

FCC Test Report

Report No.: AGC13961230501FE03

FCC ID : 2BBUE-RCII-SPINTSO

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION: BLUETOOTH INTERCOM HEADSET

BRAND NAME : SPINTSO

MODEL NAME

REFCOM II, REFCOM I, REFCOM II PRO,

REFCOM III, REFCOM PRO

APPLICANT : SPINTSO AB

DATE OF ISSUE : Jul. 12, 2023

STANDARD(S) : FCC Part 15.247

REPORT VERSION: V1.0

Attestation of Global Concilance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul. 12, 2023	Valid	Initial Release



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1. VERIFICATION OF CONFORMITY

Applicant	SPINTSO AB
Address	Drottninggatan 33, 11151 Stockholm Sweden
Manufacturer	Shenzhen NOECI Technology Co., Ltd
Address	Room 1303, Shidai building, Longsheng street, Gongye West Road, Longhua district, Shenzhen city, Guangdong province, China
Factory	Shenzhen NOECI Technology Co., Ltd
Address	Room 1303, Shidai building, Longsheng street, Gongye West Road, Longhua district, Shenzhen city, Guangdong province, China
Product Designation	BLUETOOTH INTERCOM HEADSET
Brand Name	SPINTSO
Test Model	REFCOM II
Series Model	REFCOM, REFCOM I, REFCOM II PRO, REFCOM III, REFCOM PRO
Declaration of Difference	All the same except for the model name.
Date of receipt of test item	Jun. 07, 2023
Date of test	Jun. 07, 2023 to Jul. 12, 2023
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 Huang	
	Thea Huang (Project Engineer)	Jul. 12, 2023
Reviewed By	Calin Lin	
	Calvin Liu (Reviewer)	Jul. 12, 2023
Approved By	Max Zhang	
	Max Zhang (Authorized Officer)	Jul. 12, 2023



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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

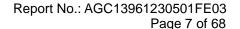
The EUT is designed as "BLUETOOTH INTERCOM HEADSET". It is designed by way of utilizing the GFSK, π /4-DQPSK and 8DPSK technology to achieve the system operation.

A major technical description of EUT is described as following

· · · · · · · · · · · · · · · · · · ·		
Operation Frequency	2.402 GHz to 2.480 GHz	
RF Output Power	5.286dBm (Max)	
Bluetooth Version	V5.1	
Modulation	BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps	
Number of channels	79 Channels	
Hardware Version	V3.0	
Software Version	V2.0	
Antenna Designation	Hardware Antenna (Comply with requirements of the FCC part 15.203)	
Antenna Gain	4.37dBi	
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:

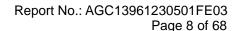
- 1. LAP/UAP of the master of the connection.
- 2. Internal master clock.

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: 2BBUE-RCII-SPINTSO** 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	$U_c = \pm 2.7 \%$
Uncertainty of Occupied Channel Bandwidth	U _c = ±2 %



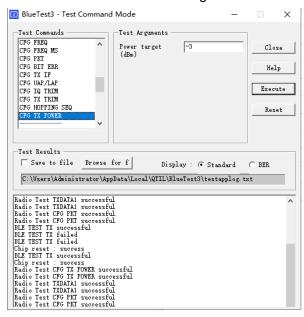
4. DESCRIPTION OF TEST MODES

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

Software Setting





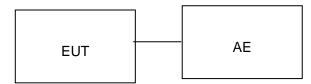
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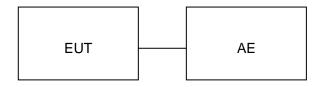
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF 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 INTERCOM HEADSET	REFCOM II	2BBUE-RCII-SPINTSO	EUT
2	Type-C Cable	N/A	1.0m unshielded	AE
3	Adapter	HW-050200C01	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	Compliant



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6. TEST FACILITY

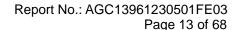
Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	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	Aug. 04, 2022	Aug. 03, 2023
LISN	R&S	ESH2-Z5	100086	Jun. 03, 2023	Jun. 02, 2024
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	Feb. 18, 2023	Feb. 17, 2024
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Aug. 04, 2022	Aug. 03, 2023
2.4GHz Filter	EM Electronics	2400-2500	N/A	Mar. 22, 2022	Mar. 21, 2024
Attenuator	ZHINAN	E-002	N/A	Aug. 04, 2022	Aug. 03, 2024
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Oct. 31, 2021	Oct. 30, 2023
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Mar. 12, 2022	Mar. 11, 2024
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	Mar. 23, 2023	Mar. 22, 2024
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 02, 2022	Sep. 01, 2024
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 05, 2023	Jan. 04, 2025
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A





7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

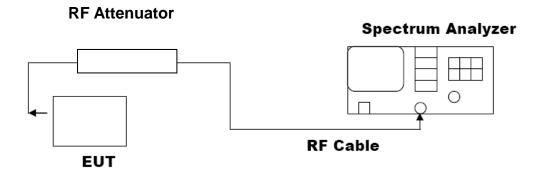
For peak power test:

- 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





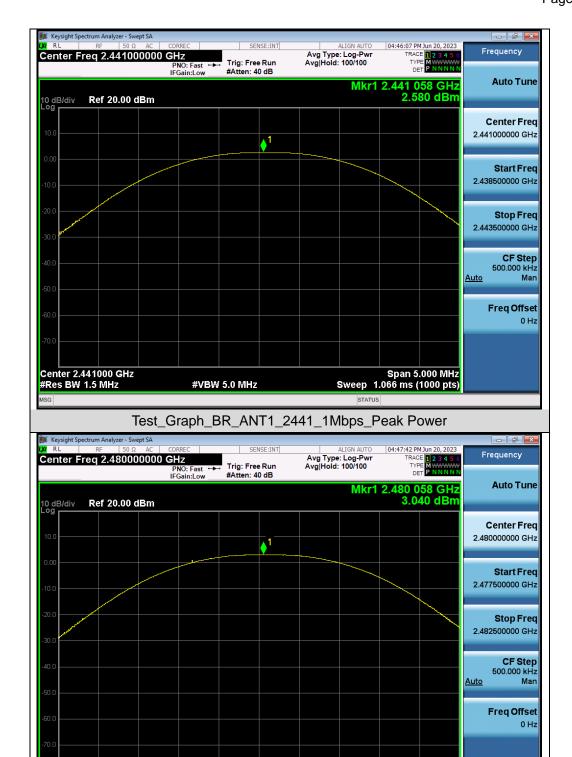
7.3. LIMITS AND MEASUREMENT RESULT

Test Data of Conducted Output Power					
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail	
GFSK	2402	2.390	≤21	Pass	
	2441	2.580	≤21	Pass	
	2480	3.040	≤21	Pass	
π /4-DQPSK	2402	4.612	≤21	Pass	
	2441	4.321	≤21	Pass	
	2480	3.554	≤21	Pass	
8DPSK	2402	5.286	≤21	Pass	
	2441	4.671	≤21	Pass	
	2480	4.938	≤21	Pass	

