

TEST REPORT

Product Name : WIFI MODULE
Brand Mark : CCL
Model No. : RF-WM-11AFB1
FCC ID : 2ALZ7-11AFB2005
Report Number : BLA-EMC-202006-A7301
Date of Sample Receipt : 2020/6/24
Date of Test : 2020/6/24 to 2020/7/4
Date of Issue : 2020/7/6
Test Standard : 47 CFR Part 15, Subpart C 15.247
Test Result : Pass

Prepared for:

CCL ELECTRONICS LIMITED

Unit 1-3, 9/F., Wang Lung Industrial Building, 11 Lung Tak Street, Tsuen Wan, N.T., H.K.

Prepared by:

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Date:

2020/7/6



REPORT REVISE RECORD

Version No.	Date	Description
00	2020/7/6	Original

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1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
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
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
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

2 GENERAL INFORMATION

Applicant	CCL ELECTRONICS LIMITED
Address	Unit 1-3, 9/F., Wang Lung Industrial Building, 11 Lung Tak Street, Tsuen Wan, N.T., H.K.
Manufacturer	Shenzhen Rfstar Technology Co.,Ltd
Address	Room 601,Block C,Skyworth Building,NanShan,Shen Zhen 518057
Factory	Shenzhen Rfstar Technology Co.,Ltd
Address	Room 601,Block C,Skyworth Building,NanShan,Shen Zhen 518057
Product Name	WIFI MODULE
Test Model No.	RF-WM-11AFB1

3 GENERAL DESCRIPTION OF E.U.T.

Hardware Version	V1.0
Software Version	V1.0
Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Channel Spacing:	5MHz
Number of Channels:	802.11b/g/n(HT20):11
Antenna Type:	PCB antenna
Antenna Gain:	0.0dBi(Provided by the customer)

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25C	3.3Vdc

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
TX mode with modulation	Keep the EUT in continuously transmitting mode with modulation. (hopping or no hopping mode)
Remark: Only the data of the worst mode would be recorded in this report. The module is connected to the serial port tools through, UART to USB connection with PC, so PC controls EUT transmission.	

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	UGREEN	CD112	N/A	N/A
Serial port tools	Customer provided	N/A	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 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	12/17/2019	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	7/4/2019	7/3/2020
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	7/3/2020
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	7/3/2020
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	7/4/2019	7/3/2020
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	7/4/2019	7/3/2020
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 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	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	7/14/2018	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	2/14/2019	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	7/4/2019	7/3/2020
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	7/14/2018	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	2/14/2019	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

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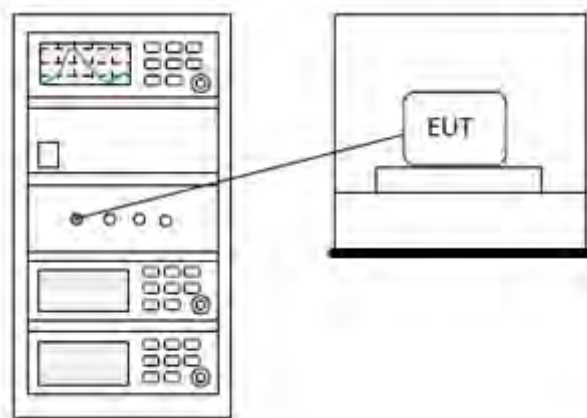
CONDUCTED SPURIOUS EMISSIONS

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 mode with modulation
Test Mode (Final Test)	TX mode with modulation
Tester	Eason
Temperature	24°C
Humidity	25%

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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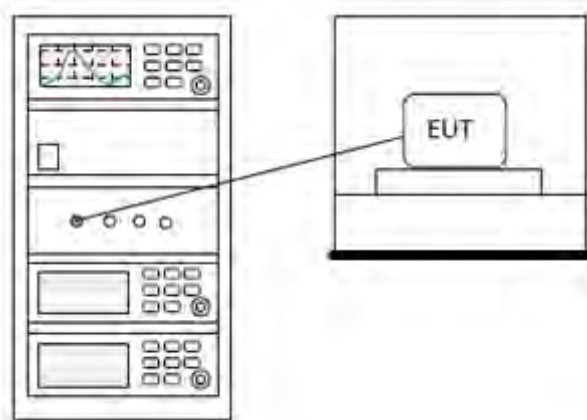
CONDUCTED BAND EDGES MEASUREMENT

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 mode with modulation
Test Mode (Final Test)	TX mode with modulation
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

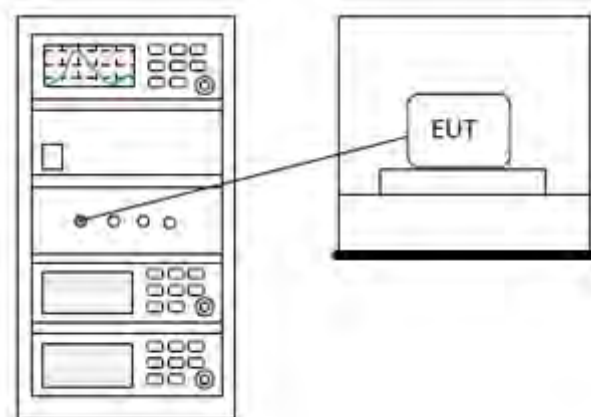
POWER SPECTRUM DENSITY

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 mode with modulation
Test Mode (Final Test)	TX mode with modulation
Tester	Eason
Temperature	24°C
Humidity	55%

LIMITS

Limit:	$\leq 8\text{dBm}$ in any 3 kHz band during any time interval of continuous transmission
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BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details
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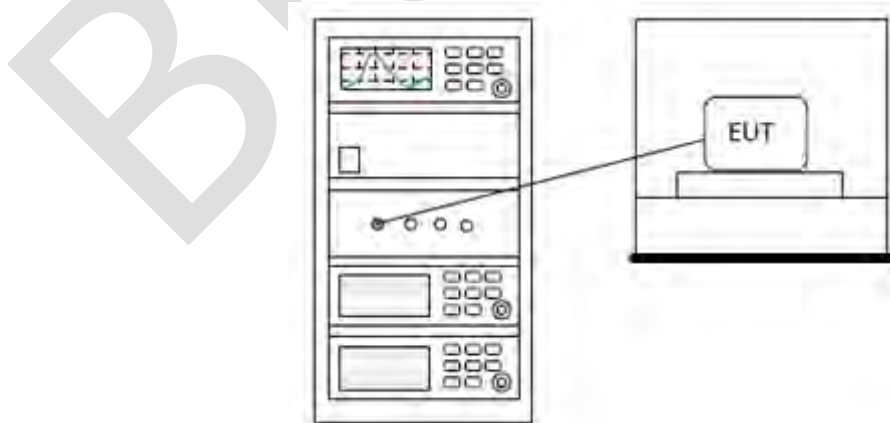
CONDUCTED PEAK OUTPUT POWER

