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Radio Testing of the

Ainstein AI Inc.
79 GHz CMOS Automotive Safety Radar
Model: T-79 and T79-REI

In accordance with CFR 47 Part 95 Subpart M and
RSS-251 Issue 2 July 2018

Ainstein AI Inc.
2029 Becker Dr
Lawrence, KS 66047 USA

COMMERCIAL-IN-CONFIDENCE

Date: May 2021
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Authorized Signatory	Xiaoying Zhang	May 13, 2021	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

EXECUTIVE SUMMARY

A sample of this product was tested and found to be in compliance with CFR 47 Part 95 Subpart M and RSS-251 Issue 2 July 2018.



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REPORT ON Radio Testing of the
Ainstein AI Inc.
Model T-79 and T79-REI 79 GHz CMOS Automotive Safety Radar


TEST REPORT NUMBER 72163184

TEST REPORT DATE May 2021

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DATED May 13, 2021



Revision History

72163184 Ainstein AI Inc. 79 GHz CMOS Automotive Safety Radar Model T-79 and T79-REI					
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SECTION 1

REPORT SUMMARY

Radio Testing of the
Ainstein AI Inc.
79 GHz CMOS Automotive Safety Radar Model T-79



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Ainstein AI Inc. 79 GHz CMOS Automotive Safety Radar Model T-79 to the requirements of CFR 47 Part 95 Subpart M and RSS-251 Issue 2 July 2018.

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	Ainstein AI Inc.
EUT	79 GHz CMOS Automotive Safety Radar
Trade Name	T-79
Model Name	T-79 and T79-REI
FCC ID	2ATMB-T79BSD
IC Number	N/A (Client not seeking ISED certification)
Serial Number(s)	0300BH220A170003, 0300BH220A170001 and REIT79V1
Number of Samples Tested	3
Test Specification/Issue/Date	<ul style="list-style-type: none">• CFR 47 Part 95 Subpart M (October 1, 2019).• RSS-251 Issue 2 July 2018 Vehicular Radar and Airport Fixed or Mobile Radar in the 76-81 GHz Frequency Band
Start of Test	October 05, 2020
Finish of Test	April 27, 2021
Name of Engineer(s)	Ferdinand Custodio
Related Document(s)	<ul style="list-style-type: none">• ANSI C63.26-2015. American National Standard for Compliance Testing of Transmitters Used in Licensed radio Services.• KDB 653005 D01 76-81 GHz Radars v01r01• Application Note 1EF107-1E Rohde & Schwarz Peak and Mean Power measurements on wideband FMCW radar signals• T-79 Data Sheet.pdf



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with CFR 47 Part 95 Subpart M and RSS-251 Issue 2 July 2018 are shown below:

Part 2	Part 95 Subpart M	RSS-251 / RSS-Gen*	Test Description	Result
§2.1046	§95.3367 (b)	9	Radiated Power Limits – Peak Power (EIRP)	Compliant
	§95.3367 (a)	8	Radiated Power Limits – Average Power (EIRP)	Compliant
§2.1049		6.7*	Occupied Bandwidth	Compliant
§2.1047		6b	Modulation Characteristics	N/A
§2.1053	§95.3379	10 and 6.3*	Unwanted Emissions Limits	Compliant
§2.1055	§95.3379 (b)	11	Frequency Stability	Compliant

N/A -Not verified. Declared by the Manufacturer as part of the Operational Description exhibit. See also Technical Description section of this test report (Section 1.3.2).



1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) is an Ainstein AI Inc. 79 GHz CMOS Automotive Safety Radar Model T-79. The EUT is a short range wideband, high resolution automotive radar sensor. It is built on RF-CMOS IC technology allowing for ultra-low power consumption and low unit cost. The sensor’s highly integrated hardware design with proprietary radar signal processing algorithms enables 360° high resolution detection when multiple units are installed on the vehicle and allow semi-autonomous or fully autonomous driving. The ultra-high range resolution, fast update rates, and CAN-FD data link options make it an ideal solution to implement sensor fusion for ADAS and self-driving applications. Two (2) models are covered in this test report. The T-79 and T79-REI. The difference between the two models are the enclosures. Both models share the same radar radio.

1.3.2 Technical Description

EUT Description	79 GHz CMOS Automotive Safety Radar		
Model Name	T-79		
Model Number	T-79 and T79-REI		
Serial Number	0300BH220A170003 ,0300BH220A170001 and REIT79V1		
Input Voltage	12VDC		
Output RF Power	28 dBm EIRP		
Frequency Range	76.1GHz to 76.4GHz (300 MHz)		
Emission Designator/s	F0N255M		
Modulation Type	Sawtooth		
Sweep Bandwidth	300 MHz		
Sweep Rate	28/33 kHz		
Sweep Time	42ms/41ms		
Frame Time	50 ms		
Duty Cycle	14%		
Chirp Time	27 µs		
Type of Equipment	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Mobile	<input type="checkbox"/> Portable
Antenna gain	16 dBi		



1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
Default	The EUT is designed to enter its operational mode (continuous TX mode) once a 12 V supply is applied to the DC_IN pin and Ignition pin and 0V of the battery is applied to the GND_IN pin. No CAN message protocol or diagnostic handshake protocol is necessary in this special mode

1.4.2 EUT Exercise Software

None. No special software was used to exercise the EUT.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
Molex	Cable Interface	Molex Part Number 34967-1001 (Terminal 34905-2447) with 10 conductors
HP	DC Power Supply	Model 6015A S/N 3044A-00106

1.4.4 Simplified Test Configuration Diagram

N/A. EUT was configured on a standalone configuration.



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: 0300BH220A170003 and 0300BH220A170001		
None	—	—

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 C63.26-2015. American National Standard for Compliance Testing of Transmitters Used in Licensed radio Services.

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 C63.26-2015. 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 1400
 Fax: 858 546 0364.

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Designation No.: US1146

TÜV SÜD 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 TÜV SÜD 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 TÜV SÜD 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)

TÜV 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)

TÜV SÜD 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-0280 and A-0281

TÜV SÜD 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.

1.9.6 RRA – Identification No. US0102

TÜV SÜD America Inc. (San Diego) is National Radio Research Agency (RRA) recognized laboratory under Phase I of the APEC Tel MRA.

1.9.7 OFCA – U.S. Identification No. US0102

TÜV SÜD America Inc. (San Diego) is recognized by Office of the Communications Authority (OFCA) under Appendix B, Phase I of the APEC Tel MRA.



SECTION 2

TEST DETAILS

Radio Testing of the
Ainstein AI Inc.
79 GHz CMOS Automotive Safety Radar Model T-79 and T79-REI



2.1 RADIATED POWER LIMITS

2.1.1 Specification Reference

Part 2.1046(a), Part 95 Subpart M §95.3367(a) (b) and RSS-251 Sec. 8.0 and Section 9.0

2.1.2 Standard Applicable

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:

(a) 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).

(b) 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

2.1.3 Equipment Under Test and Modification State

Serial No: 0300BH220A170003 ,0300BH220A170001 and REIT79V1 / Default Test Configuration

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

October 27, 2020 and April 25, 2021 / FSC

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 performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	25.0 to 26.8 °C
Relative Humidity	45.8 to 49.4 %
ATM Pressure	100.1 to 100.8z kPa

2.1.7 Additional Observations

- This is a radiated test.
- Test distance of 1 m was used for the fundamental emissions measurement.
- Offset is for the free space loss of the relevant frequency being investigated otherwise antenna gain is programmed as a transducer factor (TDF) while mixer conversion loss is programmed in the SA mixer setup.
- The FMCW chirps correction factor was calculated using the formula:

$$CF_{\text{chirp}} = 5 \times \log \left(1 + K \times \left(\frac{\text{Span}}{t \times \text{RBW}^2} \right)^2 \right)$$

- Guidance for calculating the correction factor is from Application Note 1EF107-1E Rohde & Schwarz Peak and Mean Power measurements on wideband FMCW radar signals.



- Sample calculation for FMCW chirps correction factor:

$$CF_{\text{chirp}} = 5 \times \log \left(1 + K \times \left(\frac{\text{Span}}{t \times \text{RBW}^2} \right)^2 \right)$$

$$CF_{\text{chirp}} = 5 \times \log \left(1 + 0.1947 \times \left(\frac{300 \text{ MHz}}{27 \mu\text{s} \times 1 \text{ MHz}^2} \right)^2 \right)$$

$$CF_{\text{chirp}} = 9.55 \text{ dB}$$

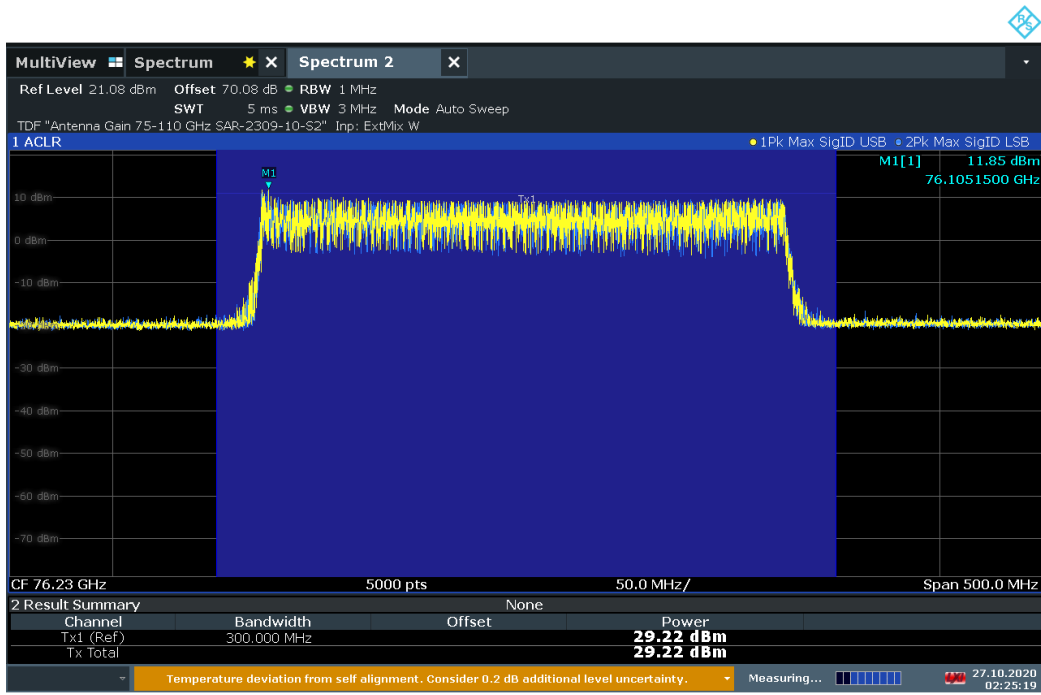
2.1.8 Test Results

Detector	Measured	FMCW Chirps Correction Factor	Corrected Level (EIRP)	EIRP Limit
T-79				
Peak	11.85 dBm/MHz	9.55 dB	21.40 dBm/MHz	55 dBm/MHz
Average	3.58 dBm/MHz		3.58 dBm/MHz	50 dBm
Average (band power)	27.64 dBm	-	27.64 dBm	
T79-REI				
Peak	13.59 dBm/MHz	9.55 dB	23.14 dBm/MHz	55 dBm/MHz
Average	4.25 dBm/MHz		4.25 dBm/MHz	50 dBm
Average (band power)	28.32 dBm	-	28.32 dBm	

Test Note: Average/MHz figures are based on 255MHz OBW of the EUT.

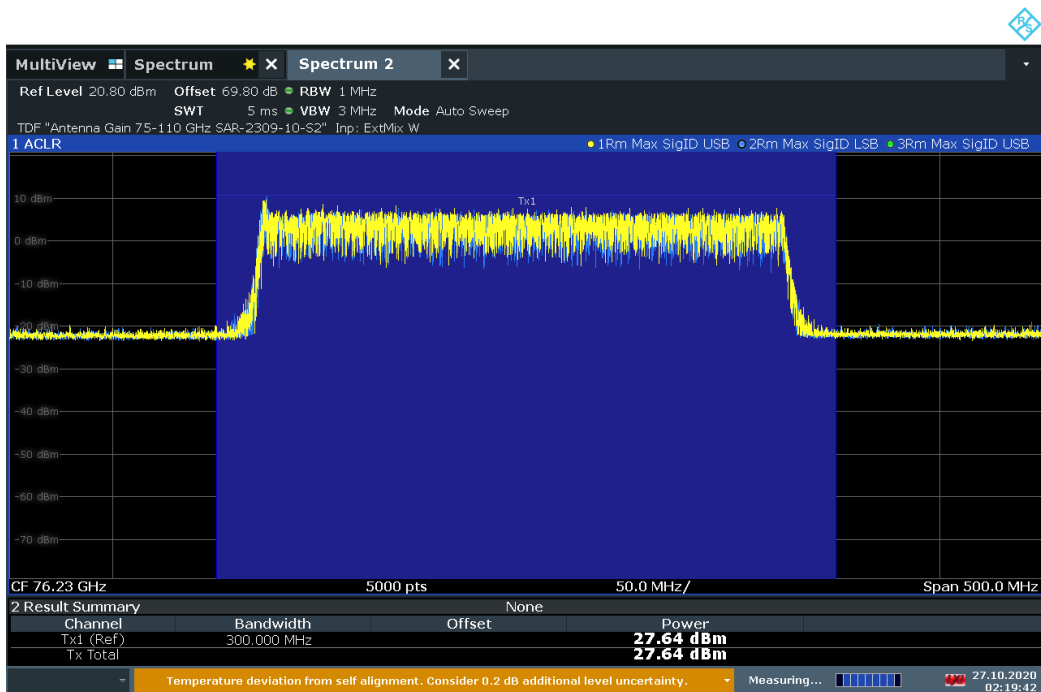


2.1.9 Test Plots



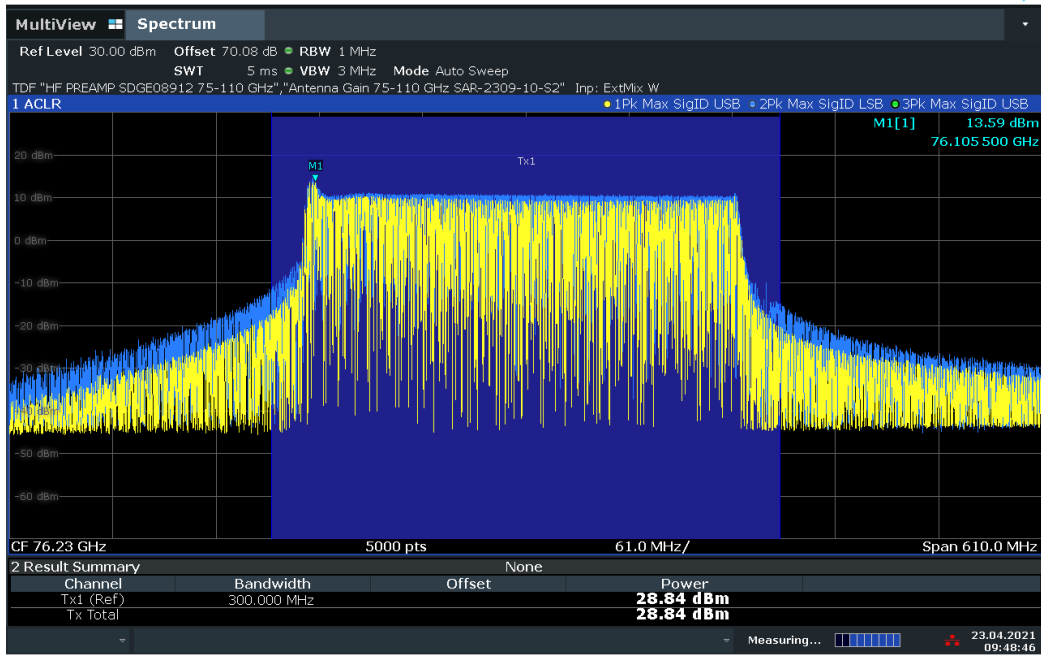
02:25:19 27.10.2020

Peak Power EIRP (T-79)



