

Test Report

Product	WLAN Handset with Bluetooth
Name and address of the applicant	Ascom (Sweden) AB Grimbodalen 2 SE-417 49 Gothenburg, Sweden
Name and address of the manufacturer	Ascom (Sweden) AB Grimbodalen 2 SE-417 49 Gothenburg, Sweden
Model	WH2
Rating	3.7V _{DC} (Li-Ion battery)
Trademark	ASCOM
Serial number	/
Additional information	WiFi, 802.11a/b/g/n, Bluetooth, 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	362353
Tested in period	2019-02-13 to 2019-05-08
Issue date	2019-05-29
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway CAB Number: FCC: NO0001 ISED: NO0470   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [G.Suhanthakumar]	
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1 INFORMATION

1.1 Test Item

Name	Ascom
FCC ID	BXZWH2
ISED ID	3724B-WH2
Model/version	WH2
Serial number	/
Hardware identity and/or version	PB
Software identity and/or version	1.0.4_Nemko
Frequency Range	2402–2480 MHz
Number of Channels	79
Operating Modes	Bluetooth Basic Rate, Bluetooth 2-EDR and Bluetooth 3-EDR
Type of Modulation	BT Basic Rate: GFSK BT 2-EDR: $\pi/4$ -DPSK BT 3-EDR: 8-DPSK
Conducted Output Power	BT Basic Rate: 6.3 mW (Peak) BT 2-EDR: 4.5 mW (Peak) BT 3-EDR: 4.9 mW (Peak)
Antenna Connector	None
Number of Antennas	1
Antenna Diversity Supported	No
Power Supply	Secondary Battery (3.7V Li-Ion)

Description of Test Item

The EUT is a WiFi Handset with Bluetooth and Bluetooth Low Energy.

This Bluetooth part has been tested as a Frequency Hopping system and fulfils all requirements for FHSS systems.

1.2 Normal test condition

Temperature:	20–25 °C
Relative humidity	20–50 %
Air pressure	860–1060 mbar
Normal test voltage	3.7 V _{DC} (Nominal Voltage)

All tests were performed with the EUT powered from a fully charged battery.

Values above are the limit registered during the test period.

1.3 Test Engineer

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ YES	☒ NO
If detachable, is the antenna connector(s) non-standard?	☐ YES	☐ NO
The tested equipment has only integral antennas. Conducted tests were performed with a temporary antenna connector.		

Requirement: FCC 15.203, 15.204

1.5 Comments

The EUT uses the Bluetooth protocol with Frequency Hopping.

Radiated measurements were done with the EUT powered by a fully charged battery.

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 and 3m.

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

☒ 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".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	N/A ¹
Channel Separation	15.247(a)(1)	5.1 (4) (RSS-247)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	Complies
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	Complies
Hopping Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	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)	Complies

¹ The EUT is battery powered and the battery is charged in an external charger

Revision history

Version	Date	Comment	Sign
1.0	2019-05-08	First edition	FS

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	20 dB Bandwidth	Channel Separation	Verdict
Basic Rate (GFSK)	0.887 MHz	1.0 MHz	Complies
2-EDR ($\pi/4$ -DPSK)	1.32 MHz	1.0 MHz	Complies
3-EDR (8-DPSK)	1.27 MHz	1.0 MHz	Complies

RF channel has no influence on 20 dB bandwidth.

See attached plots

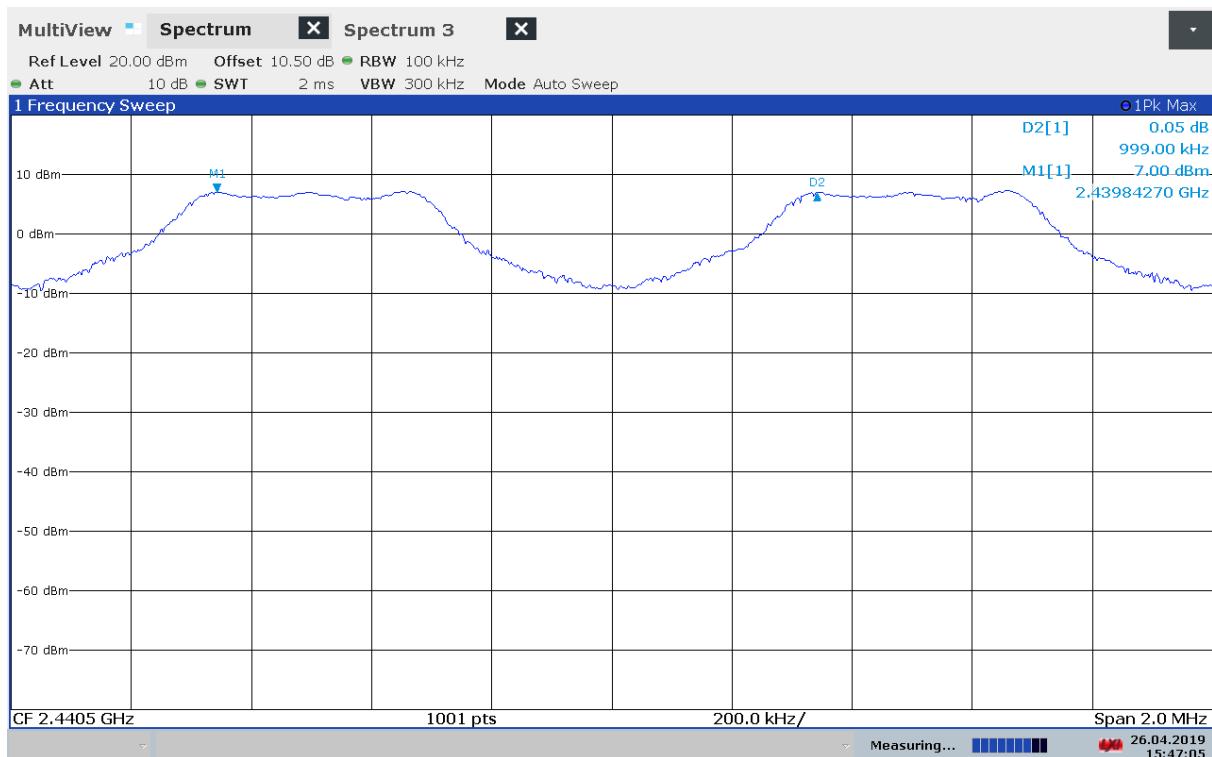
Requirement:

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.

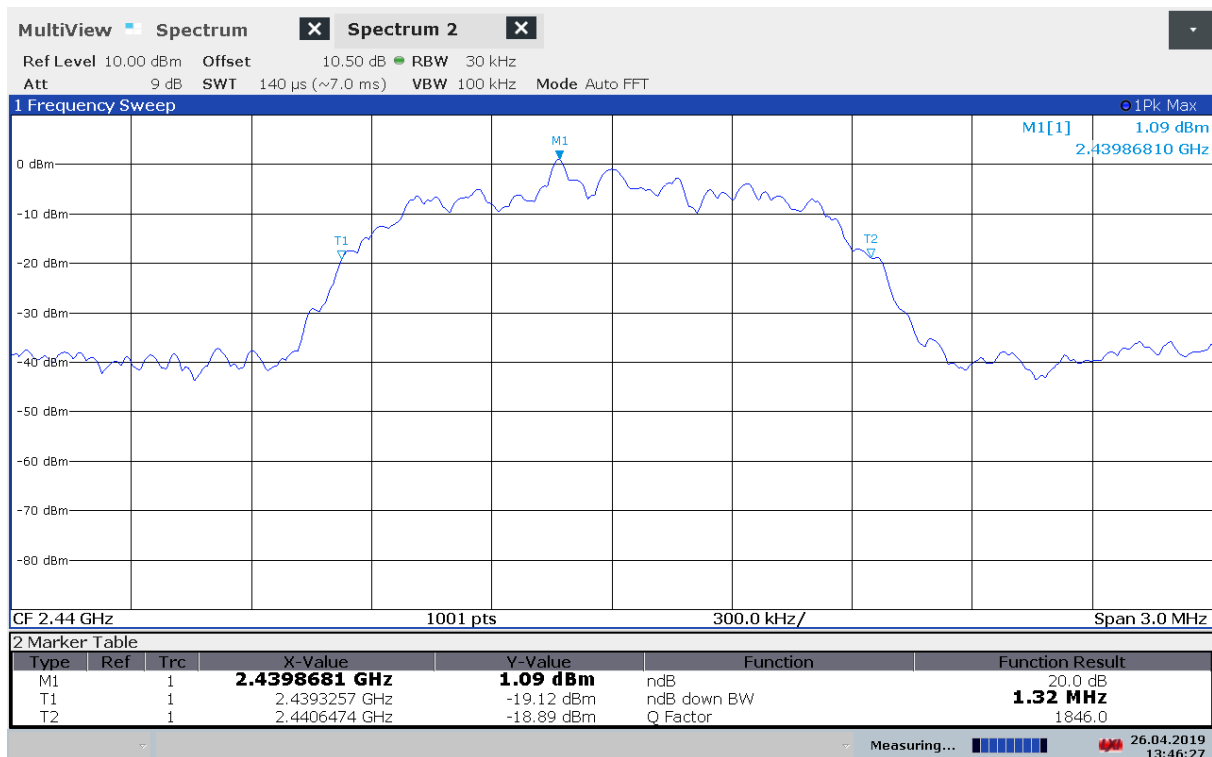
No requirements for Digital Transmission Systems.



Channel Separation



20dB Bandwidth, 2440 MHz, Basic Rate



20dB Bandwidth, 2440 MHz, 2-EDR



20dB Bandwidth, 2440 MHz, 3-EDR

3.2 Pseudorandom Hopping Algorithm

FCC Part 15.247 (a)(1)

ISED Canada RSS-247 Issue 2, Clause 5.1

Test Results: Complies

Measurement Data: /

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.

Base Table Hopping Sequence

The EUT follows the Bluetooth Standard and the hopping sequence is Pseudo Random.

3.3 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	Frame Length	Time of Occupancy	Verdict
DH1 – Basic Rate	0.385 ms	1.25 ms	0.124 sec	Complies
DH3 – Basic Rate	1.64 ms	2.50 ms	0.262 sec	Complies
DH5 – Basic Rate	2.89 ms	3.75 ms	0.308 sec	Complies
2-DH1 – 2-EDR	0.391 ms	1.25 ms	0.125 sec	Complies
2-DH3 – 2-EDR	1.64 ms	2.50 ms	0.262 sec	Complies
2-DH5 – 2-EDR	2.89 ms	3.75 ms	0.308 sec	Complies
3-DH1 – 3-EDR	0.391 ms	1.25 ms	0.125 sec	Complies
3-DH3 – 3-EDR	1.64 ms	2.50 ms	0.262 sec	Complies
3-DH5 – 3-EDR	2.89 ms	3.75 ms	0.308 sec	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

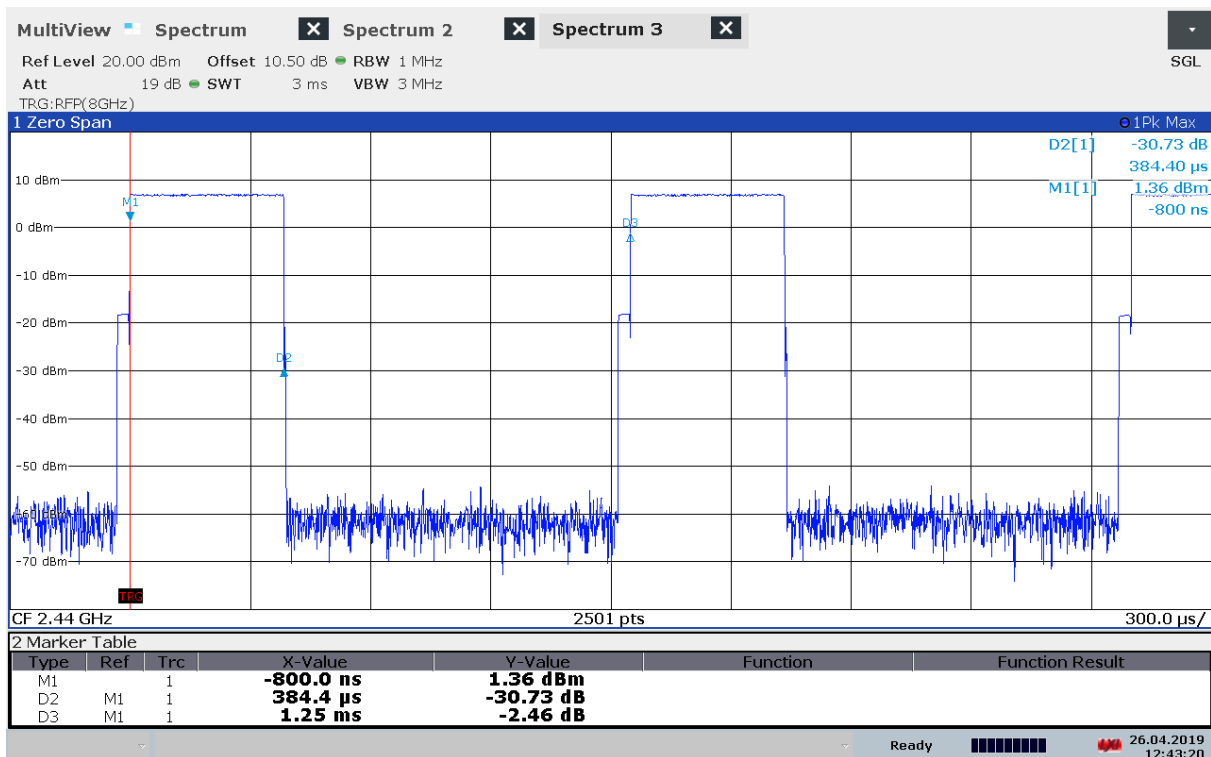
Number of RF channels is minimum 20 and maximum 78

See attached plots

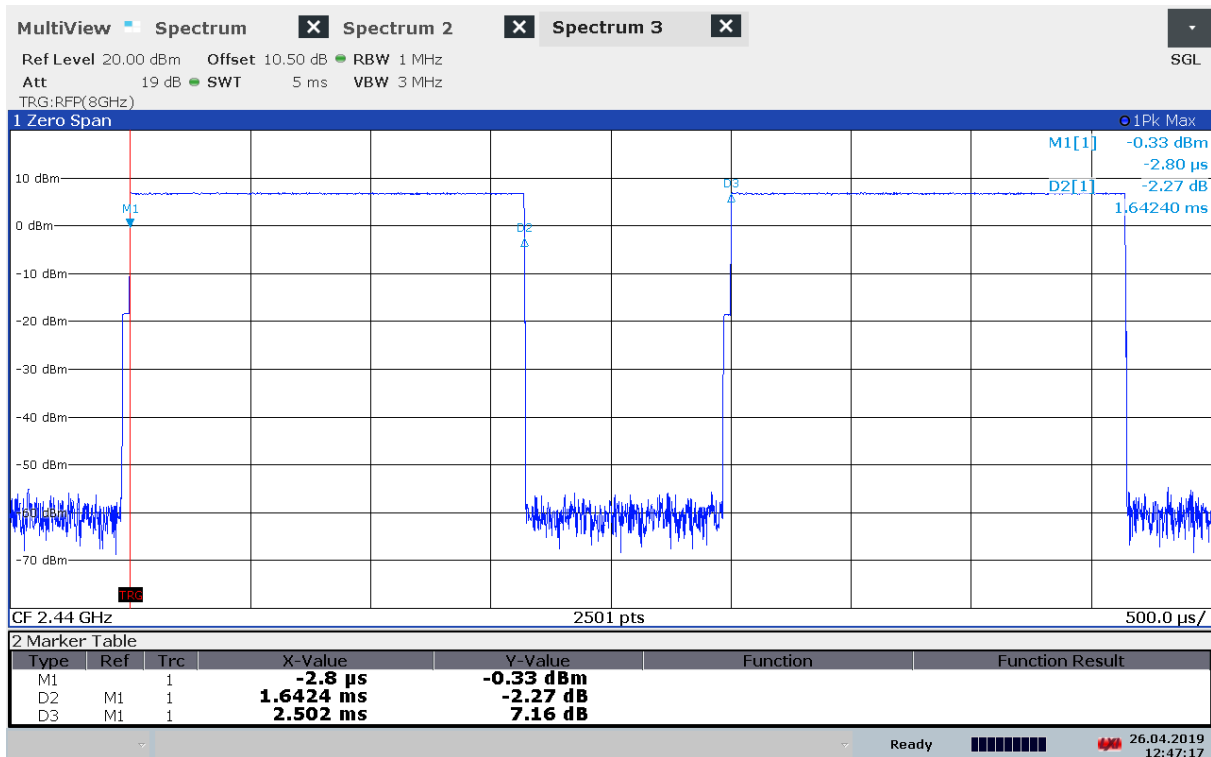
Requirements:

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.

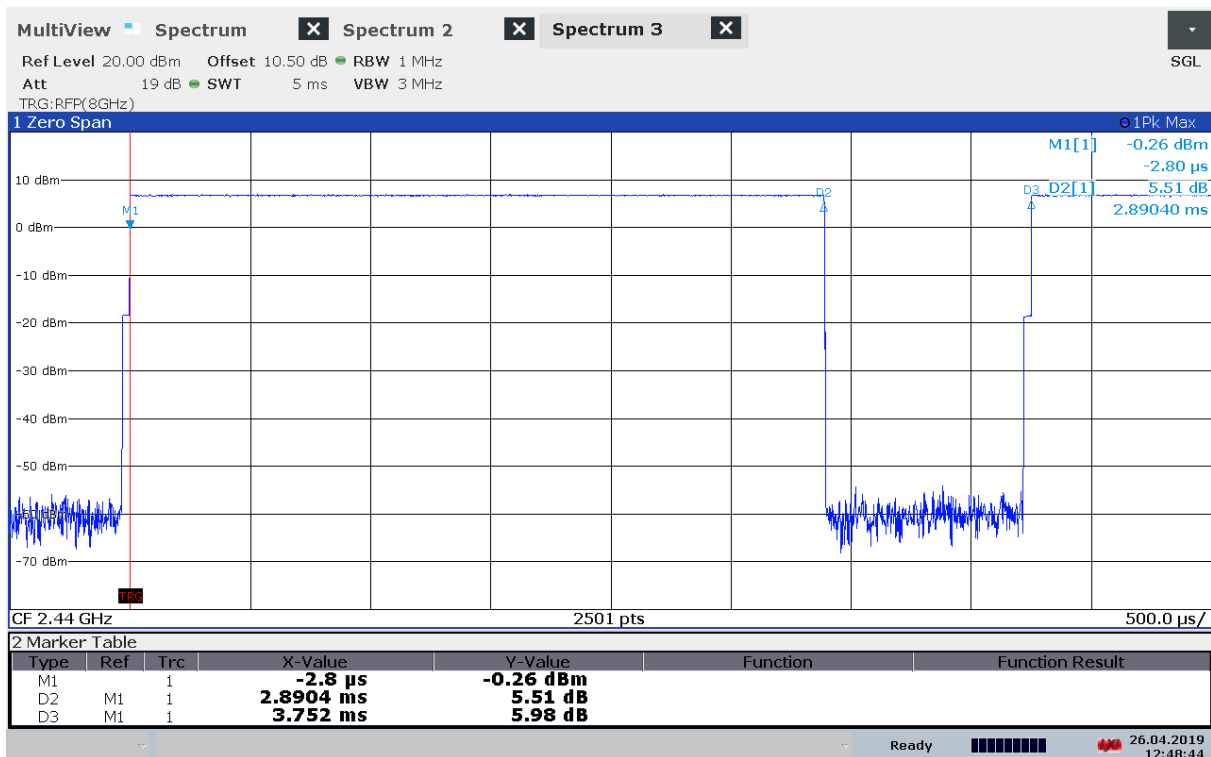
No requirements for Digital Transmission Systems.



