Report No. 466845-04-R00

Test Report

Product	Industrial Powerline Sensor
Name and address of the applicant	Heimdall Power AS St Olavs gate 28 0166 Oslo, Norway
Name and address of the manufacturer	Heimdall Power AS St Olavs gate 28 0166 Oslo, Norway
Model	Neuron V4
Rating	450 kV, 3 kA Continuous, 100 kA pulse
Trademark	Heimdall
Additional information	Bluetooth Low Energy
Tested according to	**FCC Part 15.247** Frequency Hopping Transmitters / Digital Transmission Systems **Industry Canada RSS-247, Issue 2** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	466845
Tested in period	2022-08-11 to 2022-09-16
Issue date	2023-03-28
Name and address of the testing laboratory	Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Frode Sveinsen]	Approved by [G.Suhanthakumar]

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Revision history

Revision	Date	Comment	Sign
00	2023-03-28	First edition	FS

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in “Summary of Test Data”.

1 INFORMATION

1.1 Test Item

Name	**Heimdall**
Model/version	**Neuron v4**
FCC ID	**2A9LZ-HPNV4**
Serial number	**A-10**
Hardware identity and/or version	**Neuron v4 revD**
Software identity and/or version	**V1.6.1**
Frequency Range	**2402 – 2480 MHz**
Number of Channels	**40**
Operating Modes	**Bluetooth Low Energy ☒ 1Mb ☒ 2Mb**
Type of Modulation	**GFSK**
Conducted Output Power	**0.0028 Watts**
Antenna Connector	**None**
Number of Antennas	**1**
Diversity or Smart Antennas	**No**
Power Supply	**Secondary Battery (3.7 V Li-Ion, 9800 mAh)**

Description of Test Item

The tested EUT is a Bluetooth LE transceiver in an industrial powerline sensor for monitoring powerlines.

1.2 Normal test condition

Temperature:	**20 - 24 °C**
Relative humidity:	**20 - 50 %**
Normal test voltage:	**3.7 V DC**

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ **YES**	☒ **NO**
If detachable, is the antenna connector(s) non-standard?	☐ **YES**	☐ **NO**
The tested equipment has only integral antennas. Conducted tests were performed with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.
Additional information	All tests were performed with the EUT programmed from the Nordic Semiconductor Applicaion “Direct Test Mode”.

1.6 Comments

All measurements were performed with the EUT powered from a fully charged battery.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISED RSS-247 Issue 2 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 3m.

A description of the test facility is on file with the FCC and ISED.

☒ **New Submission**	☒ **Production Unit**
☐ **Class II Permissive Change**	☐ **Pre-production Unit**
DTS Equipment Code	☐ **Family Listing**

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	N/A
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/A
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	11.8 Option 2	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	11.10.2 PKPSD (DTS)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 11.11 (DTS)	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)	Complies

3 TEST RESULTS

3.1 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

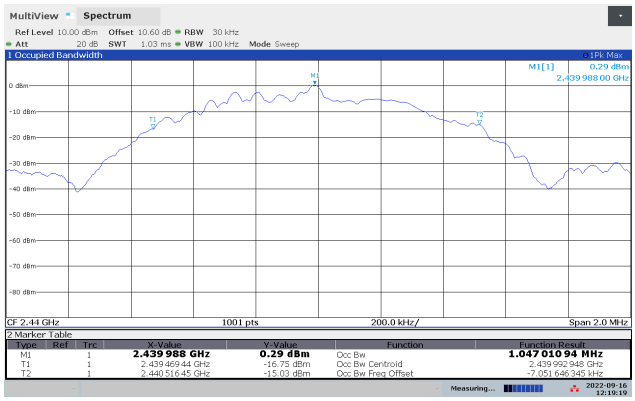
Carrier Frequency, Data Rate	Occupied Bandwidth (99% BW)
2440 MHz, 1Mb	1.05 MHz
2440 MHz, 2Mb	2.12 MHz

Occupied Bandwidth is the same for all channels

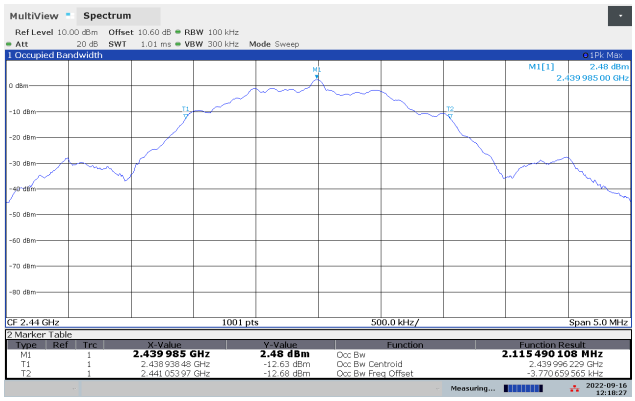
See attached plots

Requirements:

No requirements for Digital Transmission Systems.



99% Occupied BW, 1Mb



99% Occupied BW, 2Mb

3.2 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 2, Clause 5.2 (a)

Measurement procedure: **ANSI C63.10-2013 Clause 11.8**

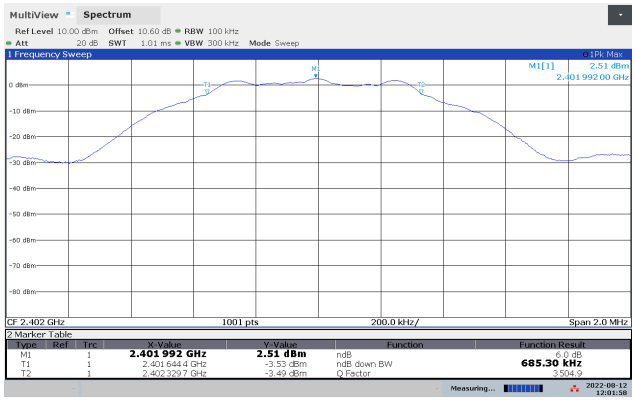
Test Results: **Complies**

Measurement Data:

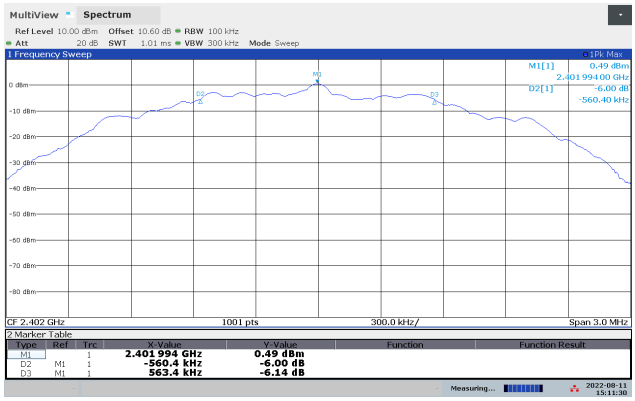
Modulation type and bitrate	Measured DTS Bandwidth		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1 Mbps	685 kHz	687 kHz	689 kHz
GFSK 2 Mbps	1124 kHz	1124 kHz	1139 kHz

Requirements:

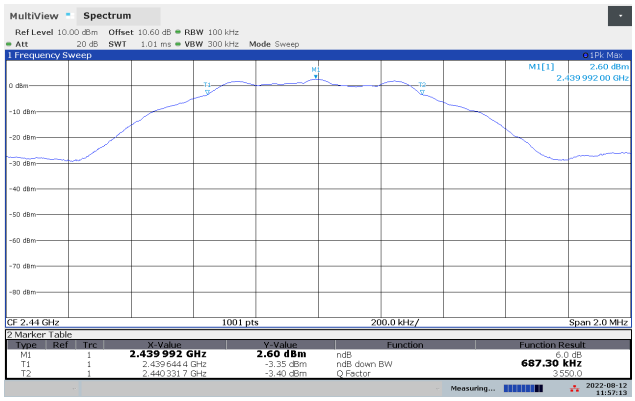
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



