

Test Report

Product	Ultrasound transmitter for an RTLS system		
Name and address of the applicant	Sonitor Technologies AS Drammensveien 288 0283 Oslo, Norway		
Name and address of the manufacturer	Sonitor Technologies AS Drammensveien 288 0283 Oslo, Norway		
Model	INF-C399		
Rating	POE 48V / DC 6V / Batteries (4 x 1.5 V)		
Trademark	Sonitor		
Additional information	/		
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 4 Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz and 5470-5875 MHz bands		
Order number	PRJ0076965		
Tested in period	2025-03-24 – 2025-10-17		
Issue date	2025-11-26		
Name and address of the testing laboratory	 Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 ISED No: 2040D-1   An accredited technical test executed under the Norwegian accreditation scheme		
Prepared by [Jan G Eriksen] Approved by [Frode Sveinsen]			
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Revision history

Revision	Date	Comment	Sign
A	2025-11-26	First edition	JGE

GENERAL REMARKS

This report applies only to the samples 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	ultraBeacon Multi-Zone
Model/version	INF-C399
FCC ID	2AD7T21124102301
ISED ID	20330-21124102301
Serial number	22323024
Hardware identity and/or version	1.0
Software identity and/or version	/
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	Bluetooth Low Energy ☒ 1Mb ☒ 2Mb
Type of Modulation	GFSK / D-QPSK
Conducted Output Power	< 10 dBm (10 mW)
Antenna Connector	None
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Internal batteries (4 x 1.5V) / external DC 6.0 V / POE 48V
Desktop Charger	N/A

Description of Test Item

The device is a gateway.

1.2 Normal test conditions

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	POE 48V for all radiated tests. 6V DC for radiated EIRP and Band Edge tests. 6V DC for conducted tests.

The values are the limit registered during the test period.

1.3 Test Engineers

Jan G Eriksen

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	/

1.6 Comments

The following power supply modes have been used during testing:

POE 48V for all radiated tests.
6V DC for radiated EIRP and Band Edge tests.
6V DC for conducted tests.

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 4	Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz and 5470-5875 MHz bands
ISED RSS-GEN Issue 5	General Requirements for Compliance of Radio Apparatus

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

Standard	Description
ANSI C63.4-2014	Unintentional Radiators
ANSI C63.10-2020 (FCC)	Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.10-2020 (ISED Canada) +cor.1-2023 +ANSI C63.10a-2024 +Errata to C63.10a-2024	Procedures for Compliance Testing of Unlicensed Wireless Devices +Corrigendum 1 +Amendment 1 +Errata to Amendment 1
FCC KDB 558074 D01	15.247 Measurement Guidance for DTS and Frequency Hopping Systems

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 4, RSS-GEN Issue 5 reference	ANSI C63.10-2020 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)	6.3 (RSS-247)	11.8 Option 2	Pass
Peak Power Output	15.247(b)	6.3.2 (RSS-247)	11.9.1.1	Pass
Power Spectral Density	15.247(d)	6.3.1 (RSS-247)	11.10.2 PKPSD (DTS)	Pass
Spurious Emissions (Antenna Conducted)	15.247(c)	6.6 (RSS-247)	6.7 11.11 (DTS)	Pass
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	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

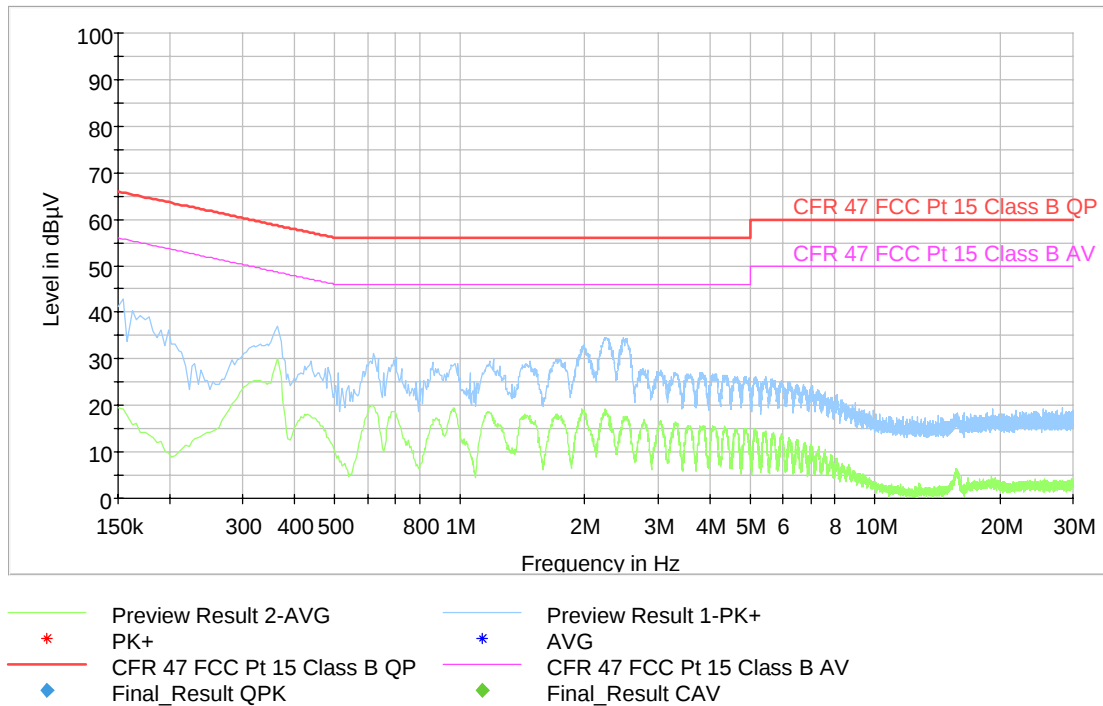
Test Results: Complies

Measurement Data: See attached plots

Highest measured value (L1 and N):

Powered from POE 48V DC:

Full Spectrum

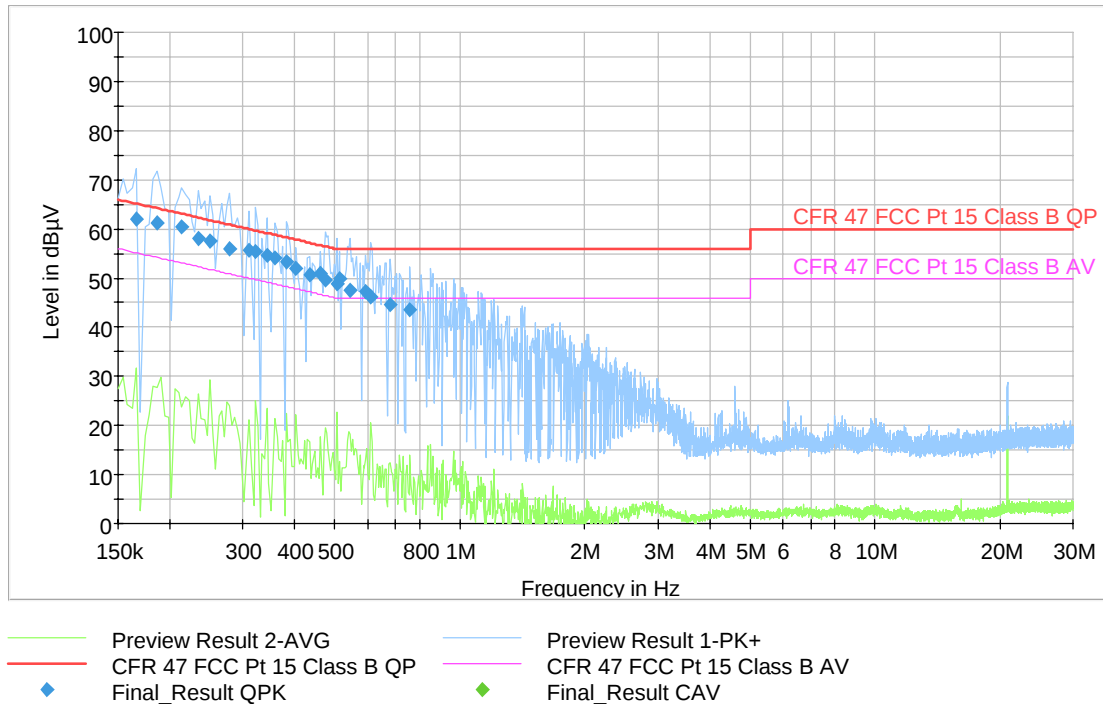


It should be noted that the lines in the plot represent the highest combined measured levels for lines L1 and N.

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)
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Powered from 6V DC:

Full Spectrum



It should be noted that the lines in the plot represent the highest combined measured levels for lines L1 and N.

