



Report No. 379011-01

FCC TEST REPORT / IC TEST REPORT

Product	Chip2Go	
Name and address of the applicant	race result AG Joseph-von-Fraunhofer-Str. 11 D - 76327 Pfinztal (Germany)	
Name and address of the manufacturer	race result AG Joseph-von-Fraunhofer-Str. 11 D - 76327 Pfinztal (Germany)	
Model	RR06	
Rating	100 – 240 VAC	
Trademark	race result	
Serial number	C2G-W0083	
Additional information	RFID 865 – 927 MHz	
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	
Report number	379011-01	
Tested in period	2019-10-23 - 2020-01-20	
Issue date	2020-01-22	
Name and address of the testing laboratory	Nemko GmbH & Co. KG Reetzstraße 58 D-76327 Pfinztal Tel.: + 49 (0) 7240 – 63 - 0 Fax: + 49 (0) 7240 – 63 - 11	 Bundesnetzagentur  BNetzA CAB-17/21-17 FCC No: 973501 IC OATS: 10921A
 Prepared by [F. Hupbauer]  Approved by [Dipl.-Ing. P. Lukas]		

Template version: B

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1 INFORMATION

1.1 Test Item

Name :	Chip2Go
FCC ID :	SZO-RR06
Industry Canada ID :	20465-RR06
Model/version :	Chip2Go RR06
Serial number:	C2G-W0083
Software version:	1.0.2 (firmware); 2.1.2_E (firmware UHF-module)
Frequency Range :	917.10 – 926.90 MHz (US band)
Number of Channels:	50
Operating Modes :	RFID
Type of Modulation :	Digital ASK
Output Power (radiated) :	5.94 mW
Type of Power Supply :	AC Adaptor: CUI SDI50-15-U (100 – 240V, 50 – 60Hz)
Antenna Connector :	None (internal antenna)
Number of Antennas	2
Antenna Diversity Supported :	No
Smart Antennas or MMO	No

Description of Test Item

Chip2Go is a programming device for passive transponders for sports timing. The RFID transponders are automatically transported and programmed from a roll. The device can be operated via a touch screen or a USB numeric keypad. At the front there is an additional antenna to check the programmed transponders. The antennas operate in the 865 - 927 MHz frequency range.
(US Band: 917.10 – 926.90 MHz)

1.2 Normal test conditions

Temperature: 19 - 22 °C
Relative humidity: 36 - 45 %
Normal test voltage: 120V / 60Hz

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frederic Hupbauer

1.4 Description of modification for Modification Filing

Not applicable.

1.5 Family List Rational

Not Applicable.

1.6 Antenna Requirement

Is the antenna detachable?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

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

1.8 Comments

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

The radiated measurements are tested on three axes.

All ports were populated during spurious emission measurements.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada 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 shielded room ($f < 1$ GHz) and a fully-anechoic shielded room ($f > 1$ GHz) at a measuring distance of 3m.

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

Test setup photo document: 379011-01TRFFCC Annex – Test set-up photos

☒ 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 4 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	8.3 (RSS-GEN)	Complies ¹
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Channel Separation	15.247(a)(1)	5.1 (4)	Complies
Time of Occupancy	15.247(a)(1)	5.1 (5)	Complies
Occupied Bandwidth	15.247(a)(1)	5.1 (7)	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	N/A ²
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	N/A ²
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) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ The tested equipment has integrated antennas only

² Not applicable for FHSS equipment

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Para. No.: 8.8

Test Performed By: Frederic Hupbauer

Date of Test: 2019-10-23

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

Test Results: Complies.

Measurement Data: See attached graph.

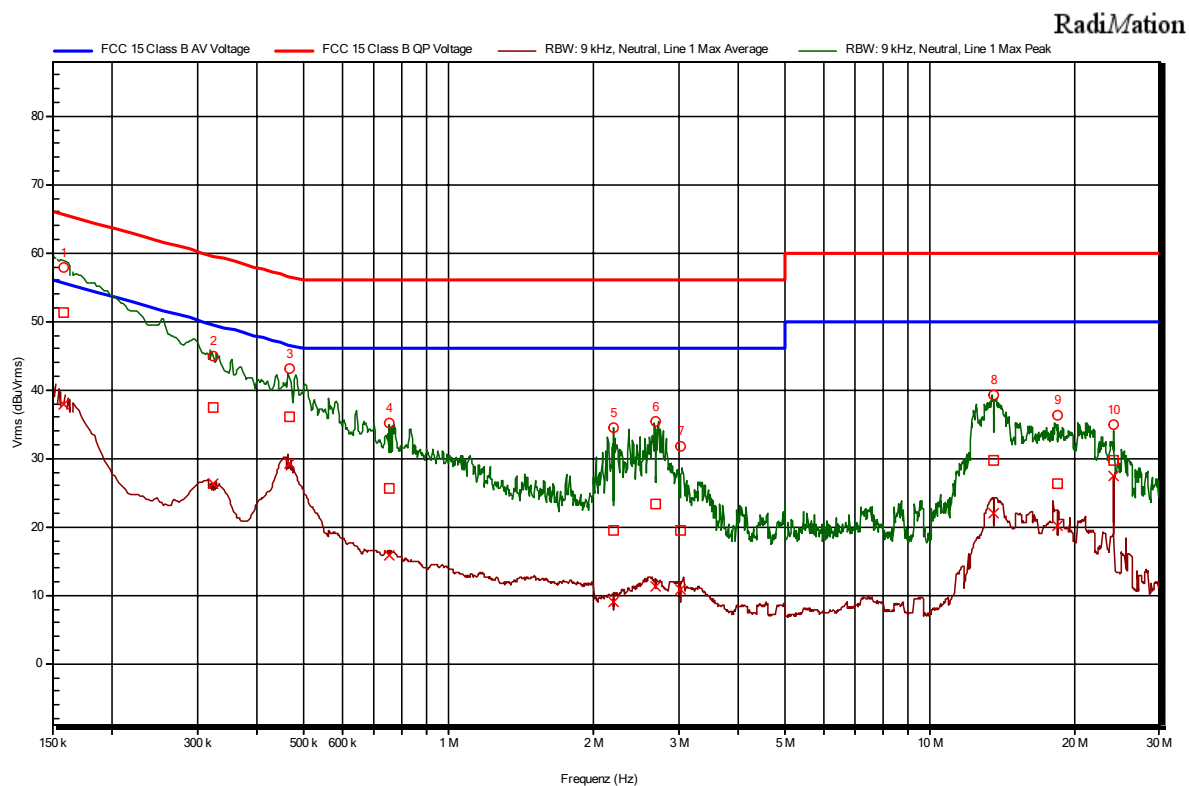
EUT supplied via AC adaptor

AC/DC adapter type: CUI SDI50-15-U

Input voltage to AC/DC adapter: 120V/60Hz

Highest measured value (L1 and N):

Diagram



Final measurements QP with Quasi-Peak-Detector

Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Quasi-Peak Difference	LISN
1	0.159000	51.41	65.52	14.11	Neutral
2	0.323250	37.48	59.62	22.15	Line 1
3	0.467250	36.03	56.56	20.53	Line 1
4	0.755250	25.70	56.00	30.30	Line 1
5	2.206500	19.49	56.00	36.51	Line 1
6	2.690250	23.44	56.00	32.56	Neutral
7	3.023250	19.38	56.00	36.62	Line 1
8	13.535250	29.65	60.00	30.35	Line 1
9	18.413250	26.40	60.00	33.60	Neutral
10	24.002250	29.71	60.00	30.29	Line 1

Final measurements AV with Average-Detector

Peak Number	Frequency	Average	Average Limit	Average Difference	LISN
1	0.159000	37.89	55.52	17.63	Neutral
2	0.323250	26.21	49.62	23.41	Line 1
3	0.467250	29.24	46.56	17.32	Line 1
4	0.755250	15.77	46.00	30.23	Line 1
5	2.206500	8.95	46.00	37.05	Line 1
6	2.690250	11.34	46.00	34.66	Neutral
7	3.023250	10.81	46.00	35.19	Line 1
8	13.535250	22.06	50.00	27.94	Line 1
9	18.413250	20.22	50.00	29.78	Neutral
10	24.002250	27.55	50.00	22.45	Line 1

3.2 Number of Operating Frequencies

Para. No.: 15.31(m)

Para. No.: 5.1 (6)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-12-03

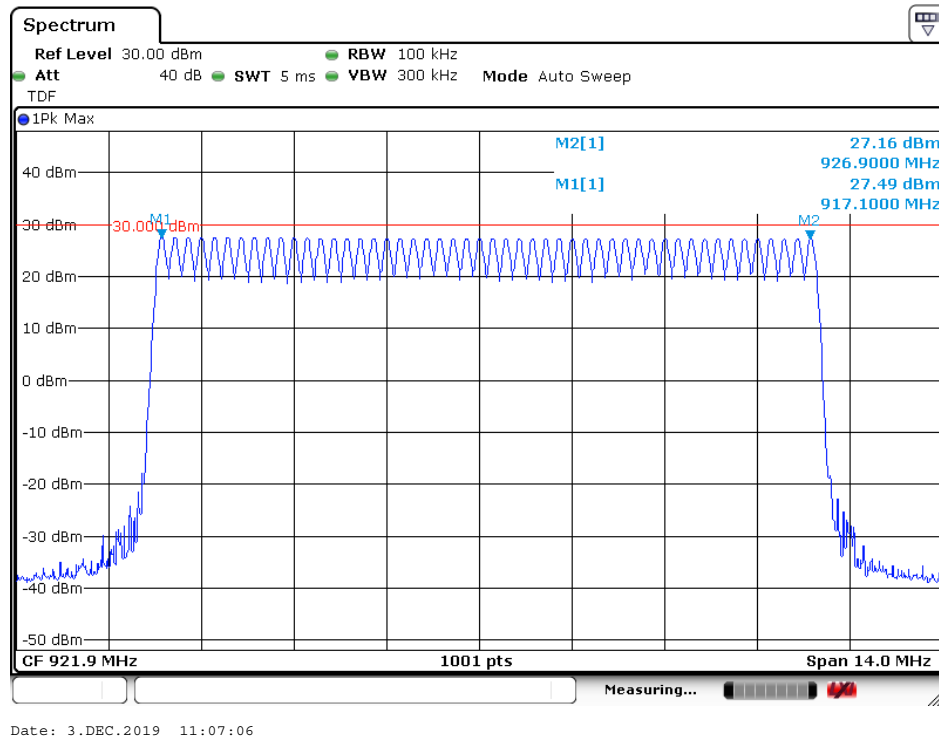
Test Results: Complies

Measurement Data:

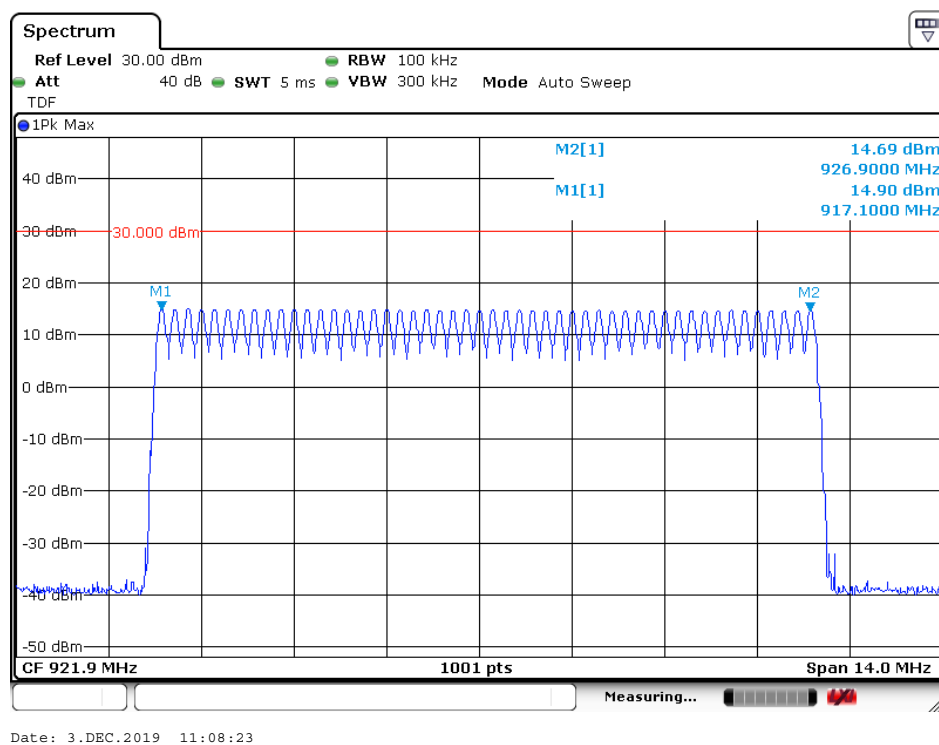
	Antenna 1	Antenna 2
Number of Operating Frequencies	50	50

Requirements:

Frequency hopping systems shall have at least 50 hopping frequencies if the 20dB BW of the hopping channel is less than 250 kHz.



Number of Operating Frequencies, Antenna 1



Number of Operating Frequencies, Antenna 2

3.3 Channel Separation

Para. No.: 15.247 (a)(1)

Para. No.: 5.1 (4)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-12-03

Test Results: Complies

Measurement Data:

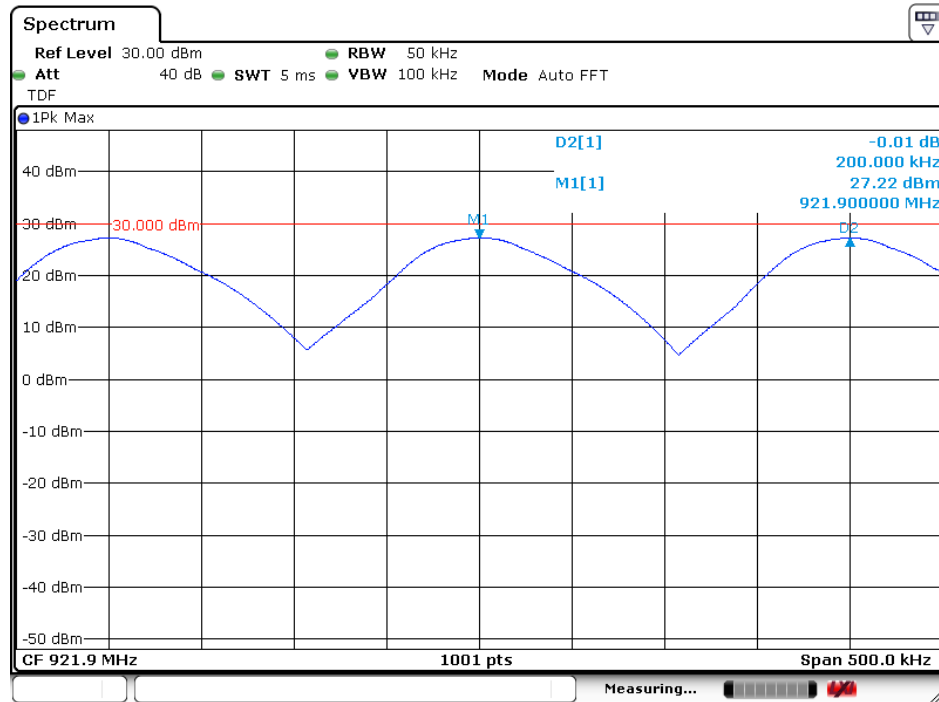
	Antenna 1	Antenna 2
Channel Separation:	200 kHz	200 kHz
Nominal value for Channel Separation:	200 kHz	200 kHz
20 dB BW of hopping channel 1 (917,1 MHz)	81.66 kHz	81.56 kHz
20 dB BW of hopping channel 25 (921,9 MHz)	81.76 kHz	81.46 kHz
20 dB BW of hopping channel 50 (926,9 MHz)	81.56 kHz	81.66 kHz

Requirements:

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.

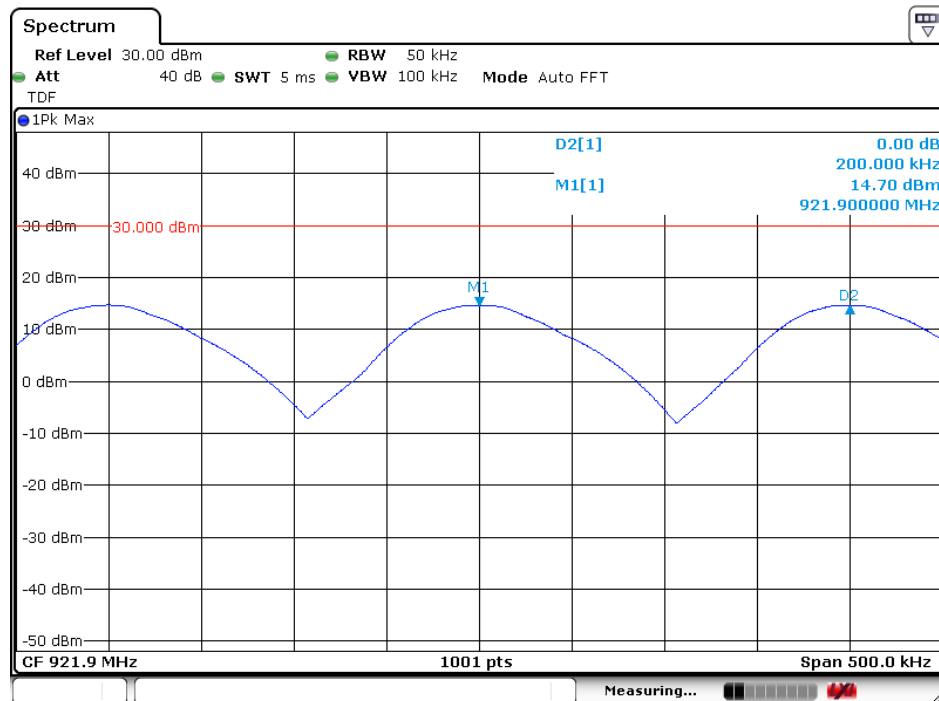
or:

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.



