

TEST REPORT

Product Name : Lenovo True Wireless Stereo Earbuds
Brand Mark : N/A
Model No. : GT2
FCC ID : 2AWS9-LENOVOGT2
Report Number : BLA-EMC-202004-A2301
Date of Sample Receipt : 2020/4/14
Date of Test : 2020/4/14 to 2020/4/24
Date of Issue : 2020/7/14
Test Standard : 47 CFR Part 15, Subpart C 15.247
Test Result : Pass

Prepared for:

SMARTAI US LIMITED

7665 MENTOR AVE NUM 116 MENTOR, OH 44060

Prepared by:

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2020/7/14



REPORT REVISE RECORD

Version No.	Date	Description
00	2020/4/27	Original
01	2020/7/14	Change applicant and product name

BlueAsia

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1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
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
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	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 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 Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	CFR 47 Part 2.1093	CFR 47 Part 2.1093	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
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
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

2 GENERAL INFORMATION

Applicant	SMARTAI US LIMITED
Address	7665 MENTOR AVE NUM 116 MENTOR, OH 44060
Manufacturer	Dongguan Liesheng Electronic Co., Ltd.
Address	Suite 1303, 1305 and 1306, 13/F, Project Phrase 2 of Gaosheng Tech Tower, Gaosheng Tech Park, No.5 Longxi Road, Zhouxi Community, Nancheng District, Dongguan City, Guangdong, China.
Product Name	Lenovo True Wireless Stereo Earbuds
Test Model No.	GT2

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	1.0
Software Version	1.0
Operation Frequency:	2402MHz-2480MHz
Modulation Type:	GFSK, p/4DQPSK, 8DPSK
Channel Spacing:	1MHz
Number of Channels:	79
Antenna Type:	Chip Antenna
Antenna Gain:	0.9dBi

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	25°C	DC3.7V

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
Transmitting mode	Keep the EUT in continuously transmitting mode with modulation. (hopping or no hopping mode,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, 8-DPSK modulation were all pre-scanned only worse case is reported.	

6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission	±4.34dB
Radiated Emission	±4.24dB
Radiated Emission	±4.68dB
AC Power Line Conducted Emission	±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	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.
IOT Test Centre of BlueAsia
No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen, China
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673
No tests were sub-contracted.

9 TEST INSTRUMENTS LIST

Test Equipment Of Conducted Band Edges Measurement					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

Test Equipment Of Dwell Time					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

Test Equipment Of Hopping Channel Number					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

Test Equipment Of Carrier Frequencies Separation					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due

Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

Test Equipment Of 20dB Bandwidth

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

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	6/10/2018	6/9/2021
Receiver	R&S	ESPI3	101082	5/7/2019	5/7/2020
LISN	R&S	ENV216	3560.6550.15	7/4/2019	7/3/2020
LISN	AT	AT166-2	AKK1806000003	12/18/2019	12/17/2020
EMI software	EZ	EZ-EMC	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	5/8/2018	5/7/2021
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020

Receiver	R&S	ESR7	101199	5/7/2019	5/6/2020
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2020
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2020
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2020	2/13/2021
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 Spurious Emissions

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

Test Equipment Of Radiated Spurious Emissions

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	5/8/2018	5/7/2021
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Receiver	R&S	ESR7	101199	5/7/2019	5/6/2020

broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2020
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2020
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2020	2/13/2021
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 Peak Output Power

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/18/2019	12/17/2020
Signal Generator	Agilent	N5182A	MY49060650	12/18/2019	12/17/2020
Signal Generator	Agilent	E8257D	MY44320250	5/7/2019	5/6/2020

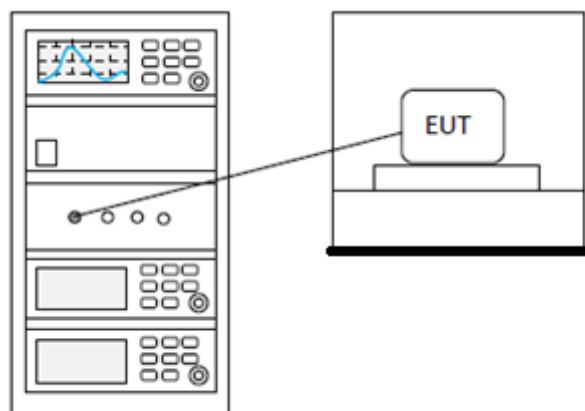
CONDUCTED BAND EDGES MEASUREMENT

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	24°C
Humidity	56%

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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BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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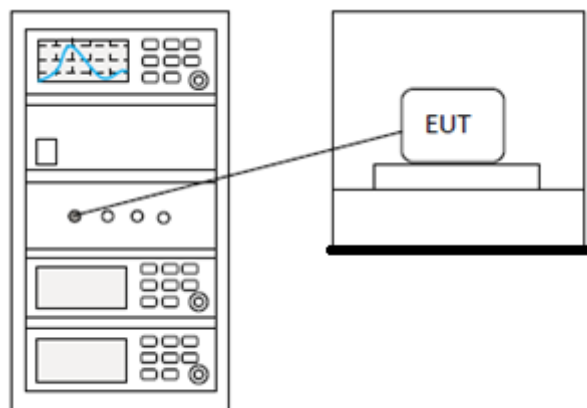
DWELL TIME

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	24℃
Humidity	55%

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 0.4Smultiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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ANTENNA REQUIREMENT

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

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 0.9dBi.



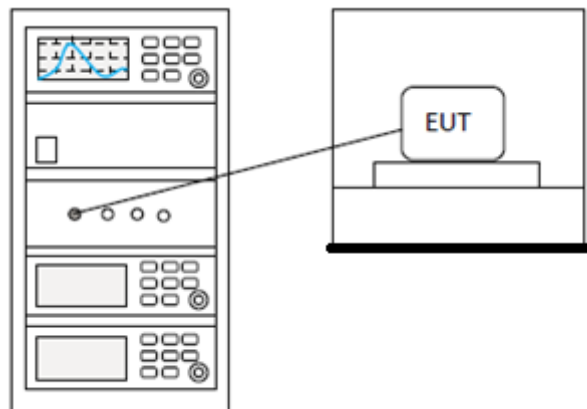
HOPPING CHANNEL NUMBER

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	24℃
Humidity	55%

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

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

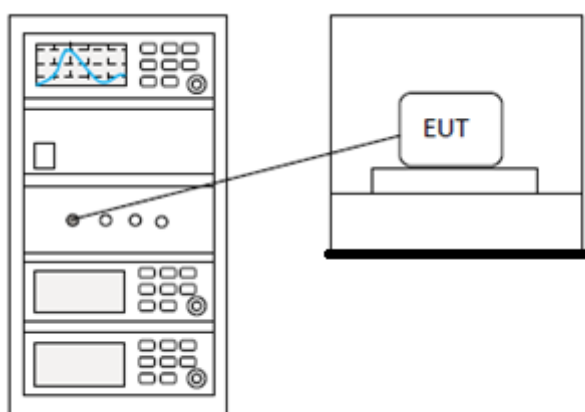
CARRIER FREQUENCIES SEPARATION

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	24°C
Humidity	55%

LIMITS

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



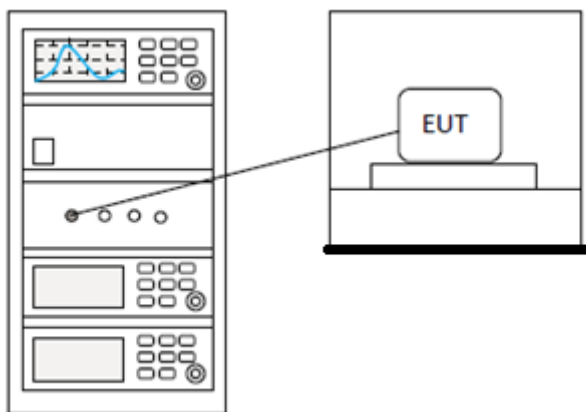
TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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	24℃
Humidity	55%

