

Test Report for the FCC and ISED Testing of an AirGlu2 to FCC Rule 47CFR 15.247 and ISED RSS-247 for Timecode Systems

Test Report number: C14485TR1

Project number: B5200

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Issue	Description						Issue by	Date
1	Copy 1		Copy 2		PDF	X	MR	3 rd February 2022

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Test Report Change History

Issue	Date	Modification Details
1	3 rd February 2022	First Issue
2		
3		
4		
5		
6		
7		
8		
9		
10		

Section 1 Test Location

All testing was performed at;

Eurofins York	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 York latest accreditation schedule can be found at:

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

Eurofins York 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 York Castleford Laboratory is recognised by ISED for certification testing.

ISED Assigned Code: 22959

Section 2 Customer Information

Company name	Timecode Systems
Address	Unit 6, Elgar Business Centre
	Mosely Road, Hallow
	Worcester
	WR2 6NJ
	United Kingdom
Contact	Paul Scurrell
Email	Paul.scurrell@atomos.com

Section 3 Equipment Details

3.1 Equipment Under Test (EUT)

Date received:	17 th November 2021		
EUT name:	AirGlu2		
PMN:	AirGlu2		
HVIN:	AirGlu2		
FVIN:	V1.00		
FCC ID:	AYV-AGLU02		
ISED number:	10427A-AGLU02		
Serial no:	00000001		
EUT description:	A transmitter/receiver module which provides wireless sync capabilities to video and audio devices. The unit contains the following radio technologies: Bluetooth Low Energy – 2.4GHz, SRD - 863.1-869.9 MHz		
Antenna	External via SMA connector. TG.09.0113, Penta-band Cellular Hinged SMA Male Monopole		
Transmission	Digital Transmission System (DTS) Bluetooth Low Energy (BLE)		
Modulation scheme	2GFSK		
Operating frequency band	2400MHz to 2483.5MHz		
No of units tested:	One		
EUT power:	3.3V via USB port		
Highest internal frequency:	2.480GHz		
Size of EUT (m)	Width: 120 mm	Depth: 85 mm	Height: 35 mm
Mode/s of operation	Continuous transmit of packetised data at top, middle and bottom channels. Channels used: 2402MHz, 2440MHz and 2480MHz		
Modifications incorporated during testing:	None		

Ports and Cables	Cable Length	Screened/ unscreened	Connected to
USB cable	1m	unscreened	PC
5Vdc supply cable	5m	unscreened	DC power supply

3.2 EUT Photographs

Photographs are supplied separately.

3.3 Configuration of EUT

The apparatus was supplied in one single possible configuration.

3.4 EUT Monitoring/Auxiliary Equipment

None.

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

For Canada

Regulation / Test Standard	<p>RSS-247 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices Issue 2 February 2017</p> <p>And,</p> <p>RSS-Gen — General Requirements for Compliance of Radio Apparatus Issue 5 April 2018 +A1 March 2019 +A2 February 2021</p>
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Requirement	ISED Regulation	Comments	Results Summary
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
Receiver radiated spurious 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
704992	Test Site Validation Requirements above 1 GHz.	12/06/2015
149045	Comparison Noise Emitter (CNE), reference noise source, .pdf	05/04/2007
913591	Measurement of radiated emissions at the band-edge for a Part 15 RF Device	04/05/2017
934285	Comparison Noise Emitters (CNE), test equipment, Broadband.pdf	05/04/2007

4.2 Compliance Statement

The AirGlu2, 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 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 +/- 5.85dB for the frequency range 30MHz to 1GHz +/- 4.64dB for the frequency range from 1GHz to 6GHz +/- 4.96dB for the frequency range from 6GHz to 18GHz
Measurement Uncertainty Conducted tests	± 1.4 dB

5.2 Procedure and Test Software Version

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

Eurofins York test procedure (30MHz to 1GHz)	CEP23b Issue 8
Eurofins York test procedure (1GHz to 40GHz)	CEP64b Issue 8
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)	Limit (dB μ V/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**

28th January 2022

5.3.4 Test Area

LAB 1 (SAC)

5.3.5 Tested by

M Dyster

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.

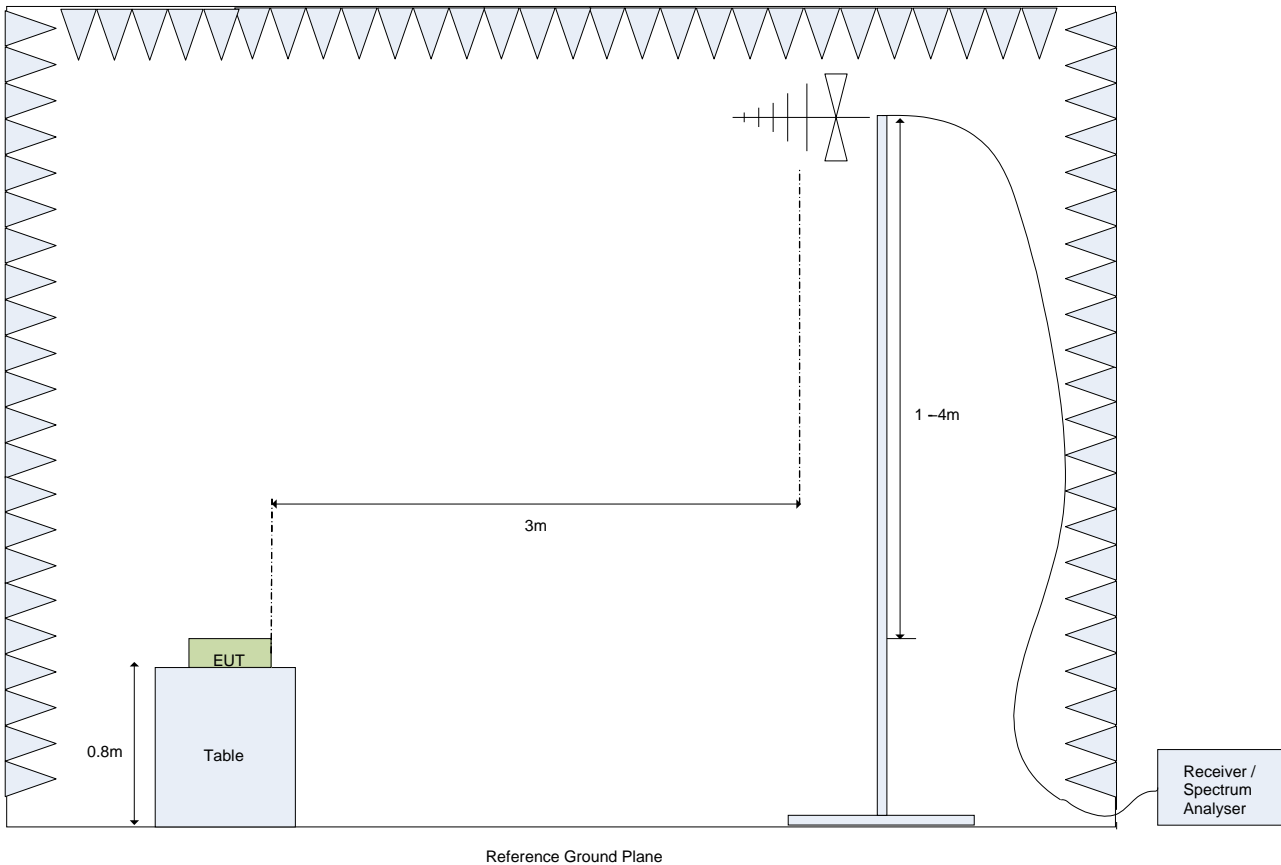


Figure 5.3.6.1: Test Setup for E-Field Measurements from 30MHz to 1GHz

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 at the same frequency on the following channels: 2402MHz, 2440MHz and 2480MHz

The equipment under test was pre-scanned using peak detection when operating on all three channels. Final measurements were performed with the equipment under test operating on 2402MHz

5.3.7 Electric field emissions, 30MHz to 1GHz

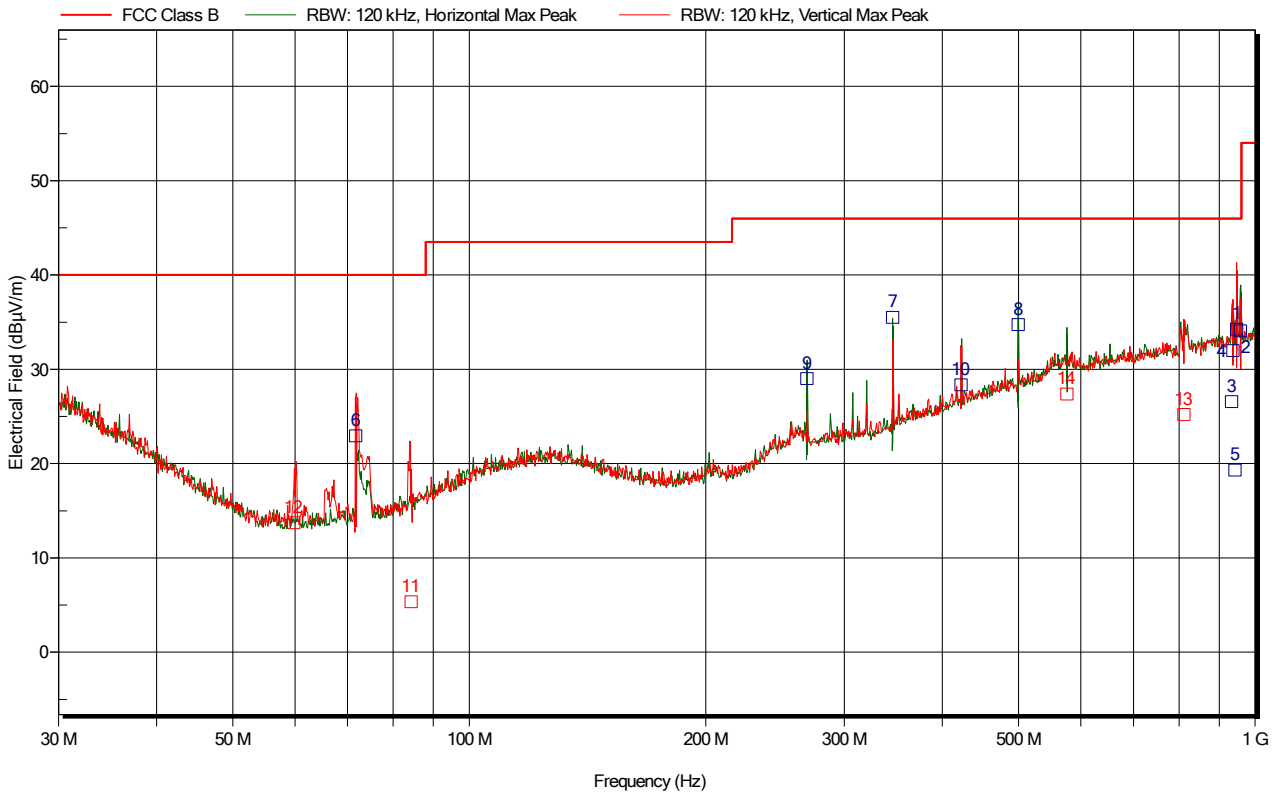


Figure 5.3.7.1: Electric field emissions Plot, 30MHz to 1GHz, 2402MHz Operation

Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	Quasi-Peak Status	Angle	Height	Polarization
MHz	dB μ V/m	dB μ V/m	dB		degrees	m	
59.802	13.7	40	-26.3	Pass	225	1.1	Vertical
71.664	22.9	40	-17.1	Pass	45	2.1	Vertical
84.360	5.4	40	-34.6	Pass	55	2.0	Vertical
268.806	29.0	46	-17.0	Pass	355	1.0	Horizontal
345.600	35.5	46	-10.5	Pass	205	1.0	Horizontal
422.406	28.3	46	-17.7	Pass	180	1.4	Vertical
499.200	34.7	46	-11.3	Pass	5	1.9	Horizontal
575.988	27.4	46	-18.6	Pass	5	1.5	Horizontal
811.638	25.2	46	-20.8	Pass	335	1.7	Vertical
932.940	26.6	46	-19.4	Pass	355	3.5	Vertical
936.816	32.0	46	-14.0	Pass	160	2.9	Vertical
942.720	19.3	46	-26.7	Pass	230	1.5	Horizontal
947.190	34.2	46	-11.8	Pass	290	1.9	Vertical
958.008	34.1	46	-11.9	Pass	180	1.3	Horizontal