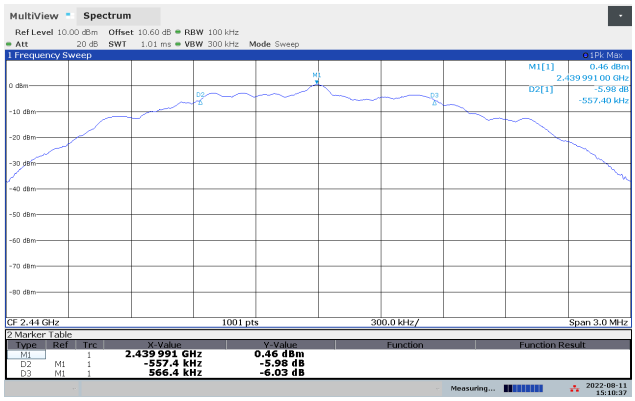
DTS BW, 2402 MHz, 1Mb



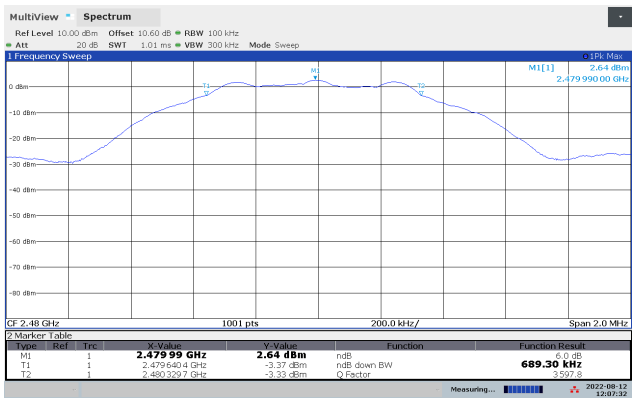
DTS BW, 2402 MHz, 2Mb, 1124kHz



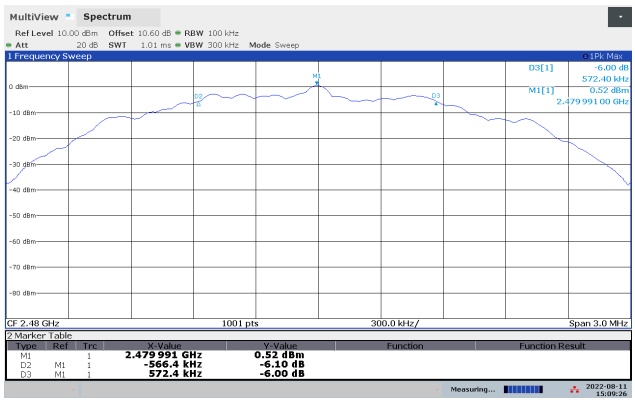
DTS BW, 2440 MHz, 1Mb



DTS BW, 2440 MHz, 2Mb, 1124kHz



DTS BW, 2480 MHz, 1Mb



DTS BW, 2480 MHz, 2Mb, 1139kHz

3.3 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency	Peak Conducted Power, dBm		Peak EIRP, dBm	Max. Ant. Gain, dBi
	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 1Mb
2402 MHz	2.67	2.65	1.00	-1.7
2440 MHz	2.49	2.49	1.90	-0.6
2480 MHz	2.41	2.64	4.50	2.1

Output Power reported is Maximum Peak Power.

Radiated Power was calculated from measured Field Strength using the method described in FCC KDB 412172 D01.

Antenna Gain is less than 6 dBi.

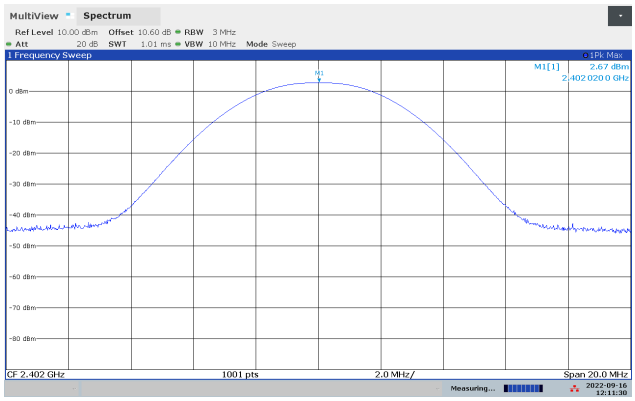
See attached plots.

Requirements:

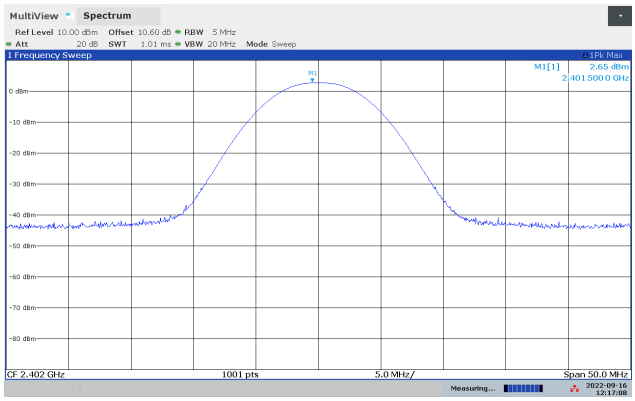
The maximum peak output power shall not exceed the following limits:

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

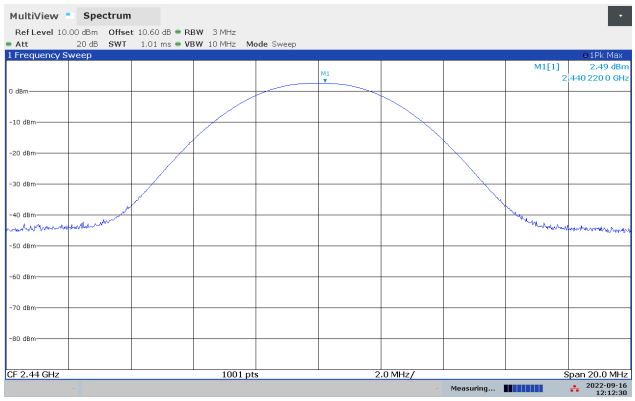
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



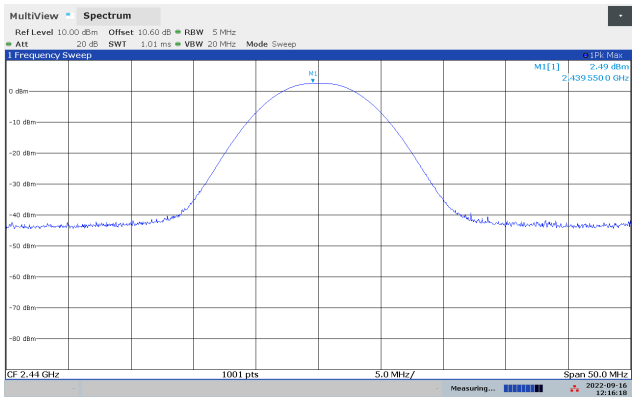
Peak Power, 2402 MHz, 1Mb



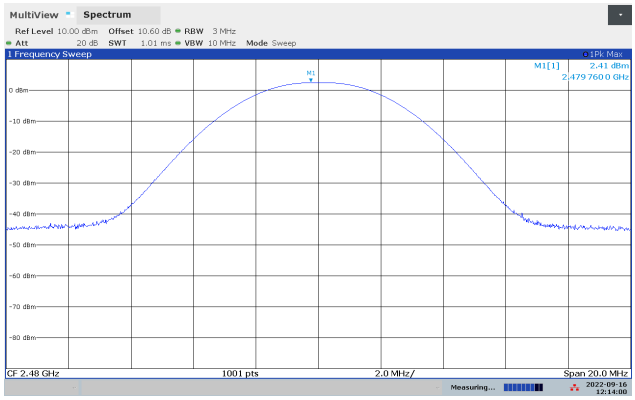
Peak Power, 2402 MHz, 2Mb



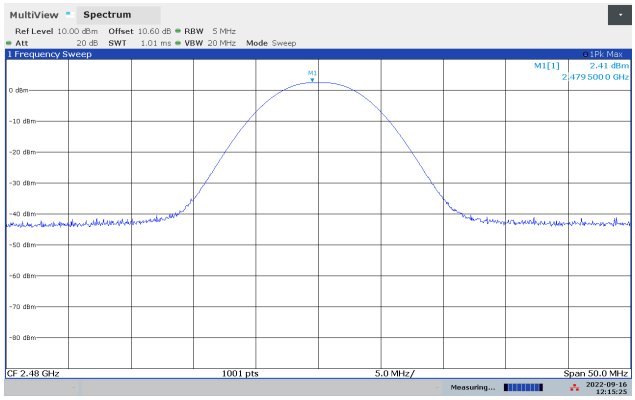
Peak Power, 2440 MHz, 1Mb



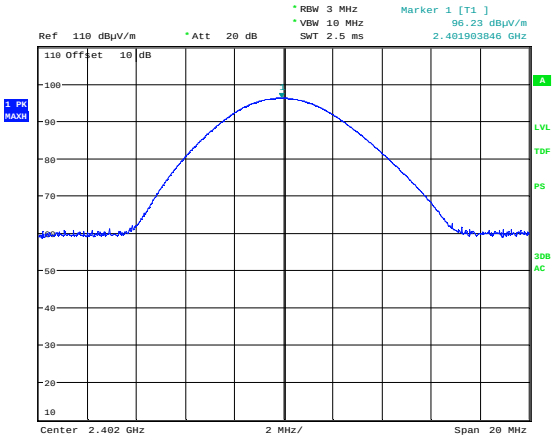
Peak Power, 2440 MHz, 2Mb



Peak Power, 2480 MHz, 1Mb

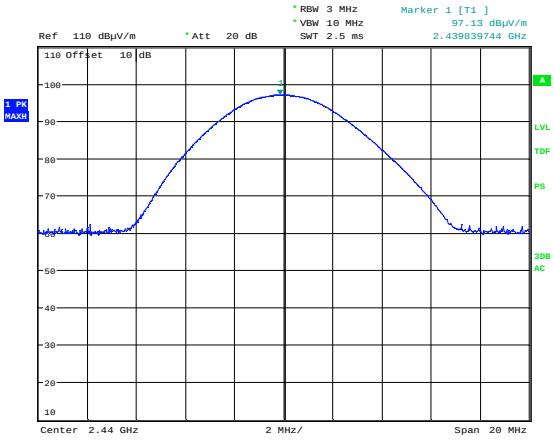


Peak Power, 2480 MHz, 2Mb



Date: 15.SEP.2022 09:52:07

Peak Field Strength, 2402 MHz, 1Mb



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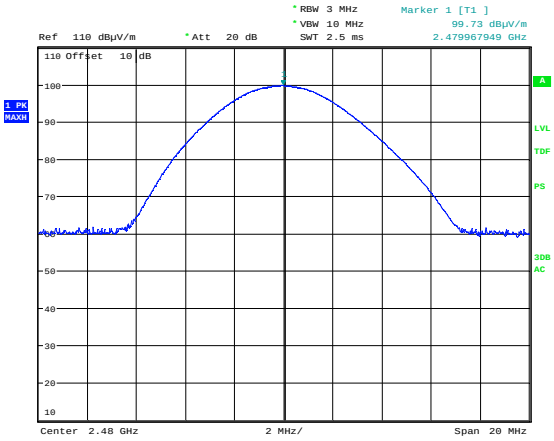
Peak Field Strength, 2440 MHz, 1Mb



