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Report On

Radio Testing of the
Delphi Deutschland GmbH
J3TR Short Range Radar

Low-power Radio-frequency Devices
Technical Regulations LP0002 (2016)

Report No. SD72133292-1117B **January 2018**

TÜV SÜD America Inc., 10040 Mesa Rim Road, San Diego, CA 92121
Tel: (858) 678-1400. Website: www.TUVamerica.com

REPORT ON	Radio Testing of the Delphi Deutschland GmbH J3TR
TEST REPORT NUMBER	SD72133292-1117B
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DATED	January 29, 2018

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Revision History

SD72133292-1117B Delphi Deutschland GmbH J3TR Short Range Radar					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
01/29/18		Initial Release			Ferdinand S. Custodio

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Delphi Deutschland GmbH
J3TR Short Range Radar

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Delphi Deutschland GmbH J3TR Short Range Radar to the requirements of Low-power Radio-frequency Devices Technical Regulations LP0002.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Delphi Deutschland GmbH
Product Name	J3TR Short Range Radar
Model Number(s)	J3TR
Serial Number(s)	286606920
Number of Samples Tested	1
Test Specification/Issue/Date	Low-power Radio-frequency Devices Technical Regulations LP0002 (August 23, 2016).
Start of Test	December 20, 2017
Finish of Test	January 16, 2018
Name of Engineer(s)	Ivan Retana
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with Low-power Radio-frequency Devices Technical Regulations LP0002 is shown below.

Section	LP0002 Spec Clause	Test Description	Result	Comments/Base Standard
2.1	3.14.1.2	Radiated Emission Limits	Compliant	
2.2	3.14.1.3	Spurious Emissions	Compliant	
2.3	3.14.1.4	Frequency Stability	Compliant	

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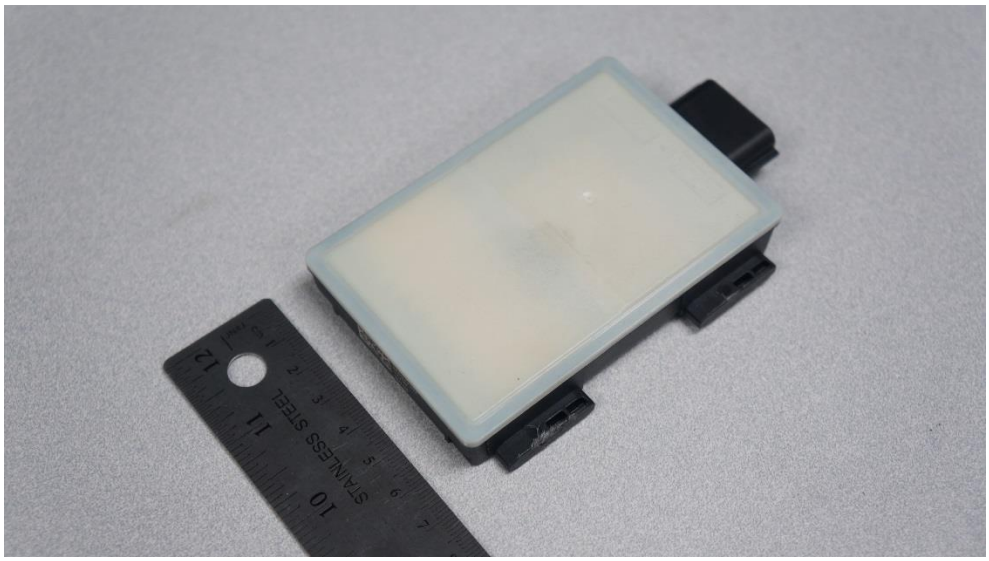
1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Delphi Deutschland GmbH J3TR Short Range Radar. The EUT is a Third-Generation Short Range Radar. The EUT operates in the 76-77 GHz band. The device employs a dynamic chirp modulated transmit array. Multiple receive antennas are used to determine target angular resolution through digital beam forming. The device is intended to be mounted at the front and rear corners of a vehicle. The EUT nominal operating voltage is 12.0 VDC or 24.0 VDC.



Equipment Under Test

1.3.2 EUT General Description

EUT Description	Third-Generation Short Range Radar
Product Name	J3TR Short Range Radar
Model Number(s)	J3TR
Rated Voltage	12.0 VDC or 24.0 VDC
Output Power	23.29 dBm Peak EIRP
Frequency Range	76.003900 GHz to 76.981600 GHz in the 76.0 GHz to 77.0 GHz band.
Channels Verified	Low, Mid and High
Antenna Type (used during evaluation)	Integral

1.3.3 Antenna Details

Manufacturer	Delphi Deutschland GmbH
Antenna Type	Planar array antenna
Antenna Gain	14 dBi
EUT Antenna Connector	N/A.
Maximum Dimensions	96.5 mm x 73.9 mm x 23.0 mm

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configurations	Description
Default	Radiated configuration. EUT transmitting continuously through the integral antenna.

1.4.2 EUT Exercise Software

Before each test, the EUT is configured using CalFlasher tool version 2.00. The tool allows configuration of operating channel and modulation bandwidth.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Dell	Support Laptop	Latitude D630 (Delphi Wireless Test configuration Support Laptop)
Dell	PA-10 AC Adapter	M/N: LA90PS1-00
Vector	Single channel CAN HW	Used for communication between EUT and Support Laptop
	Harness with pins for power supply and CAN connector.	Connects the EUT to a 12 VDC power supply and to the CAN HW

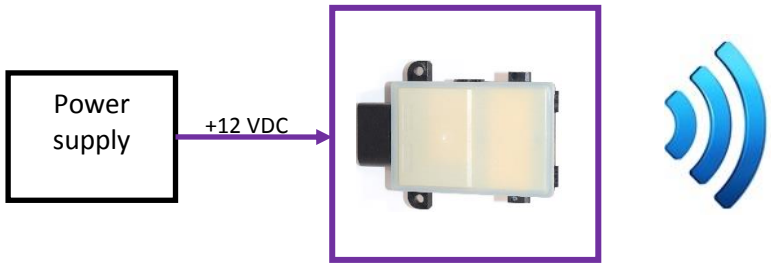
1.4.4 Worst Case Configuration

Worst-case configuration used in this test report based from Peak Power Density measurement:

Channel	Modulation BW
Low	175 MHz
Mid	300 MHz
HIgh	175 MHz

EUT is mobile device designed to be installed on a vehicular environment, for radiated spurious measurement only default configuration was evaluated (See test setup picture exhibit).

1.4.5 Simplified Test Configuration Diagram



EUT transmitting at 76-77 GHz
from integral antenna

For Illustration Purpose Only
Image presented may not represent the actual EUT or support equipment

1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number: N/A		
N/A	-	-

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.10-2013. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 Fax: 858 546 0364.

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

16936 Via Del Campo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 678-1436/65/67 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.948 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Designation is US1146.

1.9.2 Innovation, Science and Economic Development Canada (IC) Registration No.: 3067A-1 & 22806-1

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Rancho Bernardo) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 3067A-1.

The 3m Semi-anechoic chamber of TUV SUD America Inc. (San Diego Mira Mesa) has been registered by Certification and Engineering Bureau of Innovation, Science and Economic Development Canada for radio equipment testing with Registration No. 22806-1.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 NCC (National Communications Commission - US0102)

TUV SUD America Inc. (San Diego) is listed as a Foreign Recognized Telecommunication Equipment Testing Laboratory and is accredited to ISO/IEC 17025 (A2LA Certificate No.2955.13) which under APEC TEL MRA Phase 1 was designated as a Conformity Assessment Body competent to perform testing of equipment subject to the Technical Regulations covered under its scope of accreditation including RTTE01, PLMN01 and PLMN08 for TTE type of testing and LP002 for Low-Power RF Device type of testing.

1.9.5 VCCI – Registration No. A-0230

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

SECTION 2

TEST DETAILS

Radio Testing of the
Delphi Deutschland GmbH
J3TR Short Range Radar

2.1 POWER DENSITY

2.1.1 Specification Reference

LP0002 Clause 3.14.1.2

2.1.2 Standard Applicable

Emission limits:

Any emission measured at 3 meters from the transmitter surface, power density should be less than or equal to 88 microwatts/cm2 (average EIRP of 50 dBm); the peak power density should be less than or equal to 279 microwatts/cm2 (peak EIRP of 55 dBm).

2.1.3 Equipment Under Test and Modification State

Serial No: 286606920 / Default Test Configuration

2.1.4 Date of Test/Initial of test personnel who performed the test

December 20, 2017 and January 16, 2018/IR

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	25.7°C
Relative Humidity	39.8%
ATM Pressure	100.2 kPa

2.1.7 Additional Observations

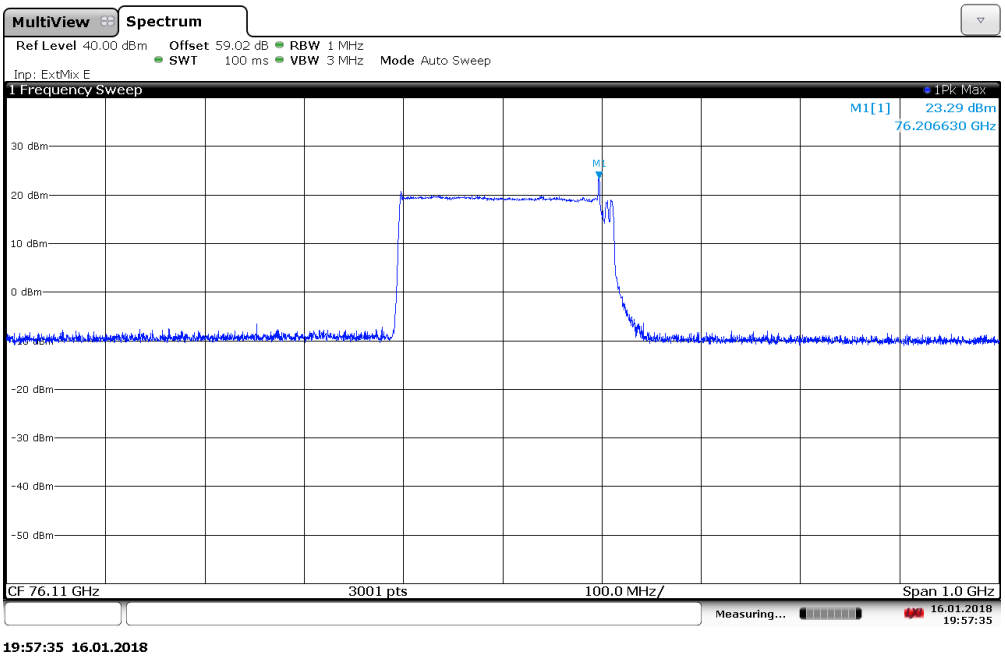
- This is a radiated test.
- Test distance of 3 m was used for the fundamental emissions measurement.
- A correction factor of 59.02-59.09 dB dB and mixer conversion loss table were used to account for the test antenna gain, free-space loss and external mixer loss.
- Sample correction factor calculation @ 76.5 GHz:

Correction Factor (dB)	Asset# 9005 (antenna)	-22.6	59.06
	External 2 dB attenuator	2.0	
	Free space loss	79.66	

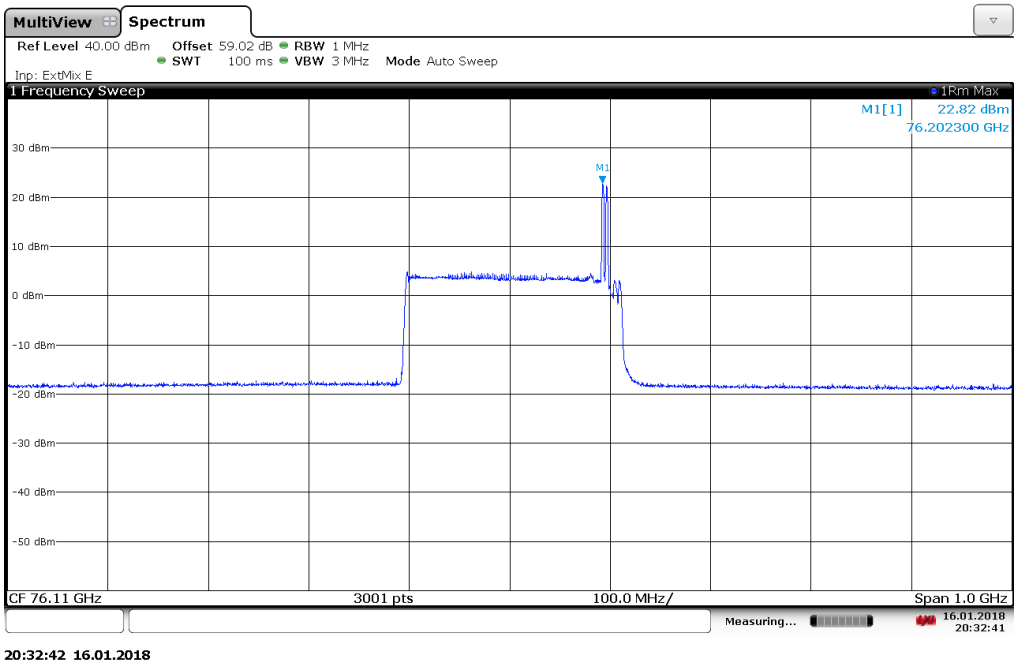
2.1.8 Test Results

Peak EIRP			
Modulation BW	**Channel**	**Measured EIRP (dBm)**	**Limit (dBm)**
175 MHz	Low (76.005 GHz)	23.29	55
	Mid (76.413GHz)	21.73	
	High (76.760 GHz)	22.52	
300 MHz	Low (76.005 GHz)	22.32	
	Mid (76.350 GHz)	21.91	
	High (76.575 GHz)	21.40	
425 MHz	Low (76.005 GHz)	21.96	
	Mid (76.288 GHz)	21.55	
	High (76.405 GHz)	22.12	
Average EIRP			
Modulation BW	**Channel**	**Measured EIRP (dBm)**	**Limit (dBm)**
175 MHz	Low (76.005 GHz)	22.82	50
	Mid (76.413GHz)	21.31	
	High (76.760 GHz)	20.86	
300 MHz	Low (76.005 GHz)	21.69	
	Mid (76.350 GHz)	21.65	
	High (76.575 GHz)	20.95	
425 MHz	Low (76.005 GHz)	21.45	
	Mid (76.288 GHz)	21.02	
	High (76.405 GHz)	20.85	
EUT complies			

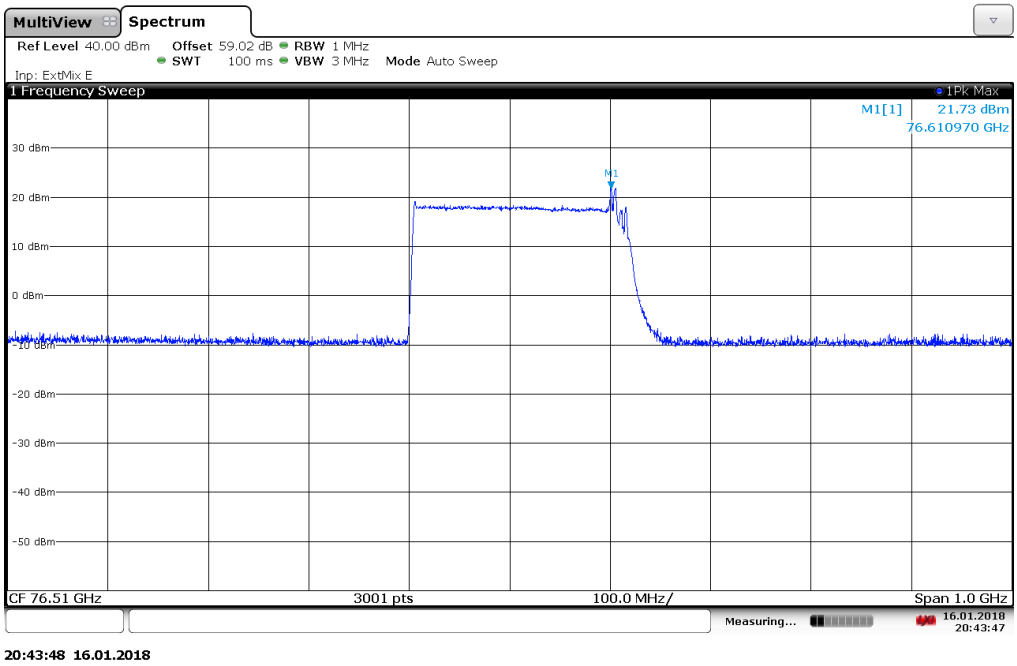
2.1.9 Test plots



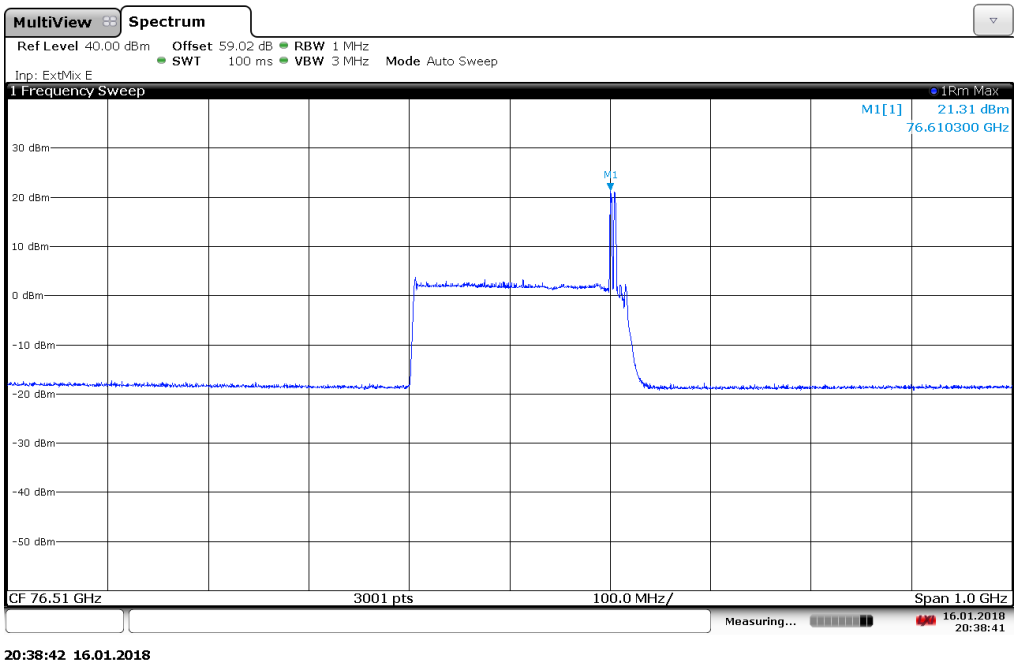
Low Channel 175 MHz BW (Peak detector)



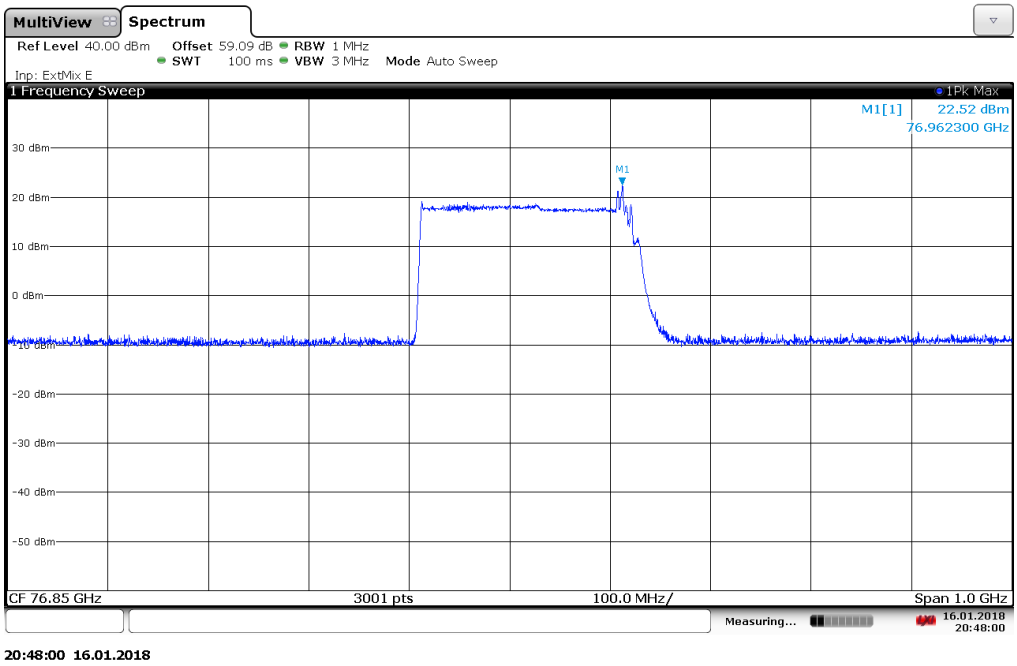
Low Channel 175 MHz BW (RMS detector)



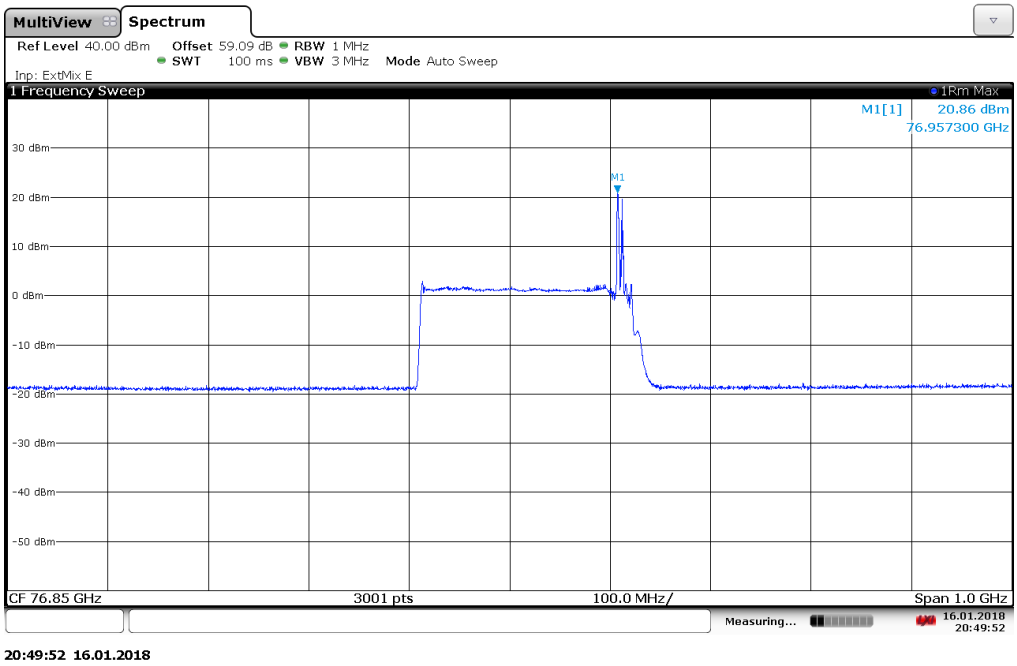
Mid Channel 175 MHz BW (Peak detector)



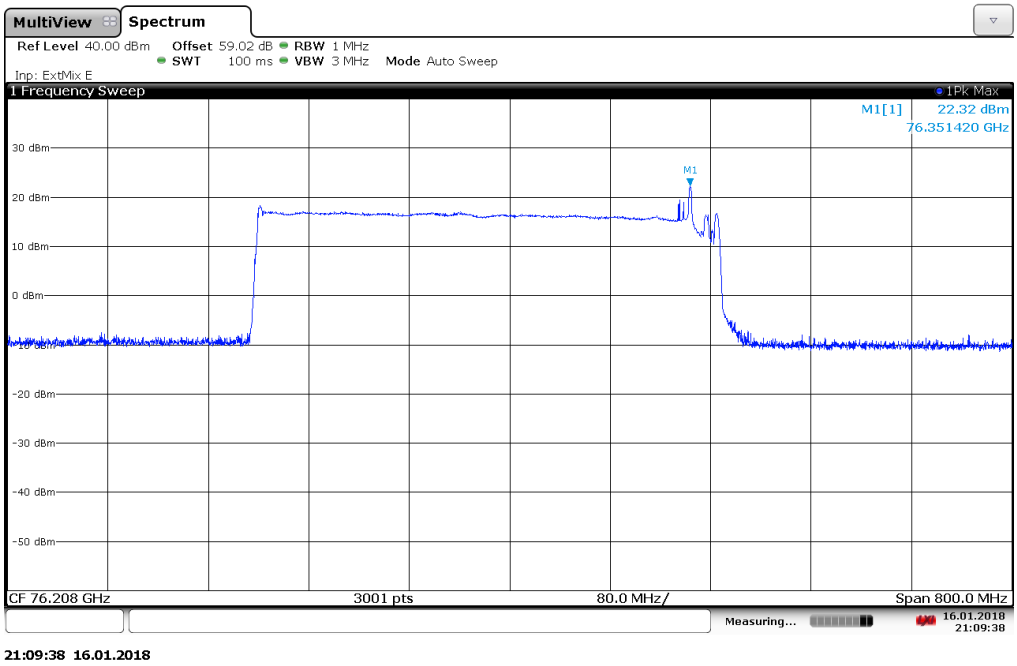
Mid Channel 175 MHz BW (RMS detector)



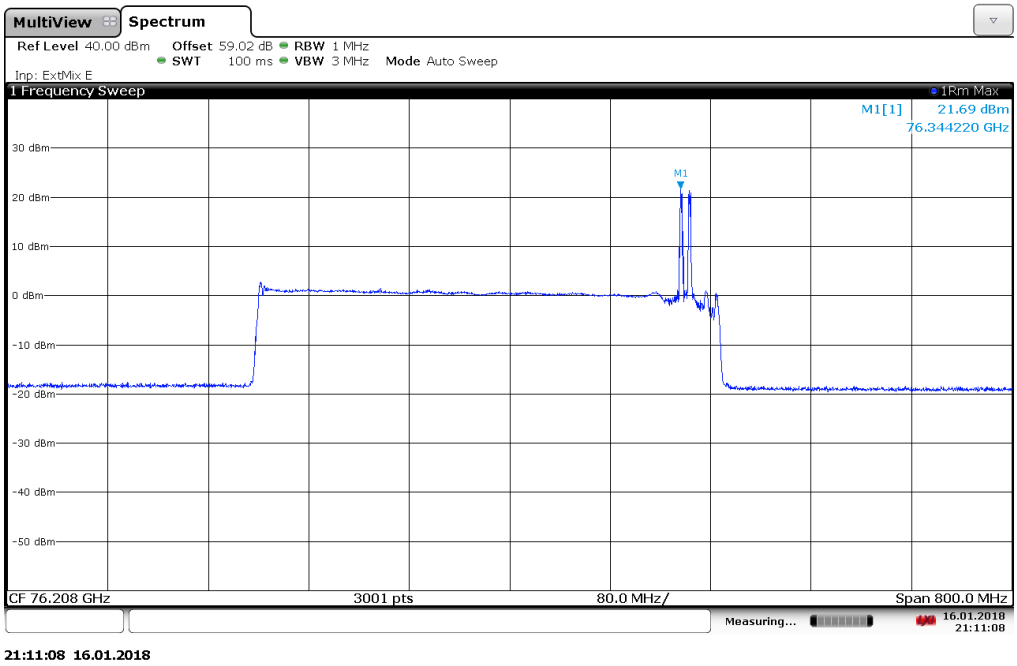
High Channel 175 MHz BW (Peak detector)



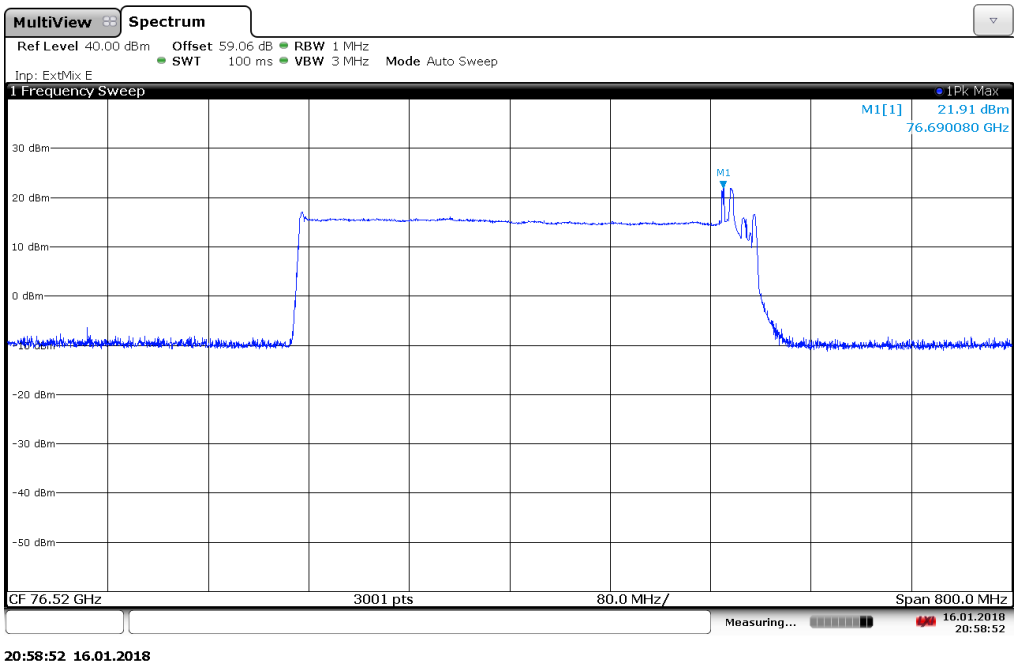
High Channel 175 MHz BW (RMS detector)



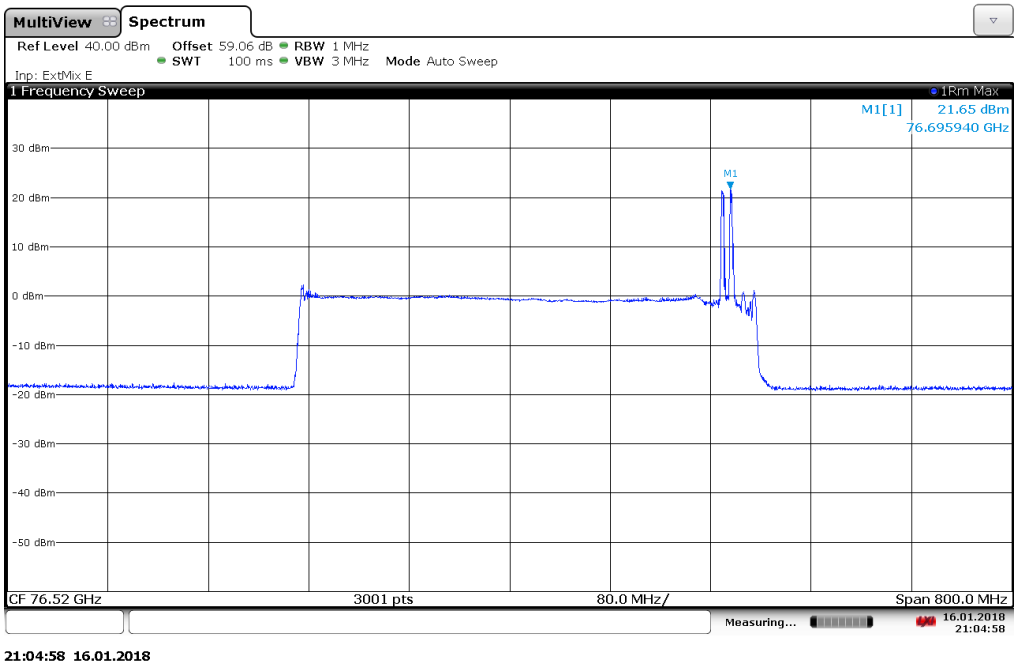
Low Channel 300 MHz BW (Peak detector)



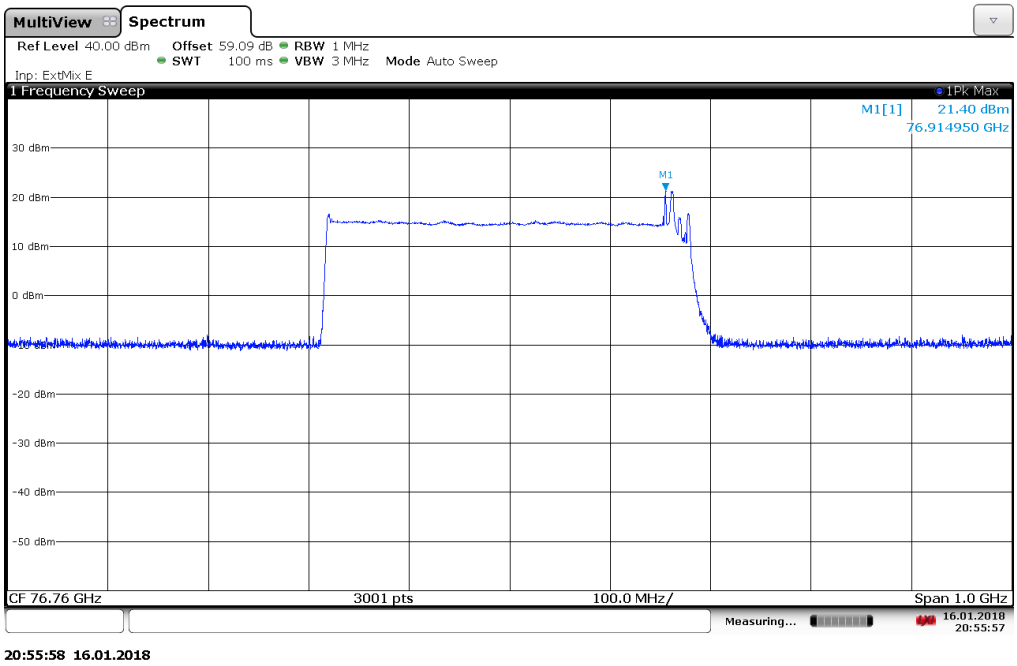
Low Channel 300 MHz BW (RMS detector)