Table 5.3.7.1 Electric Field Emissions Peaks, 30MHz to 1GHz. 2402MHz Operation

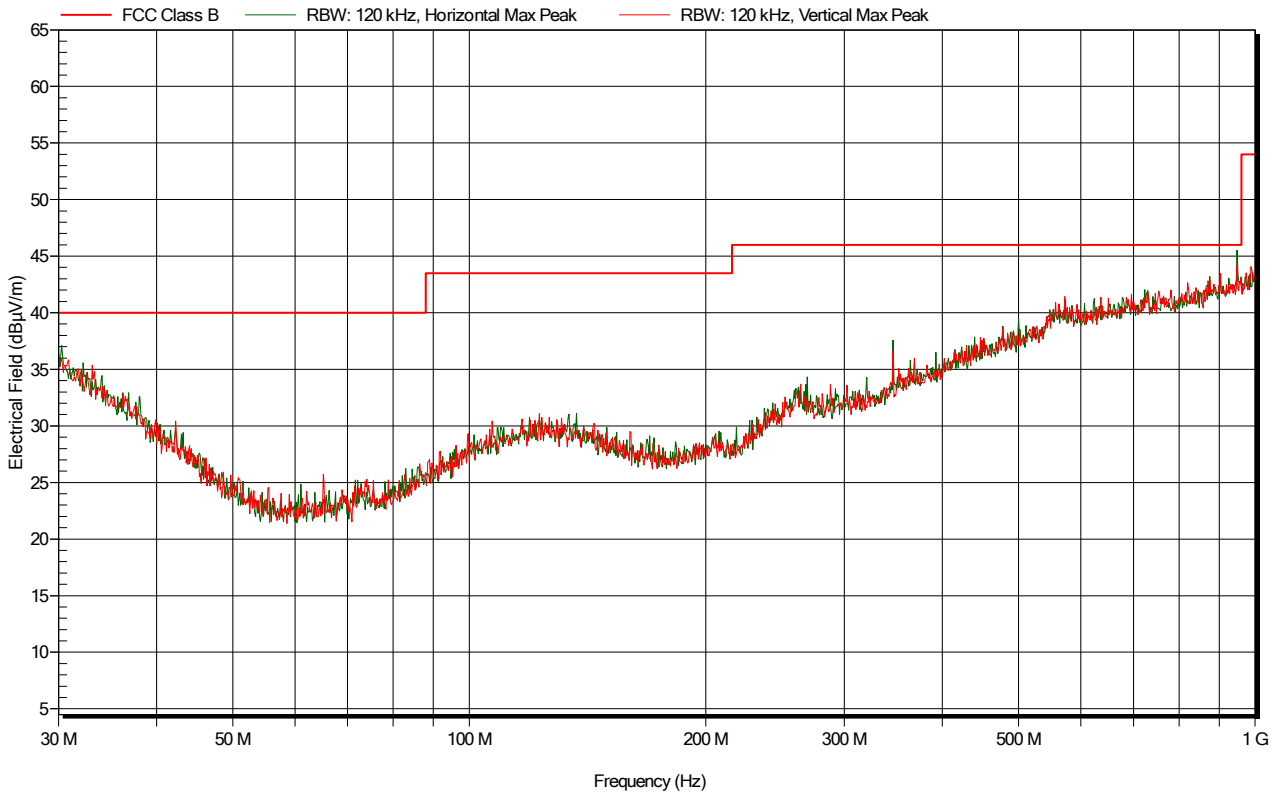


Figure 5.3.7.2: Electric field emissions Plot, 30MHz to 1GHz, Operation on 2440MHz - Peak detector scan

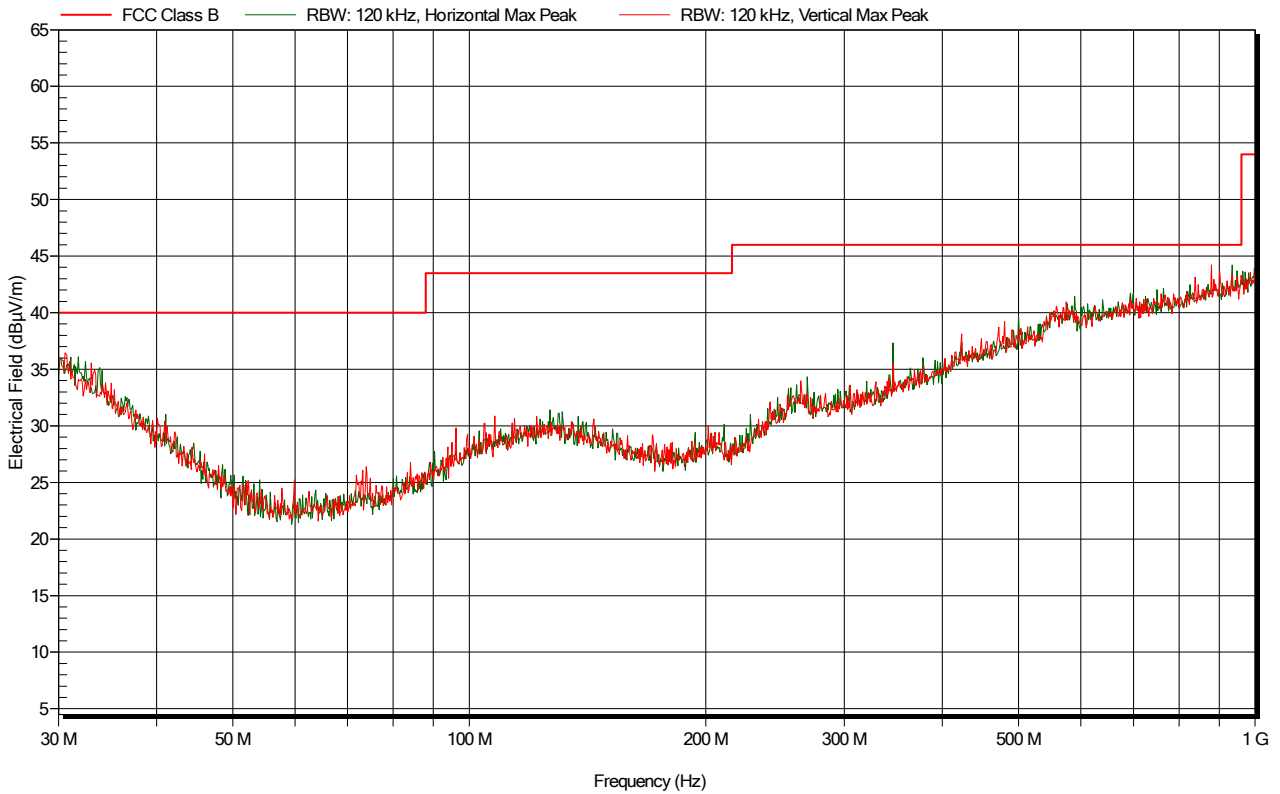


Figure 5.3.7.3: Electric field emissions Plot, 30MHz to 1GHz, Operation on 2480MHz - Peak detector scan

5.3.8 Example field strength calculation

Field strength (FS) is calculated as follows:

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

5.3.9 Sample Data

From Figure 5.3.7.1, table 5.3.7.1, the Quasi-Peak level at 557.988MHz is calculated as follows:

$$\text{FS (dB}\mu\text{V/m)} = 0.3(\text{dB}\mu\text{V}) + 24.6(\text{dB/m}) + 2.5 (\text{dB}) = 27.4 \text{ dB}\mu\text{V/m}$$

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

18th January 2022

5.4.5 Test Area

LAB 1 (SAC)

5.4.6 Tested by

M Dyster

5.4.7 Test Setup

The EUT was configured in the SAC on an 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.

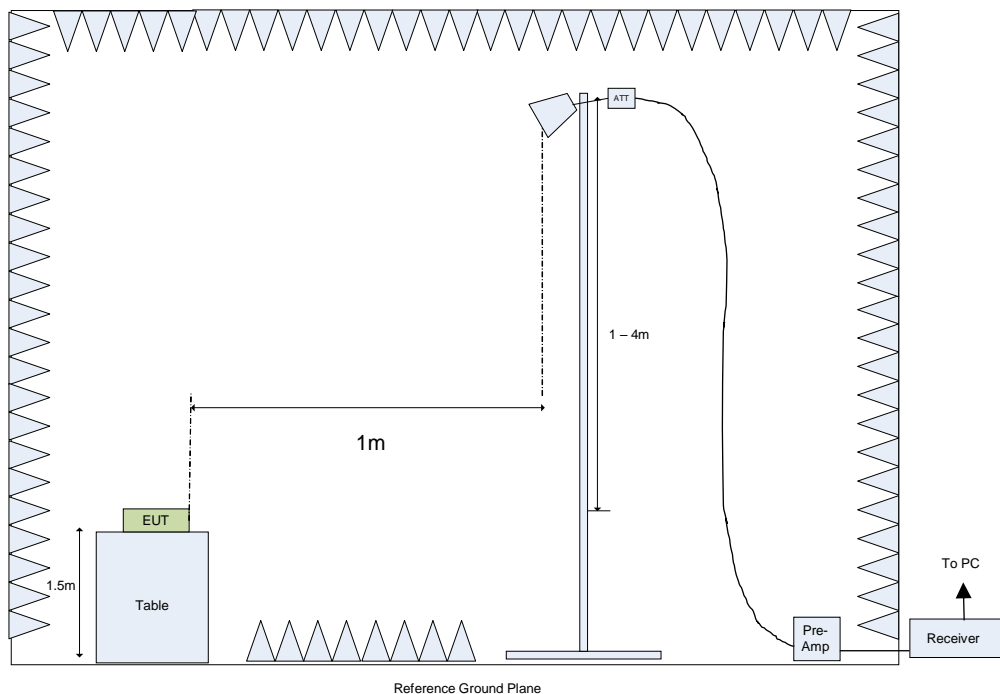


Figure 5.4.7.1: Test Setup for Final E-Field Measurements from 1GHz to 18GHz

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.

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
1.086	Transmitting on channel 2402MHz	Side face	0	1.5	V
1.431	Transmitting on channel 2402MHz	Side face	0	1.5	V
2.390	Transmitting on channel 2402MHz	Side face	0	1.5	H
8.934	Transmitting on channel 2402MHz	Side face	0	1.5	H
17.840	Transmitting on channel 2402MHz	Side face	0	1.5	V
1.431	Transmitting on channel 2440MHz	Side face	0	1.5	V
2.439	Transmitting on channel 2440MHz	Side face	0	1.5	H
1.431	Transmitting on channel 2480MHz	Side face	0	1.5	V
1.972	Transmitting on channel 2480MHz	Side face	0	1.5	V
2.488	Transmitting on channel 2480MHz	Side face	0	1.5	H
10.632	Transmitting on channel 2480MHz	Side face	0	1.5	V
16.226	Transmitting on channel 2480MHz	Side face	0	1.5	V

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°.

5.4.9 Electric field emissions, 1GHz to 18GHz

The equipment under test was pre-scanned using peak detection when operating on all three channels. Final measurements were performed with the equipment under test operating on 2402MHz

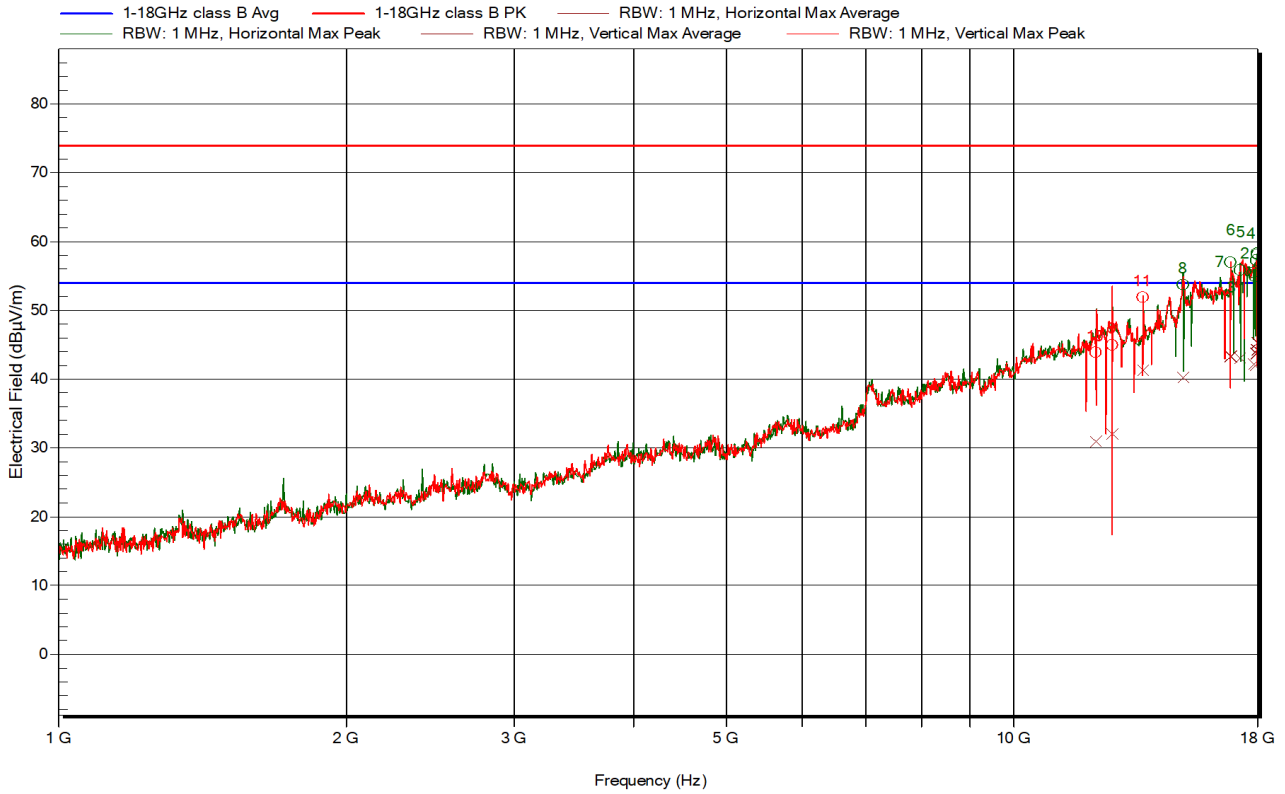


Figure 5.4.9.1: Electric field emissions Plot, 1GHz to 18GHz. Operation on 2402MHz

