

FCC Test Report

Report No.: AGC09665210802FE03

FCC ID : 2ATO6-HYPERSONNC

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION: LinearFlux Headphones

BRAND NAME : LinearFlux, HyperSonic

MODEL NAME : See page 5

APPLICANT: LinearFlux USA Inc.

DATE OF ISSUE : Sep. 22, 2021

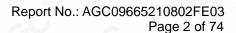
STANDARD(S) : FCC Part 15.247

REPORT VERSION : V1.0

Attestation of Global Constiance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	1	Sep. 22, 2021	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	LinearFlux USA Inc.	
Address	355 Woodrow Street, Daly City, California, 94014-1937, USA	
Manufacturer	LinearFlux USA Inc.	
Address	355 Woodrow Street, Daly City, California, 94014-1937, USA	
Factory	LinearFlux USA Inc.	
Address	355 Woodrow Street, Daly City, California, 94014-1937, USA	
Product Designation	LinearFlux Headphones	
Brand Name	LinearFlux, HyperSonic	
Test Model	HyperSonic	
Series Model	HyperSonic GAME, HyperSonic GAMER, HyperSonic GAME PRO, HyperSonic GAME MAX, HyperSonic PRO, HyperSonic EVO, HyperSonic 360, HyperSonic BOOM, HyperSonic GO, HyperSonic V2, HyperSonic V3, 4897053631079, 4897053631352, 4897053631369, 4897053631376, 4897053631383, 4897053631390, 4897053631406, 4897053631413, 4897053631420	
Declaration of Difference	All the same except for the model name	
Date of test	Aug. 16, 2021 to Sep. 22, 2021	
Deviation	No any deviation from the test method	
Condition of Test Sample	Normal	
Test Result	Pass	
Report Template	AGCRT-US-BR/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	John Zerry	
GC -	John Zeng (Project Engineer)	Sep. 22, 2021
Reviewed By	Max Zhang	
NO.	Max Zhang (Reviewer)	Sep. 22, 2021
Approved By	Formerles	
	Forrest Lei (Authorized Officer)	Sep. 22, 2021

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as "LinearFlux Headphones". It is designed by way of utilizing the GFSK, Pi/4 DQPSK and 8DPSK technology to achieve the system operation.

A major technical description of EUT is described as following

A major technical description of EoT is described as following		
Operation Frequency 2.402GHz to 2.480GHz		
RF Output Power	1.254dBm (Max)	
Bluetooth Version	V5.0	
Modulation	BR⊠GFSK, EDR⊠π /4-DQPSK, ⊠8DPSK BLE□GFSK 1Mbps □GFSK 2Mbps	
Number of channels 79 Channels		
Hardware Version V01		
Software Version V01		
Antenna Designation Ceramic Antenna (Comply with requirements of the FCC part 15.20		
Antenna Gain 2dBi		
Power Supply DC 3.6V by battery		

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
0	0	2402 MHz
	0 1	2403 MHz
	60	64 -6
© 8	38	2440 MHz
2402~2480MHz	39	2441 MHz
	40	2442 MHz
CC C	: 60	
0 00	77	2479 MHz
	78	2480 MHz

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2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 1.3MHz, in every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally, the type of connection (e.g. single of multi slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode:

40, 21, 44, 23, 04, 15, 66, 56, 19, 78, 07, 28, 69, 55,

36, 45, 05, 13, 43, 74, 57, 35, 67, 76, 02, 34, 54, 63,

42, 11, 30, 06, 64, 25, 75, 48, 17, 33, 58, 01, 29, 14,

51, 72, 03, 31, 50, 61, 77, 18, 10, 47, 12, 68, 08, 49,

20, 00, 73, 09, 16, 60, 71, 41, 24, 53, 38, 26, 46, 37,

65, 32, 70, 52, 27, 59, 22, 62, 39

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The generation of the hopping sequence in connection mode depends essentially on two input values:

- 1. LAP/UAP of the master of the connection.
- 2. Internal master clock.

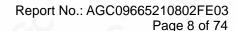
The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24MSB's of the 48BD_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For behavior action with other units only offset is used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30). In most case it is implemented as 28 bits counter. For the deriving of the hopping sequence the entire. LAP (24 bits),4LSB's(4bits) (Input 1) and the 27MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended.

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The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer (and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always differ from the first one.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2ATO6-HYPERSONNC** filing to comply with the FCC PART 15.247 requirements.