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 mode with modulation
Test Mode (Final Test)	TX mode with modulation
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 $25 \leq$ 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

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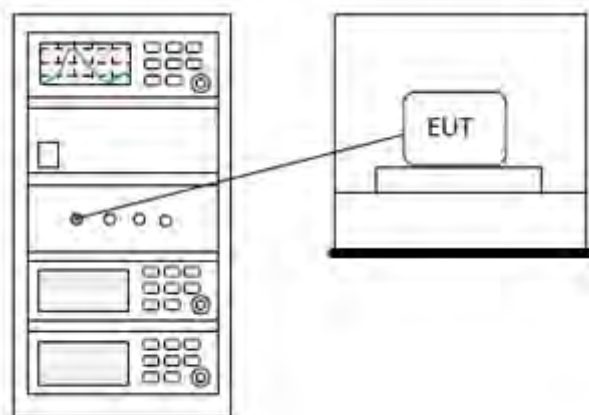
MINIMUM 6DB BANDWIDTH

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 mode with modulation
Test Mode (Final Test)	TX mode with modulation
Tester	Eason
Temperature	24°C
Humidity	55%

LIMITS

Limit:	≥500 kHz
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BLOCK DIAGRAM OF TEST SETUP



TEST DATA

Pass: Please Refer To Appendix: Appendix1 For Details

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

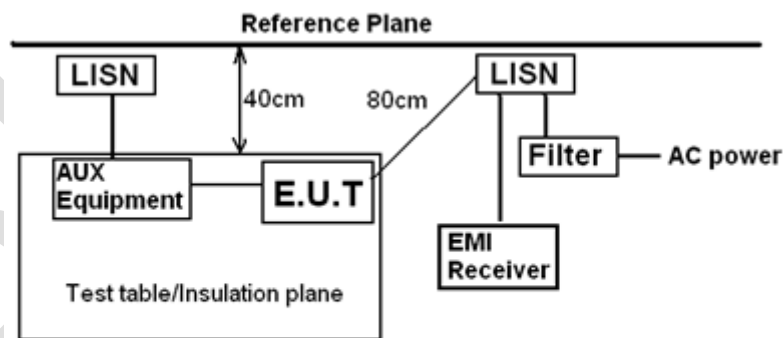
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.2
Test Mode (Pre-Scan)	TX mode with modulation
Test Mode (Final Test)	TX mode with modulation
Tester	Eason
Temperature	25°C
Humidity	56%

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.

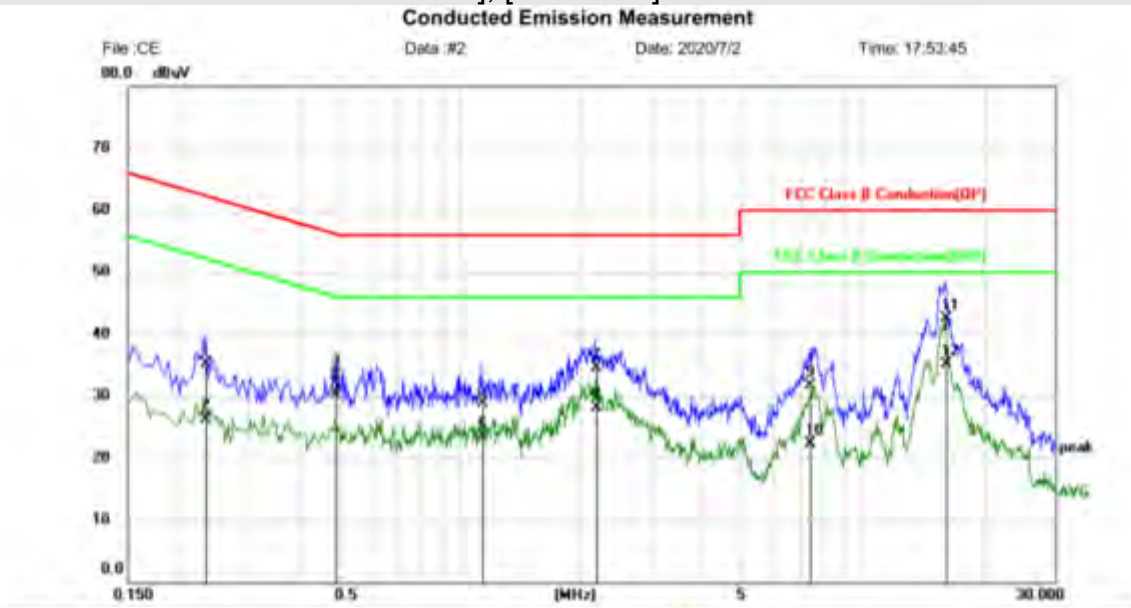
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from 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

