

Report No.: ZR/2020/6001703

Page: 1 of 84

### **FCC TEST REPORT**

Application No: ZR/2020/60017

Applicant: LG Electronics USA, Inc.

Address of Applicant 111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632

Manufacturer: Huagin Telecom Technology Co.,Ltd.

Address of Manufacturer No.1 Building, No.9 Building, No.399, Keyuan Road, Zhangjiang Hi-tech

Park, Shanghai, P.R. China

**EUT Description:** Mobile handset **Model No.:** LM-K420EMW

Trade Mark: LG

FCC ID: ZNFK420EMW

Standards: 47 CFR FCC Part 2, Subpart J

47 CFR Part 15, Subpart C

Test Method KDB558074 D01 15.247 Meas Guidance v05r02

ANSI C63.10 (2013)

**Date of Receipt:** 2020/6/22

**Date of Test:** 2020/7/22 to 2020/7/29

**Date of Issue:** 2020/7/29

Test Result: PASS \*

Authorized Signature:

Derole yang

Derek Yang

Wireless Laboratory Manager

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<sup>\*</sup> In the configuration tested, the EUT complied with the standards specified above.



Page: 2 of 84

### **Version**

Revision Record								
Version Chapter Date Modifier Remark								
01		2020/7/29		Original				

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Page: 3 of 84

**Test Summary** 

Test Item	Test Requirement	Test method	Test Result	Result			
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS			
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.3	PASS			
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.4	PASS			
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.5	PASS			
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.6	PASS			
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS			
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10 2013	Clause 4.8	PASS			
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS			

Checked By

David Chen

David Chen

Reviewer

Test By

Daniel Wang

**Project Engineer** 

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Page: 4 of 84

### **Contents**

1	GENERAL INFORMATION	5
	1.1 CLIENT INFORMATION	5
	1.2 Test Location	5
	1.3 TEST FACILITY	6
	1.4 GENERAL DESCRIPTION OF EUT	7
	1.5 TEST ENVIRONMENT	8
	1.6 DESCRIPTION OF SUPPORT UNITS	8
2	TEST RESULTS AND MEASUREMENT DATA	9
	2.1 Antenna Requirement	9
	2.2 AC POWER LINE CONDUCTED EMISSIONS	
	2.3 DUTY CYCLE	14
	2.3.1 Test Results	14
	2.3.1 Test Plots	
	2.4 CONDUCTED OUTPUT POWER	16
	2.4.1 Test Results	16
	2.4.2 Test plots:	
	2.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	
	2.5.1 Test Results	
	2.5.2 Test plots	
	2.6 POWER SPECTRAL DENSITY	
	2.6.1 Test Results	
	2.6.2 Test plots	
	2.7 BAND-EDGE FOR RF CONDUCTED EMISSIONS	
	2.7.1 Test plots	
	2.8 SPURIOUS RF CONDUCTED EMISSIONS	
	2.8.1 Test plots:	
	2.9 RADIATED SPURIOUS EMISSION	
	2.9.1 Radiated Emission below 1GHz	
	2.9.2 Transmitter Emission above 1GHz	
	2.10 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY	
	2.10.1 Test plots	
3	,	
4	EQUIPMENT LIST	84
5	PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS	84

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Page: 5 of 84

### 1 General Information

### 1.1 Client Information

Applicant:	LG Electronics USA, Inc.				
Address of Applicant:	111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632				
Manufacturer:	Huaqin Telecom Technology Co.,Ltd.				
Address of Manufacturer:	No.1 Building, No.9 Building, No.399,Keyuan Road,Zhangjiang Hi-tech Park,Shanghai,P.R.China				

#### 1.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Xi'an Branch
Address:	Single floor D, building 1, Kanghong orange square science and technology park, No.137 keyuan 3rd road, fengdong new town, Xi 'an city, Shaanxi China
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Page: 6 of 84

### 1.3 Test Facility

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

### A2LA (Certificate No. 4854.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES CO., LTD. XI'AN BRANCH is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

Test Site No.:	SGS Xi'an Site No.		FCC Designation No.
	CO01-XA	03CH01-XA	CN1271

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Page: 7 of 84

### 1.4 General Description of EUT

EUT Description::	Mobile handset
Model No.:	LM-K420EMW
Trade Mark:	LG
Operation Frequency:	2400MHz~2483.5MHz fc = 2402 MHz + N * 2 MHz, where: -fc = "Operating Frequency" in MHz, -N = "Channel Number" with the range from 0 to 39.
Bluetooth Version:	Bluetooth V5.0 LE
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	□ Portable Device, □ Module
Antenna Type:	☐ External, ⊠ Integrated
Antenna Gain:	-3.8dBi
Power Supply	☐ AC/DC Adapter; ☐ Battery ☐ PoE:; ☐ Other:

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Page: 8 of 84

	Operation Frequency of each channel									
Channel	Channel Frequency		Frequency	Channel	Frequency	Channel	Frequency			
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz			
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz			
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz			
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz			
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz			
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz			
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz			
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz			
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz			
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz			

#### Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz

### 1.5 Test Environment

Operating Environment					
Temperature:	25.0 °C				
Humidity:	50 % RH				
Atmospheric Pressure:	101.32 KPa				

### 1.6 Description of Support Units

The EUT has been tested independent unit.

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Page: 9 of 84

### 2 Test results and Measurement Data

### 2.1 Antenna Requirement

Standard requirement:

47 CFR Part 15C Section 15.203 /247(c)

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, 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.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -3.8dBi.

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Page: 10 of 84

### 2.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	150kHz to 30MHz				
	Fraguency range (MHz)	Limit (dBuV)			
	Frequency range (MHz)	Quasi-peak	Average		
Limit:	0.15-0.5	66 to 56*	56 to 46*		
LIIIII.	0.5-5	56	46		
	5-30	60	50		
	* Decreases with the logarit	hm of the frequency.			
Test Procedure:	<ol> <li>The EUT was connected Stabilization Network) we power cables of all other which was bonded to the for the unit being meas multiple power cables to exceeded.</li> <li>The tabletop EUT was pureference plane. And for horizontal ground refered.</li> <li>The test was performed EUT shall be 0.4 m from reference plane was bound a placed 0.8 m from ground reference plane. This distance was betwother units of the EUT LISN 2.</li> <li>In order to find the maxing power cables.</li> </ol>	placed upon a non-metallic to a single LISN provided the placed upon a non-metallic to a floor-standing arrangement, note plane.  I with a vertical ground reference of the vertical ground reference and the vertical ground reference of the vertical ground reference of the total ground and the boundary of the unit for LISNs mounted on top of veen the closest points of the and associated equipment we mum emission, the relative penust be changed according to	th a LISN 1 (Line Impedance $+5\Omega$ linear impedance. The inected to a second LISN 2, the same way as the LISN 1 et strip was used to connect e rating of the LISN was not able 0.8m above the ground the EUT was placed on the ence plane. The rear of the se plane. The vertical ground direference plane. The LISN under test and bonded to a the ground reference plane. The LISN under test and bonded to a the ground reference plane. The LISN under test and bonded to a the ground reference plane. The LISN 1 and the EUT. All was at least 0.8 m from the ositions of equipment and all		

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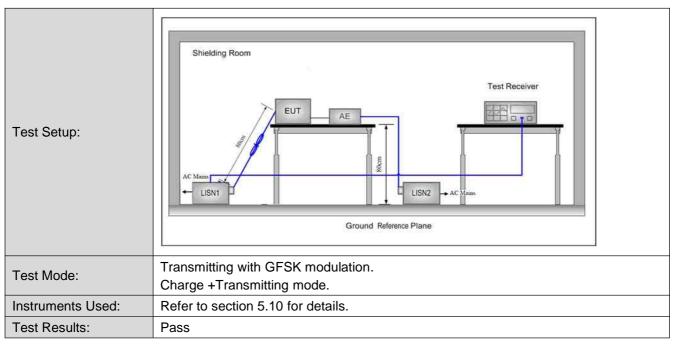
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Page: 11 of 84



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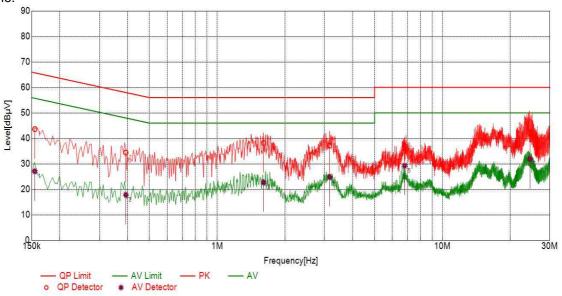
Page: 12 of 84

#### **Measurement Data**

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.