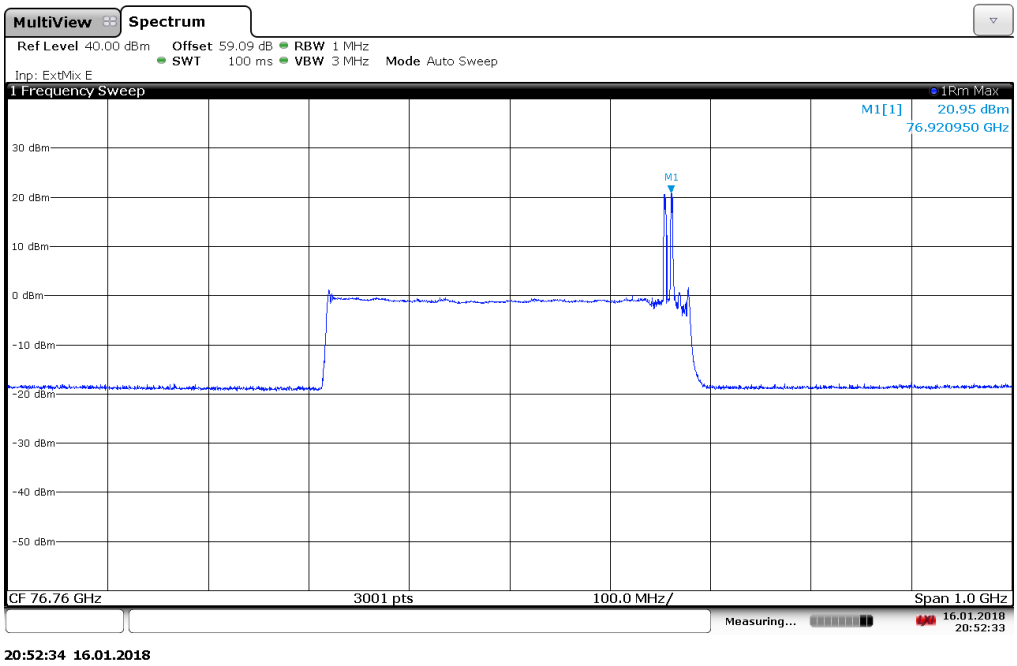
Mid Channel 300 MHz BW (Peak detector)



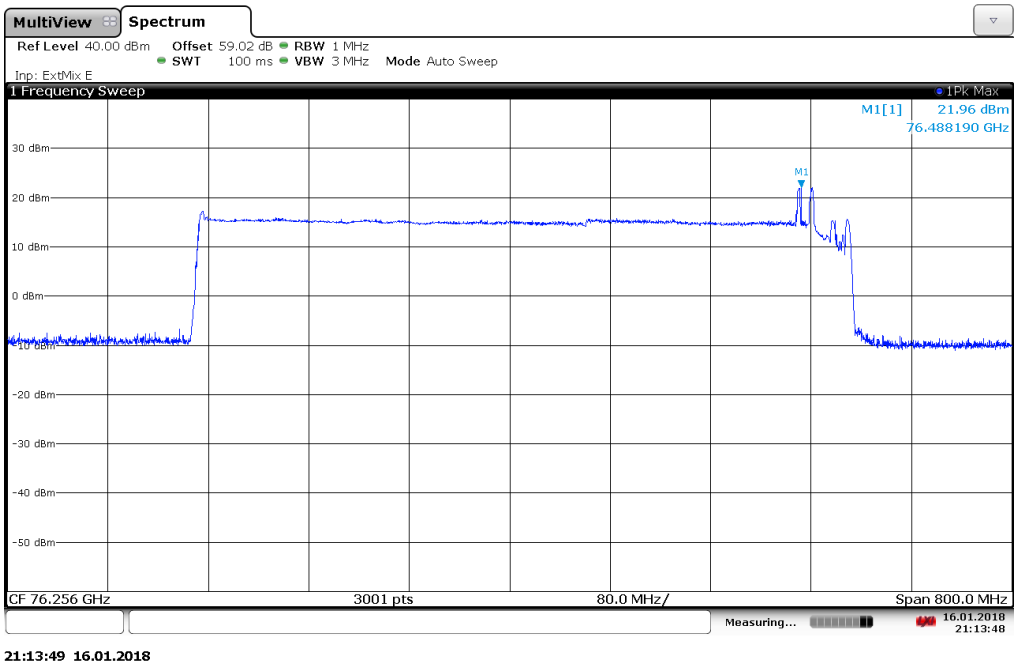
Mid Channel 300 MHz BW (RMS detector)



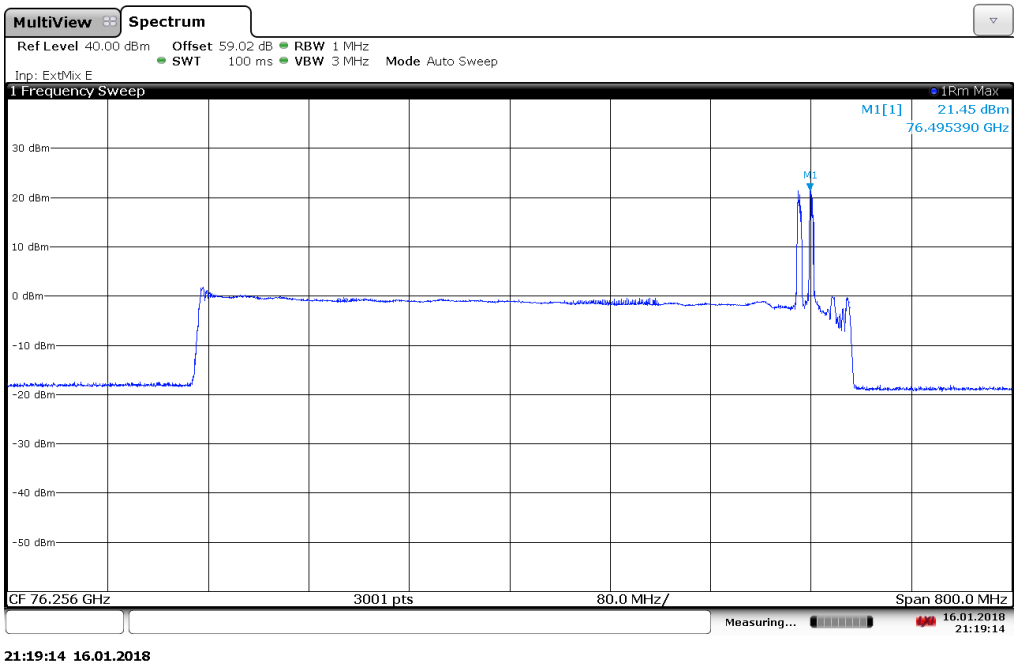
High Channel 300 MHz BW (Peak detector)



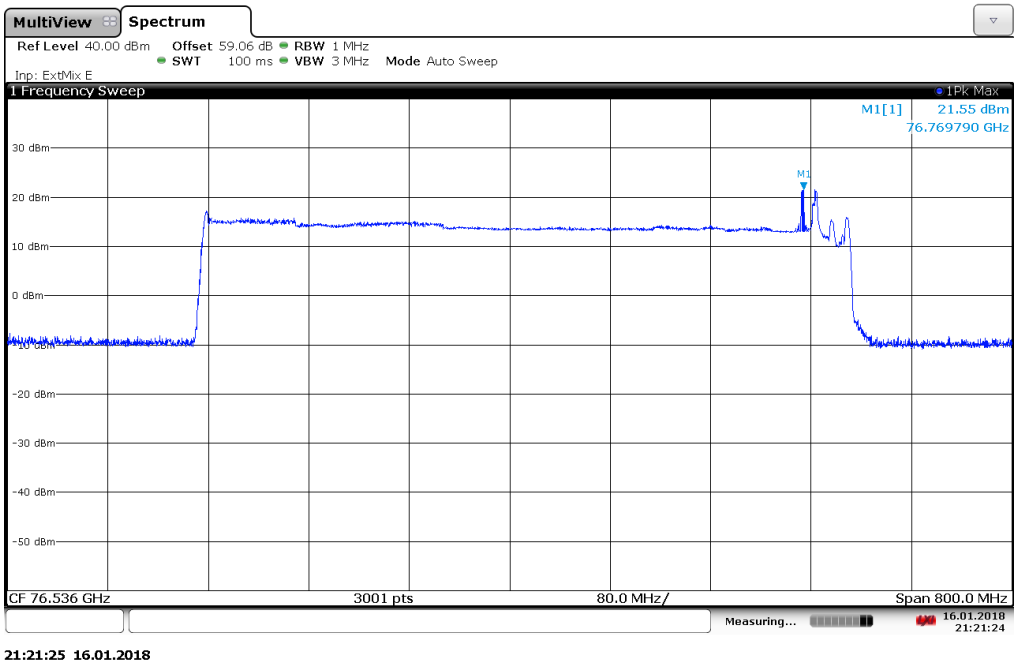
High Channel 300 MHz BW (RMS detector)



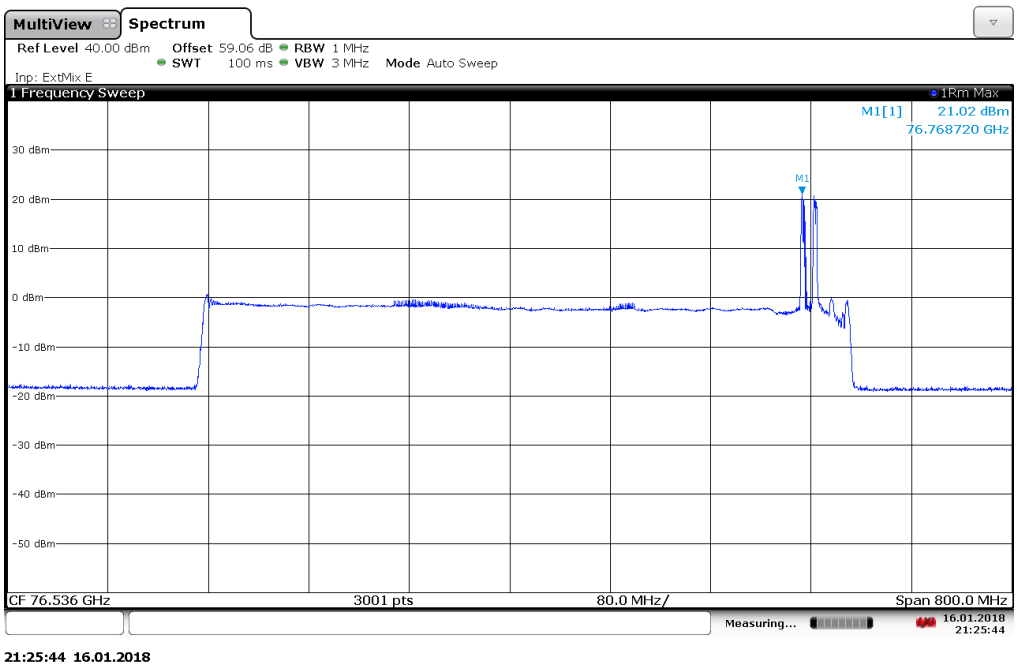
Low Channel 425 MHz BW (Peak detector)



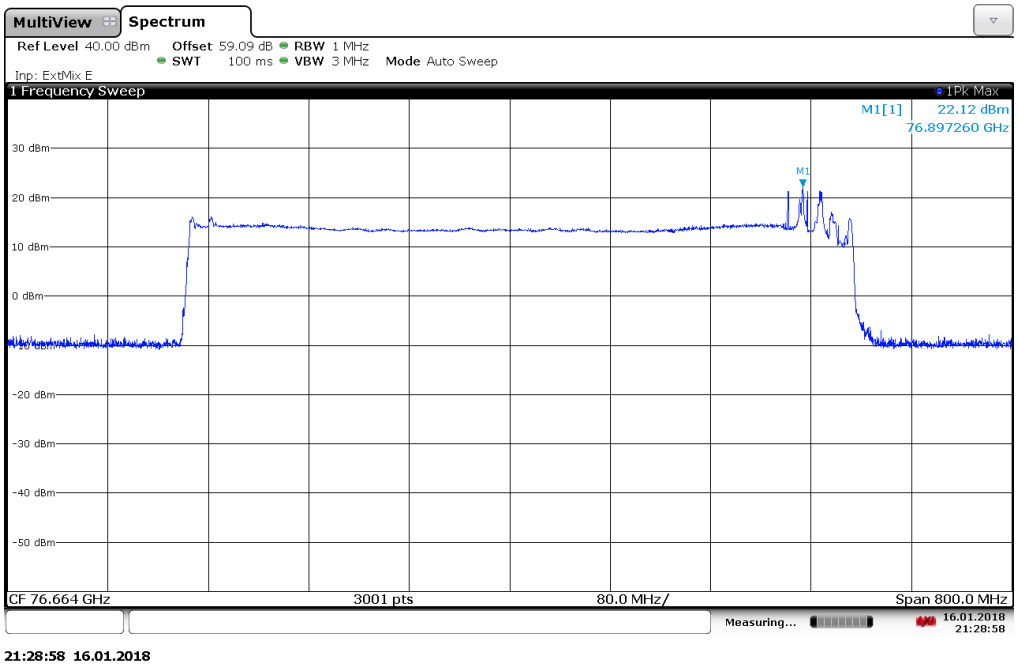
Low Channel 425 MHz BW (RMS detector)



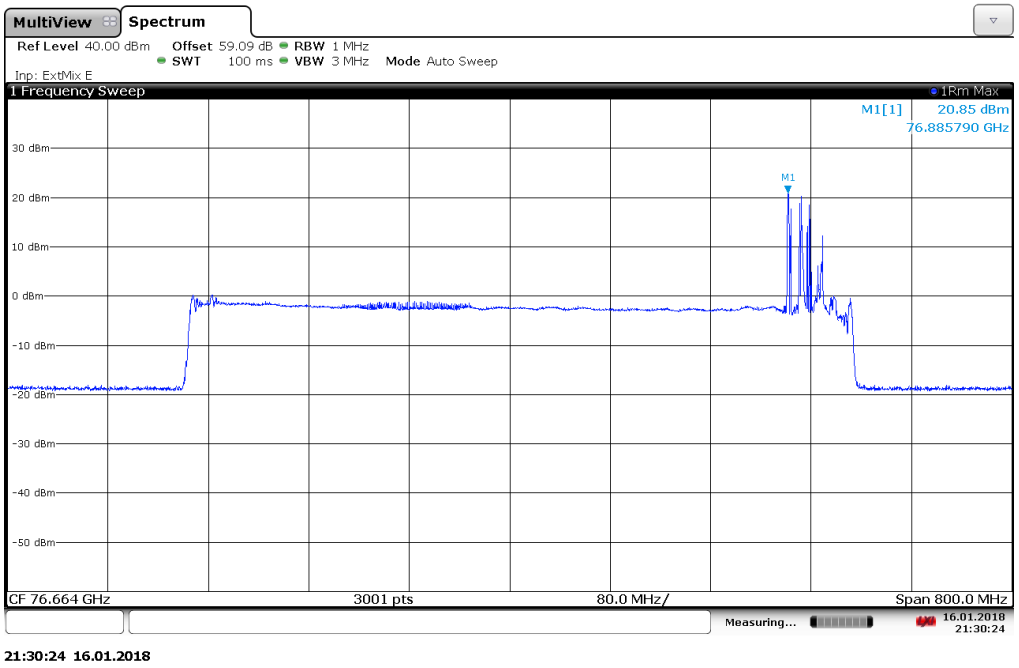
Mid Channel 425 MHz BW (Peak detector)



Mid Channel 425 MHz BW (RMS detector)



High Channel 425 MHz BW (Peak detector)



High Channel 425 MHz BW (RMS detector)

2.2 SPURIOUS RADIATED EMISSIONS

2.2.1 Specification Reference

LP0002 Clause 3.14.1.3

2.2.2 Standard Applicable

The power density of any emissions outside the operating band shall consist solely of spurious emissions and shall not exceed the following:

(1) Any emissions below 40 GHz shall comply with the requirements of 2.8.

(2) Any emissions between 40 GHz and 200 GHz, measured at 3 meters from the transmitter surface, shall be less than or equal to 600 pW/cm^2.

(3) Emission above 200 GHz, measured at 3 meters from the transmitter surface, the power density of any emission should be less than or equal to 1000 pW/cm^2.

(4) The measurement frequency of the spectrum shall be 231 GHz.

2.2.3 Equipment Under Test and Modification State

Serial No: 286606920 / Default Test Configuration

2.2.4 Date of Test/Initial of test personnel who performed the test

December 21 – December 28, 2017 /IR

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	22.0-23.6°C
Relative Humidity	28.7-39.0%
ATM Pressure	100.5-100.8 kPa

2.2.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30 MHz to 300 GHz. There are no significant spurious emissions observed.
- Test distance of 3 m was used for the spurious emissions measurement below 60 GHz. The emissions in the range from 60 GHz to 160 GHz were evaluated at 1.0 m distance. For the measurements in the ranges from 160 GHz to 220 GHz and 220 GHz to 300 GHz, the test distance was respectively reduced to 0.5 m and 0.2 m assuring that the noise floor is at least 10 dB below the applicable limit.
- Correction factors of 9.54 dB, 15.56 dB and 23.52 dB were used to extrapolate the field strengths measured at 1.0 metres, 0.5 meters and 0.2 meters to the 3 meters distance.

- All the emissions below 40 GHz comply with the general radiated emission limits of Section 2.8.
- Measurement below 40 GHz was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.2.8 for sample computation.

2.2.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

2.2.9 Test Results

Compliant, see attached plots.

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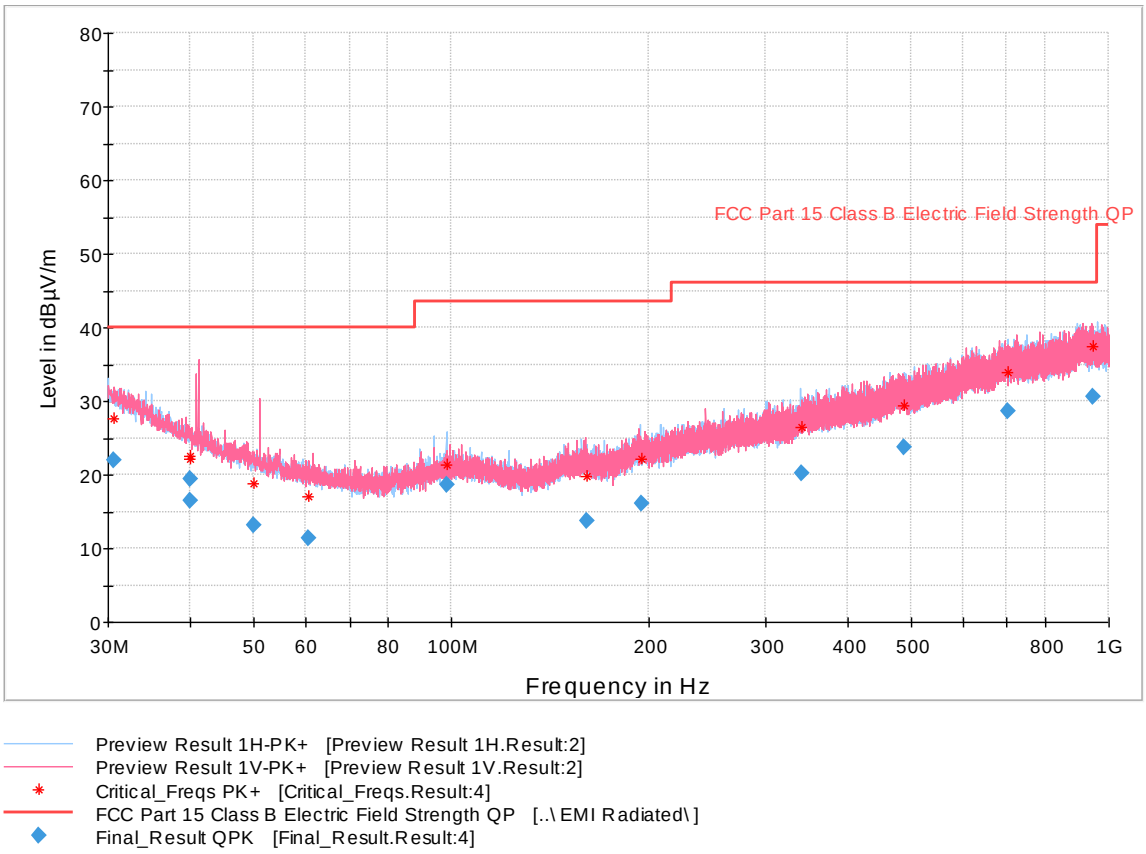
2.2.10 Test Results Below 1GHz Low Channel 175 MHz BW (worst case configuration)

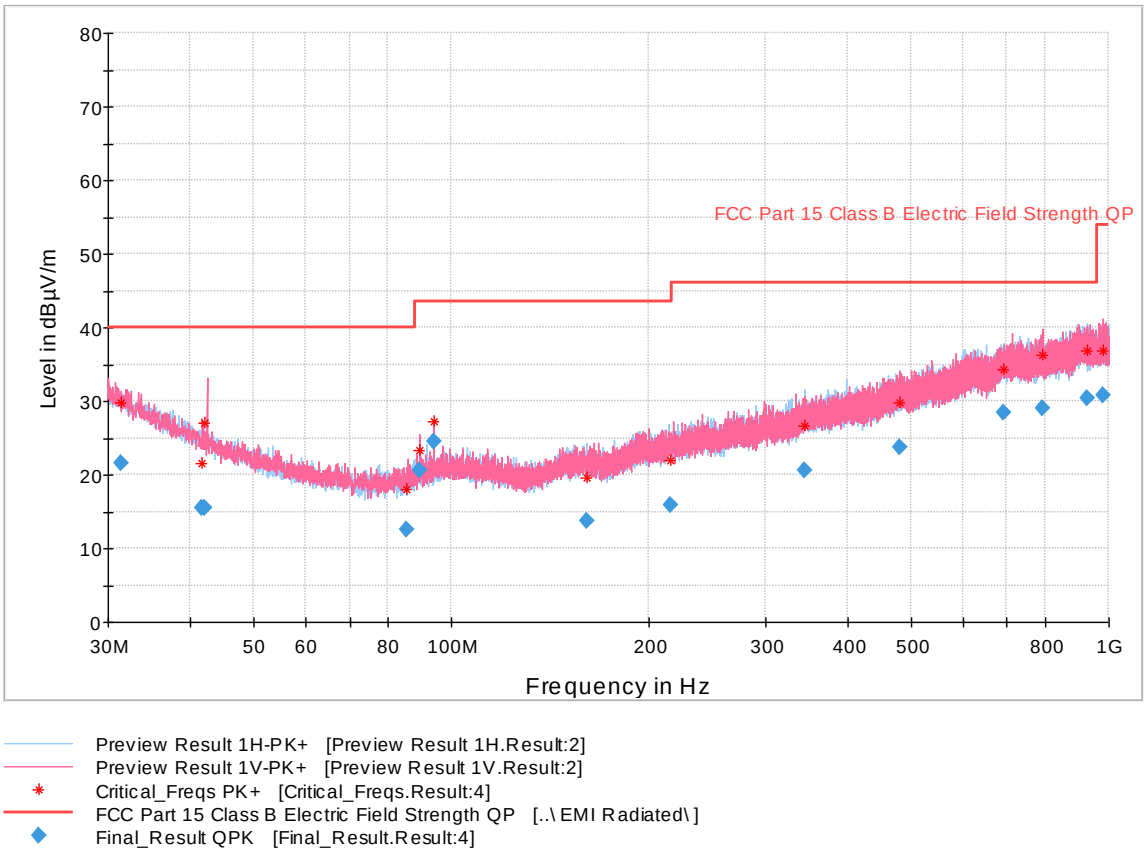


**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.680000	21.99	40.00	18.01	1000.0	120.000	225.2	H	328.0	24.3
39.991667	19.44	40.00	20.56	1000.0	120.000	178.8	V	120.0	19.1
39.995000	16.45	40.00	23.55	1000.0	120.000	325.2	V	166.0	19.1
49.856667	13.14	40.00	26.86	1000.0	120.000	325.2	V	188.0	15.8
60.597333	11.32	40.00	28.68	1000.0	120.000	104.0	V	90.0	13.9
98.126333	18.58	43.50	24.92	1000.0	120.000	410.2	H	280.0	15.2
160.563000	13.81	43.50	29.69	1000.0	120.000	99.9	V	261.0	16.1
194.914667	16.08	43.50	27.42	1000.0	120.000	374.7	H	92.0	17.7
340.094667	20.20	46.00	25.80	1000.0	120.000	294.1	H	35.0	22.4
487.645000	23.72	46.00	22.28	1000.0	120.000	99.8	H	271.0	25.7
700.630667	28.65	46.00	17.35	1000.0	120.000	325.2	H	259.0	29.4
944.146000	30.68	46.00	15.32	1000.0	120.000	325.2	V	14.0	31.6

2.2.11 Test Results Below 1GHz Mid Channel 300 MHz BW (worst case configuration)

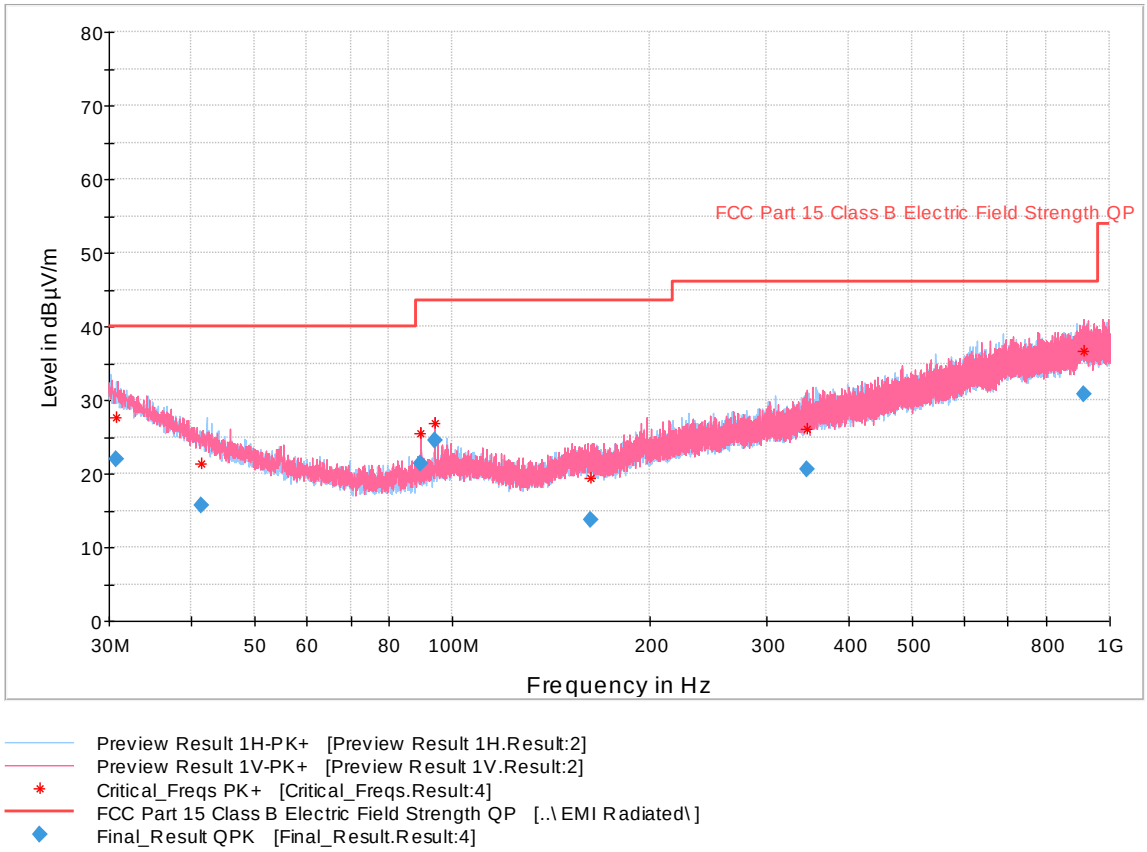


**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.440000	21.55	40.00	18.45	1000.0	120.000	118.2	V	-16.0	23.8
41.702667	15.52	40.00	24.48	1000.0	120.000	325.3	V	356.0	18.4
42.096000	15.43	40.00	24.57	1000.0	120.000	225.3	V	56.0	18.2
85.455000	12.55	40.00	27.45	1000.0	120.000	125.2	V	352.0	13.6
89.493333	20.64	43.50	22.86	1000.0	120.000	121.8	V	23.0	14.1
94.109333	24.43	43.50	19.07	1000.0	120.000	125.1	V	191.0	14.9
160.335667	13.77	43.50	29.73	1000.0	120.000	103.6	H	187.0	16.1
215.255667	15.90	43.50	27.60	1000.0	120.000	225.2	H	39.0	18.4
343.864667	20.63	46.00	25.37	1000.0	120.000	99.7	H	-4.0	22.9
480.967667	23.72	46.00	22.28	1000.0	120.000	174.7	V	38.0	25.8
691.071000	28.51	46.00	17.49	1000.0	120.000	174.4	H	54.0	29.3
791.282333	28.98	46.00	17.02	1000.0	120.000	218.3	V	162.0	29.9
927.705333	30.43	46.00	15.57	1000.0	120.000	225.2	H	31.0	31.4
982.352000	30.87	53.90	23.03	1000.0	120.000	378.7	V	22.0	31.6

2.2.12 Test Results Below 1GHz High Channel 175 MHz BW (worst case configuration)

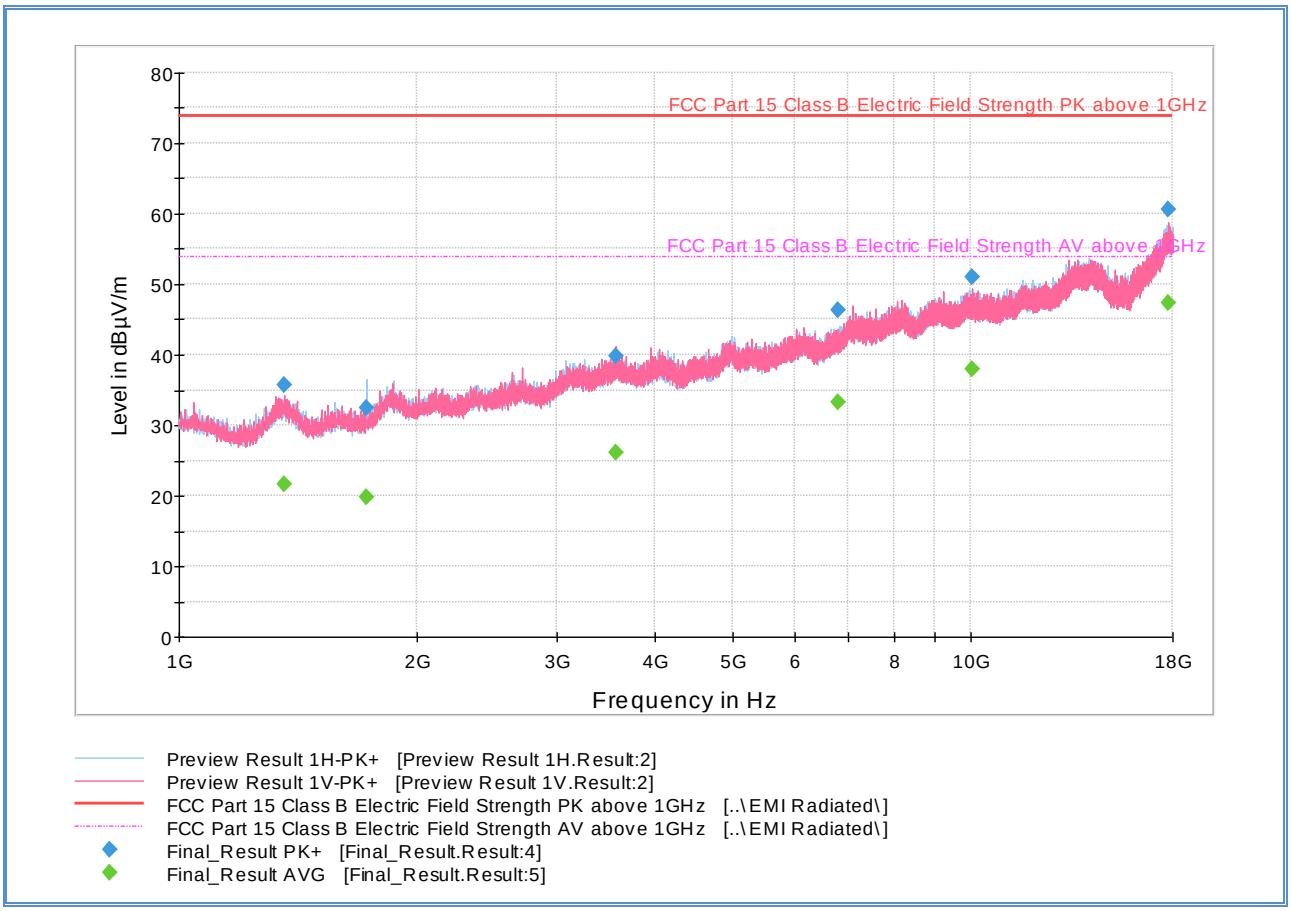


**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.760000	21.93	40.00	18.07	1000.0	120.000	125.2	H	322.0	24.2
41.421000	15.72	40.00	24.28	1000.0	120.000	105.1	H	203.0	18.5
89.493333	21.44	43.50	22.06	1000.0	120.000	110.5	V	140.0	14.1
94.092333	24.47	43.50	19.03	1000.0	120.000	109.4	V	210.0	14.9
162.130000	13.69	43.50	29.81	1000.0	120.000	274.5	V	48.0	16.0
346.156333	20.62	46.00	25.38	1000.0	120.000	379.2	V	54.0	22.9
911.853333	30.78	46.00	15.22	1000.0	120.000	410.2	V	22.0	31.9

