TEST REPORT

Product Name	:	HAYLOU Freear
Brand Mark	:	HAYLOU
Model No.	:	Haylou 100
FCC ID	:	2AMQ6-HAYLOU100
Report Number	:	BLA-EMC-202203-A1302
Date of Sample Receipt	:	2022/3/5
Date of Test	:	2022/3/6 to 2022/3/22
Date of Issue	:	2022/3/22
Test Standard	:	47 CFR Part 15, Subpart C 15.247
Test Result	:	Pass

Prepared for:

Dongguan Liesheng Electronic Co., Ltd.

Room 401-410, Building 1, No.86 Hongtu Road, Nancheng District, Dongguan City, Guangdong, China

Prepared by:

BlueAsia of Technical Services(Shenzhen) Co., Ltd

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Compiled by Kagan

Review by: Sweet Liang

Approved by: BlueZhong

Date: 2022/3/22

REPORT REVISE RECORD

Version No.	Date	Description
00	2022/3/22	Original

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1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2	47 CFR Part 15, Subpart C 15.247(d)	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11	47 CFR Part 15, Subpart C 15.247(d)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass

2 GENERAL INFORMATION

Applicant	Dongguan Liesheng Electronic Co., Ltd.
Address	Room 401-410, Building 1, No.86 Hongtu Road, Nancheng District, Dongguan City, Guangdong, China
Manufacturer	Dongguan Liesheng Electronic Co., Ltd.
Address	Room 401-410, Building 1, No.86 Hongtu Road, Nancheng District, Dongguan City, Guangdong, China
Factory	Dongguan Zhengrong Electronic Co., Ltd.
Address	No.4, Shugang Avenue, Hongmei Town, Dongguan City, Guangdong
Product Name	HAYLOU Freear
Test Model No.	Haylou 100

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	V1.0
Software Version	1.0

Operation Frequency:	2402MHz-2480MHz
Modulation Type:	GFSK
Channel Spacing:	1MHz,2MHz
Number of Channels:	40
Antenna Type:	Chip Antenna
Antenna Gain:	-1.78dBi

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	25	DC3.7

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in transmitting mode
TX mode (SE) below 1G	Keep the EUT in transmitting mode
TX mode (SE) Above 1G	Keep the EUT in transmitting mode
Remark:Only the data of the worst mode would be recorded in this report.	

6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission(9kHz-30MHz)	±4.34dB
Radiated Emission(30Mz-1000MHz)	±4.24dB
Radiated Emission(1GHz-18GHz)	±4.68dB
AC Power Line Conducted Emission(150kHz-30MHz)	±3.45dB

Parameter	Expanded Uncertainty (Confidence of 95%)
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %
Radiated Emission (30MHz ~ 1000MHz)	±4.35 dB
Radiated Emission (1GHz ~ 18GHz)	±4.44 dB

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
AC Adapter (UGREEN)	UGREEN	CD112	N/A	N/A
PC	HASEE	K610D	N/A	N/A

8 LABORATORY LOCATION

All tests were performed at:

BlueAsia of Technical Services(Shenzhen) Co., Ltd.

No.41, South of Beihuan Road, Shangwu Community, Shiyan Subdistrict, Bao’an District,

Shenzhen,Guangdong ,ChinaTelephone: TEL: +86-755-28682673 FAX: +86-755-28682673

No tests were sub-contracted.

9 TEST INSTRUMENTS LIST

Test Equipment Of Conducted Emissions at AC Power Line (150kHz-30MHz)					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Shield room	SKET	833	N/A	25/11/2020	24/11/2023
Receiver	R&S	ESPI3	101082	24/9/2021	23/9/2022
LISN	R&S	ENV216	3560.6550.15	24/9/2021	23/9/2022
LISN	安泰信	AT166-2	AKK1806000003	26/9/2021	25/9/2022
EMI software	EZ	EZ-EMC	N/A	N/A	N/A

Test Equipment Of Conducted Band Edges Measurement					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Spectrum	Agilent	N9020A	MY49100060	24/9/2021	23/9/2022
Signal Generator	Agilent	N5182A	MY49060650	24/9/2021	23/9/2022
Signal Generator	Agilent	E8257D	MY44320250	24/9/2021	23/9/2022

Test Equipment Of Radiated Spurious Emissions					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Chamber	SKET	966	N/A	10/11/2020	9/11/2023

Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Receiver	R&S	ESR7	101199	24/9/2021	23/9/2022
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	26/9/2020	25/9/2022
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	26/9/2020	25/9/2022
Amplifier	SKET	LNPA-0118-45	N/A	24/9/2021	23/9/2022
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	26/9/2020	25/9/2022

Test Equipment Of Radiated Emissions which fall in the restricted bands					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Chamber	SKET	966	N/A	10/11/2020	9/11/2023
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Receiver	R&S	ESR7	101199	24/9/2021	23/9/2022
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	26/9/2020	25/9/2022

Horn Antenna	Schwarzbeck	9120D	01892 P:00331	26/9/2020	25/9/2022
Amplifier	SKET	LNPA-0118-45	N/A	24/9/2021	23/9/2022
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	26/9/2020	25/9/2022

Test Equipment Of Conducted Spurious Emissions					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Spectrum	Agilent	N9020A	MY49100060	24/9/2021	23/9/2022
Signal Generator	Agilent	N5182A	MY49060650	24/9/2021	23/9/2022
Signal Generator	Agilent	E8257D	MY44320250	24/9/2021	23/9/2022

Test Equipment Of Power Spectrum Density					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Spectrum	Agilent	N9020A	MY49100060	24/9/2021	23/9/2022
Signal Generator	Agilent	N5182A	MY49060650	24/9/2021	23/9/2022
Signal Generator	Agilent	E8257D	MY44320250	24/9/2021	23/9/2022

Test Equipment Of Conducted Peak Output Power					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Spectrum	Agilent	N9020A	MY49100060	24/9/2021	23/9/2022
Signal Generator	Agilent	N5182A	MY49060650	24/9/2021	23/9/2022
Signal Generator	Agilent	E8257D	MY44320250	24/9/2021	23/9/2022

Test Equipment Of Minimum 6dB Bandwidth					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**
Spectrum	R&S	FSP40	100817	24/9/2021	23/9/2022
Spectrum	Agilent	N9020A	MY49100060	24/9/2021	23/9/2022
Signal Generator	Agilent	N5182A	MY49060650	24/9/2021	23/9/2022
Signal Generator	Agilent	E8257D	MY44320250	24/9/2021	23/9/2022

Test Equipment Of Antenna Requirement					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal.Date**	**Cal.Due**

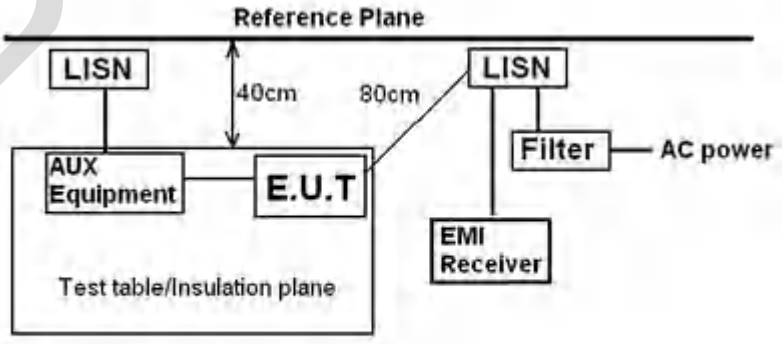
1 CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ)

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	LEO
Temperature	24℃
Humidity	55%

1.1 LIMITS

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		

1.2 BLOCK DIAGRAM OF TEST SETUP



Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

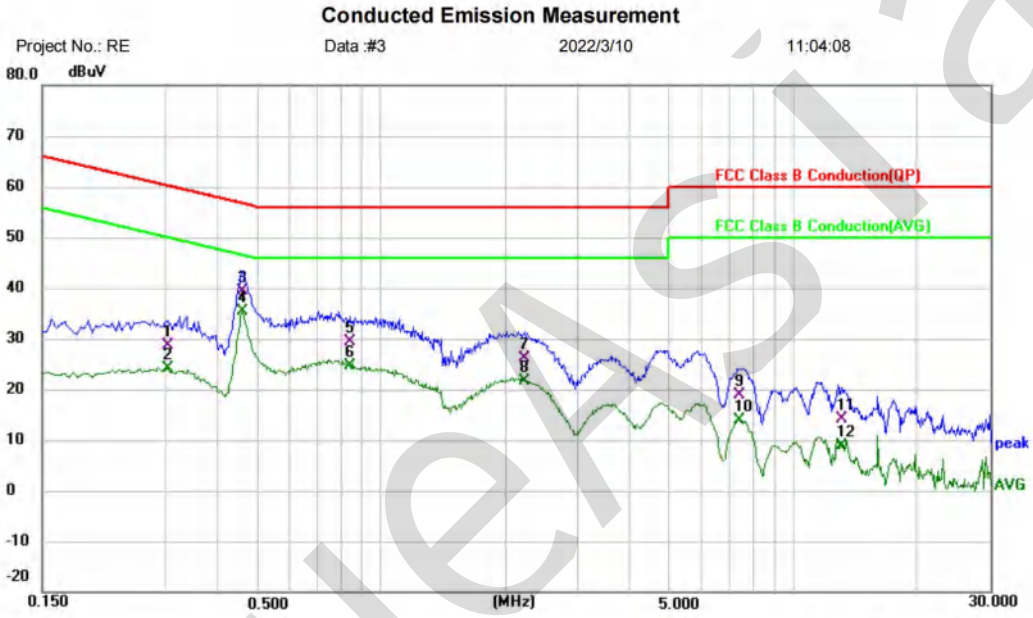
1.3 PROCEDURE

1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50H + 5ohm linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

1.4 TEST DATA

[TestMode: TX]; [Line: Line][AC POWER:AC120V/60Hz]



Site
Limit: FCC Class B Conduction(QP)
EUT: Bone-conducted earphone
M/N: Haylou 100
Mode: BLE mode
Note:

Phase: L1
Power:

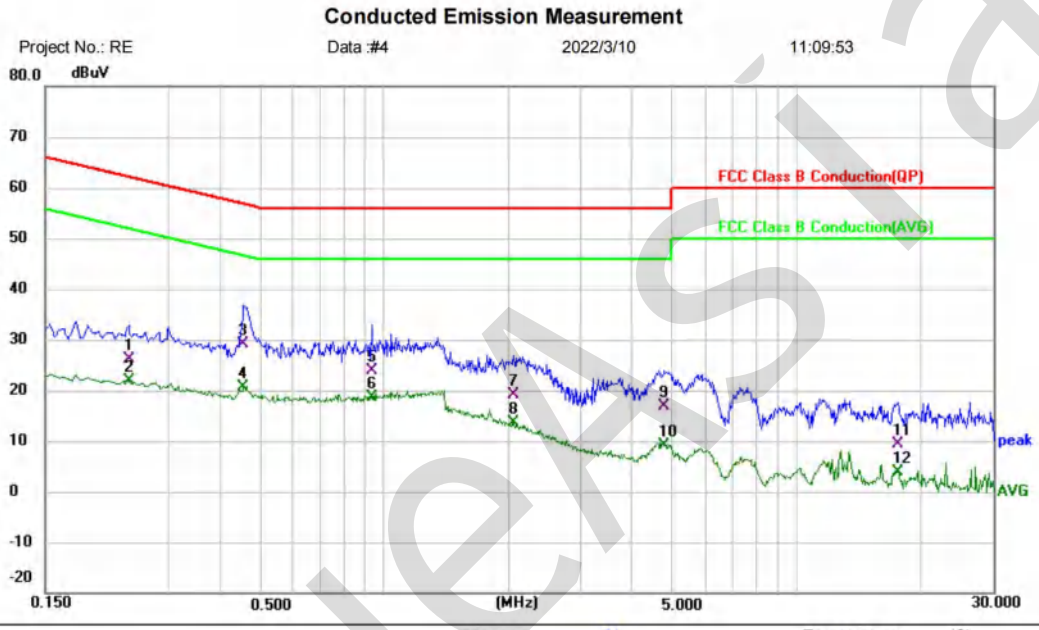
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3019	18.73	9.85	28.58	60.19	-31.61	QP	
2		0.3019	14.31	9.85	24.16	50.19	-26.03	AVG	
3		0.4580	29.51	9.87	39.38	56.73	-17.35	QP	
4	*	0.4580	25.57	9.87	35.44	46.73	-11.29	AVG	
5		0.8419	19.51	9.91	29.42	56.00	-26.58	QP	
6		0.8419	14.65	9.91	24.56	46.00	-21.44	AVG	
7		2.2259	16.24	9.94	26.18	56.00	-29.82	QP	
8		2.2259	11.63	9.94	21.57	46.00	-24.43	AVG	
9		7.3819	8.86	10.10	18.96	60.00	-41.04	QP	
10		7.3819	3.79	10.10	13.89	50.00	-36.11	AVG	
11		13.1140	3.91	10.26	14.17	60.00	-45.83	QP	
12		13.1140	-1.33	10.26	8.93	50.00	-41.07	AVG	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX]; [Line: Nutral][AC POWER:AC120V/60Hz]



Site
Limit: FCC Class B Conduction(QP)
EUT: Bone-conducted earphone
M/N: Haylou 100
Mode: BLE mode
Note:

Phase: N
Power:

Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.2380	15.90	10.24	26.14	62.17	-36.03	QP	
2		0.2380	11.62	10.24	21.86	52.17	-30.31	AVG	
3		0.4540	19.44	9.79	29.23	56.80	-27.57	QP	
4	*	0.4540	10.84	9.79	20.63	46.80	-26.17	AVG	
5		0.9300	14.11	9.83	23.94	56.00	-32.06	QP	
6		0.9300	8.73	9.83	18.56	46.00	-27.44	AVG	
7		2.0579	9.29	9.86	19.15	56.00	-36.85	QP	
8		2.0579	3.80	9.86	13.66	46.00	-32.34	AVG	
9		4.7860	6.84	9.94	16.78	56.00	-39.22	QP	
10		4.7860	-0.79	9.94	9.15	46.00	-36.85	AVG	
11		17.5740	-0.97	10.37	9.40	60.00	-50.60	QP	
12		17.5740	-6.56	10.37	3.81	50.00	-46.19	AVG	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

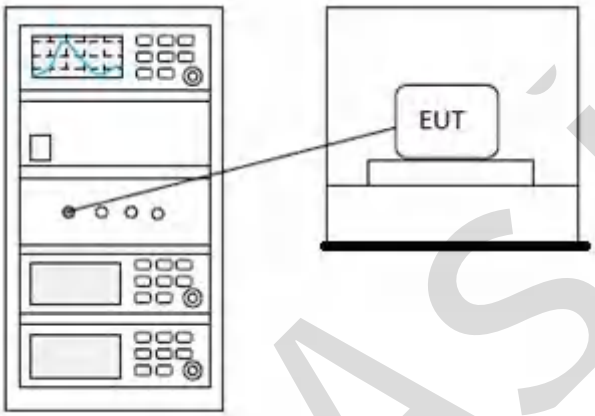
2 CONDUCTED BAND EDGES MEASUREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.8 & Section 11.13.3.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	24℃
Humidity	53%

2.1 LIMITS

Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

2.2 BLOCK DIAGRAM OF TEST SETUP



2.3 TEST DATA

Pass: Please Refer To Appendix: For Details

3 RADIATED SPURIOUS EMISSIONS

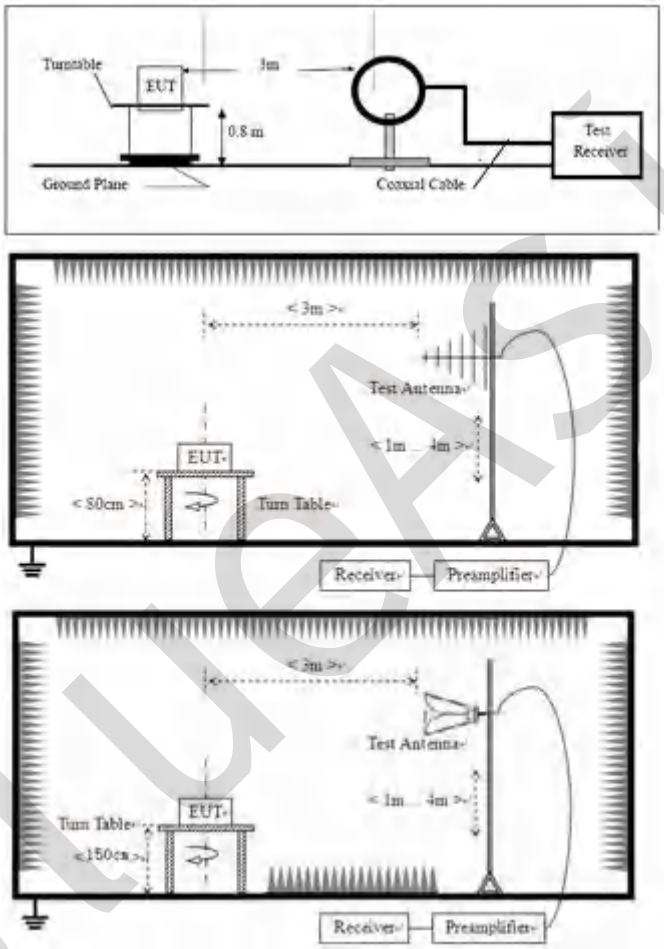
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX mode (SE) below 1G;TX mode (SE) Above 1G
Test Mode (Final Test)	TX mode (SE) below 1G;TX mode (SE) Above 1G
Tester	Ben
Temperature	25℃
Humidity	54%

3.1 LIMITS

Frequency(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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

3.2 BLOCK DIAGRAM OF TEST SETUP



3.3 PROCEDURE

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

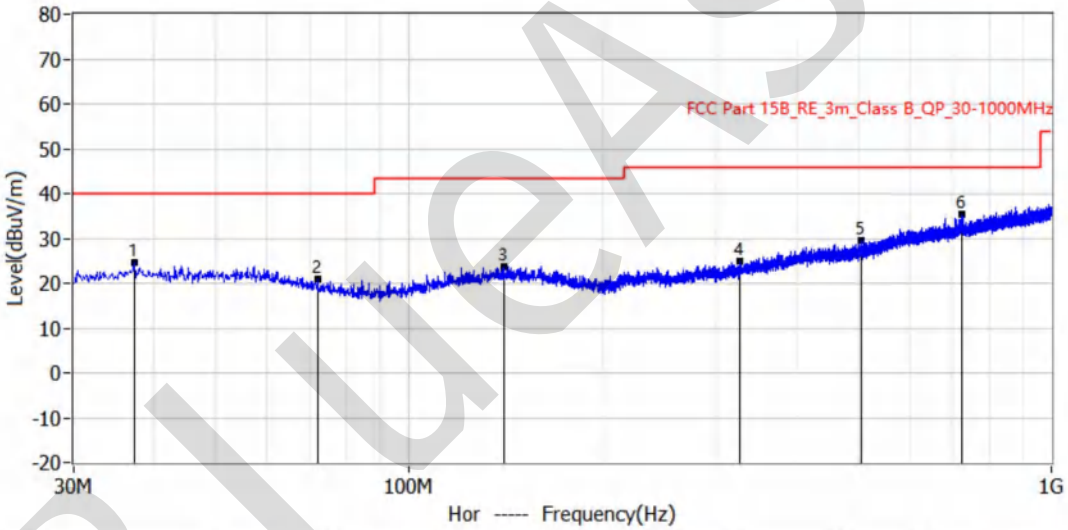
h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
j. Repeat above procedures until all frequencies measured was complete.