#### **Test Graph**

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	ΑV Limit [dBμV]	AV Margin [dB]	Туре
1	0.1550	10.10	43.65	65.73	22.08	27.07	55.73	28.66	L
2	0.3933	10.10	34.42	57.99	23.57	17.84	47.99	30.15	L
3	1.6088	10.10	38.21	56.00	17.79	22.72	46.00	23.28	L
4	3.1562	10.10	37.17	56.00	18.83	24.85	46.00	21.15	L
5	6.7983	10.10	37.01	60.00	22.99	29.27	50.00	20.73	L
6	24.4637	10.11	42.14	60.00	17.86	31.90	50.00	18.10	L

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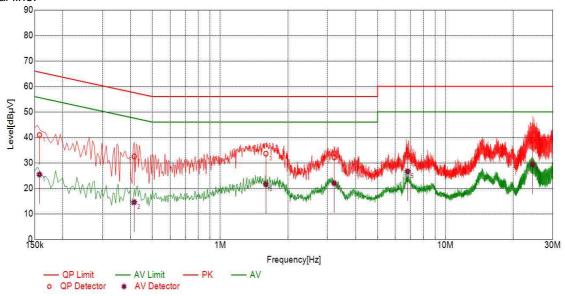
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Report No.: ZR/2020/6001703

Page: 13 of 84

#### Neutral line:



#### **Test Graph**

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Туре
1	0.1576	10.10	40.91	65.59	24.68	25.40	55.59	30.19	N
2	0.4155	10.10	32.53	57.54	25.01	14.56	47.54	32.98	N
3	1.5958	10.10	33.63	56.00	22.37	21.58	46.00	24.42	N
4	3.2109	10.10	32.11	56.00	23.89	22.02	46.00	23.98	N
5	6.8019	10.10	33.24	60.00	26.76	26.68	50.00	23.32	N
6	24.3408	10.11	38.75	60.00	21.25	29.37	50.00	20.63	N

#### Remarks:

- 1. The following Quasi-Peak and Average measurements were performed on the EUT:
- 2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

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Page: 14 of 84

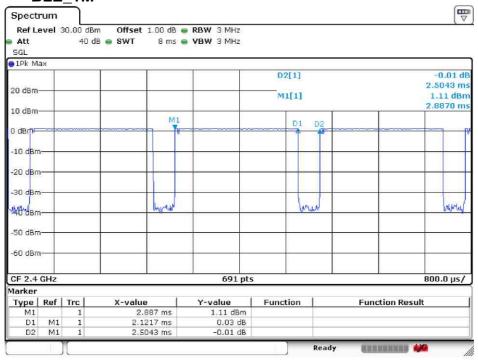
### 2.3 Duty Cycle

#### 2.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
BLE_1M	CH0,CH19,CH39	84.72
BLE_2M	CH0,CH19,CH39	56.94

#### 2.3.1 Test Plots

#### 2.3.1.1 BLE\_1M



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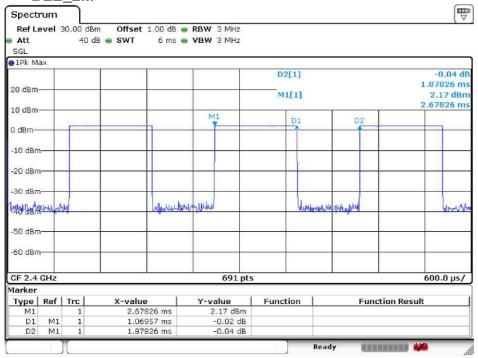
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#### 2.3.1.2 BLE 2M



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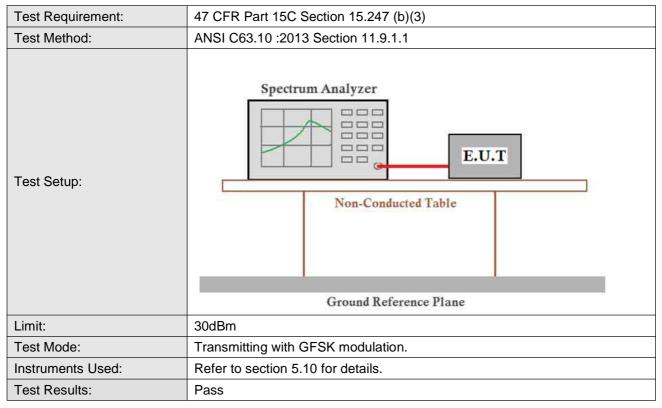
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Page: 16 of 84

### 2.4 Conducted Output Power



#### 2.4.1 Test Results

#### Measurement Data of Peak Power :

Measurement Data of Feak Fower.						
GFSK mode_1M						
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result			
Lowest	5.31	30.00	Pass			
Middle	6.31	30.00	Pass			
Highest	5.33	30.00	Pass			
GFSK mode_2M						
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result			
Lowest	5.43	30.00	Pass			
Middle	6.38	30.00	Pass			
Highest	5.45	30.00	Pass			

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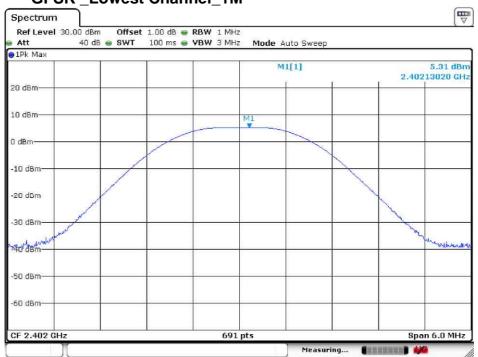
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### 2.4.2 Test plots:

#### 2.4.2.1 GFSK Lowest Channel\_1M



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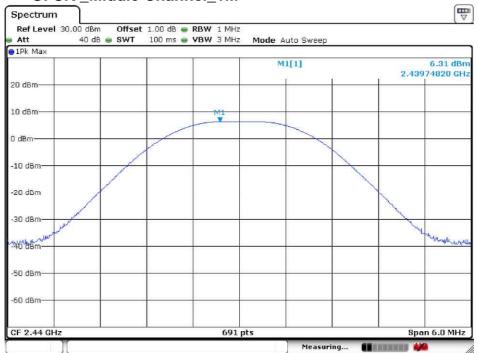
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### 2.4.2.2 GFSK \_Middle Channel\_1M



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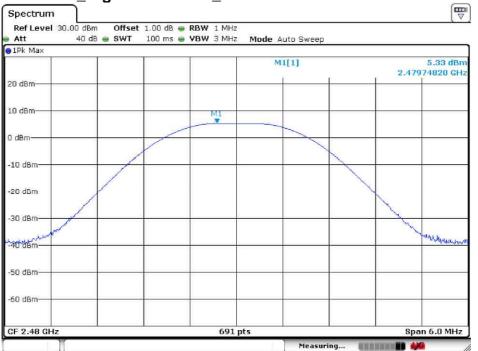
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### 2.4.2.3 GFSK \_Highest Channel\_1M



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### 2.4.2.4 GFSK \_Lowest Channel\_2M



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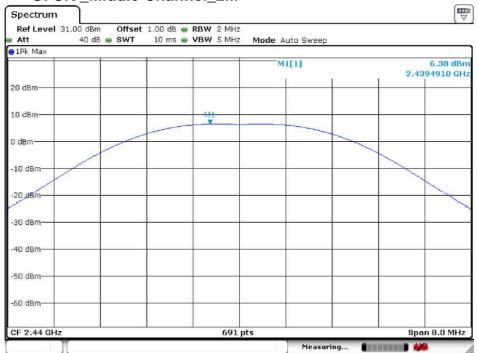
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### 2.4.2.5 GFSK Middle Channel 2M



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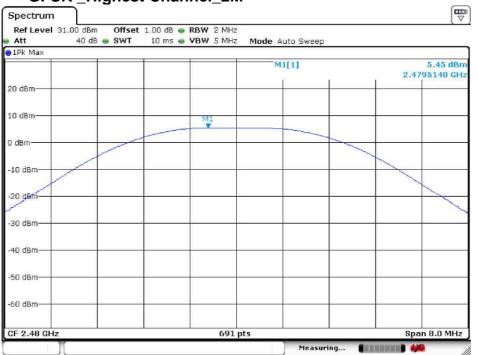
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### 2.4.2.6 GFSK \_Highest Channel\_2M



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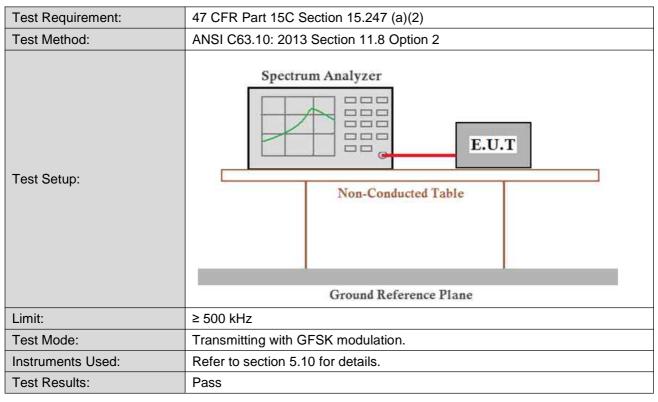
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Page: 23 of 84

