

Test Report

Product	Beat Gateway
Name and address of the applicant	Assa Abloy Global Solutions Czech Republic s.r.o. Chlumecká 3203, Horní Počernice 198 00 Prague, Czech Republic
Name and address of the manufacturer	Assa Abloy Global Solutions Czech Republic s.r.o. Chlumecká 3203, Horní Počernice 198 00 Prague, Czech Republic
Model	BGW/A1 BGW/A2
Rating	BGW/A1: 6VDC (Primary Battery CR-P2) BGW/A2: 12-24 V _{DC}
Trademark	ASSA ABLOY
Additional information	Bluetooth Low Energy, LTE
Tested according to	FCC Part 15.247 Digital Transmission Systems ISED Canada RSS-247, Issue 3 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	PRJ0027408
Tested in period	2024-01-23 to 2024-03-04
Issue date	2024-03-21
Name and address of the testing laboratory	 Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com CAB Number: FCC: N00001 ISED: N00470 ISED No: 2040D-1   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frøde Sveinsen]  Approved by [Jan G Eriksen]	
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Revision history

Revision	Date	Comment	Sign
A	2024-03-21	First edition	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

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1 INFORMATION

1.1 Test Item

Name	Beat Gateway
Model/version	BGW/A1 BGW/A2
FCC ID	2BFGYBGWA12
ISED ID	32212-BGWA12
Serial number	PRJ00274080005
Hardware identity and/or version	1.0.0
Software identity and/or version	0.0.1
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	Bluetooth Low Energy ☒ 1Mb ☐ 2Mb
Type of Modulation	GFSK
Conducted Output Power	2.24 mW
Antenna Connector	BLE: RP-SMA LTE-M: SMA
Antennas	BLE Antenna: Linx Technologies ANT-2.4-LCW-RPS (2400-2500 MHz) LTE Antenna: Quectel YECT002AA (700-960, 1710-2690 MHz) Dual Mode Antenna: 2J6947B (Cable length Min 20 cm, Max 2 m)
Diversity or Smart Antennas	No
Power Supply	BGW/A1: Primary Batteries (6V _{DC} , 2x CR-P2 or 4x CR-P2) BGW/A2: External DC Supply (12-24V _{DC})
Interfaces	USB-C, used only for setup and updates

Description of Test Item

The EUT is a wireless gateway with Bluetooth Low Energy and LTE-M wireless interfaces.

The EUT uses LTE-M (Quectel BG95-M3 modem) to communicate with internet and BLE to communicate with locking devices.

All tests were performed on a BGW/A2 with powered from a regulated DC Power Supply.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	12 V DC (DC Supply Voltage)

The values are the limit registered during the test period.

1.3 Test Engineers

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☒ YES	☐ NO
If detachable, is the antenna connector non-standard?	☒ YES	☐ NO
The BLE transceiver have a RP-SMA connector, the LTE module has a standard SMA 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	The BLE transceiver was programmed using the Nordic Semiconductor nRF test software from a computer. The computer was connected to the USB-C interface when programming.

1.6 Comments

The measurements were performed with the EUT powered by 12 V DC from a regulated power supply. It was checked that power variations between 85% of 12V DC and 115% of 24V DC, did not have any influence on the measurements.

2 TEST REPORT SUMMARY

2.1 General

The tests were conducted on a sample of the equipment for demonstrating compliance with one or more of the following standards:

Standard	Description
FCC CFR 47 Part 15.247	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz
ISED RSS-247, Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISED RSS-GEN Issue 5	General Requirements for Compliance of Radio Apparatus

The following reference standards and documents were used for one or more measurements:

Standard	Description
ANSI C63.4-2014	Unintentional Radiators
ANSI C63.10-2013	Intentional Radiators
FCC KDB 558074 D01	15.247 Measurement Guidance for DTS and Frequency Hopping Systems
FCC KDB 412172 D01	Determining ERP and EIRP

All measurements are traceable to national standards.

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

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

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 3, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	Pass
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Pass
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	Pass
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Pass
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	11.8 Option 2	Pass
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Pass
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	11.10.2 PKPSD (DTS)	Pass
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 11.11 (DTS)	Pass
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	3.3 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)	Pass

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN

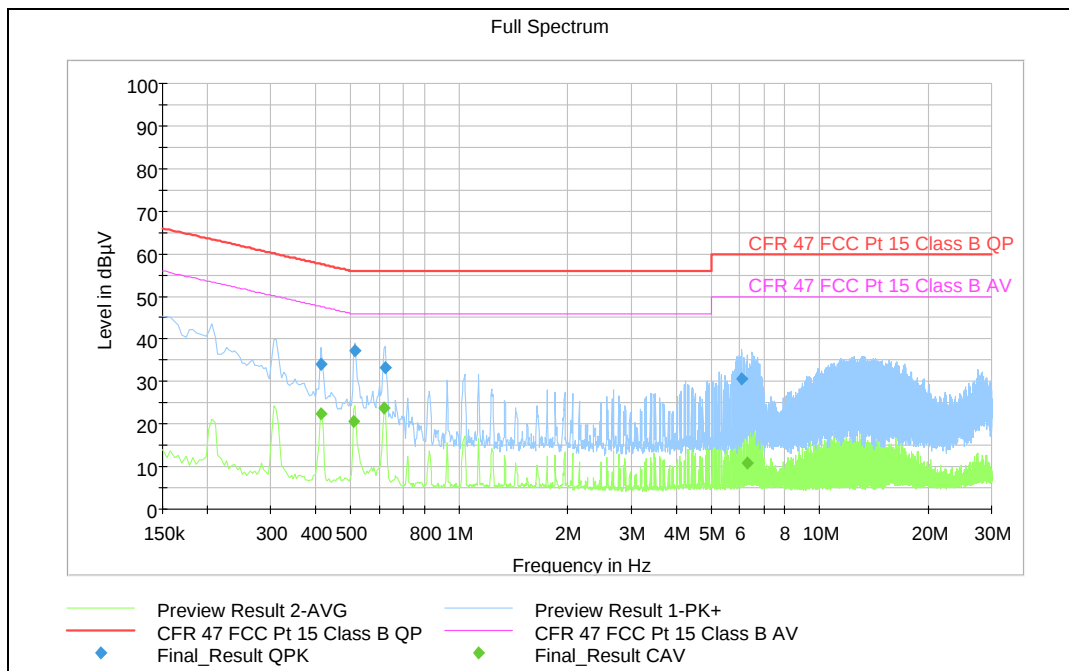
Test Results: Complies

Measurement Data: See attached plots

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.414000	34.00	---	57.57	23.57	15000.0	9.000	N	OFF	9.6
0.414000	---	22.40	47.57	25.17	15000.0	9.000	L1	OFF	9.6
0.510000	---	20.62	46.00	25.38	15000.0	9.000	N	OFF	9.6
0.514000	37.17	---	56.00	18.83	15000.0	9.000	L1	OFF	9.6
0.618000	---	23.84	46.00	22.16	15000.0	9.000	L1	OFF	9.6
0.622000	33.26	---	56.00	22.74	15000.0	9.000	N	OFF	9.6
6.098000	30.71	---	60.00	29.29	15000.0	9.000	L1	OFF	9.8
6.306000	---	10.81	50.00	39.19	15000.0	9.000	L1	OFF	9.8

Tested with 120V 60Hz AC. An external Power Supply Brand ClasOhlson Model 0055 was used for this test.



3.2 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:

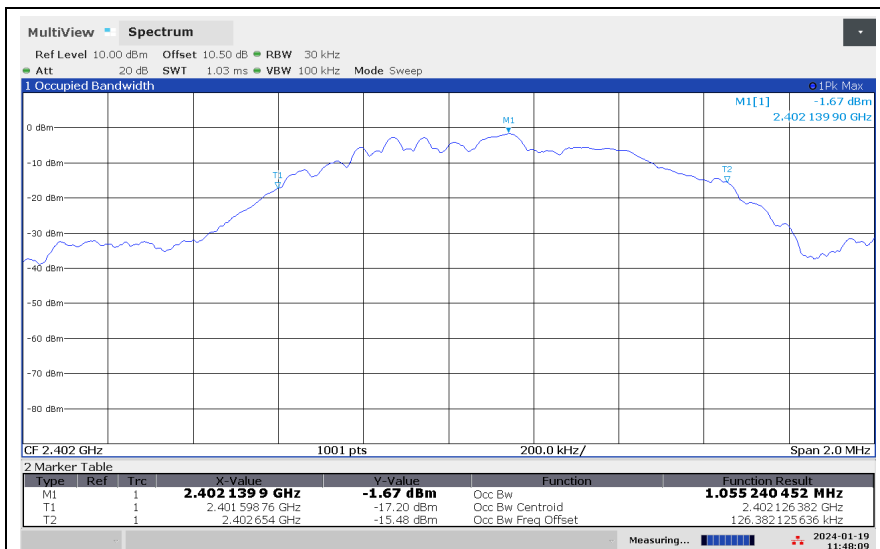
Carrier Frequency, Data Rate	Occupied Bandwidth (99% BW)
2402 MHz, 1Mb	1.06 MHz
2440 MHz, 1Mb	1.06 MHz
2480 MHz, 1Mb	1.05 MHz

Occupied Bandwidth is the same for all channels

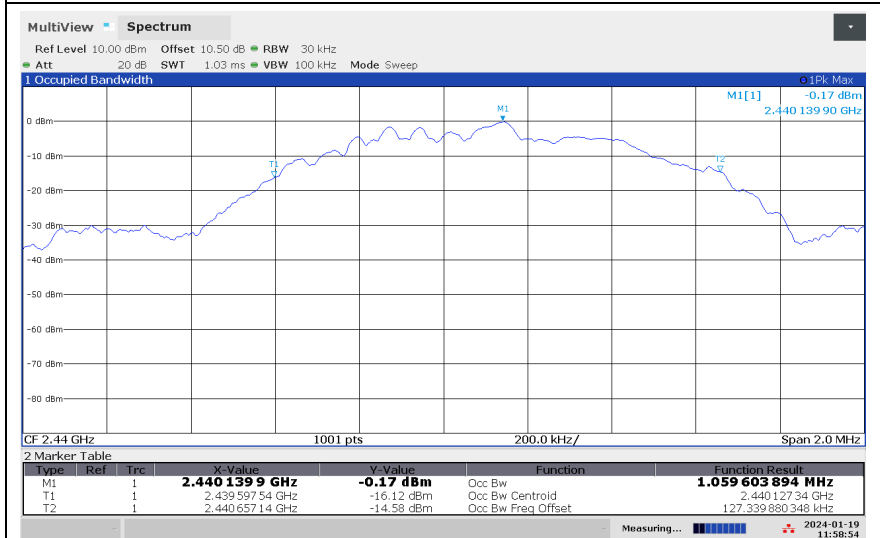
See attached plots

Requirements:

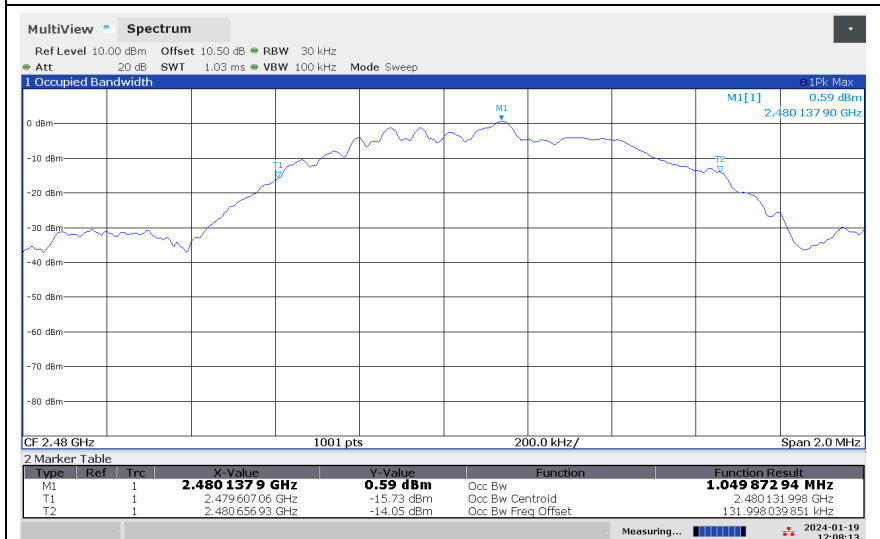
No requirement for 99% BW, reported for information only.