Remark:
1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor - Preamplifier Factor
3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

3.4 TEST DATA

[TestMode: TX mode (SE) below 1G]; [Polarity: Horizontal]

Test Lab: BlueAsia EMC Lab（RE #1）	Project: BLA-EMC-202203-A13
EUT: Bone-conducted earphone	Test Engineer: Leo
M/N: Haylou 100	Temperature:
S/N:	Humidity:
Test Mode: BLE TX mode	Test Voltage:
Note:	Test Data: 2022-03-07 15:41:22

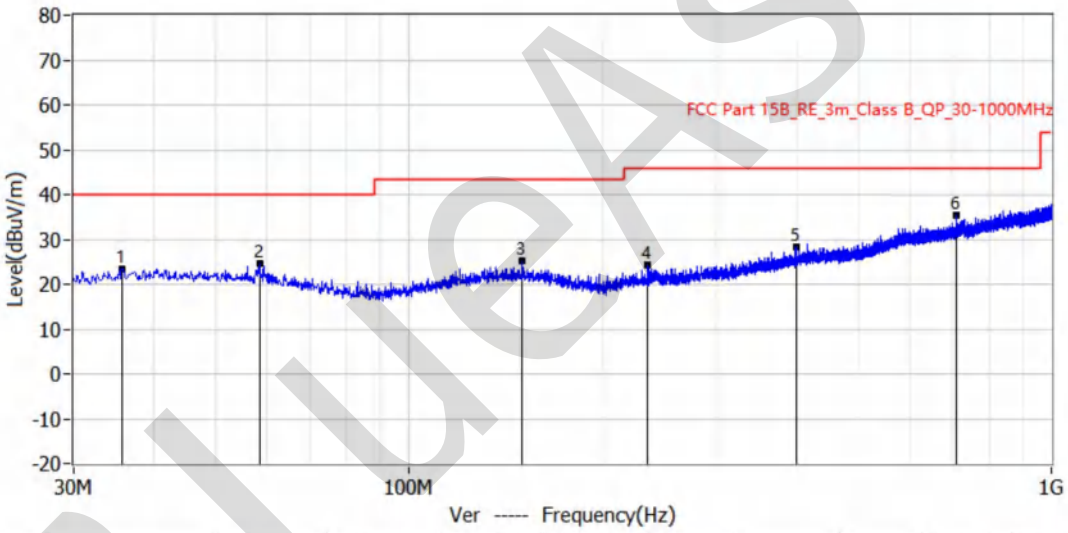


No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	37.275MHz	40.0	24.5	-15.5	0.7	23.8	QP	Hor	100.0	236.0
2*	71.831MHz	40.0	20.8	-19.2	-0.3	21.1	QP	Hor	100.0	246.0
3*	140.095MHz	43.5	23.8	-19.7	0.1	23.7	QP	Hor	100.0	2.0
4*	327.063MHz	46.0	24.9	-21.1	0.0	24.9	QP	Hor	100.0	296.0
5*	506.028MHz	46.0	29.6	-16.4	1.0	28.6	QP	Hor	100.0	131.0
6*	726.339MHz	46.0	35.3	-10.7	2.8	32.5	QP	Hor	100.0	296.0

Test Result: Pass

[TestMode: TX mode (SE) below 1G]; [Polarity: Vertical]

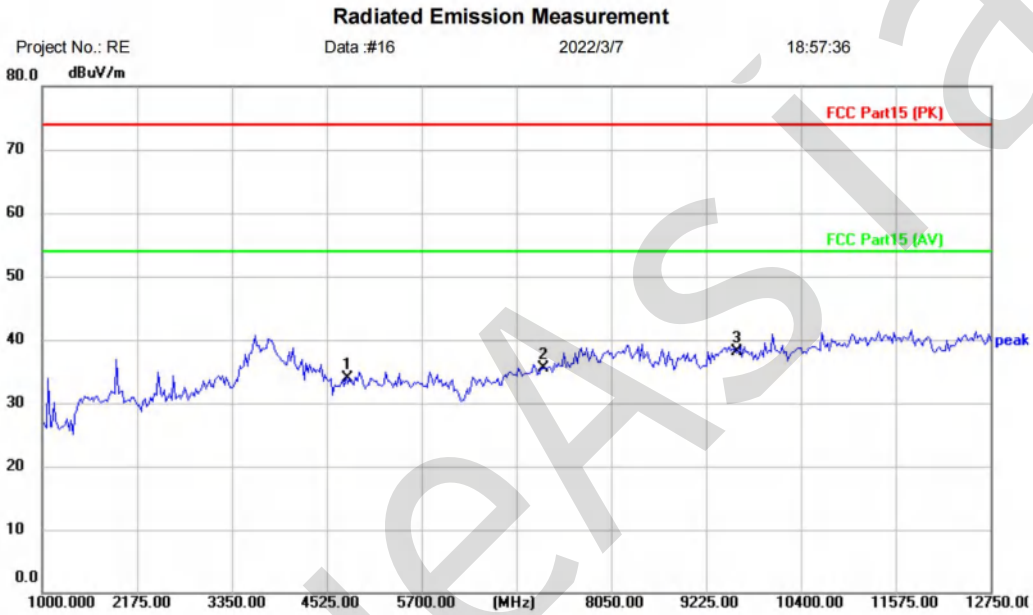
Test Lab: BlueAsia EMC Lab（RE #1）	Project: BLA-EMC-202203-A13
EUT: Bone-conducted earphone	Test Engineer: Leo
M/N: Haylou 100	Temperature:
S/N:	Humidity:
Test Mode: BLE mode	Test Voltage:
Note:	Test Data: 2022-03-07 15:39:36



No.	Frequency	Limit dBuV/m	Level dBuV/m	Delta dB	Reading dBuV	Factor dB/m	Detector	Polar	Height cm	Angle deg
1*	35.699MHz	40.0	23.4	-16.6	-0.3	23.7	QP	Ver	100.0	50.0
2*	58.373MHz	40.0	24.5	-15.5	1.0	23.5	QP	Ver	100.0	299.0
3*	149.553MHz	43.5	25.2	-18.3	1.7	23.5	QP	Ver	100.0	274.0
4*	234.670MHz	46.0	24.2	-21.8	1.7	22.5	QP	Ver	100.0	280.0
5*	400.661MHz	46.0	28.4	-17.6	1.1	27.3	QP	Ver	100.0	190.0
6*	711.668MHz	46.0	35.3	-10.7	3.1	32.2	QP	Ver	100.0	74.0

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-L
Note:

Polarization: *Horizontal*
Power:

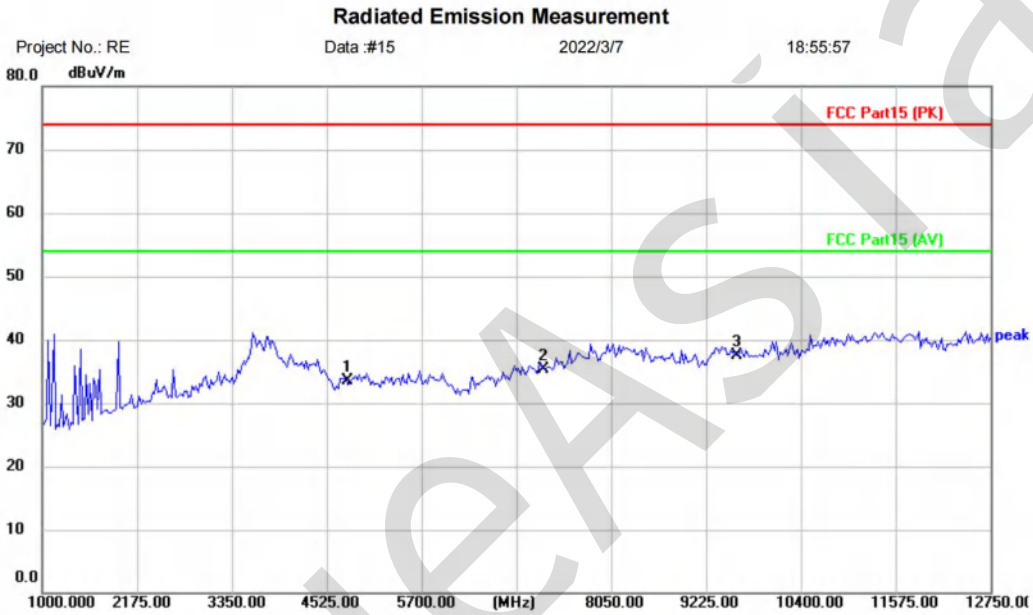
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	30.10	3.71	33.81	74.00	-40.19	peak	
2		7206.000	29.59	5.96	35.55	74.00	-38.45	peak	
3	*	9608.000	28.87	9.29	38.16	74.00	-35.84	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Vertical]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-L
Note:

Polarization: *Vertical*
Power:

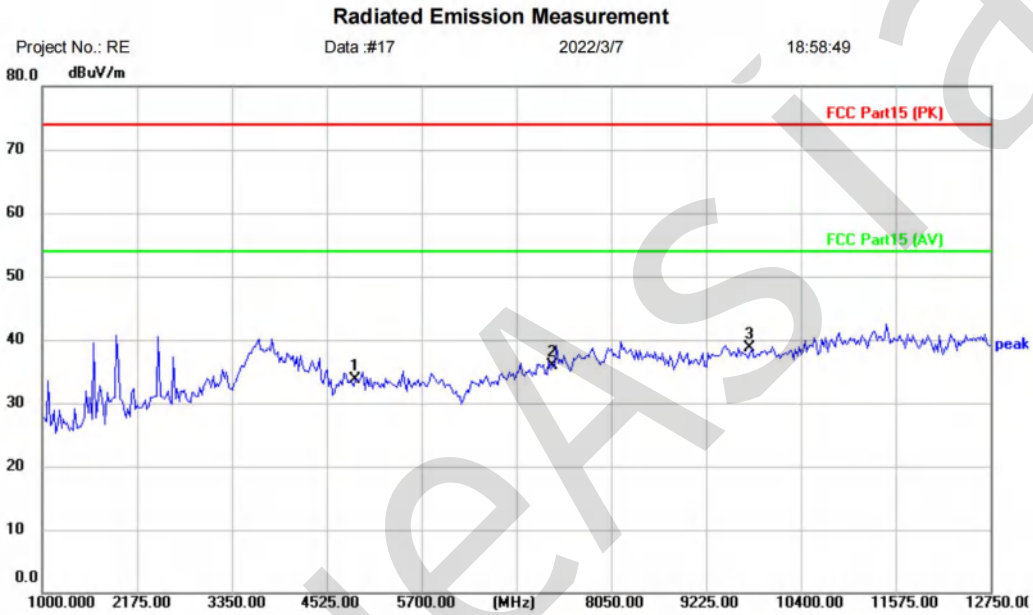
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4804.000	29.77	3.71	33.48	74.00	-40.52	peak	
2		7206.000	29.37	5.96	35.33	74.00	-38.67	peak	
3	*	9608.000	28.24	9.29	37.53	74.00	-36.47	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-M
Note:

Polarization: *Horizontal*
Power:

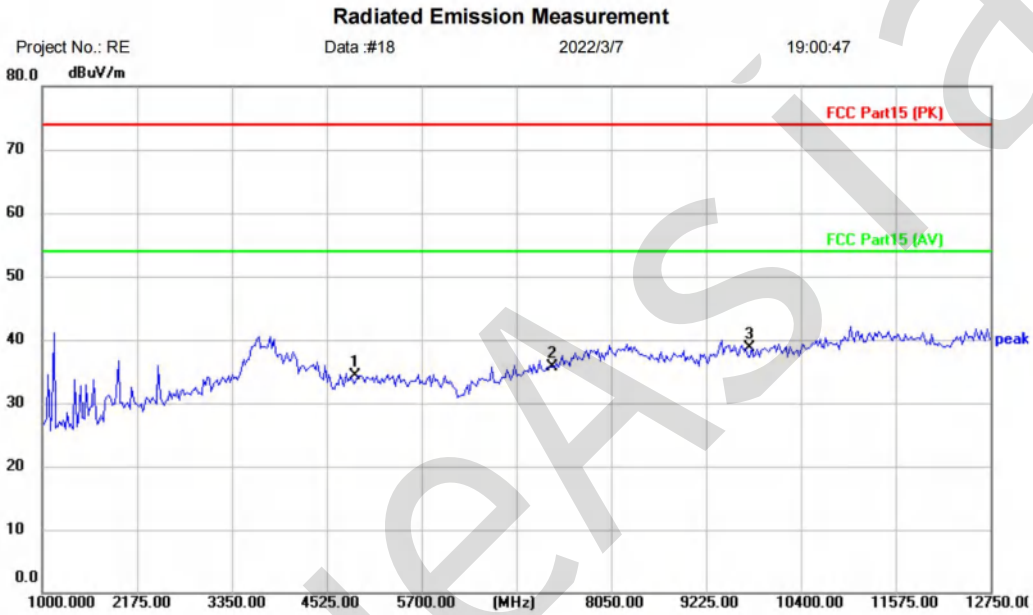
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4884.000	30.28	3.34	33.62	74.00	-40.38	peak	
2		7326.000	29.46	6.44	35.90	74.00	-38.10	peak	
3	*	9768.000	29.04	9.63	38.67	74.00	-35.33	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Vertical]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-M
Note:

Polarization: *Vertical*
Power:

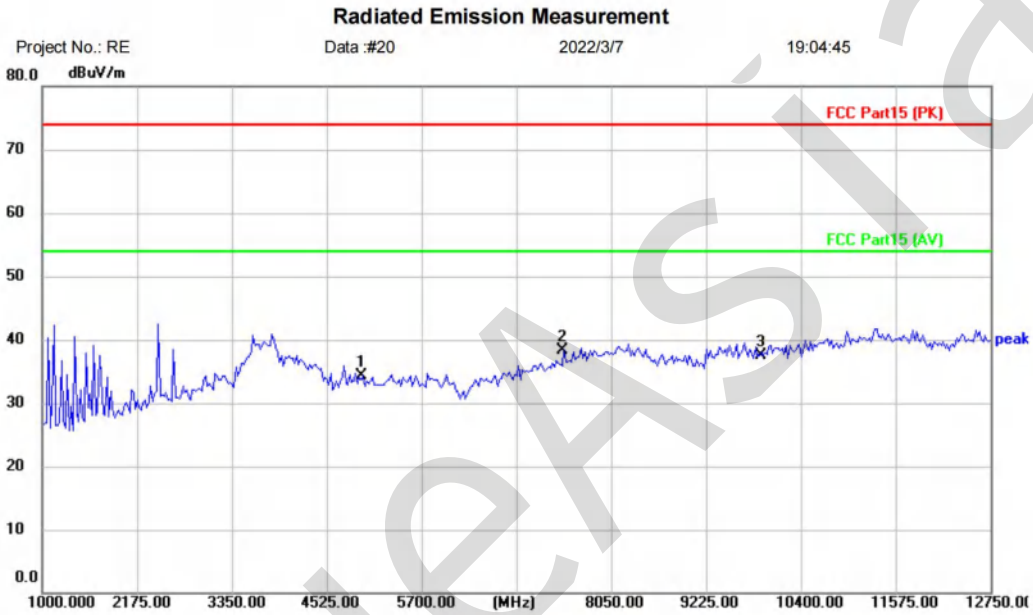
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4884.000	31.04	3.34	34.38	74.00	-39.62	peak	
2		7326.000	29.29	6.44	35.73	74.00	-38.27	peak	
3	*	9768.000	29.05	9.63	38.68	74.00	-35.32	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-H
Note:

Polarization: *Horizontal*
Power:

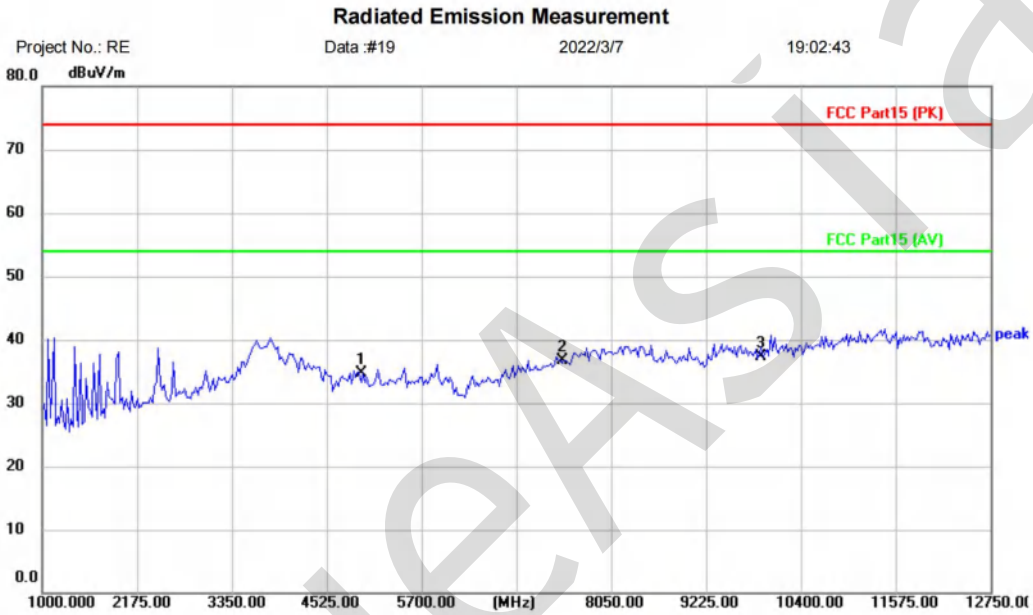
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	30.57	3.75	34.32	74.00	-39.68	peak	
2	*	7440.000	31.51	6.86	38.37	74.00	-35.63	peak	
3		9920.000	27.42	10.16	37.58	74.00	-36.42	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]; [Polarity: Vertical]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-H
Note:

Polarization: *Vertical*
Power:

Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		4960.000	30.98	3.75	34.73	74.00	-39.27	peak	
2		7440.000	29.82	6.86	36.68	74.00	-37.32	peak	
3	*	9920.000	27.15	10.16	37.31	74.00	-36.69	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

4 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

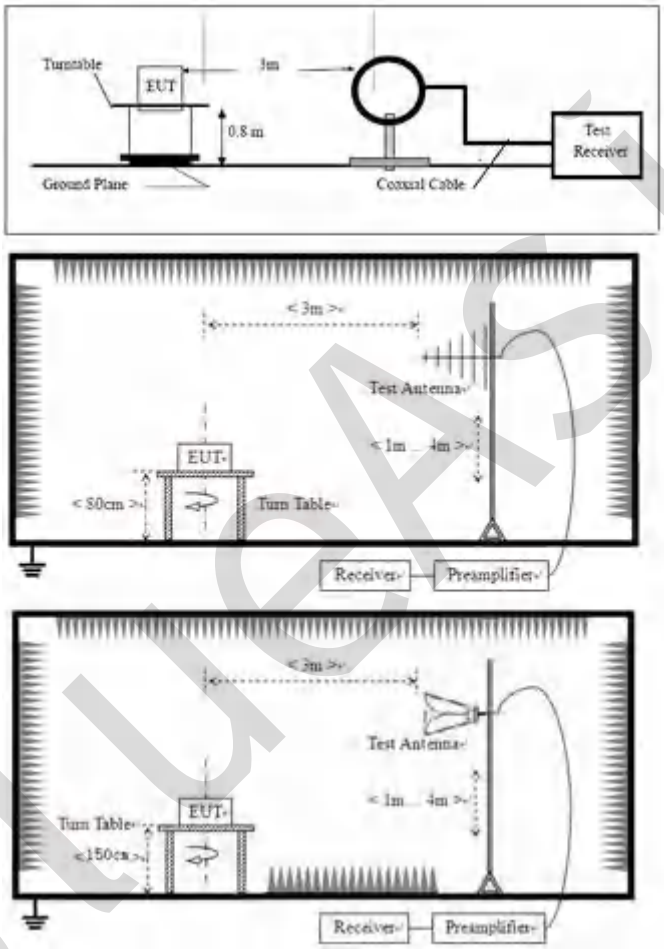
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25℃
Humidity	55%

4.1 LIMITS

Frequency(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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

4.2 BLOCK DIAGRAM OF TEST SETUP



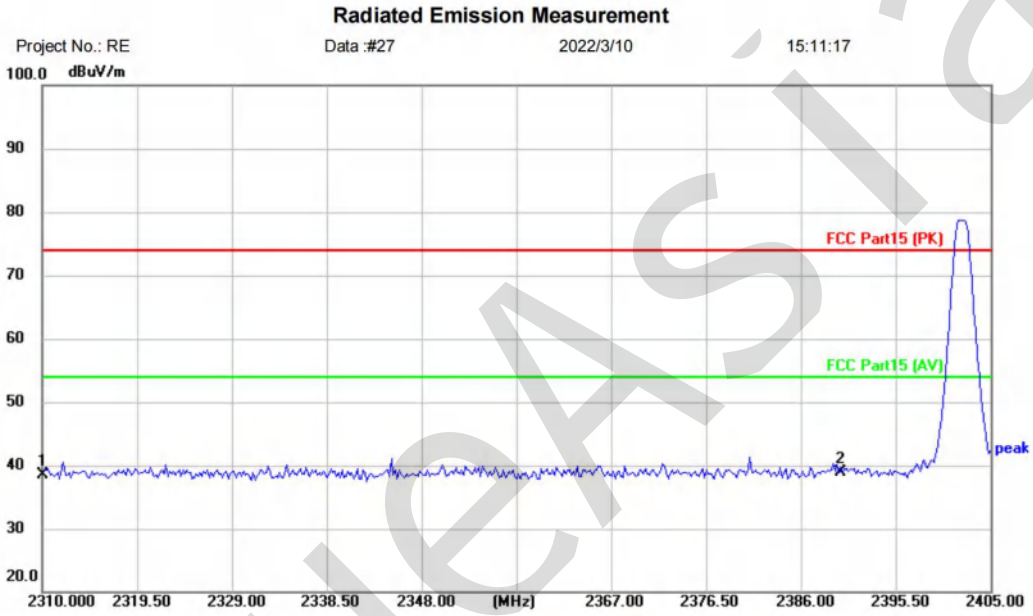
4.3 PROCEDURE

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
j. Repeat above procedures until all frequencies measured was complete.
Remark 1: Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

4.4 TEST DATA

[TestMode: TX]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-L
Note:

Polarization: *Horizontal*
Power:

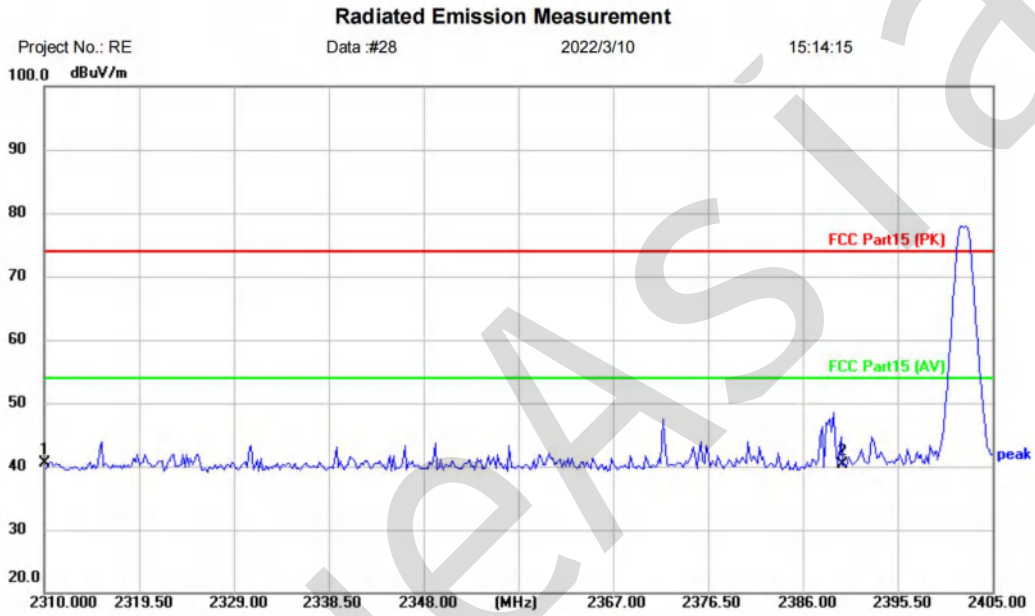
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		2310.000	42.44	-3.93	38.51	74.00	-35.49	peak	
2	*	2390.000	42.56	-3.58	38.98	74.00	-35.02	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX]; [Polarity: Vertical]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-H
Note:

Polarization: *Vertical*
Power:

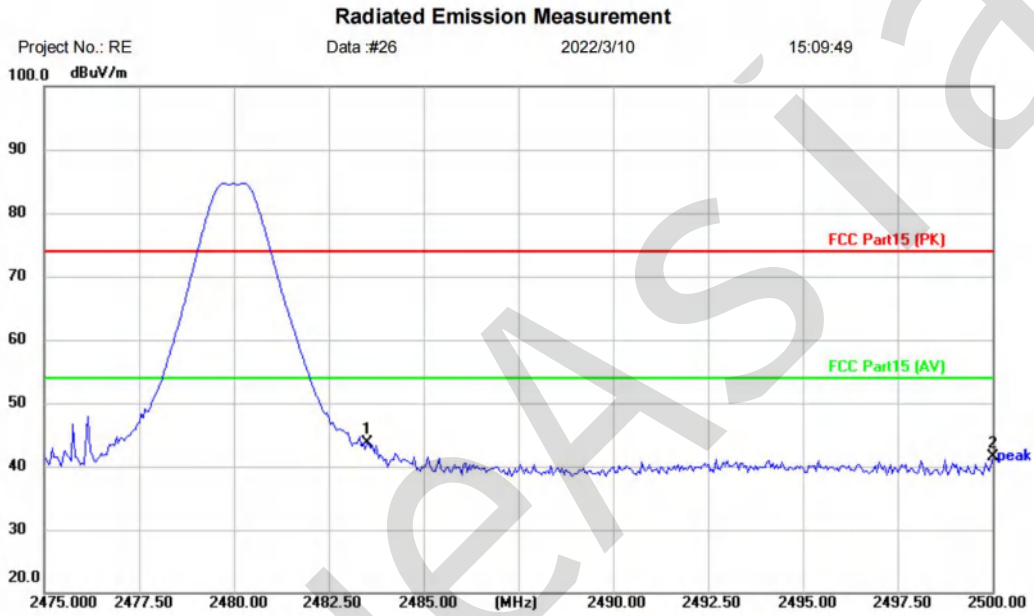
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2310.000	44.38	-3.93	40.45	74.00	-33.55	peak	
2		2390.000	43.87	-3.58	40.29	74.00	-33.71	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX]; [Polarity: Horizontal]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-H
Note:

Polarization: *Horizontal*
Power:

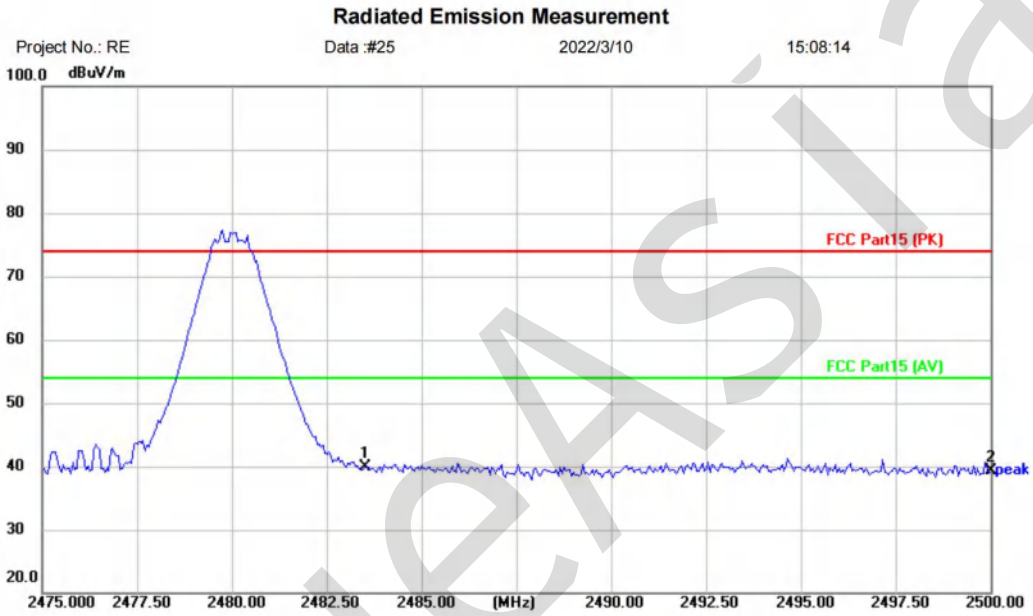
Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2483.500	46.92	-3.14	43.78	74.00	-30.22	peak	
2		2500.000	44.58	-3.08	41.50	74.00	-32.50	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

[TestMode: TX]; [Polarity: Vertical]



Site
Limit: FCC Part15 (PK)
EUT:
M/N:
Mode: BLE-H
Note:

Polarization: *Vertical*
Power:

Temperature: (C)
Humidity: %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2483.500	43.01	-3.14	39.87	74.00	-34.13	peak	
2		2500.000	42.34	-3.08	39.26	74.00	-34.74	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Test Result: Pass

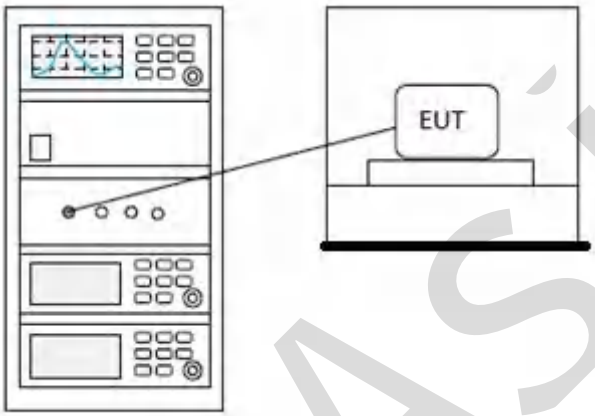
5 CONDUCTED SPURIOUS EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25℃
Humidity	55%

5.1 LIMITS

Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.2 BLOCK DIAGRAM OF TEST SETUP



5.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

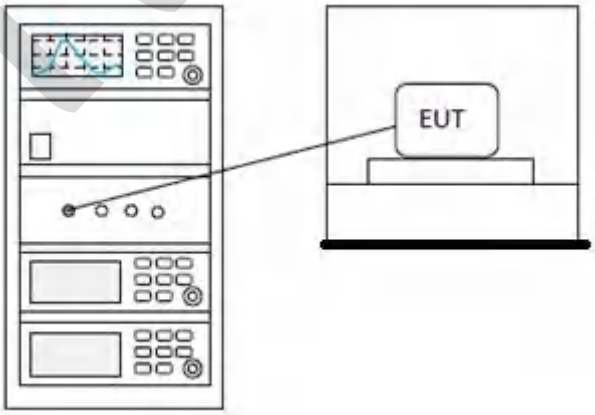
6 POWER SPECTRUM DENSITY

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.10.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25℃
Humidity	55%

6.1 LIMITS

Limit:	≤8dBm in any 3 kHz band during any time interval of continuous transmission

6.2 BLOCK DIAGRAM OF TEST SETUP



6.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

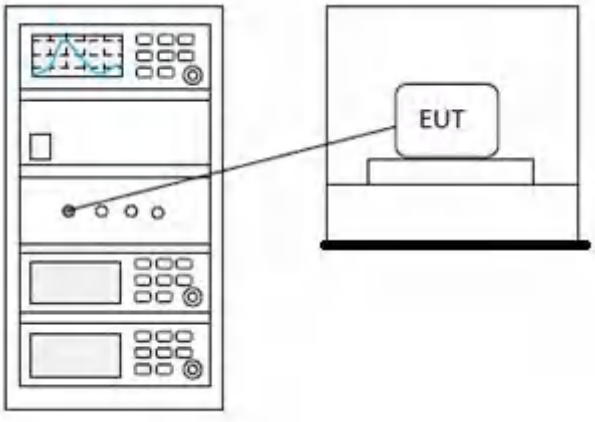
7 CONDUCTED PEAK OUTPUT POWER

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25℃
Humidity	55%

7.1 LIMITS

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2 BLOCK DIAGRAM OF TEST SETUP



