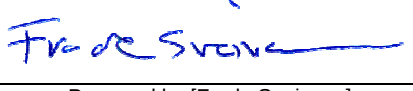


Test Report

Product	Collaboration Endpoint with Wifi and Bluetooth
Name and address of the applicant	Cisco Systems Norway AS Philip Pedersens vei 1 1366 Lysaker, NORWAY
Name and address of the manufacturer	Cisco Systems, Inc. 170 West Tasman Drive San Jose, CA 95134, USA
Model	TTC4-01
Rating	Mains (100-240V AC, 50-60Hz, 2.0-1.5A)
Trademark	CISCO
Additional information	Bluetooth LE, Bluetooth Classic, WiFi 6
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	PRJ0019248
Tested in period	2022-09-08 to 2023-01-06 and 2023-03-21
Issue date	2023-05-24
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 [Frode Sveinsen]  Approved by [G.Suhanthakumar]	
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Revision history

Revision	Date	Comment	Sign
A	2023-05-24	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	Cisco Room Bar Pro
Model/version	TTC4-01
FCC ID	LDK0401B2757
ISED ID	2461N-0401B2757
Serial number	Radiated Sample: FOC2650J4Y5 50 Ohm Sample: TTCFOC2641N3SK (TTC6-15)
Hardware identity and/or version	DV1
Software identity and/or version	RoomOS 11.30.X
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	Bluetooth Low Energy ☒ 1Mb ☒ 2Mb
Type of Modulation	GFSK
Conducted Output Power	0.74 mW
Antenna Connector	Internal U-FL
Number of Antennas	1
Diversity or Smart Antennas	No
Power Supply	Powered from Mains (120V 60Hz AC)
Antennas	Amphenol Model OCF656-15-000-R

Description of Test Item

The tested EUT is a Collaboration Endpoint with WiFi and Bluetooth.

The radio module is identical to the radio module in the already approved Cisco model TTC6-15 (FCC ID: LDK0615C2718, IC: 2461N-0615C2718), but this model has different antennas.

All 50 Ohm measurements were performed on Cisco TTC6-15.

The Bluetooth Low Energy part has been tested as a DTS system and fulfils all requirements for DTS systems.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	120 V 60 Hz

The values are the limit registered during the test period.

The EUT was powered from the AC Power Source.

1.3 Test Engineers

Frode Sveinsen

Jørn Gustavsen (Power Line Conducted)

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 EUT have internal antennas.		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	All tests were performed with the EUT set to transmit continuously at the selected channel.
Additional information	The EUT was transmitting bursts at the selected channel and with the selected output power.

1.6 Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISSED 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 ISSED.

☒ 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	Complies
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	Complies
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 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

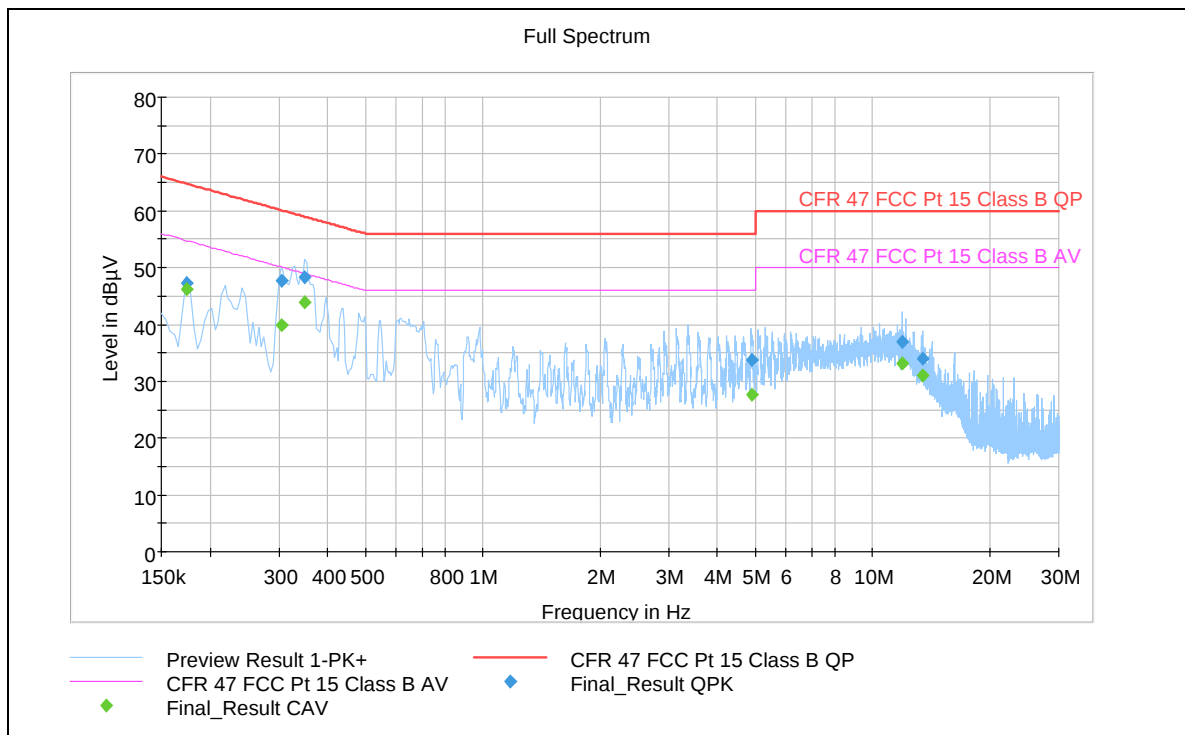
Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN

Test Results: Complies

Measurement Data: 120V 60Hz, 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)
0.174000	---	46.25	54.77	8.51	15000.0	9.000	L1	OFF	9.7
0.174000	47.25	---	64.77	17.52	15000.0	9.000	L1	OFF	9.7
0.306000	---	39.91	50.08	10.17	15000.0	9.000	N	OFF	9.7
0.306000	47.76	---	60.08	12.32	15000.0	9.000	N	OFF	9.7
0.350000	48.30	---	58.96	10.66	15000.0	9.000	L1	OFF	9.7
0.350000	---	43.88	48.96	5.08	15000.0	9.000	L1	OFF	9.7
4.894000	---	27.60	46.00	18.40	15000.0	9.000	L1	OFF	9.8
4.894000	33.72	---	56.00	22.28	15000.0	9.000	L1	OFF	9.8
11.954000	36.85	---	60.00	23.15	15000.0	9.000	L1	OFF	9.9
11.954000	---	33.09	50.00	16.91	15000.0	9.000	L1	OFF	9.9
13.482000	---	31.00	50.00	19.00	15000.0	9.000	N	OFF	9.7
13.482000	33.93	---	60.00	26.07	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 C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

Carrier Frequency, Data Rate	Occupied Bandwidth (99% BW)
2440 MHz, 1Mb	1.04 MHz
2440 MHz, 2Mb	2.08 MHz

Occupied Bandwidth is the same for all channels

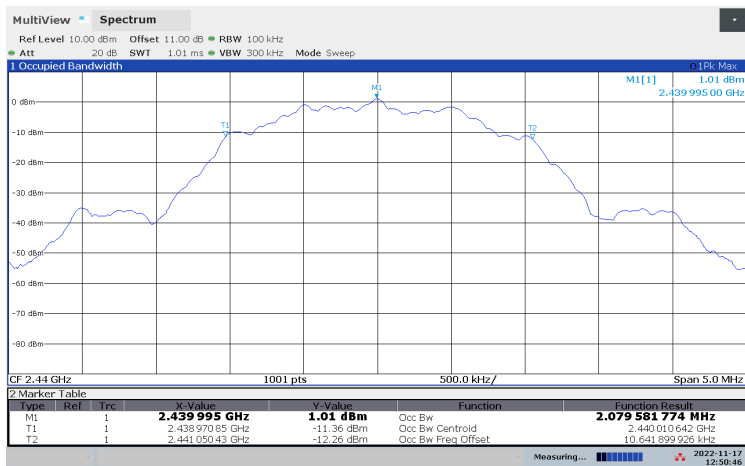
See attached plots

Requirements:

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



99% Occupied BW, 1M



99% Occupied BW, 2M

3.3 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

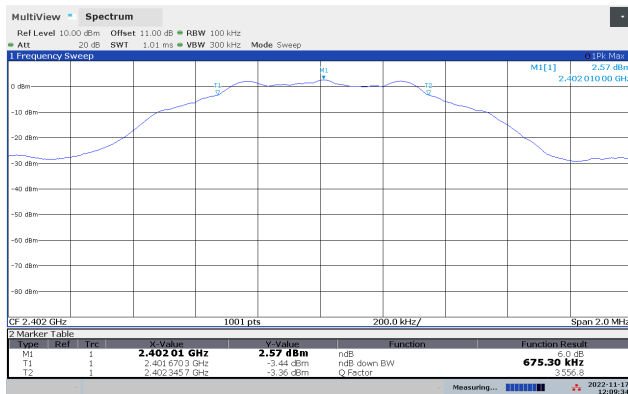
Test Results: Complies

Measurement Data:

