

# **FCC Test Report**

Report No.: AGC07240220501FE03

FCC ID : 2A3TF-CRESTMK2

**APPLICATION PURPOSE** : Original Equipment

**PRODUCT DESIGNATION**: Bluetooth headphone

**BRAND NAME** : Orange

**MODEL NAME** : Orange Crest MK 2

**APPLICANT**: OMEC Consumer Products Ltd

**DATE OF ISSUE** : May 27, 2022

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

**REPORT VERSION**: V1.0

Attestation of Global Continue (Shenzhen) Co., Ltd





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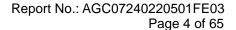
#### REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 27, 2022	Valid	Initial Release



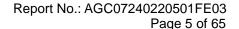
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#### 1. VERIFICATION OF CONFORMITY

Applicant	OMEC Consumer Products Ltd	
Address	OMEC House, 108 Ripon Way, Borehamwood, Hertfordshire, WD6 2JA, United Kingdom	
Manufacturer	Senmai Electron Limited	
Address	No.5 Shuiling Road, Zhouwu Industrial Zone, Dongcheng District, Dongguan City, Guangdong, China	
Factory	Senmai Electron Limited	
Address	No.5 Shuiling Road, Zhouwu Industrial Zone, Dongcheng District, Dongguan City, Guangdong, China	
Product Designation	Bluetooth headphone	
Brand Name	Orange	
Test Model	Orange Crest MK 2	
Date of test	May 23, 2022 to May 27, 2022	
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	Thea Huan	9
	Thea Huang (Project Engineer)	May 27, 2022
Reviewed By	Colin Lin	
	Calvin Liu (Reviewer)	May 27, 2022
Approved By	Max Zhang	
	Max Zhang (Authorized Officer)	May 27, 2022



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2. GENERAL INFORMATION

#### 2.1. PRODUCT DESCRIPTION

The EUT is designed as "Bluetooth headphone". 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	2.402 GHz to 2.480 GHz	
RF Output Power	6.119dBm (Max)	
Bluetooth Version	V5.0	
Modulation	BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps	
Number of channels	79	
Hardware Version	V6.0	
Software Version	5.0	
Antenna Designation	PCB Antenna (Comply with requirements of the FCC part 15.203)	
Antenna Gain	1.5dBi	
Power Supply	DC 3.7V by battery or DC 5V by adapter	

# 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
	1	2403 MHz
	:	:
	38	2440 MHz
2402~2480MHz	39	2441 MHz
	40	2442 MHz
	:	:
	77	2479 MHz
	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:

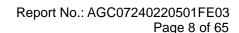
- 1. LAP/UAP of the master of the connection.
- 2. Internal master clock.

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**: **2A3TF-CRESTMK2** 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	$U_c = \pm 2 \%$	



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

# S BlueTest3 × Test Arguments Close PAUSE LO Freq. (MHz) 2441 RADIO STATUS RADIO STATUS FULL Help (Ext, Int) TXSTART Execute TXDATA2 Cold Reset Warm Reset Save to file Browse for f Display : @ Standard @ BER C:\Vsers\Administrator\AppData\Local\CSR Ltd.\BlueTest3\uetapplog.txt Opening USB SPI (602498). Transport active. (dal) (Hardware ID 0x332) firmware version 8648.

#### Software Setting



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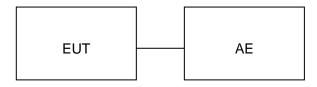
# 5. SYSTEM TEST CONFIGURATION

# **5.1. CONFIGURATION OF EUT SYSTEM**

Radiated Emission Configure:



Conducted Emission Configure:



#### **5.2. EQUIPMENT USED IN TESTED SYSTEM**

Item	Equipment	Model No.	ID or Specification	Remark
1	Bluetooth headphone	Orange Crest MK 2	2A3TF-CRESTMK2	EUT
2	Control Box	CSR USB-SPI	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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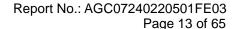
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# 6. TEST FACILITY

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 RADIATED EMISSION TEST**

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Mar. 28, 2022	Mar. 27, 2023
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Nov. 17, 2021	Nov. 16, 2022
2.4GHz Filter	EM Electronics	2400-2500	N/A	Mar. 22, 2022	Mar. 21, 2024
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
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 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





#### 7. PEAK OUTPUT POWER

#### 7.1. MEASUREMENT PROCEDURE

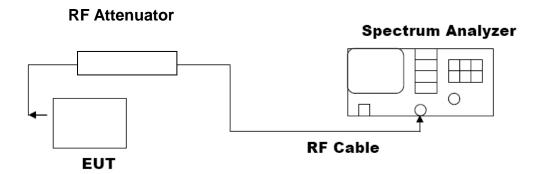
For peak power test:

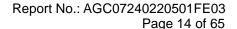
- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW ≥RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: 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

Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail	
GFSK	2402	2.947	<b></b> \$21	Pass	
	2441	5.583	<b>≨</b> 21	Pass	
	2480	6.119	<b></b> \$21	Pass	
π /4-DQPSK	2402	0.663	<b></b> \$21	Pass	
	2441	3.697	<b>≨</b> 21	Pass	
	2480	4.330	<b>≨</b> 21	Pass	
8DPSK	2402	1.012	<b></b> \$21	Pass	
	2441	4.019	<b>≨</b> 21	Pass	
	2480	4.665	<b>≨</b> 21	Pass	

# **Test Graphs of Conducted Output Power**











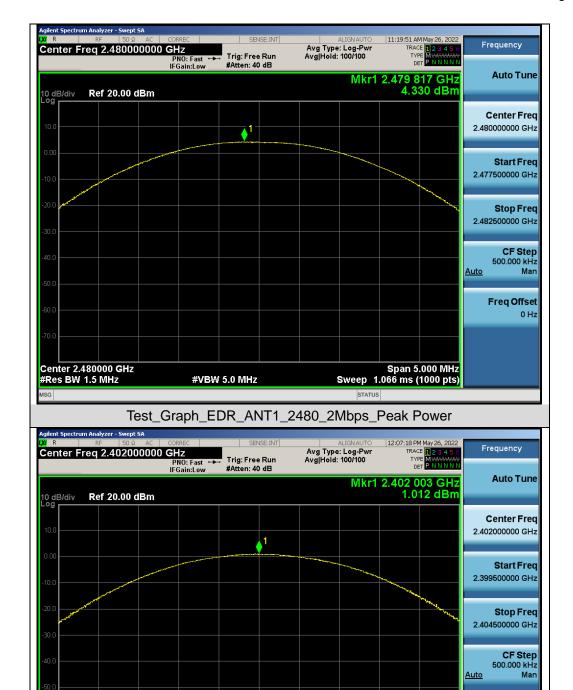




Freq Offset

Span 5.000 MHz Sweep 1.066 ms (1000 pts)





