FCC 47 CFR PART 95 SUBPART M

TEST REPORT

For

79G Radar

Model: ARS-SM01

Trade Name: ALPHA

Issued to
Alpha Networks Inc.
No.8, Li-shing 7th Rd., Science-based Industrial Park, Hsinchu, 300, Taiwan

Issued by

Compliance Certification Services Inc.
Wugu Laboratory
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City, Taiwan. (R.O.C.)
Issued Date: February 5, 2021

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	January 28, 2021	Initial Issue	ALL	Allison Chen
01	February 4, 2021	See the following Note Rev.(01)	P.4, 7, 13, 15-22, 32-40, 43, 49-53	Allison Chen
02	February 5, 2021	See the following Note Rev.(02)	P.32-40	Allison Chen

Note:
Rev.(01)
1. Added standard ANSI C63.26:2015 and KDB 653005.
2. Removed supporting device.
3. Modify test data in section 8.1 and 8.2.
4. Added test data for OBW in section 8.3

Rev.(02)
1. Modify test data in section 8.2.

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1. TEST RESULT CERTIFICATION

Applicant:	Alpha Networks Inc. No.8, Li-shing 7th Rd., Science-based Industrial Park, Hsinchu, 300, Taiwan
Manufacturer:	Alpha Networks Inc. No.8, Li-shing 7th Rd., Science-based Industrial Park, Hsinchu, 300, Taiwan
Equipment Under Test:	79G Radar
Trade Name:	ALPHA
Model:	ARS-SM01
Date of Test:	January 8 ~ February 3, 2021

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 95 Subpart M	No non-compliance noted
Statements of Conformity	
Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

We hereby certify that:

All test results conform to above mentioned standards.
The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013, ANSI C63.26: 2015 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 95.3367, 95.3379 and FCC KDB 653005 D01.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Kevin Tsai
Deputy Manager

2. EUT DESCRIPTION

Product	79G Radar
Trade Name	ALPHA
Model Number	ARS-SM01
Model Discrepancy	N/A
Received Date	December 31, 2020
Power Supply	Power from host device. (DC 12V)
Frequency Band	77.1 ~ 80.88 GHz
Modulation	FMCW
Number of Channel	1
Antenna Designation	In package antenna / Gain: 5dBi
Temperature Range	-40°C to +85 °C

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

3. TEST SUMMARY

Report Section	FCC Standard Section	Test Item	Result
8.1	95.3367	Equivalent Isotropically Radiated Power (EIRP)	Pass
8.2	95.3379(a)	Radiated spurious emissions	Pass
8.3	95.3379(b)	Frequency stability	Pass

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 , ANSI 63.4 2014, ANSI 63.26:2015 and FCC CFR 47 Part 95.3367, 95.3379, FCC KDB 653005 D01.

4.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

4.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in ANSI C63.10: 2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 1.5 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.

4.4 DESCRIPTION OF TEST MODES

The EUT (model: ARS-SM01) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed. The worst case data rate is determined as the data rate with highest output power.

The product does not transmits in stop condition.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Radiated Emission Measurement Above 1G	
Test Condition	**Radiated Emission Above 1G**
Power supply Mode	**Mode 1: EUT power by Power supply**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**
Worst Position	☐ **Placed in fixed position.** ☒ **Placed in fixed position at Y-Plane (E1-Plane)**

Radiated Emission Measurement Below 1G	
Test Condition	**Radiated Emission Below 1G**
Power supply Mode	**Mode 1: EUT power by Power supply**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**

Remark:
1. The worst mode was record in this test report.
2. EUT pre-scanned in axis Y and two polarity, for radiated measurement. The worst case(Y-Plane) were recorded in this report

5. INSTRUMENT CALIBRATION

5.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

5.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year.

Conducted Emissions Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Cal Date**	**Cal Due**
Coaxial Cable	Woken	WC12	CC001	06/29/2020	06/28/2021
Coaxial Cable	Woken	WC12	CC003	06/29/2020	06/28/2021
Horn Antenna / Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-110 / FS-Z110	10003 / 100096	12/09/2019	12/08/2021
Horn Antenna / Harmonic Mixer	A-INFOMW / ROHDE&SCHWARZ	LB-19-20-A / FS-Z60	J202020872 / 100142	12/09/2019	12/08/2021
Horn Antenna / Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-75 / FS-Z75	10001 / 100162	12/09/2019	12/08/2021
Signal Analyzer	R&S	FSV 40	101073	09/17/2020	09/16/2021
Thermostatic/Humidity Chamber	TAICHY	MHG-150LF	930619	09/24/2020	09/23/2021
Software	N/A				

3M 966 Chamber Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Cal Date**	**Cal Due**
Band Reject Filters	MICRO TRONICS	BRM 50702	120	02/25/2020	02/24/2021
Bilog Antenna	Sunol Sciences	JB3	A030105	07/24/2020	07/23/2021
Coaxial Cable	HUBER SUHNER	SUCOFLEX 104PEA	20995	02/25/2020	02/24/2021
Coaxial Cable	EMCI	EMC105	190914+327109/4	09/19/2020	09/18/2021
Horn Antenna / Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-110 / FS-Z110	10003 / 100096	12/09/2019	12/08/2021
Horn Antenna / Harmonic Mixer	A-INFOMW / ROHDE&SCHWARZ	LB-19-20-A / FS-Z60	J202020872 / 100142	12/09/2019	12/08/2021
Horn Antenna / Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-75 / FS-Z75	10001 / 100162	12/09/2019	12/08/2021
Horn Antenna / Spectrum Analyzer Mixer	Radiometer Physics GmbH	FH-PP-170 / SAM-170	10003 / 20011	12/09/2019	12/08/2021
Horn Antenna / Spectrum Analyzer Mixer	Radiometer Physics GmbH	FH-PP-220 / SAM-220	10003 / 20013	12/09/2019	12/08/2021
Digital Thermo-Hygro Meter	WISEWIND	1206	D07	01/06/2021	01/05/2022
double Ridged Guide Horn Antenna	ETC	MCTD 1209	DRH13M02003	09/30/2020	09/29/2021
Coaxial Cable	Woken	WC12	CC001	06/29/2020	06/28/2021
Coaxial Cable	Woken	WC12	CC003	06/29/2020	06/28/2021
Signal Analyzer	R&S	FSV 40	101073	09/17/2020	09/16/2021
K Type Cable	Huber+Suhner	SUCOFLEX 102	29406/2	12/09/2020	12/08/2021
K Type Cable	Huber+Suhner	SUCOFLEX 102	22470/2	12/09/2020	12/08/2021
Loop Ant	COM-POWER	AL-130	121051	03/27/2020	03/26/2021
Pre-Amplifier	EMEC	EM330	060609	02/25/2020	02/24/2021
Pre-Amplifier	EMEC	EM01G26G	060570	06/29/2020	06/28/2021
Pre-Amplifier	MITEQ	AMF-6F-18004000-37-8P	985646	09/02/2020	09/01/2021
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180323	07/24/2020	07/23/2021
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Software	e3 6.11-20180413				

5.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
Emission bandwidth, 6dB bandwidth	+/- 0.0014
RF output power, conducted	+/- 1.14
Power density, conducted	+/- 1.40
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87
3M Semi Anechoic Chamber / 40G~60G	+/- 4.62
3M Semi Anechoic Chamber / 60G~75G	+/- 3.59
3M Semi Anechoic Chamber / 75G~110G	+/- 4.34
3M Semi Anechoic Chamber / 110G~170G	+/- 4.67
3M Semi Anechoic Chamber / 170G~220G	+/- 5.01
3M Semi Anechoic Chamber / 220G~325G	+/- 5.88

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan. (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2299-9721

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

7.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID
	N/A				

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8. TEST REQUIREMENTS

8.1 EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP)

LIMIT

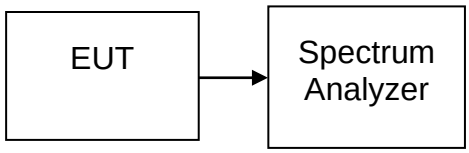
The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

According to FCC 95.3367.

The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).

The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

Test Configuration



TEST RESULTS

No non-compliance noted.

Temperature:	21.5℃	**Test date:**	January 9, 2021
Humidity:	55.2% RH	**Tested by:**	Ray Li

20℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
77.1548	67.15	46.12	1	113.27	8.47	50	RMS

-40℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
77.1548	67.91	46.12	1	114.03	9.23	50	RMS

85℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
77.1548	66.34	46.12	1	112.46	7.66	50	RMS

20℃ / 10.2V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
77.1548	67.29	46.12	1	113.41	8.61	50	RMS

20℃ / 13.8V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
77.1548	67.1	46.12	1	113.22	8.42	50	RMS

*dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

Temperature:	21.5℃	**Test date:**	January 9, 2021
Humidity:	55.2% RH	**Tested by:**	Ray Li

20℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
79.2822	87.48	46.24	1	133.72	28.92	55	Peak

-40℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
79.8724	88.72	46.24	1	134.96	30.16	55	Peak

85℃ / 12V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
79.3111	85.38	46.24	1	131.62	26.82	55	Peak

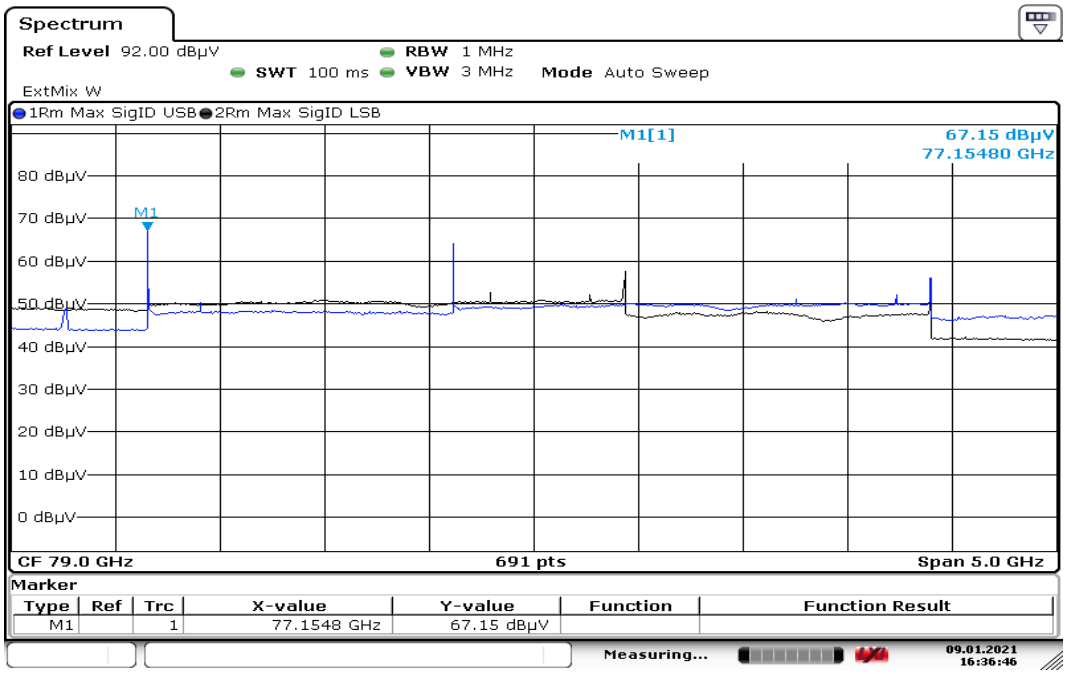
20℃ / 10.2V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
79.3401	87.32	42.89	1	130.21	25.41	55	Peak

20℃ / 13.8V							
Frequency (GHz)	**Spectrum Reading (dBuV)**	**Antenna Factor (dB/m)**	**Distance (m)**	**dBuV/m**	**E.I.R.P. (dBm)**	**Limit (dBm)**	**Detector**
79.3329	87.2	46.24	1	133.44	28.64	55	Peak

*dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)

Test Data
Average Power

20℃ / 12V



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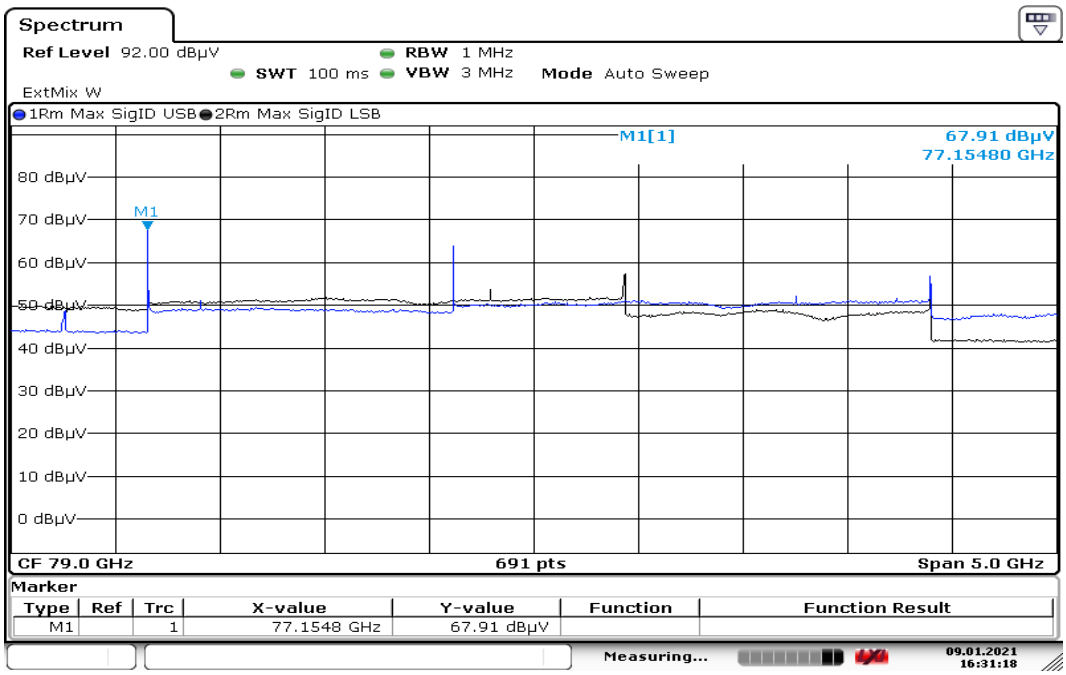
-40℃ / 12V



