Report No. **383891-02-R00**

Test Report

Product	System Control Unit with Bluetooth Basic Rate and Low Energy
Name and address of the applicant	3M Svenska AB Box 2341, 331 02 Värnamo Sweden
Name and address of the manufacturer	3M Svenska AB Box 2341, 331 02 Värnamo Sweden
Model	SCU-300NA
Rating	3.0V_{DC} (2x AAA cells, Alkaline Batteries)
Trademark	Comtac VII
Serial number	Radiated Sample: 102 / Conducted Sample: 101
Additional information	Bluetooth Basic Rate, Bluetooth LE, NFMI
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	383891
Tested in period	2020-01-22 to 2020-01-24 and 2020-03-12
Issue date	2020-04-28
Name and address of the testing laboratory	Nemko 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 ilac-MRA NORWEGIAN ACCREDITATION TEST 033 **An accredited technical test executed under the Norwegian accreditation scheme**

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

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ENTERPRISE NUMBER NO974404532

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1 INFORMATION

1.1 Test Item

Name	**Comtac VII**
Model/version	**SCU-300NA**
FCC ID	**Y9ZSCU300**
ISED ID	**4406A-SCU300**
Serial number	**Conducted Sample: 101** **Radiated Sample: 103**
Hardware identity and/or version	**K399Ava05**
Software identity and/or version	**K399-st-application-0.9.0**
Frequency Range	**2402 – 2480 MHz**
Number of Channels	**79**
Operating Modes	**Bluetooth FHSS**
Type of Modulation	**GFSK, π/4-DQPSK, 8-DPSK**
Rated Output Power	**1.54 mW**
Type of Power Supply	**Primary Batteries (2x AAA Alkaline Batteries)**
Antenna Connector	**None (Integral Antenna)**
Number of Antennas	**1**
Interfaces	**Proprietary Connector for connecting to headset or other System Control Units**

Description of Test Item

The SCU300 is a System Control Unit (SCU) with integrated NFMI radio and Bluetooth (Basic, EDR and BLE) communications. The NFMI is audio based for using with the headset Comtac VII.

The headset can also be connected to the SCU300 using a proprietary cable The Bluetooth is a dual radio chip with one antenna path that allows the user to connect the Comtac VII to a cellular phone or an external radio. The SCU can also be connected to external radio by wires. The SCU is powered by 2 x 1.5V by AAA/LR03 alkaline batteries or rechargeable NiMH batteries. The batteries can not be charged while in the SCU.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	3.0 V DC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 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

1.5 Worst-Case Configuration and Mode

Radiated Emissions was performed with the EUT set to transmit at the modulation type with the highest output power as worst-case scenario.

1.6 Comments

All measurements were done with the EUT powered by new batteries.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

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

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

Radiated tests were made in a semi-anechoic chamber at measuring distance of 3m.

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

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-production Unit

DSS 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”.

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	N/A
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	N/A
Channel Separation and 20 dB BW	15.247(a)(1)	5.1 (4) (RSS-247)	7.8.2 (FHSS)	Complies
Number of Hopping Frequencies	15.31(m)	5.1 (6) (RSS-247)	7.8.3 (FHSS)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	N/A (FHSS)	Complies
Time of Occupancy (dwell time)	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	7.8.4 (FHSS)	Complies
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	6.9.2 FHSS)	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 7.8.6 (FHSS) 7.8.8 (FHSS)	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	Complies

3 TEST RESULTS

3.1 Channel Separation and 20dB Bandwidth

FCC Part 15.247(a)(1)

ISED RSS-247 Issue 2, Clause 5.1 (b)

Measurement procedure: **ANSI C63.10-2013 Clause 7.8.2**

Test Results: **Complies**

Measurement Data:

Modulation	Channel Separation	Verdict
Basic Rate (GFSK)	1.0 MHz	Complies
2-EDR (π/4-DPSK)	1.0 MHz	Complies
3-EDR (8-DPSK)	1.0 MHz	Complies

Modulation	20 dB Bandwidth		
	2402MHz	2440MHz	2480MHz
Basic Rate (GFSK)	957 kHz	911 kHz	911 kHz
2-EDR (π/4-DPSK)	1.24 MHz	1.23 MHz	1.23 MHz
3-EDR (8-DPSK)	1.20 MHz	1.25 MHz	1.25 MHz

See attached plots

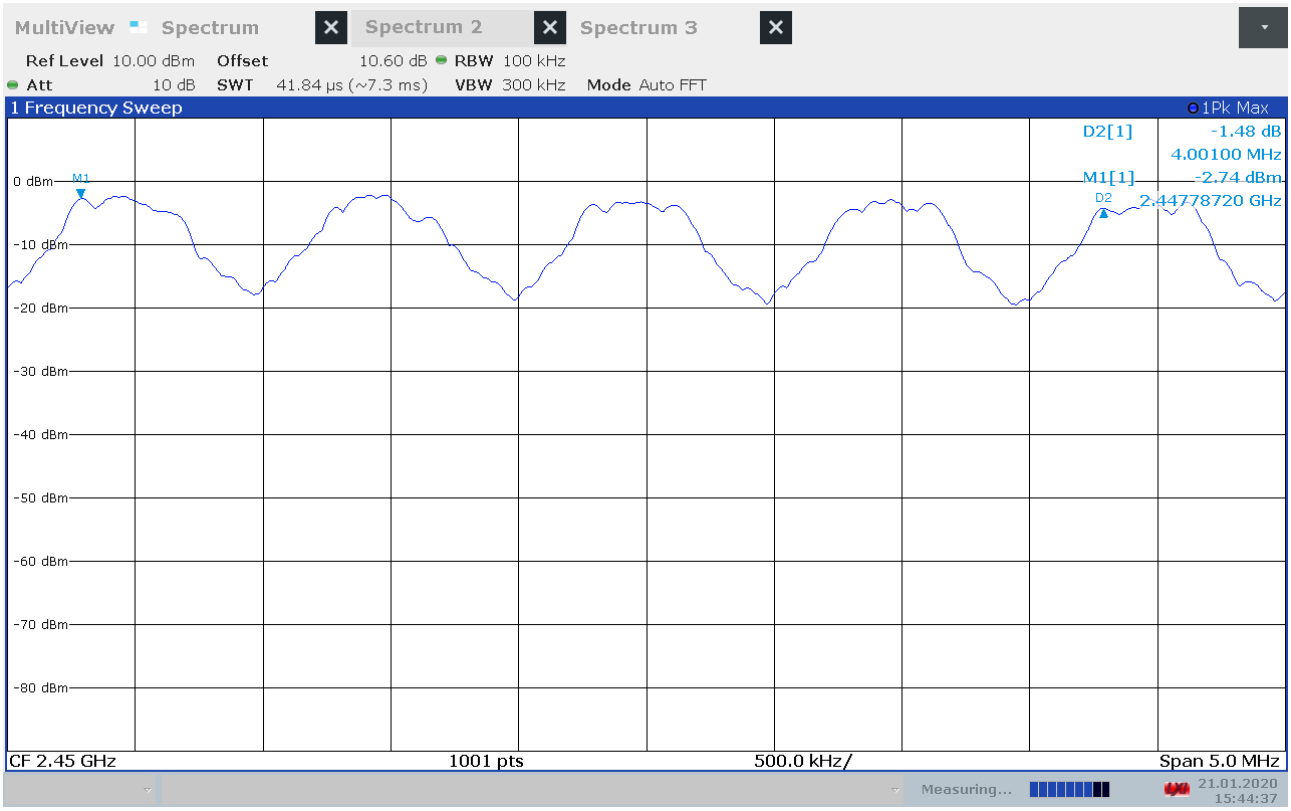
Requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

or:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.

No requirements for Digital Transmission Systems.

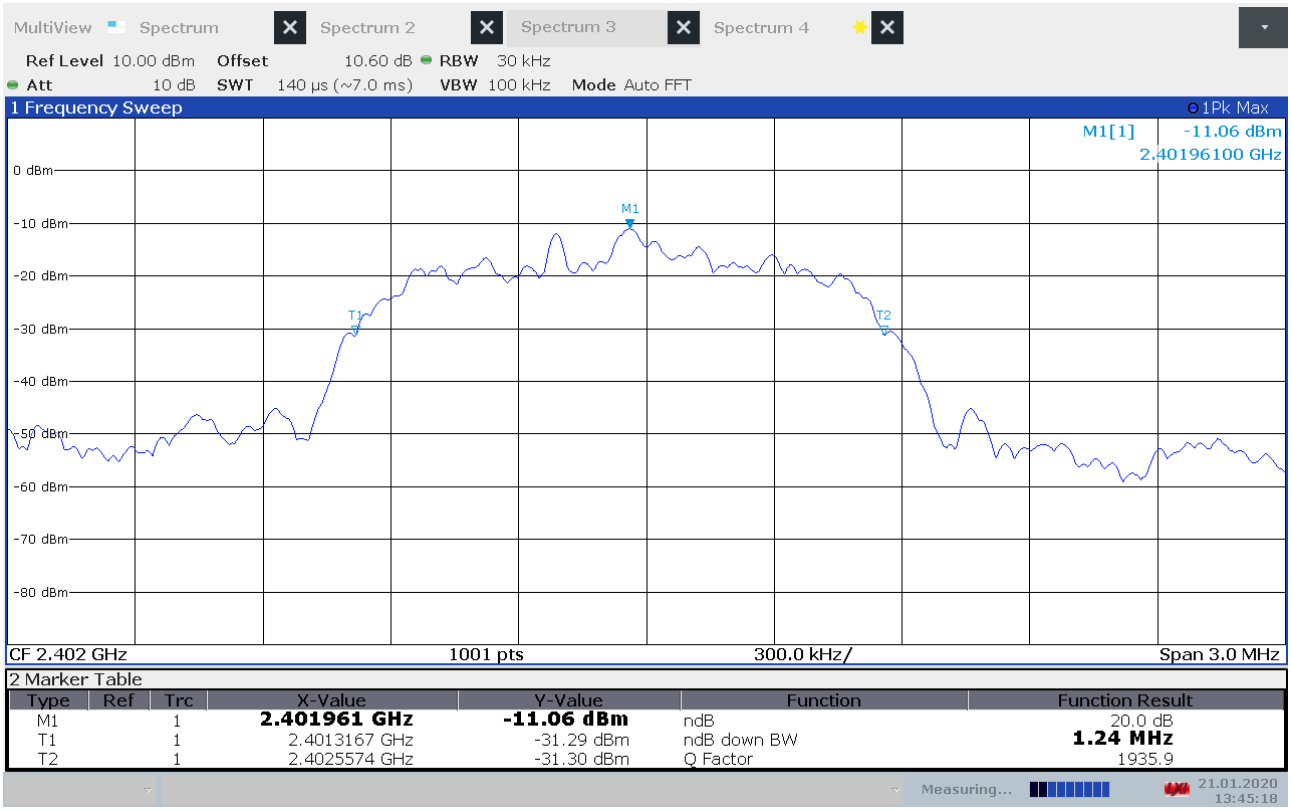


Channel Separation

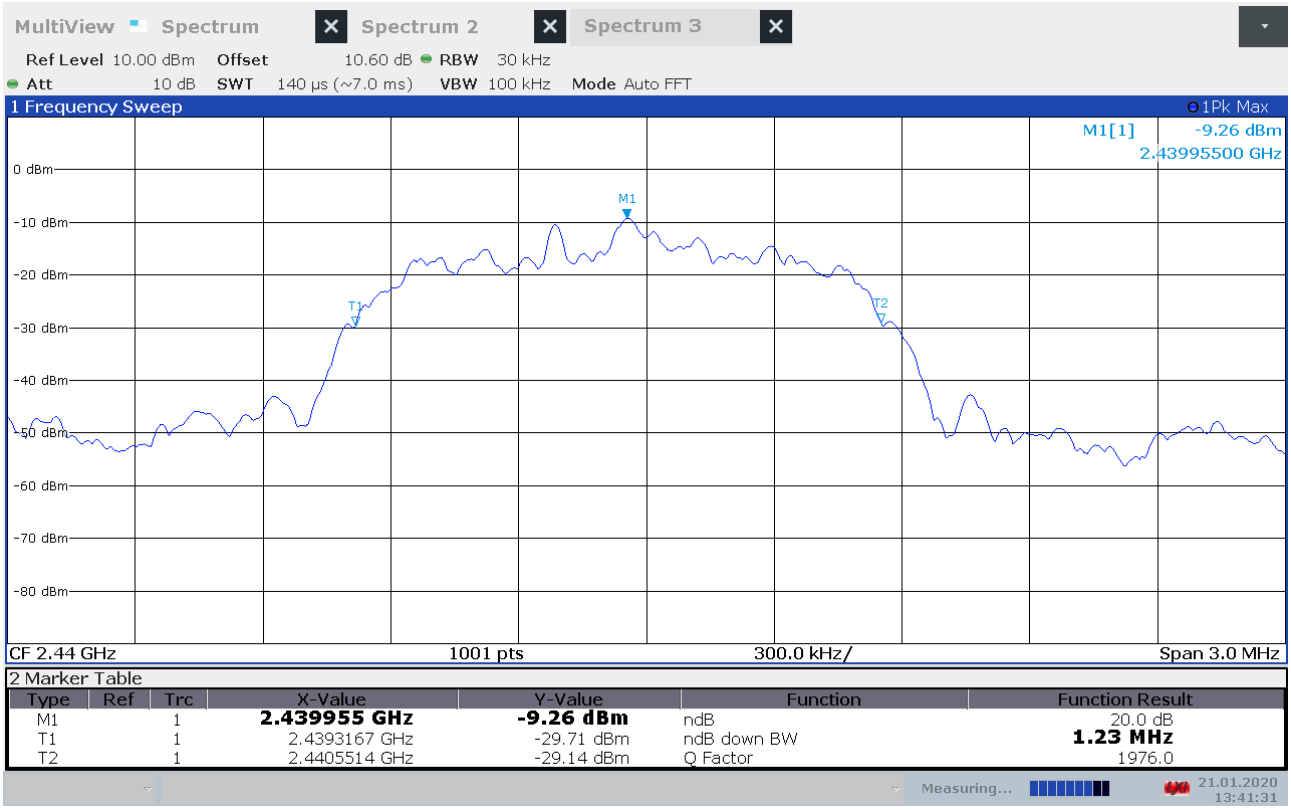
20dB Bandwidth, GFSK, 2402MHz

20dB Bandwidth, GFSK, 2440MHz

20dB Bandwidth, GFSK, 2480MHz

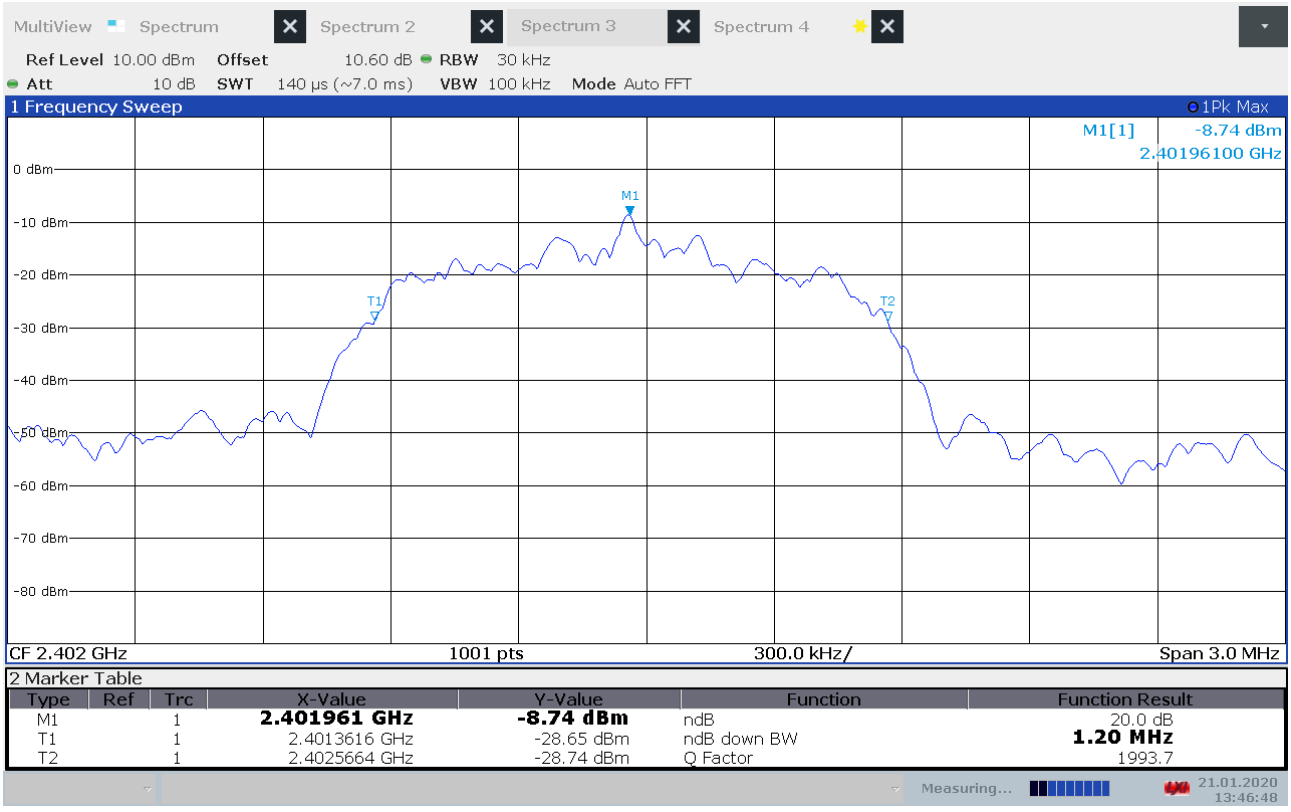


20dB Bandwidth, π/4-DQPSK, 2402MHz

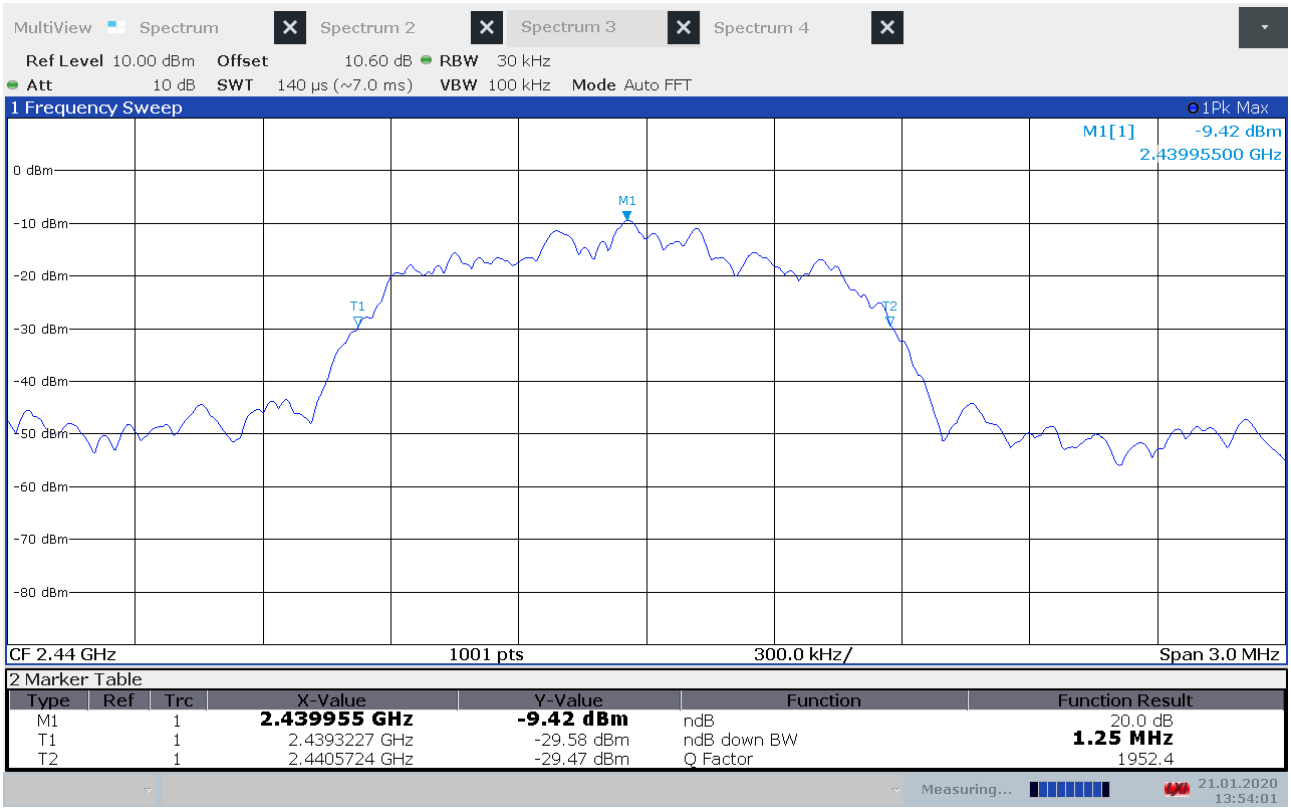


20dB Bandwidth, π/4-DQPSK, 2440MHz

20dB Bandwidth, π/4-DQPSK, 2480MHz



20dB Bandwidth, 8-DPSK, 2402MHz



20dB Bandwidth, 8-DPSK, 2440MHz

20dB Bandwidth, 8-DPSK, 2480MHz

3.2 Occupancy Time

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

ISED Canada RSS-247 Issue 2, Clause 5.1 (c)

Measurement procedure: **ANSI C63.10-2013 Clause 7.8.4**

Test Results: **Complies**

Measurement Data:

Frame Type and Data Rate	Burst Length (ms)	Frame Length (ms)	Time of Occupancy (ms)	Verdict
DH1 – Basic Rate	0.40	1.25	128.00	Complies
DH3 – Basic Rate	1.66	2.50	265.60	Complies
DH5 – Basic Rate	2.91	3.75	310.40	Complies
2-DH1 – 2-EDR	0.41	1.25	131.20	Complies
2-DH3 – 2-EDR	1.66	2.50	265.60	Complies
2-DH5 – 2-EDR	2.92	3.75	311.47	Complies
3-DH1 – 3-EDR	0.41	1.25	131.20	Complies
3-DH3 – 3-EDR	1.67	2.50	267.20	Complies
3-DH5 – 3-EDR	2.92	3.75	311.47	Complies

Time between RF burst on same channel = Frame Length * Number of Channels

Time of occupancy = (Burst Length * Number of Channels * 400 ms) / Time Between Burst on Same Channel
= (Burst Length * 400 ms) / Frame Length

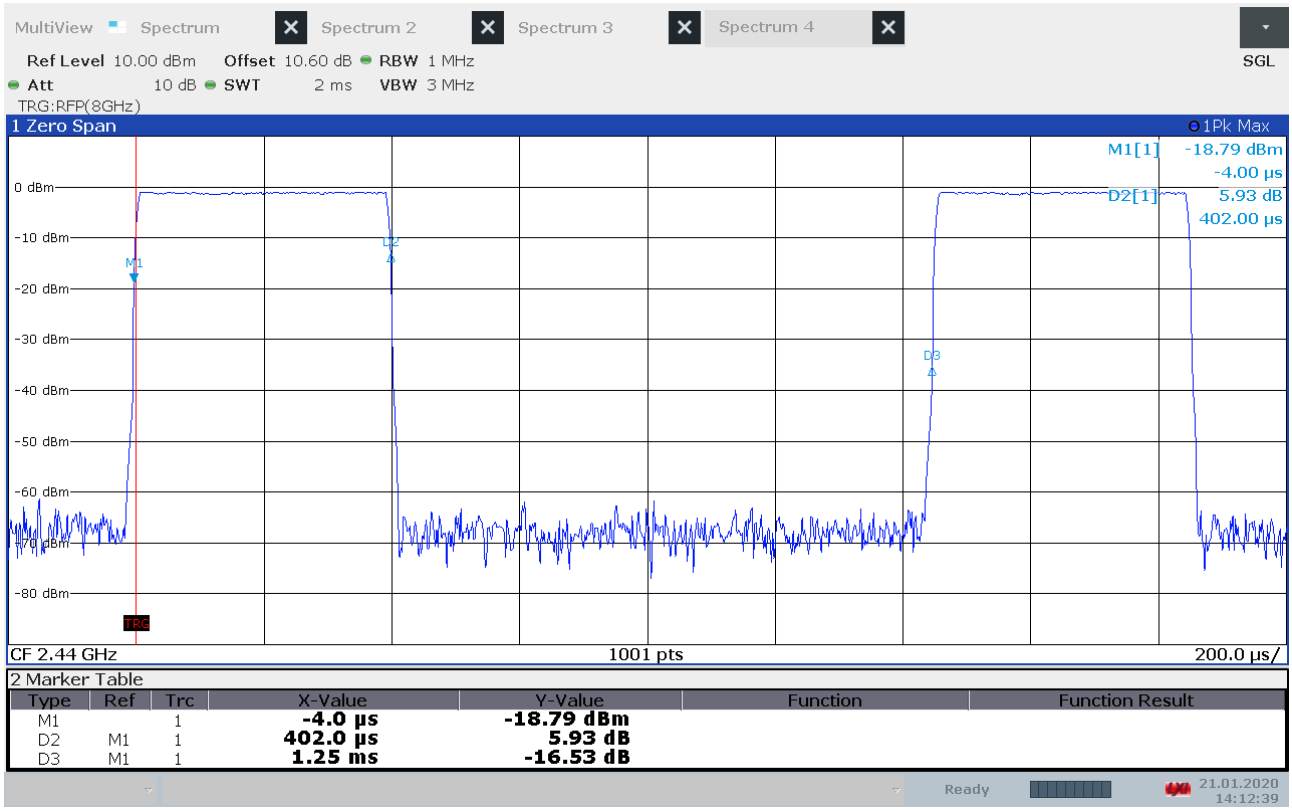
Number of RF channels is minimum 20 and maximum 78

See attached plots

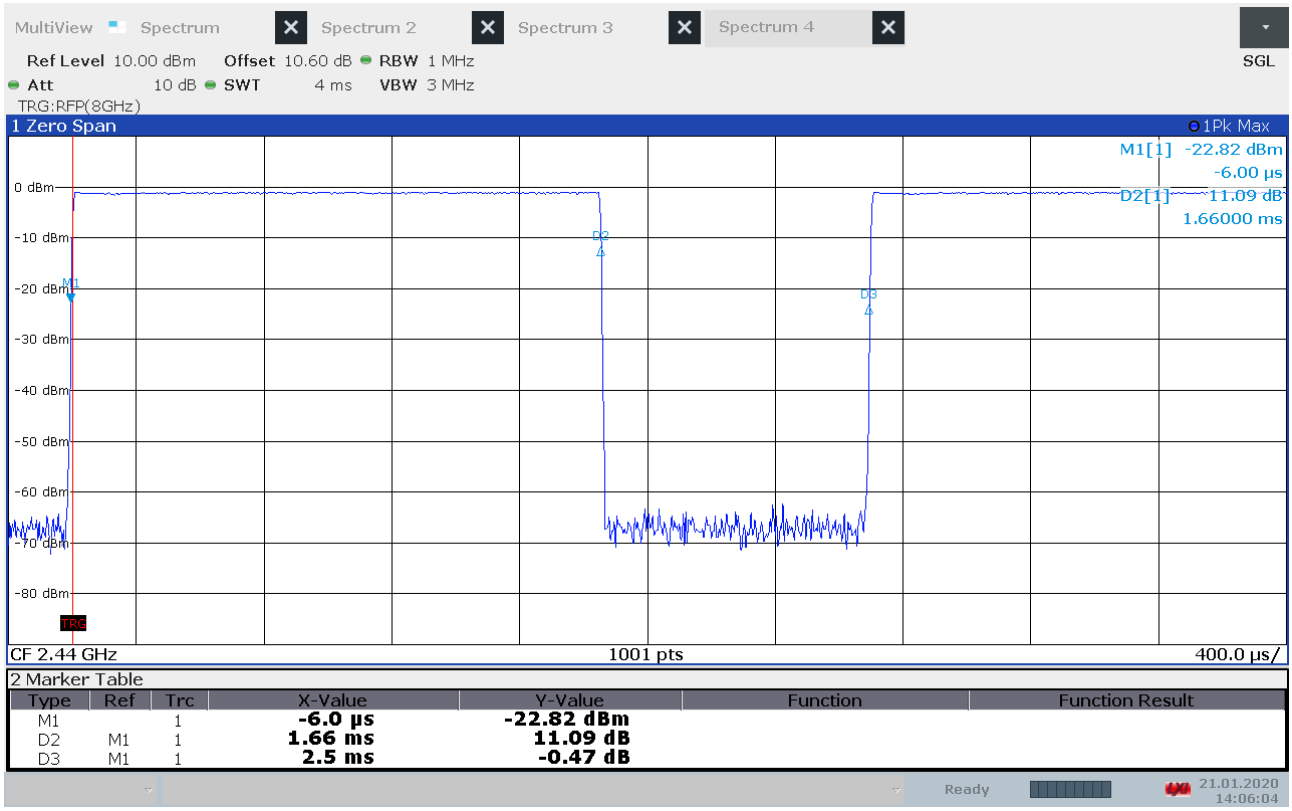
Requirements:

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

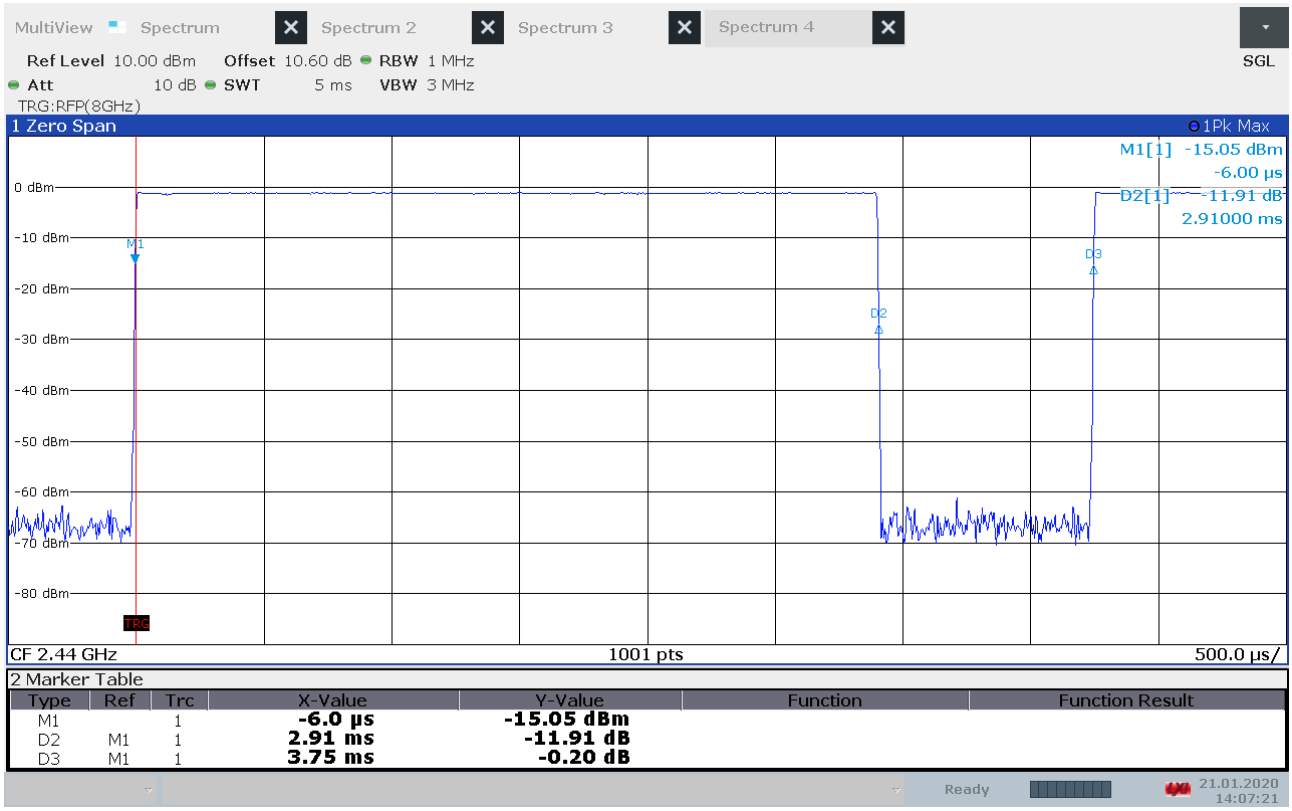
No requirements for Digital Transmission Systems.



