



## TEST REPORT

**Application No.:** GZCR2111021379AT  
**Applicant:** Qorvo International Pte. Ltd.  
**Address of Applicant:** 1 Changi Business Park Avenue 1, # 04-01, Singapore  
**Manufacturer:** Qorvo International Pte. Ltd.  
**Address of Manufacturer:** 1 Changi Business Park Avenue 1, # 04-01, Singapore  
**Factory:** Victory Concept  
**Address of Factory:** Building A, No 18 Shuiyuan Industrial District, Ruhu Town, Huizhou City, 516021, Guangdong

**Equipment Under Test (EUT):**

**EUT Name:** UWB Transceiver module  
**Model No.:** DWM3001C  
**Trade Mark:** Qorvo  
**Standard(s) :** 47 CFR Part 15 Subpart F  
**Date of Receipt:** 2021-11-15  
**Date of Test:** 2021-11-15 to 2021-11-19  
**Date of Issue:** 2021-12-02

<b>Test Result:</b>	Pass*
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\* In the configuration tested, the EUT complied with the standards specified above.

Kobe Jian  
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2021-12-02		Original

Authorized for issue by:			
		Curry Wu/Project Engineer	
		Ricky Liu/Reviewer	

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## 2 Test Summary

<b>Radio Spectrum Technical Requirement</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
Antenna Requirement	47 CFR Part 15 Subpart F	N/A	47 CFR Part 15F Section 15.519(a2), 15.521(b), 15.203	Pass

<b>Radio Spectrum Matter Part</b>				
<b>Item</b>	<b>Standard</b>	<b>Method</b>	<b>Requirement</b>	<b>Result</b>
EIRP	47 CFR Part 15 Subpart F	ANSI C63.10: 2013 section 10.3	47 CFR Part 15, Subpart F Section 15.519 (c)(e), 15.521(g)	Pass
Spurious Emissions Below 1GHz		ANSI C63.10: 2013 section 10.2	47 CFR Part 15, Subpart F Section 15.519 (c),15.209, 15.521(c)(d) (h)	Pass
Spurious Emissions Above 1GHz		ANSI C63.10: 2013 section 10.3	47 CFR Part 15, Subpart F Section 15.519 (c)(d), 15.521(d)(h)	Pass
UWB Bandwidth		ANSI C63.10:2013 section 10.1	47 CFR Part 15F Section 15.503, 15.521(e)	Pass
Dwell Time		/	47 CFR Part 15F Section 15.519(a)(1)	Pass
Conducted Emissions at AC Power Line (150kHz-30MHz)		ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart F 15.207, 15.505, 15.521(j)	Pass

**Note:**

E.U.T./EUT means Equipment Under Test.

Pass means the test result passed the test standard requirement, please find the detailed decision rule in the report relative section.

**Remark:**

1. for 47 CFR Part 15.521 General Requirement, Section15.521(f)(i), is not applicable for this product, so it's not evaluated in the report.

2. Only recorded worst case of 6.8Mbps rate in the report.

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## 4 General Information

### 4.1 Details of E.U.T.

Power supply:	For RF Module: DC3.3V from debug board For Debug Board: DC5V from PC USB port
Operating Frequency:	6489.6MHz;7987.2MHz
Modulation Type:	PM
Number of Channels:	2
Sample Type:	Hand Held Use
Antenna Type:	PCB Antenna
Antenna Gain:	0.3dBi for 6489.6MHz, 0.8dBi for 7987.2MHz
Firmware Version:	0.6.5+211103
Hardware Version:	DWM3001_D1
Testing Software:	J-Flash Lite V7.58
SN:	2123400141(Conducted), 2123400073(Radiated)
Power Setting:	-41.3dBm(AV EIRP) as default, can't be changed by end user.
Hardware Setup:	Using a terminal emulator the DWM3001 was configured to transmit on Channel 5 and 9 using a preamble length of 64, a 64M PRF with a data rate of 6.8 Mbps.

### 4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Note Book PC	LENOVO	Lenovo Xiaoxinchao 5000	PF0TNMG8
Mouse	LENOVO	MOJUUO	00BABF8
Wireless Router	MI	R4CM	18970/24772364
Cable	USB Cable (1.0m length)	/	/

### 4.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
EIRP	5.08dB
Spurious Emissions Below 1GHz	5.14dB
Spurious Emissions Above 1GHz	5.08dB
UWB Bandwidth	± 3%
Dwell time	± 0.37%
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.12dB

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#### 4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,  
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,  
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

#### 4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian/New Zealand Regulatory Compliance Mark (RCM).

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2018 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of Testing Laboratories.

- **FCC Recognized Accredited Test Firm(Registration No.: 486818)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: CN5016, Test Firm Registration Number: 486818.

- **ISED (Registration No.: 4620B, CAB identifier: CN0052)**

SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Innovation Science and Economic Development Canada for Wireless Device Testing laboratories to test to Canadian radio equipment requirements. Registration No. 4620B, CAB identifier: CN0052.

- **VCCI (Registration No.: R-12460, C-12584, G-20107 and T-11179)**

The 10m Semi-anechoic chamber, 966 Anechoic Chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-12460, C-12584, G-20107 and T-11179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2017, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

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**4.6 Deviation from Standards**

None

**4.7 Abnormalities from Standard Conditions**

None

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## 5 Equipment List

EIRP					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Chamber cable(Above 1GHz)	Scoflex	KMKG-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
EMI Test Receiver(9kHz-3GHz)	Rohde & Schwarz	ESCI	EMC0056	2021-01-03	2022-01-02
Chamber cable	HangTianXing	N/A	EMC0542	2020-09-09	2022-09-08
Trilog Broadband Antenna(25MHz-1GHz)-On Site	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	EMC2174	2019-08-08	2022-08-07
Amplifier(9kHz-1.3GHz)	HP	8447F	EMC2065	2021-05-19	2022-05-18
10m Semi-Anechoic Chamber	ETS	N/A	EMC0530	2019-10-20	2022-10-19
Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A

Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Chamber cable(Above 1GHz)	Scoflex	KMKG-8.0m	EMC0545	2020-09-09	2022-09-08
Horn Antenna(1GHz-18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	EMC2026	2019-09-25	2022-09-24
1GHz-26.5 GHz Pre-Amplifier	Agilent	8449B	EMC0521	2021-01-08	2022-01-07
966 Anechoic Chamber	C.R.T	9m x 6m x 6m	EMC2142	2020-12-20	2023-12-19
EXA Signal Analyzer(10Hz-44GHz)	Keysight	N9010A	EMC2138	2021-09-16	2022-09-15



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Test Software E3	Audix	Ver.6.120110a	GZE100-61	N/A	N/A
Horn Antenna(14-40GHz)	SCHWARZBECK	BBHA 9170	EMC2041	2020-06-28	2023-06-27
Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	EMC2172	2021-08-30	2022-08-29

<b>UWB Bandwidth</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01

<b>Dwell Time</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
EXA Signal Analyzer(10Hz-44GHz)	Agilent Technologies	N9010A	EMC2138	2021-09-16	2022-09-15
MI CABLE	SGS-EMC	0.8M	EMC2136	2021-11-01	2023-11-01

<b>Conducted Emissions at AC Power Line (150kHz-30MHz)</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
EMI Test Receiver(9kHz-3GHz)	Rohde & Schwarz	ESCI	EMC0056	2021-04-09	2022-04-08
Shielding Room	ChangZhou ZhongYu	8m x 3m x 3.8m	EMC0306	N/A	N/A
Two-Line V-Network	Rohde & Schwarz	ENV216	EMC0118	2021-01-08	2022-01-06
Two-Line V-Network-GZ	Rohde & Schwarz	ENV216	EMC2135	2021-09-24	2022-09-23
Coaxial Cable	HangTianXing	2m	EMC0107	2020-09-09	2022-09-08
Test Software E3c	Audix	Ver. 5.4.1221b	GZE100-62	N/A	N/A

<b>General used equipment</b>					
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Inventory No</b>	<b>Cal Date</b>	<b>Cal Due Date</b>
DMM	Fluke	73	EMC0006	2021-07-05	2022-07-05
DMM	Fluke	73	EMC0007	2021-07-05	2022-07-05

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## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15F Section 15.519(a2), 15.521(b), 15.203

Limit:

15.203 Requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of 15.211, 15.213, 15.217, 15.219, 15.221, or 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

15.519 requirement:

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

#### 6.1.2 Conclusion

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0.3dBi for 6489.6MHz, 0.8dBi for 7987.2MHz.

Please refer to internal photos of EUT.



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## 7 Radio Spectrum Matter Test Results

### 7.1 EIRP

Test Requirement 47 CFR Part 15, Subpart F Section 15.519 (c)(e), 15.521(g)

Test Method: ANSI C63.10: 2013 section 10.3

Measurement Distance: 3m

Limit:

Frequency	Limit	Detector	Measurement distance (m)
960MHz-1610MHz	-75.3 dBm (EIRP, RBW=1MHz)	AV	3
1610MHz-1990MHz	-63.3 dBm (EIRP, RBW=1MHz)	AV	3
1990MHz-3100MHz	-61.3 dBm (EIRP, RBW=1MHz)	AV	3
3100MHz-10600MHz	-41.3 dBm (EIRP, RBW=1MHz)	AV	3
Above 10600MHz	-61.3 dBm (EIRP, RBW=1MHz)	AV	3
Fundamental	0 dBm (EIRP, RBW=50MHz)	Peak	3

Remark: Due to some spectrum analyzer does not support 50MHz RBW setting, RBW set to the maximum value, and add a correction factor is allowed for Max Peak EIRP measurement. According to ANSI 63.10 Clause 10.3.9, the EIRP to field strength at a specified measurement distance of 3 m is below:

$$E (\text{dBuV/m}) = \text{EIRP(dBm)} + 95.3$$

For peak power test, the spectrum analyzer was set to RBW=8MHz, VBW=10MHz, and add a conversion factor of  $20 \times \log(50\text{MHz}/8\text{MHz}) = 15.92\text{dB}$ .

