

Test Report

Product	Bluetooth Low Energy Transceiver in Home Monitoring Camera
Name and address of the applicant	Panasonic Corporation of North America Two Riverfront Plaza, 9 th Floor Newark, 07102-5490, NJ, USA
Name and address of the manufacturer	Panasonic Corporation 1-62, 4-chome, Minoshima, Hakata-ku Fukuoka, 812-8531, Japan
Model	KX-HNC500, KX-HNC505C
Rating	Mains (120V ~60Hz, 350mA; 5V _{DC} 1.8A)
Trademark	Panasonic
Serial number	9KCFA000036 and 9KCFA000037
Additional information	WiFi 2.4GHz/5GHz, Bluetooth Low Energy
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 2 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	389657
Tested in period	2020-01-30 to 2020-02-05
Issue date	2020-03-10
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50   NORWEGIAN ACCREDITATION TEST 033 An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [G.Suhantakumar]	
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1 INFORMATION

1.1 Test Item

Name	Panasonic
Model/version	KX-HNC500 (US Model) KX-HNC505C (Canada Model)
FCC ID	ACJ96NKX-HNC500
ISED ID	216A-KXHNC505
Serial number	Conducted Sample: 9KCFA000037 (MAC: 4C:38:4E:87:37:AC) Radiated Sample: 9KCFA000036 (MAC: 4C:38:4E:87:37:CC)
Hardware identity and/or version	1.00
Software identity and/or version	00.40
Frequency Range	2402 – 2480 MHz
Number of Channels	40
Operating Modes	BLE v 4.2
Type of Modulation	GFSK
User Frequency Adjustment	None
Rated Output Power	0.0038 Watts (Conducted)
Type of Power Supply	AC Adaptor: PNLV251 (120V ~60Hz, 350mA; 5V _{DC} 1.8A)
Antenna Connector	None (Integral Antenna)
Number of Antennas	1
Antenna Diversity Supported	No
Smart Antennas Supported	No
Desktop Charger	N/A
Interfaces	None

Description of Test Item

The EUT is a Window Mounted Home Monitoring Camera with WiFi and Bluetooth LE.

The models KX-HNC500 and KX-HNC505C are identical.

1.2 Normal test condition

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

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit continuously.

1.8 Comments

The measurements were done with the EUT powered by 120 V 60 Hz. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

This report covers the Bluetooth Low Energy part of the EUT. 2.4 GHz and 5 GHz WLAN are covered by separate reports.

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 Industry Canada 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 made in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

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

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

DTS Equipment Code

☐ Family Listing



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

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

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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 15.107 (a)

ISED RSS-GEN Issue 5, Clause 7.2/8.8

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

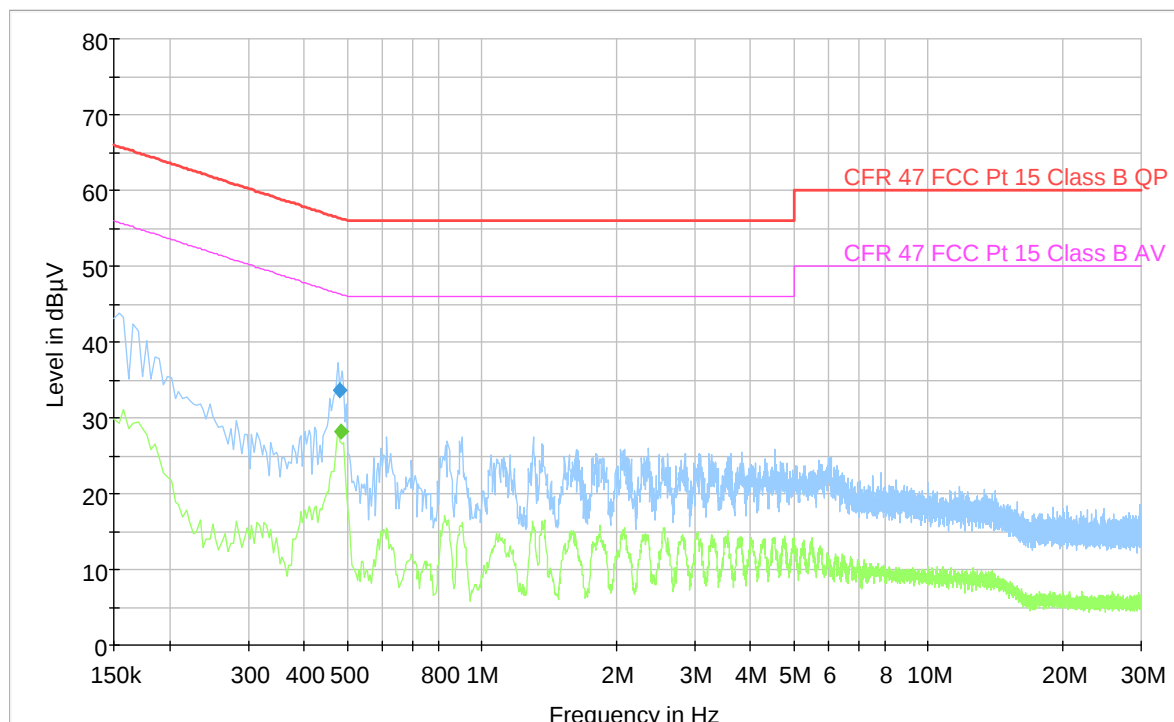
Test Results: Complies

Measurement Data: See attached plots.

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.480	33.67	---	56.34	22.66	1000	9	N	OFF
0.484	---	28.16	46.27	18.11	1000	9	N	OFF

Full Spectrum



AC Adaptor PNLV251, 120 V 60 Hz

3.2 Occupied Bandwidth (99% BW)

FCC Part 15.247 (a)(1)(iii)

ISED Canada RSS-247 Issue 2, Clause 5.1

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.3 / 7.8.3

Test Results: Complies

Measurement Data:

99% BW Measured on Centre Channel (2440 MHz)	1.02 MHz
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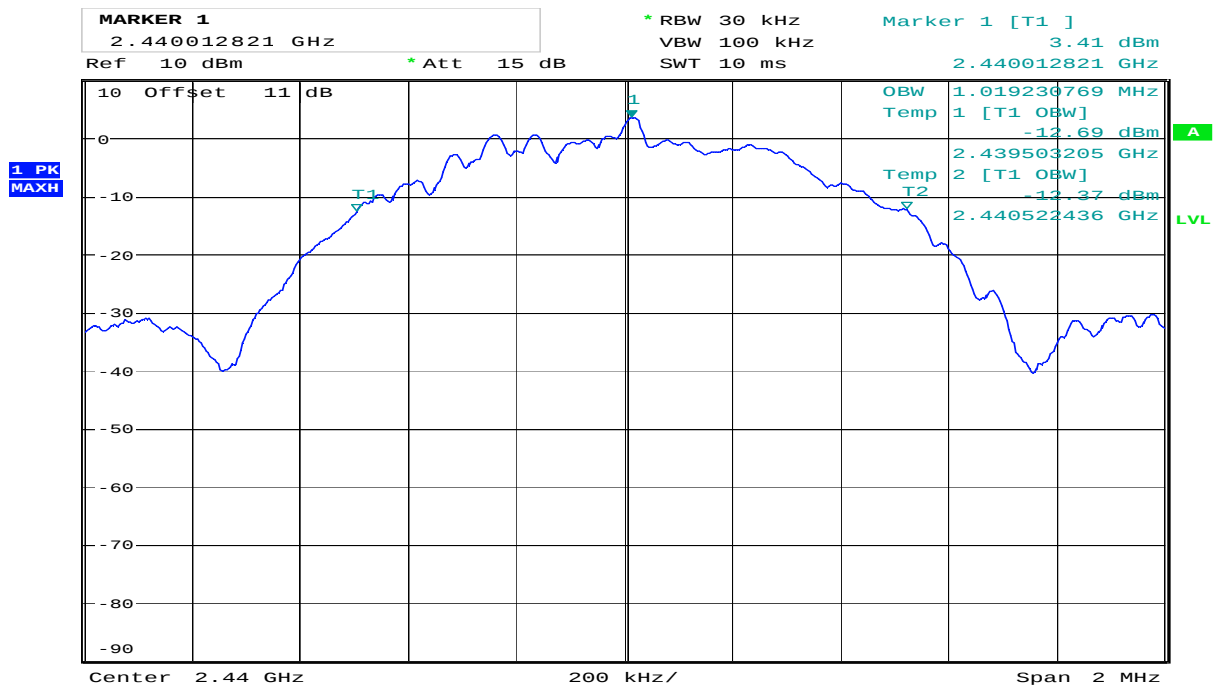
See attached plots.

Requirements:

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

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



Date: 3.FEB.2020 09:16:19

99% Bandwidth

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:

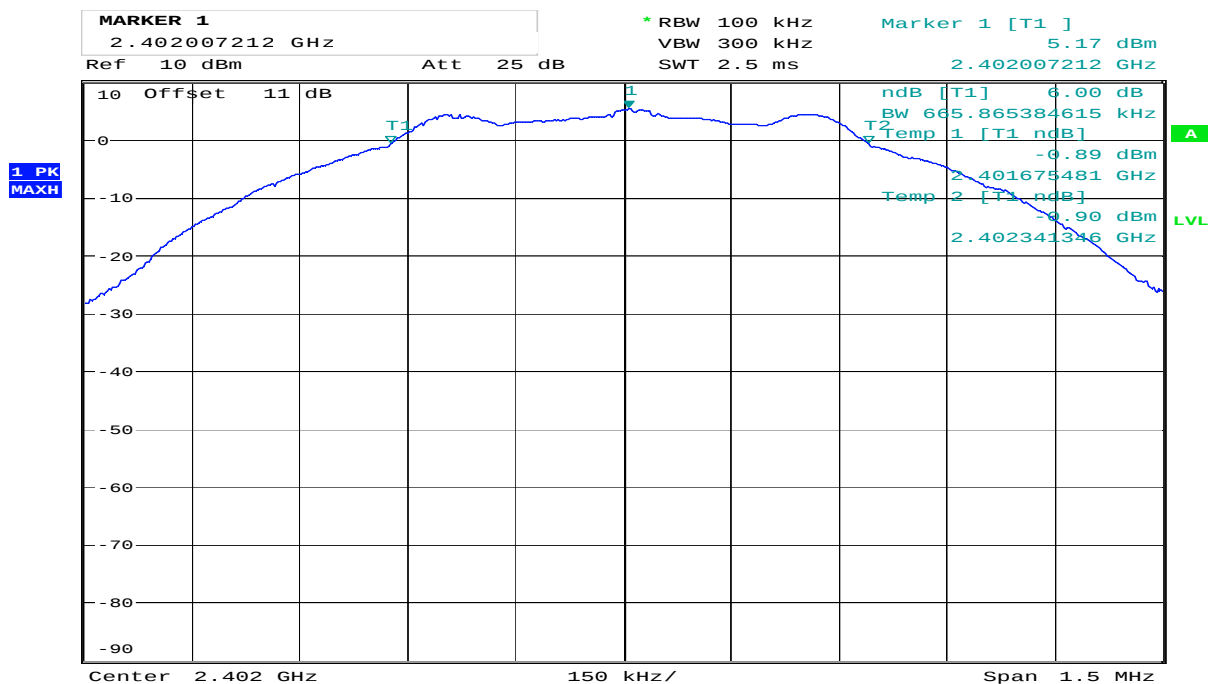
Measured DTS Bandwidth (kHz)		
2402 MHz, Ch 00	2440 MHz, Ch 19	2480 MHz, Ch 39
666	671	661

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

Requirements:

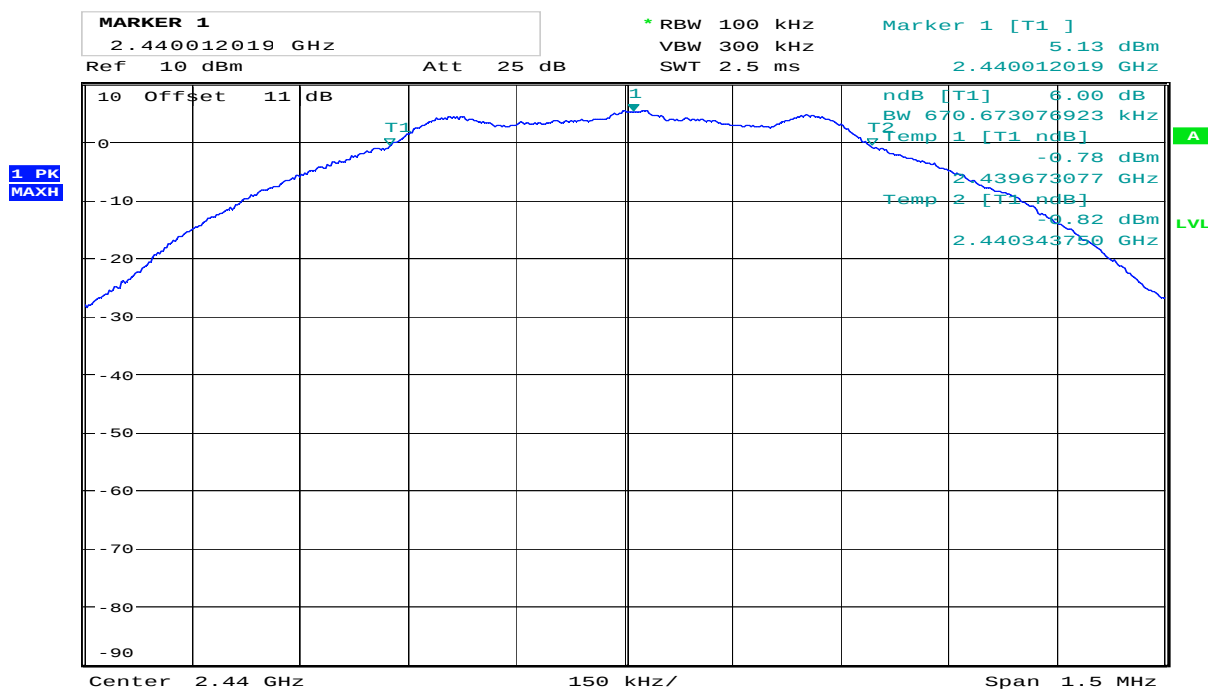
For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.

No requirements for Frequency Hopping Systems.



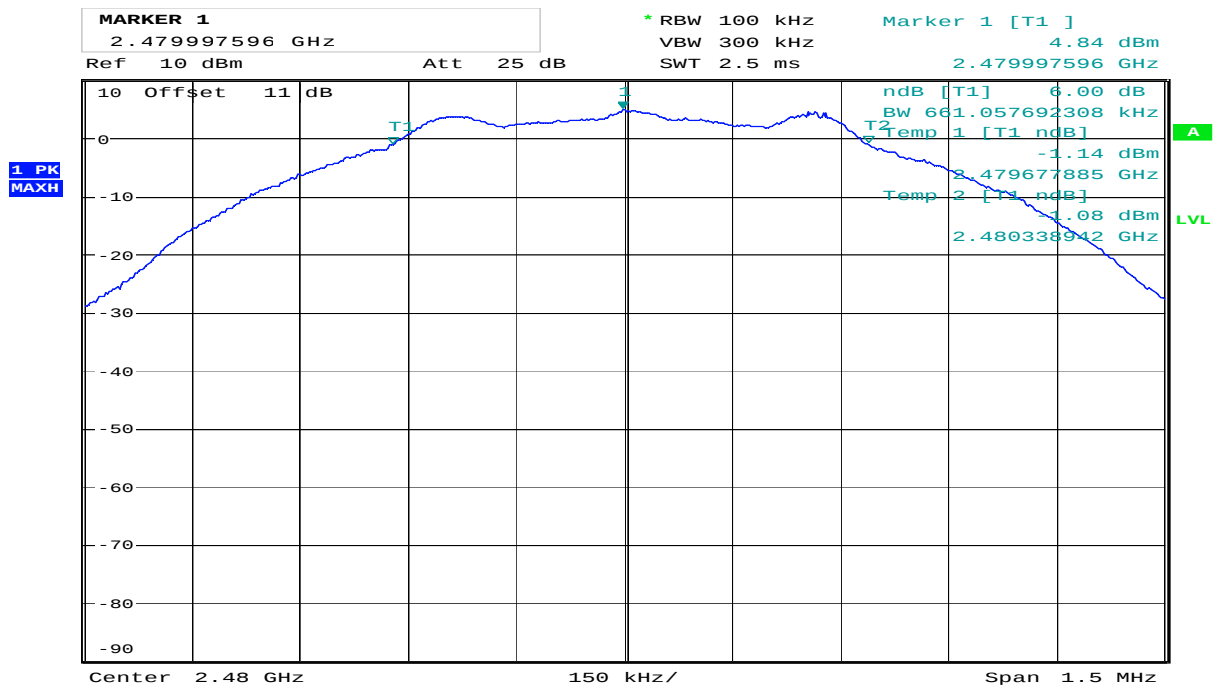
Date: 3.FEB.2020 09:08:36

DTS Bandwidth, 2402 MHz



Date: 3.FEB.2020 09:07:43

DTS Bandwidth, 2440 MHz



Date: 3.FEB.2020 09:06:42

DTS Bandwidth, 2480 MHz

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:

	2402 MHz	2440 MHz	2480 MHz
Conducted Power (dBm)	5.79	5.70	4.93
Conducted Power (Watts)	0.0038	0.0037	0.0031
Field Strength (dBμV/m)	100.45	100.69	99.86
EIRP, Calculated (Watts)	0.0033	0.0035	0.0029
Antenna gain (dBi)	-0.6	-0.2	-0.3

Output Power reported is Maximum Peak Power.

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

Antenna Gain is less than 6 dBi.

See attached plots.