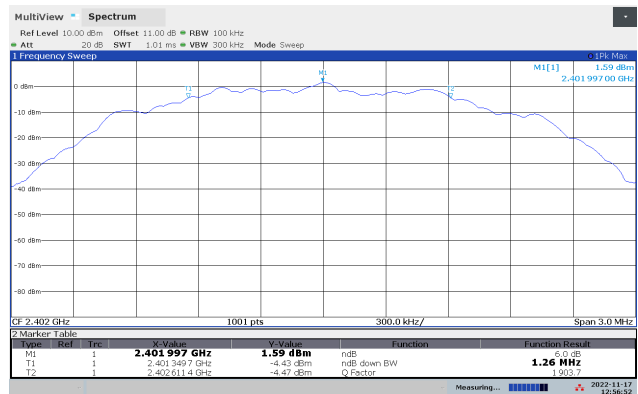
Modulation type and bitrate	Measured DTS Bandwidth (MHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1 Mbps	0.675	0.675	0.677
GFSK 2 Mbps	1.26	1.26	1.26

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

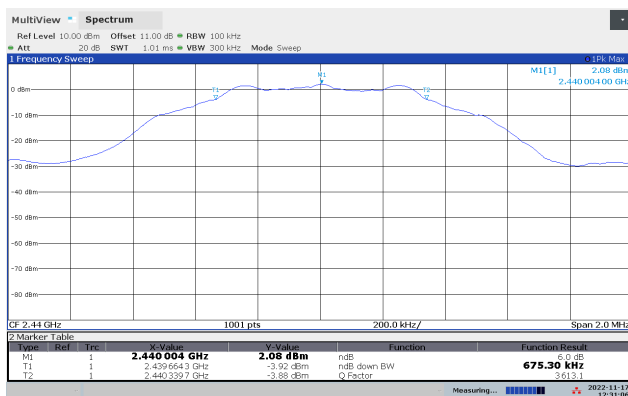
Frequency Band	Requirement for systems using Digital Modulation
902-928 MHz	The minimum 6 dB bandwidth shall be at least 500 kHz.
2400-2483.5 MHz	
5725-5850 MHz	



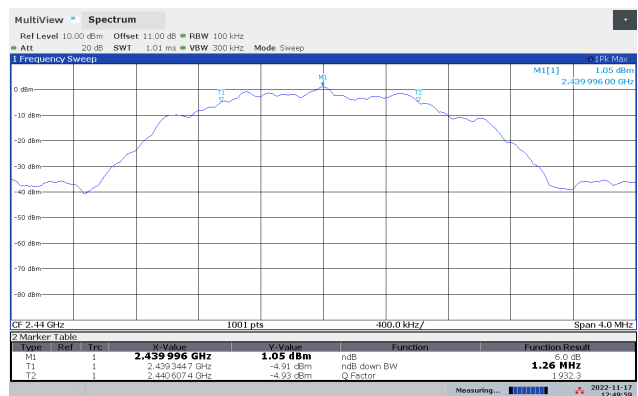
DTS BW, 2402 MHz, 1M



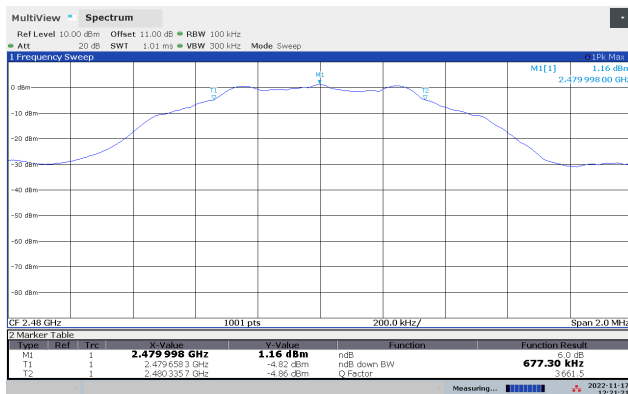
DTS BW, 2402 MHz, 2M



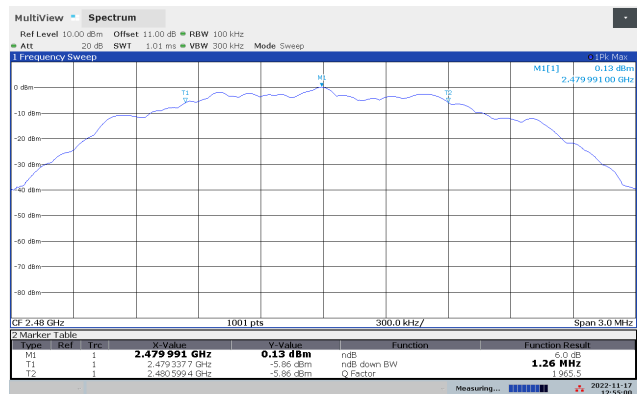
DTS BW, 2440 MHz, 1M



DTS BW, 2440 MHz, 2M



DTS BW, 2480 MHz, 1M



DTS BW, 2480 MHz, 2M

3.4 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 Conducted Power, mW		Peak EIRP, dBm		Measured Antenna Gain, dBi	
	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 2Mb	GFSK 1Mb	GFSK 2Mb
2402 MHz	-1.4	-1.3	0.72	0.74	2.75	2.57	4.1	3.8
2440 MHz	-1.5	-1.3	0.71	0.74	3.52	3.24	5.0	4.5
2480 MHz	-2.4	-2.2	0.58	0.60	1.32	1.00	3.7	3.2

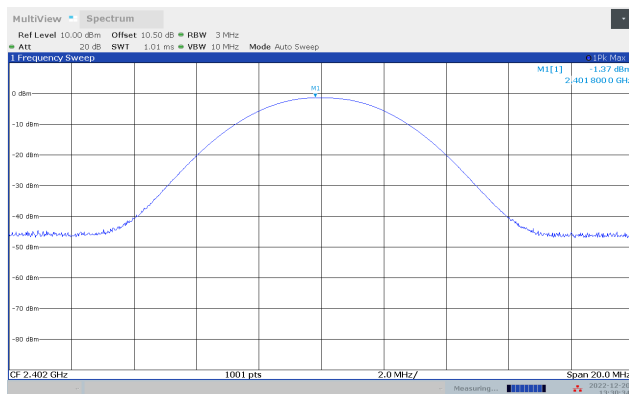
Output Power reported is Maximum Peak Power.

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

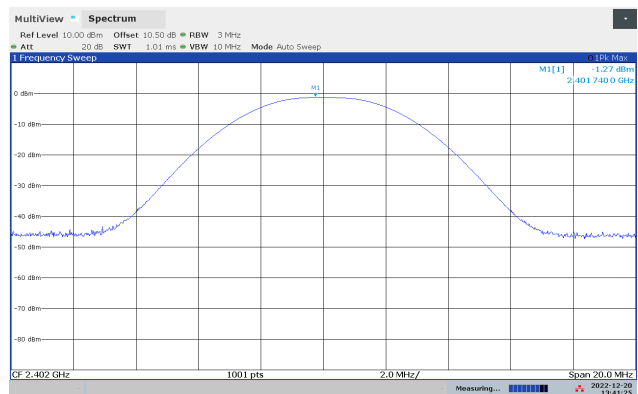
Antenna Gain is less than 6 dBi.

See attached plots.

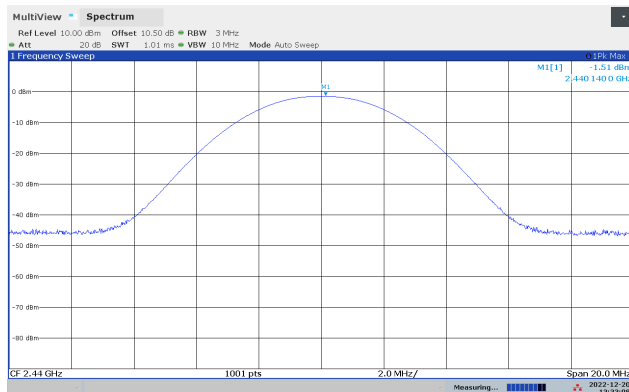
Requirements for Digital Modulation systems
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.
As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum 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.