Thus, the field strength limit for the test above 1GHz is below:

Frequency	Limit	Detector	Measurement Distance
	Field Strength (dBuV/m)		
960MHz-1610MHz	20.00	AV	3
1610MHz-1990MHz	32.00	AV	3
1990MHz-3100MHz	34.00	AV	3
3100MHz-10600MHz	54.00	AV	3
Above 10600MHz	34.00	AV	3
Fundamental	95.30	Peak	3

#### 7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C      Humidity: 54.5 % RH      Atmospheric Pressure: 1003 mbar

#### 7.1.2 Test Mode Description

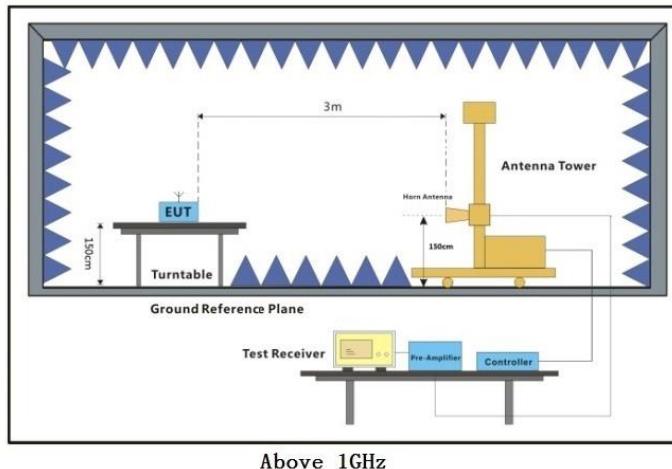
Pre-scan / Mode	Final test Code	Description
Final test	01	Continuous Tx Mode: Keep the EUT Transmitting with Modulation

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### 7.1.3 Test Setup Diagram



### 7.1.4 Measurement Procedure and Data

- 1) The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5) The test-receiver system was set to Peak detector with Maximum Hold Mode for Max Peak EIRP measurement and AV detector for Average EIRP measurement.
- 6) Test the EUT in the lowest channel, the Highest channel
- 7) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
- 8) Repeat above procedures until all frequencies measured was complete.

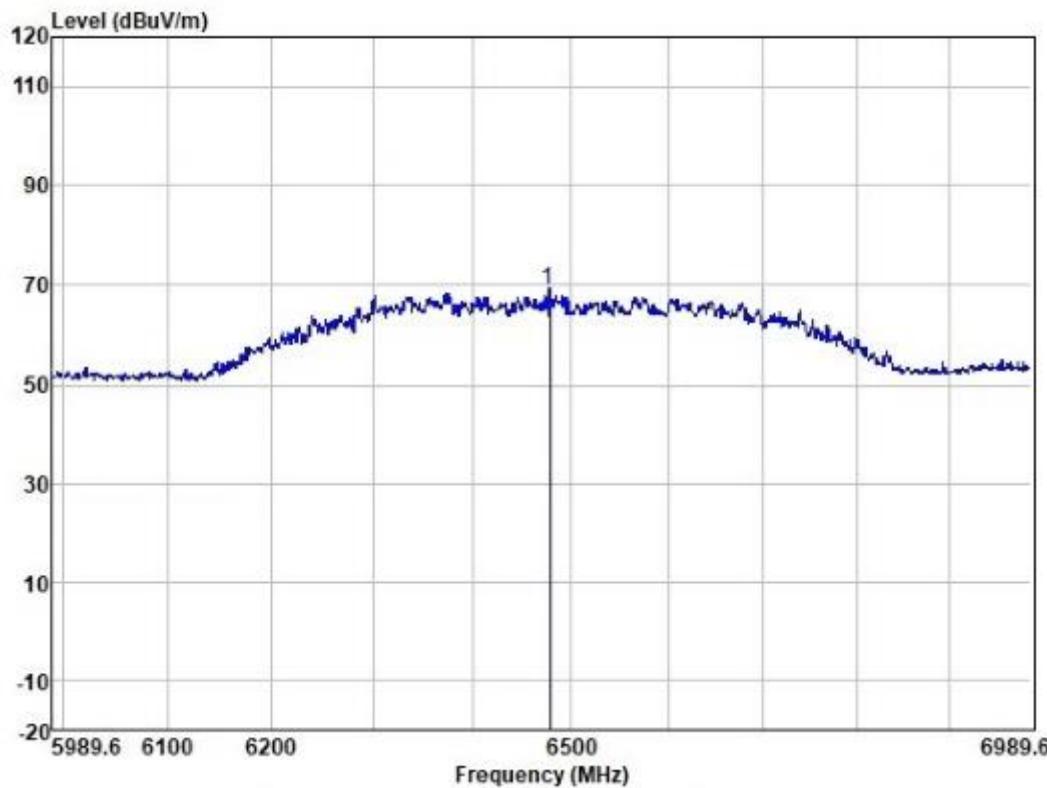
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

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**Peak Field Strength for fundamental @ RBW=8MHz**

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Polarization
6479.60	33.96	5.85	37.00	66.55	69.36	Horizontal

**Calculated Peak Field Strength of fundamental @ RBW=50MHz**

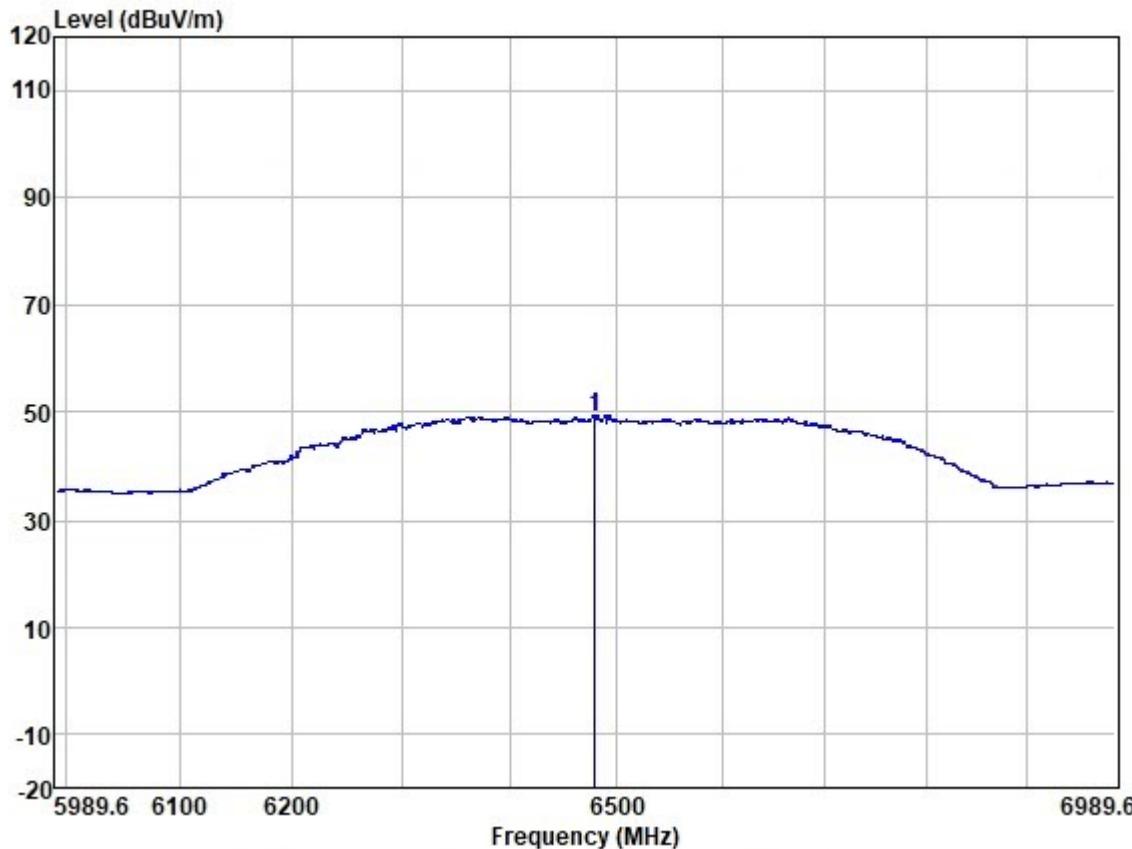
Frequency (MHz)	Measured Field Strength of fundamental (FS <sub>M</sub> ) (dBuV/m)	Calculated Field Strength of fundamental (FS <sub>C</sub> ) (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
6479.60	69.36	85.28	95.30	10.02	Horizontal

Note: FS<sub>C</sub> = FS<sub>M</sub> + 20log(50MHz/8MHz) = FS<sub>M</sub> + 15.92

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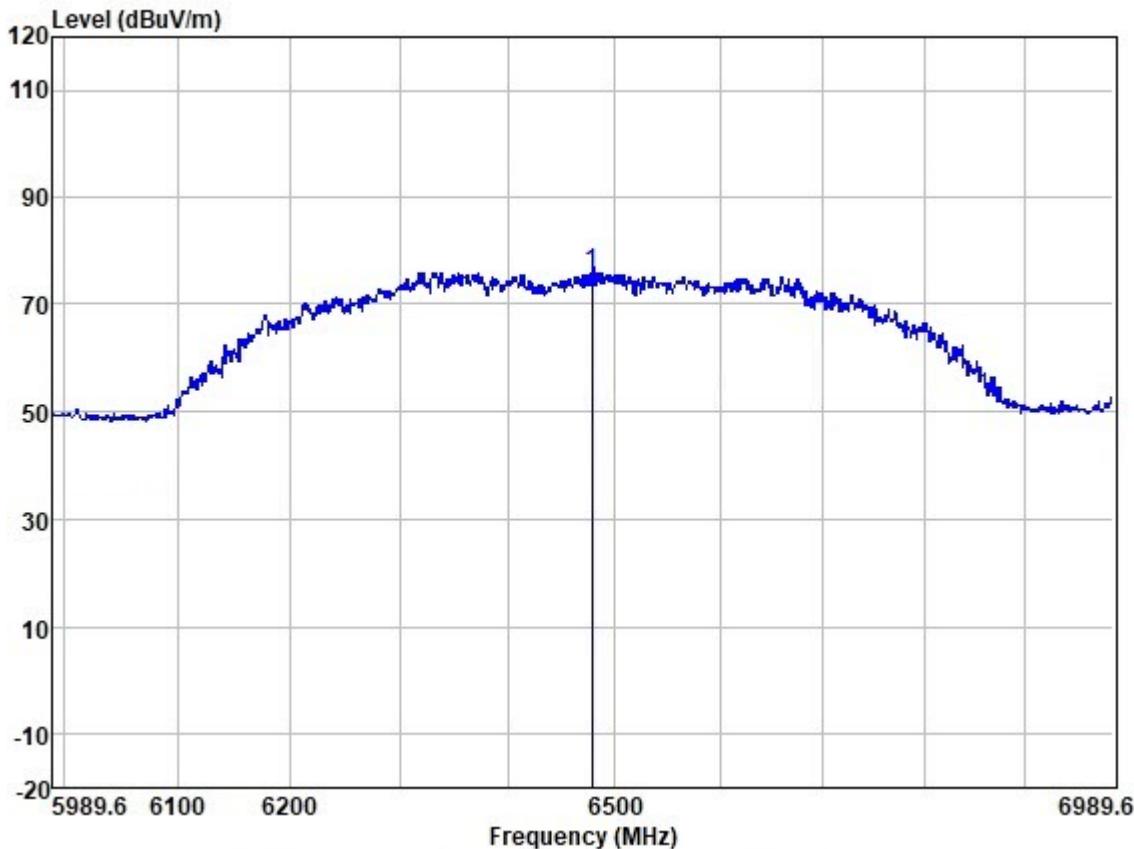


