



Report No. 320651-01-001

FCC TEST REPORT / IC TEST REPORT

Product	Receiver S-Link (receiver unit for remote control system)	
Name and address of the applicant	Sleipner Motor AS Postboks 519 1612 FREDRIKSTAD	
Name and address of the manufacturer	Same as above	
Model	RCRS-2U	
Rating	12 - 24 V DC	
Trademark	SIDE-POWER	
Serial number	-	
Additional information	-	
Tested according to	FCC Part 15.249 Low Power Transmitter. 902 – 928 MHz band. Industry Canada RSS-210, Issue 9 Licence-Exempt Radio Apparatus, Category I Equipment 902 – 928MHz band	
Order number	320651-01-001	
Tested in period	2017.11.17 - 2018.02.08	
Issue date	2018.02.08	
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 FCC No: 973501 IC OATS: 10921A-1 BNetzA-CAB-17/21-17
 Prepared by [Dipl.-Ing. M. Korny]  Approved by [Dipl.-Ing. P. Lukas]		

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1 TEST INFORMATION

1.1 Test item

Name :	SIDE-POWER
FCC ID :	S4ERCRS2
Industry Canada ID :	10917A-RCRS2
Model/version :	RCRS-2U
Serial number :	-
Hardware identity and/or version:	150402(U)-C
Software identity and/or version :	V2.000
Frequency Range :	914 - 917 MHz
Number of Channels :	4 channels (914, 915, 916 and 917 MHz)
Type of Modulation :	Digital (FSK)
User Frequency Adjustment :	None
Rated Output Power :	0.1mW
Type of Power Supply :	12 - 24 V DC
Antenna Connector :	SMA-RP
Number of antennas :	1
Antenna Diversity Supported :	No
Desktop Charger :	N/A

Description of Test Item

The EUT is a Receiver operateing in the 902 – 928MHz frequency band. The EUT includes a radio transceiver, micro-controller for controlling outputs (CAN-bus) to truster/anchor steering.

1.2 Normal test condition

Temperature: 20 - 26 °C
Relative humidity: 35 - 55 %
Normal test voltage: 24Vdc via Laboratory power supply

The values are the limit registered during the test period.

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: SMA-RP

Ref. FCC §15.203

1.7 Worst-Case Configuration and Mode

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

1.8 Comments

The measurements were done with the EUT powered by 12 - 24Vdc. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

The output level is set to maximum in the software.

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 15.249 and Industry Canada RSS-210, Issue 9 and RSS-GEN, Issue 4.

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

DXT 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-GEN Issue 4 & RSS-210 Issue 9	Result
Supply Voltage Variations	15.31(e)	F.2.2 (RSS210) 6.11,8.11 (RSS-Gen)	Complies
Antenna Requirement	15.203	6.7 (RSS-GEN)	Complies ¹
Power-line Conducted Emission	15.207(c)	8.8 (RSS-GEN)	Complies
Occupied Bandwidth	N/A	6.6 RSS-GEN)	-
Peak Power Output	15.249(a)(c)	B.10(RSS210)	Complies
Band edge Emissions	15.249(d)	B.10(RSS210)	Complies
Spurious Emissions (Radiated)	15.249 (d),(e) 15.209 15.35 (b)	8.9,8.10 (RSS-GEN) B.10(RSS210)	Complies

¹ RP-SMA connector

RSS Gen issue 4 covers section 6 & 8

RSS 210 issue 9 covers Annex B

2.3 Description of modification for modification filing

Not applicable.

2.4 Comments

The channels are selected with the use of dedicated test software from the manufacturer.

The radiated measurements are tested on three axes.

2.5 Family list rationale

Not Applicable.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)/8.8

Test Performed By: Markus Korny

Date of Test: 2017.12.06

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

Test Results: Complies.

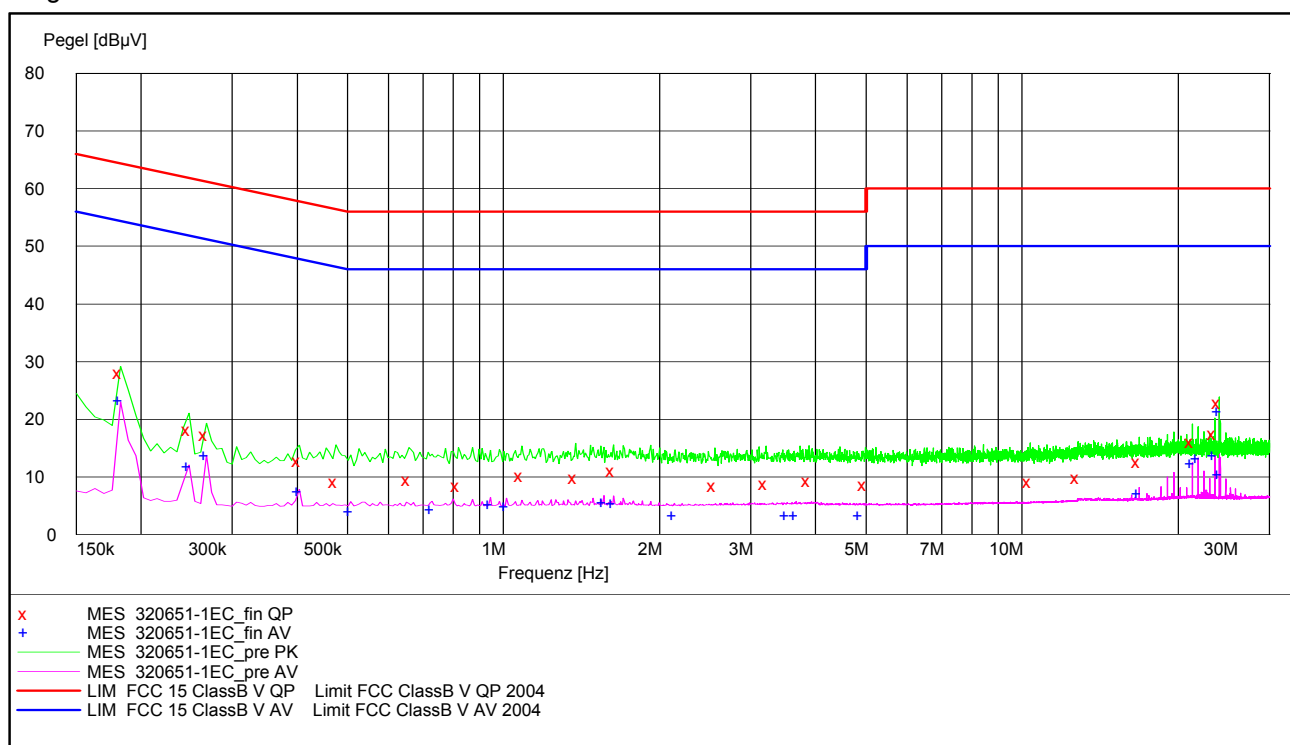
Measurement Data: See attached graph.

AC/DC adapter type: Peak Tech 6010D

Input voltage to AC/DC adapter: 115V/60Hz

Highest measured value (L1 and N):

Diagram



Final measurements QP with Quasi-Peak-Detector

Frequenz MHz	Pegel dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.182500	28.10	10.00	64.40	36.30	L1	GND
0.247500	18.20	10.00	61.80	43.60	L1	GND
0.267000	17.30	10.00	61.20	43.90	N	GND
0.403500	12.80	10.00	57.80	45.00	L1	GND
0.475000	9.10	10.00	56.40	47.40	L1	GND
0.657000	9.50	10.00	56.00	46.50	L1	GND
0.819500	8.50	10.00	56.00	47.50	N	GND
1.086000	10.20	10.00	56.00	45.80	L1	GND
1.378500	9.80	10.00	56.00	46.20	L1	GND
1.632000	11.00	10.10	56.00	45.00	L1	GND
2.555000	8.50	10.10	56.00	47.50	N	GND
3.211500	8.80	10.20	56.00	47.20	N	GND
3.887500	9.30	10.20	56.00	46.70	N	GND
4.986000	8.60	10.20	56.00	47.40	N	GND
10.368000	9.10	10.50	60.00	50.90	L1	GND
12.825000	9.90	10.70	60.00	50.10	L1	GND
16.835500	12.60	10.90	60.00	47.40	L1	GND
21.327000	16.00	11.10	60.00	44.00	L1	GND
23.569500	17.50	11.10	60.00	42.50	L1	GND
23.998500	22.90	11.10	60.00	37.10	L1	GND

Final measurements AV with Average-Detector

Frequenz MHz	Pegel dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.182500	23.30	10.00	54.40	31.00	L1	GND
0.247500	11.80	10.00	51.80	40.00	N	GND
0.267000	13.60	10.00	51.20	37.60	N	GND
0.403500	7.40	10.00	47.80	40.40	N	GND
0.507500	3.90	10.00	46.00	42.10	L1	GND
0.728500	4.20	10.00	46.00	41.80	L1	GND
0.943000	5.10	10.00	46.00	40.90	L1	GND
1.014500	4.80	10.00	46.00	41.20	L1	GND
1.560500	5.50	10.10	46.00	40.50	L1	GND
1.632000	5.30	10.10	46.00	40.70	L1	GND
2.139000	3.20	10.10	46.00	42.80	L1	GND
3.523500	3.30	10.20	46.00	42.70	N	GND
3.666500	3.20	10.20	46.00	42.80	L1	GND
4.875500	3.20	10.20	46.00	42.80	L1	GND
16.835500	7.10	10.90	50.00	42.90	L1	GND
21.327000	12.20	11.10	50.00	37.80	L1	GND
21.886000	13.20	11.10	50.00	36.80	L1	GND
23.569500	13.70	11.10	50.00	36.30	L1	GND
23.998500	21.30	11.10	50.00	28.70	L1	GND
24.128500	10.40	11.10	50.00	39.60	L1	GND

3.2 99 % Occupied Bandwidth

Para. No.: 6.6 RSS-Gen

Test Performed By: Markus Korny

Date of Test: 2018.02.08

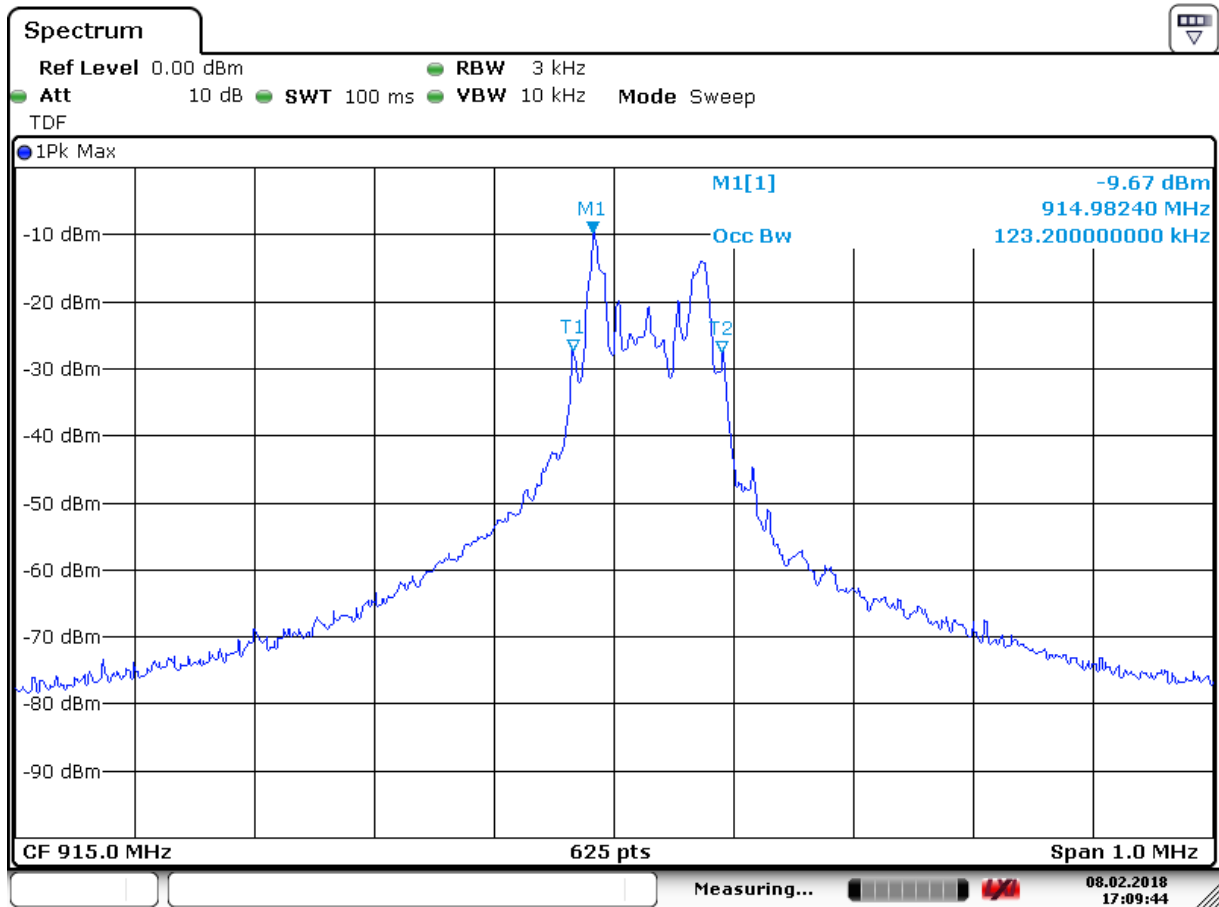
Test Results: Complies

Measurement Data:

99 % (kHz)
915 MHz
123.2

Requirements:

For information only



Date: 8.FEB.2018 17:09:44

915 MHz – 99% OCC BW

3.3 Peak power output

Para. No.: 15.249 (a) / B.10

Test Performed By: Markus Korny	Date of Test: 2017.12.07
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Test Results: Complies

Measurement data:

RF channel	914 MHz	915 MHz	917 MHz
Measured Maxium PK Field strength (dBµV/m) – VP *)	87.38	87.49	87.35
Calc. Radiated Power (dBm)	-7.85	-7.74	-7.88
Calc. Radiated Power (mW)	0.16	0.17	0.16
Measured Conducted Power (dBm) *)	-9.97	-9.98	-10.00
Calc. Conducted Power (mW)	0.1	0.1	0.1
Calculated Antenna Gain (dBd)	0.0	0.1	0.0

*) Measurement was performed with 100% duty cycle.

According to manufacturer the maximum duty cycle: TxON time/100ms = 3.84ms/100ms = 3.84%

$20 \log (0.00384) = -48.3 \text{ dB}$.

i.e. maximum duty cycle correction is 20 dB

Radiated measurements are performed at 3 m distance.

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

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

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?