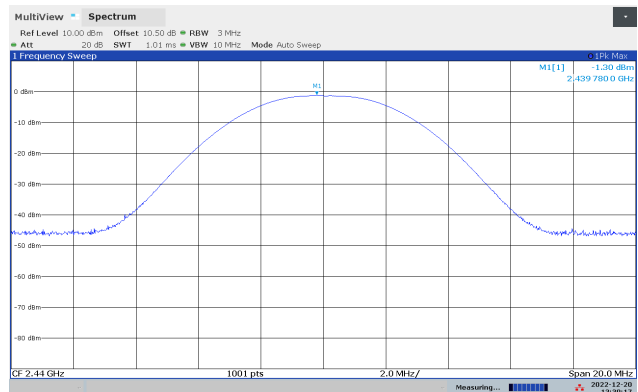
Peak Power, 2402 MHz, 1Mb



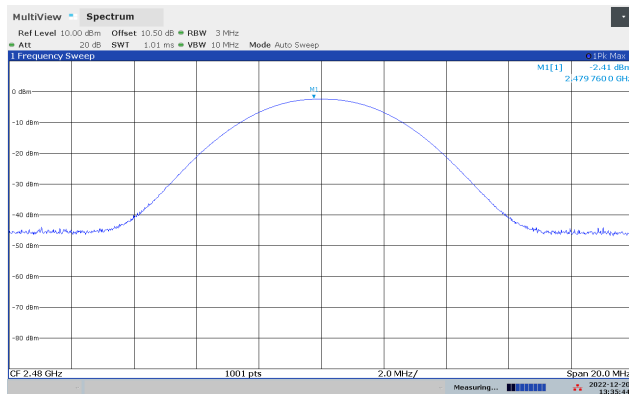
Peak Power, 2402 MHz, 2Mb



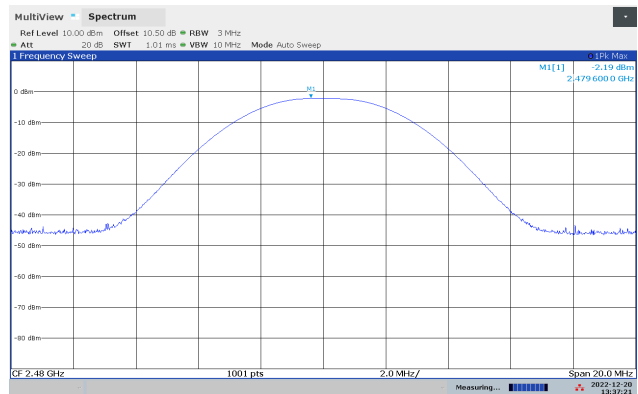
Peak Power, 2440 MHz, 1Mb



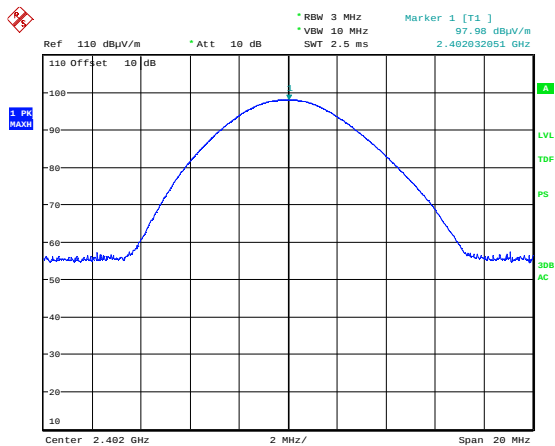
Peak Power, 2440 MHz, 2Mb



Peak Power, 2480 MHz, 1Mb

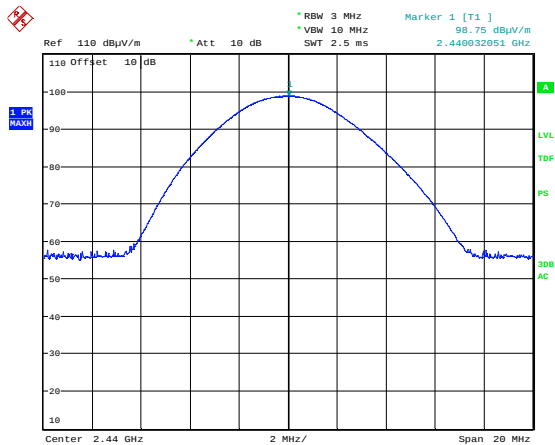


Peak Power, 2480 MHz, 2Mb



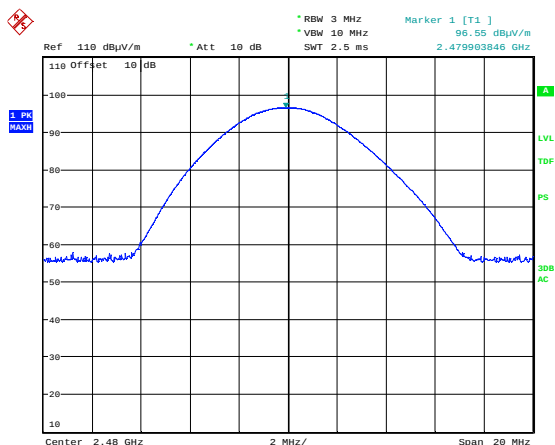
Date: 21.MAR.2023 09:58:28

Field Strength, 2402 MHz, 1Mb



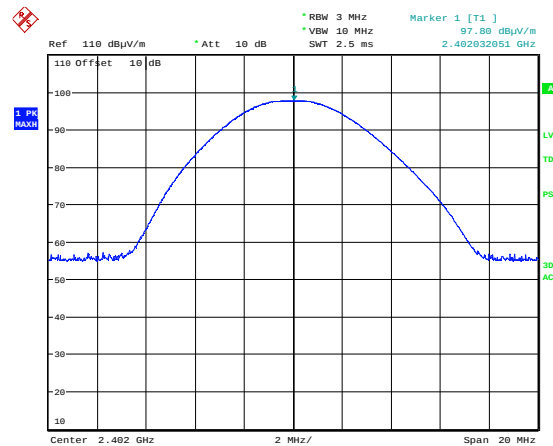
Date: 21.MAR.2023 09:37:55

Field Strength, 2440 MHz, 1Mb



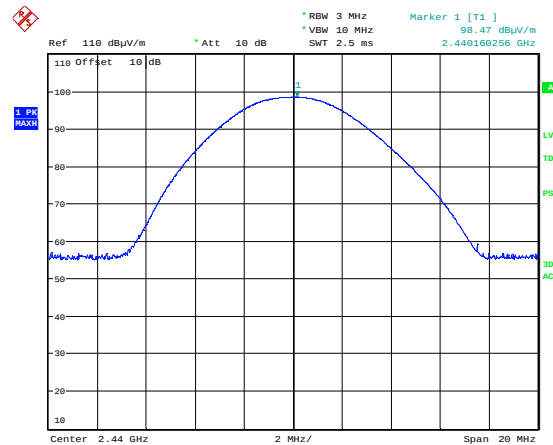
Date: 21.MAR.2023 09:44:50

Field Strength, 2480 MHz, 1Mb



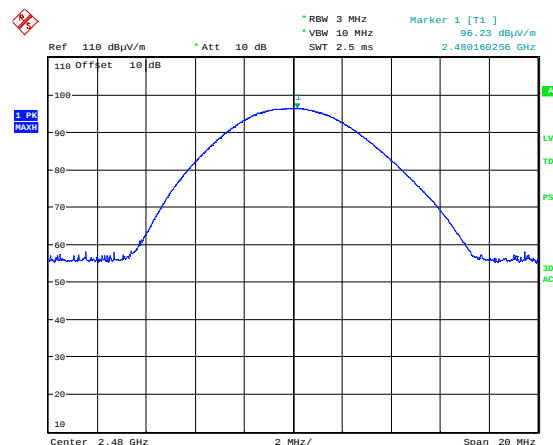
Date: 21.MAR.2023 10:04:31

Field Strength, 2402 MHz, 2Mb



Date: 21.MAR.2023 10:12:30

Field Strength, 2440 MHz, 2Mb



Date: 21.MAR.2023 09:50:16

Field Strength, 2480 MHz, 2Mb

3.5 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

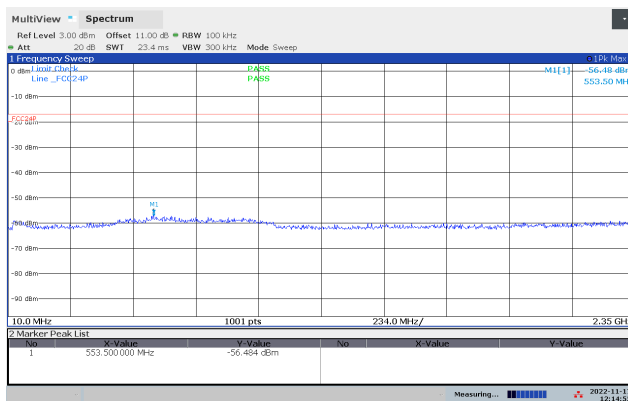
Measurement Data:

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

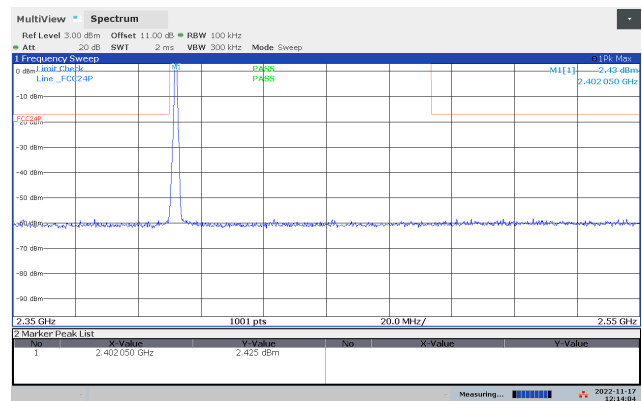
Measured with Peak Detector

RF conducted power to 25 GHz: see attached plots.

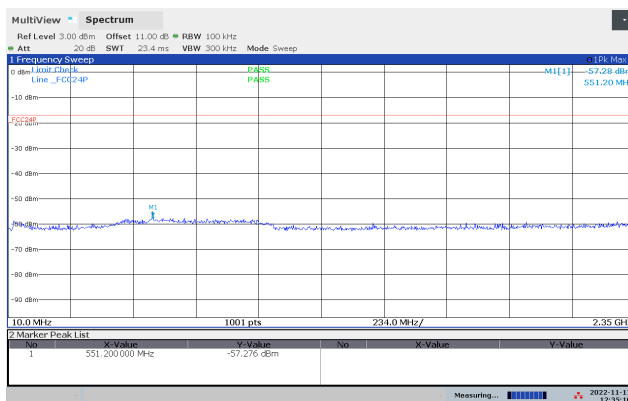
Requirements for all systems	
Peak measurement	RMS averaging (alternative measurement)
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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.	