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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

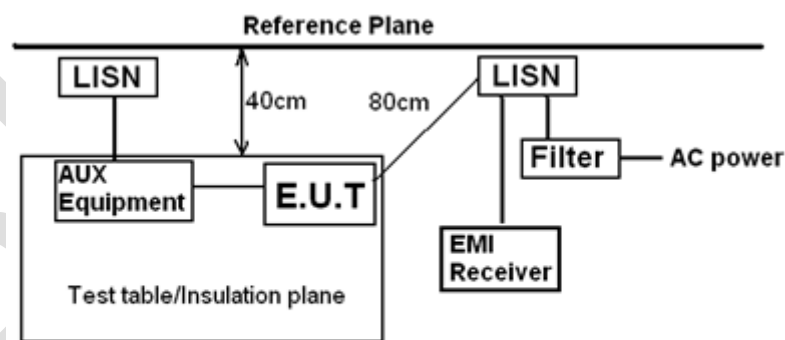
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Sweet
Temperature	25°C
Humidity	58%

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.

BLOCK DIAGRAM OF TEST SETUP



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

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?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.

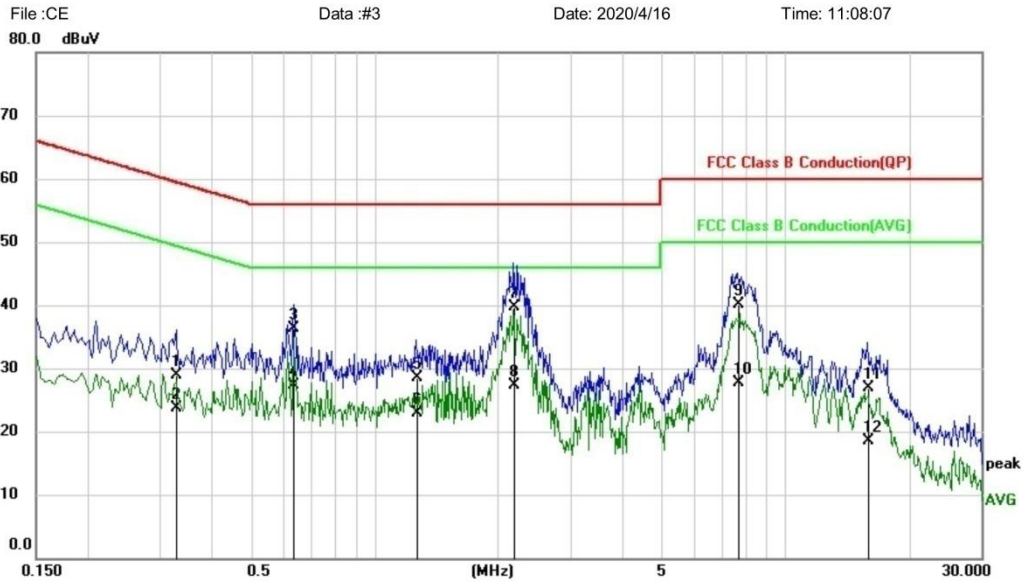
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from 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: $LISN = Read\ Level + Cable\ Loss + LISN\ Factor$

TEST DATA

[TestMode: TX]; [Line: Line]

Conducted Emission Measurement



Site: Phase: **L1** Temperature: 26
Limit: FCC Class B Conduction(QP) Power: AC 120V 60Hz Humidity: 60 %
EUT: TWS BLUETOOTH EARPHONES
M/N: Haylou- GT2
Mode: BT mode
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.3300	19.07	9.79	28.86	59.45	-30.59	QP	
2		0.3300	13.87	9.79	23.66	49.45	-25.79	AVG	
3		0.6340	26.58	9.71	36.29	56.00	-19.71	QP	
4		0.6340	17.58	9.71	27.29	46.00	-18.71	AVG	
5		1.2660	18.74	9.82	28.56	56.00	-27.44	QP	
6		1.2660	13.07	9.82	22.89	46.00	-23.11	AVG	
7	*	2.1820	29.95	9.82	39.77	56.00	-16.23	QP	
8		2.1820	17.52	9.82	27.34	46.00	-18.66	AVG	
9		7.6540	30.27	9.87	40.14	60.00	-19.86	QP	
10		7.6540	17.79	9.87	27.66	50.00	-22.34	AVG	
11		15.8340	17.01	9.95	26.96	60.00	-33.04	QP	
12		15.8340	8.62	9.95	18.57	50.00	-31.43	AVG	

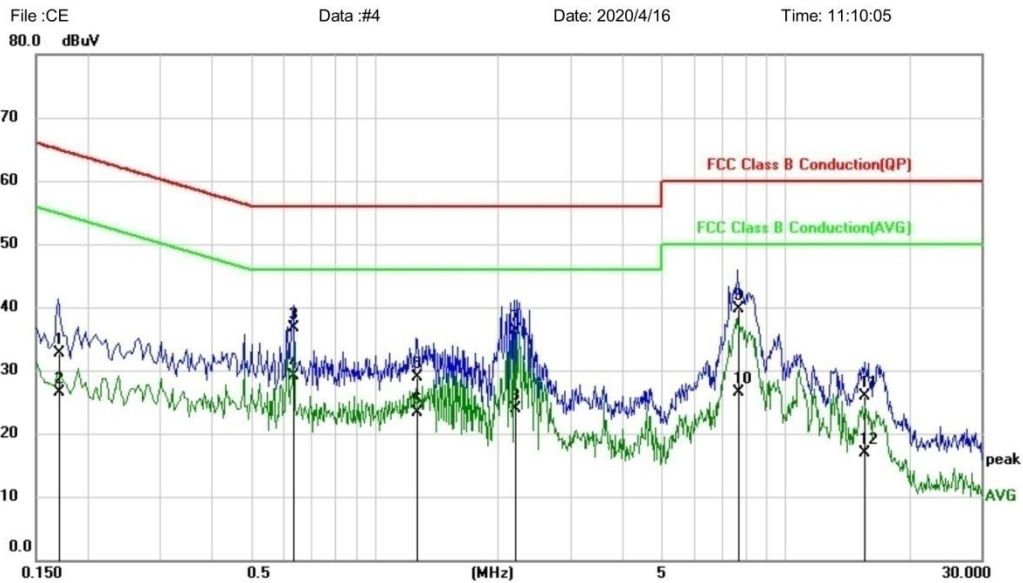
*:Maximum data x:Over limit !:over margin

<Reference Only

Test Result: Pass

[TestMode: TX]; [Line: Nutral]