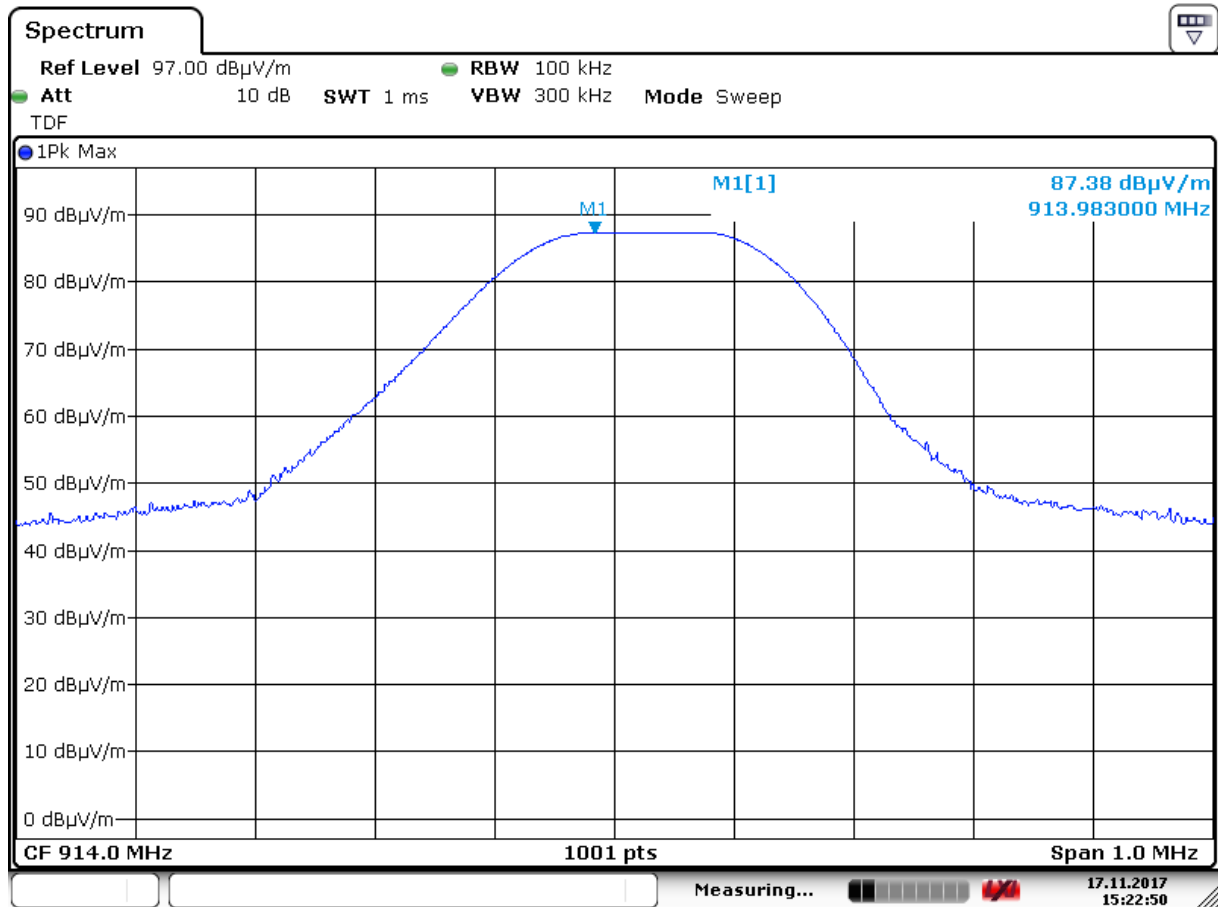
☒ Yes

☐ No

Type of antenna connector: SMA-RP

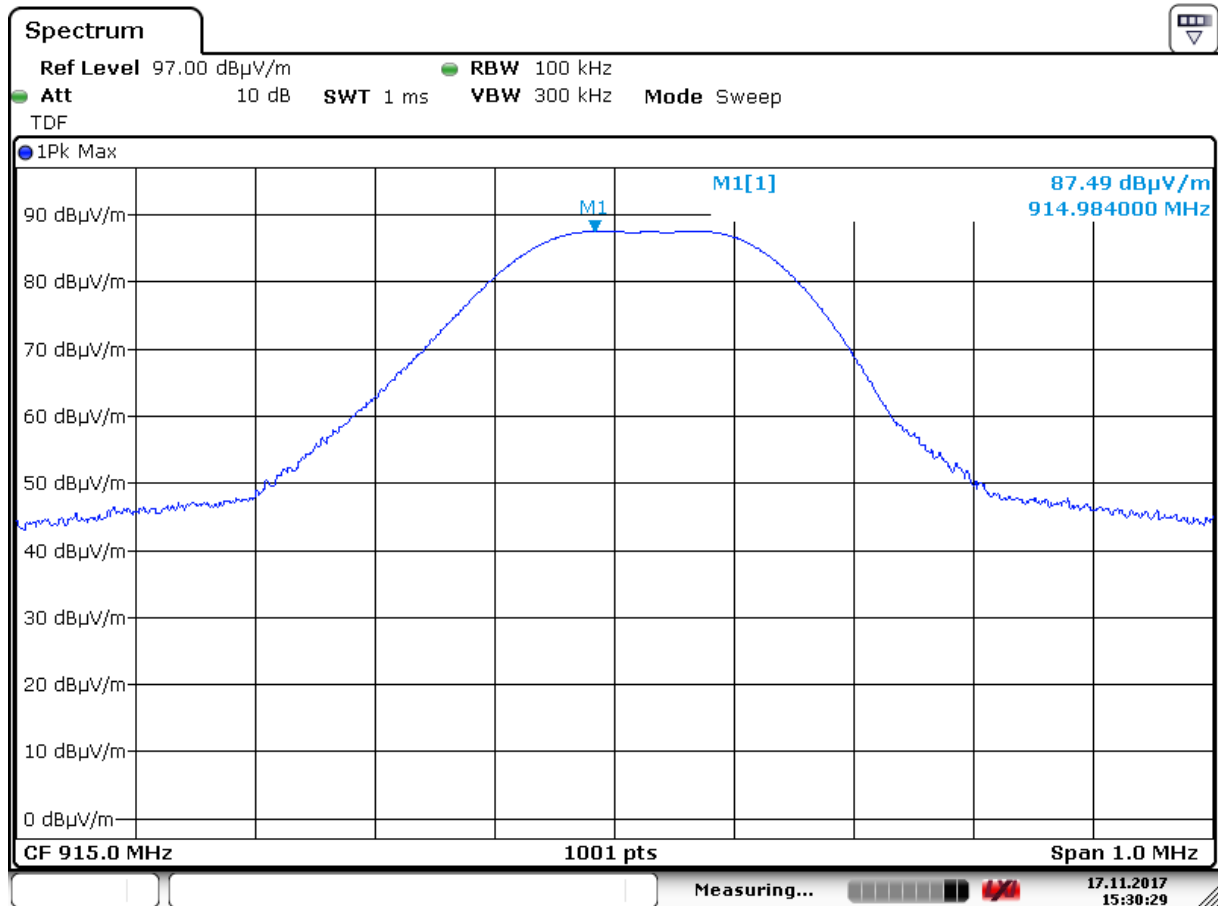
Requirements:

The maximum average output power shall be $\leq 94 \text{ dB}\mu\text{V/m}$ & Peak $\leq 114 \text{ dB}\mu\text{V/m}$



