

FCC Test Report

Report No.: AGC12848210701FE02

FCC ID : 2A2JO-BST1

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION : Black Shark BS-T1 true wireless bluetooth gaming earbuds

BRAND NAME : Black Shark

MODEL NAME : BS-T1, BS-T2, BS-T3, BS-T4, BS-T5, BS-T6, BS-T7, BS-T8,
BS-T9, BS-T10, BS-T11, BS-T12, BS-T13, BS-T14, BS-T15,
BS-T16, BS-T17, BS-T18, BS-T19, BS-T20, BS-T21,
BS-T22, BS-T23, BS-T24, BS-T25, BS-T26, BS-T27, BS-T28

APPLICANT : Shenzhen GreyShark Technology Co. LTD

DATE OF ISSUE : Jul. 21, 2021

STANDARD(S) : FCC Part 15.247

REPORT VERSION : V1.0

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul. 21, 2021	Valid	Initial Release

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1. VERIFICATION OF COMPLIANCE

Applicant	Shenzhen GreyShark Technology Co. LTD
Address	Room 1501, Building 1, Chongwen Park, Nanshan Zhiyuan, No. 3370, Liuxian Avenue, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Manufacturer	Guangdong Mingji Hi-Tech Electronics Co., Ltd.
Address	No.12 Changfu Road, Qinghutou, Tangxia Town, Dongguan City, Guangdong Province, China
Factory	Guangdong Mingji Hi-Tech Electronics Co., Ltd.
Address	No.12 Changfu Road, Qinghutou, Tangxia Town, Dongguan City, Guangdong Province, China
Product Designation	Black Shark BS-T1 true wireless bluetooth gaming earbuds
Brand Name	Black Shark
Test Model	BS-T1
Series Model	BS-T2, BS-T3, BS-T4, BS-T5, BS-T6, BS-T7, BS-T8, BS-T9, BS-T10, BS-T11, BS-T12, BS-T13, BS-T14, BS-T15, BS-T16, BS-T17, BS-T18, BS-T19, BS-T20, BS-T21, BS-T22, BS-T23, BS-T24, BS-T25, BS-T26, BS-T27, BS-T28
Declaration of Difference	All the same except for the model name.
Date of test	Jul. 15, 2021 to Jul. 21, 2021
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	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



Kelly Cheng
(Project Engineer)

Jul. 21, 2021

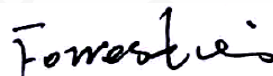
Reviewed By



Max Zhang
(Reviewer)

Jul. 21, 2021

Approved By



Forrest Lei
(Authorized Officer)

Jul. 21, 2021

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as a “Black Shark BS-T1 true wireless bluetooth gaming earbuds”. 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

Operation Frequency	2.402 GHz to 2.480GHz
RF Output Power	1M: 1.456dBm (Max) 2M: 1.454dBm (Max)
Bluetooth Version	V5.2
Modulation	BR ☐ GFSK, EDR ☐ π /4-DQPSK, ☐ 8DPSK BLE ☒ GFSK 1Mbps ☒ GFSK 2Mbps
Number of channels	40 Channel
Antenna Designation	FPC Antenna
Antenna Gain	1.5dBi
Hardware Version	V1.2
Software Version	V2.2
Power Supply	DC 3.7V by battery or DC 5V by USB

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: 2A2JO-BST1** 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.

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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	$U_c = \pm 3.1 \text{ dB}$
Uncertainty of Radiated Emission below 1GHz	$U_c = \pm 4.0 \text{ dB}$
Uncertainty of Radiated Emission above 1GHz	$U_c = \pm 4.8 \text{ dB}$
Uncertainty of total RF power, conducted	$U_c = \pm 0.8 \text{ dB}$
Uncertainty of RF power density, conducted	$U_c = \pm 2.6 \text{ dB}$
Uncertainty of spurious emissions, conducted	$U_c = \pm 2 \%$
Uncertainty of Occupied Channel Bandwidth	$U_c = \pm 2 \%$

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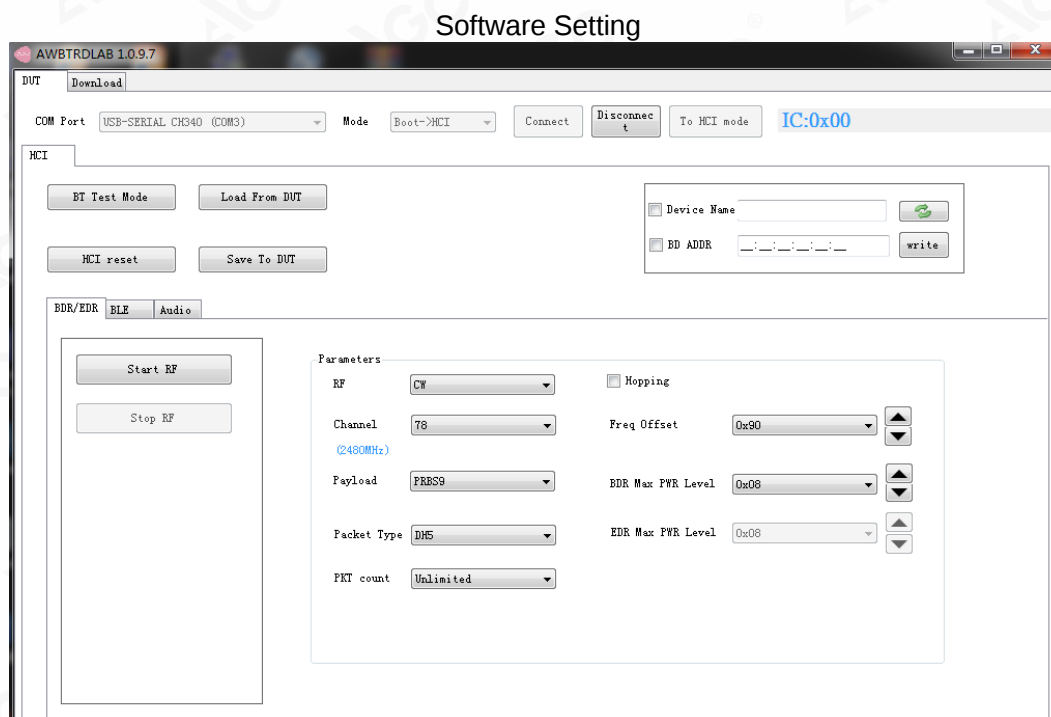


4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Charging mode

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.
4. The EUT comprises left and right channel earphone, both are the same, Both have been tested and only the test data of left earphone recorded in this report.
5. Bluetooth does not work when charging



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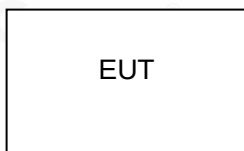
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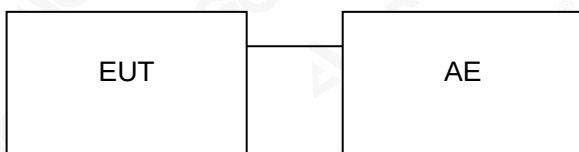
5. SYSTEM TEST CONFIGURATION

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	Black Shark BS-T1 true wireless bluetooth gaming earbuds	BS-T1	2A2JO-BST1	EUT
2	Adapter	ZL-PCB0100020502000	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

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	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	May 15,2021	May 14,2022
LISN	R&S	ESH2-Z5	100086	Jun. 09, 2021	Jun. 08, 2022
Test software	R&S	ES-K1(Ver.V1.71)	N/A	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	May 15,2021	May 14,2022
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2019	Sep. 20, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 08, 2021	Jan. 07, 2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

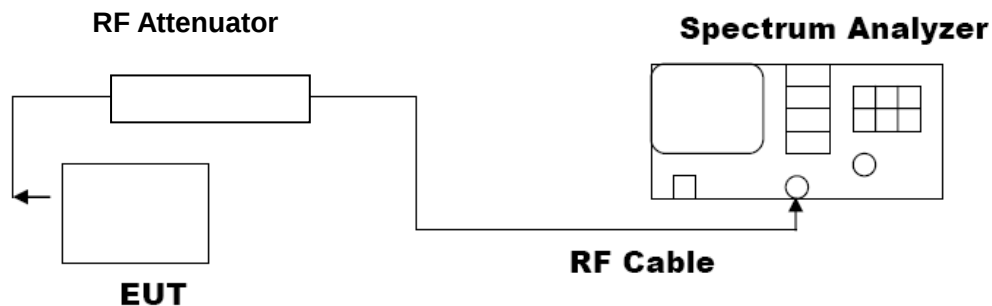
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. $RBW \geq DTS$ bandwidth
3. $VBW \geq 3 \times RBW$.
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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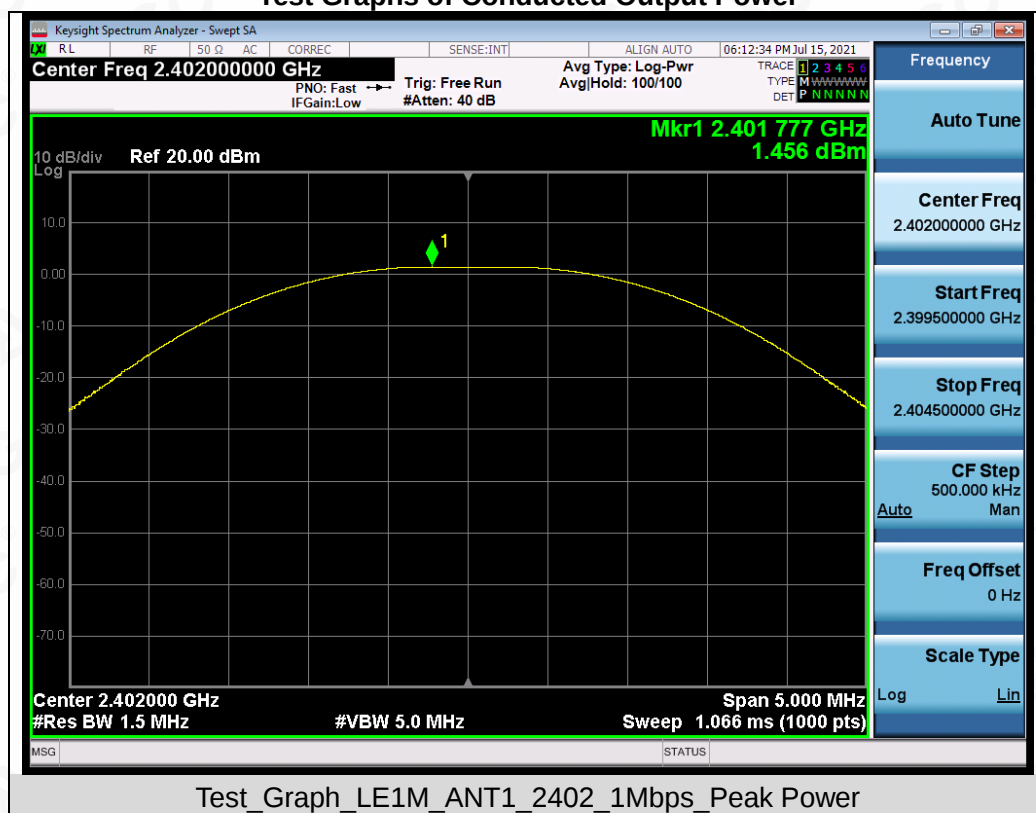
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7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power				
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK 1M	2402	1.456	≤ 30	Pass
	2440	1.412	≤ 30	Pass
	2480	1.048	≤ 30	Pass