Requirements:

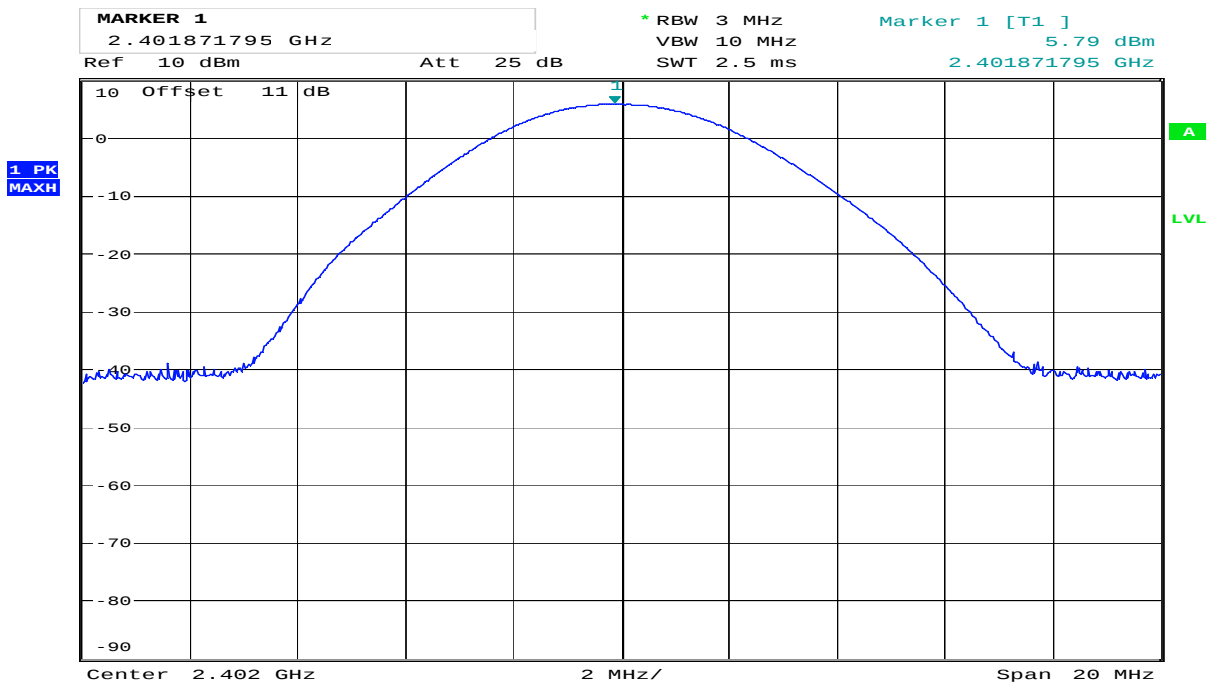
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

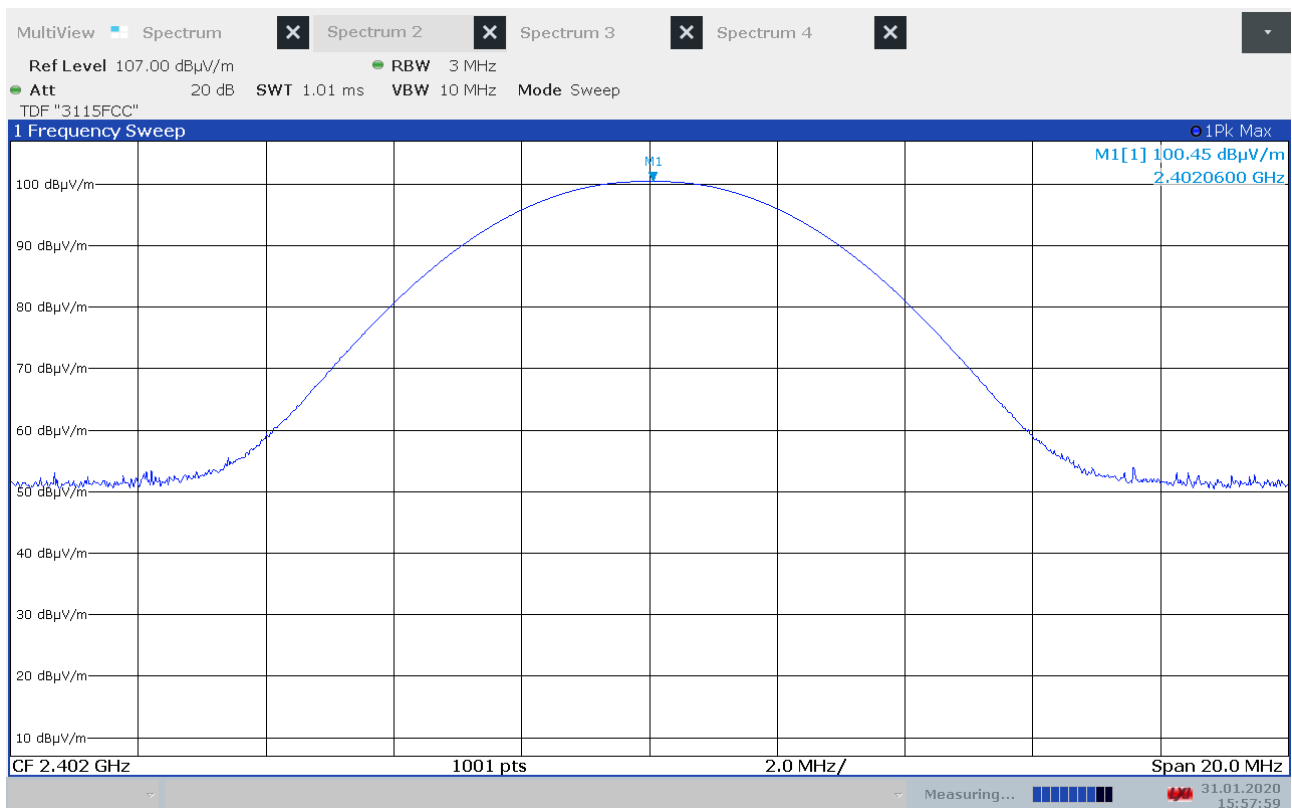
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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

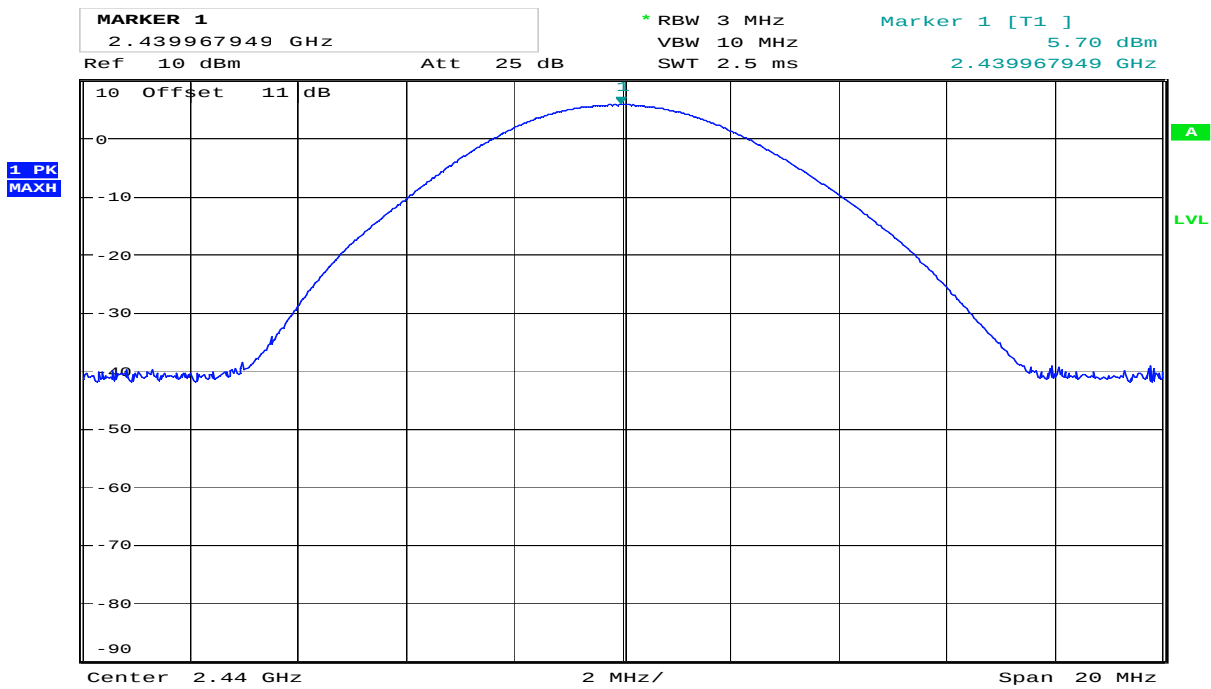


Date: 3.FEB.2020 09:02:49

Output Power, 2402 MHz

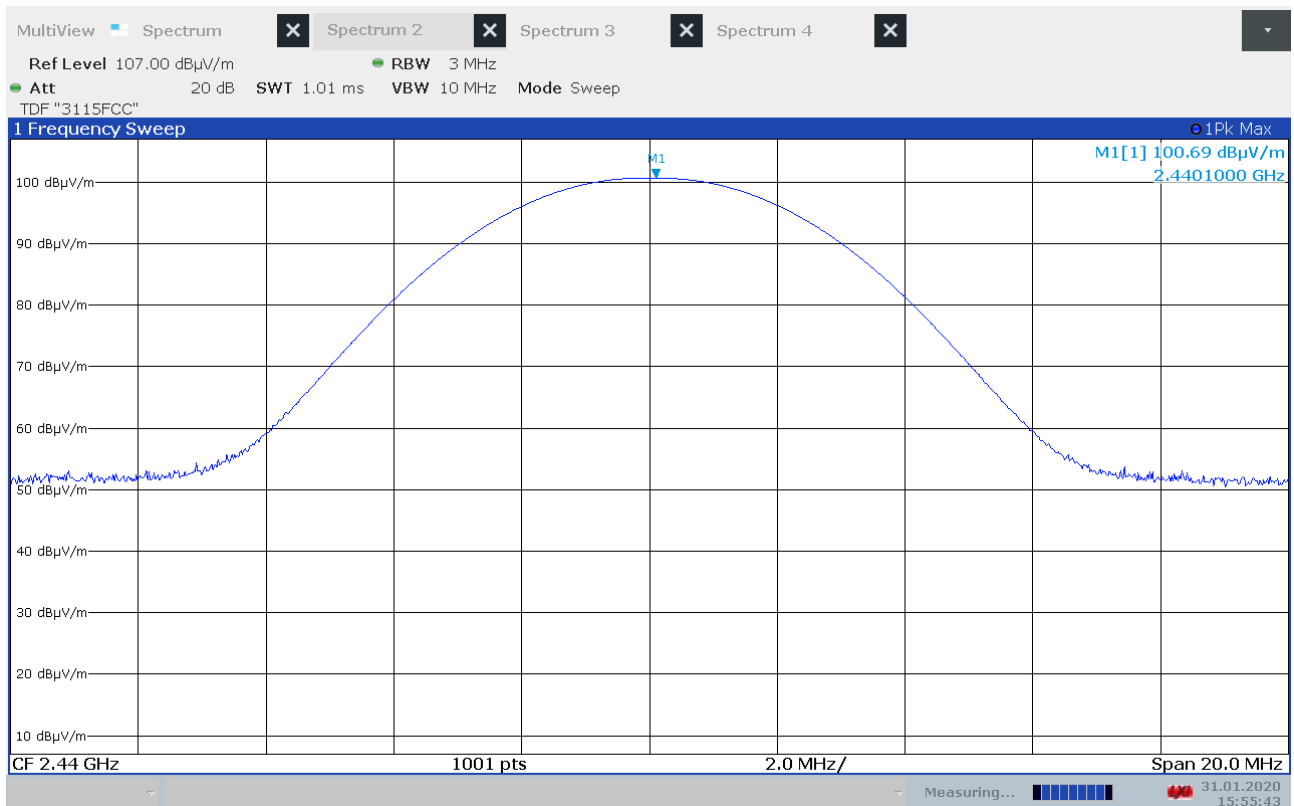


Maximum Field Strength, 2402 MHz

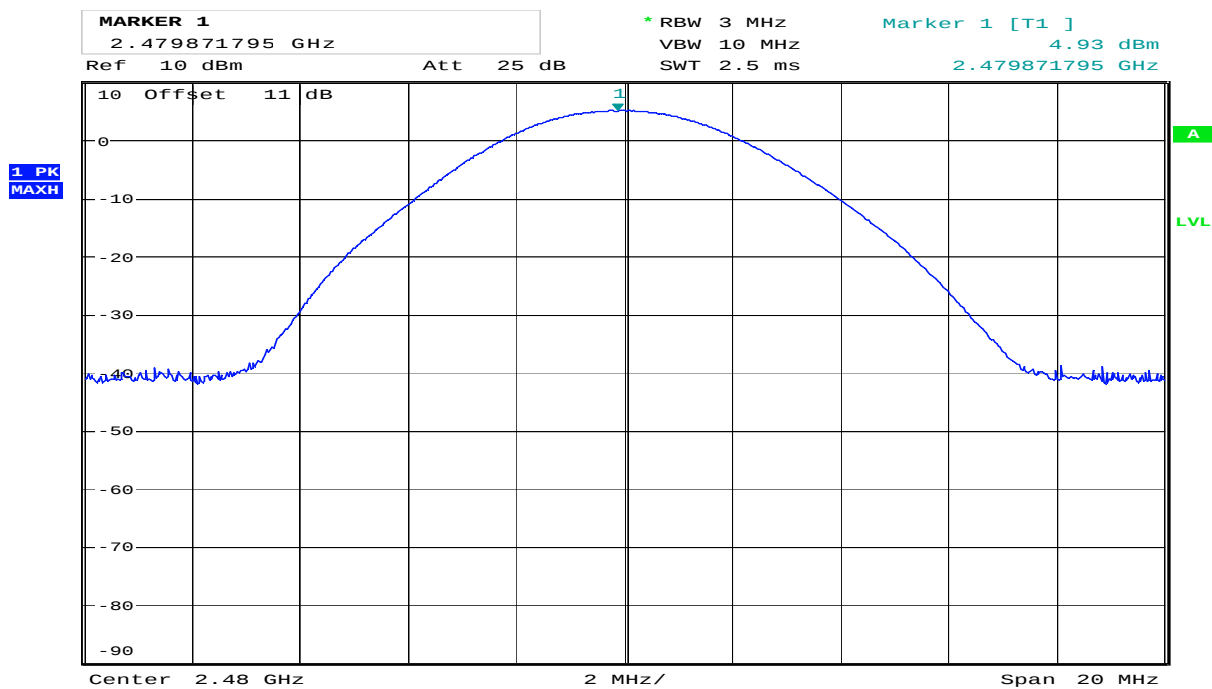


Date: 3.FEB.2020 09:04:36

Output Power, 2440 MHz

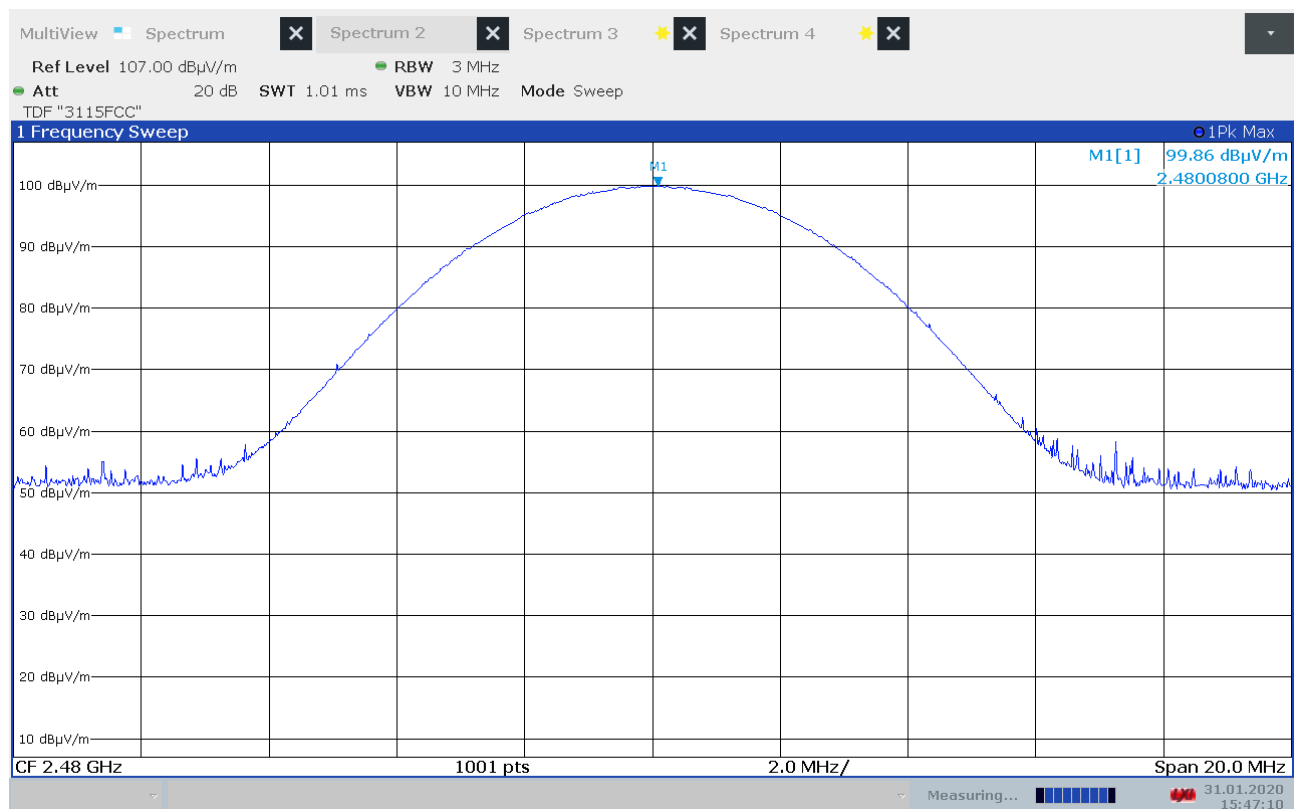


Maximum Field Strength, 2440 MHz



Date: 3.FEB.2020 09:05:07

Output Power, 2480 MHz



Maximum Field Strength, 2480 MHz

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	> 50	> 30	Pass
2402 MHz	> 50	> 30	Pass
2402 MHz	> 50	> 30	Pass

Measured with Peak Detector

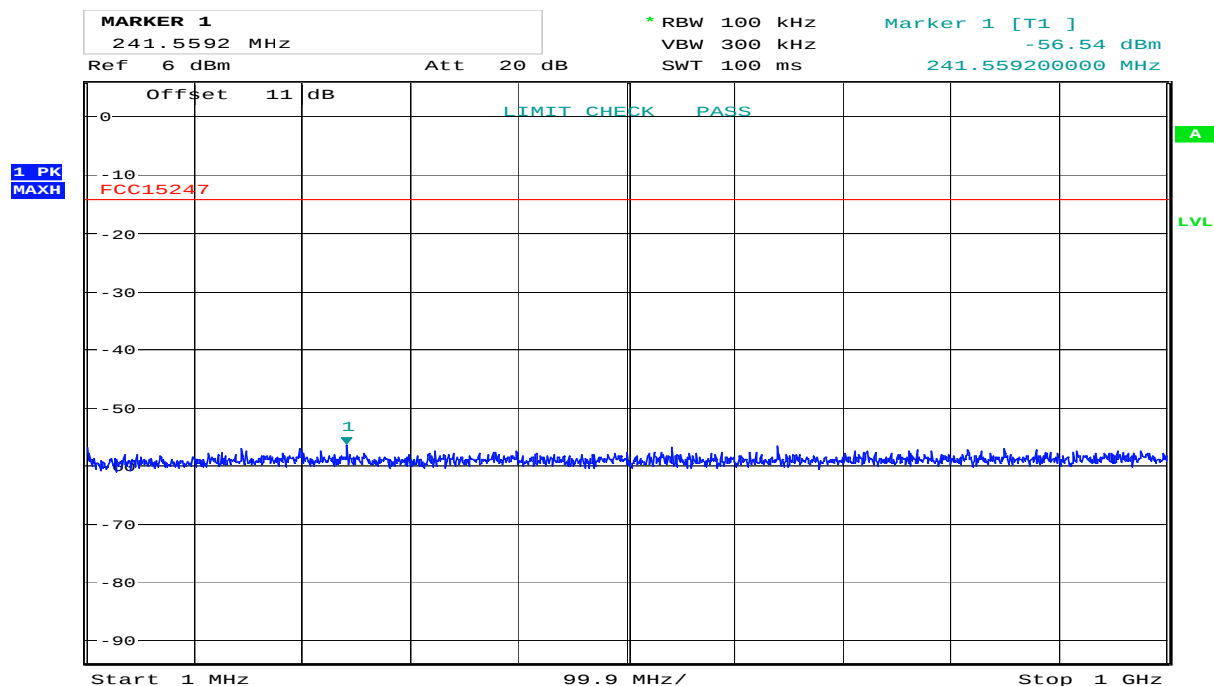
RF conducted power to 25 GHz: see attached plots.