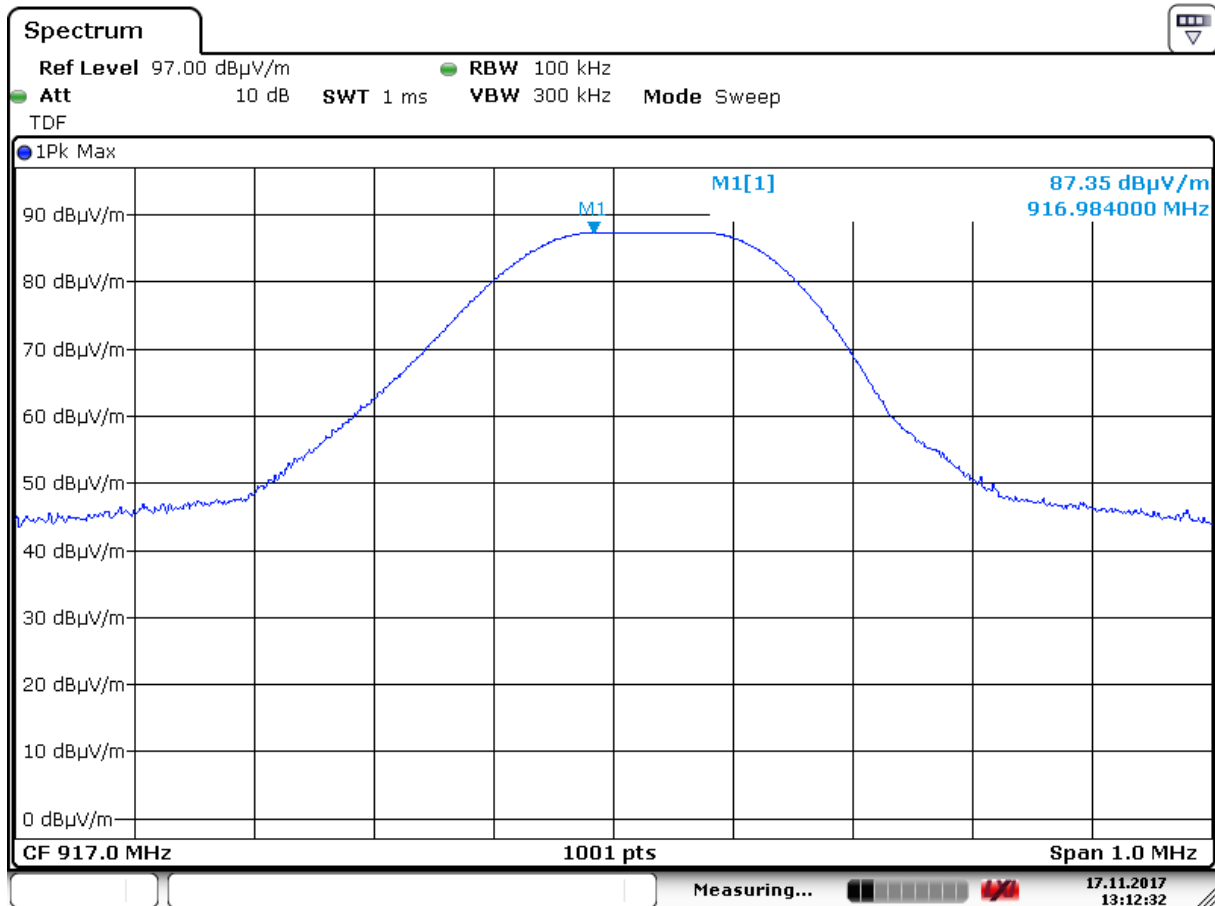
Date: 17.NOV.2017 15:22:50

Radiated field strength, VP, 914 MHz



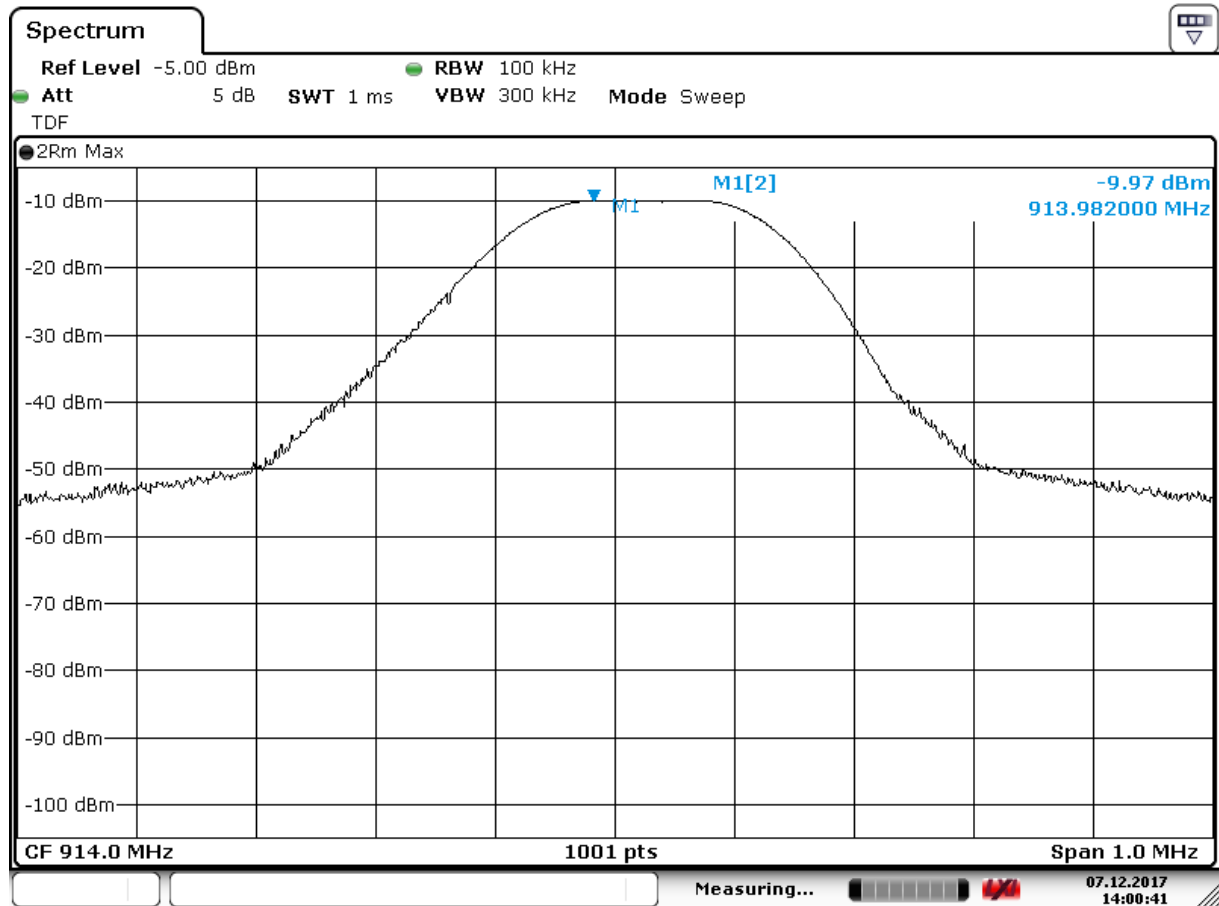
Date: 17.NOV.2017 15:30:29

Radiated field strength, VP, 915 MHz



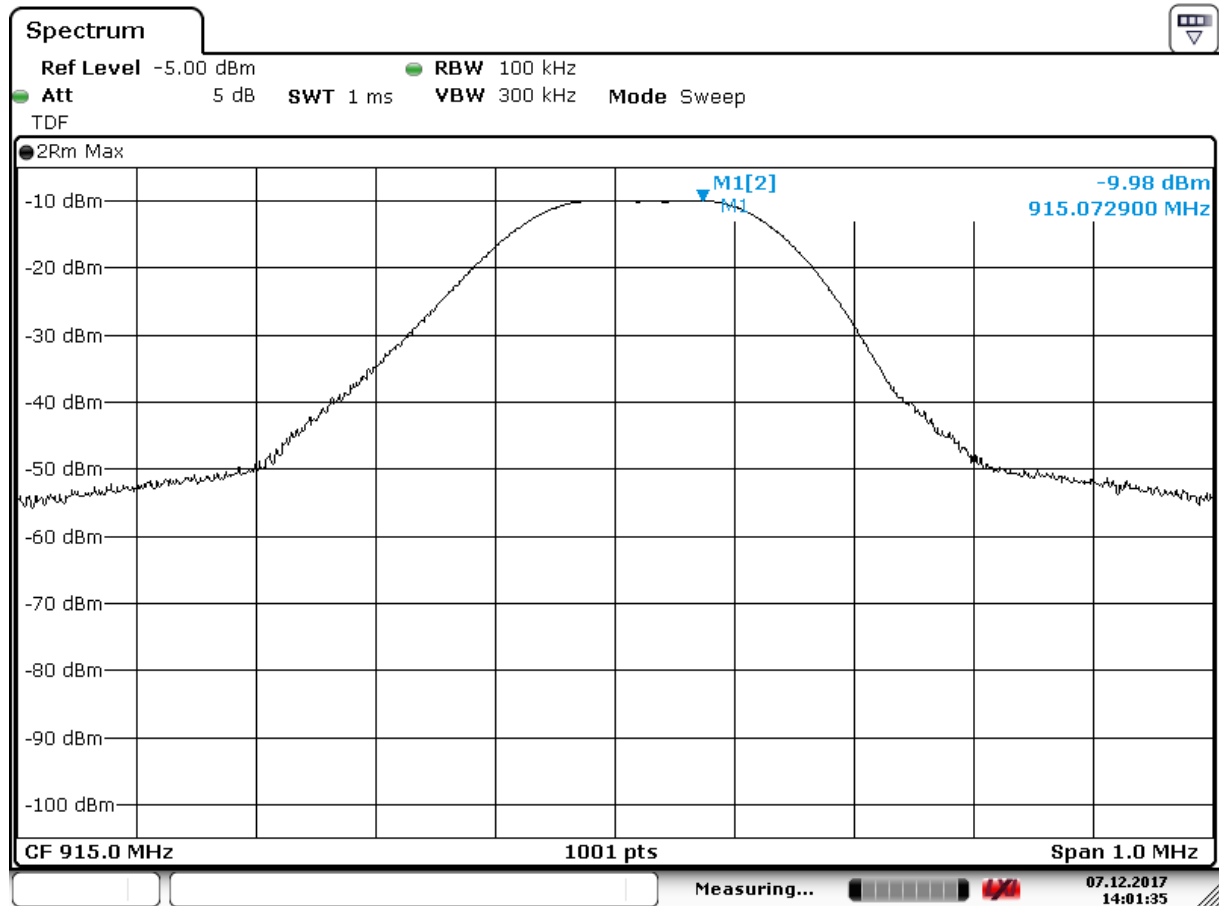
Date: 17.NOV.2017 13:12:33

Radiated field strength, VP, 917 MHz



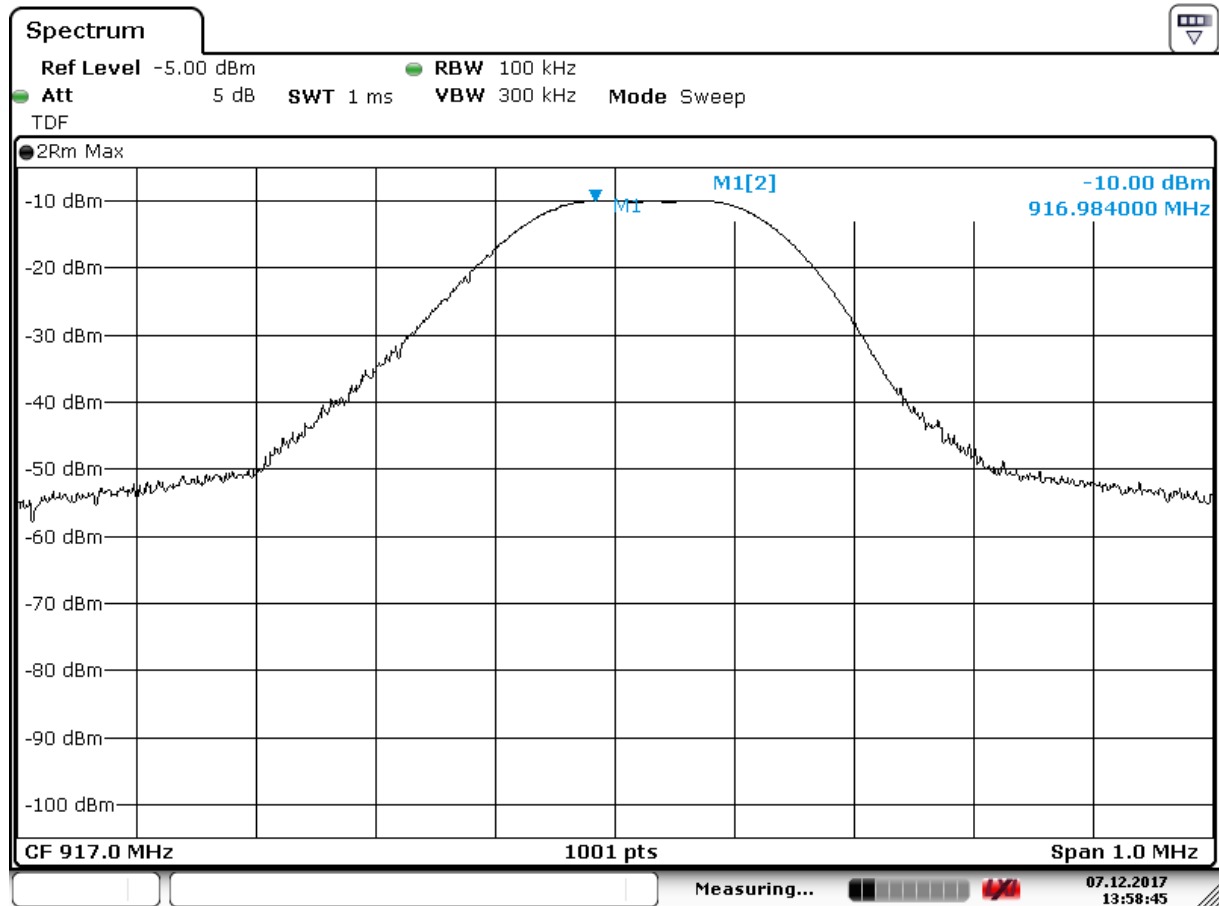
Date: 7.DEC.2017 14:00:42

Conducted power – 914 MHz



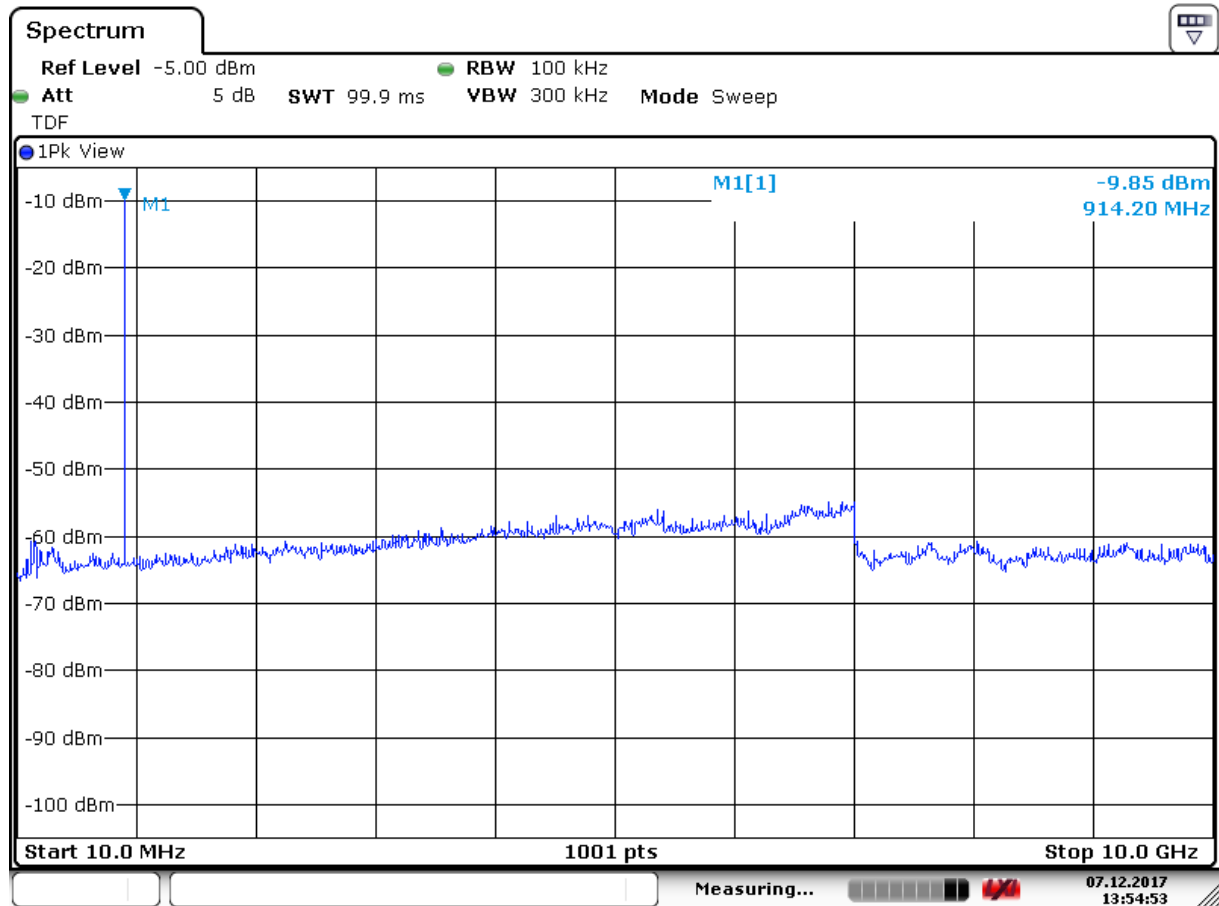
Date: 7.DEC.2017 14:01:36

Conducted power – 915 MHz



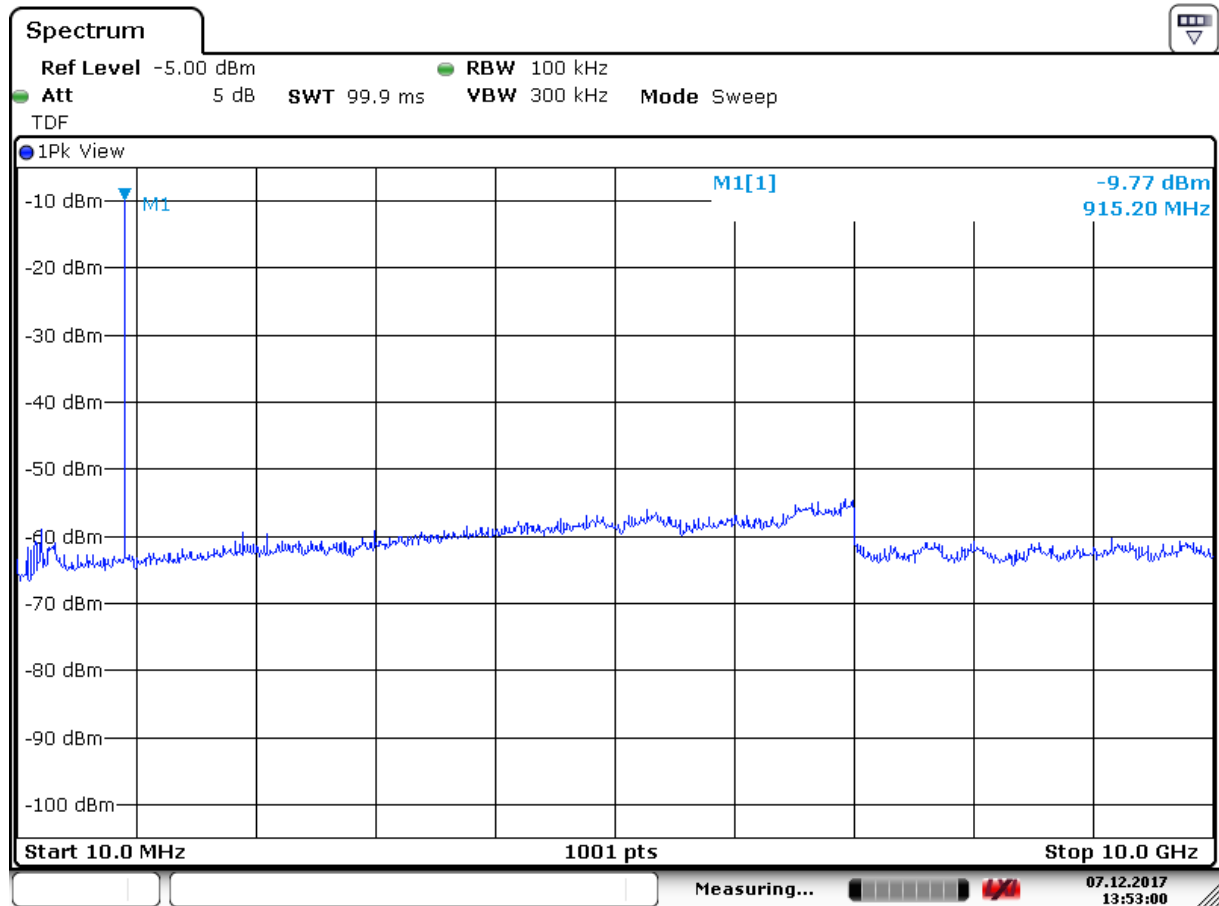
Date: 7.DEC.2017 13:58:46

Conducted power – 917 MHz



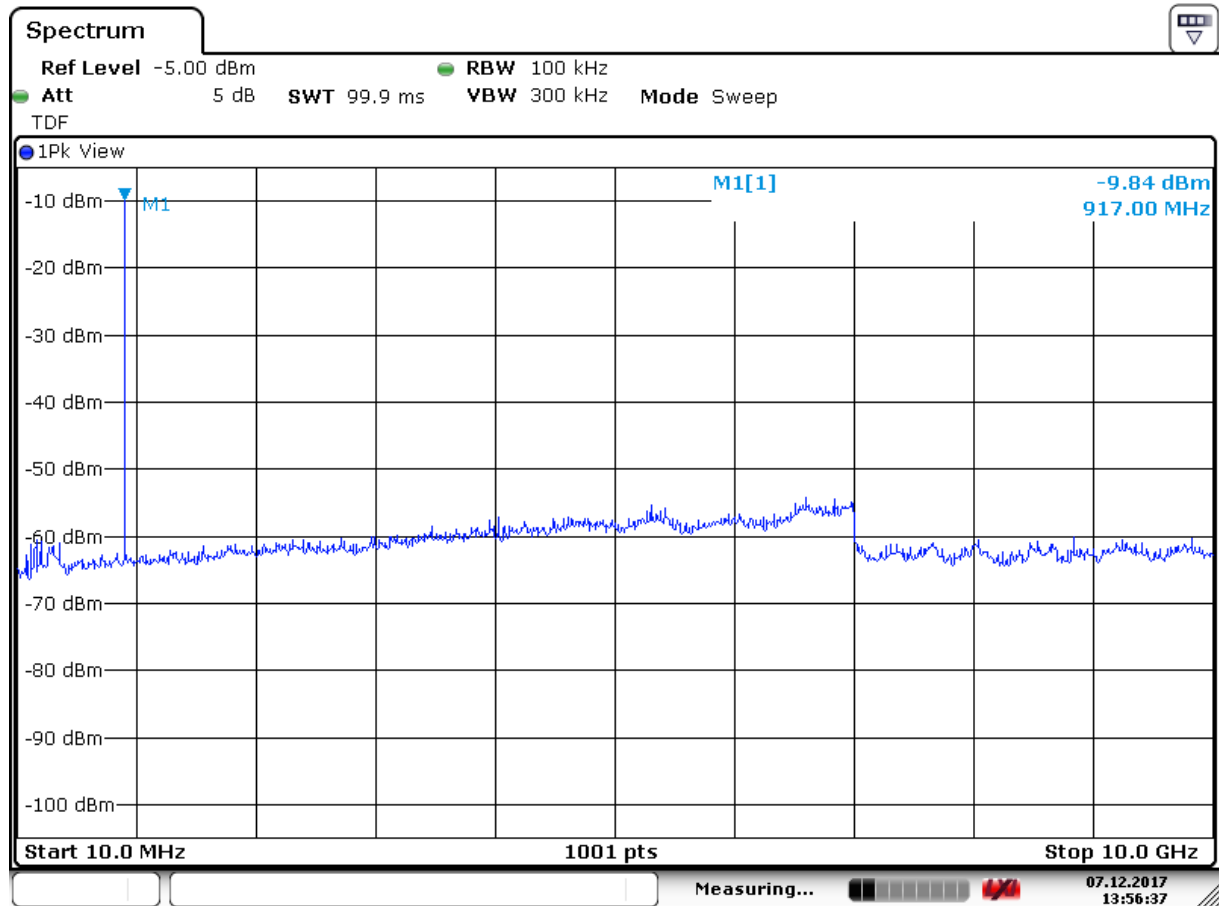
Date: 7.DEC.2017 13:54:53

Conducted spurious emission 10 MHz – 10 GHz - 914 MHz



Date: 7.DEC.2017 13:53:01

Conducted spurious emission 10 MHz – 10 GHz - 915 MHz



Date: 7.DEC.2017 13:56:38

Conducted spurious emission 10 MHz – 10 GHz - 917 MHz

3.4 Spurious emissions (radiated)

Para. No.: 15.209 / 15.249 (d) (e) / 8.9, 8.10, B10

Test Performed By: Markus Korny	Date of Test: 2017.11.17; 2017.11.28
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Test Results: Complies

Measurement Data:

Radiated Emissions with antenna, 9 kHz -10 GHz

9 kHz -10 GHz measured at a distance of 3 m.