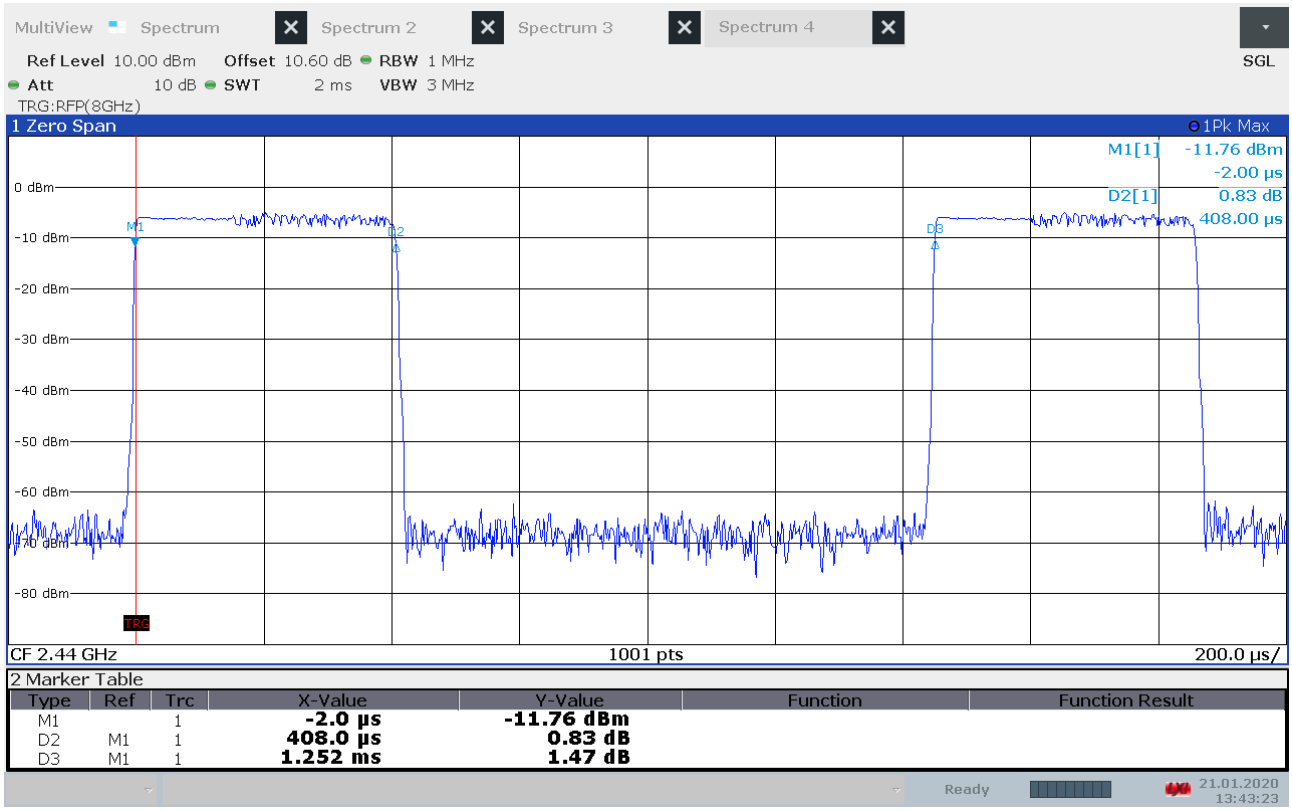
Burst Length, DH1



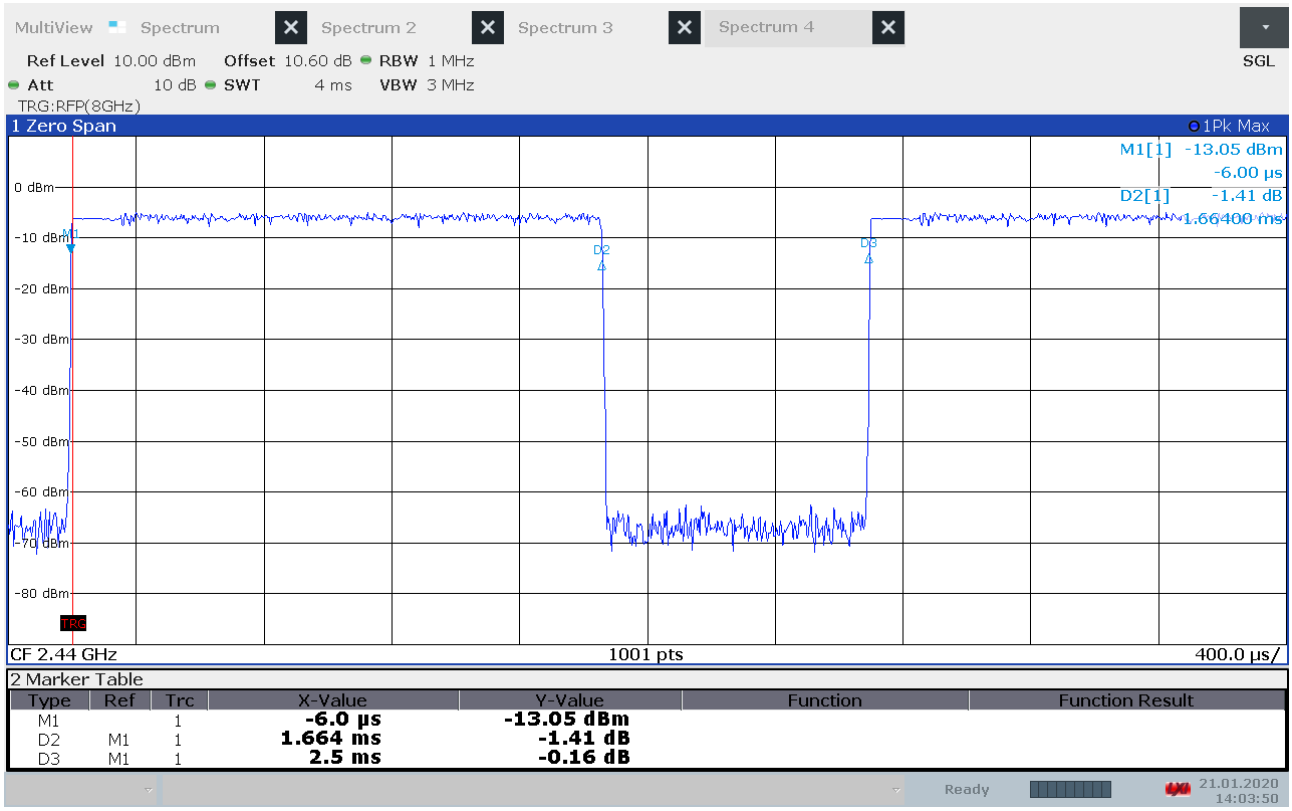
Burst Length, DH3



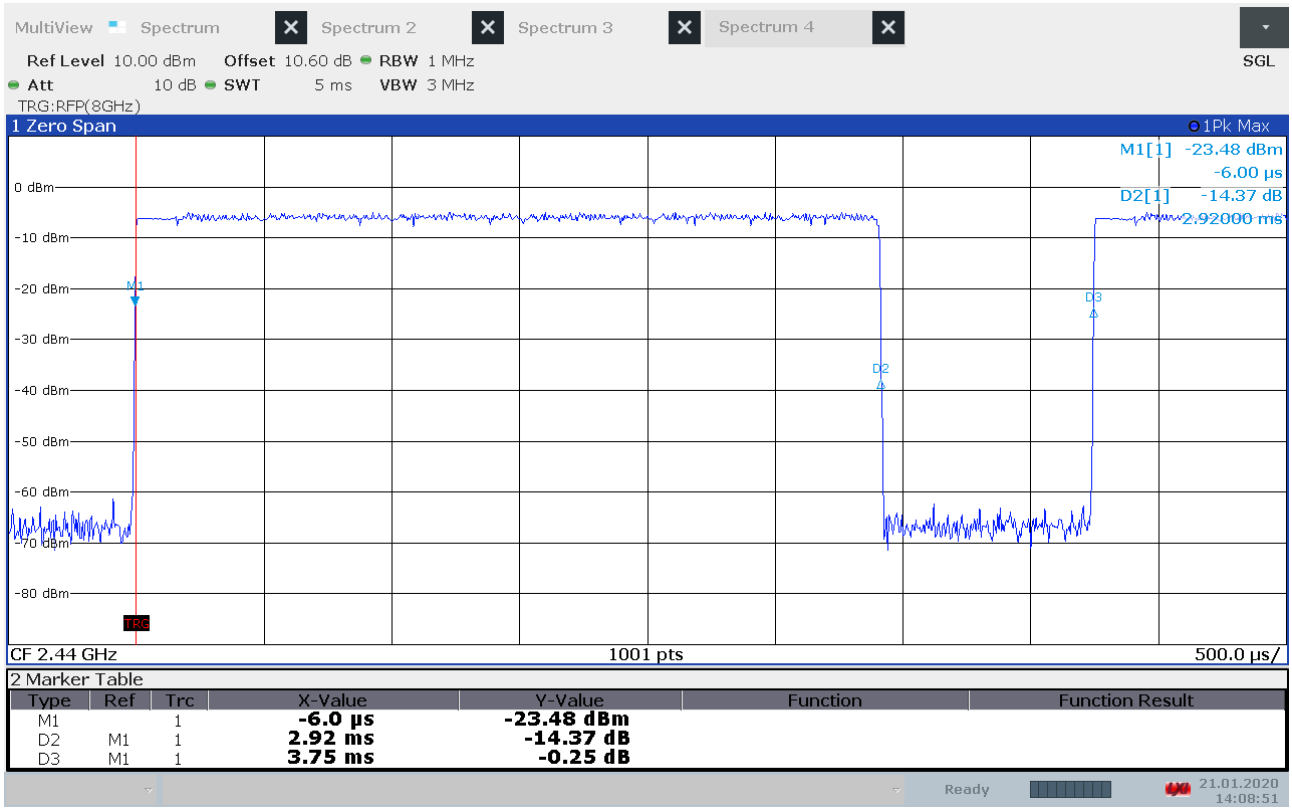
Burst Length, DH5



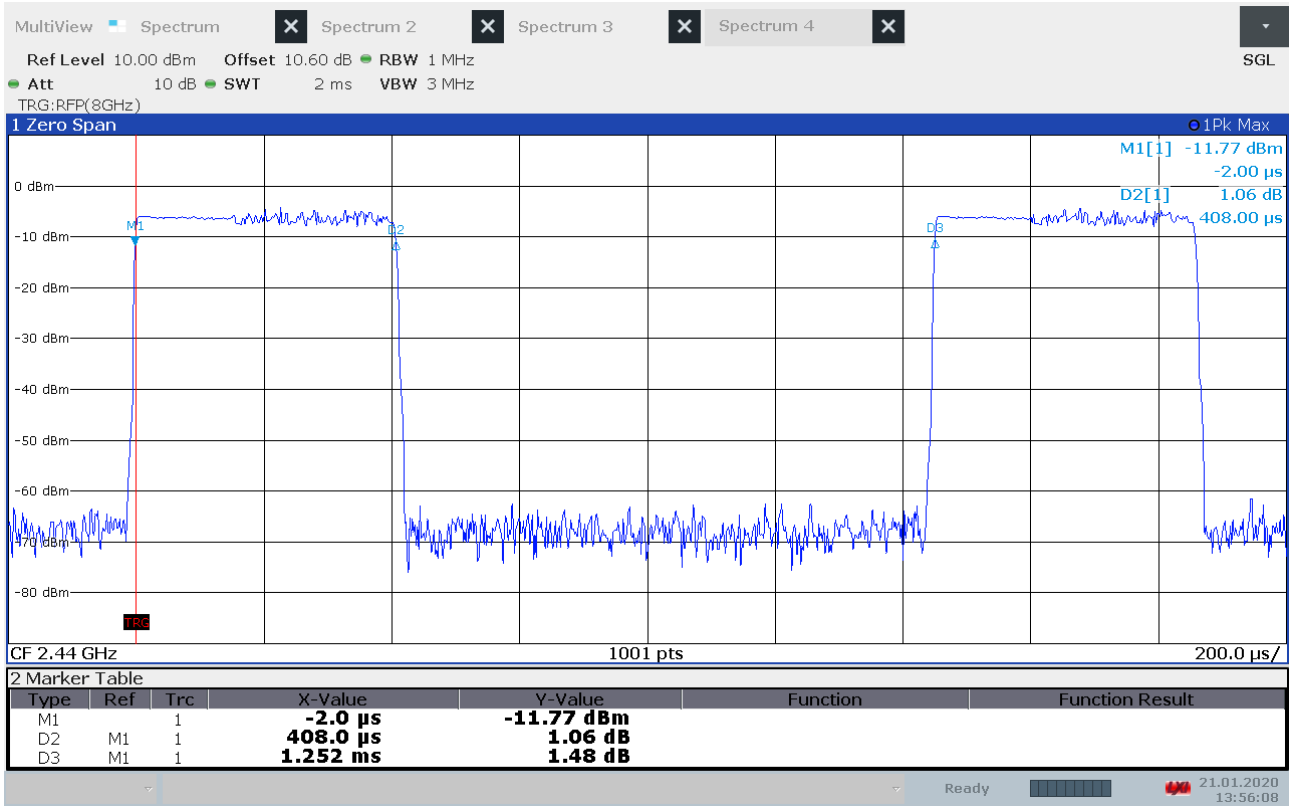
Burst Length, 2-DH1



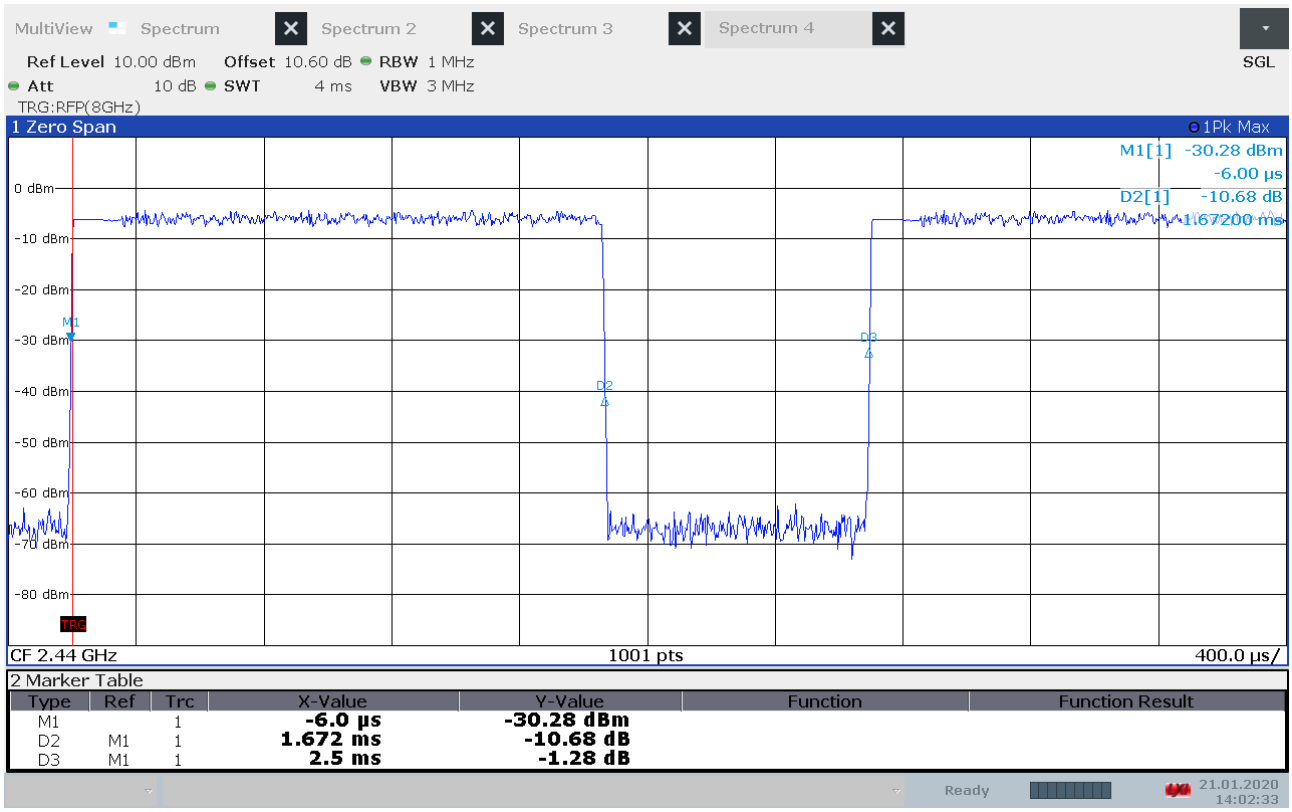
Burst Length, 2-DH3



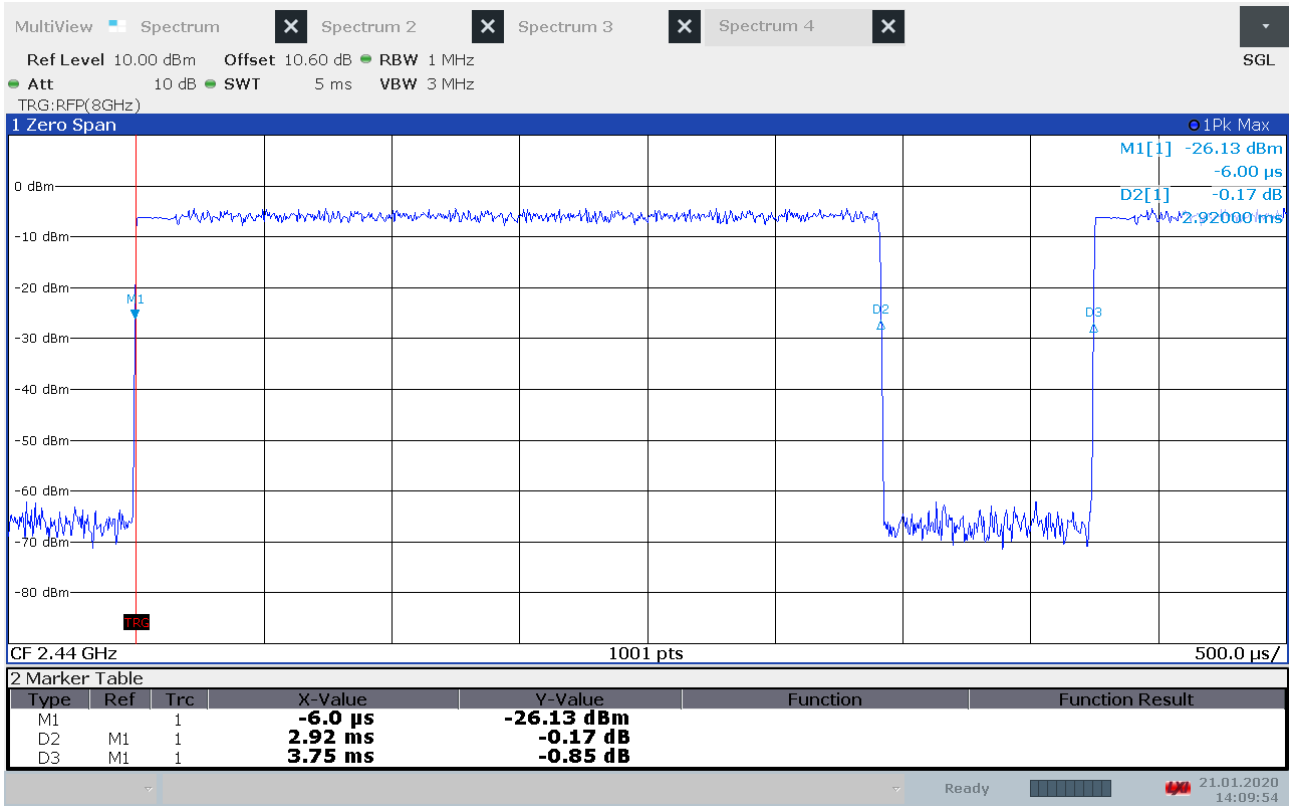
Burst Length, 2-DH5



Burst Length, 3-DH1



Burst Length, 3-DH3



Burst Length, 3-DH5

3.3 Occupied Bandwidth (99% BW) and Hopping Bandwidth

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:

Number of RF Channels in use:	**79**
Channel Centre Frequencies:	**2402 to 2480 with 1 MHz Channel Separation**

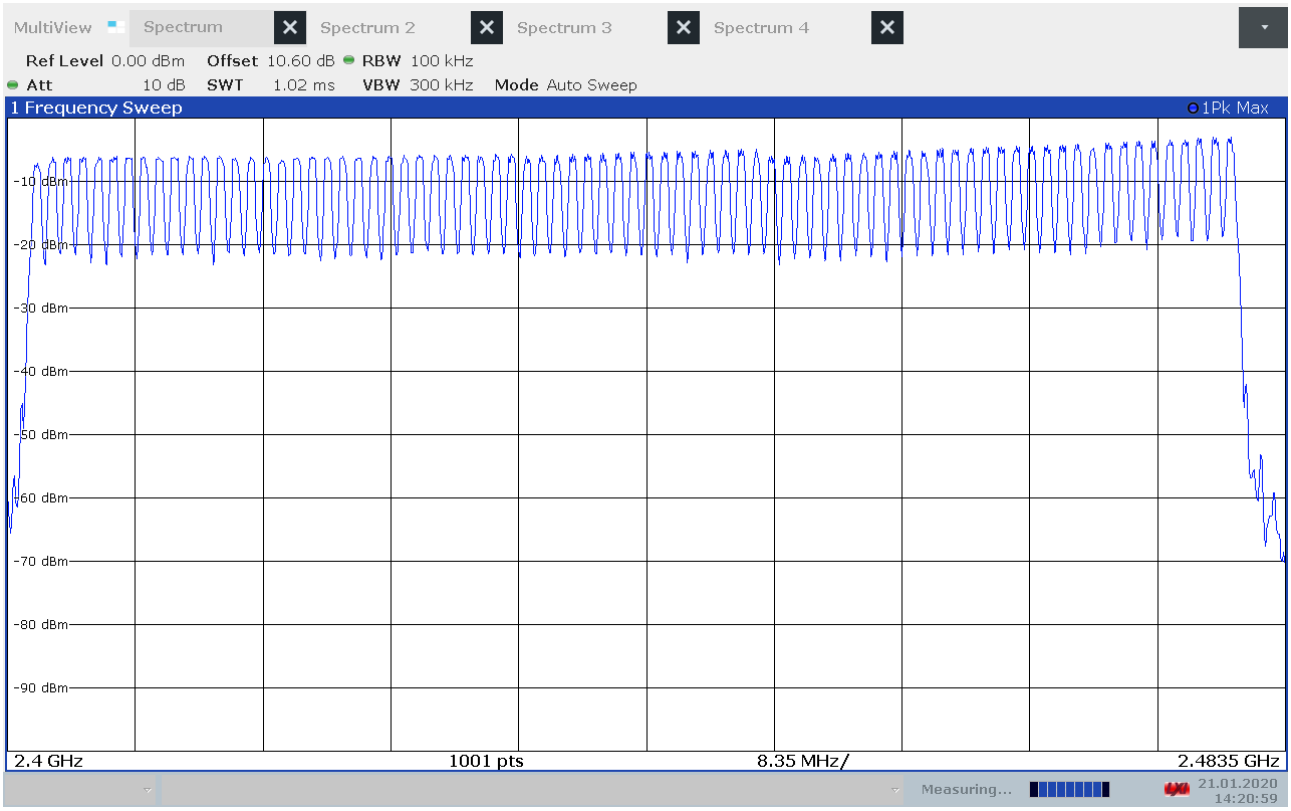
Modulation	Occupied Bandwidth (99% BW)		
	2402MHz	2440MHz	2480MHz
Basic Rate (GFSK)	840 kHz	862 kHz	865 kHz
2-EDR (π/4-DPSK)	1.16 MHz	1.16 MHz	1.16 MHz
3-EDR (8-DPSK)	1.14 MHz	1.14 MHz	1.14 MHz

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 requirement for 99% BW.

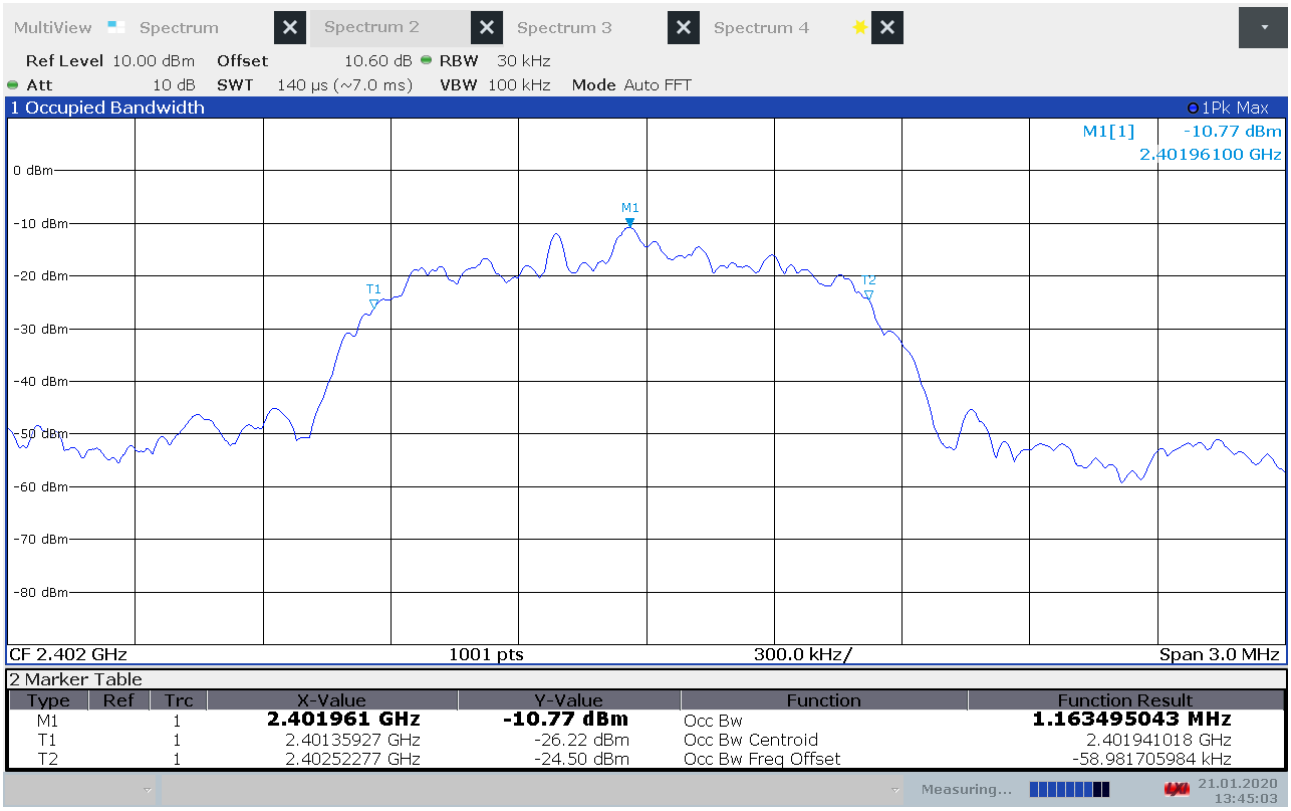


RF Channels in Use

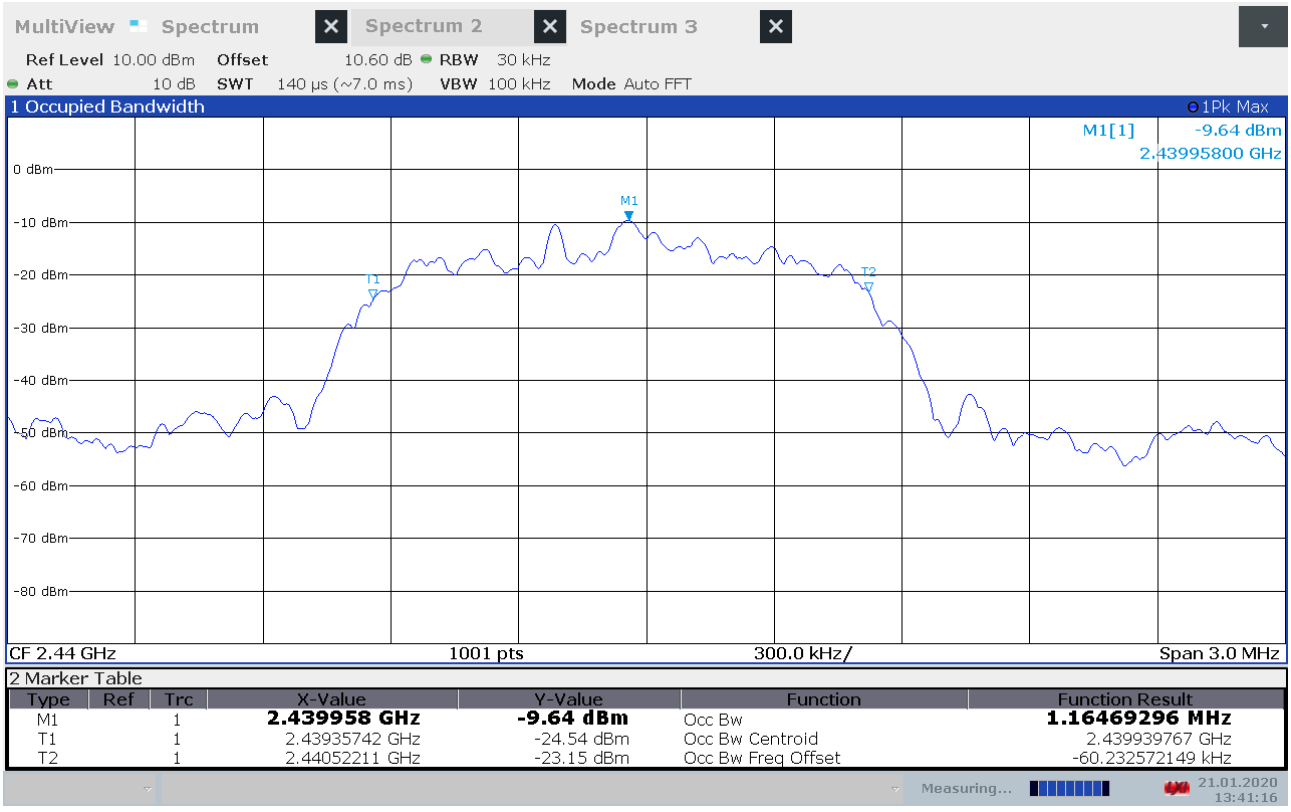
99% Bandwidth, GFSK, 2402MHz

99% Bandwidth, GFSK, 2440MHz

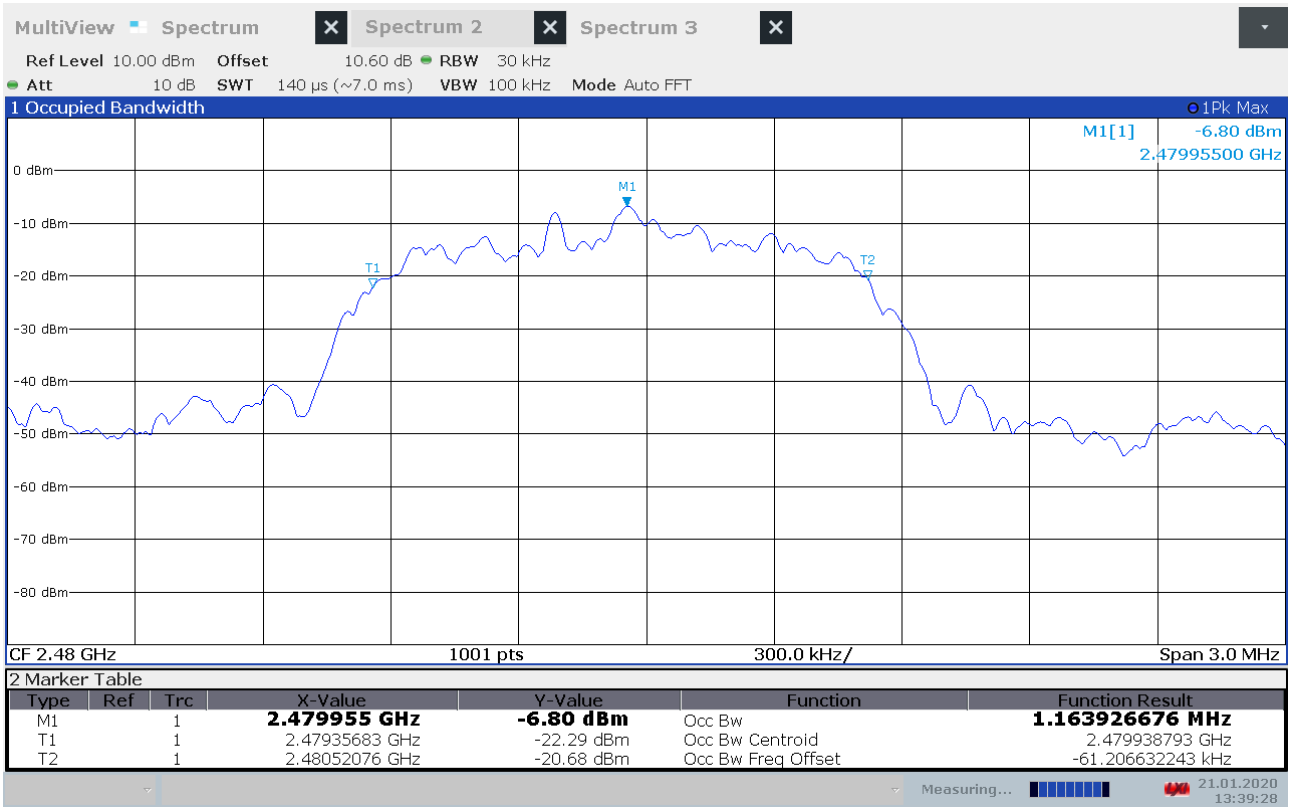
99% Bandwidth, GFSK, 2480MHz



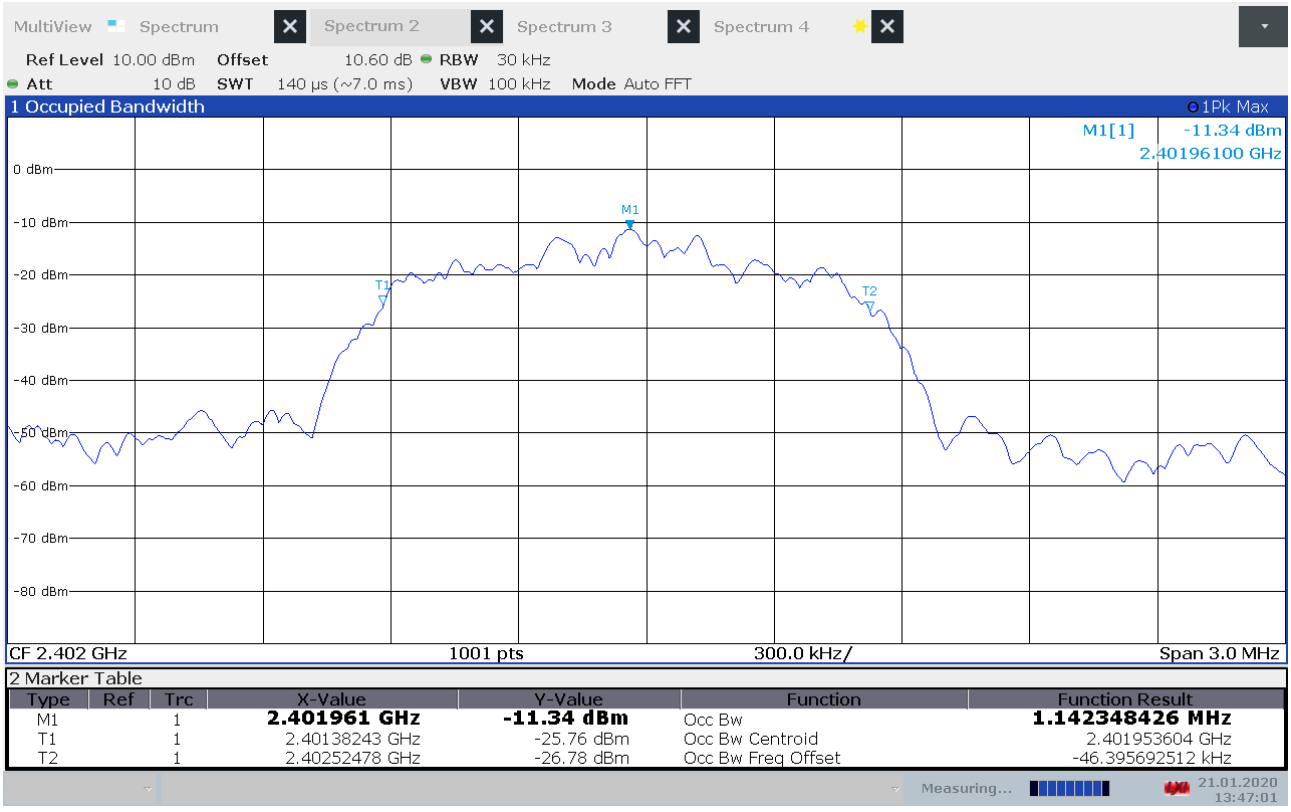
99% Bandwidth, π/4-DQPSK, 2402MHz



99% Bandwidth, π/4-DQPSK, 2440MHz

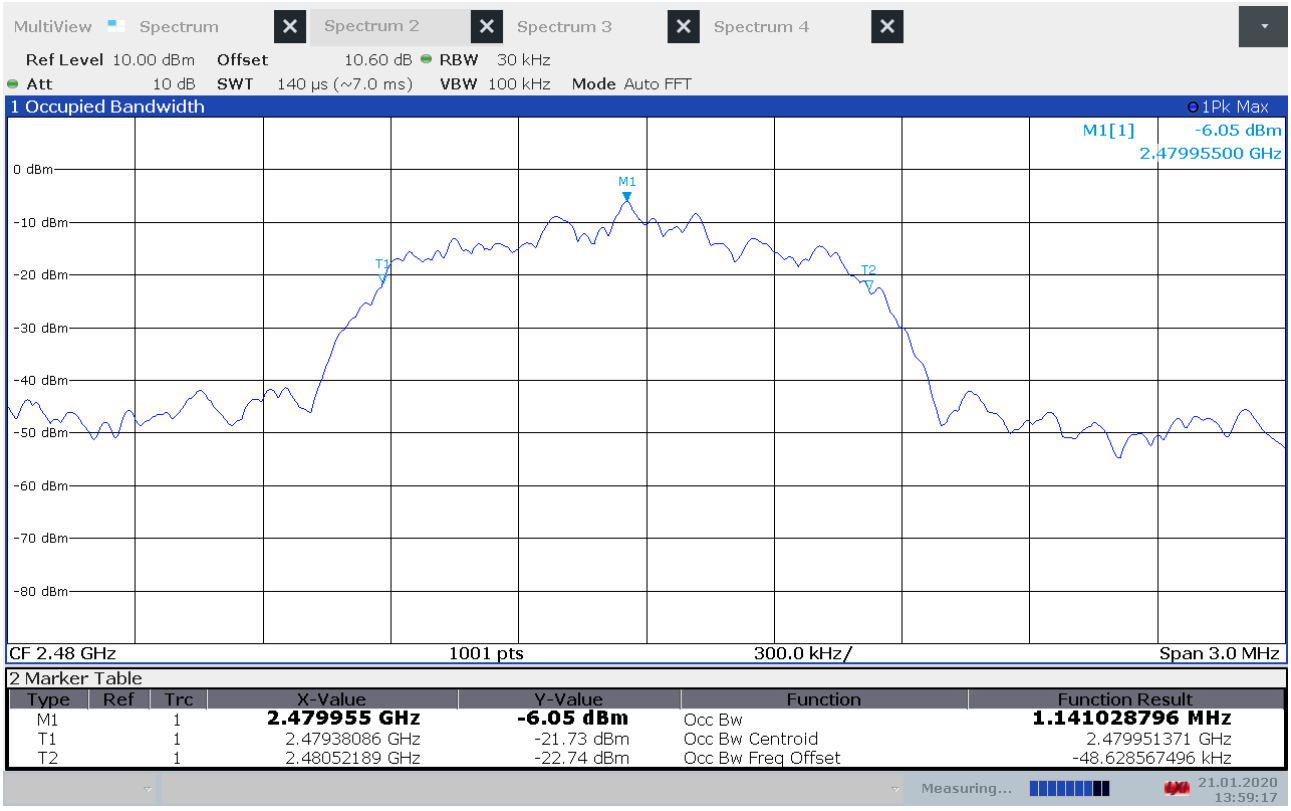


99% Bandwidth, π/4-DQPSK, 2480MHz



99% Bandwidth, 8-DPSK, 2402MHz

99% Bandwidth, 8-DPSK, 2440MHz



99% Bandwidth, 8-DPSK, 2480MHz

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:

Peak Power				
	Modulation	2402 MHz	2440 MHz	2480 MHz
Conducted Power (dBm)	GFSK	-2.08	-0.64	1.88
Conducted Power (dBm)	π/4-DQPSK	-5.86	-4.30	-1.76
Conducted Power (dBm)	8-DPSK	-5.08	-3.54	-1.04
Conducted Power (mW)	GFSK	0.62	0.86	1.54
Conducted Power (mW)	π/4-DQPSK	0.26	0.37	0.67
Conducted Power (mW)	8-DPSK	0.31	0.44	0.79

Output Power reported is Maximum Peak Power.

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

See attached plots.

Requirements:

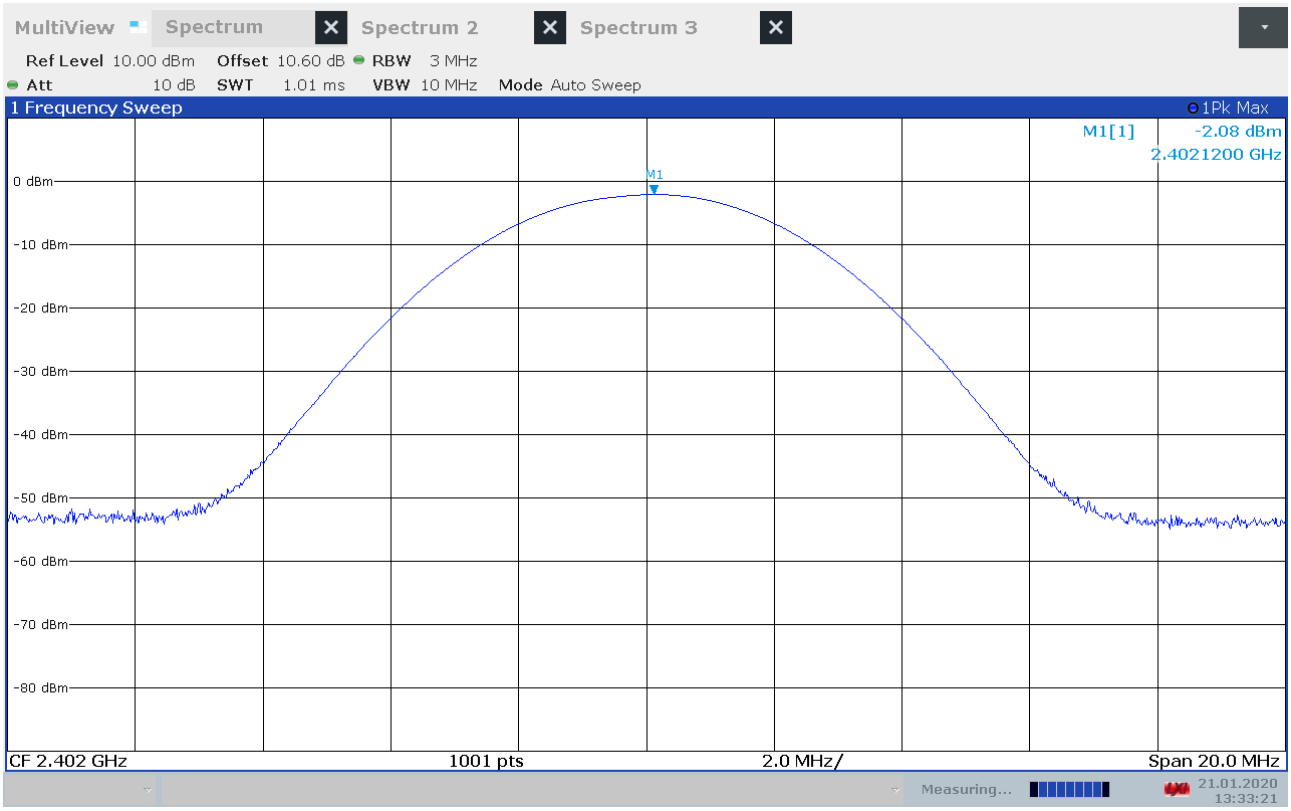
The maximum peak output power shall not exceed the following limits:

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

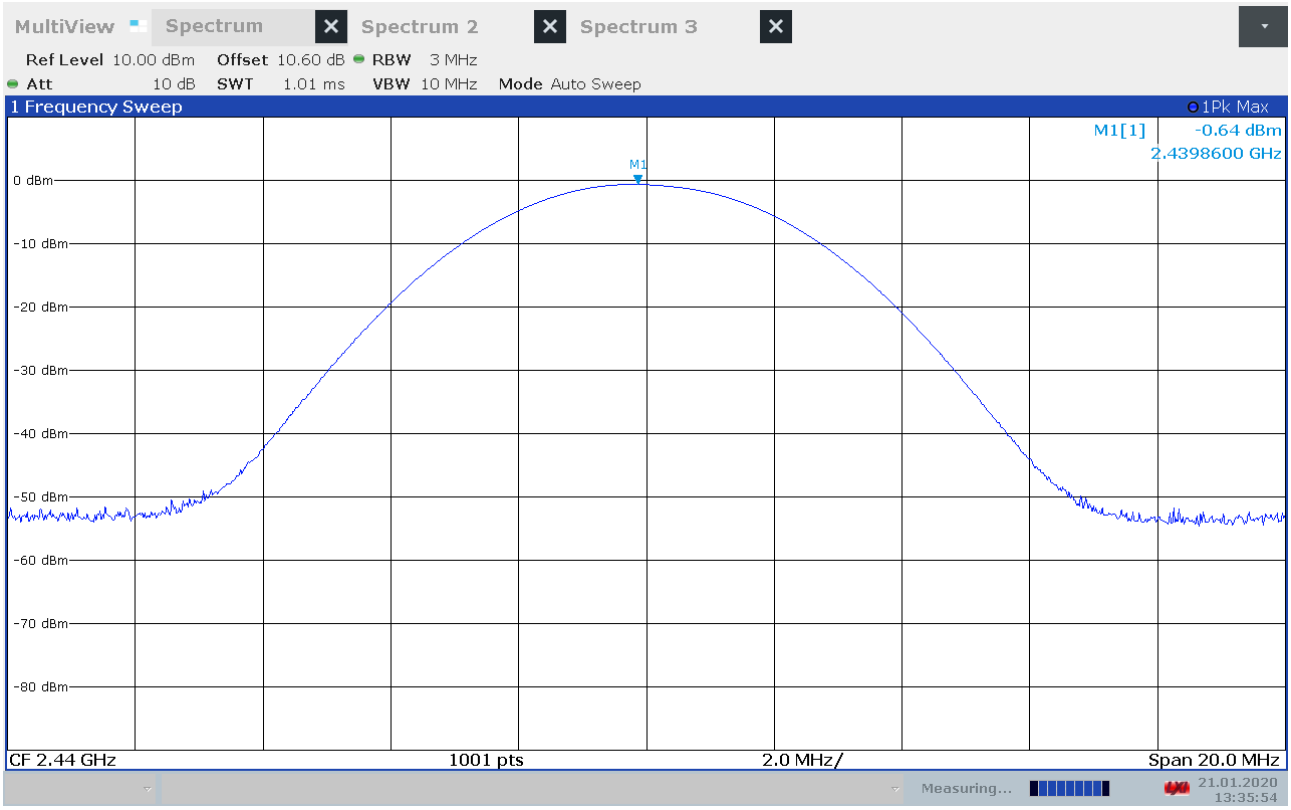
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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

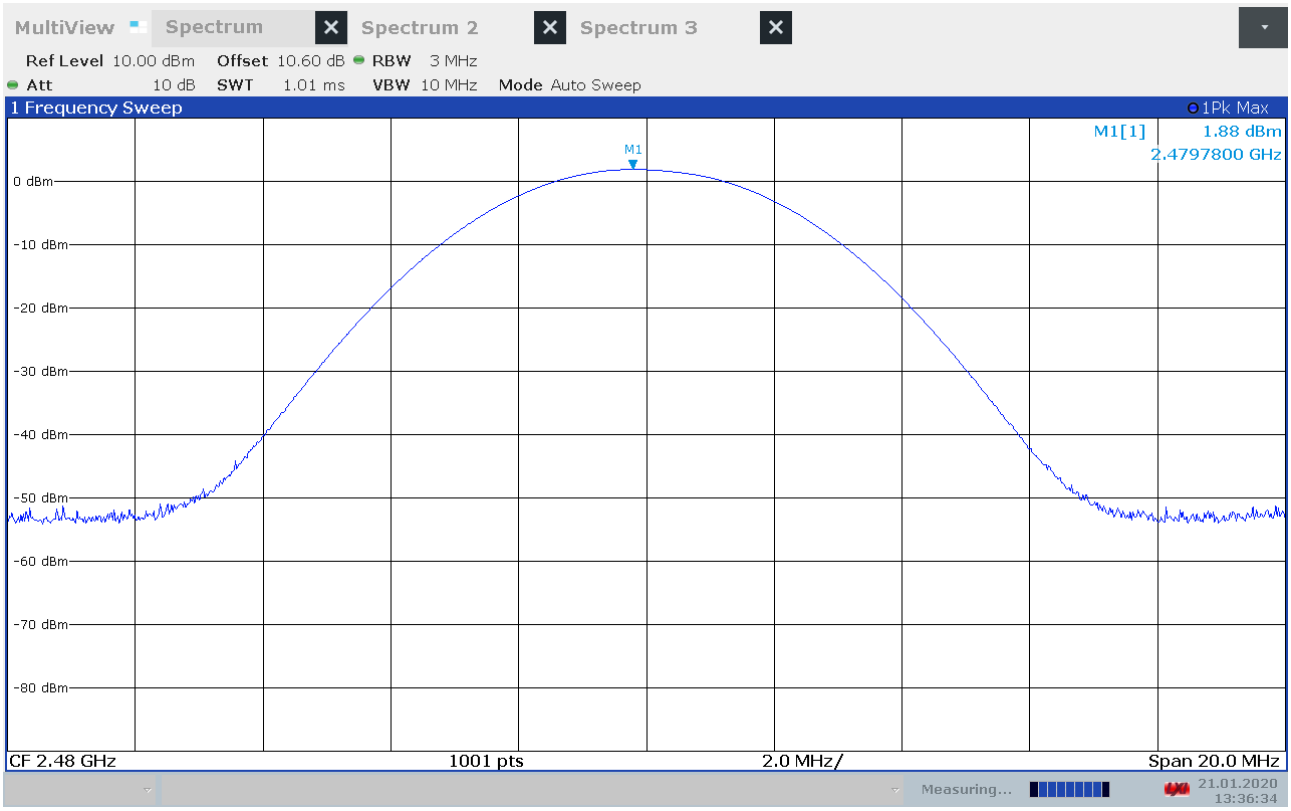
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



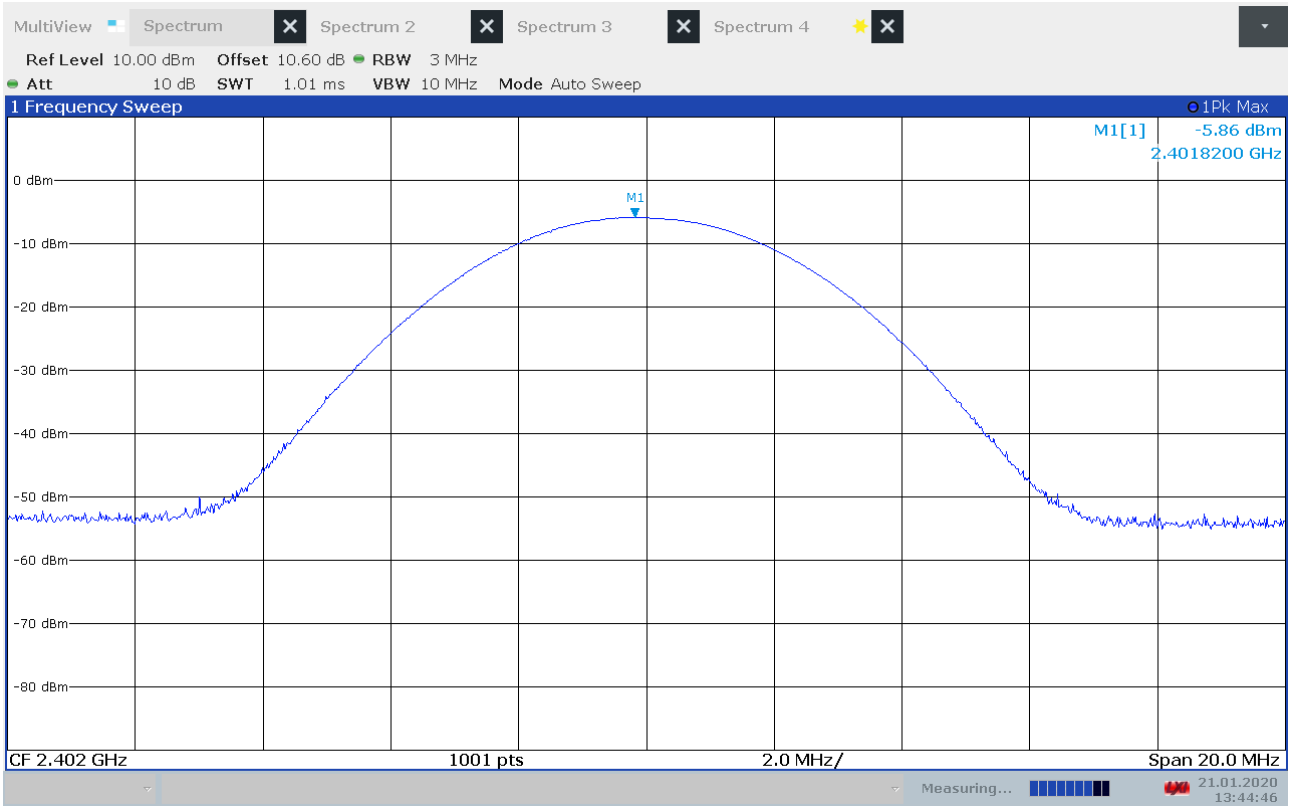
Output Power, 2402 MHz, GFSK



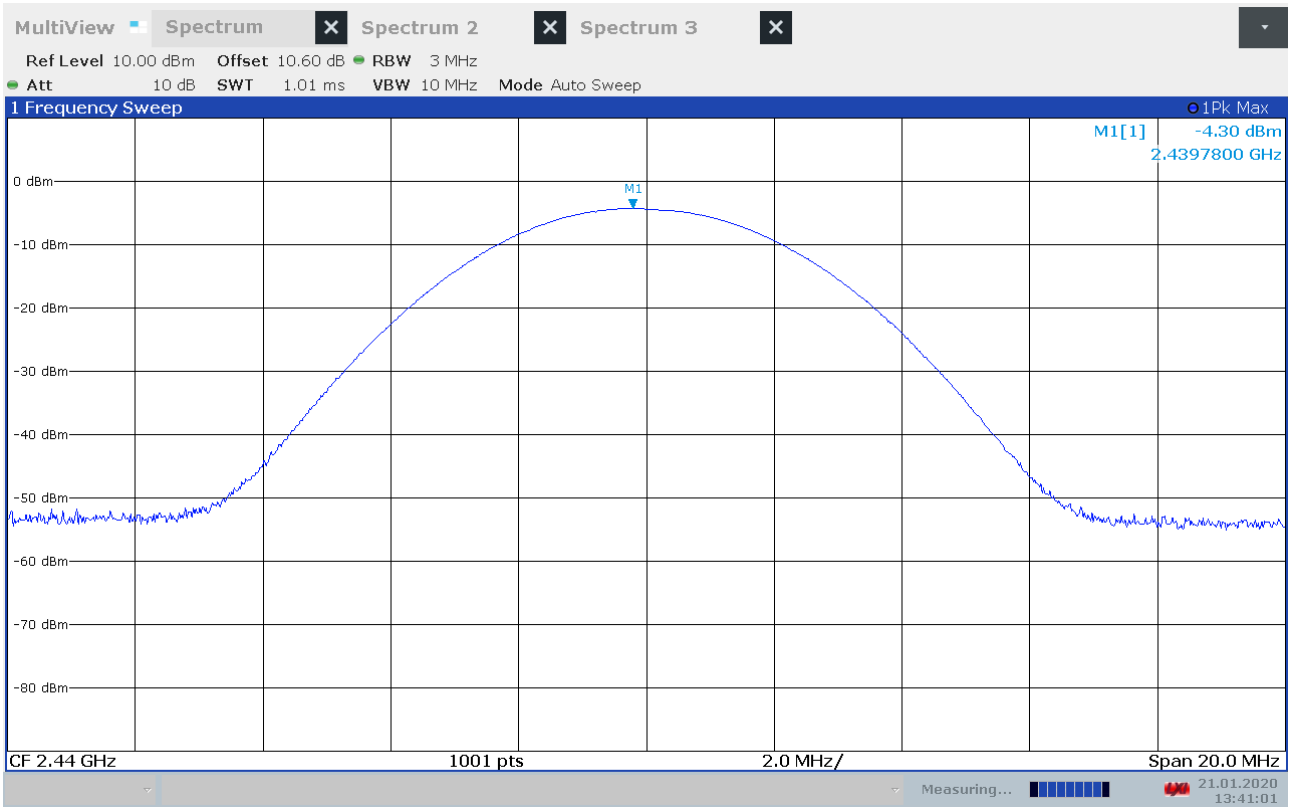
Output Power, 2440 MHz, GFSK



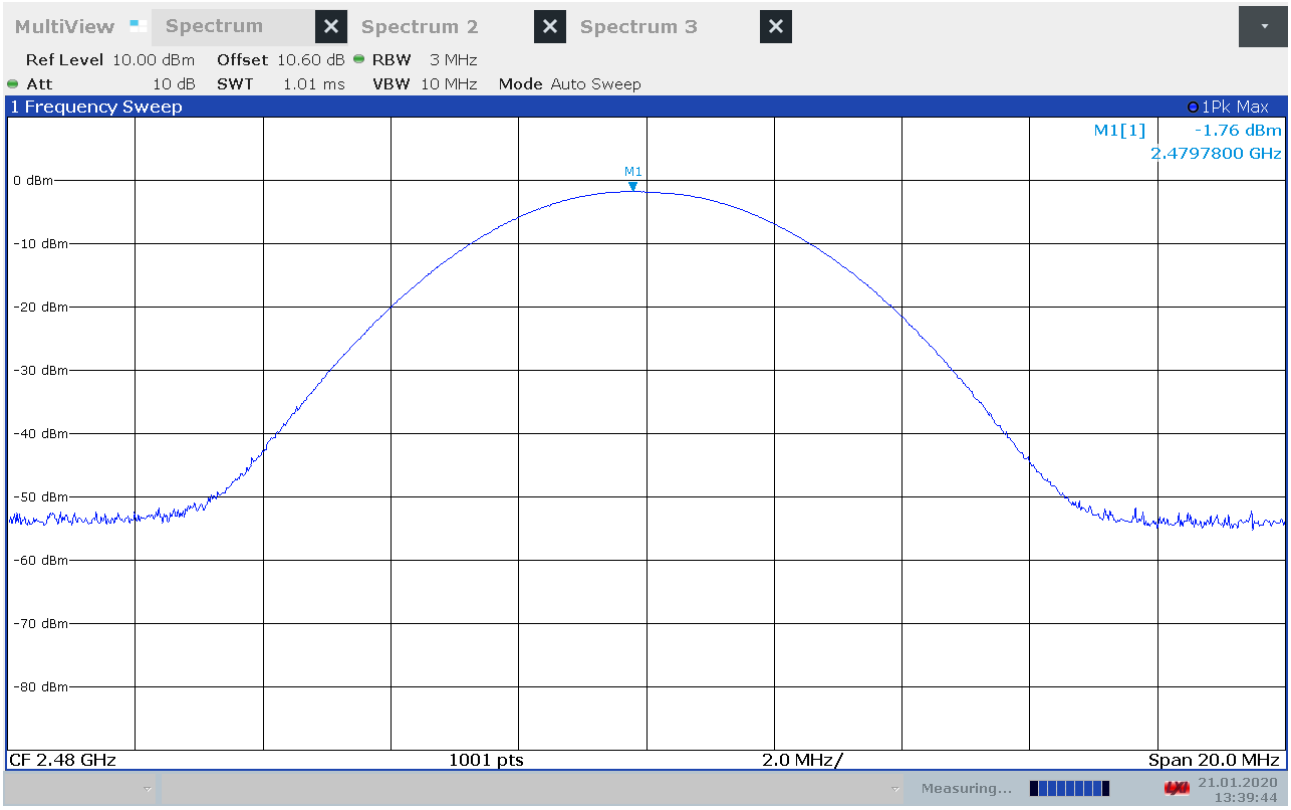
Output Power, 2480 MHz, GFSK



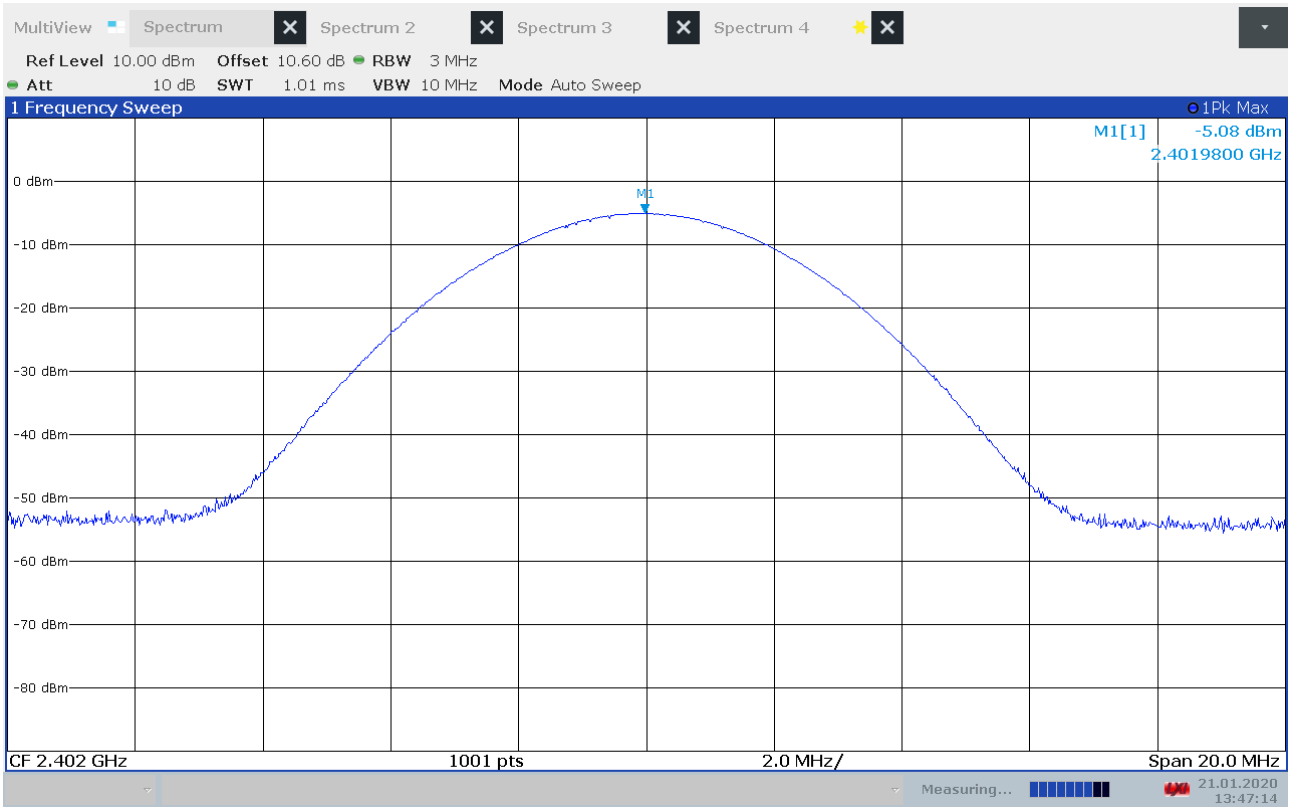
Output Power, 2402 MHz, π/4-DQPSK



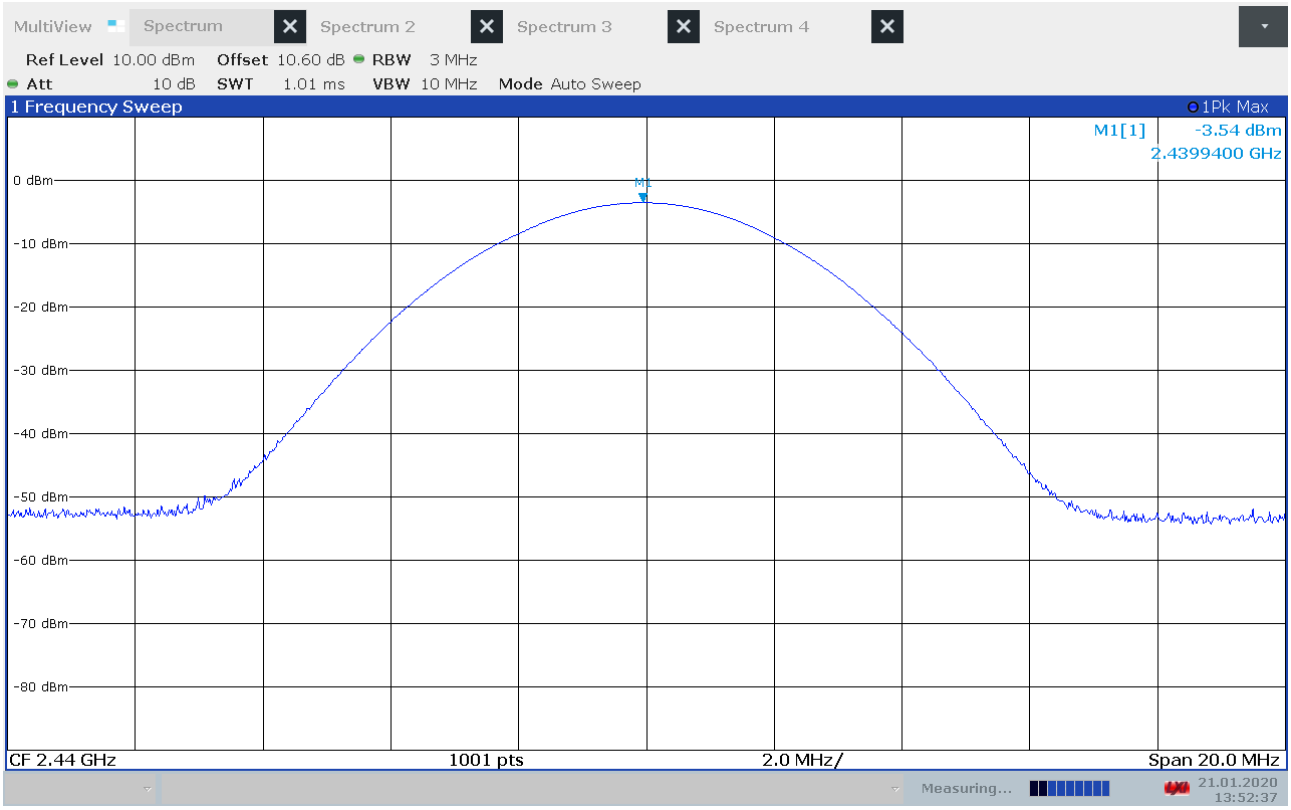
Output Power, 2440 MHz, π/4-DQPSK



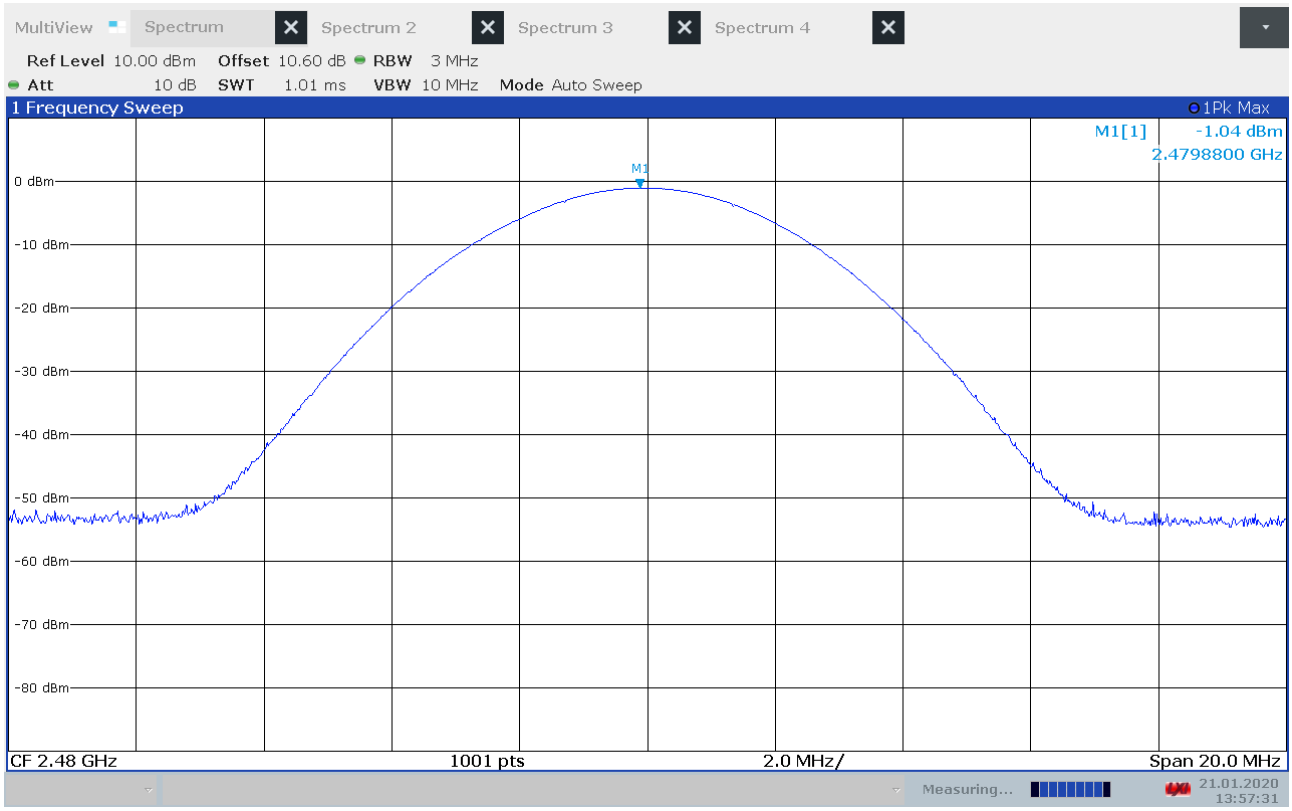
Output Power, 2480 MHz, π/4-DQPSK



Output Power, 2402 MHz, 8-DPSK



Output Power, 2440 MHz, 8-DPSK



Output Power, 2480 MHz, 8-DPSK

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
Hopping	> 40	> 20	Pass

Measured with Peak Detector

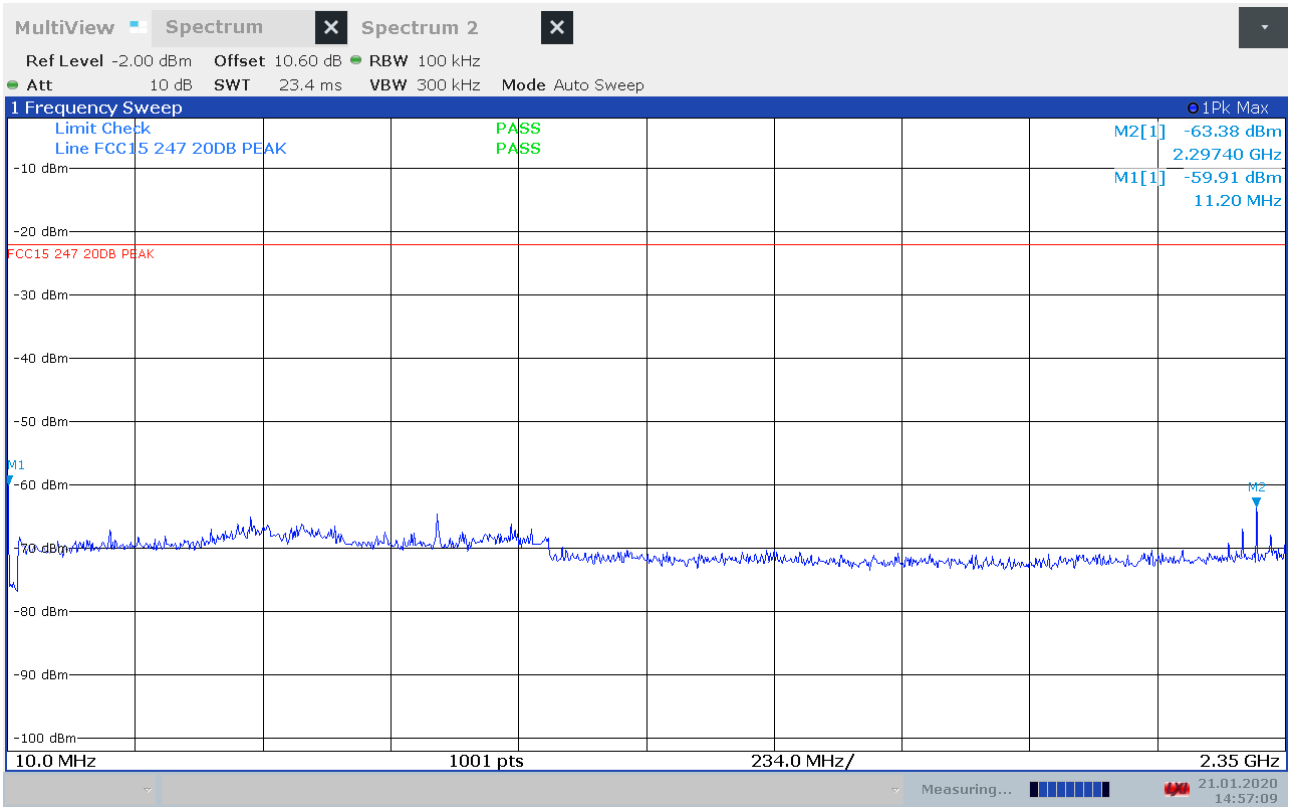
RF conducted power to 25 GHz: see attached plots.