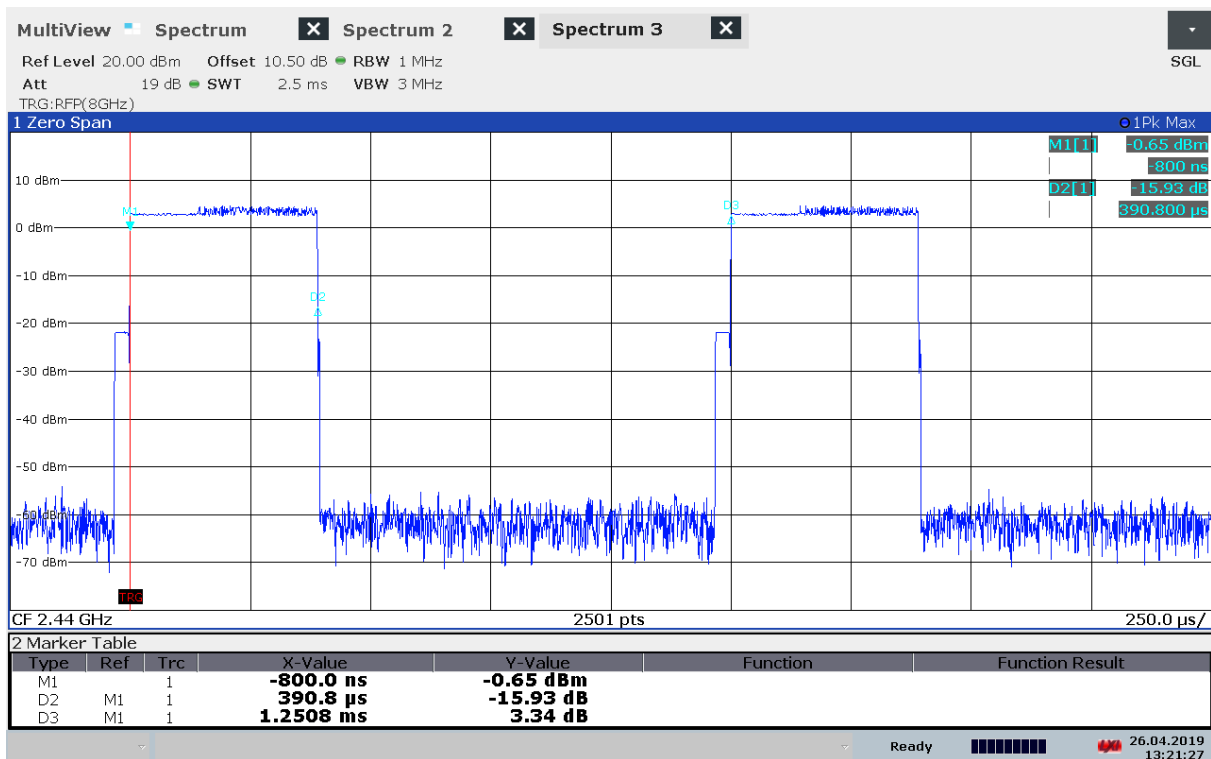
Dwell Time DH1



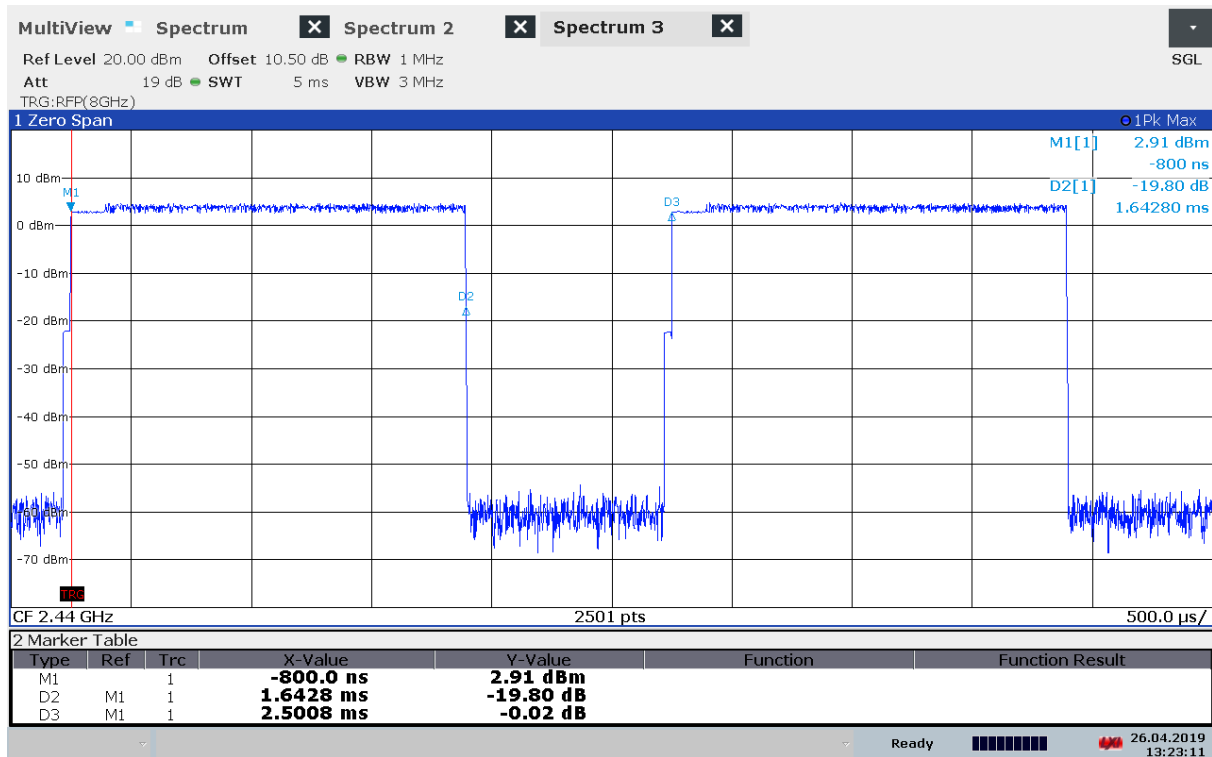
Dwell Time DH3



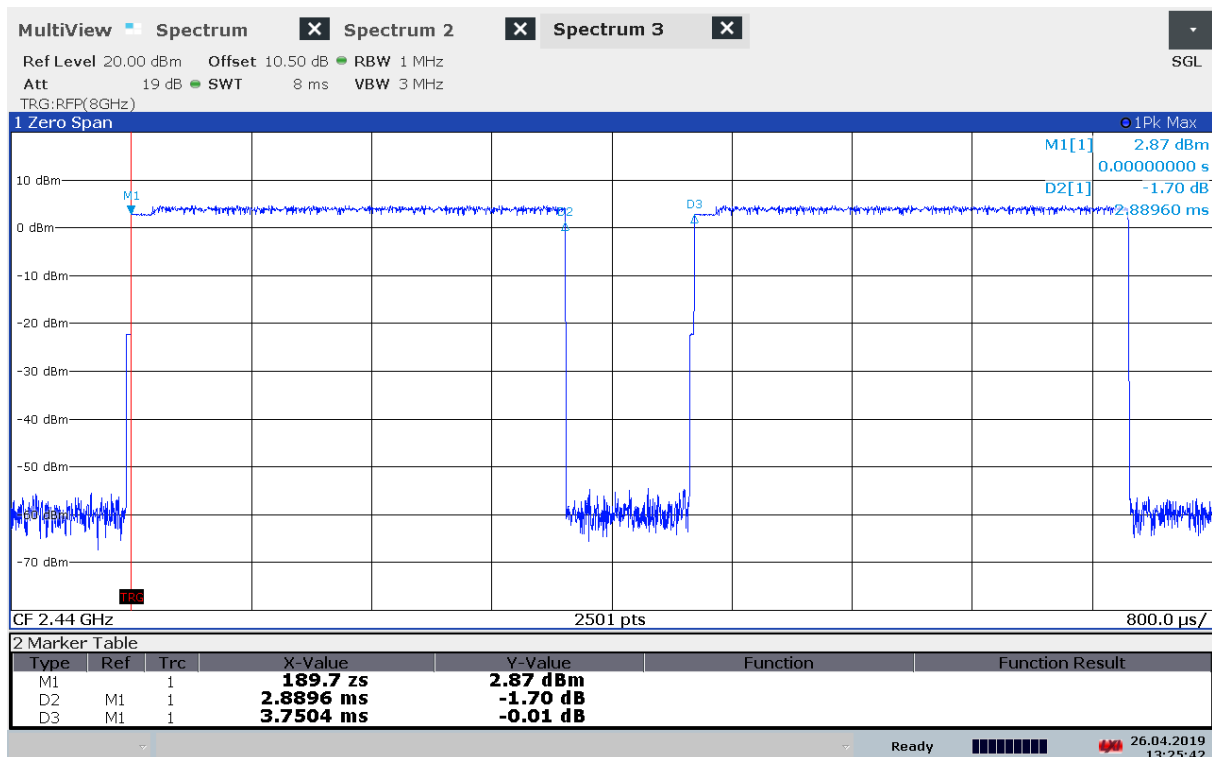
Dwell Time DH5



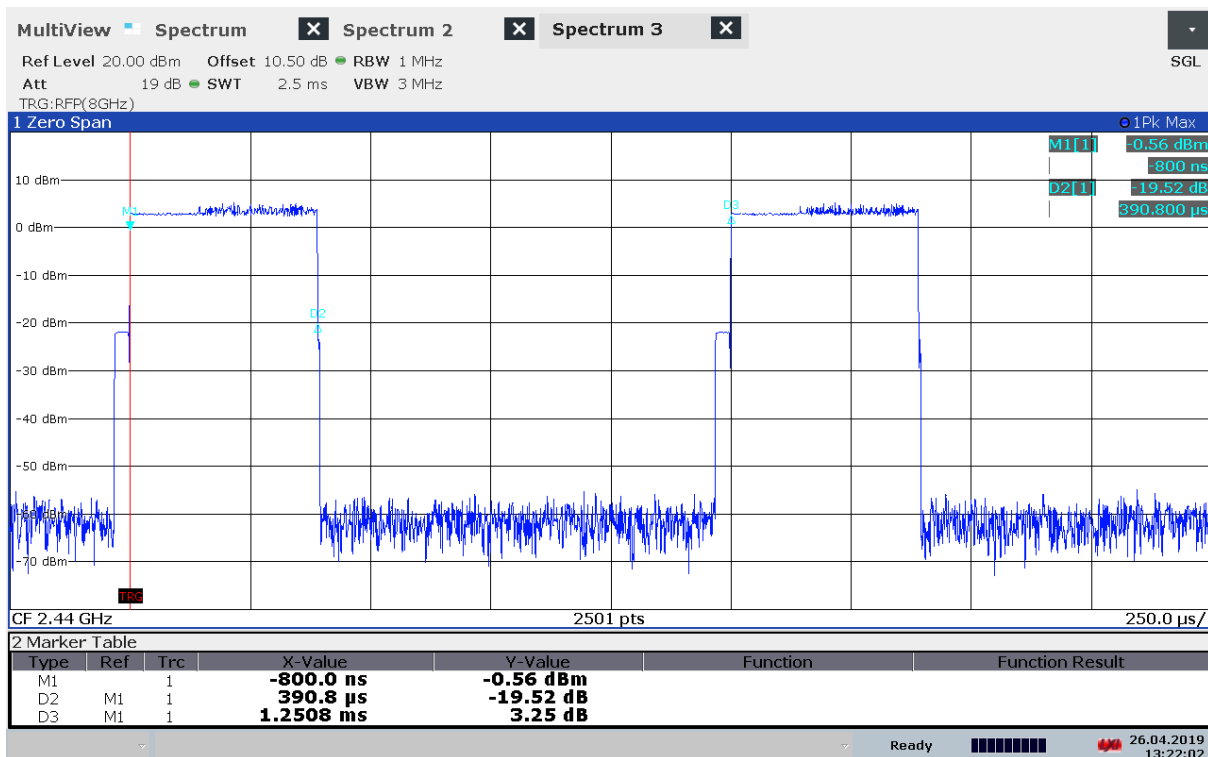
Dwell Time 2-DH1



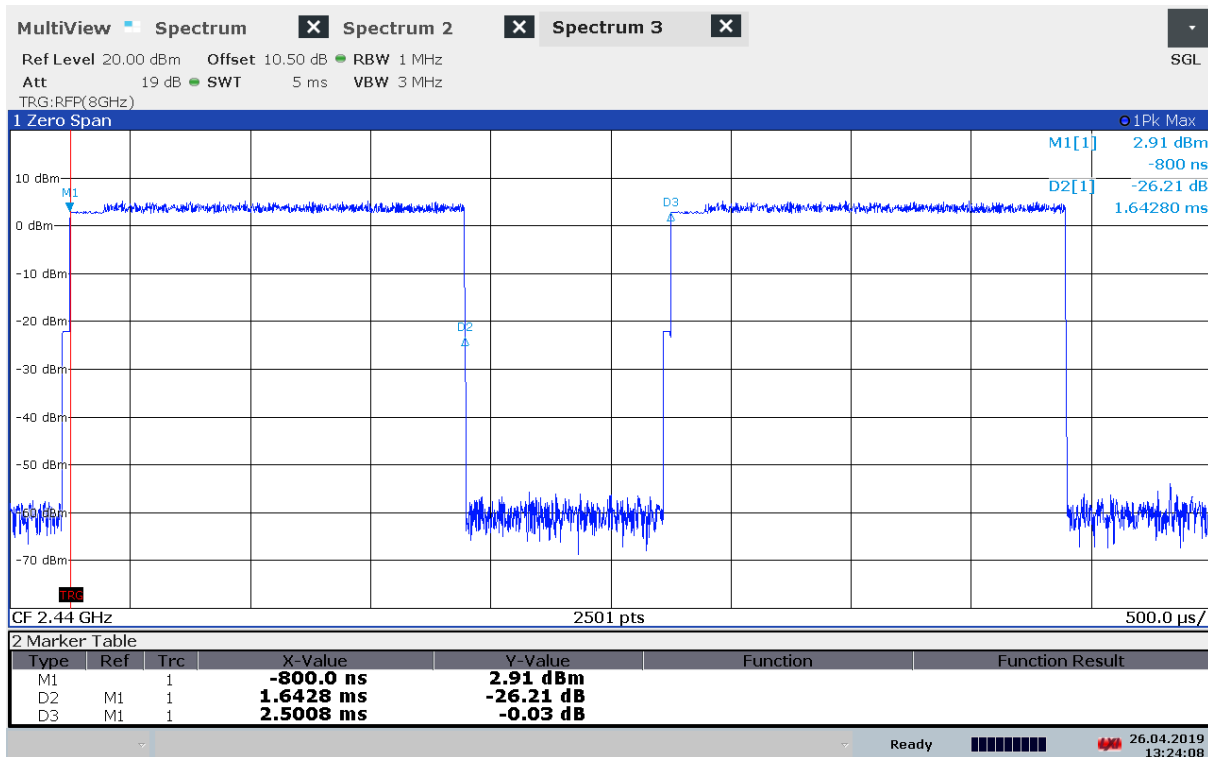
Dwell Time 2-DH3



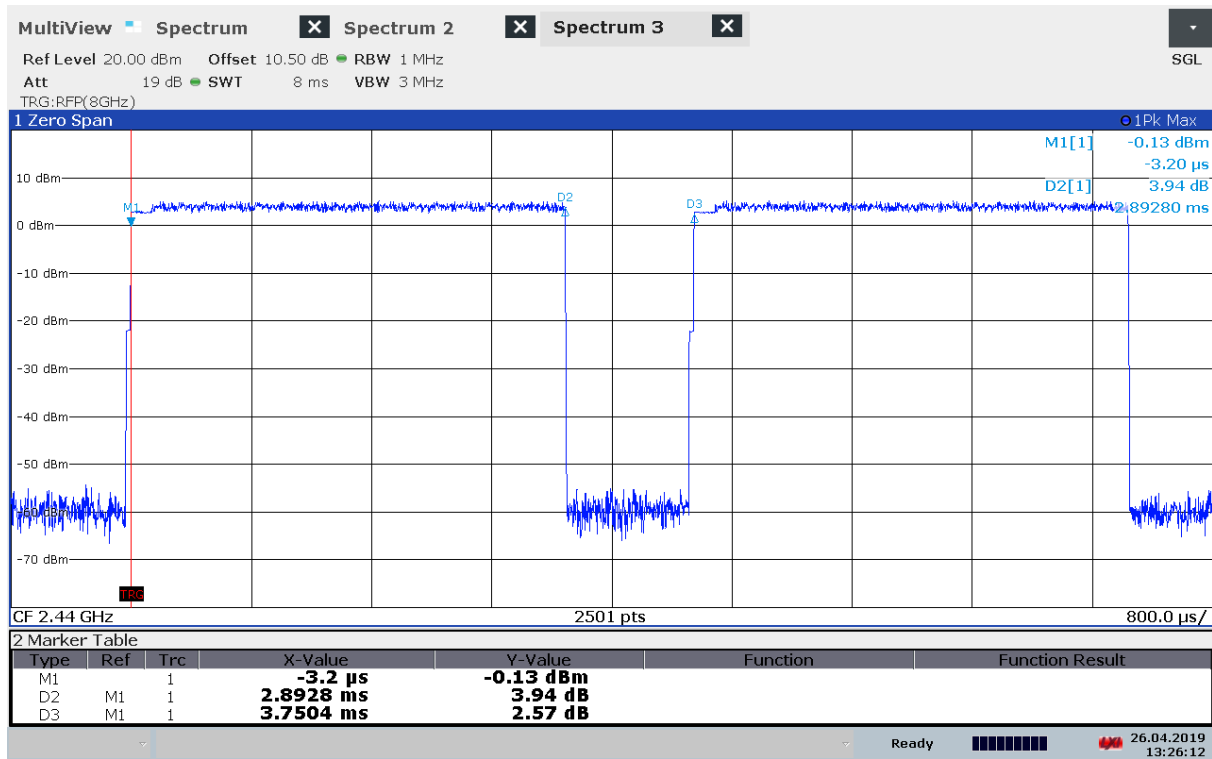
Dwell Time 2-DH5



Dwell Time 3-DH1



Dwell Time 3-DH3



Dwell Time 3-DH5

3.4 Hopping Bandwidth

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

ISED Canada RSS-247 Issue 2, Clause 5.1

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2 / 7.8.3

Test Results: Complies

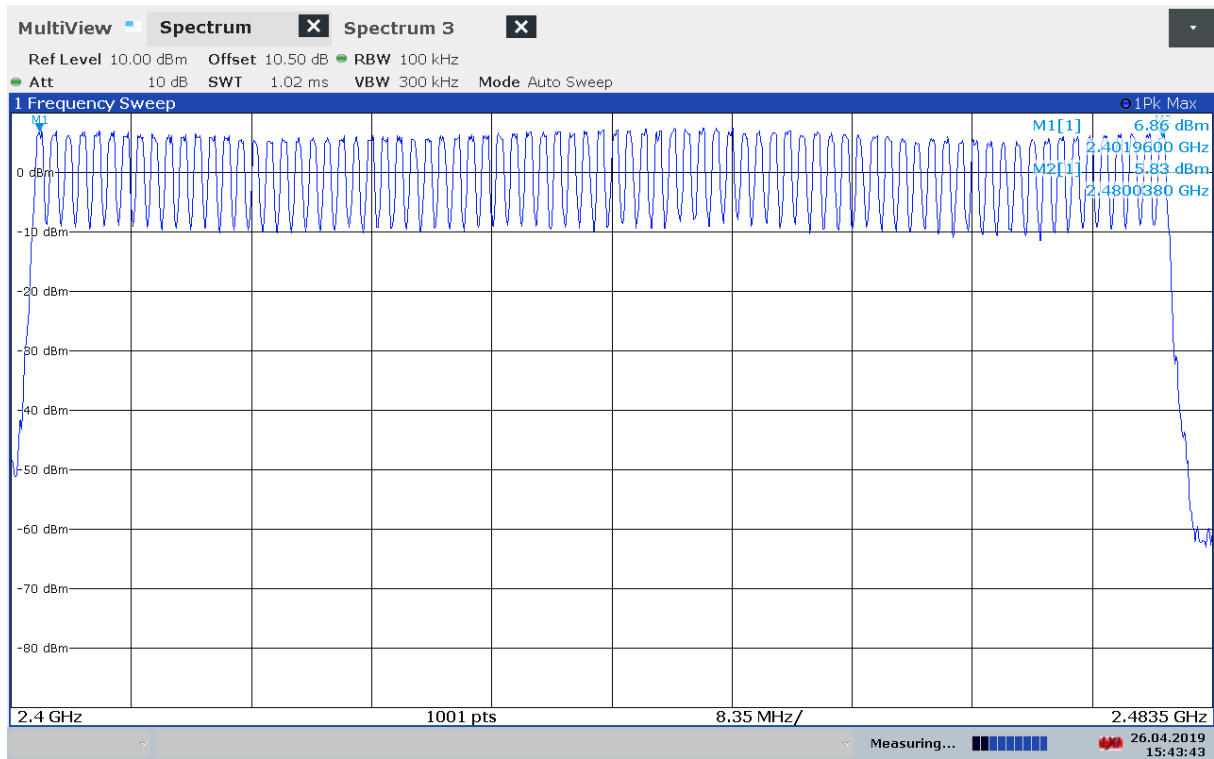
Measurement Data:

Number of RF Channels in use	20 to 79
Channel Centre Frequencies	2402 to 2480 MHz
Channel Separation	1 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.



RF Channels in Use

3.5 Occupied Bandwidth (99% BW)

RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2 / 7.8.3

Test Results: Complies

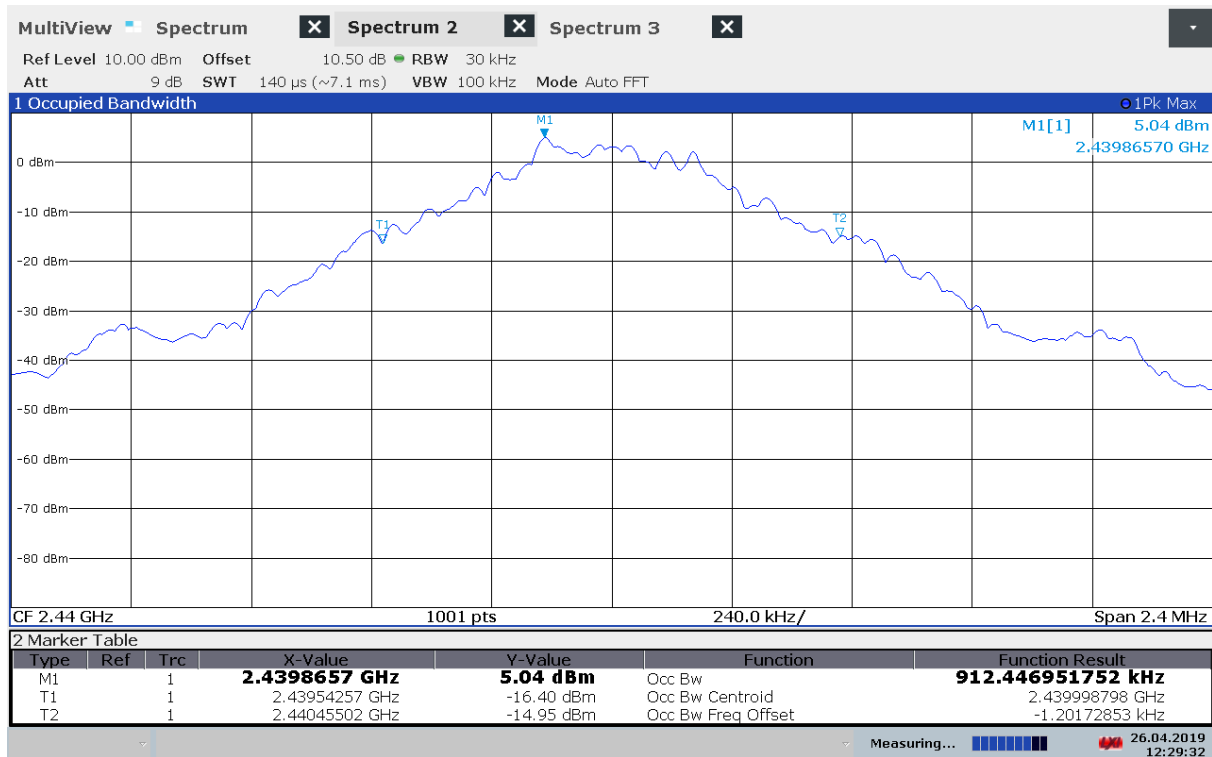
Measurement Data:

Carrier Frequency and Data Rate	Occupied Bandwidth (99% BW)
2440 MHz Basic Rate	912 kHz
2440 MHz 2-EDR	1.20 MHz
2440 MHz 3-EDR	1.18 MHz

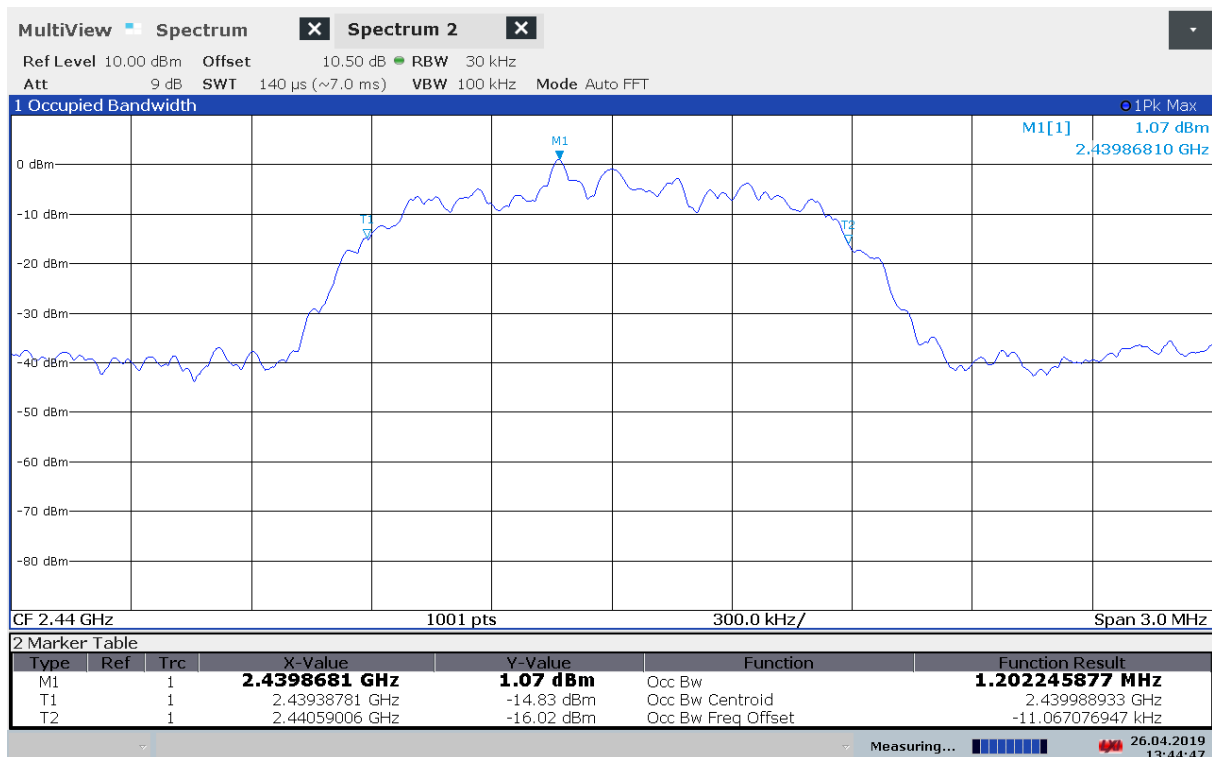
See attached plots.

Requirements:

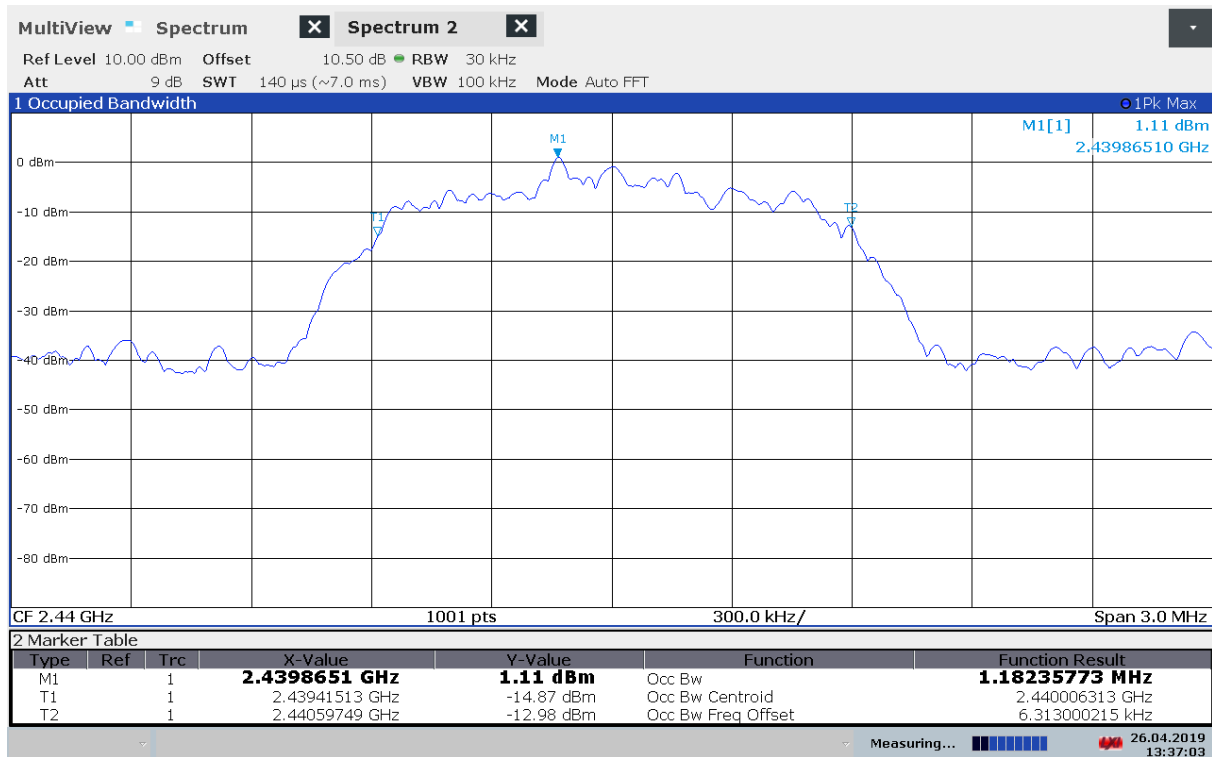
No limit specified.



