

TEST REPORT

Product Name : Haylou Wireless Earbuds
Brand Mark : Haylou
Model No. : Haylou-GT5
FCC ID : 2AMQ6-HAYLOUGT5
Report Number : BLA-EMC-202007-A5102
Date of Sample Receipt : 2020/7/17
Date of Test : 2020/7/17 to 2020/7/31
Date of Issue : 2020/8/3
Test Standard : 47 CFR Part 15, Subpart C 15.247
Test Result : Pass

Prepared for:

Dongguan Liesheng Electronic Co., Ltd.
13/F, Project Phrase 2 of GaoshengTechTower, No.5, Longxi Road,
Nancheng, Dongguan, Guangdong, China

Prepared by:

BlueAsia of Technical Services(Shenzhen) Co.,Ltd.
IOT Test Centre of BlueAsia
No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen,China
TEL: +86-755-28682673
FAX: +86-755-28682673

Compiled by:

hason

Review by:

Sweet. Liang

Approved by:

Tmen li

Date:

2020/8/3



REPORT REVISE RECORD

Version No.	Date	Description
00	2020/8/3	Original

BlueAsia

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1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
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 15.205 & 15.209	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
Antenna Requirement	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
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
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
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 & Section 11.9.1	47 CFR Part 15, Subpart C 15.247(b)(1)	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

2 GENERAL INFORMATION

Applicant	Dongguan Liesheng Electronic Co., Ltd.
Address	13/F, Project Phrase 2 of GaoshengTechTower,No.5, Longxi Road, Nancheng, Dongguan, Guangdong, China
Manufacturer	Dongguan Liesheng Electronic Co., Ltd.
Address	13/F, Project Phrase 2 of GaoshengTechTower,No.5, Longxi Road, Nancheng, Dongguan, Guangdong, China
Factory	Dongguan Liesheng Electronic Co., Ltd.
Address	13/F, Project Phrase 2 of GaoshengTechTower,No.5, Longxi Road, Nancheng, Dongguan, Guangdong, China
Product Name	Haylou Wireless Earbuds
Test Model No.	Haylou-GT5

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	V1.0
Software Version	V1.0
Spectrum Spread Technology:	DTS
Rate:	1Mbps, 2Mbps
Operation Frequency:	2402MHz-2480MHz
Modulation Type:	GFSK
Channel Spacing:	2MHz
Number of Channels:	40
Antenna Type:	Internal Antenna
Antenna Gain:	0.38 dBi(Provided by the customer)

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25°C	3.7Vdc

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in continuously transmitting mode with modulation.
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	±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
PC	HASEE	K610D	N/A	N/A
AC Adapter	PISEN	TS-C051	N/A	N/A
Note: "--" means no any support device during testing.				

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 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	7/4/2020	7/3/2021
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2019	7/13/2021
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2019	7/13/2021
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2021
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2019	2/13/2022
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 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	4/20/2020	4/19/2021
LISN	R&S	ENV216	3560.6550.15	7/4/2019	7/3/2021
LISN	AT	AT166-2	AKK1806000003	12/17/2019	12/16/2020
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	7/3/2021
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2020
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2019	7/13/2021
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2021
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2019	2/13/2022
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	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

Test Equipment Of Conducted Band Edges Measurement

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
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Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

Test Equipment Of Power Spectrum Density

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

Test Equipment Of Conducted Peak Output Power

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

Test Equipment Of 20dB Bandwidth

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020

Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021
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Test Equipment Of Minimum 6dB Bandwidth

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2021
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

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	23℃
Humidity	48%

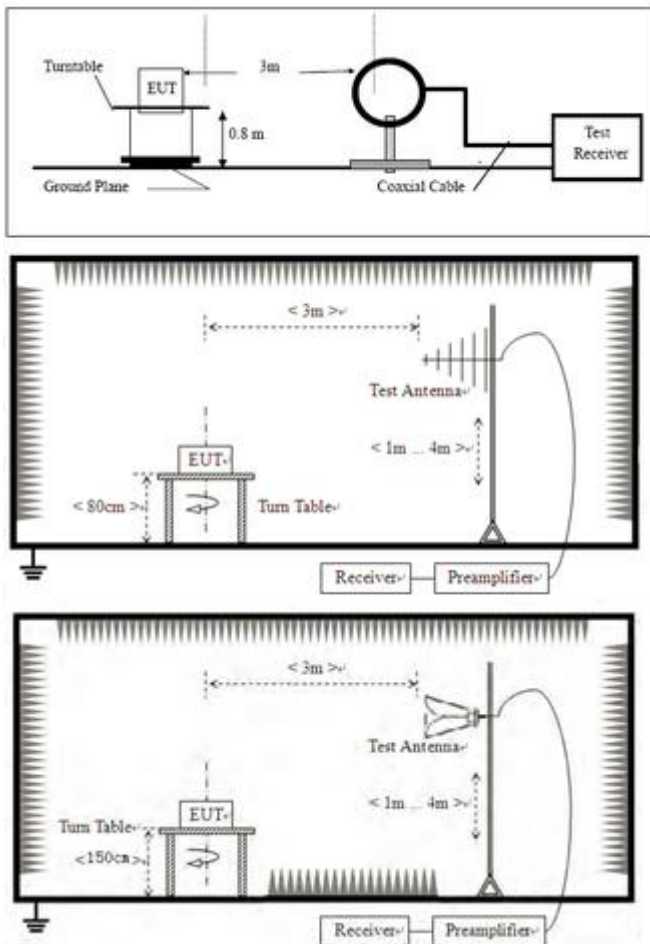
LIMITS

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.

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 12750GHz 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.

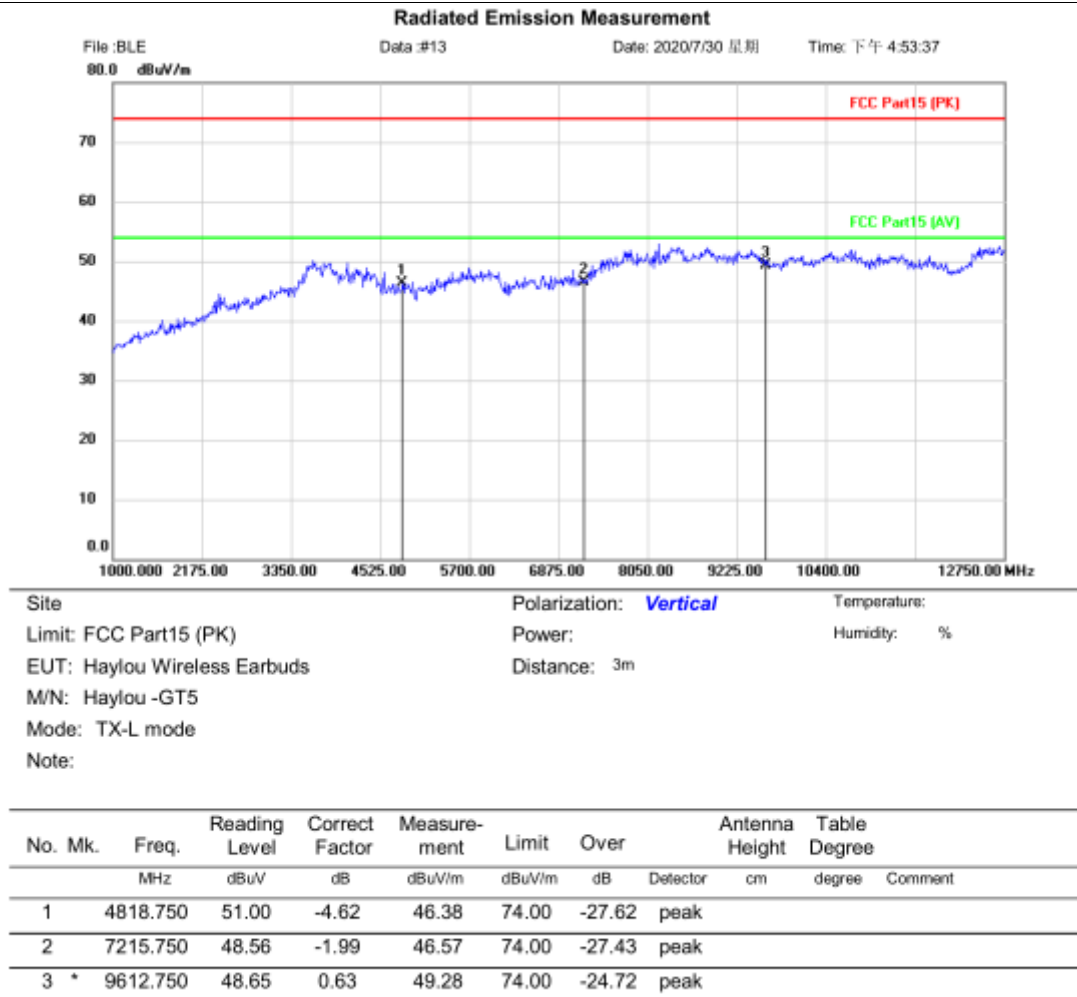
4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower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

TEST DATA

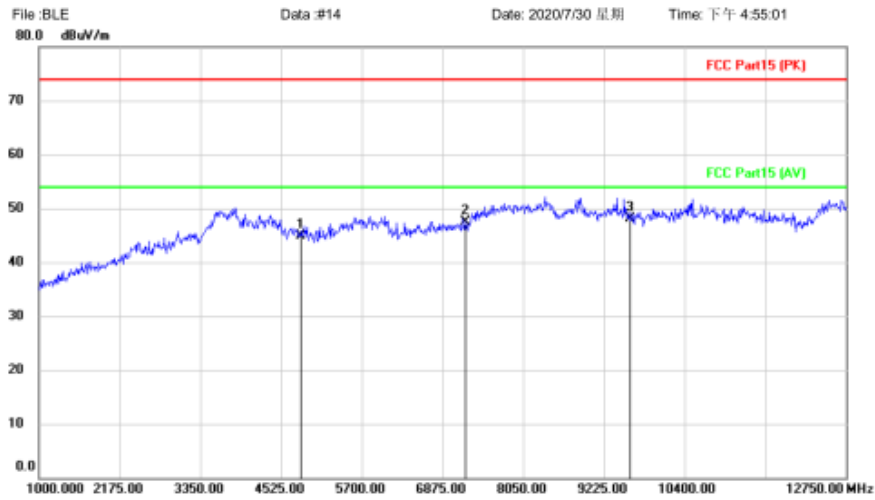
Remark: During the test, pre-scan the 1Mbps, 2 Mbps rate, and found the 2Mbps rate which it is worse case.

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

Test channel:lowest



Radiated Emission Measurement

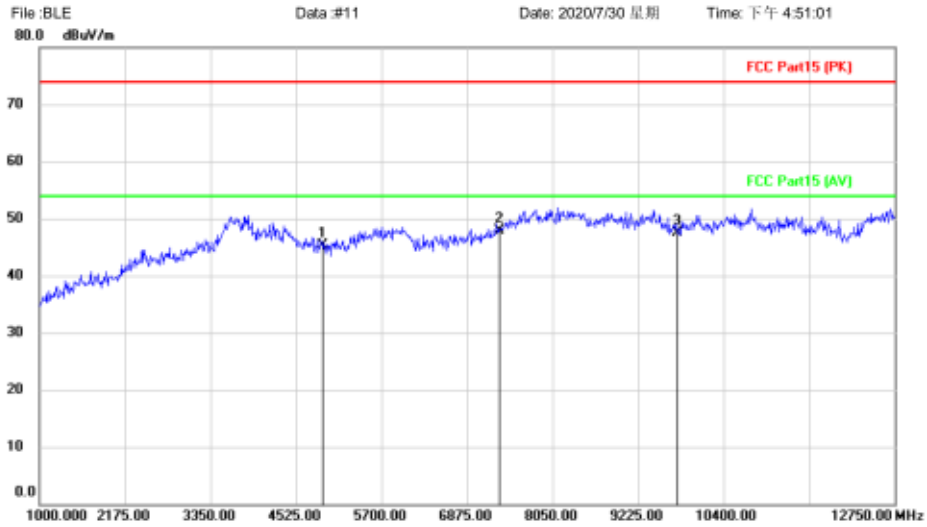


Site: Polarization: **Horizontal** Temperature:
Limit: FCC Part15 (PK) Power: Humidity: %
EUT: Haylou Wireless Earbuds Distance: 3m
M/N: Haylou -GT5
Mode: TX-L mode
Note:

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	4818.750	49.56	-4.62	44.94	74.00	-29.06	peak		
2	7215.750	49.68	-2.20	47.48	74.00	-26.52	peak		
3 *	9612.750	47.25	0.82	48.07	74.00	-25.93	peak		

Test channel: Middle

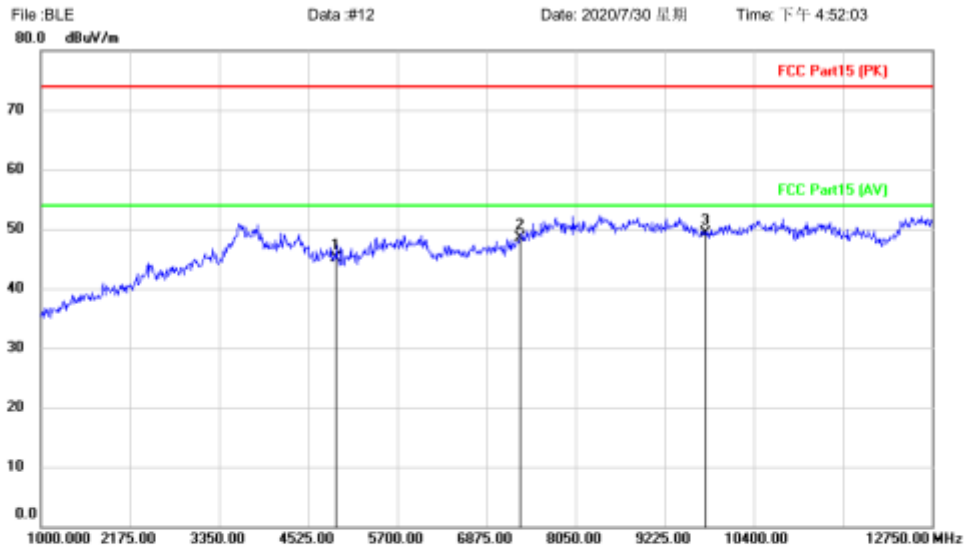
Radiated Emission Measurement



Site: Polarization: **Horizontal** Temperature:
Limit: FCC Part15 (PK) Power: Humidity: %
EUT: Haylou Wireless Earbuds Distance: 3m
M/N: Haylou -GT5
Mode: TX-M mode
Note:

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	4889.250	50.33	-5.12	45.21	74.00	-28.79	peak		
2 *	7321.500	49.31	-1.35	47.96	74.00	-26.04	peak		
3	9765.500	46.51	0.94	47.45	74.00	-26.55	peak		

Radiated Emission Measurement

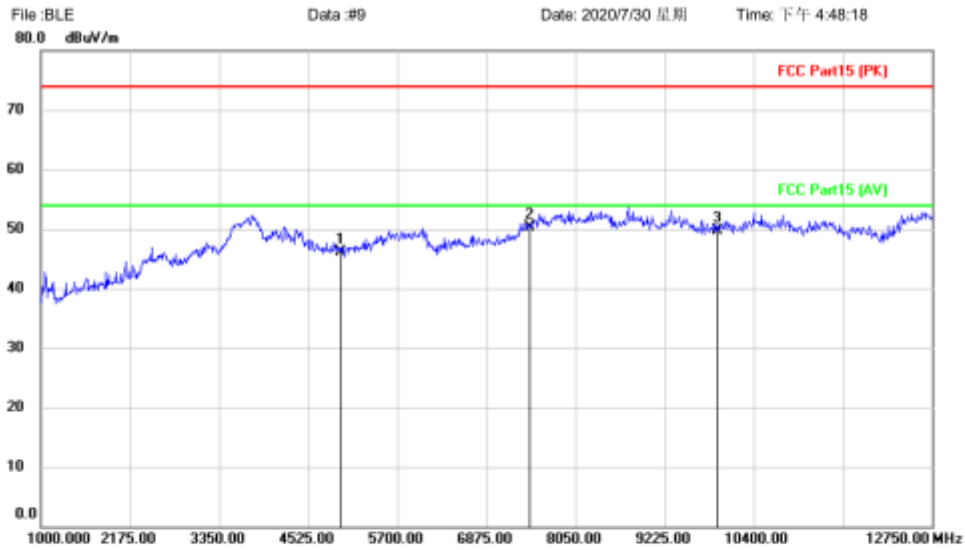


Site: Polarization: **Vertical** Temperature:
Limit: FCC Part15 (PK) Power: Humidity: %
EUT: Haylou Wireless Earbuds Distance: 3m
M/N: Haylou -GT5
Mode: TX-M mode
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		4889.250	50.25	-5.12	45.13	74.00	-28.87	peak		
2		7321.500	49.94	-1.48	48.46	74.00	-25.54	peak		
3	*	9765.500	48.34	0.91	49.25	74.00	-24.75	peak		

Test channel: Highest

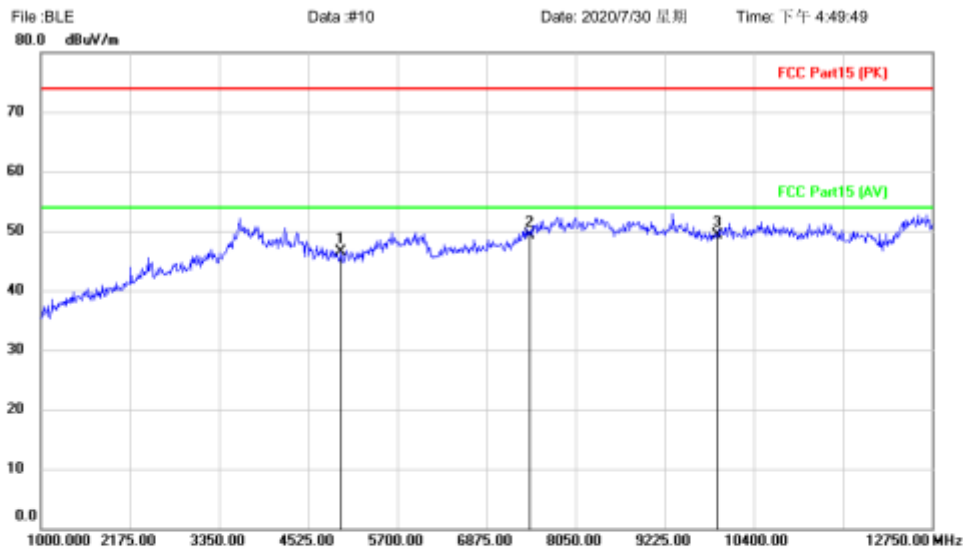
Radiated Emission Measurement



Site: Polarization: **Vertical** Temperature:
Limit: FCC Part15 (PK) Power: Humidity: %
EUT: Haylou Wireless Earbuds Distance: 3m
M/N: Haylou -GT5
Mode: TX-H mode
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		4959.750	50.99	-4.84	46.15	74.00	-27.85	peak		
2	*	7450.750	51.29	-1.06	50.23	74.00	-23.77	peak		
3		9918.250	48.31	1.41	49.72	74.00	-24.28	peak		

Radiated Emission Measurement



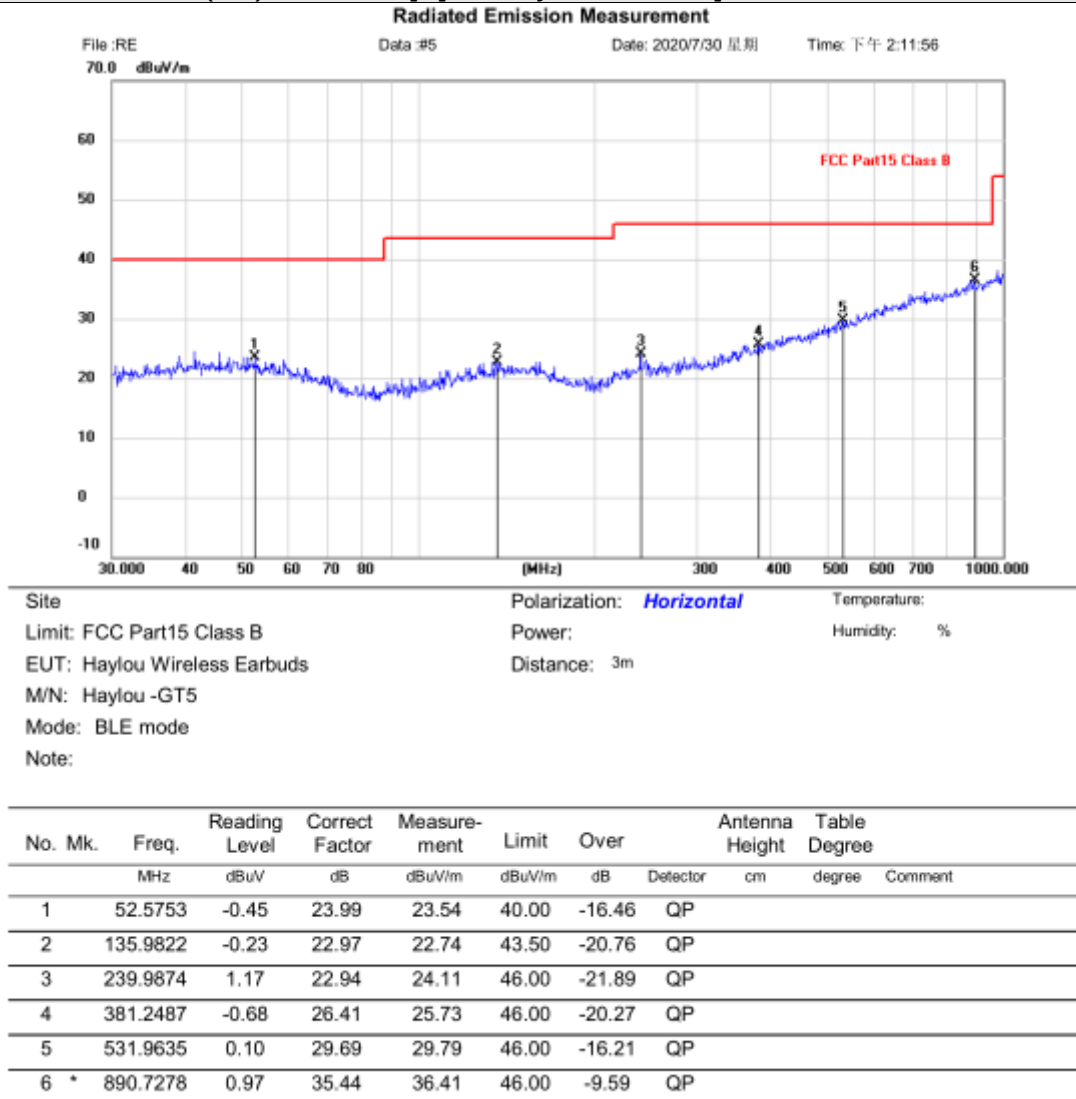
Site
Limit: FCC Part15 (PK)
EUT: Haylou Wireless Earbuds
M/N: Haylou -GT5
Mode: TX-H mode
Note:

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		4959.750	51.42	-4.84	46.58	74.00	-27.42	peak		
2		7450.750	49.75	-0.52	49.23	74.00	-24.77	peak		
3	*	9918.250	48.04	1.29	49.33	74.00	-24.67	peak		

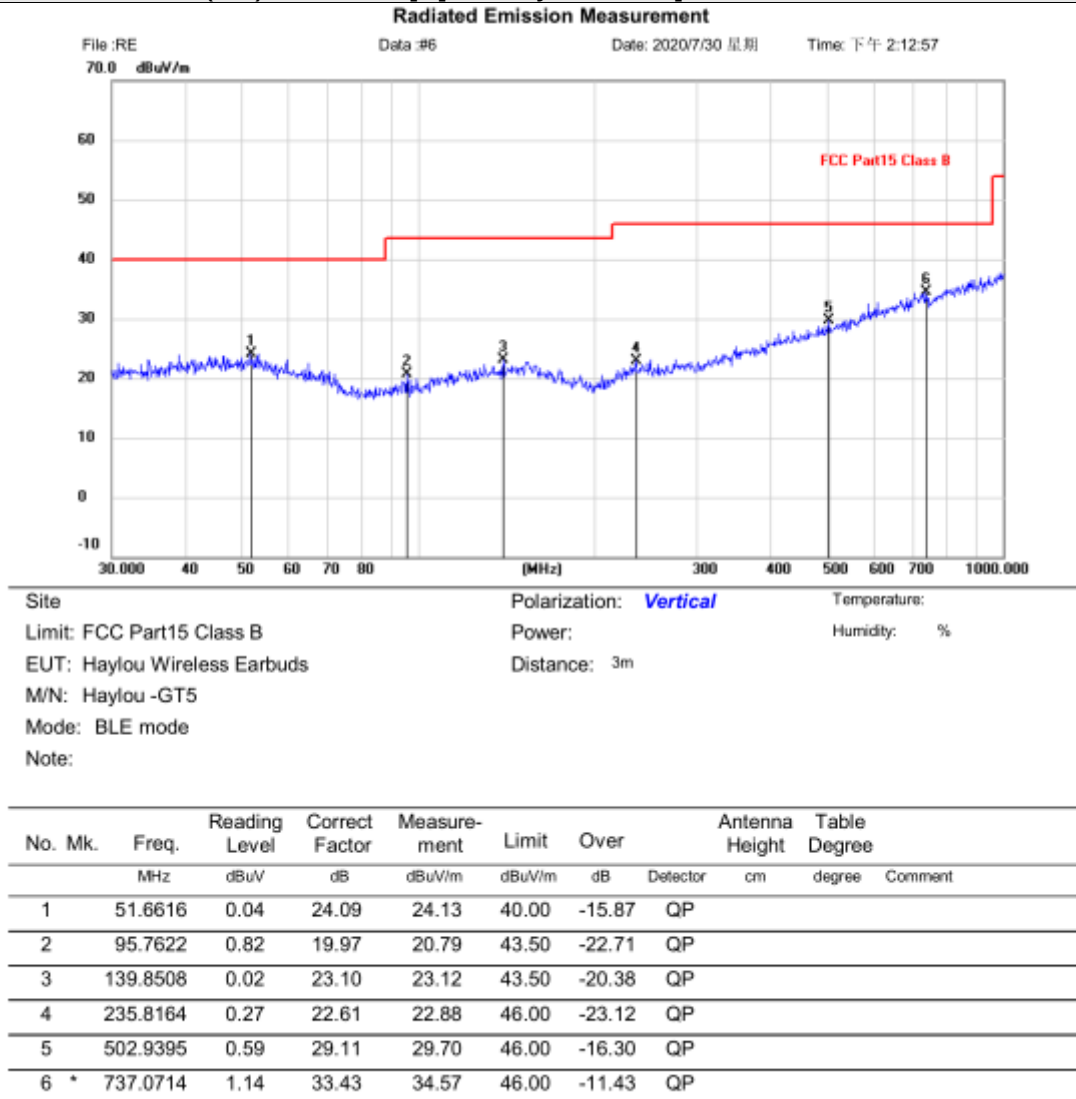
Test Result: Pass

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



Test Result: Pass

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



Test Result: Pass

RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

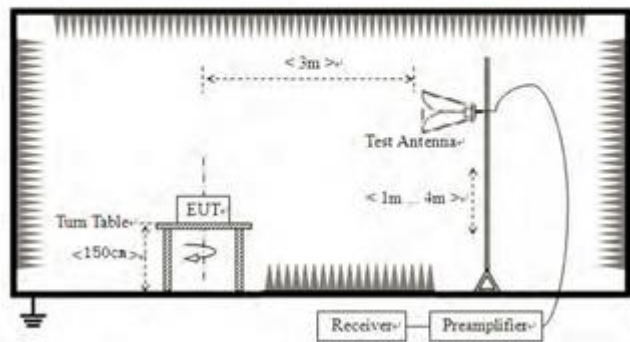
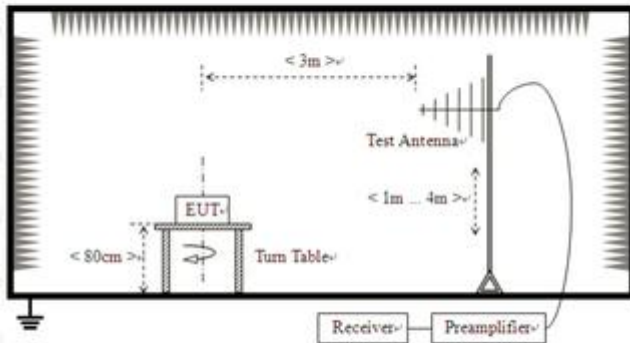
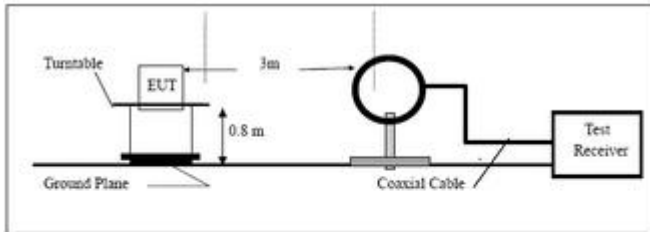
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX mode
Test Mode (Final Test)	TX mode
Tester	Eason
Temperature	23℃
Humidity	48%

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: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamplifier Factor}$

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.