Limit

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

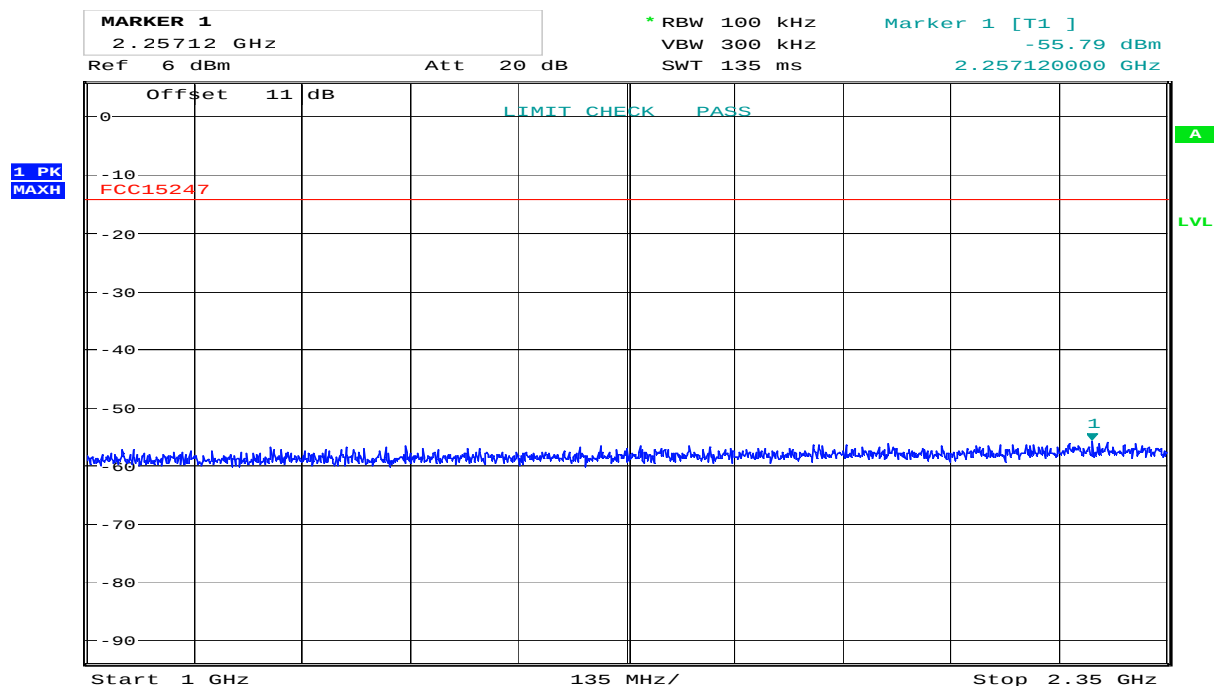
Detector type shall be the same as used for measuring Output Power.