### 2.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth



#### 2.5.1 Test Results

Mode	Test Channel	99% Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
	Lowest	1.03	0.67	≥500	Pass
GFSK_1M	Middle	1.03	0.69	≥500	Pass
	Highest	1.03	0.67	≥500	Pass
	Lowest	2.09	1.19	≥500	Pass
GFSK_2M	Middle	2.08	1.17	≥500	Pass
	Highest	2.07	1.21	≥500	Pass

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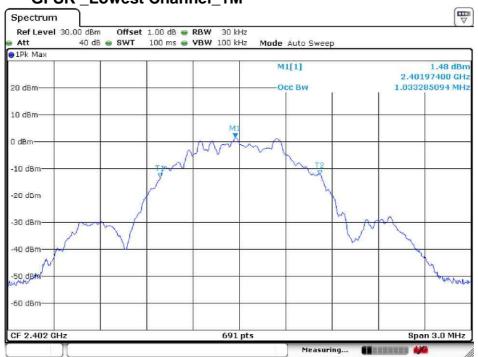
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Report No.: ZR/2020/6001703

Page: 24 of 84

### 2.5.2 Test plots

#### 2.5.2.1 GFSK Lowest Channel\_1M



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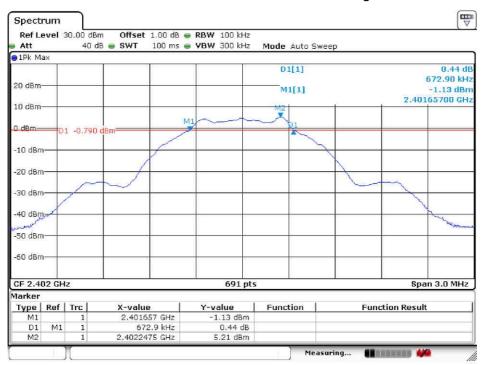
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Page: 26 of 84

### 2.5.2.2 GFSK \_Middle Channel\_1M



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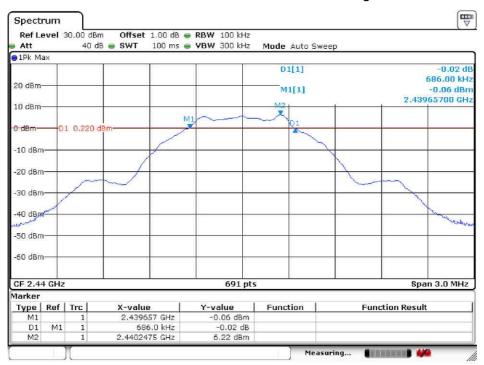
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### 2.5.2.3 GFSK \_Highest Channel\_1M



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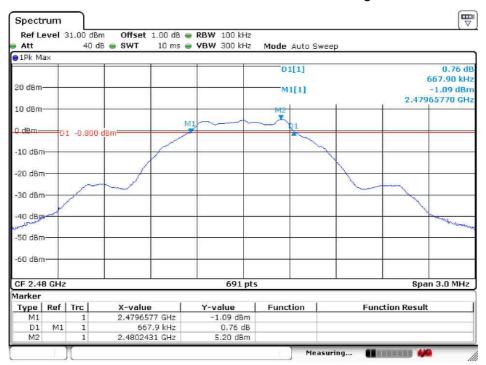
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### 2.5.2.4 GFSK \_Lowest Channel\_2M



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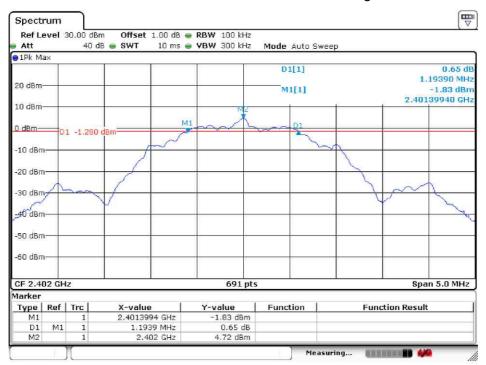
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### 2.5.2.5 GFSK \_Middle Channel\_2M



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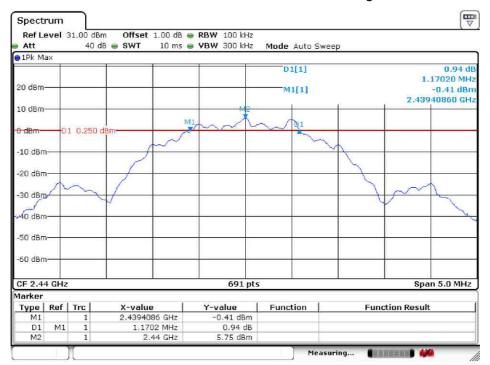
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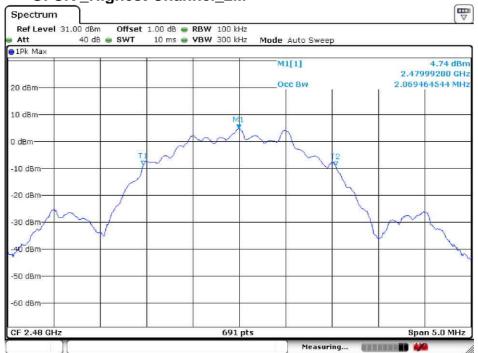
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### 2.5.2.6 GFSK \_Highest Channel\_2M



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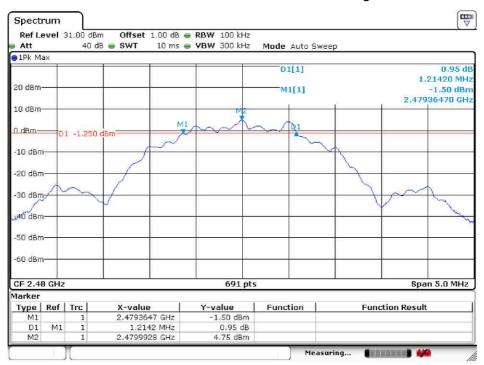
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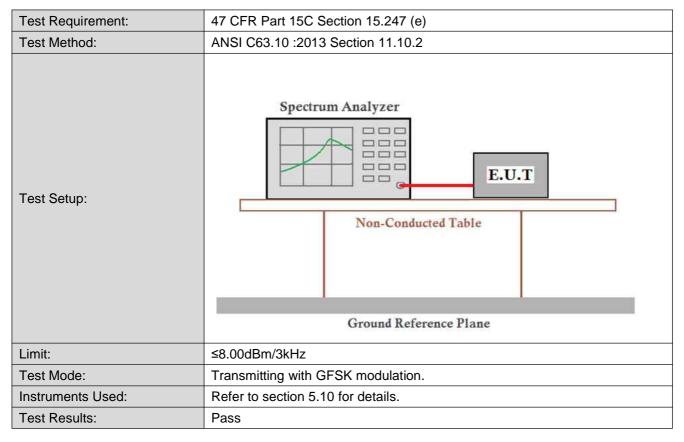
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Page: 36 of 84

### 2.6 Power Spectral Density



#### 2.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
	Lowest	-11.17	≤8.00	Pass
GFSK 1M	Middle	-10.14	≤8.00	Pass
_	Highest	-11.20	≤8.00	Pass
	Lowest	-13.42	≤8.00	Pass
GFSK 2M	Middle	-12.38	≤8.00	Pass
_	Highest	-13.41	≤8.00	Pass

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Report No.: ZR/2020/6001703

Page: 37 of 84

#### 2.6.2 Test plots

#### 2.6.2.1 GFSK Lowest Channel\_1M



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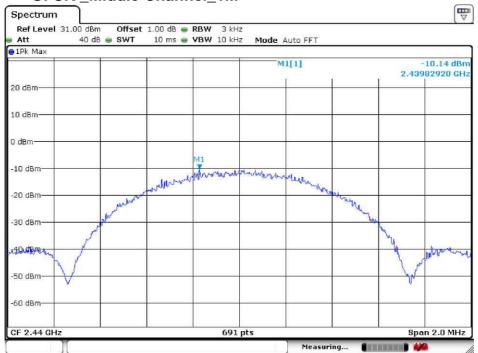
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Page: 38 of 84

#### 2.6.2.2 GFSK \_Middle Channel\_1M



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Page: 39 of 84

### 2.6.2.3 GFSK \_Highest Channel\_1M



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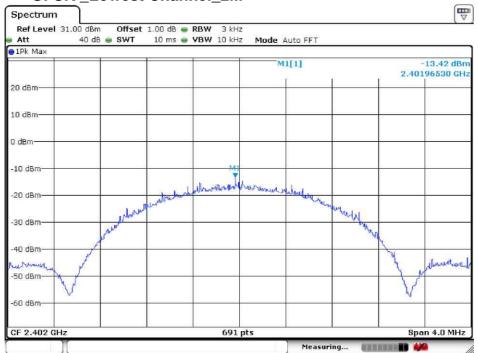
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Page: 40 of 84