Test Graphs of Conducted Output Power







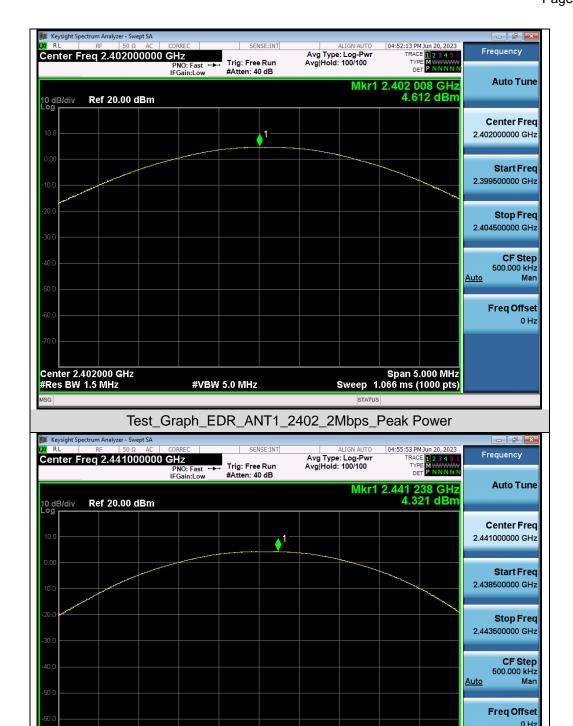
Test_Graph_BR_ANT1_2480_1Mbps_Peak Power

#VBW 5.0 MHz

Span 5.000 MHz Sweep 1.066 ms (1000 pts)

Center 2.480000 GHz #Res BW 1.5 MHz





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Test_Graph_EDR_ANT1_2441_2Mbps_Peak Power

#VBW 5.0 MHz

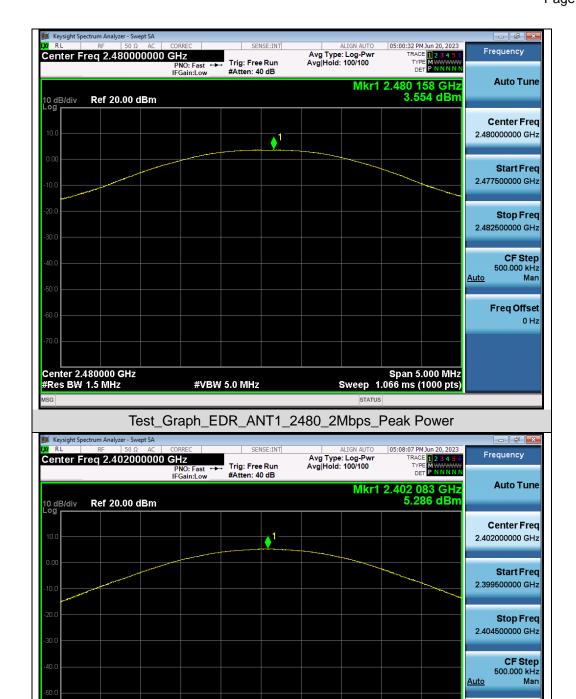
Span 5.000 MHz Sweep 1.066 ms (1000 pts)

Center 2.441000 GHz #Res BW 1.5 MHz

Freq Offset

Span 5.000 MHz Sweep 1.066 ms (1000 pts)





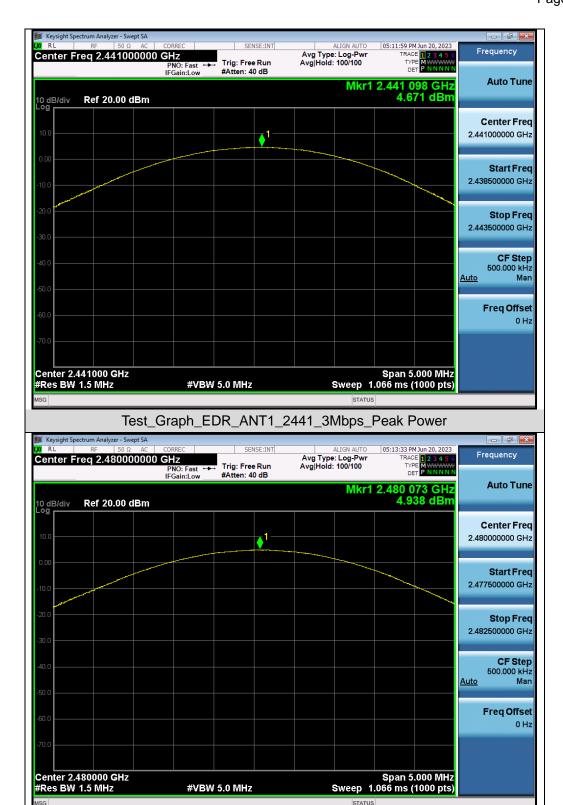
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Test_Graph_EDR_ANT1_2402_3Mbps_Peak Power

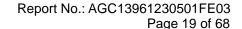
#VBW 5.0 MHz

Center 2.402000 GHz #Res BW 1.5 MHz





Test_Graph_EDR_ANT1_2480_3Mbps_Peak Power



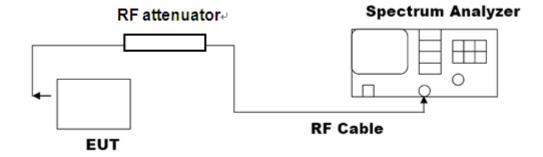


8. 20DB BANDWIDTH

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)





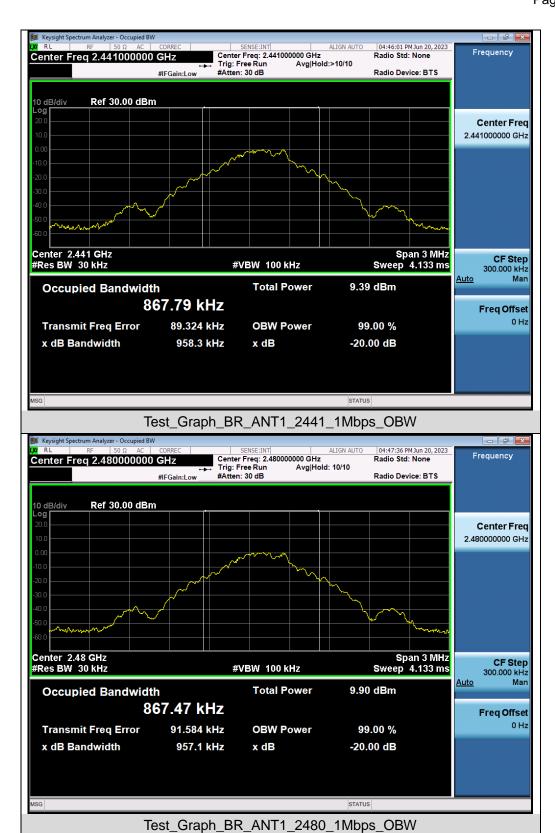
8.3. LIMITS AND MEASUREMENT RESULTS

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	0.868	0.957	N/A	Pass
	2441	0.868	0.958	N/A	Pass
	2480	0.867	0.957	N/A	Pass
π /4-DQPSK	2402	1.228	1.345	N/A	Pass
	2441	1.205	1.342	N/A	Pass
	2480	1.263	1.348	N/A	Pass
8DPSK	2402	1.218	1.329	N/A	Pass
	2441	1.207	1.313	N/A	Pass
	2480	1.213	1.313	N/A	Pass

