

TEST REPORT

Product Name : Smart Mini Pro Projector
Brand Mark : N/A
Model No. : M1200S
FCC ID : 2AW96-M1200S
Report Number : BLA-EMC-202012-A1502
Date of Sample Receipt : 2020/12/3
Date of Test : 2020/12/3 to 2020/12/17
Date of Issue : 2021/01/15
Test Standard : 47 CFR Part 15, Subpart C 15.247
Test Result : Pass

Prepared for:

Telstar USA LLC

9817 Valley View Road, Eden Prairie, MN, US

Prepared by:

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

**Building C, No. 107, Shihuan Road, Shiyao Sub-District, Baoan District,
Shenzhen, Guangdong Province, China**

TEL: +86-755-23059481

Compiled by:

Ben Tang

Review by:

Sweet. Liang

Approved by:

Jamen Li

Date:

2021/01/15



REPORT REVISE RECORD

Version No.	Date	Description
00	2021/01/15	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 15.209 & 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	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 7.8.6	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
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
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)(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
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	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	Pass

2 GENERAL INFORMATION

Applicant	Telstar USA LLC
Address	9817 Valley View Road, Eden Prairie, MN, US
Manufacturer	Telstar USA LLC
Address	9817 Valley View Road, Eden Prairie, MN, US
Factory	N/A
Address	N/A
Product Name	Smart Mini Pro Projector
Test Model No.	M1200S

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	N/A
Software Version	N/A
Operation Frequency:	2402MHz-2480MHz
Modulation Type:	GFSK
Channel Spacing:	2MHz
Number of Channels:	40
Antenna Type:	Internal Antenna
Antenna Gain:	3.0dBi(Provided by the customer)

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25°C	19Vdc

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX	Keep the EUT in transmitting mode
TX Low channel	Keep the EUT in continuously transmitting mode in low channel
TX middle channel	Keep the EUT in continuously transmitting mode in middle channel
TX high channel	Keep the EUT in continuously transmitting mode in high channel
Remark: Only the data of the worst mode would be recorded in this report.	

6 MEASUREMENT UNCERTAINTY

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

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
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 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	7/1/2020	6/30/2021
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2021
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2021
Amplifier	SKET	PA-000318G-45	N/A	7/1/2020	6/30/2021
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 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	7/1/2020	6/30/2021
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2021
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2021

Amplifier	SKET	PA-000318G-45	N/A	7/1/2020	6/30/2021
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	7/1/2020	6/30/2021
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
Spectrum	R&S	FSP40	100817	7/1/2020	6/30/2021
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	7/1/2020	6/30/2021
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 Carrier Frequencies Separation

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/1/2020	6/30/2021
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	7/1/2020	6/30/2021
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 Minimum 6dB Bandwidth

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/1/2020	6/30/2021
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 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	7/1/2020	6/30/2021
LISN	AT	AT166-2	AKK1806000003	12/17/2019	12/16/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A

1 RADIATED SPURIOUS EMISSIONS

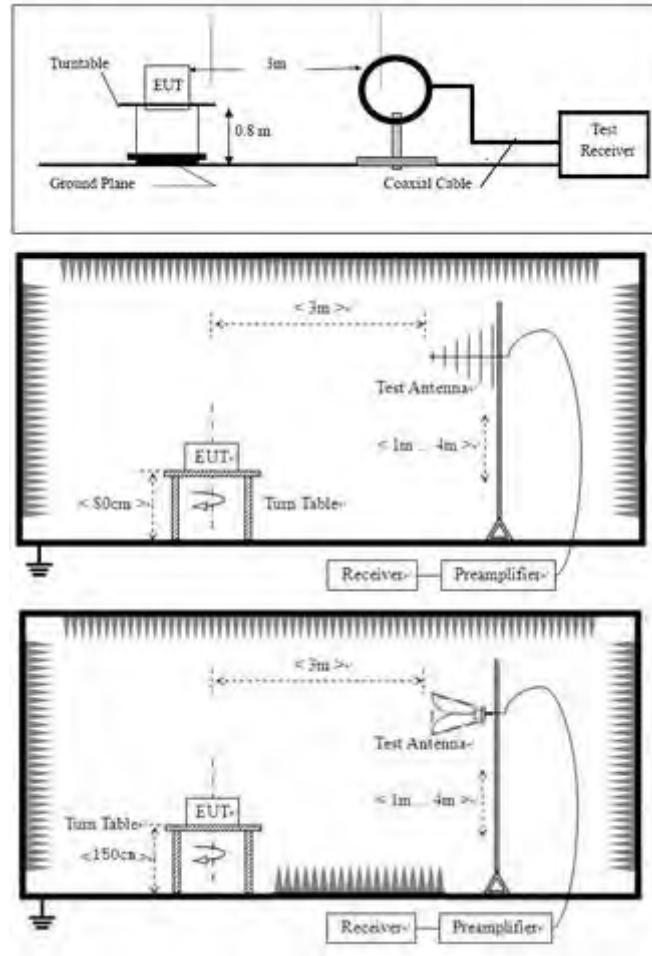
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX Low channel;TX middle channel;TX high channel
Test Mode (Final Test)	TX Low channel;TX middle channel;TX high channel
Tester	Ben
Temperature	25℃
Humidity	60%

1.1 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.

1.2 BLOCK DIAGRAM OF TEST SETUP



1.3 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.

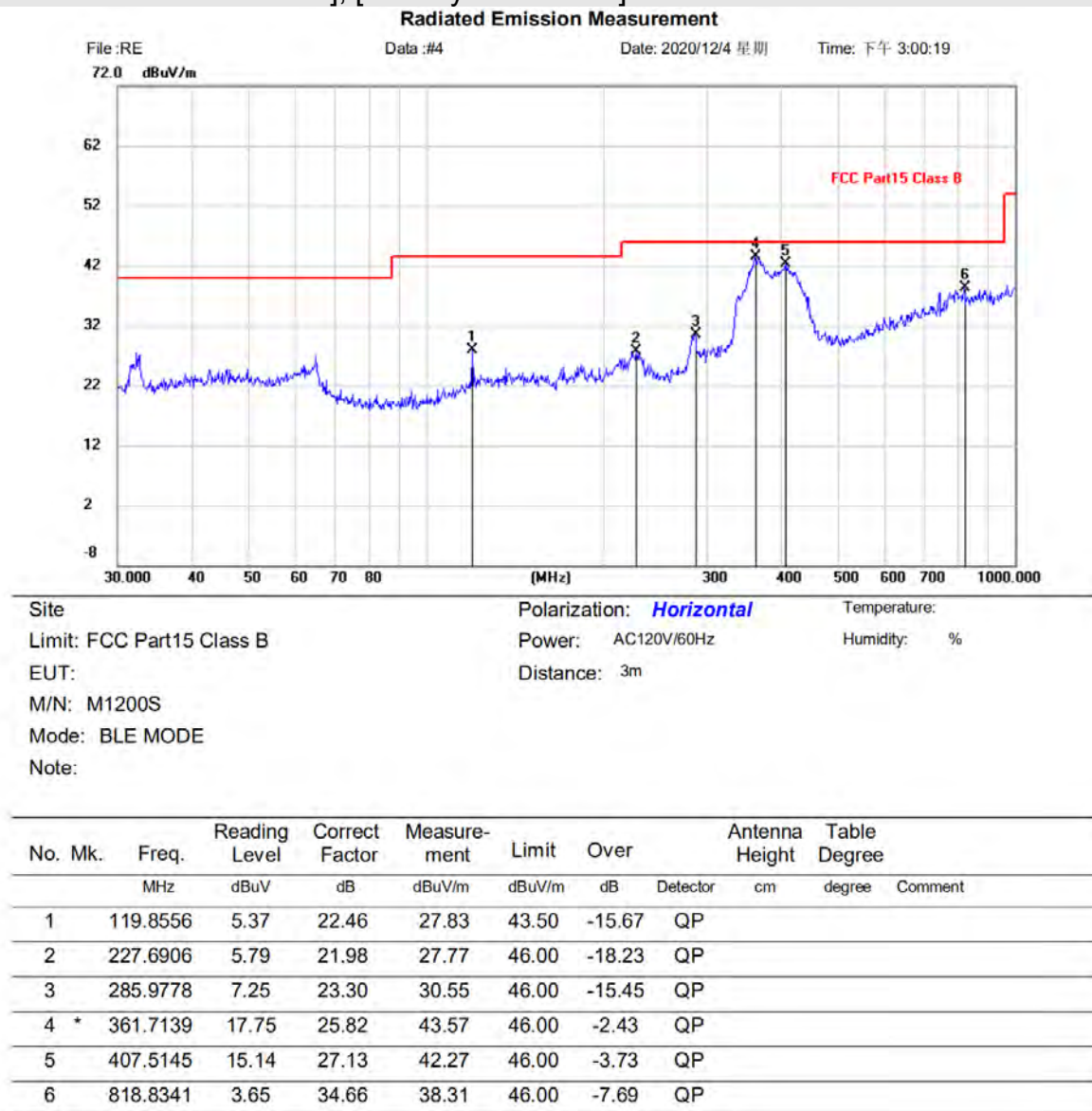
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was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