Occupied Bandwidth, 99%, 2440 MHz, Basic Rate



Occupied Bandwidth, 99%, 2440 MHz, 2-EDR



Occupied Bandwidth, 99%, 2440 MHz, 3-EDR

3.6 Peak Power Output

FCC 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:

Maximum Peak Power					
Carrier Frequency and Modulation	Conducted Power (dBm)	Conducted Power (mW)	Field Strength @3m (dBμV/m)	Calculated Radiated Power (dBm)	Antenna Gain (dBi)
2402 MHz GFSK	7.9	6.2	106.5	11.2	3.3
2440 MHz GFSK	8.0	6.3	106.2	10.9	2.9
2480 MHz GFSK	7.5	5.6	105.3	10.1	2.6
2402 MHz π/4-DPSK	6.5	4.5			
2440 MHz π/4-DPSK	6.1	4.1			
2480 MHz π/4-DPSK	5.3	3.4			
2402 MHz 8-DPSK	6.9	4.9			
2440 MHz 8-DPSK	6.4	4.4			
2480 MHz 8-DPSK	5.6	3.6			

Output Power reported is Maximum Peak Power.

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

Conducted values have been corrected 0.9 dB for cable loss.

Antenna Gain is less than 6 dBi.

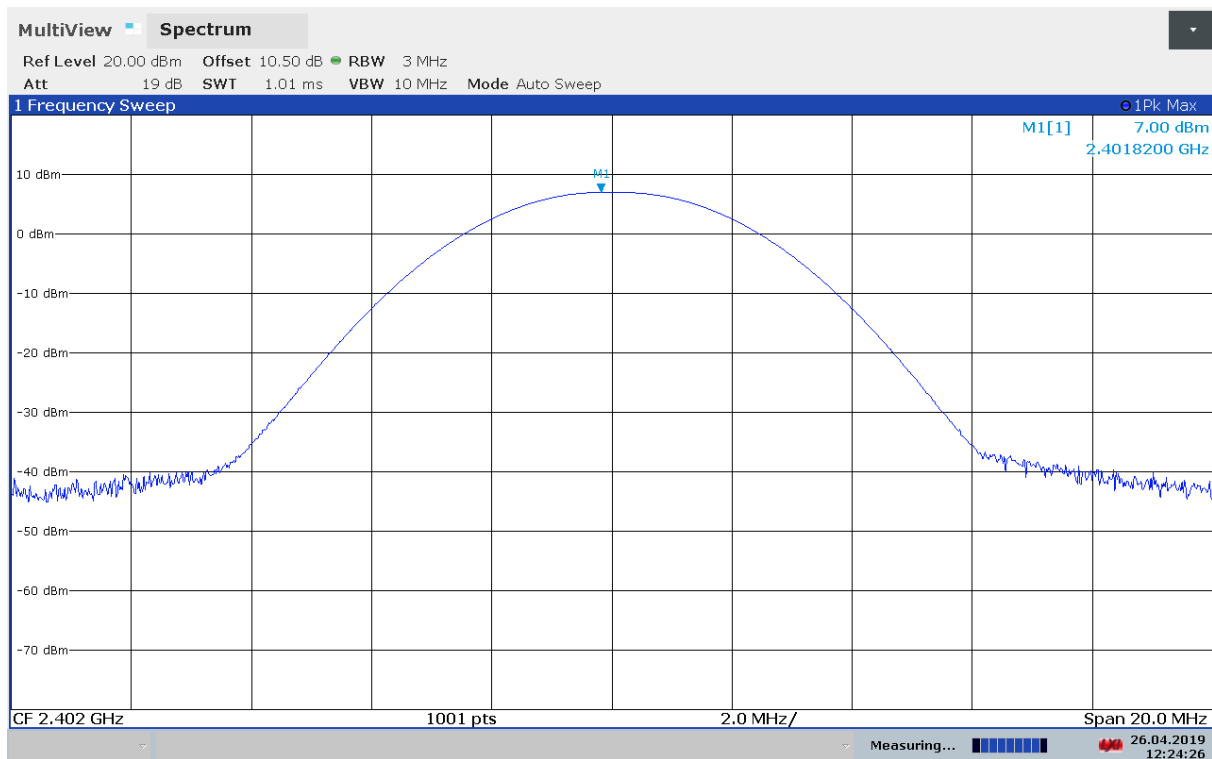
See attached plots.

Requirements:

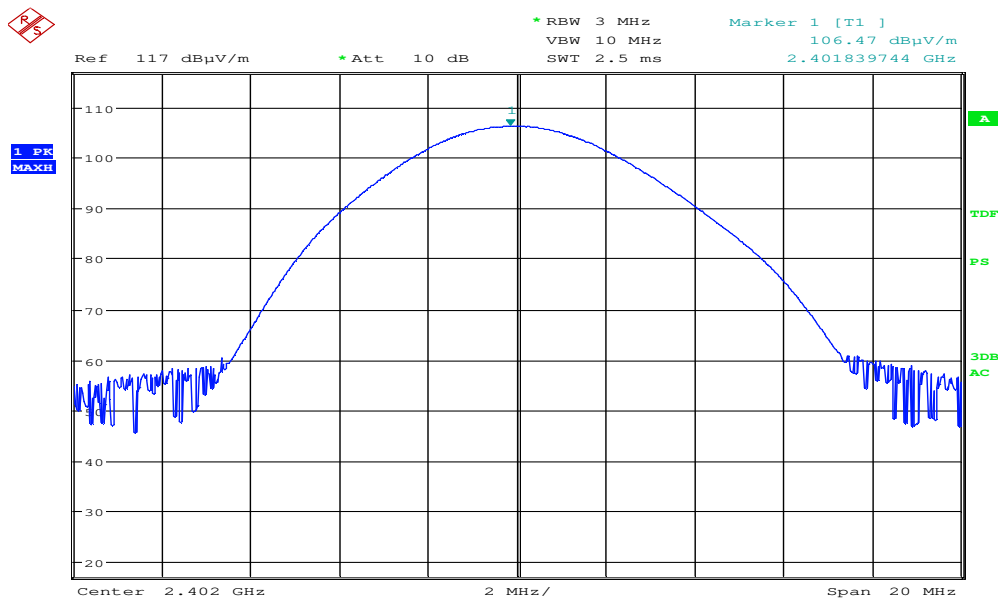
The maximum peak output power shall not exceed the following limits:

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 limit shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

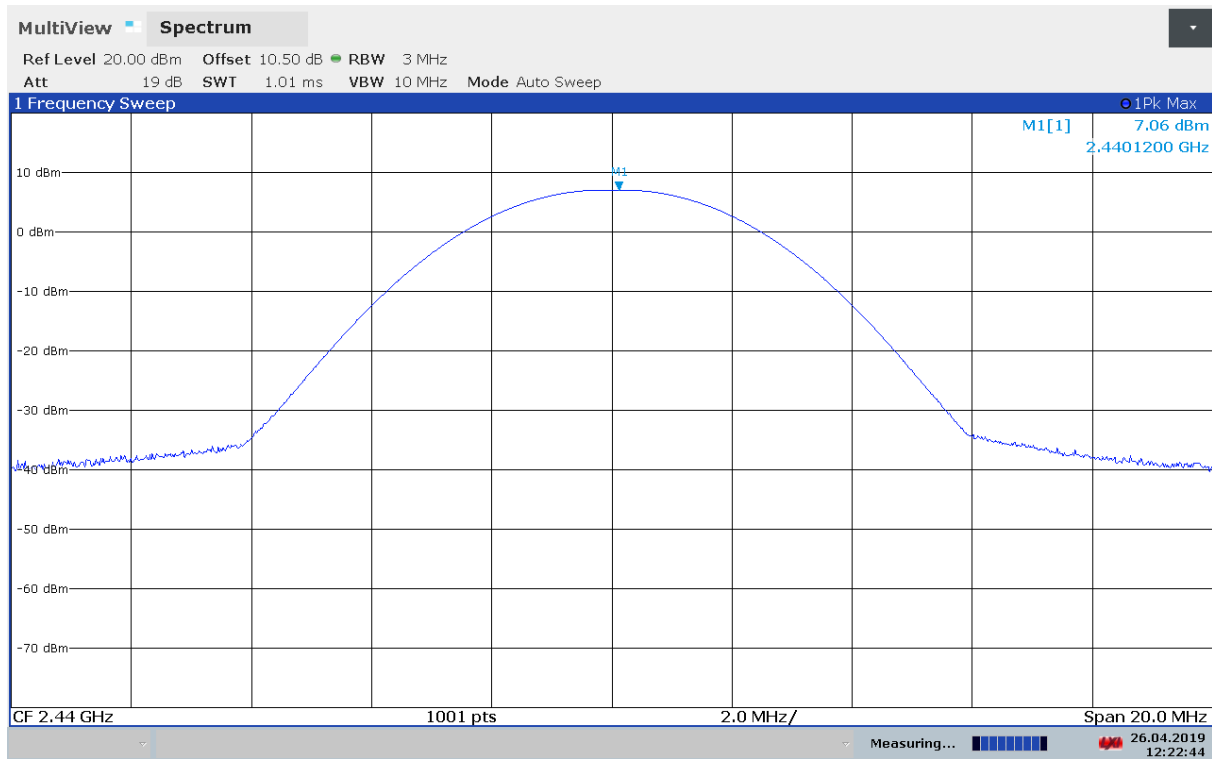


Conducted Power, 2402 MHz, Basic Rate

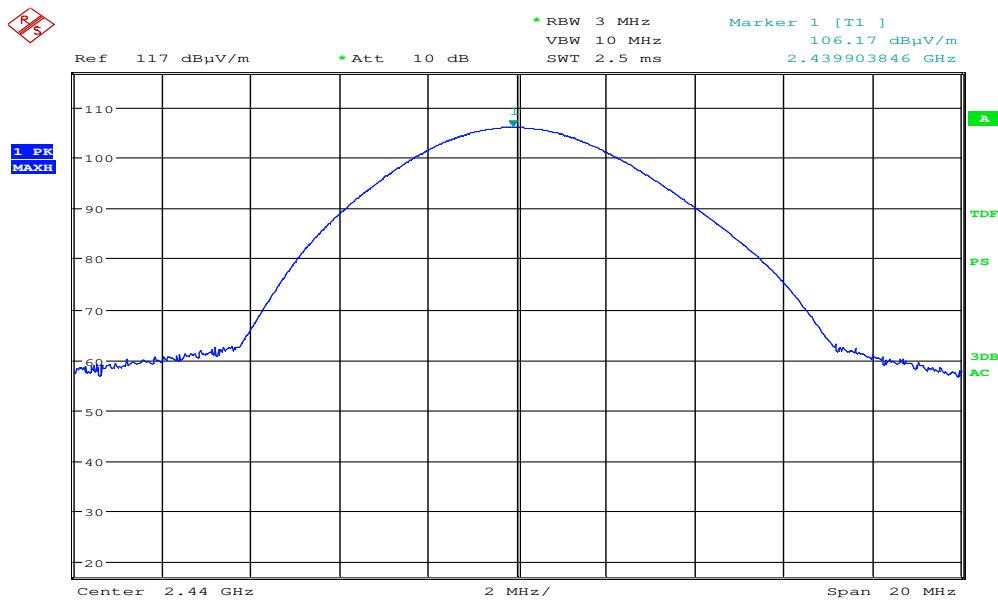


Date: 7.MAY.2019 15:40:39

Maximum Field Strength, 2402 MHz, Basic Rate

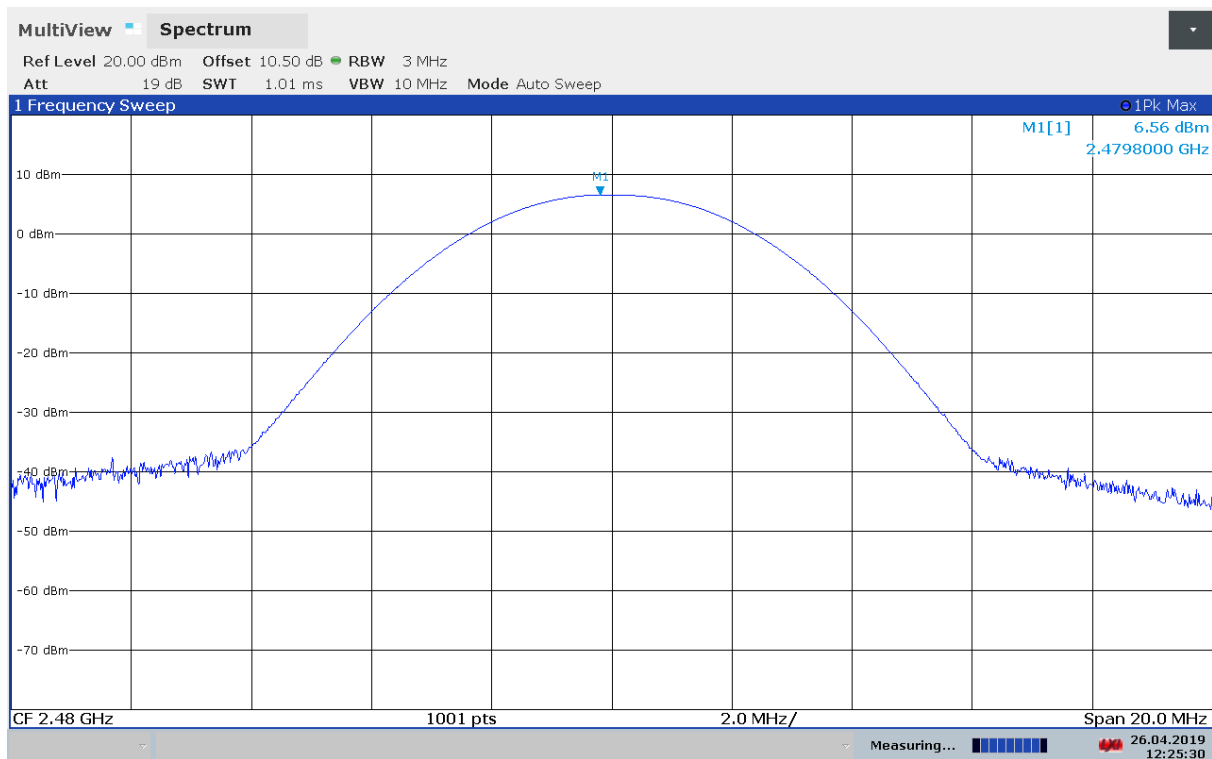


Conducted Power, 2440 MHz, Basic Rate

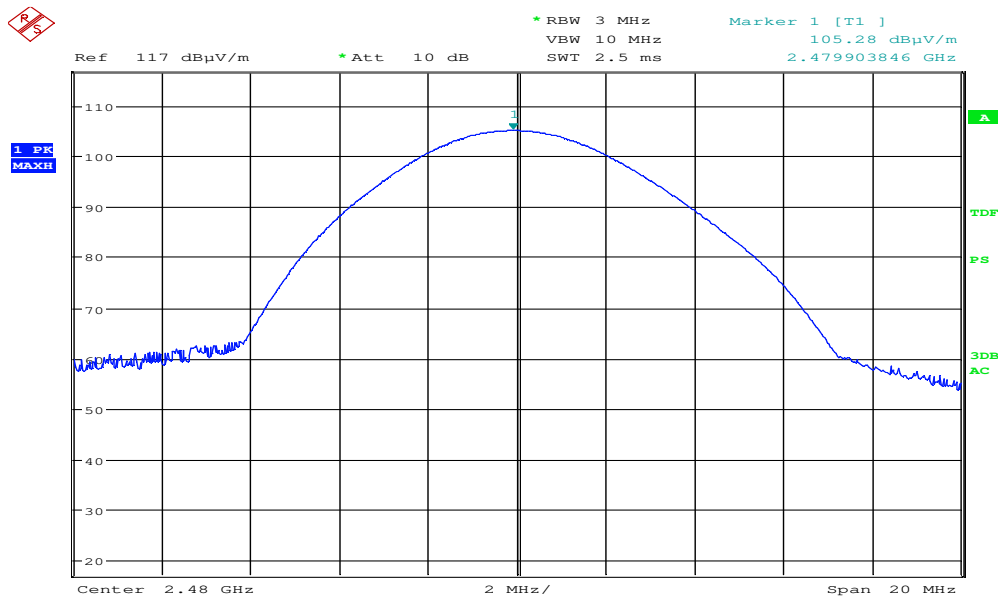


Date: 7.MAY.2019 15:37:06

Maximum Field Strength, 2440 MHz, Basic Rate

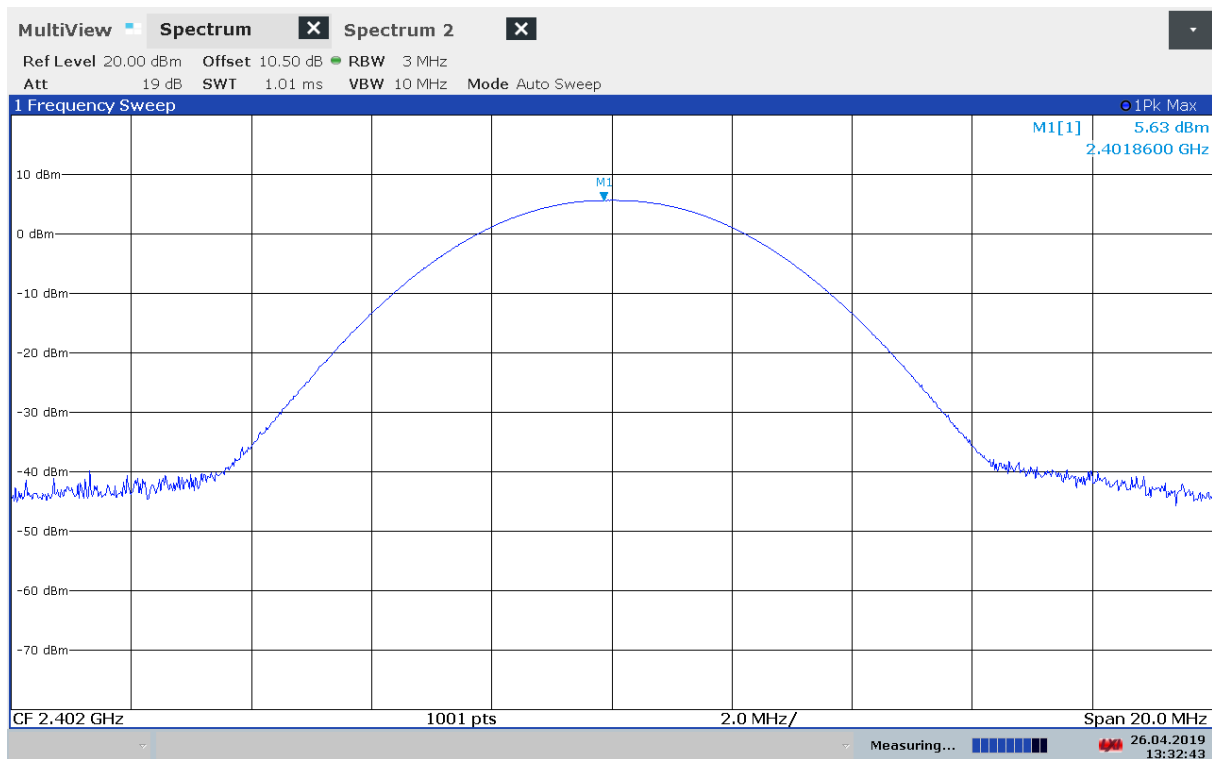


Conducted Power, 2480 MHz, Basic Rate

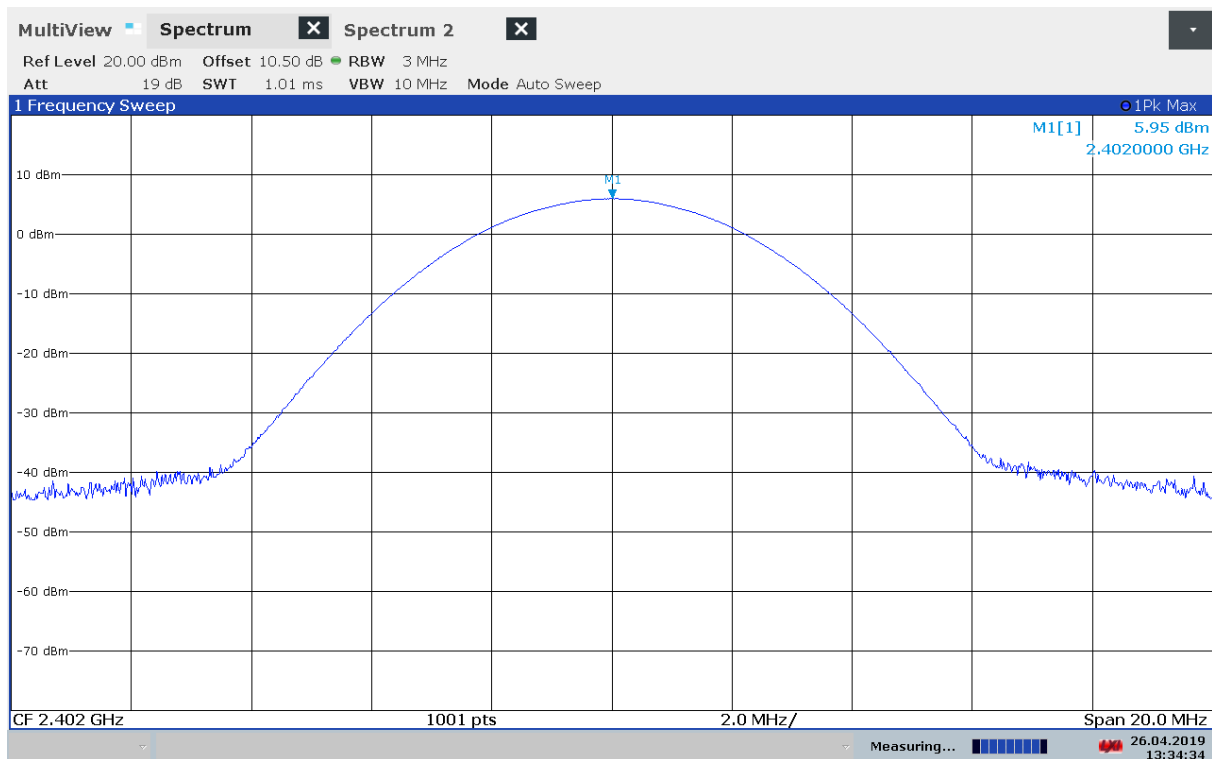


Date: 7.MAY.2019 15:46:44

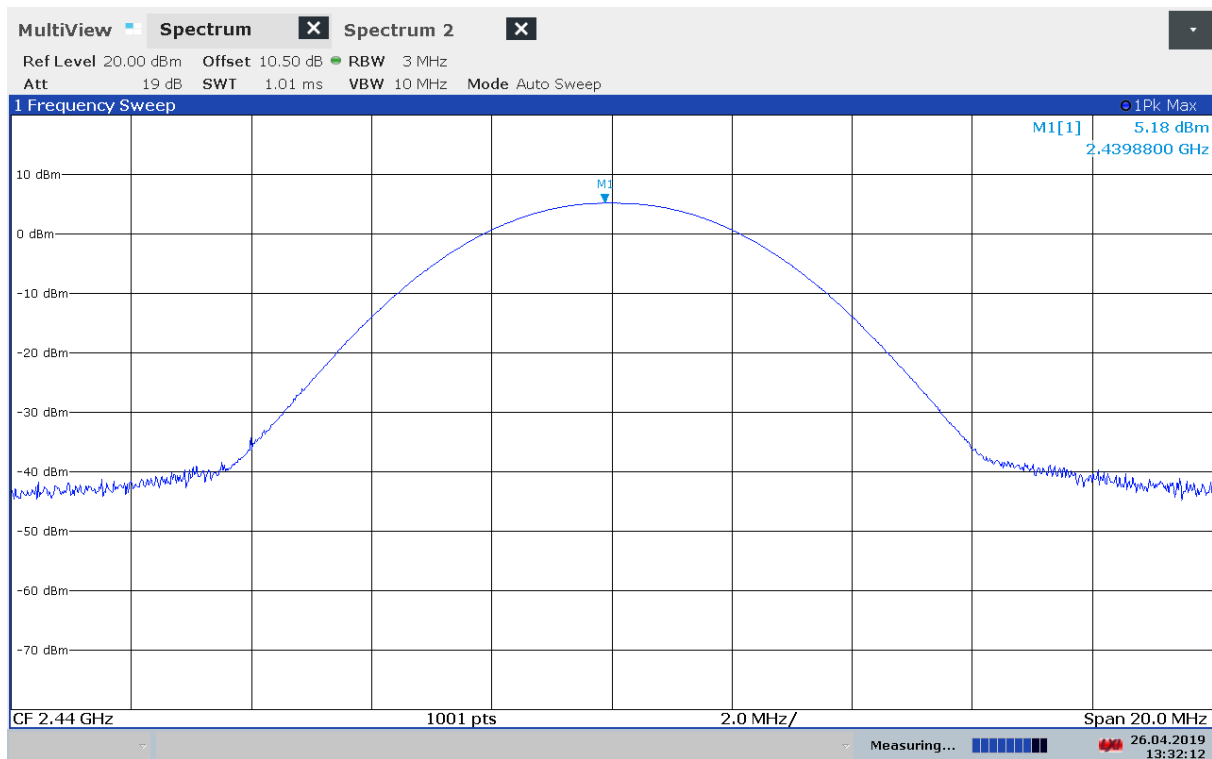
Maximum Field Strength, 2480 MHz, Basic Rate