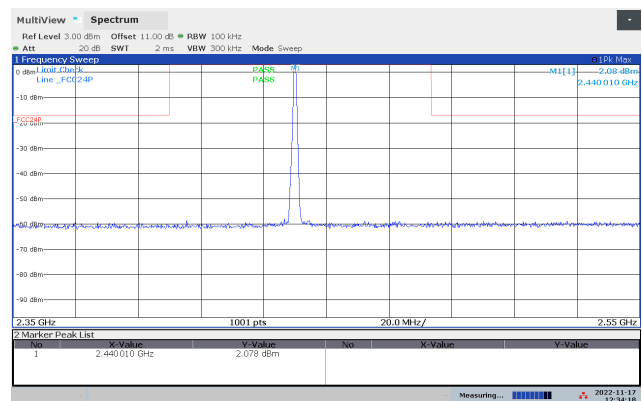
Conducted Emissions 10-2350 MHz, 2402 MHz, 1Mb



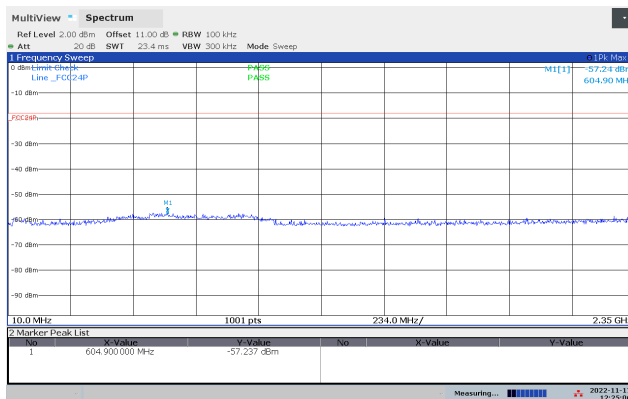
Conducted Emissions 2350-2550 MHz, 2402 MHz, 1Mb



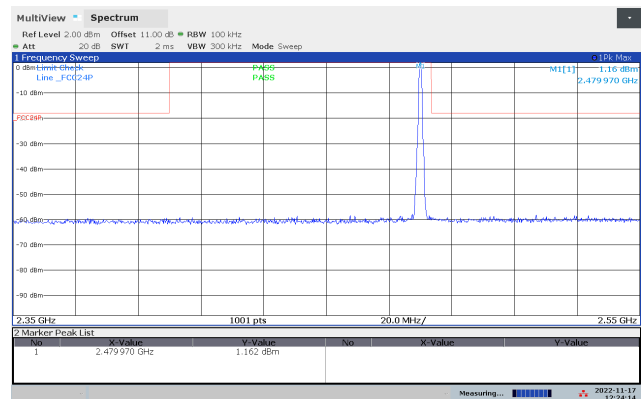
Conducted Emissions 10-2350 MHz, 2440 MHz, 1Mb



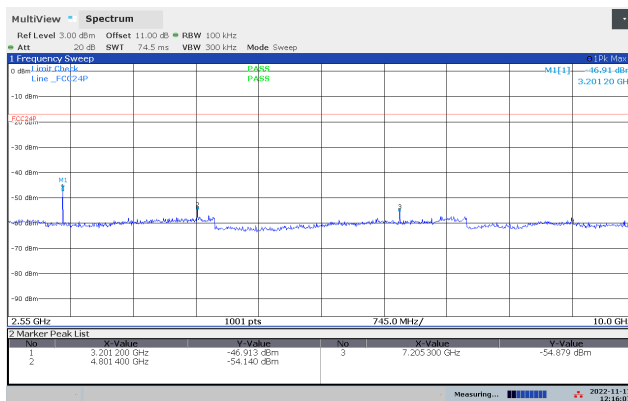
Conducted Emissions 2350-2550 MHz, 2440 MHz, 1Mb



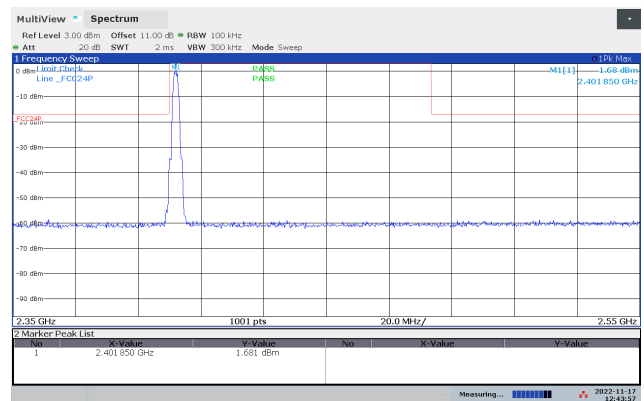
Conducted Emissions 10-2350 MHz, 2480 MHz, 1Mb



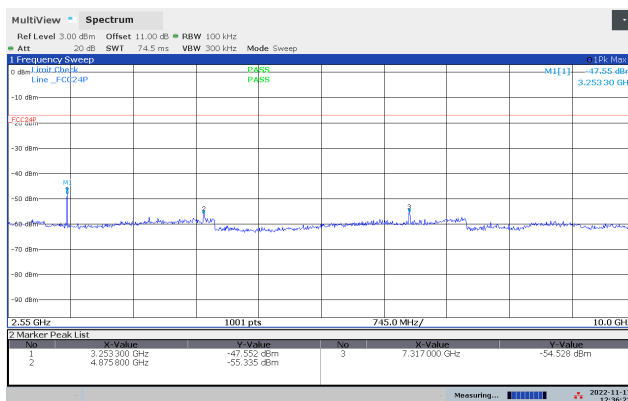
Conducted Emissions 2350-2550 MHz, 2480 MHz, 1Mb



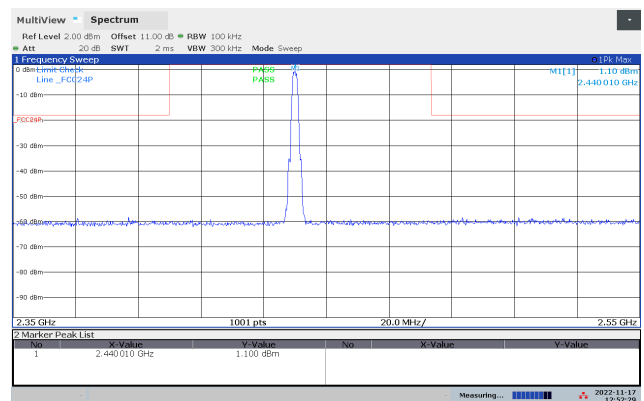
Conducted Emissions 2.55-10 GHz, 2402 MHz, 1Mb



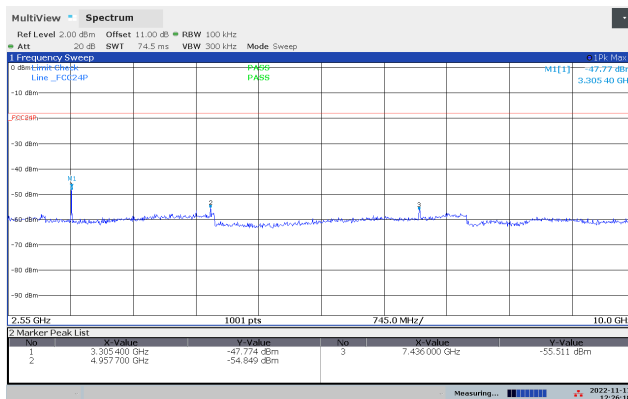
Conducted Emissions 2350-2550 MHz, 2402 MHz, 2Mb



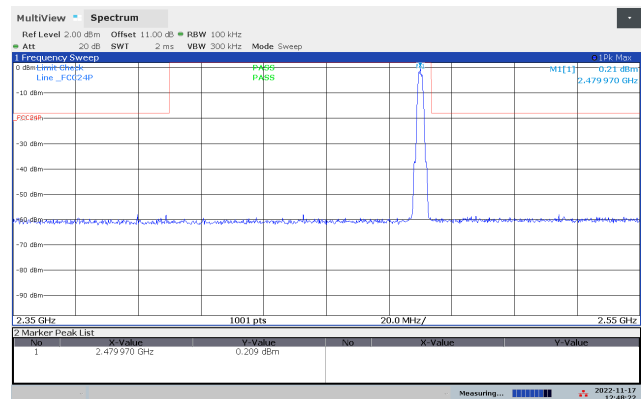
Conducted Emissions 2.55-10 GHz, 2440 MHz, 1Mb



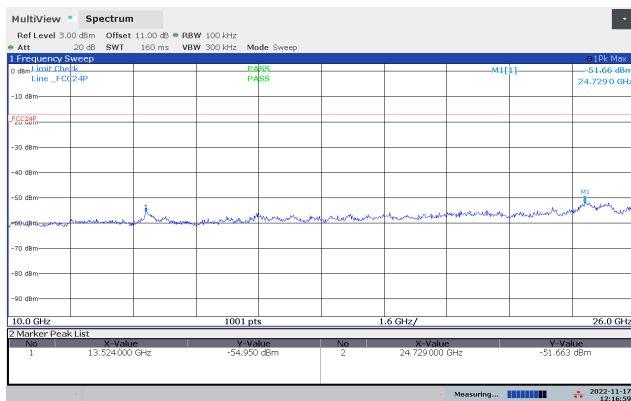
Conducted Emissions 2350-2550 MHz, 2440 MHz, 2Mb