### 2.6.2.4 GFSK \_Lowest Channel\_2M



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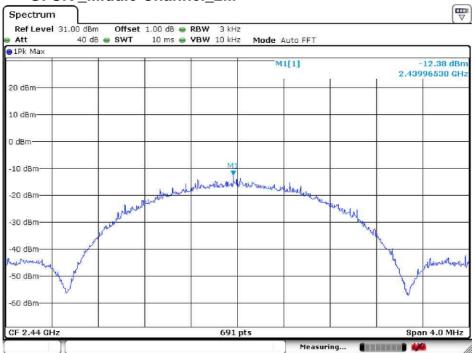
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#### 2.6.2.5 GFSK Middle Channel 2M



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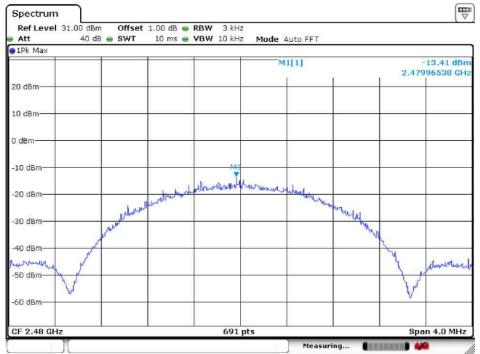
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Page: 42 of 84

### 2.6.2.6 GFSK \_Highest Channel\_2M



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Report No.: ZR/2020/6001703

Page: 43 of 84

## 2.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)						
Test Method:	ANSI C63.10: 2013 Section 11.13						
Test Setup:	Spectrum Analyzer  E.U.T  Non-Conducted Table						
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.						
Test Mode:	Transmitting with GFSK modulation.						
Instruments Used:	Refer to section 5.10 for details.						
Test Results:	Pass						

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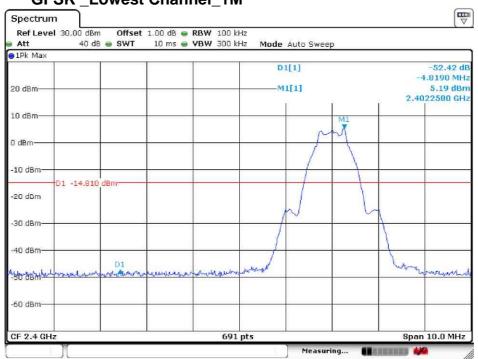
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Report No.: ZR/2020/6001703

Page: 44 of 84

#### 2.7.1 Test plots

#### 2.7.1.1 GFSK Lowest Channel\_1M



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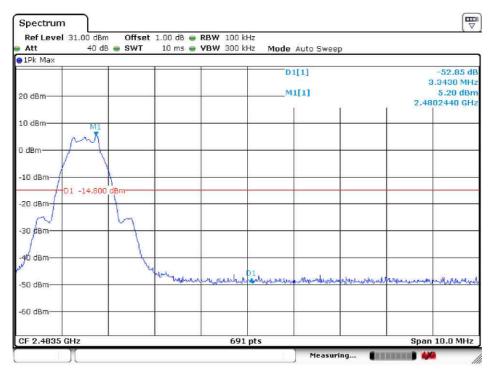
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### 2.7.1.2 GFSK \_Highest Channel\_1M



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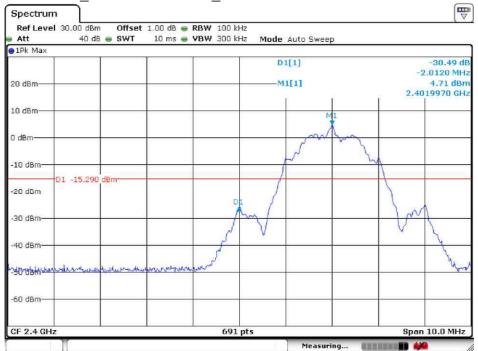
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#### 2.7.1.3 GFSK Lowest Channel\_2M



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### 2.7.1.4 GFSK \_Highest Channel\_2M



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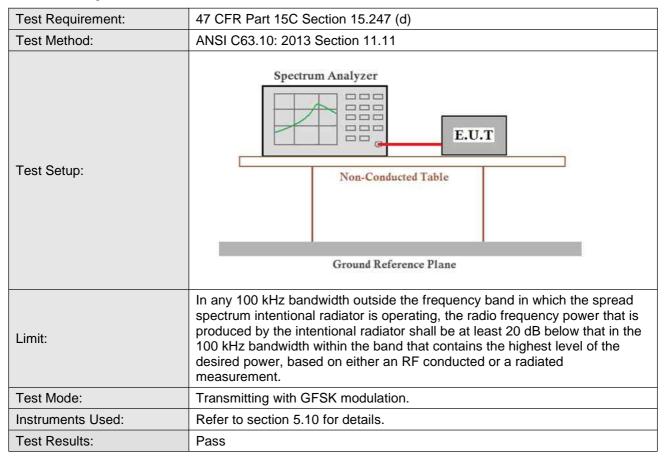
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### 2.8 Spurious RF Conducted Emissions



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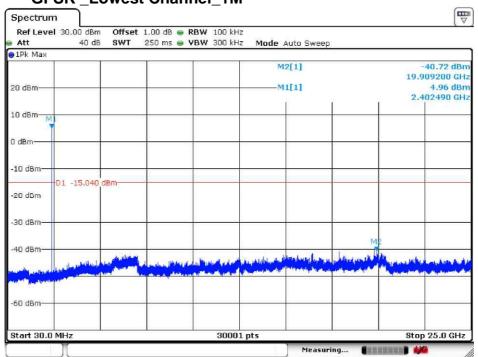


Report No.: ZR/2020/6001703

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#### 2.8.1 Test plots:

#### 2.8.1.1 GFSK Lowest Channel\_1M



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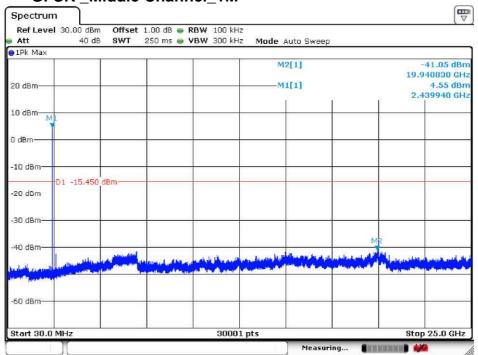
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### 2.8.1.2 GFSK \_Middle Channel\_1M



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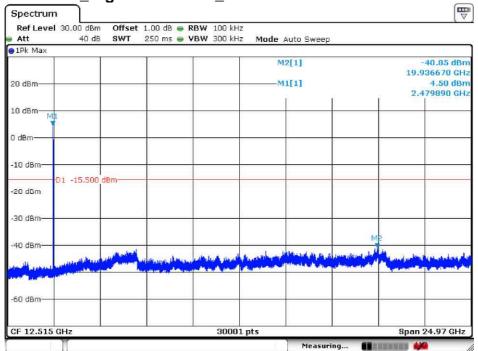
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Report No.: ZR/2020/6001703

Page: 51 of 84

#### 2.8.1.3 GFSK \_Highest Channel\_1M



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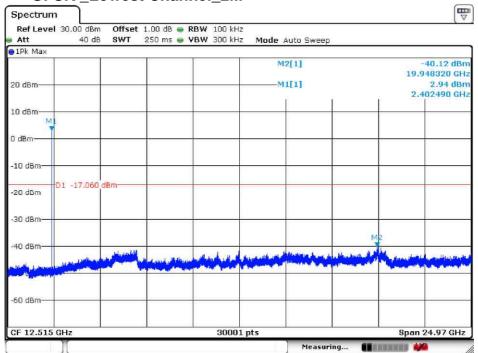
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Page: 52 of 84

#### 2.8.1.4 GFSK Lowest Channel 2M



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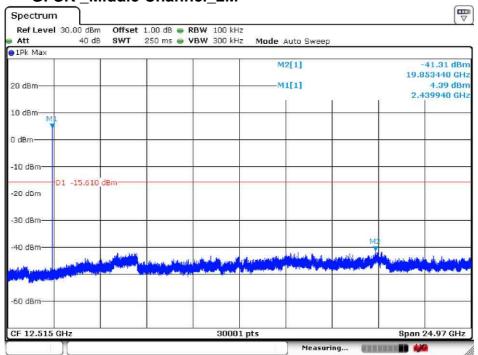
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Report No.: ZR/2020/6001703