7.3 EST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

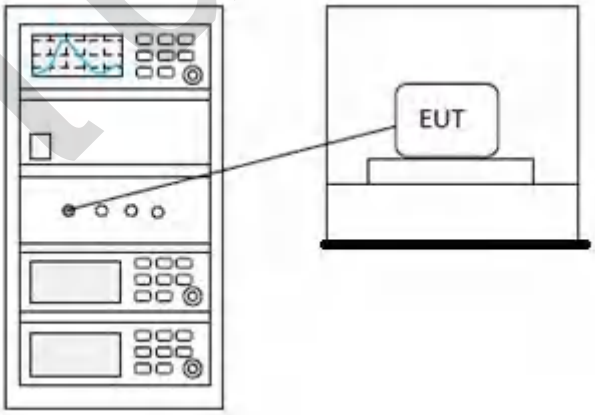
8 MINIMUM 6DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.8.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25℃
Humidity	55%

8.1 LIMITS

Limit:	≥500 kHz

8.2 BLOCK DIAGRAM OF TEST SETUP



8.3 TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

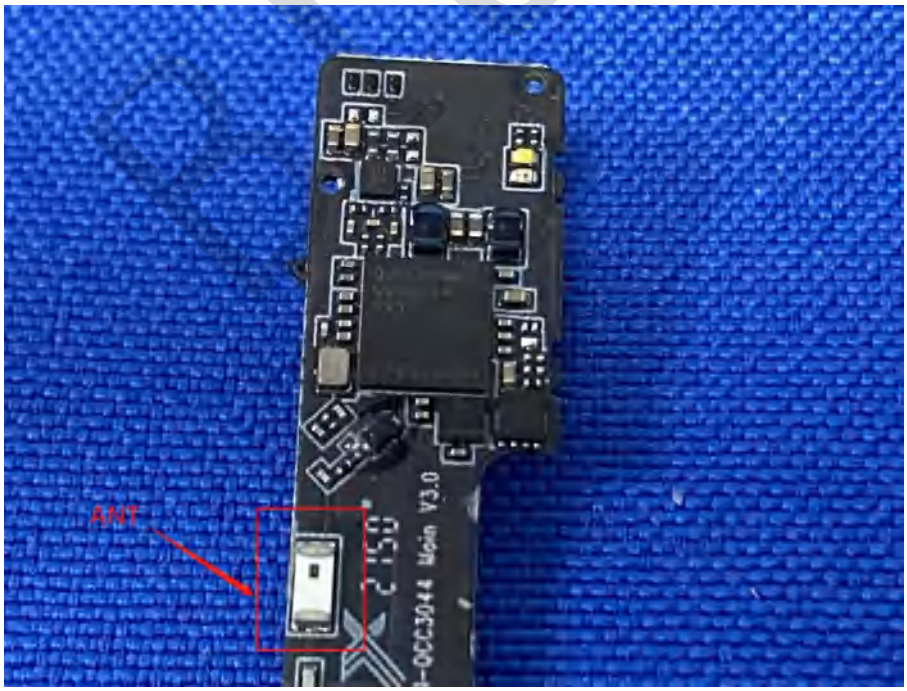
9 ANTENNA REQUIREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	N/A

9.1 CONCLUSION

Standard Requirement:
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit permanently attached antenna or of an so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -1.78dBi.

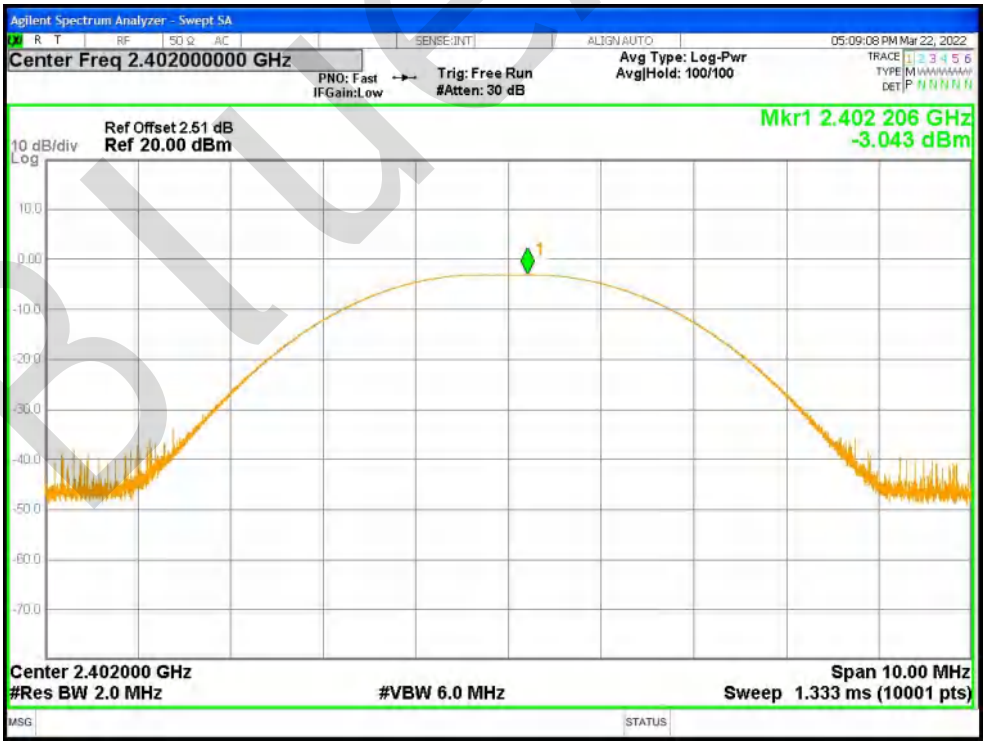


10 APPENDIX

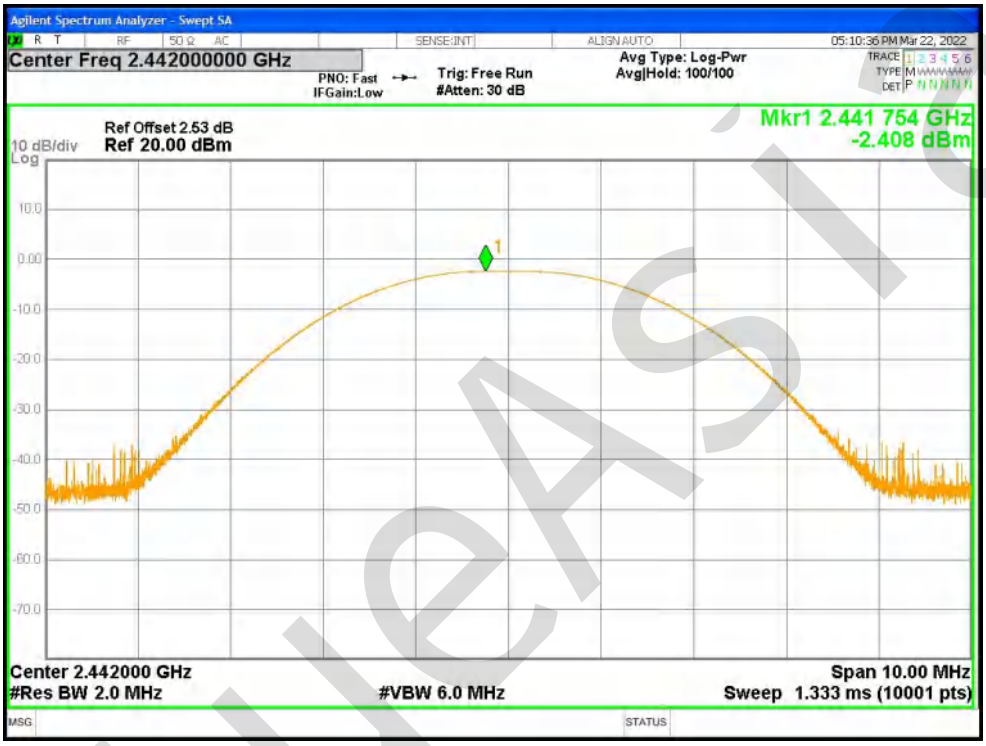
10.1 MAXIMUM CONDUCTED OUTPUT POWER

Condition	Mode	Frequency (MHz)	Conducted Power (dBm)	Duty Factor (dB)	Total Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	-3.043	0	-3.043	30	Pass
NVNT	BLE 1M	2442	-2.408	0	-2.408	30	Pass
NVNT	BLE 1M	2480	-3.309	0	-3.309	30	Pass
NVNT	BLE 2M	2402	-3.088	0	-3.088	30	Pass
NVNT	BLE 2M	2442	-2.385	0	-2.385	30	Pass
NVNT	BLE 2M	2480	-3.287	0	-3.287	30	Pass