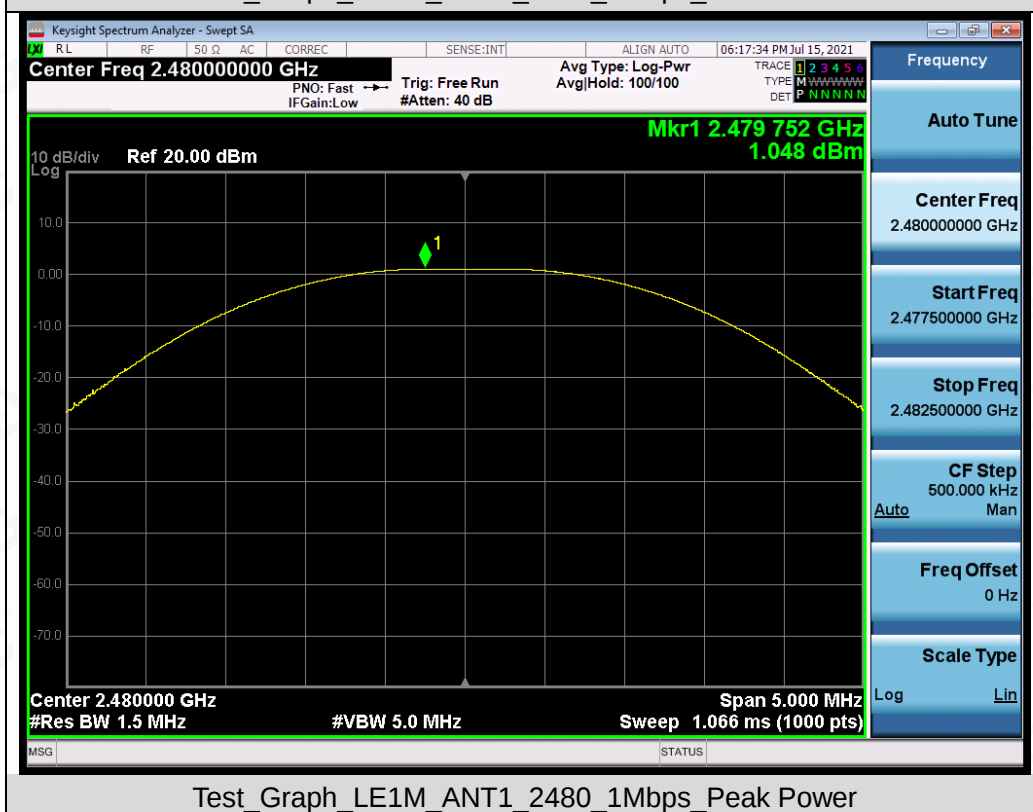
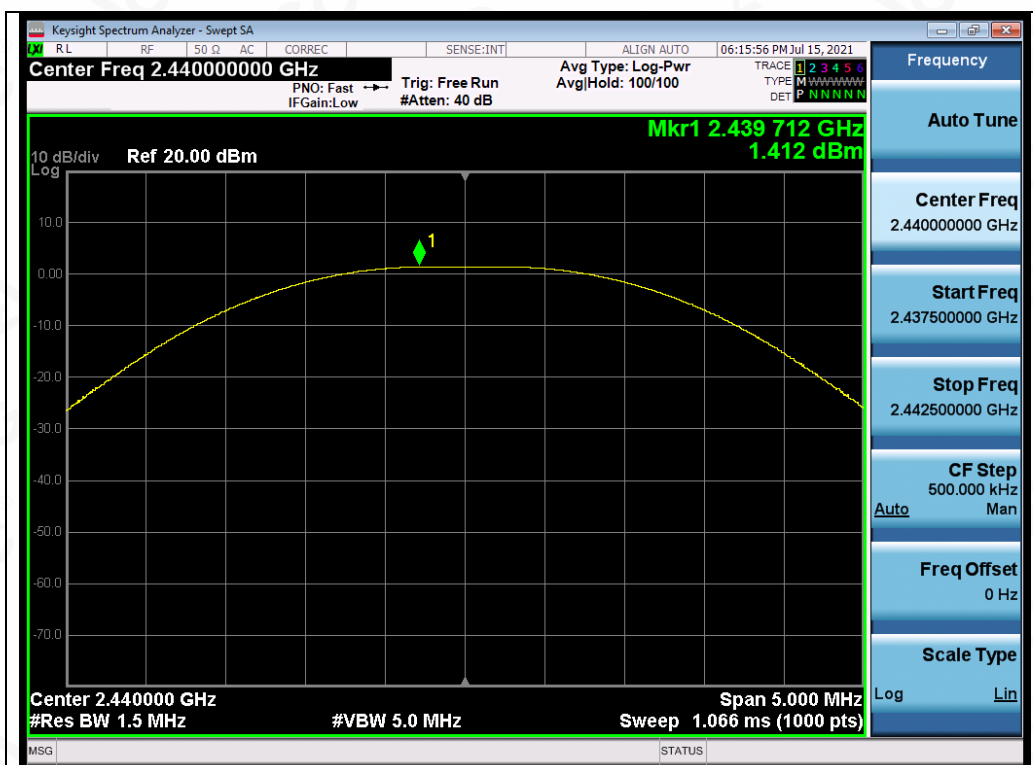
Test Graphs of Conducted Output Power



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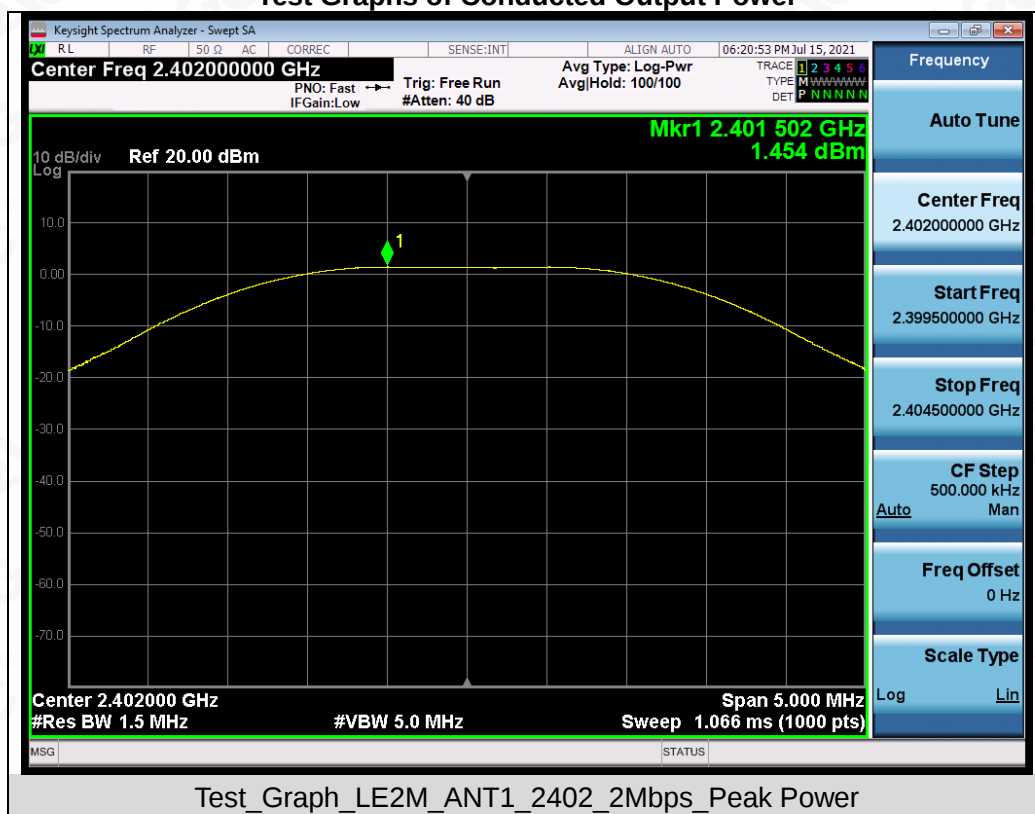
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Test Data of Conducted Output Power				
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK 2M	2402	1.454	≤ 30	Pass
	2440	1.422	≤ 30	Pass
	2480	1.087	≤ 30	Pass