Page: 53 of 84

#### 2.8.1.5 GFSK Middle Channel 2M



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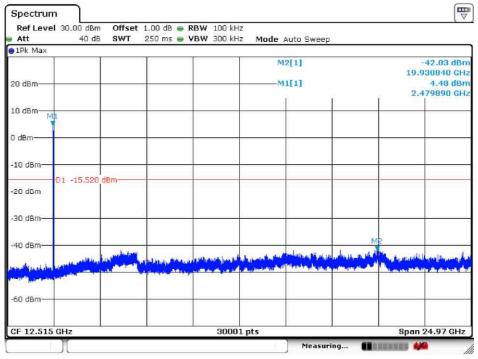
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Report No.: ZR/2020/6001703

Page: 54 of 84

### 2.8.1.6 GFSK \_Highest Channel\_2M



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#### Remark:

Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, 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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Report No.: ZR/2020/6001703

Page: 55 of 84

### 2.9 Radiated Spurious Emission

Test Requirement:	47 CFR Part 15C Section	n 15.209 and 15.2	205						
Test Method:	ANSI C63.10 :2013 Sec	tion 11.12							
Test Site:	Measurement Distance:	3m or 10m (Semi-	-Anechoic (	Chamber)					
	Frequency	Detector	RBW	VBW	Remark				
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak				
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average				
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak				
Pagaiyar Satura	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak				
Receiver Setup:	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average				
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak				
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak				
	Above 10Uz	Peak	1MHz	3MHz	Peak				
	Above 1GHz	Peak	1MHz	10Hz	Average				
	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				
Limit:	88MHz-216MHz	150	43.5	Quasi-peak	3				
	216MHz-960MHz	200	46.0	Quasi-peak	3				
	960MHz-1GHz	500	54.0	Quasi-peak	3				
	Above 1GHz	500	54.0	Average	3				
	Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.								

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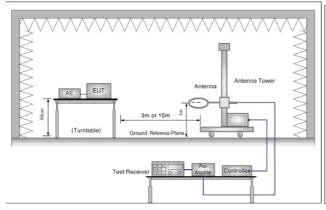
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Report No.: ZR/2020/6001703

Page: 56 of 84

#### Test Setup:



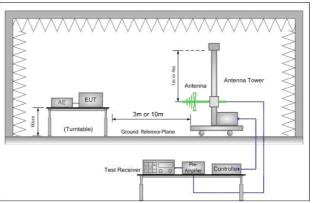


Figure 1. Below 30MHz

Figure 2. 30MHz to 1GHz

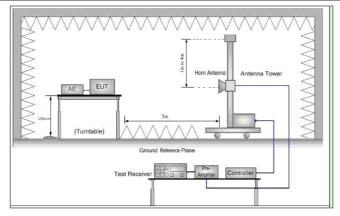


Figure 3. Above 1 GHz

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

#### Test Procedure:

- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. 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.
- e. 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

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Report No.: ZR/2020/6001703 Page: 57 of 84

	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.				
	f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.				
	g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
	h. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)				
	i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.				
	j. Repeat above procedures until all frequencies measured was complete.				
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.				
	Transmitting with GFSK modulation.				
Final Test Mode:	Pretest the EUT at Charge + Transmitting mode,				
	For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.				
Instruments Used:	Refer to section 5.10 for details.				
Test Results:	Pass				

#### 2.9.1 Radiated Emission below 1GHz

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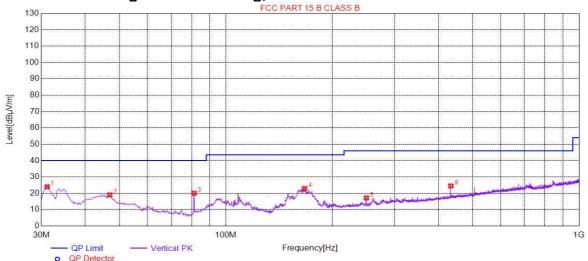
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Report No.: ZR/2020/6001703

Page: 58 of 84

### 2.9.1.1 Charge + Transmitting, Vertical



Suspected List											
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dalawita			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	31.1642	24.00	-30.05	40.00	16.00	100	84	Vertical			
2	46.8814	19.00	-30.40	40.00	21.00	100	28	Vertical			
3	81.2262	20.02	-35.85	40.00	19.98	200	28	Vertical			
4	166.991	22.94	-34.22	43.50	20.56	100	347	Vertical			
5	250.040	17.18	-29.66	46.00	28.82	100	14	Vertical			
6	433.600	24.50	-24.75	46.00	21.50	200	346	Vertical			

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Report No.: ZR/2020/6001703

Page: 59 of 84

### 2.9.1.2 Charge + Transmitting, Horizontal



Suspected List											
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dalanita			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	31.3583	15.62	-30.05	40.00	24.38	200	288	Horizontal			
2	46.4933	14.94	-30.41	40.00	25.06	200	279	Horizontal			
3	95.5851	18.71	-32.79	43.50	24.79	200	244	Horizontal			
4	160.976	21.26	-34.57	43.50	22.24	200	112	Horizontal			
5	307.281	21.70	-28.06	46.00	24.30	100	72	Horizontal			
6	728.733	27.06	-18.83	46.00	18.94	200	109	Horizontal			

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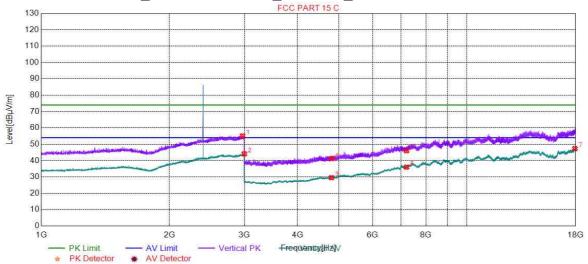


Report No.: ZR/2020/6001703

Page: 60 of 84

#### 2.9.2 Transmitter Emission above 1GHz

#### 2.9.2.1 GFSK Lowest Channel Vertical 1M



Suspe	Suspected List												
NIC	Freq.	Level	Factor	Limit	Margin	Height	Angle	D					
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity					
1	2969.99	55.14	9.59	74.00	18.86	150	143	Vertical					
2	2997.99	44.12	9.46	54.00	9.88	150	244	Vertical					
3	4804.00	29.55	-18.30	54.00	24.45	150	183	Vertical					
4	4804.00	41.22	-18.30	74.00	32.78	150	136	Vertical					
5	7206.00	46.03	-10.09	74.00	27.97	150	238	Vertical					
6	7206.00	36.00	-10.09	54.00	18.00	150	238	Vertical					
7	17923.5	47.33	0.70	54.00	6.67	150	188	Vertical					

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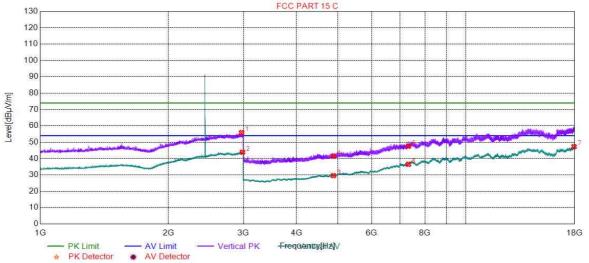
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Report No.: ZR/2020/6001703

Page: 61 of 84

### 2.9.2.2 GFSK \_Middle Channel\_ Vertical\_1M



Suspe	Suspected List											
NO.	Freq.	Level	Factor	Limit	Margin	Height	Angle	Polarity				
INO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Folarity				
1	2970.49	55.93	9.59	74.00	18.07	150	174	Vertical				
2	2984.49	43.89	9.52	54.00	10.11	150	96	Vertical				
3	4880.00	29.58	-17.97	54.00	24.42	150	51	Vertical				
4	4880.00	41.47	-17.97	74.00	32.53	150	234	Vertical				
5	7320.00	47.55	-9.72	74.00	26.45	150	1	Vertical				
6	7320.00	36.50	-9.72	54.00	17.50	150	272	Vertical				
7	17927.9	47.30	0.70	54.00	6.70	150	162	Vertical				

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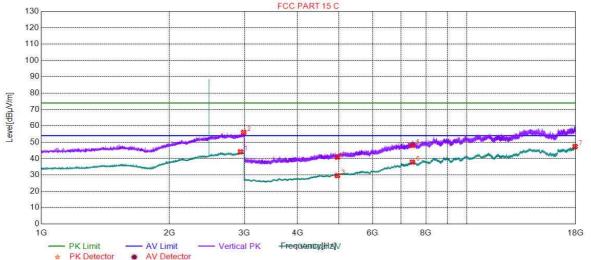
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Report No.: ZR/2020/6001703

Page: 62 of 84

### 2.9.2.3 GFSK \_Highest Channel\_ Vertical\_1M



Suspe	Suspected List												
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dalavitus					
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity					
1	2936.48	44.15	9.53	54.00	9.85	150	281	Vertical					
2	2988.99	56.01	9.50	74.00	17.99	150	314	Vertical					
3	4960.00	29.58	-17.47	54.00	24.42	150	360	Vertical					
4	4960.00	40.87	-17.47	74.00	33.13	150	136	Vertical					
5	7440.00	48.06	-9.35	74.00	25.94	150	186	Vertical					
6	7440.00	37.87	-9.35	54.00	16.13	150	186	Vertical					
7	17937.2	47.36	0.70	54.00	6.64	150	186	Vertical					