99% Occupied BW, 2402 MHz, 1Mb



99% Occupied BW, 2402 MHz, 1Mb



99% Occupied BW, 2480 MHz, 1Mb

3.3 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 3, Clause 5.2 (a)

Measurement procedure: ANSI C63.10-2013 Clause 11.8

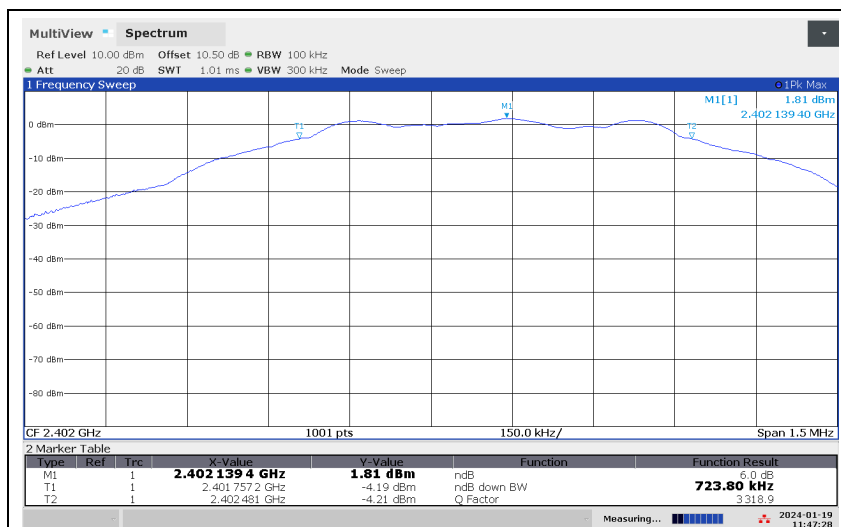
Test Results: Complies

Measurement Data:

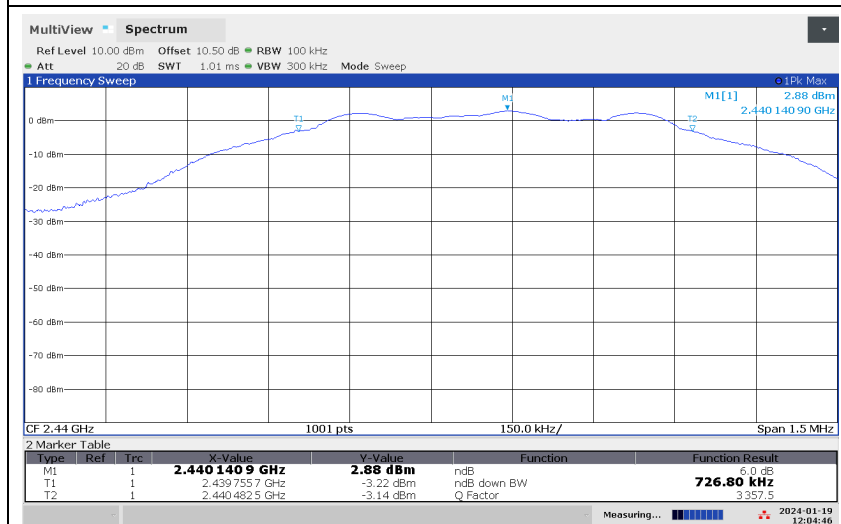
Modulation type and bitrate	Measured DTS Bandwidth (MHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1 Mbps	0.72	0.73	0.72

Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

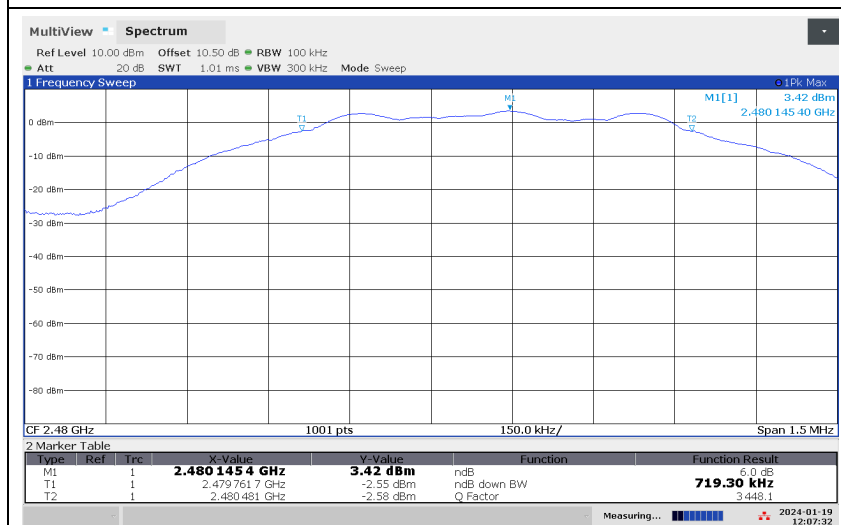
Frequency Band	Requirement for systems using Digital Modulation
902-928 MHz	The minimum 6 dB bandwidth shall be at least 500 kHz.
2400-2483.5 MHz	
5725-5850 MHz	



DTS BW, 2402 MHz, 1M



DTS BW, 2440 MHz, 1M



DTS BW, 2480 MHz, 1M

3.4 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 3, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

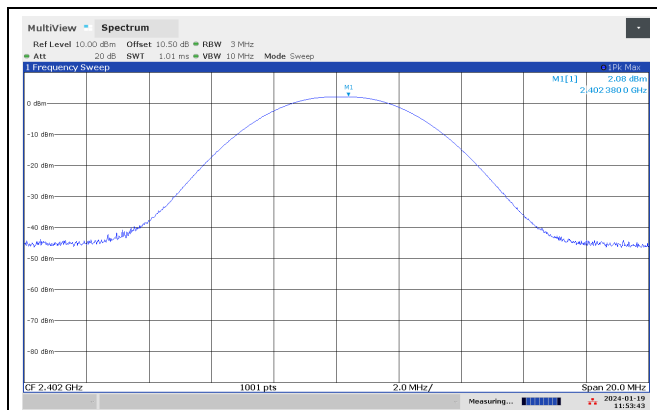
Carrier Frequency (MHz)	Peak Conducted Power (dBm)	Linx Antenna		2J Antenna	
		Peak EIRP (dBm)	Max Antenna Gain (dBi)	Peak EIRP (dBm)	Max Antenna Gain (dBi)
2402	2.08	8.33	6.3	7.02	4.9
2440	3.07	9.43	6.4	7.77	4.7
2480	3.51	10.39	6.9	8.21	4.7

Output Power reported is Maximum Peak Power.

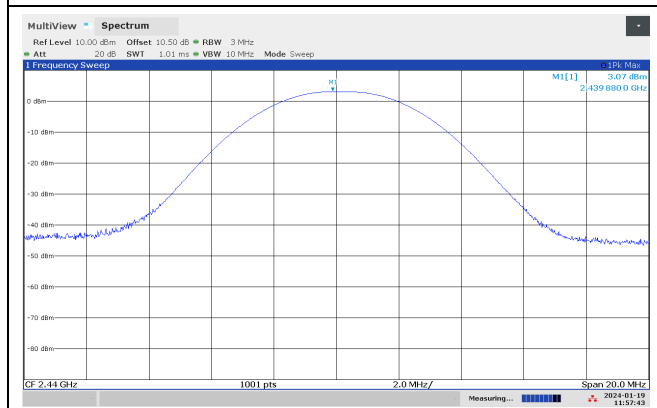
Radiated Power was calculated from measured Field Strength using the method described in FCC KDB 412172 D01.

See attached plots.

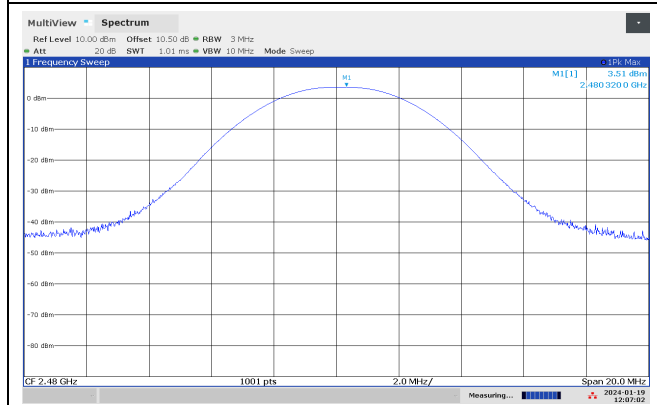
Requirements for Digital Modulation systems
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.
As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the <i>maximum conducted output power</i> is the highest total transmit power occurring in any mode.
Maximum allowed Antenna Gain
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