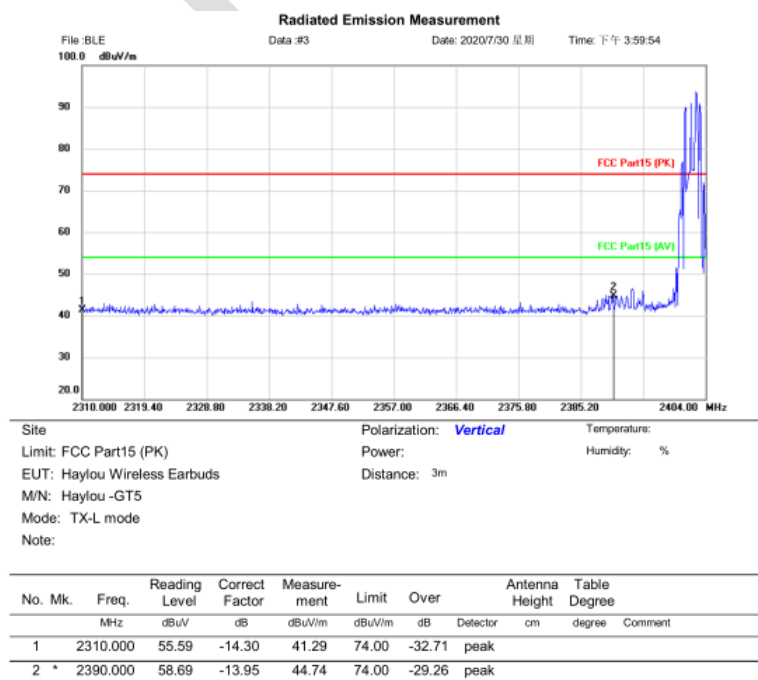
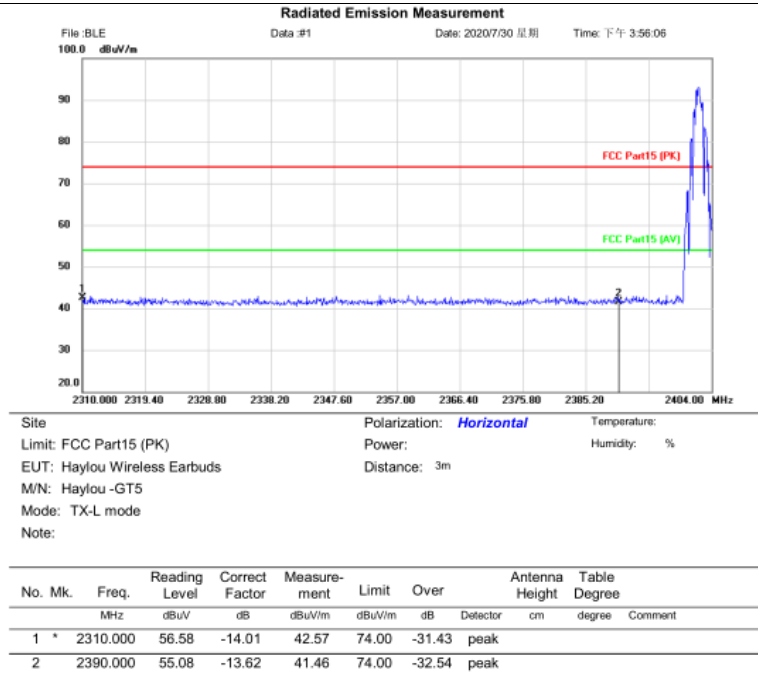
TEST DATA

Remark: During the test, pre-scan the 1Mbps, 2 Mbps rate, and found the 2Mbps rate which it is worse case.

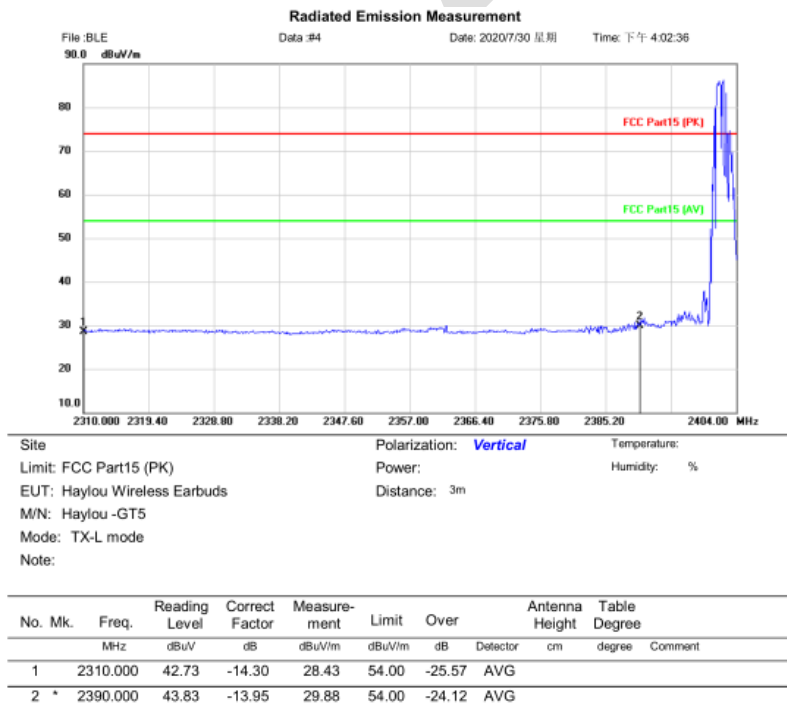
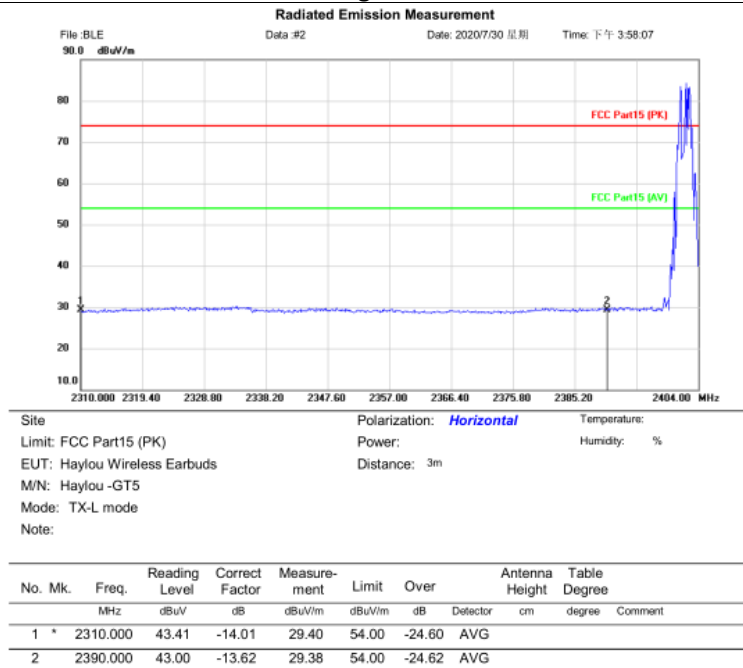
[TestMode: TX mode]

Test channel:lowest

Peak value:



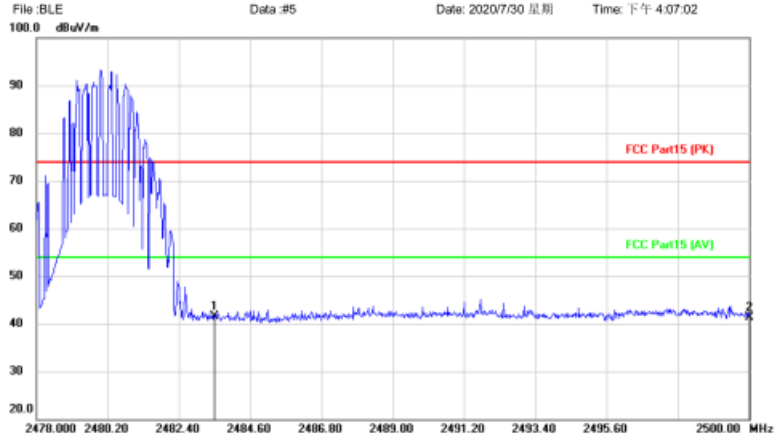
Average value:



Test channel: Highest

Peak value:

Radiated Emission Measurement

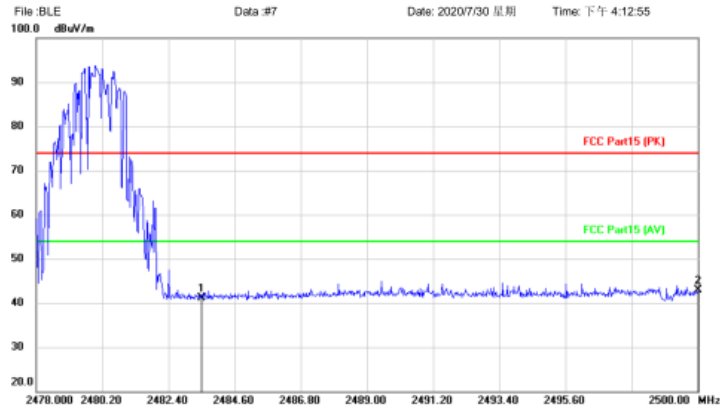


Site: Limit: FCC Part15 (PK) EUT: Haylou Wireless Earbuds M/N: Haylou -GT5 Mode: TX-H mode Note:

Polarization: **Vertical** 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	cm	degree	Comment
1	*	2483.500	54.95	-13.50	41.45	74.00	-32.55	peak		
2		2500.000	54.78	-13.42	41.36	74.00	-32.64	peak		

Radiated Emission Measurement

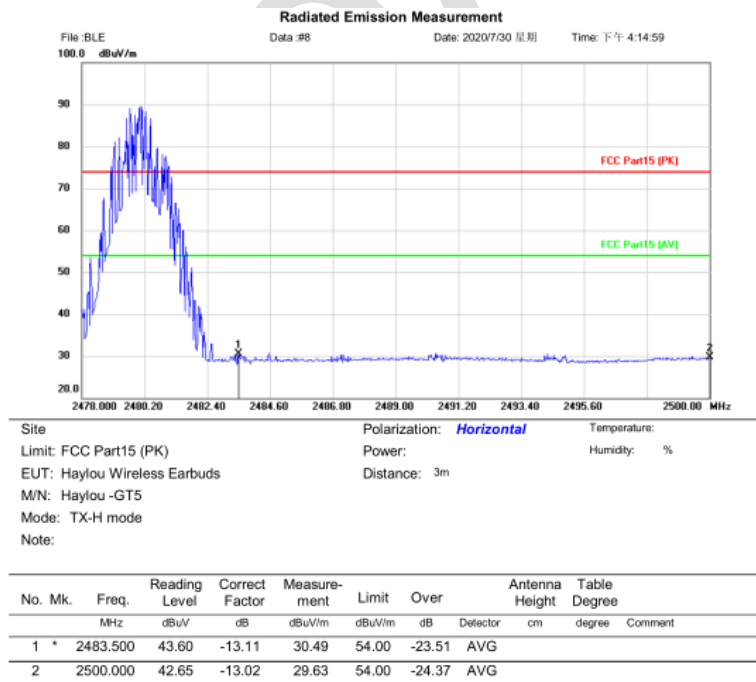
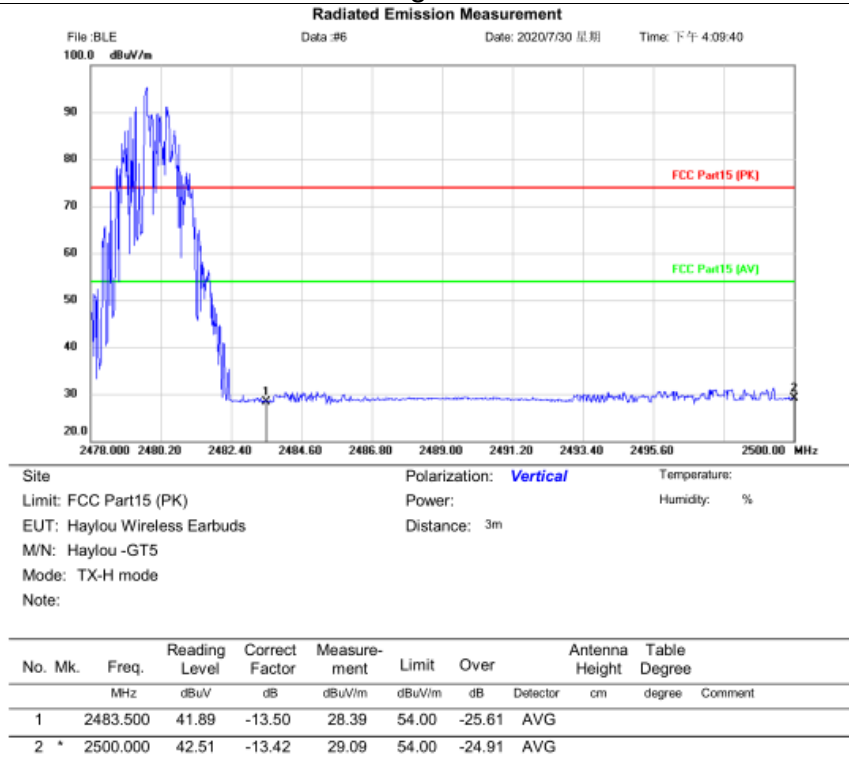


Site: Limit: FCC Part15 (PK) EUT: Haylou Wireless Earbuds M/N: Haylou -GT5 Mode: TX-H mode Note:

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	cm	degree	Comment
1		2483.500	54.27	-13.11	41.16	74.00	-32.84	peak		
2	*	2500.000	55.99	-13.02	42.97	74.00	-31.03	peak		

Average value:



Test Result: Pass

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

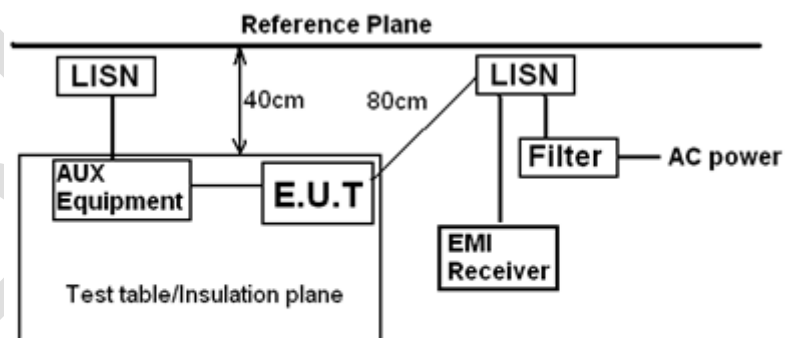
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX mode
Test Mode (Final Test)	TX mode
Tester	Eason
Temperature	25°C
Humidity	58%

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/50μH + 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.