Test Graphs of Occupied Bandwidth and -20 Bandwidth



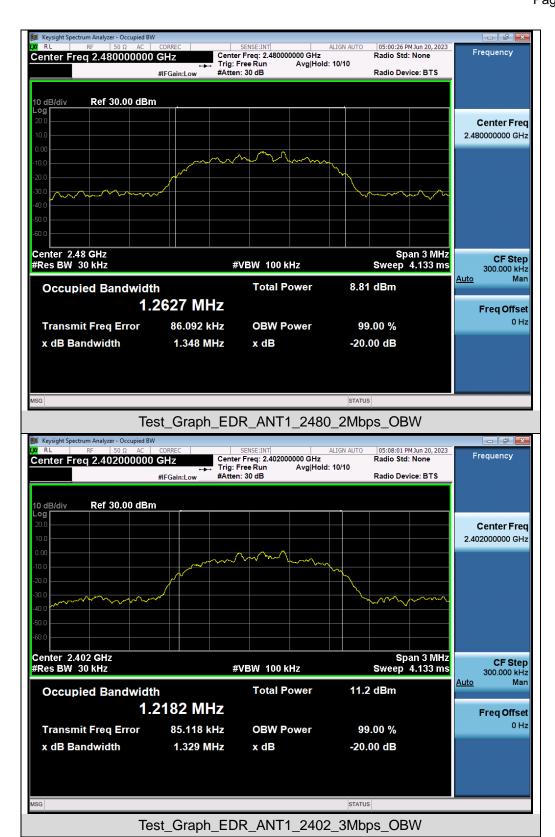


















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9. CONDUCTED SPURIOUS EMISSION

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

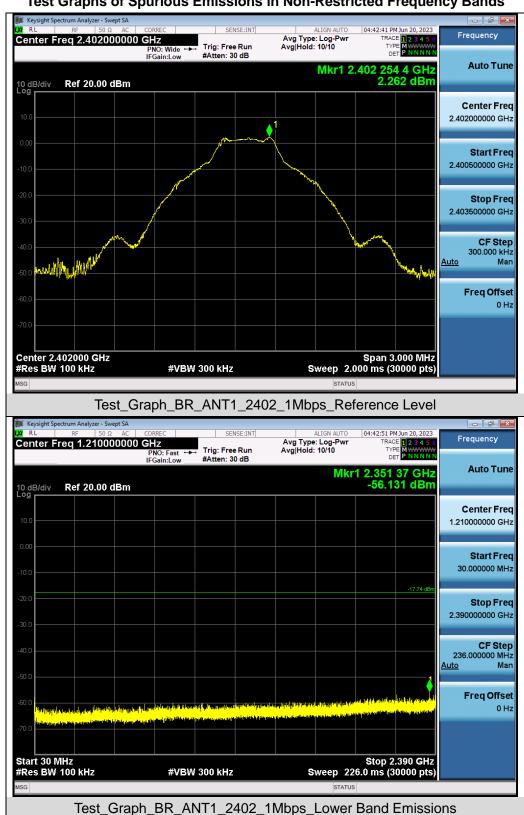
The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT				
Amuliachia Limita	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	PASS		
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))				

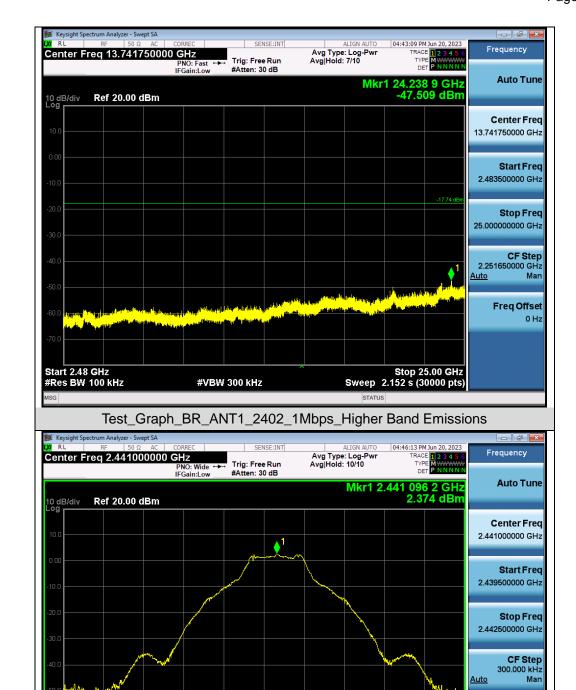


Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Freq Offset





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Test_Graph_BR_ANT1_2441_1Mbps_Reference Level

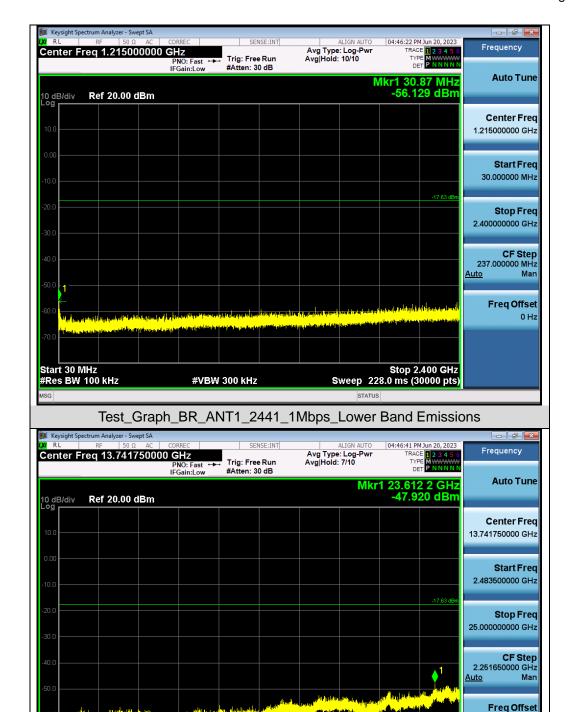
#VBW 300 kHz

Span 3.000 MHz Sweep 2.000 ms (30000 pts)

Center 2.441000 GHz #Res BW 100 kHz

0 Hz





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Test_Graph_BR_ANT1_2441_1Mbps_Higher Band Emissions

#VBW 300 kHz

Stop 25.00 GHz Sweep 2.152 s (30000 pts)

