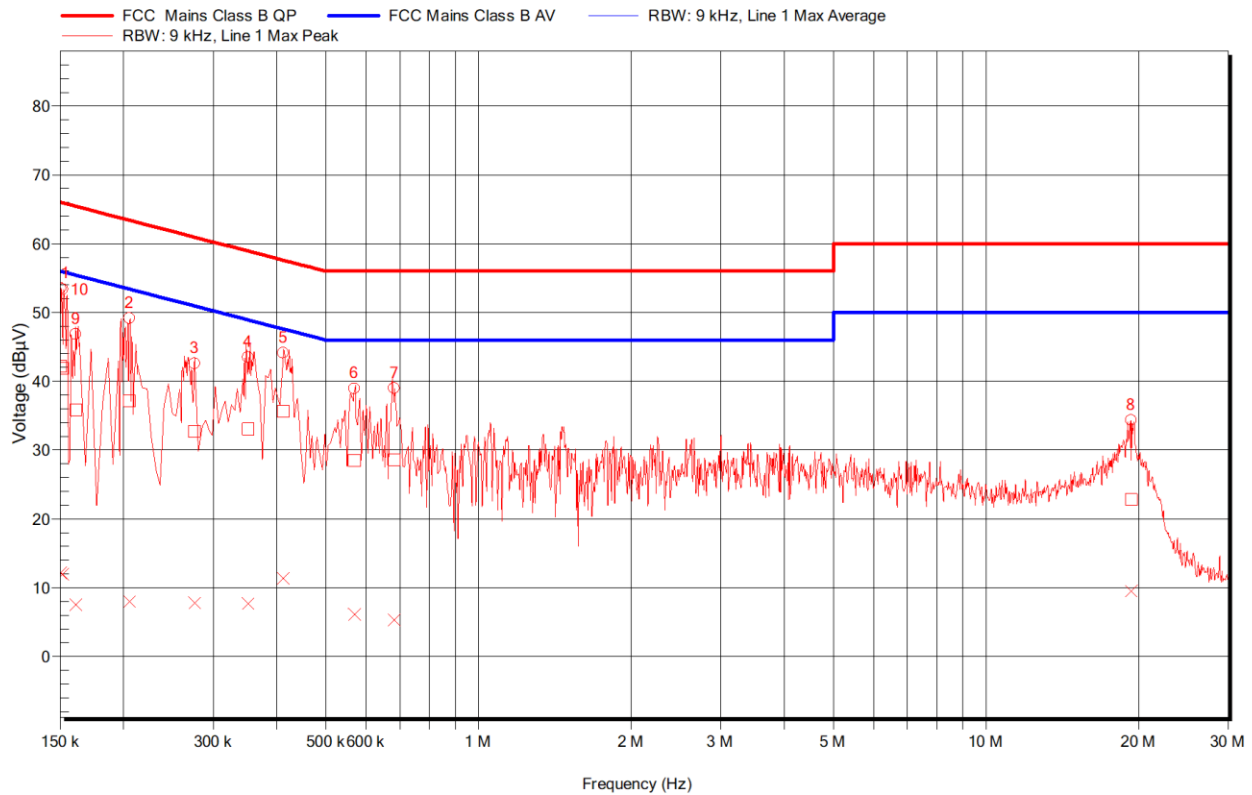


Figure 58: AC mains conducted emissions. 1MHz channel bandwidth, channel 2402MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.161	7.6	55.4	-47.8	Pass	35.9	65.4	-29.6	Pass
19.295	9.5	50.0	-40.5	Pass	22.8	60.0	-37.2	Pass
0.682	5.4	46.0	-40.7	Pass	28.6	56.0	-27.4	Pass
0.570	6.1	46.0	-39.9	Pass	28.5	56.0	-27.5	Pass
0.413	11.3	47.6	-36.3	Pass	35.7	57.6	-21.9	Pass
0.352	7.7	48.9	-41.2	Pass	33.1	58.9	-25.8	Pass
0.276	7.8	50.9	-43.1	Pass	32.7	60.9	-28.2	Pass
0.205	8.0	53.4	-45.4	Pass	37.2	63.4	-26.2	Pass
0.150	12.2	56.0	-43.8	Pass	42.2	66.0	-23.7	Pass
0.152	12.0	55.9	-43.9	Pass	41.8	65.9	-24.1	Pass