Measured with Peak Detector:

Frequency	Operational condition	Field strength, Peak	Duty cycle corr. factor	Limit	Margin
MHz	-	dB μ V/m	dB	dB μ V/m	dB
/	All channels	/	-	-	-
136.1	All channels	28.8	-	43	14.2
9681.0 *)	All channels	58	-	74	16

*) outside the Restricted Bands

See attached graphs.

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

Requirement:

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of §15.249 are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

Requirements/Limit according §15.209

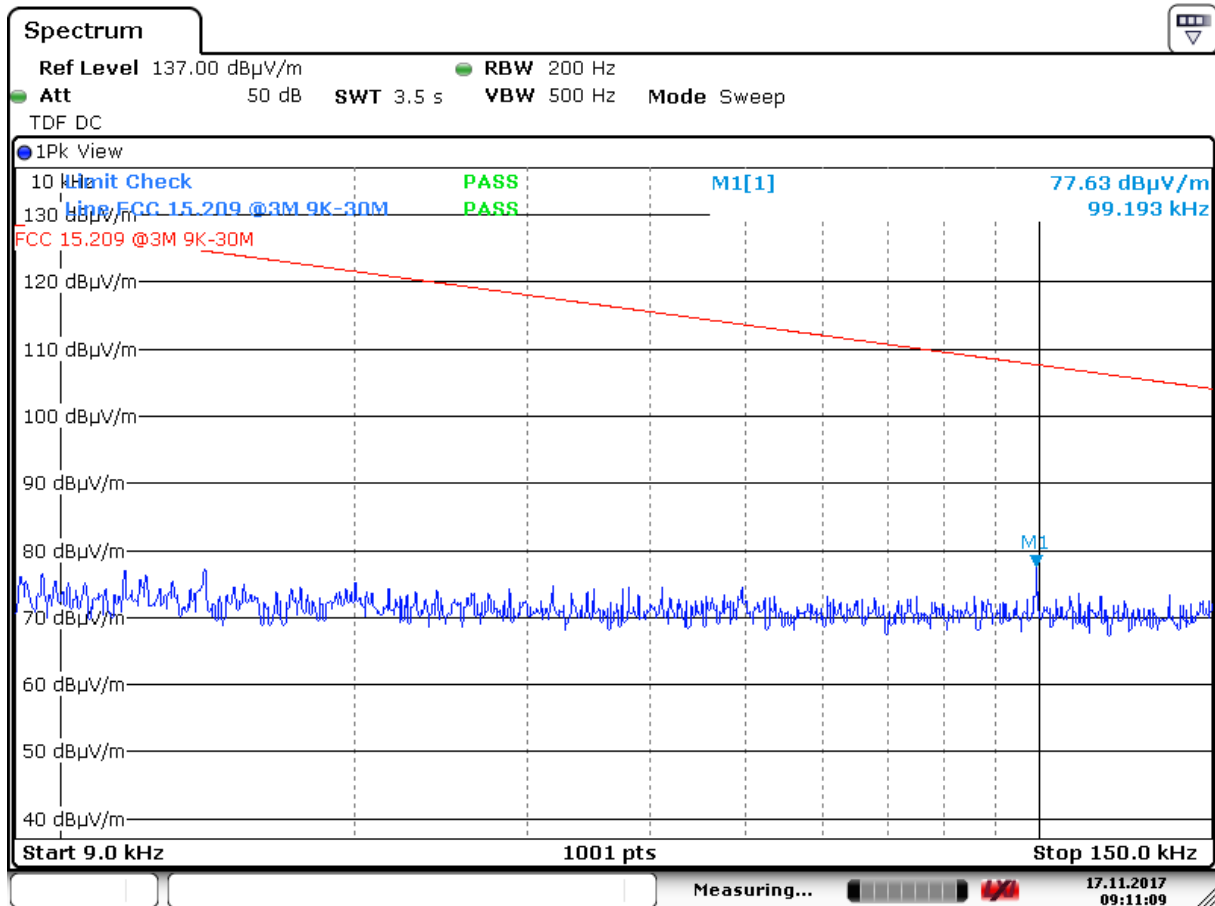
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 4, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency (MHz)	Quasi Peak (μ V/m)	Quasi Peak (dB μ V/m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Radiated emissions 9kHz – 30 MHz.

Measuring distance 3 m, measured with Peak detector.

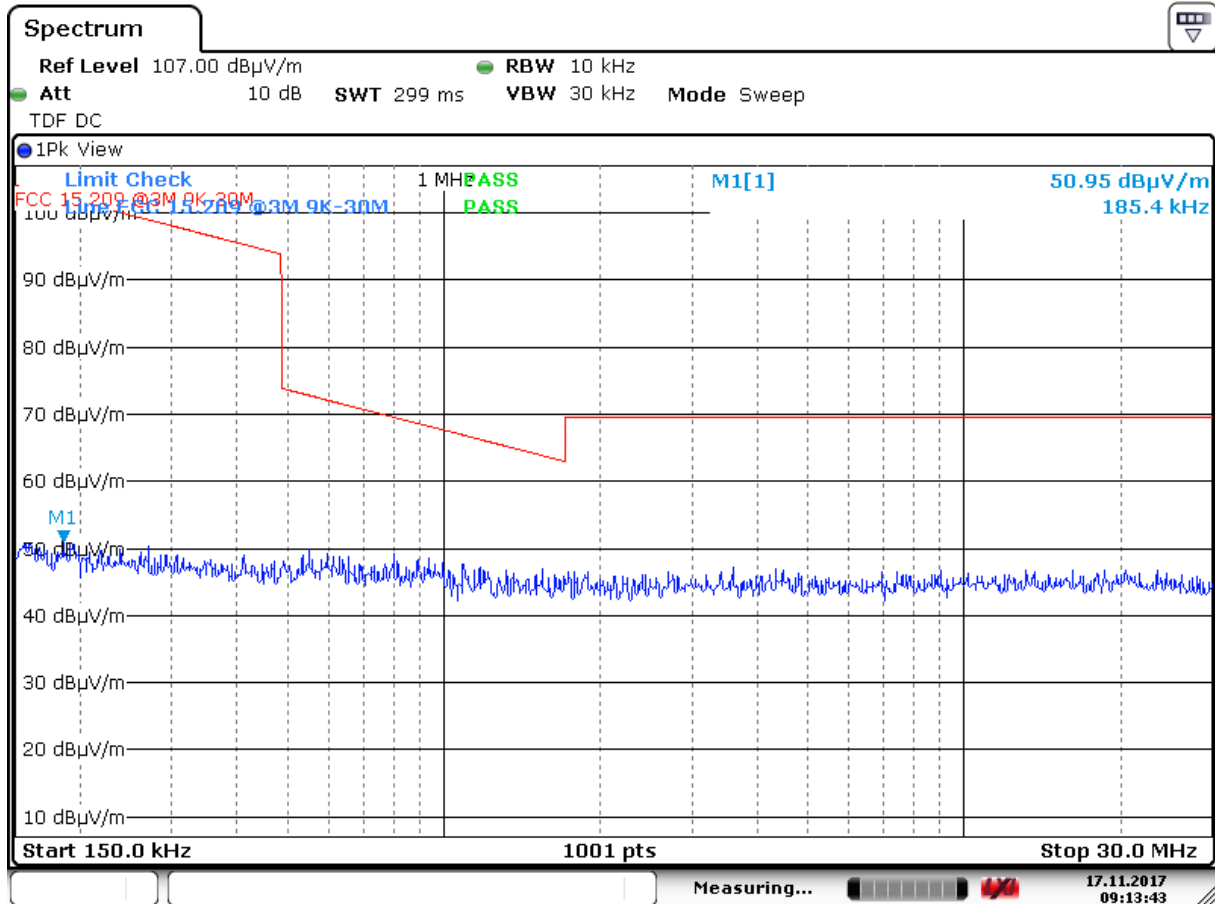
No component detected, see attached graph.

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



Date: 17.NOV.2017 09:11:09

Radiated Emissions, 9 kHz – 150 kHz @3m



Date: 17.NOV.2017 09:13:43

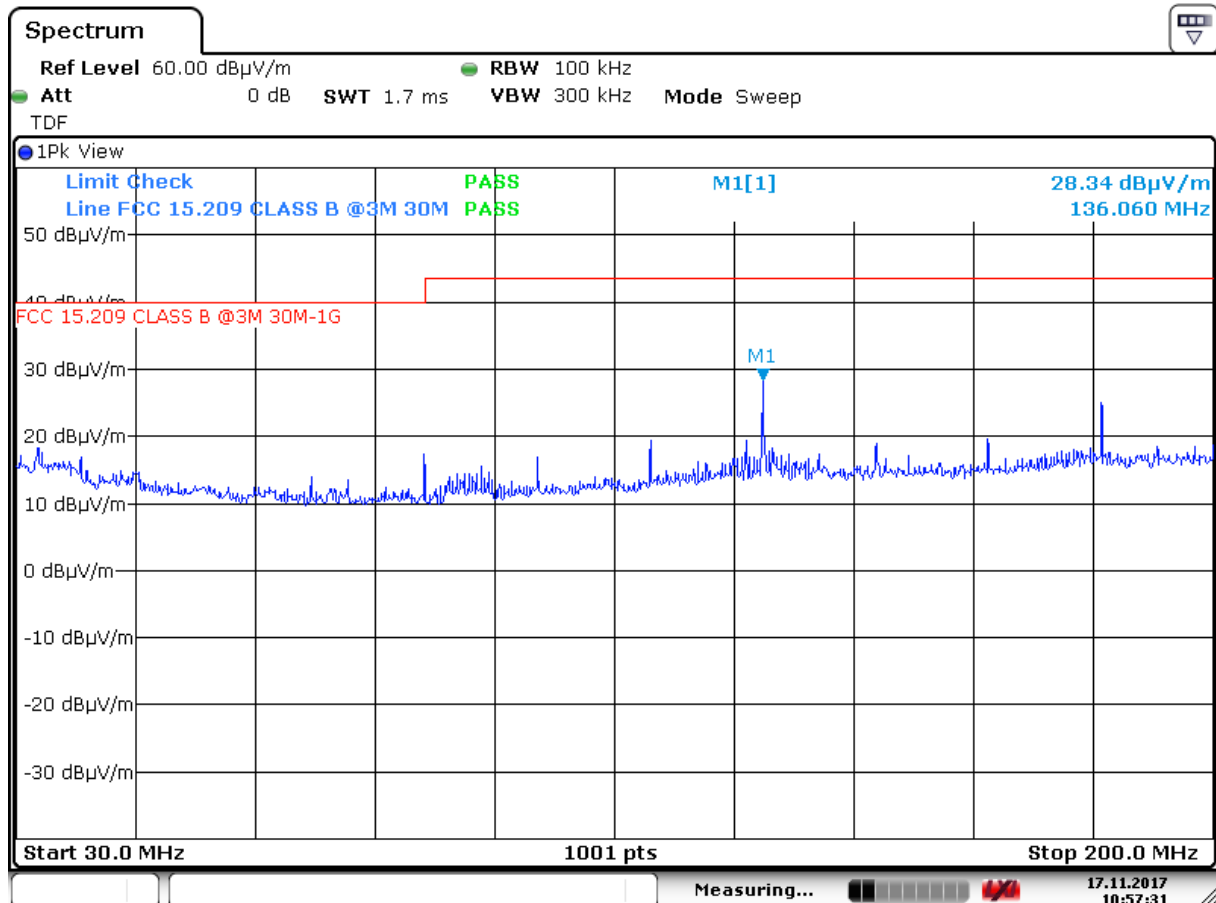
Radiated Emissions, 150 kHz - 30MHz @3m

Radiated emissions 30 – 1000 MHz.