Average Field Strength for fundamental @ RBW=1MHz								
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
6479.60	33.96	5.85	37.00	42.63	49.14	54.00	4.86	Horizontal



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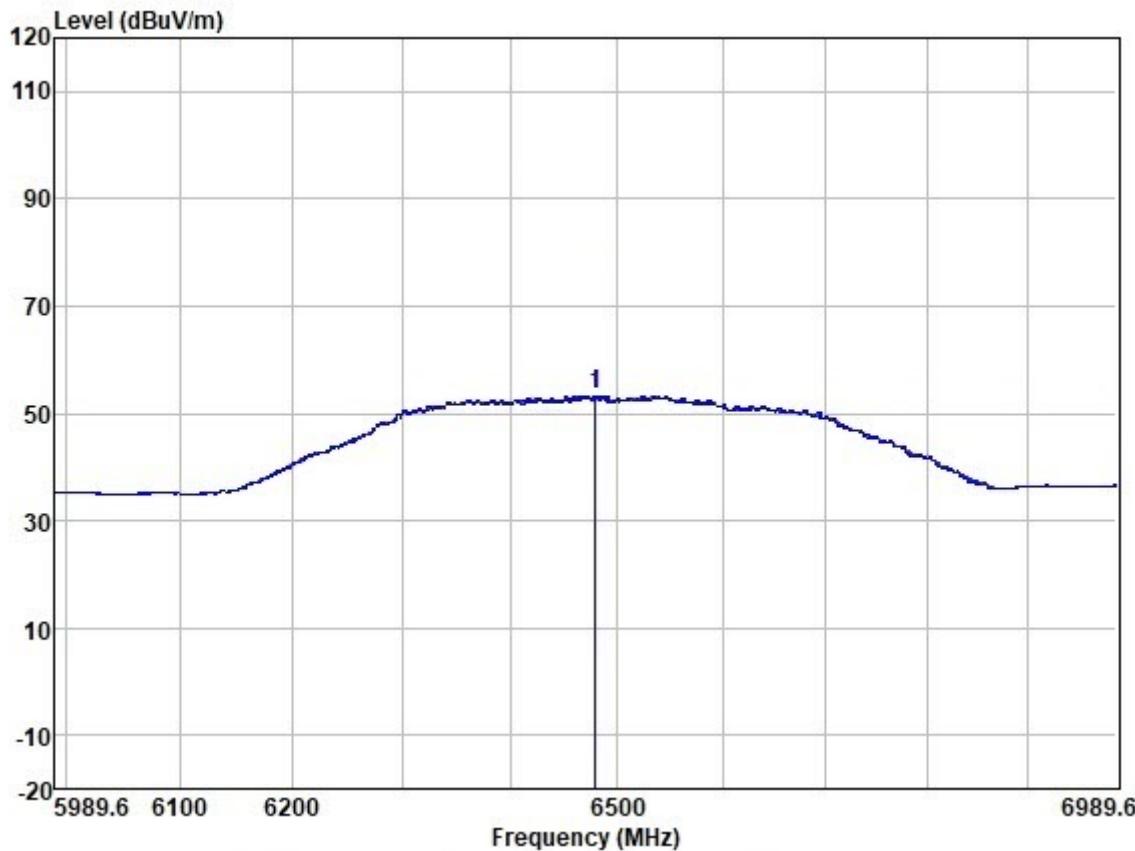


Peak Field Strength for fundamental @ RBW=8MHz						
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Polarization
6479.60	33.96	5.85	37.00	71.64	74.45	Vertical

Calculated Peak Field Strength of fundamental @ RBW=50MHz					
Frequency (MHz)	Measured Field Strength of fundamental (FS <sub>M</sub> ) (dBuV/m)	Calculated Field Strength of fundamental (FS <sub>C</sub> ) (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
6479.60	74.45	90.37	95.30	4.93	Vertical

Note: FS<sub>C</sub> = FS<sub>M</sub> + 20log(50MHz/8MHz) = FS<sub>M</sub> + 15.92





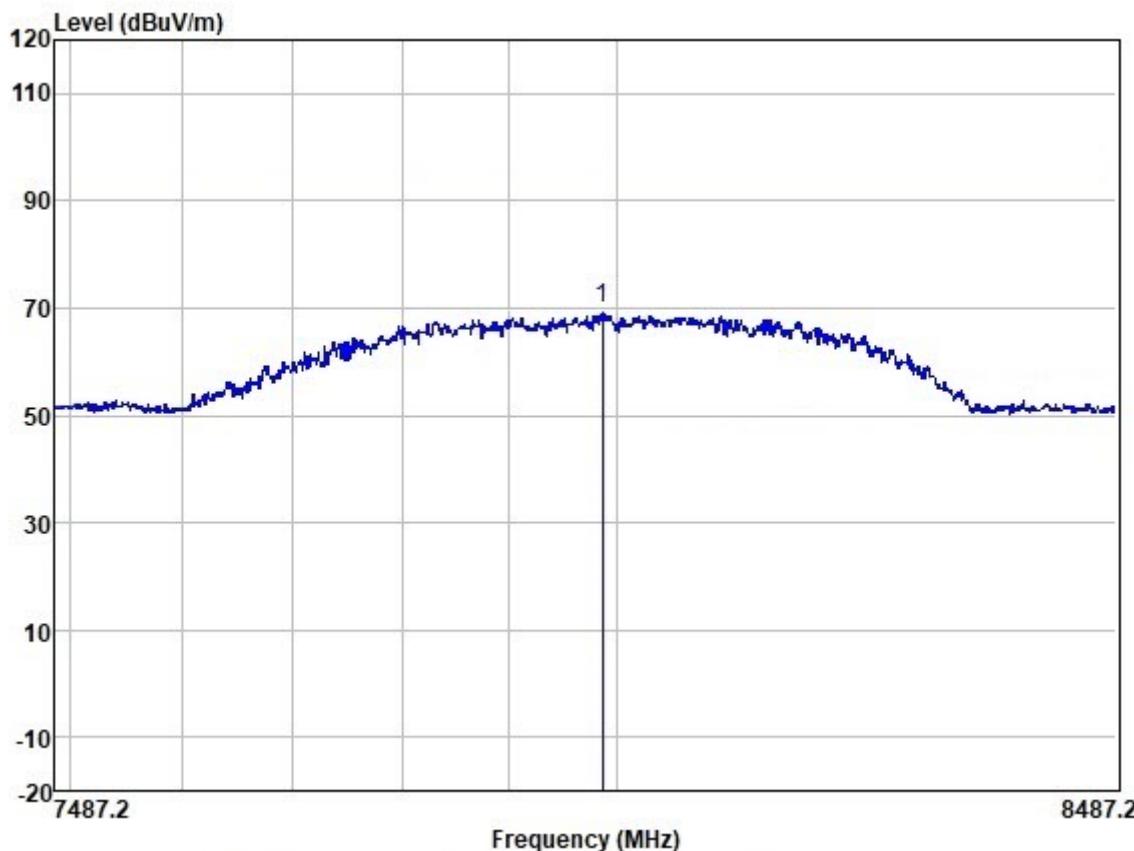
Average Field Strength for fundamental @ RBW=1MHz								
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
6479.60	33.96	5.85	37.00	50.22	53.03	54.00	0.97	Vertical

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Peak Field Strength for fundamental @ RBW=8MHz						
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Polarization
7987.20	36.90	6.15	37.60	64.35	69.80	Horizontal

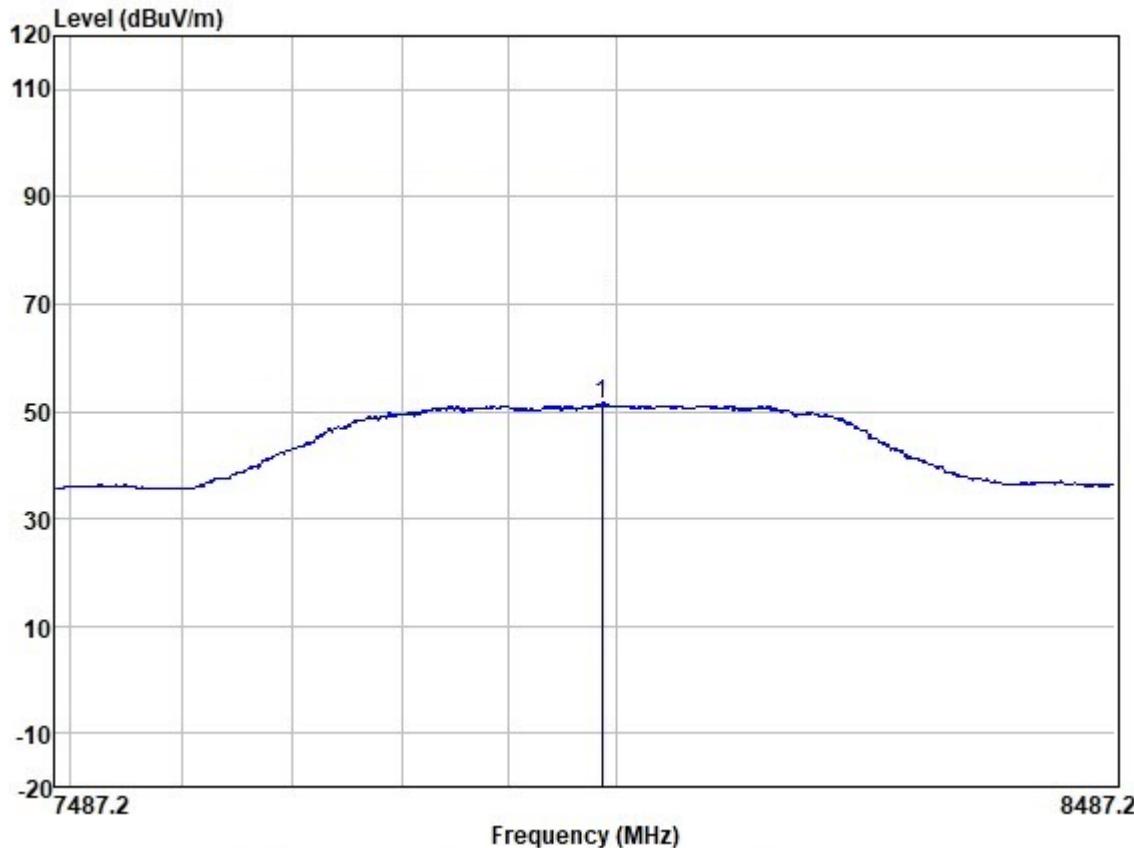
Calculated Peak Field Strength of fundamental @ RBW=50MHz						
Frequency (MHz)	Measured Field Strength of fundamental (FS <sub>M</sub> ) (dBuV/m)	Calculated Field Strength of fundamental (FS <sub>C</sub> ) (dBuV/m)	Limit (dBuV/m)	Margin	Polarization	
7987.20	69.80	85.72	95.30	9.58	Horizontal	