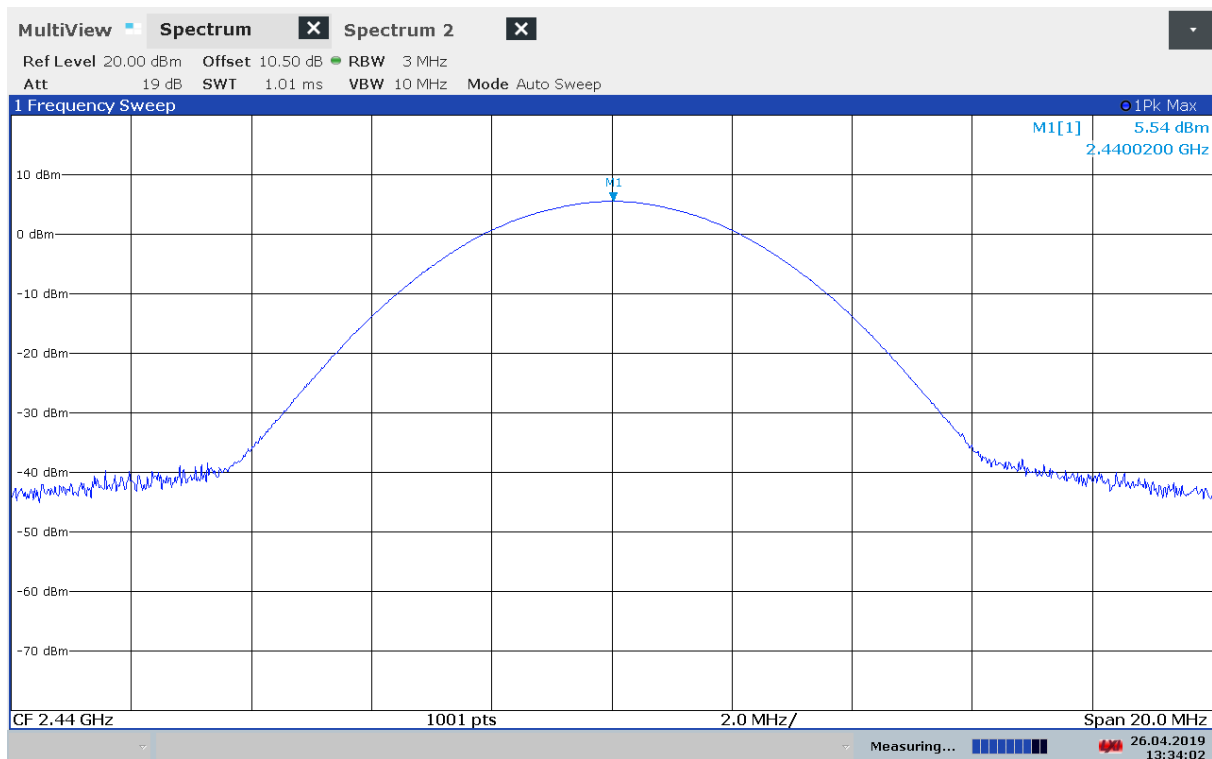
Conducted Power, 2402 MHz, 2-EDR



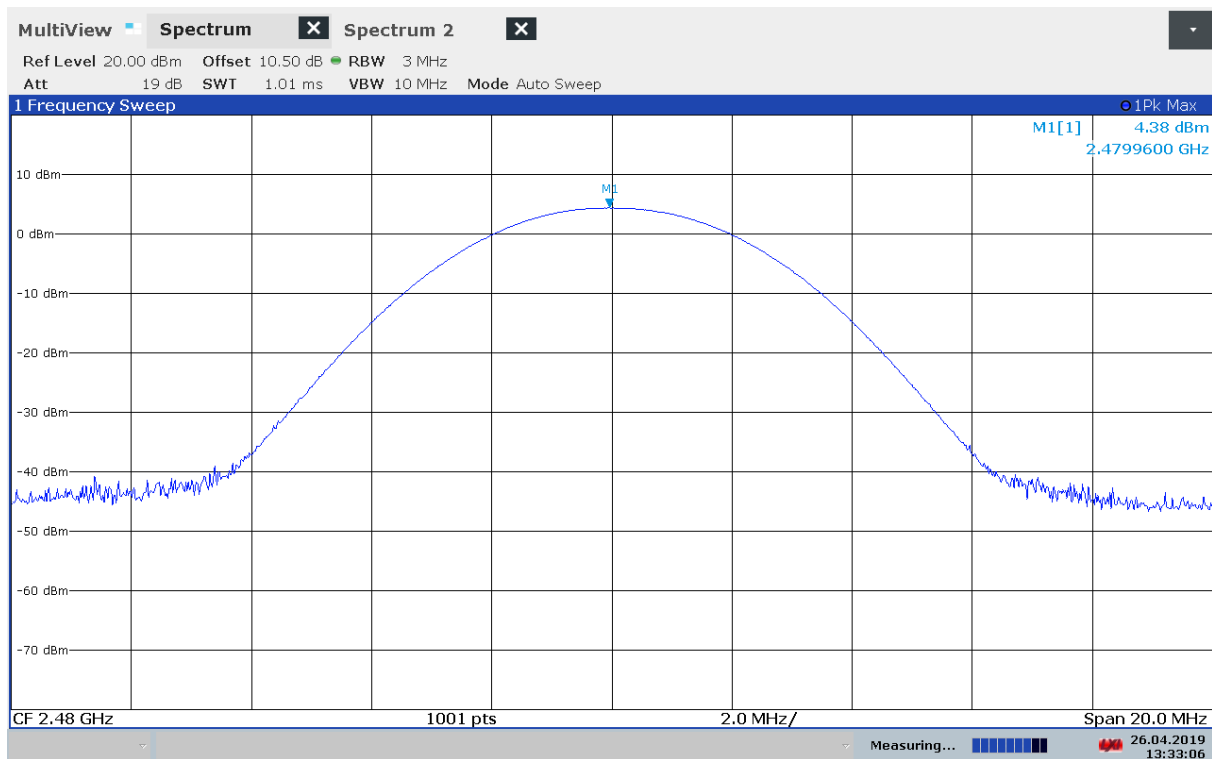
Conducted Power, 2402 MHz, 3-EDR



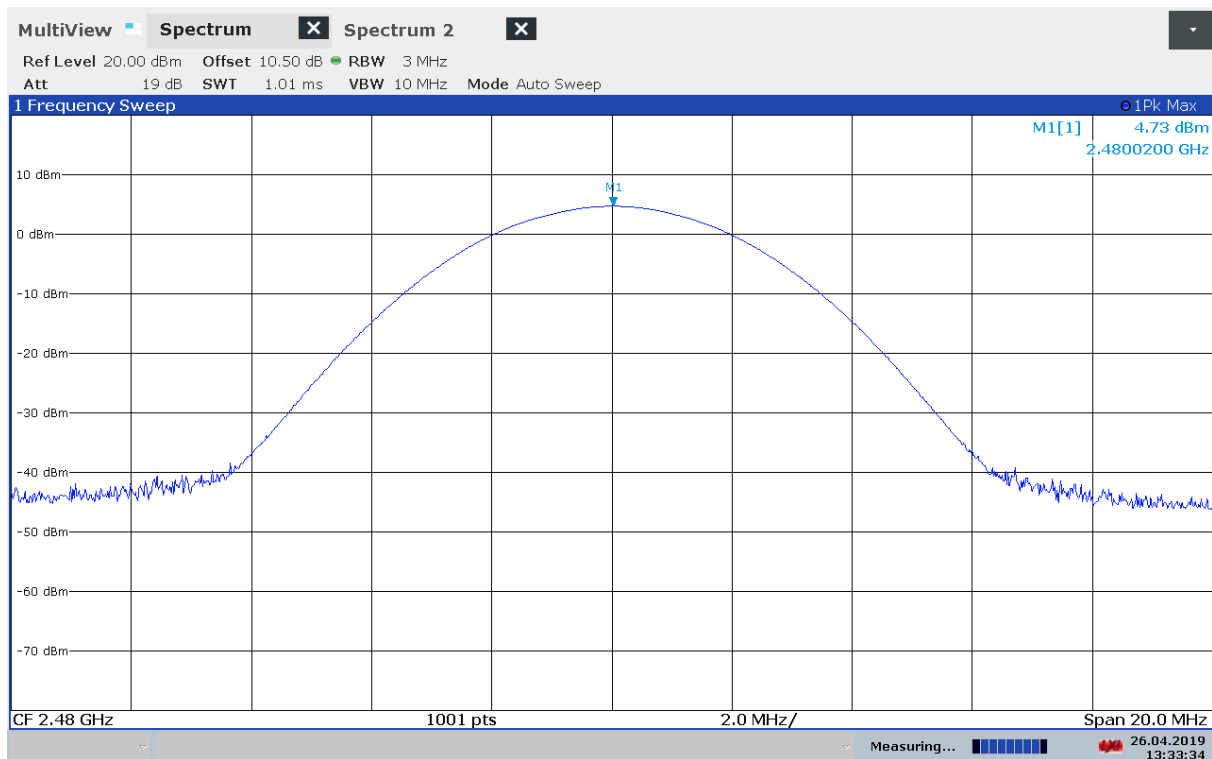
Conducted Power, 2440 MHz, 2-EDR



Conducted Power, 2440 MHz, 3-EDR



Conducted Power, 2480 MHz, 2-EDR



Conducted Power, 2480 MHz, 3-EDR

3.7 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

Test Results:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
2402 MHz	> 60	> 40	Pass
2440 MHz	> 60	> 40	Pass
2480 MHz	> 60	> 40	Pass

Measured with Peak Detector

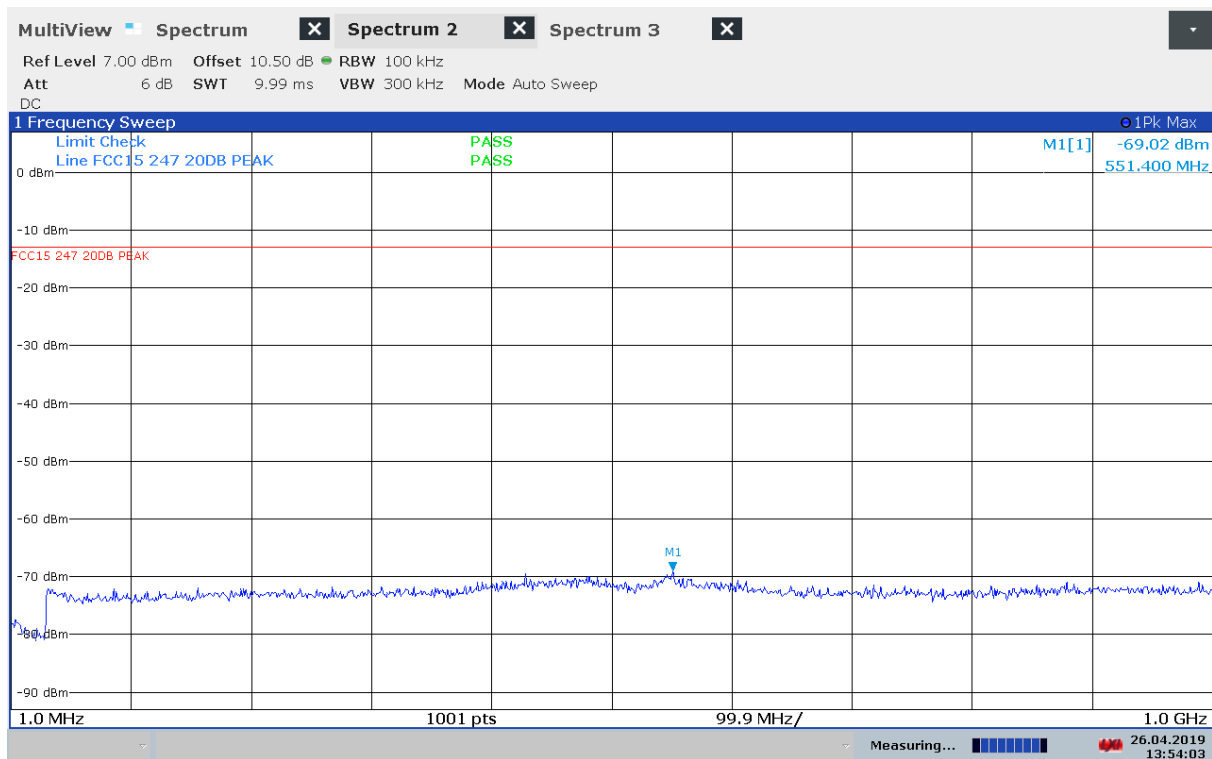
RF conducted power to 25 GHz: see attached plots.

Limit

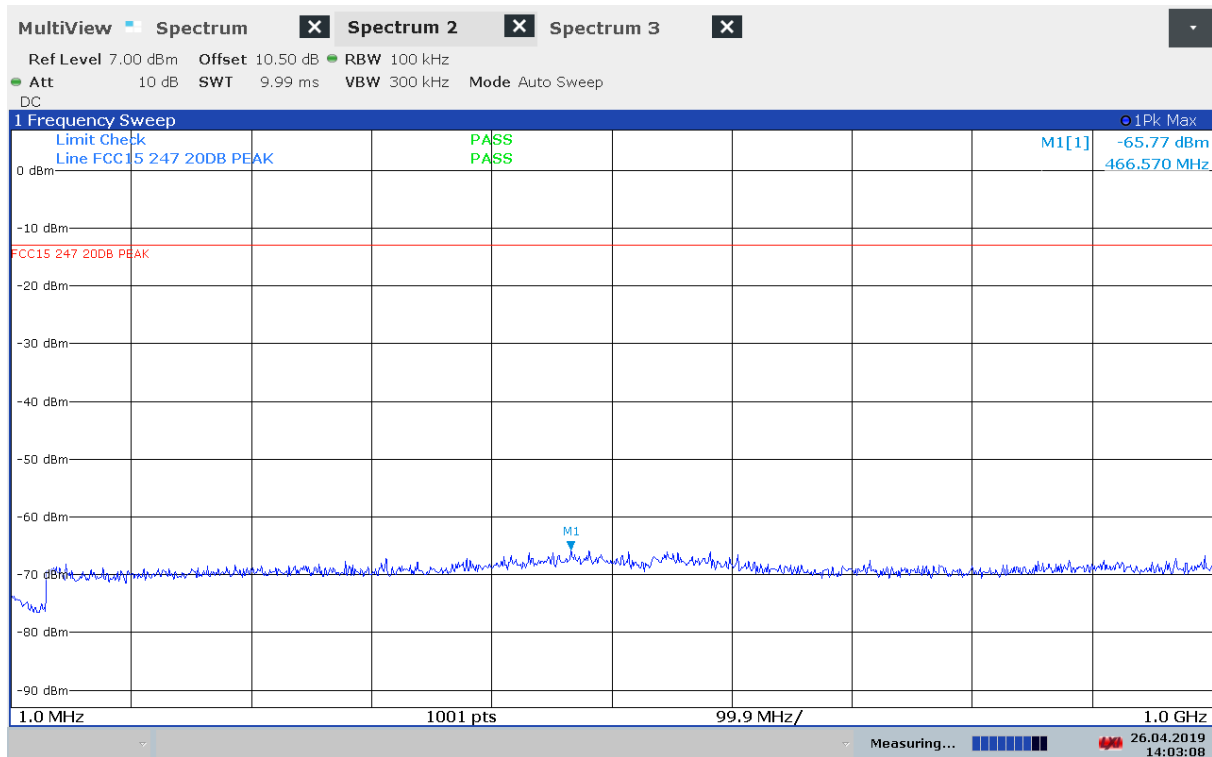
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

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

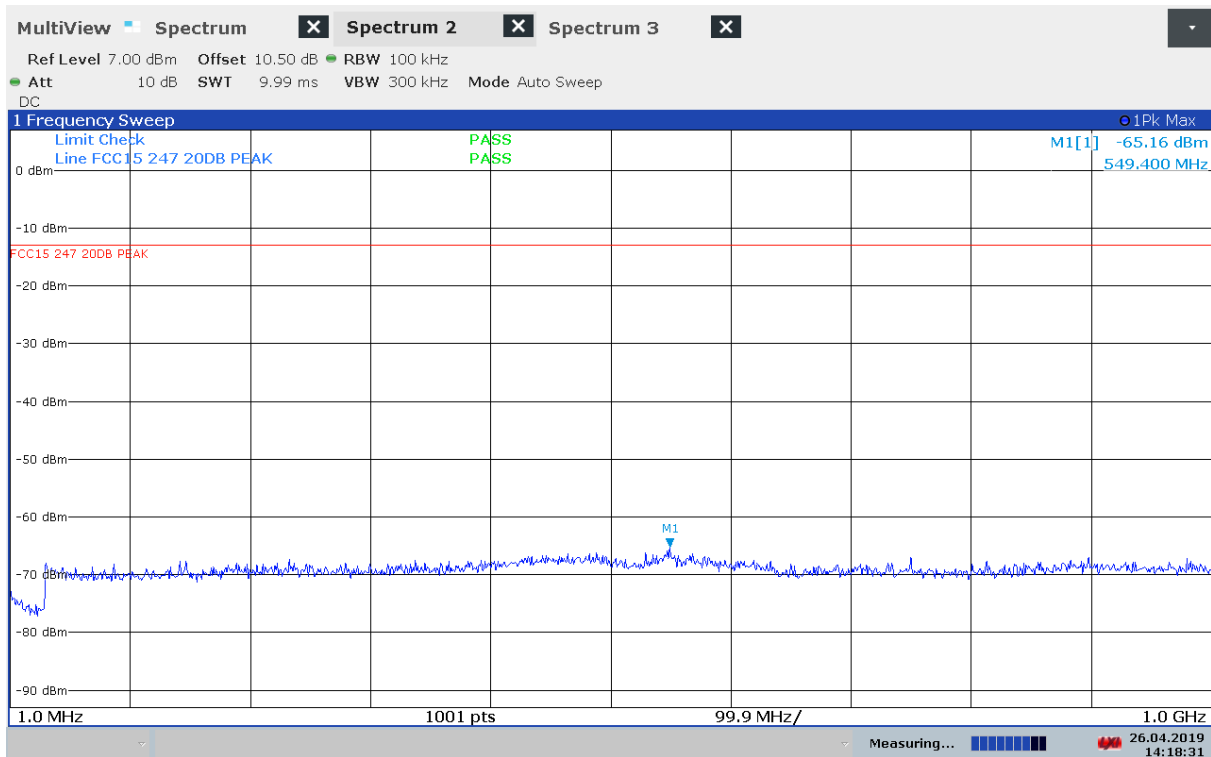
Attenuation below the general limits specified in part 15.209(a) is not required.



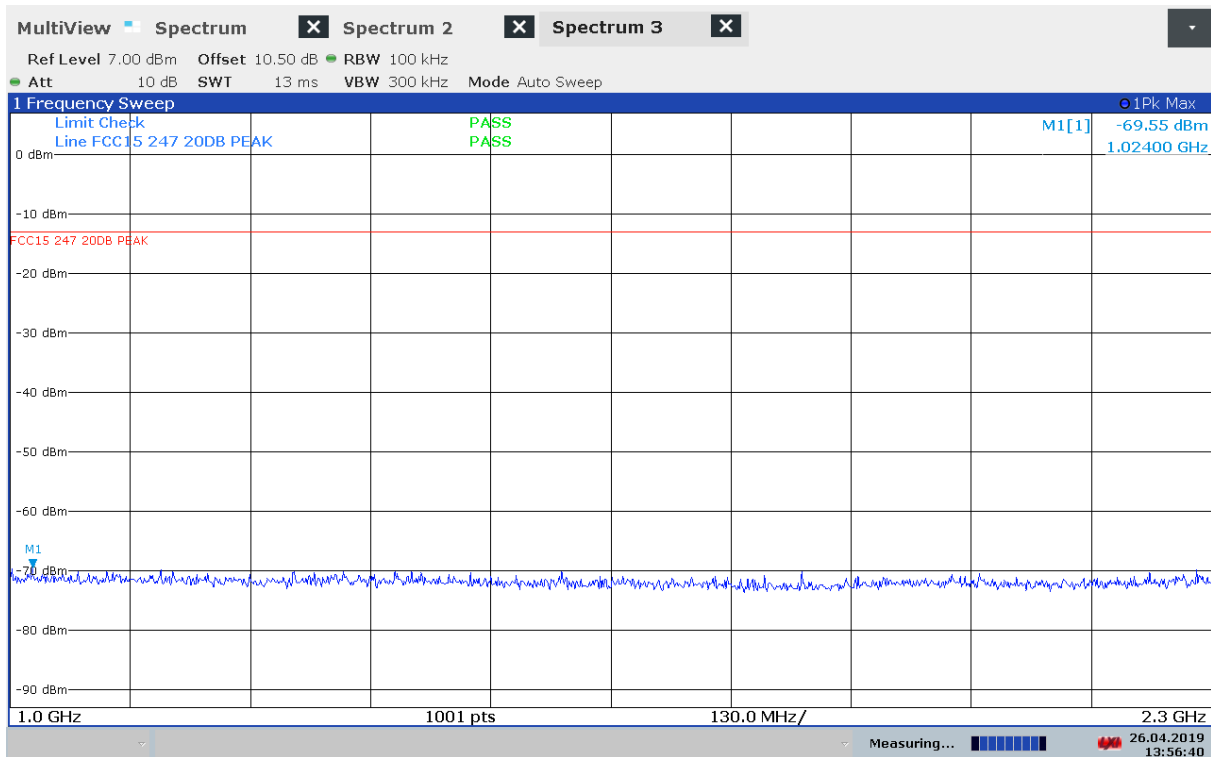
Conducted Emissions, 1 - 1000 MHz, 2440MHz, Basic Rate



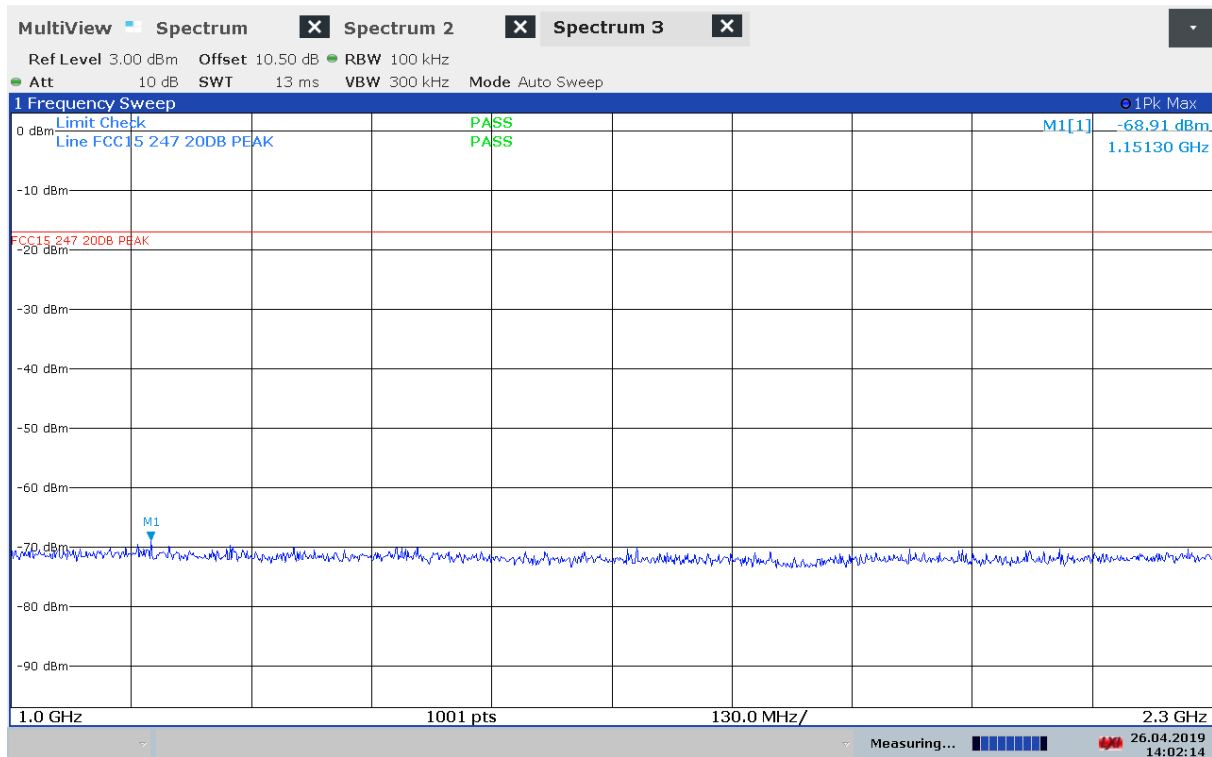
Conducted Emissions, 1 - 1000 MHz, 2440MHz, 2-EDR