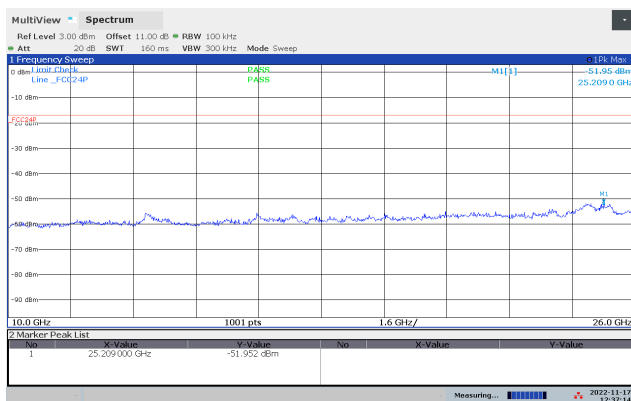
Conducted Emissions 2.55-10 GHz, 2480 MHz, 1Mb



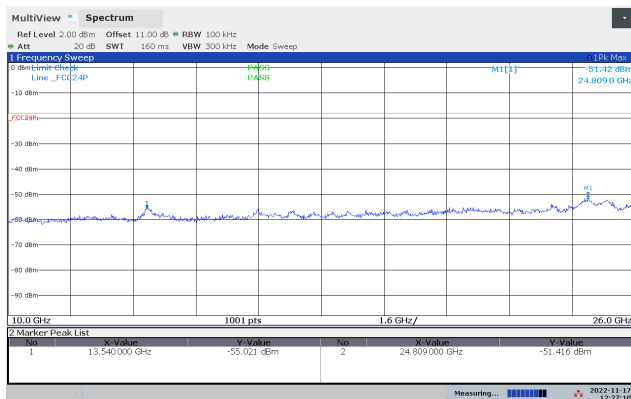
Conducted Emissions 2350-2550 MHz, 2480 MHz, 2Mb



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



Conducted Emissions 10-26 GHz, 2440 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)	ISSED (MHz)	FCC (GHz)	ISSED (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:

Peak Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	53.0	56.0	74	21.0	18.0
GFSK, 2Mb	52.9	58.5	74	21.1	15.5

Average Detector					
Modulation and Bitrate	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
GFSK, 1Mb	42.7	50.4	54	11.3	3.6
GFSK, 2Mb	45.6	52.9	54	8.4	1.1

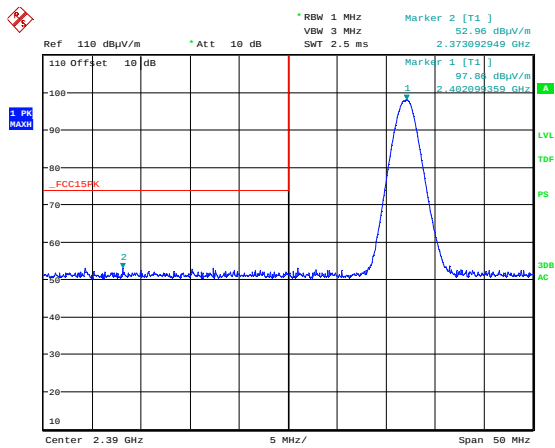
Average Detector values were measured with Power Averaging and Constant Duty Cycle (SA-2).

Average values are corrected for duty cycle.

See attached plots.

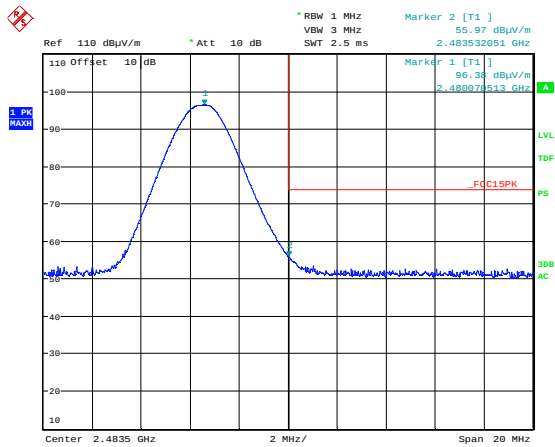
Duty Cycle

Mode	Burst Length (μ s)	Frame period (μ s)	Duty Cycle	DC Correction (dB)
1M	390	626	0.623	2.06
2M	196	626	0.313	5.04