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



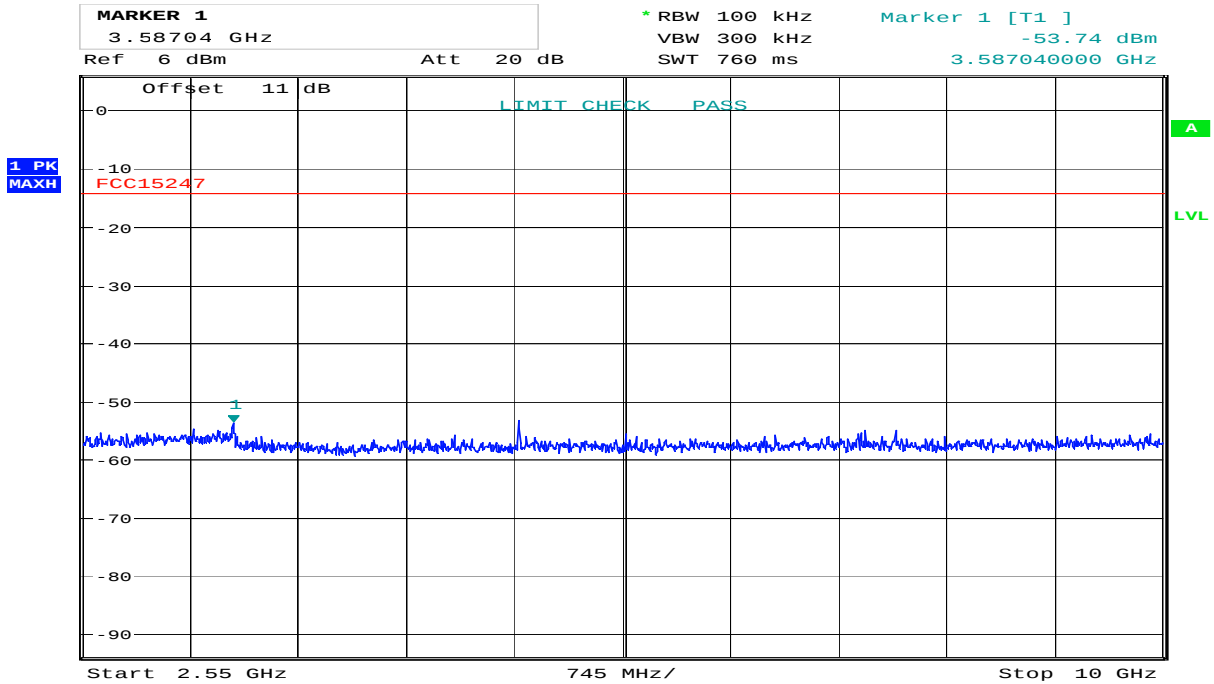
Date: 3.FEB.2020 09:25:33

Conducted Emissions, 1 -1000 MHz, 2440 MHz



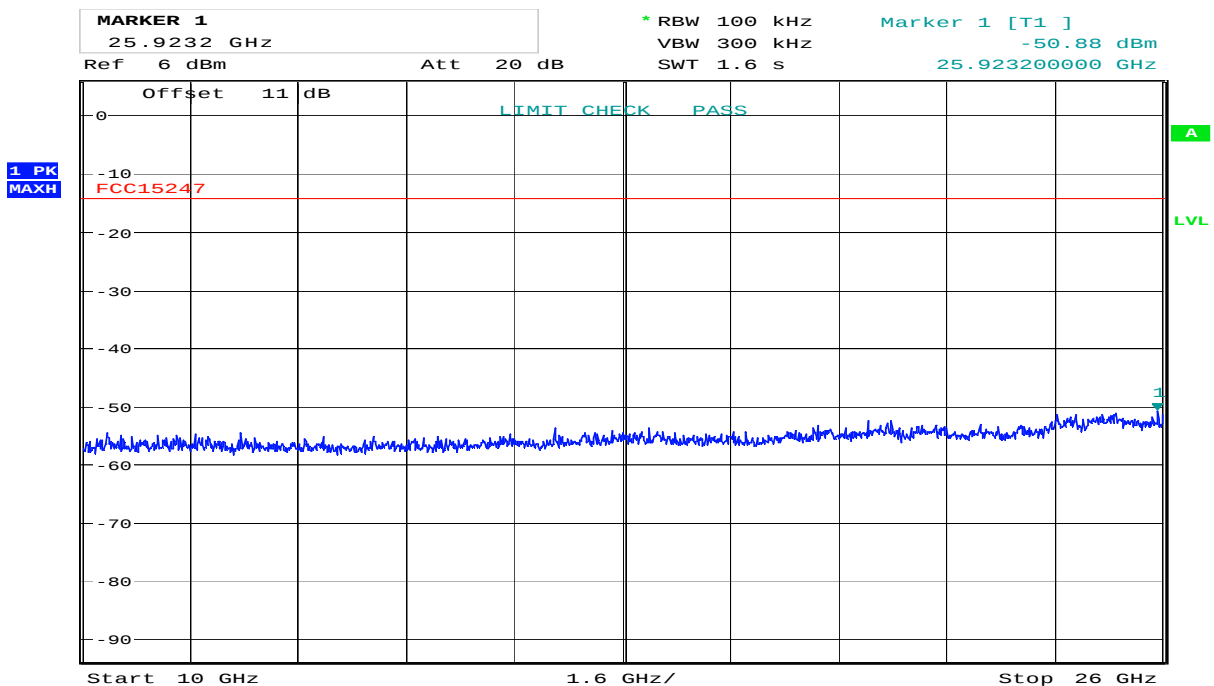
Date: 3.FEB.2020 09:26:15

Conducted Emissions, 1000 -2350 MHz, 2440 MHz



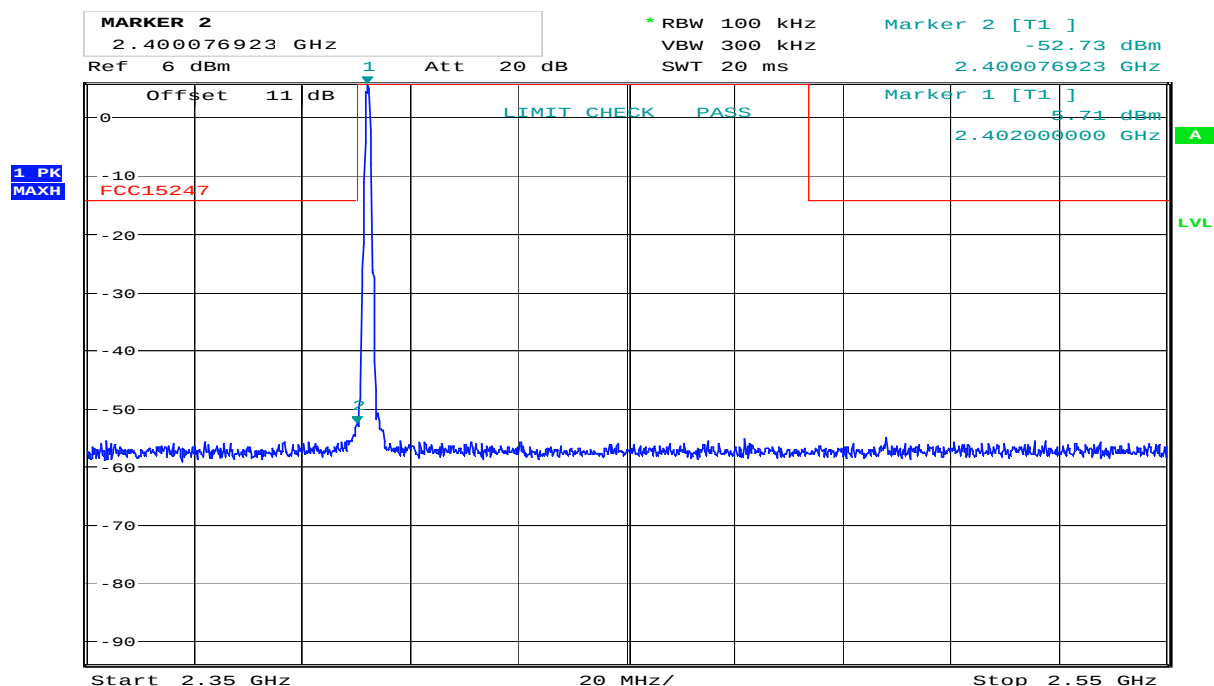
Date: 3.FEB.2020 09:27:19

Conducted Emissions, 2550 -10000 MHz, 2440 MHz



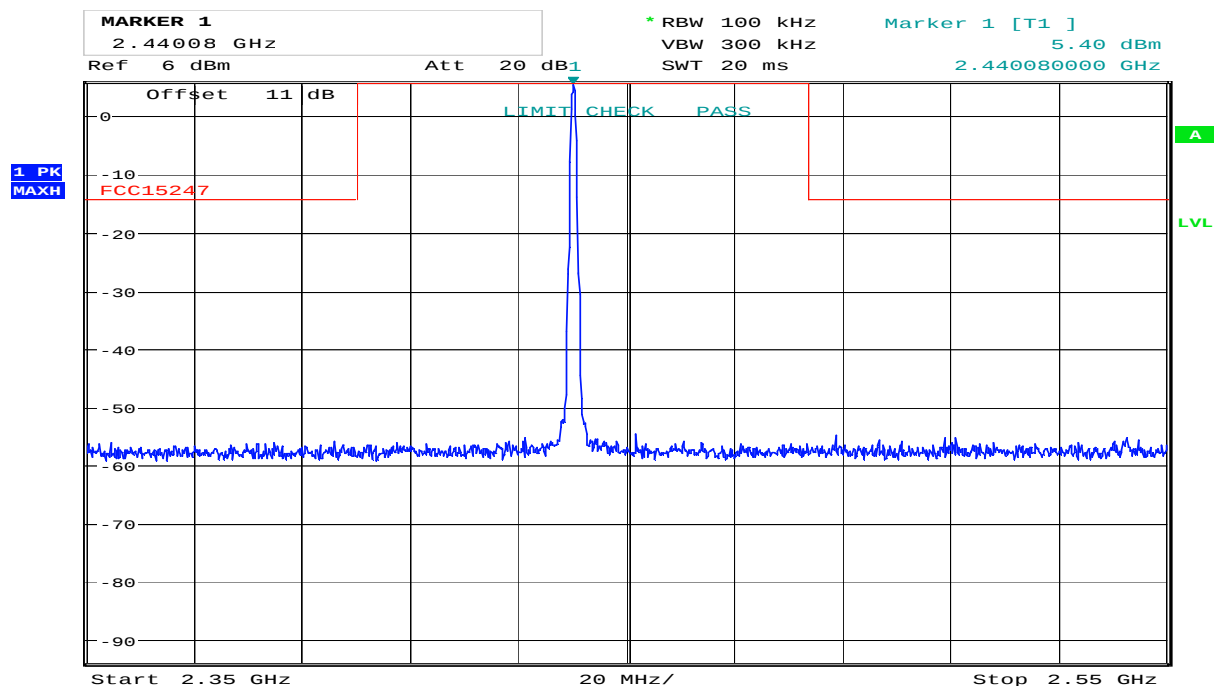
Date: 3.FEB.2020 09:28:10

Conducted Emissions, 10000 -26000 MHz, 2440 MHz



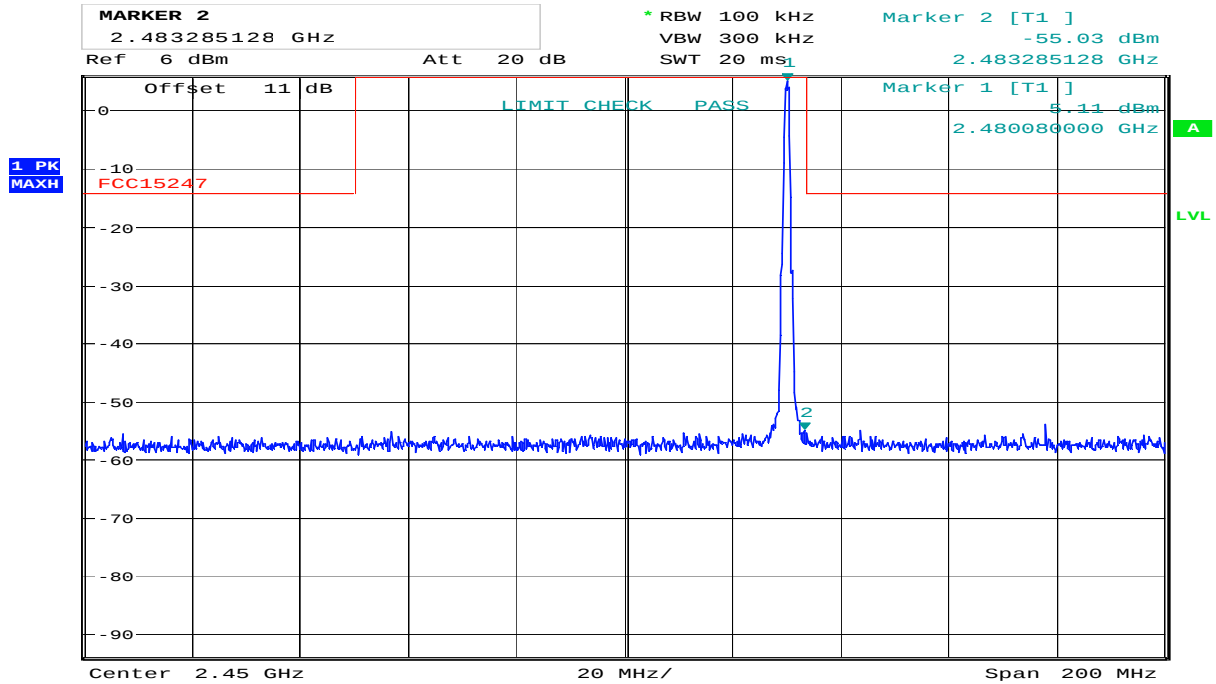
Date: 3.FEB.2020 09:29:39

Conducted Emissions, 2350 -2550 MHz, 2402 MHz



Date: 3.FEB.2020 09:31:00

Conducted Emissions, 2350 -2550 MHz, 2440 MHz



Date: 3.FEB.2020 09:34:10

Conducted Emissions, 2350 -2550 MHz, 2480 MHz

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

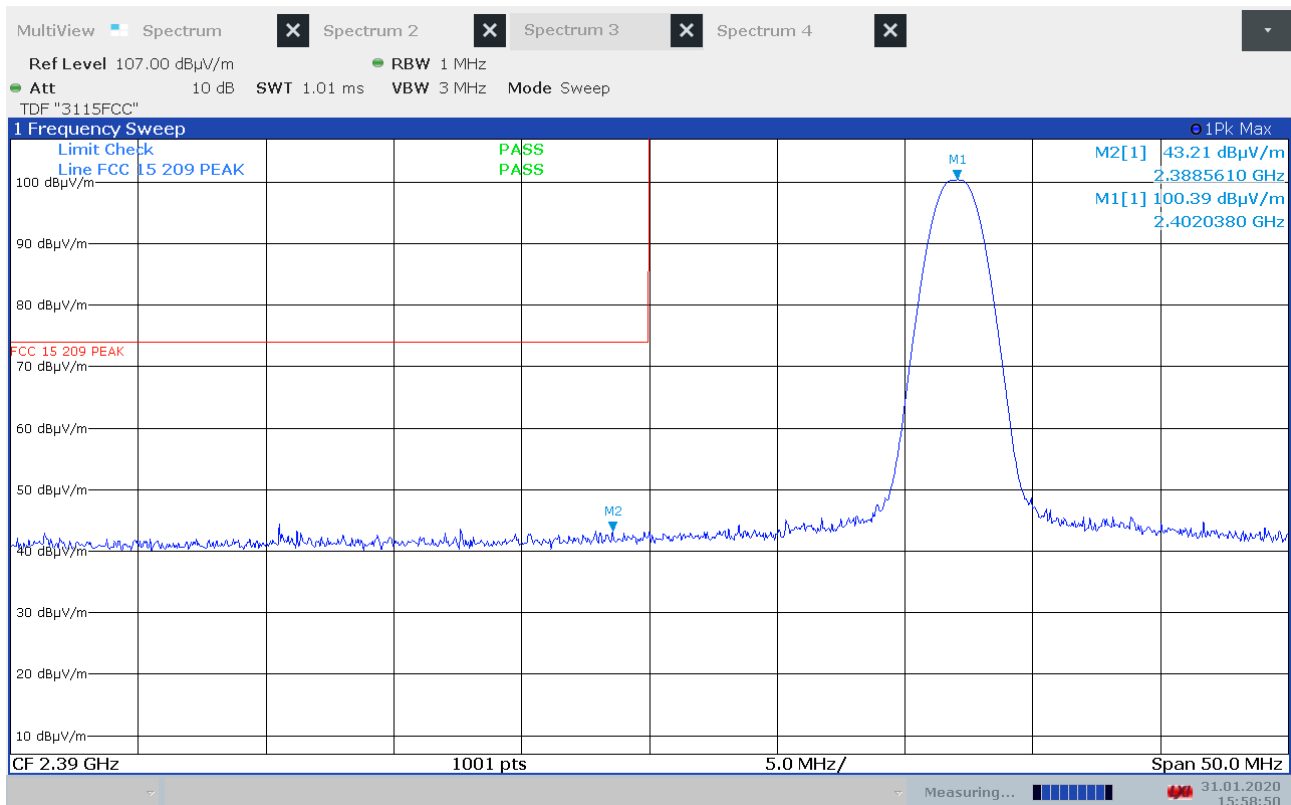
Test Results: Complies

Measurement Data:

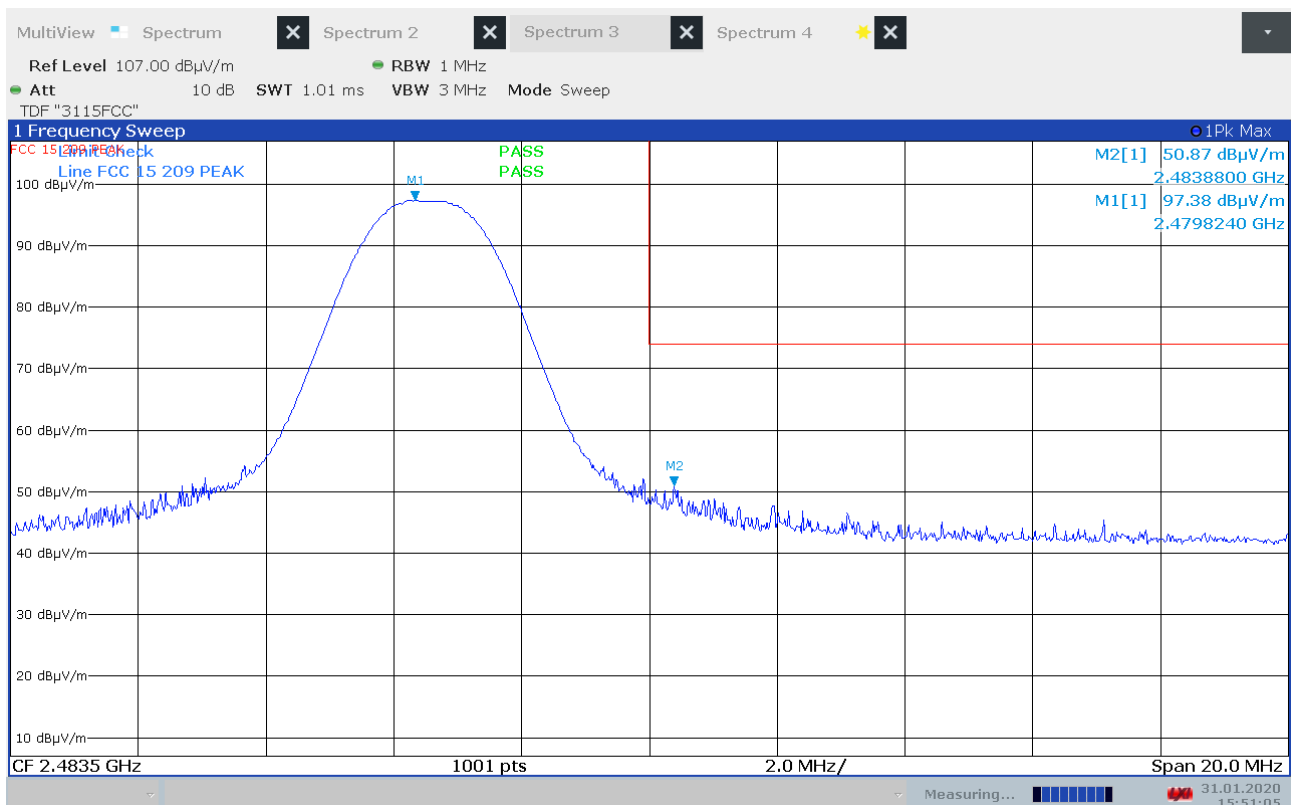
	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB μ V/m	dB	
Peak Detector	43.2	50.9	74	30.8	33.1
Average Detector	/	/	54	/	/

Peak values are below the Average Limit.

See attached plots.



Band Edge, Lower, Peak, 2402 MHz



Band Edge, Upper, Peak, 2480 MHz

3.8 Radiated Emission, 30 – 1000 MHz

FCC Part 15.209 (a)

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

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak

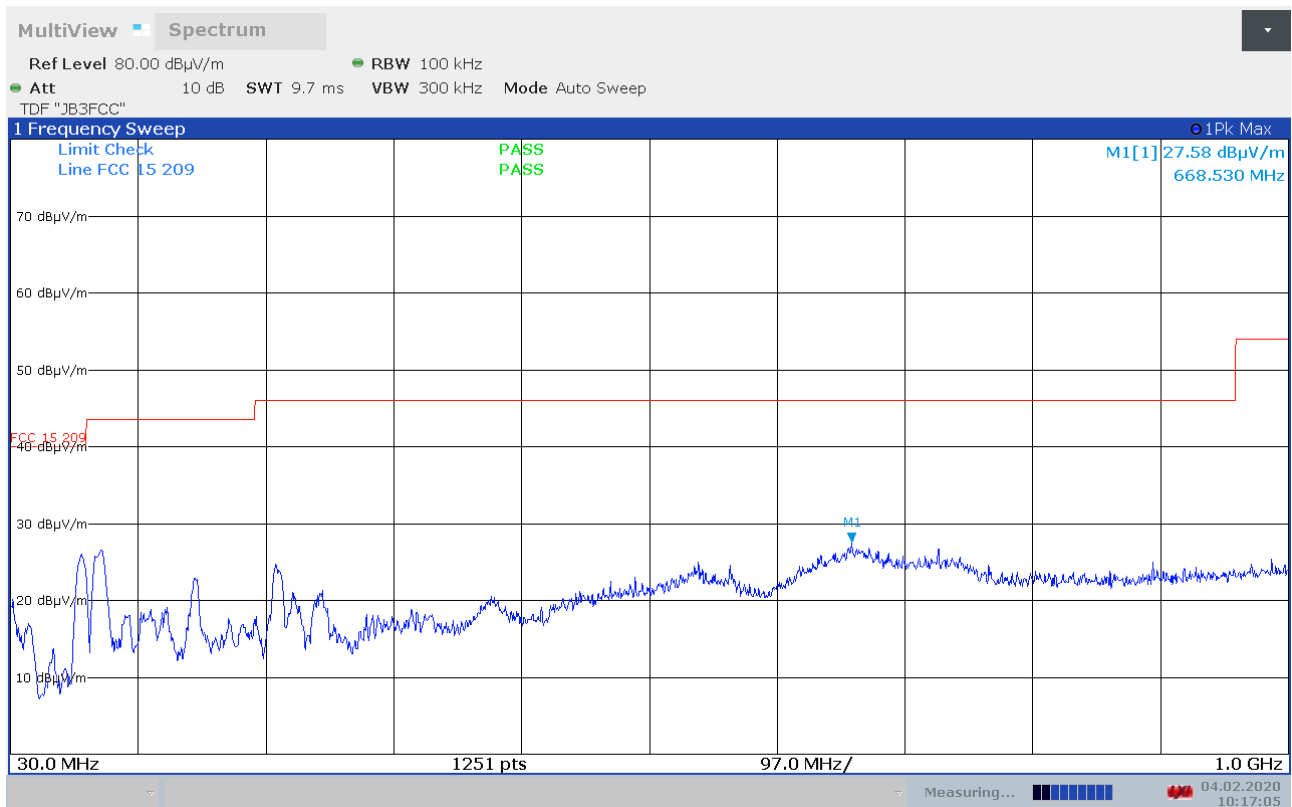
Measuring distance 3 m

Frequency MHz	Dist. corr. Factor dB	Field strength @3m QP Det., dBμV/m	Limit dBμV/m	Margin dB
30 – 88	0	< 30	40.0	> 10
88 – 216	0	< 30	43.5	> 13.5
216 – 960	0	< 30	46.0	> 16
960 – 1000	0	< 30	54.0	> 24

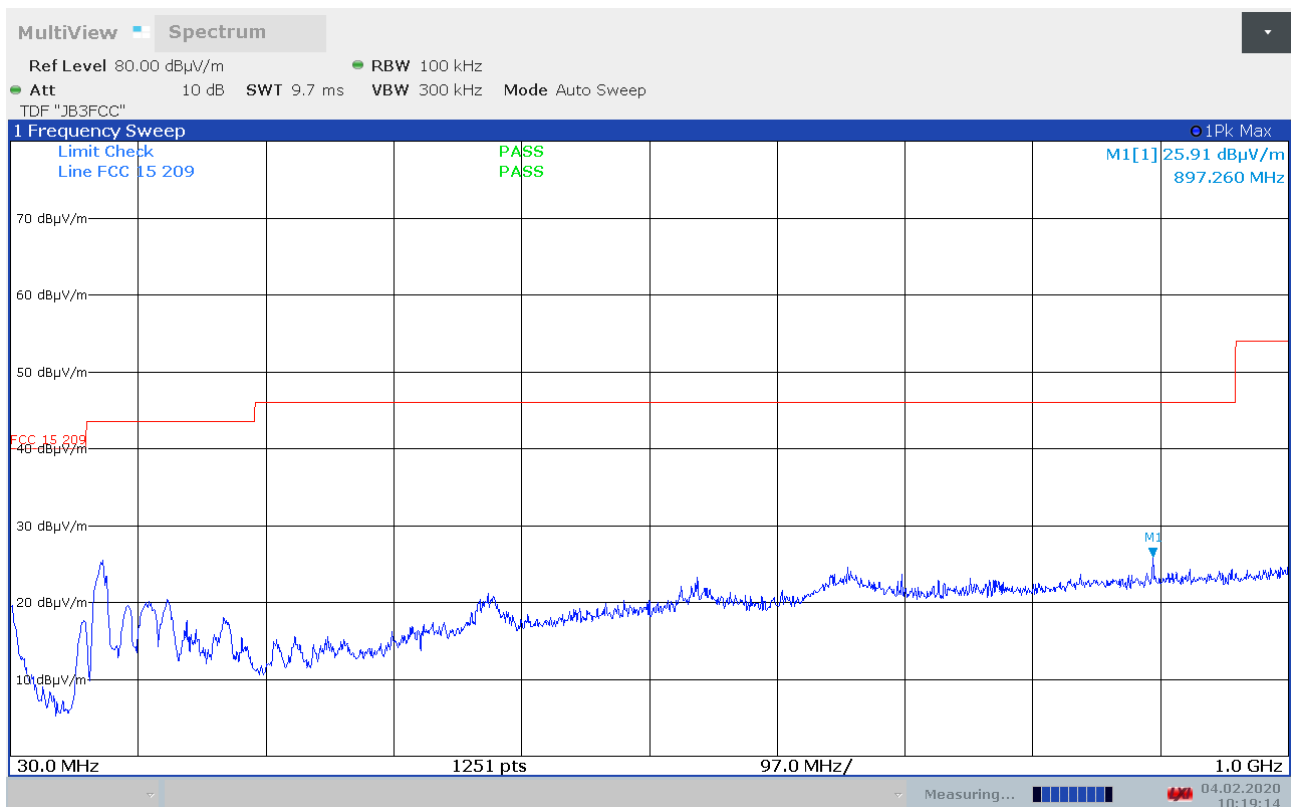
See attached plots

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	



Radiated Emissions, 2440MHz, VP



Radiated Emissions, 30 -1000MHz, 2440MHz, HP

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)

1m (18 – 26 GHz)

Peak Detector:

No spurious found.

Average Detector:

All emissions are below the Average Limit when measured with Peak Detector.

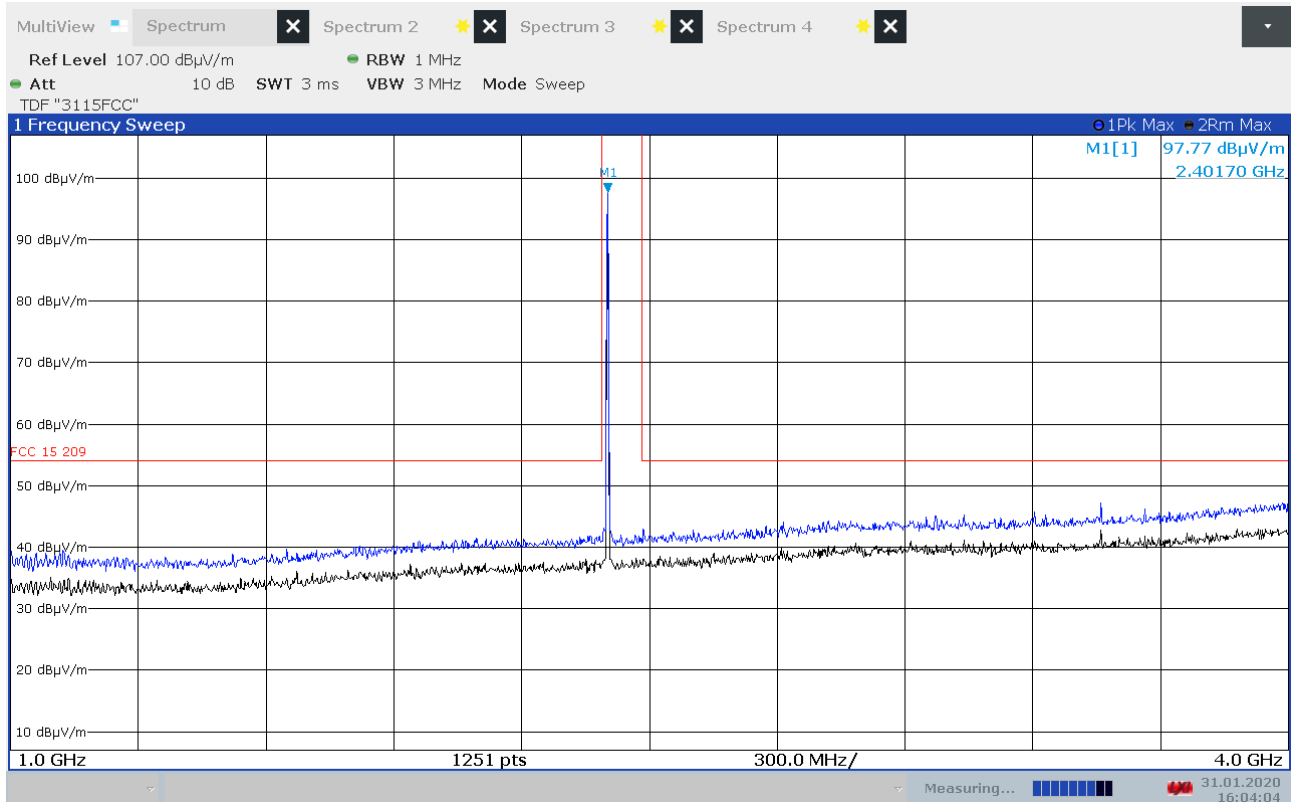
A High Pass Filter was used from 3 GHz to 18 GHz.