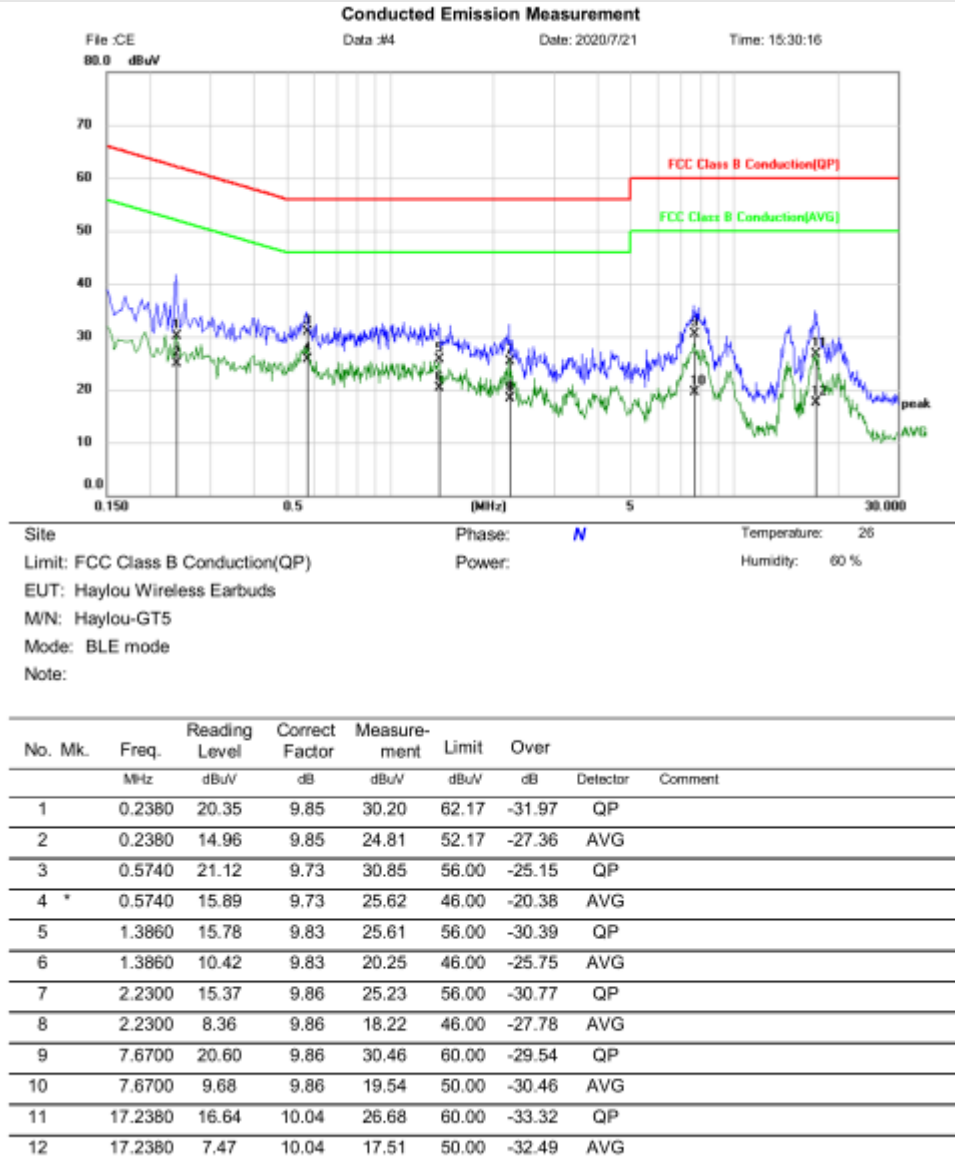
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Remark: $LISN = Read\ Level + Cable\ Loss + LISN\ Factor$

TEST DATA

[TestMode: TX mode]; [Line: Nutral]

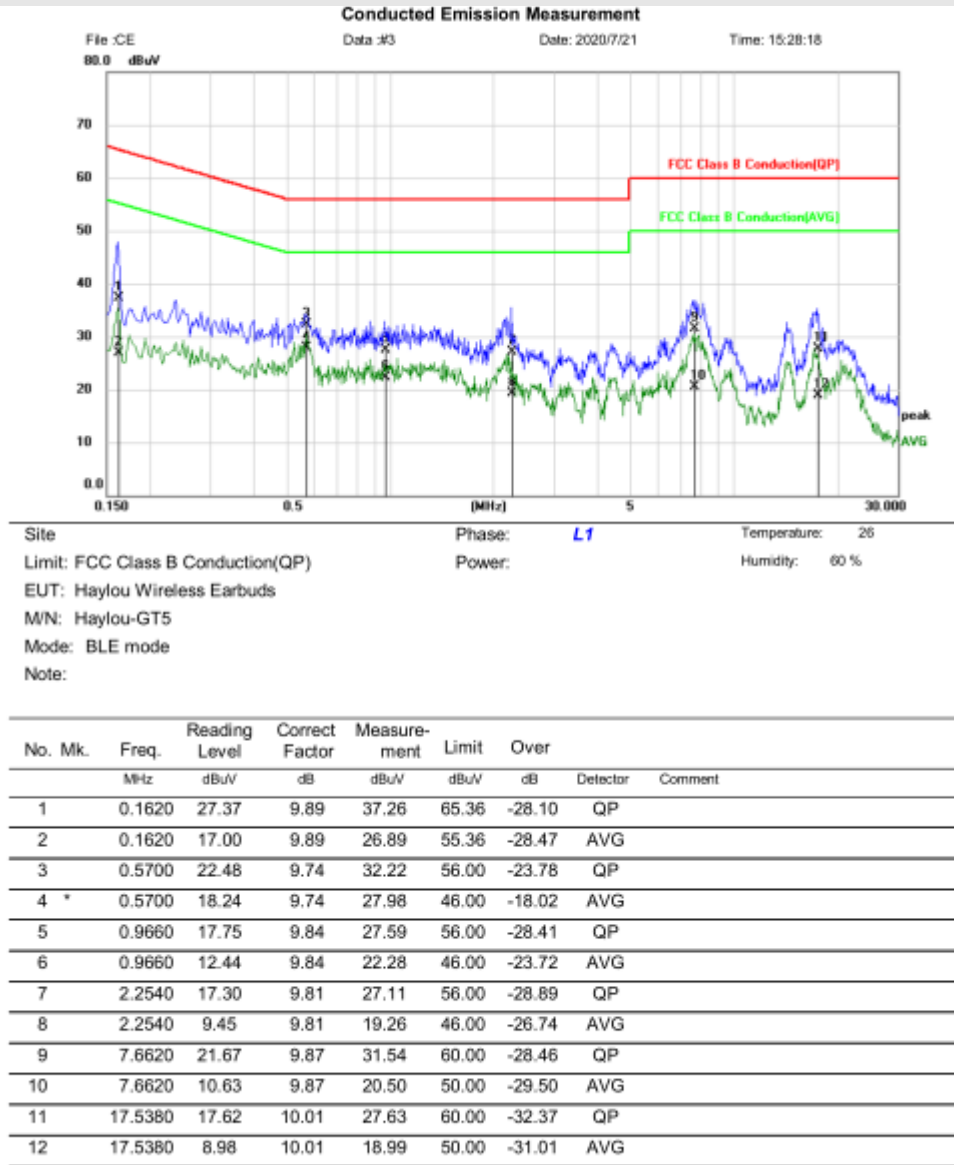
Power: AC120V/60Hz



Test Result: Pass

[TestMode: TX mode]; [Line: Line]

Power: AC120V/60Hz



Test Result: Pass

ANTENNA REQUIREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6 & Section 11.11

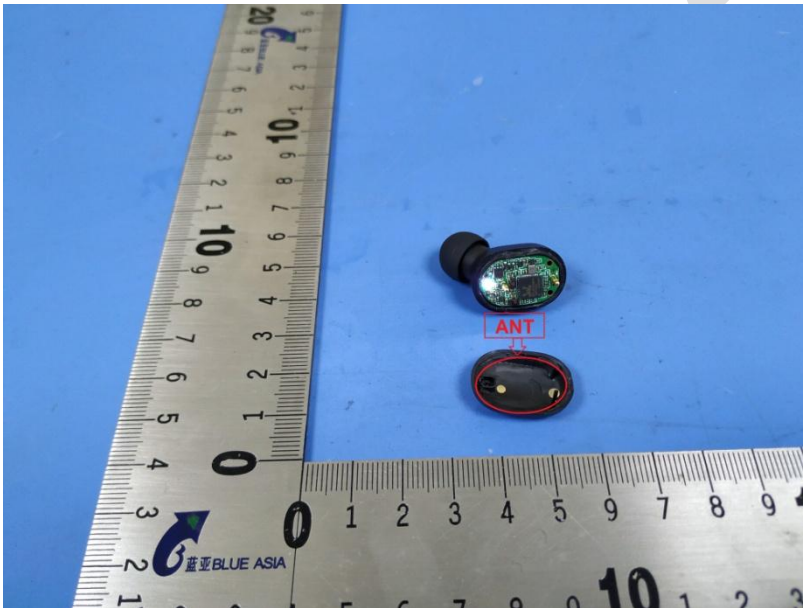
CONCLUSION

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 0.38dBi.



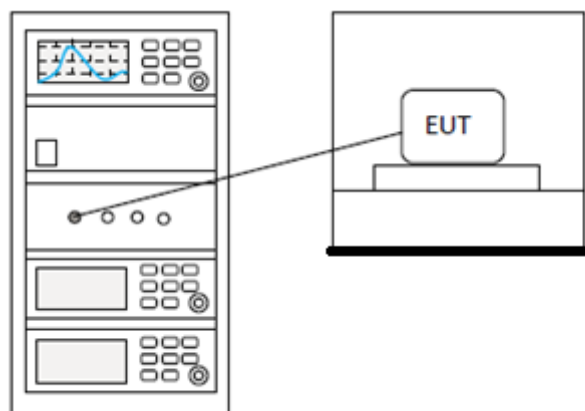
CONDUCTED SPURIOUS EMISSIONS

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	23°C
Humidity	48%

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

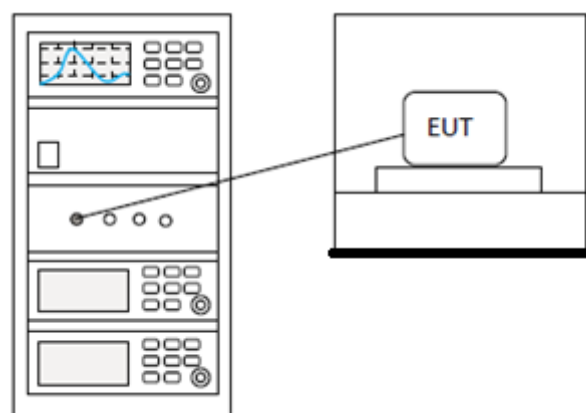
CONDUCTED BAND EDGES MEASUREMENT

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	23°C
Humidity	48%

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

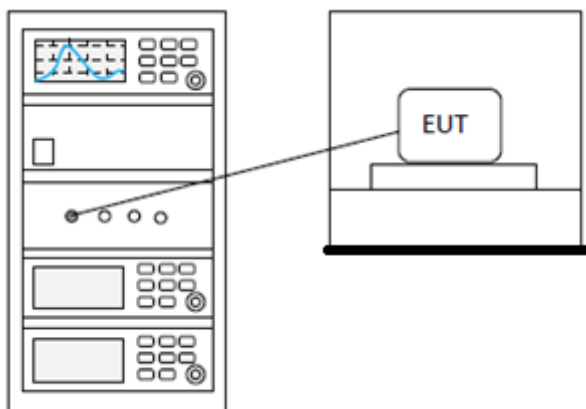
POWER SPECTRUM DENSITY

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	Eason
Temperature	23°C
Humidity	48%

LIMITS

Limit:	$\leq 8\text{dBm}$ in any 3 kHz band during any time interval of continuous transmission
---------------	--

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

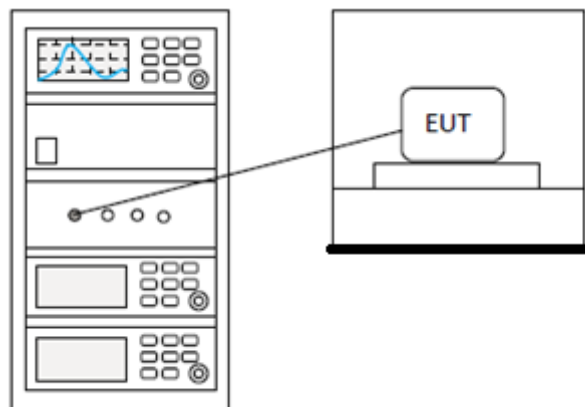
CONDUCTED PEAK OUTPUT POWER

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.5 & Section 11.9.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	23°C
Humidity	48%

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

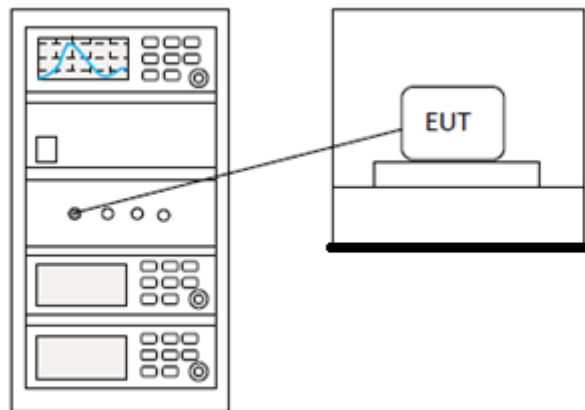
Pass: Please Refer To Appendix: Appendix1 For Details

