

TEST REPORT

Product Name : Bluetooth speaker with wireless charger
Brand Mark : DOAGEAS
Model No. : B83
FCC ID : 2AQ2W-B83
Report Number : BLA-EMC-202011-A7201
Date of Sample Receipt : 2020/11/25
Date of Test : 2020/11/25 to 2021/1/20
Date of Issue : 2021/3/25
Test Standard : 47 CFR Part 15, Subpart C 15.247
Test Result : Pass

Prepared for:

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2021/3/25



REPORT REVISE RECORD

Version No.	Date	Description
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BlueAsia

TABLE OF CONTENTS

1	TEST SUMMARY	6
2	GENERAL INFORMATION	7
3	GENERAL DESCRIPTION OF E.U.T.	7
4	TEST ENVIRONMENT	8
5	TEST MODE	8
6	MEASUREMENT UNCERTAINTY	8
7	DESCRIPTION OF SUPPORT UNIT.....	9
8	LABORATORY LOCATION.....	9
9	TEST INSTRUMENTS LIST	10
1	ANTENNA REQUIREMENT	14
1.1	CONCLUSION	14
2	CONDUCTED SPURIOUS EMISSIONS	15
2.1	LIMITS	15
2.2	BLOCK DIAGRAM OF TEST SETUP	15
2.3	TEST DATA	16
3	HOPPING CHANNEL NUMBER	17
3.1	LIMITS	17
3.2	BLOCK DIAGRAM OF TEST SETUP	17
3.3	TEST DATA	17
4	CARRIER FREQUENCIES SEPARATION	18
4.1	LIMITS	18
4.2	BLOCK DIAGRAM OF TEST SETUP	18
4.3	TEST DATA	18
5	20DB BANDWIDTH.....	19
5.1	BLOCK DIAGRAM OF TEST SETUP	19
5.2	TEST DATA	19
6	CONDUCTED PEAK OUTPUT POWER	20
6.1	LIMITS	20
6.2	BLOCK DIAGRAM OF TEST SETUP	20

6.3	EST DATA	21
7	CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ).....	21
7.1	LIMITS	21
7.2	BLOCK DIAGRAM OF TEST SETUP	21
7.3	PROCEDURE	22
7.4	TEST DATA	23
8	RADIATED SPURIOUS EMISSIONS.....	25
8.1	LIMITS	25
8.2	BLOCK DIAGRAM OF TEST SETUP	26
8.3	PROCEDURE	26
8.4	TEST DATA	28
9	RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS.....	36
9.1	LIMITS	36
9.2	BLOCK DIAGRAM OF TEST SETUP	37
9.3	PROCEDURE	37
9.4	TEST DATA	39
10	CONDUCTED BAND EDGES MEASUREMENT.....	43
10.1	LIMITS	43
10.2	BLOCK DIAGRAM OF TEST SETUP	43
10.3	TEST DATA.....	44
11	DWELL TIME.....	45
11.1	LIMITS	45
11.2	BLOCK DIAGRAM OF TEST SETUP	45
11.3	EST DATA.....	46
10	APPENDIX.....	46
10.1	APPENDIX : 20dB EMISSION BANDWIDTH	46
	Test Result.....	46
	Test Graphs	47
10.2	APPENDIX : MAXIMUM CONDUCTED OUTPUT POWER	50
	Test Result.....	50
	Test Graphs	51
10.3	APPENDIX : CARRIER FREQUENCY SEPARATION	54
	Test Result.....	54

Test Graphs	55
10.4 APPENDIX : TIME OF OCCUPANCY	56
Test Result.....	56
Test Graphs	57
10.5 APPENDIX : NUMBER OF HOPPING CHANNELS.....	59
Test Result.....	59
Test Graphs	60
10.6 APPENDIX : BAND EDGE MEASUREMENTS	61
Test Result.....	61
Test Graphs	62
10.7 APPENDIX H: CONDUCTED SPURIOUS EMISSION	66
Test Result.....	66
Test Graphs	67
APPENDIX A: PHOTOGRAPHS OF TEST SETUP	74
APPENDIX B: PHOTOGRAPHS OF EUT	76

1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	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
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
20dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	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
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
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 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
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass

2 GENERAL INFORMATION

Applicant	Shenzhen Doageas Technology Co., Ltd.
Address	5/F,4th Bldg ,Hedian Industrial Park,Guanlan,Longhua, Shenzhen,Guangdong518110,China
Manufacturer	Shenzhen Doageas Technology Co., Ltd.
Address	5/F,4th Bldg ,Hedian Industrial Park,Guanlan,Longhua, Shenzhen,Guangdong518110,China
Factory	Shenzhen Doageas Technology Co., Ltd.
Address	5/F,4th Bldg ,Hedian Industrial Park,Guanlan,Longhua, Shenzhen,Guangdong518110,China
Product Name	Bluetooth speaker with wireless charger
Test Model No.	B83

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	DGLS-B81-6928B-MK-V10
Software Version	XRS-V1.0
Operation Frequency:	2402MHz~2480MHz
Modulation Type:	GFSK, $\pi/4$ DQPSK
Channel Spacing:	1MHz
Number of Channels:	79
Antenna Type:	PCB Antenna
Antenna Gain:	-0.58 dBi (Provided by the customer)

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25°C	3.7Vdc

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
Transmitting mode	Keep the EUT in continuously transmitting mode with modulation. (hopping and non hopping mode all have been tested, non hopping mode is worse case for RE)
Remark: Full battery is used during all test except ac conducted emission, DH1, DH3, DH5 all have been tested, during the test, GFSK, Pi/4QPSK modulation were all pre-scanned Only 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

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
AC Adapter	PISEN	TS-C051	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.
Building C, No. 107, Shihuan Road, Shiyan Sub-District, Baoan District, Shenzhen, Guangdong Province, China
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673
No tests were sub-contracted.

9 TEST INSTRUMENTS LIST

Test Equipment Of Conducted Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of Hopping Channel Number					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of Carrier Frequencies Separation					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of 20dB Bandwidth					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due

Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of Conducted Peak Output Power

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

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	2020/11/25	2023/11/24
Receiver	R&S	ESPI3	101082	2020/10/12	2021/10/11
LISN	R&S	ENV216	3560.6550.15	2020/10/12	2021/10/11
LISN	AT	AT166-2	AKK1806000003	2020/10/12	2021/10/11
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A

Test Equipment Of Radiated Spurious Emissions

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11

Receiver	R&S	ESR7	101199	2020/10/12	2021/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25
Amplifier	SKET	PA-000318G-45	N/A	2020/10/16	2021/10/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

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	2020/11/10	2023/11/9
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Receiver	R&S	ESR7	101199	2020/10/12	2021/10/11
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	2020/9/26	2022/9/25
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	2020/9/26	2022/9/25
Amplifier	SKET	PA-000318G-45	N/A	2020/10/16	2021/10/15
EMI software	EZ	EZ-EMC	EEMC-3A1	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2020/9/26	2022/9/25
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A

Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	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	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

Test Equipment Of Dwell Time

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	2020/10/12	2021/10/11
Spectrum	Agilent	N9020A	MY49100060	2020/10/12	2021/10/11
Signal Generator	Agilent	N5182A	MY49060650	2020/10/12	2021/10/11
Signal Generator	Agilent	E8257D	MY44320250	2020/10/12	2021/10/11

1 ANTENNA REQUIREMENT

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

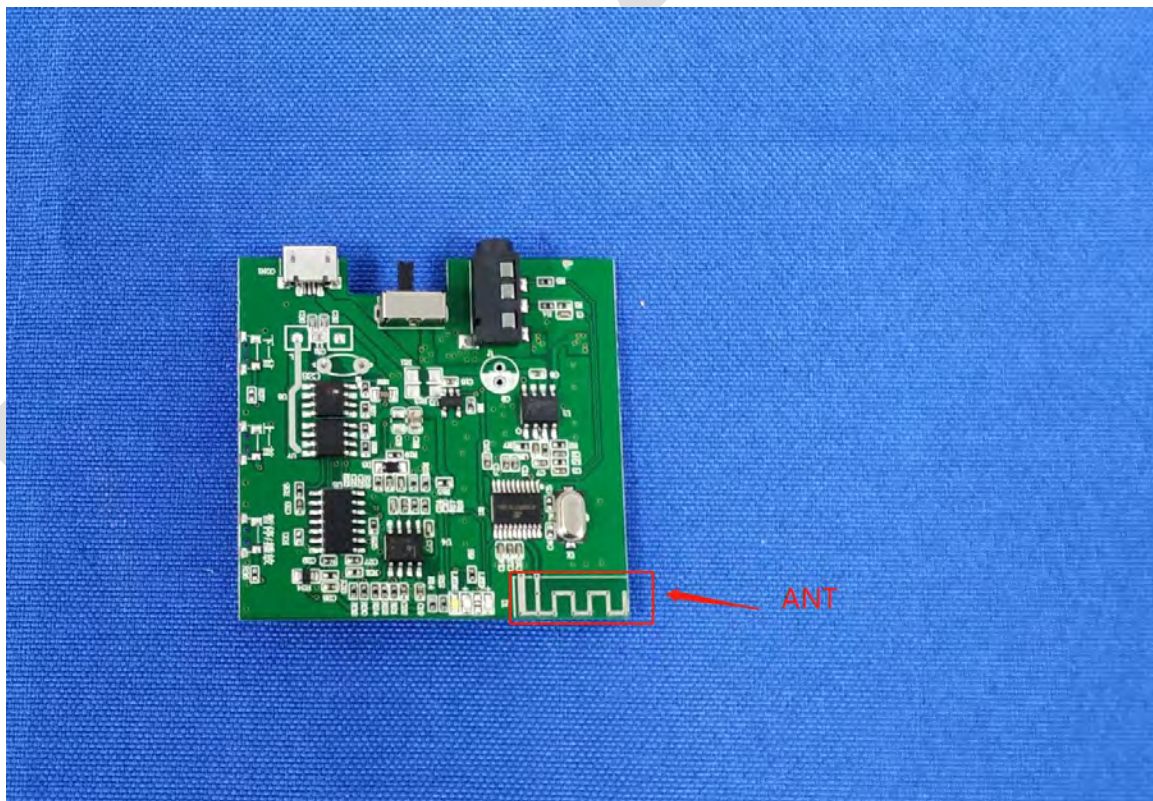
1.1 CONCLUSION

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 an 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 -0.58dBi.



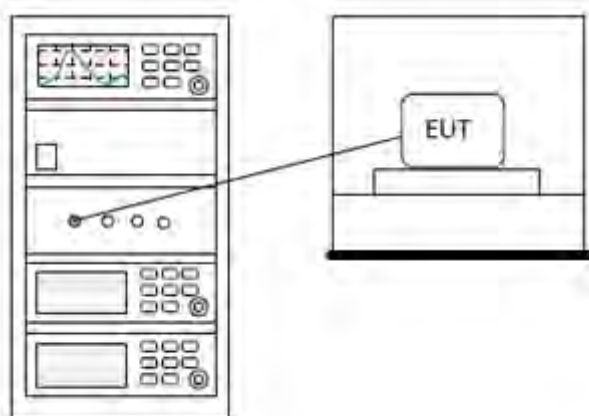
2 CONDUCTED SPURIOUS EMISSIONS

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	Eason
Temperature	25°C
Humidity	60%

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)).
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2.2 BLOCK DIAGRAM OF TEST SETUP



2.3 TEST DATA

Pass: Please Refer To Appendix: For Details

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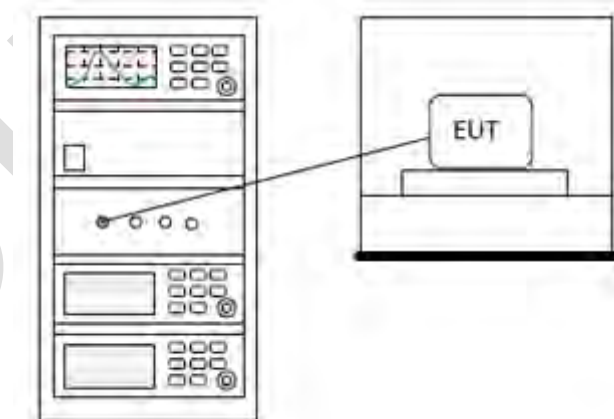
3 HOPPING CHANNEL NUMBER

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.3
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25°C
Humidity	60%

3.1 LIMITS

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

3.2 BLOCK DIAGRAM OF TEST SETUP



3.3 TEST DATA

Pass: Please Refer To Appendix: For Details

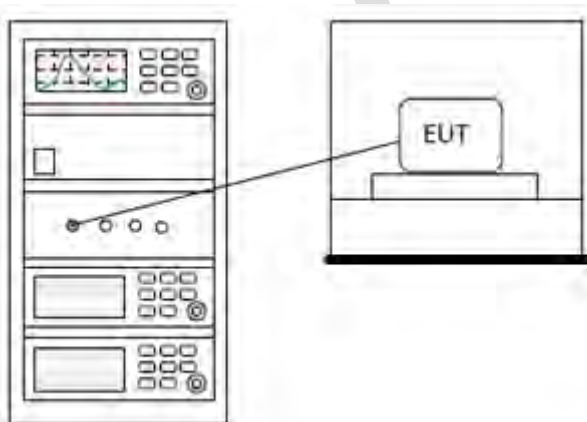
4 CARRIER FREQUENCIES SEPARATION

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25°C
Humidity	60%

4.1 LIMITS

Limit:	2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W
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4.2 BLOCK DIAGRAM OF TEST SETUP



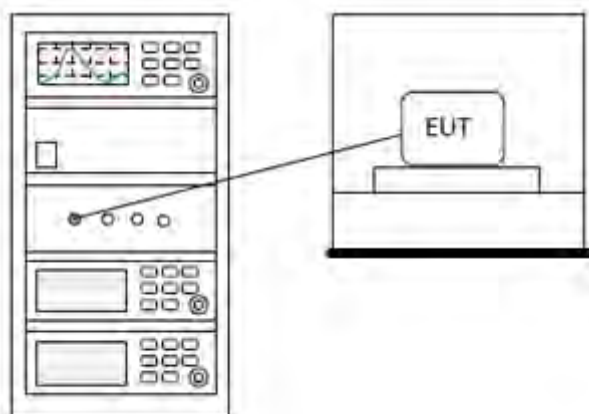
4.3 TEST DATA

Pass: Please Refer To Appendix: For Details

5 20DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.7
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25°C
Humidity	60%

5.1 BLOCK DIAGRAM OF TEST SETUP



5.2 TEST DATA

Pass: Please Refer To Appendix: For Details

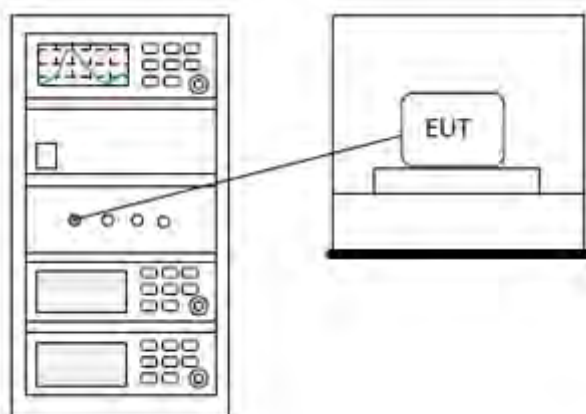
6 CONDUCTED PEAK OUTPUT POWER

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	Eason
Temperature	25°C
Humidity	60%

6.1 LIMITS

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq \text{hopping channels} < 50$
	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

6.2 BLOCK DIAGRAM OF TEST SETUP



6.3 EST DATA

Pass: Please Refer To Appendix: For Details

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

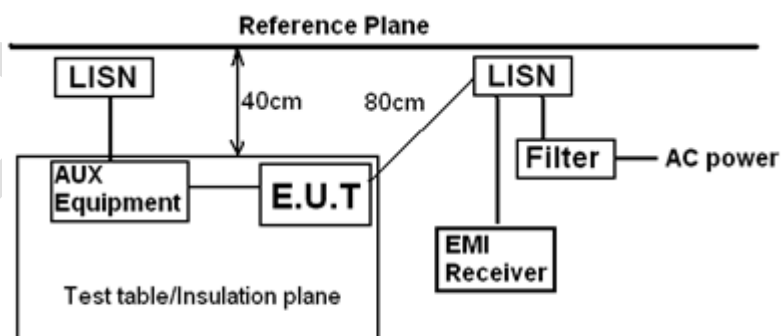
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25°C
Humidity	60%

7.1 LIMITS

Frequency of emission(MHz)	Conducted limit(dB μ V)	
	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.