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

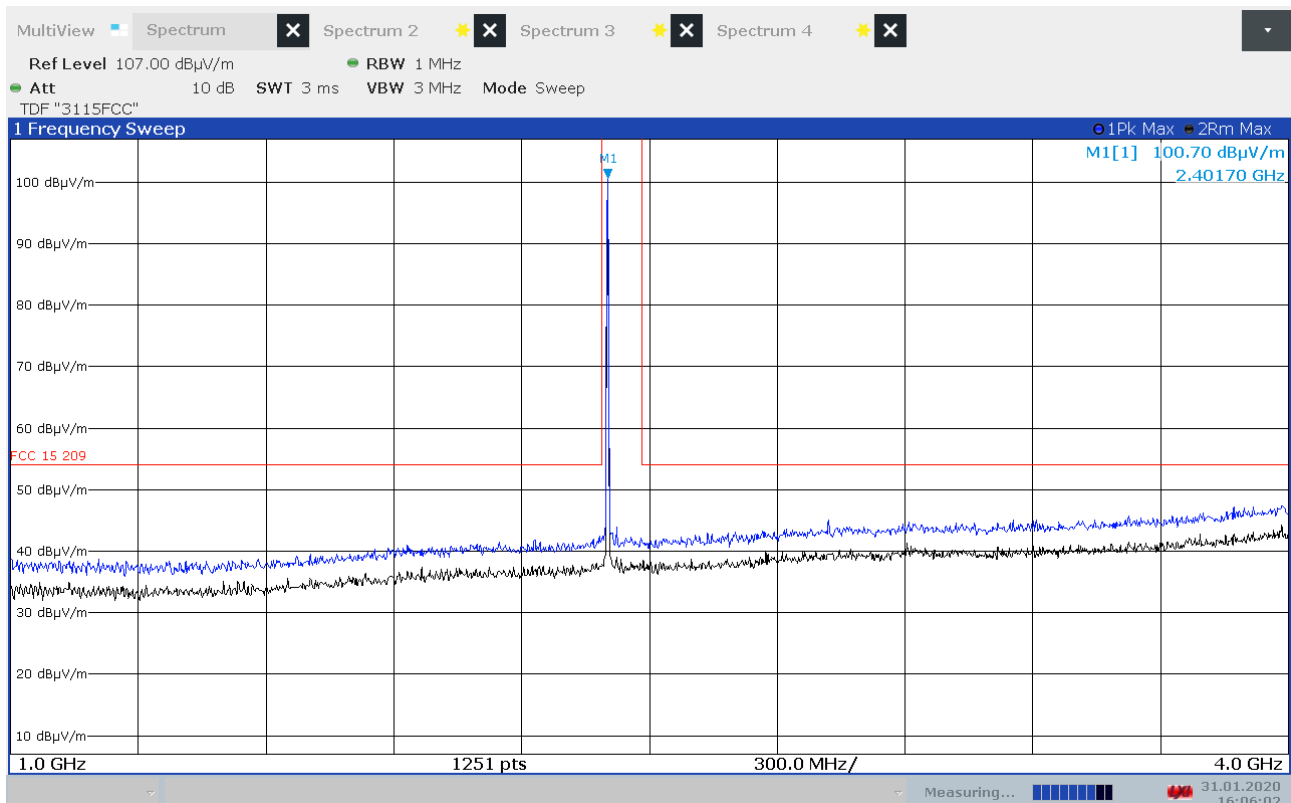
See plots.

Requirements/Limit

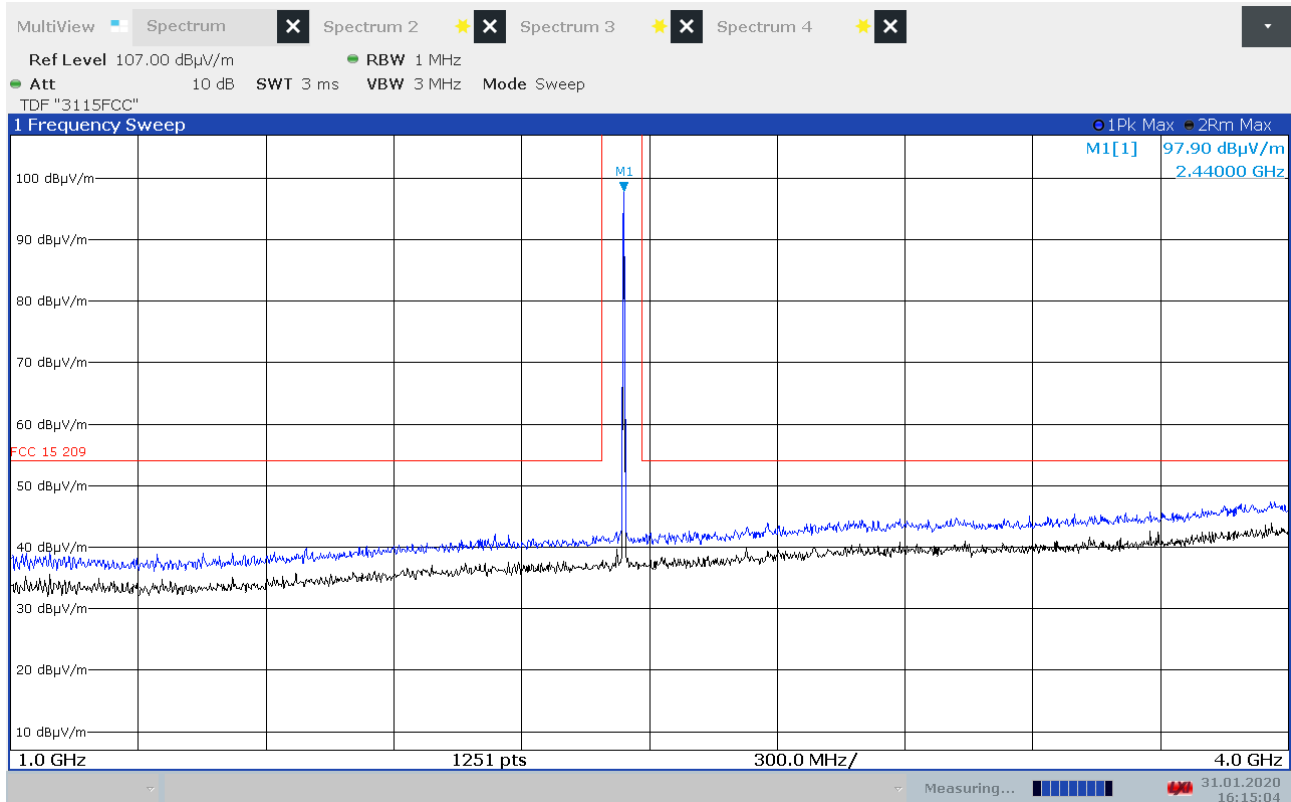
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



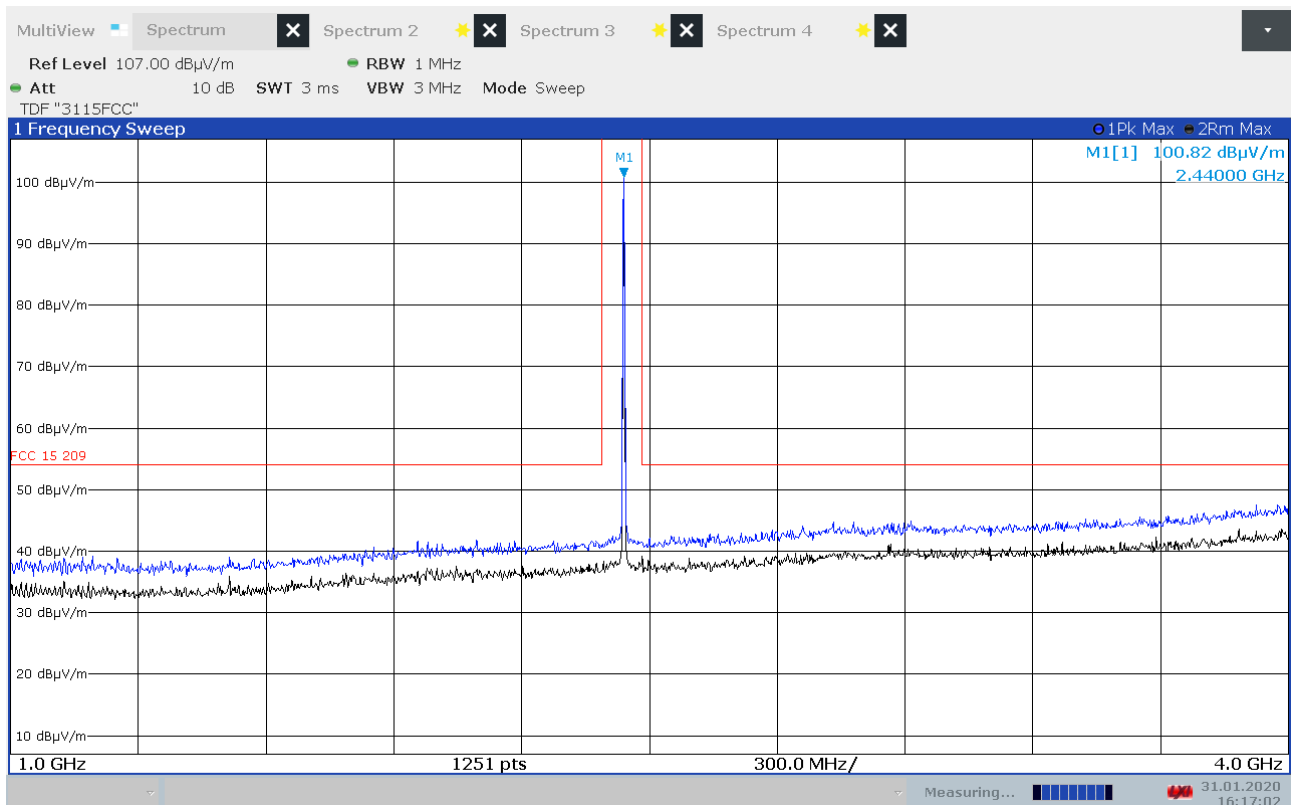
Radiated Emissions, 1000 -4000MHz, 2402MHz, VP



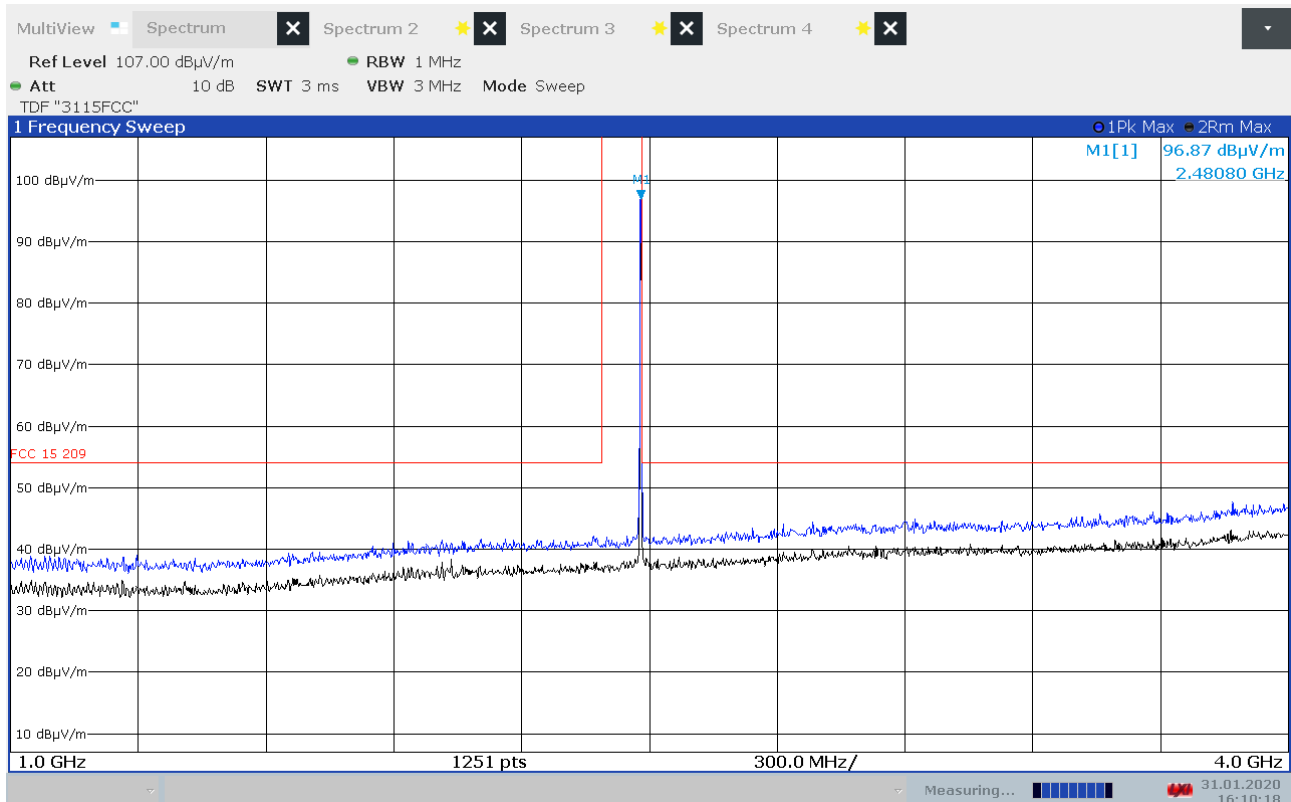
Radiated Emissions, 1000 -4000MHz, 2402MHz, HP



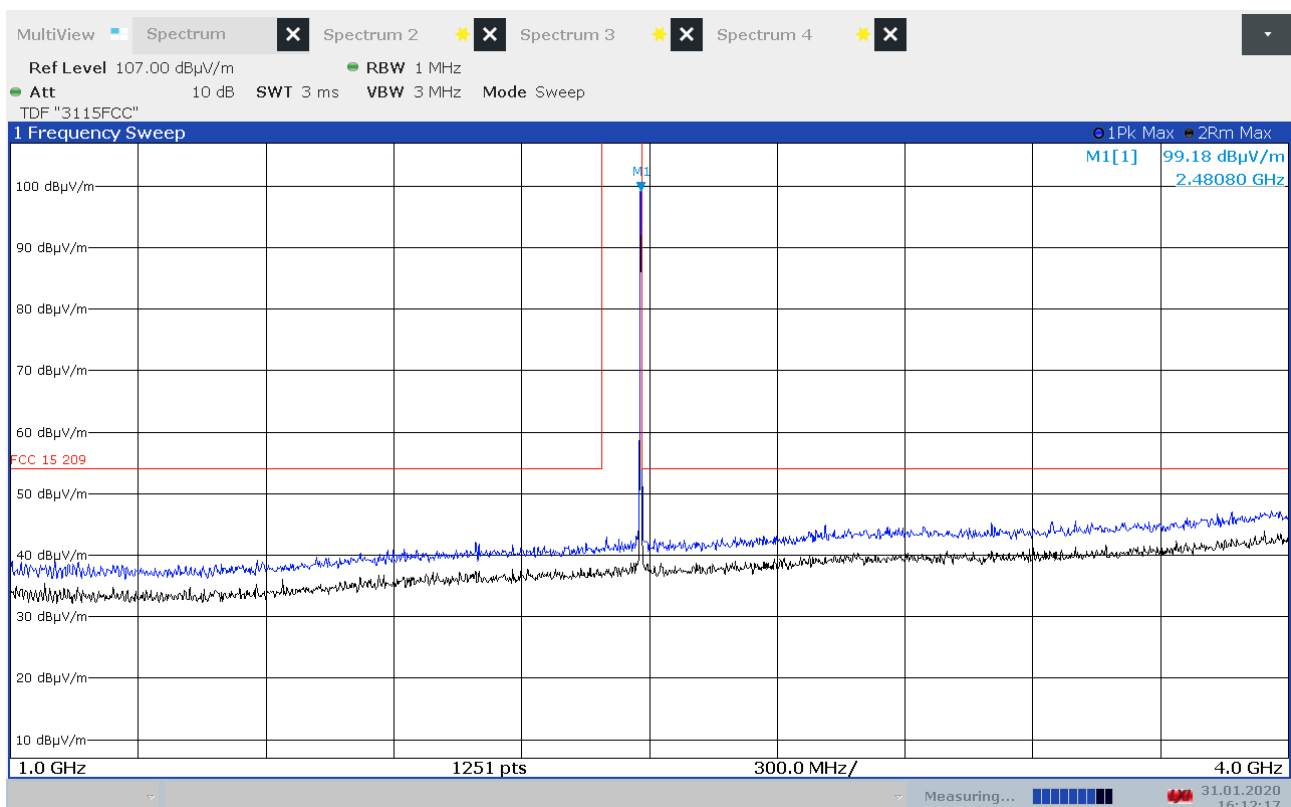
Radiated Emissions, 1000 -4000MHz, 2440MHz, VP