1.4 TEST DATA

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

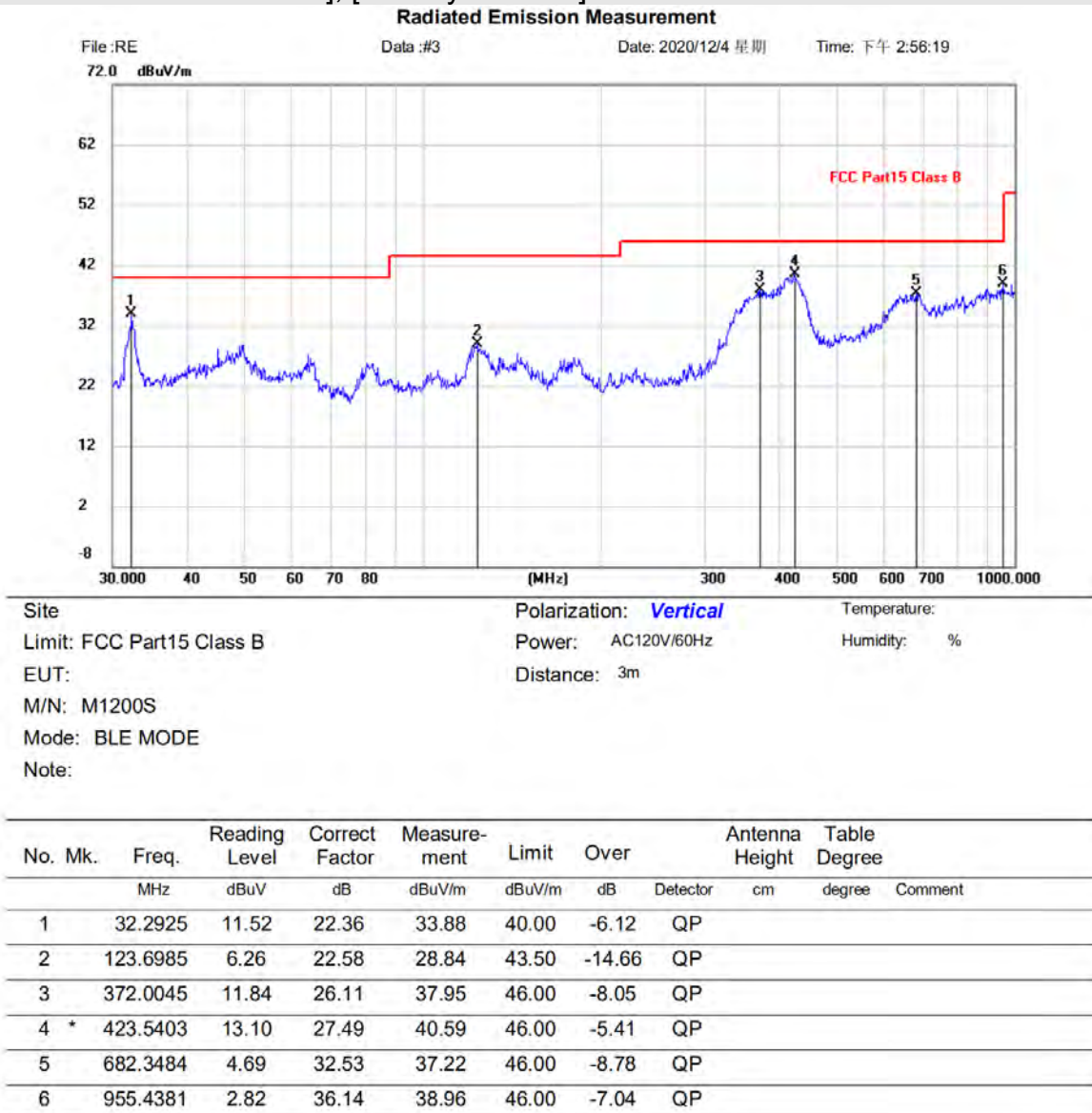


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

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

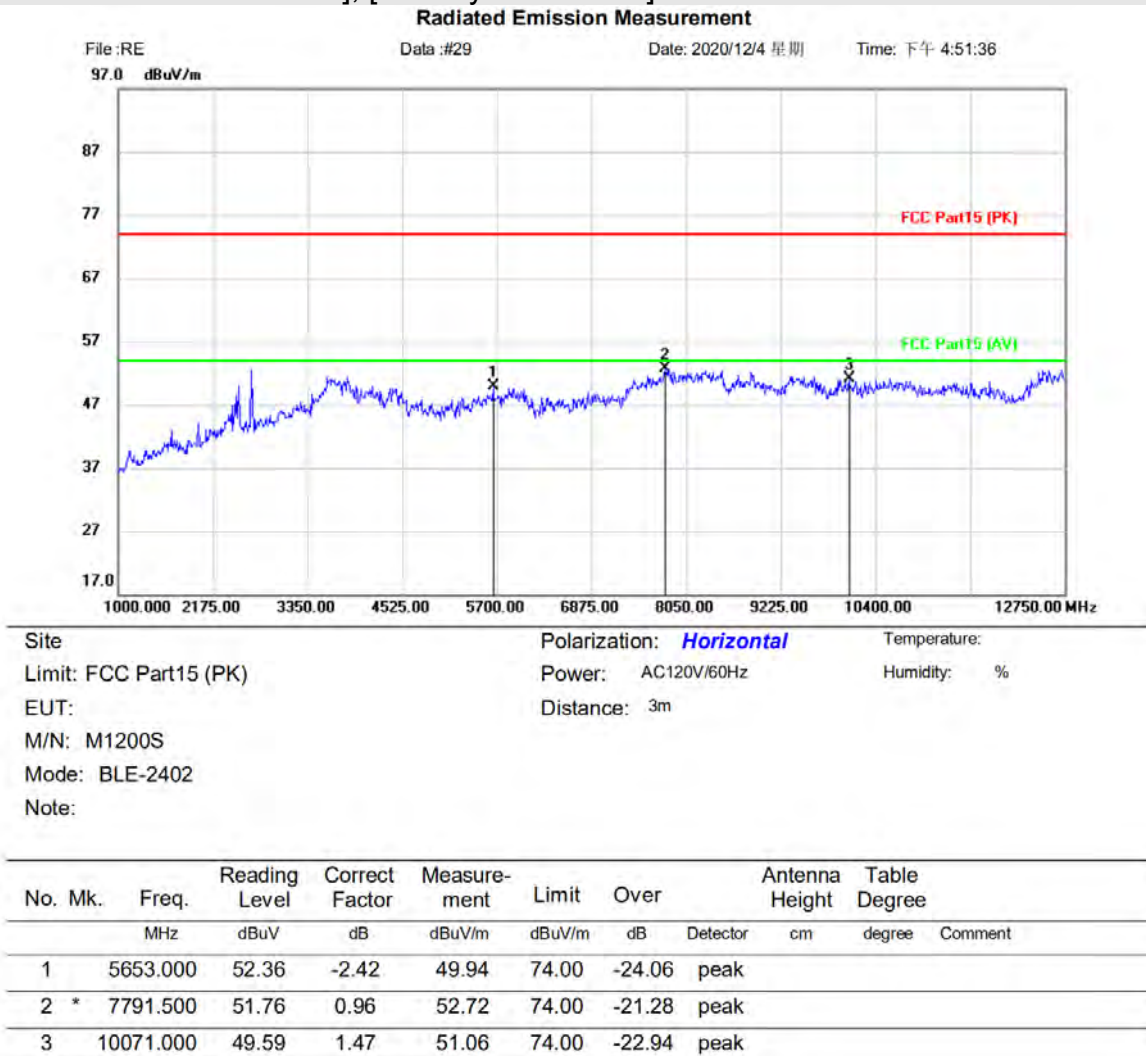


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

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

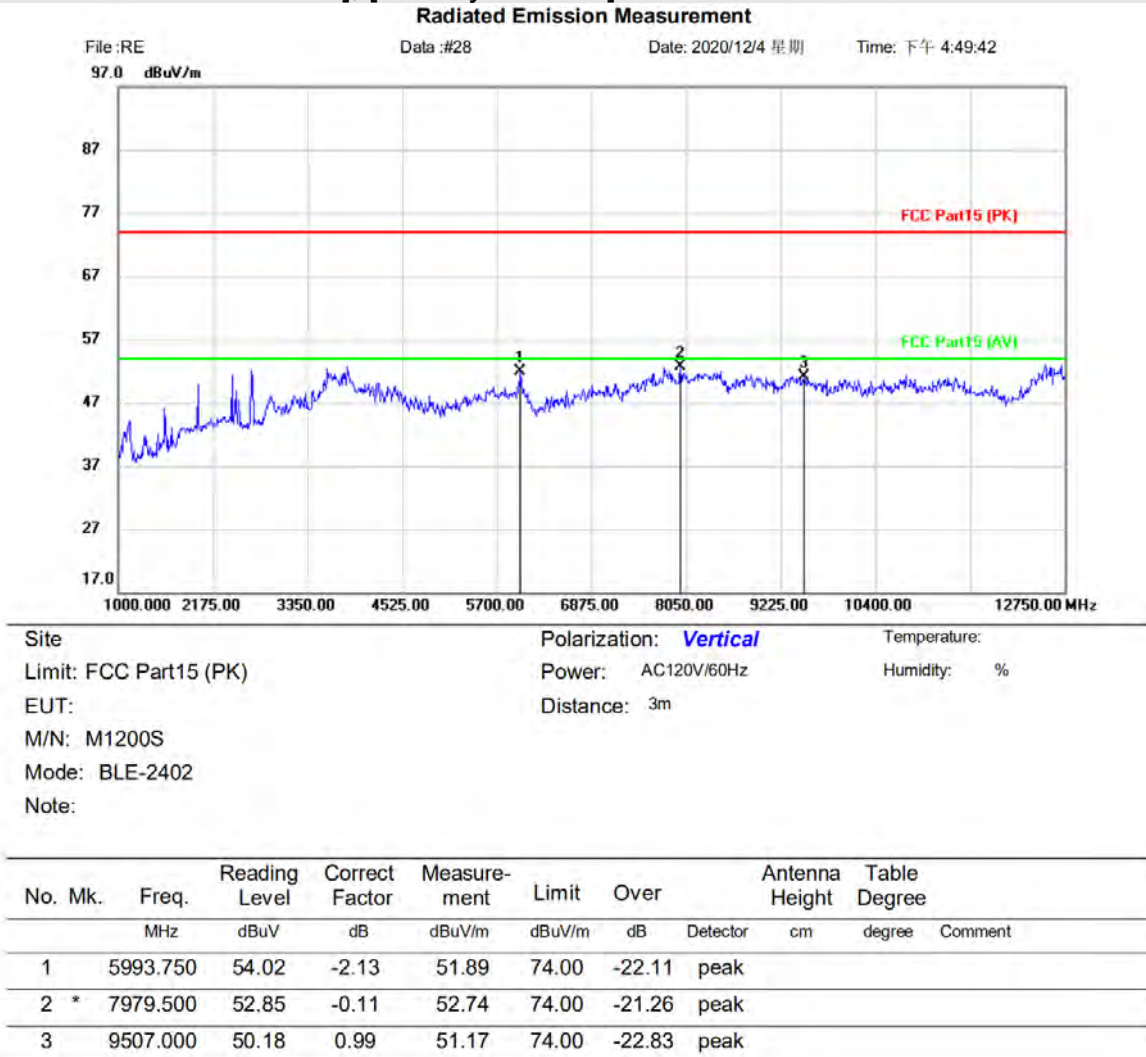