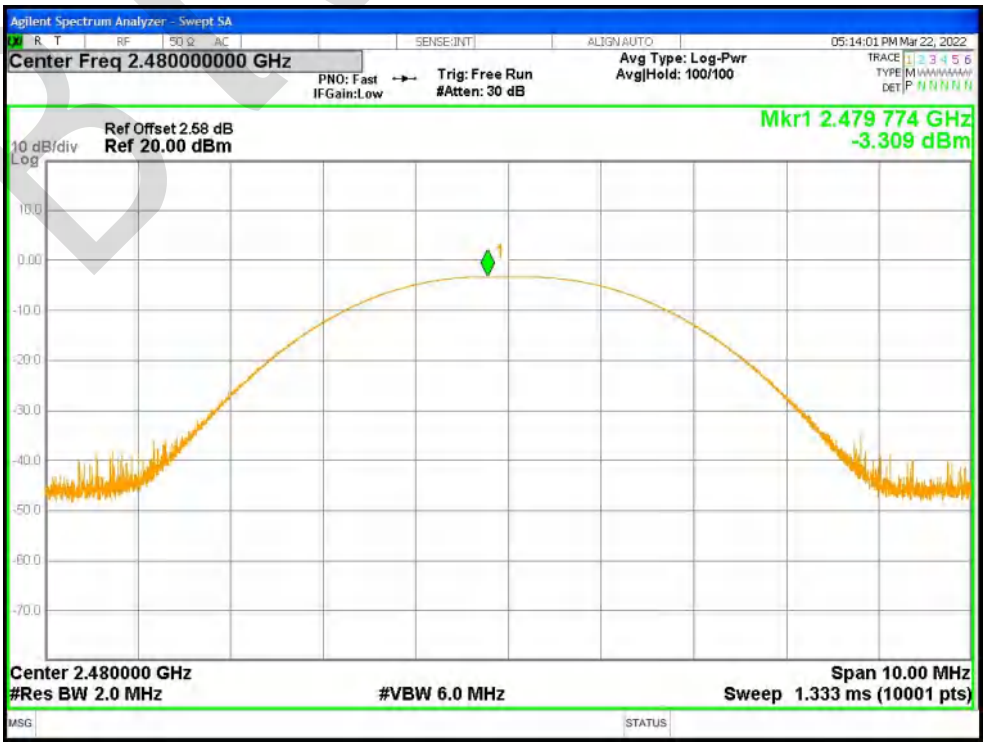
Power NVNT BLE 1M 2402MHz Ant1



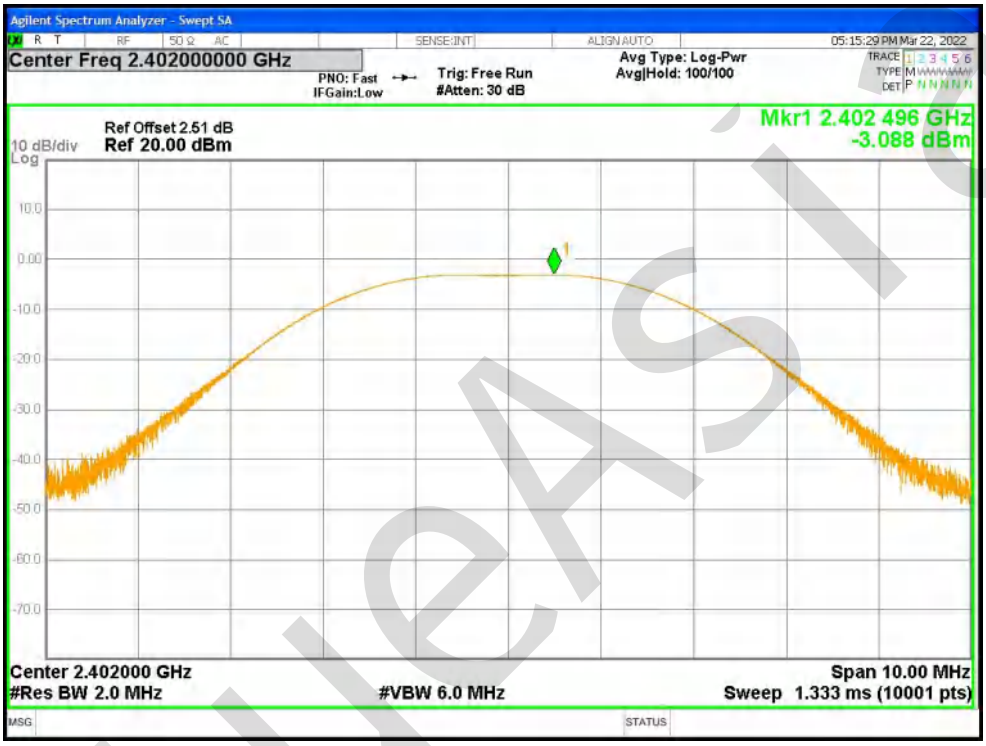
Power NVNT BLE 1M 2442MHz Ant1



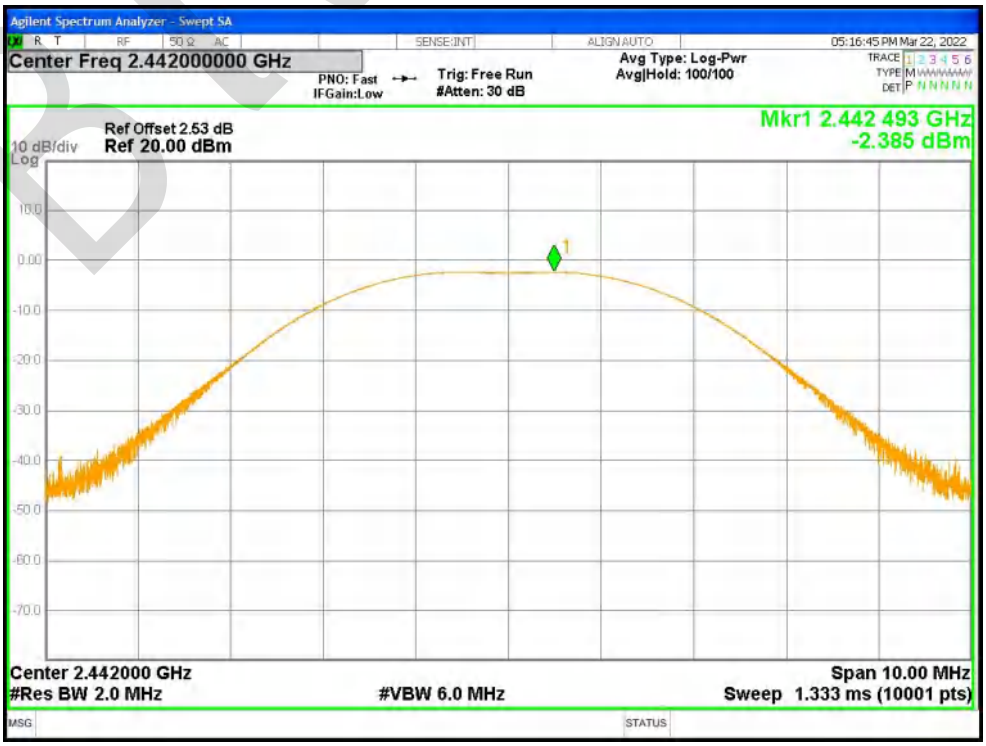
Power NVNT BLE 1M 2480MHz Ant1



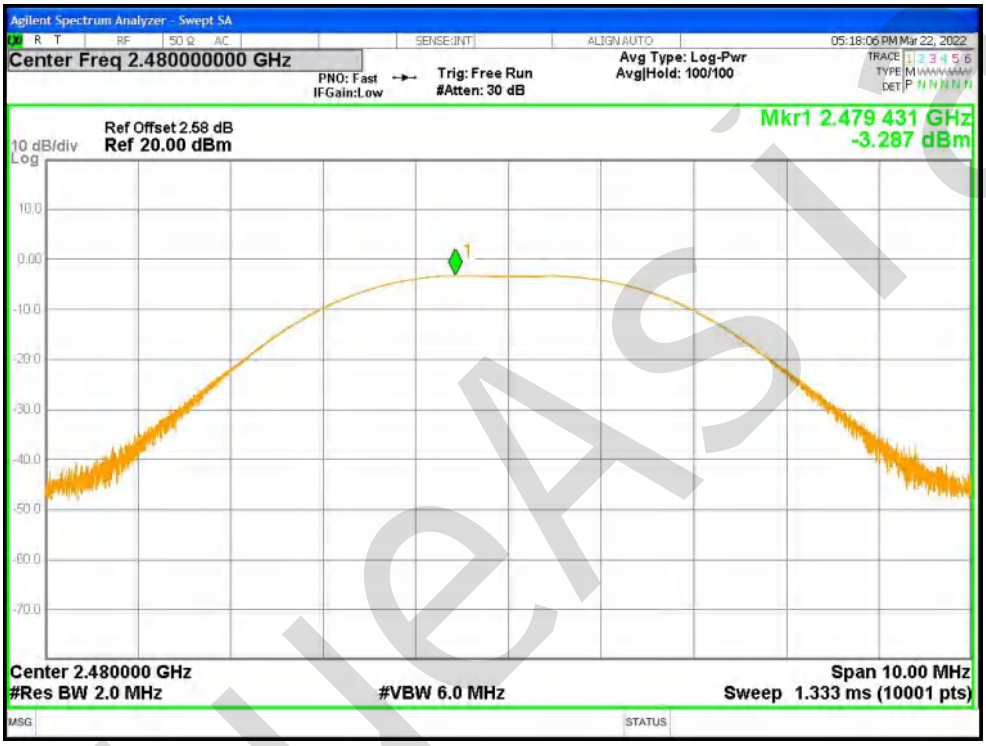
Power NVNT BLE 2M 2402MHz Ant1



Power NVNT BLE 2M 2442MHz Ant1



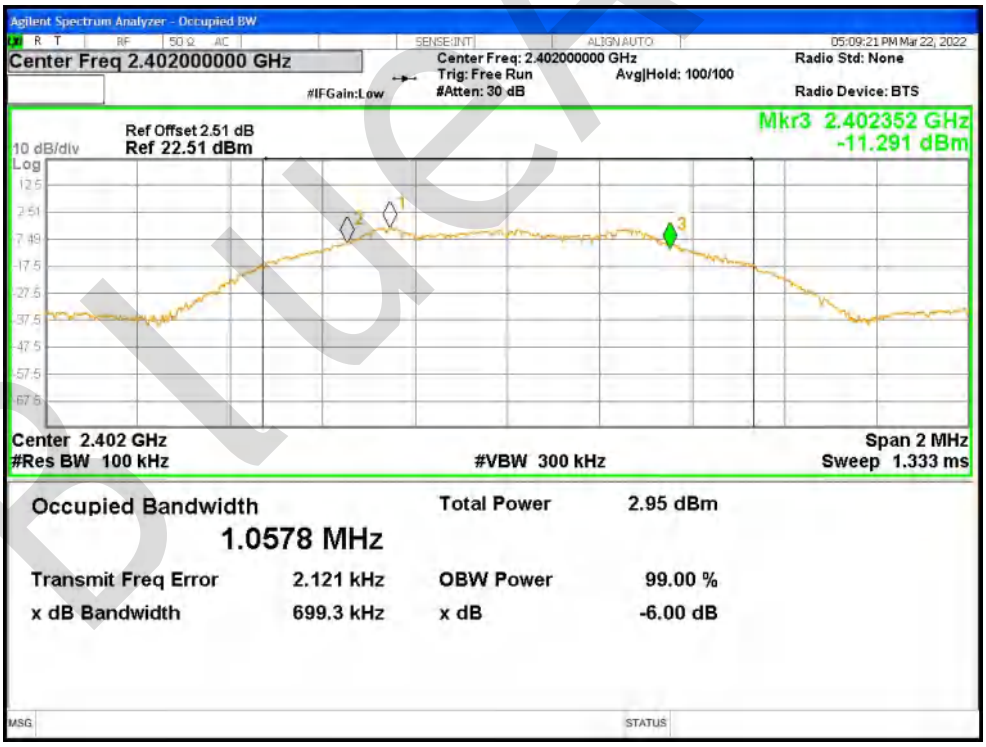
Power NVNT BLE 2M 2480MHz Ant1



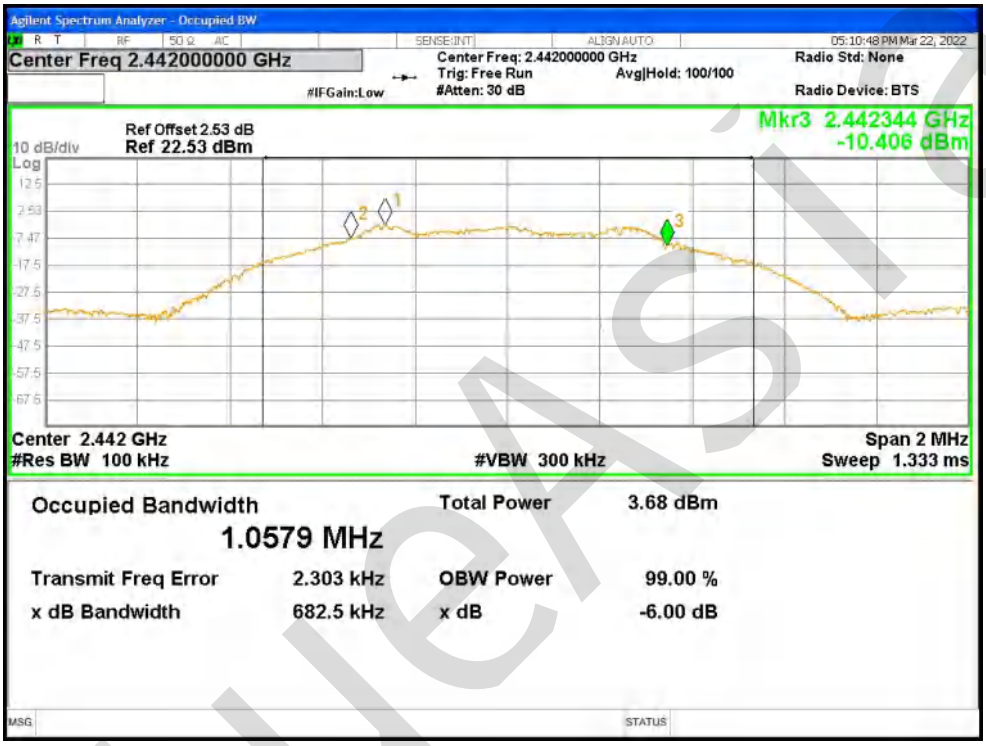
10.2 -6DB BANDWIDTH

Condition	Mode	Frequency (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 1M	2402	0.699	0.5	Pass
NVNT	BLE 1M	2442	0.683	0.5	Pass
NVNT	BLE 1M	2480	0.712	0.5	Pass
NVNT	BLE 2M	2402	1.201	0.5	Pass
NVNT	BLE 2M	2442	1.24	0.5	Pass
NVNT	BLE 2M	2480	1.189	0.5	Pass

-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1

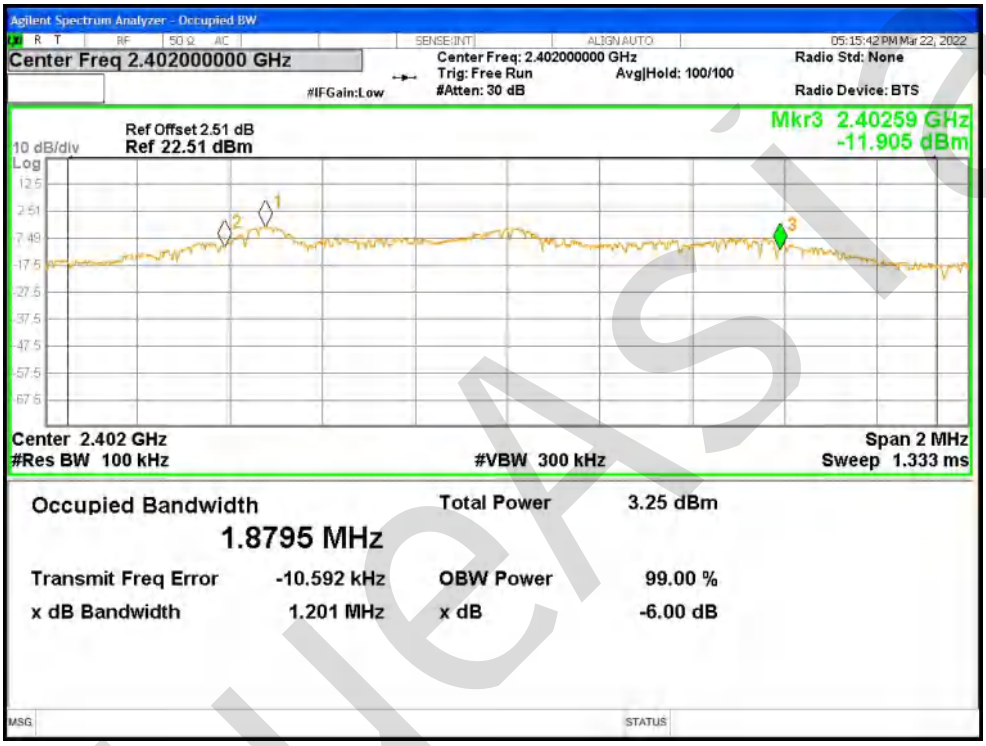


-6dB Bandwidth NVNT BLE 1M 2442MHz Ant1

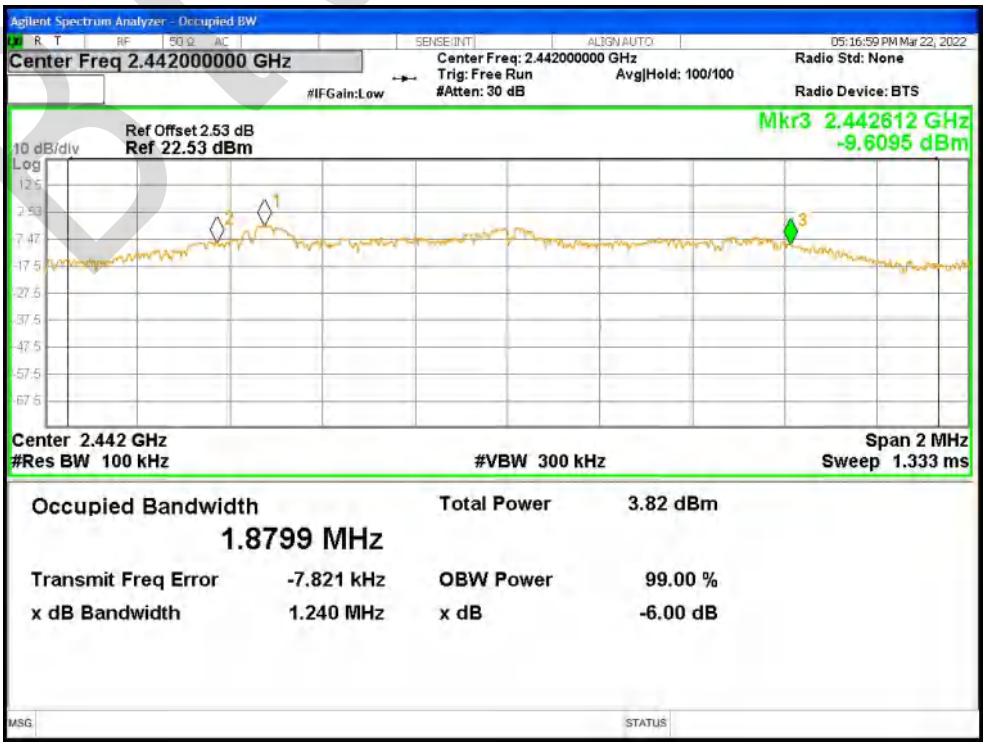


-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1

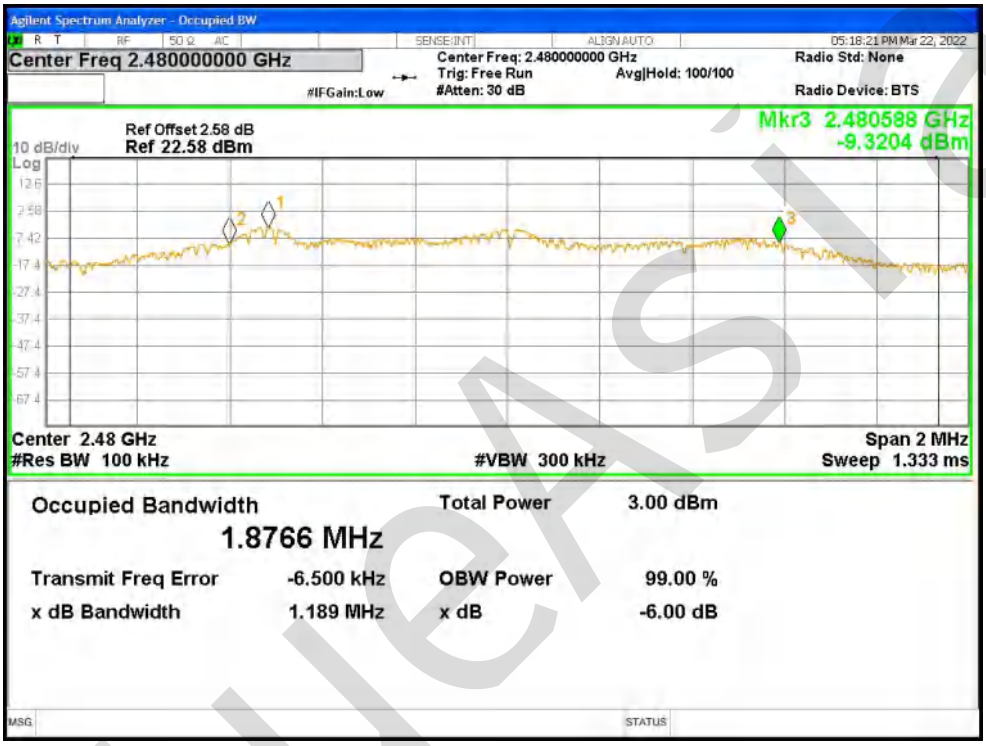
-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2442MHz Ant1



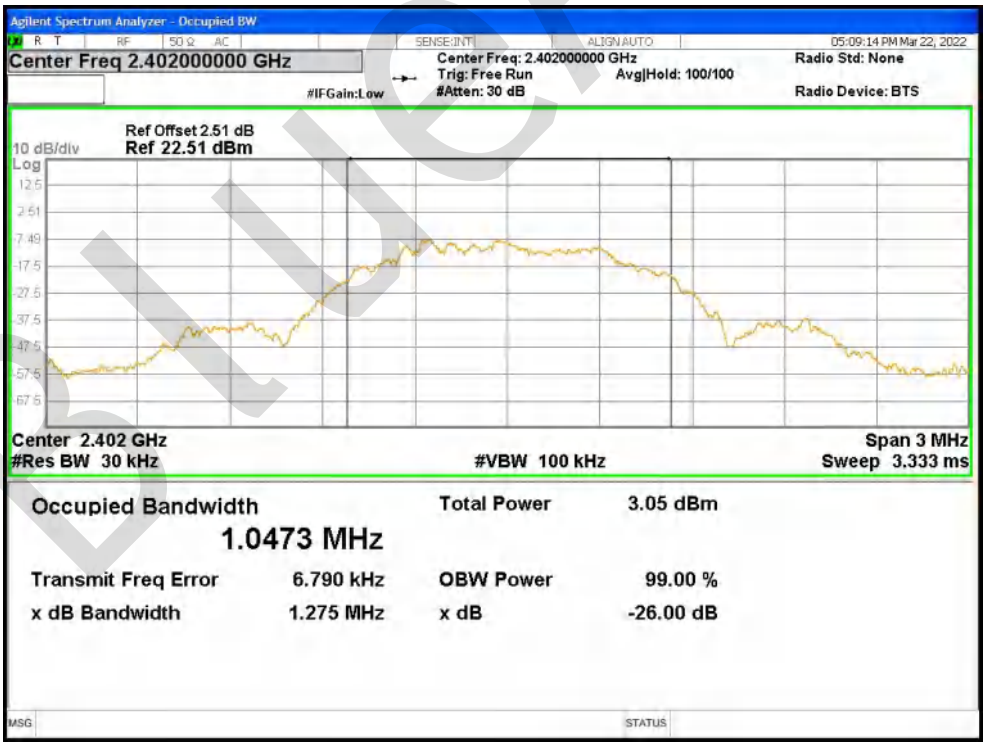
-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1



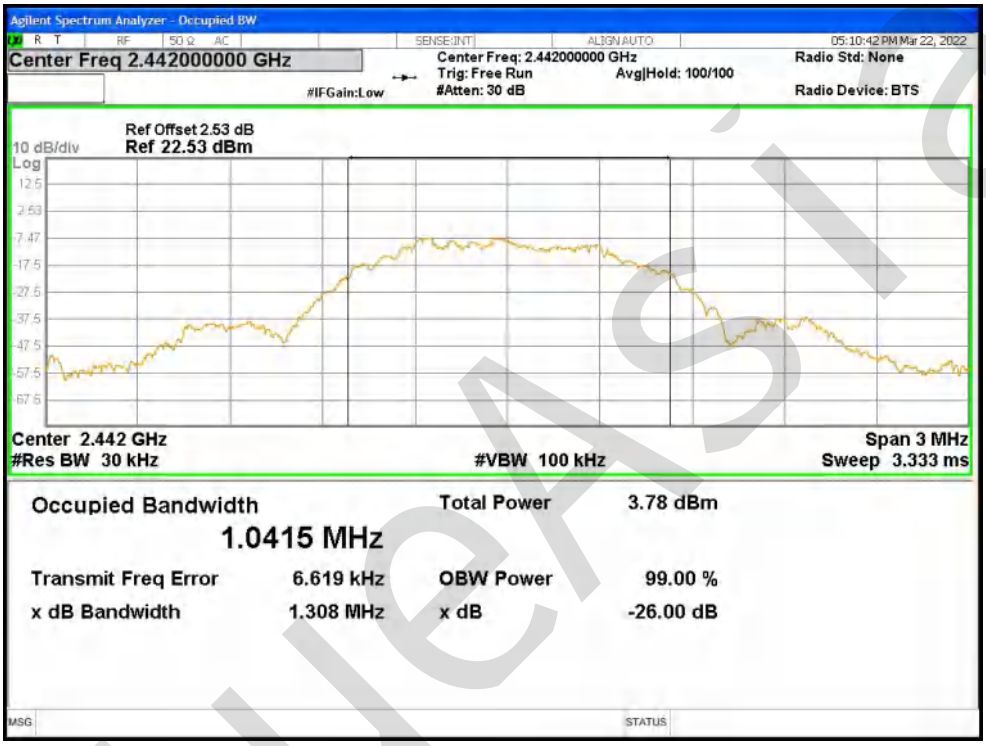
10.3 OCCUPIED CHANNEL BANDWIDTH

Condition	Mode	Frequency (MHz)	99% OBW (MHz)
NVNT	BLE 1M	2402	1.047297717
NVNT	BLE 1M	2442	1.041514169
NVNT	BLE 1M	2480	1.041514573
NVNT	BLE 2M	2402	2.045954408
NVNT	BLE 2M	2442	2.043678473
NVNT	BLE 2M	2480	2.041136353