7.2 BLOCK DIAGRAM OF TEST SETUP



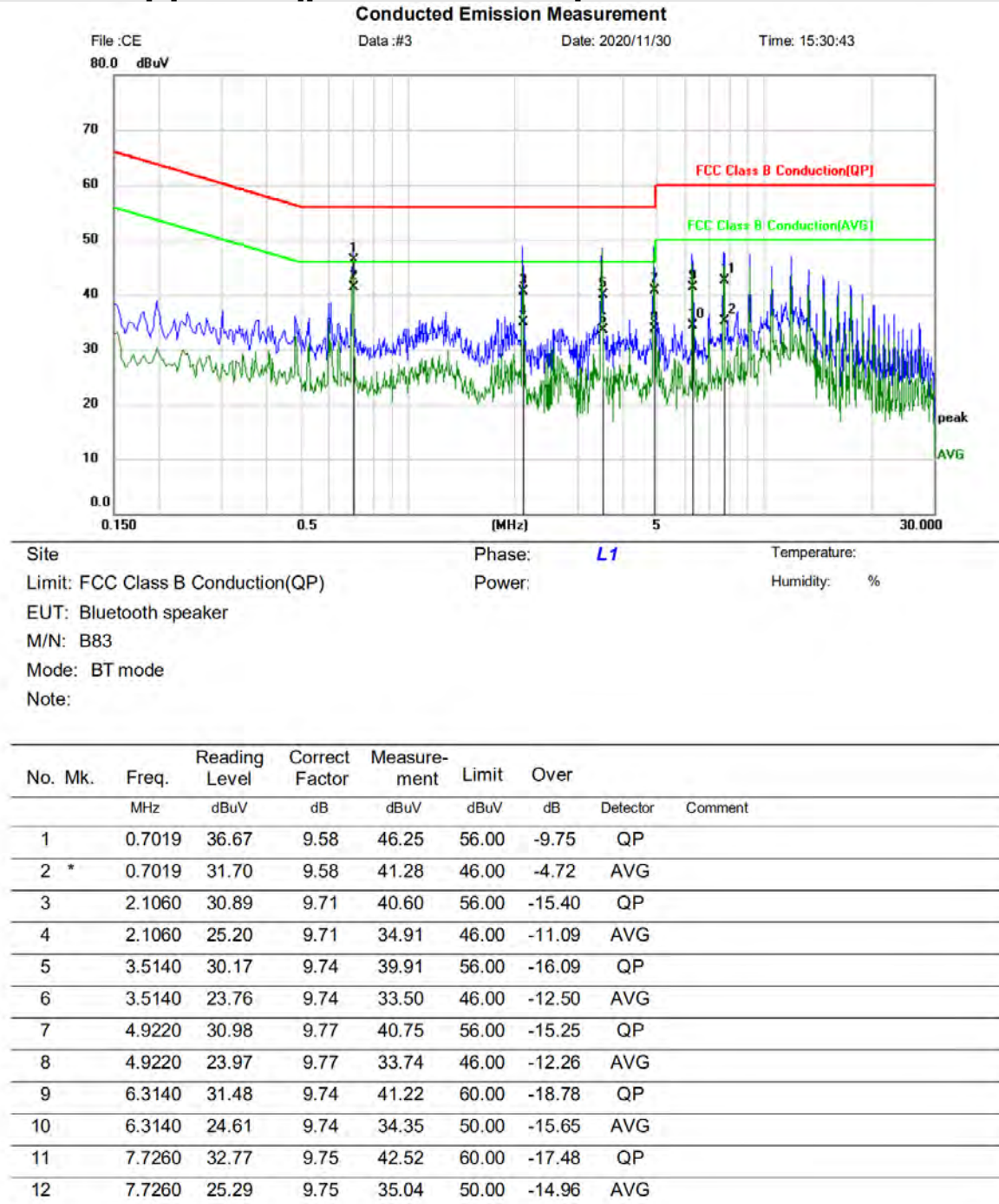
Remark
E.U.T: Equipment Under Test
LISN: Line Impedance Stabilization Network
Test table height=0.8m

7.3 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/50 μ H + 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

7.4 TEST DATA

[Test Mode: TX]; [Line: Line][Power:AC120V/60Hz]



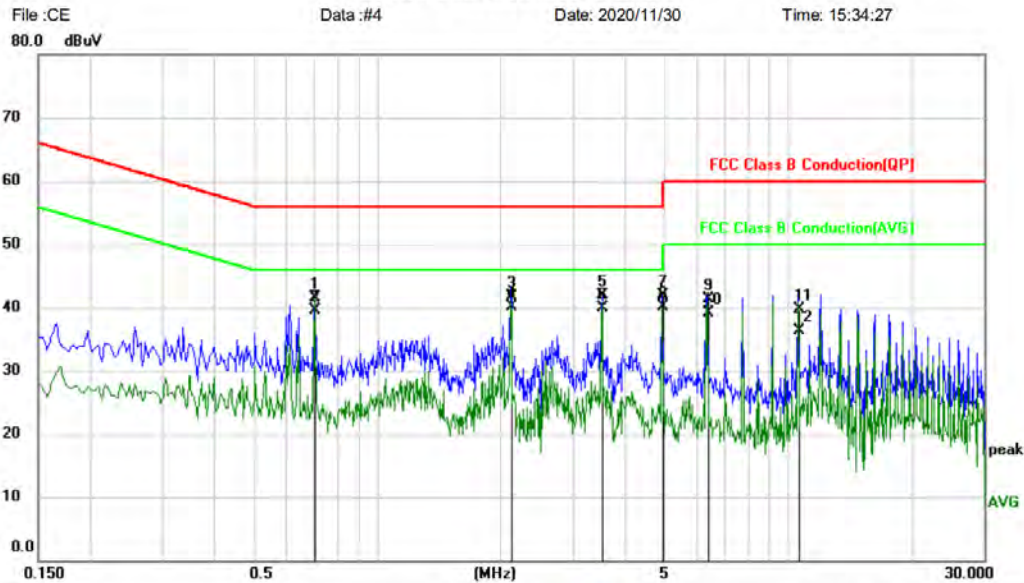
*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[Test Mode: TX]; [Line: Neutral] [Power: AC120V/60Hz]

Conducted Emission Measurement



Site: Phase: **N** Temperature:
Limit: FCC Class B Conduction(QP) Power: Humidity: %
EUT: Bluetooth speaker
M/N: B83
Mode: BT mode
Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.7060	31.85	9.65	41.50	56.00	-14.50	QP	
2	0.7060	29.92	9.65	39.57	46.00	-6.43	AVG	
3	2.1180	32.05	9.75	41.80	56.00	-14.20	QP	
4 *	2.1180	30.26	9.75	40.01	46.00	-5.99	AVG	
5	3.5300	32.11	9.75	41.86	56.00	-14.14	QP	
6	3.5300	30.06	9.75	39.81	46.00	-6.19	AVG	
7	4.9420	32.07	9.80	41.87	56.00	-14.13	QP	
8	4.9420	30.21	9.80	40.01	46.00	-5.99	AVG	
9	6.3540	31.47	9.74	41.21	60.00	-18.79	QP	
10	6.3540	29.46	9.74	39.20	50.00	-10.80	AVG	
11	10.5900	29.80	9.83	39.63	60.00	-20.37	QP	
12	10.5900	26.40	9.83	36.23	50.00	-13.77	AVG	

*:Maximum data x:Over limit !:over margin

<Reference Only

Test Result: Pass

8 RADIATED SPURIOUS EMISSIONS

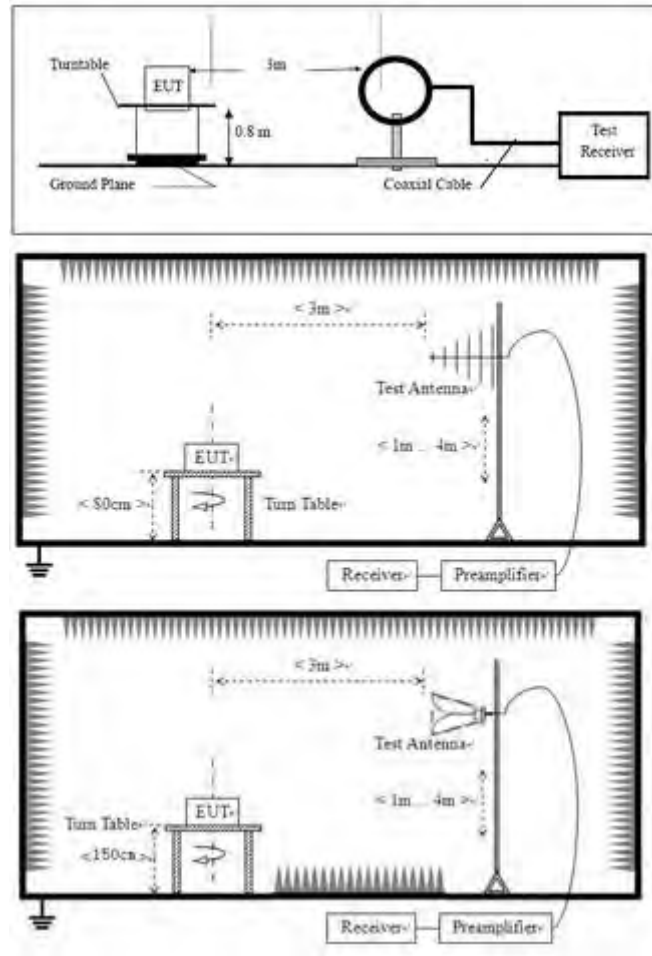
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX mode (SE) below 1G; TX mode (SE) above 1G
Test Mode (Final Test)	TX mode (SE) below 1G; TX mode (SE) above 1G
Tester	Eason
Temperature	25℃
Humidity	60%

8.1 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.

8.2 BLOCK DIAGRAM OF TEST SETUP



8.3 PROCEDURE

- 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.
- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.

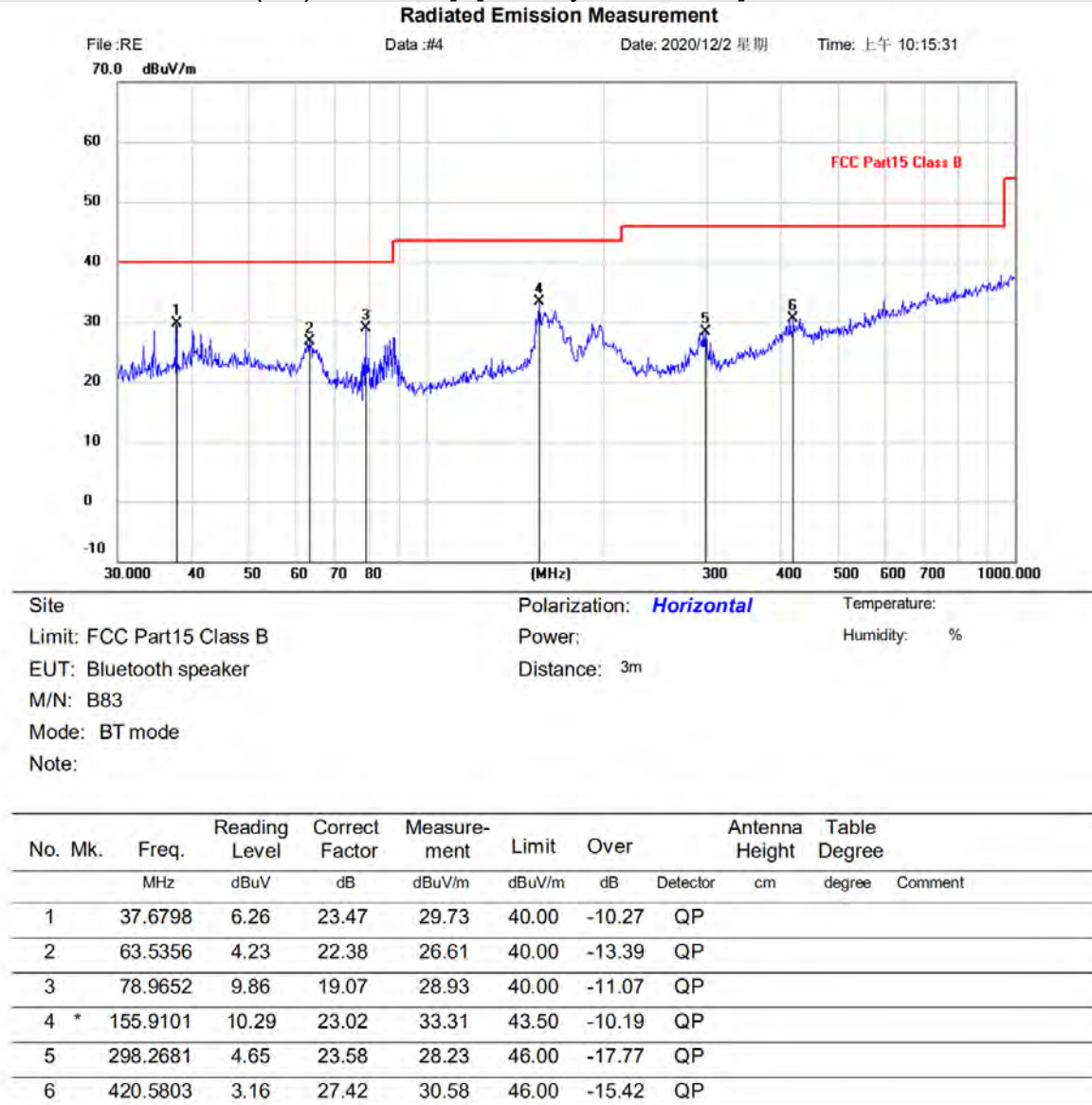
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was 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 12.75GHz 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. Fundamental frequency is blocked by filter ,and only spurious emission is shown.
- 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.