2.7. 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.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.10. 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 ±U, where expended 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 = ±2 %
Uncertainty of Occupied Channel Bandwidth	U _c = ±2 %

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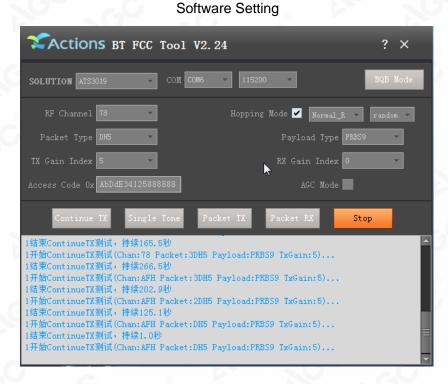


4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION		
1	Low channel GFSK		
2	Middle channel GFSK		
3	High channel GFSK		
4	Low channel π/4-DQPSK		
5	Middle channel π/4-DQPSK		
6	High channel π/4-DQPSK		
7	Low channel 8DPSK		
8	Middle channel 8DPSK		
9	High channel 8DPSK		
10	Hopping mode GFSK		
11	Hopping mode π/4-DQPSK		
12	Hopping mode 8DPSK		

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.



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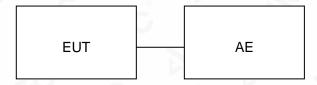
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



5.2. EQUIPMENT USED IN TESTED SYSTEM

lt	em	Equipment	Model No.	ID or Specification	Remark
	1	LinearFlux Headphones	HyperSonic	2ATO6-HYPERSONNC	EUT
	2	Control Box	USB-TTL	N/A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247 (a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	Not applicable

Note: The BT function cannot transmit when charging.

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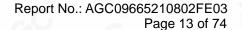
6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd		
Location 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Comr 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 A2			

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Apr. 14, 2021	Apr. 13, 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	BBHA9170	768	Oct.09, 2019	Oct. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS	3117	00034609	Apr. 23, 2021	Apr. 22, 2023
Preamplifier Assembly	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
WIDEBAND REQUENCY ANTENNA	SCHWARZBECK	VULB9168	VULB9168-49 4	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

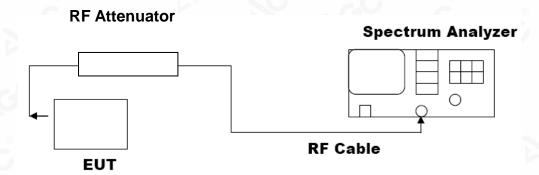
For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW ≥RBW.
- 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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n/Inspection
The test results
the test report.



7.3. LIMITS AND MEASUREMENT RESULT

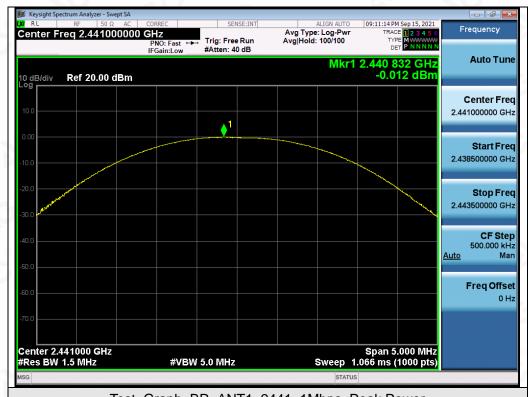
Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail	
a.C	2402	-0.500	≪21 ⊚	Pass	
GFSK	2441	-0.012	⊉ 1	Pass	
	2480	1.065	₹21	Pass	
®	2402	-0.431	₹21	Pass	
π /4-DQPSK	2441	0.177	₹ 1	Pass	
	2480	1.254	≤21	Pass	
0	2402	-0.374	₹21	Pass	
8DPSK	2441	0.192	⊉ 1	Pass	
	2480	1.233	₹ 1	Pass	