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Peak Field Strength, 2480 MHz, 1Mb

3.4 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 2, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

Measurement Data:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
2402 MHz	> 36	> 10	Pass
2440 MHz	> 36	> 10	Pass
2480 MHz	> 36	> 10	Pass

Measured with Peak Detector

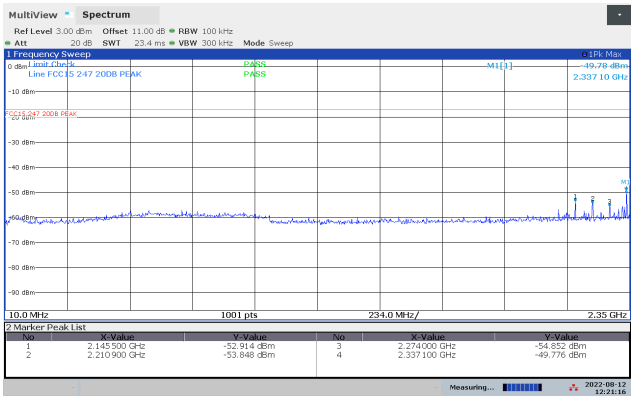
RF conducted power to 25 GHz: see attached plots.

Limit

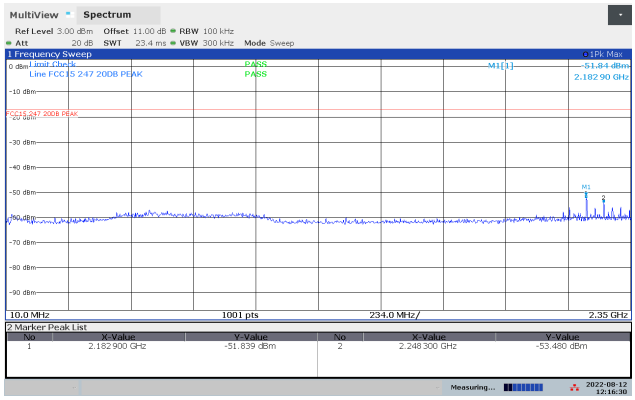
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

Detector type shall be the same as used for measuring Output Power.

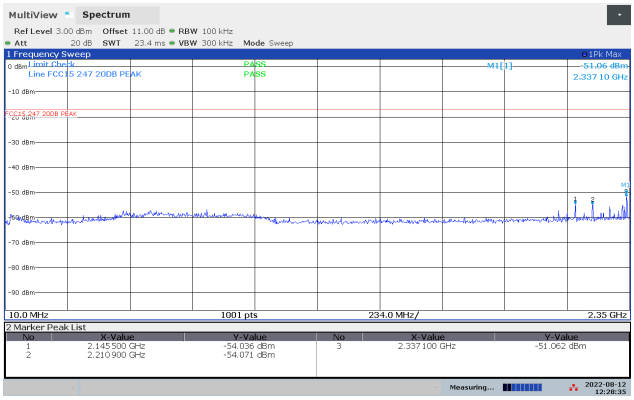
Attenuation below the general limits specified in part 15.209(a) is not required.



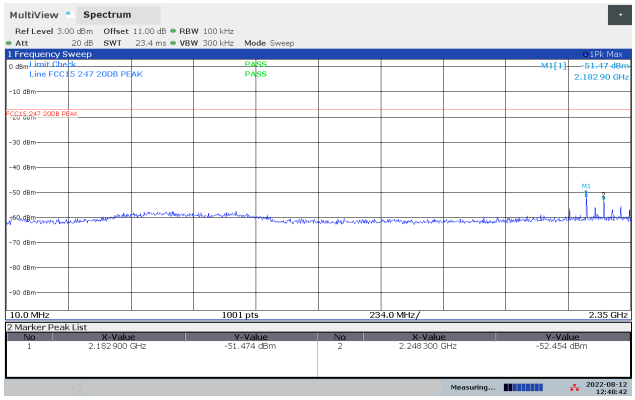
Conducted Emissions 10-2350 MHz, 2402 MHz, 1Mb



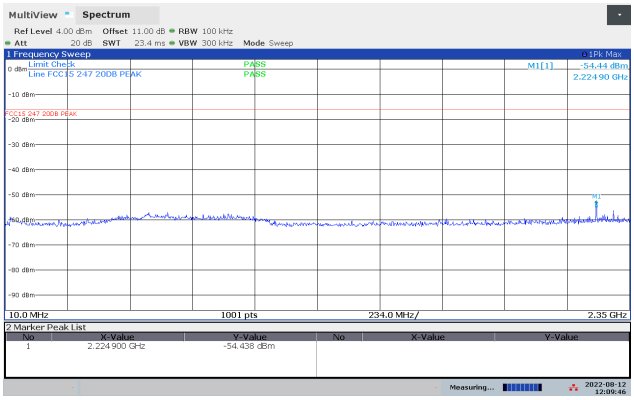
Conducted Emissions 10-2350 MHz, 2440 MHz, 1Mb



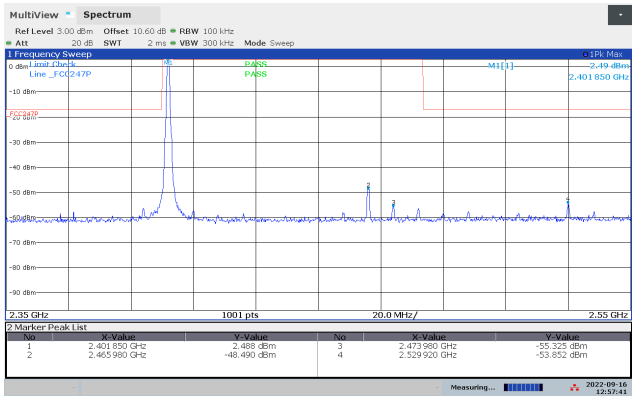
Conducted Emissions 10-2350 MHz, 2402 MHz, 2Mb



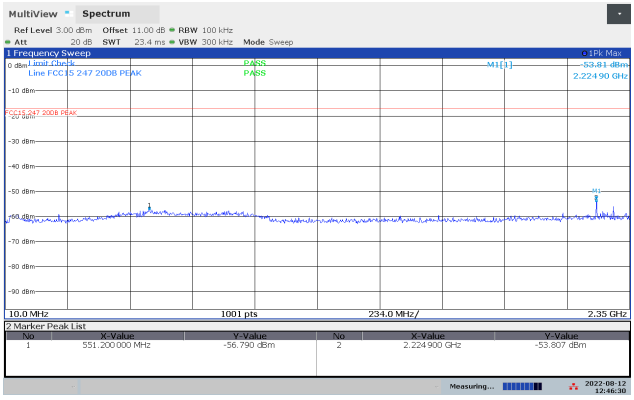
Conducted Emissions 10-2350 MHz, 2440 MHz, 2Mb



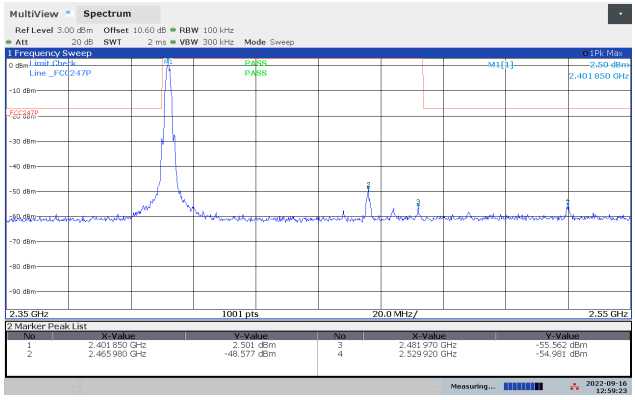
Conducted Emissions 10-2350 MHz, 2480 MHz, 1Mb



