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# FCC Test Report

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Report No.: AGC12845220807FE02

**FCC ID** : 2A2LL-G21

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION** : Excavator Guidance System

**BRAND NAME** : FJD Easydig

**MODEL NAME** : G21

**APPLICANT** : FJ Dynamics Co., Ltd.

**DATE OF ISSUE** : Apr. 14, 2023

**STANDARD(S)** : FCC Part 15.247

**REPORT VERSION** : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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**REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Apr. 14, 2023	Valid	Initial Release

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## TABLE OF CONTENTS

<b>1. VERIFICATION OF COMPLIANCE</b> .....	<b>5</b>
<b>2. GENERAL INFORMATION</b> .....	<b>6</b>
2.1. PRODUCT DESCRIPTION .....	6
2.2. TABLE OF CARRIER FREQUENCIES .....	6
2.3. RELATED SUBMITTAL(S)/GRANT(S).....	7
2.4. TEST METHODOLOGY .....	7
2.5. SPECIAL ACCESSORIES.....	7
2.6. EQUIPMENT MODIFICATIONS.....	7
2.7. ANTENNA REQUIREMENT .....	7
<b>3. MEASUREMENT UNCERTAINTY</b> .....	<b>8</b>
<b>4. DESCRIPTION OF TEST MODES</b> .....	<b>9</b>
<b>5. SYSTEM TEST CONFIGURATION</b> .....	<b>10</b>
5.1. CONFIGURATION OF TESTED SYSTEM.....	10
5.2. EQUIPMENT USED IN TESTED SYSTEM .....	10
5.3. SUMMARY OF TEST RESULTS.....	10
<b>6. TEST FACILITY</b> .....	<b>11</b>
<b>7. PEAK OUTPUT POWER</b> .....	<b>12</b>
7.1. MEASUREMENT PROCEDURE.....	12
7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	12
7.3. LIMITS AND MEASUREMENT RESULT .....	13
<b>8. BANDWIDTH</b> .....	<b>17</b>
8.1. MEASUREMENT PROCEDURE.....	17
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	17
8.3. LIMITS AND MEASUREMENT RESULTS .....	17
<b>9. CONDUCTED SPURIOUS EMISSION</b> .....	<b>24</b>
9.1. MEASUREMENT PROCEDURE.....	24
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	24
9.3. MEASUREMENT EQUIPMENT USED .....	24
9.4. LIMITS AND MEASUREMENT RESULT .....	24

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<b>10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY .....</b>	<b>36</b>
10.1. MEASUREMENT PROCEDURE .....	36
10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) .....	36
10.3. MEASUREMENT EQUIPMENT USED .....	36
10.4. LIMITS AND MEASUREMENT RESULT .....	36
<b>11. RADIATED EMISSION .....</b>	<b>40</b>
11.1. MEASUREMENT PROCEDURE .....	40
11.2. TEST SETUP .....	41
11.3. LIMITS AND MEASUREMENT RESULT .....	42
11.4. TEST RESULT .....	42
<b>12. LINE CONDUCTED EMISSION TEST .....</b>	<b>56</b>
12.1. LIMITS OF LINE CONDUCTED EMISSION TEST .....	56
12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST .....	56
12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST .....	57
12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST .....	57
12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST .....	57
<b>APPENDIX A: PHOTOGRAPHS OF TEST SETUP .....</b>	<b>60</b>
<b>APPENDIX B: PHOTOGRAPHS OF EUT .....</b>	<b>60</b>

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### 1. VERIFICATION OF COMPLIANCE

<b>Applicant</b>	FJ Dynamics Co., Ltd.
<b>Address</b>	1709, WeiXing Building 61 GaoXin South 9th Rd Nanshan District, Shenzhen, China
<b>Manufacturer</b>	FJ Dynamics Co., Ltd.
<b>Address</b>	1709, WeiXing Building 61 GaoXin South 9th Rd Nanshan District, Shenzhen, China
<b>Factory</b>	FJ Dynamics Co., Ltd.
<b>Address</b>	1709, WeiXing Building 61 GaoXin South 9th Rd Nanshan District, Shenzhen, China
<b>Product Designation</b>	Excavator Guidance System
<b>Brand Name</b>	FJD Easydig
<b>Test Model</b>	G21
<b>Date of receipt of test item</b>	Sep. 06, 2022
<b>Date of test</b>	Sep. 06, 2022 to Apr. 14, 2023
<b>Deviation</b>	No any deviation from the test method
<b>Condition of Test Sample</b>	Normal
<b>Test Result</b>	Pass
<b>Report Template</b>	AGCRT-US-BLE/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC part 15.247.

Prepared By   
 Bibo Zhang  
 (Project Engineer) Apr. 14, 2023

Reviewed By   
 Calvin Liu  
 (Reviewer) Apr. 14, 2023

Approved By   
 Max Zhang  
 (Authorized Officer) Apr. 14, 2023

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## 2. GENERAL INFORMATION

### 2.1. PRODUCT DESCRIPTION

The EUT is designed as a “Excavator Guidance System”. It is designed by way of utilizing the GFSK technology to achieve the system operation.

A major technical description of EUT is described as following

<b>Operation Frequency</b>	2.402 GHz to 2.480GHz
<b>RF Output Power</b>	LE 1Mbps: -4.644dBm (Max) LE 2Mbps: -4.658dBm (Max)
<b>Bluetooth Version</b>	V5.0
<b>Modulation</b>	BR <input type="checkbox"/> GFSK, EDR <input type="checkbox"/> π/4-DQPSK, <input type="checkbox"/> 8DPSK BLE <input checked="" type="checkbox"/> GFSK 1Mbps <input checked="" type="checkbox"/> GFSK 2Mbps
<b>Number of channels</b>	40 Channels
<b>Antenna Designation</b>	PCB Antenna (Comply with requirements of the FCC part 15.203)
<b>Antenna Gain</b>	1.74dBi
<b>Hardware Version</b>	V1.0
<b>Software Version</b>	V1.0
<b>Power Supply</b>	DC 3.6V by battery or DC 5V by adapter

### 2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402 MHz
	1	2404 MHz
	:	:
	38	2478 MHz
	39	2480 MHz

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### **2.3. RELATED SUBMITTAL(S)/GRANT(S)**

This submittal(s) (test report) is intended for **FCC ID: 2A2LL-G21** filing to comply with the FCC Part 15.247 requirements.

### **2.4. TEST METHODOLOGY**

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

### **2.5. SPECIAL ACCESSORIES**

Refer to section 5.2.

### **2.6. EQUIPMENT MODIFICATIONS**

Not available for this EUT intended for grant.

### **2.7. ANTENNA REQUIREMENT**

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

### 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	$U_c = \pm 3.1$ dB
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 4.0$ dB
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.8$ dB
Uncertainty of total RF power, conducted	$U_c = \pm 0.8$ dB
Uncertainty of RF power density, conducted	$U_c = \pm 2.6$ dB
Uncertainty of spurious emissions, conducted	$U_c = \pm 2.7$ %
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2$ %

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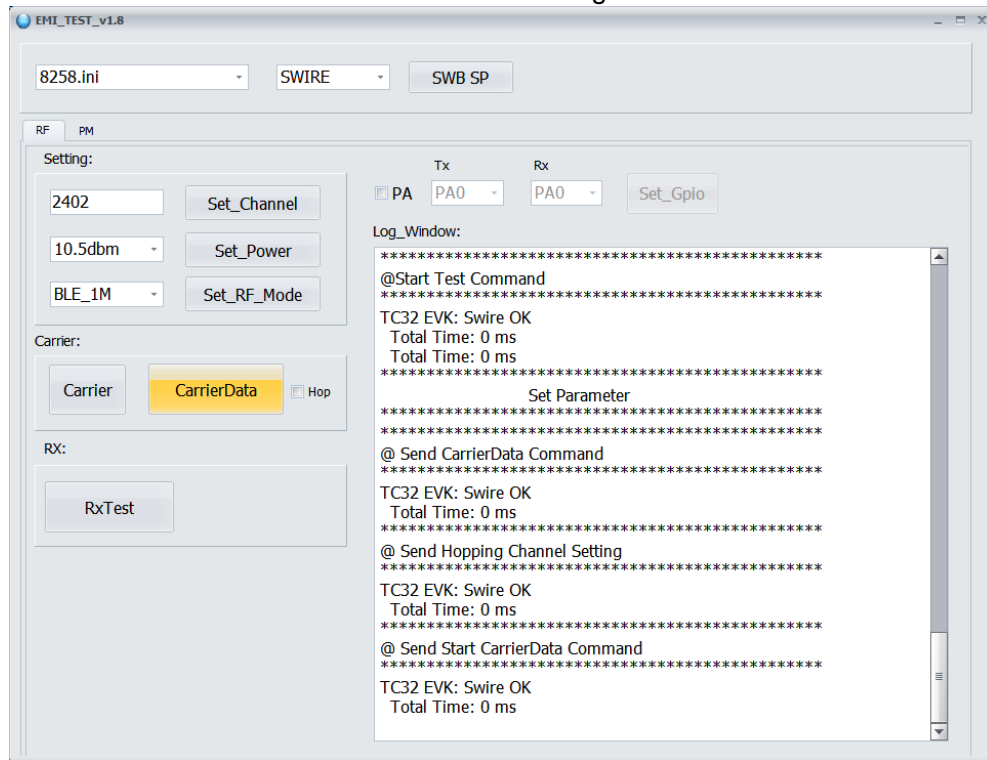
#### 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX for GFSK 1Mbps
2	Middle channel TX for GFSK 1Mbps
3	High channel TX for GFSK 1Mbps
4	Low channel TX for GFSK 2Mbps
5	Middle channel TX for GFSK 2Mbps
6	High channel TX for GFSK 2Mbps

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

#### Software Setting



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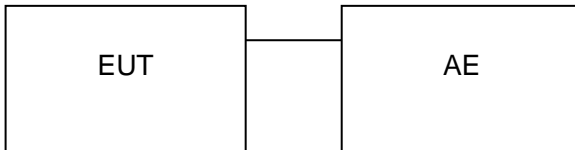
## 5. SYSTEM TEST CONFIGURATION

### 5.1. CONFIGURATION OF TESTED SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



### 5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Excavator Guidance	G21	2A2LL-G21	EUT
2	Adapter	HW-050200C01	DC 5V	AE
3	Xiaomi phone	Mi 10	N/A	AE

### 5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(3)	Peak Output Power	Compliant
15.247 (a)(2)	6 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.247 (e)	Maximum Conducted Output Power Density	Compliant
15.209	Radiated Emission	Compliant
15.207	Conducted Emission	Compliant

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## 6. TEST FACILITY

<b>Test Site</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd
<b>Location</b>	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
<b>Designation Number</b>	CN1259
<b>FCC Test Firm Registration Number</b>	975832
<b>A2LA Cert. No.</b>	5054.02
<b>Description</b>	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA

### TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Mar. 28, 2022	Mar. 27, 2023
TEST RECEIVER	R&S	ESPI	101206	Feb. 18, 2023	Feb. 17, 2024
LISN	R&S	ESH2-Z5	100086	Jun. 08, 2022	Jun. 07, 2023
Test software	R&S	ES-K1	Ver V1.71	N/A	N/A

### TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
TEST RECEIVER	R&S	ESCI	10096	Feb. 18, 2023	Feb. 17, 2024
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Aug. 04, 2022	Aug. 03, 2023
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 18, 2022	Mar. 19, 2024
Attenuator	ZHINAN	E-002	N/A	Aug. 04, 2022	Aug. 03, 2024
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 31, 2021	Oct. 30, 2023
Active Loop Antenna (9K-30Mhz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2024
Double-Ridged Waveguide Horn	ETS	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Double-Ridged Waveguide Horn	ETS	3117	00154520	Sep. 06, 2021	Sep. 05, 2023
Preamplifier Assembly	ETS	3117PA	00225134	Sep. 01, 2022	Sep. 02, 2024
Wideband Antenna	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 08, 2020	Jan. 07, 2023
Wideband Antenna	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 05, 2023	Jan. 04, 2025
Test software	FARA	EZ-EMC	Ver RA-03A	N/A	N/A

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## 7. PEAK OUTPUT POWER

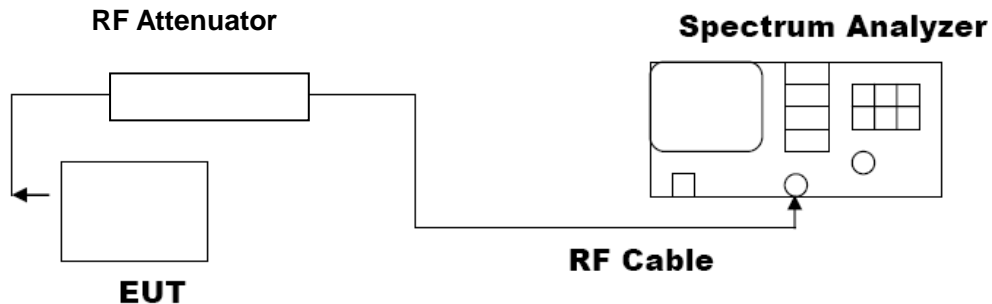
### 7.1. MEASUREMENT PROCEDURE

For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2.  $RBW \geq DTS$  bandwidth
3.  $VBW \geq 3 * RBW$ .
4.  $SPAN \geq VBW$ .
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

### 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) PEAK POWER TEST SETUP

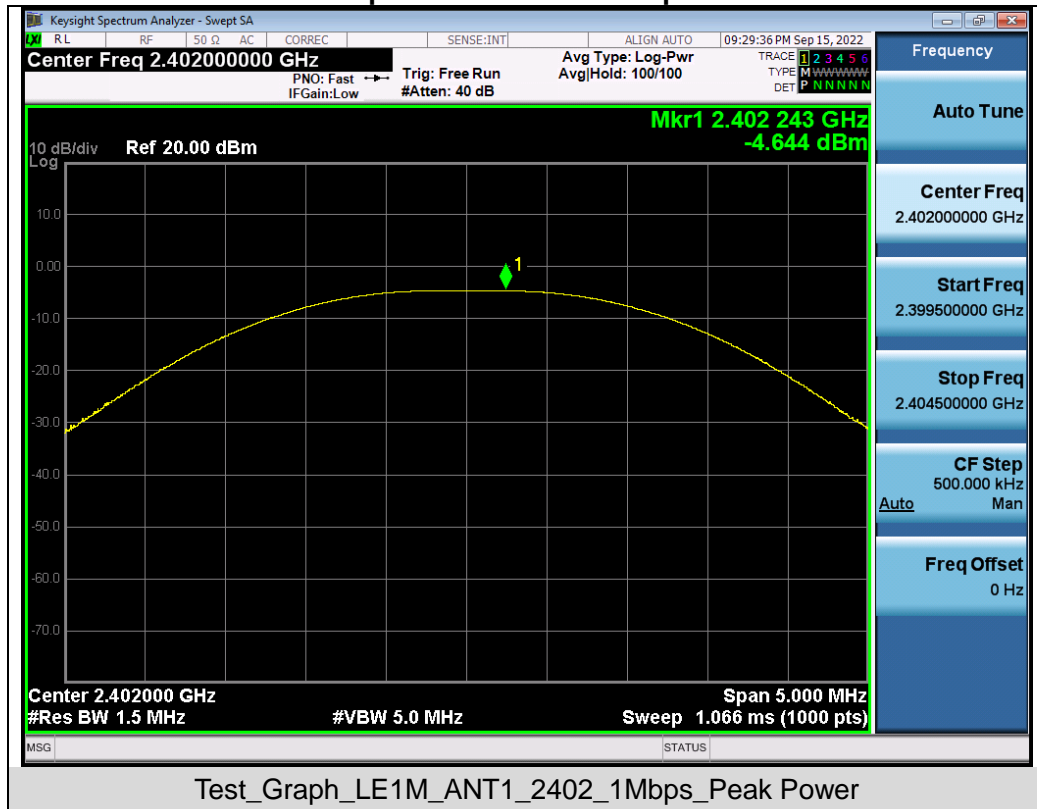


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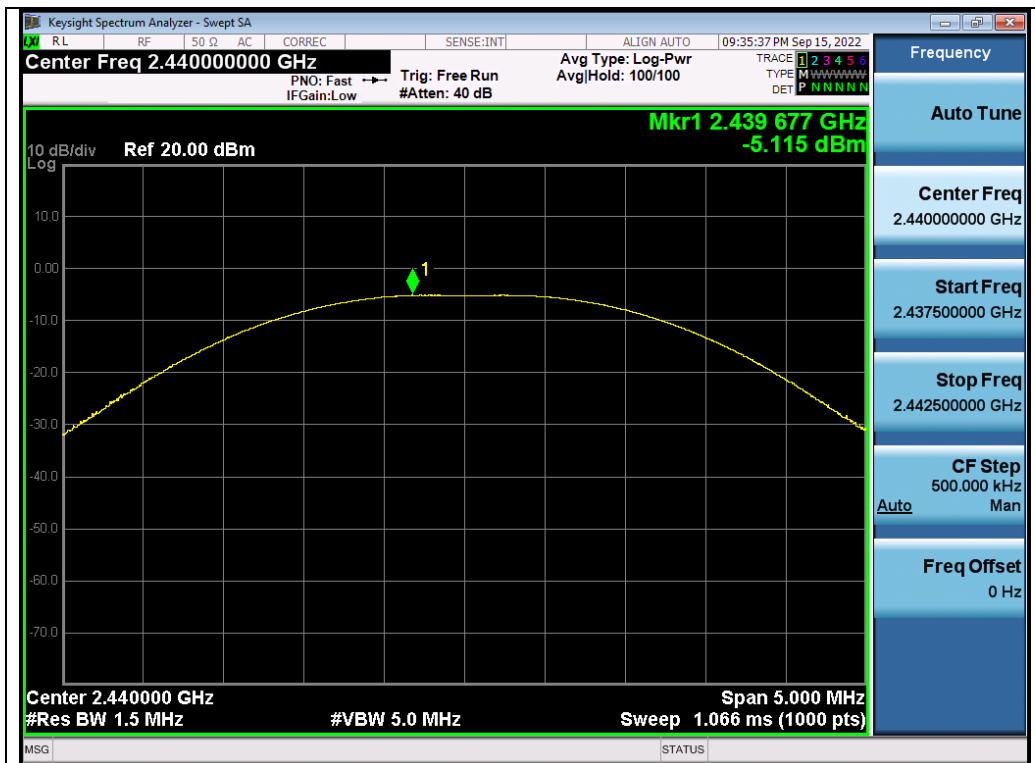
### 7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power				
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK 1M	2402	-4.644	≤30	Pass
	2440	-5.115	≤30	Pass
	2480	-5.586	≤30	Pass
GFSK 2M	2402	-4.658	≤30	Pass
	2440	-5.178	≤30	Pass
	2480	-5.672	≤30	Pass