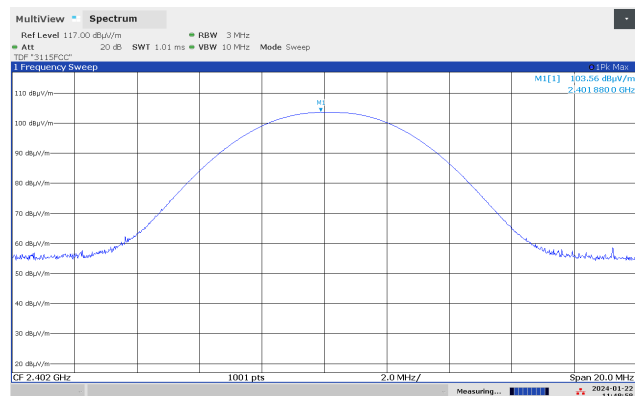


Peak Power, 2440 MHz, 1Mb



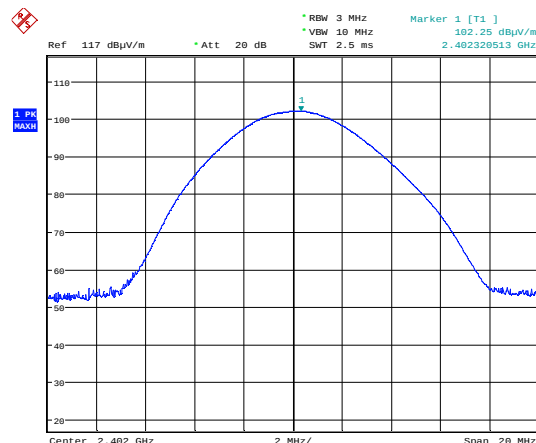
Peak Power, 2480 MHz, 1Mb

Linx Antenna



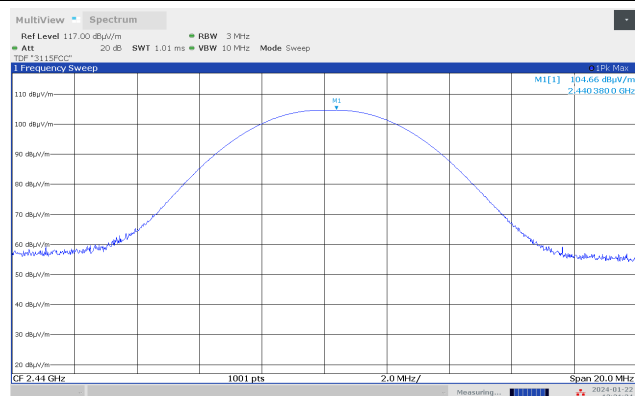
Peak EIRP, 2402 MHz, 1Mb

2J Antenna

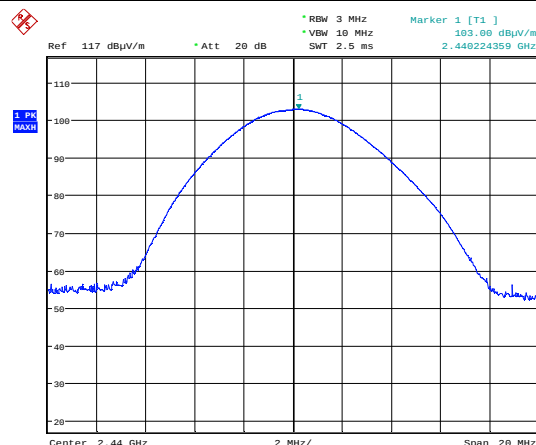


Date: 4. MAR. 2024 12:47:05

Peak EIRP, 2402 MHz, 1Mb

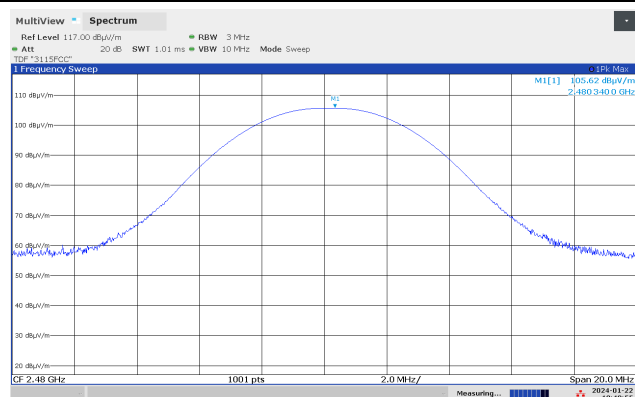


Peak EIRP, 2440 MHz, 1Mb

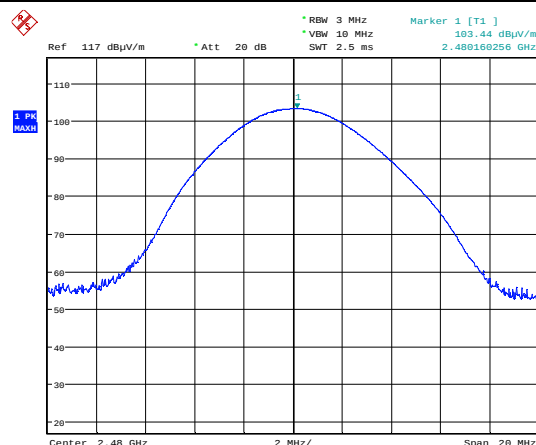


Date: 4. MAR. 2024 12:38:45

Peak EIRP, 2440 MHz, 1Mb



Peak EIRP, 2480 MHz, 1Mb



Date: 4. MAR. 2024 12:32:28

Peak EIRP, 2480 MHz, 1Mb

3.5 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 3, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

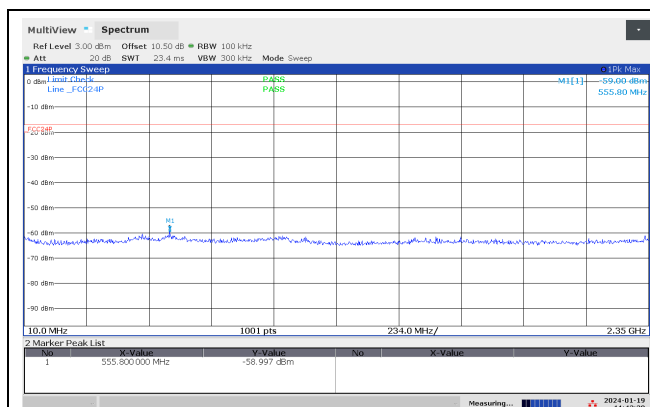
Measurement Data:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
2402 MHz	> 40	> 20	Pass
2440 MHz	> 40	> 20	Pass
2480 MHz	> 40	> 20	Pass

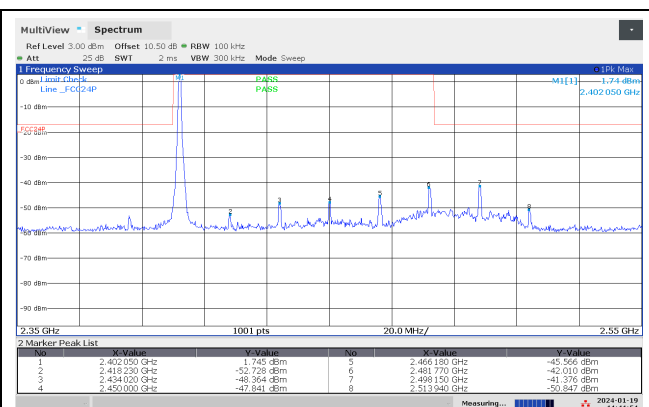
Measured with Peak Detector

RF conducted power to 25 GHz: see attached plots.

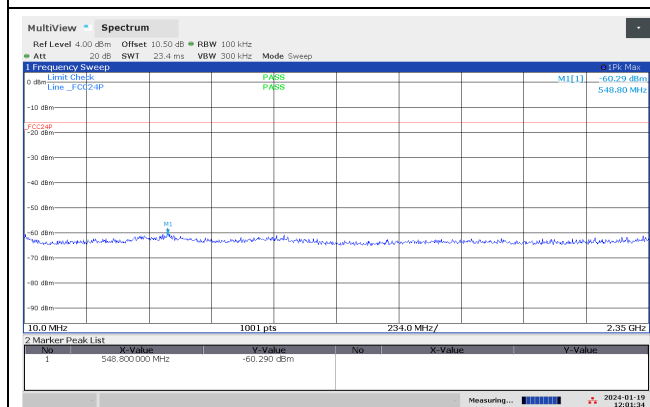
Requirements for all systems	
Peak measurement	RMS averaging (alternative measurement)
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.	



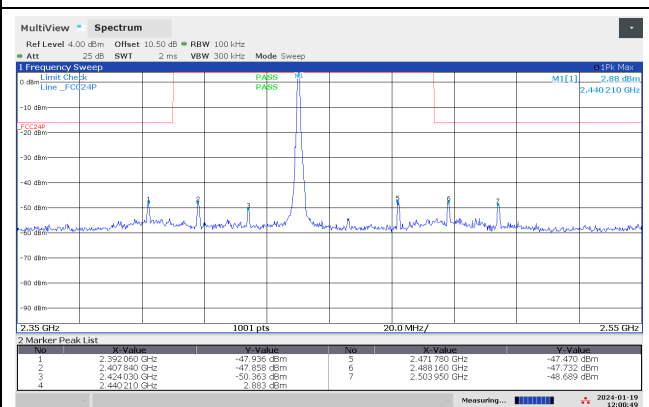
Conducted Emissions 10-2350 MHz, 2402 MHz, 1Mb



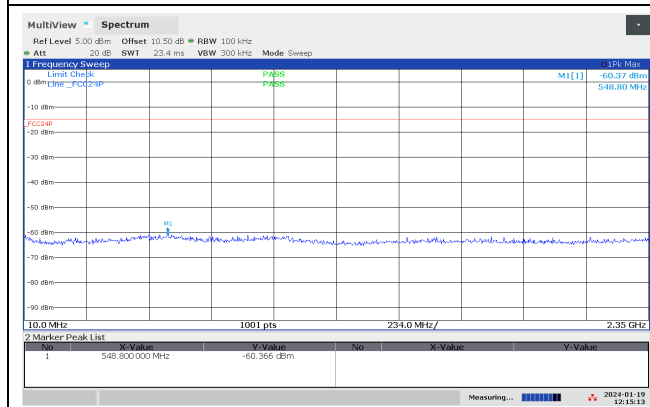
Conducted Emissions 2350-2550 MHz, 2402 MHz, 1Mb



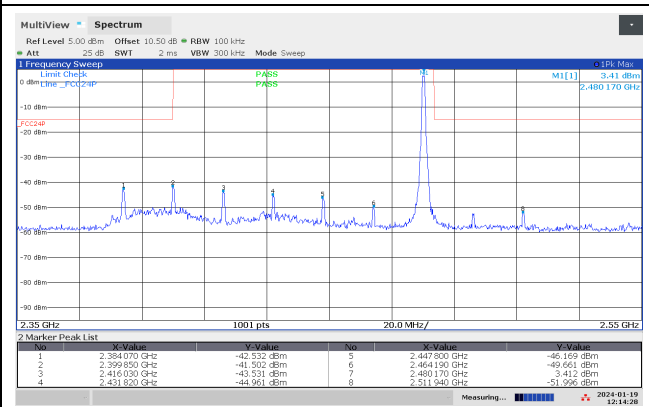
Conducted Emissions 10-2350 MHz, 2440 MHz, 1Mb



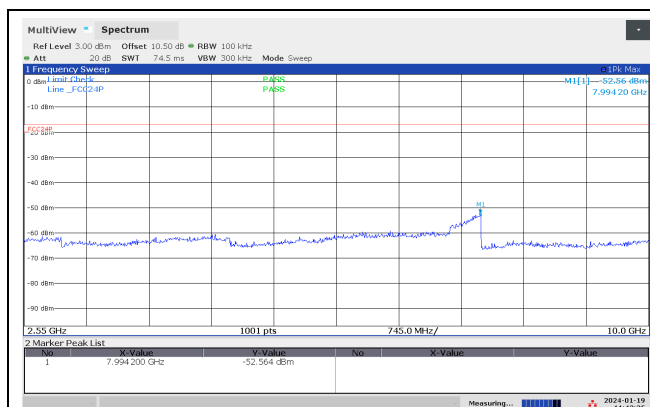
Conducted Emissions 2350-2550 MHz, 2440 MHz, 1Mb



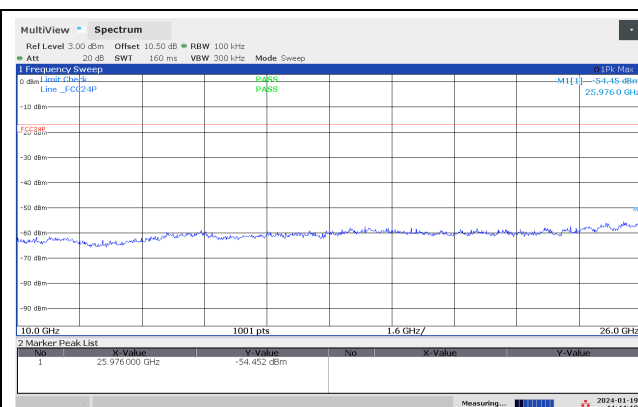
Conducted Emissions 10-2550 MHz, 2480 MHz, 1Mb



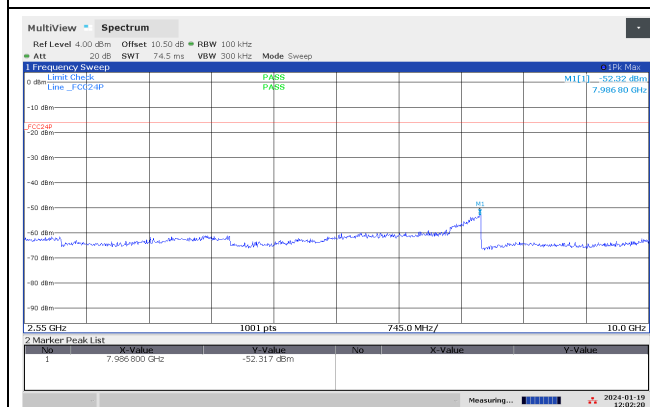
Conducted Emissions 2350-2550 MHz, 2480 MHz, 1Mb



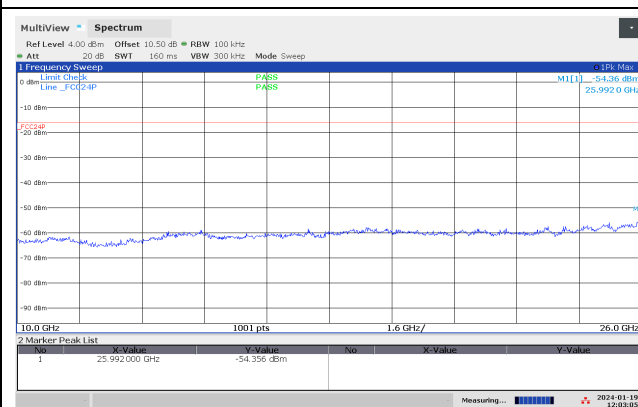
Conducted Emissions 2.55-10 GHz, 2402 MHz, 1Mb