BlueAsia

20DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.9
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Eason
Temperature	23℃
Humidity	48%

BLOCK DIAGRAM OF TEST SETUP



TEST DATA

N/A

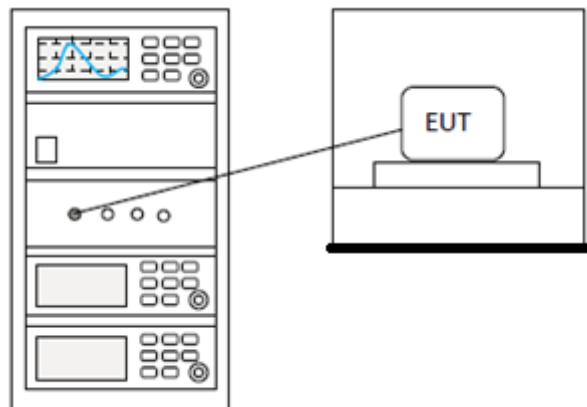
MINIMUM 6DB BANDWIDTH

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	Eason
Temperature	23°C
Humidity	48%

LIMITS

Limit:	≥ 500 kHz
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BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

10 APPENDIX

Appendix1

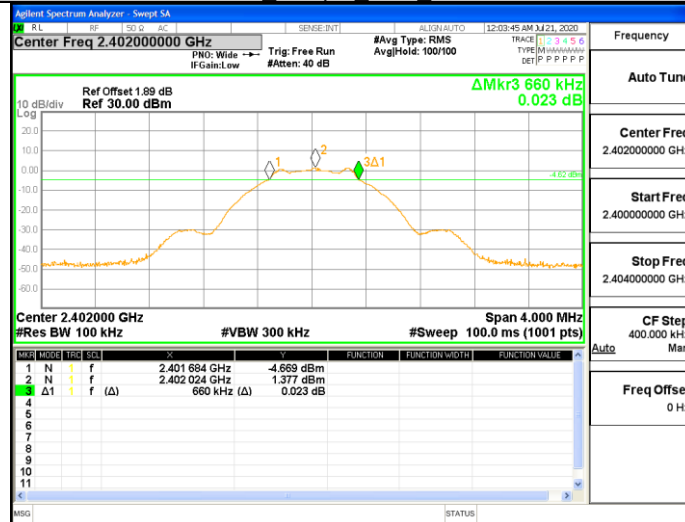
10.1 APPENDIX A: DTS BANDWIDTH

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1Mbps	Ant1	2402	0.660	2401.684	2402.344	≥ 0.5	PASS
		2442	0.668	2441.680	2442.348	≥ 0.5	PASS
		2480	0.672	2479.676	2480.348	≥ 0.5	PASS
BLE_2Mbps	Ant1	2402	1.148	2401.460	2402.608	≥ 0.5	PASS
		2442	1.120	2441.460	2442.580	≥ 0.5	PASS
		2480	1.124	2479.456	2480.580	≥ 0.5	PASS

Test Graphs

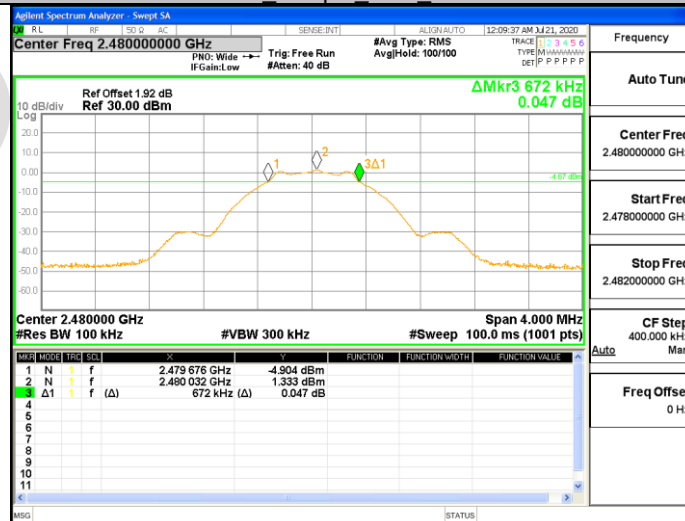
BLE 1Mbps Ant1 2402



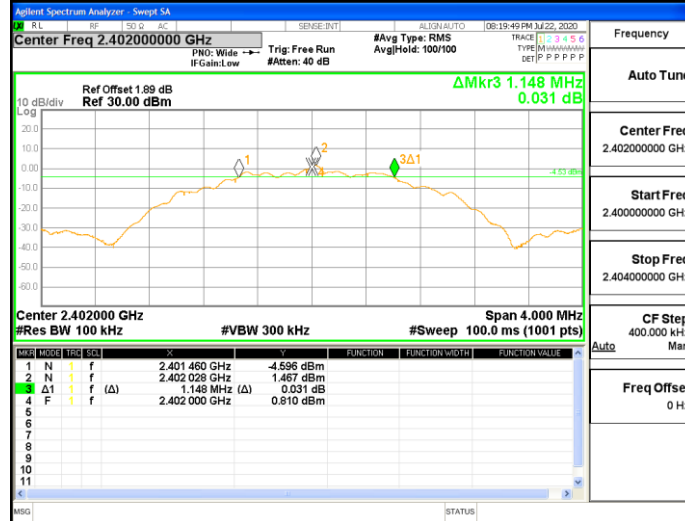
BLE 1Mbps Ant1 2442



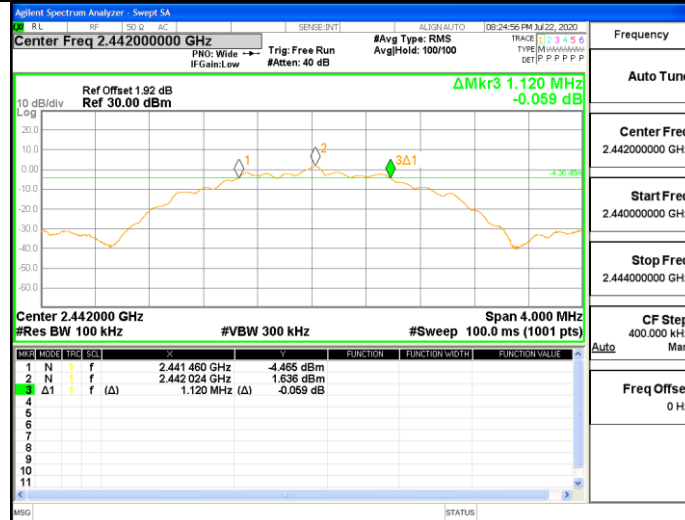
BLE 1Mbps Ant1 2480



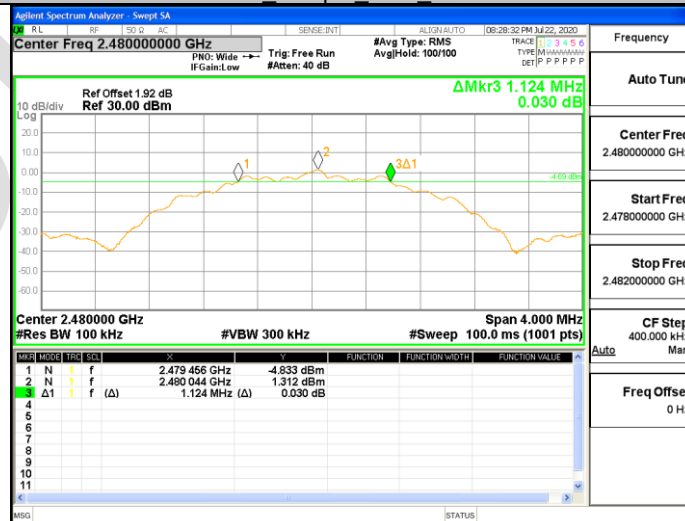
BLE 2Mbps Ant1 2402



BLE 2Mbps Ant1 2442



BLE 2Mbps Ant1 2480



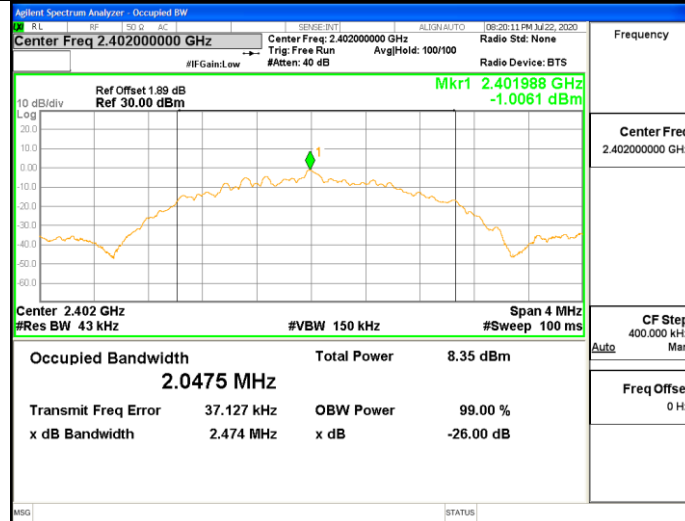
10.2 APPENDIX B: OCCUPIED CHANNEL BANDWIDTH**Test Result**

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_1Mbps	Ant1	2402	1.0240	2401.508	2402.532	---	PASS
		2442	1.0254	2441.508	2442.533	---	PASS
		2480	1.0258	2479.507	2480.533	---	PASS
BLE_2Mbps	Ant1	2402	2.0475	2401.013	2403.061	---	PASS
		2442	2.0502	2441.011	2443.061	---	PASS
		2480	2.0497	2479.009	2481.059	---	PASS

