




FCC TEST REPORT / IC TEST REPORT

Product	Remote control receiver	
Name and address of the applicant	Multiplex Modellsport GmbH & Co. KG Westliche Gewerbestr. 1 D – 75015 Bretten-Gölshausen (Germany)	
Name and address of the manufacturer	Multiplex Modellsport GmbH & Co. KG Westliche Gewerbestr. 1 D – 75015 Bretten-Gölshausen (Germany)	
Model	WSRX2.4GHz	
Rating	6.4Vdc	
Trademark	MULTIPLEX	
Serial number	/	
Additional information	2.4 GHz FHSS Transceiver.	
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	347034-01	
Test set-up photo document	347034-01TRFFCC Annex - Test set-up photos	
Tested in period	2018-03-28 - 2019-04-16	
Issue date	2019-04-25	
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
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Prepared by [Dipl.-Ing. M. Korny] </div> <div style="text-align: center;">  Approved by [Dipl.-Ing. P. Lukas] </div> </div>		

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1 INFORMATION

1.1 Test Item

Name :	Multiplex
FCC ID :	2APABWSRX
Industry Canada ID :	23810-WSRX
Model/version :	WSRX2.4GHz
Frequency Range :	2402 - 2479 MHz
Tunable Bands :	None
Number of Channels:	39
Operating Modes :	Transceiver
Type of Modulation :	FHSS
User Frequency Adjustment :	None
Output Power (conducted) at antenna port 1:	27.99 mW
Output Power (conducted) at antenna port 2:	29.44 mW
Type of Power Supply :	6.4 Vdc (LiFe-Battery)
Antenna Connector :	U.FL
Antenna Diversity Supported :	Yes
Desktop Charger :	No

Description of Test Item

The EUT is a remote-control receiver for model planes. The receiver is controlled by the main microcontroller. Two wired antennas are utilized. The main microcontroller decides which antenna is used. Only one antenna is transmitting at the same time. The device will communicate with the transmitter controlled by the user. Communication is bi-directional.

Theory of Operation

Operational description of the M-LINK „Spectrum Sharing Mechanism“

M-LINK is a bidirectional FHSS-system hopping over 39 channels. The hopping sequence is generated during production by a random generator, so in every sequence each hopping frequency appears uniquely. The hopping channel separation is 2MHz. The EUT is using only 15 channels (out of 39) for transmitting and 39 for receiving.

1.2 Normal test conditions

Temperature: 20 - 26 °C
Relative humidity: 45 - 55 %
Normal test voltage: 6.4 Vdc (LiFe-Battery)

The values are the limit registered during the test period. All tests were performed with fully charged batteries.

1.3 Test Engineer(s)

Markus Korny

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: U.FL

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 output level is set to maximum (Power Level 5) in the software.

The radiated measurements are tested on three axes.

Fully charged batteries are used.

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.

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)	N/A ²
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)	8.8 (RSS-GEN)	N/A ²
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
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	Complies
Occupied Bandwidth / 99% OCC-BW	N/A	6.7 (RSS-GEN)	-
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	N/A ¹
Peak Power Output	15.247(b)(1)	5.4 (RSS-247)	Complies
Power Spectral Density	15.247(e)	5.2 (2) (RSS-247)	N/A ¹
Spurious Emissions (Antenna Conducted)	15.247(d)	5.5 (RSS-247)	Complies
Spurious Emissions (Radiated)	15.247(d) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ Not applicable for FHSS equipment

² EUT is battery powered

- Only for information

3 TEST RESULTS

3.1 Channel Separation

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

Test Performed By: Markus Korny	Date of Test: 2018-07-27, 2019-04-02
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Test Results: **Complies**

Measurement Data:

Antenna port 1:

Channel Separation	2002 kHz
Nominal value for Channel Separation	2000 kHz
20 dB BW of hopping channel at 2403 MHz	1.1000 MHz
20 dB BW of hopping channel at 2440 MHz	1.1360 MHz
20 dB BW of hopping channel at 2479 MHz	1.1867 MHz

Fully charged battery is used

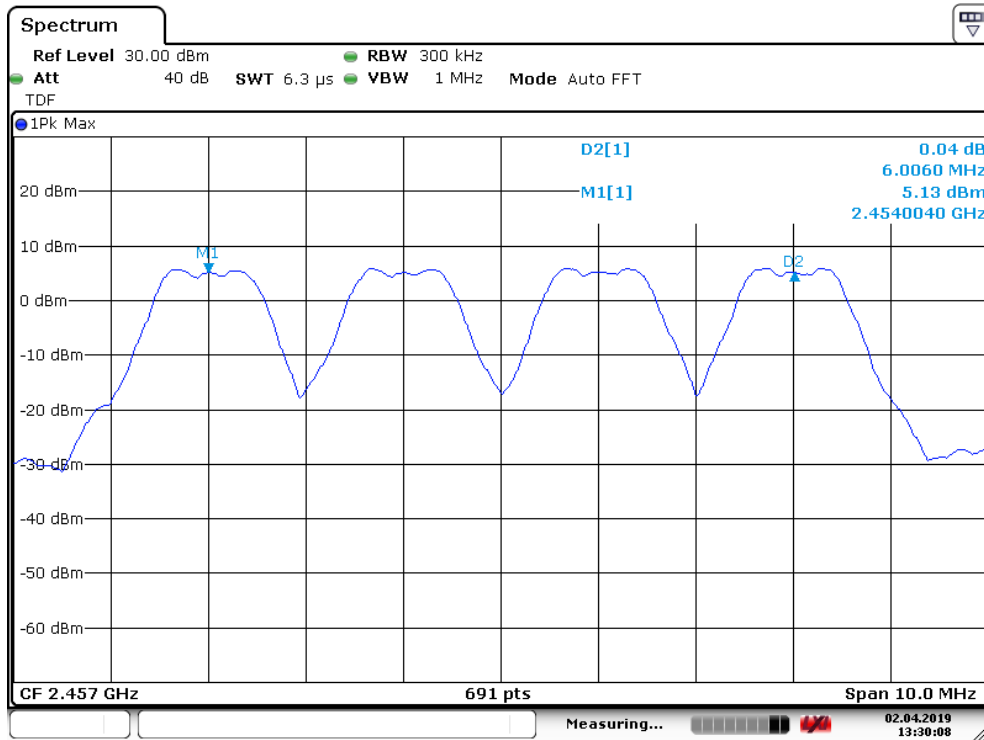
Antenna port 2:

Channel Separation	2002 kHz
Nominal value for Channel Separation	2000 kHz
20 dB BW of hopping channel at 2403 MHz	1.1071 MHz
20 dB BW of hopping channel at 2440 MHz	1.1505 MHz
20 dB BW of hopping channel at 2479 MHz	1.1650 MHz

Fully charged battery is used

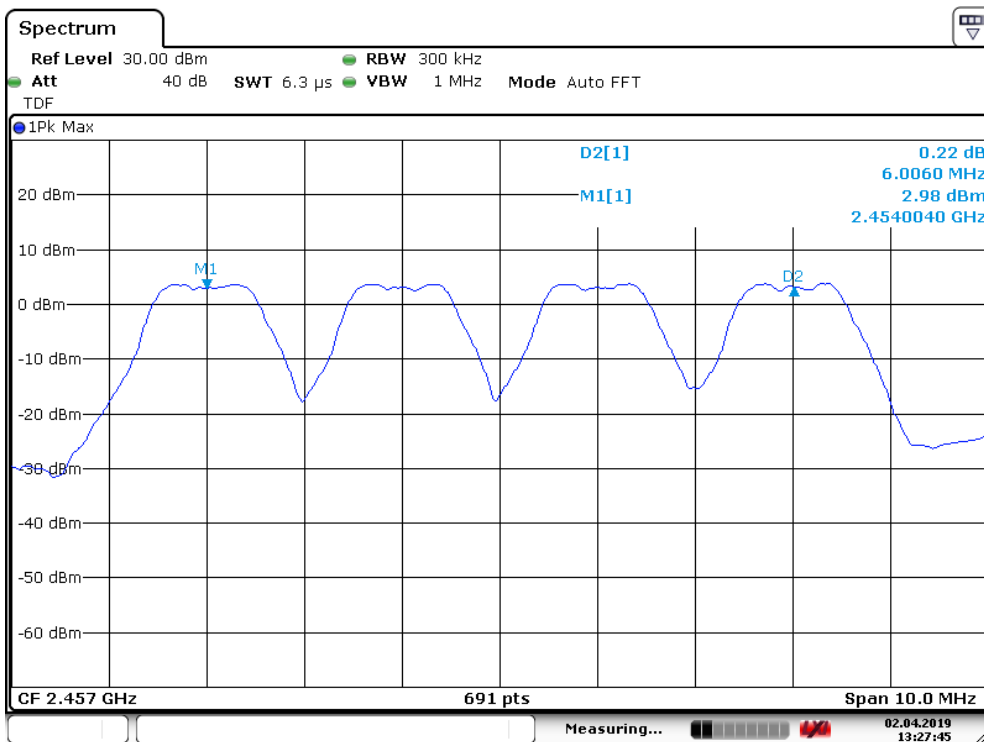
Requirements:

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.



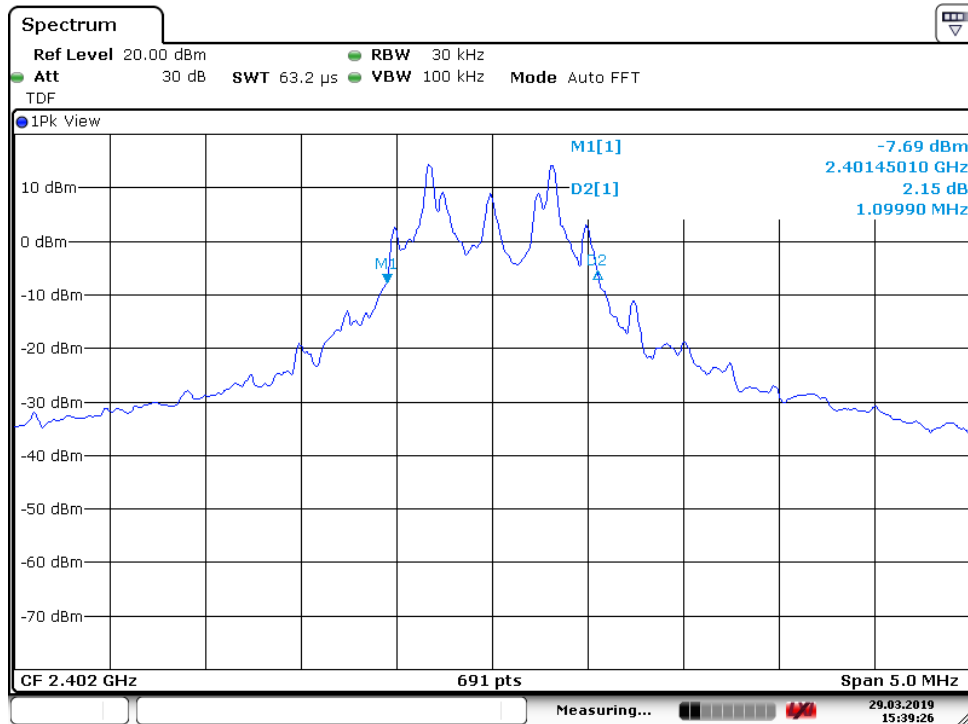
Date: 2.APR.2019 13:30:09

Channel Separation (antenna port 1)



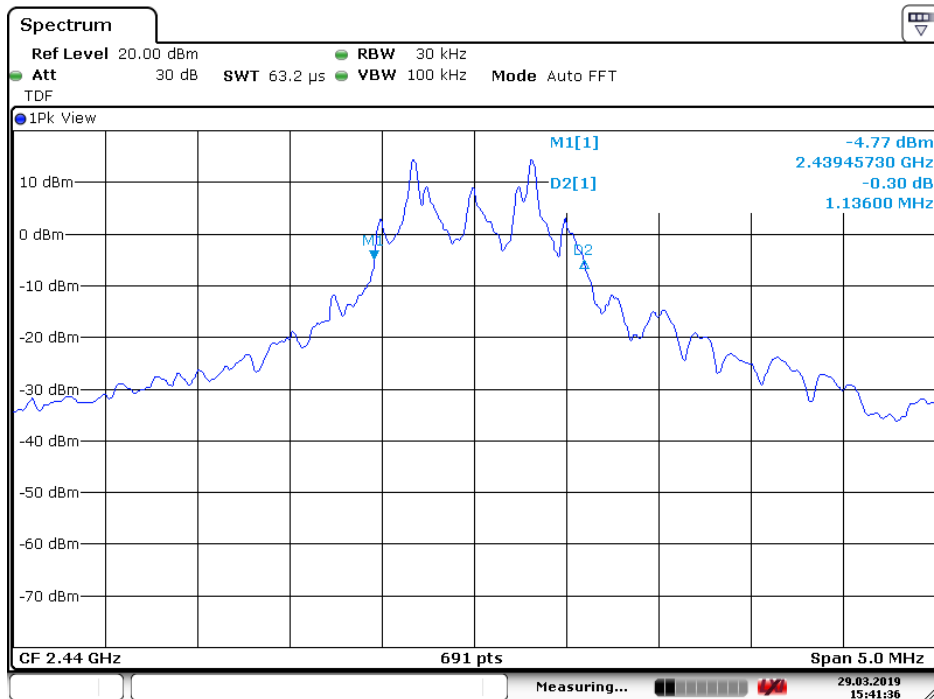
Date: 2.APR.2019 13:27:46

Channel Separation (antenna port 2)



Date: 29.MAR.2019 15:39:27

20 dB Bandwidth, 2402 MHz (antenna port 1)



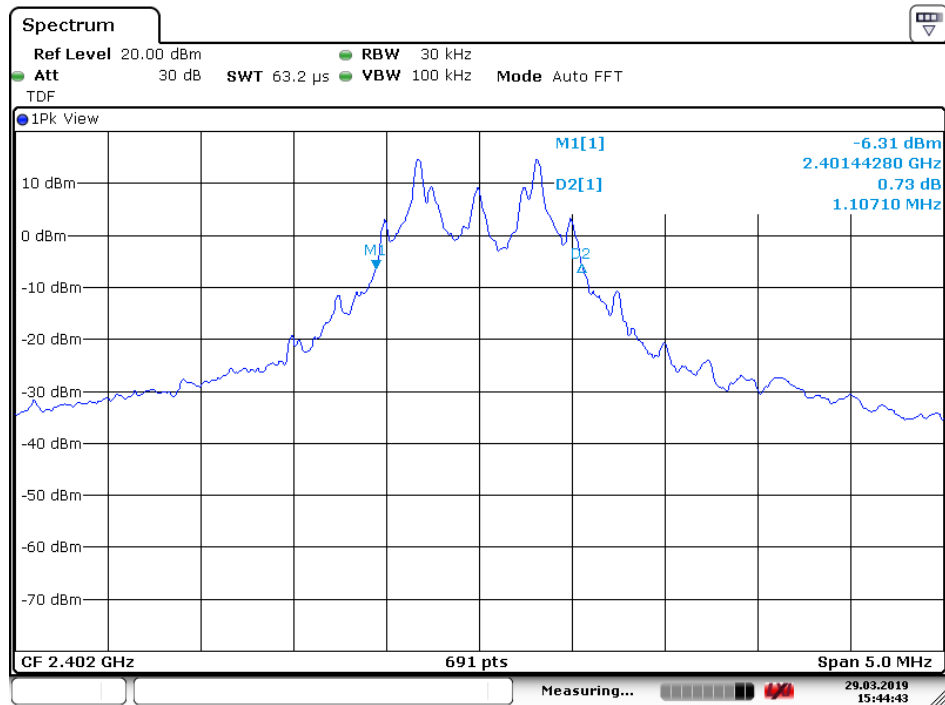
Date: 29.MAR.2019 15:41:36

20 dB Bandwidth, 2440 MHz (antenna port 1)



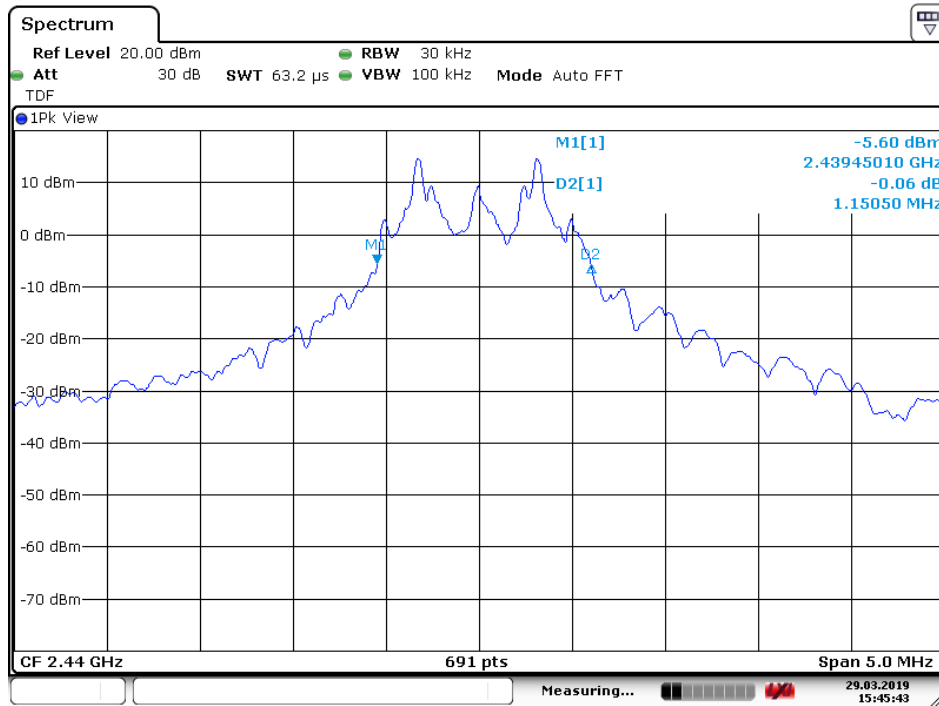
Date: 29.MAR.2019 15:43:18

20 dB Bandwidth, 2479 MHz (antenna port 1)



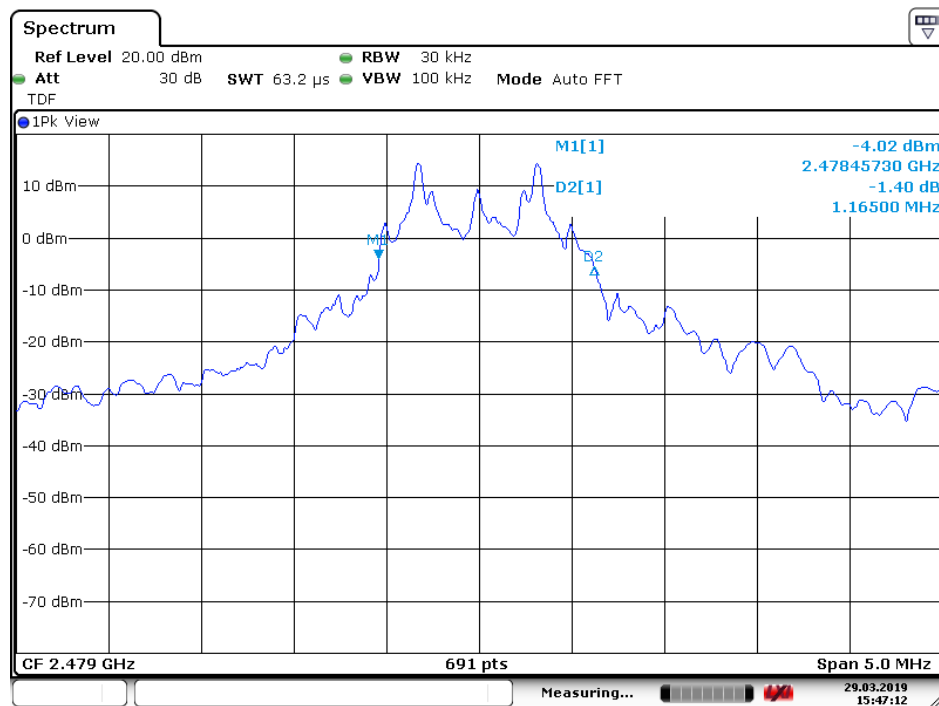
Date: 29.MAR.2019 15:44:43

20 dB Bandwidth, 2402 MHz (antenna port 2)



Date: 29.MAR.2019 15:45:43

20 dB Bandwidth, 2440 MHz (antenna port 2)



Date: 29.MAR.2019 15:47:12

20 dB Bandwidth, 2479 MHz (antenna port 2)

3.2 Pseudorandom Hopping Algorithm

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

Test Performed By: Markus Korny	Date of Test: 2018-09-06, 2019-04-03
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Test Results: Complies

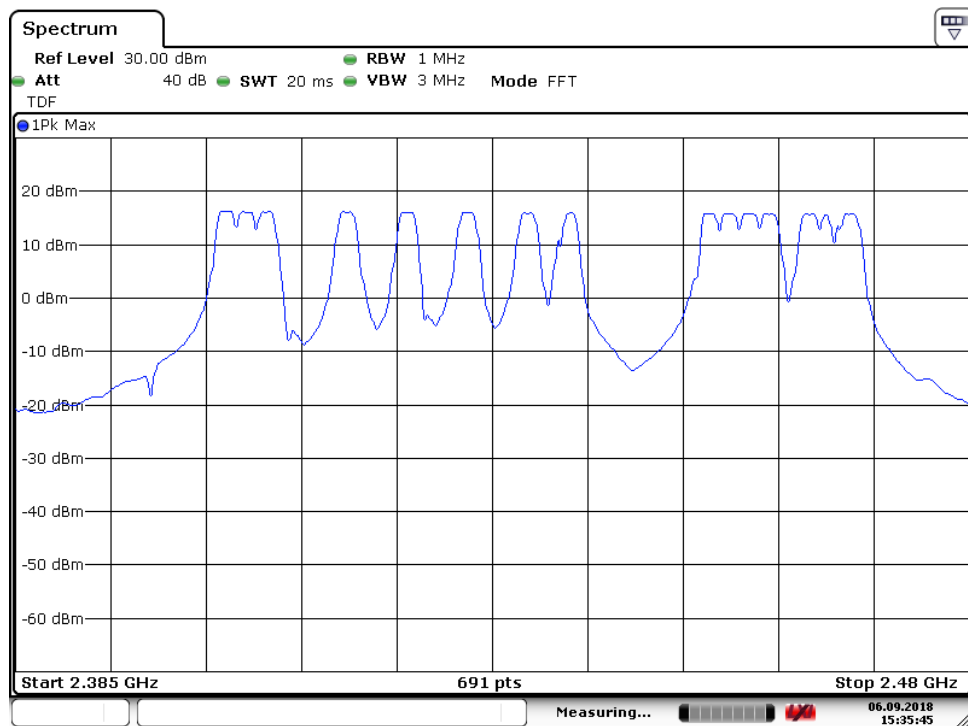
Measurement Data:

At the tranceiver startup, a random hopping table is generated in the software by using non-deterministic, random data. The table ensures that all generated hopping sequences are evenly distributed and that all frequencies are used equally. The random data itself is created by a random generator within the software. The used algorithm ensures the randomness of the generated sequences as well as the selection of the sequence being used. It can be ensured, that each hopping sequence is unique and that the sequence of two transceivers will always differ from each other.

Requirements:

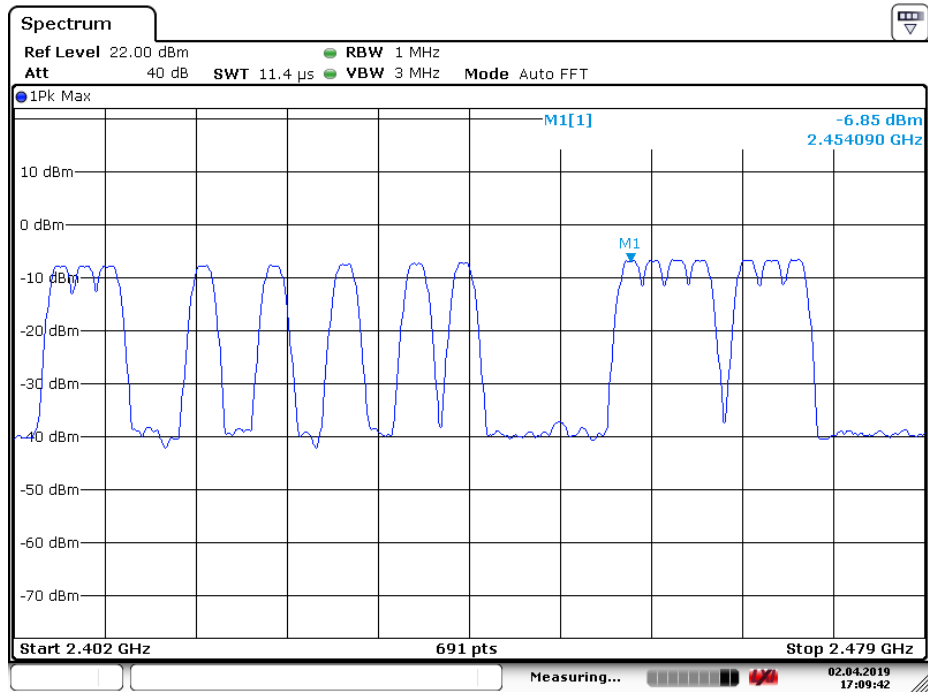
The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.



Date: 6.SEP.2018 15:35:45

15 (out of 39) channels at antenna port 2



Date: 2.APR.2019 17:09:42

15 (out of 39) channels at antenna port 1

3.3 Time of Occupancy

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

Test Performed By: Markus Korny	Date of Test: 2018-09-06, 2019-04-03
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Test Results: Complies

Measurement Data:

Antenna port 1:

Number of RF Channels	15
Maximum length of RF burst pr. channel	4.17 ms
Time between RF burst on same RF channel	951 ms
Time of Occupancy	28.14 ms

Fully charged battery is used

Time between RF burst on the same channel: $(59.25 \text{ ms} + 4.17 \text{ ms}) \times 15 = 951 \text{ ms}$

Time of occupancy: $(4.17 \text{ ms} \times 400 \text{ ms} \times 15) / 951 \text{ ms} = 26.31 \text{ ms}$

Antenna port 2:

Number of RF Channels	15
Maximum length of RF burst pr. channel	4.17 ms
Time between RF burst on same RF channel	951 ms
Time of Occupancy	28.14 ms

Fully charged battery is used

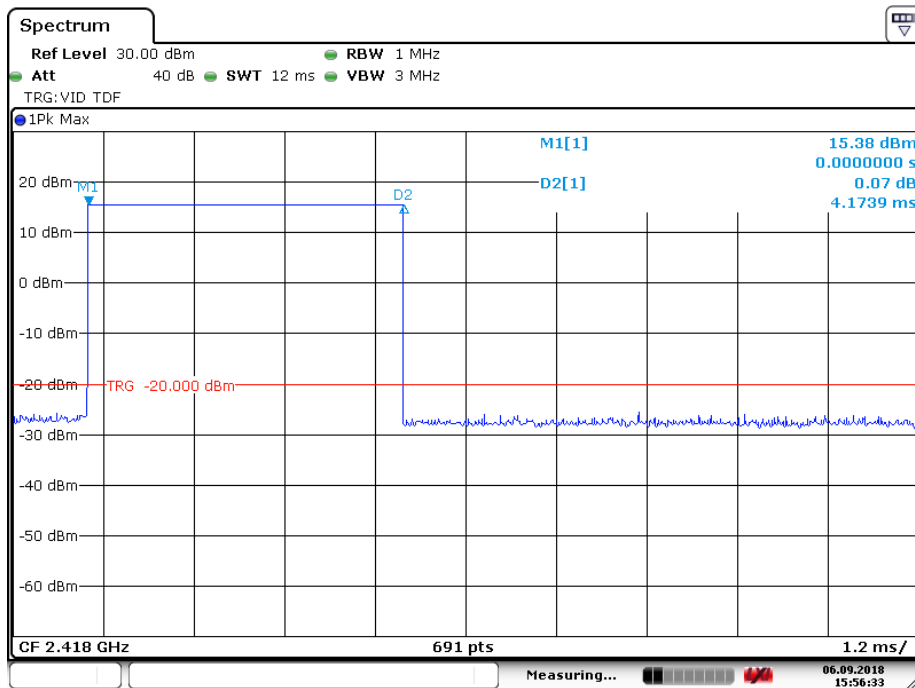
Time between RF burst on the same channel: $(59.25 \text{ ms} + 4.17 \text{ ms}) \times 15 = 951 \text{ ms}$

Time of occupancy: $(4.17 \text{ ms} \times 400 \text{ ms} \times 15) / 951 \text{ ms} = 26.31 \text{ ms}$

Requirements:

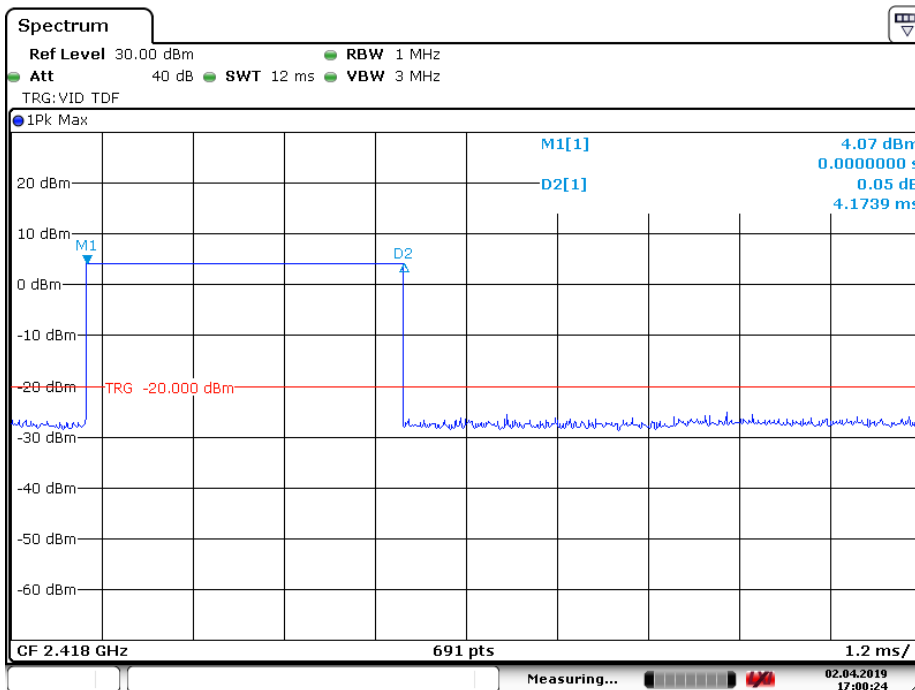
The system shall use at least 15 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

No requirements for Digital Transmission Systems.



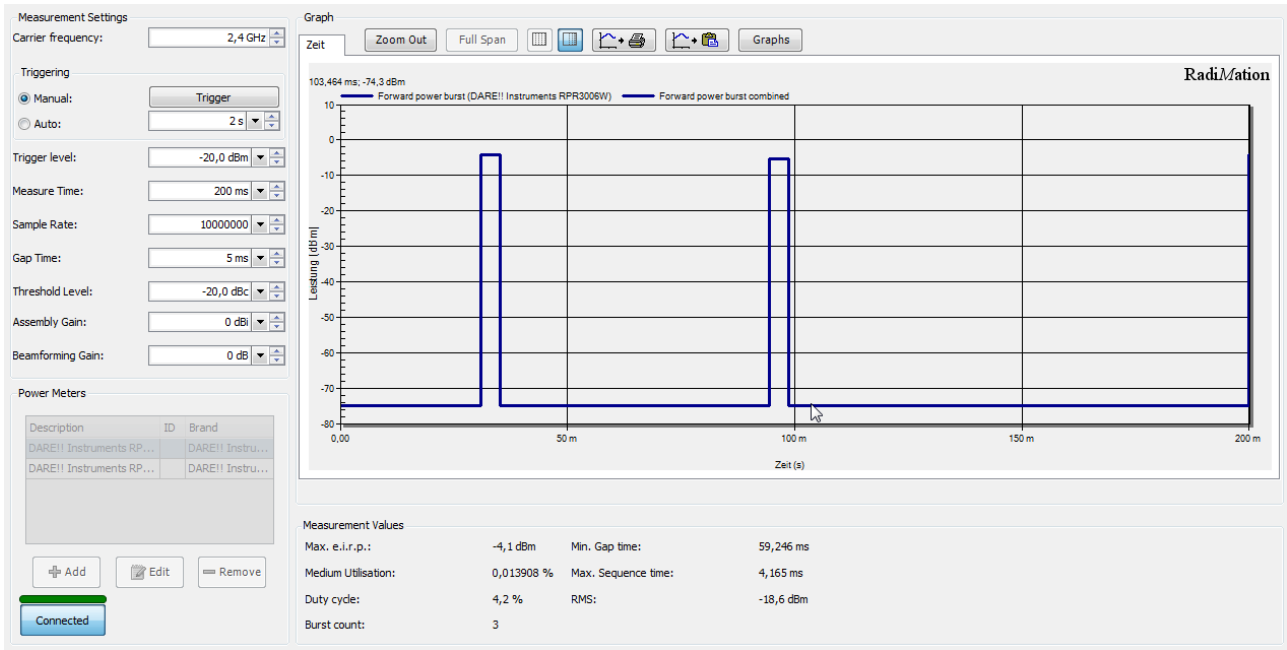
Date: 6.SEP.2018 15:56:33

Burst length at antenna port 2



Date: 2.APR.2019 17:00:25

Burst length at antenna port 1



Min gap time between all channels

3.4 Occupied Bandwidth

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

Para. No.: 6.6 RSS-Gen

Test Performed By: Markus Korny	Date of Test: 2018-07-27
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Test Results: Complies

Measurement Data:

Antenna port 1:

Number of RF Channels in use:	15
Channel Center Frequencies:	The channels are centered at each full 2 MHz from 2402 to 2479 MHz
99 % Bandwidth (OBW)	1129 kHz

*) see 3.1 channel separation
 Fully charged battery is used

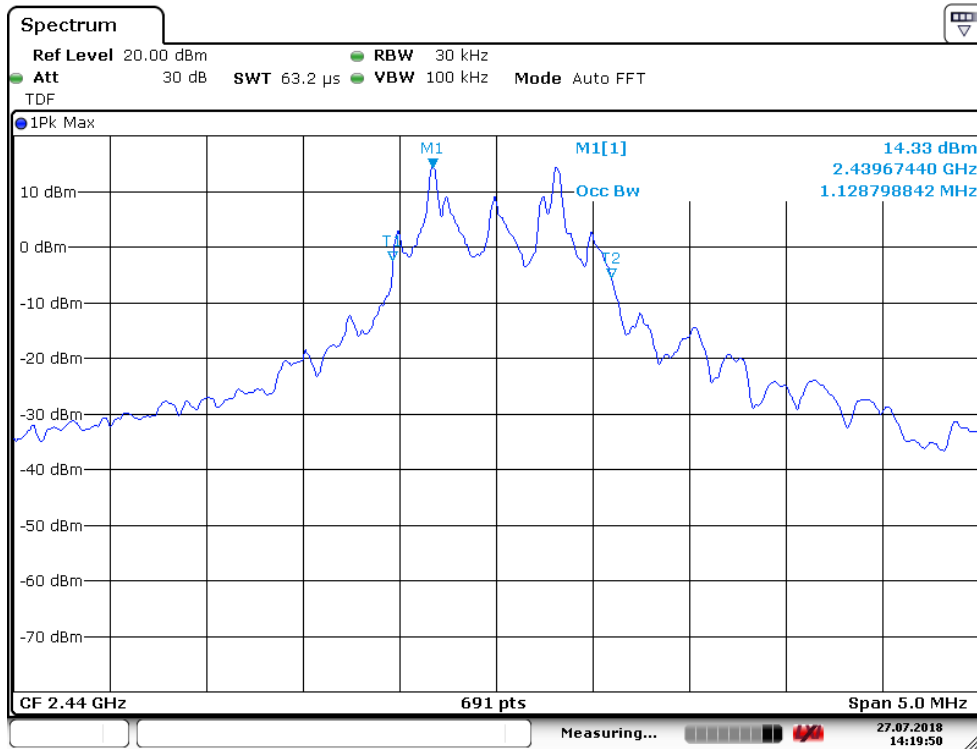
Antenna port 2:

Number of RF Channels in use:	15
Channel Center Frequencies:	The channels are centered at each full 2 MHz from 2402 to 2479 MHz
99 % Bandwidth (OBW)	1151 kHz

*) see 3.1 channel separation
 Fully charged battery is used

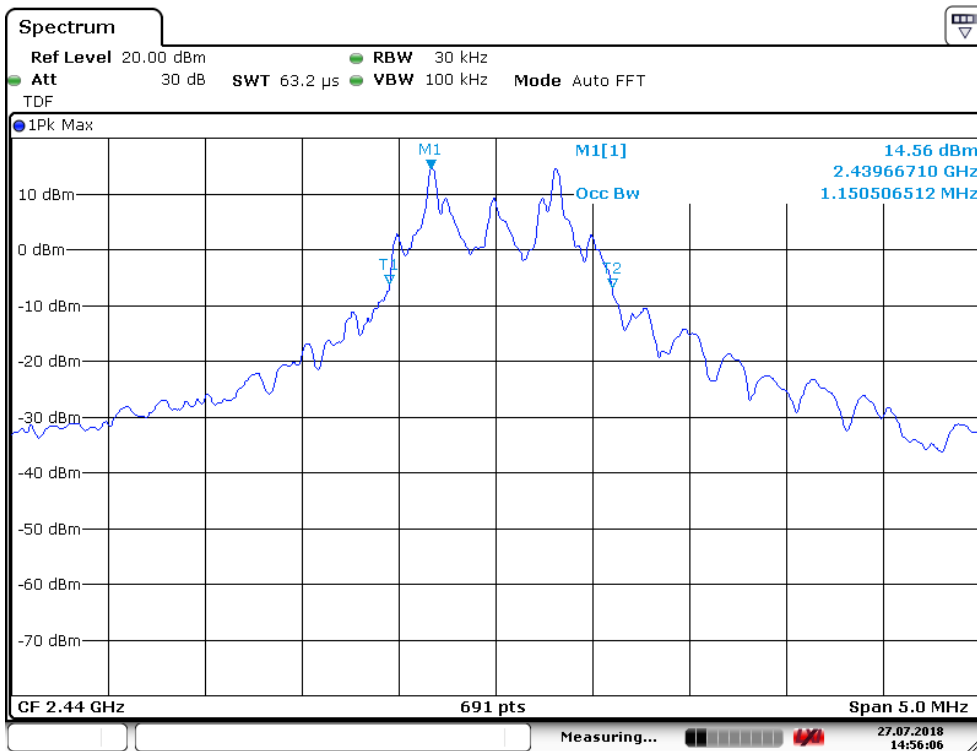
Requirements:

For information only.



