

Test Report

Product	Maritime Broadband Radio		
Name and address of the applicant	Kongsberg Seatex AS Pirsenteret, N-7492 Trondheim, Norway		
Name and address of the manufacturer	Kongsberg Seatex AS Pirsenteret, N-7492 Trondheim, Norway		
Model	MBR 144 OEM		
Rating	24Vdc		
Trademark	Kongsberg seatex		
Serial number	9532		
Additional information	The tested device contains radio module operates in U-NII Band III.		
Tested according to	FCC Part 15.407 Unlicensed National Information Infrastructure Devices (U-NII) Industry Canada RSS-247, Issue 2 Licence-Exempt Local Area Network (LE-LAN) Devices		
Order number	379761		
Tested in period	2019.10.10 - 2019.10.26		
Issue date	2020.04.30		
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	 
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [G.Suhanthakumar]		 Approved by [Frode Sveinsen]	
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1 INFORMATION

1.1 Test Item

Name	Kongsberg seatex
Model	MBR 144 OEM
FCC ID	Q8IM144M2OEM
ISED ID	5637A-M144M2OEM
Serial number	9532
Hardware identity and/or version	1.4
Software identity and/or version	2.10.05
Frequency Ranges	U-NII 3: 5735 – 5840 MHz: 4 channels
Operating Modes	TX
Type of Modulation	GMSK
Conducted Output Power	885 mW
Antenna Connector	SMA
Number of Antennas	4
Antenna Diversity Supported	N/A
Smart Antennas Supported	Yes (Phased array – electronical steerable antenna direction)
TPC Supported	N/A
DFS Supported	N/A
Power Supply	24Vdc
Desktop Charger	N/A

Description of Test Item

MBR 144 OEM is the low weight, compact version in the MBR family. Designed for customer specific integration, with a flexible form for easy fit into existing platforms. The antenna connections are connector-based, thus the antennas can be adjusted for the customer specific design.

Theory of Operation

The Maritime Broadband Radio is a smart antenna designed for use in maritime applications where digital high-speed reliable communication and data transfer is crucial for efficient and safe operation. The MBR 144 versions has a phased array consisting of 4 antennas and can real time adjust phase and amplitude in order to increase gain in the direction of the receiver.

1.3 Normal test conditions

Temperature: 20 - 24 °C
 Relative humidity: 20 - 50 %
 Normal test voltage: 24 Vdc

The values are the limit registered during the test period.

1.4 Test Engineer(s)

G.Suwanthakumar

1.5 Description of modification for Modification Filing

Not applicable.

1.6 Family List Rational

Not Applicable.

1.7 Antenna Requirement

Is the antenna detachable? Yes No

If detachable, is the antenna connector non-standard? Yes No

Type of antenna connector: SMA for professional use

1.8 Worst-Case Configuration

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

Radiated Emissions tests were performed with all transmit antennas active.

1.9 EUT Operating Modes

Description of operating modes	Continuous TX, 5 GHz maximum BW Mode
Additional information	/

1.10 Comments

The measurements were done with the EUT powered by 24 V dc. It was checked that power variations between 85% and 115% did not have any influence on the measurements. (20.4 - 27.6Vdc)

All ports were populated during spurious emission measurements.

1.11 EUT Power settings

Channel	Freq (MHz)	Maximum power setting
1	5735	31
2	5770	31
3	5805	31
4	5840	31

1.12 TEST REPORT SUMMARY

1.13 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.407 and ISED RSS-247 Issue 2.

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

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 1m and 3m.

New Submission

Production Unit

Class II Permissive Change

Pre-production Unit

Nil 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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1.14 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
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)	Complies
Maximum Output Power	15.407(a)	6.2	Complies
Power Spectral Density	15.407(a)	6.2	Complies
Emission Bandwidth	15.407(a)(2)	6.2	Complies
Unwanted Emissions	15.407(b)	6.2	Complies
Discontinuation of Transmission	15.407(c)	6.3	N/T ¹
6 dB Bandwidth	15.407(e)	6.2.4	Complies
Transmit Power Control	15.407(h)	6.2.3	N/A ²
Dynamic Frequency Selection	15.407(h)	6.3	N/A ²
Radiated Emissions	15.205 15.209	7.3 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ See manufacturers declaration

² Not required for U-NII Band III

³ The EUT is a Client Device without Radar Detection.

Revision history

Revision	Date	Comment	Sign
00	2020.02.10	First Version	gns
01	2020.04.30	Editorial changes	FS

2 TEST RESULTS

2.1 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

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

Test Results: Complies

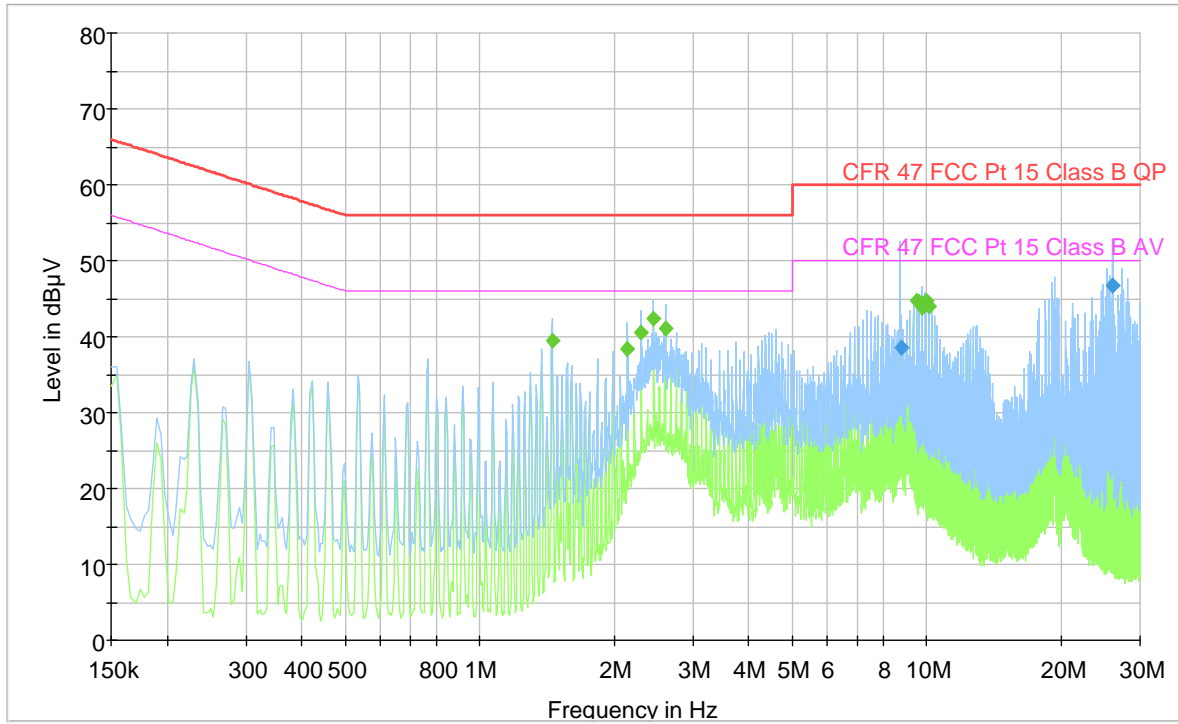
Measurement Data: See attached plots

Highest measured value (L1 and N):

120Vac, 60Hz Using external power supply model with external DC power supply, model no: CPX400S

Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
1.452	---	39.46	46.00	6.54	1000	9	N	OFF
2.140	---	38.36	46.00	7.64	1000	9	N	OFF
2.296	---	40.46	46.00	5.54	1000	9	L1	OFF
2.448	---	42.39	46.00	3.61	1000	9	N	OFF
2.600	---	41.08	46.00	4.92	1000	9	N	OFF
8.796	38.59	---	60.00	21.41	1000	9	N	OFF
9.484	---	44.66	50.00	5.34	1000	9	L1	OFF
9.636	---	44.53	50.00	5.47	1000	9	L1	OFF
9.788	---	43.80	50.00	6.20	1000	9	L1	OFF
9.944	---	44.68	50.00	5.32	1000	9	L1	OFF
10.096	---	44.07	50.00	5.93	1000	9	L1	OFF
26.016	46.71	---	60.00	13.29	1000	9	L1	OFF

Full Spectrum



2.2 Maximum Output Power, e.i.r.p.

FCC 15.407 (a)

ISED RSS-247, Issue 2, Clause 6.2

Measurement procedure: ANSI C63.10-2013 Clause 12.3, method SA-1

Test Results: Complies

Measurement Data: conducted

Ch. No.	Nominal Frequency (MHz)	Maximum Conducted Output Power (dBm)				Total power Σ dBm	Limit \leq dBm
		Antenna 1	Antenna 2	Antenna 3	Antenna 4		
1	5735	23.65	23.43	23.91	21.82	29.29	30
2	5770	23.69	23.16	23.91	21.32	29.15	30
3	5805	23.90	22.31	22.74	22.61	28.95	30
4	5840	23.53	22.74	23.91	23.54	29.47	30

Maximum antenna gain 6 dBi

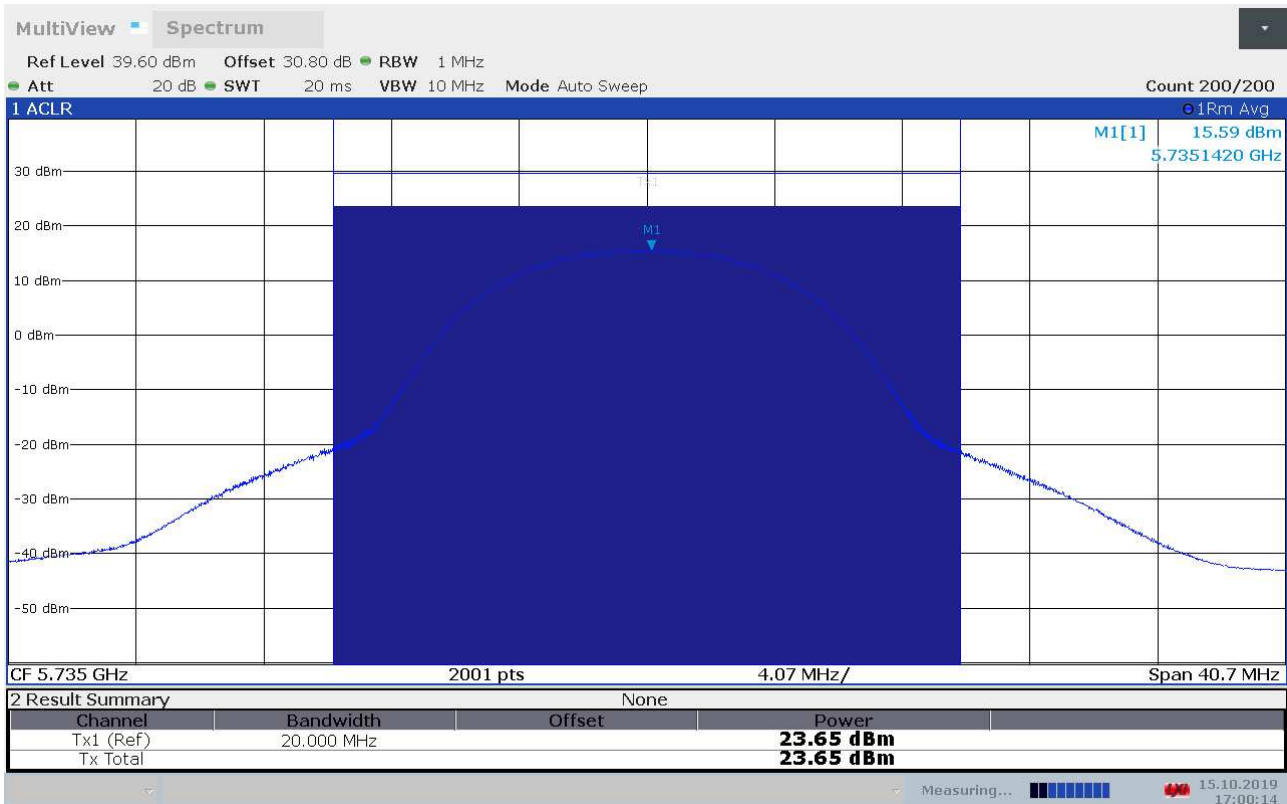
The EUT operates continuously; therefore, method SA-1 of ANSI C63.10-2013 clause 12.3 was used.

EIRP values were calculated from Field Strength values using the method described in KDB 412172 D01.

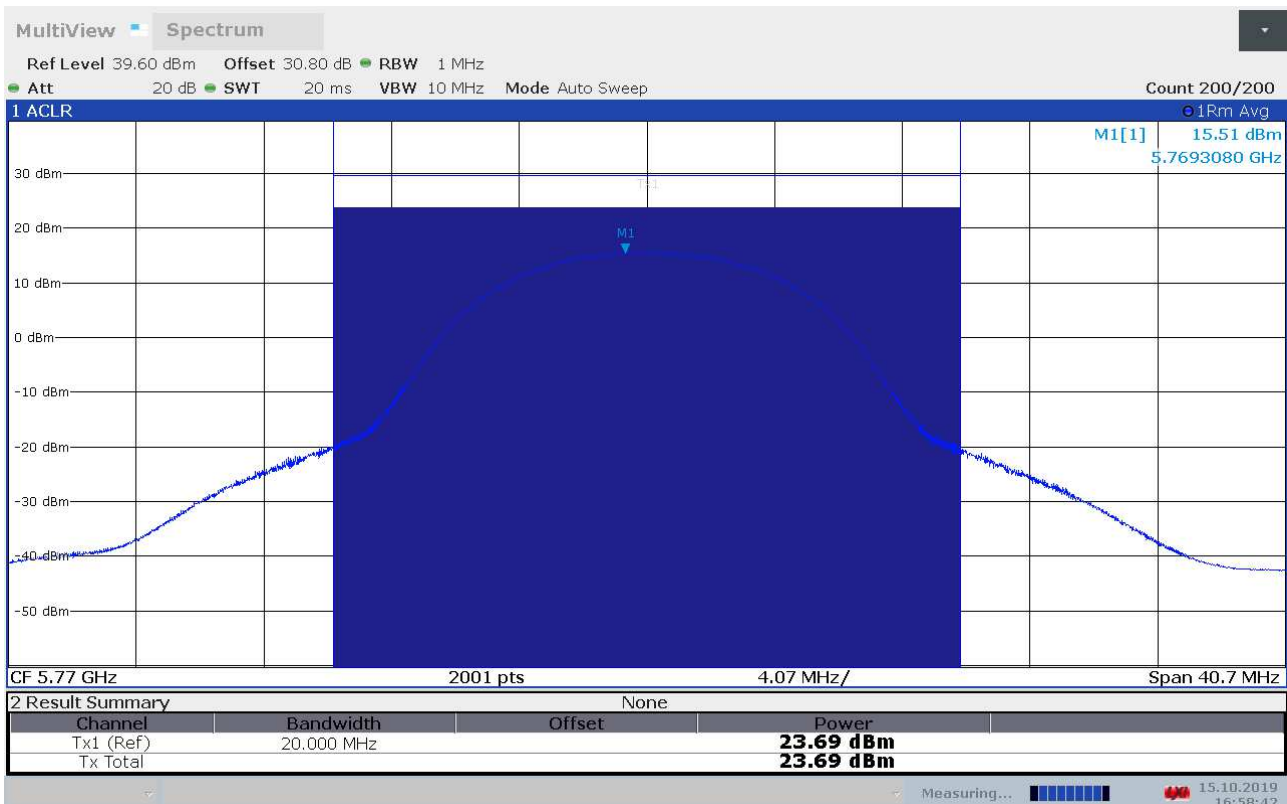
This is a device with maximum directional Antenna Gain of 6 dBi.

Limits:

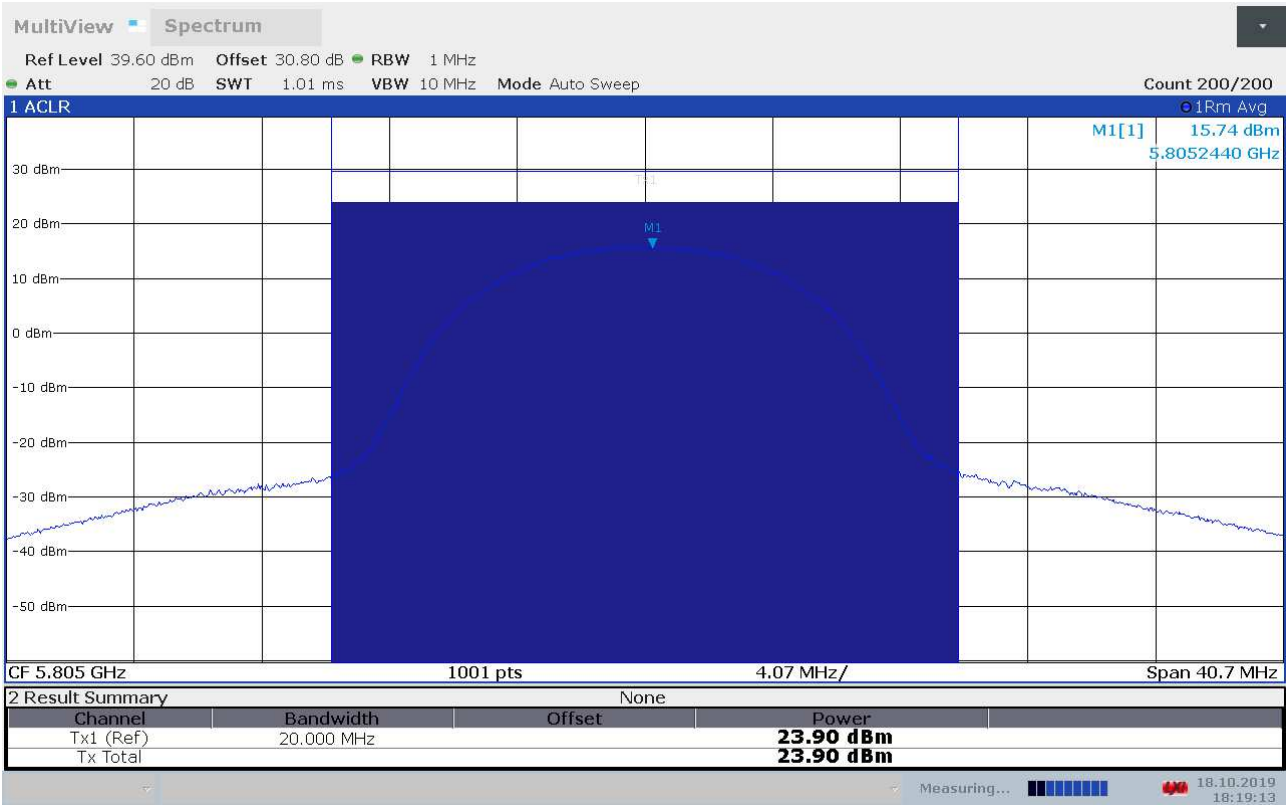
Frequency Band	FCC 15.407(a)	ISED RSS-247 Issue 2
5725 – 5825 MHz	Less than 1 Watt	Less than 1 Watt If Antenna Gain is more than 6 dBi the Power Limit is reduced by the amount exceeding 6 dBi
	If Antenna Gain is more than 6 dBi the Power Limit is reduced by the amount exceeding 6 dBi	
	<i>B</i> is the 26dB emission bandwidth in MHz	<i>B</i> is the 99% emission bandwidth in MHz



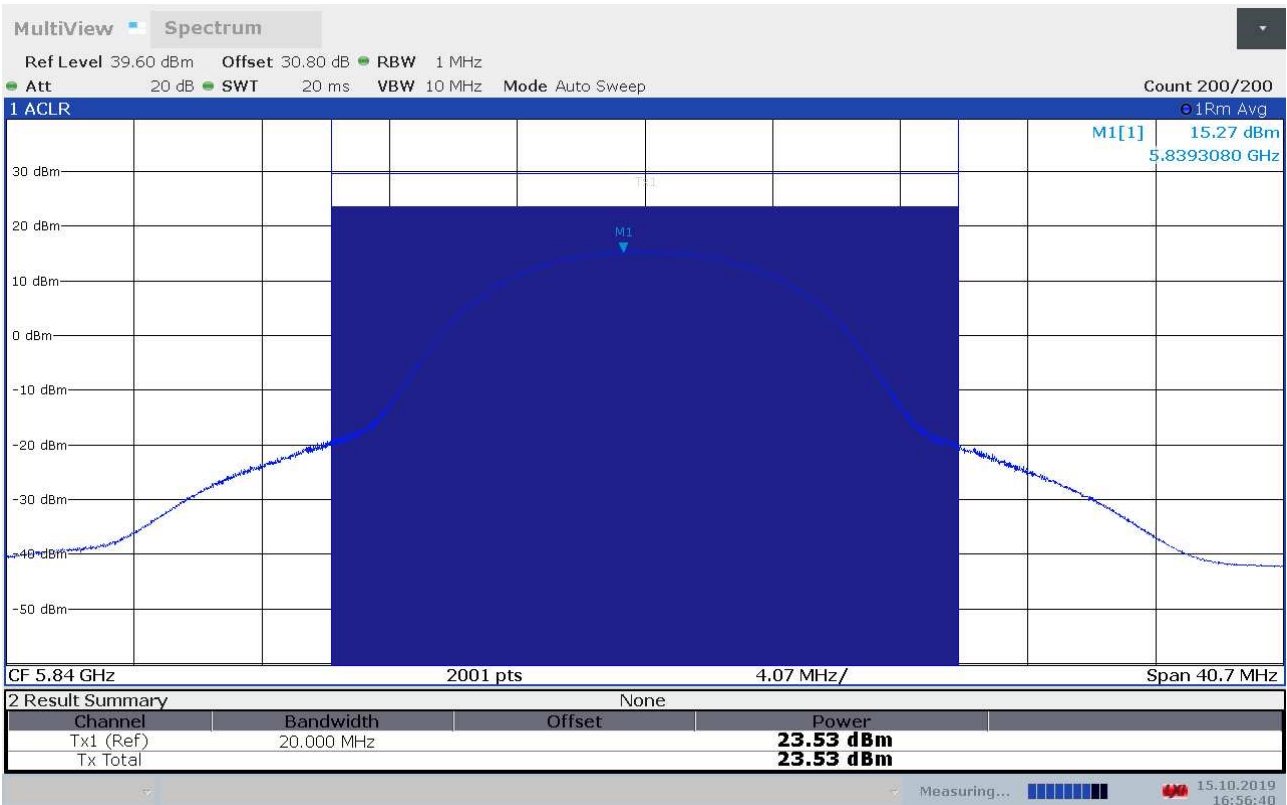
Output Power, 5735 MHz, Port 1, Conducted



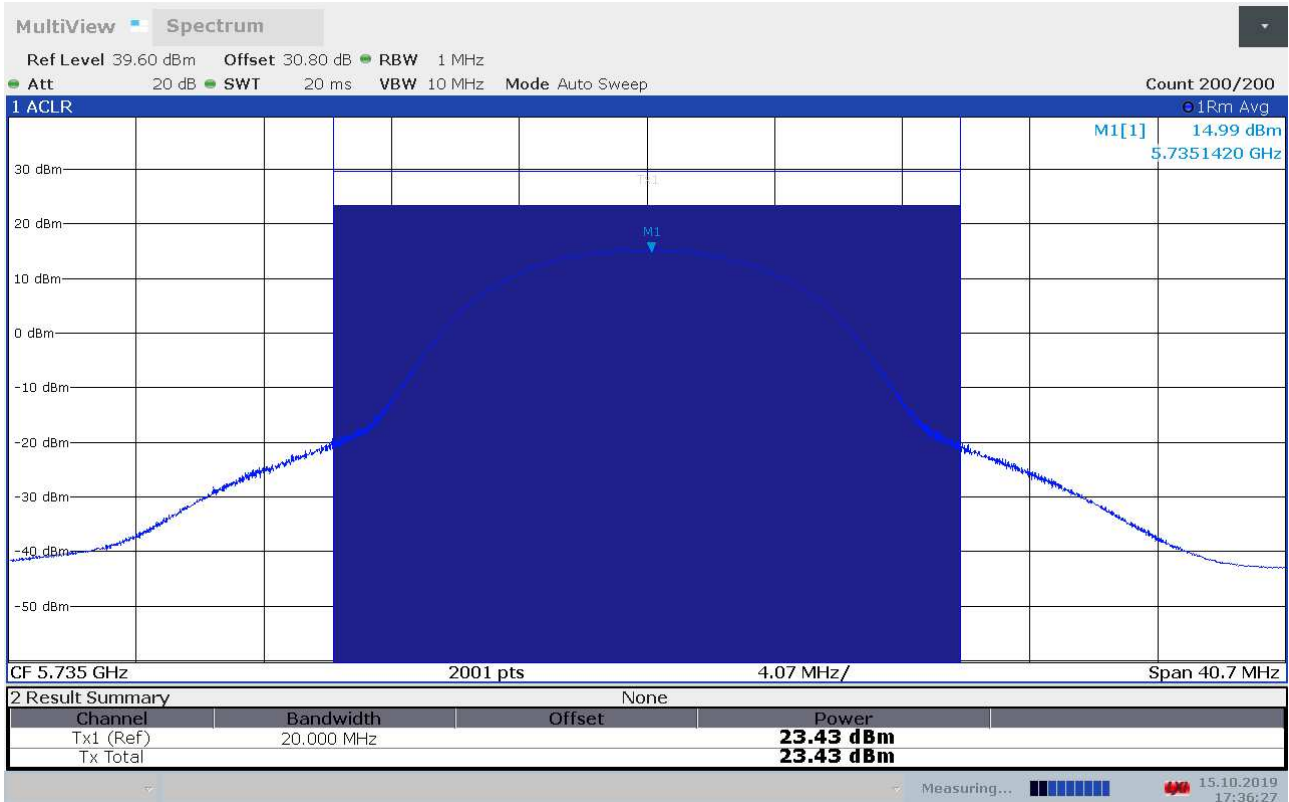
Output Power, 5770 MHz, Port 1, Conducted