Detector: Peak

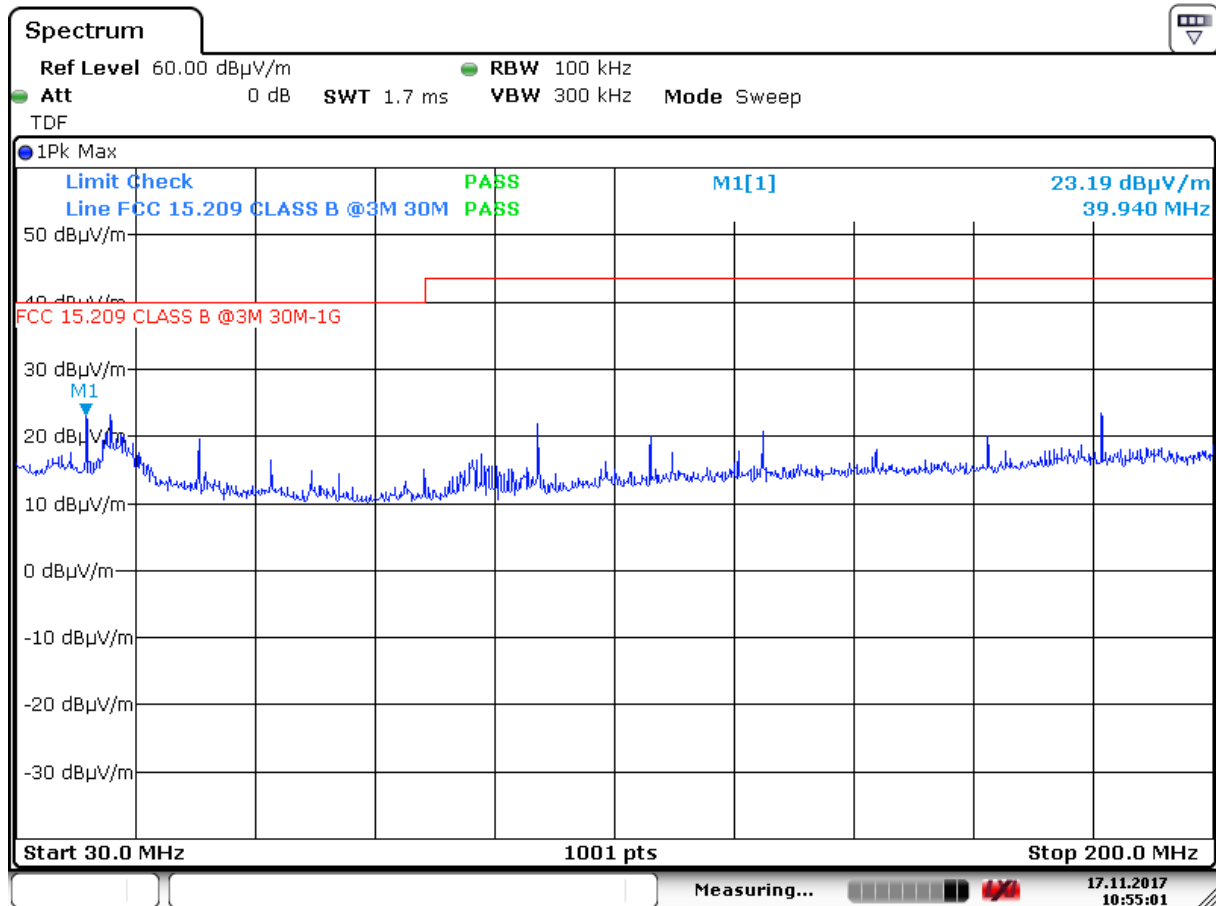
Measuring distance 3 m.

The graph shows peak scan and highest values. Since there is no spurious found no QP values are measured.