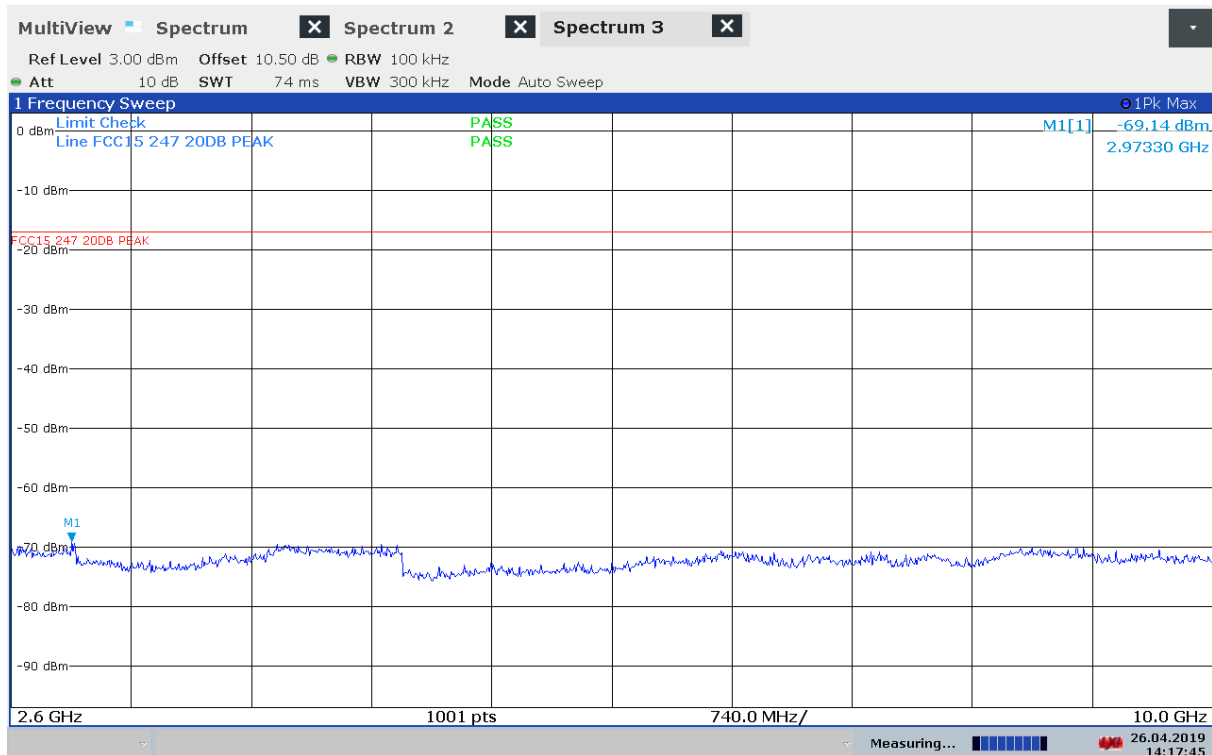
Conducted Emissions, 1 - 1000 MHz, 2440MHz, 3-EDR



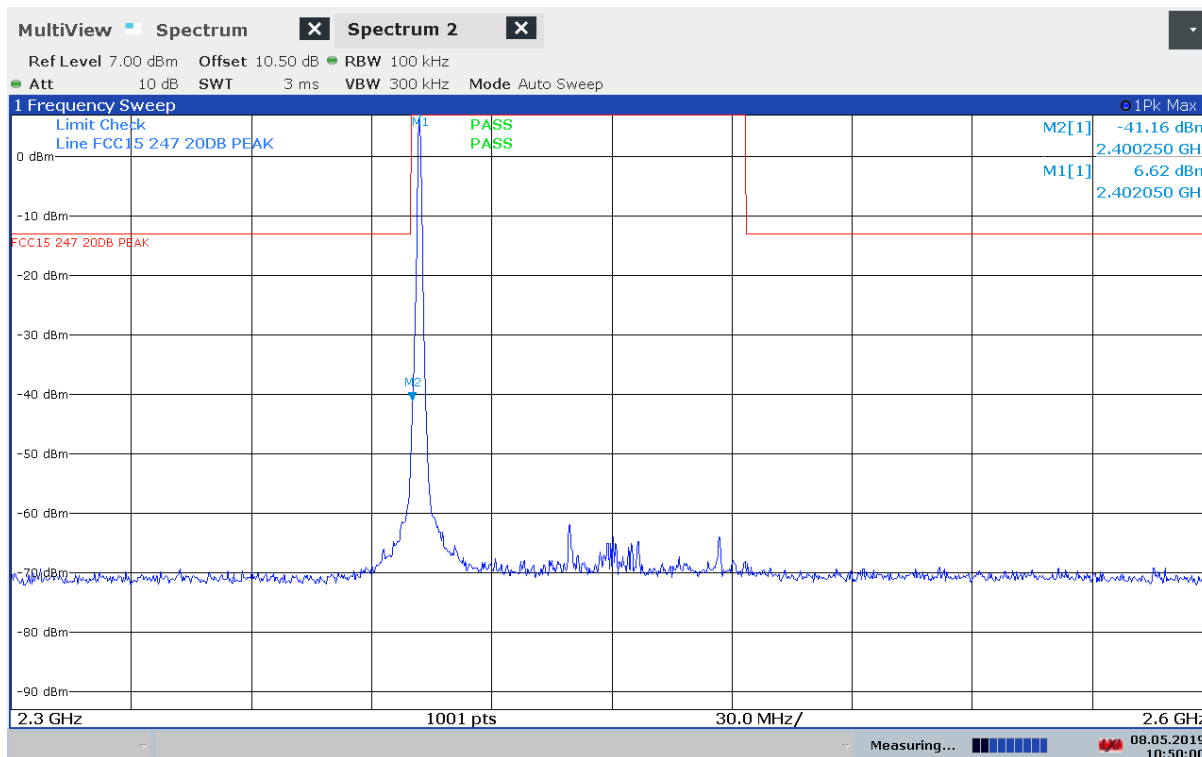
Conducted Emissions, 1000 - 2300 MHz, 2440MHz, Basic Rate



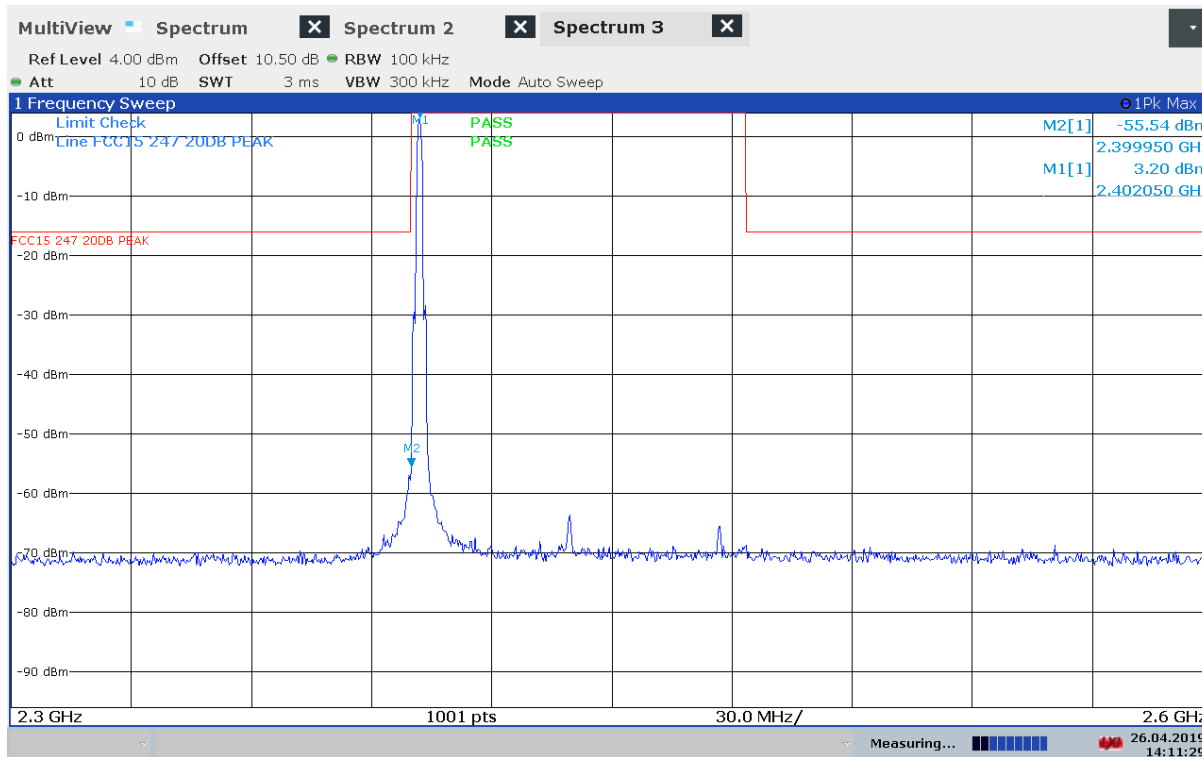
Conducted Emissions, 1000 - 2300 MHz, 2440MHz, 2-EDR



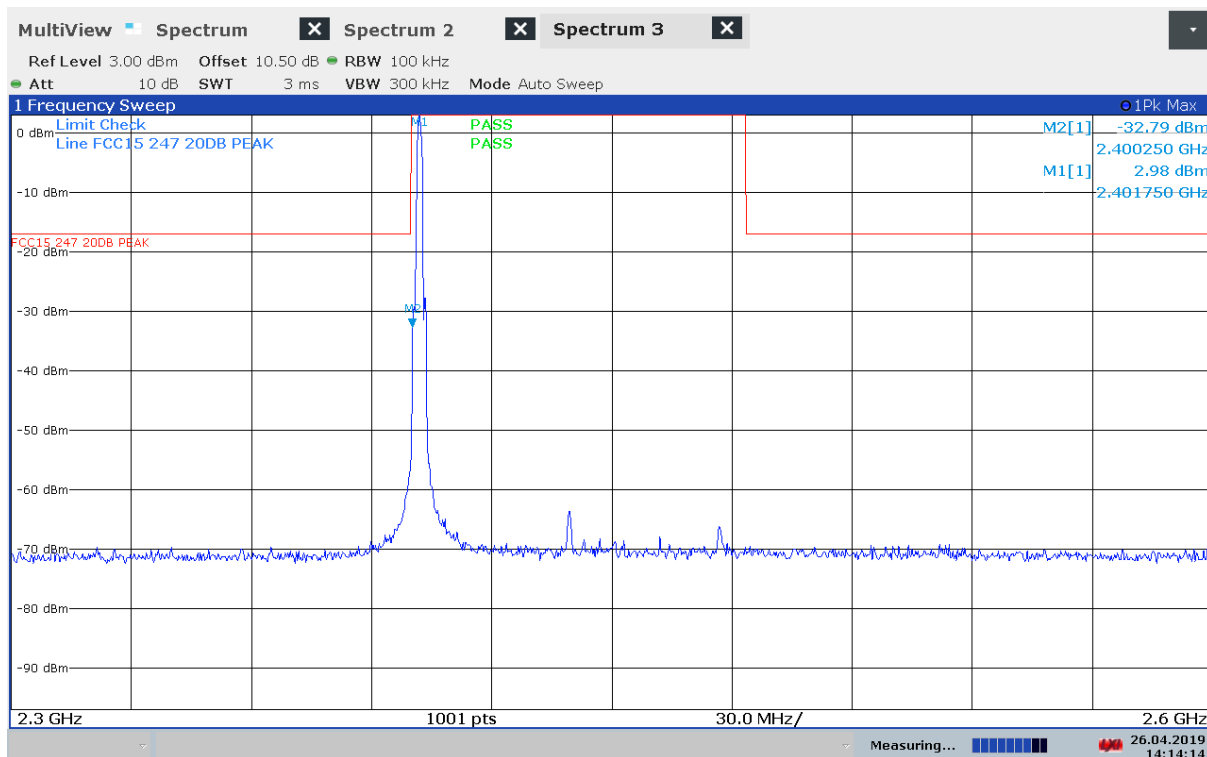
Conducted Emissions, 1000 - 2300 MHz, 2440MHz, 3-EDR



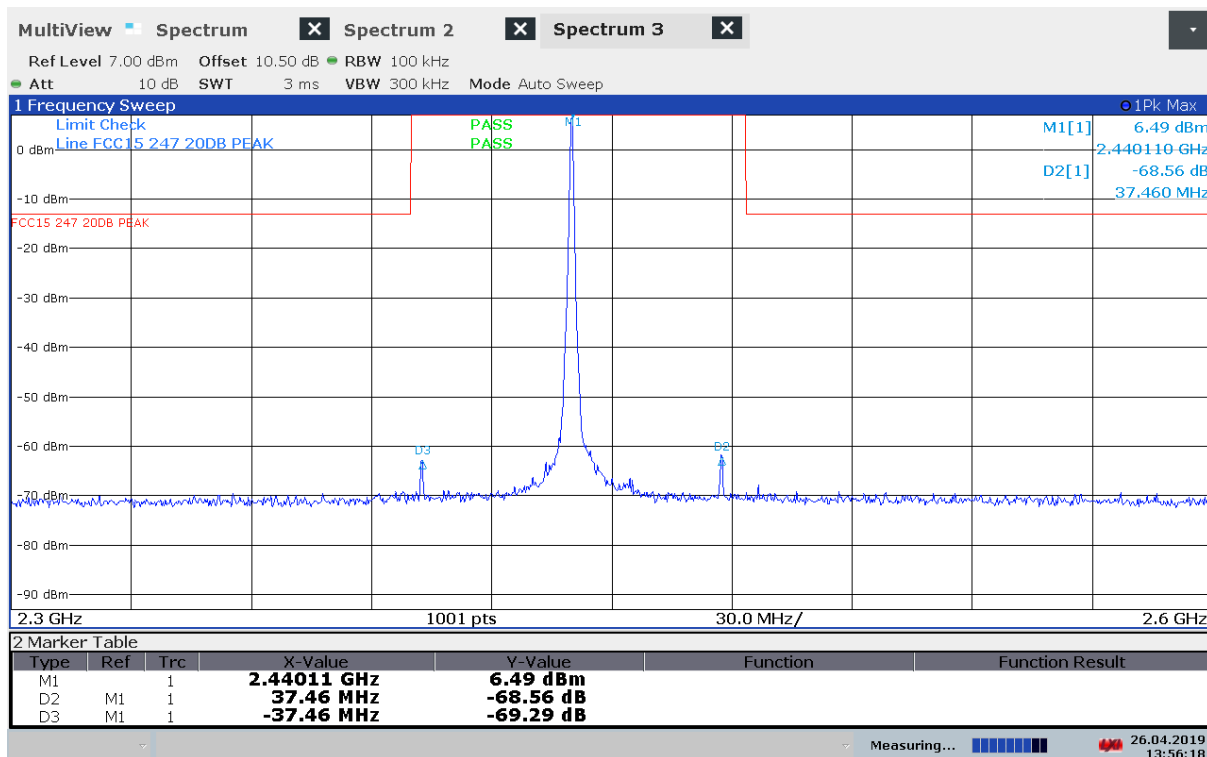
Conducted Emissions, 2300 - 2600 MHz, 2402MHz, Basic Rate



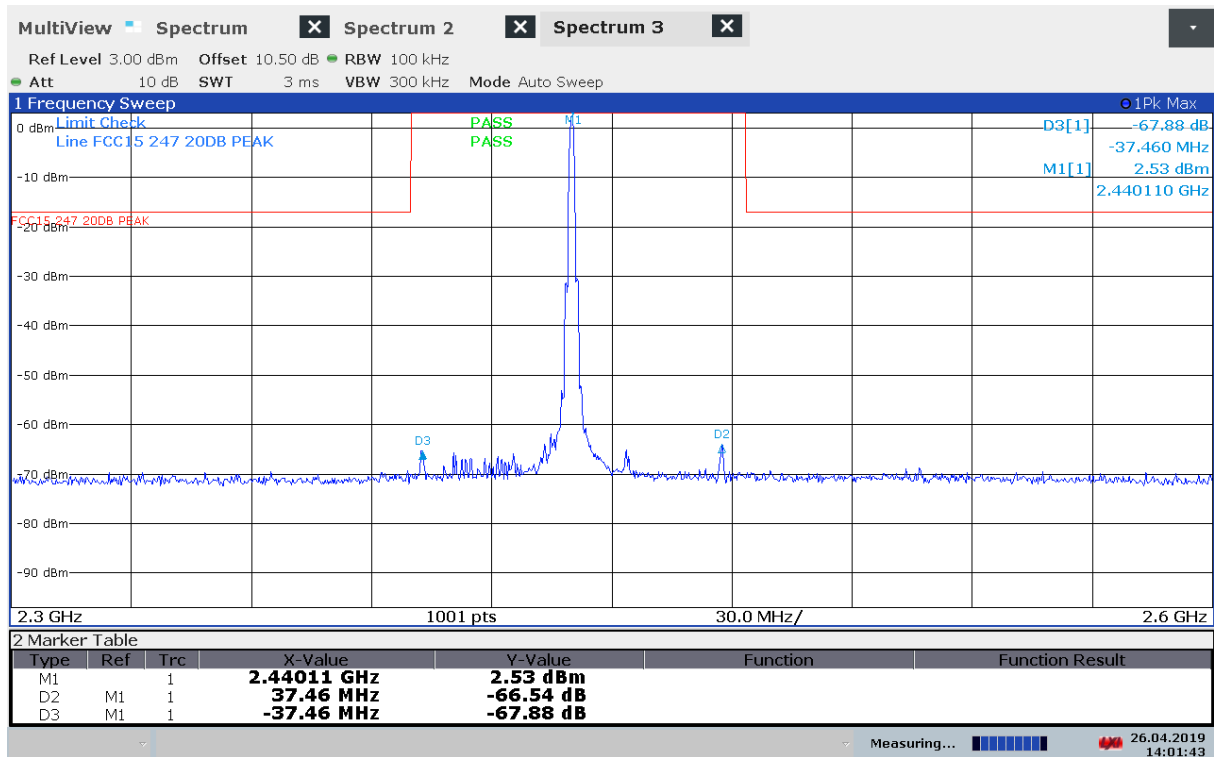
Conducted Emissions, 2300 - 2600 MHz, 2402MHz, 2-EDR



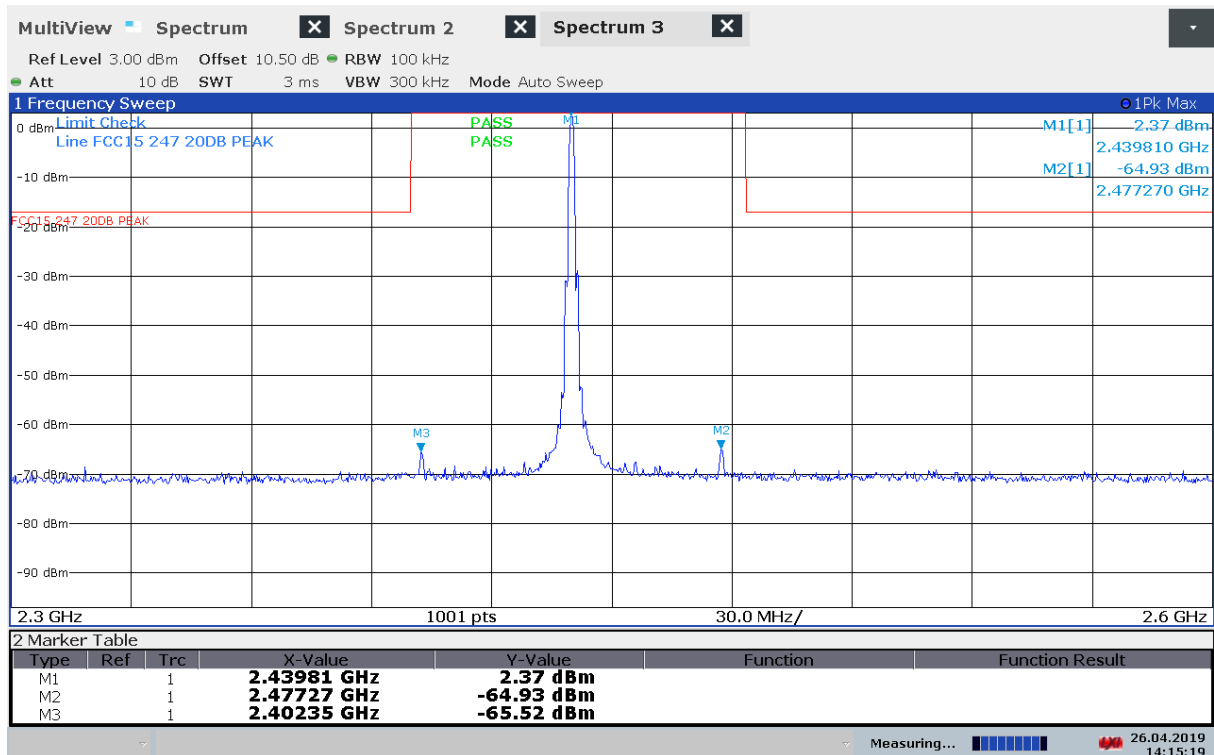
Conducted Emissions, 2300 - 2600 MHz, 2402MHz, 3-EDR



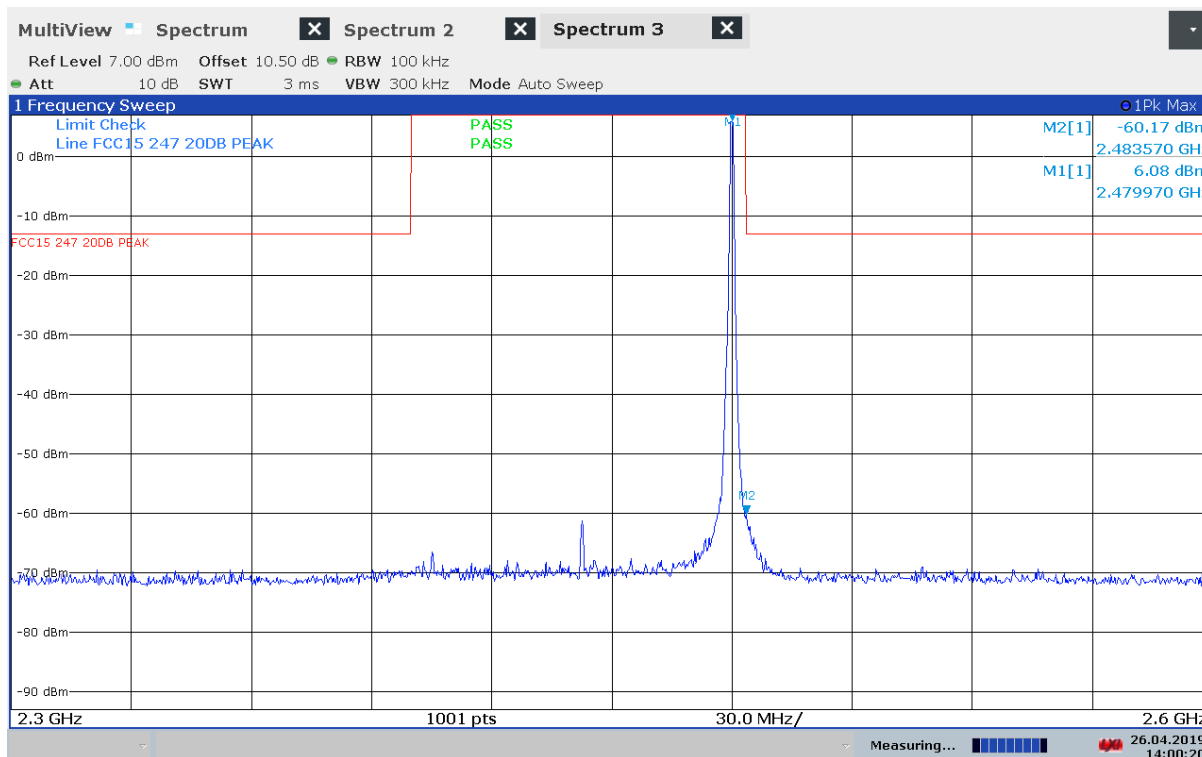
Conducted Emissions, 2300 - 2600 MHz, 2440MHz, Basic Rate



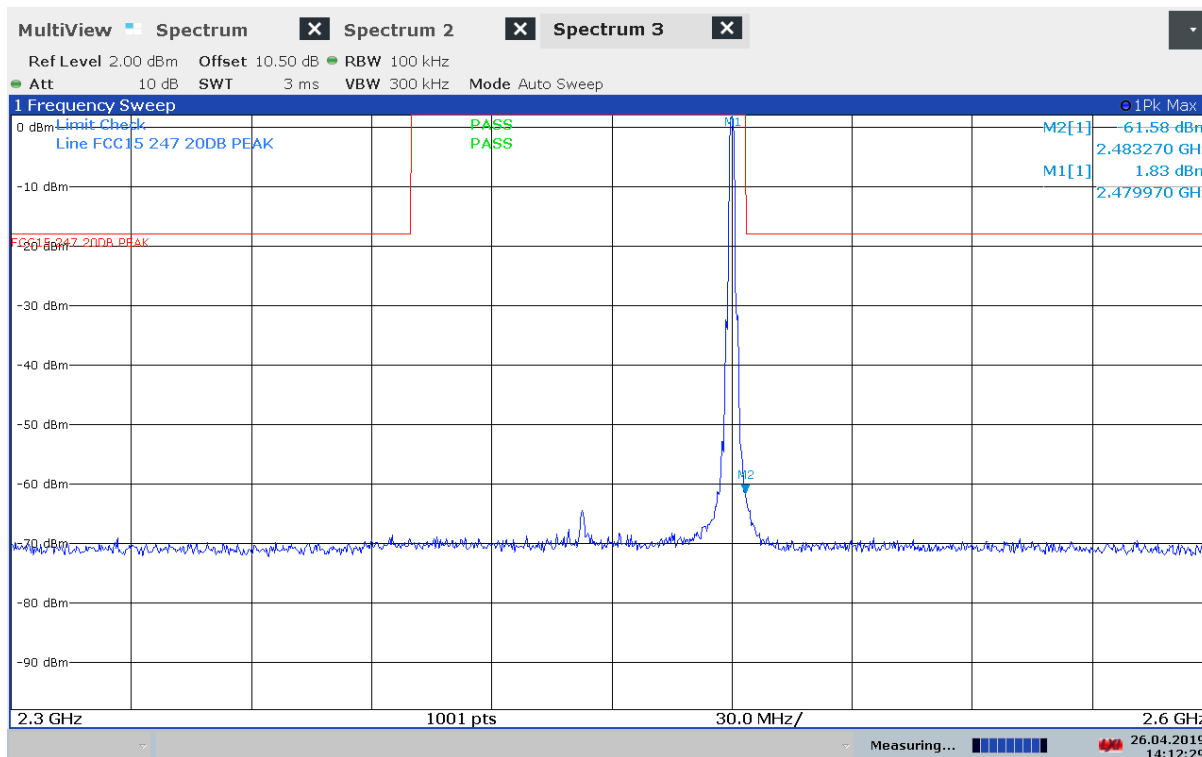
Conducted Emissions, 2300 - 2600 MHz, 2440MHz, 2-EDR