Table 18: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2402MHz - Live

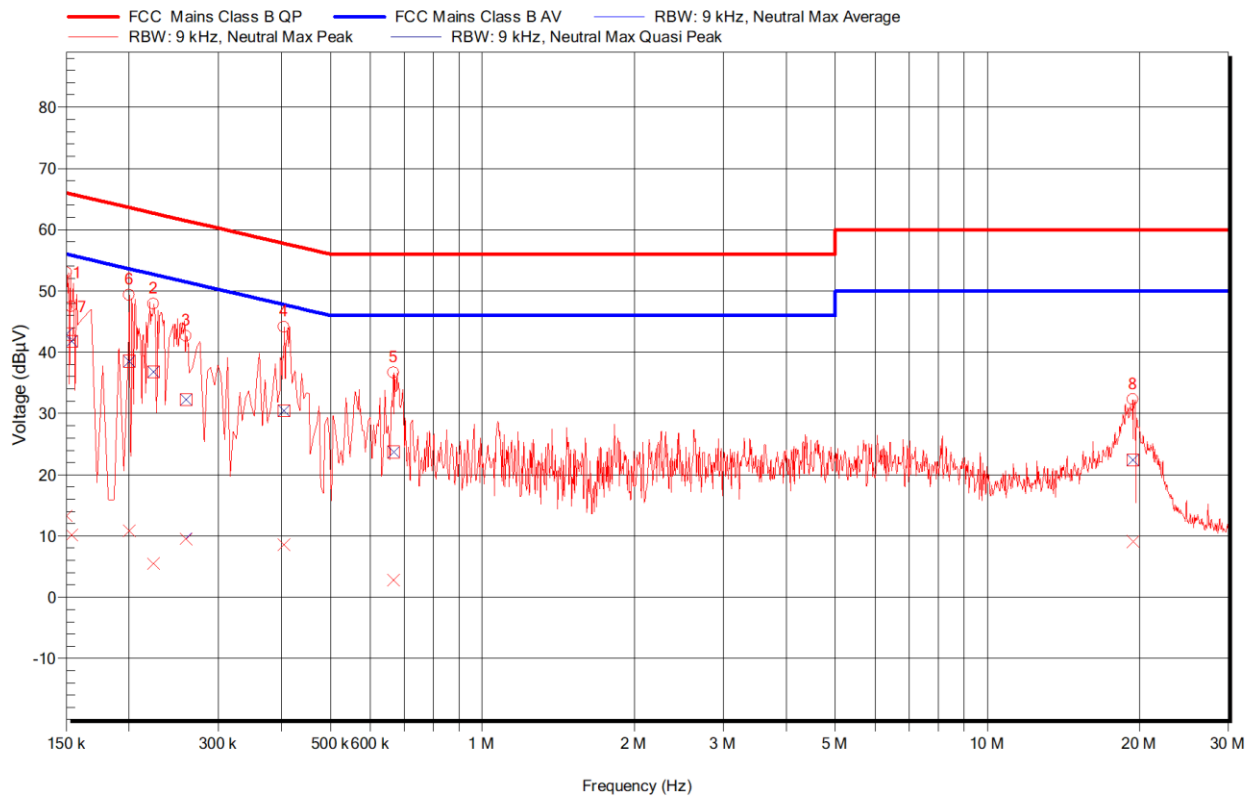


Figure 59: AC mains conducted emissions. 1MHz channel bandwidth, channel 2402MHz – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.150	13.2	56.0	-42.8	Pass	42.9	66.0	-23.1	Pass
0.233	5.5	52.7	-47.2	Pass	36.8	62.7	-25.9	Pass
0.259	9.5	51.5	-42.0	Pass	32.3	61.5	-29.2	Pass
0.405	8.6	47.8	-39.2	Pass	30.4	57.8	-27.3	Pass
0.668	2.8	46.0	-43.2	Pass	23.7	56.0	-32.3	Pass
0.200	10.8	53.6	-42.8	Pass	38.5	63.6	-25.1	Pass
0.154	10.2	55.8	-45.6	Pass	41.8	65.8	-24.1	Pass
19.399	9.1	50.0	-40.9	Pass	22.4	60.0	-37.6	Pass

Table 19: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2402MHz - Neutral

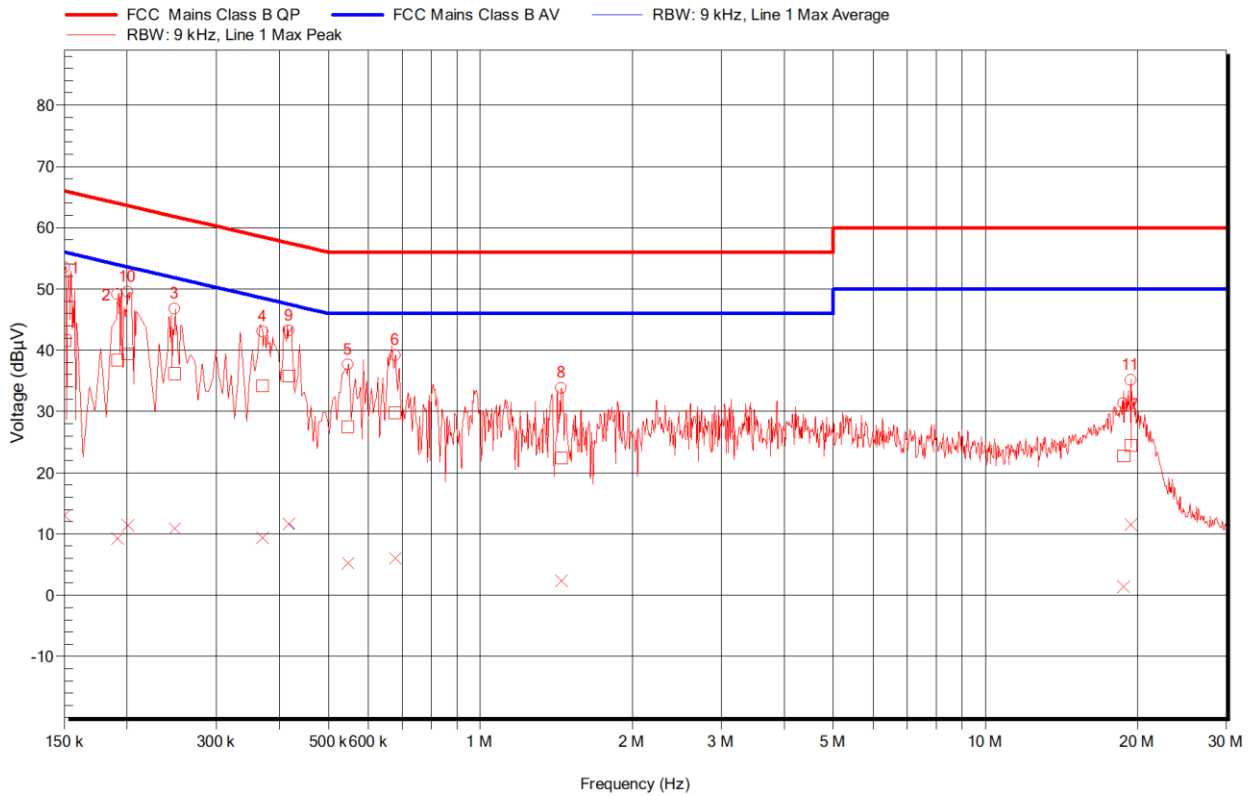


Figure 60: AC mains conducted emissions. 1MHz channel bandwidth, channel 2440MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.150	13.0	56.0	-43.0	Pass	41.5	66.0	-24.5	Pass
0.191	9.3	54.0	-44.7	Pass	38.4	64.0	-25.6	Pass
0.248	10.9	51.8	-40.9	Pass	36.2	61.8	-25.6	Pass
0.371	9.3	48.5	-39.1	Pass	34.2	58.5	-24.3	Pass
0.547	5.2	46.0	-40.8	Pass	27.6	56.0	-28.4	Pass
0.678	6.0	46.0	-40.0	Pass	29.7	56.0	-26.3	Pass
18.785	1.4	50.0	-48.6	Pass	22.8	60.0	-37.2	Pass
1.446	2.3	46.0	-43.7	Pass	22.4	56.0	-33.6	Pass
0.418	11.7	47.5	-35.8	Pass	35.8	57.5	-21.7	Pass
0.200	11.4	53.6	-42.2	Pass	39.4	63.6	-24.2	Pass
19.397	11.5	50.0	-38.5	Pass	24.4	60.0	-35.6	Pass