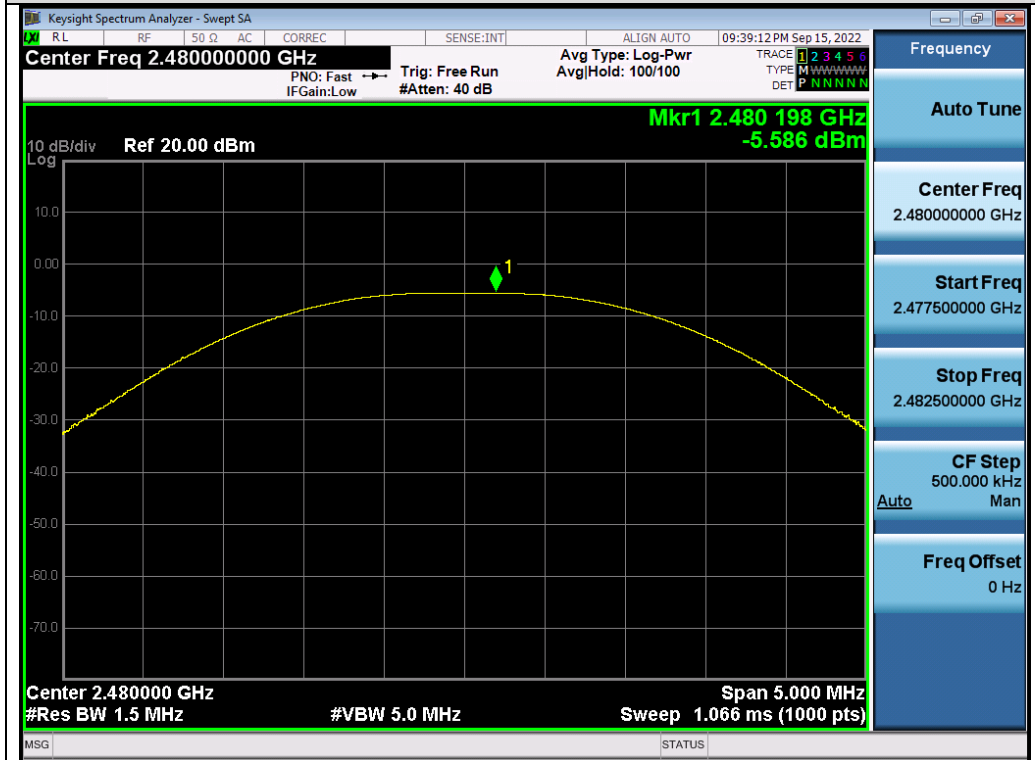
### Test Graphs of Conducted Output Power



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Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_Peak Power



Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Peak Power

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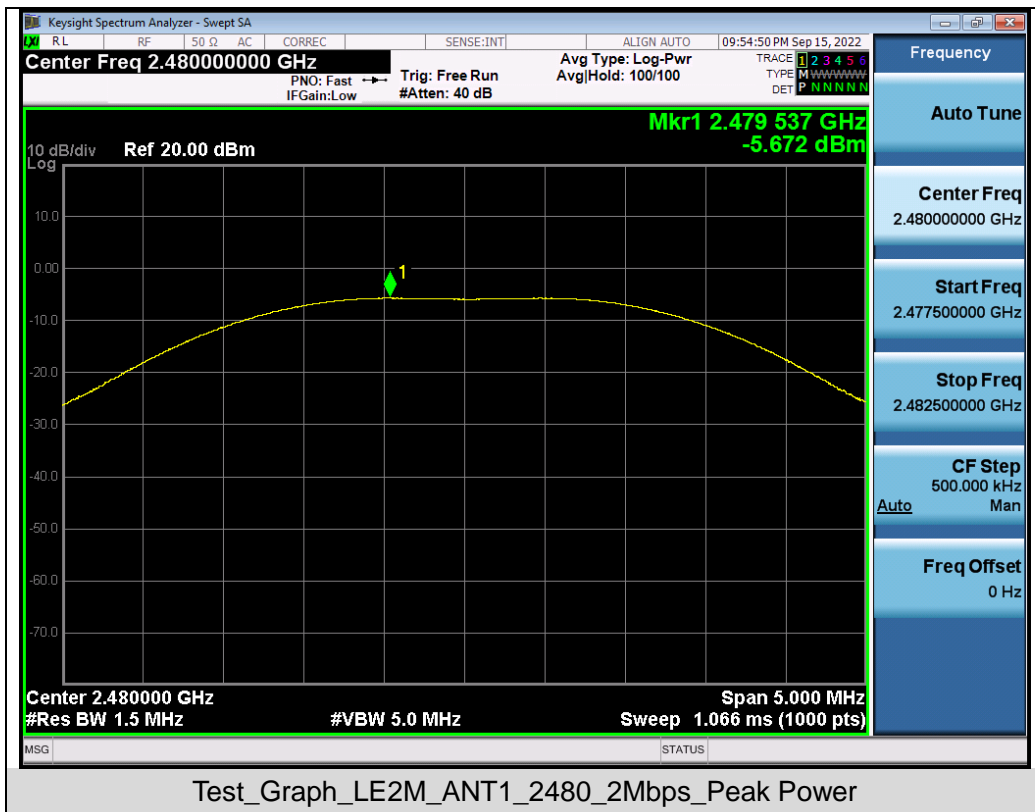


Test\_Graph\_LE2M\_ANT1\_2402\_2Mbps\_Peak Power



Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_Peak Power

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## 8. BANDWIDTH

### 8.1. MEASUREMENT PROCEDURE

6dB bandwidth:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 kHz, VBW  $\geq 3 \times$  RBW.
4. Set SPA Trace 1 Max hold, then View.

Occupied bandwidth:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel  
The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

### 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

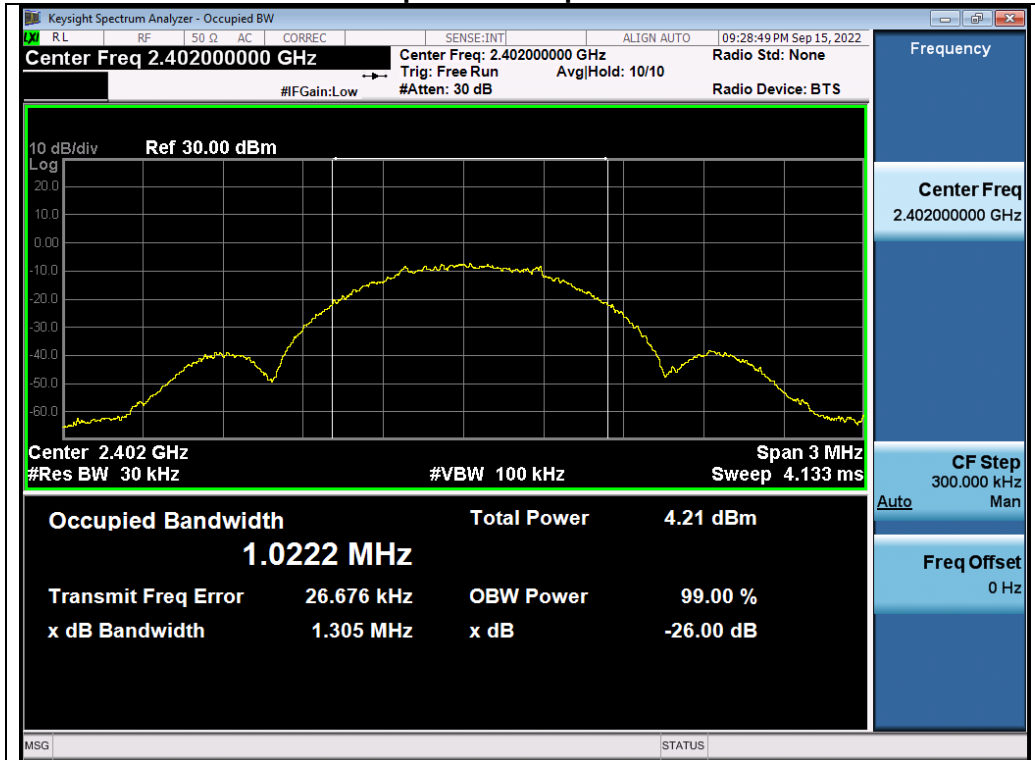
The same as described in section 7.2.

### 8.3. LIMITS AND MEASUREMENT RESULTS

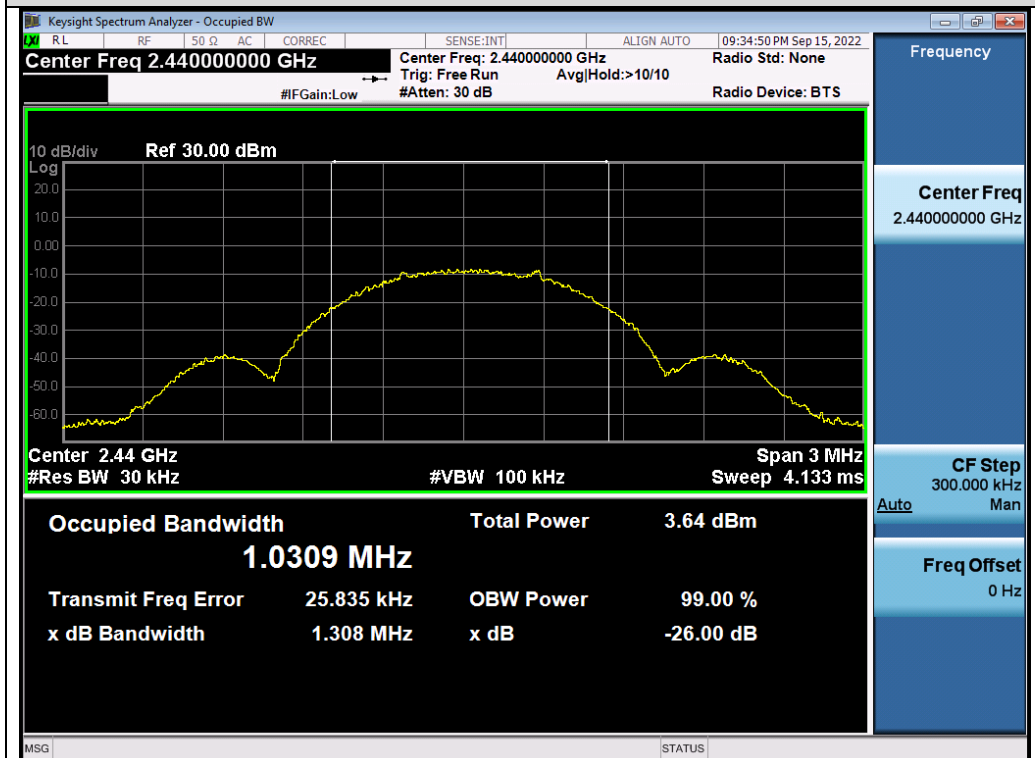
Test Data of Occupied Bandwidth and DTS Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
GFSK 1M	2402	1.022	0.678	$\geq 0.5$	Pass
	2440	1.031	0.691	$\geq 0.5$	Pass
	2480	1.020	0.677	$\geq 0.5$	Pass
GFSK 2M	2402	2.042	1.384	$\geq 0.5$	Pass
	2440	2.040	1.344	$\geq 0.5$	Pass
	2480	2.041	1.418	$\geq 0.5$	Pass

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### Test Graphs of Occupied Bandwidth



Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_OBW

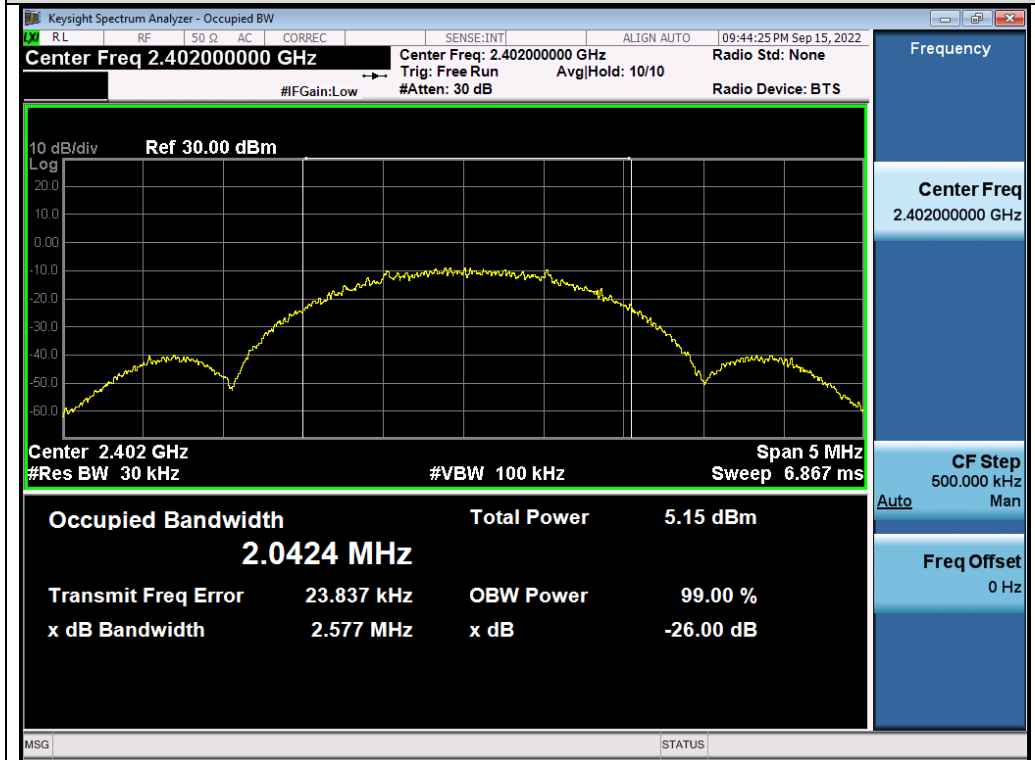


Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_OBW

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Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_OBW

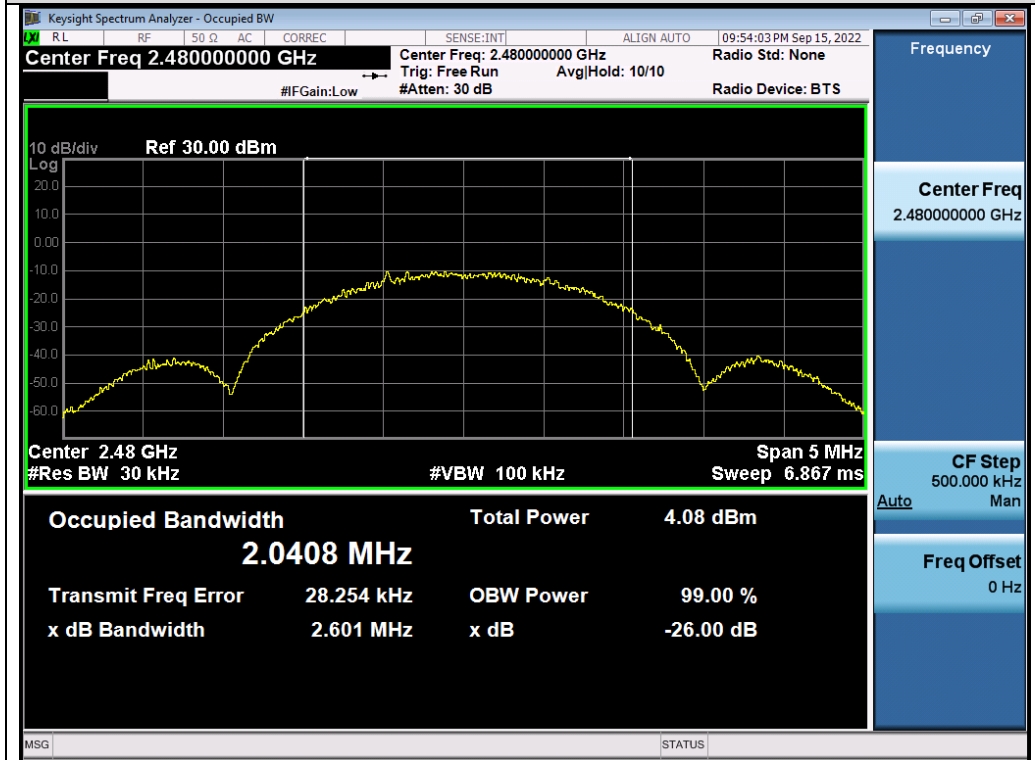


Test\_Graph\_LE2M\_ANT1\_2402\_2Mbps\_OBW

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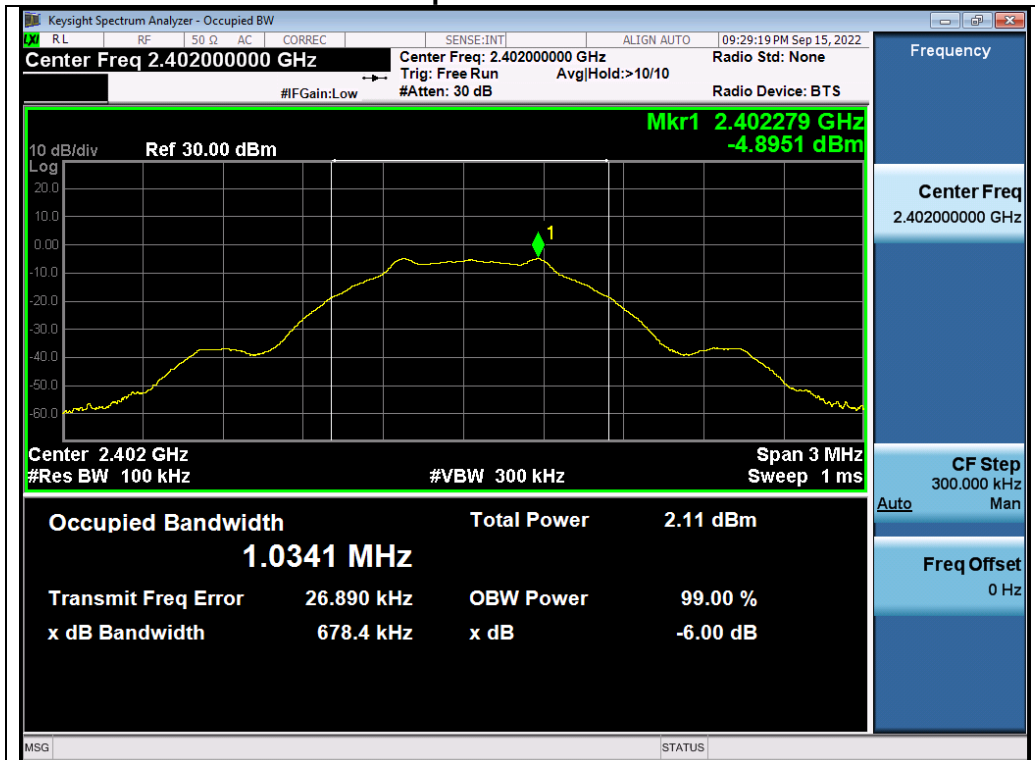
Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_OBW



