

FCC Test Report

Report No.: AGC11059211001FE03

FCC ID : 2AX2R-ZE3000

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION: Bluetooth Earphone

BRAND NAME : final

MODEL NAME : FI-ZE3DPLTW

APPLICANT: final Inc.

DATE OF ISSUE : Nov. 05, 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	Nov. 05, 2021	Valid	Initial Release

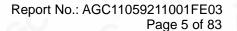


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1. VERIFICATION OF CONFORMITY

Applicant	final Inc.	
Address	3-12-7, Kitakase, Saiwai-ku, Kawasaki, Kanagawa, Japan 212-0057	
Manufacturer	final Inc.	
Address	3-12-7, Kitakase, Saiwai-ku, Kawasaki, Kanagawa, Japan 212-0057	
Factory	Shenzhen Victory Flag Technology Co., Ltd.	
Address	No.1 Xiangqian Lane Huangzhu Village, Pingdi Sub-district, Longgang district, Shenzhen, Guangdong, China	
Product Designation Bluetooth Earphone		
Brand Name	final	
Test Model	FI-ZE3DPLTW	
Date of test Oct. 19, 2021 to Nov. 04, 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 Zeng	
,c _c	John Zeng (Project Engineer)	Nov. 05, 2021
Reviewed By	Calin Lin	
Page 1	Calvin Liu (Reviewer)	Nov. 05, 2021
Approved By	Formst vei	CC CC
P. 10	Forrest Lei (Authorized Officer)	Nov. 05, 2021



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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

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

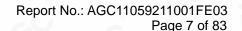
A major technical description of EUT is described as following

Operation Frequency 2.402GHz to 2.480GHz		
RF Output Power	5.725dBm (Max)	
Bluetooth Version	V5.2	
Modulation	BR⊠GFSK, EDR⊠π /4-DQPSK, ⊠8DPSK BLE□GFSK 1Mbps □GFSK 2Mbps	
Number of channels 79 Channels		
Hardware Version	V3.0	
Software Version	V1.0.8	
Antenna Designation FPC Antenna (Comply with requirements of the FCC part 15.203)		
Antenna Gain 2dBi		
Power Supply DC 3.7V by battery		

Note: The EUT comprises left and right channel headsets, both are the same in SCH but different in the PCB Layout. The RF output power of each headset had been tested and recorded in the report. For the other test items, the left headset had been tested and recorded in this report as the worst case because of the higher power.

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
CO C	1	2403 MHz
	38	2440 MHz
2402~2480MHz	39	2441 MHz
100	40	2442 MHz
	CO CO	
~ GO	77	2479 MHz
60	78	2480 MHz





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:

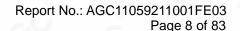
- 1. LAP/UAP of the master of the connection.
- 2. Internal master clock.

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.





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**: **2AX2R-ZE3000** 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	$U_c = \pm 2 \%$	
Uncertainty of Occupied Channel Bandwidth	U _c = ±2 %	



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.
- For Conducted Test method, a temporary antenna connector is provided by the manufacture.

BlueTest3 - LE Tester Interface Mode Test Commands Channel (0-78) PACKET TX Power (0-9) PACKET RX Help QHS RF TEST STOP BREDR 3-PR15 -Execute Pattern bits (1-POWER TABLE GET POWER TABLE SET Pattern (hex) 00000001 ☐ Save to file Browse for f C:\Users\Administrator\AppData\Local\QTIL\BlueTest3\testapplog txt HEC errors: RSSI (dBm) Total HEC errors: Total CRC errors: Total Bit errors Channel frequency = 2480MHz CONTINUOUS TX successful

Software Setting



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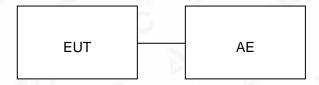
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



5.2. EQUIPMENT USED IN TESTED SYSTEM

It	tem	Equipment	Model No.	ID or Specification	Remark
	1	Bluetooth Earphone	FI-ZE3DPLTW	2AX2R-ZE3000	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 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 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
Horn Antenna	SCHWARZBECK	BBHA9170	768	Oct. 31, 2021	Oct.30, 2023
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	FARA	EZ-EMC(Ver.RA-0 3A)	N/A	N/A	N/A



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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

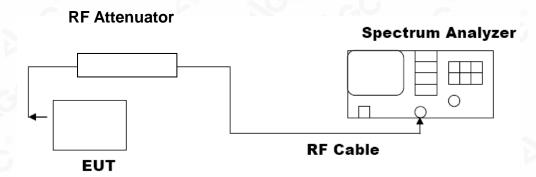
For peak power test:

- 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





7.3. LIMITS AND MEASUREMENT RESULT

Left earphone

	Test Da	ta of Conducted Output	Power	
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
9	2402	4.886	≨ 1	Pass
GFSK	2441	5.603	₹21	Pass
	2480	5.725	≨2 1	Pass
π /4-DQPSK	2402	2.591	≨ 21	Pass
	2441	3.175	₹ 1	Pass
	2480	3.228	≨ 21	Pass
8DPSK	2402	3.091	≨ 1	Pass
	2441	3.786	\$21	Pass
	2480	3.913	\$21	Pass

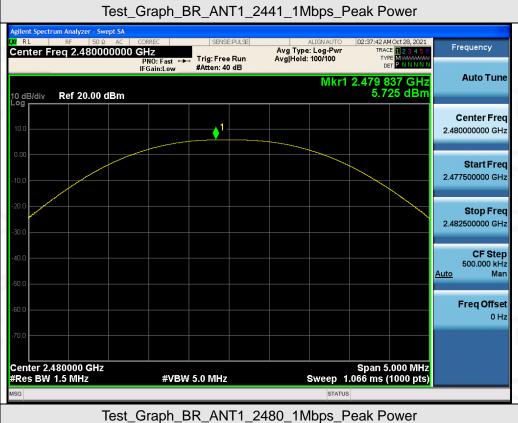
Test Graphs of Conducted Output Power



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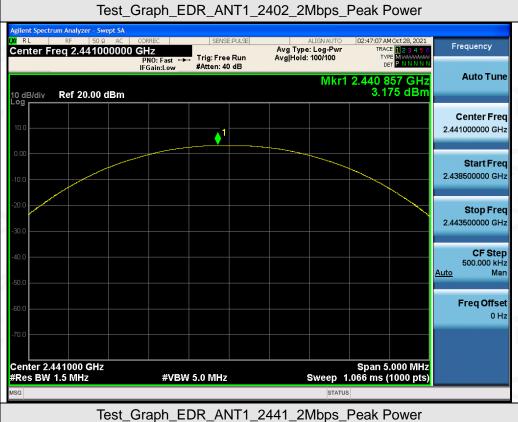






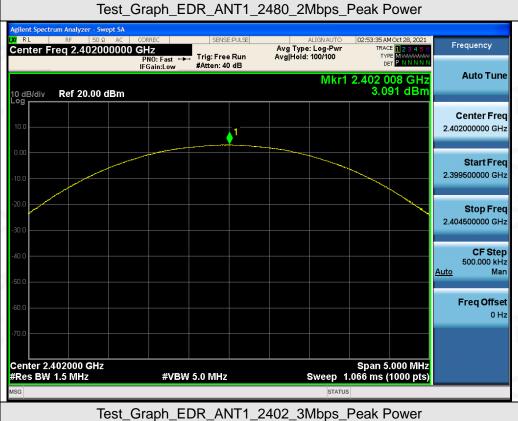






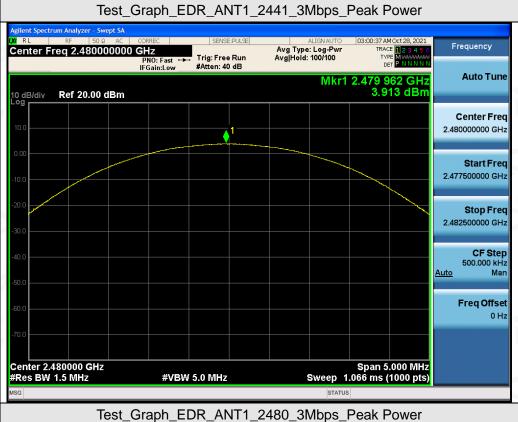












n/Inspection
The test results
the test report.



Right earphone

	Test Dat	ta of Conducted Output F	ower	
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
	2402	5.330	≤21	Pass
GFSK	2441	5.704	⊉ 1	Pass
	2480	5.119	≨ 21	Pass
0	2402	3.952	≨21	Pass
π /4-DQPSK	2441	3.490	₹ 1	Pass
	2480	2.891	≨21	Pass
8DPSK	2402	4.537	≨ 21	Pass
	2441	4.041	₹ 1	Pass
	2480	3.378	≤21	Pass