2.2.13 Test Results 1 GHz to 18 GHz Low Channel 175 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

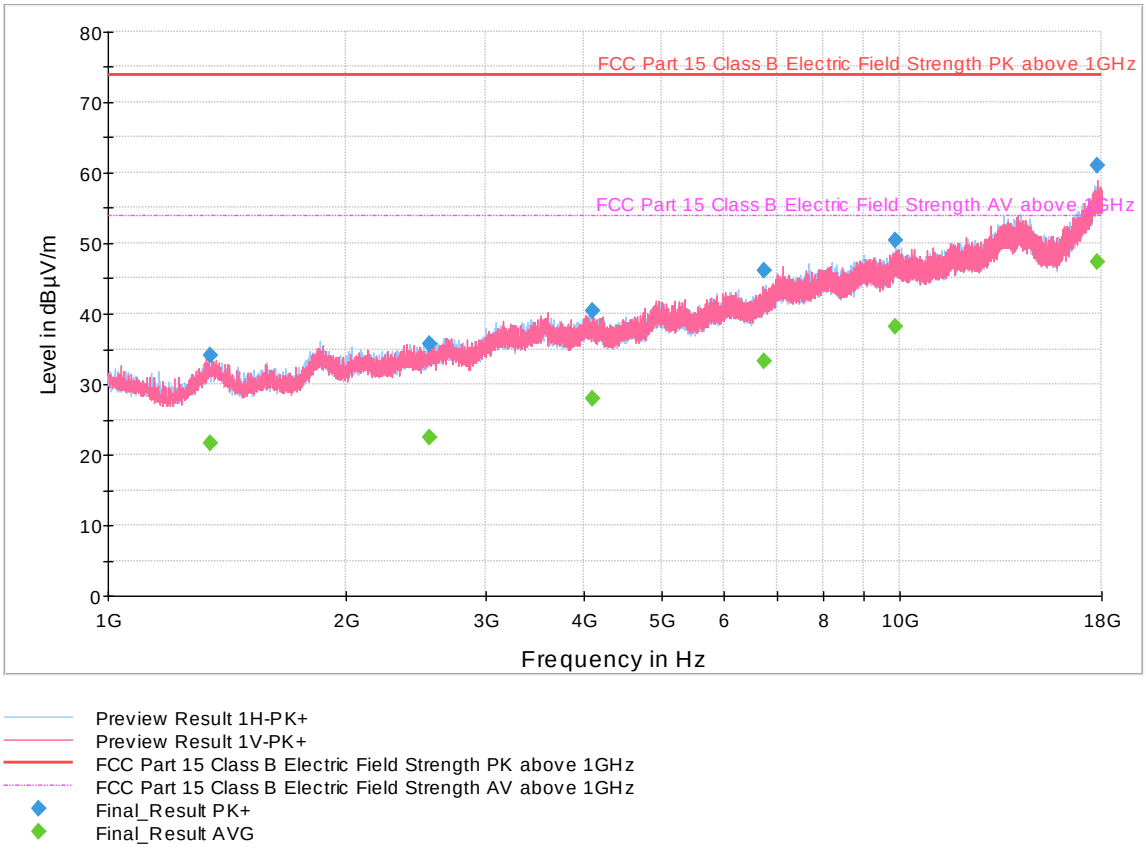
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1358.90000	35.65	73.90	38.25	1000.0	1000.000	351.6	V	188.0	-3.7
1724.26666	32.36	73.90	41.54	1000.0	1000.000	250.2	H	321.0	-2.2
3568.06666	39.83	73.90	34.07	1000.0	1000.000	115.7	V	308.0	5.3
6814.43333	46.26	73.90	27.64	1000.0	1000.000	349.6	H	313.0	14.5
10032.6666	51.04	73.90	22.86	1000.0	1000.000	405.8	V	282.0	20.1
17783.2666	60.68	73.90	13.22	1000.0	1000.000	250.2	V	235.0	29.3

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1358.90000	21.70	53.90	32.20	1000.0	1000.000	351.6	V	188.0	-3.7
1724.26666	19.80	53.90	34.10	1000.0	1000.000	250.2	H	321.0	-2.2
3568.06666	26.12	53.90	27.78	1000.0	1000.000	115.7	V	308.0	5.3
6814.43333	33.36	53.90	20.54	1000.0	1000.000	349.6	H	313.0	14.5
10032.6666	38.01	53.90	15.89	1000.0	1000.000	405.8	V	282.0	20.1
17783.2666	47.30	53.90	6.60	1000.0	1000.000	250.2	V	235.0	29.3

2.2.14 Test Results 1 GHz to 18 GHz Mid Channel 300 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

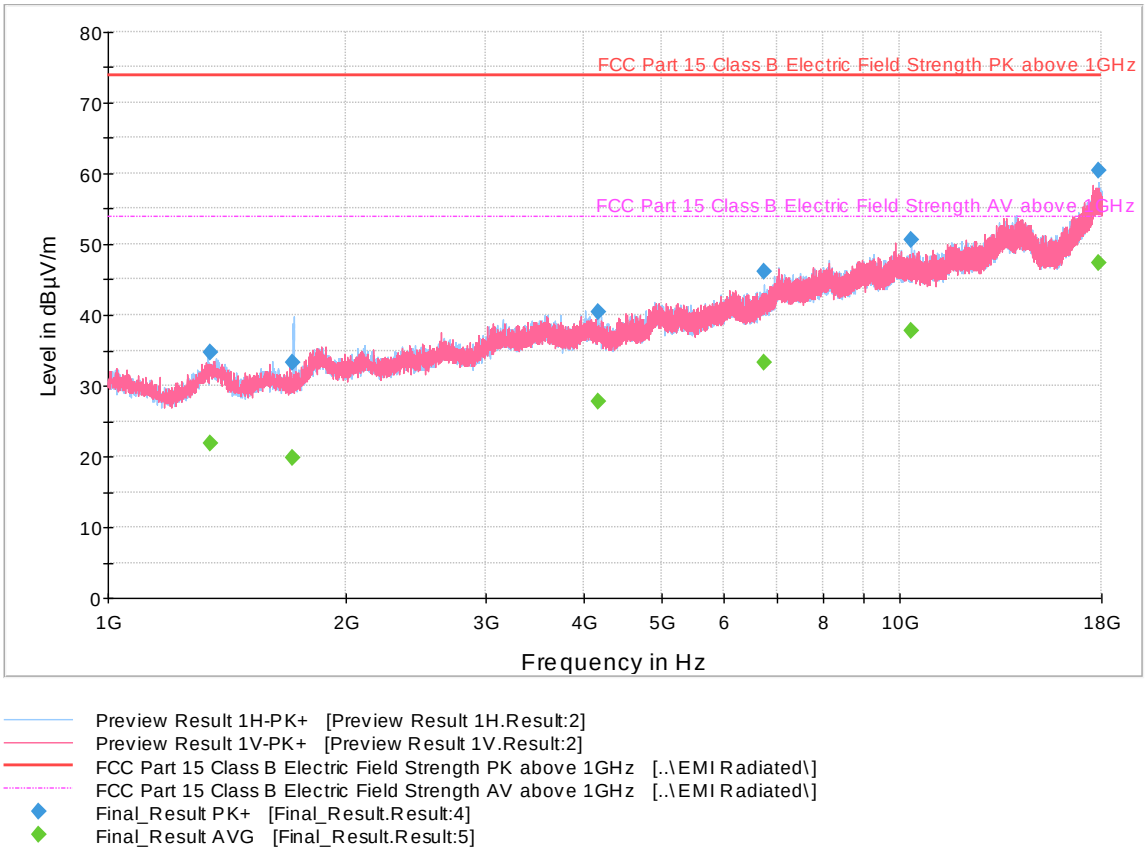
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1347.70000	34.17	73.90	39.73	1000.0	1000.000	187.7	V	259.0	-3.7
2545.33333	35.81	73.90	38.09	1000.0	1000.000	410.2	H	79.0	1.3
4092.86666	40.45	73.90	33.45	1000.0	1000.000	196.3	V	51.0	7.3
6752.23333	46.20	73.90	27.70	1000.0	1000.000	227.9	H	215.0	14.3
9887.70000	50.34	73.90	23.56	1000.0	1000.000	410.3	H	220.0	20.0
17774.5333	61.07	73.90	12.83	1000.0	1000.000	151.6	V	82.0	29.2

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1347.70000	21.66	53.90	32.24	1000.0	1000.000	187.7	V	259.0	-3.7
2545.33333	22.52	53.90	31.38	1000.0	1000.000	410.2	H	79.0	1.3
4092.86666	27.93	53.90	25.97	1000.0	1000.000	196.3	V	51.0	7.3
6752.23333	33.20	53.90	20.70	1000.0	1000.000	227.9	H	215.0	14.3
9887.70000	38.07	53.90	15.83	1000.0	1000.000	410.3	H	220.0	20.0
17774.5333	47.30	53.90	6.60	1000.0	1000.000	151.6	V	82.0	29.2

2.2.15 Test Results 1 GHz to 18 GHz High Channel 175 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

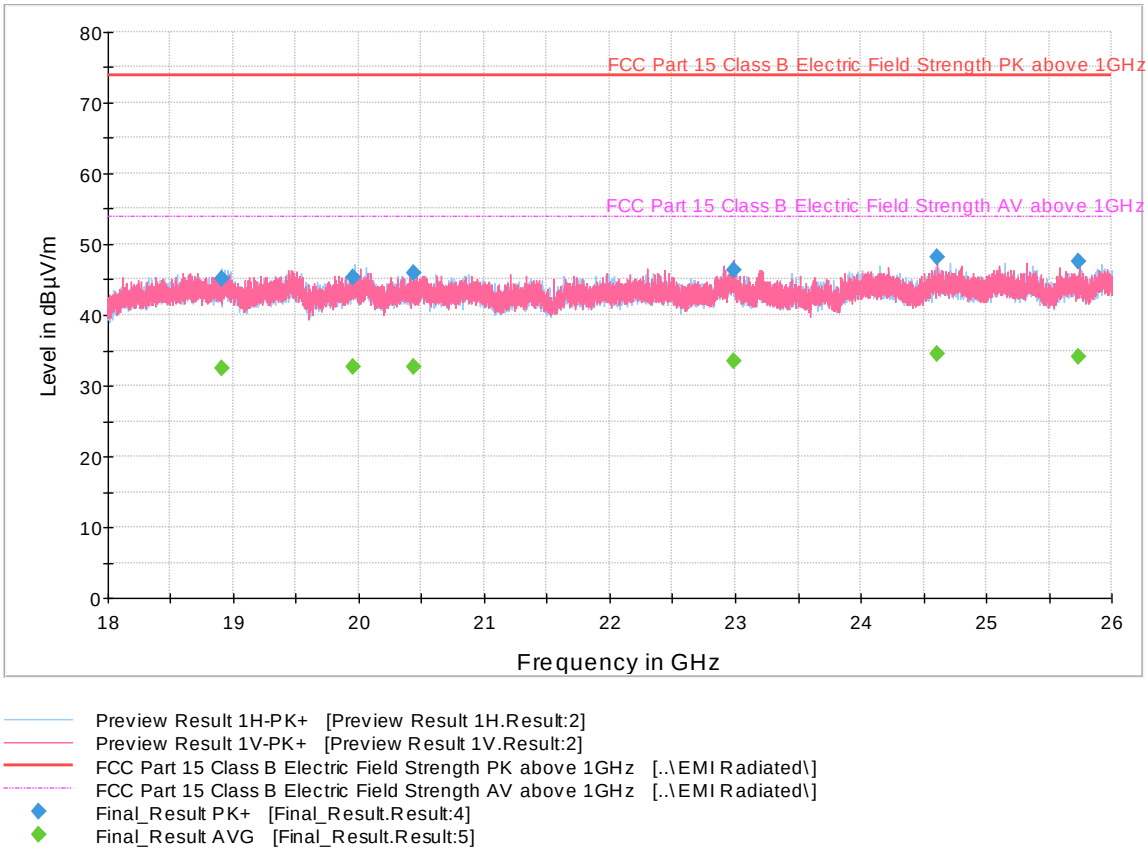
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1348.30000	34.62	73.90	39.28	1000.0	1000.000	99.9	H	80.0	-3.7
1713.53333	33.30	73.90	40.60	1000.0	1000.000	99.8	H	-6.0	-2.3
4158.53333	40.36	73.90	33.54	1000.0	1000.000	394.8	H	88.0	7.3
6753.23333	46.08	73.90	27.82	1000.0	1000.000	386.2	H	257.0	14.3
10339.4666	50.55	73.90	23.35	1000.0	1000.000	285.3	H	330.0	19.8
17827.5333	60.31	73.90	13.59	1000.0	1000.000	250.3	H	7.0	29.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1348.30000	21.78	53.90	32.12	1000.0	1000.000	99.9	H	80.0	-3.7
1713.53333	19.76	53.90	34.14	1000.0	1000.000	99.8	H	-6.0	-2.3
4158.53333	27.68	53.90	26.22	1000.0	1000.000	394.8	H	88.0	7.3
6753.23333	33.28	53.90	20.62	1000.0	1000.000	386.2	H	257.0	14.3
10339.4666	37.78	53.90	16.12	1000.0	1000.000	285.3	H	330.0	19.8
17827.5333	47.43	53.90	6.47	1000.0	1000.000	250.3	H	7.0	29.4

2.2.16 Test Results from 18 GHz to 26 GHz Low Channel 175 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

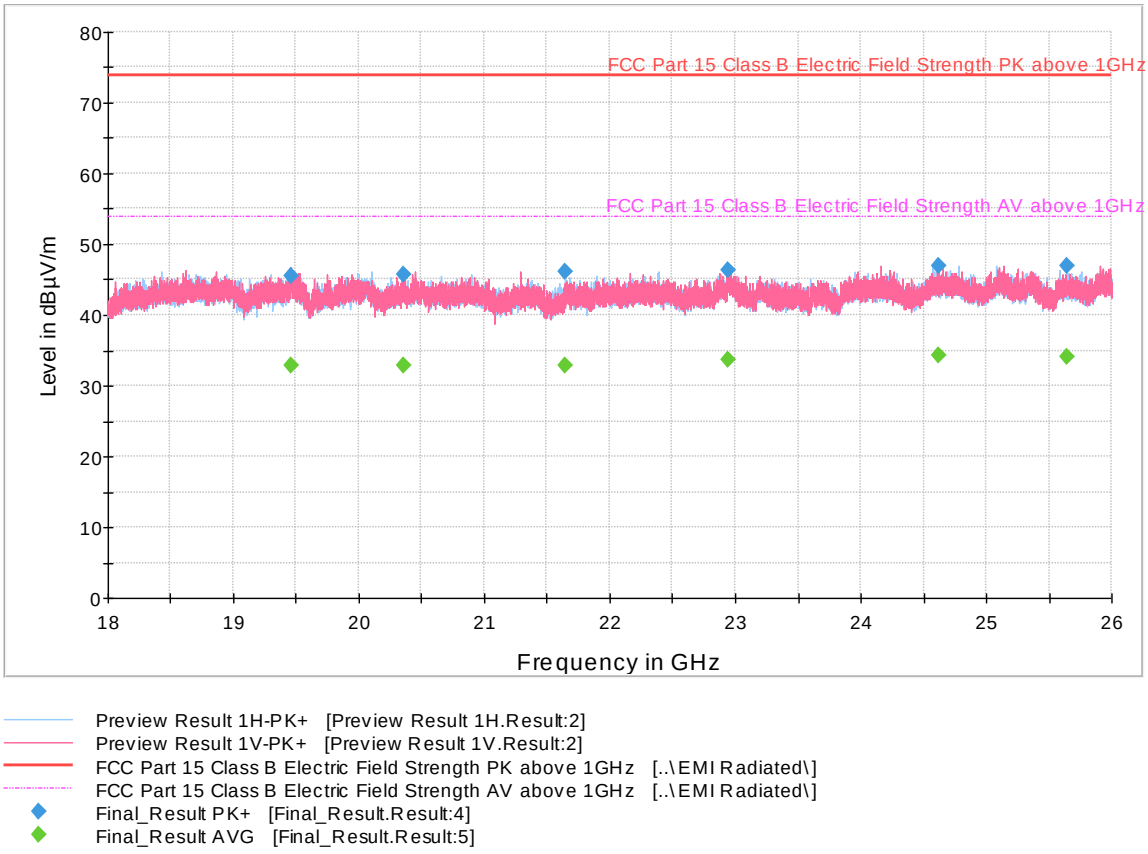
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18912.6000	45.18	73.90	28.72	1000.0	1000.000	148.1	H	38.0	-0.7
19955.4000	45.34	73.90	28.56	1000.0	1000.000	149.4	H	274.0	-0.7
20442.2000	45.94	73.90	27.96	1000.0	1000.000	175.3	H	271.0	-0.7
22993.4000	46.35	73.90	27.55	1000.0	1000.000	99.7	V	37.0	0.9
24604.2000	48.11	73.90	25.79	1000.0	1000.000	101.6	V	36.0	1.6
25739.4000	47.54	73.90	26.36	1000.0	1000.000	175.2	V	96.0	1.8

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18912.6000	32.40	53.90	21.50	1000.0	1000.000	148.1	H	38.0	-0.7
19955.4000	32.67	53.90	21.23	1000.0	1000.000	149.4	H	274.0	-0.7
20442.2000	32.60	53.90	21.30	1000.0	1000.000	175.3	H	271.0	-0.7
22993.4000	33.51	53.90	20.39	1000.0	1000.000	99.7	V	37.0	0.9
24604.2000	34.44	53.90	19.46	1000.0	1000.000	101.6	V	36.0	1.6
25739.4000	34.14	53.90	19.76	1000.0	1000.000	175.2	V	96.0	1.8

2.2.17 Test Results from 18 GHz to 26 GHz Mid Channel 300 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
19461.0000	45.44	73.90	28.46	1000.0	1000.000	149.7	V	145.0	-1.0
20360.6000	45.77	73.90	28.13	1000.0	1000.000	171.0	V	301.0	-0.7
21646.6000	46.08	73.90	27.82	1000.0	1000.000	101.7	H	32.0	-0.1
22946.2000	46.26	73.90	27.64	1000.0	1000.000	115.9	V	13.0	0.8
24618.2000	46.93	73.90	26.97	1000.0	1000.000	125.2	H	162.0	1.6
25639.4000	46.95	73.90	26.95	1000.0	1000.000	175.0	H	170.0	1.7

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
19461.0000	32.79	53.90	21.11	1000.0	1000.000	149.7	V	145.0	-1.0
20360.6000	32.92	53.90	20.98	1000.0	1000.000	171.0	V	301.0	-0.7
21646.6000	32.77	53.90	21.13	1000.0	1000.000	101.7	H	32.0	-0.1
22946.2000	33.60	53.90	20.30	1000.0	1000.000	115.9	V	13.0	0.8
24618.2000	34.34	53.90	19.56	1000.0	1000.000	125.2	H	162.0	1.6
25639.4000	34.03	53.90	19.87	1000.0	1000.000	175.0	H	170.0	1.7

2.2.18 Test Results from 18 GHz to 26 GHz High Channel 175 MHz BW (worst case configuration)

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

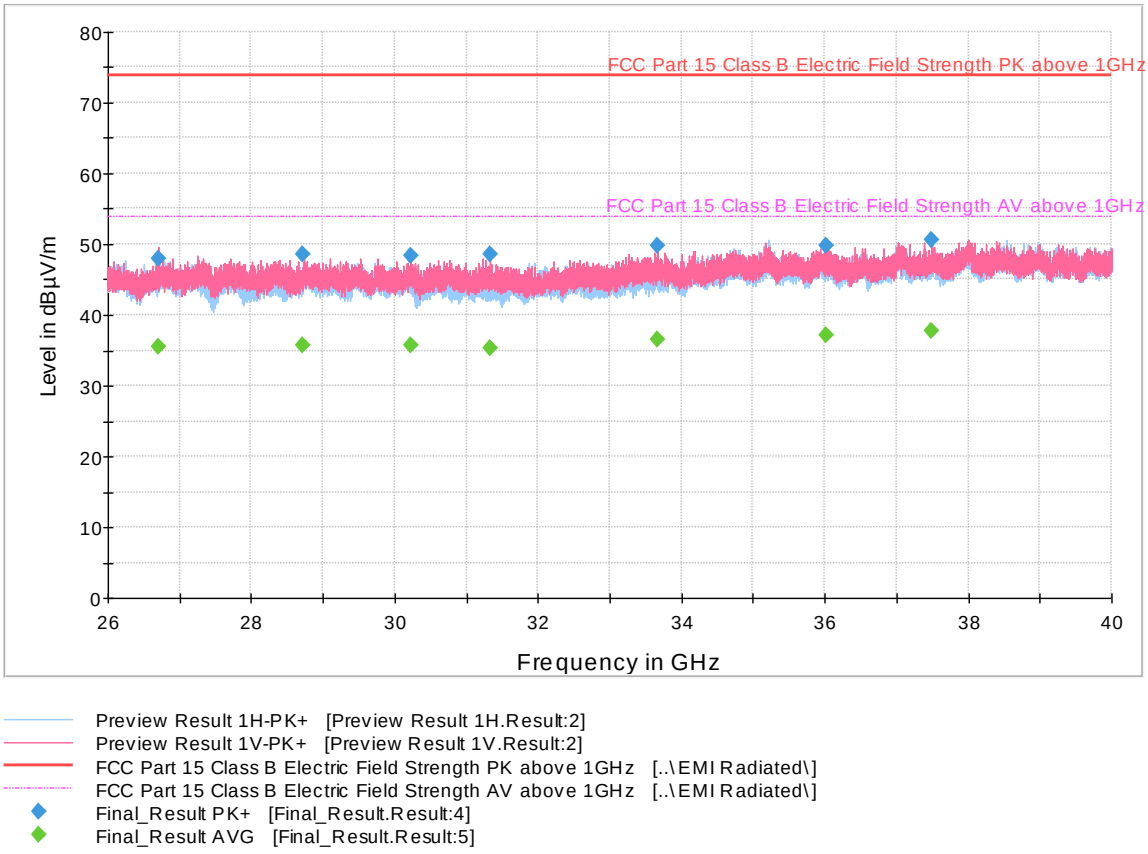
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18651.8000	45.27	73.90	28.63	1000.0	1000.000	114.8	H	239.0	-0.6
20043.0000	45.45	73.90	28.45	1000.0	1000.000	125.2	V	201.0	-0.6
20775.8000	45.72	73.90	28.18	1000.0	1000.000	126.9	H	1.0	-0.1
22991.8000	46.87	73.90	27.03	1000.0	1000.000	175.0	H	51.0	0.9
24233.8000	47.55	73.90	26.35	1000.0	1000.000	125.2	V	70.0	1.3
25892.2000	47.24	73.90	26.66	1000.0	1000.000	167.9	V	190.0	1.8

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18651.8000	32.40	53.90	21.50	1000.0	1000.000	114.8	H	239.0	-0.6
20043.0000	32.56	53.90	21.34	1000.0	1000.000	125.2	V	201.0	-0.6
20775.8000	32.85	53.90	21.05	1000.0	1000.000	126.9	H	1.0	-0.1
22991.8000	33.75	53.90	20.15	1000.0	1000.000	175.0	H	51.0	0.9
24233.8000	34.10	53.90	19.80	1000.0	1000.000	125.2	V	70.0	1.3
25892.2000	34.57	53.90	19.33	1000.0	1000.000	167.9	V	190.0	1.8

2.2.19 Test Results from 26 GHz to 40 GHz Low Channel 175 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

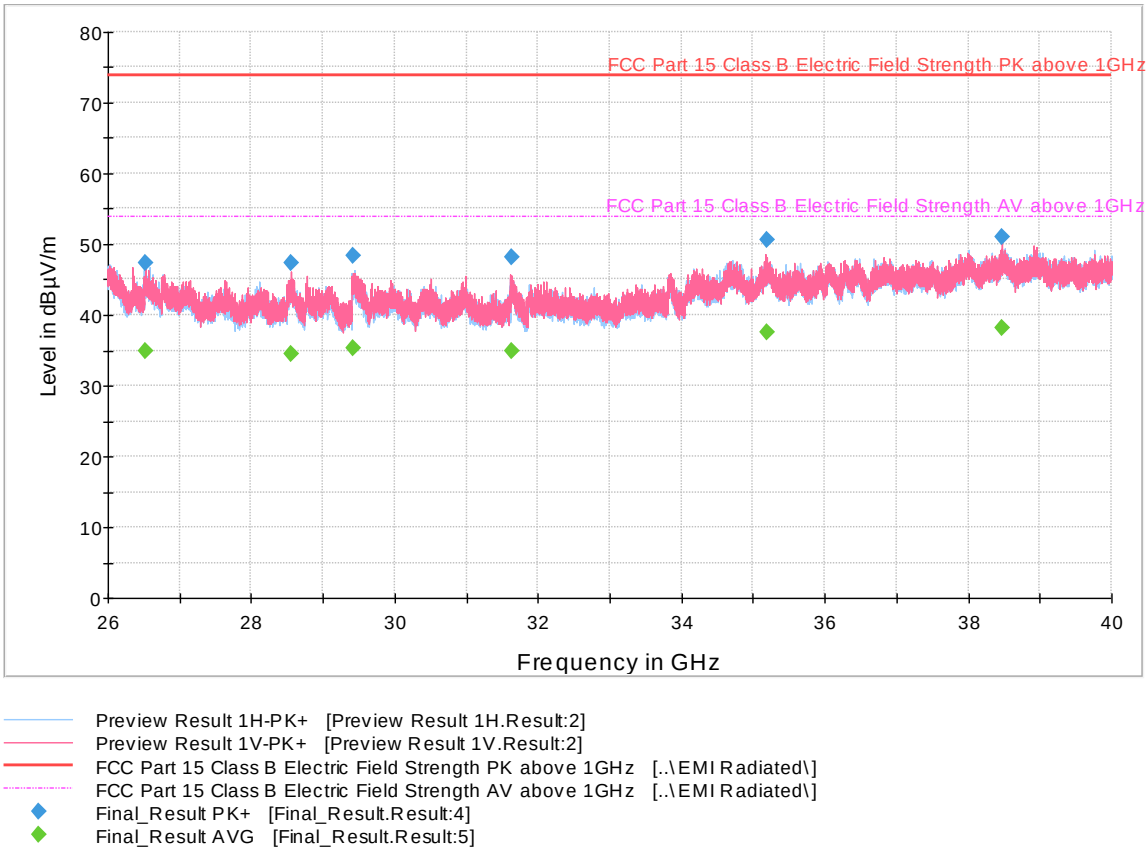
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26707.2723	47.95	73.90	25.95	1000.0	1000.000	116.5	V	213.0	2.4
28724.0842	48.60	73.90	25.30	1000.0	1000.000	107.4	V	198.0	3.5
30215.8446	48.45	73.90	25.45	1000.0	1000.000	125.2	V	190.0	3.9
31335.1119	48.55	73.90	25.35	1000.0	1000.000	104.0	V	39.0	4.6
33662.8726	49.71	73.90	24.19	1000.0	1000.000	120.7	V	143.0	6.0
36012.3730	49.81	73.90	24.09	1000.0	1000.000	126.6	V	290.0	6.7
37491.5192	50.55	73.90	23.35	1000.0	1000.000	117.7	V	73.0	7.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26707.2723	35.46	53.90	18.44	1000.0	1000.000	116.5	V	213.0	2.4
28724.0842	35.80	53.90	18.10	1000.0	1000.000	107.4	V	198.0	3.5
30215.8446	35.70	53.90	18.20	1000.0	1000.000	125.2	V	190.0	3.9
31335.1119	35.38	53.90	18.52	1000.0	1000.000	104.0	V	39.0	4.6
33662.8726	36.46	53.90	17.44	1000.0	1000.000	120.7	V	143.0	6.0
36012.3730	37.20	53.90	16.70	1000.0	1000.000	126.6	V	290.0	6.7
37491.5192	37.78	53.90	16.12	1000.0	1000.000	117.7	V	73.0	7.4

2.2.20 Test Results from 26 GHz to 40 GHz Mid Channel 300 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

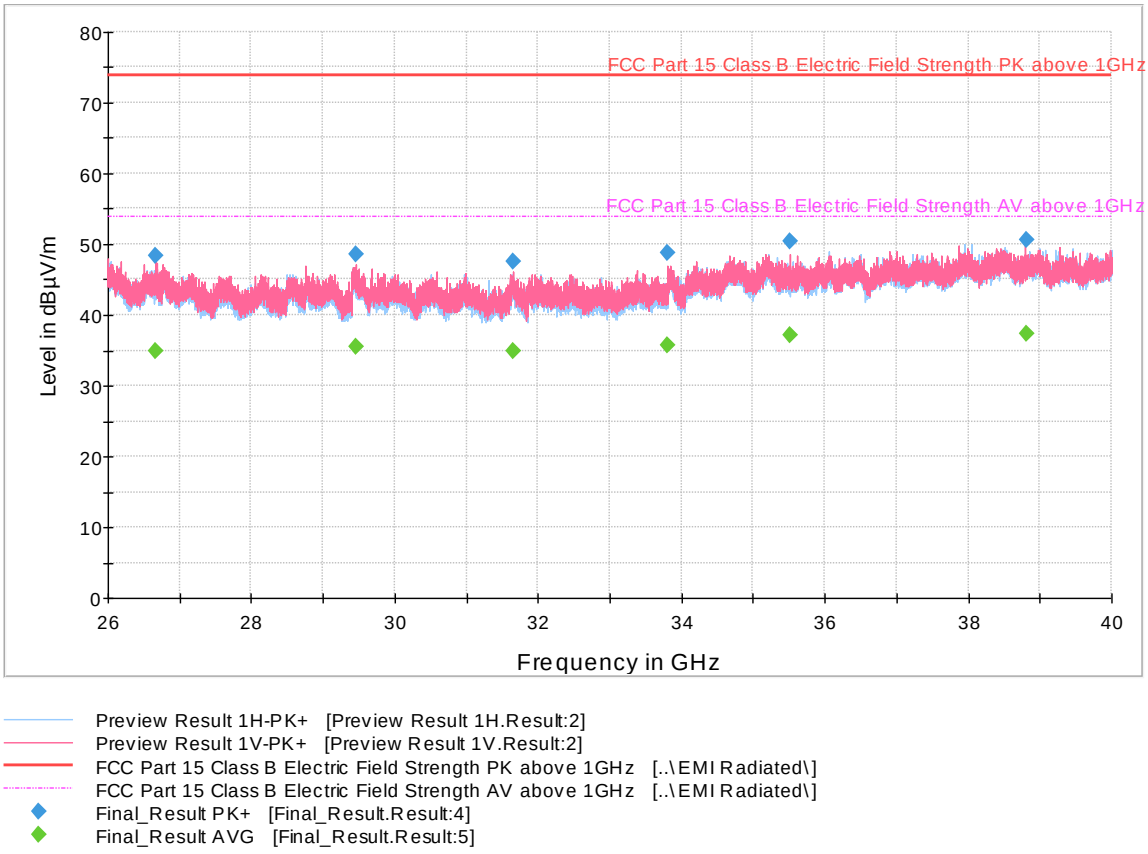
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26516.3930	47.24	73.90	26.66	1000.0	1000.000	101.7	V	258.0	2.3
28549.2842	47.40	73.90	26.50	1000.0	1000.000	125.3	V	157.0	3.5
29427.3730	48.30	73.90	25.60	1000.0	1000.000	125.3	H	-12.0	3.4
31629.6665	48.13	73.90	25.77	1000.0	1000.000	99.8	V	38.0	4.6
35185.3776	50.55	73.90	23.35	1000.0	1000.000	139.1	V	112.0	6.5
38464.8980	51.10	73.90	22.80	1000.0	1000.000	143.4	V	60.0	8.3