*:Maximum data x:Over limit !:over margin

〈Reference Only

Test Result: Pass

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

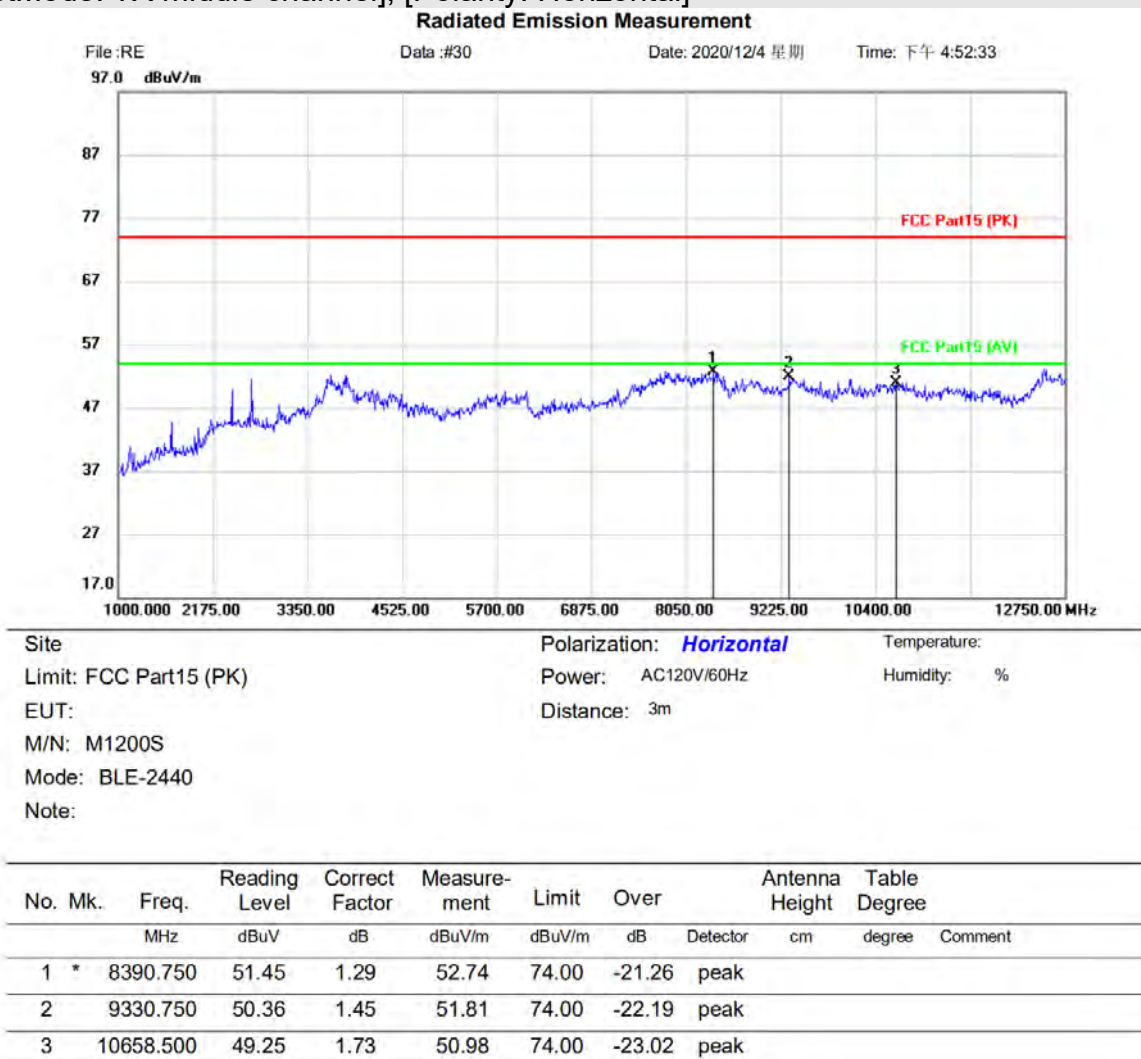


*:Maximum data x:Over limit !:over margin

<Reference Only

Test Result: Pass

[TestMode: TX middle channel]; [Polarity: Horizontal]

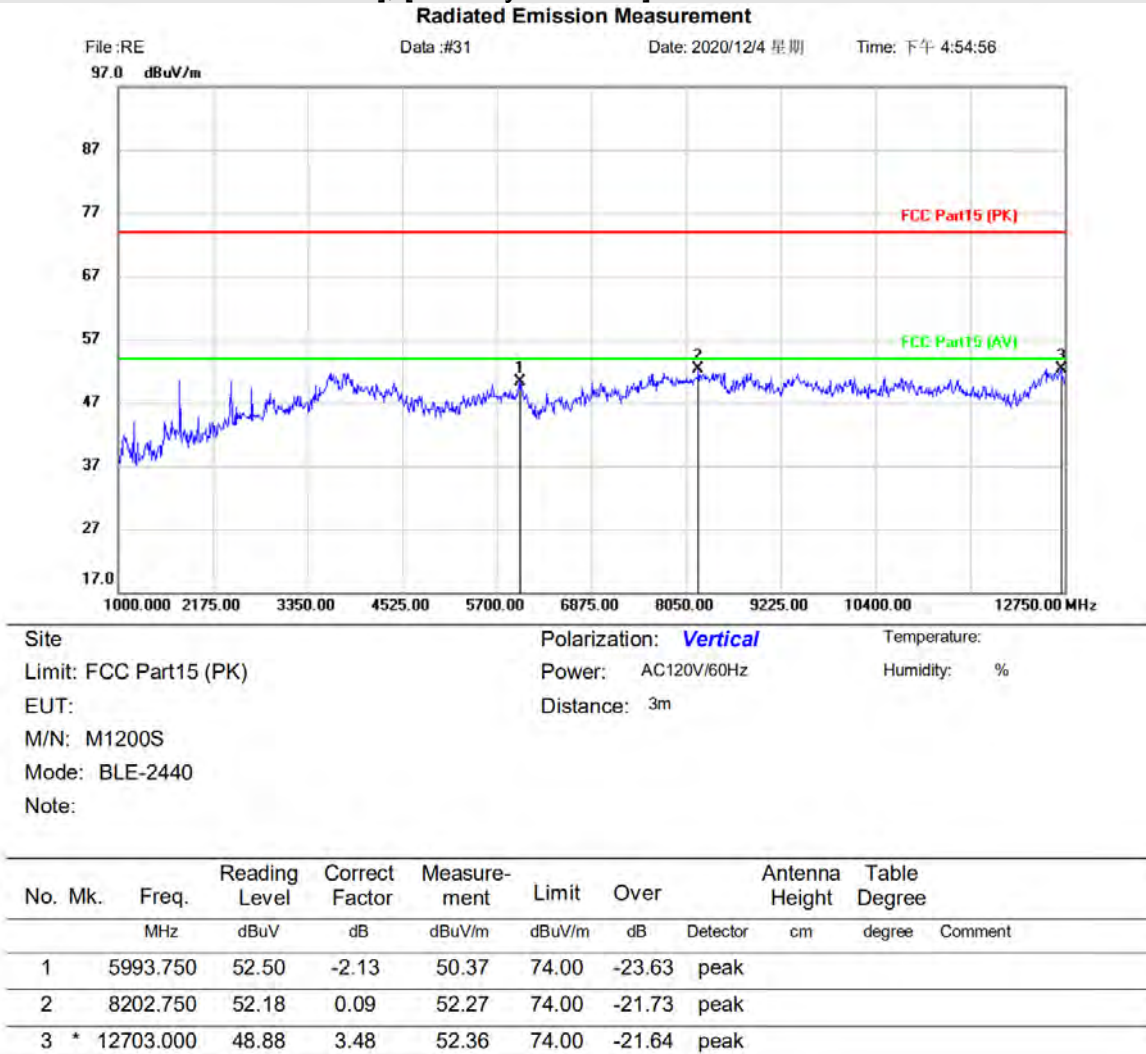


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

[TestMode: TX middle channel]; [Polarity: Vertical]