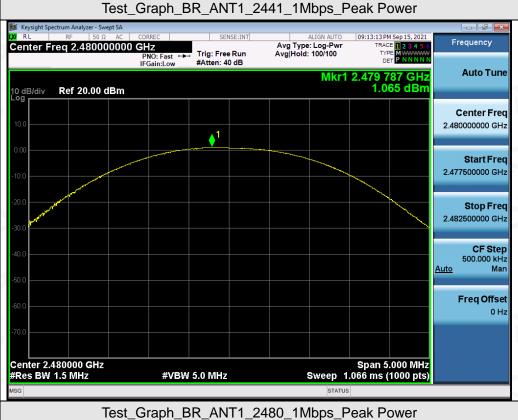
Test Graphs of Conducted Output Power



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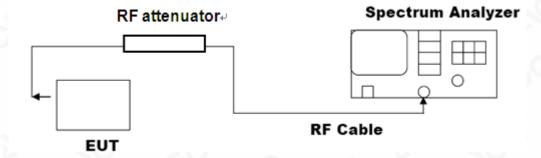


8. 20DB BANDWIDTH

8.1. 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 Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping 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.

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



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8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and -20dB Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-20dB Bandwidth (MHz)	Limits	Pass or Fail
-0	2402	0.898	0.951	N/A	Pass
GFSK	2441	0.898	0.950	N/A	Pass
	2480	0.900	0.949	N/A	Pass
π /4-DQPSK	2402	1.152	1.228	N/A	Pass
	2441	1.152	1.226	N/A	Pass
	2480	1.155	1.229	N/A	Pass
8DPSK	2402	1.138	1.200	N/A	Pass
	2441	1.137	1.198	N/A	Pass
	2480	1.140	1.202	N/A	Pass

Test Graphs of Occupied Bandwidth and -20 Bandwidth



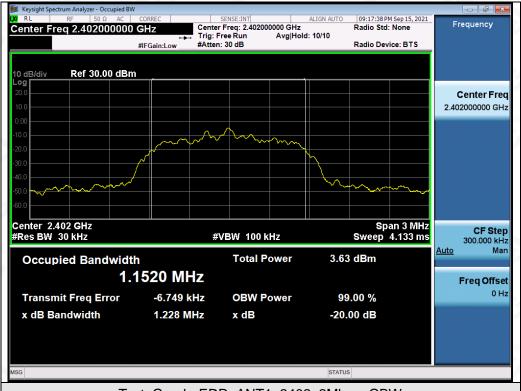
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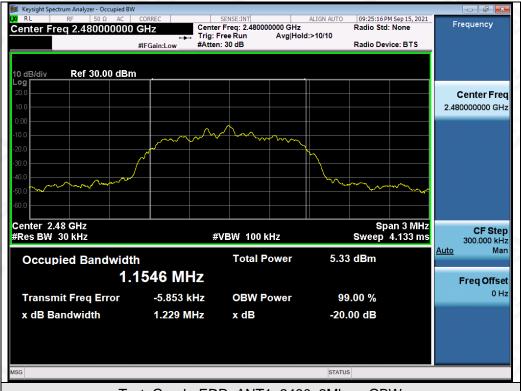






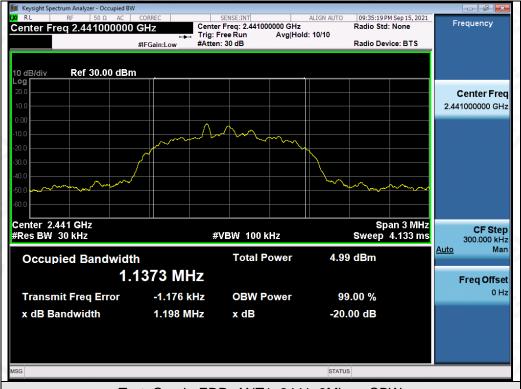
















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9. CONDUCTED SPURIOUS EMISSION

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 the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
 RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
- 4. Set SPA Trace 1 Max hold, then View.

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

The same as described in section 8.2

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

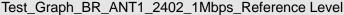
LIMITS AND MEASUREMENT RESULT				
Applicable Limite	Measurement Result			
Applicable Limits	Test Data	Criteria		
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum	At least -20dBc than the limit Specified on the BOTTOM	PASS		
intentional radiator is operating, the radio frequency	Channel			
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. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the TOP Channel	PASS		

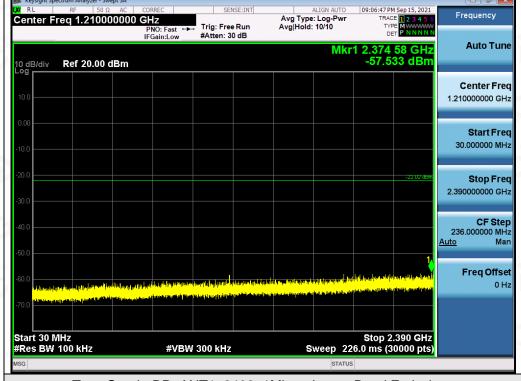
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Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands