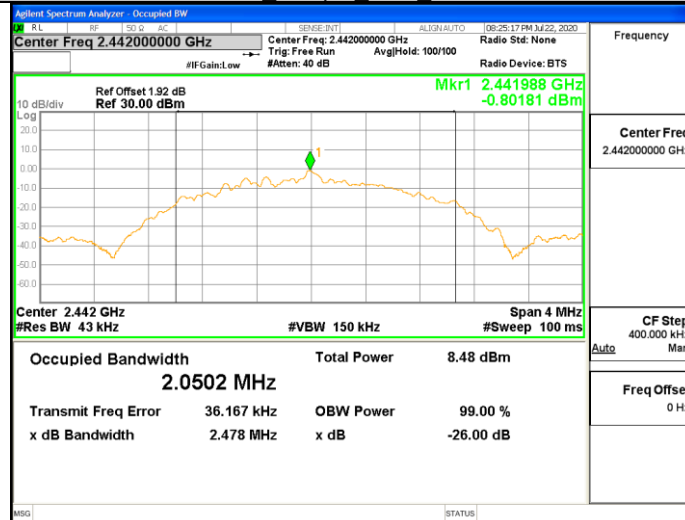
Test Graphs



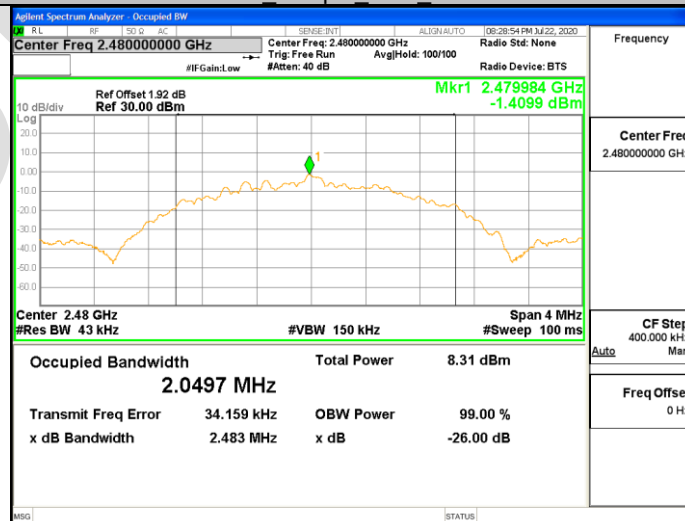
BLE 2Mbps Ant1 2402



BLE 2Mbps Ant1 2442



BLE 2Mbps Ant1 2480

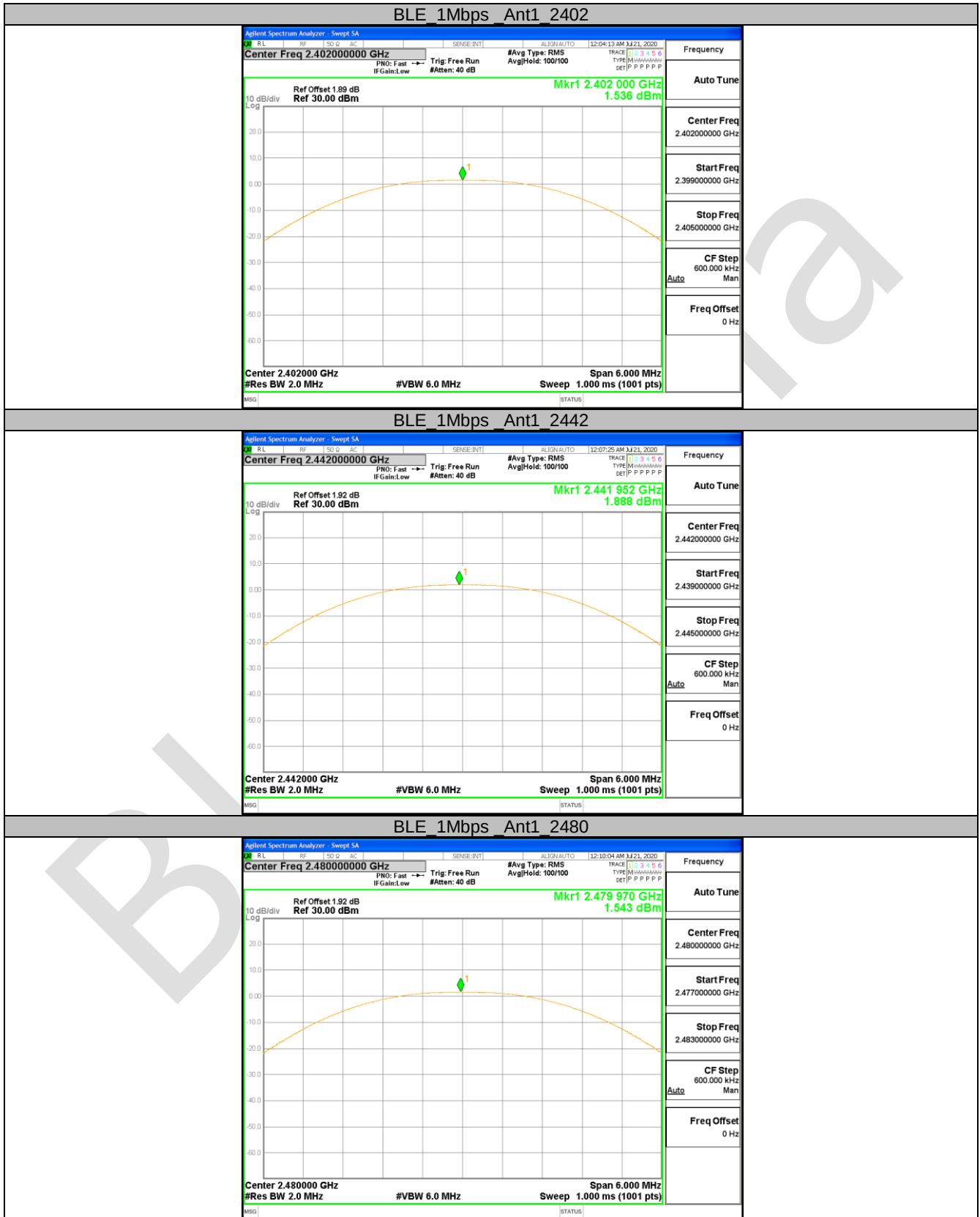


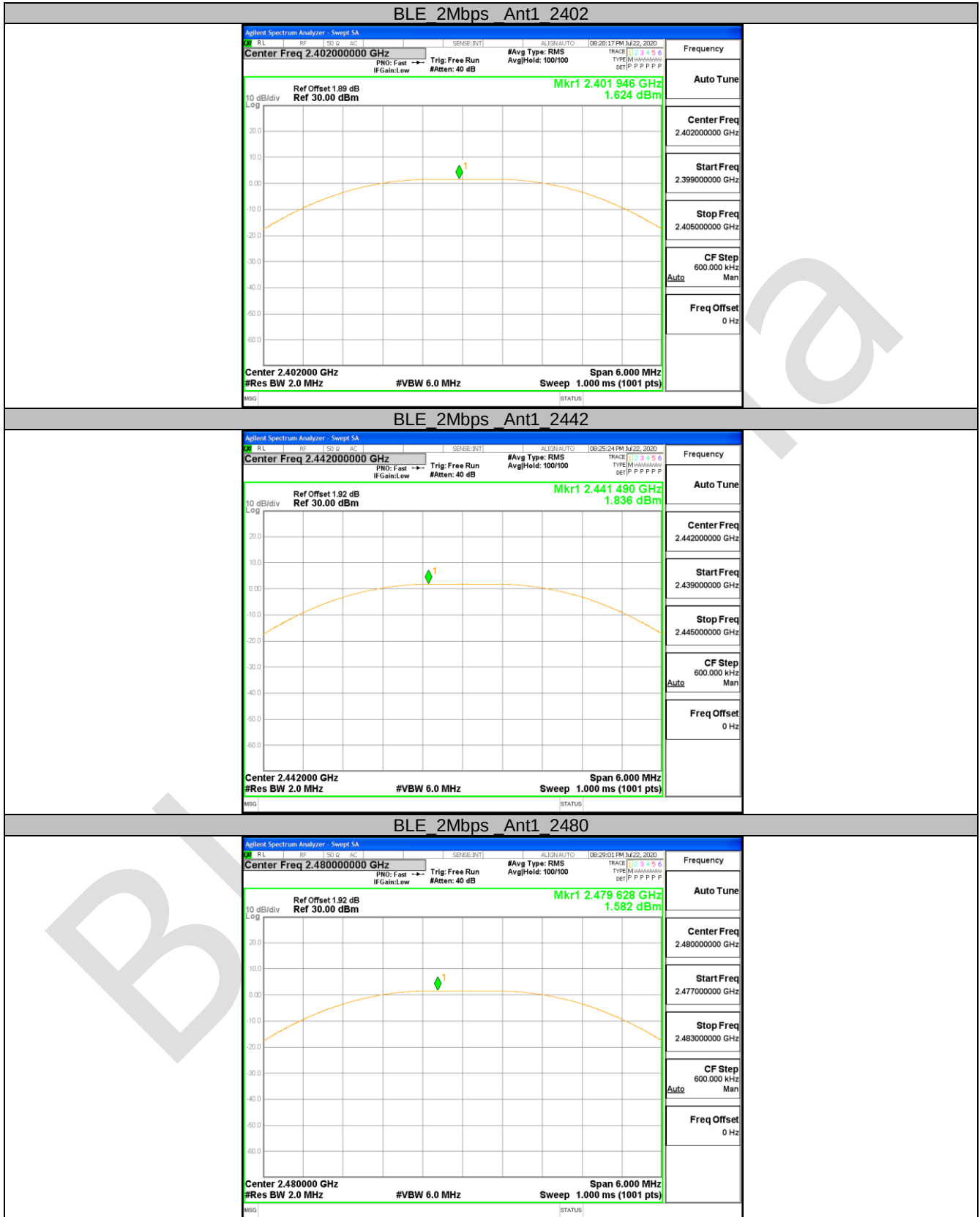
10.3 APPENDIX C: MAXIMUM CONDUCTED OUTPUT POWER

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1Mbps	Ant1	2402	1.54	<=30	PASS
		2442	1.89	<=30	PASS
		2480	1.54	<=30	PASS
BLE_2Mbps	Ant1	2402	1.62	<=30	PASS
		2442	1.84	<=30	PASS
		2480	1.58	<=30	PASS

Test Graphs

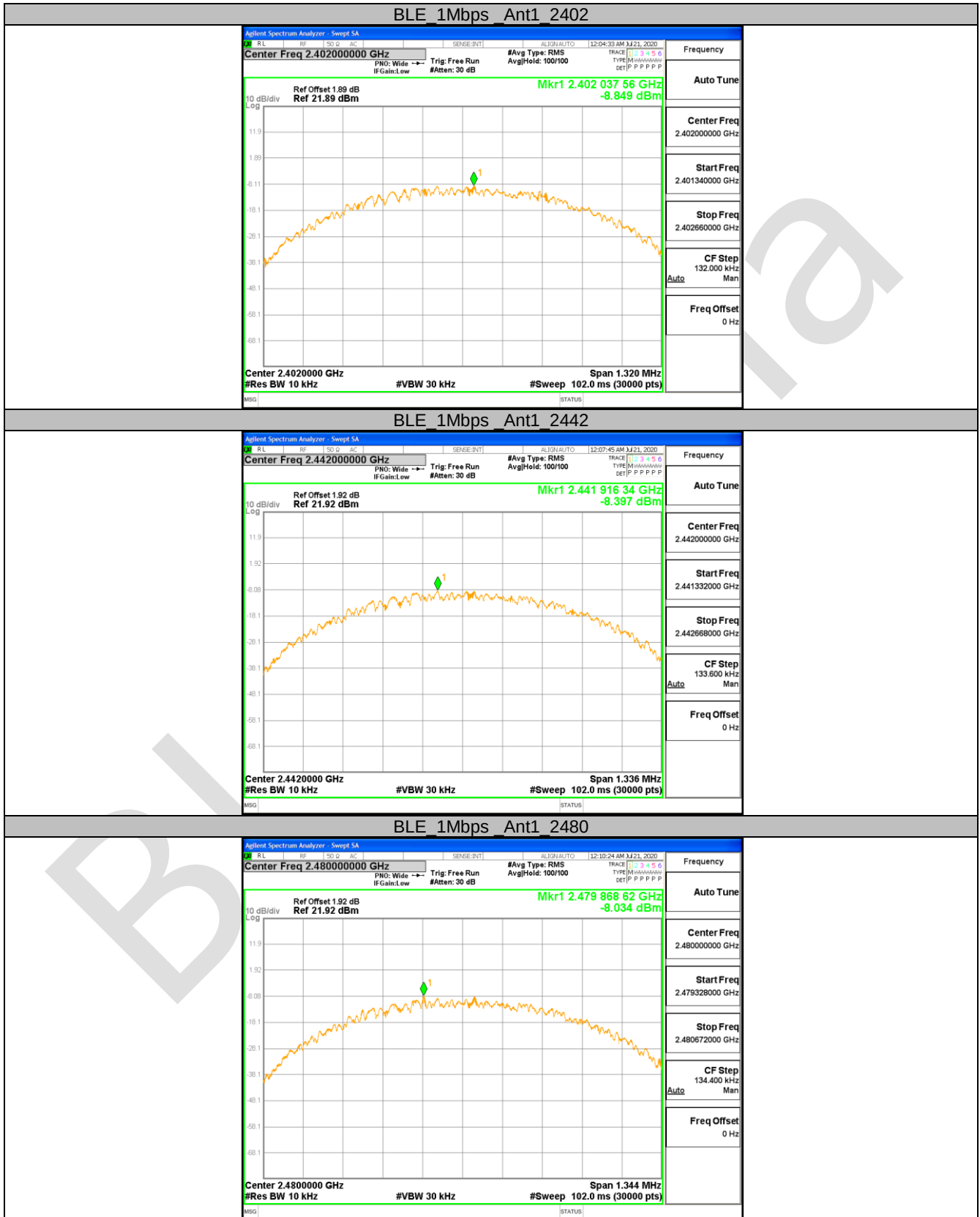




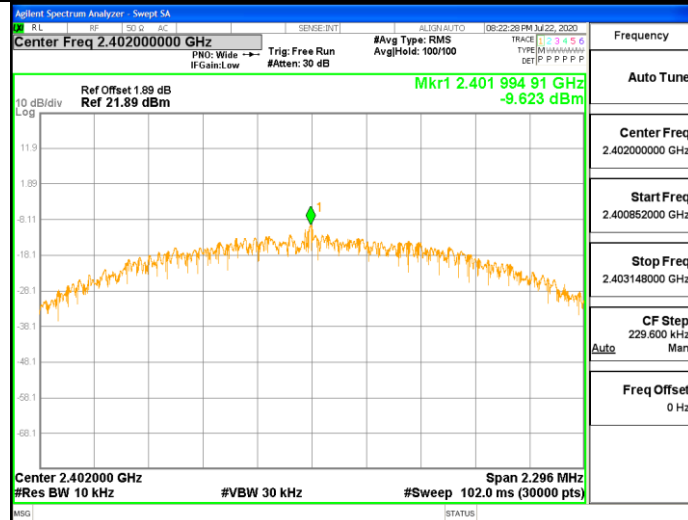
10.4 APPENDIX D: MAXIMUM POWER SPECTRAL DENSITY**Test Result**

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_1Mbps	Ant1	2402	-8.85	<=8	PASS
		2442	-8.4	<=8	PASS
		2480	-8.03	<=8	PASS
BLE_2Mbps	Ant1	2402	-9.62	<=8	PASS
		2442	-9.5	<=8	PASS
		2480	-10.16	<=8	PASS