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Test\_Graph\_EDR\_ANT1\_2402\_3Mbps\_Peak Power

#VBW 5.0 MHz

Center 2.402000 GHz #Res BW 1.5 MHz

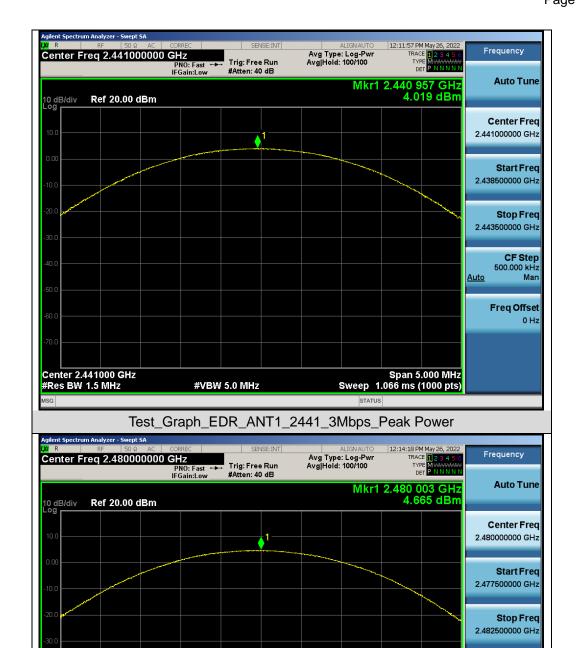
CF Step 500.000 kHz Man

Freq Offset

Auto

Span 5.000 MHz Sweep 1.066 ms (1000 pts)



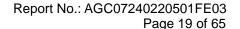


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Test\_Graph\_EDR\_ANT1\_2480\_3Mbps\_Peak Power

#VBW 5.0 MHz

Center 2.480000 GHz #Res BW 1.5 MHz



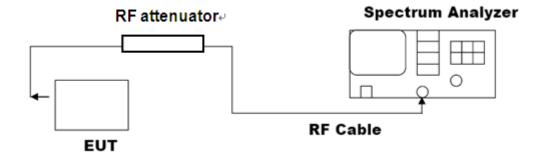


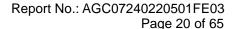
# 8. 20DB BANDWIDTH

# **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)



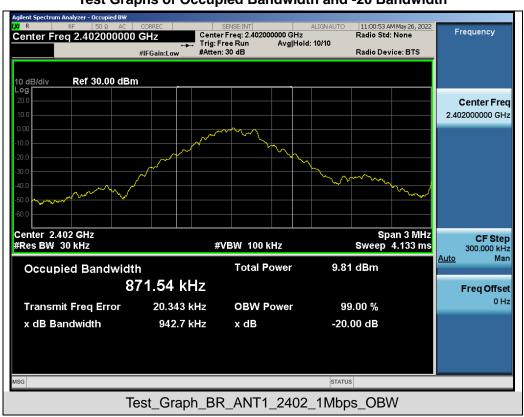




#### 8.3. LIMITS AND MEASUREMENT RESULTS

Test Data of Occupied Bandwidth and -20dB Bandwidth					
Test Mode	Test Channel (MHz)	99% Occupied Bandwidth (MHz)	-20dB Bandwidth (MHz)	Limits	Pass or Fail
GFSK	2402	0.872	0.943	N/A	Pass
	2441	0.857	0.940	N/A	Pass
	2480	0.862	0.942	N/A	Pass
π /4-DQPSK	2402	1.172	1.262	N/A	Pass
	2441	1.167	1.229	N/A	Pass
	2480	1.169	1.234	N/A	Pass
8DPSK	2402	1.164	1.273	N/A	Pass
	2441	1.160	1.259	N/A	Pass
	2480	1.162	1.260	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					
Amplicable Limite	Measurement Result				
Applicable Limits	Test Data	Criteria			
In any 100 kHz Bandwidth Outside the	At least -20dBc than the limit				
frequency band in which the spread spectrum	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.	At least -20dBc than the limit	DAGO			
In addition, radiation emissions which fall in the	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))					



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



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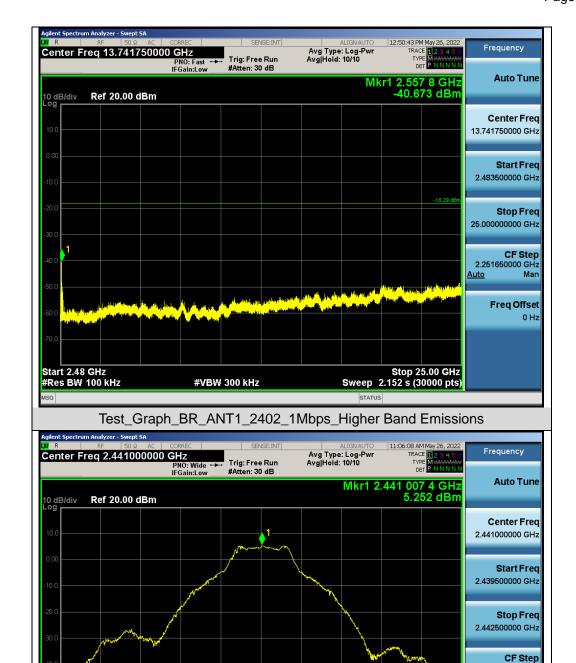
300.000 kHz Man

Freq Offset

Auto

Span 3.000 MHz Sweep 2.000 ms (30000 pts)