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.154000	62.91	---	65.16	3.10	15000.0	9.000	N	OFF	9.6
0.166000	62.06	---	65.16	3.10	15000.0	9.000	N	OFF	9.6
0.186000	61.08	---	64.21	3.13	15000.0	9.000	N	OFF	9.6
0.214000	60.39	---	63.05	2.66	15000.0	9.000	N	OFF	9.6
0.234000	58.18	---	62.31	4.13	15000.0	9.000	L1	OFF	9.7
0.250000	57.45	---	61.76	4.31	15000.0	9.000	L1	OFF	9.7
0.278000	55.97	---	60.88	4.90	15000.0	9.000	L1	OFF	9.7
0.310000	55.58	---	59.97	4.39	15000.0	9.000	N	OFF	9.6
0.322000	55.44	---	59.66	4.22	15000.0	9.000	N	OFF	9.6
0.342000	54.74	---	59.16	4.41	15000.0	9.000	N	OFF	9.6
0.358000	53.96	---	58.78	4.81	15000.0	9.000	N	OFF	9.6
0.382000	53.38	---	58.24	4.86	15000.0	9.000	N	OFF	9.6
0.402000	51.85	---	57.81	5.96	15000.0	9.000	L1	OFF	9.6
0.434000	50.78	---	57.18	6.40	15000.0	9.000	L1	OFF	9.6
0.462000	50.92	---	56.66	5.74	15000.0	9.000	N	OFF	9.6
0.474000	49.71	---	56.44	6.73	15000.0	9.000	L1	OFF	9.6
0.506000	48.77	---	56.00	7.23	15000.0	9.000	N	OFF	9.6
0.514000	49.91	---	56.00	6.09	15000.0	9.000	N	OFF	9.6
0.542000	47.49	---	56.00	8.51	15000.0	9.000	L1	OFF	9.6
0.594000	47.15	---	56.00	8.85	15000.0	9.000	N	OFF	9.6
0.610000	46.25	---	56.00	9.75	15000.0	9.000	L1	OFF	9.6
0.678000	44.55	---	56.00	11.45	15000.0	9.000	N	OFF	9.6
0.758000	43.66	---	56.00	12.34	15000.0	9.000	N	OFF	9.7

3.2 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2020 Clause 6.9.2

Test Results: Complies

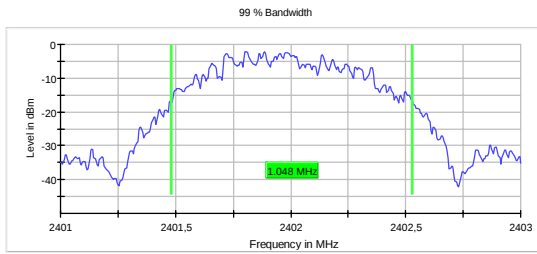
Measurement Data:

Carrier Frequency	Occupied Bandwidth (99% BW)	
	1Mb	2Mb
2402 MHz	1048 kHz	2035 kHz
2440 MHz	1043 kHz	2035 kHz
2480 MHz	1048 kHz	2035 kHz

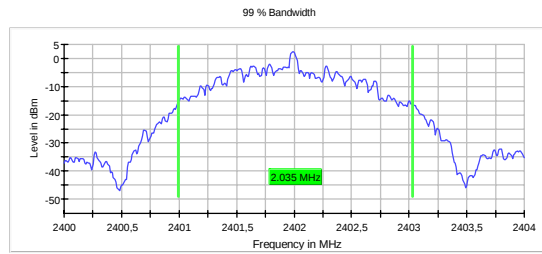
See attached plots

Requirements:

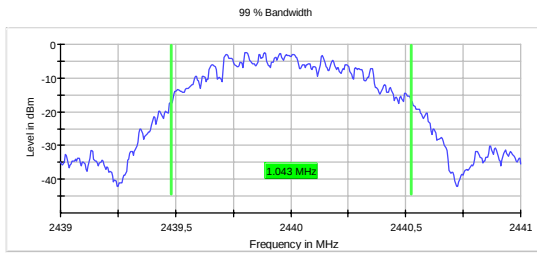
No requirement for 99% BW, reported for information only.



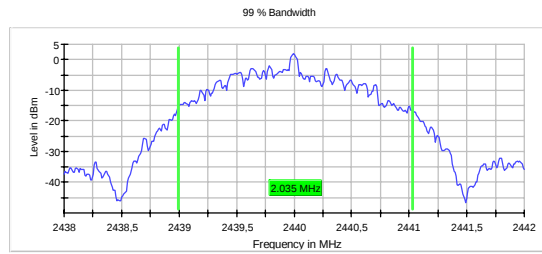
99% Occupied BW, 2402 MHz, 1Mb



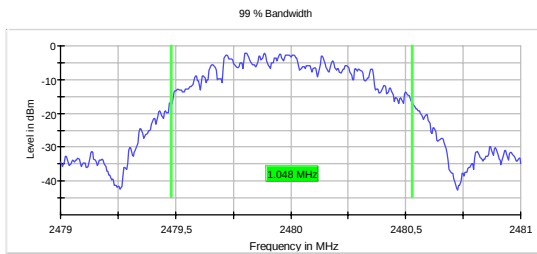
99% Occupied BW, 2402 MHz, 2Mb



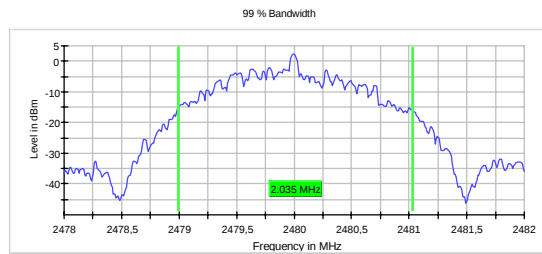
99% Occupied BW, 2440 MHz, 1Mb



99% Occupied BW, 2440 MHz, 2Mb



99% Occupied BW, 2480 MHz, 1Mb



99% Occupied BW, 2480 MHz, 2Mb

3.3 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 4, Clause 6.3

Measurement procedure: ANSI C63.10-2020 Clause 11.8

Test Results: **Complies**

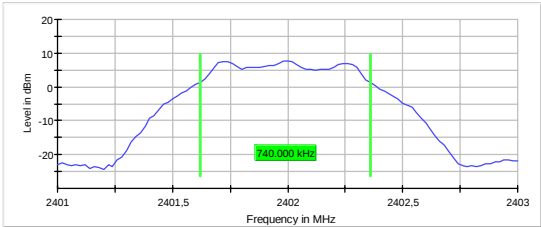
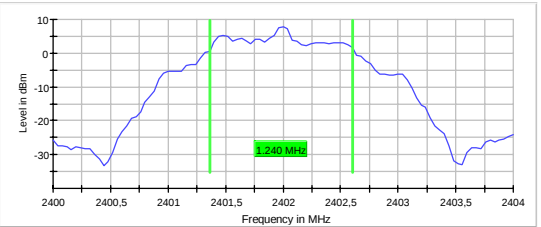
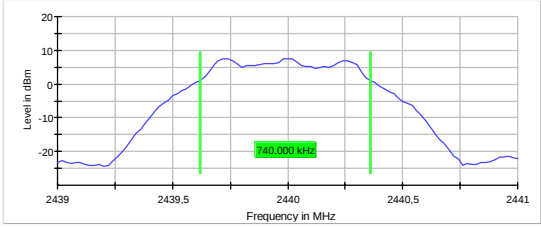
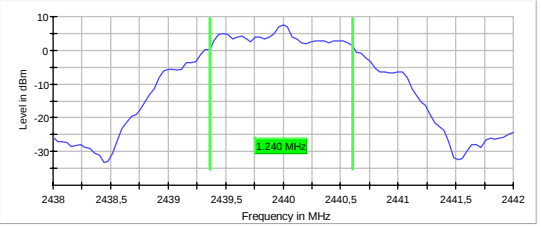
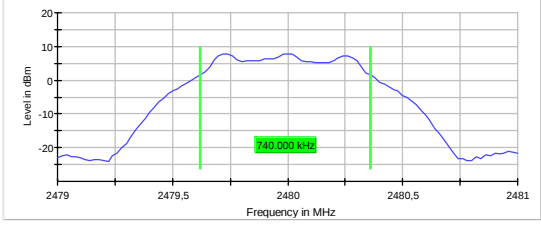
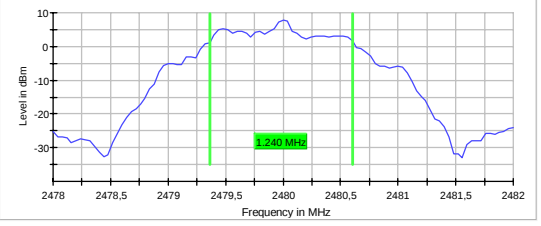
Measurement Data:

Modulation type and bitrate	Measured DTS Bandwidth (kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1 Mbps	740	740	740
GFSK 2 Mbps	1240	1240	1240

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	

No requirements for Frequency Hopping Systems.