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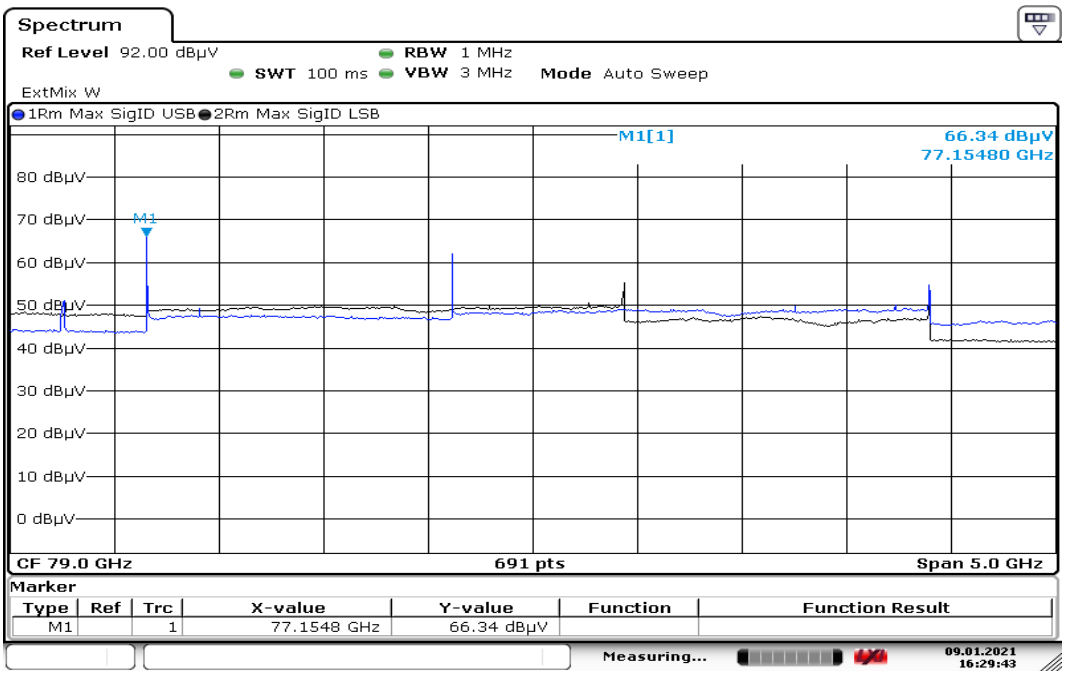
85℃ / 12V



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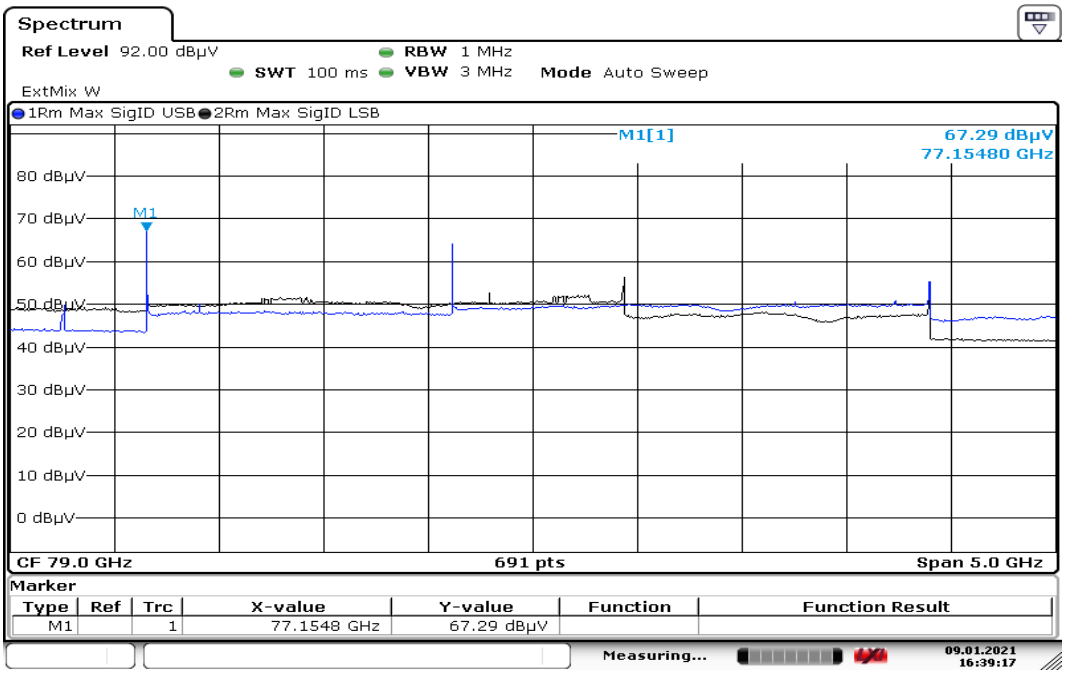
20℃ / 10.2V



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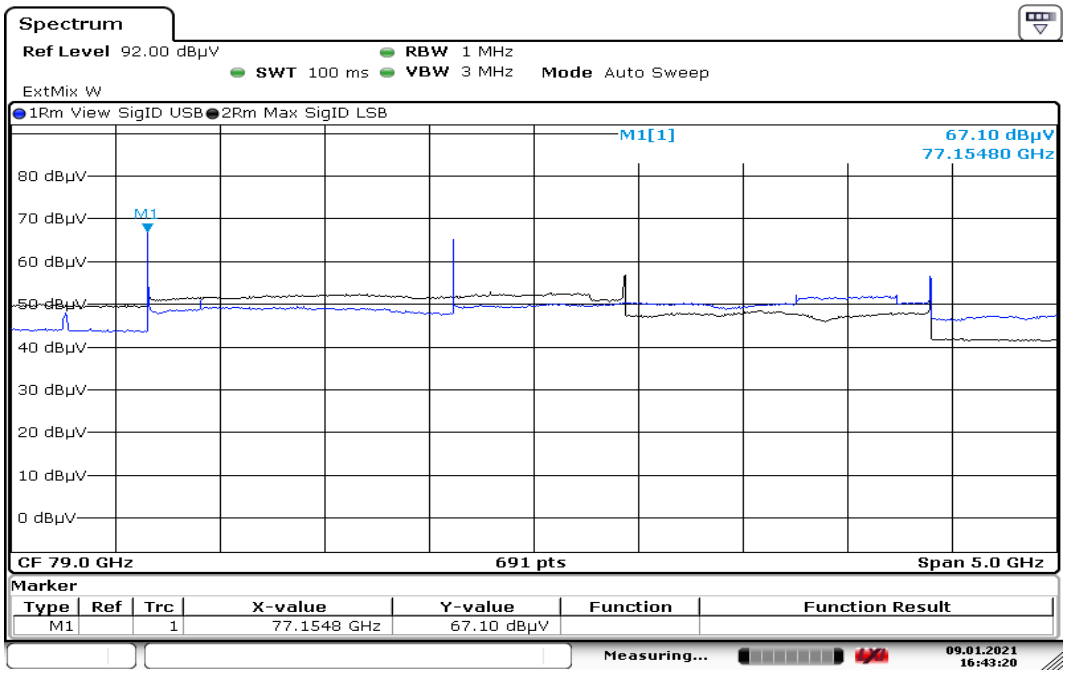
20℃ / 13.8V



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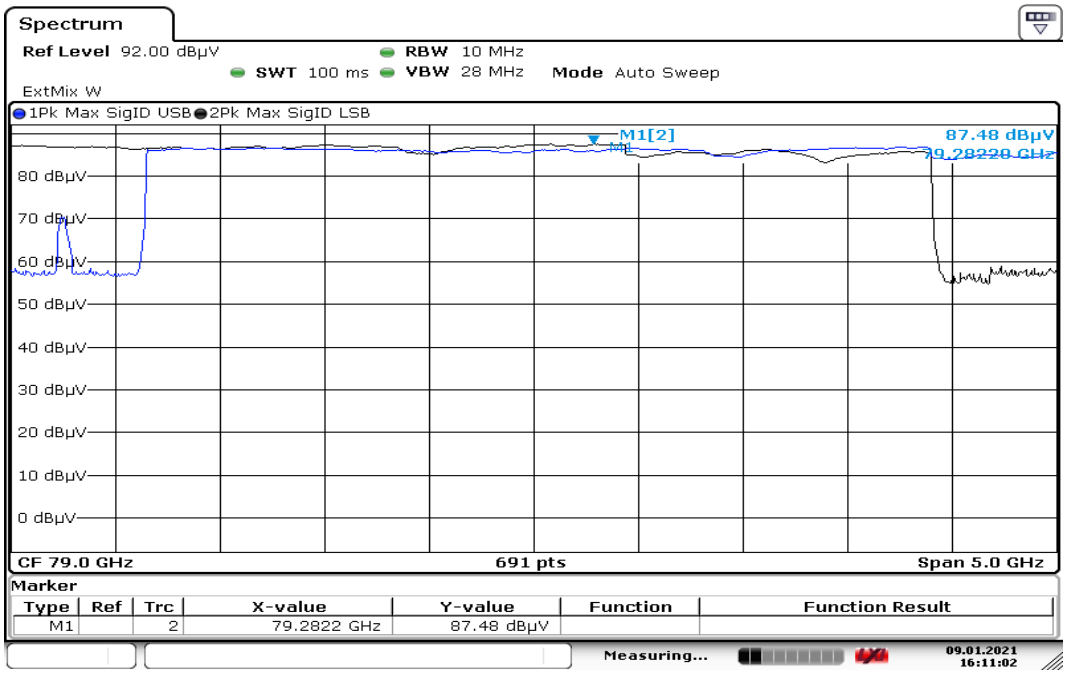
Peak Power

20℃ / 12V



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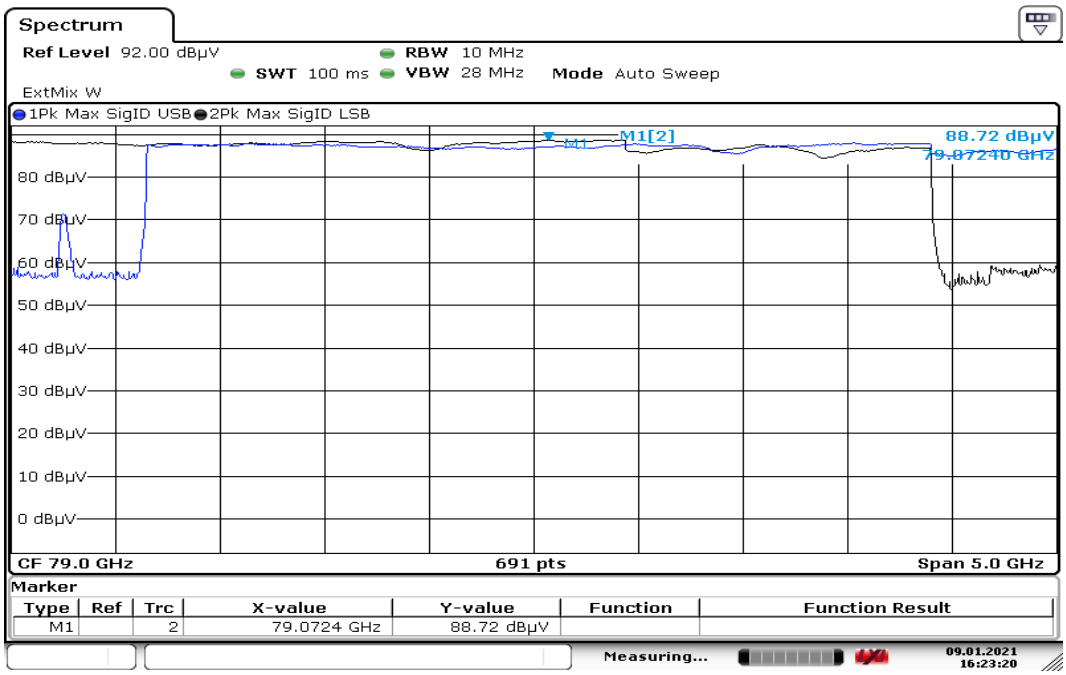
-40℃ / 12V



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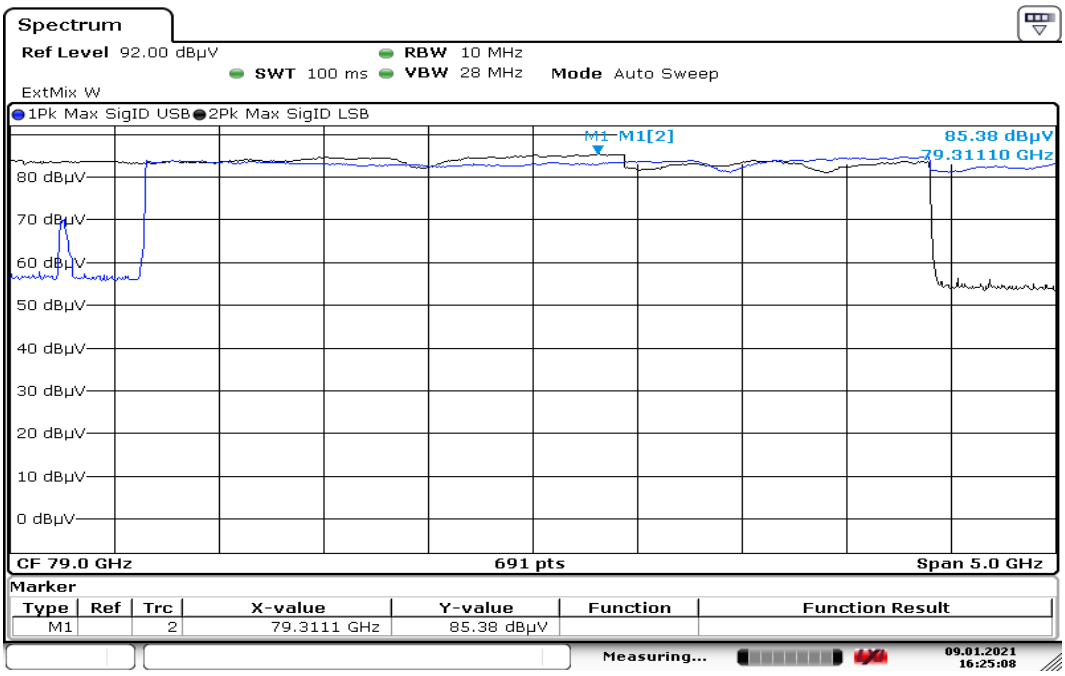
85℃ / 12V