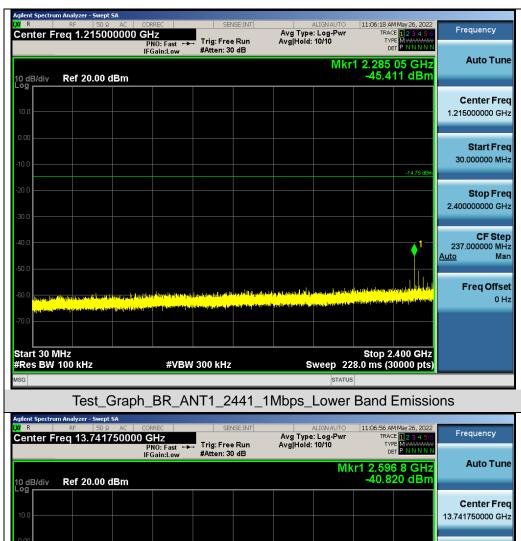
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Test\_Graph\_BR\_ANT1\_2441\_1Mbps\_Reference Level

#VBW 300 kHz

Center 2.441000 GHz #Res BW 100 kHz





Center Freq
13.741750000 GHz

Start Freq
2.483500000 GHz

Stop Freq
25.000000000 GHz

CF Step
2.251650000 GHz

Auto Man

Freq Offset
0 Hz

WES BW 100 kHz #VBW 300 kHz Sweep 2.152 s (30000 pts)

Test\_Graph\_BR\_ANT1\_2441\_1Mbps\_Higher Band Emissions

Stop Freq 2.400000000 GHz

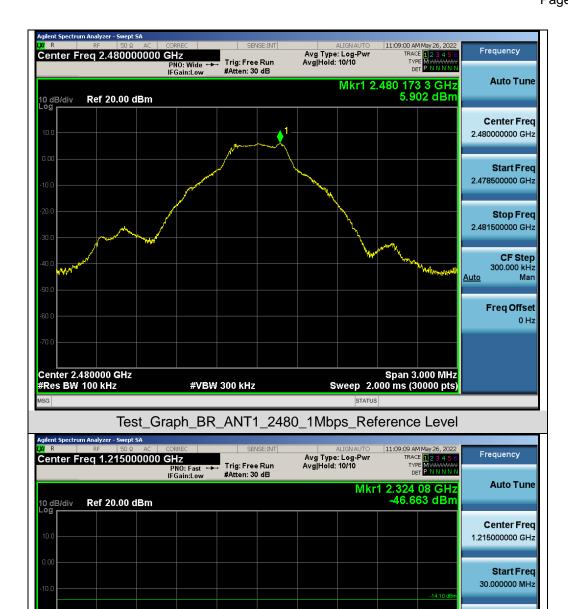
CF Step 237.000000 MHz to Man

Freq Offset

Auto

Stop 2.400 GHz Sweep 228.0 ms (30000 pts)





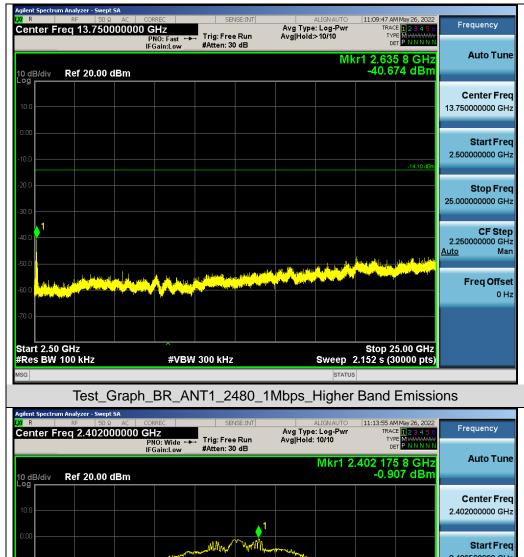
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Test\_Graph\_BR\_ANT1\_2480\_1Mbps\_Lower Band Emissions

#VBW 300 kHz

Start 30 MHz #Res BW 100 kHz





| Center Freq | 2.40200000 GHz | Start Freq | 2.403500000 GHz | Stop Freq | 2.403500000 GHz | St

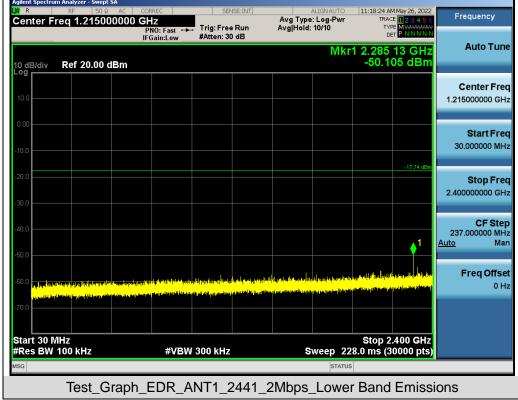












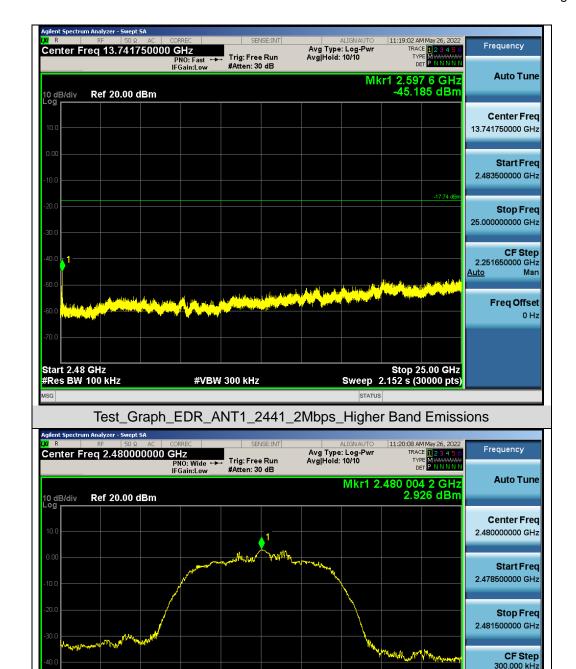
Man

Freq Offset

Auto

Span 3.000 MHz Sweep 2.000 ms (30000 pts)