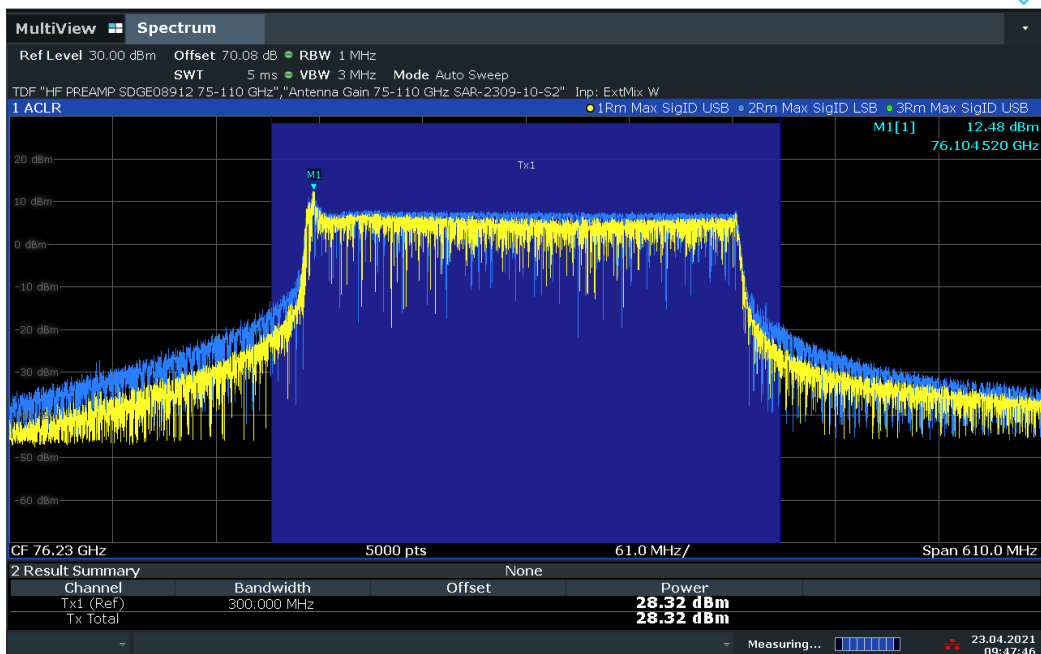
02:19:43 27.10.2020

Average Power EIRP (T-79)



09:48:47 23.04.2021

Peak Power EIRP (T79-REI)



09:47:46 23.04.2021

Average Power EIRP (T79-REI)



2.2 OCCUPIED BANDWIDTH

2.2.1 Specification Reference

Part 2.1049 and RSS-GEN Issue 5 Section 6.7

2.2.2 Standard Applicable

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

2.2.3 Equipment Under Test and Modification State

Serial No: 0300BH220A170003 and 0300BH220A170001 / Default Test Configuration

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

October 27, 2020/ FSC

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 performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature	25.0 °C
Relative Humidity	49.4 %
ATM Pressure	100.1 kPa

2.2.7 Additional Observations

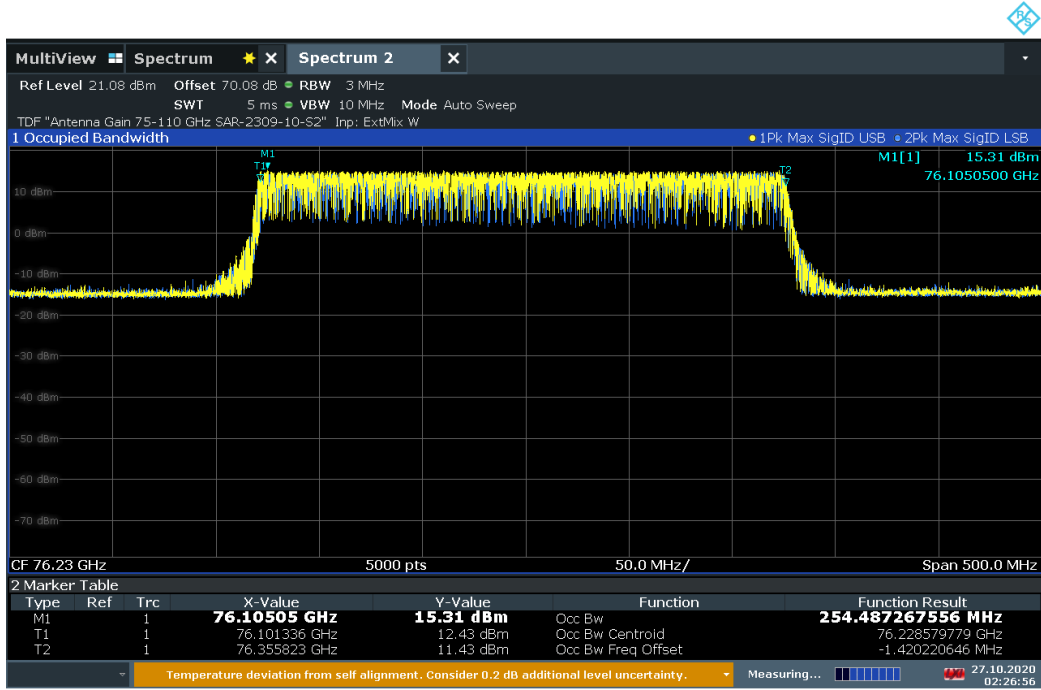
- This is a radiated test.
- Span is wide enough to capture the channel transmission.
- VBW > RBW.
- Trace is max hold.
- Detector is peak.
- Sweep time is set to Auto.
- 99% OBW measurement function of the spectrum analyzer was used for this test.
- RBW is between 1% to 5% of the anticipated OBW.

2.2.8 Test Results

99% OBW	255 MHz
---------	---------



2.2.9 Test Plot



02:26:57 27.10.2020

99% OBW



2.3 UNWANTED EMISSIONS LIMITS

2.3.1 Specification Reference

Part 2.1053, FCC Part 95 Subpart M §95.3379 and RSS-251 Section 10

2.3.2 Standard Applicable

(a) The power density of any emissions outside the 76-81 GHz band shall consist solely of spurious emissions and shall not exceed the following:

(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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

(i) In the emissions table in paragraph (a)(1) of this section, the tighter limit applies at the band edges.

(ii) The limits in the table in paragraph (a)(1) of this section are based on the frequency of the unwanted emissions and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(iii) The emissions limits shown in the table in paragraph (a)(1) of this section are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9.0-90.0 kHz, 110.0-490.0 kHz, and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector with a 1 MHz RBW.

(2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:

(i) 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/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

(ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

(3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

For radar devices that operate solely in the 76-77 GHz band (i.e., the occupied bandwidth is entirely contained in the 76-77 GHz band), an unwanted emissions limit of 0 dBm/MHz shall apply for the unwanted emission that fall in the 73.5-76 GHz band. Outside of the 73.5-76 GHz band, the unwanted emission limits prescribed in table 1 shall apply.



2.3.3 Equipment Under Test and Modification State

Serial No: 0300BH220A170003 ,0300BH220A170001 and REIT79V1 / Default Test Configuration

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

October 05, 26 and 27, 2020 / FSC
 February 4, 5 and 8, 2021 / FSC
 April 1, 23 and 27, 2021 / FSC

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 performed at TÜV SÜD America Inc. Mira Mesa facility

Ambient Temperature 22.8 - 26.6 °C
 Relative Humidity 27.2 – 42.9 %
 ATM Pressure 100.1– 100.5 kPa

2.3.7 Additional Observations

- This is a radiated test.
- The spectrum was searched from 30MHz to 231GHz.
- Measurement was done using EMC32 automated software for below 40GHz. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See below table for sample computation at 30MHz:

Measuring equipment raw measurement (dbµV) @ 30 MHz		24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3
	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

- For measurements above 40GHz, the corresponding transducer factor (TDF) were programmed directly to the Spectrum Analyzer (e.g., antenna gain, LNA and the free space loss).
- Measurement above 40GHz is maximized by hand and the worst-case plot (max hold) presented.
- Tests distances and frequency ranges performed are summarized below:

Frequency Range	Test Distance
30 MHz to 1GHz	3 meters
1 GHz to 18 GHz	3 meters
18 GHz to 26 GHz	3 meters



26 GHz to 40 GHz	3 meters
40 GHz to 60 GHz	3 meters
60 GHz to 75 GHz	3 meters
75 GHz to 110 GHz	1 meter
110 GHz to 160 GHz	1 meter
160 GHz to 200 GHz	1 meter
200 GHz to 231 GHz	0.2 meter

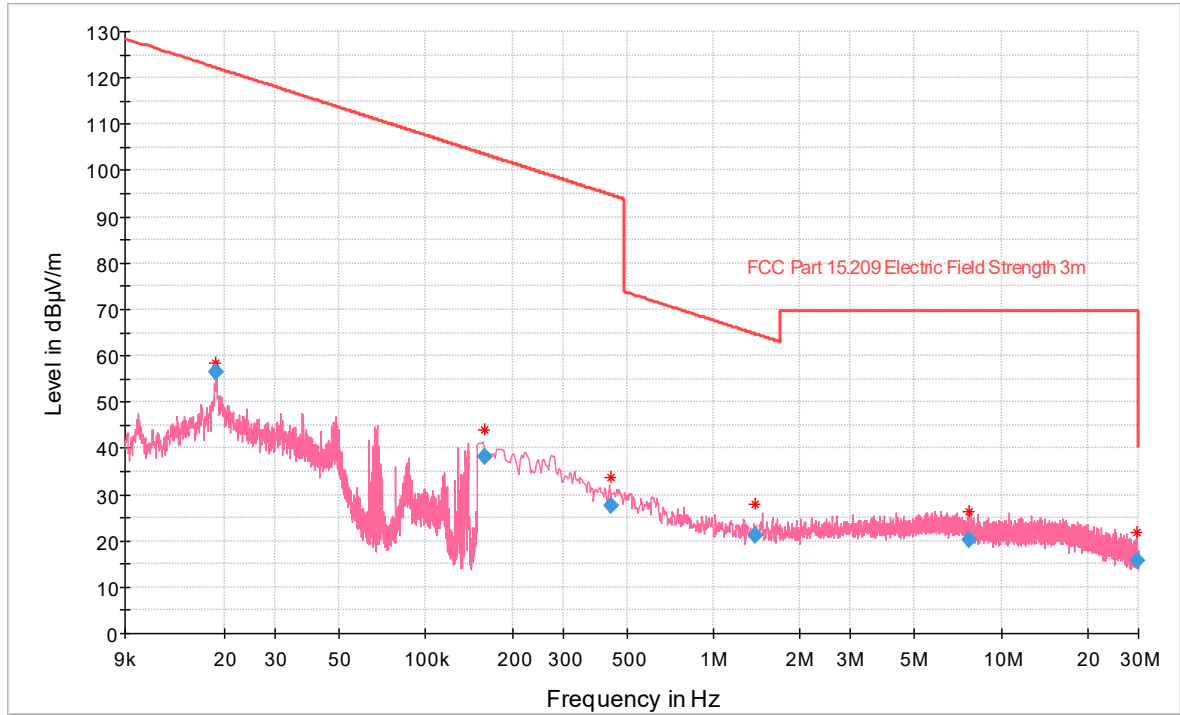
2.3.8 Test Results

Complies. See attached plots.



2.3.9 Below 30MHz Radiated Emission Test (T-79)

Full Spectrum



- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- * Critical_Freqs PK+ [Critical_Freqs.Result:4]
- FCC Part 15.209 Electric Field Strength 3m [.\EMI Radiated]
- ◆ Final_Result QPK [Final_Result.Result:4]

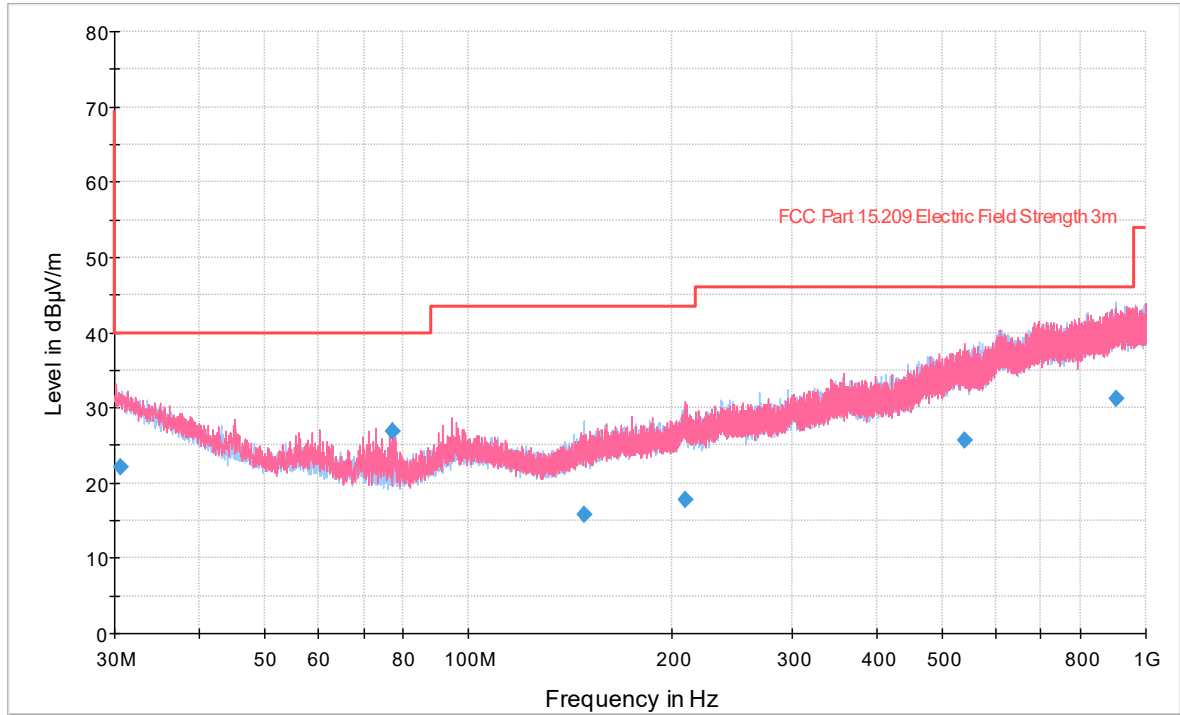
Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Height (cm)	Corr. (dB/m)
0.018653	56.40	122.18	65.78	1000.0	0.200	H	16.0	15
0.159500	38.22	103.55	65.33	1000.0	9.000	H	209.0	14
0.438655	27.53	94.76	67.23	1000.0	9.000	H	312.0	14
1.399304	21.05	64.68	43.63	1000.0	9.000	H	56.0	14
7.721743	20.31	69.50	49.19	1000.0	9.000	H	73.0	15
29.814347	15.66	69.50	53.84	1000.0	9.000	H	128.0	13



2.3.10 30MHz to 1GHz Radiated Emission Test (T-79)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15.209 Electric Field Strength 3m [.\EMI Radiated]
- ◆ Final_Result QPK [Final_Result.Result:4]