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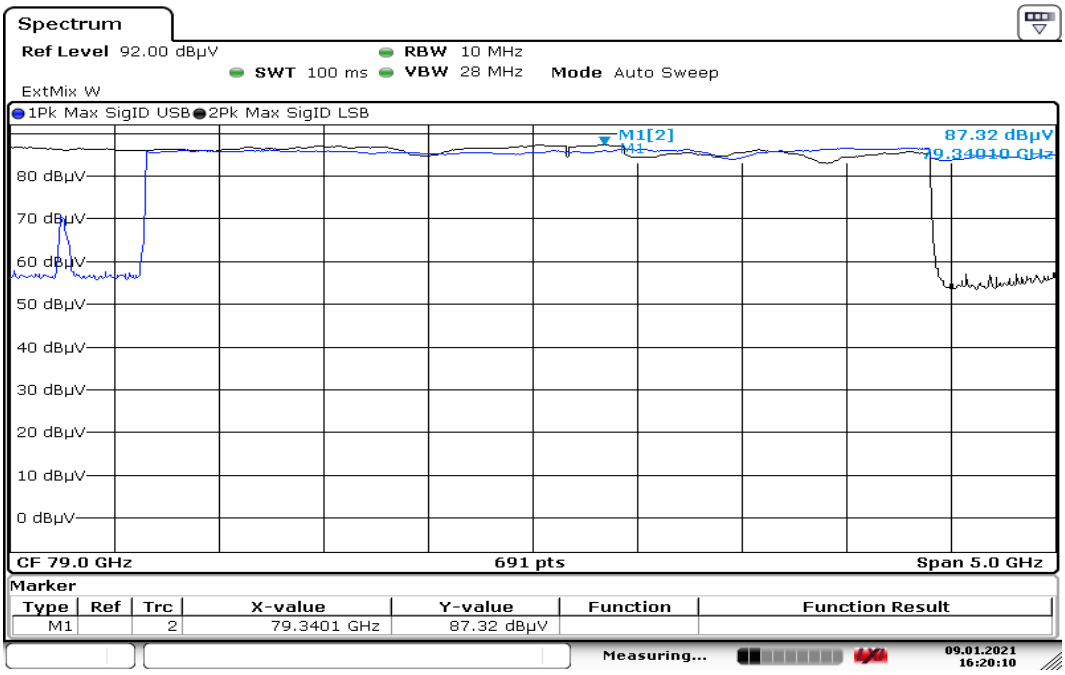
20℃ / 10.2V



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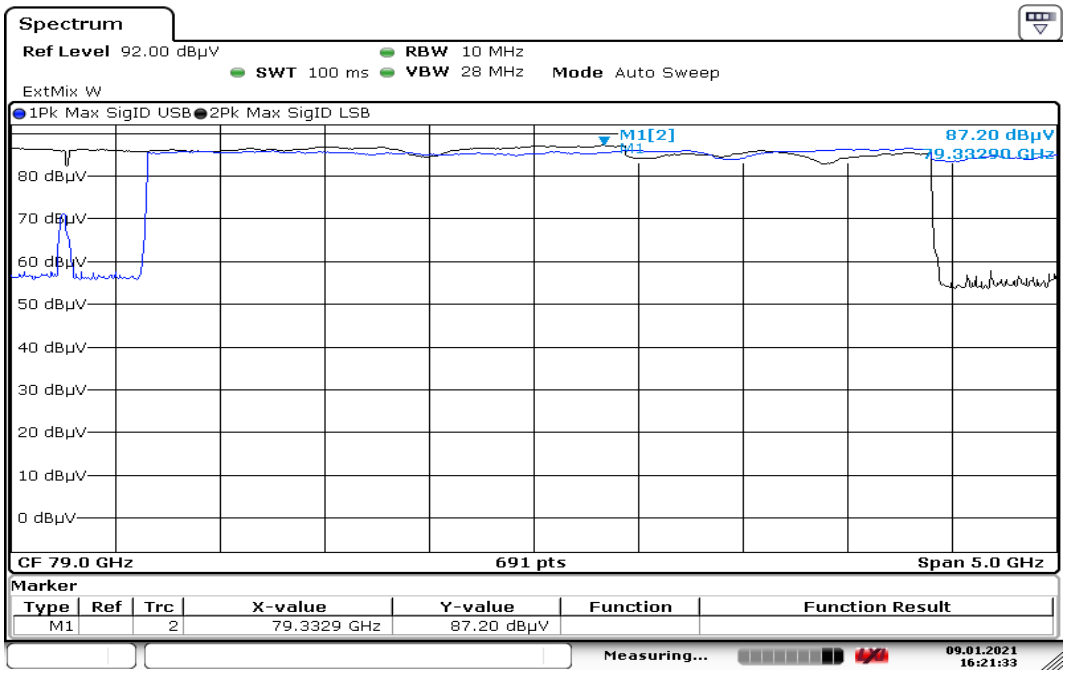
20℃ / 13.8V



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8.2 SPURIOUS EMISSIONS

8.2.1 Radiated Emissions

LIMIT

1. According to FCC PART 95.3379(a), Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

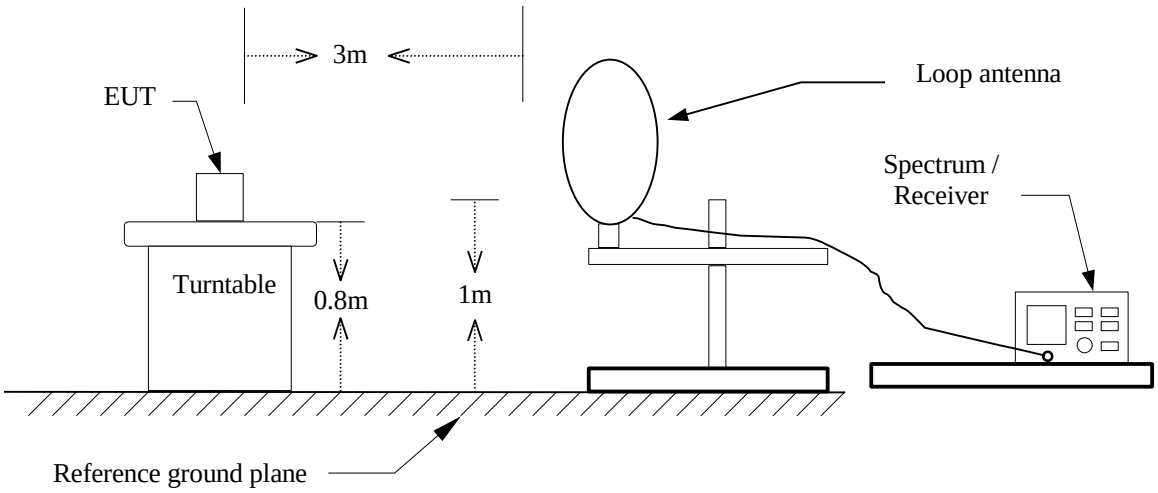
2. For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.
3. For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm^2 at a distance of 3 meters from the exterior surface of the radiating structure.

Notes:
P(mW) = Power density (mW/m^2) X 4π(r)^2
600 pW/cm^2 = -1.7dBm @ 3m = 7.84 dBm @ 1m
1000 pW/cm^2 = 0.5 dBm @ 3m = 10.04 dBm @ 1m

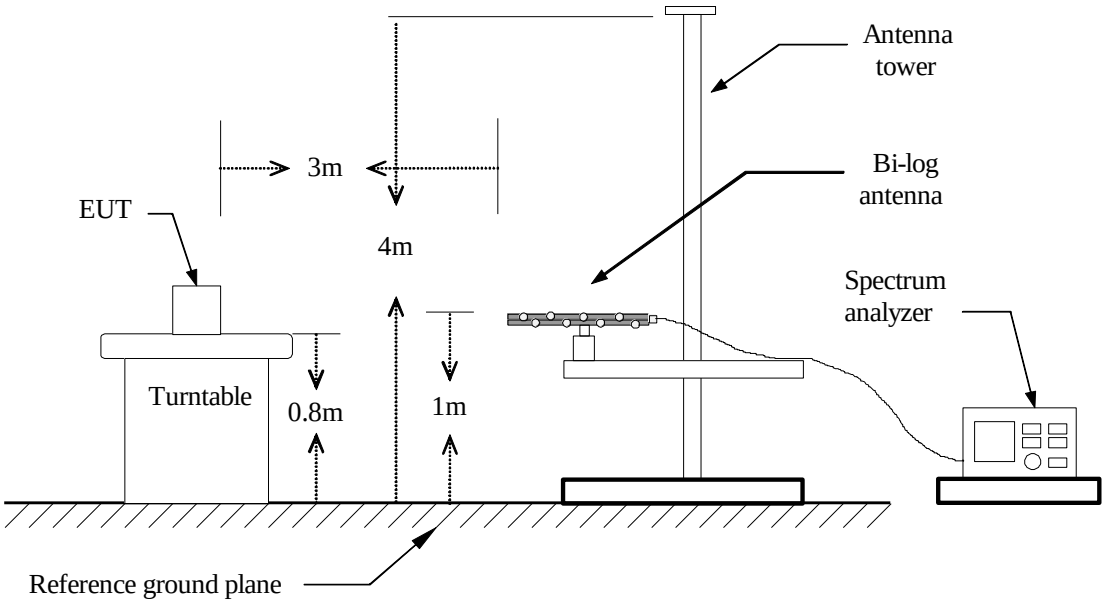
P: Power
r: measurement distance(m)

Test Configuration

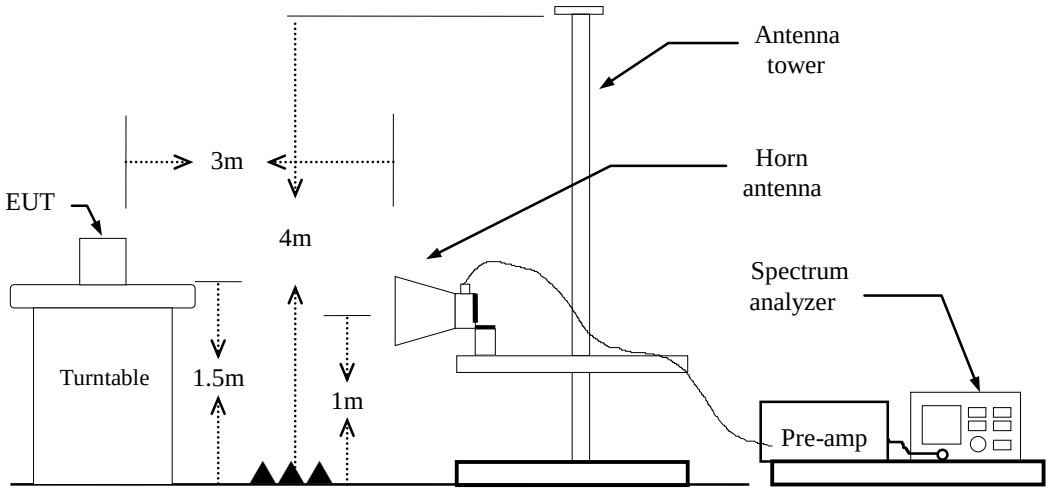
9kHz ~ 30MHz



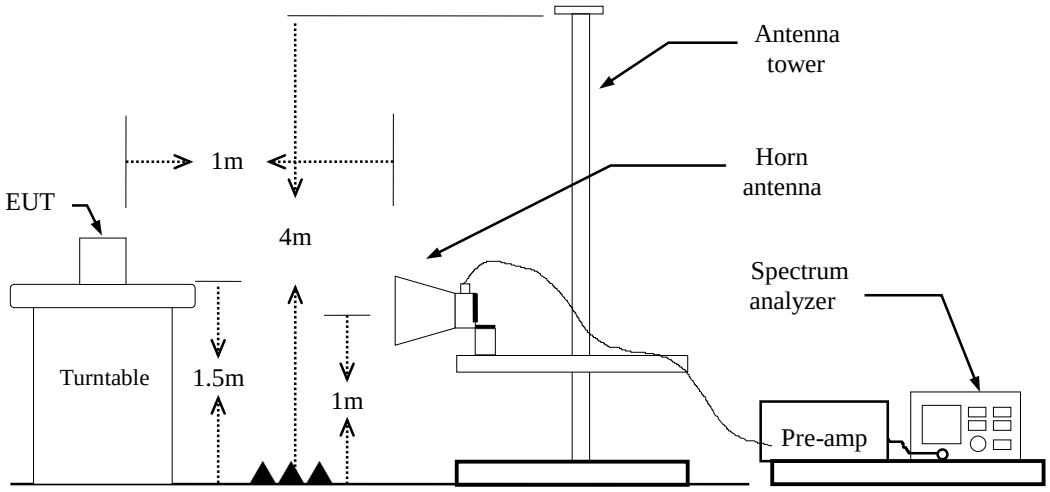
30MHz ~ 1 GHz



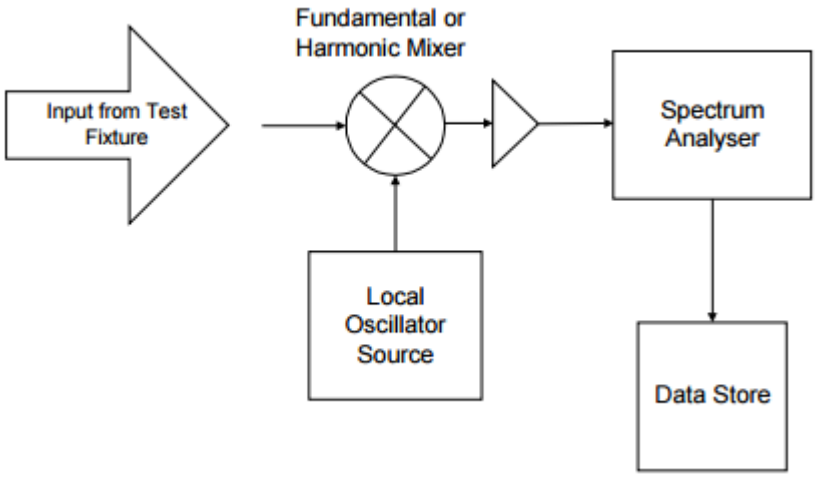
Above 1 GHz ~ 18GHz



18GHz ~ 40GHz



Above 40 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a)PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

   (b)AVERAGE: RBW=1MHz,

   Above 40GHz:

   RBW = 1 MHz, VBW= 3 MHz,

   Detector = Peak, Trace mode = max hold, Sweep = AUTO.
7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz

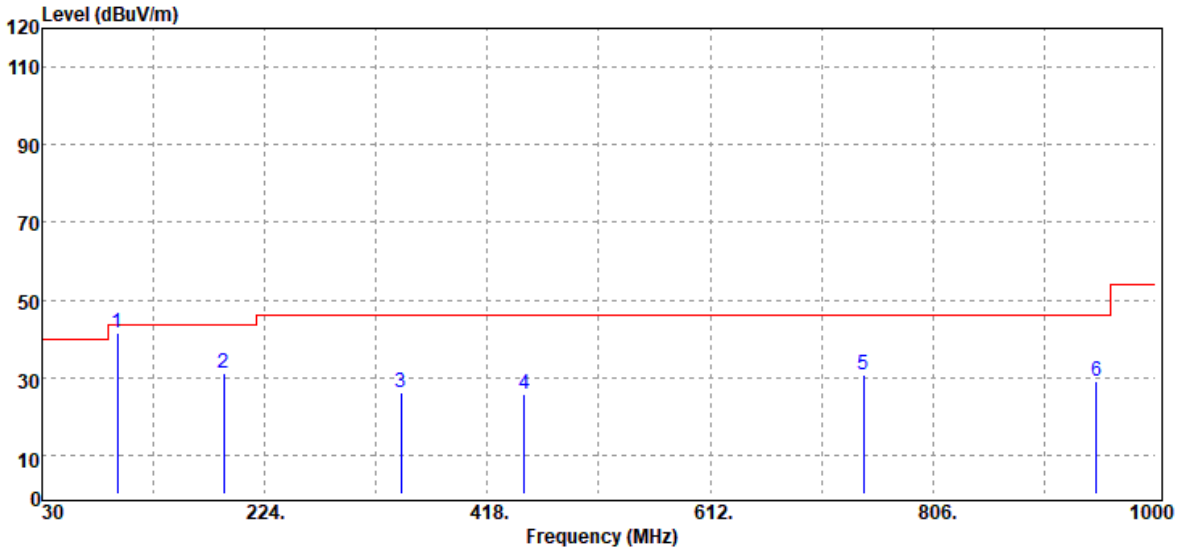
Operation Mode:	TX CH Mid	**Polarity:**	Ver. / Hor.
Temperature:	21.9℃	**Tested by:**	Ray Li
Humidity:	54% RH	**Test Date:**	2021/01/20

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
95.96	Peak	55.71	-14.22	41.49	43.50	-2.01	V
188.11	Peak	42.53	-11.24	31.29	43.50	-12.21	V
342.34	Peak	33.86	-7.65	26.21	46.00	-19.79	V
450.01	Peak	30.02	-4.26	25.76	46.00	-20.24	V
745.86	Peak	29.98	0.77	30.75	46.00	-15.25	V
948.59	Peak	24.79	4.34	29.13	46.00	-16.87	V
102.75	Peak	52.08	-12.09	39.99	43.50	-3.51	H
162.89	Peak	45.49	-10.42	35.07	43.50	-8.43	H
354.95	Peak	32.98	-7.03	25.95	46.00	-20.05	H
498.51	Peak	29.78	-3.30	26.48	46.00	-19.52	H
757.50	Peak	28.12	0.95	29.07	46.00	-16.93	H
927.25	Peak	25.53	3.46	28.99	46.00	-17.01	H

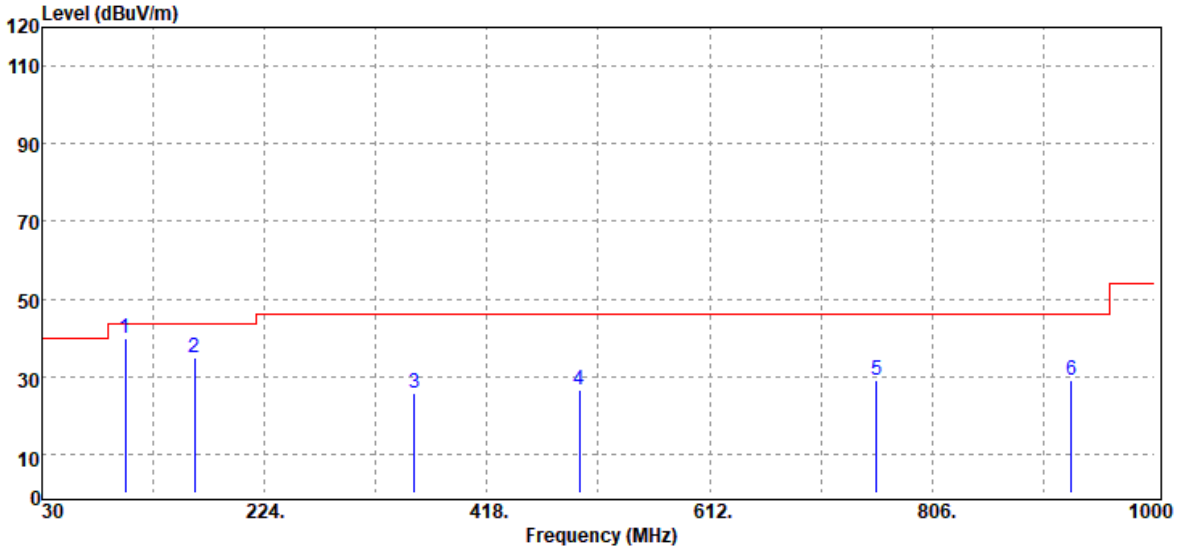
Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

Polarity : Vertical



Polarity : Horizontal



Above 1 GHz

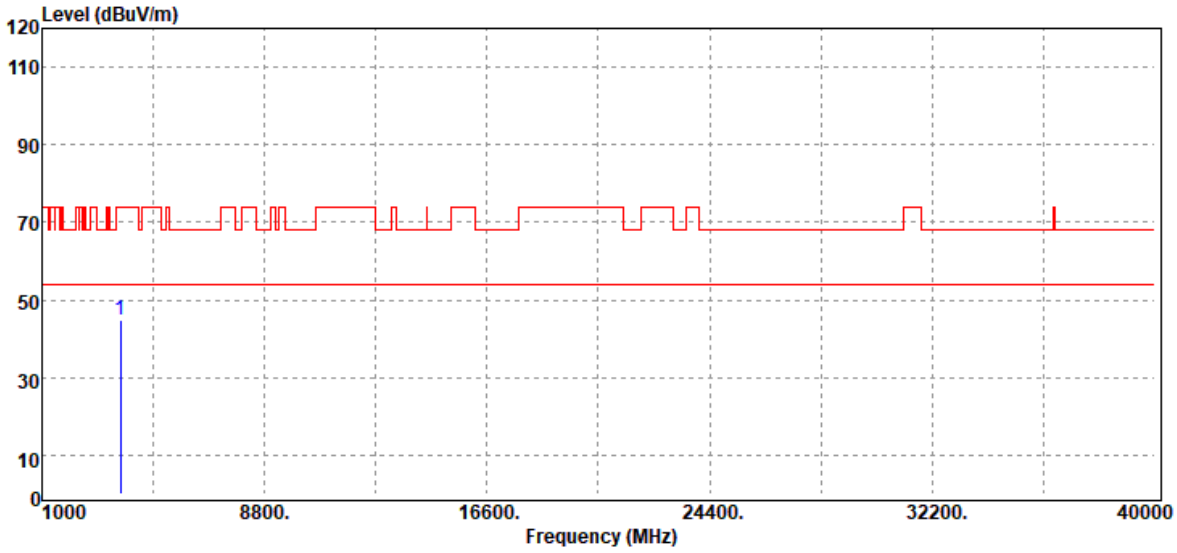
Operation Mode:	TX CH Mid	**Polarity:**	Ver. / Hor.
Temperature:	21.9℃	**Tested by:**	Ray Li
Humidity:	54% RH	**Test Date:**	2021/01/20

Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m dBµV/m	Margin dB	Ant. Pol. (H/V)
3747.70	Peak	35.18	9.65	44.83	74.00	-29.17	V
N/A							
3747.70	Peak	34.33	9.65	43.98	74.00	-30.02	H
N/A							

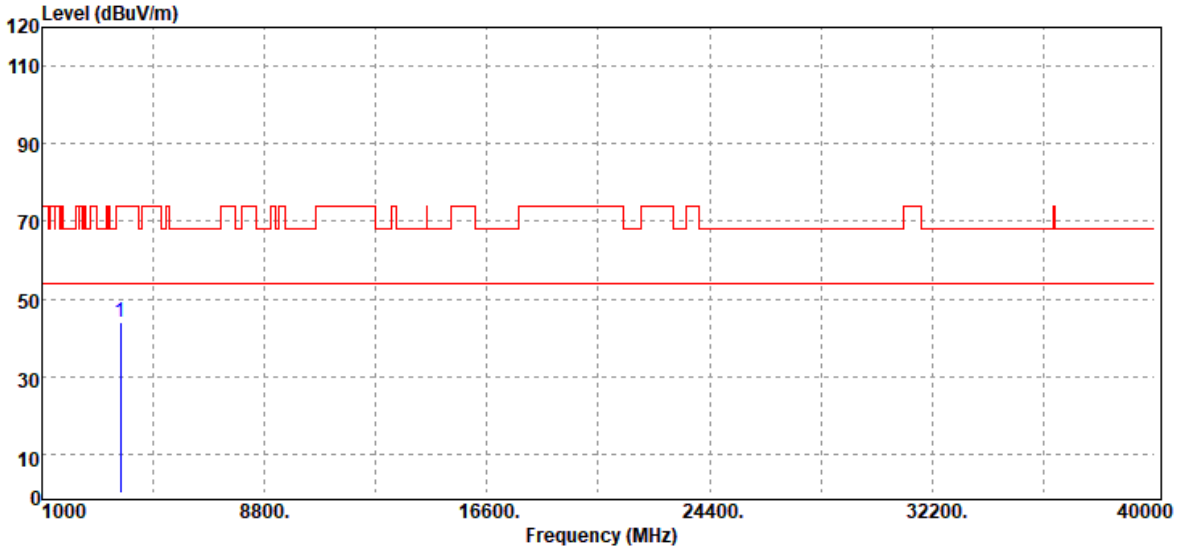
Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

Polarity : Vertical



Polarity : Horizontal

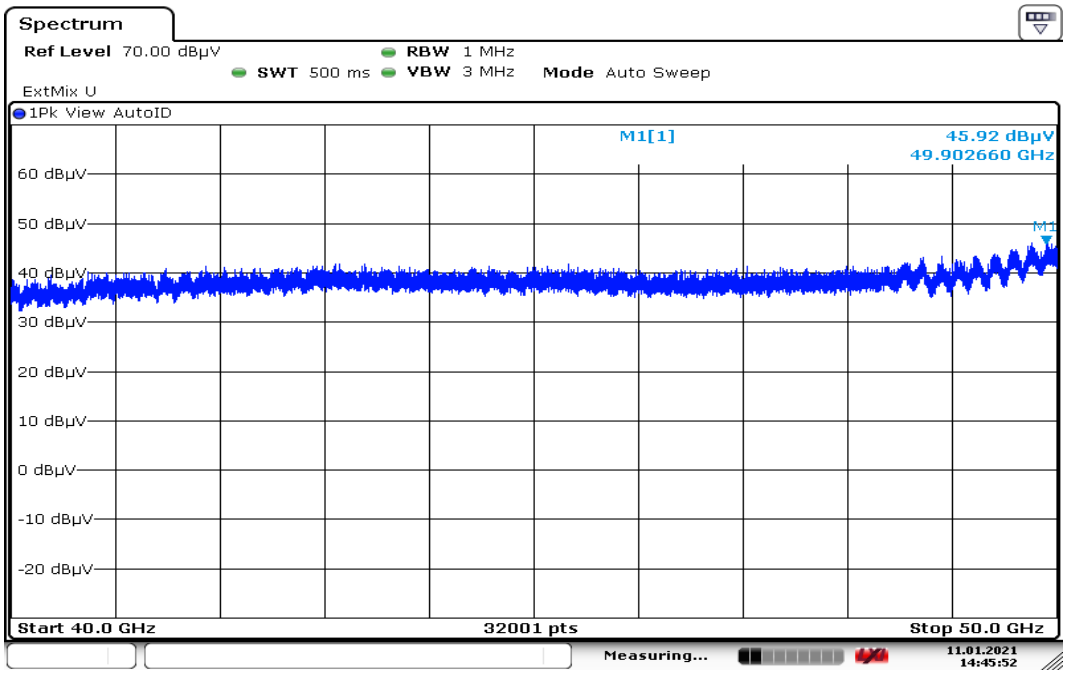


40G-50G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 14:45:52

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
49.90266	45.92	42.89	3	88.81	93.54	Peak

Remark:

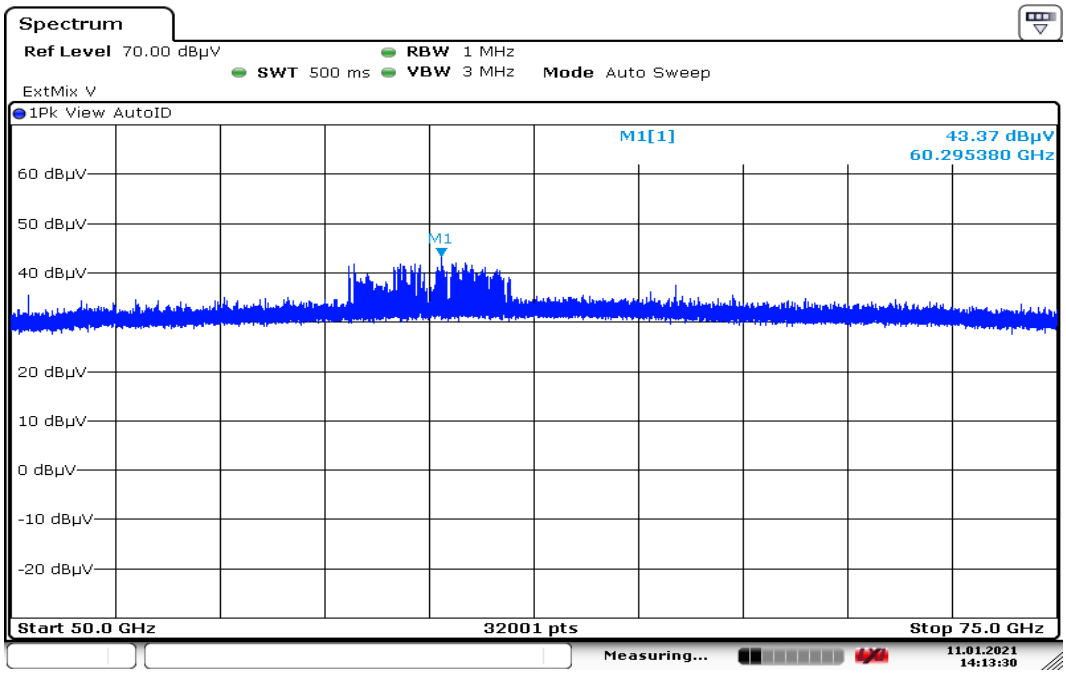
1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：
   @ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
   @ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
   @ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