8.4 TEST DATA

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

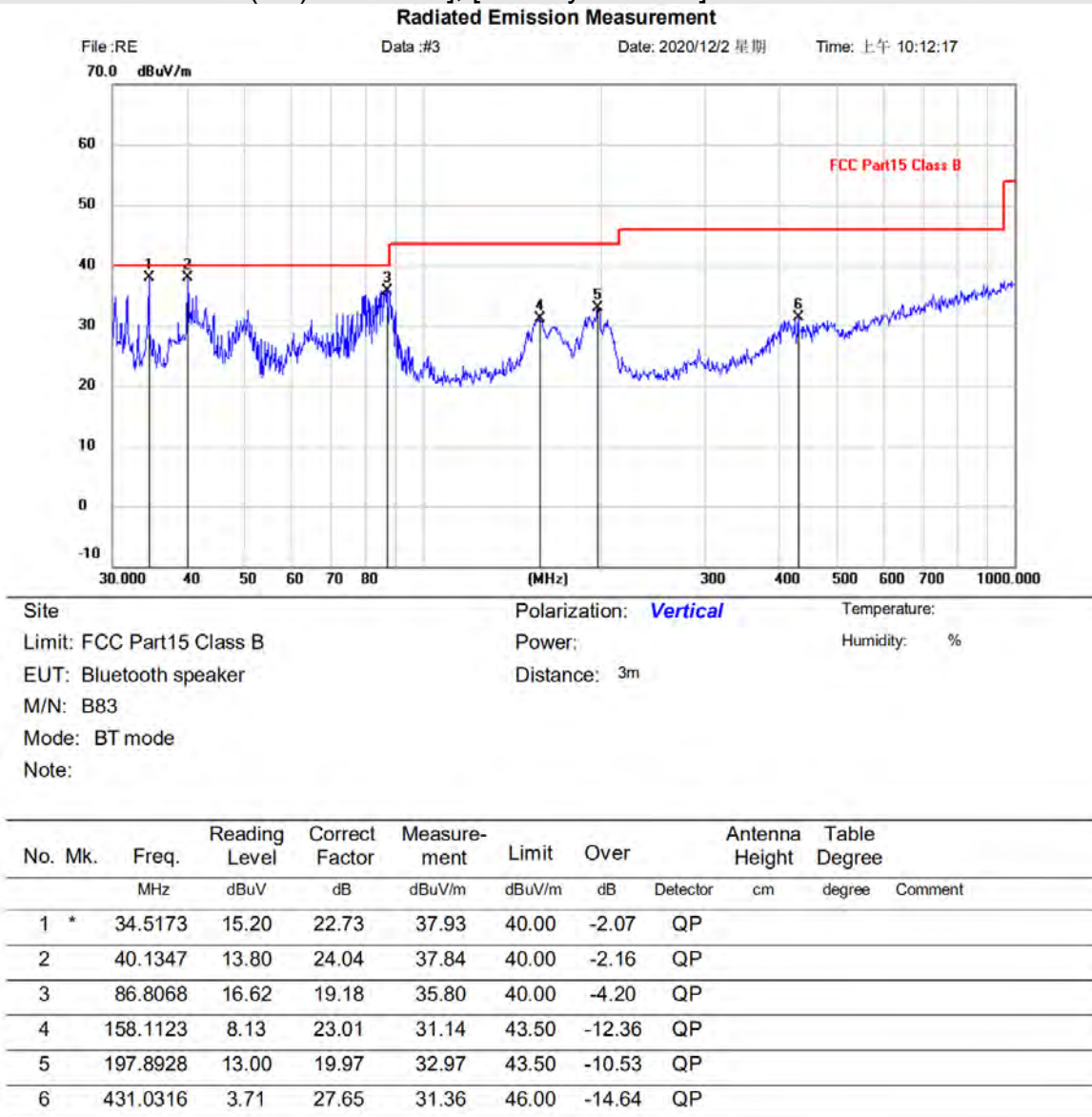


*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

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



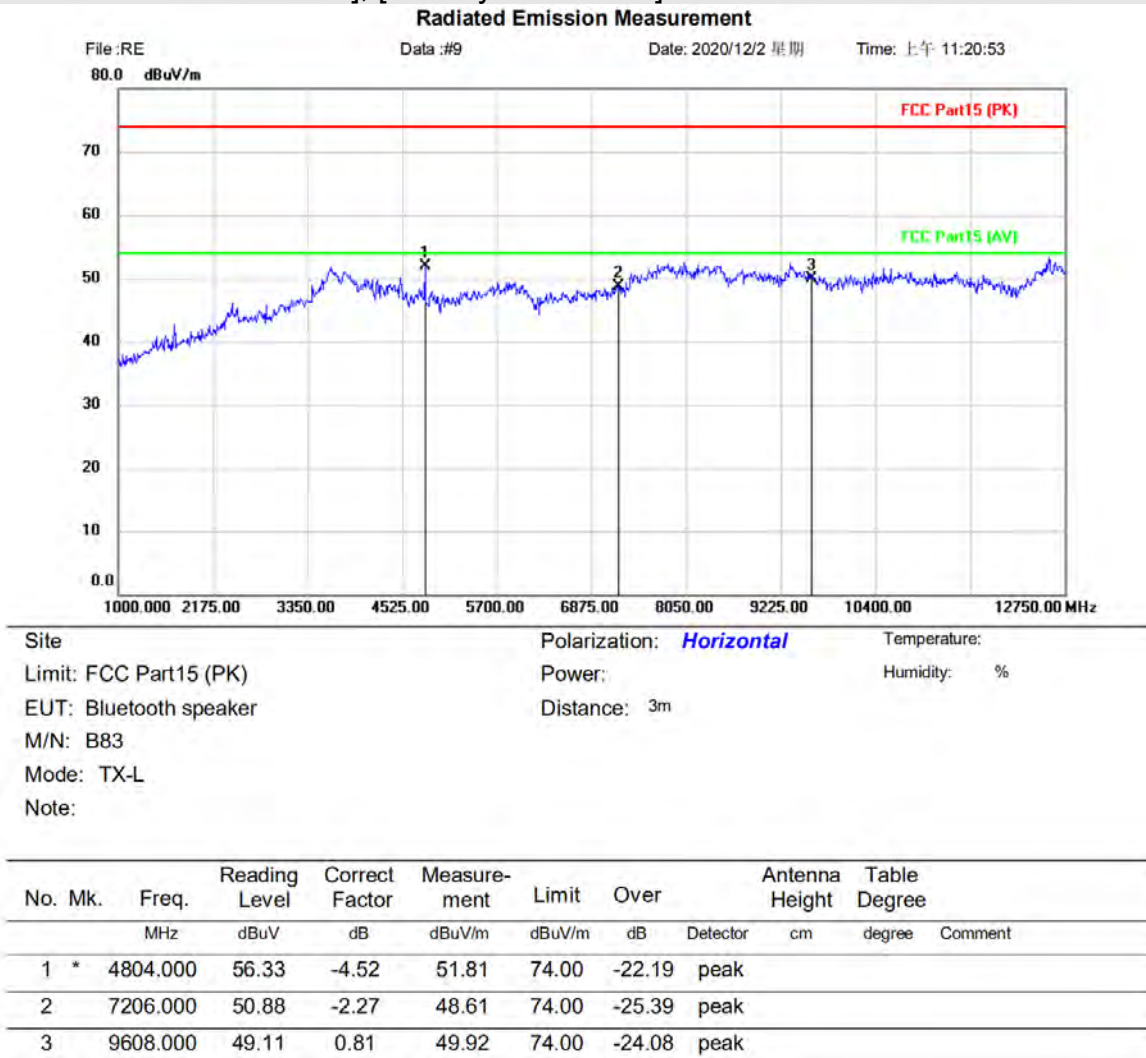
*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

Remark: During the test, pre-scan the GFSK, Pi/4QPSK modulation, and found the Pi/4QPSK modulation which it is worse case.

[Test Mode: TX Low channel]; [Polarity: Horizontal]

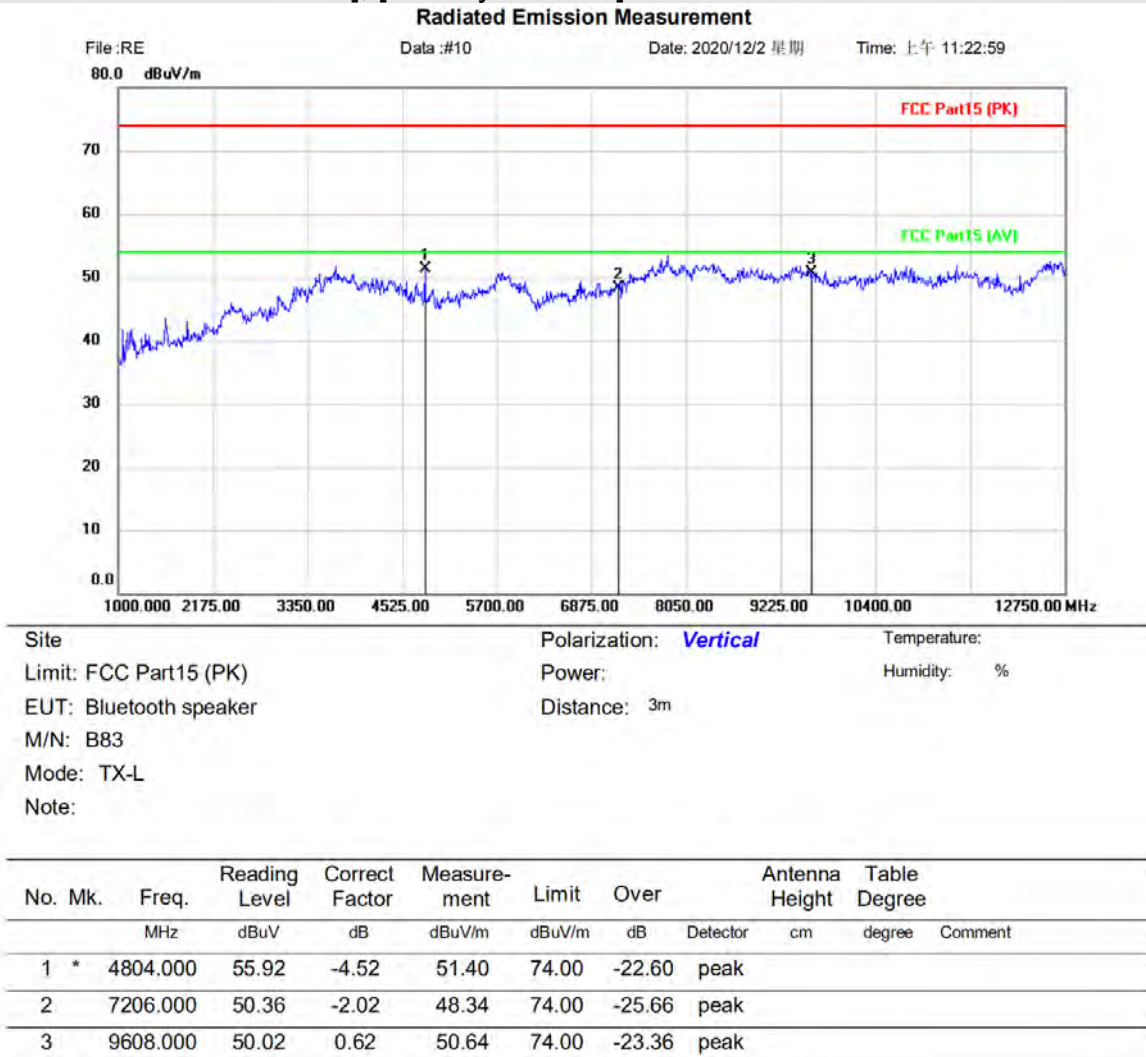


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

[Test Mode: TX Low channel]; [Polarity: Vertical]

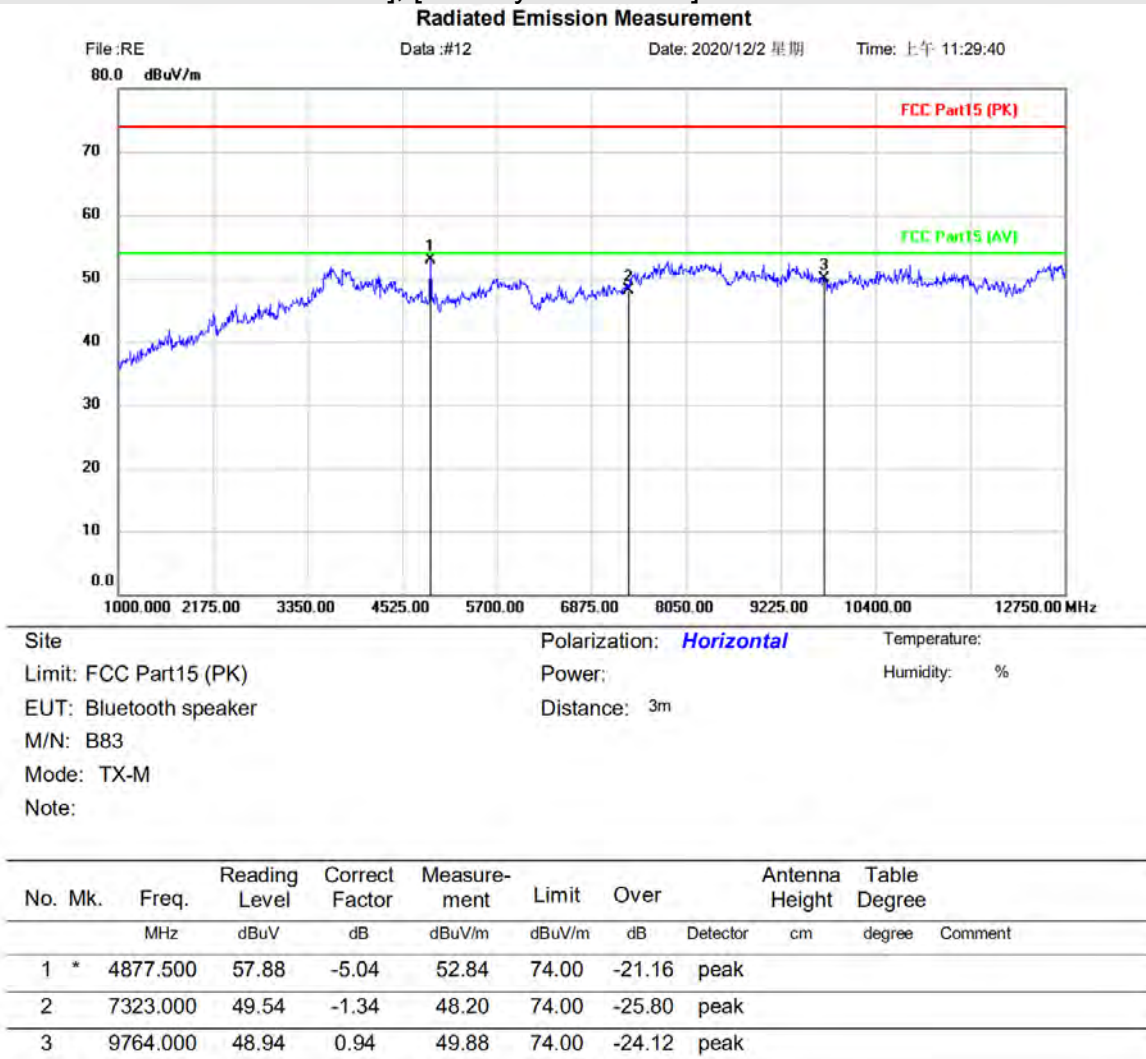


*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[Test Mode: TX middle channel]; [Polarity: Horizontal]

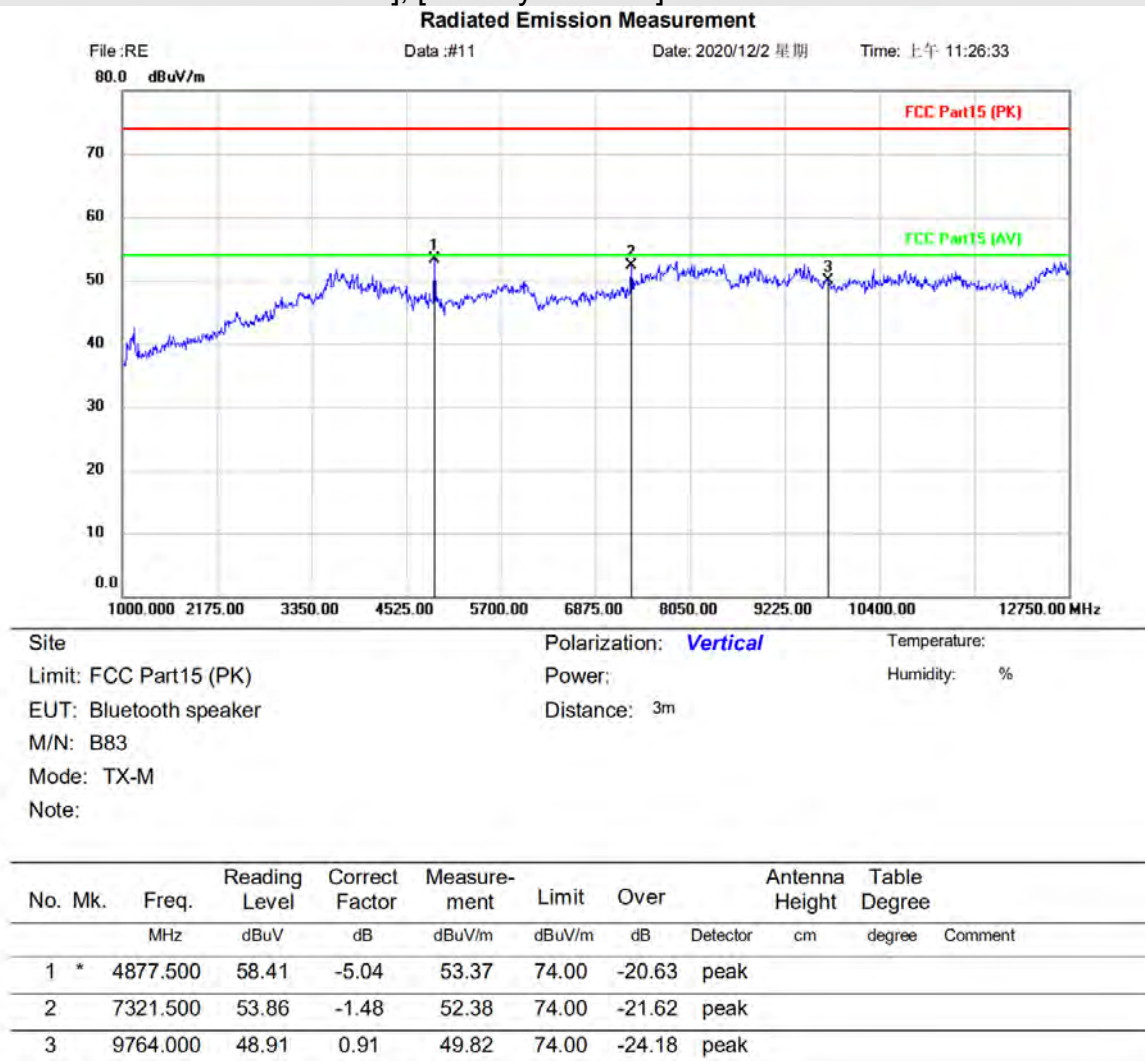


*:Maximum data x:Over limit !:over margin

⟨Reference Only⟩

Test Result: Pass

[Test Mode: TX middle channel]; [Polarity: Vertical]