Conducted Emission Measurement



Site: Phase: **N** Temperature: 26
Limit: FCC Class B Conduction(QP) Power: AC 120V 60Hz Humidity: 60 %
EUT: TWS BLUETOOTH EARPHONES
M/N: Haylou- GT2
Mode: BT mode
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1700	22.74	9.87	32.61	64.96	-32.35	QP	
2		0.1700	16.71	9.87	26.58	54.96	-28.38	AVG	
3		0.6340	26.99	9.74	36.73	56.00	-19.27	QP	
4	*	0.6340	19.32	9.74	29.06	46.00	-16.94	AVG	
5		1.2660	19.08	9.83	28.91	56.00	-27.09	QP	
6		1.2660	13.49	9.83	23.32	46.00	-22.68	AVG	
7		2.1980	26.43	9.86	36.29	56.00	-19.71	QP	
8		2.1980	13.99	9.86	23.85	46.00	-22.15	AVG	
9		7.6500	29.85	9.86	39.71	60.00	-20.29	QP	
10		7.6500	16.61	9.86	26.47	50.00	-23.53	AVG	
11		15.5940	15.81	10.00	25.81	60.00	-34.19	QP	
12		15.5940	6.99	10.00	16.99	50.00	-33.01	AVG	

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

<Reference Only

Test Result: Pass

RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	CFR 47 Part 2.1093
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	23°C
Humidity	56%

LIMITS

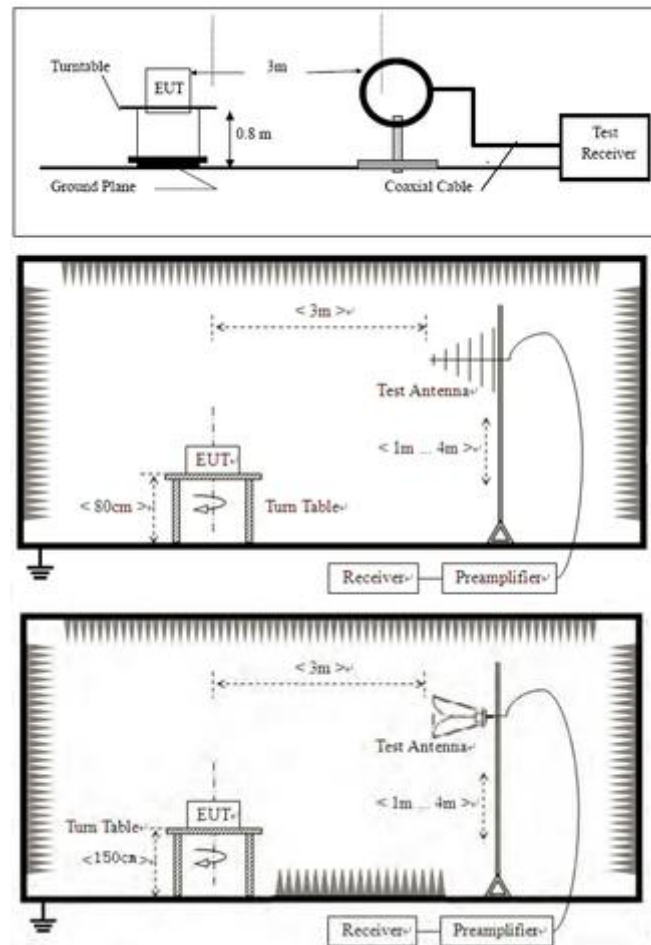
The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right] \cdot \sqrt{f(\text{GHz})} \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

- ☐ $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- ☐ Power and distance are rounded to the nearest mW and mm before calculation¹⁷
- ☐ The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

BLOCK DIAGRAM OF TEST SETUP



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.

TEST DATA

[TestMode: TX]

Remark: During the test, pre-scan the GFSK, Pi/4QPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

Test channel:lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	45.46	-4.2	41.26	74	-32.74	Horizontal
2390	48.49	-3.88	44.61	74	-29.39	Horizontal
2310	45.48	-4.49	40.99	74	-33.01	Vertical
2390	46.44	-4.21	42.23	74	-31.77	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	32.96	-4.2	28.76	54	-25.24	Horizontal
2390	35.52	-3.88	31.64	54	-22.36	Horizontal
2310	32.34	-4.49	27.85	54	-26.15	Vertical
2390	34.36	-4.21	30.15	54	-23.85	Vertical

Test channel:Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	66.74	-3.38	63.36	74	-10.64	Horizontal
2500	48.75	-3.3	45.45	74	-28.55	Horizontal
2483.5	68.46	-3.77	64.69	74	-9.31	Vertical
2500	51.58	-3.7	47.88	74	-26.12	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	51.66	-3.38	48.28	54	-5.72	Horizontal
2500	32.78	-3.3	29.48	54	-24.52	Horizontal
2483.5	53.44	-3.77	49.67	54	-4.33	Vertical
2500	37.45	-3.7	33.75	54	-20.25	Vertical

Test Result: Pass

BlueAsia

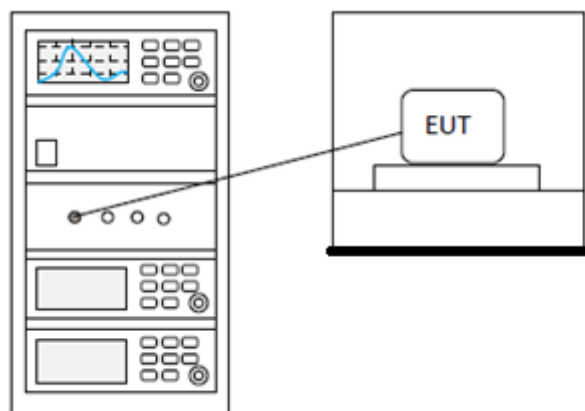
CONDUCTED SPURIOUS EMISSIONS

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	24°C
Humidity	55%

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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BLOCK DIAGRAM OF TEST SETUP



TEST DATA**Pass: Please Refer To Appendix: Appendix1 For Details**

BlueAsia

RADIATED SPURIOUS EMISSIONS

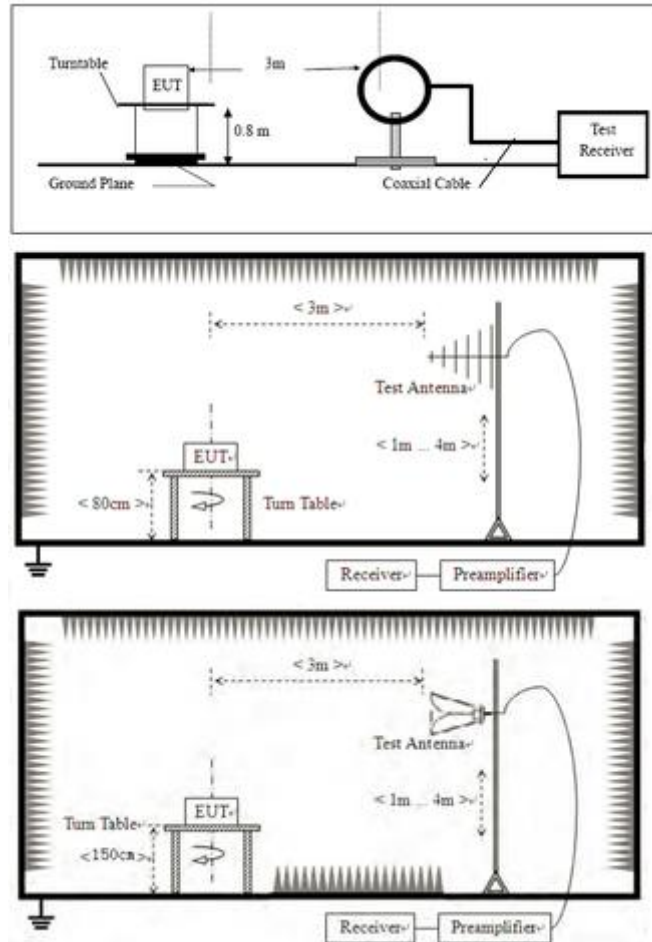
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX mode (SE) below 1G;TX mode (SE) Above 1G
Test Mode (Final Test)	TX mode (SE) below 1G;TX mode (SE) Above 1G
Tester	Eason
Temperature	24℃
Humidity	55%

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.