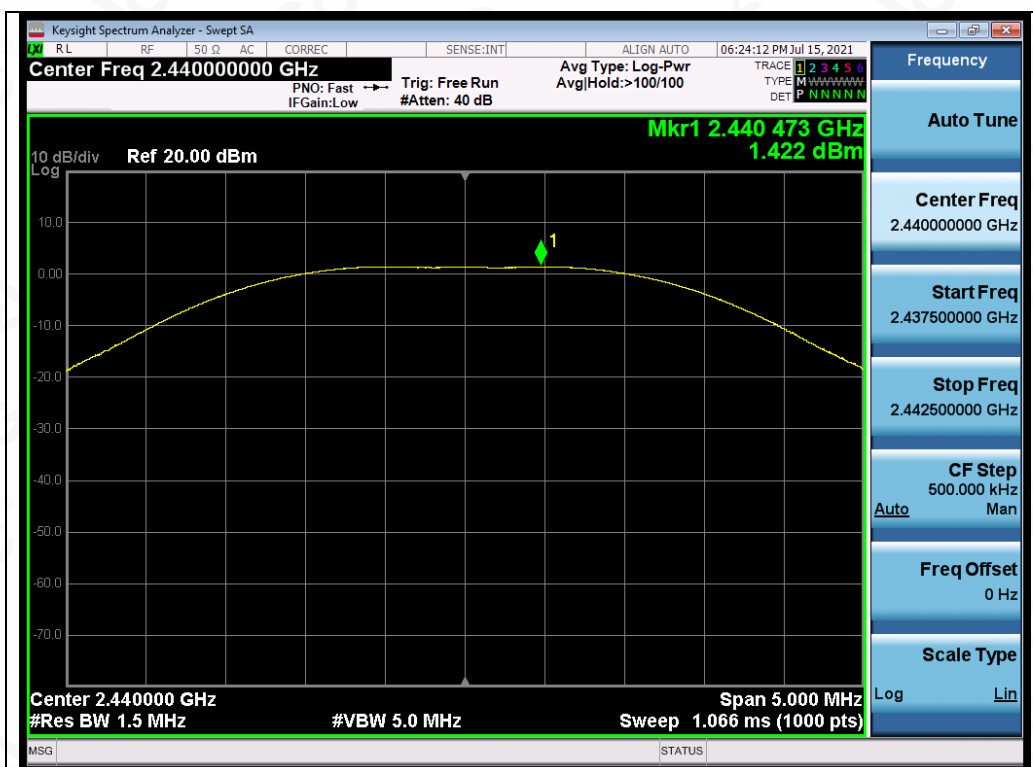
Test Graphs of Conducted Output Power



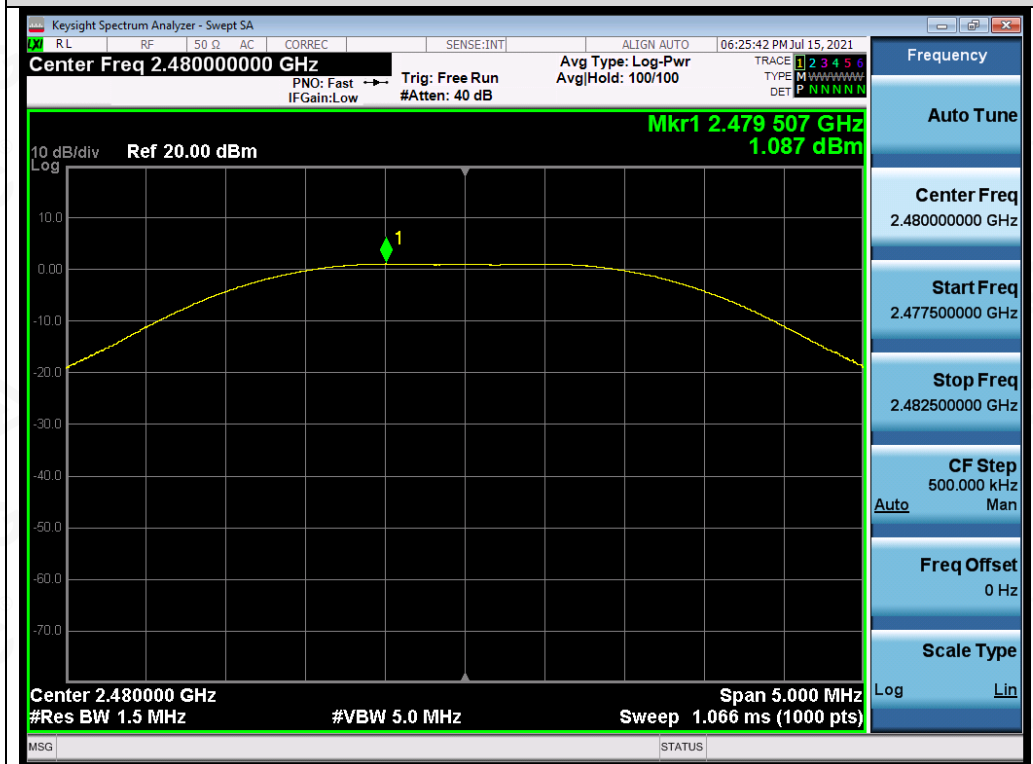
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Test_Graph_LE2M_ANT1_2440_2Mbps_Peak Power



Test_Graph_LE2M_ANT1_2480_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	1.037	0.677	≥ 0.5	Pass
	2440	1.035	0.674	≥ 0.5	Pass
	2480	1.035	0.675	≥ 0.5	Pass

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Test Graphs of Occupied Bandwidth



Test_Graph_LE1M_ANT1_2402_1Mbps_OBW

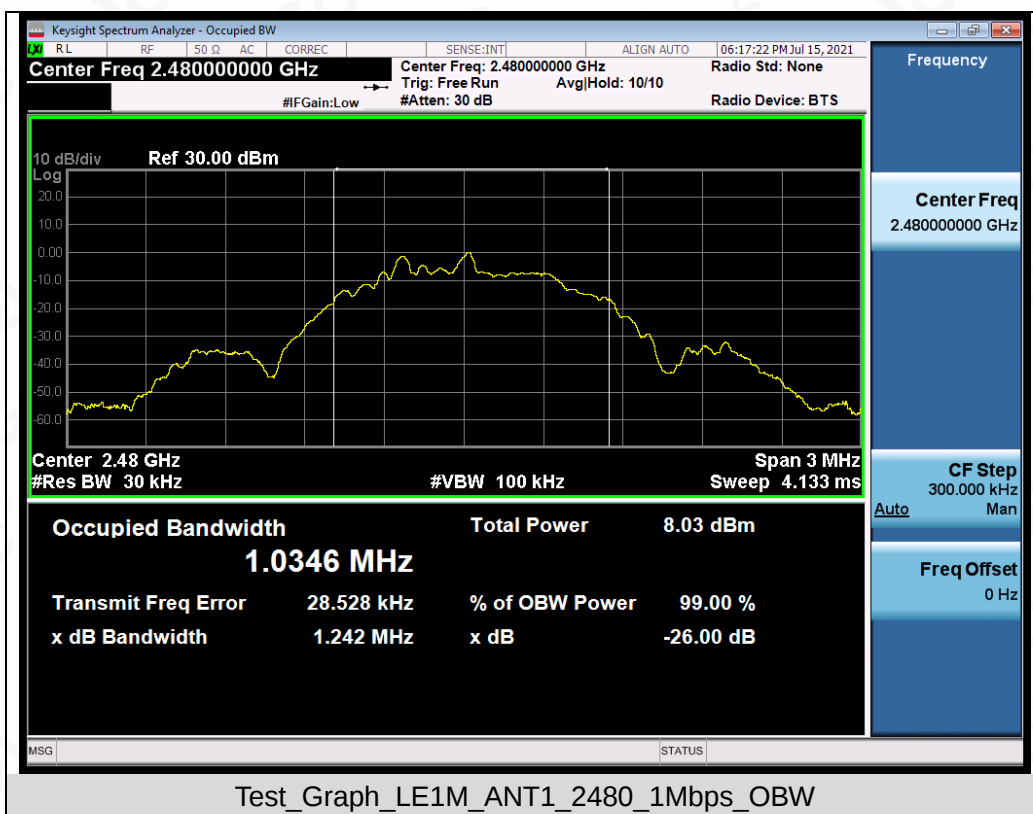


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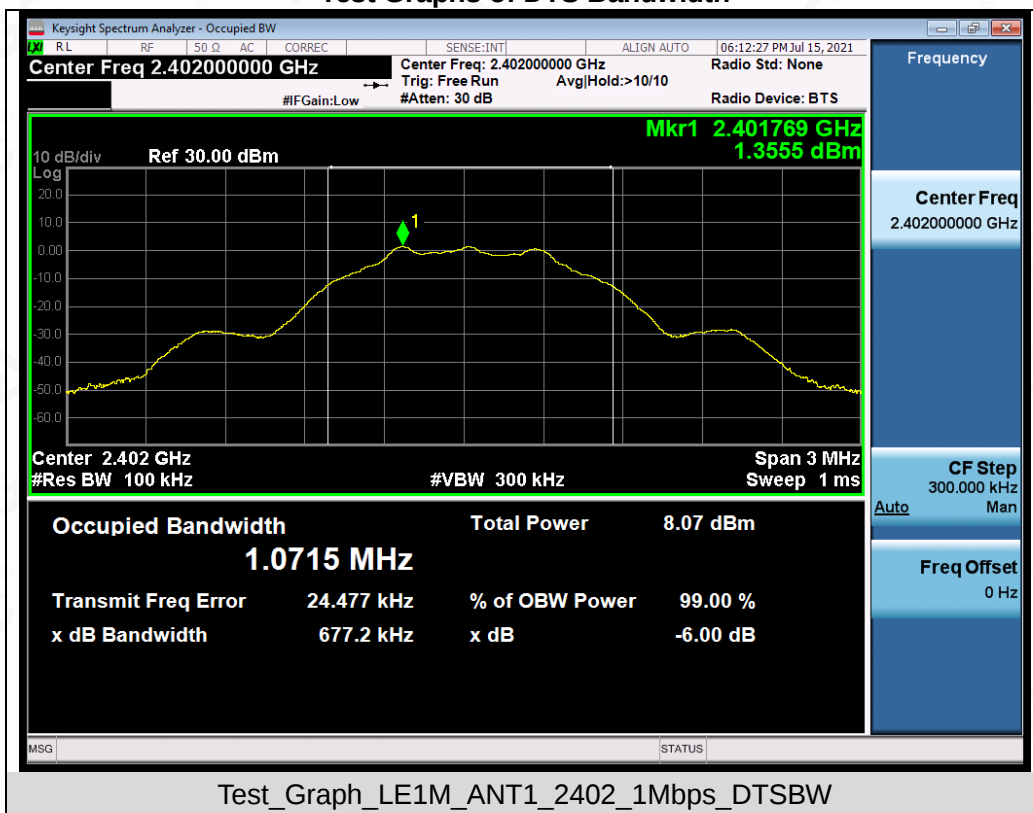
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Test Graphs of DTS Bandwidth