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

#VBW 300 kHz

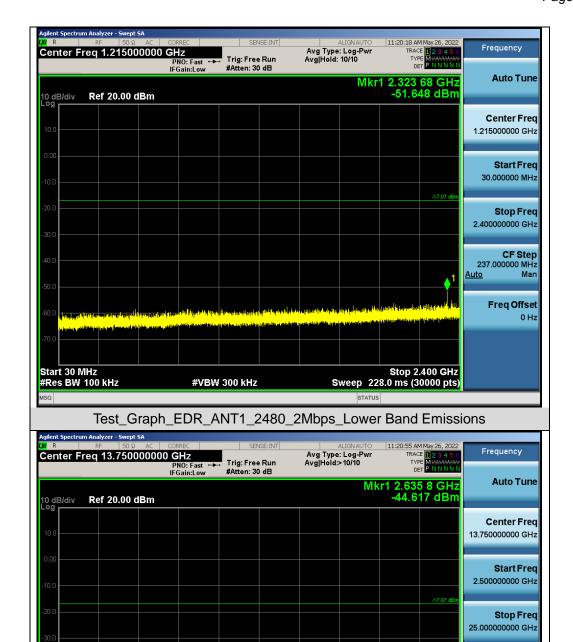
Center 2.480000 GHz #Res BW 100 kHz

2.250000000 GHz uto Man

Freq Offset

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





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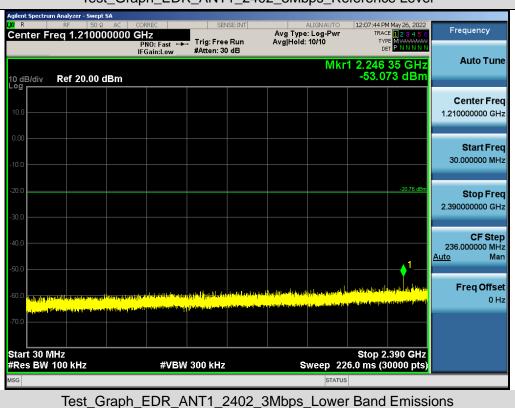
Test\_Graph\_EDR\_ANT1\_2480\_2Mbps\_Higher Band Emissions

#VBW 300 kHz

Start 2.50 GHz #Res BW 100 kHz



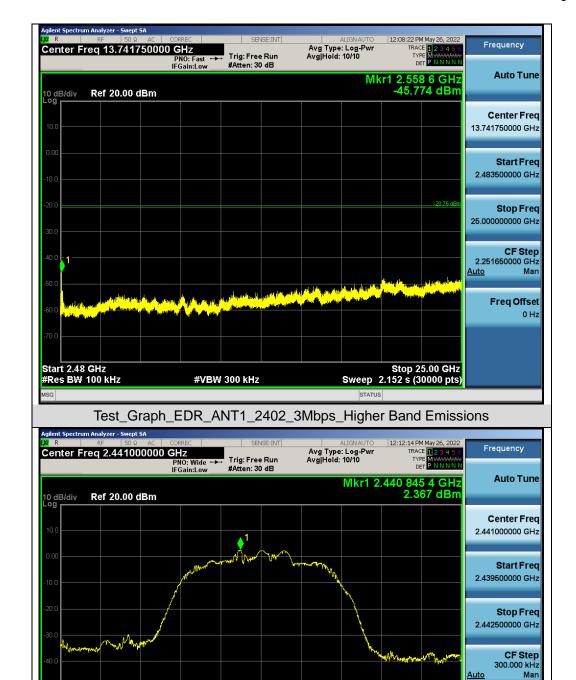




Freq Offset

Span 3.000 MHz Sweep 2.000 ms (30000 pts)





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Test\_Graph\_EDR\_ANT1\_2441\_3Mbps\_Reference Level

#VBW 300 kHz

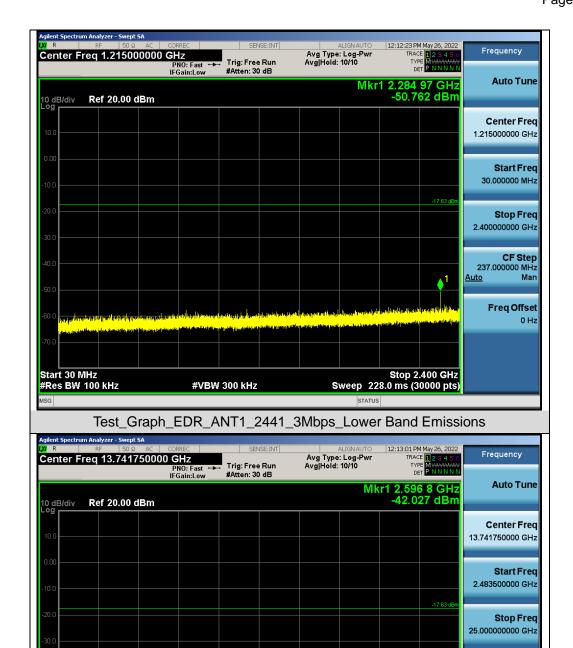
Center 2.441000 GHz #Res BW 100 kHz

**CF Step** 2.251650000 GHz

Freq Offset

Stop 25.00 GHz Sweep 2.152 s (30000 pts) Man





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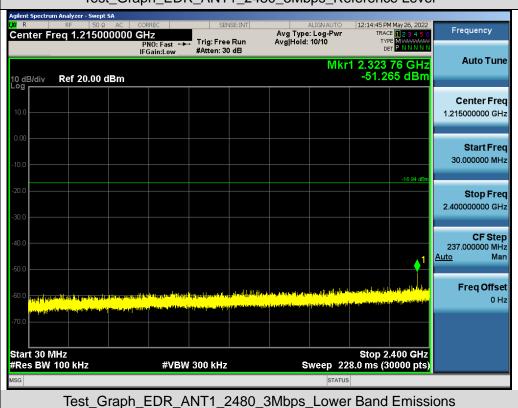
Test\_Graph\_EDR\_ANT1\_2441\_3Mbps\_Higher Band Emissions