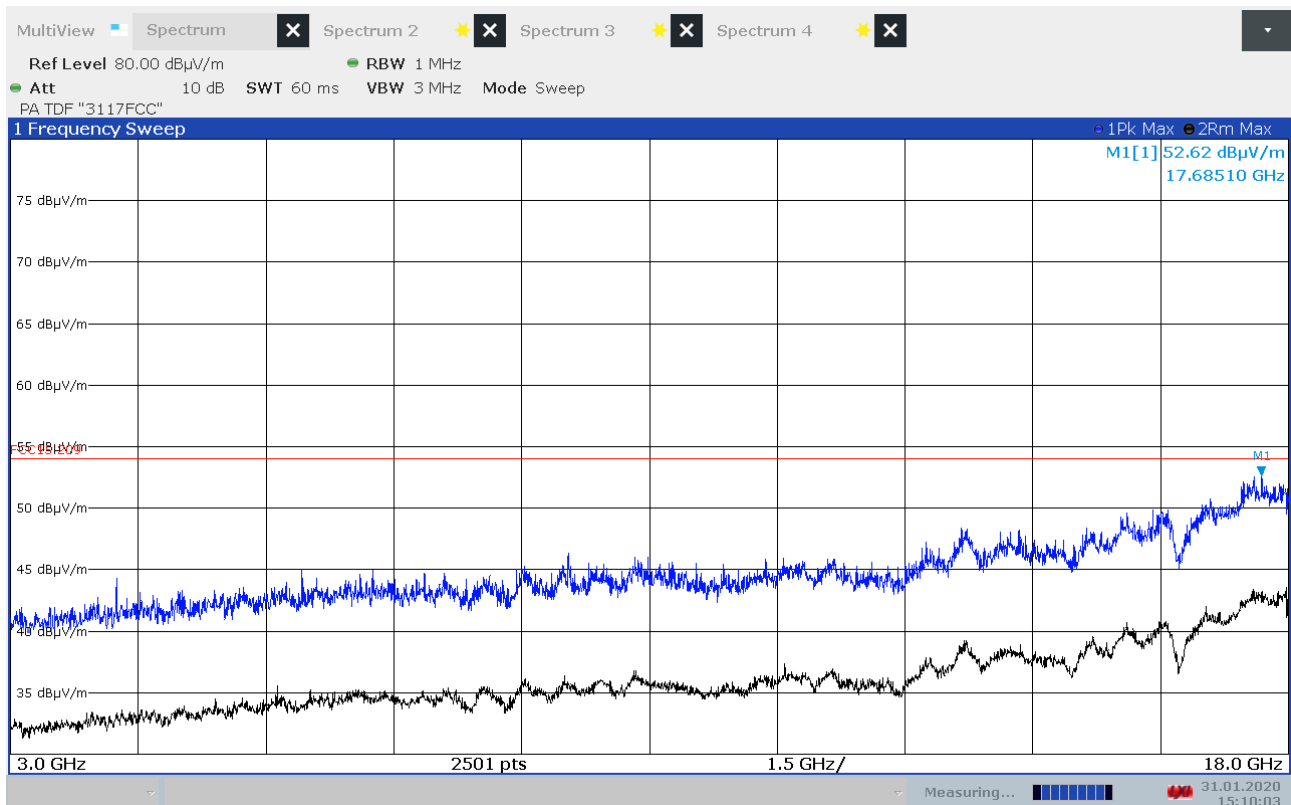
Radiated Emissions, 1000 -4000MHz, 2440MHz, HP



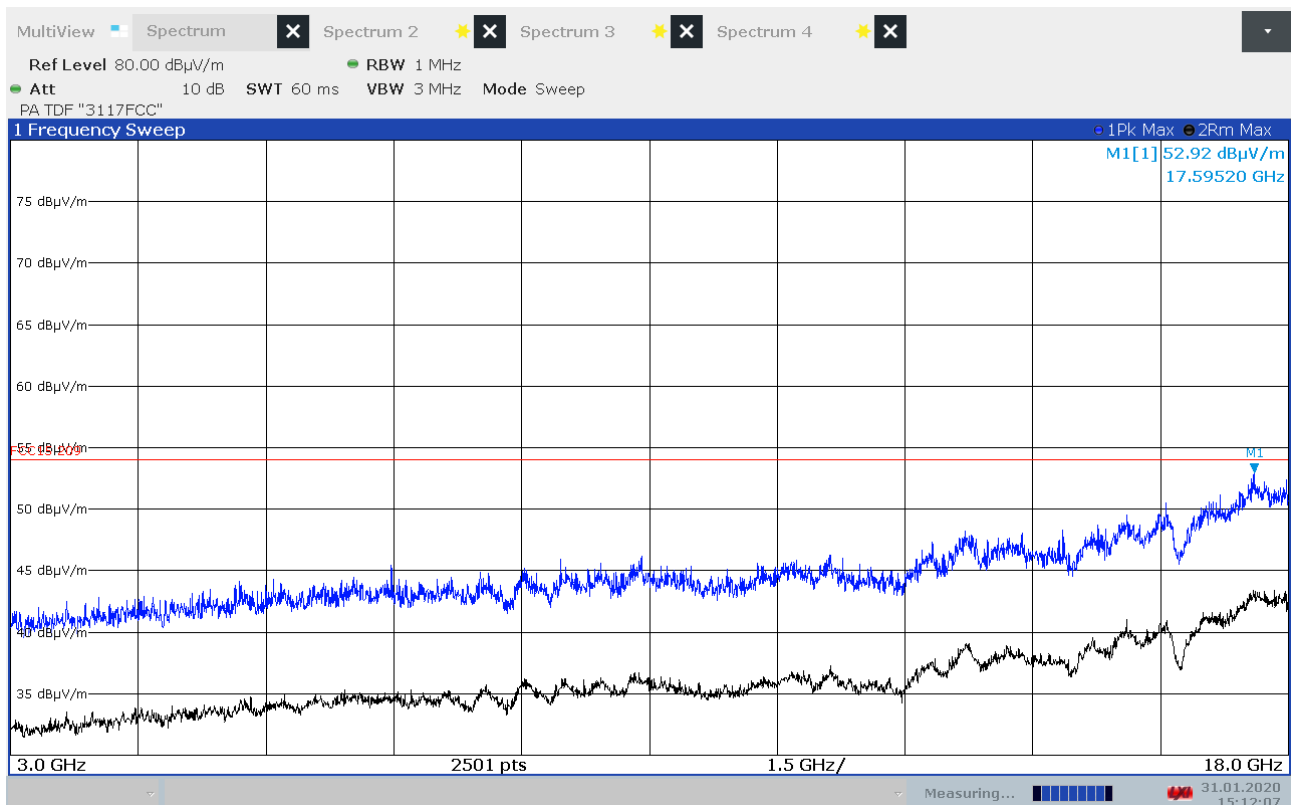
Radiated Emissions, 1000 -4000MHz, 2480MHz, VP



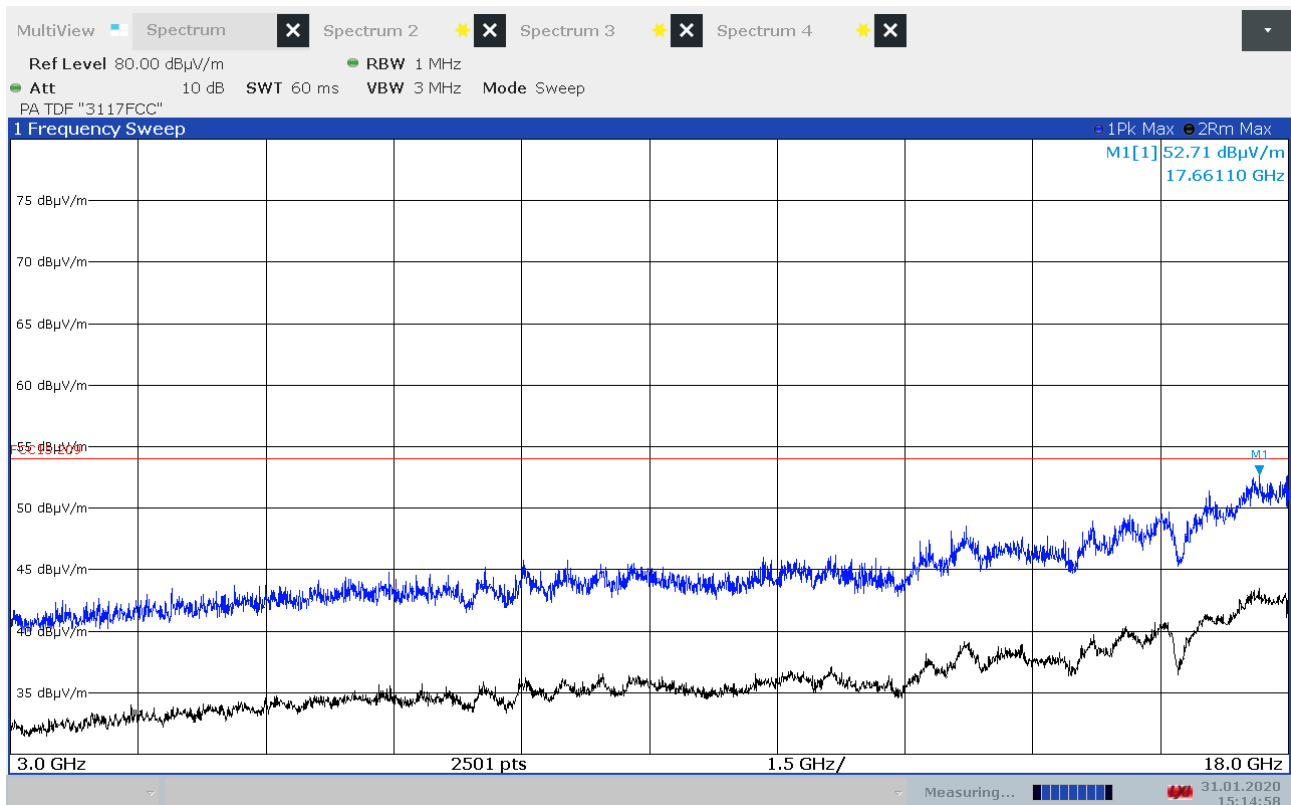
Radiated Emissions, 1000 -4000MHz, 2480MHz, HP



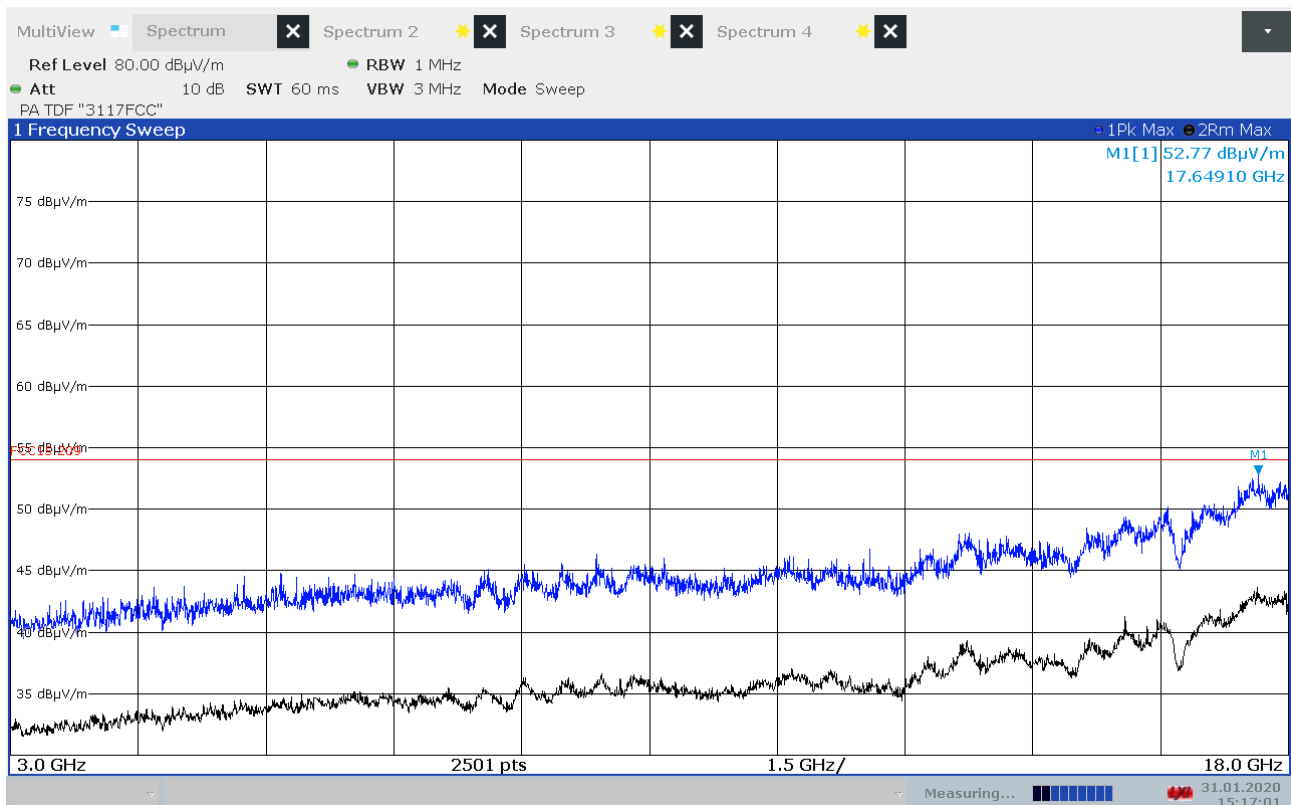
Radiated Emissions, 3000 -18000MHz, 2402MHz, VP



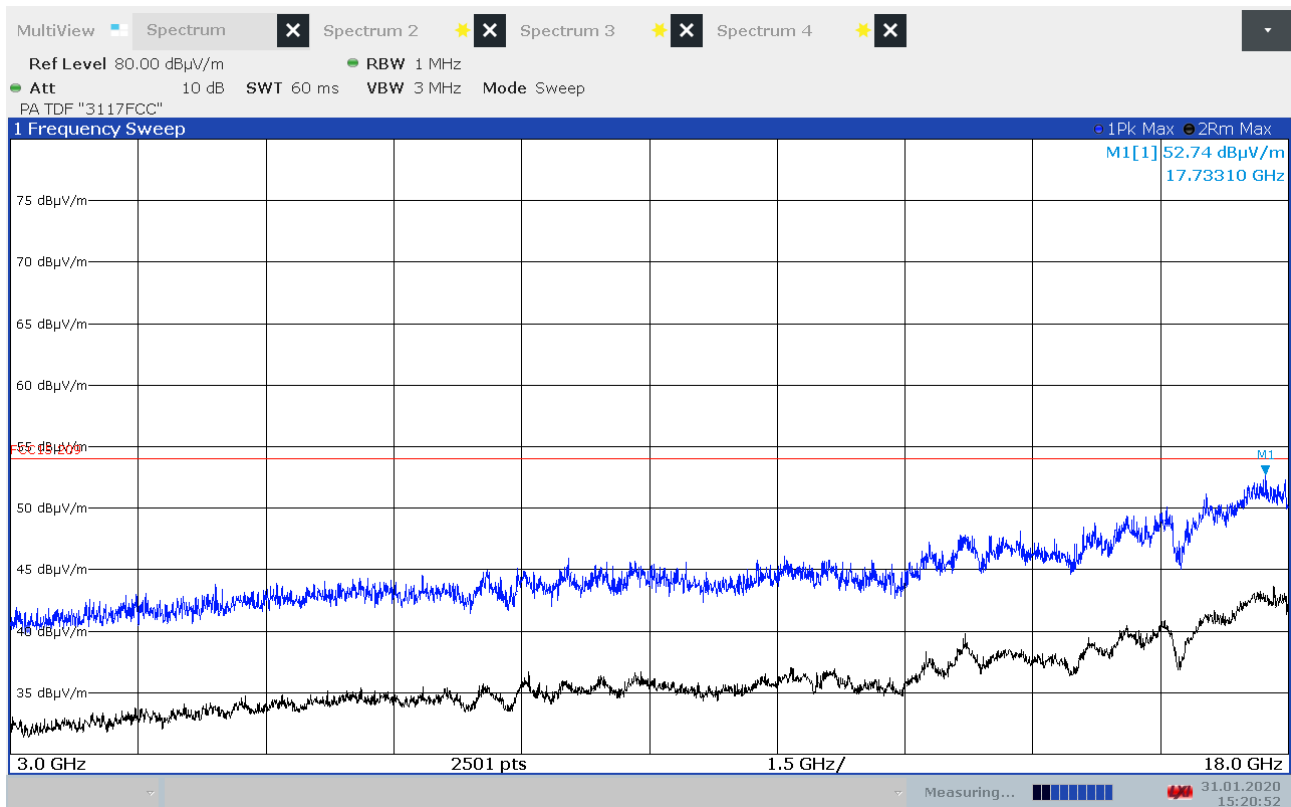
Radiated Emissions, 3000 -18000MHz, 2402MHz, HP



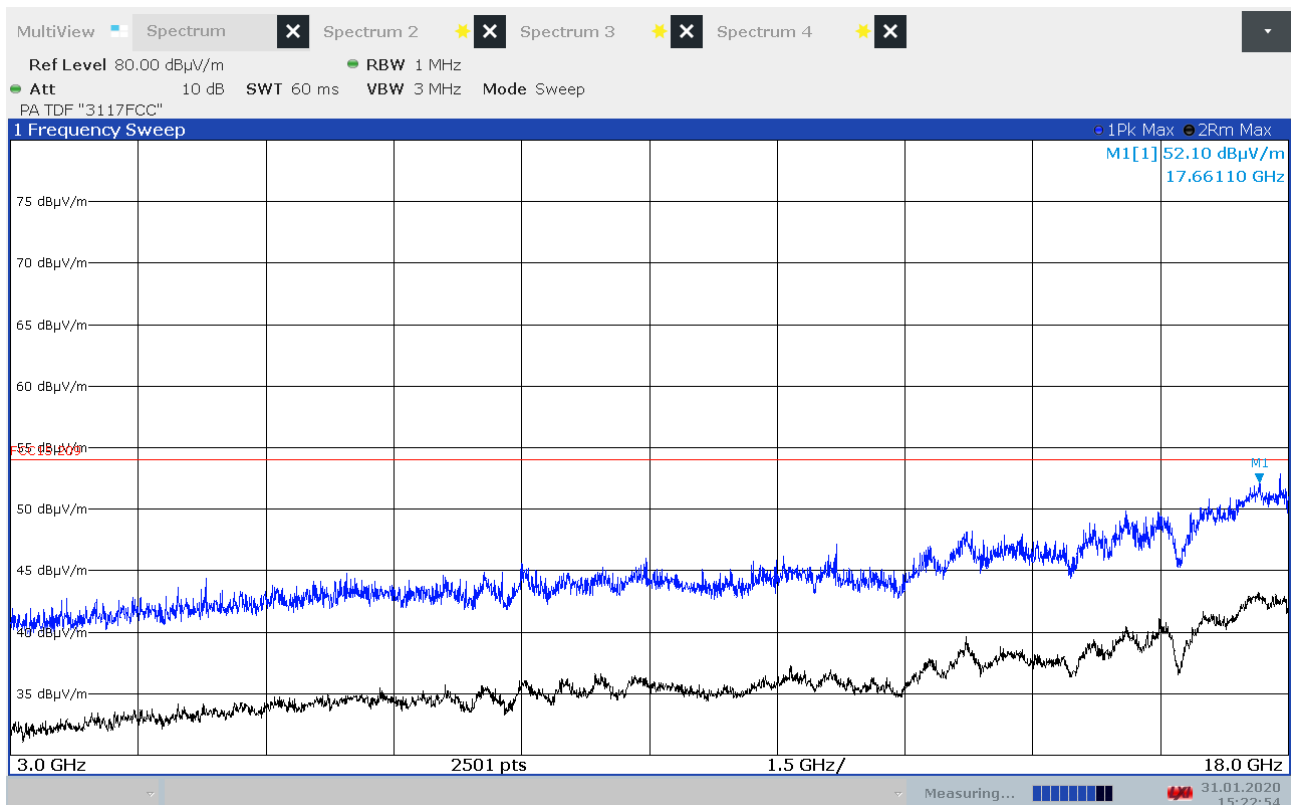
Radiated Emissions, 3000 -18000MHz, 2440MHz, VP