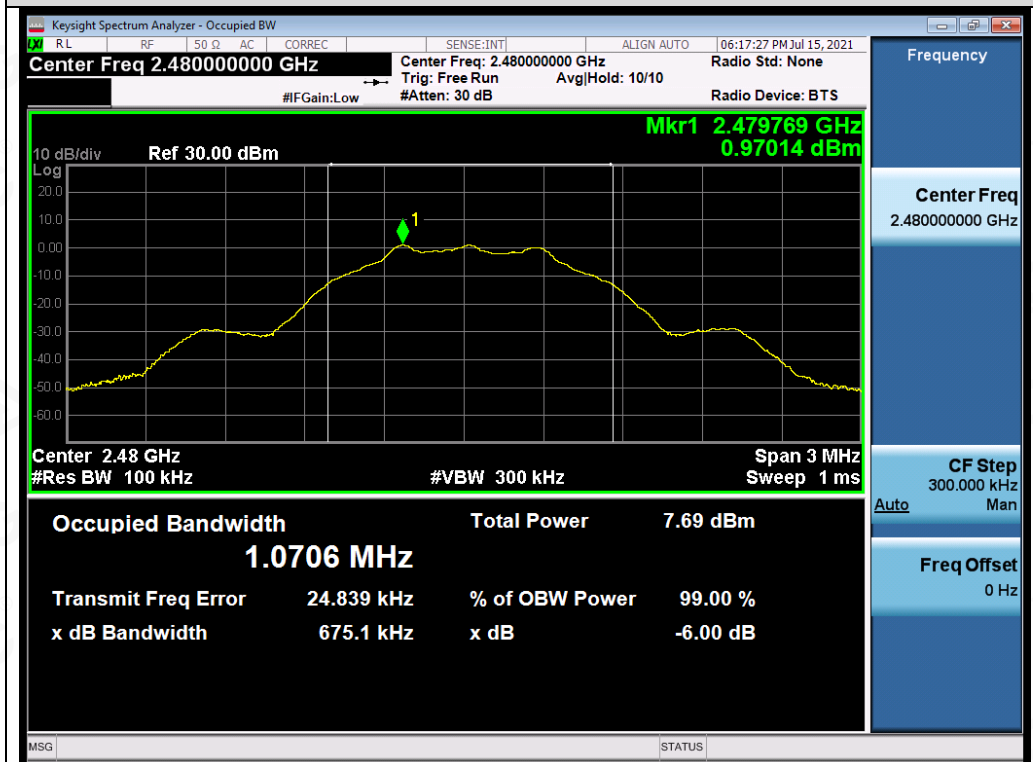
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Test_Graph_LE1M_ANT1_2440_1Mbps_DTSBW



Test_Graph_LE1M_ANT1_2480_1Mbps_DTSBW

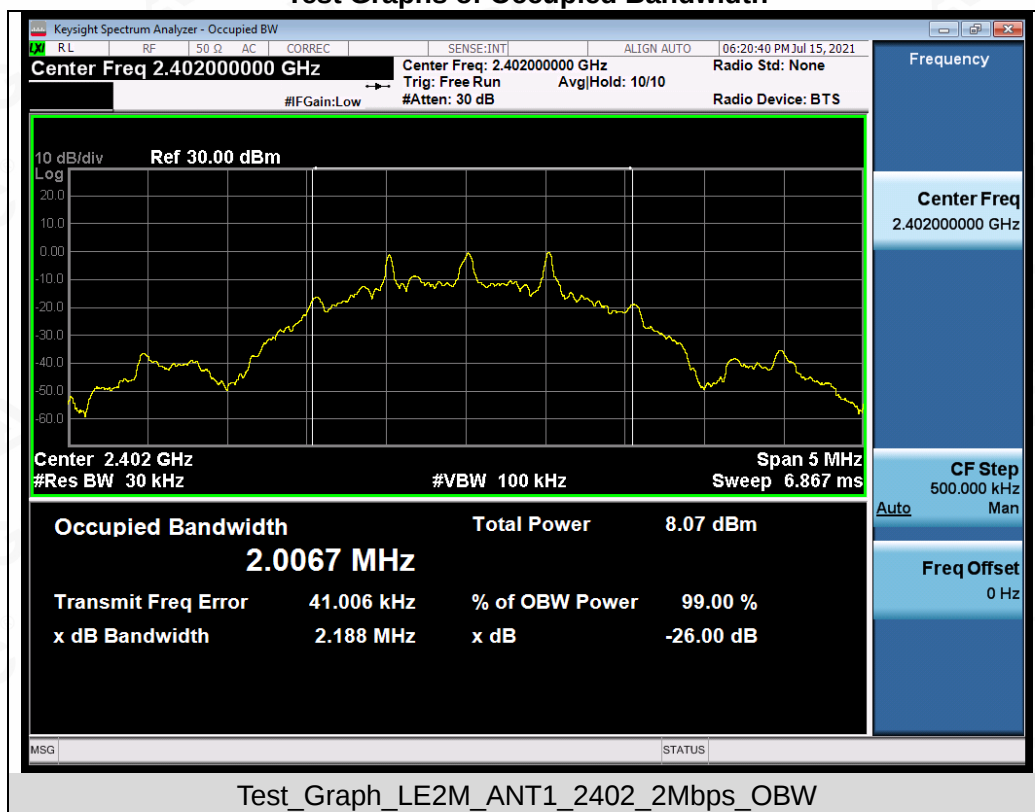
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Test Data of Occupied Bandwidth and DTS Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
GFSK 2M	2402	2.007	1.160	≥ 0.5	Pass
	2440	2.007	1.167	≥ 0.5	Pass
	2480	2.008	1.164	≥ 0.5	Pass

Test Graphs of Occupied Bandwidth



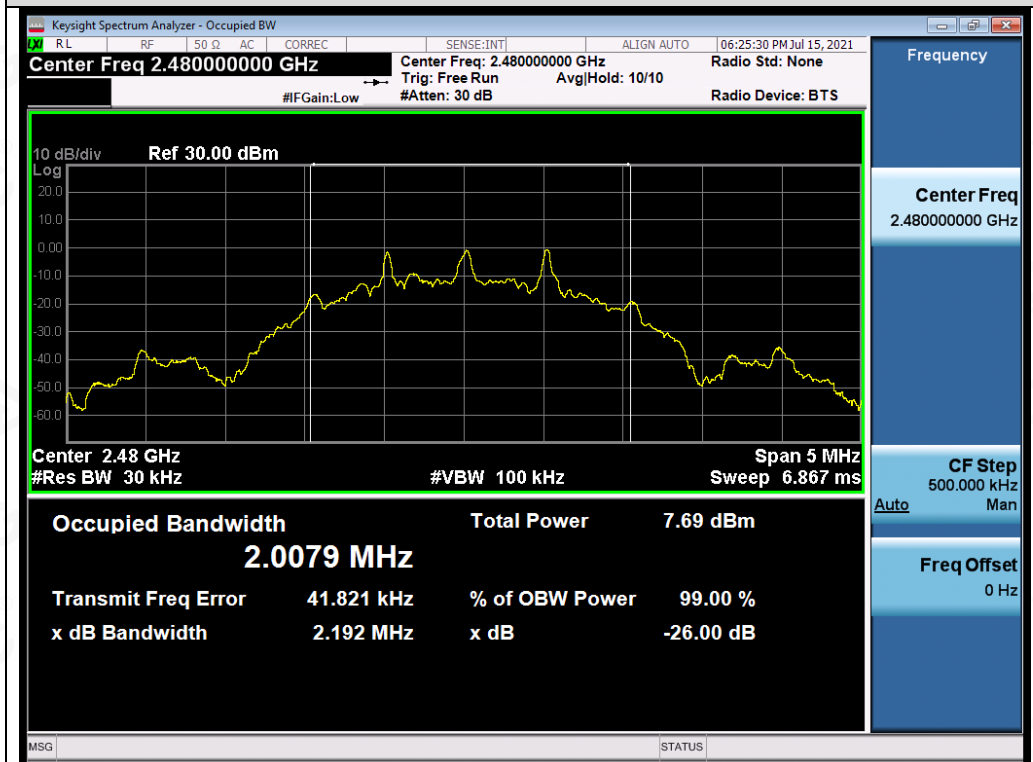
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Test_Graph_LE2M_ANT1_2440_2Mbps_OBW



Test_Graph_LE2M_ANT1_2480_2Mbps_OBW

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Test Graphs of DTS Bandwidth



Test_Graph_LE2M_ANT1_2402_2Mbps_DTSBW

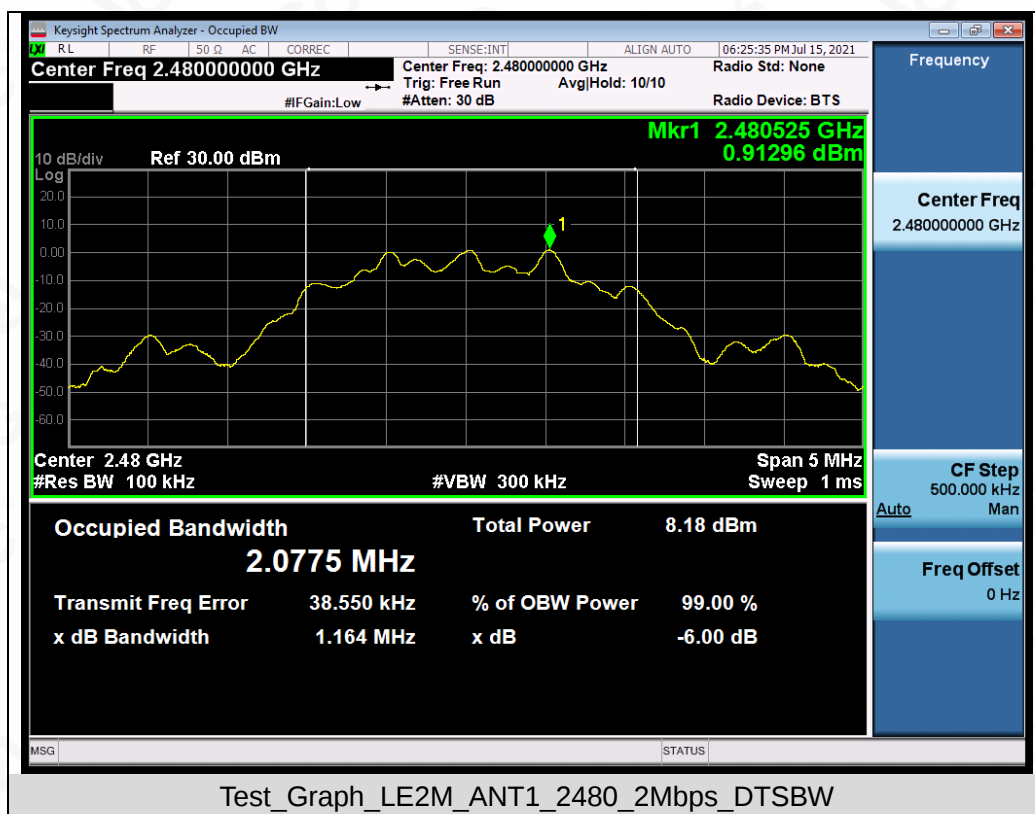


Test_Graph_LE2M_ANT1_2440_2Mbps_DTSBW

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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