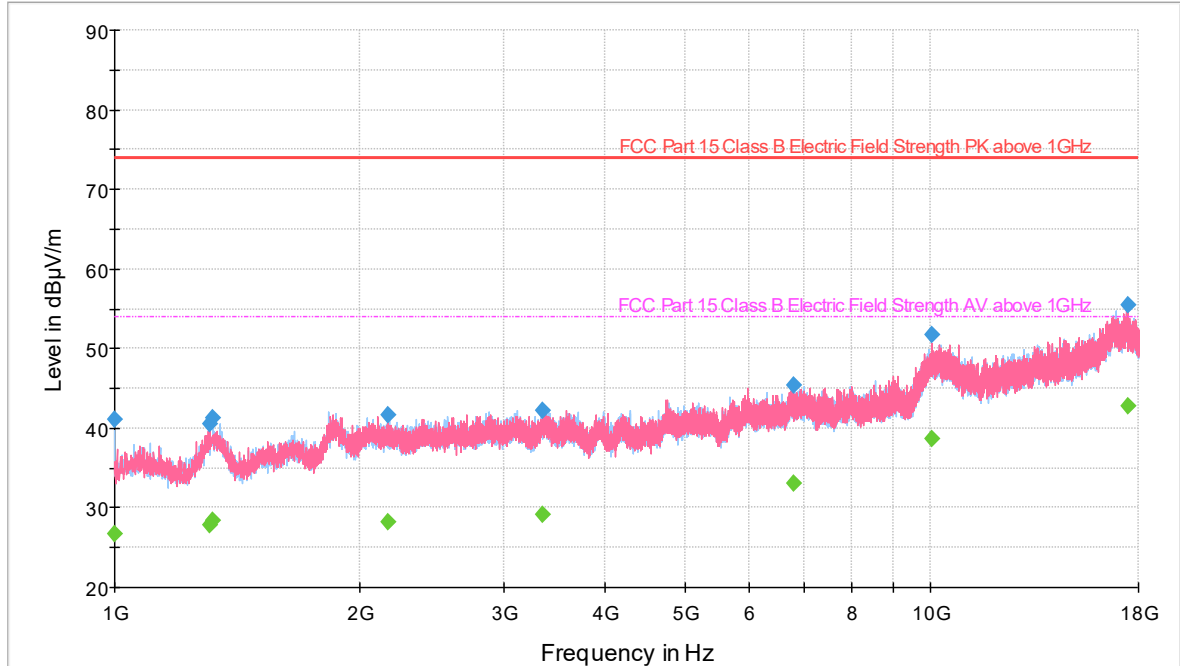
Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.600000	22.04	40.00	17.96	1000.0	120.000	214.0	V	286.0	22
77.206667	26.78	40.00	13.22	1000.0	120.000	100.0	V	7.0	12
148.095000	15.84	43.50	27.66	1000.0	120.000	313.0	H	24.0	16
208.760000	17.84	43.50	25.66	1000.0	120.000	410.0	V	233.0	19
539.577667	25.77	46.00	20.23	1000.0	120.000	225.0	V	298.0	26
904.196333	31.28	46.00	14.72	1000.0	120.000	125.0	H	218.0	31



2.3.11 From 1GHz to 18GHz Radiated Emission Test (T-79)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- - - FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.400000	41.01	73.90	32.89	1000.0	1000.000	365.0	H	197.0	-1
1306.566667	40.60	73.90	33.30	1000.0	1000.000	286.0	V	97.0	0
1321.366667	41.20	73.90	32.70	1000.0	1000.000	310.0	V	116.0	0
2165.400000	41.58	73.90	32.32	1000.0	1000.000	125.0	H	2.0	3
3349.200000	42.23	73.90	31.67	1000.0	1000.000	125.0	V	127.0	4
6807.833333	45.31	73.90	28.59	1000.0	1000.000	335.0	H	284.0	11
10053.800000	51.82	73.90	22.08	1000.0	1000.000	125.0	V	74.0	18
17446.266667	55.40	73.90	18.50	1000.0	1000.000	318.0	V	8.0	22



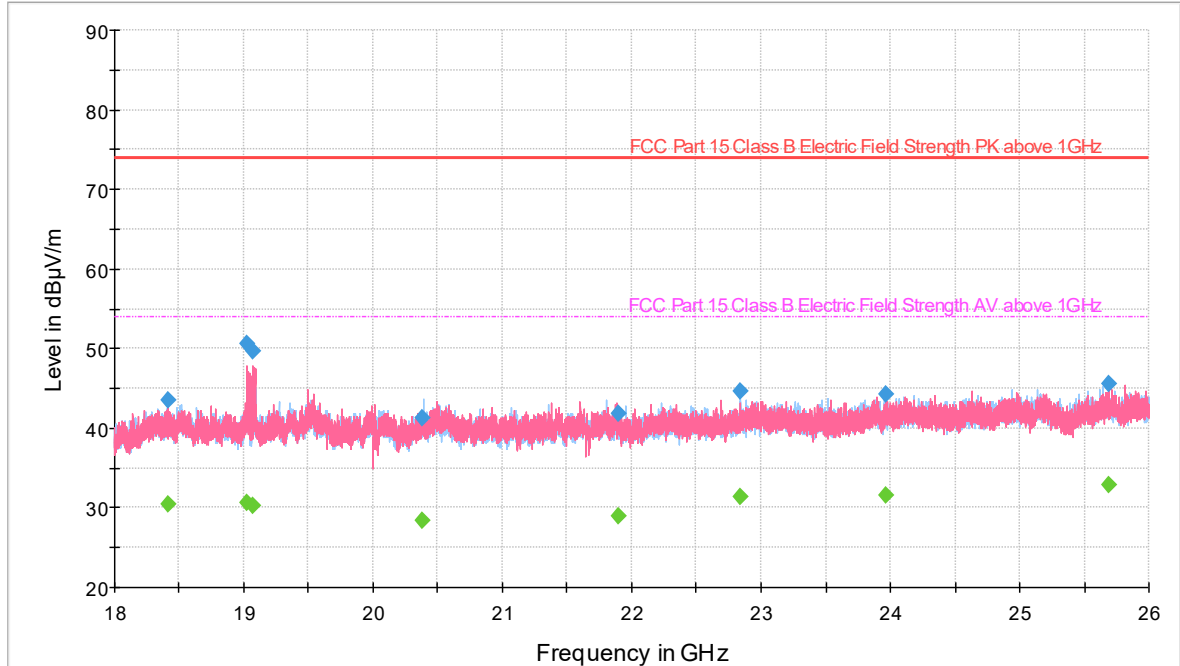
Average Data

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.400000	26.64	53.90	27.26	1000.0	1000.000	365.0	H	197.0	-1
1306.566667	27.93	53.90	25.97	1000.0	1000.000	286.0	V	97.0	0
1321.366667	28.34	53.90	25.56	1000.0	1000.000	310.0	V	116.0	0
2165.400000	28.30	53.90	25.60	1000.0	1000.000	125.0	H	2.0	3
3349.200000	29.17	53.90	24.73	1000.0	1000.000	125.0	V	127.0	4
6807.833333	33.06	53.90	20.84	1000.0	1000.000	335.0	H	284.0	11
10053.800000	38.62	53.90	15.28	1000.0	1000.000	125.0	V	74.0	18
17446.266667	42.72	53.90	11.18	1000.0	1000.000	318.0	V	8.0	22



2.3.12 18GHz to 26GHz Radiated Emission Test (T-79)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- - - FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18412.518500	43.47	73.90	30.43	1000.0	1000.000	138.0	H	182.0	-3
19026.080500	50.62	73.90	23.28	1000.0	1000.000	193.0	V	172.0	-3
19070.792000	49.75	73.90	24.15	1000.0	1000.000	141.0	V	172.0	-4
20380.980500	41.37	73.90	32.53	1000.0	1000.000	162.0	H	181.0	-3
21895.333000	41.76	73.90	32.14	1000.0	1000.000	204.0	H	63.0	-2
22842.297500	44.69	73.90	29.21	1000.0	1000.000	213.0	H	246.0	-1
23961.638000	44.25	73.90	29.65	1000.0	1000.000	139.0	V	337.0	0
25688.707000	45.49	73.90	28.41	1000.0	1000.000	162.0	V	288.0	1



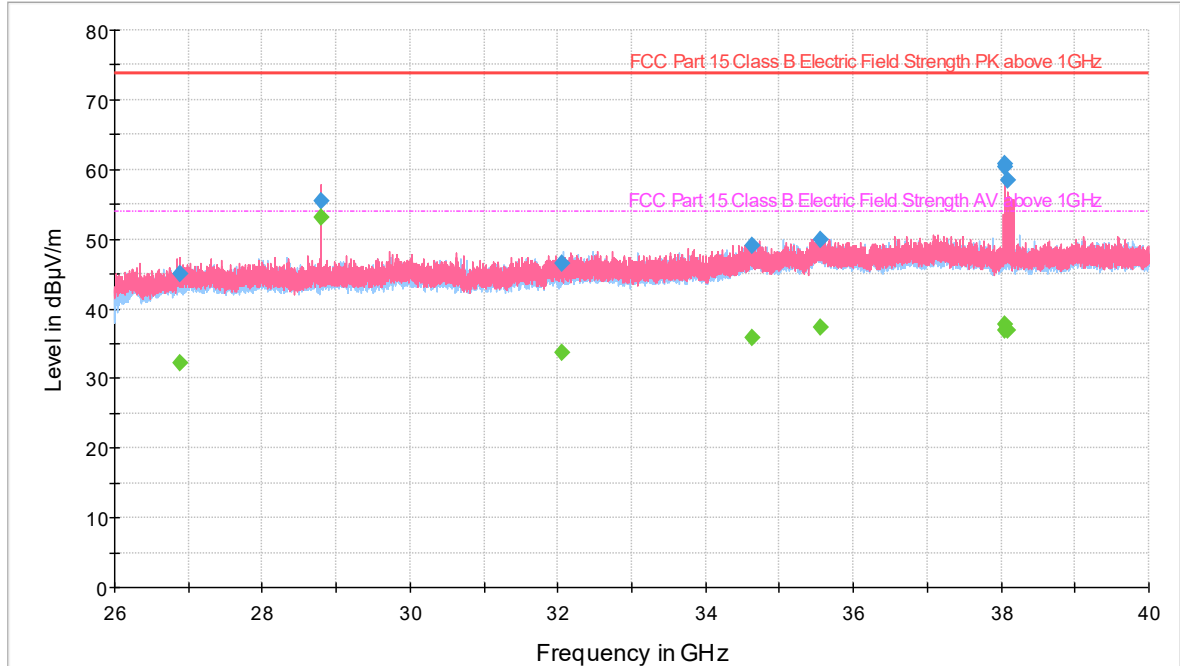
Average Data

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18412.518500	30.49	53.90	23.41	1000.0	1000.000	138.0	H	182.0	-3
19026.080500	30.68	53.90	23.22	1000.0	1000.000	193.0	V	172.0	-3
19070.792000	30.33	53.90	23.57	1000.0	1000.000	141.0	V	172.0	-4
20380.980500	28.47	53.90	25.43	1000.0	1000.000	162.0	H	181.0	-3
21895.333000	28.99	53.90	24.91	1000.0	1000.000	204.0	H	63.0	-2
22842.297500	31.30	53.90	22.60	1000.0	1000.000	213.0	H	246.0	-1
23961.638000	31.58	53.90	22.32	1000.0	1000.000	139.0	V	337.0	0
25688.707000	32.79	53.90	21.11	1000.0	1000.000	162.0	V	288.0	1



2.3.13 26GHz to 40GHz Radiated Emission Test (T-79)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

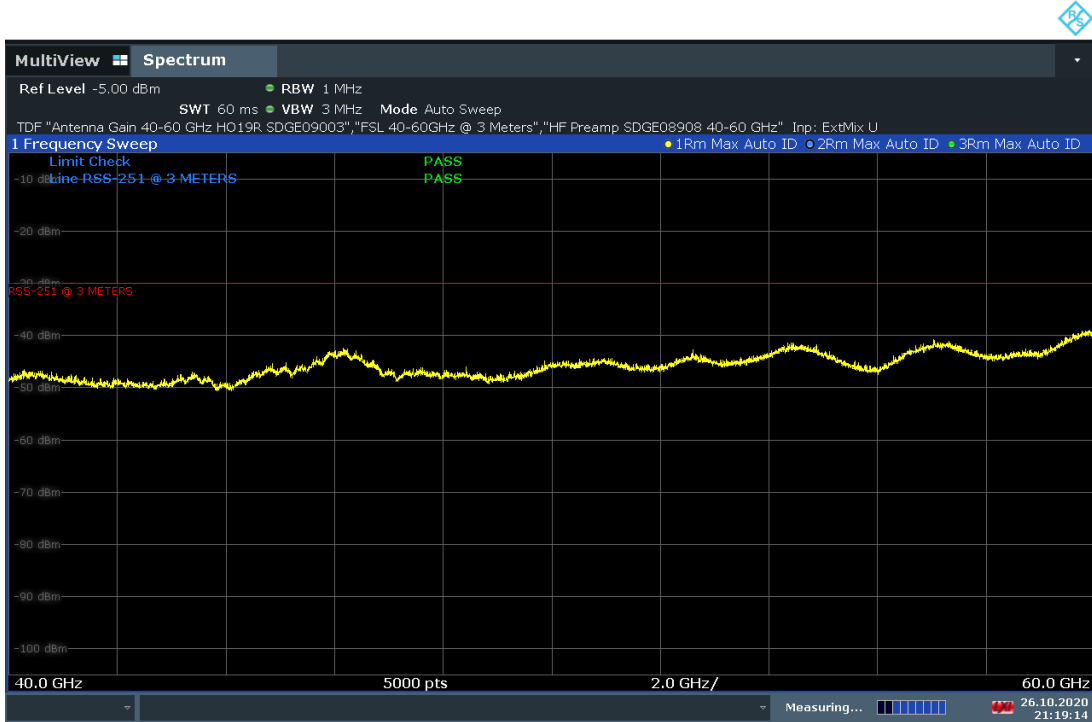
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
26886.861538	45.10	73.90	28.80	1000.0	1000.000	175.0	V	47.0	1
28799.419231	55.56	73.90	18.34	1000.0	1000.000	195.0	V	243.0	2
32063.918846	46.58	73.90	27.32	1000.0	1000.000	137.0	H	190.0	5
34627.896154	48.99	73.90	24.91	1000.0	1000.000	128.0	H	44.0	6
35551.201154	49.86	73.90	24.04	1000.0	1000.000	175.0	V	28.0	6
38049.683461	60.73	73.90	13.17	1000.0	1000.000	225.0	V	247.0	7
38051.244231	60.30	73.90	13.60	1000.0	1000.000	225.0	V	244.0	7
38080.907309	58.39	73.90	15.51	1000.0	1000.000	177.0	V	246.0	7



Average Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
26886.861538	32.31	53.90	21.59	1000.0	1000.000	175.0	V	47.0	1
28799.419231	53.17	53.90	0.73	1000.0	1000.000	195.0	V	243.0	2
32063.918846	33.79	53.90	20.11	1000.0	1000.000	137.0	H	190.0	5
34627.896154	35.89	53.90	18.01	1000.0	1000.000	128.0	H	44.0	6
35551.201154	37.23	53.90	16.67	1000.0	1000.000	175.0	V	28.0	6
38049.683461	37.76	53.90	16.14	1000.0	1000.000	225.0	V	247.0	7
38051.244231	36.86	53.90	17.04	1000.0	1000.000	225.0	V	244.0	7
38080.907309	36.84	53.90	17.06	1000.0	1000.000	177.0	V	246.0	7



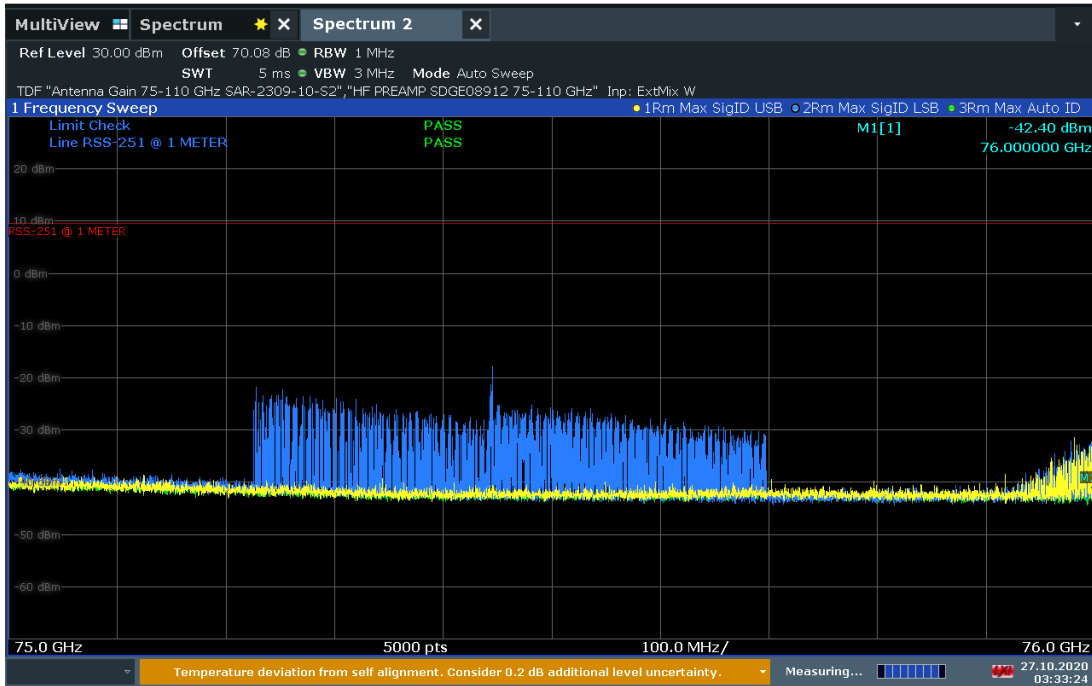
21:19:14 26.10.2020

40-60 GHz (T-79)