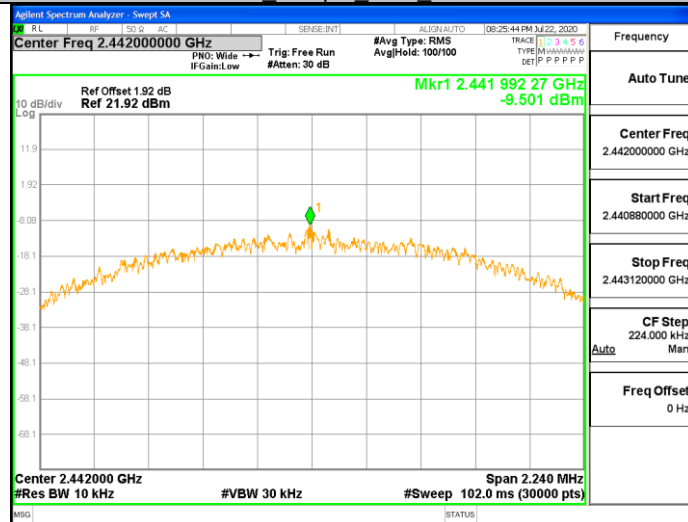
Test Graphs



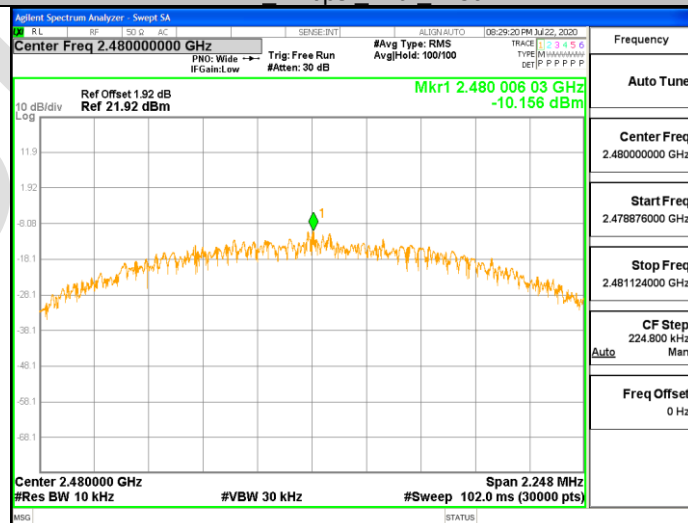
BLE 2Mbps Ant1 2402



BLE 2Mbps Ant1 2442



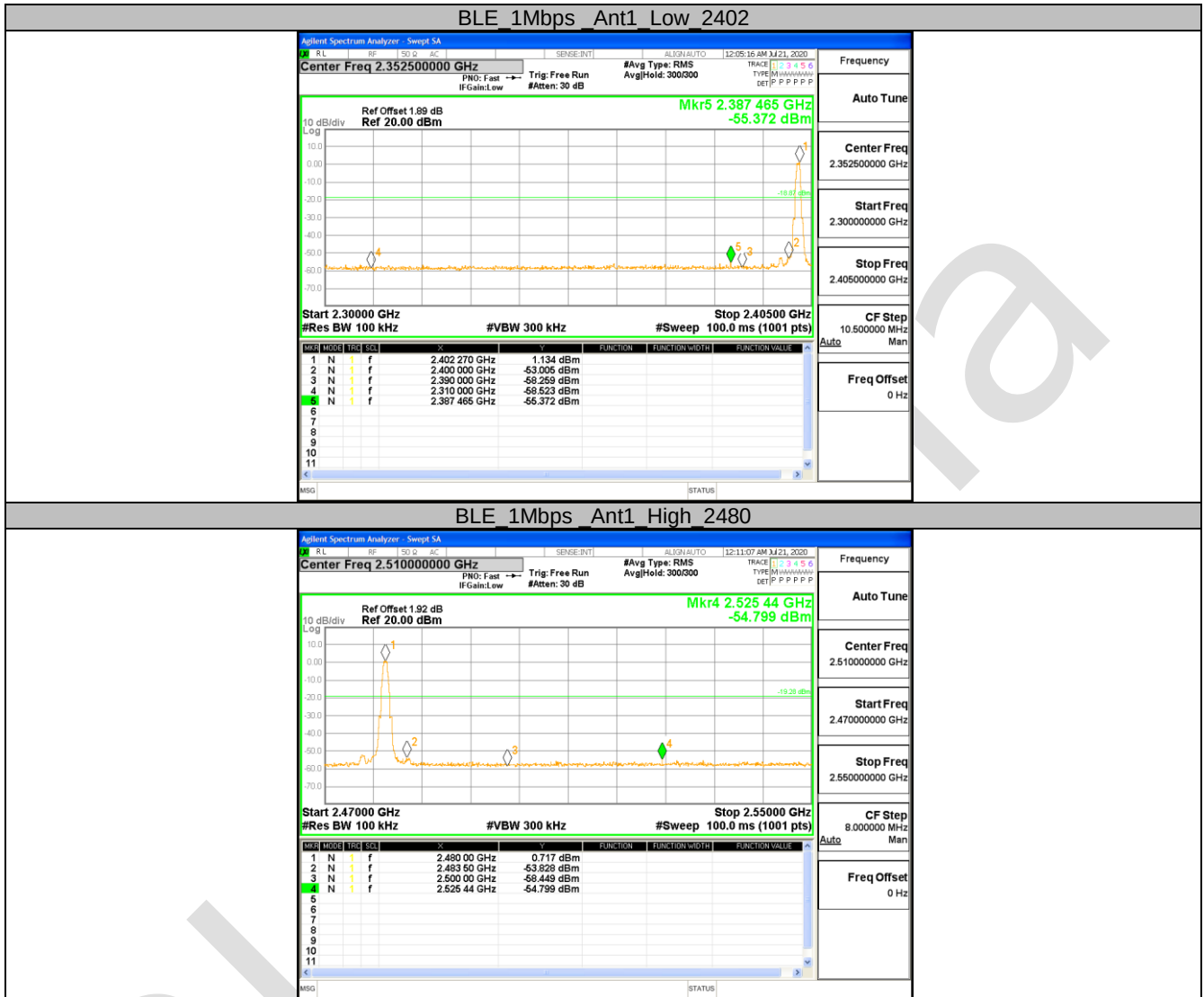
BLE 2Mbps Ant1 2480



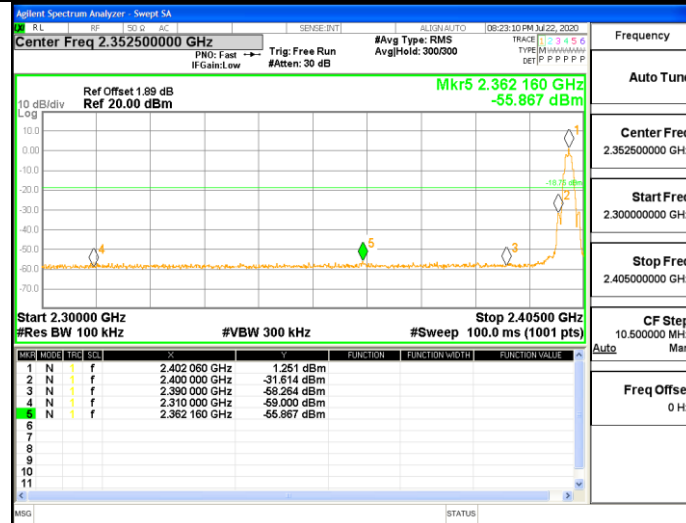
10.5 APPENDIX E: BAND EDGE MEASUREMENTS**Test Result**

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1Mbps	Ant1	Low	2402	1.13	-55.37	≤ -18.87	PASS
		High	2480	0.72	-54.8	≤ -19.28	PASS
BLE_2Mbps	Ant1	Low	2402	1.25	-55.87	≤ -18.75	PASS
		High	2480	1.25	-55.66	≤ -18.75	PASS