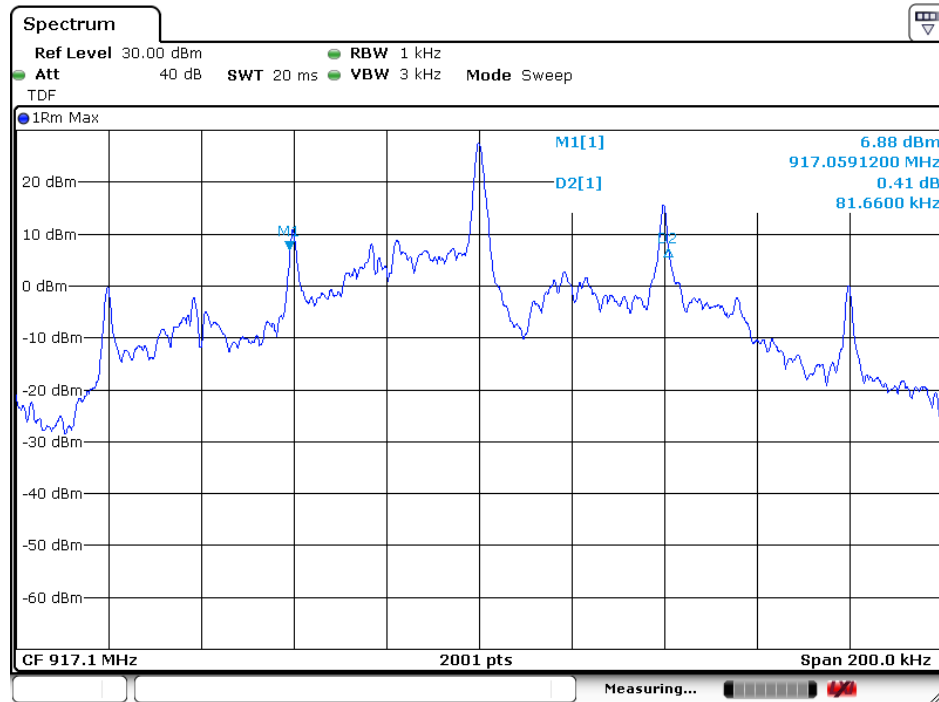
Date: 3.DEC.2019 11:16:22

Channel Separation, Antenna 1



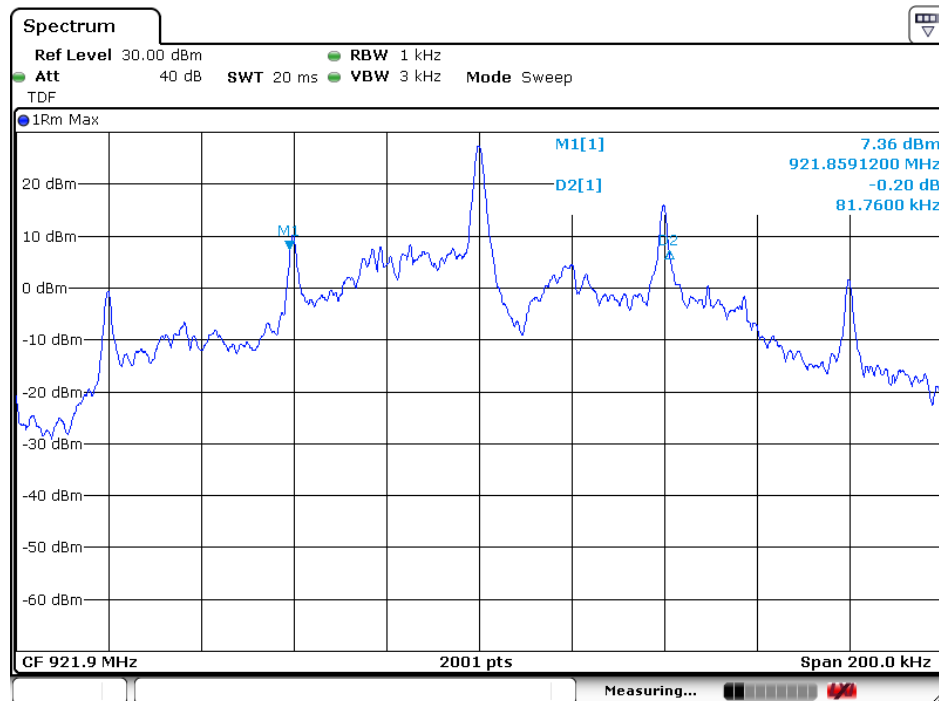
Date: 3.DEC.2019 11:15:08

Channel Separation, Antenna 2



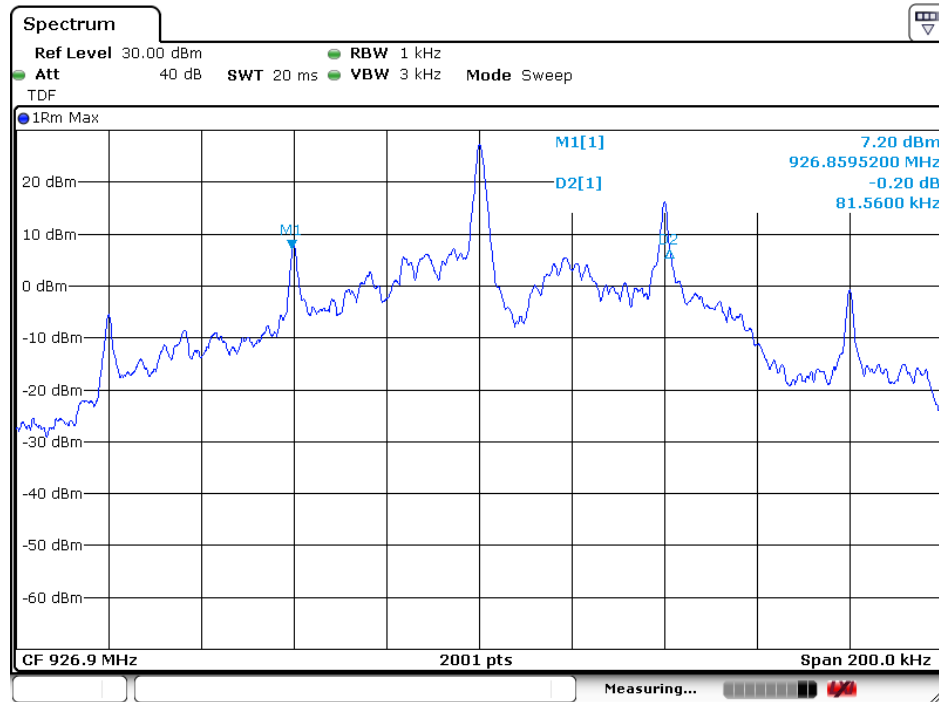
Date: 3.DEC.2019 12:11:34

20dB BW, Ch. 1, Antenna 1



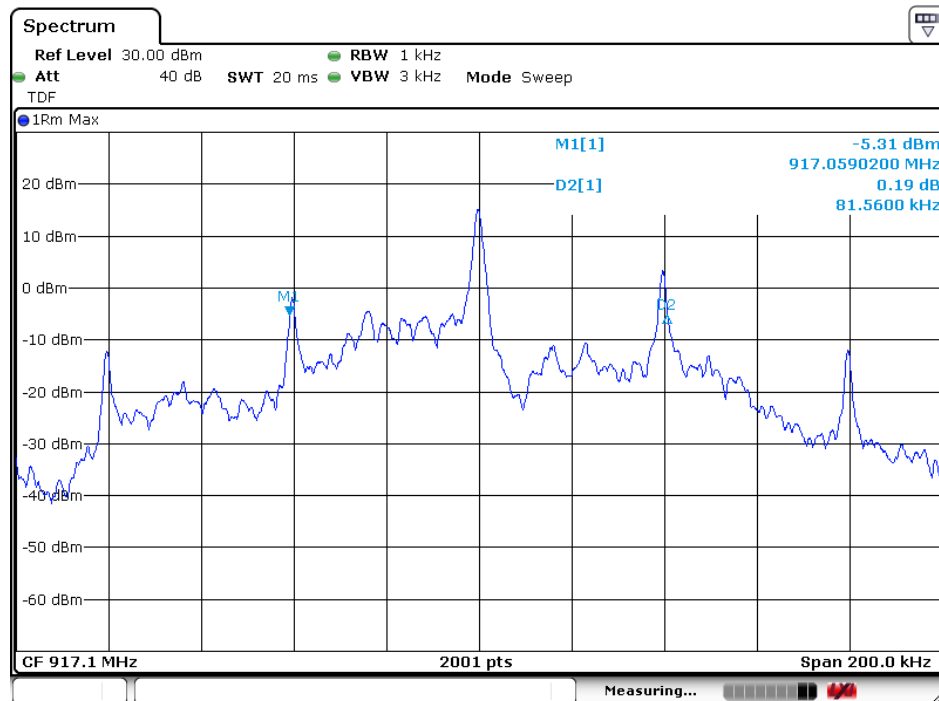
Date: 3.DEC.2019 12:09:39

20dB BW, Ch. 25, Antenna 1



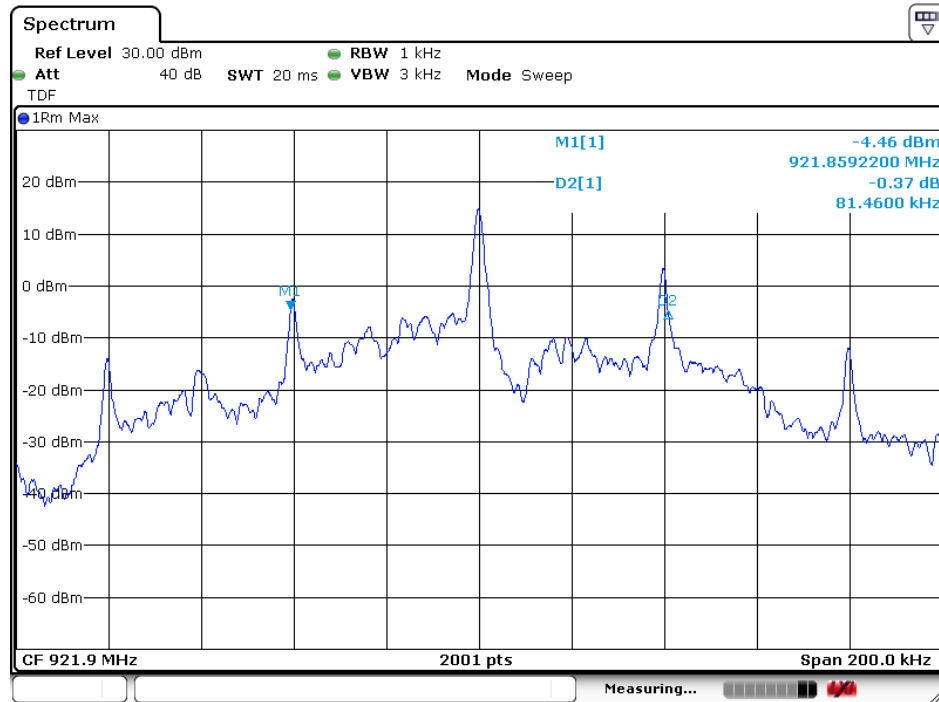
Date: 3.DEC.2019 12:54:39

20dB BW, Ch. 50, Antenna 1



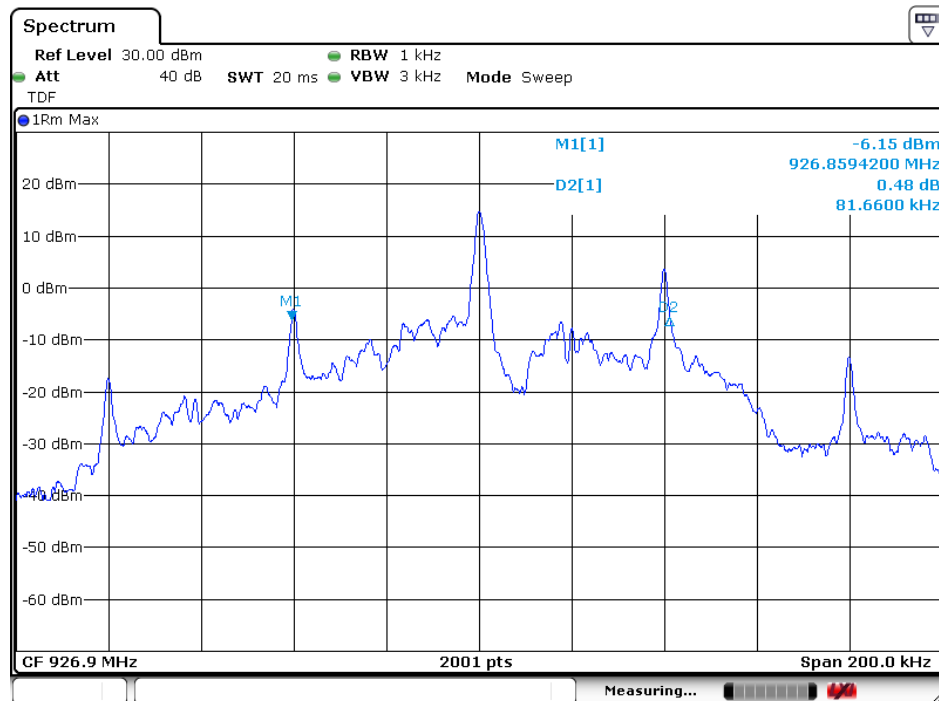
Date: 3.DEC.2019 13:00:03

20dB BW, Ch. 1, Antenna 2



Date: 3.DEC.2019 13:01:53

20dB BW, Ch. 25, Antenna 2



Date: 3.DEC.2019 13:03:33

20dB BW, Ch. 50, Antenna 2

3.4 Occupancy Time

Para. No.: 15.247 (a)(1)(iii)

Para. No.: 5.1 (5)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-12-03

Test Results: Complies

Measurement Data:

Number of RF Channels	50
Maximum Length of RF Burst pr. channel	33.1 ms
Time of Occupancy	331 ms

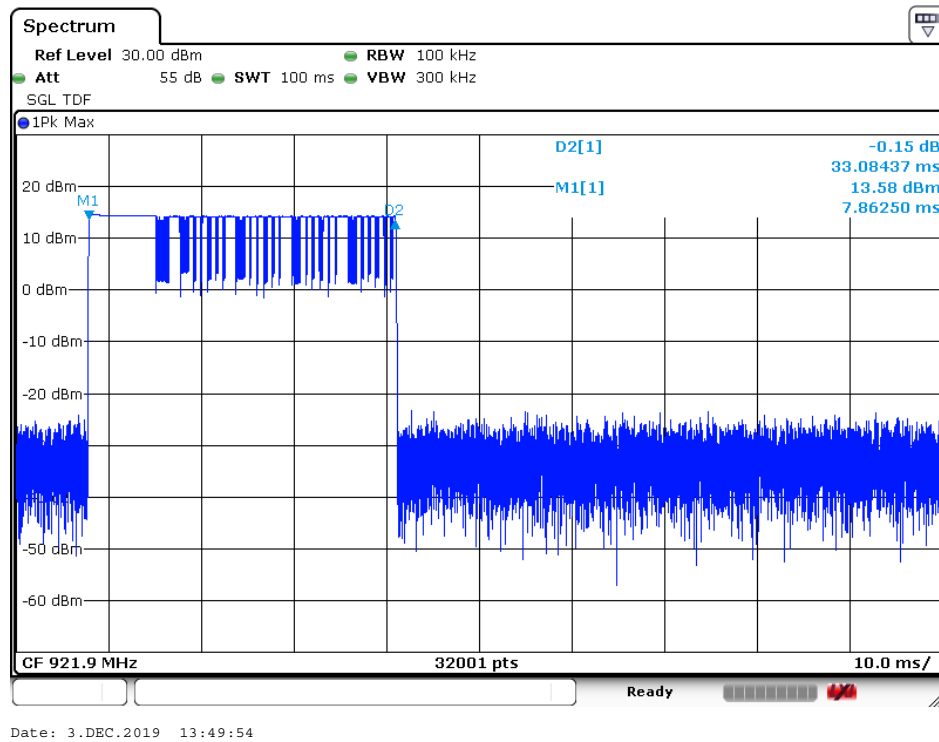
Number of bursts in a period of 20s: 10

Time of occupancy: $10 \times 33.1\text{ms} = 331\text{ ms}$

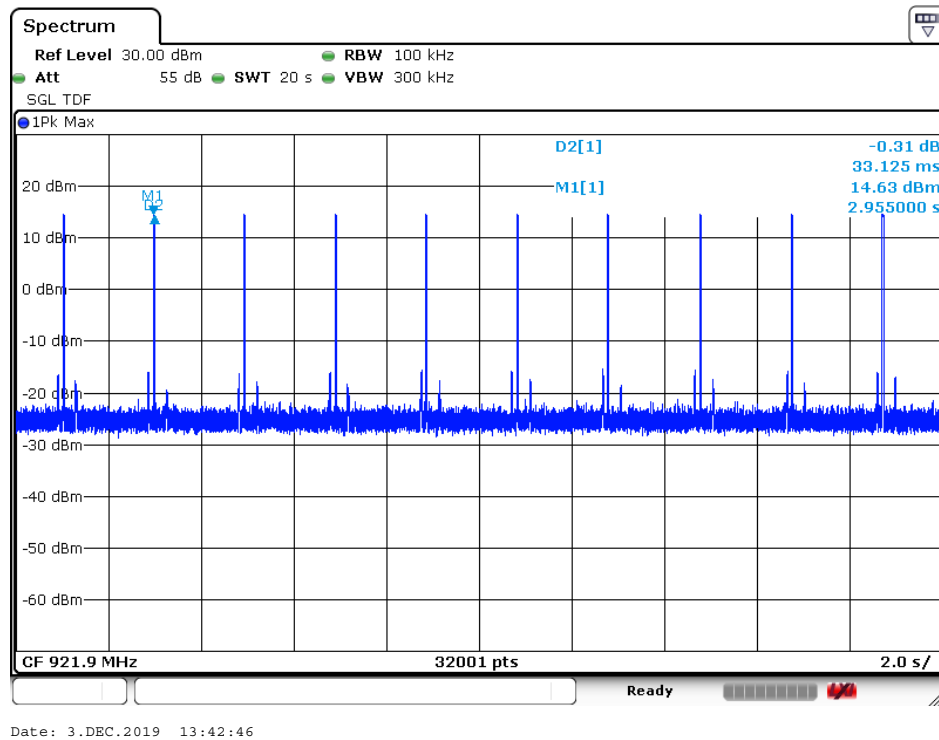
Requirements:

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 20 seconds.

No requirements for Digital Transmission Systems.



Burst length



Number of Bursts

3.5 Occupied Bandwidth

Para. No.: 15.247 (a)(1)(iii)

Para. No.: 5.1 (7)

Test Performed By: Frederic Hupbauer

Date of Test: 2019-12-03

Test Results: Complies

Measurement Data:

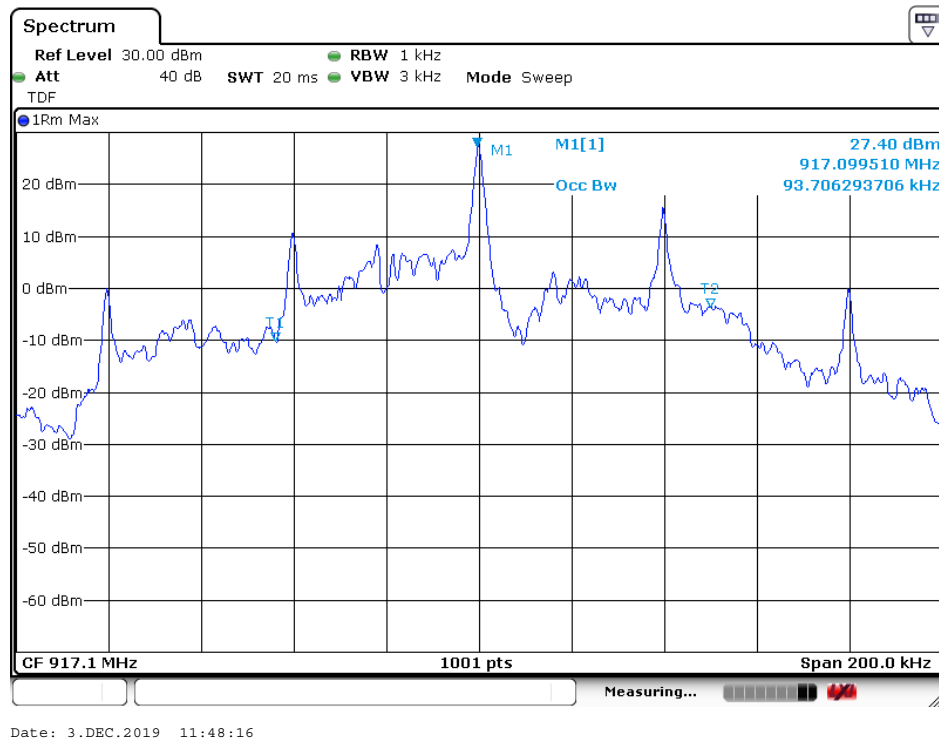
Antenna	Occupied Bandwidth (99% BW) (kHz)		
	Ch 01, 917.1 MHz	Ch 25, 921.9 MHz	Ch 50, 926.9 MHz
Antenna 1	93.71	101.3	89.11
Antenna 2	91.51	93.91	89.11

Requirements:

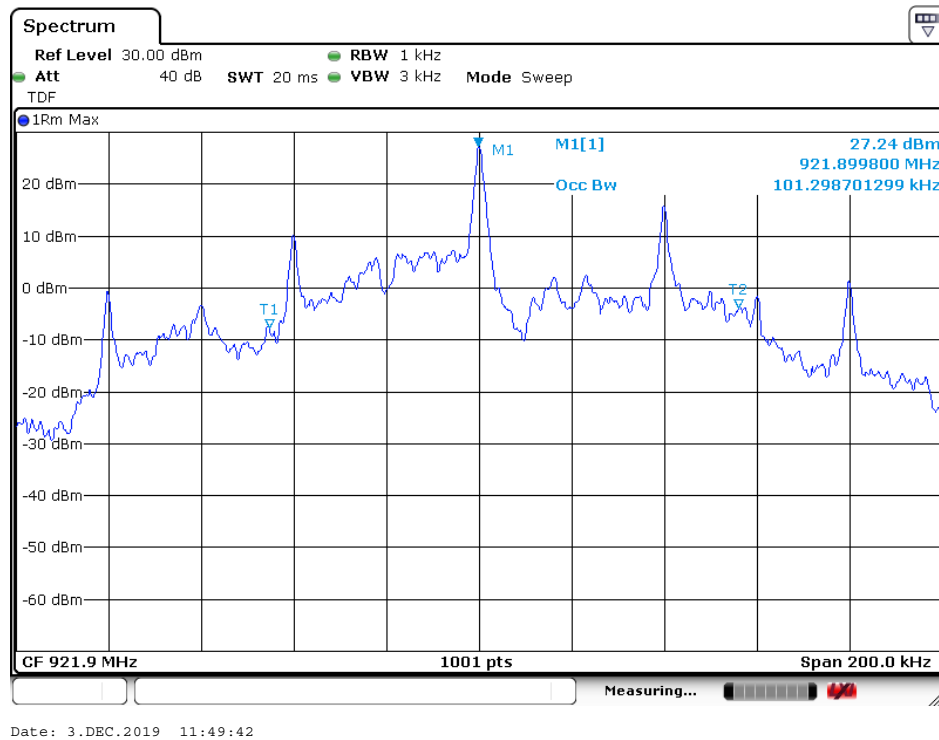
No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

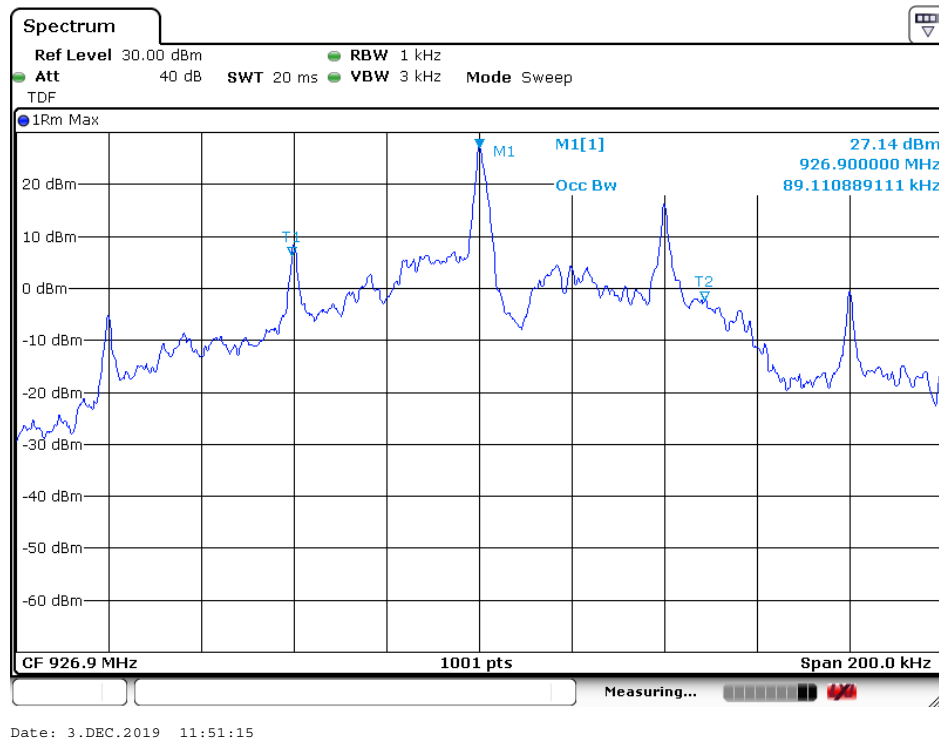
Reported for information only



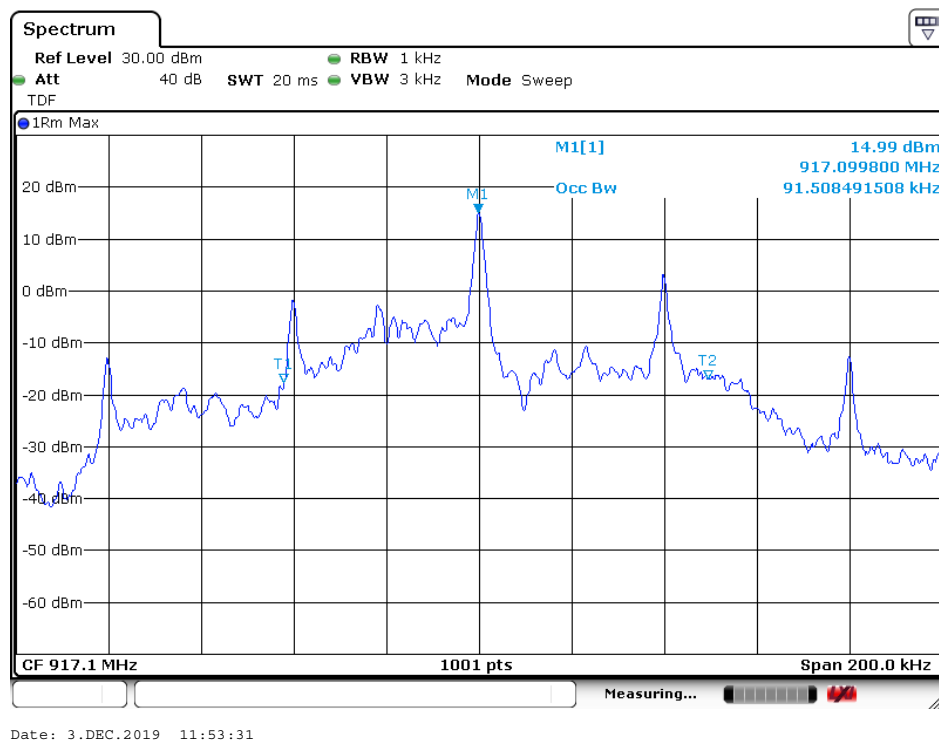
99% OCC BW, Ch. 1, Antenna 1



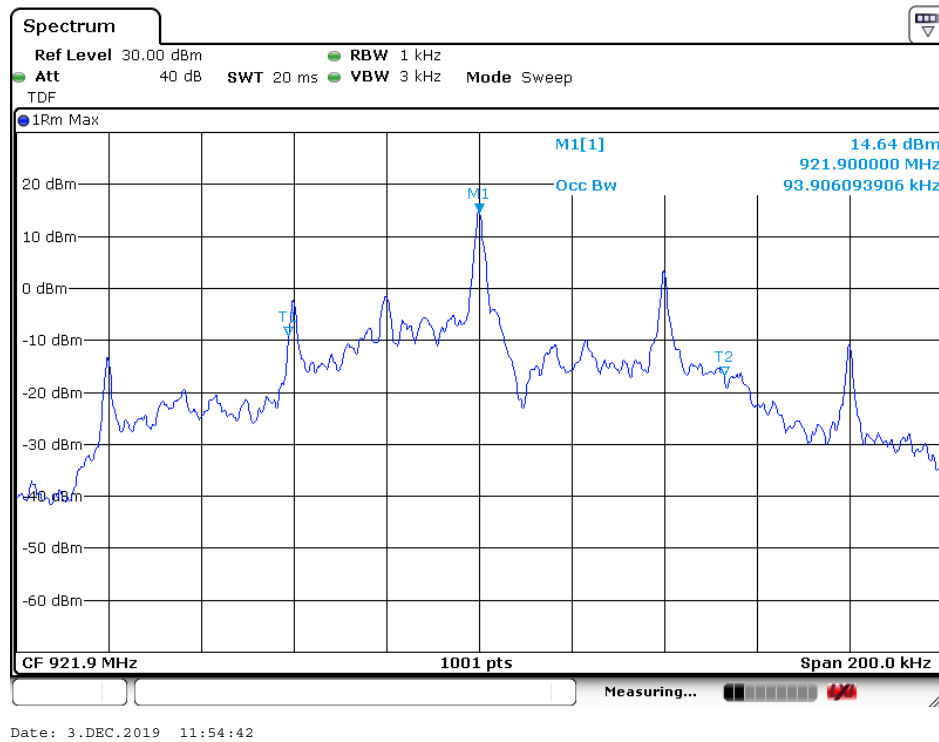
99% OCC BW, Ch. 25, Antenna 1



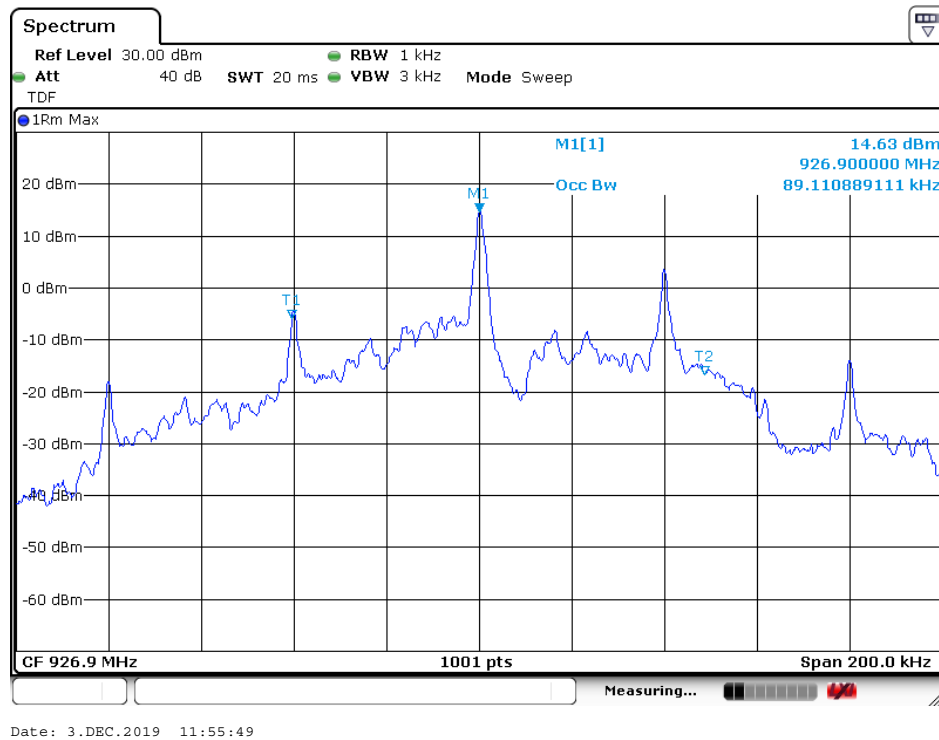
99% OCC BW, Ch. 50, Antenna 1



99% OCC BW, Ch. 1, Antenna 2



99% OCC BW, Ch. 25, Antenna 2



99% OCC BW, Ch. 50, Antenna 2

3.6 Peak Power Output

Para. No.: 15.247 (b)

Para. No.: 5.4

Test Performed By: Frederic Hupbauer

Date of Test: 2019-12-03; 2020-01-20

Test Results: Complies

Measurement Data:

Antenna	1		
Carrier Frequency	917.1 MHz	921.9 MHz	926.9 MHz
Measured Maximum Field strength (dBμV/m) – HP	93.0	91.8	91.9
Calc. Radiated Power (dBm)	-2.24	-3.41	-3.35
Calc. Radiated Power (mW)	0.60	0.46	0.46
Measured Conducted Power (dBm)	27.5	27.3	27.3
Calculated Conducted Power (mW)	566.24	535.80	537.03
Calculated Antenna Gain (dBi)	-31.9	-32.8	-32.8

Antenna	2		
Carrier Frequency	917.1 MHz	921.9 MHz	926.9 MHz
Measured Maximum Field strength (dBμV/m) – VP	102.3	102.8	103.0
Calc. Radiated Power (dBm)	7.10	7.52	7.74
Calc. Radiated Power (mW)	5.13	5.65	5.94
Measured Conducted Power (dBm)	15.1	14.8	14.8
Calculated Conducted Power (mW)	32.06	30.34	29.99
Calculated Antenna Gain (dBi)	-10.1	-9.4	-9.2

Antenna gain = $10 \cdot \log(\text{EIRP} / \text{Conducted power})$ dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01.