Frequency	Average	Average	Average	Average	Angle	Height	Polarization
GHz	dB μ V/m	dB μ V/m	dB	Status	degrees	m	
12.185	30.92	54	-23.08	Pass	220	2.9	Vertical
12.675	32.05	54	-21.95	Pass	145	1.0	Vertical
13.648	41.29	54	-12.71	Pass	305	3.7	Vertical
15.044	40.20	54	-13.80	Pass	300	2.1	Horizontal
16.866	43.27	54	-10.73	Pass	130	3.8	Vertical
17.253	43.03	54	-10.97	Pass	150	2.8	Horizontal
17.837	42.15	54	-11.85	Pass	85	2.4	Horizontal
17.888	41.94	54	-12.06	Pass	195	3.4	Horizontal
17.954	43.70	54	-10.30	Pass	325	3.4	Horizontal
17.981	44.27	54	-9.73	Pass	350	3.4	Horizontal
17.993	45.28	54	-8.72	Pass	300	4.0	Vertical

Table 5.4.9.1 Electric Field Emissions Peaks, 1GHz to 18GHz – Operation on 2402MHz

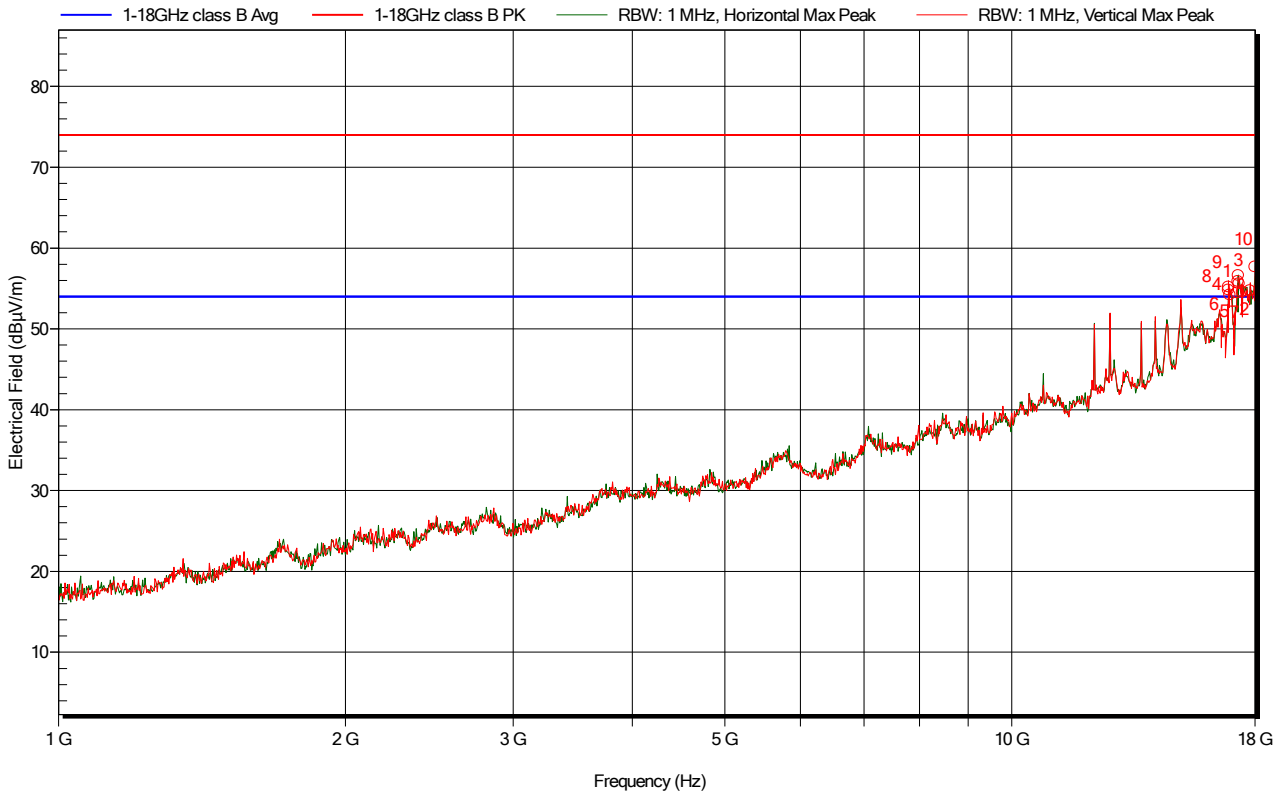


Figure 5.4.9.2: Electric field emissions Plot, 1GHz to 18GHz, Operation on 2440MHz - Peak detector scan

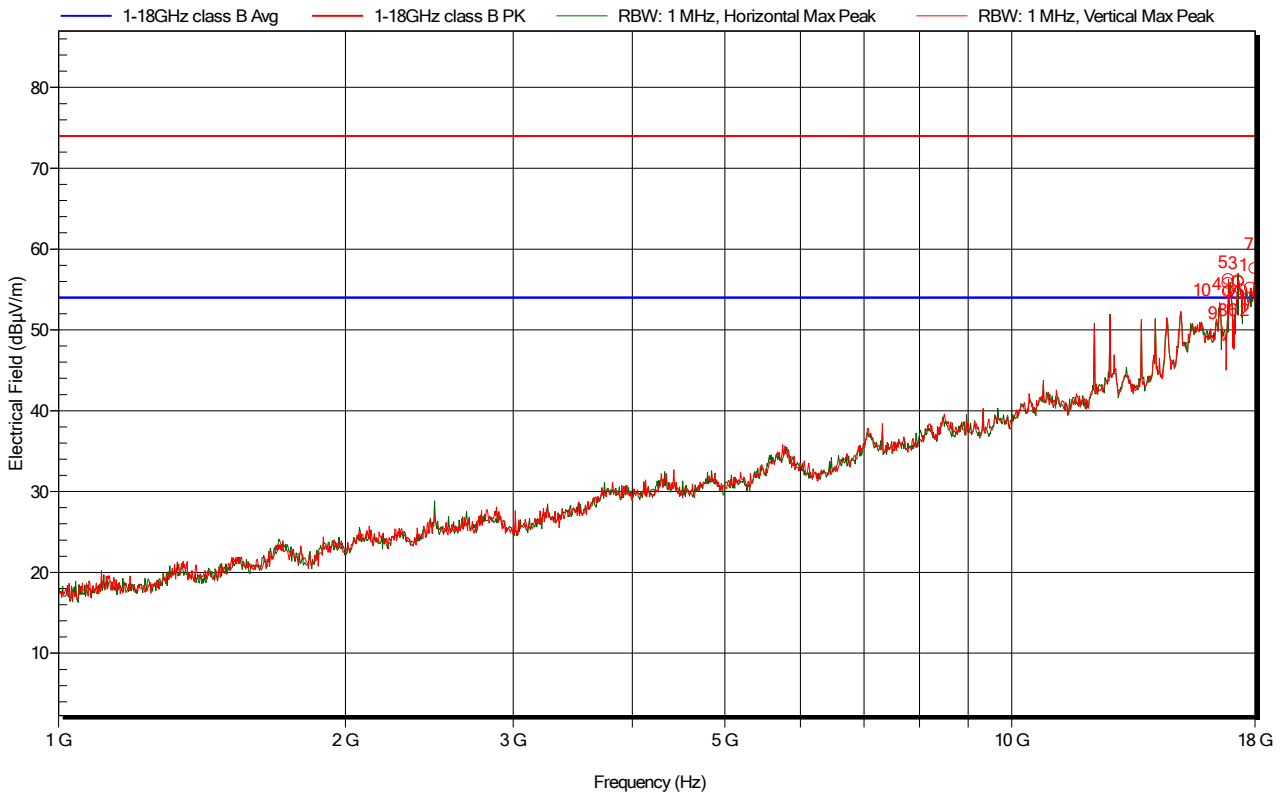


Figure 5.4.9.3: Electric field emissions Plot, 1GHz to 18GHz, Operation on 2480MHz – Peak detector scan

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); Attenuator loss (AL) and Cable loss (CL).

Field strength (FS) is calculated as follows:

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

5.4.11 Sample Data

From Figure 5.4.9.1 and table 5.4.9.1, The Average level at 13.648GHz is calculated as follows:

$$\text{FS (dB}\mu\text{V/m)} = 63.41(\text{dB}\mu\text{V}) - 50.23(\text{dB}) + 24.29(\text{dB/m}) + 3.82 (\text{dB}) = 41.29\text{B}\mu\text{V/m}$$

5.5 Radiated Emissions (18GHz to 26GHz)**5.5.1 Limits**

Frequency (GHz)	Limit (dB μ V/m)	Limit (dB μ V/m)
	Peak	Average
18-26	74.0	54.0

5.5.2 Receiver Settings

Receiver Parameters	Setting
Detector Function	Average and Peak
Start Frequency	18GHz
Stop Frequency	26GHz
Resolution Bandwidth	1MHz
Video Bandwidth	Auto

5.5.3 Emissions measurements**5.5.4 Date of Test**31st January 2022**5.5.5 Test Area**

LAB 1 (SAC)

5.5.6 Tested by

M Dyster

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

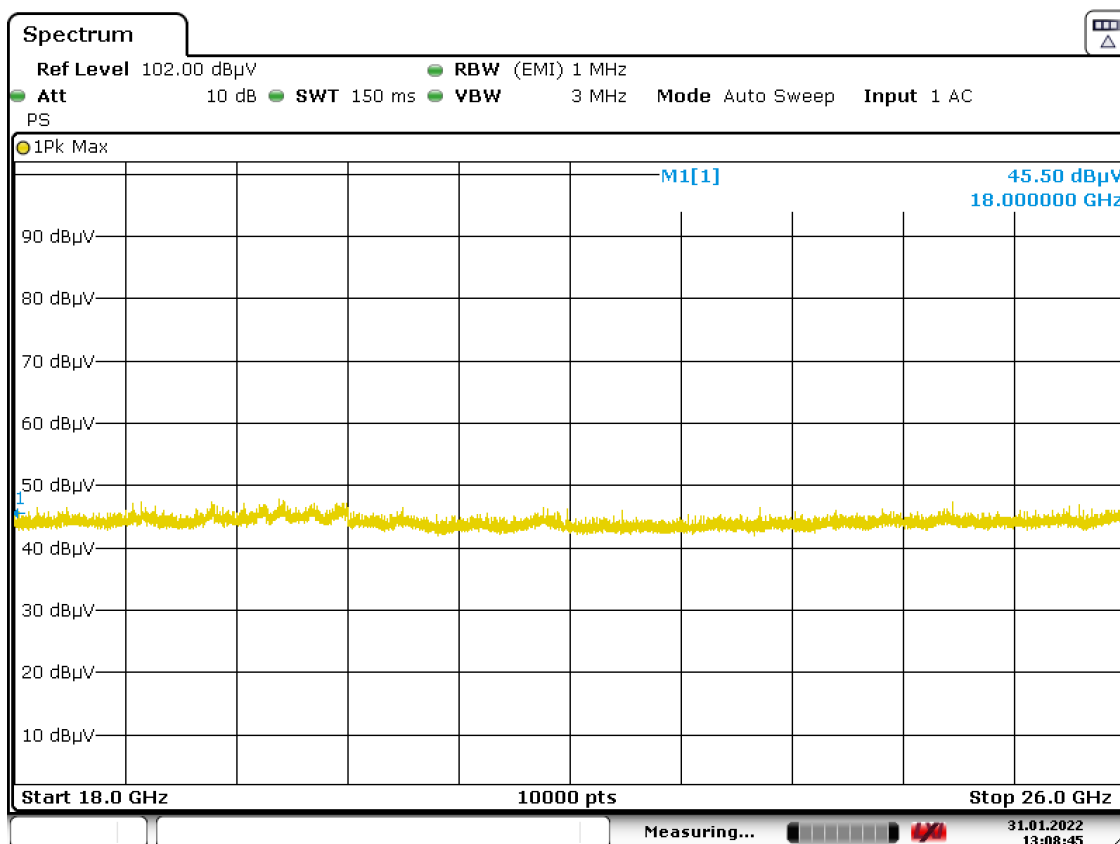
During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance 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 4: Frequencies identified during Exploratory Radiated Emission maximization

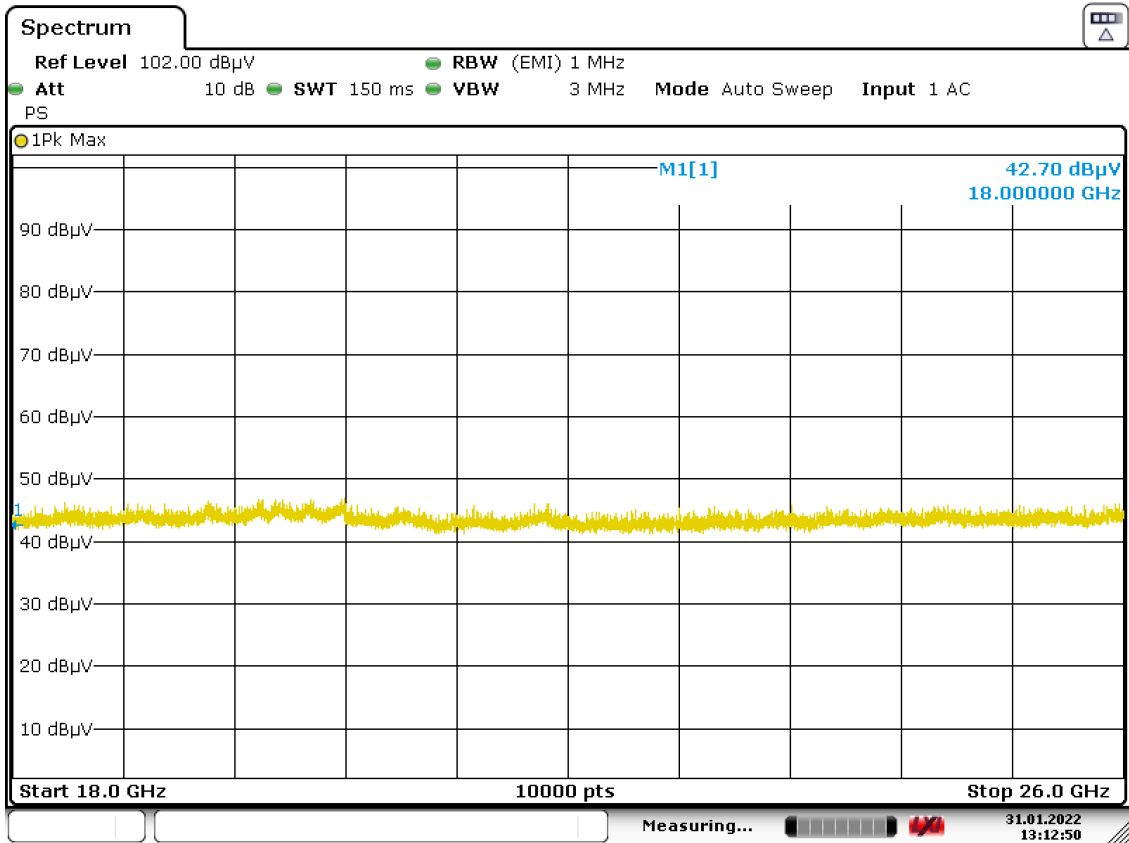
Note 2 : The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction through 360°.