Limit

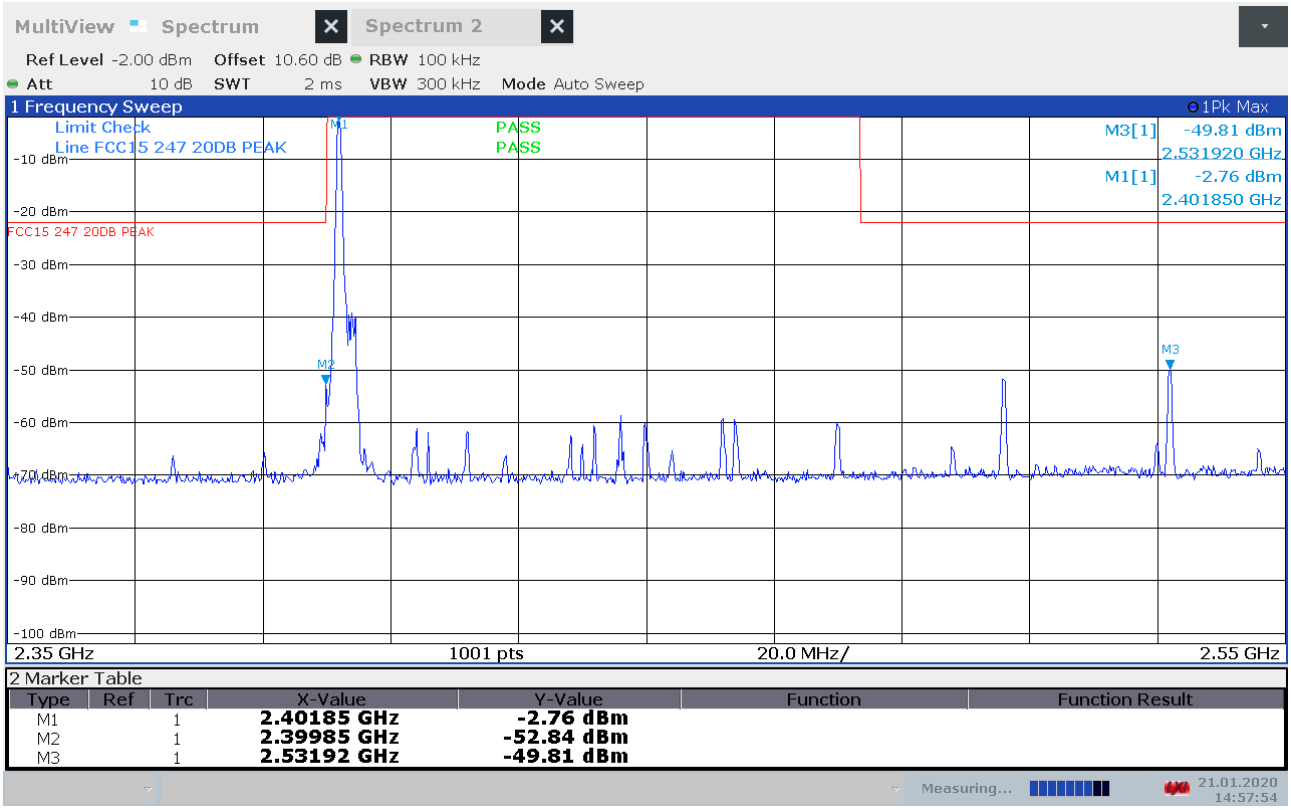
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

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

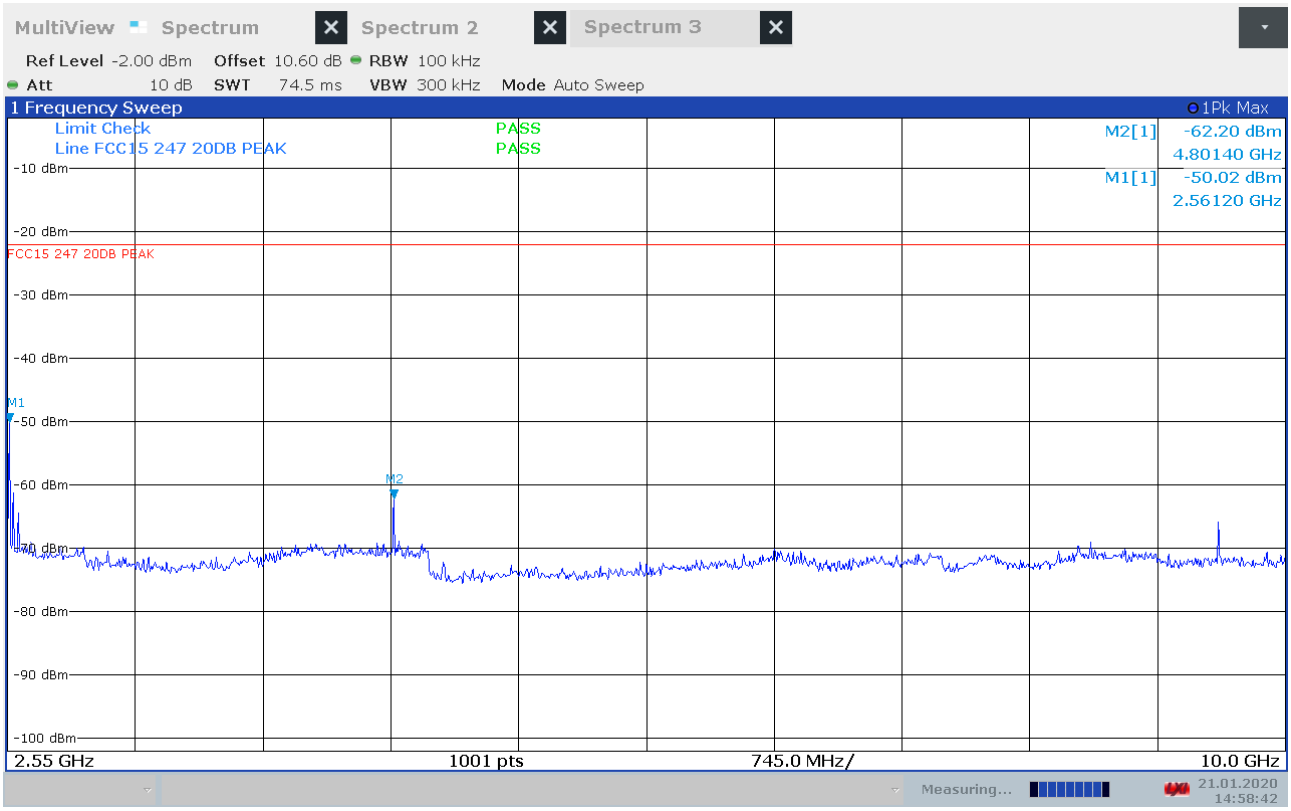
Attenuation below the general limits specified in part 15.209(a) is not required.



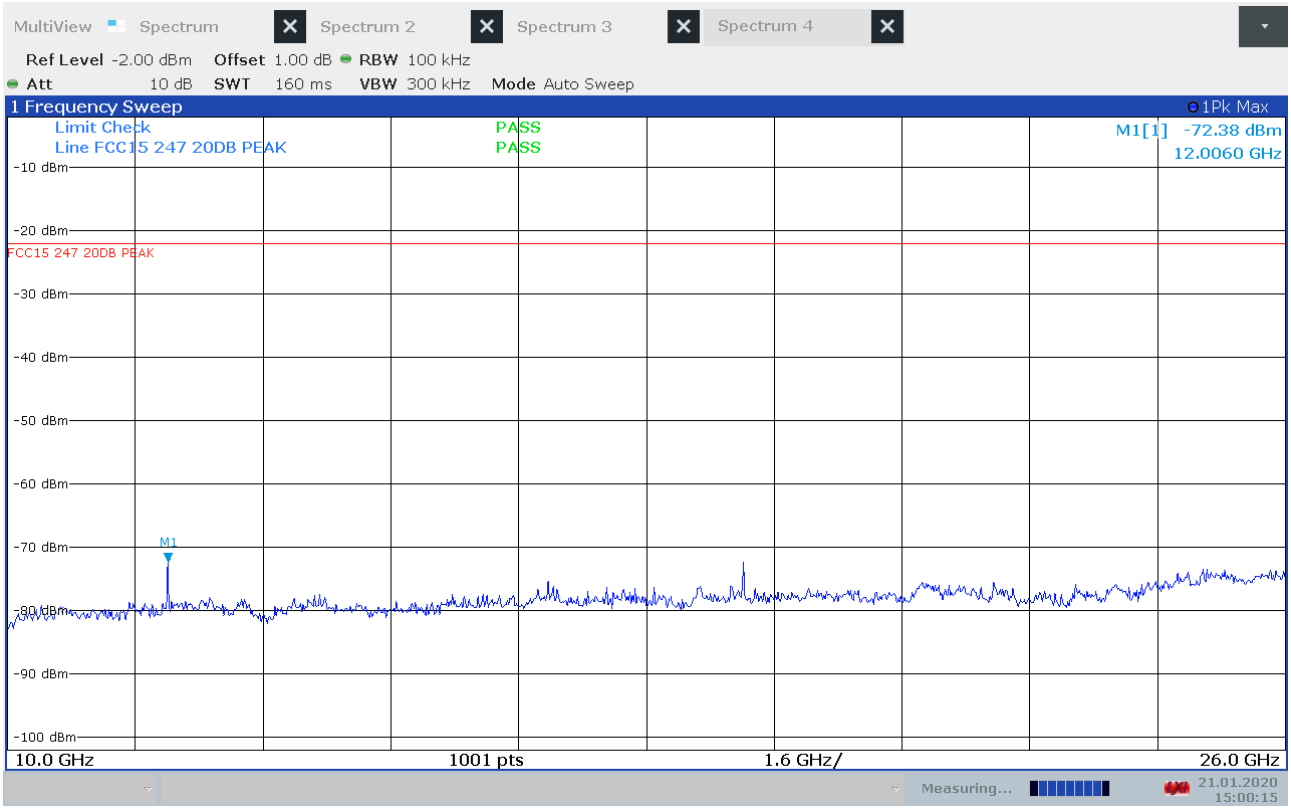
Conducted Emissions, 10 -2350 MHz, 2402 MHz, GFSK



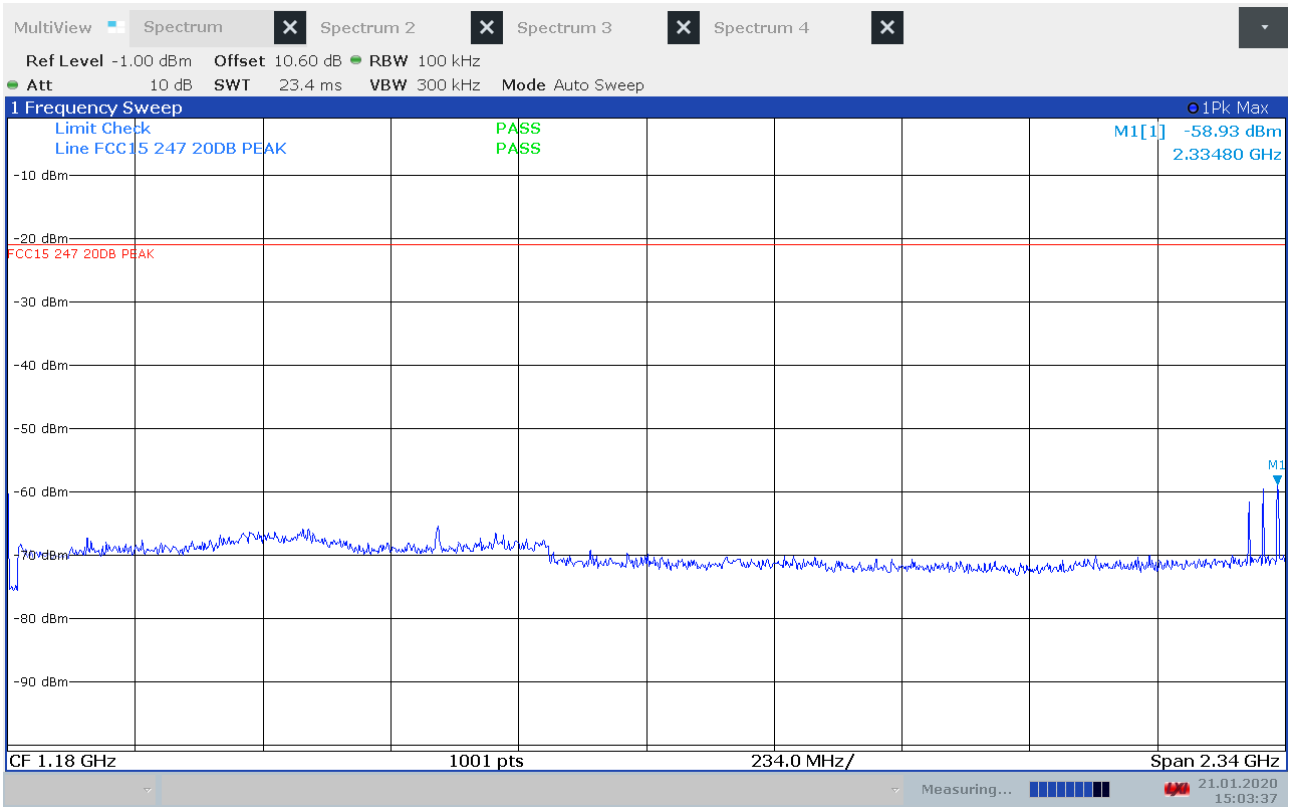
Conducted Emissions, 2350 -2550 MHz, 2402 MHz, GFSK



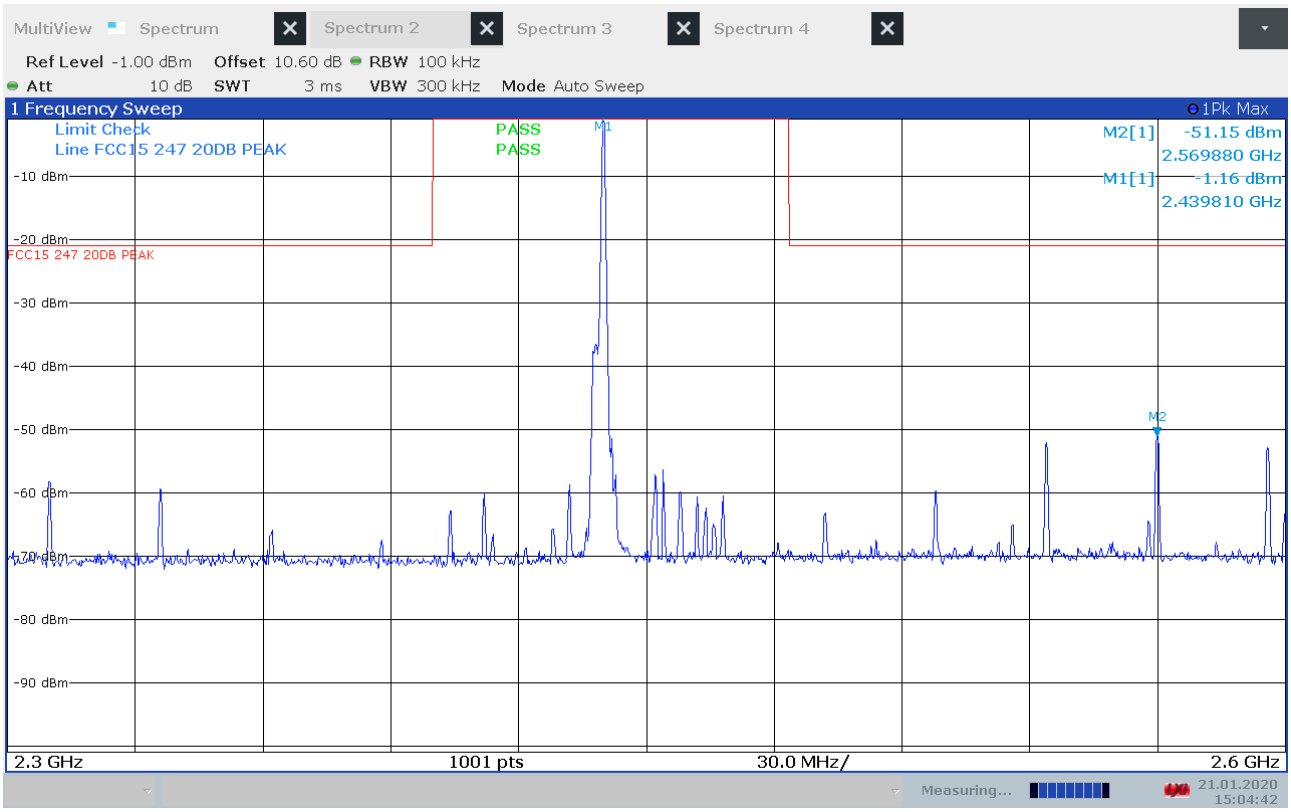
Conducted Emissions, 2550 -10000 MHz, 2402 MHz, GFSK



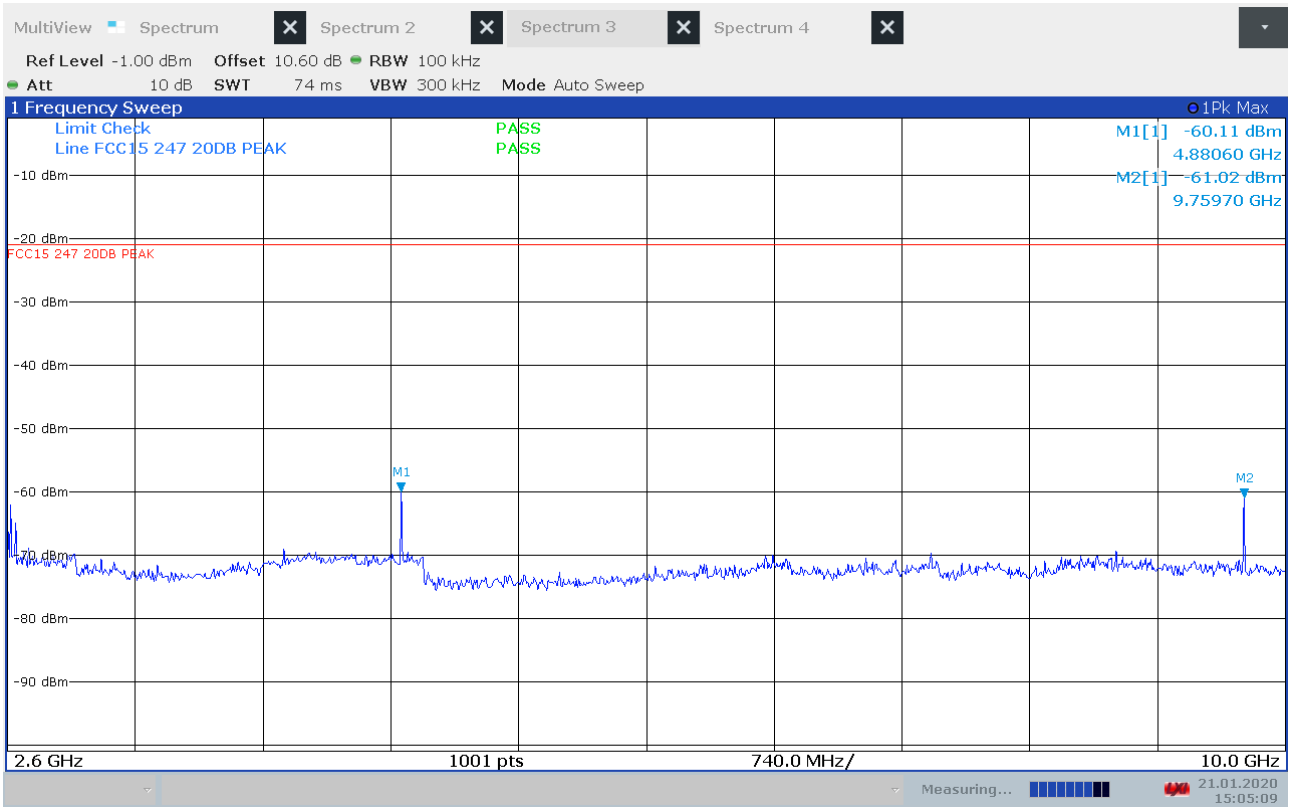
Conducted Emissions, 10000 -26000 MHz, 2402 MHz, GFSK



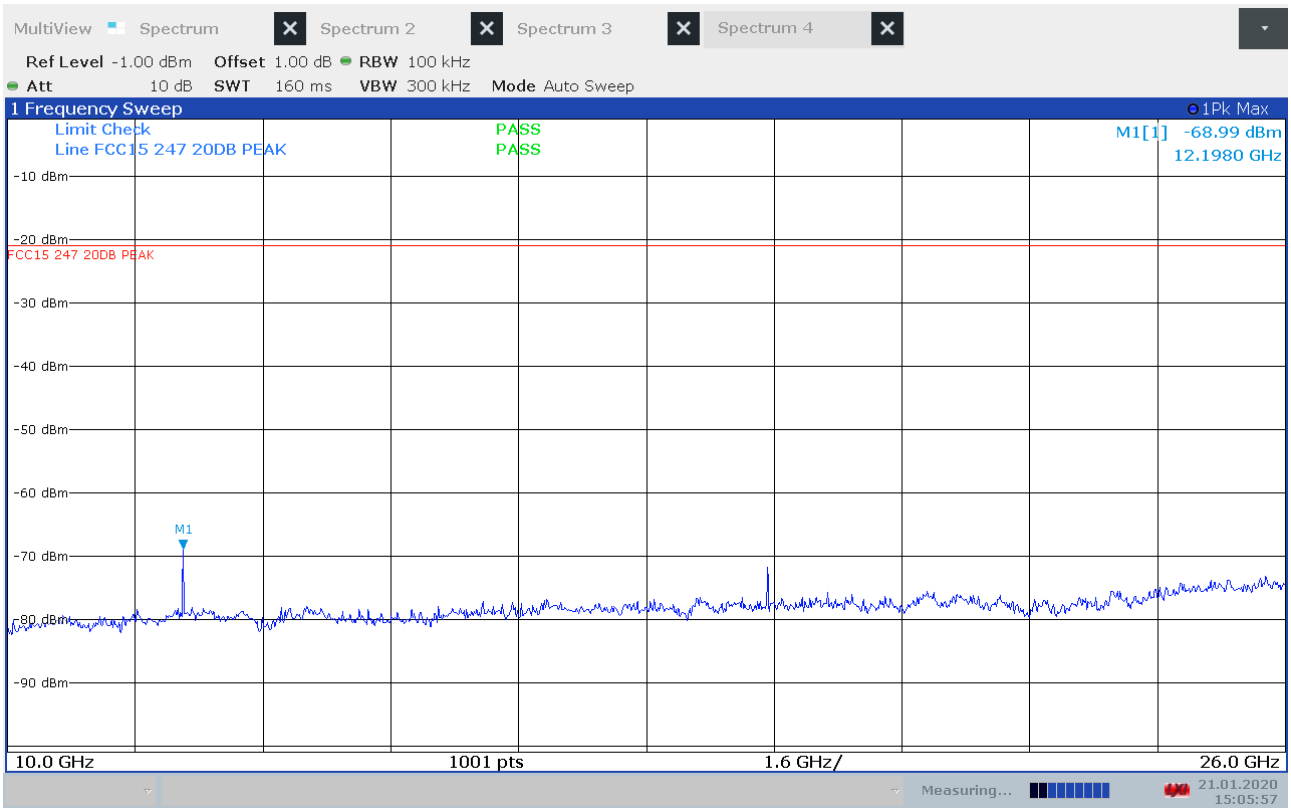
Conducted Emissions, 10 -2350 MHz, 2440 MHz, GFSK



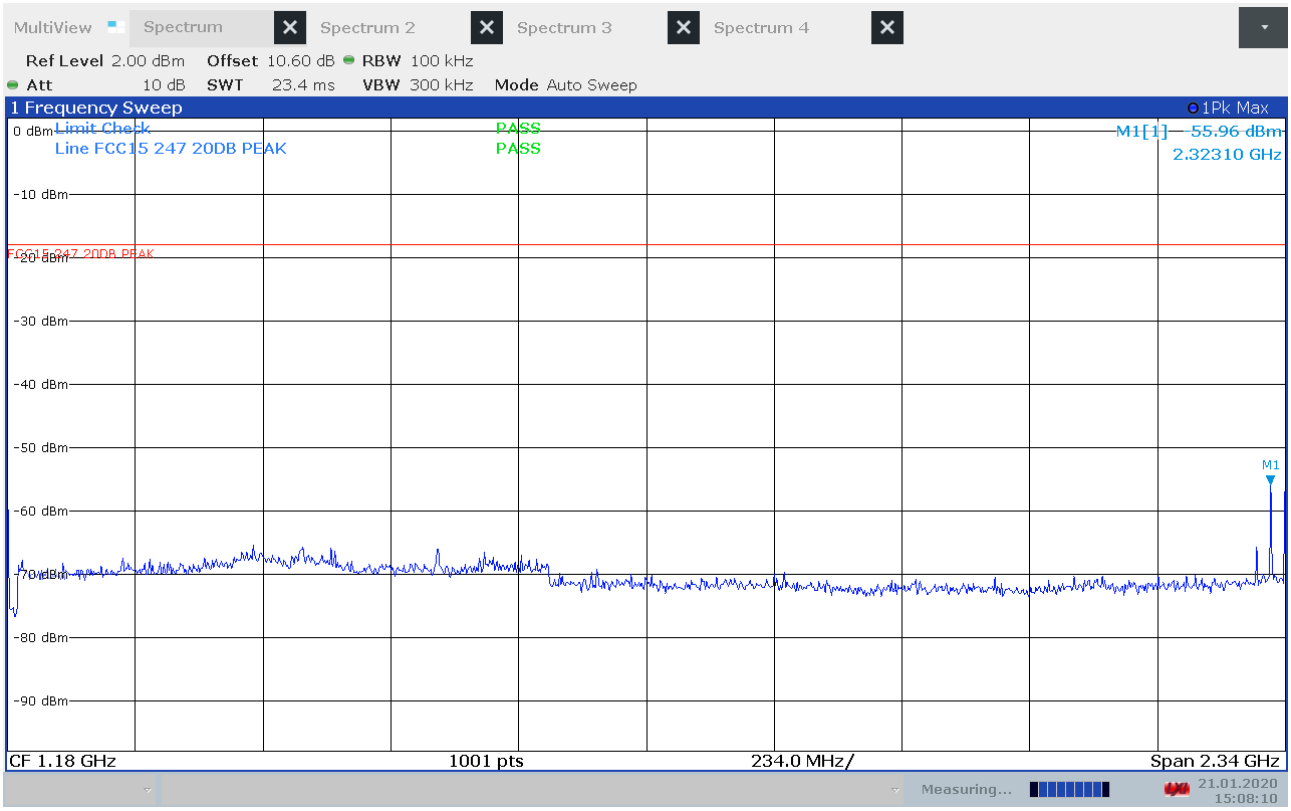
Conducted Emissions, 2300 -2600 MHz, 2440 MHz, GFSK



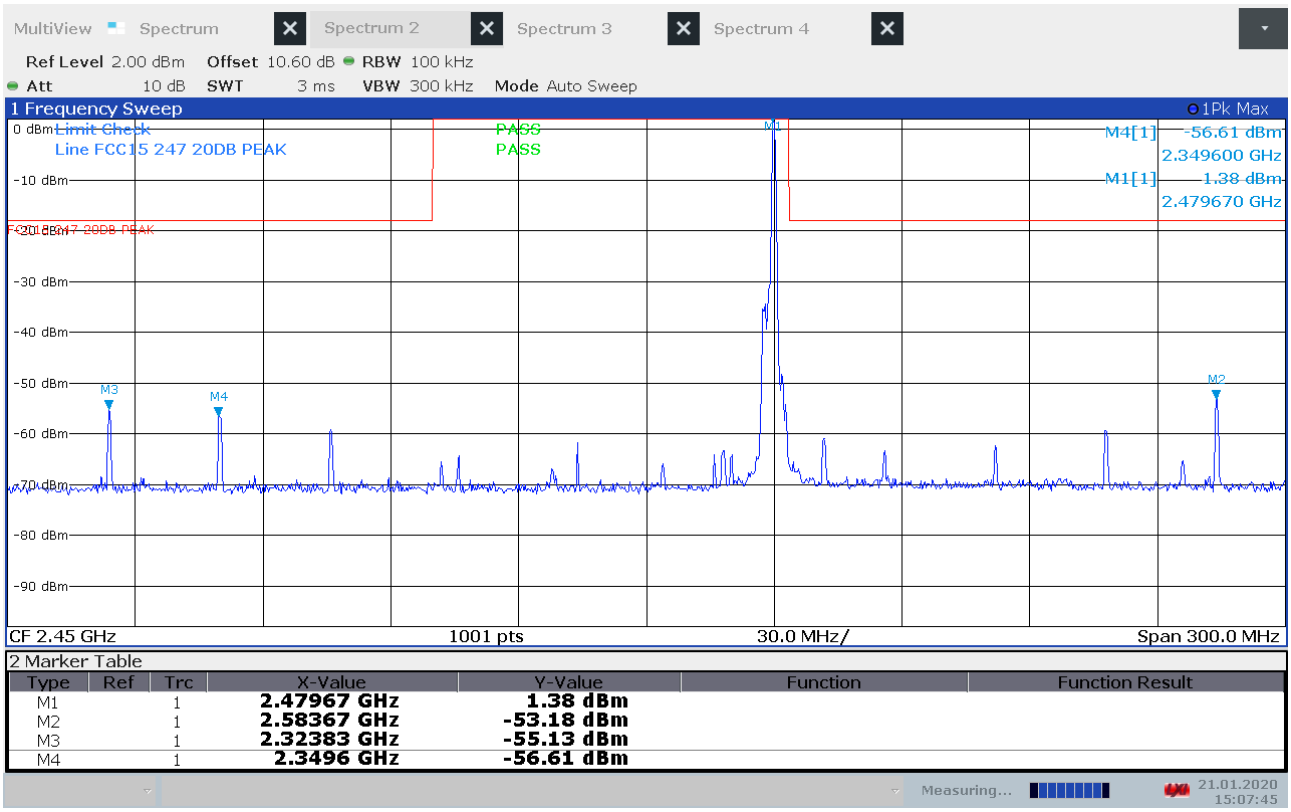
Conducted Emissions, 2600 -10000 MHz, 2440 MHz, GFSK