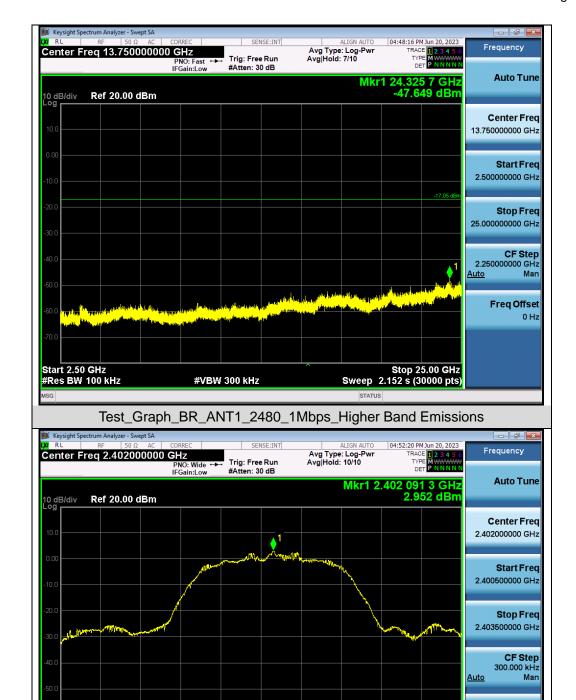
Start 2.48 GHz #Res BW 100 kHz





Freq Offset





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Test_Graph_EDR_ANT1_2402_2Mbps_Reference Level

#VBW 300 kHz

Span 3.000 MHz Sweep 2.000 ms (30000 pts)

Center 2.402000 GHz #Res BW 100 kHz

CF Step 2.251650000 GHz

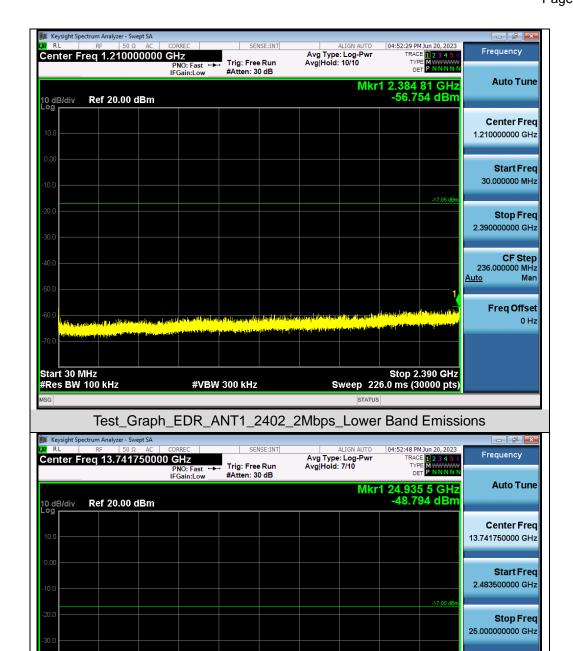
Freq Offset 0 Hz

Mar

<u>Auto</u>

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





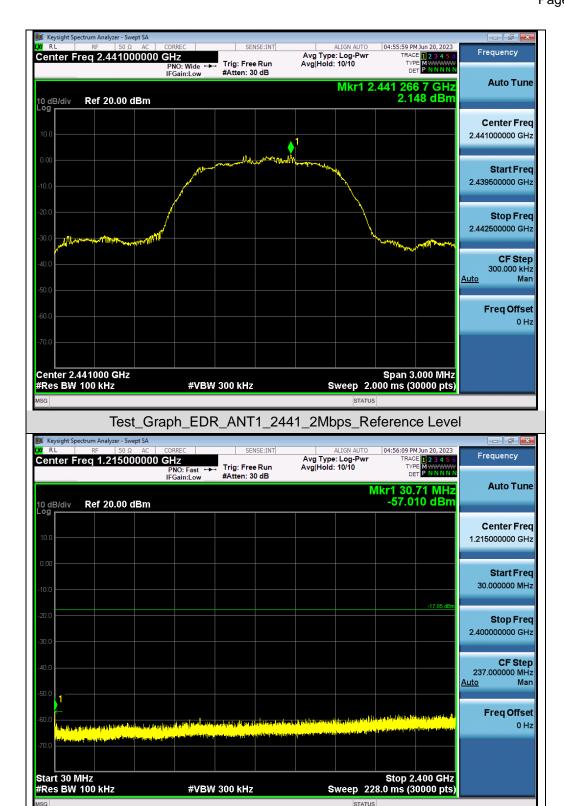
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the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