Note: FS<sub>C</sub> = FS<sub>M</sub> + 20log(50MHz/8MHz) = FS<sub>M</sub> + 15.92



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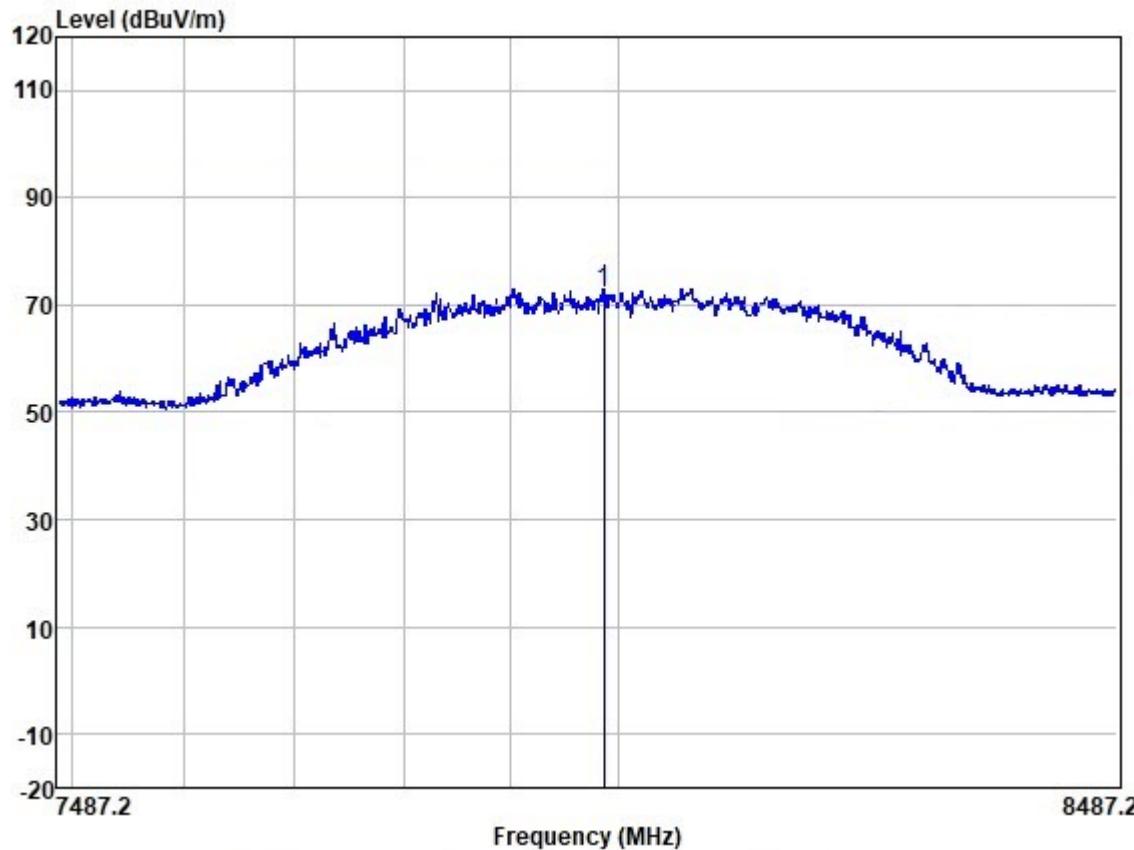
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Average Field Strength for fundamental @ RBW=1MHz								
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
7987.20	36.90	6.15	37.60	45.72	51.17	54.00	2.83	Horizontal

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Peak Field Strength for fundamental @ RBW=8MHz						
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Polarization
7987.20	36.90	6.15	37.60	67.48	72.93	Vertical

Calculated Peak Field Strength of fundamental @ RBW=50MHz					
Frequency (MHz)	Measured Field Strength of fundamental (FS <sub>M</sub> ) (dBuV/m)	Calculated Field Strength of fundamental (FS <sub>C</sub> ) (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
7987.20	72.93	88.85	95.30	6.45	Vertical

Note: FS<sub>C</sub> = FS<sub>M</sub> + 20log(50MHz/8MHz) = FS<sub>M</sub> + 15.92



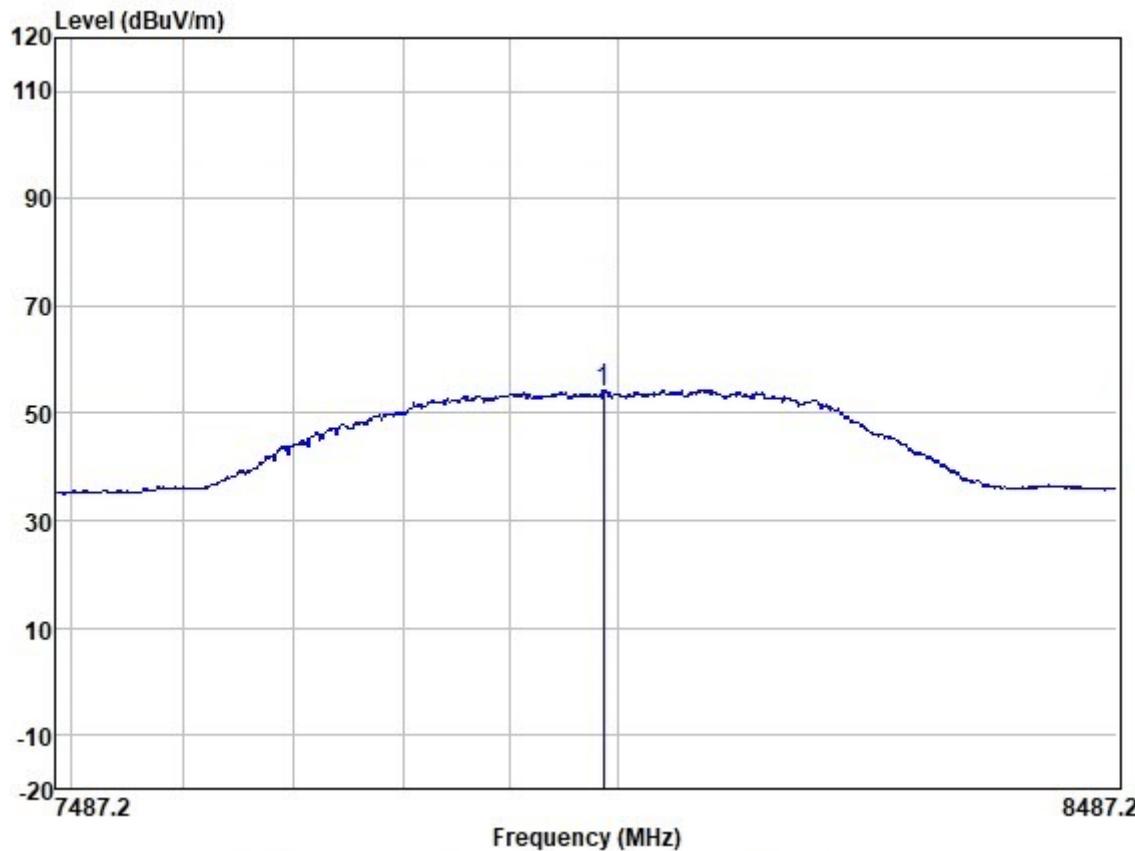
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Average Field Strength for fundamental @ RBW=1MHz								
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin	Polarization
7987.20	36.90	6.15	37.60	48.19	53.64	54.00	0.36	Vertical

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## 7.2 Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart F Section 15.519 (c), 15.209, 15.521(c)(d) (h)

Test Method: ANSI C63.10: 2013 section 10.2

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1000MHz	-	20	AV	3

### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.5 °C

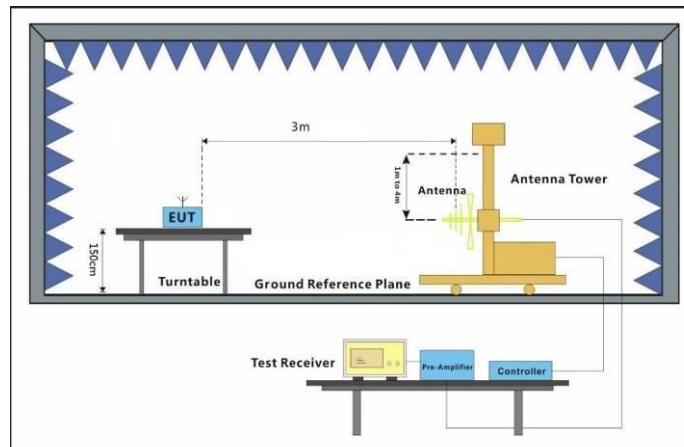
Humidity: 46.0 % RH

Atmospheric Pressure: 1003 mbar

### 7.2.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Continuous Tx Mode: Keep the EUT Transmitting with Modulation

### 7.2.3 Test Setup Diagram



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**7.2.4 Measurement Procedure and Data**

- 1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5) The test-receiver system was set to Peak detector with Maximum Hold Mode. And use Quasi-Peak to measure the six highest frequencies.
- 6) Test the EUT in the lowest channel, the Highest channel and only recorded worst channel--Lowest channel in the test report.
- 7) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
- 8) Repeat above procedures until all frequencies measured was complete

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2. According to FCC Part 15.521(h), test was performed from 9KHz to 40GHz for the EUT.