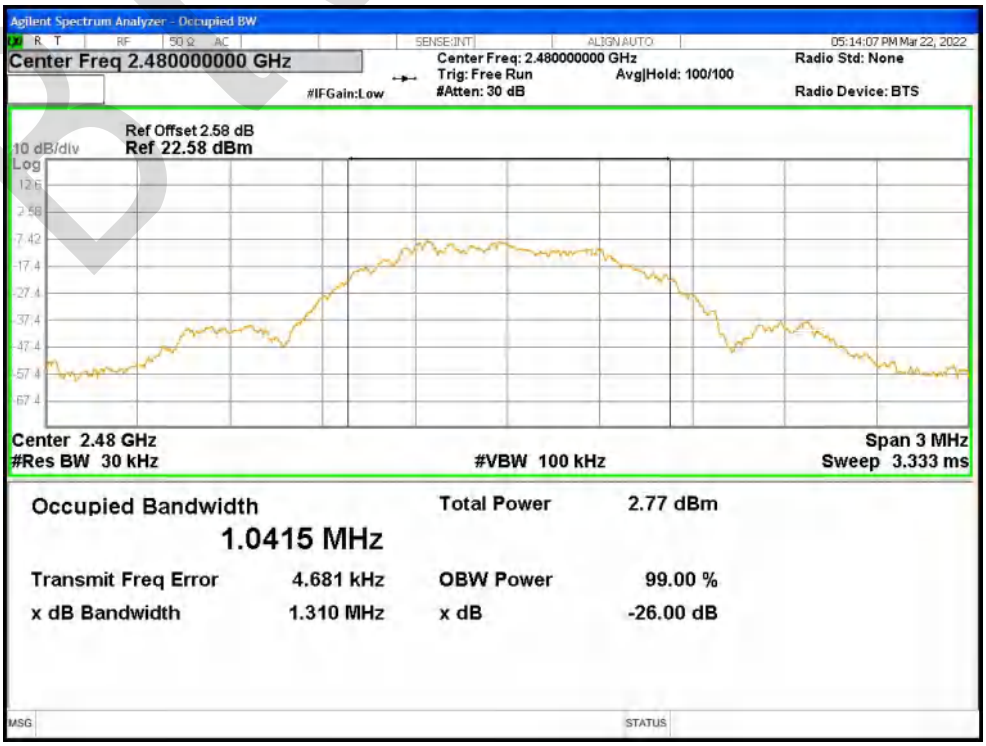
OBW NVNT BLE 1M 2402MHz Ant1



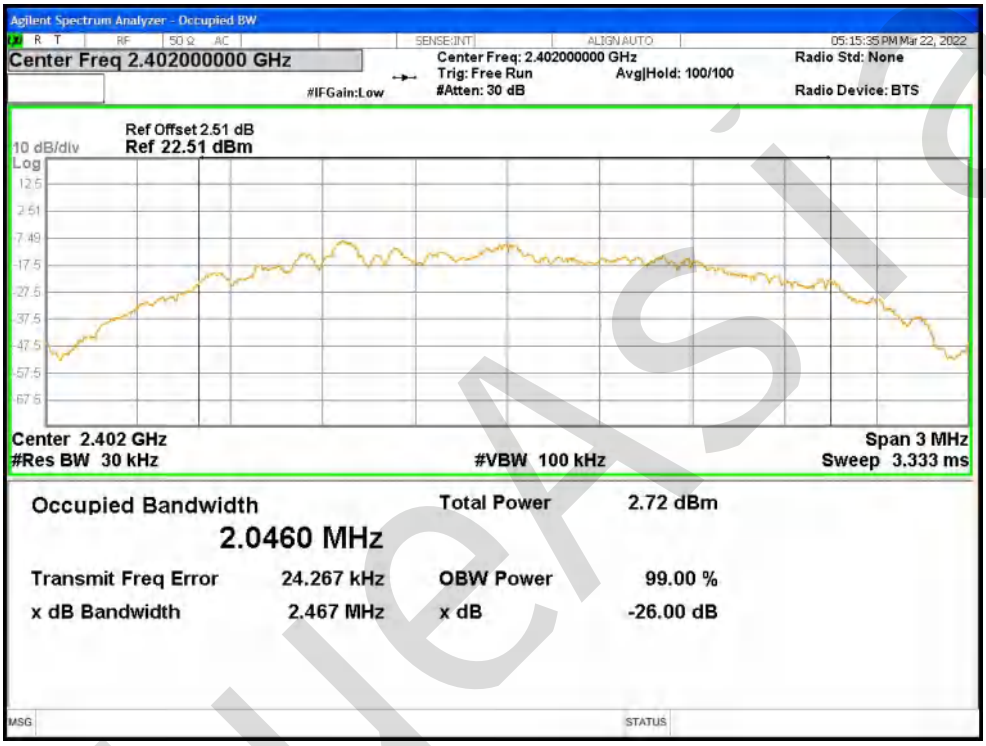
OBW NVNT BLE 1M 2442MHz Ant1



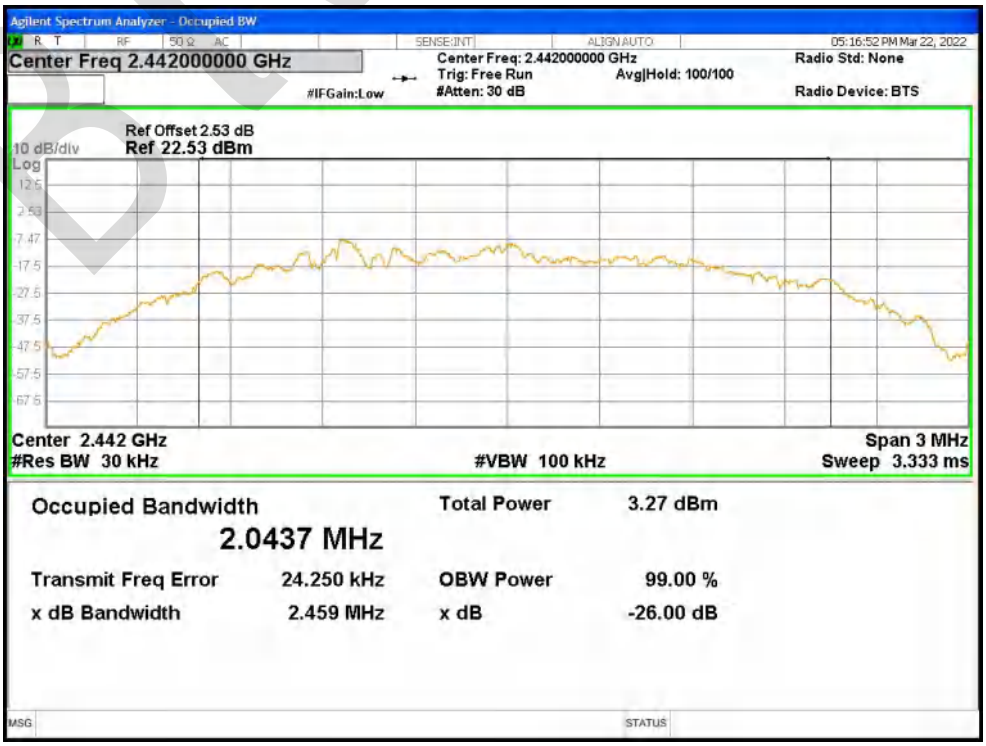
OBW NVNT BLE 1M 2480MHz Ant1



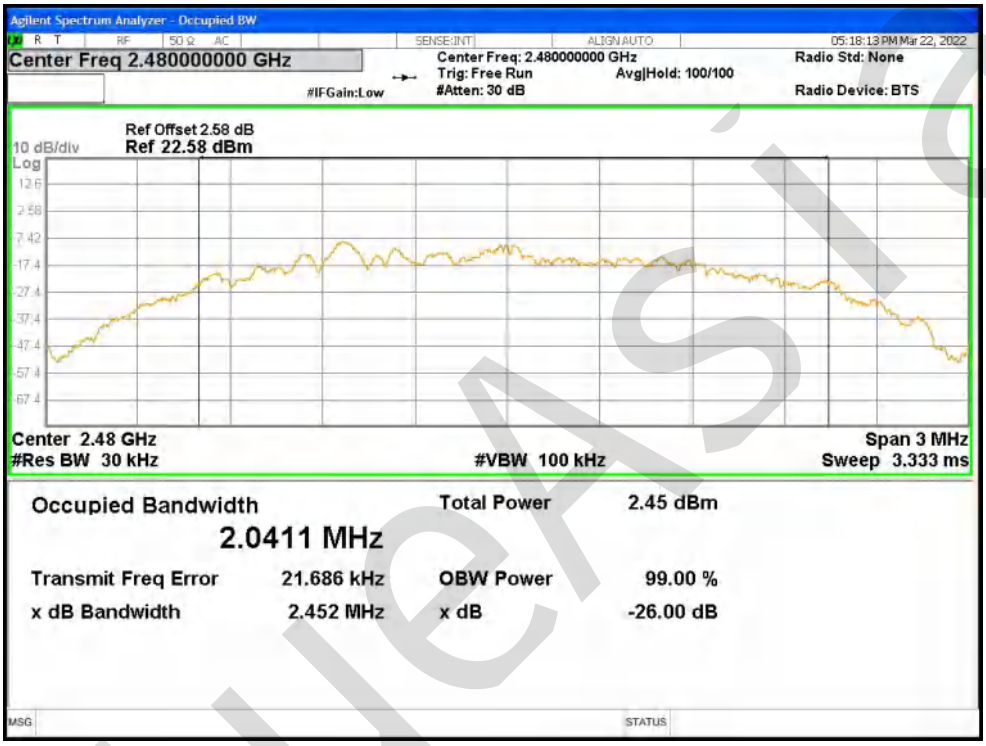
OBW NVNT BLE 2M 2402MHz Ant1



OBW NVNT BLE 2M 2442MHz Ant1



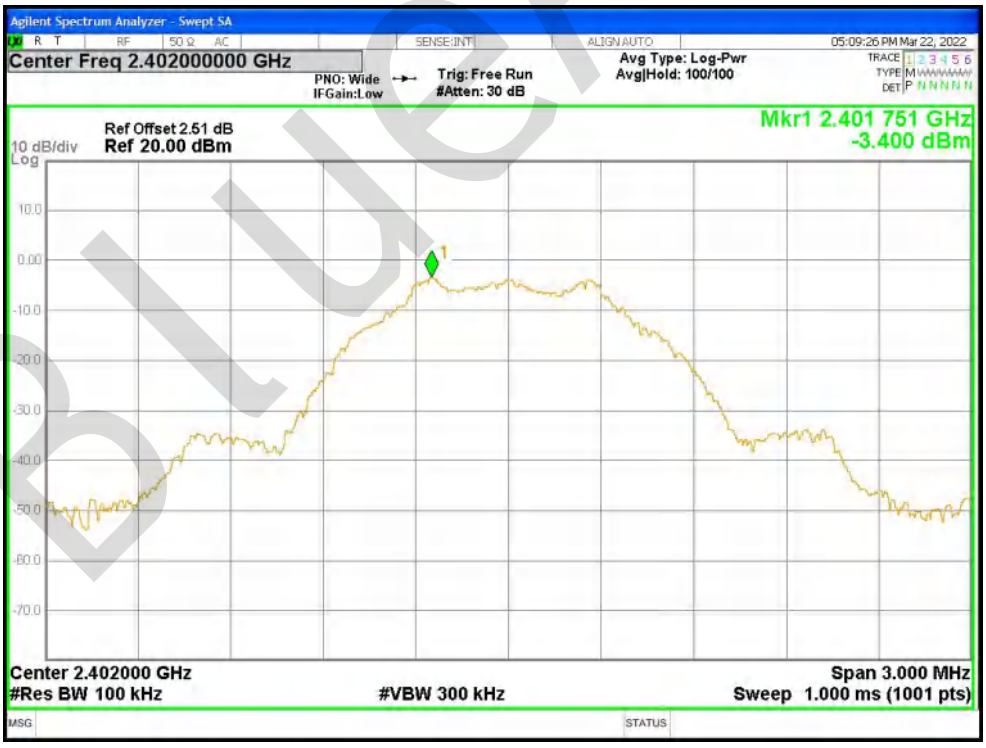
OBW NVNT BLE 2M 2480MHz Ant1



10.4 MAXIMUM POWER SPECTRAL DENSITY LEVEL

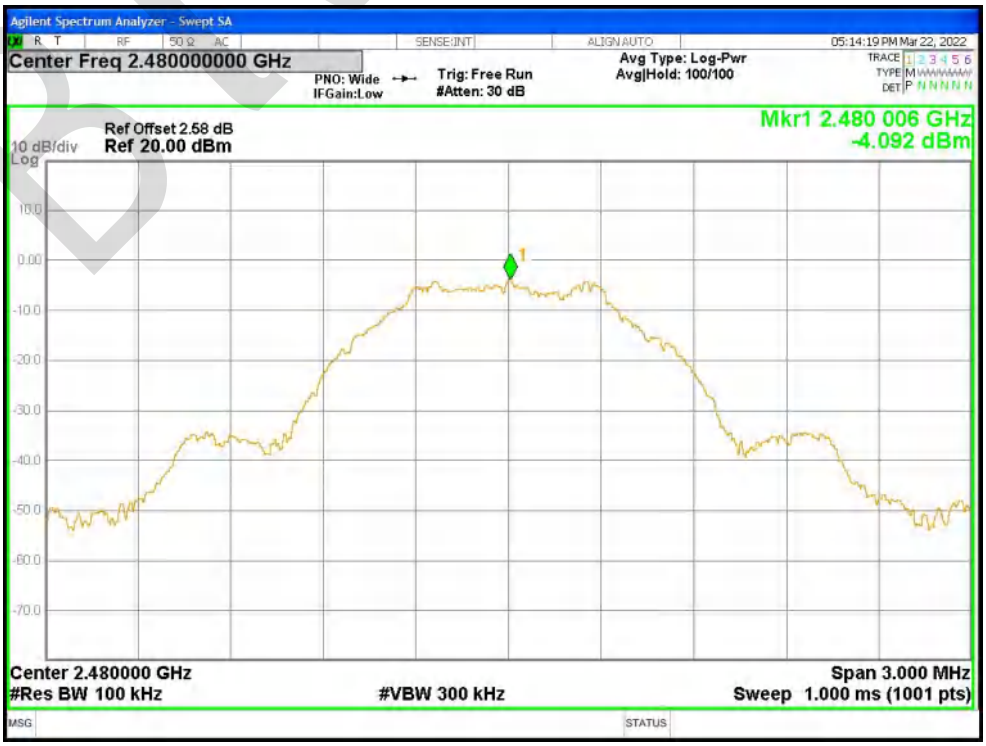
Condition	Mode	Frequency (MHz)	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	-3.4	8	Pass
NVNT	BLE 1M	2442	-2.56	8	Pass
NVNT	BLE 1M	2480	-4.092	8	Pass
NVNT	BLE 2M	2402	-3.955	8	Pass
NVNT	BLE 2M	2442	-2.594	8	Pass
NVNT	BLE 2M	2480	-3.504	8	Pass