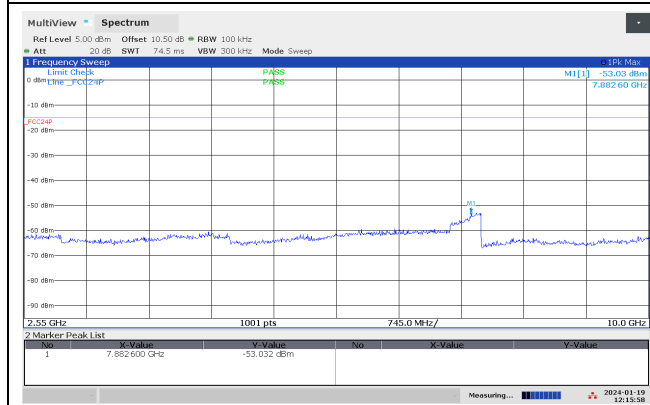
Conducted Emissions 10-26 GHz, 2402 MHz, 1Mb



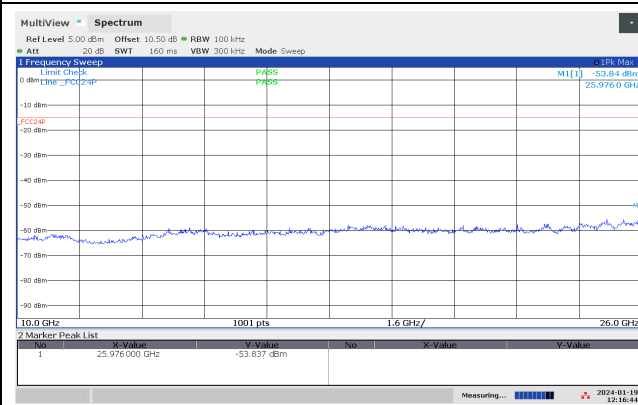
Conducted Emissions 2.55-10 GHz, 2440 MHz, 1Mb



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



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



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

3.6 Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED 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 ISSED, all other frequencies are common.

3.7 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:

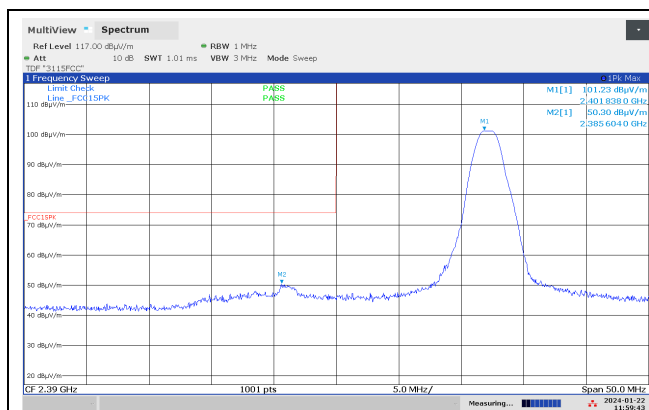
Linx Antenna					
Detector	Measured field strength (dB μ V/m @3m)		Limit dB	Margin dB	
	2390 MHz	2483.5 MHz		dB	
Peak	50.3	63.0	74	23.7	11.0
Average	39.8	48.8	54	14.2	5.2

2J Antenna					
Detector	Measured field strength (dB μ V/m @3m)		Limit dB	Margin dB	
	2390 MHz	2483.5 MHz		dB	
Peak	50.7	57.5	74	23.3	16.5
Average	40.8	44.5	54	13.2	9.5

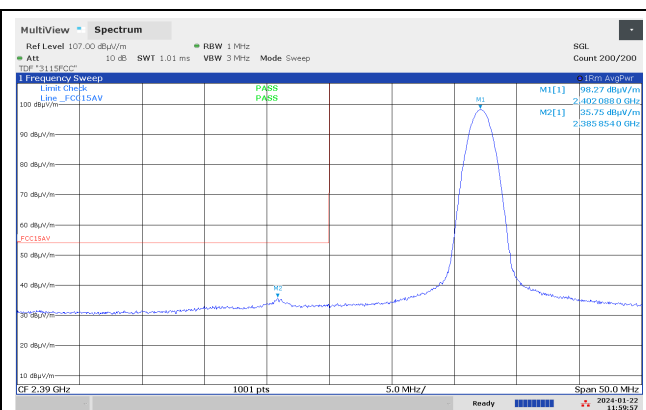
Average values were measured using trace averaging as described in ANSI C63.10-2013 clause 11.12.2.5.1

Average values are corrected by 4.0 dB for Duty Cycle (63%).

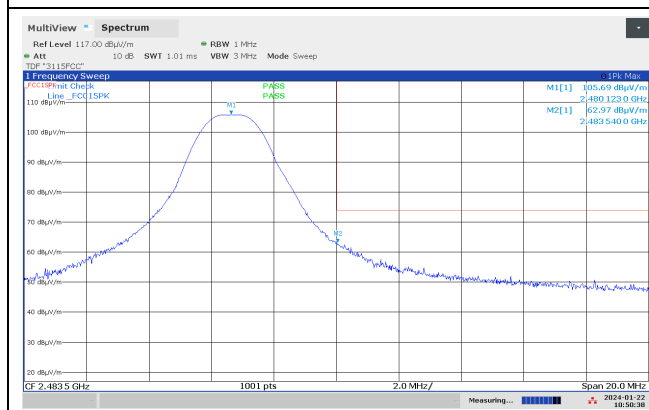
See attached plots.



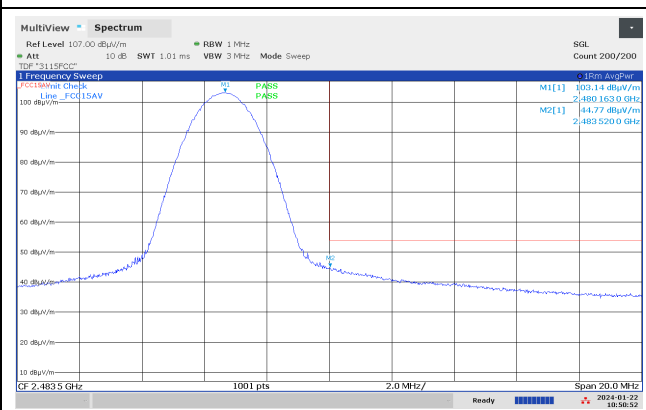
Lower Band Edge, 2402 MHz, 1Mb, Peak



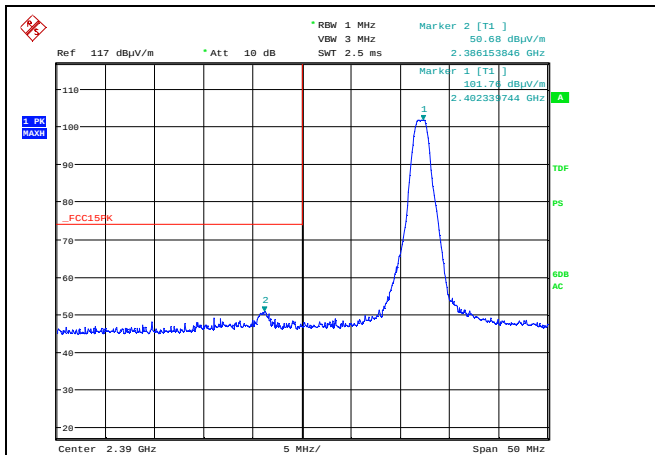
Lower Band Edge, 2402 MHz, 1Mb, Average



Upper Band Edge, 2480 MHz, 1Mb, Peak

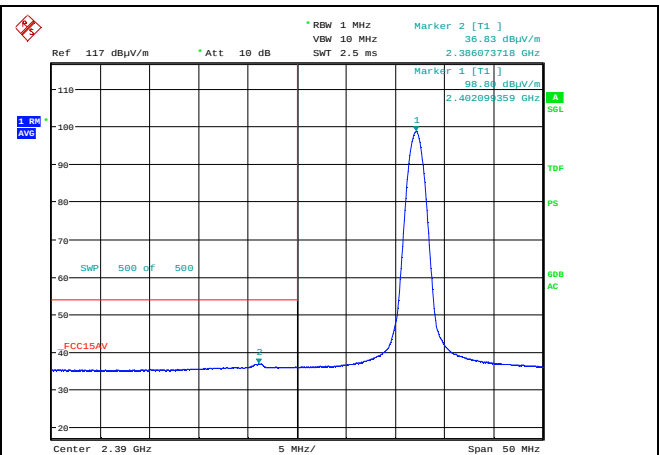


Upper Band Edge, 2480 MHz, 1Mb, Average



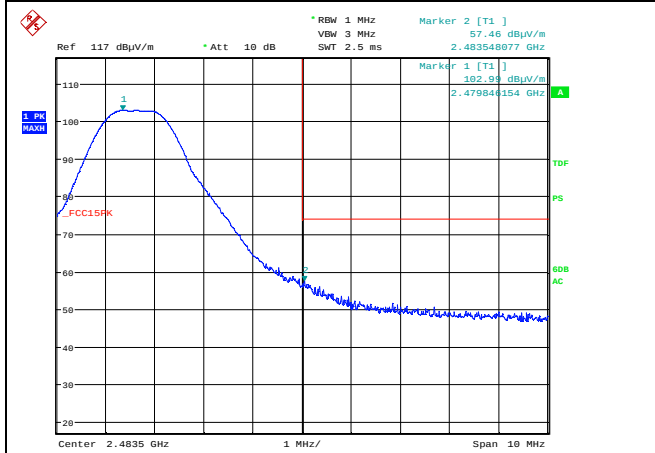
Date: 4.MAR.2024 12:47:51

Lower Band Edge, 2402 MHz, 1Mb, Peak



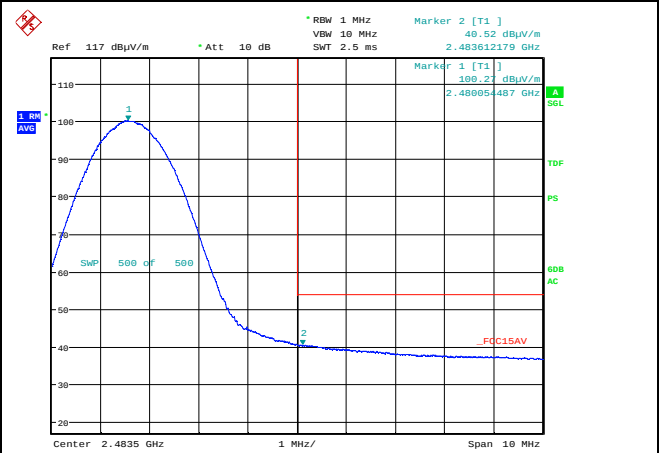
Date: 4.MAR.2024 12:48:28

Lower Band Edge, 2402 MHz, 1Mb, Average



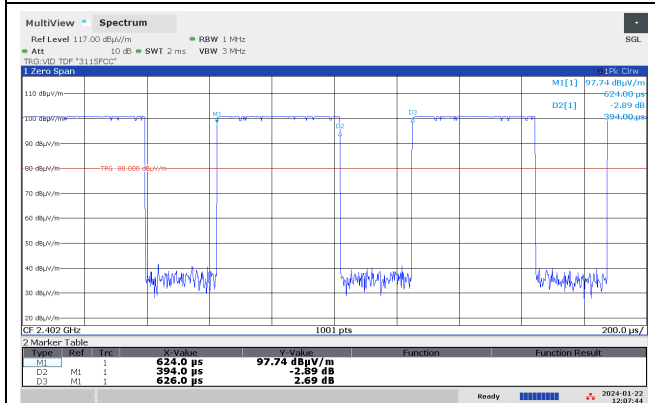
Date: 4.MAR.2024 12:33:14

Upper Band Edge, 2480 MHz, 1Mb, Peak



Date: 4.MAR.2024 12:33:39

Upper Band Edge, 2480 MHz, 1Mb, Average



Duty Cycle (63%)

3.8 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: Quasi-Peak

Measuring distance 3 m

Tested in test mode with EUT transmitting on ch19.