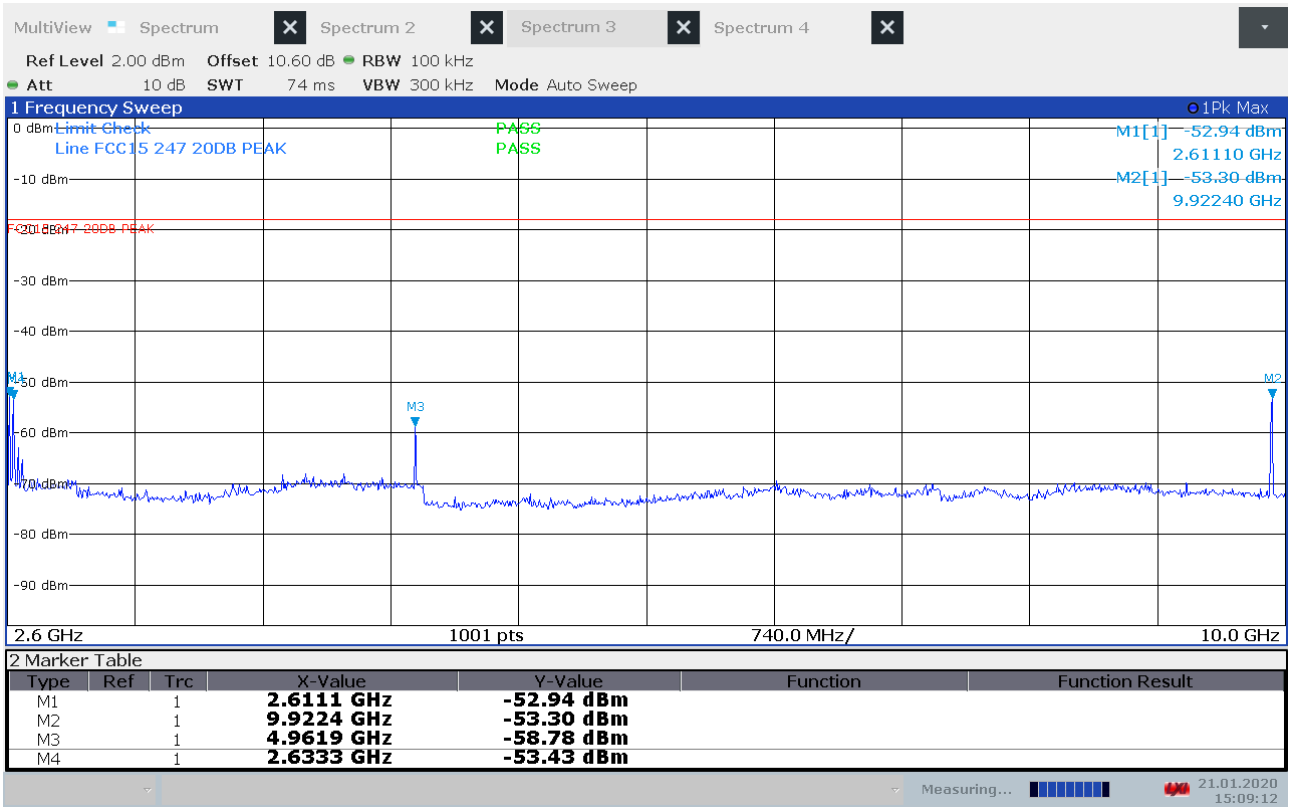
Conducted Emissions, 10000 -26000 MHz, 2440 MHz, GFSK



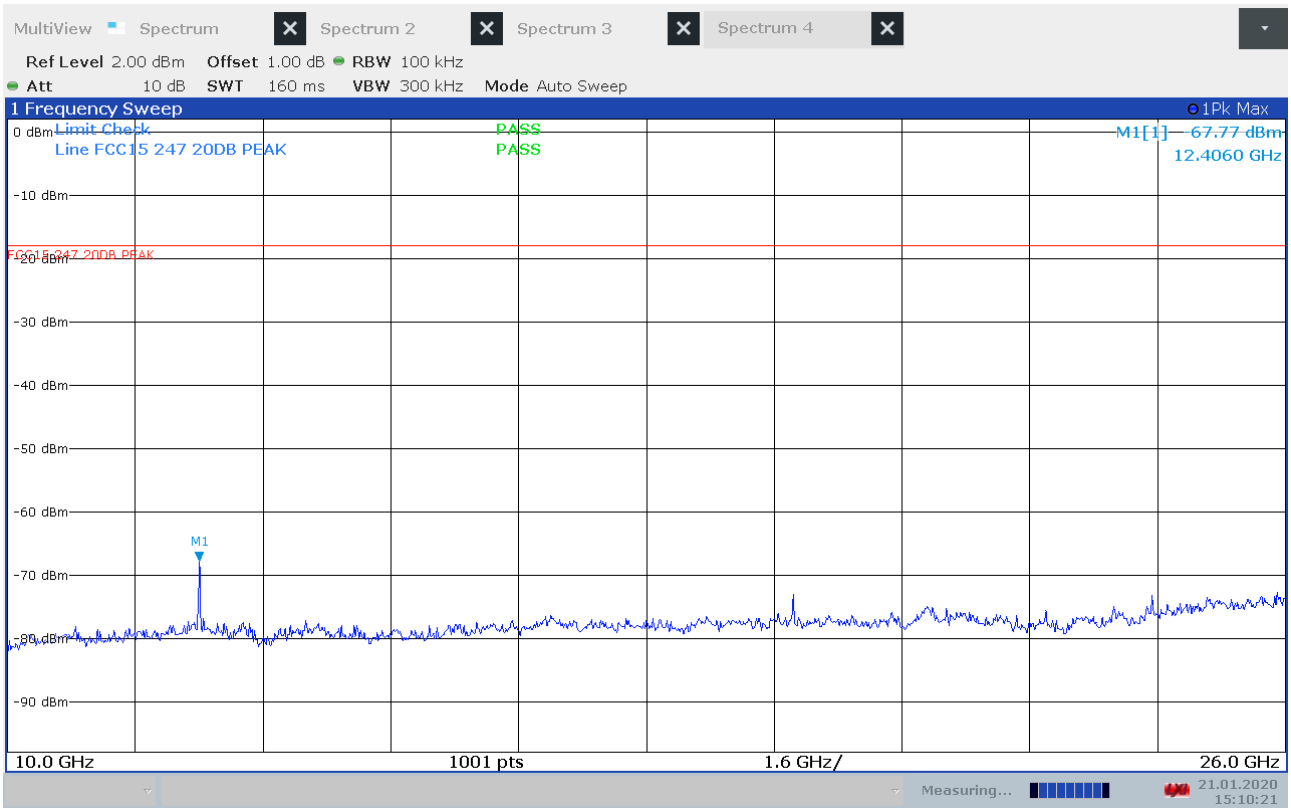
Conducted Emissions, 10 -2300 MHz, 2480 MHz, GFSK



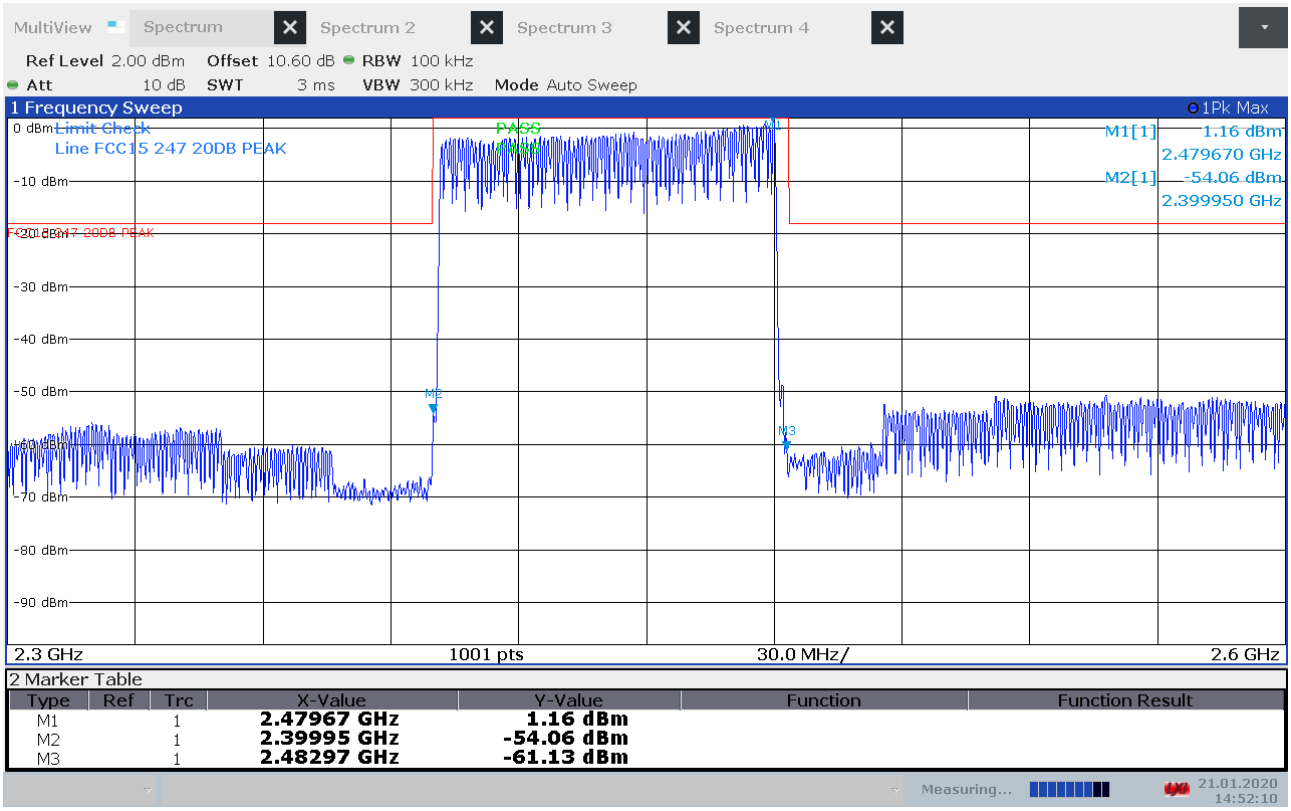
Conducted Emissions, 2300 -2600 MHz, 2480 MHz, GFSK



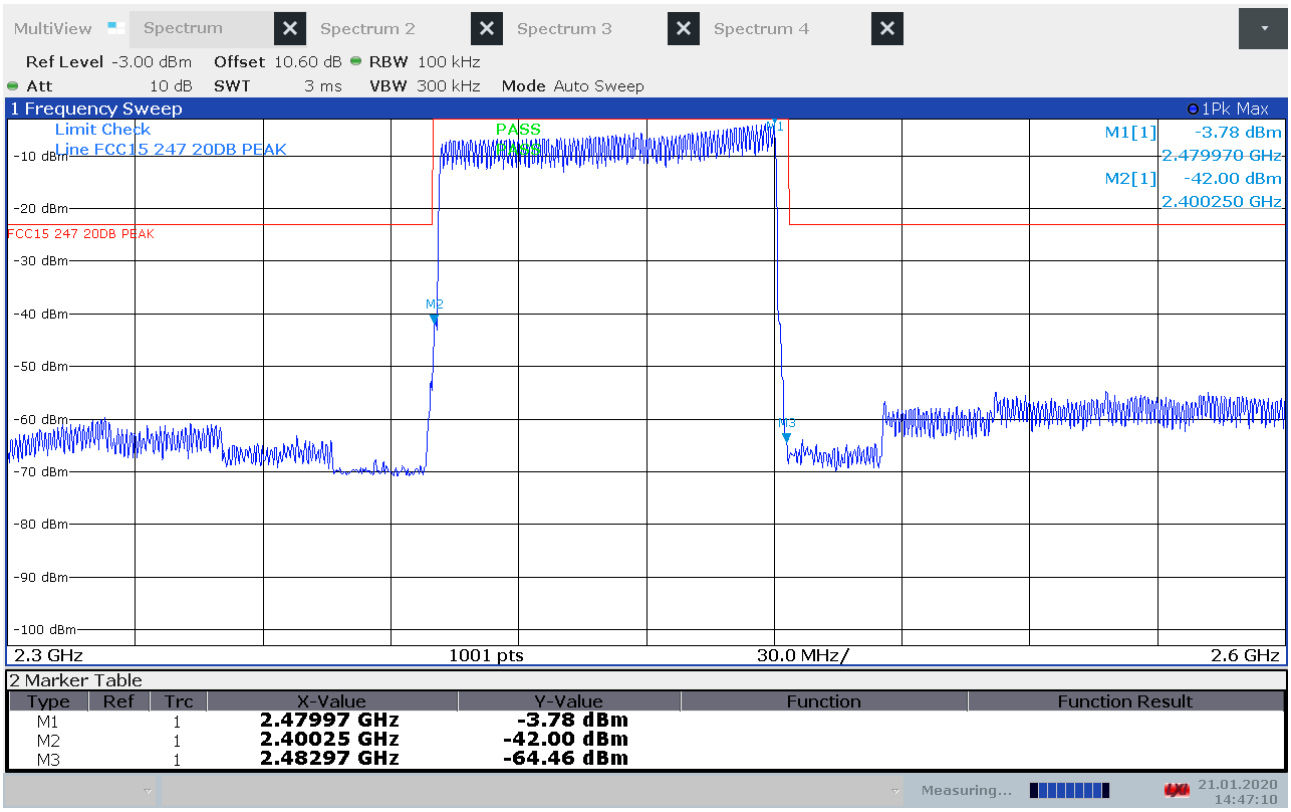
Conducted Emissions, 2600 -10000 MHz, 2480 MHz, GFSK



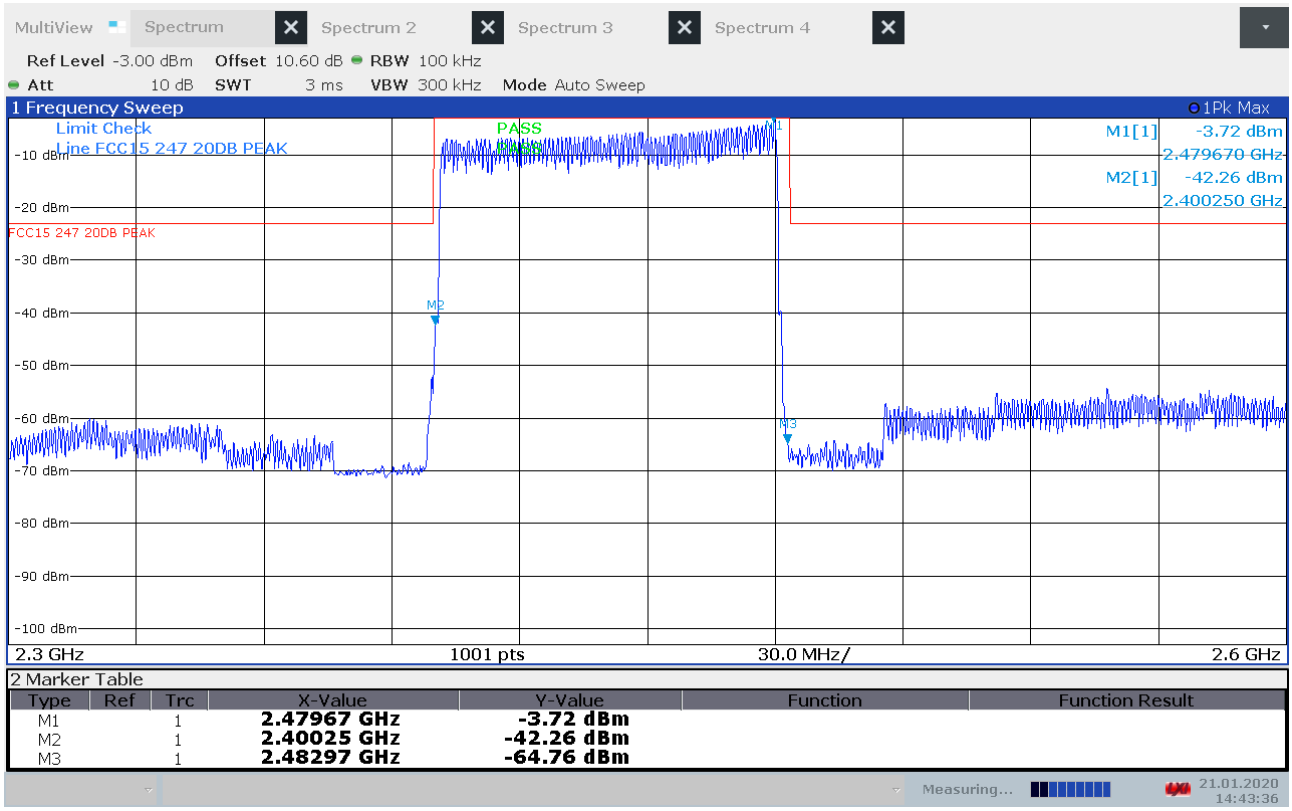
Conducted Emissions, 10000 -26000 MHz, 2480 MHz, GFSK



Conducted Emissions, 2300 -2600 MHz, Hopping, GFSK



Conducted Emissions, 2300 -2600 MHz, Hopping, π/4-DQPSK



Conducted Emissions, 2300 -2600 MHz, Hopping, 8-DPSK

3.6 Restricted Bands of operation

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

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

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

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

3.7 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:

Detector	Modulation	Measured field strength (dBµV/m)		Limit	Margin	
		2390 MHz	2483.5 MHz	dBµV/m	dB	
Peak	GFSK	42.0	62.2	74	32.0	11.8
	π/-DQPSK	41.7	61.8	74	32.3	12.2
	8-DPSK	42.5	67.7	74	31.5	6.3
Average	GFSK	22.0	42.2	54	32.0	11.8
	π/-DQPSK	21.7	41.8	54	32.3	12.2
	8-DPSK	22.5	47.7	54	31.5	6.3

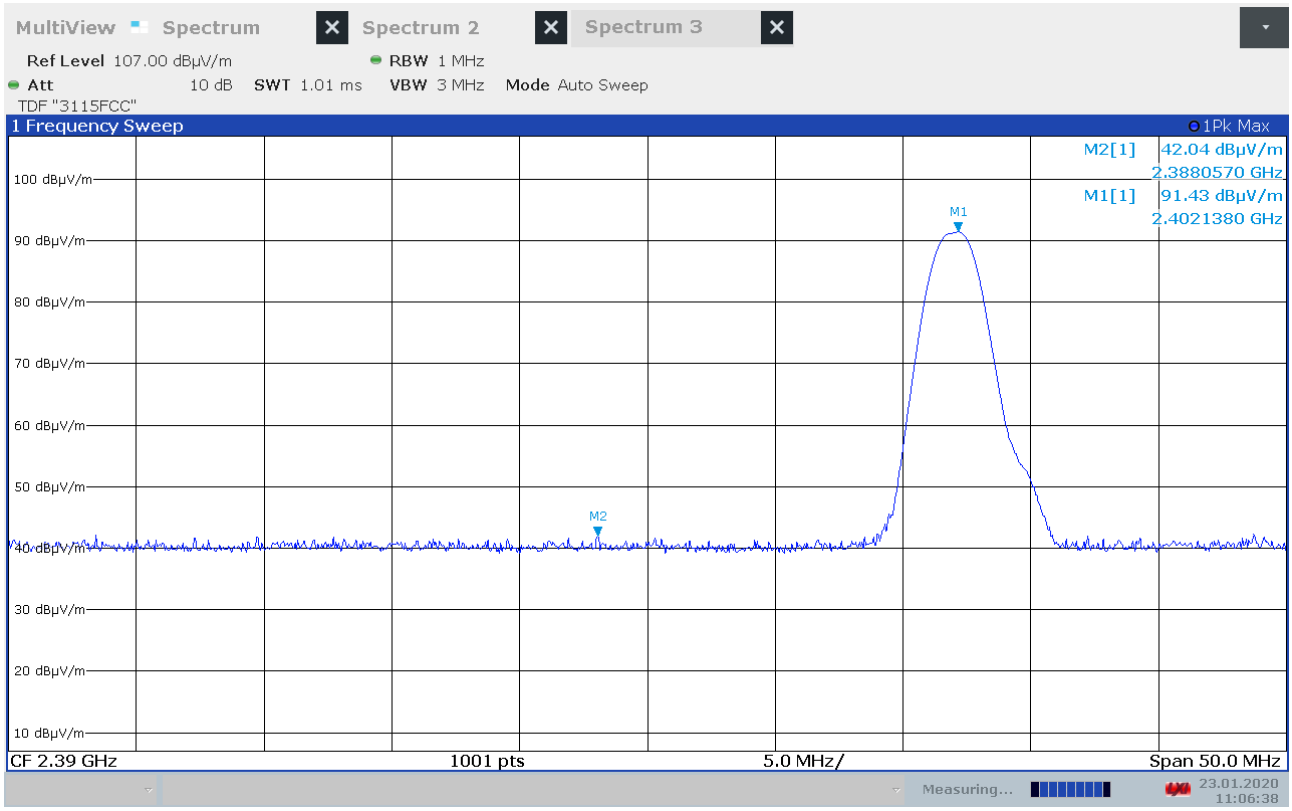
Average Detector values are measured with Peak Detector and corrected for Duty Cycle.

See attached plots.

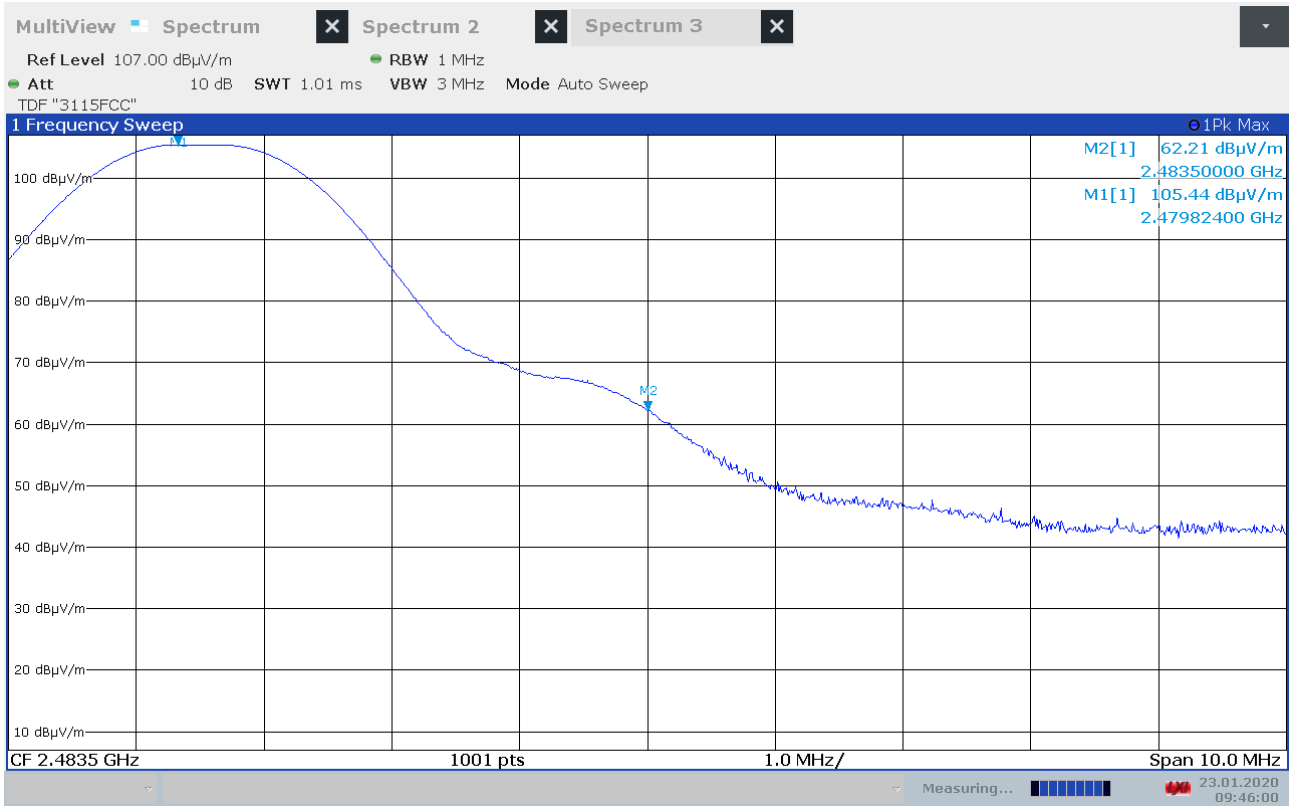
Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / (frame length * number of hopping channels)

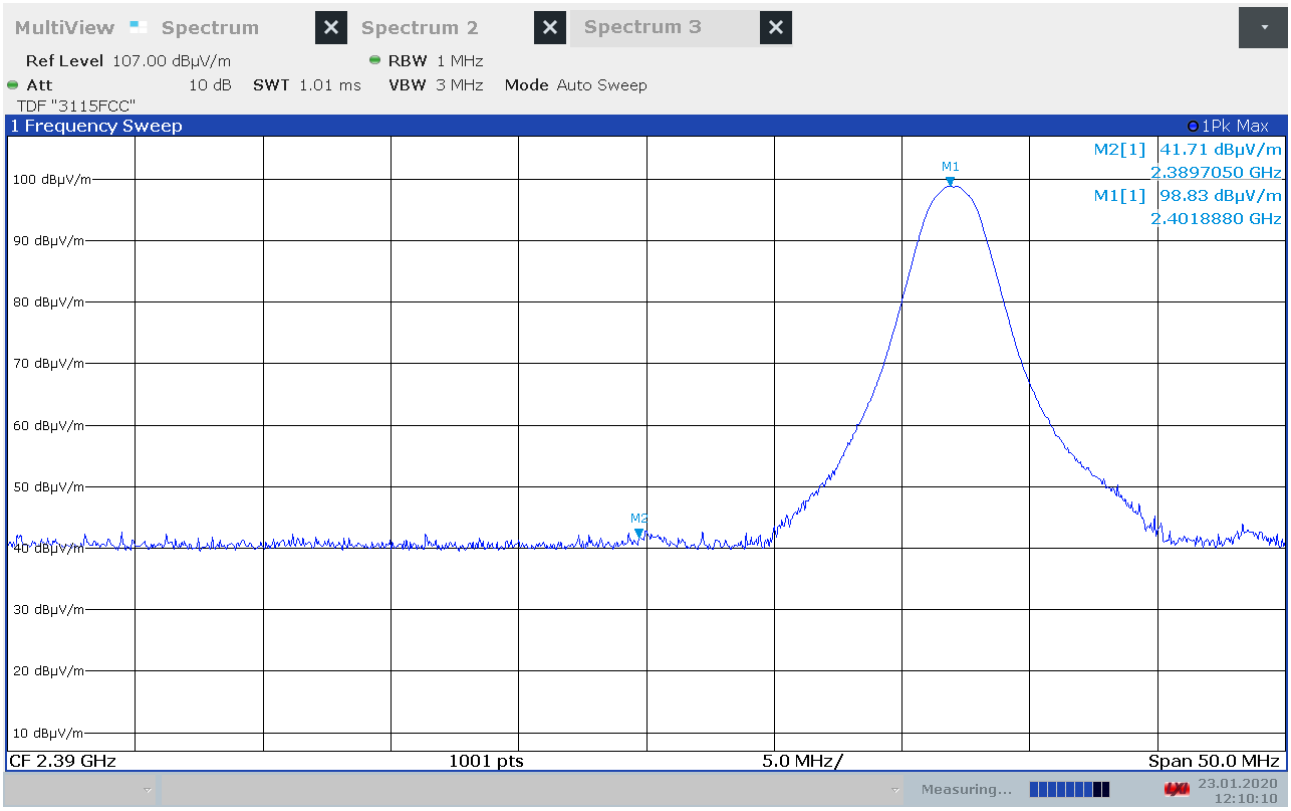
Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB



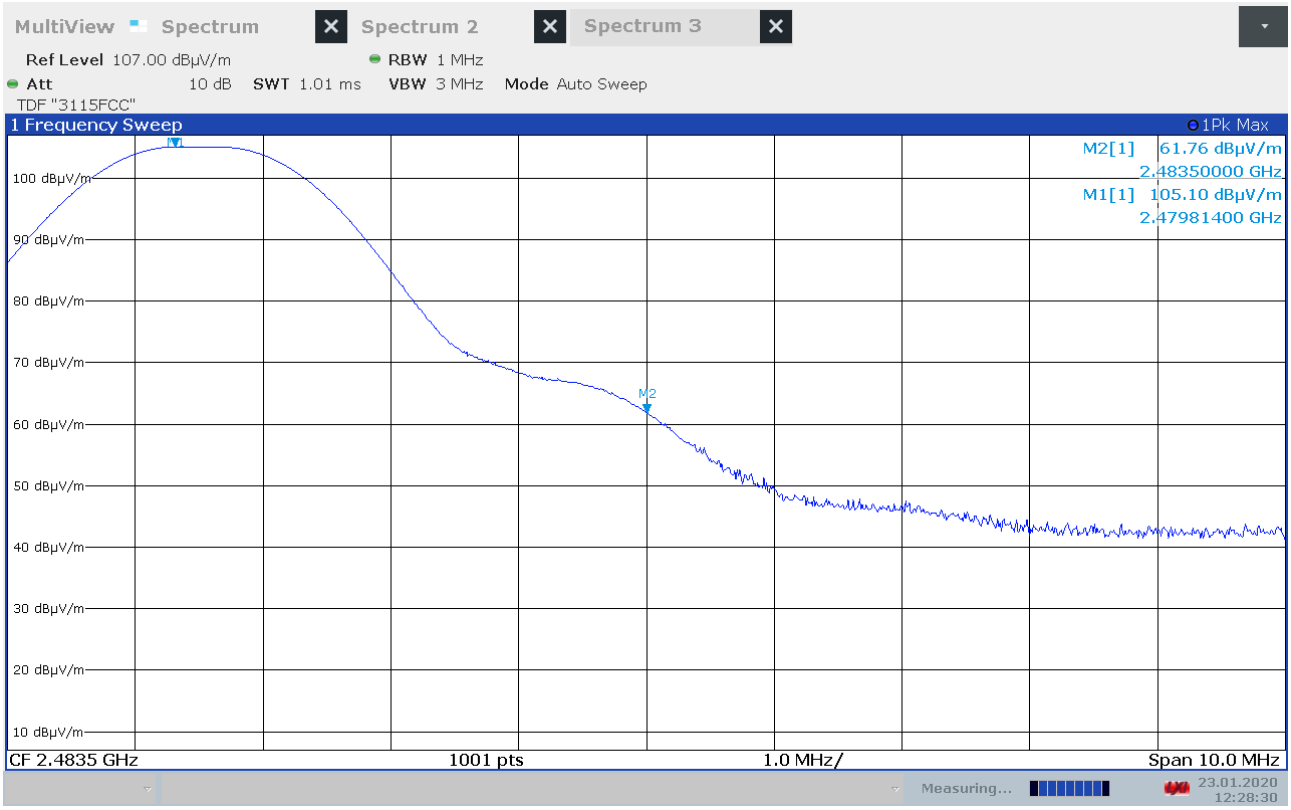
Band Edge, 2402MHz, GFSK



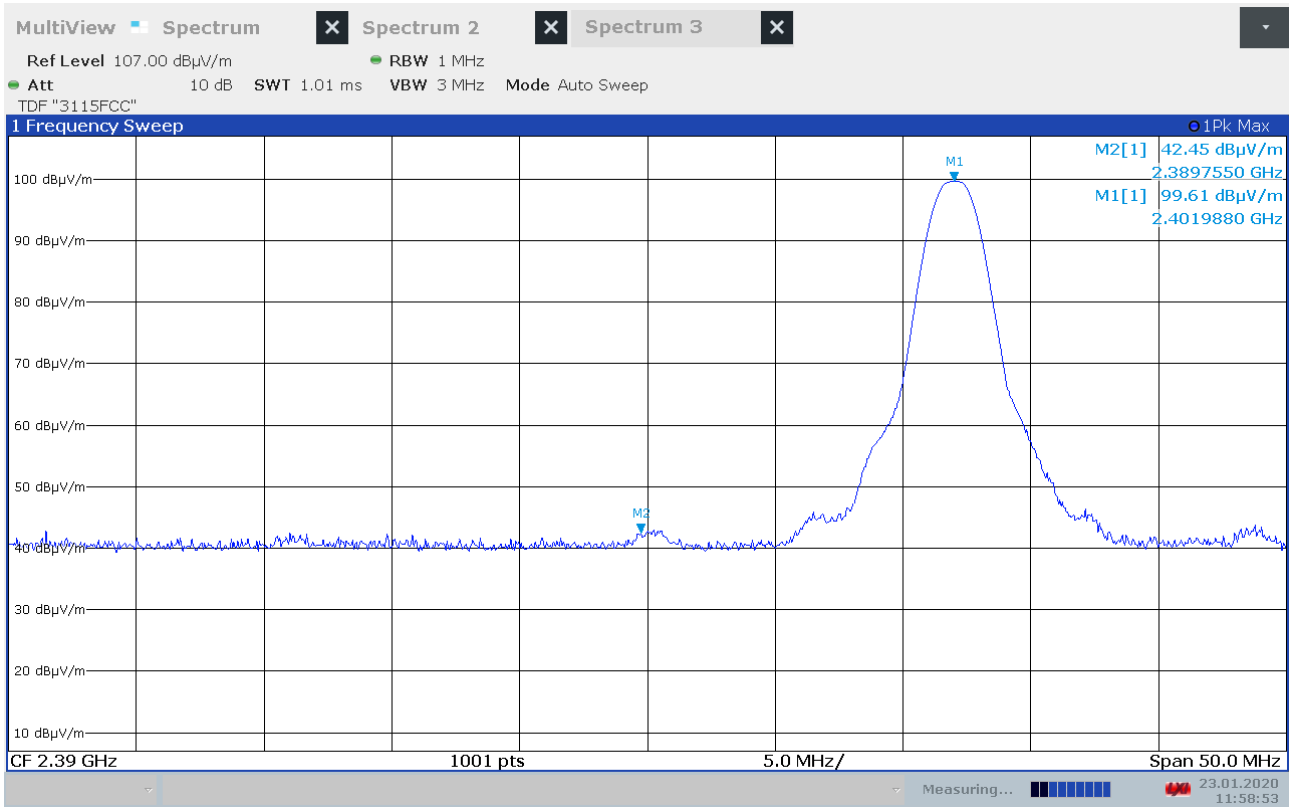
Band Edge, 2480MHz, GFSK



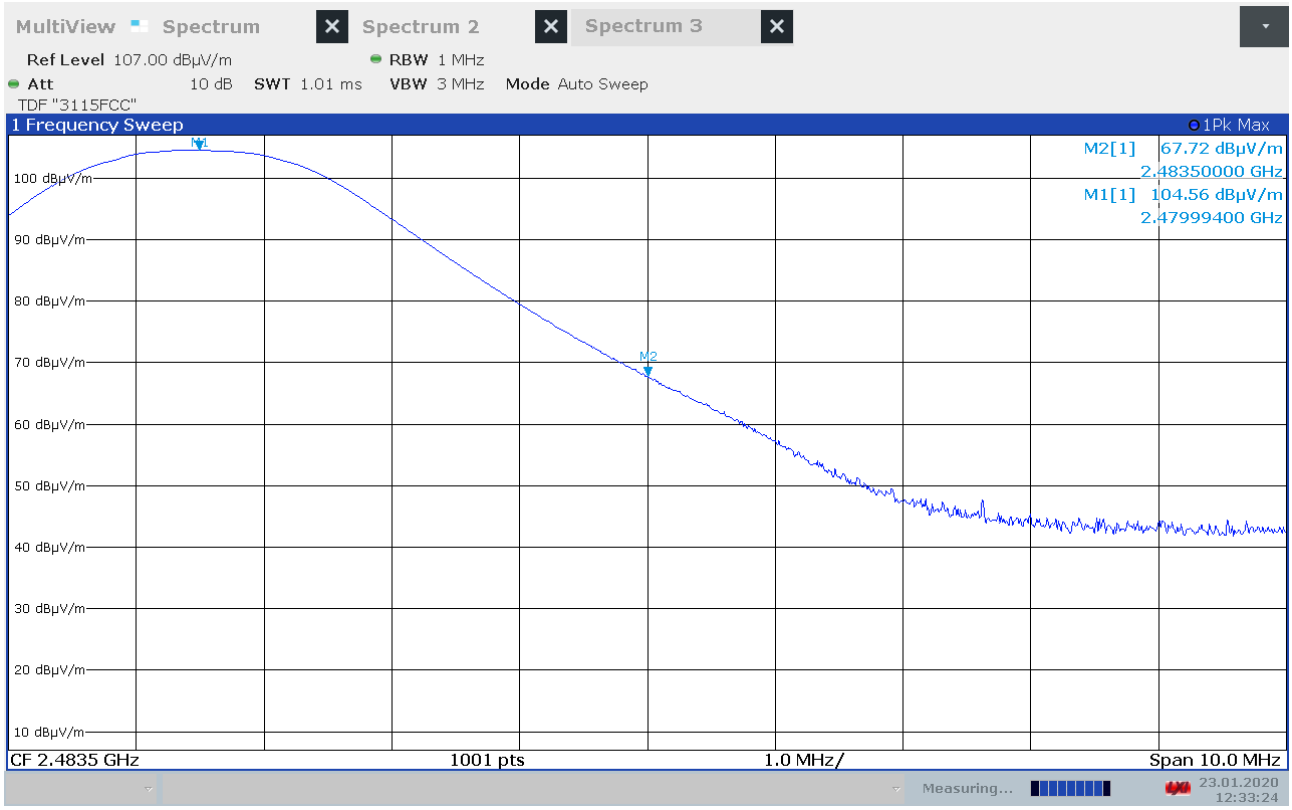
Band Edge, 2402MHz, π/4-DQPSK



Band Edge, 2480MHz, π/4-DQPSK



Band Edge, 2402MHz, 8-DPSK



Band Edge, 2480MHz, 8-DPSK

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 (found frequencies were measured with Quasi-Peak Detector)