Emission below 30MHz was very low, so it's not recorded in the test report.

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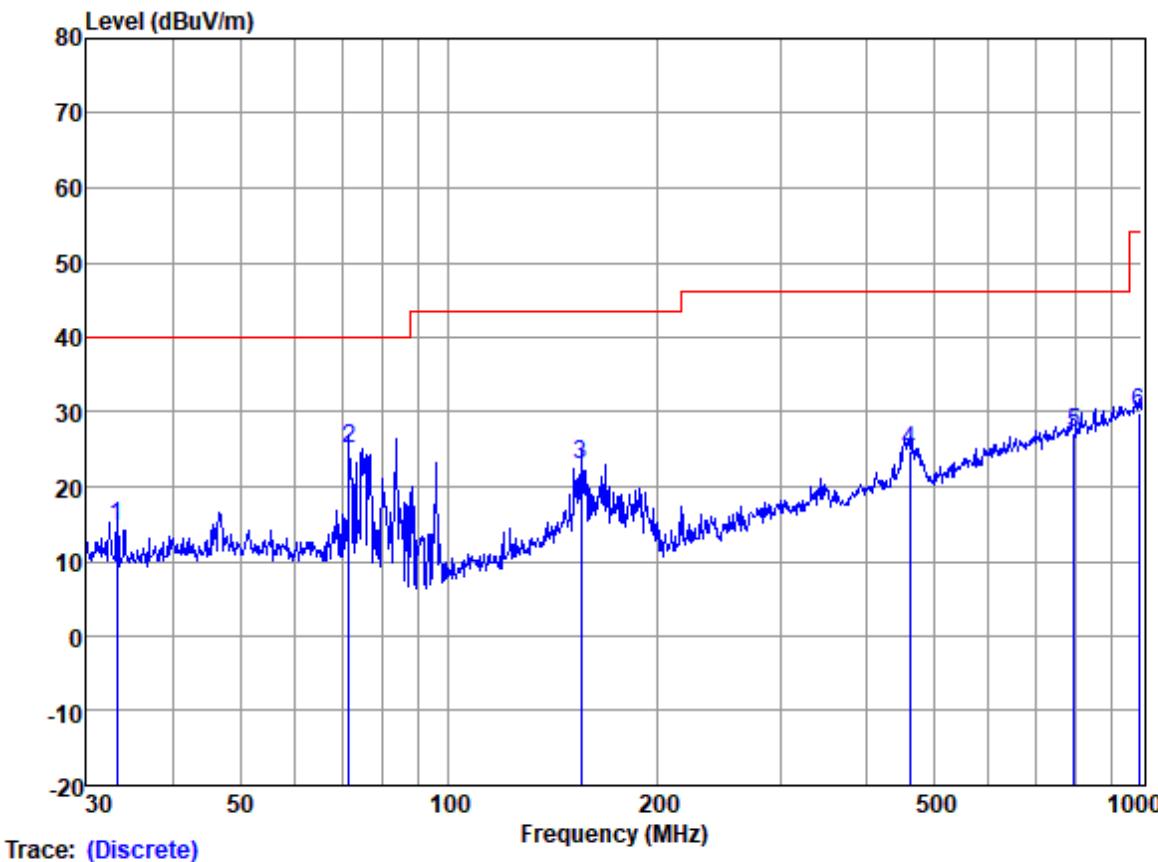
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Test Mode: 01; Polarity: Horizontal



Trace: (Discrete)

Site : SGS  
Job :  
Model :  
Power :  
Test Mode :

Freq	Read	Antenna	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dBuV		
1	33.21	28.11	12.76	1.05	27.19	14.73	40.00	-25.27	HORIZONTAL QP
2	71.83	39.29	11.54	1.42	27.12	25.13	40.00	-14.87	HORIZONTAL QP
3	154.82	33.65	13.75	2.28	26.81	22.87	43.50	-20.63	HORIZONTAL QP
4	462.35	30.92	17.47	4.27	27.81	24.85	46.00	-21.15	HORIZONTAL QP
5	796.18	26.44	22.57	6.14	28.03	27.12	46.00	-18.88	HORIZONTAL QP
6	989.54	25.98	24.20	7.37	27.67	29.88	54.00	-24.12	HORIZONTAL QP

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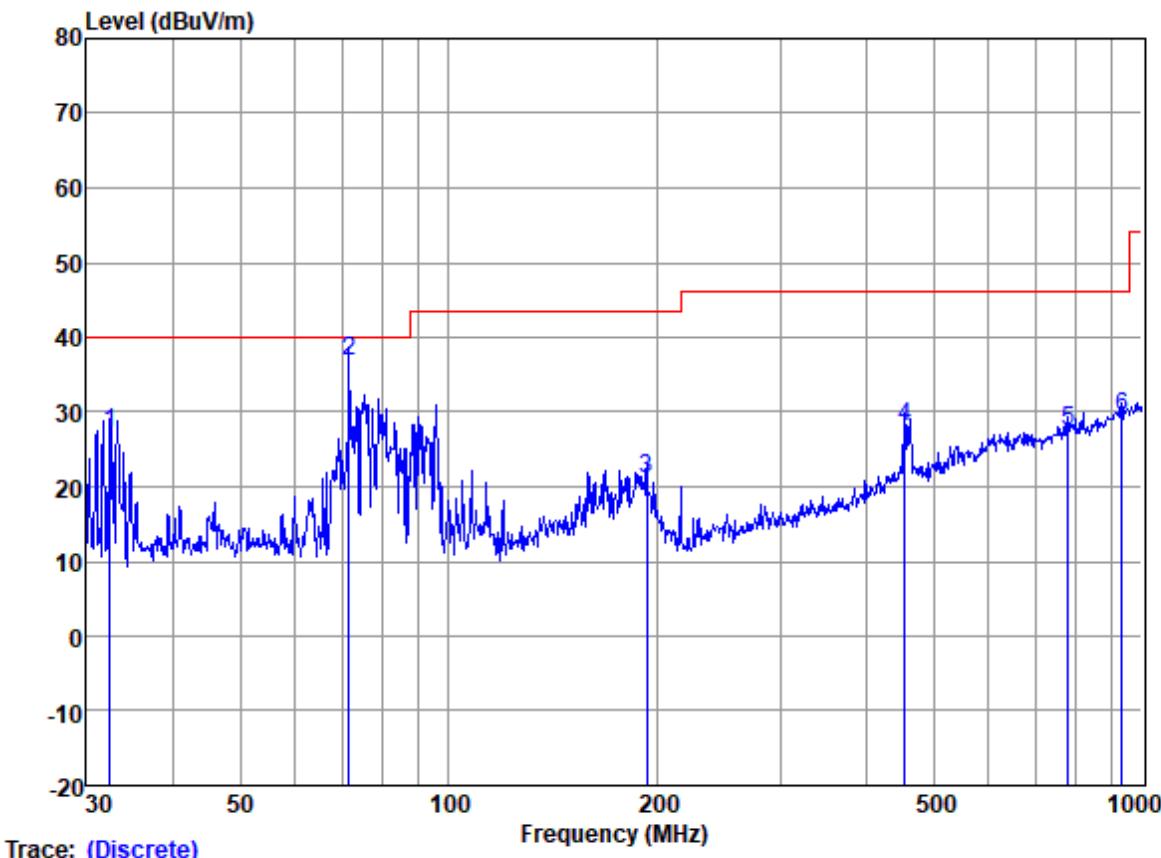
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Test Mode: 01; Polarity: Vertical



Site : SGS  
Job :  
Model :  
Power :  
Test Mode :

Freq	Read	Antenna	Cable	Preamp	Measured	Limit	Over	Pol/	Remark
	Level	Factor	Loss	Factor	Level	Line	Limit	Phase	
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dBuV		
1 32.41	40.69	12.72	1.05	27.19	27.27	40.00	-12.73	VERTICAL	QP
2 71.83	50.88	11.54	1.42	27.12	36.72	40.00	-3.28	VERTICAL	QP
3 193.09	34.39	10.83	2.50	26.74	20.98	43.50	-22.52	VERTICAL	QP
4 454.31	34.14	17.40	4.22	27.74	28.02	46.00	-17.98	VERTICAL	QP
5 782.35	27.14	22.35	6.11	28.05	27.55	46.00	-18.45	VERTICAL	QP
6 935.55	26.36	23.80	7.06	27.78	29.44	46.00	-16.56	VERTICAL	QP

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### 7.3 Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart F Section 15.519 (c)(d), 15.521(d) (h)

Test Method: ANSI C63.10: 2013 section 10.3

Measurement Distance: 3m

Limit:

Frequency	Limit (dBuV/m)	RBW	Detector	Measurement distance (m)
1000MHz-1610MHz	20.0	1MHz	AV	3
1610MHz-1990MHz	32.0	1MHz	AV	3
1990MHz-3100MHz	34.0	1MHz	AV	3
3100MHz-10600MHz	54.0	1MHz	AV	3
Above 10600MHz	34.0	1MHz	AV	3
1164MHz-1240MHz	10.0	1KHz	AV	3
1559MHz-1610MHz	10.0	1KHz	AV	3

#### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C

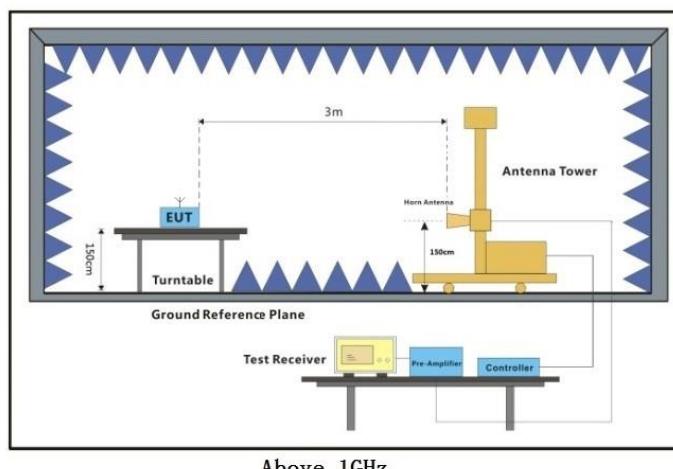
Humidity: 54.5 % RH

Atmospheric Pressure: 1003 mbar

#### 7.3.2 Test Mode Description

Pre-scan / Final test	Mode / Code	Description
Final test	01	Continuous Tx Mode: Keep the EUT Transmitting with Modulation

#### 7.3.3 Test Setup Diagram



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**7.3.4 Measurement Procedure and Data**

- 1) The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5) The test-receiver system was set to Peak detector with Maximum Hold Mode.
- 6) Test the EUT in the lowest channel, the Highest channel
- 7) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
- 8) Repeat above procedures until all frequencies measured was complete

Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor

2: As the EUT operate at 6489.6MHz and 7987.2MHz, according to Part 15.521(h), test was performed at frequency up to 40GHz. For frequency above 18GHz, emission was very low, so it's not recorded in the test report.