PSD NVNT BLE 1M 2402MHz Ant1

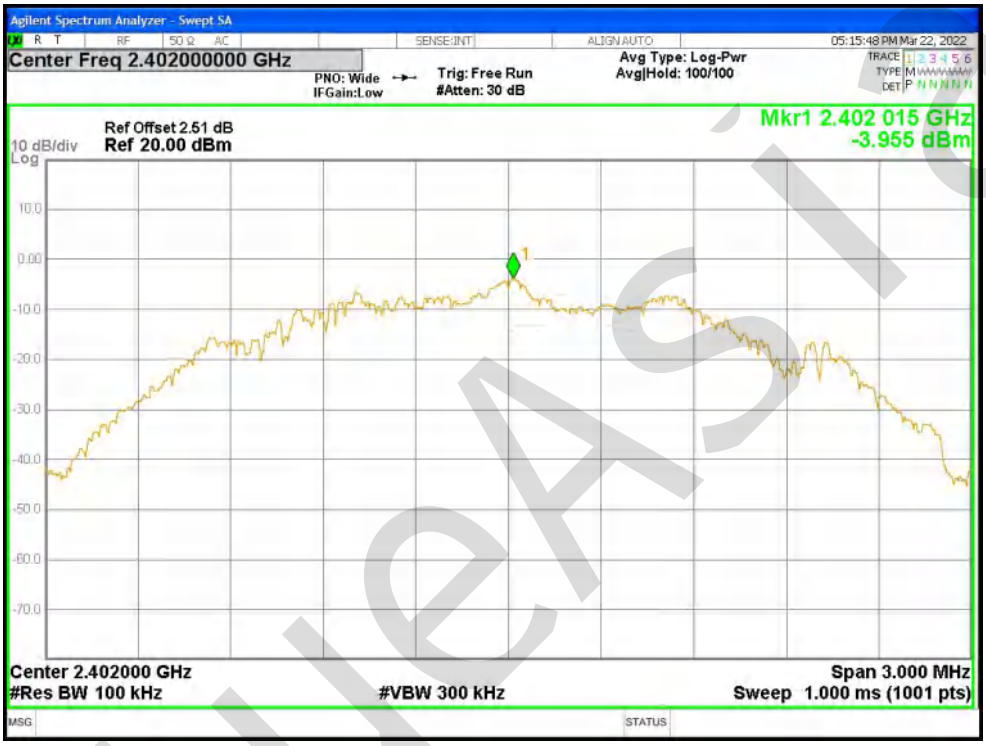


PSD NVNT BLE 1M 2442MHz Ant1

PSD NVNT BLE 1M 2480MHz Ant1



PSD NVNT BLE 2M 2402MHz Ant1



PSD NVNT BLE 2M 2442MHz Ant1

PSD NVNT BLE 2M 2480MHz Ant1

10.5 BAND EDGE

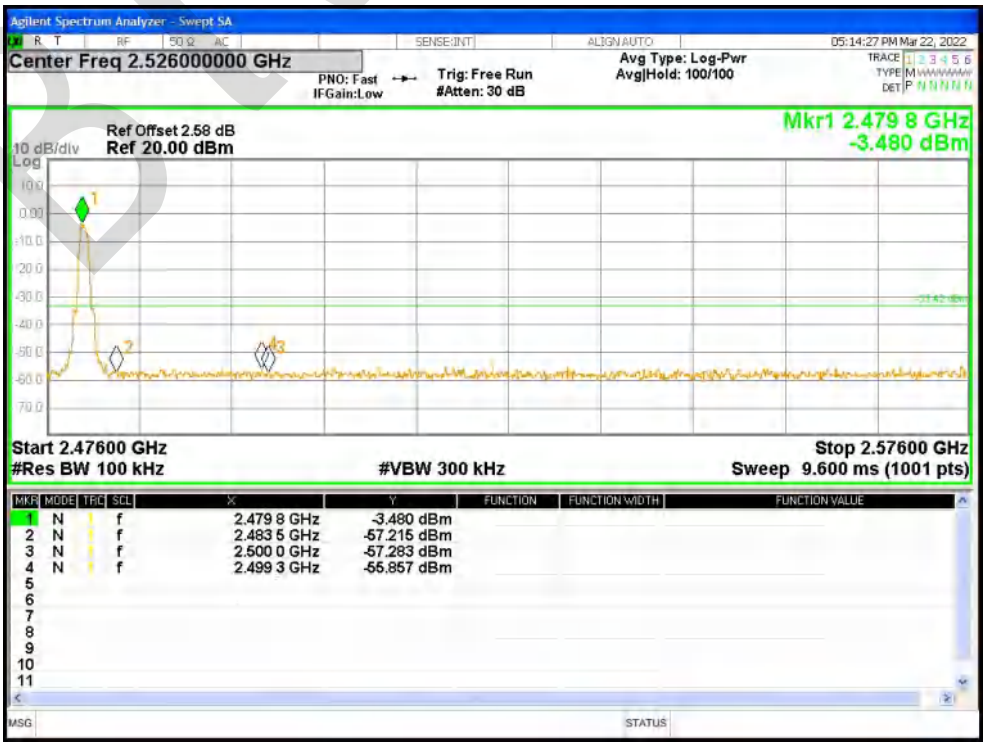
Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	-50.99	-30	Pass
NVNT	BLE 1M	2480	-52.43	-30	Pass
NVNT	BLE 2M	2402	-50.66	-30	Pass
NVNT	BLE 2M	2480	-51.31	-30	Pass

Band Edge NVNT BLE 1M 2402MHz Ant1 Ref

Band Edge NVNT BLE 1M 2402MHz Ant1 Emission

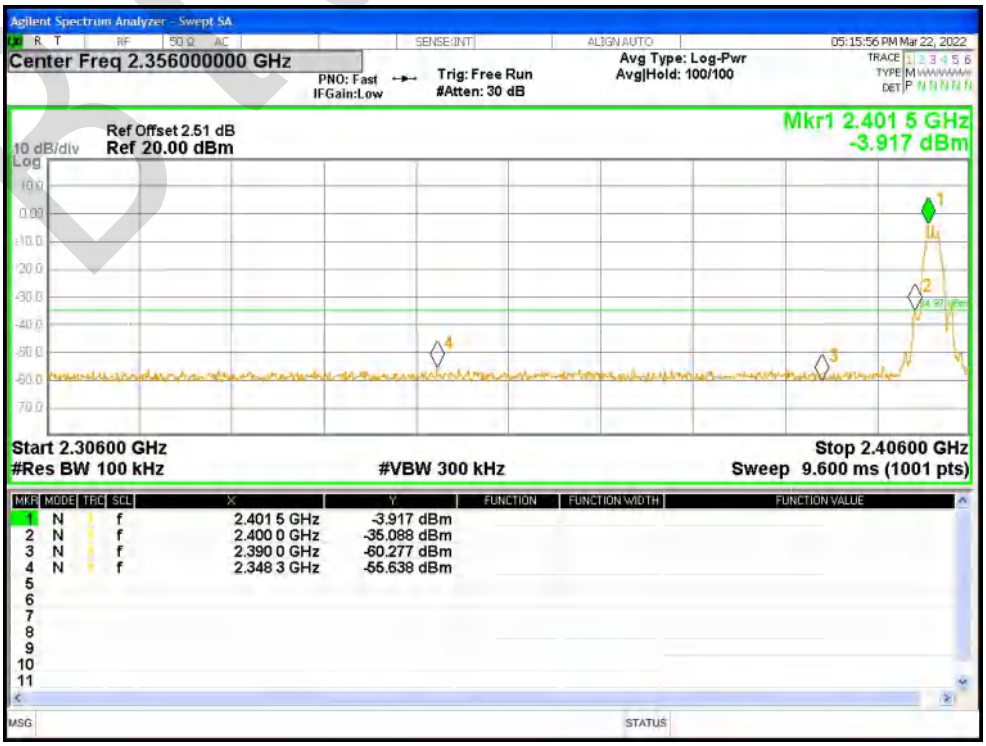
Band Edge NVNT BLE 1M 2480MHz Ant1 Ref

Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



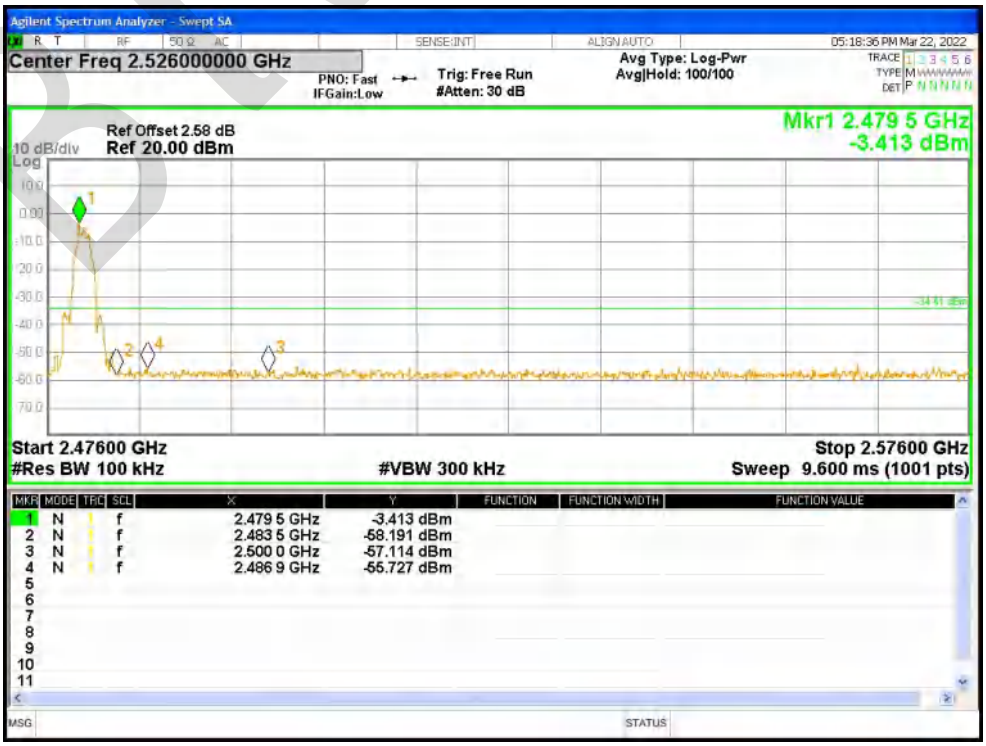
Band Edge NVNT BLE 2M 2402MHz Ant1 Ref

Band Edge NVNT BLE 2M 2402MHz Ant1 Emission



Band Edge NVNT BLE 2M 2480MHz Ant1 Ref

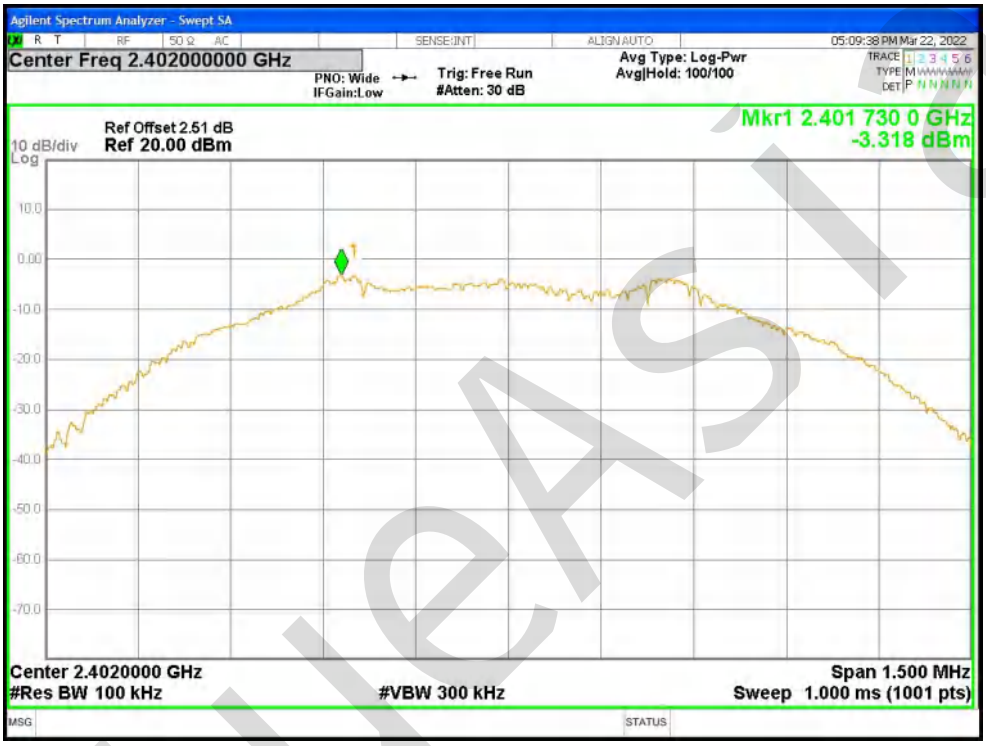
Band Edge NVNT BLE 2M 2480MHz Ant1 Emission



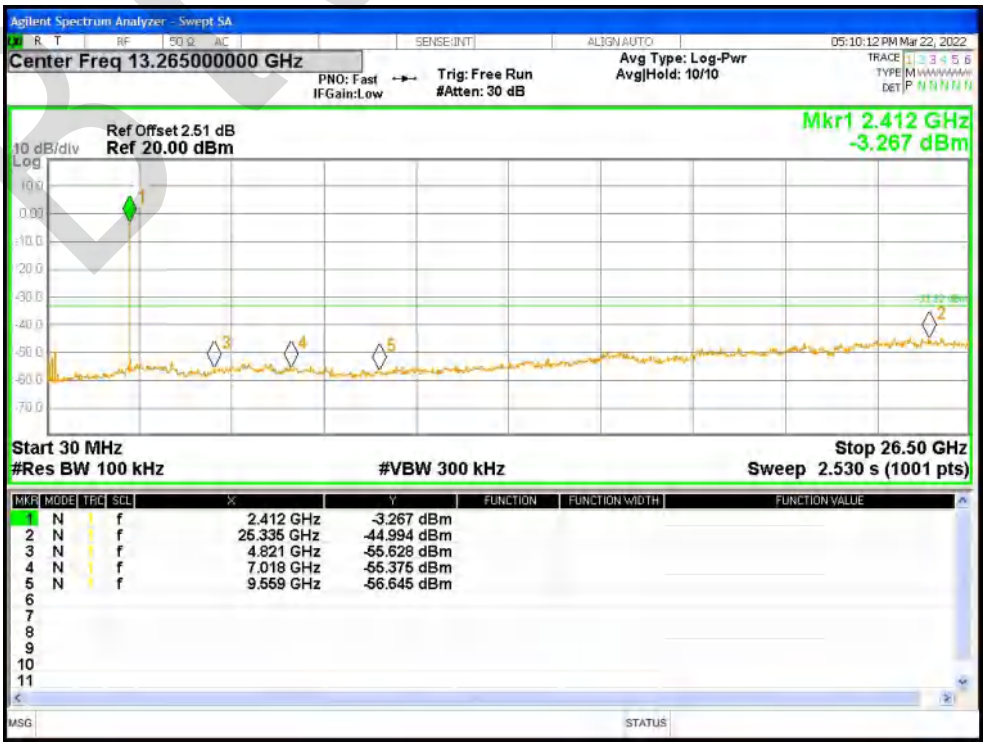
10.6 CONDUCTED RF SPURIOUS EMISSION

Condition	Mode	Frequency (MHz)	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	-41.67	-30	Pass
NVNT	BLE 1M	2442	-42.76	-30	Pass
NVNT	BLE 1M	2480	-41.64	-30	Pass
NVNT	BLE 2M	2402	-42.06	-30	Pass
NVNT	BLE 2M	2442	-42.57	-30	Pass
NVNT	BLE 2M	2480	-41.6	-30	Pass

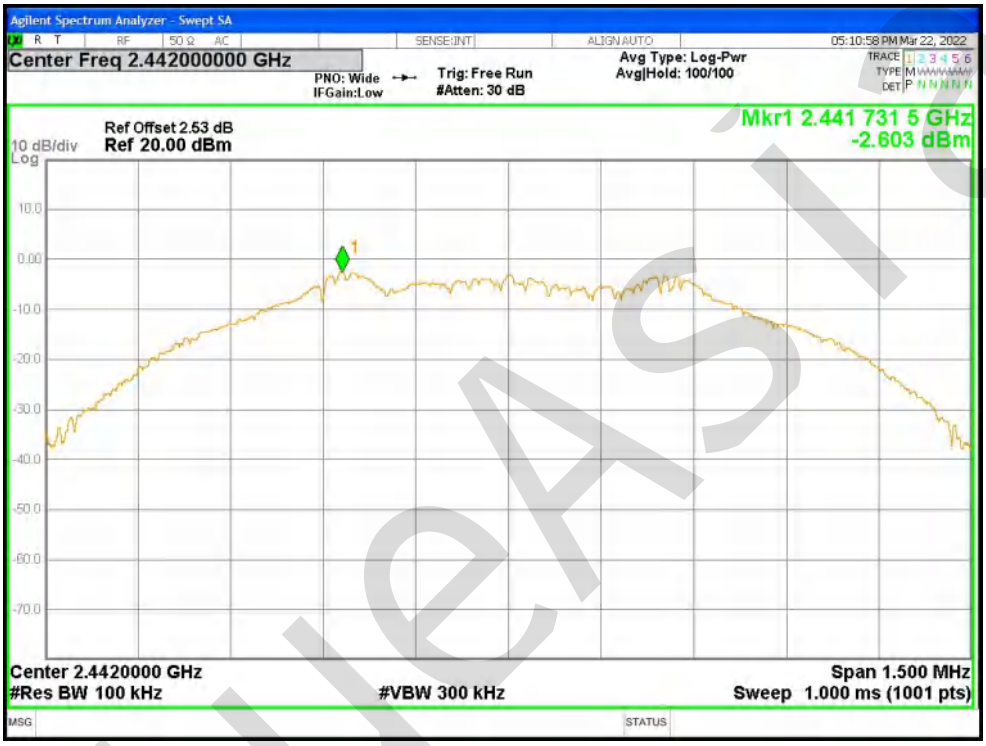
Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Ref



Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission

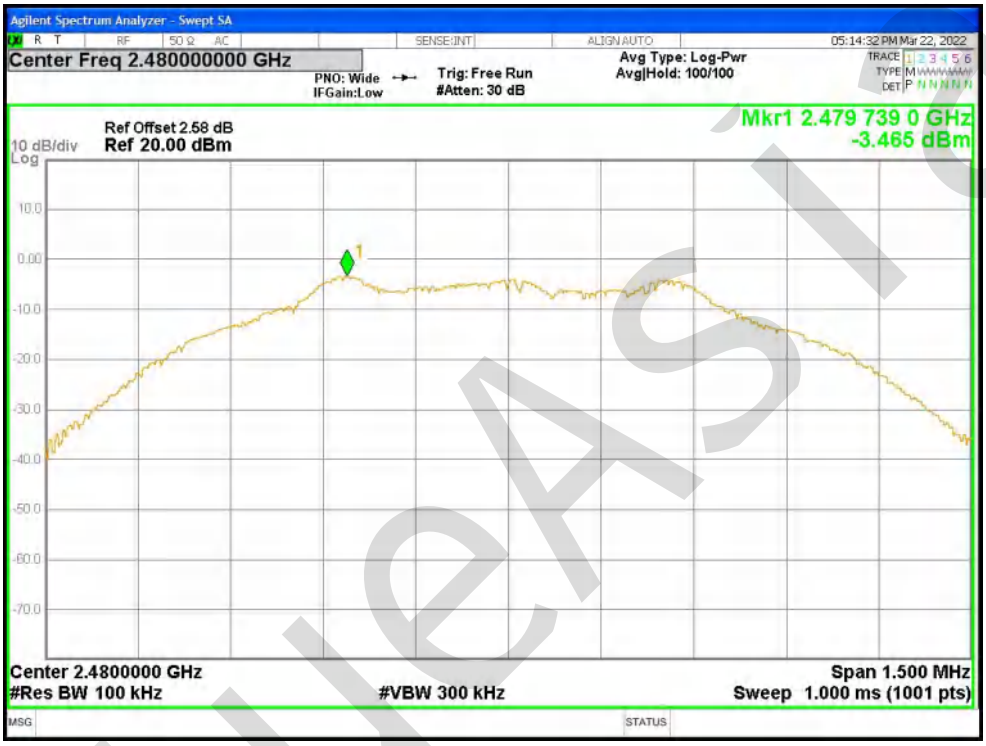


Tx. Spurious NVNT BLE 1M 2442MHz Ant1 Ref

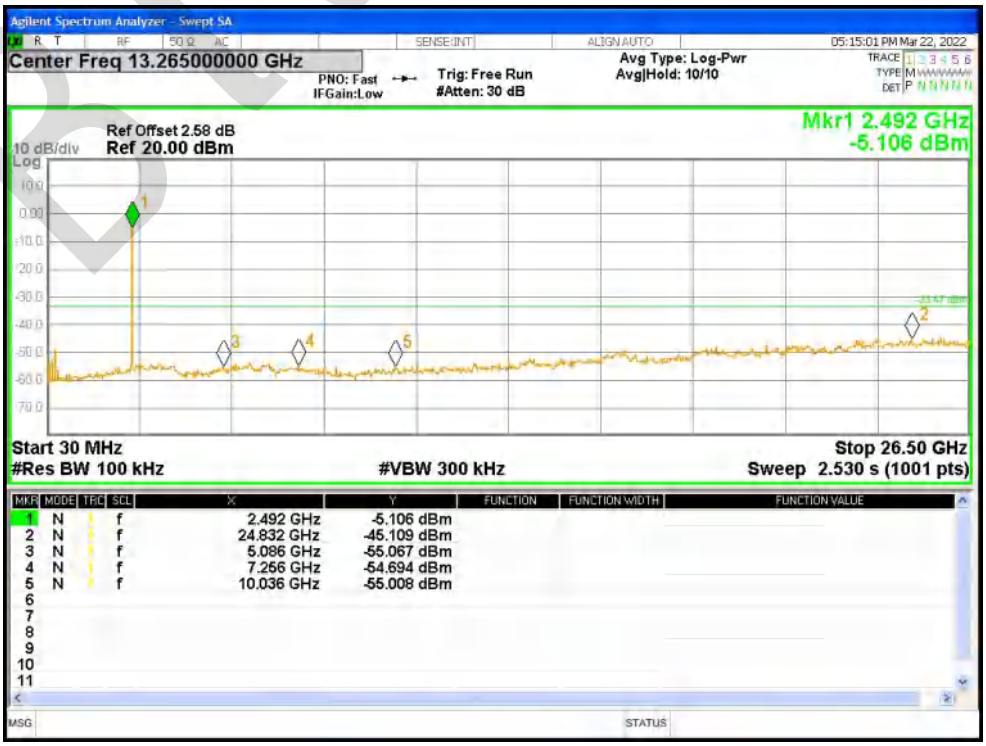


Tx. Spurious NVNT BLE 1M 2442MHz Ant1 Emission

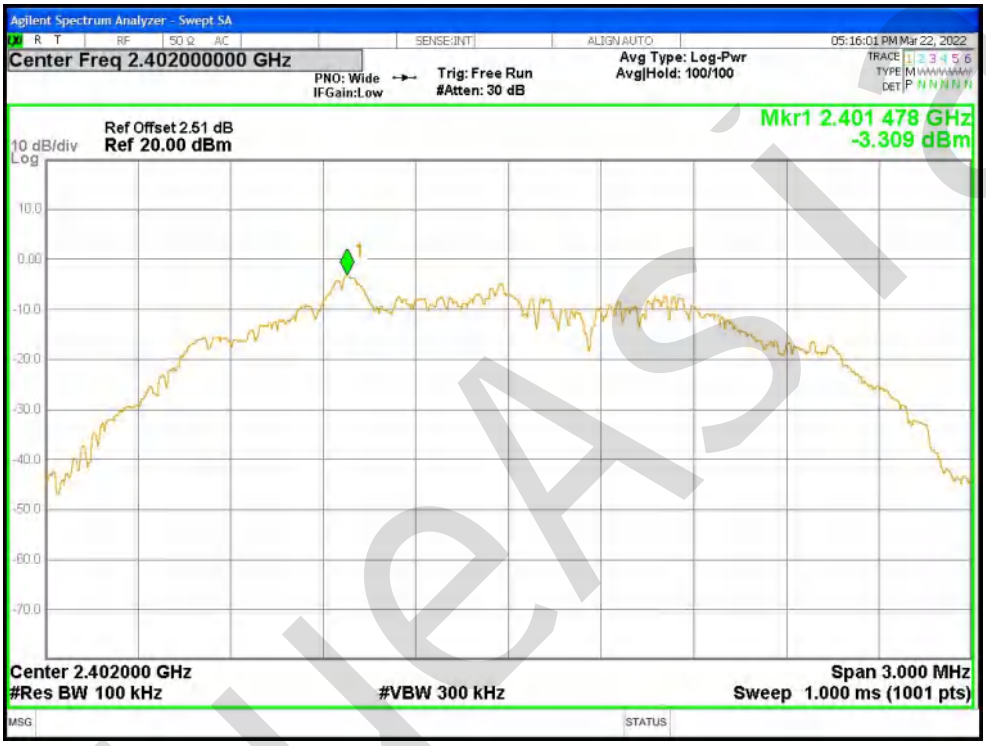
Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Ref



Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission

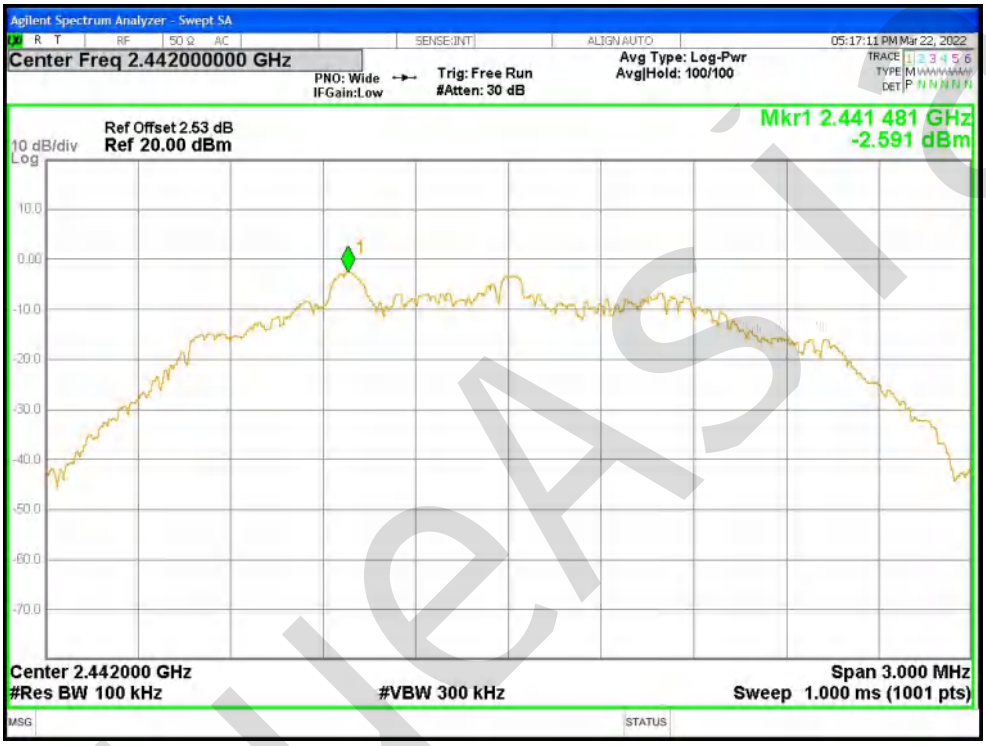


Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Ref



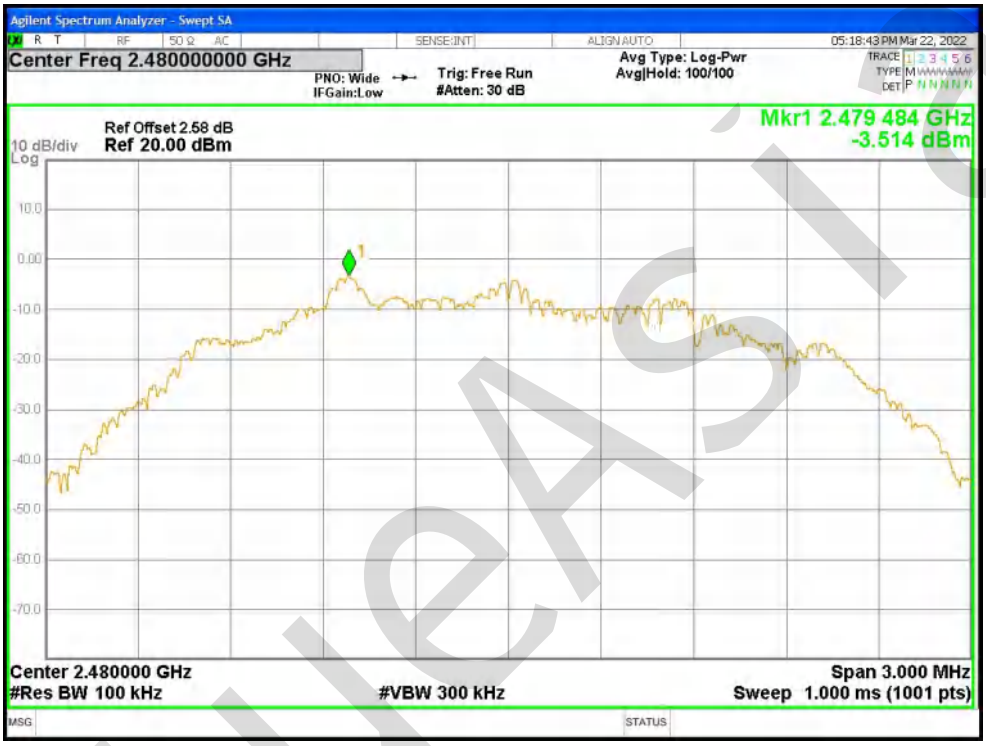
Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Emission

Tx. Spurious NVNT BLE 2M 2442MHz Ant1 Ref

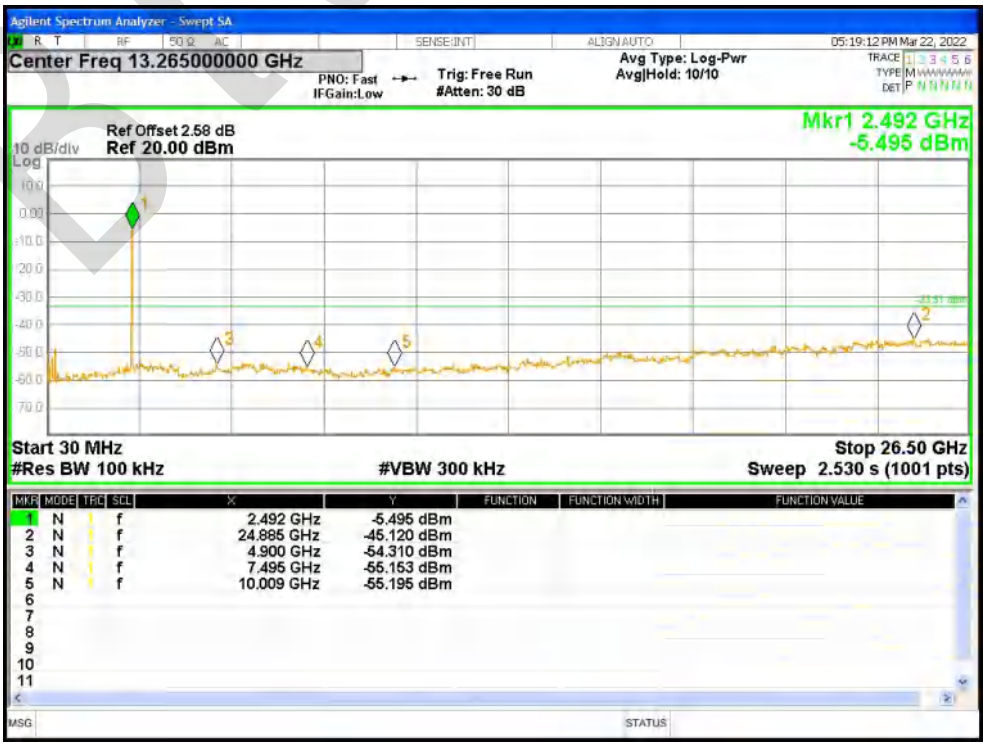


Tx. Spurious NVNT BLE 2M 2442MHz Ant1 Emission

Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Ref

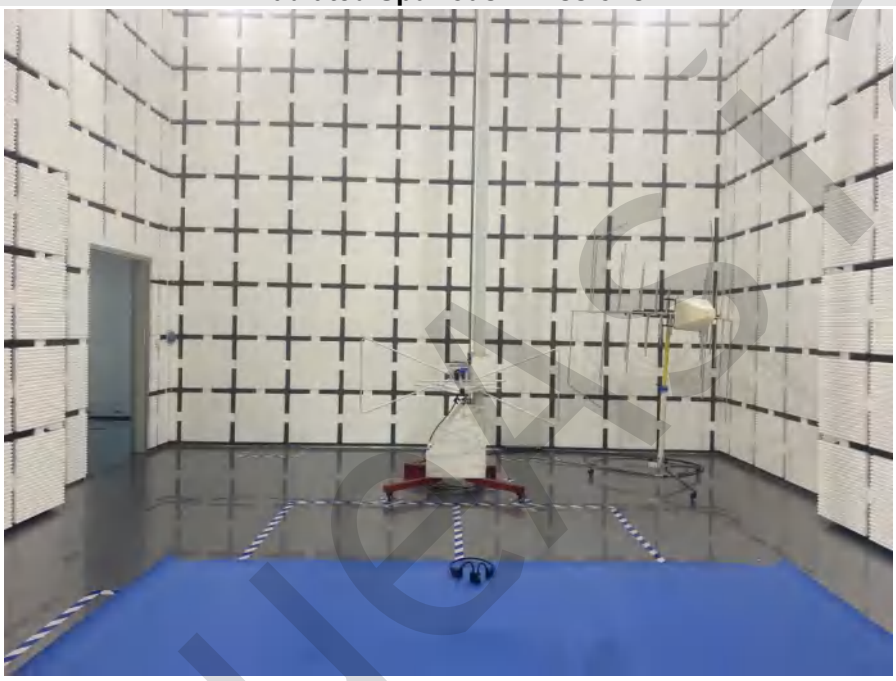


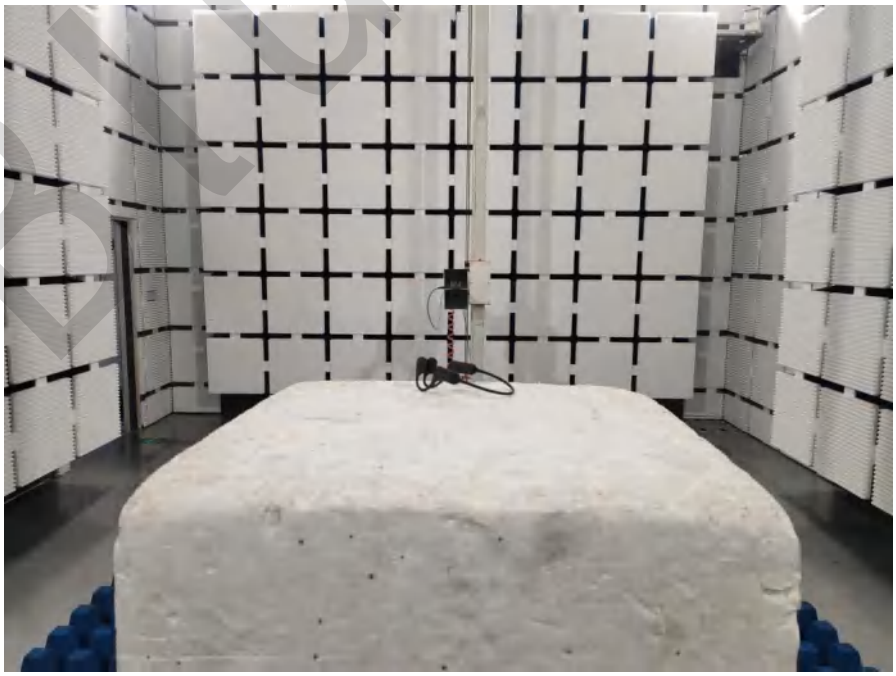
Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Emission



APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Radiated Spurious Emissions





Conducted Emissions at AC Power Line (150kHz-30MHz)

----END OF REPORT----