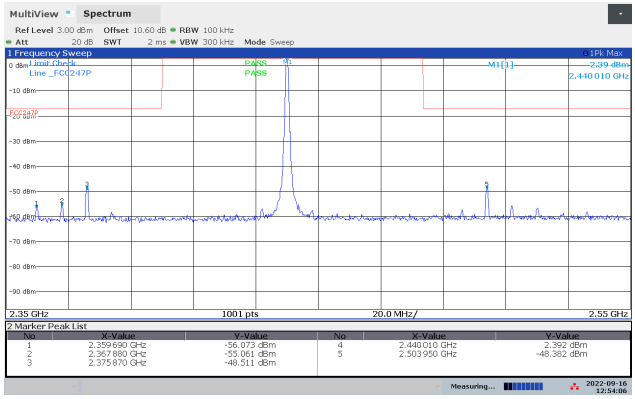
Conducted Emissions 2350-2550 MHz, 2402 MHz, 1Mb



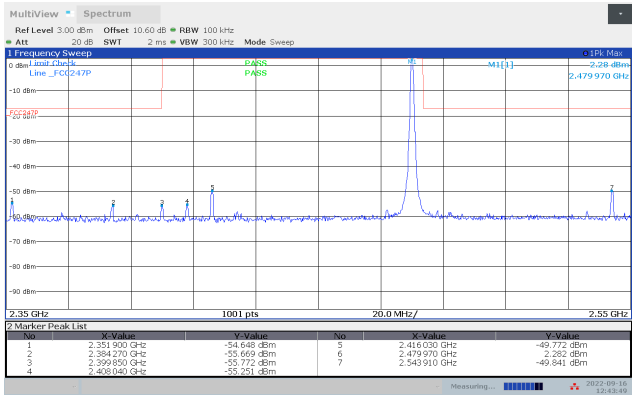
Conducted Emissions 10-2350 MHz, 2480 MHz, 2Mb



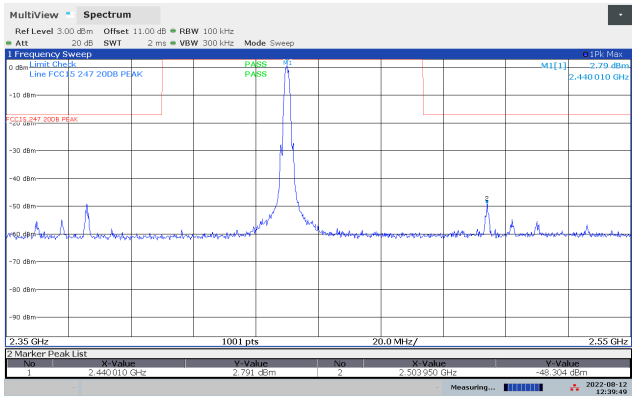
Conducted Emissions 2350-2550 MHz, 2402 MHz, 2Mb



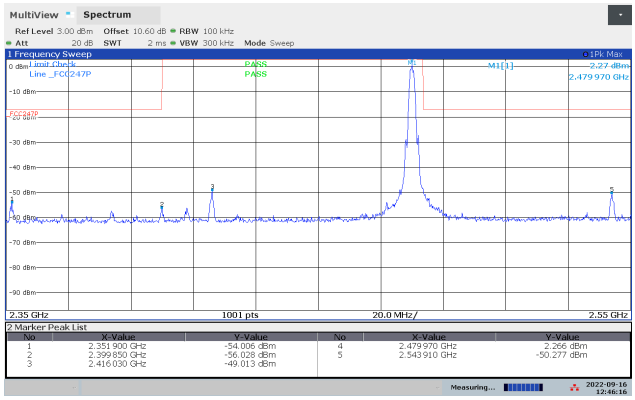
Conducted Emissions 2350-2550 MHz, 2440 MHz, 1Mb



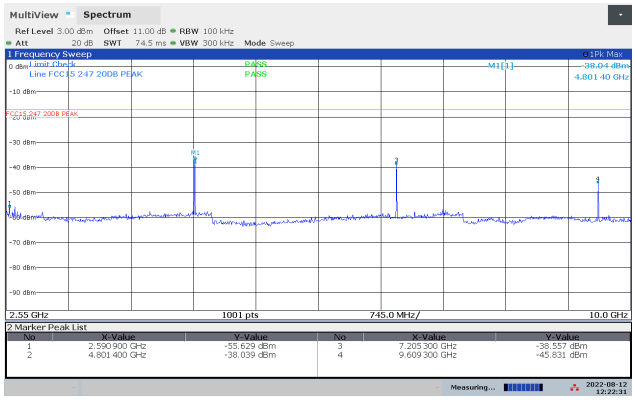
Conducted Emissions 2350-2550 MHz, 2480 MHz, 1Mb



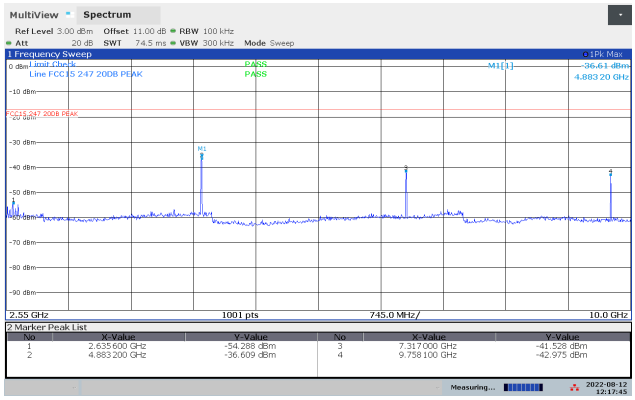
Conducted Emissions 2350-2550 MHz, 2440 MHz, 2Mb



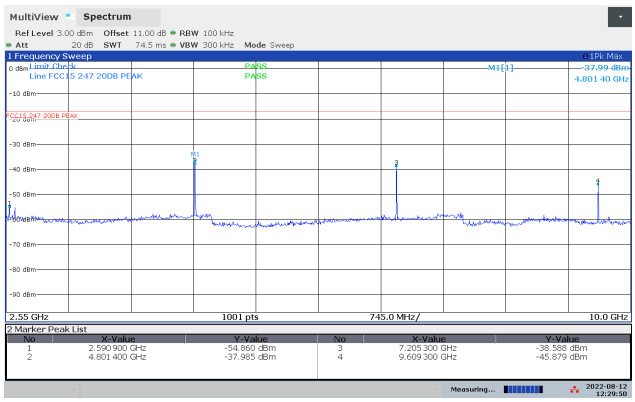
Conducted Emissions 2350-2550 MHz, 2480 MHz, 2Mb



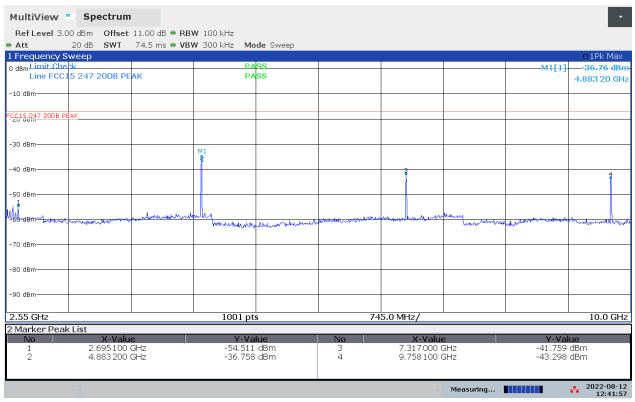
Conducted Emissions 2.55-10 GHz, 2402 MHz, 1Mb



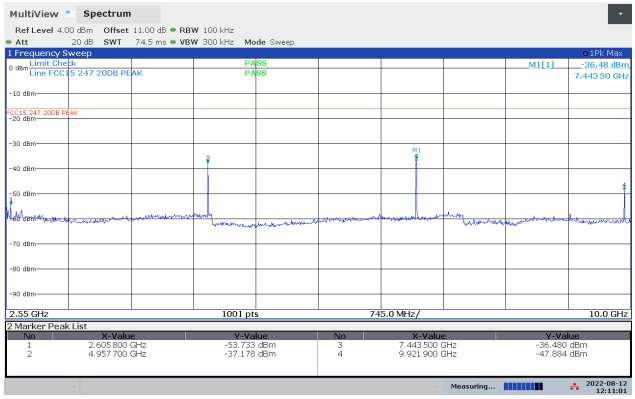
Conducted Emissions 2.55-10 GHz, 2440 MHz, 1Mb



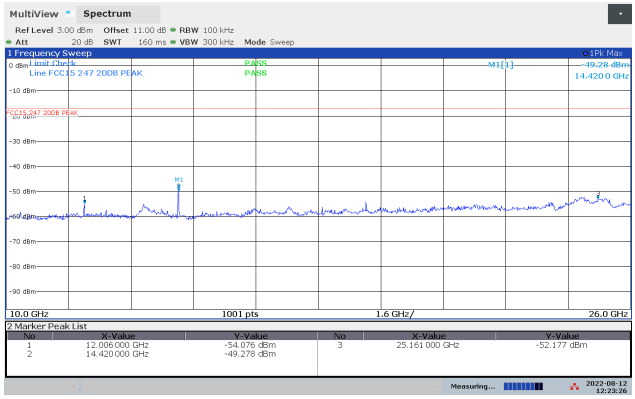
Conducted Emissions 2.55-10 GHz, 2402 MHz, 2Mb