No emissions were identified for further investigation above 18GHz.



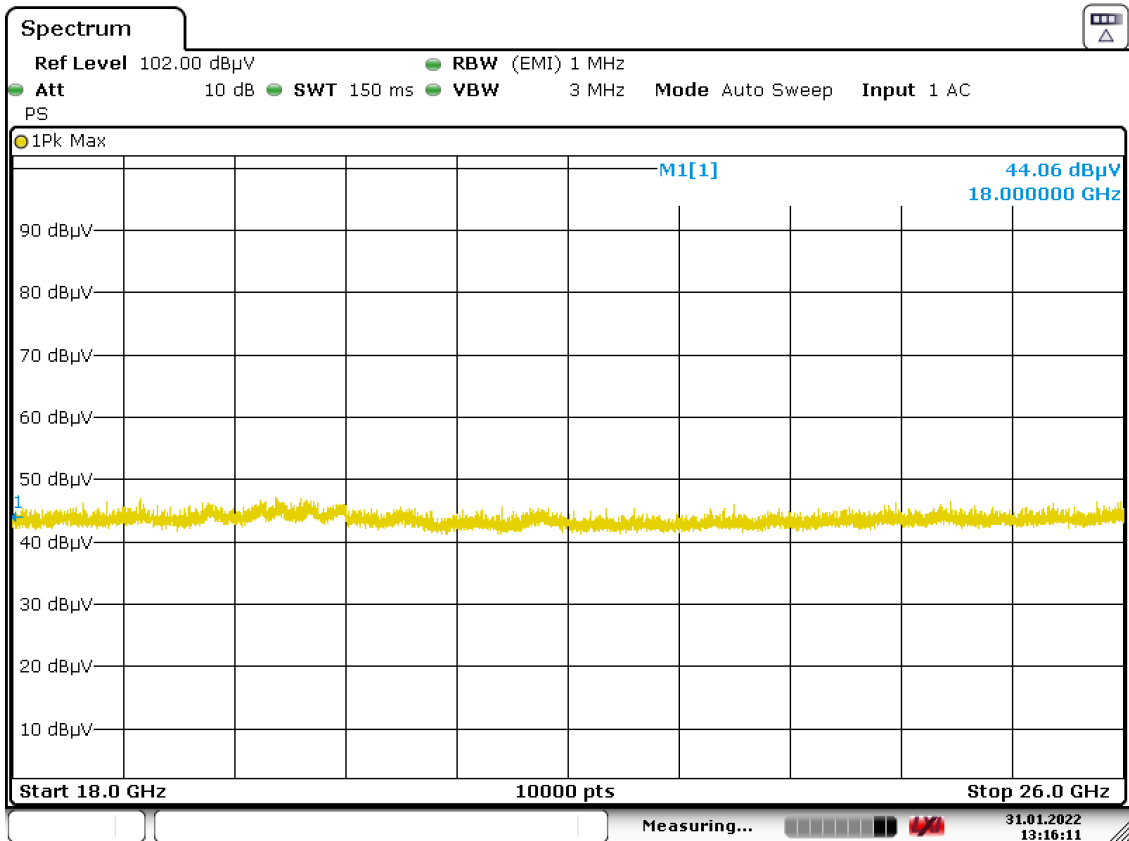
Date: 31.JAN.2022 13:08:45

Figure 5.5.8.1 – manual investigation – Operating on channel 2402MHz



Date: 31.JAN.2022 13:12:51

Figure 5.5.8.2 – manual investigation – Operating on channel 2440MHz



Date: 31.JAN.2022 13:16:12

Figure 5.5.8.3 – manual investigation – Operating on channel 2480MHz

5.6 Conducted Spurious Emissions 30MHz to 26GHz**5.6.1 Limits**

Frequency (MHz)	Limit, 47CFR 15.247(d)
	Peak
30 – 26000	-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	1000MHz
Start Frequency	1000MHz
Stop Frequency	26000MHz
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**

20th January 2022

5.6.4 Test Area

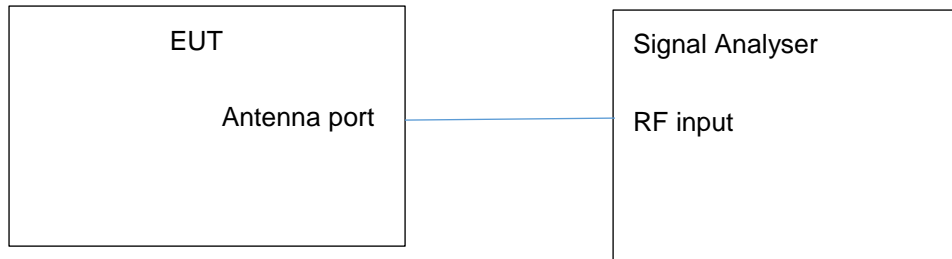
LAB 1

5.6.5 Tested by

J Beavers

5.6.6 Test Setup

The antenna port was connected directly to the signal analyser.

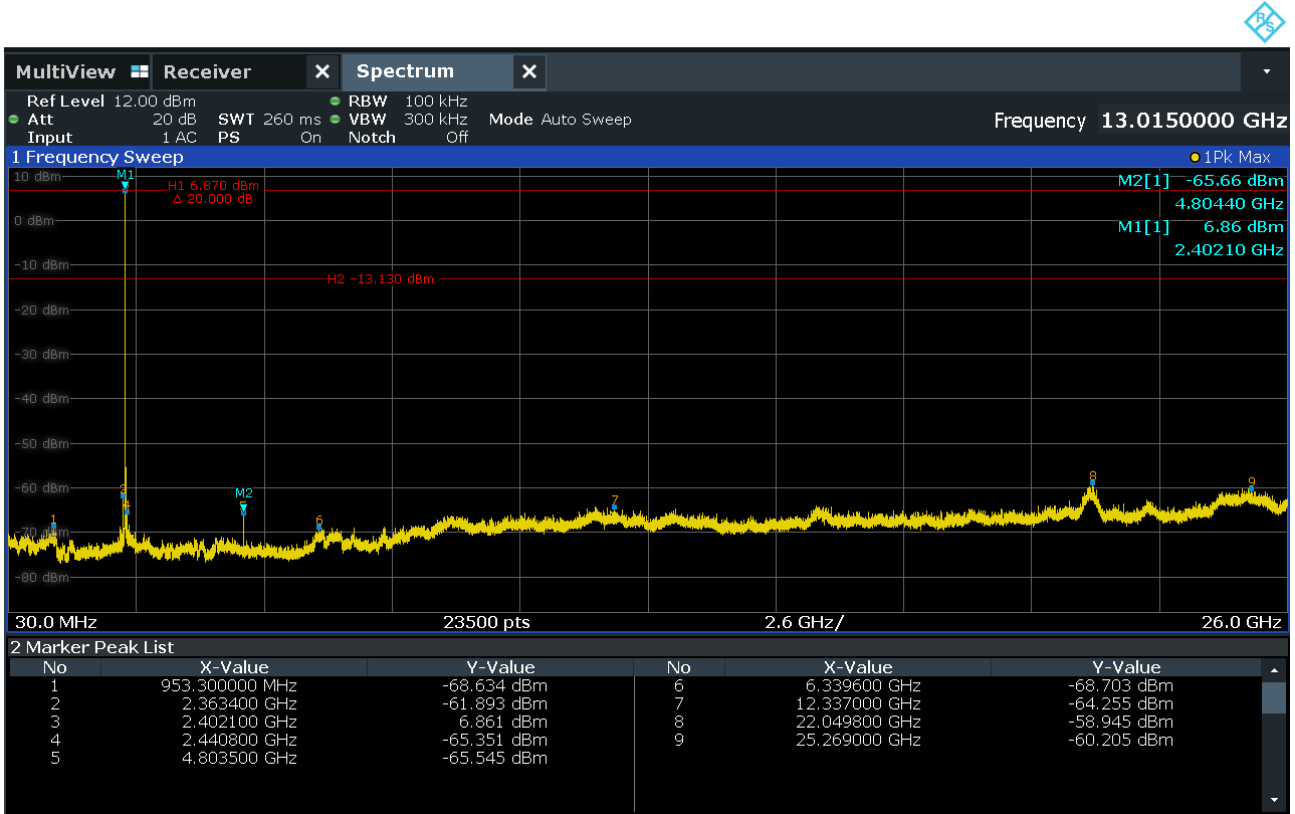


5.6.7 Test Results

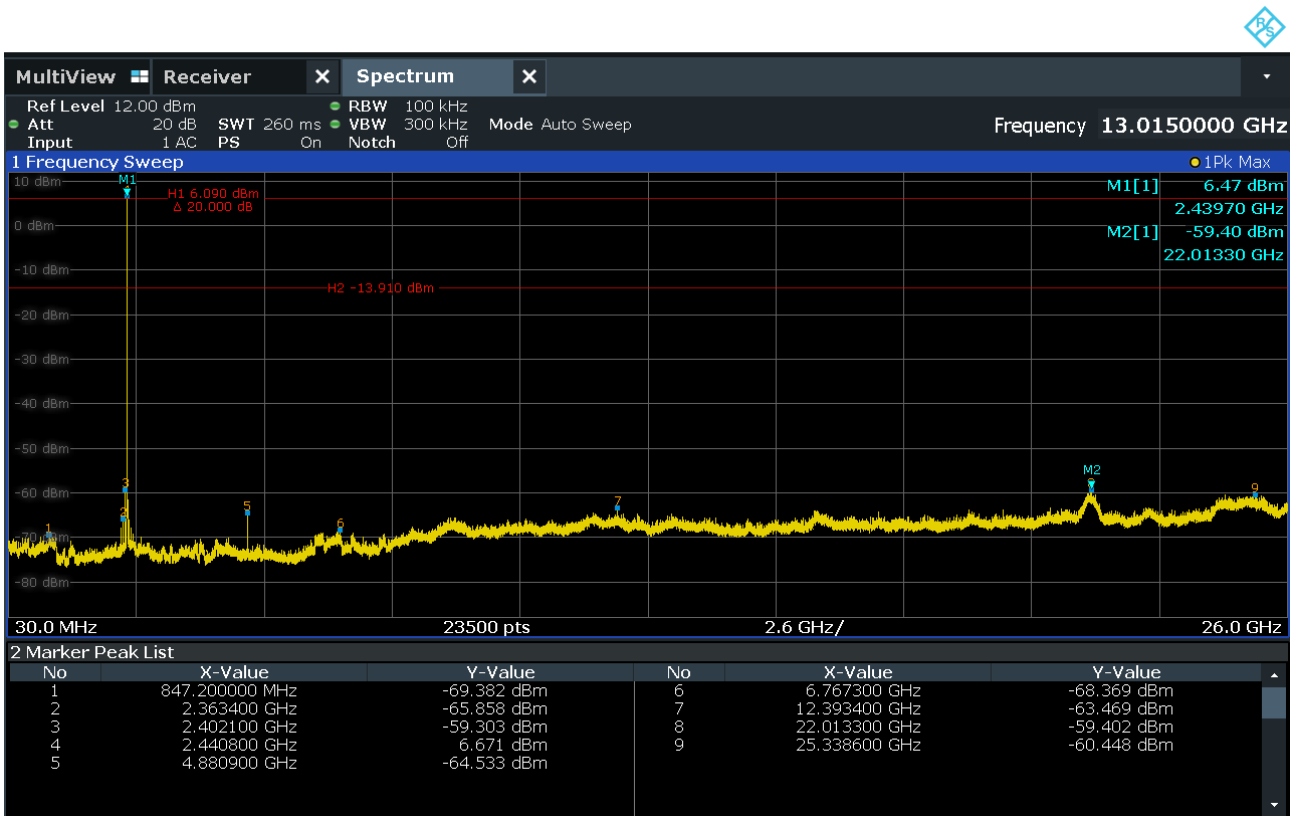
The results of the conducted spurious emissions are stated below and by the signal analyser images.

All disturbances detected were > 20dB below the carrier.