See attached graph.

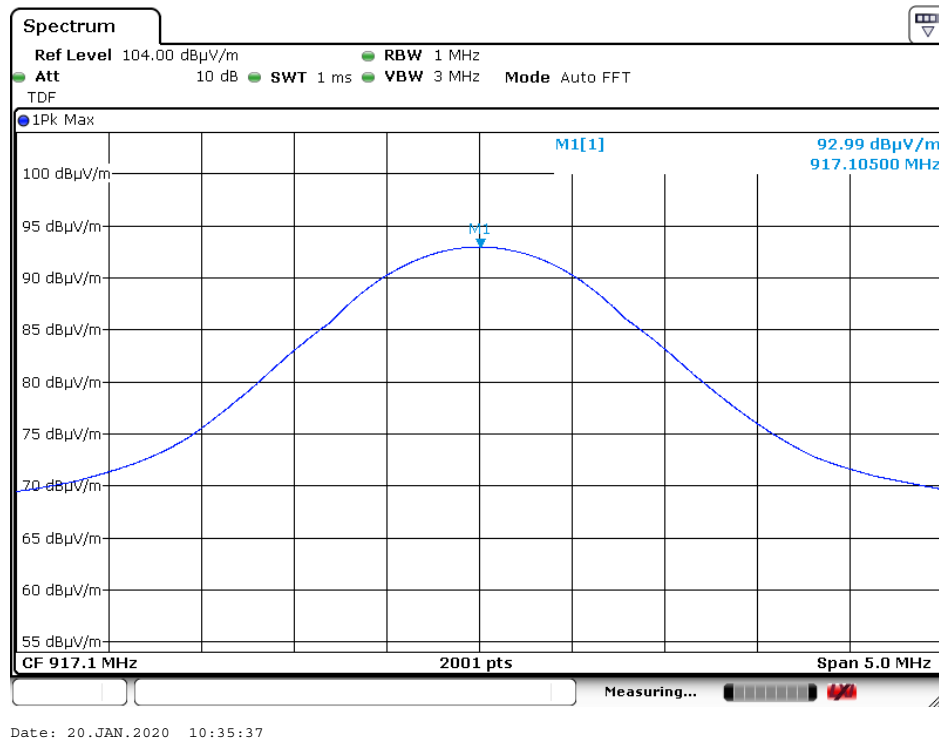
Requirements:

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

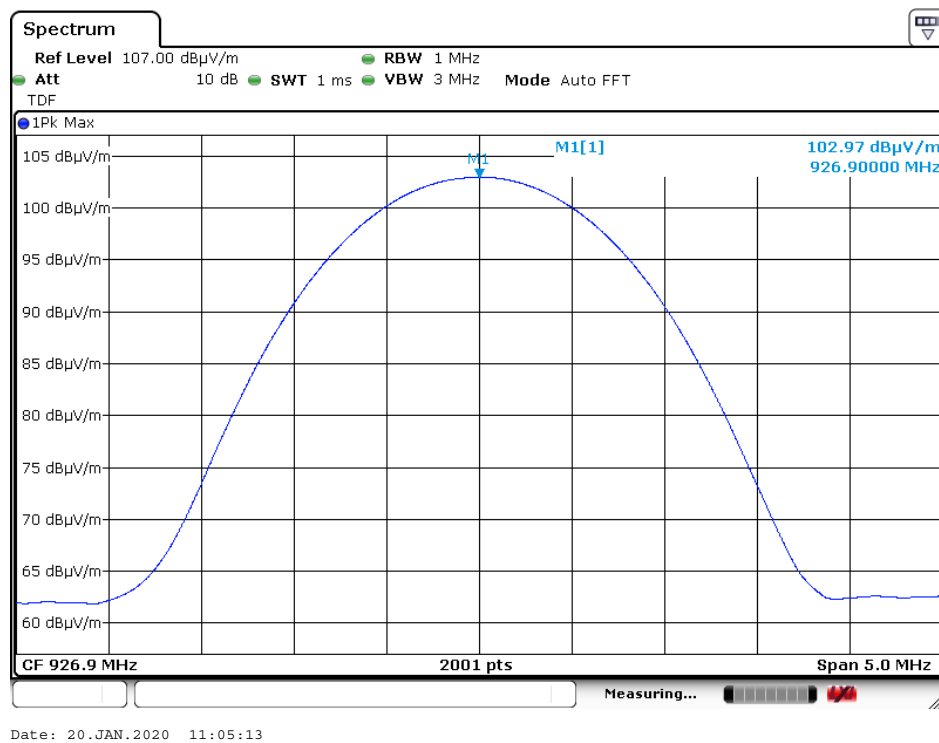
For frequency hopping systems in the 902 – 928 MHz band employing at least 50 hopping channels: 1 Watt

For frequency hopping systems in the 902 – 928 MHz band employing less than 50 hopping channels: 0.25 Watt

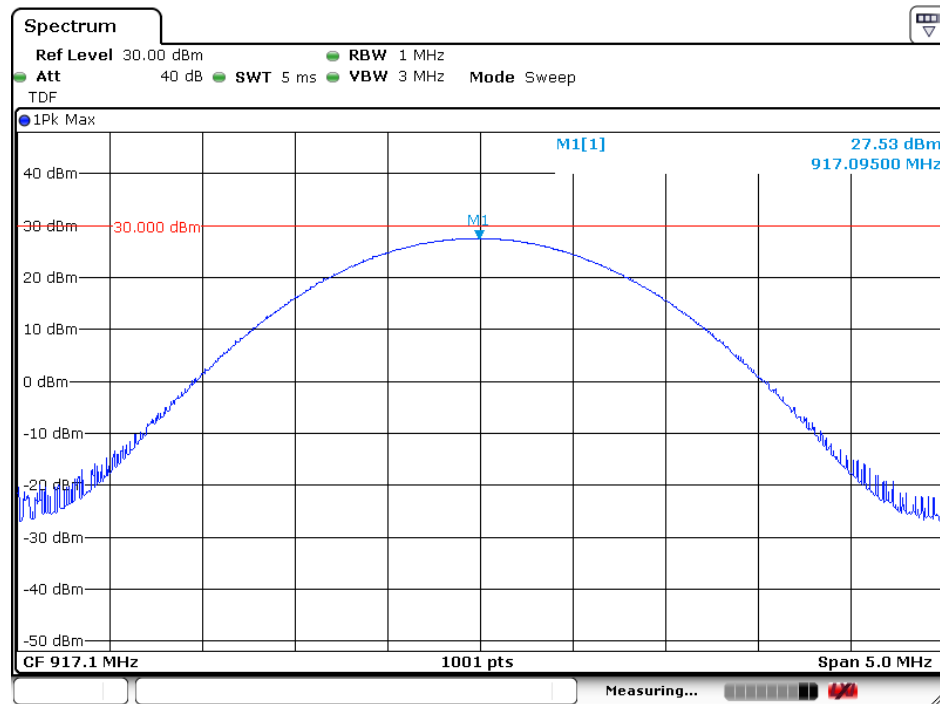
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Radiated field strength, HP, Ch. 1, Antenna 1

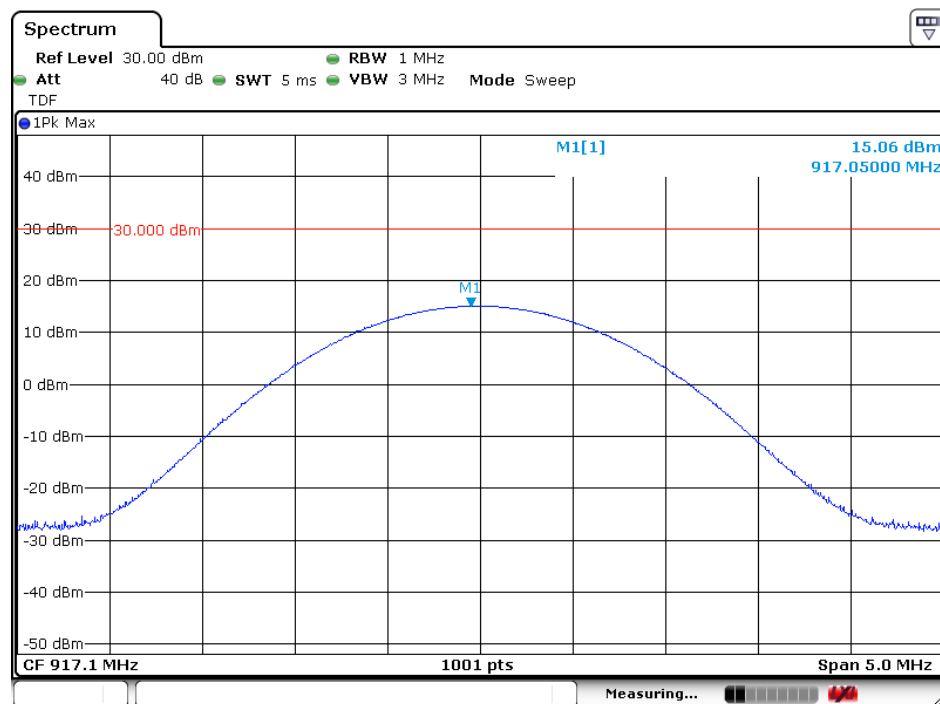


Radiated field strength, VP, Ch. 50, Antenna 2



Date: 3.DEC.2019 11:24:30

Conducted power, Ch. 1, Antenna 1



Date: 3.DEC.2019 11:29:06

Conducted power, Ch. 1, Antenna 2

3.7 Conducted Emissions at Antenna Connector

Para. No.: 15.247 (d)

Para. No.: 5.5

Test Performed By: Frederic Hupbauer	Date of Test: 2019-12-03
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Test Results: Complies

RF conducted power to 10 GHz see attached plots.

Maximum RF level outside operating band:

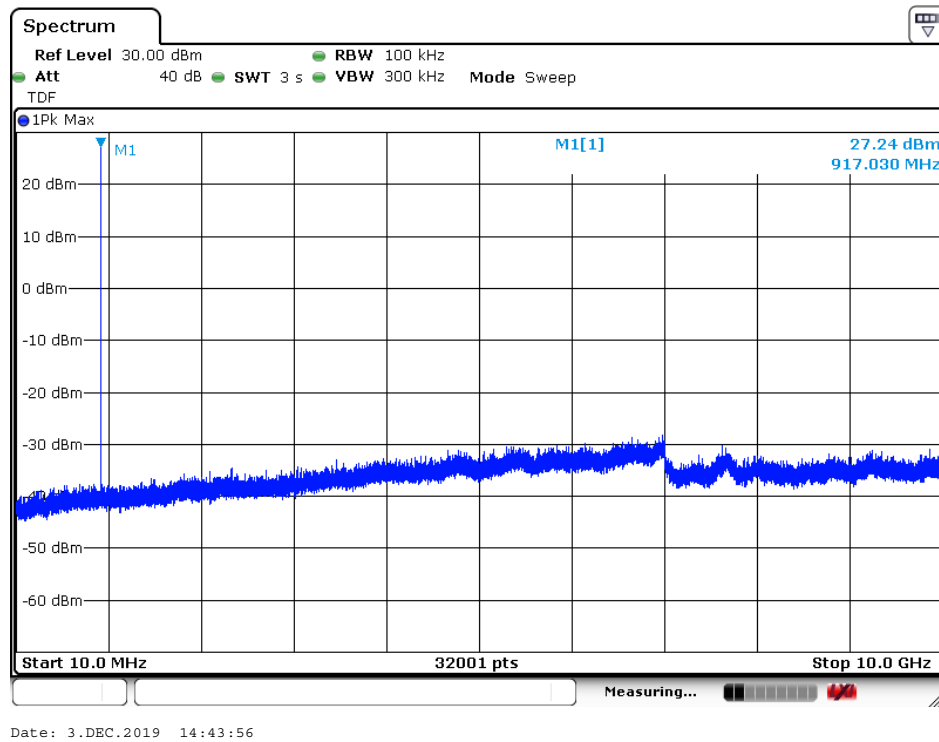
All Carrier Frequency > 40 dBc, margin >20 dB

Limit

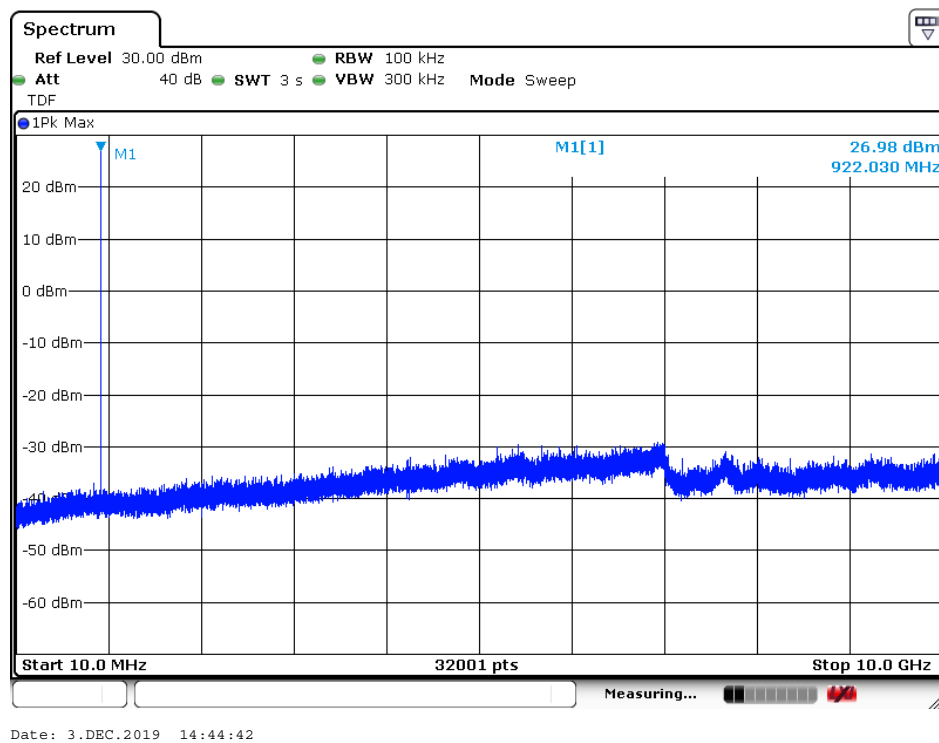
Peak measurement	RMS averaging
20 dBc or more in 100 kHz bandwidth	30 dBc or more in 100 kHz bandwidth

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

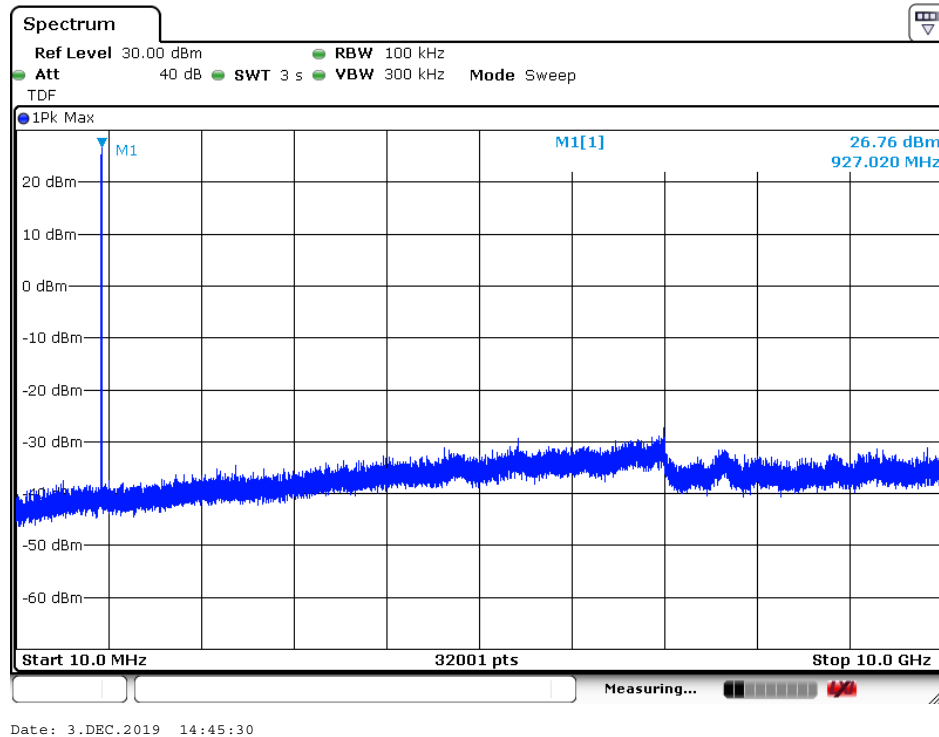
Attenuation below the general limits specified in part 15.209(a) is not required.



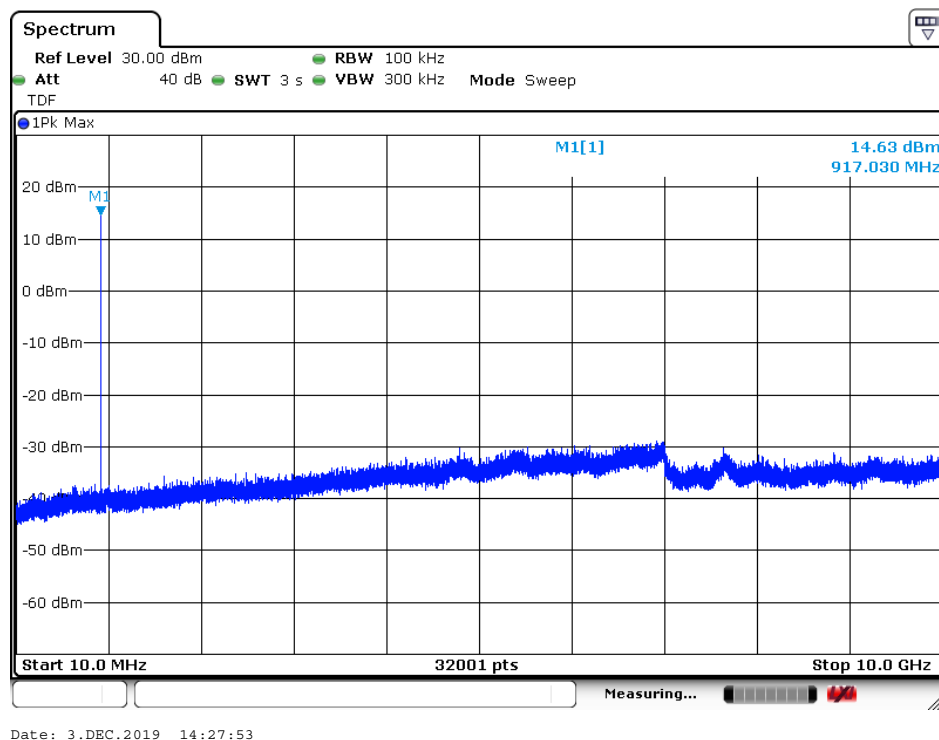
Conducted emissions 10MHz – 10GHz, Ch. 1, Antenna 1



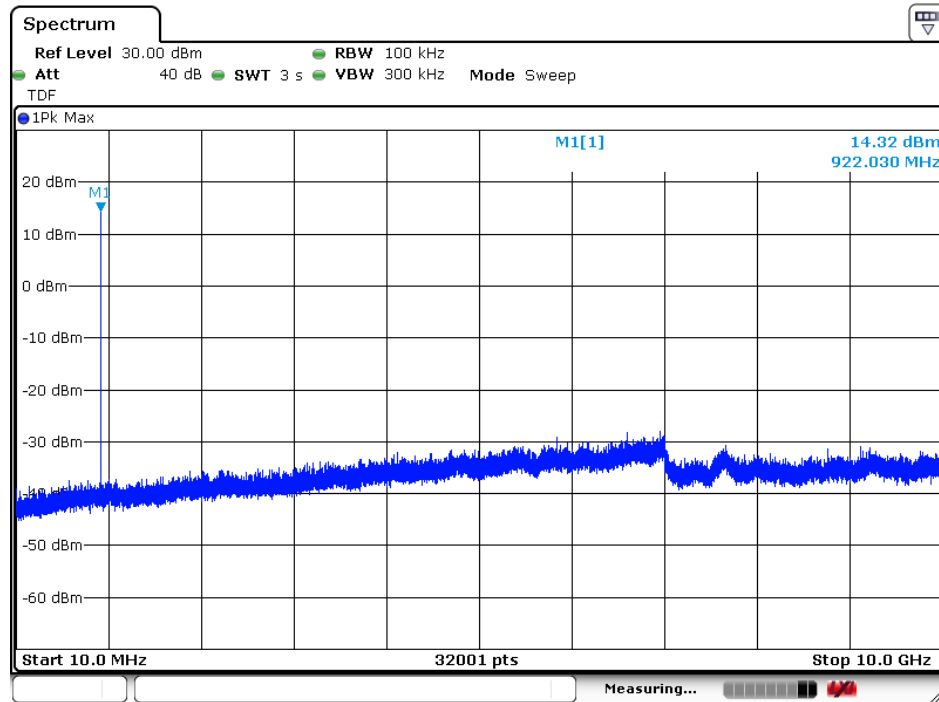
Conducted emissions 10MHz – 10GHz, Ch. 25, Antenna 1



Conducted emissions 10MHz – 10GHz, Ch. 50, Antenna 1

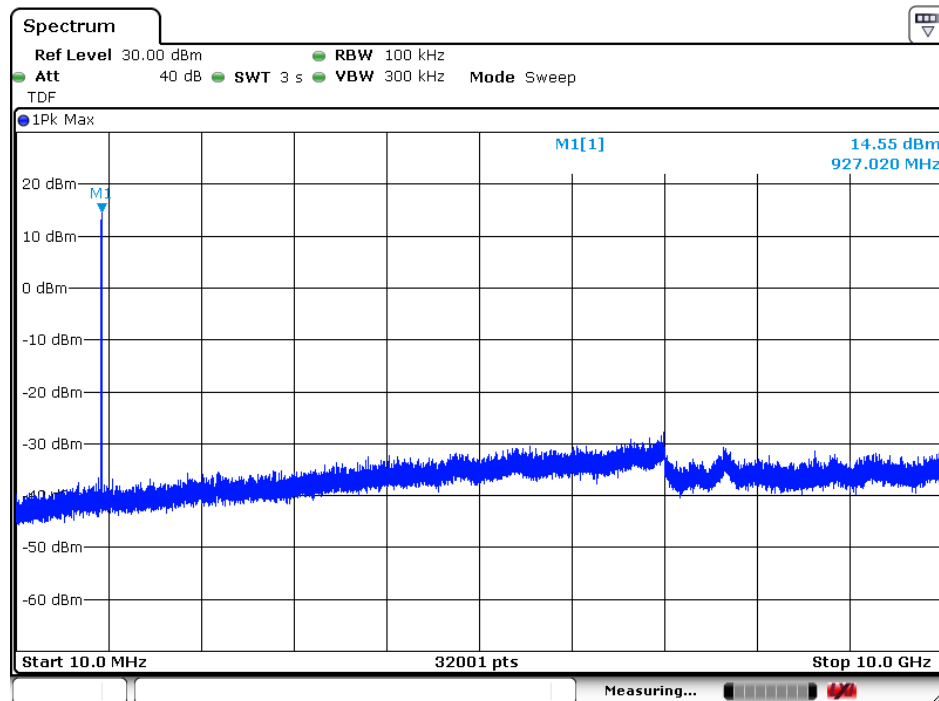


ConduConducted emissions 10MHz – 10GHz, Ch. 1, Antenna 2



Date: 3.DEC.2019 14:29:04

Conducted emissions 10MHz – 10GHz, Ch. 25, Antenna 2



Date: 3.DEC.2019 14:41:49

Conducted emissions 10MHz – 10GHz, Ch. 50, Antenna 2

3.8 Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED RSS-GEN, Issue 4 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 4, 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.