50G-75G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 14:13:31

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
60.29538	43.37	42.75	3	86.12	93.54	Peak

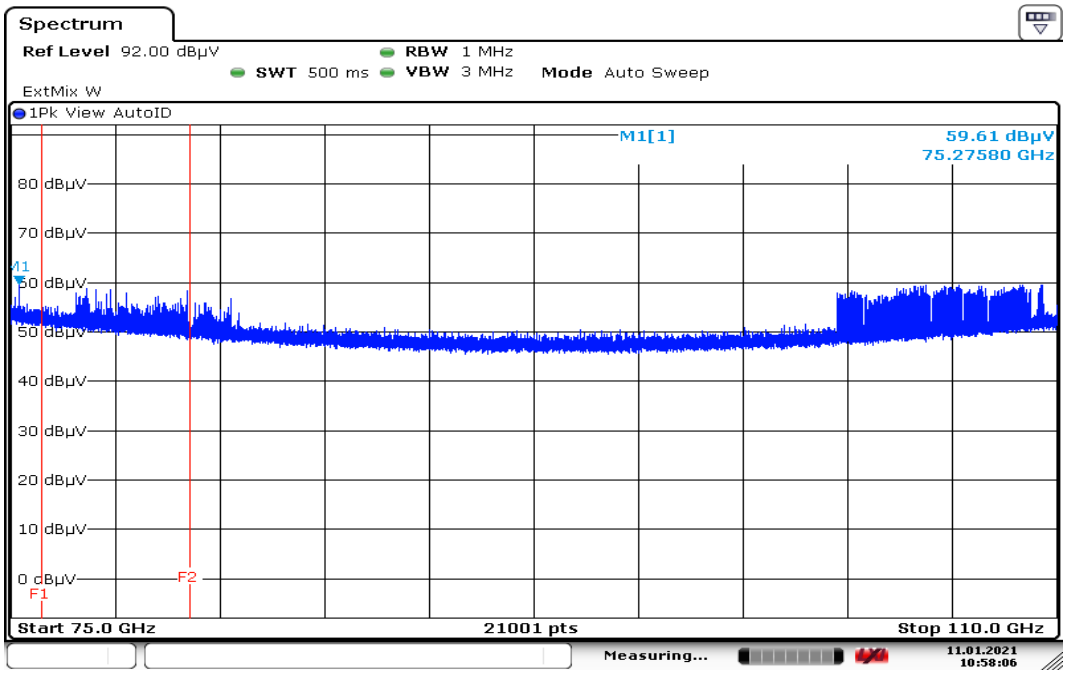
Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

75G-110G

Operation Mode:	Test Mode		
Temperature:	15.8℃	**Test Date:**	January 11, 2021
Humidity:	62% RH	**Tested by:**	Ray Li



Date: 11.JAN.2021 10:58:07

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
75.2758	59.61	44.93	0.5	104.54	109.1	Peak

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

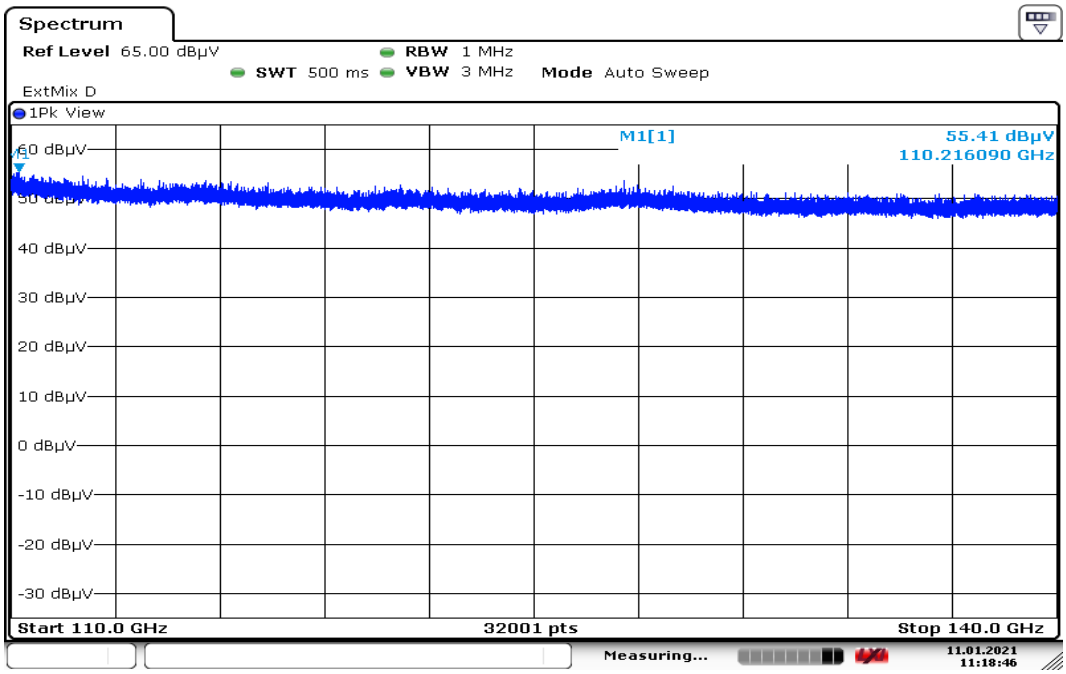
@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

110G-140G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 11:18:47

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
110.21609	55.41	50.40	0.5	105.81	109.1	Peak

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

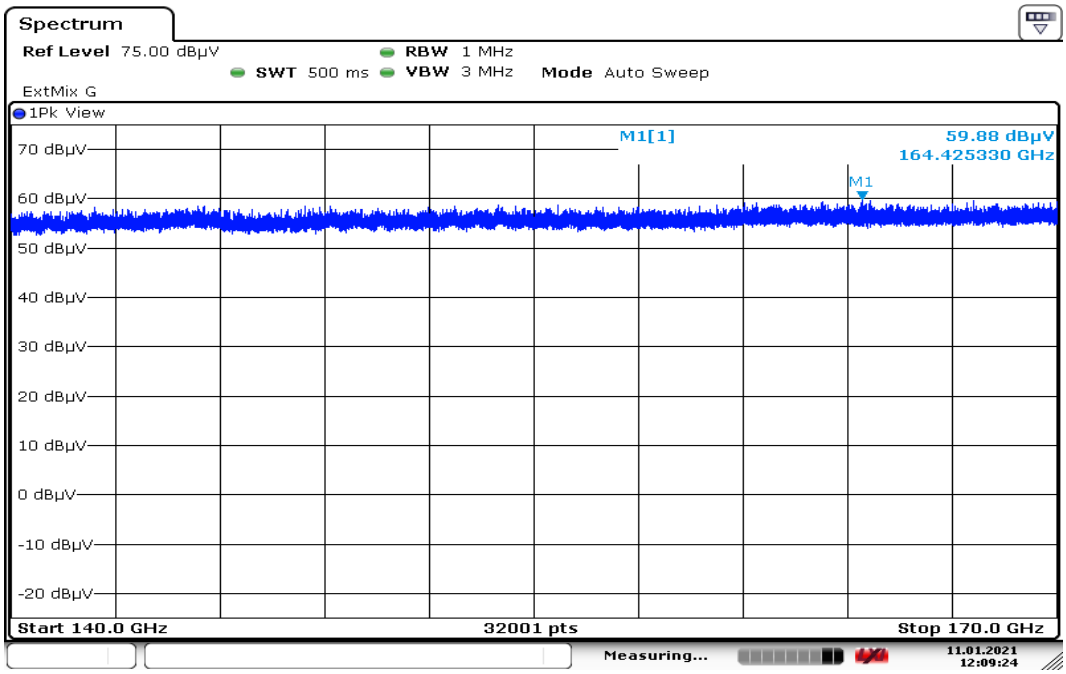
@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

140G-170G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 12:09:24

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
164.42533	59.88	53.29	0.2	113.17	117.06	Peak

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

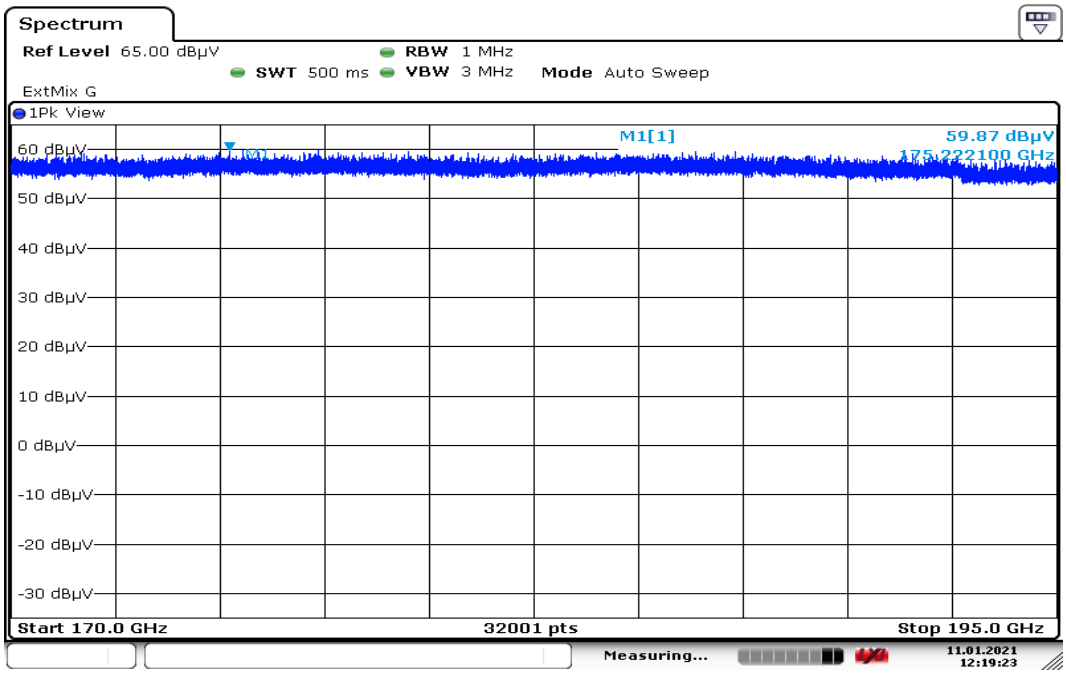
@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

170G-195G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 12:19:24

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
175.2221	59.87	54.31	0.2	114.18	117.06	Peak

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

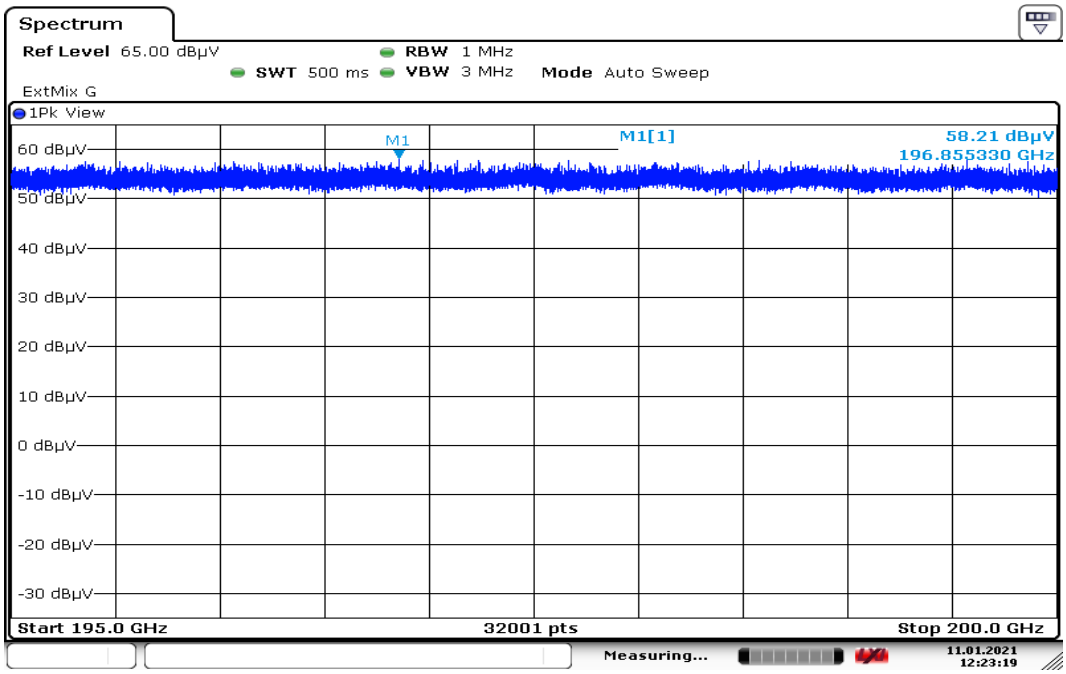
@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

195G-200G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 12:23:20

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
196.85533	58.21	54.26	0.2	112.47	117.06	Peak

Remark:

1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. 40GHz~200GHz Limit：

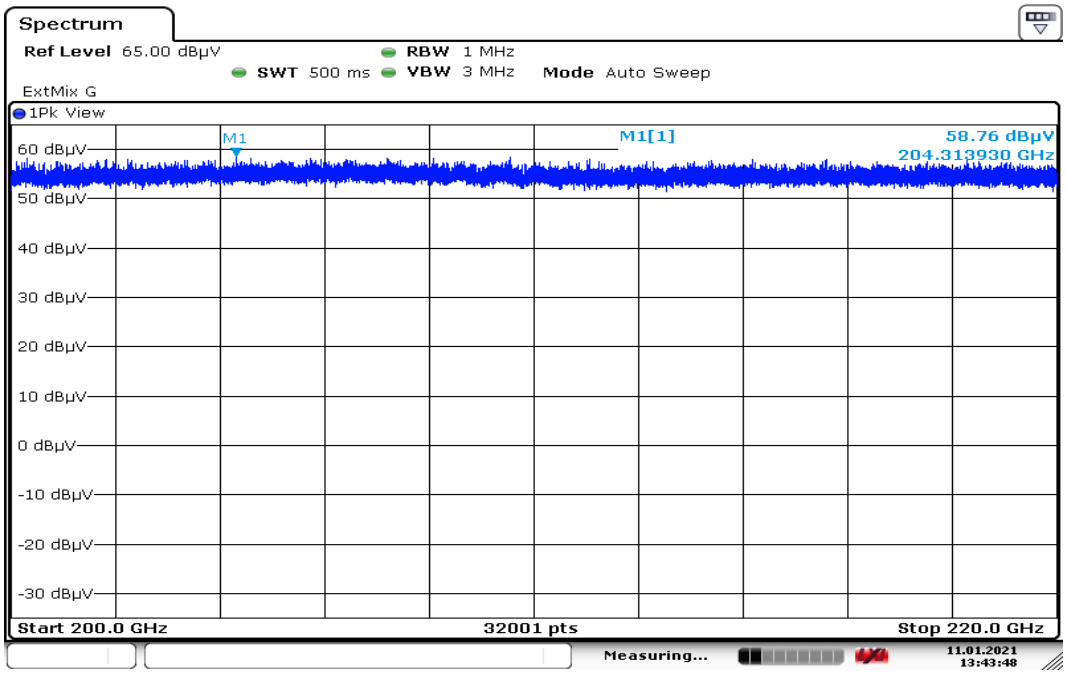
@ 3m Limit = 20*Log { (0.000006*377)^0.5 * 1000000} = 93.54dBuV/m
@ 0.5m Limit = 93.54 + 20*Log (3/0.5) = 109.1dBuV/m
@ 0.2m Limit = 93.54 + 20*Log (3/0.2) = 117.06dBuV/m

200G-220G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 13:43:48

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
204.31393	58.76	54.24	0.2	113.00	119.28	Peak

Remark:

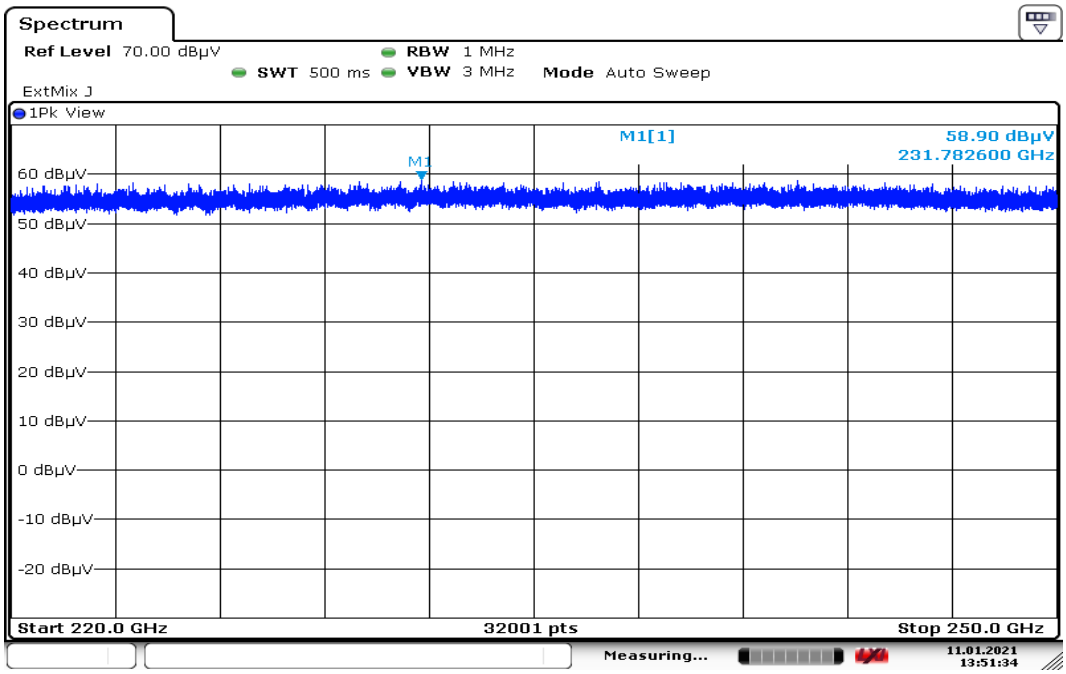
1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. Above 200GHz Limit：
   @ 3m Limit = 20*Log { (0.00001*377)^0.5 * 1000000} = 95.76dBuV/m
   @ 0.2m Limit = 95.76 + 20*Log (3/0.2) = 119.28dBuV/m

220G-250G

Operation Mode: Test Mode

Temperature: 15.8℃ **Test Date:** January 11, 2021

Humidity: 62% RH **Tested by:** Ray Li



Date: 11.JAN.2021 13:51:34

Frequency (GHz)	Spectrum Reading (dBuV)	Antenna Factor (dB/m)	Distance (m)	dBuV/m	Limit (dBuV/m)	Detector
231.7826	58.9	54.54	0.2	113.44	119.28	Peak

Remark:

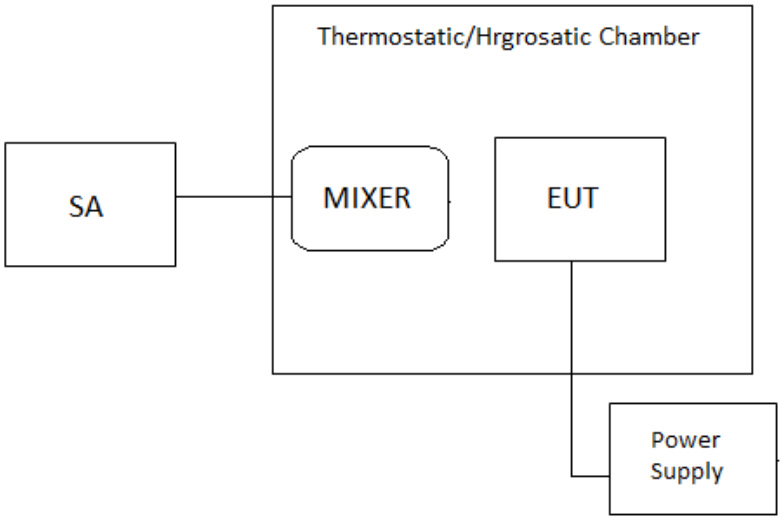
1. dBuV/m = Spectrum Reading (dBuV) + Antenna Factor (dB/m)
2. Above 200GHz Limit：
   @ 3m Limit = 20*Log { (0.00001*377)^0.5 * 1000000} = 95.76dBuV/m
   @ 0.2m Limit = 95.76 + 20*Log (3/0.2) = 119.28dBuV/m

8.3 FREQUENCY STABILITY

LIMIT

According to FCC 95.3379(b), Fundamental emissions must be contained within the frequency bands specified in this section 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, unless justification is presented to demonstrate otherwise.

Test Configuration



TEST PROCEDURE

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to –30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

TEST RESULTS

No non-compliance noted.

99%

Temperature:	21.5℃	**Test date:**	January 9, 2021
Humidity:	55.2% RH	**Tested by:**	Ray Li
Temperature:	22.5℃	**Test date:**	January 14, 2021
Humidity:	54.2% RH	**Tested by:**	Ray Li
Temperature:	21.9℃	**Test date:**	January 20, 2021
Humidity:	54% RH	**Tested by:**	Ray Li

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range(GHz)**	**Test Result**
85	12	77.1404	80.8741	76-81	Pass
80		77.1548	80.8958		Pass
70		77.1548	80.8958		Pass
60		77.1548	80.8958		Pass
50		77.1548	80.8886		Pass
40		77.1548	80.8886		Pass
30		77.1548	80.8958		Pass
20		77.1548	80.8958		Pass
10		77.1548	80.8958		Pass
0		77.1548	80.8958		Pass
-10		77.1548	80.8958		Pass
-20		77.1548	80.8886		Pass
-30		77.1548	80.8958		Pass
-40		77.1621	80.903		Pass

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range(GHz)**	**Test Result**
20	10.2	77.1476	80.8813	76-81	Pass
	12	77.1548	80.8886		Pass
	13.8	77.1404	80.8813		Pass

OBW: 26dB

Temperature:	21.5℃	**Test date:**	February 3, 2021
Humidity:	55.2% RH	**Tested by:**	Ray Li

Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range(GHz)**	**Test Result**
85	12	77.1479	80.9001	76-81	Pass
80		77.1479	80.9001		Pass
70		77.1479	80.9001		Pass
60		77.1479	80.9001		Pass
50		77.1479	80.9001		Pass
40		77.1479	80.9001		Pass
30		77.1479	80.9001		Pass
20		77.1479	80.9001		Pass
10		77.1479	80.9061		Pass
0		77.1479	80.9001		Pass
-10		77.1479	80.9001		Pass
-20		77.1479	80.9061		Pass
-30		77.1479	80.9001		Pass
-40		77.1479	80.9001		Pass

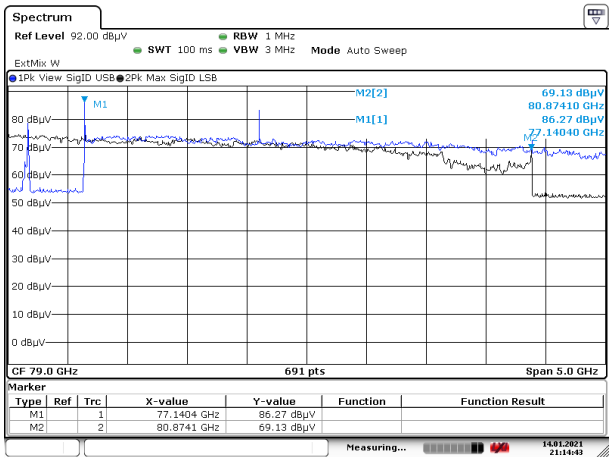
Operating Frequency					
Environment Temperature(ºC)	**Voltage (V)**	**FL (GHz)**	**FH (GHz)**	**Limit Range(GHz)**	**Test Result**
20	10.2	77.1479	80.9001	76-81	Pass
	12	77.1479	80.9001		Pass
	13.8	77.1479	80.9001		Pass