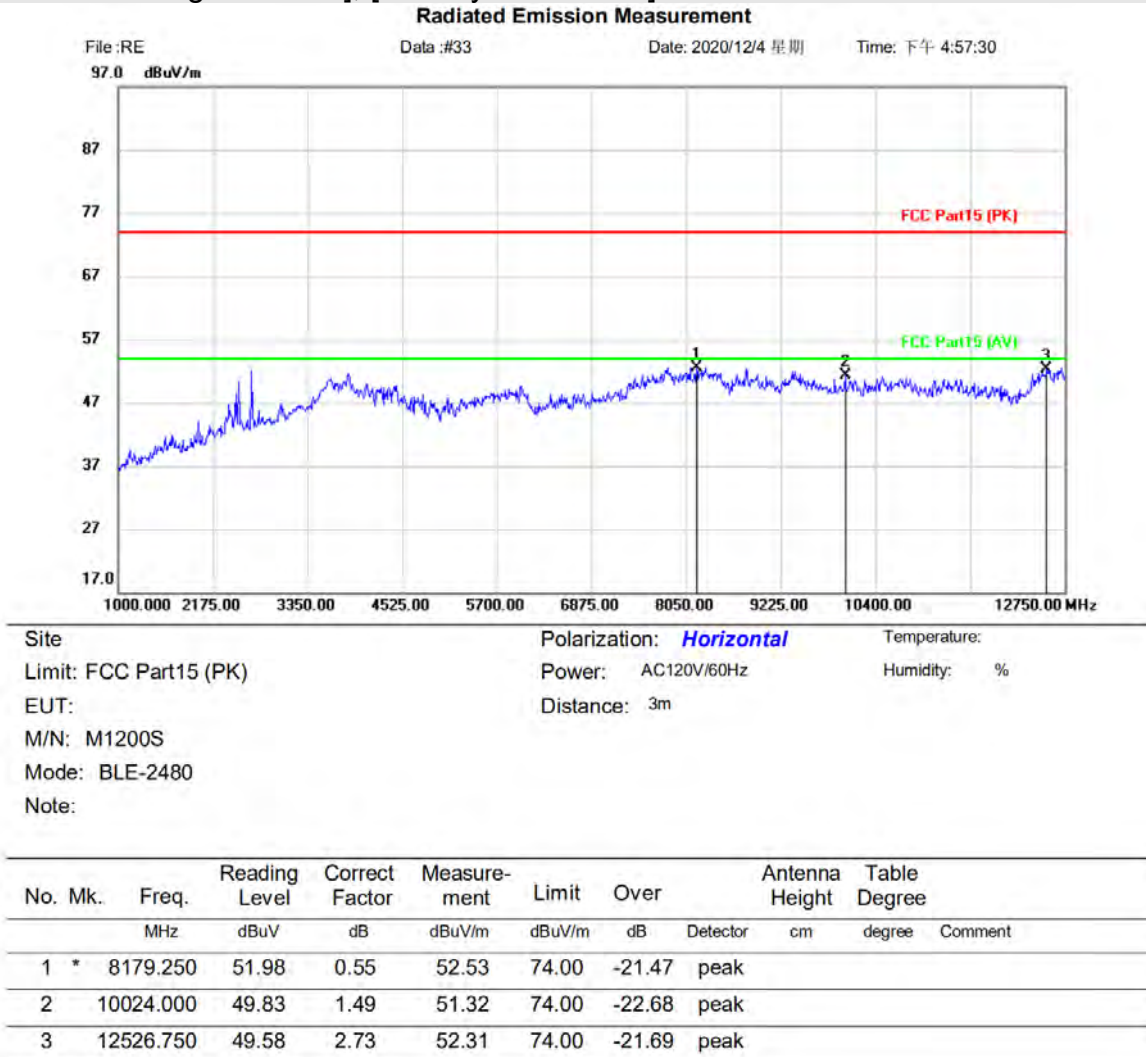


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

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

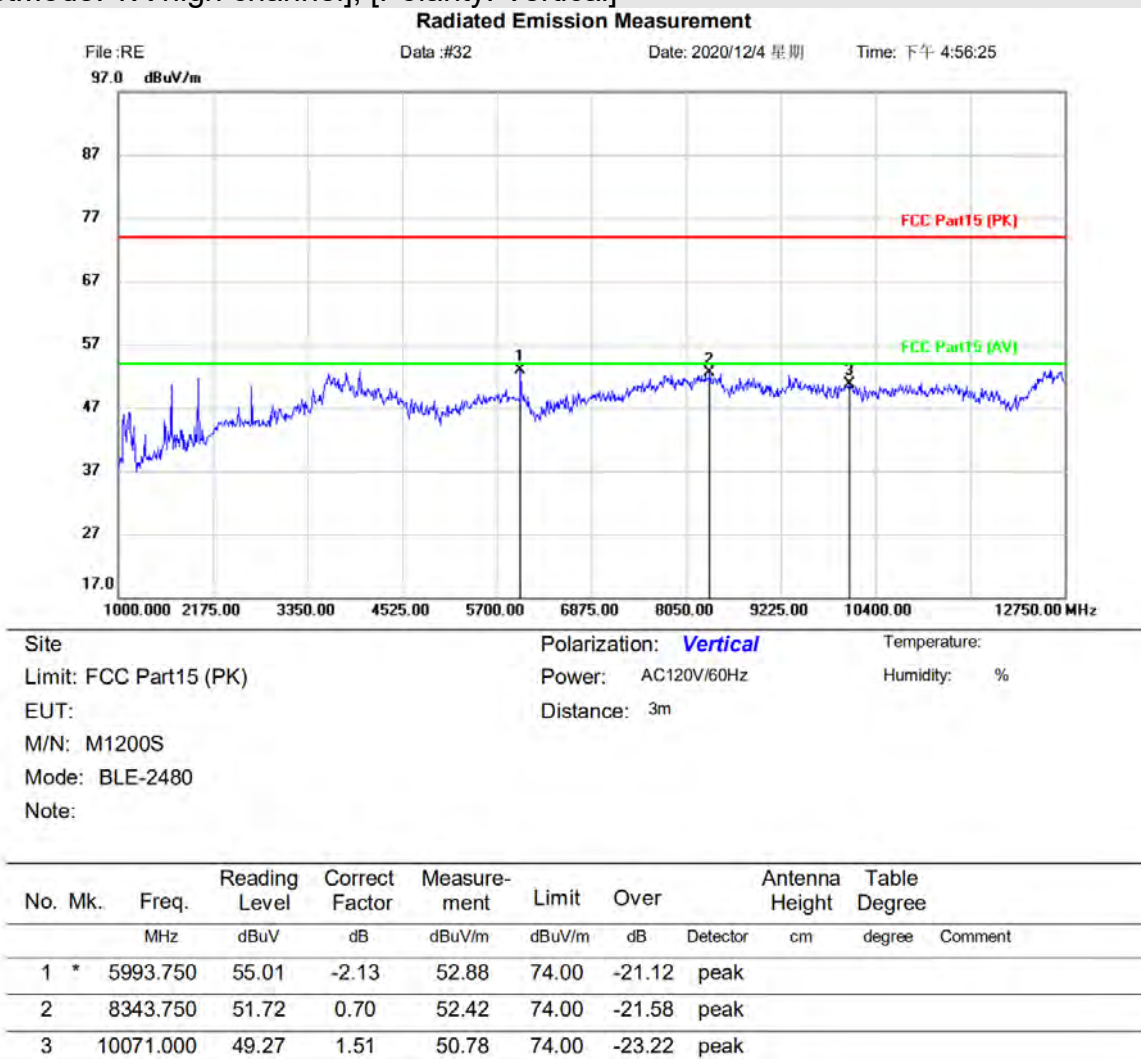


*:Maximum data x:Over limit !:over margin

〈Reference Only

Test Result: Pass

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



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

⟨Reference Only

Test Result: Pass

2 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

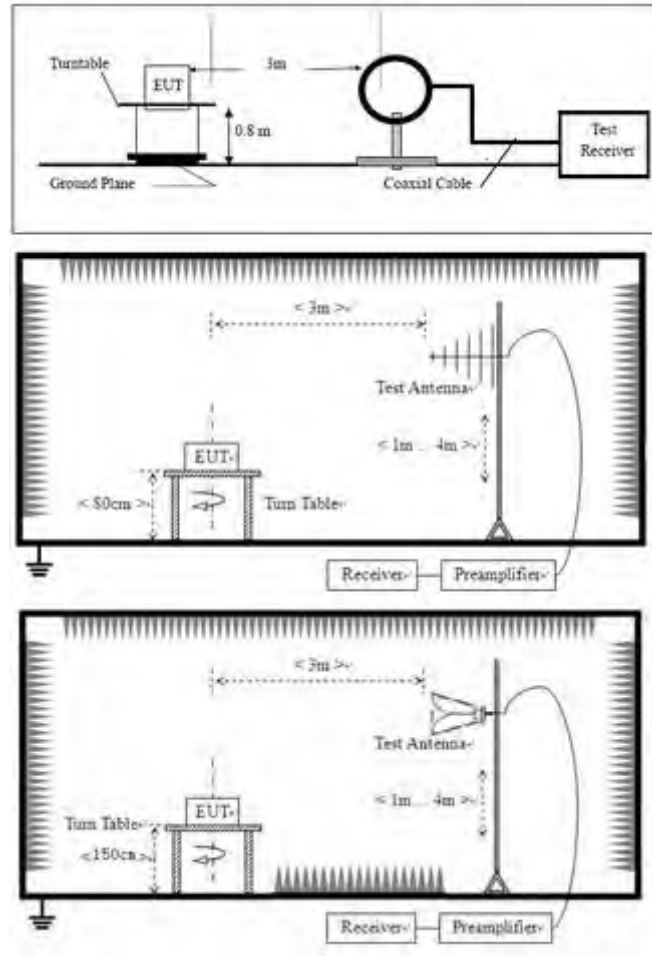
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX Low channel;TX middle channel;TX high channel
Test Mode (Final Test)	TX Low channel;TX high channel
Tester	Ben
Temperature	25℃
Humidity	60%

2.1 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.

2.2 BLOCK DIAGRAM OF TEST SETUP



2.3 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.

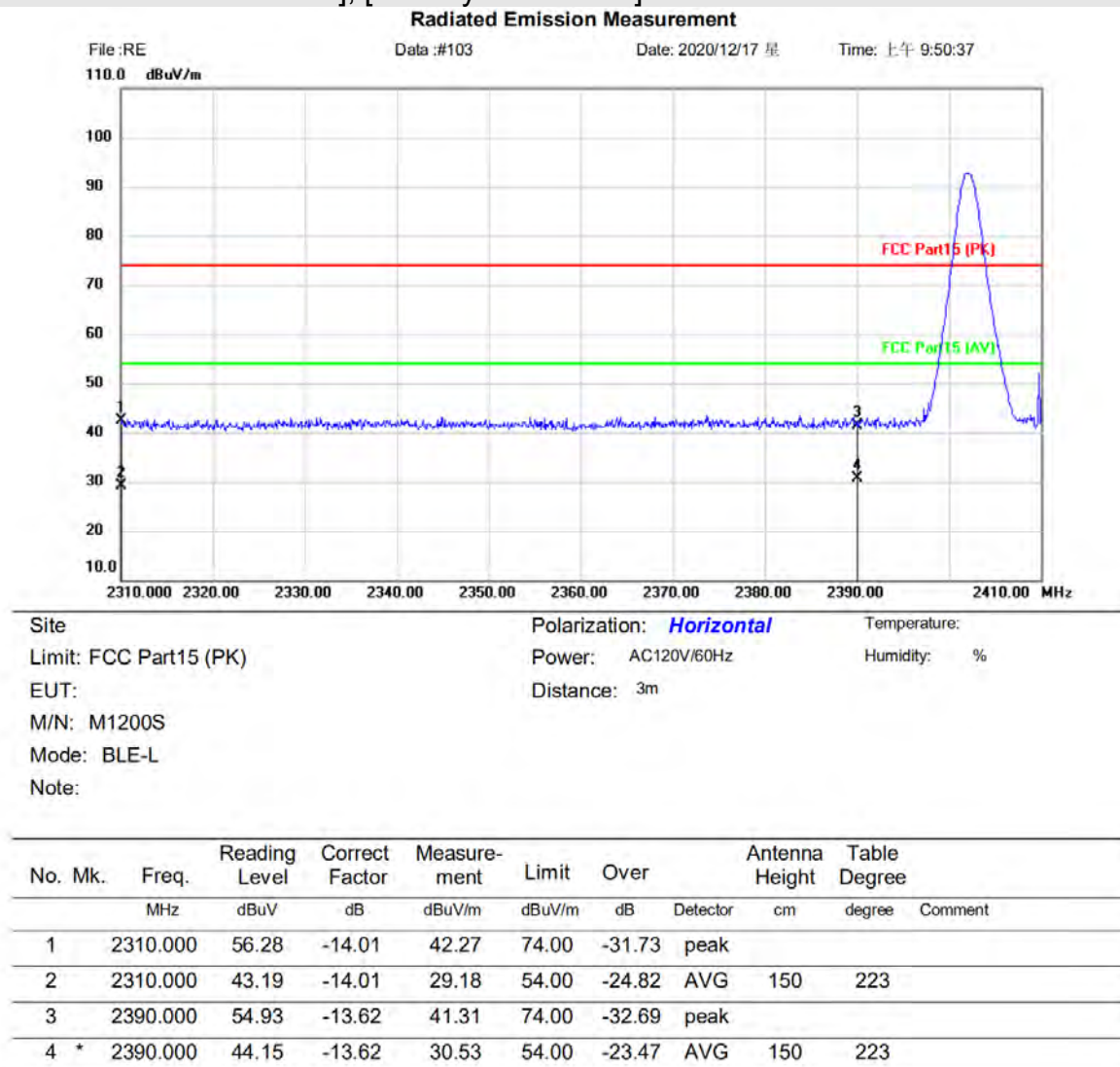
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was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