3.9 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Para. No.: 5.5

Test Performed By: Frederic Hupbauer	Date of Test: 2019-11-28; 2019-11-29; 2020-01-17
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Test Results: Complies

Measurement Data:

Band-edge, @3m

Antenna 1				
Frequency (MHz)	Measured field strength (dBμV/m)	Detector	Limit (dBμV/m)	Margin (dB)
917.1	25.55	PK	74	48.45
	5.55	AV	54	48.45
926.9	34.4	PK	74	39.6
	14.4	AV	54	39.6

Antenna 2				
Frequency (MHz)	Measured field strength (dBμV/m)	Detector	Limit (dBμV/m)	Margin (dB)
917.1	25.04	PK	74	48.96
	5.04	AV	54	48.96
926.9	40.88	PK	74	33.12
	20.88	AV	54	33.12

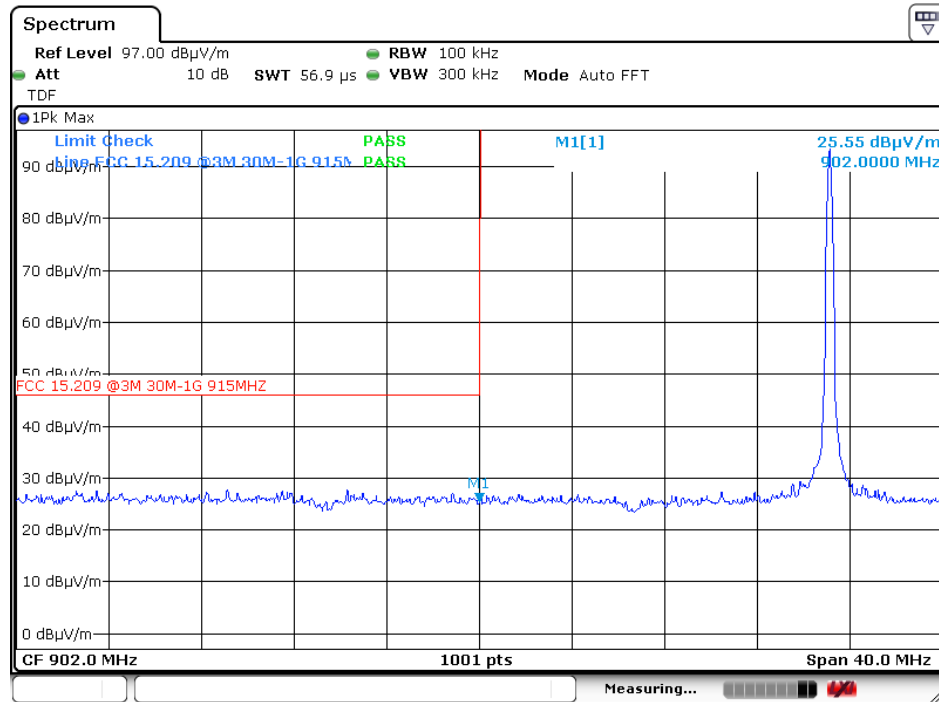
Average values are calculated from Peak Values.
See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = On Time / (Period * Number of Channels) = 33 ms / (39 ms * 50) = 0.017

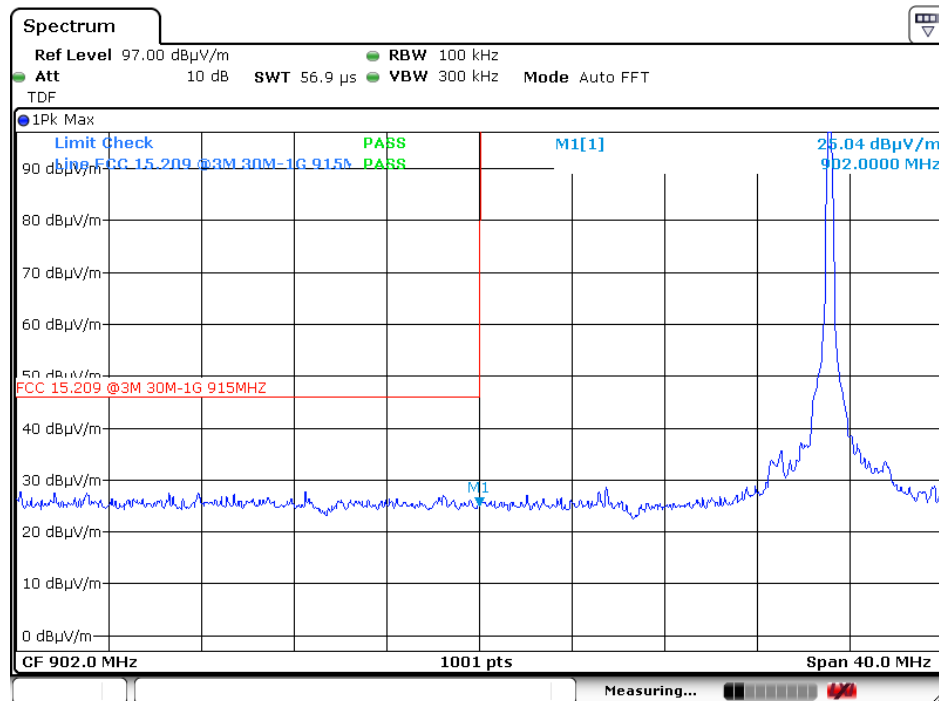
Duty Cycle Correction factor = -20 x log (Duty Cycle) = 35.4 dB

Maximum allowed Duty Cycle Correction: 20 dB



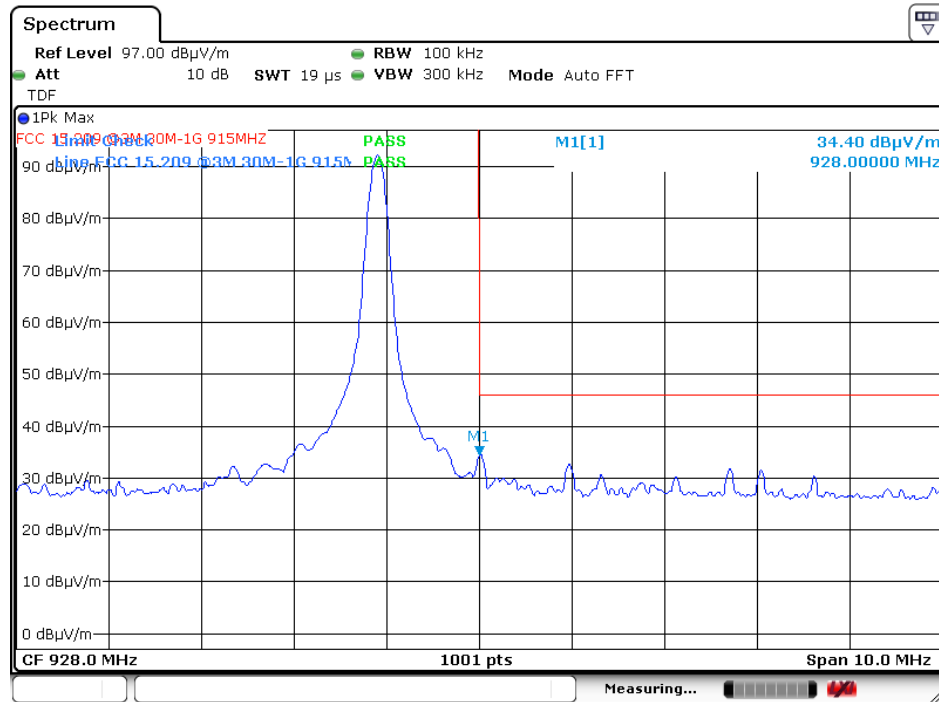
Date: 28.NOV.2019 14:14:26

Lower Band Edge, Ch. 1, Antenna 1



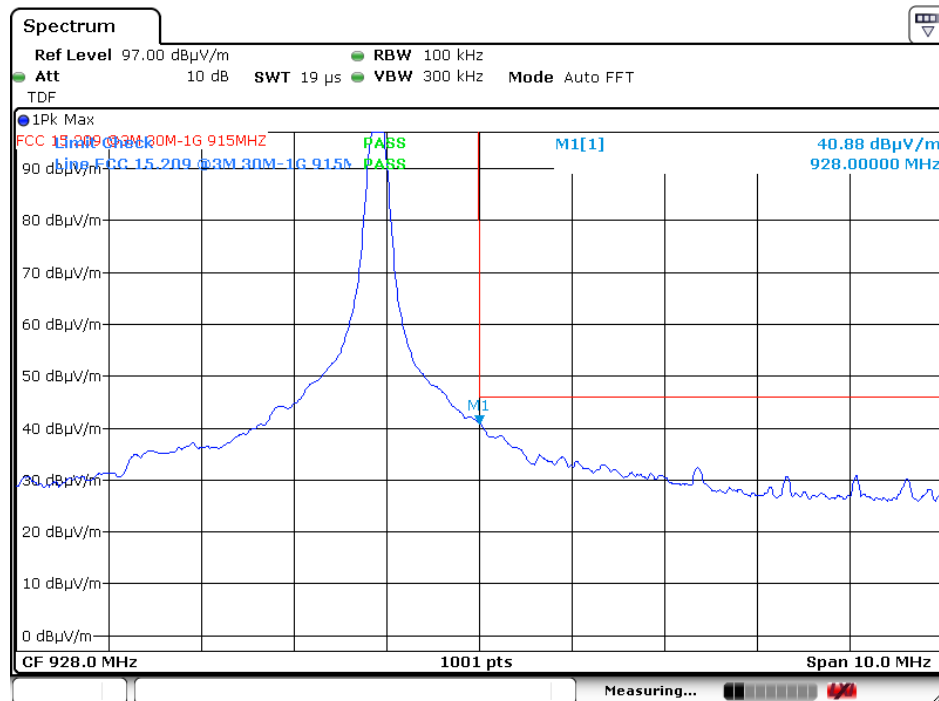
Date: 28.NOV.2019 14:40:45

Lower Band Edge, Ch. 1, Antenna 2



Date: 28.NOV.2019 14:49:31

Upper Band Edge, Ch. 50, Antenna 1



Date: 28.NOV.2019 14:53:24

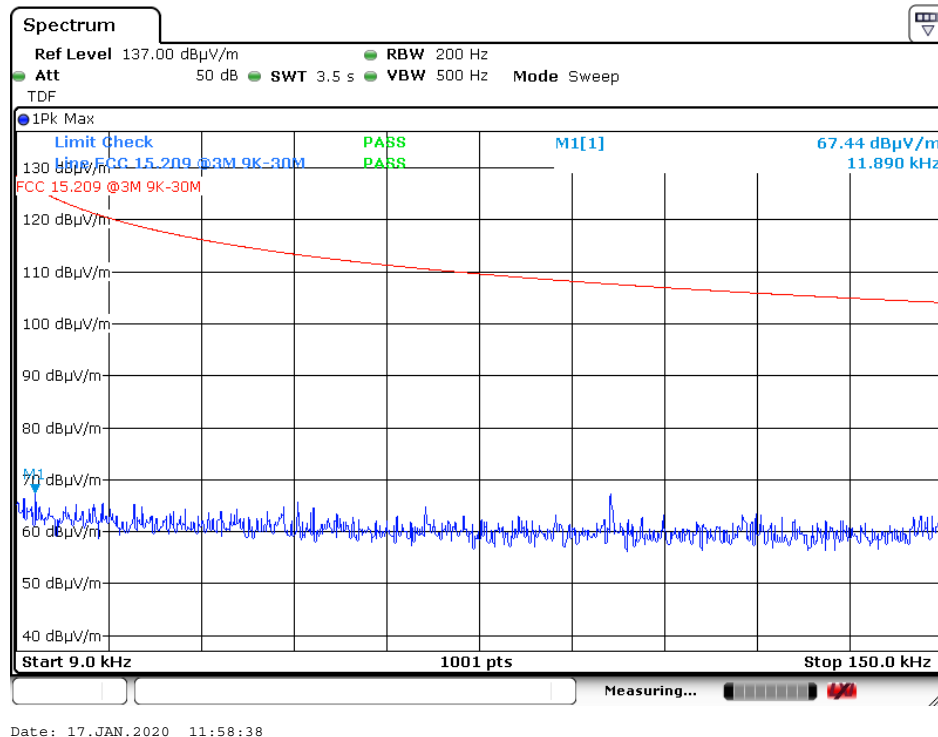
Upper Band Edge, Ch. 50, Antenna 2

Radiated emissions 10 kHz-30 MHz.

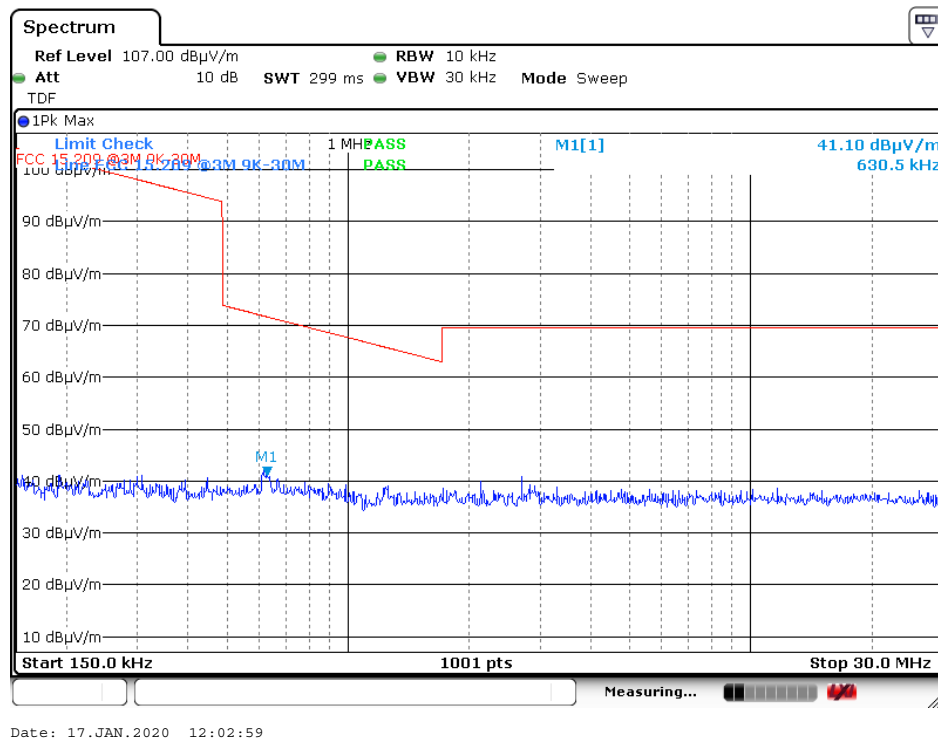
Measuring distance 3 m, measured with Peak detector.

No component detected, see attached graph.

Limit is converted to 3 m using 40 dB/decade according to 15.31 (f) (2).



Radiated Emissions, 9 kHz – 150 kHz @3m



Radiated Emissions, 150 kHz - 30MHz @3m

Radiated emission 30 – 1000 MHz.

Detector: Peak

Measuring distance 3 m.

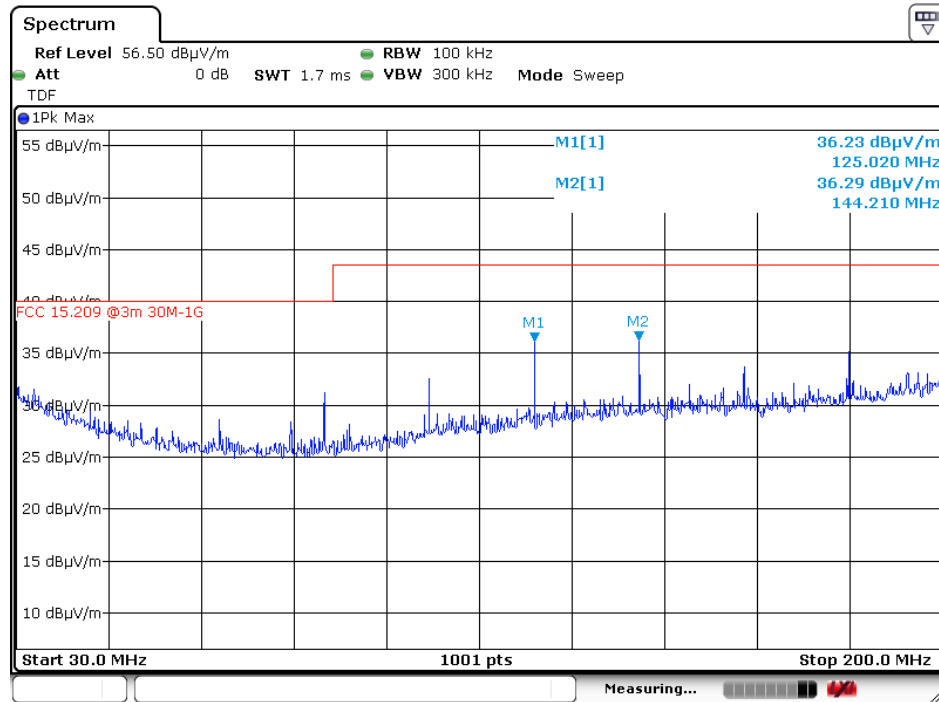
Measurement Data:

Measured Frequency (MHz)	Carrier Frequency (MHz)	Antenna	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
144.21	921.9	1	36.29	43.5	7.21
62.52	921.9	1	34.61	40.0	5.39
144.21	921.9	2	36.25	43.5	7.25
937.26	926.9	1	43.98	46	2.02
202.0	926.9	1	41.27	46	4.73
894.11	926.9	2	43.80	46	2.2

See attached graphs.

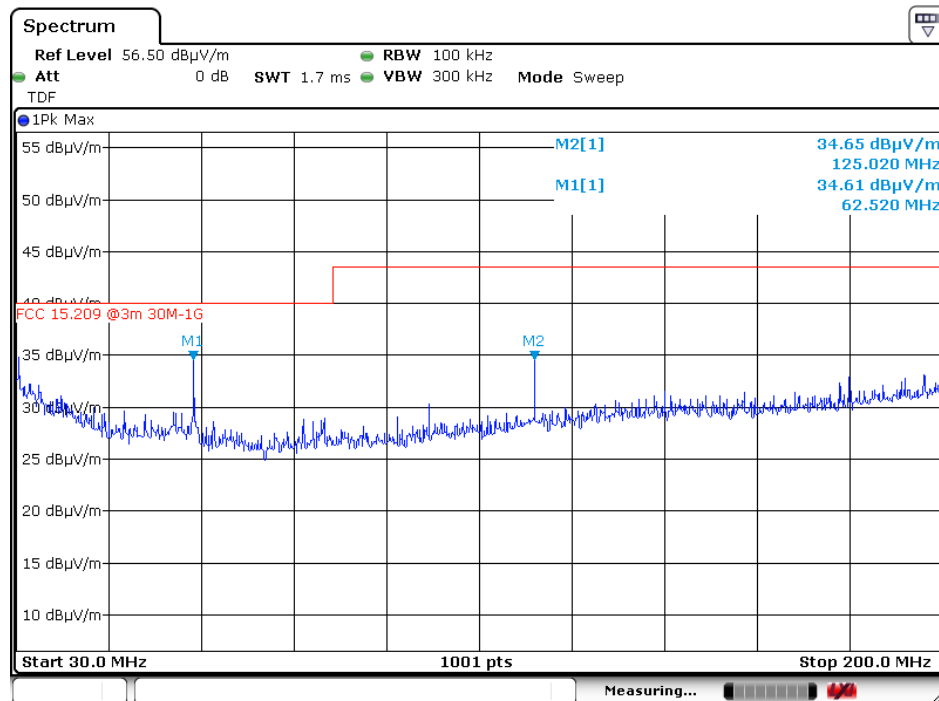
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (µV/m)	Quasi Peak (dBµV/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0