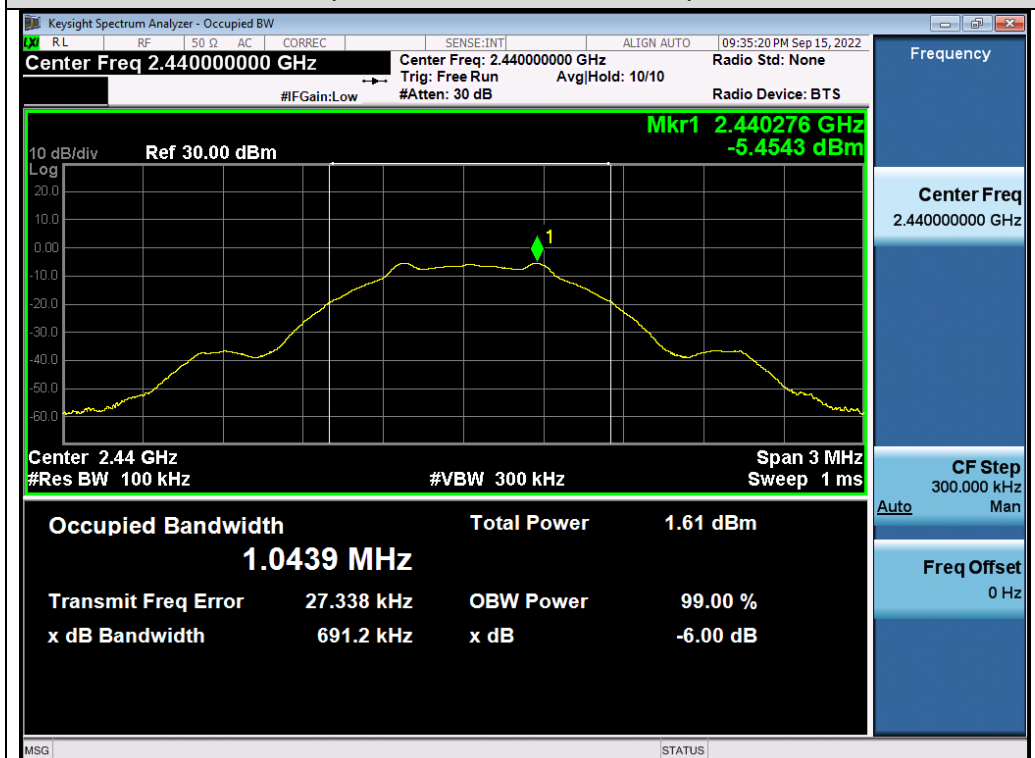
Test\_Graph\_LE2M\_ANT1\_2480\_2Mbps\_OBW

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### Test Graphs of DTS Bandwidth



Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_DTSBW



Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_DTSBW

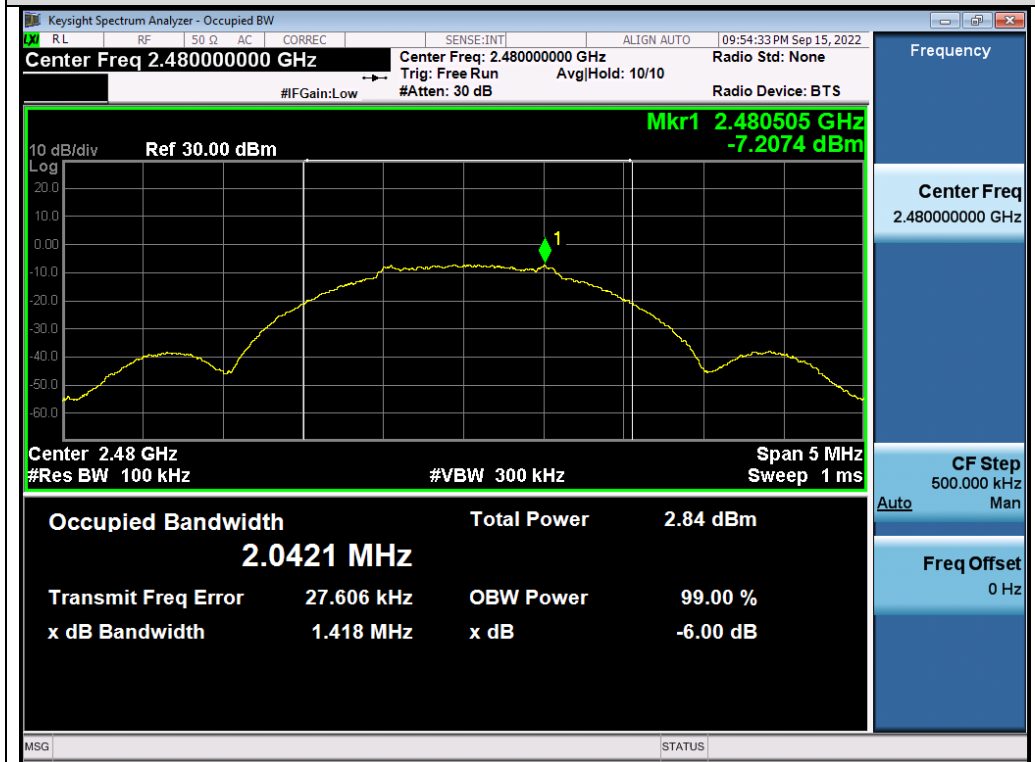
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



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Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_DTSBW



Test\_Graph\_LE2M\_ANT1\_2480\_2Mbps\_DTSBW

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## 9. CONDUCTED SPURIOUS EMISSION

### 9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

**Note:** The EUT was tested according to ANSI C63.10 for compliance to FCC PART 15.247 requirements.

### 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 7.2.

### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

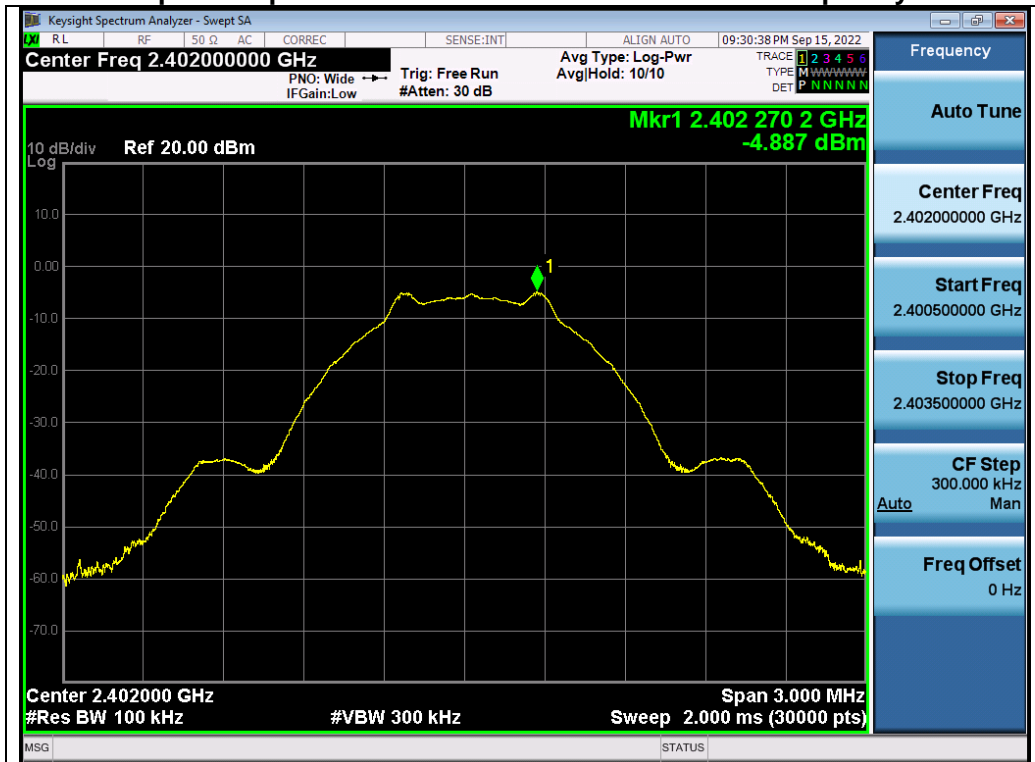
### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test Data	Criteria
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.	At least -20dBc than the reference level	PASS

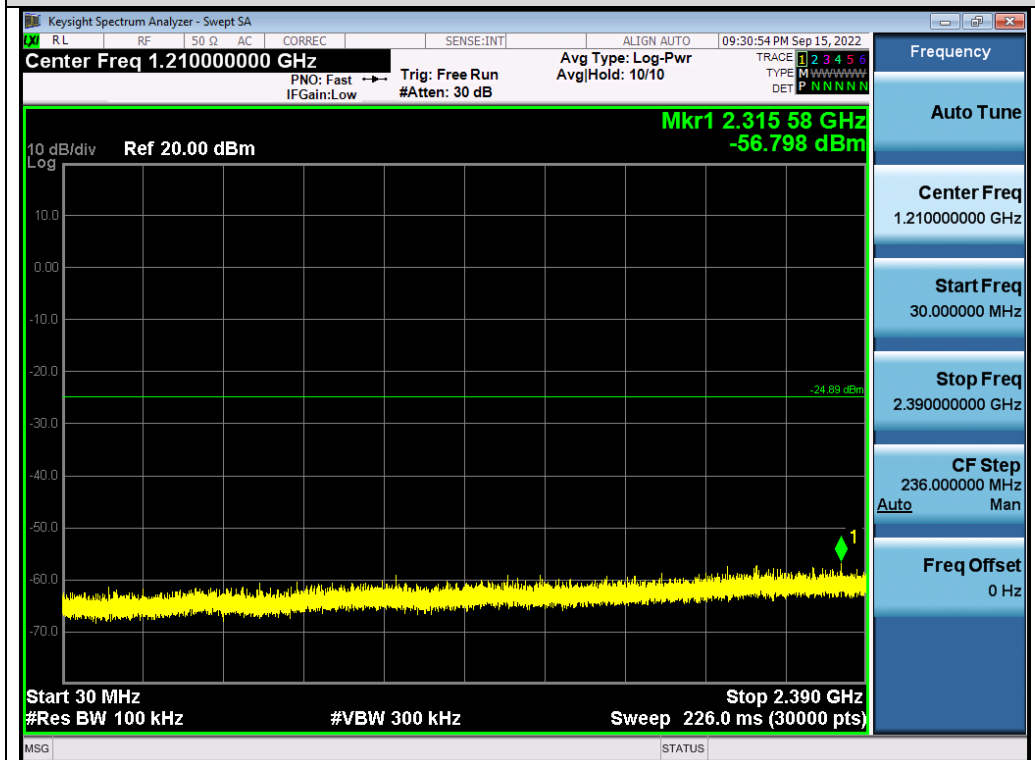
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



### Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands

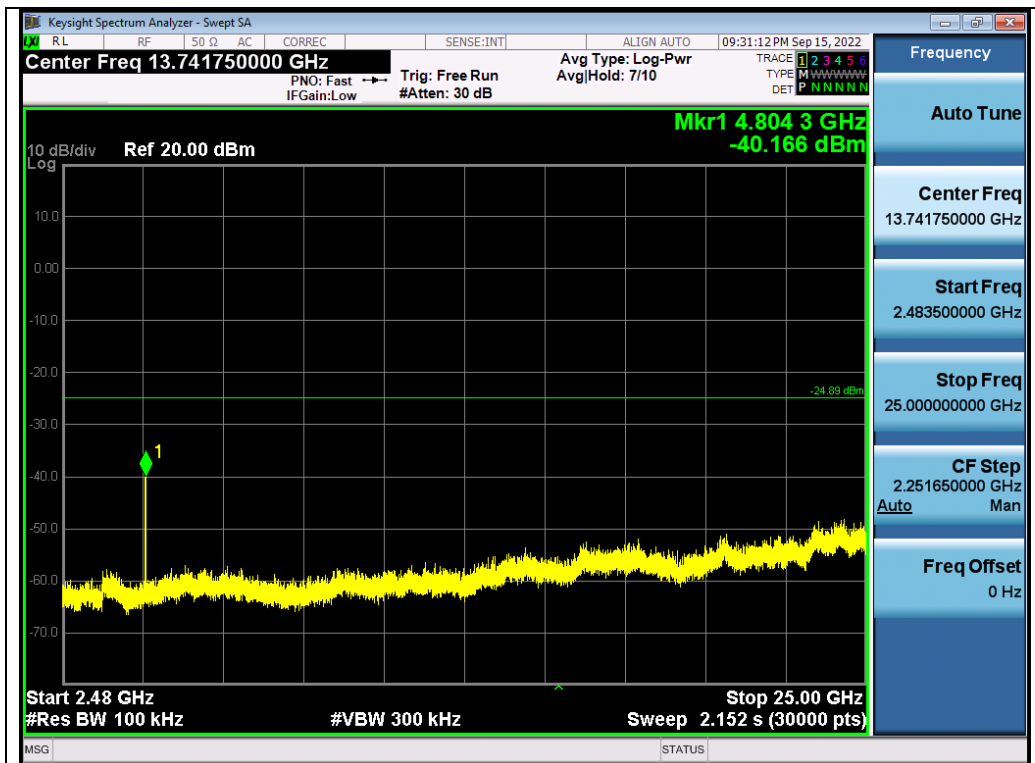


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_Reference Level

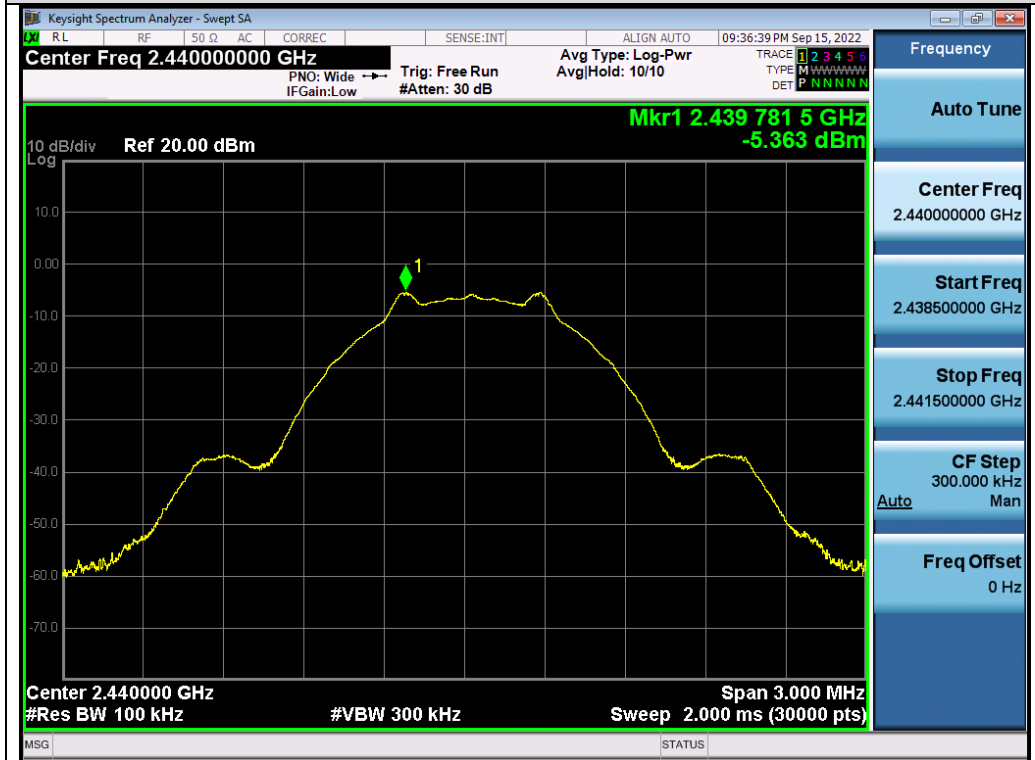


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_Lower Band Emissions

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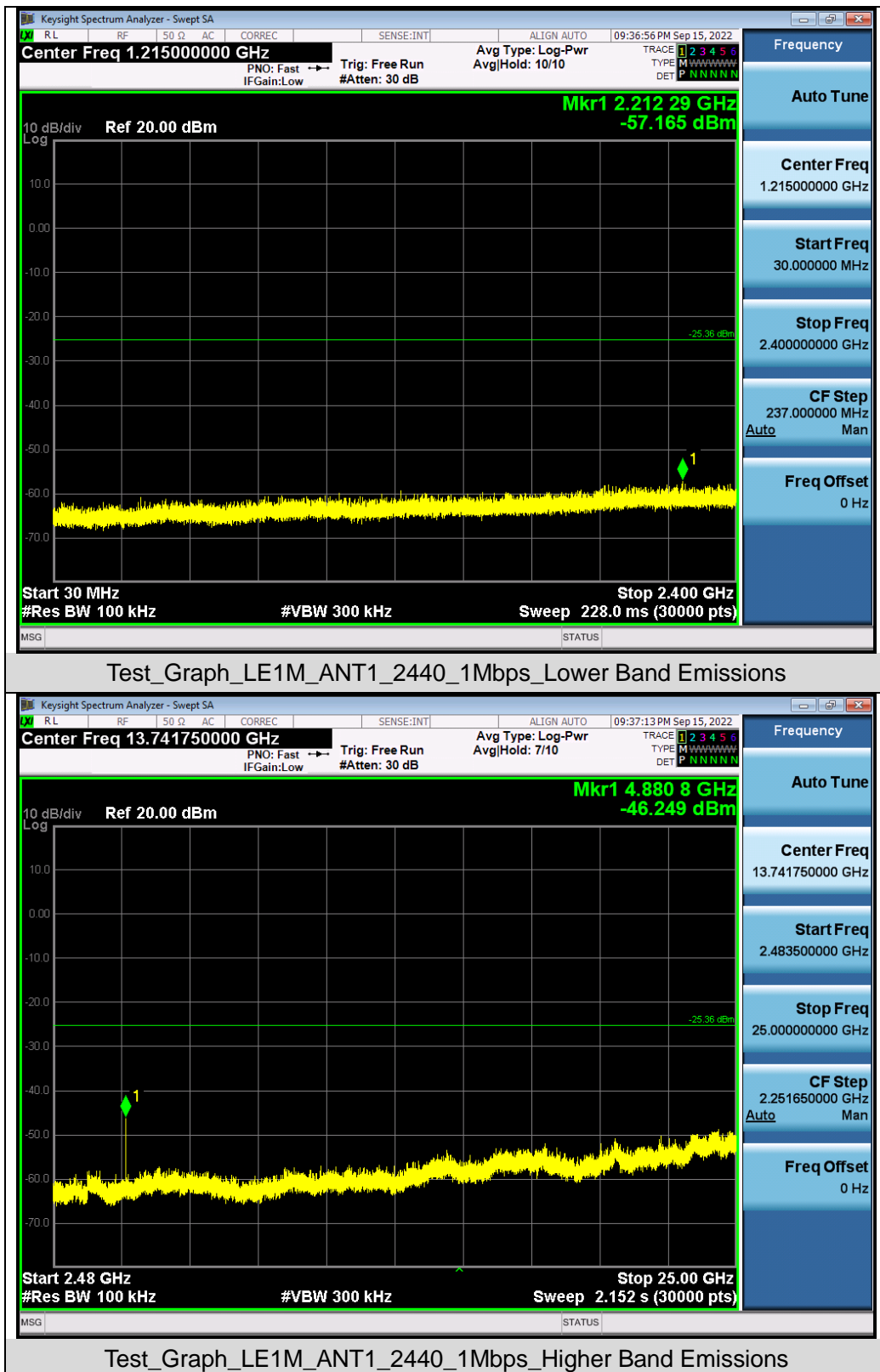


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_Higher Band Emissions



Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_Reference Level

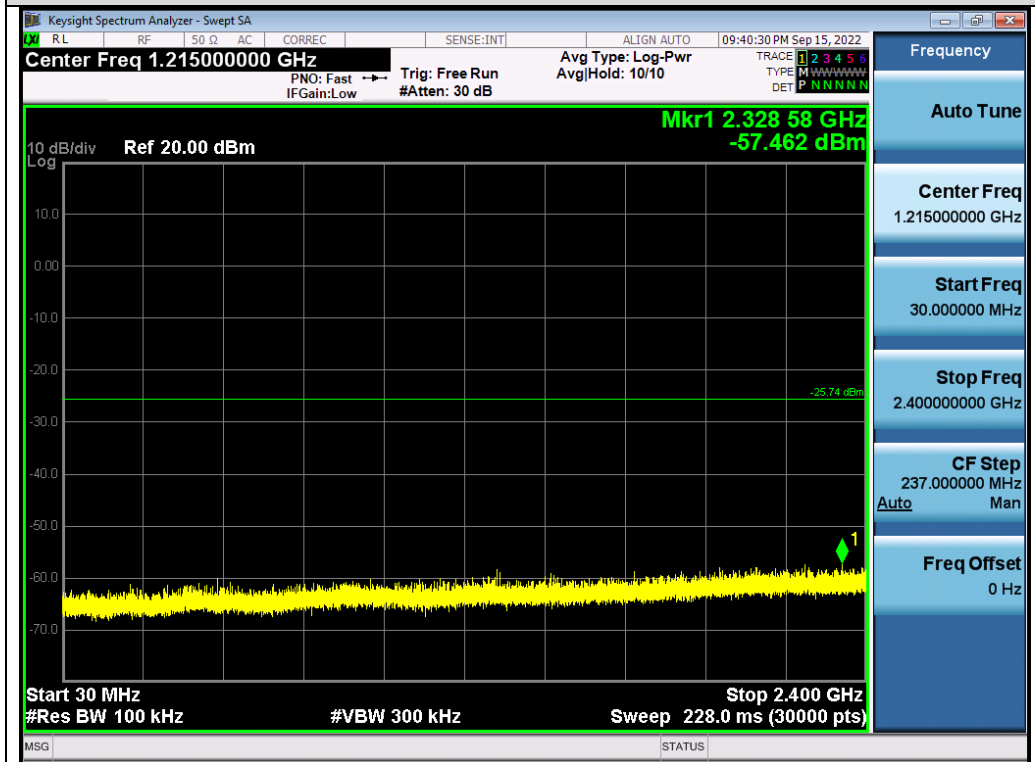
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



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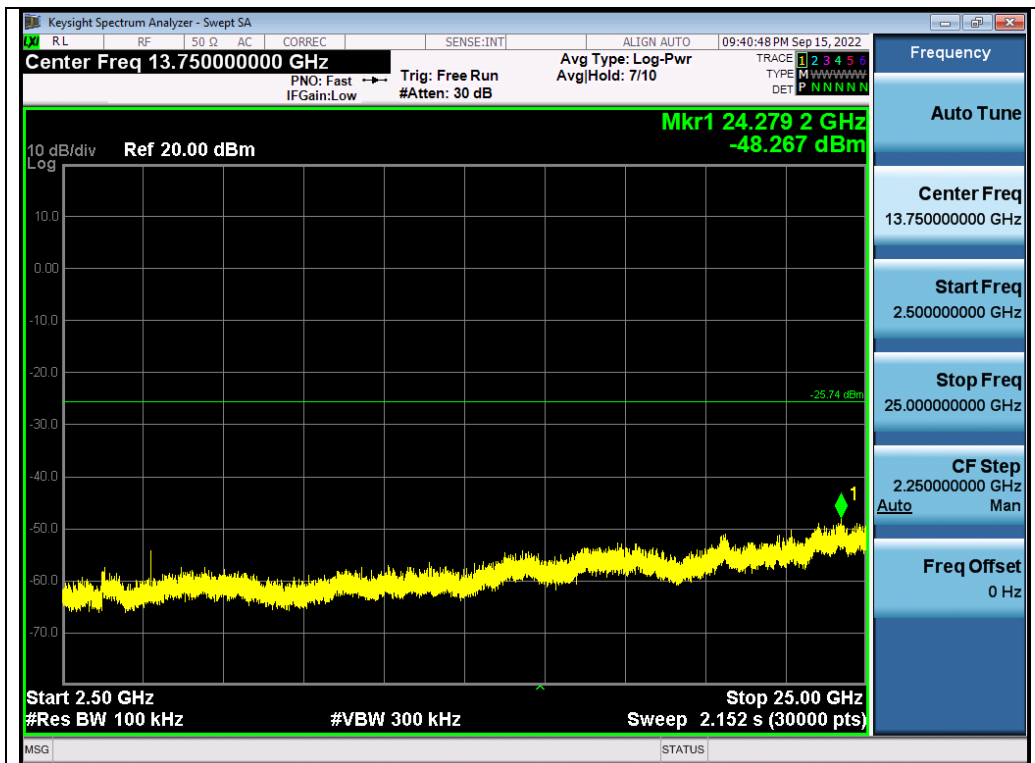


Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Reference Level



Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Lower Band Emissions

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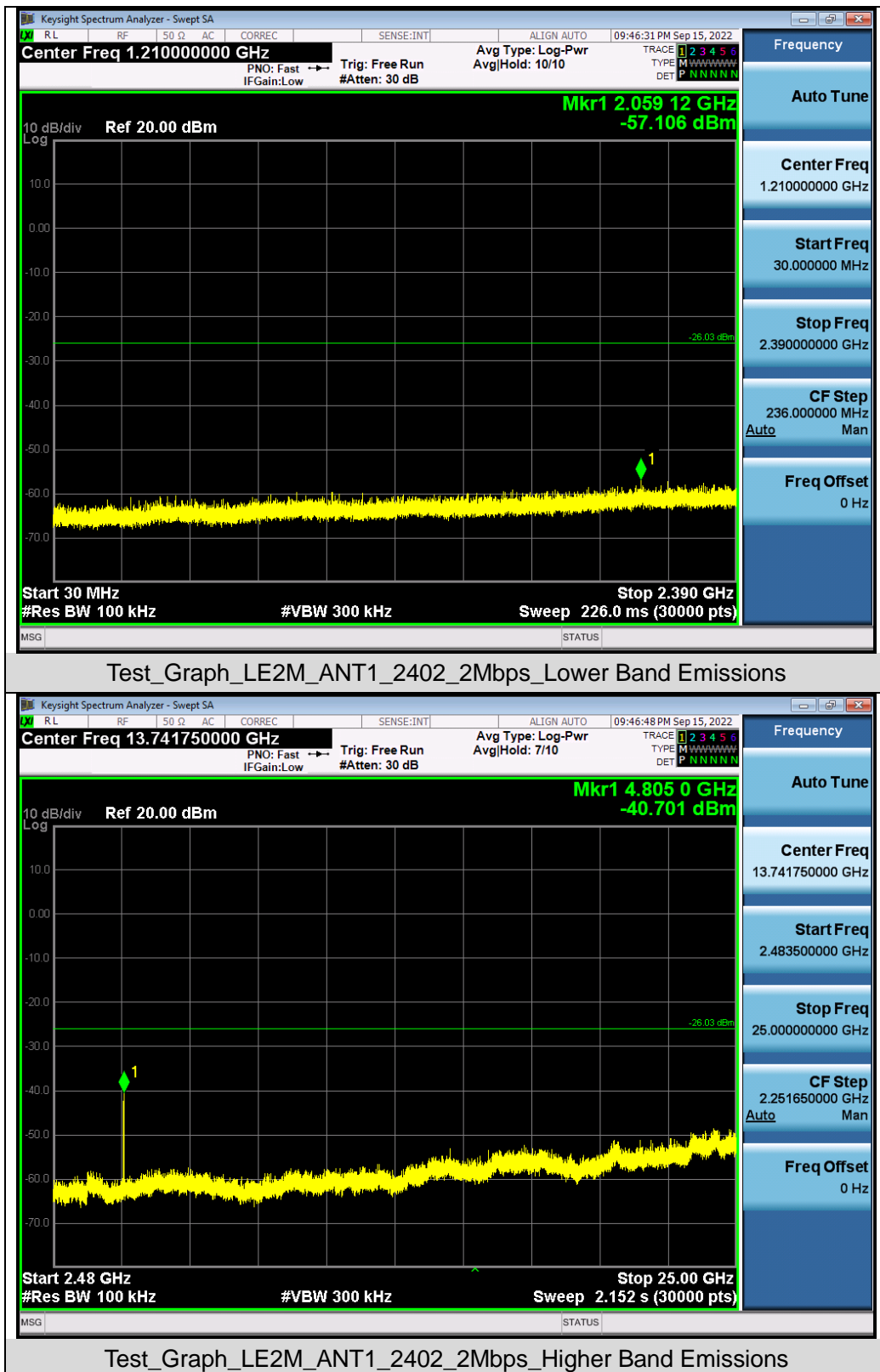


Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Higher Band Emissions



Test\_Graph\_LE2M\_ANT1\_2402\_2Mbps\_Reference Level

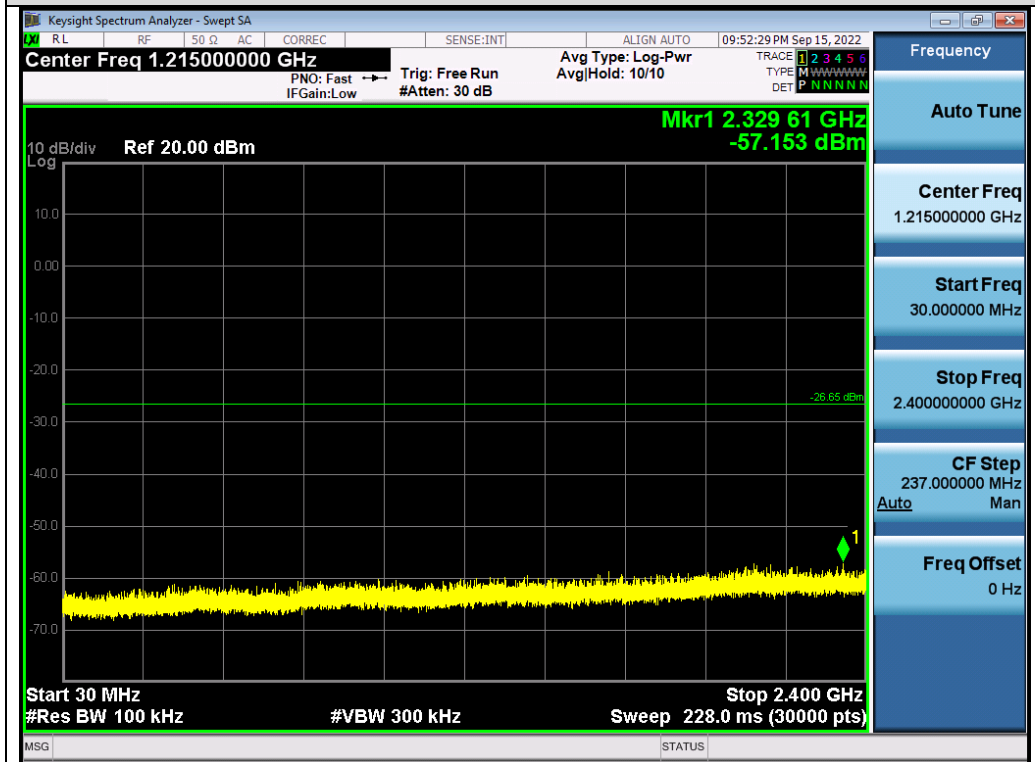
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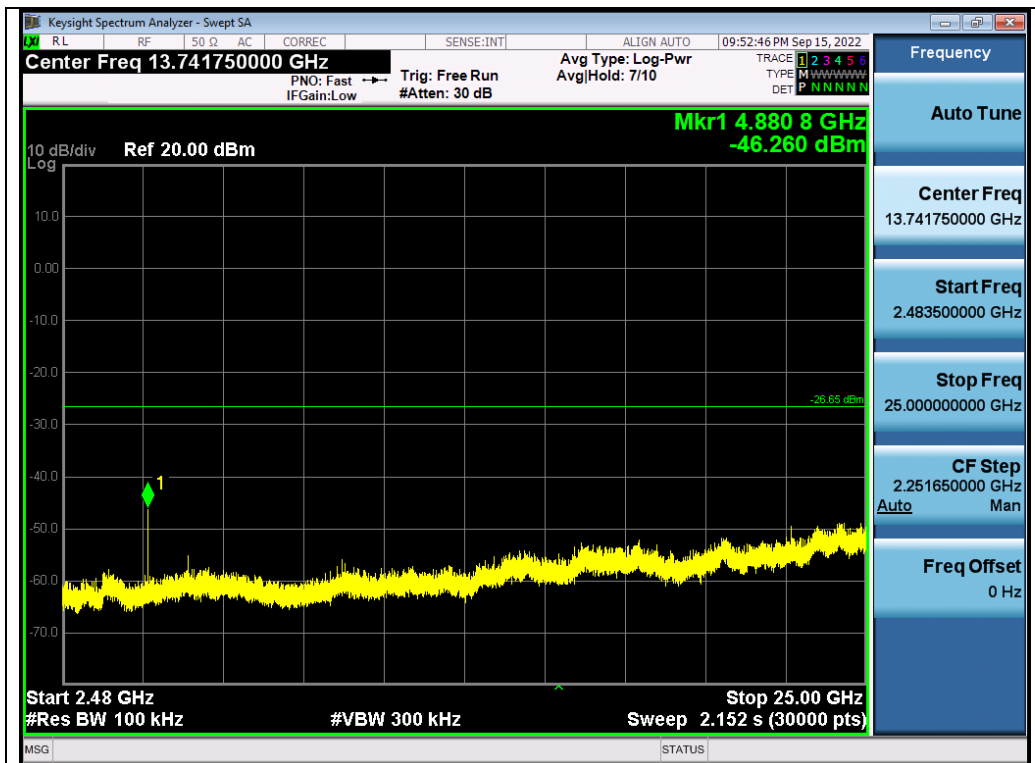


Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_Reference Level



Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_Lower Band Emissions

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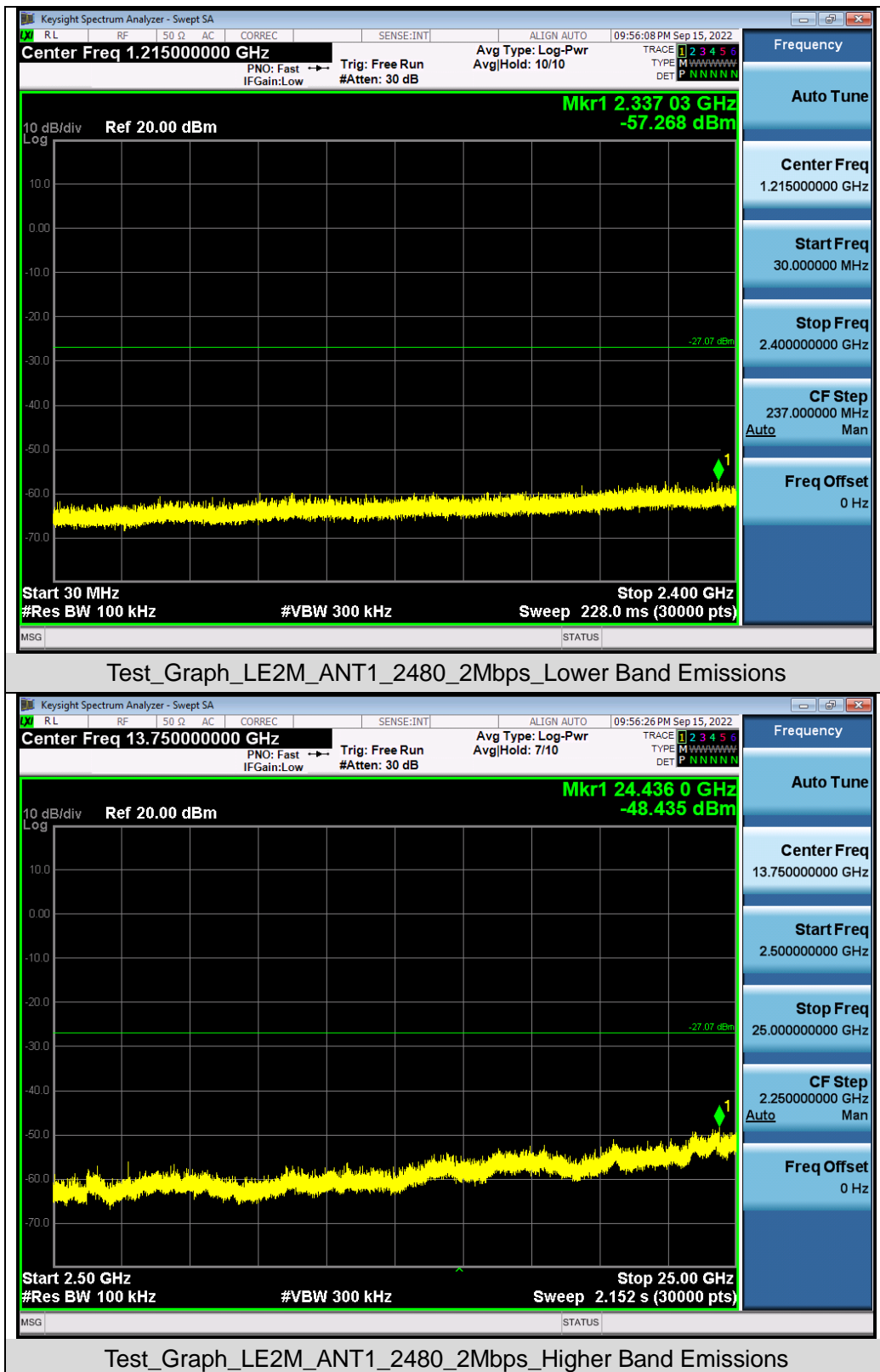
Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_Higher Band Emissions



Test\_Graph\_LE2M\_ANT1\_2480\_2Mbps\_Reference Level

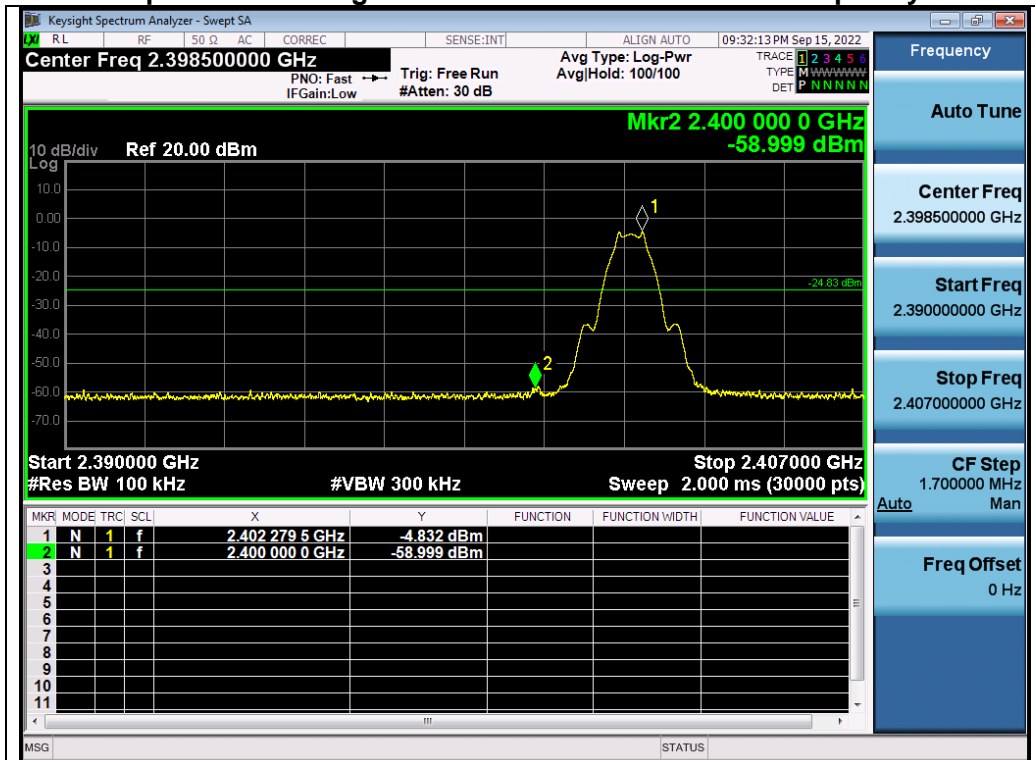
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



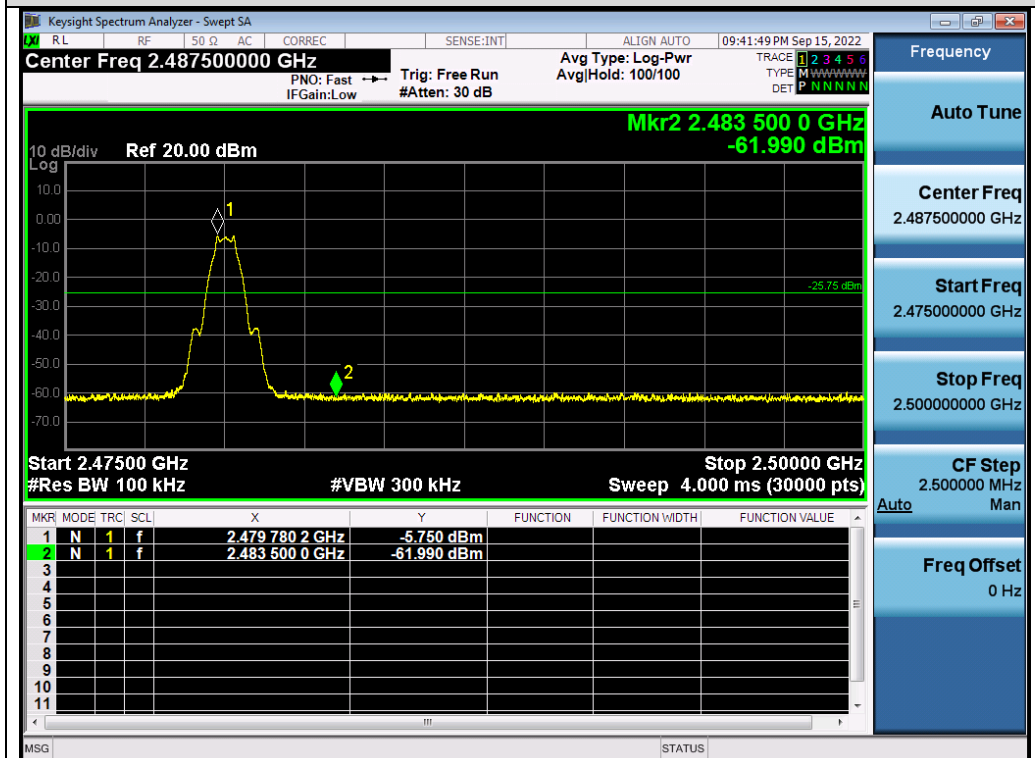


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### Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands

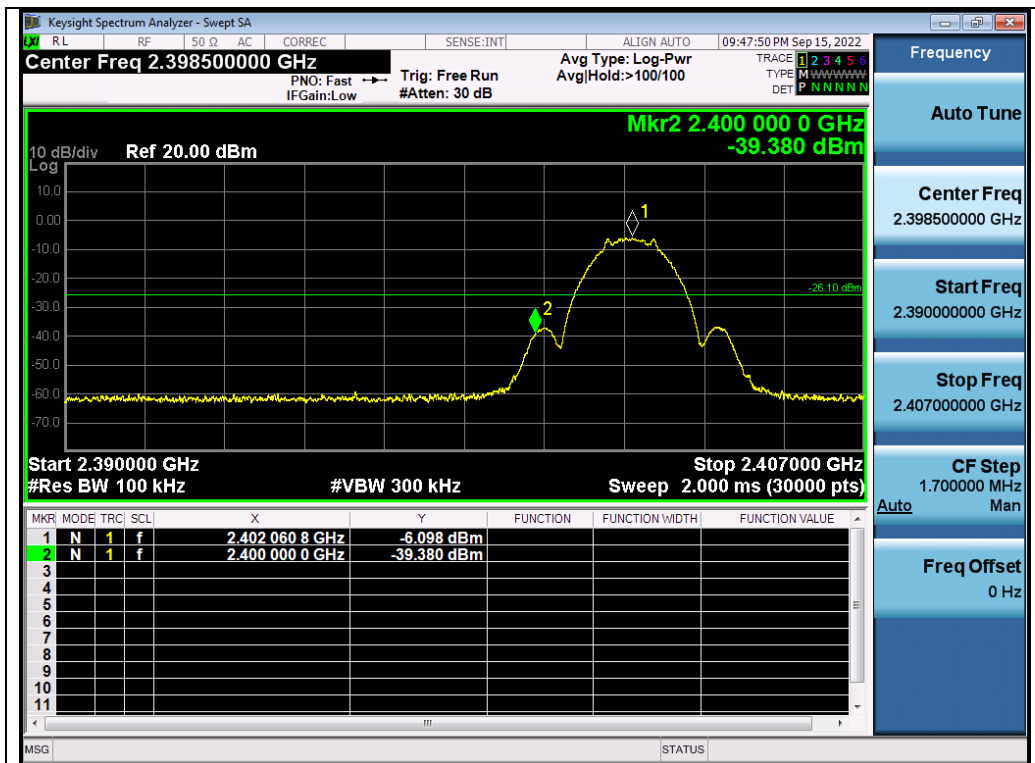


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_Lower Band Edge Emissions

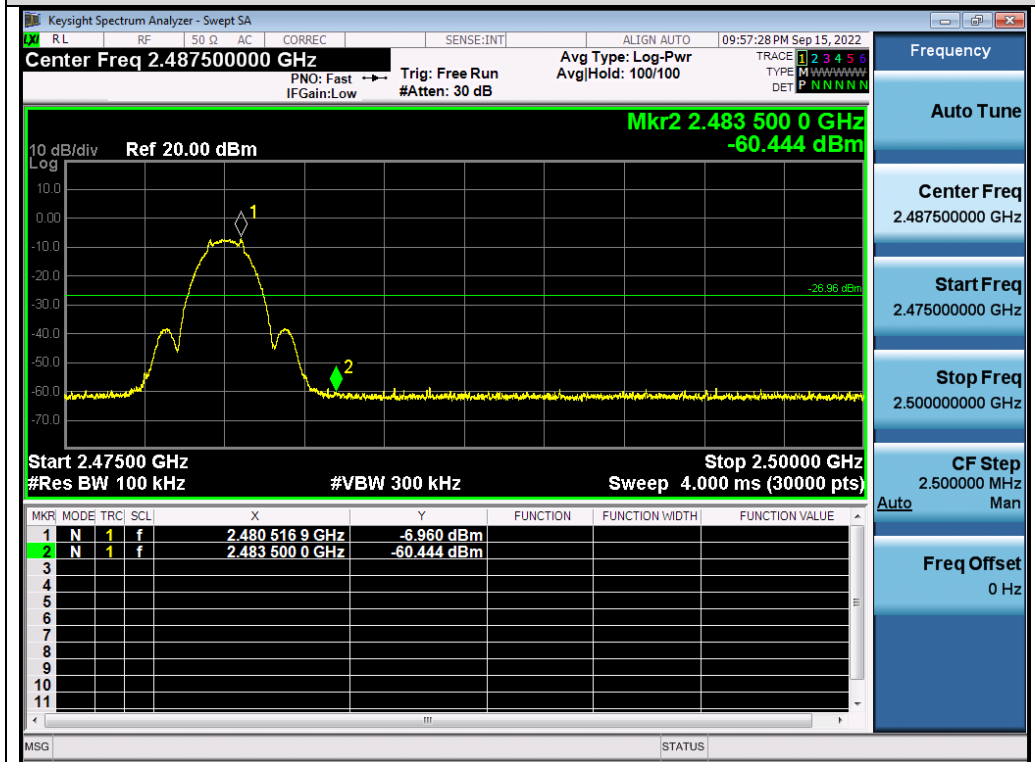


Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_Higher Band Edge Emissions

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Test\_Graph\_LE2M\_ANT1\_2402\_2Mbps\_Lower Band Edge Emissions



Test\_Graph\_LE2M\_ANT1\_2480\_2Mbps\_Higher Band Edge Emissions

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## 10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

### 10.1. MEASUREMENT PROCEDURE

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set the SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 8.4 was used in this testing.

### 10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer to Section 7.2.

### 10.3. MEASUREMENT EQUIPMENT USED

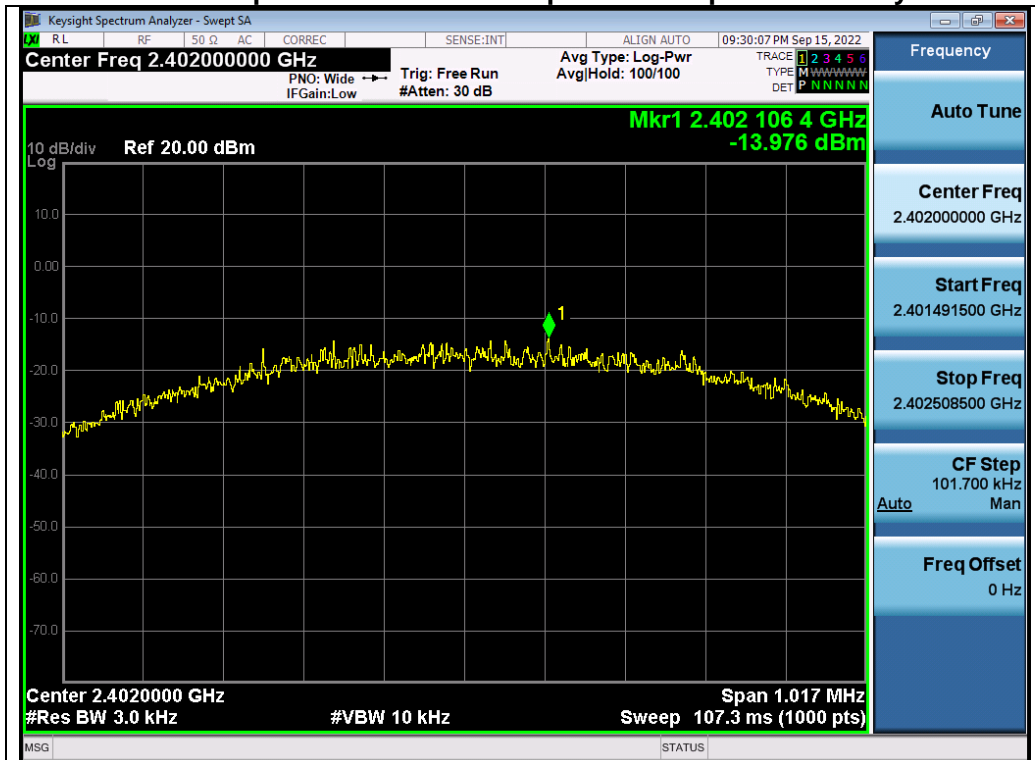
Refer to Section 6.