BLOCK DIAGRAM OF TEST SETUP



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.

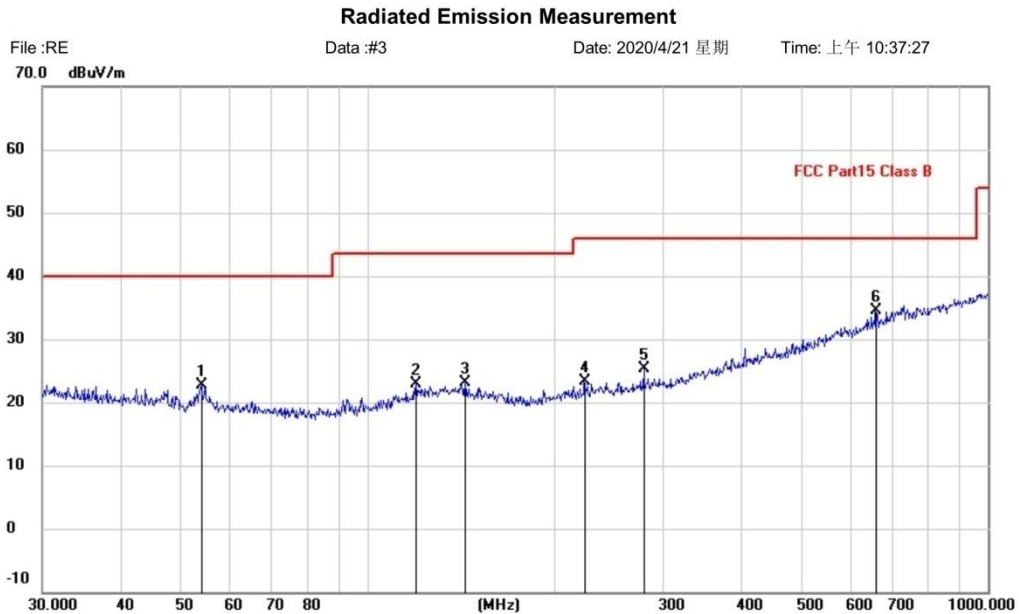
Remark:

- 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 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.

TEST DATA

Remark: During the test, pre-scan the GFSK, Pi/4QPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

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



Site
Limit: FCC Part15 Class B
EUT: TWS BLUETOOTH EARPHONES
M/N: Haylou-GT2
Mode: BT mode
Note:

Polarization: **Horizontal** Temperature:
Power: Humidity: %
Distance: 3m

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		54.0711	-1.29	24.04	22.75	40.00	-17.25	QP		
2		119.8556	0.17	22.68	22.85	43.50	-20.65	QP		
3		143.8295	-0.08	23.28	23.20	43.50	-20.30	QP		
4		223.7334	1.37	21.84	23.21	46.00	-22.79	QP		
5		279.0436	1.99	23.29	25.28	46.00	-20.72	QP		
6	*	658.8362	2.44	32.08	34.52	46.00	-11.48	QP		

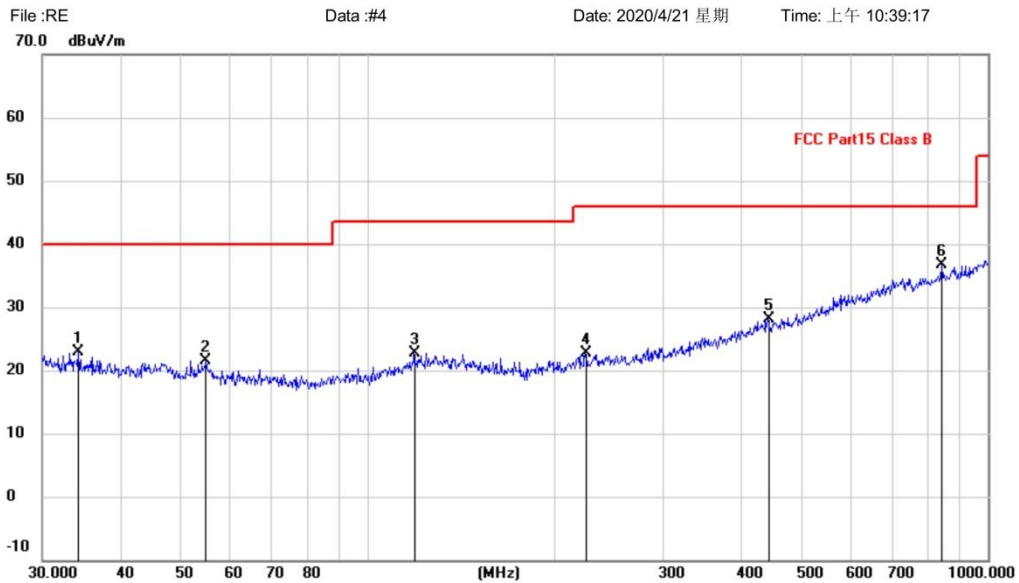
*:Maximum data x:Over limit !:over margin

〈Reference Only

Test Result: Pass

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

Radiated Emission Measurement



Site
Limit: FCC Part15 Class B
EUT: TWS BLUETOOTH EARPHONES
M/N: Haylou-GT2
Mode: BT mode
Note:

Polarization: **Vertical**
Power:
Distance: 3m
Temperature:
Humidity: %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		34.2760	-0.12	23.09	22.97	40.00	-17.03	QP		
2		55.0274	-2.39	23.93	21.54	40.00	-18.46	QP		
3		119.0180	0.09	22.59	22.68	43.50	-20.82	QP		
4		224.5193	0.71	21.90	22.61	46.00	-23.39	QP		
5		441.7426	0.26	27.90	28.16	46.00	-17.84	QP		
6	*	842.1296	2.00	34.65	36.65	46.00	-9.35	QP		

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

⟨Reference Only

Test Result: Pass

[TestMode: TX mode (SE) Above 1G]						
Test channel:lowest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	45.2	2.38	47.58	74	-26.42	Vertical
7206.00	47.36	2.17	49.53	74	-24.47	Vertical
9608.00	46.63	2.06	48.69	74	-25.31	Vertical
12010.00	*			74		Vertical
14412.00	*			74		Vertical
4804.00	46.45	2.38	48.83	74	-25.17	Horizontal
7206.00	48.26	2.17	50.43	74	-23.57	Horizontal
9608.00	47.58	2.06	49.64	74	-24.36	Horizontal
12010.00	*			74		Horizontal
14412.00	*			74		Horizontal
Test channel:Middle						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	43.71	0.17	43.88	74	-30.12	Vertical
7323.00	48.69	1.43	50.12	74	-23.88	Vertical
9764.00	49.02	1.26	50.28	74	-23.72	Vertical
12205.00	*			74		Vertical
14646.00	*			74		Vertical
4882.00	44.89	0.17	45.06	74	-28.94	Horizontal
7323.00	47.78	1.43	49.21	74	-24.79	Horizontal
9764.00	48.26	1.26	49.52	74	-24.48	Horizontal
12205.00	*			74		Horizontal
14646.00	*			74		Horizontal
Test channel:Highest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	43.08	1.04	44.12	74	-29.88	Vertical
7440.00	48.75	2.59	51.34	74	-22.66	Vertical