Test_Graph_EDR_ANT1_2402_2Mbps_Higher Band Emissions

#VBW 300 kHz

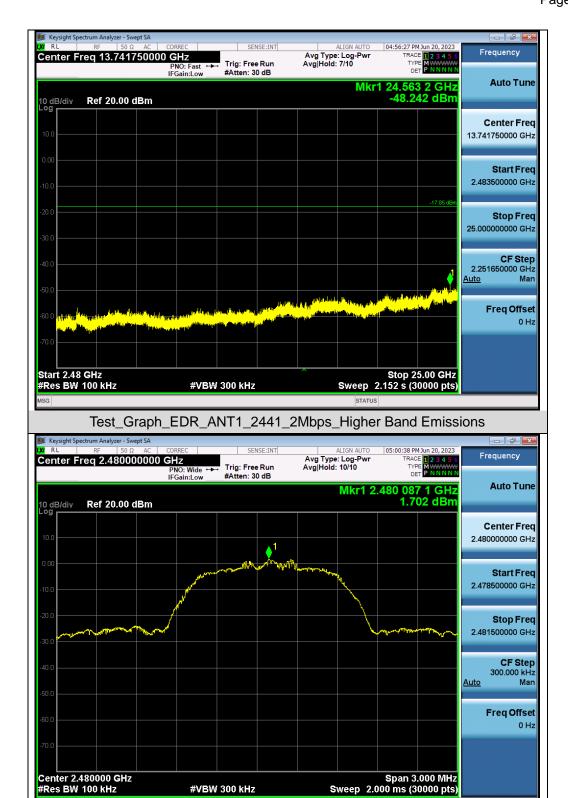
Start 2.48 GHz #Res BW 100 kHz





Test_Graph_EDR_ANT1_2441_2Mbps_Lower Band Emissions





Test_Graph_EDR_ANT1_2480_2Mbps_Reference Level

25.000000000 GHz

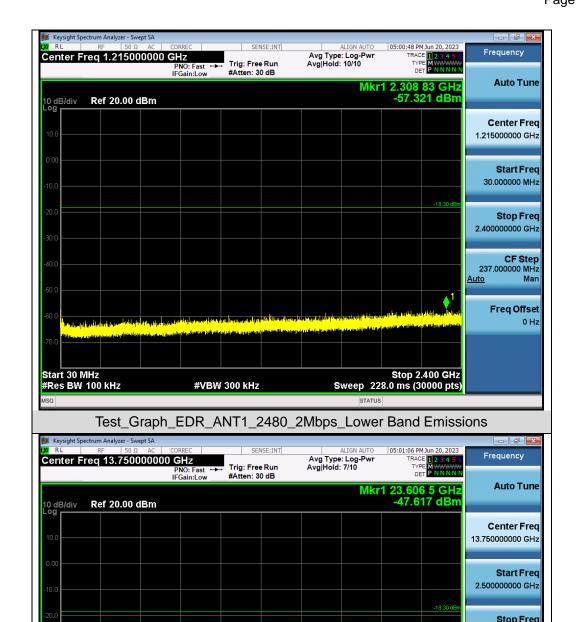
<u>Auto</u>

Stop 25.00 GHz Sweep 2.152 s (30000 pts) CF Step 2.250000000 GHz

> Freq Offset 0 Hz

Mar





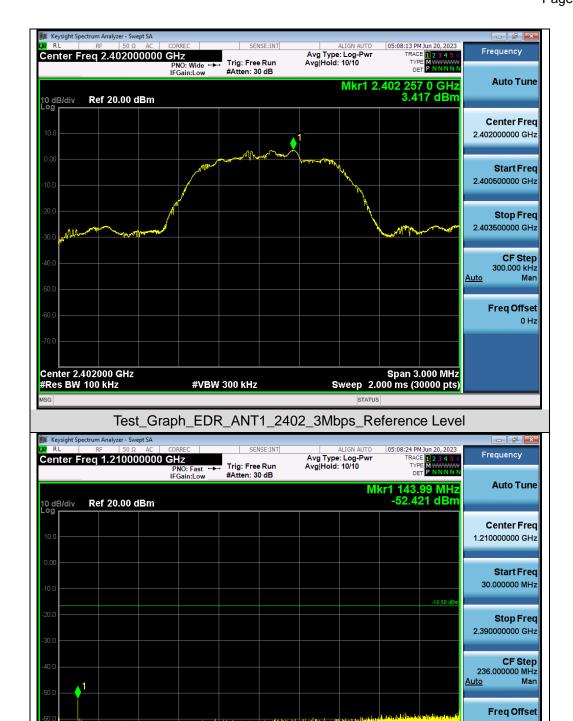
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the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

Test_Graph_EDR_ANT1_2480_2Mbps_Higher Band Emissions

#VBW 300 kHz

Start 2.50 GHz #Res BW 100 kHz





Test_Graph_EDR_ANT1_2402_3Mbps_Lower Band Emissions

#VBW 300 kHz

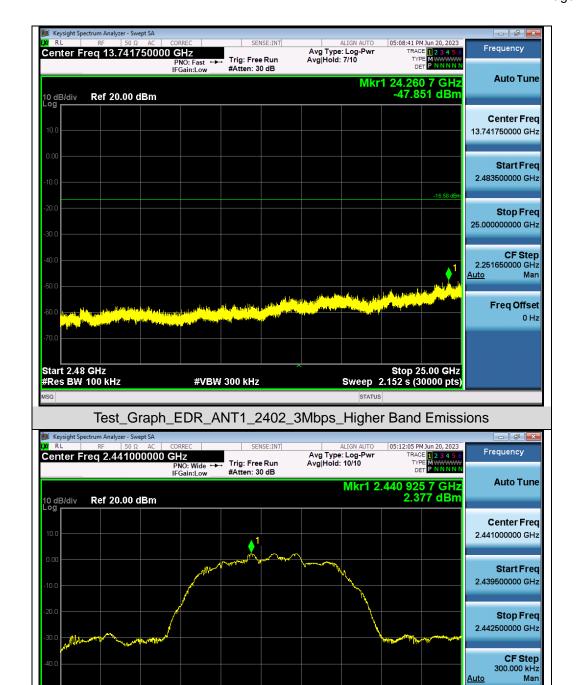
Stop 2.390 GHz Sweep 226.0 ms (30000 pts)

Start 30 MHz #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

2.251650000 GHz

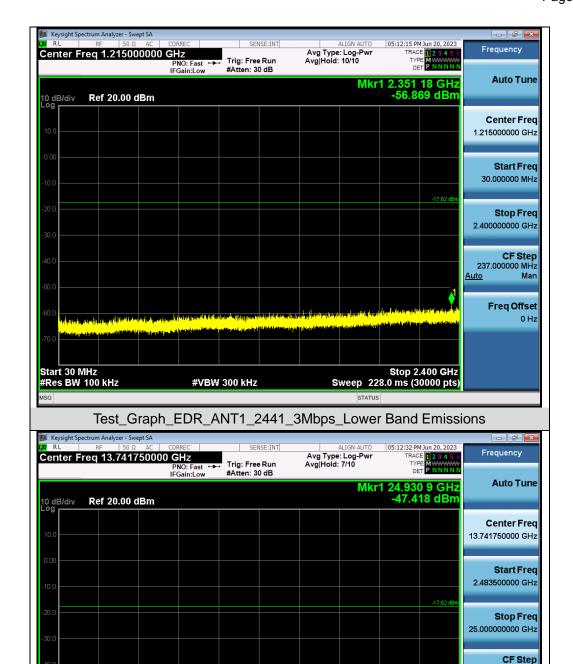
Freq Offset 0 Hz

Mar

<u>Auto</u>

Stop 25.00 GHz Sweep 2.152 s (30000 pts)





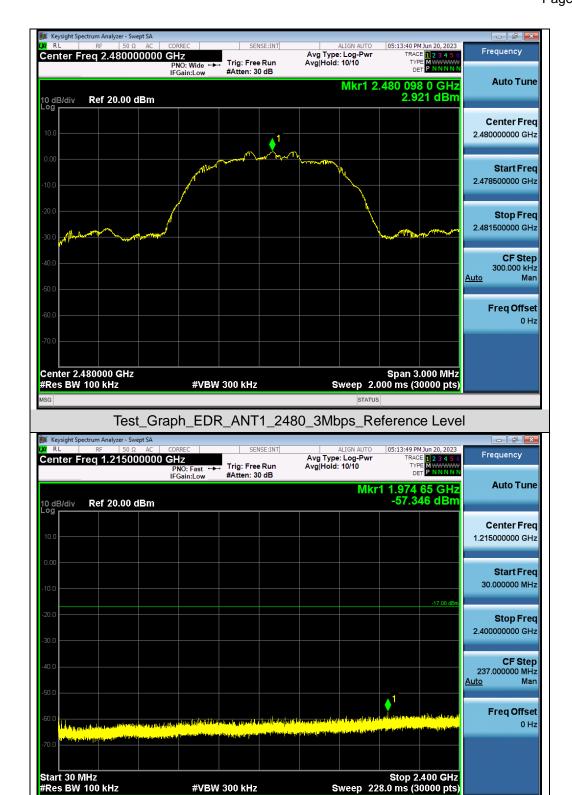
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the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