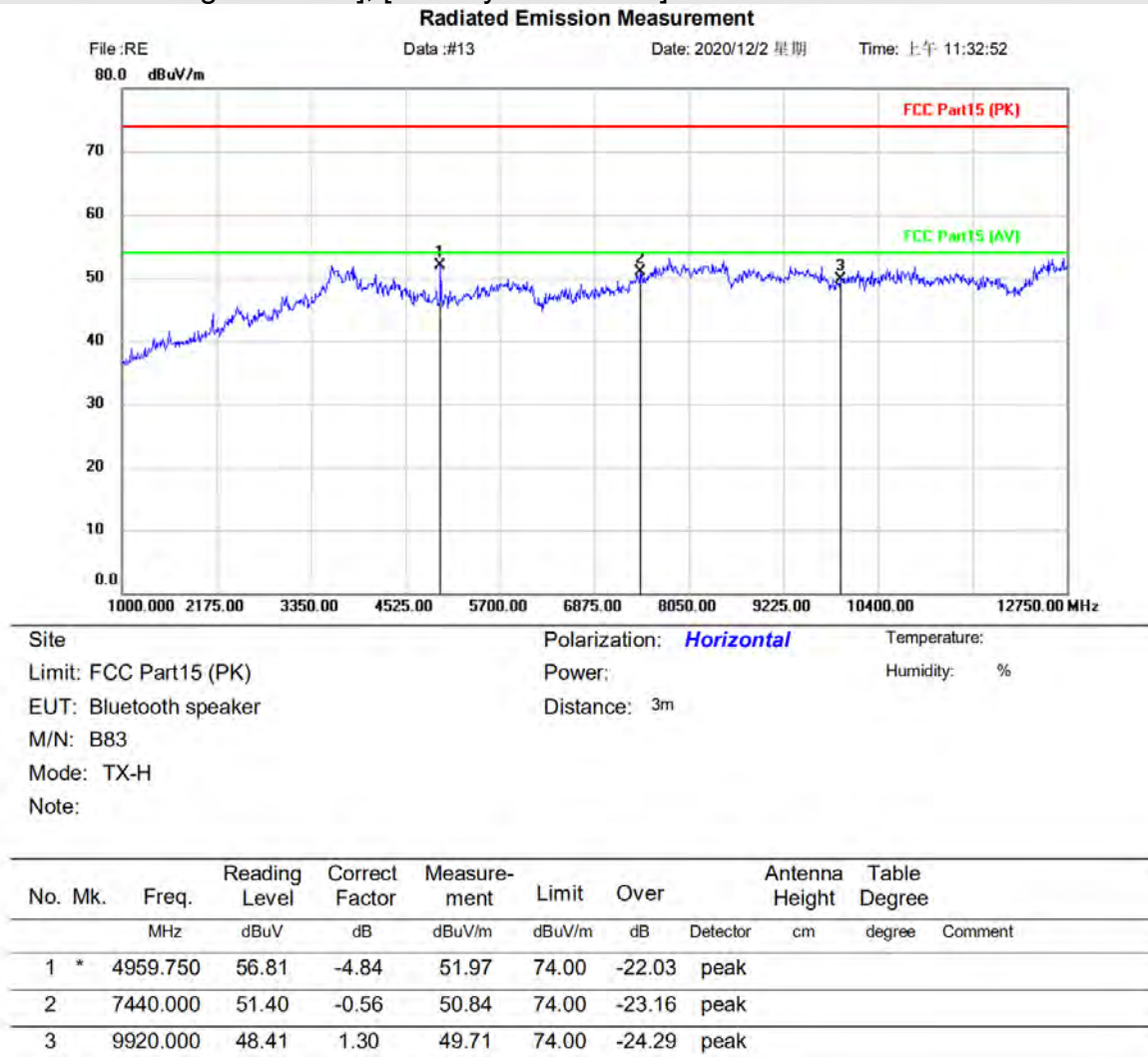


*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[Test Mode: TX high channel]; [Polarity: Horizontal]

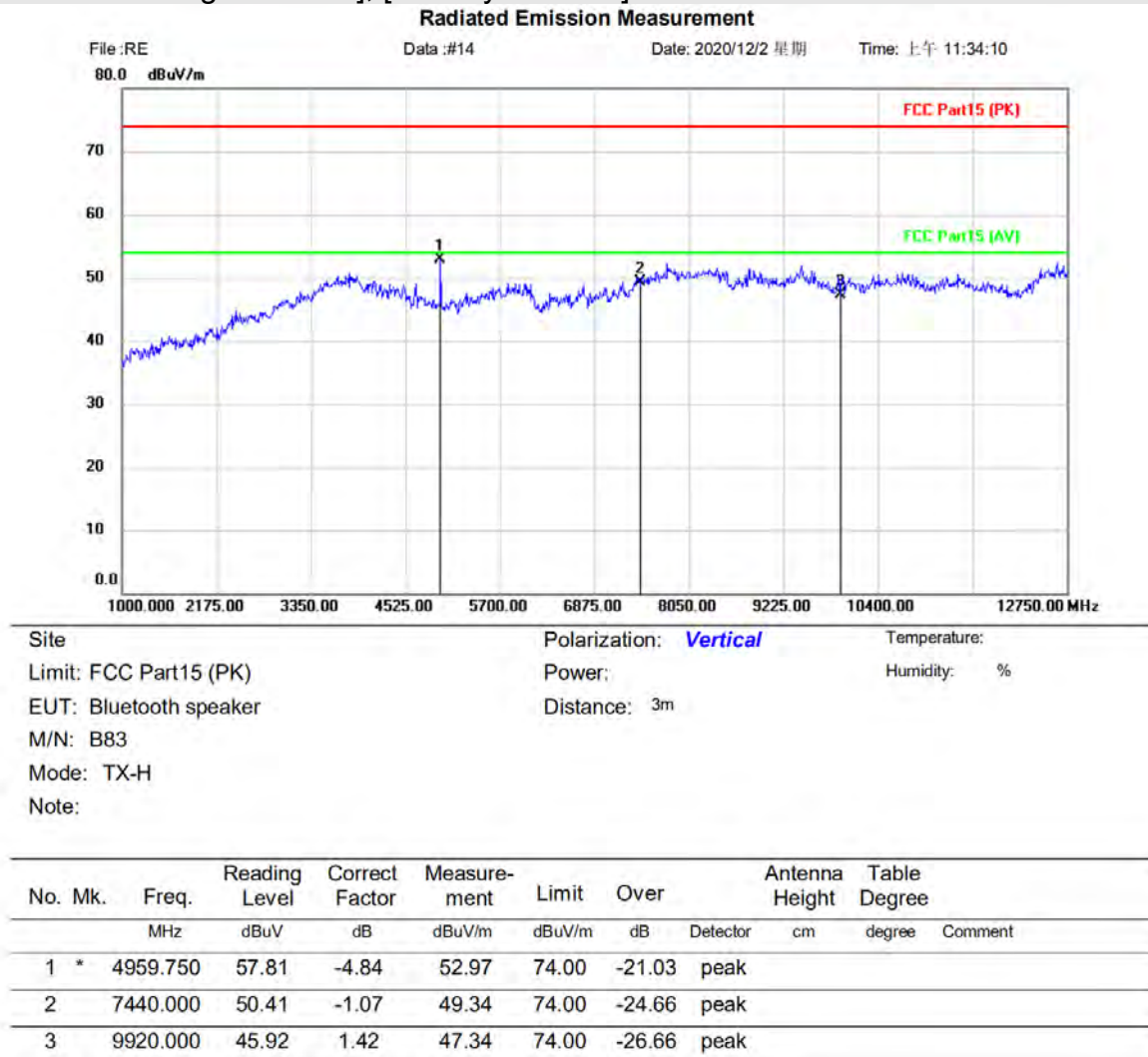


*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

[Test Mode: TX high channel]; [Polarity: Vertical]



*:Maximum data x:Over limit !:over margin

<Reference Only

Test Result: Pass

9 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

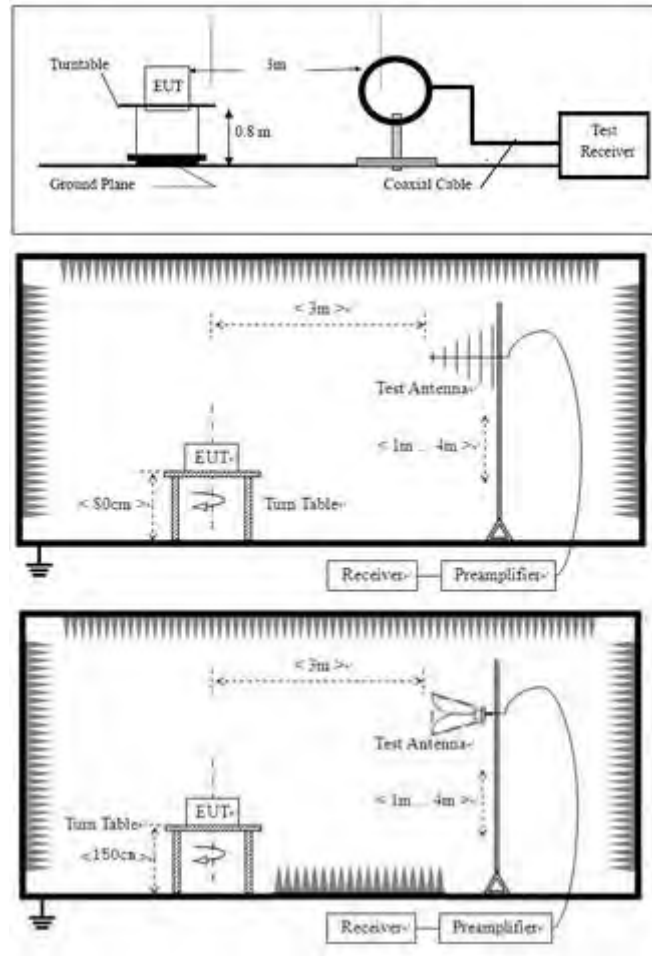
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX Low channel;TX high channel
Test Mode (Final Test)	TX Low channel;TX high channel
Tester	Eason
Temperature	25℃
Humidity	60%

9.1 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.

9.2 BLOCK DIAGRAM OF TEST SETUP



9.3 PROCEDURE

- 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.
- 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.
- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamplifier Factor}$

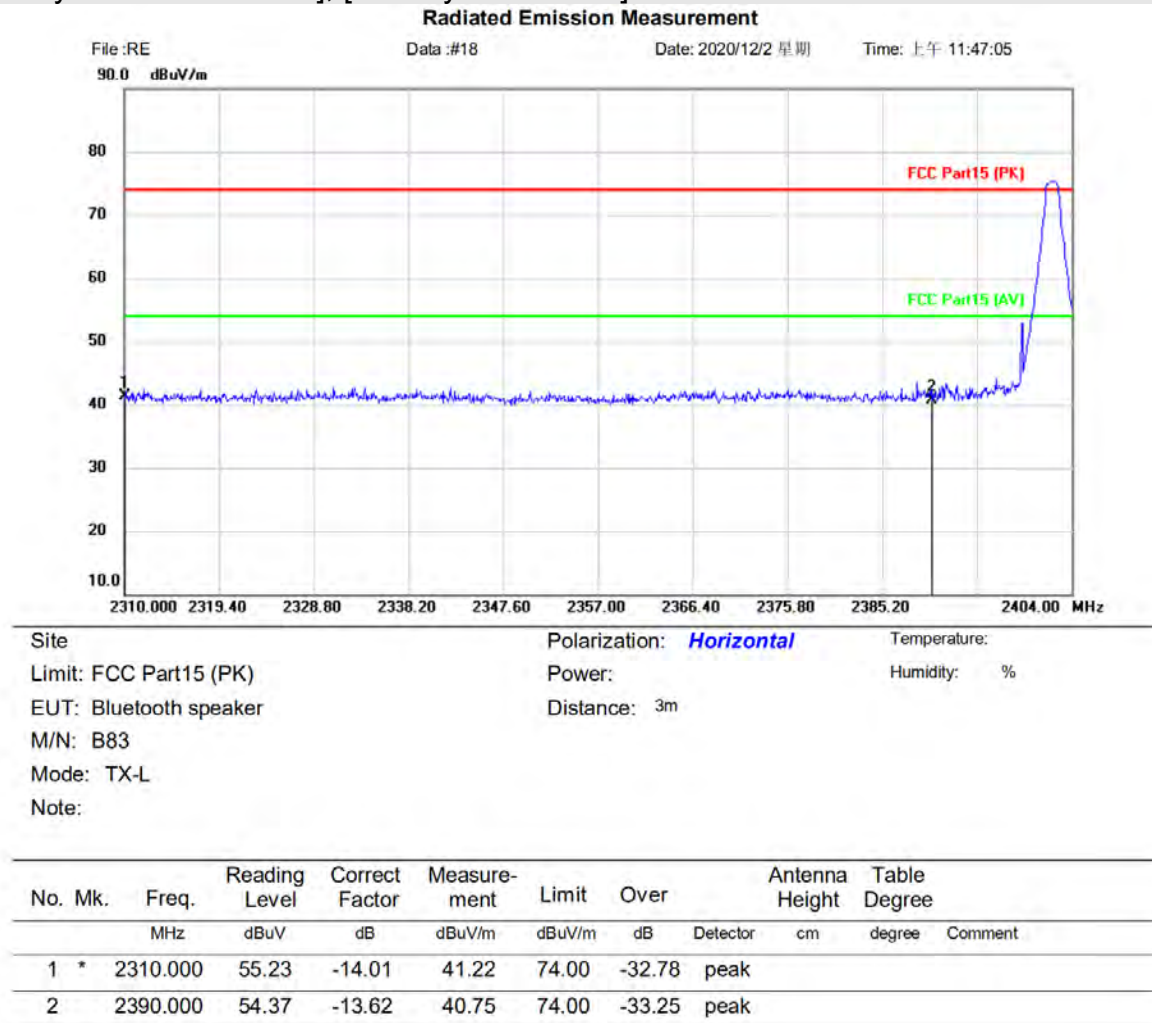
Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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9.4 TEST DATA

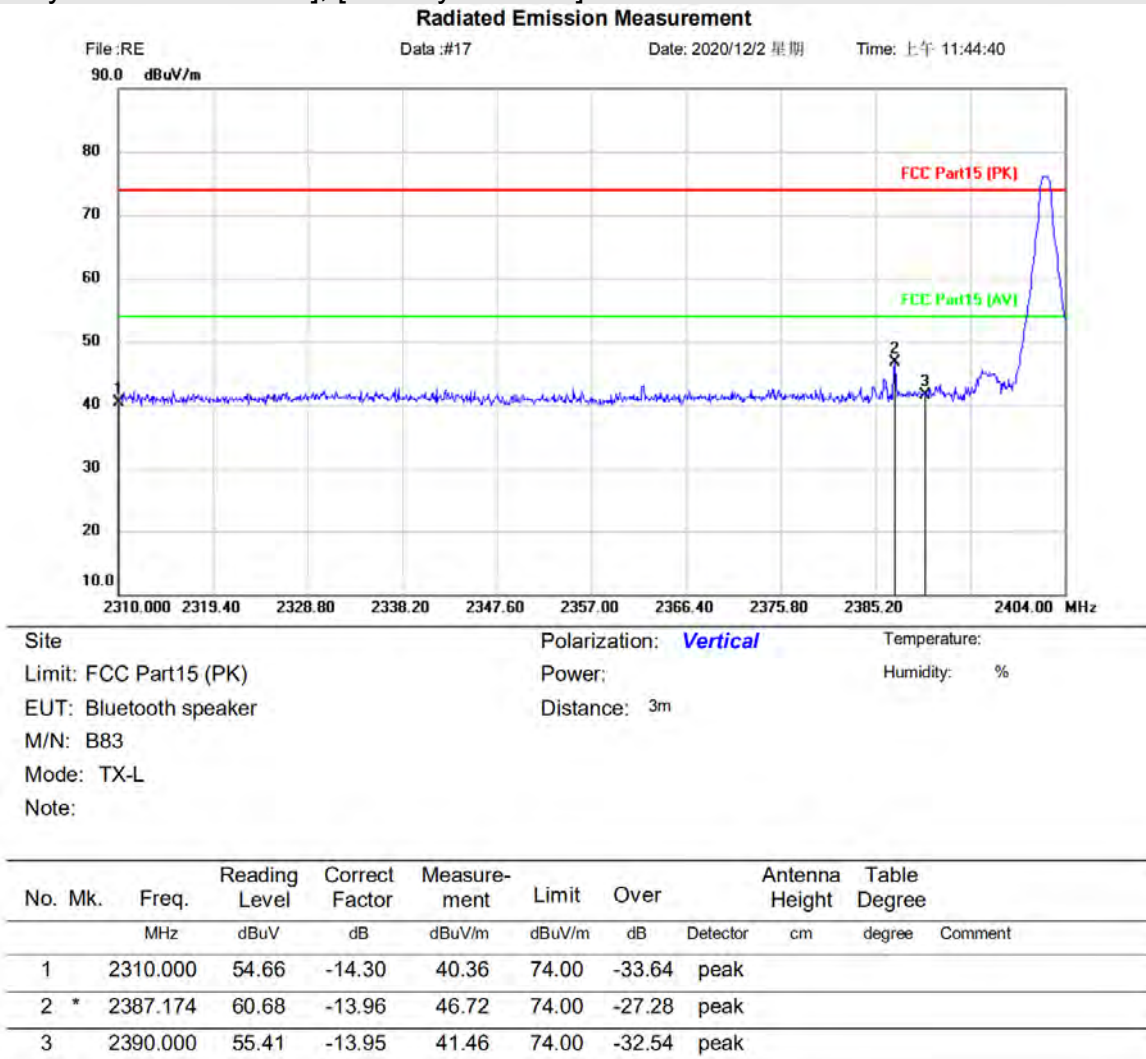
Remark: During the test, pre-scan the GFSK, Pi/4QPSK modulation, and found the Pi/4QPSK modulation which it is worse case.