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26516.3930	34.82	53.90	19.08	1000.0	1000.000	101.7	V	258.0	2.3
28549.2842	34.55	53.90	19.35	1000.0	1000.000	125.3	V	157.0	3.5
29427.3730	35.23	53.90	18.67	1000.0	1000.000	125.3	H	-12.0	3.4
31629.6665	34.82	53.90	19.08	1000.0	1000.000	99.8	V	38.0	4.6
35185.3776	37.64	53.90	16.26	1000.0	1000.000	139.1	V	112.0	6.5
38464.8980	38.06	53.90	15.84	1000.0	1000.000	143.4	V	60.0	8.3

2.2.21 Test Results from 26 GHz to 40 GHz High Channel 175 MHz BW (worst case configuration)



**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

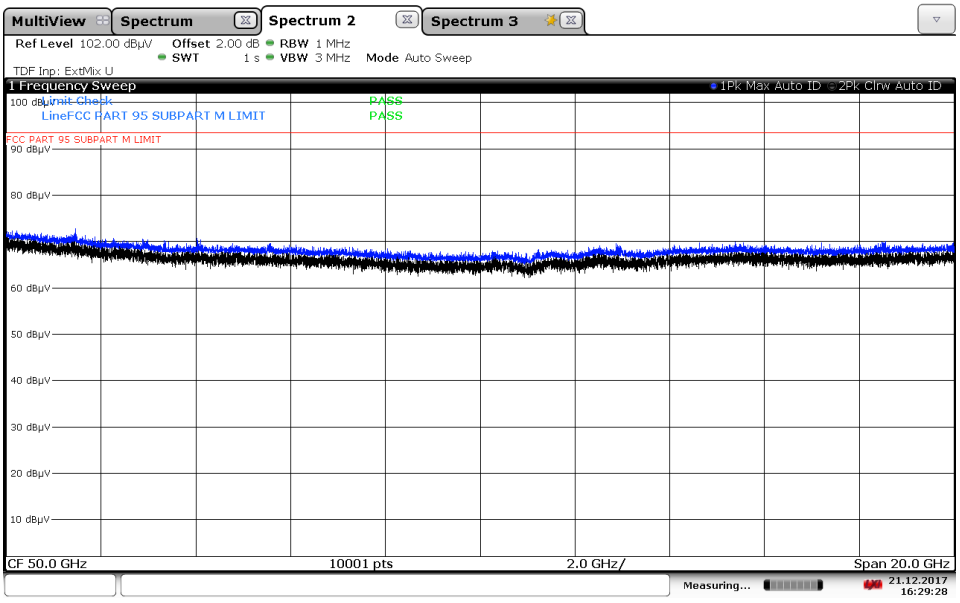
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26658.7400	48.30	73.90	25.60	1000.0	1000.000	120.8	V	245.0	2.4
29455.2088	48.62	73.90	25.28	1000.0	1000.000	115.3	V	241.0	3.4
31646.9634	47.58	73.90	26.32	1000.0	1000.000	125.1	V	0.0	4.6
33810.6303	48.73	73.90	25.17	1000.0	1000.000	131.5	V	155.0	6.0
35507.0984	50.40	73.90	23.50	1000.0	1000.000	125.3	V	225.0	6.8
38803.3011	50.52	73.90	23.38	1000.0	1000.000	125.3	V	332.0	8.4

Average Data

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
26658.7400	34.97	53.90	18.93	1000.0	1000.000	120.8	V	245.0	2.4
29455.2088	35.58	53.90	18.32	1000.0	1000.000	115.3	V	241.0	3.4
31646.9634	34.86	53.90	19.04	1000.0	1000.000	125.1	V	0.0	4.6
33810.6303	35.78	53.90	18.12	1000.0	1000.000	131.5	V	155.0	6.0
35507.0984	37.15	53.90	16.75	1000.0	1000.000	125.3	V	225.0	6.8
38803.3011	37.45	53.90	16.45	1000.0	1000.000	125.3	V	332.0	8.4