Date: 27.JUL.2018 14:19:51

2440 MHz – 99% OCC BW at antenna port 1



Date: 27.JUL.2018 14:56:06

2440 MHz – 99% OCC BW at antenna port 2

3.5 Peak Power Output

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

Test Performed By: Markus Korny	Date of Test: 2018-03-21, 2018-05-30
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Test Results: Complies

Measurement Data at antenna port 1:

RF channel	2402 MHz	2440 MHz	2479 MHz
Measured Maxium Field strength (dBµV/m) – HP	109.19	109.82	108.62
Calc. Radiated Power (dBm)	13.96	14.59	13.39
Calc. Radiated Power (mW)	24.90	28.78	21.83
Measured Conducted Power (dBm)	14.41	14.47	14.22
Measured Conducted Power (mW)	27.61	27.99	26.42
Calculated Antenna Gain (dBi)	-0.4	0.1	-0.8

Fully charged battery is used

Measurement Data at antenna port 2:

RF channel	2402 MHz	2440 MHz	2479 MHz
Measured Maxium Field strength (dBµV/m) – HP	112.13	113.40	113.48
Calc. Radiated Power (dBm)	16.90	18.17	18.25
Calc. Radiated Power (mW)	48.99	65.63	66.85
Measured Conducted Power (dBm)	14.69	14.68	14.49
Measured Conducted Power (mW)	29.44	29.38	28.12
Calculated Antenna Gain (dBi)	2.2	3.5	3.8

Fully charged battery is used

Antenna gain = 10*log (EIRP/Conducted power) dBi

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

Measured Field strength U_{RX} [dBµV/m] is calculated inside the Measurement Receiver from the input signal U_{in} by considering Antenna Factor AF, attenuation of cables a_c , Pre-Amplifier gain g_{pre} , attenuators a_d .

$$U_{RX} = U_{in} + AF + a_c + g_{pre} + a_d$$

The maximum field strength is obtained in XY plane and Horizontal polarization

See attached graph.

Detachable antenna?

Yes No

If detachable, is the antenna connector non-standard?

Yes No

Type of antenna connector: U.FL

Requirements:

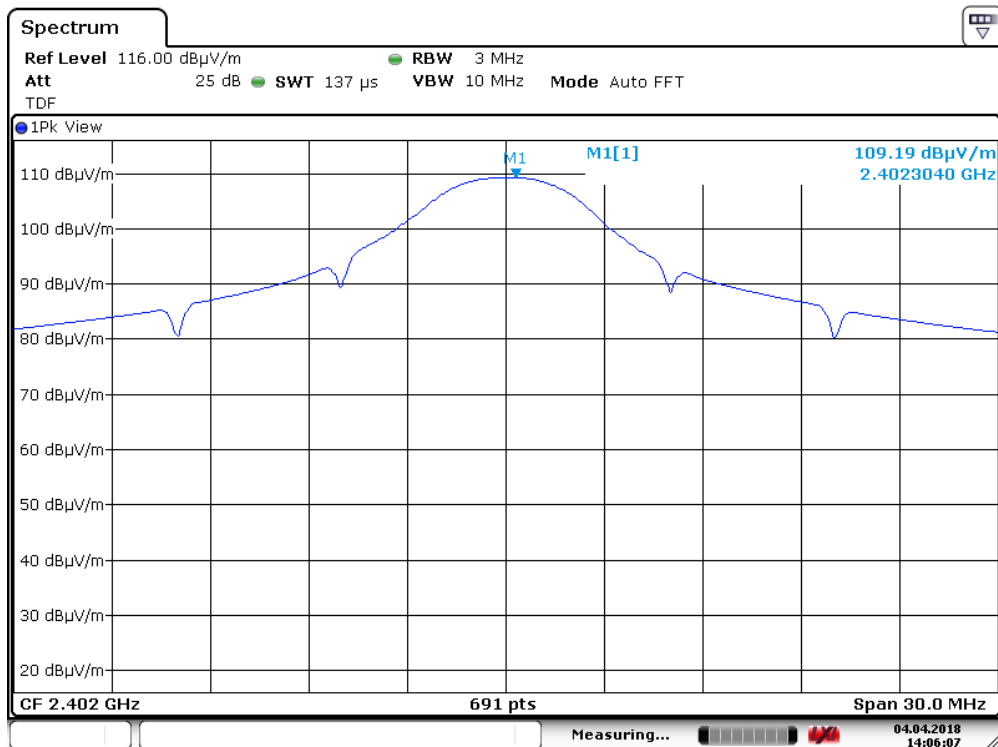
The maximum peak output power shall not exceed the following limits:

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

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

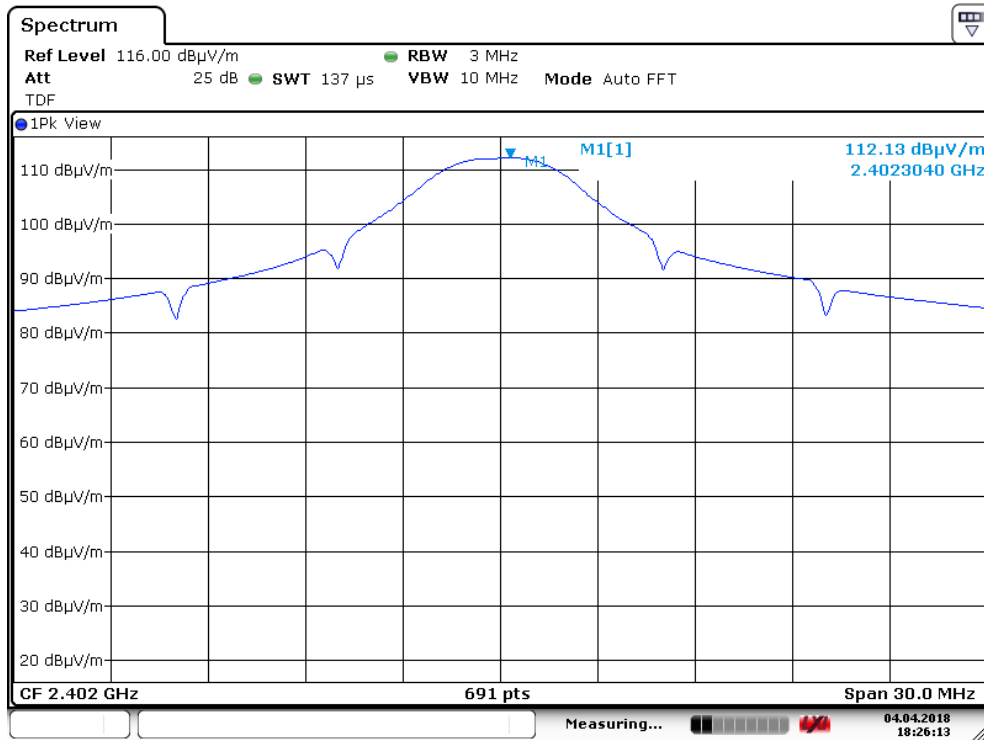
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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



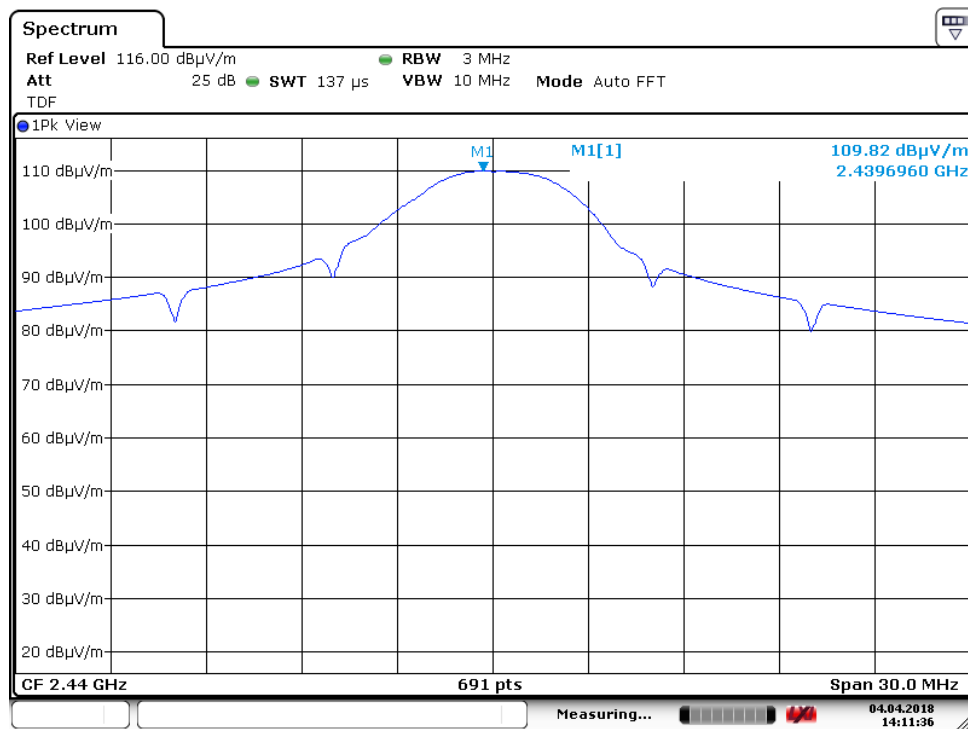
Date: 4. APR. 2018 14:06:07

Radiated field strength, HP, 2402 MHz, antenna 1



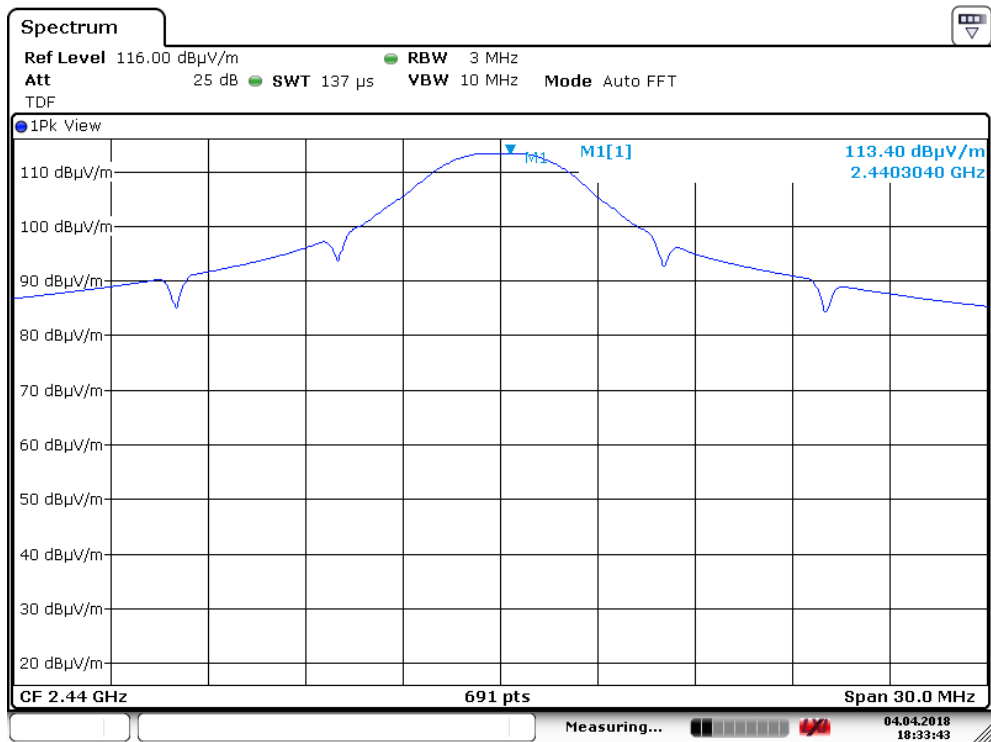
Date: 4.APR.2018 18:26:13

Radiated field strength, HP, 2402 MHz, antenna 2



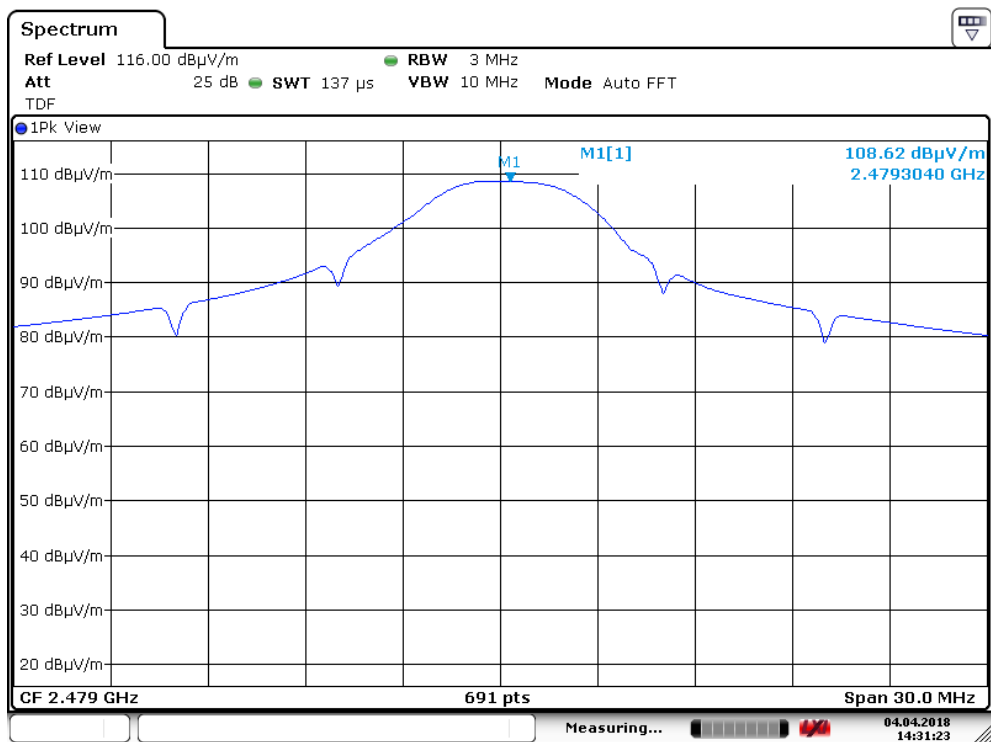
Date: 4.APR.2018 14:11:36

Radiated field strength, HP, 2440 MHz, antenna 1



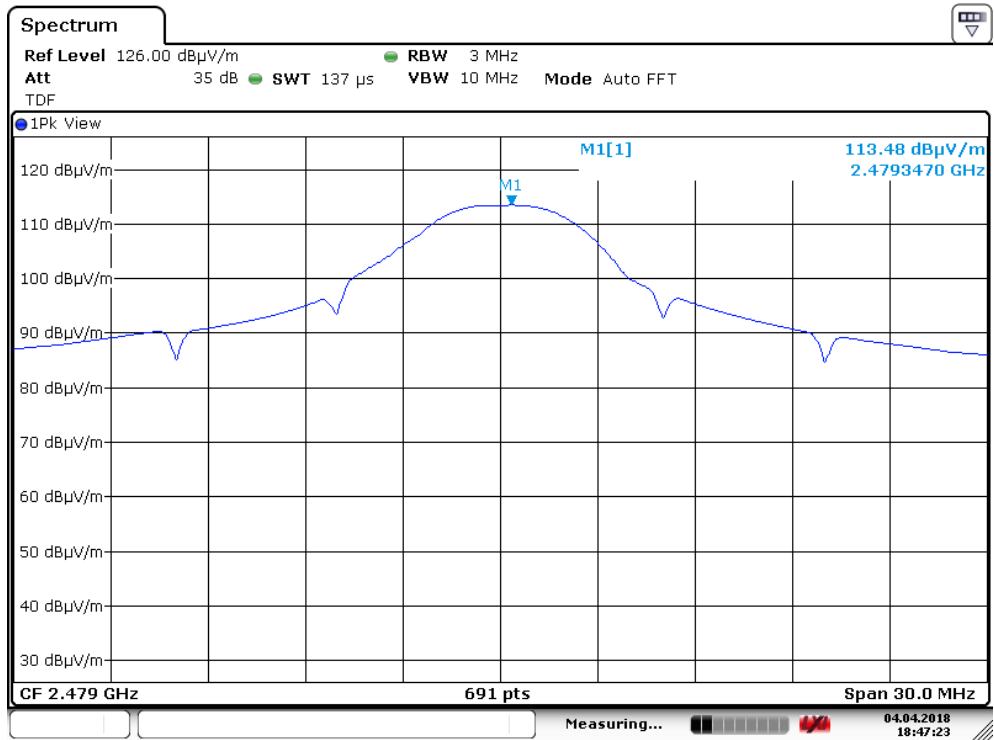
Date: 4.APR.2018 18:33:43

Radiated field strength, HP, 2440 MHz, antenna 2



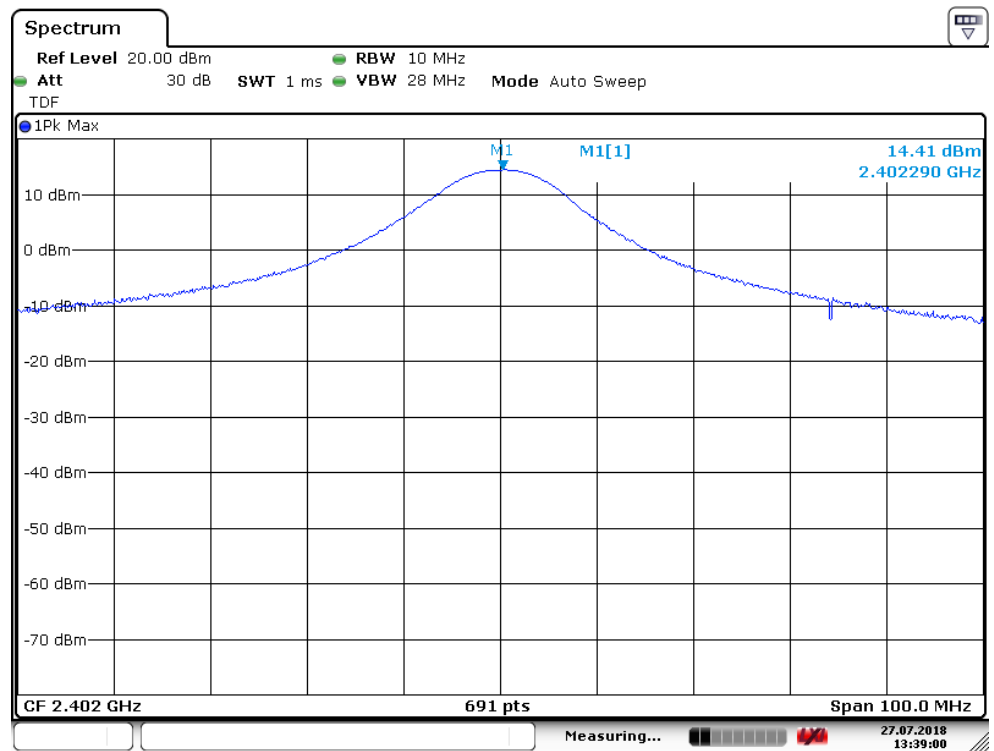
Date: 4.APR.2018 14:31:23

Radiated field strength, HP, 2479 MHz, antenna 1



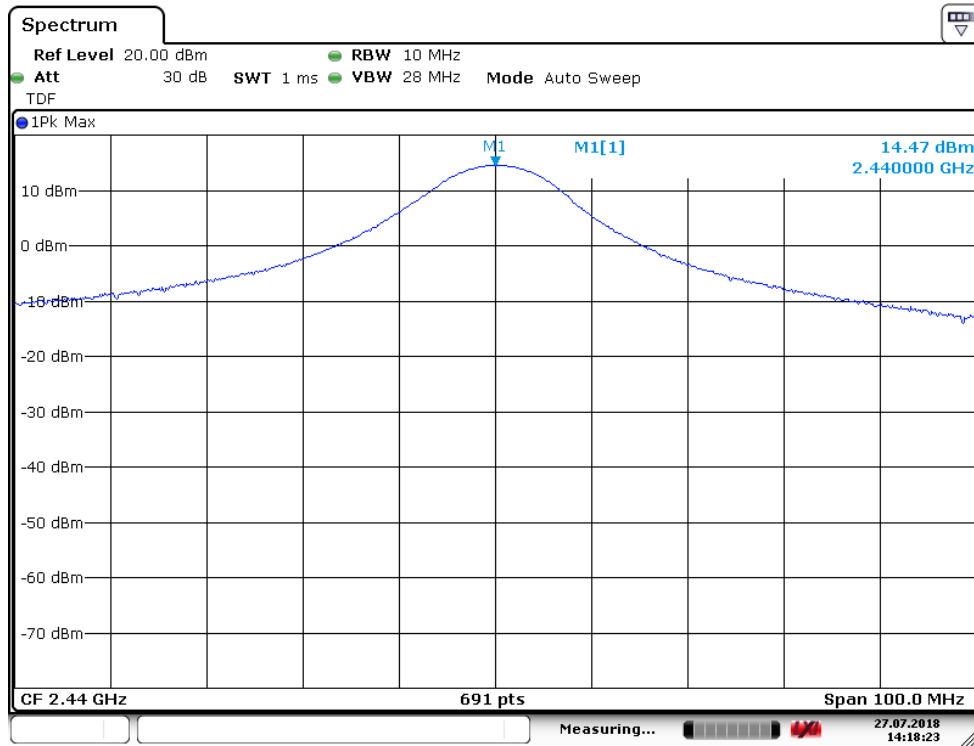
Date: 4.APR.2018 18:47:24

Radiated field strength, HP, 2479 MHz, antenna 2



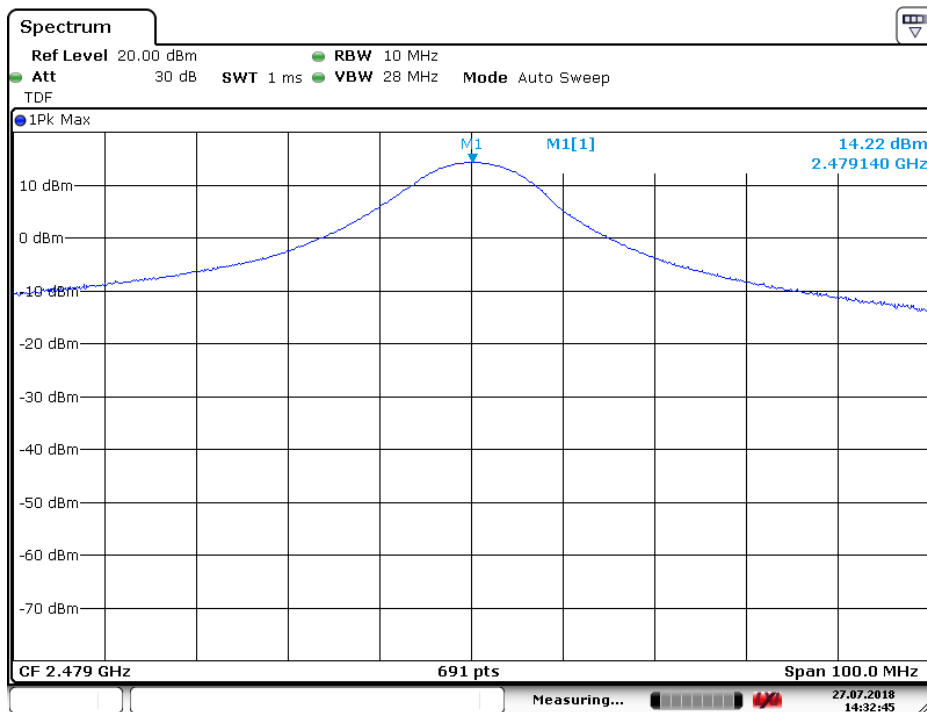
Date: 27.JUL.2018 13:39:00

Conducted power – 2402MHz, antenna 1



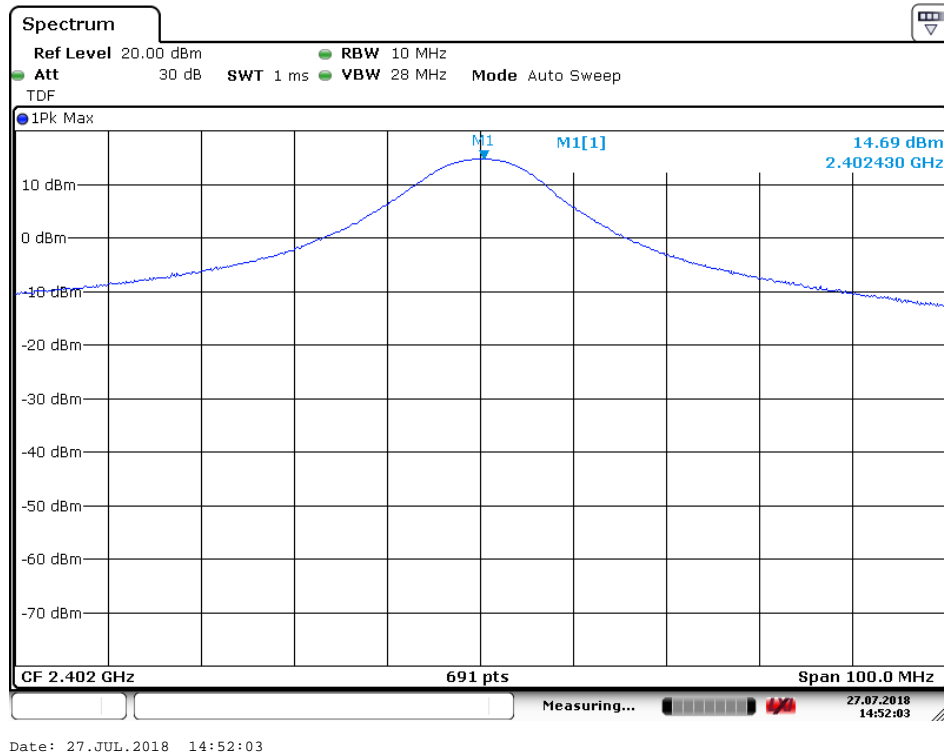
Date: 27.JUL.2018 14:18:23

Conducted power – 2440MHz, antenna 1

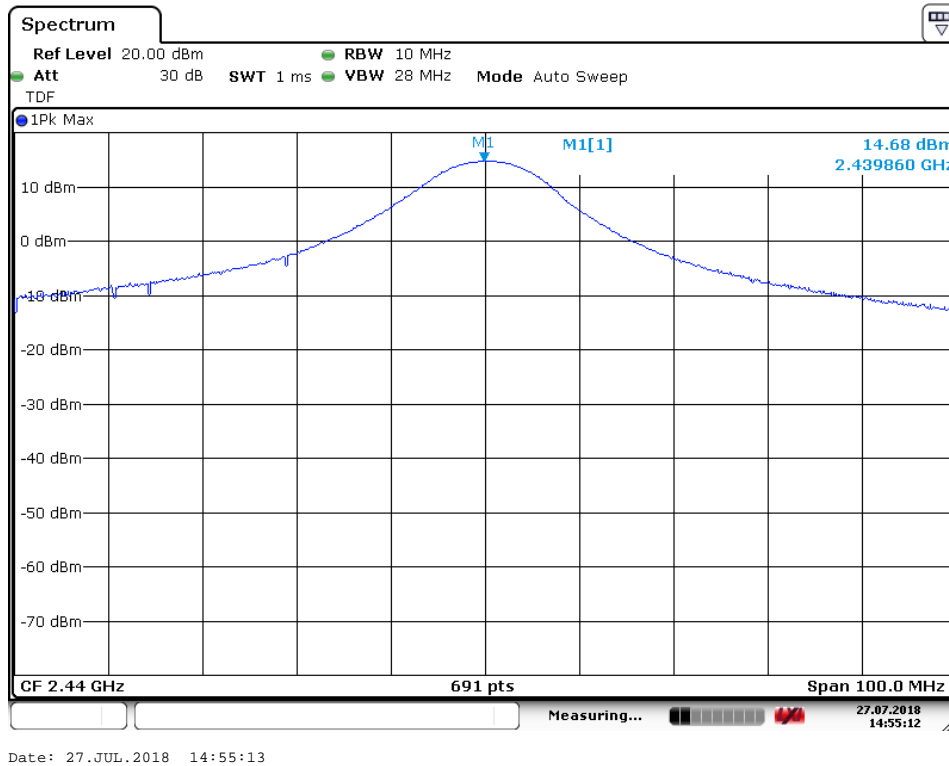


Date: 27.JUL.2018 14:32:46

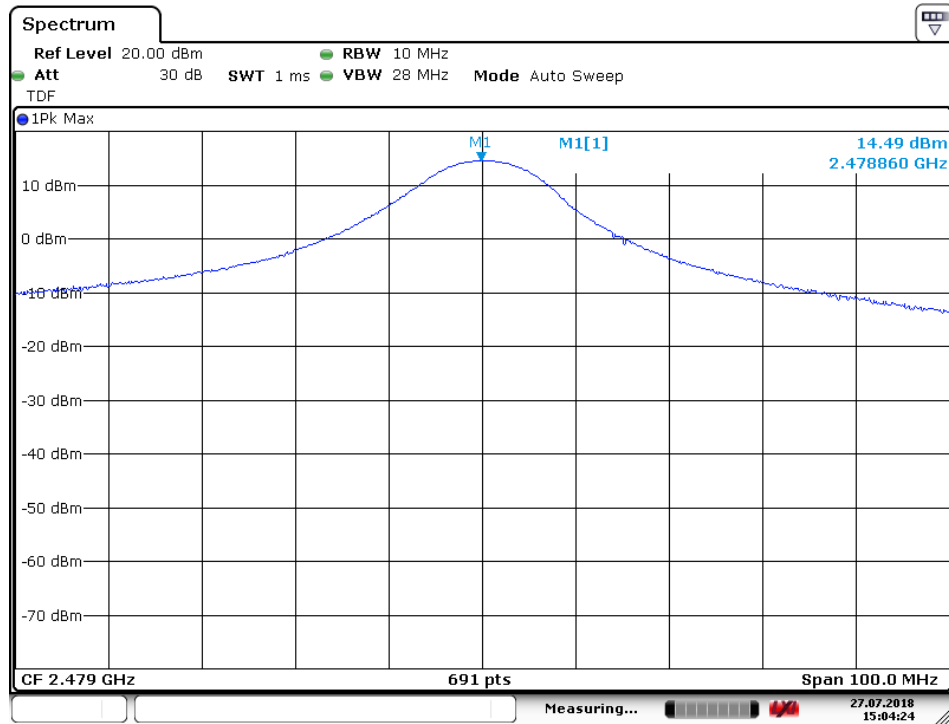
Conducted power – 2479MHz, antenna 1



Conducted power – 2402MHz, antenna 2



Conducted power – 2440MHz, antenna 2



Date: 27.JUL.2018 15:04:24

Conducted power – 2479MHz, antenna 2

3.6 Conducted Emissions at Antenna Connector

Para. No.: 15.247 (d)

Test Performed By: Markus Korny	Date of Test: 2018-07-27
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Test Results: Complies

RF conducted power to 25 GHz see attached plots.

Maximum RF level outside operating band, at antenna port 1:

RF ch 2402MHz: margin >50 dBc

RF ch 2440MHz: margin >50 dBc

RF ch 2479MHz: margin >50 dBc

Fully charged battery is used

Maximum RF level outside operating band, at antenna port 2:

RF ch 2402MHz: margin >50 dBc

RF ch 2440MHz: margin >50 dBc

RF ch 2479MHz: margin >50 dBc

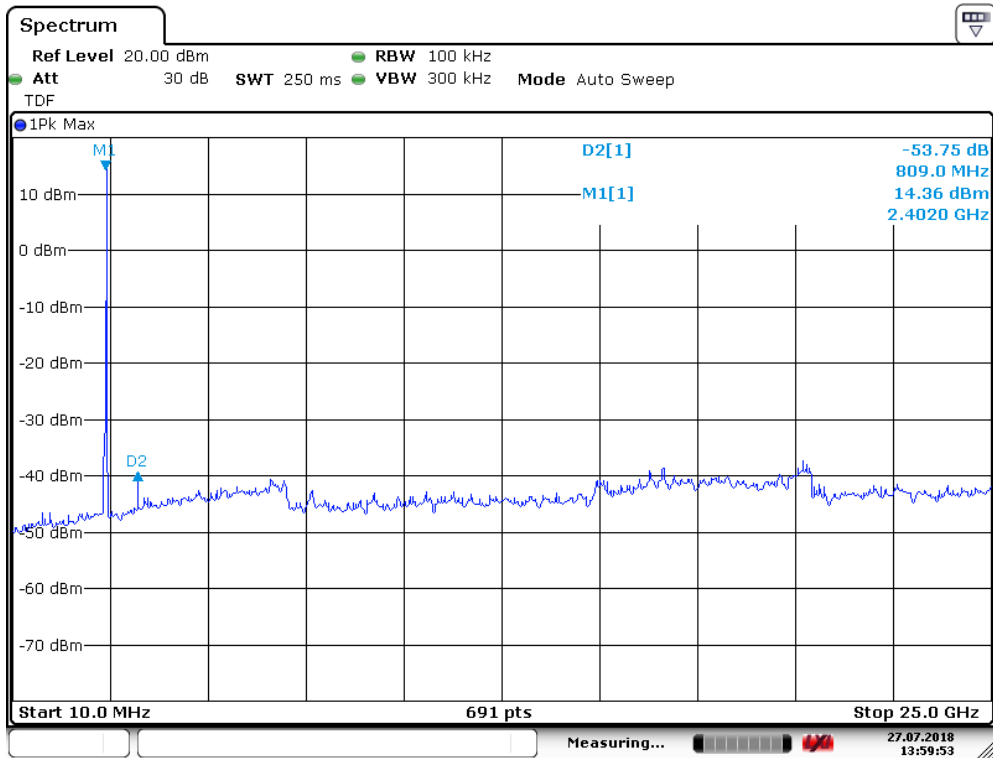
Fully charged battery is used

Limit

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

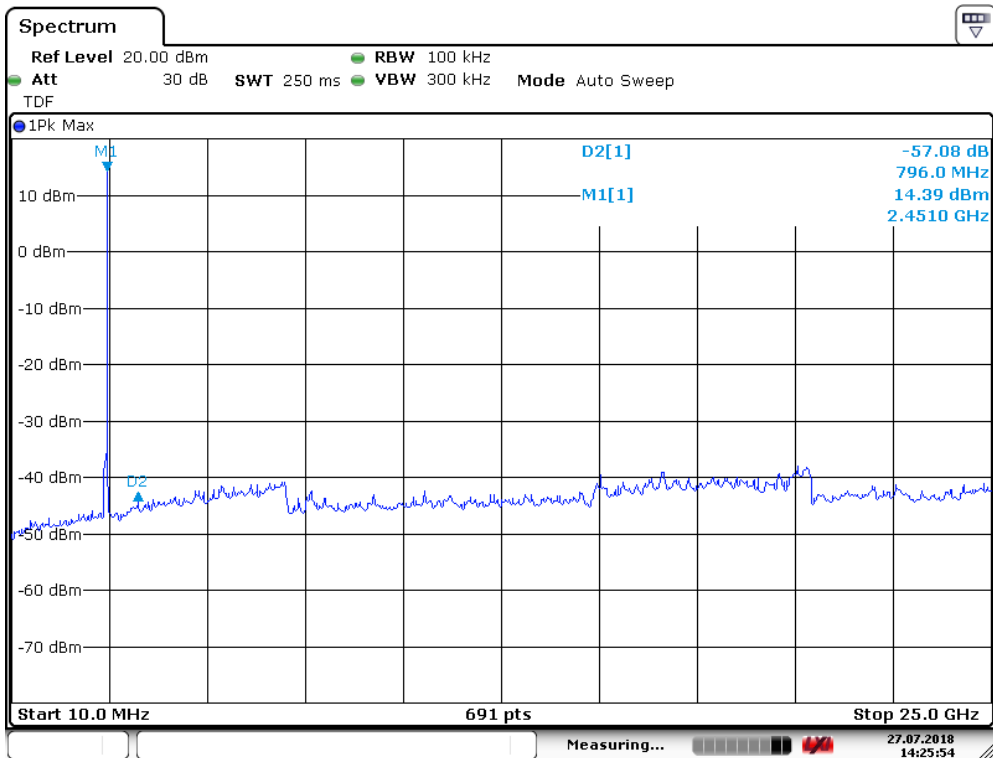
Detector type shall be the same as used for measuring Output Power.