Table 20: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2440MHz - Live

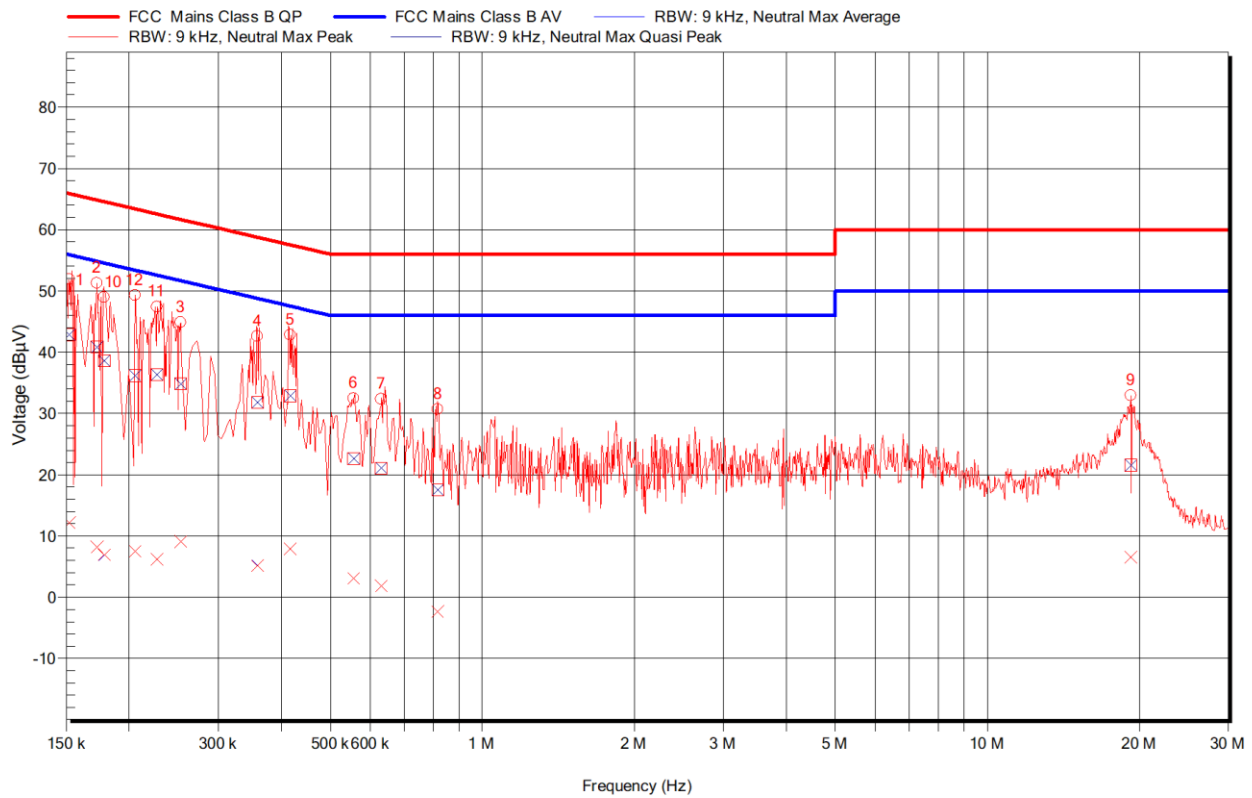


Figure 61: AC mains conducted emissions. 1MHz channel bandwidth, channel 2440MHz – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.152	12.2	55.9	-43.7	Pass	42.8	65.9	-23.0	Pass
0.173	8.2	54.8	-46.6	Pass	40.9	64.8	-24.0	Pass
0.253	9.1	51.7	-42.6	Pass	34.8	61.7	-26.9	Pass
0.358	5.2	48.8	-43.6	Pass	31.8	58.8	-27.0	Pass
0.417	7.9	47.5	-39.6	Pass	32.9	57.5	-24.6	Pass
0.556	3.1	46.0	-42.9	Pass	22.6	56.0	-33.4	Pass
0.631	1.9	46.0	-44.1	Pass	21.1	56.0	-35.0	Pass
0.816	-2.3	46.0	-48.3	Pass	17.5	56.0	-38.5	Pass
19.250	6.5	50.0	-43.5	Pass	21.6	60.0	-38.4	Pass
0.178	7.0	54.6	-47.6	Pass	38.6	64.6	-26.0	Pass
0.227	6.2	52.6	-46.3	Pass	36.4	62.6	-26.2	Pass
0.205	7.5	53.4	-45.9	Pass	36.2	63.4	-27.2	Pass

Table 21: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2440MHz - Neutral

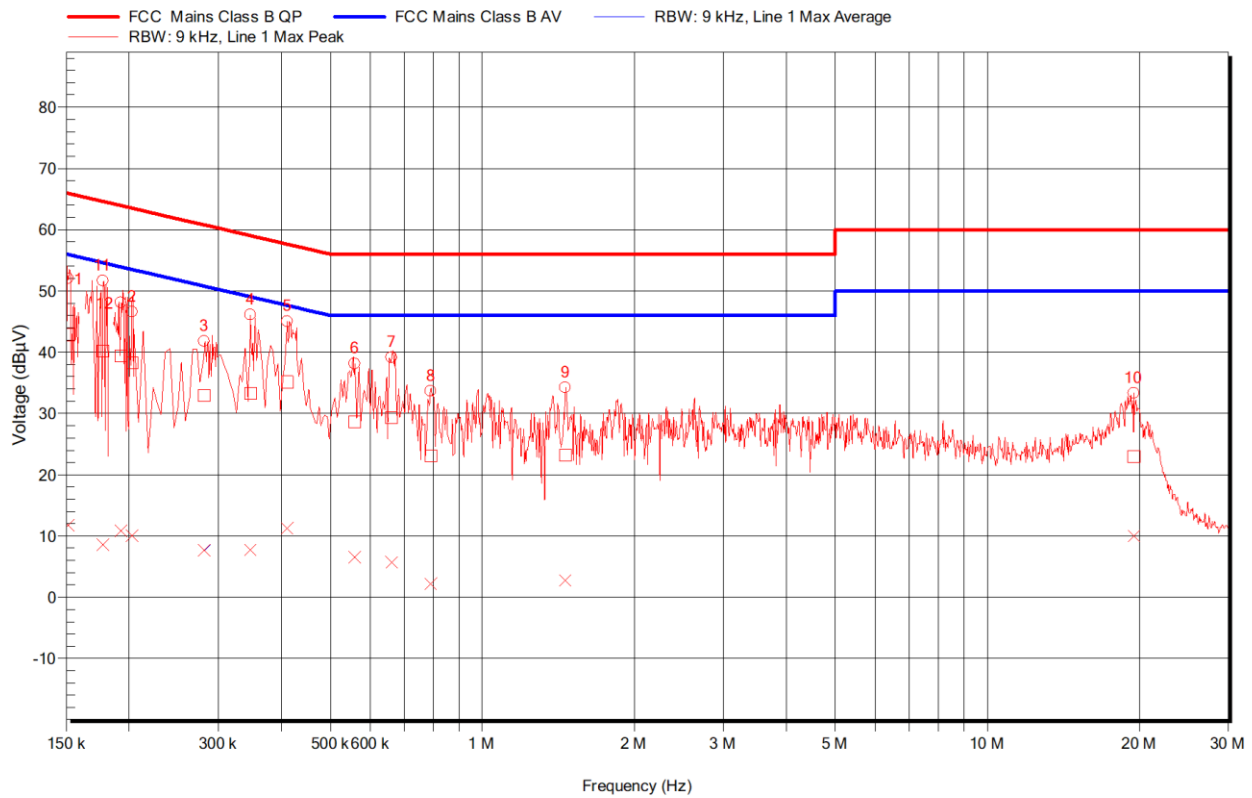


Figure 62: AC mains conducted emissions. 1MHz channel bandwidth, channel 2480MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.151	11.7	55.9	-44.2	Pass	42.8	65.9	-23.1	Pass
0.203	10.1	53.5	-43.5	Pass	38.2	63.5	-25.3	Pass
0.281	7.6	50.8	-43.2	Pass	33.0	60.8	-27.8	Pass
0.347	7.7	49.0	-41.3	Pass	33.3	59.0	-25.8	Pass
0.411	11.3	47.6	-36.4	Pass	35.2	57.6	-22.5	Pass
0.559	6.5	46.0	-39.5	Pass	28.7	56.0	-27.3	Pass
0.661	5.7	46.0	-40.3	Pass	29.3	56.0	-26.7	Pass
0.790	2.2	46.0	-43.8	Pass	23.1	56.0	-32.9	Pass
1.460	2.7	46.0	-43.3	Pass	23.2	56.0	-32.8	Pass
19.490	10.0	50.0	-40.0	Pass	22.9	60.0	-37.1	Pass
0.177	8.6	54.6	-46.0	Pass	40.2	64.6	-24.4	Pass
0.192	10.8	53.9	-43.1	Pass	39.4	63.9	-24.6	Pass