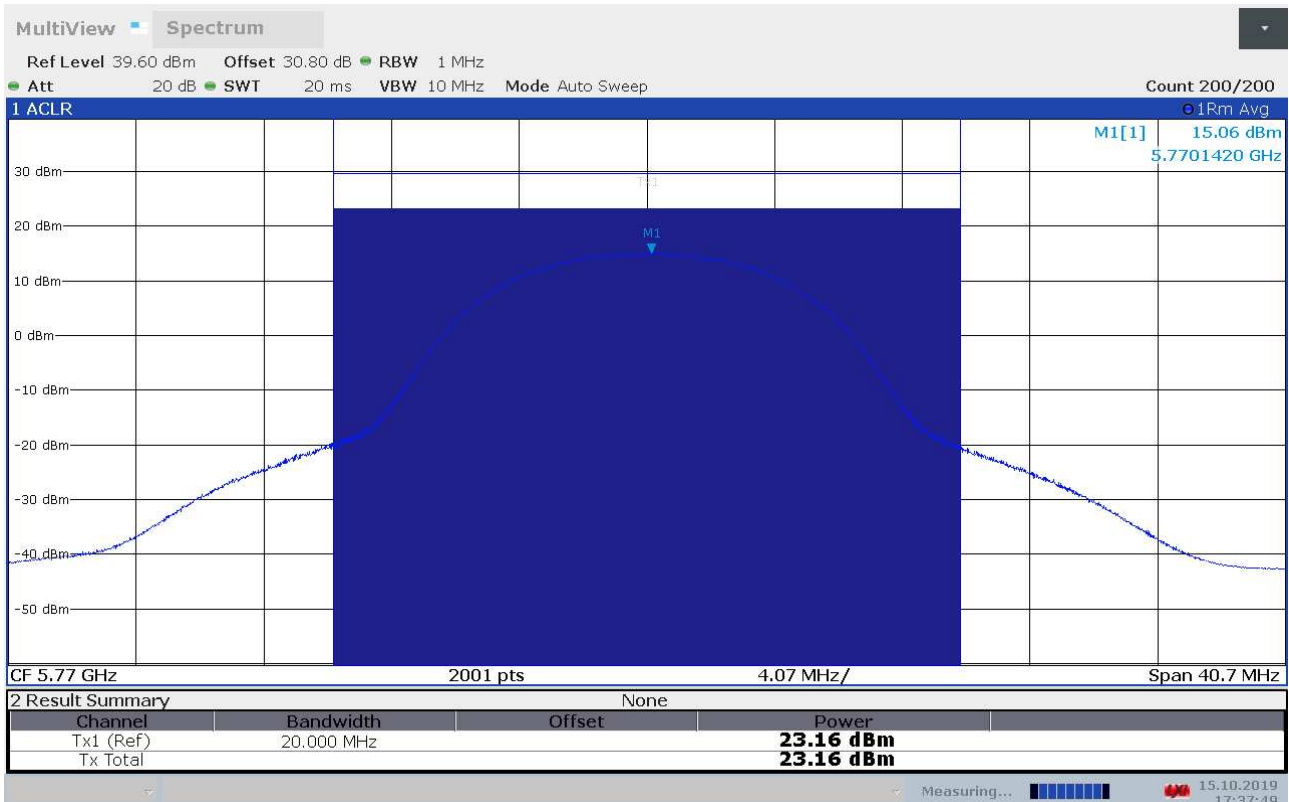
Output Power, 5805 MHz, Port 1, Conducted



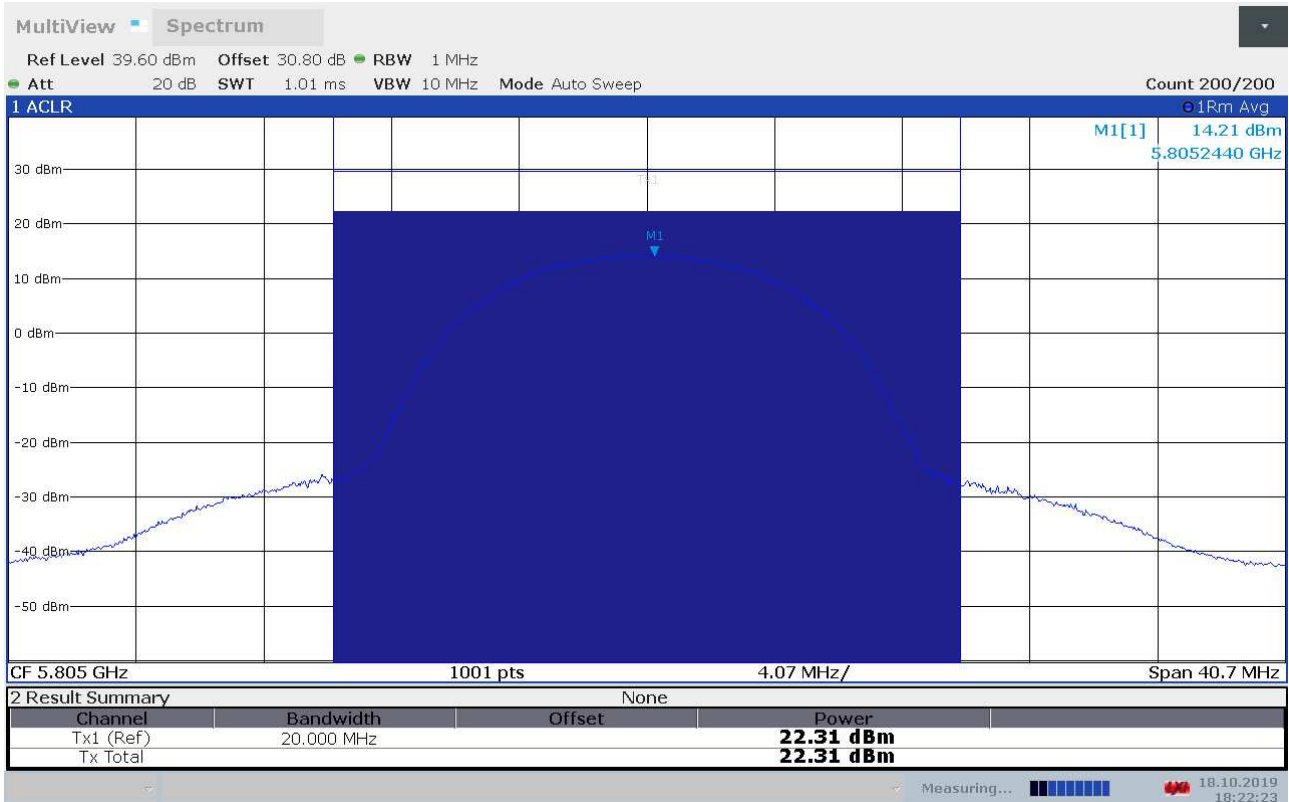
Output Power, 5840 MHz, Port 1, Conducted



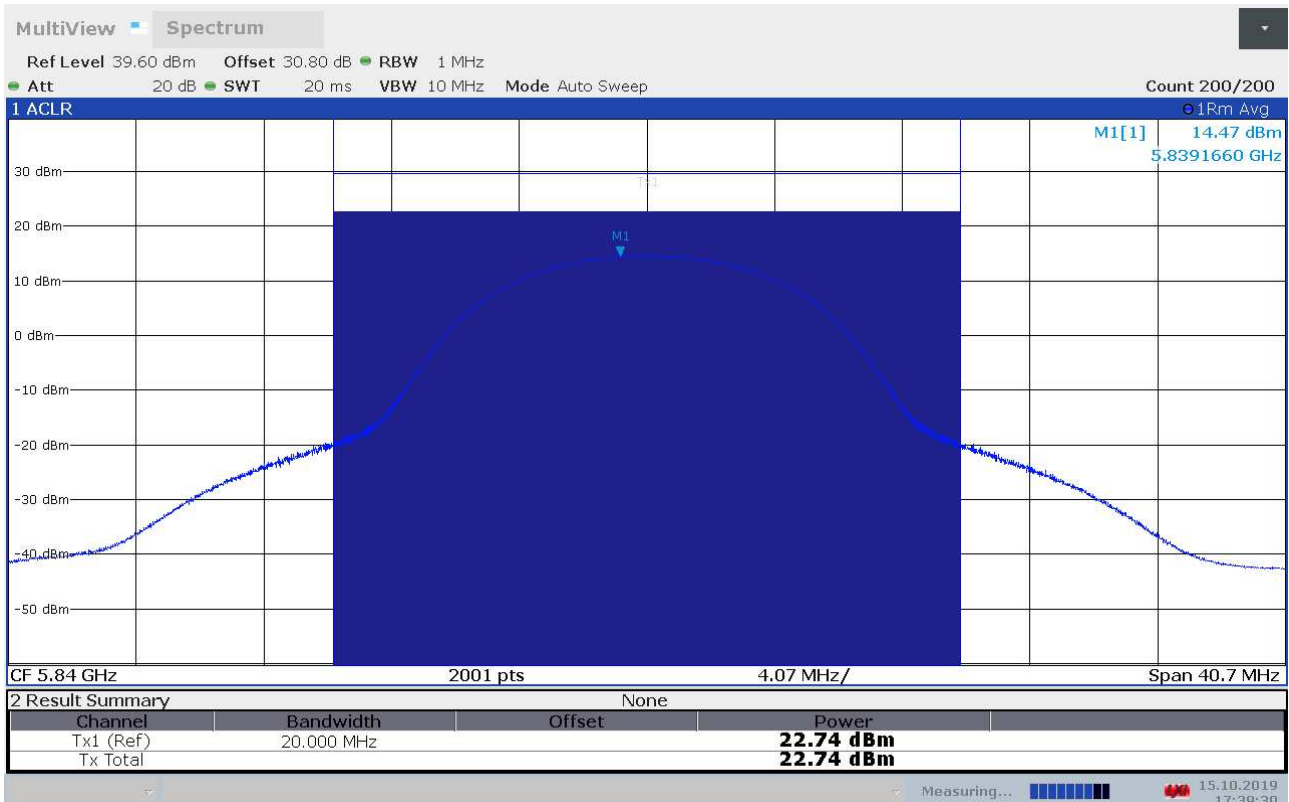
Output Power, 5735 MHz, Port 2, Conducted



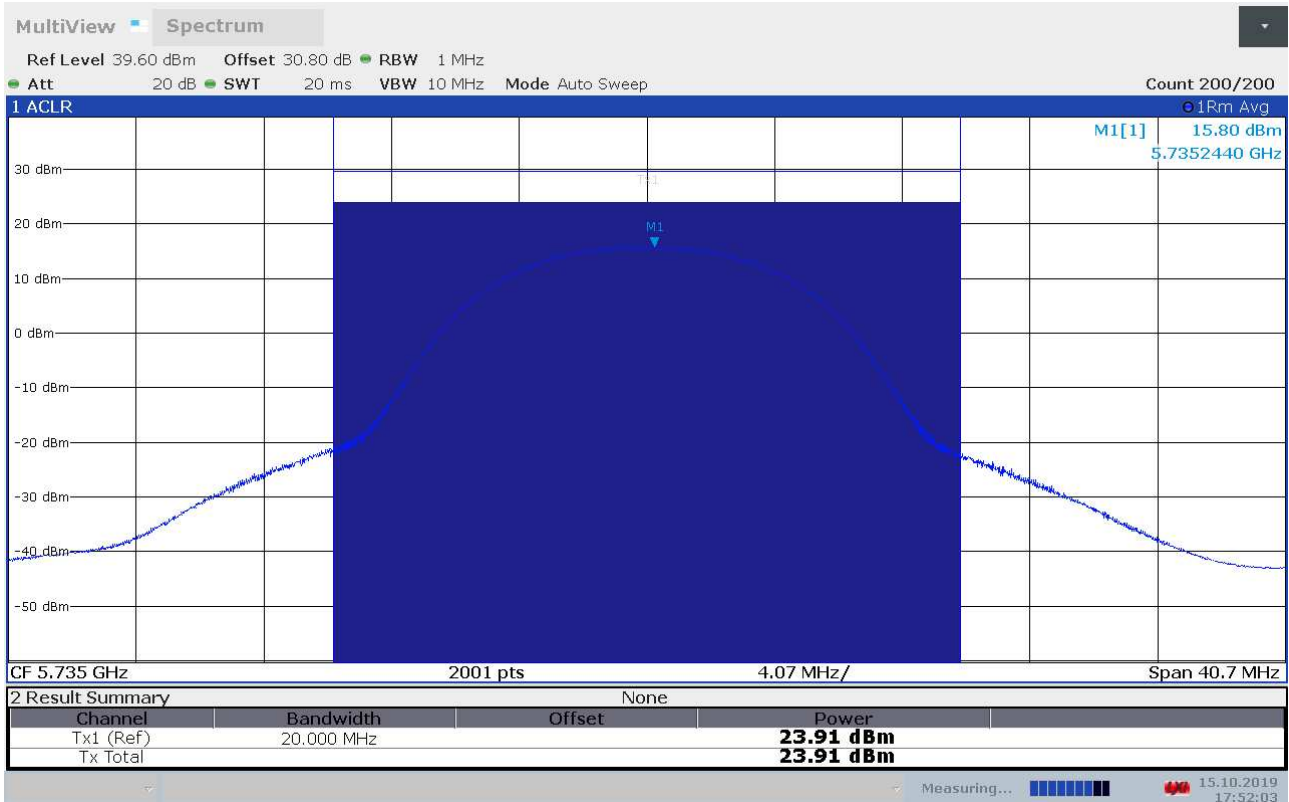
Output Power, 5770 MHz, Port 2, Conducted



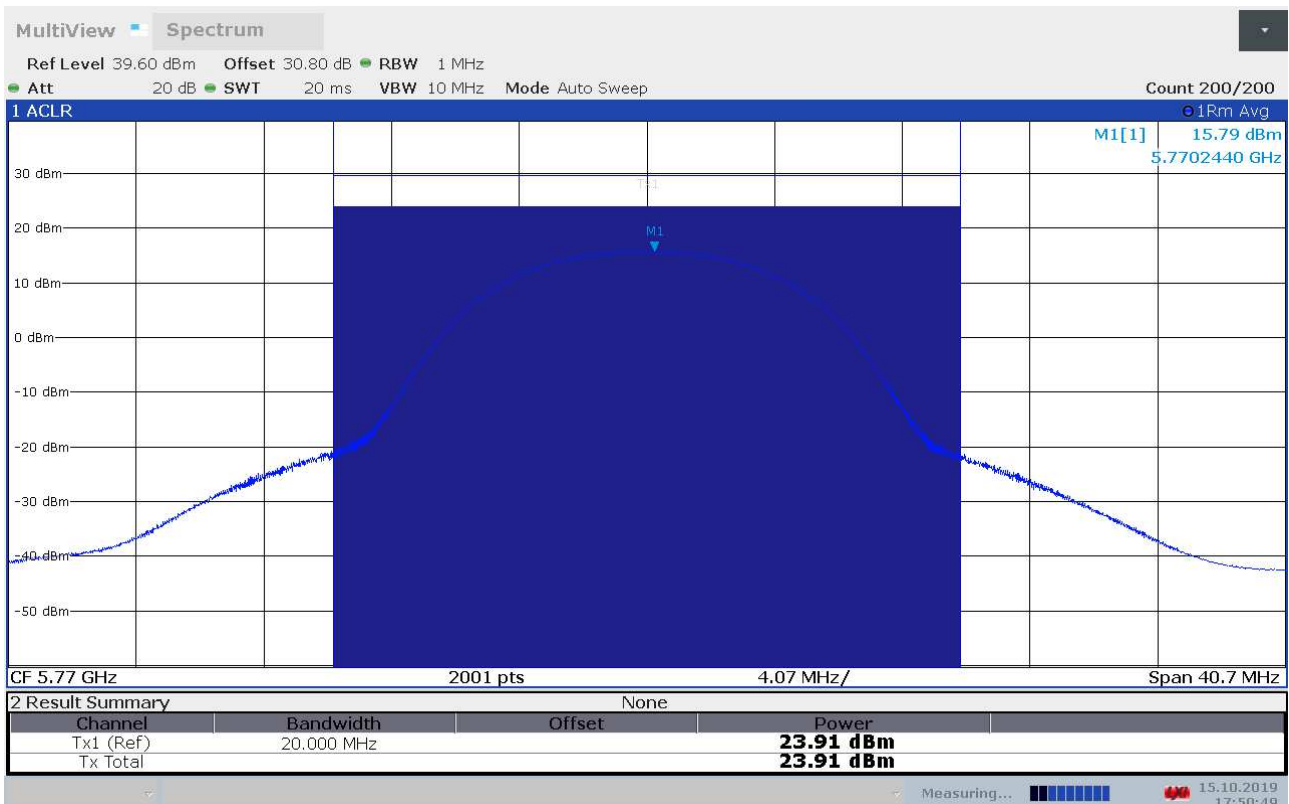
Output Power, 5805 MHz, Port 2, Conducted



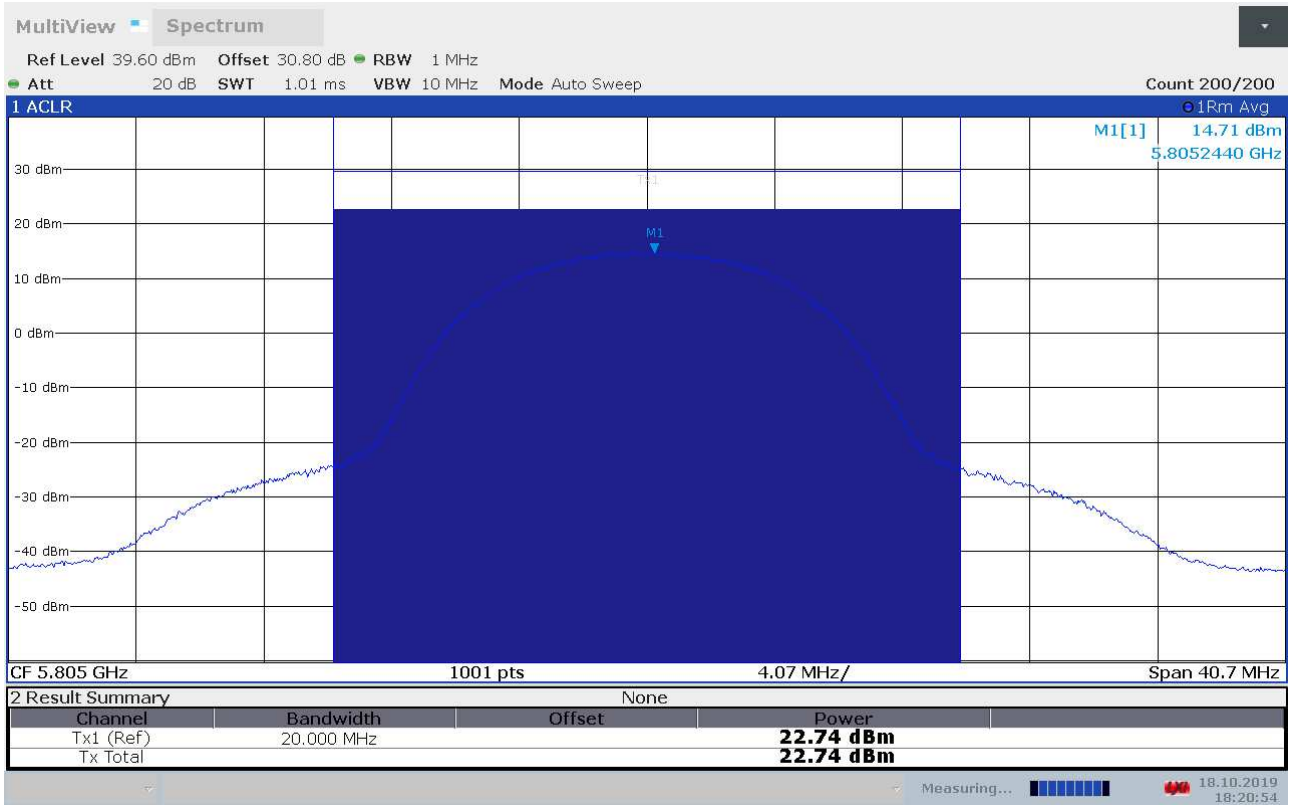
Output Power, 5840 MHz, Port 2, Conducted



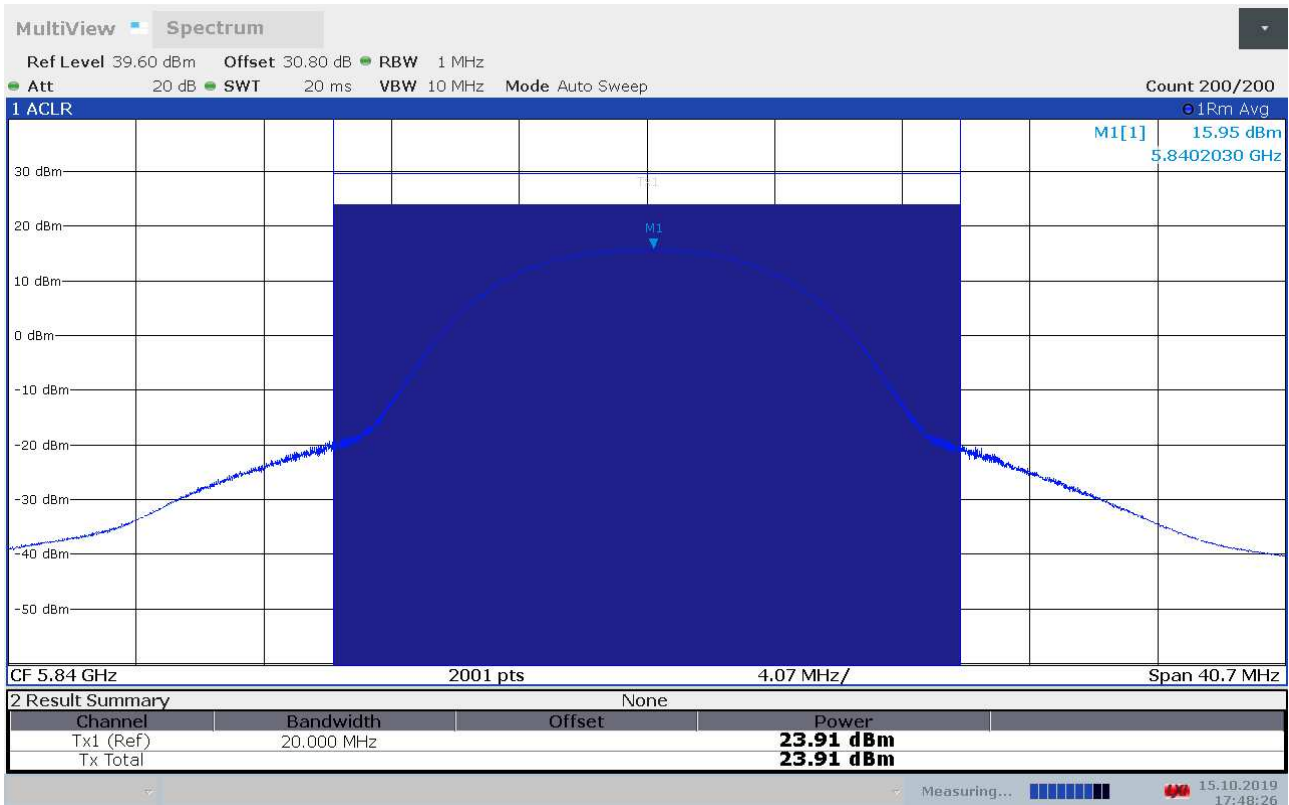
Output Power, 5735 MHz, Port 3, Conducted