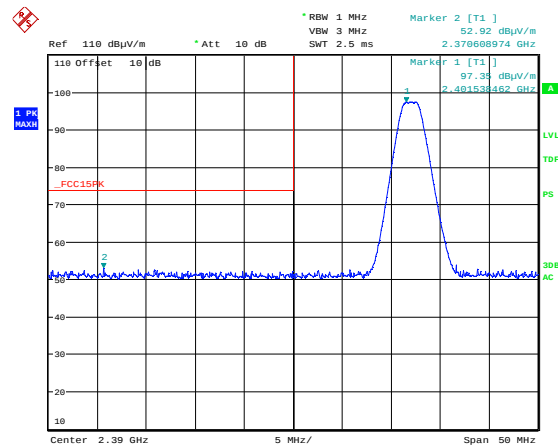
Date: 21.MAR.2023 09:59:14

Lower Band Edge, 2402 MHz, 1Mb, Peak



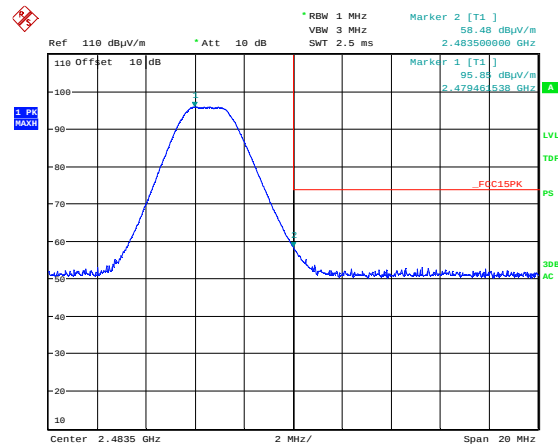
Date: 21.MAR.2023 09:45:36

Upper Band Edge, 2480 MHz, 1Mb, Peak



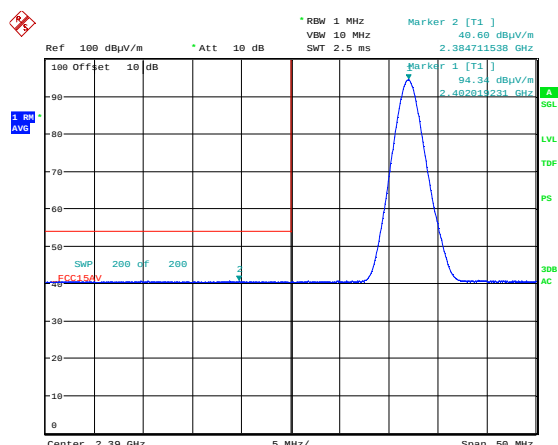
Date: 21.MAR.2023 10:05:17

Lower Band Edge, 2402 MHz, 2Mb, Peak



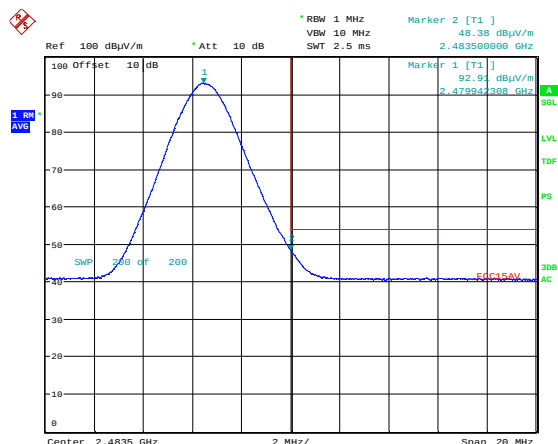
Date: 21.MAR.2023 09:51:02

Upper Band Edge, 2480 MHz, 2Mb, Peak



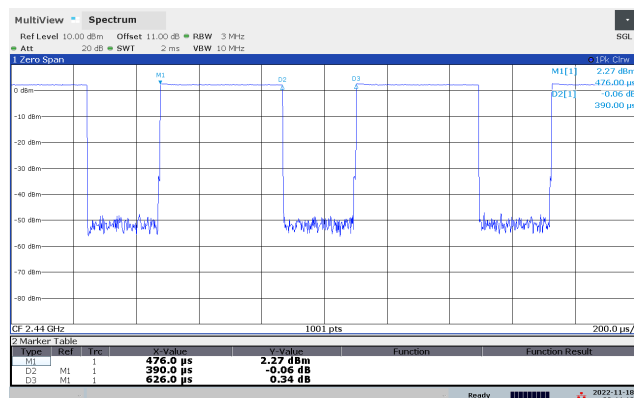
Date: 21.MAR.2023 09:59:35

Lower Band Edge, 2402 MHz, 1Mb, Average

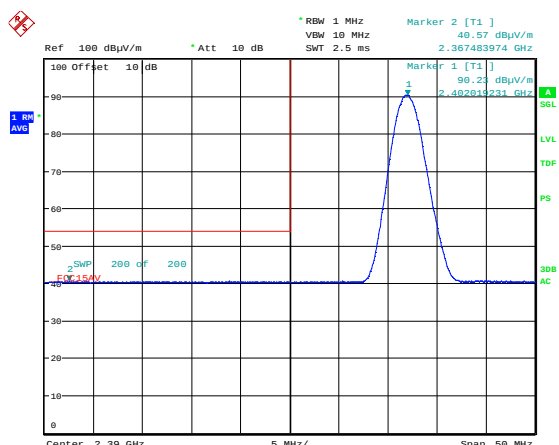


Date: 21.MAR.2023 09:45:56

Upper Band Edge, 2480 MHz, 1Mb, Average

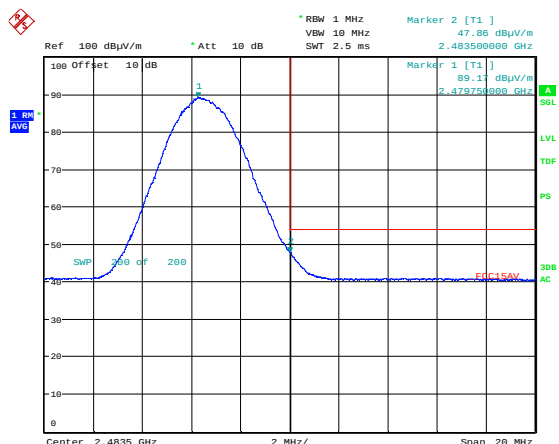


Duty Cycle, 1M



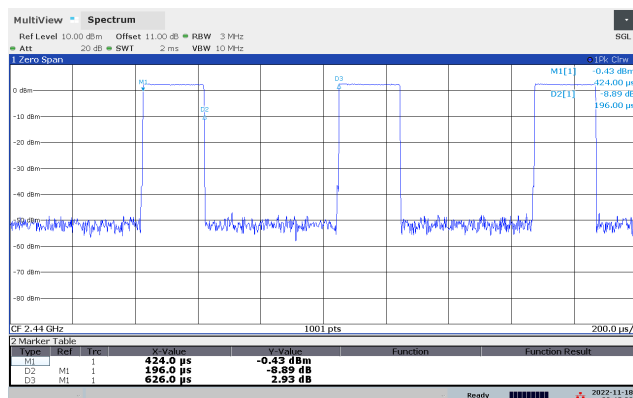
Date: 21.MAR.2023 10:05:38

Lower Band Edge, 2402 MHz, 2Mb, Average



Date: 21.MAR.2023 09:51:22

Upper Band Edge, 2480 MHz, 2Mb, Average



Duty Cycle, 2M

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 3m

Tested in test mode with EUT transmitting on 2440 MHz

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.272526	27.73	40.00	12.27	15000.0	120.000	104.0	V	119.0	-15.5
147.455732*	45.75	43.50	-2.25	15000.0	120.000	254.0	H	1.0	-17.4
180.611896	36.95	43.50	6.55	15000.0	120.000	104.0	H	29.0	-15.9
221.182824	39.83	46.00	6.17	15000.0	120.000	126.0	H	336.0	-13.5
614.398270	43.14	46.00	2.86	15000.0	120.000	128.0	H	25.0	-3.2

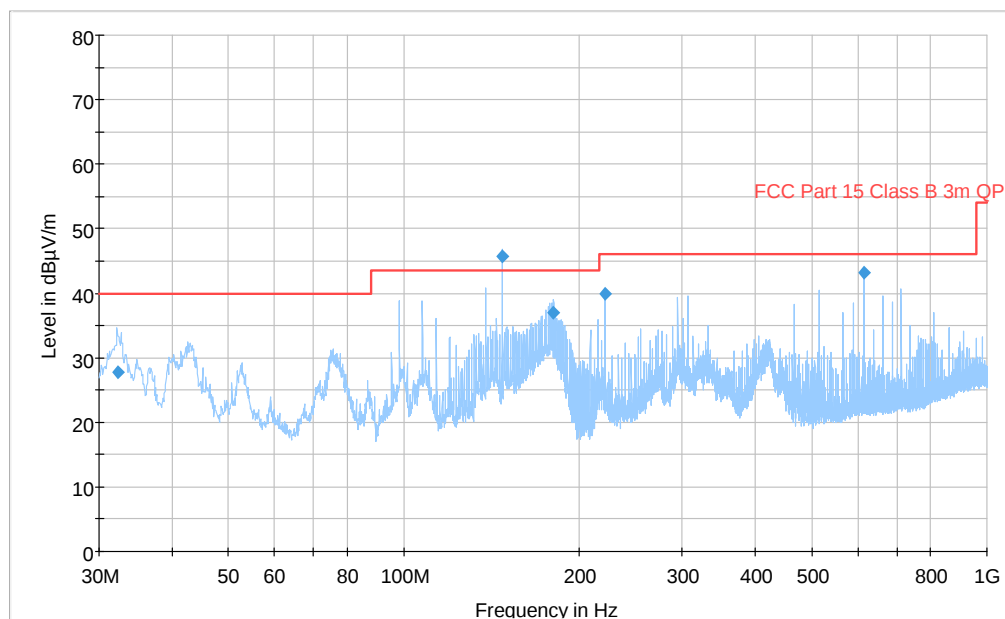
*This is a Class A product and the spurious at 147.46 MHz is not from the radio part.

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		

Full Spectrum



Radiated Emissions, 30-1000 MHz, GFSK

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

Carrier Frequency (MHz)	Measured Frequency (GHz)	Mode	Measured Emissions (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
Any	Any	1M / 2M	<60	<50	74	54	>14	>4
Any	5.0135	1M / 2M	55.4	51.6	74	54	18.6	2.4

* The spurious at 5.0135 GHz is a CW signal

No Emissions from the RF part were detected.

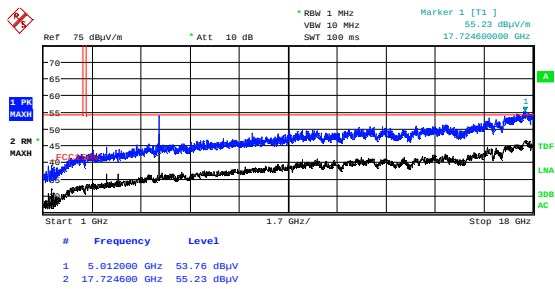
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

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

See plots.