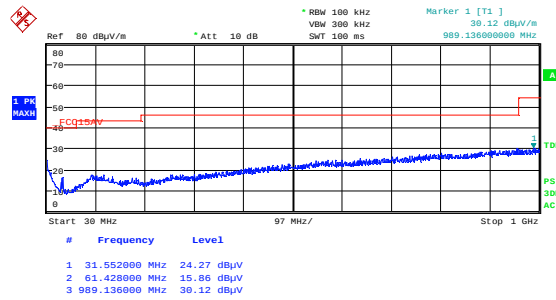
No spurious emissions were found.

See attached plots.

Requirements/Limit

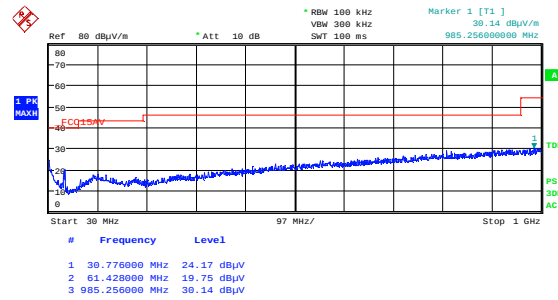
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m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

Linx Antenna:



Date: 14.FEB.2024 16:54:38

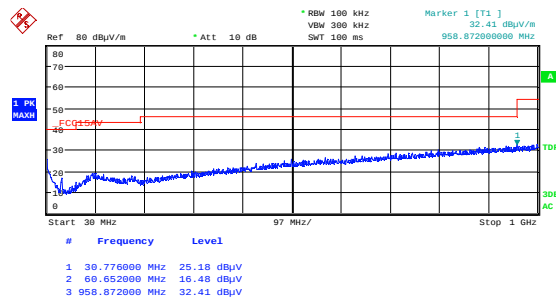
Radiated Emissions 30 - 1000 MHz, 1Mb, HP



Date: 14.FEB.2024 16:52:48

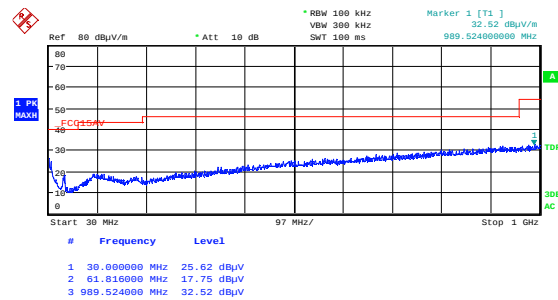
VP

2J Antenna:



Date: 14.FEB.2024 15:54:21

Radiated Emissions 30 - 1000 MHz, 1Mb, HP



Date: 14.FEB.2024 15:52:31

VP

3.9 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)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

RBW=1 MHz

Linx Antenna								
Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
2402	7206	1Mb	55.9	52.1	74	54	18.1	1.9
2440	7320	1Mb	55.5	51.8	74	54	18.5	2.2
2480	7440	1Mb	54.9	50.9	74	54	19.1	3.1

2J Antenna								
Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
2402	7206	1Mb	55.6	51.3	74	54	18.4	2.7
2440	7320	1Mb	55.2	50.8	74	54	18.8	3.2
2480	7440	1Mb	55.7	51.5	74	54	18.3	2.5

Average detector values are corrected for duty cycle ($-20 \cdot \log_{10}(0.63) = 4.0$ dB)

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

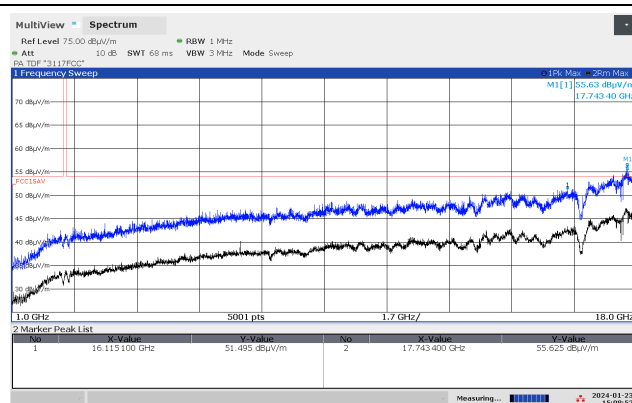
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

See plots.

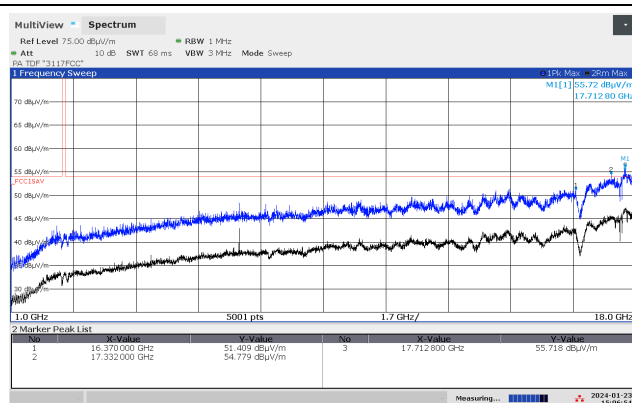
Requirements/Limit

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 dBuV/m	74.0 dBuV/m

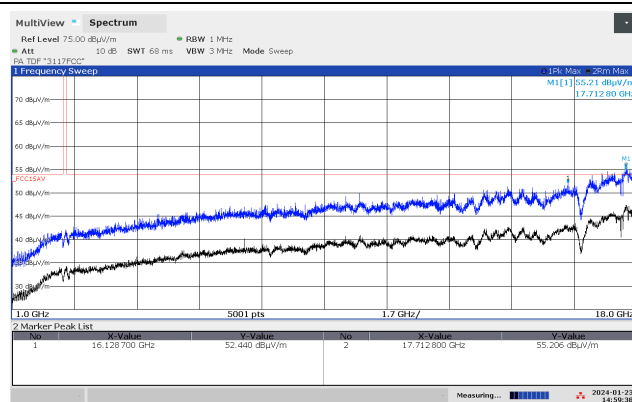
Linx Antenna



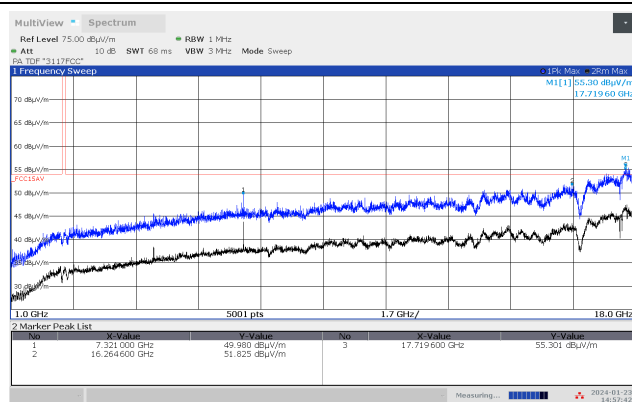
Radiated Emissions 1 - 18 GHz, 2402 MHz, EUT V, HP



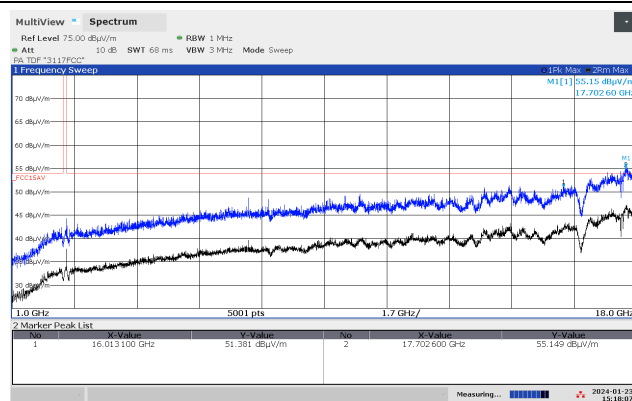
VP



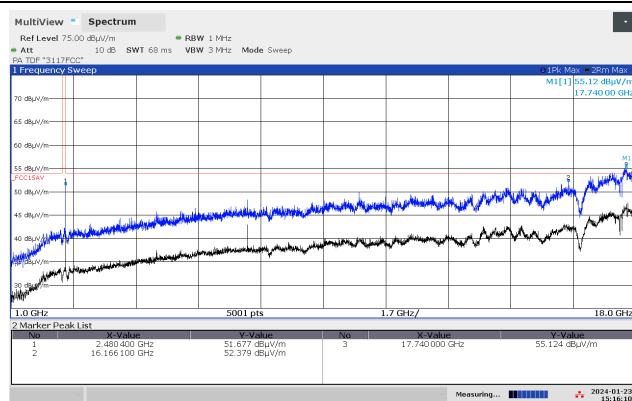
Radiated Emissions 1 - 18 GHz, 2440 MHz, EUT V, HP



VP

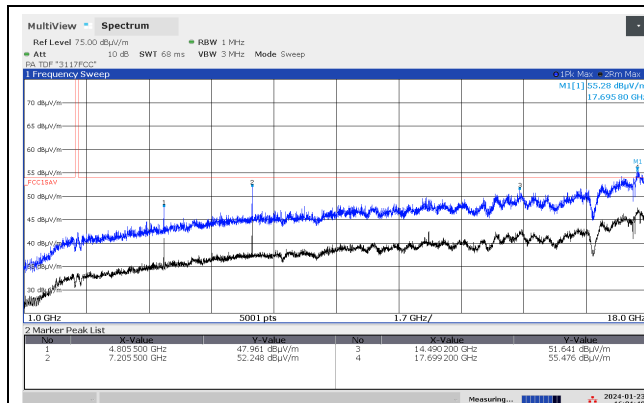


Radiated Emissions 1 - 18 GHz, 2480 MHz, EUT V, HP

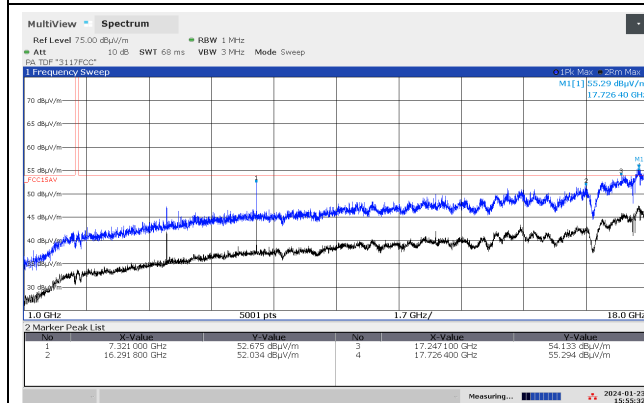


VP

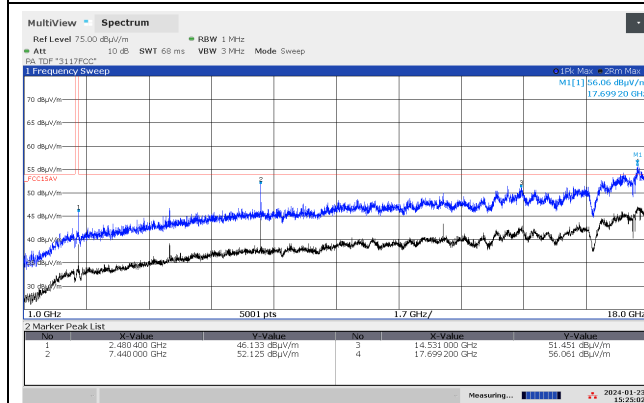
Linx Antenna



Radiated Emissions 1 - 18 GHz, 2402 MHz, EUT H, HP



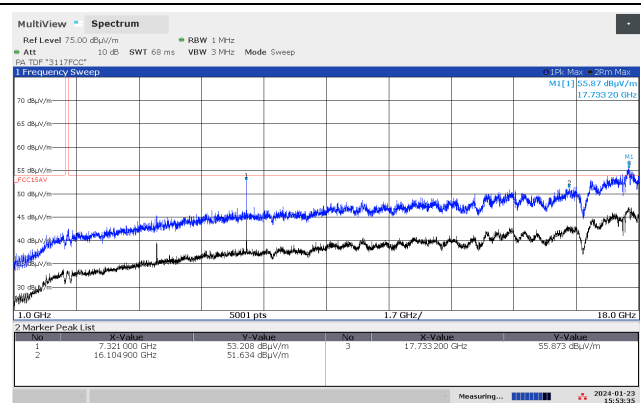
Radiated Emissions 1 - 18 GHz, 2440 MHz, EUT H, HP