#VBW 300 kHz

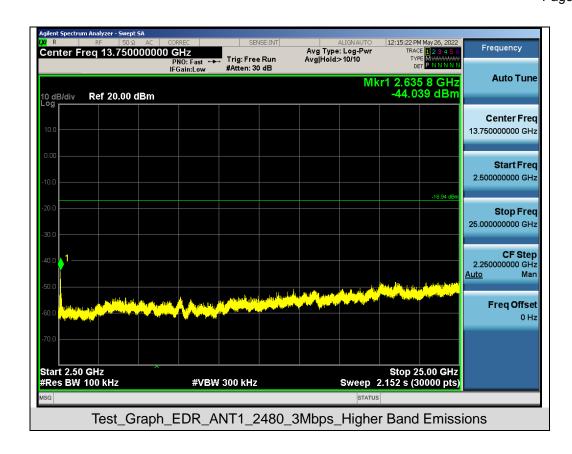
Start 2.48 GHz #Res BW 100 kHz





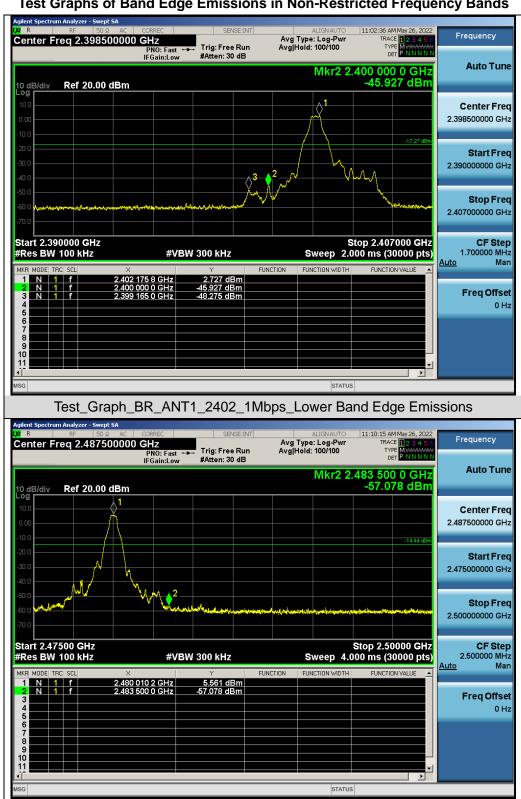








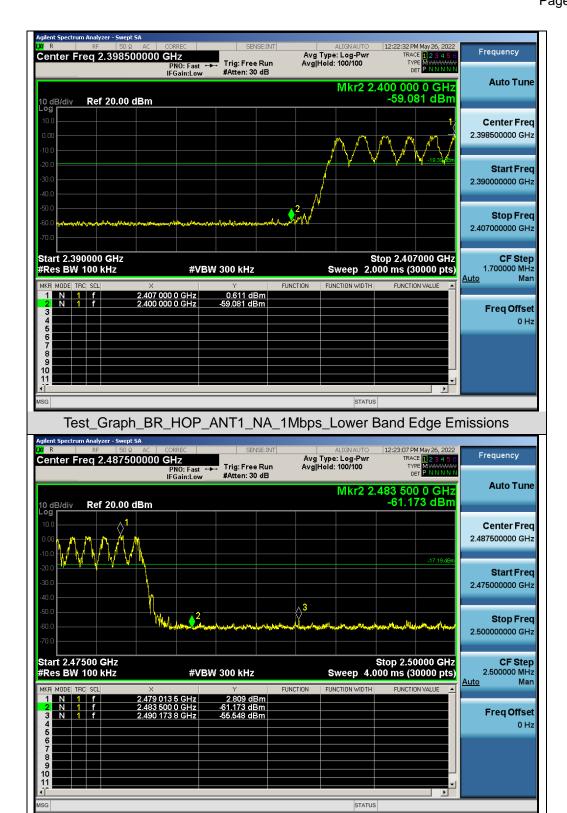
# Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



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





Test\_Graph\_BR\_HOP\_ANT1\_NA\_1Mbps\_Higher Band Edge Emissions





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

Stop Freq 2.500000000 GHz

2.500000 MHz

Freq Offset

Man

Auto

Stop 2.50000 GHz

Sweep 4.000 ms (30000 pts)

FUNCTION WIDTH





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**#VBW** 300 kHz

FUNCTION

Test\_Graph\_EDR\_HOP\_ANT1\_NA\_2Mbps\_Higher Band Edge Emissions

Start 2.47500 GHz

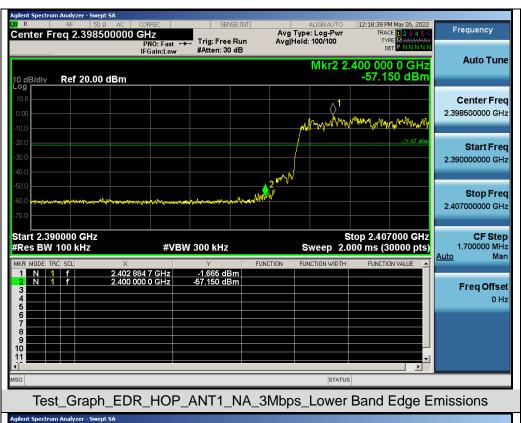
#Res BW 100 kHz

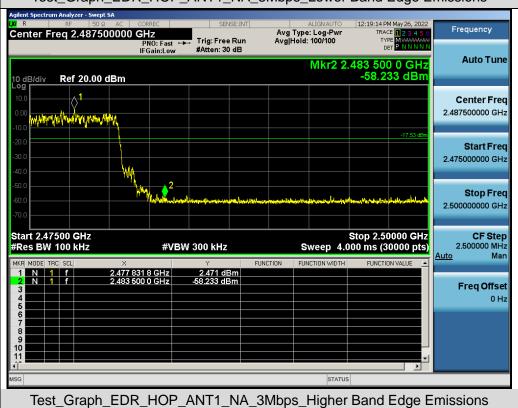




Test\_Graph\_EDR\_ANT1\_2480\_3Mbps\_Higher Band Edge Emissions









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### 10. RADIATED EMISSION

### 10.1. 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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# The following table is the setting of spectrum analyzer and receiver.