Test_Graph_EDR_ANT1_2441_3Mbps_Higher Band Emissions

#VBW 300 kHz

Start 2.48 GHz #Res BW 100 kHz

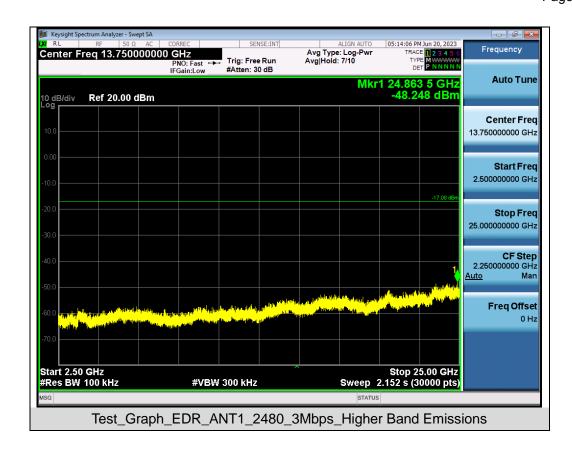




Test_Graph_EDR_ANT1_2480_3Mbps_Lower Band Emissions

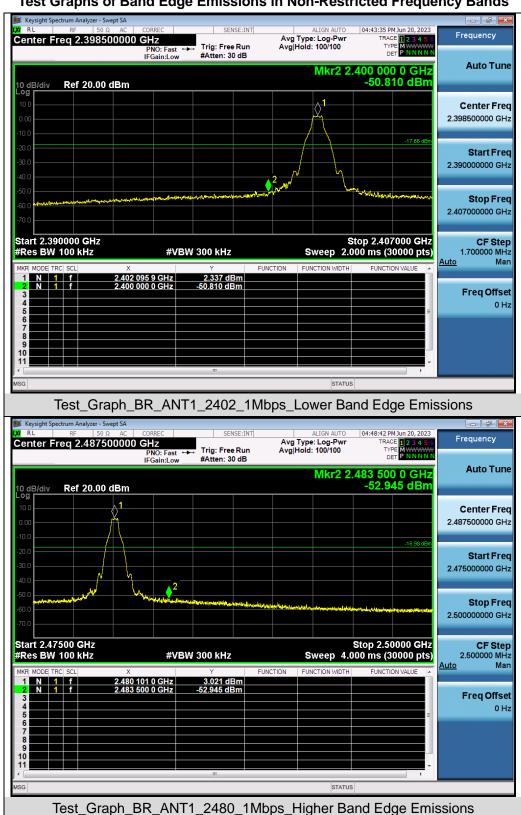
#VBW 300 kHz



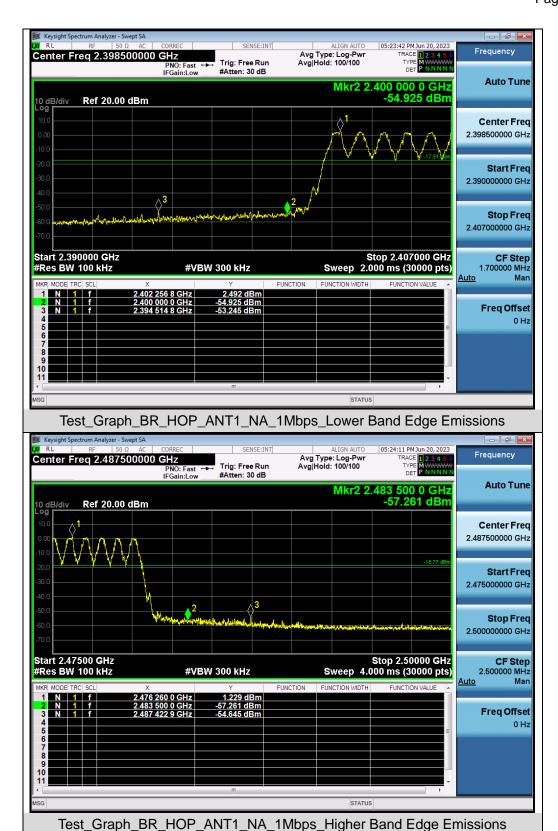




Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands











Test_Graph_EDR_ANT1_2480_2Mbps_Higher Band Edge Emissions













Test_Graph_EDR_HOP_ANT1_NA_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.

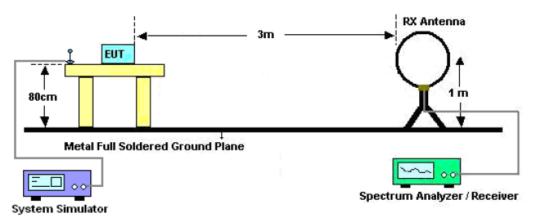
Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz
Start ~Stop Frequency	1MHz/3MHz for Peak, 1MHz/3MHz for Average

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

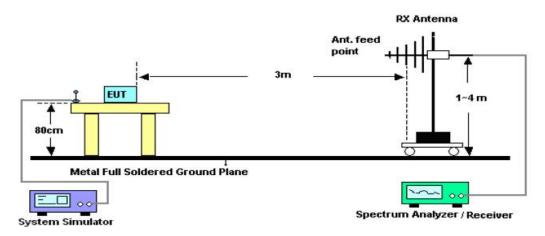


10.2. TEST SETUP

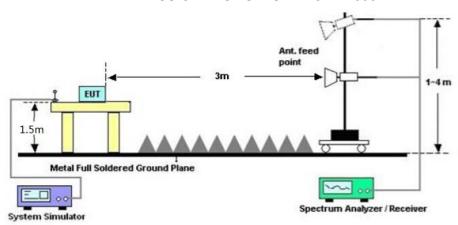
Radiated Emission Test-Setup Frequency Below 30MHz



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

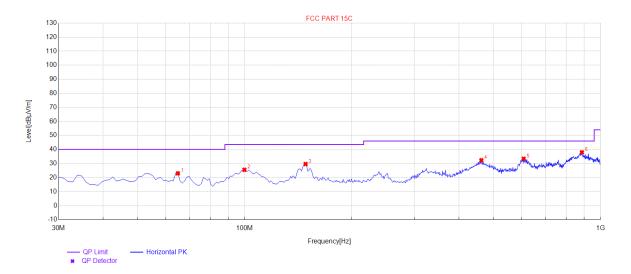
Radiated emission below 30MHz

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 INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Horizontal

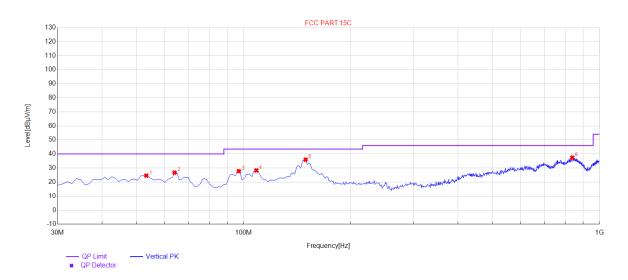


NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	64.92	23.02	12.14	40.00	16.98	100	320	Horizontal
2	99.84	25.55	21.38	43.50	17.95	100	300	Horizontal
3	148.34	29.63	14.46	43.50	13.87	100	280	Horizontal
4	462.62	32.35	27.40	46.00	13.65	100	50	Horizontal
5	608.12	33.39	28.42	46.00	12.61	100	360	Horizontal
6	886.51	37.97	32.77	46.00	8.03	100	10	Horizontal

RESULT: PASS



EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	53.28	24.60	13.84	40.00	15.40	100	130	Vertical
2	63.95	26.72	14.37	40.00	13.28	100	100	Vertical
3	96.93	27.74	12.76	43.50	15.76	100	230	Vertical
4	108.57	28.30	14.84	43.50	15.20	100	250	Vertical
5	149.31	35.98	20.81	43.50	7.52	100	340	Vertical
6	838.01	37.40	32.44	46.00	8.60	100	120	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Limit-Level.