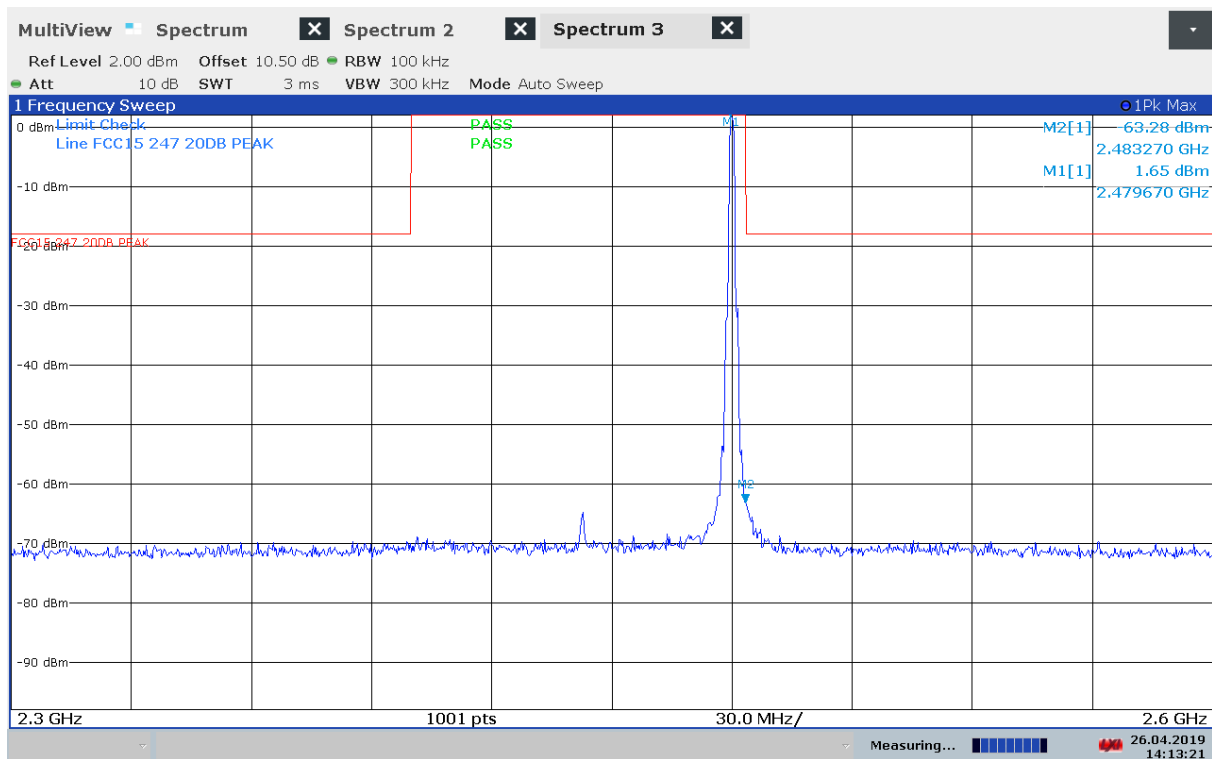
Conducted Emissions, 2300 - 2600 MHz, 2440MHz, 3-EDR



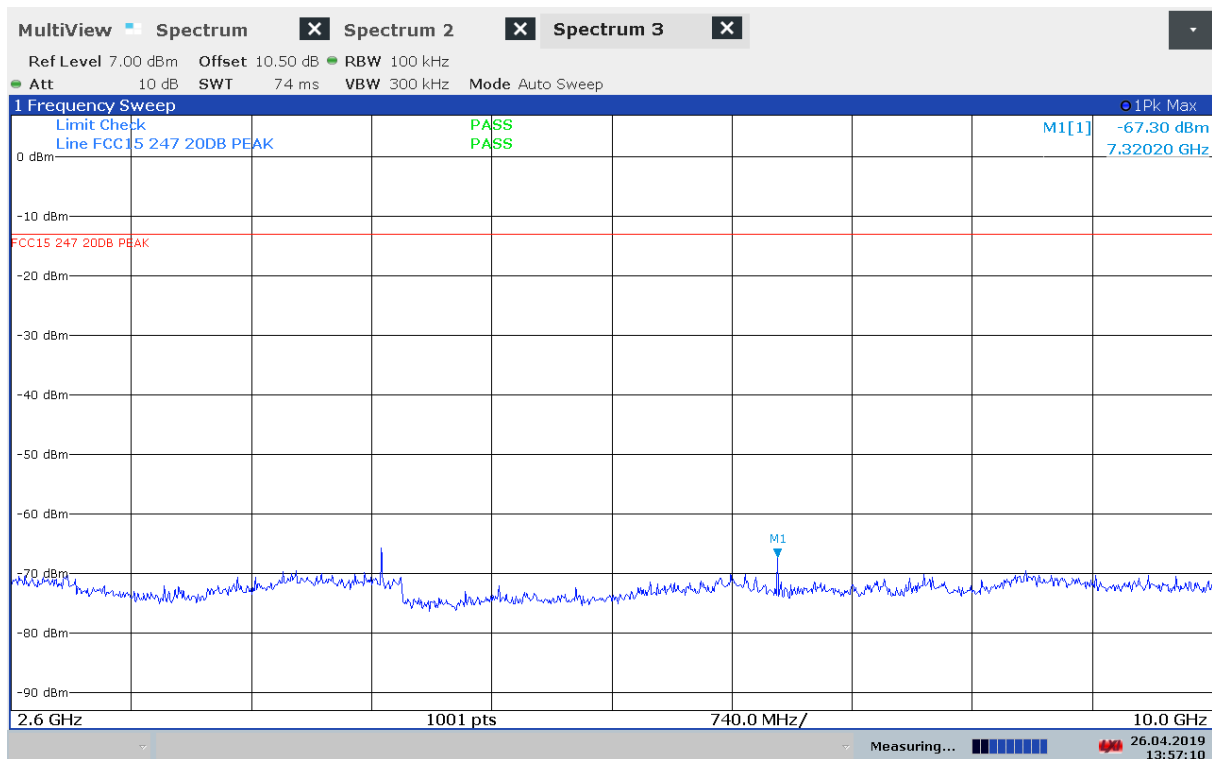
Conducted Emissions, 2300 - 2600 MHz, 2480MHz, Basic Rate



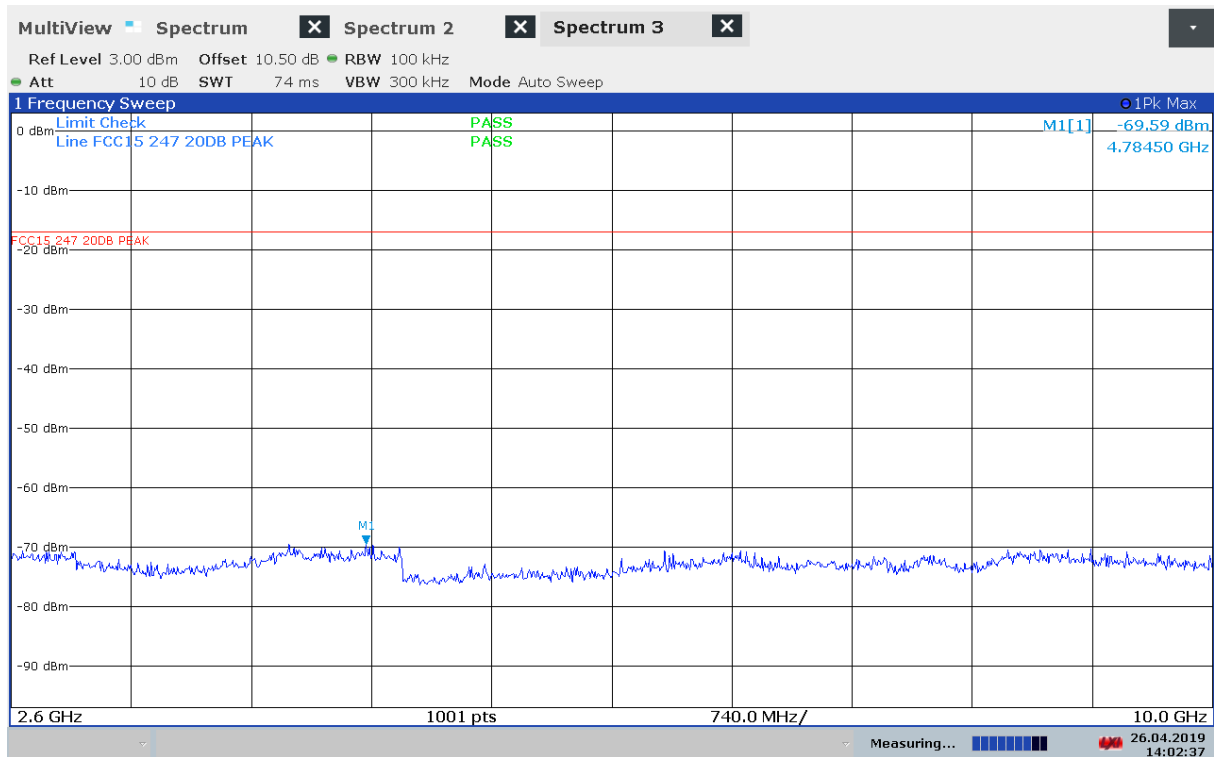
Conducted Emissions, 2300 - 2600 MHz, 2480MHz, 2-EDR



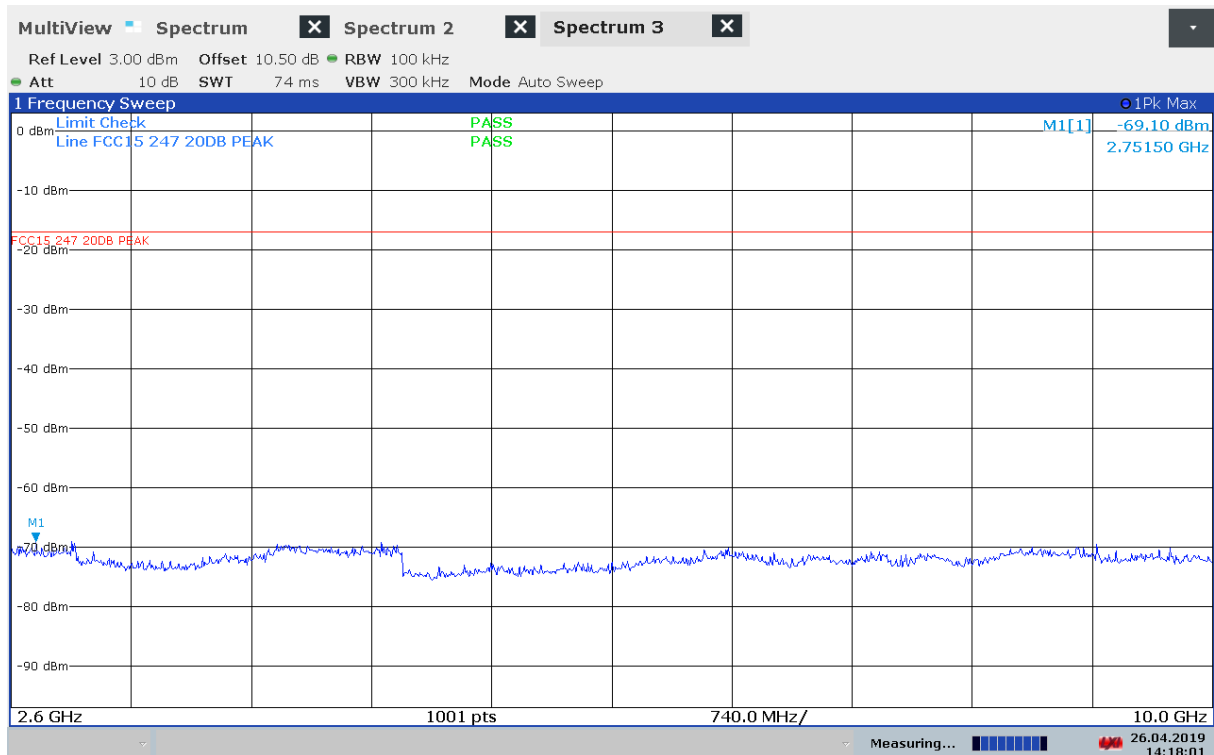
Conducted Emissions, 2300 - 2600 MHz, 2480MHz, 3-EDR



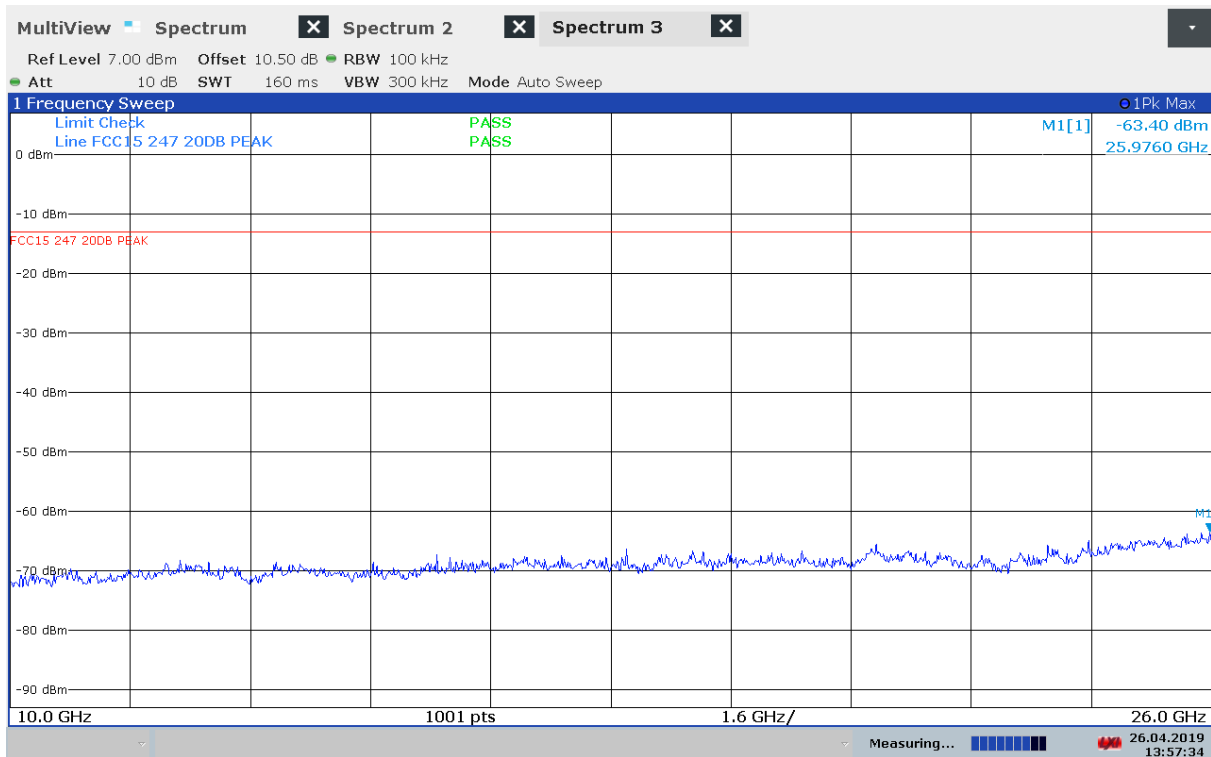
Conducted Emissions, 2600 - 10000 MHz, 2440MHz, Basic Rate



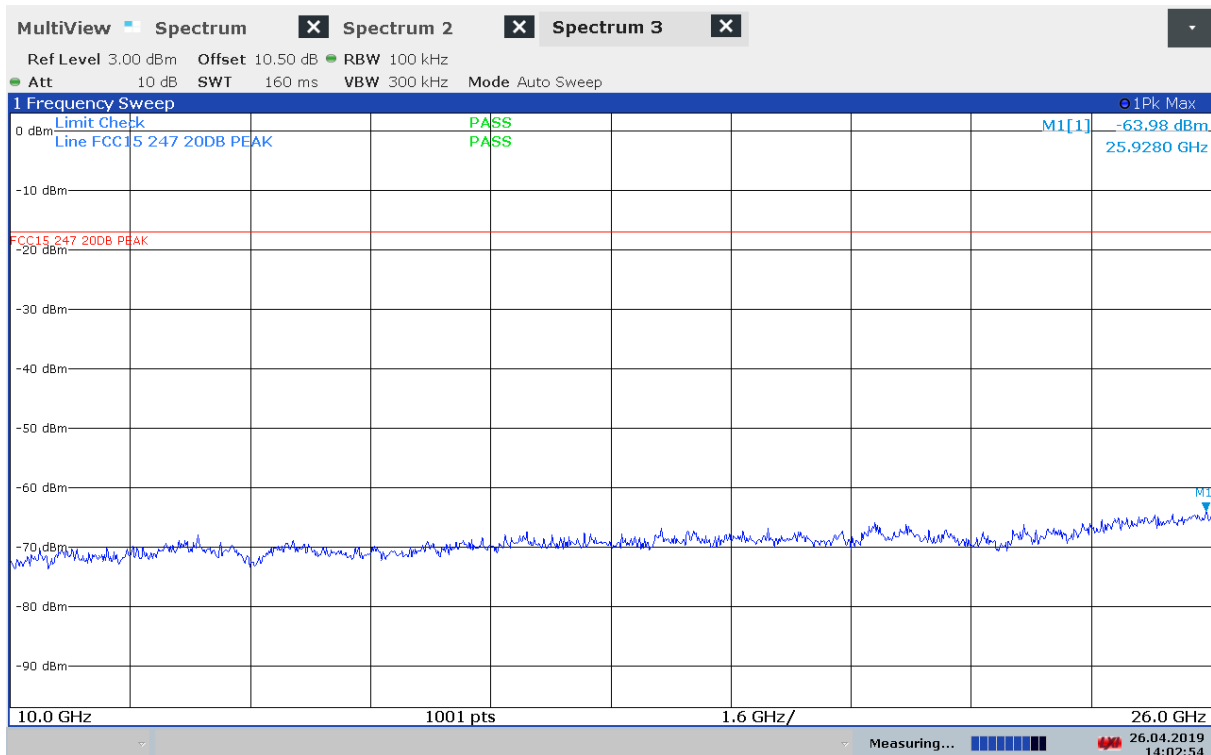
Conducted Emissions, 2600 - 10000 MHz, 2440MHz, 2-EDR



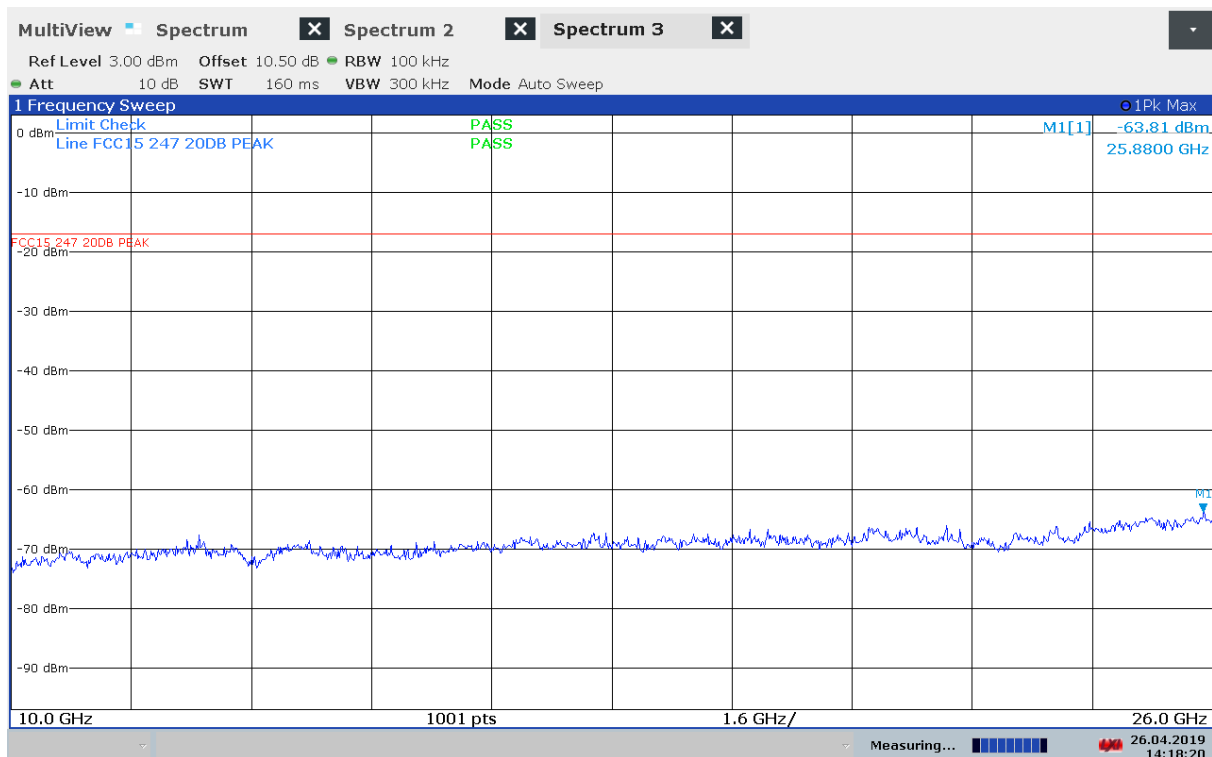
Conducted Emissions, 2600 - 10000 MHz, 2440MHz, 3-EDR



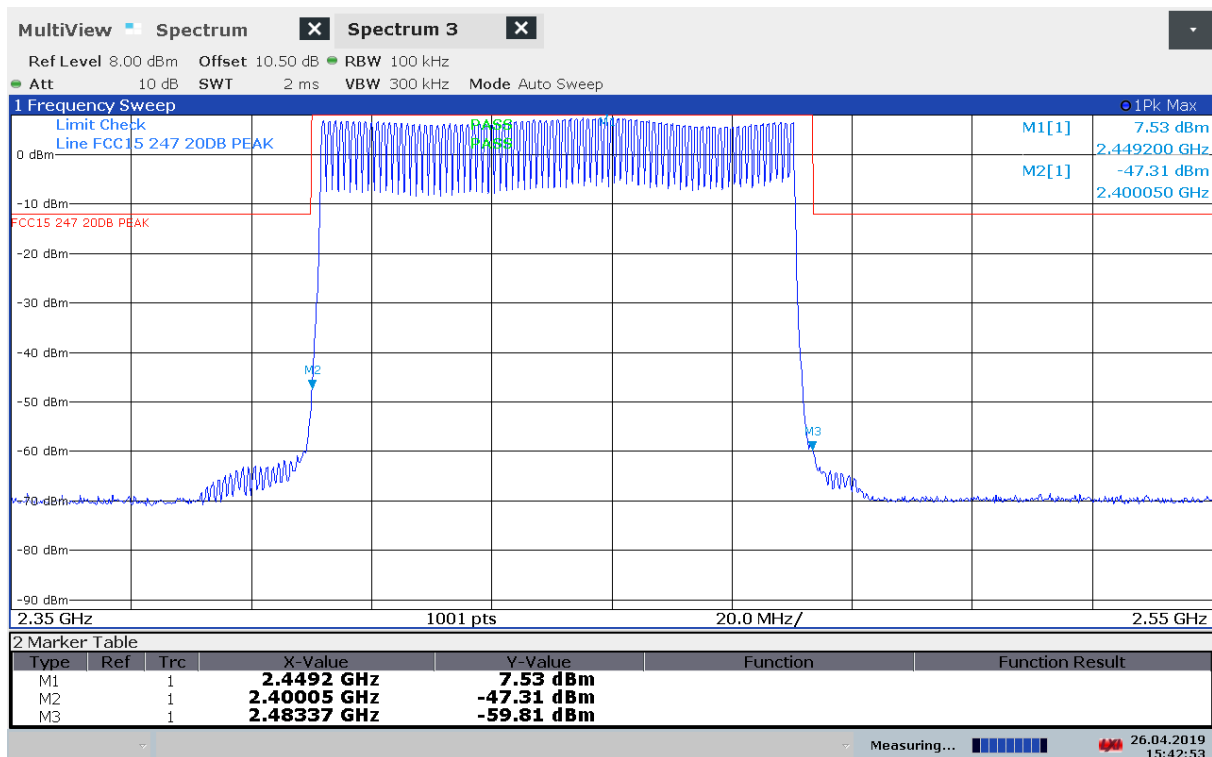
Conducted Emissions, 10000 - 26000 MHz, 2440MHz, Basic Rate



Conducted Emissions, 10000 - 26000 MHz, 2440MHz, 2-EDR



Conducted Emissions, 10000 - 26000 MHz, 2440MHz, 3-EDR



Conducted Emissions, Band Edge, Hopping

3.8 Restricted Bands of operation

Restricted Bands of operation for FCC and ISCED are defined in FCC Part 15.205 and ISCED 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)	ISCED (MHz)	FCC (GHz)	ISCED (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 ISCED, all other frequencies are common.