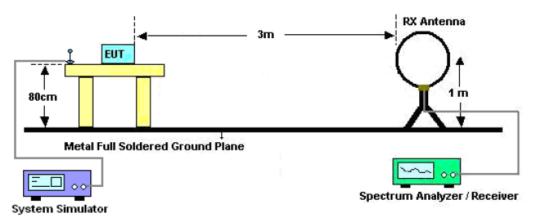
Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz
Start ~Stop Frequency	1MHz/3MHz for Peak, 1MHz/3MHz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

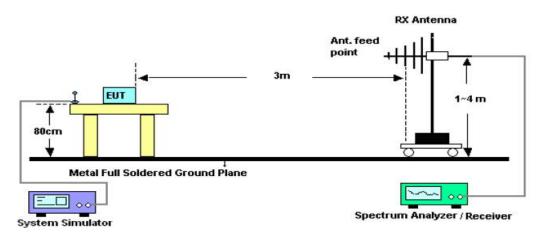


#### 10.2. TEST SETUP

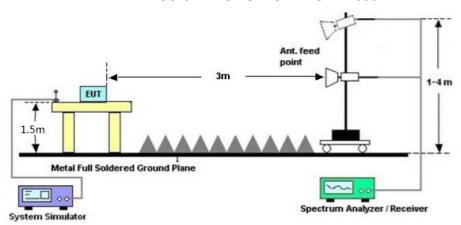
### Radiated Emission Test-Setup Frequency Below 30MHz



### RADIATED EMISSION TEST SETUP 30MHz-1000MHz



## RADIATED EMISSION TEST SETUP ABOVE 1000MHz





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#### 10.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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.

## 10.4. TEST RESULT

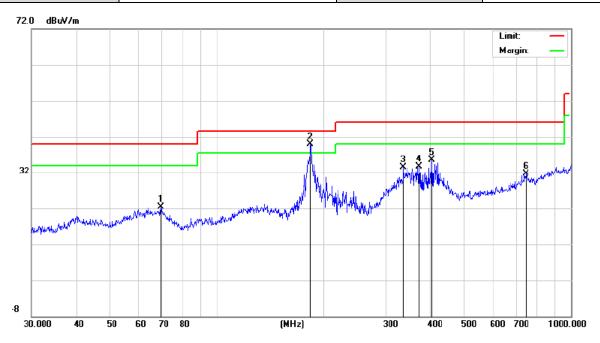
#### Radiated emission below 30MHz

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



### Radiated emission from 30MHz to 1000MHz

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

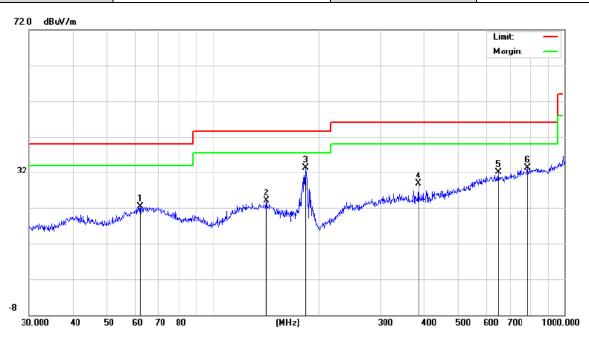


No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		69.3568	5.34	17.07	22.41	40.00	-17.59	peak
2	*	183.8440	23.79	16.02	39.81	43.50	-3.69	peak
3		336.0352	12.98	20.53	33.51	46.00	-12.49	peak
4		372.0045	13.09	20.61	33.70	46.00	-12.30	peak
5		404.6665	14.75	20.70	35.45	46.00	-10.55	peak
6		747.4825	7.89	23.75	31.64	46.00	-14.36	peak

**RESULT: PASS** 



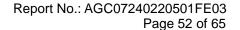
EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical



No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		61.9951	5.63	16.92	22.55	40.00	-17.45	peak
2		141.8262	6.11	18.04	24.15	43.50	-19.35	peak
3	*	183.8440	17.03	16.35	33.38	43.50	-10.12	peak
4		383.9318	9.91	19.06	28.97	46.00	-17.03	peak
5		647.3856	6.97	25.04	32.01	46.00	-13.99	peak
6		785.0935	6.33	27.07	33.40	46.00	-12.60	peak

Note: 1. Factor=Antenna Factor + Cable loss, Over=Measurement-Limit.

2. All test modes had been pre-tested. The mode 3 is the worst case and recorded in the report.





Radiated emission above 1GHz

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

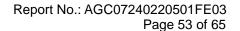
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	44.89	0.08	44.97	74	-29.03	peak
4804.000	37.62	0.08	37.7	54	-16.3	AVG
7206.000	40.74	2.21	42.95	74	-31.05	peak
7206.000	32.75	2.21	34.96	54	-19.04	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	43.67	0.08	43.75	74	-30.25	peak
4804.000	36.84	0.08	36.92	54	-17.08	AVG
7206.000	40.59	2.21	42.8	74	-31.2	peak
7206.000	31.62	2.21	33.83	54	-20.17	AVG
Remark:						

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





EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type	
4882.000	45.32	0.14	45.46	74	-28.54	peak	
4882.000	38.45	0.14	38.59	54	-15.41	AVG	
7323.000	41.51	2.36	43.87	74	-30.13	peak	
7323.000	34.68	2.36	37.04	54	-16.96	AVG	
Remark:	1		1		l		
Factor = Anter	na Factor + Cabl	e Loss – Pre-a	amplifier.			_	

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type	
4882.000	45.75	0.14	45.89	74	-28.11	peak	
4882.000	37.48	0.14	37.62	54	-16.38	AVG	
7323.000	40.62	2.36	42.98	74	-31.02	peak	
7323.000	33.61	2.36	35.97	54	-18.03	AVG	
Remark:							
actor = Anter	nna Factor + Cabl	e Loss – Pre-	amplifier.				



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EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.000	46.87	0.22	47.09	74	-26.91	peak
4960.000	38.69	0.22	38.91	54	-15.09	AVG
7440.000	41.52	2.64	44.16	74	-29.84	peak
7440.000	32.41	2.64	35.05	54	-18.95	AVG
Domark:						

Remark:

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

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type
4960.000	46.56	0.22	46.78	74	-27.22	peak
4960.000	38.63	0.22	38.85	54	-15.15	AVG
7440.000	40.39	2.64	43.03	74	-30.97	peak
7440.000	31.23	2.64	33.87	54	-20.13	AVG
Remark:						
Factor = Anter	nna Factor + Cabl	e 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, Margin=Level-Limit.