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TEST DATA

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

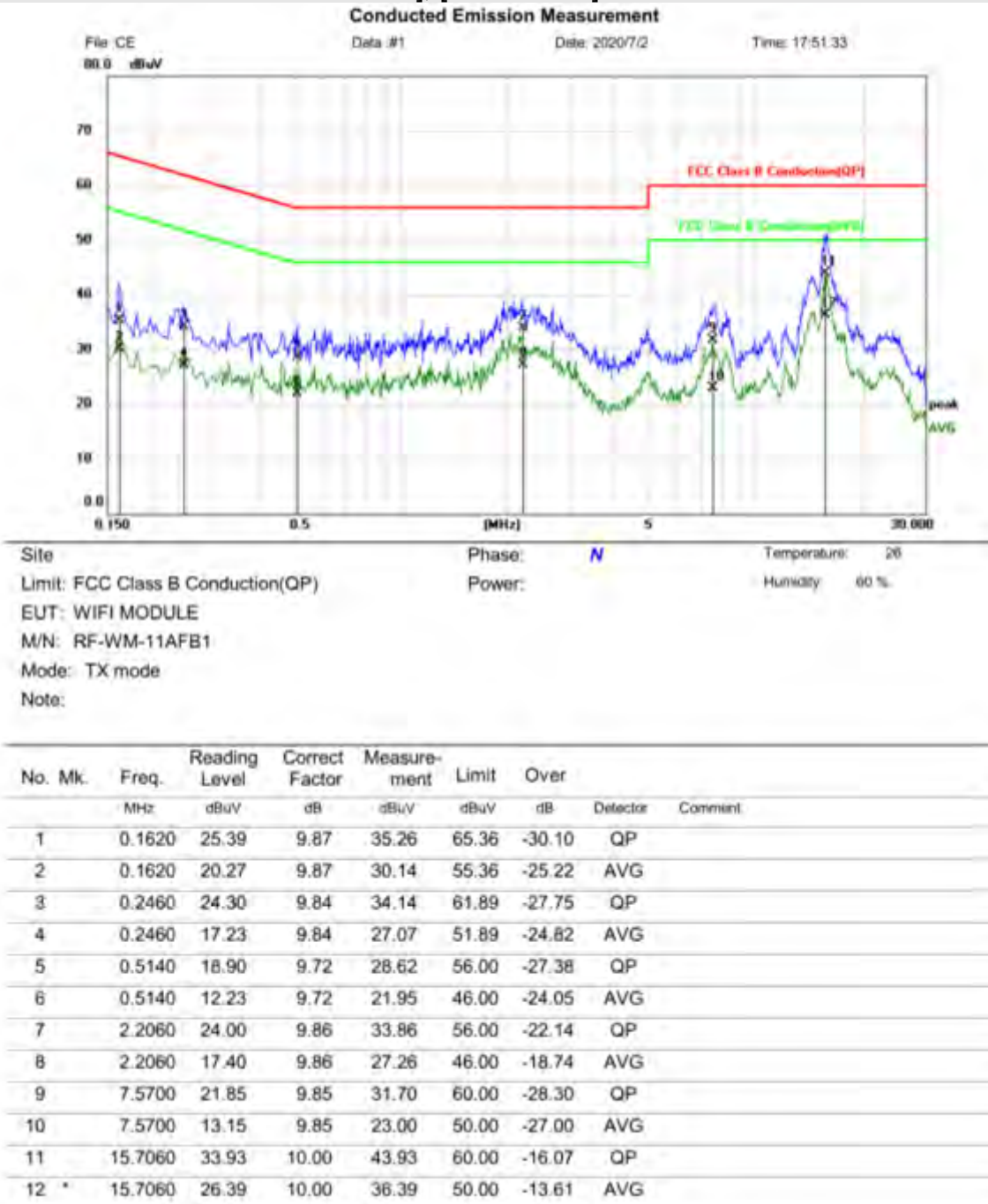


File: CE Data: #2 Date: 2020/7/2 Time: 17:53:45
 Site: Phase: **L1** Temperature: 26
 Limit: FCC Class B Conduction(QP) Power: Humidity: 60 %
 EUT: WIFI MODULE
 M/N: RF-WM-11AFB1
 Mode: TX mode
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2340	25.11	9.92	35.03	62.31	-27.28	QP	
2		0.2340	16.40	9.92	26.32	52.31	-25.99	AVG	
3		0.4940	23.81	9.73	33.54	56.10	-22.56	QP	
4		0.4940	20.52	9.73	30.25	46.10	-15.85	AVG	
5		1.1380	19.17	9.83	29.00	56.00	-27.00	QP	
6		1.1380	13.39	9.83	23.22	46.00	-22.78	AVG	
7		2.1860	24.59	9.82	34.41	56.00	-21.59	QP	
8		2.1860	18.25	9.82	28.07	46.00	-17.93	AVG	
9		7.4380	21.78	9.87	31.65	60.00	-28.35	QP	
10		7.4380	12.40	9.87	22.27	50.00	-27.73	AVG	
11		16.0820	32.62	9.95	42.57	60.00	-17.43	QP	
12	*	16.0820	25.21	9.95	35.16	50.00	-14.84	AVG	

Test Result: Pass

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



Test Result: Pass

ANTENNA REQUIREMENT

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

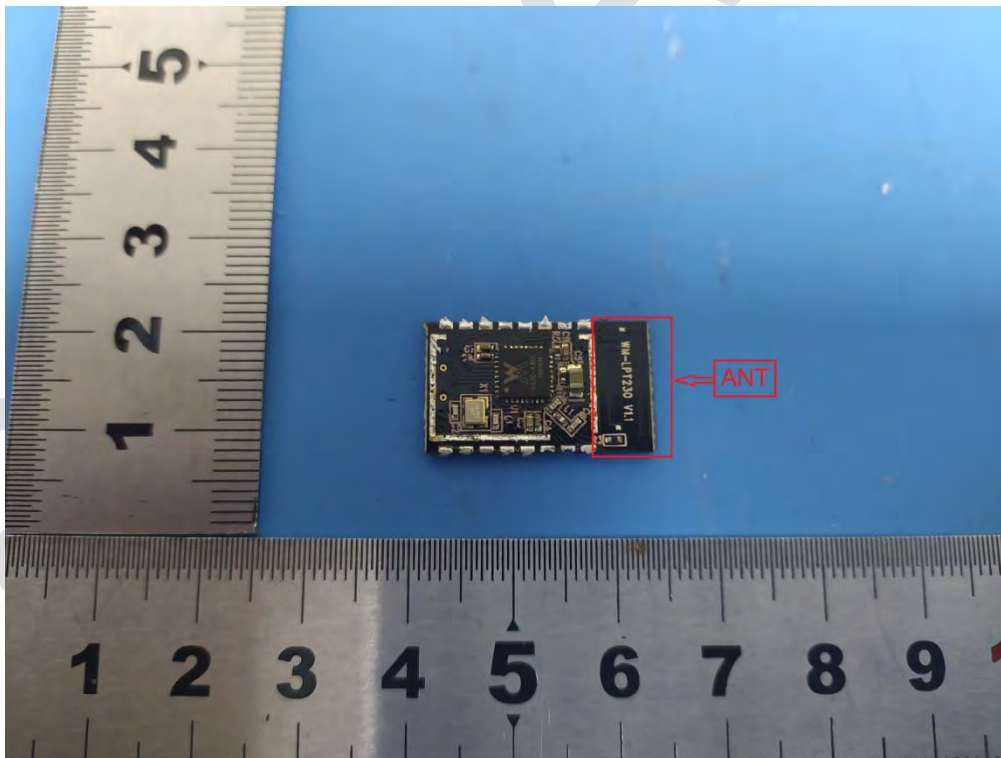
CONCLUSION

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 -1.0dBi.