6 dB Bandwidth 	6 dB Bandwidth 
DTS BW, 2402 MHz, 1Mb	DTS BW, 2402 MHz, 2Mb
6 dB Bandwidth 	6 dB Bandwidth 
DTS BW, 2440 MHz, 1Mb	DTS BW, 2440 MHz, 2Mb
6 dB Bandwidth 	6 dB Bandwidth 
DTS BW, 2480 MHz, 1Mb	DTS BW, 2480 MHz, 2Mb

3.4 Peak Power Output

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 4, Clause 6.3.2

Measurement procedure: ANSI C63.10-2020 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency	Peak Conducted Power, dBm		Peak EIRP, dBuV/m		Peak EIRP, dBm	
	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 2Mb
2402 MHz	7.8	7.8	106.1	106.0	10.9	10.8
2440 MHz	7.6	7.6	105.2	105.8	10.0	10.6
2480 MHz	7.9	7.9	106.2	105.5	11.0	10.3

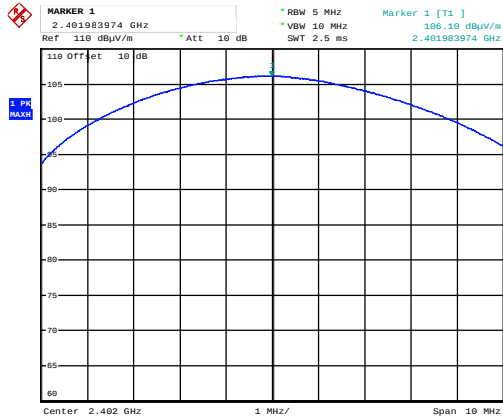
Output Power reported is Maximum Peak Power.

Radiated Power was calculated from measured Field Strength using the method described in ANSI C63.10-2020 Annex G.

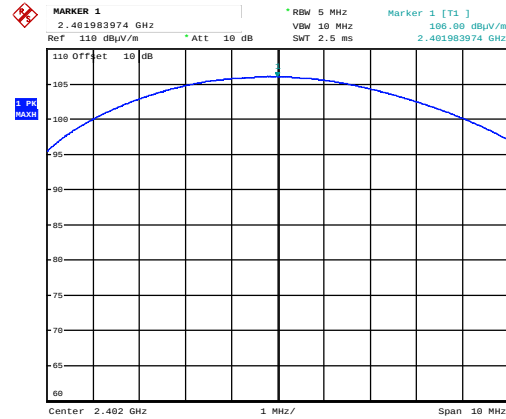
Antenna Gain is less than 6 dBi.

See attached plots.

Frequency Band	Requirements for Frequency Hopping systems
902-928 MHz	For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels
2400-2483.5 MHz	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
5725-5850 MHz	For all frequency hopping systems in the 5725-5850 MHz band: 1 watt
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.	



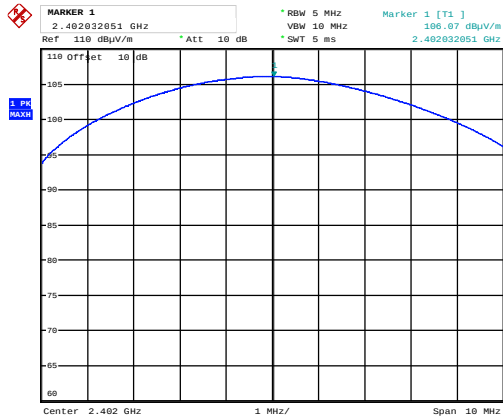
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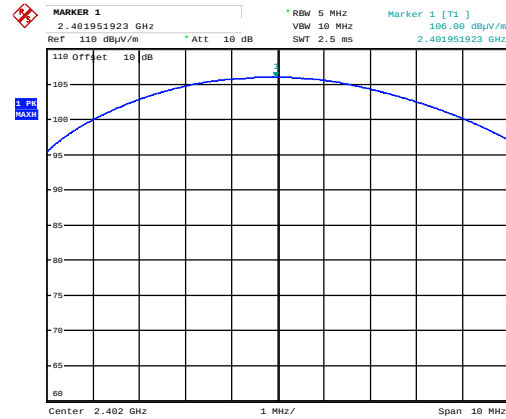
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Peak EIRP, 6V DC, 2402 MHz, 1Mb

, 2Mb



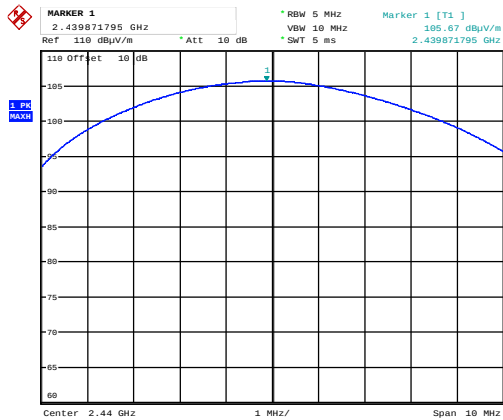
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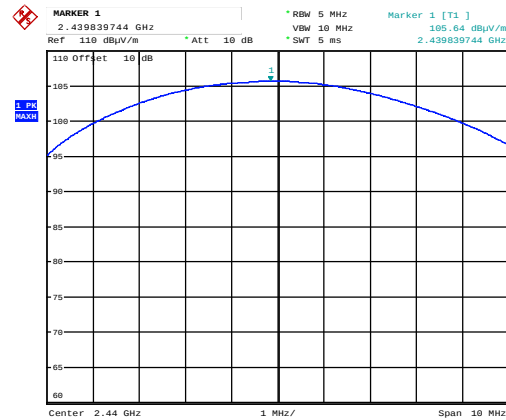
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Peak EIRP, 48V POE, 2402 MHz, 1Mb

, 2Mb



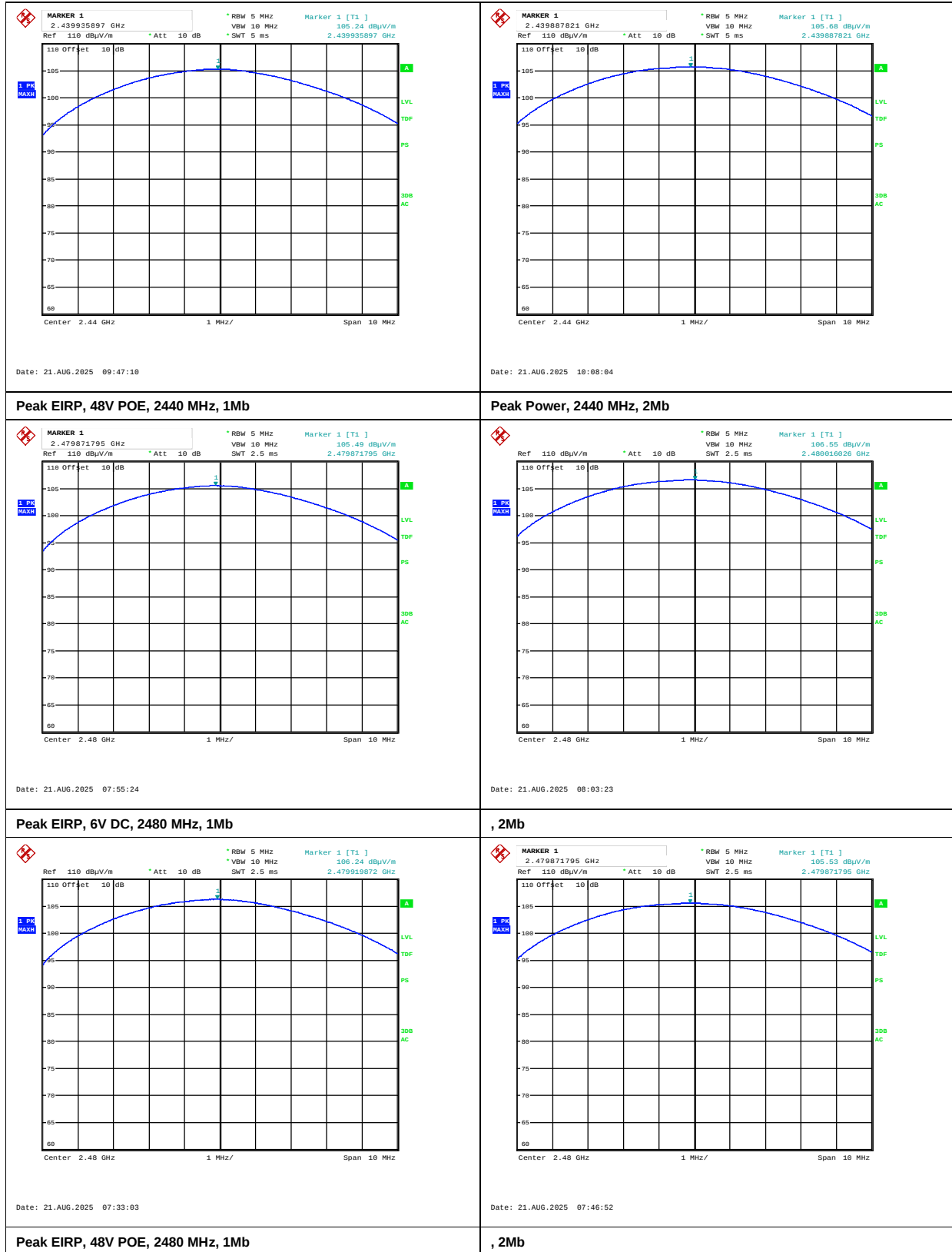
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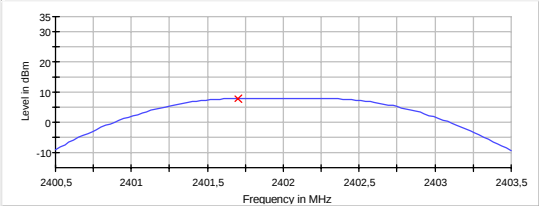
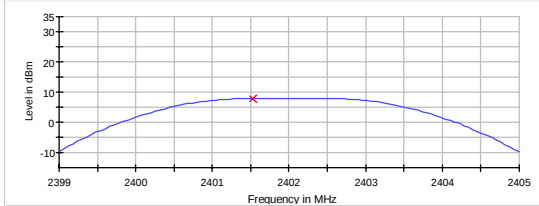
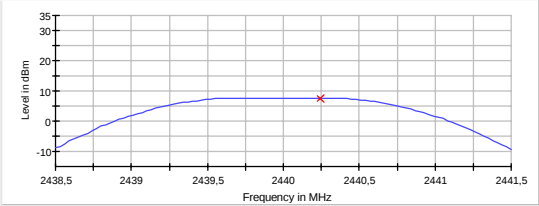
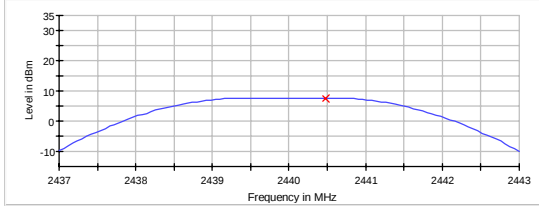
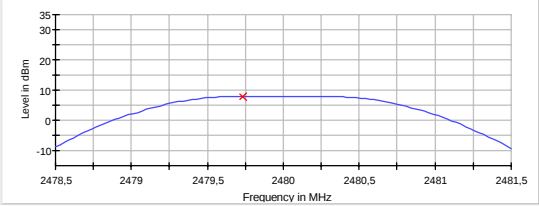
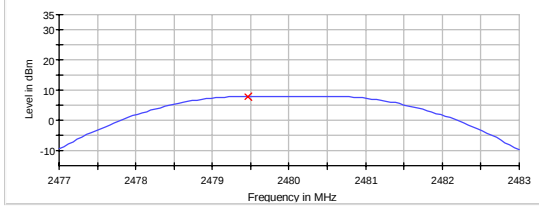