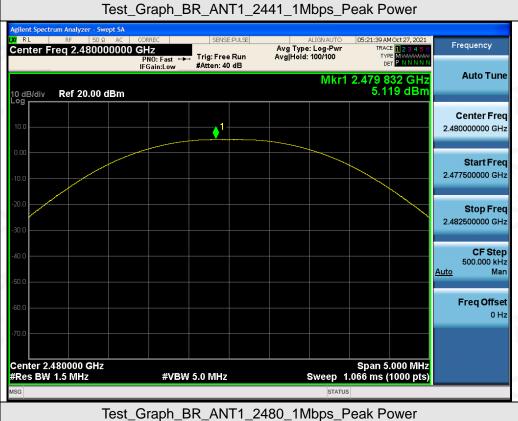
Test Graphs of Conducted Output Power



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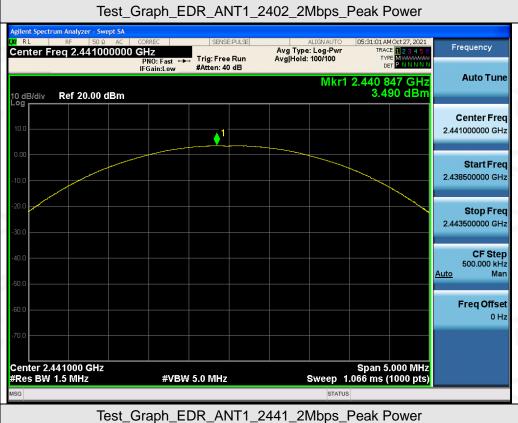






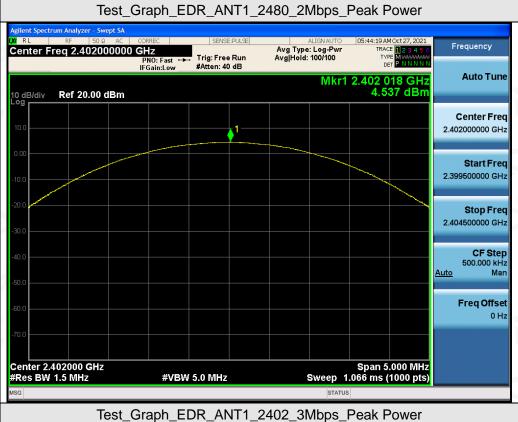






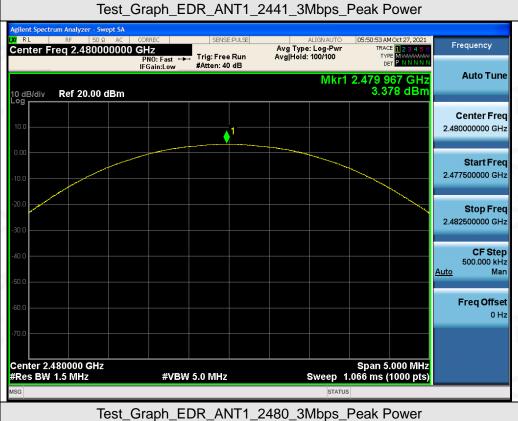


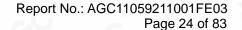












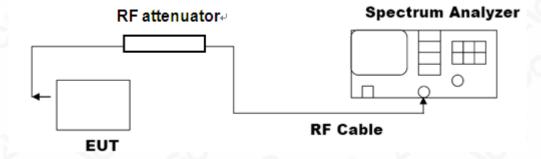


8. 20DB BANDWIDTH

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)

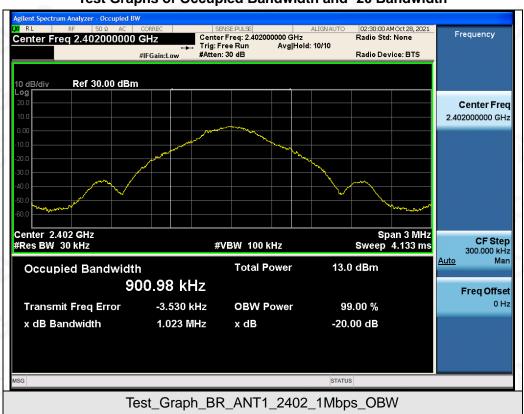




8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and -20dB Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-20dB Bandwidth (MHz)	Limits	Pass or Fail
-6	2402	0.901	1.023	N/A	Pass
GFSK	2441	0.903	1.020	N/A	Pass
	2480	0.896	1.010	N/A	Pass
π /4-DQPSK	2402	1.197	1.359	N/A	Pass
	2441	1.197	1.363	N/A	Pass
	2480	1.197	1.362	N/A	Pass
8DPSK	2402	1.202	1.360	N/A	Pass
	2441	1.202	1.362	N/A	Pass
	2480	1.200	1.357	N/A	Pass

