

Johnson Health Tech. Co., Ltd

TEST REPORT

SCOPE OF WORK:

47 CFR FCC Part 15.225 – Radio Spectrum report

Model:

Target Training Console-02

REPORT NUMBER

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Radio Spectrum TEST REPORT

Applicant:	Johnson Health Tech. Co., Ltd. No.999, Sec. 2, Dongda Rd., Daya Dist Taichung City 428, Taiwan
Product:	Console for Exercise Machine
Model No.:	Target Training Console-02
Brand Name:	MATRIX FITNESS
FCC ID:	TN7PHOENIX2
Test Method/ Standard:	47 CFR FCC Part 15.225
Test By:	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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Revision History

Report No.	Issue Date	Revision Summary
210700129THC-001	Sep. 09, 2021	Original report

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Summary of Test Data

Test Requirement	Applicable Rule (Section 15.225)	Result
Fundamental emission	15.225 (a)	Pass
20 dB Bandwidth	15.215	Pass
Frequency Satiability	15.225 (e)	Pass
In band Radiated Emissions	15.225(b),15.225(c)	Pass
Out of band Radiated Emissions	15.225(d)	Pass
AC Power Line Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass

Note: Please note that the test results with statement of conformity, the decision rules which are based on: Safety Testing: the specification, standard or IEC Guide 115.

Other Testing: the specification, standard and not taking into account the measurement uncertainty.

1. General Information

1.1 Identification of the EUT

Product:	Console for Exercise Machine
Model No.:	Target Training Console-02
Operating Frequency:	13.56 MHz
Rated Power:	DC 5V
Power Cord:	N/A
Sample receiving date:	2021/07/09
Sample condition:	Workable
Test Date(s):	2021/08/27 ~ 2021/09/08

1.2 Antenna description

Antenna Type : Loop Antenna
Connector Type : Fixed

1.3 Operation mode

TX mode: The EUT transmit 13.56MHz signal continuously while we power on the EUT.

2. Fundamental emission

2.1 Operating environment

Temperature:	27	°C
Relative Humidity:	63	%
Requirement & Test method	15.225 (a)	

2.2 Limit for Fundamental emission

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 uV/m(83.99 dBuV/m) at 30 meters.

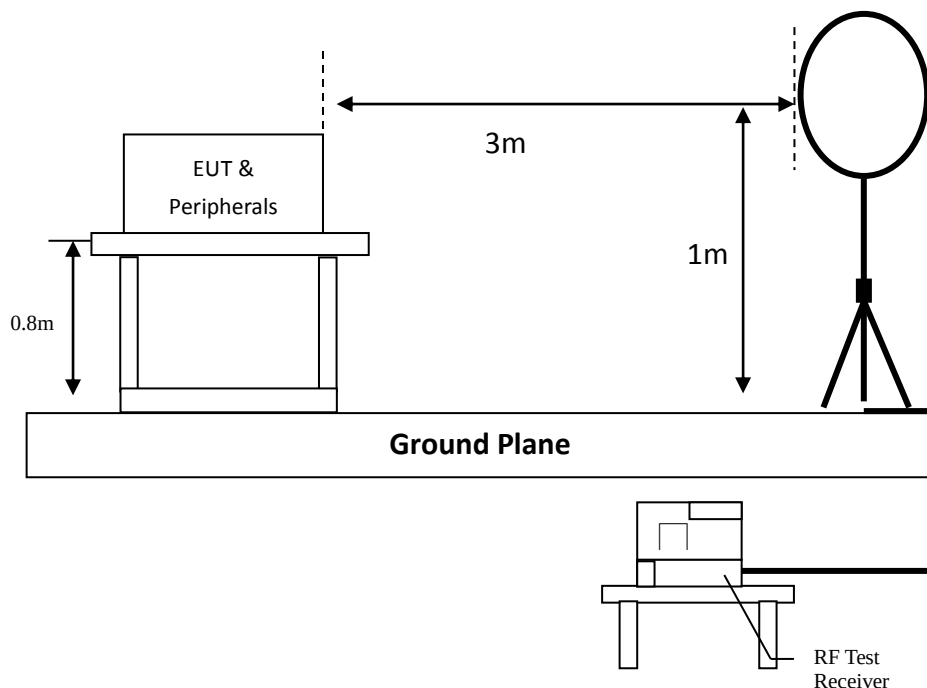
2.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	QP
RBW	10 kHz
Sweep	Auto couple
Trace	Max hold
Span	900 kHz
Attenuation	Auto

2.4 Test procedure

1. Configure the EUT according to ANSI C63.10: 2013. The EUT was placed on the top of the turntable 0.8 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was one meter above ground to find the maximum emission field strength of the both plane and coaxial polarity
4. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.

2.5 Test diagram



2.6 Test result

Parallel

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
13.56	QP	21.82	51.55	73.37	124.00	-50.63

Perpendicular

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
13.56	QP	21.82	51.34	73.16	124.00	-50.84

Ground-parallel

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
13.56	QP	21.82	51.33	73.15	124.00	-50.85

Limit= 84dBuV +40 dBuV (decade) = 124 dBμV

3. 20 dB Bandwidth

3.1 Operating environment

Temperature:	27	°C
Relative Humidity:	63	%
Requirement & Test method	15.215	

3.2 Limit for 20 dB bandwidth

None

3.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	1kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	≥ 1.2 times the 20 dB bandwidth
Attenuation	Auto

3.4 Test procedure

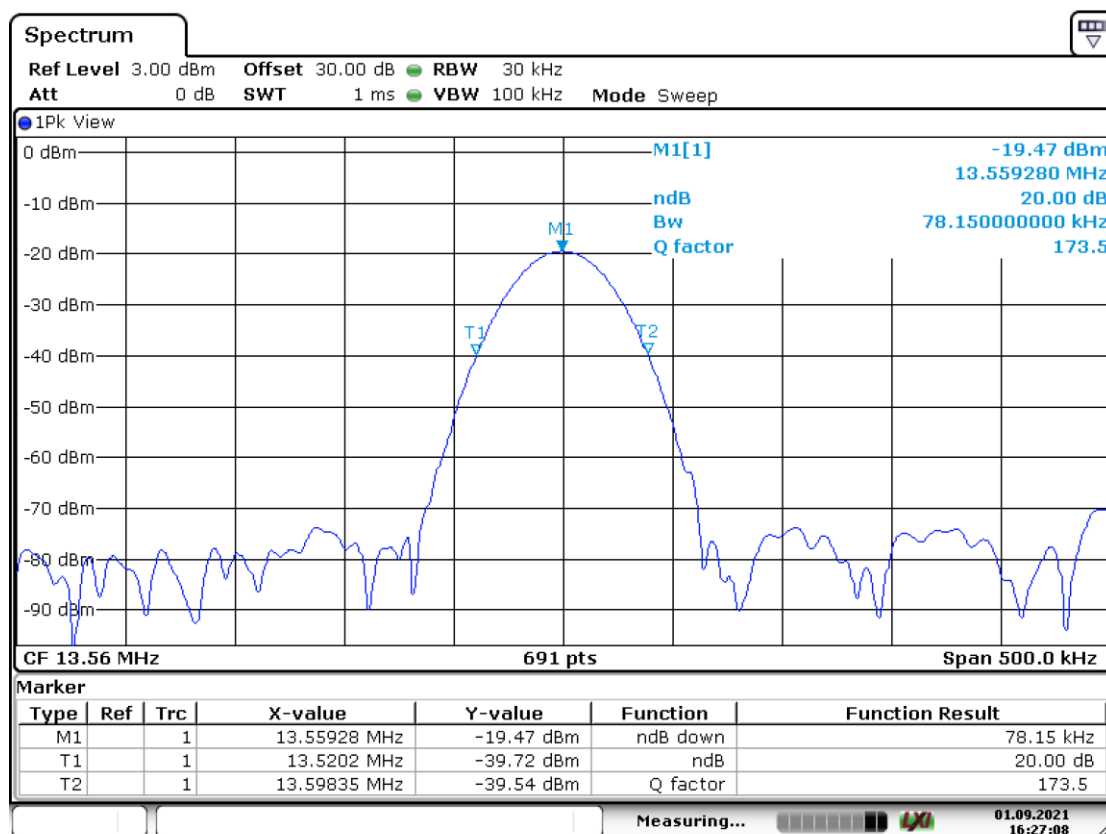
The 20 dB bandwidth was measured by spectrum analyzer connected to a receive antenna placed near the test sample while it is transmitting.