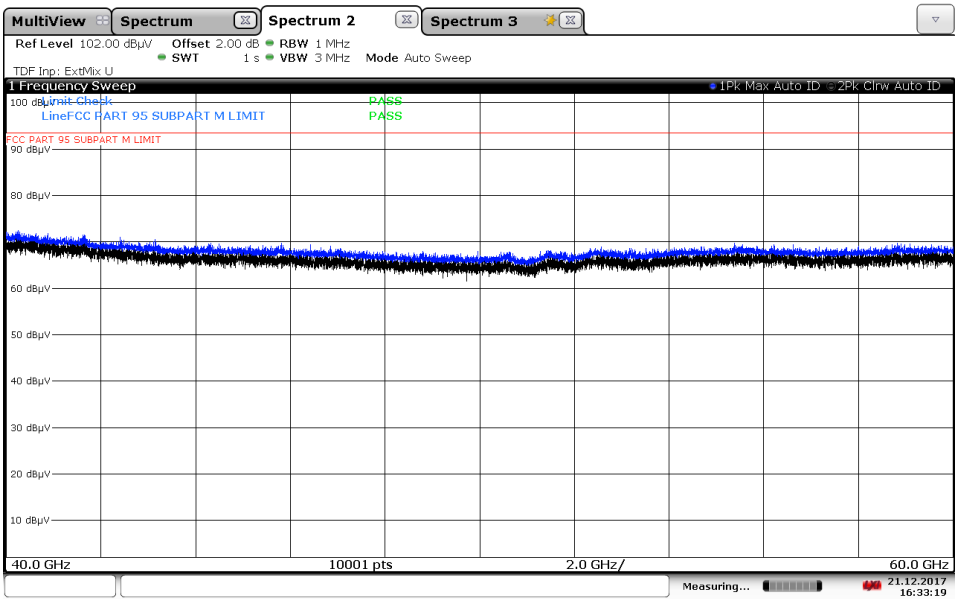
2.2.22 Test Results 40 GHz to 300 GHz



16:29:28 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

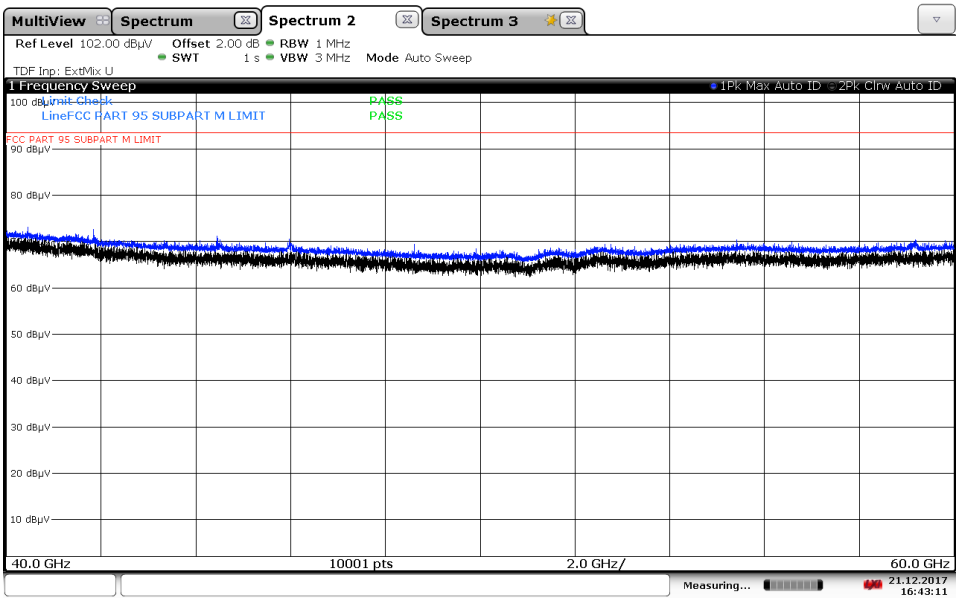
40 to 60 GHz Low Channel 175 MHz BW



16:33:19 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

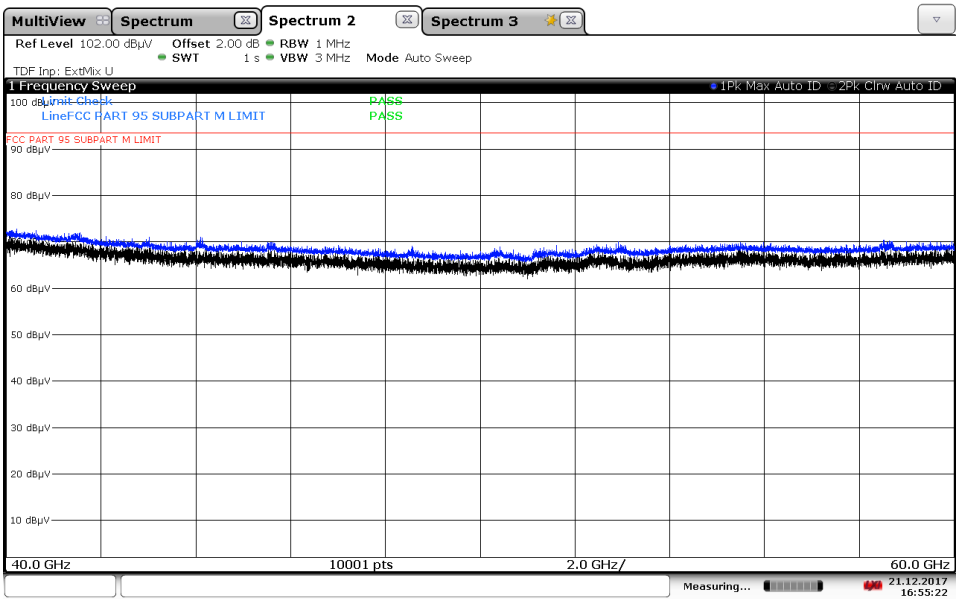
40 to 60 GHz Mid Channel 175 MHz BW



16:43:11 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

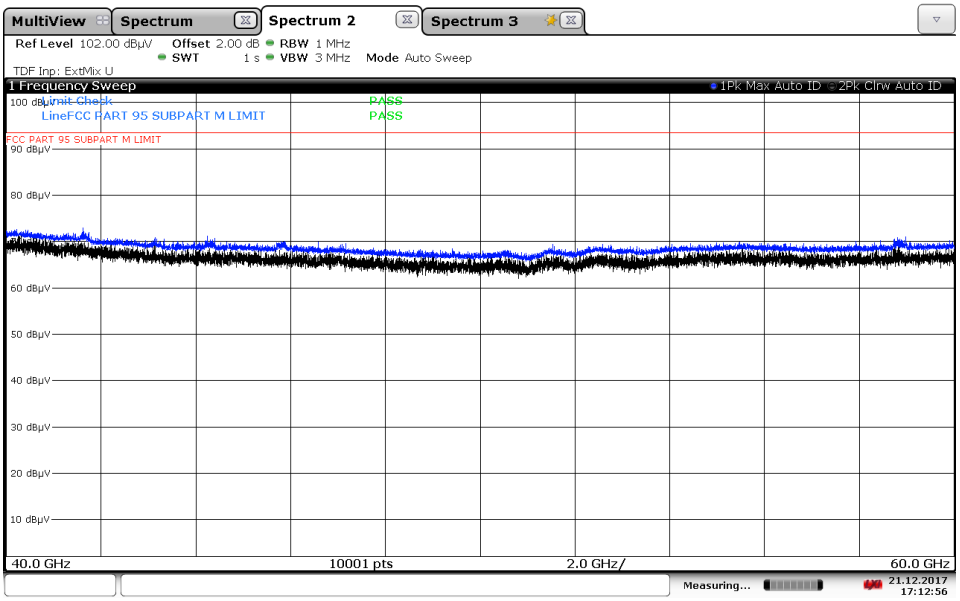
40 to 60 GHz High Channel 175 MHz BW



16:55:22 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

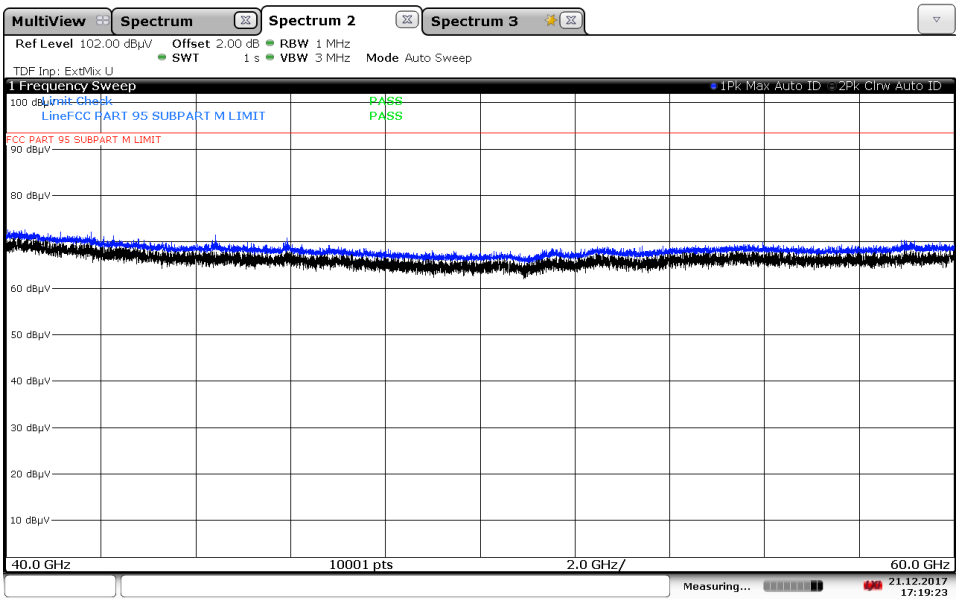
40 to 60 GHz Low Channel 300 MHz BW



17:12:56 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

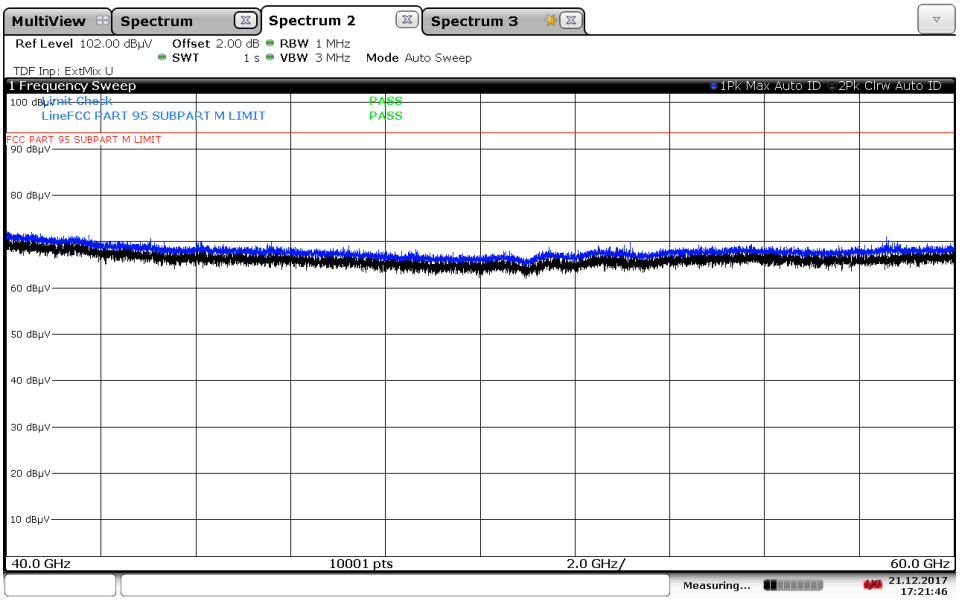
40 to 60 GHz Mid Channel 300 MHz BW



17:19:23 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

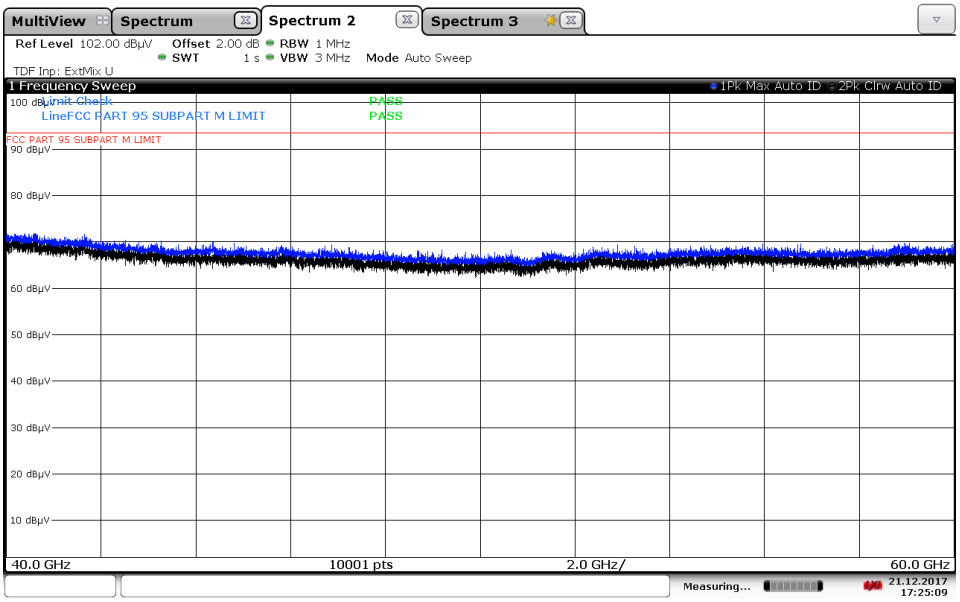
40 to 60 GHz High Channel 300 MHz BW



17:21:47 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

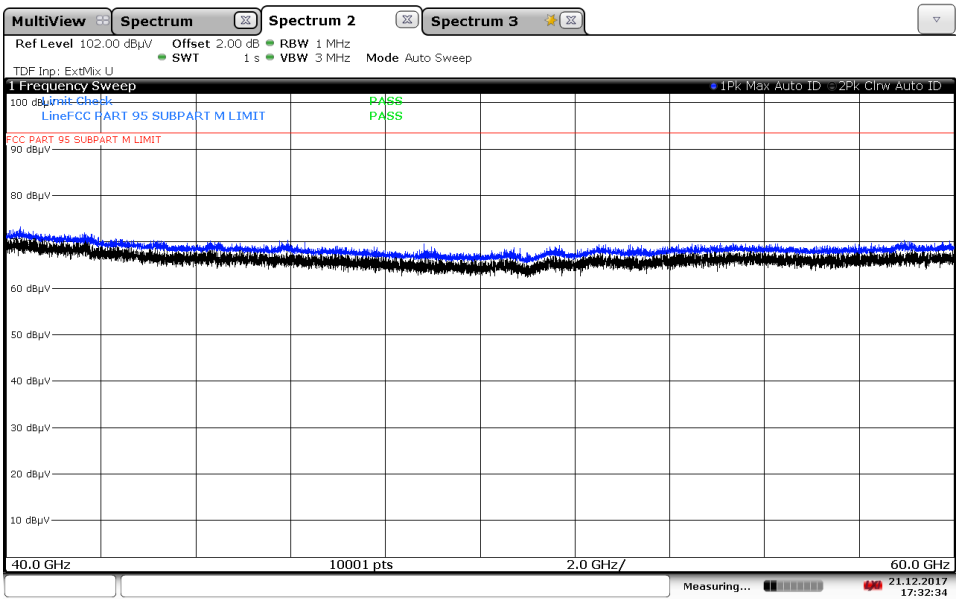
40 to 60 GHz Low Channel 425 MHz BW



17:25:09 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

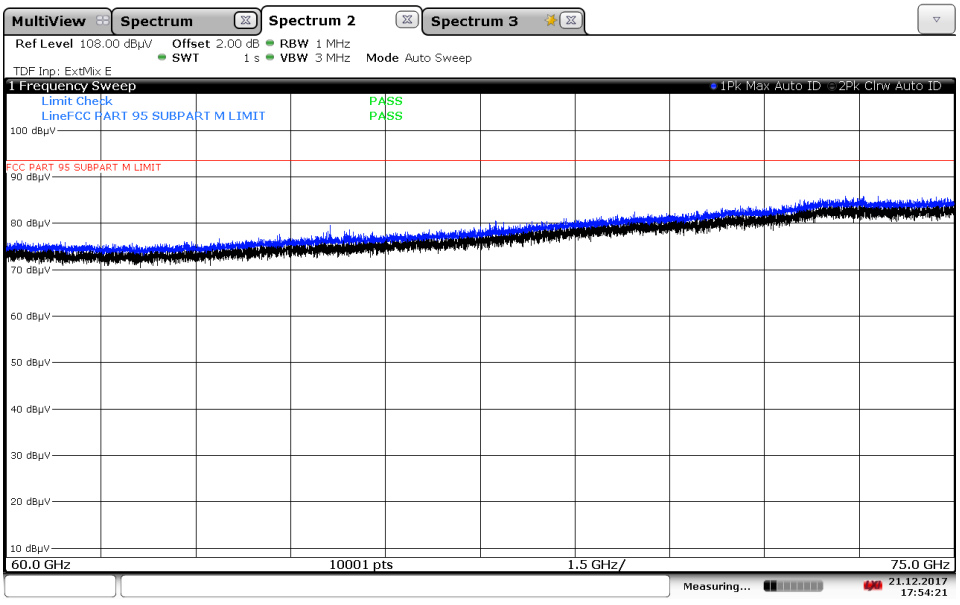
40 to 60 GHz Mid Channel 425 MHz BW



17:32:35 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

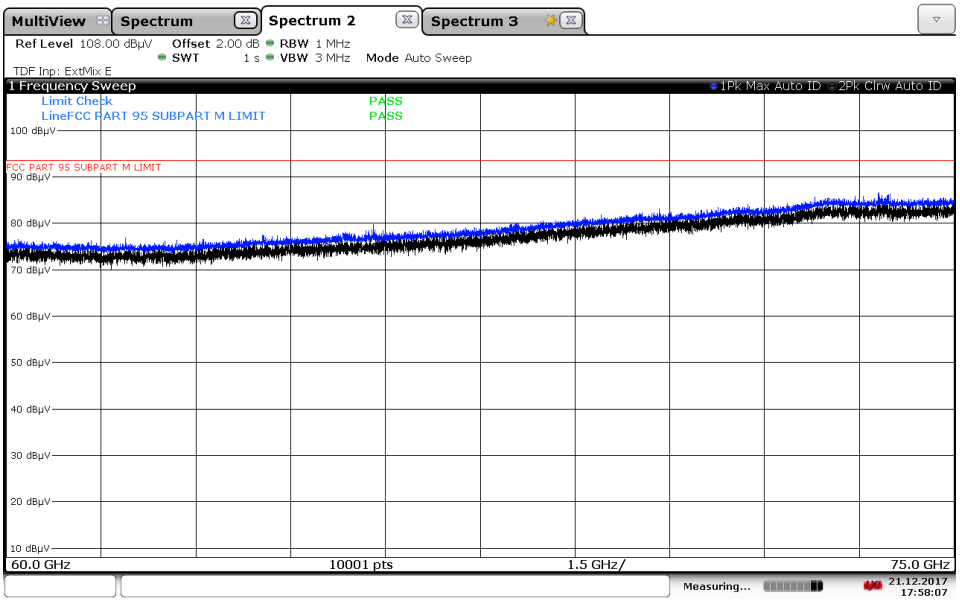
40 to 60 GHz High Channel 425 MHz BW



17:54:21 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

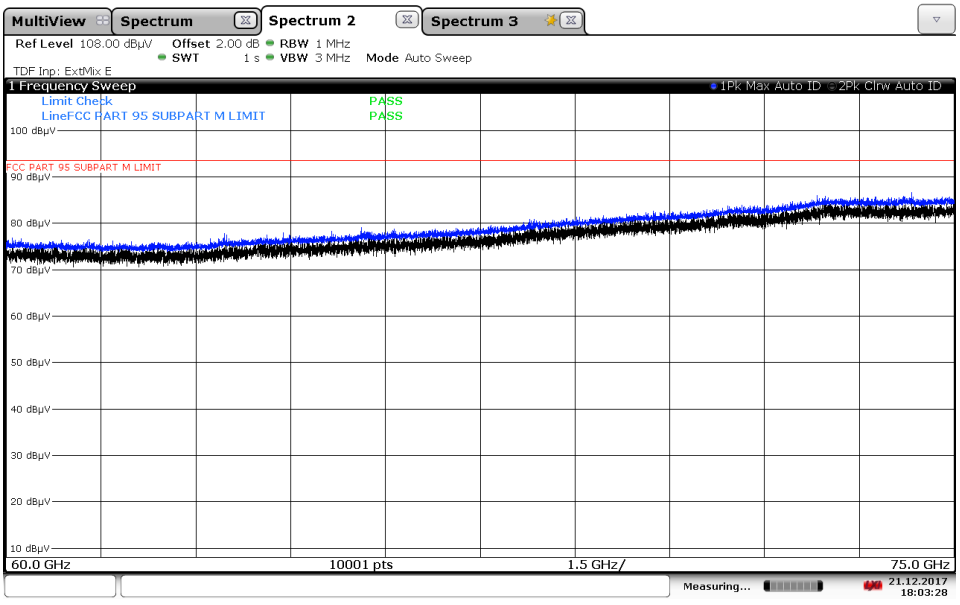
60 to 75 GHz Low Channel 175 MHz BW



17:58:08 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

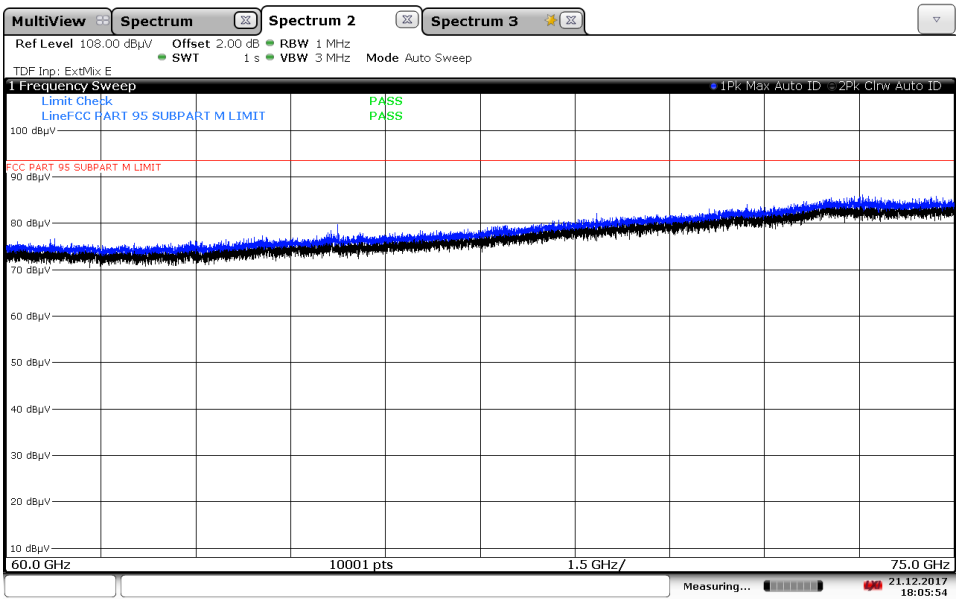
60 to 75 GHz Mid Channel 175 MHz BW



18:03:28 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

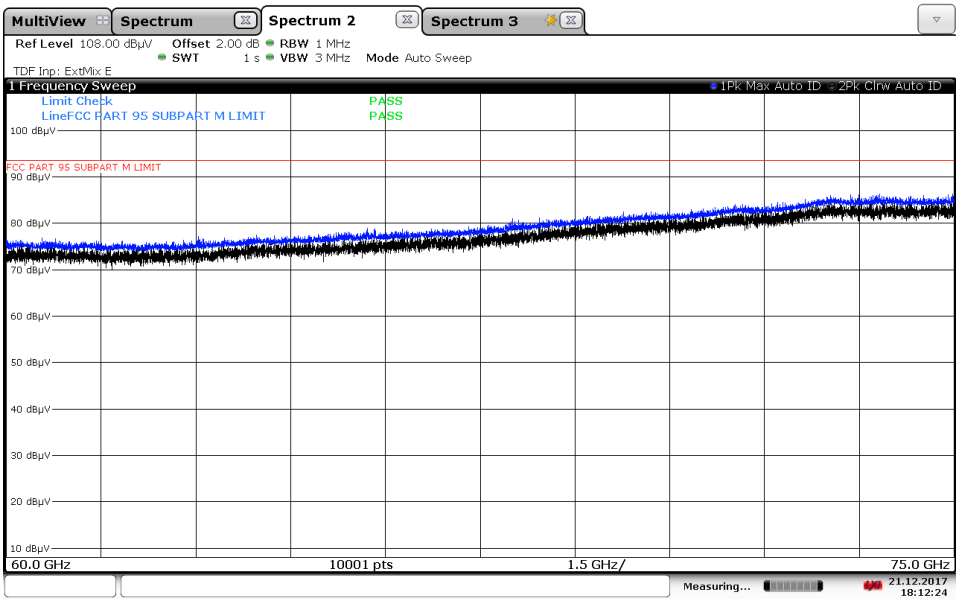
60 to 75 GHz High Channel 175 MHz BW



18:05:55 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

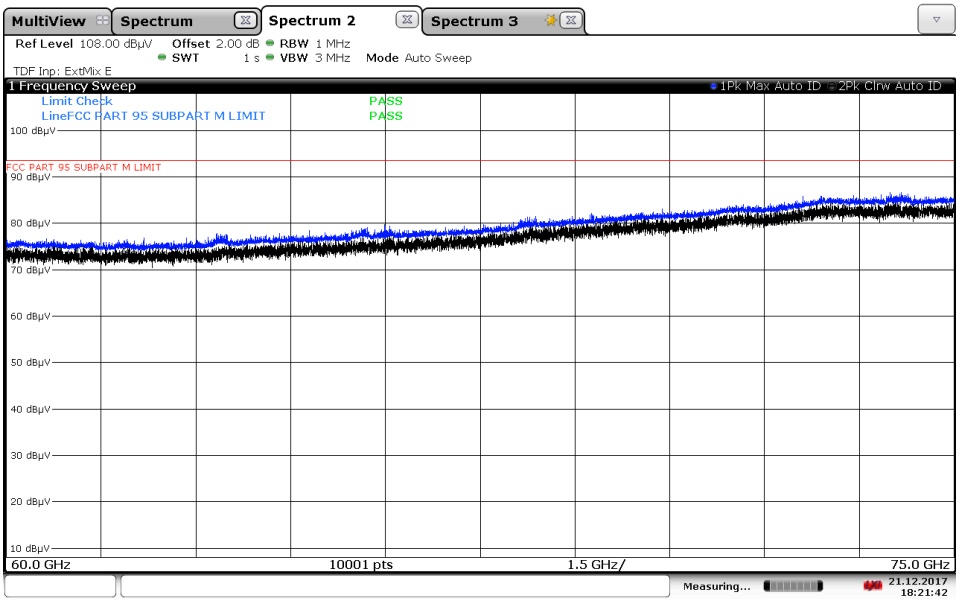
60 to 75 GHz Low Channel 300 MHz BW



18:12:24 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

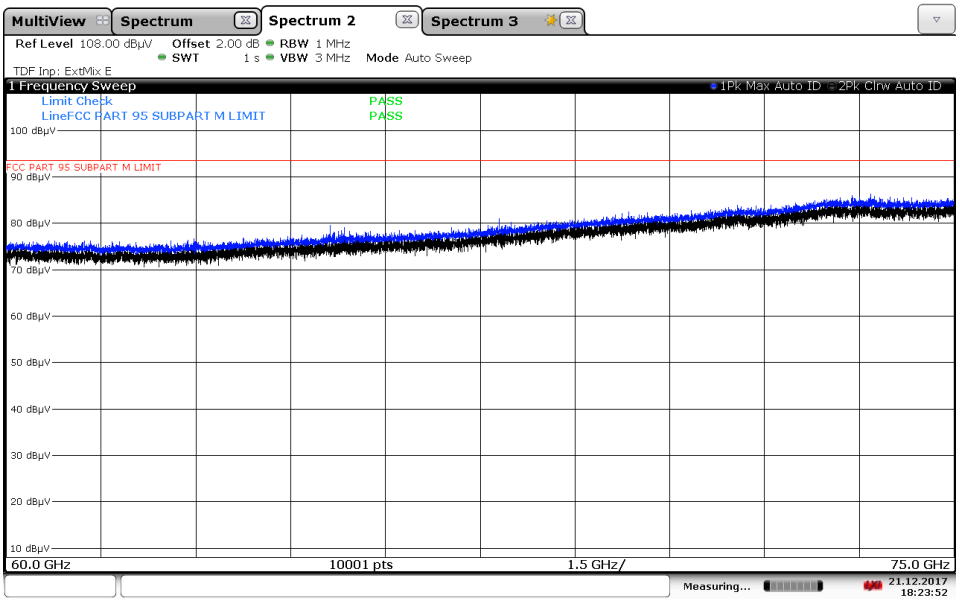
60 to 75 GHz Mid Channel 300 MHz BW



18:21:42 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

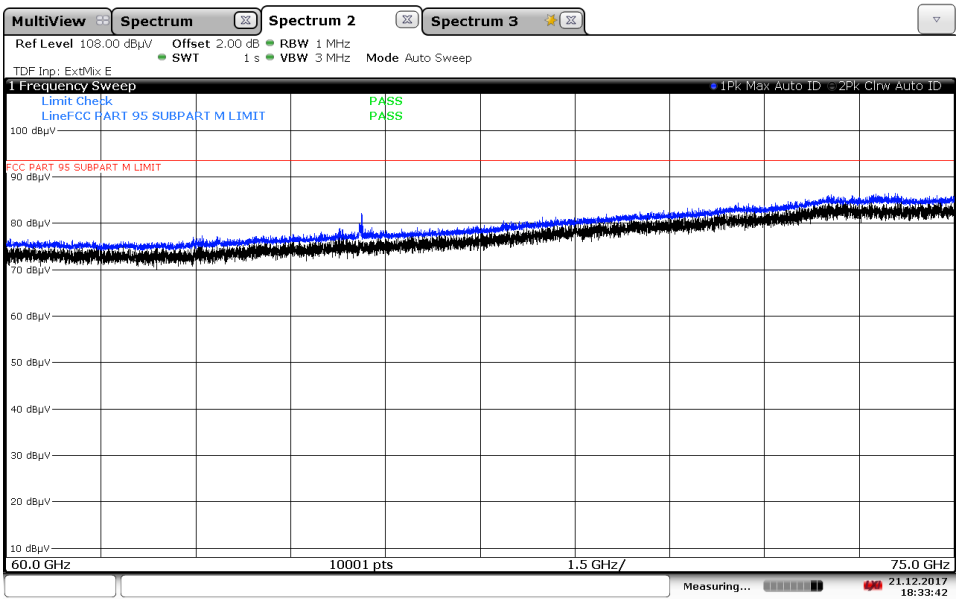
60 to 75 GHz High Channel 300 MHz BW



18:23:52 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

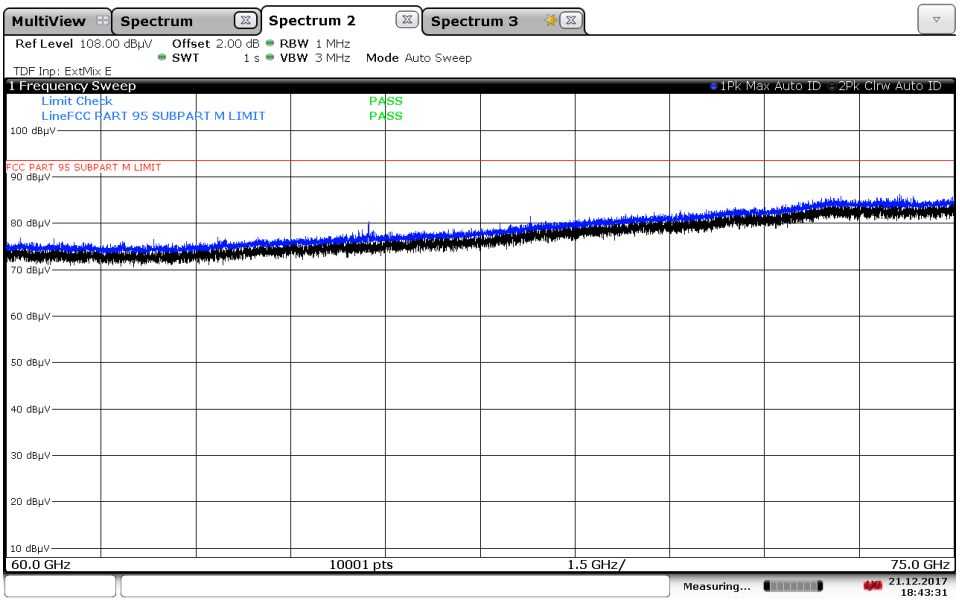
60 to 75 GHz Low Channel 425 MHz BW



18:33:42 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

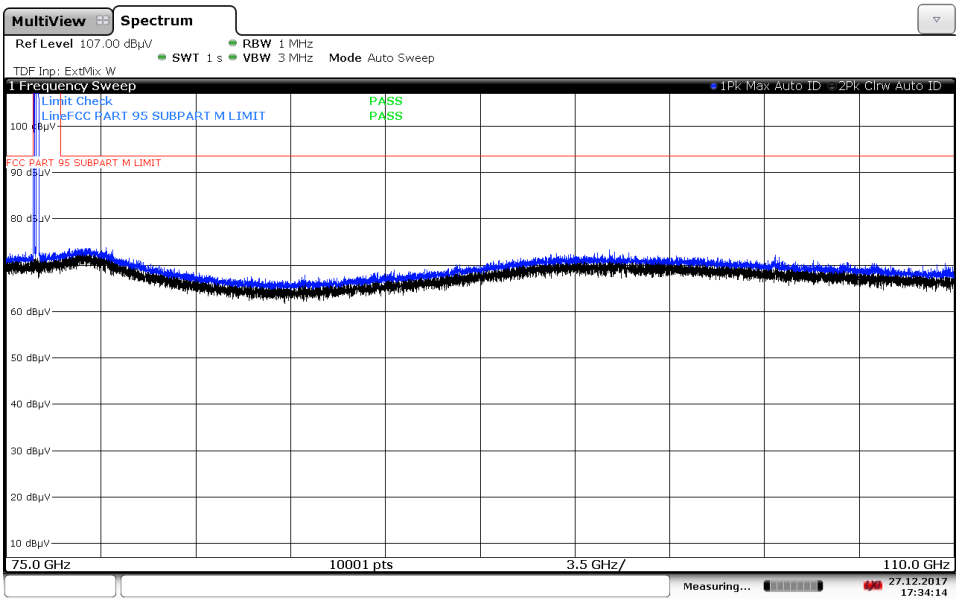
60 to 75 GHz Mid Channel 425 MHz BW



18:43:31 21.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

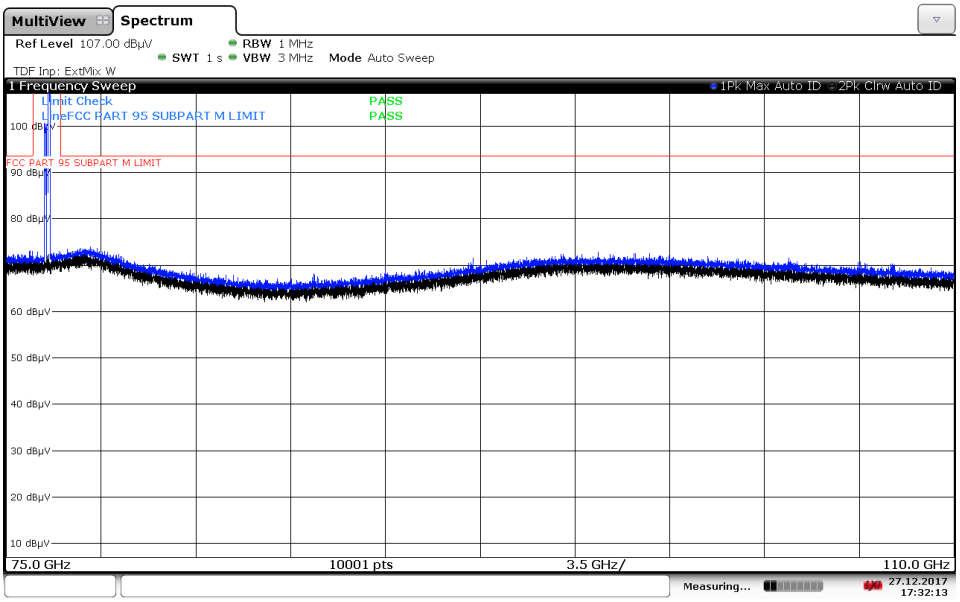
60 to 75 GHz High Channel 425 MHz BW



17:34:14 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

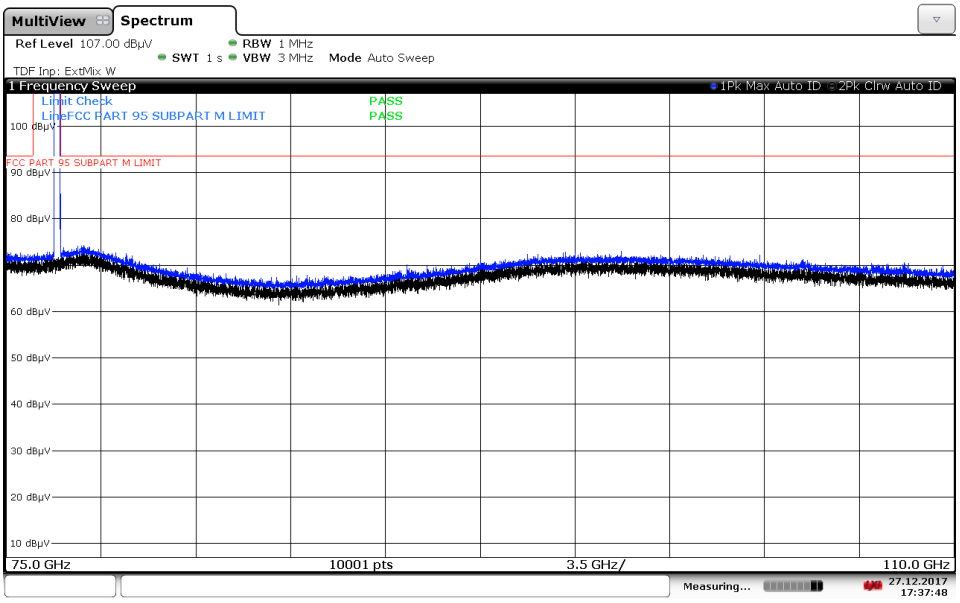
75 to 110 GHz Low Channel 175 MHz BW



17:32:13 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

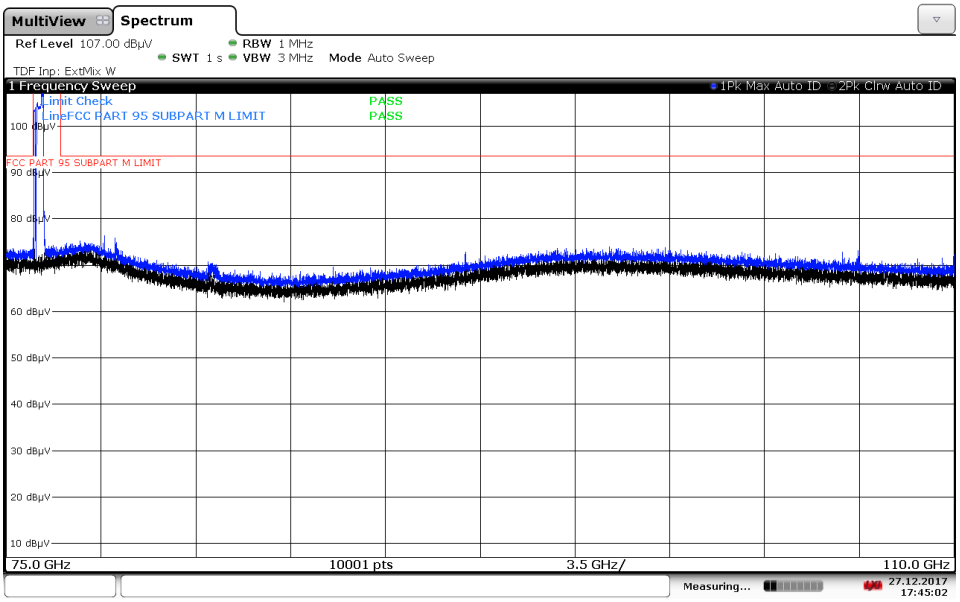
75 to 110 GHz Mid Channel 175 MHz BW



17:37:49 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

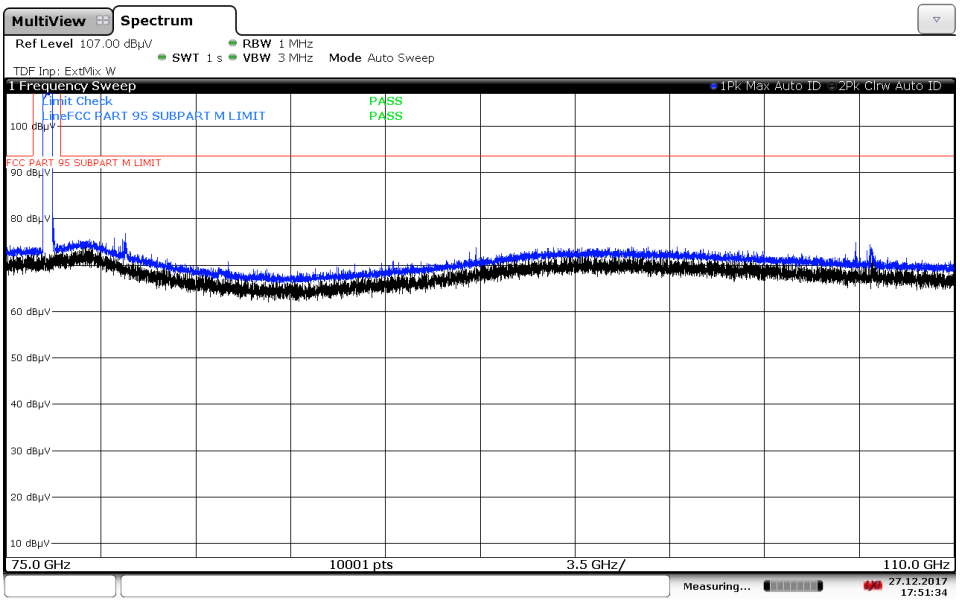
75 to 110 GHz High Channel 175 MHz BW



17:45:02 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

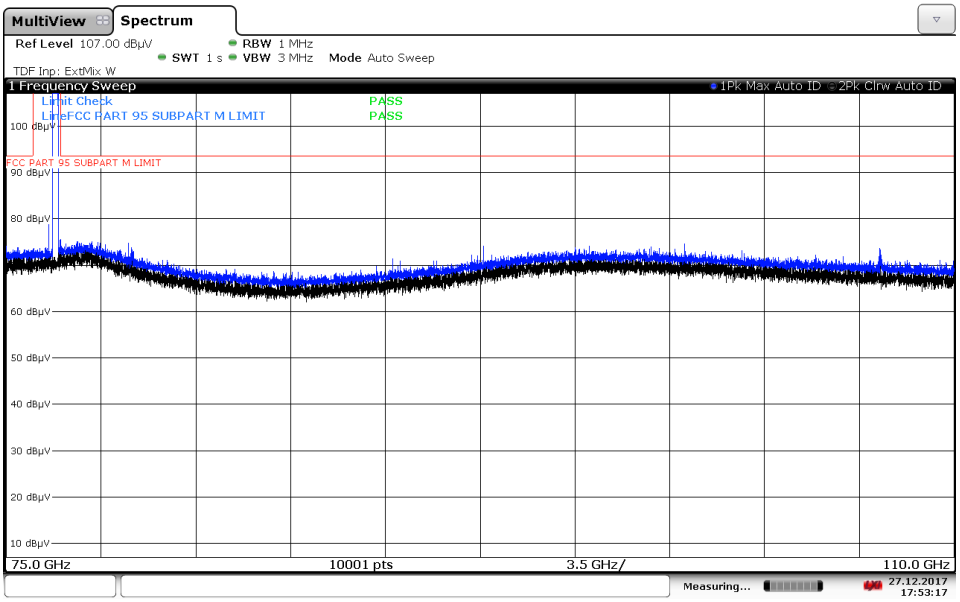
75 to 110 GHz Low Channel 300 MHz BW



17:51:34 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