Test Graphs of Occupied Bandwidth and -20 Bandwidth







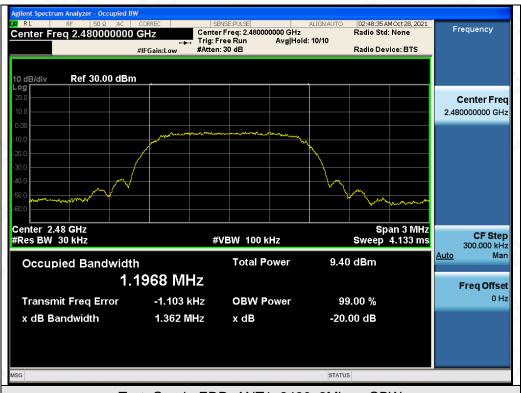


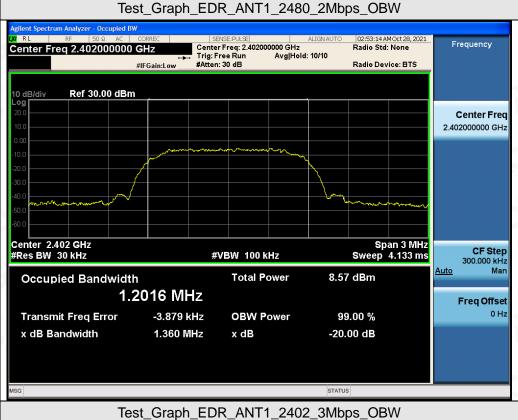




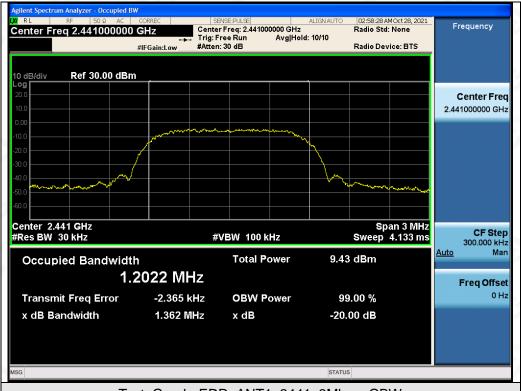
















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9. CONDUCTED SPURIOUS EMISSION

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

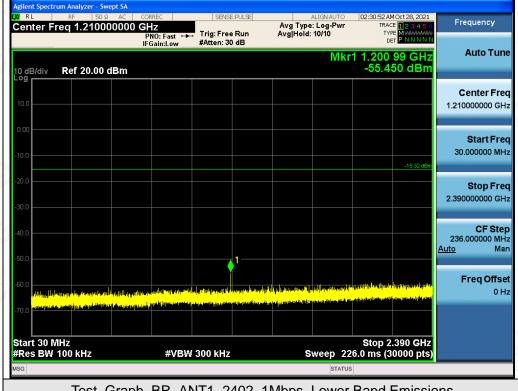
LIMITS AND MEASUREMENT RESULT				
Applicable Limite	Measurement Result			
Applicable Limits	Test Data	Criteria		
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum	At least -20dBc than the limit Specified on the BOTTOM	PASS		
intentional radiator is operating, the radio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



Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Test_Graph_BR_ANT1_2402_1Mbps_Reference Level

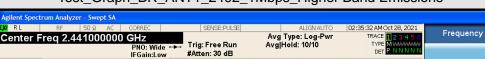


Test_Graph_BR_ANT1_2402_1Mbps_Lower Band Emissions

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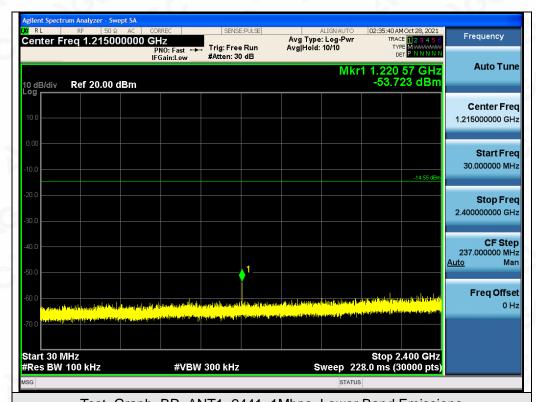






Test_Graph_BR_ANT1_2441_1Mbps_Reference Level

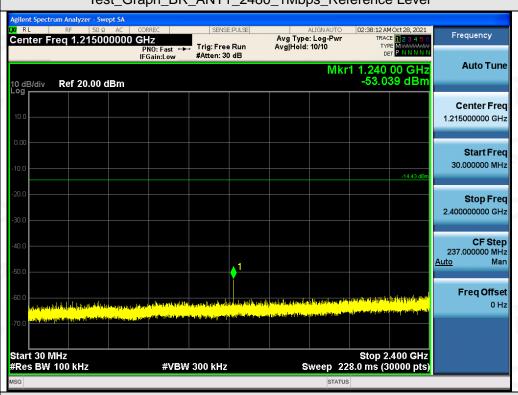












Test_Graph_BR_ANT1_2480_1Mbps_Lower Band Emissions