3.9 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:

Carrier Frequency and Data Rate	Band Edge Frequency	Measured Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
		Peak Detector	Average Detector	Peak Det	Average Det	Peak Det	Average Det
2402 MHz GFSK	2390 MHz	46.1	26.1	74	54	27.9	27.9
2480 MHz GFSK	2483.5 MHz	61.8	41.8			12.2	12.2
2402 MHz 2-EDR	2390 MHz	43.8	23.8			30.2	30.2
2480 MHz 2-EDR	2483.5 MHz	59.2	39.2			14.8	14.8
2402 MHz 3-EDR	2390 MHz	44.7	24.7			29.3	29.3
2480 MHz 3-EDR	2483.5 MHz	59.0	39.0			15.0	15.0

Band Edge is measured with the EUT transmitting on 2402 and 2480 MHz

Average values are calculated from Peak Values using the Duty Cycle correction factor.

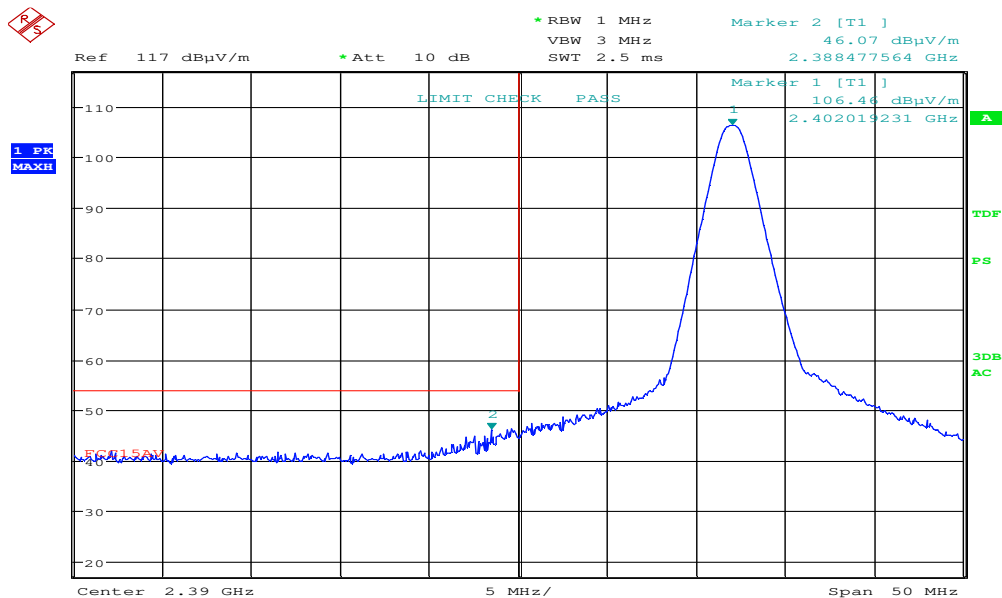
See attached plots.

Duty Cycle Correction Factors

Correction Factor = $-20 \times \log(\text{Sum of Bursts} / (\text{Frame Length} \times (\text{Min \# Hopping Channels} / \text{Bursts per frame})))$

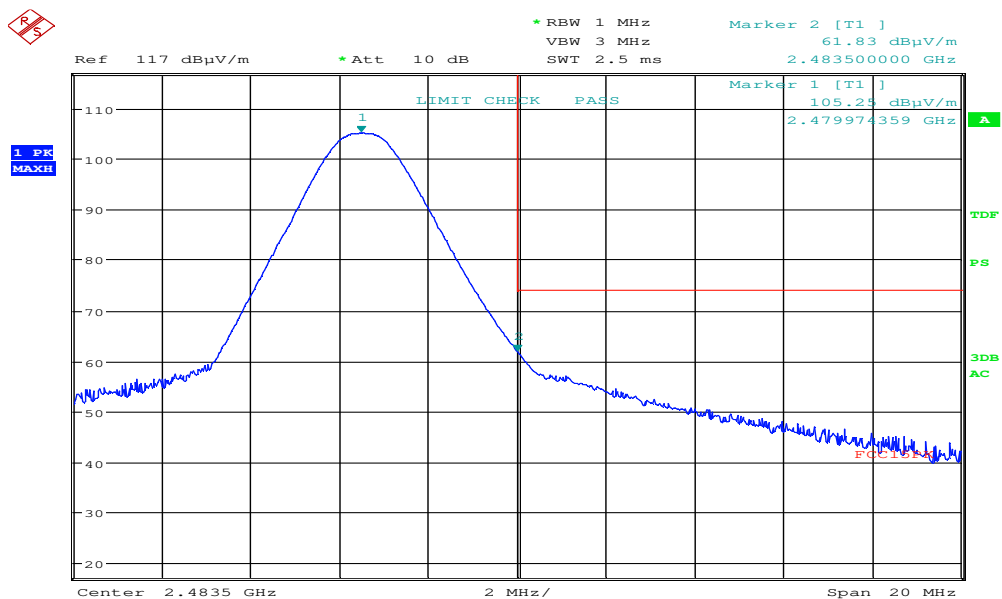
= $-20 \times \log((0.140 + 3 \times 0.164) / (4.000 \times (20 / 4)))$ dB = $-20 \times \log(0.632 / 20)$ = 30.0 dB

Maximum Allowed Correction Factor = 20 dB



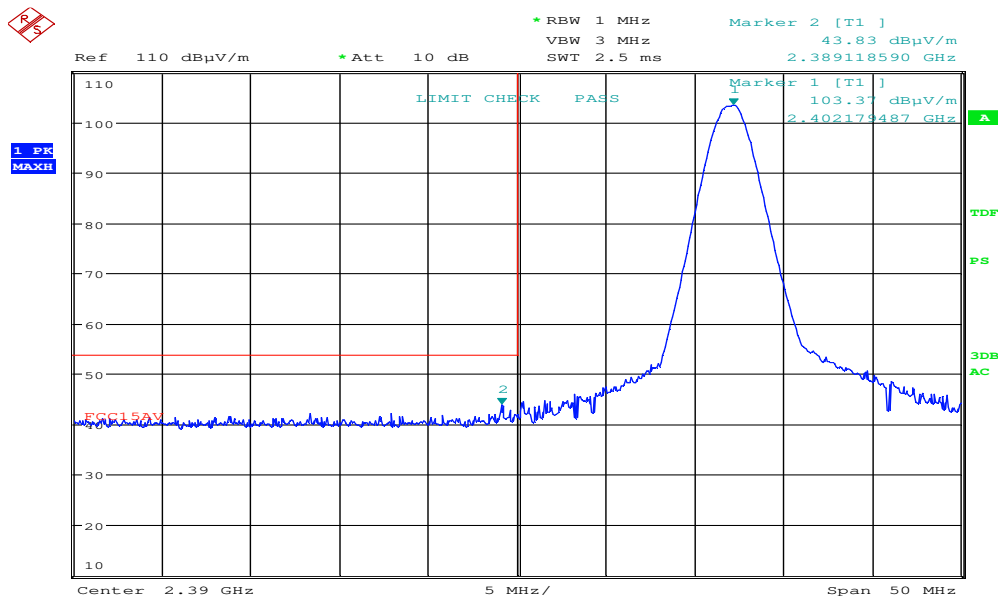
Date: 7.MAY.2019 15:41:53

Lower Band Edge, Peak, 2402 MHz GFSK



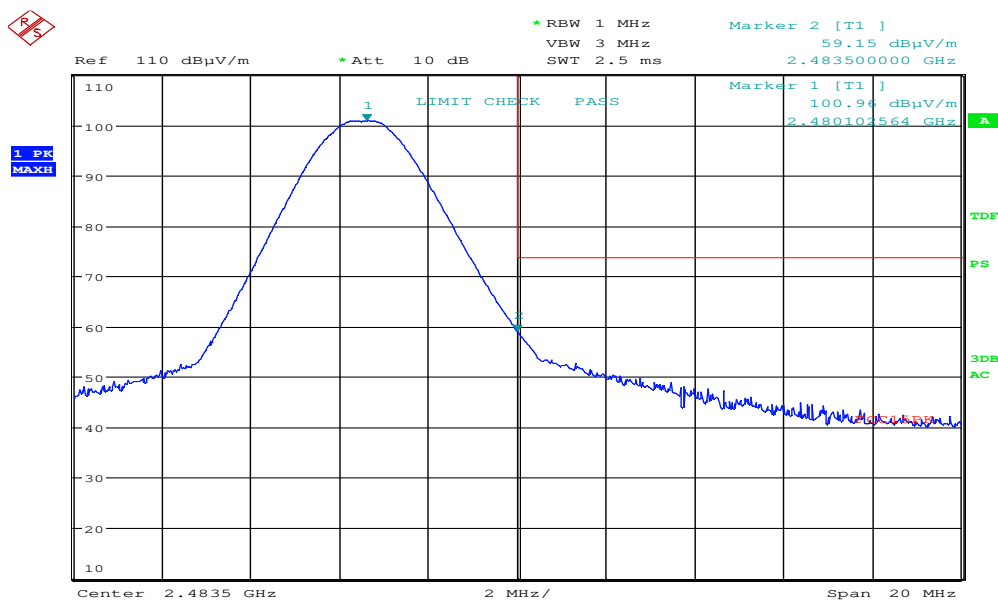
Date: 7.MAY.2019 15:45:44

Upper Band Edge, Peak, 2480 MHz GFSK



Date: 7.MAY.2019 13:28:15

Lower Band Edge, Peak, 2402 MHz 2-EDR



Date: 7.MAY.2019 13:40:05

Upper Band Edge, Peak, 2480 MHz 2-EDR



Lower Band Edge, Peak, 2402 MHz 3-EDR



Upper Band Edge, Peak, 2480 MHz 3-EDR

3.10 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 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 3 m.

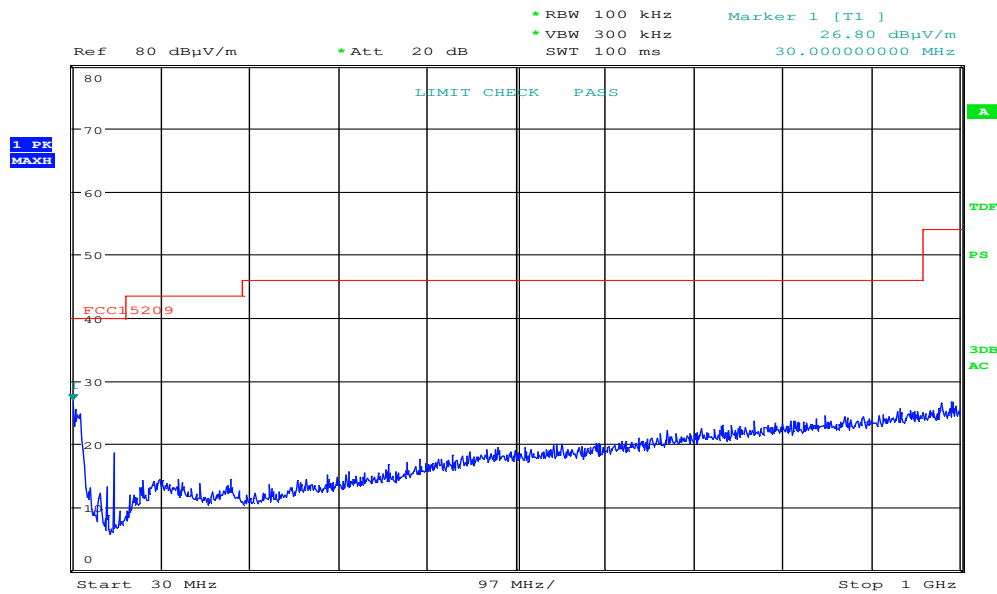
Tested in test mode with EUT transmitting.

No spurious emissions were detected.

See attached plots.

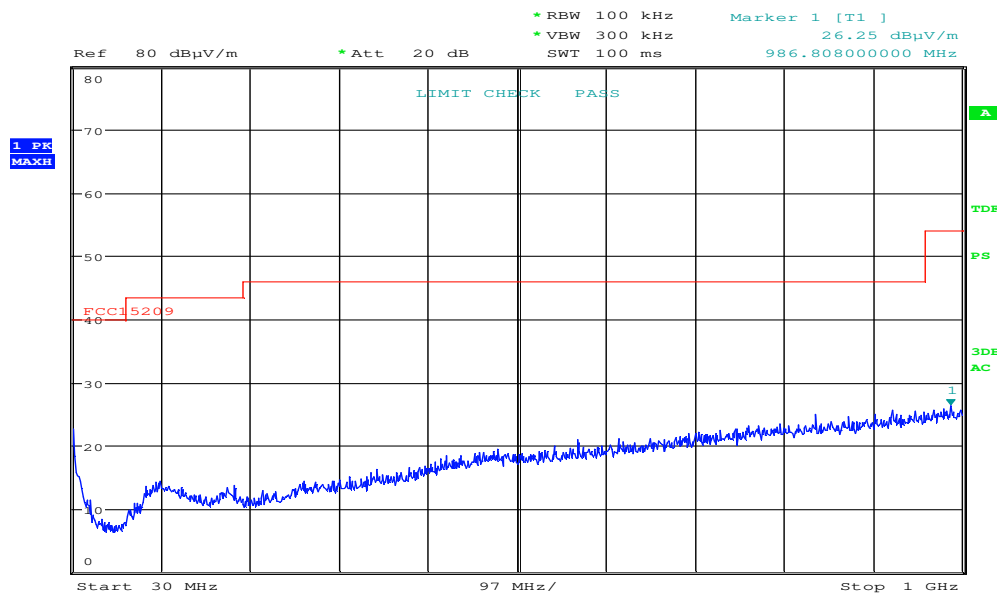
Requirements/Limit

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 $\mu\text{V/m}$	40.0 dB $\mu\text{V/m}$
88 – 216 MHz	150 $\mu\text{V/m}$	43.5 dB $\mu\text{V/m}$
216 – 960 MHz	200 $\mu\text{V/m}$	46.0 dB $\mu\text{V/m}$
960 – 1000 MHz	500 $\mu\text{V/m}$	54.0 dB $\mu\text{V/m}$
Limits above are with Quasi Peak Detector		



Date: 29.MAR.2019 15:59:23

Radiated Emissions, 30 – 1000 MHz, 2440 MHz, EUT V, VP



Date: 29.MAR.2019 16:01:58

Radiated Emissions, 30 – 1000 MHz, 2440 MHz, EUT V, HP

3.11 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: 3 m (1–18 GHz)
Pre-scan (18-26 GHz)

Measured values:

Frequency (MHz)	Channel	Polarization	Peak (dBµV/m)	Average (dBµV/m)	Peak Margin (dB)	Av Margin (dB)
Any	00/38/78	V/H	< 54	< 44	> 20	> 10

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

All measurements were performed with the EUT transmitting on a fixed channel.

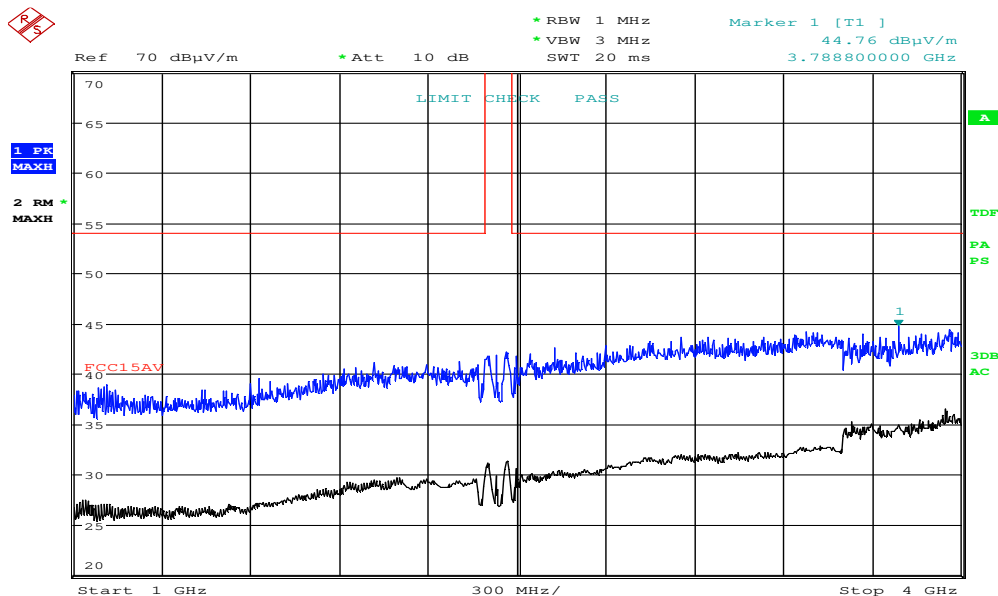
A Band Reject Filter was used for measurements from 1 GHz to 4 GHz and a High Pass Filter was used from 3 GHz to 18 GHz.

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

See plots.