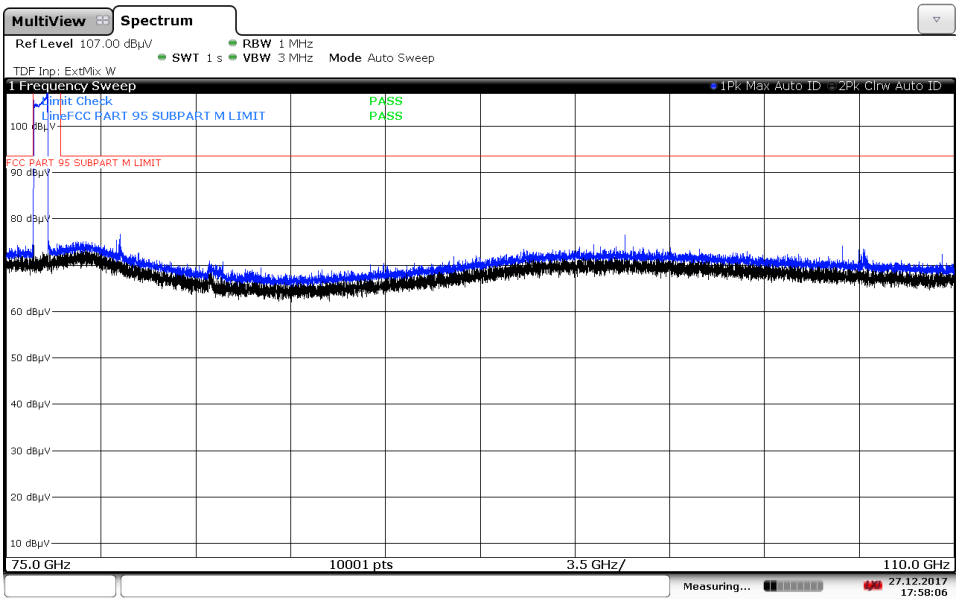
75 to 110 GHz Mid Channel 300 MHz BW



17:53:17 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

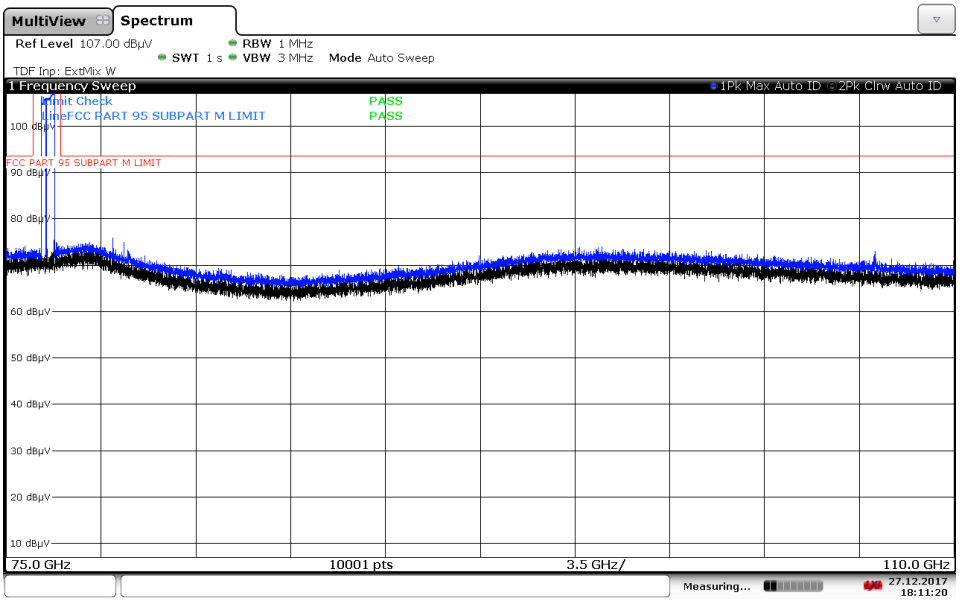
75 to 110 GHz High Channel 300 MHz BW



17:58:06 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

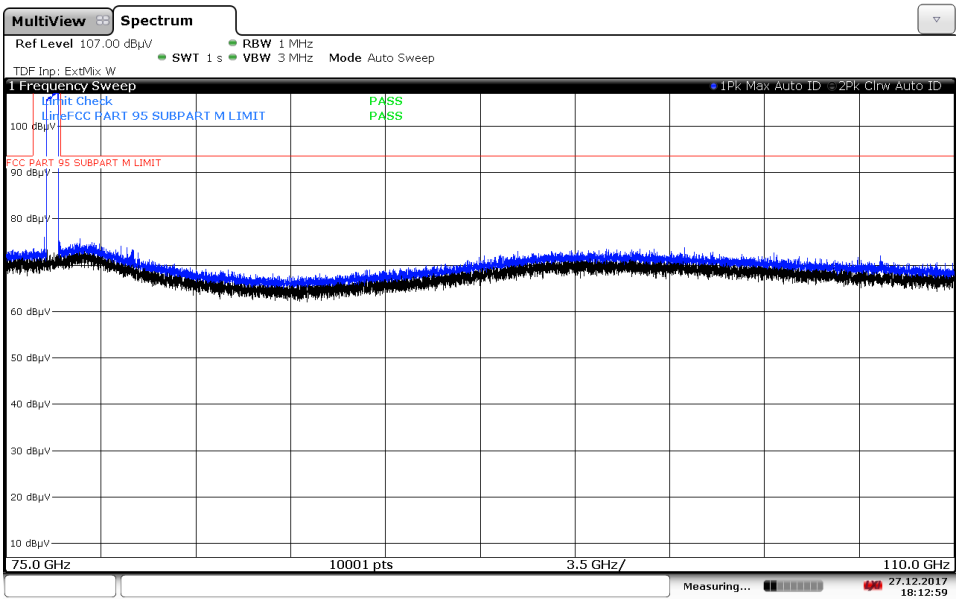
75 to 110 GHz Low Channel 425 MHz BW



18:11:20 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

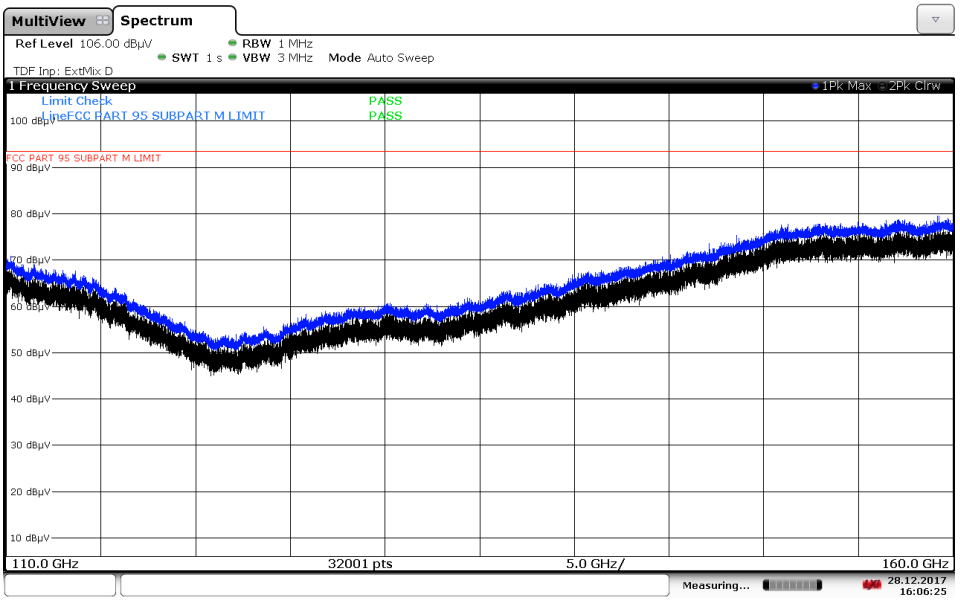
75 to 110 GHz Mid Channel 425 MHz BW



18:12:59 27.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

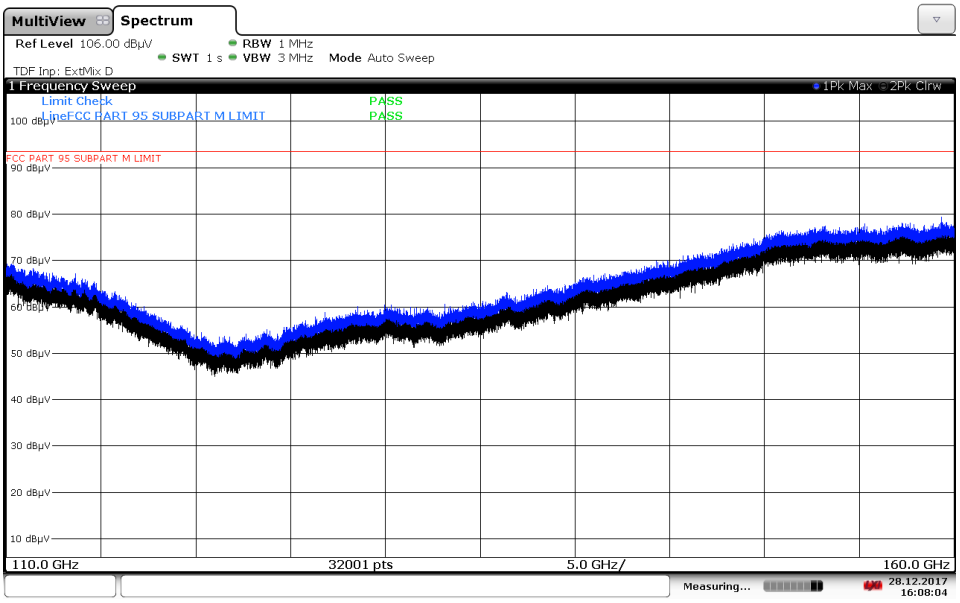
75 to 110 GHz High Channel 425 MHz BW



16:06:25 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

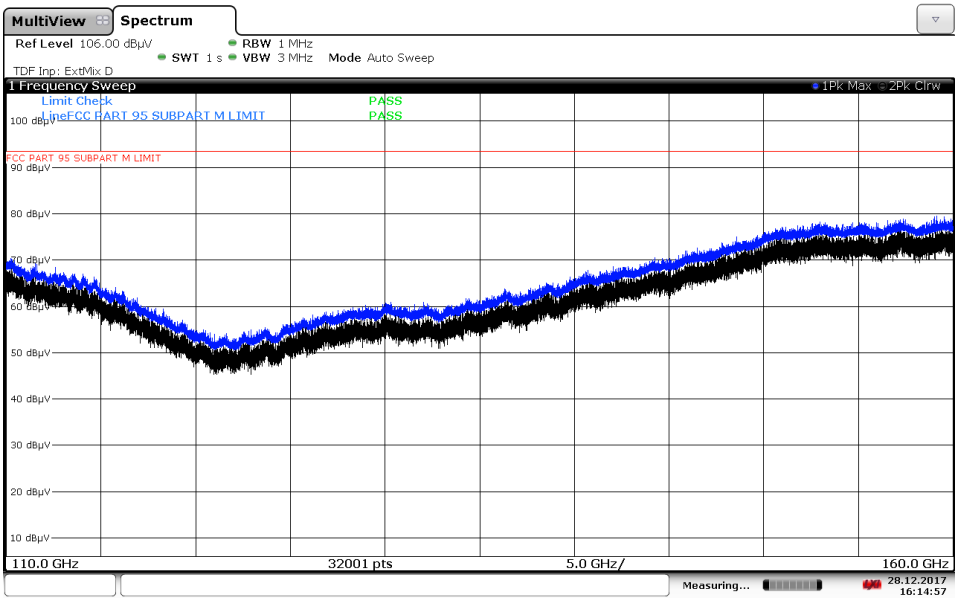
110 to 160 GHz Low Channel 175 MHz BW



16:08:04 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

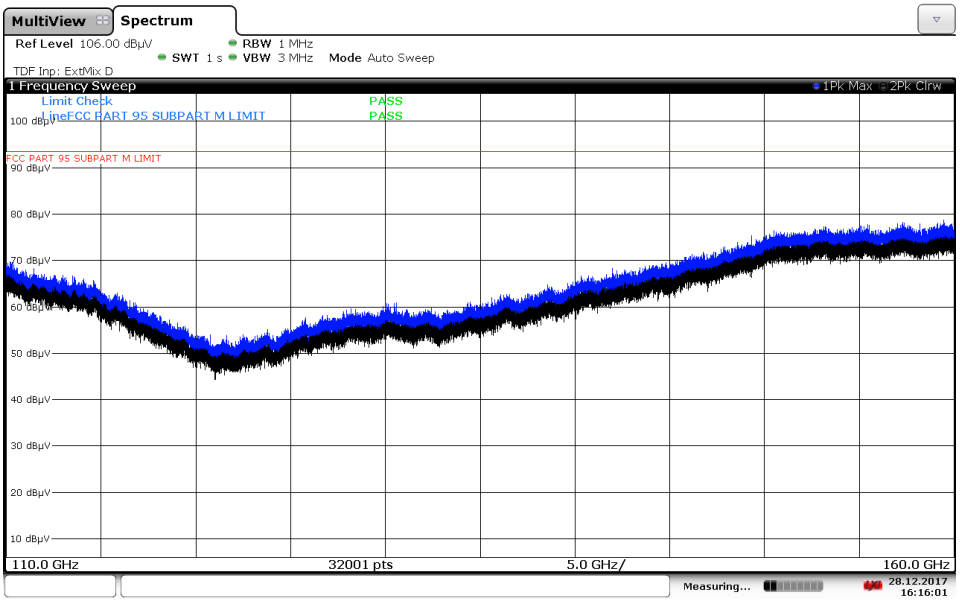
110 to 160 GHz Mid Channel 175 MHz BW



16:14:58 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

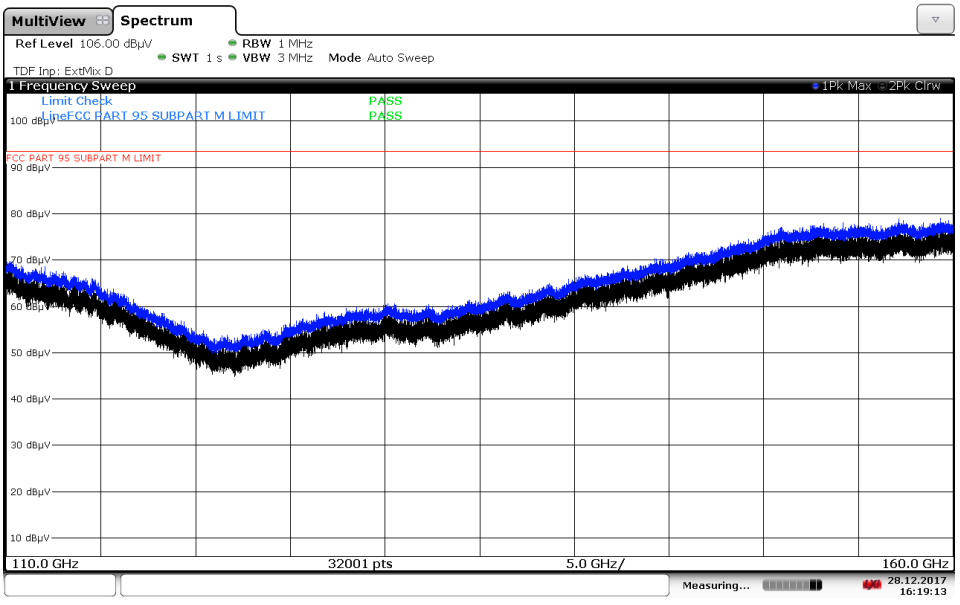
110 to 160 GHz High Channel 175 MHz BW



16:16:02 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

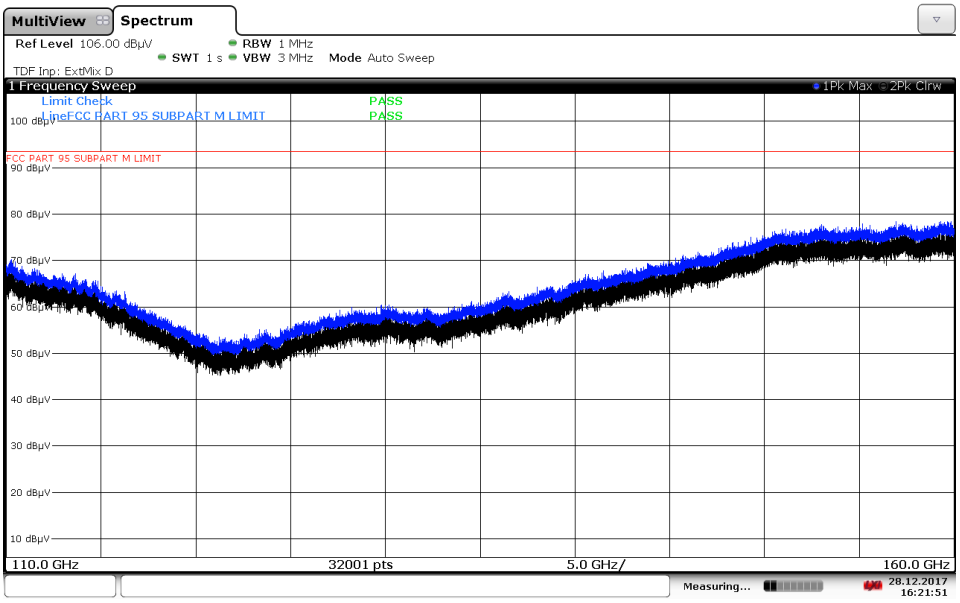
110 to 160 GHz Low Channel 300 MHz BW



16:19:13 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

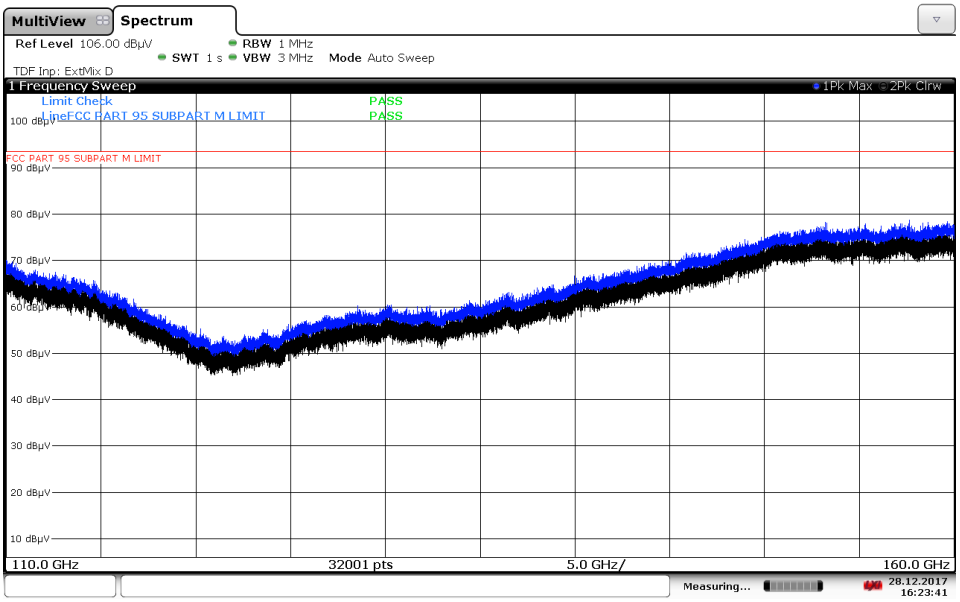
110 to 160 GHz Mid Channel 300 MHz BW



16:21:51 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

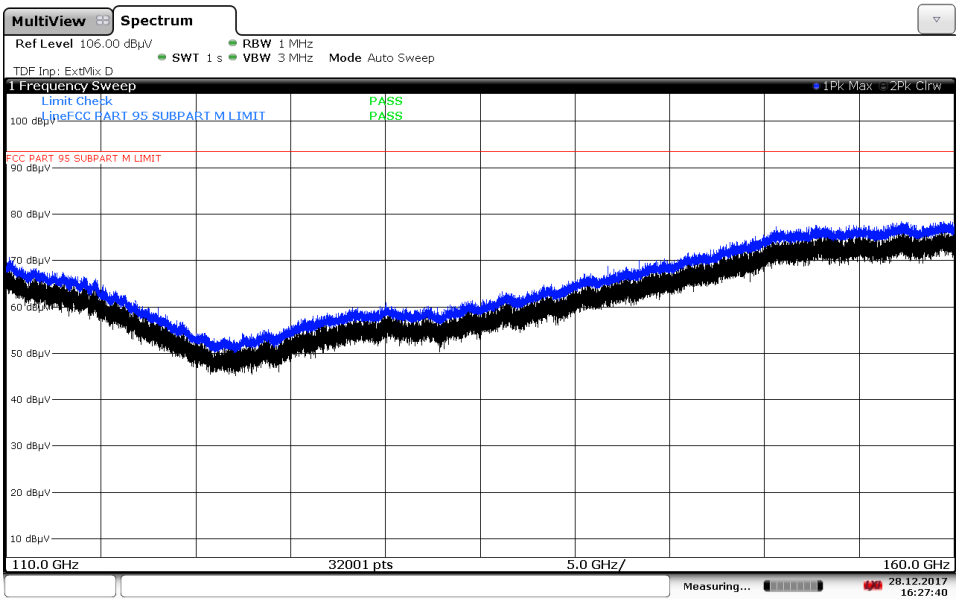
110 to 160 GHz High Channel 300 MHz BW



16:23:41 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

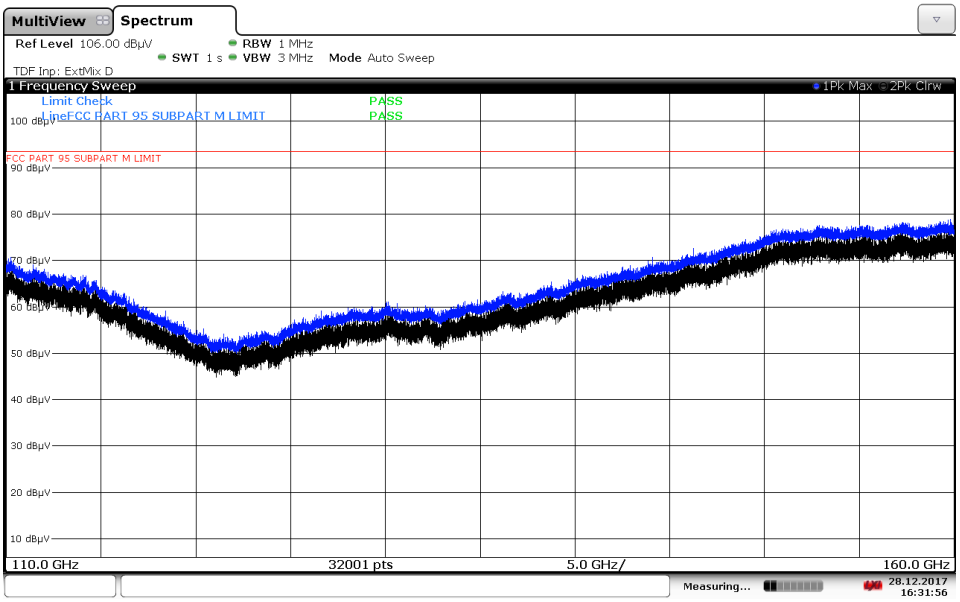
110 to 160 GHz Low Channel 425 MHz BW



16:27:41 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

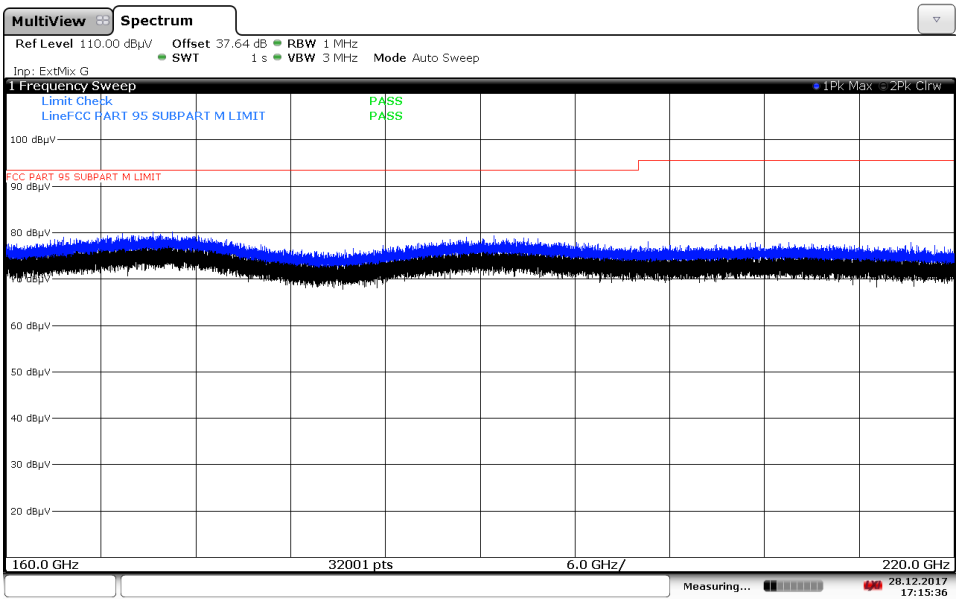
110 to 160 GHz Mid Channel 425 MHz BW



16:31:57 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

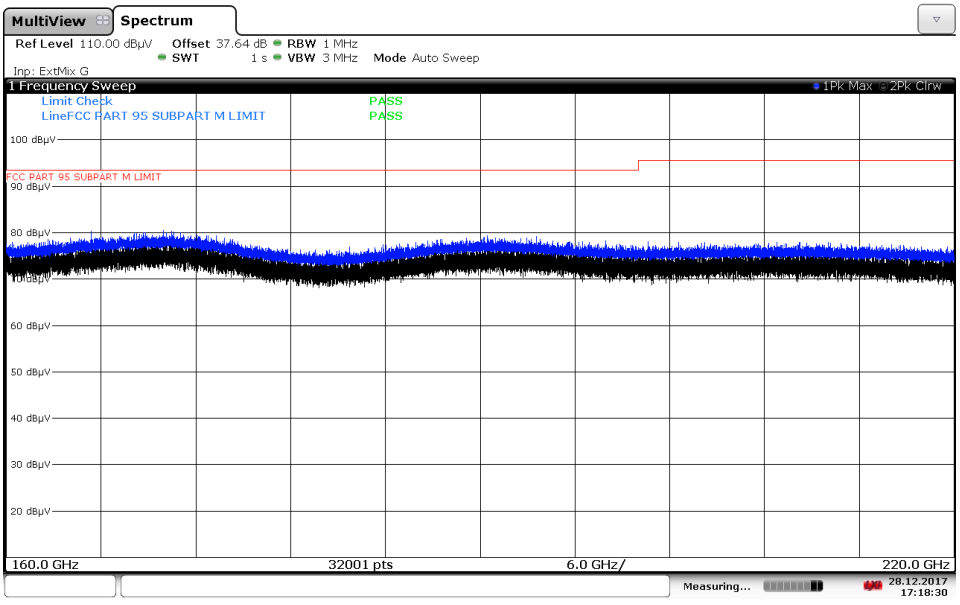
110 to 160 GHz High Channel 425 MHz BW



17:15:36 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

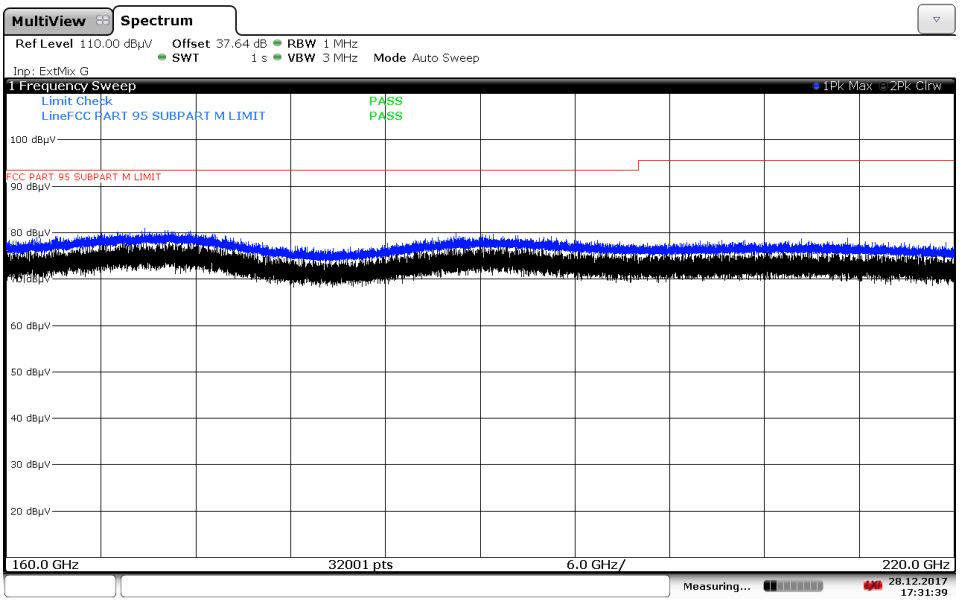
160 to 220 GHz Low Channel 175 MHz BW



17:18:30 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

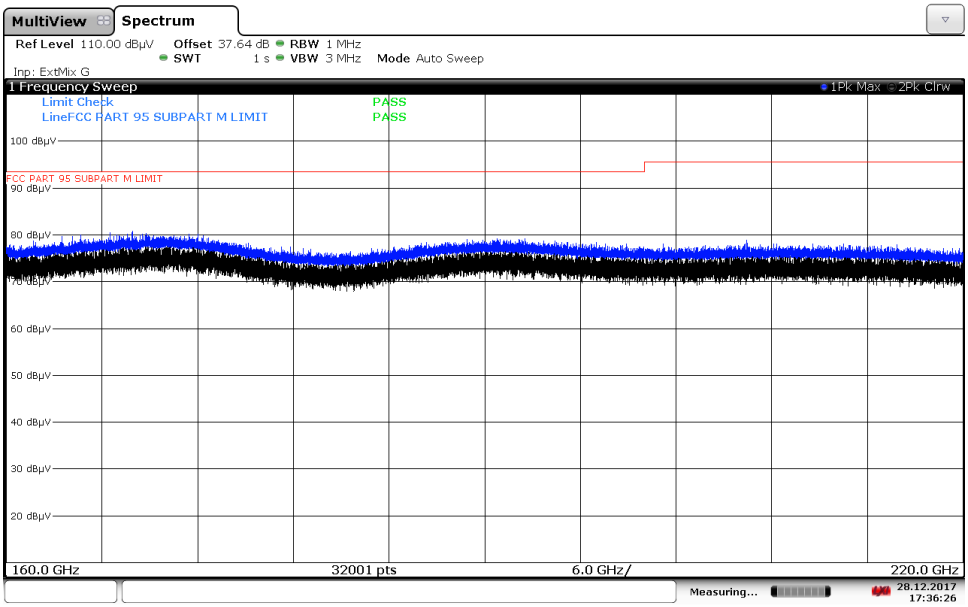
160 to 220 GHz Mid Channel 175 MHz BW



17:31:39 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

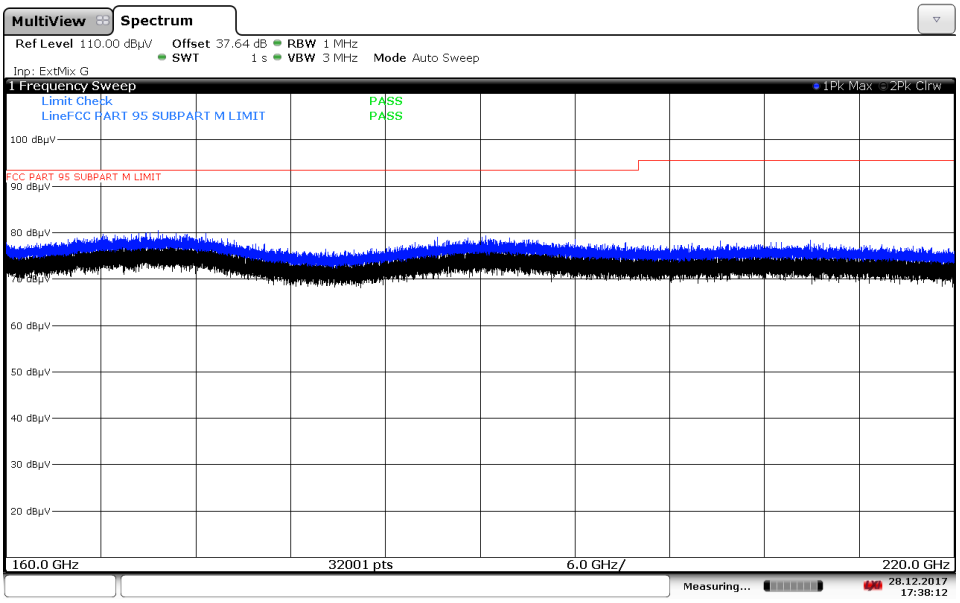
160 to 220 GHz High Channel 175 MHz BW



17:36:26 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

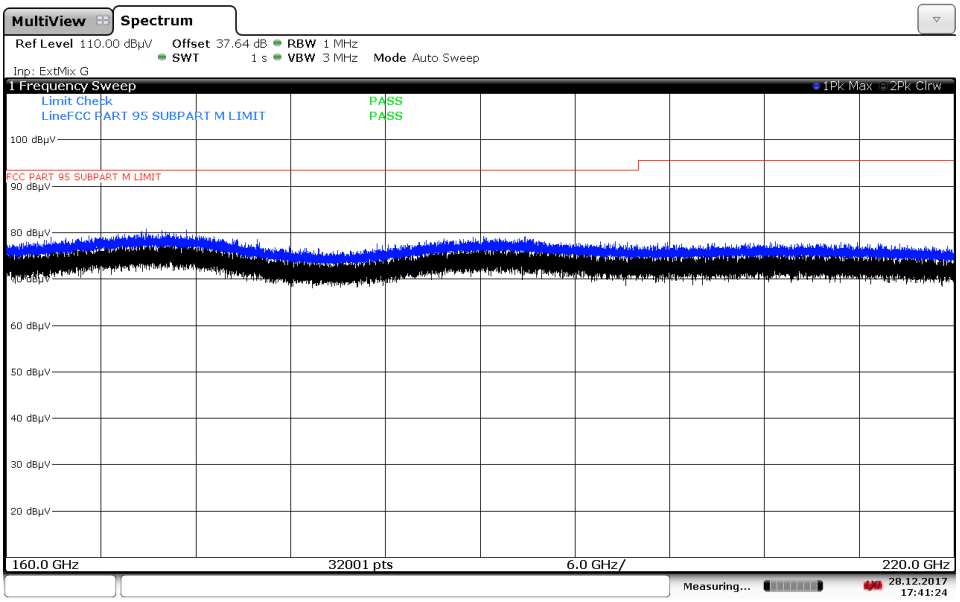
160 to 220 GHz Low Channel 300 MHz BW



17:38:12 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

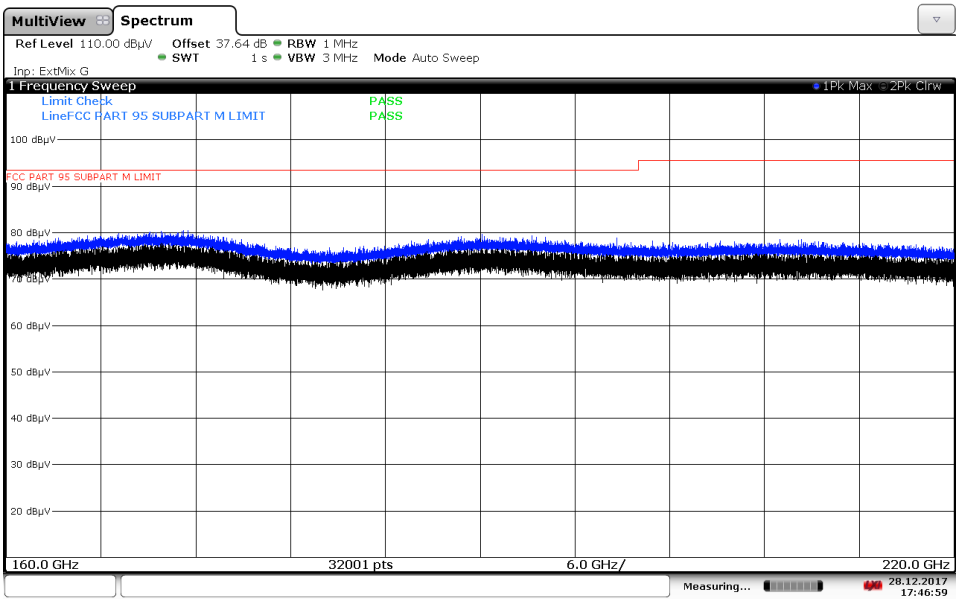
160 to 220 GHz Mid Channel 300 MHz BW



17:41:25 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

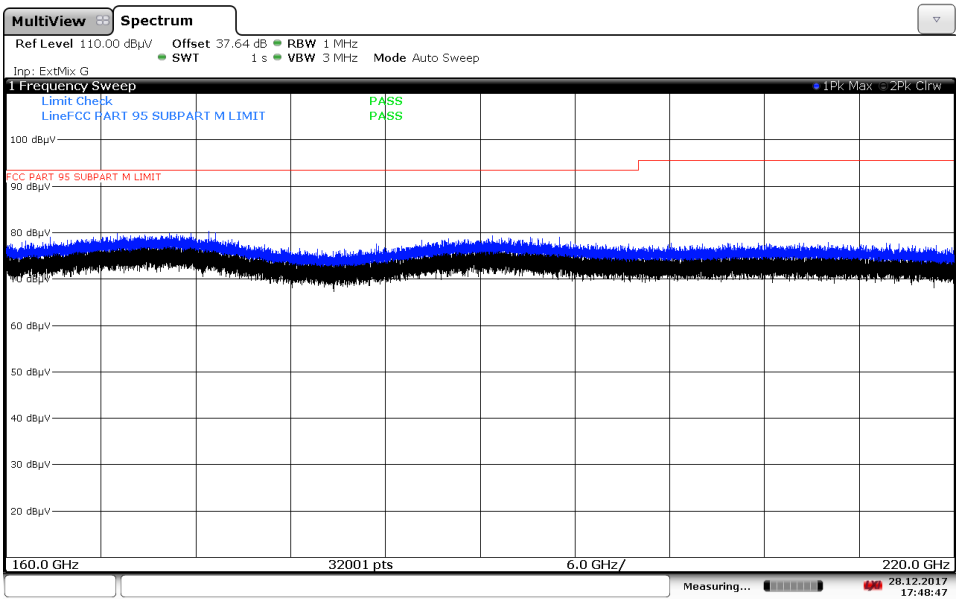
160 to 220 GHz High Channel 300 MHz BW



17:46:59 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

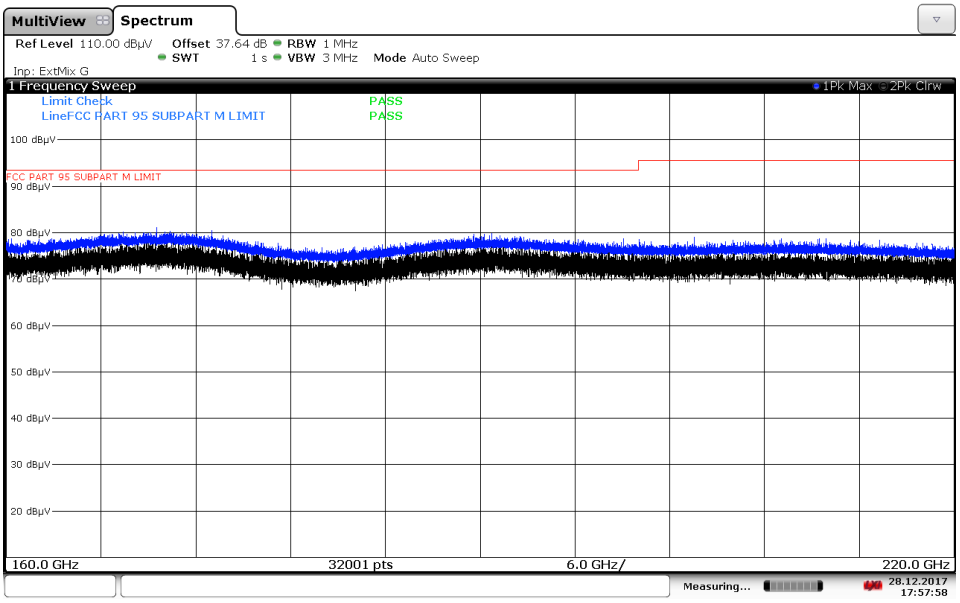
160 to 220 GHz Low Channel 425 MHz BW



17:48:47 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

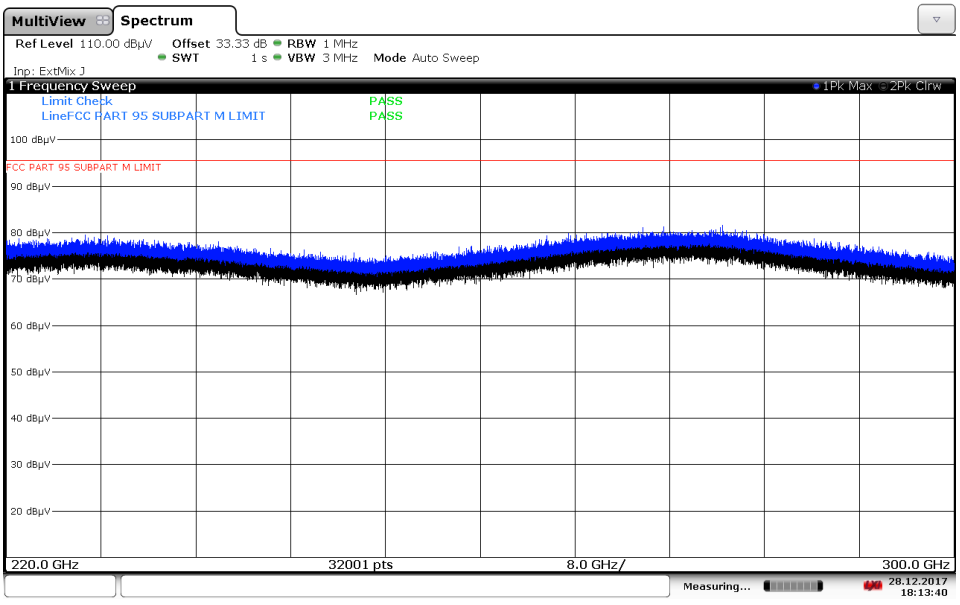
160 to 220 GHz Mid Channel 425 MHz BW



17:57:59 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

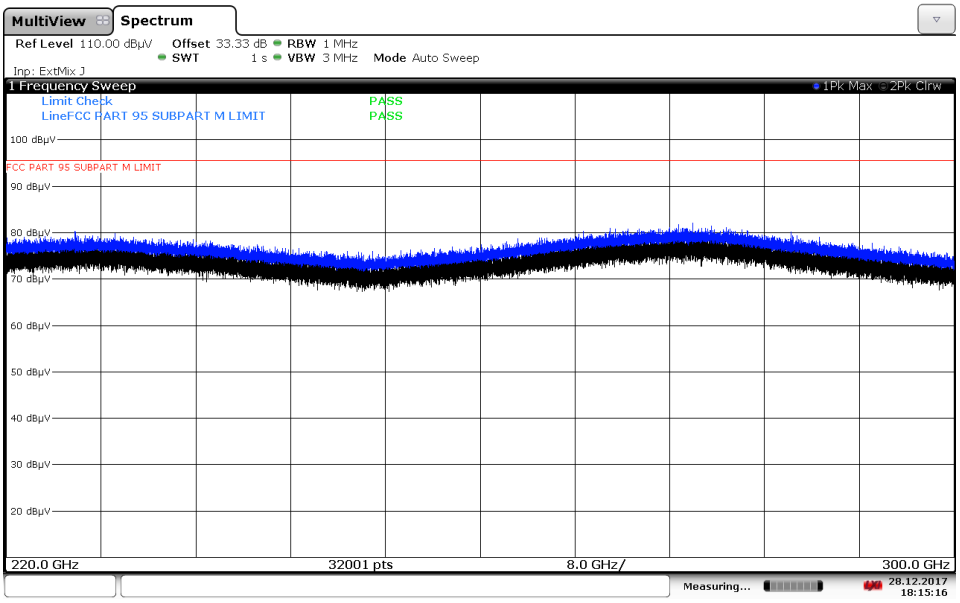
160 to 220 GHz High Channel 425 MHz BW