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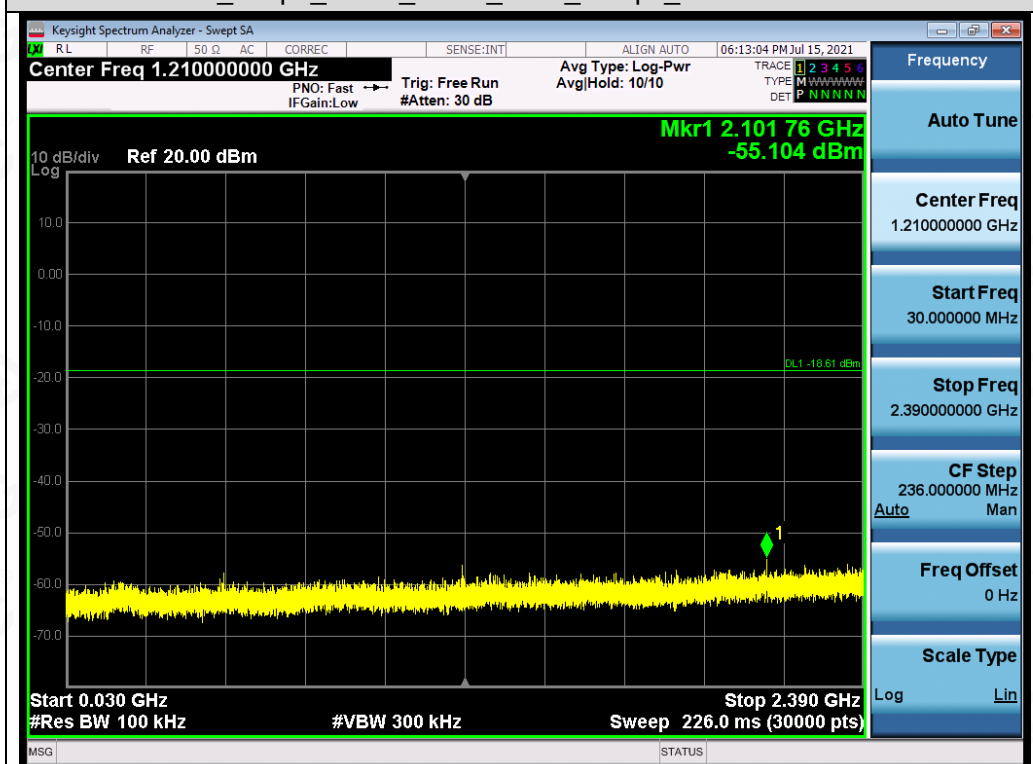
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Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Test_Graph_LE1M_ANT1_2402_1Mbps_Reference Level

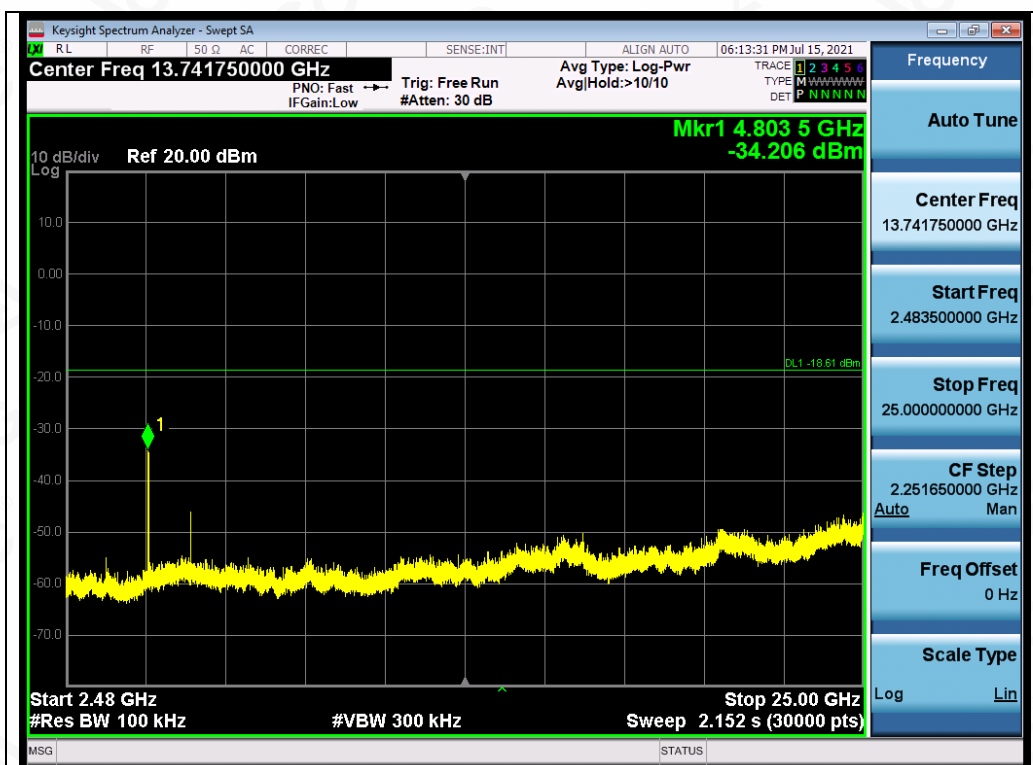


Test_Graph_LE1M_ANT1_2402_1Mbps_Lower Band Emissions

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Test_Graph_LE1M_ANT1_2402_1Mbps_Higher Band Emissions

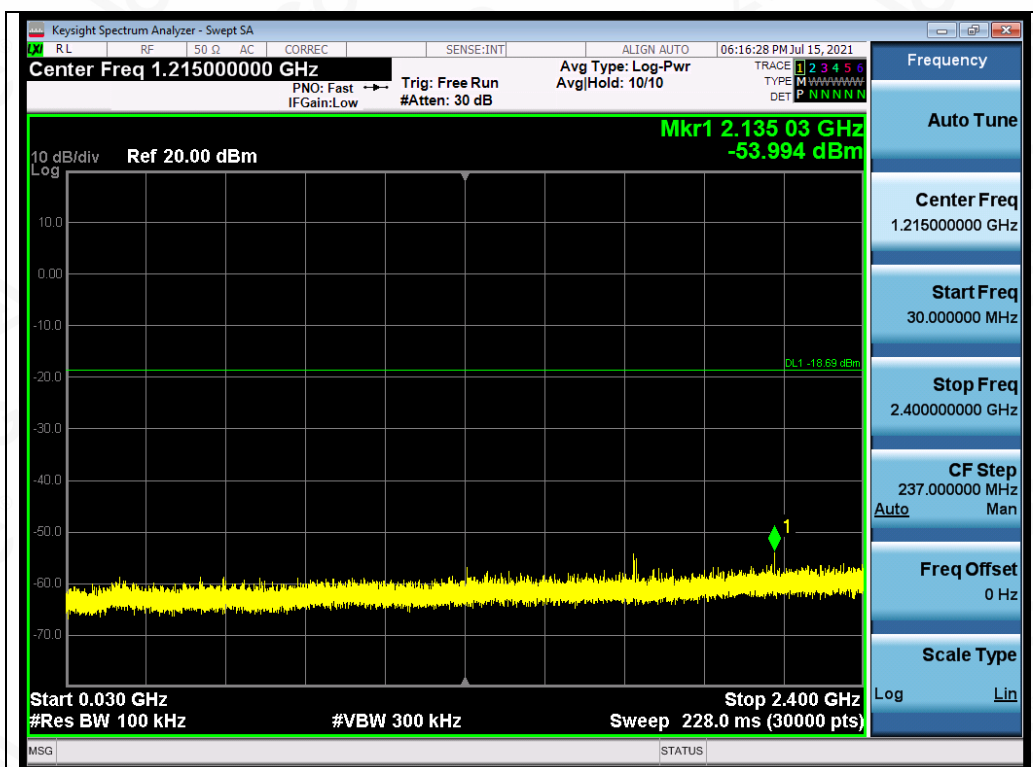


Test_Graph_LE1M_ANT1_2440_1Mbps_Reference Level

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Test_Graph_LE1M_ANT1_2440_1Mbps_Lower Band Emissions



Test_Graph_LE1M_ANT1_2440_1Mbps_Higher Band Emissions

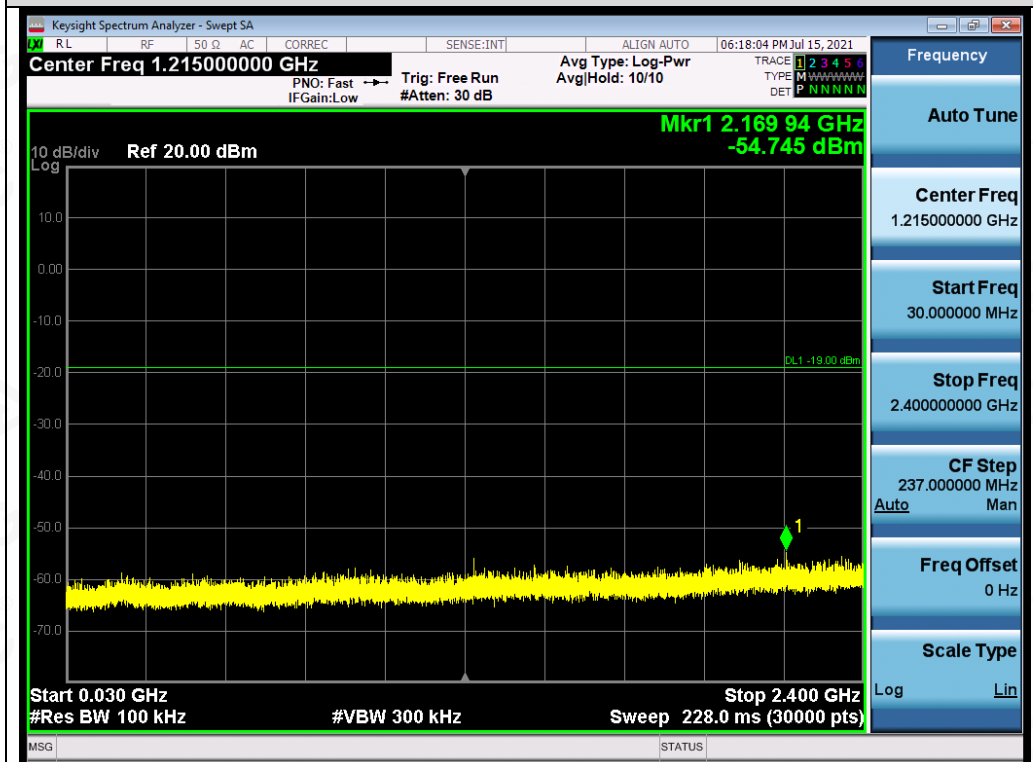
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Test_Graph_LE1M_ANT1_2480_1Mbps_Reference Level