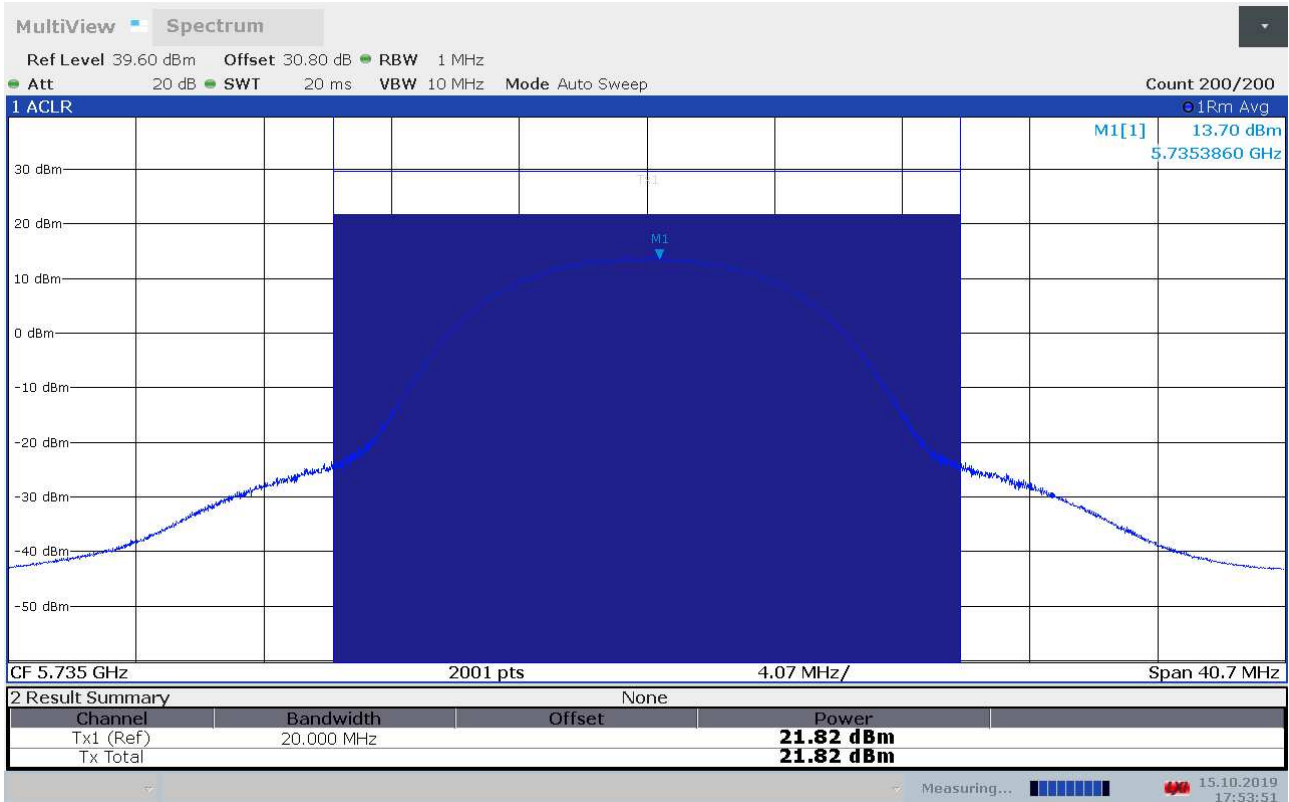
Output Power, 5770 MHz, Port 3, Conducted



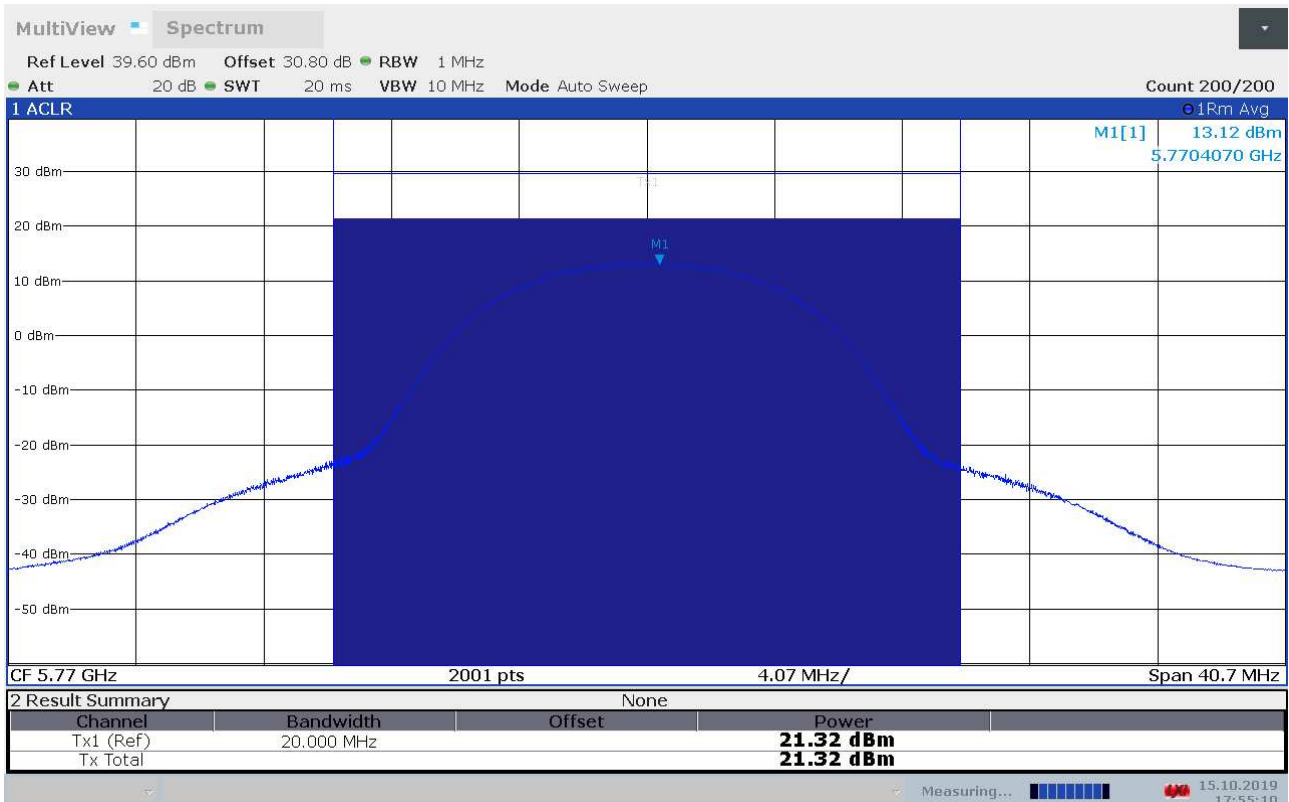
Output Power, 5805 MHz, Port 3, Conducted



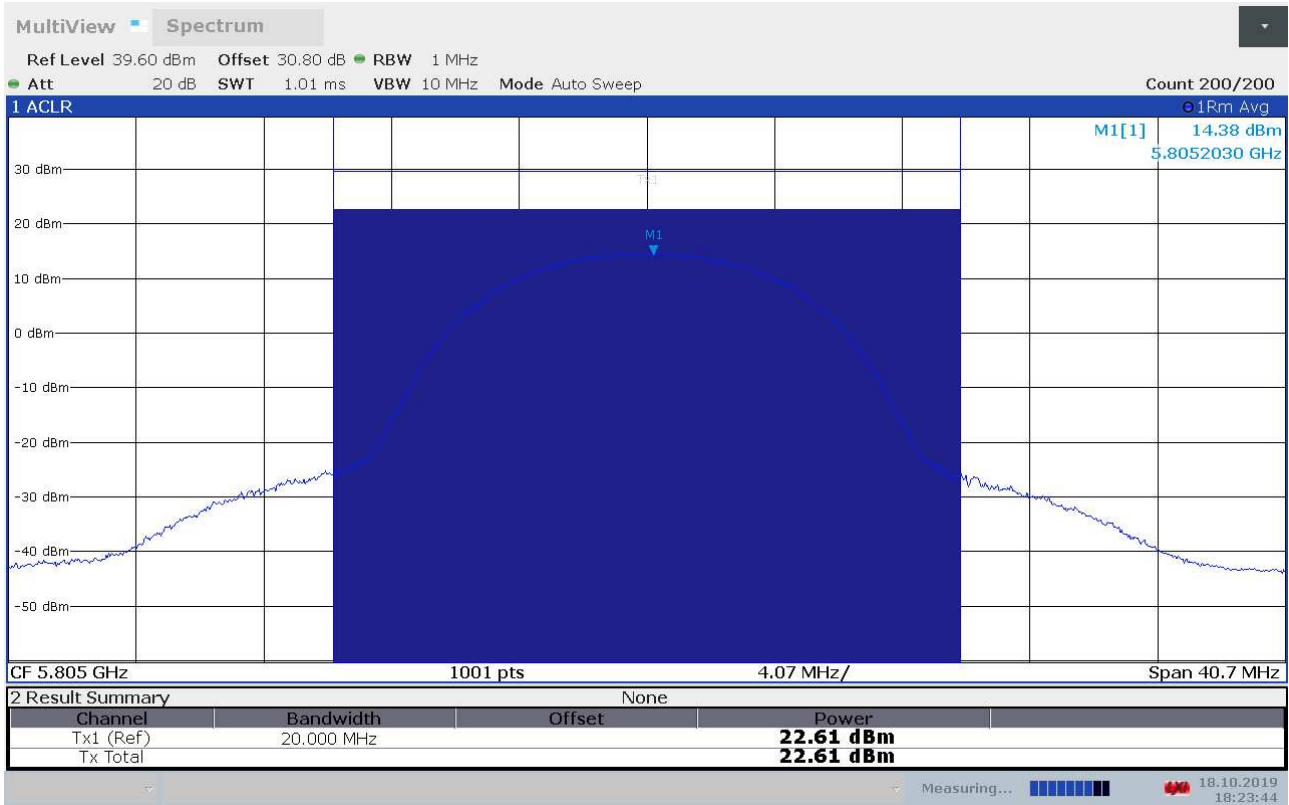
Output Power, 5840 MHz, Port 3, Conducted



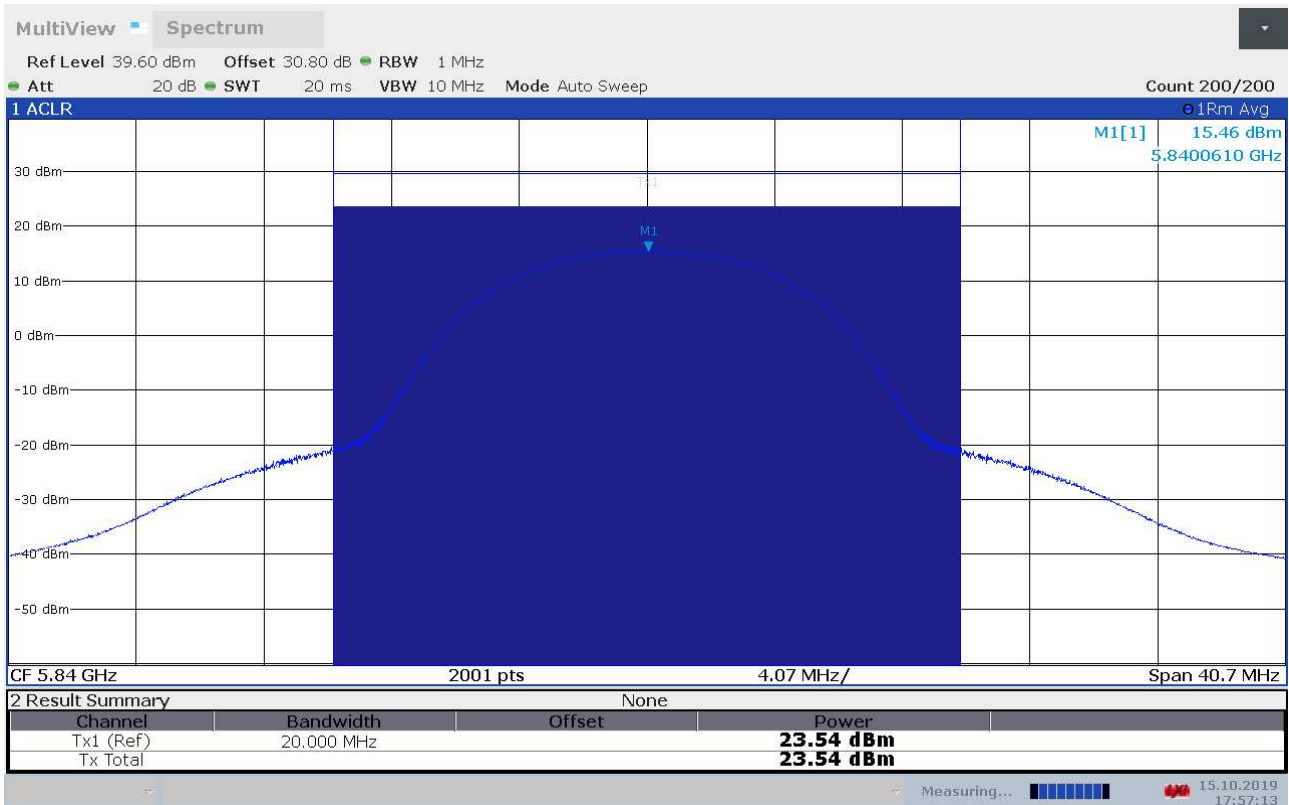
Output Power, 5735 MHz, Port 4, Conducted



Output Power, 5770 MHz, Port 4, Conducted



Output Power, 5805 MHz, Port 4, Conducted



Output Power, 5840 MHz, Port 4, Conducted

2.3 Emission Bandwidth

Para. No.: 15.407(a)(2)

ISED RSS-247, Issue 2, Clause 6.2

Measurement procedure: ANSI C63.10-2013 Clause 6.9.3 and 12.4.1

Test Results: Complies

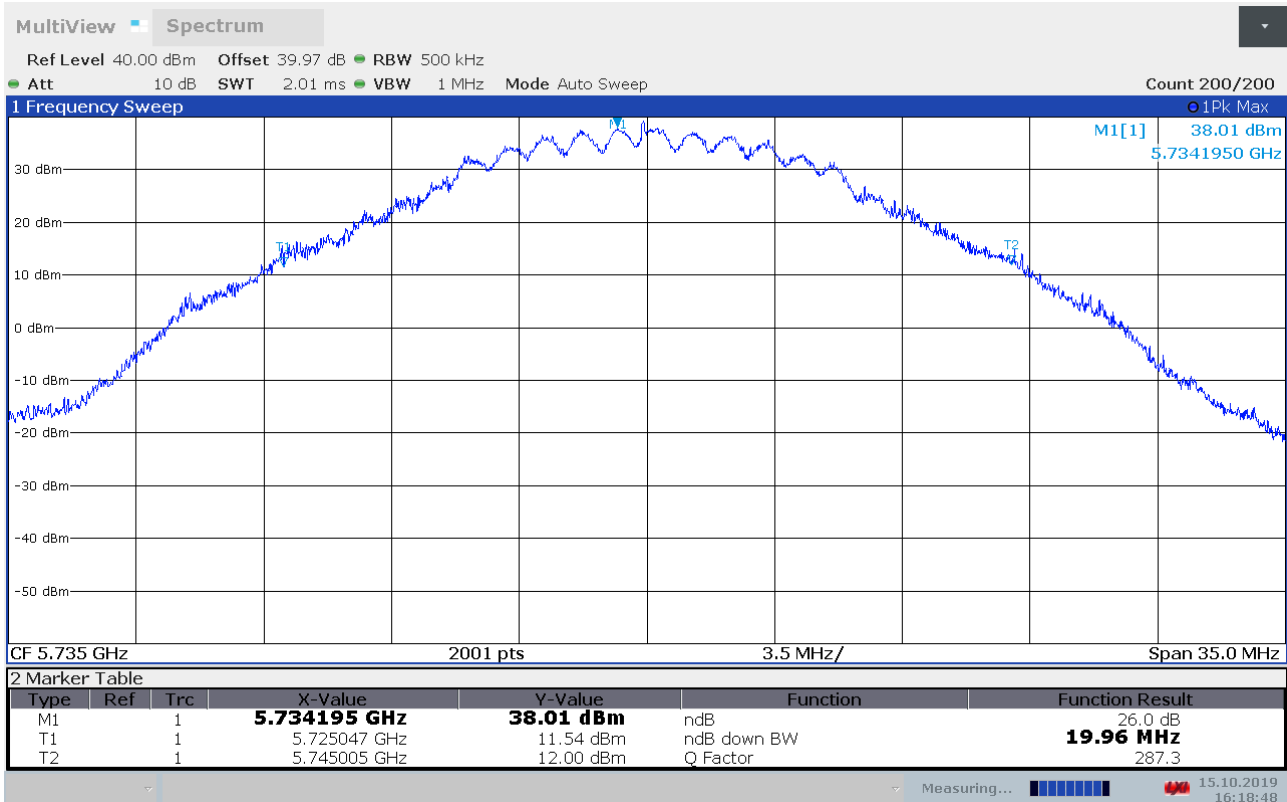
Measurement Data:

Ch. No.	Nominal Frequency (MHz)	FCC
		26dB Bandwidth, Measured Values (MHz)
1	5735	19.96
2	5770	19.94
4	5840	20.17

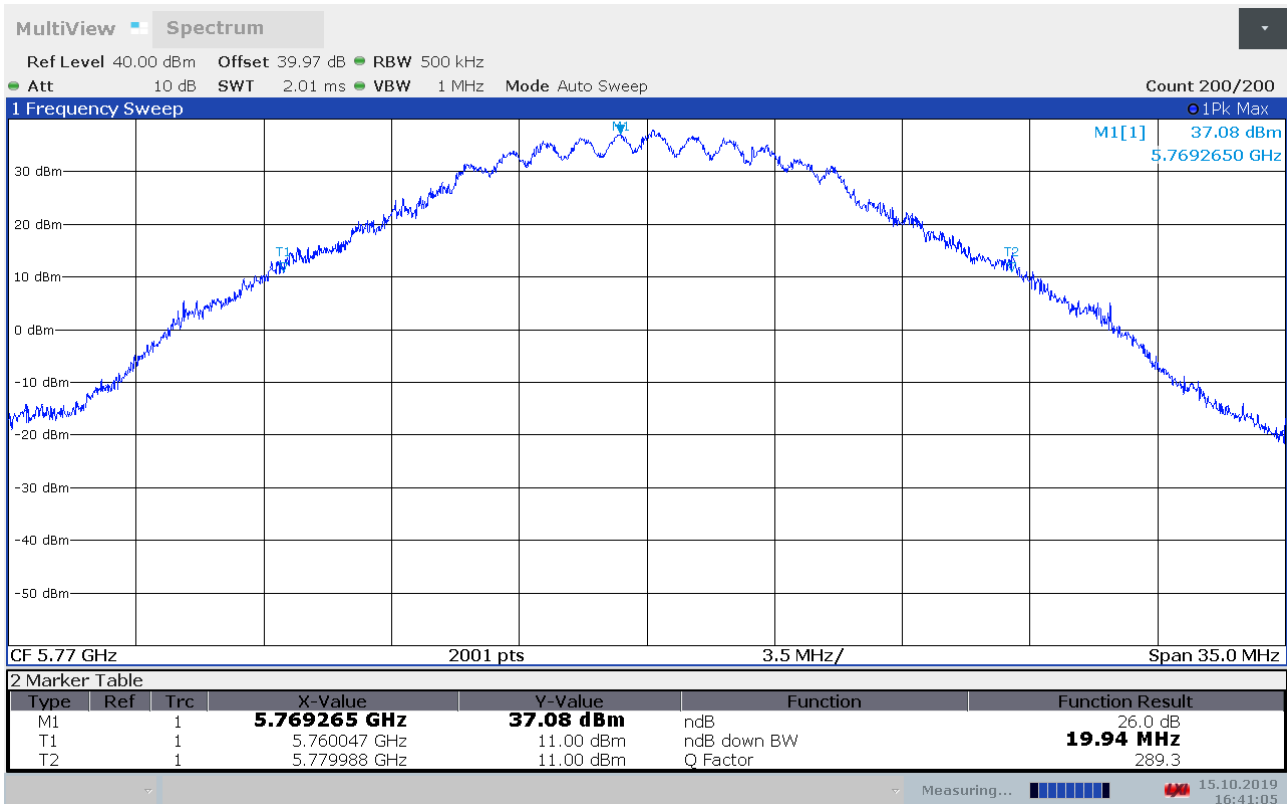
Ch. No.	Nominal Frequency (MHz)	ISED Canada
		99% Bandwidth, Measured Values (MHz)
1	5735	15.75
2	5770	15.96
4	5840	15.89

Limit:

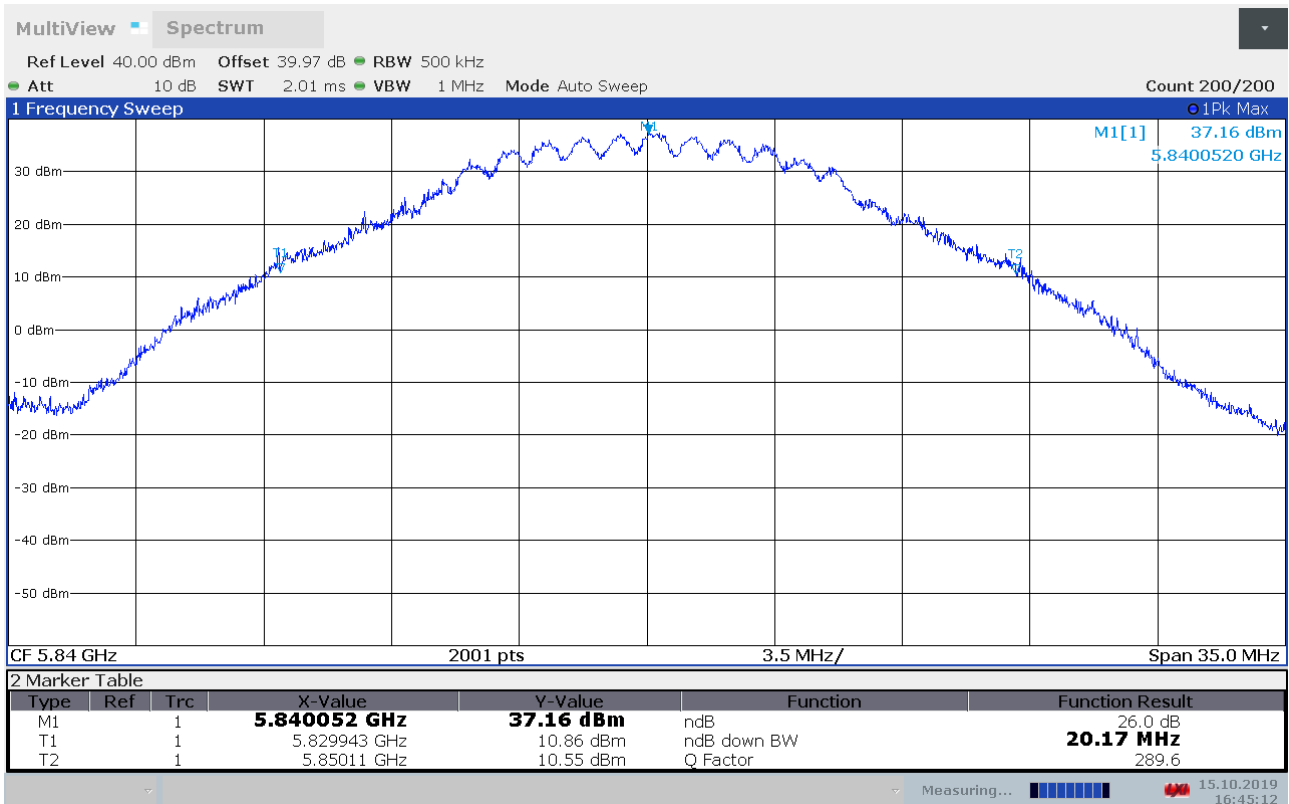
No requirements as long as the emissions are within the band-edges.