18:13:40 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

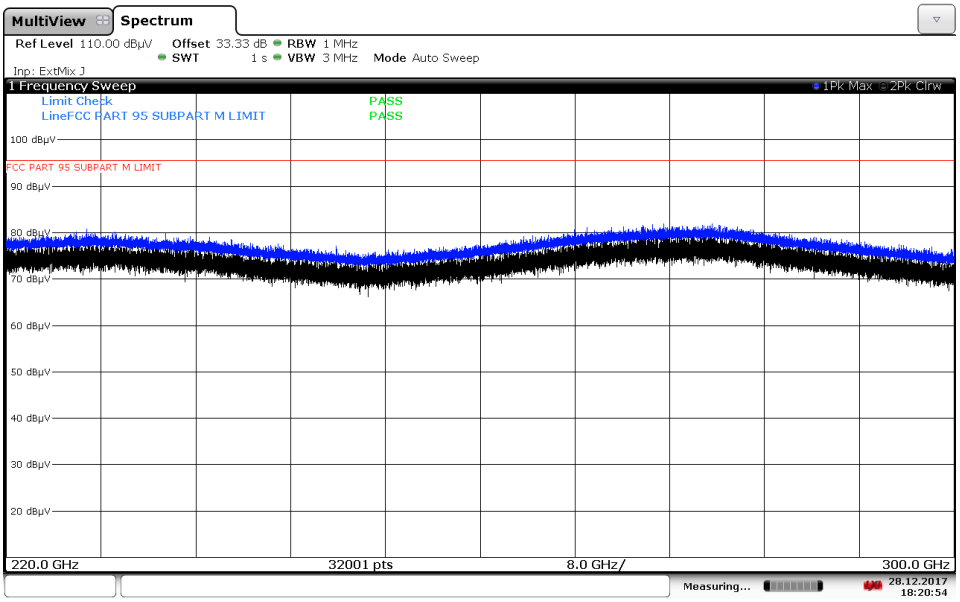
220 to 300 GHz Low Channel 175 MHz BW



18:15:17 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

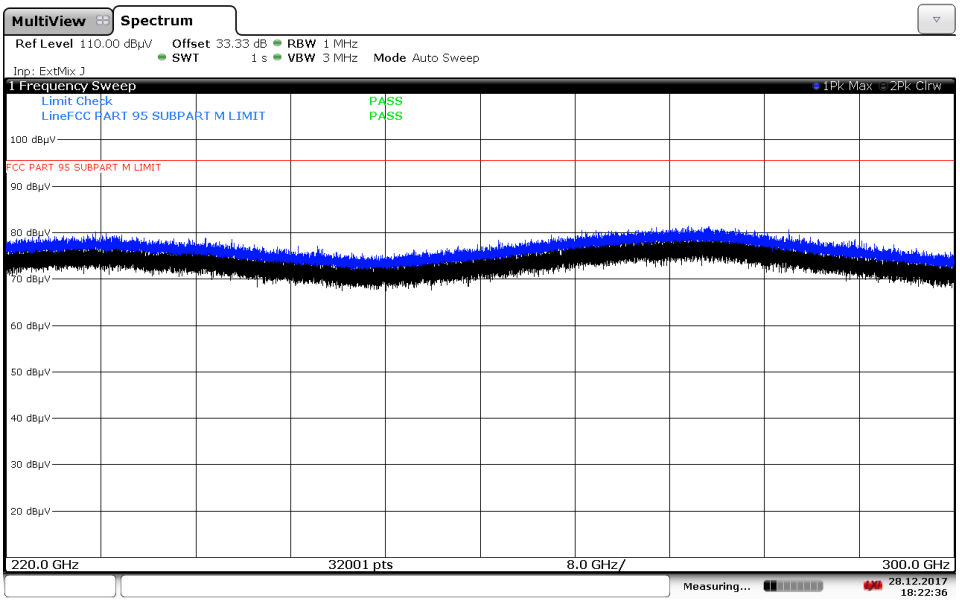
220 to 300 GHz Mid Channel 175 MHz BW



18:20:54 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

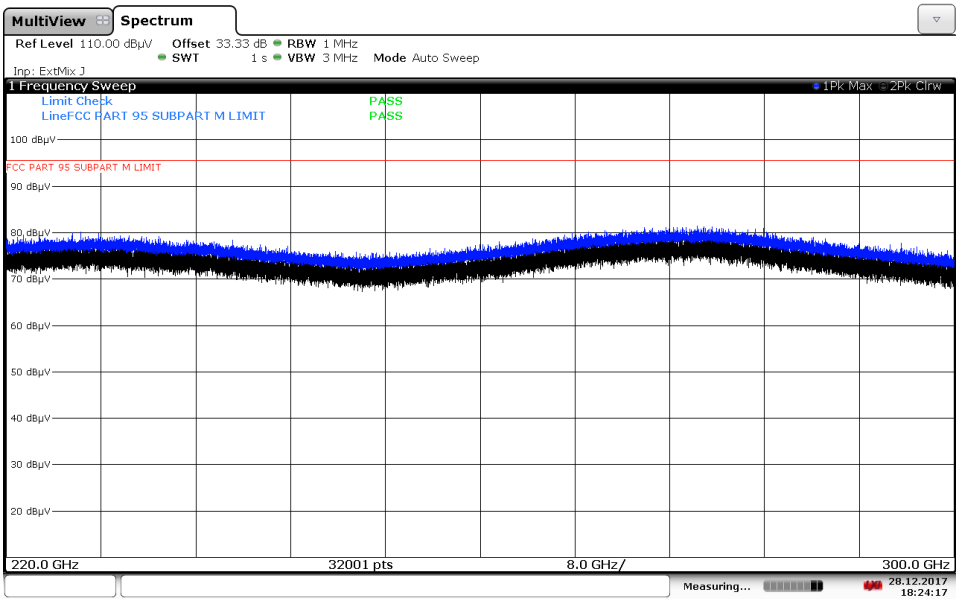
220 to 300 GHz High Channel 175 MHz BW



18:22:37 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

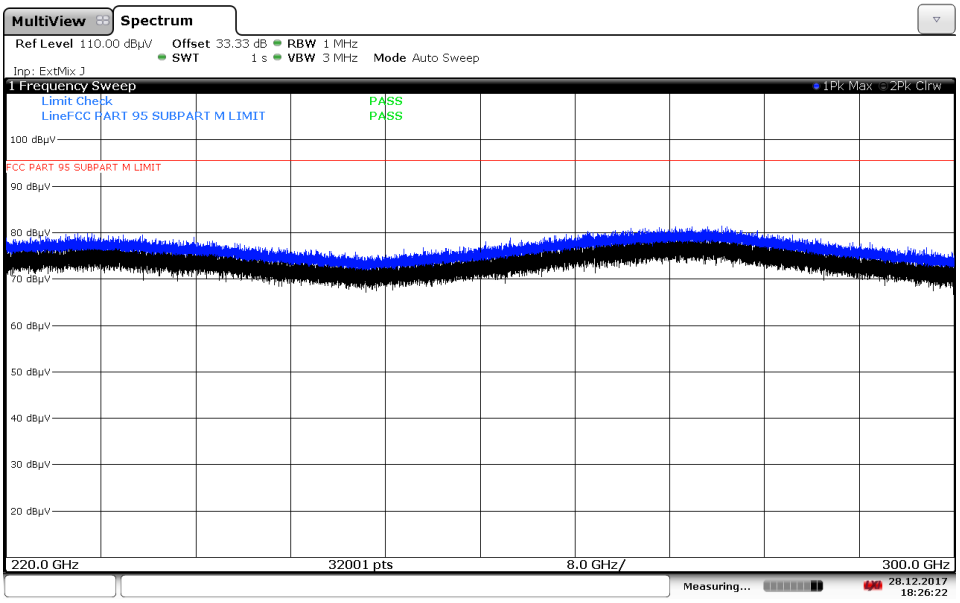
220 to 300 GHz Low Channel 300 MHz BW



18:24:17 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

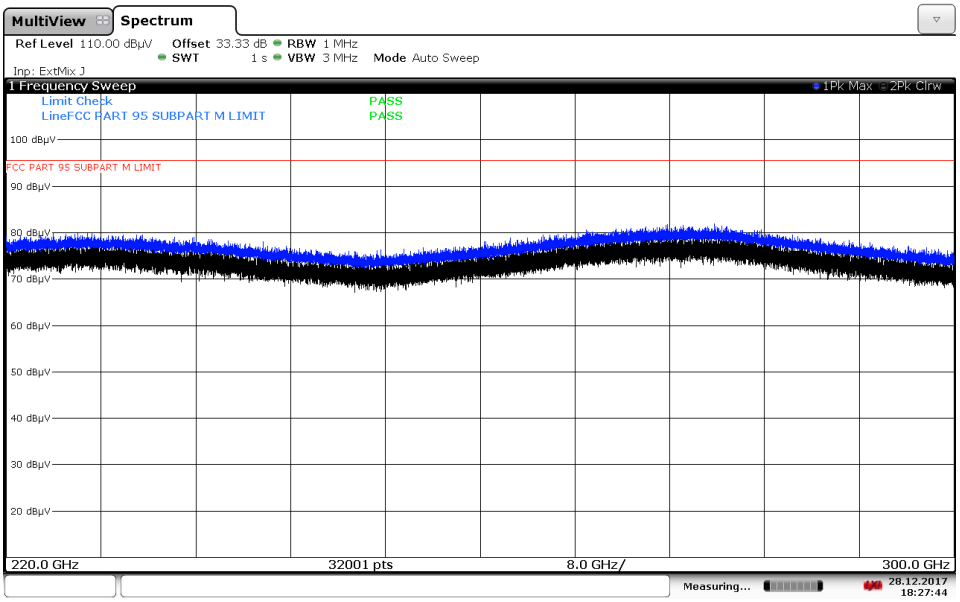
220 to 300 GHz Mid Channel 300 MHz BW



18:26:22 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

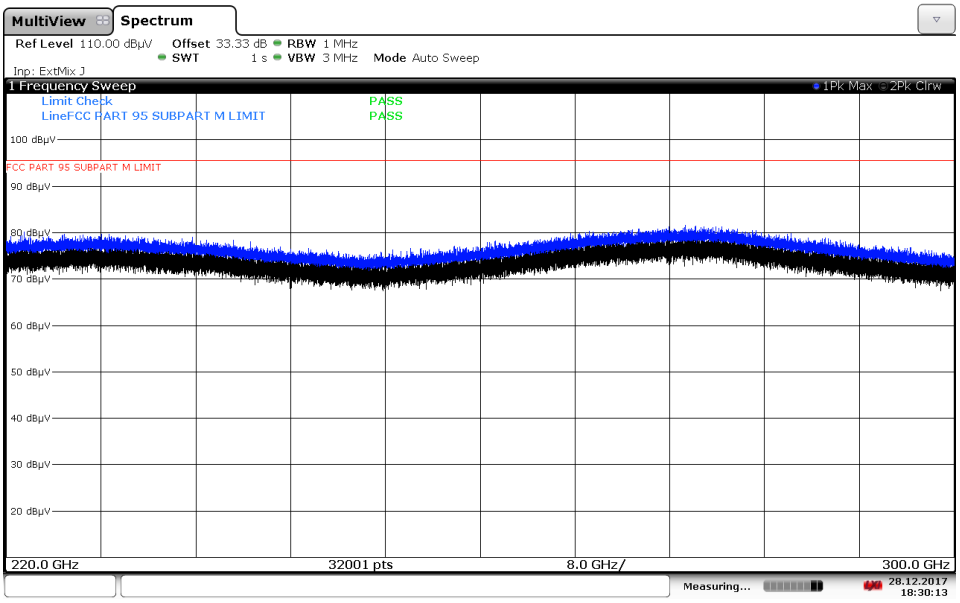
220 to 300 GHz High Channel 300 MHz BW



18:27:44 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

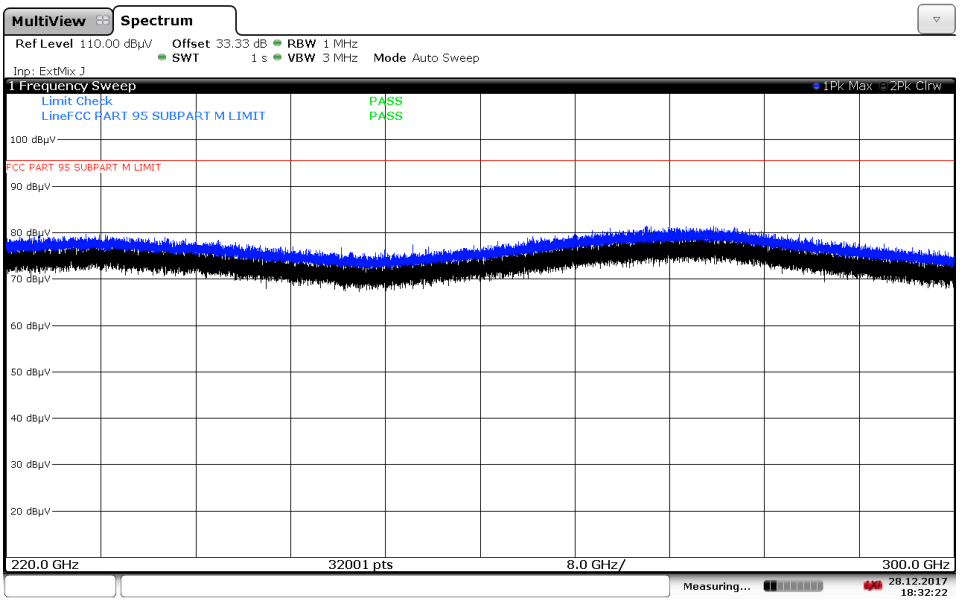
220 to 300 GHz Low Channel 425 MHz BW



18:30:13 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

220 to 300 GHz Mid Channel 425 MHz BW



18:32:22 28.12.2017

**Test Note: FCC limits are identical to LP002 limits in section 2.2.2*

220 to 300 GHz High Channel 425 MHz BW

2.3 FREQUENCY STABILITY

2.3.1 Specification Reference

LP0002 Clause 3.14.1.4

2.3.2 Standard Applicable

Fundamental emissions must be contained within the frequency band during all conditions of operation. Equipment is presumed to operate over the temperature range −20 to 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.

2.3.3 Equipment Under Test and Modification State

Serial No: 286606920 / Default Test Configuration

2.3.4 Date of Test/Initial of test personnel who performed the test

January 02, 2018/IR

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions/Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	24.2°C
Relative Humidity	39.1%
ATM Pressure	99.5 kPa

2.3.7 Additional Observations

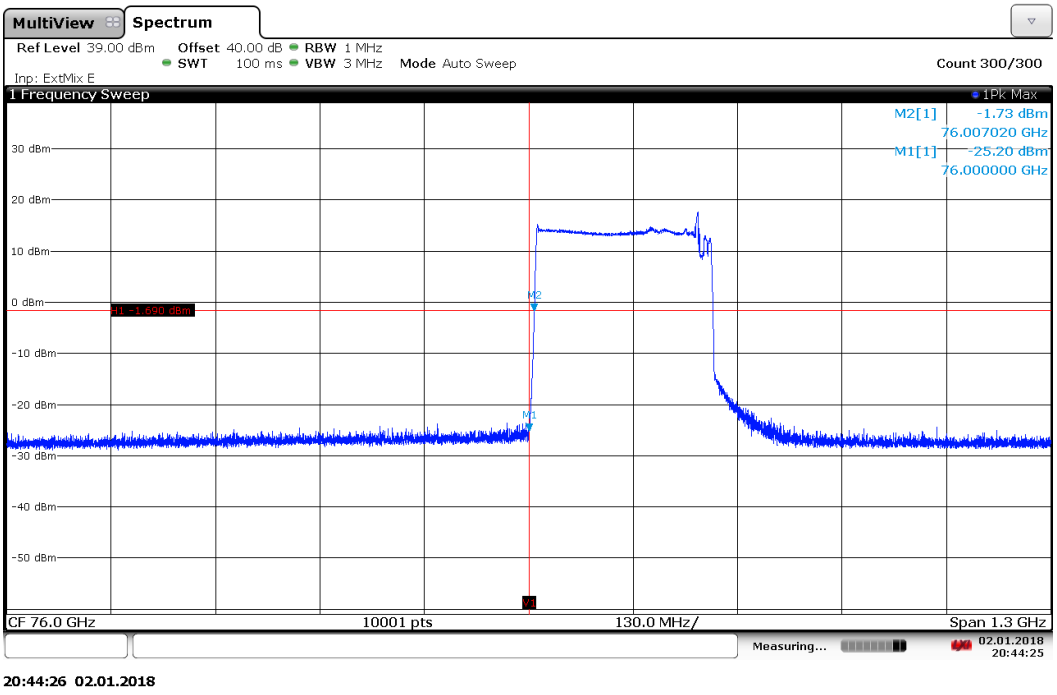
- EUT has no antenna port available. The measurements under this section were performed using radiated measurement method.
- Extreme temperature range used is -30°C to +85°C. During test the EUT spectrum was monitored in the entire temperature range but only the data obtained at extreme temperatures is presented as worst case results.
- Extreme test source voltage used is 10.2 VDC and 13.8 VDC (85 % and 115 % of nominal voltage). No considerable frequency variations were observed at extreme supply voltages.
- An offset of 40.0 dB was added to account for the test setup loss.
- RBW is 1 MHz while VBW is 3 MHz
- Detector is Peak
- Trace is Max Hold
- During the test low and high frequencies (f_L and f_H) of the signal spectrum were monitored. The applicable spurious emissions limit was used to define f_L and f_H.

2.3.8 Test Results

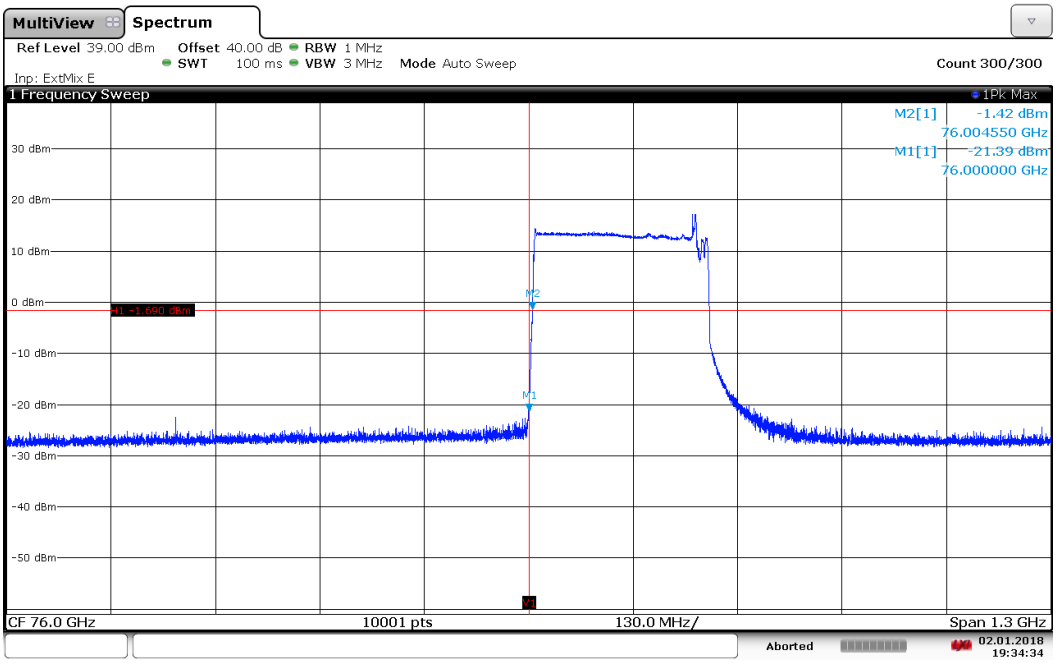
Temperature variation

Modulation BW	Temperature	Frequency Low f_L (GHz)	Frequency High f_H (GHz)
175 MHz	85°C	**76.003900**	76.9737400
	20°C	76.004550	76.981600
	-30°C	76.007020	76.979750
300 MHz	85°C	76.005330	76.936050
	20°C	76.005200	76.943130
	-30°C	76.007800	76.948660
425 MHz	85°C	76.006370	76.931690
	20°C	76.006760	76.940660
	-30°C	76.009100	**76.947490**
f_L=76.003900 GHz > 76.0 GHz f_H=76.947490 GHz < 77.0 GHz EUT Complies			