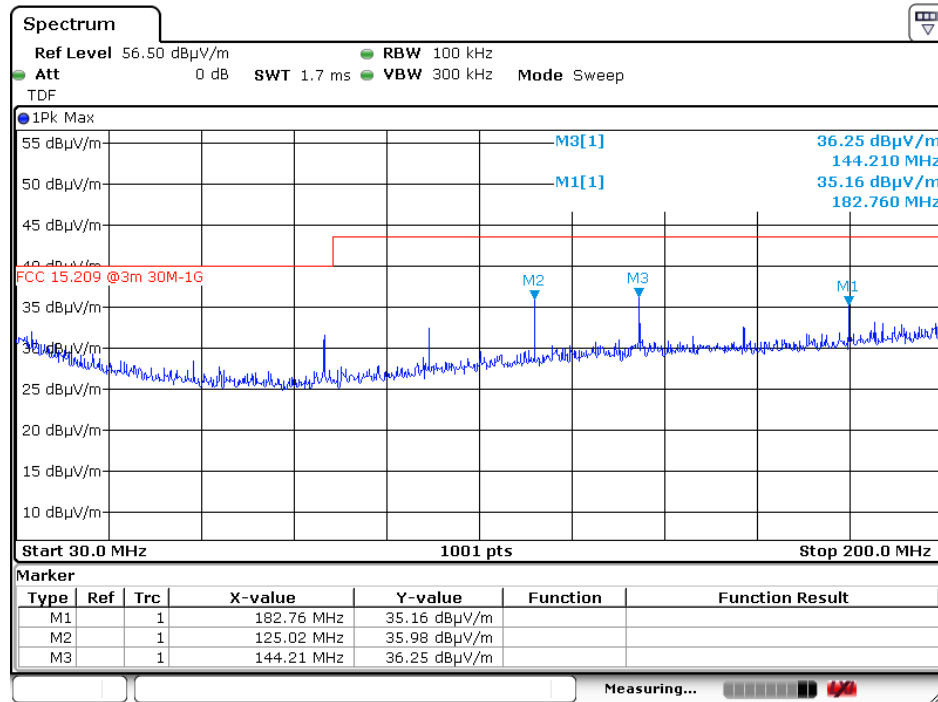
Date: 29.NOV.2019 10:25:54

Radiated Emissions, 30 – 200 MHz, HP, Ch. 25, Ant. 1, PK scan



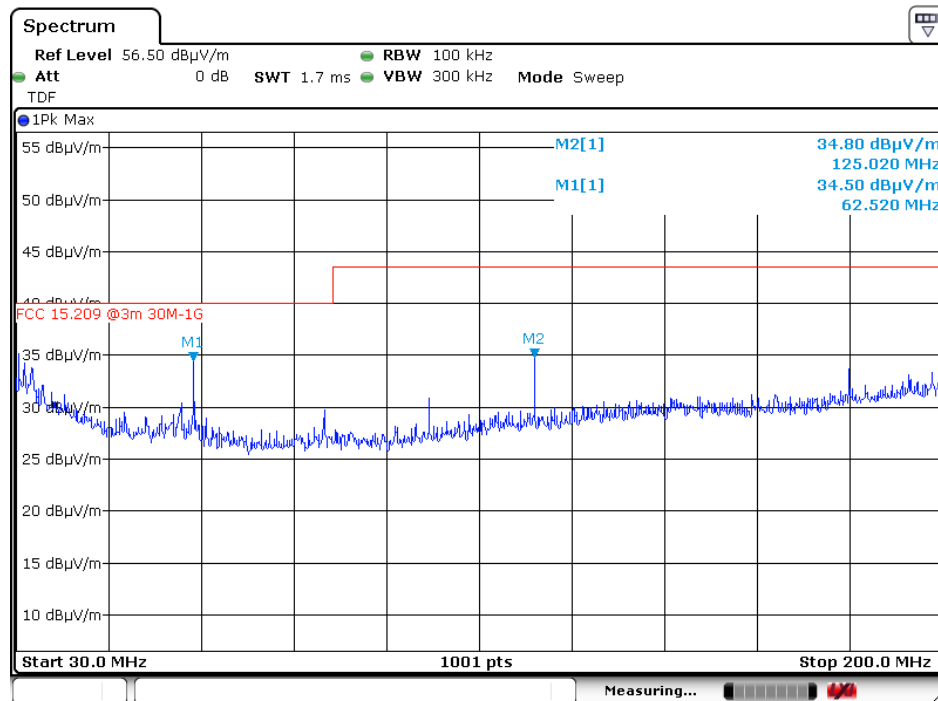
Date: 29.NOV.2019 10:27:29

Radiated Emissions, 30 – 200 MHz, VP, Ch. 25, Ant. 1, PK scan



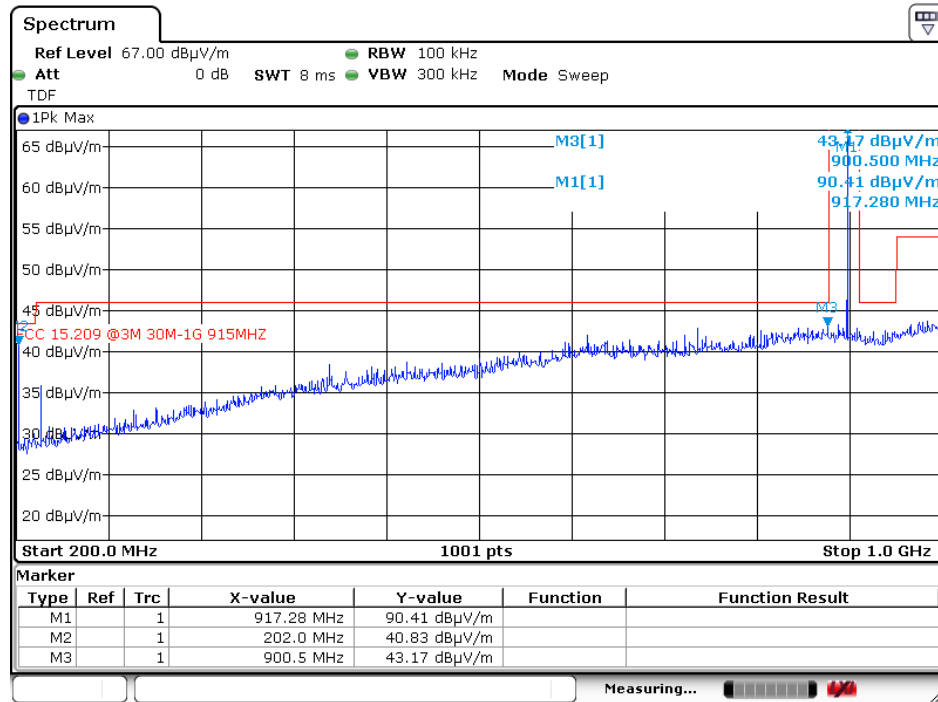
Date: 29.NOV.2019 10:31:31

Radiated Emissions, 30 – 200 MHz, HP, Ch. 25, Ant. 2, PK scan



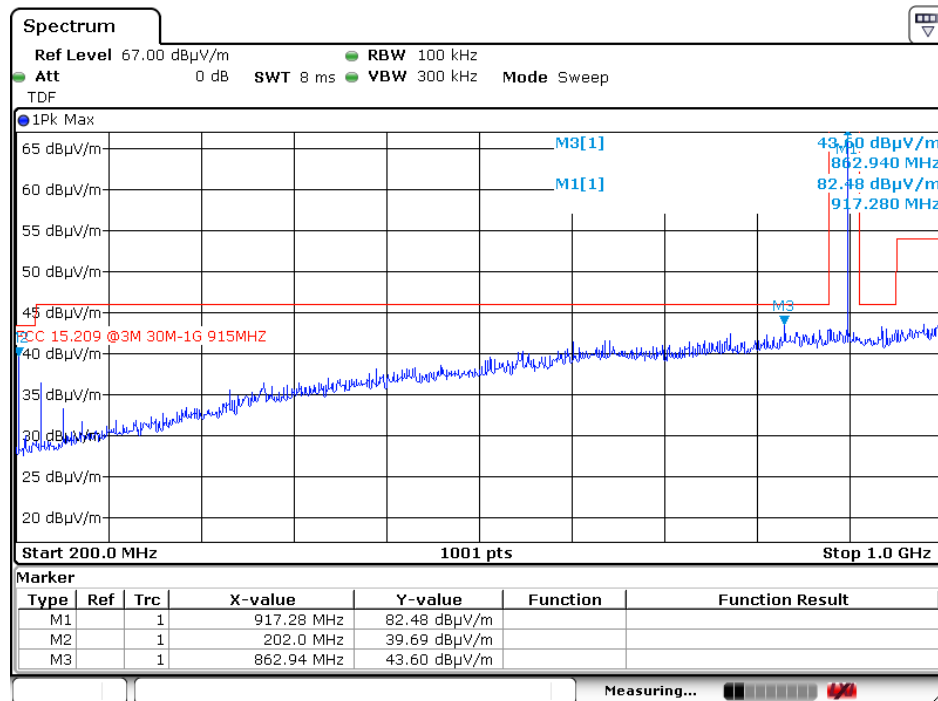
Date: 29.NOV.2019 10:29:44

Radiated Emissions, 30 – 200 MHz, VP, Ch. 25, Ant. 2, PK scan



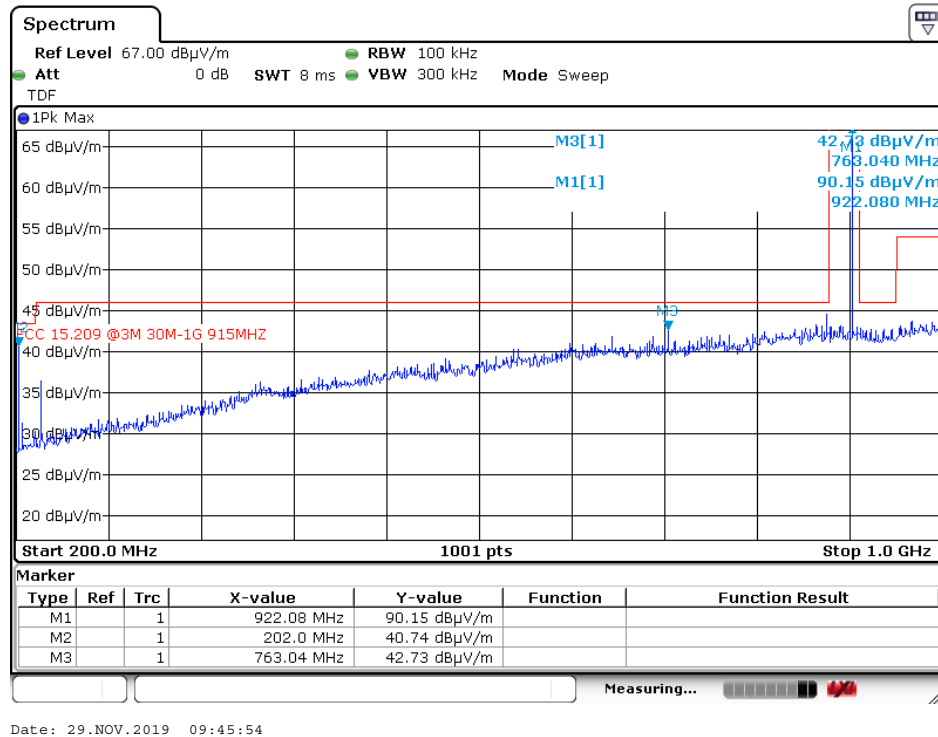
Date: 29.NOV.2019 09:40:05

Radiated Emissions, 200 - 1000 MHz, HP, Ch. 1, Ant. 1, PK scan

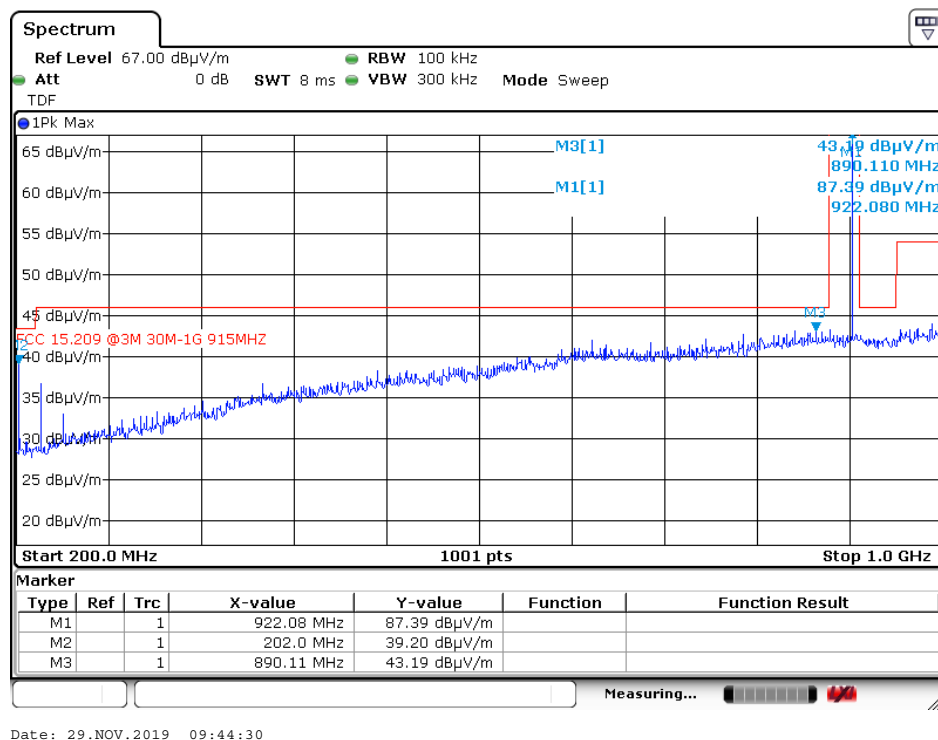


Date: 29.NOV.2019 09:41:02

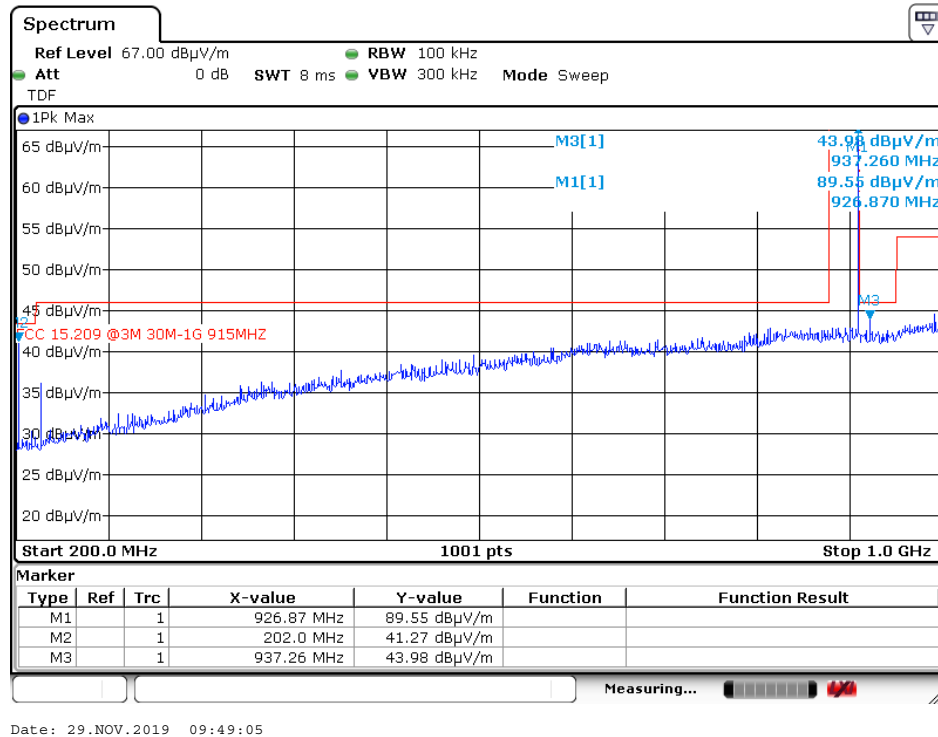
Radiated Emissions, 200 - 1000 MHz, VP, Ch. 1, Ant. 1, PK scan



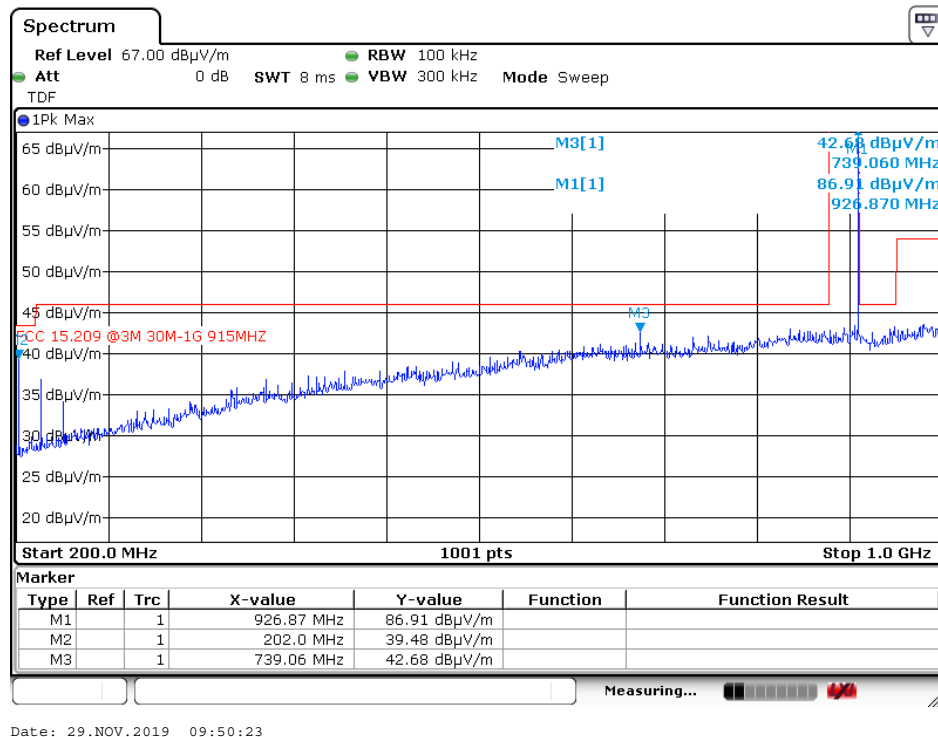
Radiated Emissions, 200 - 1000 MHz, HP, Ch. 25, Ant. 1, PK scan



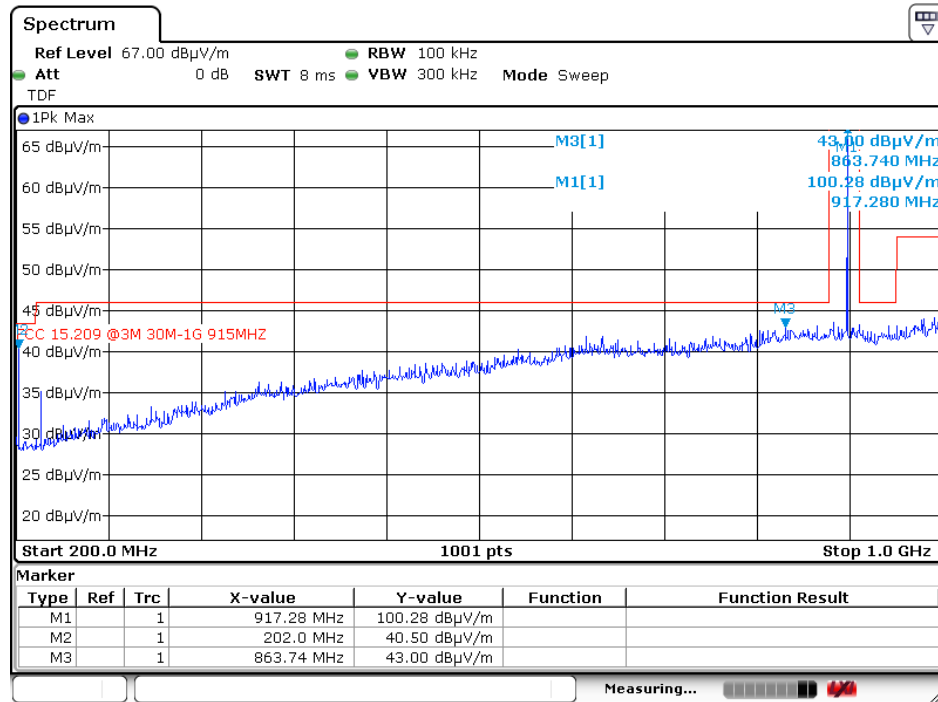
Radiated Emissions, 200 - 1000 MHz, VP, Ch. 25, Ant. 1, PK scan



Radiated Emissions, 200 - 1000 MHz, HP, Ch. 50, Ant. 1, PK scan

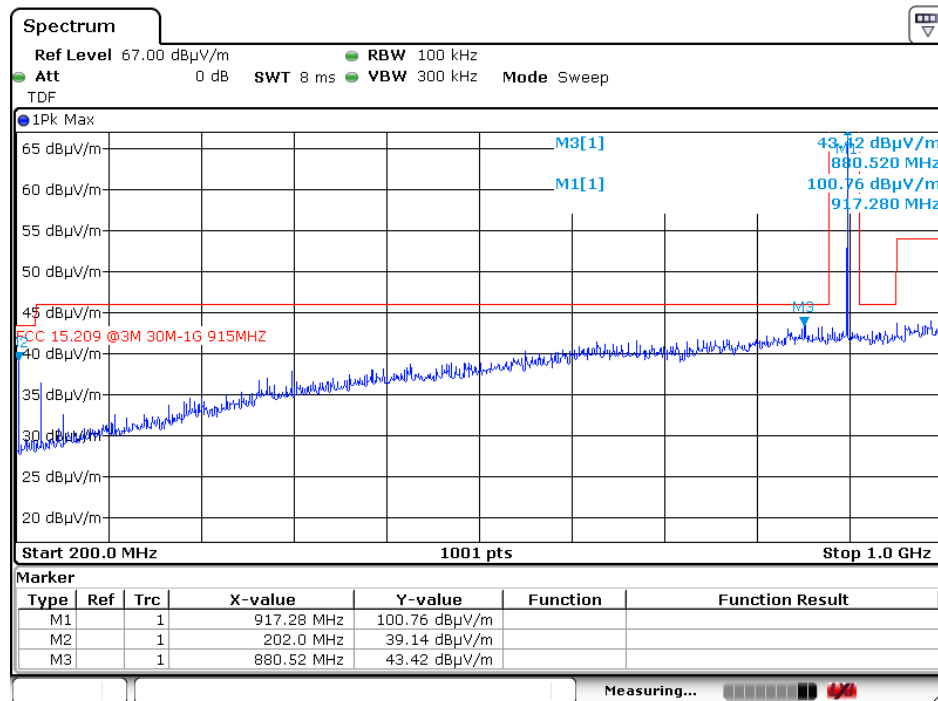


Radiated Emissions, 200 - 1000 MHz, VP, Ch. 50, Ant. 1, PK scan



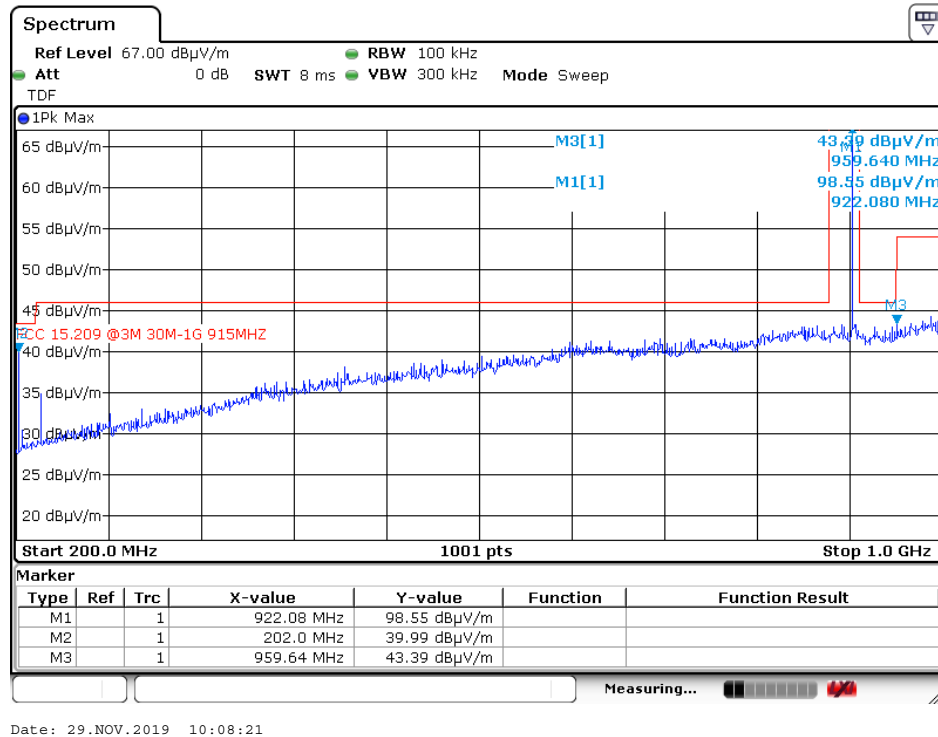
Date: 29.NOV.2019 10:04:27

Radiated Emissions, 200 - 1000 MHz, HP, Ch. 1, Ant. 2, PK scan

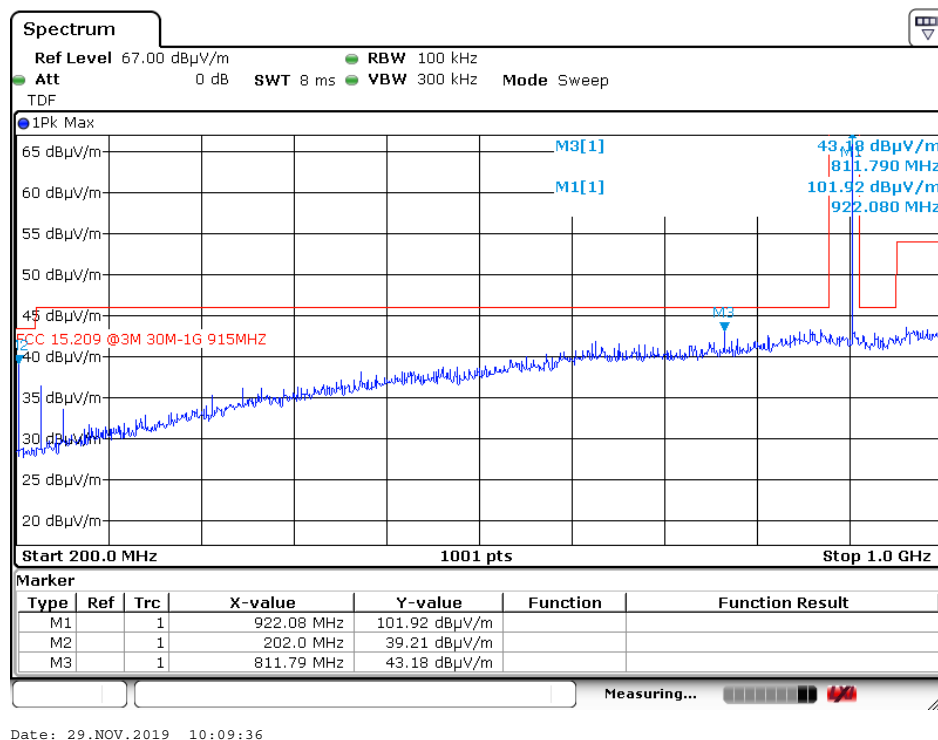


Date: 29.NOV.2019 09:54:01

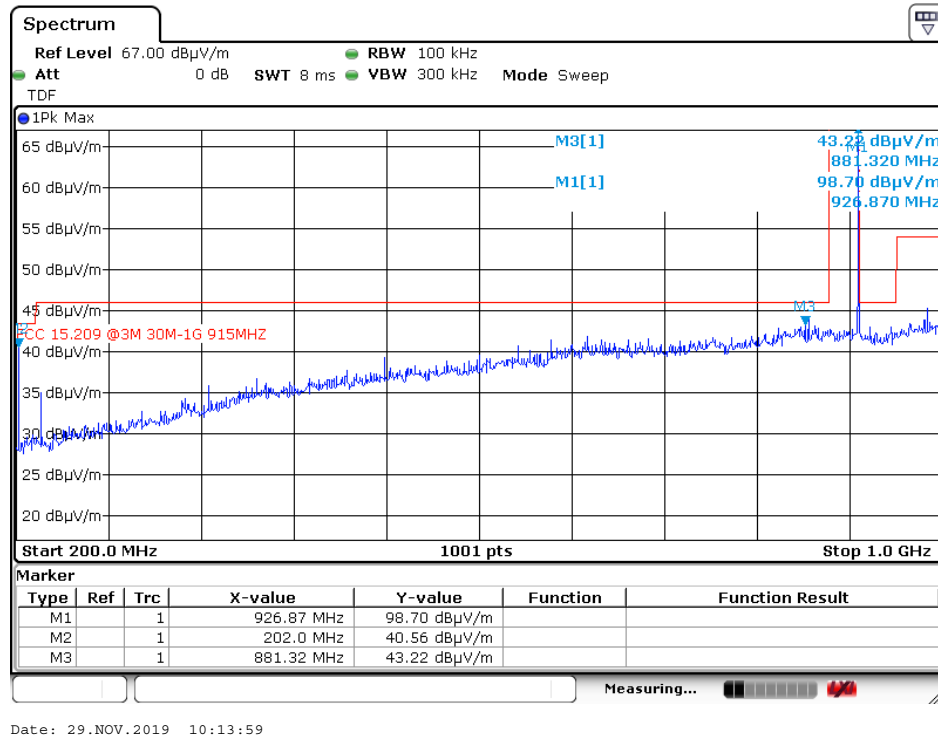
Radiated Emissions, 200 - 1000 MHz, VP, Ch. 1, Ant. 2, PK scan



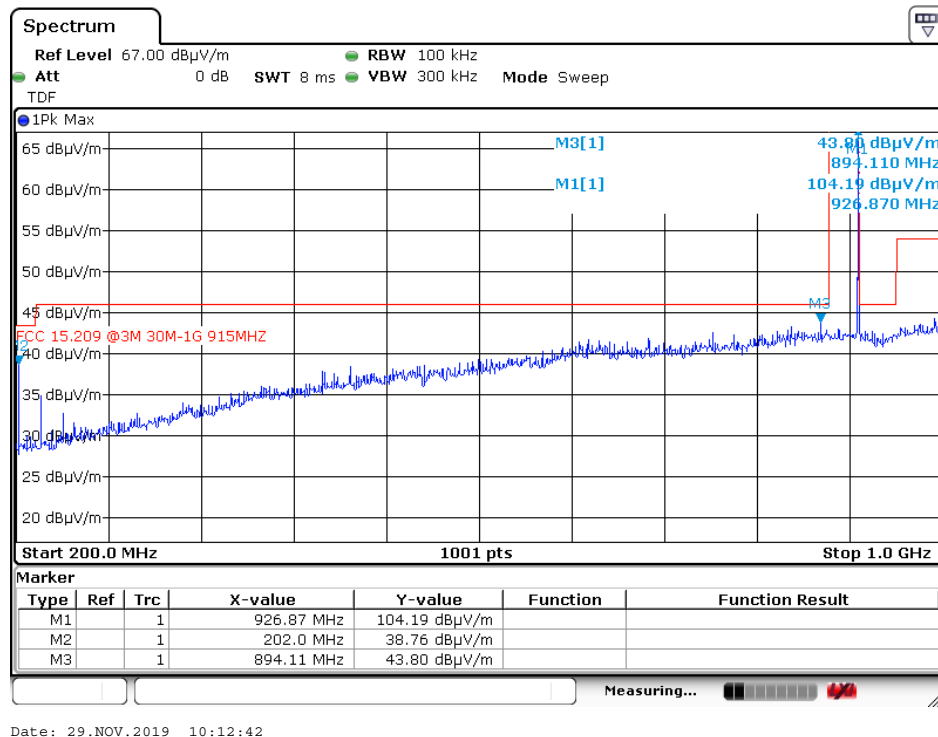
Radiated Emissions, 200 - 1000 MHz, HP, Ch. 25, Ant. 2, PK scan



Radiated Emissions, 200 - 1000 MHz, VP, Ch. 25, Ant. 2, PK scan



Radiated Emissions, 200 - 1000 MHz, HP, Ch. 50, Ant. 2, PK scan



Radiated Emissions, 200 - 1000 MHz, VP, Ch. 50, Ant. 2, PK scan

Radiated Emissions, 1-10 GHz

Measuring distance: 3m (1 – 10 GHz)

A pre-scan was performed above 10 GHz and no spurious emissions were detected.