RADIATED SPURIOUS EMISSIONS

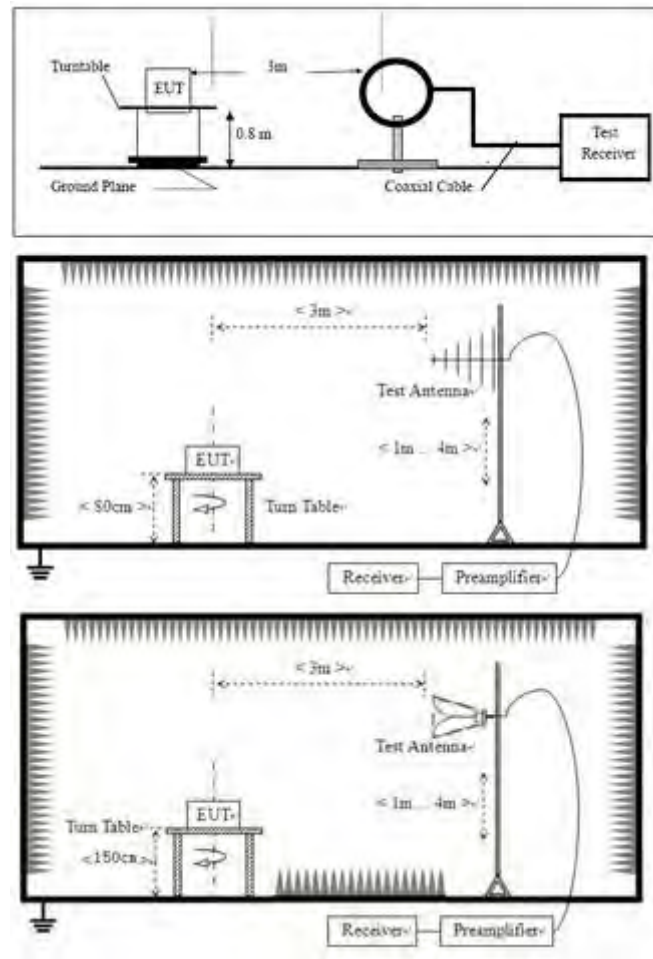
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.4,6.5,6.6
Test Mode (Pre-Scan)	TX mode (SE) below 1GHz;TX mode (SE) Above 1GHz
Test Mode (Final Test)	TX mode (SE) below 1GHz;TX mode (SE) Above 1GHz
Tester	Eason
Temperature	24℃
Humidity	55%

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 13GHz 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

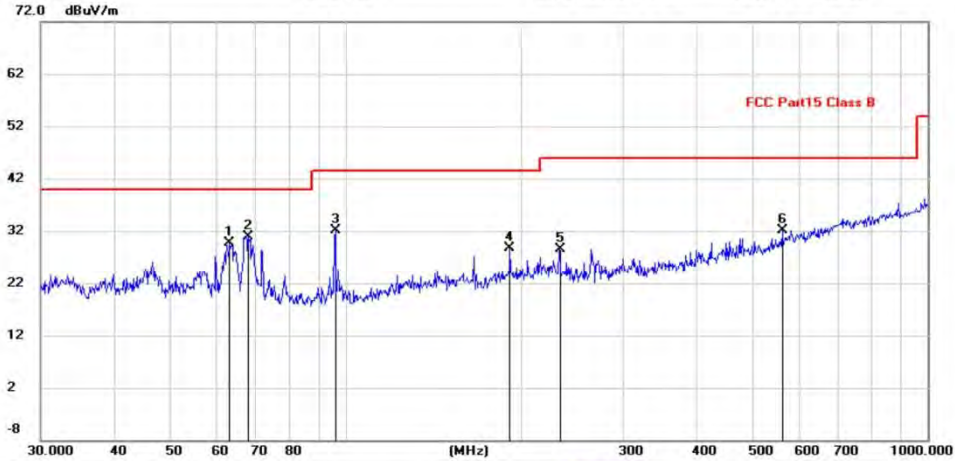
[TestMode: TX mode (SE) below 1G]; [Polarity: Vertical]



Company: Qianhai BlueAsia of Technical Services (Shenzhen) Co., Ltd.
Address: 深圳市龙岗区坂田街道布龙路448号BlueAsia物联网测试中心
Tel: +86-755-28682673 or +86-755-23059481

Radiated Emission Measurement

File: RE Data: #20 Date: 2020/7/4 星期 Time: 下午 4:59:32



Site: Polarization: **Vertical** Temperature:
Limit: FCC Part15 Class B Power: AC120V/60Hz Humidity: %
EUT: Wifi module Distance: 3m
M/N: RF-WM-11AFB1
Mode: wifi mode
Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		63.3132	7.05	22.65	29.70	40.00	-10.30	QP	145	312	
2	*	68.1512	9.41	21.59	31.00	40.00	-9.00	QP	243	134	
3		96.0986	11.94	20.25	32.19	43.50	-11.31	QP	231	122	
4		191.7450	8.25	20.43	28.68	43.50	-14.82	QP	198	234	
5		233.3487	6.02	22.54	28.56	46.00	-17.44	QP	341	187	
6		562.6624	1.75	30.39	32.14	46.00	-13.86	QP	129	245	

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

File: RE\Data: #20

Page: 1

Engineer Signature: Jozu

Test Result: Pass

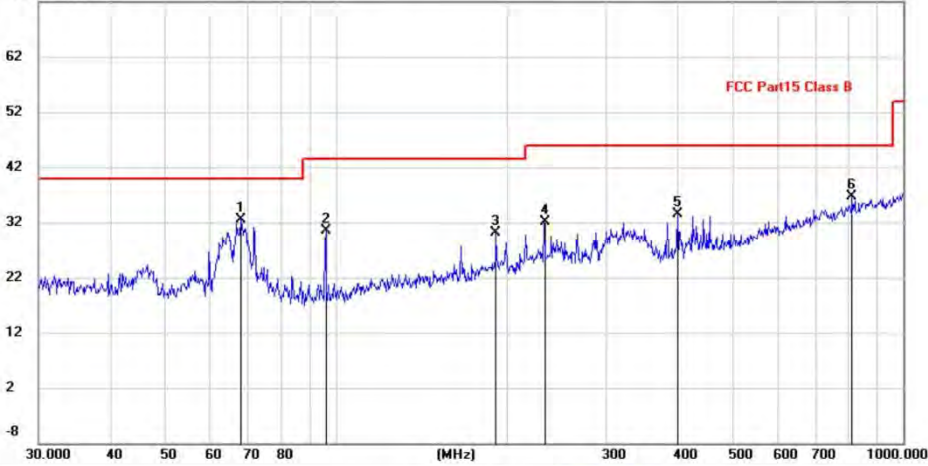
[TestMode: TX mode (SE) below 1G]; [Polarity: Horizontal]



Company: Qianhai BlueAsia of Technical Services (Shenzhen) Co., Ltd.
Address: 深圳市龙岗区坂田街道布龙路448号BlueAsia物联网测试中心
Tel: +86-755-28682673 or +86-755-23059481

Radiated Emission Measurement

File: RE Data: #19 Date: 2020/7/4 星期 Time: 下午 4:59:01



Site: Polarization: **Horizontal** Temperature:
Limit: FCC Part15 Class B Power: AC120V/60Hz Humidity: %
EUT: Wifi module Distance: 3m
M/N: RF-WM-11AFB1
Mode: wifi 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
1	*	68.1512	10.95	21.59	32.54	40.00	-7.46	QP 183	312
2		96.0986	10.31	20.25	30.56	43.50	-12.94	QP 234	134
3		191.7450	9.59	20.43	30.02	43.50	-13.48	QP 124	321
4		233.3487	9.61	22.54	32.15	46.00	-13.85	QP 231	123
5		400.4318	6.53	27.01	33.54	46.00	-12.46	QP 187	234
6		813.1115	2.38	34.38	36.76	46.00	-9.24	QP 198	352