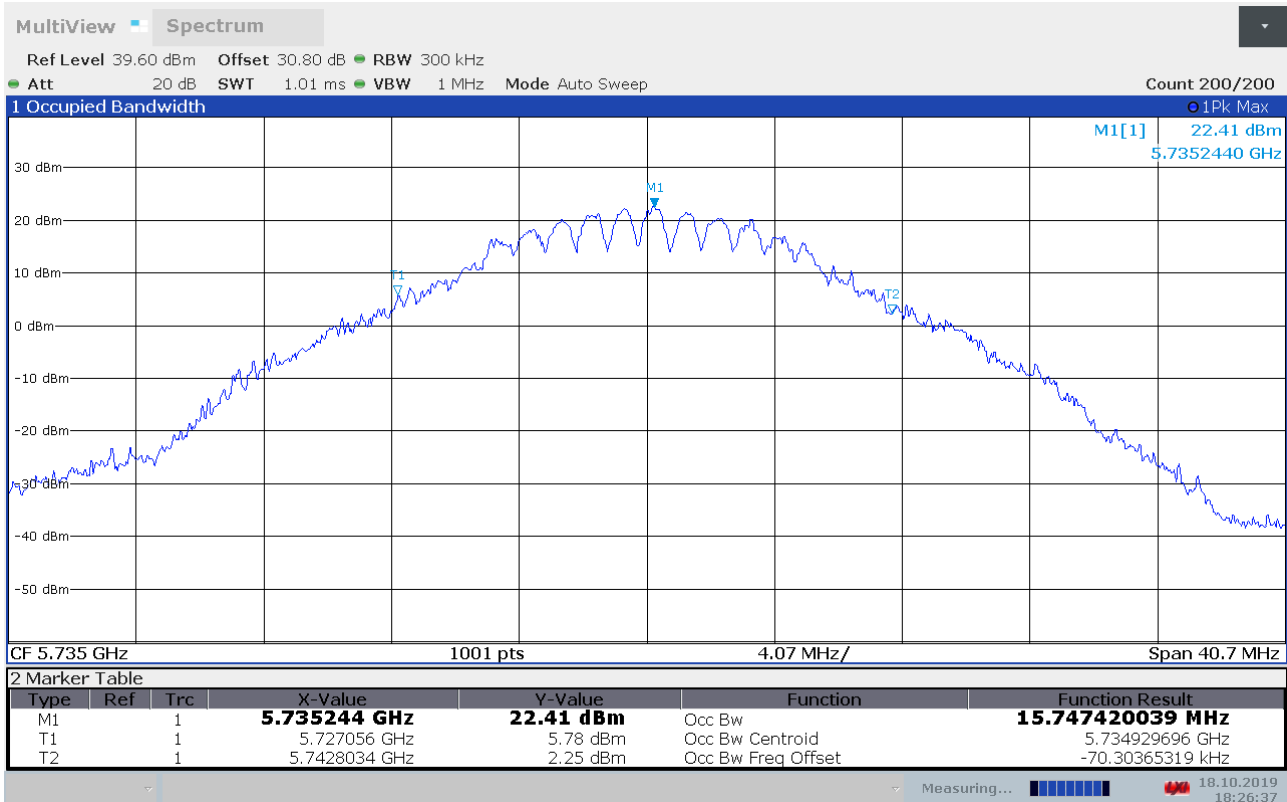
Emission Bandwidth B, 5735 MHz



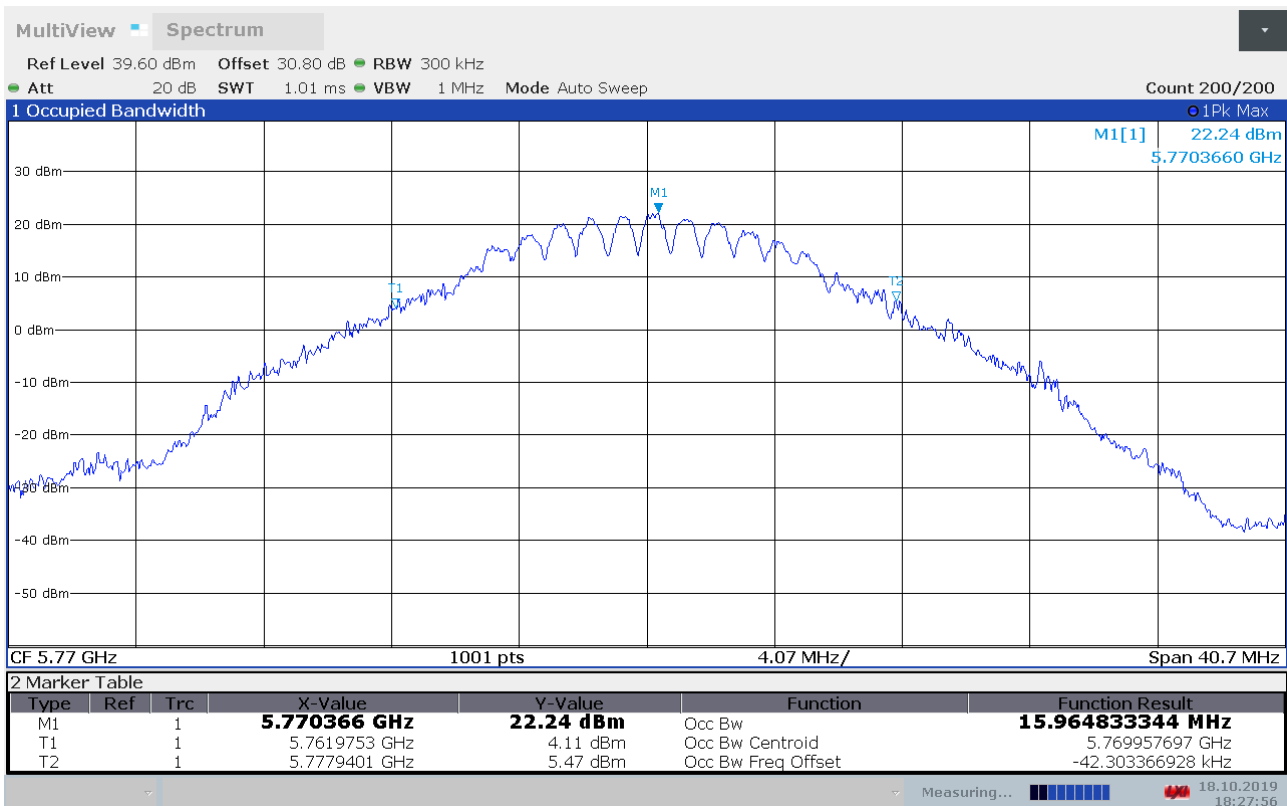
Emission Bandwidth B, 5770 MHz



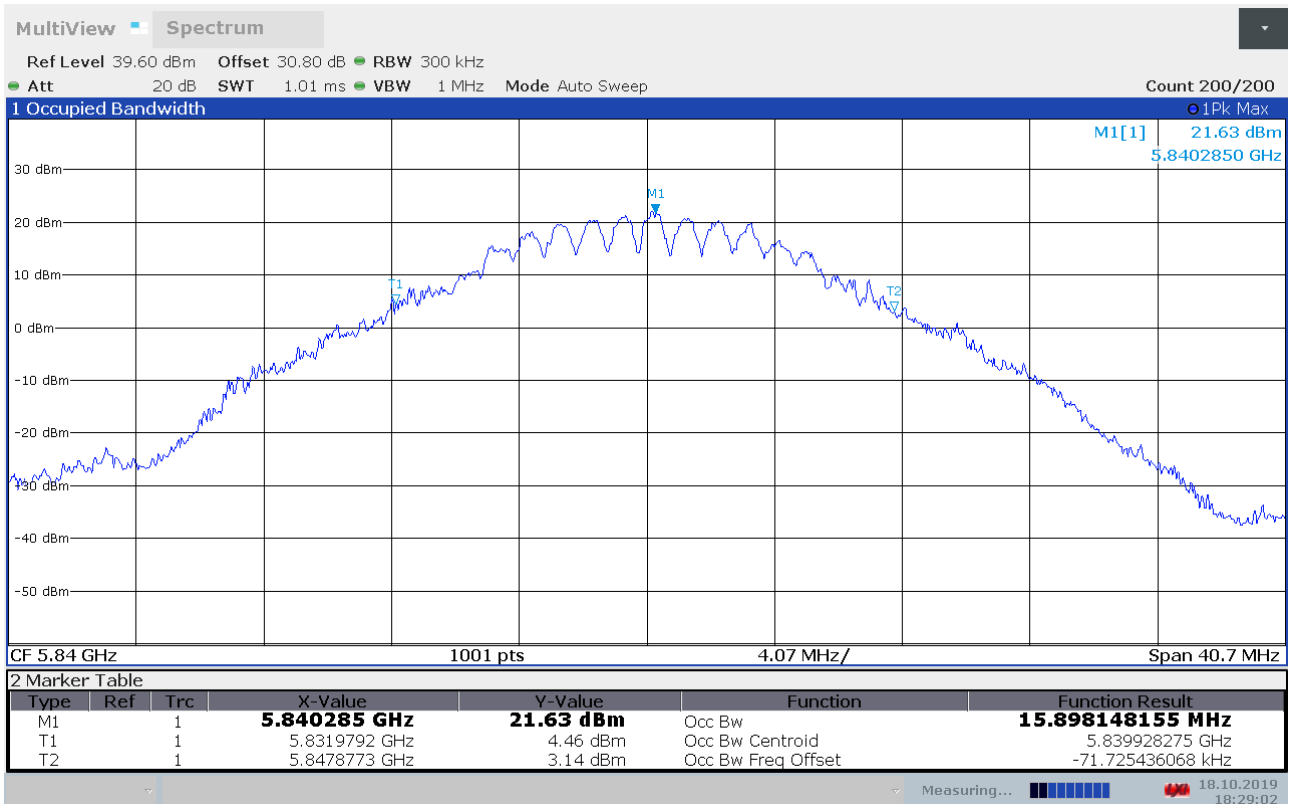
Emission Bandwidth B, 5840 MHz



99% Bandwidth, 5735 MHz



99% Bandwidth, 5770 MHz



99% Bandwidth, 5840 MHz

2.4 DTS Bandwidth

Para. No.: 15.407(e)

ISED RSS-247, Issue 2, Clause 6.2.4

Measurement procedure: ANSI C63.10-2013 Clause 11.8, Option 1

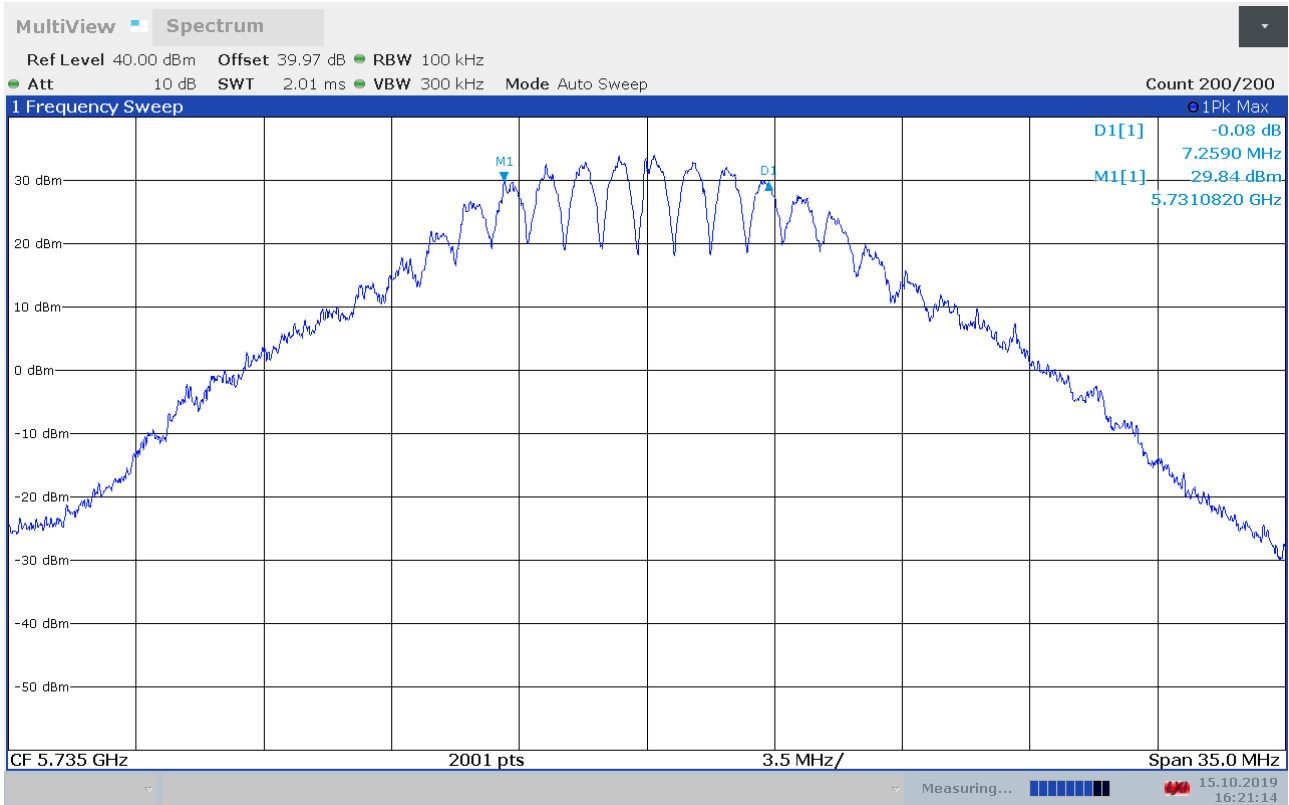
Test Results: Complies

Measurement Data:

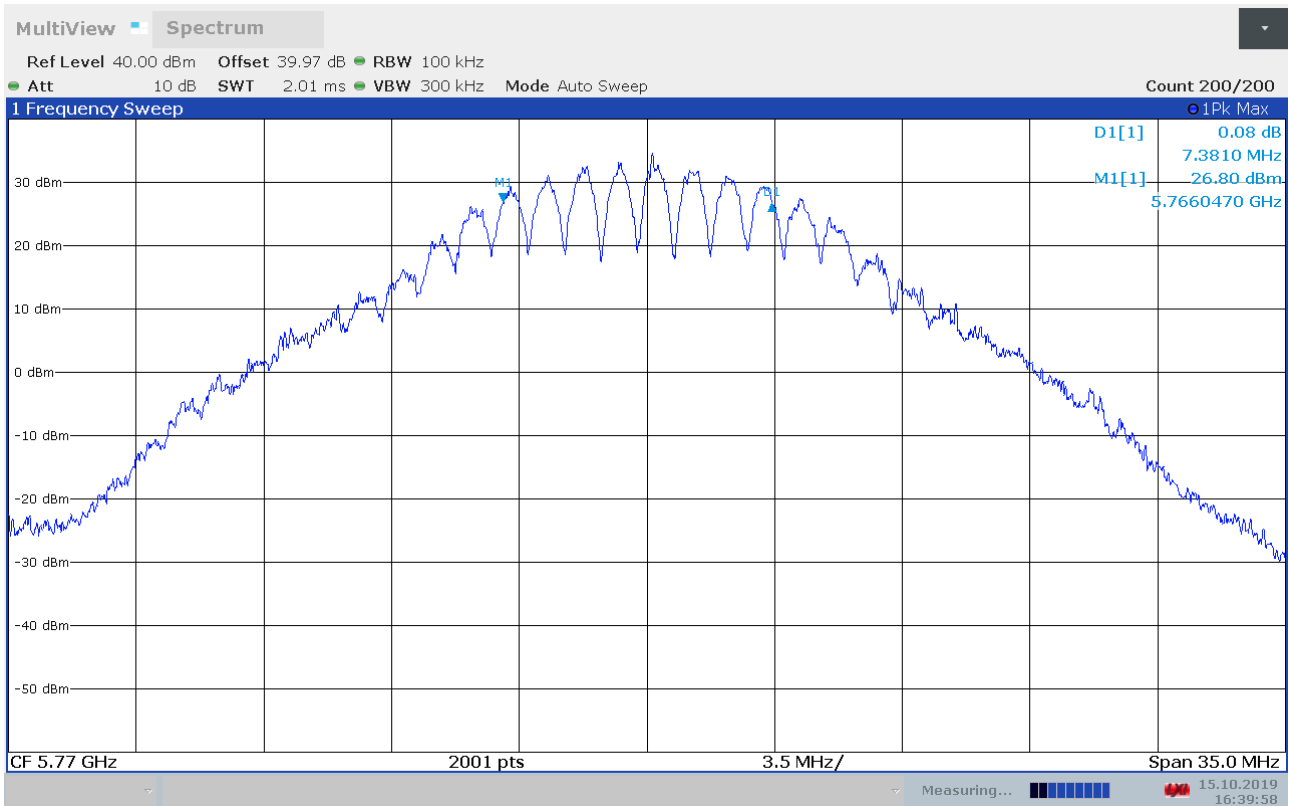
Ch. No.	Nominal Frequency (MHz)	DTS Bandwidth Measured Values (MHz)
1	5735	7.26
2	5770	7.38
4	5840	7.29

Limit:

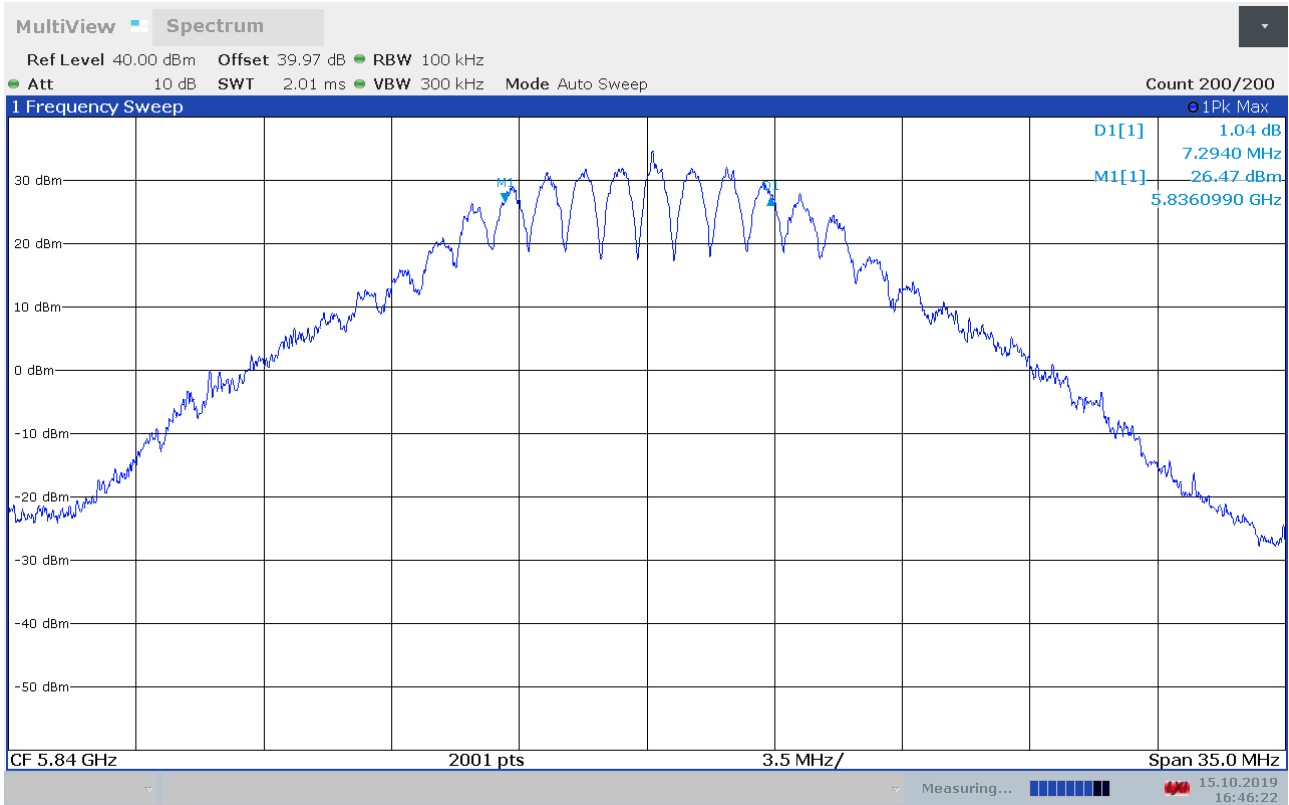
Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.



DTS Bandwidth, 5735 MHz



DTS Bandwidth, 5770 MHz



DTS Bandwidth, 5840 MHz

2.5 Peak Power Spectral Density

FCC 15.407(a)

ISED RSS-247, Issue 2, Clause 6.2

Measurement procedure: ANSI C63.10-2013 Clause 12.5

Test Results: Complies

Measurement Data:

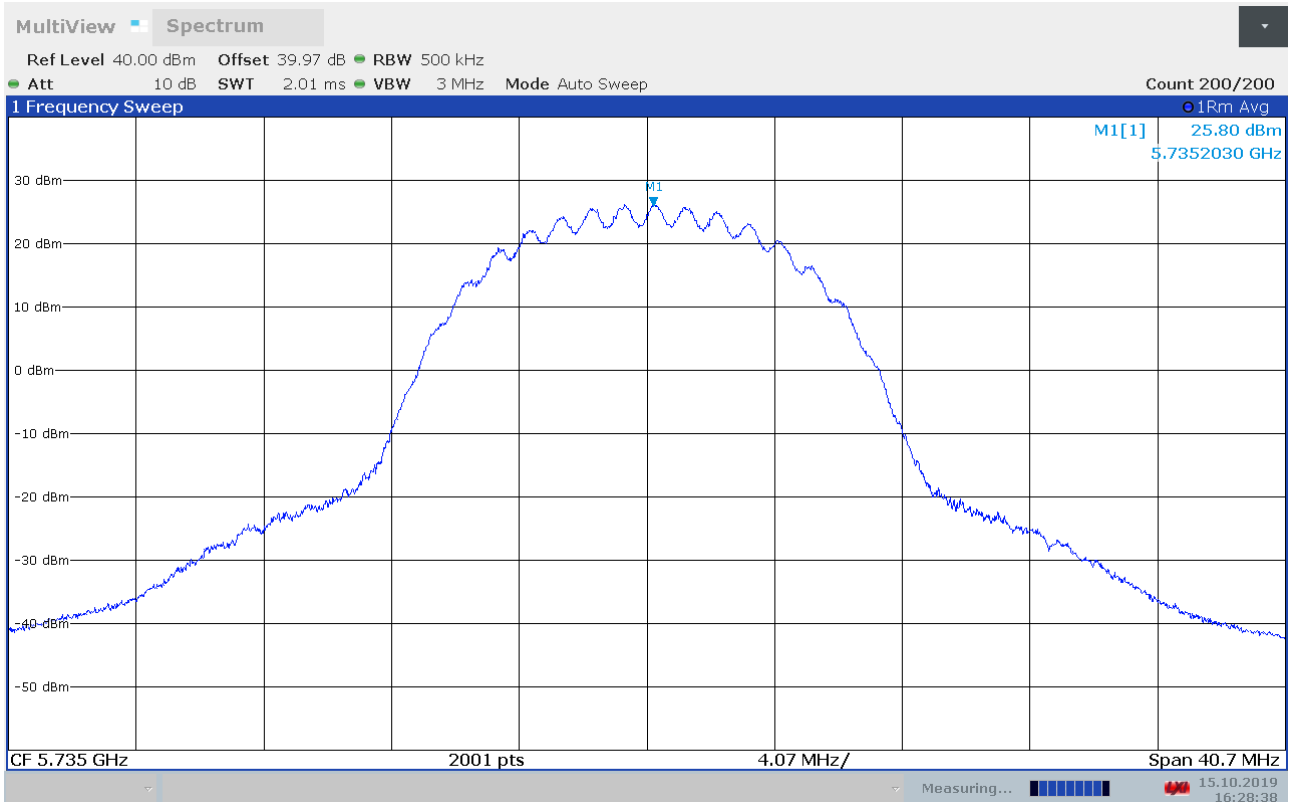
Ch. No.	Nominal Frequency (MHz)	Measured Value (dBm/500kHz)
1	5735	25.80
2	5770	26.04
4	5840	26.00

The EUT operates continuously; therefore, method SA-1 of ANSI C63.10-2013 clause 12.3 was used.