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



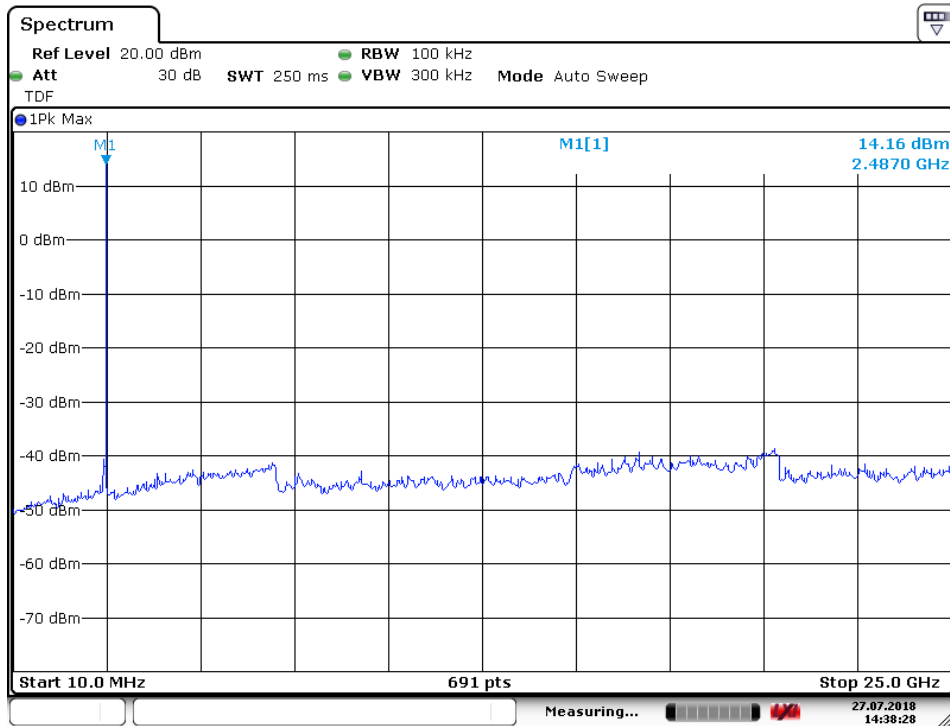
Date: 27.JUL.2018 13:59:53

Conductd spurious emission 10MHz – 25GHz - ch2402MHz, antenna 1



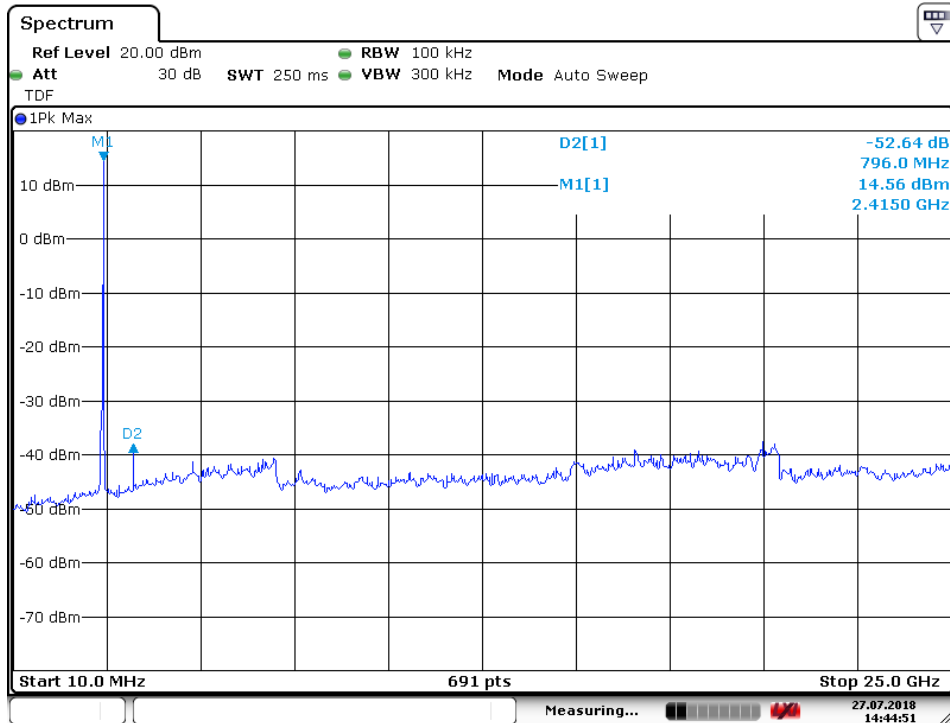
Date: 27.JUL.2018 14:25:54

Conductd spurious emission 10MHz – 25GHz - ch2440MHz, antenna 1



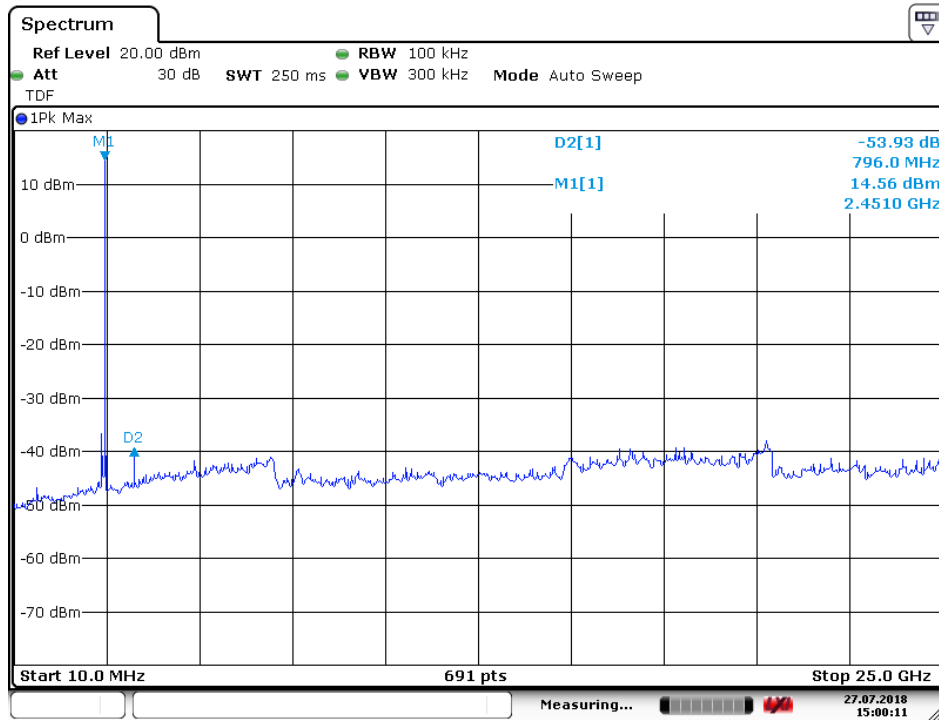
Date: 27.JUL.2018 14:38:28

Conducted spurious emission 10MHz – 25GHz - ch2479MHz, antenna 1



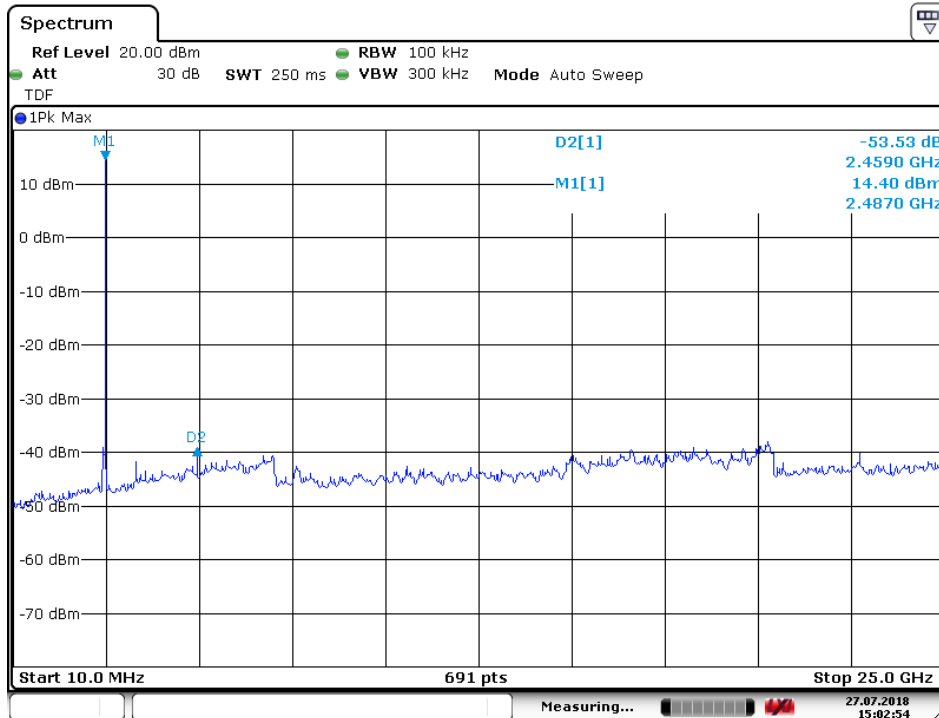
Date: 27.JUL.2018 14:44:52

Conductd spurious emission 10MHz – 25GHz - ch2402MHz, antenna 2



Date: 27.JUL.2018 15:00:12

Conductd spurious emission 10MHz – 25GHz - ch2440MHz, antenna 2



Date: 27.JUL.2018 15:02:55

Conducted spurious emission 10MHz – 25GHz - ch2479MHz, antenna 2

3.7 Restricted Bands of operation

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

3.8 Spurious Emissions (Radiated)

Para. No.: 15.247 (d)

Test Performed By: Markus Korny	Date of Test: 2018-04-06, 2019-04-17
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Test Results: Complies

Band-edge, hopping off, @3m, antenna port 1:

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.39 GHz	44.63	PK	74	29.37
	24.63 *)	AV	54	29.37
2.4835 GHz	57.21	PK	74	16.79
	37.21 **)	AV	54	16.79

*) 2.390GHz: 44.63dBµV/m – 20 dB=24.63 dBµV/m

***) 2.4835GHz: 57.21dBµV/m – 20 dB=37.21 dBµV/m

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

Fully charged battery is used

See attached plots.

Band-edge, hopping off @3m, antenna port 2:

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.39 GHz	49.33	PK	74	24.67
	29.33 *)	AV	54	24.67
2.4835 GHz	60.16	PK	74	13.84
	40.16 **)	AV	54	13.84

*) 2.390GHz: 49.33dBµV/m – 20 dB=29.33 dBµV/m

***) 2.4835GHz: 60.16dBµV/m – 20 dB=40.16 dBµV/m

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

Fully charged battery is used

See attached plots.

Band-edge, hopping on, @3m, antenna port 1:

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.39 GHz	56.61	PK	74	17.39
	36.61 *)	AV	54	17.39
2.4835 GHz	51.73	PK	74	22.27.
	31.73 **)	AV	54	22.27.

*) 2.390GHz: 56.61dBµV/m – 20 dB=36.61 dBµV/m

***) 2.4835GHz: 51.73dBµV/m – 20 dB=31.73 dBµV/m

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

Fully charged battery is used

See attached plots.

Band-edge, hopping on @3m, antenna port 2:

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.39 GHz	59.26	PK	74	14.74
	39.26 *)	AV	54	14.74
2.4835 GHz	56.25	PK	74	17.75
	36.25 **)	AV	54	17.75

*) 2.390GHz: 59.26dBµV/m – 20 dB=39.26 dBµV/m

***) 2.4835GHz: 56.25dBµV/m – 20 dB=36.25 dBµV/m

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

Fully charged battery is used

See attached plots.

Duty Cycle Correction Factor Calculation:

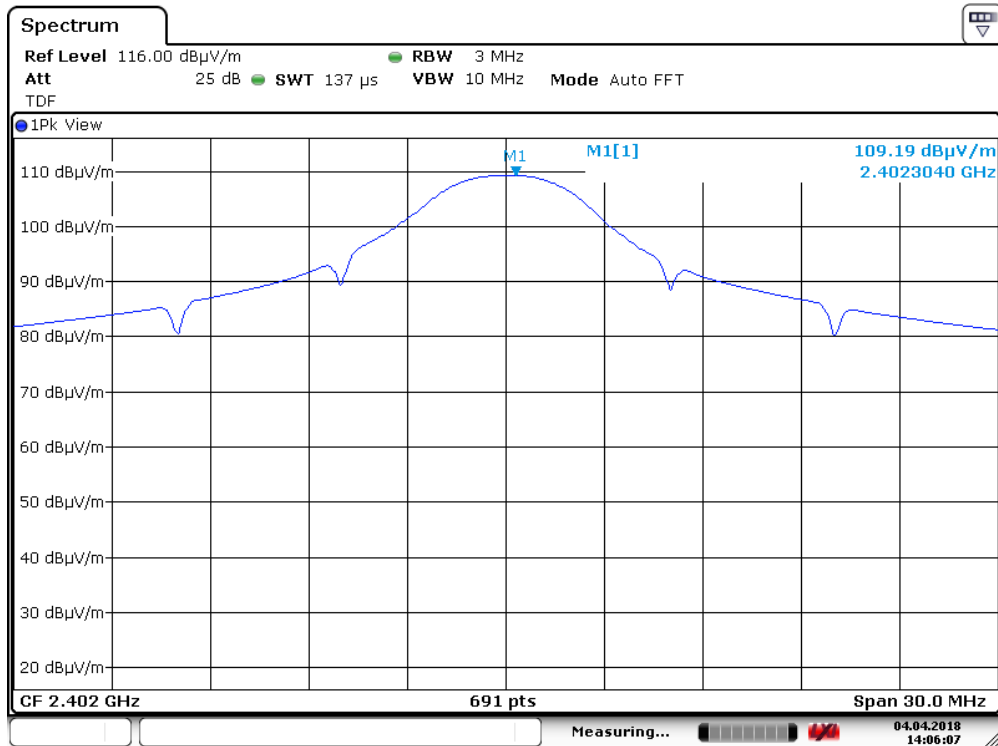
Duty Cycle = On Time / (Period * Number of Channels) = 4.17 ms / [(59.25 ms + 4.17 ms) * 15] = 0.00438

Duty Cycle Correction factor = -20 x log (Duty Cycle) = 47.2 dB

Maximum allowed Duty Cycle Correction: 20 dB

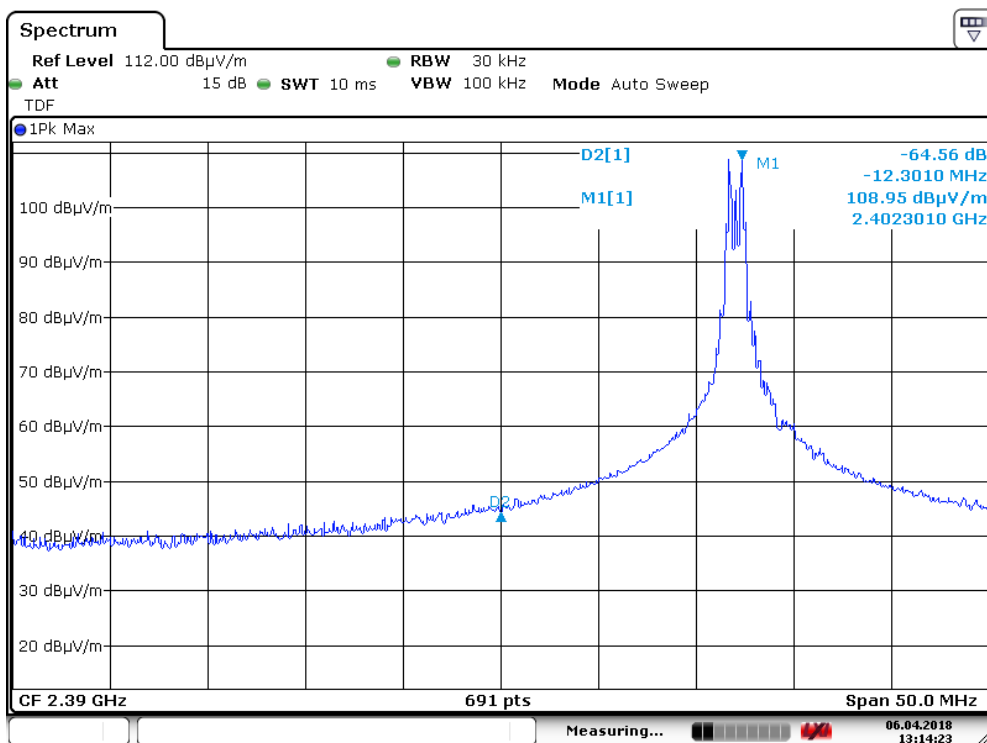
Measured Field strength U_{RX} [dBµV/m] is calculated inside the Measurement Receiver from the input signal U_{in} by considering Antenna Factor AF, attenuation of cables a_c , Pre-Amplifier gain g_{pre} , attenuators a_d and filters a_f .