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

File :RE\Data :#19

Page: 1

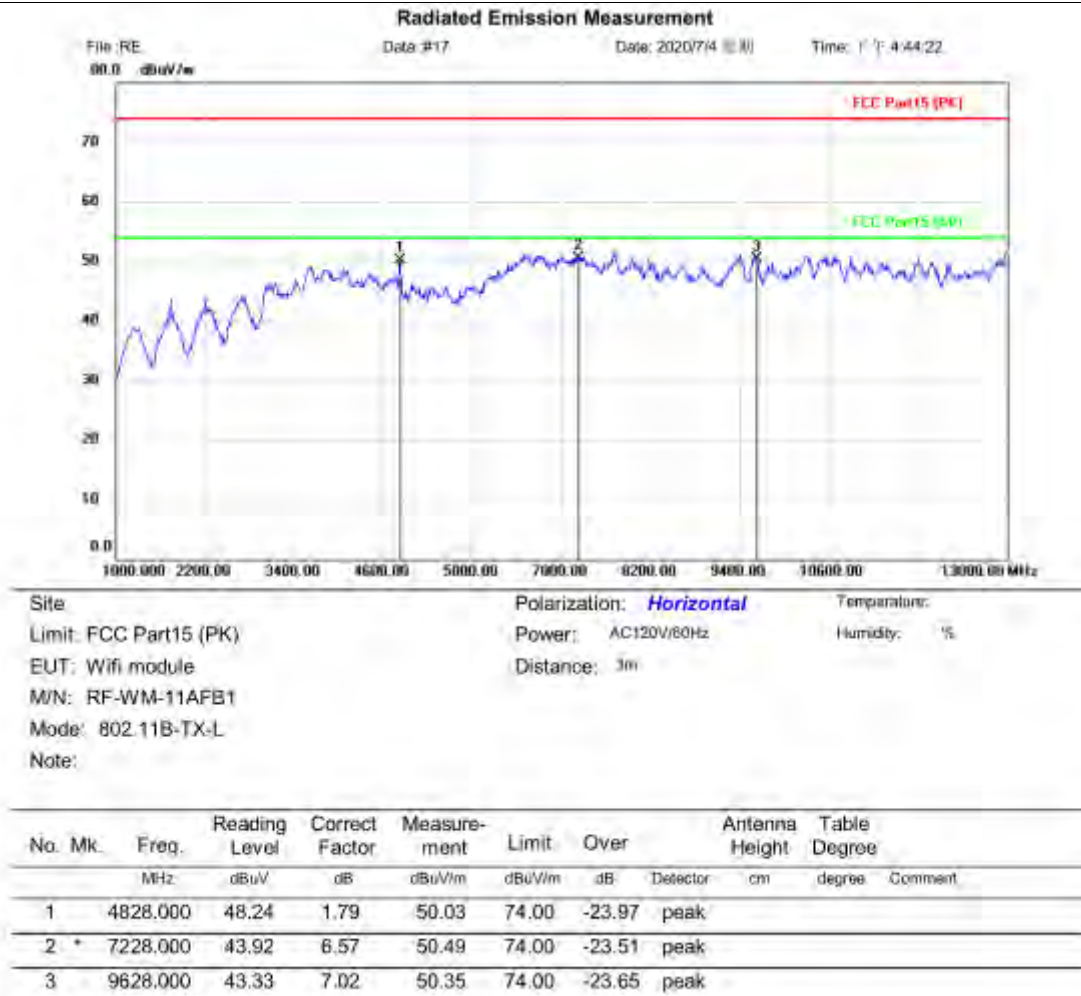
Engineer Signature: Jozu

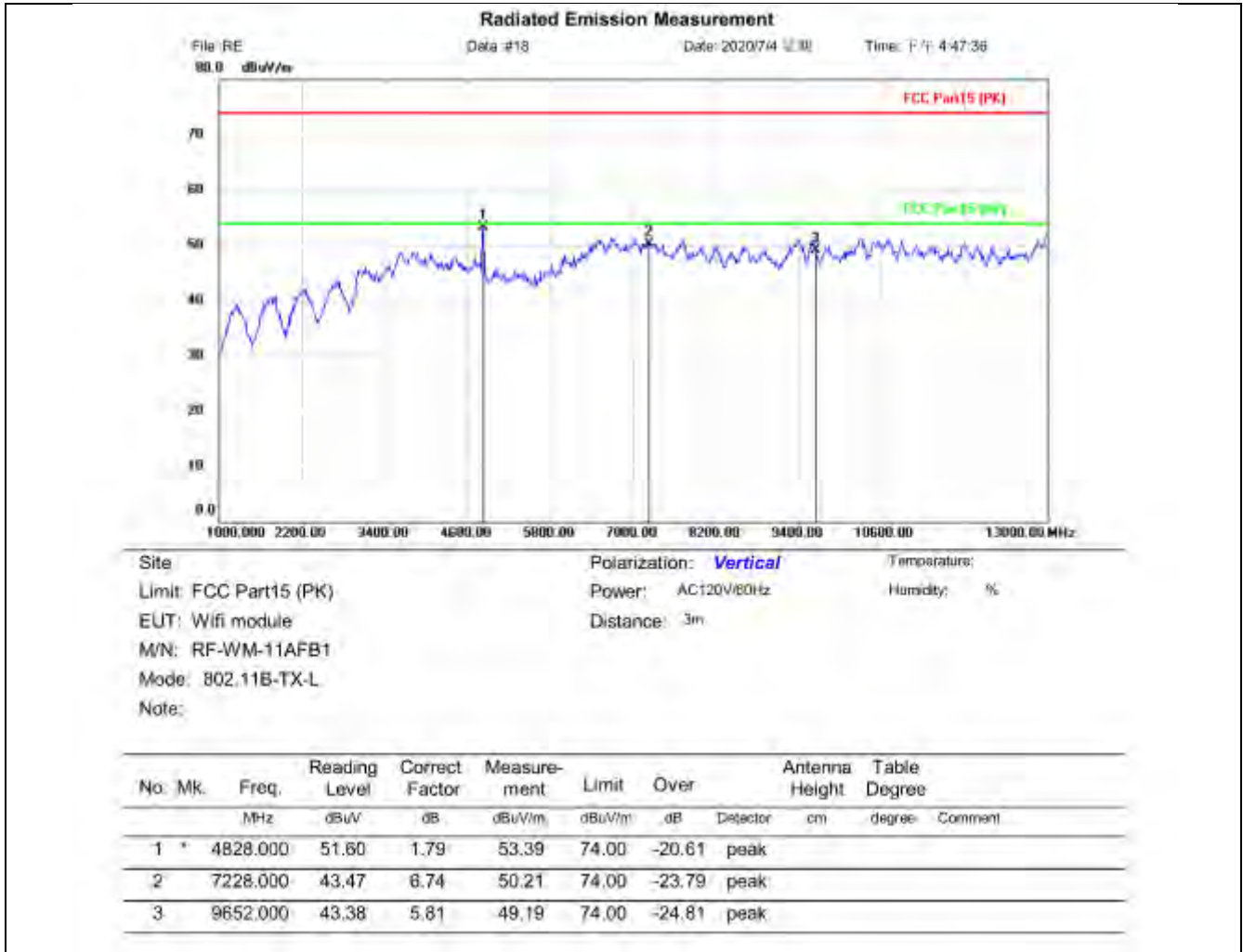
Test Result: Pass

[TestMode: 802.11b]; [Above 1GHz]