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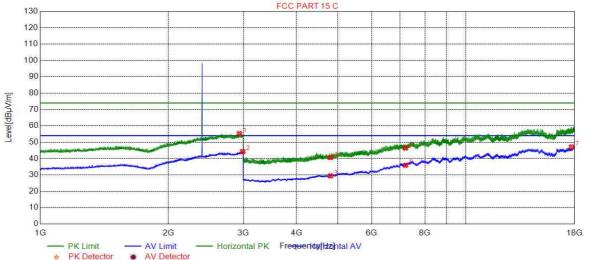
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Report No.: ZR/2020/6001703

Page: 63 of 84

### 2.9.2.4 GFSK \_Lowest Channel\_ Horizontal\_1M



Suspe	Suspected List											
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovity				
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity				
1	2936.98	55.25	9.54	74.00	18.75	150	360	Horizontal				
2	2988.49	44.29	9.50	54.00	9.71	150	18	Horizontal				
3	4804.00	29.41	-18.30	54.00	24.59	150	230	Horizontal				
4	4804.00	40.70	-18.30	74.00	33.30	150	344	Horizontal				
5	7206.00	46.46	-10.09	74.00	27.54	150	229	Horizontal				
6	7206.00	35.95	-10.09	54.00	18.05	150	128	Horizontal				
7	17690.8	47.14	1.36	54.00	6.86	150	342	Horizontal				

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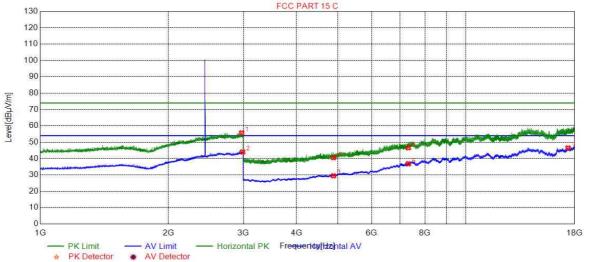
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Report No.: ZR/2020/6001703

Page: 64 of 84

### 2.9.2.5 GFSK \_Middle Channel\_ Horizontal\_1M



Suspe	Suspected List												
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovitu					
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity					
1	2971.49	55.69	9.58	74.00	18.31	150	360	Horizontal					
2	2986.99	44.08	9.51	54.00	9.92	150	161	Horizontal					
3	4880.00	29.45	-17.97	54.00	24.55	150	251	Horizontal					
4	4880.00	40.60	-17.97	74.00	33.40	150	279	Horizontal					
5	7320.00	46.64	-9.72	74.00	27.36	150	222	Horizontal					
6	7320.00	36.83	-9.72	54.00	17.17	150	274	Horizontal					
7	17362.5	46.49	0.10	54.00	7.51	150	72	Horizontal					

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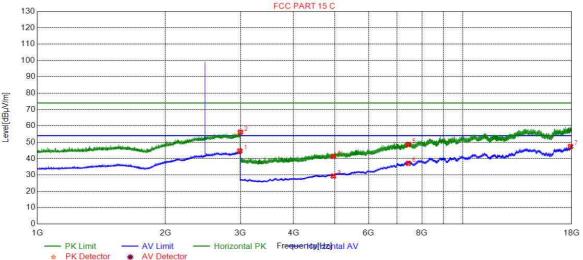
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Report No.: ZR/2020/6001703

Page: 65 of 84

### 2.9.2.6 GFSK \_Highest Channel \_ Horizontal \_ 1M



Suspe	Suspected List											
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovitu				
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity				
1	2990.99	44.65	9.49	54.00	9.35	150	30	Horizontal				
2	3000.00	56.13	9.45	74.00	17.87	150	358	Horizontal				
3	4960.00	29.31	-17.47	54.00	24.69	150	134	Horizontal				
4	4960.00	41.33	-17.47	74.00	32.67	150	72	Horizontal				
5	7440.00	48.52	-9.35	74.00	25.48	150	279	Horizontal				
6	7440.00	37.11	-9.35	54.00	16.89	150	279	Horizontal				
7	17881.7	47.41	0.45	54.00	6.59	150	279	Horizontal				

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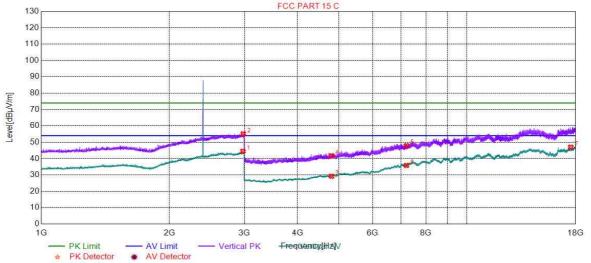
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Report No.: ZR/2020/6001703

Page: 66 of 84

### 2.9.2.7 GFSK \_Lowest Channel\_ Vertical\_2M



Suspe	Suspected List												
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovity					
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity					
1	2975.99	44.50	9.56	54.00	9.50	150	103	Vertical					
2	2981.49	55.14	9.54	74.00	18.86	150	7	Vertical					
3	4804.00	29.21	-18.30	54.00	24.79	150	313	Vertical					
4	4804.00	41.69	-18.30	74.00	32.31	150	199	Vertical					
5	7206.00	47.86	-10.09	74.00	26.14	150	238	Vertical					
6	7206.00	35.83	-10.09	54.00	18.17	150	238	Vertical					
7	17519.8	46.99	1.00	54.00	7.01	150	186	Vertical					

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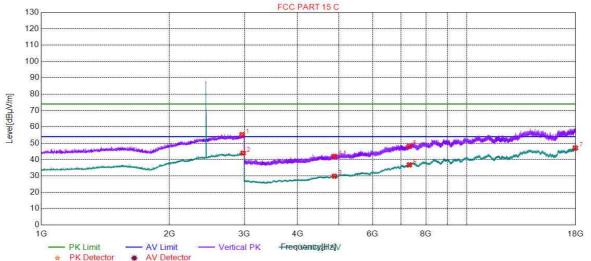
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Report No.: ZR/2020/6001703

Page: 67 of 84

### 2.9.2.8 GFSK \_Middle Channel\_ Vertical\_2M



Suspected List									
NO.	Freq.	Level	Factor	Limit	Margin	Height	Angle	Polarity	
	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]		
1	2963.49	55.28	9.62	74.00	18.72	150	39	Vertical	
2	2978.49	43.98	9.55	54.00	10.02	150	326	Vertical	
3	4880.00	29.86	-17.97	54.00	24.14	150	160	Vertical	
4	4880.00	41.98	-17.97	74.00	32.02	150	246	Vertical	
5	7320.00	48.09	-9.72	74.00	25.91	150	2	Vertical	
6	7320.00	36.79	-9.72	54.00	17.21	150	334	Vertical	
7	17960.3	47.08	0.71	54.00	6.92	150	168	Vertical	

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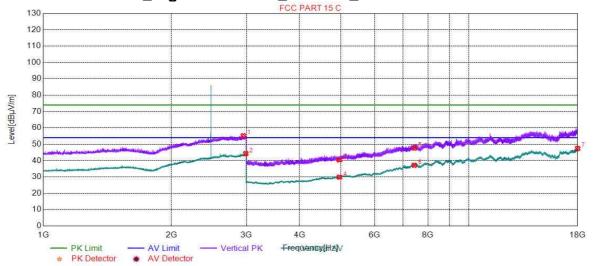
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Report No.: ZR/2020/6001703

Page: 68 of 84

### 2.9.2.9 GFSK \_Highest Channel\_ Vertical\_2M



Suspected List									
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovity	
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity	
1	2950.48	55.20	9.68	74.00	18.80	150	181	Vertical	
2	2989.49	44.28	9.50	54.00	9.72	150	143	Vertical	
3	4960.00	40.43	-17.47	74.00	33.57	150	360	Vertical	
4	4960.00	29.90	-17.47	54.00	24.10	150	293	Vertical	
5	7440.00	47.63	-9.35	74.00	26.37	150	217	Vertical	
6	7440.00	37.15	-9.35	54.00	16.85	150	113	Vertical	
7	17988.4	47.38	0.72	54.00	6.62	150	217	Vertical	

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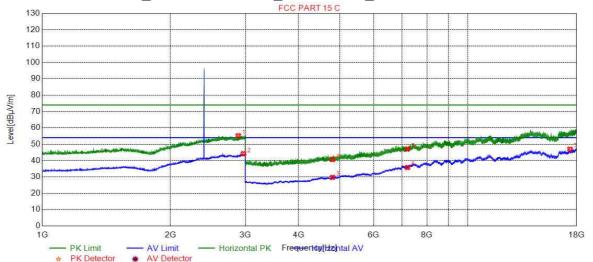
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Report No.: ZR/2020/6001703