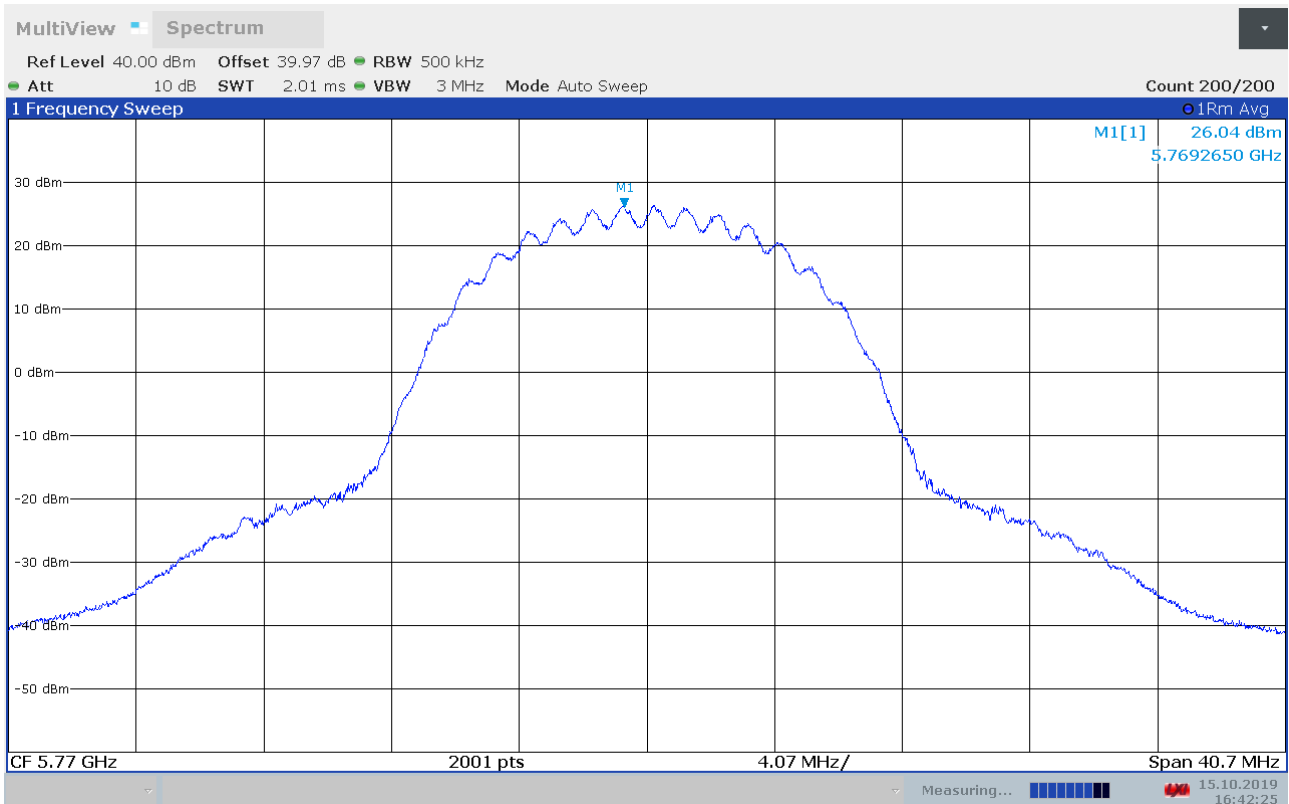
Antenna Gain is less than 6 dBi for all frequencies above.

Limits:

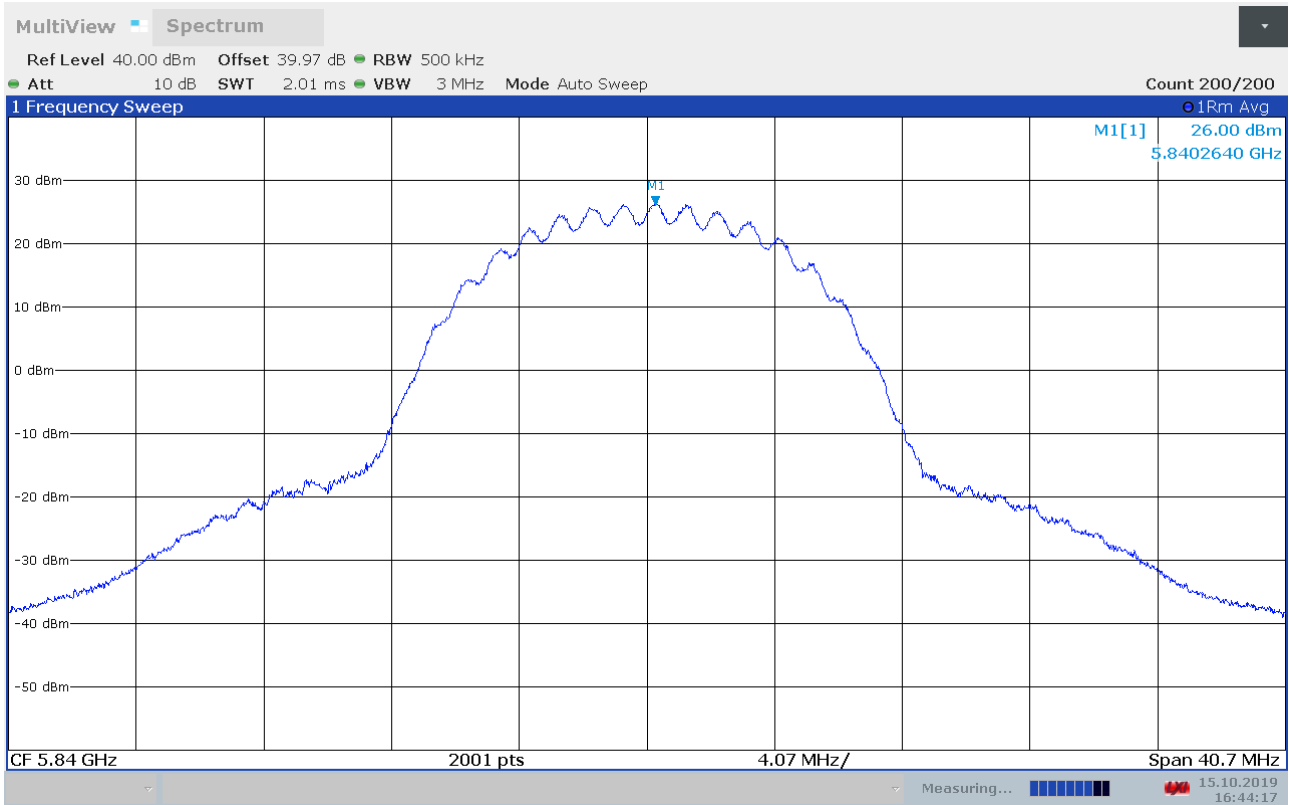
Frequency Band	FCC 15.407(a)	RSS-247, Issue 2
5150 – 5250 MHz	Less than 17 dBm/MHz for master device Less than 11 dBm/MHz for client device	Less than 10 dBm/MHz e.i.r.p. (only indoor allowed)
5250 – 5350 MHz	Less than 11 dBm/MHz	Less than 11 dBm/MHz
5470 – 5725 MHz	Less than 11 dBm/MHz	Less than 11 dBm/MHz
5725 – 5825 MHz	Less than 30 dBm/500kHz	Less than 30 dBm/500kHz
	If Antenna Gain is more than 6 dBi the limit above is reduced by the amount exceeding 6 dBi	



Power Spectral Density, 5735 MHz, Method 2



Power Spectral Density, 5770 MHz, Method 2



Power Spectral Density, 5840 MHz, Method 2

2.6 Unwanted Emissions

FCC 15.407 (b)

ISED RSS-247, Issue 2, clause 6.2

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Radiated Band Edge Emissions:

Ch. No.	Carrier Frequency (MHz)	Band Edge Frequency (MHz)	Measured Values (dBm/MHz, e.i.r.p.)	
			Lower	Upper
1	5735	5651	-27.6	-
4	5840	5933	-	-30.8

The measurement was performed conducted with 100% duty cycle.

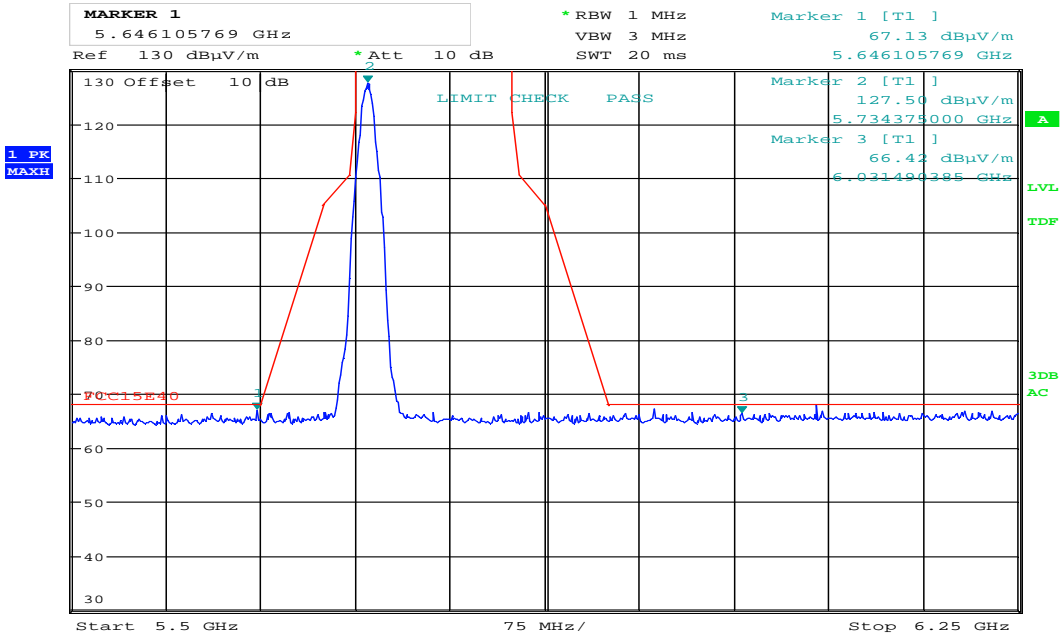
EIRP values were calculated from field strength using the method described in KDB 412172 D01.

Measurement was performed with Peak Detector.

Limits:

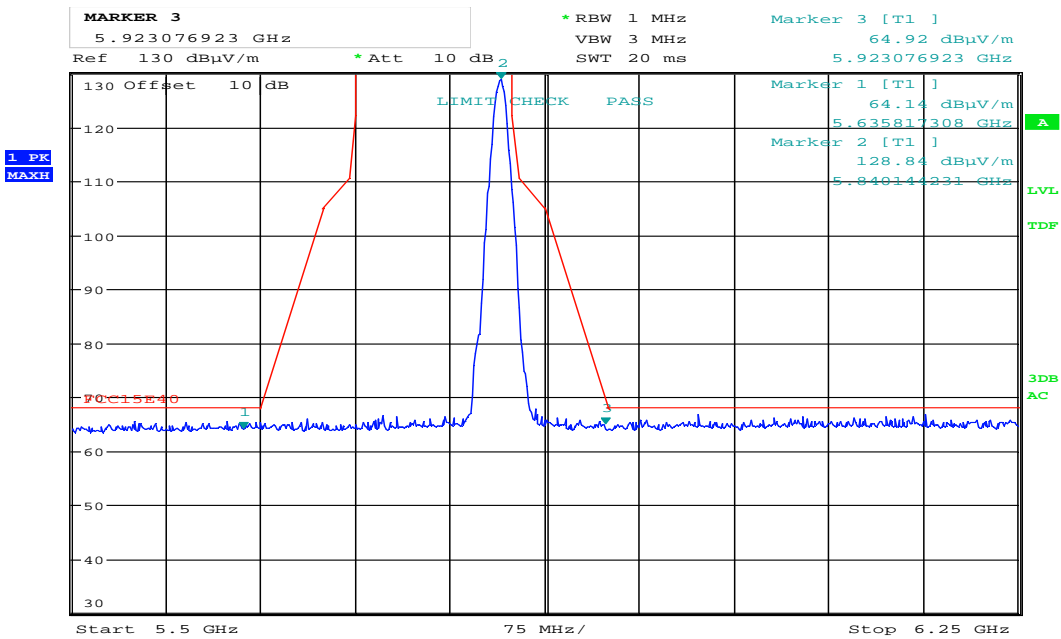
Operating Frequency band	Limit for Emissions Outside Operating Frequency Band
5150 – 5250 MHz	-27 dBm/MHz e.i.r.p.
5250 – 5350 MHz	-27 dBm/MHz e.i.r.p.
5470 – 5725 MHz	-27 dBm/MHz e.i.r.p.
5725 – 5825 MHz	See FCC 15.407(b)(4)(i) or 15.407(b)(4)(ii)

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.



Date: 26.NOV.2019 13:24:32

Unwanted Emissions, lower Band Edge, 5735 MHz, Ch1, Radiated, PK



Date: 26.NOV.2019 13:53:29

Unwanted Emissions, upper Band Edge, 5840 MHz, Ch4, radiated, PK

2.7 Restricted Bands of operation

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

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

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

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

2.8 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 15.209, 15.407

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Detector: Peak

Measuring distance 3 m

Tested in test mode with EUT transmitting on ch1

Measured Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Azimuth (deg)	Pol
37.53	39.73	40	0.27	102	337	V
45.78	39.53	40	0.47	103	44	V
50.42	36.08	40	3.92	118	54	V
88 – 216	/	43.5	/	/	/	/
216 – 960	/	46.0	/	/	/	/
960 – 1000	/	54.0	/	/	/	/

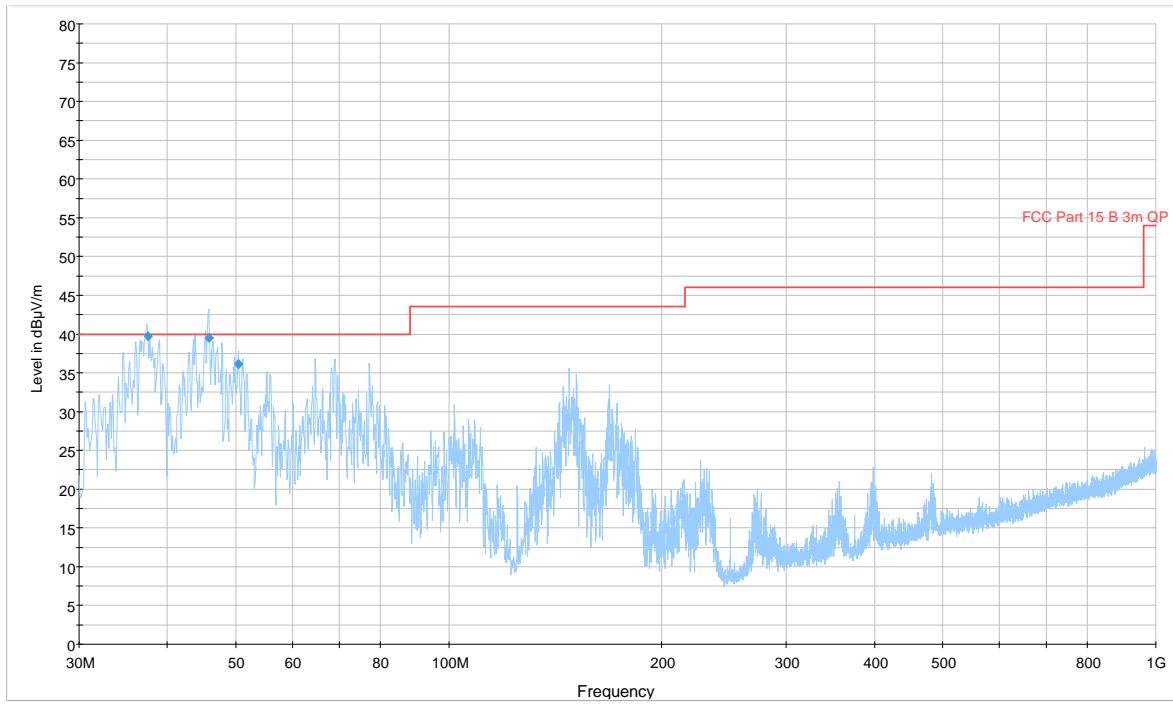
This is a Class A device and all emissions are from Ethernet port.

Margin to Class A limit is 9.5 dB better than shown in table.

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	
Radiated emission limit @3 meters		
Frequency (MHz)	Quasi Peak (μ V/m)	Quasi Peak (dB μ V/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
960 – 1000	500	54.0



Radiated Emissions, 30 - 1000 MHz

2.9 Radiated Emissions, 1 – 40 GHz

FCC 15.205, 15.209, 15.407

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 GHz - 18 GHz)

A prescan at 1m was performed from 18 – 40 GHz

Radiated, Peak Detector, RBW=1 MHz

Carrier freq. (MHz)	Frequency range (GHz)	PoI	Measured Frequency (GHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5735	1 – 5.5	VP/HP	5.63	65.02	68.23	3.21
	5.8 – 6.5	VP/HP	6.00	61.70	68.23	6.53
	6.5 - 18	VP/HP	17.64	52.67	68.23	15.56
	18 - 26	VP/HP	/	/	68.23	/
	26 - 40	VP/HP	/	/	68.23	/
5805	1 – 5.75	VP/HP	5.57	65.77	68.23	2.46
	5.85 – 6.5	VP/HP	6.33	66.62	68.23	1.61
	6.5 - 18	VP/HP	17.70	52.41	68.23	15.82
	18 - 26	VP/HP	/	/	68.23	/
	26 - 40	VP/HP	/	/	68.23	/
5840	1 – 5.75	VP/HP	5.63	65.72	68.23	2.51
	5.9 – 6.5	VP/HP	6.11	67.59	68.23	0.64
	6.5 - 18	VP/HP	17.74	53.16	68.23	15.07
	18 - 26	VP/HP	/	/	68.23	/
	26 - 40	VP/HP	/	/	68.23	/

Detected harmonic emissions are outside restricted bands. Measured with 100% duty cycle.

Non detected with pre-scan.

A High Pass Filter was used for measurements from 6.5 to 18 GHz.

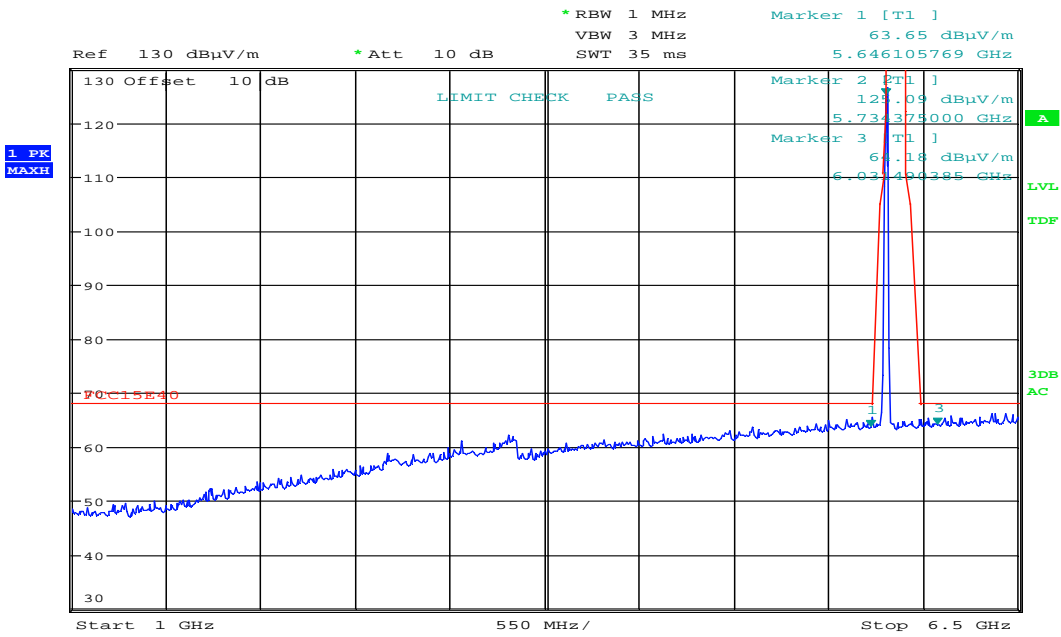
Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

See attached plots.

Requirements/Limit

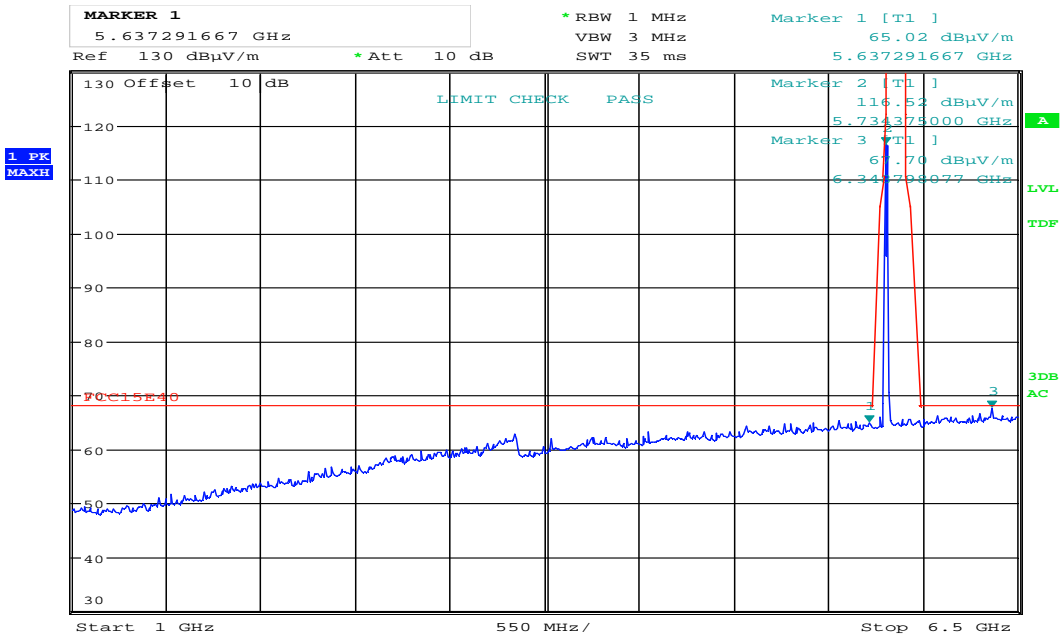
FCC	Part 15.209 and 407 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector (dBµV/m)	Peak Detector (dBµV/m)
1 – 40 GHz	54.0	68.23

Operating Frequency band	Limit for Emissions Outside Operating Frequency Band
5725 – 5825 MHz	See FCC 15.407(b)(4)(i) or 15.407(b)(4)(ii)