Date: 21.AUG.2025 10:19:40

Peak EIRP, 6V DC, 2440 MHz, 1Mb

Peak Power, 2440 MHz, 2Mb



Peak Power  Connector 1 X Peak Connector 1	Peak Power  Connector 1 X Peak Connector 1
Peak Power, 2402 MHz, 1Mb	, 2Mb
Peak Power  Connector 1 X Peak Connector 1	Peak Power  Connector 1 X Peak Connector 1
Peak Power, 2440 MHz, 1Mb	, 2Mb
Peak Power  Connector 1 X Peak Connector 1	Peak Power  Connector 1 X Peak Connector 1
Peak Power, 2480 MHz, 1Mb	, 2Mb

3.5 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 4, Clause 6.6

Measurement procedure: ANSI C63.10-2020 Clause 11.11

Test Results: Complies

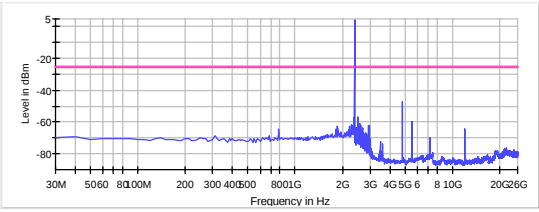
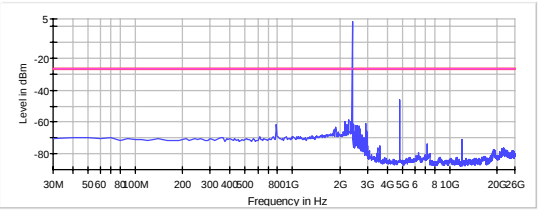
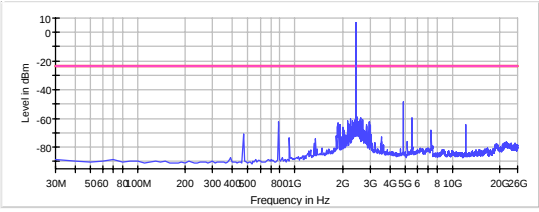
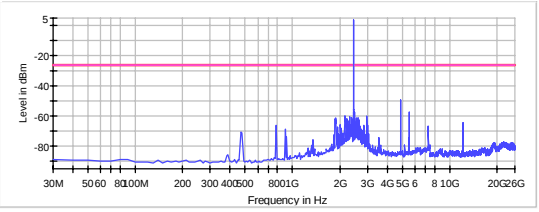
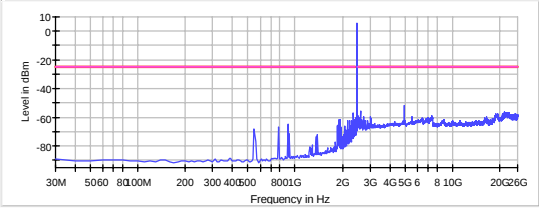
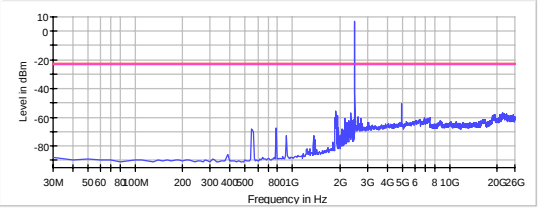
Measurement Data:

Carrier Frequency	Inband Peak (dBm)		Freq highest value (MHz)	Highest Value (dBc)		Margin (dB)		Verdict
	1M	2M		1M	2M	1M	2M	
2402 MHz	4.5	3.4	4803.154762	51.8	49.5	31.8	29.5	Pass
2440 MHz	6.6	3.6	4873.144345	55.1	52.7	35.1	32.7	Pass
2480 MHz	5.4	7.0	4953.132440	56.9	57.5	36.9	37.5	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.	

Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical	Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical
Conducted Emissions 10-26000 MHz, 2402 MHz, 1Mb	, 2Mb
Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical	Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical
Conducted Emissions 10-26000 MHz, 2440 MHz, 1Mb	, 2Mb
Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical	Spurious  — Limit — Sum Level — Threshold × Critical × Final Critical
Conducted Emissions 10-26000 MHz, 2480 MHz, 1Mb	, 2Mb

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 C63.10-2020 Clause 11.12

Test Results: Complies

Measurement Data:

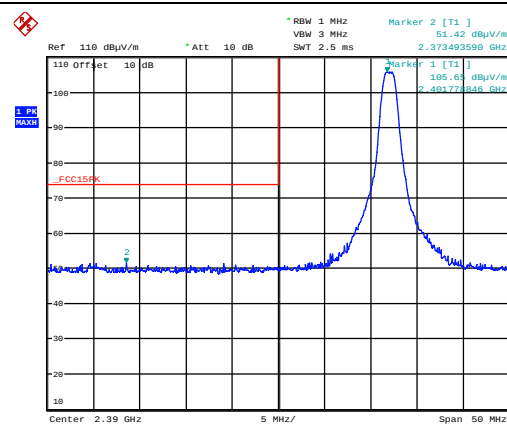
Peak Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	51.4	58.7	74	22.6	15.3
GFSK, 2Mb	52.1	61.0	74	21.9	13.0

Average Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	31.4	38.7	54	22.6	15.3
GFSK, 2Mb	32.1	41.0	54	21.9	13.0

The manufacturer states a maximum duty cycle during a 100 ms transmission period of 2,23 % and 1,12 % at 1Mbps and 2 Mbps respectively.

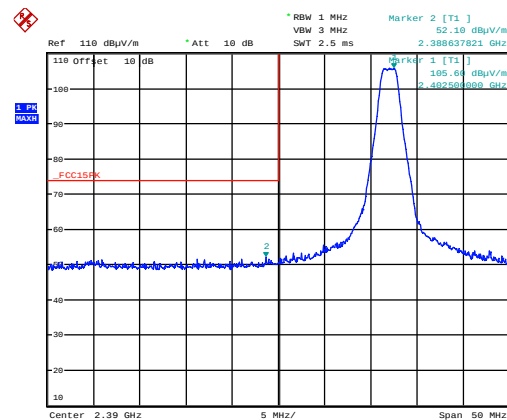
Duty Cycle Correction factor is thus 20 dB for both 1Mb and 2Mb. Average values are calculated from Peak values by subtracting the DC correction factor.