$$U_{RX} = U_{in} + AF + a_c + g_{pre} + a_d + a_f$$



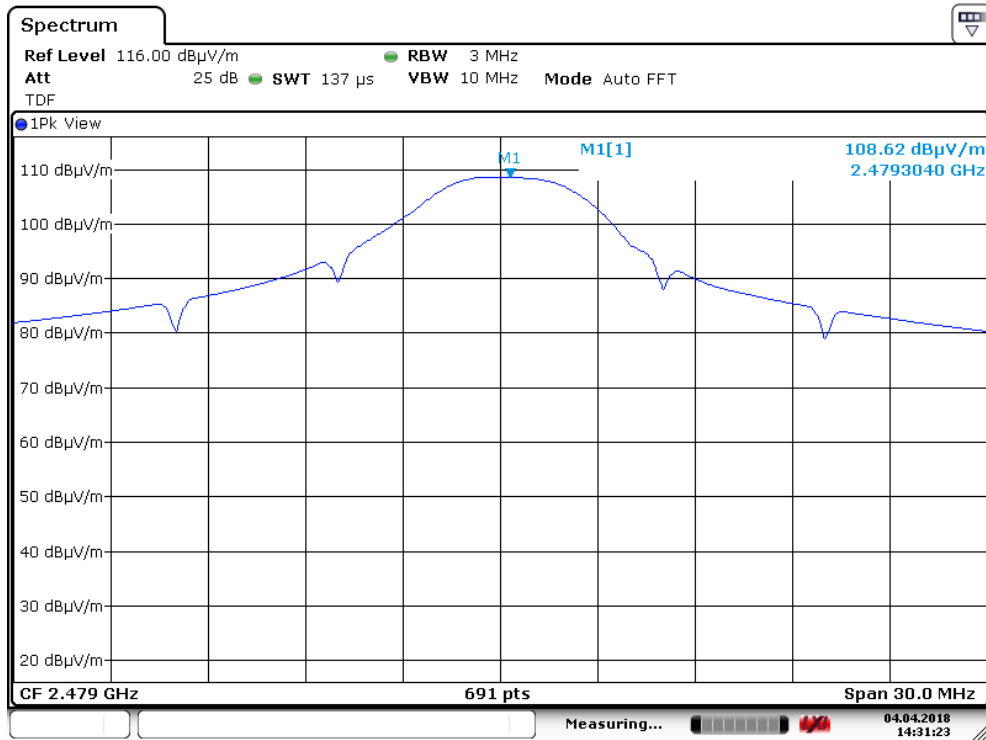
Date: 4.APR.2018 14:06:07

Max field strength at lowest channel, hopping off, antenna 1



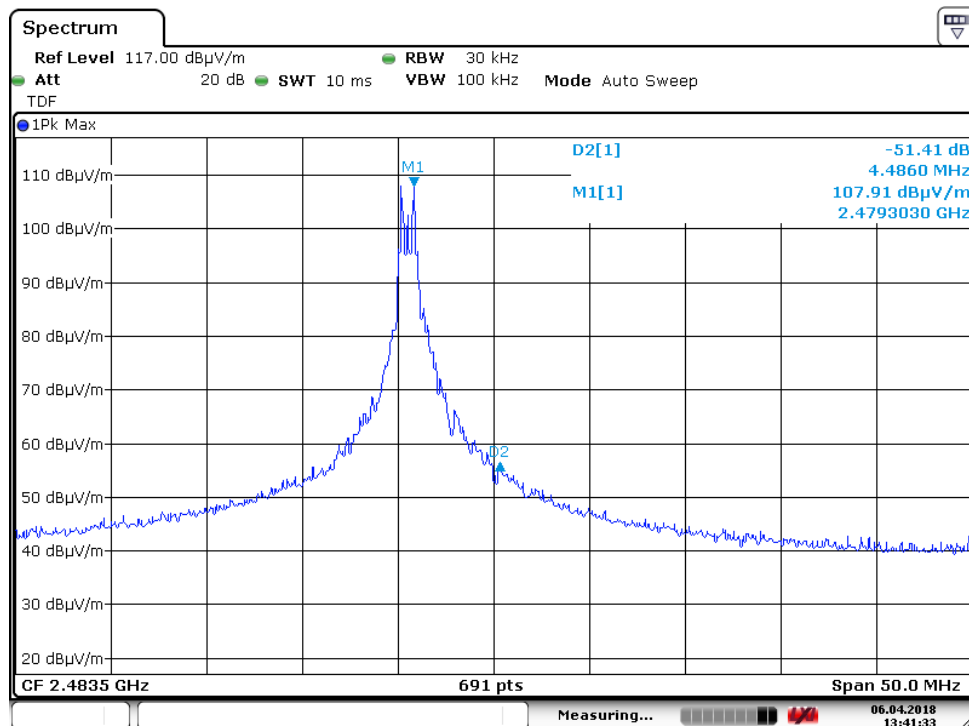
Date: 6.APR.2018 13:14:24

Marker Delta, 2390 MHz, Peak Detector, hopping off, antenna 1



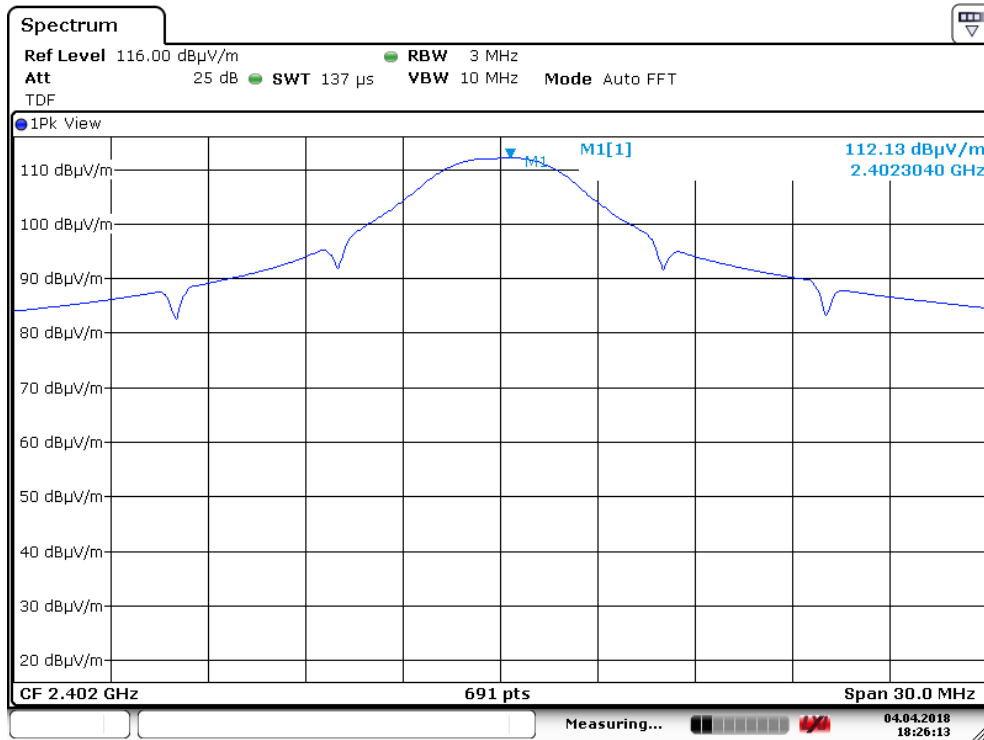
Date: 4.APR.2018 14:31:23

Max field strength at highest channel, hopping off, antenna 1



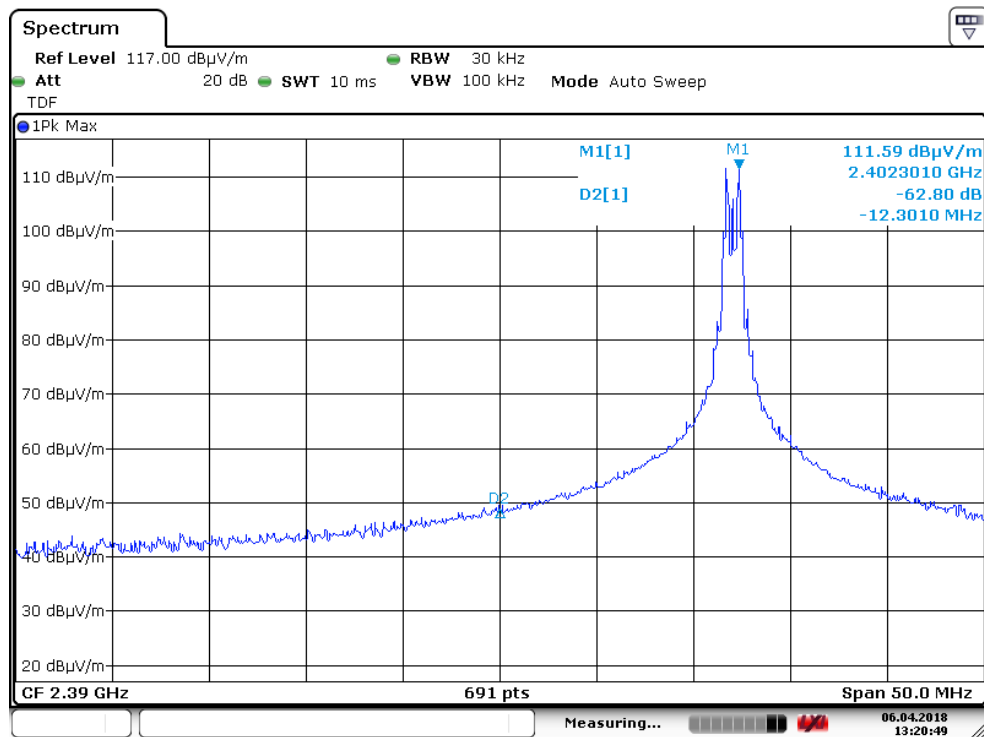
Date: 6.APR.2018 13:41:34

Marker Delta, 2483.5 MHz, Peak Detector, hopping off, antenna 1



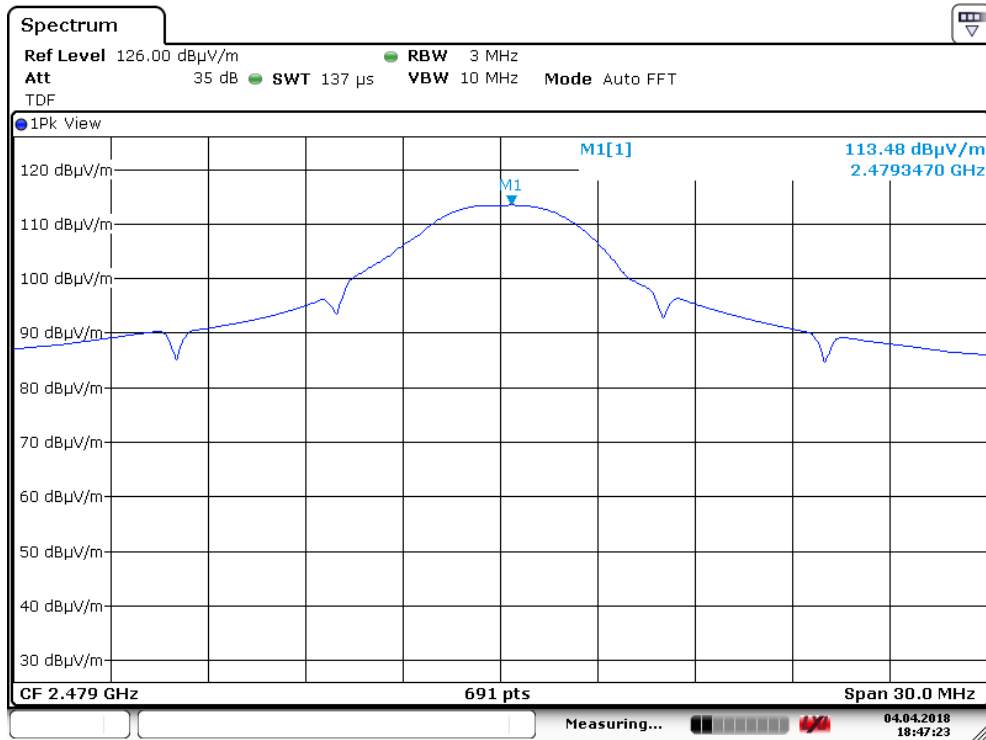
Date: 4.APR.2018 18:26:13

Max field strength at lowest channel, hopping off, antenna 2



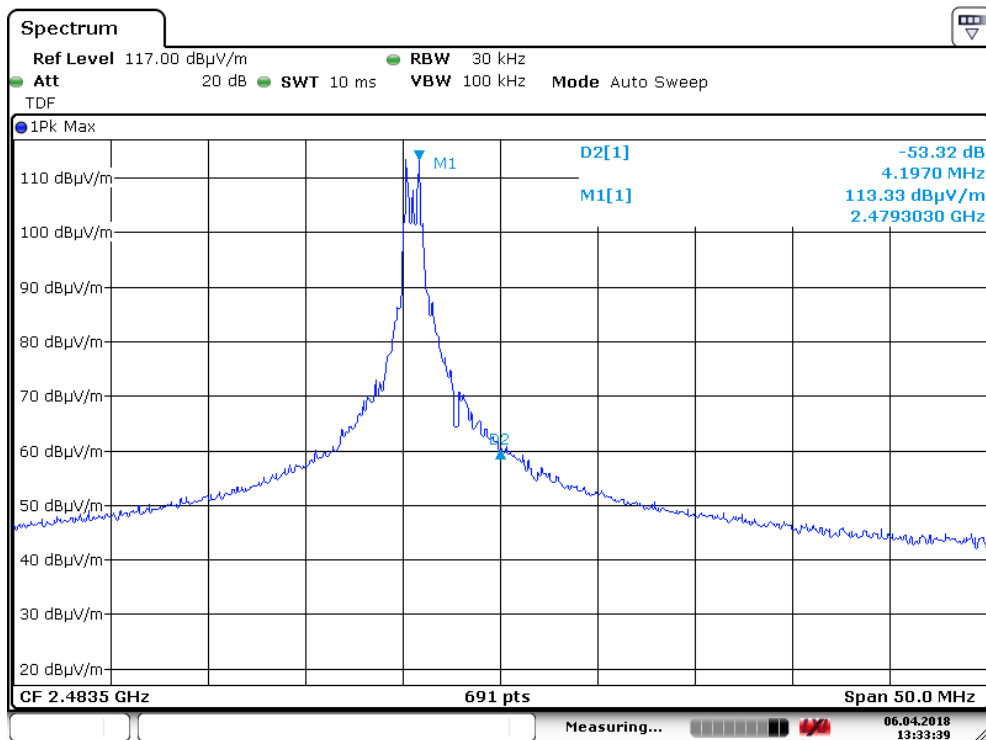
Date: 6.APR.2018 13:20:49

Marker Delta, 2390 MHz, Peak Detector, hopping off, antenna 2



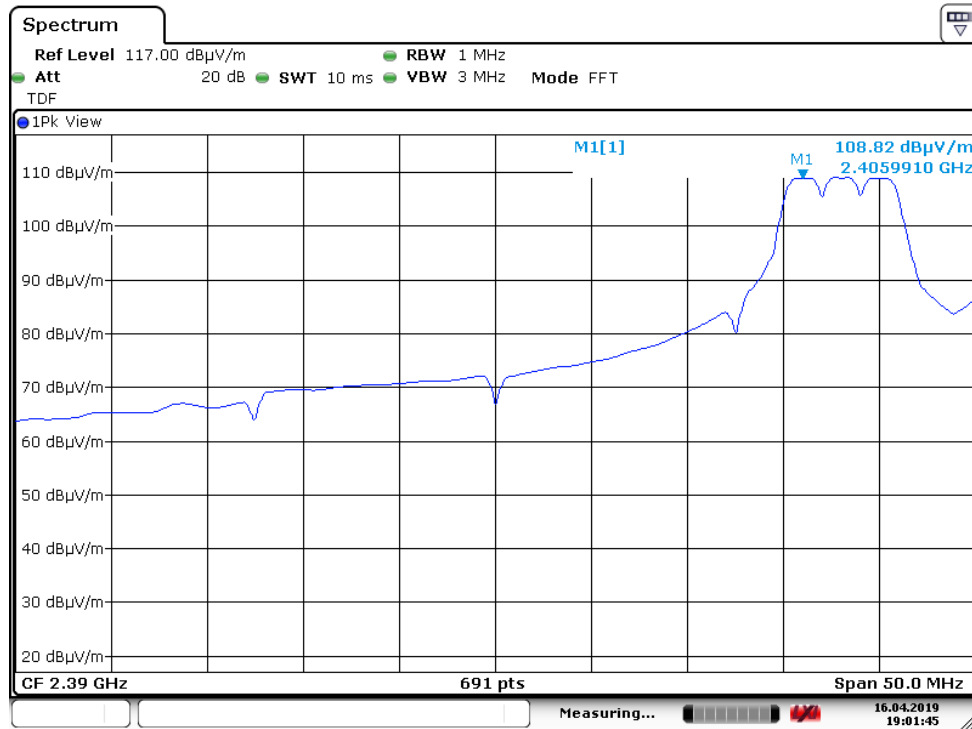
Date: 4.APR.2018 18:47:24

Max field strength at highest channel, hopping off, antenna 2



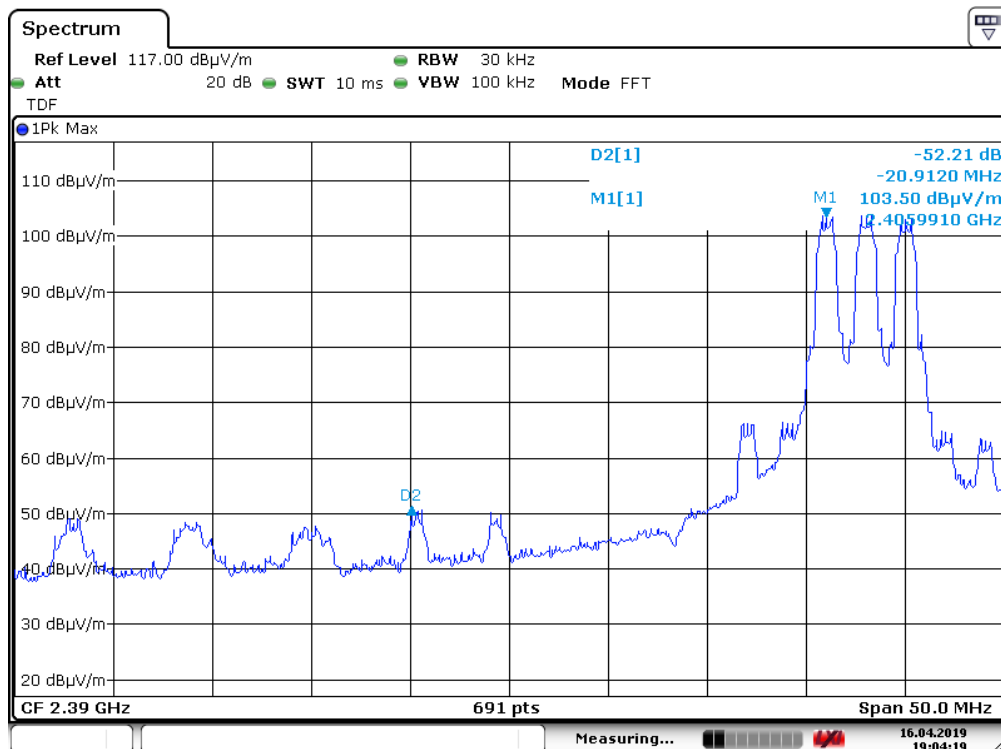
Date: 6.APR.2018 13:33:39

Marker Delta, 2483.5 MHz, Peak Detector, hopping off, antenna 2



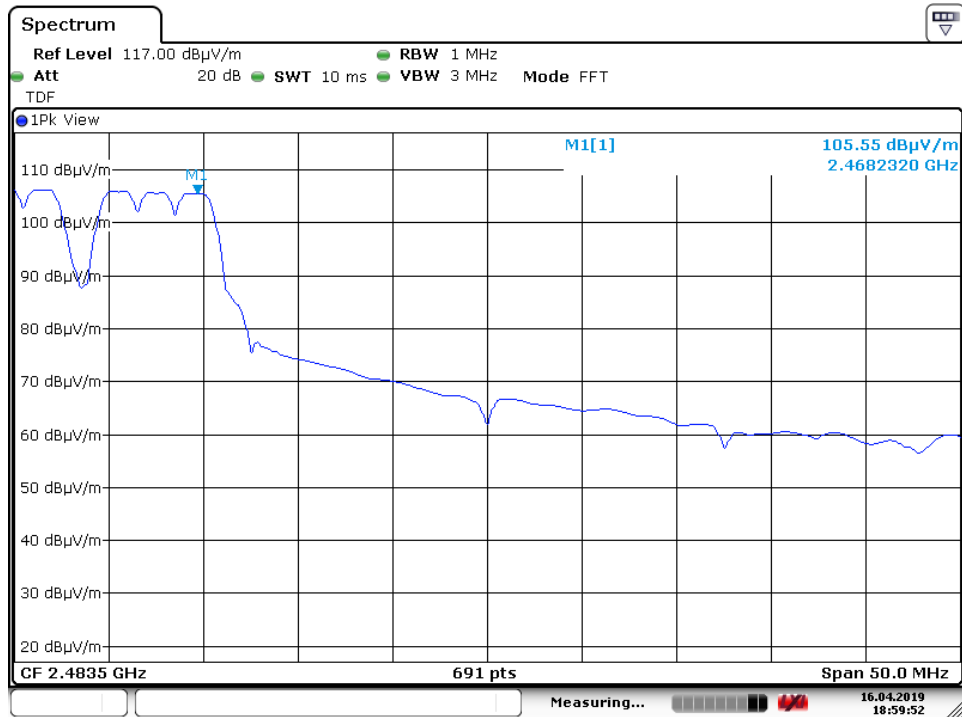
Date: 16.APR.2019 19:01:45

Max field strength at lowest channel, hopping on, antenna 1



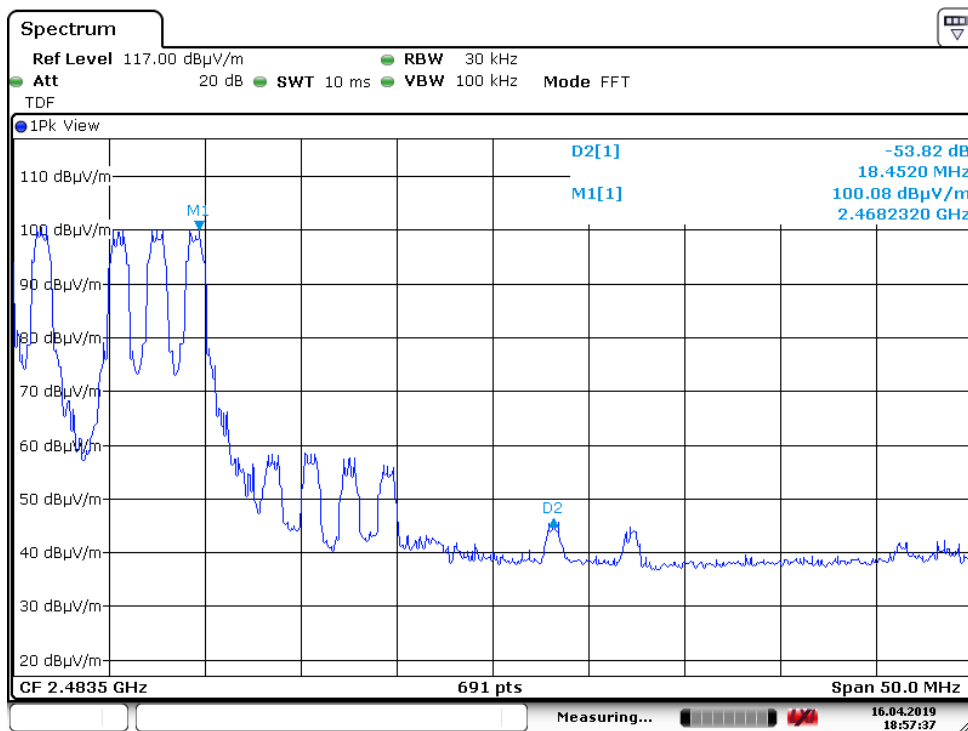
Date: 16.APR.2019 19:04:20

Marker Delta, 2390 MHz, Peak Detector, hopping on, antenna 1



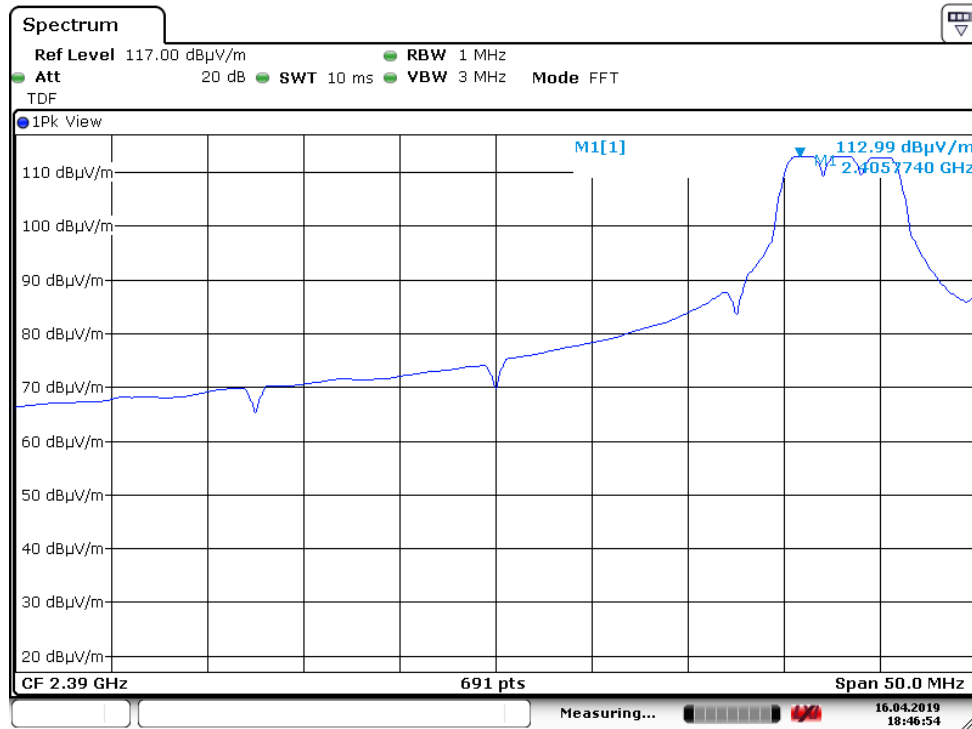
Date: 16.APR.2019 18:59:52

Max field strength at highest channel, hopping on, antenna 1



Date: 16.APR.2019 18:57:37

Marker Delta, 2483.5 MHz, Peak Detector, hopping on, antenna 1



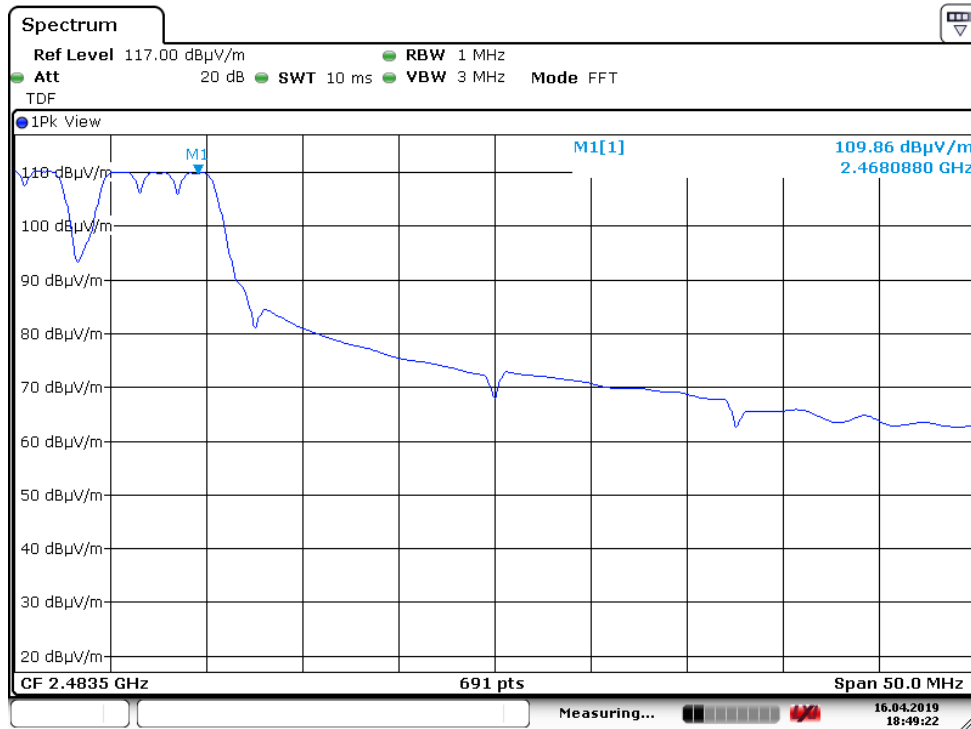
Date: 16.APR.2019 18:46:55

Max field strength at lowest channel, hopping on, antenna 2



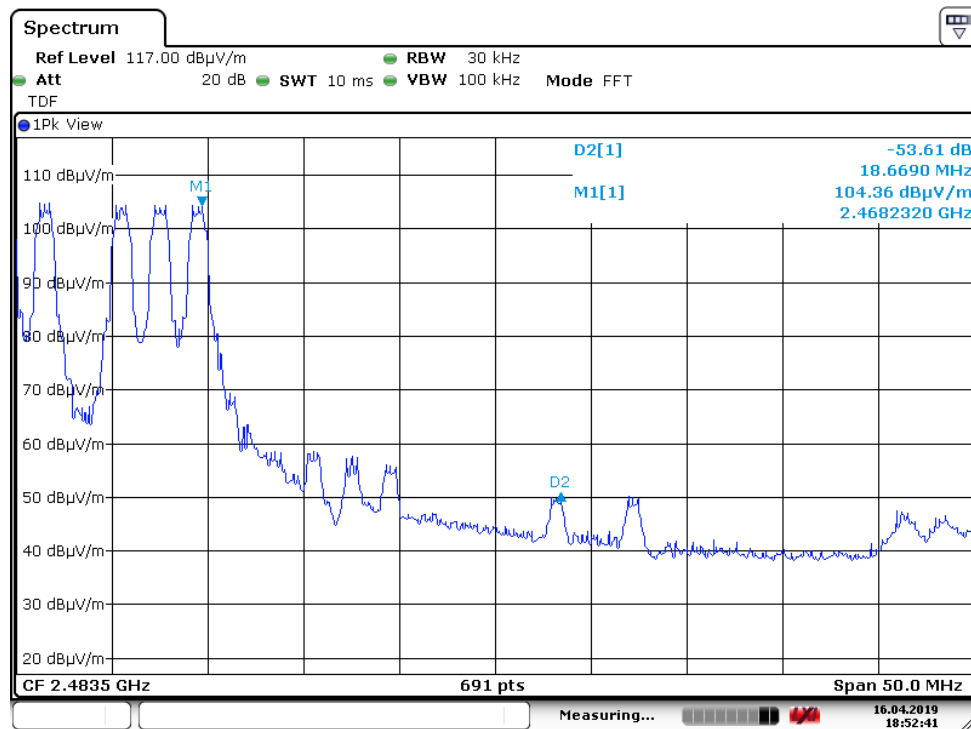
Date: 16.APR.2019 18:43:53

Marker Delta, 2390 MHz, Peak Detector, hopping on, antenna 2



Date: 16.APR.2019 18:49:22

Max field strength at highest channel, hopping on, antenna 2



Date: 16.APR.2019 18:52:41

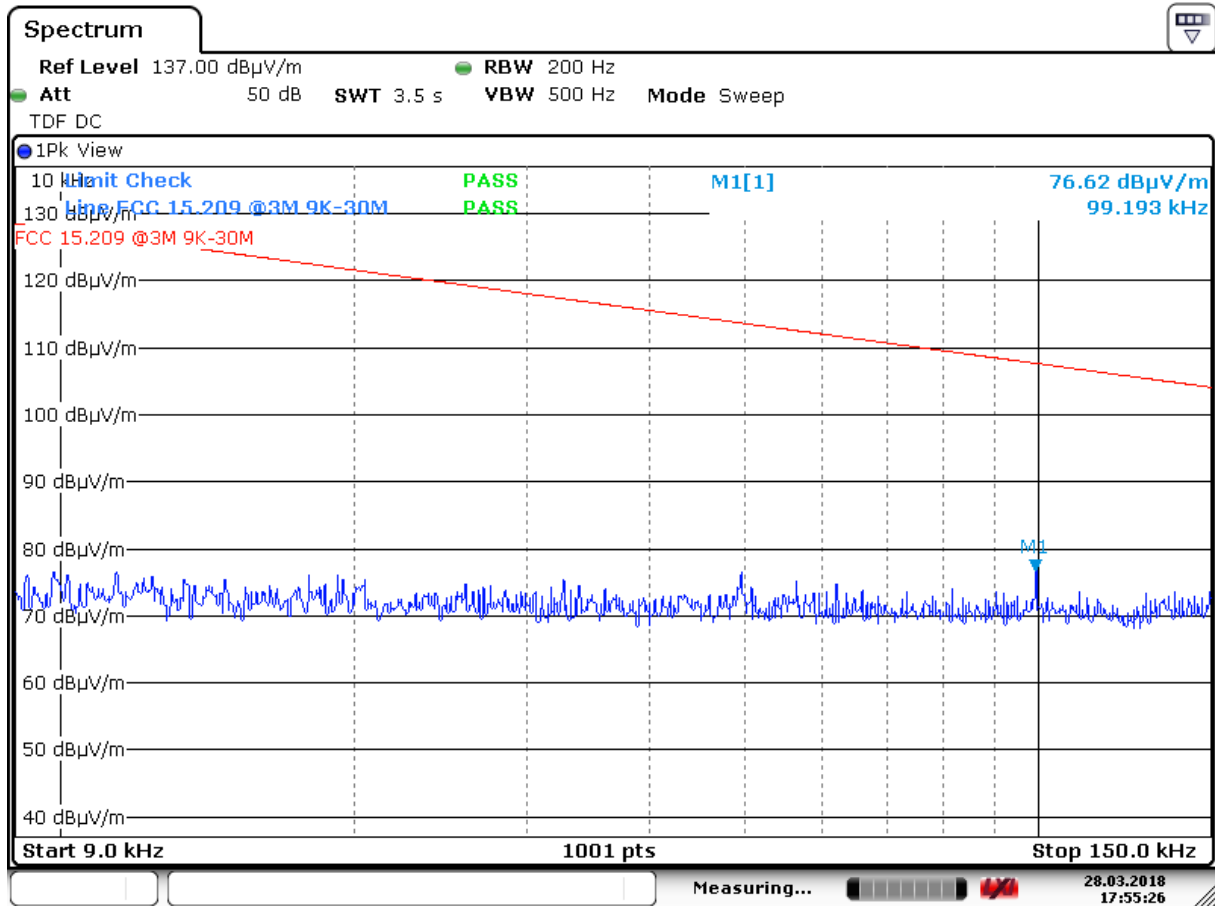
Marker Delta, 2483.5 MHz, Peak Detector, hopping on, antenna 2

Radiated emissions 10 kHz-30 MHz.

Measuring distance 3 m, measured with Peak detector.

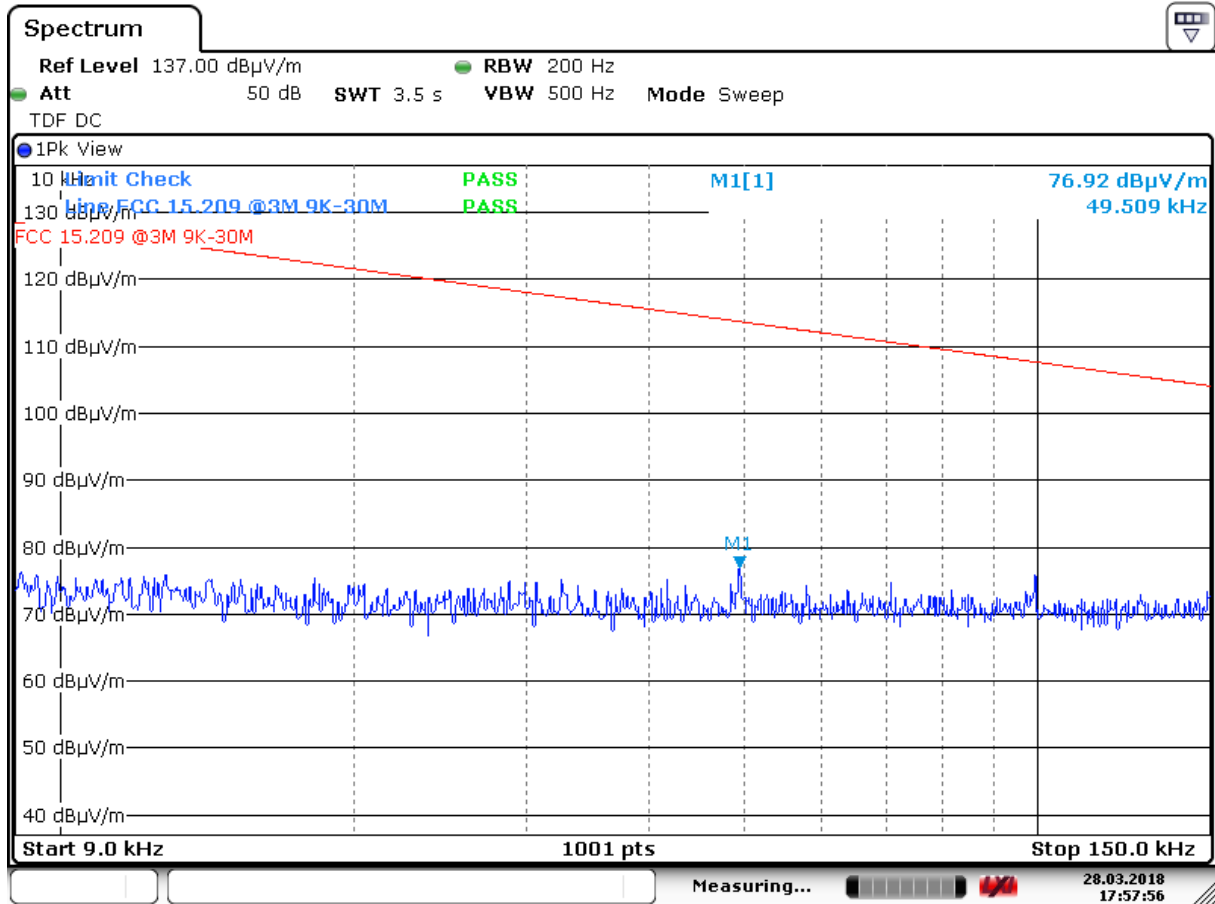
No component detected, see attached graph.

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



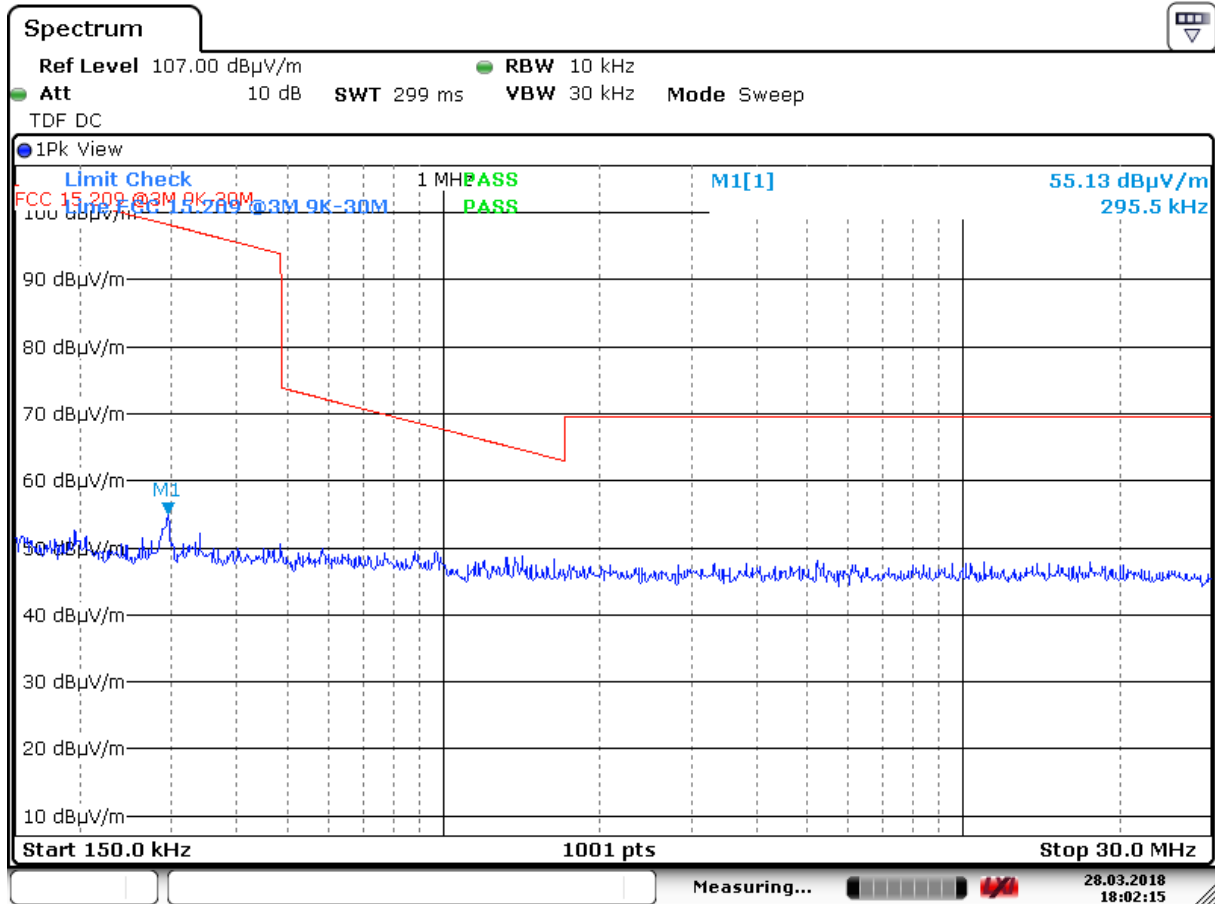
Date: 28.MAR.2018 17:55:27

Radiated Emissions, 9 kHz – 150 kHz @3m, antenna 1



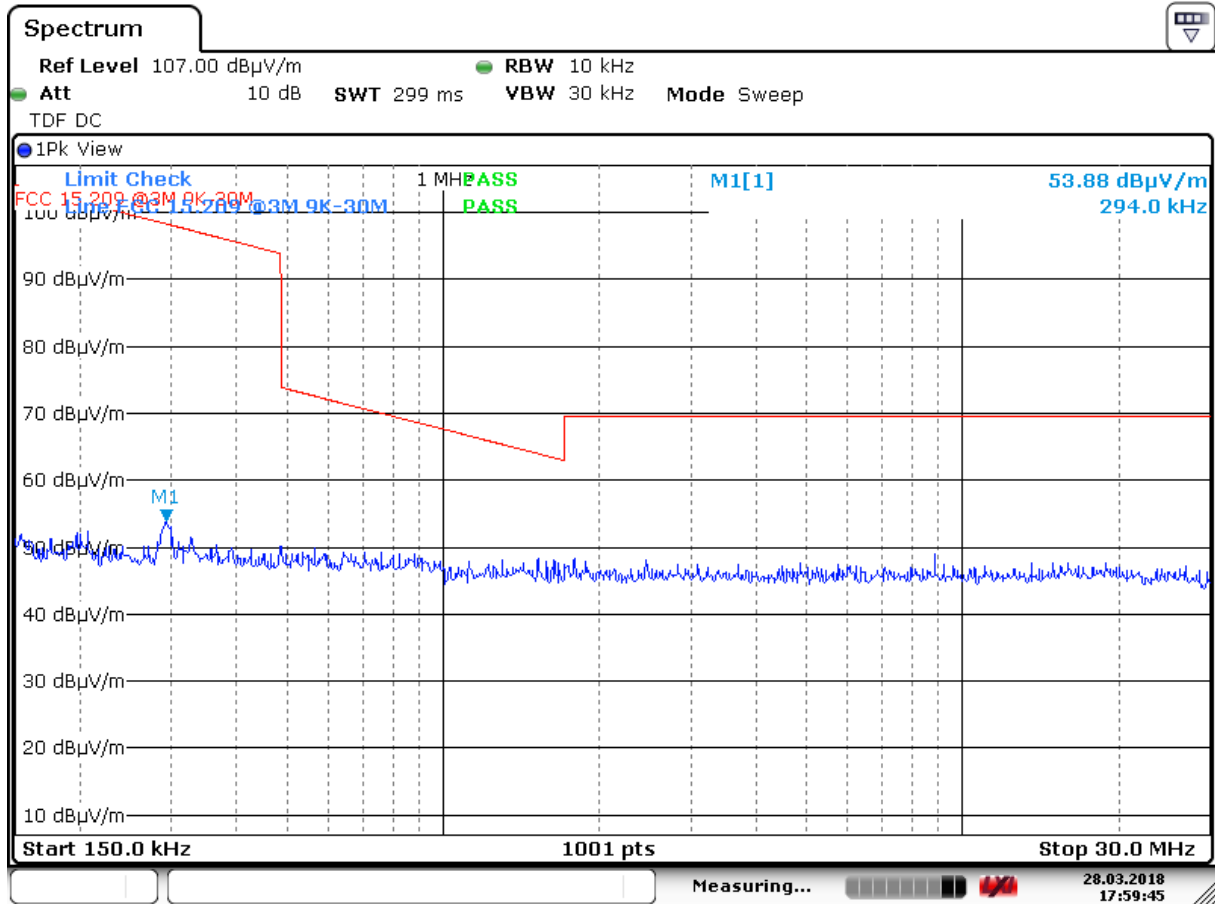
Date: 28.MAR.2018 17:57:56

Radiated Emissions, 9 kHz – 150 kHz @3m, antenna 2



Date: 28.MAR.2018 18:02:15

Radiated Emissions, 150 kHz - 30MHz @3m, antenna 1



Date: 28.MAR.2018 17:59:45

Radiated Emissions, 150 kHz - 30MHz @3m, antenna 2

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m.

Antenna 1:

Frequency	Operational condition	Detector	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz			dB μ V/m	metres	dB μ V/m	dB
801.640	TX on	QP	42.09	3	46.0	3.91

Fully charged battery is used

Antenna 2:

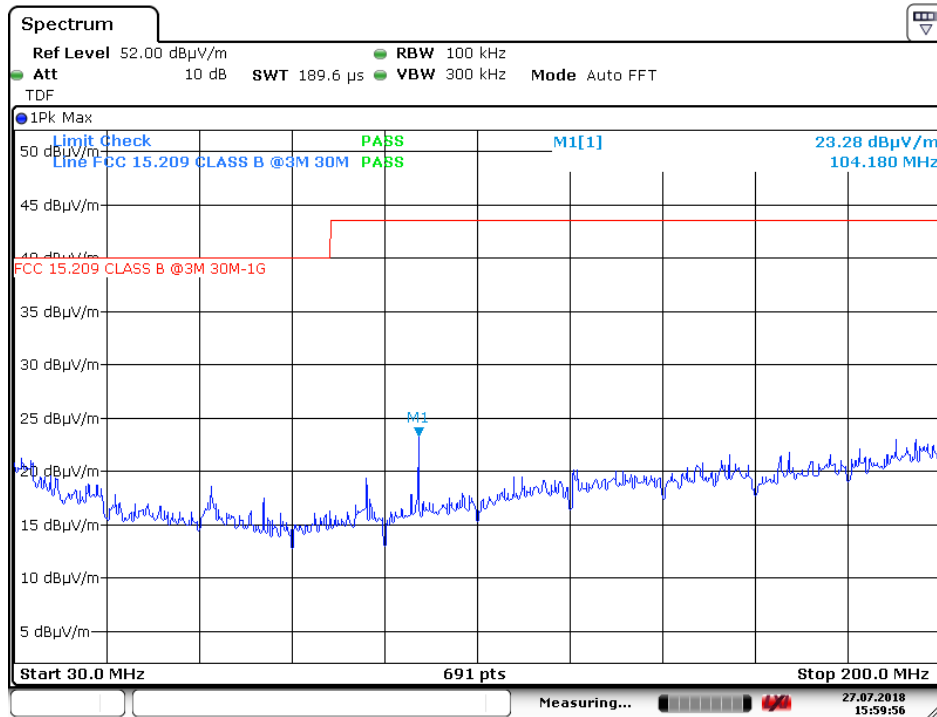
Frequency	Operational condition	Detector	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz			dB μ V/m	metres	dB μ V/m	dB
801.640	TX on	QP	44.08	3	46.0	1.92

Fully charged battery is used

See attached graphs.

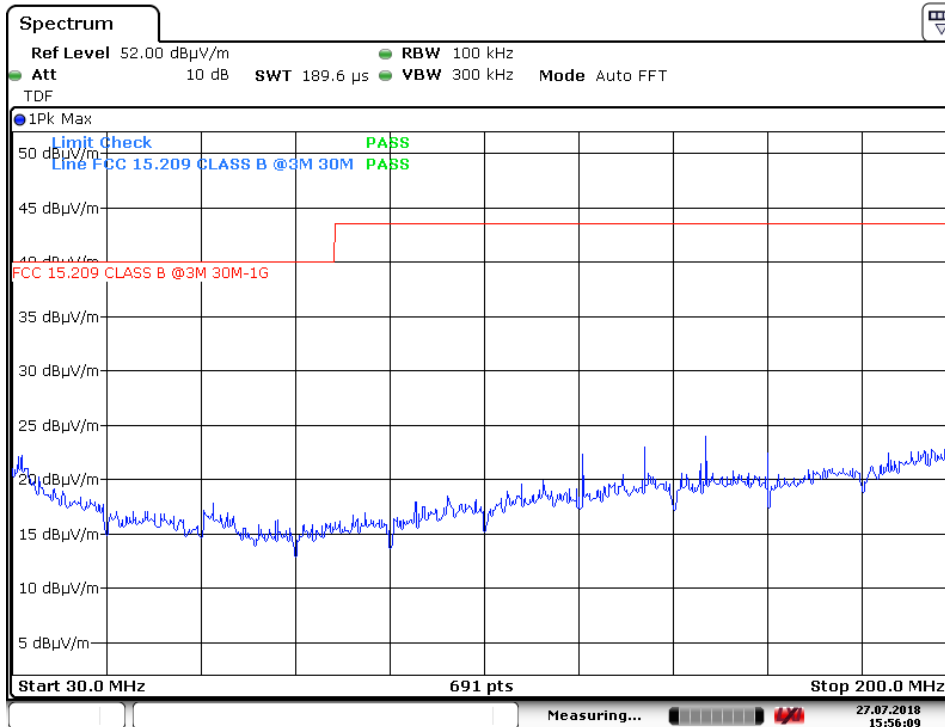
Requirements/Limit

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



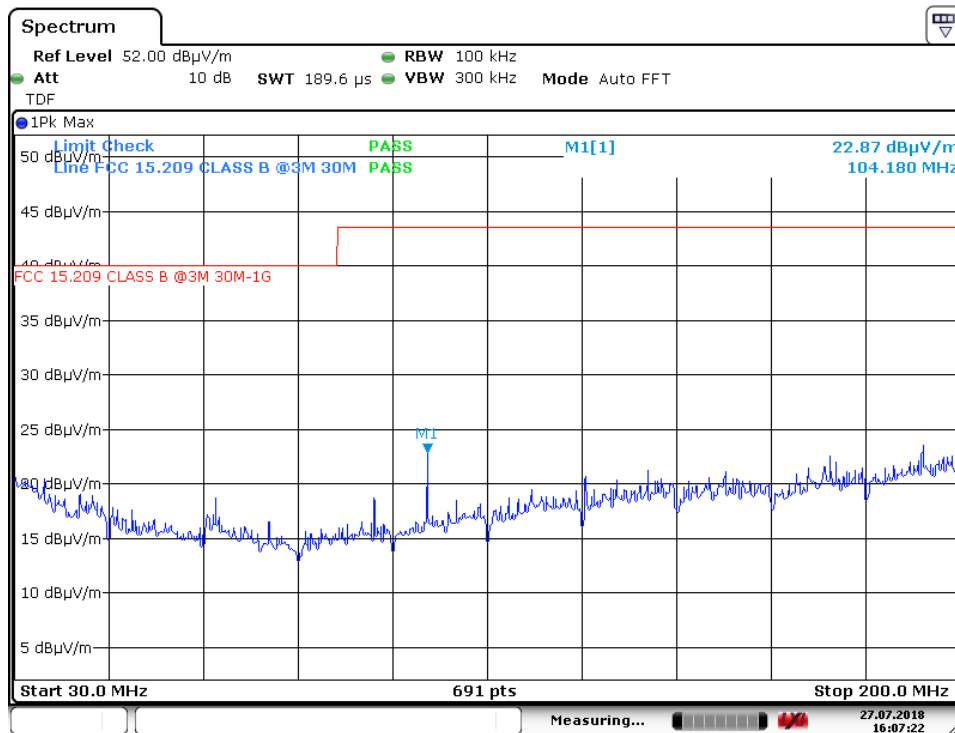
Date: 27.JUL.2018 15:59:57

Radiated Emissions, 30 – 200 MHz, VP, @3m, PK scan, antenna 1



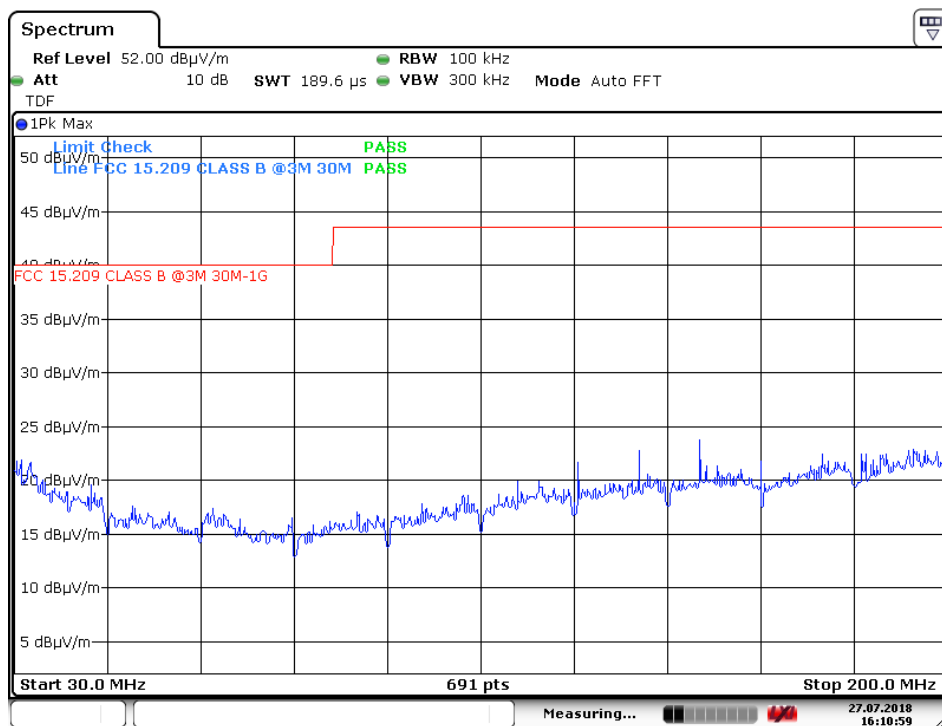
Date: 27.JUL.2018 15:56:09

Radiated Emissions, 30 – 200 MHz, HP, @3m, PK scan, antenna 1



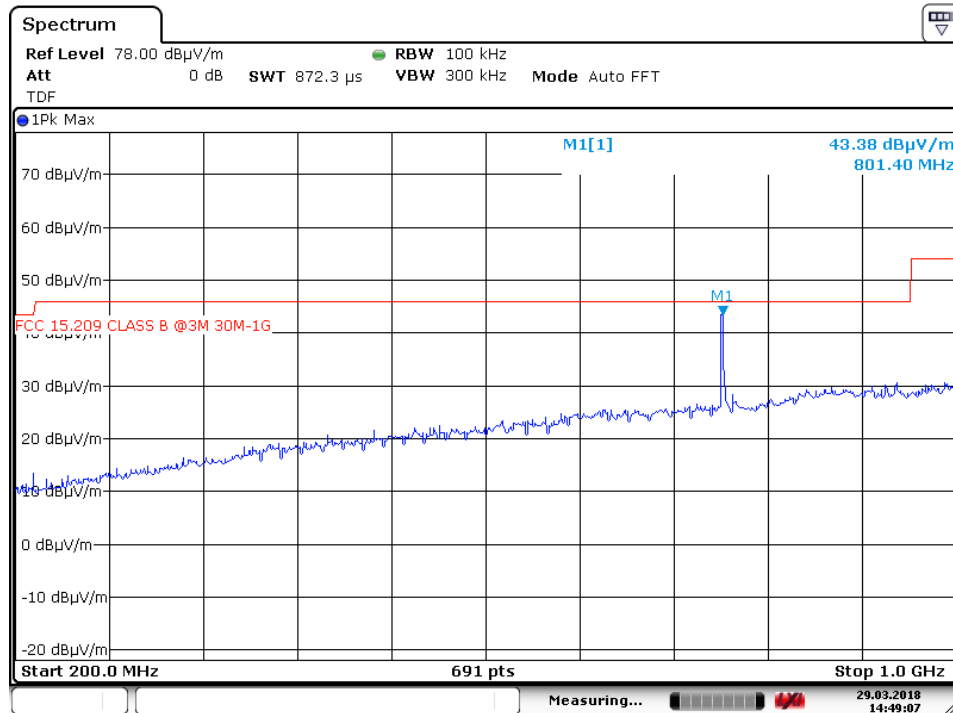
Date: 27.JUL.2018 16:07:22

Radiated Emissions, 30 – 200 MHz, VP, @3m, PK scan, antenna 2



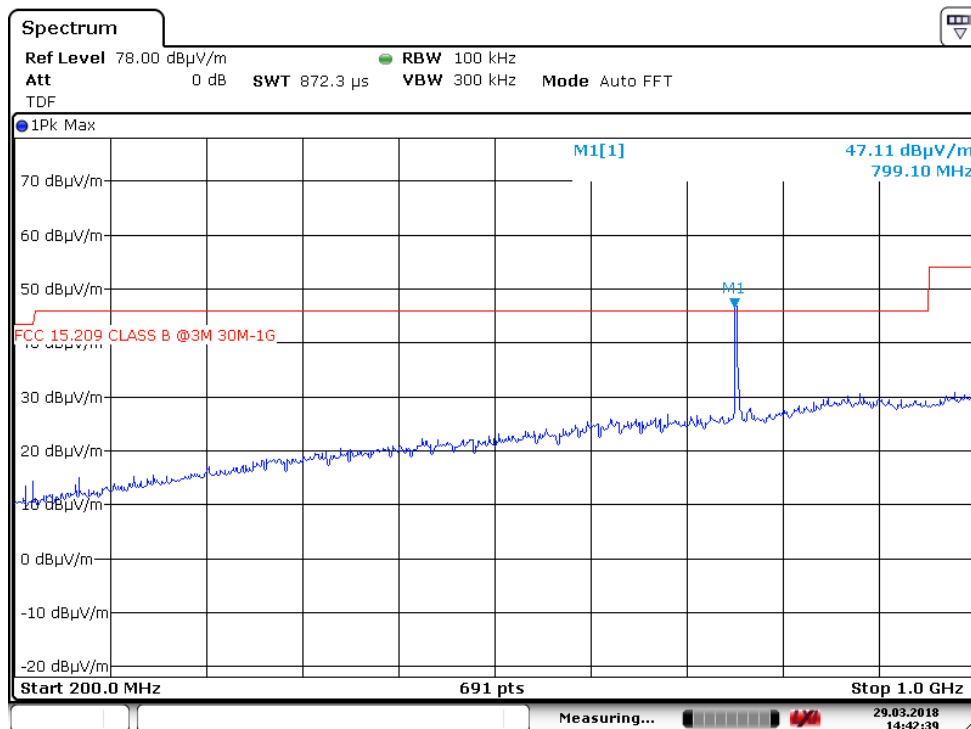
Date: 27.JUL.2018 16:10:59

Radiated Emissions, 30 – 200 MHz, HP, @3m, PK scan, antenna 2



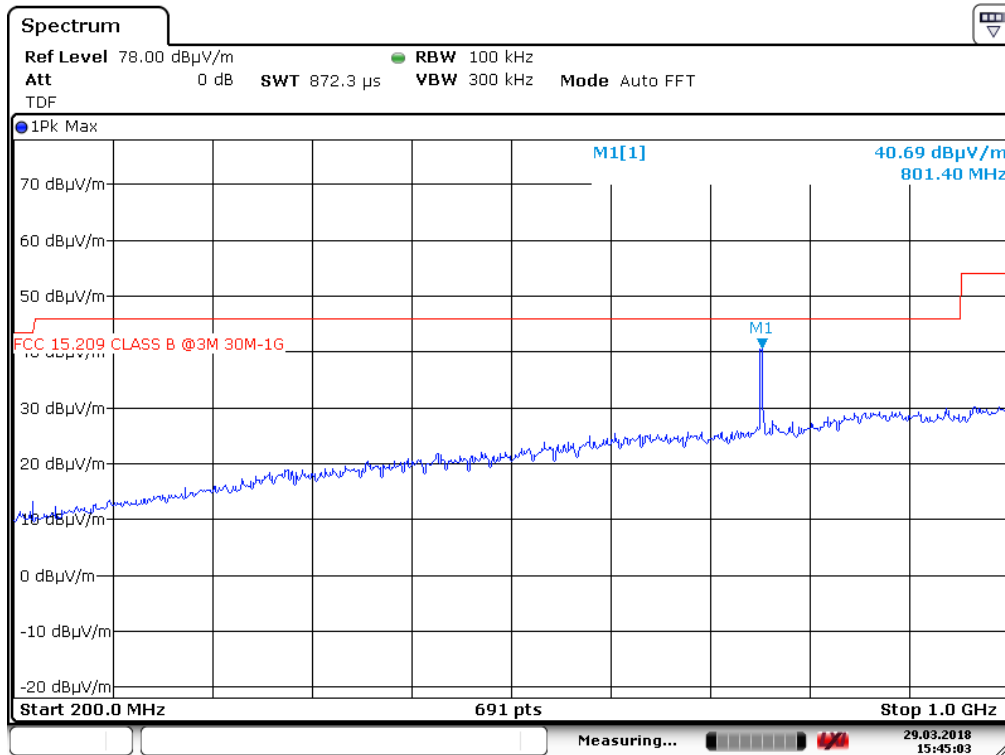
Date: 29.MAR.2018 14:49:07

Radiated Emissions, 200 - 1000 MHz, VP, @3m, PK scan, antenna 1



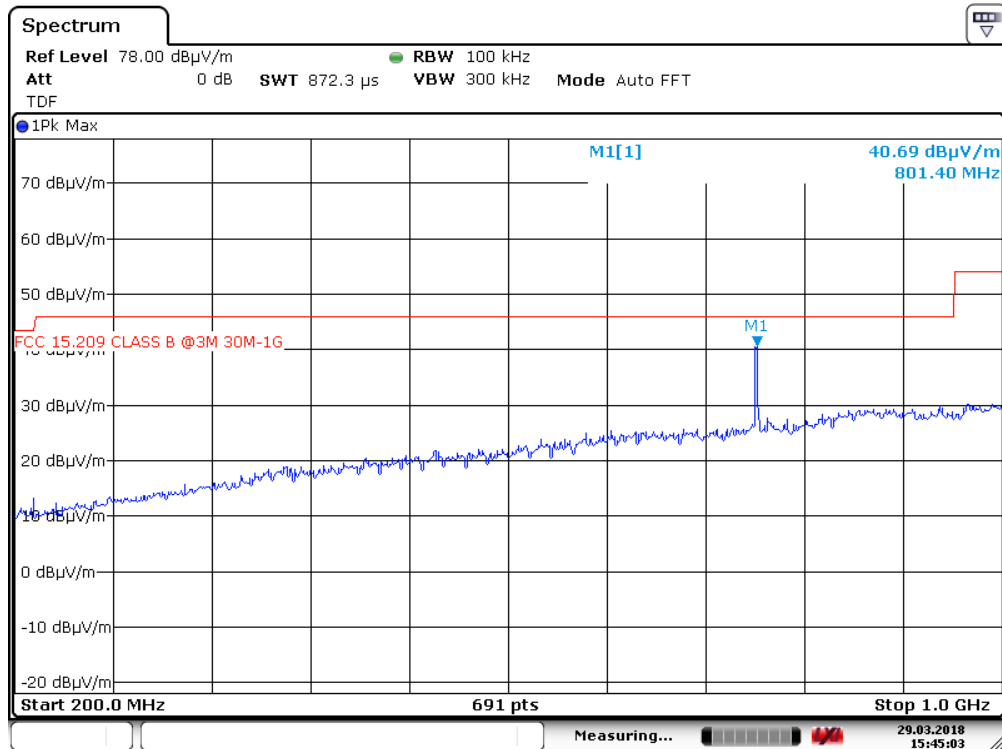
Date: 29.MAR.2018 14:42:39

Radiated Emissions, 200 - 1000 MHz, HP, @3m, PK scan, antenna 1
 QP values are listed on page 46



Date: 29.MAR.2018 15:45:03

Radiated Emissions, 200 - 1000MHz, VP, @3m, PK scan, antenna 2



Date: 29.MAR.2018 15:45:03

Radiated Emissions, 200 - 1000MHz, HP, @3m, PK scan, antenna 2

Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 25 GHz)

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

Peak Detector, antenna 1:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.800	L	0	65.81	0	74	8.19
4.880	M	0	59.86	0	74	14.14
4.960	H	0	61.15	0	74	12.85
7.207	L	0	60.55	0	74	13.45
7.319	M	0	58.77	0	74	15.23
7.438	H	0	59.18	0	74	14.82
9.609	L	0	60.57	0	74	13.43
9.759	M	0	59.10	0	74	14.90
9.917	H	0	60.87	0	74	13.13
12.010	L	0	60.21	0	74	13.79
12.200	M	0	59.39	0	74	14.61
12.395	H	0	59.32	0	74	14.68
17.848	L,M,H	0	62.67	0	74	11.33
Other freqs	L,M,H	/	< 54	0	74	>20

Fully charged battery is used

Average Detector, antenna 1:

Frequency	RF channel	Dist. corr. factor	Field strength, Average Detector	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.80	L	0	45.81 *)	20	54	8.19
4.88	M	0	39.86 *)	20	54	14.14
4.96	H	0	41.15 *)	20	54	12.85
7.207	L	0	40.55 *)	20	54	13.45
7.319	M	0	38.77 *)	20	54	15.23
7.438	H	0	39.18 *)	20	54	14.82
9.609	L	0	40.57 *)	20	54	13.43
9.759	M	0	39.10 *)	20	54	14.90
9.917	H	0	40.87 *)	20	54	13.13
12.010	L	0	60.21 *)	20	54	13.79
12.200	M	0	59.39 *)	20	54	14.61
12.395	H	0	59.32 *)	20	54	14.68
17.848	L,M,H	0	51.45	0	54	2.55
Other freqs	L,M,H	/	/	0	54	/

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

Fully charged battery is used

Peak Detector, antenna 2:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.80	L	0	60.39	0	74	13.61
4.88	M	0	57.73	0	74	16.27
4.96	H	0	62.27	0	74	11.73
7.207	L	0	58.11	0	74	15.89
7.319	M	0	57.60	0	74	16.40
7.438	H	0	57.28	0	74	16.72
9.609	L	0	59.24	0	74	14.76
9.759	M	0	57.38	0	74	16.62
9.917	H	0	57.87	0	74	16.13
12.010	L	0	60.43	0	74	13.57
12.200	M	0	60.44	0	74	13.56
12.395	H	0	60.83	0	74	13.17
17.848	L,M,H	0	62.58	0	74	11.42
Other freqs	L,M,H	/	< 54	0	74	>20

Fully charged battery is used

Average Detector, antenna 2:

Frequency	RF channel	Dist. corr. factor	Field strength, Average Detector	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.80	L	0	40.39 *)	20	54	13.61
4.88	M	0	37.73 *)	20	54	16.27
4.96	H	0	42.27 *)	20	54	11.73
7.207	L	0	38.11 *)	20	54	15.89
7.319	M	0	37.60 *)	20	54	16.40
7.438	H	0	37.28 *)	20	54	16.72
9.609	L	0	39.24 *)	20	54	14.76
9.759	M	0	37.38 *)	20	54	16.62
9.917	H	0	37.87 *)	20	54	16.13
12.010	L	0	60.43 *)	20	74	13.57
12.200	M	0	60.44 *)	20	74	13.56
12.395	H	0	60.83 *)	20	74	13.17
17.848	L,M,H	0	51.34	0	54	2.66
Other freqs	L,M,H	/	/	0	54	/

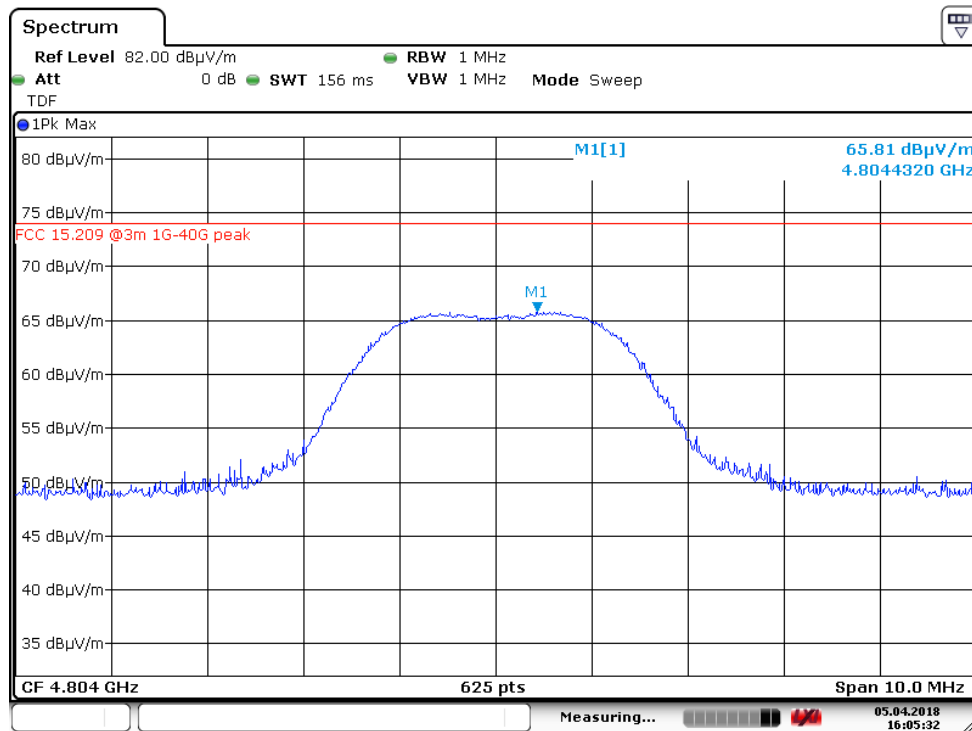
*) Average Values are calculated from Peak Values by Duty Cycle Correction Factor.