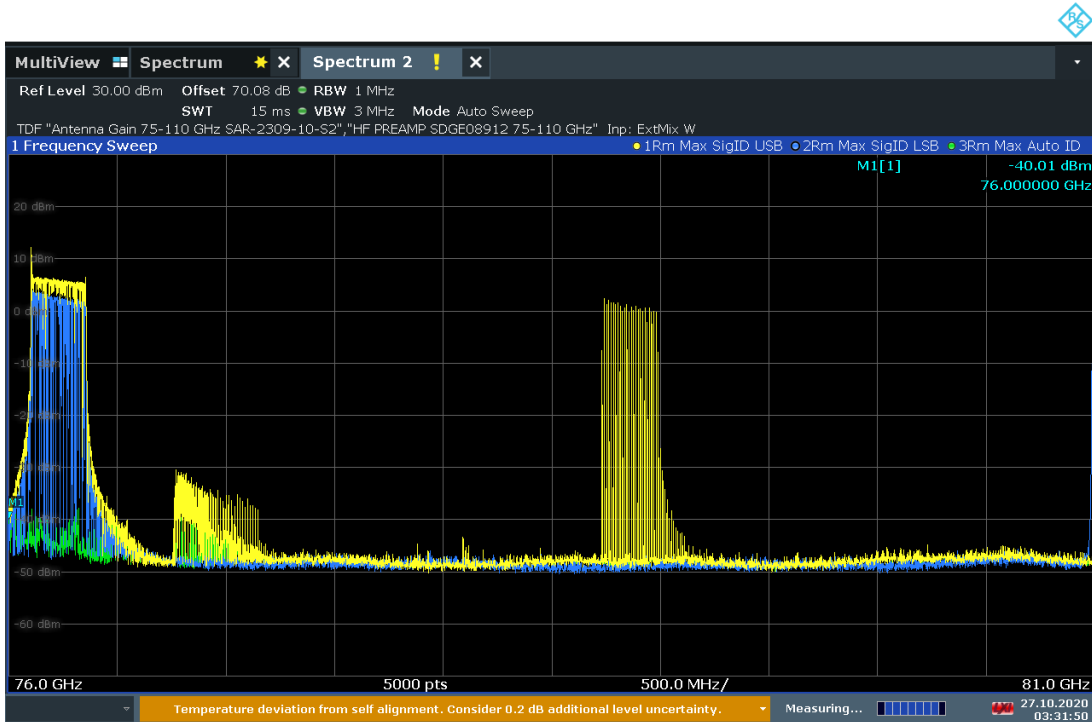
22:31:29 27.10.2020

60 to 75GHz (T-79)



03:33:24 27.10.2020

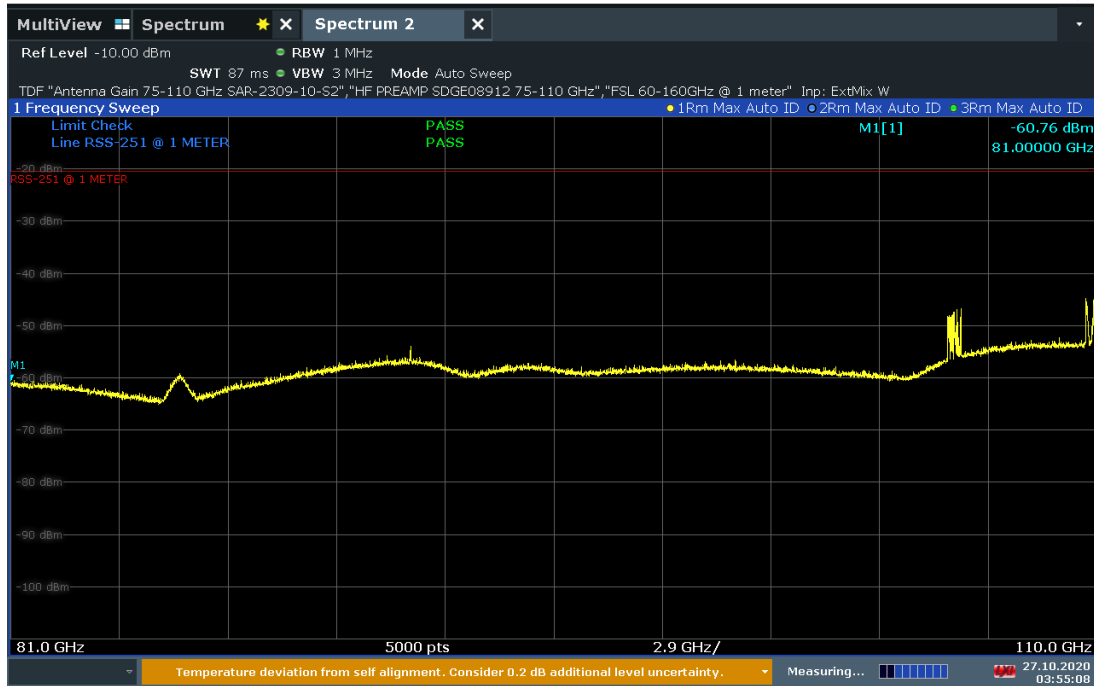
75-76GHz (T-79)



03:31:51 27.10.2020

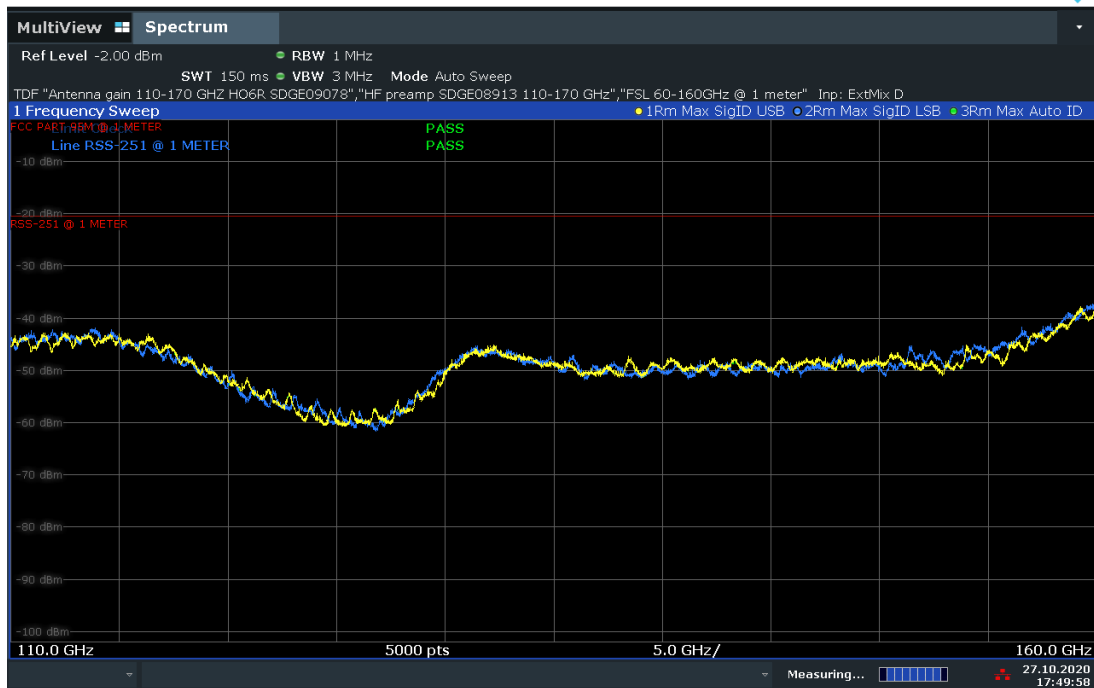
76-81GHz in band (T-79)

Test Note: When using Signal ID function, traces not common to both Yellow and Blue traces are by-products of the mixing and are not real.



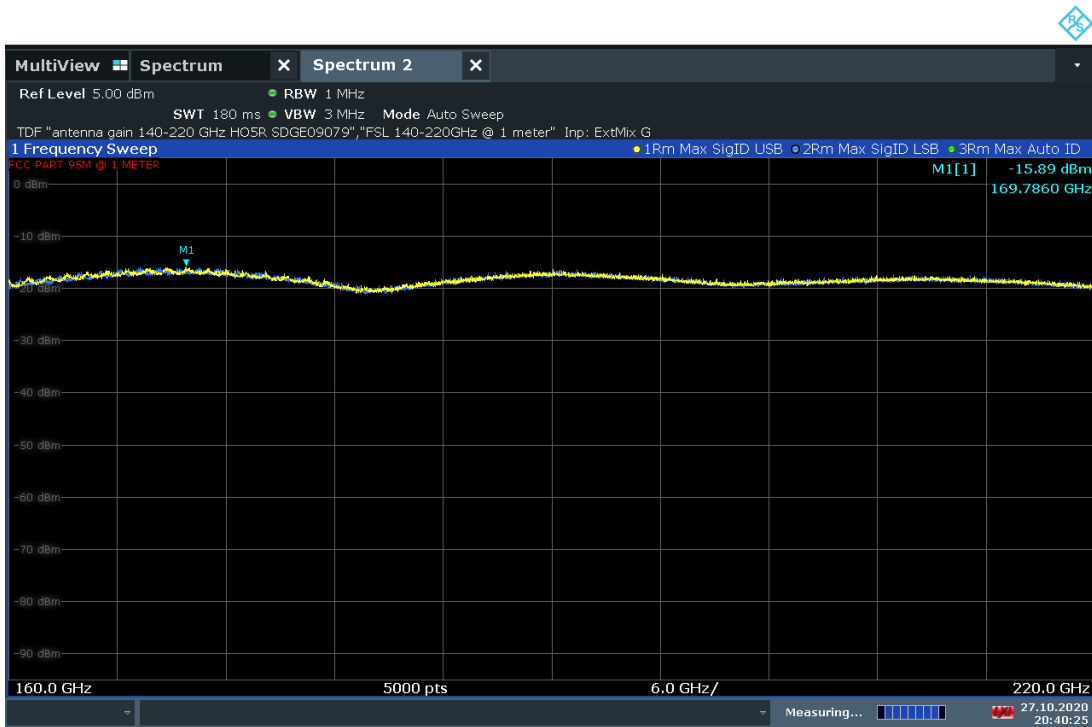
03:55:09 27.10.2020

81 to 110GHz (T-79)



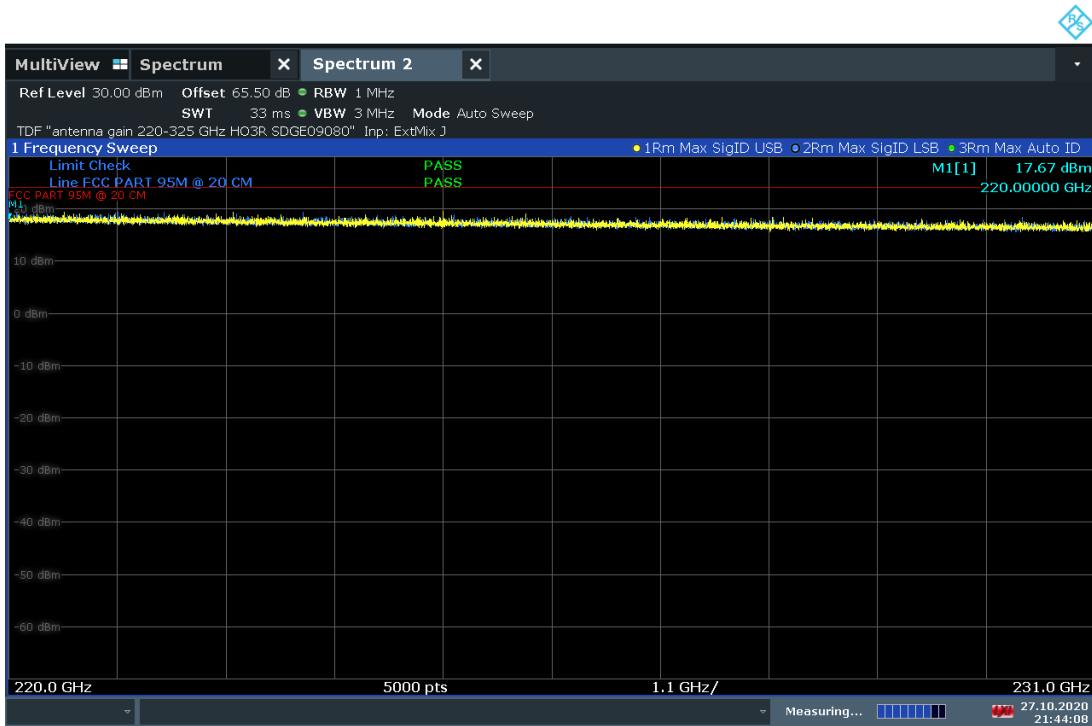
17:49:58 27.10.2020

110 to 160 GHz (T-79)



20:40:26 27.10.2020

160 to 220 GHz (T-79)



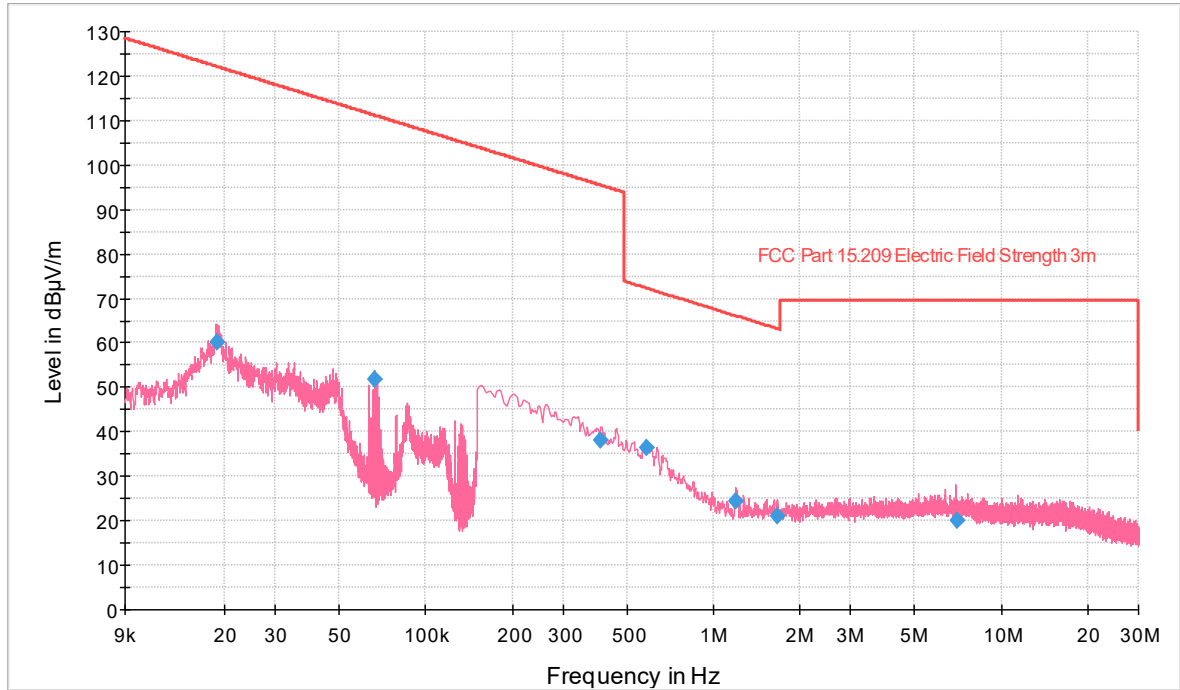
21:44:08 27.10.2020

220 to 231 GHz (T-79)