[Polarity: TX Low channel]; [Polarity: Horizontal]



Test Result: Pass

[Polarity: TX Low channel]; [Polarity: Vertical]

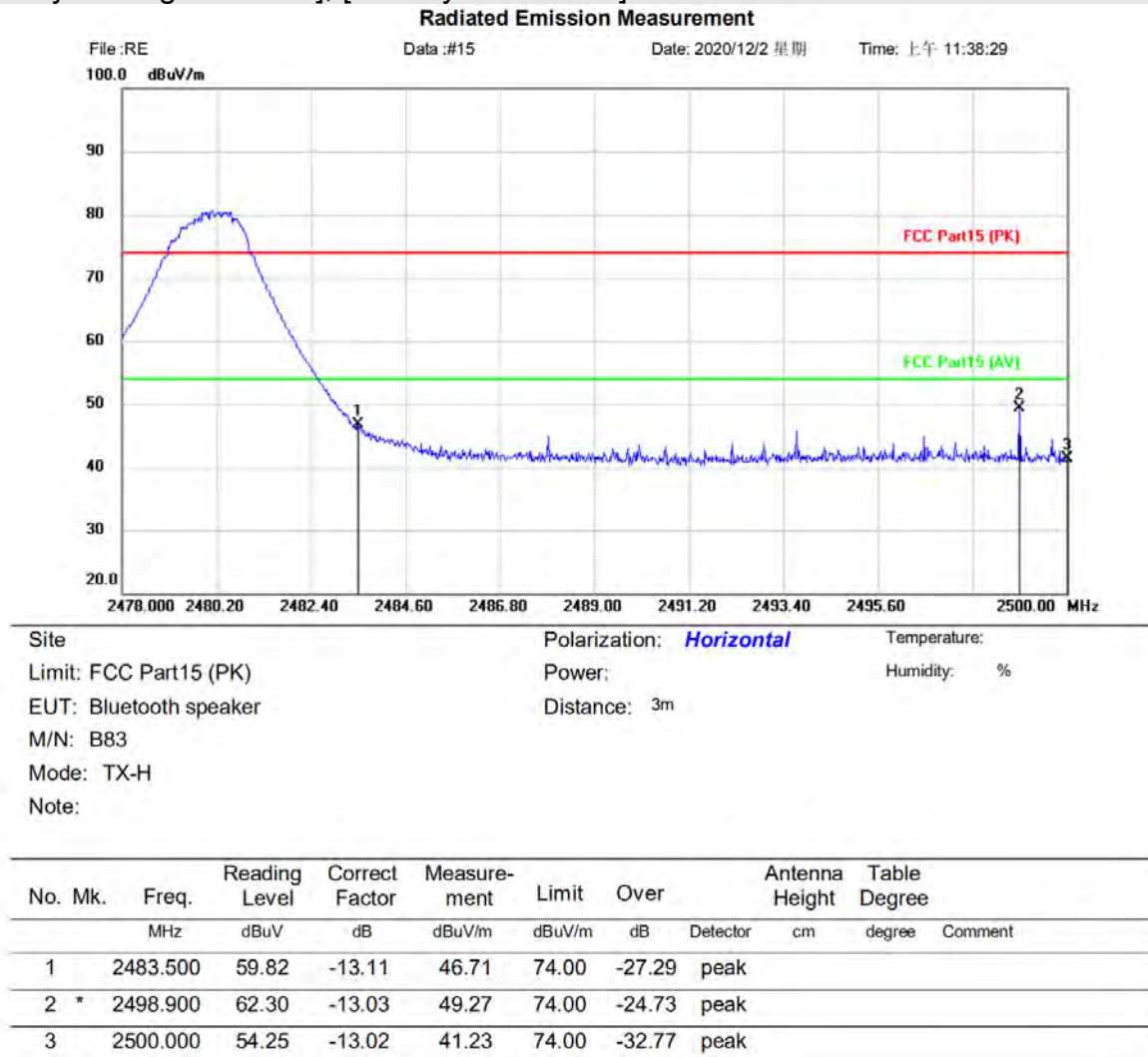


*:Maximum data x:Over limit !:over margin

<Reference Only

Test Result: Pass

[Polarity: TX high channel]; [Polarity: Horizontal]

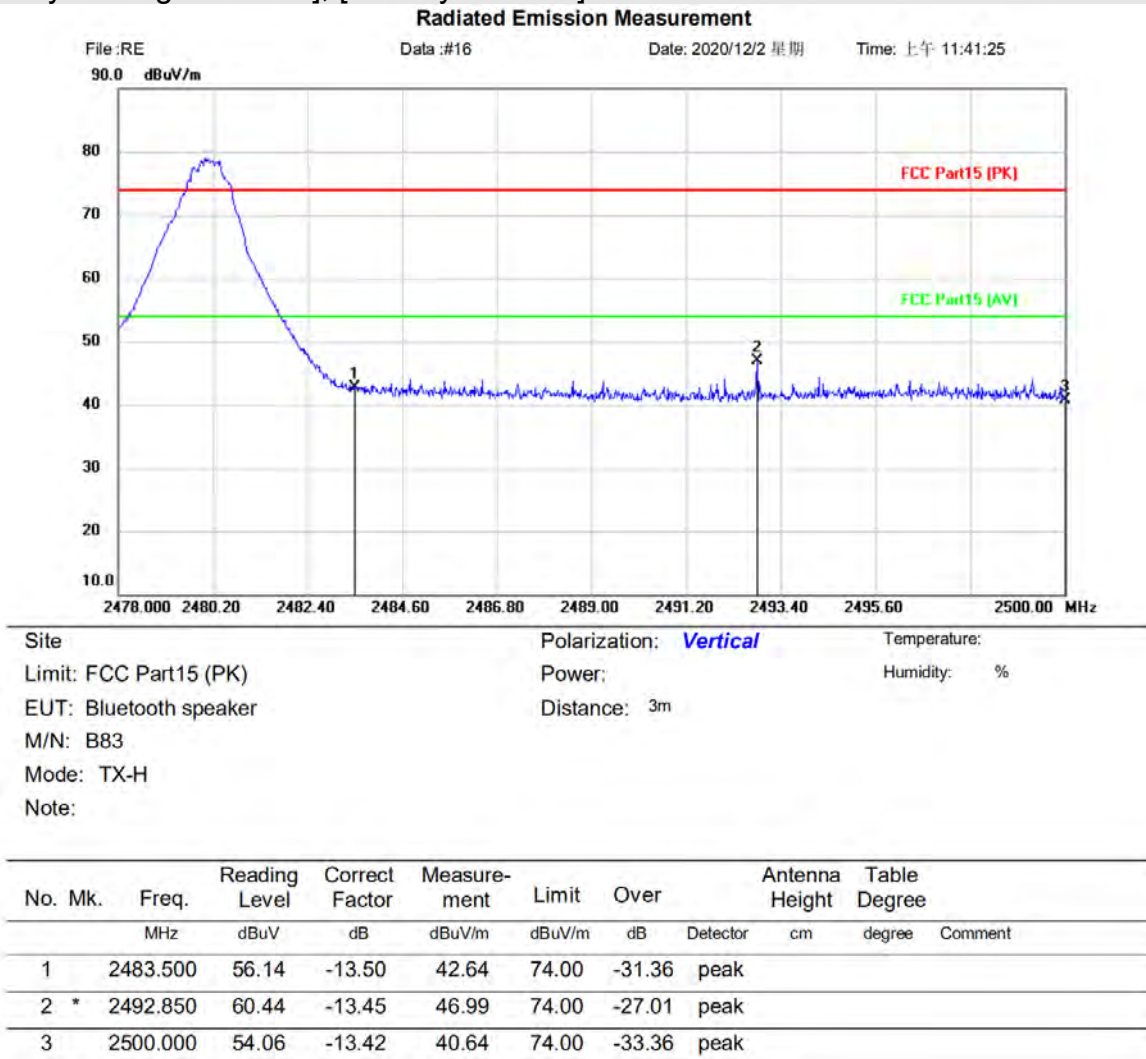


*:Maximum data x:Over limit !:over margin

〈Reference Only

Test Result: Pass

[Polarity: TX high channel]; [Polarity: Vertical]



*:Maximum data x:Over limit !:over margin

(Reference Only)

Test Result: Pass

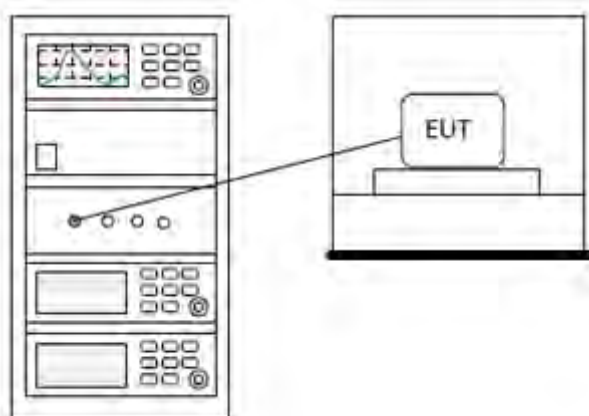
10 CONDUCTED BAND EDGES MEASUREMENT

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	Eason
Temperature	25°C
Humidity	60%

10.1 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)).
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10.2 BLOCK DIAGRAM OF TEST SETUP



10.3 TEST DATA

Pass: Please Refer To Appendix: For Details

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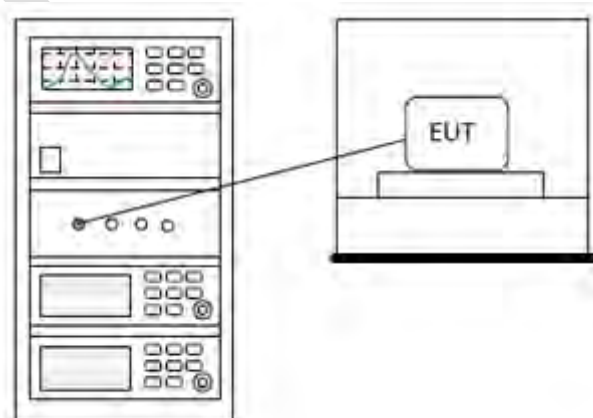
11 DWELL TIME

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.4
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	25°C
Humidity	60%

11.1 LIMITS

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4S multiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

11.2 BLOCK DIAGRAM OF TEST SETUP



11.3 EST DATA

Pass: Please Refer To Appendix: For Details

10 APPENDIX

10.1 APPENDIX : 20DB EMISSION BANDWIDTH

Test Result

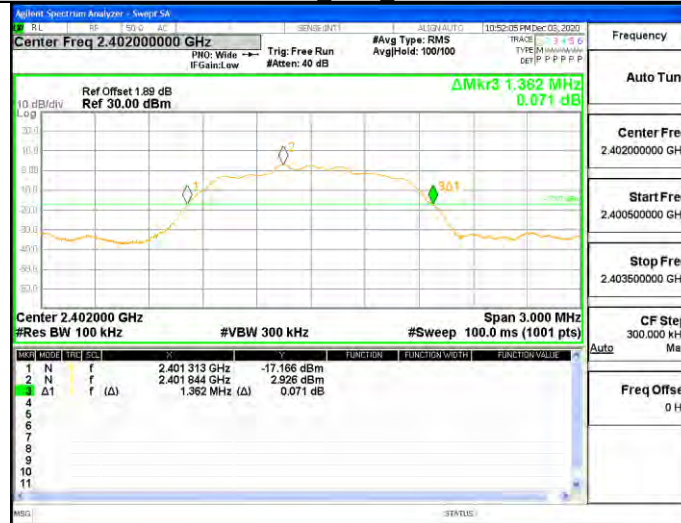
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.077	2401.463	2402.540	---	PASS
		2441	1.077	2440.463	2441.540	---	PASS
		2480	1.080	2479.460	2480.540	---	PASS
2DH1	Ant1	2402	1.362	2401.313	2402.675	---	PASS
		2441	1.368	2440.310	2441.678	---	PASS
		2480	1.368	2479.307	2480.675	---	PASS

Test Graphs





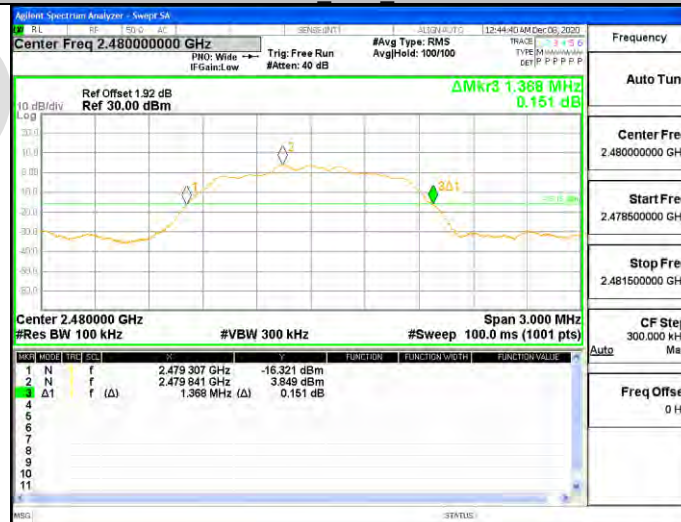
2DH1 Ant1 2402



2DH1 Ant1 2441



2DH1 Ant1 2480

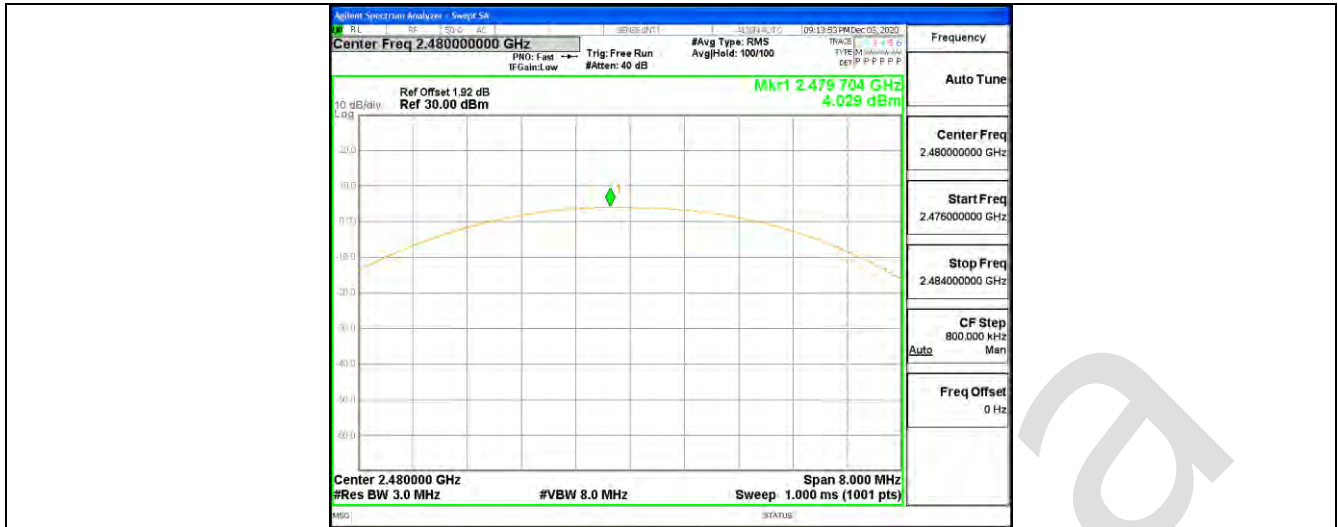


10.2 APPENDIX : MAXIMUM CONDUCTED OUTPUT POWER**Test Result**

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	3.27	<=30	PASS
		2441	3.64	<=30	PASS
		2480	4.03	<=30	PASS
2DH1	Ant1	2402	3.91	<=30	PASS
		2441	4.21	<=30	PASS
		2480	4.64	<=30	PASS

Test Graphs





2DH1_Ant1_2402



2DH1_Ant1_2441



2DH1_Ant1_2480



10.3 APPENDIX : CARRIER FREQUENCY SEPARATION

Test Result

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH1	Ant1	Hop	0.996	≥ 0.720	PASS
2DH1	Ant1	Hop	1.008	≥ 0.912	PASS