Measurement Data:

Measured Frequency (GHz)	Carrier Frequency (MHz)	Antenna	Measured Emission Peak (dBμV/m)	Average (dBμV/m)	PK Margin (dB)	AV Margin (dB)
1.83	917.1	2	66.28	46.28	7.72	7.72
1.84	921.9	2	67.06	47.06	6.94	6.94
1.85	926.9	2	58.63	38.63	15.37	15.37
2.75	917.1	1	73.46	53.46	0.54	0.54
2.75	917.1	2	60.56	40.56	13.44	13.44
2.76	921.9	1	61.55	41.55	12.45	12.45
2.76	921.9	2	60.92	40.92	13.08	13.08
2.78	926.9	1	70.19	50.19	3.81	3.81
2.78	926.9	2	64.28	44.28	9.72	9.72
4.59	917.1	1	52.12	-	>20	-
4.59	917.1	2	61.20	41.20	12.80	12.80
4.61	921.9	1	51.74	-	>20	-
4.61	921.9	2	60.35	40.35	13.65	13.65
4.63	926.9	1	51.31	-	>20	-
4.63	926.9	2	57.22	37.22	16.78	16.78
Other freqs.	-	-	<54	-	>20	-

Average Values are calculated from Peak Values by Duty Cycle Correction Factor.

Tested according to KDB 558074 D01 DTS Meas Guidance v03r05, Section 12.2.5.2

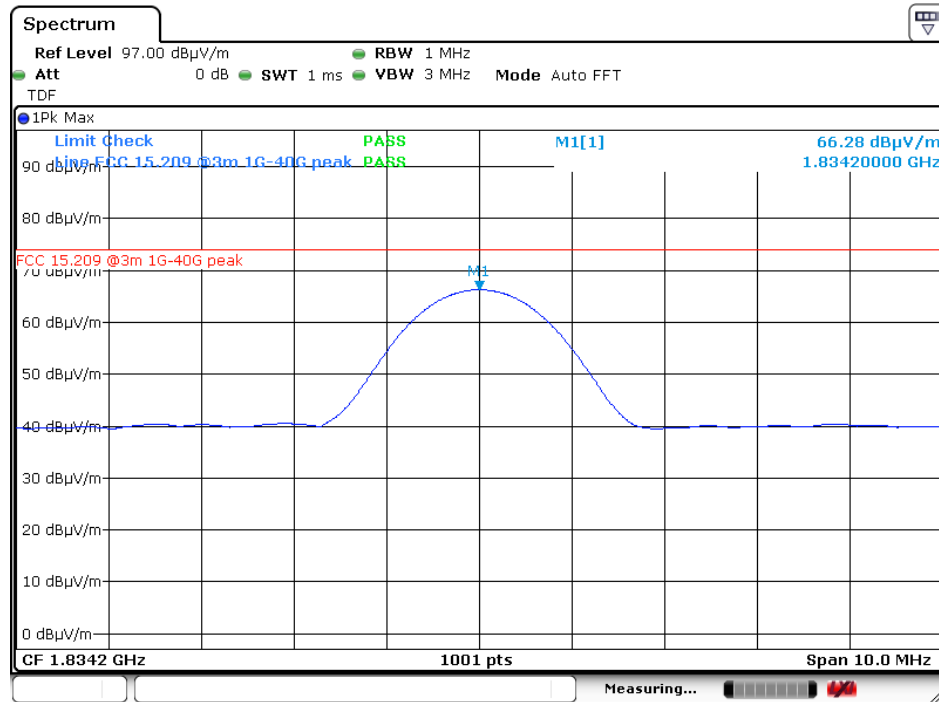
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

See plots.

No harmonics detected in the frequency range 10 – 25 GHz

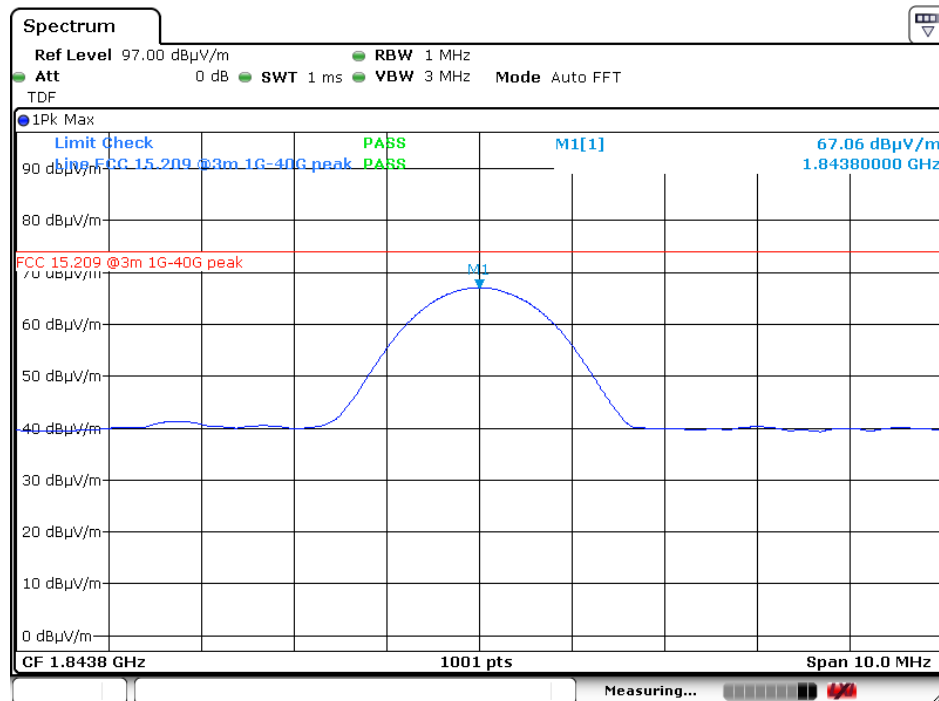
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	AV (dBμV/m)	PK (dBμV/m)
Above 1 GHz	54	74