3.5 Test results

Single TX

Mode	Frequency (MHz)	20dB Occupied Bandwidth (kHz)
NFC	13.56	78.15

20dB Bandwidth @ NFC 13.56MHz



Date: 1.SEP.2021 16:27:08

4. Frequency Satiability

4.1 Operating environment

Temperature:	-20~50	°C
Relative Humidity:	61	%
Requirement & Test method	15.225(e)	

4.2 Limit for Frequency Satiability

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

4.3 Measuring instrument setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	Peak
RBW	1MHz
VBW	1kHz
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Sufficient to see the complete emission BW
Attenuation	Auto

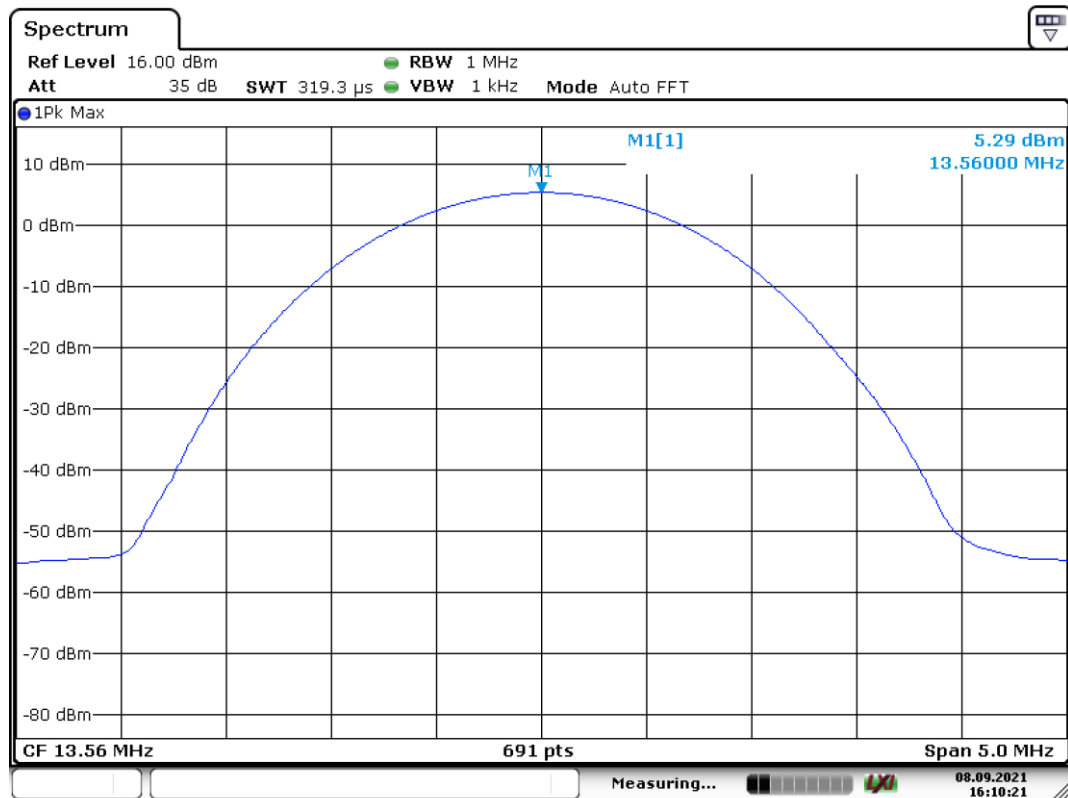
4.4 Test procedure

Turn the EUT on, and couple its output to a frequency counter or other frequency-measuring device of sufficient accuracy, considering the frequency tolerance with which the EUT shall comply.

4.5 Test result

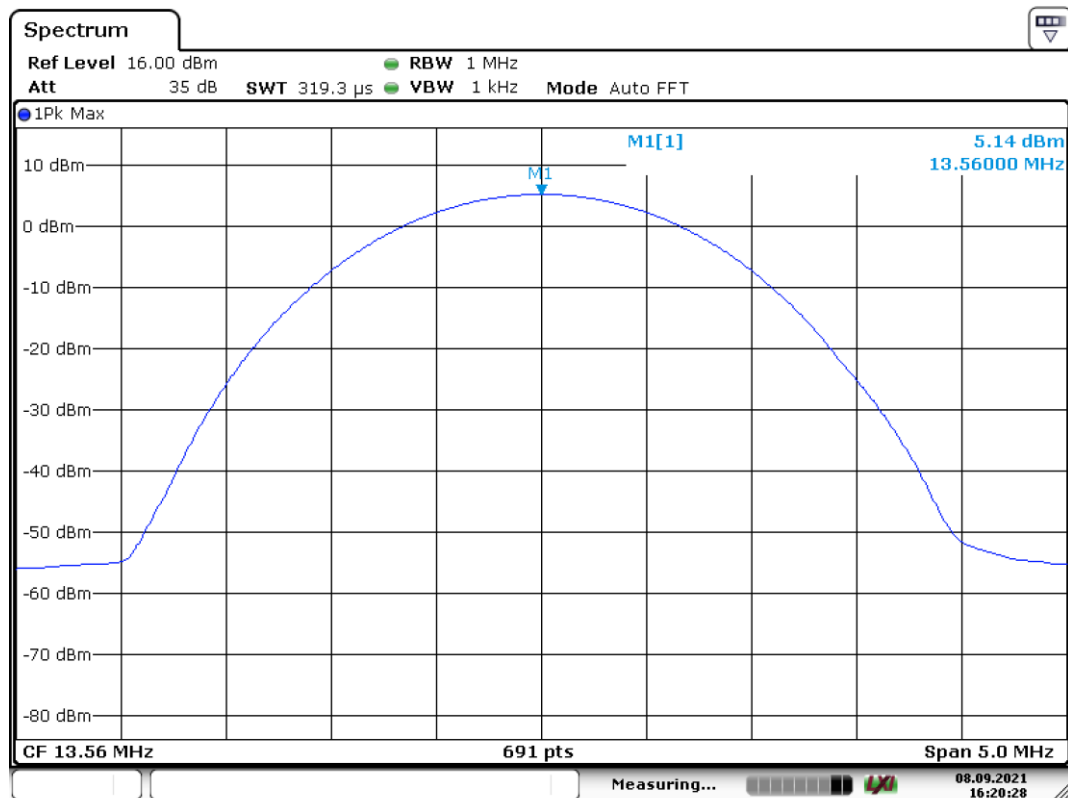
Temperature (°C)	Frequency (MHz)	Voltage (Vdc)	Center	Deviation (MHz)	Deviation (%)	Limit(%)	Result
-20	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
-10	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
0	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
10	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
20	13.5600	4.25	13.5600	0.0000	0.0000%	±0.01	Pass
	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
	13.5600	5.75	13.5600	0.0000	0.0000%	±0.01	Pass
30	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
40	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass
50	13.5600	5.00	13.5600	0.0000	0.0000%	±0.01	Pass

20°C (5.00Vdc)