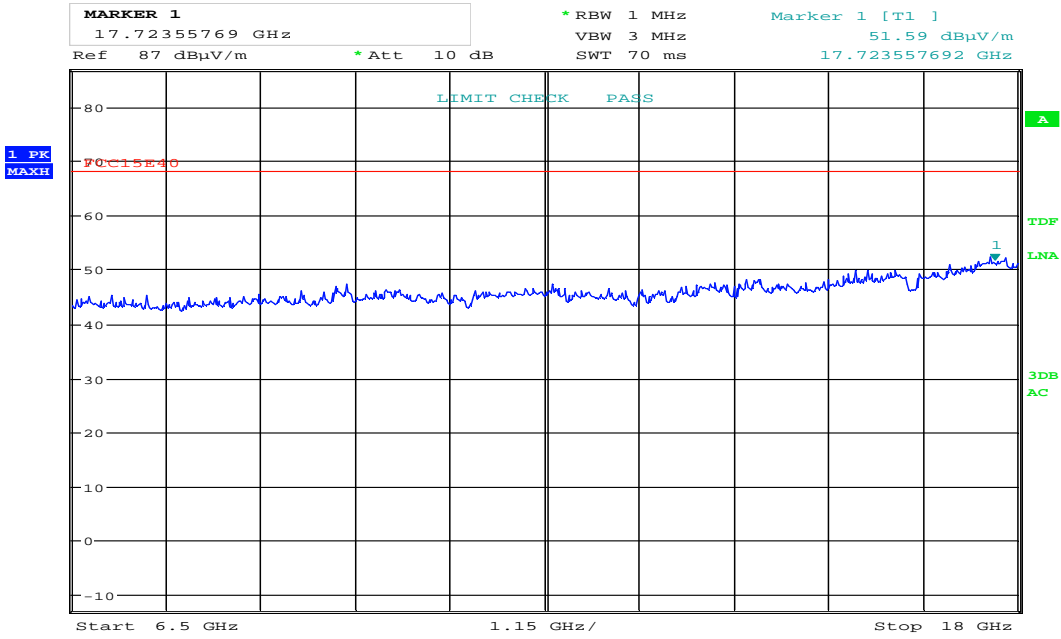
Date: 26.NOV.2019 13:25:16

Radiated Emissions, 1000 - 6500 MHz, 5735 MHz, VP, PK



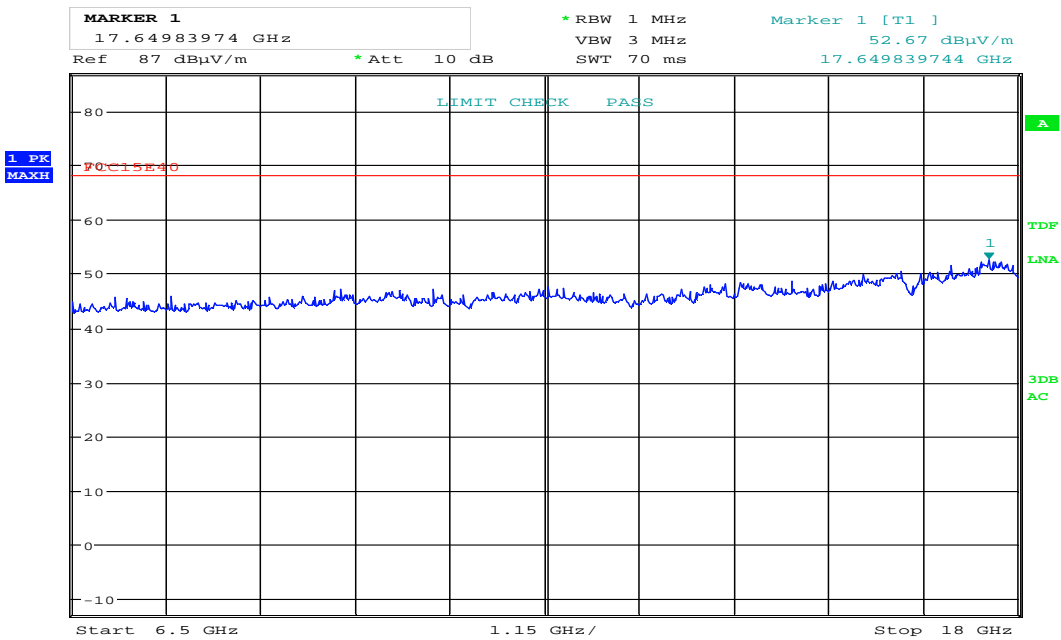
Date: 26.NOV.2019 13:26:41

Radiated Emissions, 1000 - 6500 MHz, 5735 MHz, HP, PK



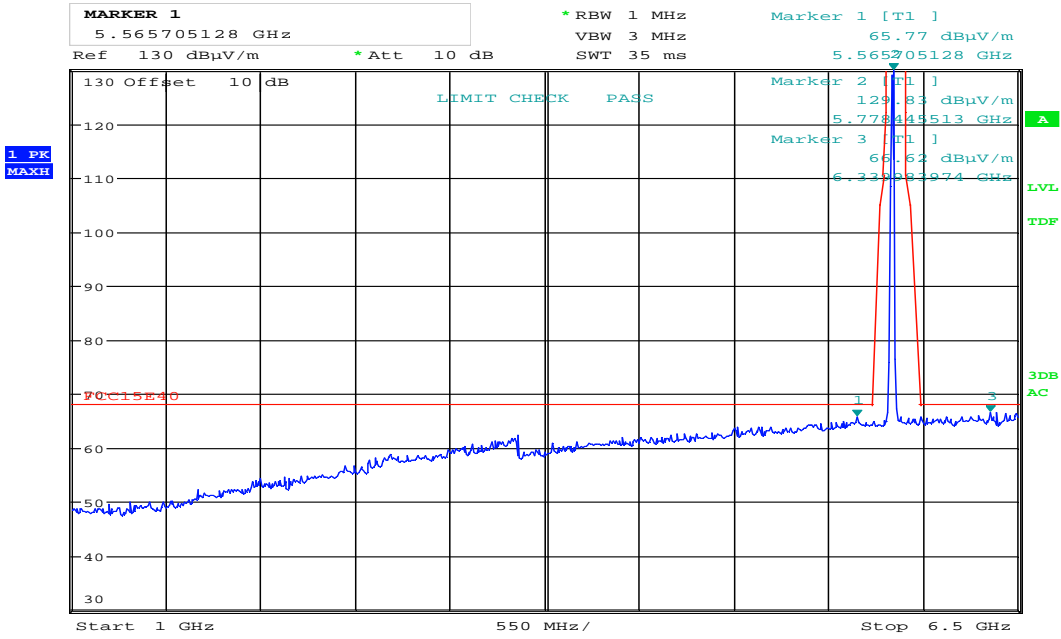
Date: 26.NOV.2019 14:13:15

Radiated Emissions, 6500 - 18000 MHz, 5735 MHz, VP, PK



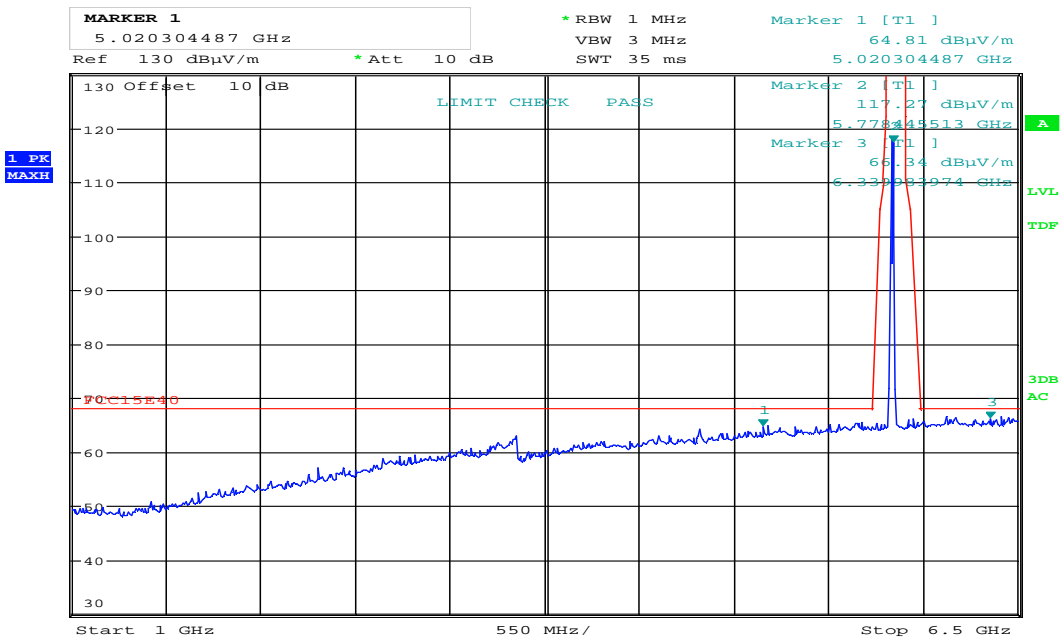
Date: 26.NOV.2019 14:12:46

Radiated Emissions, 6500 - 18000 MHz, 5735 MHz, HP, PK



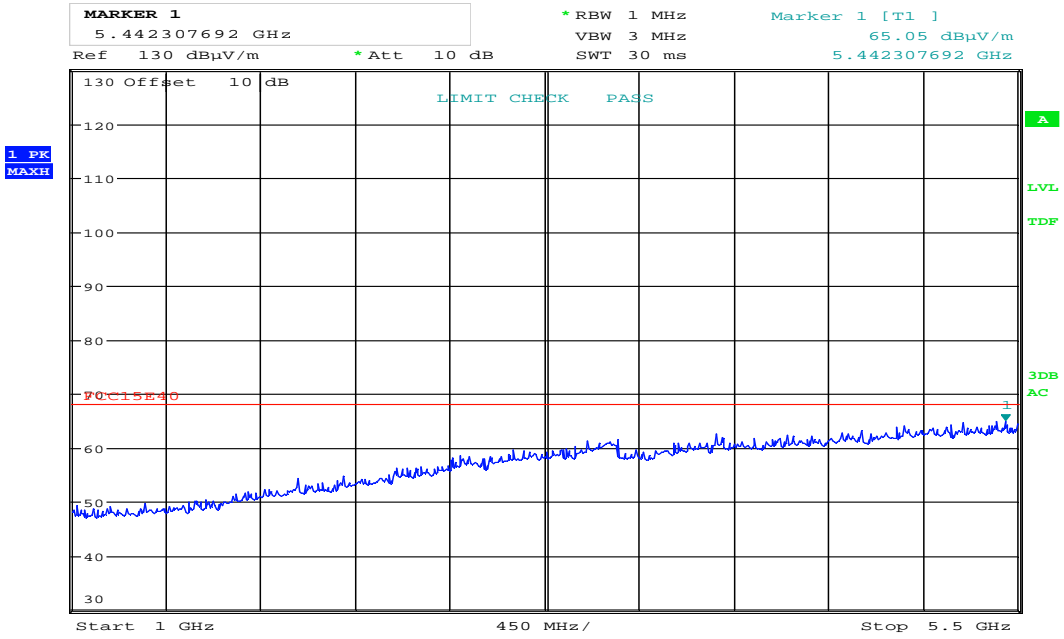
Date: 26.NOV.2019 13:47:30

Radiated Emissions, 1000 - 6500 MHz, 5770 MHz, VP, PK



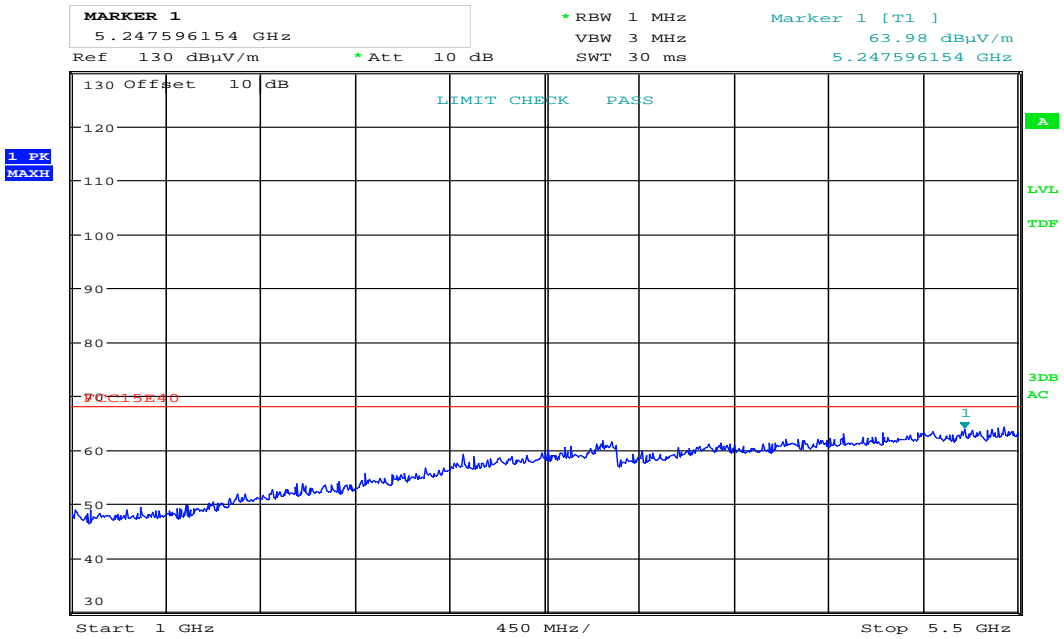
Date: 26.NOV.2019 13:45:36

Radiated Emissions, 1000 - 6500 MHz, 5770 MHz, HP, PK



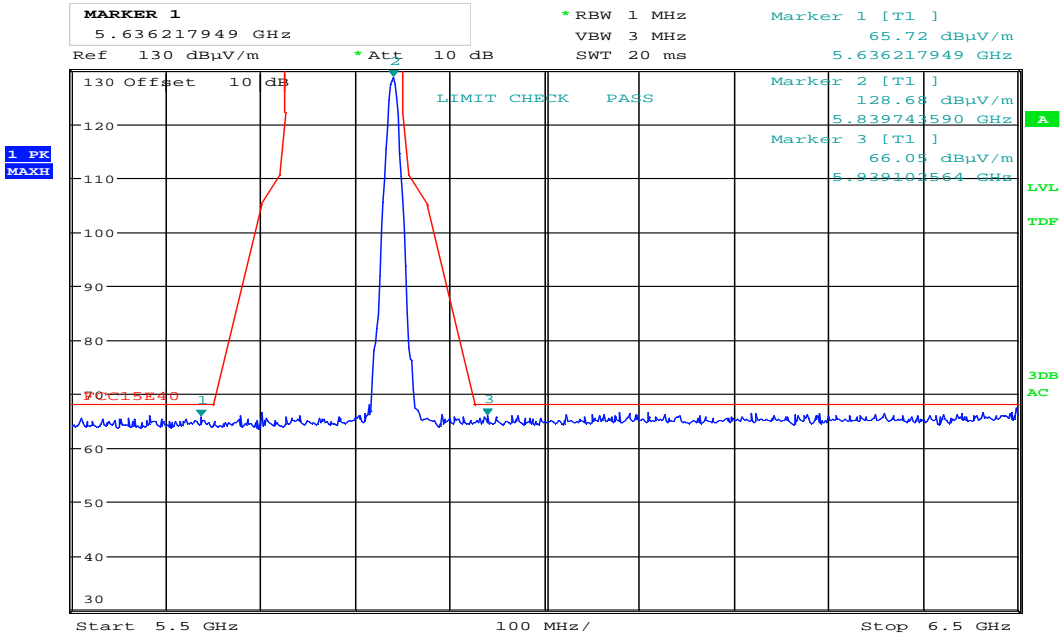
Date: 26.NOV.2019 13:56:08

Radiated Emissions, 1000 - 5500 MHz, 5840 MHz, VP, PK



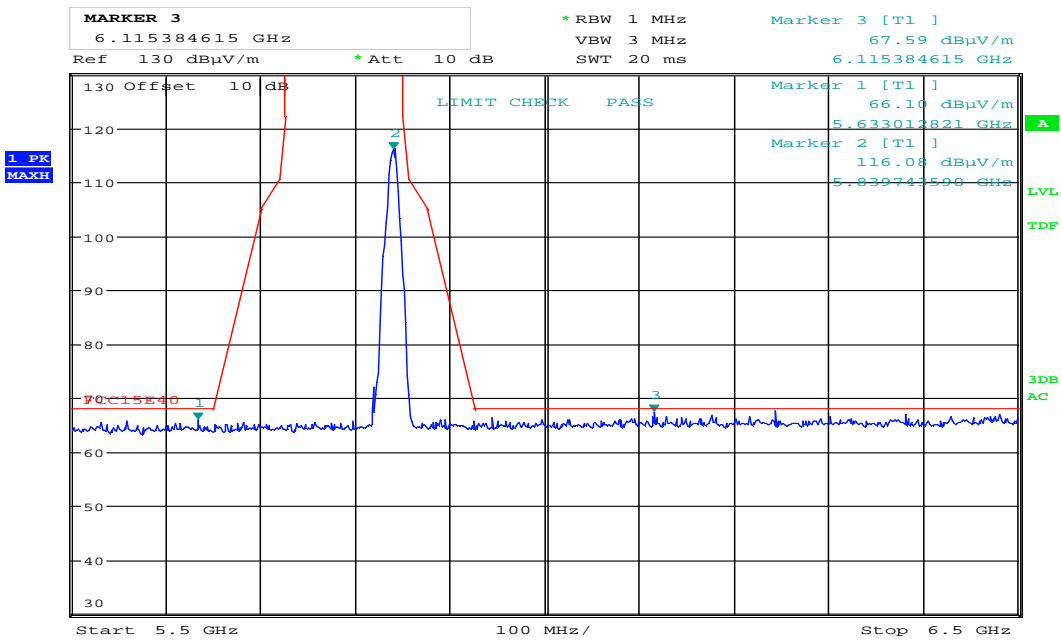
Date: 26.NOV.2019 13:56:42

Radiated Emissions, 1000 - 5550 MHz, 5840 MHz, HP, PK



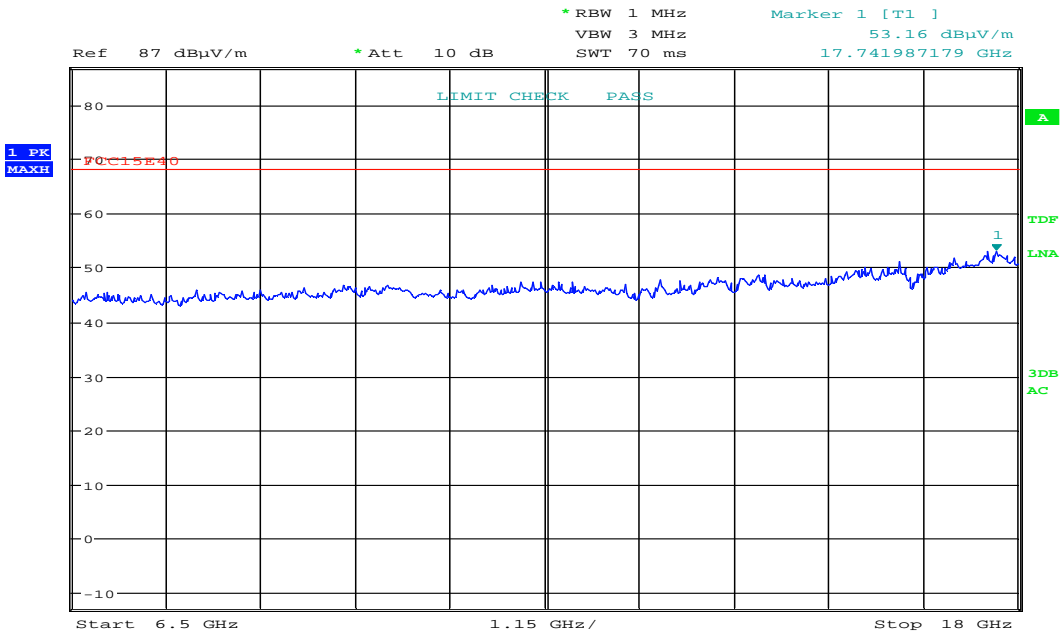
Date: 26.NOV.2019 13:55:30

Radiated Emissions, 5500 - 6500 MHz, 5840 MHz, VP, PK