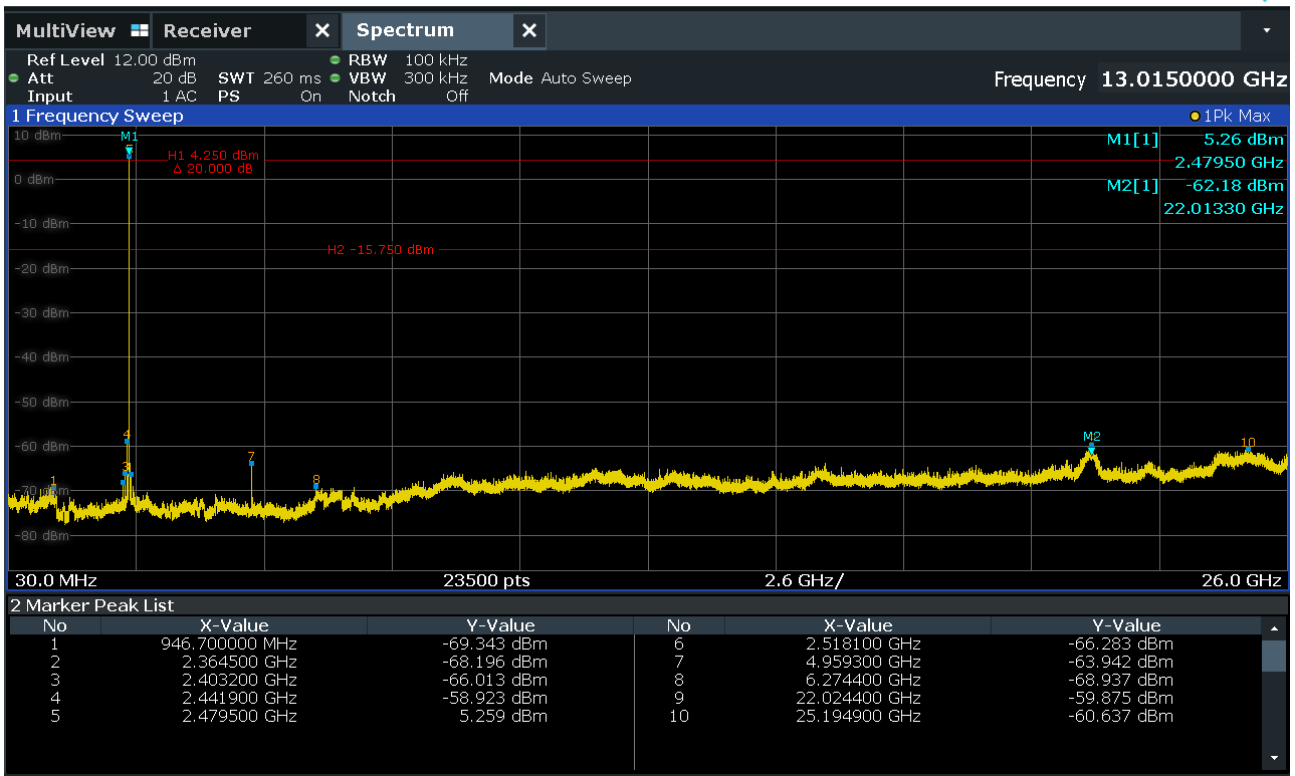
5.6.8 Antenna port conducted emissions 30MHz to 26GHz



Conducted emissions 30MHz to 26GHz. Operation on channel 2402MHz.



Conducted emissions 30MHz to 26GHz. Operation on channel 2440MHz.



Conducted emissions 30MHz to 26GHz. Operation on 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

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	Setting
Detector Function	Peak
Span	3 x RBW
Resolution Bandwidth	100kHz
Video Bandwidth	300kHz
Sweep rate	Auto couple
Trace mode	Max hold

6.2.1 Emissions measurements

6.2.2 Date of Test

20th January 2021

6.2.3 Test Area

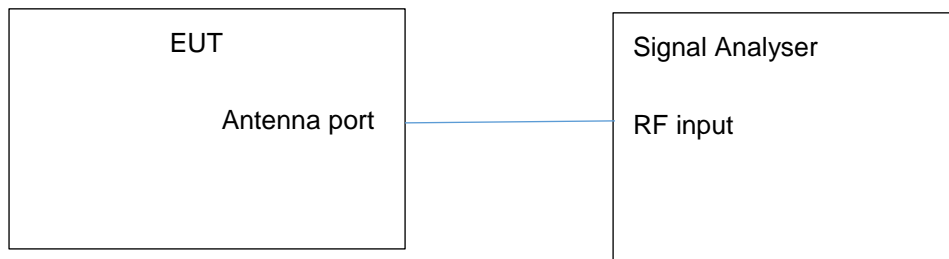
LAB 1

6.2.4 Tested by

J Beavers

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 (MHz)	99% Occupied Bandwidth (kHz)	Measured 6dB bandwidth (kHz)	Minimum requirement (kHz)	Figure	Result
2402.0	1044.8	525.74	500.0	6.2.6.1	Pass
2440.0	1046.2	534.04	500.0	6.2.6.2	Pass
2480.0	1044.7	525.11	500.0	6.2.6.3	Pass

6dB Bandwidth Measurement

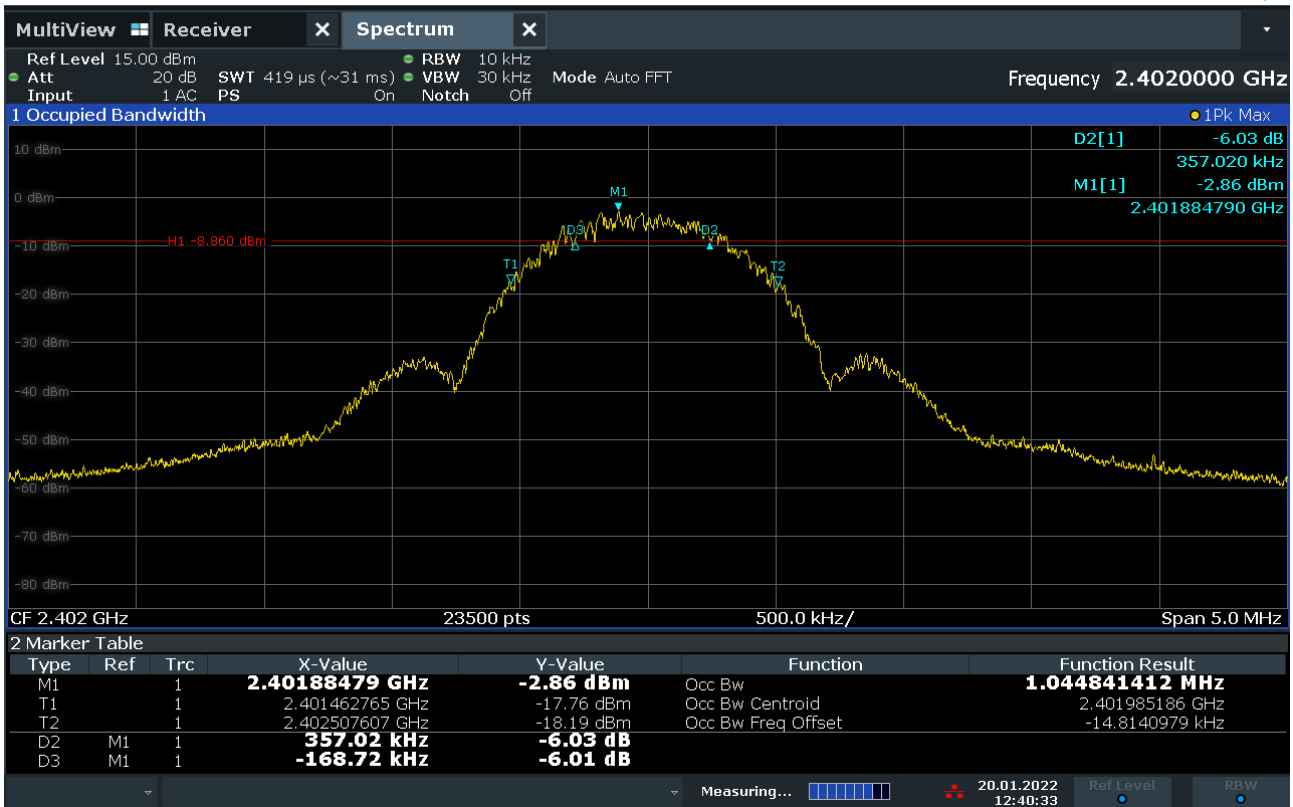


Figure 6.2.6.1 Bandwidth at 6dB Point. Operation on 2402MHz

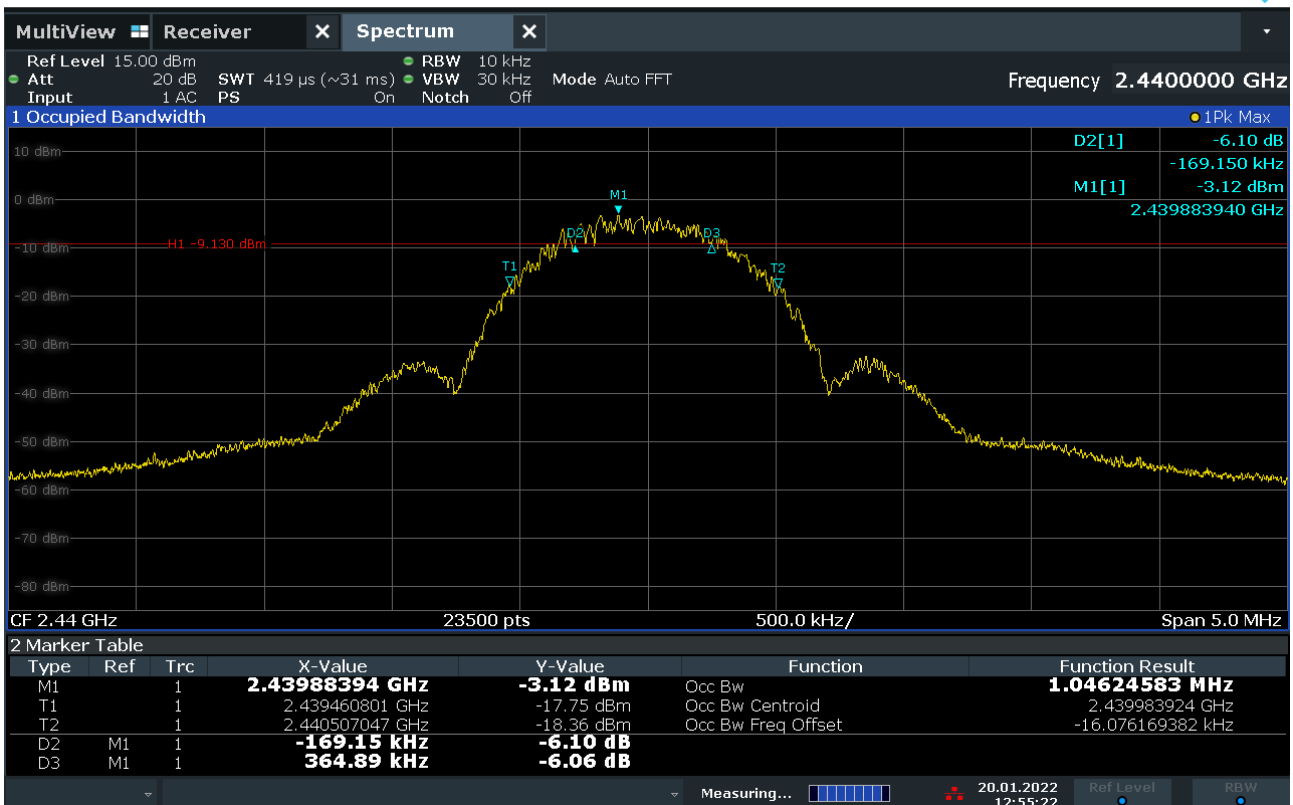


Figure 6.2.6.2 Bandwidth at 6dB Point. Operation on 2440MHz

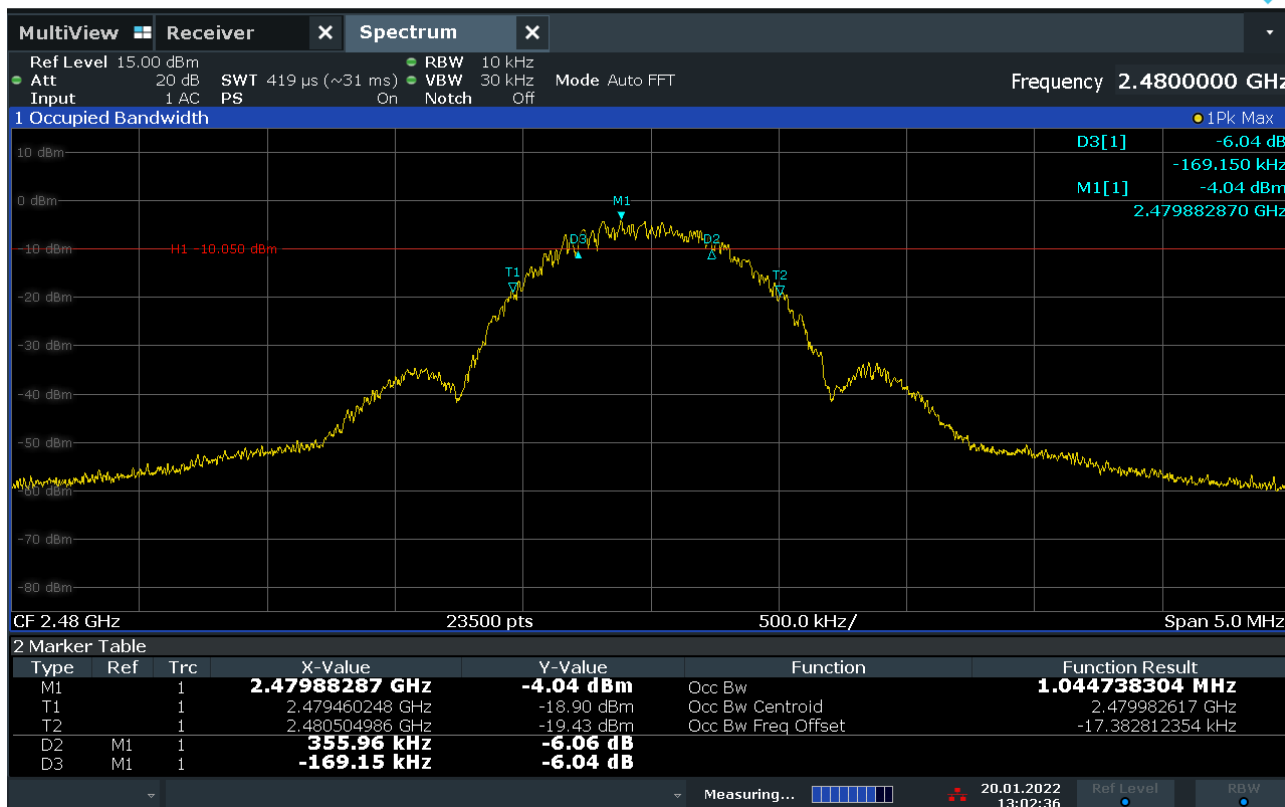


Figure 6.2.6.3 Bandwidth at 6dB Point. Operation on 2480MHz

Section 7 Peak Output Power

7.1 Test Specification

FCC Rule Part	46CFR 15.247 (b)(3)
Standard	ANSI C63.10:2013

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	3 x RBW
Resolution Bandwidth	1MHz (>DTS Bandwidth)
Video Bandwidth	3MHz
Sweep rate	Auto couple
Trace mode	Max hold