Test Graphs

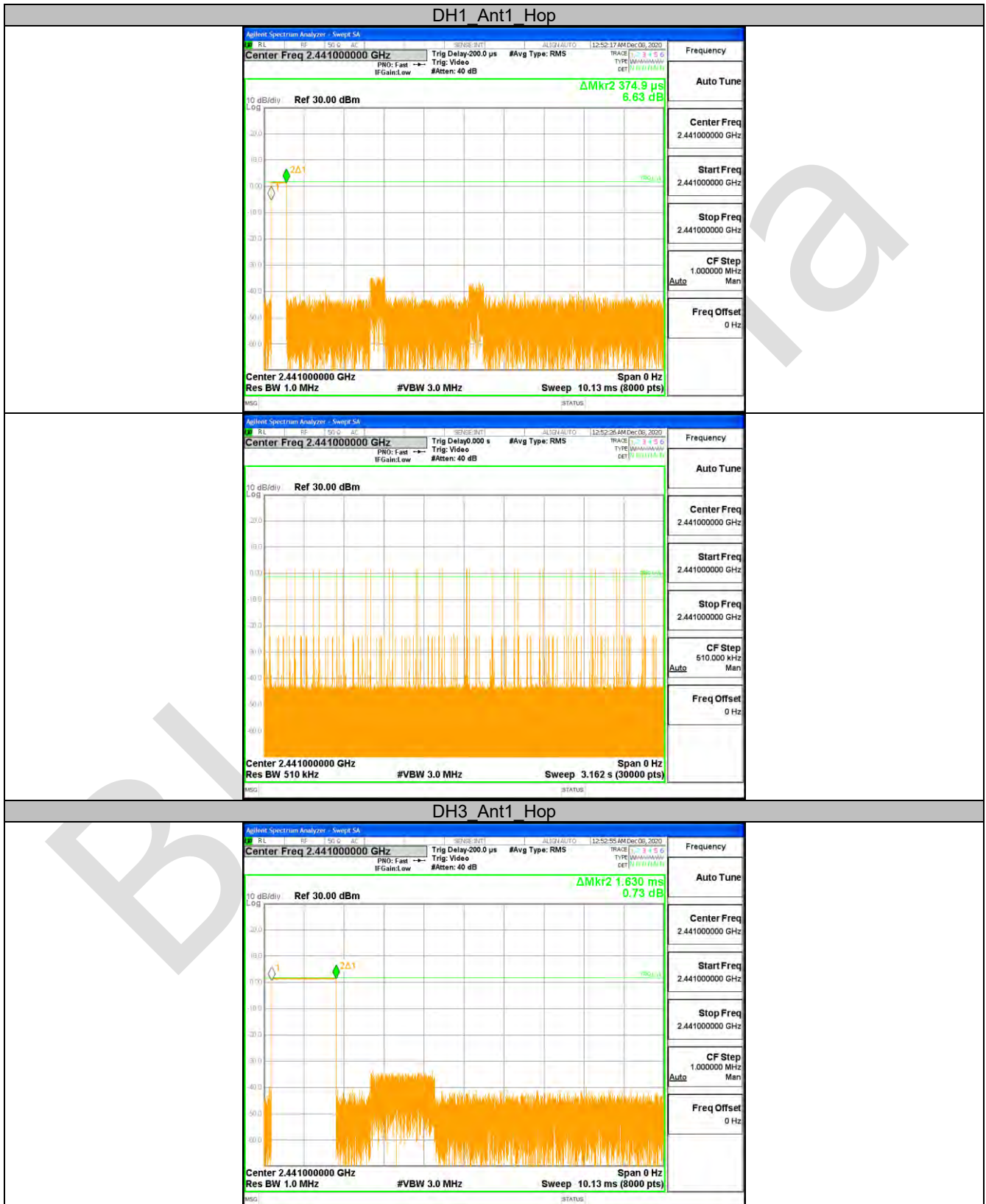


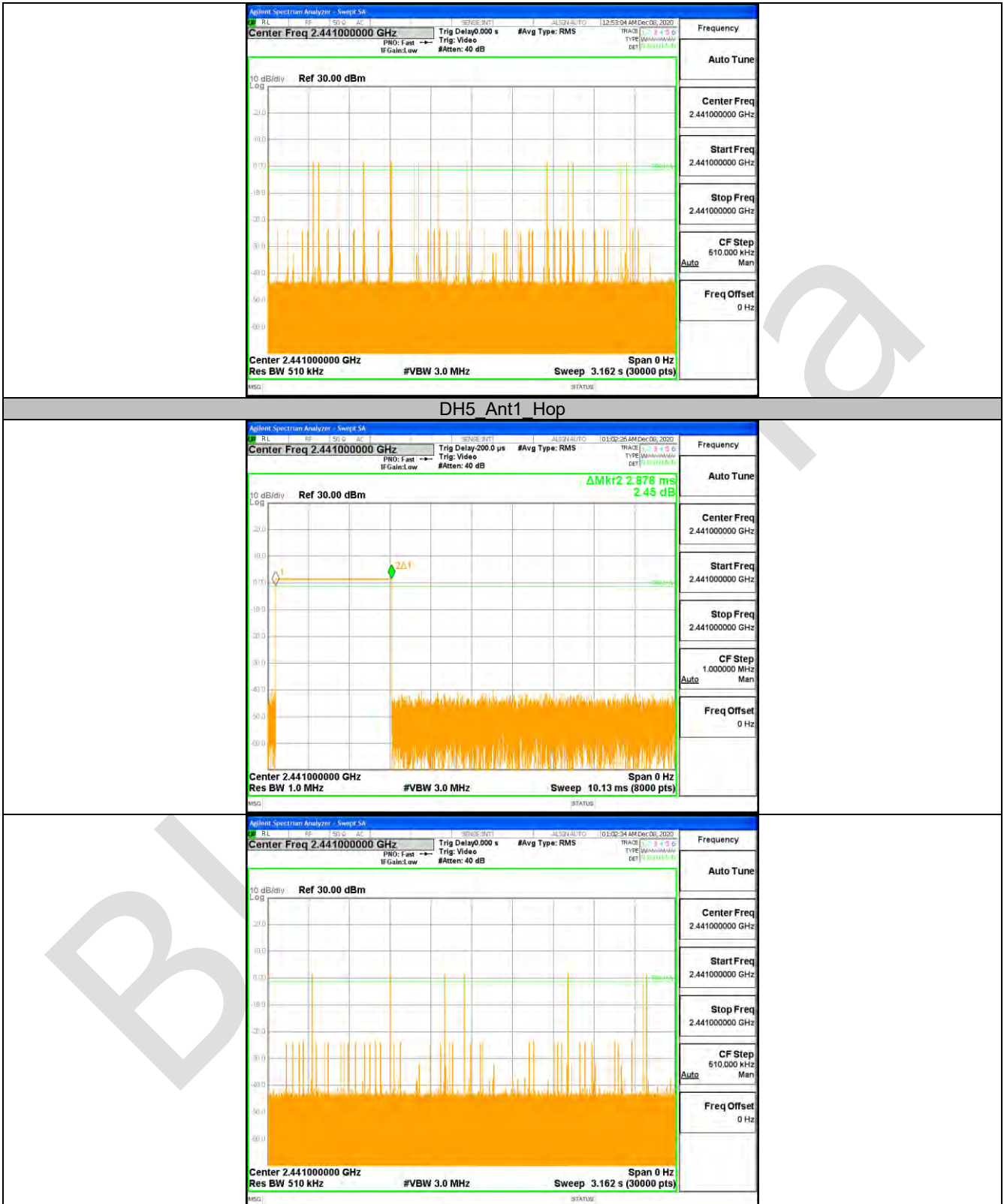
10.4 APPENDIX : TIME OF OCCUPANCY

Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.37	330	0.124	≤ 0.4	PASS
DH3	Ant1	Hop	1.63	160	0.261	≤ 0.4	PASS
DH5	Ant1	Hop	2.88	80	0.23	≤ 0.4	PASS

Test Graphs





10.5 APPENDIX : NUMBER OF HOPPING CHANNELS**Test Result**

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH1	Ant1	Hop	79	≥ 15	PASS
2DH1	Ant1	Hop	79	≥ 15	PASS

Test Graphs



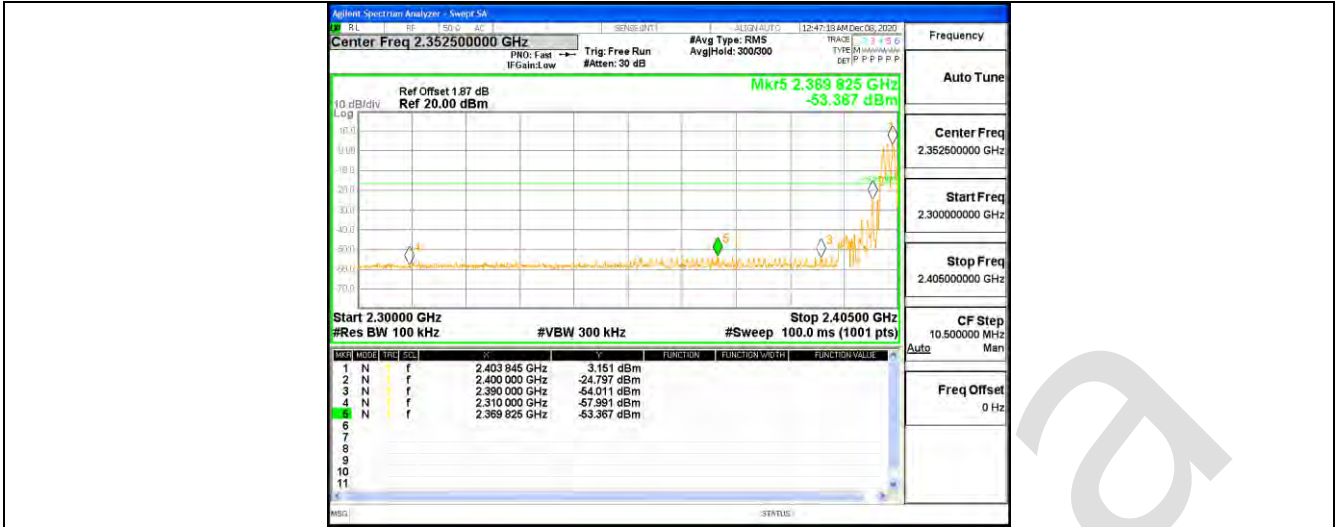
10.6 APPENDIX : BAND EDGE MEASUREMENTS

Test Result

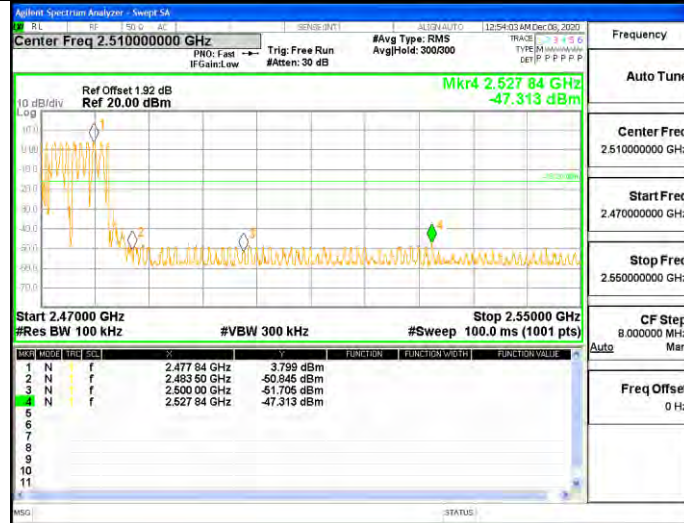
TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	Low	2402	2.89	-53.05	<=-17.11	PASS
		High	2480	3.73	-47.57	<=-16.27	PASS
		Low	Hop_2402	3.15	-53.37	-16.85	PASS
		High	Hop_2480	3.80	-47.31	-16.2	PASS
2DH1	Ant1	Low	2402	2.84	-53.03	<=-17.16	PASS
		High	2480	3.81	-47.72	<=-16.19	PASS
		Low	Hop_2402	2.77	-53.33	-17.23	PASS
		High	Hop_2480	3.53	-48.03	-16.47	PASS

Test Graphs





DH1 Ant1 High Hop 2480

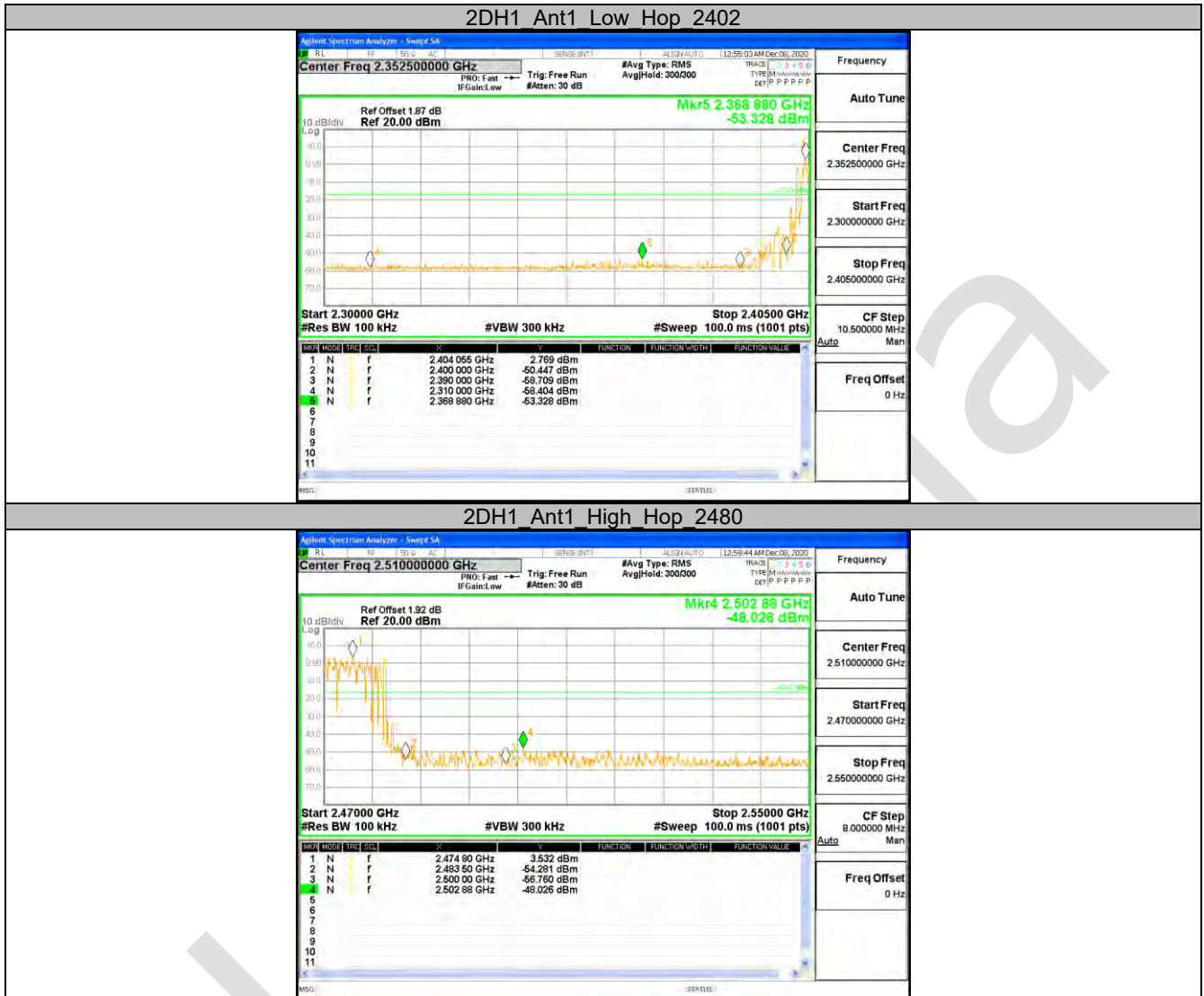


2DH1 Ant1 Low 2402



2DH1 Ant1 High 2480





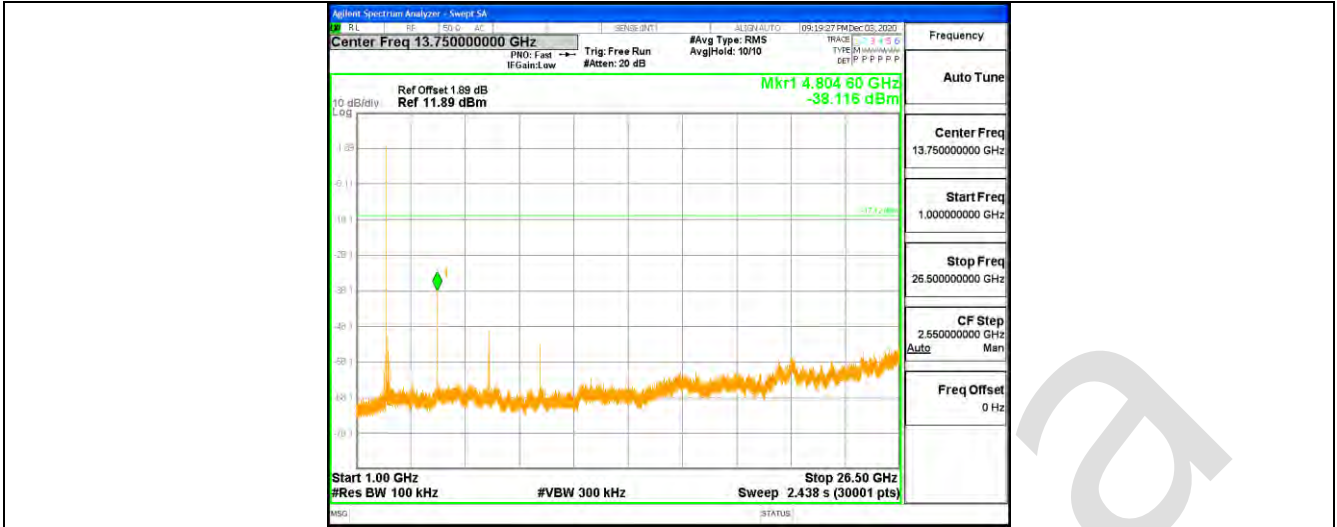
10.7 APPENDIX H: CONDUCTED SPURIOUS EMISSION

Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH1	Ant1	2402	Reference	2.88	2.88	---	PASS
			30~1000	30~1000	-51.678	<=-17.122	PASS
			1000~26500	1000~26500	-38.116	<=-17.122	PASS
		2441	Reference	3.11	3.11	---	PASS
			30~1000	30~1000	-51.135	<=-16.889	PASS
			1000~26500	1000~26500	-38.9	<=-16.889	PASS
		2480	Reference	3.45	3.45	---	PASS
			30~1000	30~1000	-53.575	<=-16.546	PASS
			1000~26500	1000~26500	-36.941	<=-16.546	PASS
2DH1	Ant1	2402	Reference	2.84	2.84	---	PASS
			30~1000	30~1000	-51.819	<=-17.163	PASS
			1000~26500	1000~26500	-36.995	<=-17.163	PASS
		2441	Reference	3.44	3.44	---	PASS
			30~1000	30~1000	-51.47	<=-16.562	PASS
			1000~26500	1000~26500	-42.819	<=-16.562	PASS
		2480	Reference	3.27	3.27	---	PASS
			30~1000	30~1000	-51.187	<=-16.732	PASS
			1000~26500	1000~26500	-36.965	<=-16.732	PASS