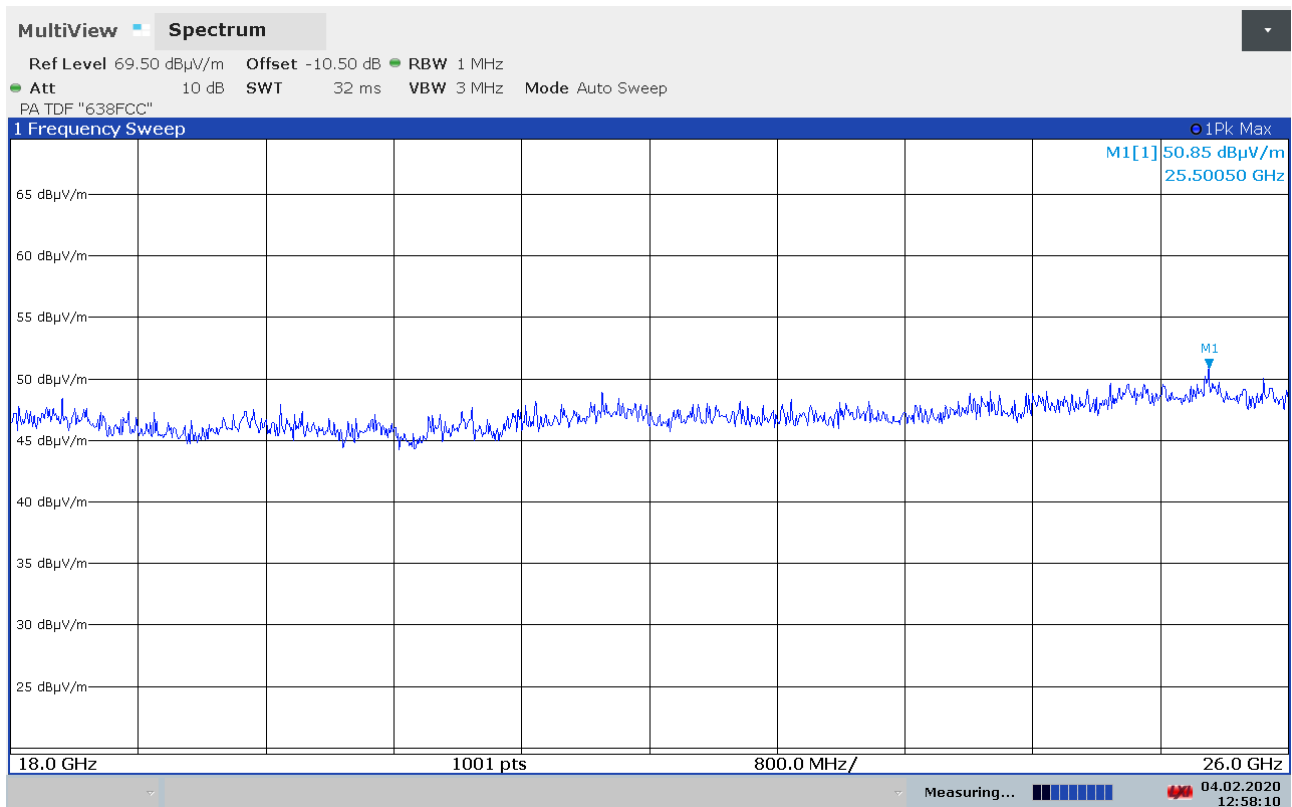
Radiated Emissions, 3000 -18000MHz, 2440MHz, HP



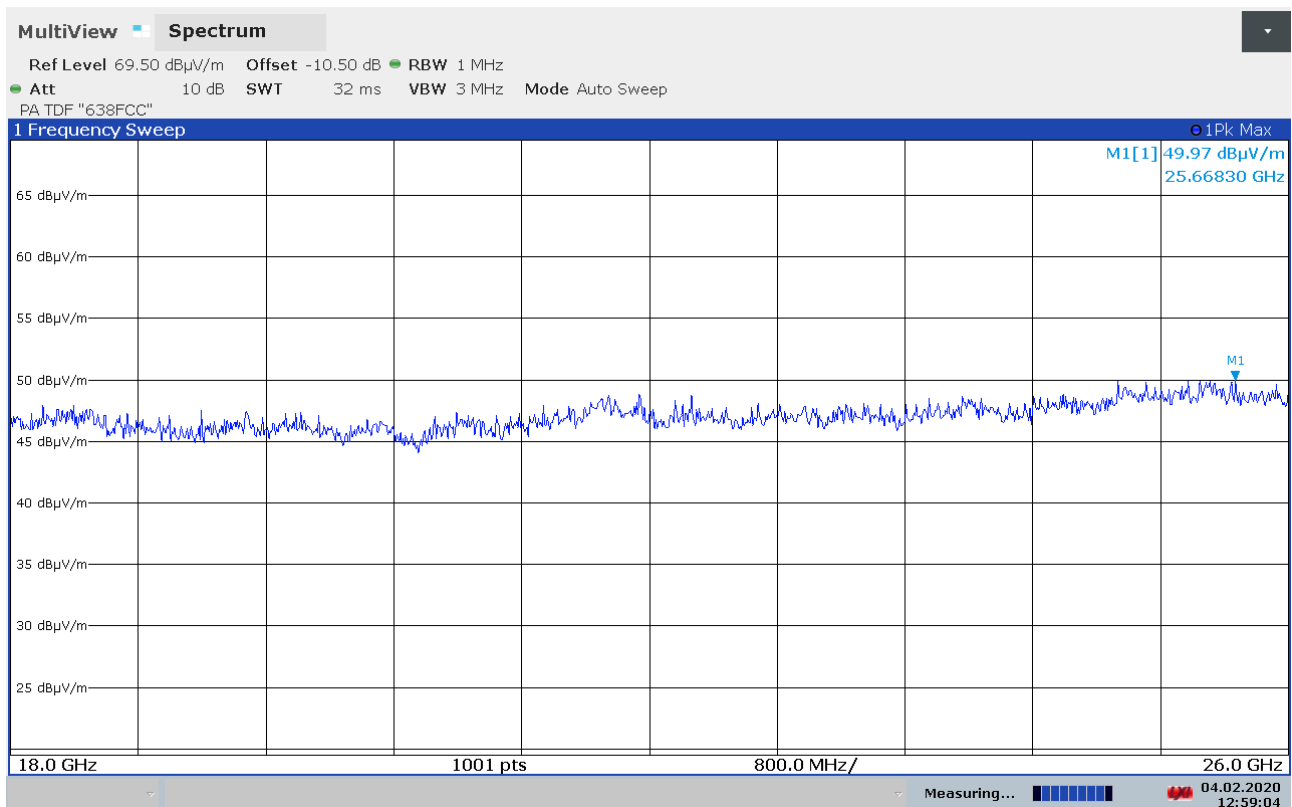
Radiated Emissions, 3000 -18000MHz, 2480MHz, VP



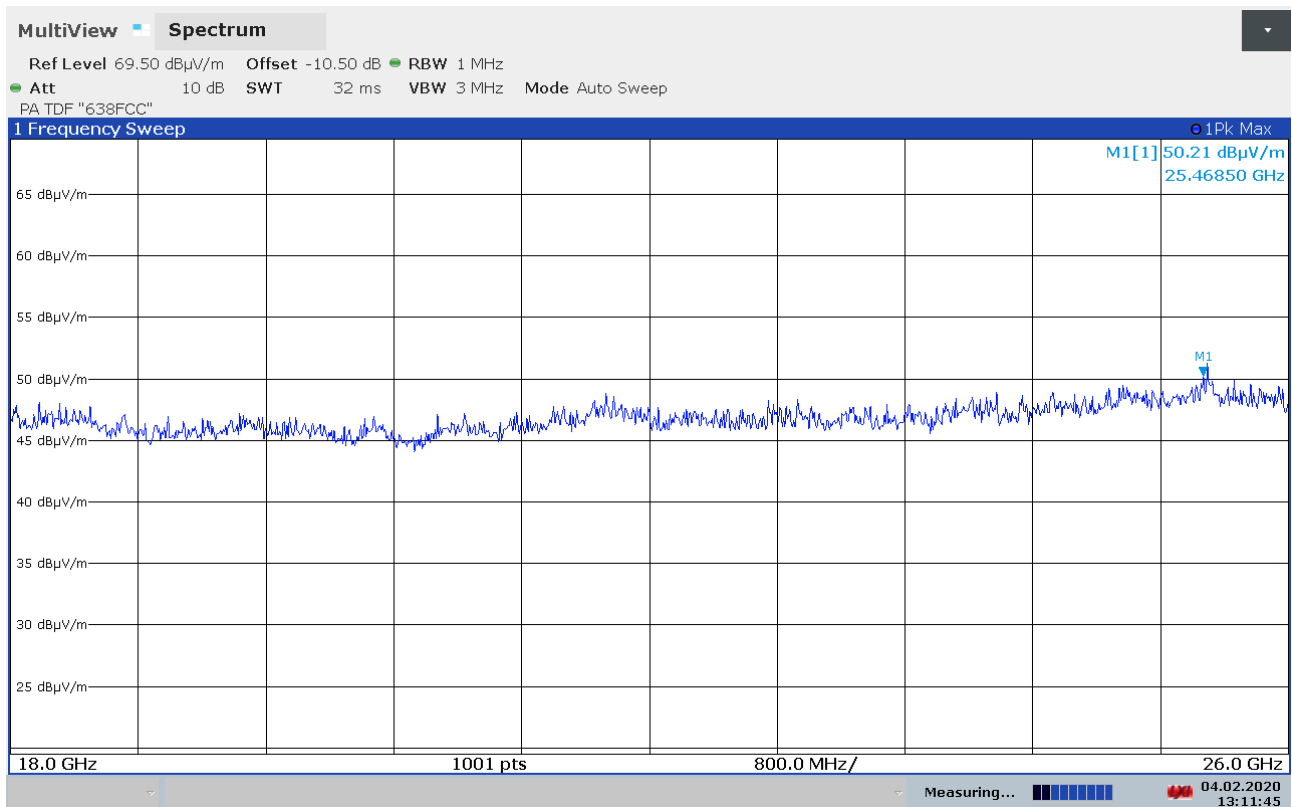
Radiated Emissions, 3000 -18000MHz, 2480MHz, HP



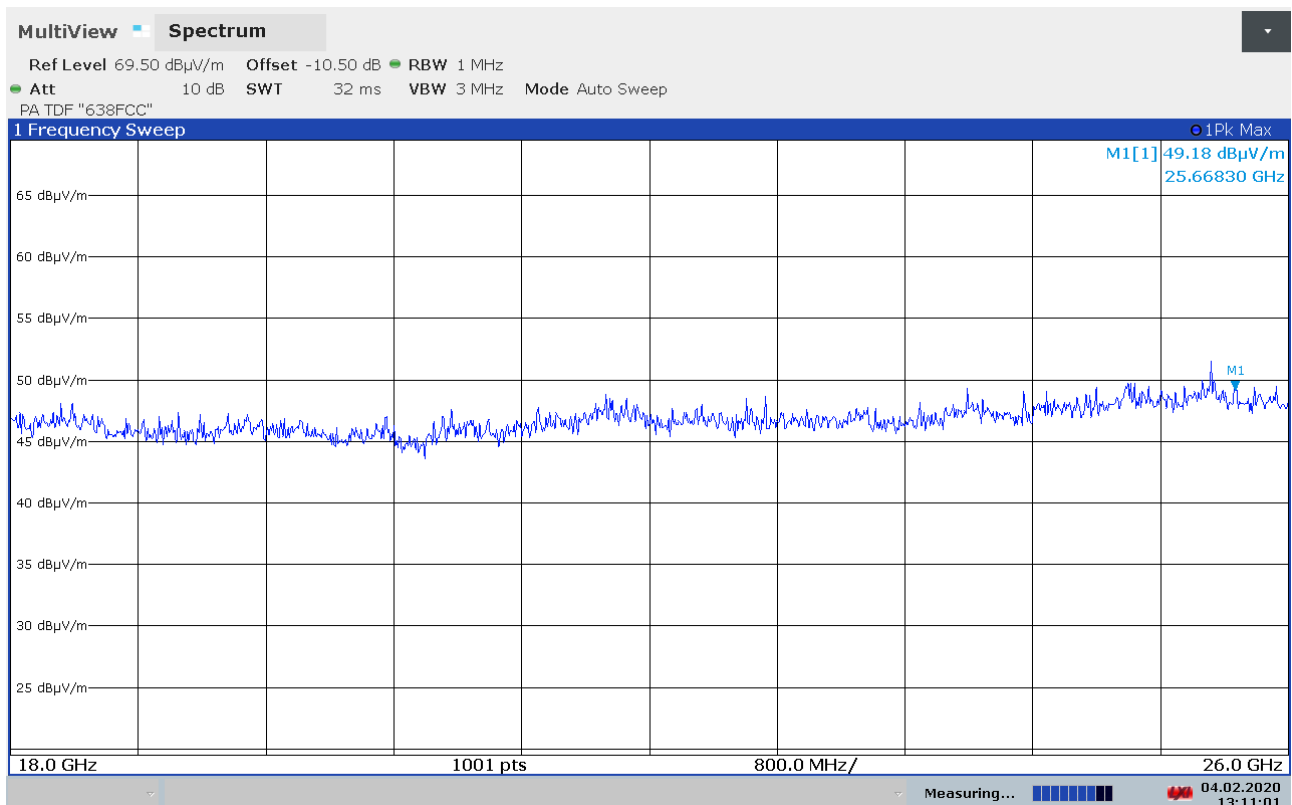
Radiated Emissions, 18 -26GHz, 2402MHz, VP, @1m



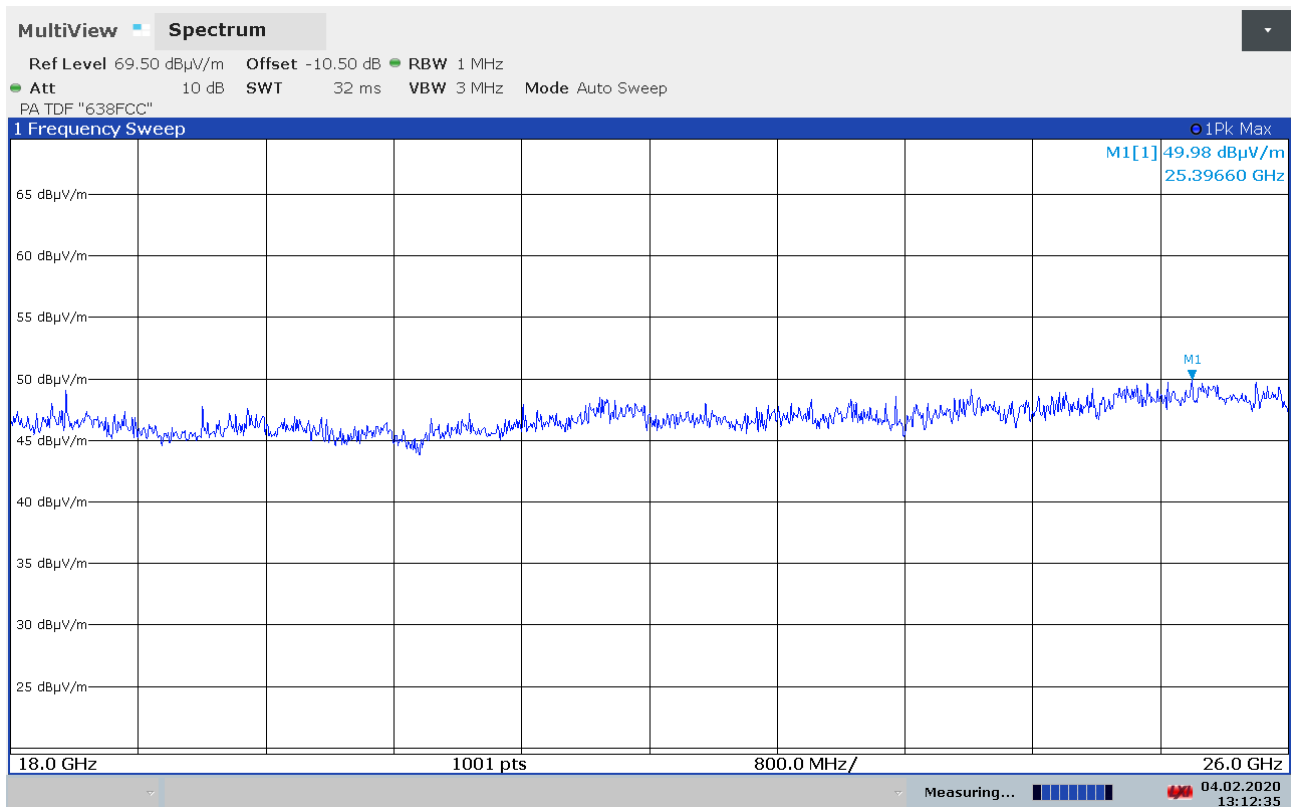
Radiated Emissions, 18 -26GHz, 2402MHz, HP, @1m