2.3.14 Below 30MHz Radiated Emission Test (T79-REI)

Full Spectrum



- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15.209 Electric Field Strength 3m [.\EMI Radiated]
- ◆ Final_Result QPK [Final_Result.Result:4]
- × MaxPeak-PK+ (Single) [Result Table_Single.Result:1]
- + QuasiPeak-QPK (Single) [Result Table_Single.Result:2]

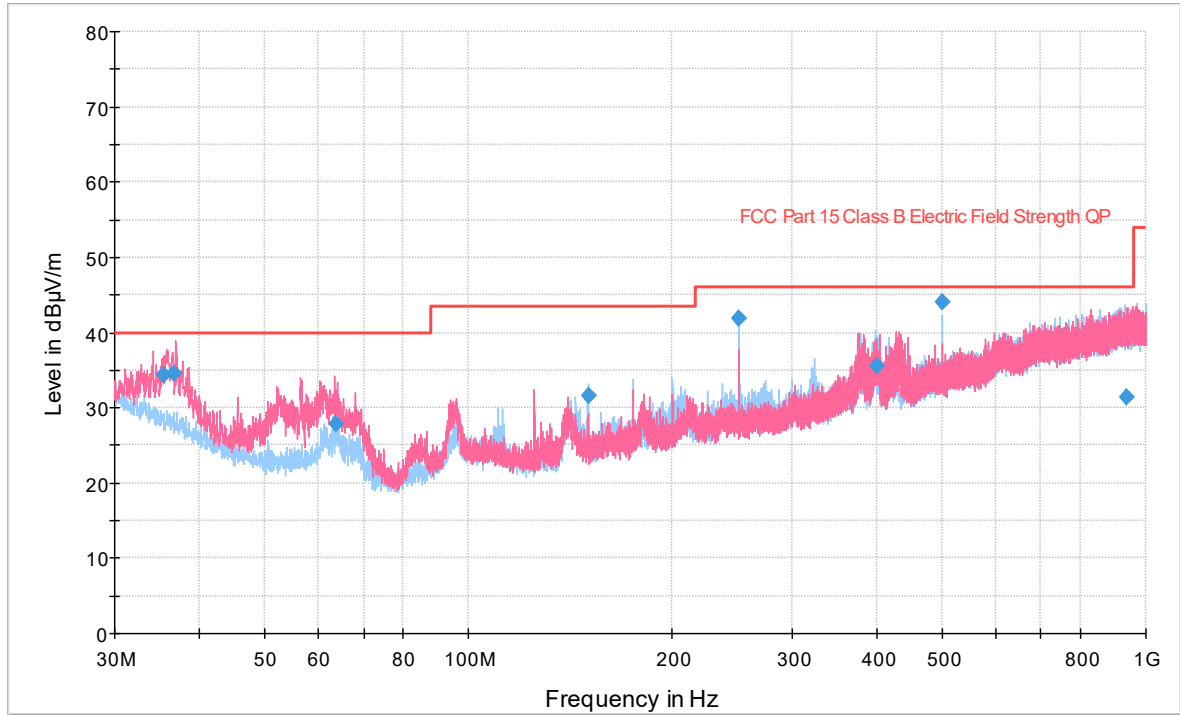
Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Height (cm)	Corr. (dB/m)
0.018728	60.25	122.15	61.90	1000.0	0.200	100.0	H	68.0
0.066553	51.79	111.14	59.34	1000.0	0.200	100.0	H	44.0
0.406760	38.25	95.42	57.16	1000.0	9.000	100.0	H	116.0
0.586295	36.58	72.24	35.66	1000.0	9.000	100.0	H	180.0
1.195761	24.53	66.04	41.51	1000.0	9.000	100.0	H	172.0
1.666128	21.05	63.16	42.12	1000.0	9.000	100.0	H	247.0
7.046557	20.19	69.50	49.31	1000.0	9.000	100.0	H	172.0



2.3.15 30MHz to 1GHz Radiated Emission Test (T79-REI)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength QP [..\EMI Radiated\]
- ◆ Final_Result QPK [Final_Result.Result:4]

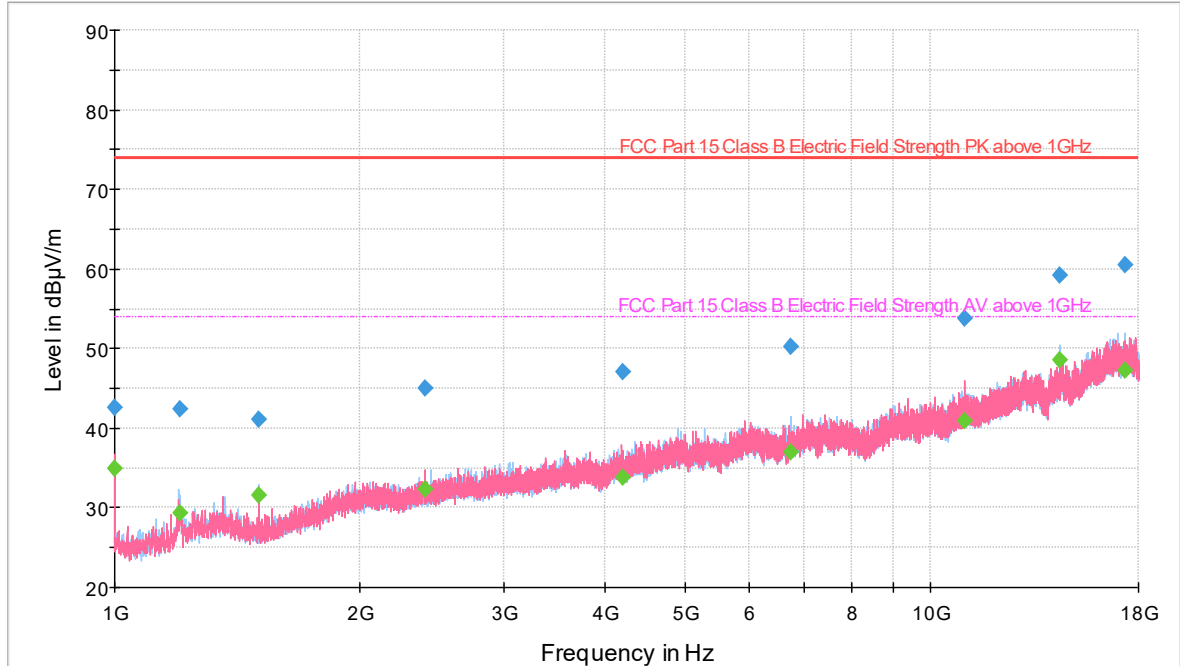
Quasi-Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.451000	34.28	40.00	5.72	1000.0	120.000	108.0	V	171.0	20
36.664000	34.56	40.00	5.44	1000.0	120.000	100.0	V	0.0	19
63.592667	27.94	40.00	12.06	1000.0	120.000	175.0	V	258.0	13
149.989000	31.51	43.50	11.99	1000.0	120.000	194.0	H	257.0	16
250.003667	41.80	46.00	4.20	1000.0	120.000	125.0	H	249.0	20
400.251000	35.54	46.00	10.46	1000.0	120.000	200.0	H	139.0	23
500.005000	44.09	46.00	1.91	1000.0	120.000	182.0	H	283.0	25
934.404333	31.45	46.00	14.55	1000.0	120.000	395.0	H	168.0	31



2.3.16 From 1GHz to 18GHz Radiated Emission Test (T79-REI)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- - - FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.000000	42.66	73.90	31.24	1000.0	1000.000	175.0	V	208.0	-6
1200.233333	42.40	73.90	31.50	1000.0	1000.000	175.0	H	47.0	-2
1500.000000	41.09	73.90	32.81	1000.0	1000.000	175.0	H	213.0	-4
2399.866667	44.94	73.90	28.96	1000.0	1000.000	300.0	V	57.0	1
4189.800000	47.12	73.90	26.78	1000.0	1000.000	295.0	V	296.0	5
6753.566667	50.25	73.90	23.65	1000.0	1000.000	339.0	H	50.0	6
11000.733333	53.74	73.90	20.16	1000.0	1000.000	157.0	V	27.0	14
14399.766667	59.11	73.90	14.79	1000.0	1000.000	170.0	H	341.0	13
17368.033333	60.42	73.90	13.48	1000.0	1000.000	222.0	H	8.0	19



America

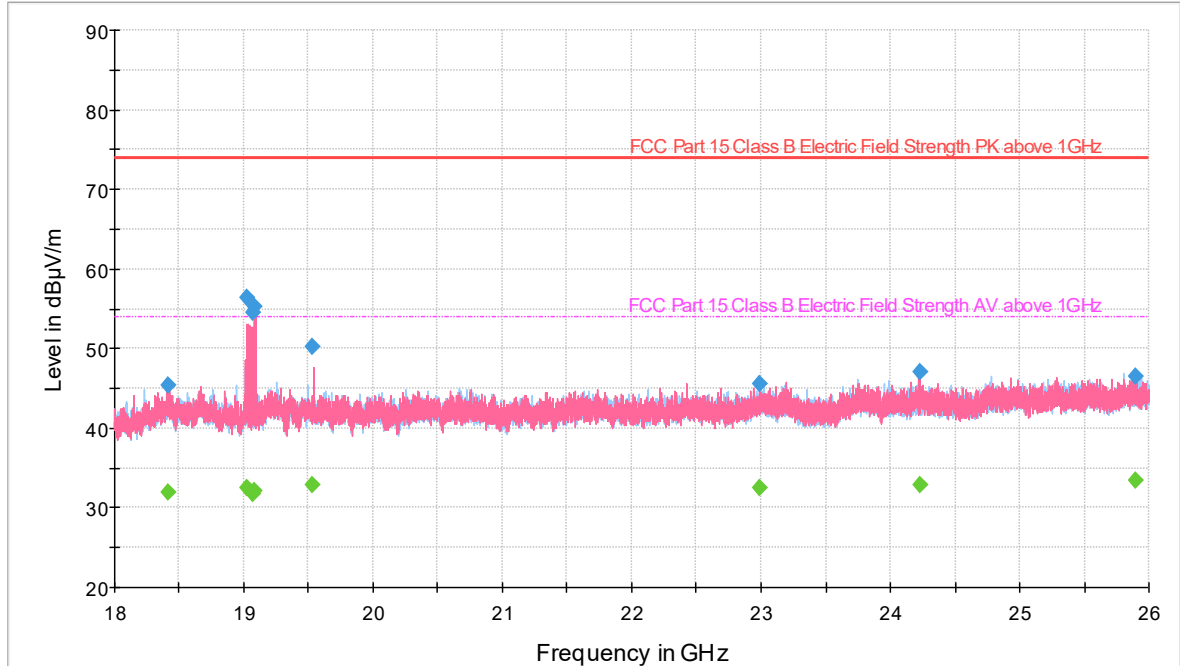
Average Data

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1000.000000	34.99	53.90	18.91	1000.0	1000.000	175.0	V	208.0	-6
1200.233333	29.34	53.90	24.56	1000.0	1000.000	175.0	H	47.0	-2
1500.000000	31.60	53.90	22.30	1000.0	1000.000	175.0	H	213.0	-4
2399.866667	32.35	53.90	21.55	1000.0	1000.000	300.0	V	57.0	1
4189.800000	33.90	53.90	20.00	1000.0	1000.000	295.0	V	296.0	5
6753.566667	37.04	53.90	16.86	1000.0	1000.000	339.0	H	50.0	6
11000.733333	40.99	53.90	12.91	1000.0	1000.000	157.0	V	27.0	14
14399.766667	48.60	53.90	5.30	1000.0	1000.000	170.0	H	341.0	13
17368.033333	47.19	53.90	6.71	1000.0	1000.000	222.0	H	8.0	19



2.3.17 18GHz to 26GHz Radiated Emission Test (T79-REI)

Full Spectrum



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- - - FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18417.148500	45.45	73.90	28.45	1000.0	1000.000	151.0	V	8.0	-3
19027.760000	56.38	73.90	17.52	1000.0	1000.000	151.0	V	89.0	-3
19068.652500	54.48	73.90	19.42	1000.0	1000.000	150.0	V	87.0	-4
19082.902500	55.22	73.90	18.68	1000.0	1000.000	152.0	V	88.0	-4
19528.907000	50.18	73.90	23.72	1000.0	1000.000	212.0	V	-12.0	-3
22989.061000	45.57	73.90	28.33	1000.0	1000.000	202.0	H	310.0	-1
24231.181000	47.16	73.90	26.74	1000.0	1000.000	212.0	V	334.0	0
25891.865500	46.54	73.90	27.36	1000.0	1000.000	191.0	H	38.0	1

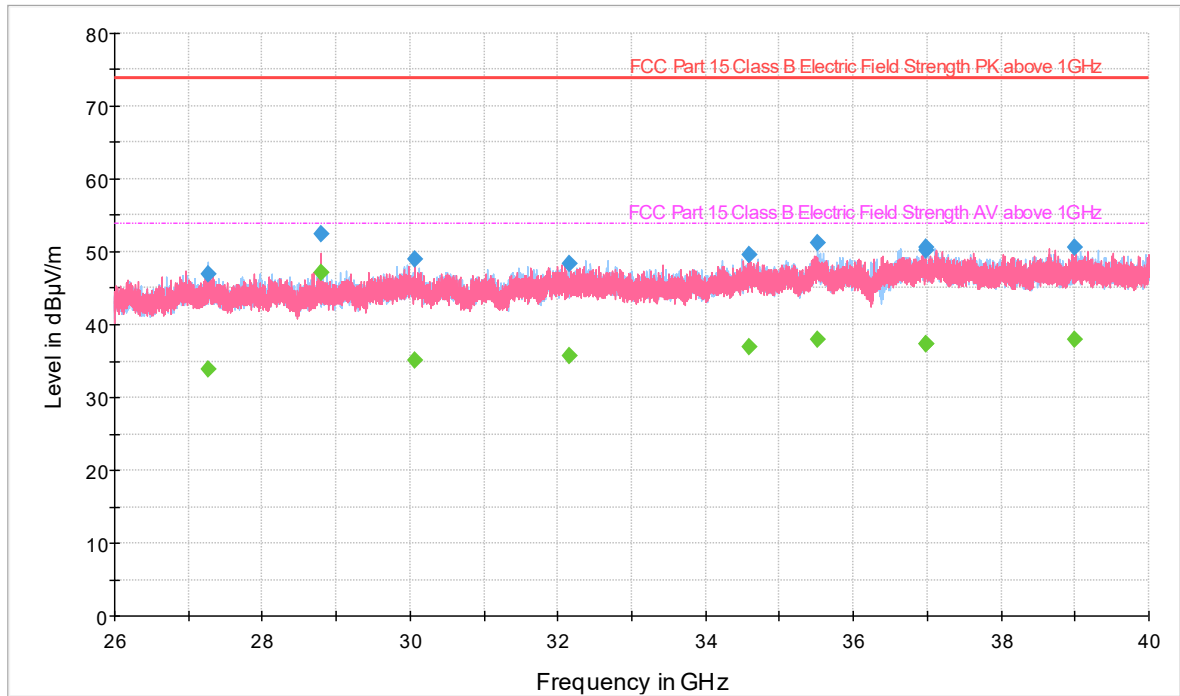


Average Data

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18417.148500	31.88	53.90	22.02	1000.0	1000.000	151.0	V	8.0	-3
19027.760000	32.45	53.90	21.45	1000.0	1000.000	151.0	V	89.0	-3
19068.652500	31.67	53.90	22.23	1000.0	1000.000	150.0	V	87.0	-4
19082.902500	32.18	53.90	21.72	1000.0	1000.000	152.0	V	88.0	-4
19528.907000	32.83	53.90	21.07	1000.0	1000.000	212.0	V	-12.0	-3
22989.061000	32.47	53.90	21.43	1000.0	1000.000	202.0	H	310.0	-1
24231.181000	32.91	53.90	20.99	1000.0	1000.000	212.0	V	334.0	0
25891.865500	33.37	53.90	20.53	1000.0	1000.000	191.0	H	38.0	1



2.3.18 26GHz to 40GHz Radiated Emission Test (T79-REI)



- Preview Result 1H-PK+ [Preview Result 1H.Result:2]
- Preview Result 1V-PK+ [Preview Result 1V.Result:2]
- FCC Part 15 Class B Electric Field Strength PK above 1GHz [.\EMI Radiated\]
- FCC Part 15 Class B Electric Field Strength AV above 1GHz [.\EMI Radiated\]
- ◆ Final_Result PK+ [Final_Result.Result:4]
- ◆ Final_Result AVG [Final_Result.Result:5]