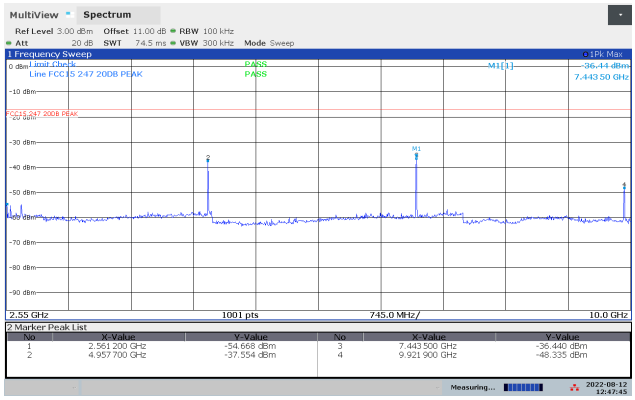
Conducted Emissions 2.55-10 GHz, 2440 MHz, 2Mb



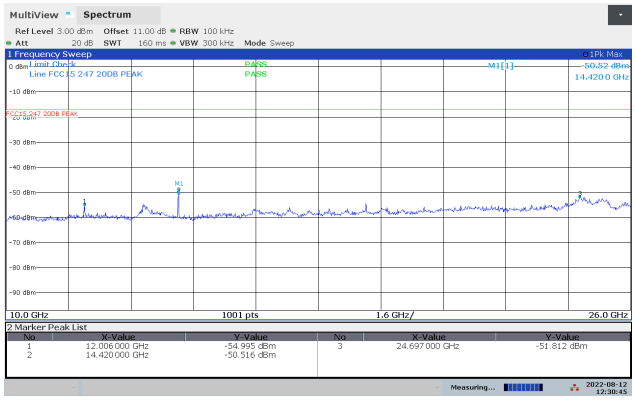
Conducted Emissions 2.55-10 GHz, 2480 MHz, 1Mb



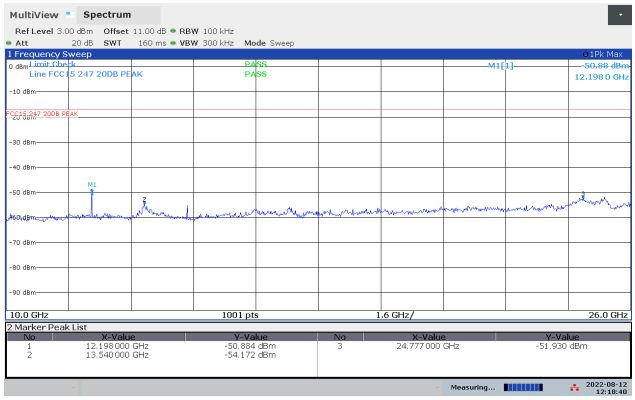
Conducted Emissions 10-26 GHz, 2402 MHz, 1Mb



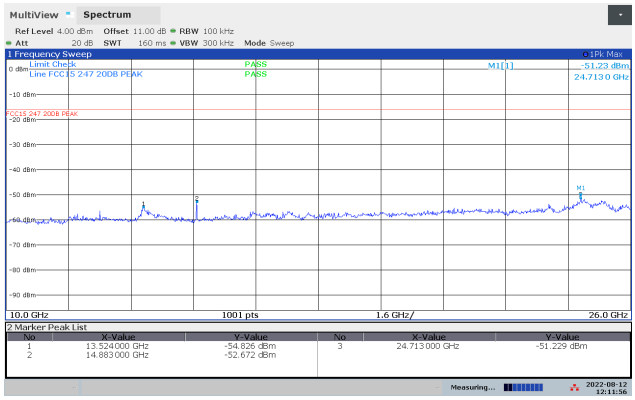
Conducted Emissions 2.55-10 GHz, 2480 MHz, 2Mb



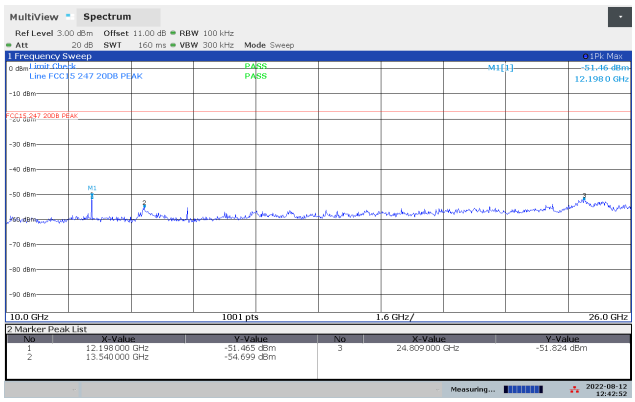
Conducted Emissions 10-26 GHz, 2402 MHz, 2Mb



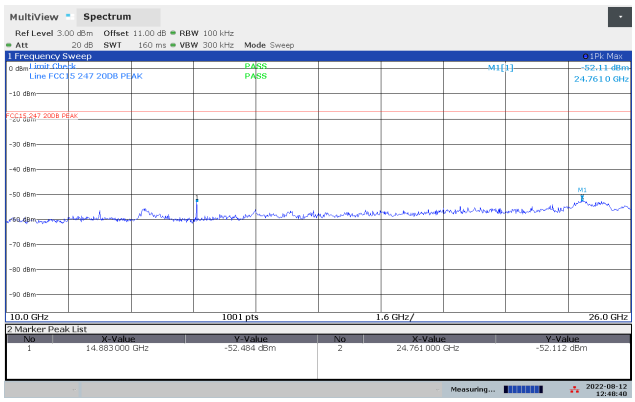
Conducted Emissions 10-26 GHz, 2440 MHz, 1Mb



Conducted Emissions 10-26 GHz, 2480 MHz, 1Mb



Conducted Emissions 10-26 GHz, 2440 MHz, 2Mb



Conducted Emissions 10-26 GHz, 2480 MHz, 2Mb

3.5 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		**0.96-1.24** **1.3-1.427**	**0.96-1.427**
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		**2.69-2.9**	**2.655-2.9**
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		**3.6-4.4**	**3.5-4.4**
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 **123-138**	**108-138**	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.6 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Peak Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	53.5	59.6	74	20.5	14.4
GFSK, 2Mb	54.4	65.3	74	19.6	8.7

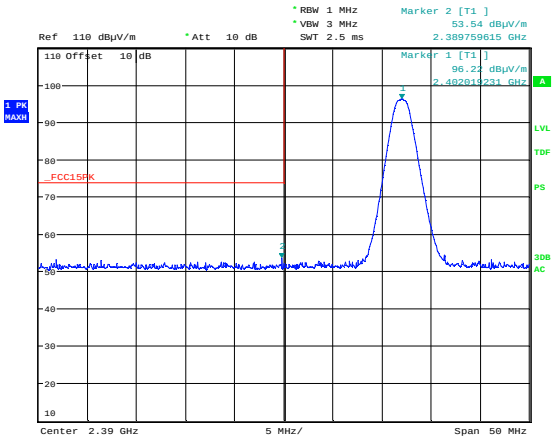
Average Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	40.7	52.8	54	13.3	1.2
GFSK, 2Mb	37.9	53.1	54	16.1	0.9

Average values were measured with RMS Detector using SA2 and are corrected for Duty Cycle.

Duty Cycle

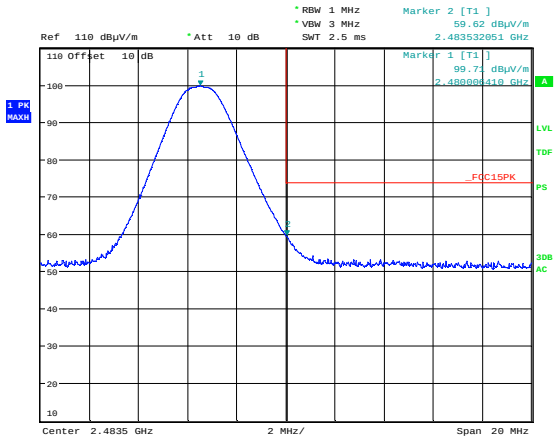
Bitrate	Duty Cycle	DC Corr Factor, Linear, dB	DC Corr Factor, RMS, dB
GFSK, 1Mb	0.40	8.0 dB	4.0
GFSK, 2Mb	0.20	14.0 dB	7.0

See attached plots.