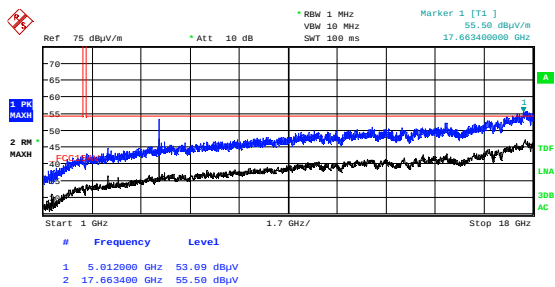
Requirements/Limit

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



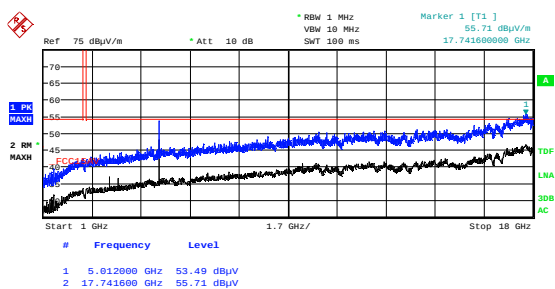
Date: 21.MAR.2023 14:28:37

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



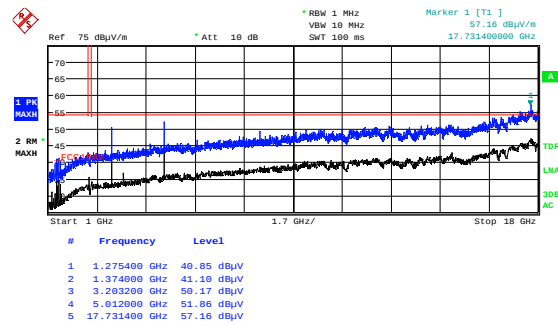
Date: 21.MAR.2023 14:22:47

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



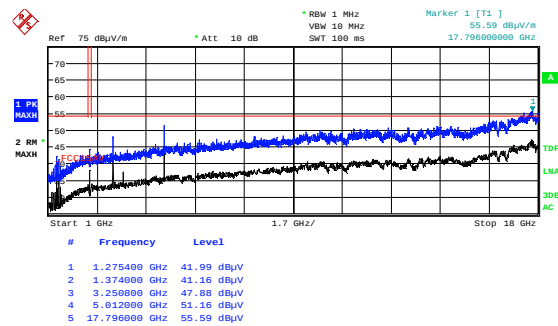
Date: 21.MAR.2023 14:37:36

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



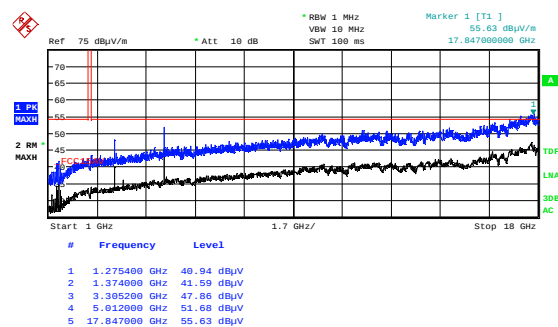
Date: 21.MAR.2023 14:26:40

VP



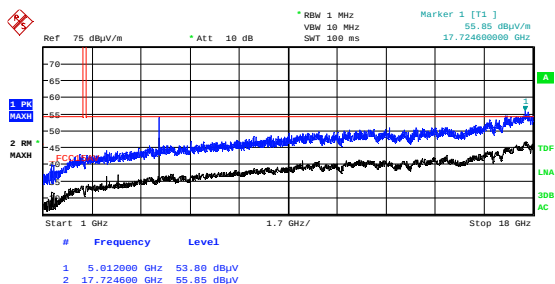
Date: 21.MAR.2023 14:20:28

VP



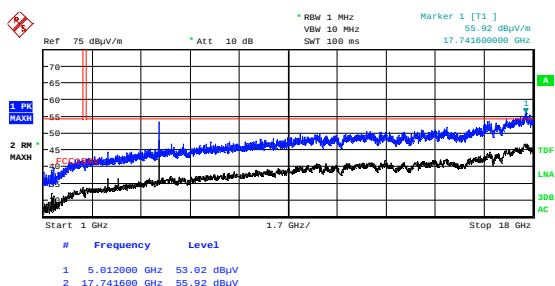
Date: 21.MAR.2023 14:35:40

VP



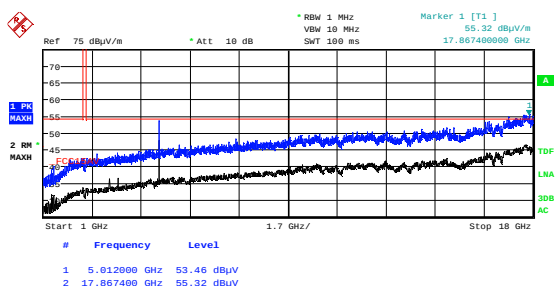
Date: 21.MAR.2023 15:08:44

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



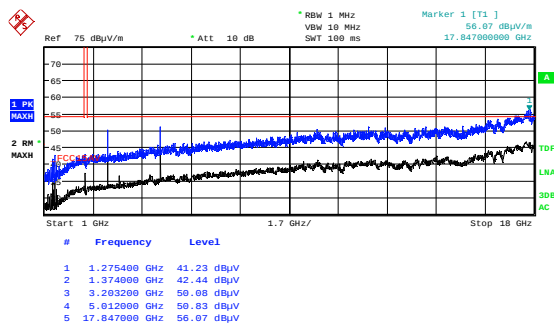
Date: 21.MAR.2023 14:43:53

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



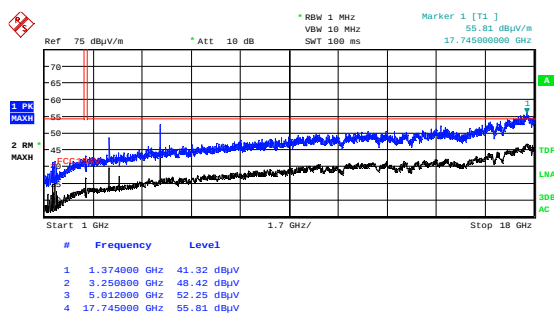
Date: 21.MAR.2023 15:08:05

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



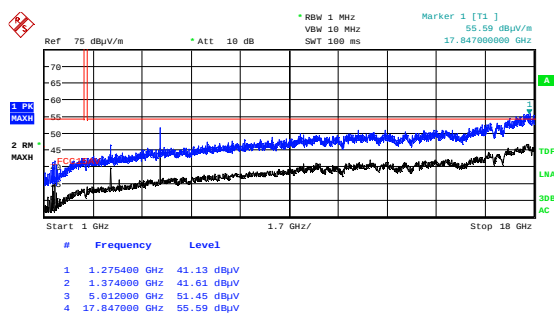
Date: 21.MAR.2023 14:58:47

VP



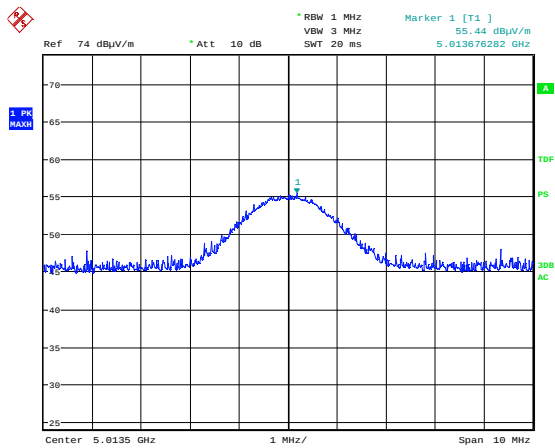
Date: 21.MAR.2023 14:41:56

VP



Date: 21.MAR.2023 15:06:07

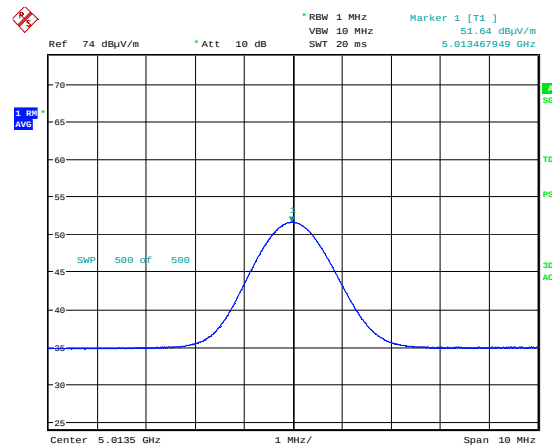
VP



Date: 21.MAR.2023 14:52:55

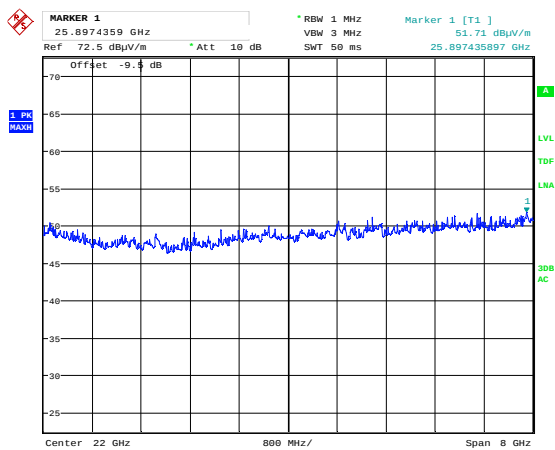
Spurious 5013.5 MHz, Max: HP, Peak

The spurious at 5013.5 MHz is a CW signal and is independent of RF



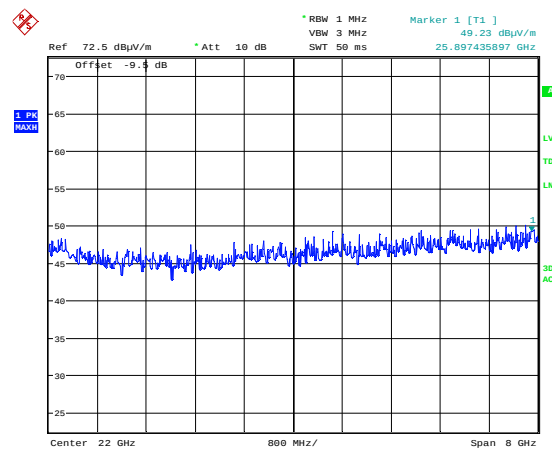
Date: 21.MAR.2023 14:53:45

Spurious 5013.5 MHz, Max: HP, Average



Date: 22.MAR.2023 14:37:41

Radiated Emissions 18 - 26 GHz, 2440 MHz, 1M, HP, @1m



Date: 22.MAR.2023 14:35:22

VP, @1m

3.10 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

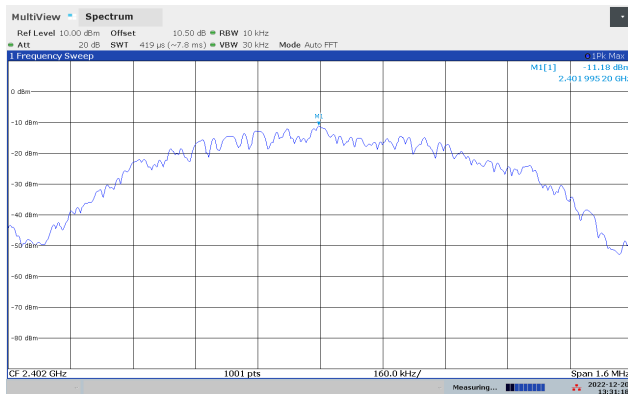
Measurement Data:

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

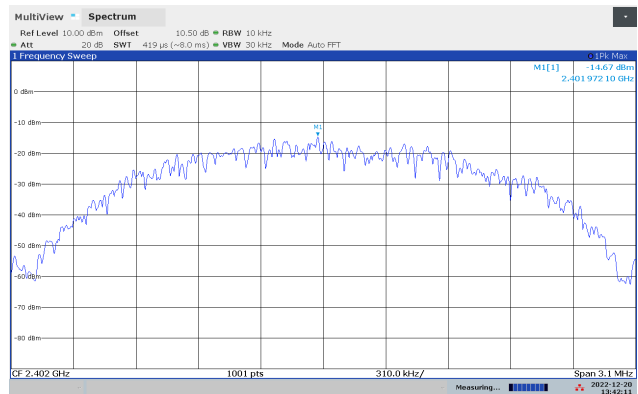
Modulation Type and Bitrate	Measured Power Spectral Density (dBm/3kHz)		
	2402 MHz	2440 MHz	2480 MHz
GFSK 1Mb	-16.4	-16.5	-17.4
GFSK 2Mb	-19.9	-19.9	-20.8

The measured values with 10kHz RBW are corrected by a Bandwidth Correction Factor of 5.2 dB.