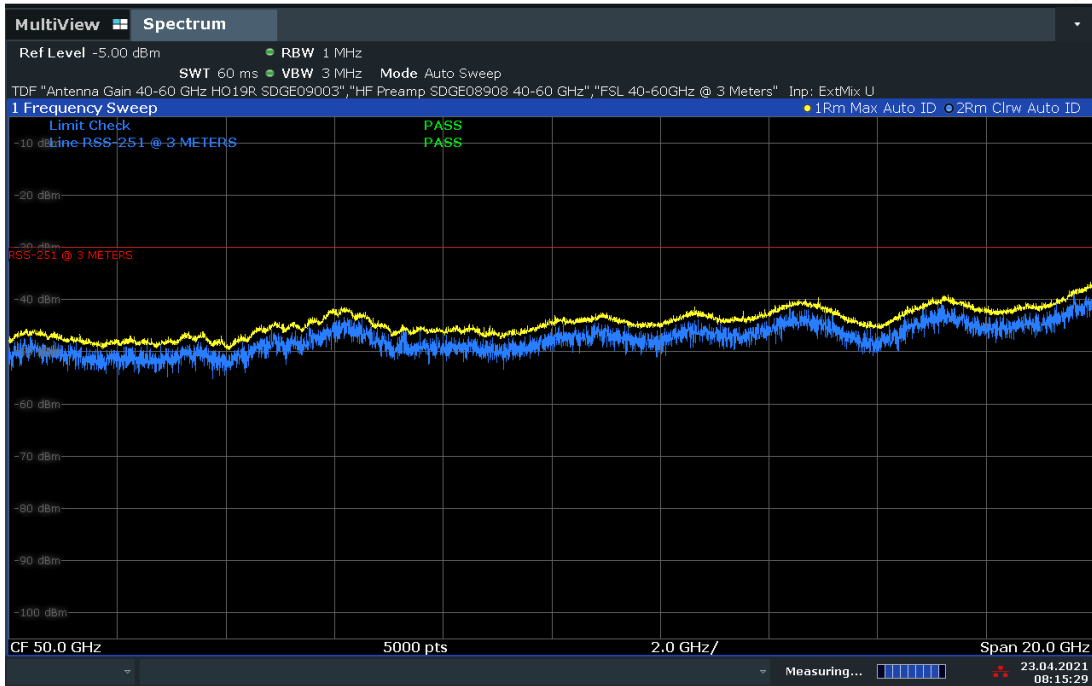
Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
27261.335000	47.04	73.90	26.86	1000.0	1000.000	141.0	H	329.0	2
28799.551153	52.46	73.90	21.44	1000.0	1000.000	154.0	V	18.0	2
30072.079230	49.01	73.90	24.89	1000.0	1000.000	207.0	V	10.0	3
32146.548077	48.35	73.90	25.55	1000.0	1000.000	192.0	H	341.0	5
34591.143462	49.54	73.90	24.36	1000.0	1000.000	225.0	H	226.0	6
35507.833846	51.28	73.90	22.62	1000.0	1000.000	175.0	H	284.0	6
36973.753847	50.67	73.90	23.23	1000.0	1000.000	126.0	H	219.0	7
36977.828462	50.17	73.90	23.73	1000.0	1000.000	126.0	H	242.0	7
39000.278077	50.65	73.90	23.25	1000.0	1000.000	178.0	H	95.0	7



Average Data

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
27261.335000	33.92	53.90	19.98	1000.0	1000.000	141.0	H	329.0	2
28799.551153	47.10	53.90	6.80	1000.0	1000.000	154.0	V	18.0	2
30072.079230	35.17	53.90	18.73	1000.0	1000.000	207.0	V	10.0	3
32146.548077	35.79	53.90	18.11	1000.0	1000.000	192.0	H	341.0	5
34591.143462	36.90	53.90	17.00	1000.0	1000.000	225.0	H	226.0	6
35507.833846	37.90	53.90	16.00	1000.0	1000.000	175.0	H	284.0	6
36973.753847	37.26	53.90	16.64	1000.0	1000.000	126.0	H	219.0	7
36977.828462	37.30	53.90	16.60	1000.0	1000.000	126.0	H	242.0	7
39000.278077	37.89	53.90	16.01	1000.0	1000.000	178.0	H	95.0	7



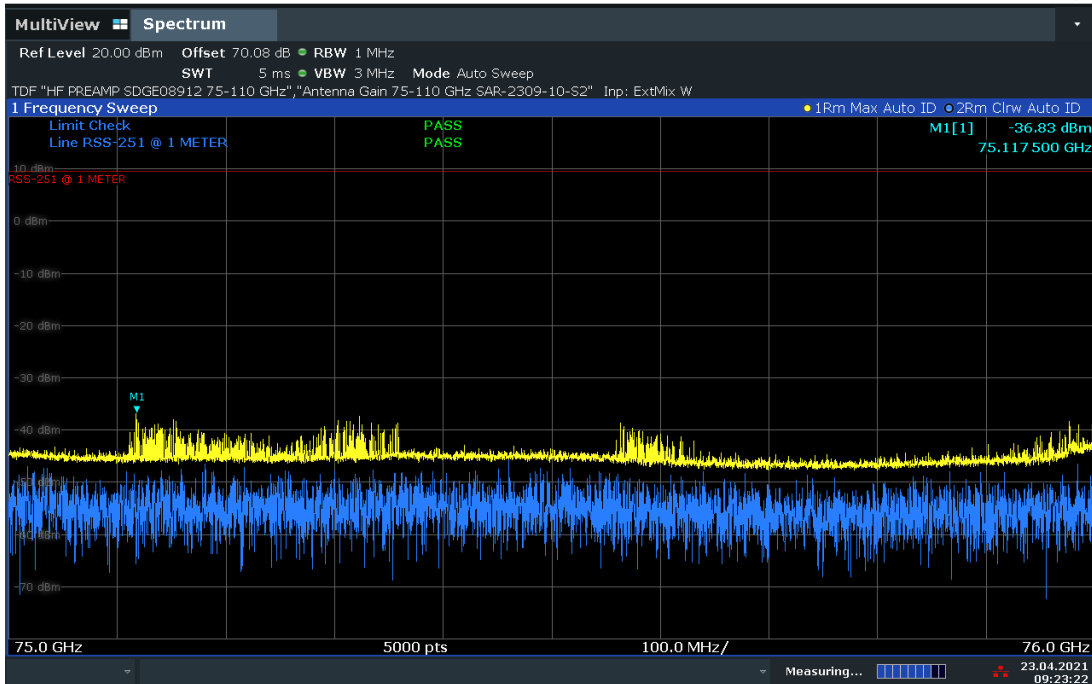
08:15:29 23.04.2021

40-60 GHz (T79-REI)



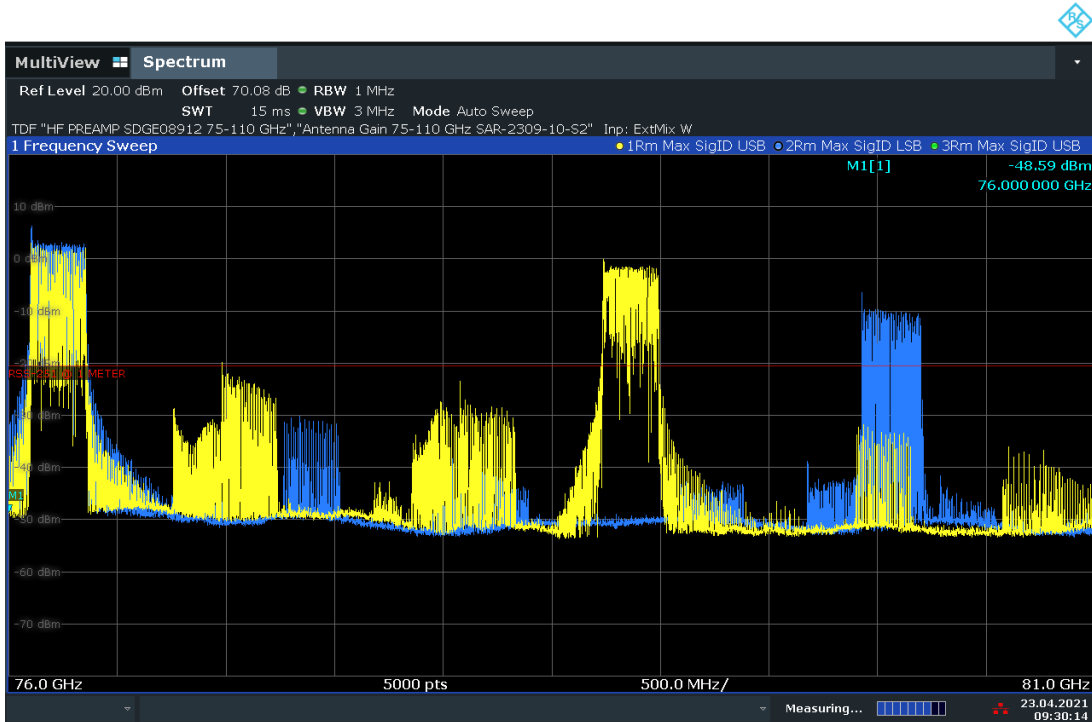
08:25:02 23.04.2021

60 to 75GHz (T79-REI)



09:23:23 23.04.2021

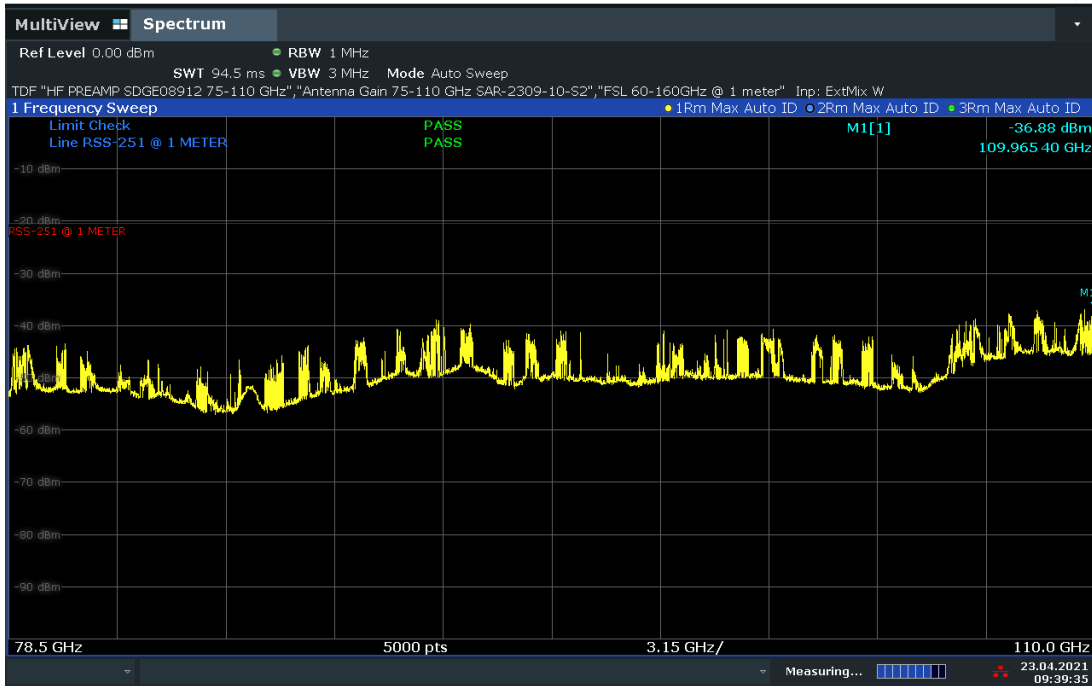
75-76GHz (T79-REI)



09:30:15 23.04.2021

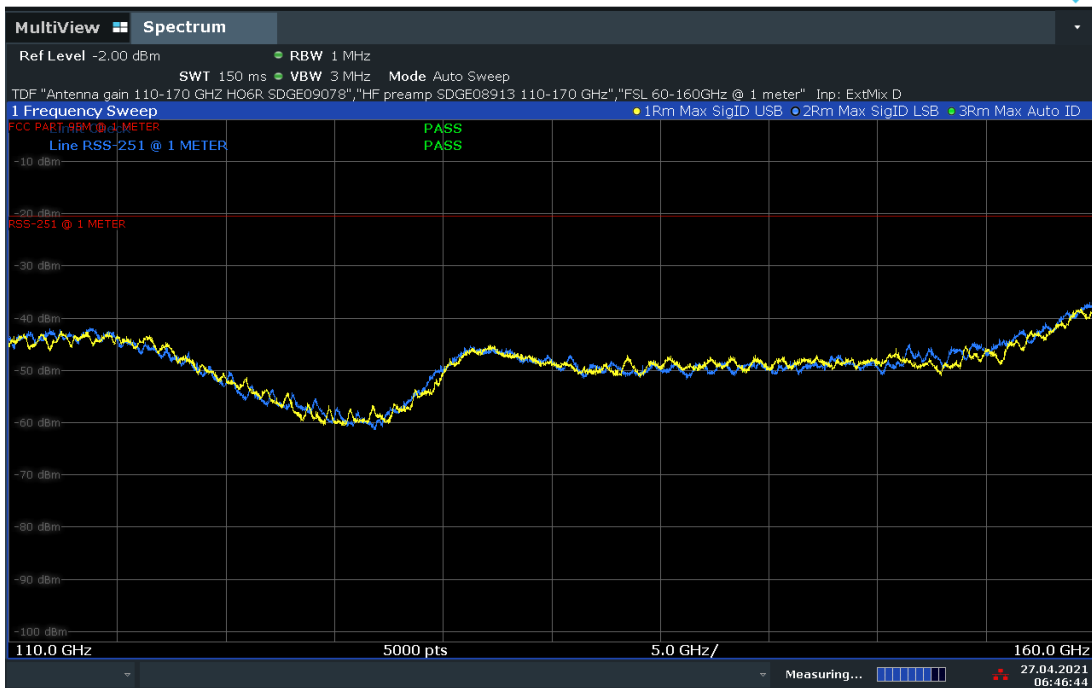
76-81GHz in band (T79-REI)

Test Note: When using Signal ID function, traces not common to both Yellow and Blue traces are by-products of the mixing and are not real. Plot above shows that the only valid signal in 76 to 81 GHz band is the fundamental.



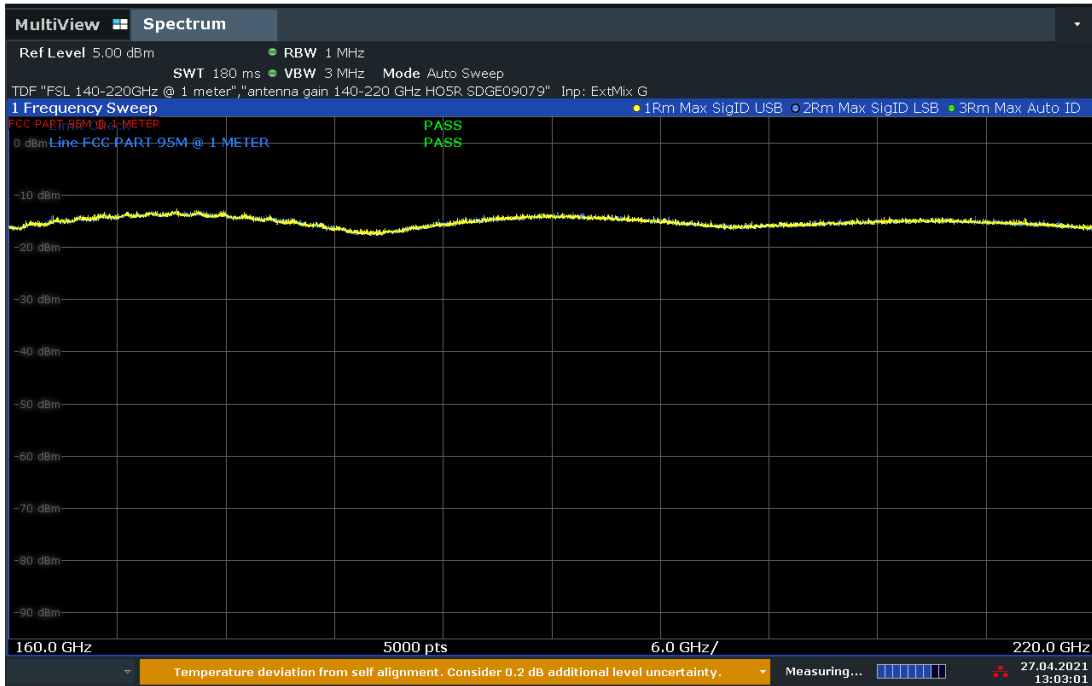
09:39:35 23.04.2021

81 to 110GHz (T79-REI)



06:46:45 27.04.2021

110 to 160 GHz (T79-REI)



13:03:02 27.04.2021

160 to 220 GHz (T79-REI)



16:20:50 27.04.2021

220 to 231 GHz (T79-REI)



2.4 FREQUENCY STABILITY

2.4.1 Specification Reference

Part 2.1055, FCC Part 95 Subpart M §95.3379(b) and RSS-251 Section 11

2.4.2 Standard Applicable

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.