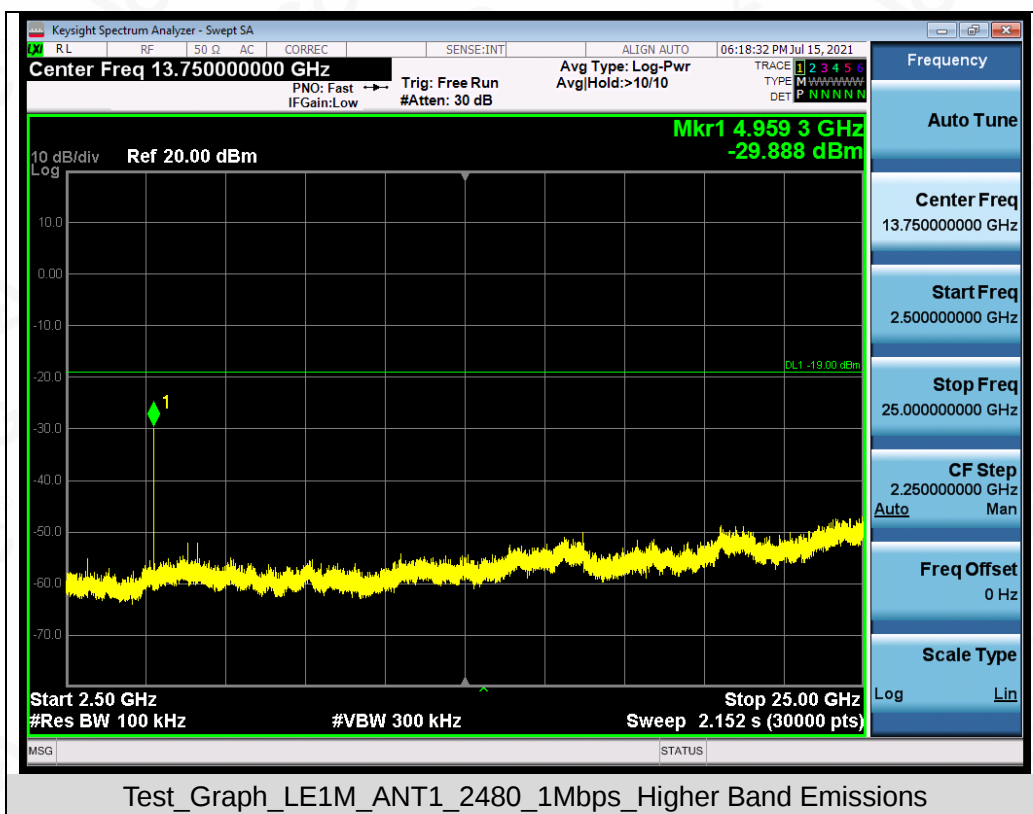


Test_Graph_LE1M_ANT1_2480_1Mbps_Lower Band Emissions

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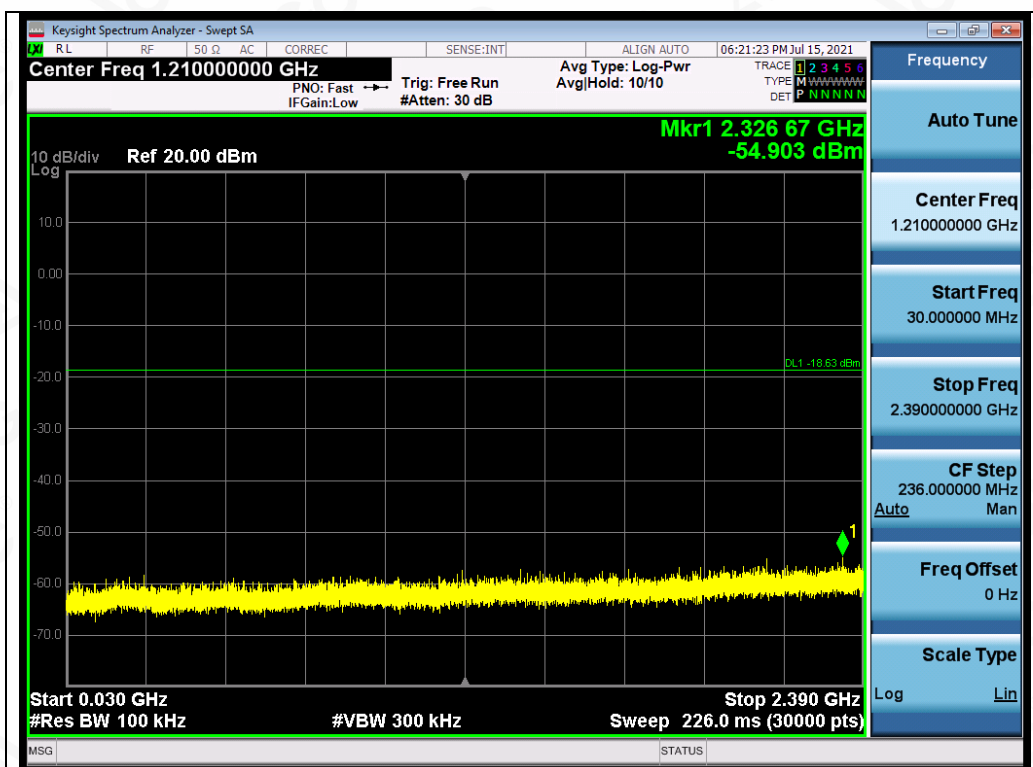
Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



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Test_Graph_LE2M_ANT1_2402_2Mbps_Lower Band Emissions



Test_Graph_LE2M_ANT1_2402_2Mbps_Higher Band Emissions

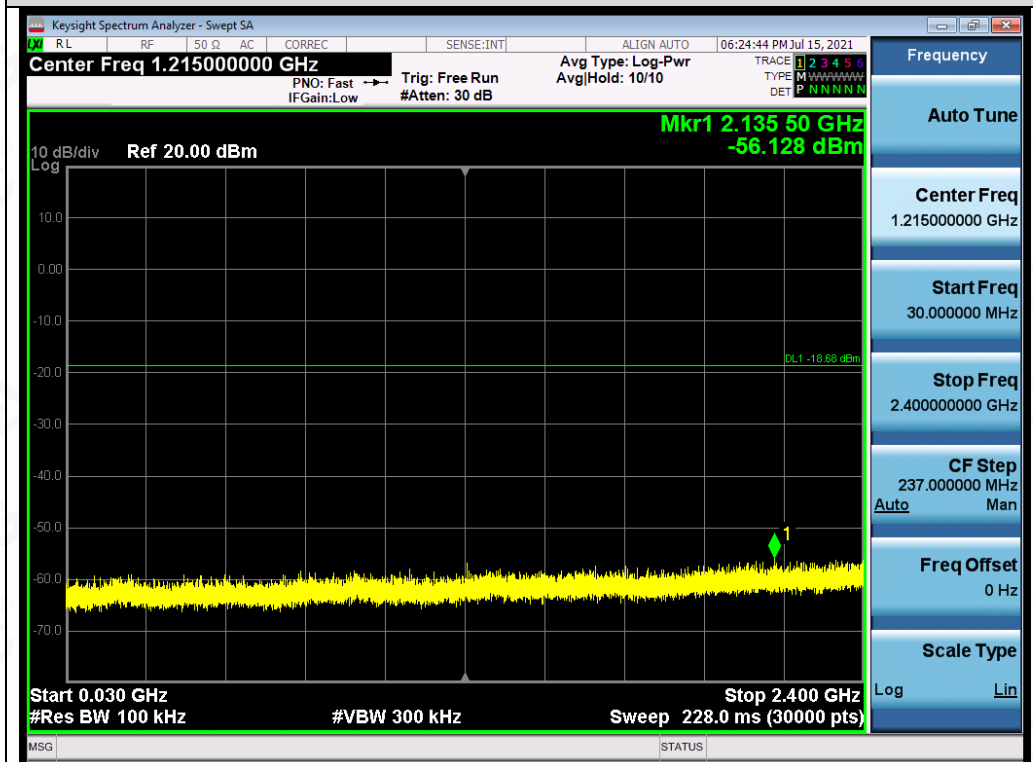
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Test_Graph_LE2M_ANT1_2440_2Mbps_Reference Level