7.2.1 Emissions measurements

7.2.2 Date of Test

20th January 2022

7.2.3 Test Area

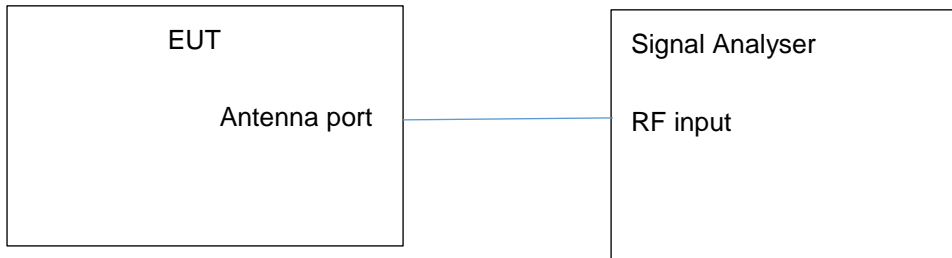
LAB 1

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 (MHz)	Peak Power (dBm)	Peak Power (Watts)	Limit (Watts)	Figure
2402	7.25	0.0053	1	7.2.6.1
2440	6.98	0.0050	1	7.2.6.2
2480	6.01	0.0040	1	2.2.6.3

Peak Output Power Measurement

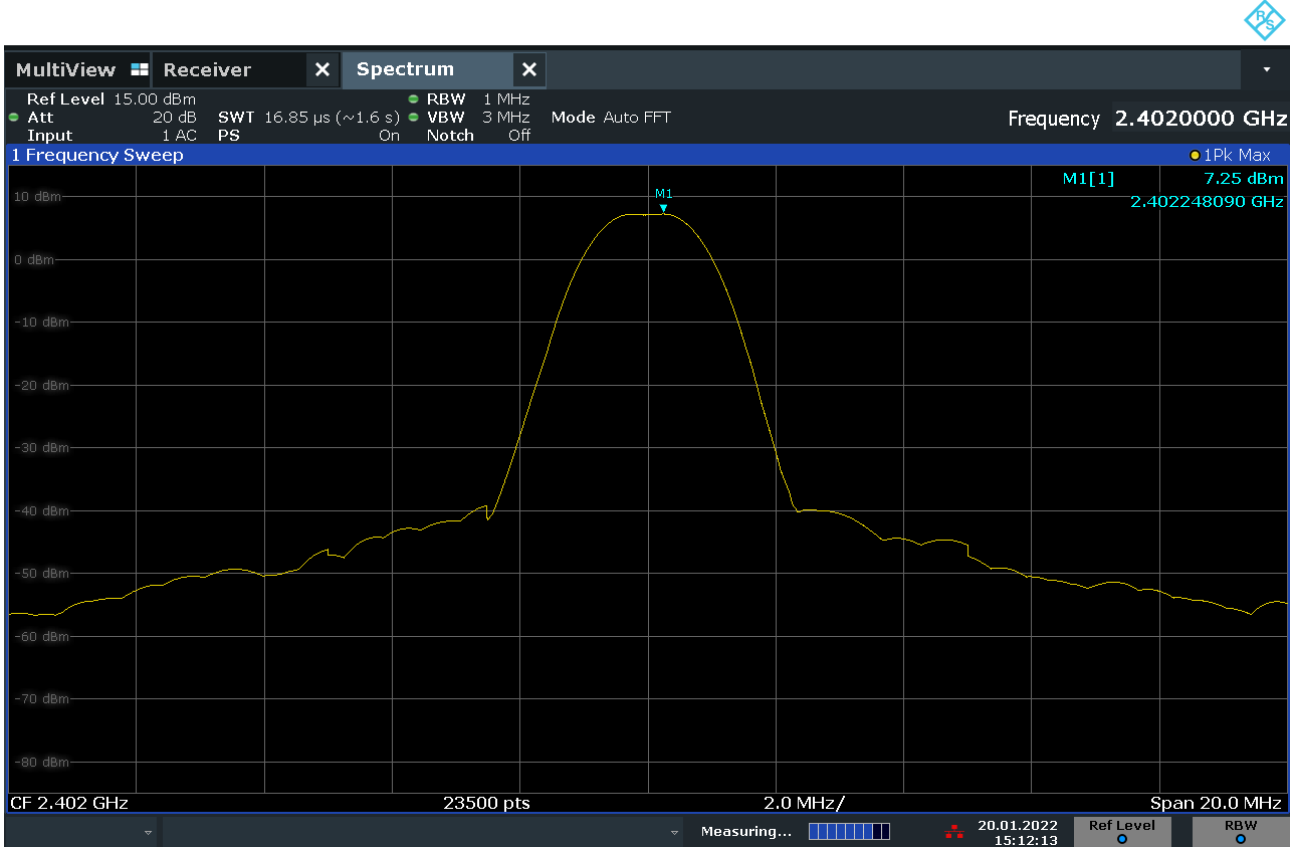


Figure 7.2.6.1 Peak output power, Operation on 2402MHz

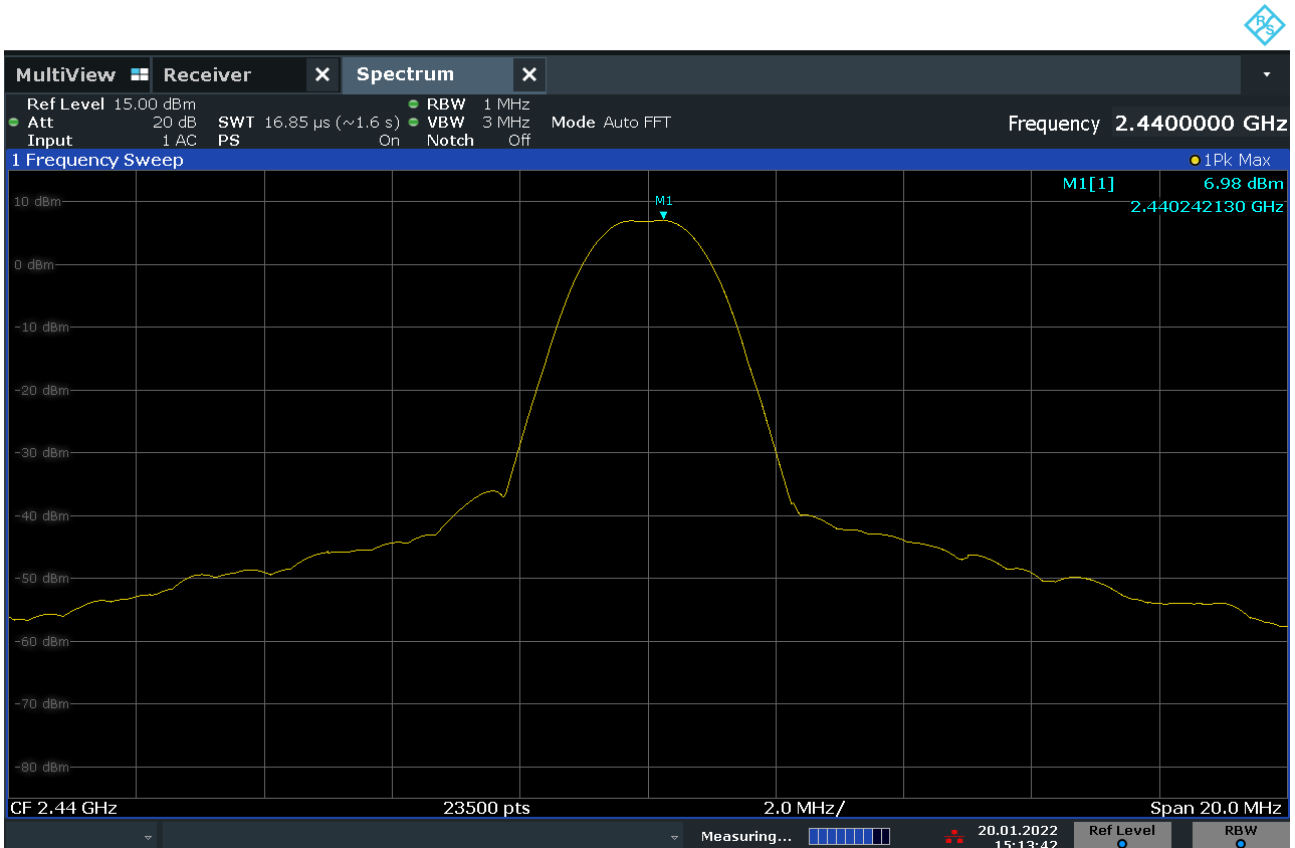


Figure 7.2.6.2 Peak output power, Operation on 2440MHz

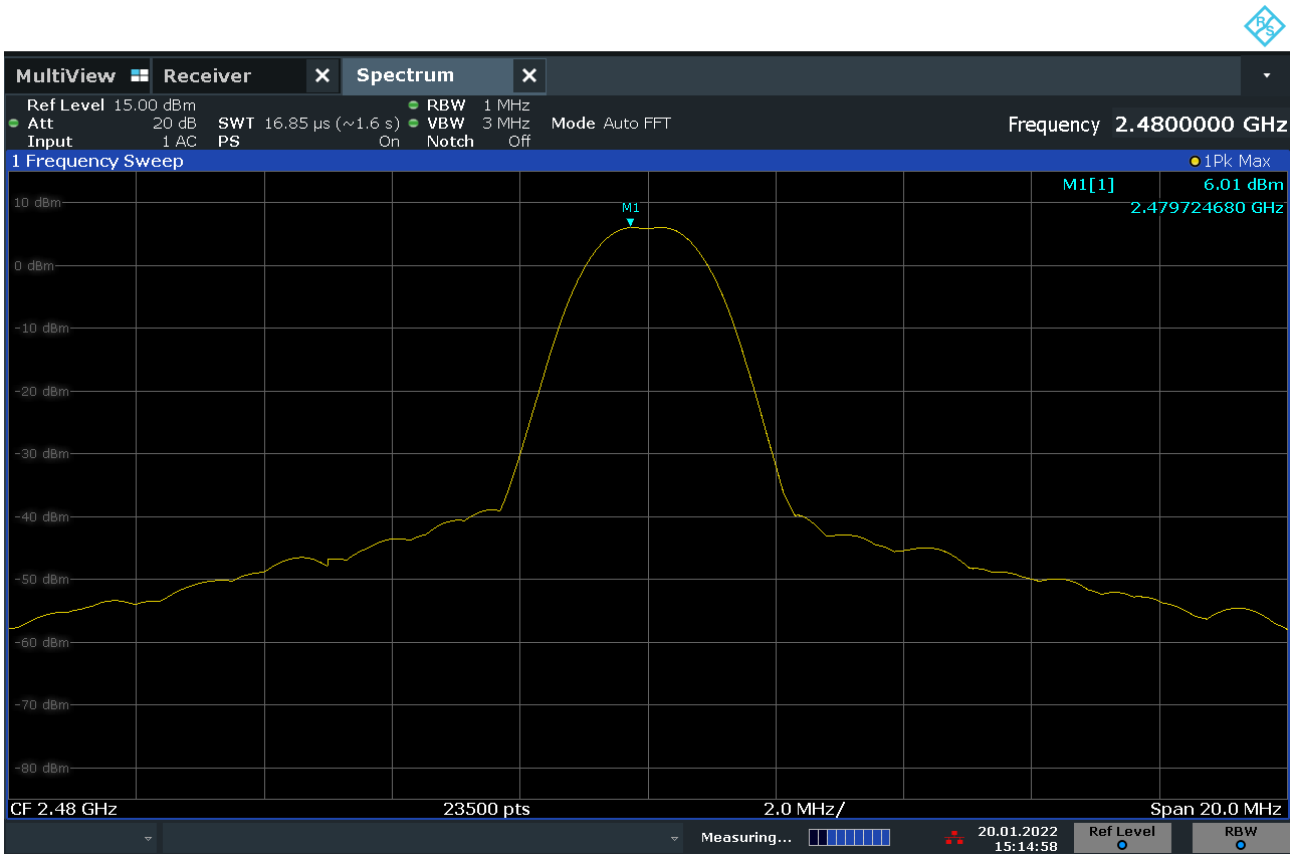


Figure 7.2.6.3 Peak output power, Operation on 2480MHz

Section 8 Power Spectral Density

8.1 Test Specification

FCC Rule Part	46CFR 15.247 (e)
Standard	ANSI C63.10:2013

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	1.5xDTS 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