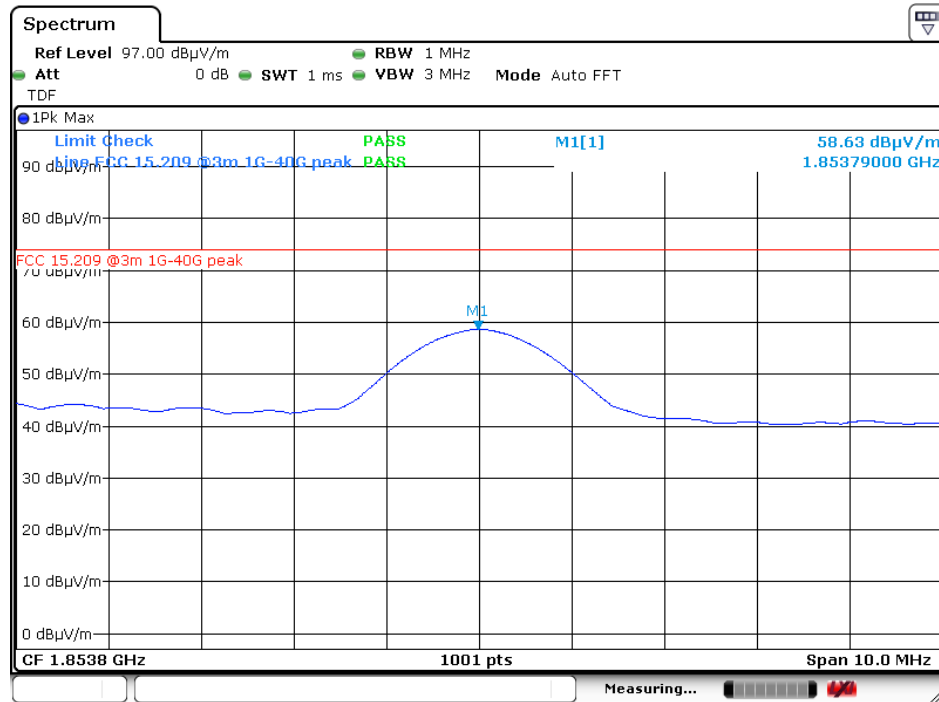
Date: 20.JAN.2020 09:53:02

Radiated Emissions, 1.83GHz, Ch. 1, Ant. 2, VP, Peak



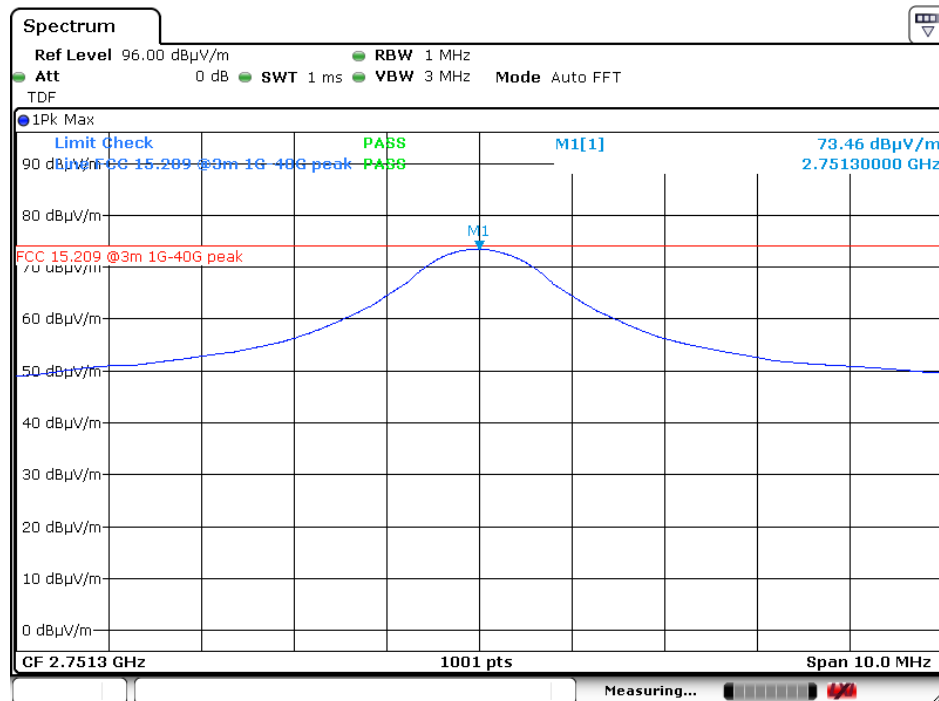
Date: 20.JAN.2020 09:57:04

Radiated Emissions, 1.84GHz, Ch. 25, Ant. 2, VP, Peak



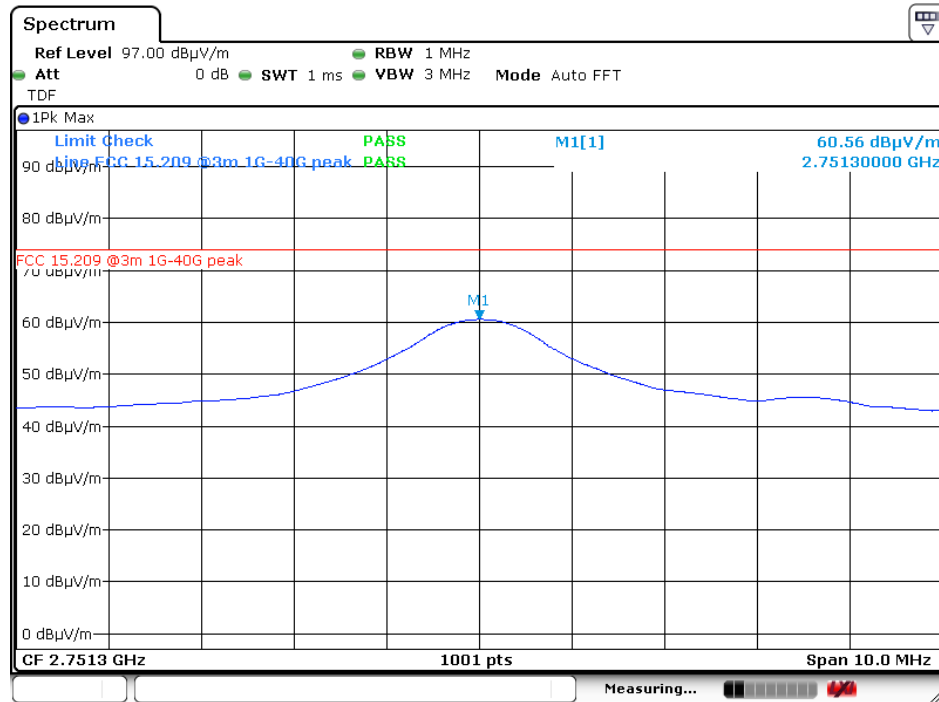
Date: 20.JAN.2020 09:12:16

Radiated Emissions, 1.85GHz, Ch. 50, Ant. 2, VP, Peak



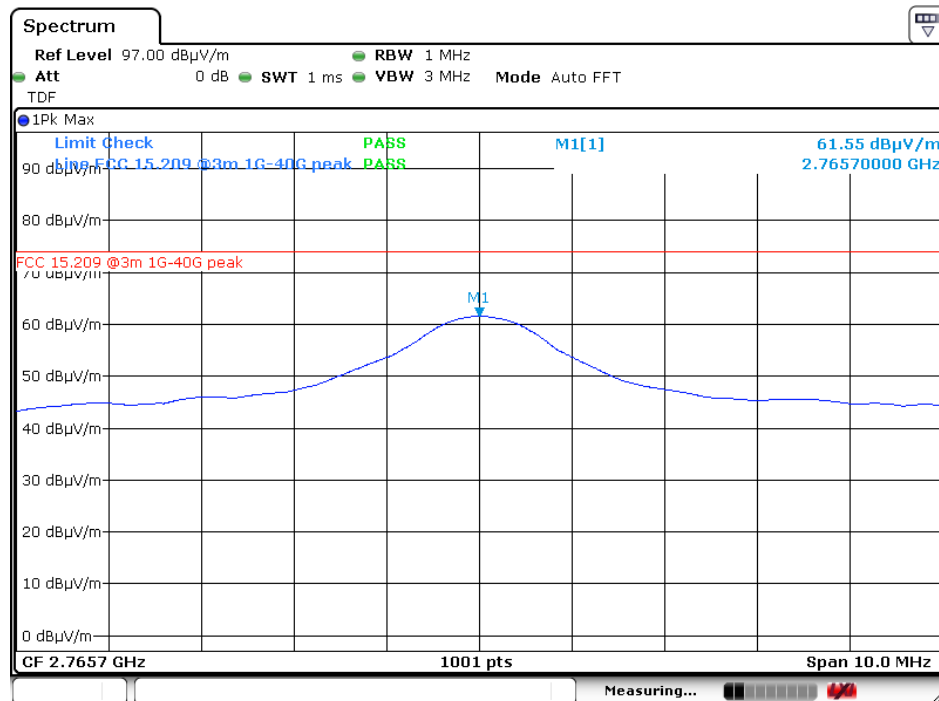
Date: 29.NOV.2019 14:23:07

Radiated Emissions, 2.75GHz, Ch. 1, Ant. 1, VP, Peak



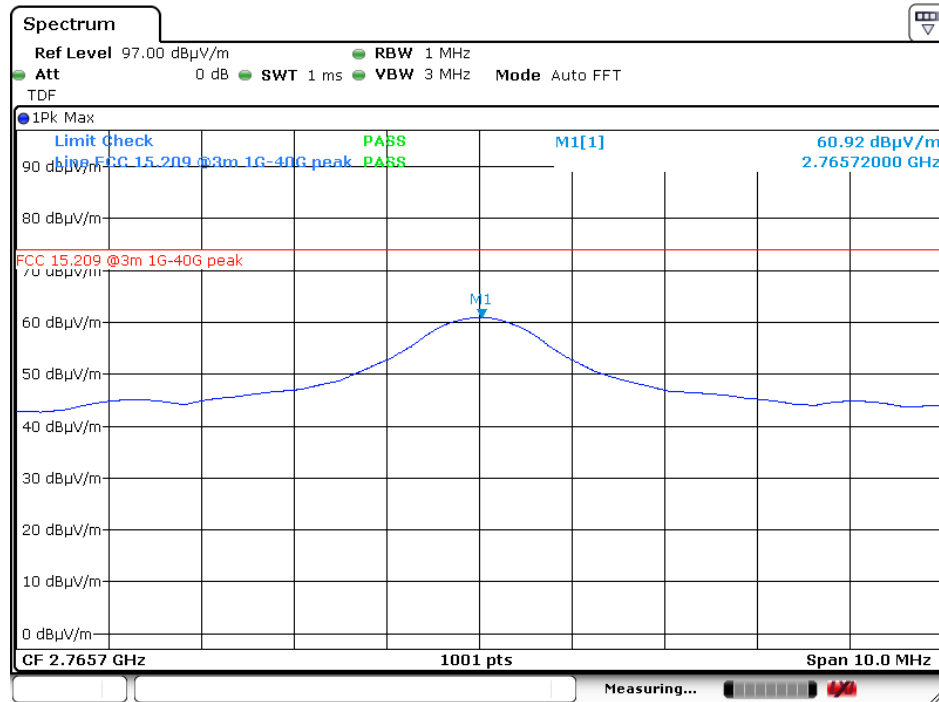
Date: 17.JAN.2020 14:39:26

Radiated Emissions, 2.75GHz, Ch. 1, Ant. 2, HP, Peak



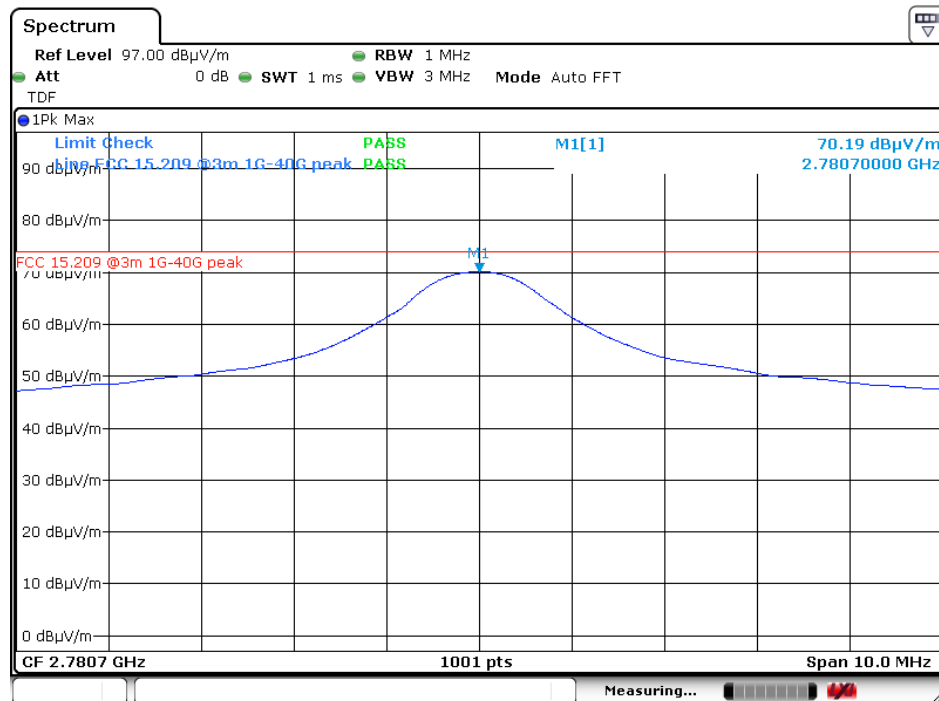
Date: 29.NOV.2019 14:44:55

Radiated Emissions, 2.76GHz, Ch. 25, Ant. 1, HP, Peak



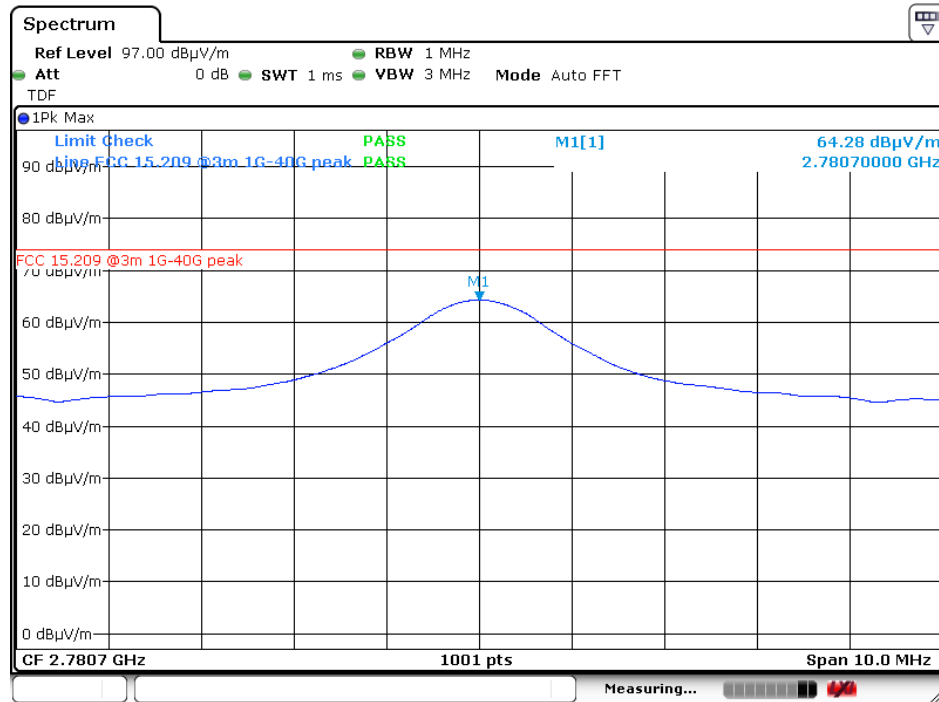
Date: 17.JAN.2020 15:07:06

Radiated Emissions, 2.76GHz, Ch. 25, Ant. 2, HP, Peak



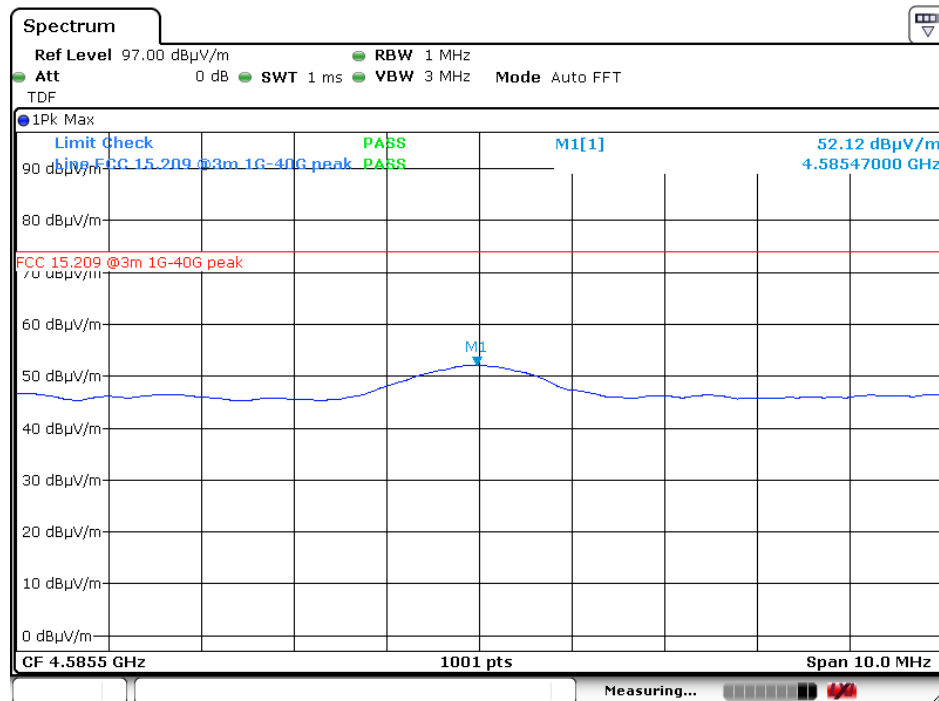
Date: 17.JAN.2020 14:14:26

Radiated Emissions, 2.78GHz, Ch. 50, Ant. 1, HP, Peak



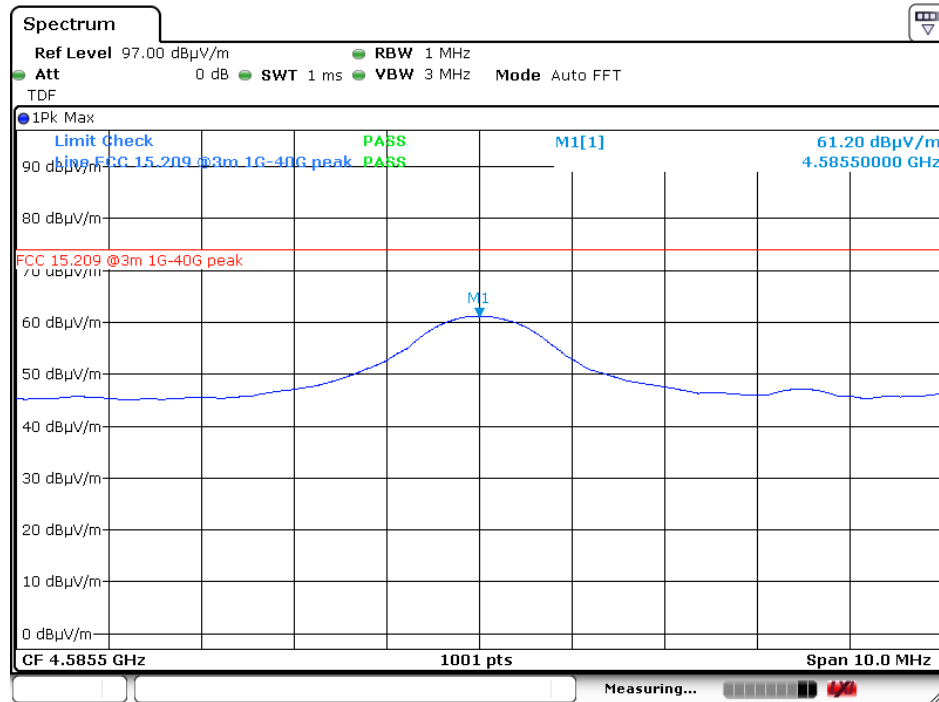
Date: 20.JAN.2020 09:19:07

Radiated Emissions, 2.78GHz, Ch. 50, Ant. 2, HP, Peak



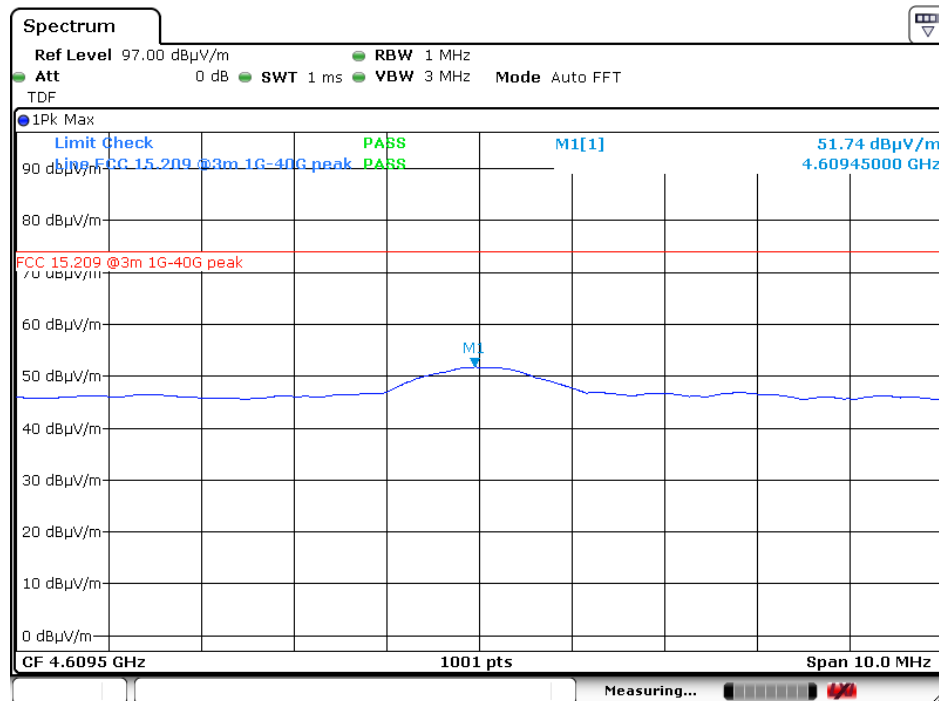
Date: 29.NOV.2019 14:37:45

Radiated Emissions, 4.59GHz, Ch. 1, Ant. 1, HP, Peak



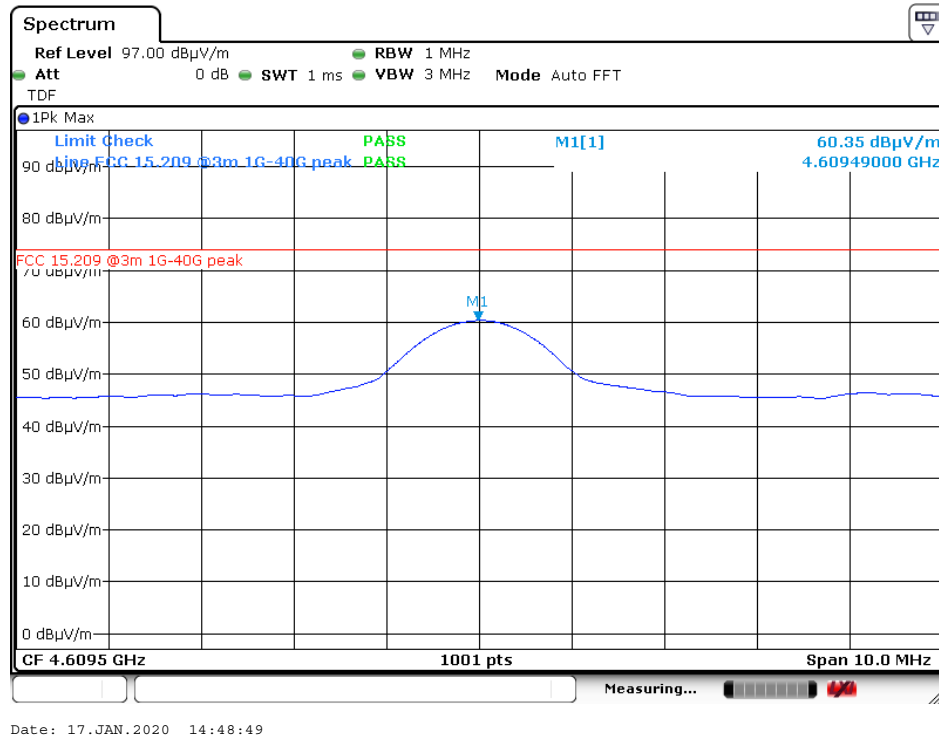
Date: 17.JAN.2020 14:44:48

Radiated Emissions, 4.59GHz, Ch. 1, Ant. 2, VP, Peak

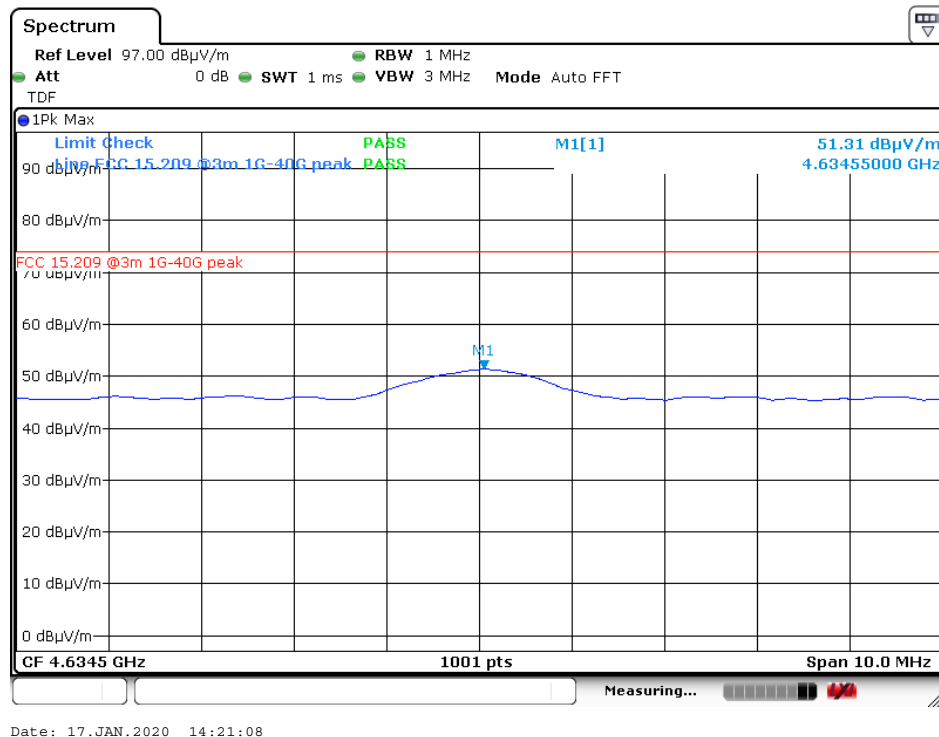


Date: 29.NOV.2019 14:52:22

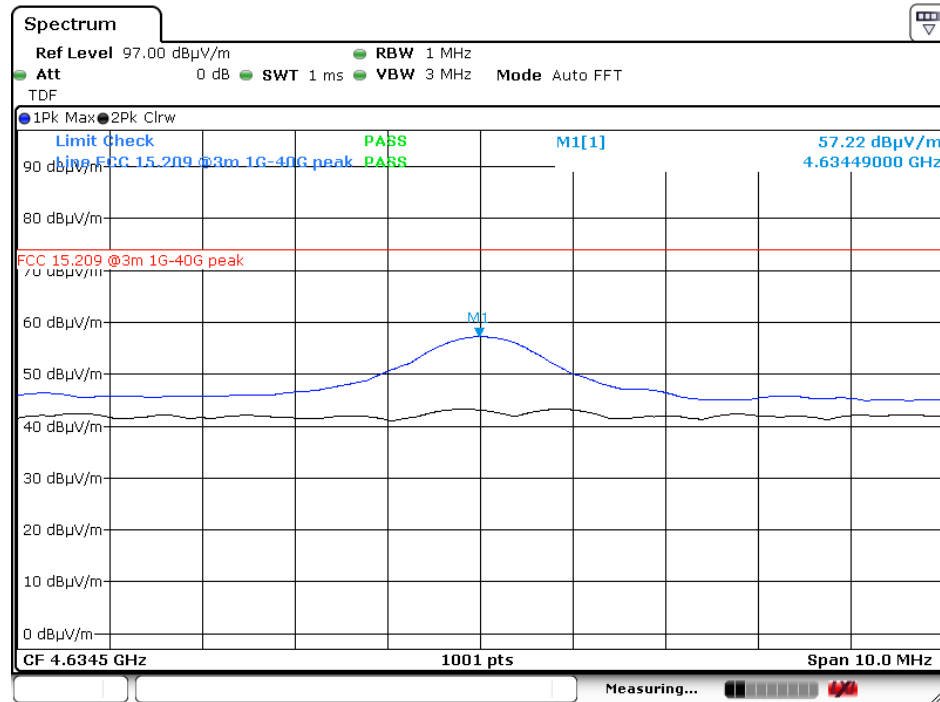
Radiated Emissions, 4.61GHz, Ch. 25, Ant. 1, HP, Peak



Radiated Emissions, 4.61GHz, Ch. 25, Ant. 2, VP, Peak

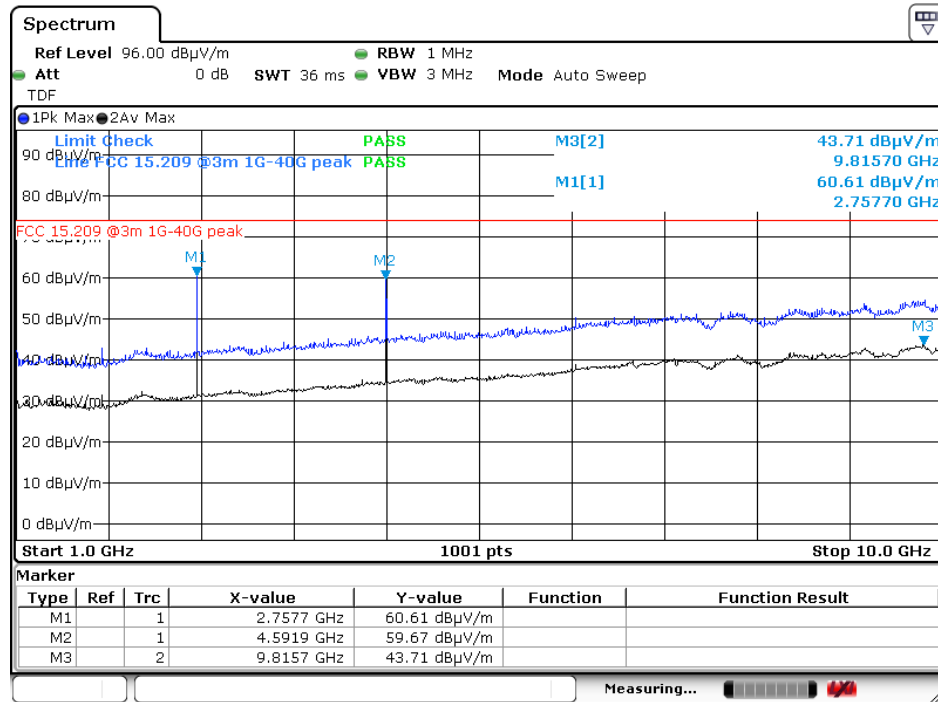


Radiated Emissions, 4.63GHz, Ch. 50, Ant. 1, HP, Peak



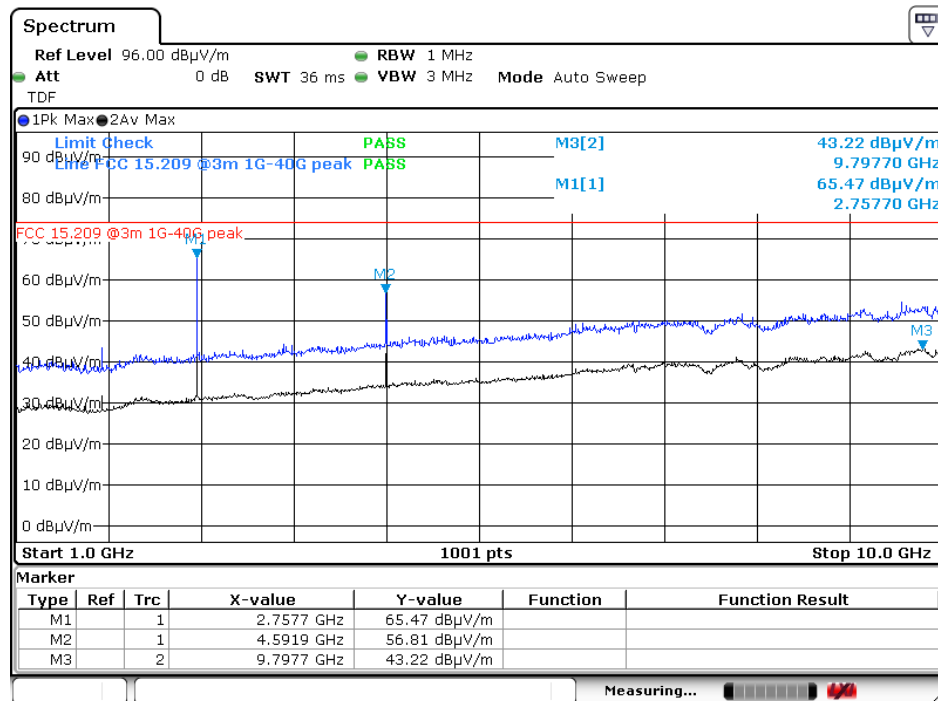
Date: 20.JAN.2020 09:23:57

Radiated Emissions, 4.63GHz, Ch. 50, Ant. 2, VP, Peak



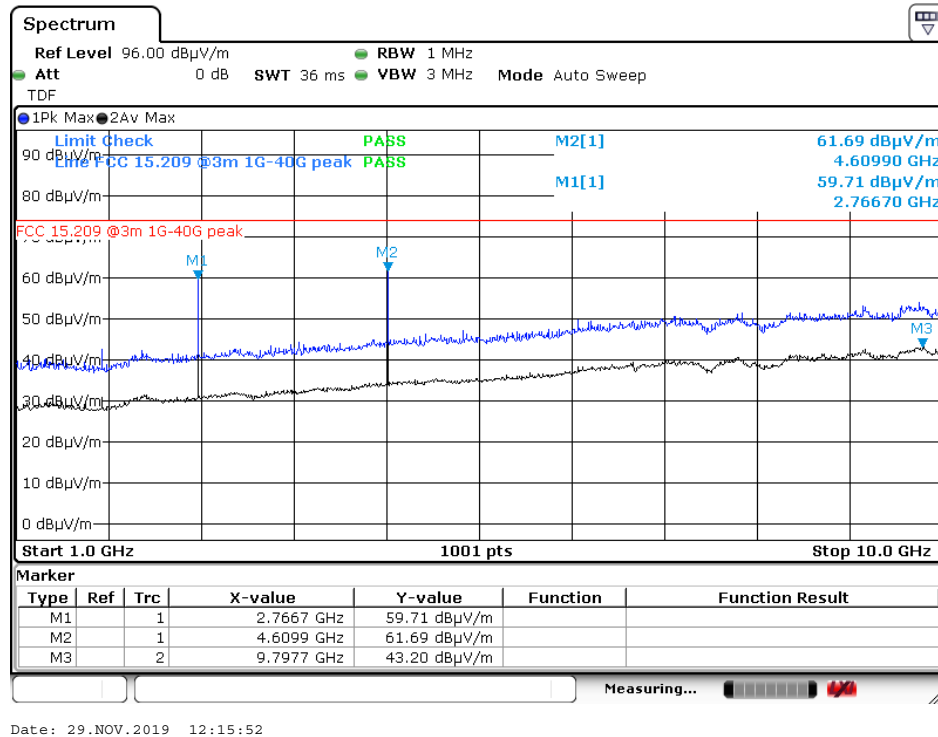
Date: 29.NOV.2019 12:09:02

Radiated Emissions, 1GHz – 10GHz, Ch. 1, Ant. 1, VP

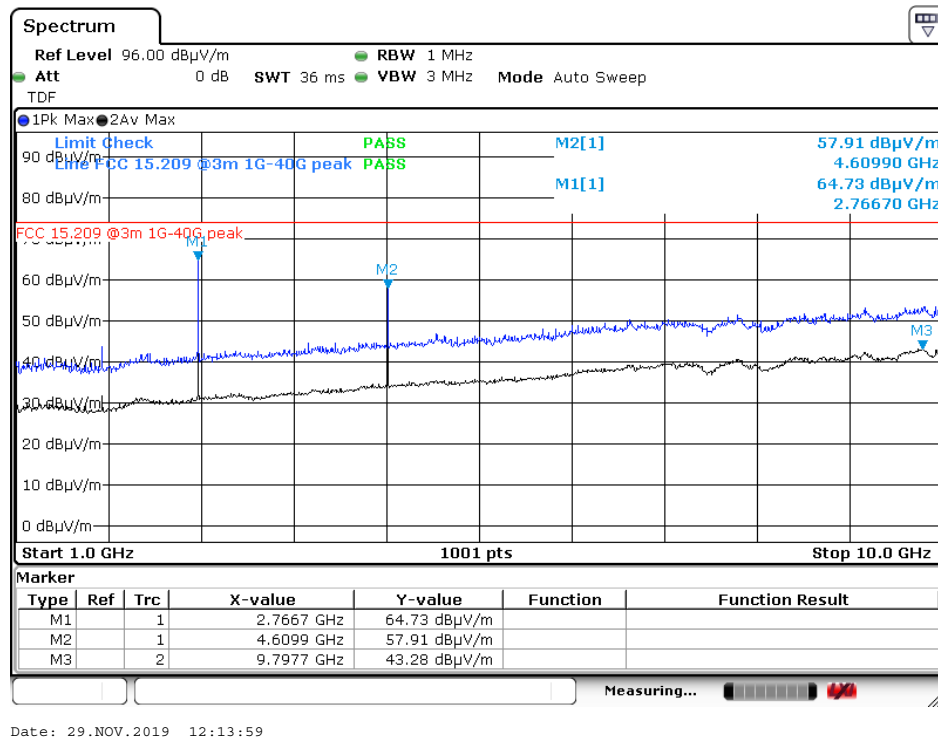


Date: 29.NOV.2019 12:11:08

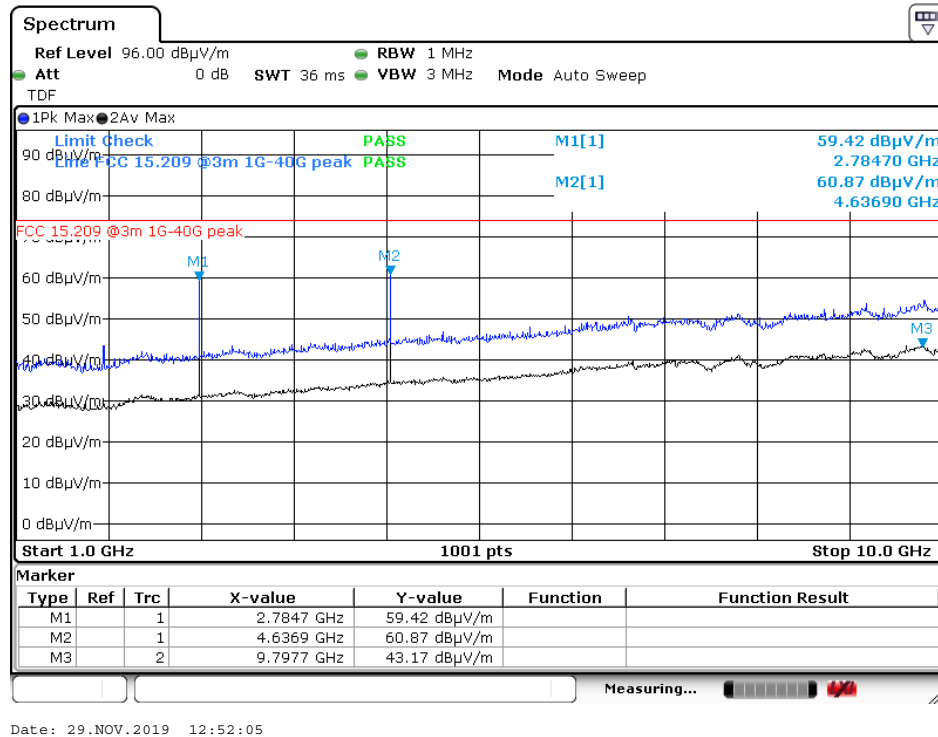
Radiated Emissions, 1GHz – 10GHz, Ch. 1, Ant. 1, HP