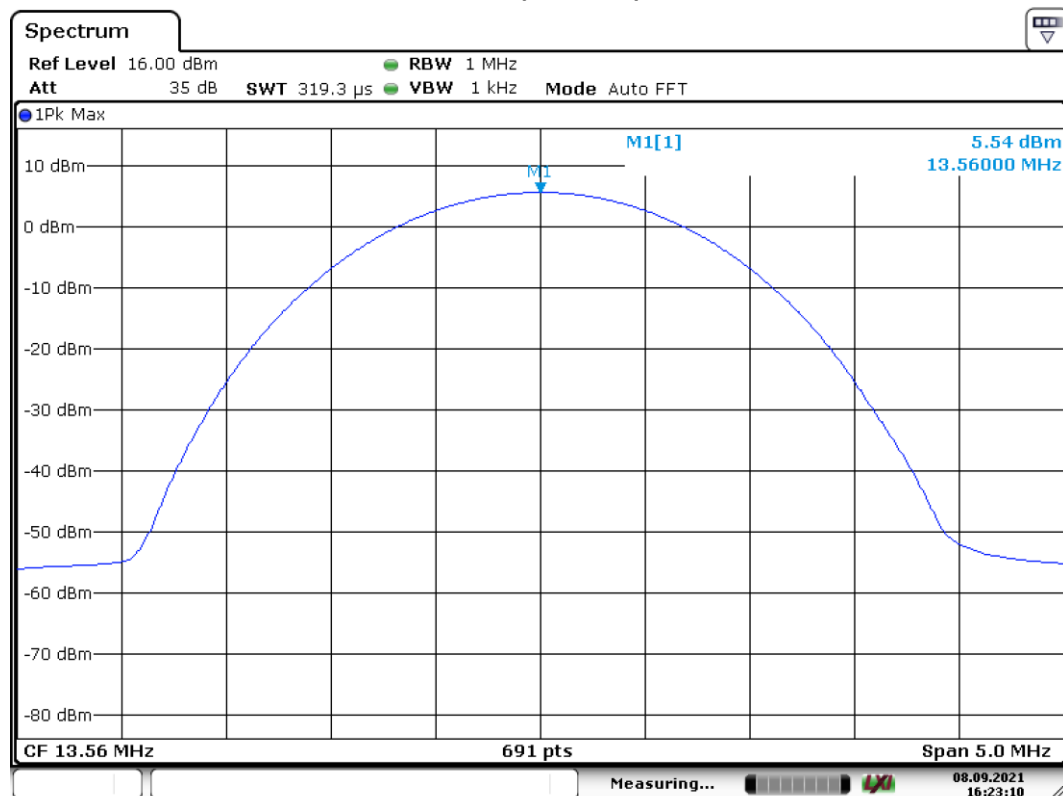
Date: 8.SEP.2021 16:10:21

20°C (4.25Vdc)



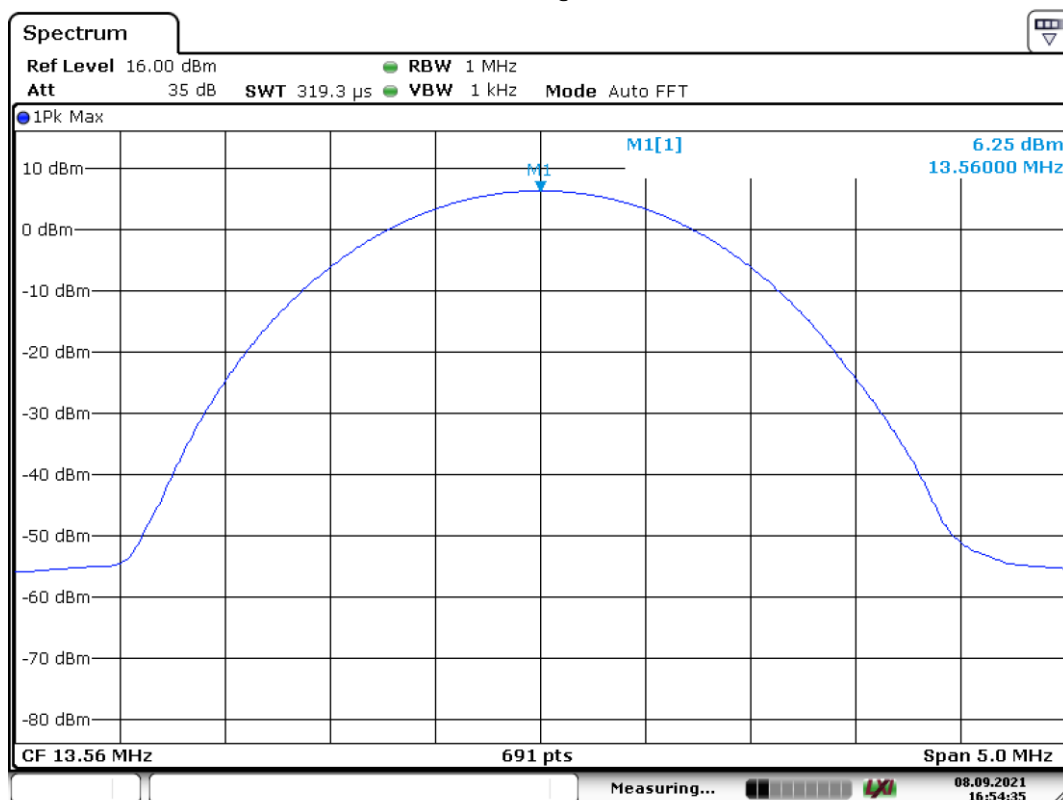
Date: 8.SEP.2021 16:20:27

20°C (5.75Vdc)