### 10.4. LIMITS AND MEASUREMENT RESULT

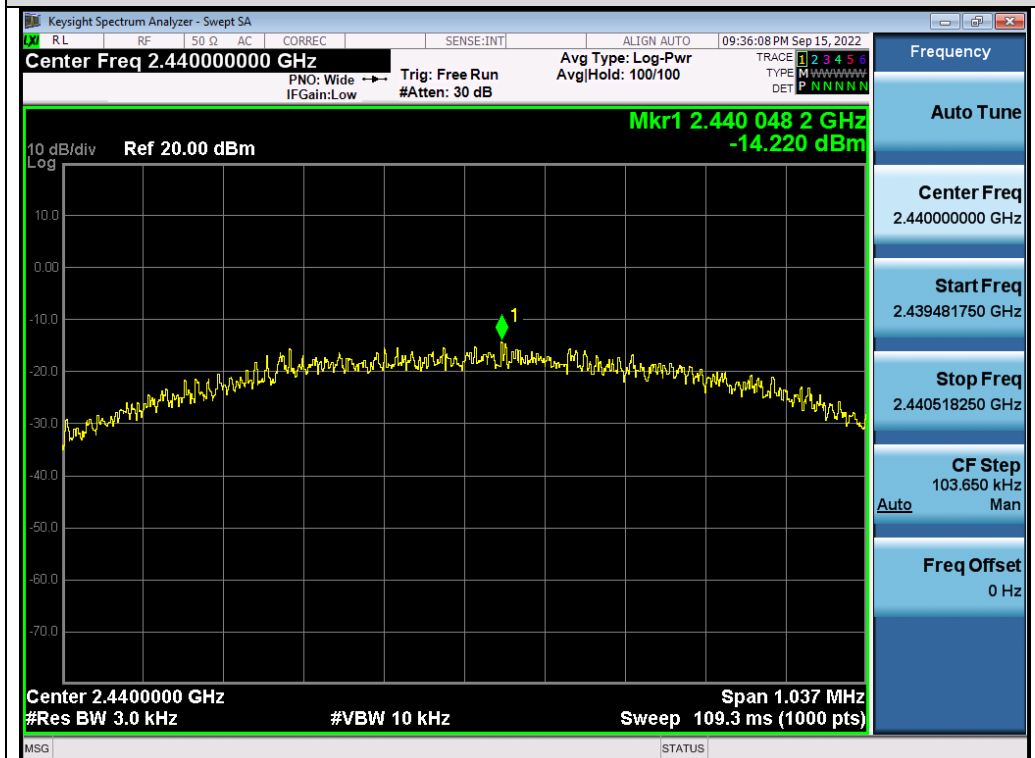
Test Data of Conducted Output Power Spectral Density				
Test Mode	Test Channel (MHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
GFSK 1M	2402	-13.976	≤8	Pass
	2440	-14.220	≤8	Pass
	2480	-14.489	≤8	Pass
GFSK 2M	2402	-17.613	≤8	Pass
	2440	-17.256	≤8	Pass
	2480	-18.817	≤8	Pass

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### Test Graphs of Conducted Output Power Spectral Density

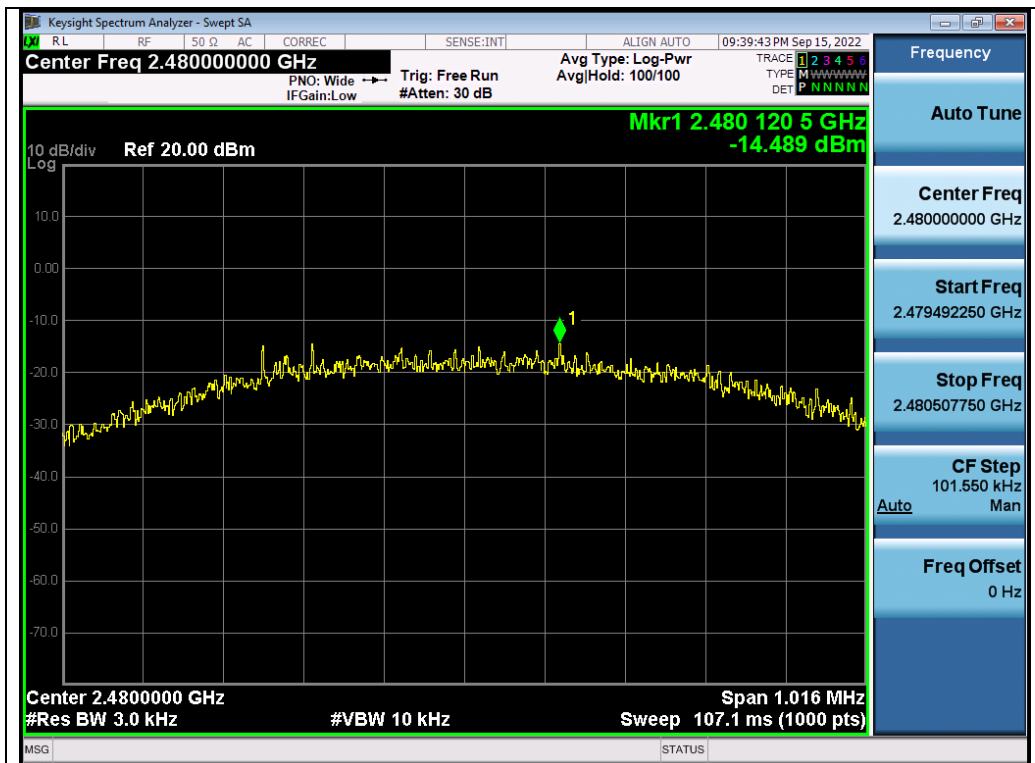


Test\_Graph\_LE1M\_ANT1\_2402\_1Mbps\_PSD



Test\_Graph\_LE1M\_ANT1\_2440\_1Mbps\_PSD

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Test\_Graph\_LE1M\_ANT1\_2480\_1Mbps\_PSD

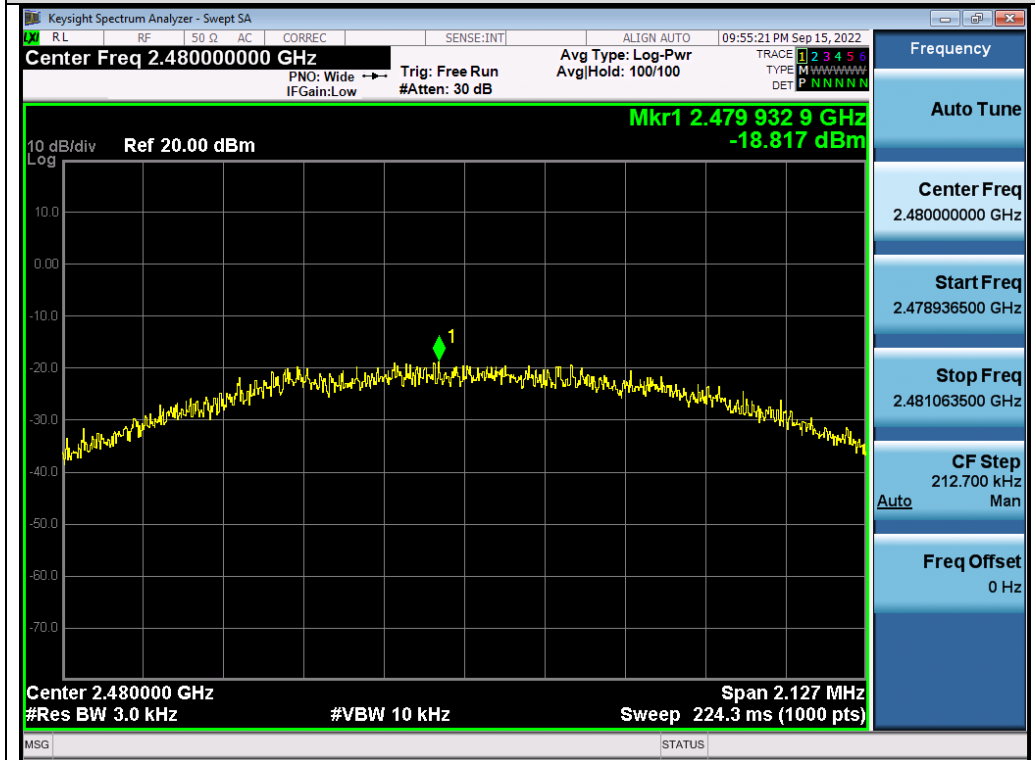


Test\_Graph\_LE2M\_ANT1\_2402\_2Mbps\_PSD

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Test\_Graph\_LE2M\_ANT1\_2440\_2Mbps\_PSD



Test\_Graph\_LE2M\_ANT1\_2480\_2Mbps\_PSD

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## 11. RADIATED EMISSION

### 11.1. MEASUREMENT PROCEDURE

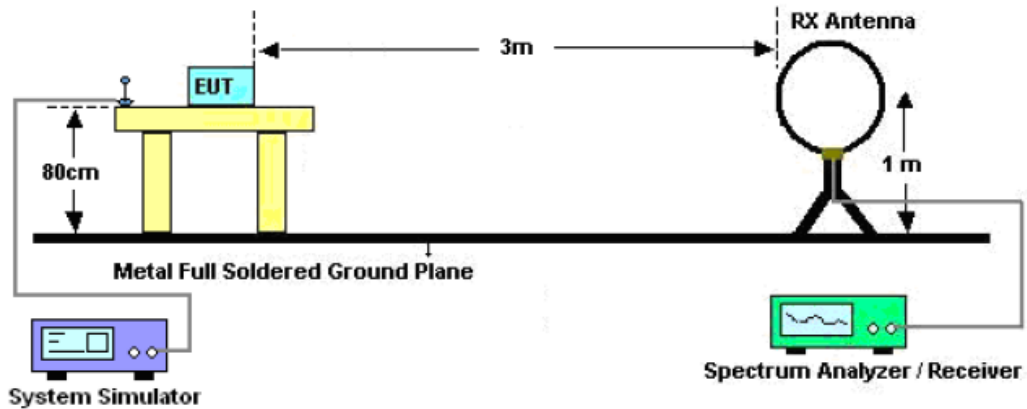
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

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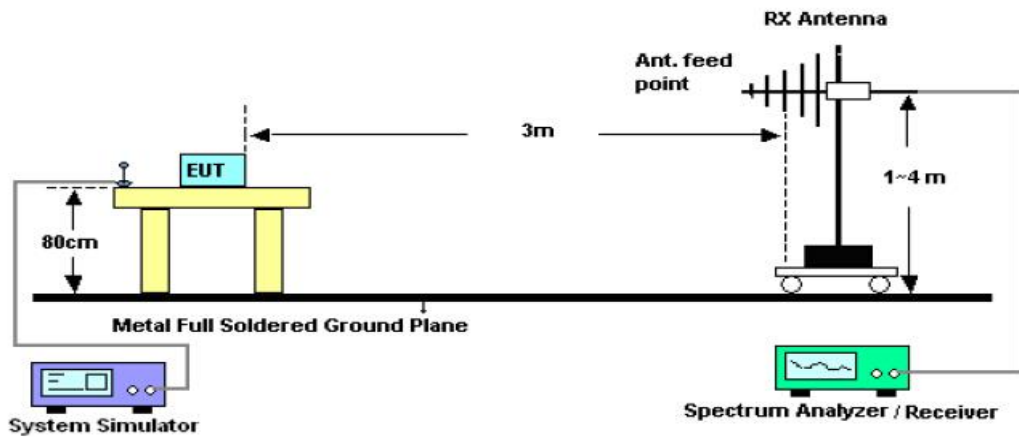


### 11.2. TEST SETUP

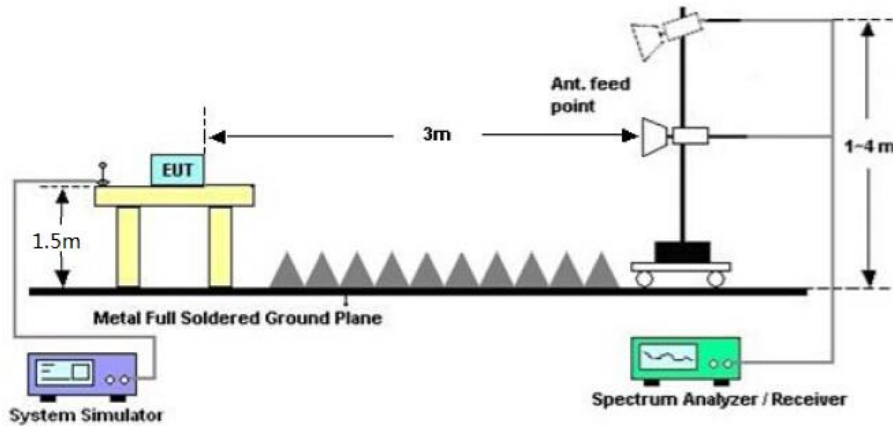
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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**11.3. LIMITS AND MEASUREMENT RESULT**

15.209 Limit in the below table has to be followed

<b>Frequencies (MHz)</b>	<b>Field Strength (microvolts/meter)</b>	<b>Measurement Distance (meters)</b>
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

**11.4. TEST RESULT**

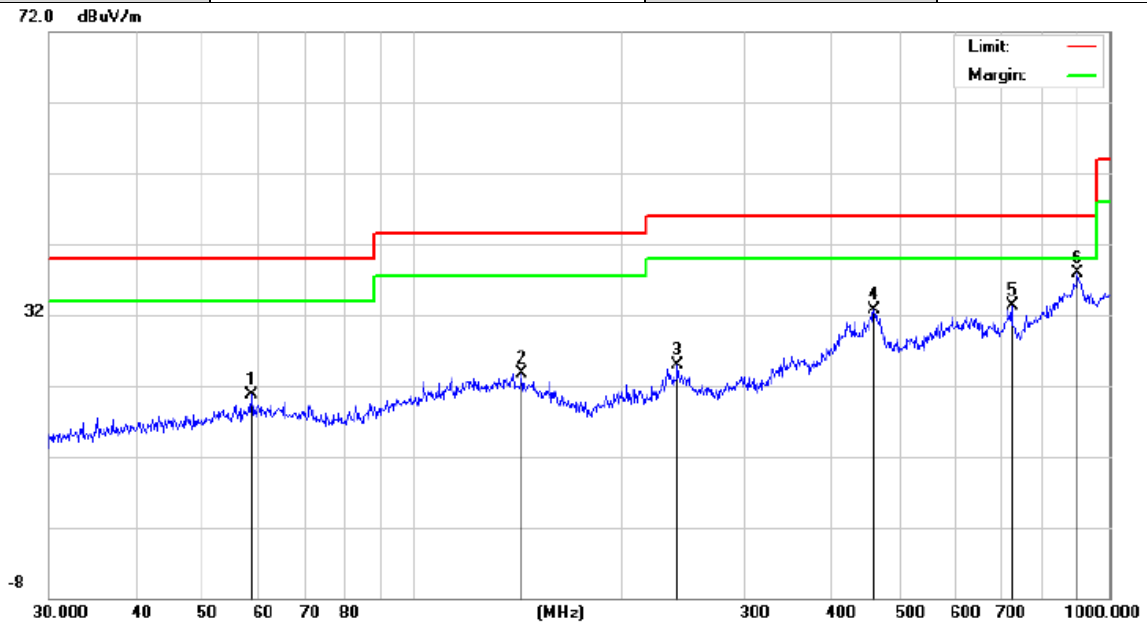
**Radiated emission below 30MHz**

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.

**Radiated emission from 30MHz to 1000MHz**

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Horizontal

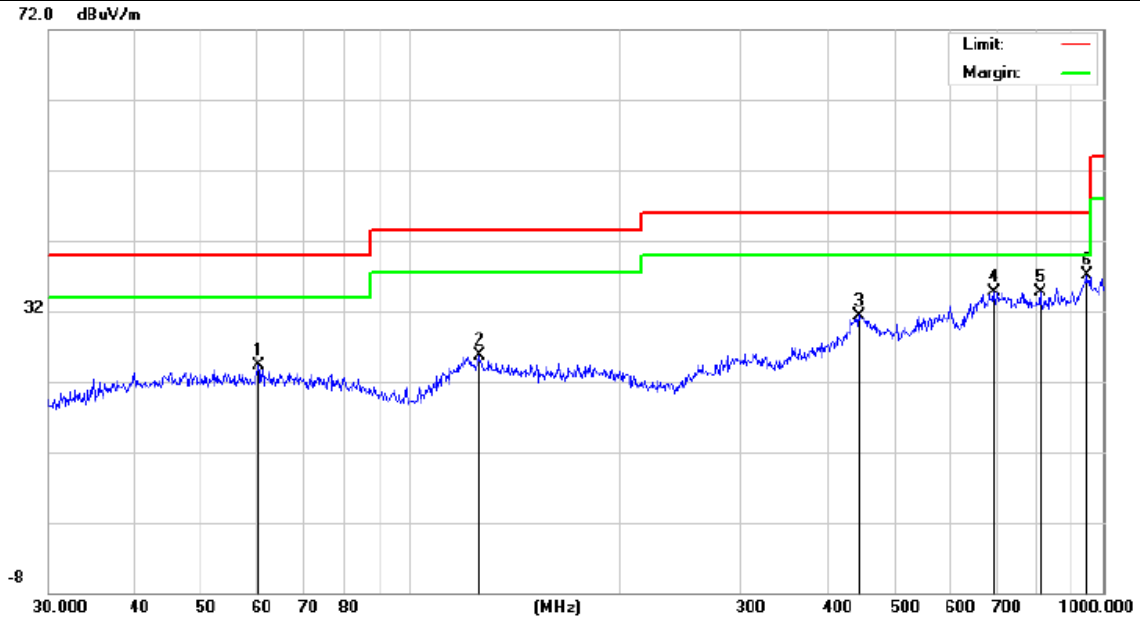


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		58.6126	7.63	13.04	20.67	40.00	-19.33	peak
2		143.3261	6.82	16.87	23.69	43.50	-19.81	peak
3		239.9874	6.59	18.40	24.99	46.00	-21.01	peak
4		459.1144	5.48	27.25	32.73	46.00	-13.27	peak
5		724.2611	7.24	25.97	33.21	46.00	-12.79	peak
6	*	900.1474	6.20	31.78	37.98	46.00	-8.02	peak

**RESULT: PASS**

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<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		60.2801	7.26	17.10	24.36	40.00	-15.64	peak
2		125.4457	6.41	19.29	25.70	43.50	-17.80	peak
3		443.2943	5.45	25.95	31.40	46.00	-14.60	peak
4		694.4174	6.73	27.99	34.72	46.00	-11.28	peak
5		810.2654	7.05	27.75	34.80	46.00	-11.20	peak
6	*	945.4399	6.40	30.78	37.18	46.00	-8.82	peak

**RESULT: PASS**

**Note:**

1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
2. All test modes had been tested. The mode 1 is the worst case and recorded in the report.