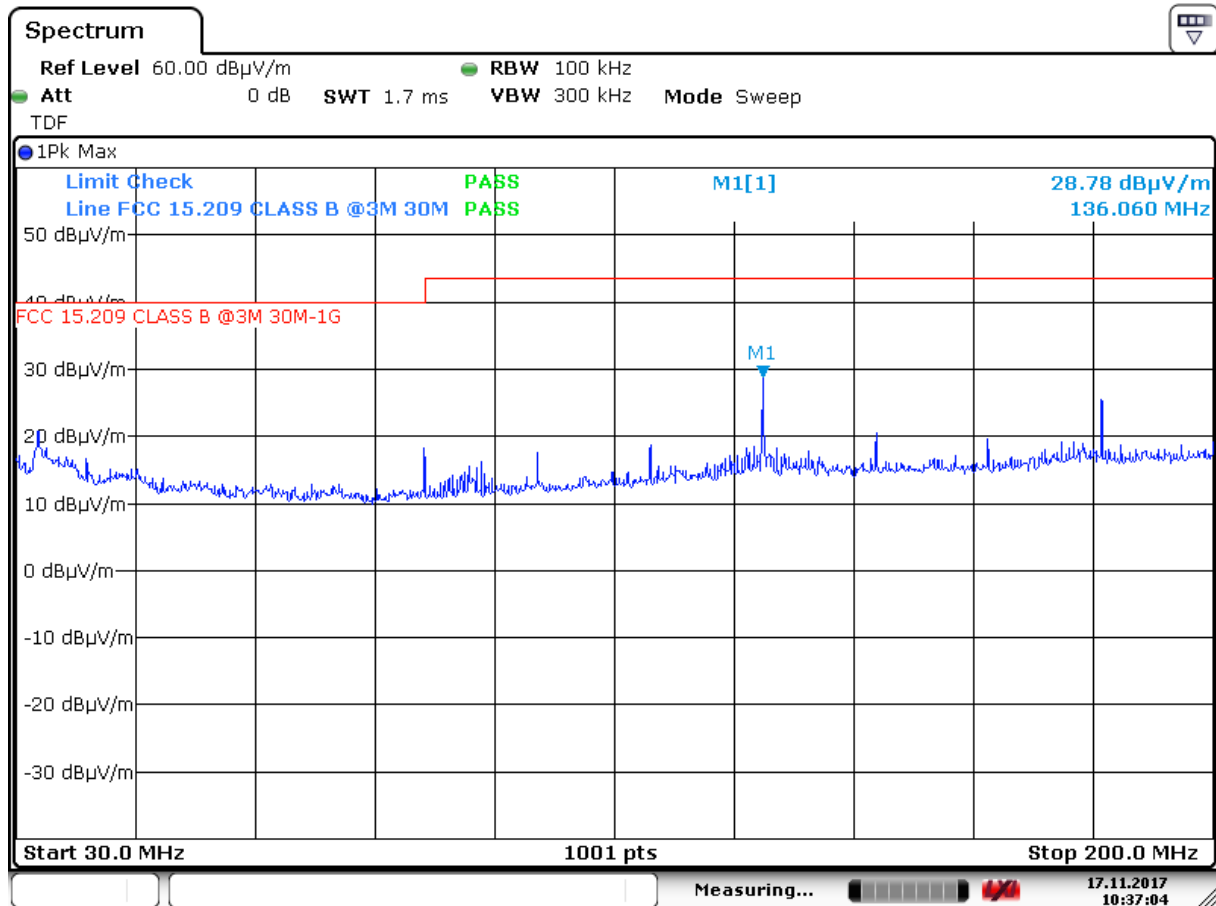
Date: 17.NOV.2017 10:57:31

Radiated Emissions, 917 MHz, 30 – 200 MHz, HP, @3m, PK scan



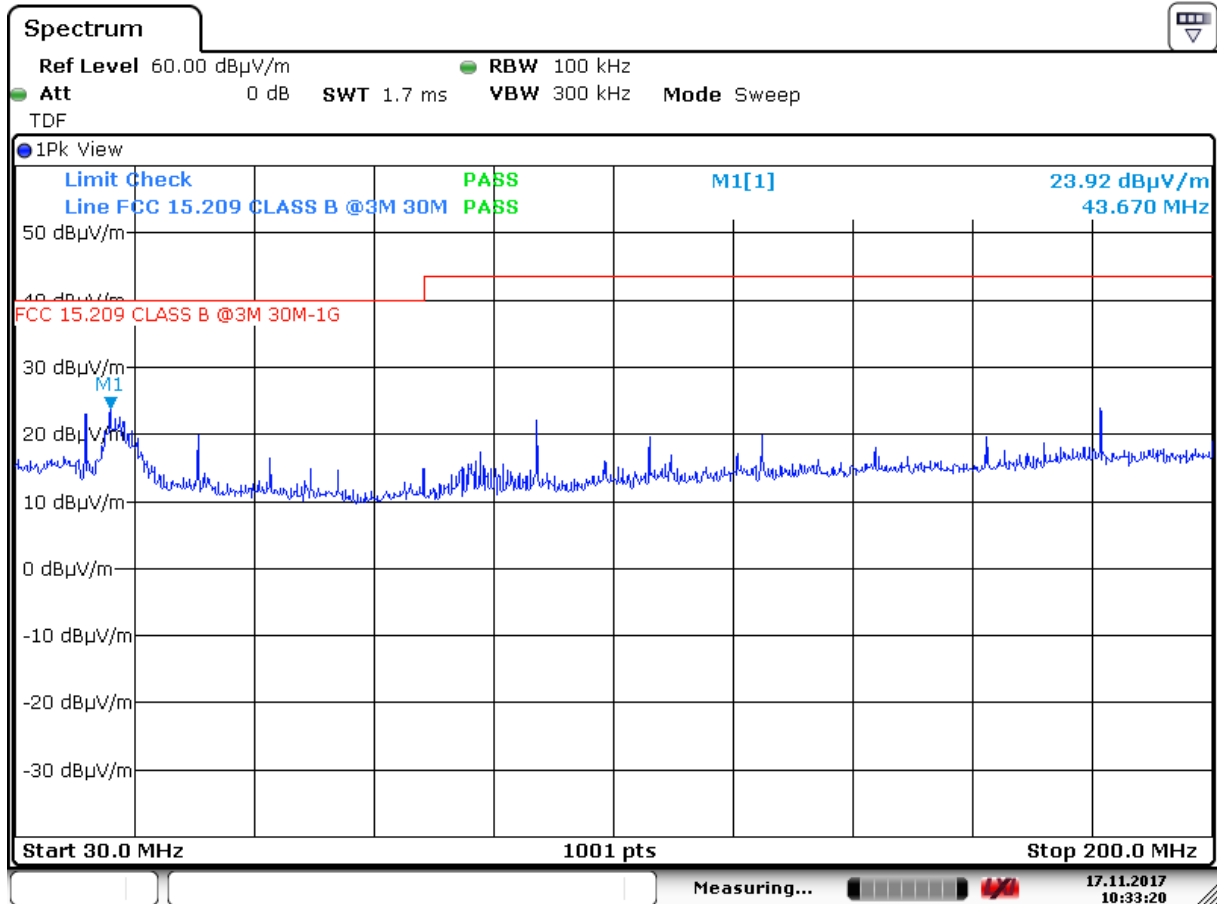
Date: 17.NOV.2017 10:55:01

Radiated Emissions, 917 MHz, 30 – 200 MHz, VP, @3m, PK scan



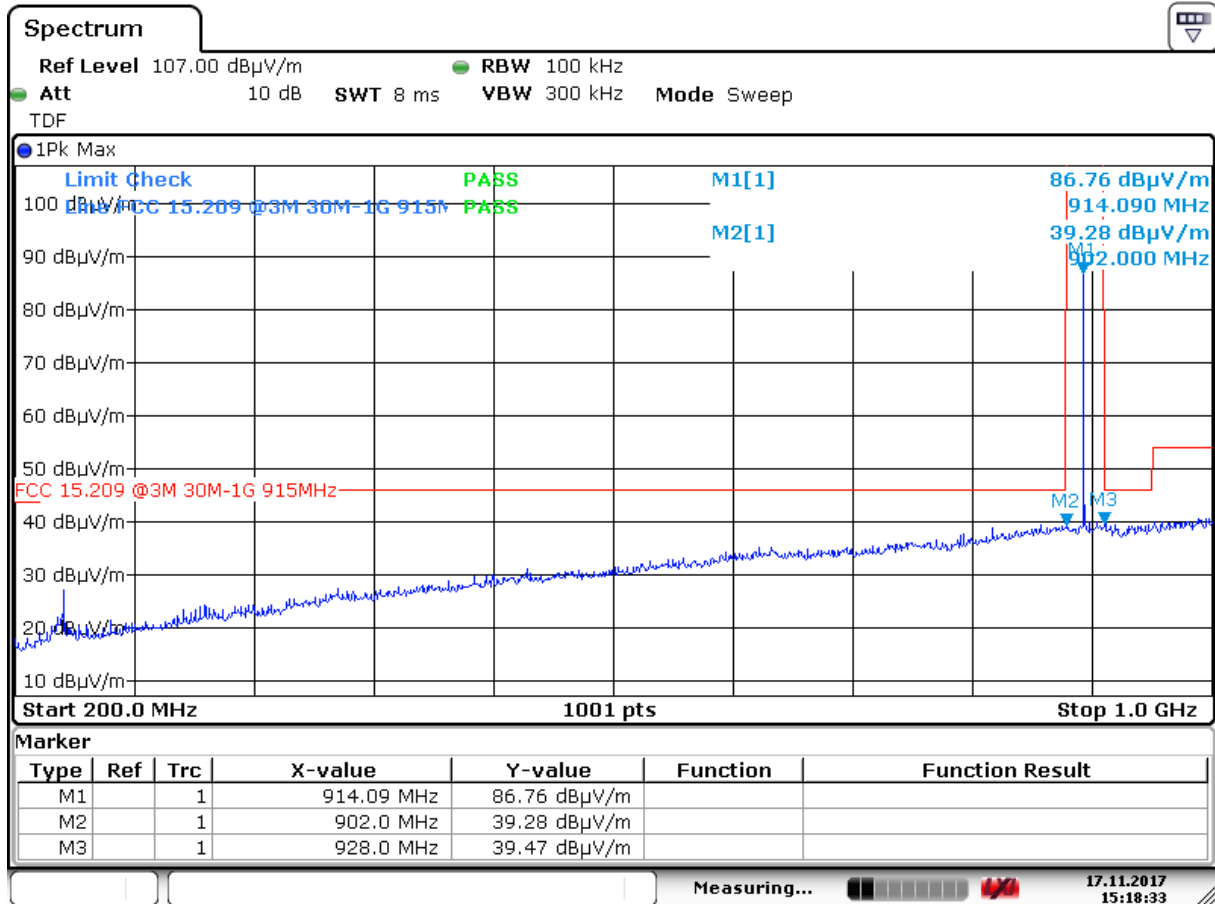
Date: 17.NOV.2017 10:37:05

Radiated Emissions, 914 MHz, 30 – 200 MHz, HP, @3m, PK scan



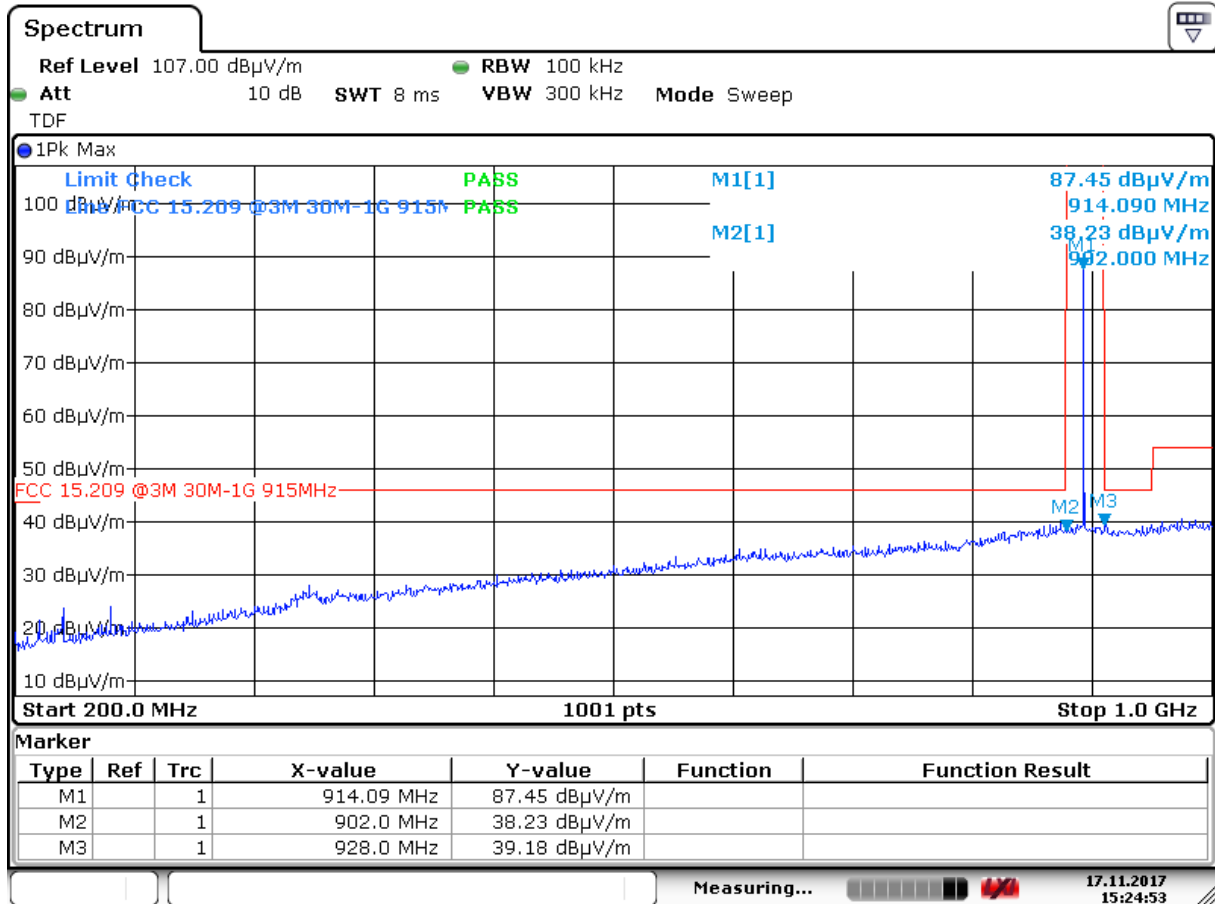
Date: 17.NOV.2017 10:33:20

Radiated Emissions, 914 MHz, 30 – 200 MHz, VP, @3m, PK scan



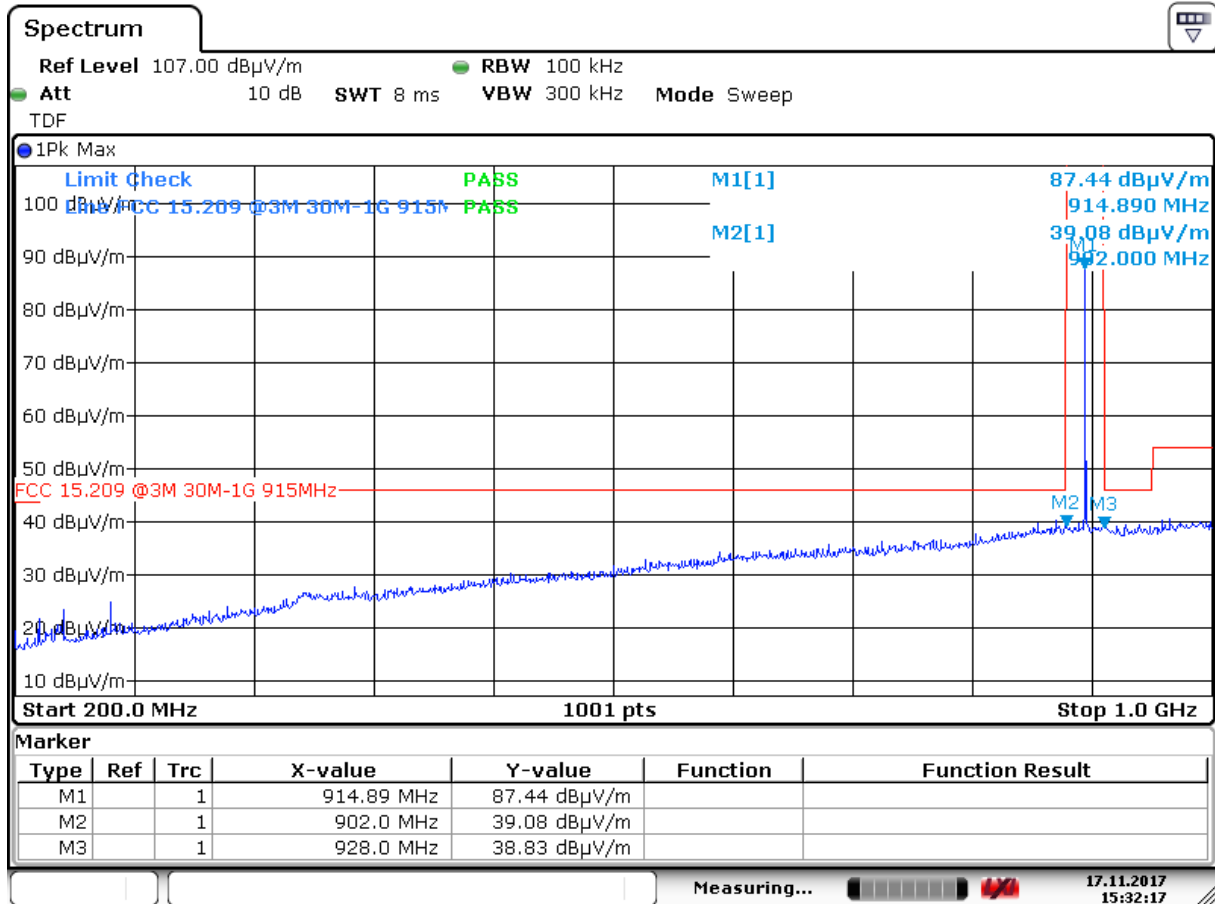
Date: 17.NOV.2017 15:18:33

Radiated Emissions, 914 MHz, 200 – 1000 MHz, HP, @3m, PK scan



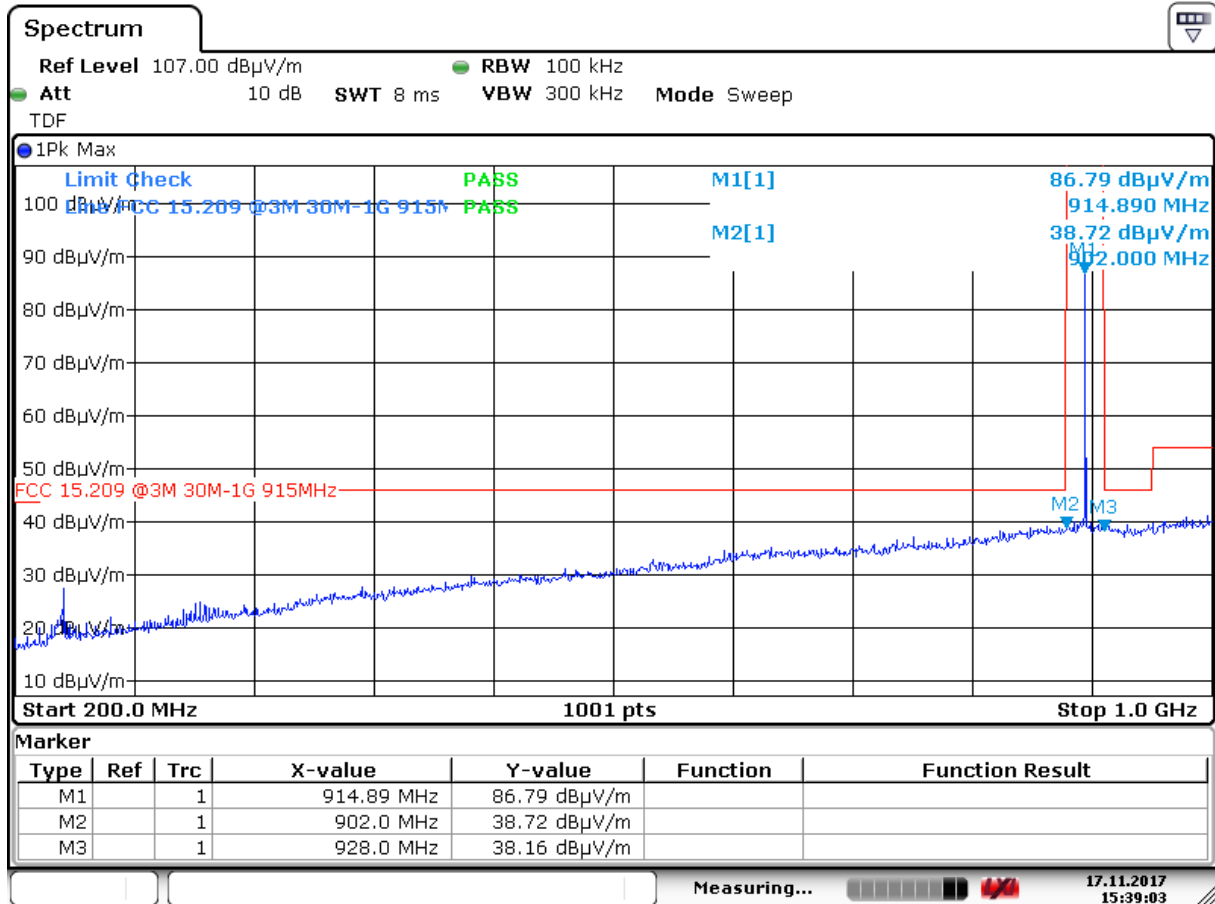