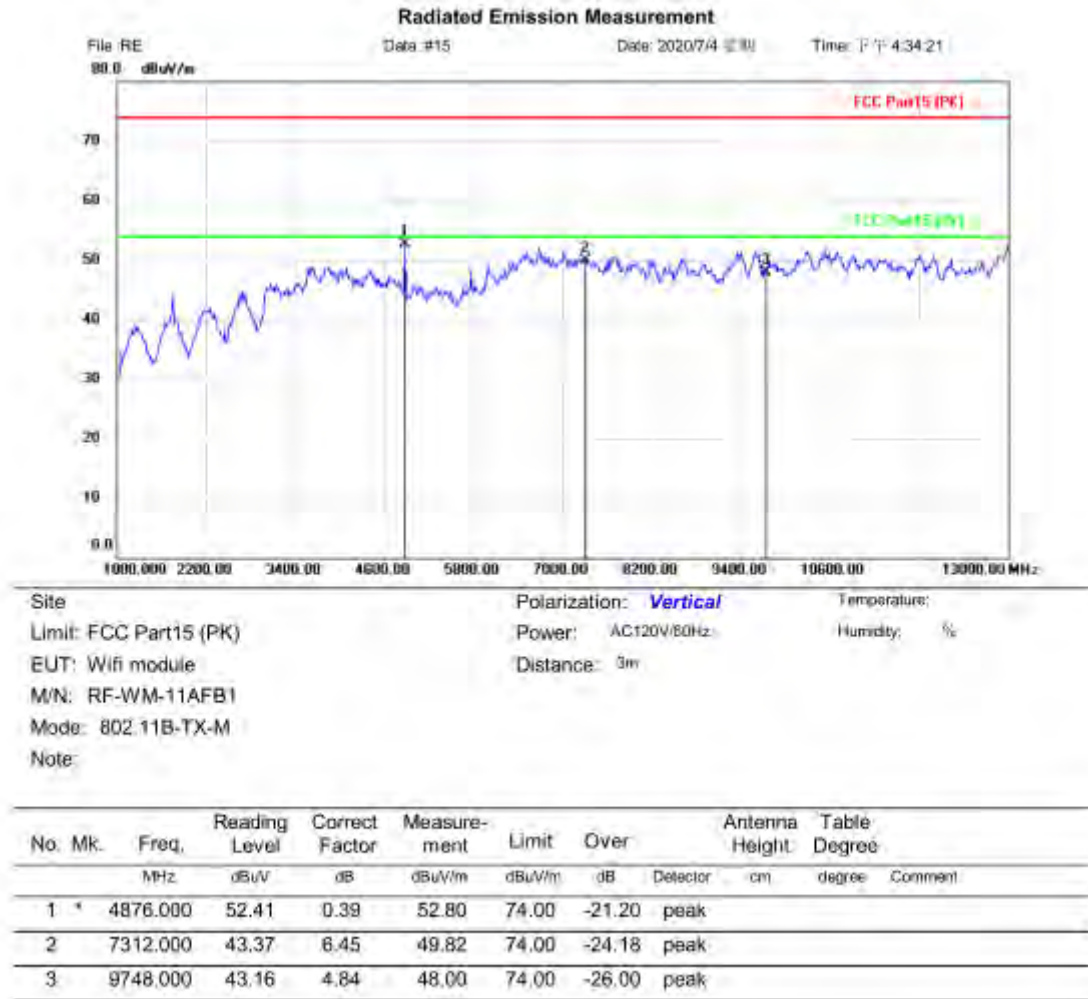
Remark: During the test, pre-scan the 802.11b/g/n mode, and found the 802.11b mode which it is worse case.