20th January 2022

8.2.3 Test Area

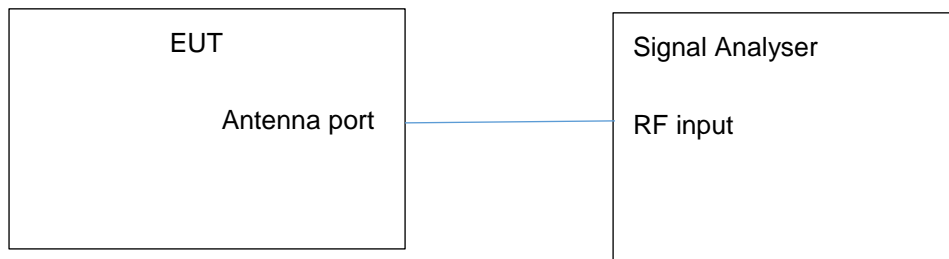
LAB 1

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 (MHz)	Power in 3kHz RBW (dBm)	Limit (dBm)	Figure	Result
2402	-9.30	8.0	8.2.6.1	Pass
2440	-9.42	8.0	8.2.6.3	Pass
2480	-10.37	8.0	8.2.6.5	Pass

Peak Spectral Density Measurement

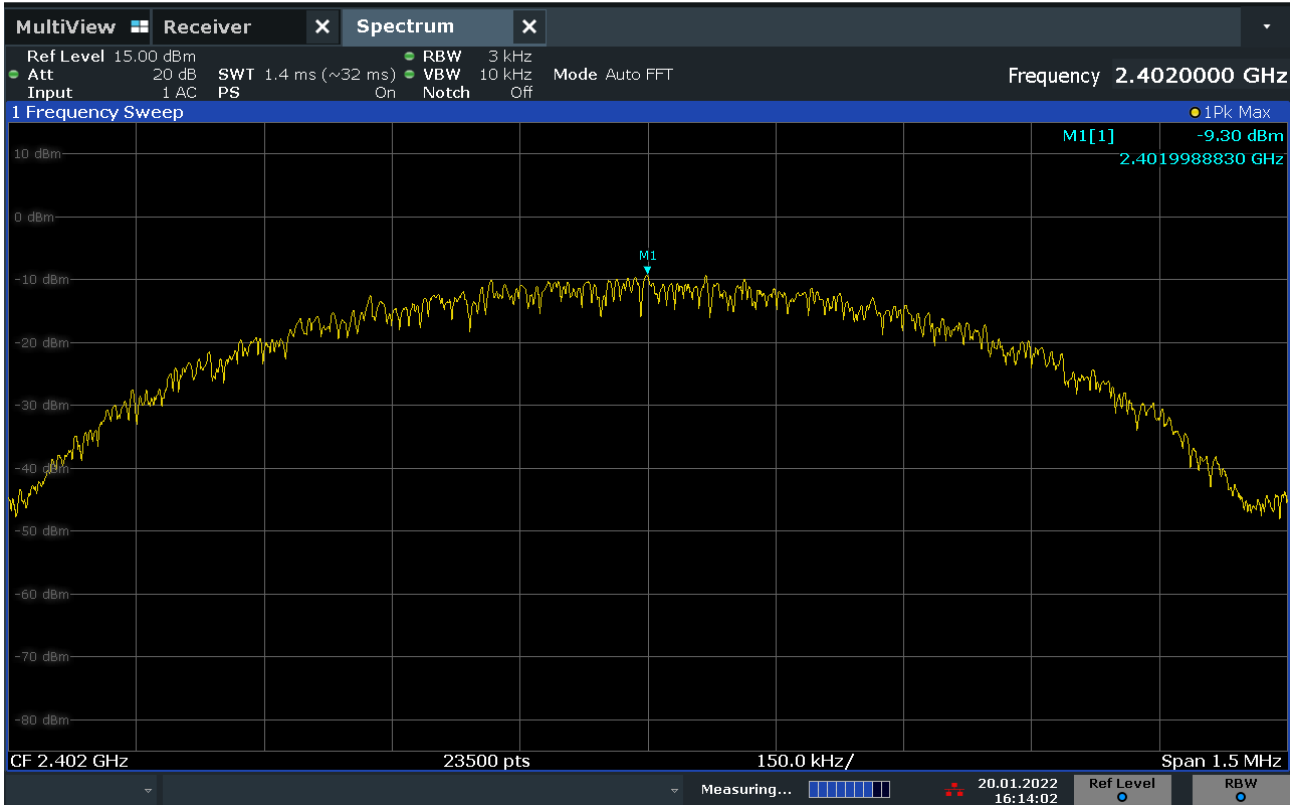


Figure 8.2.6.1 Power spectral density, operation on channel 2402MHz

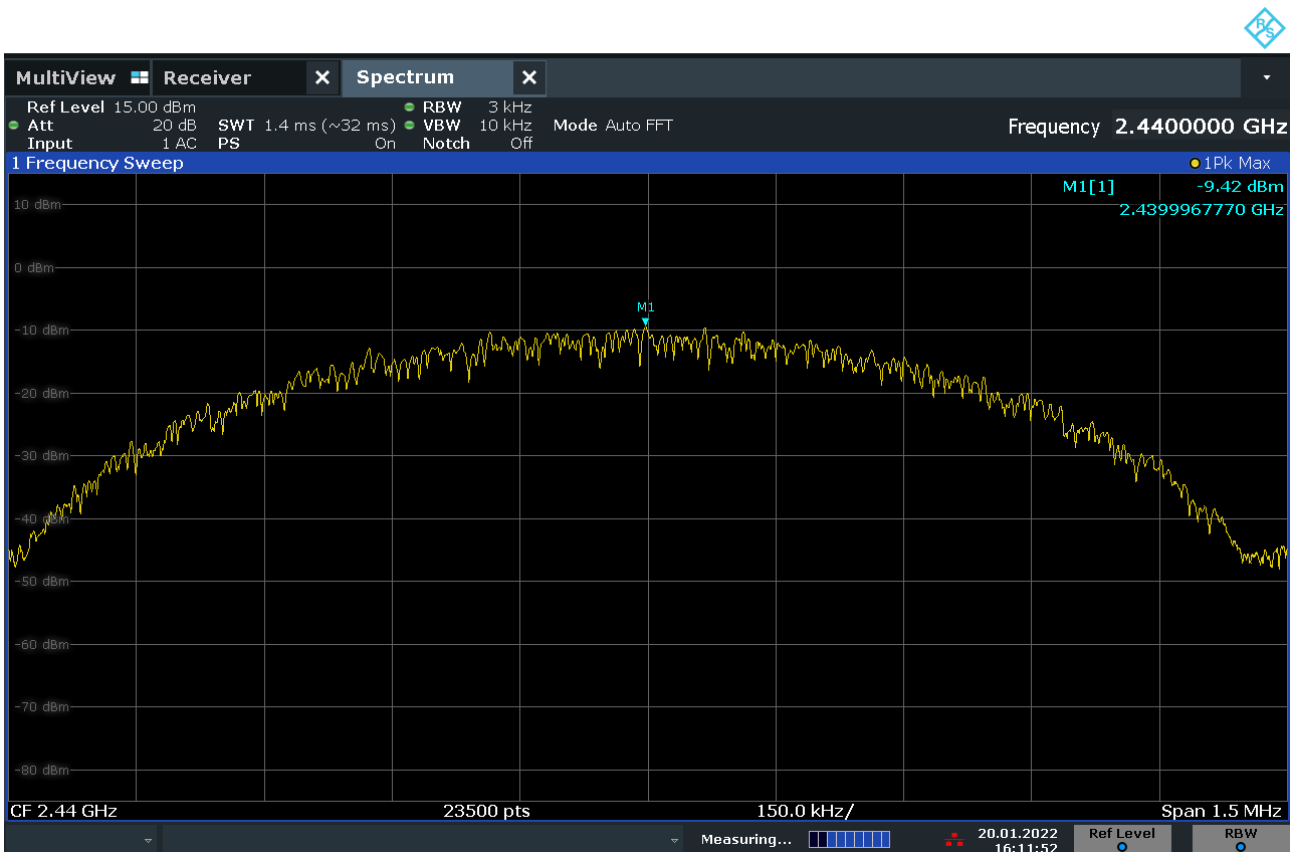


Figure 8.2.6.2 Power spectral density, operation on channel 2440MHz

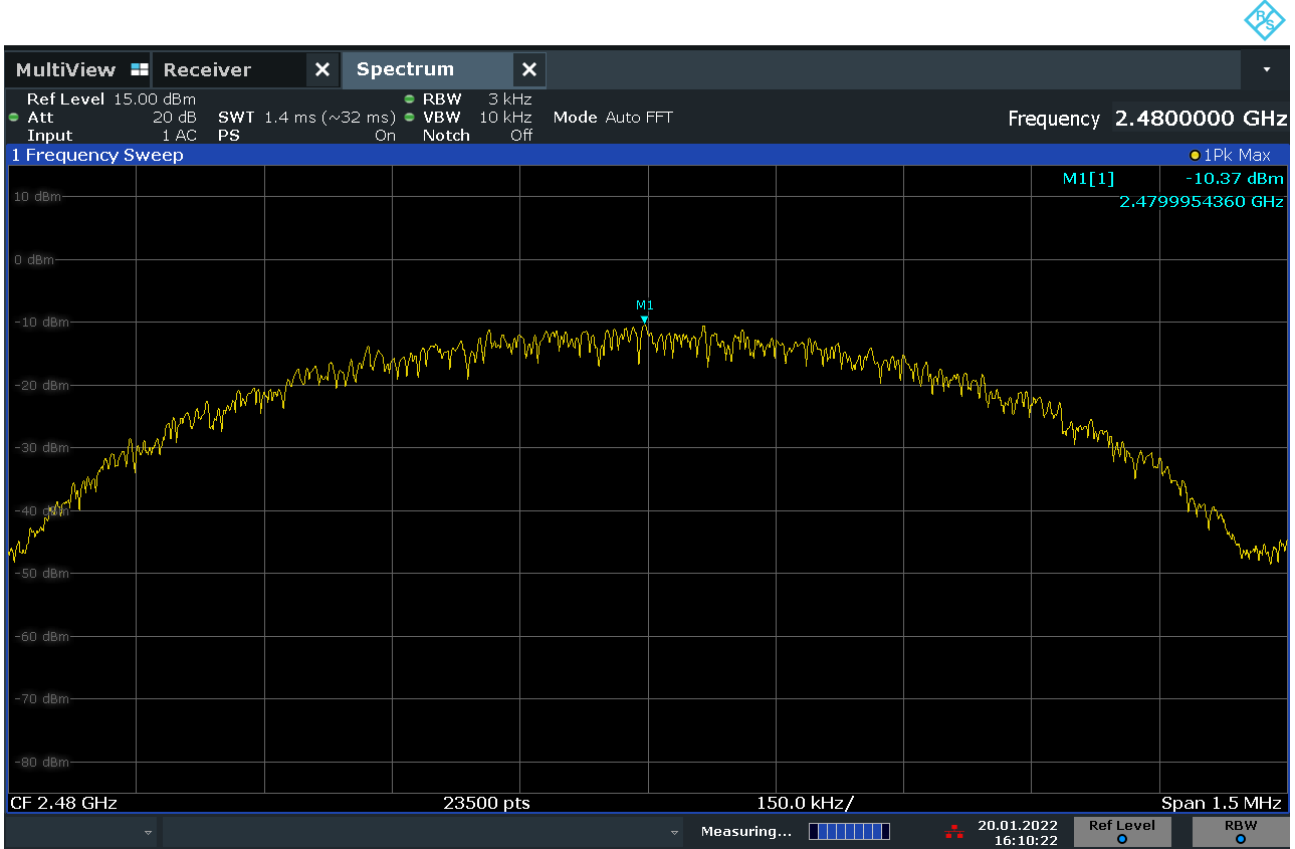


Figure 8.2.6.3 Power spectral density, operation on channel 2480MHz

Section 9 Band Edge Compliance

9.1 Test Specification

FCC Rule Part	46CFR 15.205 and 47CFR15.209
Standard	ANSI C63.10:2013

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

18th January 2022

9.2.3 Test Area

LAB 1

9.2.4 Tested by

J Beavers

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

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	25.60	50.61	4.28	29.89	9.15	74	-64.85
V	2483.5	20.70	50.61	4.28	29.89	4.25	74	-69.75

Operation on 2480MHz Channel, 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	13.50	50.61	4.28	29.89	-2.95	54	-56.95
V	2483.5	9.50	50.61	4.28	29.89	-6.95	54	-60.95