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**Radiated emission above 1GHz**

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	46.36	0.08	46.44	74	-27.56	peak
4804.000	36.54	0.08	36.62	54	-17.38	AVG
7206.000	41.05	2.21	43.26	74	-30.74	peak
7206.000	32.57	2.21	34.78	54	-19.22	AVG

Remark:  
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	47.51	0.08	47.59	74	-26.41	peak
4804.000	38.64	0.08	38.72	54	-15.28	AVG
7206.000	42.19	2.21	44.4	74	-29.6	peak
7206.000	33.24	2.21	35.45	54	-18.55	AVG

Remark:  
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 2	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	45.26	0.14	45.4	74	-28.6	peak
4880.000	36.54	0.14	36.68	54	-17.32	AVG
7320.000	40.16	2.36	42.52	74	-31.48	peak
7320.000	32.57	2.36	34.93	54	-19.07	AVG

Remark:  
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 2	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	46.28	0.14	46.42	74	-27.58	peak
4880.000	36.27	0.14	36.41	54	-17.59	AVG
7320.000	41.02	2.36	43.38	74	-30.62	peak
7320.000	31.59	2.36	33.95	54	-20.05	AVG

Remark:  
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 3	<b>Antenna</b>	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	46.29	0.22	46.51	74	-27.49	peak
4960.000	37.54	0.22	37.76	54	-16.24	AVG
7440.000	41.02	2.64	43.66	74	-30.34	peak
7440.000	32.58	2.64	35.22	54	-18.78	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 3	<b>Antenna</b>	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	43.15	0.22	43.37	74	-30.63	peak
4960.000	34.59	0.22	34.81	54	-19.19	AVG
7440.000	39.64	2.64	42.28	74	-31.72	peak
7440.000	30.15	2.64	32.79	54	-21.21	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

**RESULT: PASS**

**Note:**

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

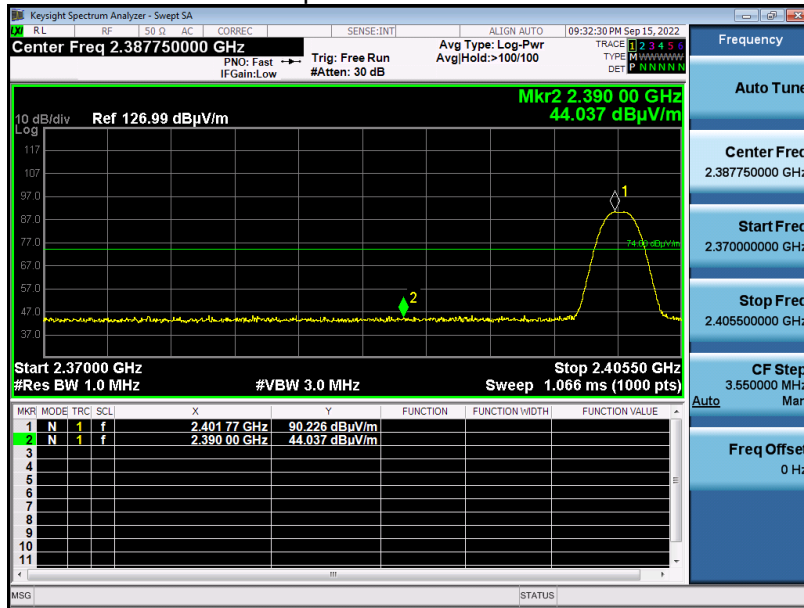
All test modes had been tested. The LE 1Mbps is the worst case and recorded in the report.

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the “Dedicated Testing/Inspection Stamp” is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.

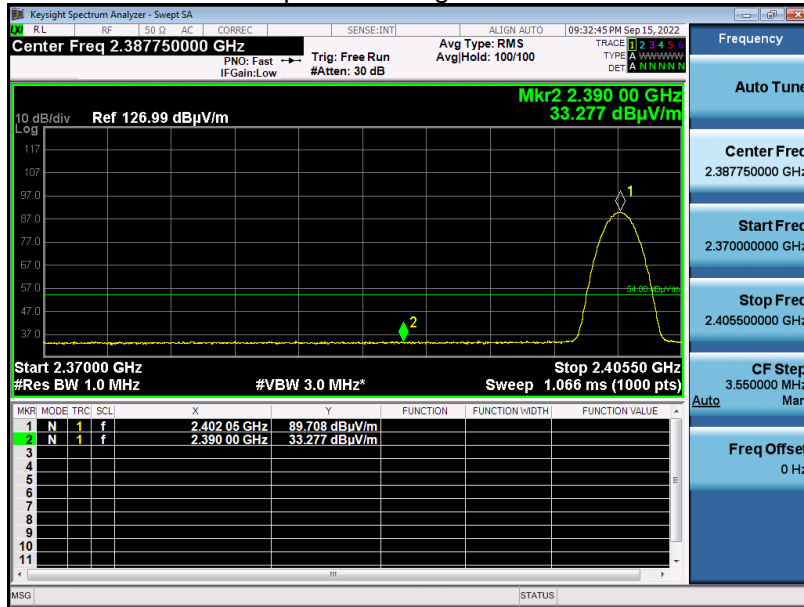
**Test result for band edge emission at restricted bands**

<b>EUT</b>	Excavator Guidance System	<b>Model Name</b>	G21
<b>Temperature</b>	25° C	<b>Relative Humidity</b>	55.4%
<b>Pressure</b>	960hPa	<b>Test Voltage</b>	Normal Voltage
<b>Test Mode</b>	Mode 1	<b>Antenna</b>	Horizontal

**Test Graph for Peak Measurement**



**Test Graph for Average Measurement**



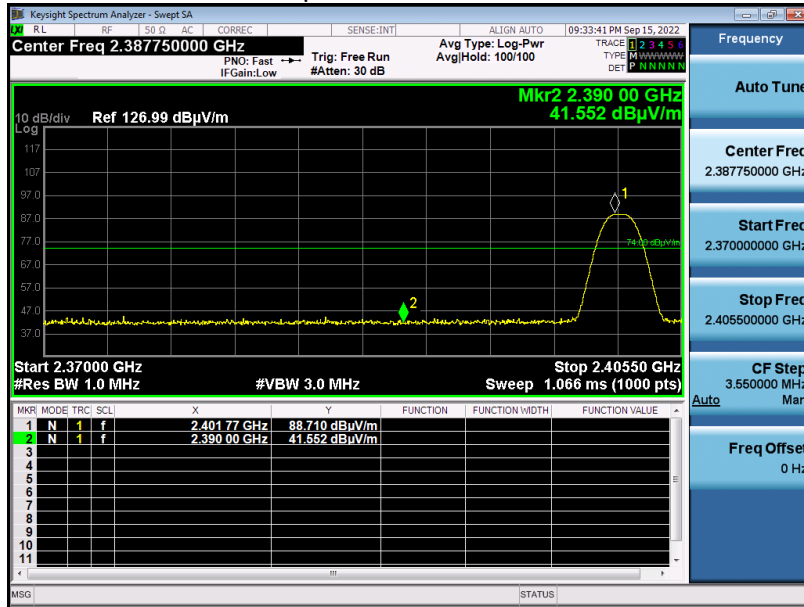
**RESULT: PASS**

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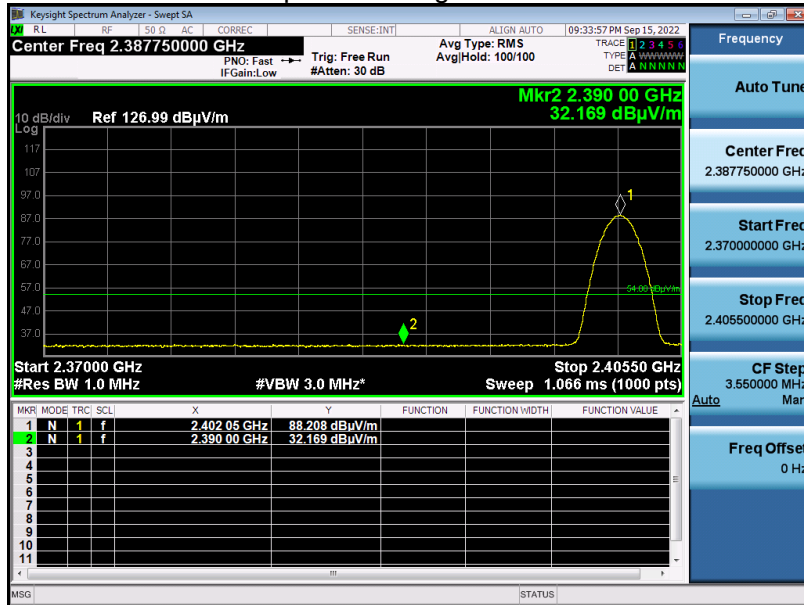


EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



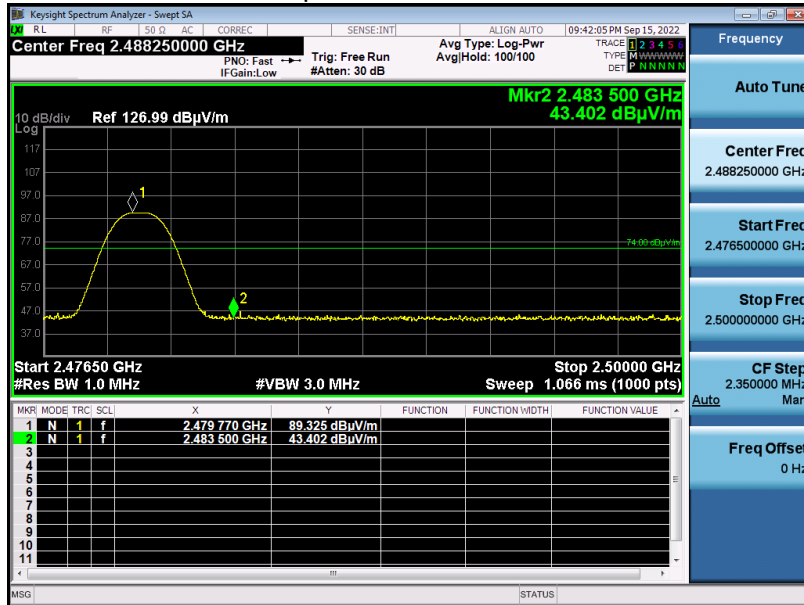
**RESULT: PASS**

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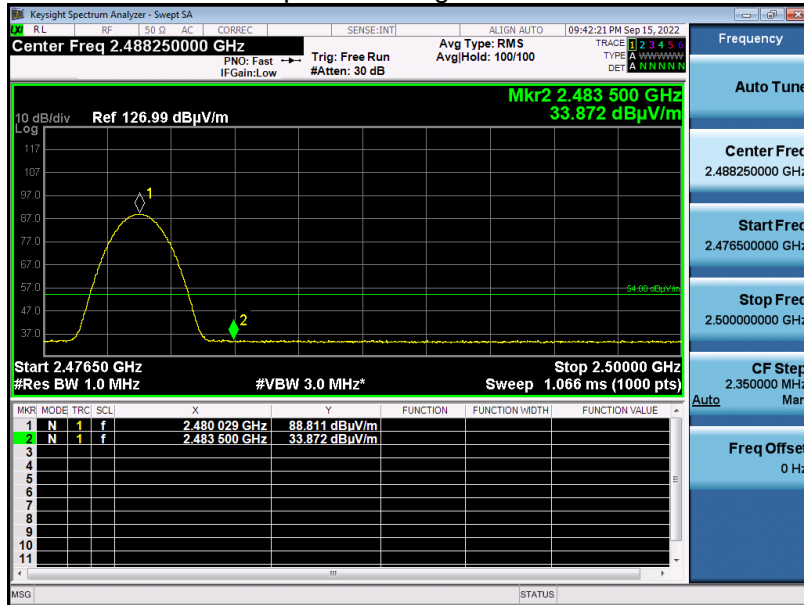
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EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



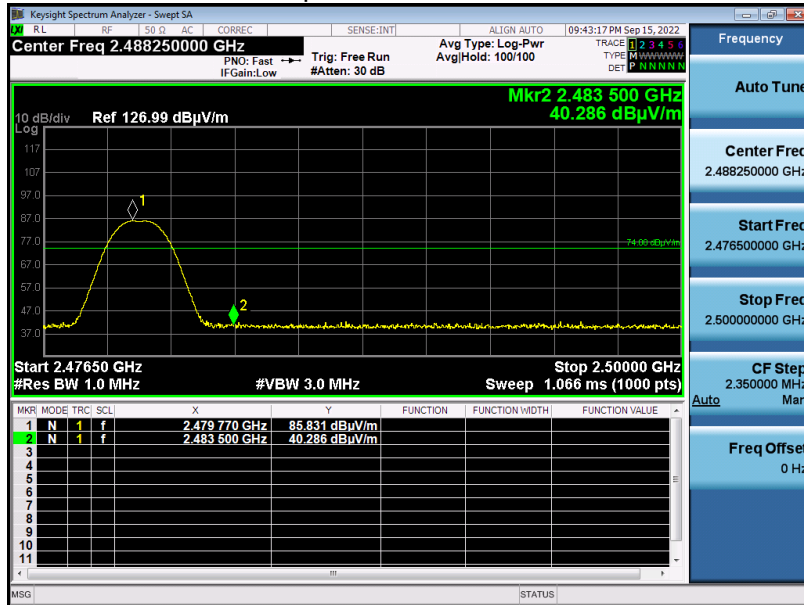
**RESULT: PASS**

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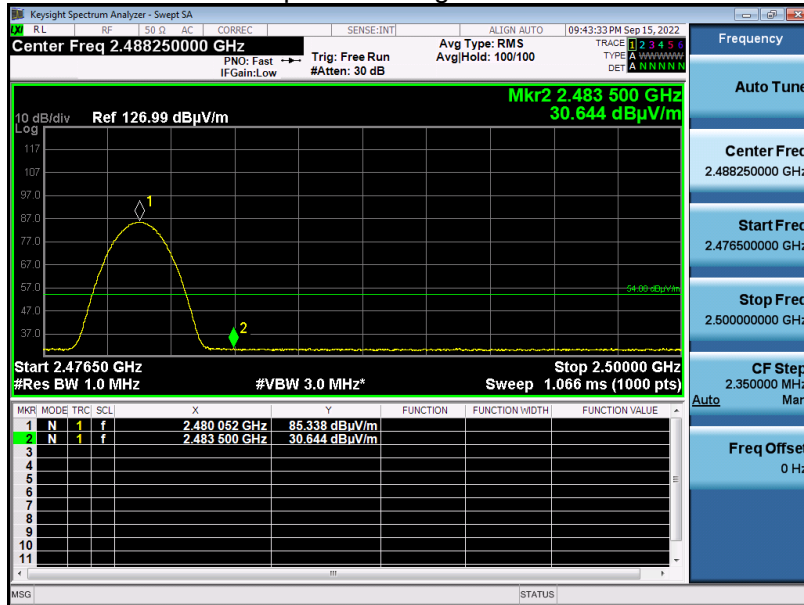
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EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



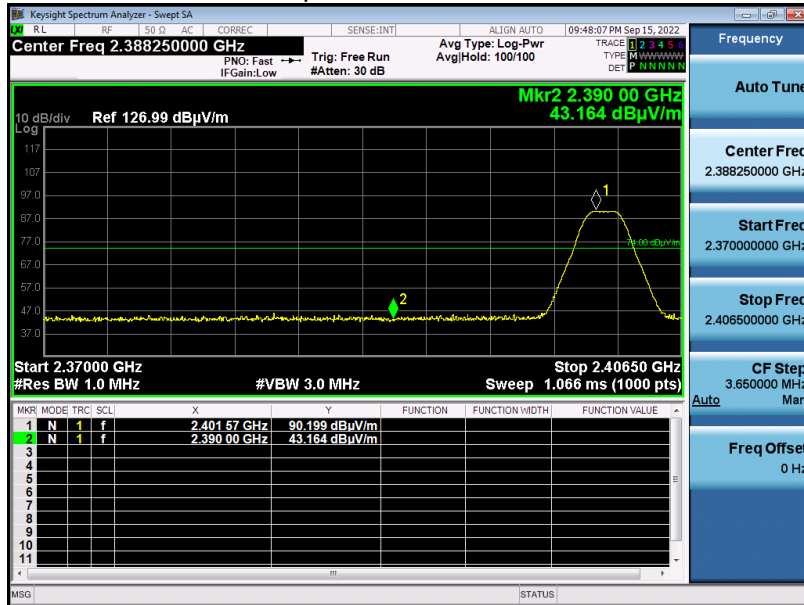
**RESULT: PASS**

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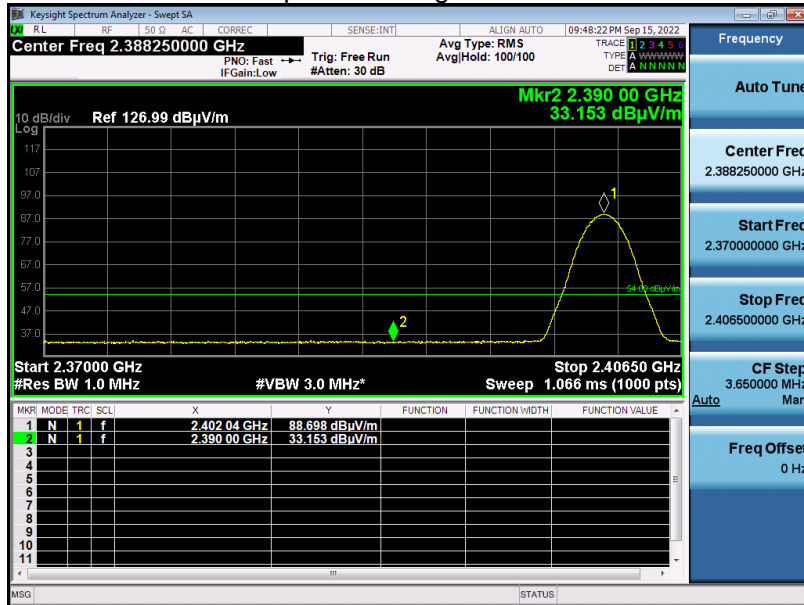
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EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