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Transmitting with modulation Mode at 6489.6MHz									
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Detector
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>									
1185.32	24.62	2.37	38.40	17.79	6.38	10.00	3.62	Horizontal	AV
1585.52	25.56	2.80	38.00	16.45	6.81	10.00	3.19	Horizontal	AV
<b>frequency out of 1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz band</b>									
1672.78	25.67	2.80	37.91	37.82	28.38	32.00	3.62	Horizontal	AV
4230.40	30.26	4.61	36.81	45.08	43.14	54.00	10.86	Horizontal	AV
4812.24	31.45	5.42	36.83	44.49	44.53	54.00	9.47	Horizontal	AV
6640.60	34.24	5.83	37.06	43.52	46.53	54.00	7.47	Horizontal	AV
8213.66	36.99	6.39	37.59	43.55	49.34	54.00	4.66	Horizontal	AV
16914.22	41.18	9.40	35.36	14.36	29.58	34.00	4.42	Horizontal	AV
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>									
1182.70	24.60	2.37	38.40	16.64	5.21	10.00	4.79	Vertical	AV
1586.18	25.57	2.80	38.00	16.63	7.00	10.00	3.00	Vertical	AV
<b>frequency out of 1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz band</b>									
1702.04	25.72	2.80	37.89	38.58	29.21	32.00	2.79	Vertical	AV
4230.40	30.26	4.61	36.81	50.64	48.70	54.00	5.30	Vertical	AV
5039.29	31.71	5.68	36.86	50.33	50.86	54.00	3.14	Vertical	AV
6640.73	34.24	5.83	37.06	47.91	50.92	54.00	3.08	Vertical	AV
8215.81	36.99	6.39	37.59	46.33	52.12	54.00	1.88	Vertical	AV
8611.24	38.37	7.07	37.42	44.93	52.95	54.00	1.05	Vertical	AV

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Transmitting with modulation Mode at 7987.2MHz									
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Detector
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>									
1212.09	24.77	2.32	38.39	18.44	7.14	10.00	2.86	Horizontal	AV
1606.74	25.59	2.80	37.98	16.93	7.34	10.00	2.66	Horizontal	AV
<b>frequency out of 1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz band</b>									
1697.13	25.71	2.80	37.89	38.91	29.53	32.00	2.47	Horizontal	AV
4405.09	30.68	4.70	36.81	50.58	49.15	54.00	4.85	Horizontal	AV
4761.12	32.13	6.15	36.89	48.85	50.24	54.00	3.76	Horizontal	AV
6995.17	35.00	5.81	37.25	49.20	52.76	54.00	1.24	Horizontal	AV
9608.00	38.37	7.07	37.42	43.88	51.90	54.00	2.10	Horizontal	AV
15998.28	38.30	9.85	35.40	19.23	31.98	34.00	2.02	Horizontal	AV
<b>1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz</b>									
1205.13	24.72	2.33	38.39	18.04	6.70	10.00	3.30	Vertical	AV
1604.72	25.59	2.80	37.98	17.30	7.71	10.00	2.29	Vertical	AV
<b>frequency out of 1164MHz ≤ f ≤ 1240MHz &amp; 1559MHz ≤ f ≤ 1610MHz band</b>									
1663.14	25.65	2.80	37.91	38.73	29.27	32.00	2.73	Vertical	AV
4133.70	30.01	4.60	36.80	48.81	46.62	54.00	7.38	Vertical	AV
4419.98	30.70	4.74	36.81	50.45	49.08	54.00	4.92	Vertical	AV
6995.17	35.00	5.81	37.25	47.52	51.08	54.00	2.92	Vertical	AV
9608.00	38.37	7.07	37.42	43.90	51.92	54.00	2.08	Vertical	AV
15941.32	38.37	9.85	35.40	18.28	31.10	34.00	2.90	Vertical	AV

## Remark:

- 1) Scan from 9kHz to 40GHz, disturbance above 18GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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## 7.4 UWB Bandwidth

Test Requirement 47 CFR Part 15F Section 15.503,15.521(e)  
Test Method: ANSI C63.10:2013 section 10.1  
Limit:  $\geq 500\text{MHz}$

### 7.4.1 E.U.T. Operation

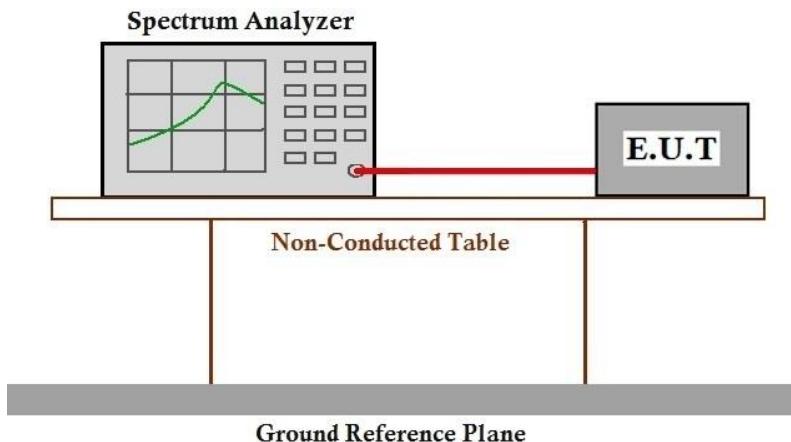
Operating Environment:

Temperature: 22.8 °C      Humidity: 43.5 % RH      Atmospheric Pressure: 1003 mbar

### 7.4.2 Test Mode Description

Pre-scan / Mode	Description	
Final test	Code	
Final test	01	Continuous Tx Mode: Keep the EUT Transmitting with Modulation

### 7.4.3 Test Setup Diagram



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**7.4.4 Measurement Procedure and Data**

The frequency at which the maximum power level is measured with the peak detector is designated fM. The peak power measurements shall be made using a spectrum analyzer or EMI receiver with a 1 MHz resolution bandwidth and a video bandwidth of 1 MHz or greater. The instrument shall be set to peak detection using the maximum-hold trace mode. The outermost 1 MHz segments above and below fM, where the peak power falls by 10 dB relative to the level at fM, are designated as fH and fL, respectively:

- a) For the lowest frequency bound fL, the emission is searched from a frequency lower than fM that has, by inspection, a peak power much lower than 10 dB less than the power at fM and increased toward fM until the peak power indicates 10 dB less than the power at fM. The frequency of that segment is recorded.
- b) This process is repeated for the highest frequency bound fH, beginning at a frequency higher than fM that has, by inspection, a peak power much lower than 10 dB below the power at fM. The frequency of that segment is recorded.
- c) The two recorded frequencies represent the highest fH and lowest fL bounds of the UWB transmission, and the -10 dB bandwidth (B - 10) is defined as (fH - fL). The center frequency (fc) is mathematically determined from  $(fH - fL) / 2$ .
- d) The fractional bandwidth is defined as  $2(fH - fL) / (fH + fL)$ .
- e) Determine whether the -10 dB bandwidth (fH - fL) is  $\geq 500$  MHz, or whether the fractional bandwidth  $2(fH - fL) / (fH + fL)$  is  $\geq 0.2$ .