Table 22: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2480MHz - Live

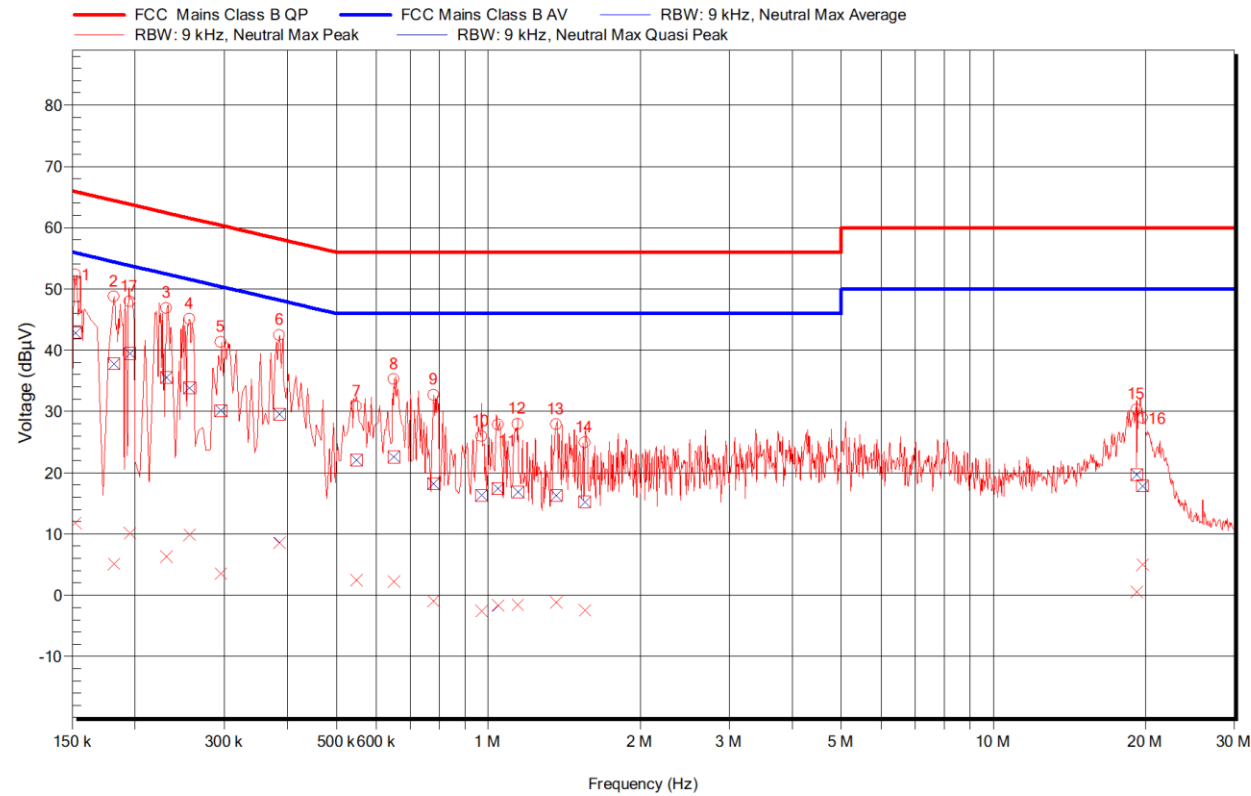


Figure 63: AC mains conducted emissions. 1MHz channel bandwidth, channel 2480MHz – Neutral

Frequency (MHz)	Average (dB μ V)	Average Limit (dB μ V)	Average Difference (dB)	Average Status	Quasi-Peak (dB μ V)	Quasi-Peak Limit (dB μ V)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.152	11.8	55.9	-44.1	Pass	42.8	65.9	-23.1	Pass
0.182	5.1	54.4	-49.3	Pass	37.8	64.4	-26.6	Pass
0.321	6.3	52.4	-46.1	Pass	35.6	62.4	-26.8	Pass
0.256	9.8	51.6	-41.7	Pass	33.8	61.6	-27.7	Pass
0.295	3.5	50.4	-46.9	Pass	30.1	60.4	-30.3	Pass
0.386	8.6	48.2	-39.6	Pass	29.6	58.2	-28.6	Pass
0.548	2.5	46.0	-43.5	Pass	22.1	56.0	-33.9	Pass
0.650	2.2	46.0	-43.8	Pass	22.6	56.0	-33.4	Pass
0.780	-0.9	46.0	-46.9	Pass	18.2	56.0	-37.8	Pass
0.969	-2.5	46.0	-48.5	Pass	16.3	56.0	-39.7	Pass
1.046	-1.7	46.0	-47.7	Pass	17.4	56.0	-38.6	Pass
1.144	-1.5	46.0	-47.5	Pass	16.9	56.0	-39.1	Pass
1.363	-1.1	46.0	-47.1	Pass	16.2	56.0	-39.8	Pass
1.554	-2.4	46.0	-48.4	Pass	15.2	56.0	-40.8	Pass
19.226	0.5	50.0	-49.5	Pass	19.7	60.0	-40.3	Pass
19.75	5.0	50.0	-45.0	Pass	17.9	60.0	-42.1	Pass
0.195	10.1	53.8	-43.7	Pass	39.5	63.8	-24.4	Pass

Table 23: Electric Field Emissions Peaks, 150kHz to 30MHz – 1MHz channel bandwidth, channel 2480MHz - Neutral