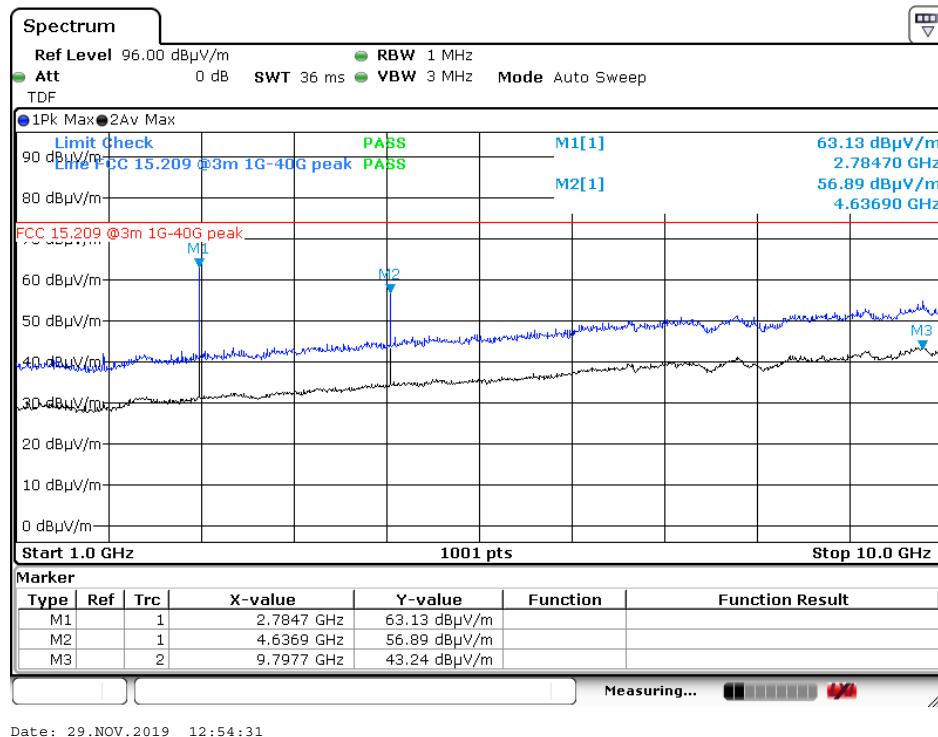
Radiated Emissions, 1GHz – 10GHz, Ch. 25, Ant. 1, VP



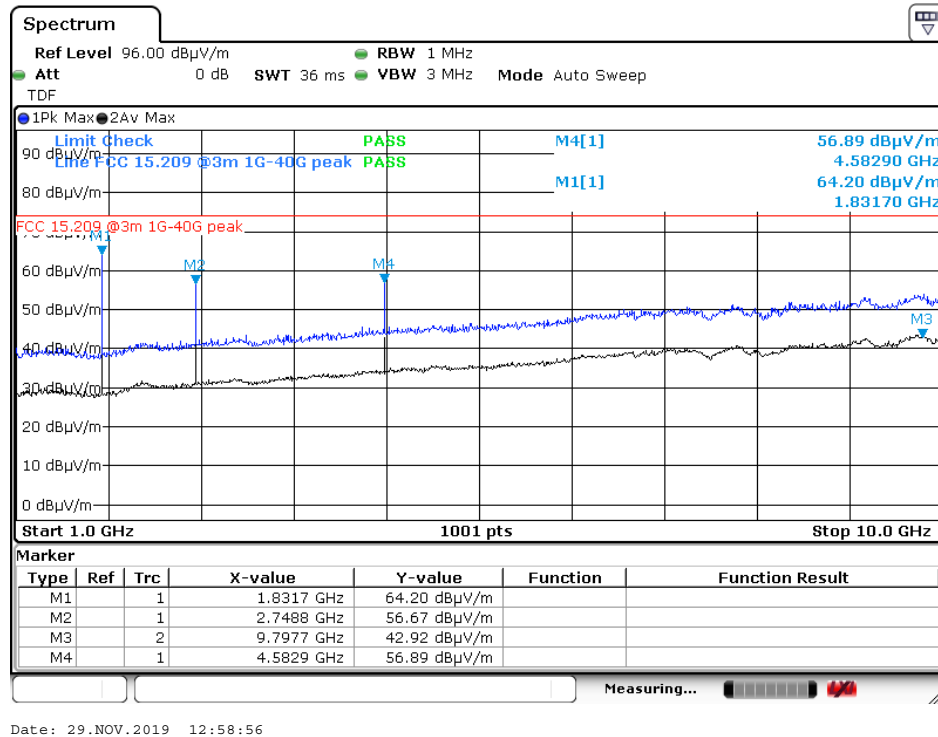
Radiated Emissions, 1GHz – 10GHz, Ch. 25, Ant. 1, HP



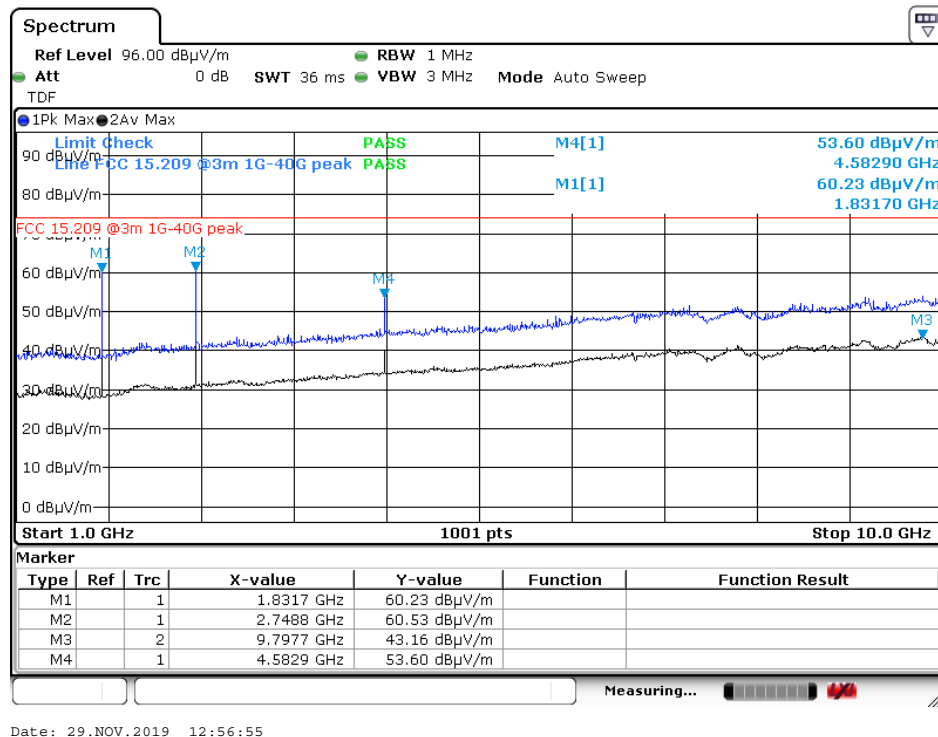
Radiated Emissions, 1GHz – 10GHz, Ch. 50, Ant. 1, VP



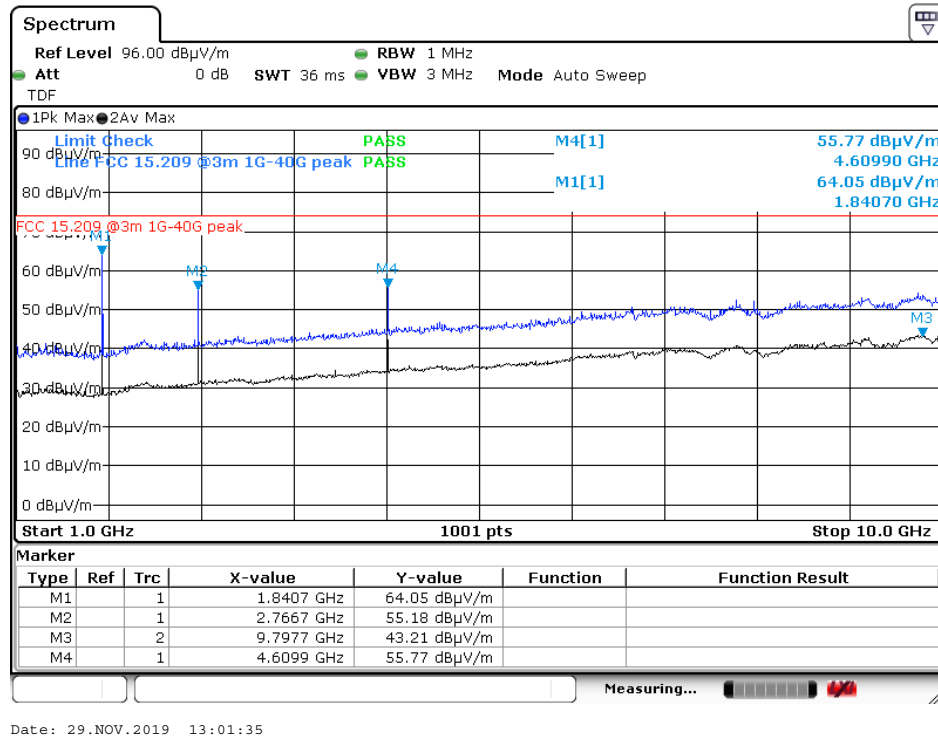
Radiated Emissions, 1GHz – 10GHz, Ch. 50, Ant. 1, HP



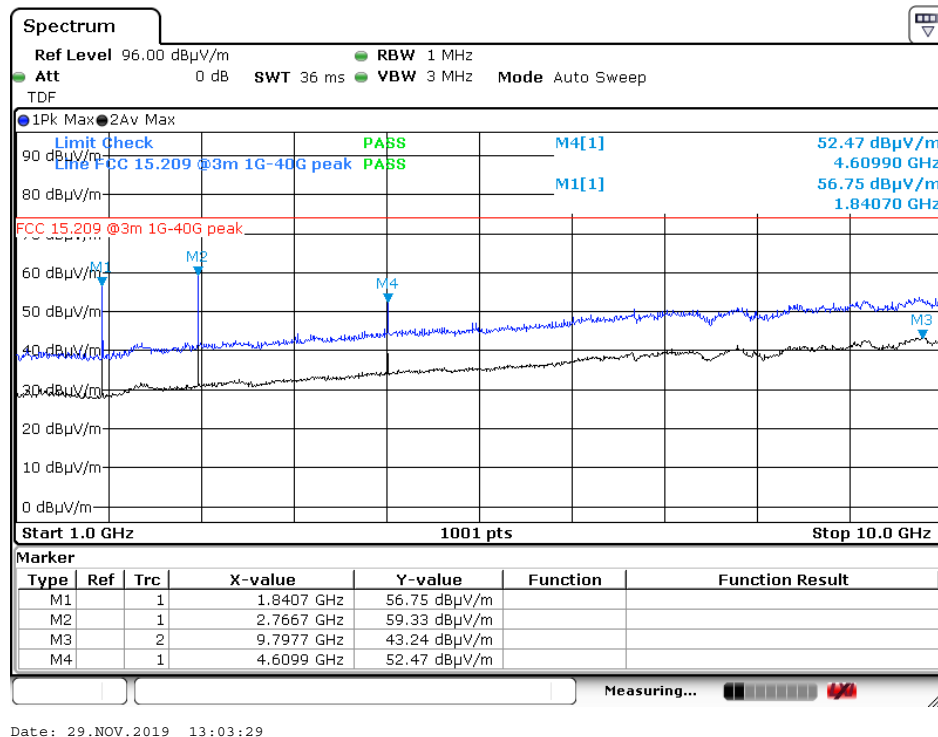
Radiated Emissions, 1GHz – 10GHz, Ch. 1, Ant. 2, VP



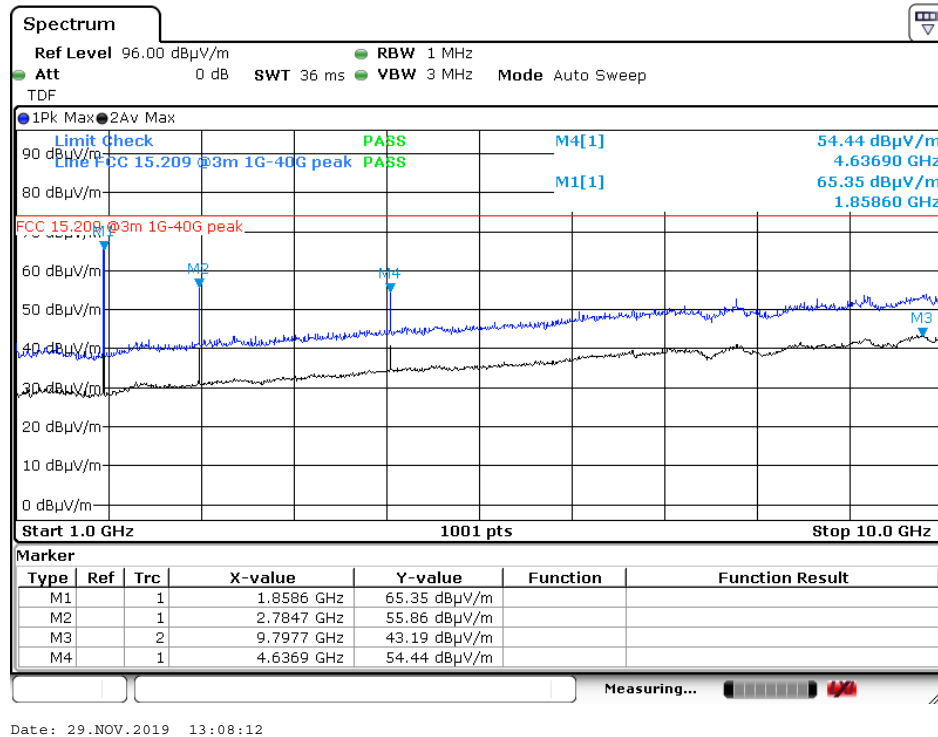
Radiated Emissions, 1GHz – 10GHz, Ch. 1, Ant. 2, HP



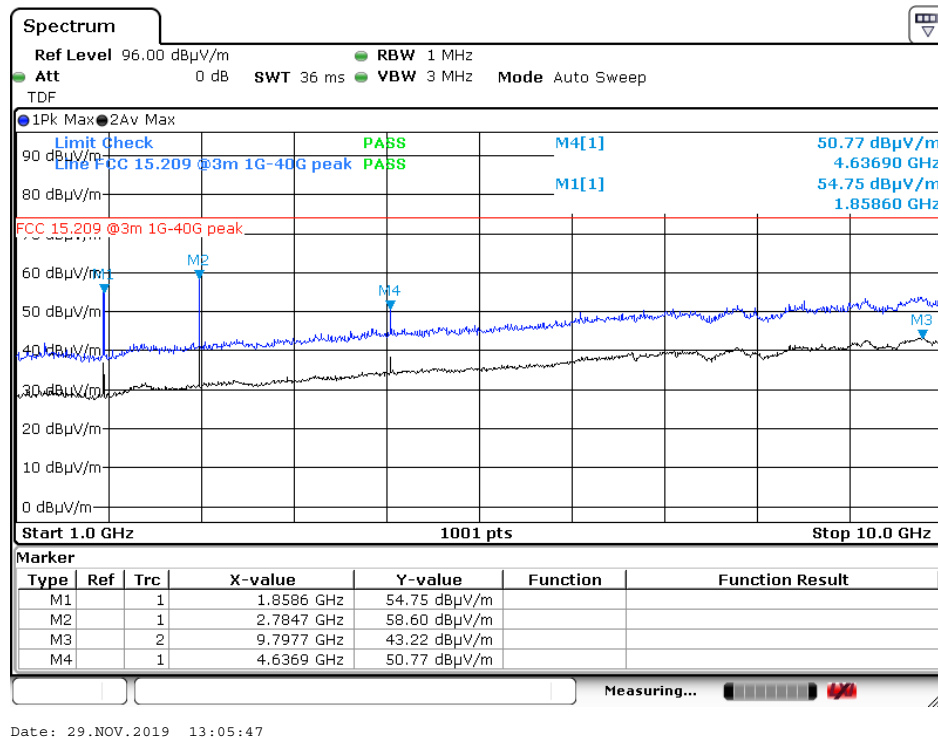
Radiated Emissions, 1GHz – 10GHz, Ch. 25, Ant. 2, VP



Radiated Emissions, 1GHz – 10GHz, Ch. 25, Ant. 2, HP



Radiated Emissions, 1GHz – 10GHz, Ch. 50, Ant. 2, VP



Radiated Emissions, 1GHz – 10GHz, Ch. 50, Ant. 2, HP

4 MEASUREMENT UNCERTAINTY

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.8 dB
Power Spectral Density		±0.8 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.8 dB
	> 3.6 GHz	±1.2 dB
Spurious Emissions, Radiated	< 200 MHz	±4.77 dB
	200 MHz - 1 GHz	±5.02 dB
	1 GHz – 18 GHz	±4.94 dB
	> 18 GHz	±5.91 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		±3.58 %
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

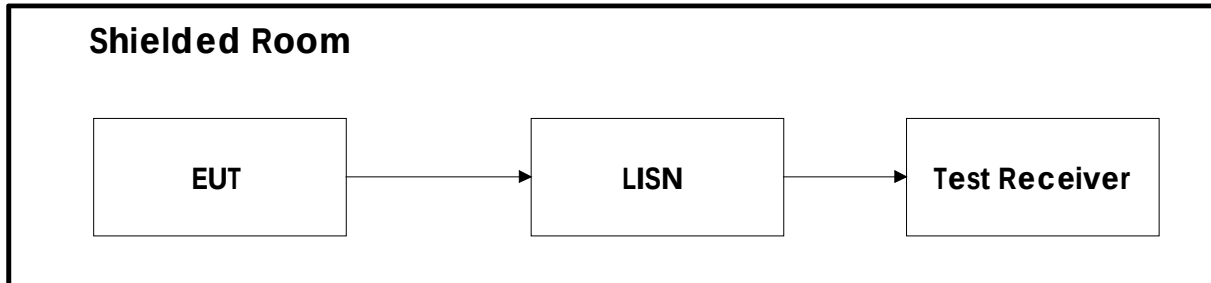
5 LIST OF TEST EQUIPMENT

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.

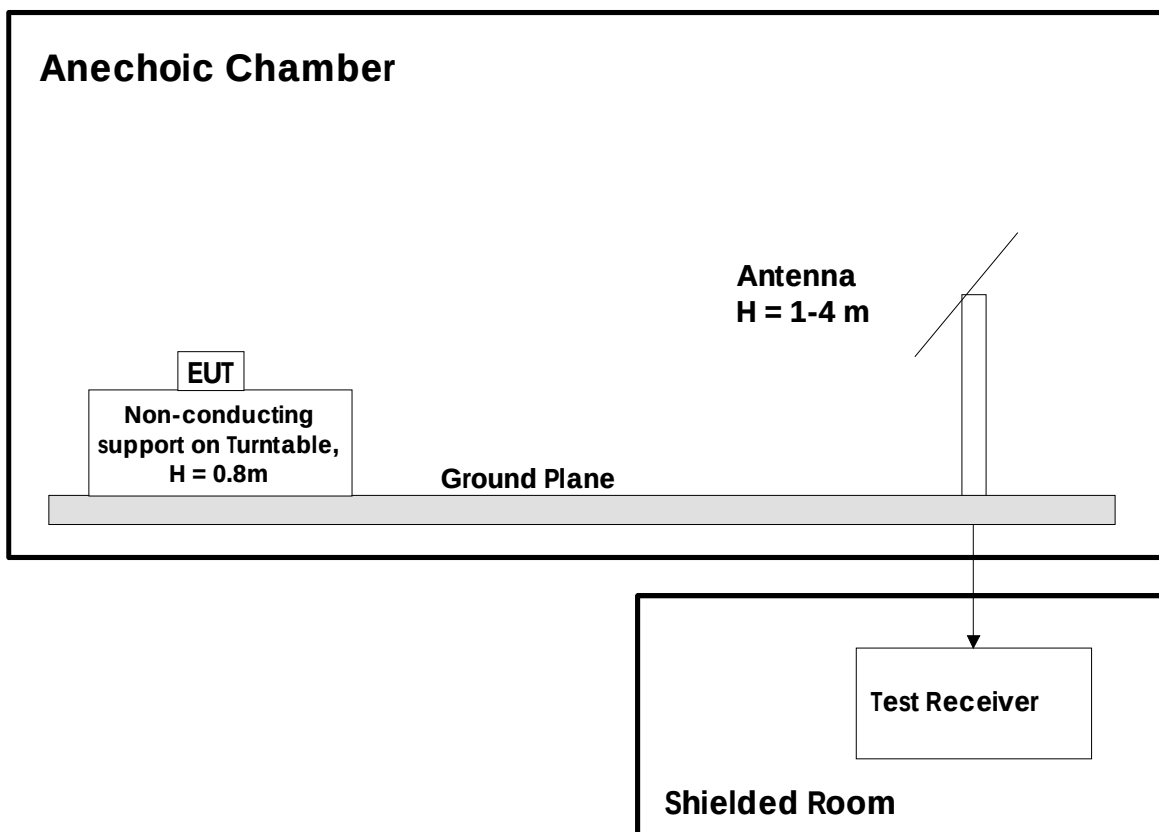
Inv.-Nr.	Instrument/ ancillary	Manufacturer	Type	Serial number	Cal. Date	Cal. Due
1-0037	Artificial mains network, 3ph	Rohde & Schwarz	ESH2-Z5	882394/019	2019-09	2020-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	888945/007	2017-07	2020-07
1-0054	Pulse limiter	Rohde & Schwarz	ESH3-Z2	3MSE/0099	2019-09	2020-09
1-0055	LogPer antenna	Rohde & Schwarz	HL223	826517/014	2017-07	2020-07
1-0072	Artificial mains network, 1ph	Rohde & Schwarz	ESH3-Z5	840062/001	2019-09	2020-09
1-0080	Turntable	H. Deisel	DS 420	1361114	N / A	N / A
1-0200	Trilog antenna	Schwarzbeck	VULB 9163	VULB 9163-107	2019-02	2022-02
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	1124	2017-06	2020-06
1-0364	Antenna cable 2	Kabelwerk Eupen	CMS / RG 214-N/7	none	2019-09	2022-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	100203	2019-09	2020-09
1-0611	Spectrum analyzer	Rohde & Schwarz	FSV 40	100898	2019-11	2020-11
1-0614	Log.-per. antenna	Schwarzbeck	STLP 9148	STLP 9148-133	2019-08	2022-08
1-0615	Pre amplifier	Schwarzbeck	BBV-9718	BBV 9718-191	2019-09	2020-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	70168/6	2019-09	2022-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	70619/6	2019-09	2022-09
1-0624	EMI-Software Radimation	DARE	Radimation	not applicable	N / A	N / A
1-0770	Horn antenna	Schwarzbeck	BBHA 9170	BBHA 9170-477	2018-06	2021-06
1-0771	Horn antenna	Schwarzbeck	BBHA 9170	BBHA 9170-476	2018-03	2021-03
1-0772	Horn antenna	Schwarzbeck	BBHA 9120D	BBHA 9120D-972	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck	BBV 9721	BBV 9721-001	2019-09	2020-09
1-0782	Antenna cable	Huber & Suhner	FB142A1060002020	75193-01	2017-10	2020-10
1-0794	Coaxial cable	Rosenberger	FB142A0010002020	65627-01	2017-10	2020-10
1-0806	Controller	Innco	CO 3000	821/34571114/L	N / A	N / A
1-0807	Antenna mast	Innco	MA-400-XPET	4681114	N / A	N / A
1-0870	10 dB Attenuator	mini circuits	BW-N10W5+	1429	2019-09	2022-09
1-0871	10 dB Attenuator	mini circuits	BW-N10W5+	1414	2019-09	2022-09
1-0925	Coaxial cable	HARBOUR	RG316 MIL	#003	2019-09	2022-09
1-0927	Coaxial cable	HARBOUR	RG316 MIL	#005	2019-09	2022-09
1-0993	6 dB Attenuator	mini circuits	BW-N6W5+	1725	2017-10	2020-10
1-0994	3 dB Attenuator	mini circuits	BW-N3W5+	1734	2017-10	2020-10
1-0995	6 dB Attenuator	mini circuits	UNAT-6+	15542	2017-09	2021-09
1-1012	Coaxial cable	Rosenberger	LA2-018-2000	010-1964471 0001	2018-09	2021-09
1-1037	Coaxial cable	Schwarzbeck	AK 9515H	AK 9515H #91	2018-09	2021-09

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

Revision history

Version	Date	Comment	Sign
00	2020-01-22	First version	FH