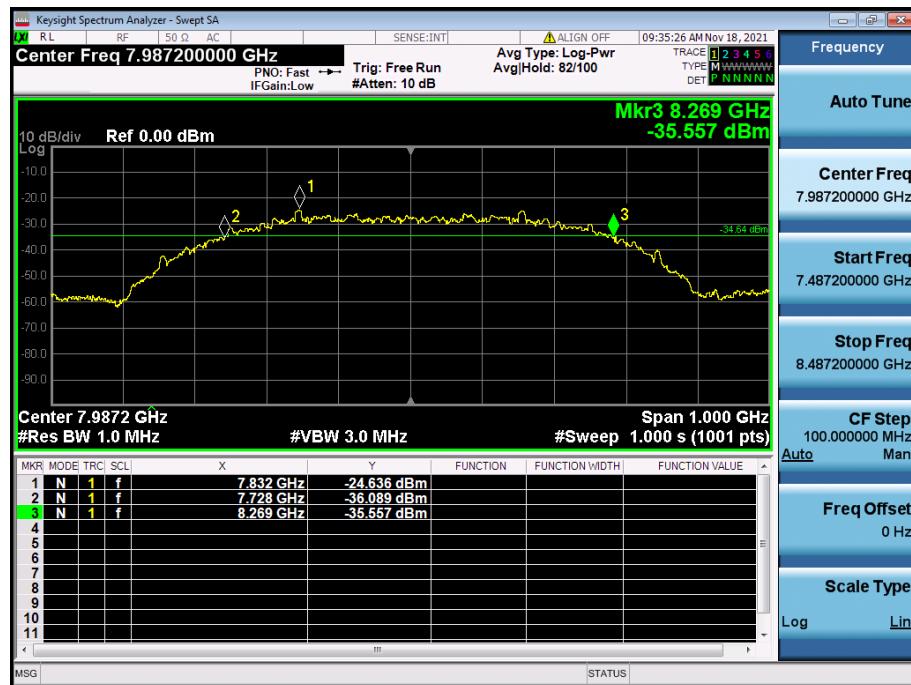
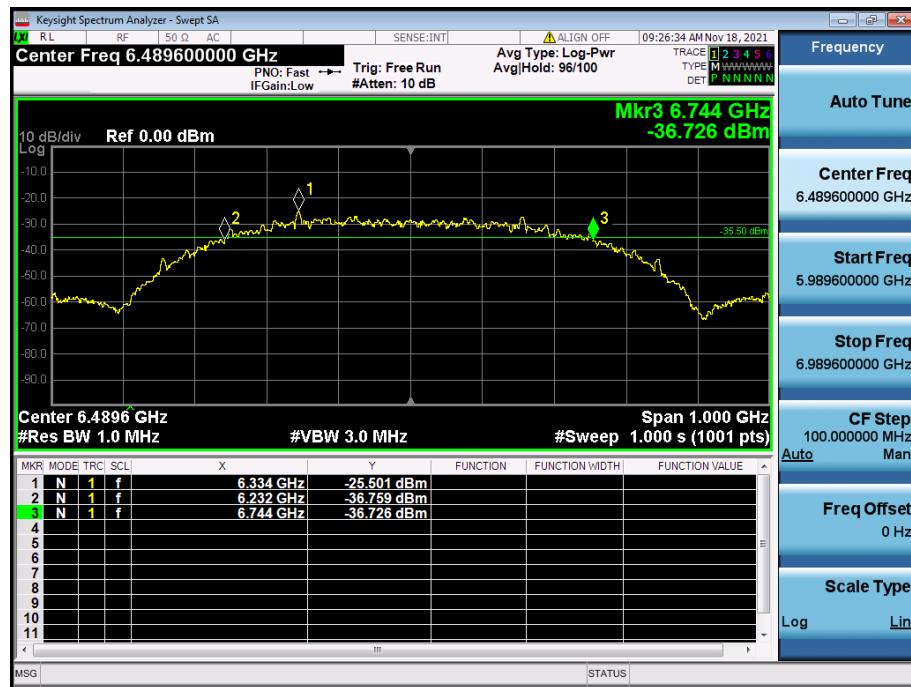
Test Frequency (MHz)	FM(MHz)	FL (MHz)	FH (MHz)	10dB bandwidth (MHz)	Limit (MHz)	Results
6489.6	6334	6232	6744	512	$\geq 500$ MHz	Pass
7987.2	7832	7728	8269	541	$\geq 500$ MHz	Pass

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## 7.5 Dwell Time

Test Requirement 47 CFR Part 15F Section 15.519(a)(1)

Test Method: /

Limit:

The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received.

### 7.5.1 E.U.T. Operation

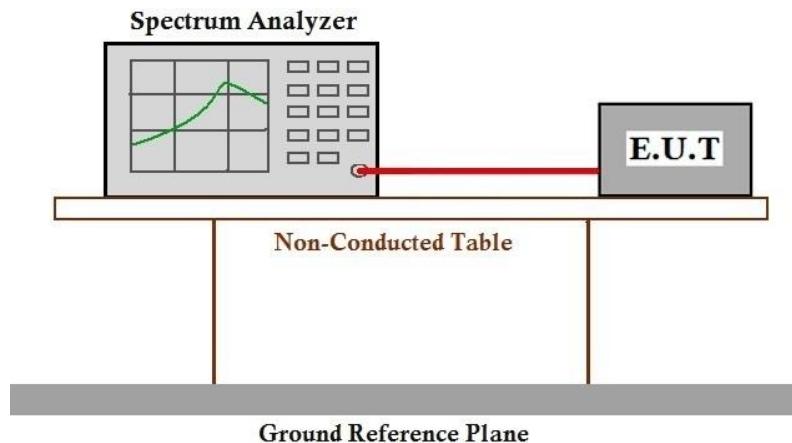
Operating Environment:

Temperature: 22.8 °C      Humidity: 43.5 % RH      Atmospheric Pressure: 1003 mbar

### 7.5.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	03	Normal operating_Keep the EUT communication with the companion device.

### 7.5.3 Test Setup Diagram

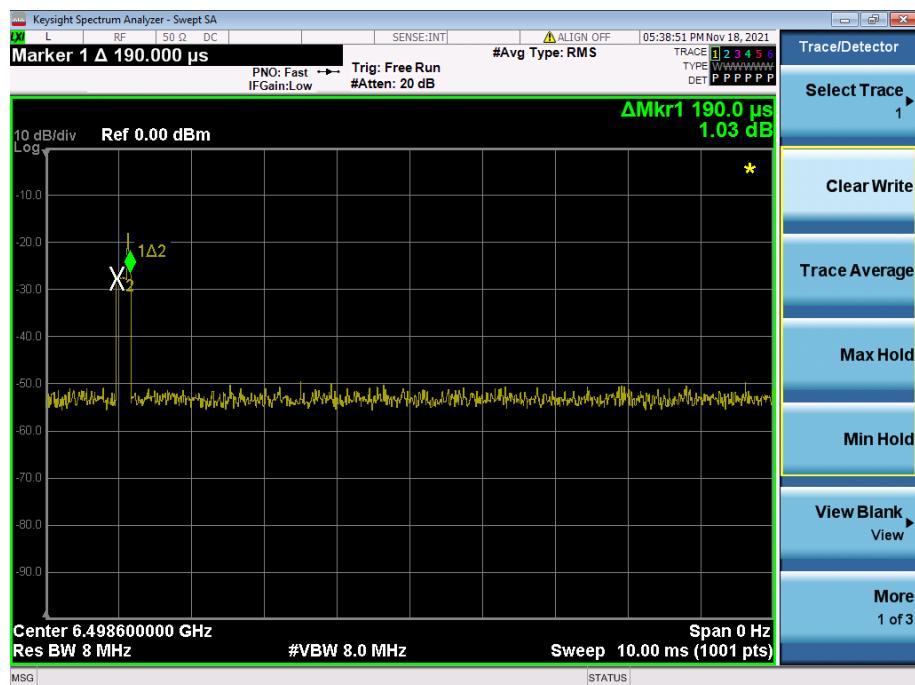
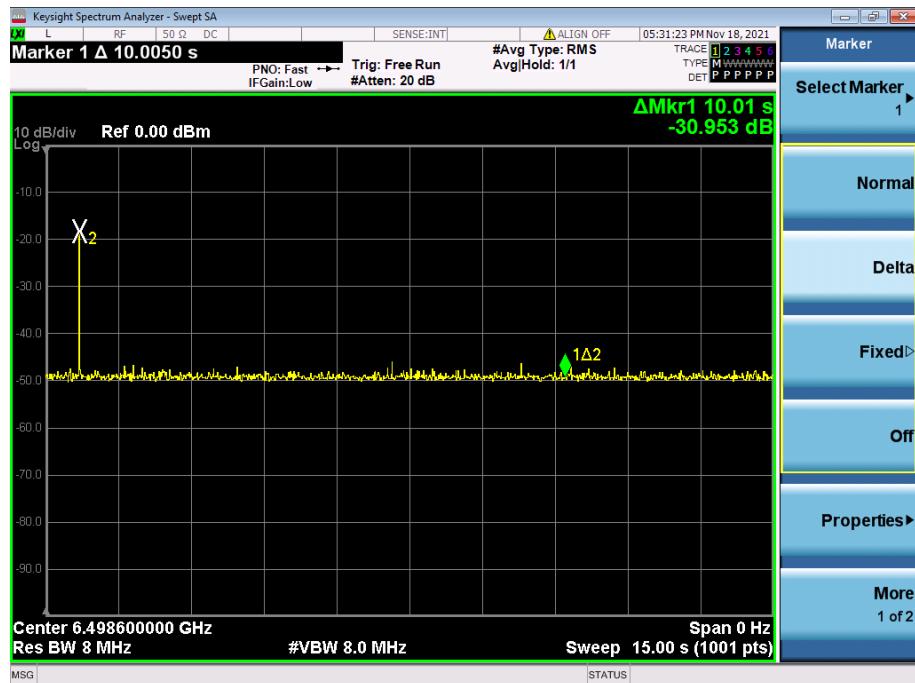


### 7.5.4 Measurement Procedure and Data

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6498.6MHz



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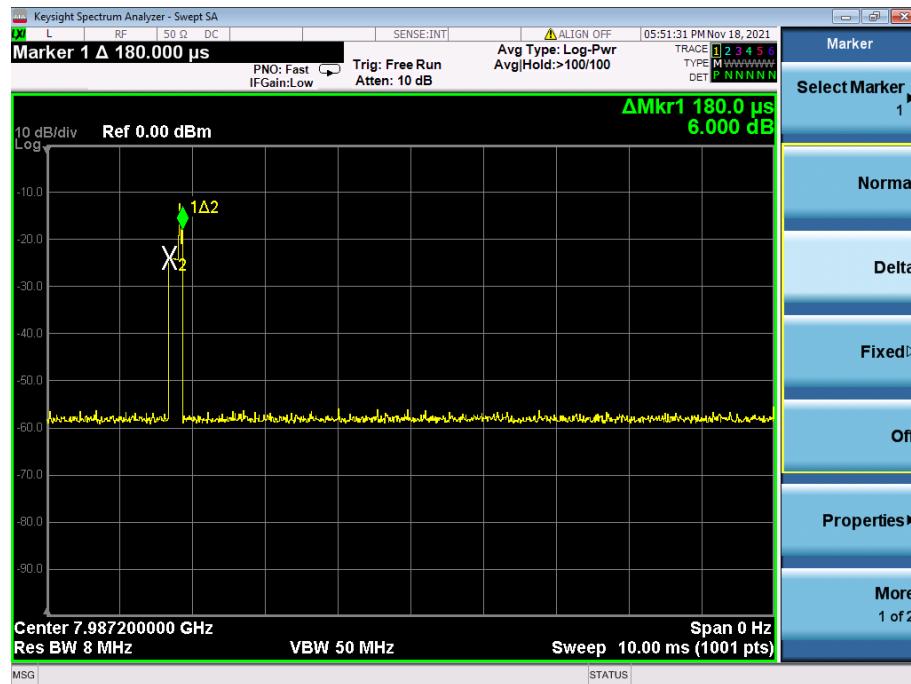
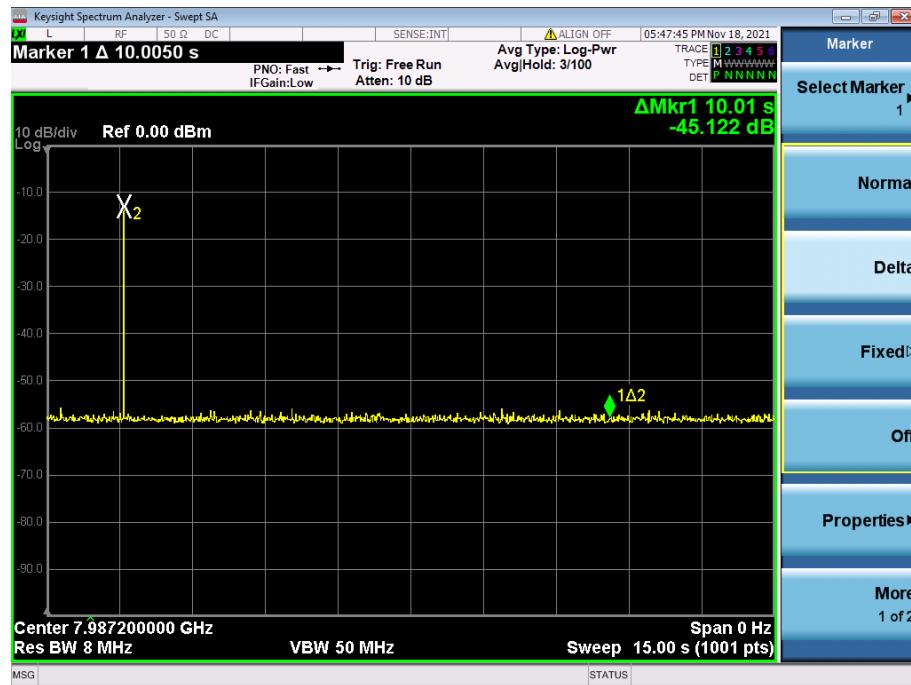
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7987.2MHz