9920.00	47.02	2.74	49.76	74	-24.24	Vertical
12400.00	*			74		Vertical
14880.00	*			74		Vertical
4960.00	45.12	1.04	46.16	74	-27.84	Horizontal
7440.00	48.88	2.59	51.47	74	-22.53	Horizontal
9920.00	47.62	2.74	50.36	74	-23.64	Horizontal
12400.00	*			74		Horizontal
14880.00	*			74		Horizontal

Test Result: Pass

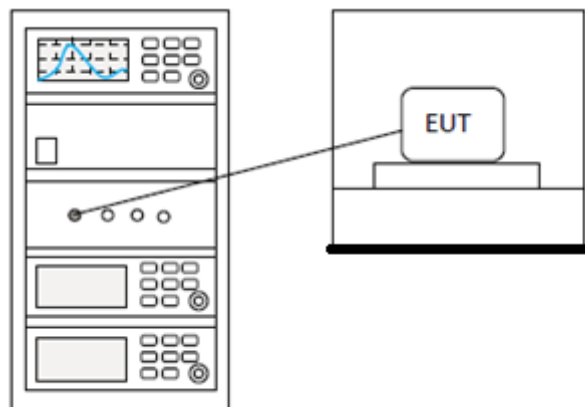
CONDUCTED PEAK OUTPUT POWER

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	24°C
Humidity	55%

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

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

BlueAsia

10 APPENDIX

Appendix1

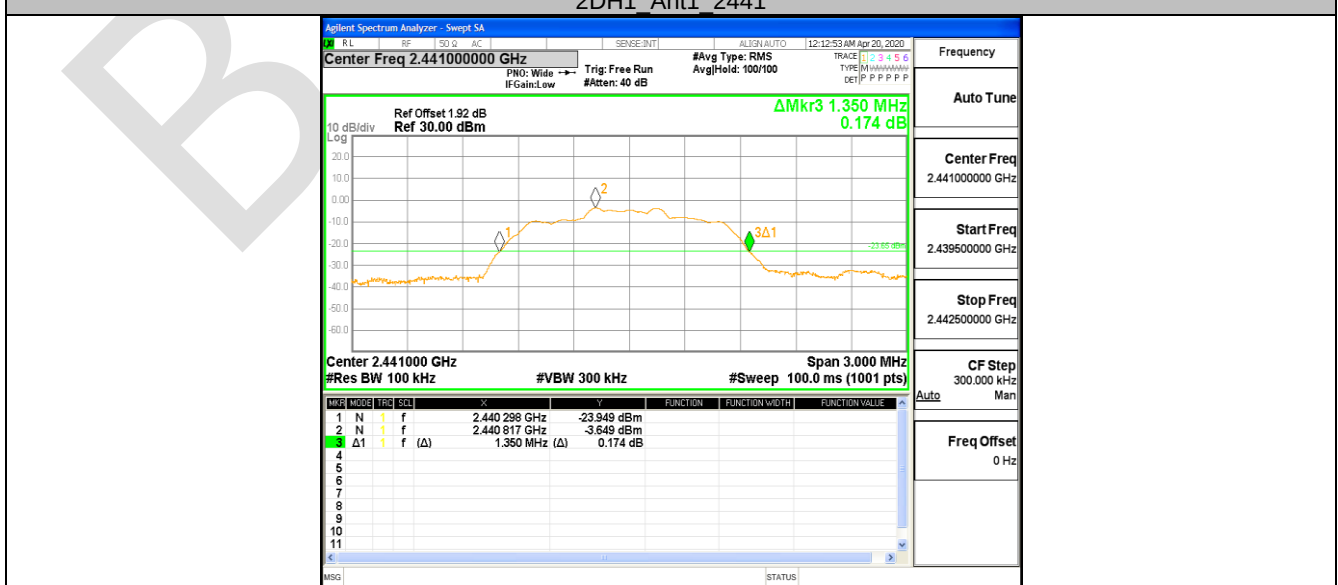
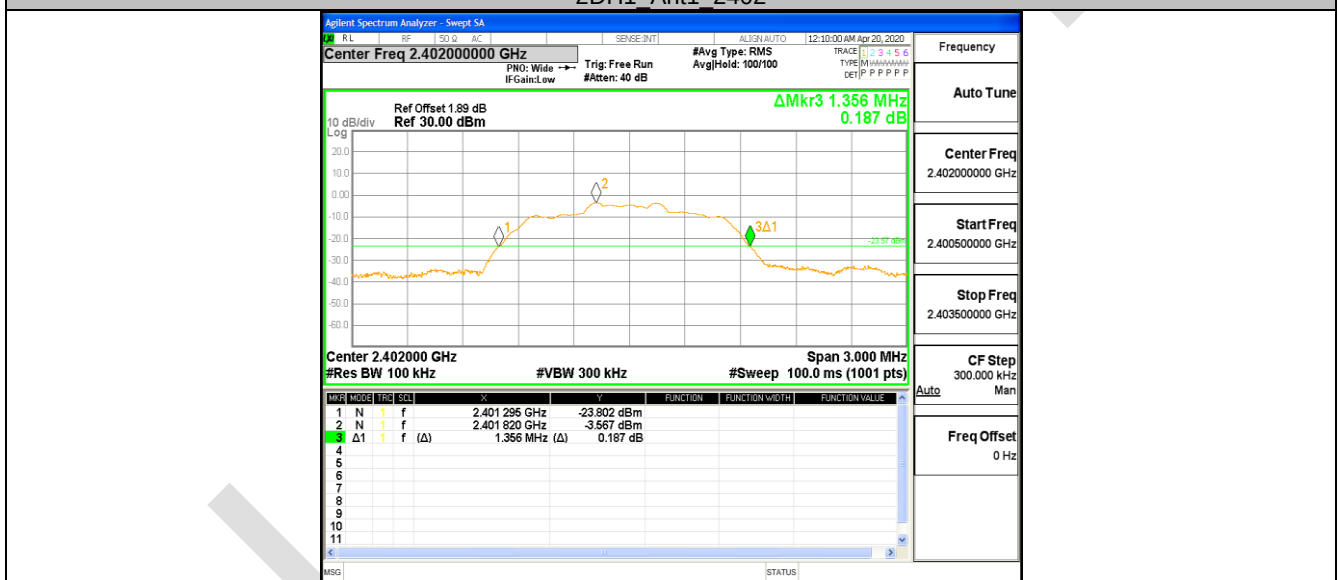
10.1 APPENDIX: 20DBEMISSION BANDWIDTH