See attached plots.



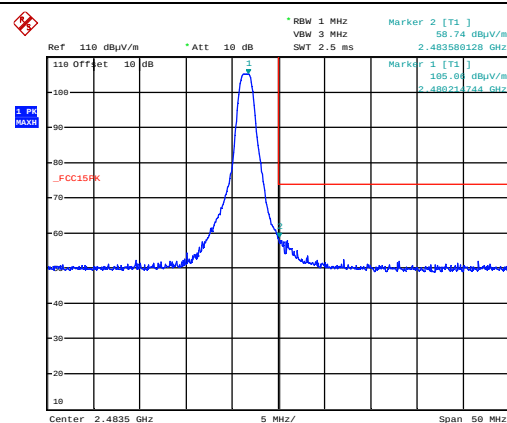
Date: 21.AUG.2025 08:25:33

Lower Band Edge, 6VDC, 2402 MHz, 1Mb, Peak



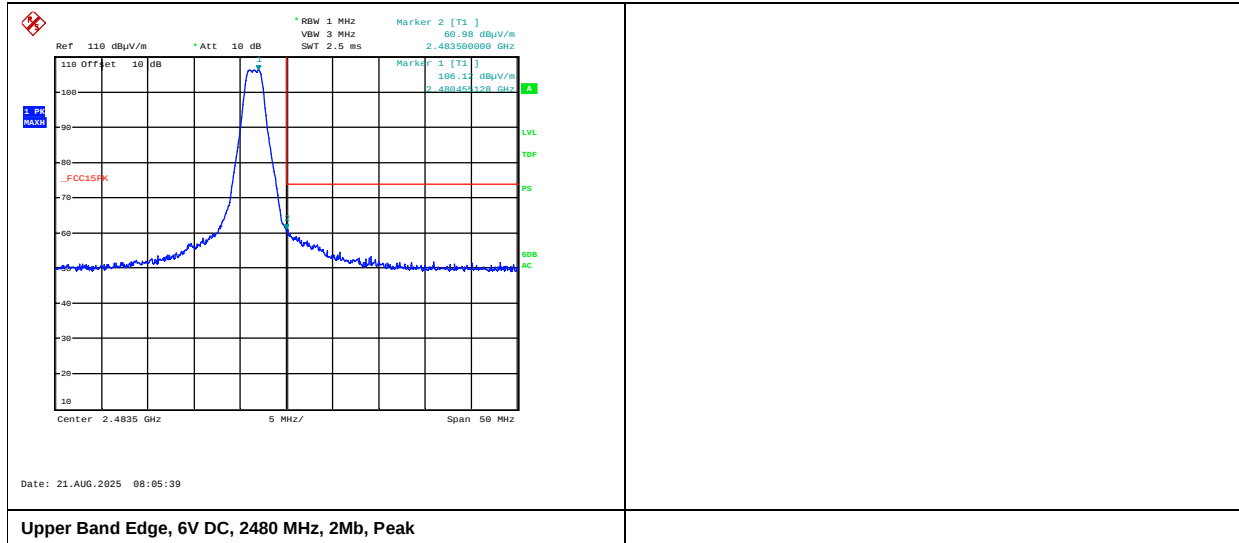
Date: 21.AUG.2025 08:35:25

Lower Band Edge, 6V DC, 2402 MHz, 2Mb, Peak



Date: 21.AUG.2025 07:56:35

Upper Band Edge, 6V DC, 2480 MHz, 1Mb, Peak



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 C63.10-2020 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Quasi-Peak

Measuring distance 3 m

Spurious as measured at carriers 2402, 2440, and 2480 – in table below named L, M, H respectively.

The device was powered from POE (48V DC) and 6V DC.

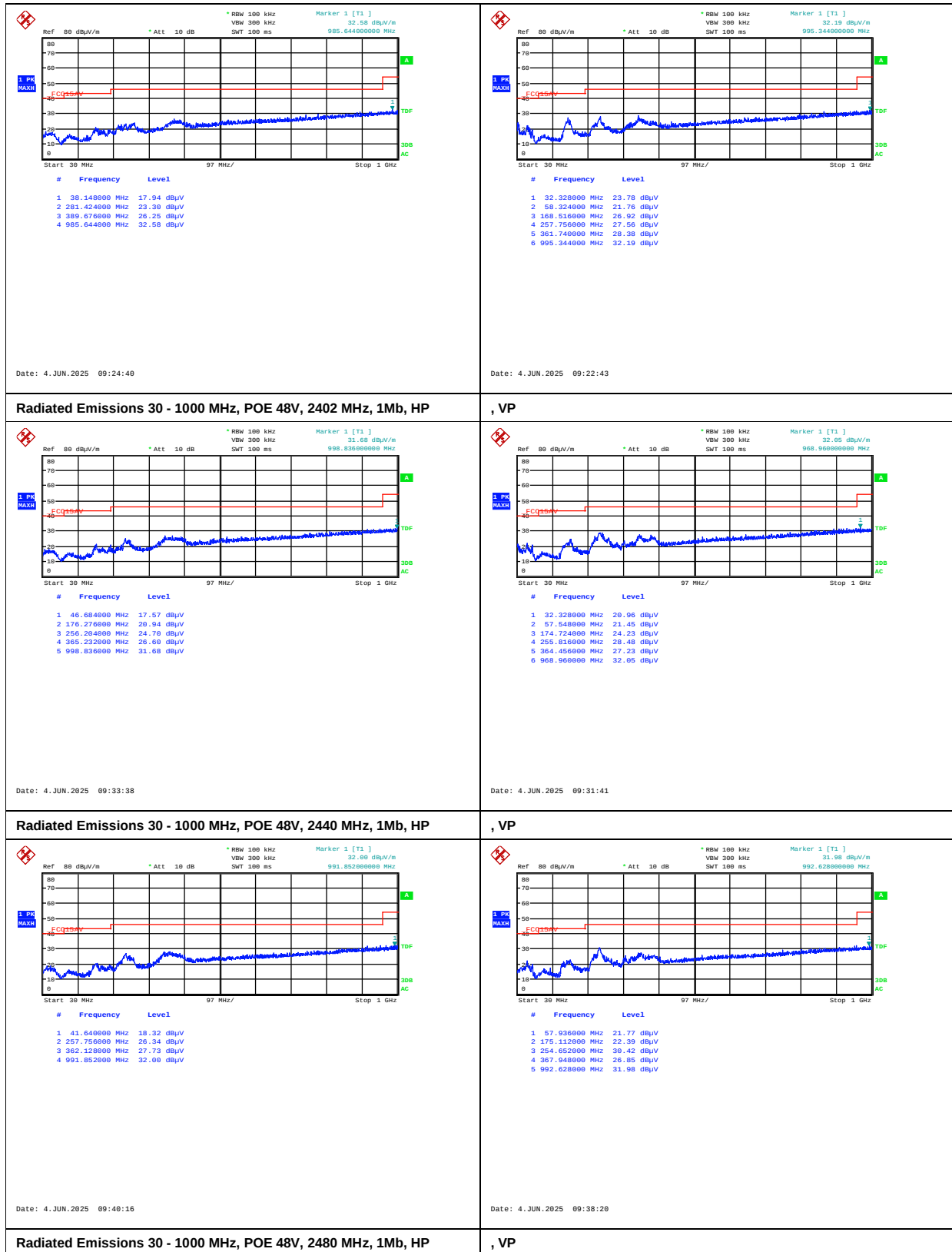
As can be seen from the plots below, the POE has slightly more spurious below 500 MHz in vertical polarization. However, the spurious is well below the limit.