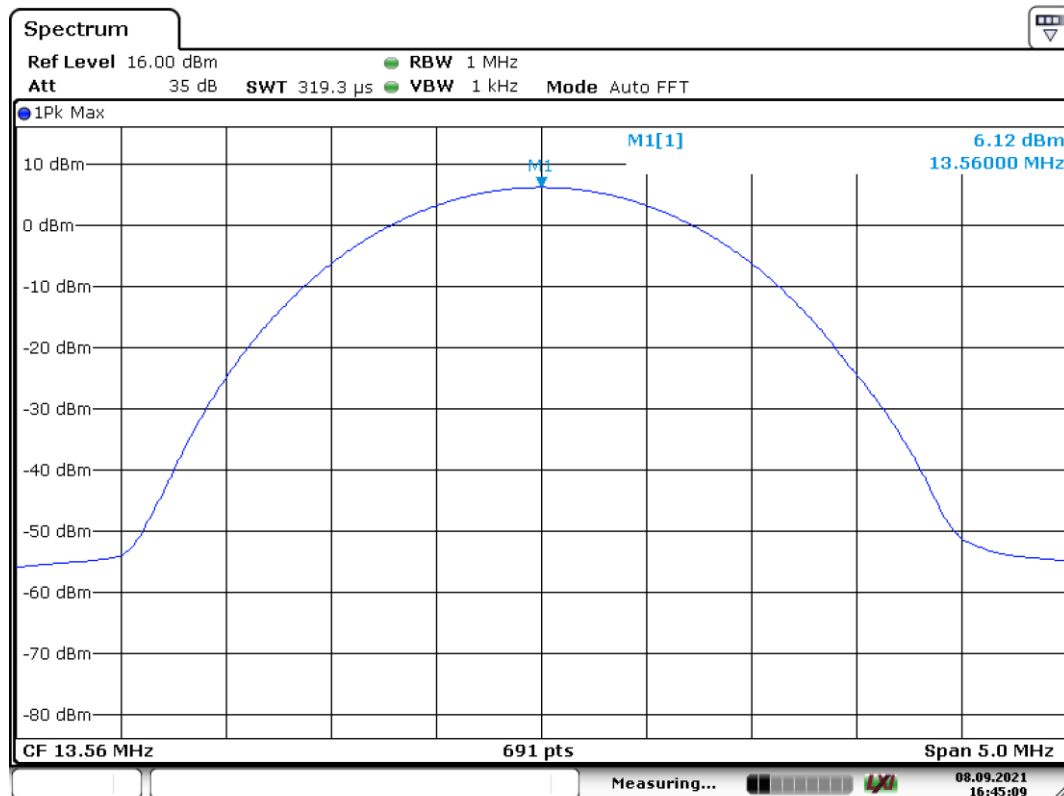
Date: 8.SEP.2021 16:23:10

-20°C



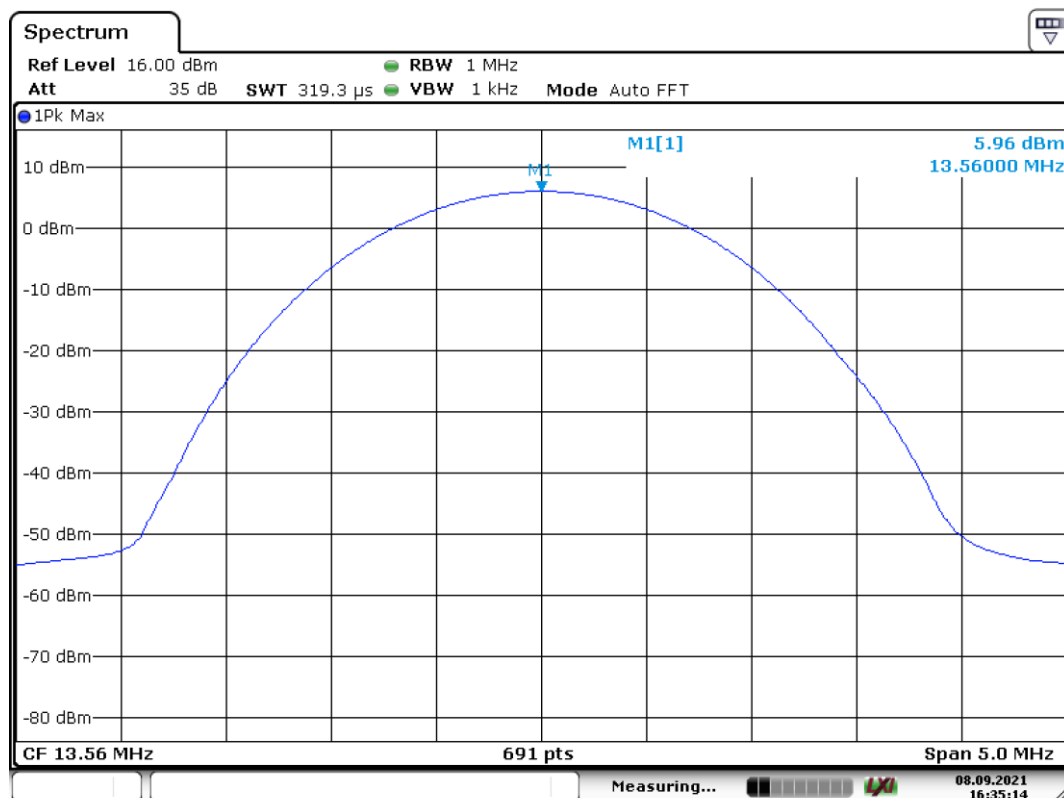
Date: 8.SEP.2021 16:54:35

-10°C



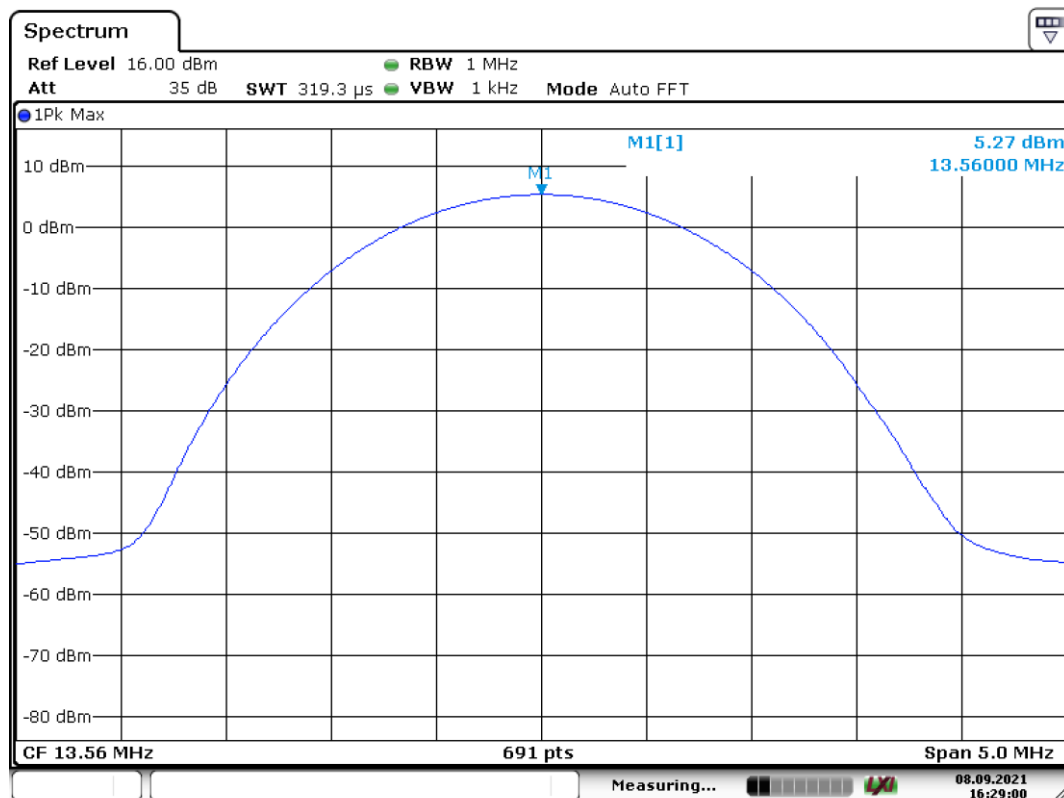
Date: 8.SEP.2021 16:45:09

0°C



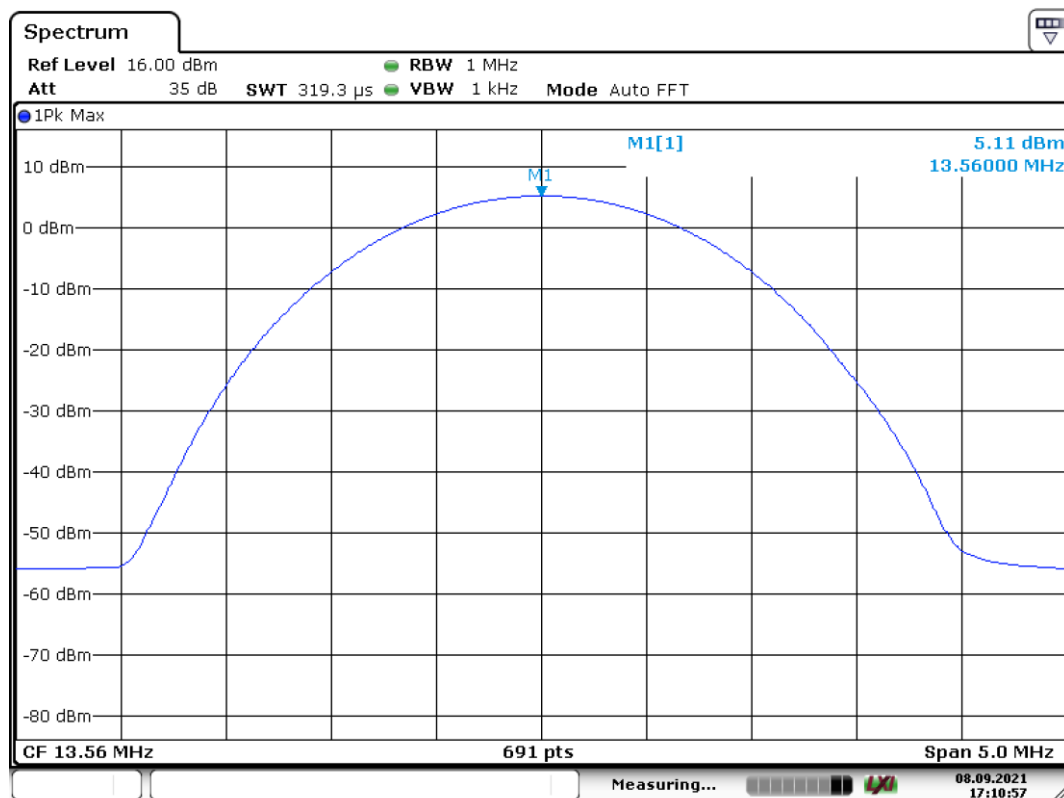
Date: 8.SEP.2021 16:35:14

10°C



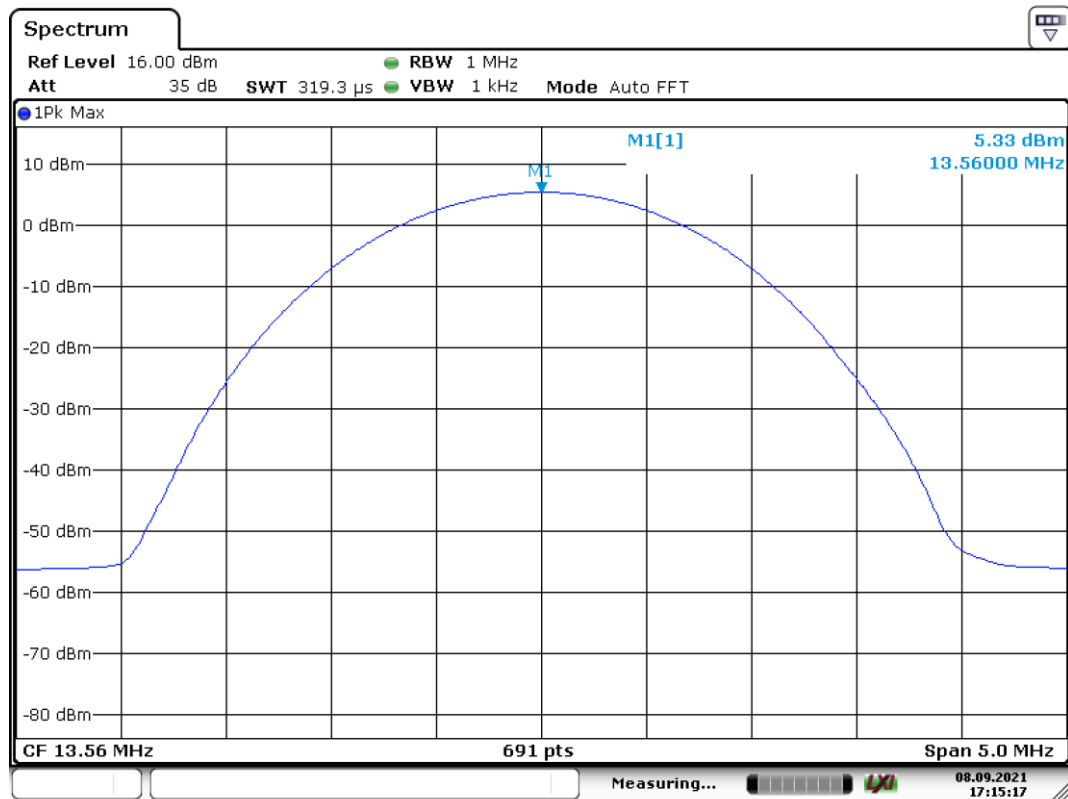
Date: 8.SEP.2021 16:29:00

30°C



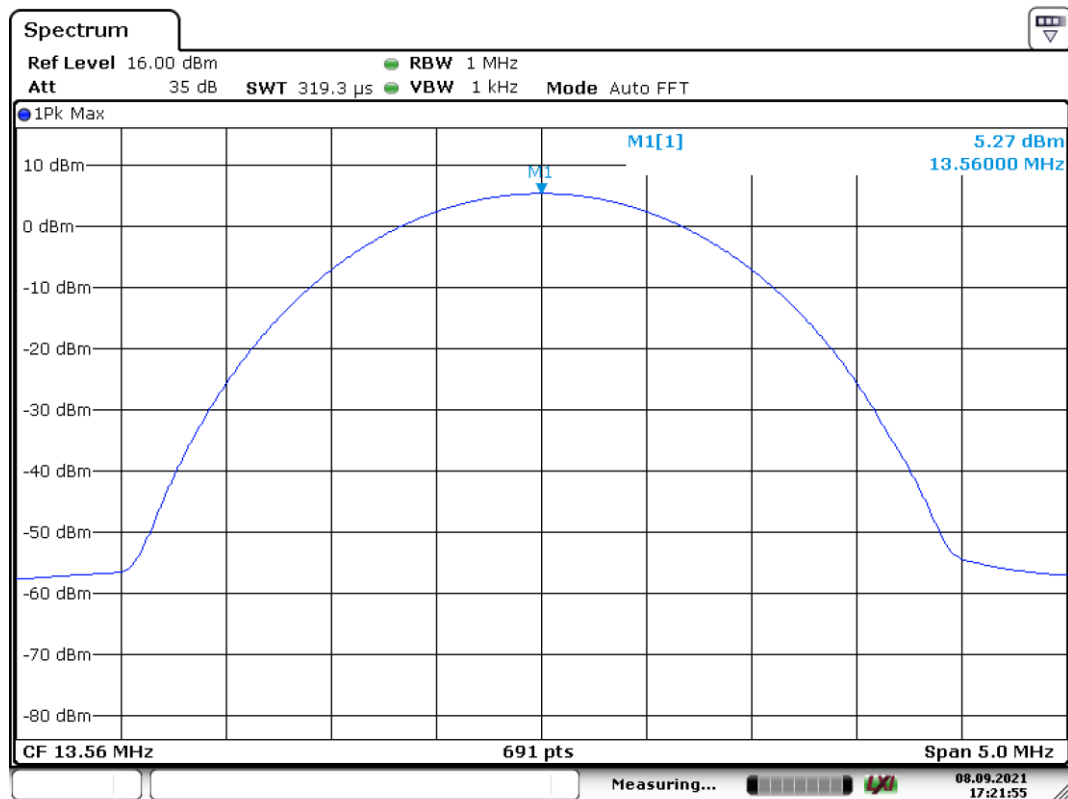
Date: 8.SEP.2021 17:10:58

40°C



Date: 8.SEP.2021 17:15:18

50°C