Page: 69 of 84

#### 2.9.2.10 GFSK Lowest Channel Horizontal 2M



Suspected List									
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovitu	
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity	
1	2887.47	55.19	9.17	74.00	18.81	150	344	Horizontal	
2	2968.49	44.25	9.59	54.00	9.75	150	54	Horizontal	
3	4804.00	29.72	-18.30	54.00	24.28	150	228	Horizontal	
4	4804.00	40.67	-18.30	74.00	33.33	150	297	Horizontal	
5	7206.00	47.12	-10.09	74.00	26.88	150	223	Horizontal	
6	7206.00	35.80	-10.09	54.00	18.20	150	274	Horizontal	
7	17353.7	46.96	0.05	54.00	7.04	150	21	Horizontal	

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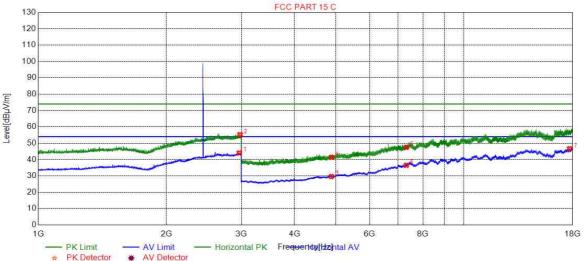
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Report No.: ZR/2020/6001703

Page: 70 of 84

#### 2.9.2.11 GFSK \_Middle Channel \_ Horizontal \_ 2M



Suspected List									
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolovitu	
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity	
1	2965.49	44.03	9.61	54.00	9.97	150	162	Horizontal	
2	2977.49	55.25	9.55	74.00	18.75	150	101	Horizontal	
3	4880.00	29.63	-17.97	54.00	24.37	150	58	Horizontal	
4	4880.00	41.40	-17.97	74.00	32.60	150	268	Horizontal	
5	7320.00	47.51	-9.72	74.00	26.49	150	32	Horizontal	
6	7320.00	36.53	-9.72	54.00	17.47	150	342	Horizontal	
7	17705.1	46.66	1.26	54.00	7.34	150	189	Horizontal	

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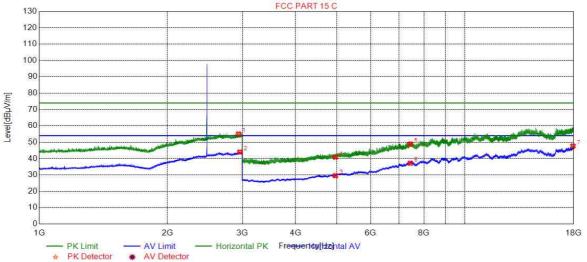
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Report No.: ZR/2020/6001703

Page: 71 of 84

### 2.9.2.12 GFSK \_Highest Channel \_ Horizontal \_2M



Suspected List									
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dalavitus	
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity	
1	2938.48	55.05	9.56	74.00	18.95	150	142	Horizontal	
2	2960.99	44.00	9.63	54.00	10.00	150	30	Horizontal	
3	4960.00	29.55	-17.47	54.00	24.45	150	21	Horizontal	
4	4960.00	40.89	-17.47	74.00	33.11	150	172	Horizontal	
5	7440.00	48.87	-9.35	74.00	25.13	150	208	Horizontal	
6	7440.00	37.17	-9.35	54.00	16.83	150	261	Horizontal	
7	17922.4	47.65	0.70	54.00	6.35	150	0	Horizontal	

#### Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor

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Report No.: ZR/2020/6001703

Page: 72 of 84

2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes have been tested, but only the worst case data displayed in this report.

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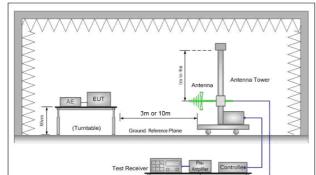
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Page: 73 of 84

### 2.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section	n 15.209 and 15.205						
Test Method:	ANSI C63.10: 2013 Sec	tion 11.12						
Test Site:	Measurement Distance:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)						
	Frequency	Limit (dBuV/m @3m)	Remark					
	30MHz-88MHz	40.0	Quasi-peak Value					
	88MHz-216MHz	43.5	Quasi-peak Value					
Limit:	216MHz-960MHz	46.0	Quasi-peak Value					
	960MHz-1GHz	54.0	Quasi-peak Value					
	Ab av a 401 la	54.0	Average Value					
	Above 1GHz	74.0	Peak Value					
Test Setup:								



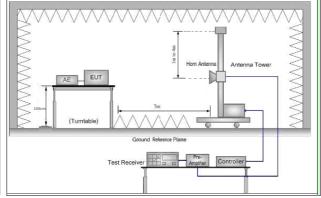


Figure 1. 30MHz to 1GHz

Test Procedure:

Figure 2. Above 1 GHz

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. 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.
- e. 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.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

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Report No.: ZR/2020/6001703

Page: 74 of 84

	<ul> <li>g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</li> <li>h. Test the EUT in the lowest channel, the Highest channel</li> <li>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</li> <li>j. Repeat above procedures until all frequencies measured was complete.</li> </ul>
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation.  Pretest the EUT at Charge + Transmitting mode.  Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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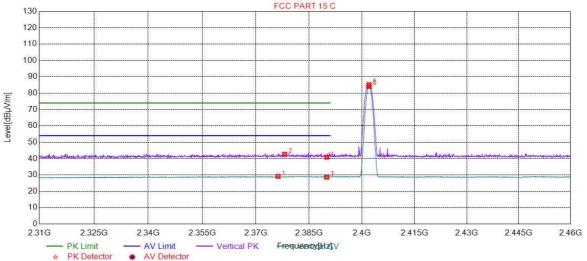
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Page: 75 of 84

#### 2.10.1 Test plots

#### 2.10.1.1 Worst Case Mode(GFSK) Lowest Channel\_ Vertical\_1M



Suspe	Suspected List										
NO.	Freq.	Level	Factor	Limit	Margin	Height	Angle	Polarity			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Folality			
1	2376.25	29.12	7.78	54.00	24.88	150	117	Vertical			
2	2378.13	42.64	7.78	74.00	31.36	150	182	Vertical			
3	2390.00	28.67	7.77	54.00	25.33	150	95	Vertical			
4	2390.00	40.85	7.77	74.00	33.15	150	253	Vertical			
5	2402.00	85.20	7.77	0.00	-85.20	150	278	Vertical			
6	2402.00	84.04	7.77	0.00	-84.04	150	286	Vertical			

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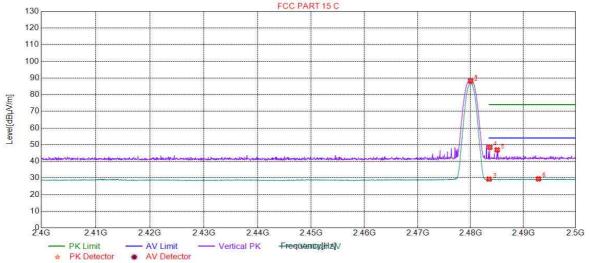
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Report No.: ZR/2020/6001703

Page: 76 of 84

#### 2.10.1.2 Worst Case Mode(GFSK) Highest Channel\_ Vertical\_1M



Suspe	Suspected List										
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	D. L. di			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	2480.00	88.26	8.01	0.00	-88.26	150	166	Vertical			
2	2480.00	87.44	8.01	0.00	-87.44	150	324	Vertical			
3	2483.50	29.32	8.01	54.00	24.68	150	290	Vertical			
4	2483.64	48.42	8.01	74.00	25.58	150	318	Vertical			
5	2485.04	46.88	8.01	74.00	27.12	150	295	Vertical			
6	2492.89	29.44	8.02	54.00	24.56	150	13	Vertical			

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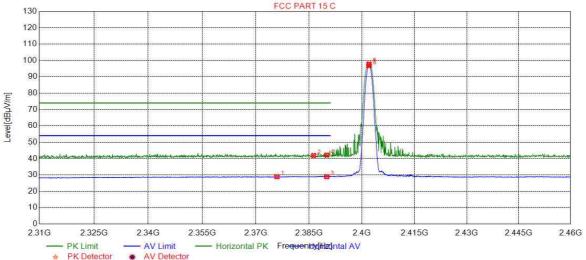
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Report No.: ZR/2020/6001703

Page: 77 of 84

### 2.10.1.3 Worst Case Mode(GFSK) Lowest Channel\_ Horizontal\_1M



Suspe	ected List							
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	5.1."
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity
1	2375.95	28.93	7.78	54.00	25.07	150	213	Horizontal
2	2386.31	41.88	7.77	74.00	32.12	150	150	Horizontal
3	2390.00	28.93	7.77	54.00	25.07	150	265	Horizontal
4	2390.00	42.12	7.77	74.00	31.88	150	301	Horizontal
5	2402.00	97.83	7.77	0.00	-97.83	150	236	Horizontal
6	2402.00	96.81	7.77	0.00	-96.81	150	236	Horizontal