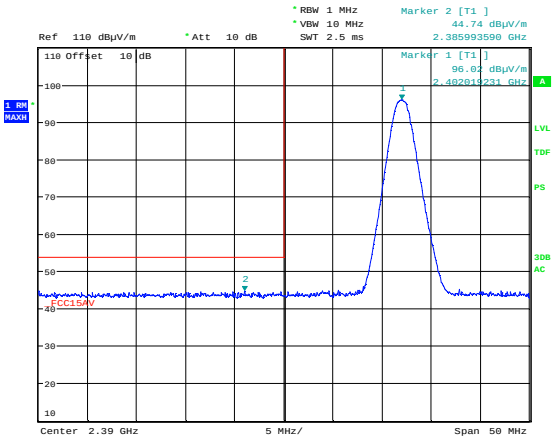
Date: 15.SEP.2022 09:53:15

Lower Band Edge, 2402 MHz, 1Mb, Peak



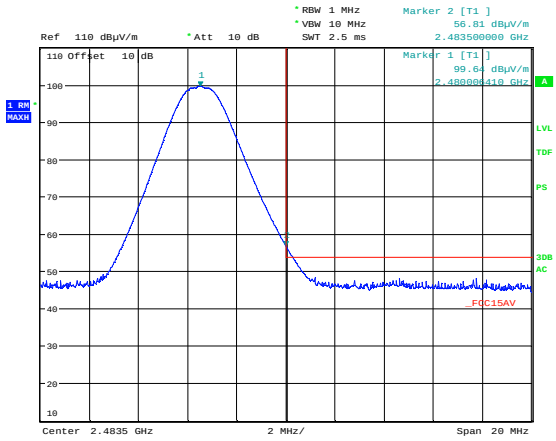
Date: 15.SEP.2022 09:19:13

Upper Band Edge, 2480 MHz, 1Mb, Peak



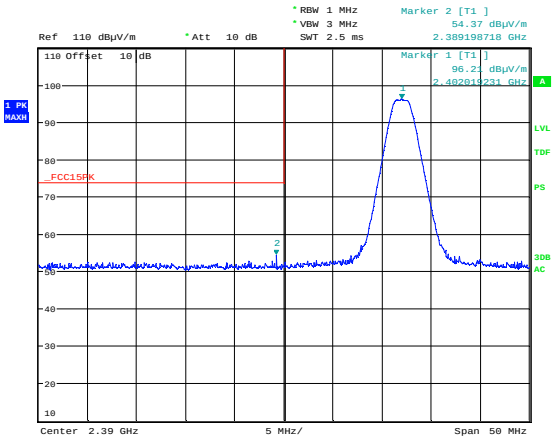
Date: 15.SEP.2022 09:54:50

Lower Band Edge, 2402 MHz, 1Mb, Average



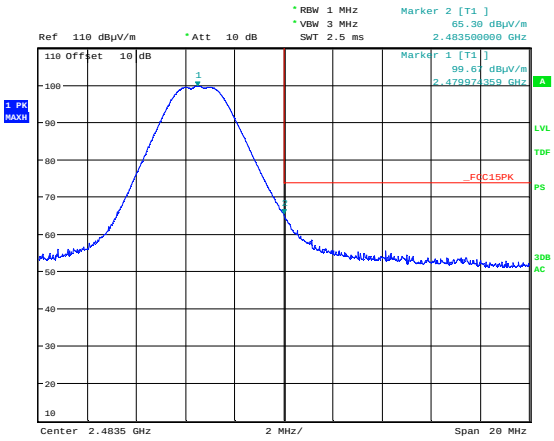
Date: 15.SEP.2022 09:20:48

Upper Band Edge, 2480 MHz, 1Mb, Average



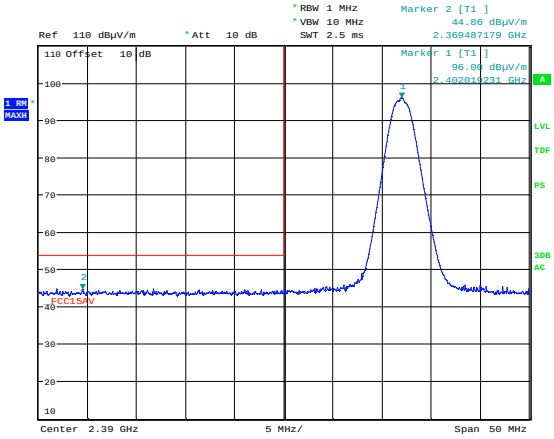
Date: 15.SEP.2022 09:58:39

Lower Band Edge, 2402 MHz, 2Mb, Peak



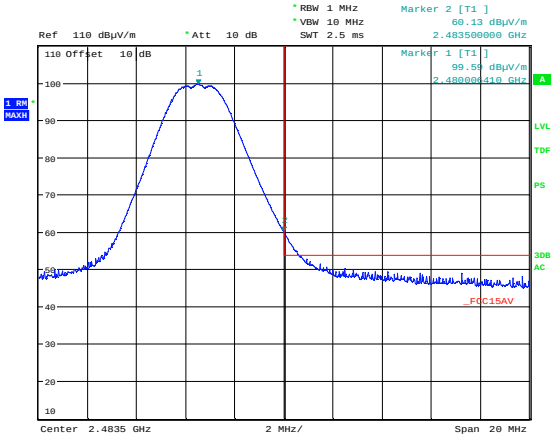
Date: 15.SEP.2022 09:26:40

Upper Band Edge, 2480 MHz, 2Mb, Peak



Date: 15.SEP.2022 09:59:37

Lower Band Edge, 2402 MHz, 2Mb, Average



Date: 15.SEP.2022 09:27:37

Upper Band Edge, 2480 MHz, 2Mb, Average

3.7 Radiated Emissions, 30 – 1000 MHz.

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak

Measuring distance 3m.

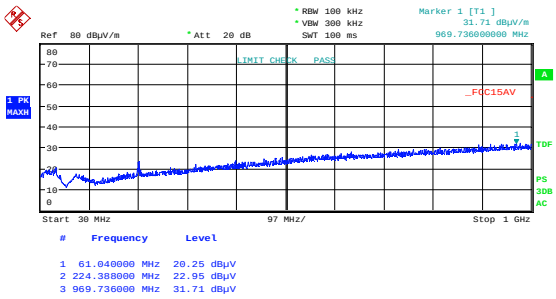
Tested in test mode with EUT transmitting on 2440 MHz.

Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30 – 88	2440	GFSK	< 30	40.0	> 10
88 – 216	2440	GFSK	< 30	43.5	> 13.5
216 – 960	2440	GFSK	< 30	46.0	> 16
960 – 1000	2440	GFSK	< 40	54.0	> 14

See attached plots.

Requirements/Limit

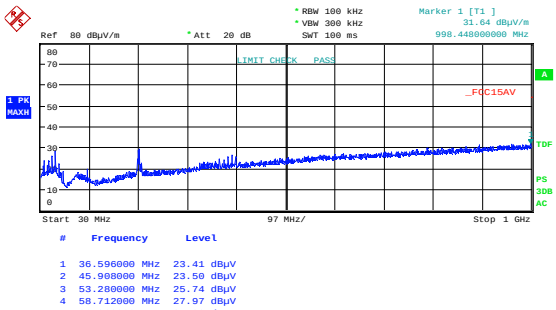
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	



#	Frequency	Level
1	61.040000 MHz	20.25 dBµV
2	224.388000 MHz	22.95 dBµV
3	969.736000 MHz	31.71 dBµV

Date: 11.AUG.2022 10:58:03

Radiated Emissions 30 - 1000 MHz, HP



#	Frequency	Level
1	36.596000 MHz	23.41 dBµV
2	45.908000 MHz	23.50 dBµV
3	53.280000 MHz	25.74 dBµV
4	58.712000 MHz	27.97 dBµV
5	66.860000 MHz	21.80 dBµV
6	121.956000 MHz	19.21 dBµV
7	224.388000 MHz	29.07 dBµV
8	998.448000 MHz	31.64 dBµV

Date: 11.AUG.2022 10:56:14

Radiated Emissions 30 - 1000 MHz, VP

3.8 Radiated Emissions, 1 – 26 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)

Detector: Peak

A pre-scan was performed above 18 GHz.

No spuriouses were detected. See plots.

A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

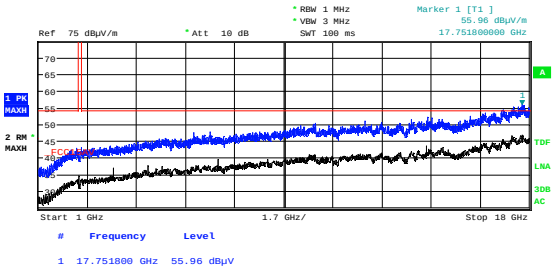
Antenna factor, amplifier gain, and cable loss are included in spectrum analyzer “Transducer factor”.

Average values are calculated from Peak values and corrected for Duty Cycle.