Date: 17.NOV.2017 15:24:53

Radiated Emissions, 914 MHz, 200 – 1000 MHz, VP, @3m, PK scan



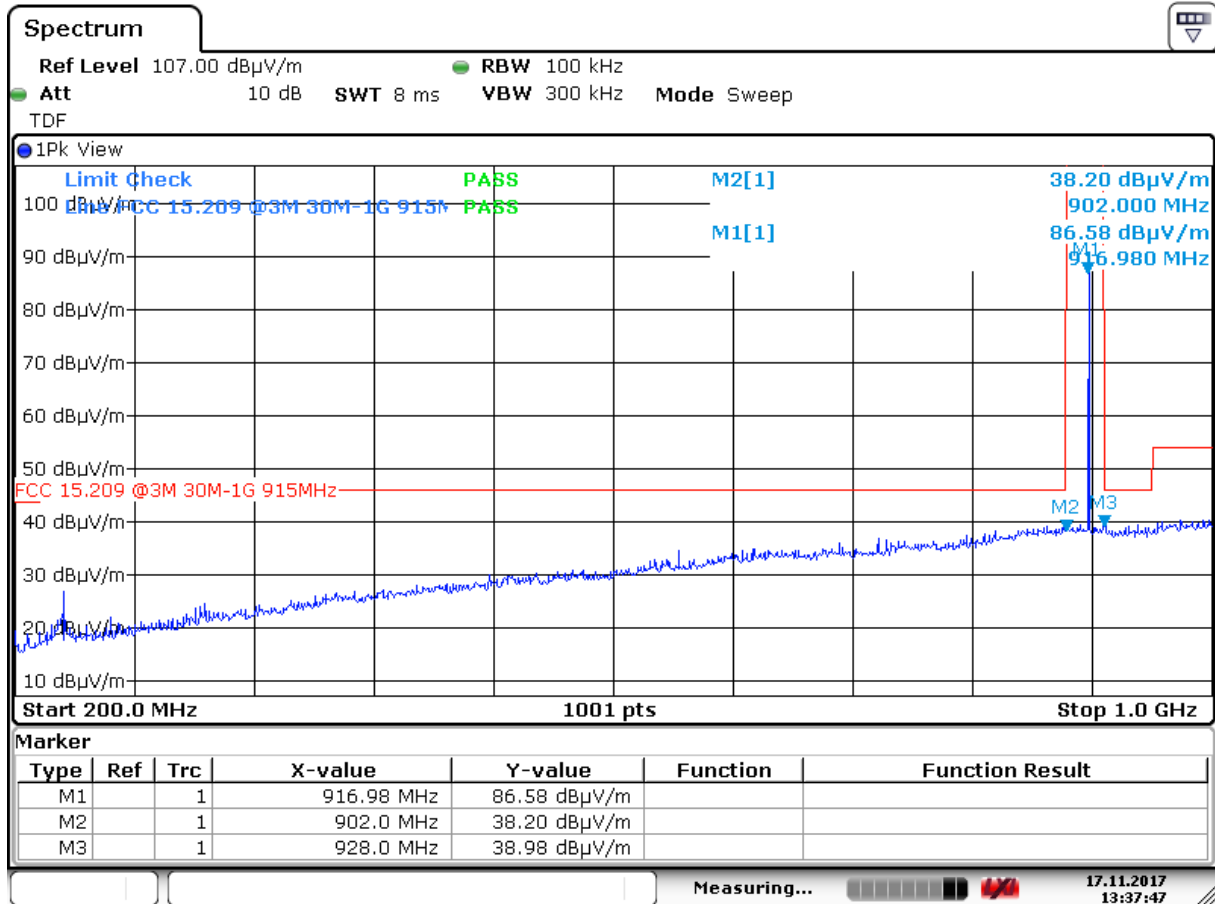
Date: 17.NOV.2017 15:32:18

Radiated Emissions, 915 MHz, 200 – 1000 MHz, VP, @3m, PK scan



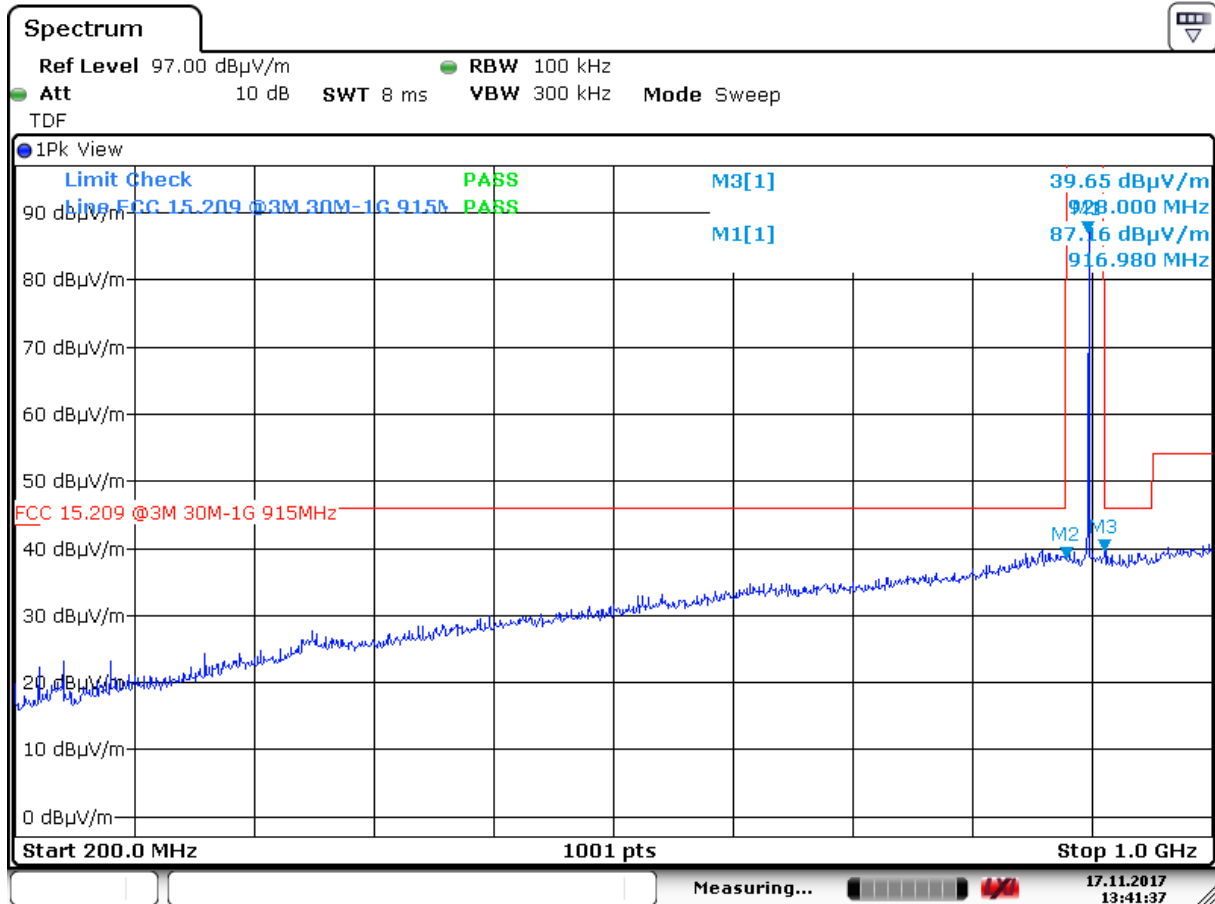
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Radiated Emissions, 915 MHz, 200 – 1000 MHz, HP, @3m, PK scan



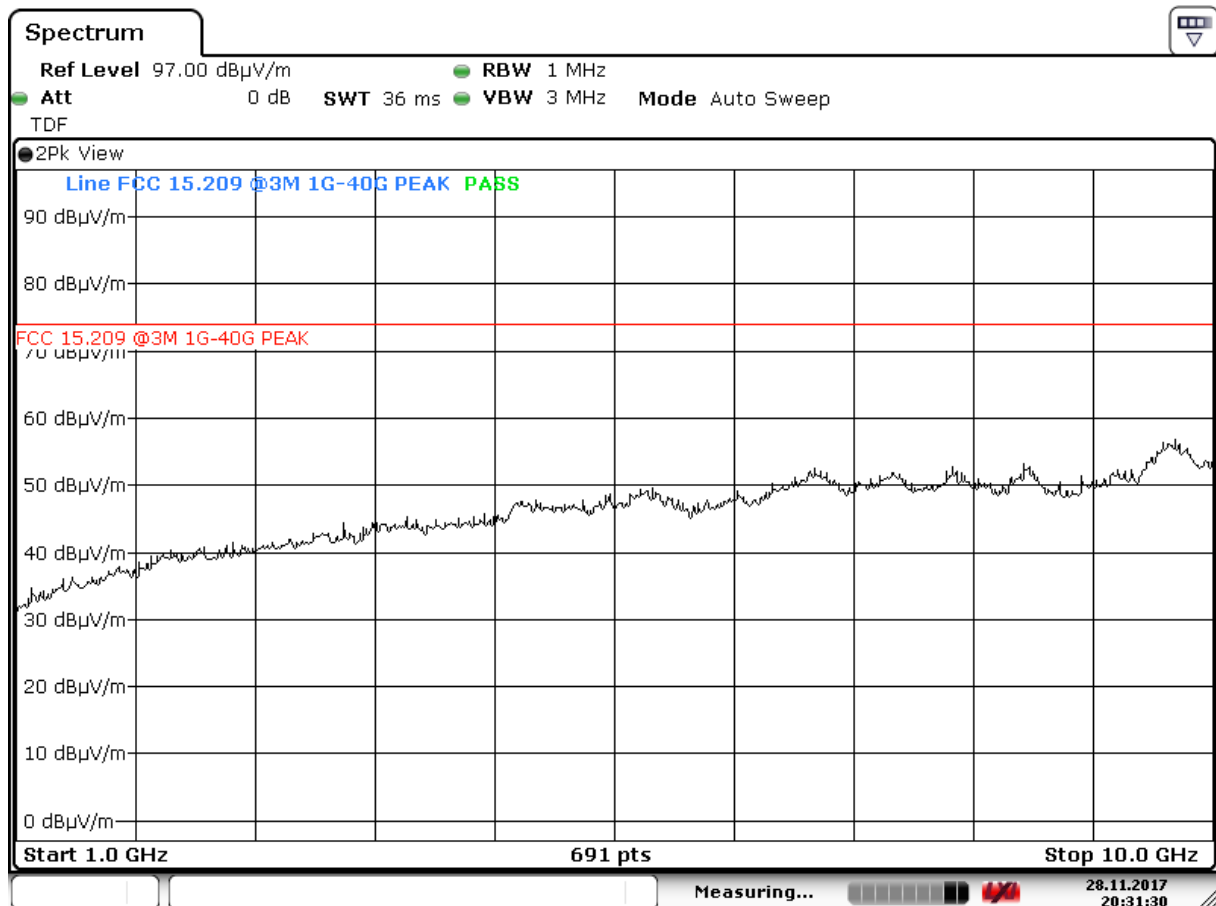
Date: 17.NOV.2017 13:37:47

Radiated Emissions, 917 MHz, 200 – 1000 MHz, HP, @3m, PK scan



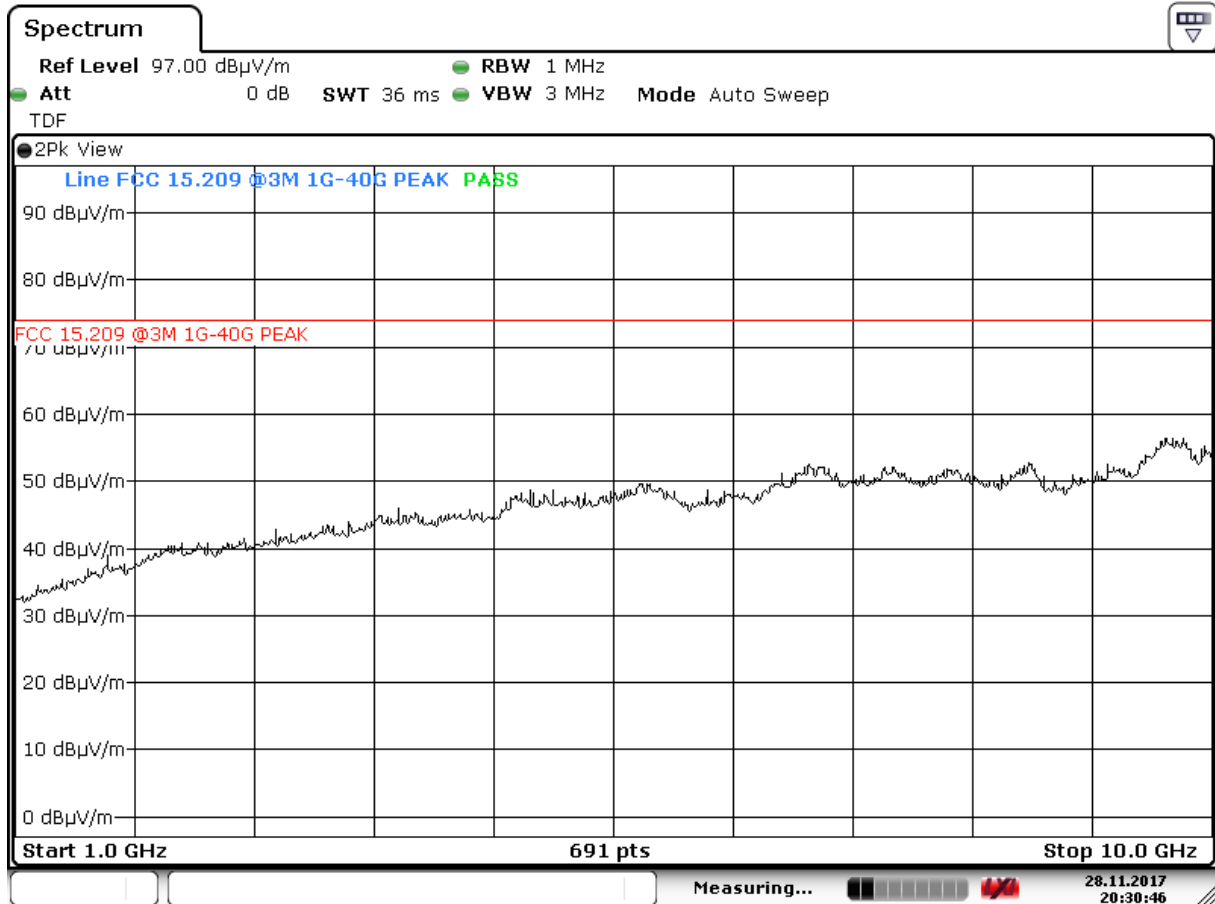
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Radiated Emissions, 917 MHz, 200 – 1000 MHz, VP, @3m, PK scan