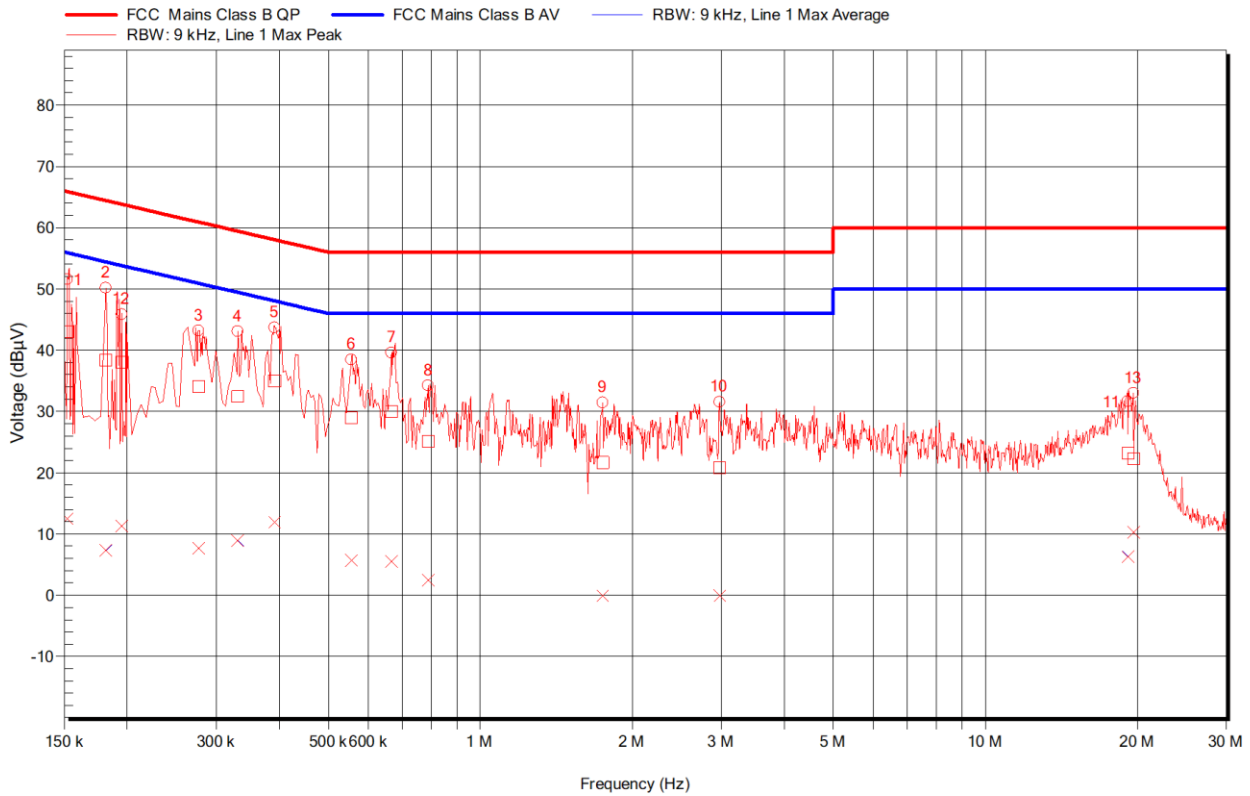


Figure 64: AC mains conducted emissions. 2MHz channel bandwidth, channel 2402MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.152	12.5	55.9	-43.4	Pass	43.0	65.9	-22.9	Pass
0.182	7.3	54.4	-47.1	Pass	38.4	64.4	-26.0	Pass
0.227	7.6	50.9	-43.3	Pass	34.1	60.9	-26.8	Pass
0.331	8.9	49.4	-40.5	Pass	32.5	59.4	-27.0	Pass
0.392	11.9	48.0	-36.1	Pass	35.0	58.0	-23.0	Pass
0.555	5.7	46.0	-40.3	Pass	28.9	56.0	-27.1	Pass
0.668	5.5	46.0	-40.5	Pass	30.0	56.0	-26.0	Pass
0.788	2.4	46.0	-43.6	Pass	25.1	56.0	-30.9	Pass
1.747	-0.1	46.0	-46.1	Pass	21.7	56.0	-34.3	Pass
2.978	-0.1	46.0	-46.1	Pass	20.8	56.0	-35.2	Pass
19.145	6.3	50.0	-43.7	Pass	23.2	60.0	-36.9	Pass
0.195	11.3	53.8	-42.5	Pass	38.0	63.8	-25.8	Pass
19.644	10.3	50.0	-39.7	Pass	22.3	60.0	-37.7	Pass

Table 24: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2402MHz - Live

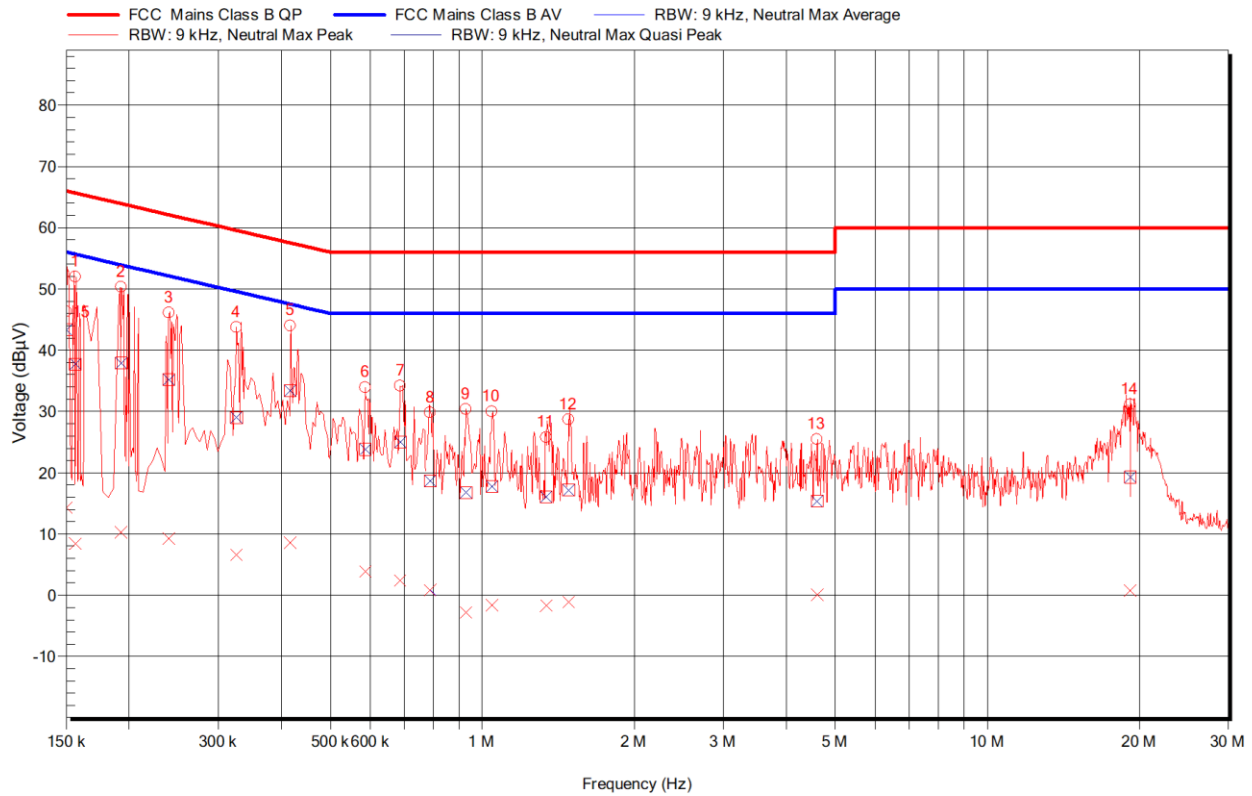


Figure 65: AC mains conducted emissions. 2MHz channel bandwidth, channel 2402MHz – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.156	8.4	55.7	-47.2	Pass	37.7	65.7	-27.9	Pass
0.193	10.3	53.9	-43.6	Pass	37.9	63.9	-26.0	Pass
0.240	9.3	52.1	-42.9	Pass	35.2	62.1	-26.9	Pass
0.326	6.6	49.6	-42.9	Pass	29.0	59.6	-30.5	Pass
0.417	8.6	47.5	-38.9	Pass	33.4	57.5	-24.1	Pass
0.587	3.9	46.0	-42.2	Pass	23.8	56.0	-32.2	Pass
0.687	2.4	46.0	-43.6	Pass	25.0	56.0	-31.0	Pass
0.788	0.8	46.0	-45.2	Pass	18.7	56.0	-37.3	Pass
0.928	-2.8	46.0	-48.8	Pass	16.8	56.0	-39.2	Pass
1.045	-1.7	46.0	-47.7	Pass	17.8	56.0	-38.2	Pass
1.338	-1.7	46.0	-47.7	Pass	16.1	56.0	-39.9	Pass
1.482	-1.1	46.0	-47.1	Pass	17.2	56.0	-38.8	Pass
4.597	0.1	46.0	-45.9	Pass	15.3	56.0	-40.7	Pass
19.167	0.8	50.0	-49.2	Pass	19.3	60.0	-40.7	Pass
0.150	14.3	56.0	-41.7	Pass	43.3	66.0	-22.7	Pass