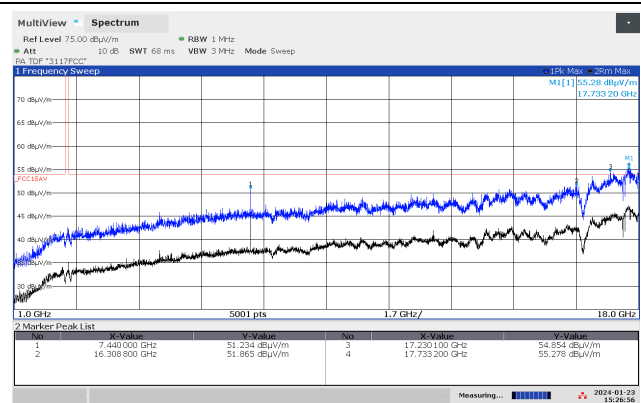
Radiated Emissions 1 - 18 GHz, 2480 MHz, EUT H, HP



VP

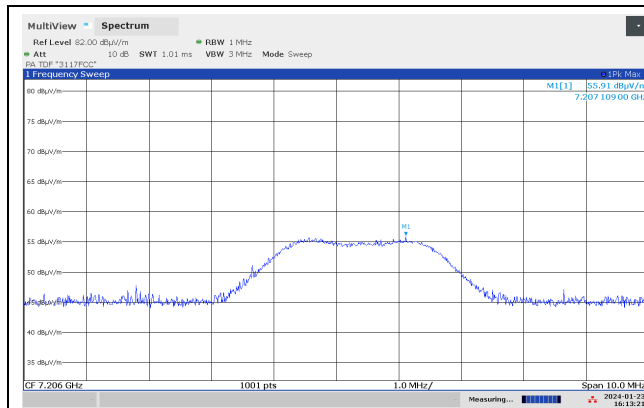


VP

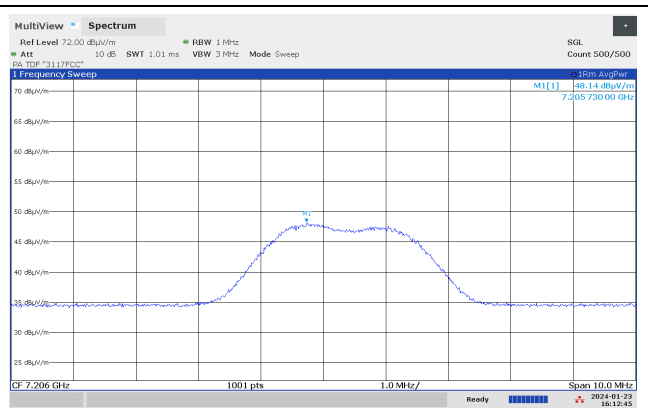


VP

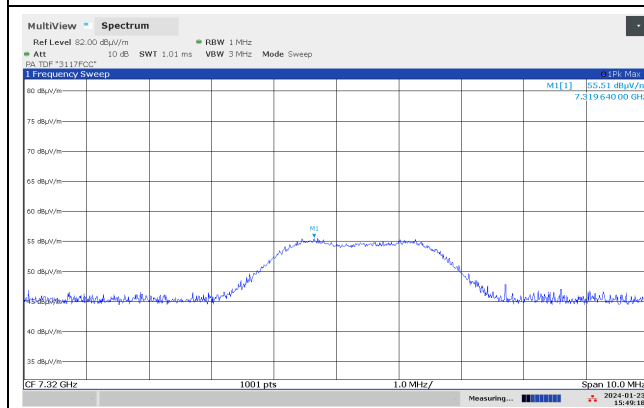
Linx Antenna



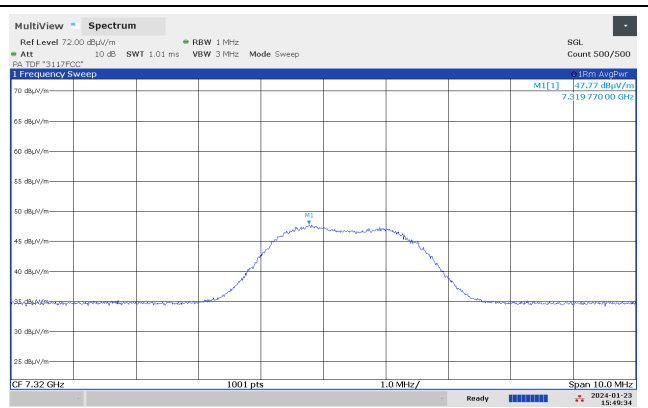
Spurious 7206 MHz, 2402, EUT H, Max: HP, Peak



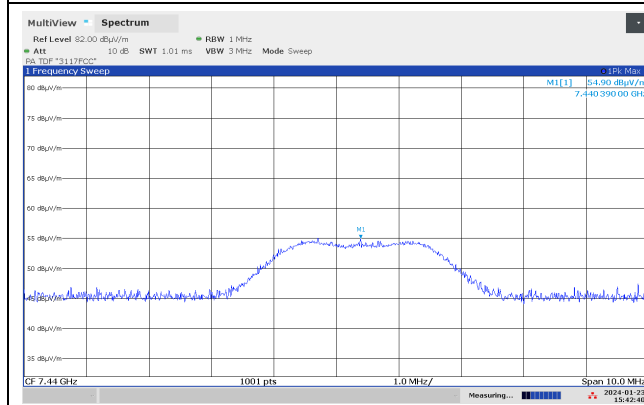
Av



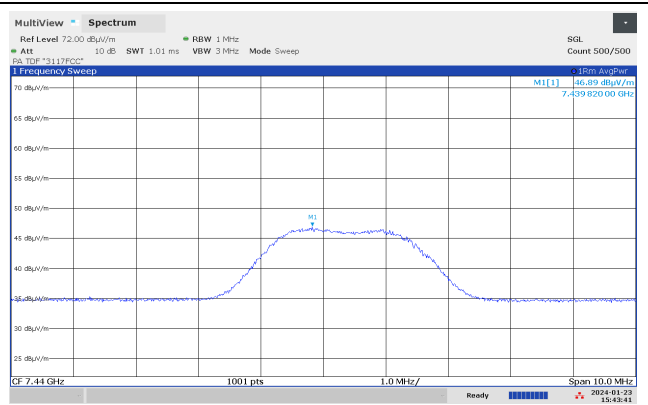
Spurious 7320 MHz, 2440, EUT H, Max: HP, Peak



Av

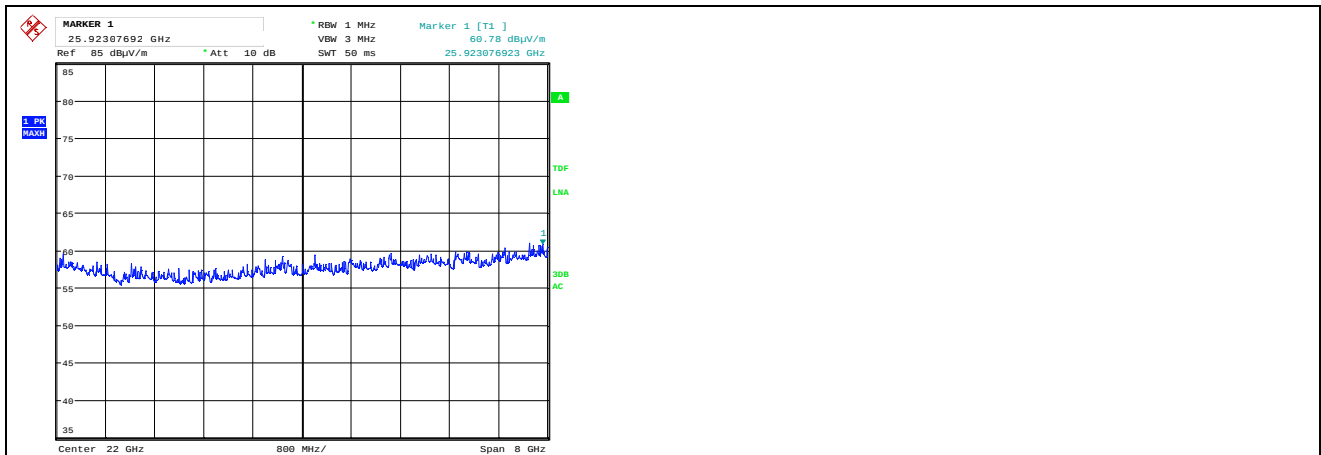


Spurious 7440 MHz, 2480, EUT H, Max: HP, Peak



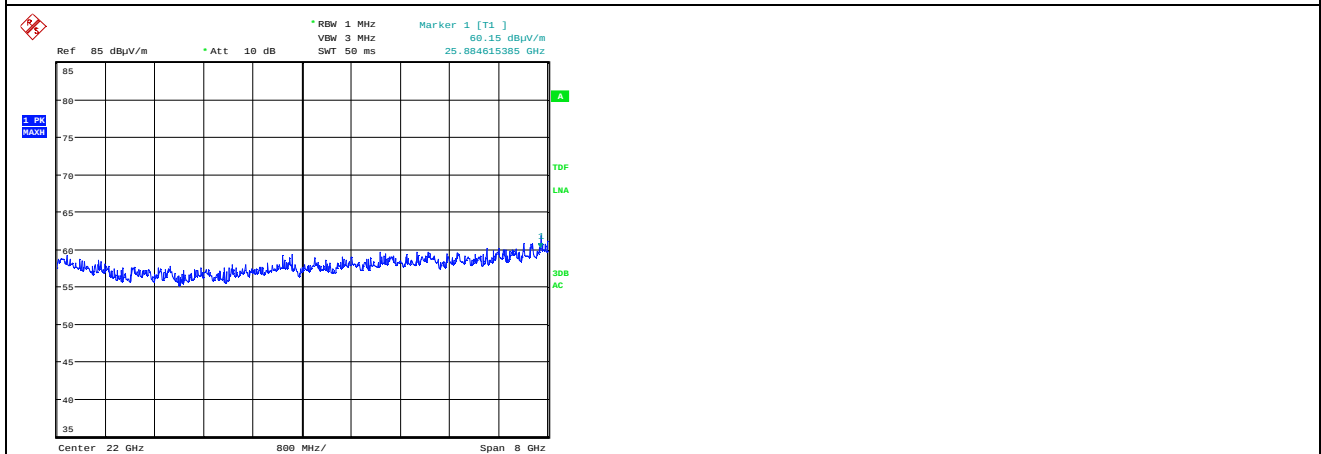
Av

Linx Antenna (distance correction factor is not included in plots below)