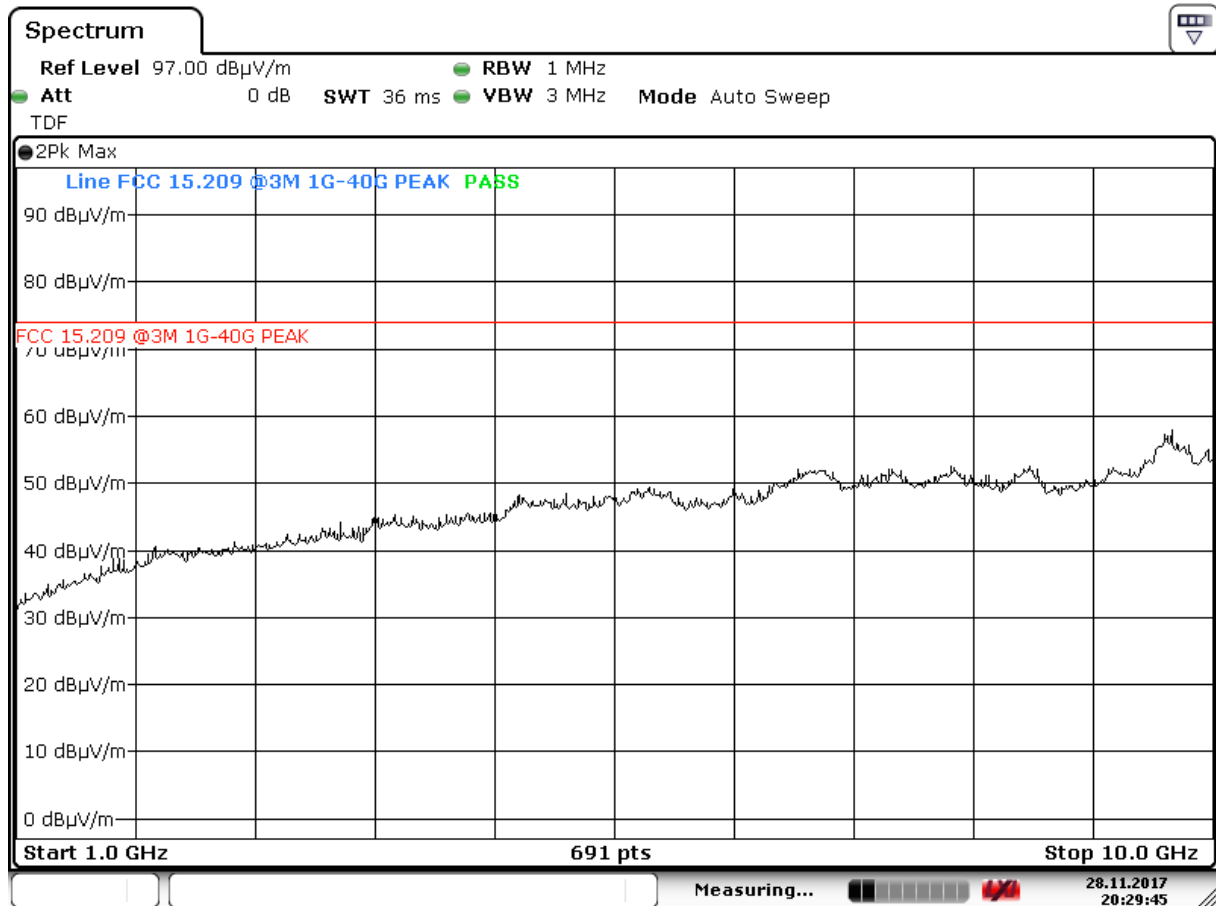
Date: 28.NOV.2017 20:31:31

Radiated Emissions, 914 MHz, 1 – 10 GHz, VP, @3m, PK scan



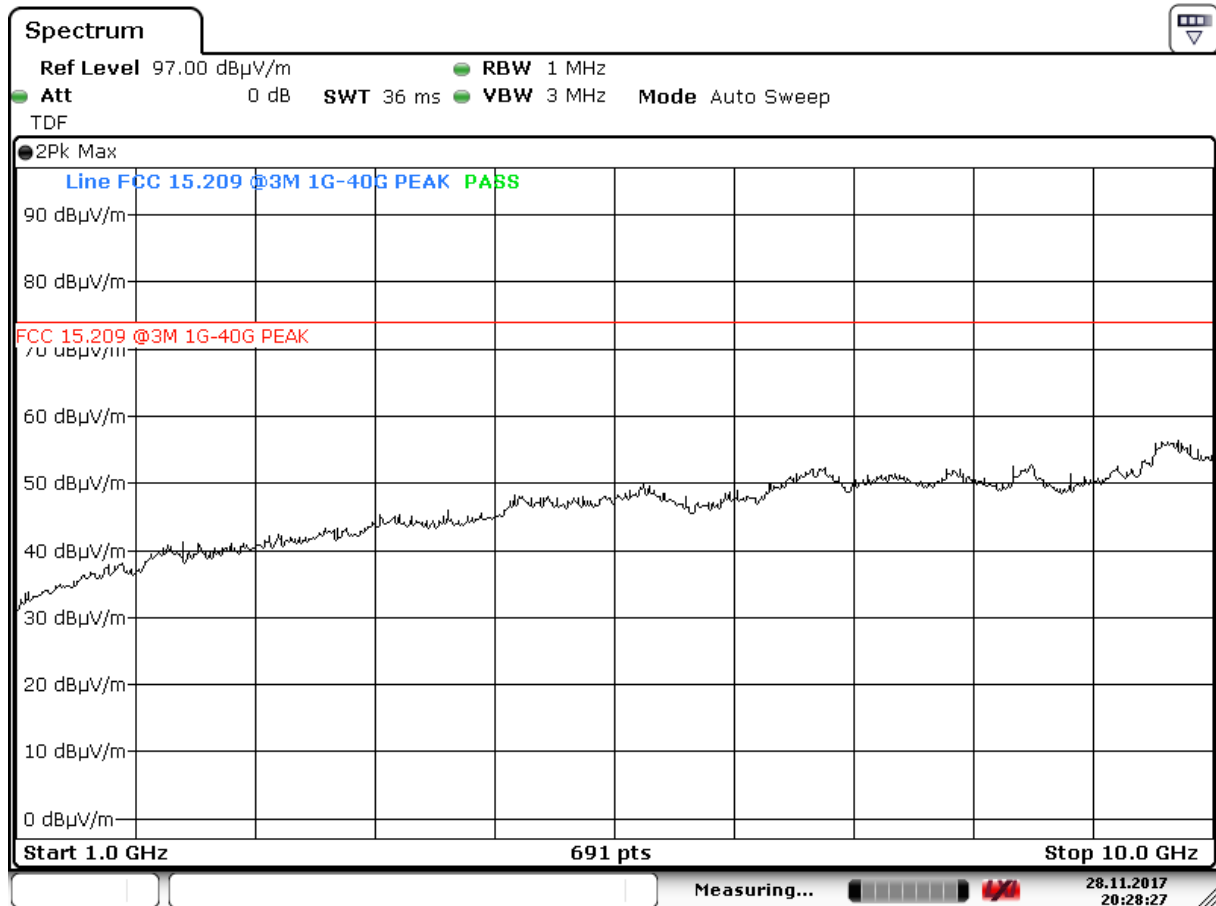
Date: 28.NOV.2017 20:30:46

Radiated Emissions, 914 MHz, 1 – 10 GHz, HP, @3m, PK scan



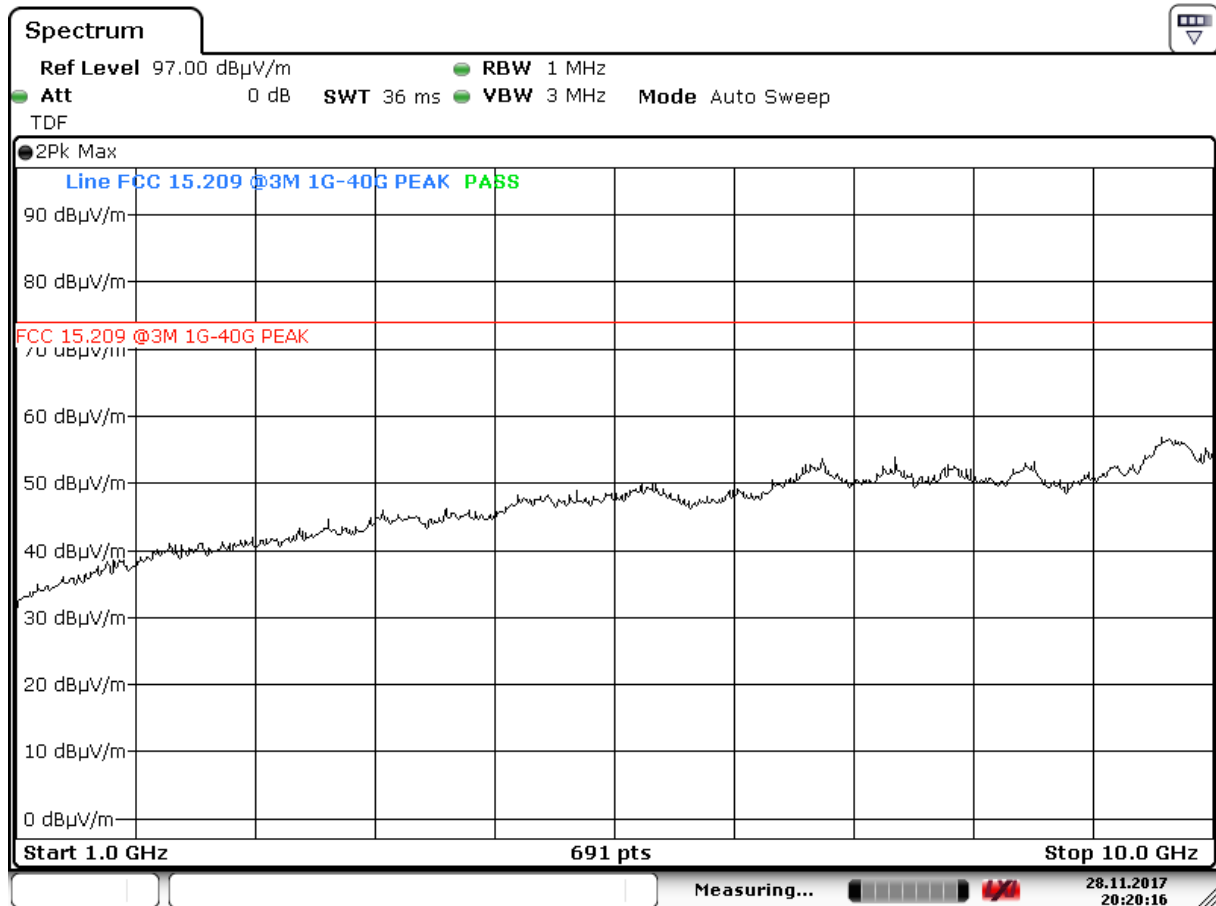
Date: 28.NOV.2017 20:29:46

Radiated Emissions, 915 MHz, 1 – 10 GHz, HP, @3m, PK scan



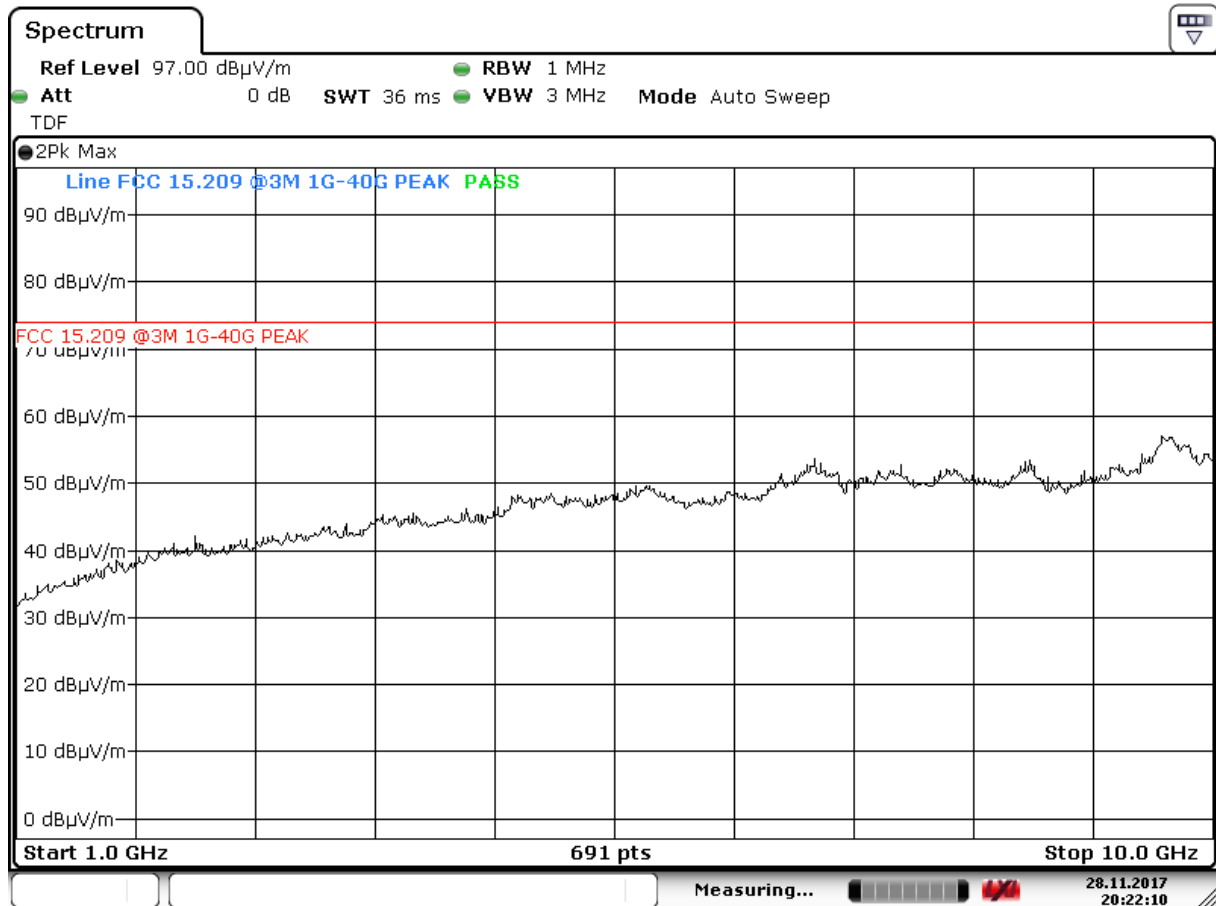
Date: 28.NOV.2017 20:28:27

Radiated Emissions, 915 MHz, 1 – 10 GHz, VP, @3m, PK scan



Date: 28.NOV.2017 20:20:16

Radiated Emissions, 917 MHz, 1 – 10 GHz, VP, @3m, PK scan



Date: 28.NOV.2017 20:22:11

Radiated Emissions, 917 MHz, 1 – 10 GHz, HP, @3m, PK scan

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

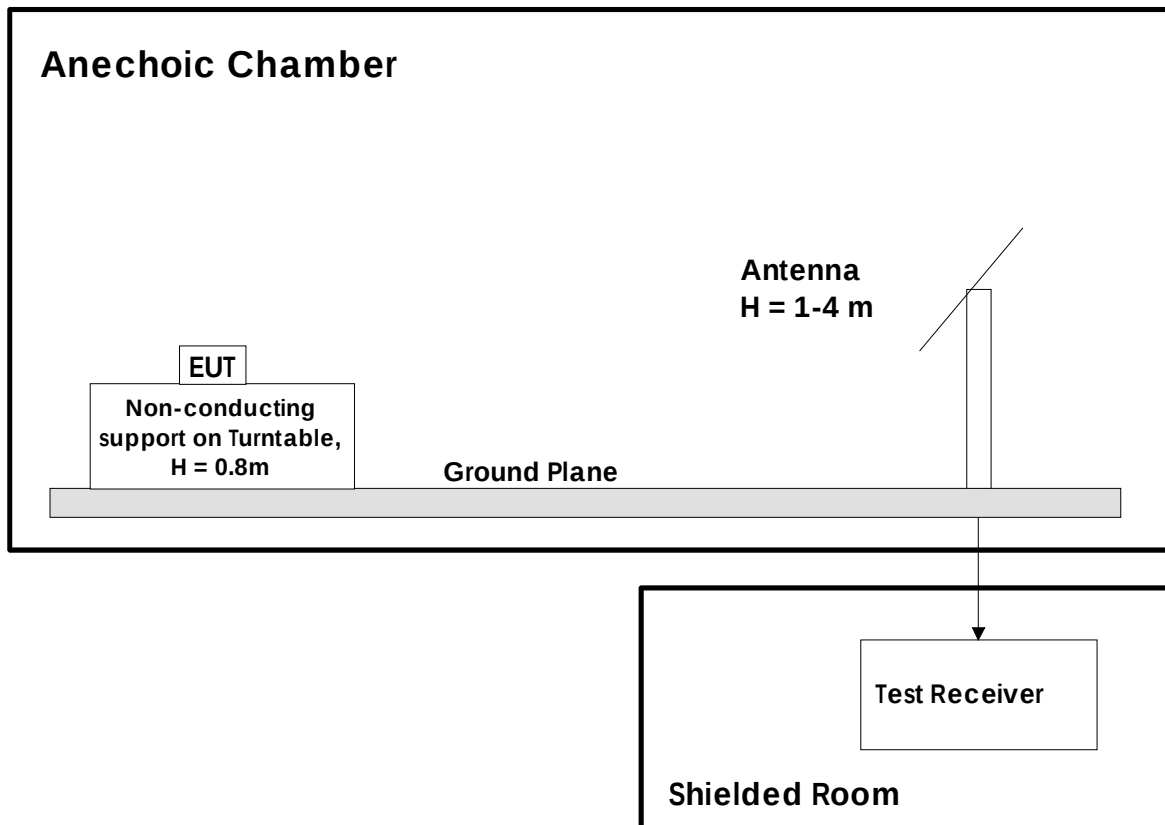
5 LIST OF TEST EQUIPMENT

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.

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
1-0770	Broadband Horn antenna	Schwarzbeck Mess-Elektronik	SHF-EHF Horn, 15-40GHz	2015-02	2018-02
1-0771	Broadband Horn antenna	Schwarzbeck Mess-Elektronik	SHF-EHF Horn, 15-40GHz	2015-02	2018-02
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

6 BLOCK DIAGRAM

6.1 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	2017.12.19	First version	mk
001	2018.02.08	OCC BW replaced	mk