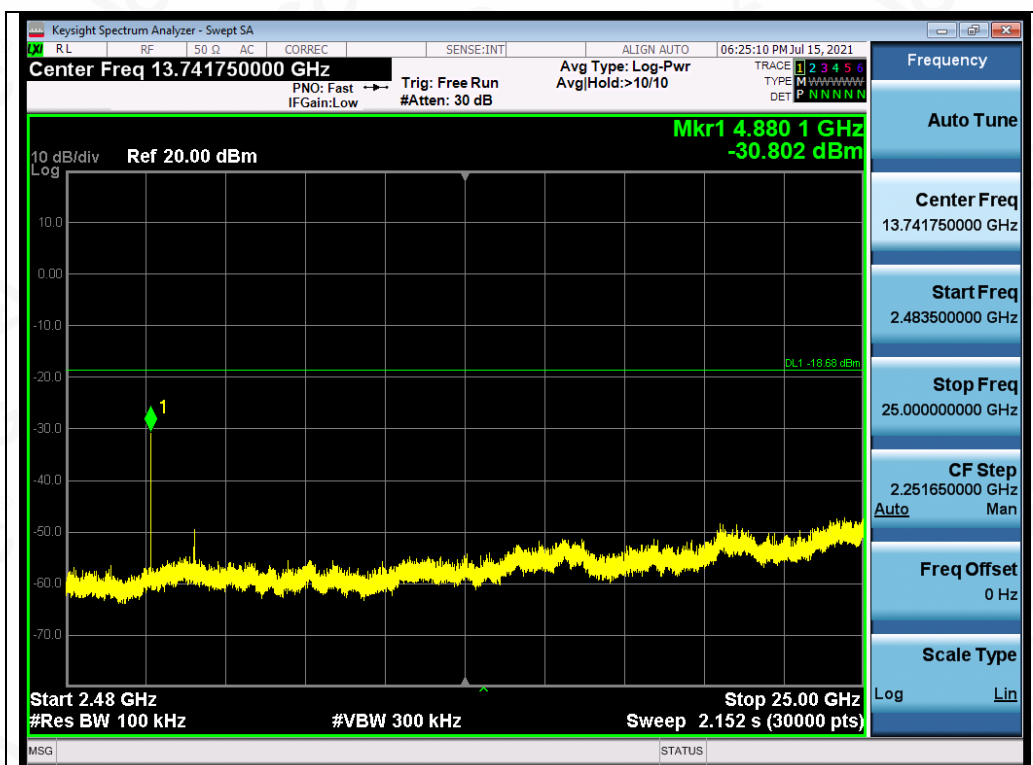


Test_Graph_LE2M_ANT1_2440_2Mbps_Lower Band Emissions

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Test_Graph_LE2M_ANT1_2440_2Mbps_Higher Band Emissions

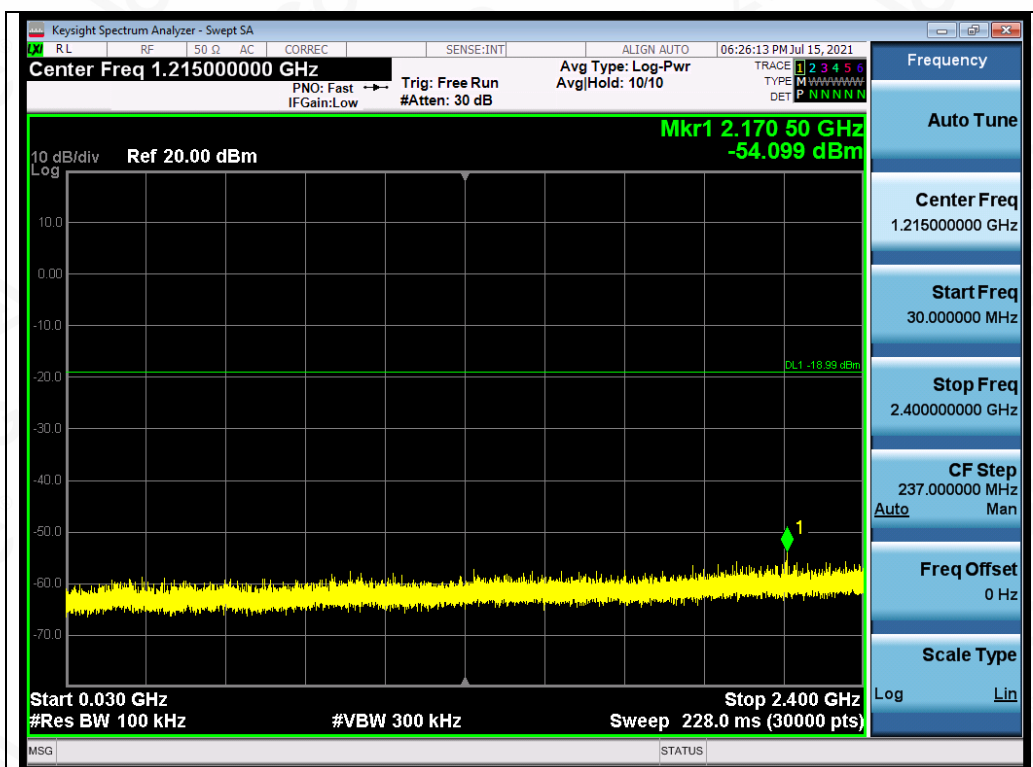


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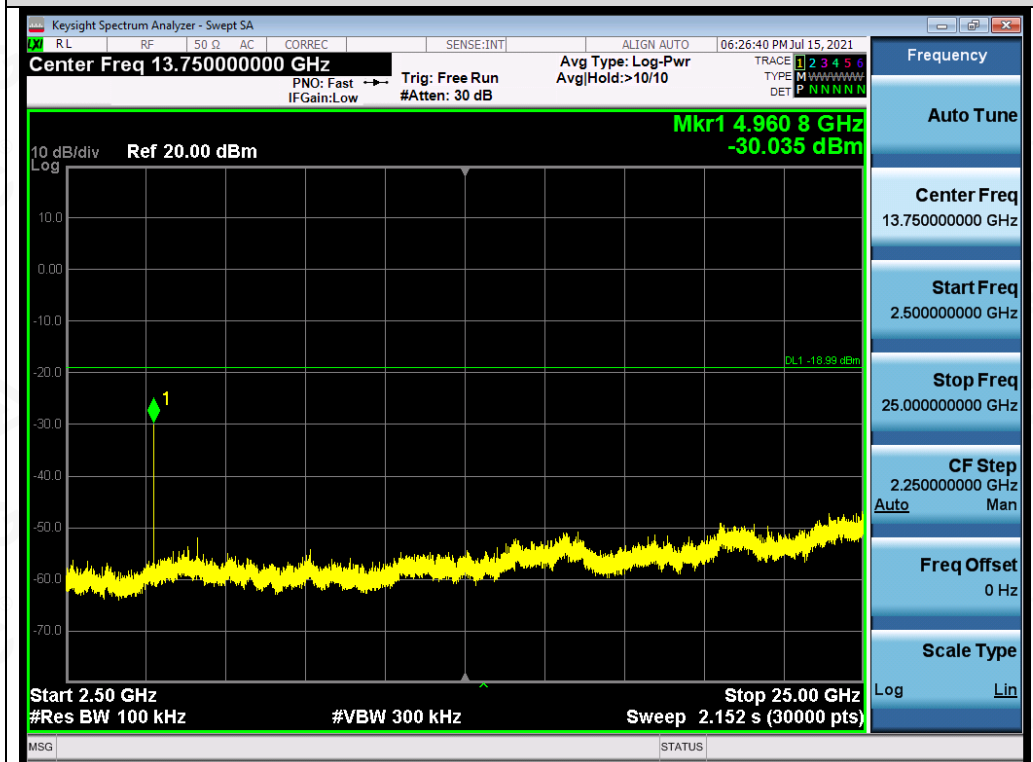
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Test_Graph_LE2M_ANT1_2480_2Mbps_Lower Band Emissions



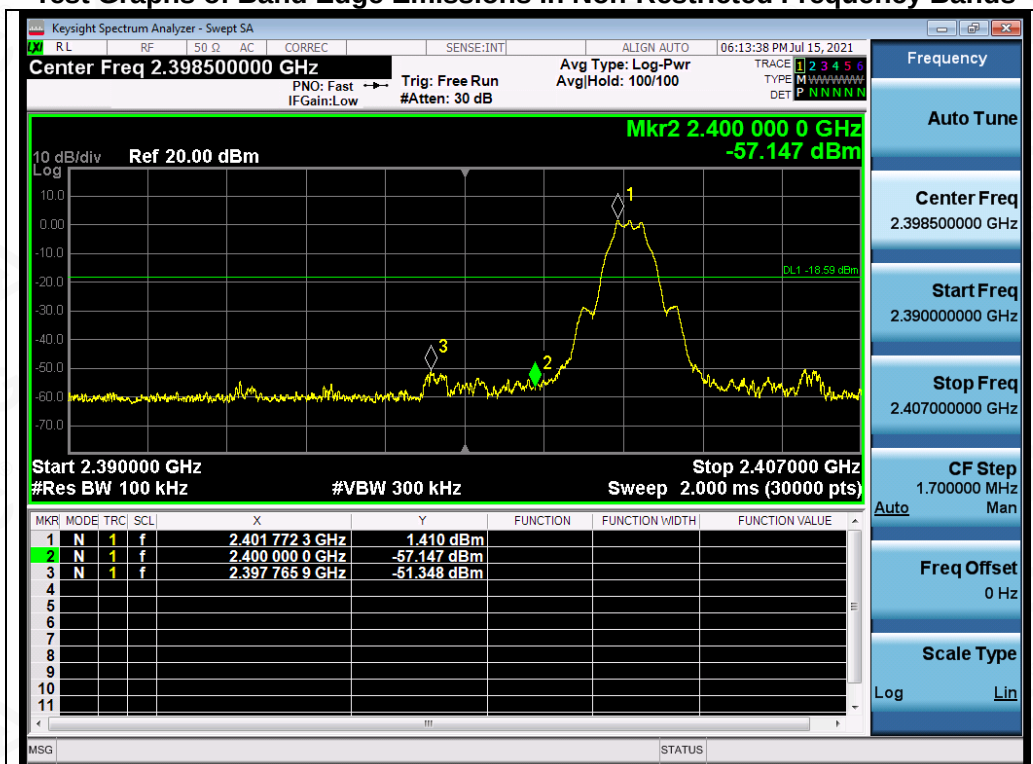
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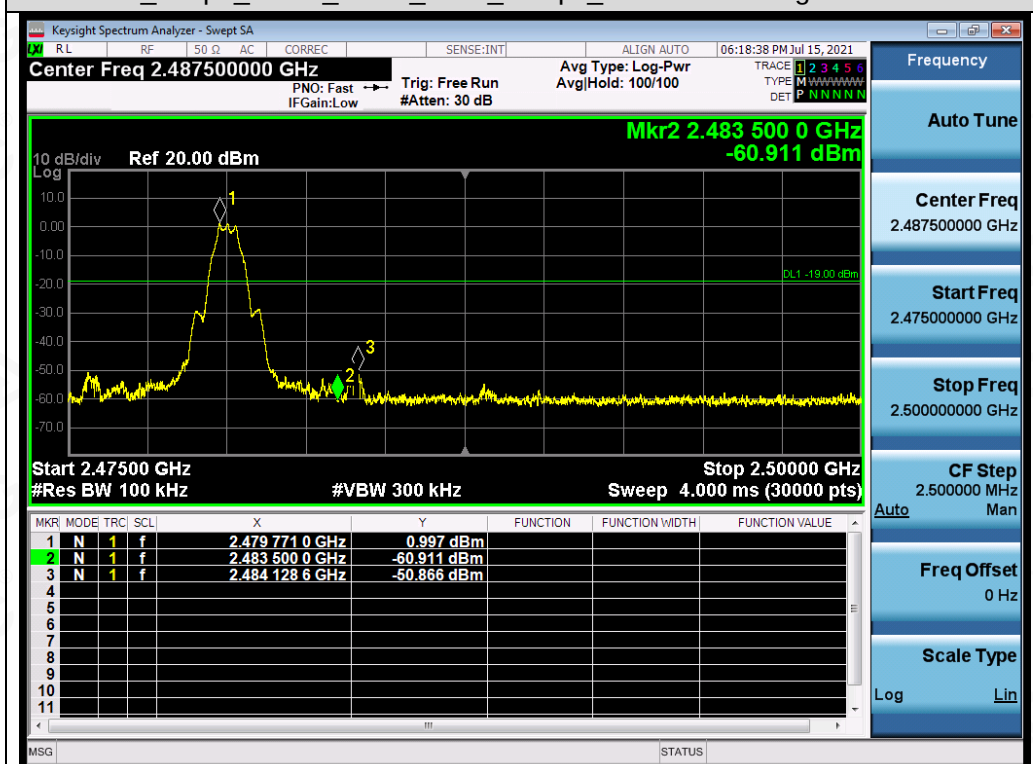
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Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