2. All test modes had been pre-tested. The mode 7 is the worst case and recorded in the report.



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Radiated emission above 1GHz

EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	44.58	0.08	44.66	74	-29.34	peak
4804.000	37.41	0.08	37.49	54	-16.51	AVG
7206.000	40.69	2.21	42.9	74	-31.1	peak
7206.000	32.32	2.21	34.53	54	-19.47	AVG

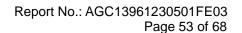
Remark:

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

EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	43.78	0.08	43.86	74	-30.14	peak
4804.000	36.41	0.08	36.49	54	-17.51	AVG
7206.000	40.25	2.21	42.46	74	-31.54	peak
7206.000	31.36	2.21	33.57	54	-20.43	AVG
Remark:						

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





EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 8	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.000	45.59	0.14	45.73	74	-28.27	peak
4882.000	38.48	0.14	38.62	54	-15.38	AVG
7323.000	41.23	2.36	43.59	74	-30.41	peak
7323.000	34.41	2.36	36.77	54	-17.23	AVG
Remark:						
actor = Anter	na Factor + Cabl	e Loss – Pre-	amplifier.			

EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 8	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.000	45.48	0.14	45.62	74	-28.38	peak
4882.000	37.36	0.14	37.5	54	-16.5	AVG
7323.000	40.59	2.36	42.95	74	-31.05	peak
7323.000	33.22	2.36	35.58	54	-18.42	AVG
Remark:						
actor = Anter	nna Factor + Cable	Loss – Pre-	amplifier.			





EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 9	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.000	46.57	0.22	46.79	74	-27.21	peak
4960.000	38.74	0.22	38.96	54	-15.04	AVG
7440.000	41.86	2.64	44.5	74	-29.5	peak
7440.000	32.39	2.64	35.03	54	-18.97	AVG
Remark:						_
Factor = Anter	nna Factor + Cabl	e Loss – Pre-	amplifier.			

EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 9	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.000	46.71	0.22	46.93	74	-27.07	peak
4960.000	38.53	0.22	38.75	54	-15.25	AVG
7440.000	40.45	2.64	43.09	74	-30.91	peak
7440.000	31.26	2.64	33.9	54	-20.1	AVG
Remark:						
factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

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

Factor = Antenna Factor + Cable loss - Amplifier gain, Margin=Level-Limit.

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

All test modes had been tested. The 8DPSK modulation is the worst case and recorded in the report.



Test result for band edge emission at restricted bands

EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 7	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

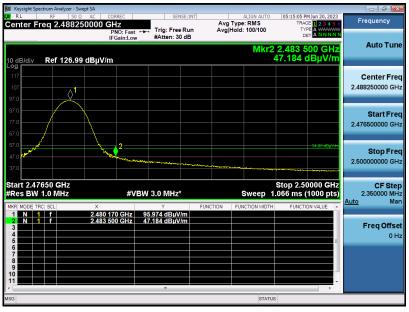


EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 9	Antenna	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

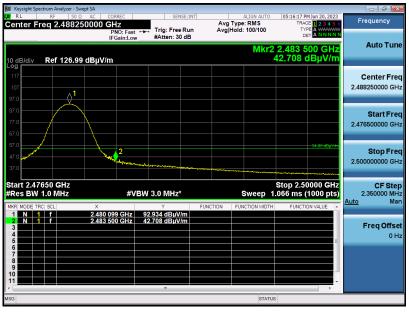


EUT	BLUETOOTH INTERCOM HEADSET	Model Name	REFCOM II
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 9	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

Note: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. The 8DPSK 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 > 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

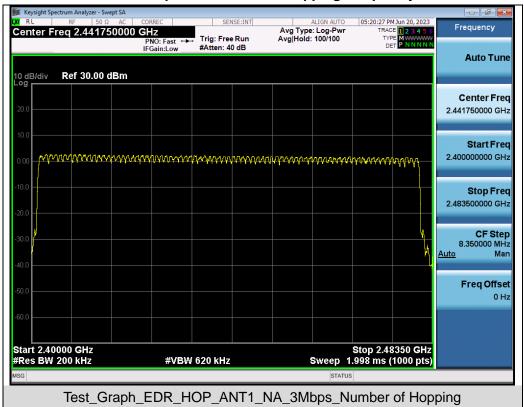
11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

11.4. LIMITS AND MEASUREMENT RESULT

Test Data of Number of Hopping Frequency				
Test Mode	Limits	Pass or Fail		
8DPSK Hopping	79	>=15	Pass	

Test Graphs of Number of Hopping Frequency



Note: The 8DPSK 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

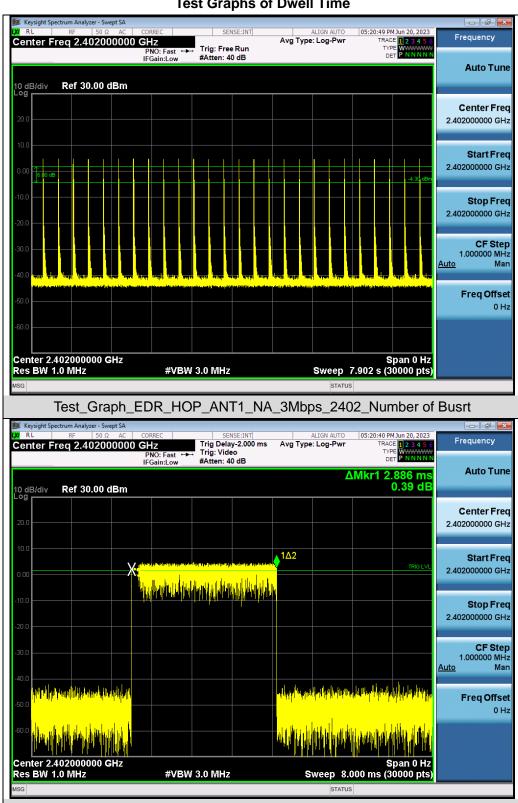
12.4. LIMITS AND MEASUREMENT RESULT

Test Data of Dwell Time								
Channel	Time of Pulse for 3DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)	Pass or Fail			
2402	2.886	26.0*4	300.144	400	Pass			
2441	2.886	27.0*4	311.688	400	Pass			
2480	2.886	27.0*4	311.688	400	Pass			

Note: The 8DPSK modulation is the worst case and recorded in the report.