Test Result

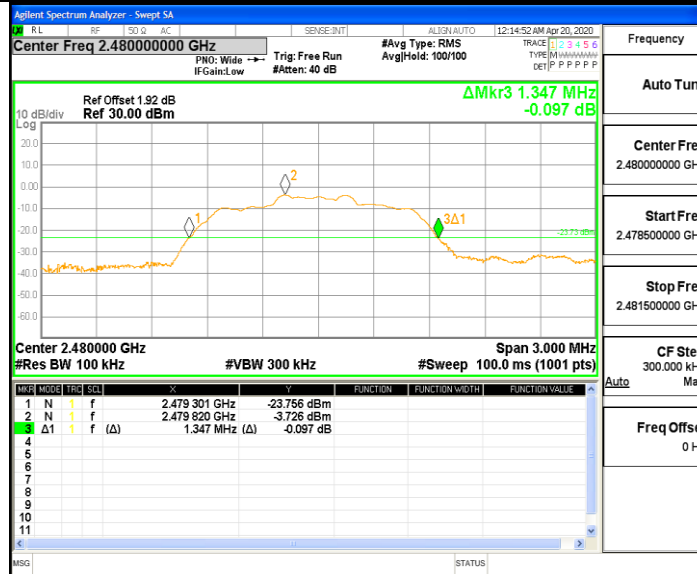
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	1.092	2401.439	2402.531	---	PASS
		2441	1.098	2440.433	2441.531	---	PASS
		2480	1.092	2479.436	2480.528	---	PASS
2DH1	Ant1	2402	1.356	2401.295	2402.651	---	PASS
		2441	1.350	2440.298	2441.648	---	PASS
		2480	1.347	2479.301	2480.648	---	PASS
3DH1	Ant1	2402	1.356	2401.304	2402.660	---	PASS
		2441	1.353	2440.304	2441.657	---	PASS
		2480	1.350	2479.307	2480.657	---	PASS