2.3.9 Test Plots

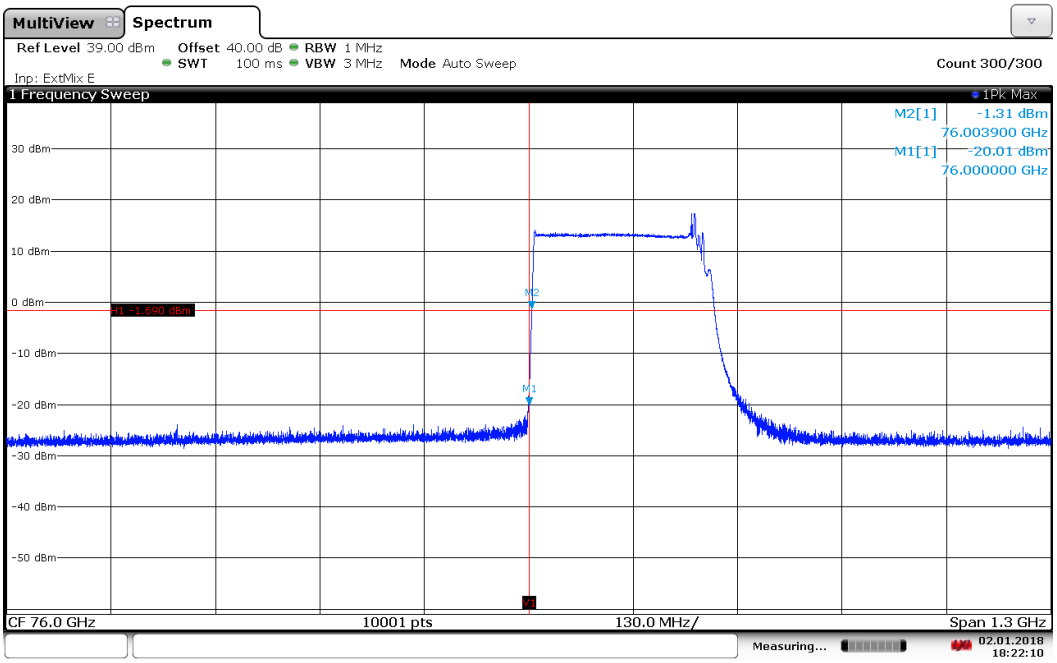


-30 DEG 12.0 VDC Low channel 175 MHz BW



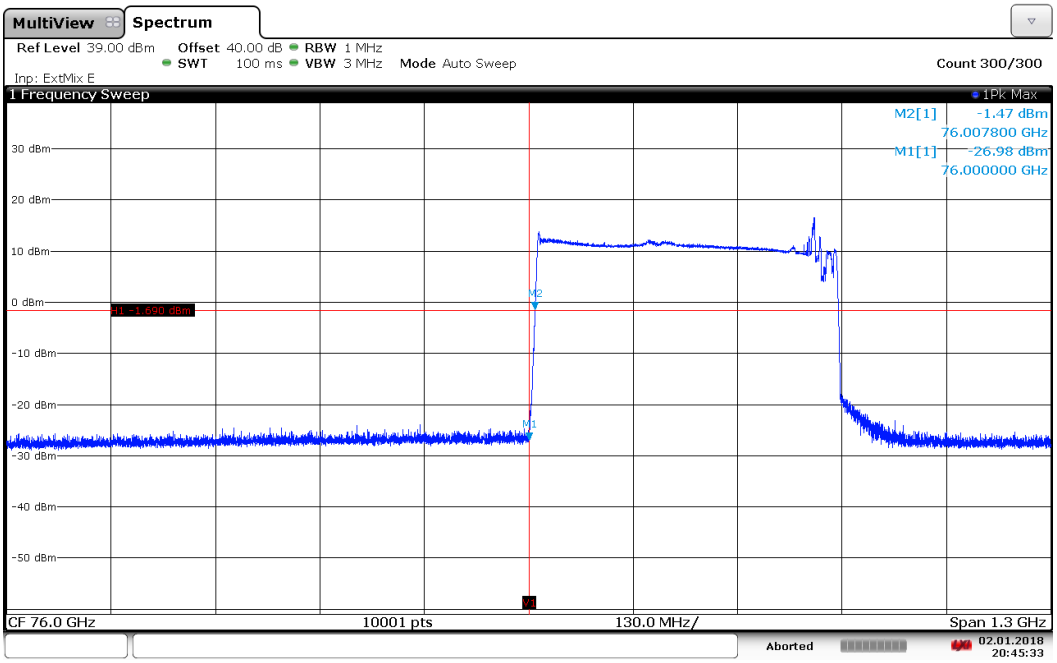
19:34:35 02.01.2018

20 DEG 10.2/12.0/13.8 VDC Low channel 175 MHz BW



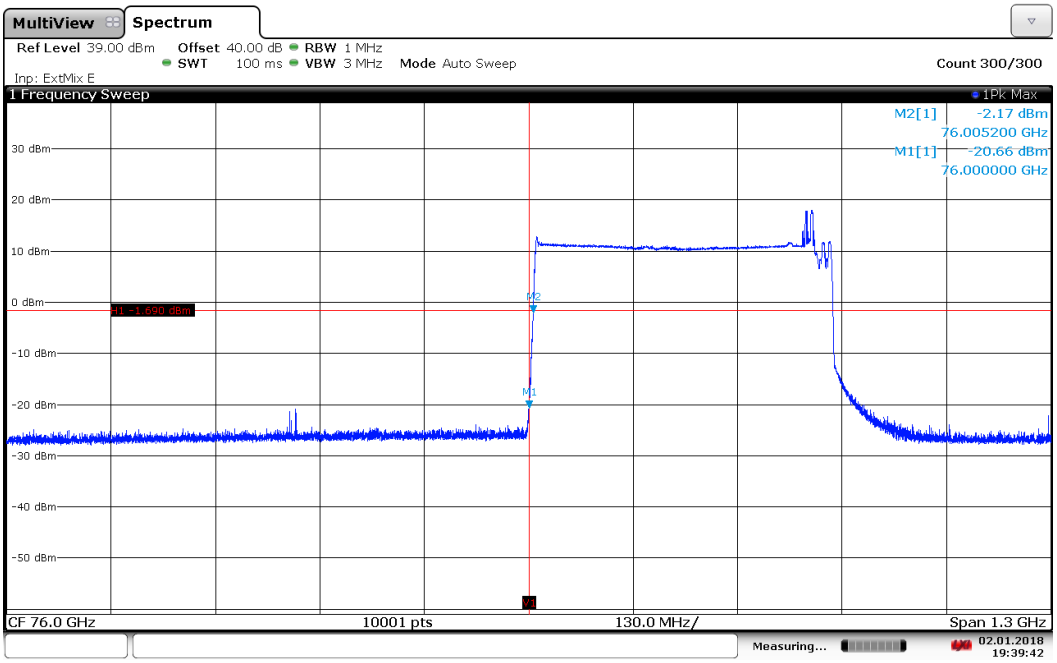
18:22:10 02.01.2018

85 DEG 12.0 VDC Low channel 175 MHz BW



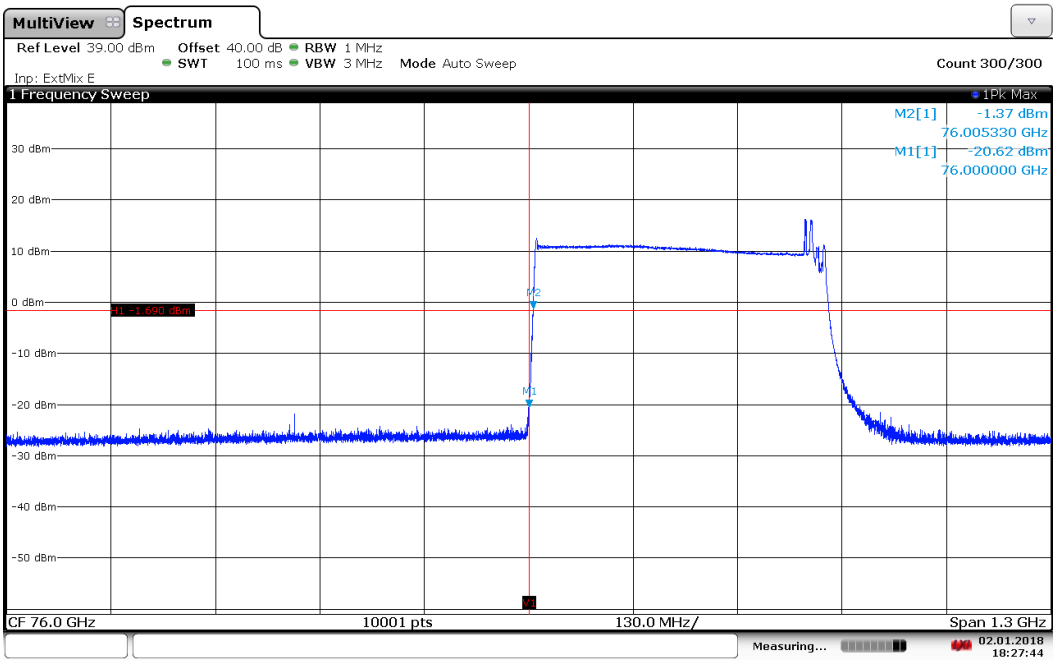
20:45:34 02.01.2018

-30 DEG 12 VDC Low channel 300 MHz BW



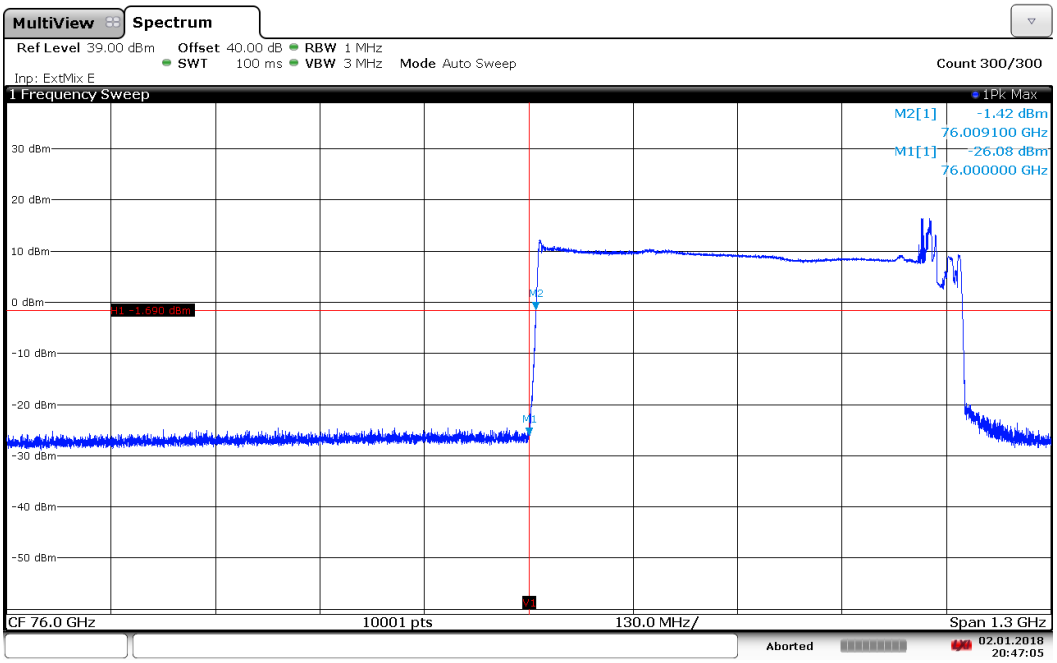
19:39:42 02.01.2018

20 DEG 10.2/12.0/13.8 VDC Low channel 300 MHz BW



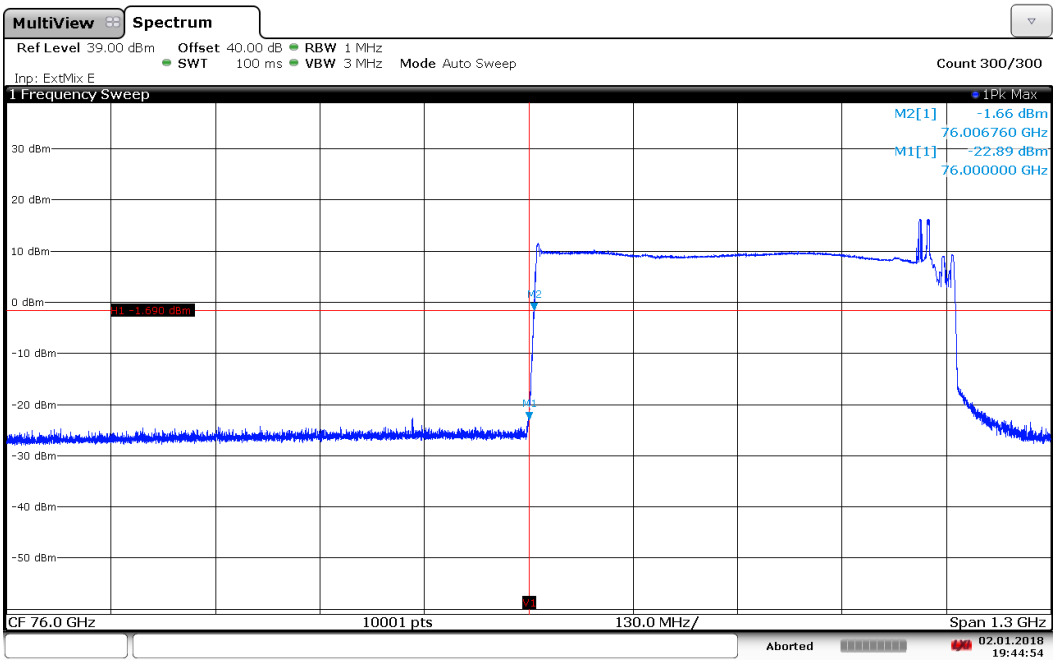
18:27:44 02.01.2018

85 DEG 12.0 VDC Low channel 300 MHz BW



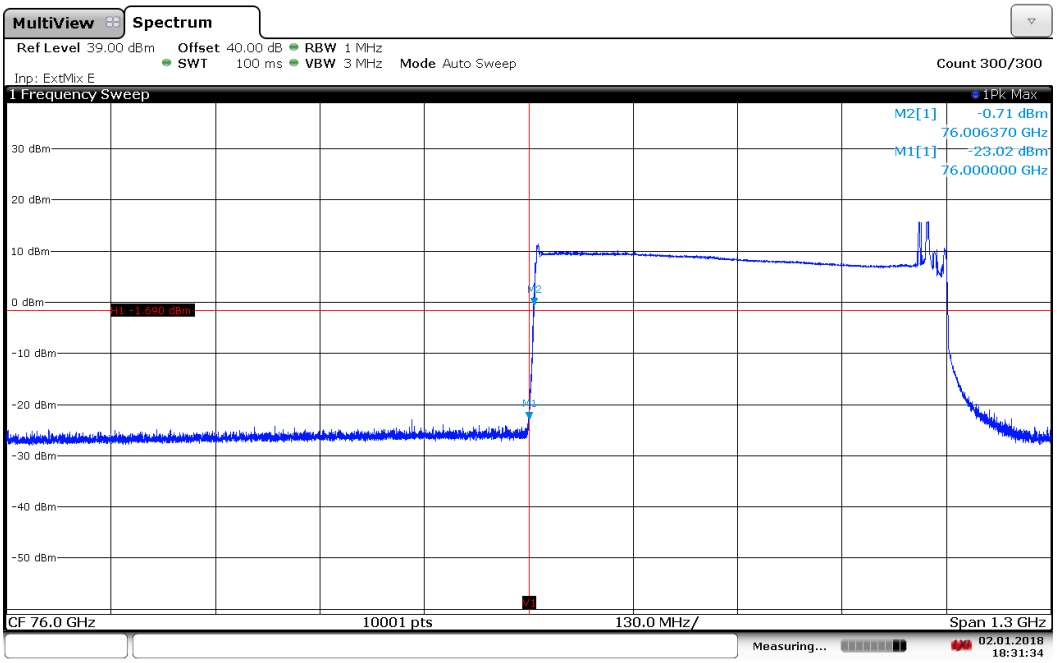
20:47:05 02.01.2018

-30 DEG 12.0 VDC Low channel 425 MHz BW



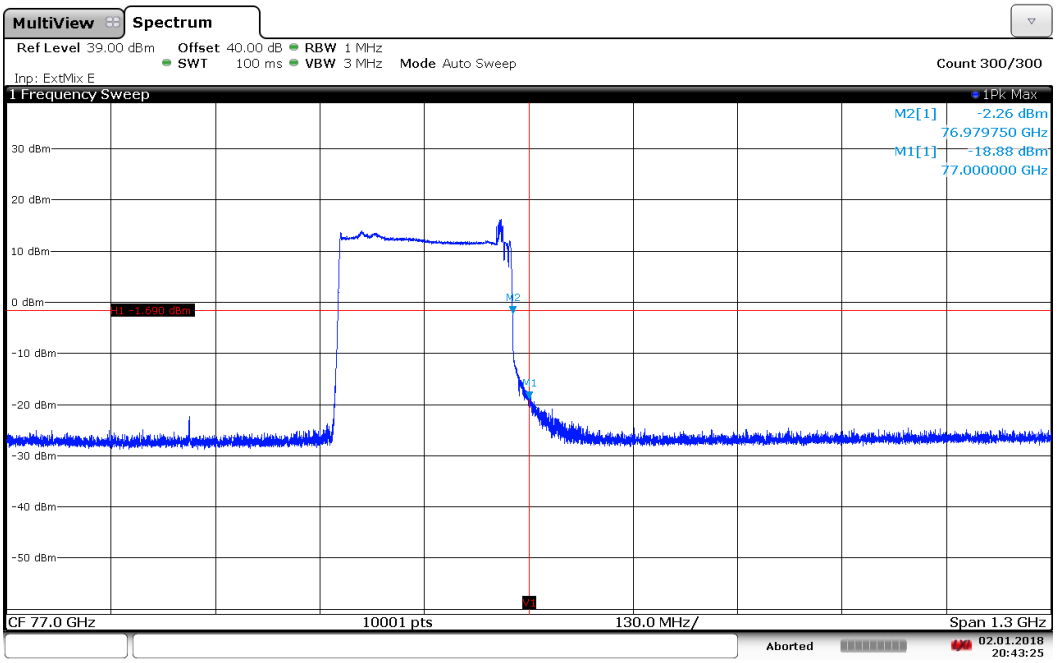
19:44:55 02.01.2018

20 DEG 10.2/12.0/13.8 VDC Low channel 425 MHz BW



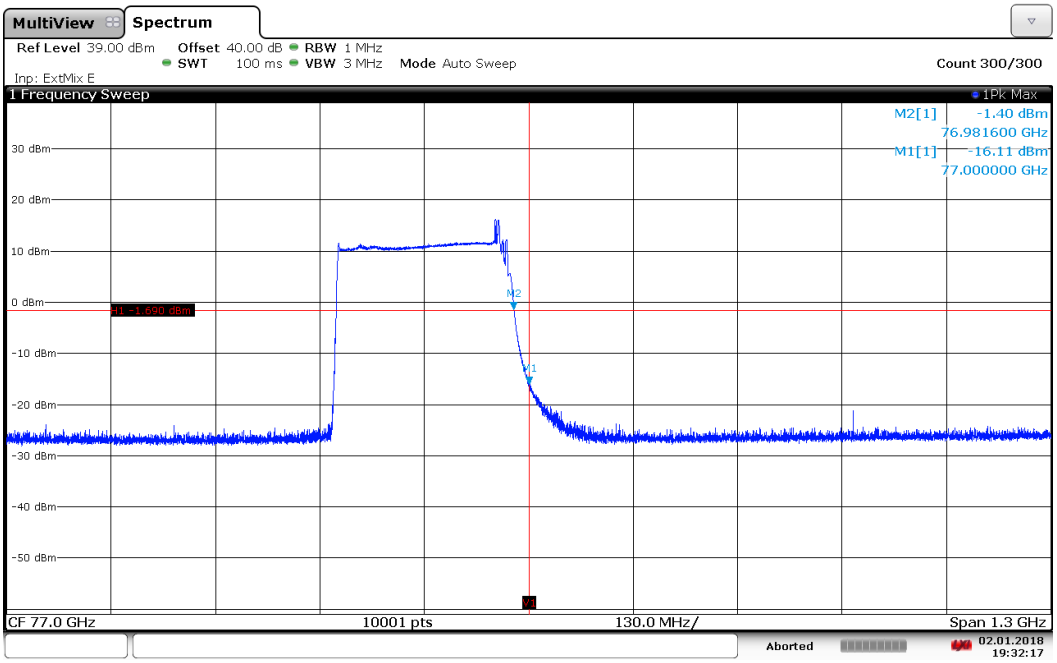
18:31:35 02.01.2018

85 DEG 12.0 VDC Low channel 425 MHz BW



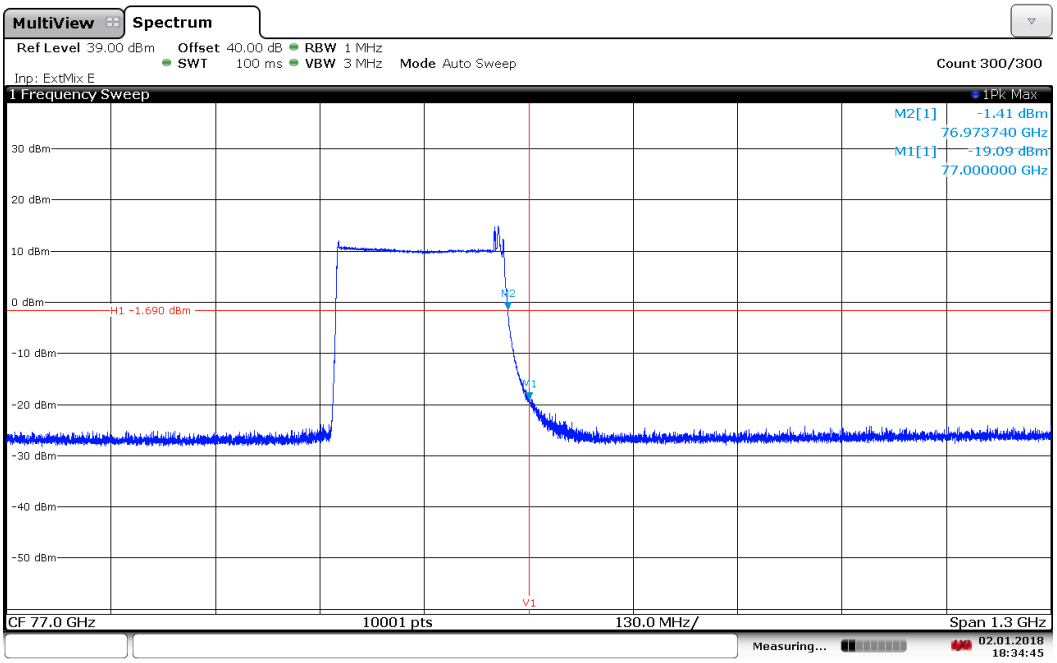
20:43:26 02.01.2018

-30 DEG 12.0 VDC High channel 175 MHz BW



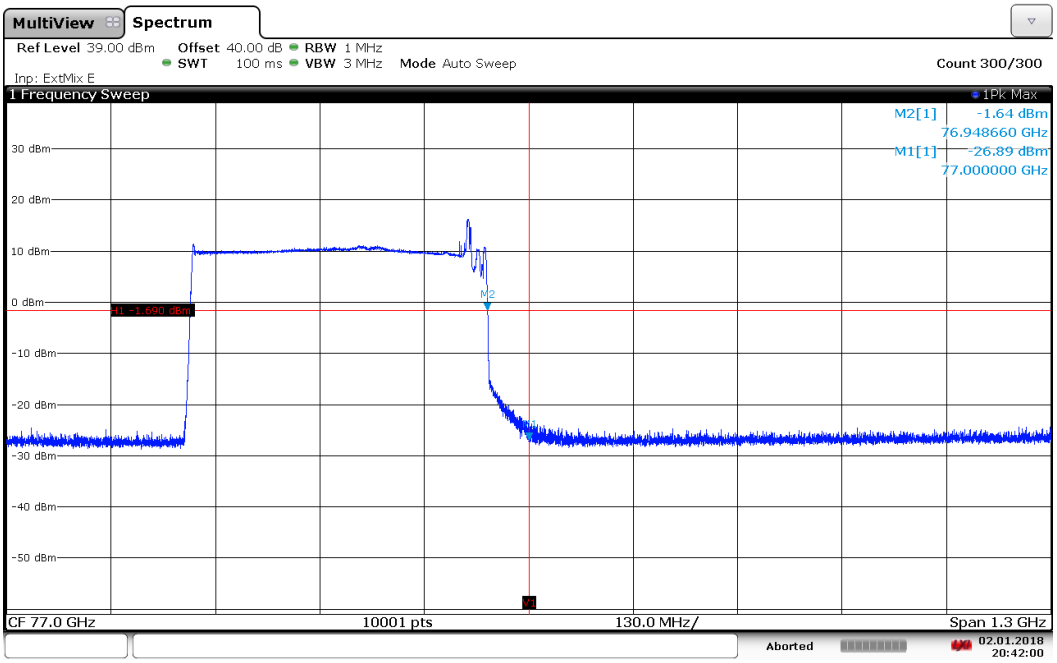
19:32:18 02.01.2018

20 DEG 10.2/ 12.0/13.8 VDC High channel 175 MHz BW



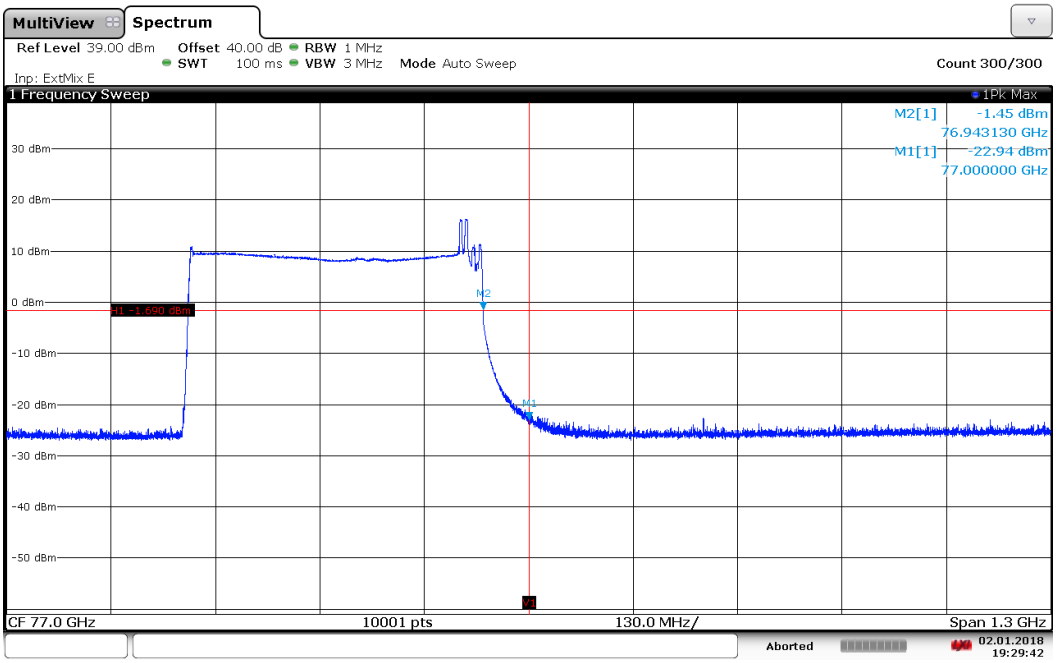
18:34:45 02.01.2018

85 DEG 12.0 VDC High channel 175 MHz BW

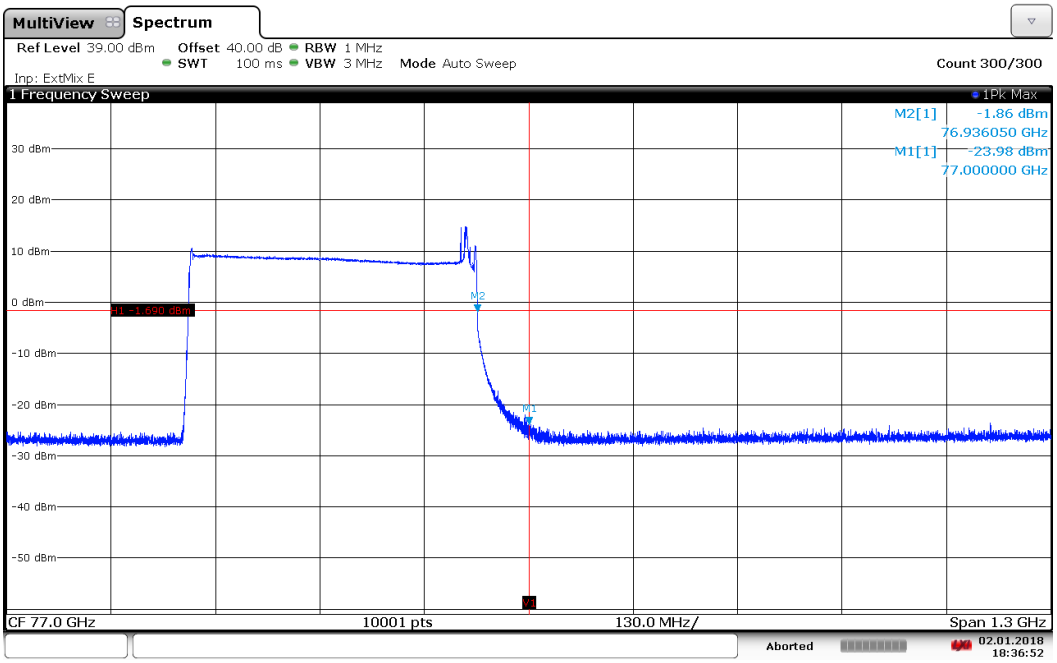


20:42:01 02.01.2018

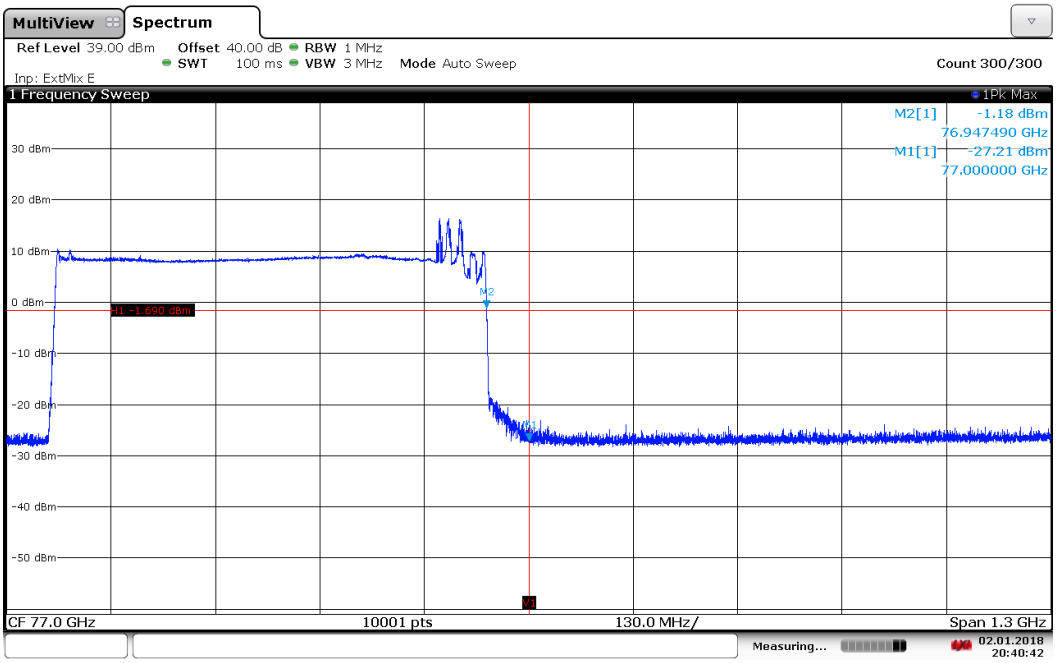
-30 DEG 12.0 VDC High channel 300 MHz BW



20 DEG 10.2/12.0/13.8 VDC High channel 300 MHz BW

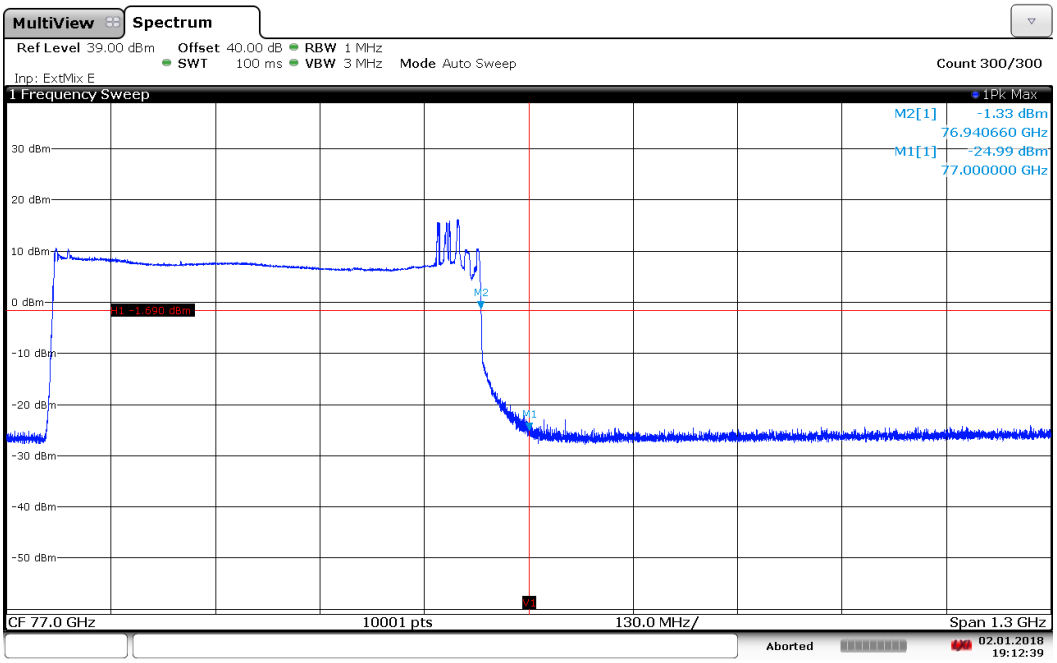


85 DEG 12.0 VDC High channel 300 MHz BW



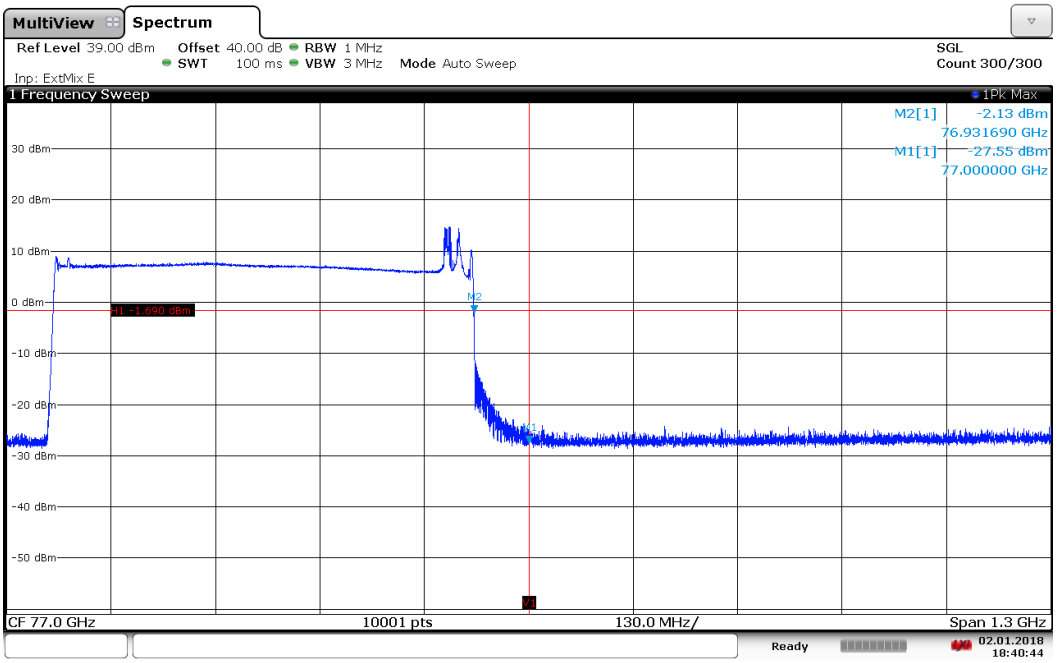
20:40:42 02.01.2018

-30 DEG 12.0 VDC High channel 425 MHz BW



19:12:40 02.01.2018

20 DEG 10.2/12.0/13.8 VDC High channel 425 MHz BW



85 DEG 12.0 VDC High channel 425 MHz BW

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Radiated Test Setup						
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	05/16/17	05/16/18
7611	Signal/Spectrum Analyzer	FSW26	102017	Rhode & Schwarz	04/25/17	04/25/18
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	11/20/17	11/20/19
8891	Pre-Amplifier	PE15A3262	1012	TUV SUD America	06/15/17	06/15/18
7631	Double-ridged waveguide horn antenna	3117	00205418	ETS-Lindgren	08/03/17	08/03/18
9001	Horn antenna (18-26 GHz)	HO42S	101	Custom Microwaves	08/18/17	08/18/19
9002	Horn antenna (26-40 GHz)	HO28S	102	Custom Microwaves	07/14/17	07/14/19
9003	Horn antenna (40-60 GHz)	HO19R	103	Custom Microwaves	07/19/17	07/19/19
9004	Horn antenna (50-75 GHz)	HO15R	104	Custom Microwaves	07/19/17	07/19/19
7628	Horn antenna (75-110 GHz)	SAR-2309-10-S2	13481-01	Sage Millimeter, Inc.	08/16/17	08/16/19
9081	Horn antenna (110-170 GHz)	HO6R	N/A	Custom Microwaves	Verified	
9082	Horn antenna (140-220 GHz)	HO5R	N/A	Custom Microwaves	Verified	
9080	Horn antenna (220-325 GHz)	HO3R	N/A	Custom Microwaves	Verified	
7620	EMI Test Receiver	ESU40	100399	Rhode & Schwarz	10/17/17	10/17/18
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	02/09/17	02/09/18
8893	Pre-amplifier (18-40 GHz)	SLKKa-30-6	15G27	Spacek Labs	Verified by 1003 and 7611	
7637	Harmonics mixer (40-60 GHz)	FS-Z60	100009	Rhode & Schwarz	01/26/16	01/26/18
7636	Harmonics mixer (60-90 GHz)	FS-Z90	100092	Rhode & Schwarz	Verified	
7633	Harmonics mixer (75-110 GHz)	HM-110-7	101000	Radiometer Physics	Verified	
7634	Harmonics mixer (110-170 GHz)	HM-170	0062	Radiometer Physics	05/10/16	05/10/18
7635	Harmonics mixer (170-220 GHz)	HM-220	020022	Radiometer Physics	06/10/16	06/10/18
7632	Harmonics mixer (220-325 GHz)	HM-325	020075	Radiometer Physics	06/14/16	06/14/18
8872	Direct Reading Attenuator	STA-60-19-D1	11875-01	Sage Millimeter, Inc.	Verified	
8860	Direct Reading Attenuator	STA-60-15-D1	11466-01	Sage Millimeter, Inc.	Verified	
8861	Direct Reading Attenuator	STA-60-10-D1	11466-01	Sage Millimeter, Inc.	Verified	
8873	Active Multiplier (40-60 GHz)	AMC-19-RFH00	124	Millitech, Inc.	Verified	
8914	Active Multiplier (50-75 GHz)	AMC-15-RFH00	283	Millitech, Inc.	Verified	
8915	Active Multiplier (75-110 GHz)	AMC-10-RFH00	606	Millitech, Inc.	Verified	
8922	High-frequency cable	R90-088-200	N/A	Teledyne	02/10/17	02/10/18
1026	High-frequency cable	3M-7/C2	N/A	MicroCoax	04/26/17	04/26/18
8849	High-frequency cable (1-18 GHz)	SAC-26G-6.1	363	A.H.Systems	04/23/17	04/23/18
8771	6dB attenuator	606-06-1F4/DR	N/A	MECA	10/11/17	10/11/18
Miscellaneous						
6708	Multimeter	34401A	US36086974	Hewlett Packard	07/05/17	07/05/18
7554	Barometer/Temperature/Humidity Transmitter	iBTHX-W	0400706	Omega	01/17/17	01/17/18
7579	Temperature Chamber	115	151617	TestQuity	08/22/17	08/22/18
118208	DC Power Supply	Pad 250-4.5L	29051058	Kikusui Electronics Corp.	Verified by 6708	
9076	DC Power Supply	18020M	P802039	Protek	Verified by 6708	
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Radiated Emission Measurements (Below 1 GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Triangular	3.55	1.45	2.10
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	1.69
				Coverage Factor (k):	2
				Expanded Uncertainty:	3.38

3.2.2 Radiated Emission Measurements (1 GHz to 18 GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Triangular	3.55	1.45	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

3.2.3 Radiated Emission Measurements (Above 18 GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Spectrum Analyzer/External Mixer	Rectangular	3.34	1.93	3.72
2	Cables	Rectangular	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	2.70	1.56	2.43
6	EUT Setup	Rectangular	1.50	0.87	0.75
				Combined Uncertainty (u_c):	2.67
				Coverage Factor (k):	2
				Expanded Uncertainty:	5.35

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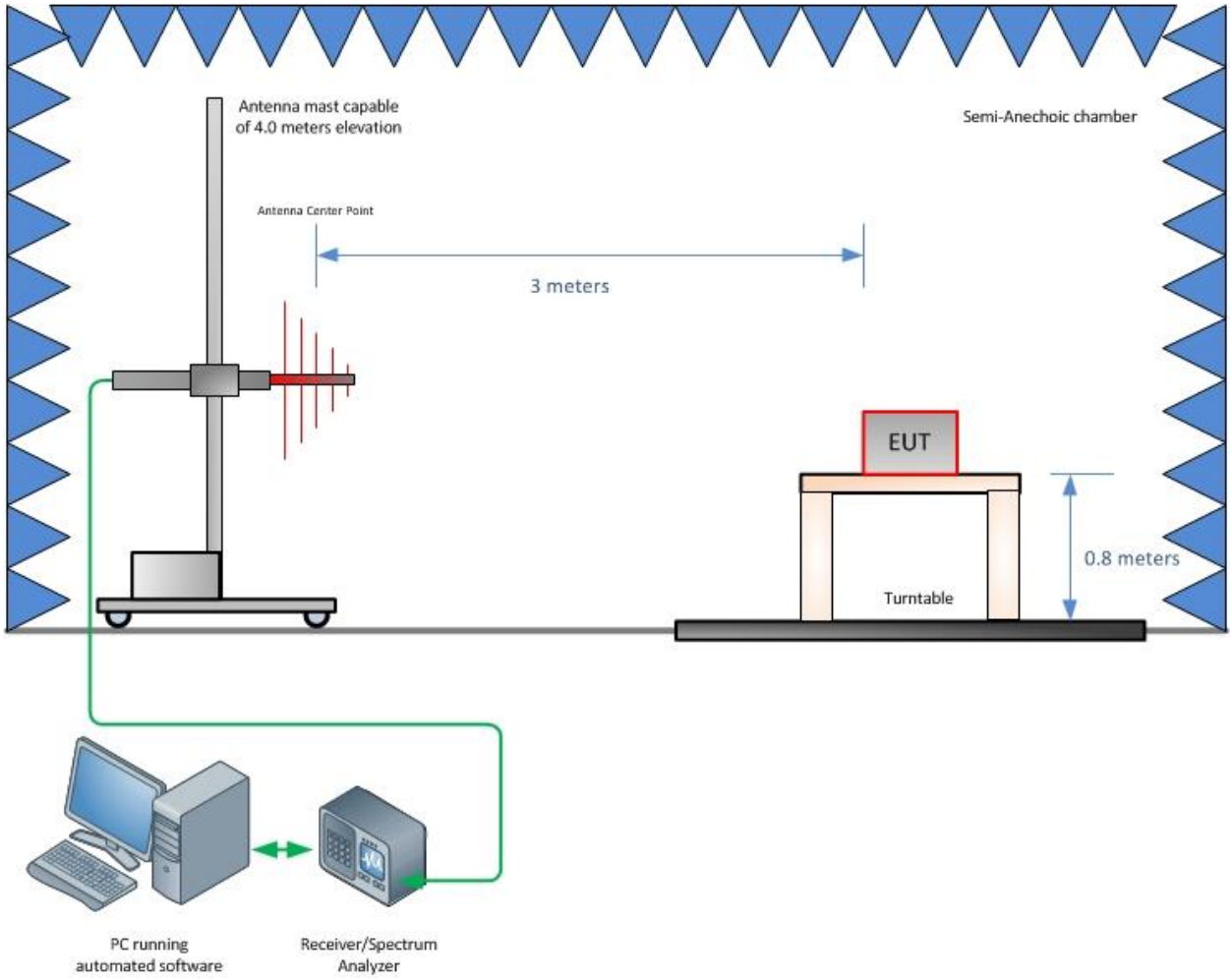
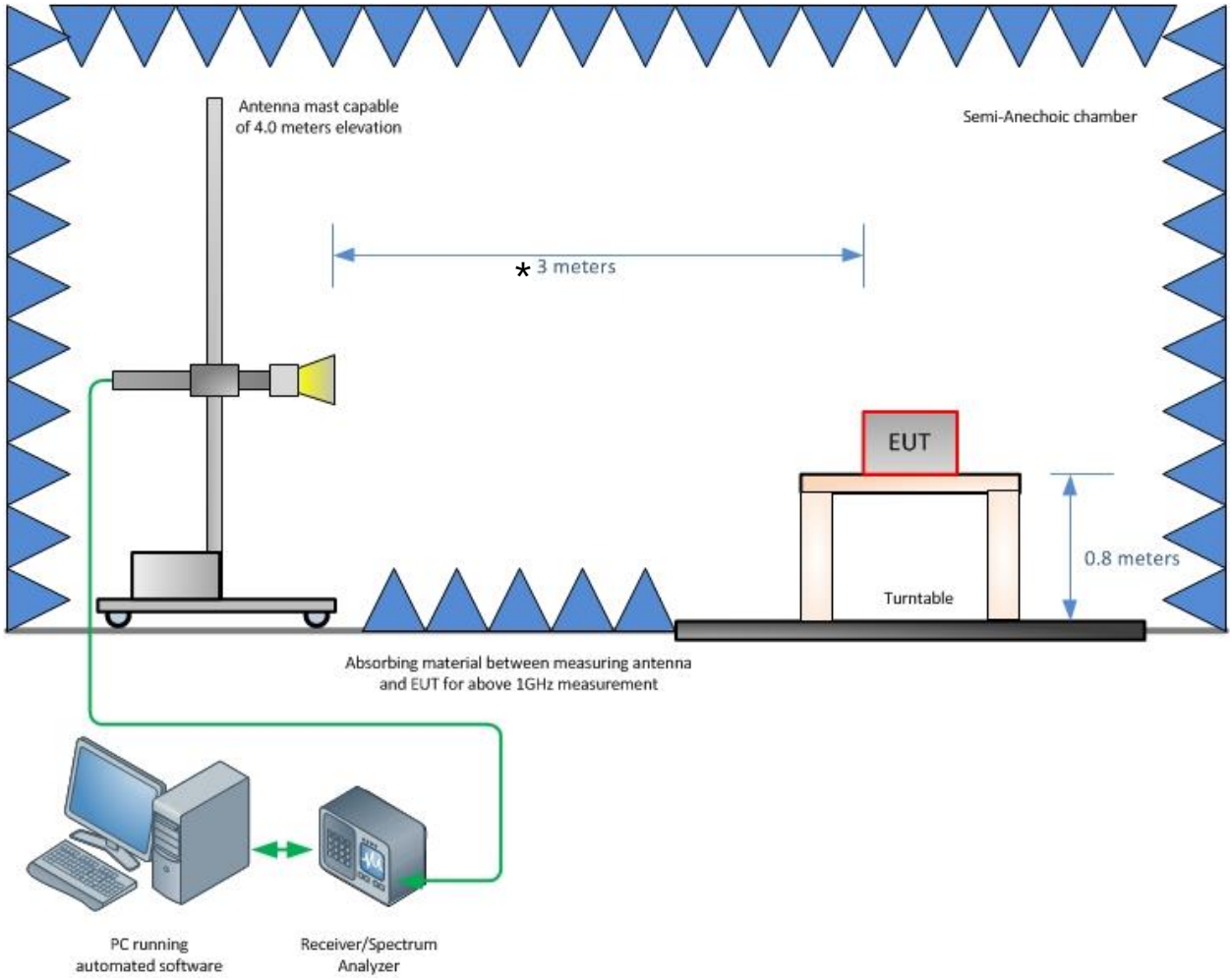
SECTION 4

DIAGRAM OF TEST SETUP

4.1 RADIATED EMISSION TEST SETUP (BELOW 1 GHZ)



4.2 RADIATED EMISSION TEST SETUP (ABOVE 1 GHZ)



*A test distance of 3 m was used for measurements below 60 GHz. The emissions in the range from 60 GHz to 160 GHz were evaluated at 1.0 m distance. For the measurements from 160 GHz to 220 GHz, the test distance was reduced to 0.5 m to assure that the noise floor is at least 10 dB below the applicable limit. Measurements above 220 GHz were taken at 0.2 m distance.

America

4.3 LABORATORY LAYOUT

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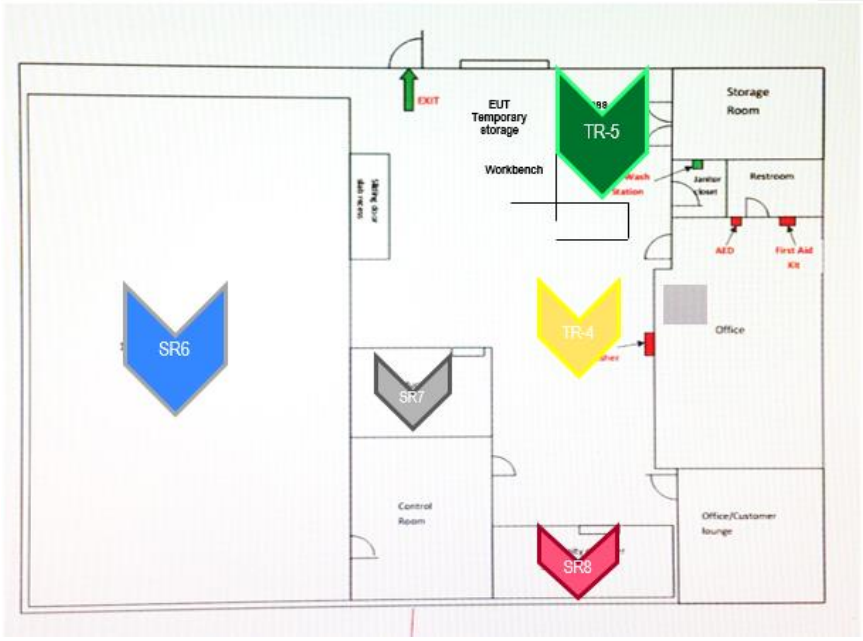
Choose certainty.
Add value.



- SR6 • SAC Chamber (10m)
- SR7 • CE Chamber
- SR8 • Debugging Chamber
- TR-5 • Wireless Area
- TR-4 • Ground Plane

4.4 LABORATORY PICTURES

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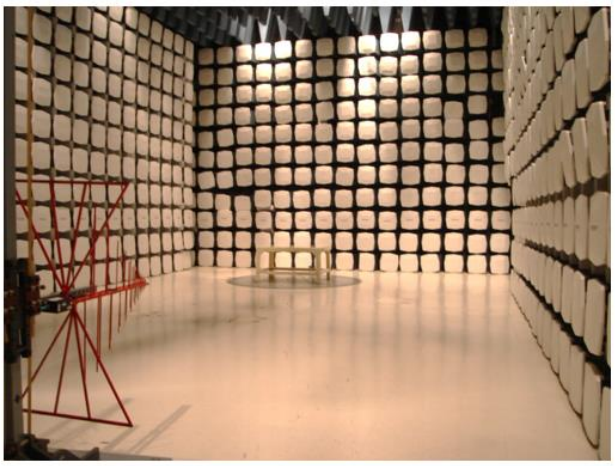

10m semi Anechoic Chamber

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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