Table 25: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2402MHz - Neutral

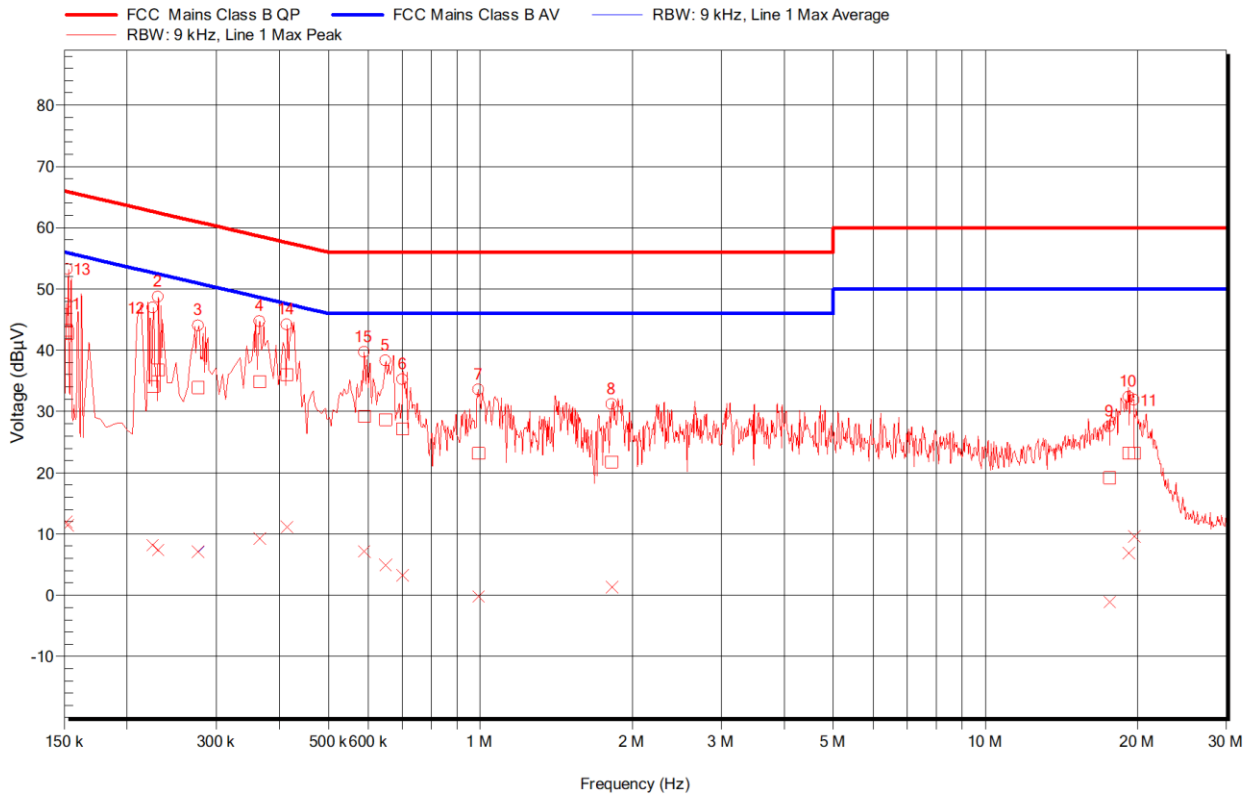


Figure 66: AC mains conducted emissions. 2MHz channel bandwidth, channel 2440MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.151	12.0	55.9	-44.0	Pass	43.3	65.9	-22.7	Pass
0.230	7.4	52.4	-45.0	Pass	36.8	62.4	-25.7	Pass
0.276	7.1	50.9	-43.8	Pass	33.9	60.9	-27.0	Pass
0.366	9.3	48.6	-39.3	Pass	34.9	58.6	-23.7	Pass
0.650	4.9	46.0	-41.1	Pass	28.7	56.0	-27.4	Pass
0.701	3.2	46.0	-42.8	Pass	27.1	56.0	-28.9	Pass
0.992	-0.2	46.0	-46.2	Pass	23.2	56.0	-32.8	Pass
1.819	1.3	46.0	-44.7	Pass	21.8	56.0	-34.2	Pass
17.630	-1.1	50.0	-51.1	Pass	19.2	60.0	-40.8	Pass
19.240	6.9	50.0	-43.1	Pass	23.2	60.0	-36.8	Pass
19.700	9.6	50.0	-40.4	Pass	23.2	60.0	-36.8	Pass
0.225	8.2	52.6	-44.4	Pass	34.1	62.6	-28.5	Pass
0.152	11.4	55.9	-44.5	Pass	42.7	65.9	-23.2	Pass
0.414	11.1	47.6	-36.4	Pass	36.0	57.6	-21.6	Pass
0.589	7.1	46.0	-38.9	Pass	29.1	56.0	-26.9	Pass