Measuring distance 3 m

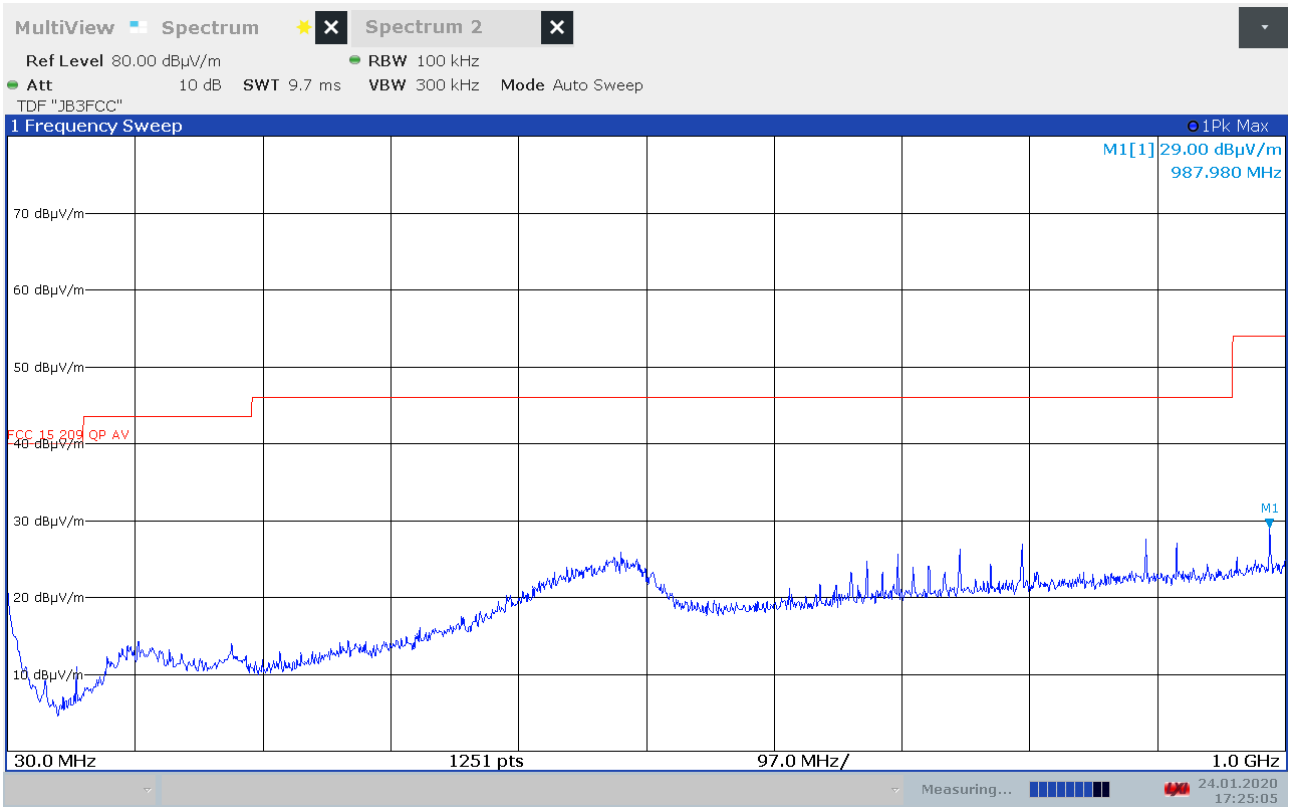
Tested in speech mode with active connection

Frequency (MHz)	Dist. corr. Factor (dB)	Field strength @3m QP Detector (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30 – 88	0	< 20	40.0	> 20
88 – 216	0	< 20	43.5	> 23.5
216 – 960	0	< 30	46.0	> 16
960 – 1000	0	< 30	54.0	> 24

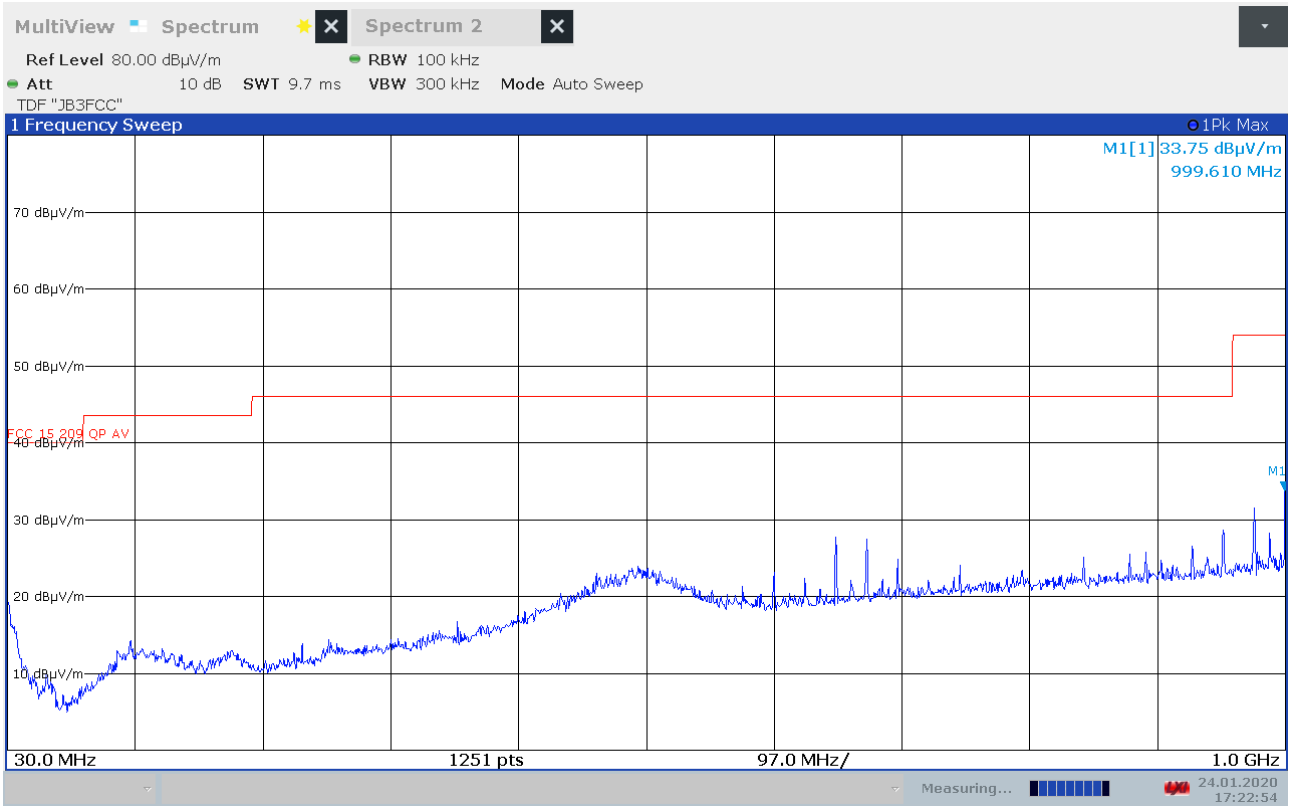
See attached plots

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, 30 -1000MHz, 2440MHz, GFSK, HP



Radiated Emissions, 30 -1000MHz, 2440MHz, GFSK, VP

3.9 Radiated Emissions, 1-26 GHz

FCC Part 15.209 (a)

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

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

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)

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

Peak Detector:

Frequency (MHz)	RF channel (L/M/H)	Field strength, Peak Detector, @3m (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4804	L	53.6	74	20.4
7206		53.7	74	20.3
9608		51.6	74	22.4
12010		58.6	74	15.4
4880	M	53.5	74	20.5
7320		54.7	74	19.3
9760		52.8	74	21.2
12200		56.5	74	17.5
4960	H	47.6	74	26.4
7440		51.4	74	22.6
9920		54.0	74	20.0
12400		51.8	74	22.2
Other freqs	L / M / H	None detected	74	>20

Average Detector:

Frequency (MHz)	RF channel (L/M/H)	Field strength, Average Detector, @3m (dBµV/m)	Duty cycle corr. Factor (dB)	Limit (dBµV/m)	Margin (dB)
12010	L	38.6	20	74	15.4
7320	M	34.7	20	74	19.3
12200		36.5	20	74	17.5
9920	H	34.0	20	74	20
Other freqs	L / M / H	None detected	20	74	>20

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

Average Value is not required when Peak Value is below Average Limit.

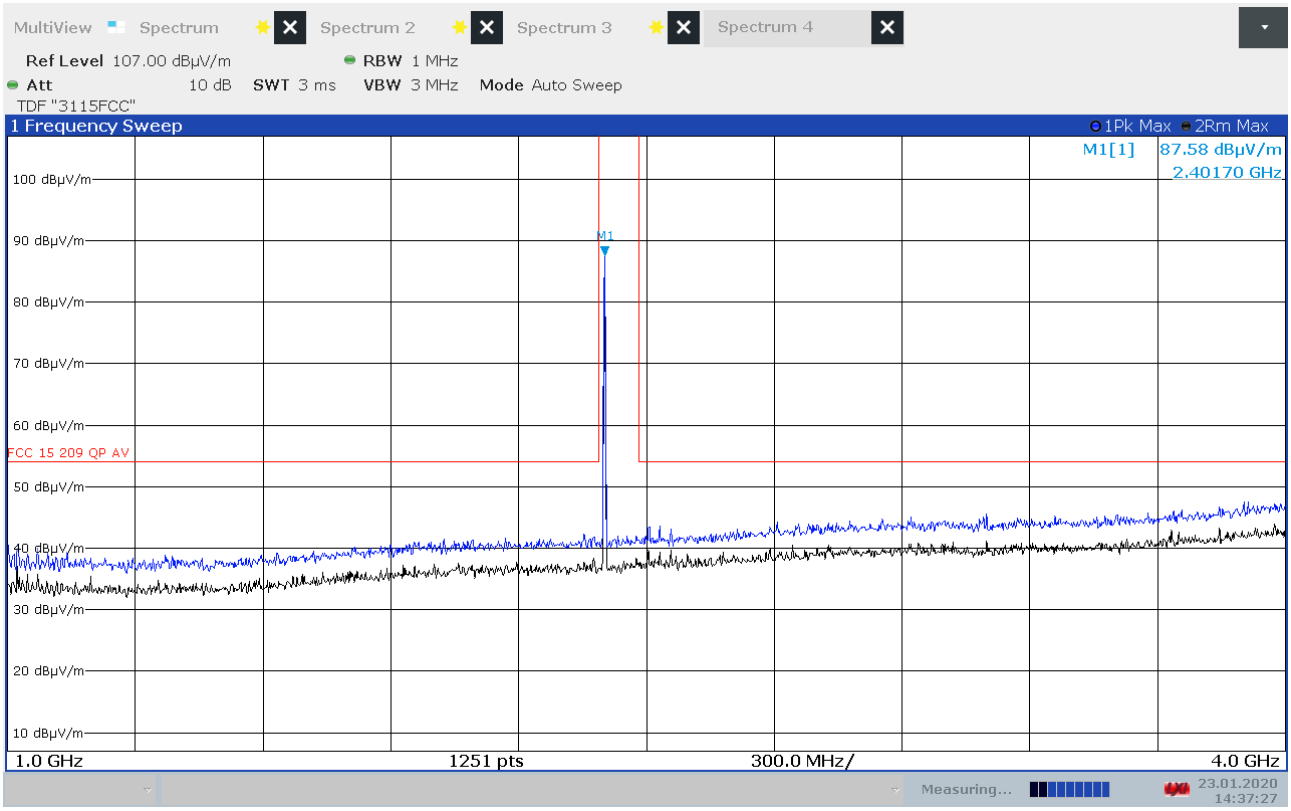
A Band Reject Filter was used for measurements from 1 GHz to 4 GHz and a High Pass Filter was used from 3 GHz to 18 GHz.

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

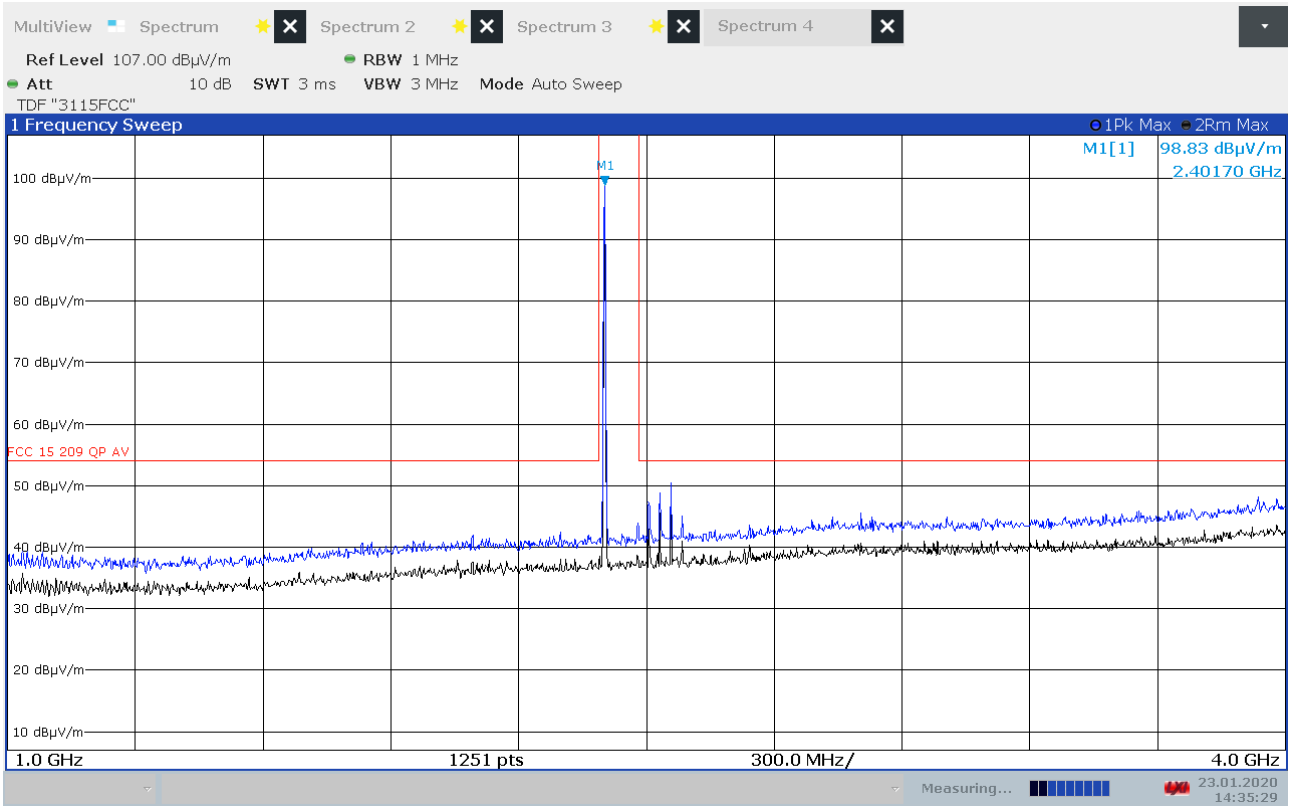
See plots.

Requirements/Limit

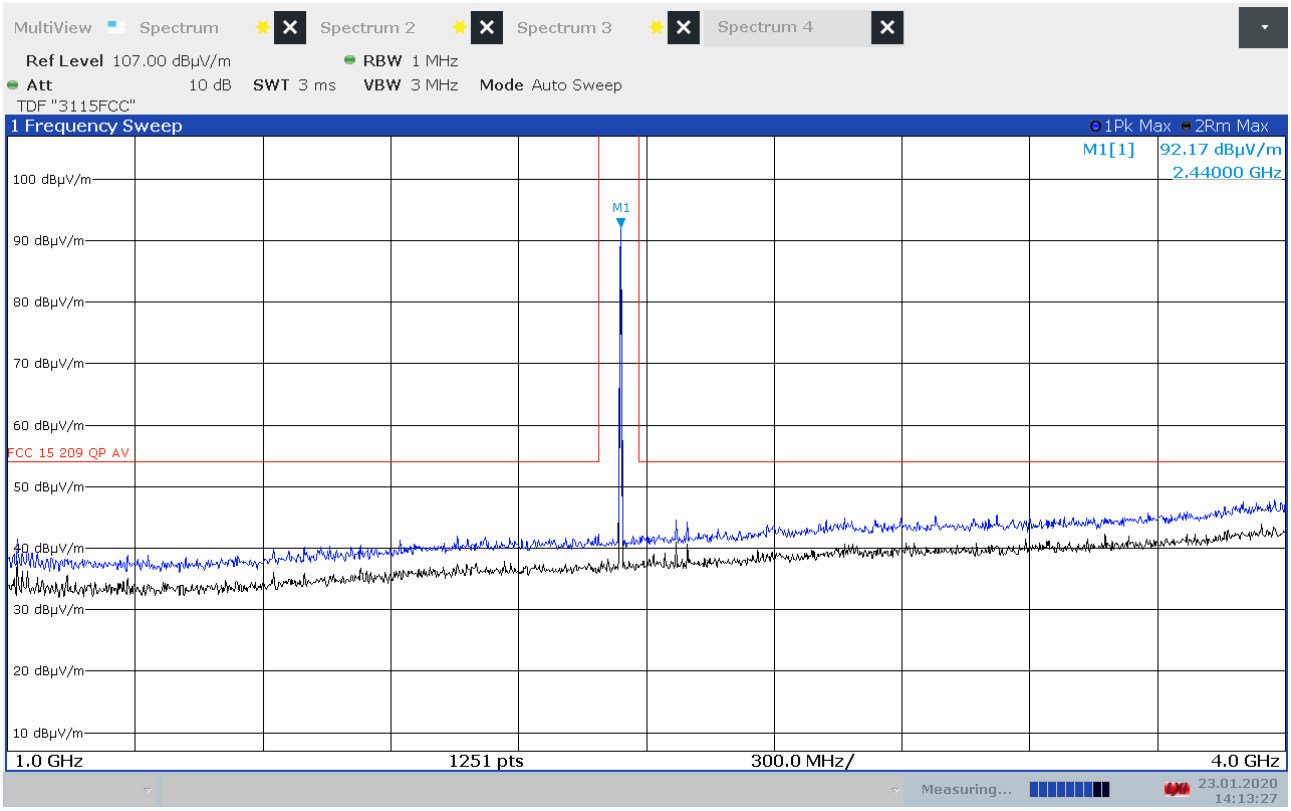
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



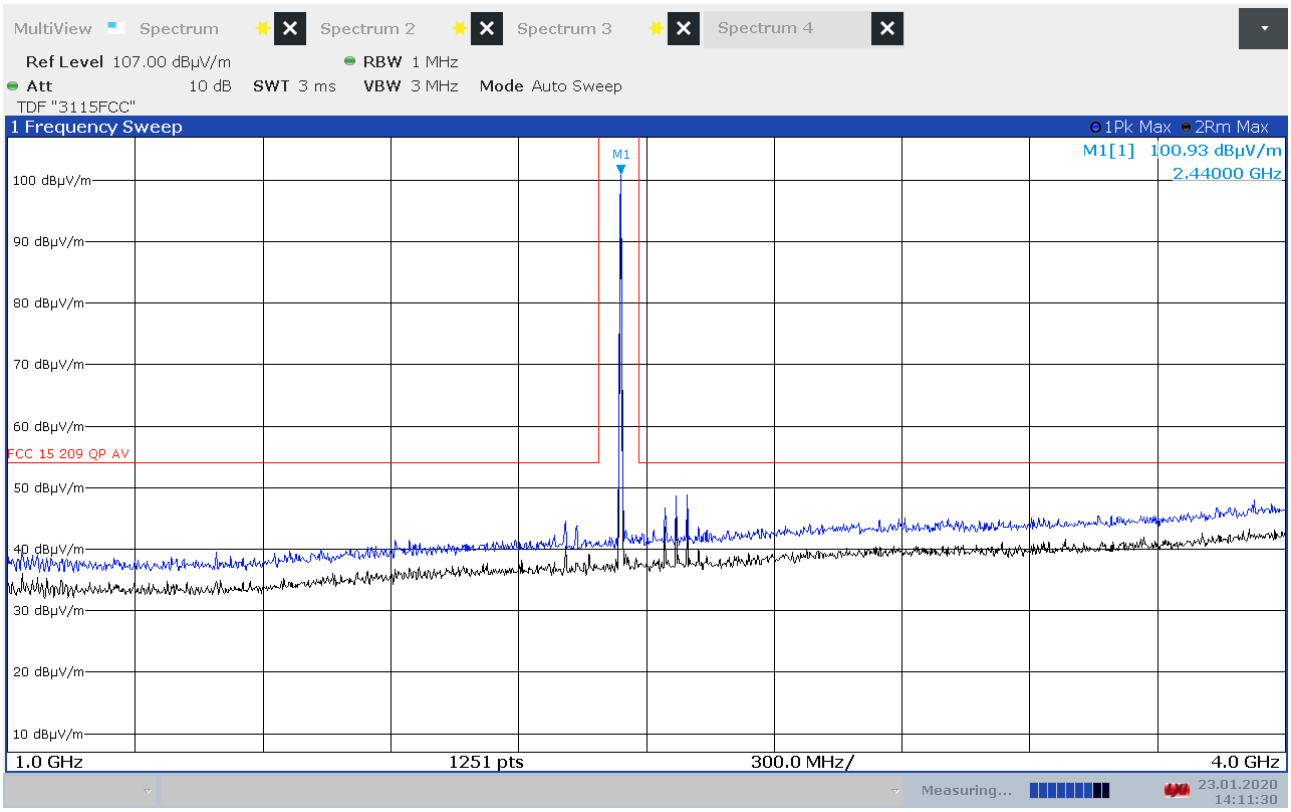
Radiated Emissions, 1000 -4000MHz, 2402MHz, GFSK, HP



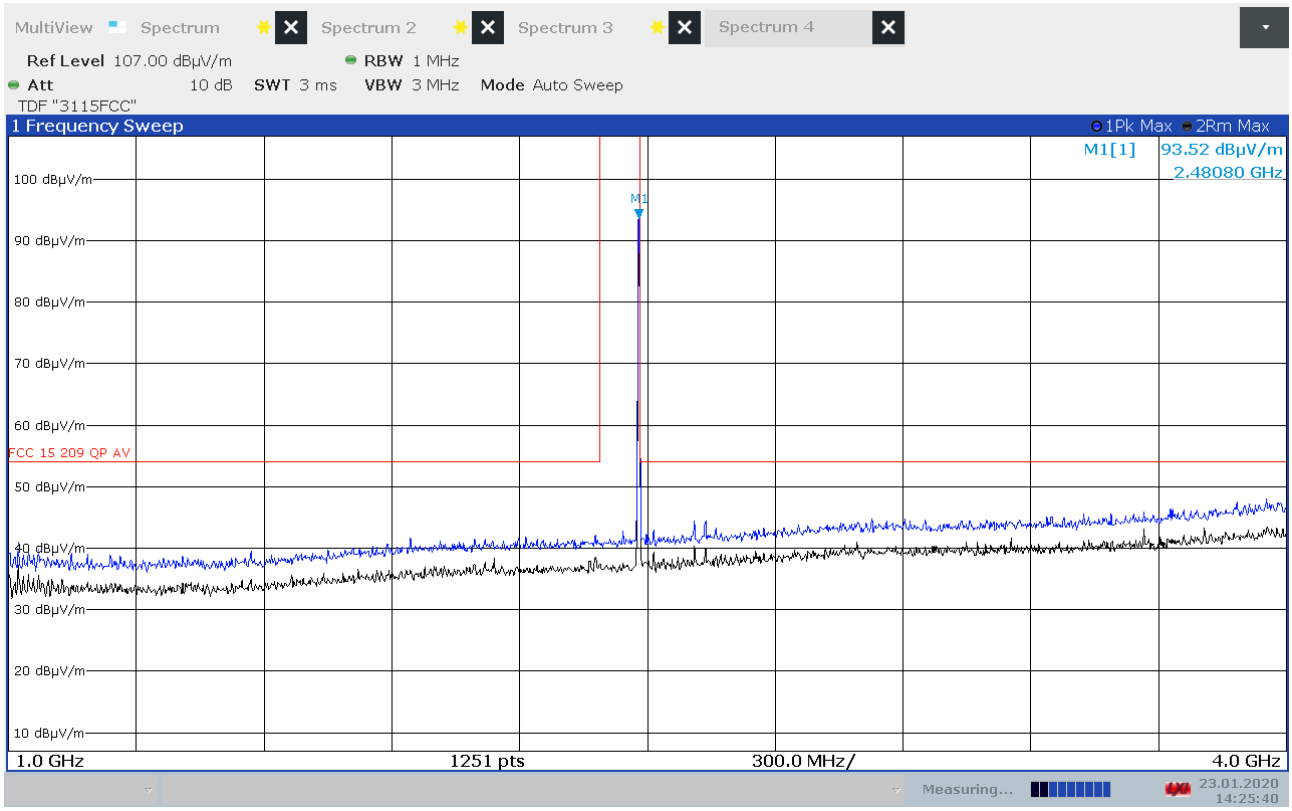
Radiated Emissions, 1000 -4000MHz, 2402MHz, GFSK, VP



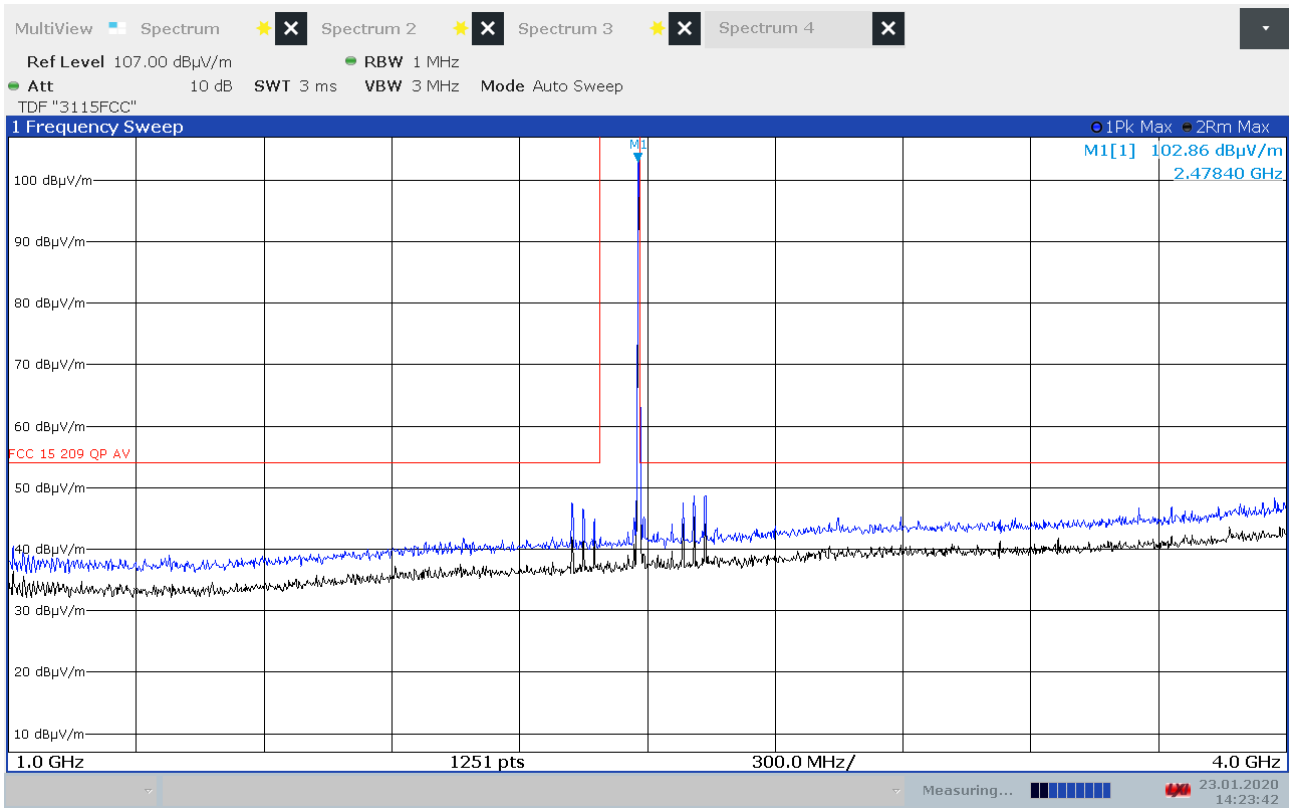
Radiated Emissions, 1000 -4000MHz, 2440MHz, GFSK, HP