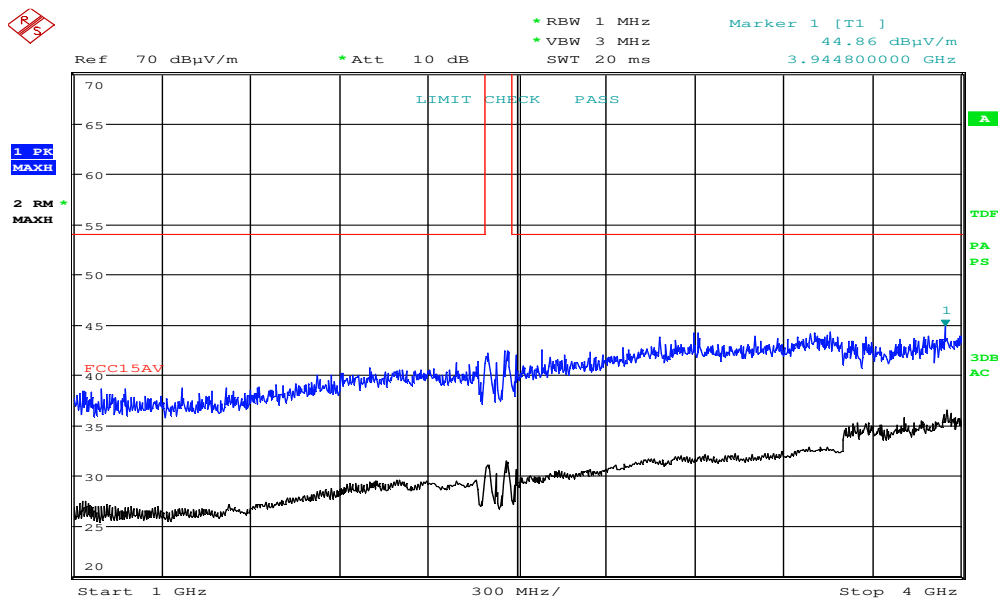
Requirements/Limit

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



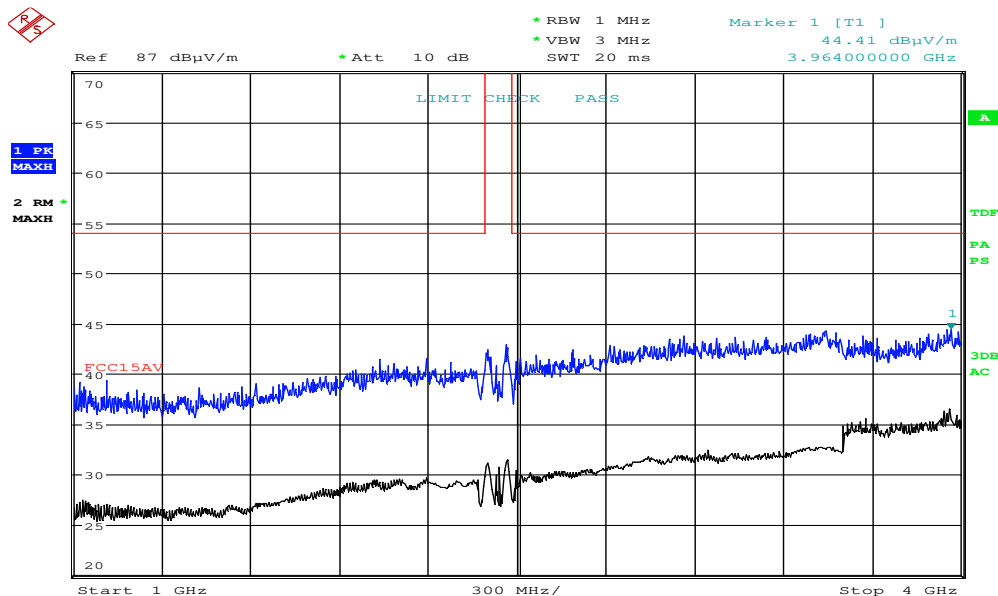
Date: 7.MAY.2019 13:50:40

Radiated Emissions, 1000 – 4000 MHz, 2402 MHz GFSK, EUT V, VP



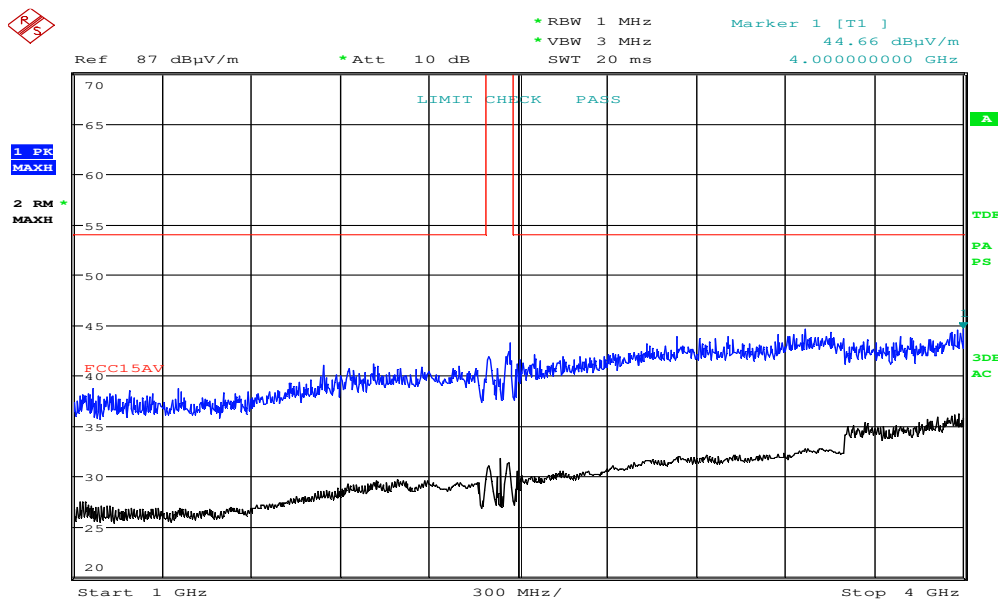
Date: 7.MAY.2019 13:52:35

Radiated Emissions, 1000 – 4000 MHz, 2402 MHz GFSK, EUT V, HP



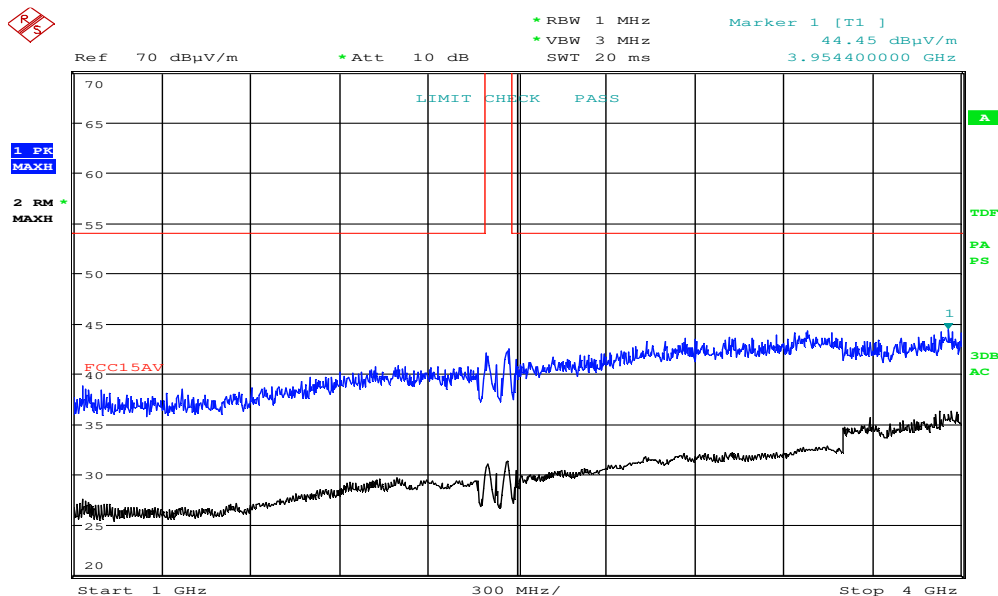
Date: 7.MAY.2019 13:58:09

Radiated Emissions, 1000 – 4000 MHz, 2440 MHz GFSK, EUT V, VP



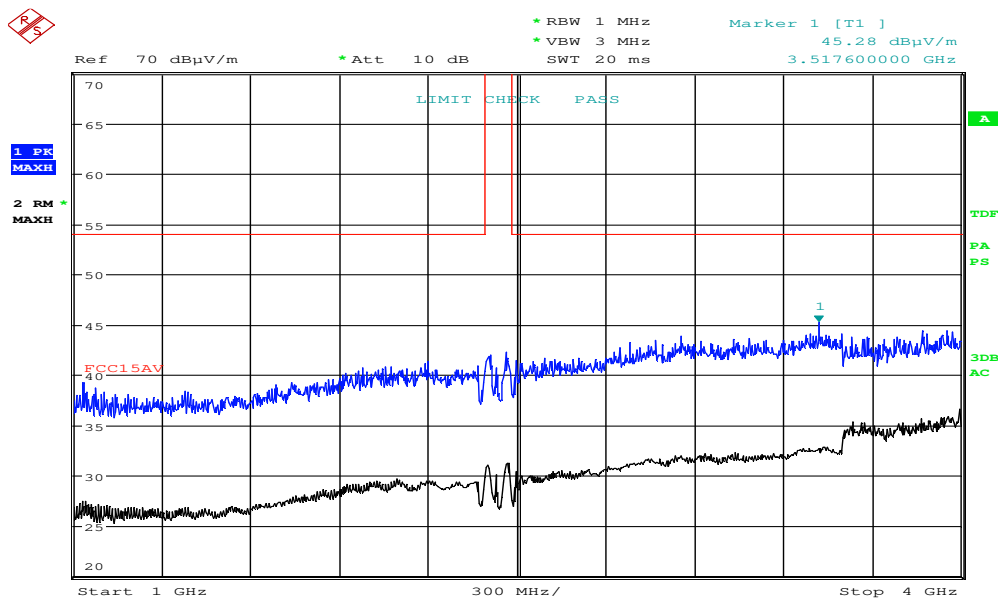
Date: 7.MAY.2019 14:00:04

Radiated Emissions, 1000 – 4000 MHz, 2440 MHz GFSK, EUT V, HP



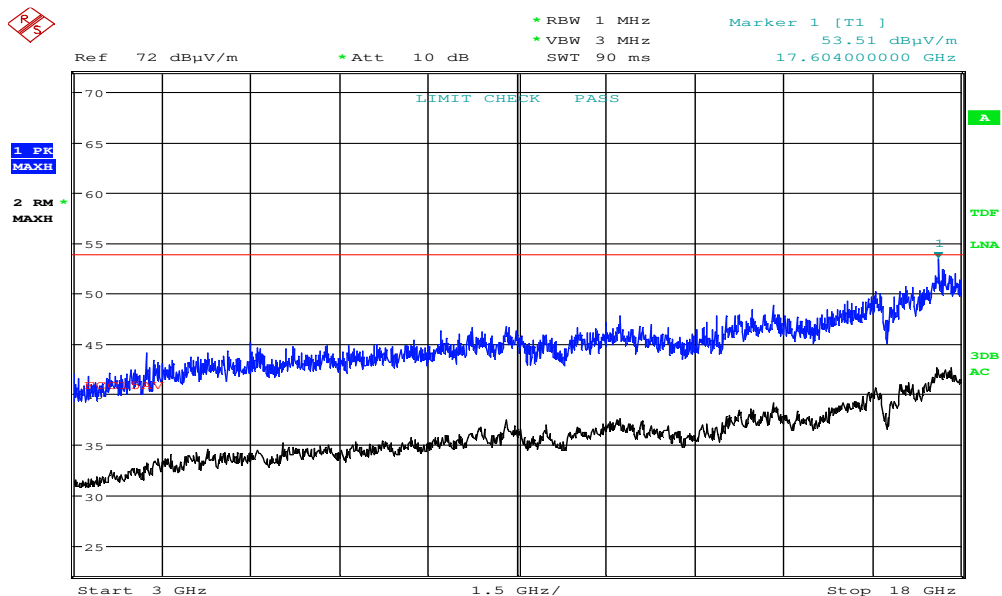
Date: 7.MAY.2019 14:12:55

Radiated Emissions, 1000 – 4000 MHz, 2480 MHz GFSK, EUT V, VP



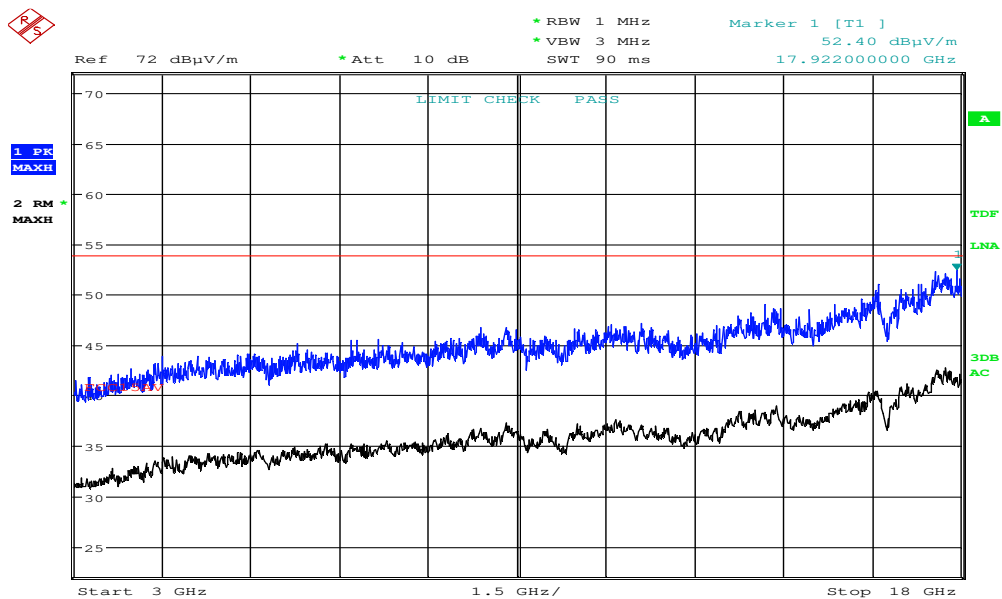
Date: 7.MAY.2019 14:14:50

Radiated Emissions, 1000 – 4000 MHz, 2480 MHz GFSK, EUT V, HP



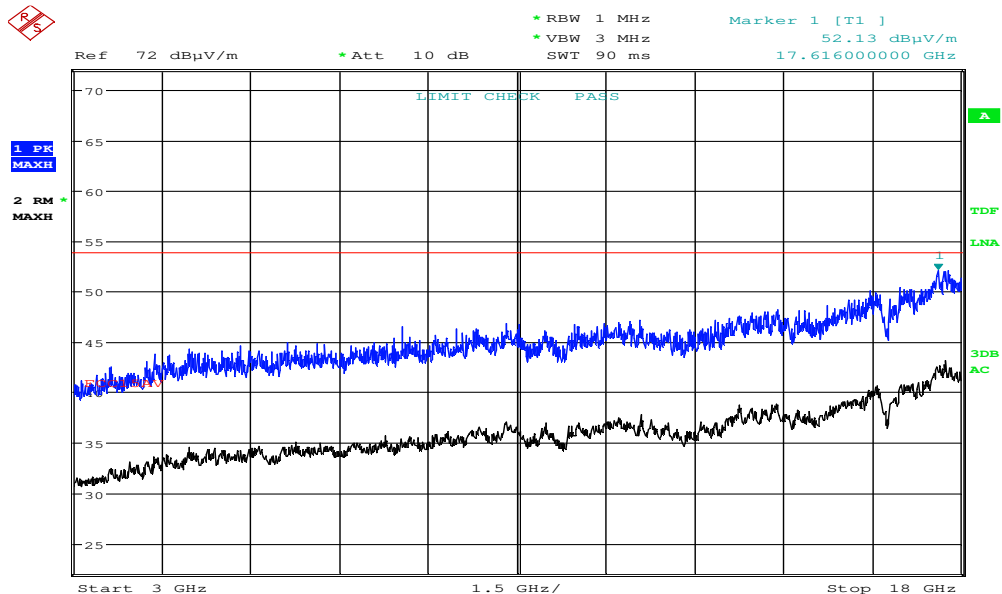
Date: 7.MAY.2019 14:40:27

Radiated Emissions, 3000 – 18000 MHz, 2402 MHz GFSK, EUT V, VP



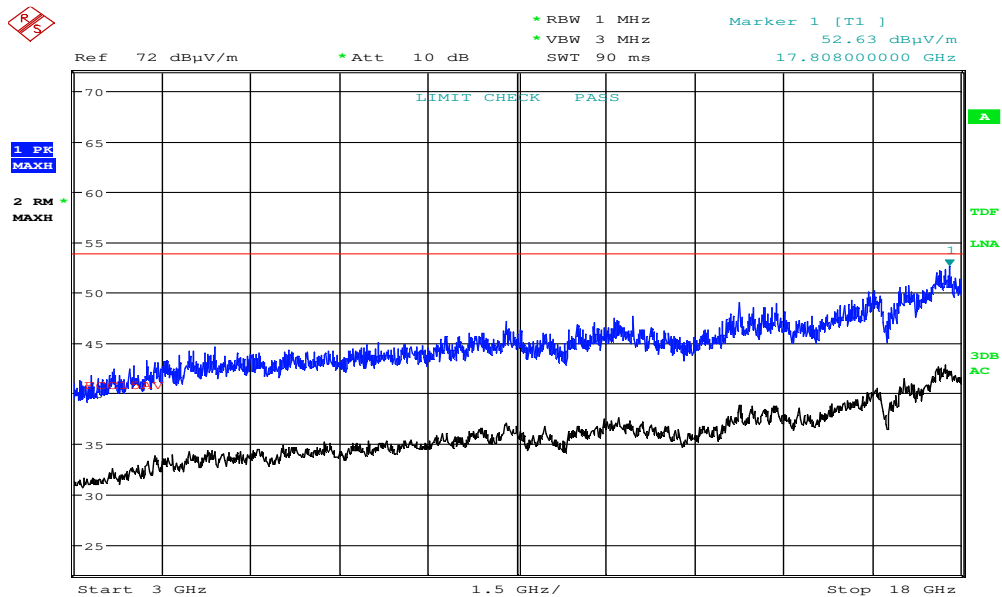
Date: 7.MAY.2019 14:42:23

Radiated Emissions, 3000 – 18000 MHz, 2402 MHz GFSK, EUT V, HP



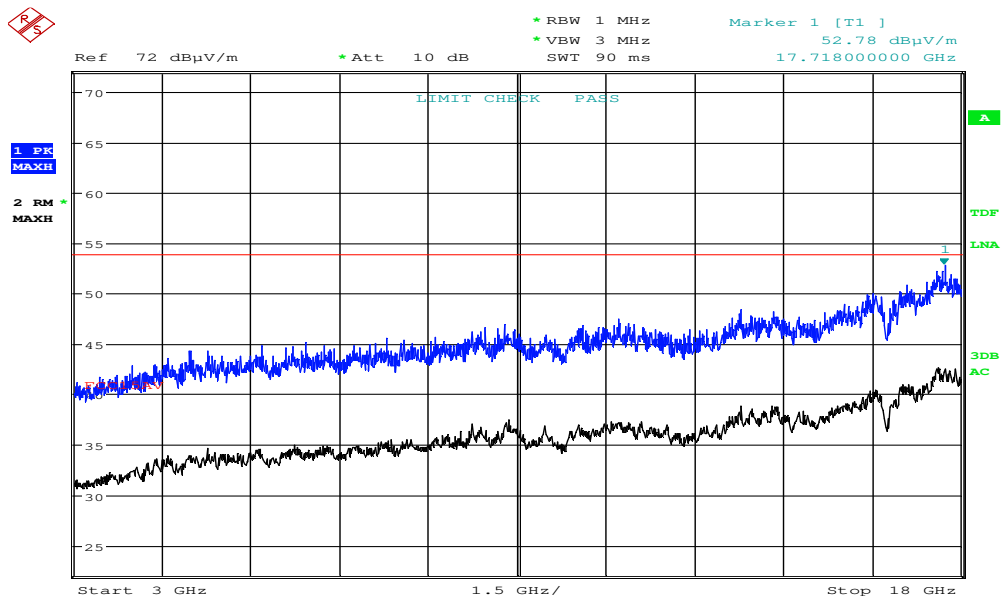
Date: 7.MAY.2019 14:46:10

Radiated Emissions, 3000 – 18000 MHz, 2440 MHz GFSK, EUT V, VP



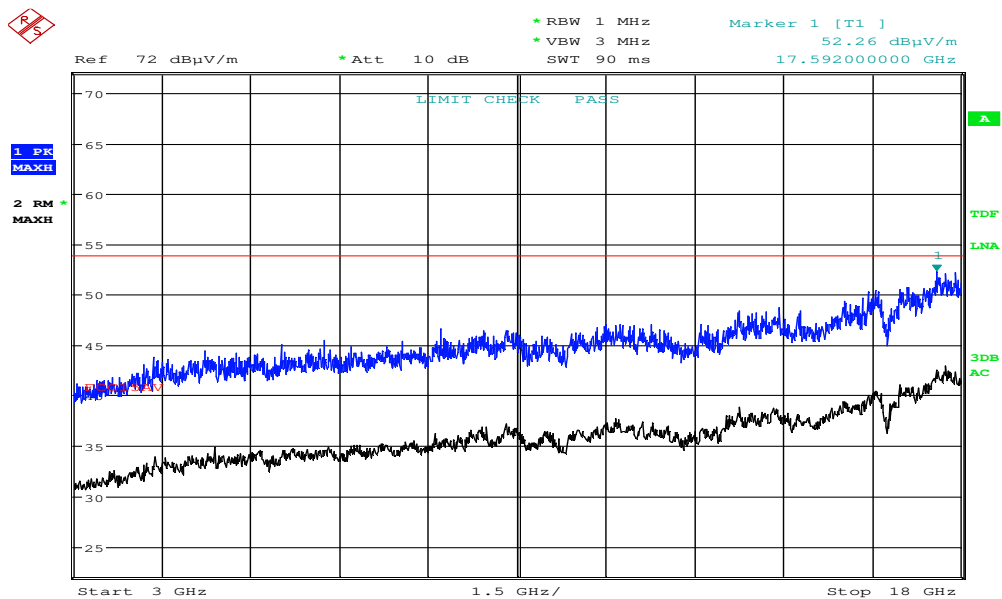
Date: 7.MAY.2019 14:48:06

Radiated Emissions, 3000 – 18000 MHz, 2440 MHz GFSK, EUT V, HP



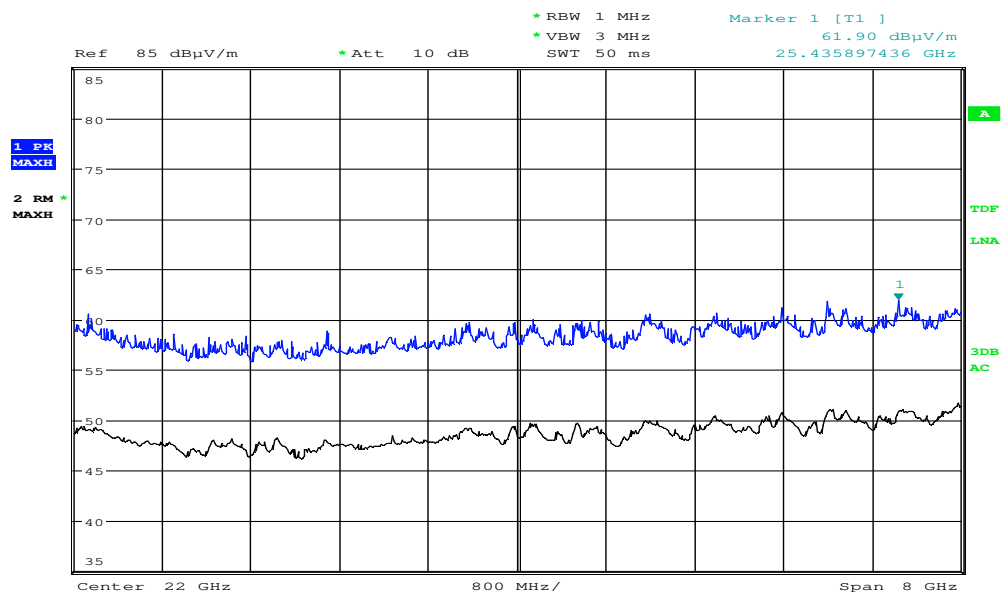
Date: 7.MAY.2019 14:51:40

Radiated Emissions, 3000 – 18000 MHz, 2480 MHz GFSK, EUT V, VP



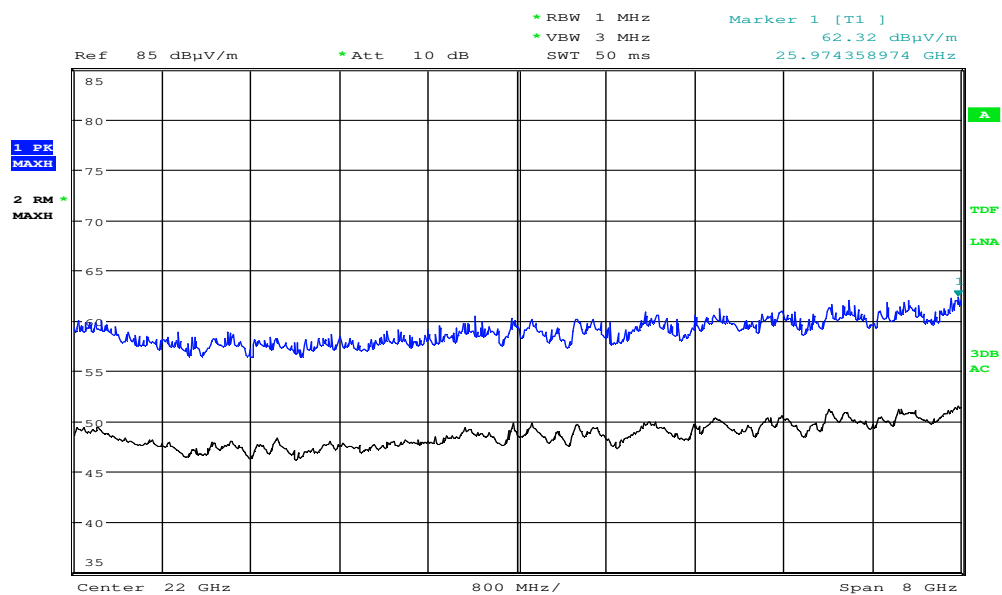
Date: 7.MAY.2019 14:53:35

Radiated Emissions, 3000 – 18000 MHz, 2480 MHz GFSK, EUT V, HP



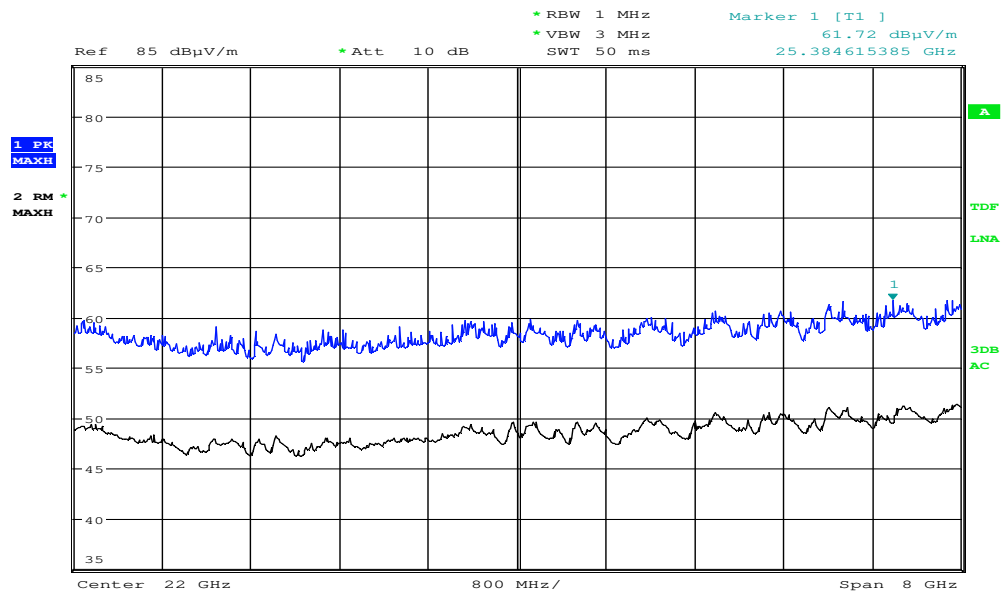
Date: 29.MAR.2019 14:47:09

Prescan, 18 – 26 GHz, 2402 MHz, ~10cm



Date: 29.MAR.2019 14:45:21

Prescan, 18 – 26 GHz, 2440 MHz, ~10cm



Date: 29.MAR.2019 14:48:41

Prescan, 18 – 26 GHz, 2480 MHz, ~10cm

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	2019-01	2020-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2019-01	2020-01
3	6810.17B	Attenuator	Suhner	LR 1669	COU	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	COU	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2016-05	2019-05
6	317	Preamplifier	Sonoma Inst.	LR 1687	2018-07	2019-07
7	3115	Horn Antenna	EMCO	LR 1330	2016-10	2019-10
8	3117-PA	Horn Antenna with Preamp	EMCO	LR 1717	2017-12	2019-12
9	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2018-07	2019-07
10	638	Horn Antenna	Narda	LR 1480	2010-06	2020-06
11	WRCG2400/2483.5	Band Reject Filter	Wainwright Inst.	LR 1530	COU	
12	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
13	SF102/1000MM	RF Cable	Suhner	SN 50113/2	COU	
14	SF102/2000MM	RF Cable	Suhner	SN 500100/2	COU	

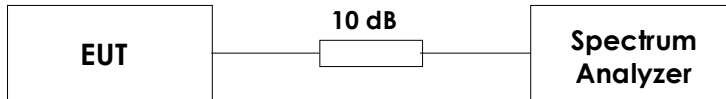
COU - Calibrate ON Use; N/A – Not Applicable

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

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.20.10	Radiated Emission test software
2	Rohde & Schwarz	GPBShot	2.7	Screenshots from R&S Spectrum Analyzers
3				

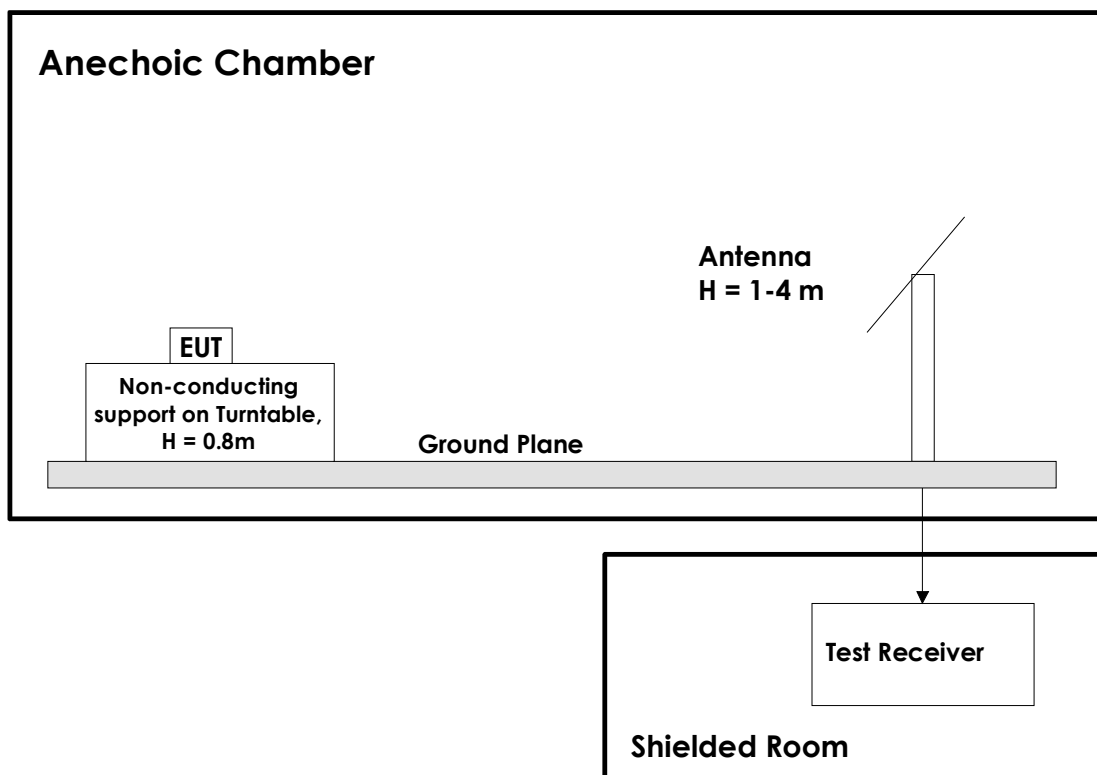
6 BLOCK DIAGRAM

6.1 Conducted Tests



This test set-up is used for all Conducted tests.

6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. The measuring distance 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, and High-Pass filter is used for all harmonics.