Table 26: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2440MHz - Live

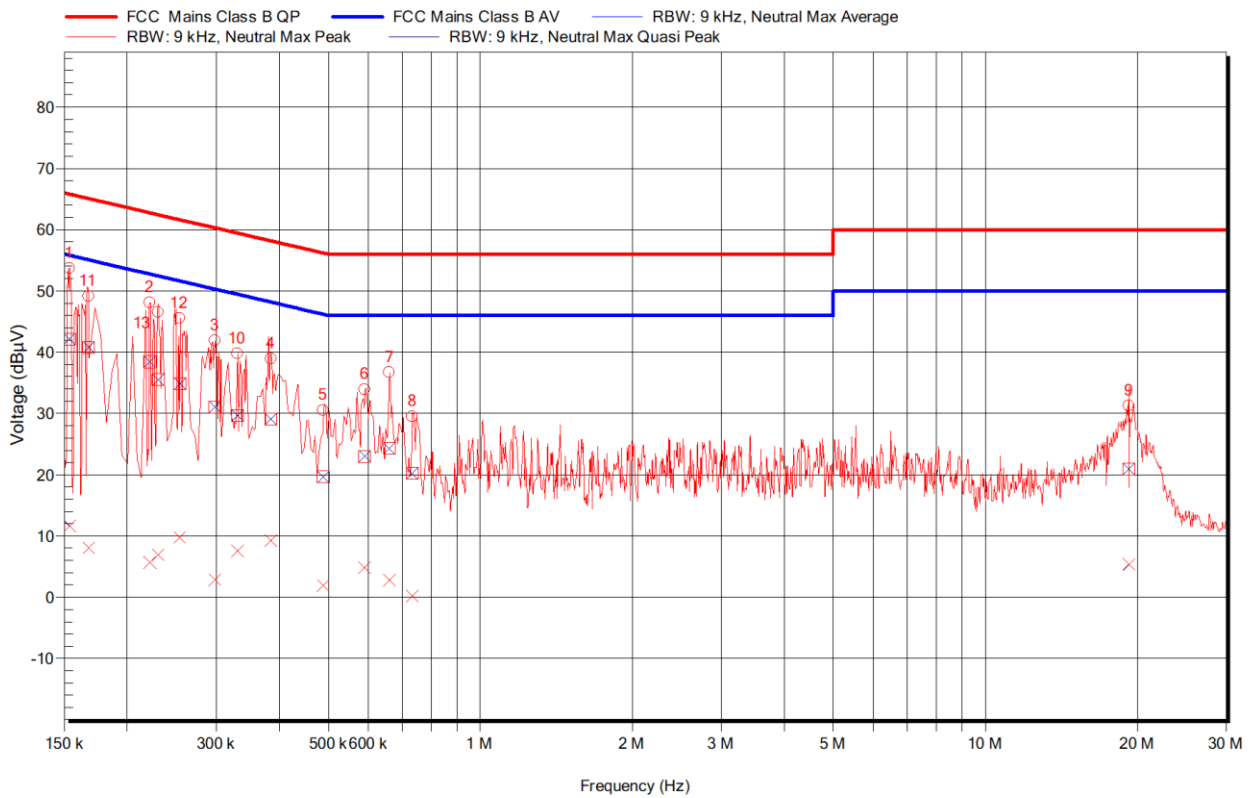


Figure 67: AC mains conducted emissions. 2MHz channel bandwidth, channel 2440MHz – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.154	11.6	55.8	-44.2	Pass	42.2	65.8	-23.6	Pass
0.222	5.6	52.8	-47.1	Pass	38.4	62.8	-24.3	Pass
0.298	2.8	50.3	-47.5	Pass	31.0	60.3	-29.3	Pass
0.385	9.3	48.2	-38.9	Pass	29.1	58.2	-29.1	Pass
0.488	1.9	46.2	-44.3	Pass	19.7	56.2	-36.5	Pass
0.590	4.8	46.0	-41.2	Pass	23.0	56.0	-33.0	Pass
0.660	2.8	46.0	-43.2	Pass	24.3	56.0	-31.7	Pass
0.733	0.2	46.0	-45.8	Pass	20.2	56.0	-35.8	Pass
19.242	5.4	50.0	-44.6	Pass	20.9	60.0	-39.1	Pass
0.330	7.6	49.4	-41.9	Pass	29.7	59.4	-29.7	Pass
0.168	8.1	55.1	-47.0	Pass	40.8	65.1	-24.3	Pass
0.254	9.8	51.6	-41.8	Pass	34.9	61.6	-26.8	Pass
0.230	6.9	52.4	-45.5	Pass	35.5	62.4	-26.9	Pass

Table 27: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2440MHz - Neutral

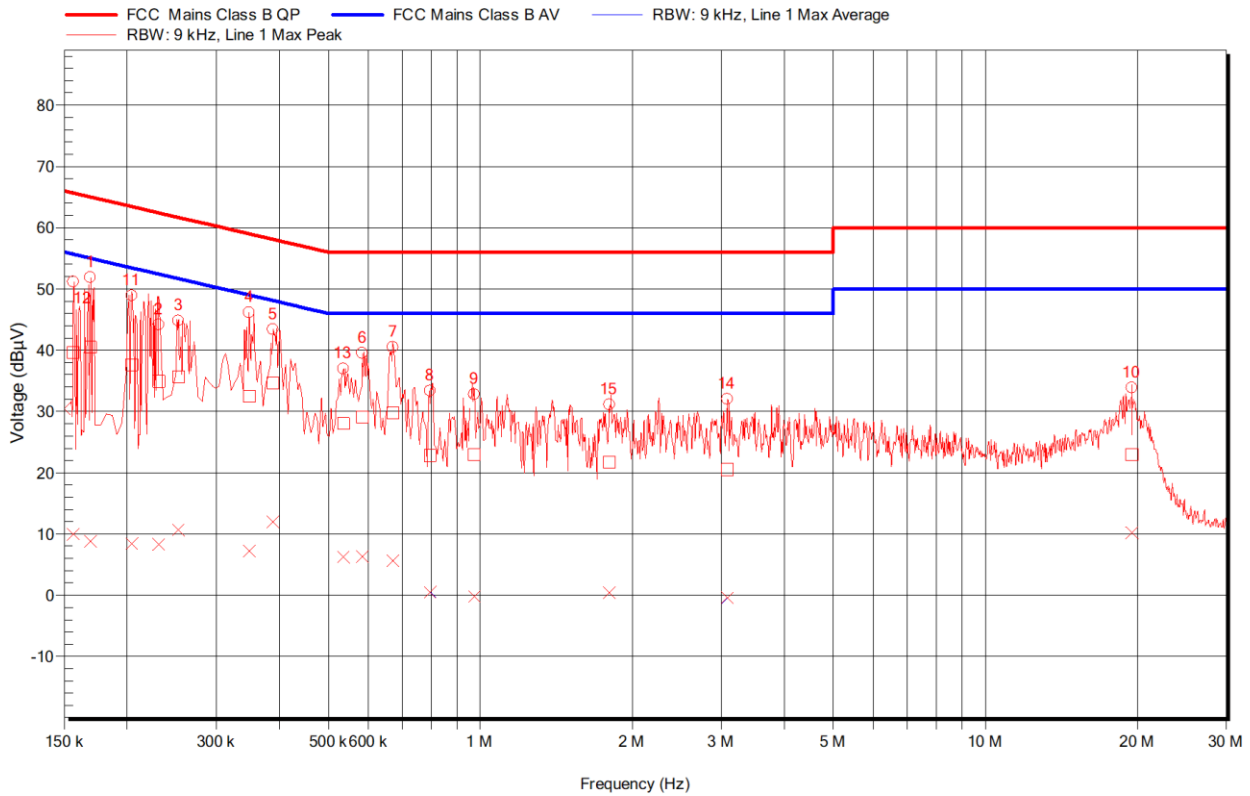


Figure 68: AC mains conducted emissions. 2MHz channel bandwidth, channel 2480MHz – Live

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.169	8.8	55.0	-46.2	Pass	40.5	65.0	-24.5	Pass
0.231	8.3	52.4	-44.1	Pass	34.9	62.4	-27.5	Pass
0.252	10.7	51.7	-41.0	Pass	35.7	61.7	-26.0	Pass
0.348	7.2	49.0	-41.8	Pass	32.5	59.0	-26.5	Pass
0.389	11.9	48.1	-36.2	Pass	34.6	58.1	-23.5	Pass
0.584	6.3	46.0	-39.7	Pass	29.1	56.0	-26.9	Pass
0.671	5.6	46.0	-40.4	Pass	29.8	56.0	-26.2	Pass
0.795	0.5	46.0	-45.5	Pass	22.8	56.0	-33.2	Pass
0.973	-0.2	46.0	-46.2	Pass	23.0	56.0	-33.0	Pass
19.507	10.1	50.0	-39.9	Pass	22.9	60.0	-37.1	Pass
0.204	8.4	53.4	-45.0	Pass	37.6	63.4	-25.8	Pass
0.156	9.9	55.7	-45.7	Pass	39.6	65.7	-26.1	Pass
0.536	6.2	46.0	-39.8	Pass	28.0	56.0	-28.0	Pass
3.085	-0.4	46.0	-46.4	Pass	20.5	56.0	-35.5	Pass
1.801	0.4	46.0	-45.6	Pass	21.8	56.0	-34.2	Pass