2.4 TEST DATA

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

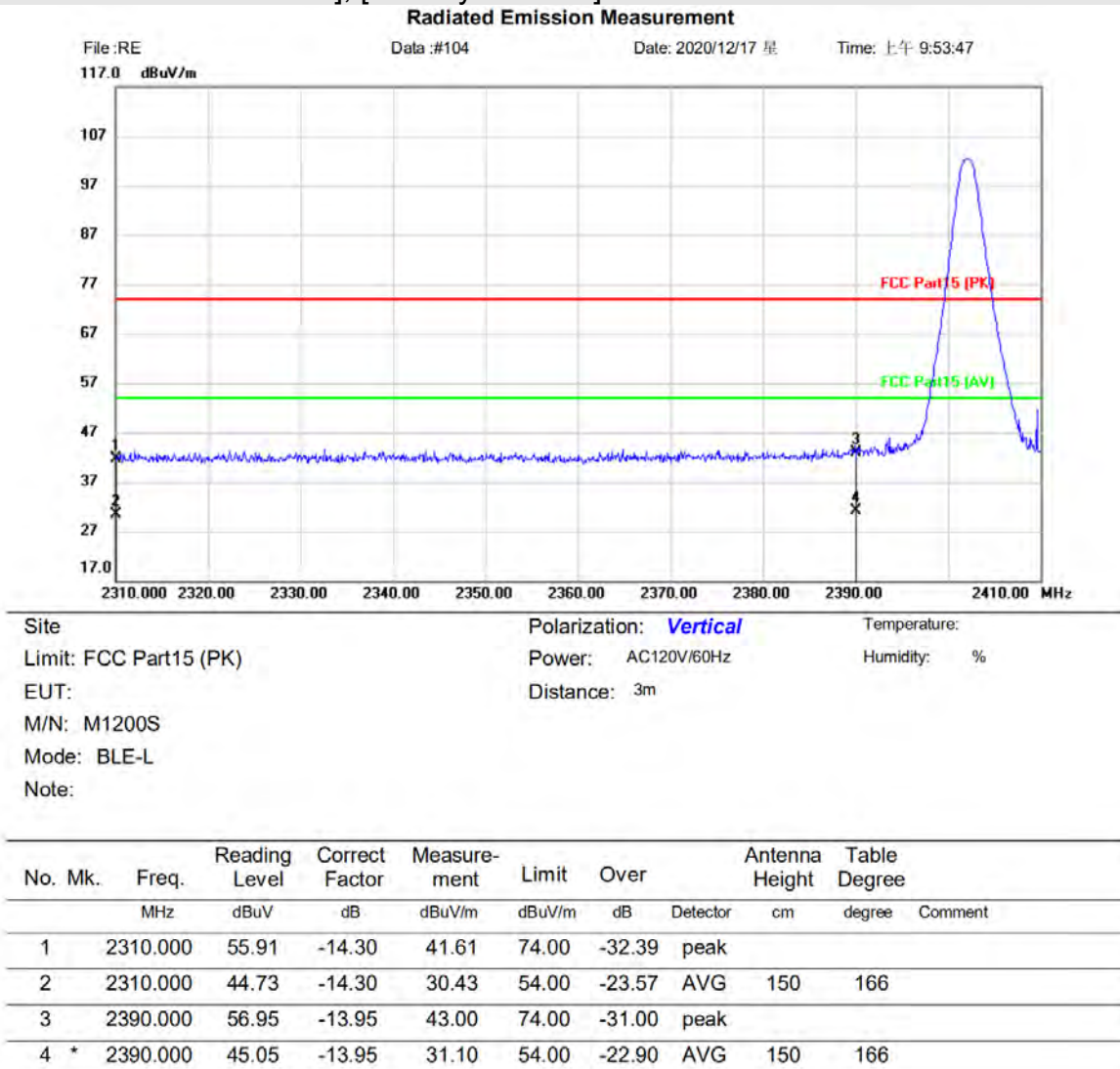


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

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

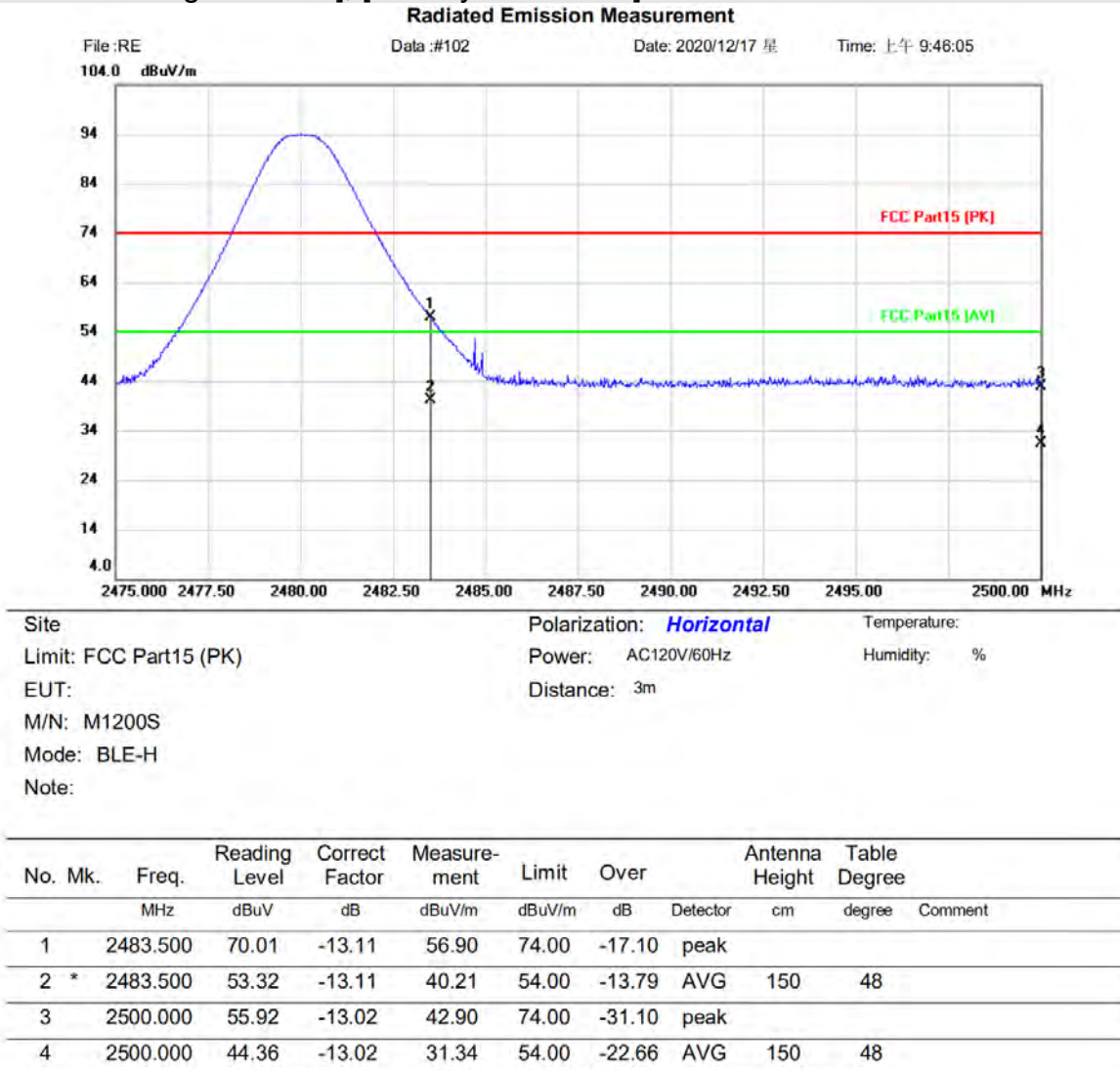


*:Maximum data x:Over limit !:over margin

⟨Reference Only

Test Result: Pass

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

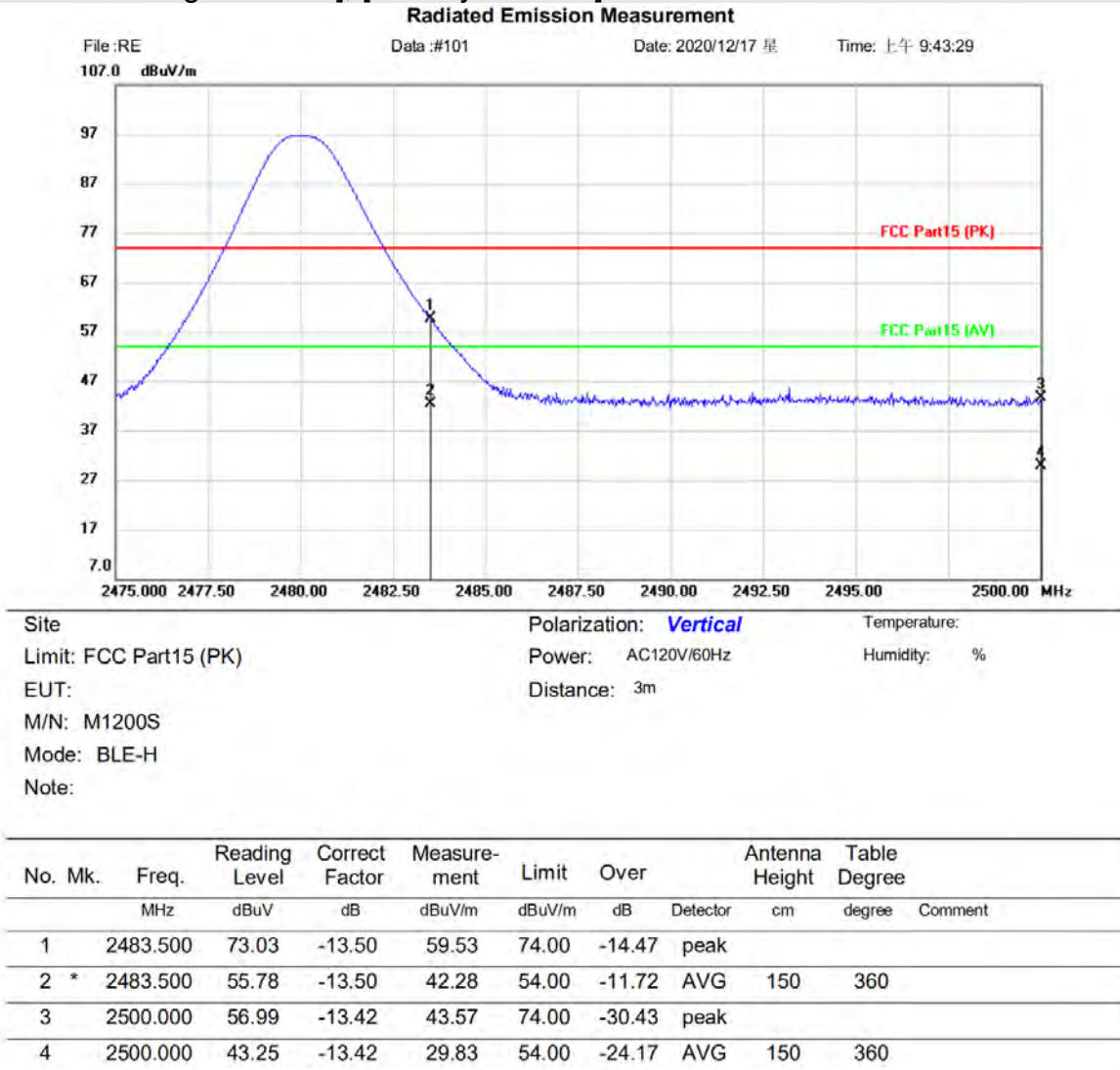


*:Maximum data x:Over limit !:over margin

〈Reference Only

Test Result: Pass

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



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

⟨Reference Only

Test Result: Pass

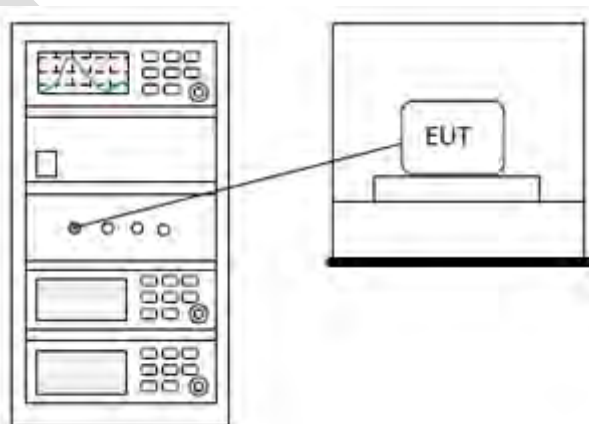
3 CONDUCTED SPURIOUS EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.8
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