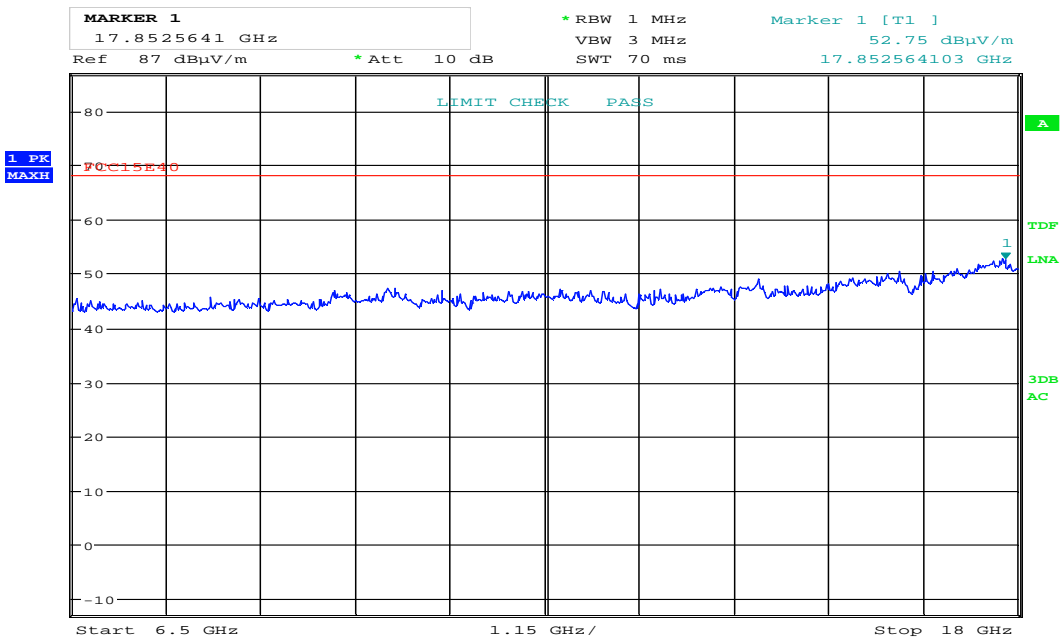
Date: 26.NOV.2019 13:58:00

Radiated Emissions, 5500 - 6500 MHz, 5840 MHz, HP, PK



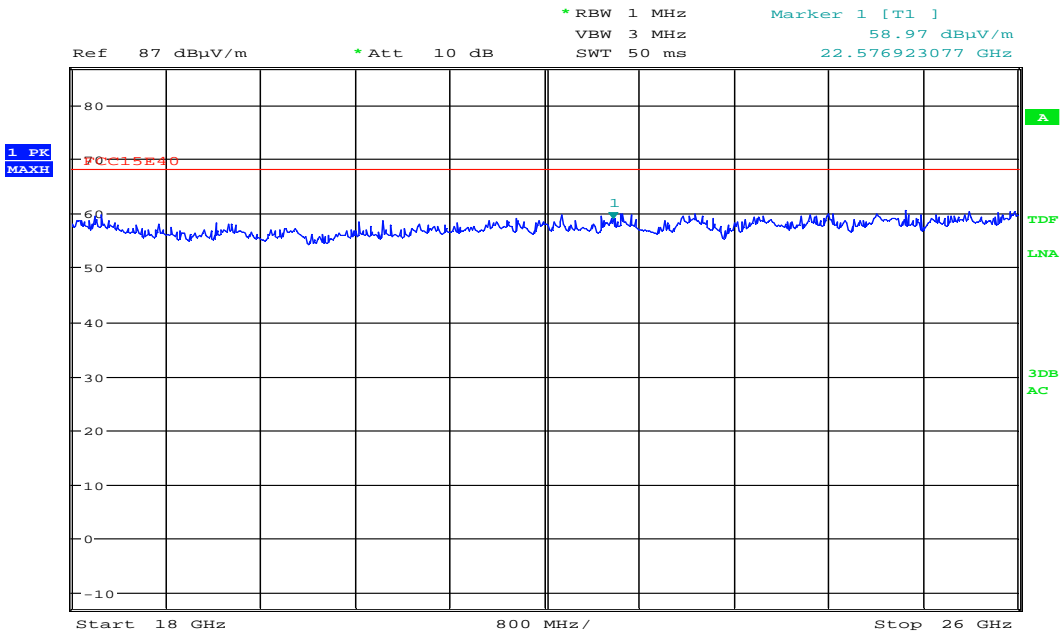
Date: 26.NOV.2019 14:10:31

Radiated Emissions, 6500 - 18000 MHz, 5840 MHz, VP, PK



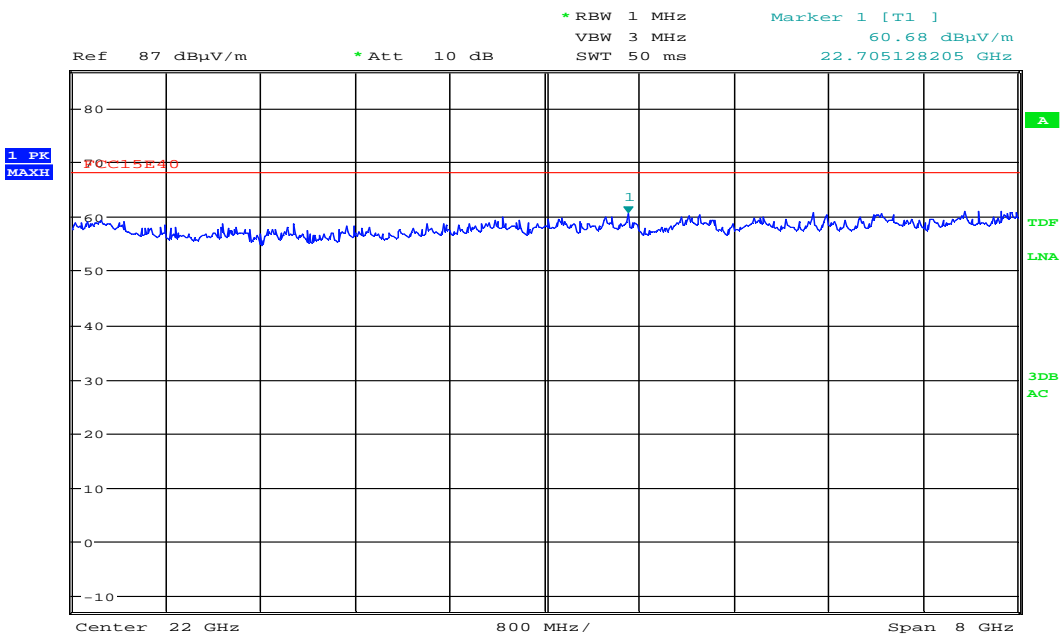
Date: 26.NOV.2019 14:11:18

Radiated Emissions, 6500 - 18000 MHz, 5840 MHz, HP, PK



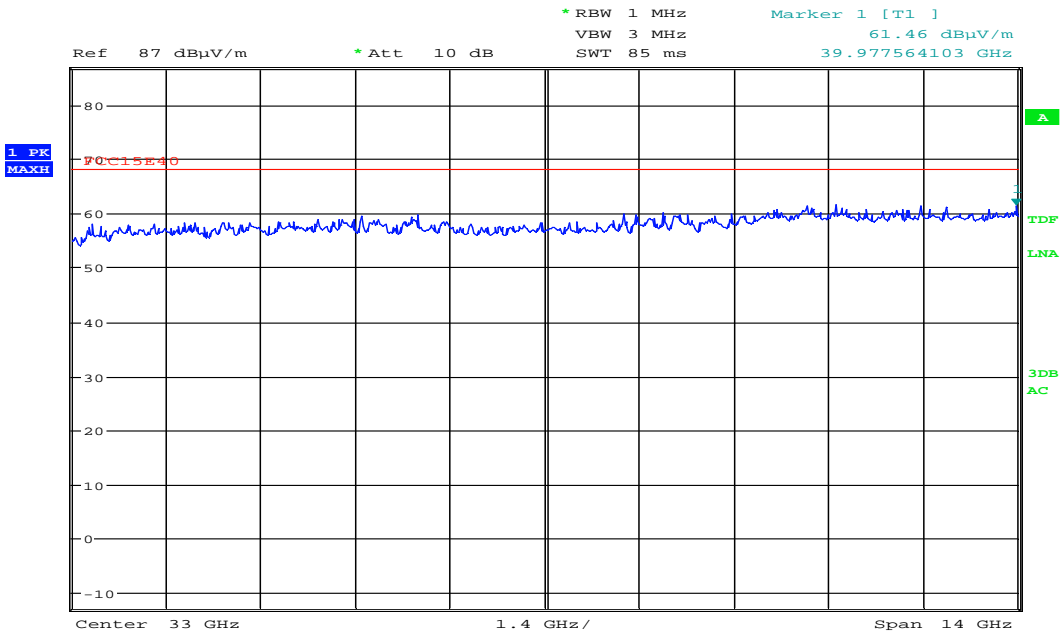
Date: 26.NOV.2019 15:44:03

PK, Prescan, 18 – 26 GHz, VP @ 1m distance



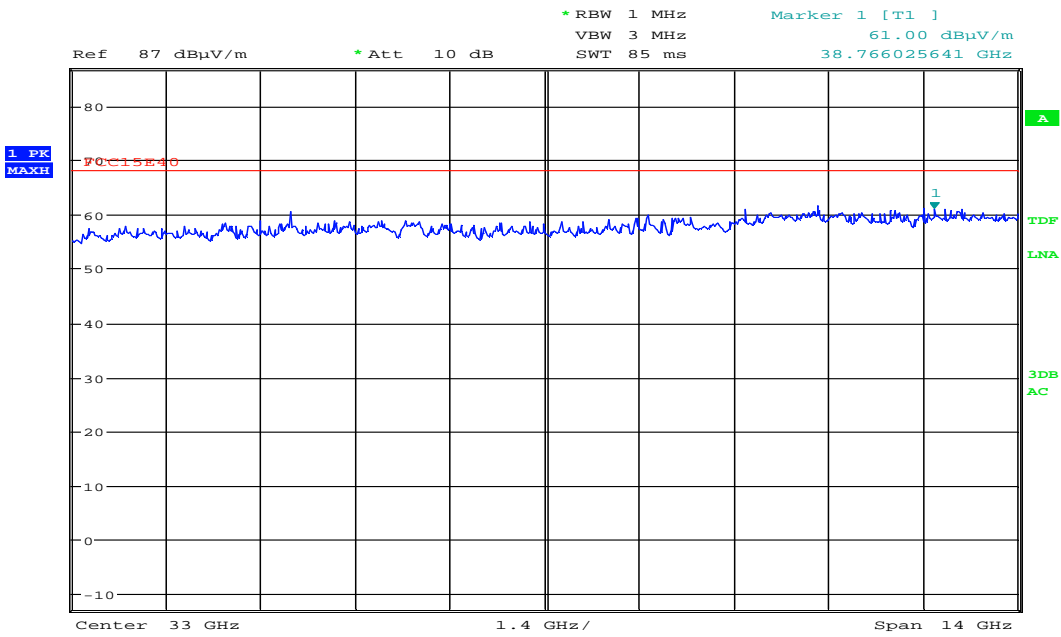
Date: 26.NOV.2019 15:44:21

PK, Prescan, 18 – 26 GHz, HP @ 1m distance



Date: 26.NOV.2019 16:24:42

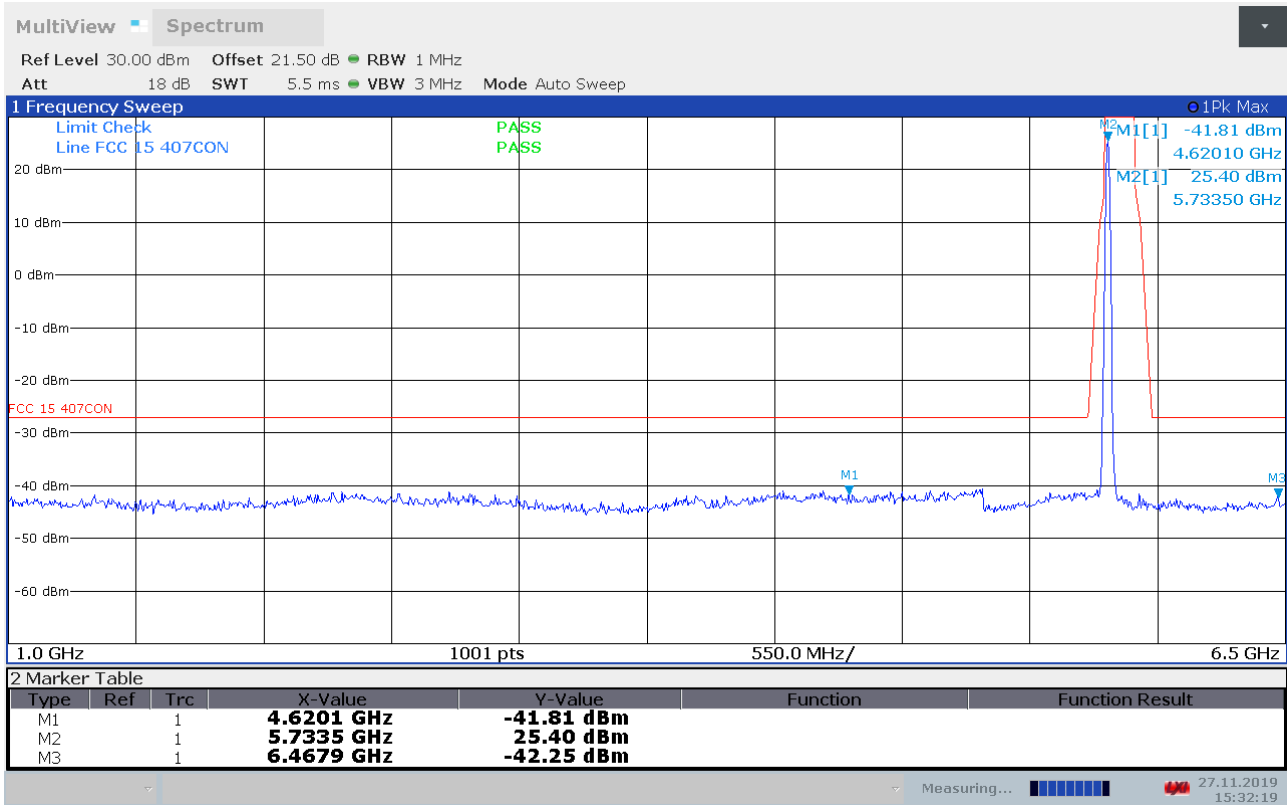
PK, Prescan, 26 – 40 GHz, VP @ 1m distance



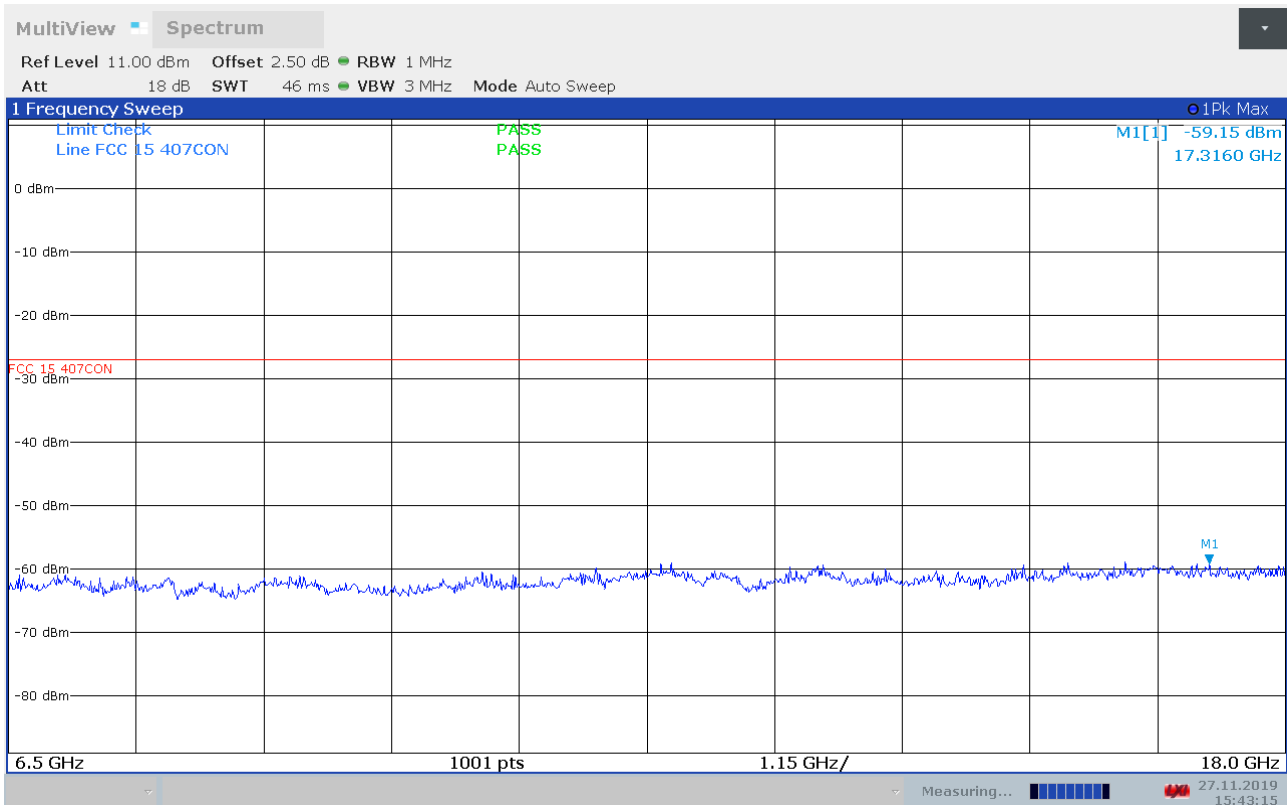
Date: 26.NOV.2019 16:24:56

PK, Prescan, 26 – 40 GHz, HP @ 1m distance

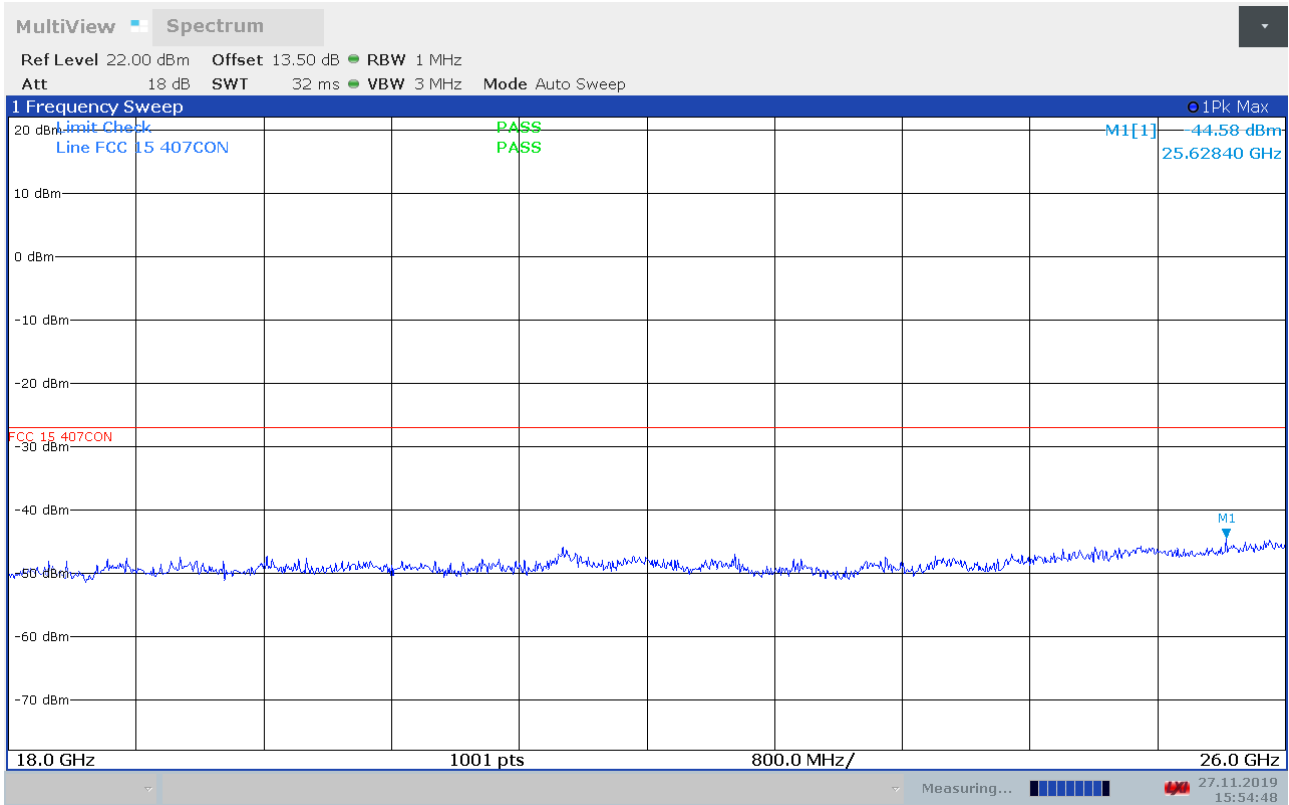
Conducted emissions:



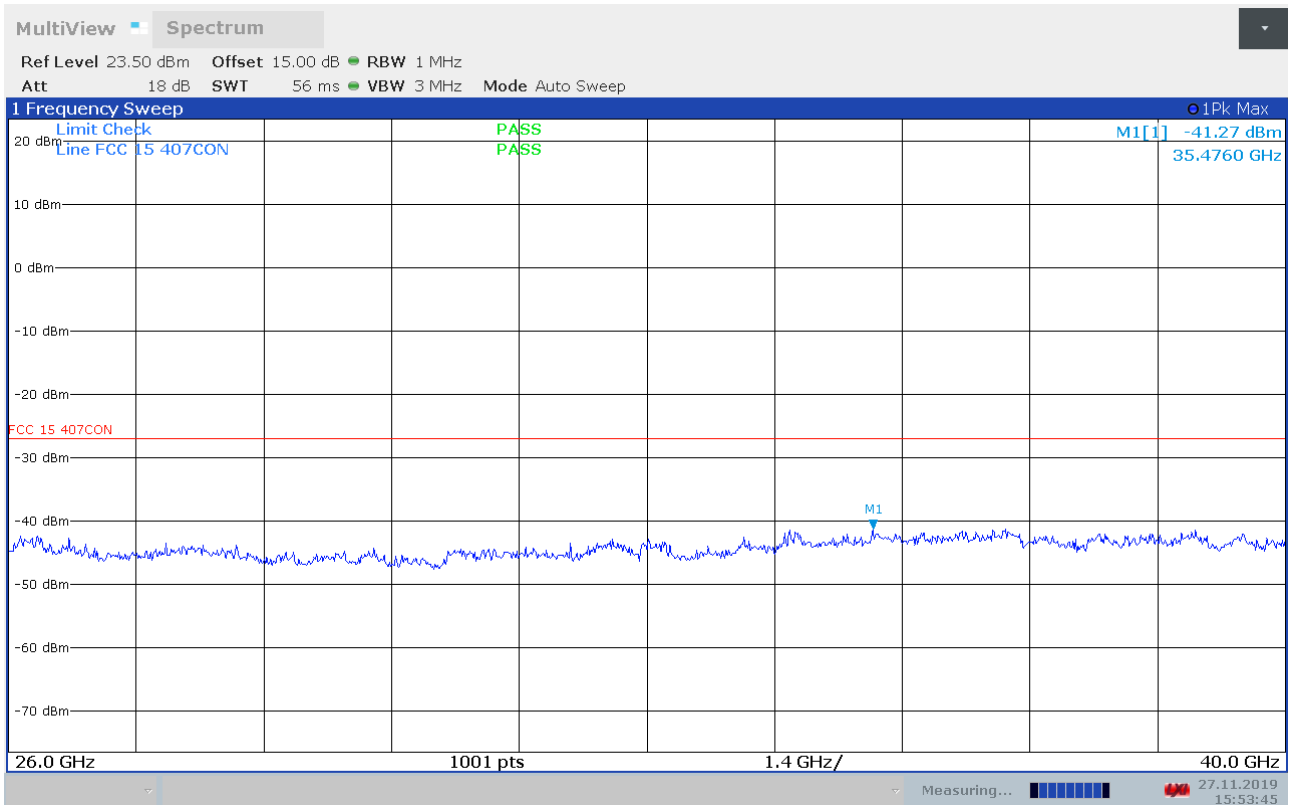
Conducted emissions 1 - 6.5 GHz, ch5735MHz



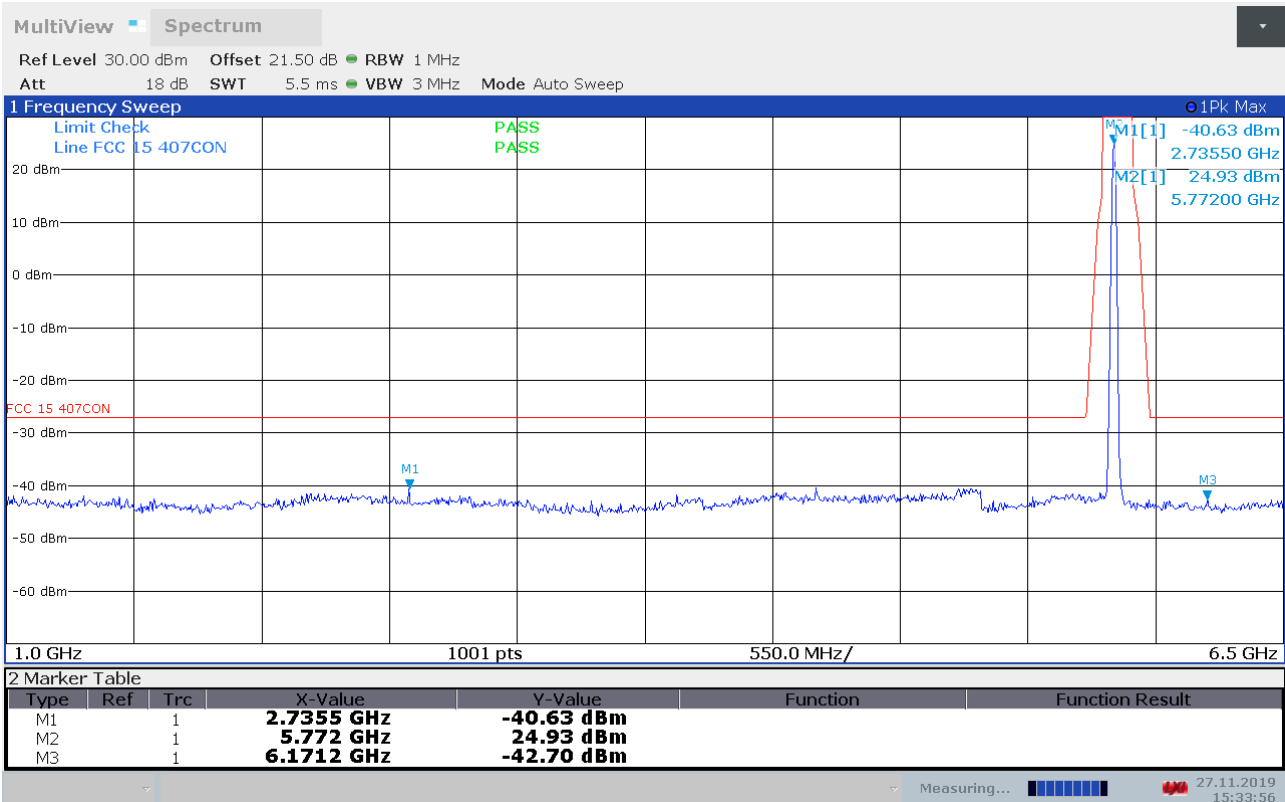
Conducted emissions 6.5 - 18GHz, ch5735MHz



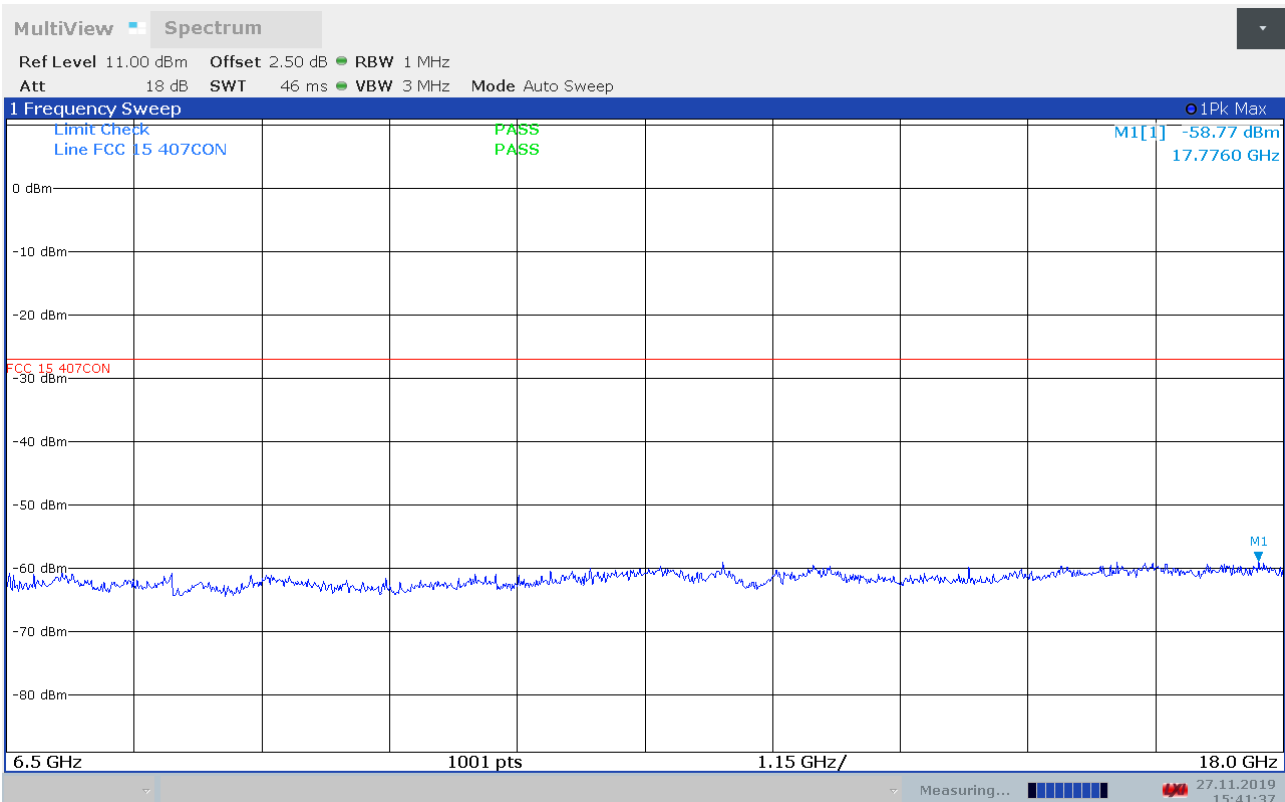
Conducted emissions 18 - 26 GHz, ch5735MHz