Test Plot

99%

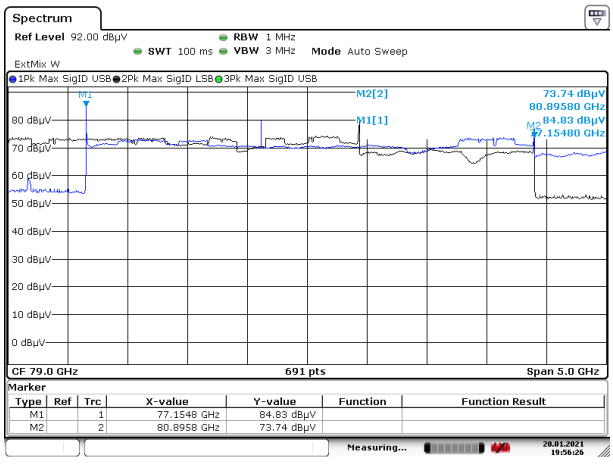
Voltage: 12V

Environment Temperature: 85℃



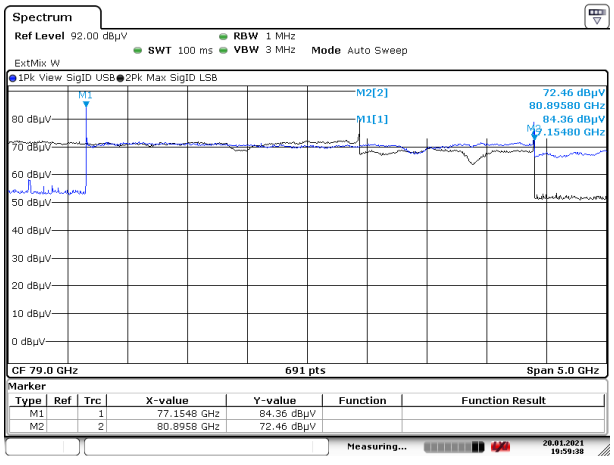
Date: 14.JAN.2021 21:14:43

Environment Temperature: 80℃



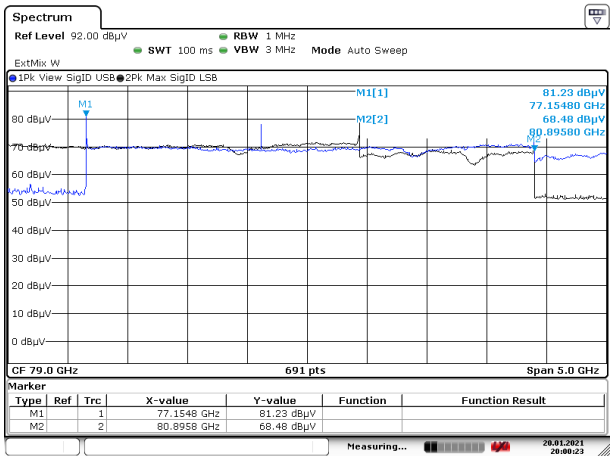
Date: 20.JAN.2021 19:56:26

Environment Temperature: 70℃

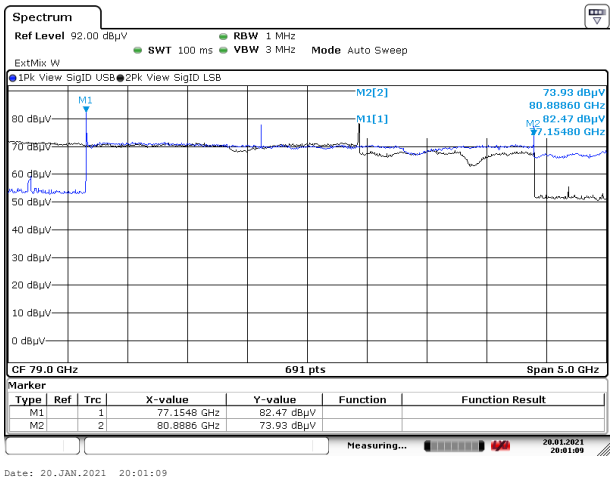
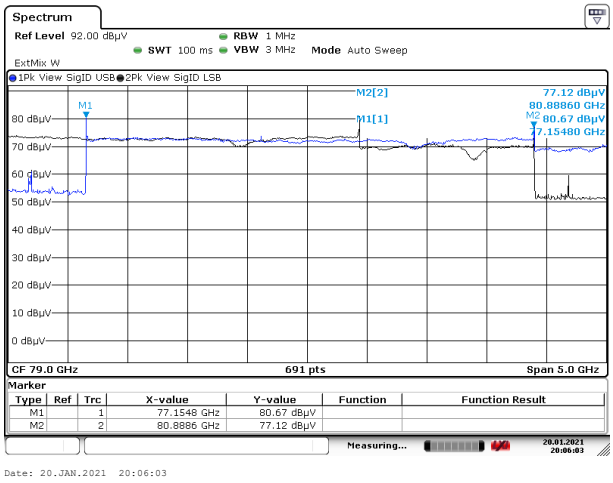
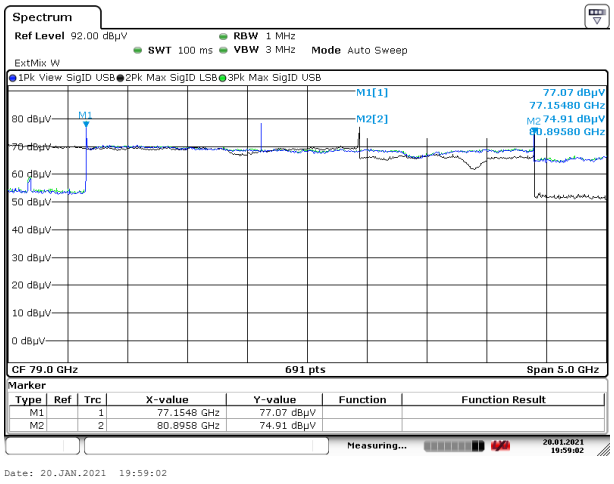
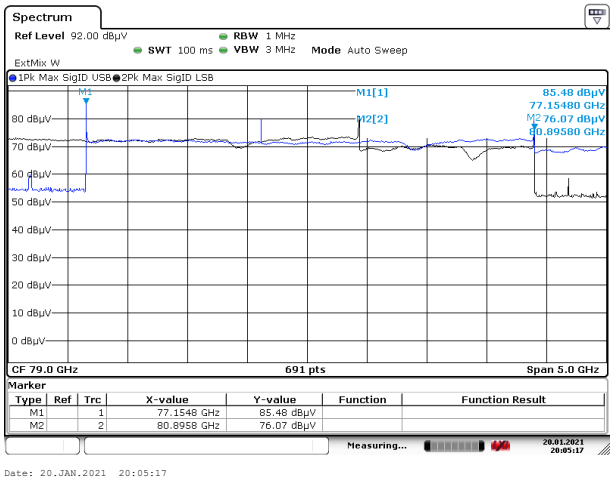


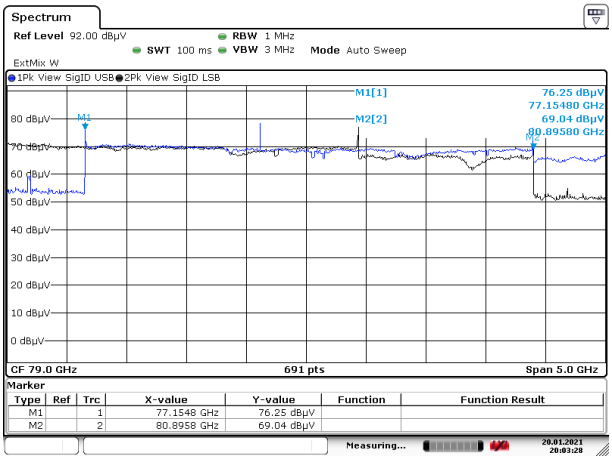
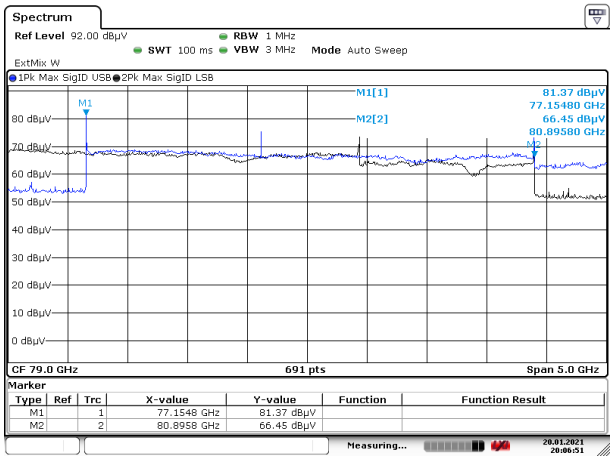
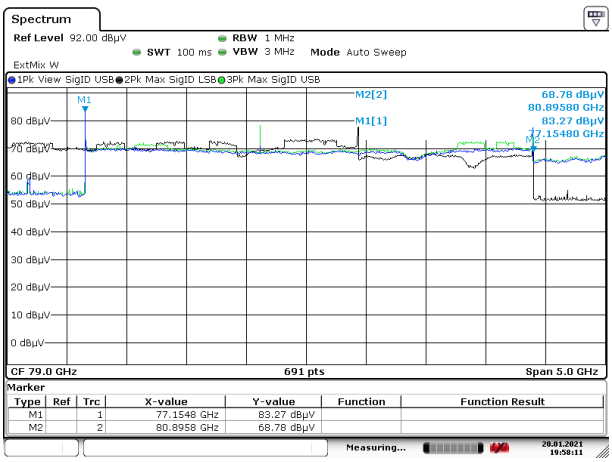
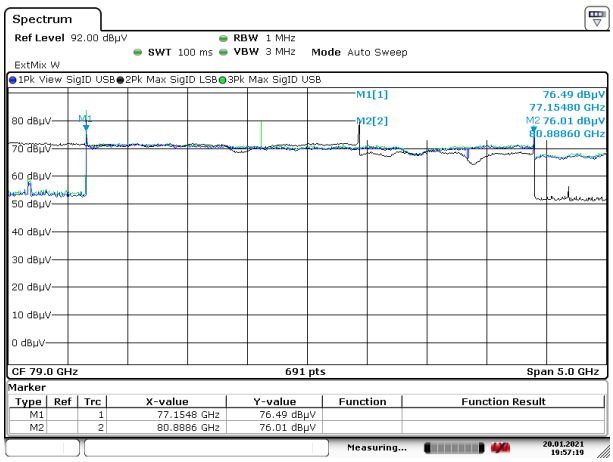
Date: 20.JAN.2021 19:59:38

Environment Temperature: 60℃

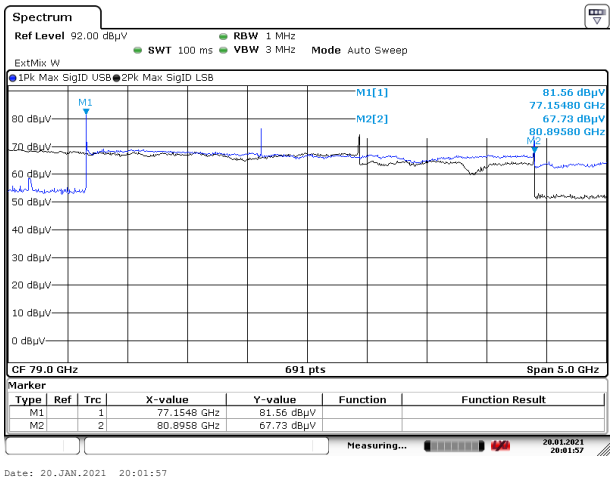


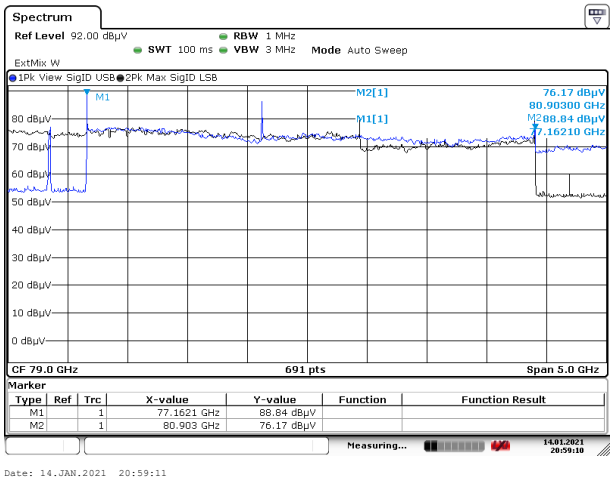
Date: 20.JAN.2021 20:00:23

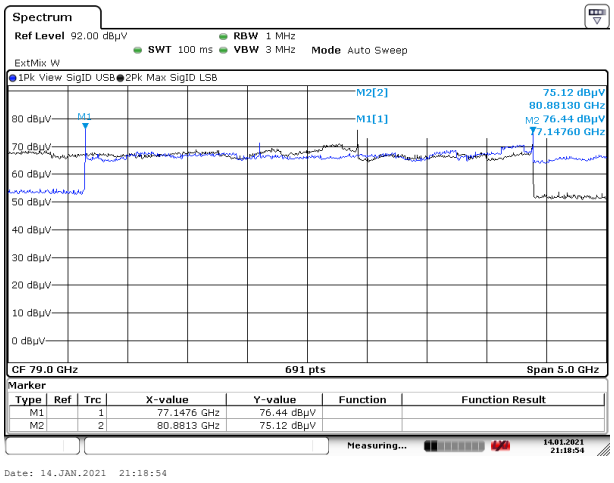
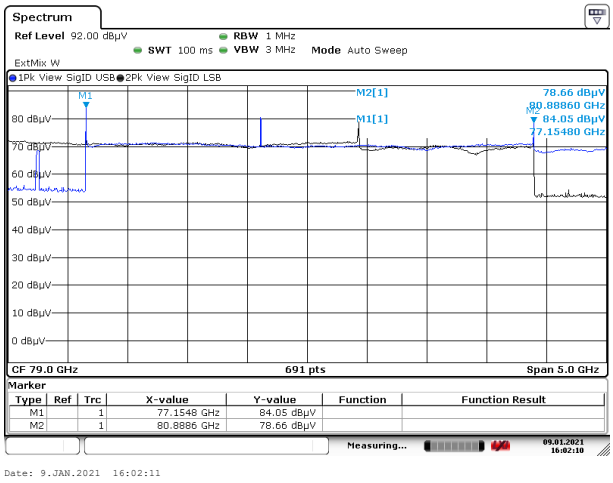
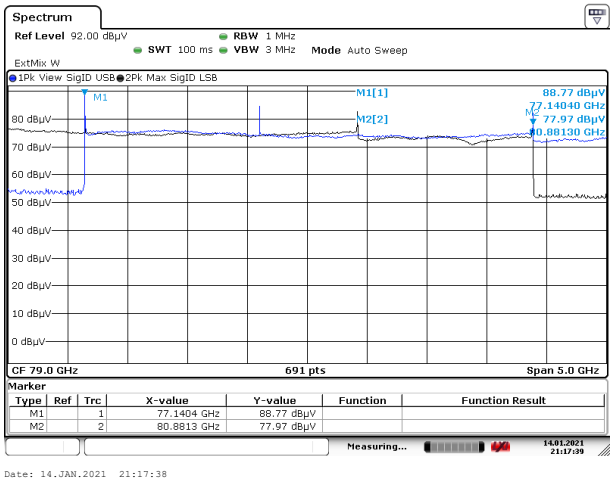
Voltage: 12V	
Environment Temperature: 50℃	**Environment Temperature: 40℃**
	