Test_Graph_BR_ANT1_2402_1Mbps_Lower Band Emissions

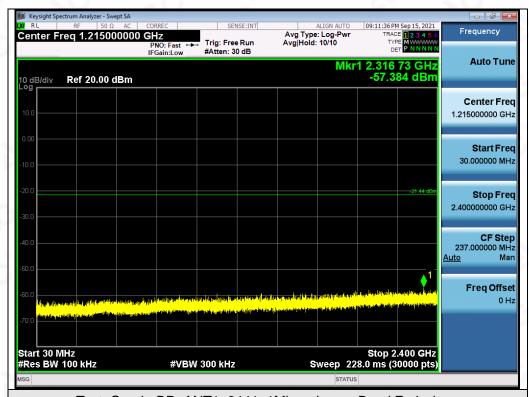
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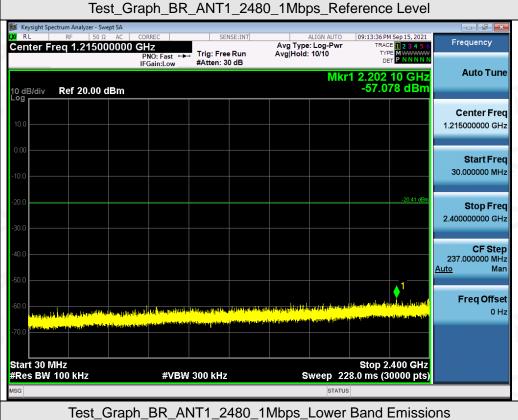