3.1 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)).
---------------	--

3.2 BLOCK DIAGRAM OF TEST SETUP



3.3 TEST DATA

Pass: Please Refer To Appendix: For Details

BlueAsia

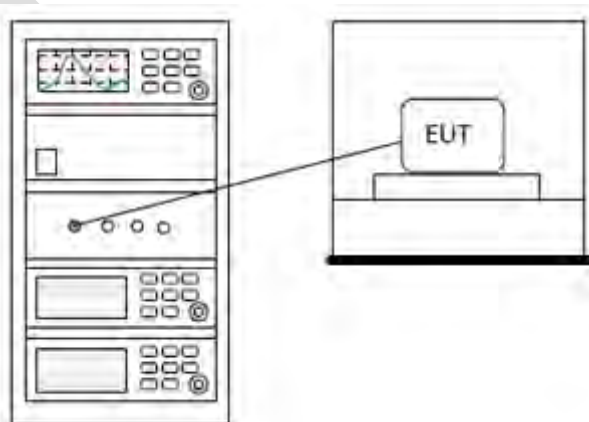
4 CONDUCTED BAND EDGES MEASUREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

4.1 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)).
---------------	--

4.2 BLOCK DIAGRAM OF TEST SETUP



4.3 TEST DATA

Pass: Please Refer To Appendix: For Details

BlueAsia

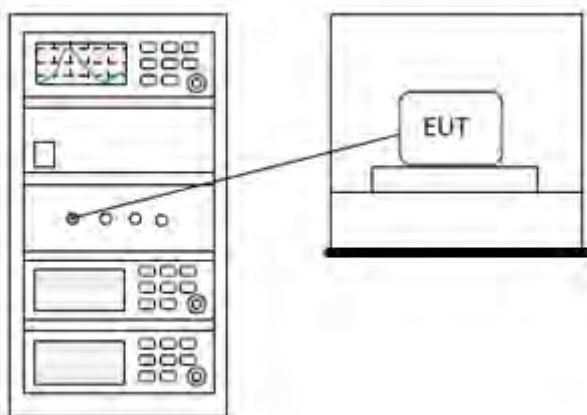
5 POWER SPECTRUM DENSITY

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.10.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

5.1 LIMITS

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

5.2 BLOCK DIAGRAM OF TEST SETUP



5.3 TEST DATA

Pass: Please Refer To Appendix: For Details
--

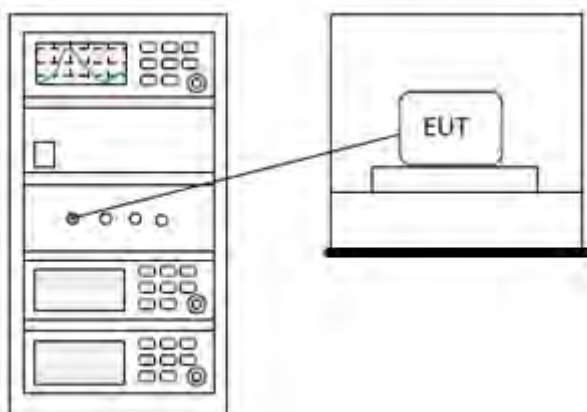
6 CARRIER FREQUENCIES SEPARATION

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	Ben
Temperature	25°C
Humidity	60%

6.1 LIMITS

Limit:	2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W
---------------	--

6.2 BLOCK DIAGRAM OF TEST SETUP



6.3 TEST DATA

Pass: Please Refer To Appendix: For Details

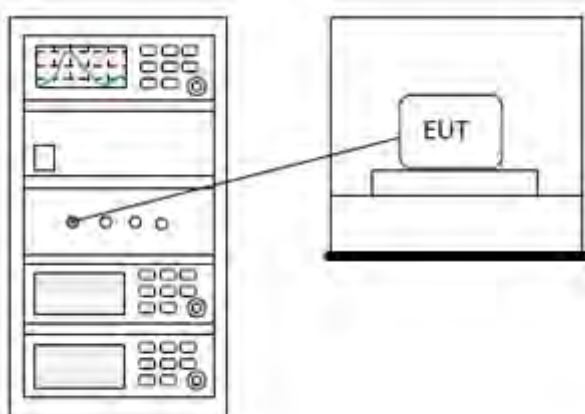
7 CONDUCTED PEAK OUTPUT POWER

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.5
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

7.1 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

7.2 BLOCK DIAGRAM OF TEST SETUP



7.3 EST DATA

Pass: Please Refer To Appendix: For Details

BlueAsia

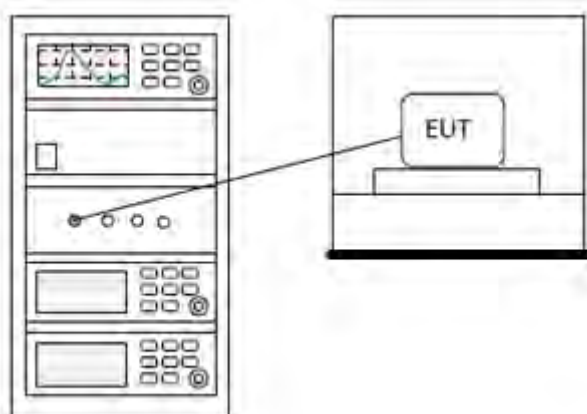
8 MINIMUM 6DB BANDWIDTH

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 11.8.1
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

8.1 LIMITS

Limit:	≥ 500 kHz
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8.2 BLOCK DIAGRAM OF TEST SETUP



8.3 TEST DATA

Pass: Please Refer To Appendix: For Details

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

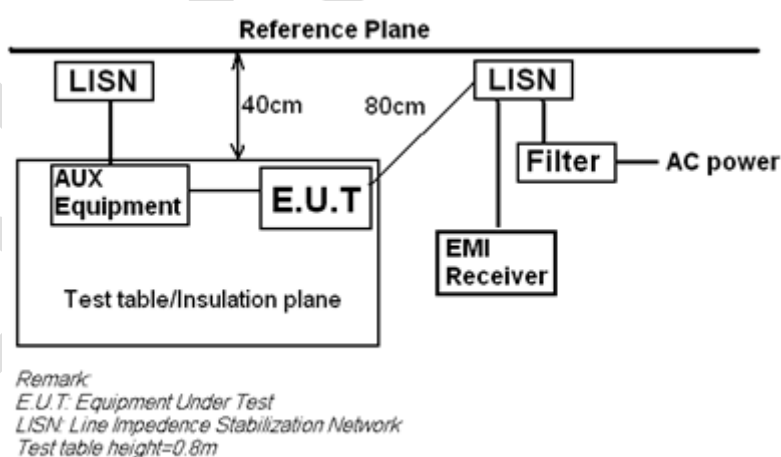
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	60%

9.1 LIMITS

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

*Decreases with the logarithm of the frequency.

9.2 BLOCK DIAGRAM OF TEST SETUP



9.3 PROCEDURE

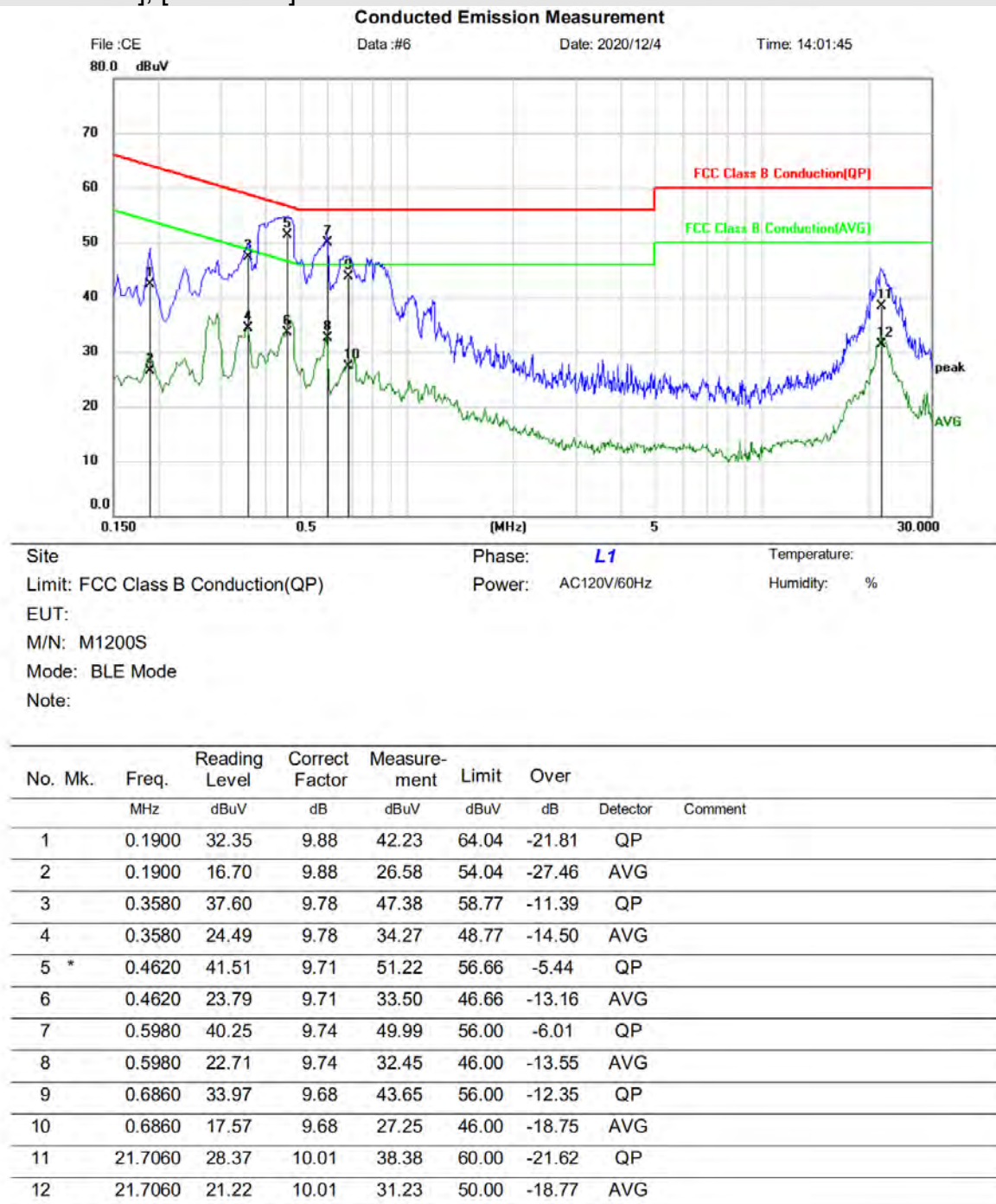
- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50ohm/50?H + 5ohm linear impedance. The power cables of all other units of the EUT were connected to 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: $LISN = Read\ Level + Cable\ Loss + LISN\ Factor$

9.4 TEST DATA

[TestMode: TX]; [Line: Line]



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

(Reference Only)

Test Result: Pass

[TestMode: TX]; [Line: Nutral]

Conducted Emission Measurement


Site
Limit: FCC Class B Conduction(QP)
EUT:
M/N: M1200S
Mode: BLE Mode
Note:

Phase: **N**
Power: AC120V/60Hz

Temperature:
Humidity: %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3620	34.49	9.75	44.24	58.68	-14.44	QP	
2		0.3620	20.07	9.75	29.82	48.68	-18.86	AVG	
3		0.3899	39.18	9.71	48.89	58.07	-9.18	QP	
4		0.3899	18.39	9.71	28.10	48.07	-19.97	AVG	
5	*	0.4540	39.60	9.72	49.32	56.80	-7.48	QP	
6		0.4540	21.43	9.72	31.15	46.80	-15.65	AVG	
7		0.5980	37.71	9.74	47.45	56.00	-8.55	QP	
8		0.5980	20.08	9.74	29.82	46.00	-16.18	AVG	
9		0.6780	31.28	9.74	41.02	56.00	-14.98	QP	
10		0.6780	15.38	9.74	25.12	46.00	-20.88	AVG	
11		21.9540	27.31	10.02	37.33	60.00	-22.67	QP	
12		21.9540	20.12	10.02	30.14	50.00	-19.86	AVG	

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

<Reference Only

Test Result: Pass

10 ANTENNA REQUIREMENT

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

10.1 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 3.0dBi.