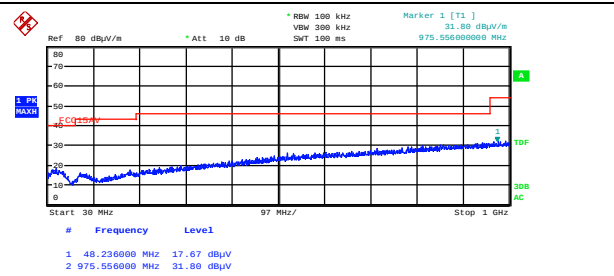
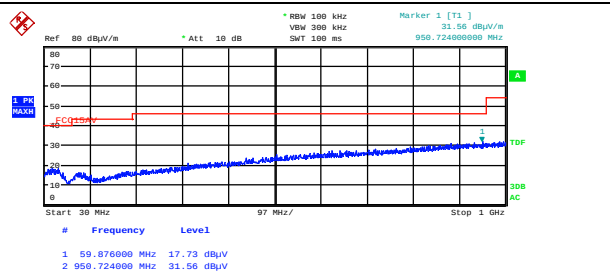
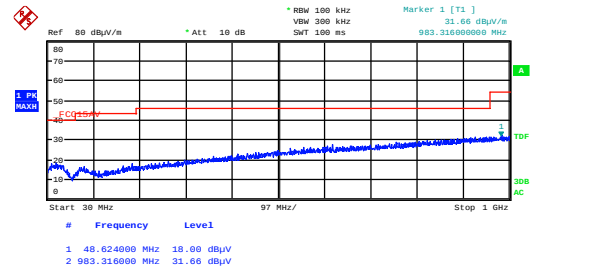
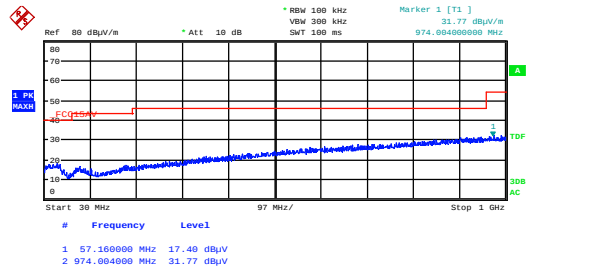
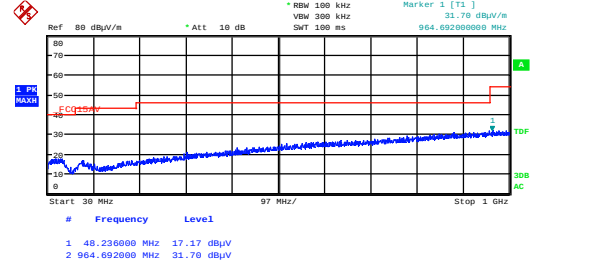
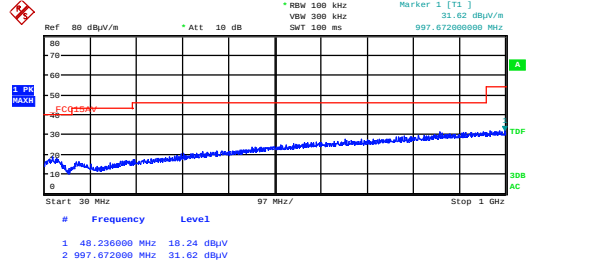
Measured Frequency (MHz)	Carrier Frequency (MHz)	Modulation	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30 – 88	L / M / H	1M / 2M	< 30	40.0	> 10.0
88 – 216	L / M / H	1M / 2M	< 30	43.5	> 13.5
216 – 960	L / M / H	1M / 2M	< 35	46.0	> 11.0
960 – 1000	L / M / H	1M / 2M	< 40	54.0	> 14.0

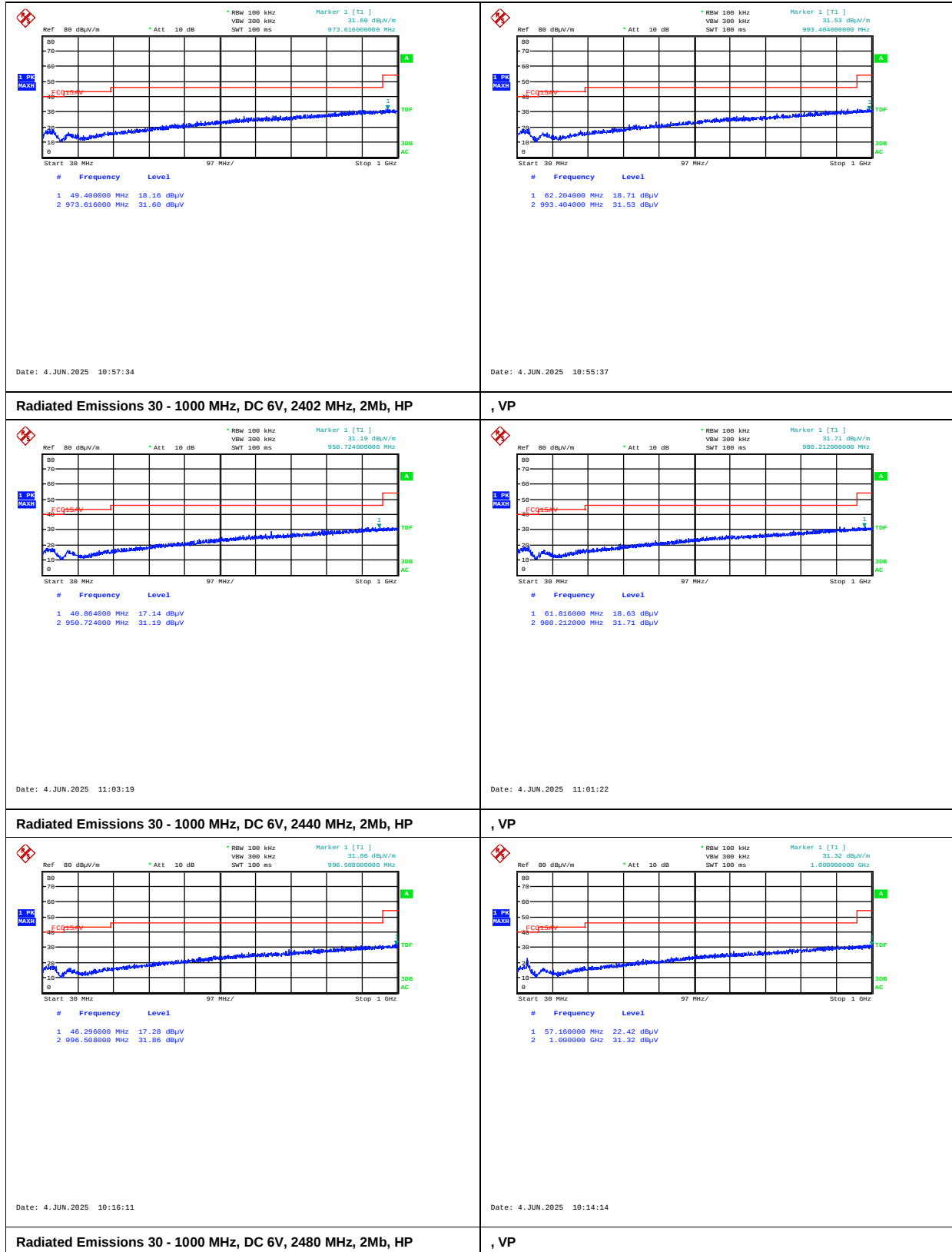
See attached plots

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		



 Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.80 dBµV/m VBW 300 kHz 975.55600000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 48.236000 MHz 17.67 dBµV 2 975.556000 MHz 31.80 dBµV Date: 4 JUN. 2025 10:31:20	 Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.56 dBµV/m VBW 300 kHz 950.72400000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 59.876000 MHz 17.73 dBµV 2 950.724000 MHz 31.56 dBµV Date: 4 JUN. 2025 10:29:23
Radiated Emissions 30 - 1000 MHz, DC 6V, 2402 MHz, 1Mb, HP  Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.66 dBµV/m VBW 300 kHz 983.31600000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 48.624000 MHz 18.00 dBµV 2 983.316000 MHz 31.66 dBµV Date: 4 JUN. 2025 10:45:42	, VP  Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.77 dBµV/m VBW 300 kHz 974.00400000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 57.160000 MHz 17.40 dBµV 2 974.004000 MHz 31.77 dBµV Date: 4 JUN. 2025 10:43:45
Radiated Emissions 30 - 1000 MHz, DC 6V, 2440 MHz, 1Mb, HP  Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.70 dBµV/m VBW 300 kHz 964.69200000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 48.236000 MHz 17.17 dBµV 2 964.692000 MHz 31.70 dBµV Date: 4 JUN. 2025 10:52:01	, VP  Ref 80 dBµV/m * Att 10 dB * RBW 100 kHz Marker 1 [T1] 31.62 dBµV/m VBW 300 kHz 997.67200000 MHz SMT 100 ms 1 PR MAXN Start 30 MHz 97 MHz/ Stop 1 GHz # Frequency Level 1 48.236000 MHz 18.24 dBµV 2 997.672000 MHz 31.62 dBµV Date: 4 JUN. 2025 10:50:04
Radiated Emissions 30 - 1000 MHz, DC 6V, 2480 MHz, 1Mb, HP	, 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 C63.10-2020 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.

Spurious as measured at carriers 2402, 2440, and 2480 – in table below named L, M, H respectively.