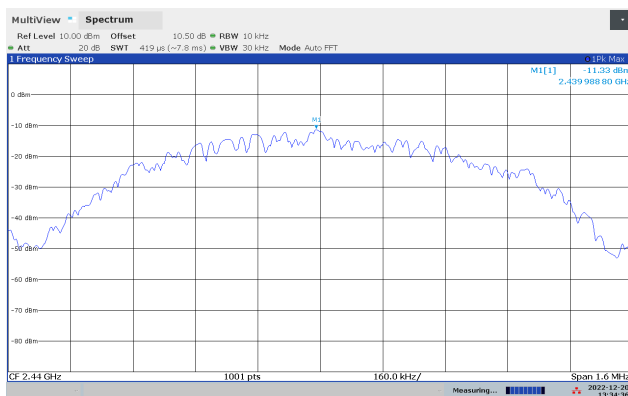
Requirement for systems using Digital Modulation
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
No requirements for Frequency Hopping Systems.



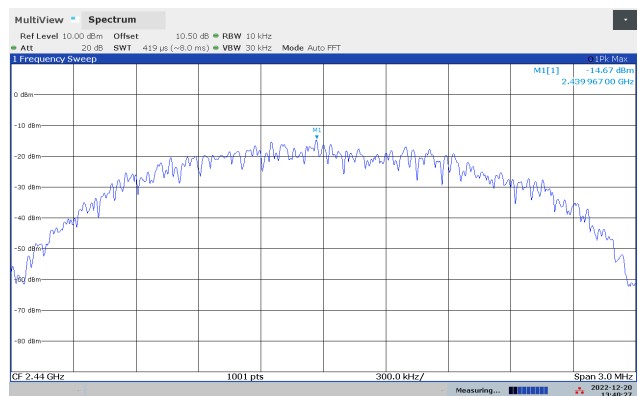
PSD, 2402 MHz, 1Mb



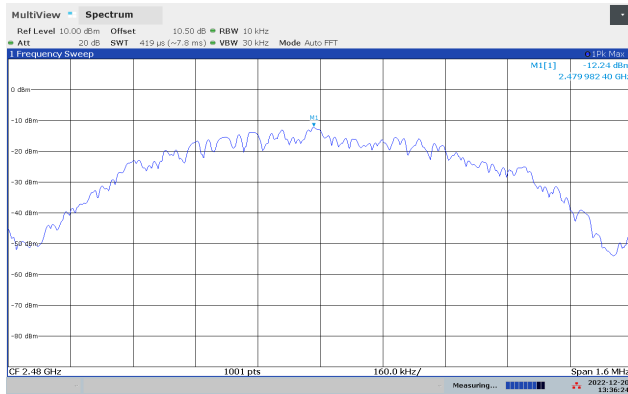
PSD, 2402 MHz, 2Mb



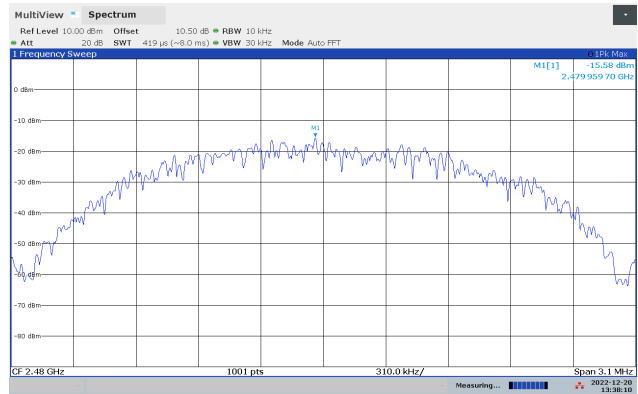
PSD, 2440 MHz, 1Mb



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.

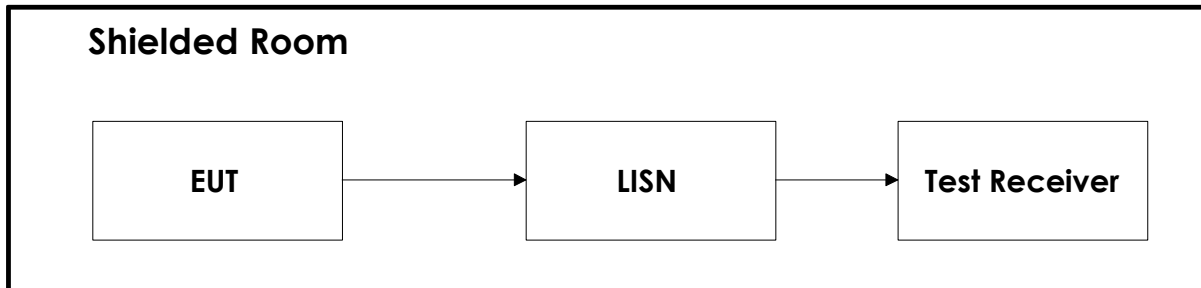
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2022-01 2023-01	2023-01 2024-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01 2023-01	2023-01 2024-01
3	6810.17B	Attenuator	Suhner	LR 1669	2022-05	2023-05
4	NO324415	Band Reject Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2021-05	2024-05
6	310	Pre-amplifier	Sonoma Inst.	LR 1686	2022-08	2023-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2022-08	2023-08
8	L01G18G1	LowPass Filter (1 GHz)	Microwave Circuits	LR 1768	COU	
9	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2022-08	2023-08
10	3115	Horn Antenna	EMCO	LR 1226	2022-11	2027-11
11	638	Antenna Horn	Narda	LR 1480	N/A	
12	6812B	AC Power Source	Agilent	LR 1515	2022-11	2024-11
13	Model 87V	Multimeter	Fluke	LR 1600	2022-03	2024-03
14	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2021-12	2023-12
15	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2021-10	2023-10
16	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	

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

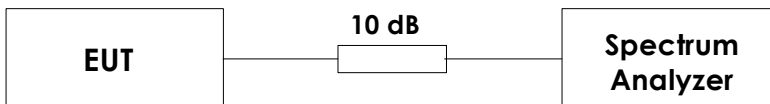
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission

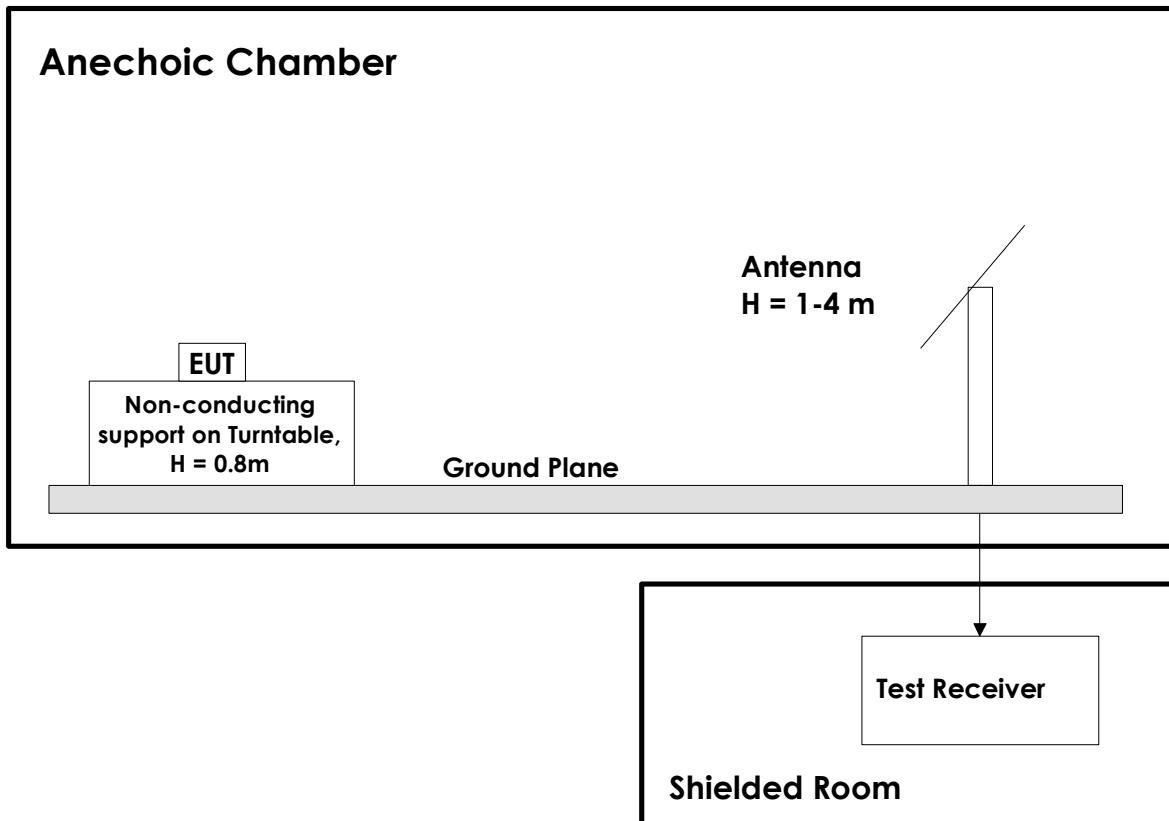


6.2 Conducted Tests



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.