10 APPENDIX

10.1 APPENDIX: DTS BANDWIDTH

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	0.524	2401.688	2402.212	≥ 0.5	PASS
		2440	0.528	2439.684	2440.212	≥ 0.5	PASS
		2480	0.528	2479.684	2480.212	≥ 0.5	PASS

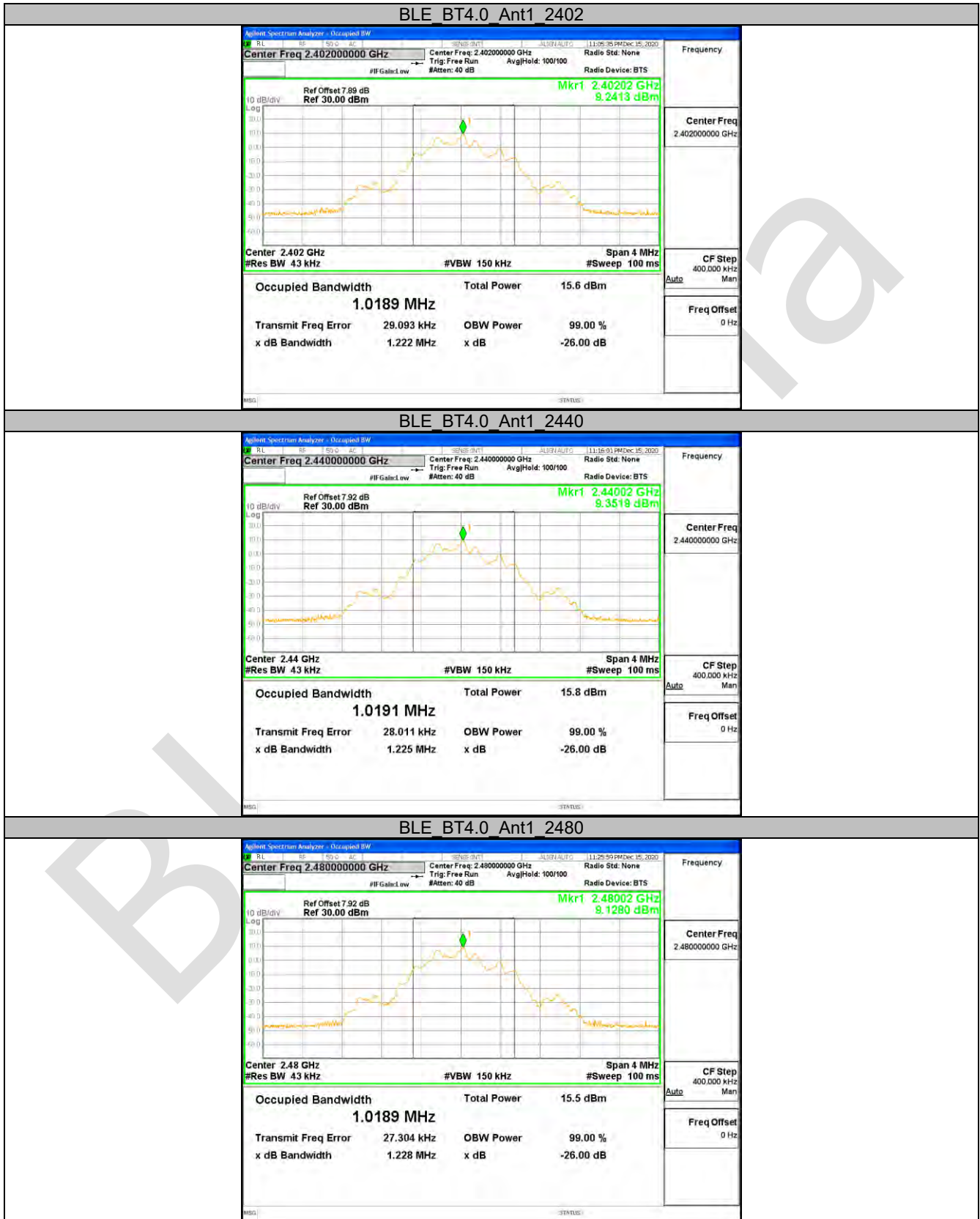
Test Graphs



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

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
BLE_BT4.0	Ant1	2402	1.0189	2401.520	2402.539	---	PASS
		2440	1.0191	2439.518	2440.538	---	PASS
		2480	1.0189	2479.518	2480.537	---	PASS

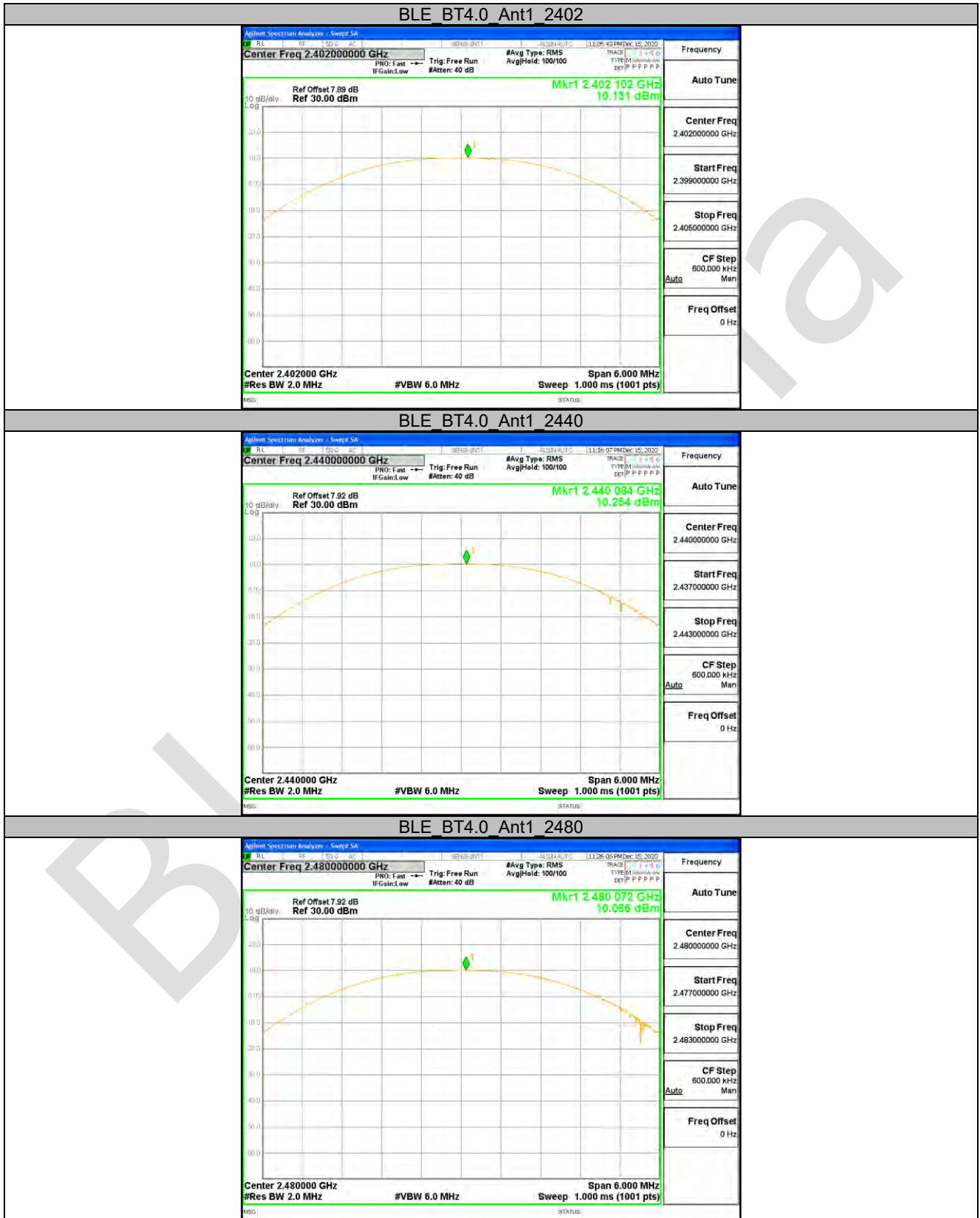
Test Graphs



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

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_BT4.0	Ant1	2402	10.13	<=30	PASS
		2440	10.25	<=30	PASS
		2480	10.07	<=30	PASS