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

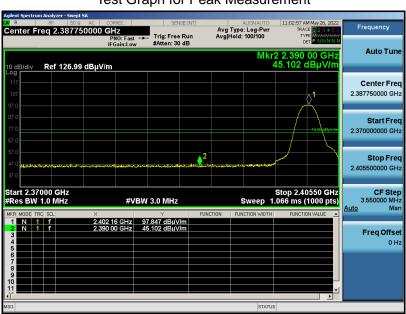
All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.



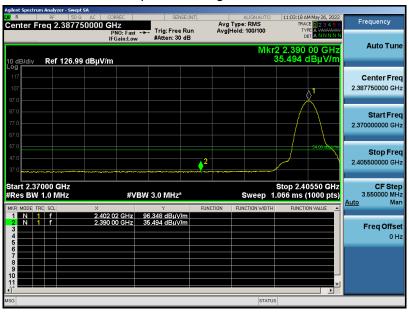
# Test result for band edge emission at restricted bands

EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

### Test Graph for Peak Measurement



Test Graph for Average Measurement

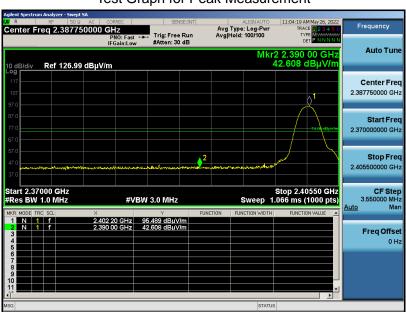


**RESULT: PASS** 

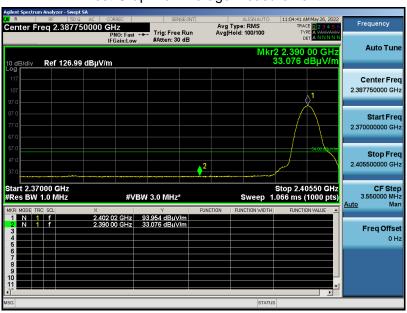


EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Test Graph for Peak Measurement



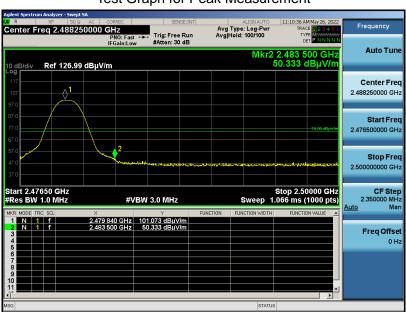
Test Graph for Average Measurement



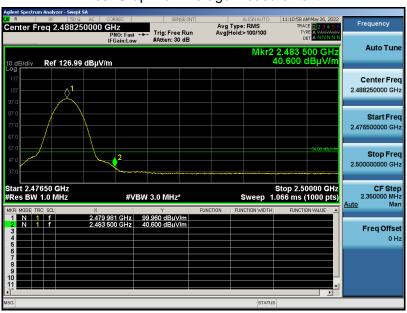


EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Test Graph for Peak Measurement



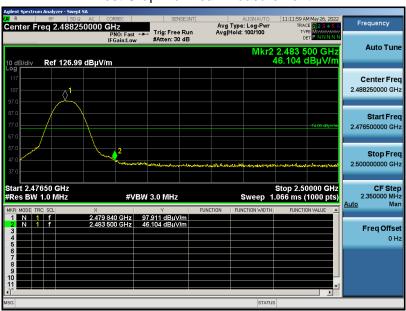
Test Graph for Average Measurement



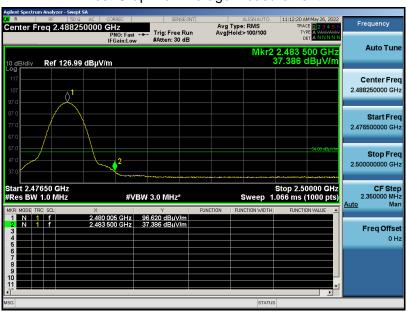


EUT	Bluetooth headphone	Model Name	Orange Crest MK 2
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



Note: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. The GFSK modulation is the worst case and recorded in the report.



### 11. NUMBER OF HOPPING FREQUENCY

#### 11.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- 1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- 2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- 3. VBW  $\geq$  RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.
- 4. Allow the trace to stabilize.

## 11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

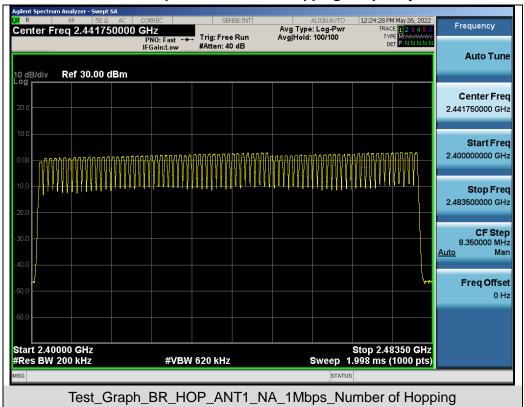
### 11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

#### 11.4. LIMITS AND MEASUREMENT RESULT

Test Data of Number of Hopping Frequency					
Test Mode Number of Hopping Frequency Limits Pass or Fa					
GFSK Hopping	79	>=15	Pass		

### **Test Graphs of Number of Hopping Frequency**



Note: The GFSK modulation is the worst case and recorded in the report.