2.4.3 Equipment Under Test and Modification State

Serial No: 0300BH220A170003 / Default Test Configuration

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

October 08, 2020/ FSC

2.4.5 Test Equipment Used

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

2.4.6 Environmental Conditions

Test performed at TÜV SÜD America Inc. Mira Mesa facility

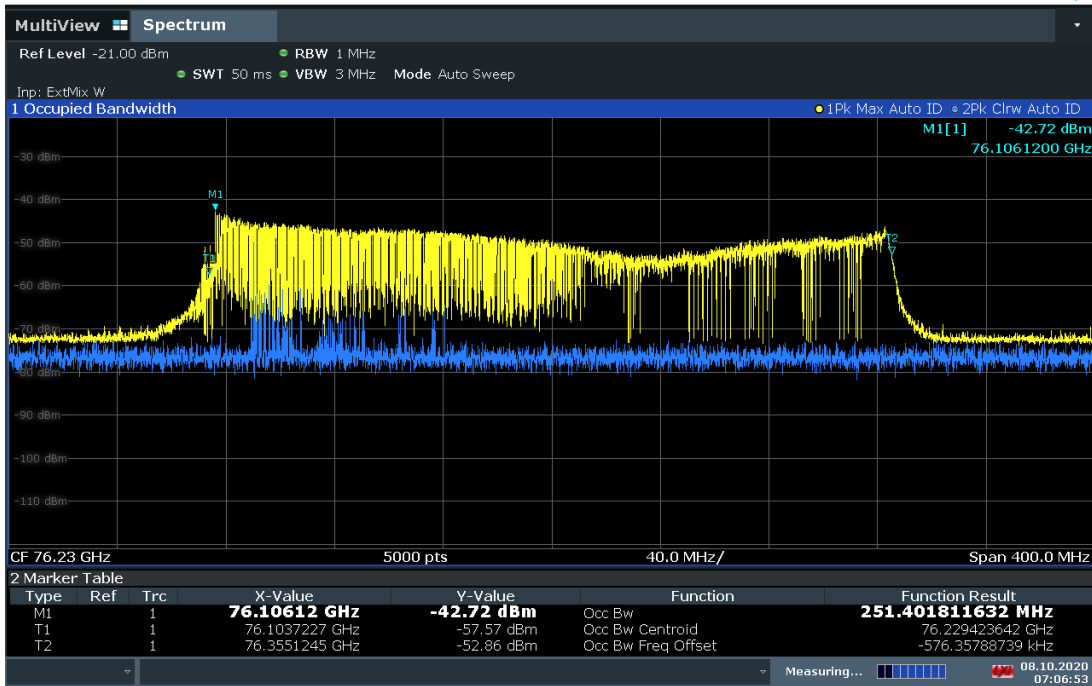
Ambient Temperature	25.0 °C
Relative Humidity	49.4 %
ATM Pressure	100.1 kPa

2.4.7 Additional Observations

- EUT has no antenna port available. The measurements under this section were performed using radiated measurement method.
- Temperature range used is -20°C to +50°C. During test the EUT spectrum was monitored in the entire temperature range at 10 °C intervals.
- Extreme test source voltage used is 20.4 VDC and 27.6 VDC (85 % and 115 % of nominal voltage). No considerable frequency variations were observed at extreme supply voltages.
- An offset of 2.0 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 the frequencies peak of the signal spectrum were monitored. EUT was tested for the lowest channel CW modulation.

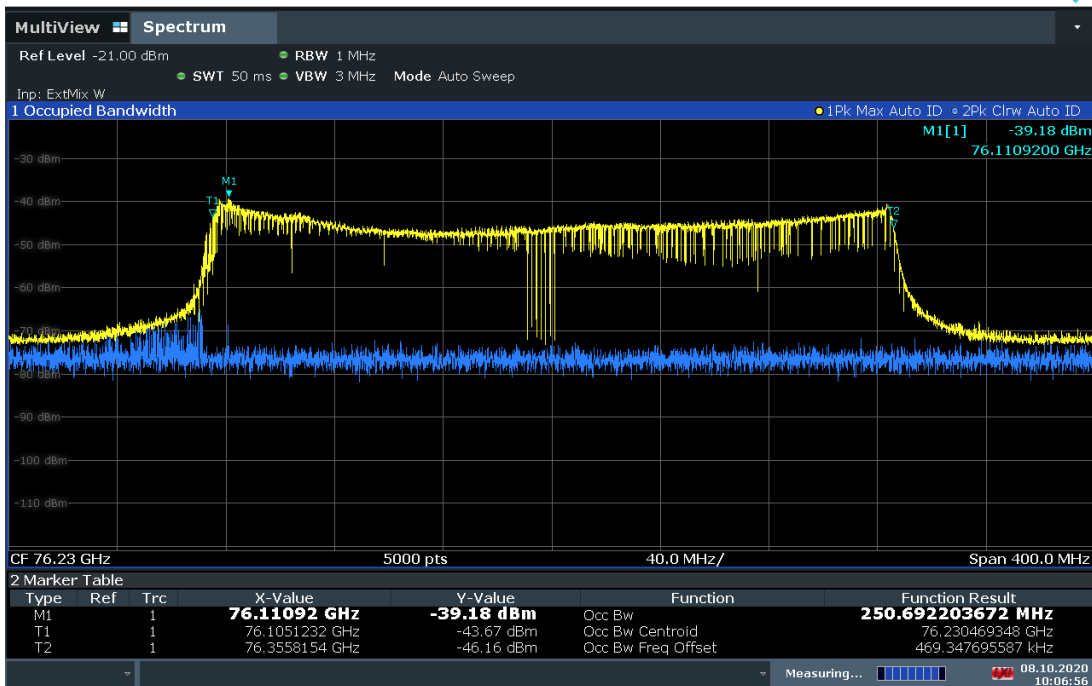


2.4.8 Test Results



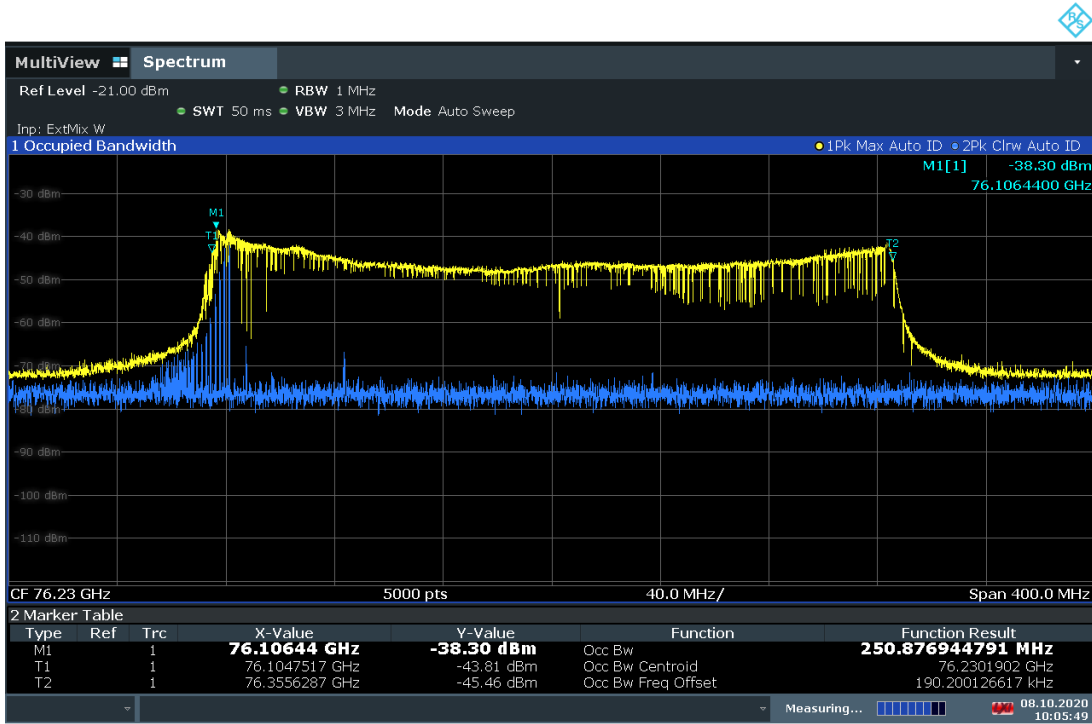
07:06:53 08.10.2020

50°C



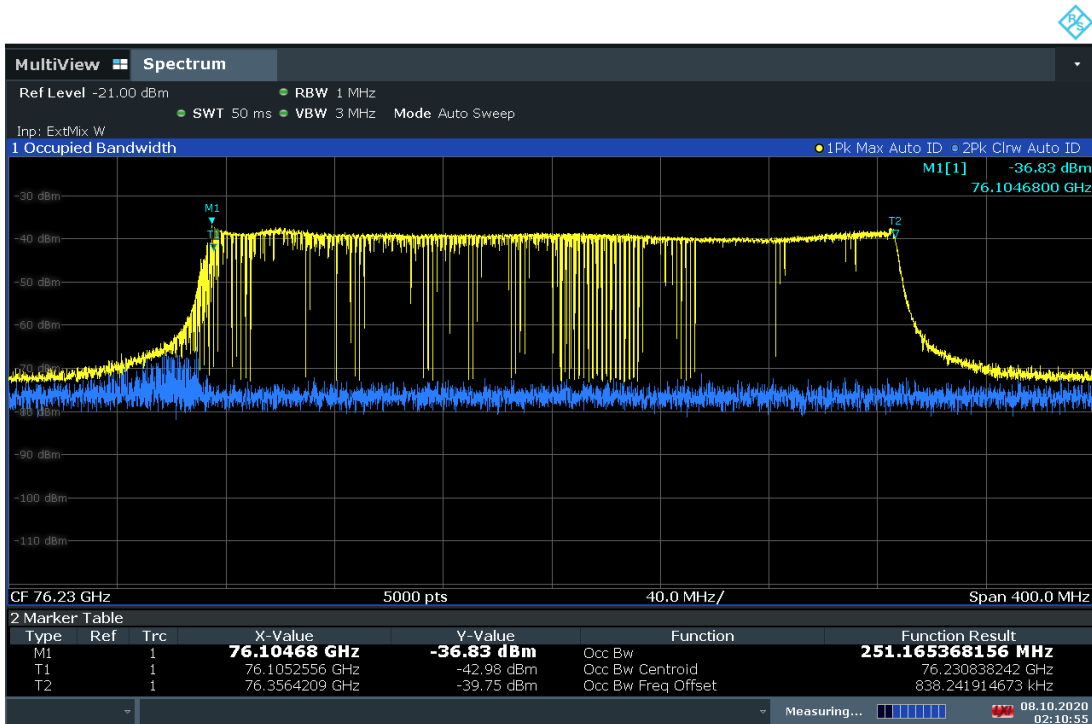
10:06:56 08.10.2020

115% of Nominal Voltage @ 20°C



10:05:49 08.10.2020

85% of Nominal Voltage @ 20°C



02:10:55 08.10.2020

-20°C



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 Emission						
1049	EMI Test Receiver	ESU40	100133	Rohde & Schwarz	09/25/20	09/25/21
7611	Signal/Spectrum Analyzer	FSW26	102017	Rohde & Schwarz	02/02/21	02/02/22
6628	Loop Antenna	HFH2-Z2335.4711.52	FNr.800.458/25	Schwarbeck	05/22/20	05/20/22
1002	Bilog Antenna	3142C	0058717	EMCO	10/09/19	10/09/21
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	06/18/20	06/18/21
7631	Double-ridged waveguide horn	3117	00205418	ETS-Lindgren	09/16/20	09/16/22
46797	Preamplifier	PA-122	181925	Com Power	10/28/20	10/28/21
9001	Horn antenna (18-26.5GHz)	HO42S	101	Custom Microwave	09/09/19	09/09/21
9003	Horn antenna (26-40 GHz)	HO28S	102	Custom Microwaves	09/09/19	09/09/21
40815	Pre-amplifier (18-40 GHz)	19D18	15G27	Spacek Labs	10/05/20	10/05/21
7637	Harmonics mixer (40-60 GHz)	FS-Z60	100009	Rhode & Schwarz	07/29/20	07/29/23
7636	Harmonics mixer (60-90 GHz)	FS-Z90	100092	Rhode & Schwarz	07/29/20	07/29/23
7633	Harmonics mixer (75-110 GHz)	HM-110-7	101000	Radiometer Physics	02/22/21	07/29/23
7634	Harmonics mixer (110-170 GHz)	HM-170	0062	Radiometer Physics	02/22/21	07/29/23
7635	Harmonics mixer (170-220 GHz)	HM-220	020022	Radiometer Physics	02/22/21	07/29/23
7632	Harmonics mixer (220-325 GHz)	HM-325	020075	Radiometer Physics	02/22/21	07/29/23
9003	Horn antenna (40-60 GHz)	HO19R	103	Custom Microwaves	10/14/19	07/29/23
9004	Horn antenna (50-75 GHz)	HO15R	104	Custom Microwaves	10/10/19	07/29/23
7628	Horn antenna (75-110 GHz)	SAR-2309-10-S2	13481-01	Sage Millimeter, Inc.	Verified by 7611 and corresponding antenna/Active multiplier combination	
9081	Horn antenna (110-170 GHz)	HO6R	N/A	Custom Microwaves		
9082	Horn antenna (140-220 GHz)	HO5R	N/A	Custom Microwaves		
9080	Horn antenna (220-325 GHz)	HO3R	N/A	Custom Microwaves		
8872	Direct Reading Attenuator (40-60)	STA-60-19-D1	11875-01	Sage Millimeter, Inc.	Verified by 7611 and corresponding antenna/mixer combination	
8860	Direct Reading Attenuator (50-75)	STA-60-15-D1	11466-01	Sage Millimeter, Inc.		
8861	Direct Reading Attenuator (75-110)	STA-60-10-D1	11466-01	Sage Millimeter, Inc.		



ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
8919	Direct Reading Attenuator (90-140)	STA-60-08-D1	12605-01	Sage Millimeter, Inc.	Verified by 7611 and corresponding antenna/mixer combination	
8909	Direct Reading Attenuator (140-220)	STA-60-05-D1	12020-01	Sage Millimeter, Inc.		
8873	Active Multiplier (40-60 GHz)	AMC-19-RFH00	124	Millitech, Inc.		
8914	Active Multiplier (50-75 GHz)	AMC-15-RFH00	283	Millitech, Inc.		
8915	Active Multiplier (75-110 GHz)	AMC-10-RFH00	606	Millitech, Inc.		
8920	Active Multiplier (90-140 GHz)	AMC-08-RFH00	58	Millitech, Inc.		
8909	Active Multiplier (140-220 GHz)	MCA-05-150096	13	Millitech, Inc.		
Miscellaneous						
43003	True RMS Multimeter	85 III	69880143	Fluke	10/23/20	10/23/21
7579	Temperature Chamber	115	151617	TestQuity	10/22/20	10/22/21
11312	Mini Environmental Quality Meter	850027	CF099-56010-340	11312	05/22/20	05/22/21
6726	Temp/Humidity Sensor	RTRH	16248370	Dickson	06/18/20	06/18/21
-	Test Software	EMC32	V10.50.40	Rhode & Schwarz	N/A	



3.2 MEASUREMENT UNCERTAINTY

Calculation of Measurement Uncertainty per CISPR 16-4-2:2011 with Corr. 1

3.2.1 Antenna Conducted Port Measurements

Antenna Port Conducted Measurements							
	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$	
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01	
2	Cable attenuation	1.00 dB	Normal, k=2	2.000	0.50	0.25	
3	Receiver sinewave accuracy	0.08 dB	Normal, k=2	2.000	0.04	0.00	
4	Receiver pulse amplitude	0.00 dB	Rectangular	1.732	0.00	0.00	
5	Receiver pulse repetition rate	0.00 dB	Rectangular	1.732	0.00	0.00	
6	Noise floor proximity	0.00 dB	Rectangular	1.732	0.00	0.00	
7	Frequency interpolation	0.10 dB	Rectangular	1.732	0.06	0.00	
8	Mismatch	0.07 dB	U-shaped	1.414	0.05	0.00	
Combined standard uncertainty			Normal		0.52 dB		
Expanded uncertainty			Normal, k=2		1.03 dB		

3.2.2 Radiated Measurements (Below 30MHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$	
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01	
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01	
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.22	0.05	
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.08	0.01	
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75	
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75	
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08	
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45	
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03	
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00	
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24	
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33	
13	Cross-polarization	0.90 dB	Rectangular	1.732	0.52	0.27	
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00	
15	Site imperfections	3.76 dB	Triangular	2.449	0.00	0.00	
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03	
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.00	0.00	
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00	
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00	
20	Effect of ambient noise on OATS	0.00 dB				0.00	
Combined standard uncertainty			Normal		2.95 dB		
Expanded uncertainty			Normal, k=2		5.90 dB		



3.2.3 Radiated Measurements (30MHz to 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$	
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01	
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01	
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14	
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.23	0.05	
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75	
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75	
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08	
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45	
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03	
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00	
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24	
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33	
13	Cross-polarization	0.90 dB	Rectangular	1.732	0.52	0.27	
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00	
15	Site imperfections	3.76 dB	Triangular	2.449	1.54	2.36	
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03	
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20	
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00	
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00	
20	Effect of ambient noise on OATS	0.00 dB				0.00	
Combined standard uncertainty				Normal	2.95 dB		
Expanded uncertainty				Normal, k=2	5.90 dB		

3.2.4 Radiated Emission Measurements (Above 1GHz)

	Input Quantity (Contribution) X_i	Value	Prob. Dist.	Divisor	$u_i(x)$	$u_i(x)^2$
1	Receiver reading	0.10 dB	Normal, k=1	1.000	0.10	0.01
2	Attenuation: antenna-receiver	0.20 dB	Normal, k=2	2.000	0.10	0.01
3	Antenna factor AF	0.75 dB	Normal, k=2	2.000	0.38	0.14
4	Receiver sinewave accuracy	0.45 dB	Normal, k=2	2.000	0.23	0.05
5	Receiver pulse amplitude	1.50 dB	Rectangular	1.732	0.87	0.75
6	Receiver pulse repetition rate	1.50 dB	Rectangular	1.732	0.87	0.75
7	Noise floor proximity	0.50 dB	Rectangular	1.732	0.29	0.08
8	Mismatch: antenna-receiver	0.95 dB	U-shaped	1.414	0.67	0.45
9	AF frequency interpolation	0.30 dB	Rectangular	1.732	0.17	0.03
10	AF height deviations	0.10 dB	Rectangular	1.732	0.06	0.00
11	Directivity difference at 3 m	3.12 dB	Rectangular	1.732	1.80	3.24
12	Phase center location at 3 m	1.00 dB	Rectangular	1.732	0.58	0.33
13	Cross-polarization	0.90 dB	Rectangular	1.732	0.52	0.27



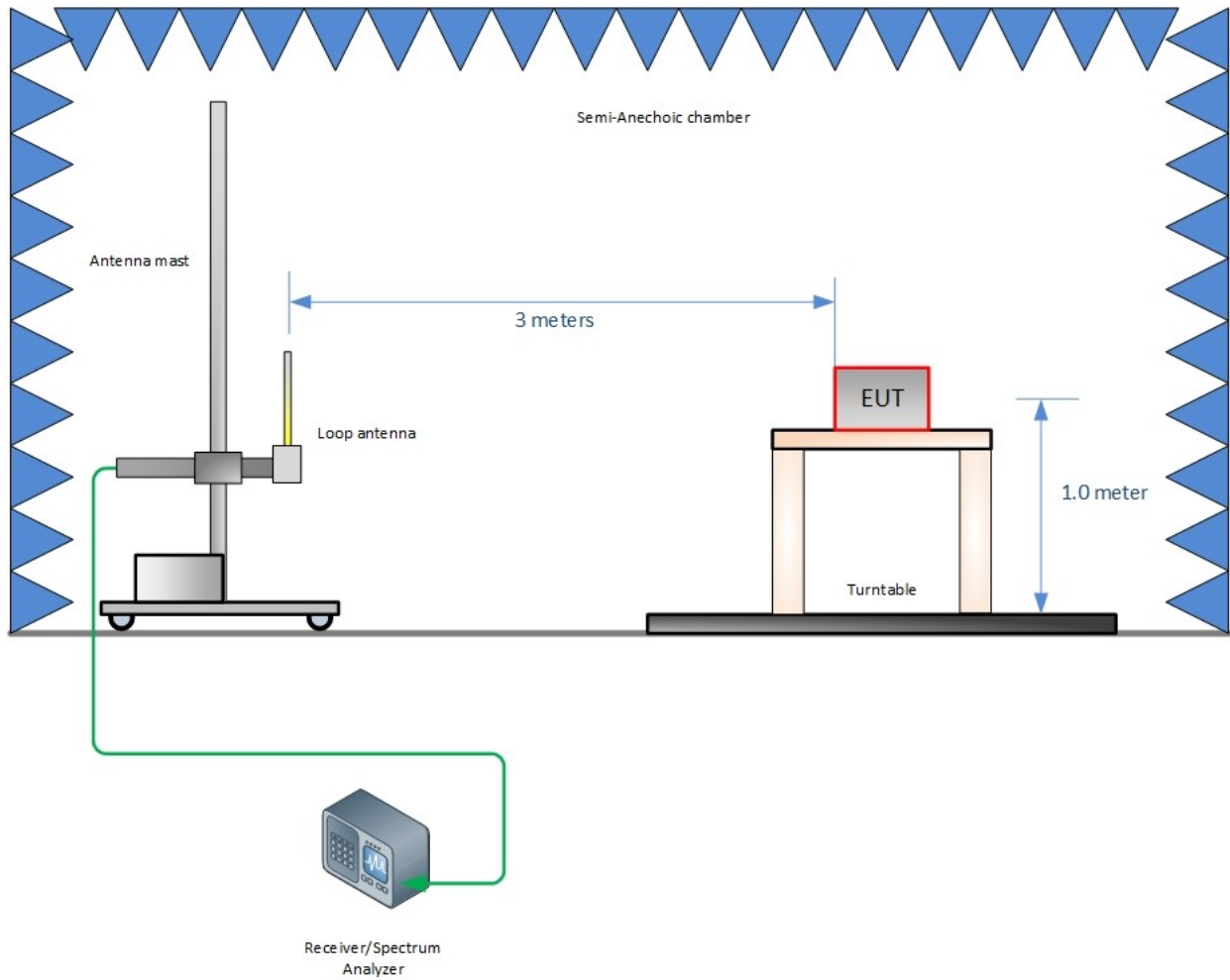
14	Balance	0.00 dB	Rectangular	1.732	0.00	0.00														
15	Site imperfections	3.25 dB	Triangular	2.449	1.33	1.76														
16	Separation distance at 3 m	0.30 dB	Rectangular	1.732	0.17	0.03														
17	Effect of setup table material	0.77 dB	Rectangular	1.732	0.44	0.20														
18	Table height at 3 m	0.10 dB	Normal, k=2	2.000	0.05	0.00														
19	Near-field effects	0.00 dB	Triangular	2.449	0.00	0.00														
20	Effect of ambient noise on OATS	0.00 dB				0.00														
<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td colspan="3">Combined standard uncertainty</td> <td>Normal</td> <td colspan="3">2.85 dB</td> </tr> <tr> <td colspan="3">Expanded uncertainty</td> <td>Normal, k=2</td> <td colspan="3">5.70 dB</td> </tr> </tbody> </table>							Combined standard uncertainty			Normal	2.85 dB			Expanded uncertainty			Normal, k=2	5.70 dB		
Combined standard uncertainty			Normal	2.85 dB																
Expanded uncertainty			Normal, k=2	5.70 dB																



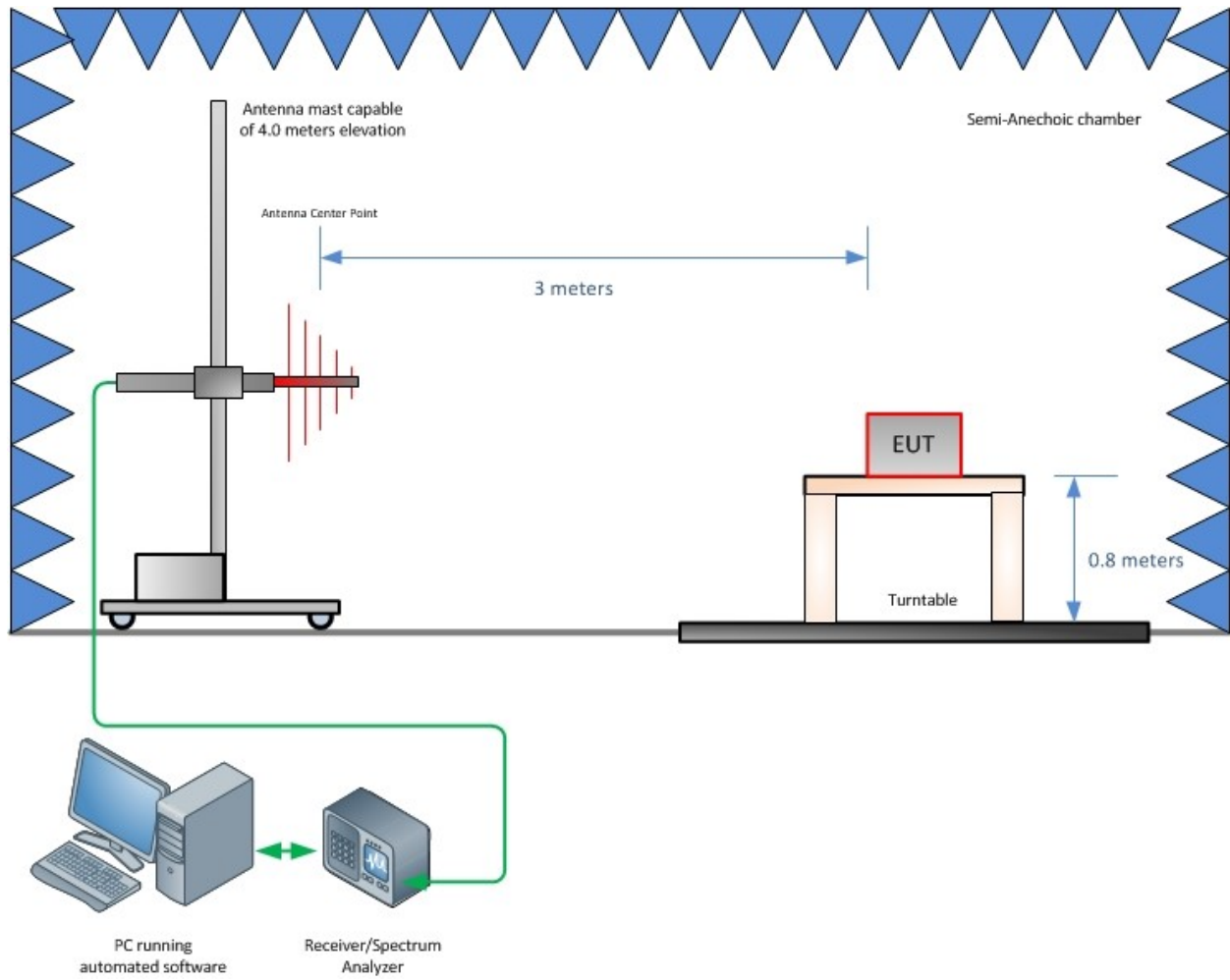
SECTION 4

DIAGRAM OF TEST SETUP

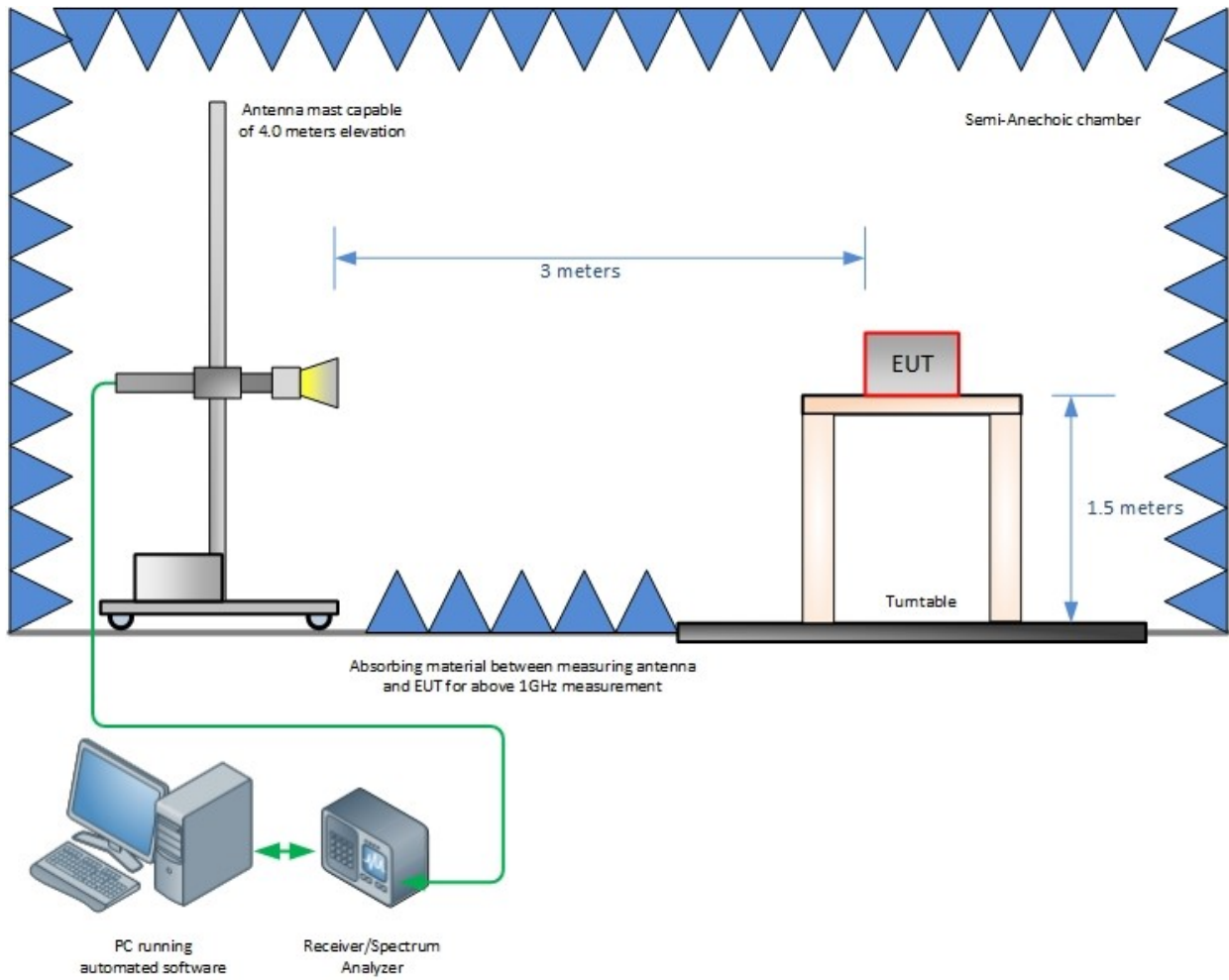
4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 30MHz)



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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