Date: 8.SEP.2021 17:21:56

5. In band Radiated Emissions

5.1 Operating environment

Temperature:	27	°C
Relative Humidity:	63	%
Requirement	15.225(b),15.225(c)	

5.2 Limit for emissions in non-restricted frequency bands

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

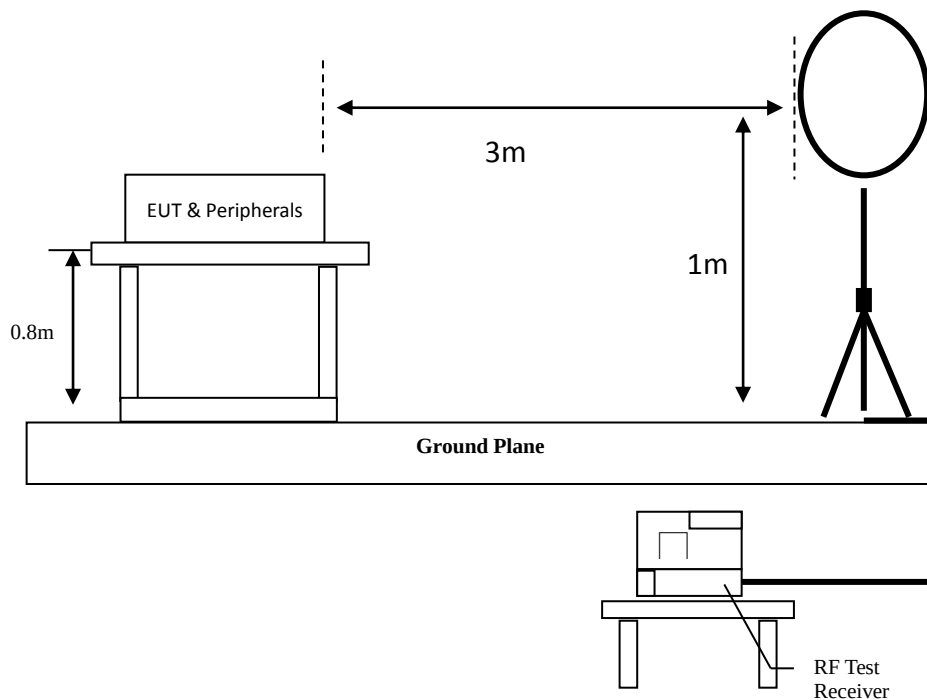
5.3 Measuring instruments setting

Spectrum analyzer settings	
Spectrum Analyzer function	Setting
Detector	QP
RBW	10 kHz
Sweep	Auto couple
Trace	Max hold
Span	900 kHz
Attenuation	Auto