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# 12. TIME OF OCCUPANCY (DWELL TIME)

### 12.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- 1. Span: Zero span, centered on a hopping channel.
- 2. RBW shall be ≤channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
- 3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- 4. Detector function: Peak. Trace: Max hold.
- 5. Use the marker-delta function to determine the transmit time per hop.
- 6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer)  $\times$  (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

## 12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

## 12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

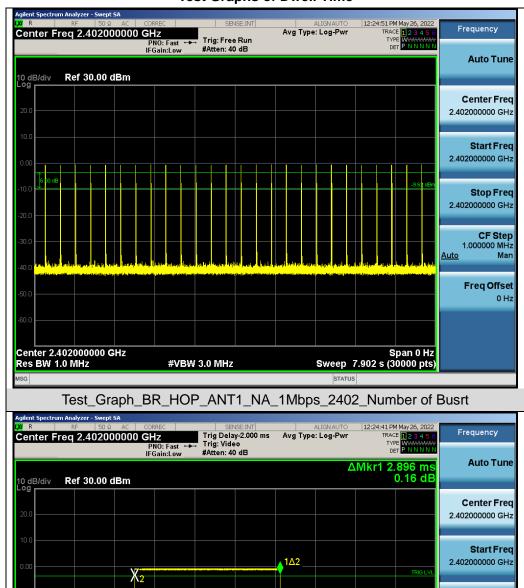
#### 12.4. LIMITS AND MEASUREMENT RESULT

Test Data of Dwell Time						
Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)	Pass or Fail	
2402	2.896	26.0*4	301.184	400	Pass	
2441	2.896	26.0*4	301.184	400	Pass	
2480	2.896	27.0*4	312.768	400	Pass	

Note: The GFSK modulation is the worst case and recorded in the report.



# **Test Graphs of Dwell Time**



2.402000000 GHz

Stop Freq
2.402000000 GHz

CF Step
1.000000 MHz
Auto
Man

Freq Offset
0 Hz

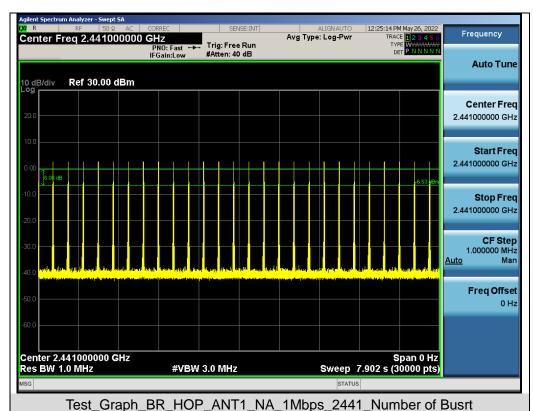
Center 2.402000000 GHz

Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 8.000 ms (30000 pts)

Test\_Graph\_BR\_HOP\_ANT1\_NA\_1Mbps\_2402\_Time per Burst

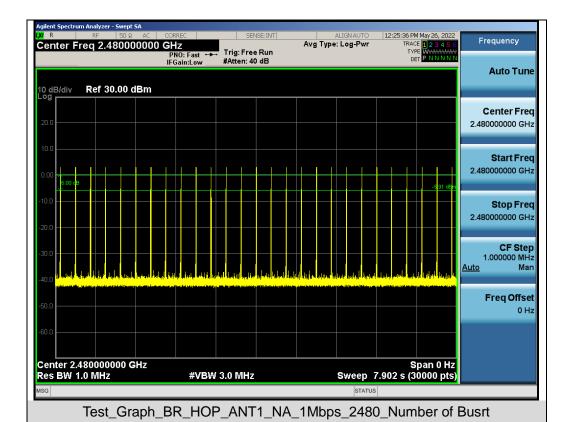
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12:25:04 PM May 26, 2022 TRACE 1 2 3 4 5 6 TYPE WHATHAM DET P N N N N N Frequency Trig Delay-2.000 ms Trig: Video #Atten: 40 dB Center Freq 2.441000000 GHz Avg Type: Log-Pwr PNO: Fast ↔ IFGain:Low **Auto Tune** ΔMkr1 2.896 ms 0.14 dE 10 dB/div Ref 30.00 dBm Center Frea 2.441000000 GHz Start Freq 1Δ2 2 441000000 GHz  $X_2$ Stop Frea 2.441000000 GHz 1.000000 MHz Auto Man Freq Offset Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 8.000 ms (30000 pts) #VBW 3.0 MHz Test\_Graph\_BR\_HOP\_ANT1\_NA\_1Mbps\_2441\_Time per Burst





Frequency Trig Delay-2.000 ms Trig: Video #Atten: 40 dB Center Freq 2.480000000 GHz Avg Type: Log-Pwr PNO: Fast ↔ IFGain:Low **Auto Tune** ΔMkr1 2.896 ms 0.10 dE 10 dB/div Ref 30.00 dBm Center Frea 2.480000000 GHz Start Freq 1Δ2 2 480000000 GHz  $X_2$ Stop Frea 2.480000000 GHz 1.000000 MHz Auto Man Freq Offset Center 2.480000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 8.000 ms (30000 pts) **#VBW 3.0 MHz** 

Test\_Graph\_BR\_HOP\_ANT1\_NA\_1Mbps\_2480\_Time per Burst

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## 13. FREQUENCY SEPARATION

### 13.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- 1. Span: Wide enough to capture the peaks of two adjacent channels.
- 2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
- 3. Video (or average) bandwidth (VBW) ≥ RBW.
- 4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

## 13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 6.2

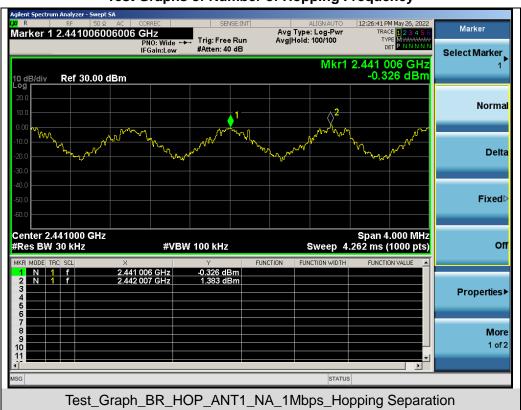
#### 13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

### 13.4. LIMITS AND MEASUREMENT RESULT

Test Data of Frequency Separation						
Test Mode	Channel Separation (MHz)	Limits	Pass or Fail			
GFSK Hopping	1.001	>= 2/3 -20dB BW	Pass			

### **Test Graphs of Number of Hopping Frequency**



Note: The GFSK modulation is the worst case and recorded in the report.



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## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Refer to the Report No.: AGC07240220501AP01

**APPENDIX B: PHOTOGRAPHS OF EUT** 

Refer to the Report No.: AGC07240220501AP02

----END OF REPORT----



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