Fully charged battery is used

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

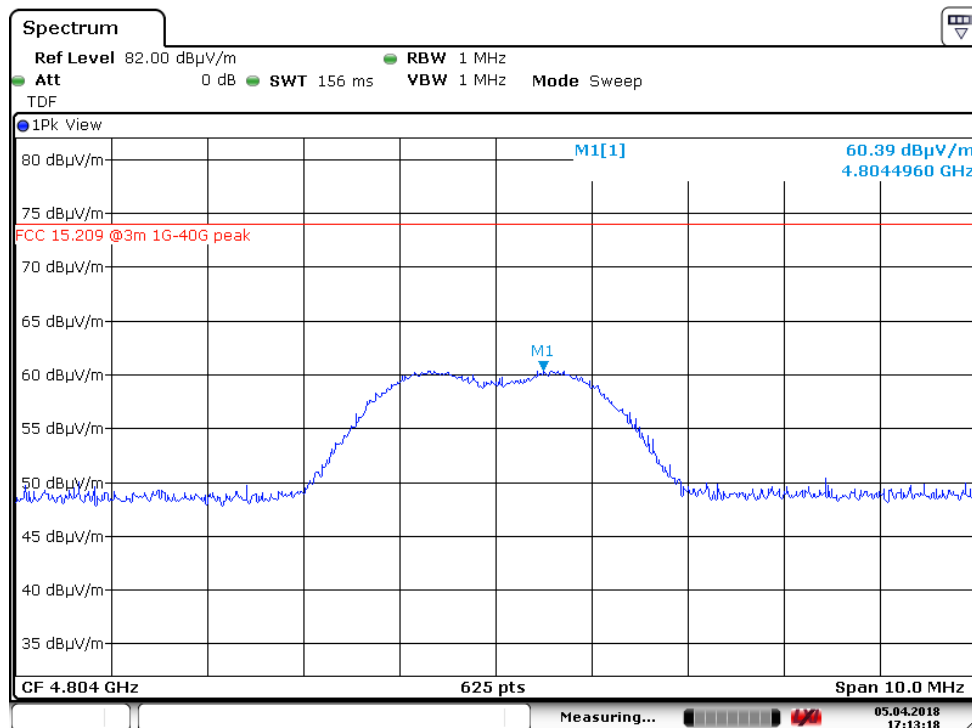
See plots.