Test Graphs of Dwell Time

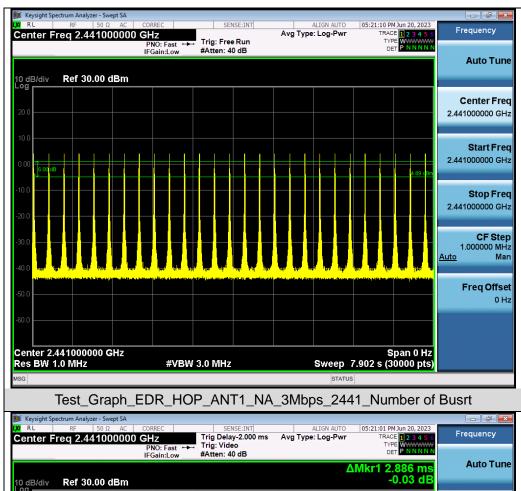


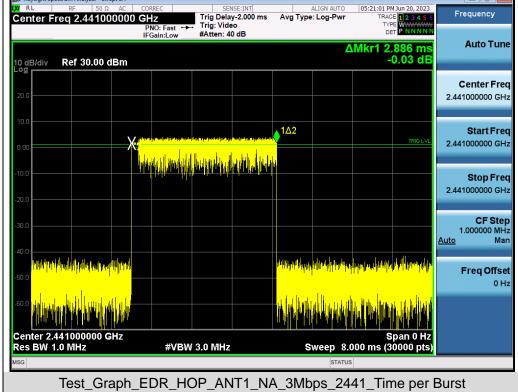
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Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2402_Time per Burst

Web: http://www.agccert.com/

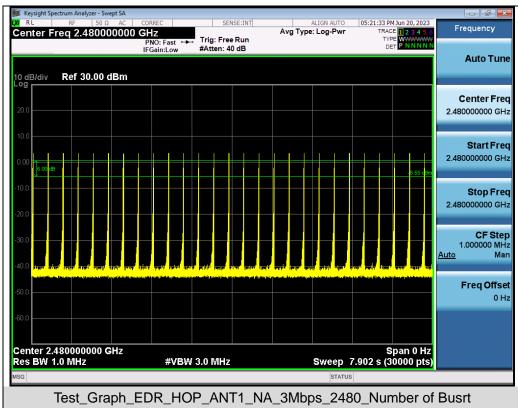


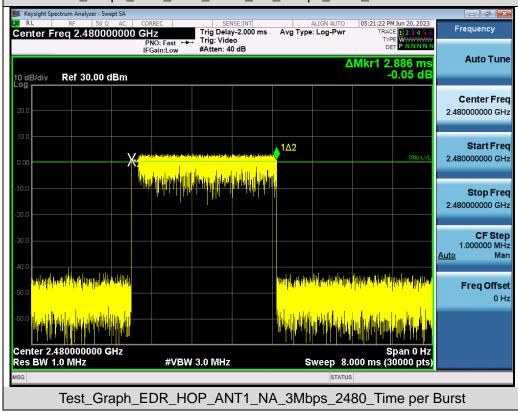




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13. FREQUENCY SEPARATION

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 F							
8DPSK Hopping	1.009	>= 2/3 -20dB BW	Pass				

Test Graphs of Number of Hopping Frequency



Note: The 8DPSK modulation is the worst case and recorded in the report.



14. LINE CONDUCTED EMISSION TEST

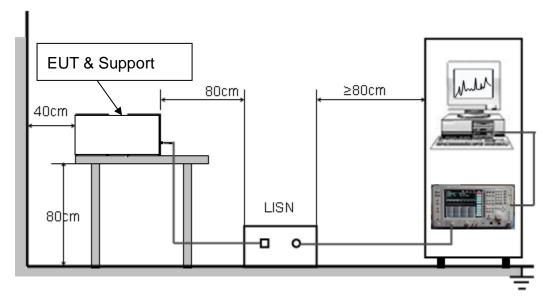
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

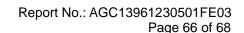
F	Maximum RF Line Voltage				
Frequency	Q.P. (dBμV)	Average (dBμV)			
150kHz~500kHz	66-56	56-46			
500kHz~5MHz	56	46			
5MHz~30MHz	60	50			

Note:

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

14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST







14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

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

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

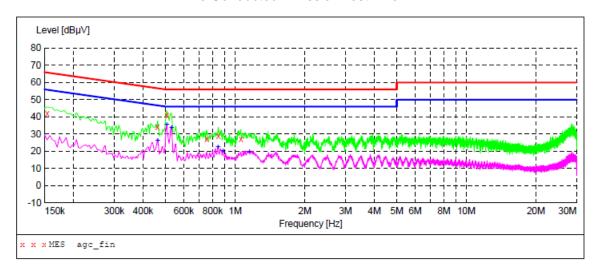
14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

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



14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



MEASUREMENT RESULT: "agc_fin"

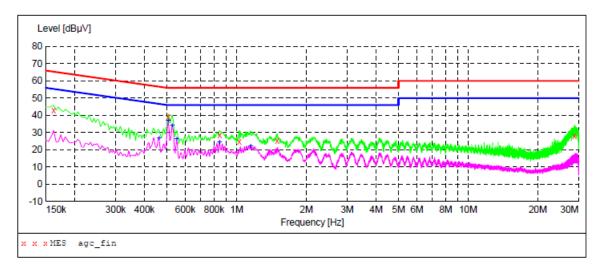
Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
42.00	6.1	66	23.8	QP	L1
34.30	6.1	57	22.4	QP	L1
41.00	6.1	56	15.0	QP	L1
27.20	6.2	56	28.8	QP	L1
29.00	6.2	56	27.0	QP	L1
26.90	6.2	56	29.1	QP	L1
	dBμV 42.00 34.30 41.00 27.20 29.00	dBμV dB 42.00 6.1 34.30 6.1 41.00 6.1 27.20 6.2 29.00 6.2	dBμV dB dBμV 42.00 6.1 66 34.30 6.1 57 41.00 6.1 56 27.20 6.2 56 29.00 6.2 56	dBμV dB dBμV dB 42.00 6.1 66 23.8 34.30 6.1 57 22.4 41.00 6.1 56 15.0 27.20 6.2 56 28.8 29.00 6.2 56 27.0	42.00 6.1 66 23.8 QP 34.30 6.1 57 22.4 QP 41.00 6.1 56 15.0 QP 27.20 6.2 56 28.8 QP 29.00 6.2 56 27.0 QP

MEASUREMENT RESULT: "agc fin2"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.462000	26.20	6.1	47	20.5	AV	L1
0.506000	35.60	6.1	46	10.4	AV	L1
0.530000	33.70	6.1	46	12.3	AV	L1
0.842000	22.40	6.2	46	23.6	AV	L1
0.886000	20.30	6.2	46	25.7	AV	L1
1.154000	19.60	6.2	46	26.4	AV	L1



Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "agc fin"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.162000	42.90	6.1	65	22.5	QP	N
0.506000	39.40	6.1	56	16.6	QP	N
0.846000	28.40	6.2	56	27.6	QP	N
1.026000	24.80	6.2	56	31.2	QP	N
1.498000	25.10	6.2	56	30.9	QP	N
28.774000	28.20	9.0	60	31.8	QP	N

MEASUREMENT RESULT: "agc fin2"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.462000	26.70	6.1	47	20.0	AV	N
0.506000	37.00	6.1	46	9.0	AV	N
0.526000	34.10	6.1	46	11.9	AV	N
0.550000	26.30	6.1	46	19.7	AV	N
0.842000	24.10	6.2	46	21.9	AV	N
1.150000	22.20	6.2	46	23.8	AV	N

RESULT: PASS

Note: All the test modes had been tested, the mode 7 was the worst case. Only the data of the worst case would be record in this test report.



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APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Refer to the Report No.: AGC13961230501AP02

APPENDIX B: PHOTOGRAPHS OF EUT

Refer to the Report No.: AGC13961230501AP03

----END OF REPORT----



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