5.4 Test procedure

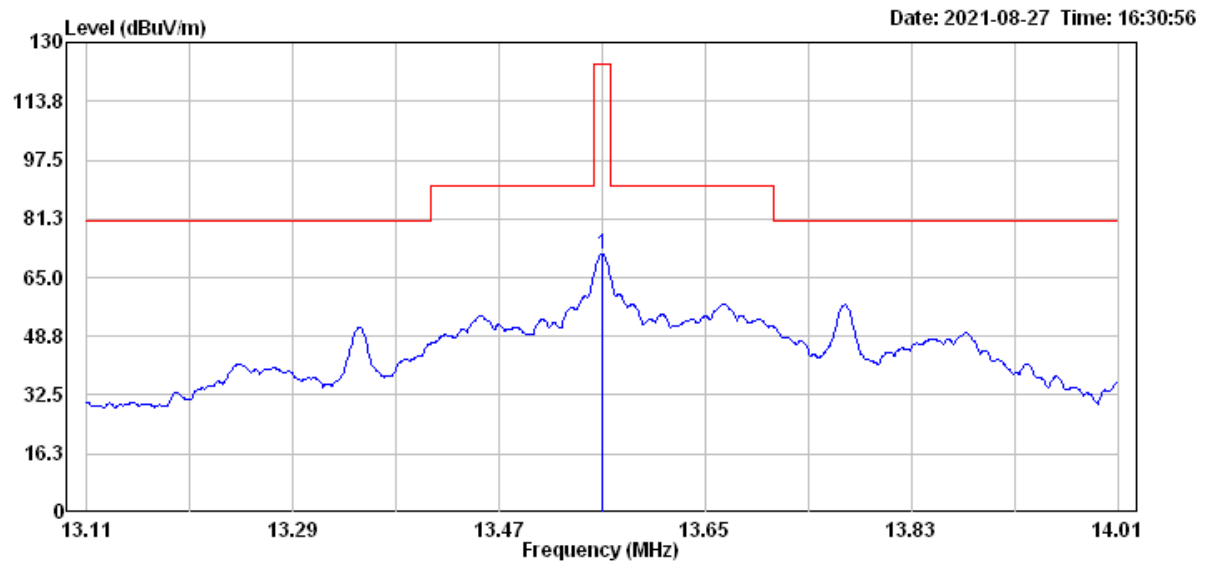
1. Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna is one meter above ground to find the maximum emission field strength of the both plane and coaxial polarity
4. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.

5.5 Test diagram



5.6 Test results

FCC 15.225 Mask @ NFC 13.56MHz



6. Out of band Radiated Emissions

6.1 Operating environment

Temperature:	27	°C
Relative Humidity:	63	%
Requirement	15.225(d), 15.205, 15.209	

6.2 Limit for emission in restricted frequency bands (Radiated emission measurement)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	2400/F(kHz)	30
1.705~30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

6.3 Measuring instrument setting

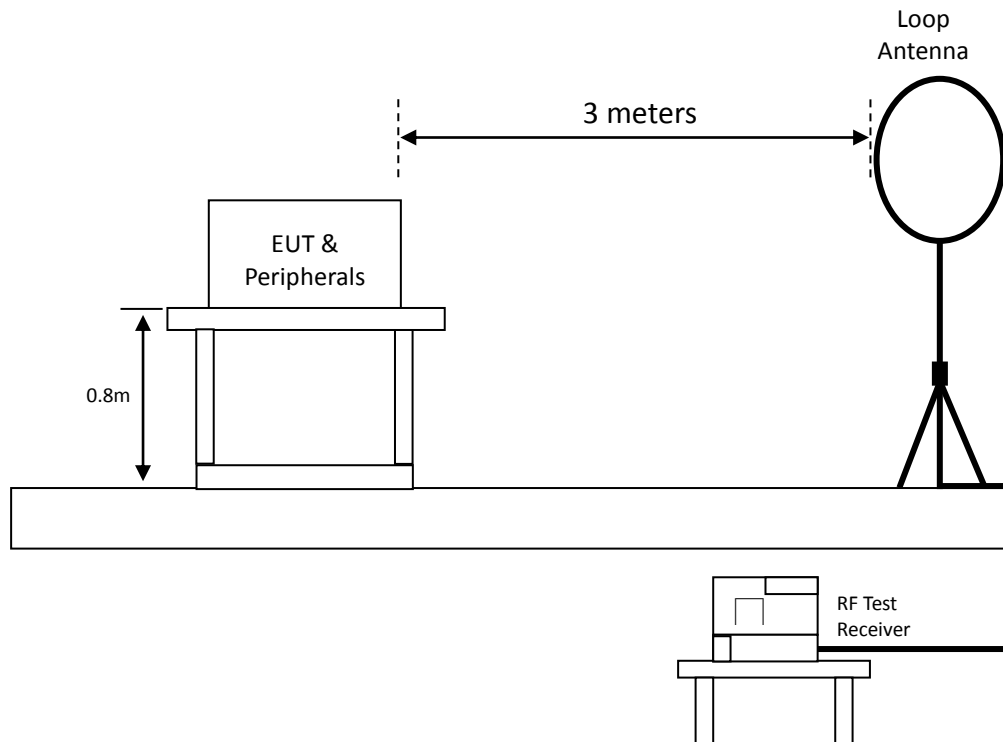
Receiver settings	
Receiver function	Setting
Detector	QP
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Attenuation	Auto

6.4 Test procedure

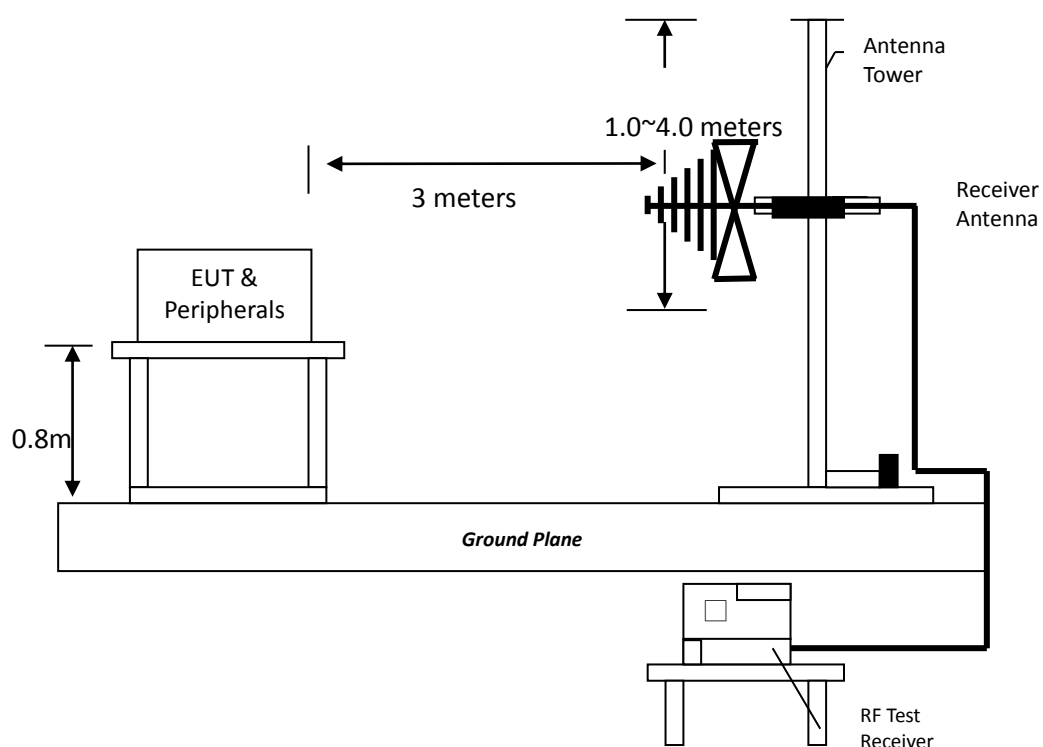
1. Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
3. The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization
4. If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
5. Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
6. If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.