Test Graphs

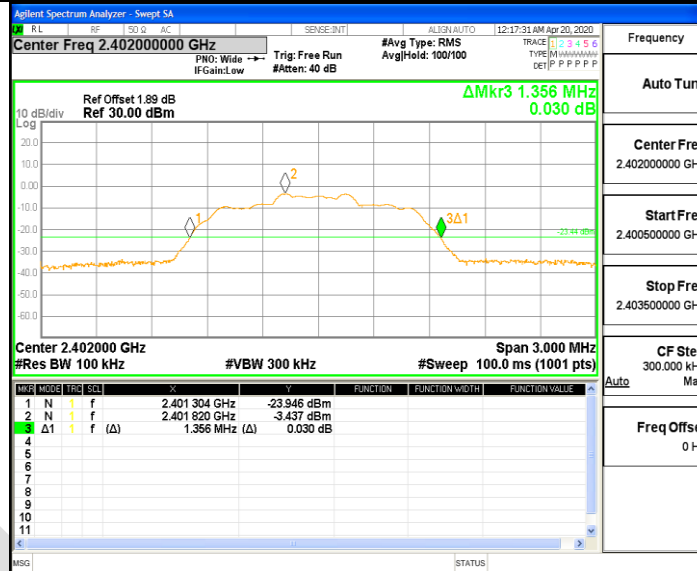




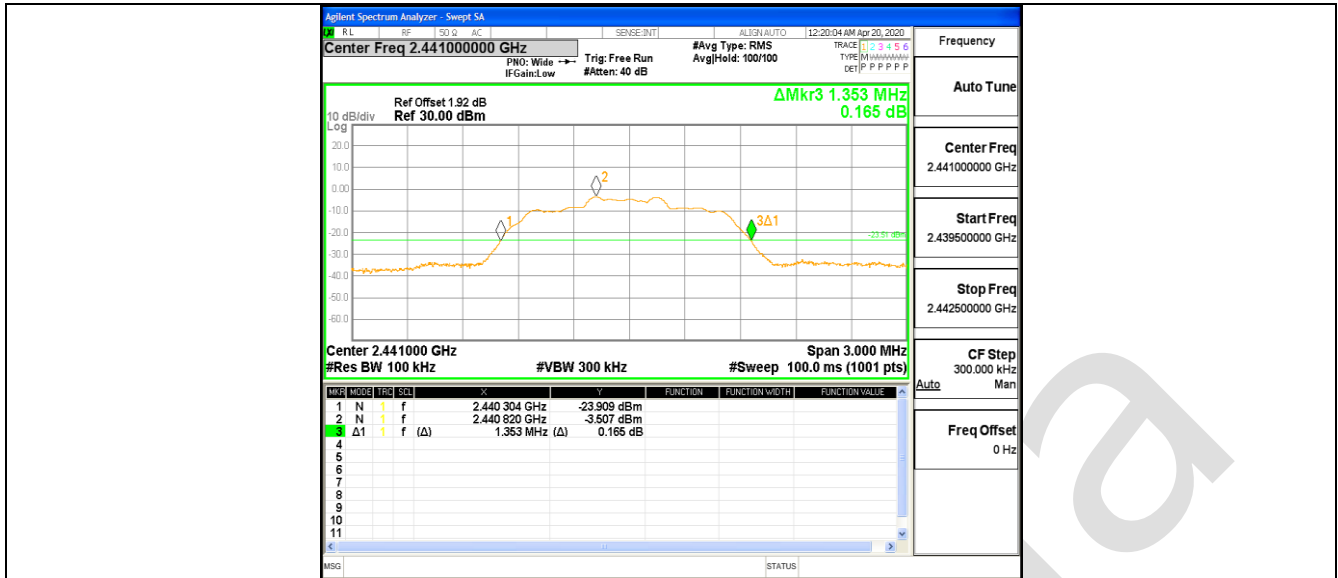
2DH1 Ant1 2480



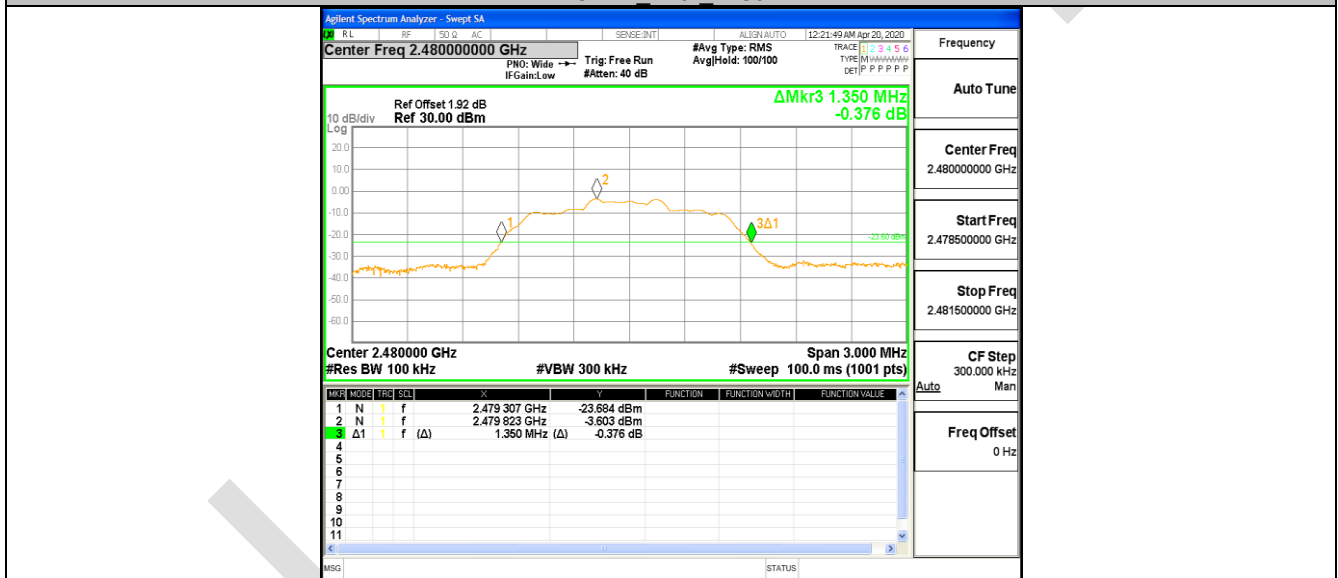
3DH1 Ant1 2402



3DH1 Ant1 2441



3DH1 Ant1 2480

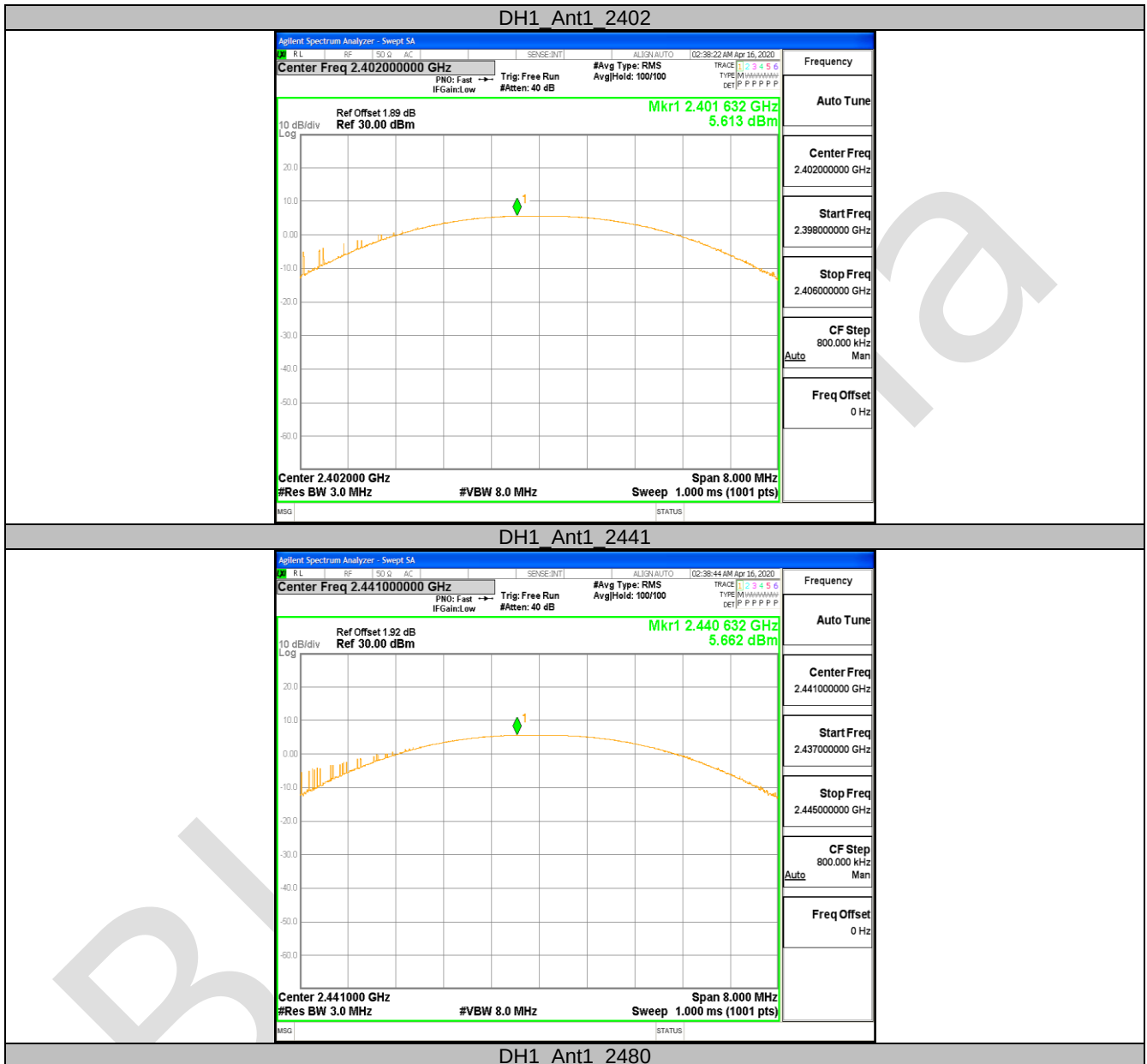


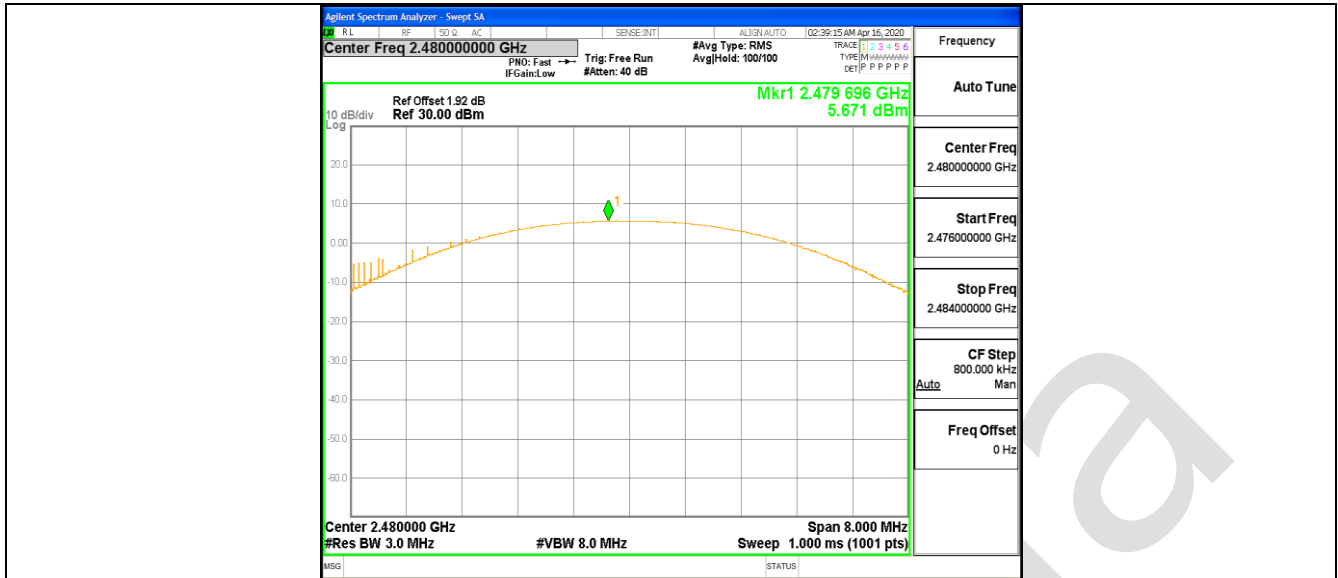
10.2 APPENDIX: MAXIMUM CONDUCTED OUTPUT POWER

Test Result

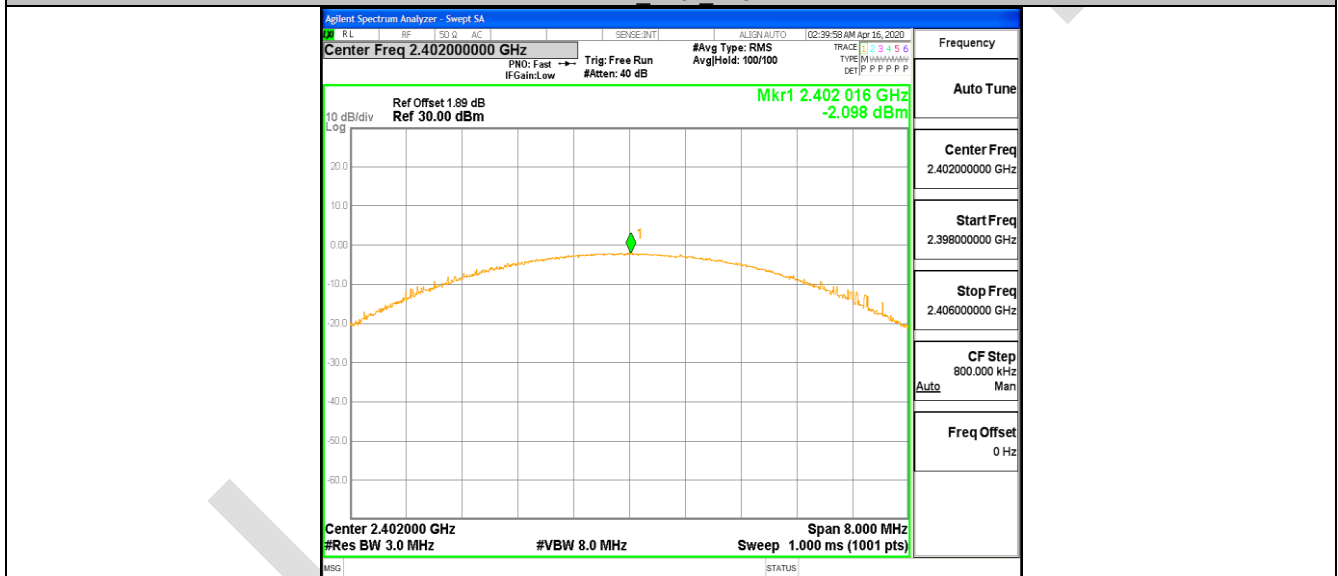
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH1	Ant1	2402	5.61	<=21	PASS