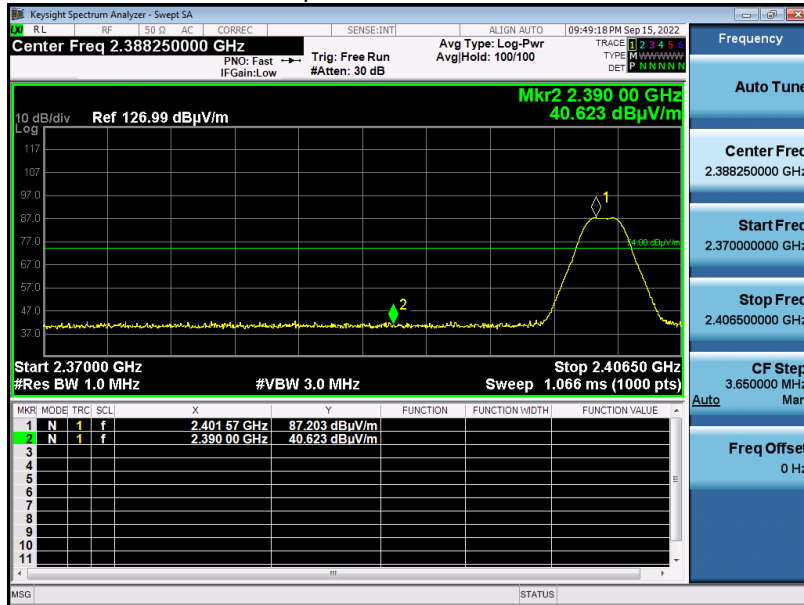
**RESULT: PASS**

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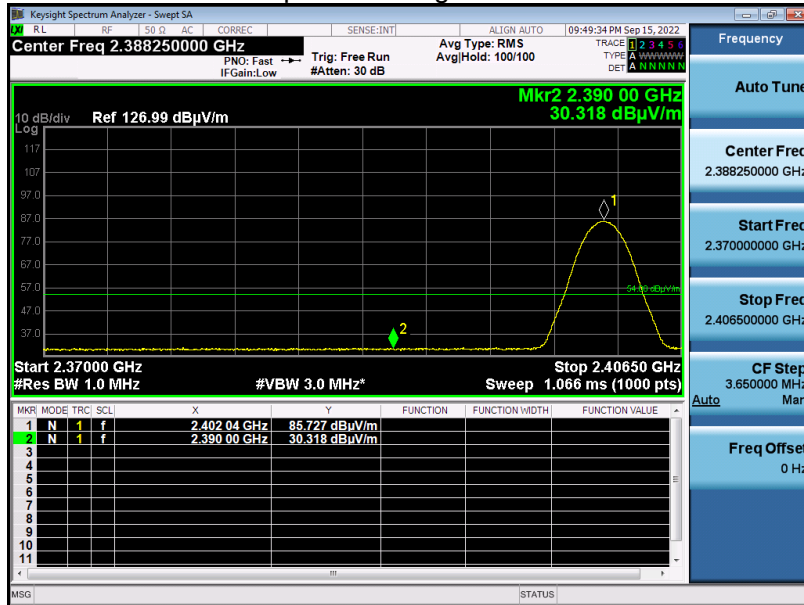
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EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



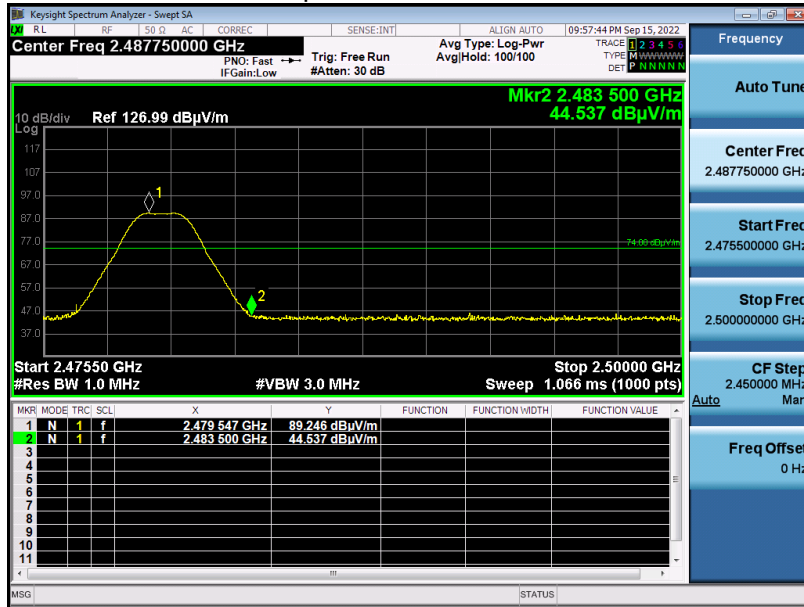
RESULT: PASS

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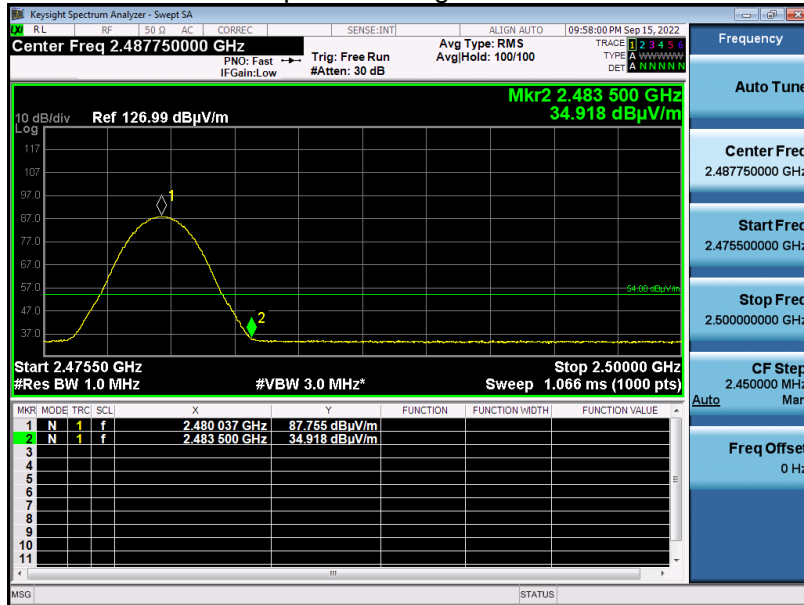
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EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



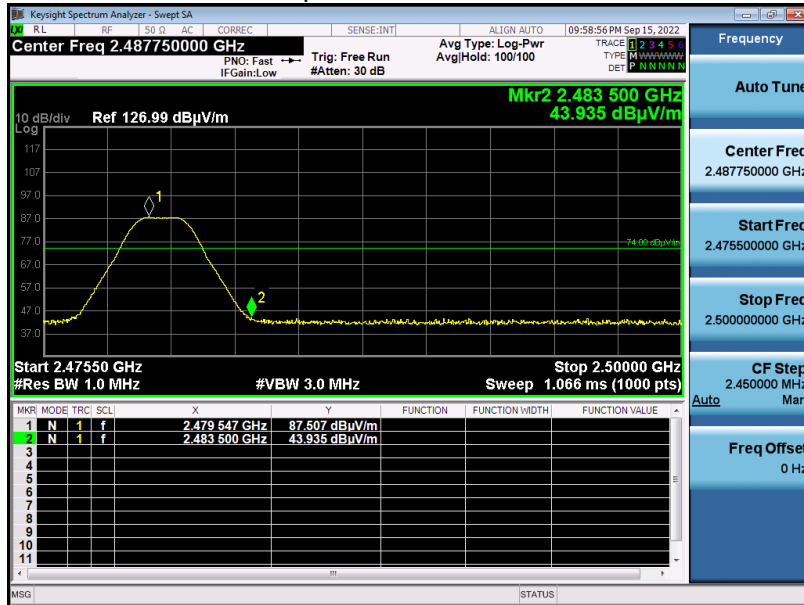
RESULT: PASS

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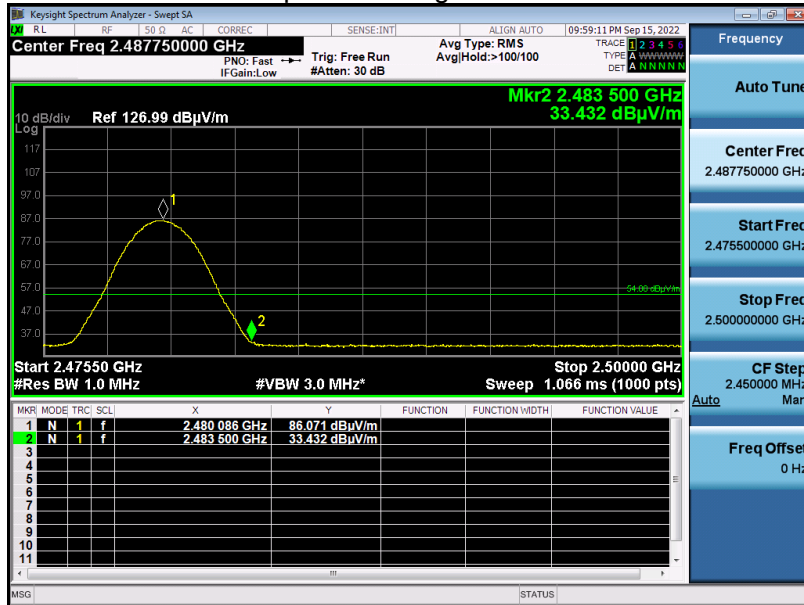
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Tel: +86-755 2523 4088 E-mail: agc@agccert.com Web: http://www.agccert.com/

EUT	Excavator Guidance System	Model Name	G21
Temperature	25° C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 6	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



**RESULT: PASS**

Note: The factor had been edited in the “Input Correction” of the Spectrum Analyzer.

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## 12. LINE CONDUCTED EMISSION TEST

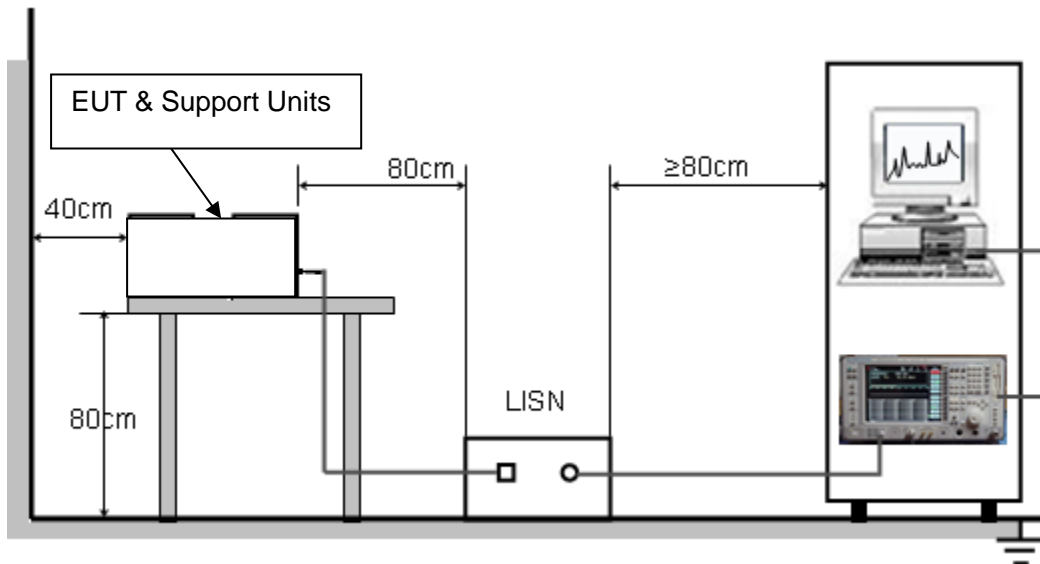
### 12.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.( dBuV)	Average( dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



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### 12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 5V power from adapter which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

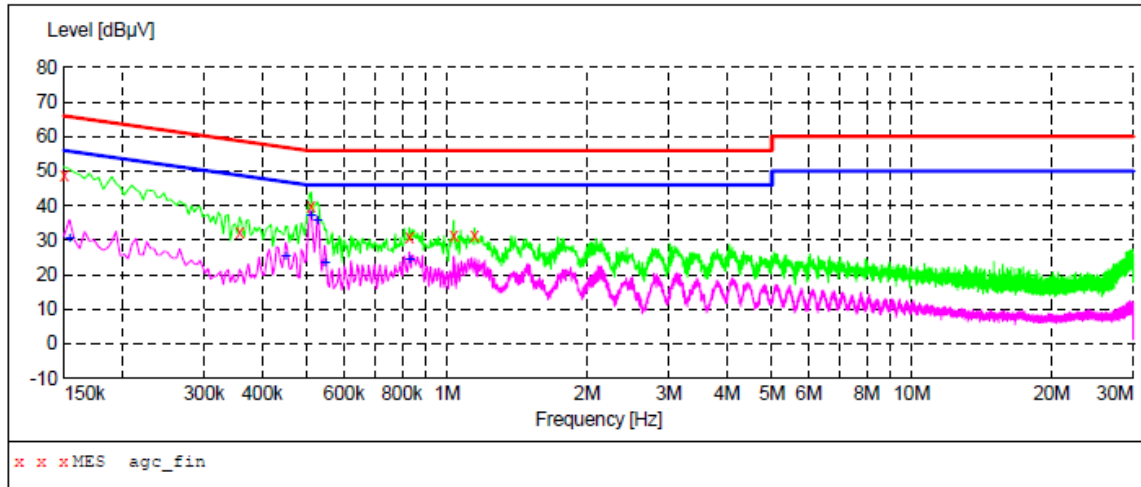
### 12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less – 2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

### 12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

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Line Conducted Emission Test Line 1-L



**MEASUREMENT RESULT: "agc\_fin"**

2023/4/7 9:32

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.150000	48.70	6.2	66	17.3	QP	L1
0.358000	32.20	6.2	59	26.6	QP	L1
0.510000	39.80	6.2	56	16.2	QP	L1
0.830000	30.70	6.3	56	25.3	QP	L1
1.034000	31.20	6.3	56	24.8	QP	L1
1.146000	31.20	6.3	56	24.8	QP	L1

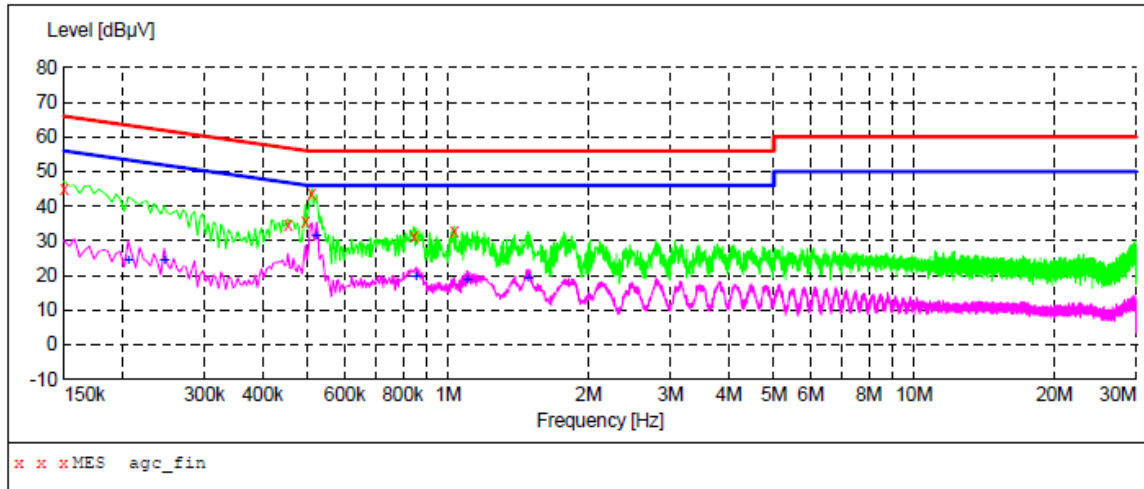
**MEASUREMENT RESULT: "agc\_fin2"**

2023/4/7 9:32

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.154000	30.20	6.2	56	25.6	AV	L1
0.450000	25.20	6.2	47	21.7	AV	L1
0.510000	37.10	6.2	46	8.9	AV	L1
0.526000	35.50	6.2	46	10.5	AV	L1
0.546000	23.30	6.2	46	22.7	AV	L1
0.830000	24.50	6.3	46	21.5	AV	L1

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Line Conducted Emission Test Line 2-N



**MEASUREMENT RESULT: "agc\_fin"**

2023/4/7 9:36

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.150000	44.90	6.2	66	21.1	QP	N
0.454000	34.70	6.2	57	22.1	QP	N
0.494000	35.40	6.2	56	20.7	QP	N
0.510000	43.60	6.2	56	12.4	QP	N
0.846000	31.20	6.3	56	24.8	QP	N
1.030000	32.60	6.3	56	23.4	QP	N

**MEASUREMENT RESULT: "agc\_fin2"**

2023/4/7 9:37

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.206000	24.50	6.2	53	28.9	AV	N
0.246000	24.40	6.2	52	27.5	AV	N
0.522000	31.40	6.2	46	14.6	AV	N
0.854000	19.70	6.3	46	26.3	AV	N
1.098000	18.60	6.3	46	27.4	AV	N
1.486000	19.10	6.3	46	26.9	AV	N

**RESULT: PASS**

Note: All the test modes had been tested, the mode 1 was the worst case. Only the data of the worst case would be record in this test report.

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## **APPENDIX A: PHOTOGRAPHS OF TEST SETUP**

Refer to the Report No.: AGC12845220807AP02

## **APPENDIX B: PHOTOGRAPHS OF EUT**

Refer to the Report No.: AGC12845220807AP03

**----END OF REPORT----**

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7. Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.
8. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.
9. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.

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