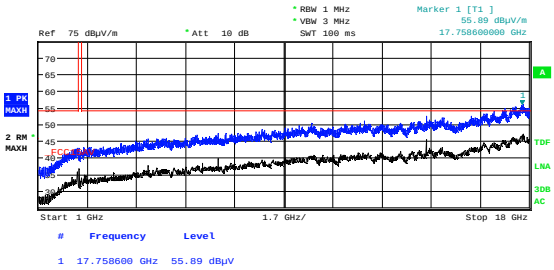
See plots.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



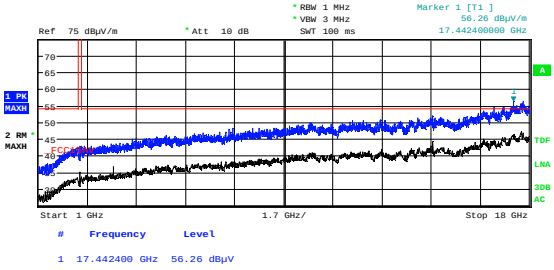
Date: 15.SEP.2022 10:36:26



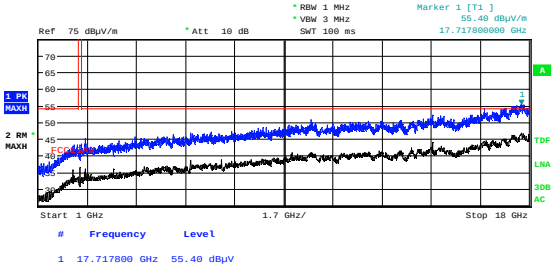
Date: 15.SEP.2022 10:34:30

Radiated Emissions 1 - 18 GHz, 2402 MHz, 1Mb, HP

VP



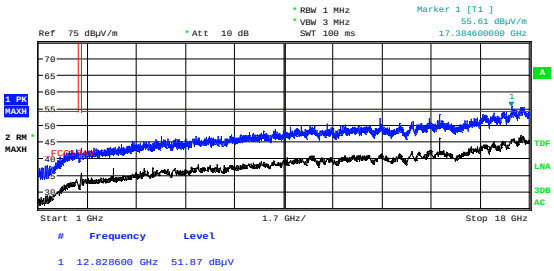
Date: 15.SEP.2022 10:21:45



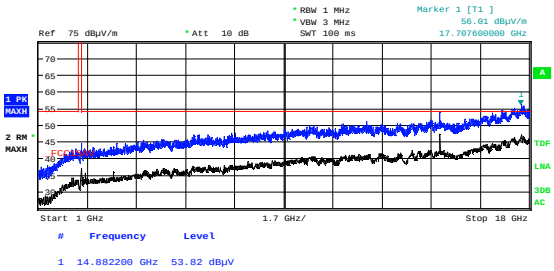
Date: 15.SEP.2022 10:19:49

Radiated Emissions 1 - 18 GHz, 2440 MHz, 1Mb, HP

VP



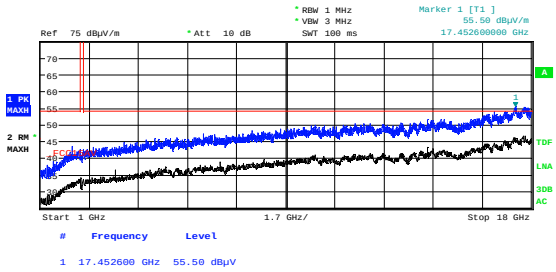
Date: 15.SEP.2022 10:49:44



Date: 15.SEP.2022 10:47:48

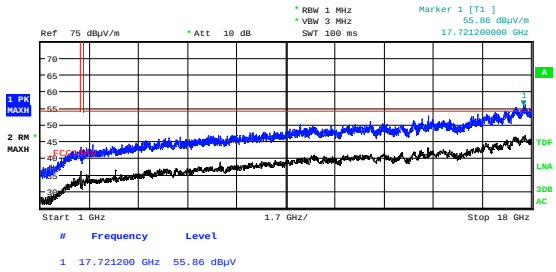
Radiated Emissions 1 - 18 GHz, 2480 MHz, 1Mb, HP

VP



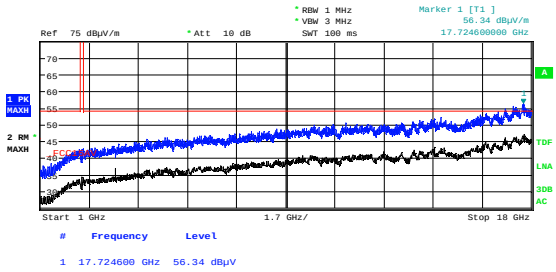
Date: 15.SEP.2022 10:42:32

Radiated Emissions 1 - 18 GHz, 2402 MHz, 2Mb, HP



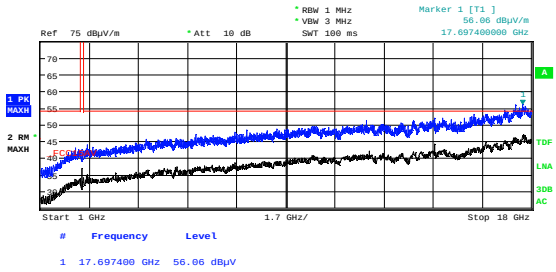
Date: 15.SEP.2022 10:40:36

VP



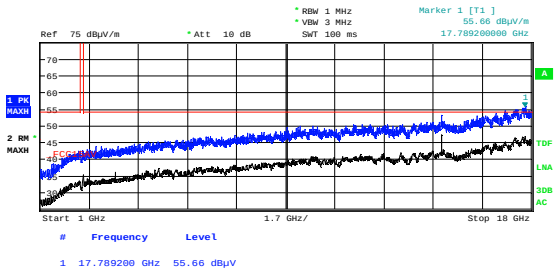
Date: 15.SEP.2022 10:29:58

Radiated Emissions 1 - 18 GHz, 2440 MHz, 2Mb, HP



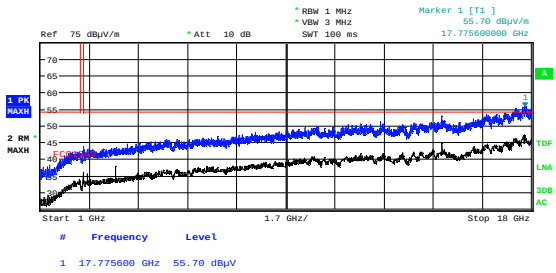
Date: 15.SEP.2022 10:28:02

VP



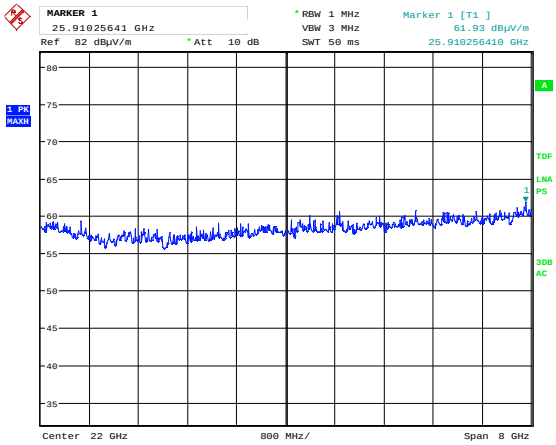
Date: 15.SEP.2022 10:56:05

Radiated Emissions 1 - 18 GHz, 2480 MHz, 2Mb, HP



Date: 15.SEP.2022 10:54:09

VP



Date: 11.AUG.2022 14:35:02

Pre-scan 18 - 26 GHz, 2440 MHz, 1Mb, @10cm

3.9 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 2, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

Test Results: Complies

Measurement Data:

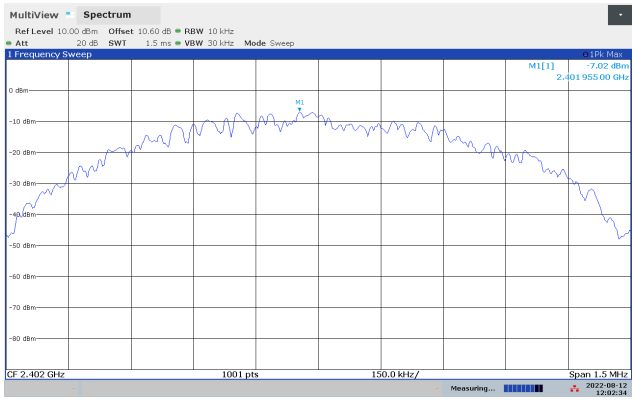
The measurement procedure PKPSD described in ANSI C63.10-2013 was used.

Modulation Type and Bitrate	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1Mb	-12.3	-12.2	-12.2
GFSK 2Mb	-12.5	-12.5	-12.4

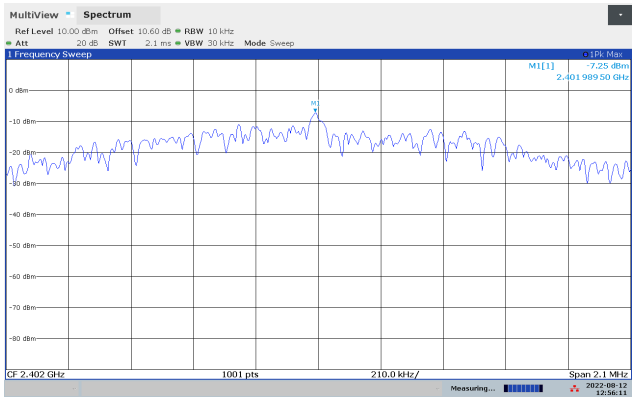
The measured values with 30kHz RBW are corrected by a Bandwidth Correction Factor of -5.2 dB.