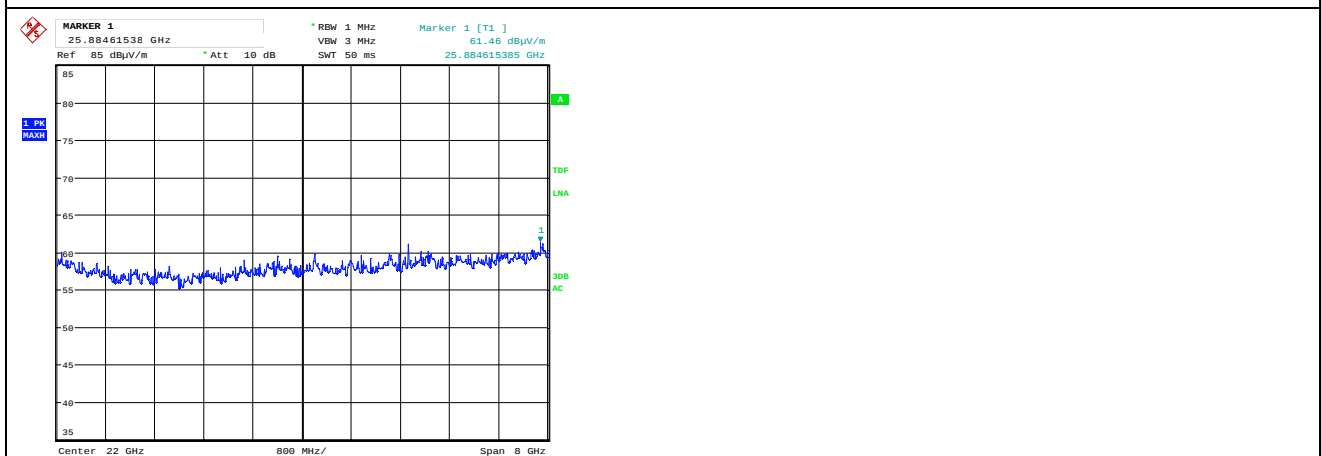
Date: 4.MAR.2024 15:40:51

Pre-scan 18 - 26 GHz, 2402 MHz, 1M, @approx 10cm



Date: 4.MAR.2024 15:39:38

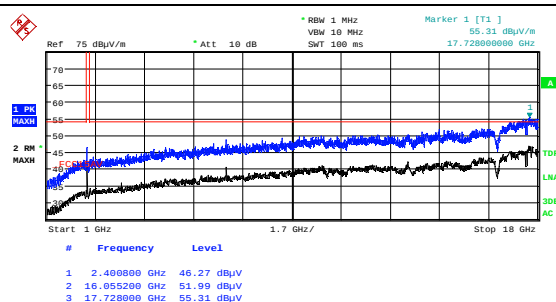
Pre-scan 18 - 26 GHz, 2440 MHz, 1M, @approx 10cm



Date: 4.MAR.2024 15:38:06

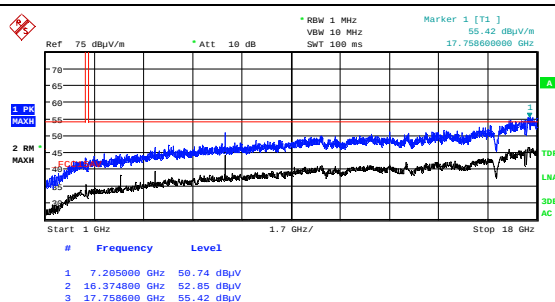
Pre-scan 18 - 26 GHz, 2480 MHz, 1M, @approx 10cm

2J Antenna



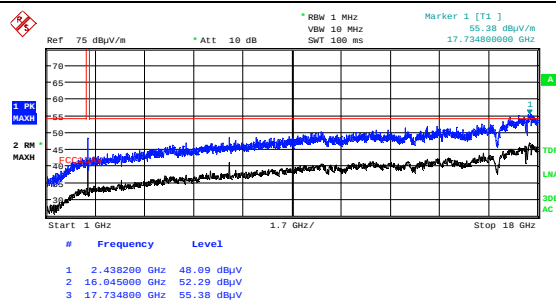
Date: 4.MAR.2024 13:05:55

Radiated Emissions 1 - 18 GHz, 2402 MHz, 1M, EUT V, HP



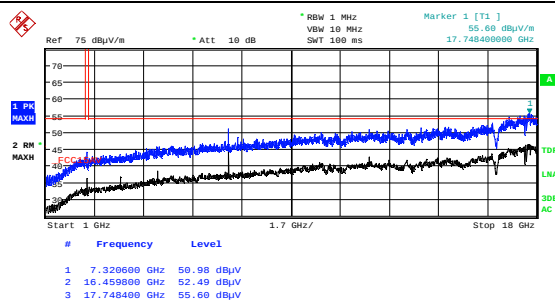
Date: 4.MAR.2024 13:03:58

VP



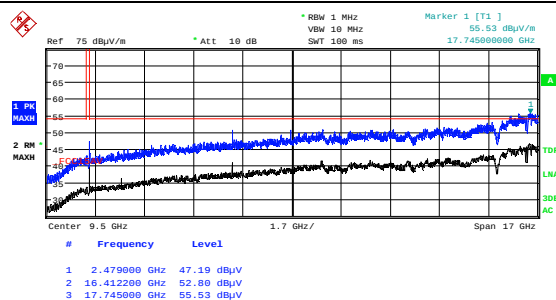
Date: 4.MAR.2024 13:59:40

Radiated Emissions 1 - 18 GHz, 2440 MHz, 1M, EUT V, HP



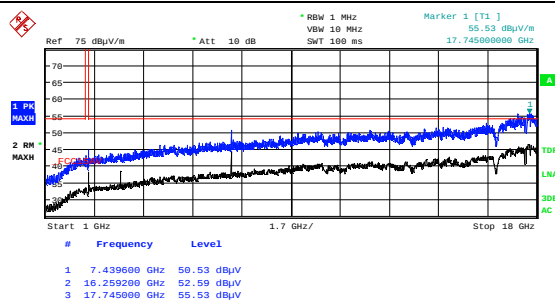
Date: 4.MAR.2024 13:57:44

VP



Date: 4.MAR.2024 13:12:23

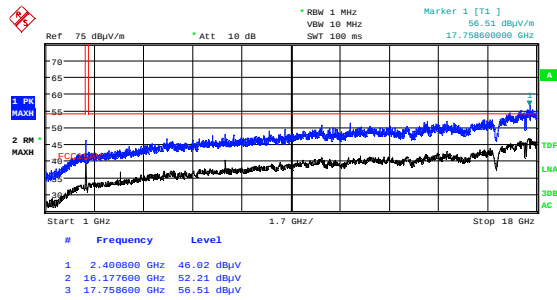
Radiated Emissions 1 - 18 GHz, 2480 MHz, 1M, EUT V, HP



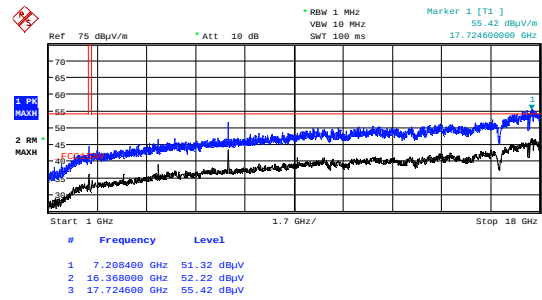
Date: 4.MAR.2024 13:10:26

VP

2J Antenna



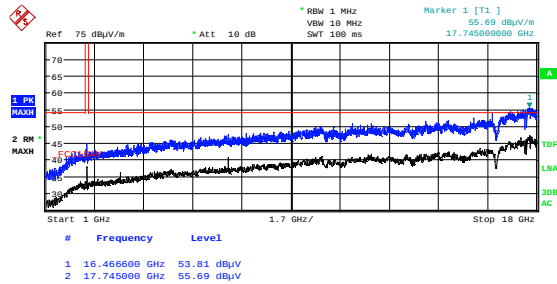
Date: 4.MAR.2024 14:42:56



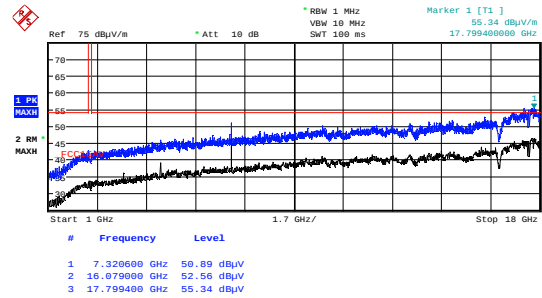
Date: 4.MAR.2024 14:40:59

Radiated Emissions 1 - 18 GHz, 2402 MHz, 1M, EUT H, HP

VP



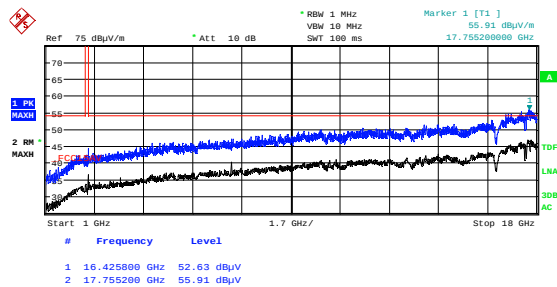
Date: 4.MAR.2024 14:12:19



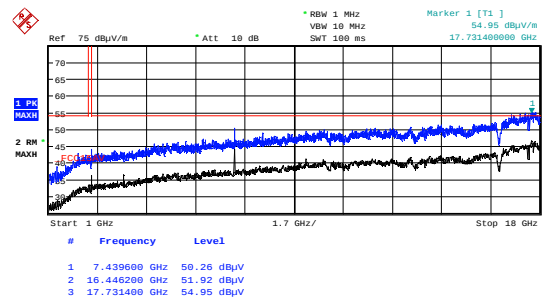
Date: 4.MAR.2024 14:10:22

Radiated Emissions 1 - 18 GHz, 2440 MHz, 1M, EUT H, HP

VP



Date: 4.MAR.2024 14:49:17



Date: 4.MAR.2024 14:47:20

Radiated Emissions 1 - 18 GHz, 2480 MHz, 1M, EUT H, HP

VP

The image displays two side-by-side spectral plots, each showing a signal spectrum with a peak at 7.286 GHz. The left plot shows a noisy signal, while the right plot shows a filtered signal.

Left Plot (Noisy Signal):

- Y-axis:** dBμV/m, ranging from 20 to 70.
- X-axis:** Frequency, ranging from 7.285 GHz to 7.287 GHz.
- Peak:** A peak is visible at 7.286 GHz, marked with a green '1' and a value of 55.61 dBμV/m.
- Labels:** 'A' (green), 'TDF' (green), 'LNA' (green), '30B AC' (green).
- Controls:** '1 PR MAX' (blue) is visible in the top left corner.

Right Plot (Filtered Signal):

- Y-axis:** dBμV/m, ranging from 20 to 70.
- X-axis:** Frequency, ranging from 7.285 GHz to 7.287 GHz.
- Peak:** A peak is visible at 7.286 GHz, marked with a green '1' and a value of 47.31 dBμV/m.
- Labels:** 'A' (green), 'TDF' (green), 'LNA' (green), '30B AC' (green).
- Controls:** '1 BW AVG' (blue) is visible in the top left corner.

Date: 4.MAR.2024 13:46:59

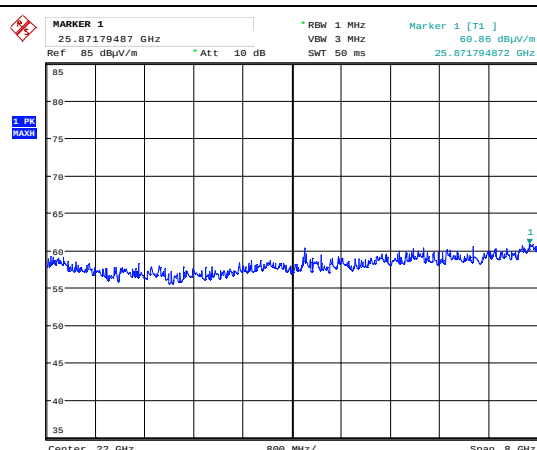
Figure 1: Frequency response of the LNA. The left plot shows the response before the filter, and the right plot shows the response after the filter. The plots show the power spectrum density (PSD) in dBm/V/m versus frequency in MHz. The center frequency is 7.32 GHz, and the span is 10 MHz. The y-axis ranges from 20 to 70 dBm/V/m. The x-axis ranges from 70 to 100 MHz. The 'After' plot shows a clear bandpass filter response with a peak gain of approximately 15 dB.

Date: 4.MAR.2024 13:54:56

Two side-by-side plots showing the TDF and LNA noise floor. The left plot is labeled "1. PR MAX" and the right plot is labeled "1. BW AVG". Both plots show a noise floor with a peak at 7.439 GHz. The left plot has a peak value of 55.73 dBuV/m, and the right plot has a peak value of 47.54 dBuV/m. The plots are labeled with "TDF", "LNA", "3dB AC", and "A".