Test Graphs

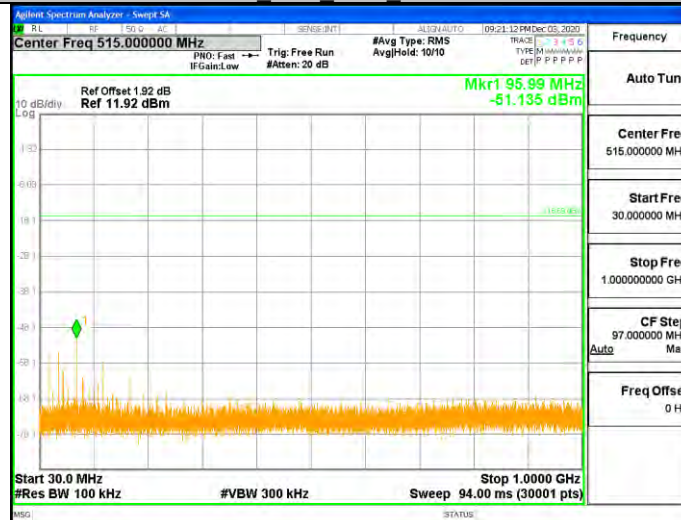




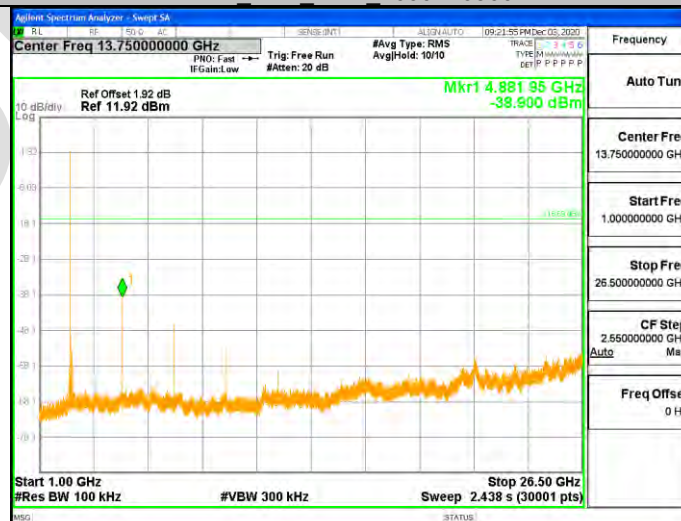
DH1 Ant1 2441 0~Reference



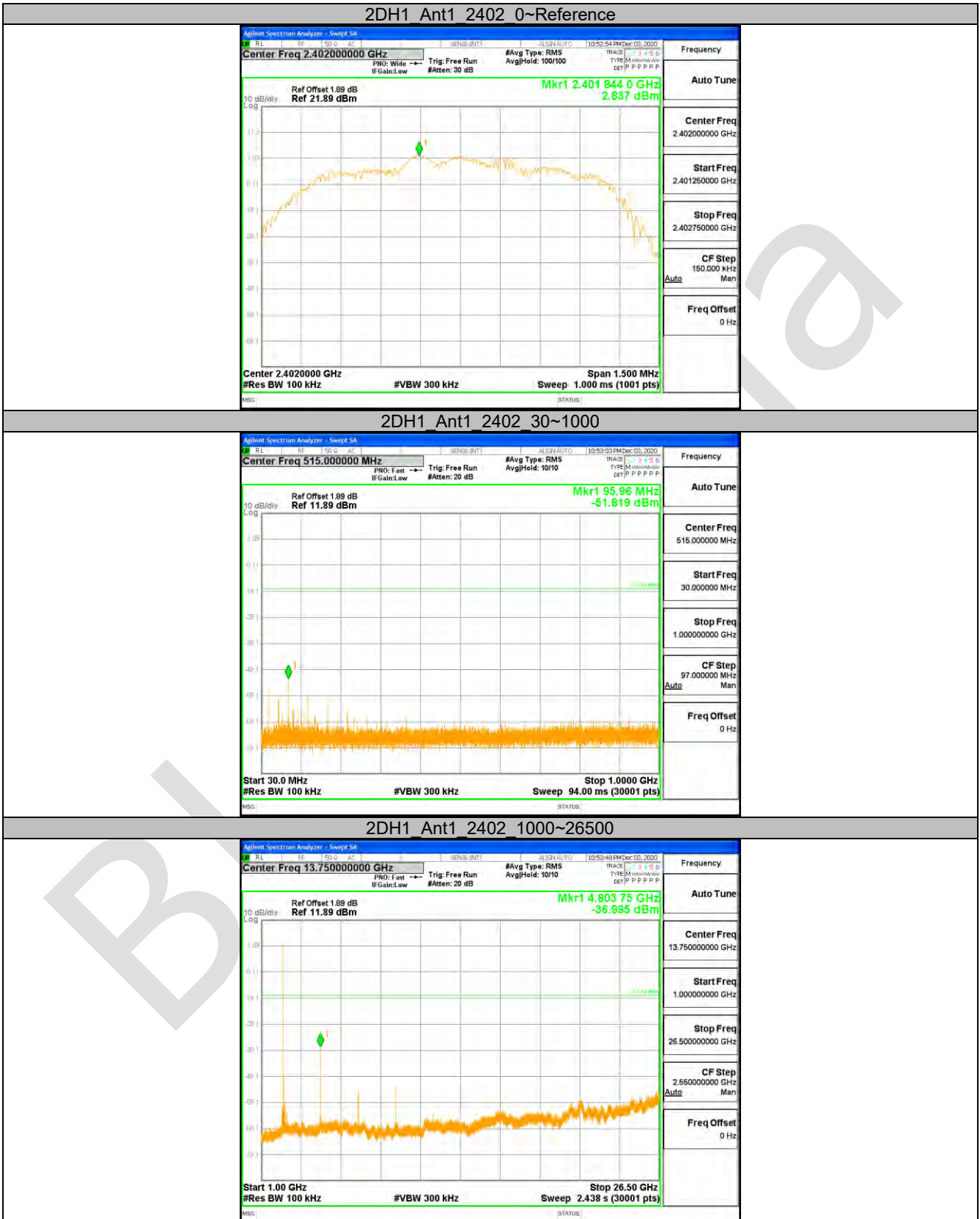
DH1 Ant1 2441 30~1000



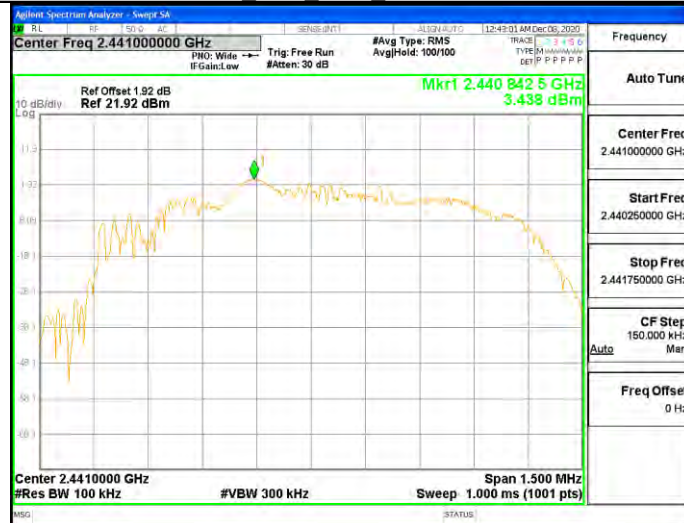
DH1 Ant1 2441 1000~26500



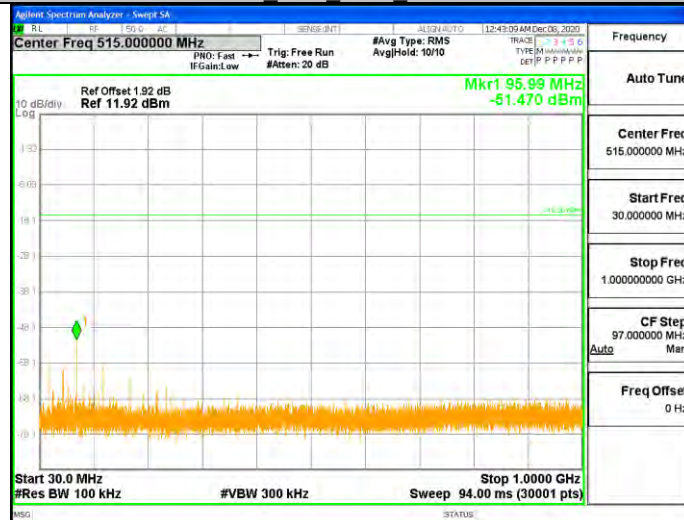




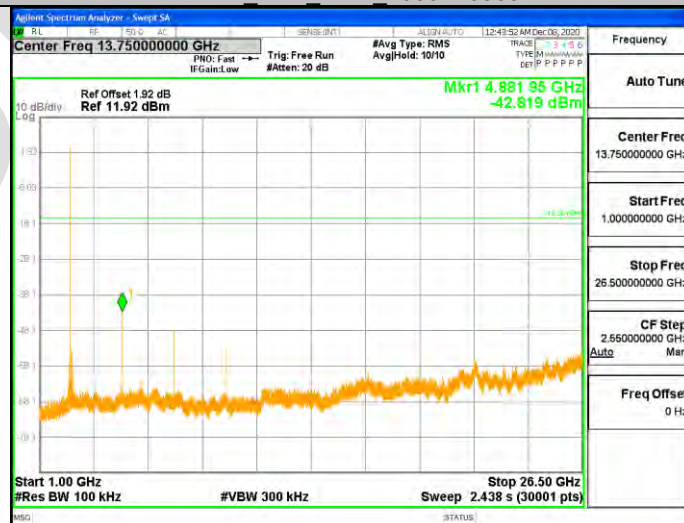
2DH1 Ant1 2441 0~Reference

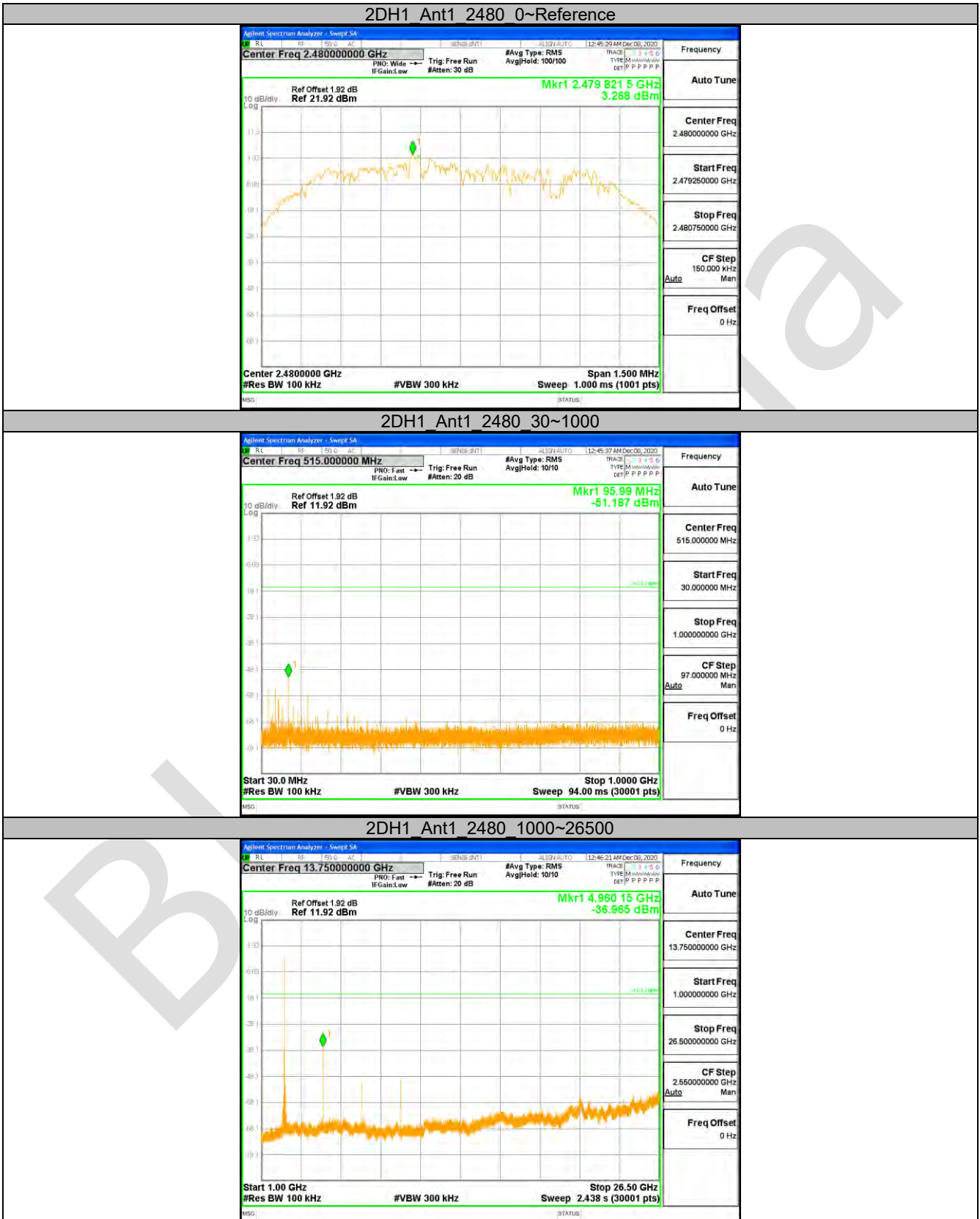


2DH1 Ant1 2441 30~1000



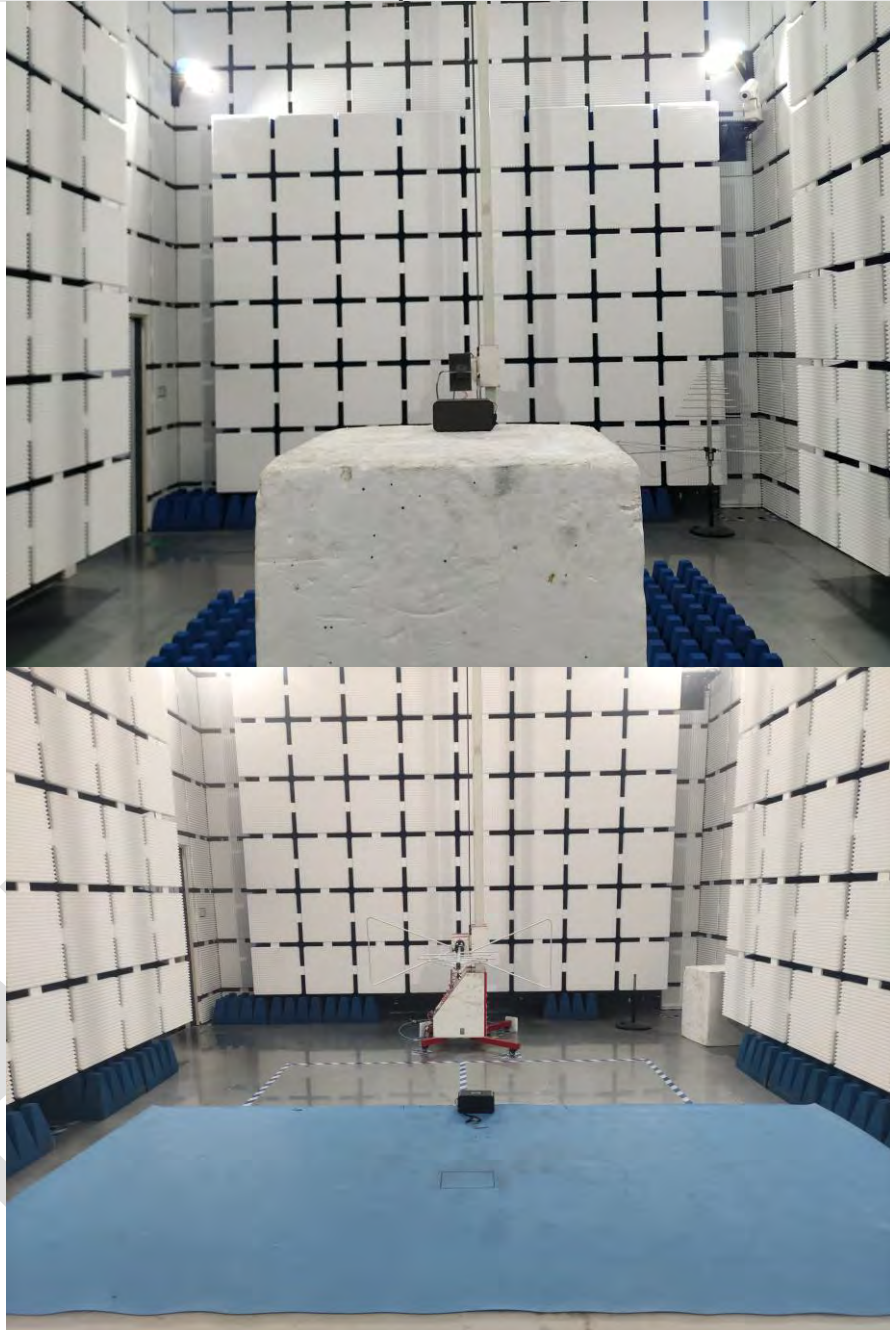
2DH1 Ant1 2441 1000~26500





APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Radiated Spurious Emissions