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**7.6 Conducted Emissions at AC Power Line (150kHz-30MHz)**

Test Requirement 47 CFR Part 15, Subpart F 15.207, 15.505, 15.521(j)

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

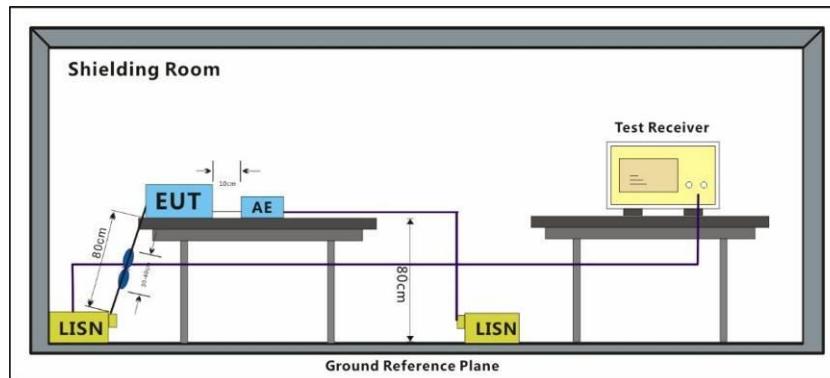
**7.6.1 E.U.T. Operation**

Operating Environment:

Temperature: 24.5 °C Humidity: 52.5 % RH Atmospheric Pressure: 1003 mbar

**7.6.2 Test Mode Description**

Pre-scan / Mode	Final test Code	Description
	Final test 01	Continuous Tx Mode: Keep the EUT Transmitting with Modulation

**7.6.3 Test Setup Diagram**

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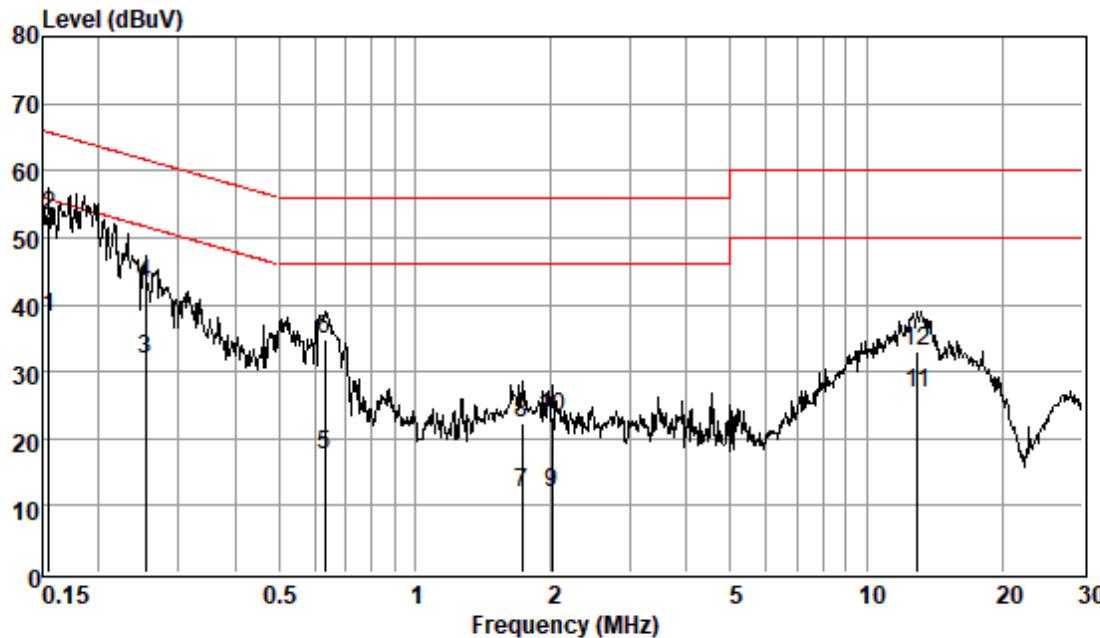
**7.6.4 Measurement Procedure and Data**

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50μH + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor



Test Mode: 01; Line: Live line



Pol :LINE

Mode :

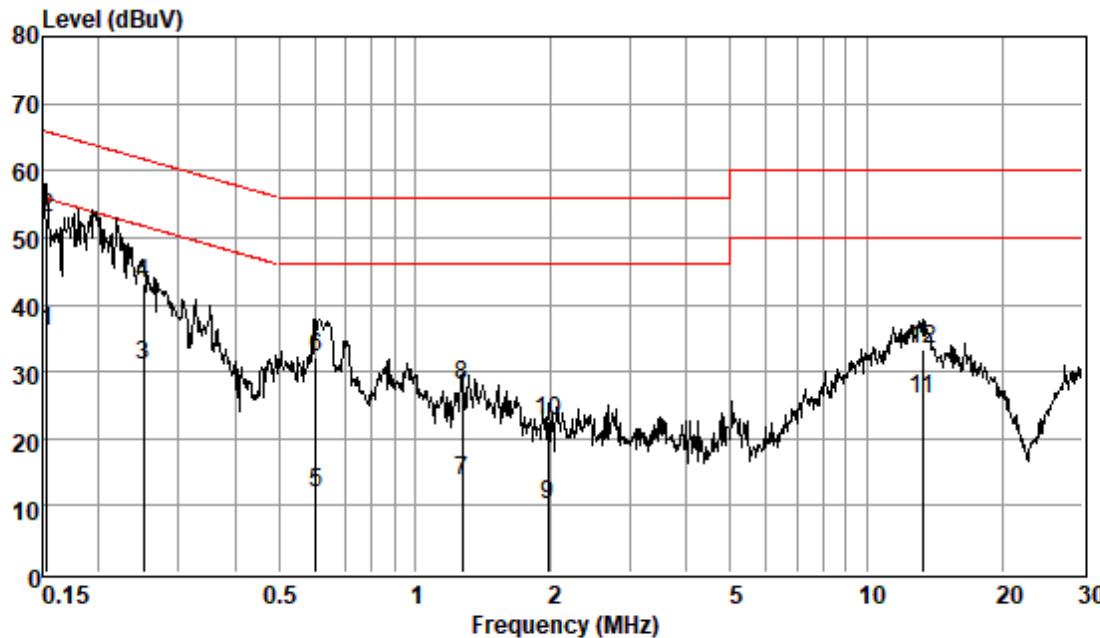
Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.15	28.42	0.06	9.62	38.10	55.74	-17.64	Average
0.15	43.56	0.06	9.62	53.24	65.74	-12.50	QP
0.25	22.00	0.06	9.62	31.68	51.64	-19.96	Average
0.25	33.44	0.06	9.62	43.12	61.64	-18.52	QP
0.63	7.78	0.07	9.63	17.48	46.00	-28.52	Average
0.63	25.09	0.07	9.63	34.79	56.00	-21.21	QP
1.73	2.05	0.11	9.61	11.77	46.00	-34.23	Average
1.73	12.65	0.11	9.61	22.37	56.00	-33.63	QP
2.01	2.14	0.12	9.62	11.88	46.00	-34.12	Average
2.01	13.54	0.12	9.62	23.28	56.00	-32.72	QP
12.92	16.85	0.28	9.72	26.85	50.00	-23.15	Average
12.92	23.14	0.28	9.72	33.14	60.00	-26.86	QP

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Test Mode: 01; Line: Neutral Line



Pol : NEUTRAL

Mode :

Model :

Frequenc MHz	Read Level dBuV	Cable Loss dB	LISN Factor dB	Measured Level dBuV	Limit Line dBuV	Over Limit dB	Remark
0.15	26.52	0.06	9.55	36.13	55.82	-19.69	Average
0.15	43.39	0.06	9.55	53.00	65.82	-12.82	QP
0.25	21.46	0.06	9.55	31.07	51.73	-20.66	Average
0.25	33.42	0.06	9.55	43.03	61.73	-18.70	QP
0.60	2.16	0.07	9.54	11.77	46.00	-34.23	Average
0.60	22.37	0.07	9.54	31.98	56.00	-24.02	QP
1.28	4.11	0.09	9.55	13.75	46.00	-32.25	Average
1.28	18.18	0.09	9.55	27.82	56.00	-28.18	QP
1.97	0.39	0.12	9.54	10.05	46.00	-35.95	Average
1.97	12.96	0.12	9.54	22.62	56.00	-33.38	QP
13.27	16.04	0.29	9.62	25.95	50.00	-24.05	Average
13.27	23.52	0.29	9.62	33.43	60.00	-26.57	QP

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## 8 Test Setup Photo

Refer to Appendix - Test Setup Photo for GZCR2111021379AT



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## 9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External & Internal Photographs for GZCR211021379AT

- End of the Report -



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