No harmonics detected in the frequency range 18 – 25 GHz



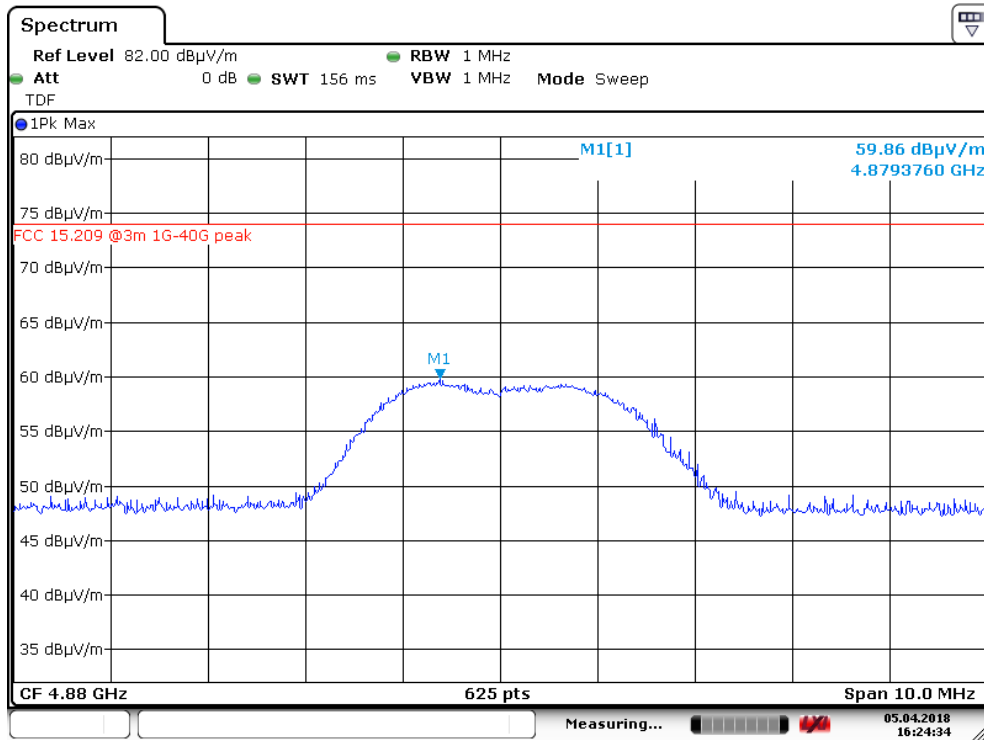
Date: 5.APR.2018 16:05:32

2nd harmonic – ch2402MHz, HP – PK, antenna 1



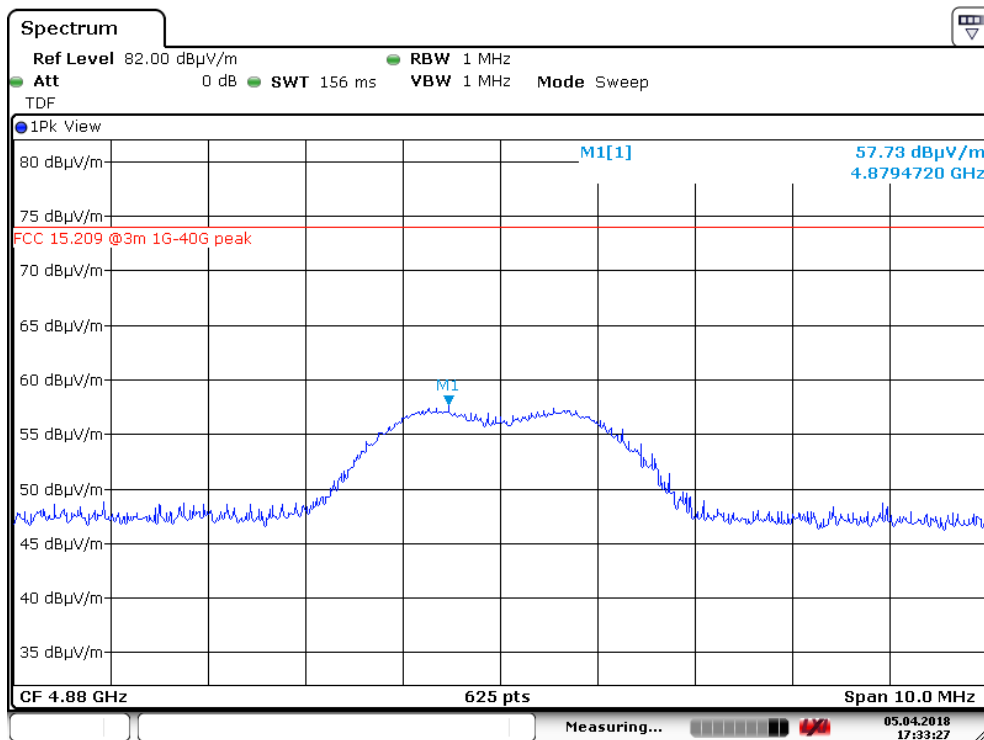
Date: 5.APR.2018 17:13:18

2nd harmonic – ch2402MHz, HP – PK, antenna 2



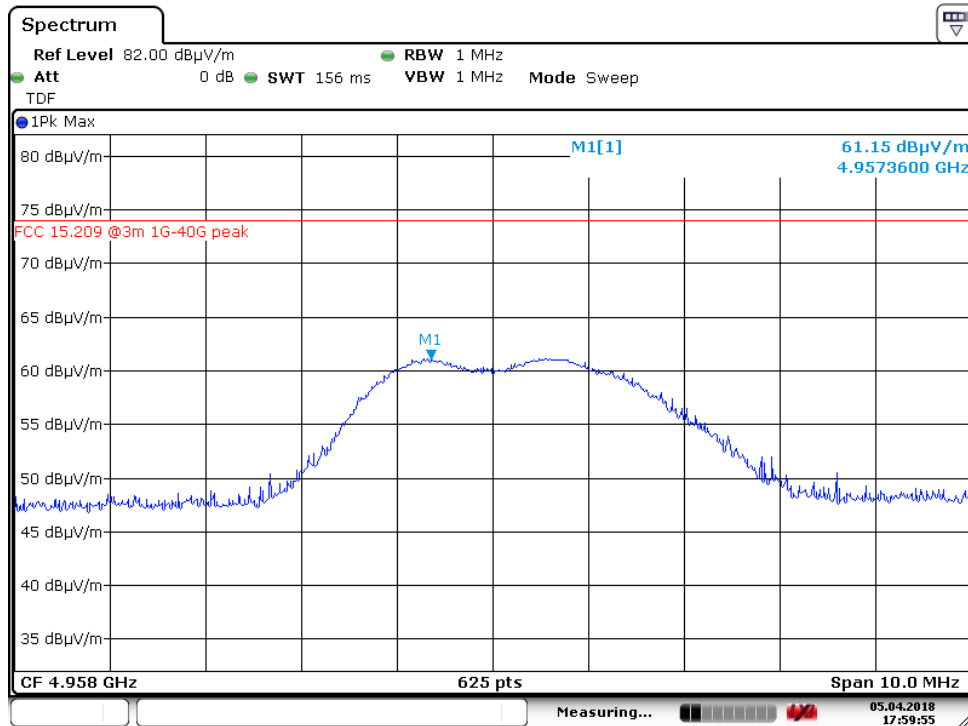
Date: 5.APR.2018 16:24:35

2nd harmonic – ch2440MHz, HP – PK, antenna 1



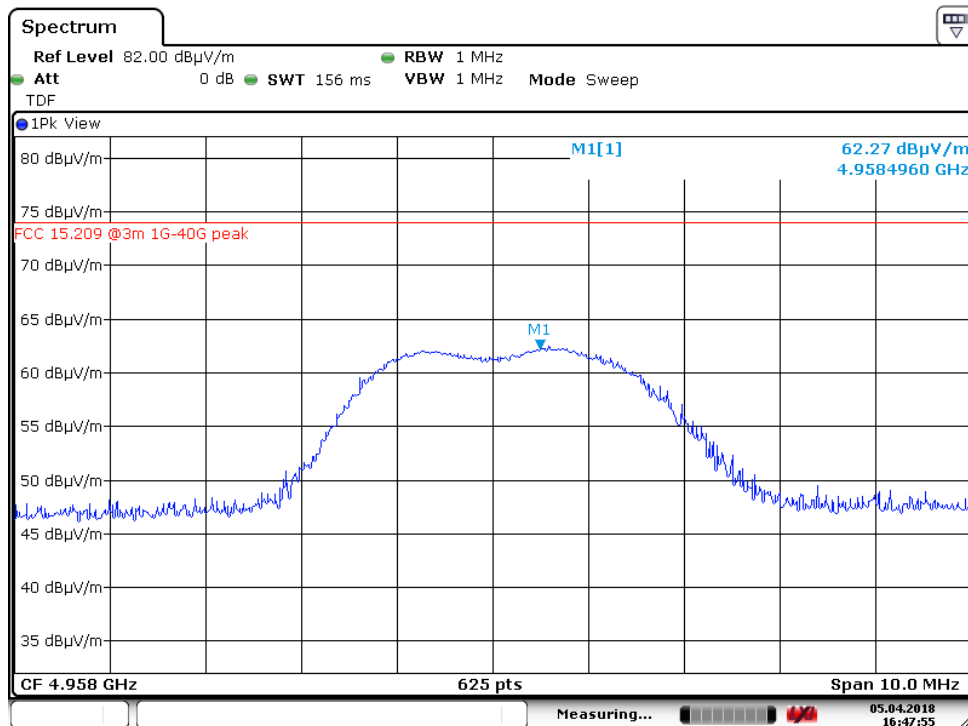
Date: 5.APR.2018 17:33:28

2nd harmonic – ch2440MHz, VP – PK, antenna 2



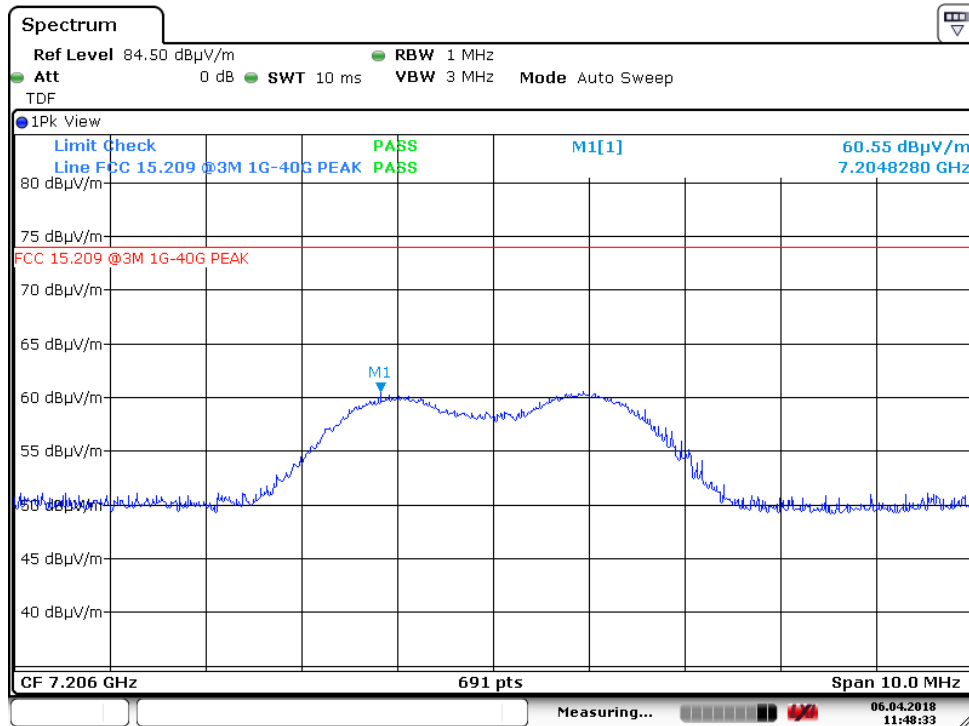
Date: 5.APR.2018 17:59:56

2nd harmonic – ch2479MHz, VP – PK, antenna 1



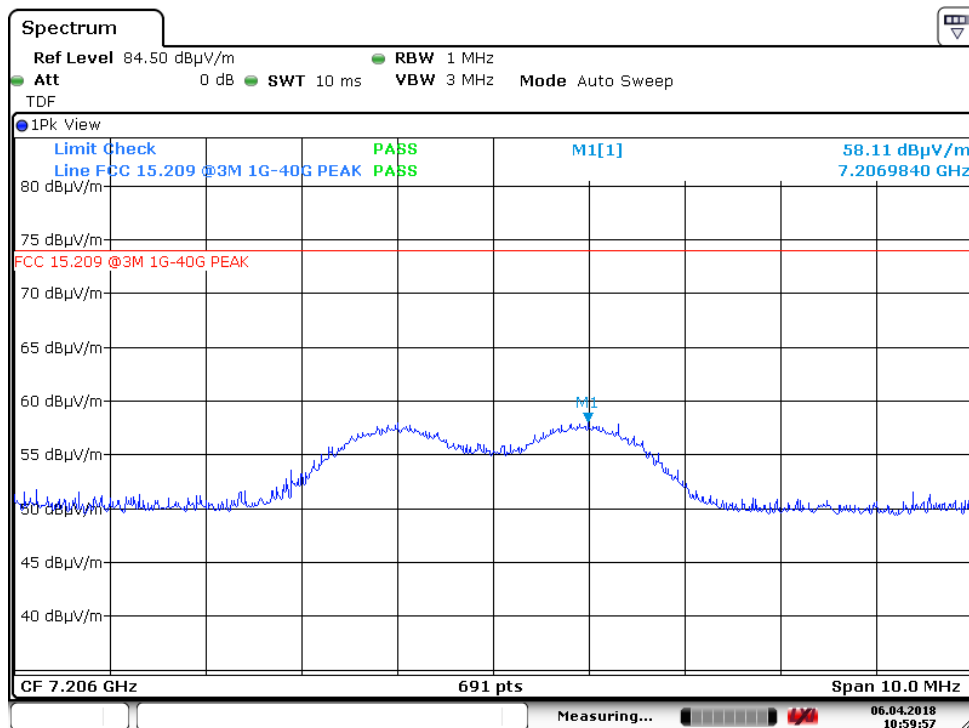
Date: 5.APR.2018 16:47:55

2nd harmonic – ch2479MHz, HP – PK, antenna 2



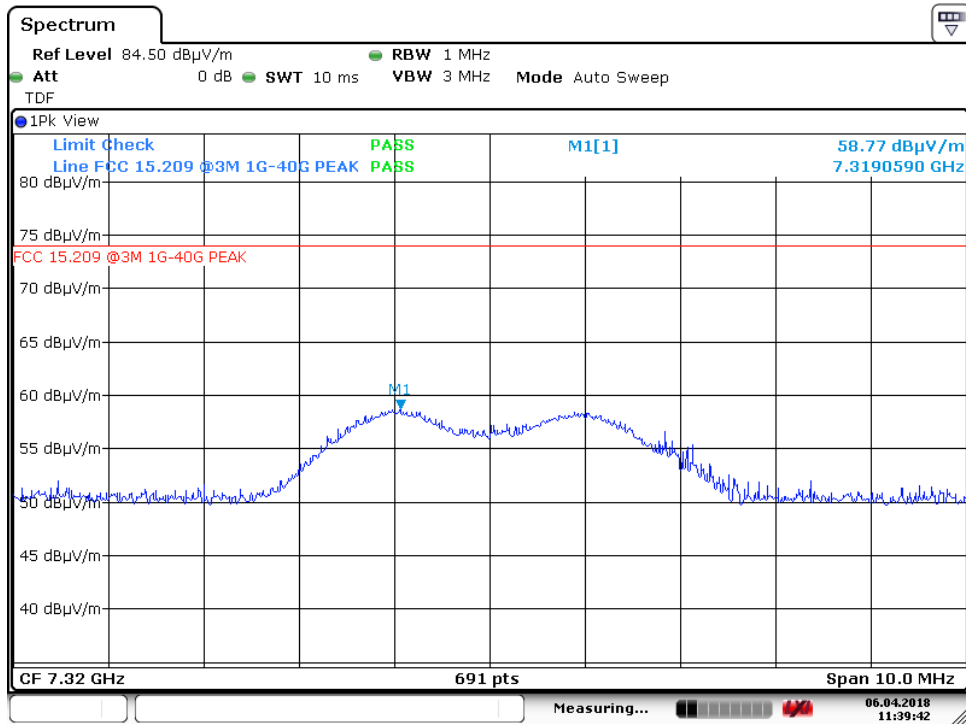
Date: 6.APR.2018 11:48:34

3rd harmonic – ch2402MHz, VP – PK, antenna 1



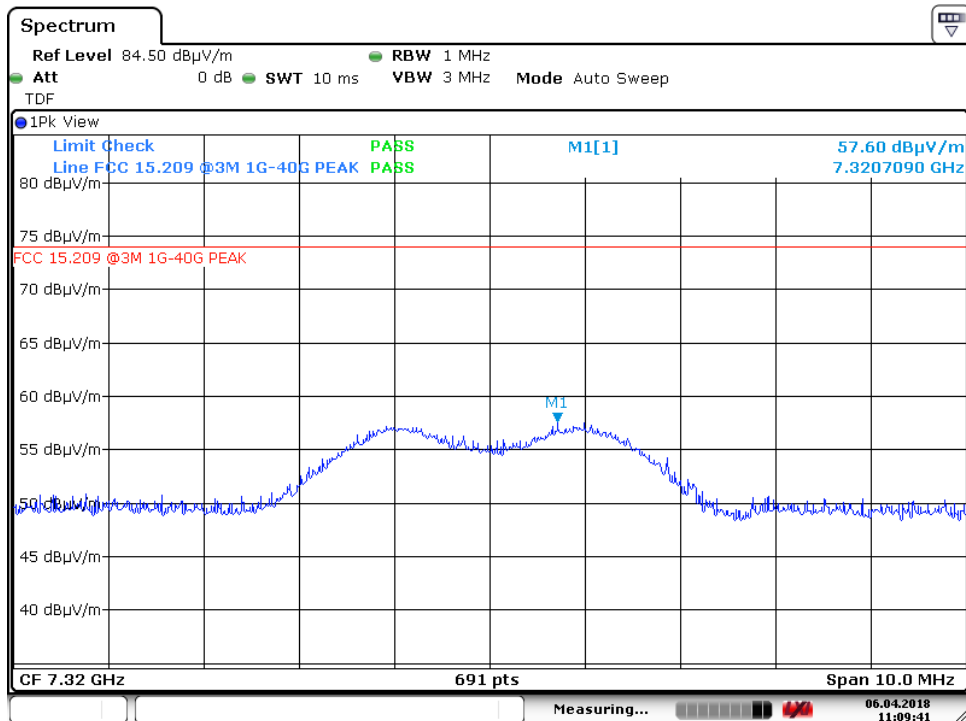
Date: 6.APR.2018 10:59:58

3rd harmonic – ch2402MHz, VP – PK, antenna 2



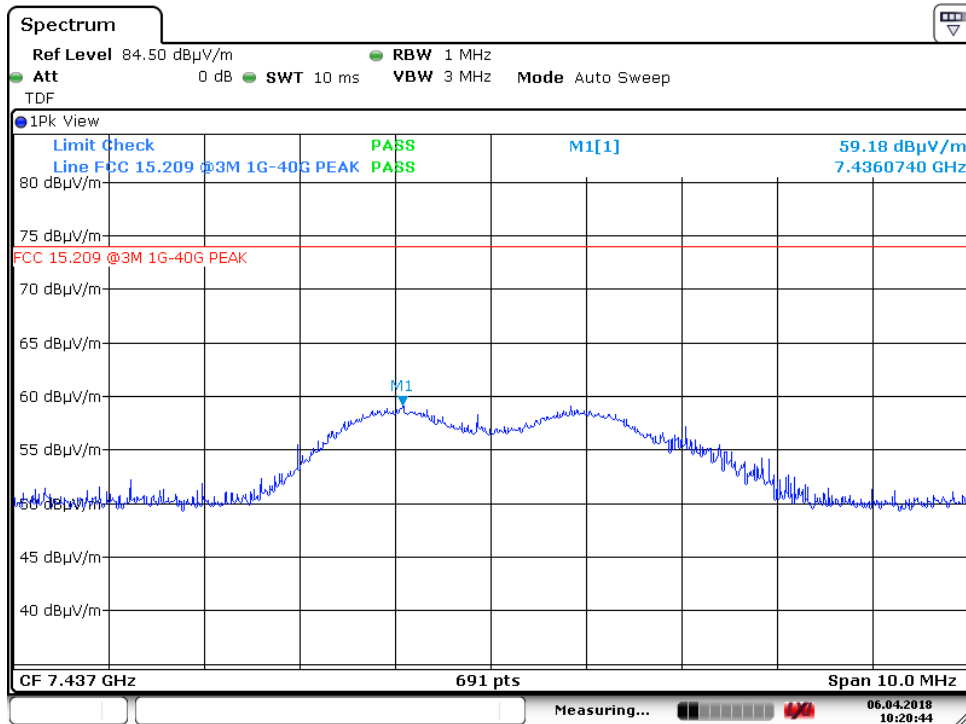
Date: 6.APR.2018 11:39:42

3rd harmonic – ch2440MHz, VP – PK, antenna 1



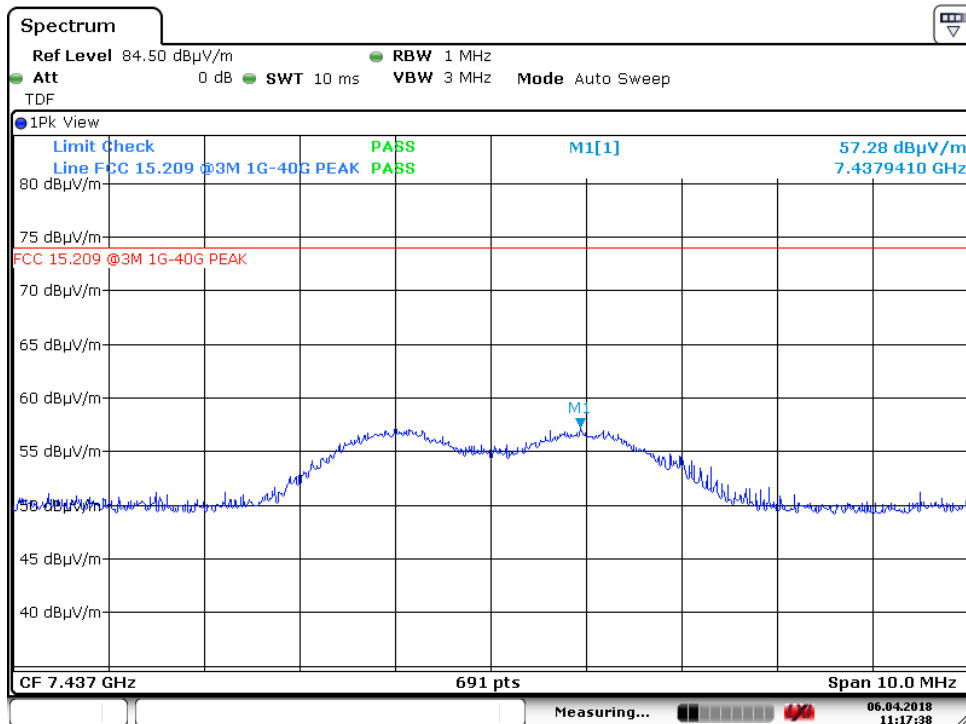
Date: 6.APR.2018 11:09:42

3rd harmonic – ch2440MHz, VP – PK, antenna 2



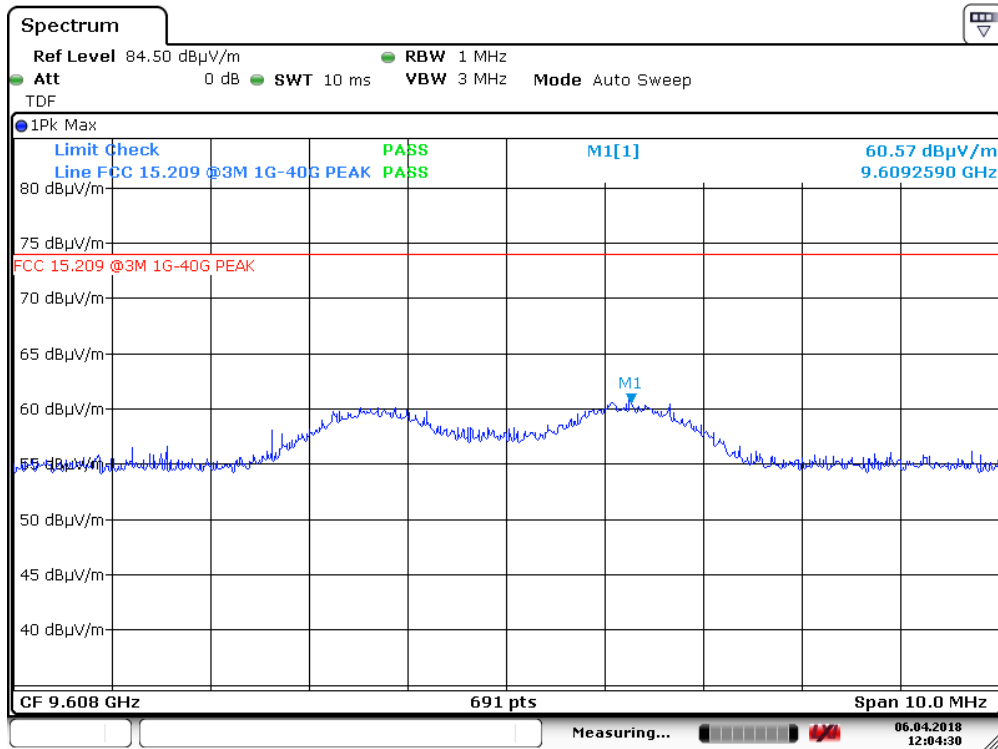
Date: 6.APR.2018 10:20:45

3rd harmonic – ch2479MHz, HP – PK, antenna 1



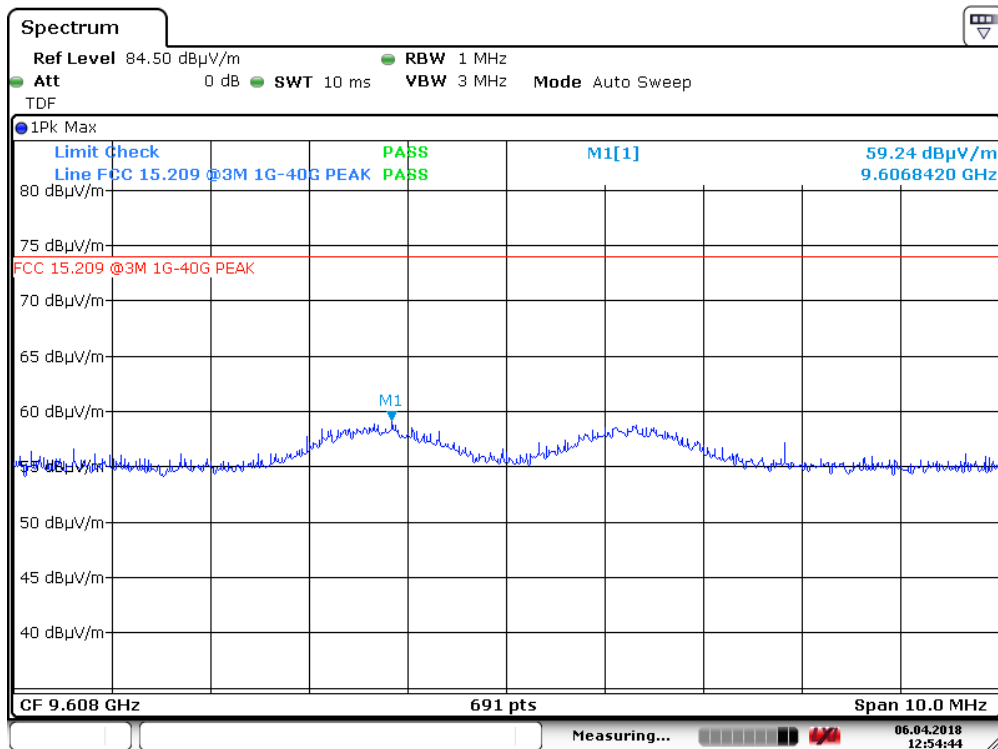
Date: 6.APR.2018 11:17:38

3rd harmonic – ch2479MHz, VP – PK, antenna 2



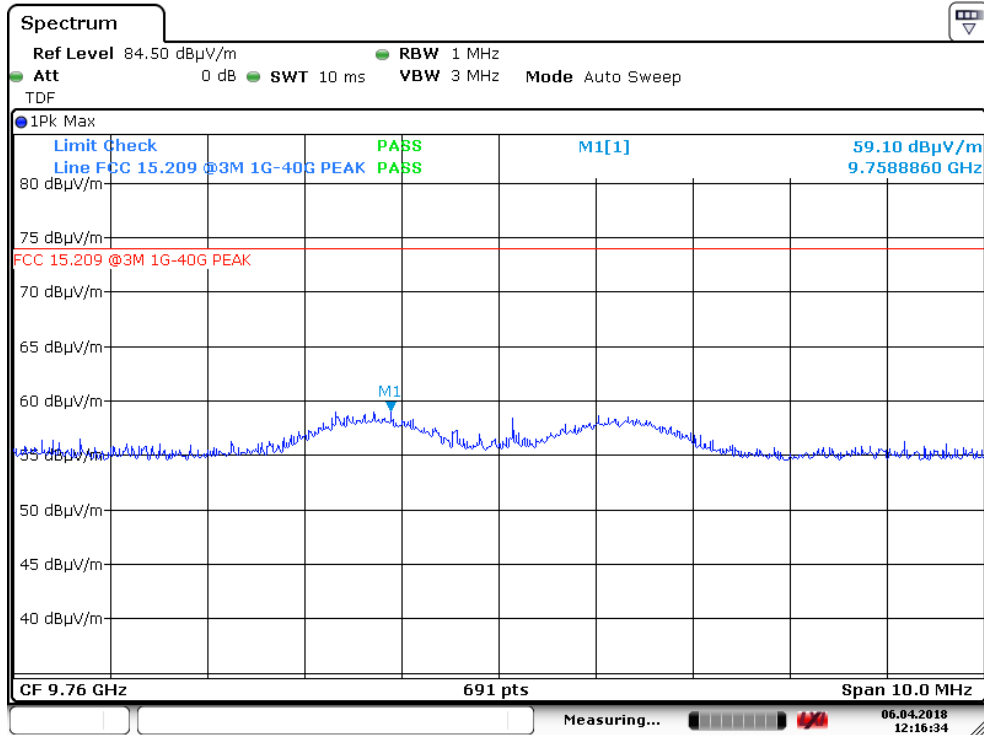
Date: 6.APR.2018 12:04:31

4th harmonic – ch2402MHz, VP – PK, antenna 1



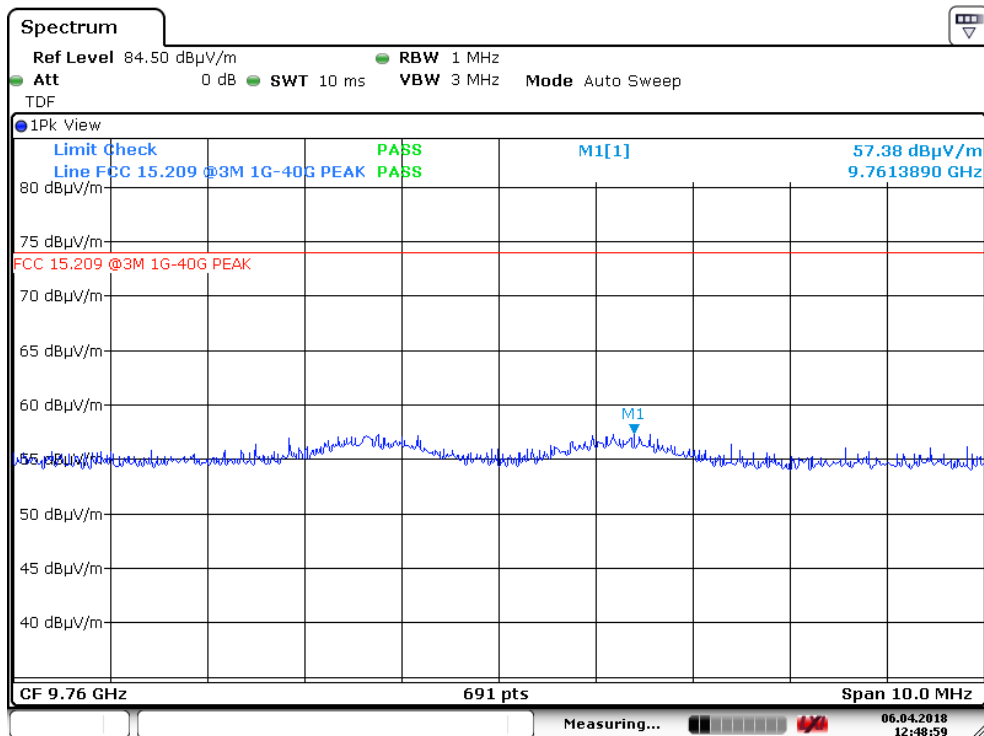
Date: 6.APR.2018 12:54:44

4th harmonic – ch2402MHz, VP – PK, antenna 2



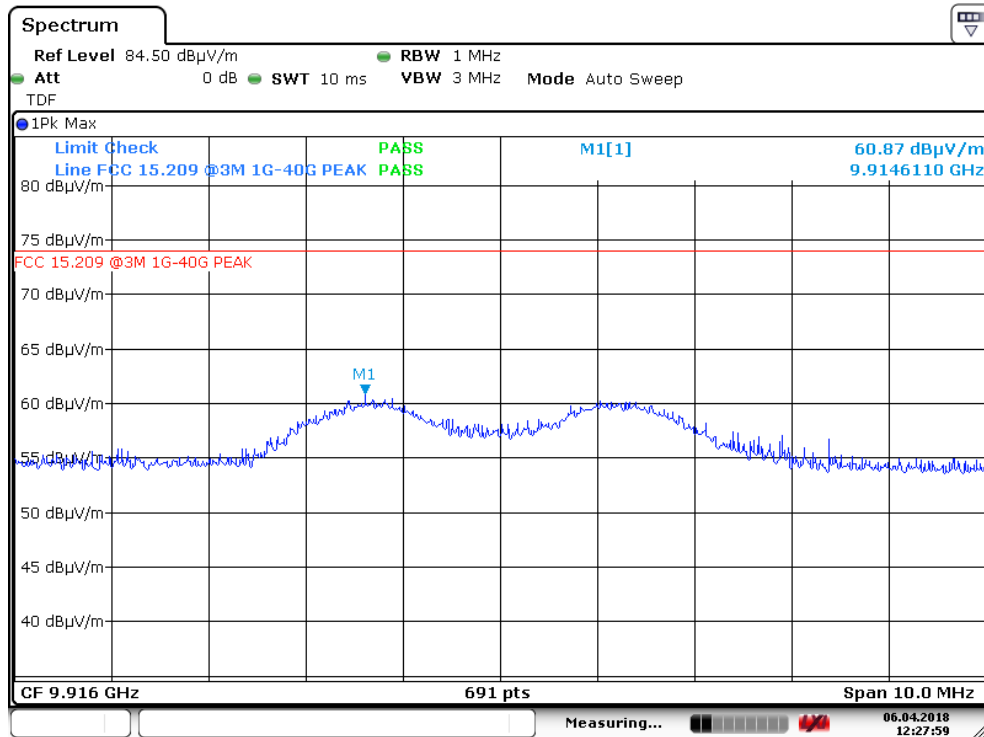
Date: 6.APR.2018 12:16:34

4th harmonic – ch2440MHz, VP – PK, antenna 1



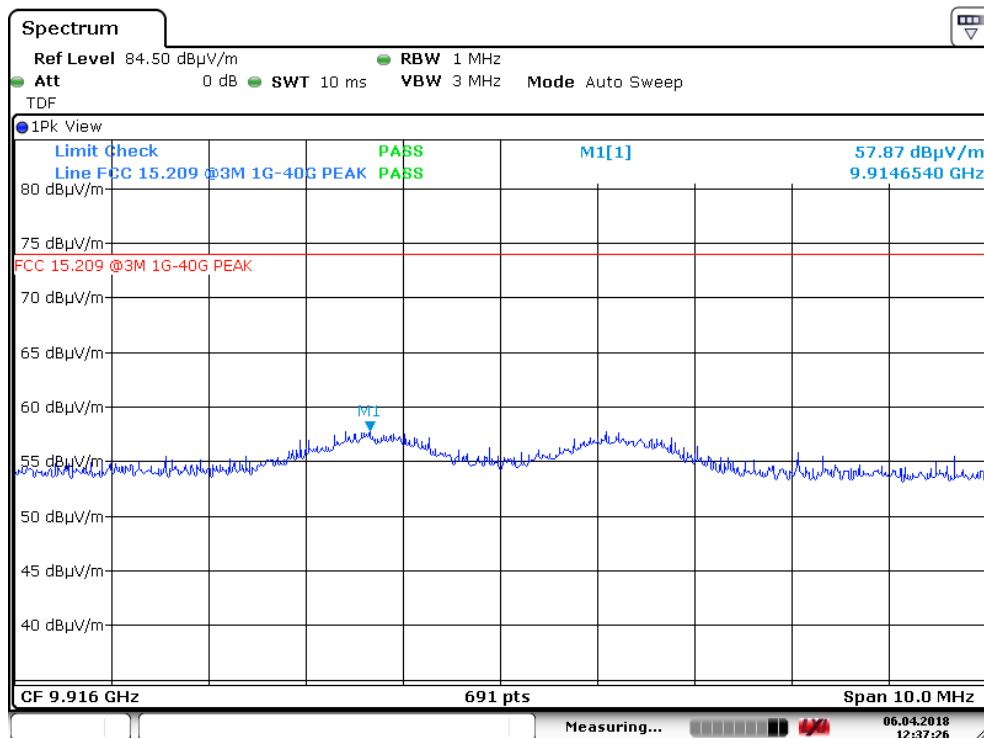
Date: 6.APR.2018 12:48:59

4th harmonic – ch2440MHz, VP – PK, antenna 2



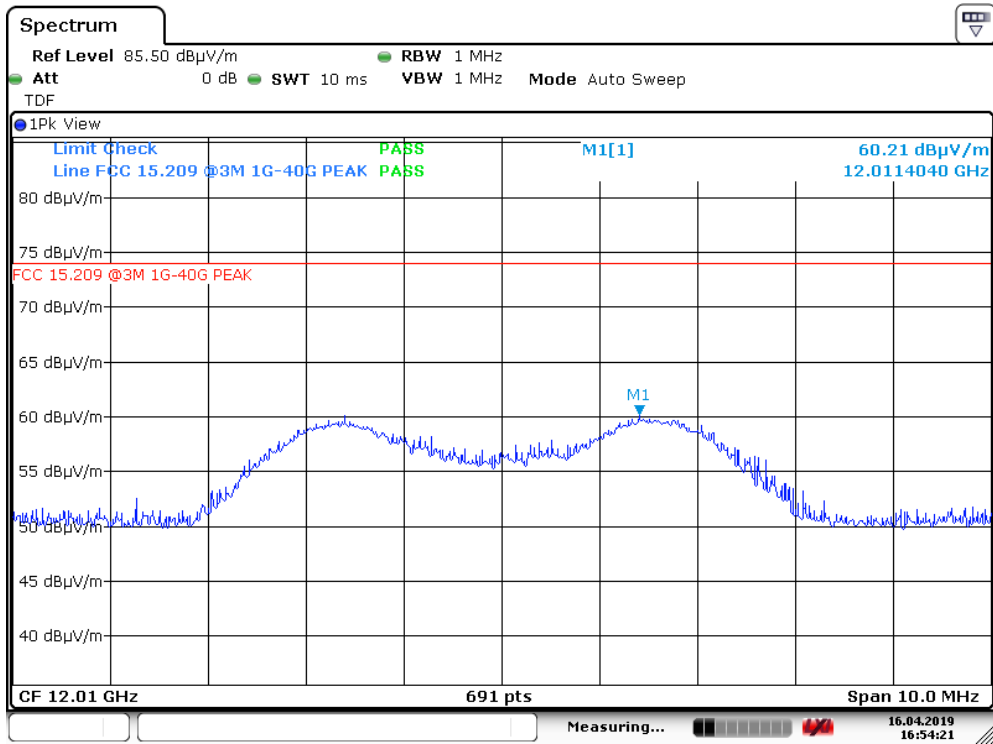
Date: 6.APR.2018 12:27:59

4th harmonic – ch2479MHz, VP – PK, antenna 1



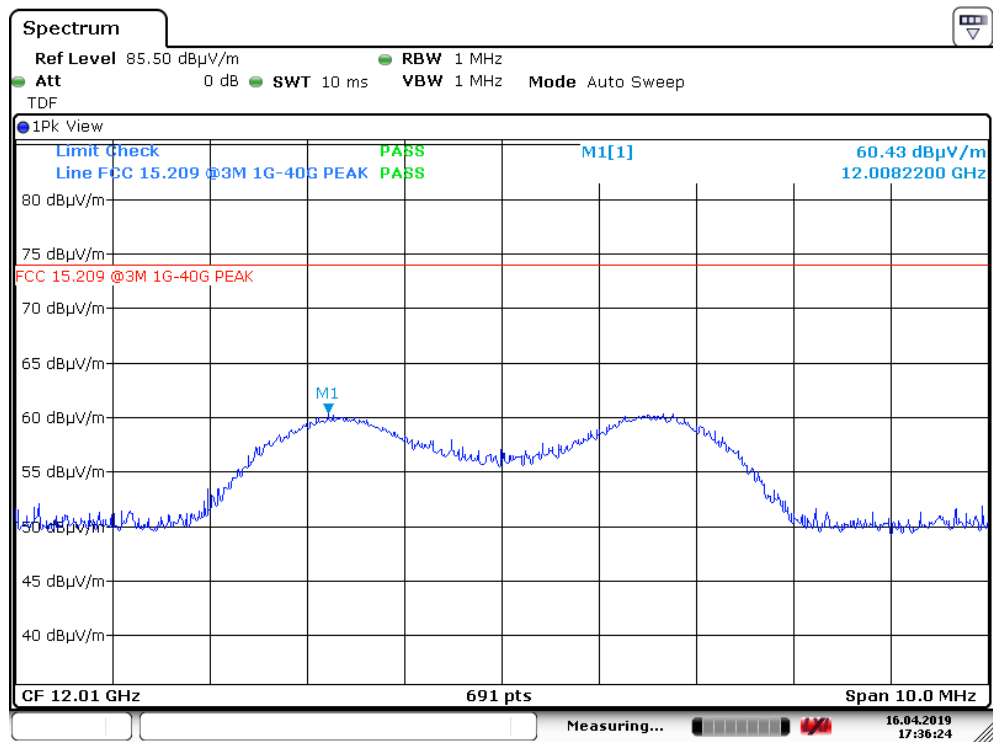
Date: 6.APR.2018 12:37:27

4th harmonic – ch2479MHz, VP – PK, antenna 2



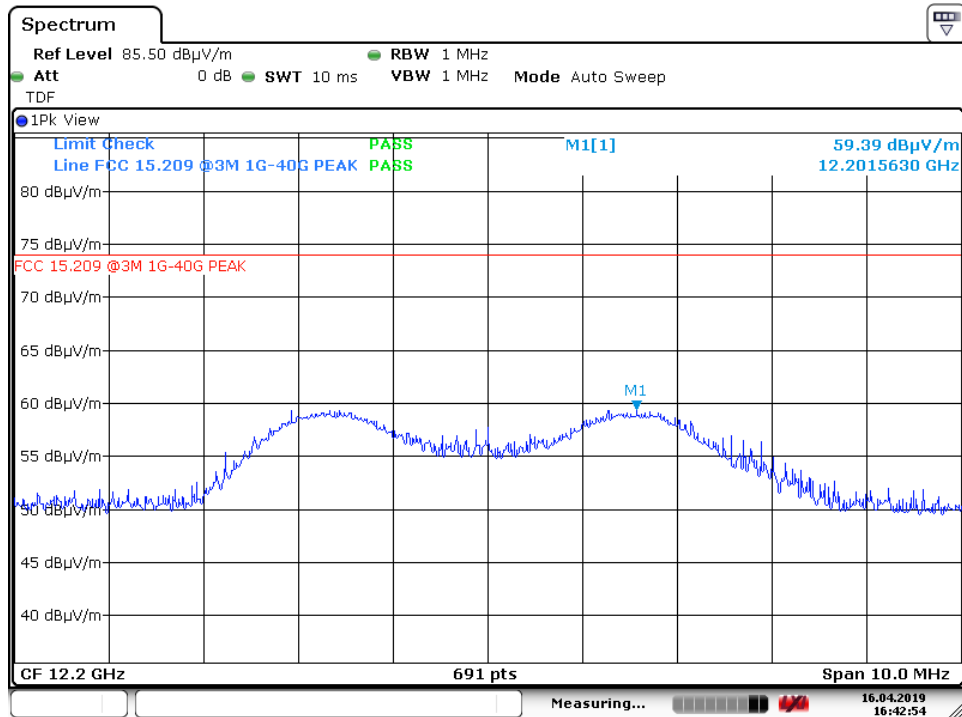
Date: 16.APR.2019 16:54:21

5th harmonic – ch2402MHz, VP – PK, antenna 1



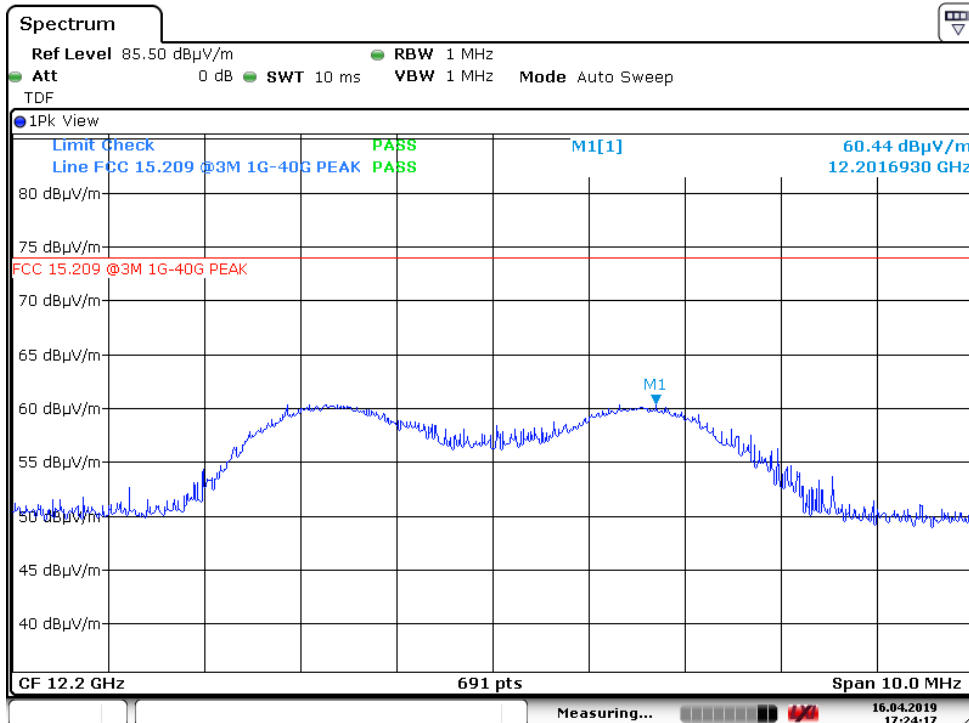
Date: 16.APR.2019 17:36:25

5th harmonic – ch2402MHz, VP – PK, antenna 2



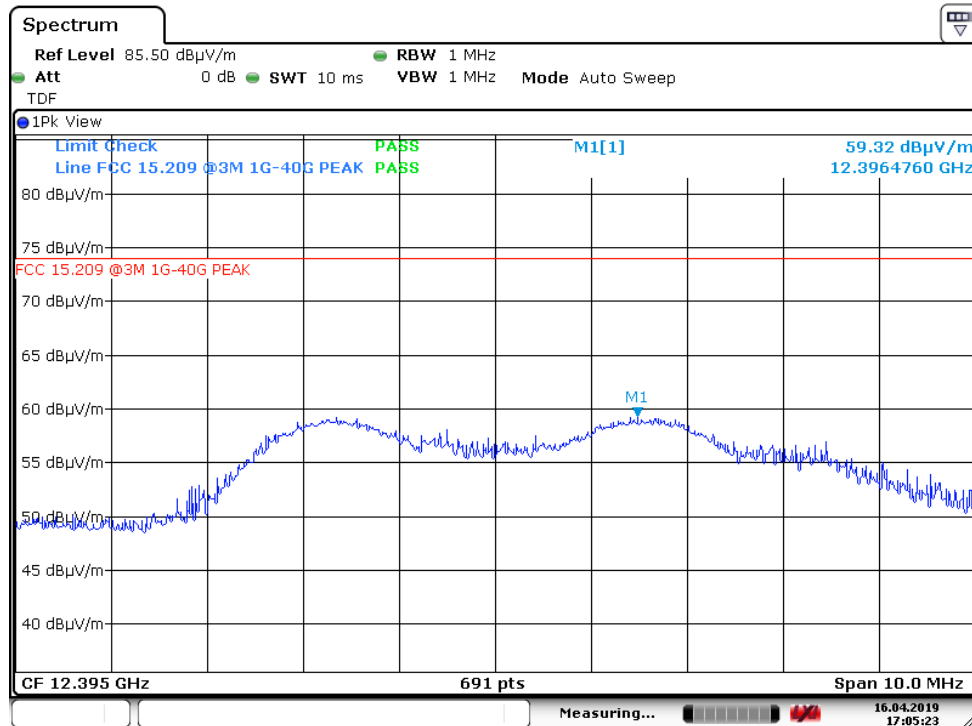
Date: 16.APR.2019 16:42:54

5th harmonic – ch2440MHz, VP – PK, antenna 1



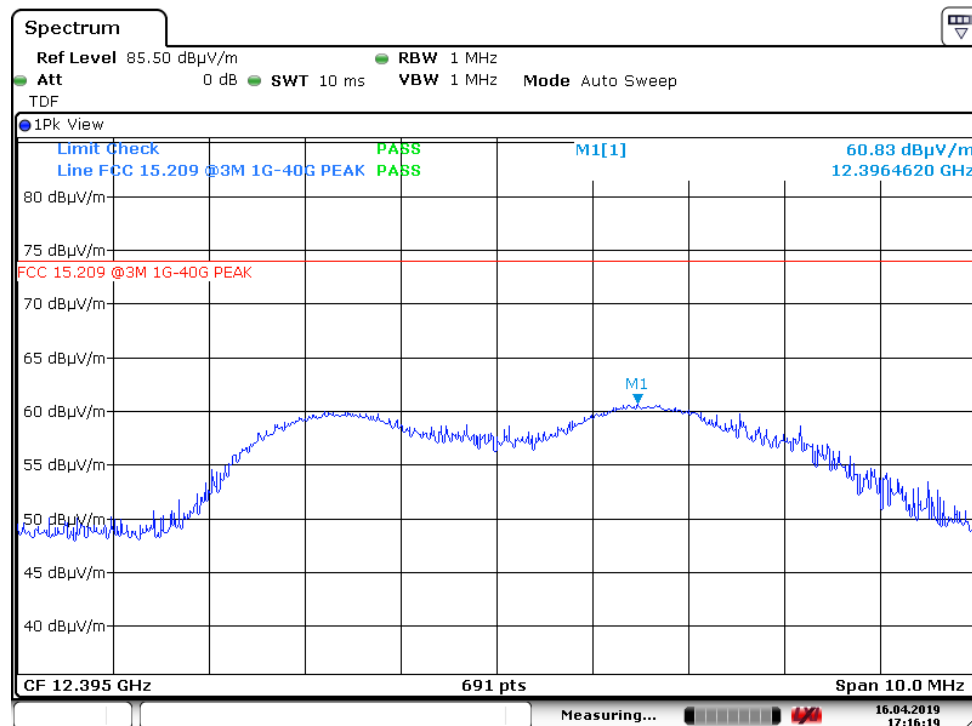
Date: 16.APR.2019 17:24:17

5th harmonic – ch2440MHz, VP – PK, antenna 2



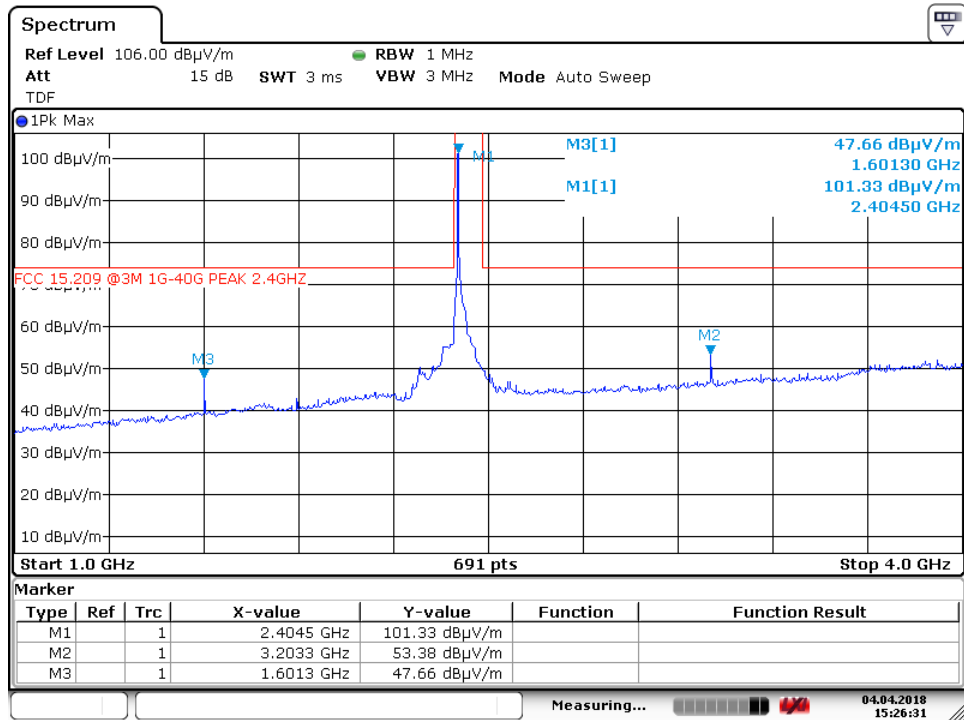
Date: 16. APR. 2019 17:05:24

5th harmonic – ch2479MHz, VP – PK, antenna 1



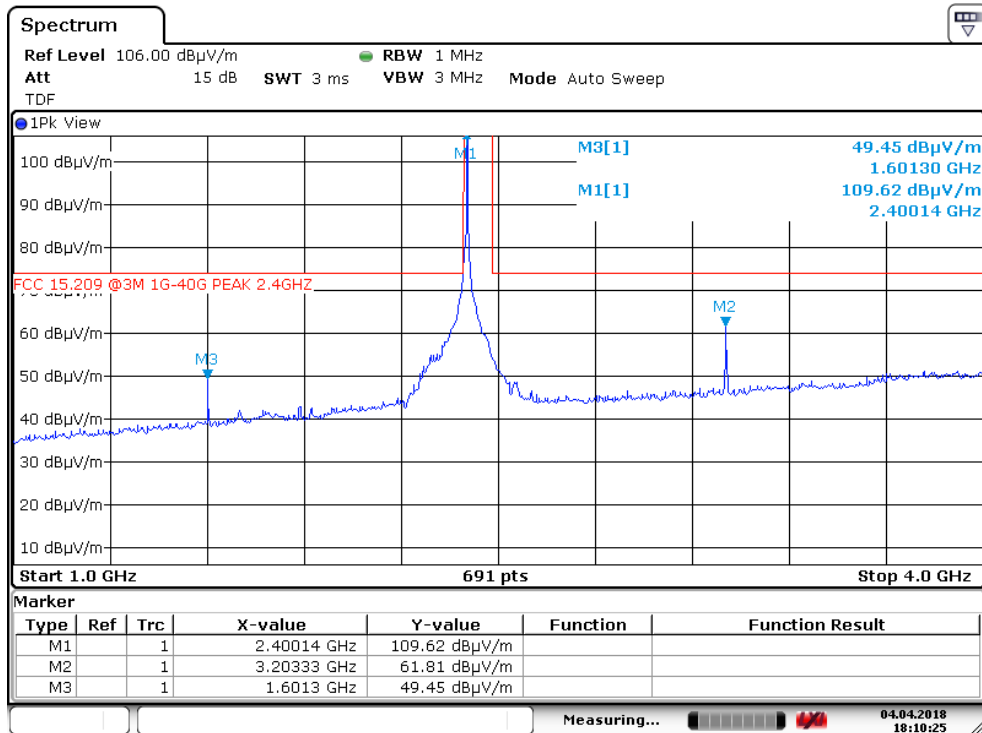
Date: 16. APR. 2019 17:16:20

5th harmonic – ch2479MHz, VP – PK, antenna 2



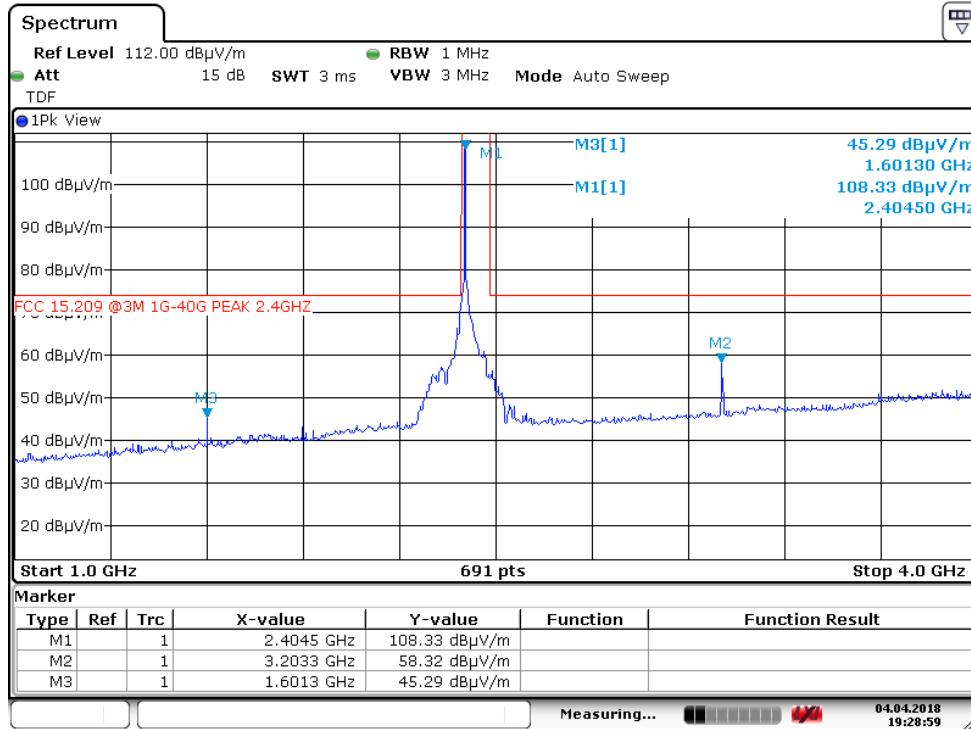
Date: 4.APR.2018 15:26:32

Radiated Emissions, 2402 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 1



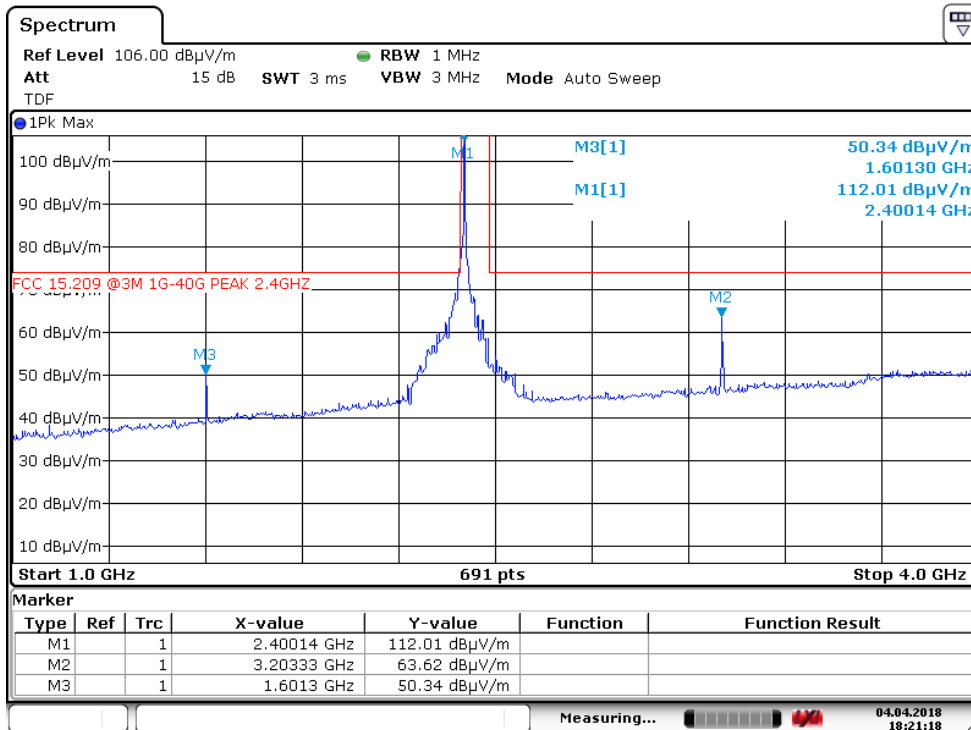
Date: 4.APR.2018 18:10:25

Radiated Emissions, 2402 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 1



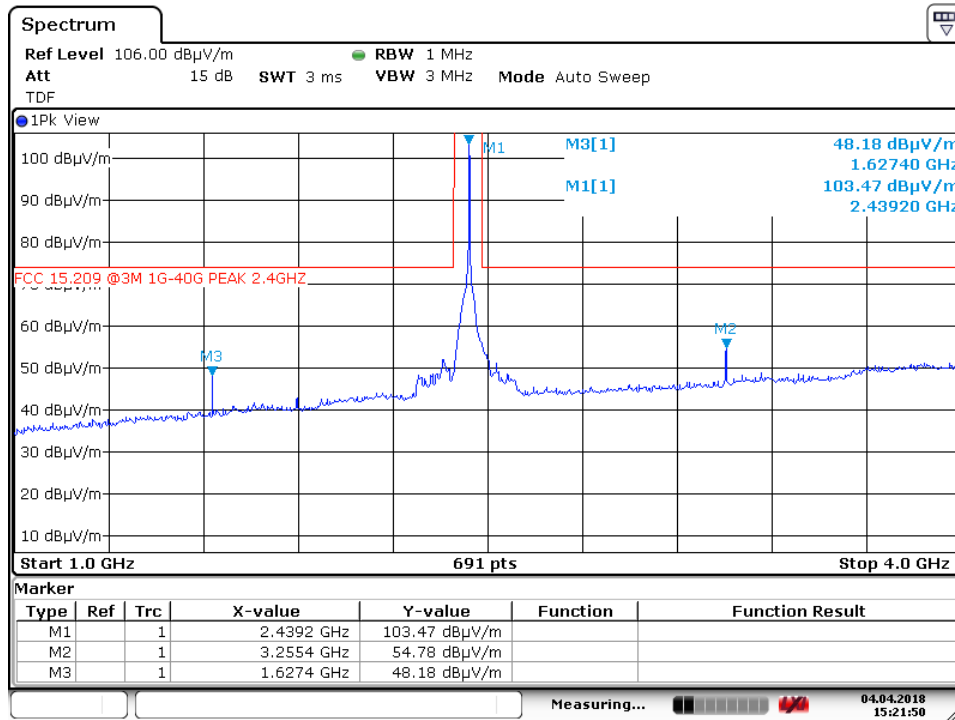
Date: 4.APR.2018 19:29:00

Radiated Emissions, 2402 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 2



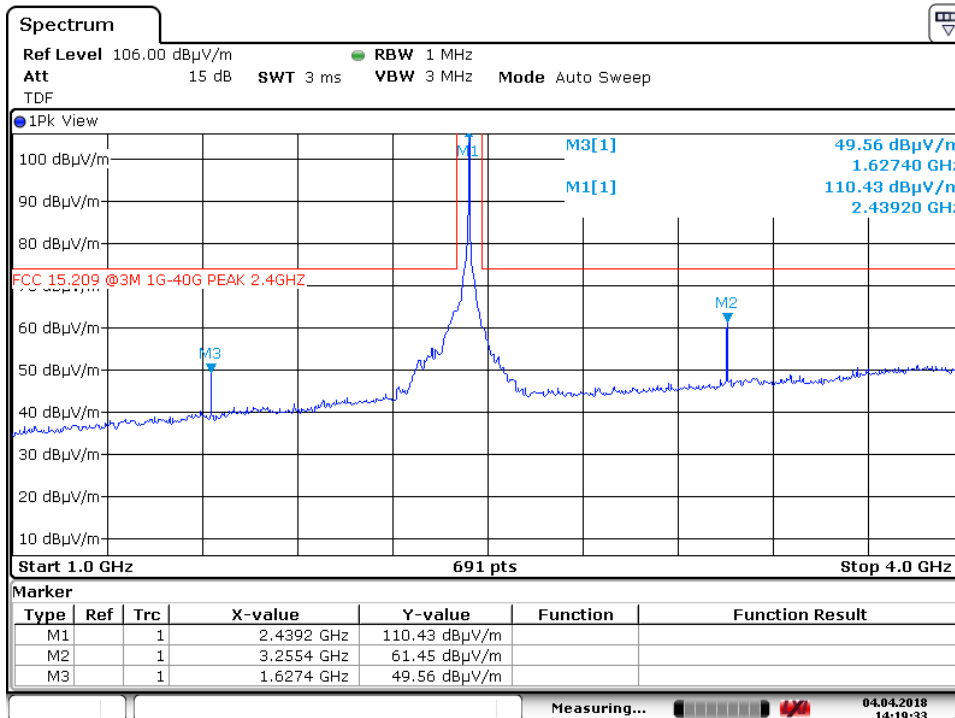
Date: 4.APR.2018 18:21:18

Radiated Emissions, 2402 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 2



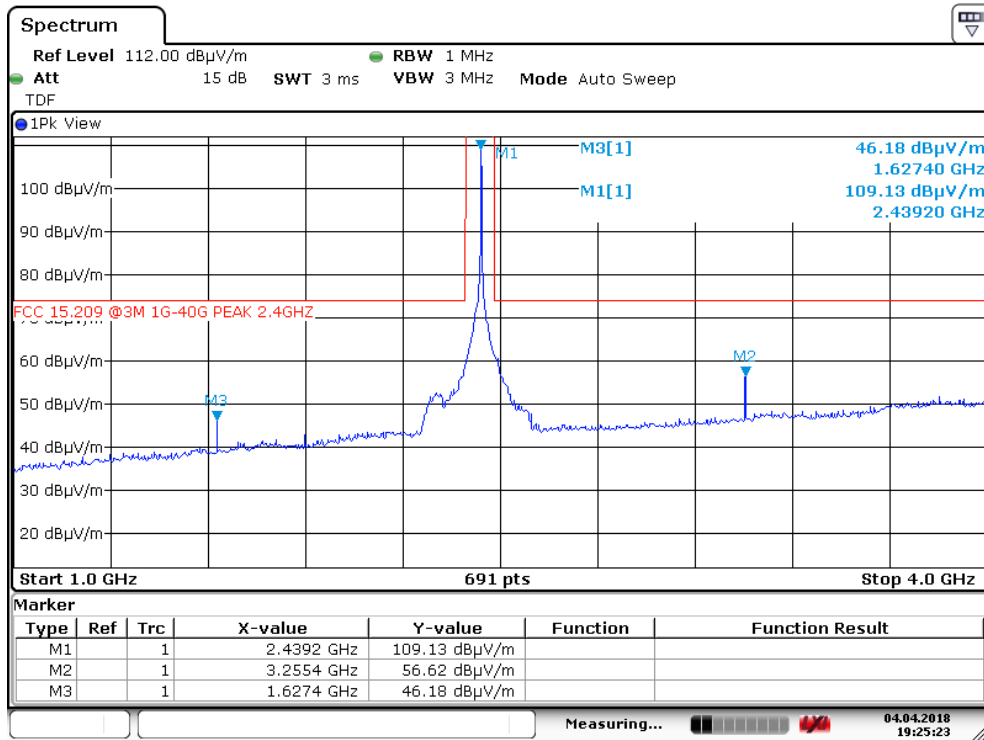
Date: 4.APR.2018 15:21:50

Radiated Emissions ch. 2440 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 1



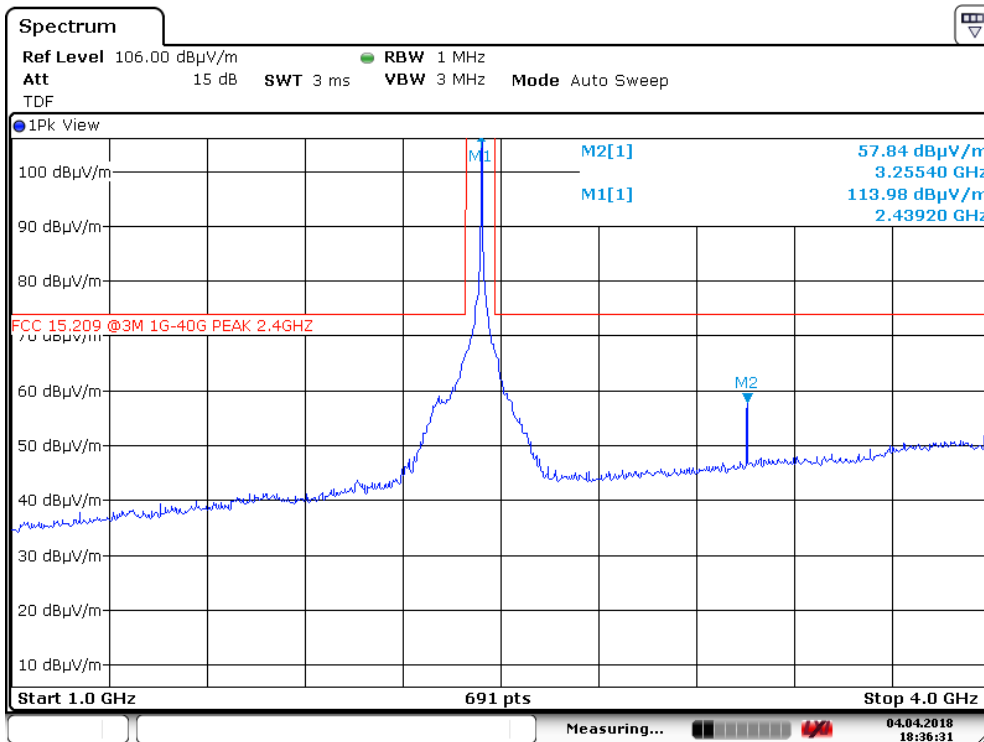
Date: 4.APR.2018 14:19:33

Radiated Emissions ch. 2440 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 1