6.5 Test configuration

6.5.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



6.5.2 Radiated emission below 1GHz using Bilog Antenna



6.6 Test result

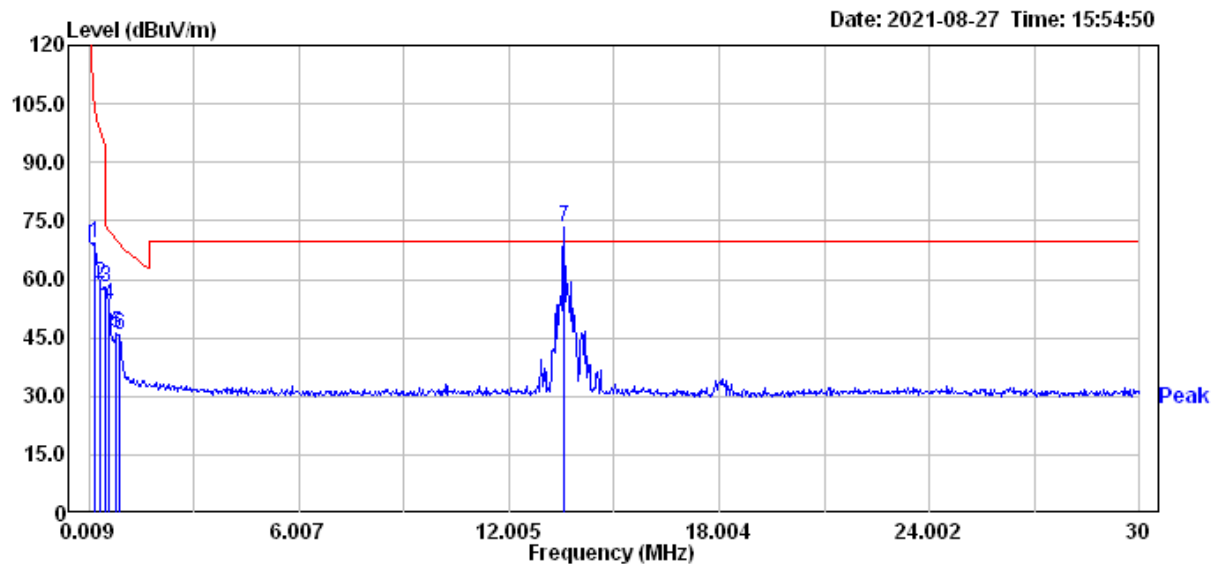
6.6.1 Measurement results: frequency range from 9 kHz to 30 MHz

Parallel

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
0.16	AV	18.57	50.66	69.23	103.63	-34.40
0.31	AV	18.72	40.14	58.86	97.82	-38.96
0.49	AV	19.34	38.47	57.81	93.82	-36.01
0.58	QP	19.33	34.06	53.39	72.38	-18.99
0.79	QP	19.64	26.58	46.22	69.68	-23.46
0.88	QP	19.63	26.12	45.75	68.78	-23.03

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

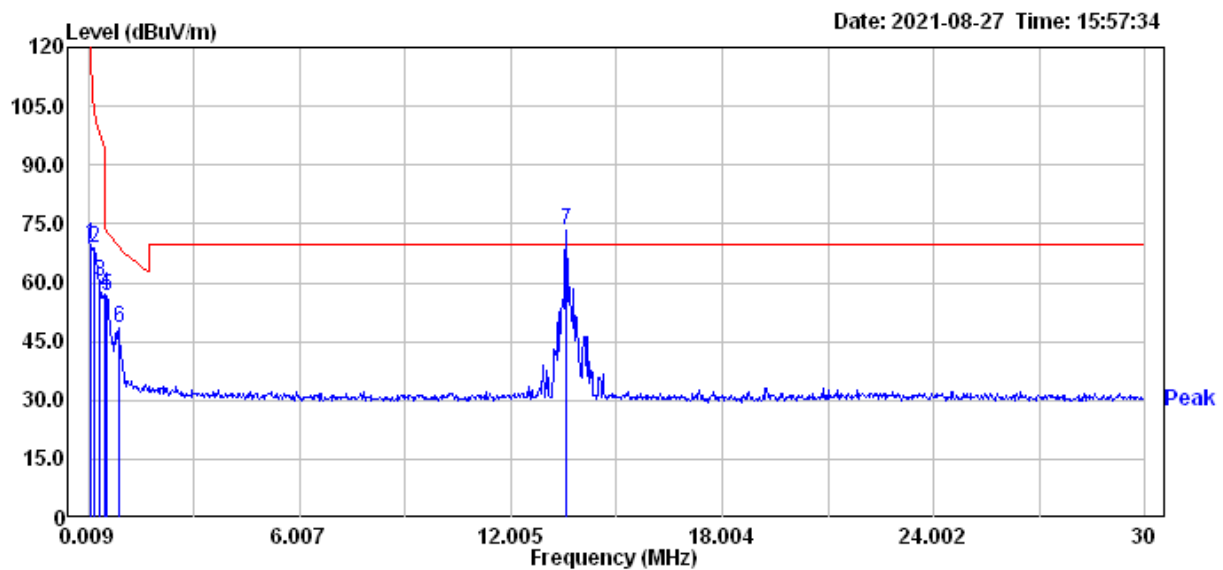


Perpendicular

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
0.07	AV	19.08	50.85	69.93	114.73	-44.80
0.16	QP	18.57	50.37	68.94	103.63	-34.69
0.31	QP	18.72	41.54	60.26	97.82	-37.56
0.46	AV	19.17	37.91	57.08	94.38	-37.30
0.52	QP	19.39	37.12	56.51	73.34	-16.83
0.85	QP	19.64	28.67	48.31	69.07	-20.76

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

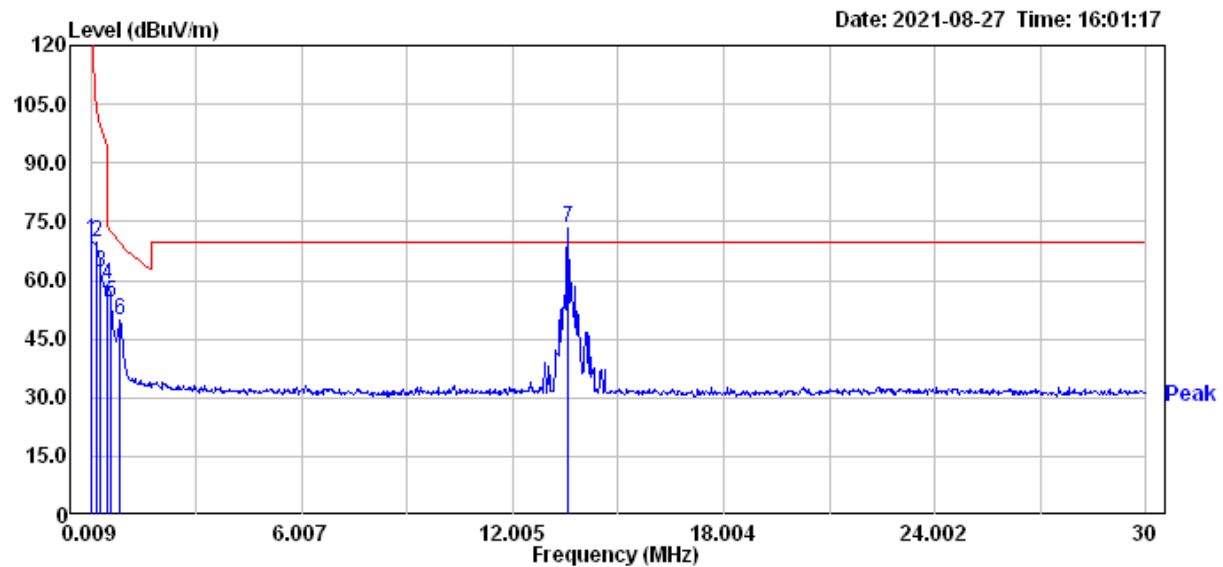


Ground-parallel

Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
0.04	AV	19.54	50.87	70.41	121.63	-51.22
0.16	AV	18.57	51.04	69.61	103.63	-34.02
0.28	AV	18.72	43.15	61.87	98.73	-36.86
0.49	AV	19.34	39.48	58.82	93.82	-35.00
0.58	QP	19.33	35.00	54.33	72.38	-18.05
0.82	QP	19.65	29.98	49.63	69.36	-19.73