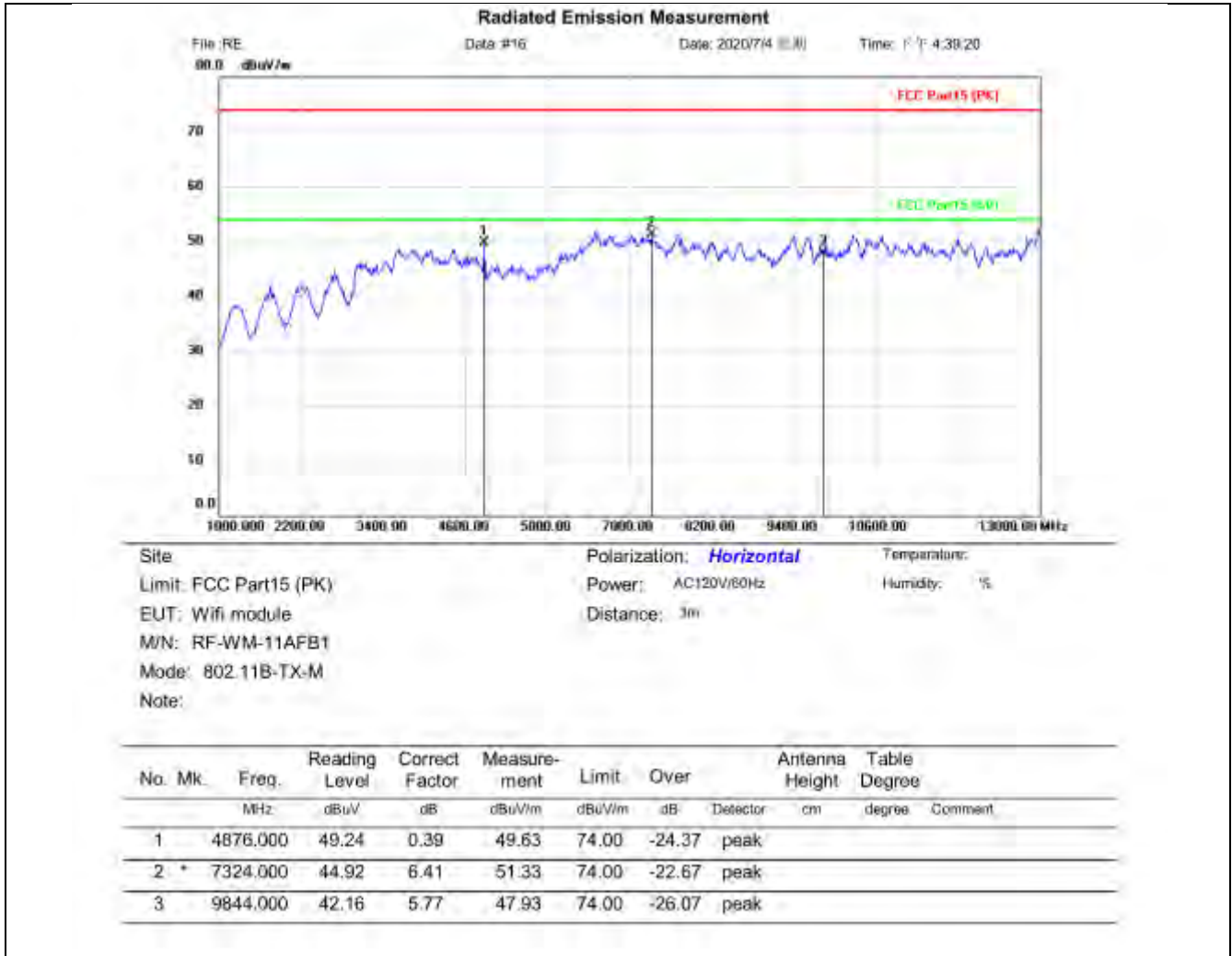
Test channel:lowest



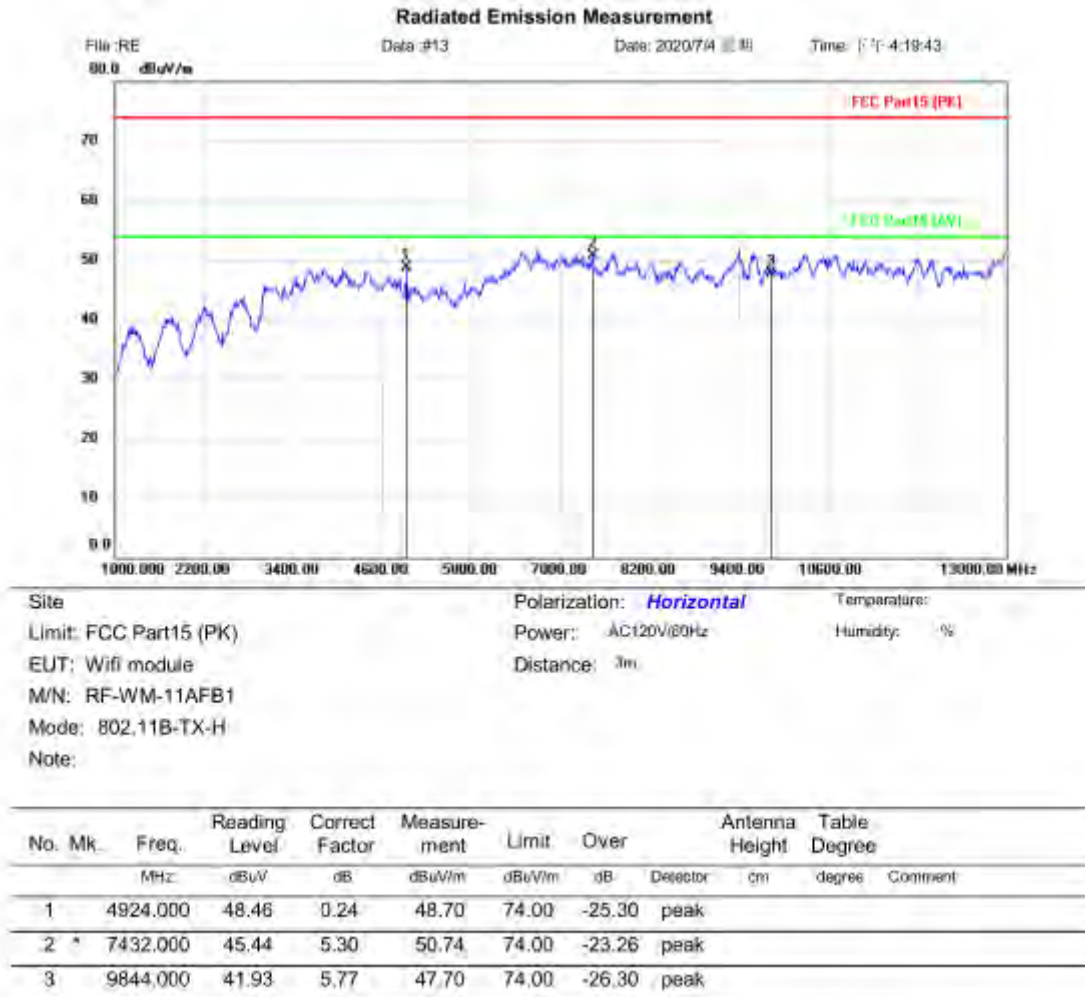


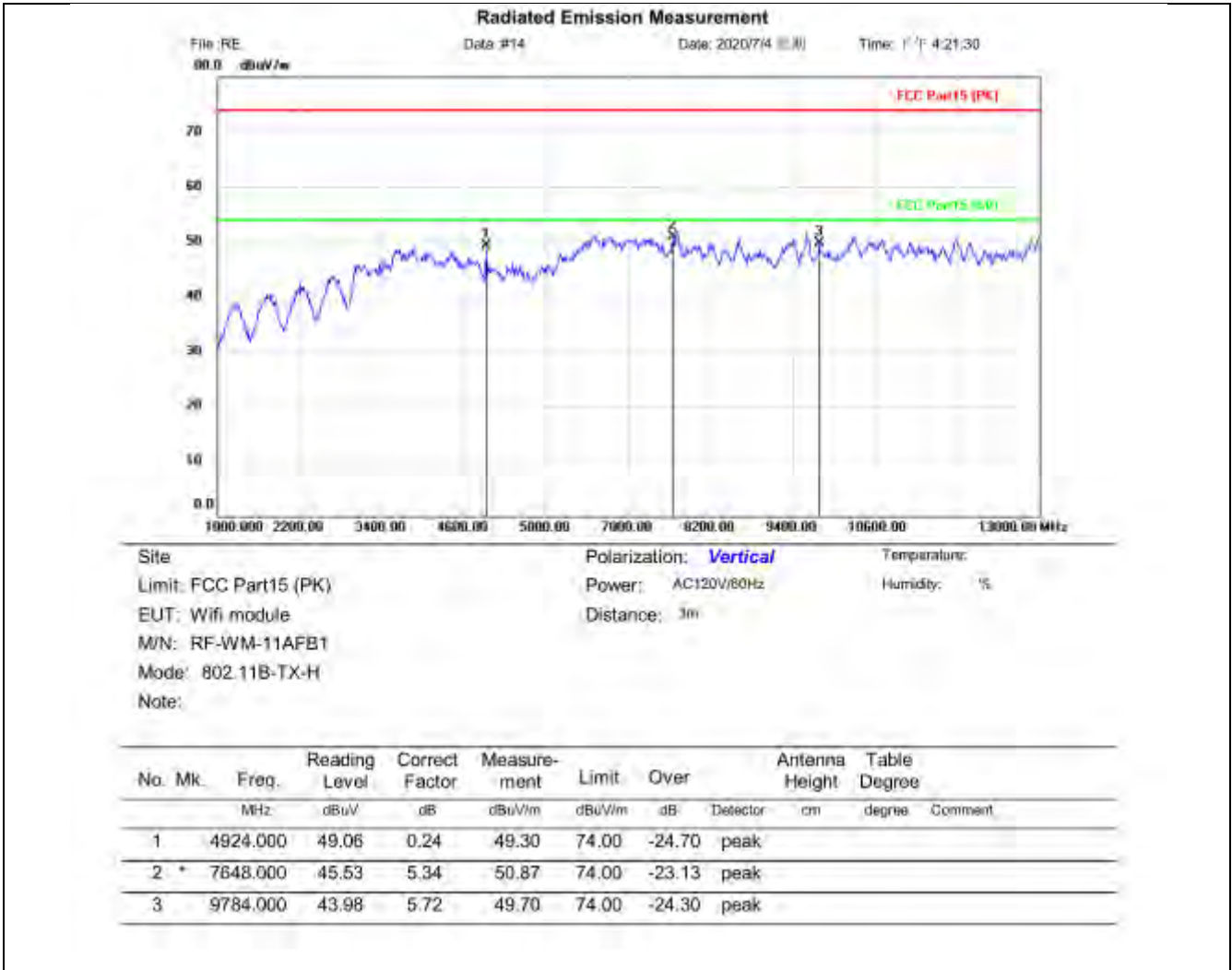
Test channel: Middle





Test channel: Highest





Test Result: Pass

RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

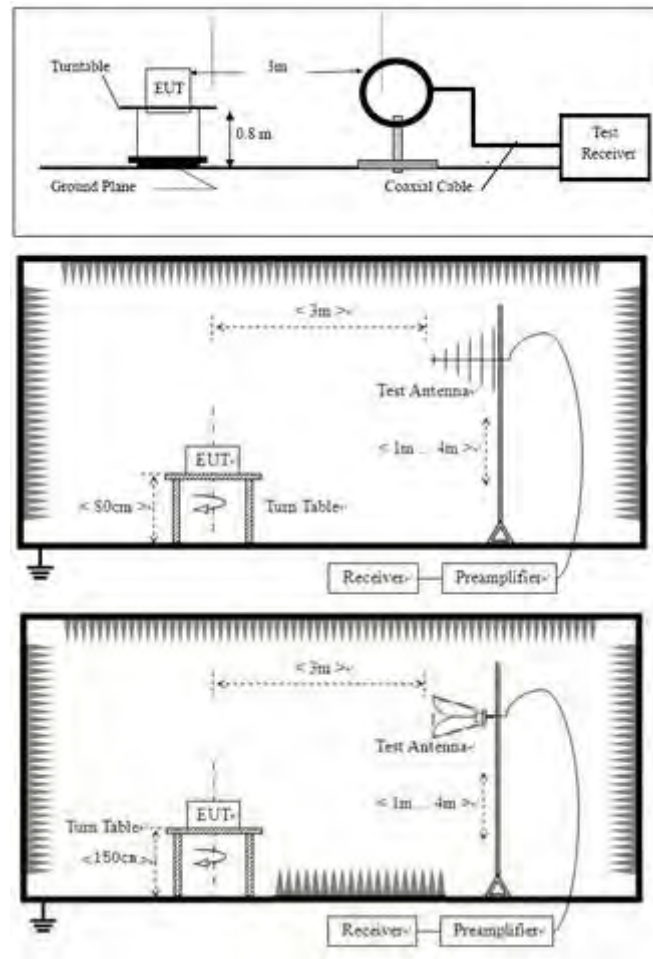
Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 6.10.5