Test_Graph_LE1M_ANT1_2402_1Mbps_Lower Band Edge Emissions

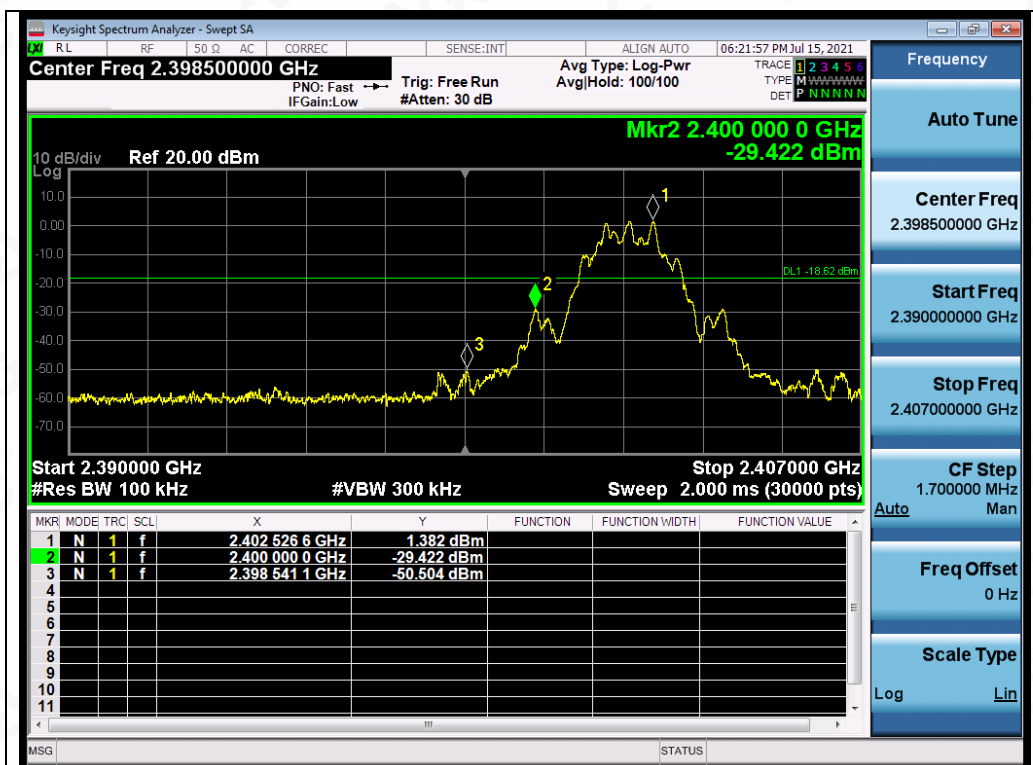


Test_Graph_LE1M_ANT1_2480_1Mbps_Higher Band Edge Emissions

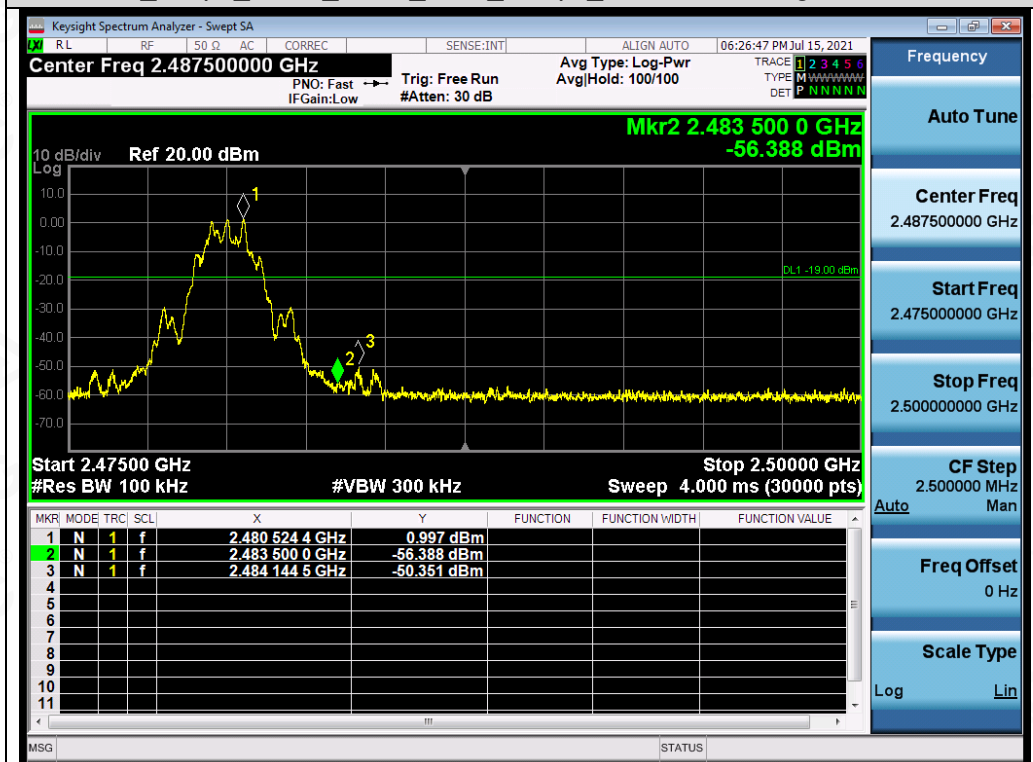
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Test_Graph_LE2M_ANT1_2402_2Mbps_Lower Band Edge Emissions



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.

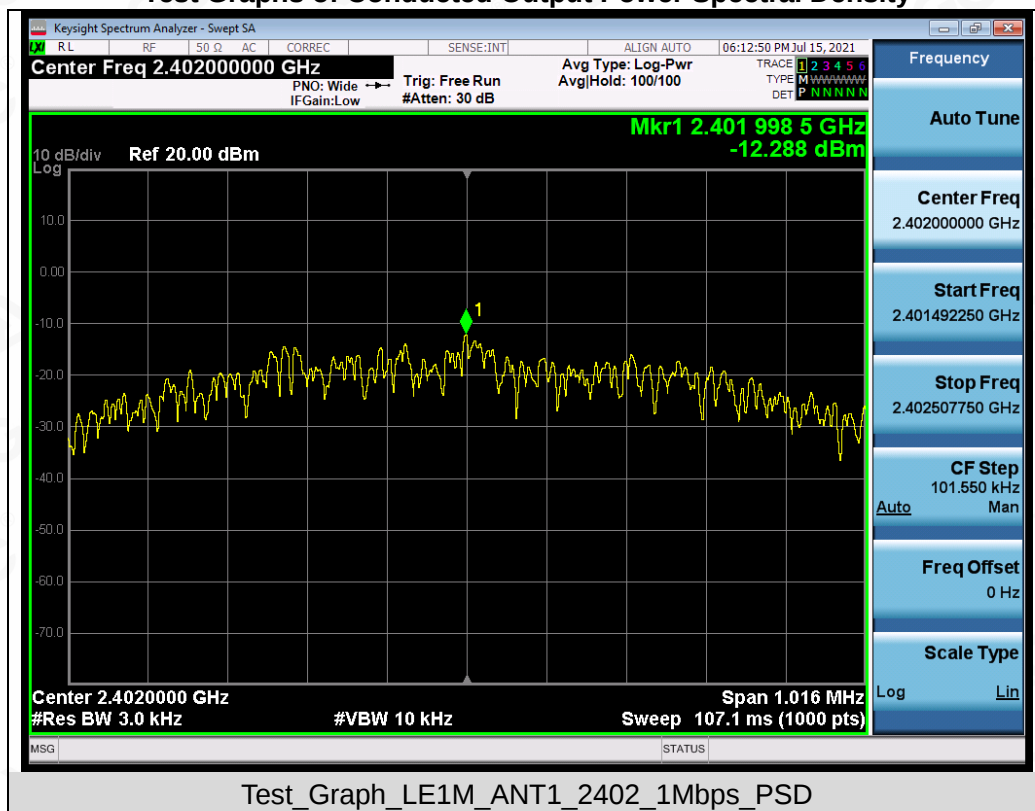
10.3. MEASUREMENT EQUIPMENT USED

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	-12.288	≤ 8	Pass
	2440	-12.284	≤ 8	Pass
	2480	-12.575	≤ 8	Pass

Test Graphs of Conducted Output Power Spectral Density



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