Table 28: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2480MHz - Live

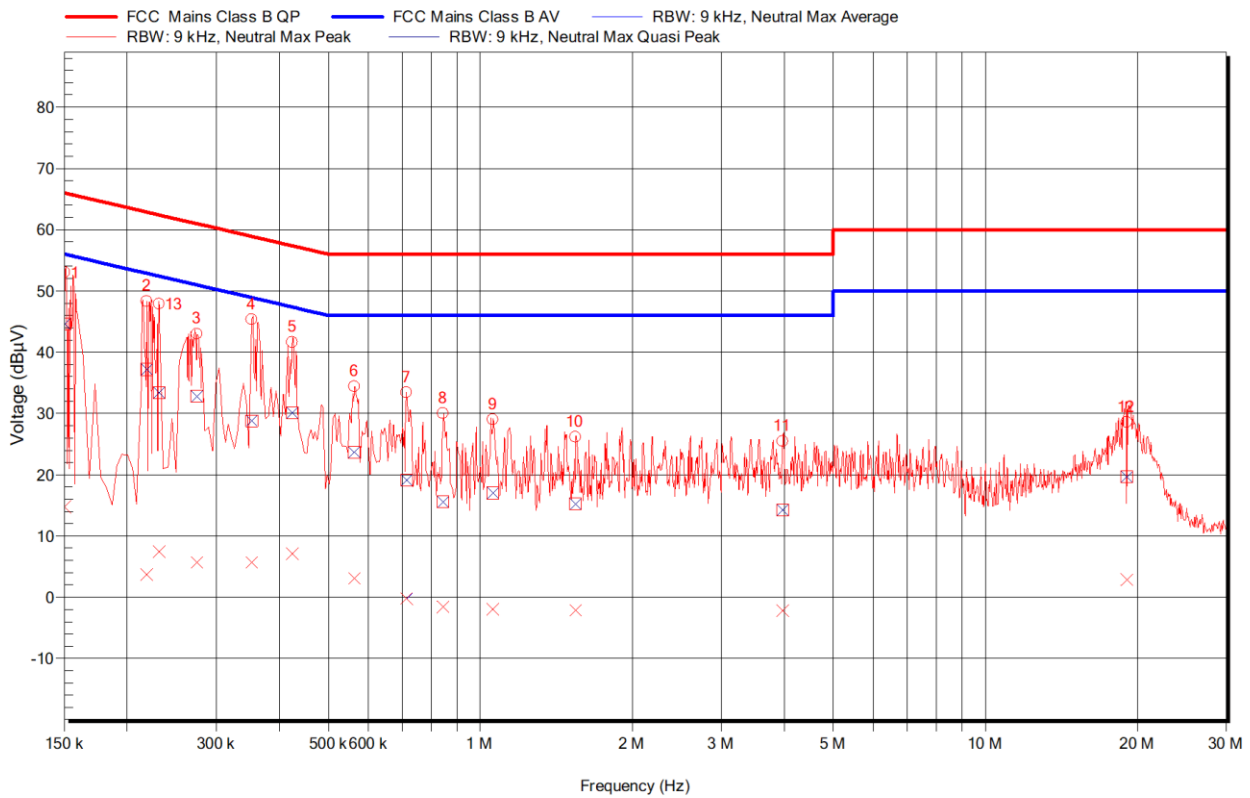


Figure 69: AC mains conducted emissions. 2MHz channel bandwidth, channel 2480MHz – Neutral

Frequency (MHz)	Average (dBμV)	Average Limit (dBμV)	Average Difference (dB)	Average Status	Quasi-Peak (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Difference (dB)	Quasi-Peak Status
0.150	14.8	56.0	-41.2	Pass	44.6	66.0	-21.3	Pass
218.4	3.7	52.9	-49.2	Pass	37.2	62.9	-25.7	Pass
0.275	5.7	51.0	-45.3	Pass	32.8	61.0	-28.2	Pass
0.353	5.7	48.9	-43.2	Pass	28.8	58.9	-30.1	Pass
0.425	7.1	47.4	-40.3	Pass	30.1	57.4	-27.2	Pass
0.563	3.1	46.0	-42.9	Pass	23.7	56.0	-32.3	Pass
0.714	-0.2	46.0	-46.2	Pass	19.1	56.0	-36.9	Pass
0.843	-1.6	46.0	-47.6	Pass	15.6	56.0	-40.4	Pass
1.058	-2.0	46.0	-48.0	Pass	17.0	56.0	-39.0	Pass
1.543	-2.1	46.0	-48.1	Pass	15.2	56.0	-40.8	Pass
3.969	-2.2	46.0	-48.2	Pass	14.3	56.0	-41.8	Pass
19.053	2.9	50.0	-47.1	Pass	19.7	60.0	-40.4	Pass
0.231	7.5	52.4	-45.0	Pass	33.4	62.4	-29.0	Pass

Table 29: Electric Field Emissions Peaks, 150kHz to 30MHz – 2MHz channel bandwidth, channel 2480MHz - Neutral

10.5.1 Example calculation

This correction factors required consists of LISN Insertion loss (IL), Cable loss (CL) and Transient Limiter Loss (TL)

The Actual Signal Level (ASL) is calculated as follows:

$$\text{ASL (dB}\mu\text{V)} = \text{Indicated Signal Level (dB}\mu\text{V)} + \text{IL (dB)} + \text{CL (dB)} + \text{TL (dB)}$$

10.5.2 Sample Data

The Quasi-Peak level at 0.231 MHz

$$\text{ASL (dB}\mu\text{V)} = 33.40\text{B}\mu\text{V} = 23.19\text{B}\mu\text{V} + 0.15\text{dB} + 0.00\text{dB} + 10.06\text{dB}$$

Appendix A EUT Test Photos

Test set up photographs are supplied separately.

Appendix B Test Equipment List

Conducted Emissions from Antenna Port

Item	Serial No.	Last Calibration Date	Calibration Interval
R&S ESW44 EMI Receiver	C0751	10 th July 2023	12 Months
Kikusui PCR200M	C0198	-	-

Radiated Emissions Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	C0471	6 th December 2022 (NSA) (Svswr)	36 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	N/A	N/A
R & S ESR26	C0502	8 th August 2023	12 Months
Rohde & Schwarz ESW 44	C0751	10 th July 2023	12 Months
Kikusui PCR200M	C0198	-	-
Teseq CBL6112D Bilog Antenna	C0506	13 th January 2023	36 Months
HF 46 Cable	21068.01.14.001	7 th December 2023	12 Months
HF 27 Cable	19149.03.13.004	13 th December 2023	12 Months
HF 35 Cable	19149.02.13.003	13 th December 2023	12 Months
Schwarzbeck STLP9148 Stacked log periodic Antenna	C0626	12 th April 2022	36 Months
Micro-Tronics 2.4GHz band reject filter	C0473	7 th December 2023	12 Months
BONN BLMA 0118-M Preamplifier	C0702	7 th July 2023	12 Months
ETS Lingren 3116C-PA Horn Antenna 18-40GHz	C0433	28 th September 2022	36 Months

AC Mains conducted emissions equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Rohde & Schwarz ESR 7	C0499	6 th April 2023	12 Months
Rohde & Schwarz ESH3-Z5	78119	9 th January 2024	12 Months
Cable	LF3	21 st December 2023	12 Months
Cable	J7	21 st December 2023	12 Months
Cable	J9	21 st December 2023	12 Months
10dB Transient limiter	34718	5 th January 2024	12 Months
Kikusui PCR2000M	C0198	N/A	N/A

-----END OF REPORT-----