RBW=1 MHz

Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
L / M / H	1-4.4	1M / 2M	< 50	< 40	74	54	> 24	> 14
L / M / H	4.4-9.5	1M / 2M	< 50	< 40	74	54	> 24	> 14
L	12.010	1M	< 54	< 50	74	54	> 20	> 4
L	12.010	2M	< 54	< 50	74	54	> 20	> 4
L / M / H	9.5-18.0	1M / 2M	< 54	< 44	74	54	> 24	> 10

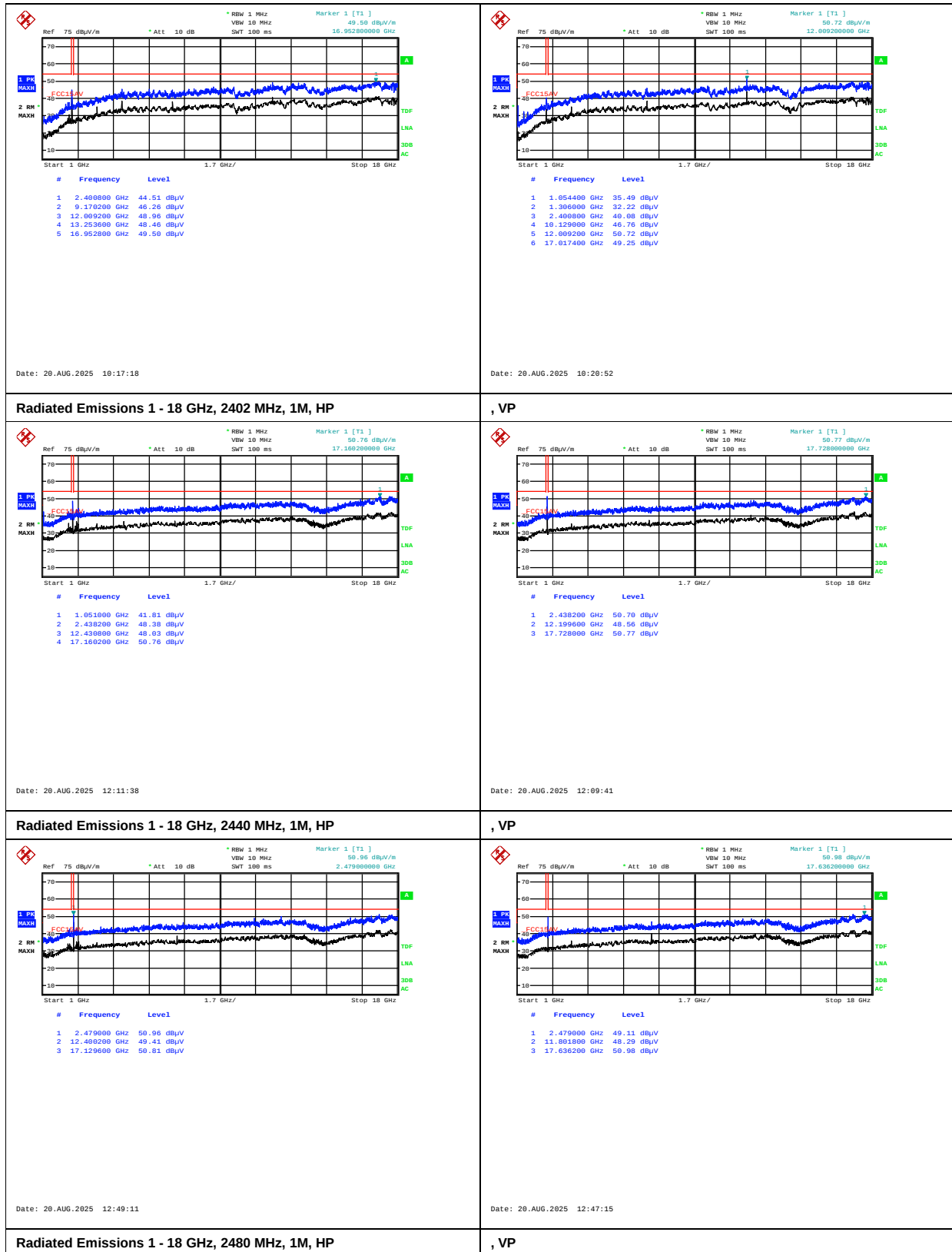
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz.

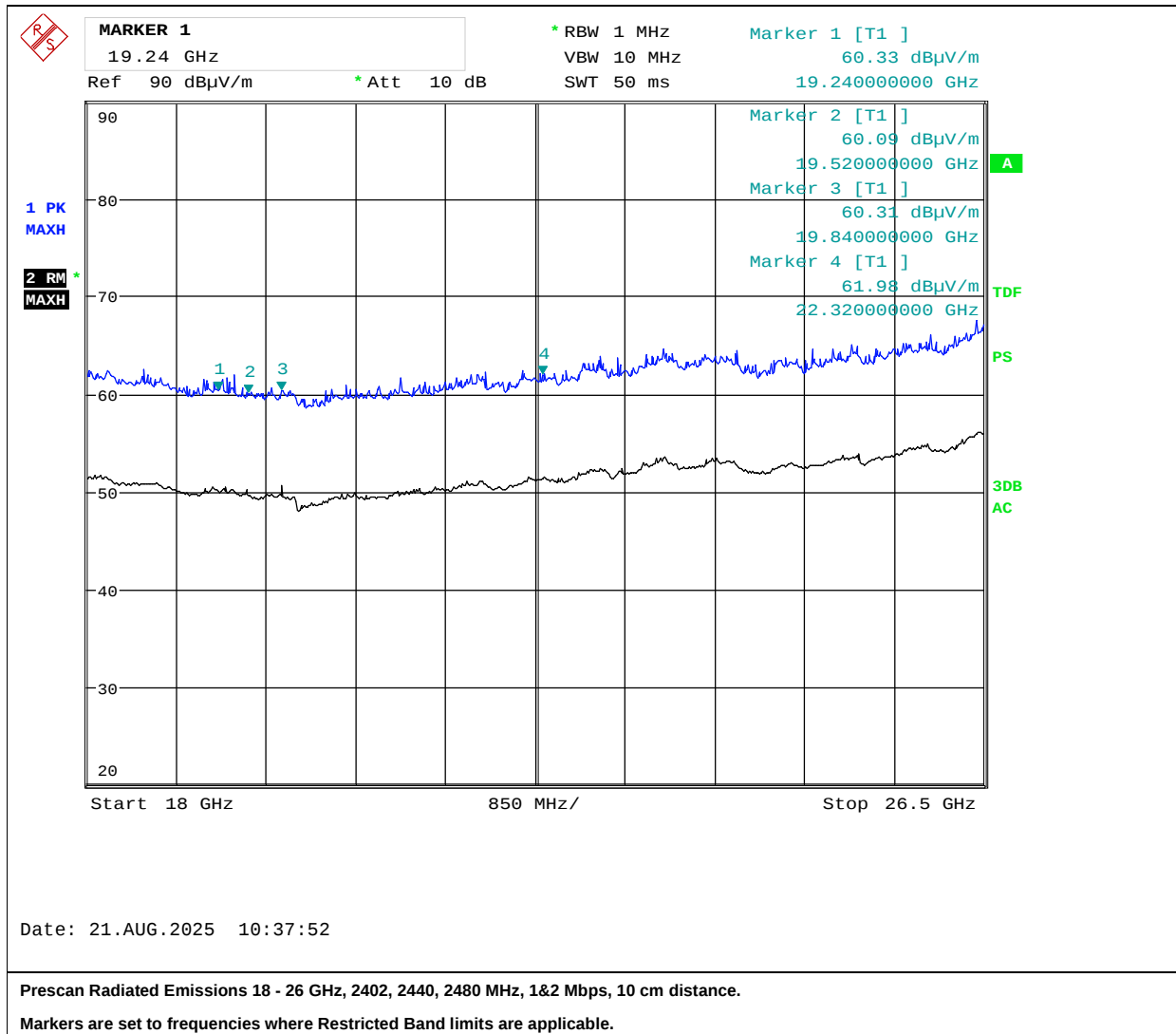
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

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 dBµV/m	74.0 dBµV/m





3.10 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 4, Clause 6.3.1

Measurement procedure: ANSI C63.10-2020 Clause 11.10

Test Results: Complies

Measurement Data:

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

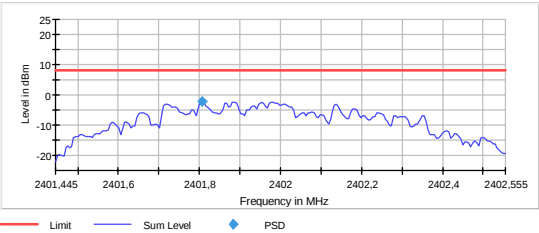
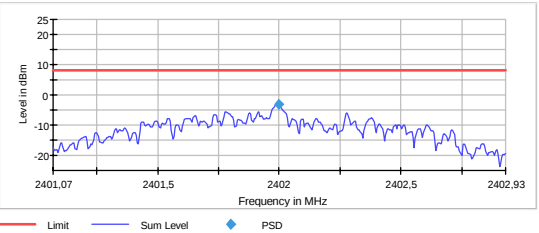
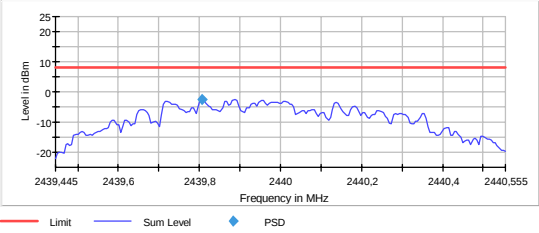
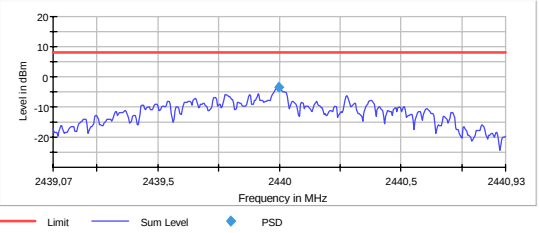
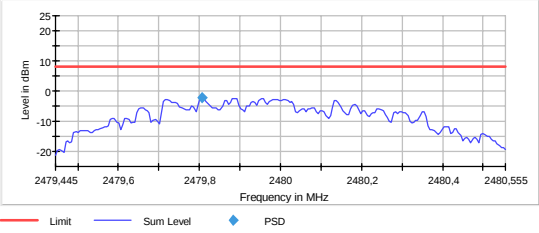
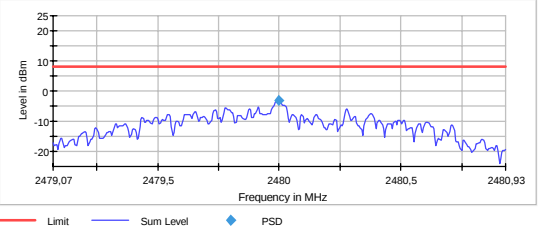
The measurement bandwidth was 10 kHz.

Modulation Type and Bitrate	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1Mb	-7.3	-7.6	-7.4
GFSK 2Mb	-8.4	-8.7	-8.4

See plots below: The measurements were performed with a 10 kHz bandwidth. Thus, the figures above are **reduced** by $10 * \log (10 / 3) = 5.2$ dB.

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.

Peak Power Spectral Density  — Limit — Sum Level ◆ PSD	Peak Power Spectral Density  — Limit — Sum Level ◆ PSD
PSD, 2402 MHz, 1Mb	PSD, 2402 MHz, 2Mb
Peak Power Spectral Density  — Limit — Sum Level ◆ PSD	Peak Power Spectral Density  — Limit — Sum Level ◆ PSD
PSD, 2440 MHz, 1Mb	PSD, 2440 MHz, 2Mb
Peak Power Spectral Density  — Limit — Sum Level ◆ PSD	Peak Power Spectral Density  — Limit — Sum Level ◆ PSD
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 testhouse.

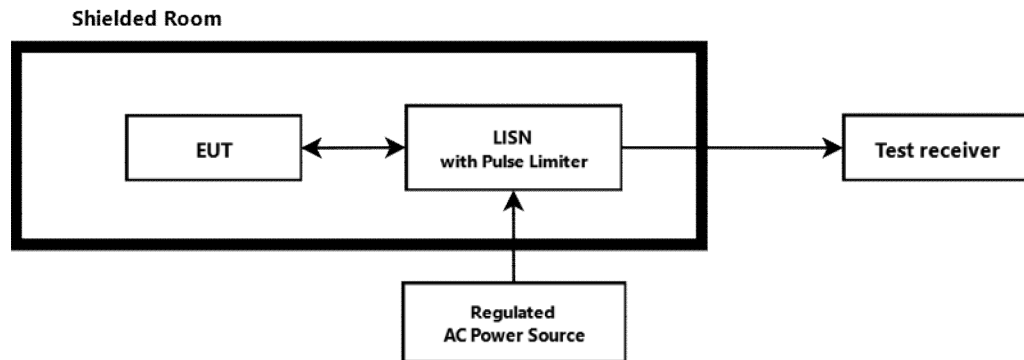
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2025-02	2026-02
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2025-01	2026-01
3	6810.17B	Attenuator	Suhner	LR 1669	COU	
4	NO324415	Band Reject Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
5	JB3	BiLog Antenna	Sunol	N-4525	2023-04	2026-04
6	310	Preamplifier	Sonoma Inst.	LR 1686	2024-09	2026-09
7	3115	Horn Antenna	EMCO	LR 1330	2022-11	2027-11
8	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2024-09	2026-09
9	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2024-09	2026-09
10	WLK5-1100-1485-7000-40SS	Low Pass Filter (1 GHz)	Wainwright Inst.	LR 1761	COU	
11	638	Antenna Horn	Narda	LR 1480	N/A	
12	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

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

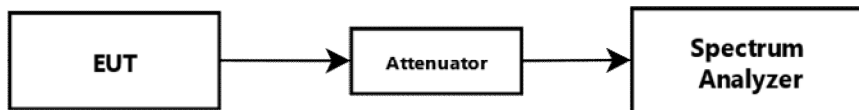
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAMS

6.1 Power Line Conducted Emission

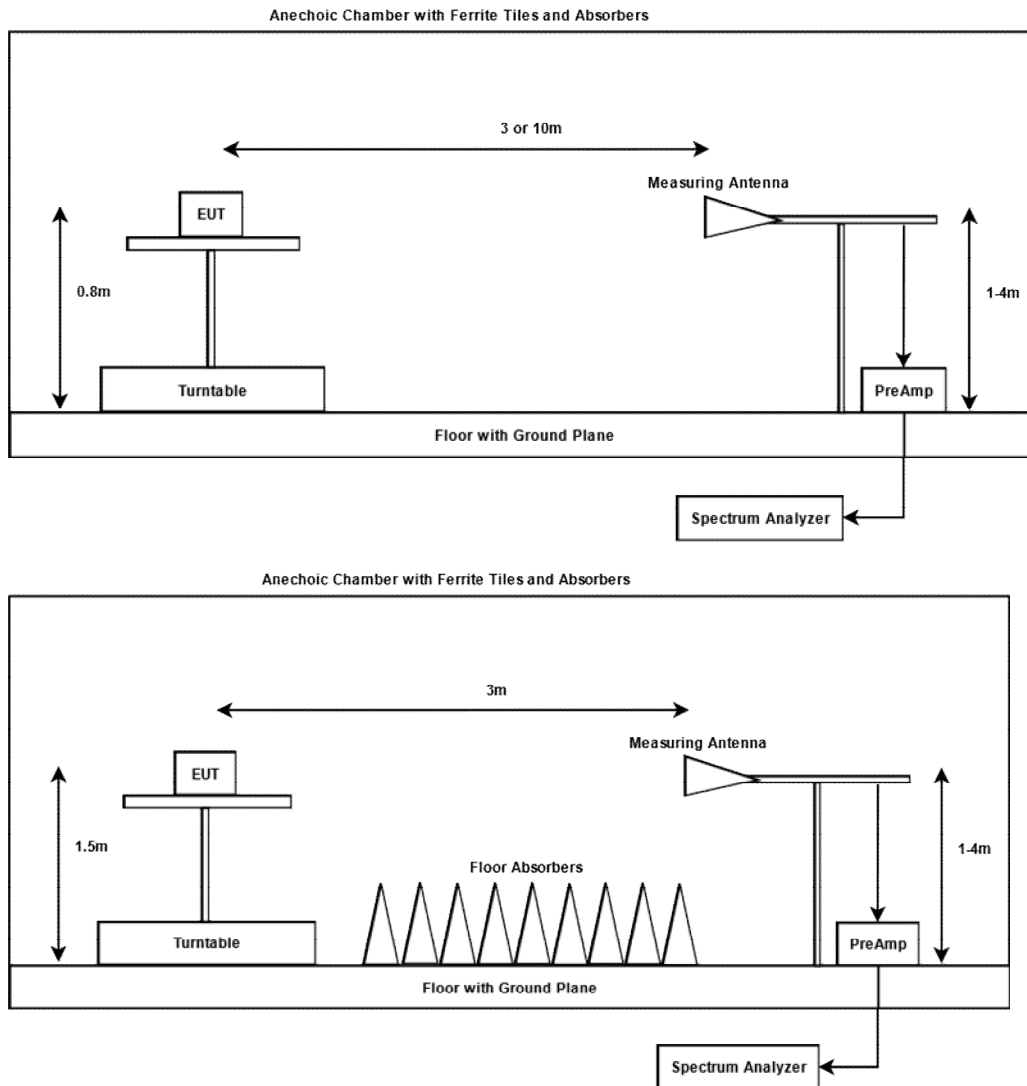


6.2 Conducted Tests



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. Measuring distance is 3m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

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. A Band-Stop filter is used for all measurements from 1 to 18 GHz and a Low-Pass filter is used below 1 GHz.

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. Measurements above 18 GHz are performed at 1m measuring distance.