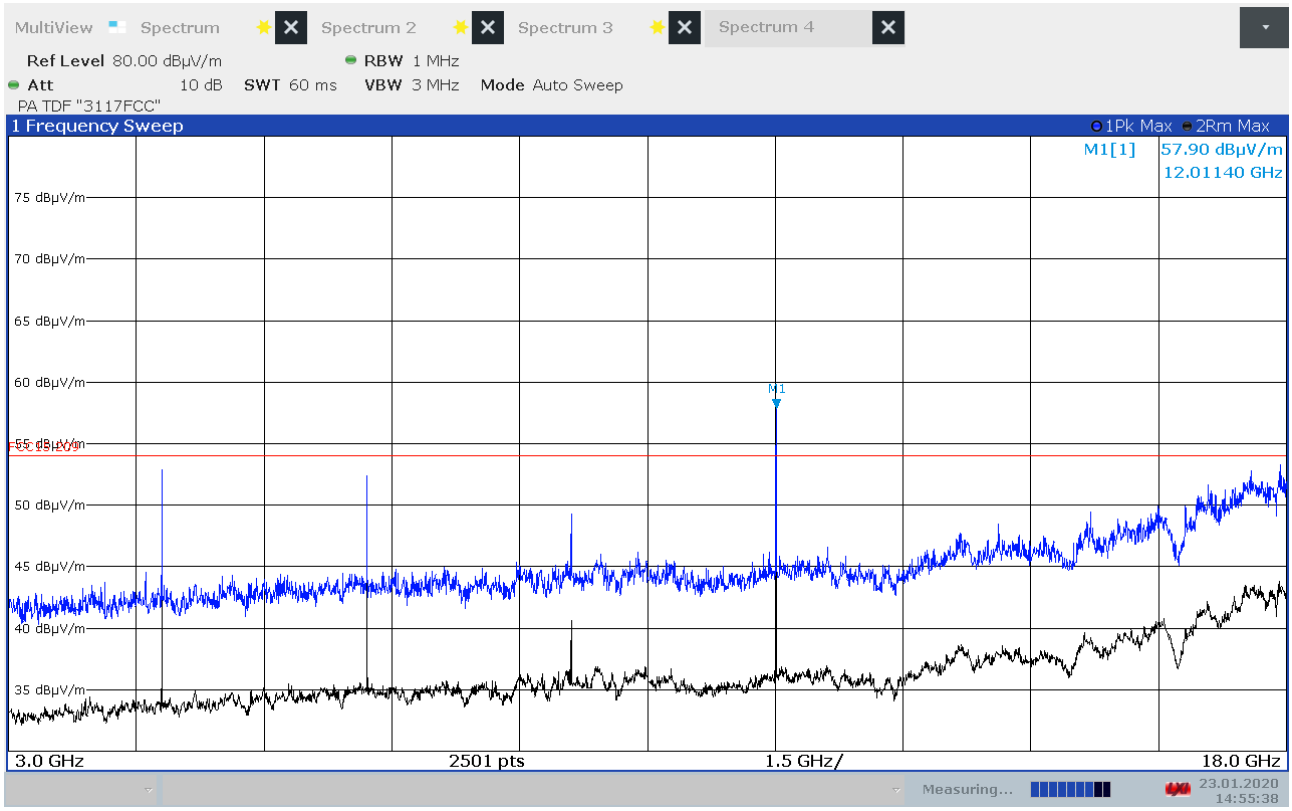
Radiated Emissions, 1000 -4000MHz, 2440MHz, GFSK, VP



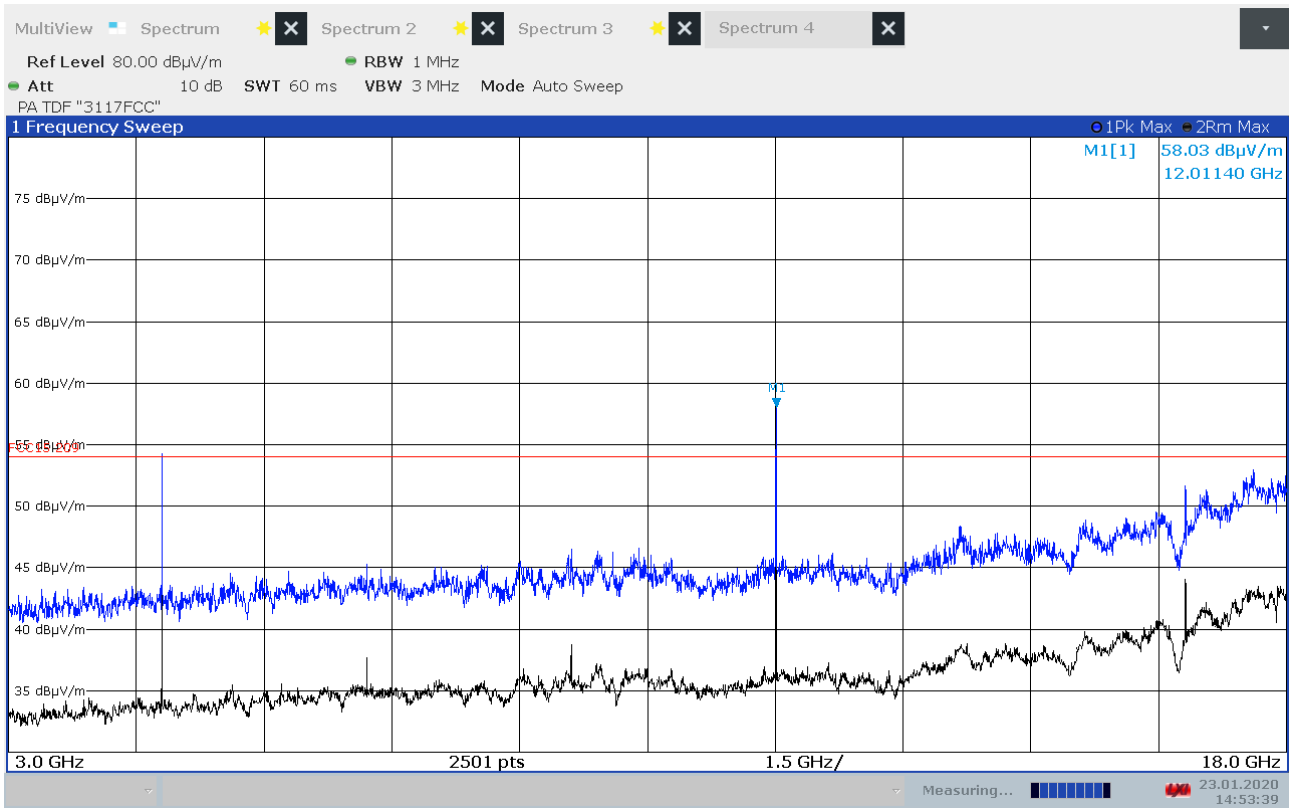
Radiated Emissions, 1000 -4000MHz, 2480MHz, GFSK, HP



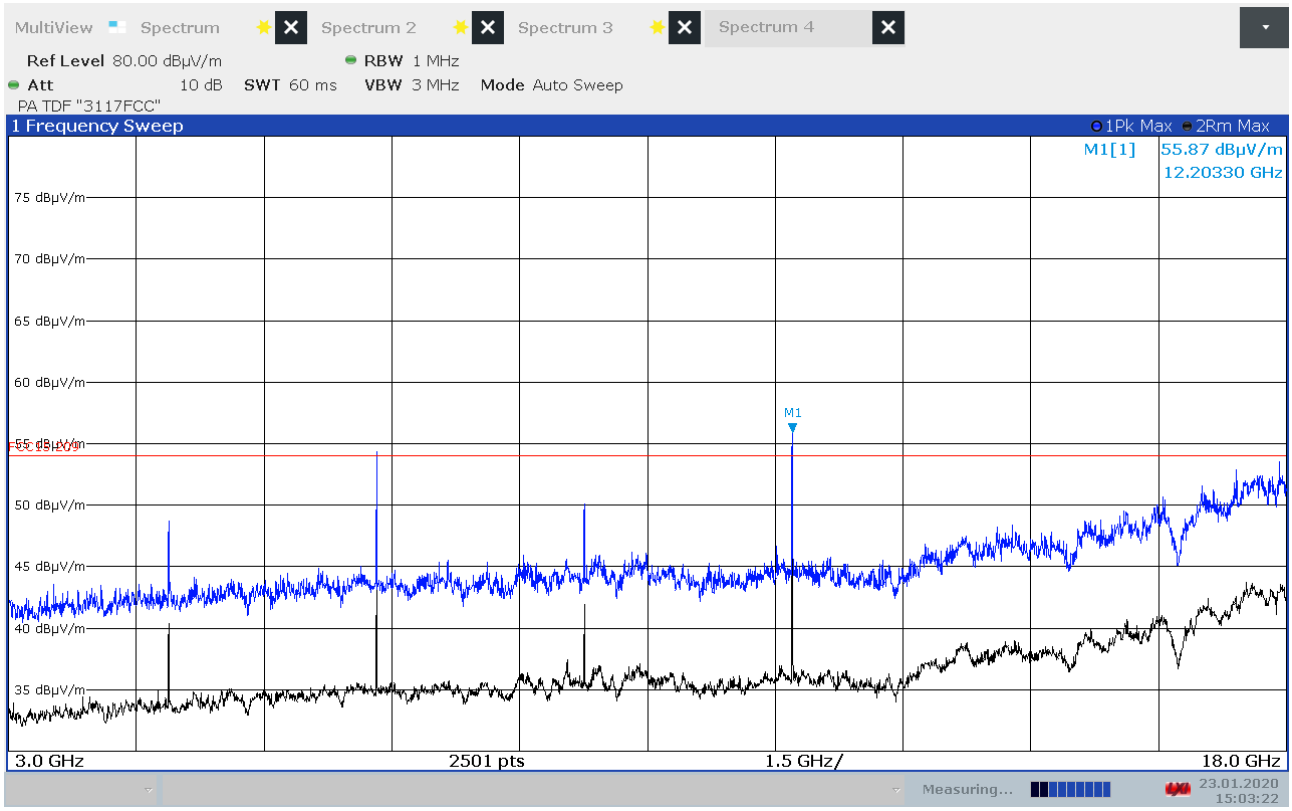
Radiated Emissions, 1000 -4000MHz, 2480MHz, GFSK, VP



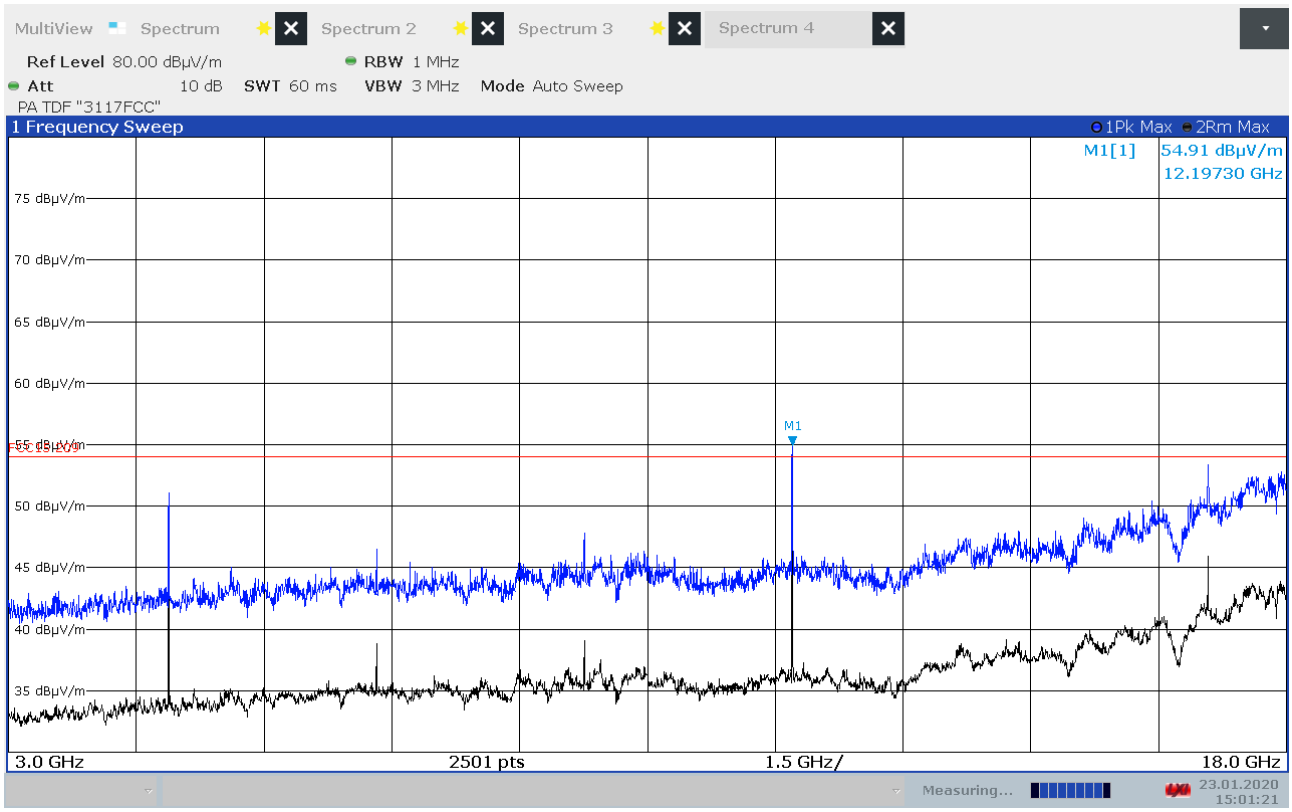
Radiated Emissions, 3000 -18000MHz, 2402MHz, GFSK, HP



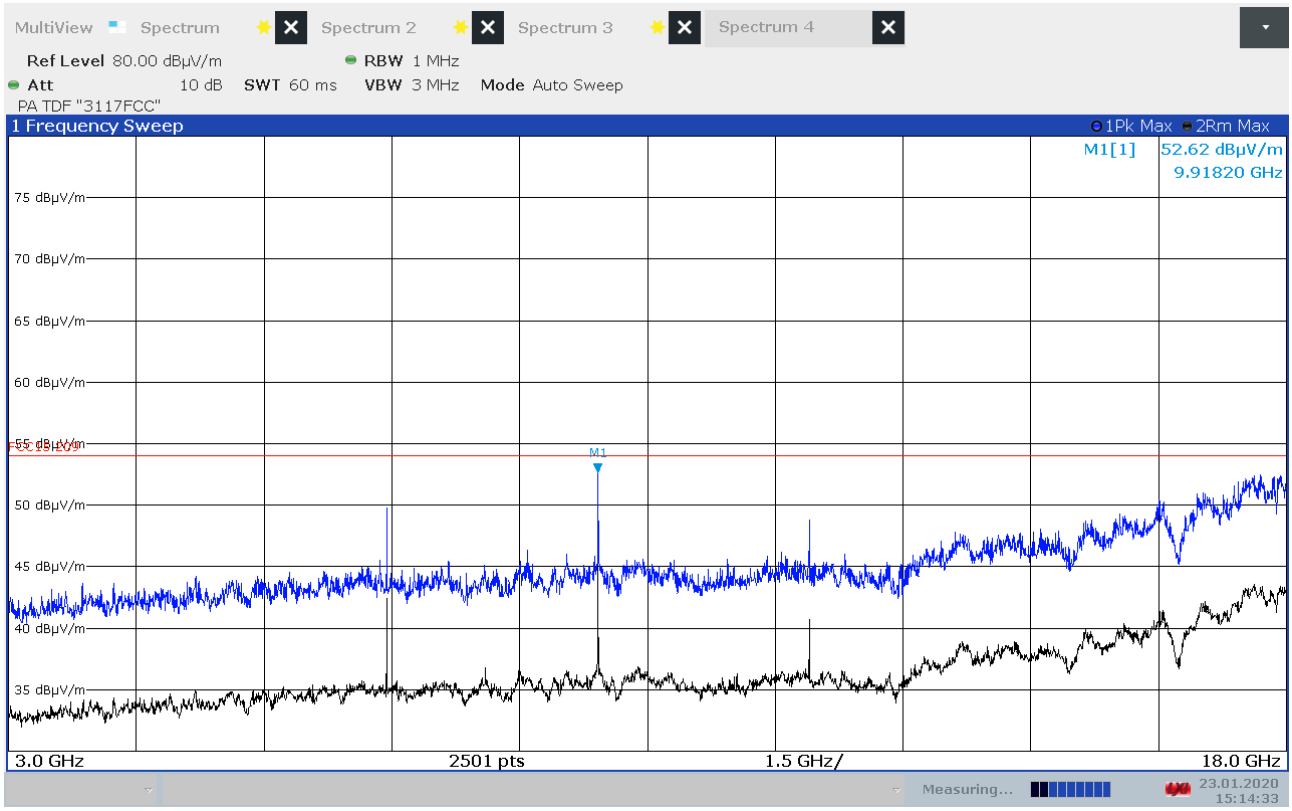
Radiated Emissions, 3000 -18000MHz, 2402MHz, GFSK, VP



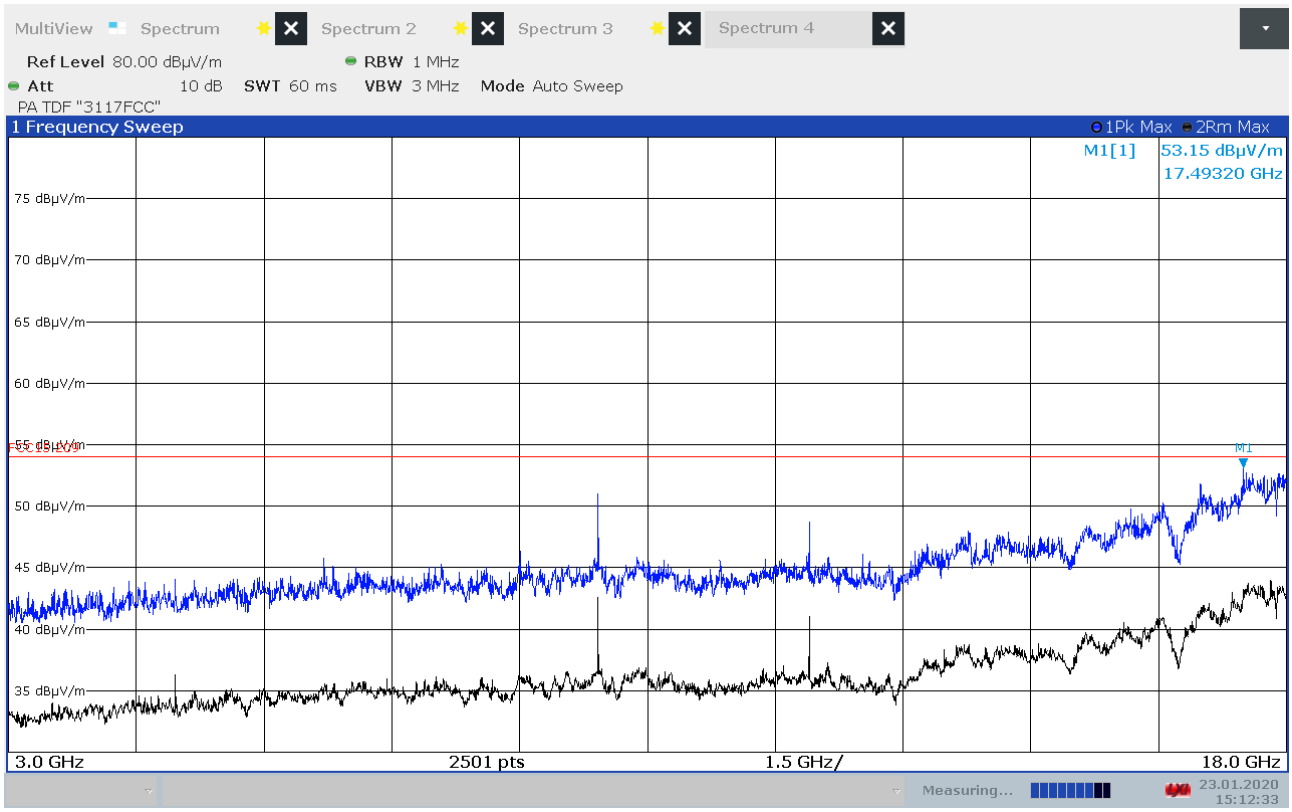
Radiated Emissions, 3000 -18000MHz, 2440MHz, GFSK, HP



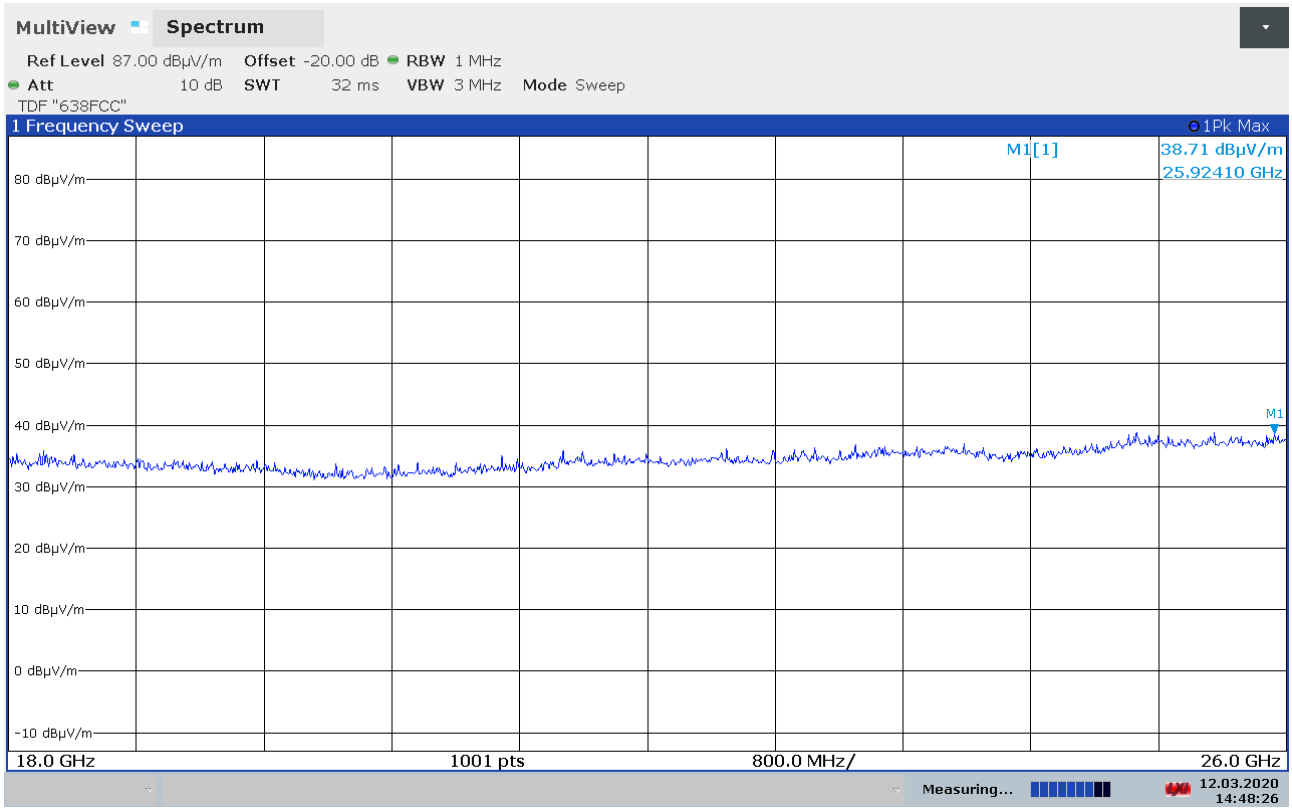
Radiated Emissions, 3000 -18000MHz, 2440MHz, GFSK, VP



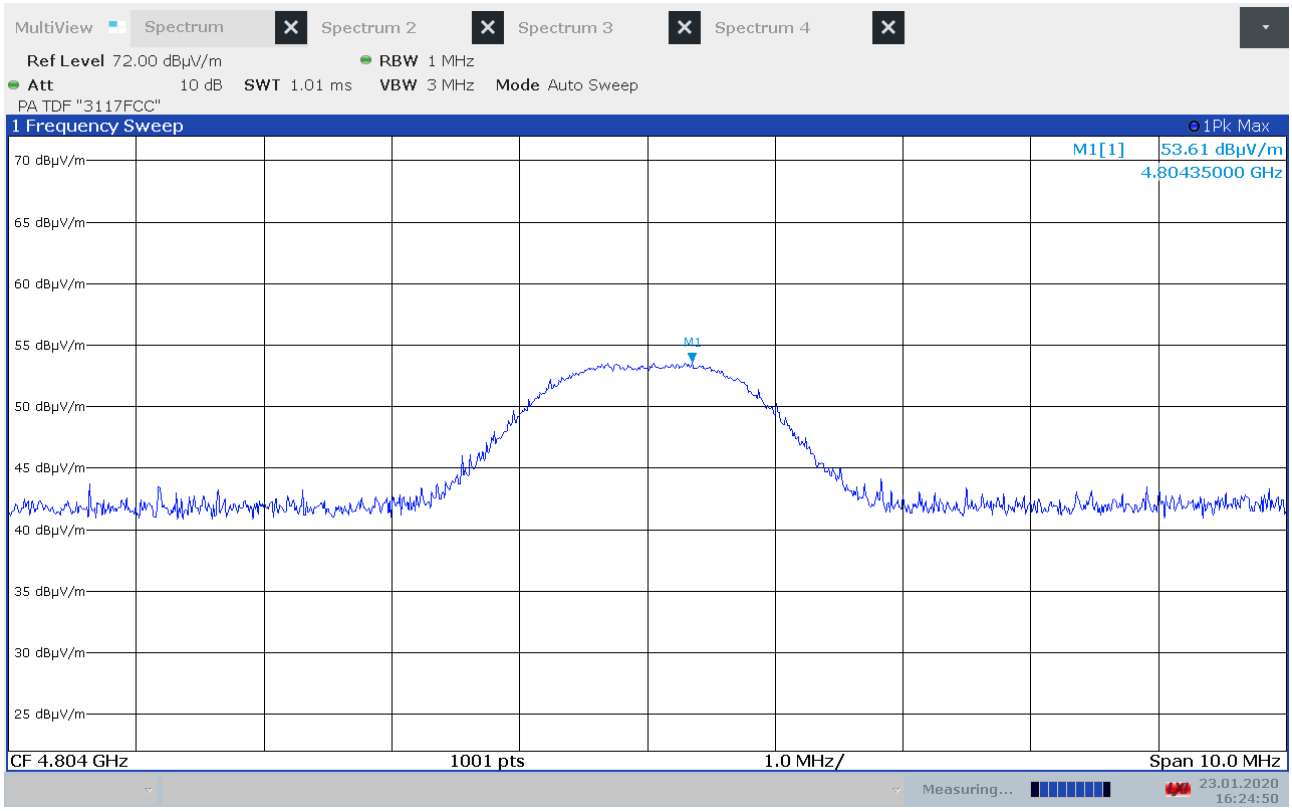
Radiated Emissions, 3000 -18000MHz, 2480MHz, GFSK, HP



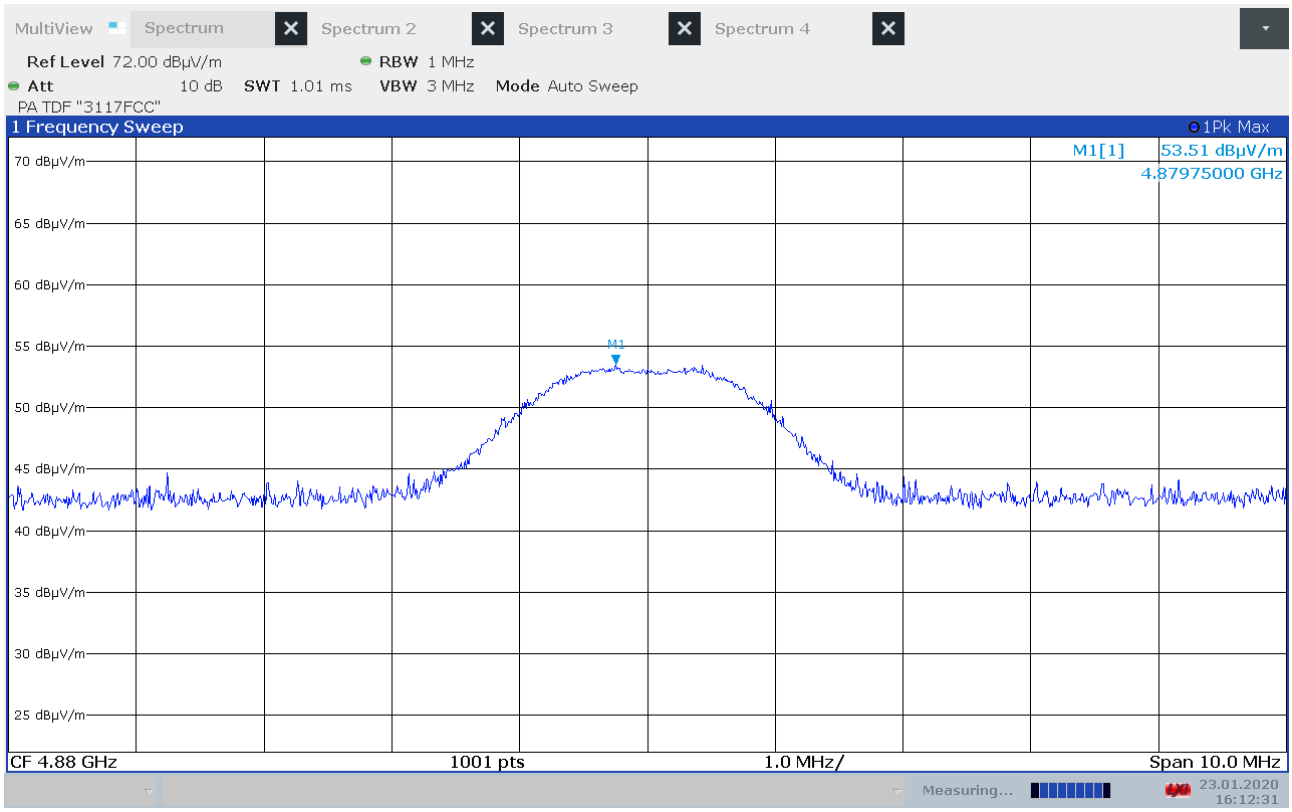
Radiated Emissions, 3000 -18000MHz, 2480MHz, GFSK, VP



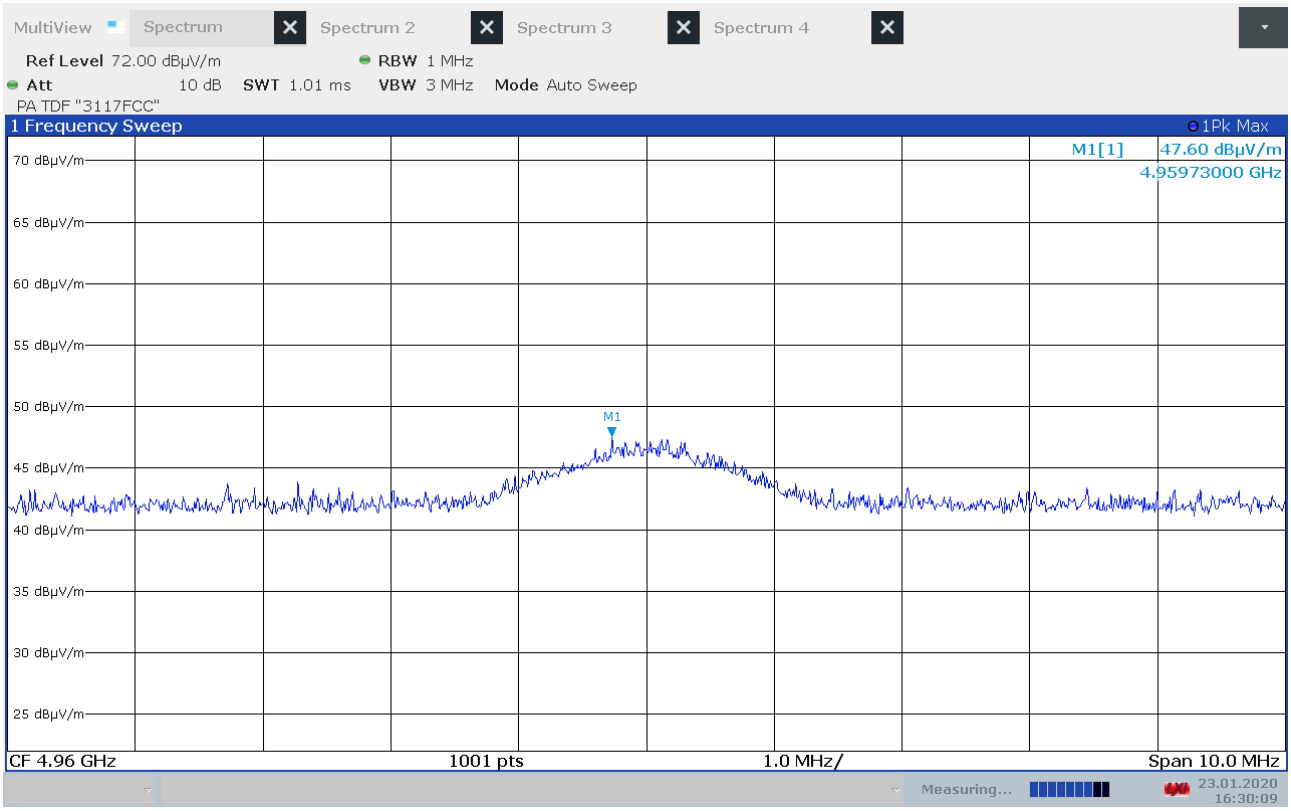
Pre-scan, 18 -26 GHz, 2440MHz @30cm



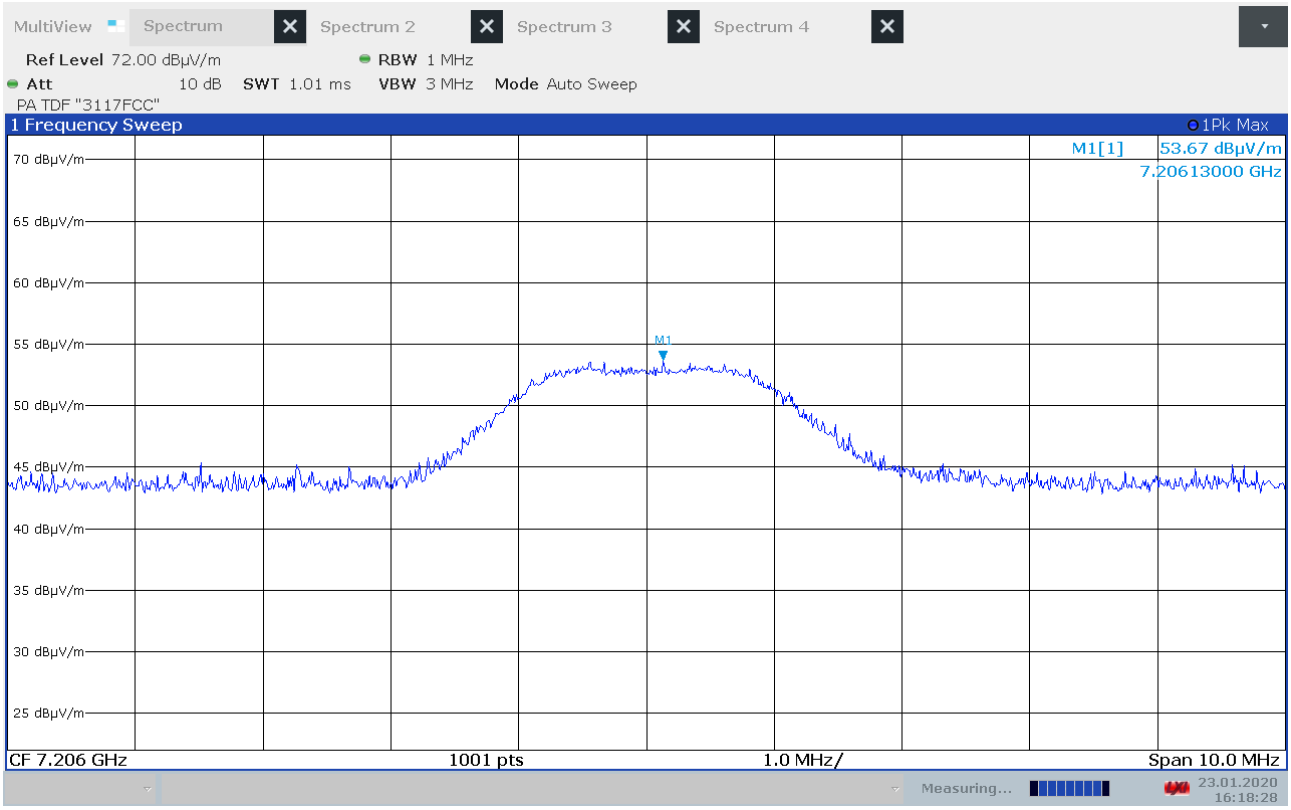
Maximum Radiated Emissions, 4804MHz, 2402MHz, GFSK