Remark:

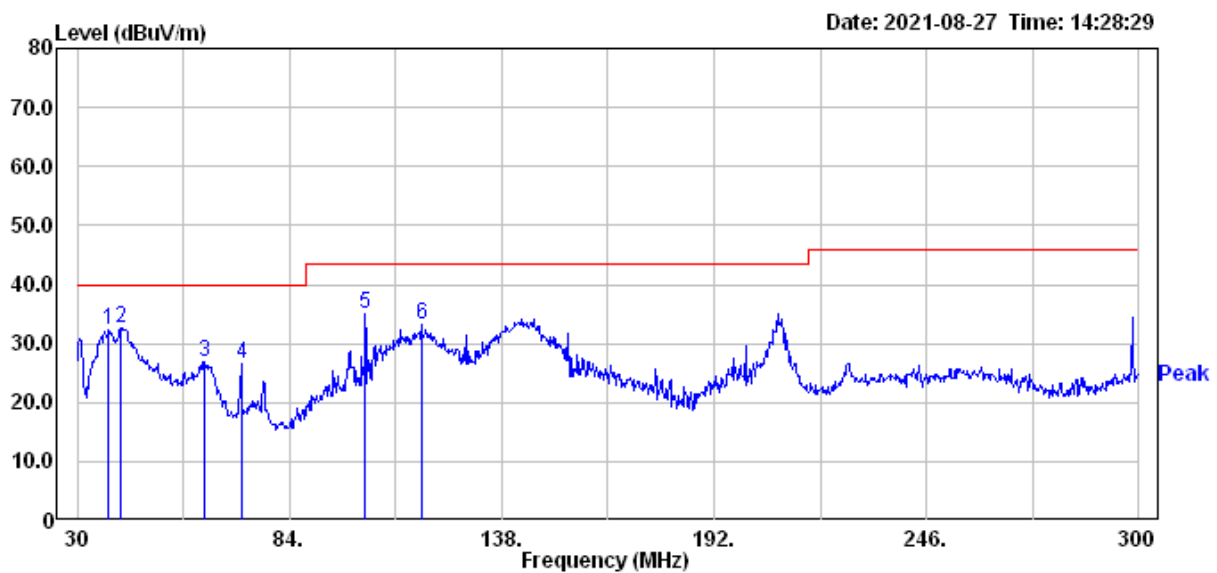
1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor



6.6.2 Measurement results: frequencies below 1 GHz

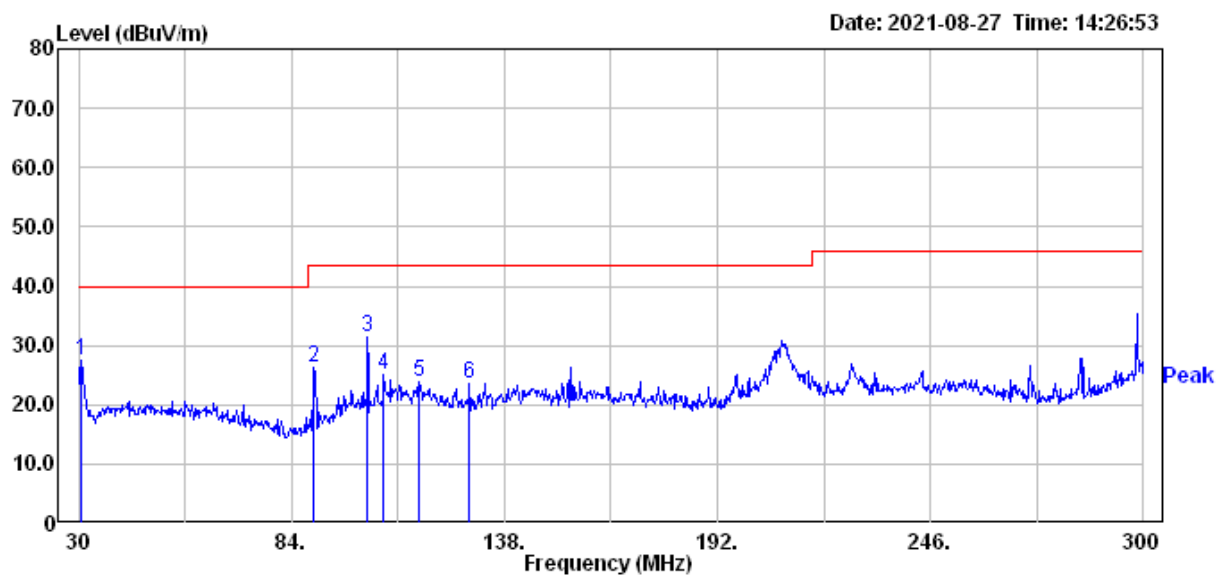
Antenna polarity (H/V)	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	37.83	QP	20.45	11.72	32.17	40.00	-7.83
Vertical	41.07	QP	20.55	12.16	32.71	40.00	-7.29
Vertical	62.40	QP	20.26	6.57	26.83	40.00	-13.17
Vertical	71.58	QP	18.68	7.79	26.47	40.00	-13.53
Vertical	103.17	QP	16.89	18.22	35.11	43.50	-8.39
Vertical	117.48	QP	18.54	14.62	33.16	43.50	-10.34

Remark: Corr. Factor = Antenna Factor + Cable Loss



Antenna polarity (H/V)	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dB μ V)	Corrected Reading (dB μ V/m)	Limit @ 3 m (dB μ V/m)	Margin (dB)
Horizontal	30.54	QP	19.33	8.05	27.38	40.00	-12.62
Horizontal	89.67	QP	15.50	10.66	26.16	43.50	-17.34
Horizontal	103.17	QP	16.89	14.59	31.48	43.50	-12.02
Horizontal	107.22	QP	17.50	7.50	25.00	43.50	-18.50
Horizontal	116.13	QP	18.40	5.36	23.76	43.50	-19.74
Horizontal	129.09	QP	19.75	3.95	23.70	43.50	-19.80

Remark: Corr. Factor = Antenna Factor + Cable Loss



7. AC Power Line Conducted Emission

Since the EUT is not connected to AC source, therefore, the test can be waived.

Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESR7	101822	2021/08/16	2022/08/15
Spectrum Analyzer	R&S	FSP30	100137	2021/08/20	2022/08/19
FSV40 Signal Analyzer	Rohde & Schwarz	FSV40	101532	2020/09/28	2021/09/27
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2021/04/14	2022/04/13
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2021/01/29	2022/01/28
966-2(A) Cable	SUHNER	SUCOLEX 104	295105/4	2021/03/08	2022/03/07
966-2(B) Cable	SUHNER	SUCOFLEX 104P	CB0005	2021/03/08	2022/03/07
RF Cable	SUHNER	SUCOFLEX 104P	CB0006	2021/04/29	2022/04/28
20dB Attenuator	Mini-Circuits	BW-S20W5+	N/A	2021/05/26	2022/05/25
10dB Attenuator	Mini-Circuits	VAT-10W2+	N/A	2021/05/26	2022/05/25
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2021/01/15	2022/01/14
Temperature & Humidity Test Chamber	TERCHY	MHU-225LRU(SA)	950838	2021/07/15	2022/07/14
Test software	Audix	e3	V9	NCR	NCR

Note: No Calibration Required (NCR)

Appendix B: Measurement Uncertainty

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

Item	Uncertainty
Fundamental emission	4.32 dB
Occupied Bandwidth	7.78 %
Frequency stability	0.01118 ppm
In band Radiated Emission	1.27 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.70 dB
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.16 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.02 dB
AC Power Line Conducted Emission	3.08 dB