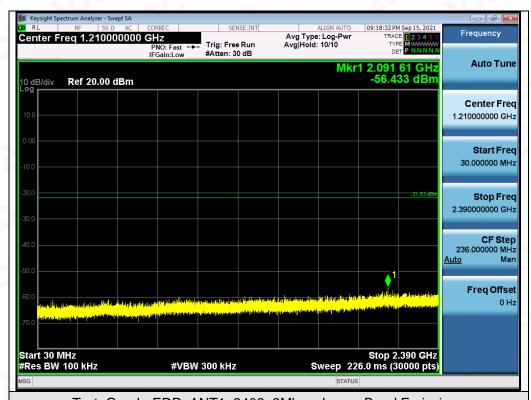






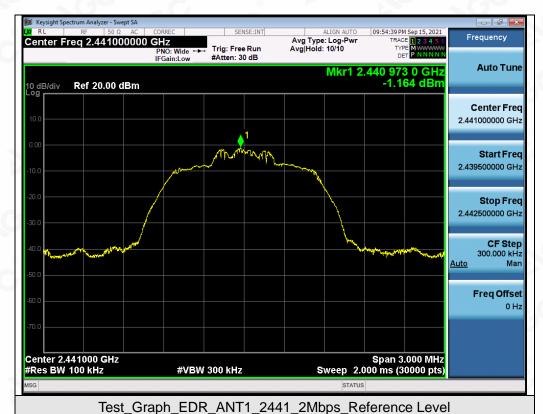








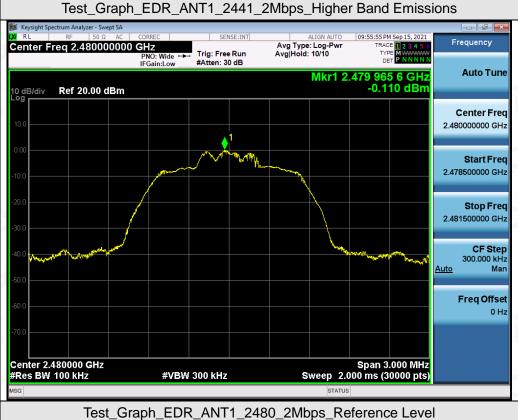










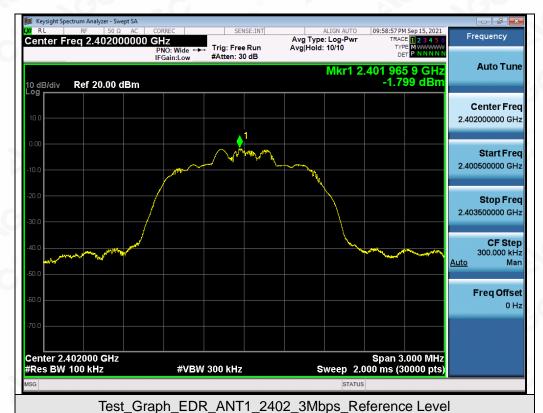












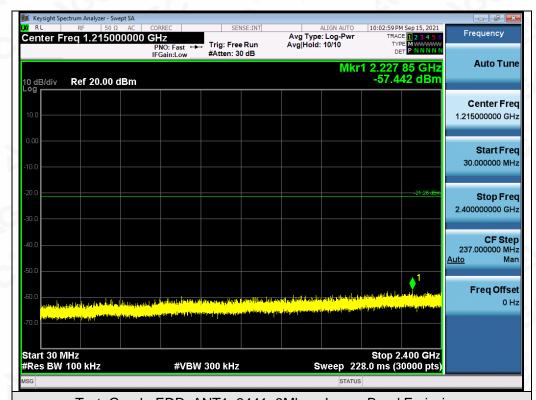








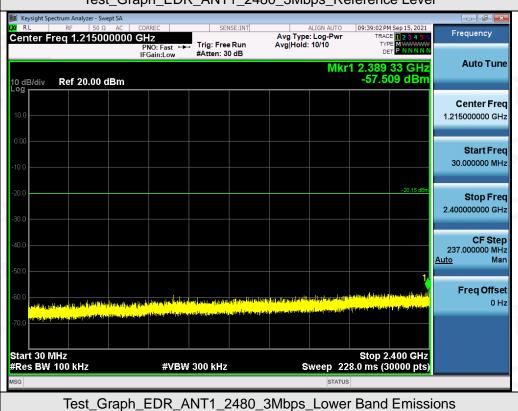






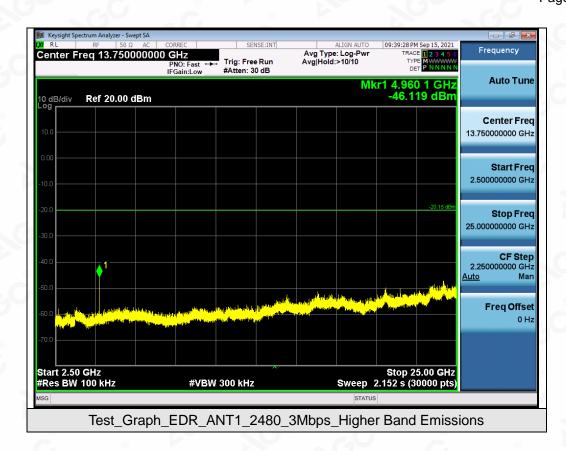






g/Inspection
The test results
the test report.

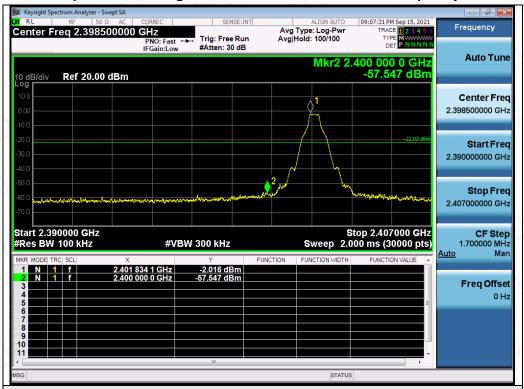




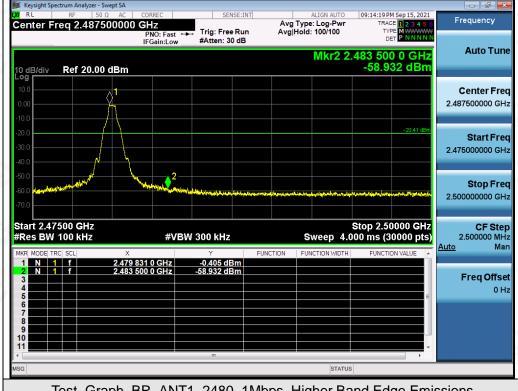
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Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



Test_Graph_BR_ANT1_2402_1Mbps_Lower Band Edge Emissions



Test_Graph_BR_ANT1_2480_1Mbps_Higher Band Edge Emissions

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