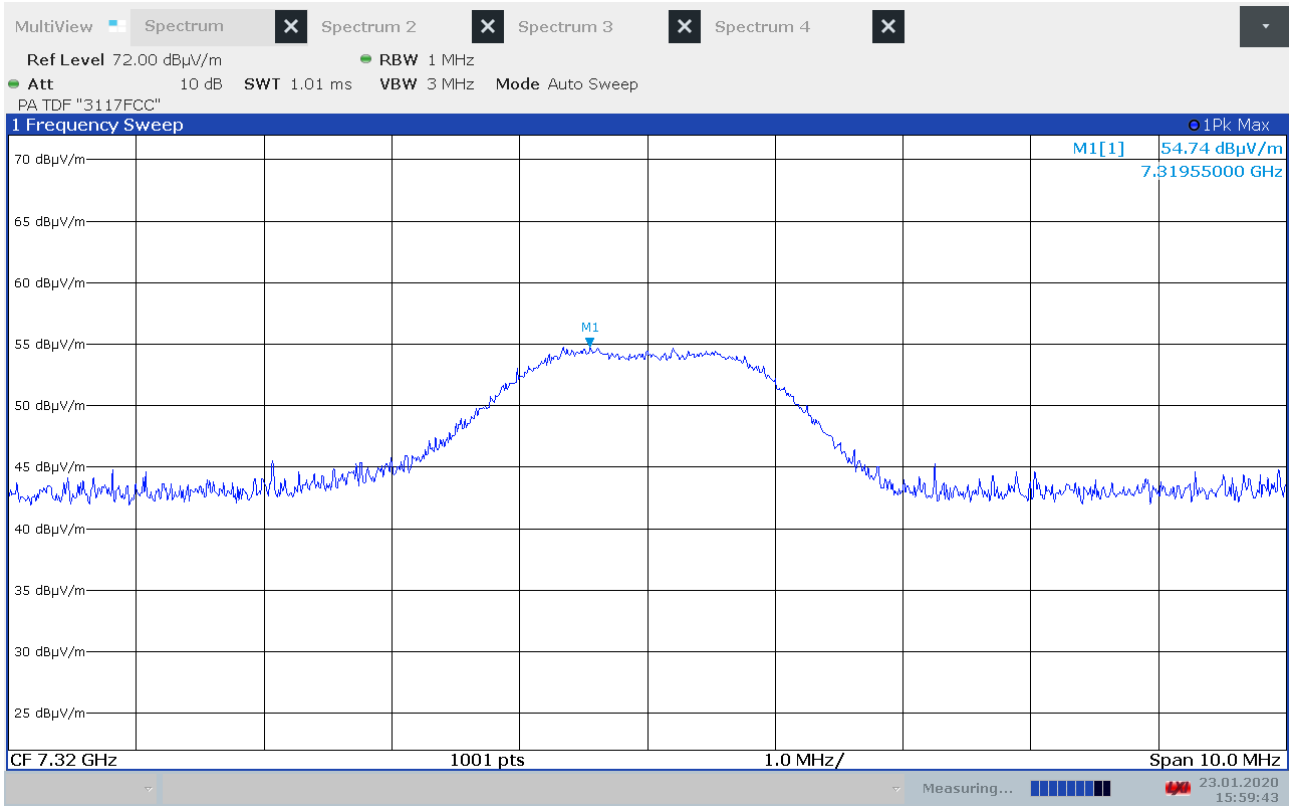
Maximum Radiated Emissions, 4880MHz, 2440MHz, GFSK



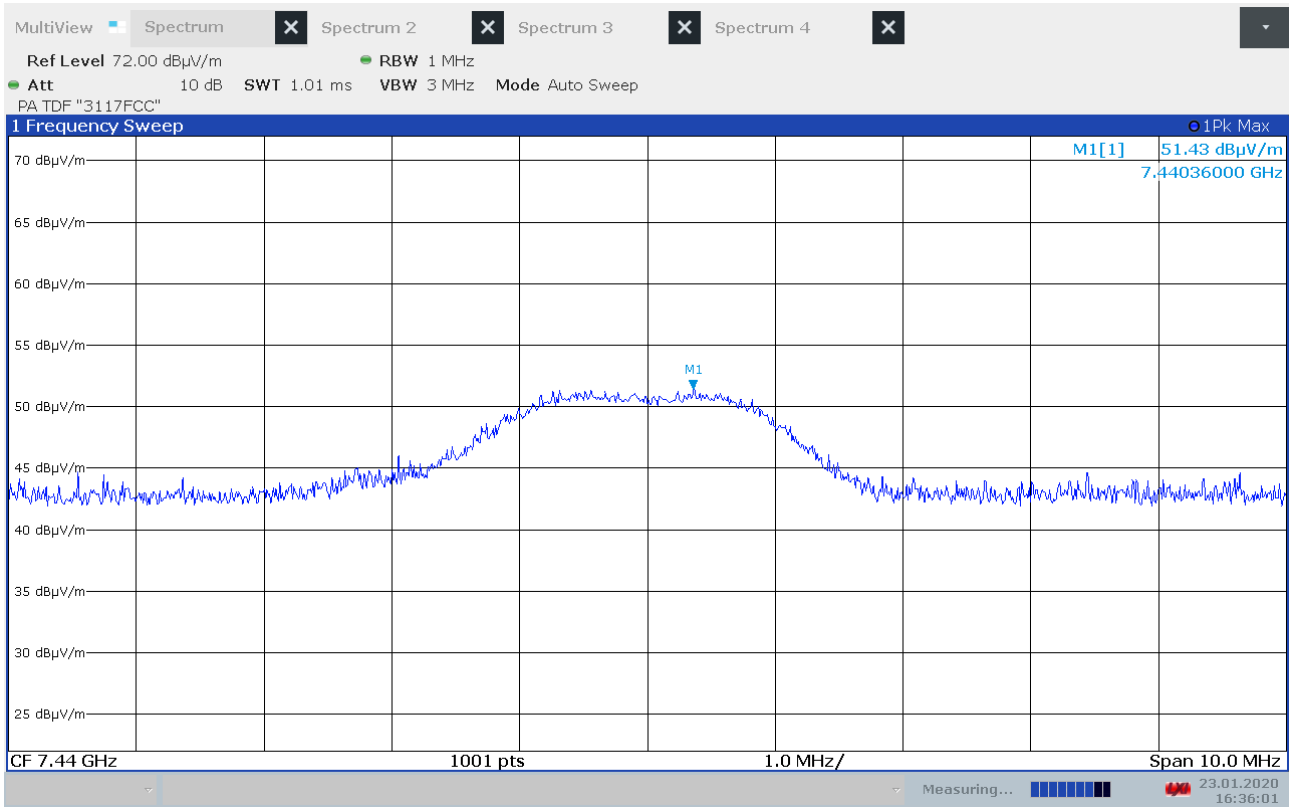
Maximum Radiated Emissions, 4960MHz, 2480MHz, GFSK



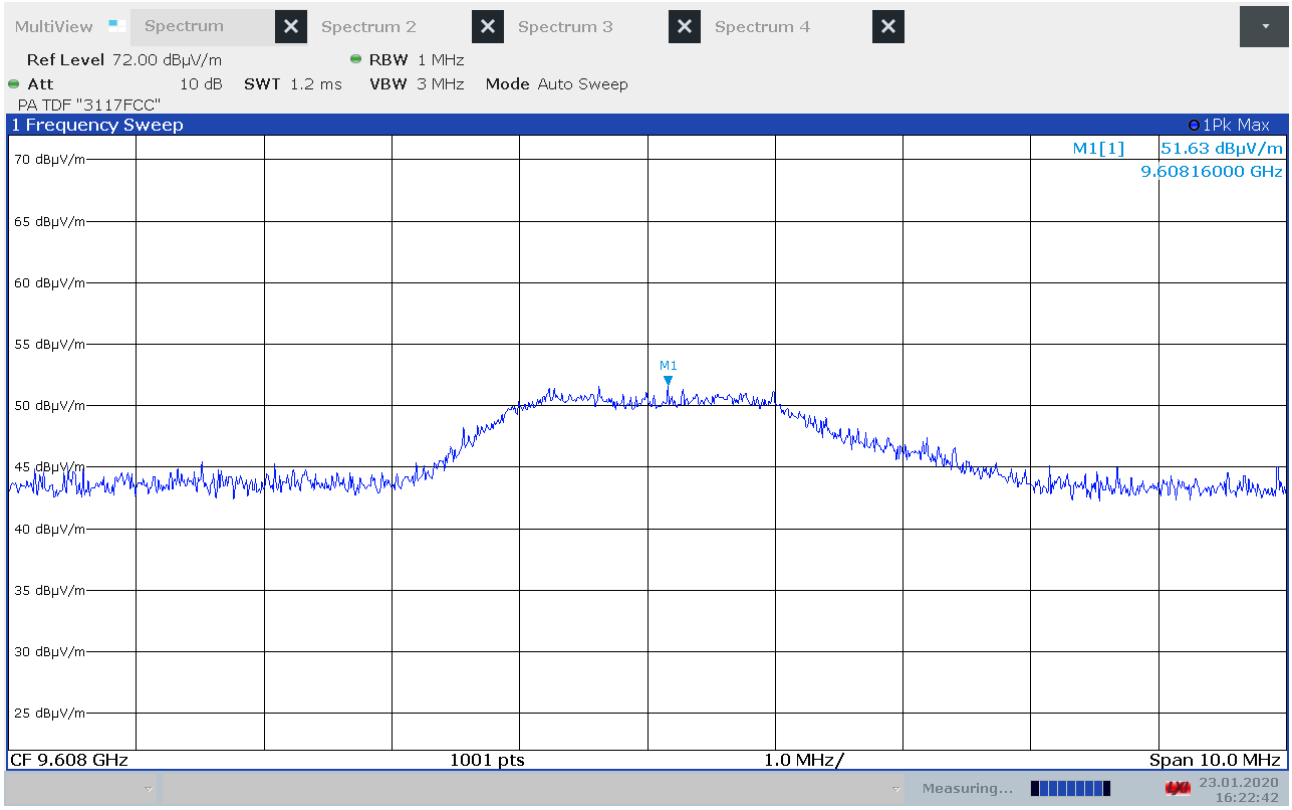
Maximum Radiated Emissions, 7206MHz, 2402MHz, GFSK



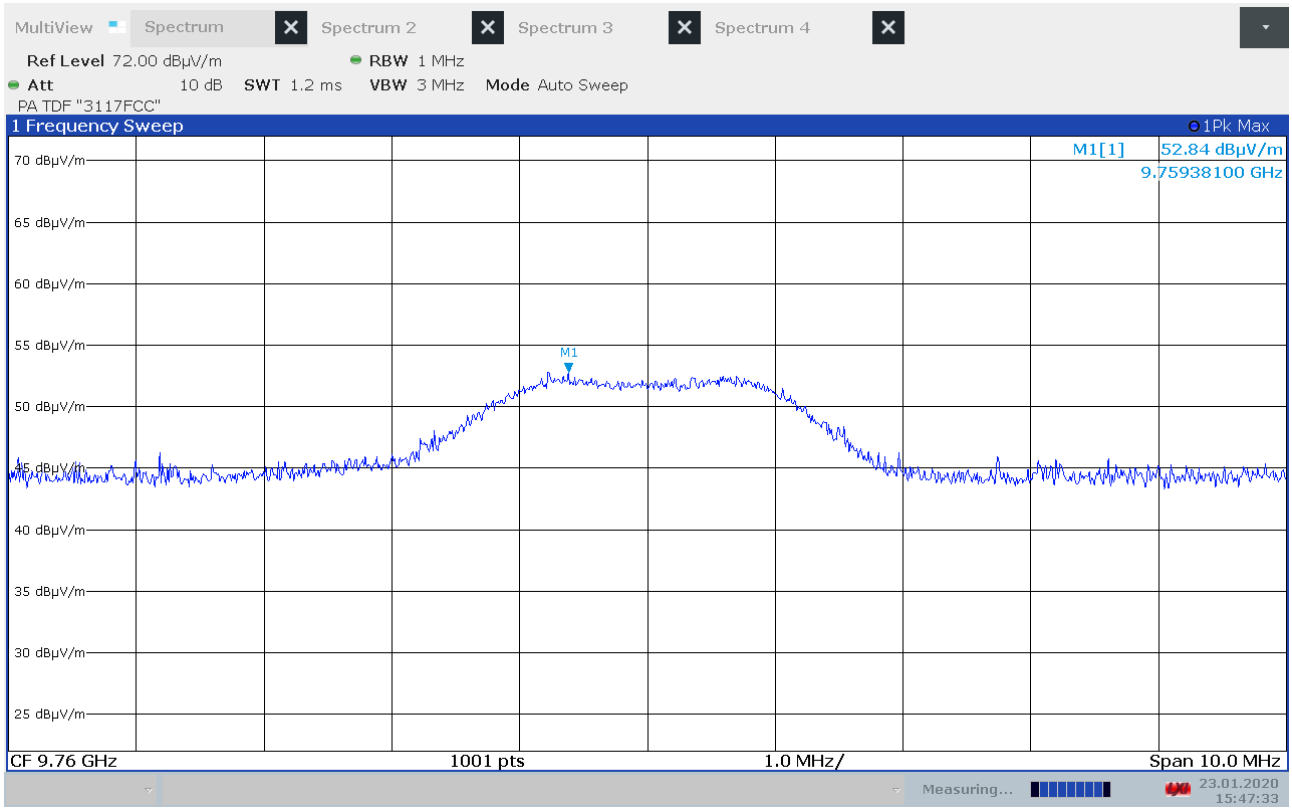
Maximum Radiated Emissions, 7320MHz, 2440MHz, GFSK



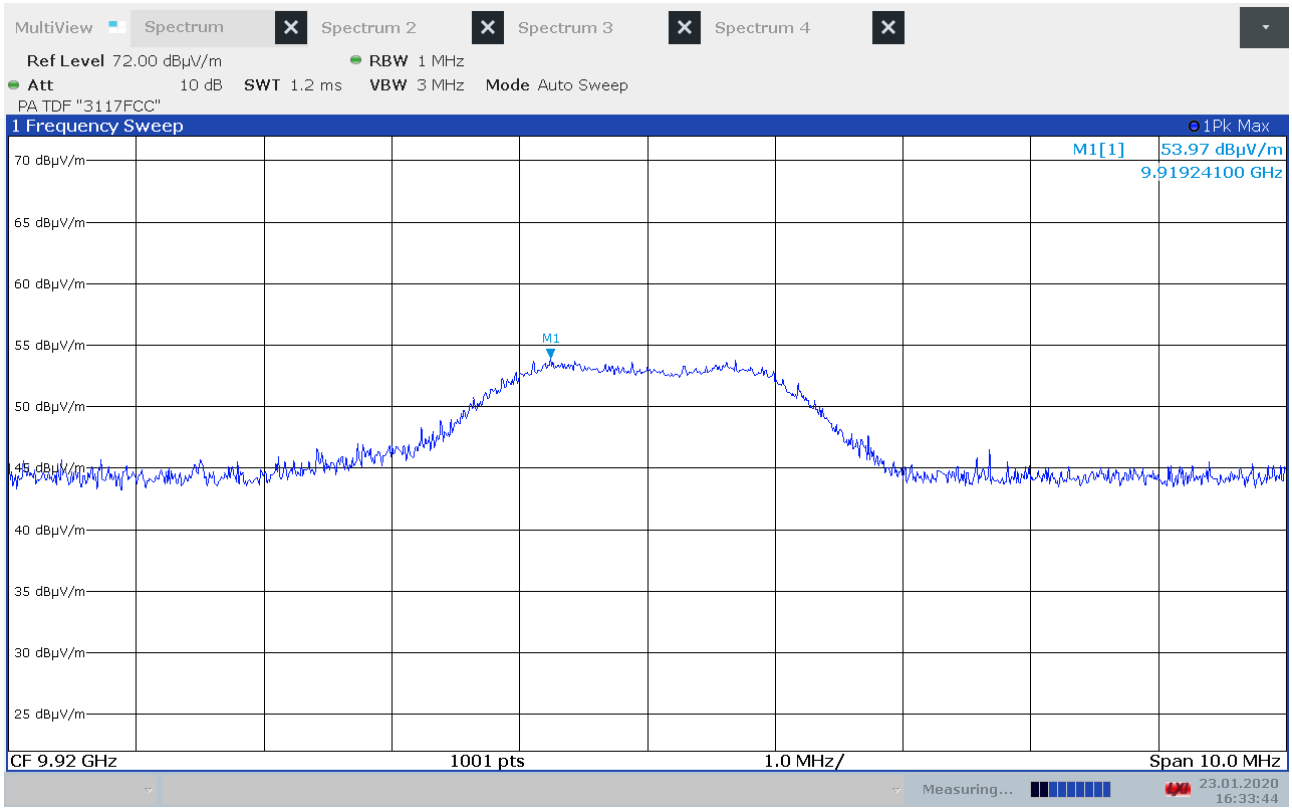
Maximum Radiated Emissions, 7440MHz, 2480MHz, GFSK



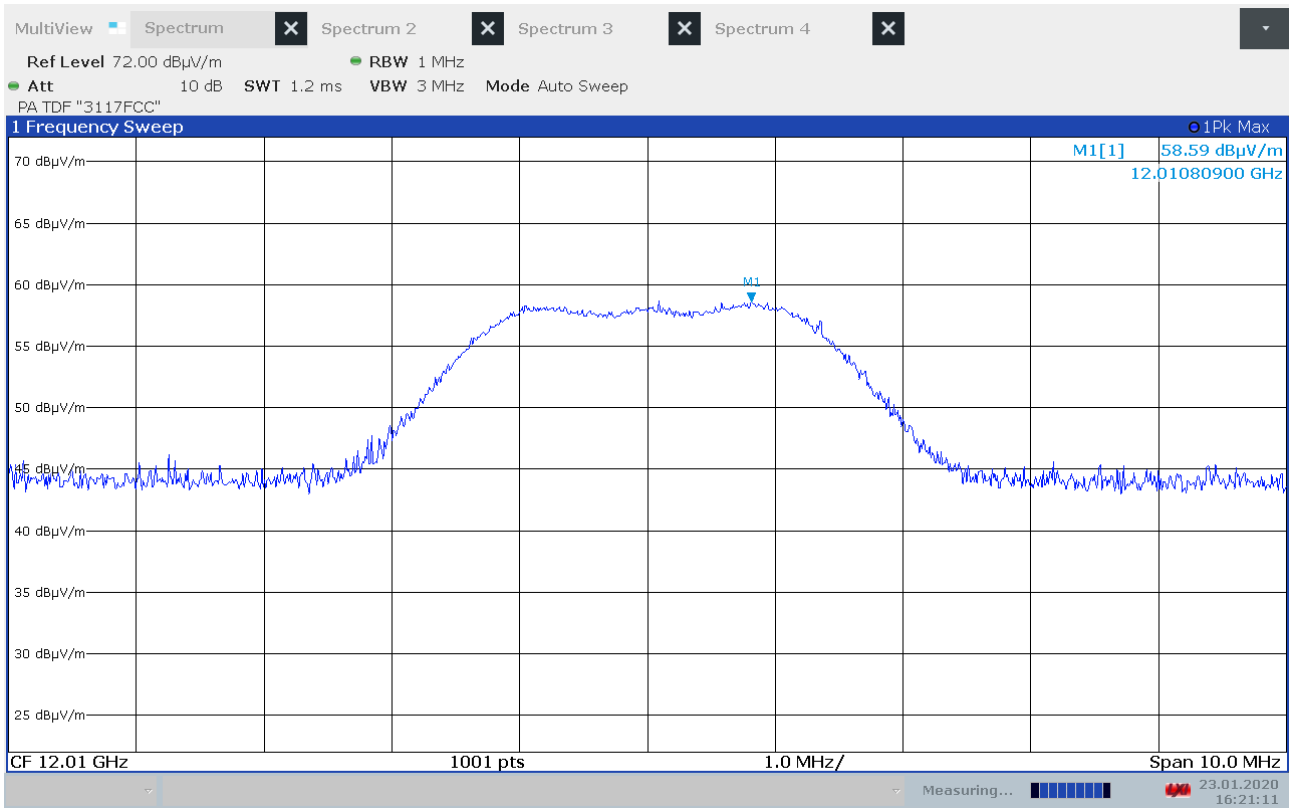
Maximum Radiated Emissions, 9608MHz, 2402MHz, GFSK



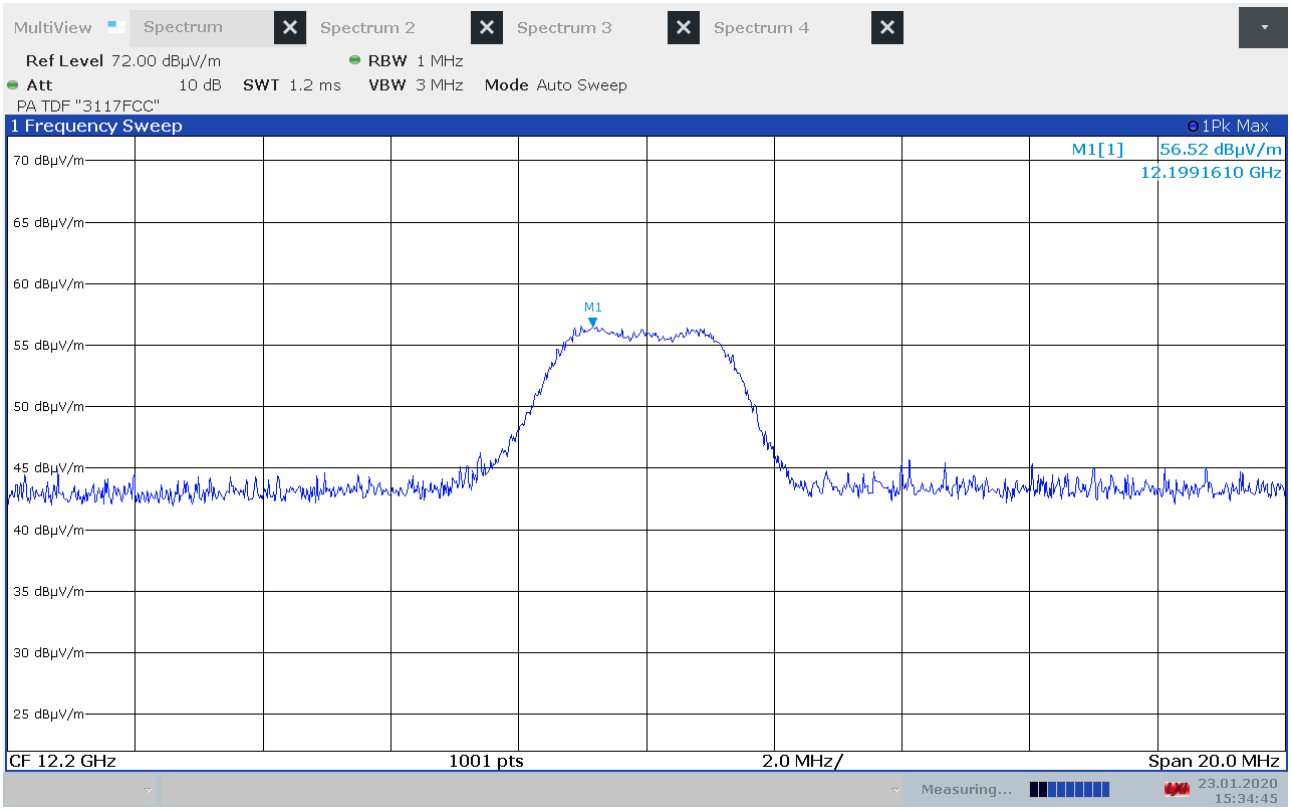
Maximum Radiated Emissions, 9760MHz, 2440MHz, GFSK



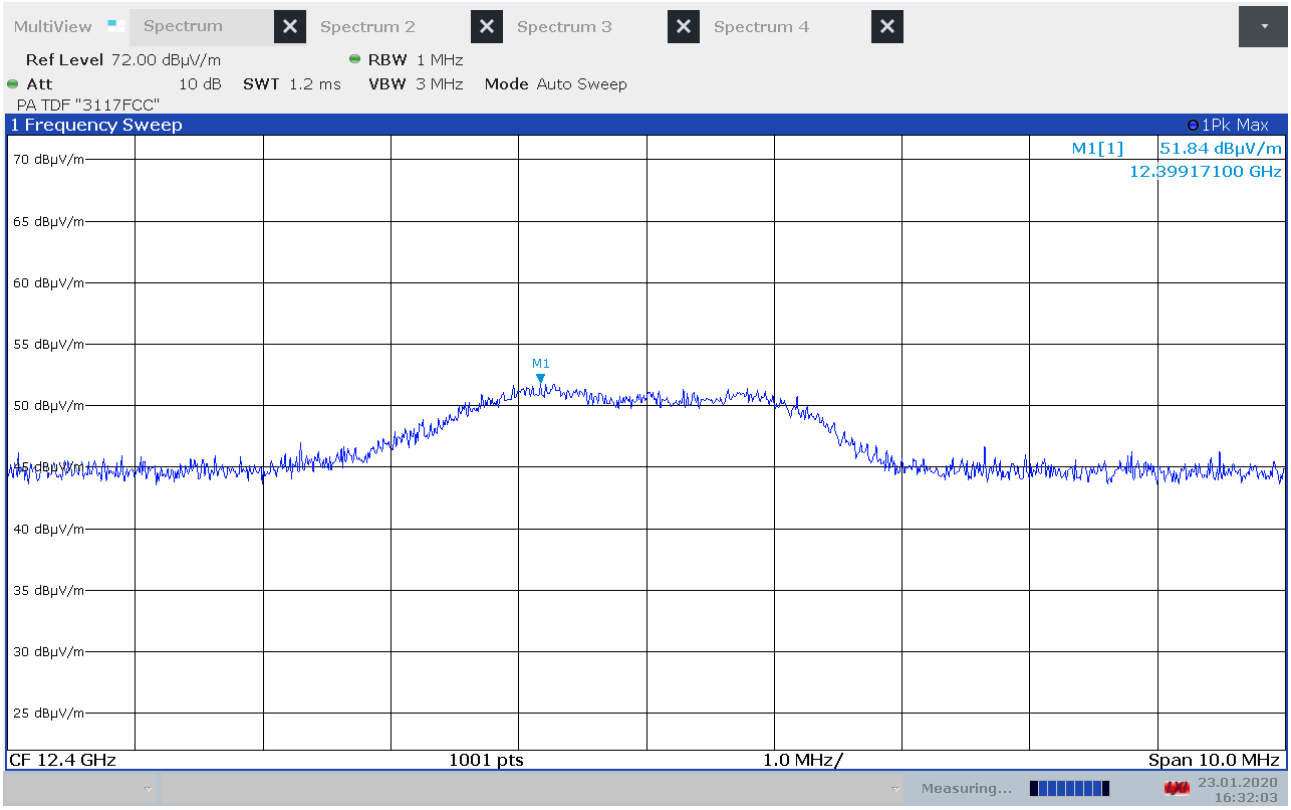
Maximum Radiated Emissions, 9920MHz, 2480MHz, GFSK



Maximum Radiated Emissions, 12010MHz, 2402MHz, GFSK



Maximum Radiated Emissions, 12200MHz, 2440MHz, GFSK



Maximum Radiated Emissions, 12400MHz, 2480MHz, GFSK

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	6810.17B	Attenuator	Suhner	LR 1669	2019-07	2020-07
3	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	2019-07	2020-07
4	VULB9163	BiLog Antenna	Schwarzbech	LR 1616	2020-01	2023-01
5	Model 317	PreAmplifier	Sonoma	LR 1687	2019-07	2020-07
6	3117-PA	Horn Antenna with PreAmp	EMCO	LR 1717	2017-12	2020-12
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2021-10
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2019-07	2020-07
9	638	Antenna Horn	Narda	LR 1480	2010-06	2020-06
10	ST 8/SMAm/Nm/36	RF Cable	Suhner	LR 1630	COU	

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

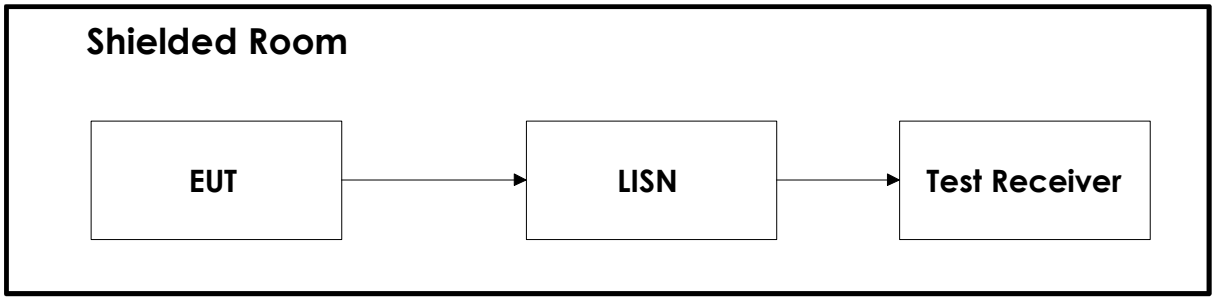
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.10	Radiated Emissions test software
2	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers

Revision history

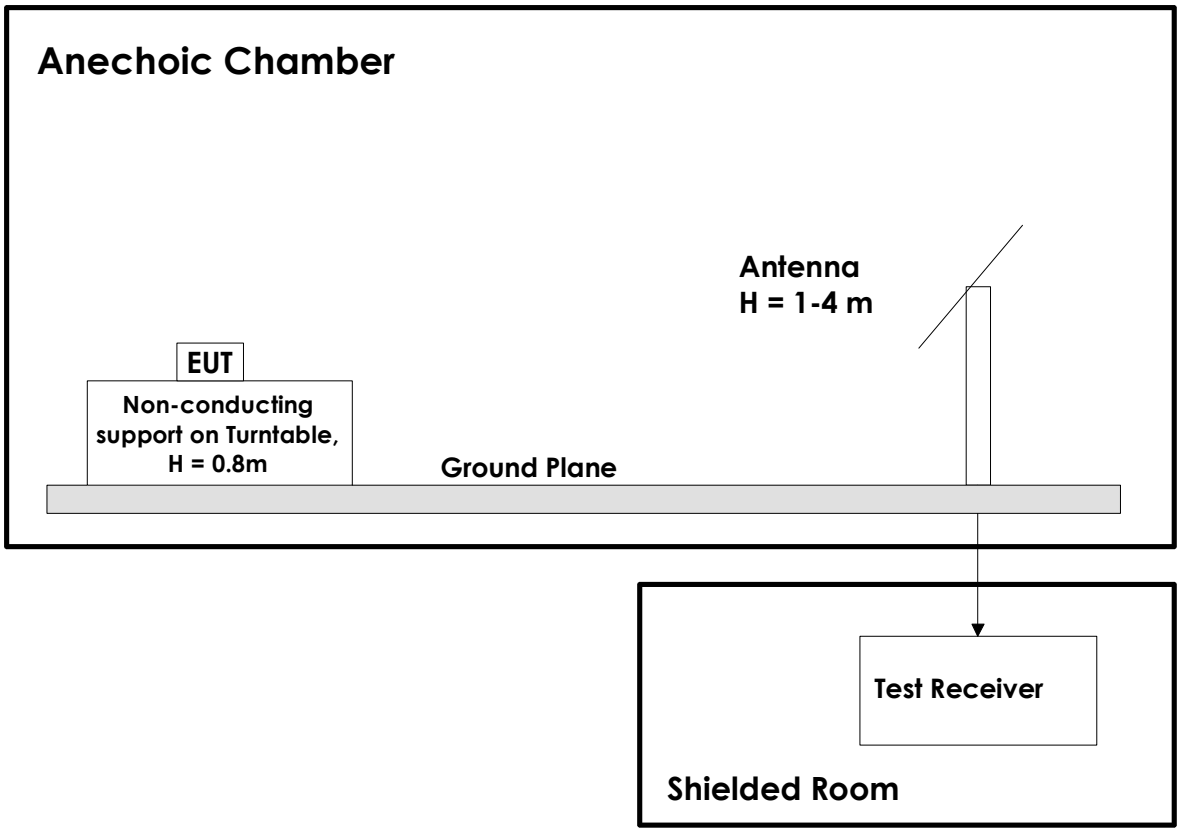
Revision	Date	Comment	Sign
00	2020-04-28	First edition	FS

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. 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.