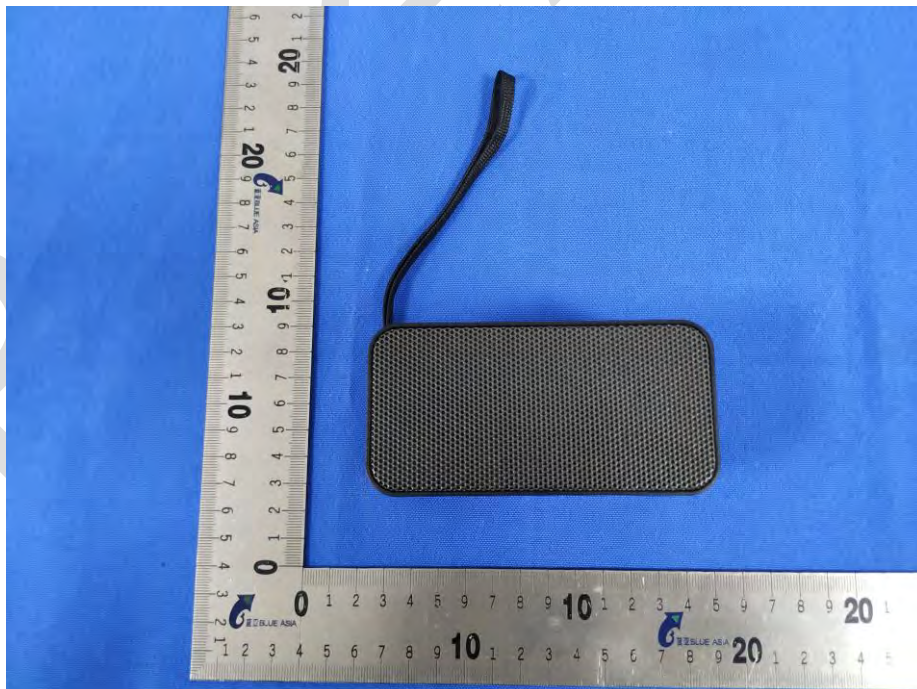


Conducted Emissions at AC Power Line (150kHz-30MHz)



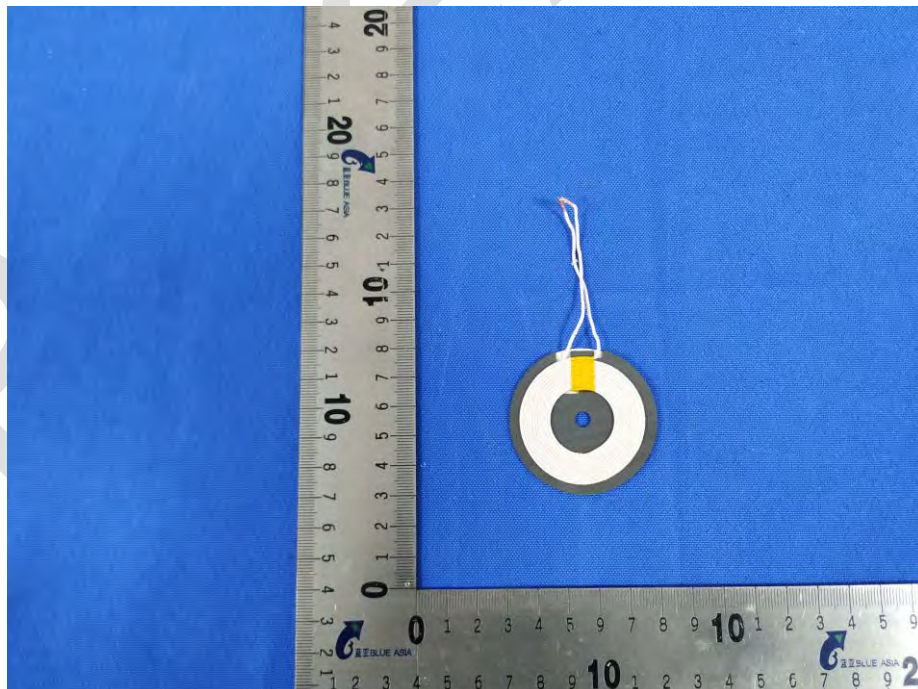
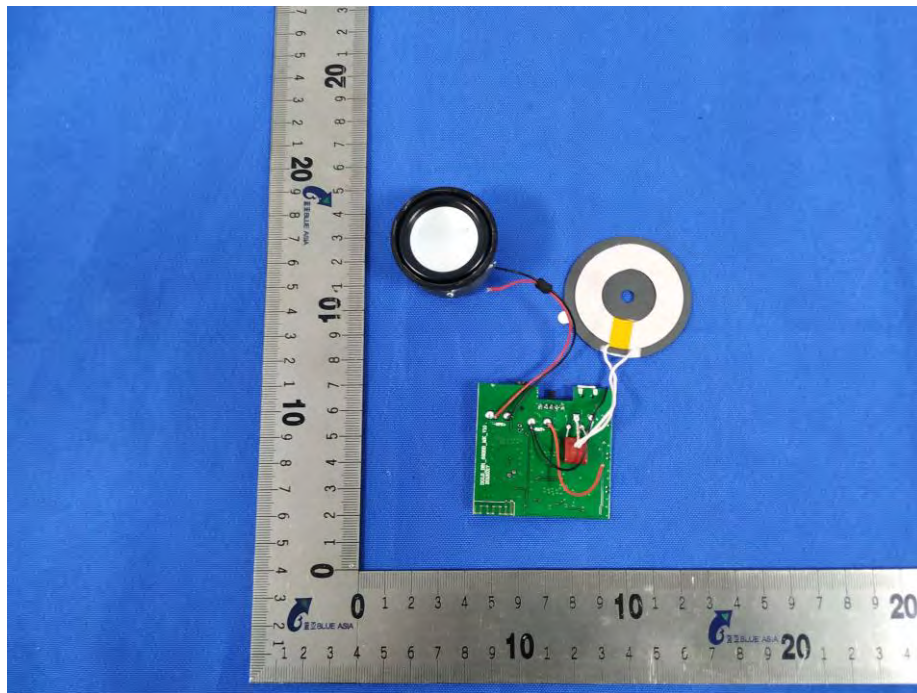
APPENDIX B: PHOTOGRAPHS OF EUT

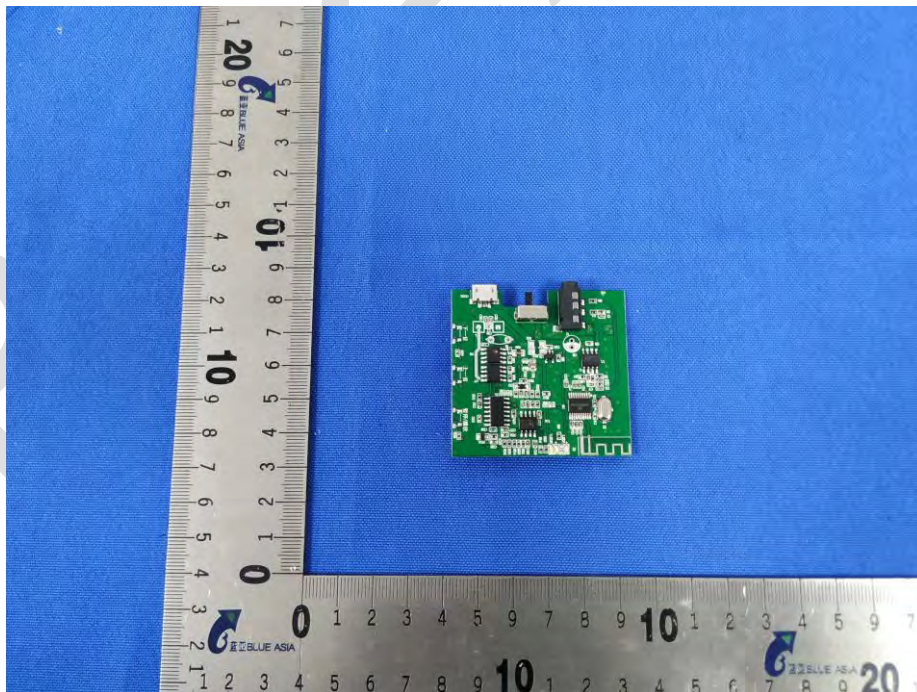
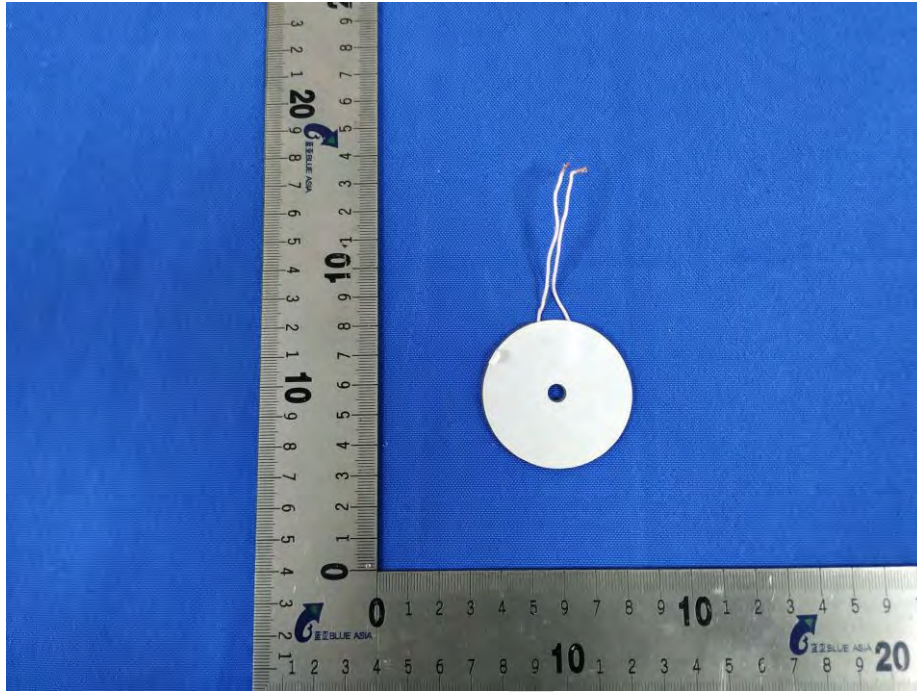


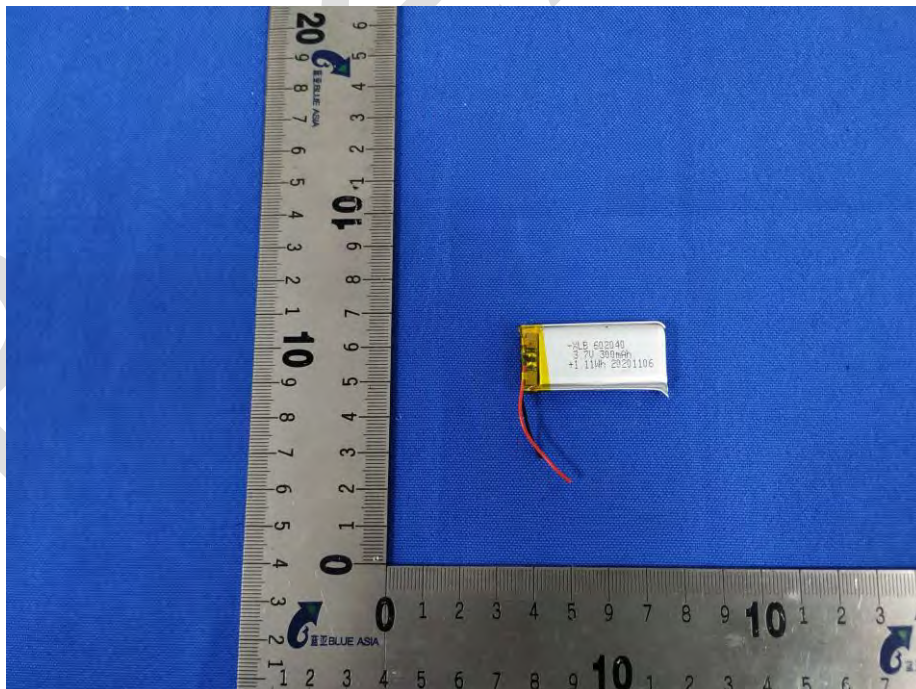
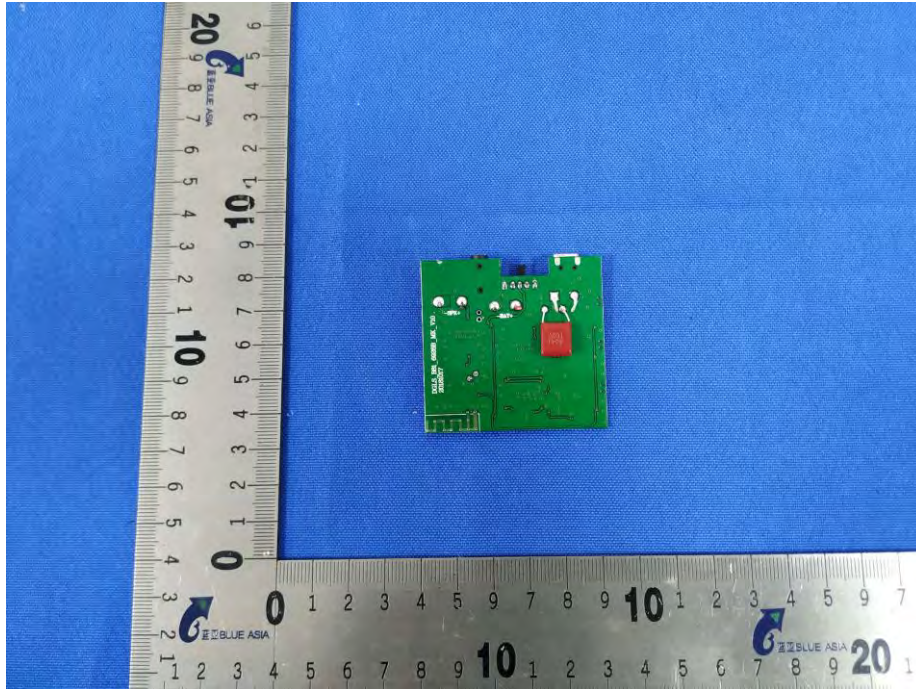


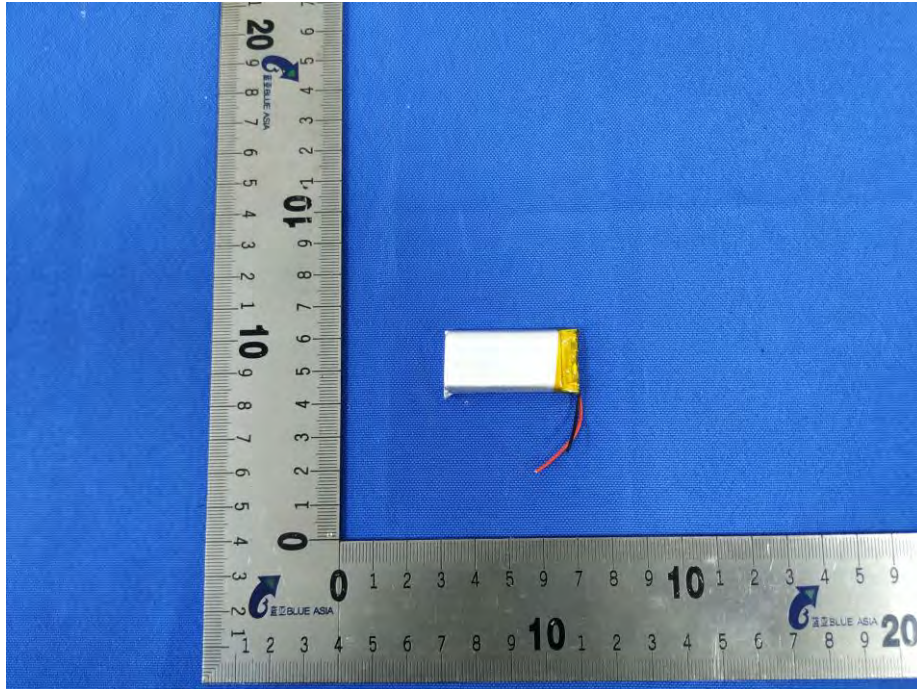












----END OF REPORT----

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