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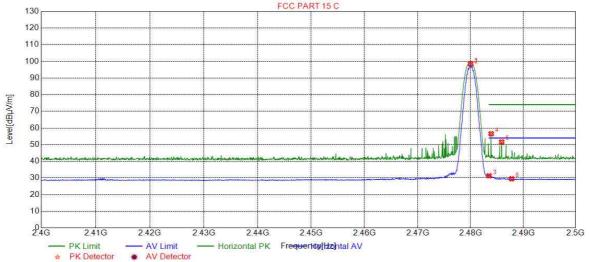
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Page: 78 of 84

### 2.10.1.4 Worst Case Mode(GFSK) Highest Channel\_ Horizontal\_1M



Suspe	ected List							
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	5.1."
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity
1	2480.00	98.58	8.01	0.00	-98.58	150	238	Horizontal
2	2480.00	97.89	8.01	0.00	-97.89	150	238	Horizontal
3	2483.50	31.29	8.01	54.00	22.71	150	238	Horizontal
4	2483.89	56.57	8.01	74.00	17.43	150	197	Horizontal
5	2485.89	51.65	8.01	74.00	22.35	150	197	Horizontal
6	2487.79	29.49	8.02	54.00	24.51	150	208	Horizontal

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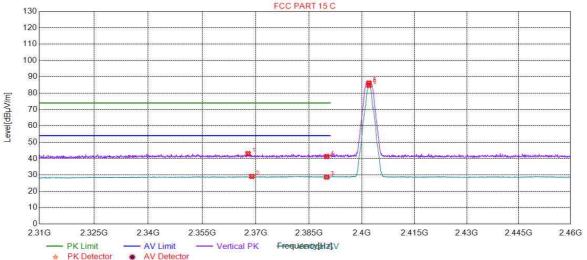
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Report No.: ZR/2020/6001703

Page: 79 of 84

#### 2.10.1.5 Worst Case Mode(GFSK) Lowest Channel\_ Vertical\_2M



Suspe	Suspected List										
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	5.1."			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	2367.85	43.03	7.79	74.00	30.97	150	43	Vertical			
2	2368.90	29.08	7.79	54.00	24.92	150	298	Vertical			
3	2390.00	28.71	7.77	54.00	25.29	150	231	Vertical			
4	2390.00	41.29	7.77	74.00	32.71	150	29	Vertical			
5	2402.00	86.21	7.77	0.00	-86.21	150	198	Vertical			
6	2402.00	84.82	7.77	0.00	-84.82	150	198	Vertical			

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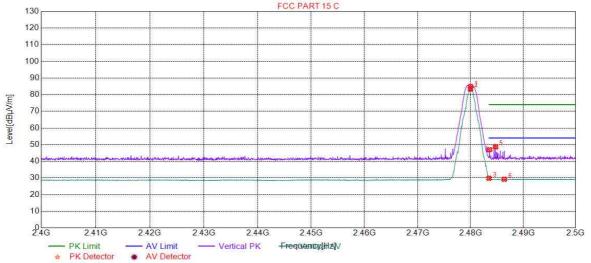
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Report No.: ZR/2020/6001703

Page: 80 of 84

#### 2.10.1.6 Worst Case Mode(GFSK) Highest Channel\_ Vertical\_2M



Suspe	Suspected List										
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	5			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	2480.00	84.85	8.01	0.00	-84.85	150	148	Vertical			
2	2480.00	83.44	8.01	0.00	-83.44	150	148	Vertical			
3	2483.50	29.85	8.01	54.00	24.15	150	291	Vertical			
4	2483.59	46.99	8.01	74.00	27.01	150	276	Vertical			
5	2484.74	48.71	8.01	74.00	25.29	150	276	Vertical			
6	2486.39	29.25	8.01	54.00	24.75	150	300	Vertical			

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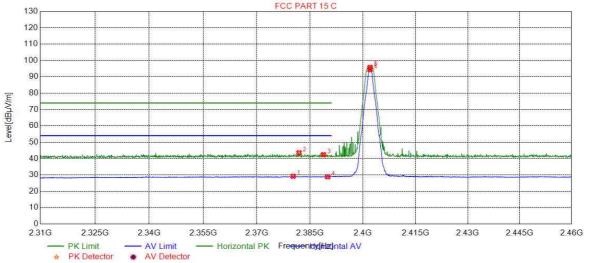
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Report No.: ZR/2020/6001703

Page: 81 of 84

#### 2.10.1.7 Worst Case Mode(GFSK) Lowest Channel\_ Horizontal\_2M



Suspe	Suspected List										
NO	Freq.	Level	Factor	Limit	Margin	Height	Angle	D. L. H			
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity			
1	2380.23	29.20	7.78	54.00	24.80	150	84	Horizontal			
2	2381.88	43.55	7.78	74.00	30.45	150	113	Horizontal			
3	2388.78	42.40	7.77	74.00	31.60	150	305	Horizontal			
4	2390.00	28.86	7.77	54.00	25.14	150	353	Horizontal			
5	2402.00	95.74	7.77	0.00	-95.74	150	236	Horizontal			
6	2402.00	94.39	7.77	0.00	-94.39	150	236	Horizontal			

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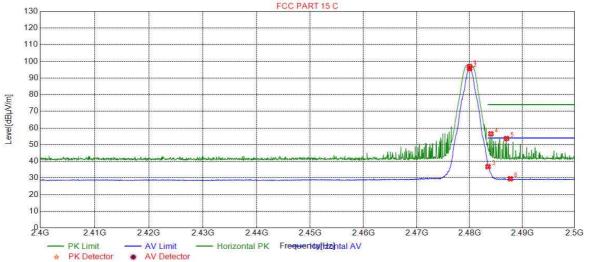
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Page: 82 of 84

### 2.10.1.8 Worst Case Mode(GFSK) Highest Channel\_ Horizontal\_2M



Suspe	ected List							
NO.	Freq.	Level	Factor	Limit	Margin	Height	Angle	Dolority
NO.	[MHz]	[dBµV/m]	[dB]	[dBµV/m]	[dB]	[cm]	[°]	Polarity
1	2480.00	96.95	8.01	0.00	-96.95	150	225	Horizontal
2	2480.00	95.67	8.01	0.00	-95.67	150	218	Horizontal
3	2483.50	36.81	8.01	54.00	17.19	150	225	Horizontal
4	2484.04	56.53	8.01	74.00	17.47	150	310	Horizontal
5	2486.99	53.72	8.01	74.00	20.28	150	359	Horizontal
6	2487.74	29.53	8.02	54.00	24.47	150	232	Horizontal

#### Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor All Modes have been tested, but only the worst case data displayed in this report.

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Page: 83 of 84

### 3 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty			
1	Total RF power, conducted	±0.75dB			
2	Duty cycle	± 0.37%			
3	Occupied Bandwidth	± 0.2%			
4	RF power density, conducted	±2.84dB			
5	Spurious emissions, conducted	±0.75dB			
		±4.8dB (30MHz-1GHz)			
	Dedicted Couries amineian test	±5.2dB (1GHz-6GHz)			
6	Radiated Spurious emission test	±5.5dB (6GHz-18GHz)			
		±5.02dB (18GHz-40GHz)			
7	Conduct emission test	±3.4 dB (9KHz- 30MHz)			

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### 4 Equipment List

	BT&WIFI	Test System			
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MXA signal analyzer	Angilent	N9020A	XAW01-06-07	2020-04-16	2021-04-15
MXG vector signal Generator	Angilent	N5182B	XAW01-07-16	2020-04-16	2021-04-15
MXG vector signal Generator	Angilent	N5181A	XAW01-07-17	2020-04-16	2021-04-15
Measurement Software	Tonscend	JS1120-3	XAW02-13-02	NCR	NCR
RF control unit	Tonscend	JS0806-2	XAW03-37-01	NCR	NCR
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2019-11-28	2020-11-28
temperature chamber	Votsch	VT4002	XAW01-18-01	2020-06-28	2021-06-28
power supply	Angilent	66311B	XAW01-17-01	2020-06-20	2021-06-20
	RE in	Chamber			
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	966	XAW03-35-01	NCR	NCR
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-02
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2020-04-02	2021-04-02
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06

				_	-
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-02
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2020-04-02	2021-04-02
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Receiving antenna	Rosenberger	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna	Rosenberger	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna	Rosenberger	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2019-11-18	2020-11-18
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2019-11-18	2020-11-18
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-03
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2019-11-18	2020-11-18
5G UXM	Keysight	E7515B	XAW01-04-01	2019-09-04	2020-09-03
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-11-28	2020-11-28
Measurement Software	Tonscend	TS+ RSE&RE	XAW02-05-01	NCR	NCR
Measurement Software	Tonscend	TS+ CE	XAW02-05-02	NCR	NCR

### 5 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for ZR/2020/60017.

The End

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