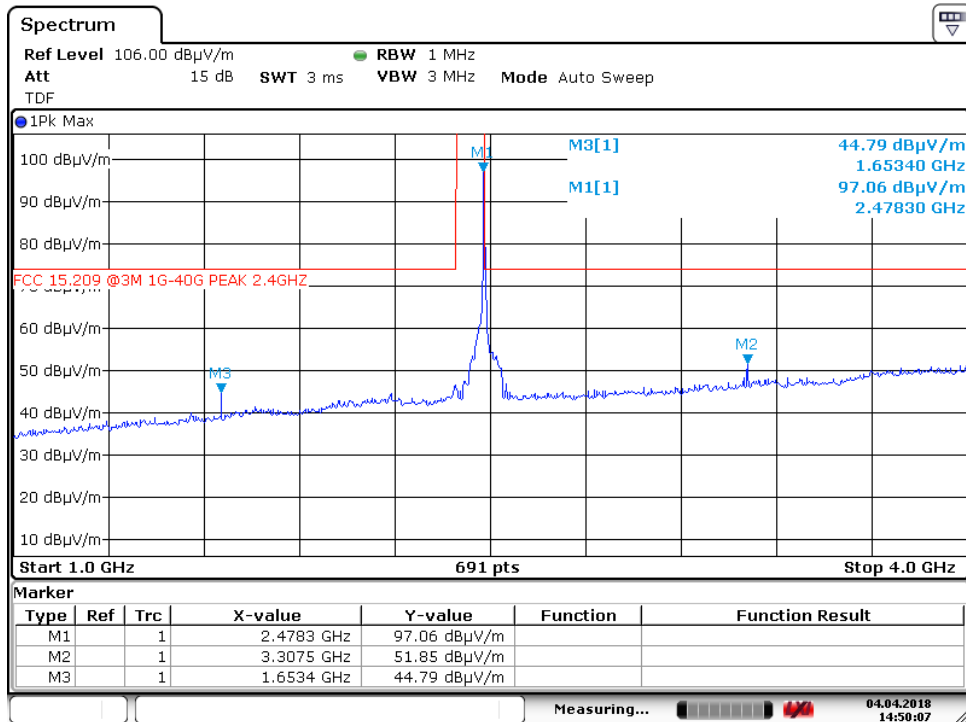
Date: 4.APR.2018 19:25:23

Radiated Emissions ch. 2440 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 2



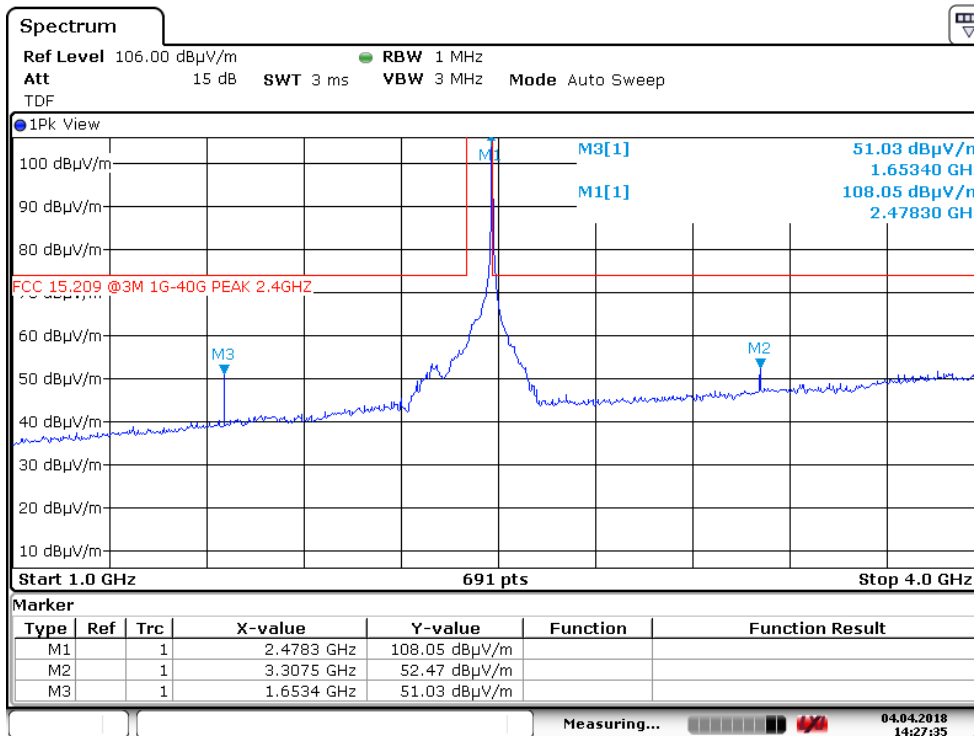
Date: 4.APR.2018 18:36:32

Radiated Emissions ch. 2440 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 2



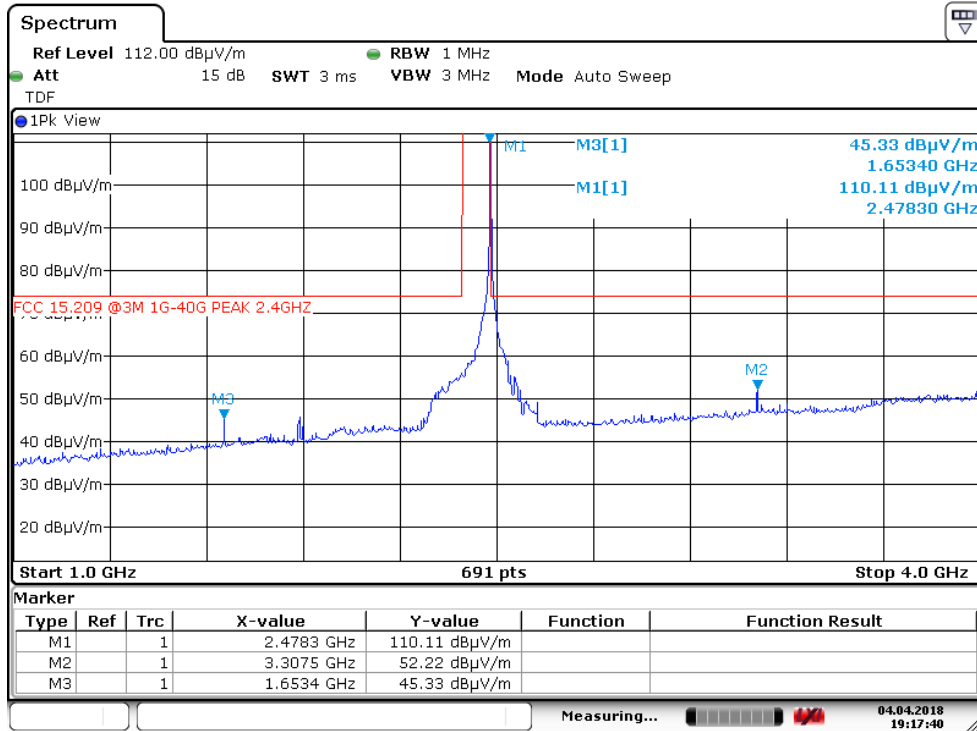
Date: 4.APR.2018 14:50:07

Radiated Emissions ch. 2479 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 1



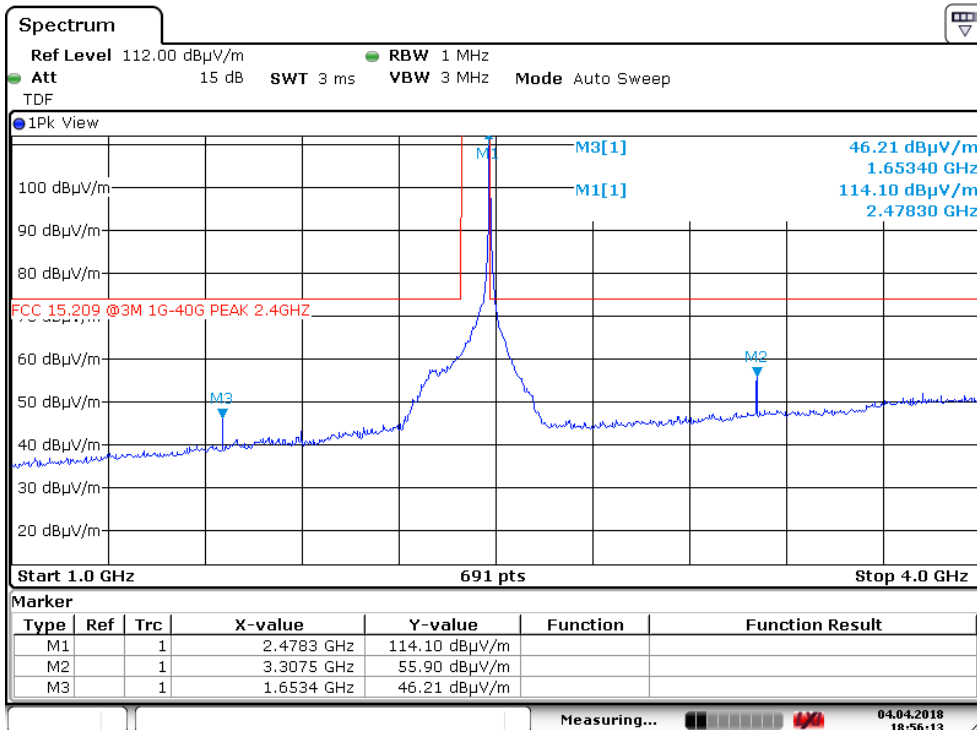
Date: 4.APR.2018 14:27:35

Radiated Emissions ch. 2479 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 1