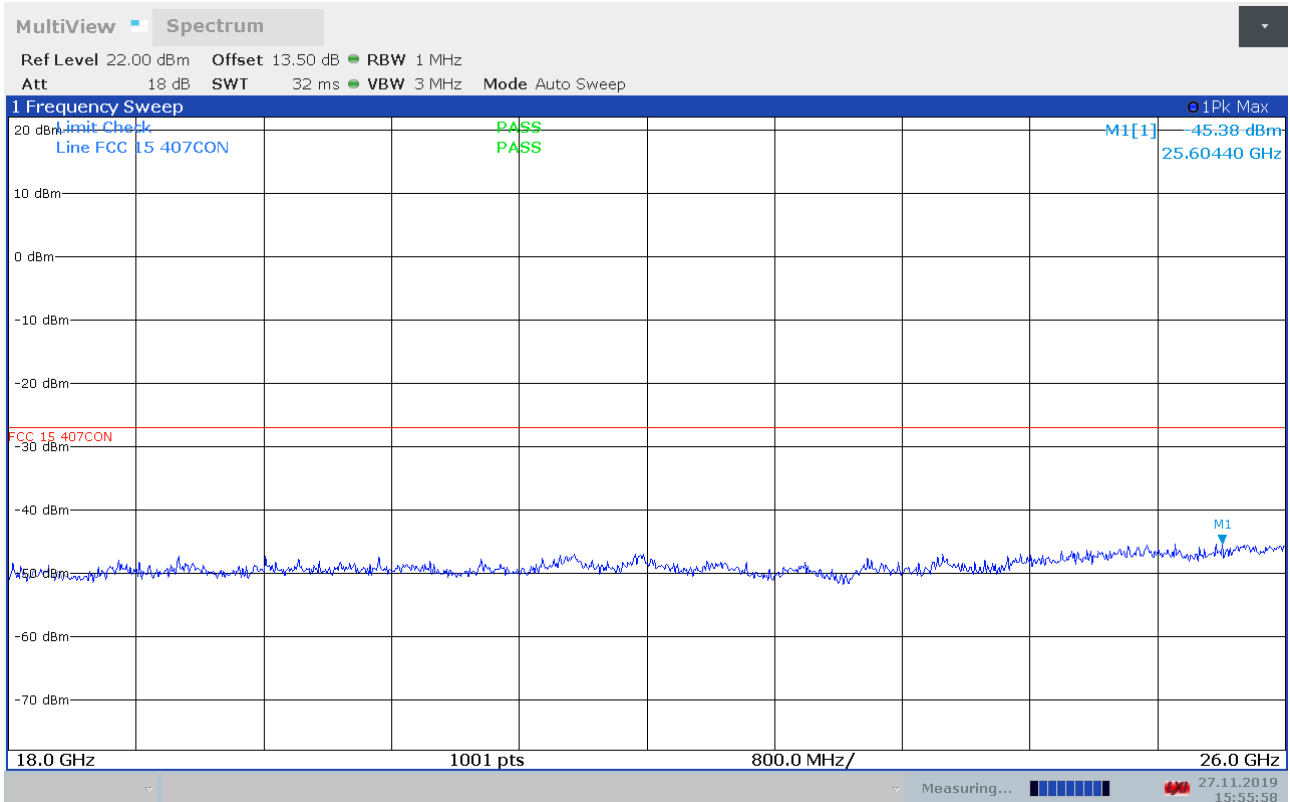
Conducted emissions 26 - 40 GHz, ch5735MHz



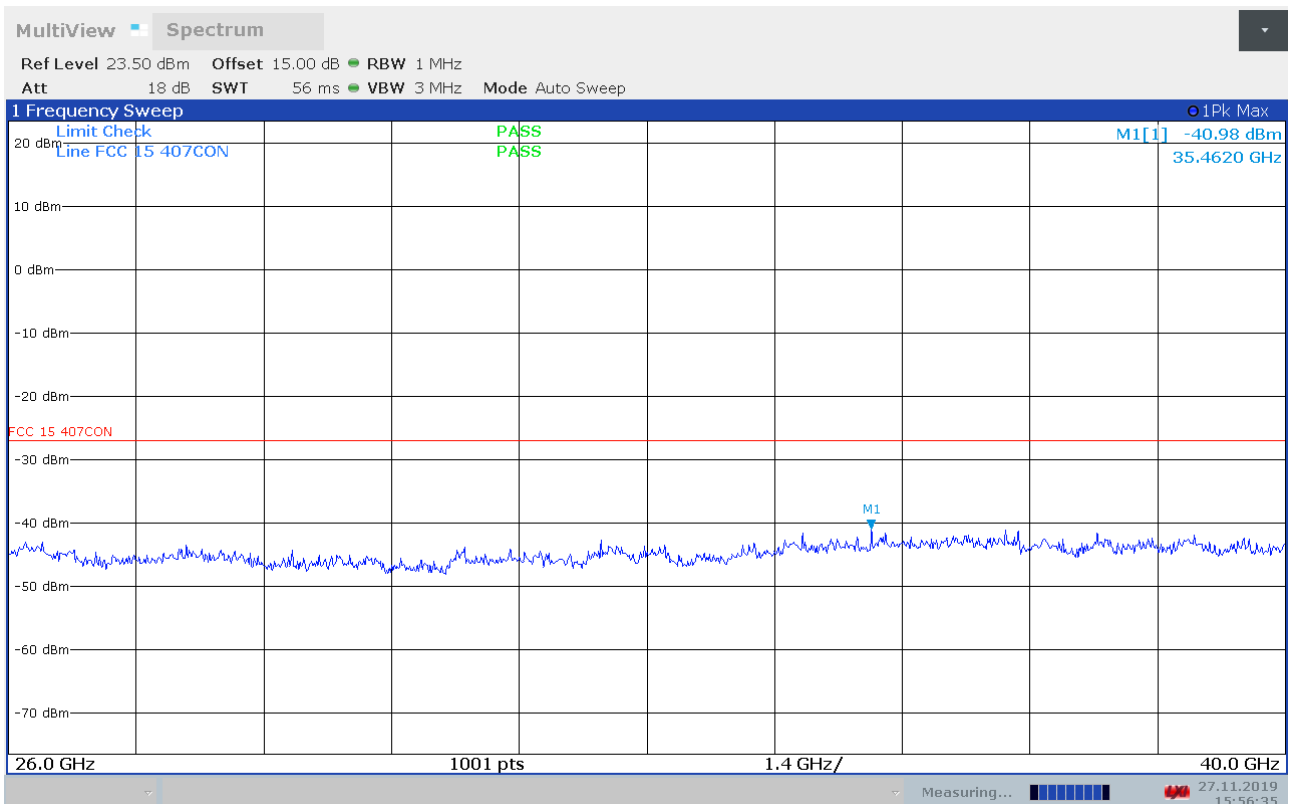
Conducted emissions 1 - 6.5 GHz, ch5770MHz



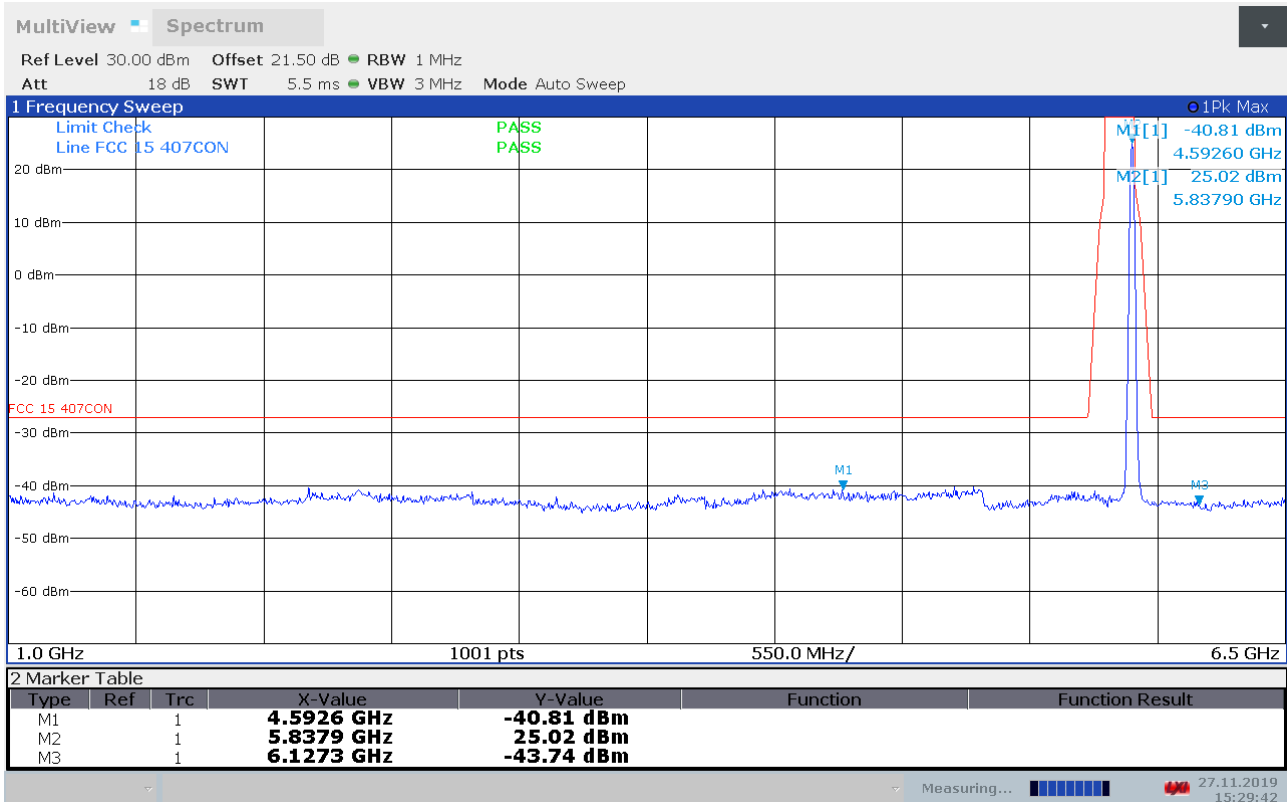
Conducted emissions 6.5 - 18 GHz, ch5770MHz



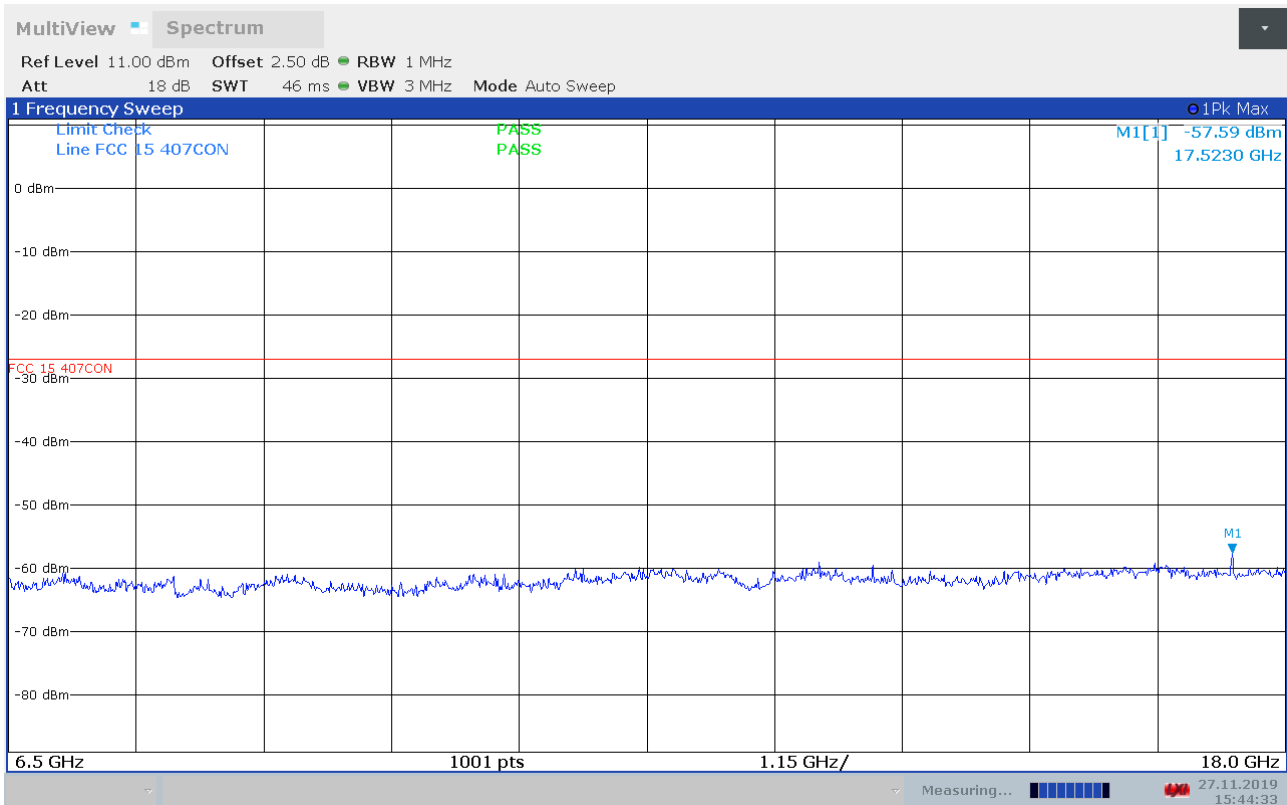
Conducted emissions 18 - 26 GHz, ch5770MHz



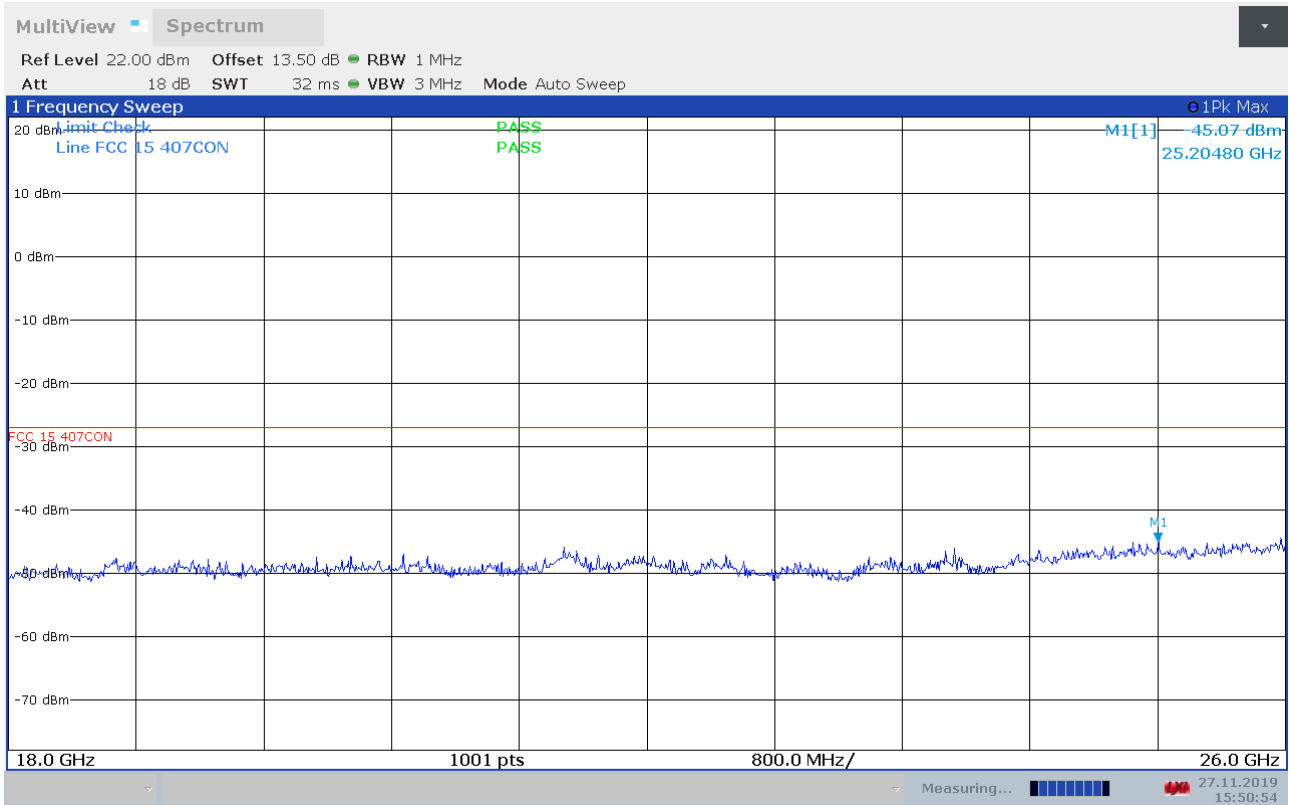
Conducted emissions 26 - 40 GHz, ch5770MHz



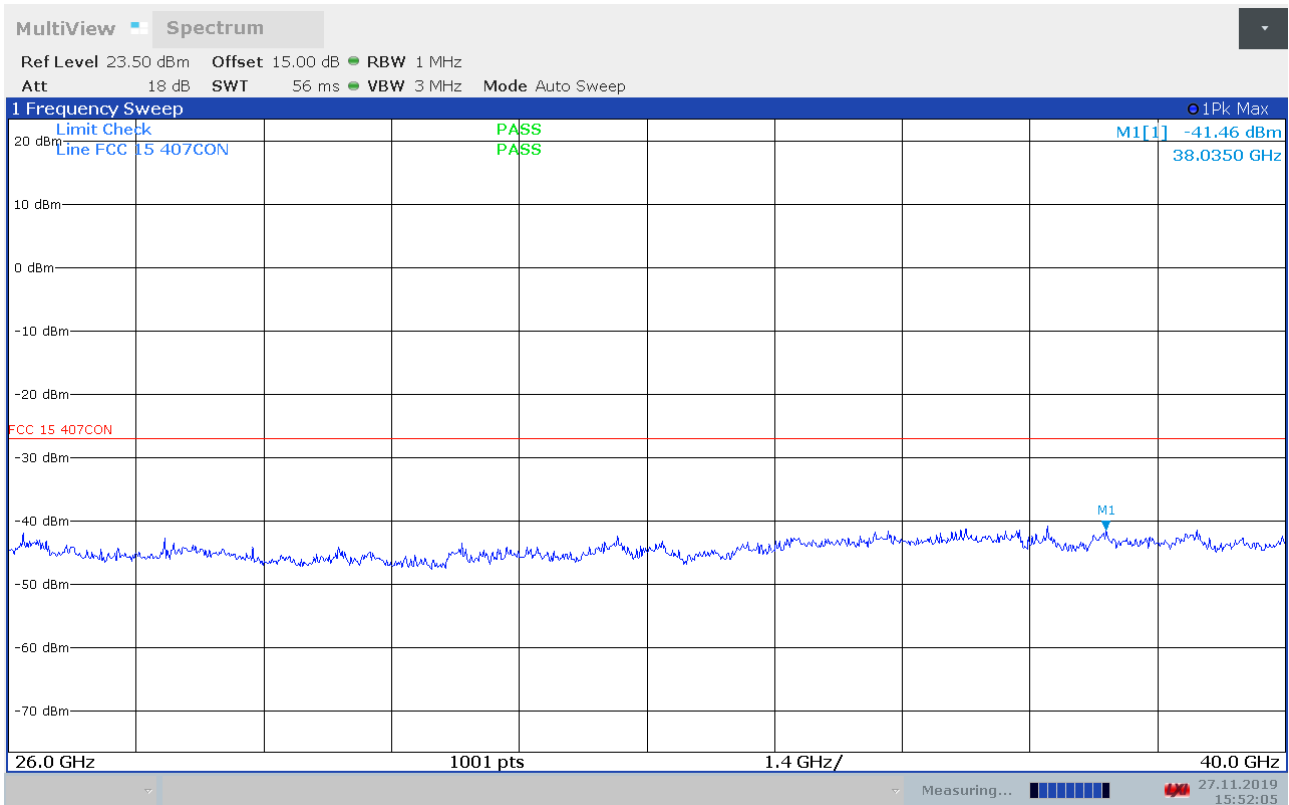
Conducted emissions 1 - 6.5 GHz, ch5840MHz



Conducted emissions 6.5 - 18GHz, ch5840MHz



Conducted emissions 18 - 26 GHz, ch5840MHz



Conducted emissions 26 - 40 GHz, ch5770MHz

3 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

4 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	WHKX6.5/18G	Highpass Filter	Wainwright Inst.	LR 1619	COU	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2016-05	2020-05
6	310	Preamplifier	Sonoma Inst.	LR 1686	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	2019.12
9	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-12	2019-12
10	Model 638	Antenna Horn	Narda	LR 1480	N/A	
11	Model 87 V	Multimeter	Fluke	LR 1599	2019-02	2021-02
12	6032A	DC power supply	HP	LR 1062	COU	
14	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2017-11	2019-11
15	ESC13	Measuring Receiver	Rohde & Schwarz	N-4259	2019-10	2021-10
16	Model V637	Horn Antenna	Narda	LR 099	N/A	
17	JS4-20004000	Preamplifier	Miteq	LR 1591	2019-07	2020-07
18	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
19	SF102/1000MM	RF Cable	Suhner	SN 50113/2	COU	
20	SF102/2000MM	RF Cable	Suhner	SN 500100/2	COU	

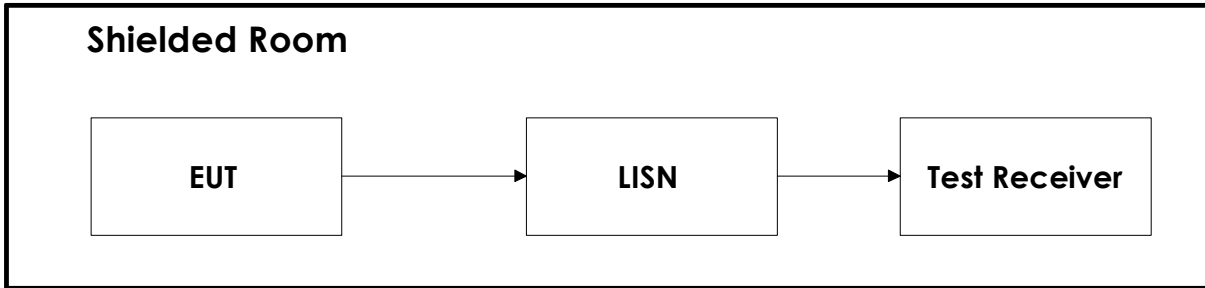
Note: COU – calibrate on use; N/A – Not Applicable

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

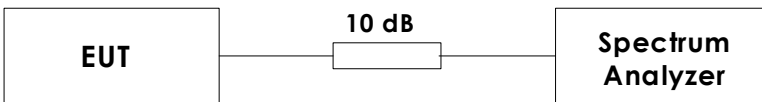
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.40.10	Power Line Conducted test software
2	Rohde & Schwarz	EMC32	10.40.10	Radiated Emission test software
3	Rohde & Schwarz	GPIBShot	2.7	Screenshots from R&S Spectrum Analyzers

5 BLOCK DIAGRAM

5.1 Power Line Conducted Emission

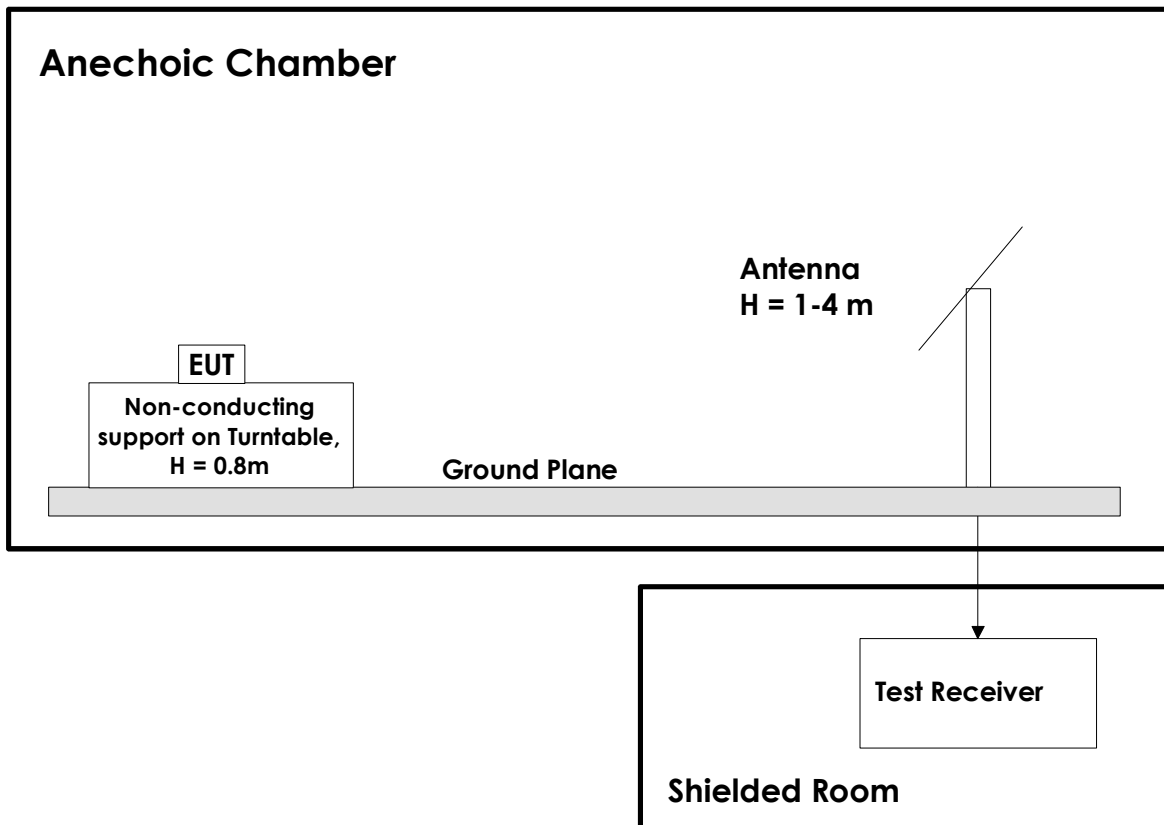


5.2 Conducted Tests



This test set-up is used for all Conducted tests. For the Frequency Stability test the EUT was placed in a climatic chamber.

5.3 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies.

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.