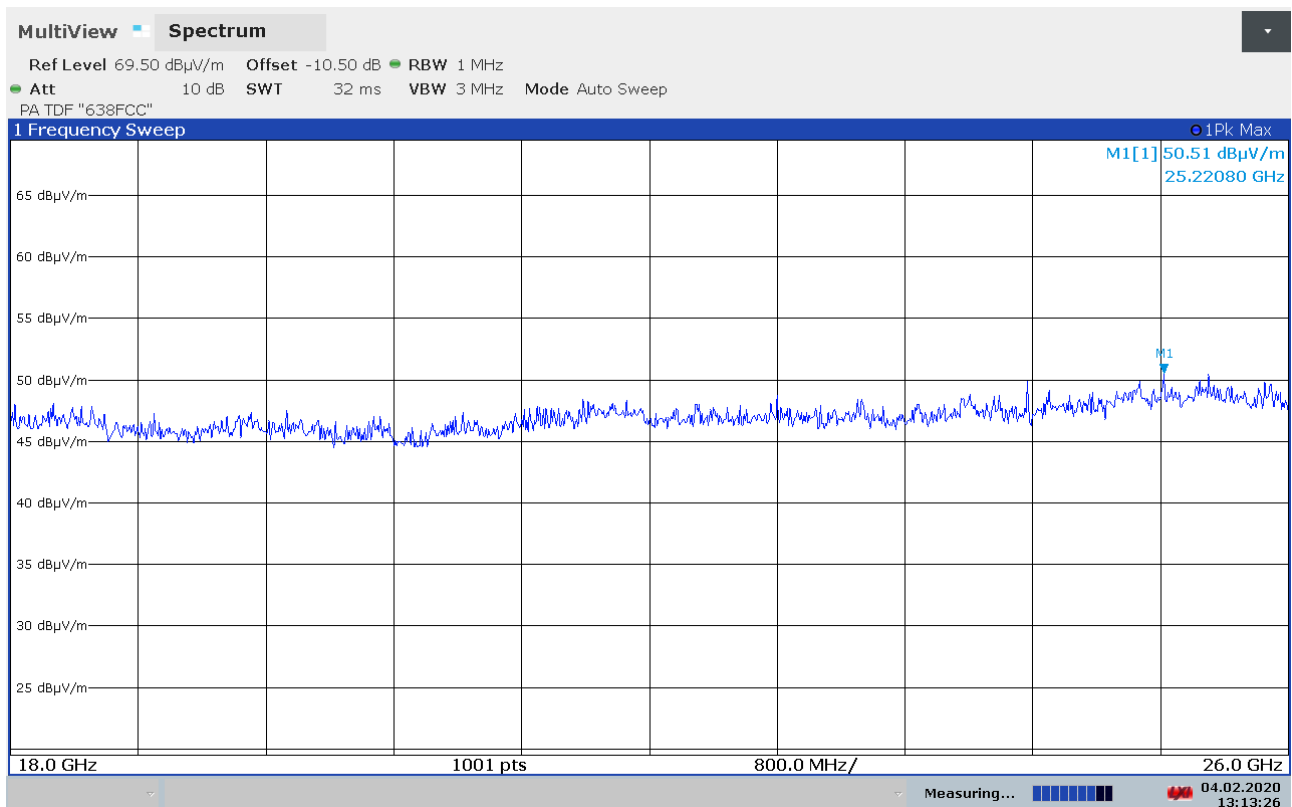
Radiated Emissions, 18 -26GHz, 2440MHz, VP, @1m



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



Radiated Emissions, 18 -26GHz, 2480MHz, VP, @1m



Radiated Emissions, 18 -26GHz, 2480MHz, HP, @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:

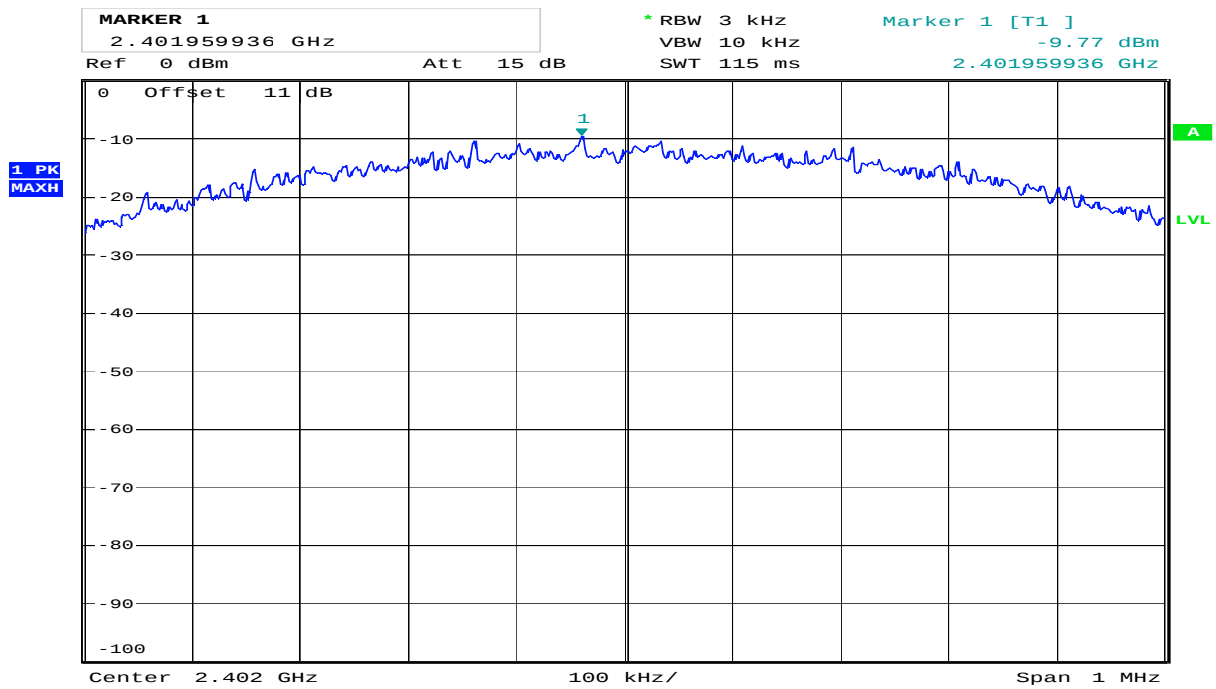
The measurement procedure PKPSD described in ANSI C63.10-2013 was used.

Carrier Frequency	Measured Power Spectral Density (dBm/3kHz)
2402 MHz	-9.8
2440 MHz	-11.2
2480 MHz	-9.3

Requirements:

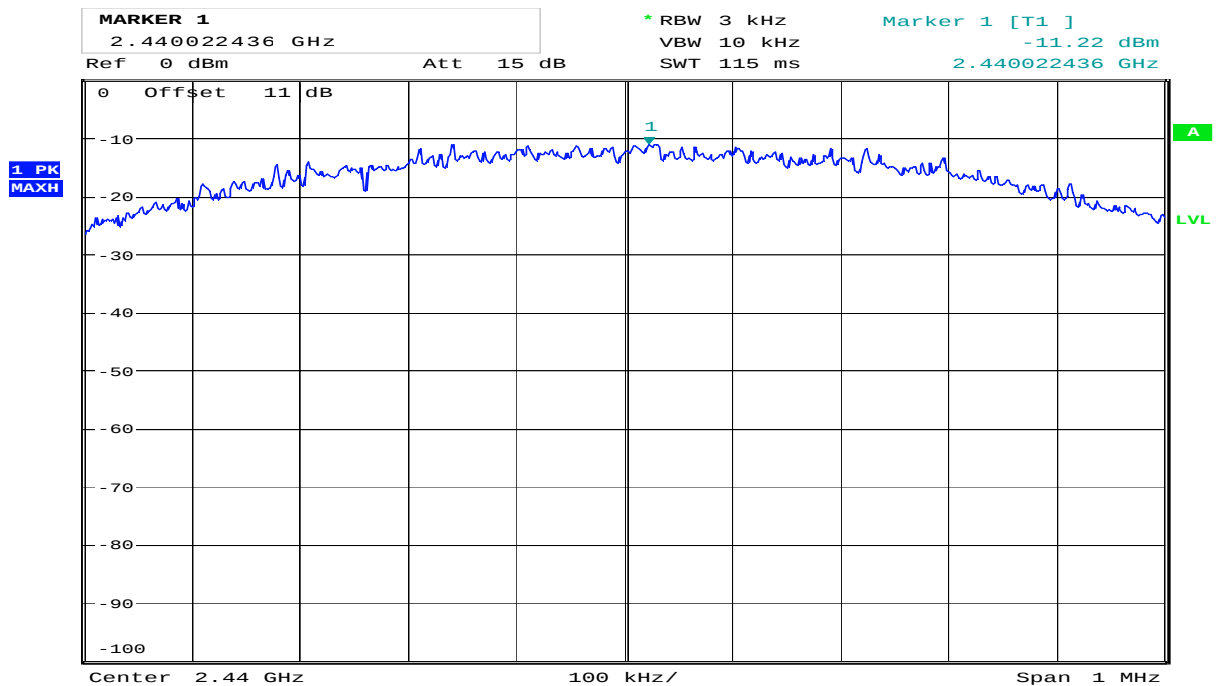
The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band

No requirements for Frequency Hopping Systems.



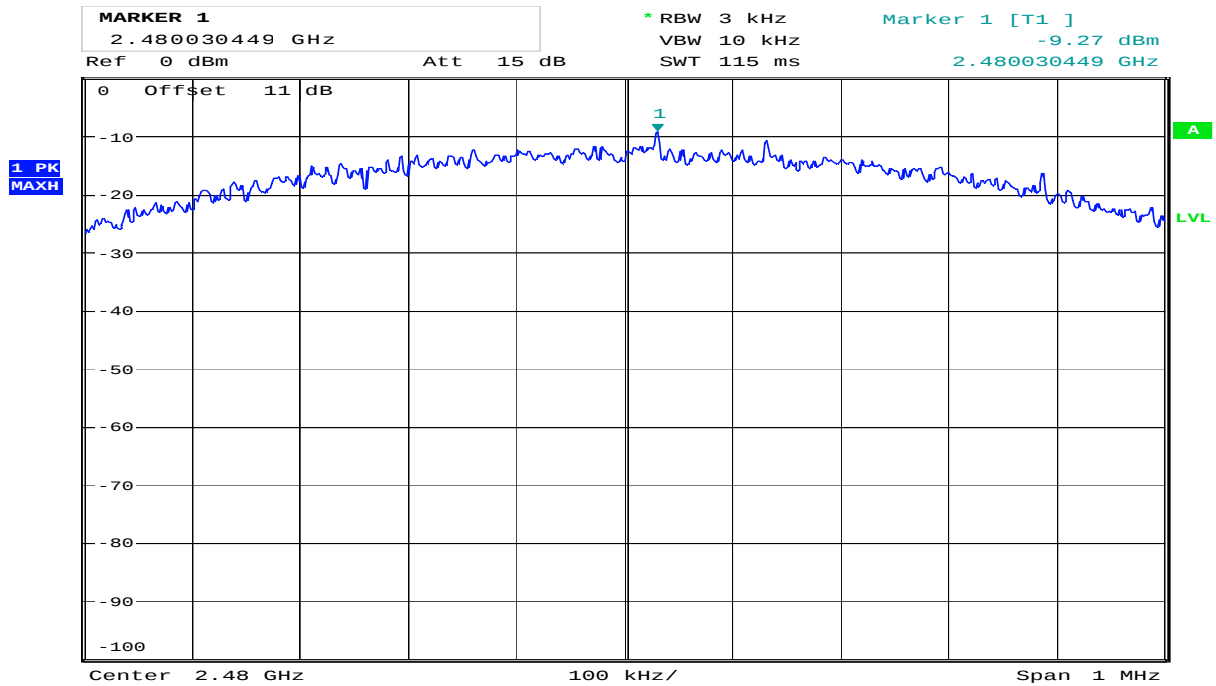
Date: 3.FEB.2020 09:10:20

PSD, 2402 MHz



Date: 3.FEB.2020 09:11:41

PSD, 2440 MHz



Date: 3.FEB.2020 09:13:14

PSD, 2480 MHz

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	2020-01	2021-01
2	FSU26	Measuring Receiver	Rohde & Schwarz	LR 1504	2020-01	2021-01
3	6810.17B	Attenuator	Narda	LR 1669	2019-07	2020-07
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	2019-07	2020-07
5	JB1	BiLog Antenna	SunAR	LR 1734	2018-05	2021-05
6	317	Preamplifier	Sonoma Inst.	LR 1687	2019-07	2020-07
7	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2019-07	2020-07
8	3115	Horn Antenna	EMCO	LR 1330	2016-10	2021-10
9	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-12	2020-12
10	Model 638	Antenna Horn	Narda	LR 1480	2010-06	2020-06
11	Model 87 V	Multimeter	Fluke	LR 1597	2018-02	2020-02
12	6812B	AC Power Source	Agilent	LR 1515	COU	
14	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2019-11	2021-11
15	ESC13	Measuring Receiver	Rohde & Schwarz	N-4259	2019-10	2021-10
16	ST18/SMA/N/72	RF Cable	Suhner	LR 1705	COU	

Note: COU – calibrate on use; N/A – Not Applicable

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

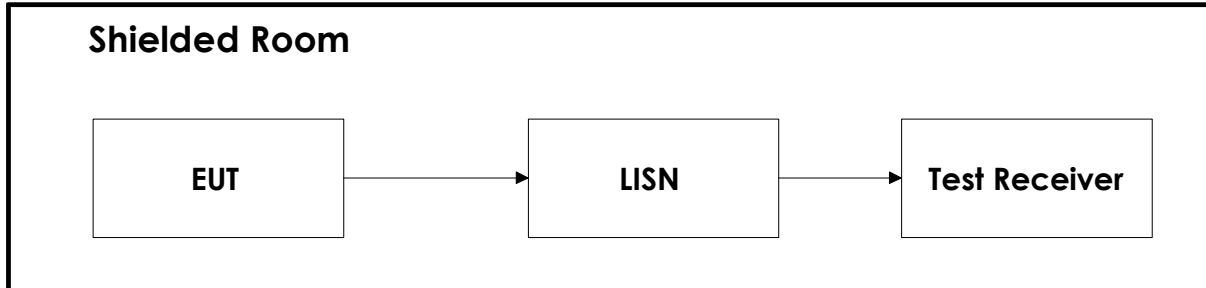
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.10	Power Line Conducted test software
2	Rohde & Schwarz	GPBShot	2.7	Screenshots from R&S Spectrum Analyzers

Revision history

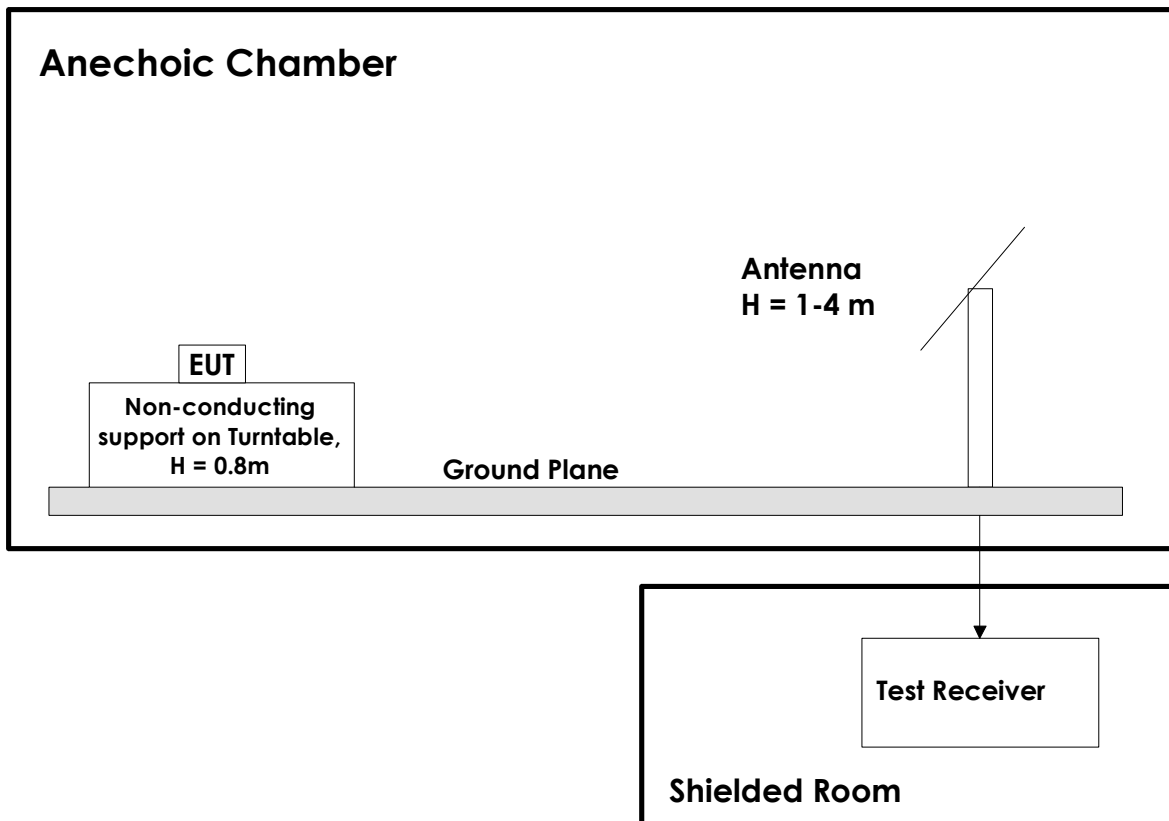
Revision	Date	Comment	Sign
00	2020-03-10	First edition	FS

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies below 18 GHz, and 1m above 18 GHz. 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, and High-Pass filter is used for all harmonics.