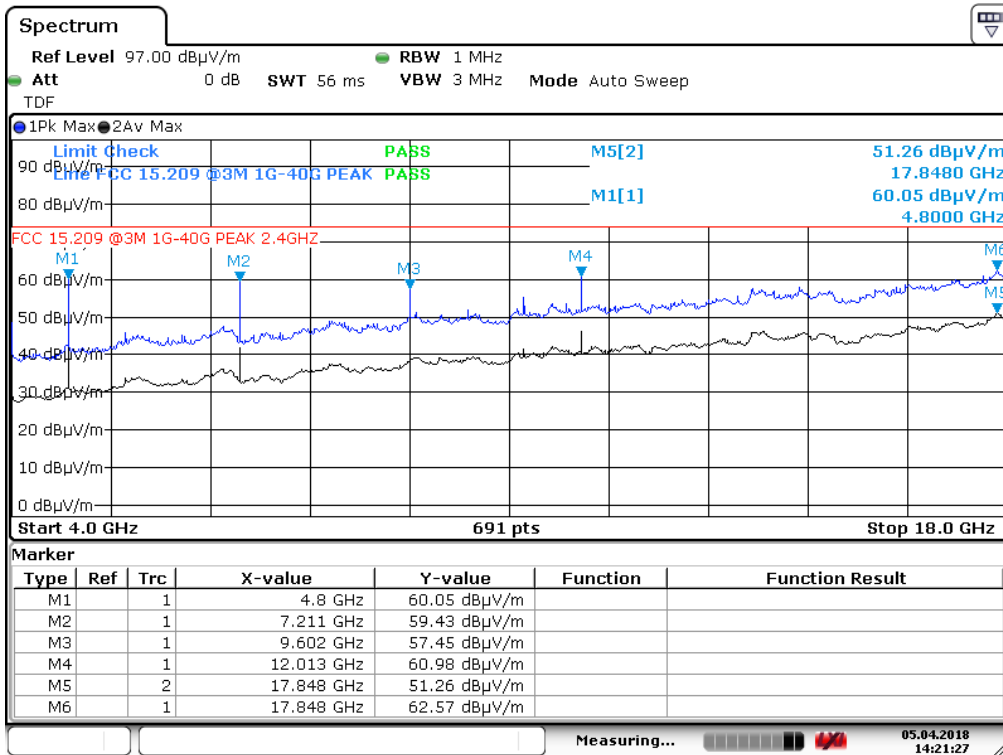
Date: 4.APR.2018 19:17:41

Radiated Emissions ch. 2479 MHz, 1 – 4 GHz, VP, @3m – Pre-scan, antenna 2



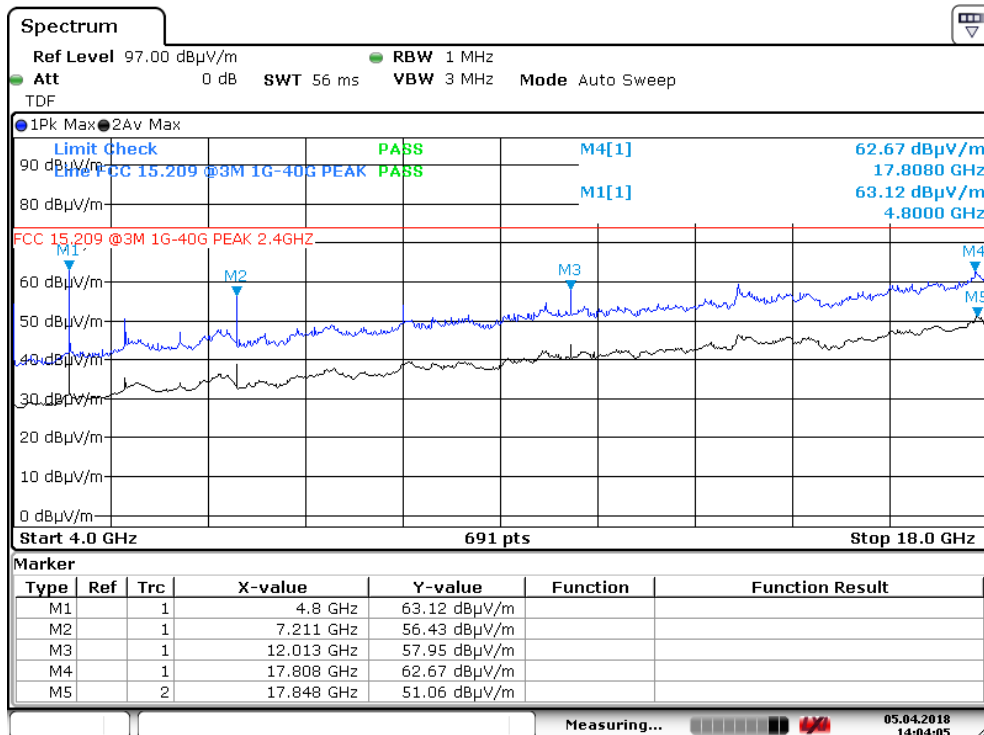
Date: 4.APR.2018 18:56:14

Radiated Emissions ch. 2479 MHz, 1 – 4 GHz, HP, @3m – Pre-scan, antenna 2



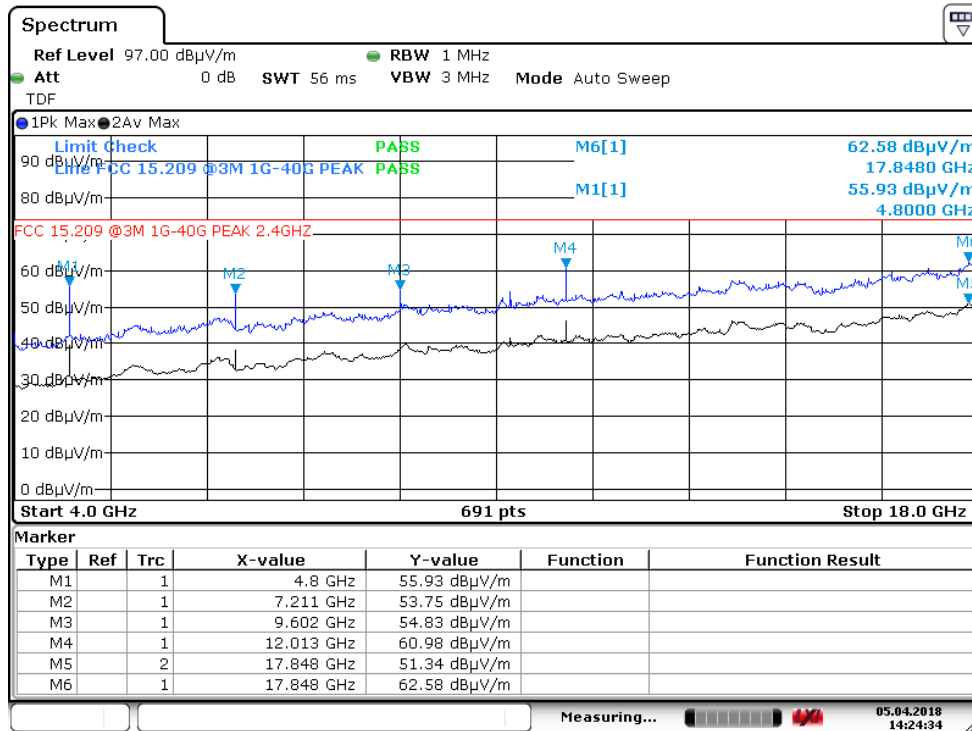
Date: 5.APR.2018 14:21:28

Radiated Emissions ch. 2402 MHz, 4 – 18 GHz, VP, @3m – Pre-scan, antenna 1



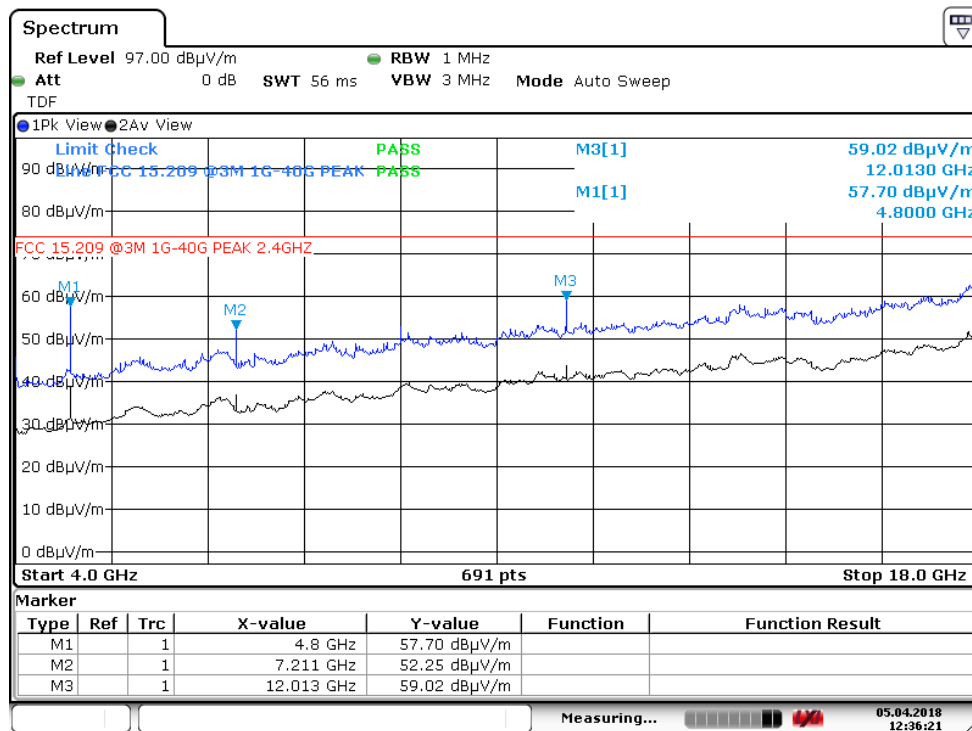
Date: 5.APR.2018 14:04:05

Radiated Emissions ch. 2402 MHz, 4 – 18 GHz, HP, @3m – Pre-scan, antenna 1



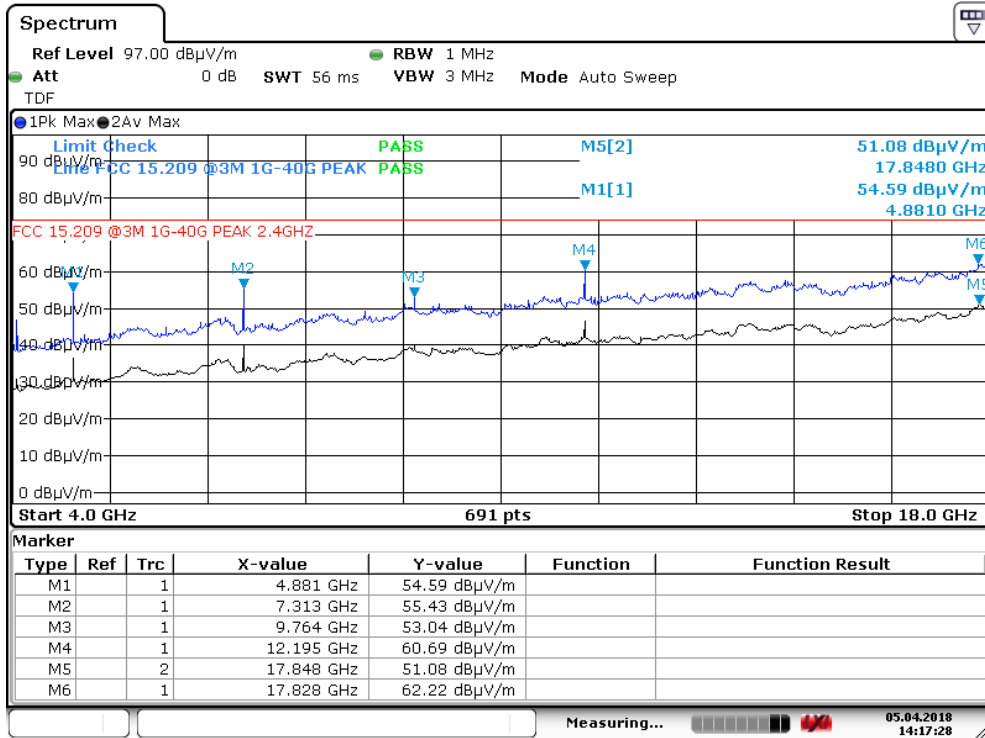
Date: 5.APR.2018 14:24:34

Radiated Emissions ch. 2402 MHz, 4 – 18 GHz, VP, @3m – Pre-scan, antenna 2



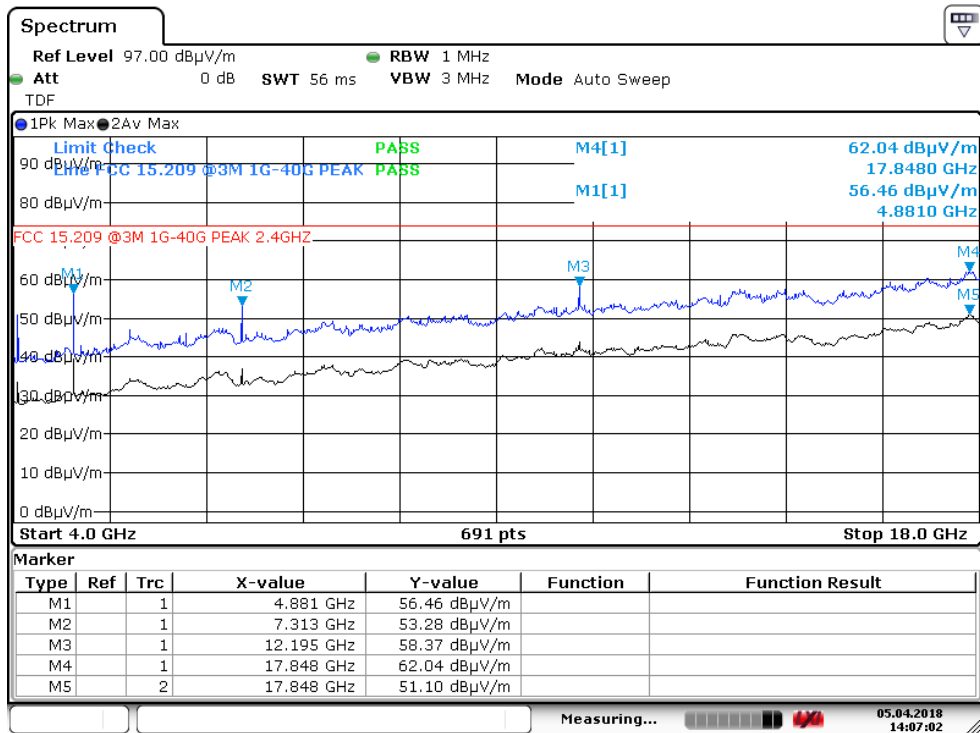
Date: 5.APR.2018 12:36:22

Radiated Emissions ch. 2402 MHz, 4 – 18 GHz, HP, @3m – Pre-scan, antenna 2



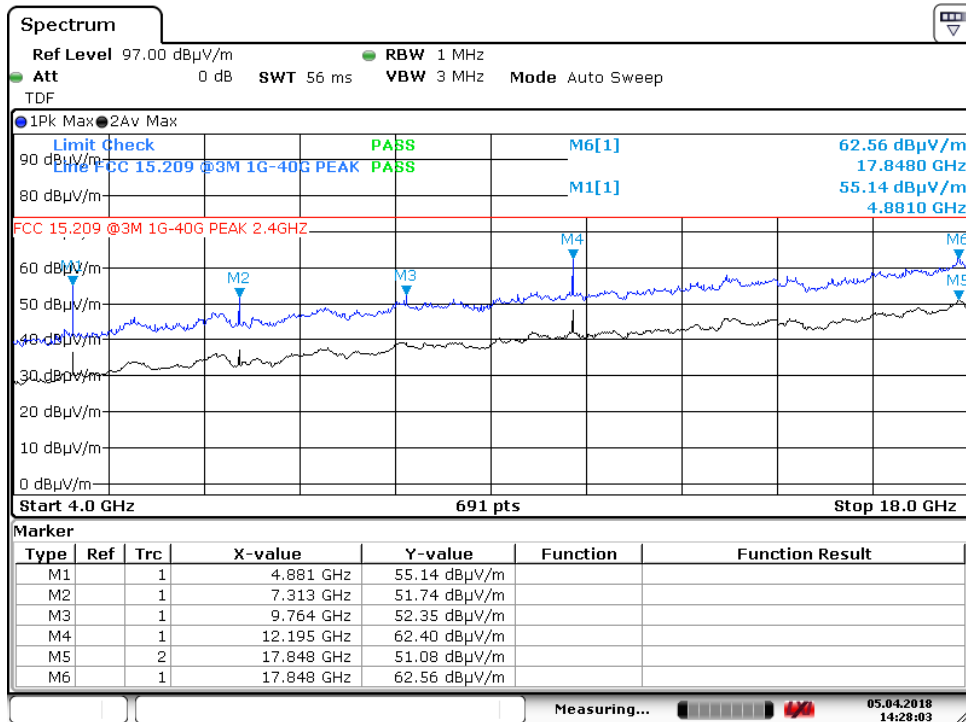
Date: 5.APR.2018 14:17:28

Radiated Emissions ch. 2440 MHz, 4 – 18 GHz, VP, @3m – Pre-scan, antenna 1



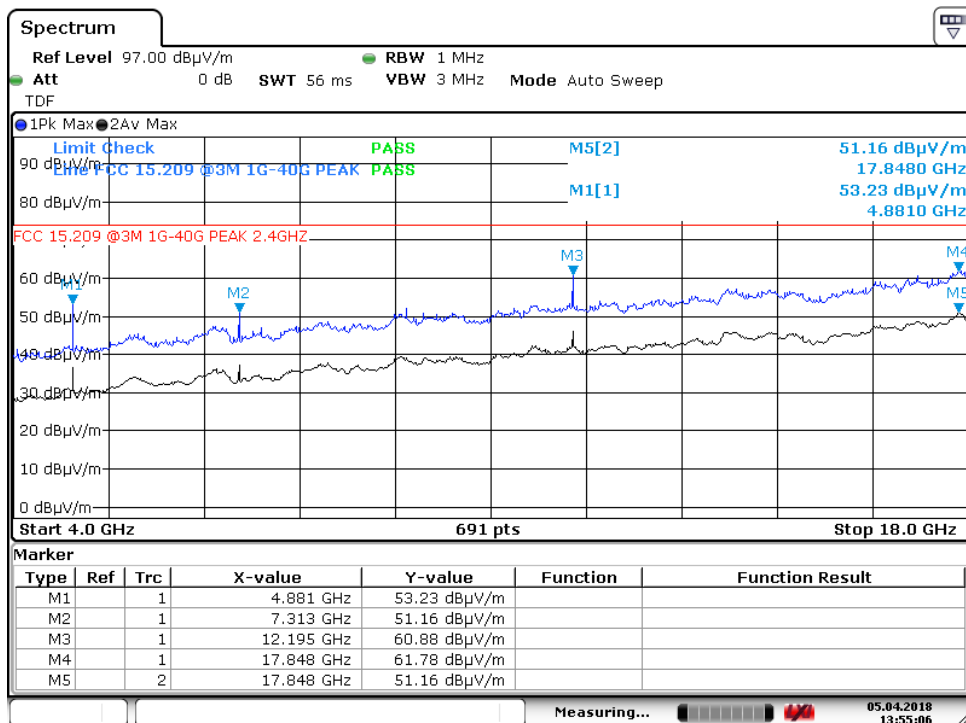
Date: 5.APR.2018 14:07:03

Radiated Emissions ch. 2440 MHz, 4 – 18 GHz, HP, @3m – Pre-scan, antenna 1



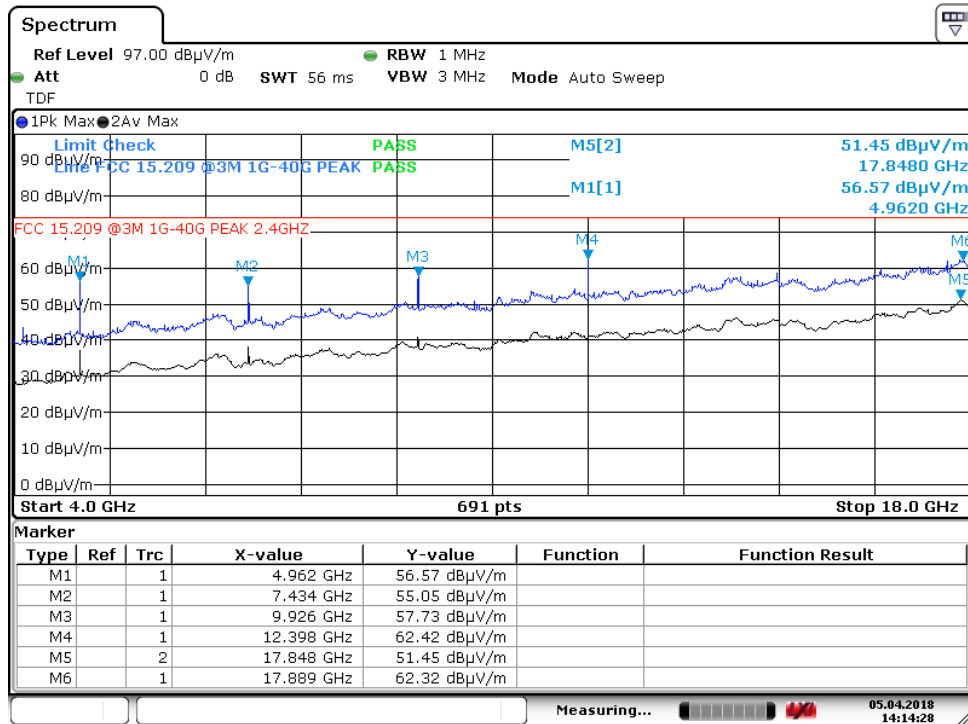
Date: 5. APR. 2018 14:28:04

Radiated Emissions ch. 2440 MHz, 4 - 18 GHz, VP, @3m - Pre-scan, antenna 2



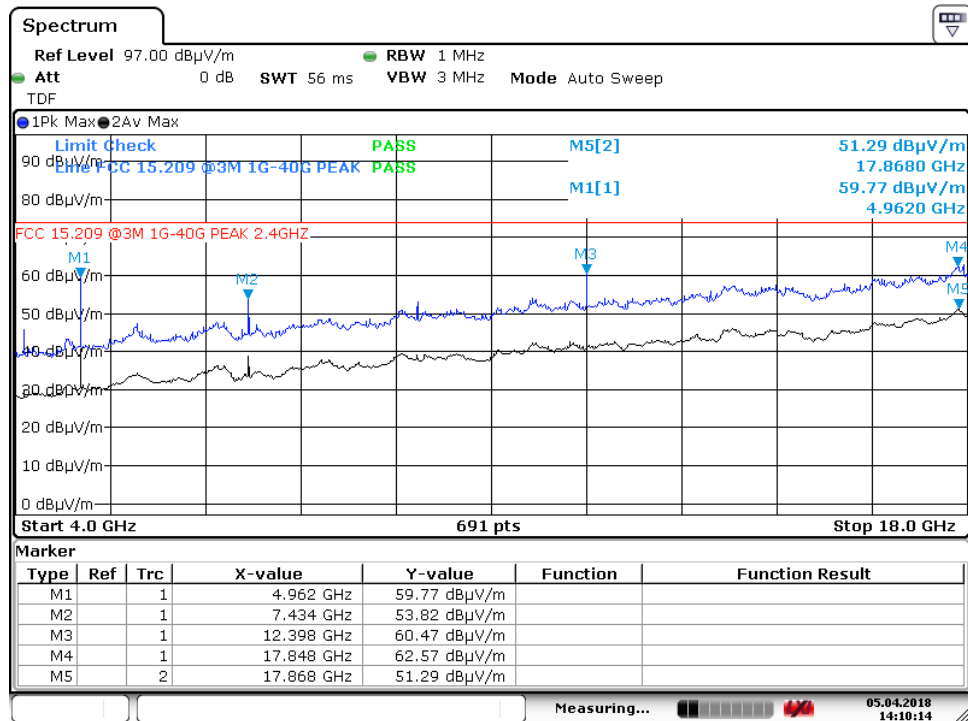
Date: 5. APR. 2018 13:55:07

Radiated Emissions ch. 2440 MHz, 4 - 18 GHz, HP, @3m - Pre-scan, antenna 2



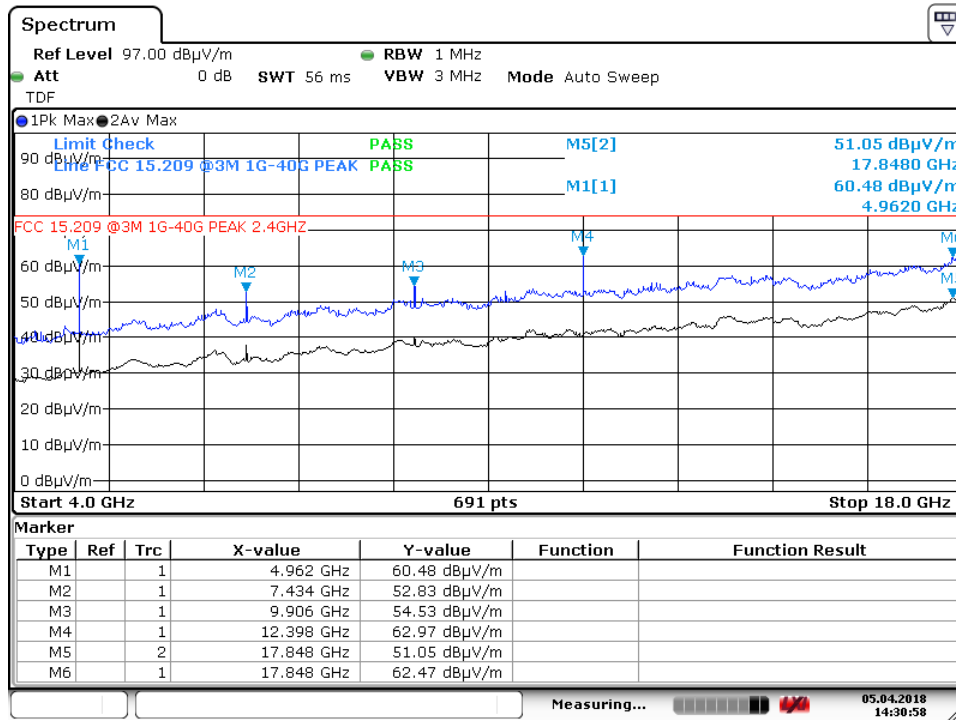
Date: 5.APR.2018 14:14:29

Radiated Emissions ch. 2479 MHz, 4 – 18 GHz, VP, @3m – Pre-scan, antenna 1



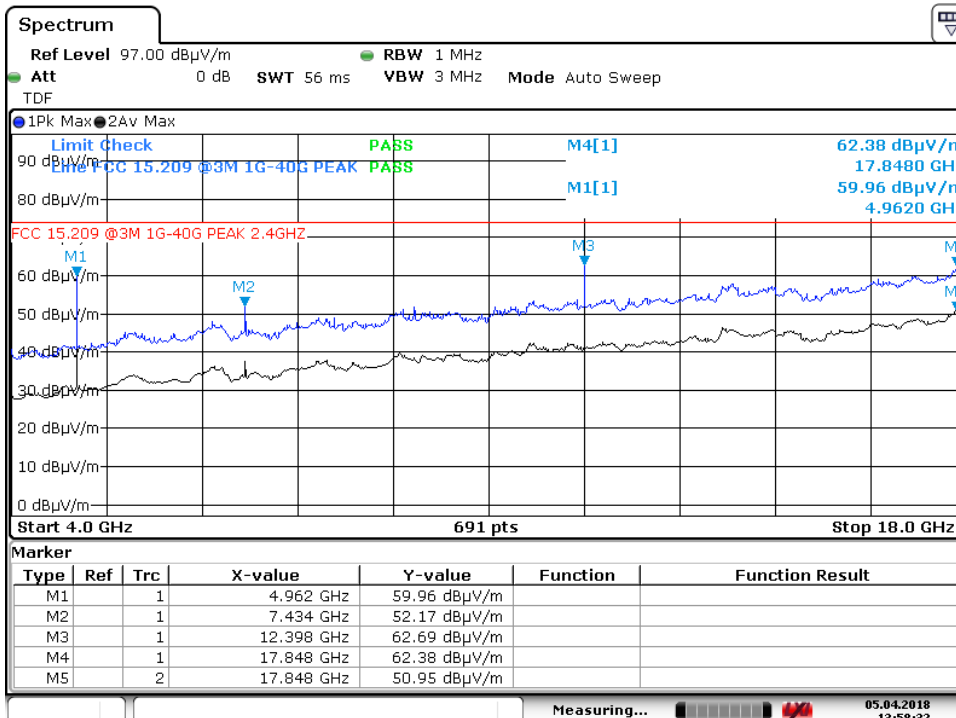
Date: 5.APR.2018 14:10:14

Radiated Emissions ch. 2479 MHz, 4 – 18 GHz, HP, @3m – Pre-scan, antenna 1



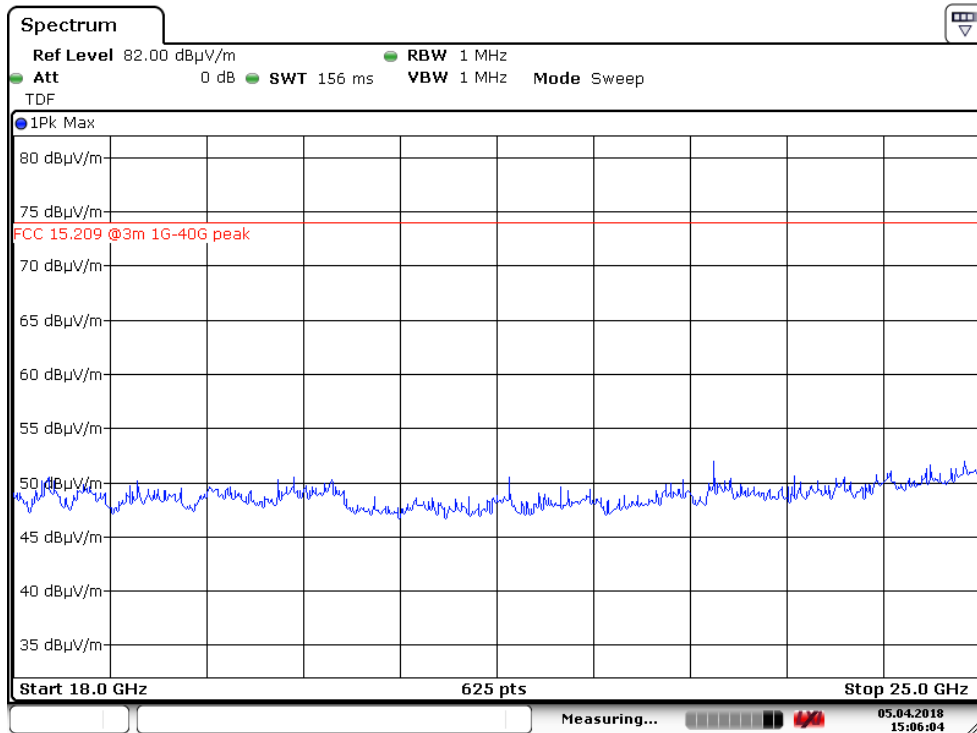
Date: 5. APR. 2018 14:30:58

Radiated Emissions ch. 2479 MHz, 4 – 18 GHz, VP, @3m – Pre-scan, antenna 2



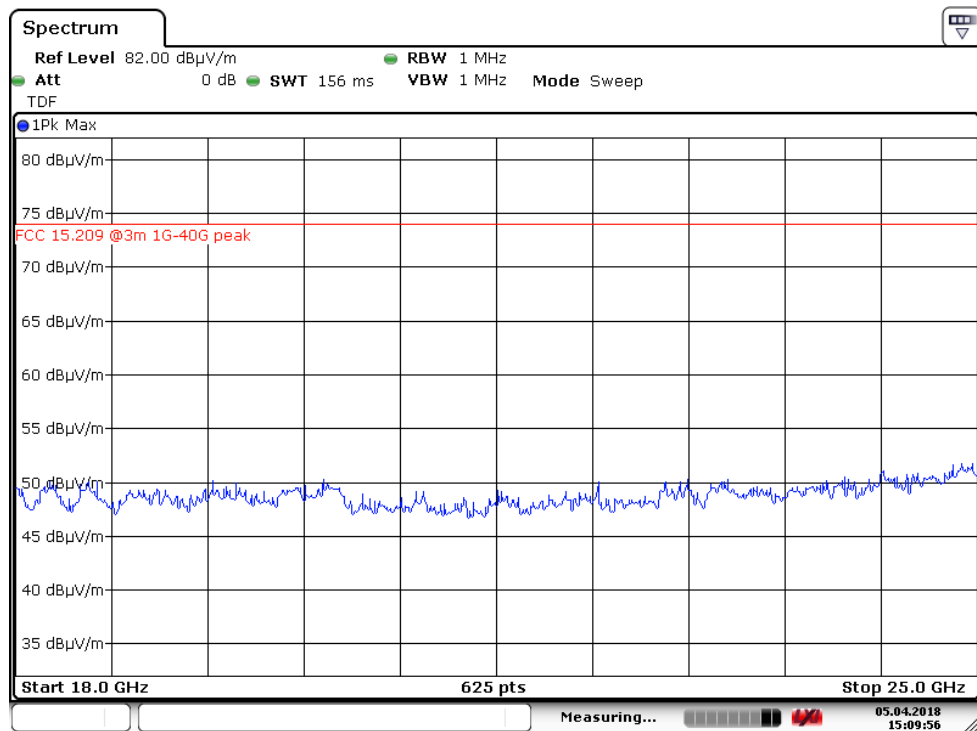
Date: 5. APR. 2018 13:58:32

Radiated Emissions ch. 2479 MHz, 4 – 18 GHz, HP, @3m – Pre-scan, antenna 2



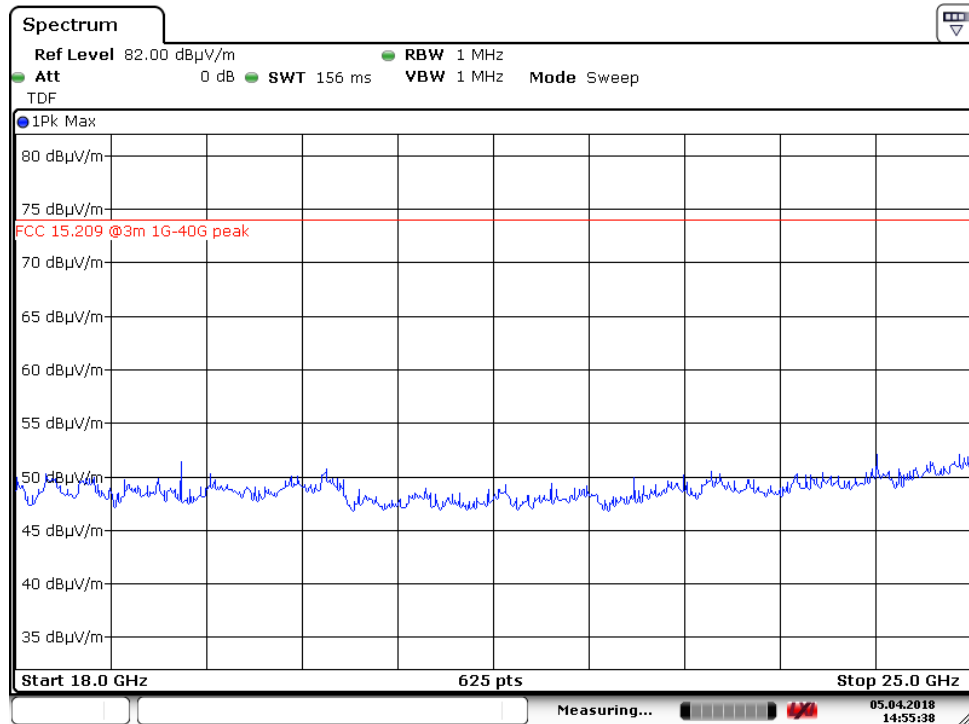
Date: 5.APR.2018 15:06:05

Radiated Emissions ch. 2402 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 1



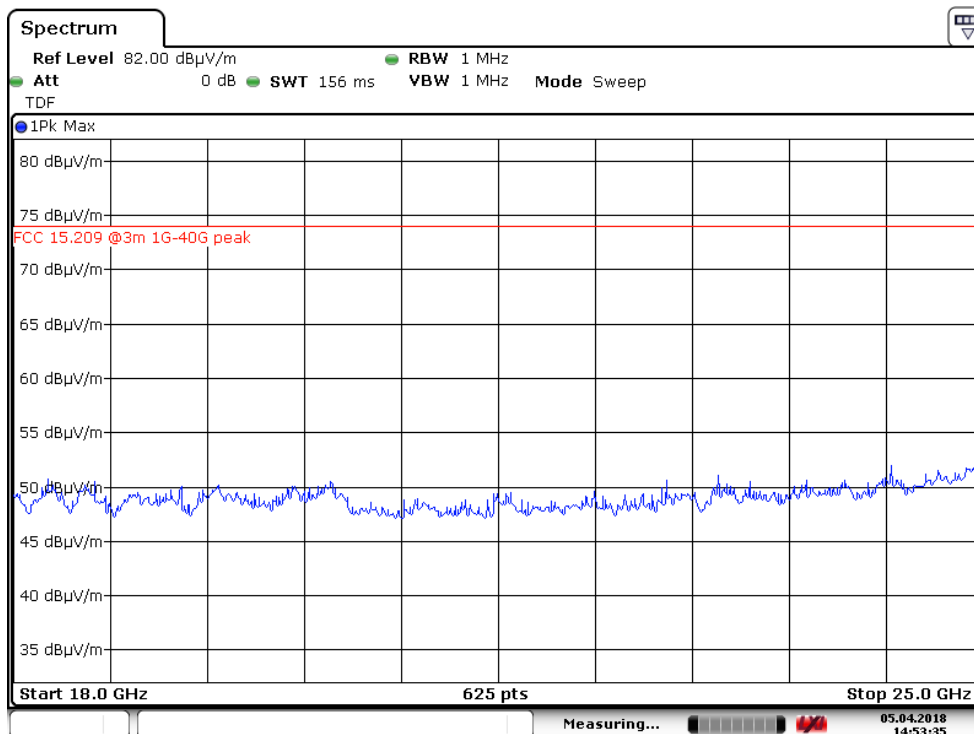
Date: 5.APR.2018 15:09:56

Radiated Emissions ch. 2402 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 1



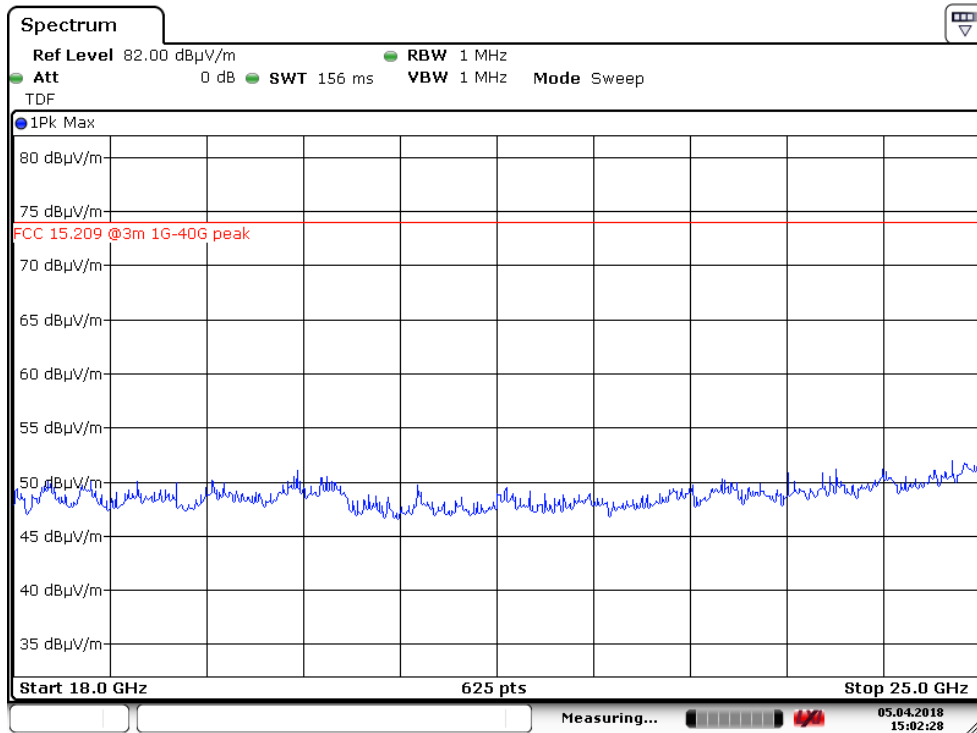
Date: 5.APR.2018 14:55:39

Radiated Emissions ch. 2402 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 2



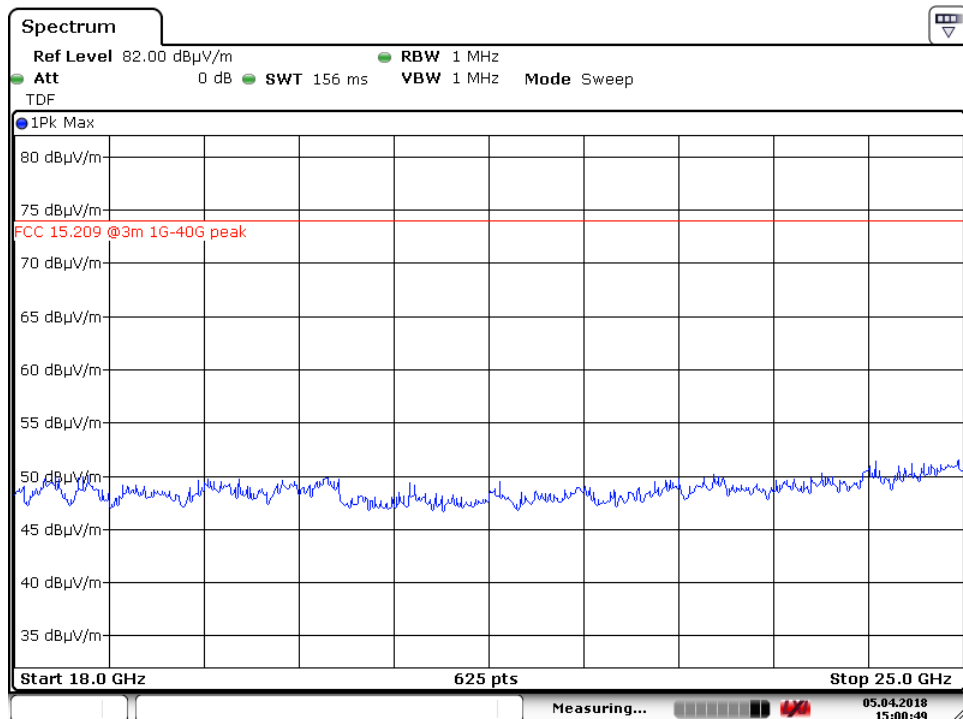
Date: 5.APR.2018 14:53:36

Radiated Emissions ch. 2402 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 2



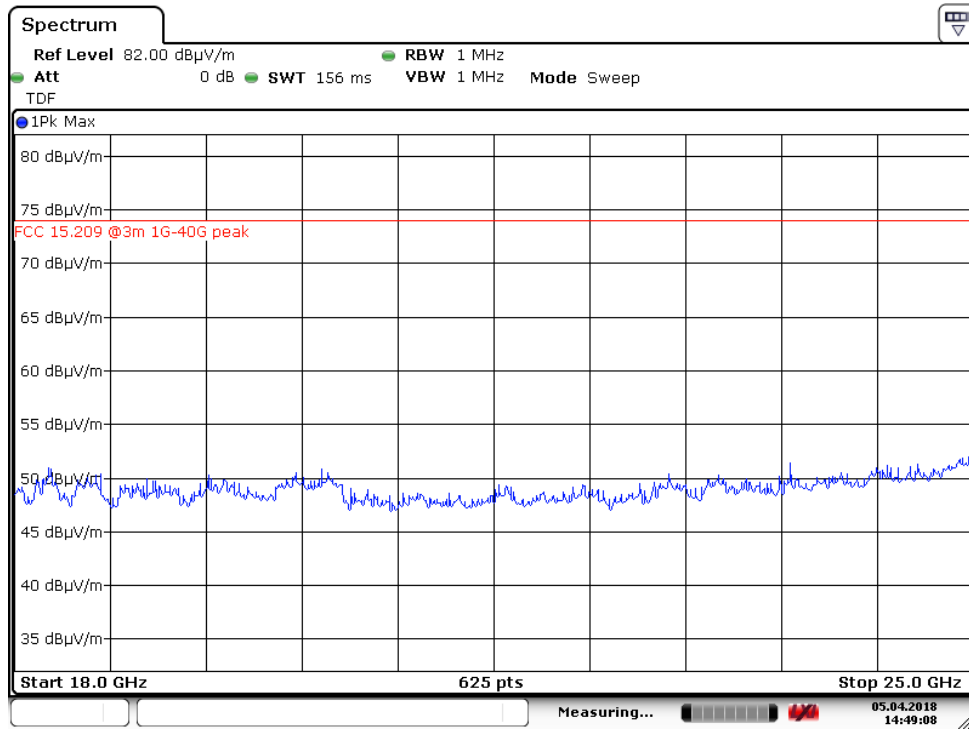
Date: 5.APR.2018 15:02:29

Radiated Emissions ch. 2440 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 1



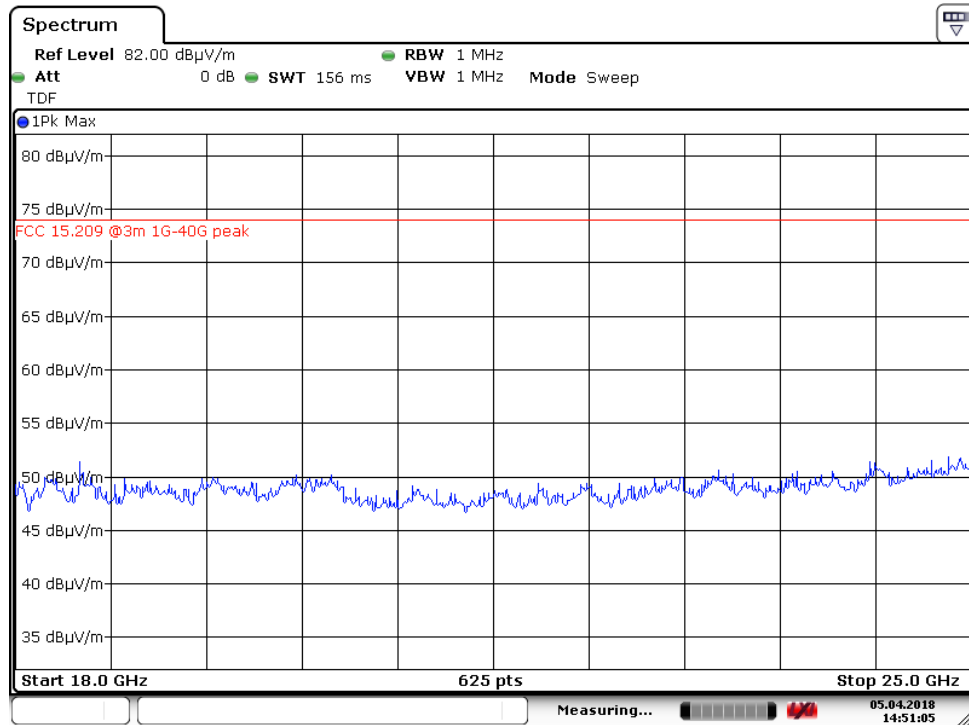
Date: 5.APR.2018 15:00:49

Radiated Emissions ch. 2440 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 1



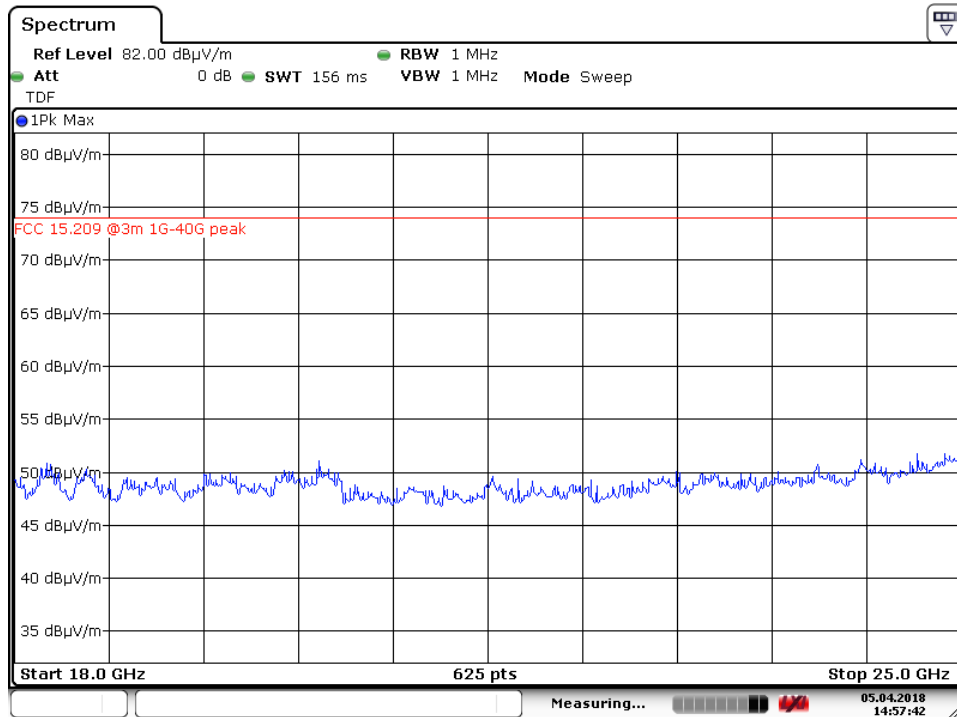
Date: 5.APR.2018 14:49:08

Radiated Emissions ch. 2440 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 2



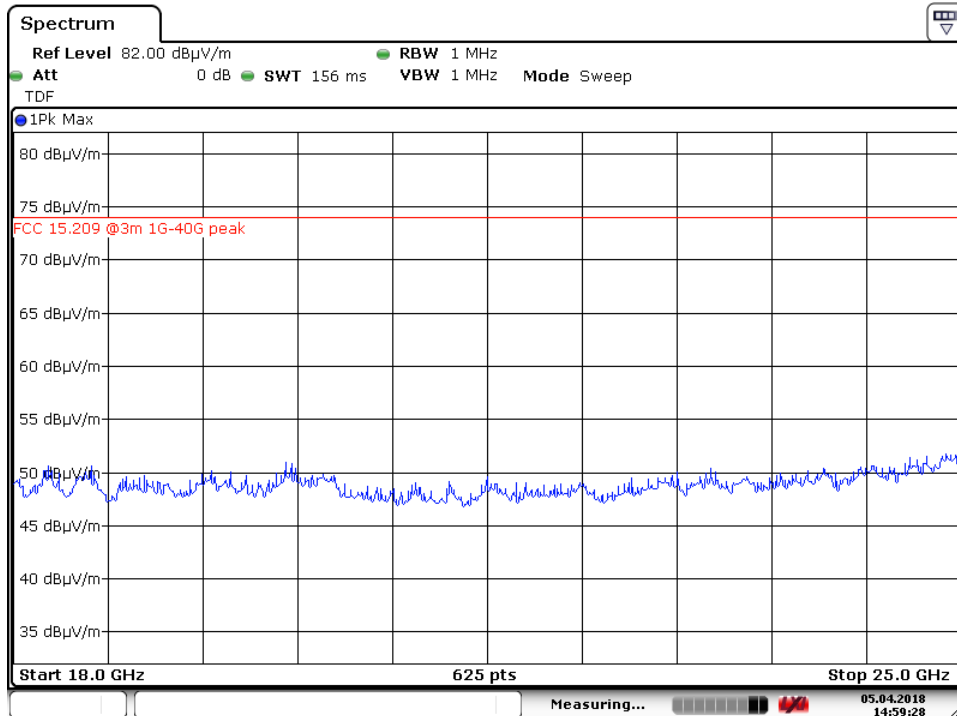
Date: 5.APR.2018 14:51:05

Radiated Emissions ch. 2440 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 2



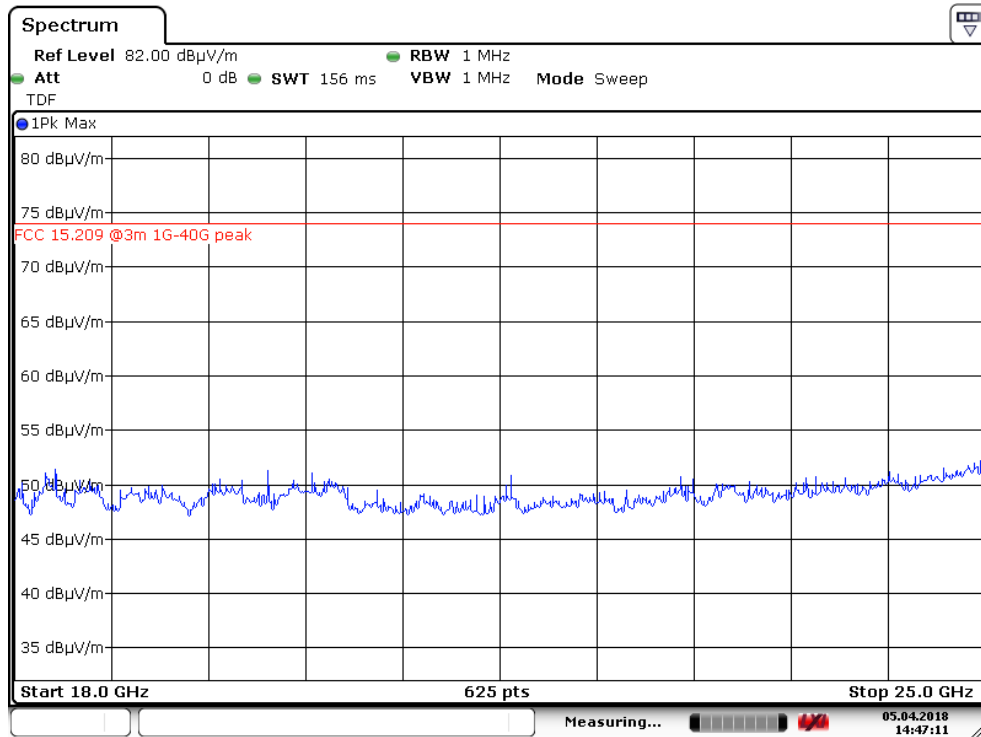
Date: 5. APR. 2018 14:57:43

Radiated Emissions ch. 2479 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 1



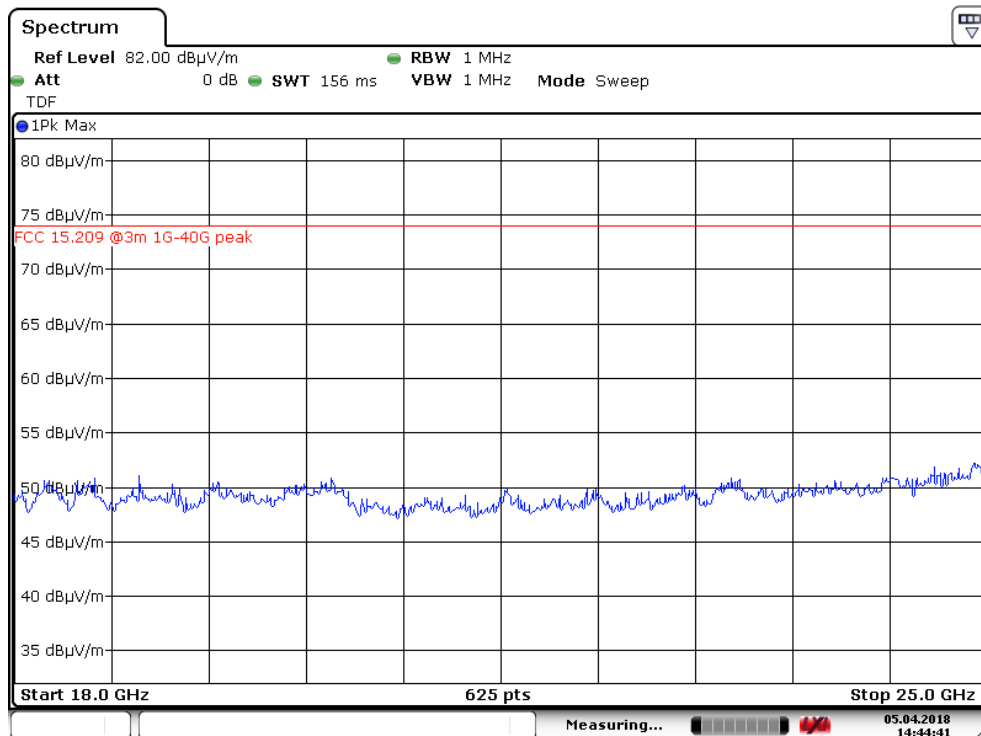
Date: 5. APR. 2018 14:59:29

Radiated Emissions ch. 2479 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 1



Date: 5.APR.2018 14:47:12

Radiated Emissions ch. 2479 MHz, 18 – 25 GHz, VP, @3m – Pre-scan, antenna 2



Date: 5.APR.2018 14:44:42

Radiated Emissions ch. 2479 MHz, 18 – 25 GHz, HP, @3m – Pre-scan, antenna 2

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

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.

Test equipment list before 2018-09:

Ref No	Instrument/ ancillary	Manufacturer	Type of instrument/ ancillary	Cal. Date	Cal. Due
1-0039	Loop antenna	Rohde & Schwarz	HFH2-Z2	2017-09	2018-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	2015-08	2018-08
1-0055	LopPer antenna	Rohde & Schwarz	HL223	2015-08	2018-08
1-0080	Turntable	H. Deisel	DS 420	--	--
1-0256	Horn antenna	Schwarzbeck Mess-Elektronik	BBHA 9120	--	--
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	2017-06	2020-06
1-0364	Antenna cable 2	Kabelwerk Eupen	RF/Cord CMS / RG 214-N/7	2016-09	2019-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	2017-09	2018-09
1-0611	Signal analyzer	Rohde & Schwarz	FSV 40	2017-09	2018-09
1-0614	Log.-per. antenna	Schwarzbeck Mess-Elektronik	STLP 9148 Stacked Log.-Per. Antenne	2016-11	2019-11
1-0615	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV-9718 Broadband Preamplifier	2017-09	2018-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	2016-09	2019-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	2016-09	2019-09
1-0771	Broadband Horn antenna	Schwarzbeck Mess-Elektronik	SHF-EHF Horn, 15-40GHz	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV 9721	2017-09	2018-09
1-0782	Antenna cable	Huber & Suhner	FB142A	2015-07	2018-07
1-0789	High Pass Filter	Mini Circuits	VHF-1320+ 1700-3800 MHz	2016-09	2019-09
1-0790	High Pass Filter	Mini Circuits	VHF-3100+ 3400-9900MHz	2016-09	2019-09
1-0791	High Pass Filter	Mini Circuits	VHF-740+ 900-2200MHz	2016-09	2019-09
1-0870	10 dB Attenuator	Mini Circuits	BW-N10W5+	2016-09	2019-09
1-0924	Cable 1m	---	SMA	2016-09	2019-09
1-0925	Cable 1m	---	SMA	2016-09	2019-09
1-0926	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0927	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0966	RF power meter	DARE	RPR3006W	2017-07	2018-07
1-1000	Pre amplifier	Nemko GmbH & Co. KG	BBV 30M1G Broadband Preamplifier	2018-09	2019-09
1-1017	High Pass Filter	Wainwright Instruments GmbH	WHKX10-3150-3500-18000-40SS	2018-06	2019-06

Ref No	Instrument/ ancillary	Manufacturer	Type of instrument/ ancillary	Cal. Date	Cal. Due
1-1018	High Pass Filter	Wainwright Instruments GmbH	WHKX8-5913-7300-18000-60SS	2018-06	2019-06
1-1019	High Pass Filter	Wainwright Instruments GmbH	WHKX12-915-1000-18000-40SS	2018-06	2019-06

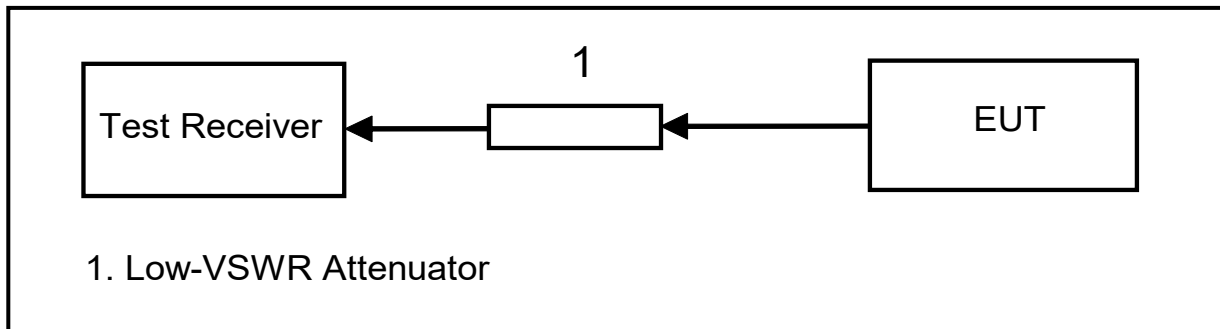
Test equipment list after 2018-09:

Ref No	Instrument/ ancillary	Manufacturer	Type of instrument/ ancillary	Cal. Date	Cal. Due
1-0039	Loop antenna	Rohde & Schwarz	HFH2-Z2	2018-09	2019-09
1-0040	Biconical antenna	Rohde & Schwarz	HK116	2017-07	2020-07
1-0055	LopPer antenna	Rohde & Schwarz	HL223	2017-07	2020-07
1-0080	Turntable	H. Deisel	DS 420	--	--
1-0115	Netzgerät	Toellner GmbH	TOE 8742-60	--	--
1-0189	Netzgerät	Toellner GmbH	TOE 8721-4	--	--
1-0200	Trilog antenna	Schwarzbeck Mess-Elektronik	VULB 9163	2019-02	2022-02
1-0250	HF-Signalgenerator	Rohde & Schwarz	SML03	2018-09	2019-09
1-0256	Horn antenna	Schwarzbeck Mess-Elektronik	BBHA 9120	--	--
1-0334	Climate chamber	WEISS-TECHNIK	1000SB/+10IU/40DU	2018-09	2019-09
1-0361	Semi anechoic chamber	Reinhold & Mahla	3m	2017-06	2020-06
1-0364	Antenna cable 2	Kabelwerk Eupen	RF/Cord CMS / RG 214-N/7	2016-09	2019-09
1-0604	EMI test receiver	Rohde & Schwarz	ESU8	2018-09	2019-09
1-0611	Signal analyzer	Rohde & Schwarz	FSV 40	2018-09	2019-09
1-0614	Log.-per. antenna	Schwarzbeck Mess-Elektronik	STLP 9148 Stacked Log.-Per. Antenne	2016-11	2019-11
1-0615	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV-9718 Broadband Preamplifier	2018-09	2019-09
1-0619	Coaxial cable (to SAC)	Huber+Suhner	SF106/2x11N-651/2m	2016-09	2019-09
1-0620	Antenna cable 3	Huber+Suhner	SF106/2x11N-651/3m	2016-09	2019-09
1-0628	Multimeter	Agilent Technologies	U1252B	2018-09	2019-09
1-0771	Broadband Horn antenna	Schwarzbeck Mess-Elektronik	SHF-EHF Horn, 15-40GHz	2018-03	2021-03
1-0781	Pre amplifier	Schwarzbeck Mess-Elektronik	BBV 9721	2018-09	2019-09
1-0782	Antenna cable	Huber & Suhner	FB142A	2017-10	2020-10
1-0792	Splitter	Mini Circuits	ZFRSC.42-S+ DC-4200MHz	--	--
1-0795	Dual Rotary Attenuator	JFW Industries	50DR-125	2016-09	2019-09
1-0870	10 dB Attenuator	Mini Circuits	BW-N10W5+	2016-09	2019-09
1-0871	10 dB Attenuator	Mini Circuits	BW-N10W5+	2016-09	2019-09

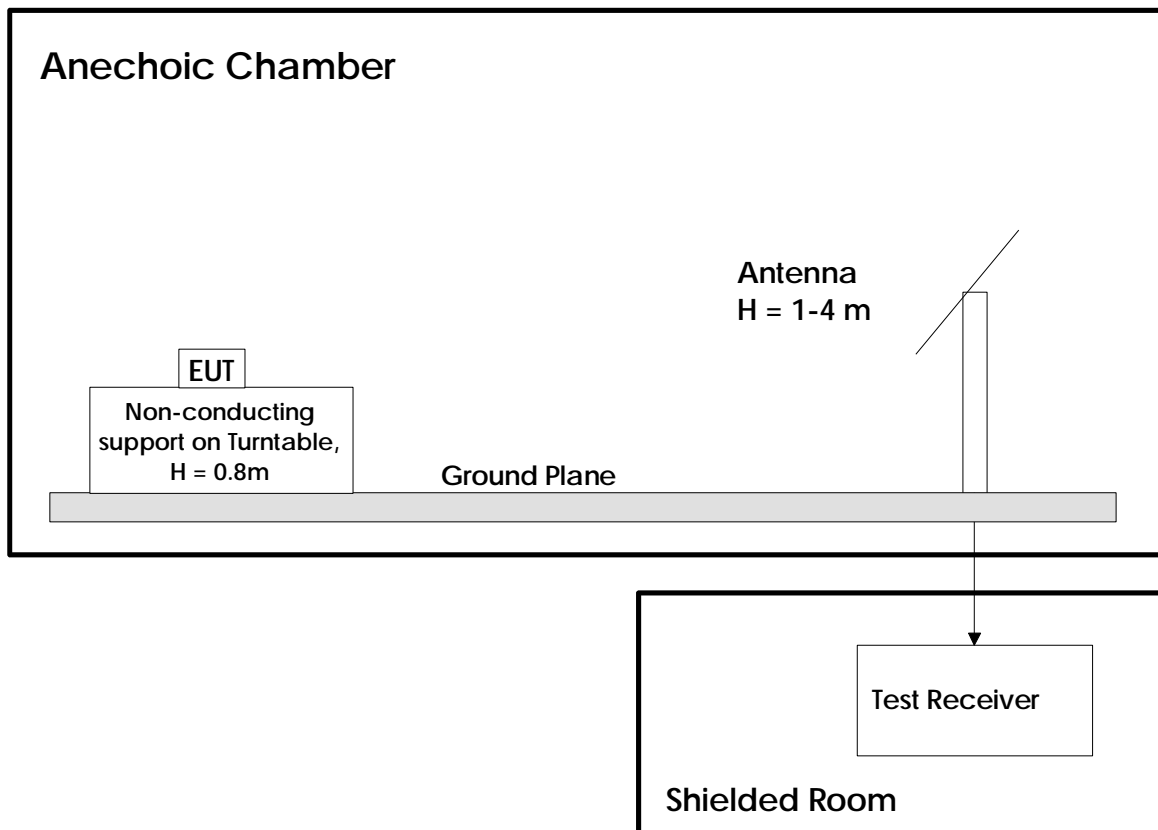
Ref No	Instrument/ ancillary	Manufacturer	Type of instrument/ ancillary	Cal. Date	Cal. Due
1-0872	Attenuator	Mini Circuits	BW-S10-2W263+	2016-09	2019-09
1-0873	Attenuator	Mini Circuits	BW-S10-2W263+	2016-09	2019-09
1-0920	Multimeter	Agilent Technologies	U1252B	2018-11	2019-11
1-0923	Cable 1m	---	SMA	2016-09	2019-09
1-0924	Cable 1m	---	SMA	2016-09	2019-09
1-0925	Cable 1m	---	SMA	2016-09	2019-09
1-0926	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0927	Cable 1m	Harbour Industries	SMA	2016-09	2019-09
1-0966	RF power meter	DARE	RPR3006W	2019-01	2020-01
1-0994	Attenuator	Mini Circuits	BW-N3W5+	2017-10	2020-10
1-1000	Pre amplifier	Nemko GmbH & Co. KG	BBV 30M1G Broadband Preampfier	2018-09	2019-09
1-1017	High Pass Filter	Wainwright Instruments GmbH	WHKX10-3150-3500-18000-40SS	2018-06	2019-06
1-1018	High Pass Filter	Wainwright Instruments GmbH	WHKX8-5913-7300-18000-60SS	2018-06	2019-06
1-1019	High Pass Filter	Wainwright Instruments GmbH	WHKX12-915-1000-18000-40SS	2018-06	2019-06

5 BLOCK DIAGRAM

5.1 Conducted Measurements at the Antenna Port



5.2 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	2018-05-31	First version	mk