Environment Temperature: 30℃	**Environment Temperature: 20℃**
	

Voltage: 12V	
Environment Temperature: 10℃	**Environment Temperature: 0℃**
	
Environment Temperature: -10℃	**Environment Temperature: -20℃**
	

Voltage: 12V	
Environment Temperature: -30℃	**Environment Temperature: -40℃**



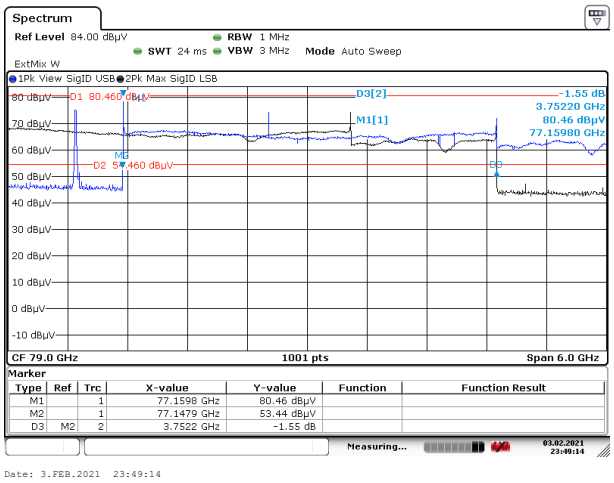


Environment Temperature: 20℃	
Voltage: 10.2V	**Voltage: 12V**
	
Voltage: 13.8V	
	

OBW: 26dB

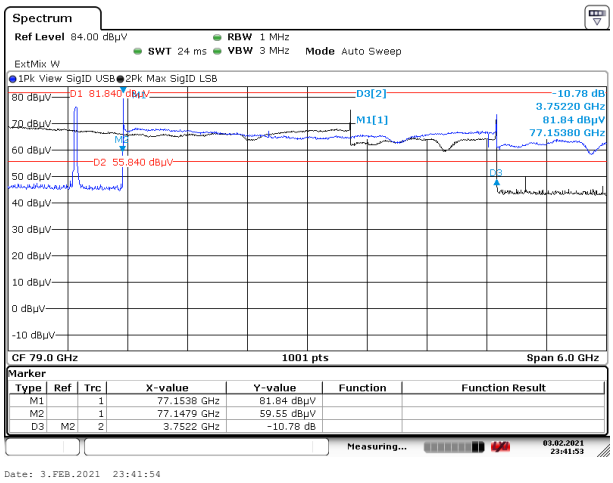
Voltage: 12V

Environment Temperature: 85℃



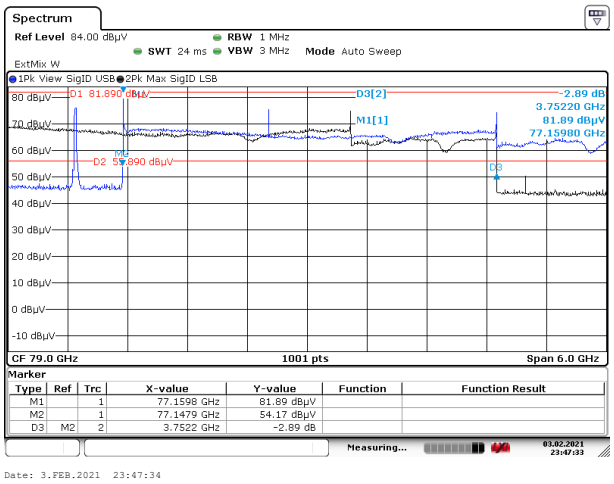
Date: 3.FEB.2021 23:49:14

Environment Temperature: 80℃



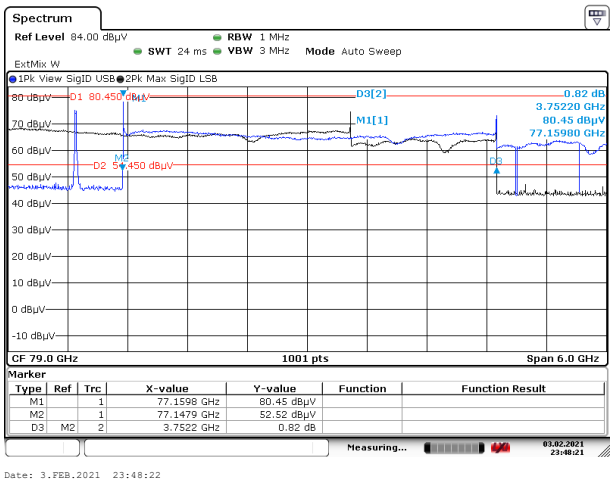
Date: 3.FEB.2021 23:41:54

Environment Temperature: 70℃

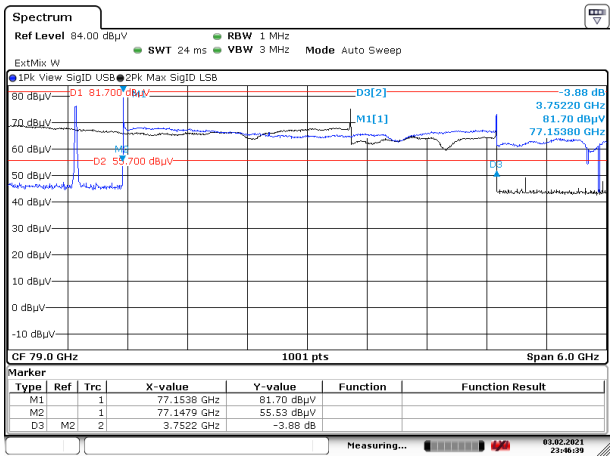
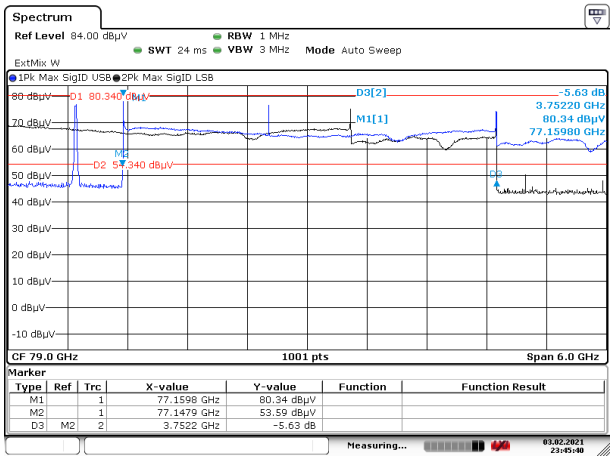
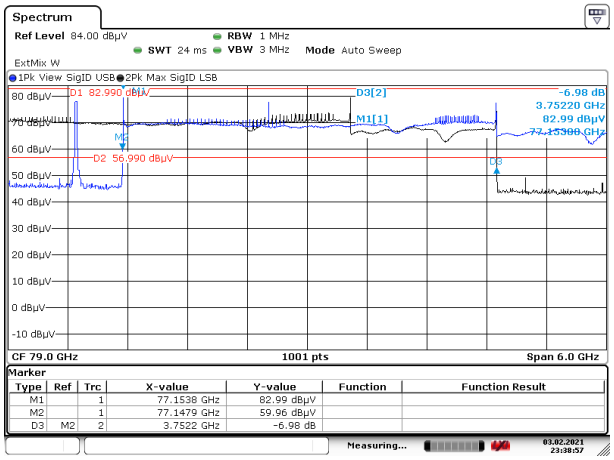
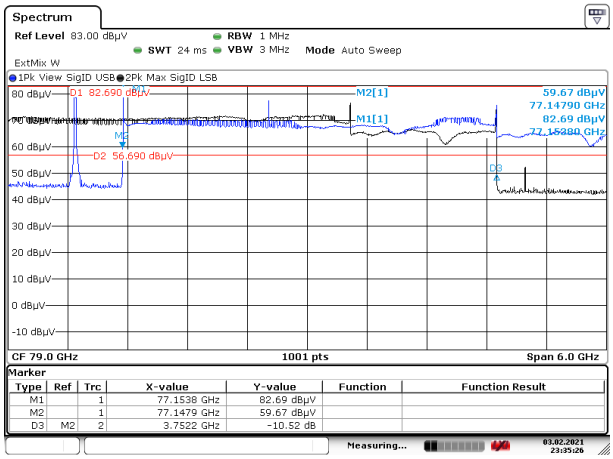


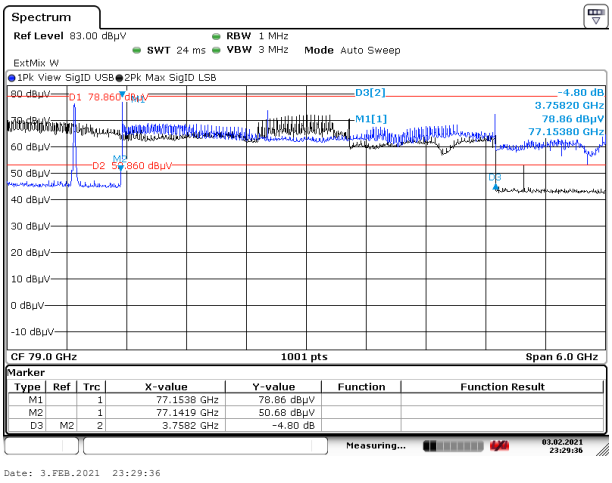
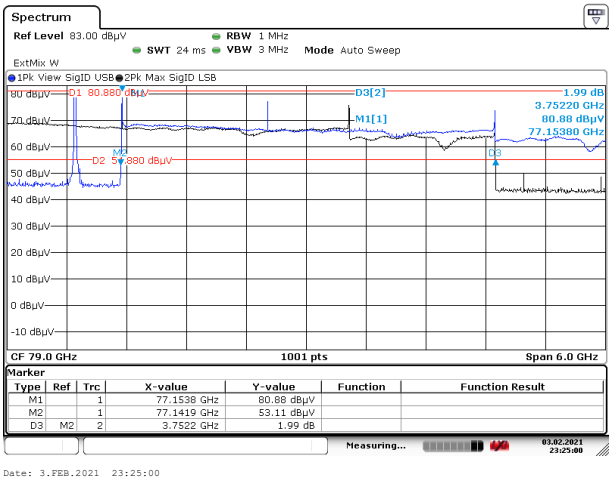
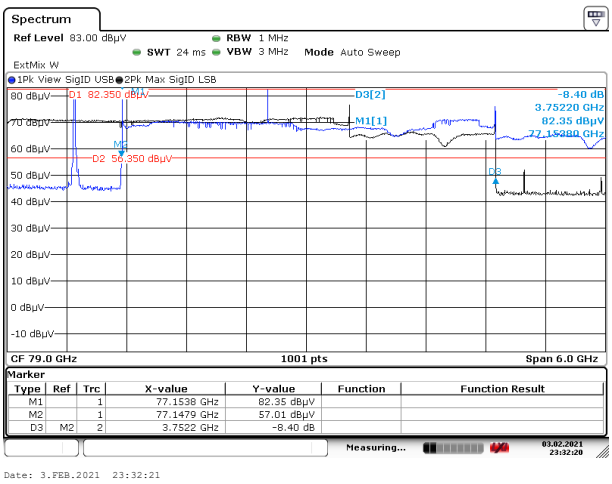
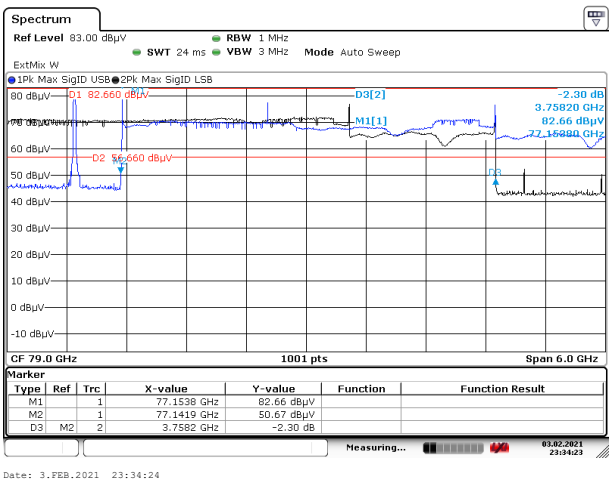
Date: 3.FEB.2021 23:47:34

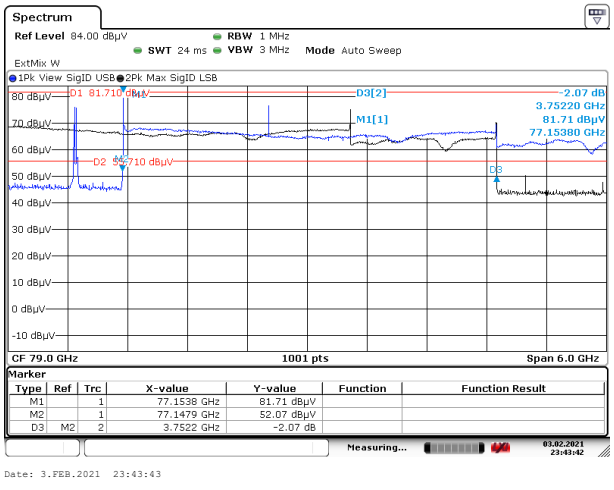
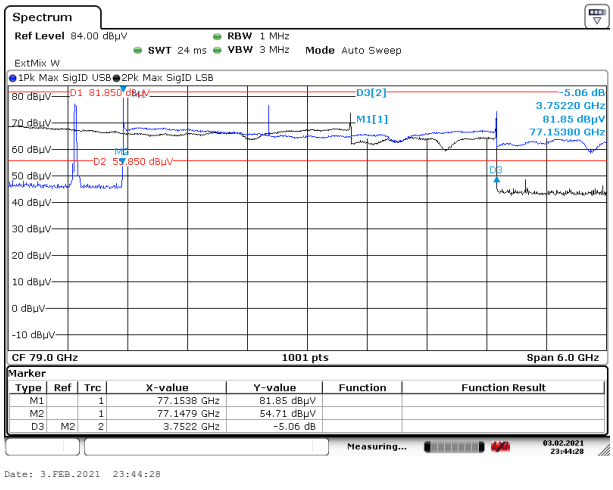
Environment Temperature: 60℃

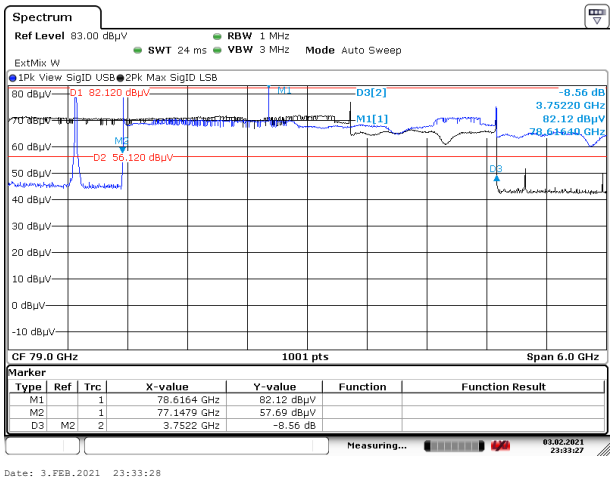
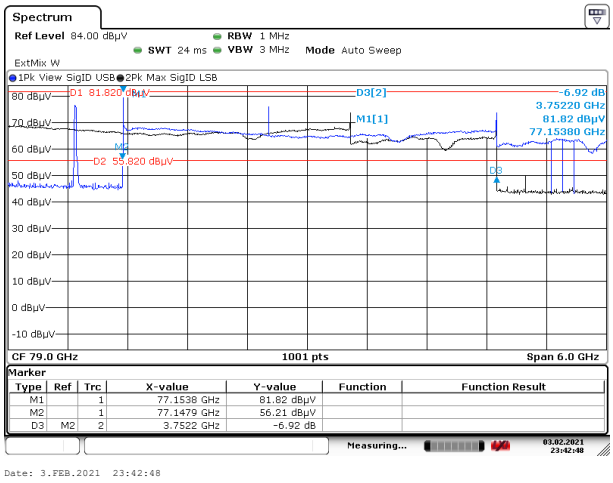
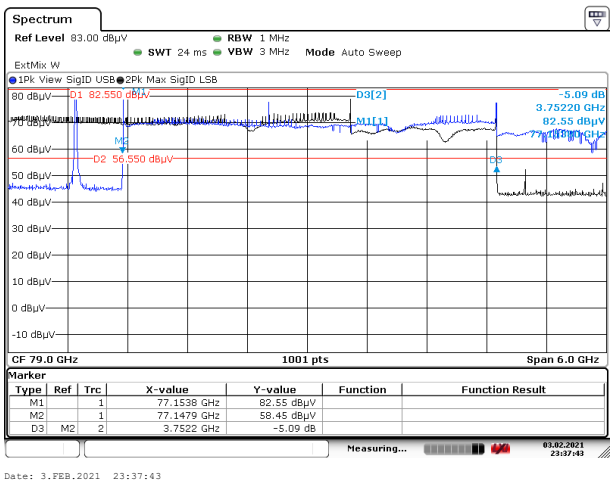


Date: 3.FEB.2021 23:48:22

Voltage: 12V	
Environment Temperature: 50℃	**Environment Temperature: 40℃**
	
Environment Temperature: 30℃	**Environment Temperature: 20℃**
	

Voltage: 12V	
Environment Temperature: 10℃	**Environment Temperature: 0℃**
	
Environment Temperature: -10℃	**Environment Temperature: -20℃**
	

Voltage: 12V	
Environment Temperature: -30℃	**Environment Temperature: -40℃**
	

Environment Temperature: 20℃	
Voltage: 10.2V	**Voltage: 12V**
	
Voltage: 13.8V	
	

- End of Test Report -