		2441	5.66	<=21	PASS
		2480	5.67	<=21	PASS
2DH1	Ant1	2402	-2.1	<=21	PASS
		2441	-2.14	<=21	PASS
		2480	-2.26	<=21	PASS
3DH1	Ant1	2402	-1.71	<=21	PASS
		2441	-1.77	<=21	PASS
		2480	-1.82	<=21	PASS

Test Graphs

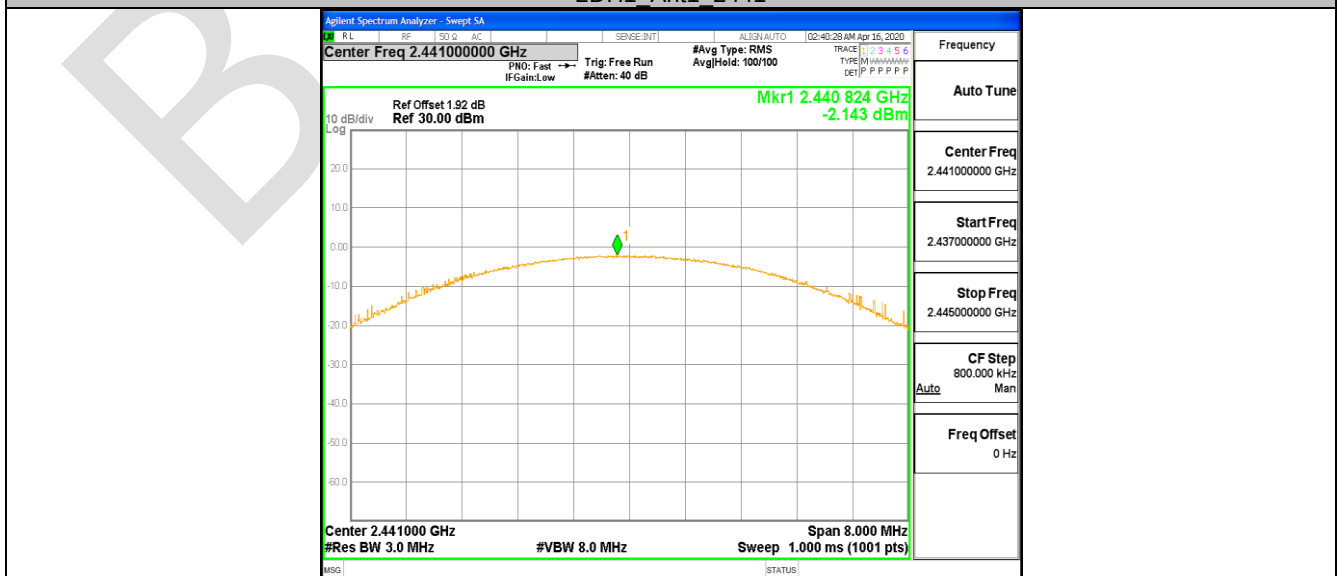




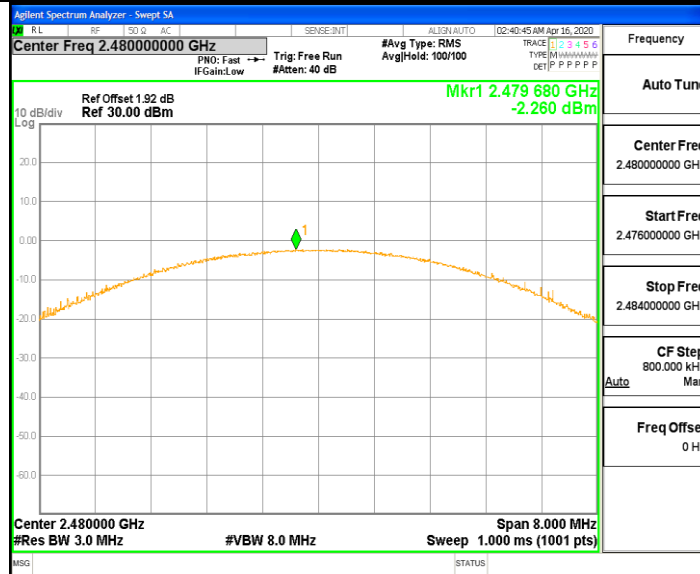
2DH1 Ant1 2402



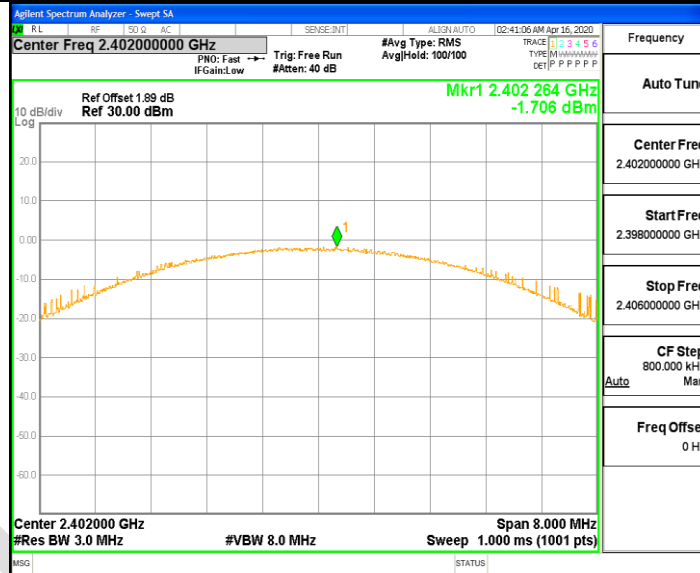
2DH1 Ant1 2441



2DH1 Ant1 2480



3DH1 Ant1 2402



3DH1 Ant1 2441