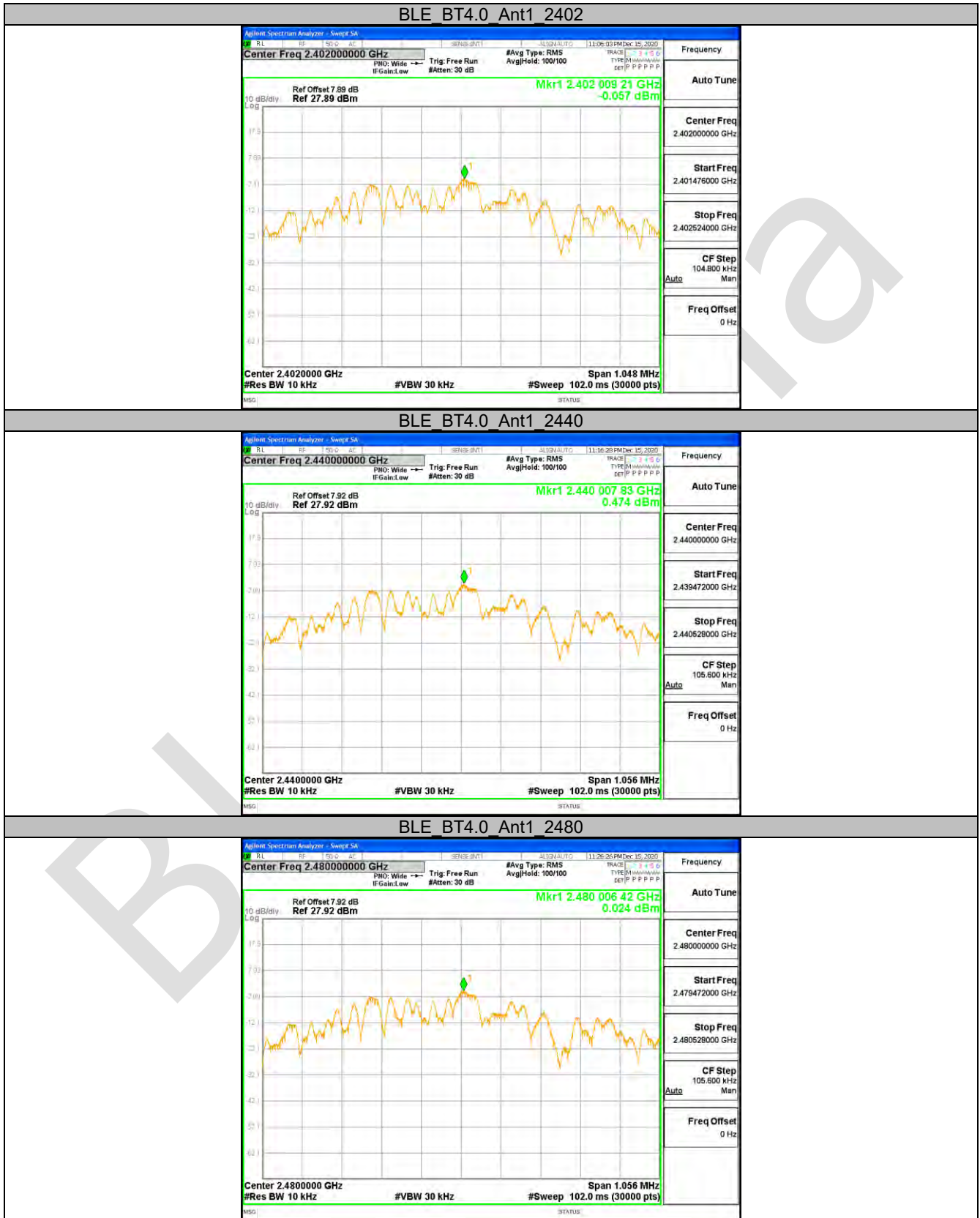
Test Graphs



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

TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
BLE_BT4.0	Ant1	2402	-0.06	<=8	PASS
		2440	0.47	<=8	PASS
		2480	0.02	<=8	PASS

Test Graphs



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

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_BT4.0	Ant1	Low	2402	10.00	-50.57	<=-10	PASS
		High	2480	9.97	-49.43	<=-10.03	PASS

Test Graphs



10.6 APPENDIX: CONDUCTED SPURIOUS EMISSION

Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_BT4.0	Ant1	2402	Reference	9.96	9.96	---	PASS
			30~1000	30~1000	-55.995	<=-20.045	PASS
			1000~26500	1000~26500	-46.404	<=-20.045	PASS
		2440	Reference	10.03	10.03	---	PASS
			30~1000	30~1000	-56.956	<=-19.967	PASS
			1000~26500	1000~26500	-47.805	<=-19.967	PASS
		2480	Reference	9.99	9.99	---	PASS
			30~1000	30~1000	-61.416	<=-20.015	PASS
			1000~26500	1000~26500	-47.715	<=-20.015	PASS

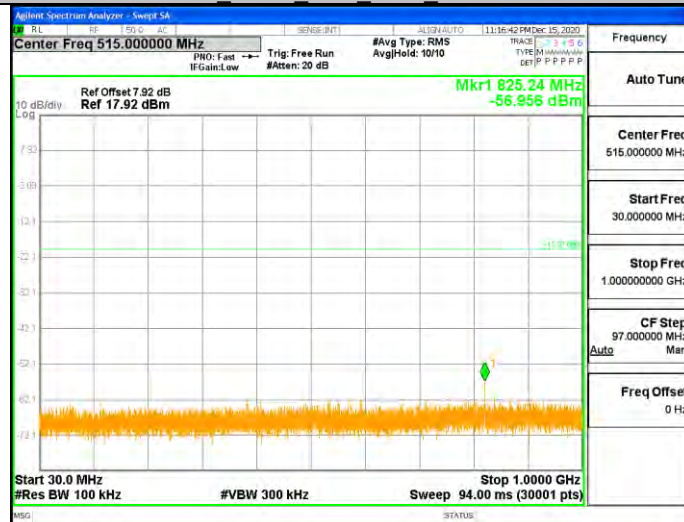
Test Graphs



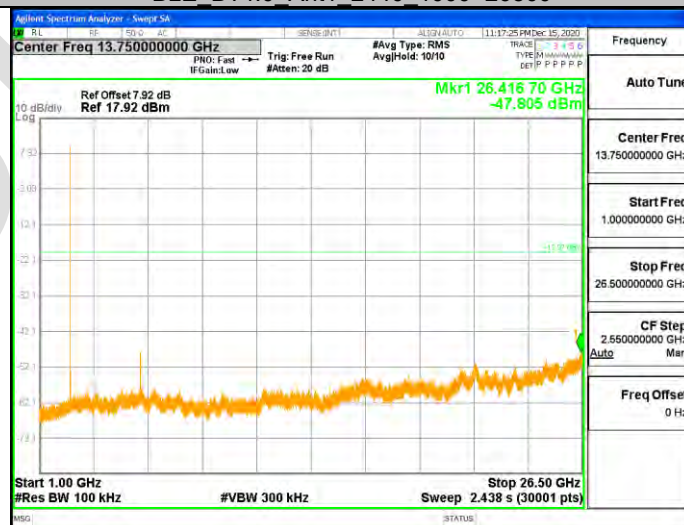
BLE BT4.0 Ant1 2440 0~Reference



BLE BT4.0 Ant1 2440 30~1000



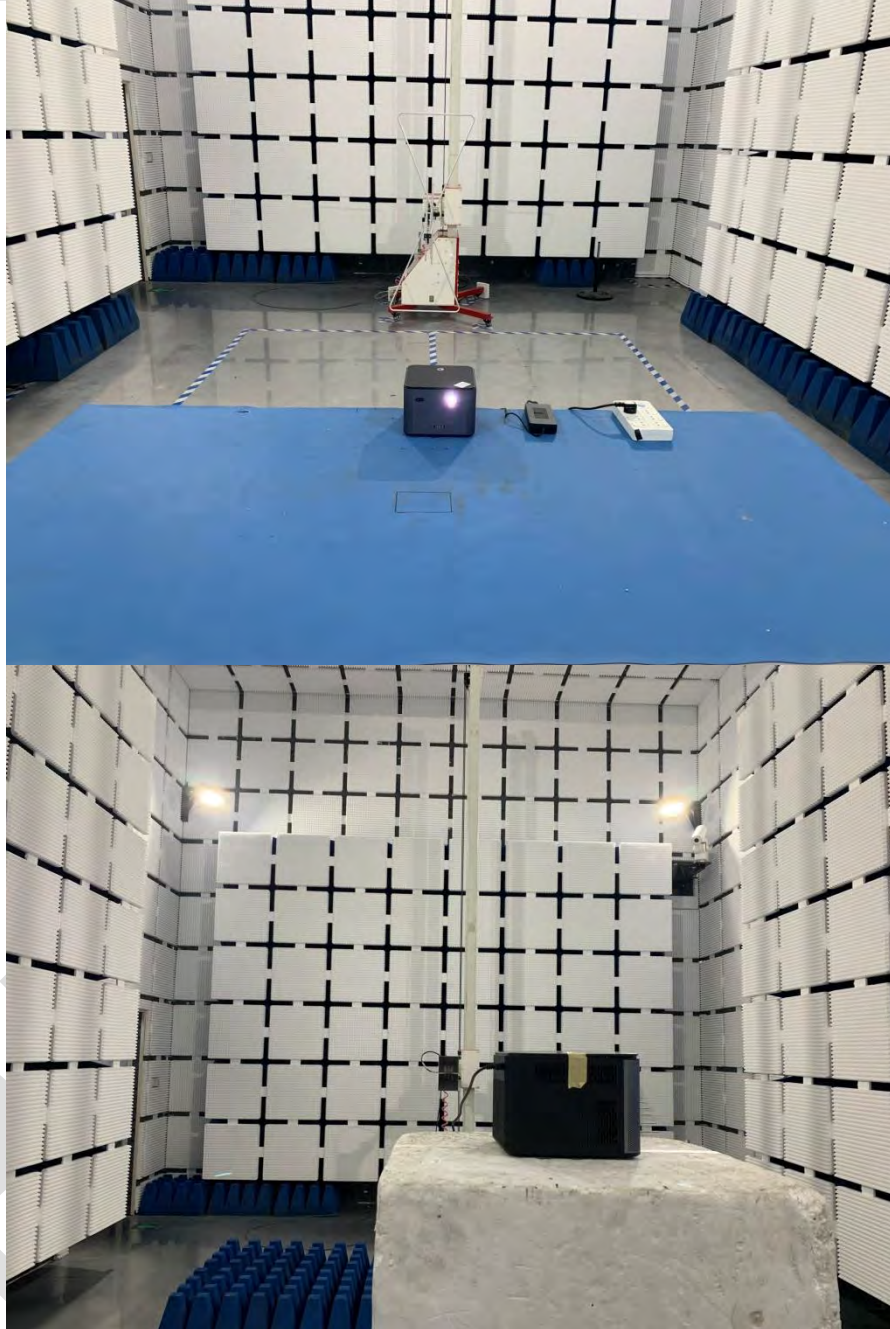
BLE BT4.0 Ant1 2440 1000~26500

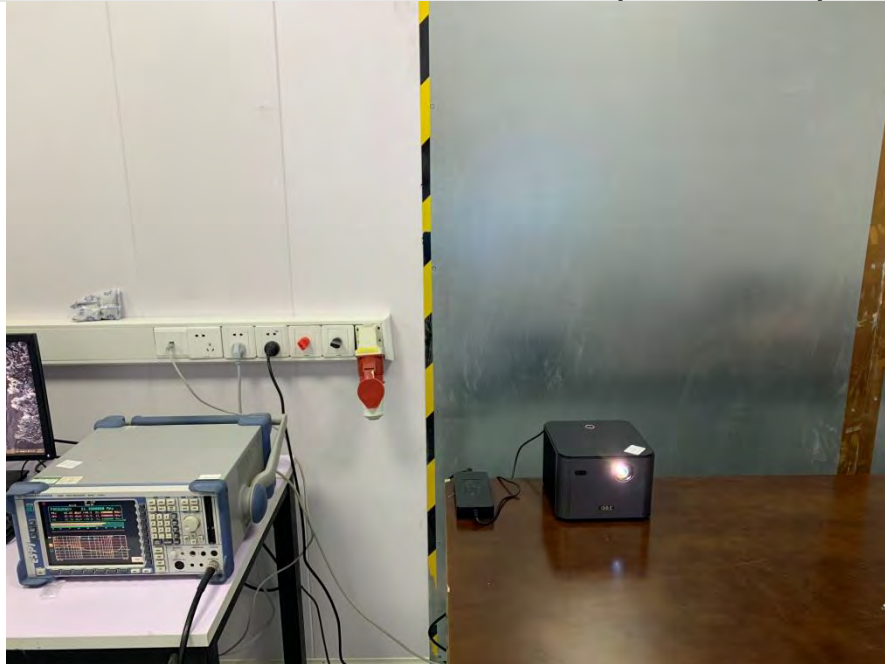




APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Radiated Spurious Emissions



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

----END OF REPORT----

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