Test Graphs



BLE 2Mbps Ant1 Low 2402



BLE 2Mbps Ant1 High 2480

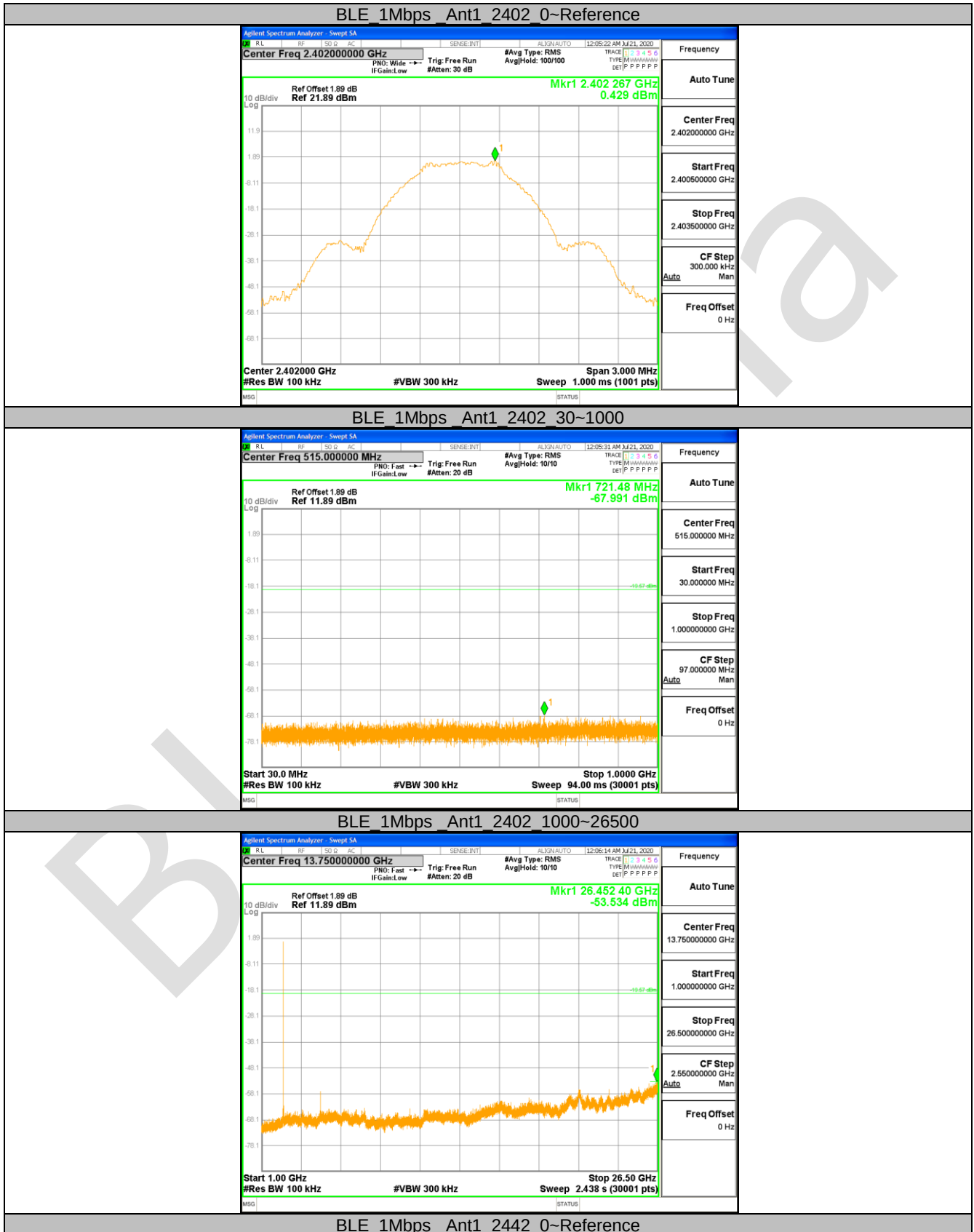


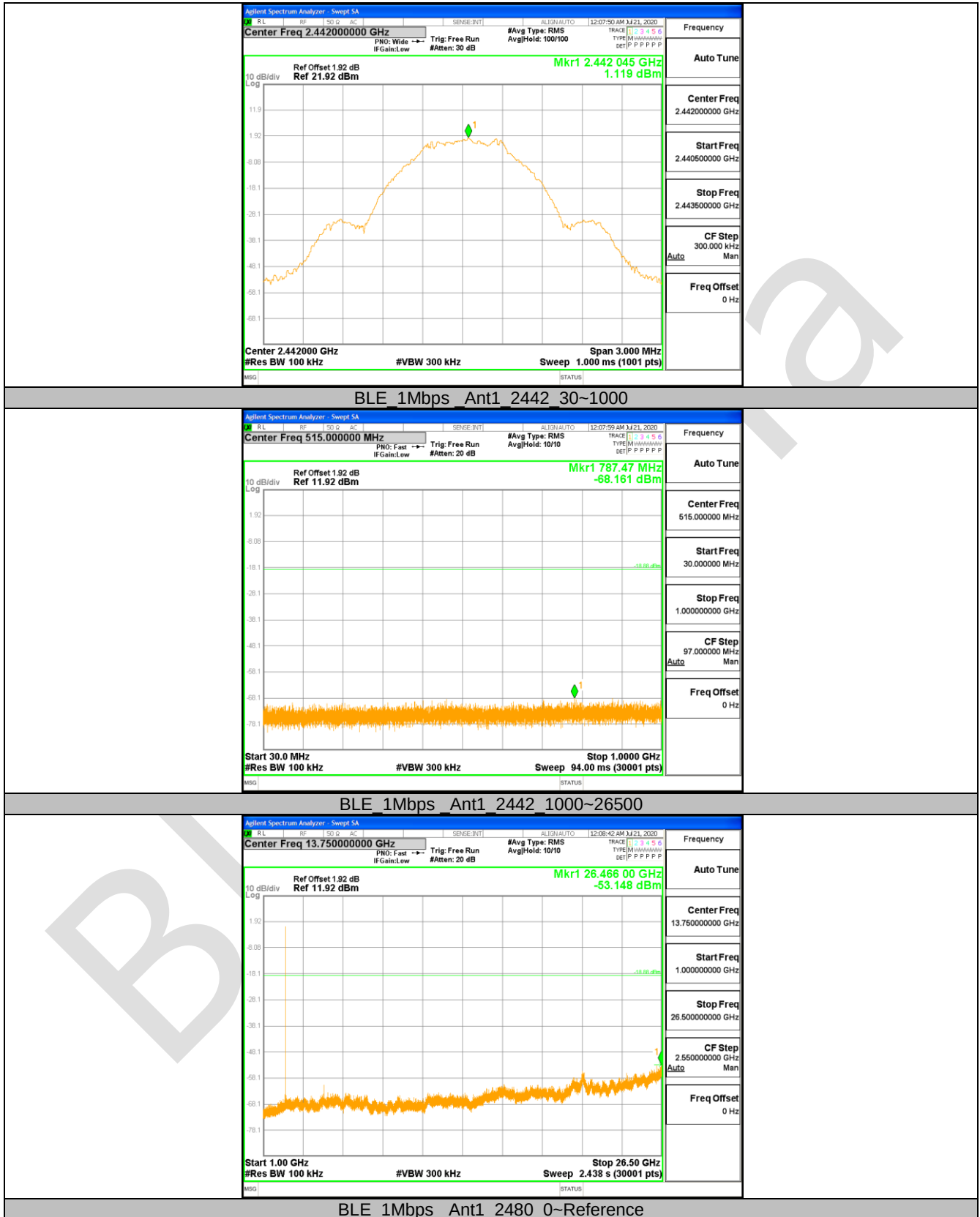
10.6 APPENDIX F: CONDUCTED SPURIOUS EMISSION

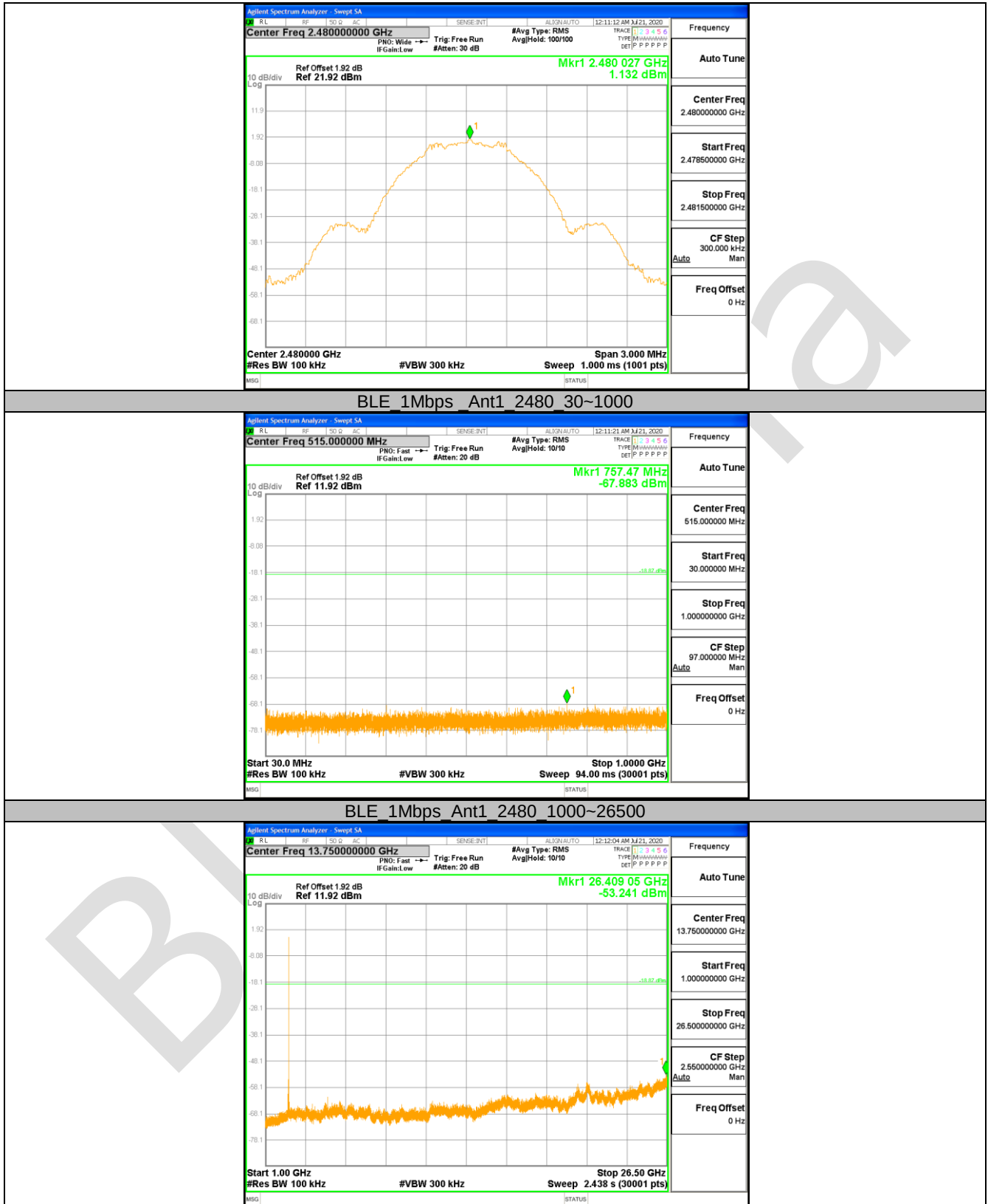
Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1Mbps	Ant1	2402	Reference	0.43	0.43	---	PASS
			30~1000	30~1000	-67.991	<=-19.571	PASS
			1000~26500	1000~26500	-53.534	<=-19.571	PASS
		2442	Reference	1.12	1.12	---	PASS
			30~1000	30~1000	-68.161	<=-18.881	PASS
			1000~26500	1000~26500	-53.148	<=-18.881	PASS
		2480	Reference	1.13	1.13	---	PASS
			30~1000	30~1000	-67.883	<=-18.868	PASS
			1000~26500	1000~26500	-53.241	<=-18.868	PASS
BLE_2Mbps	Ant1	2402	Reference	0.14	0.14	---	PASS
			30~1000	30~1000	-67.306	<=-19.856	PASS
			1000~26500	1000~26500	-53.562	<=-19.856	PASS
		2442	Reference	0.73	0.73	---	PASS
			30~1000	30~1000	-66.461	<=-19.268	PASS
			1000~26500	1000~26500	-53.667	<=-19.268	PASS
		2480	Reference	1.12	1.12	---	PASS
			30~1000	30~1000	-67.12	<=-18.881	PASS
			1000~26500	1000~26500	-53.689	<=-18.881	PASS

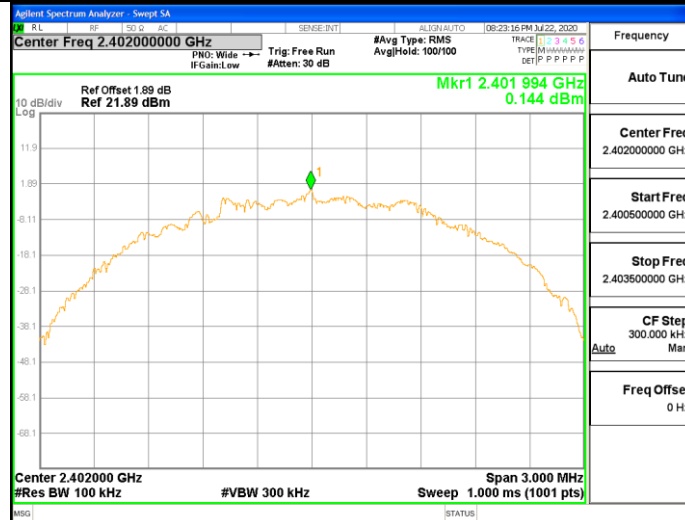
Test Graphs



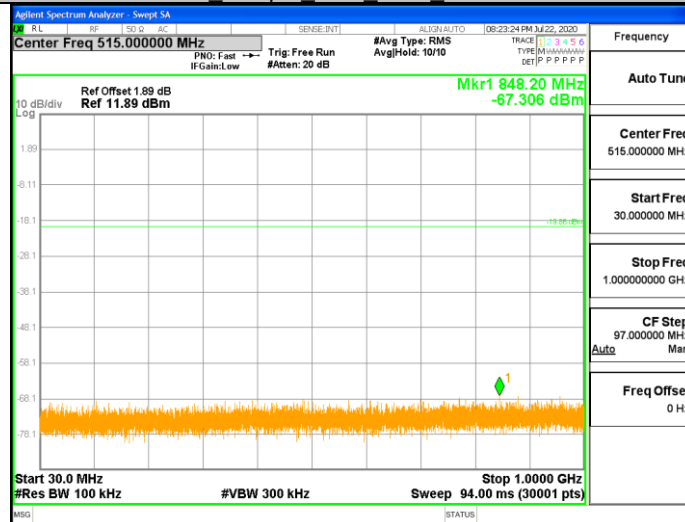




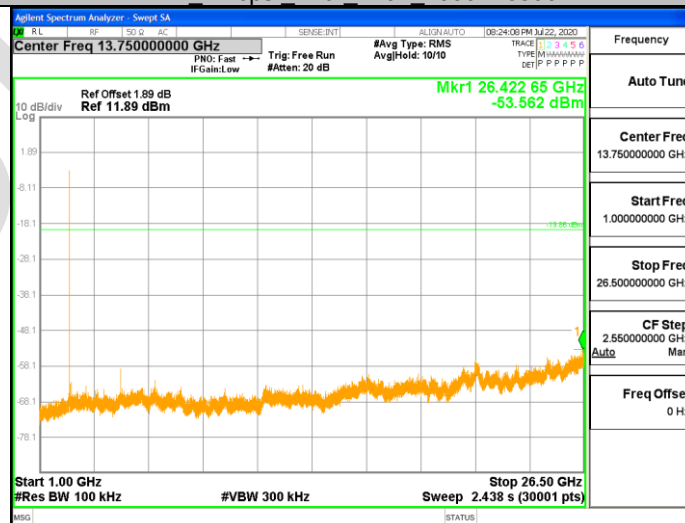
BLE 2Mbps Ant1 2402 0~Reference



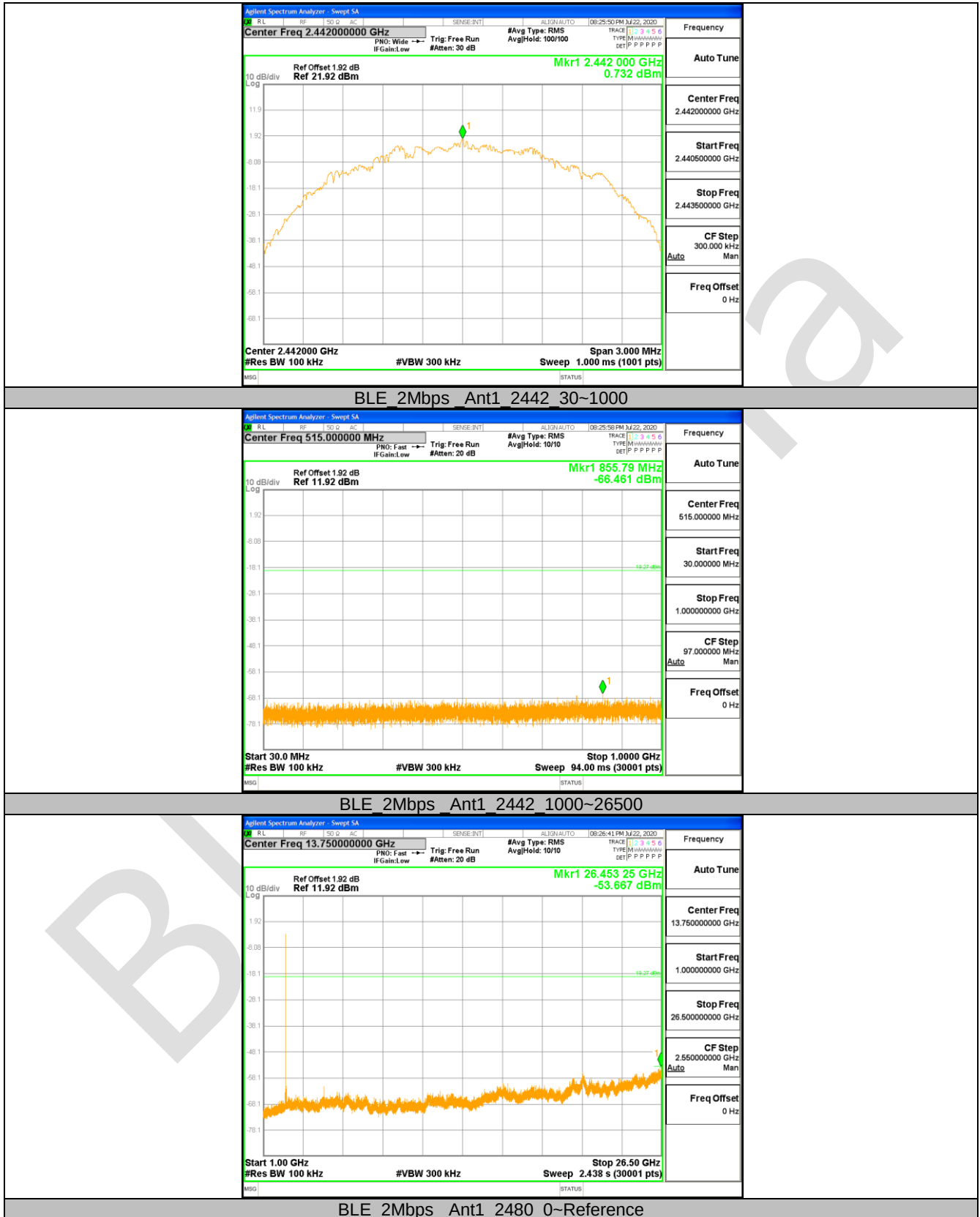
BLE 2Mbps Ant1 2402 30~1000

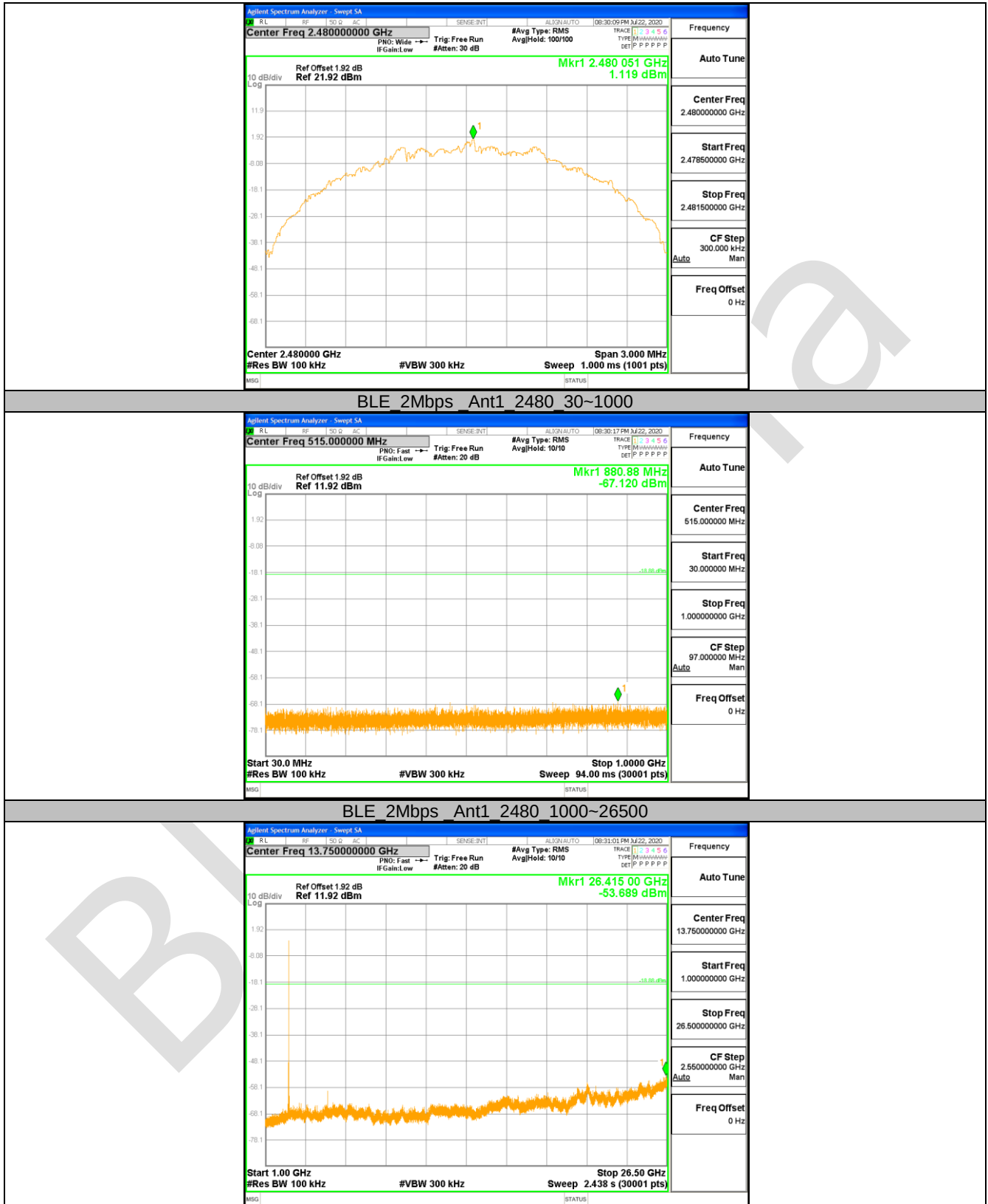


BLE 2Mbps Ant1 2402 1000~26500



BLE 2Mbps Ant1 2442 0~Reference





APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Radiated Spurious Emissions



Conducted Emissions at AC Power Line (150kHz-30MHz)**APPENDIX B: PHOTOGRAPHS OF EUT**

Reference to the test report No. BLA-EMC-202007-A5101

----END OF REPORT----

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