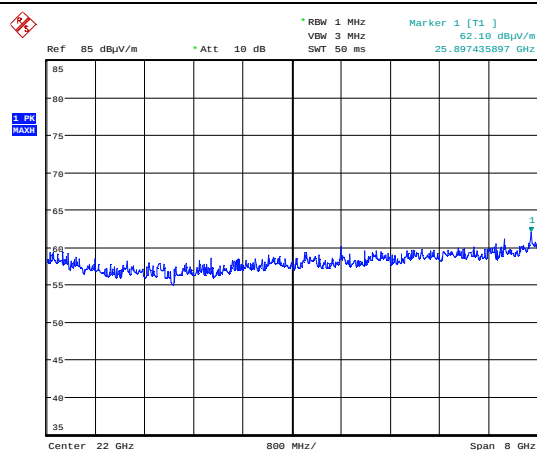
Date: 4.MAR.2024 13:29:41

2J Antenna (distance correction factor is not included in plots below)



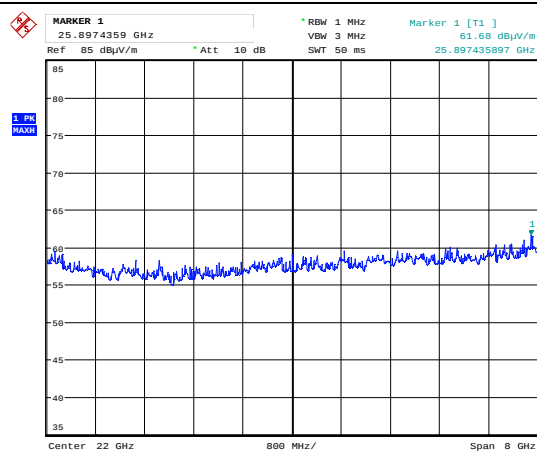
Date: 4.MAR.2024 15:34:00

Pre-scan 18 - 26 GHz, 2402 MHz, 1M, @approx 10cm



Date: 4.MAR.2024 15:31:55

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



Date: 4.MAR.2024 15:35:28

Pre-scan 18 - 26 GHz, 2480 MHz, 1M, @approx 10cm

3.10 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 3, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

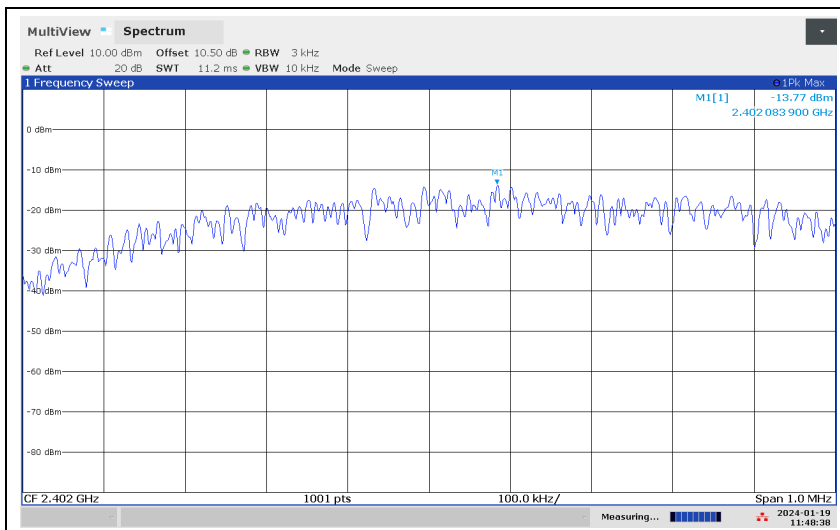
Test Results: Complies

Measurement Data:

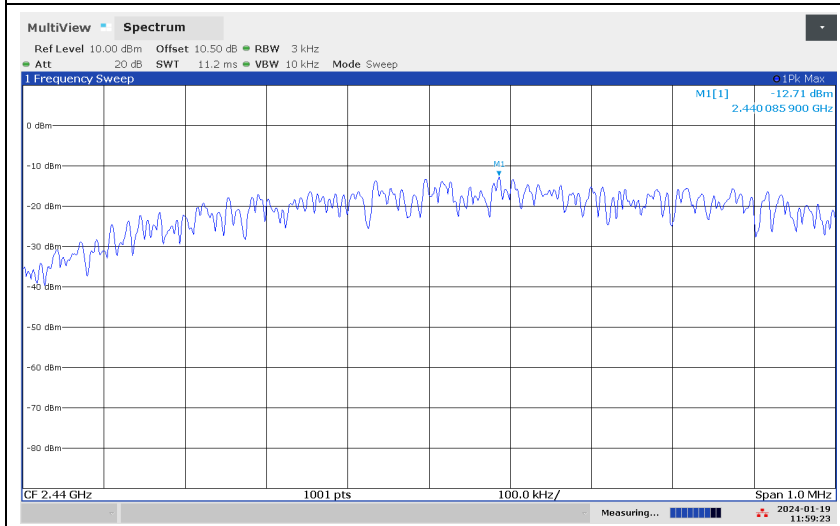
The measurement procedure PKPSD described in ANSI C63.10-2013 was used.

Modulation Type and Bitrate	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1Mb	-13.8	-12.7	-12.2

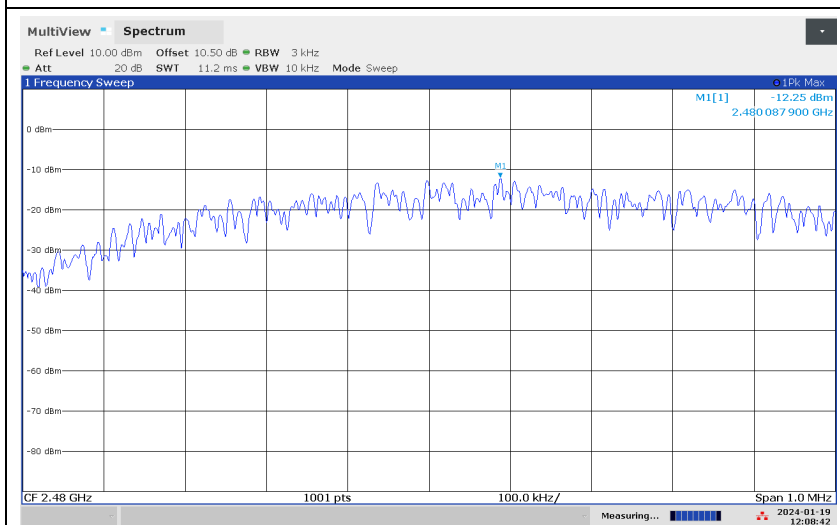
Requirement for systems using Digital Modulation
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
No requirements for Frequency Hopping Systems.



PSD, 2402 MHz, 1Mb



PSD, 2440 MHz, 1Mb



PSD, 2480 MHz, 1Mb

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.

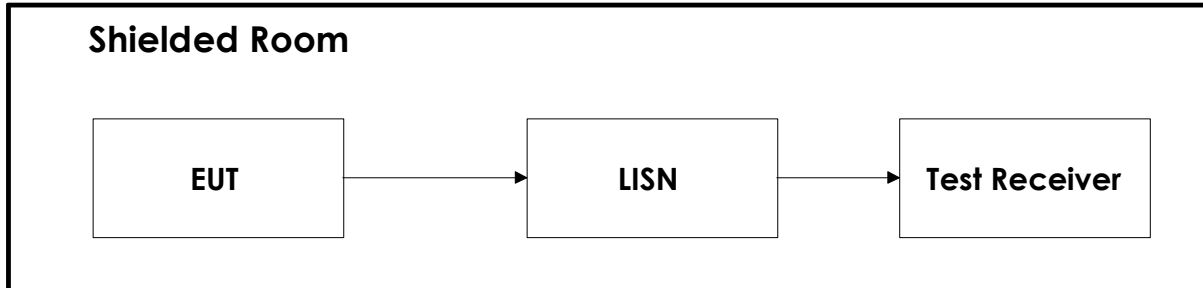
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2024-01	2025-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2024-01	2025-01
3	6810.17B	Attenuator	Suhner	LR 1669	2023-05	2024-05
4	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
5	JB3	BiLog Antenna	Sunol	N-4525	2023-04	2026-04
6	310	Preamplifier	Sonoma Inst.	LR 1686	2023-08	2024-08
7	3115	Horn Antenna	EMCO	LR 1226	2022-12	2027-12
8	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2023-08	2024-08
9	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2023-08	2024-08
10	WLK5-1100-1485-7000-40SS	Low Pass Filter	Wainwright Inst.	LR 1761	COU	
11	638	Antenna Horn	Narda	LR 1480	N/A	
12	9205B	Power Supply	BK Precision	LR 1846	COU	
13	CPX400S	Power Supply	AimTTi	LR 1711	COU	
14	Model 87V	Multimeter	Fluke	LR 1597	2023-04	2024-04
16	ST18/SMA/N/36	RF Cable	Suhner	LR 1628	COU	

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

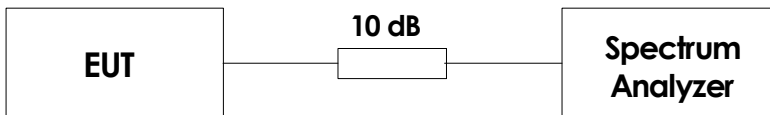
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission

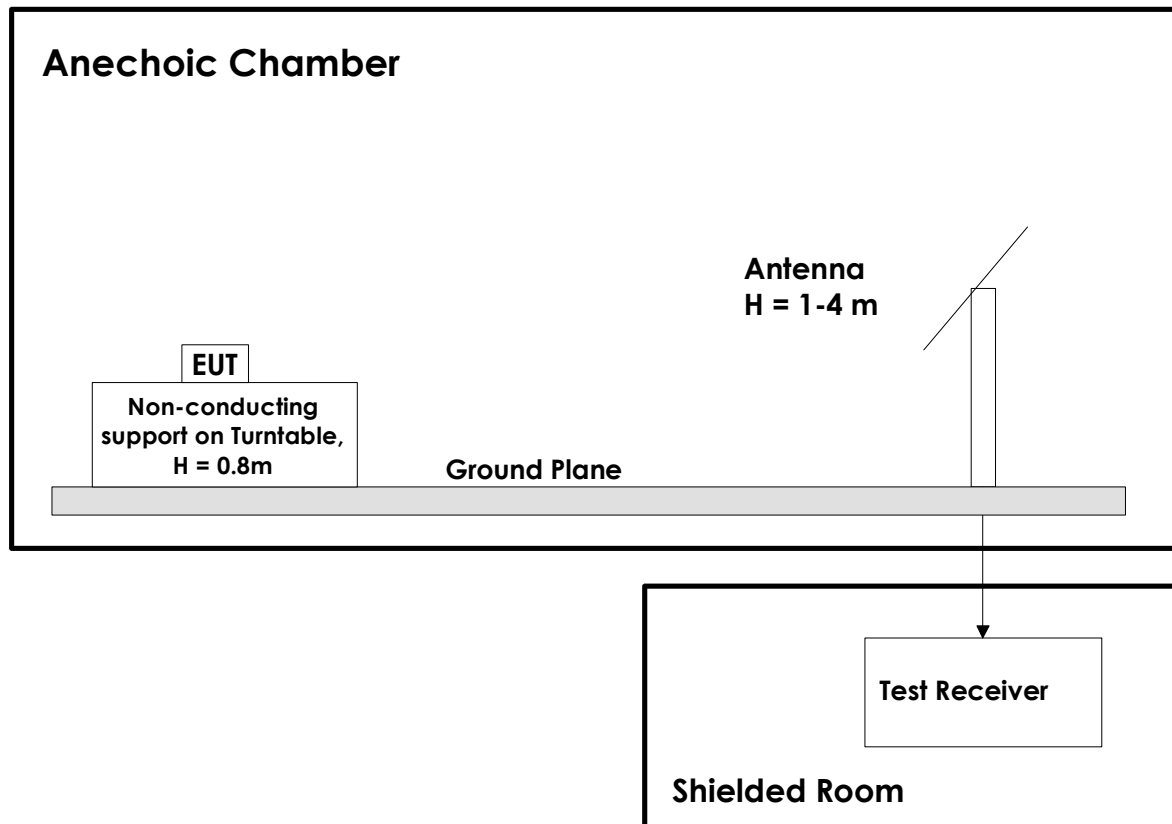


6.2 Conducted Tests



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.