Operation on Channel 2480MHz, average detector measurements

Lower band edge

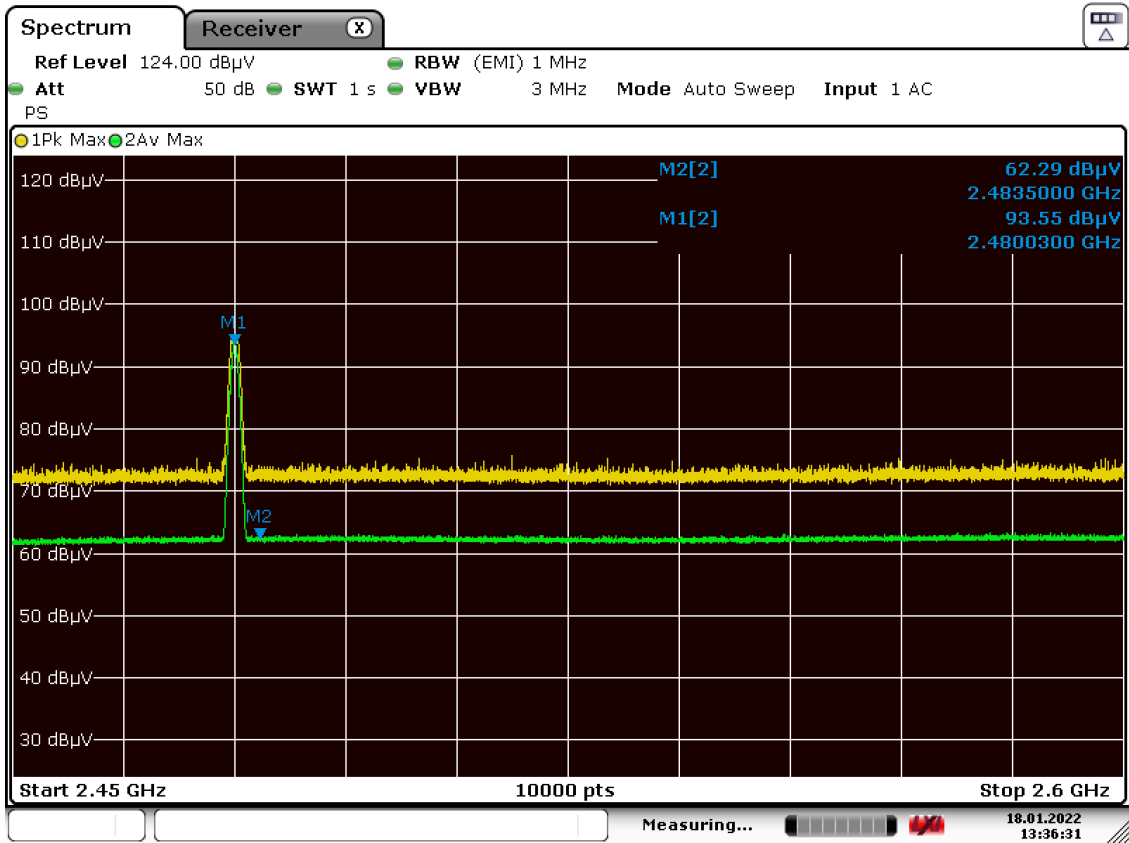
Polarity	frequency (MHz)	Amplitude (dBuV)	Preamp (dB)	Cable loss (dB)	AF(dB/m)	E (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	2400	29.60	50.61	4.16	29.67	12.82	74	-61.18
V	2400	26.90	50.61	4.16	29.67	10.12	74	-63.88

Operation on 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	18.30	50.61	4.16	29.67	1.52	54	-52.48
V	2400	15.90	50.61	4.16	29.67	-0.88	54	-54.88

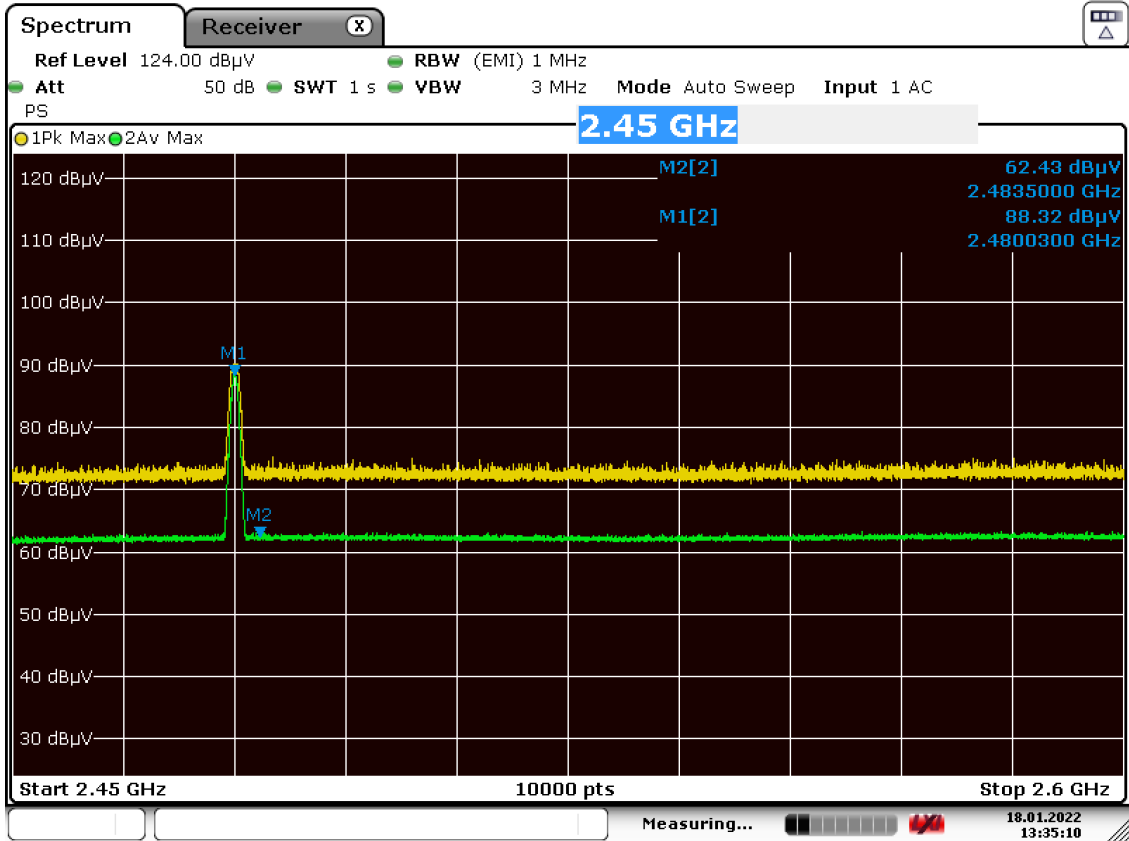
Operation on 2402MHz average detector measurements

Spectrum analyser displays



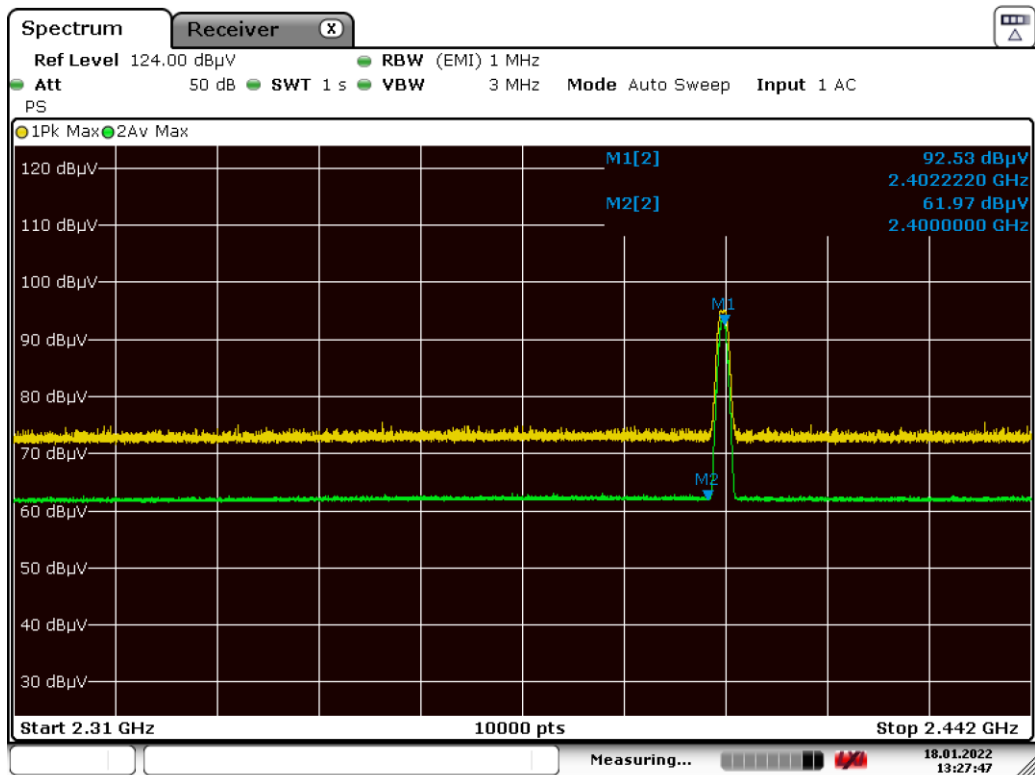
Date: 18.JAN.2022 13:36:31

Band Edge Measurement – upper band edge - horizontal polarity



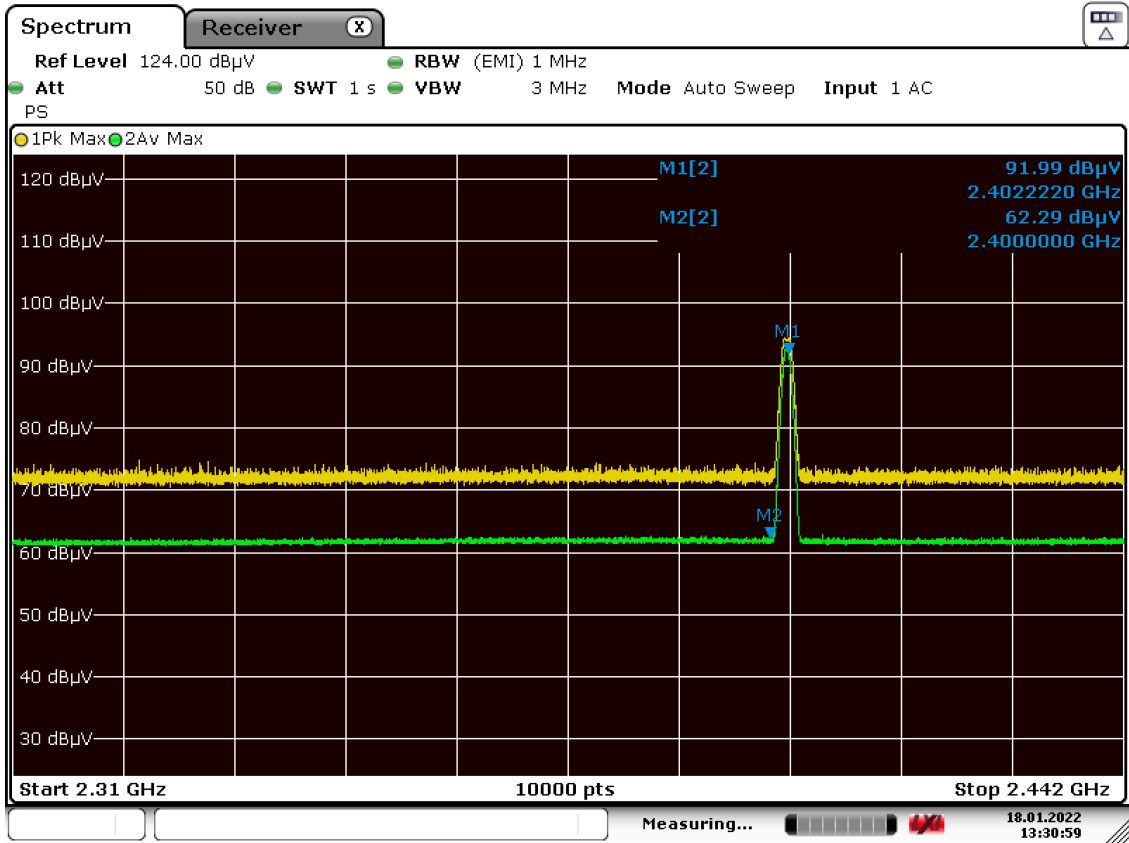
Date: 18.JAN.2022 13:35:10

Band Edge Measurement – upper band edge - vertical polarity



Date: 18.JAN.2022 13:27:47

Band Edge Measurement – lower band edge - horizontal polarity



Date: 18.JAN.2022 13:31:00

Band Edge Measurement – lower band edge - vertical polarity

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
RF Cable	Cable 9	January 2022	12 Months
Rhode & Schwarz ESW EMI Receiver	C0658	15 th November 2021	12 Months

Radiated Emissions Equipment

Item	Serial No.	Last Calibration Date	Calibration Interval
Laboratory 1 Semi-Anechoic Chamber	Lab 1	28 th January 2020	36 Months
ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism	--	N/A	N/A
R & S ESR	C0502	10 th November 2021	12 Months
Chase CBL6112B Bilog Antenna, 78167	1503	13 th December 2019	36 Months
6dB Attenuator (For use with Bilog Antenna)	78708B	13 th December 2019	36 Months
HF26 Cable	HF26	17 th January 2022	12 Months
HF35 Cable	HF35	17 th January 2022	12 Months
HF27 Cable	HF27	17 th January 2022	12 Months
Schwarzbeck D-69250 Antenna 1-18GHz	C0626	23 rd December 2021	24 Months
BONN BLMA 0118-5A Preamplifier	149759	9 th March 2021	12 Months
ETS Lingren 3116C-PA Horn Antenna 18-40GHz	C0433	17 th October 2019	36 Months