Requirements:

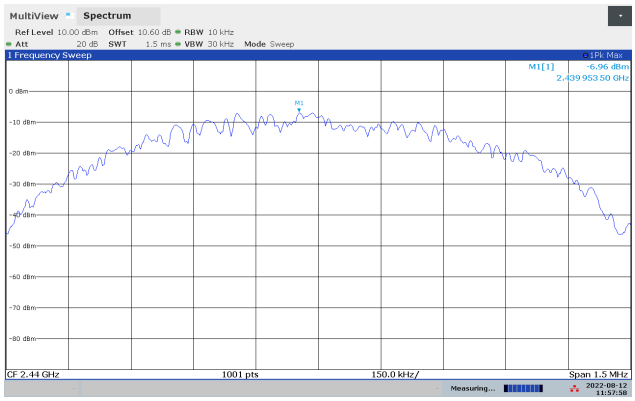
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band



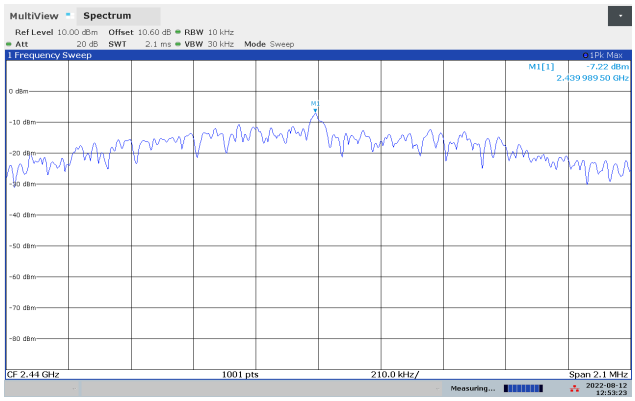
PSD, 2402 MHz, 1Mb



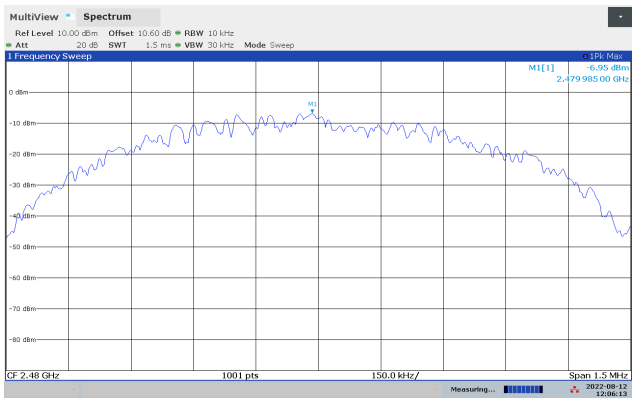
PSD, 2402 MHz, 2Mb



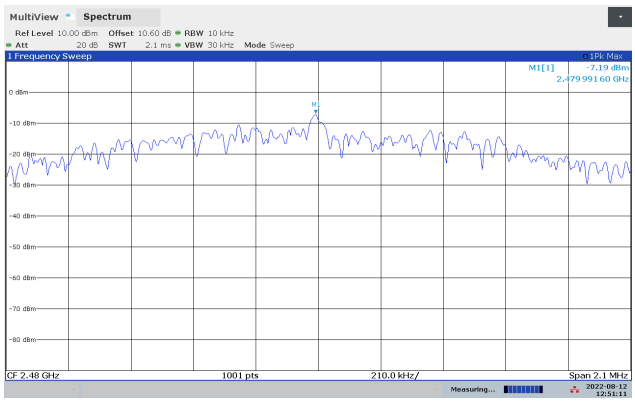
PSD, 2440 MHz, 1Mb



PSD, 2440 MHz, 2Mb



PSD, 2480 MHz, 1Mb



PSD, 2480 MHz, 2Mb

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

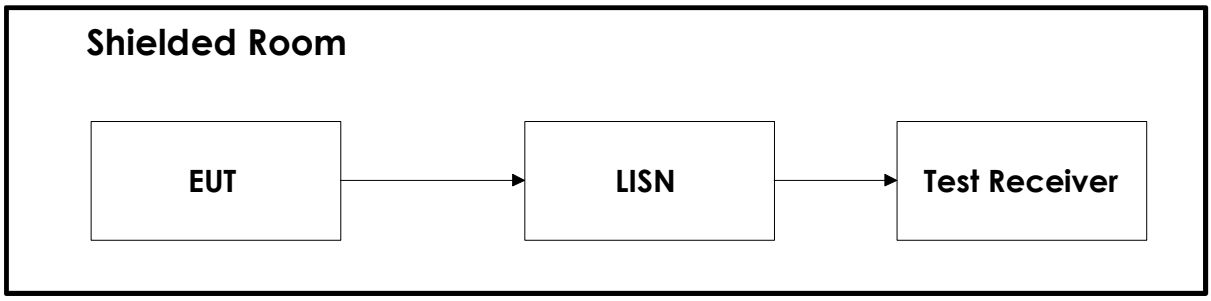
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2022-01	2023-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
3	6810.17B	Attenuator	Suhner	LR 1669	2022-08	2023-08
4	NO324415	Band Reject Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2021-05	2024-05
6	317	Preamplifier	Sonoma Inst.	LR 1687	2022-08	2023-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2022-08	2023-08
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2022-08	2023-08
9	L01G1185G1	Low Pass Filter (1.0 GHz)	Microwave Circuits	LR 1768	COU	
10	638	Antenna Horn	Narda	LR 1480	N/A	
11	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

The software listed below has been used for one or more tests.

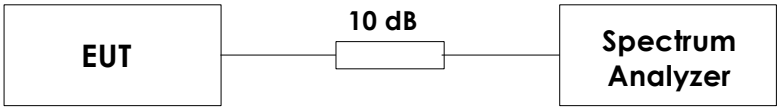
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission

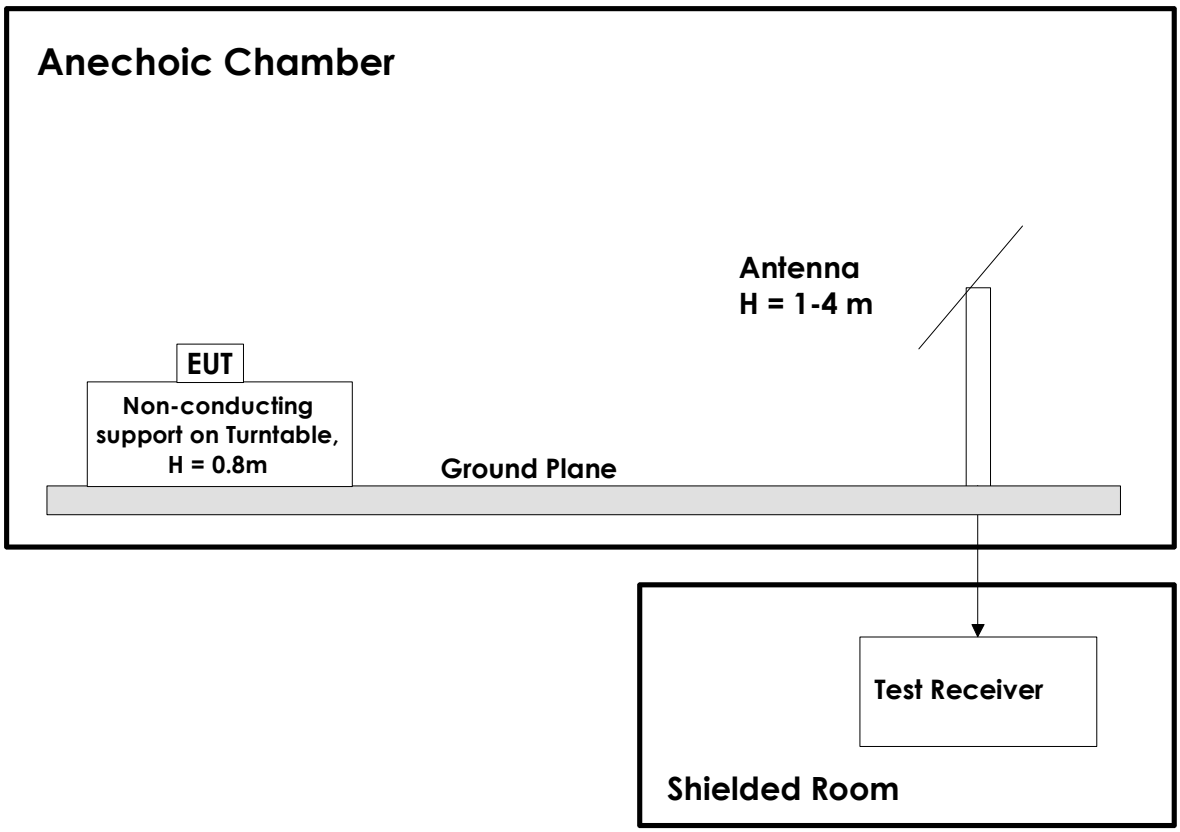


6.2 Conducted Tests



This test set-up is used for all Conducted tests.
For Frequency Stability test the EUT was placed in a climatic chamber.

6.3 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.