Test Mode (Pre-Scan)	TX mode with modulation
Test Mode (Final Test)	TX mode with modulation
Tester	Eason
Temperature	23°C
Humidity	56%

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.

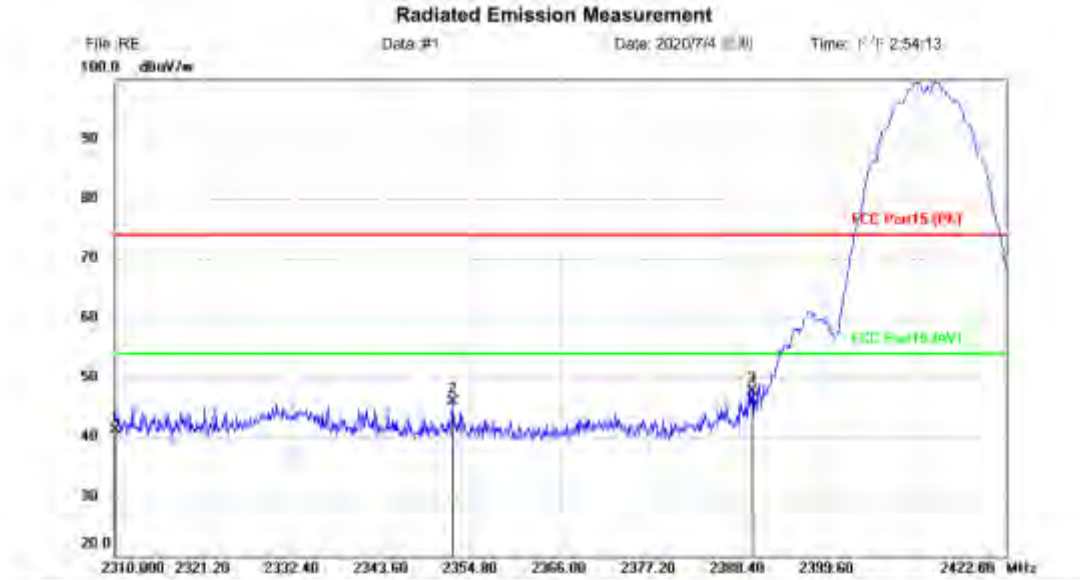
Remark 1: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

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

BlueAsia

TEST DATA

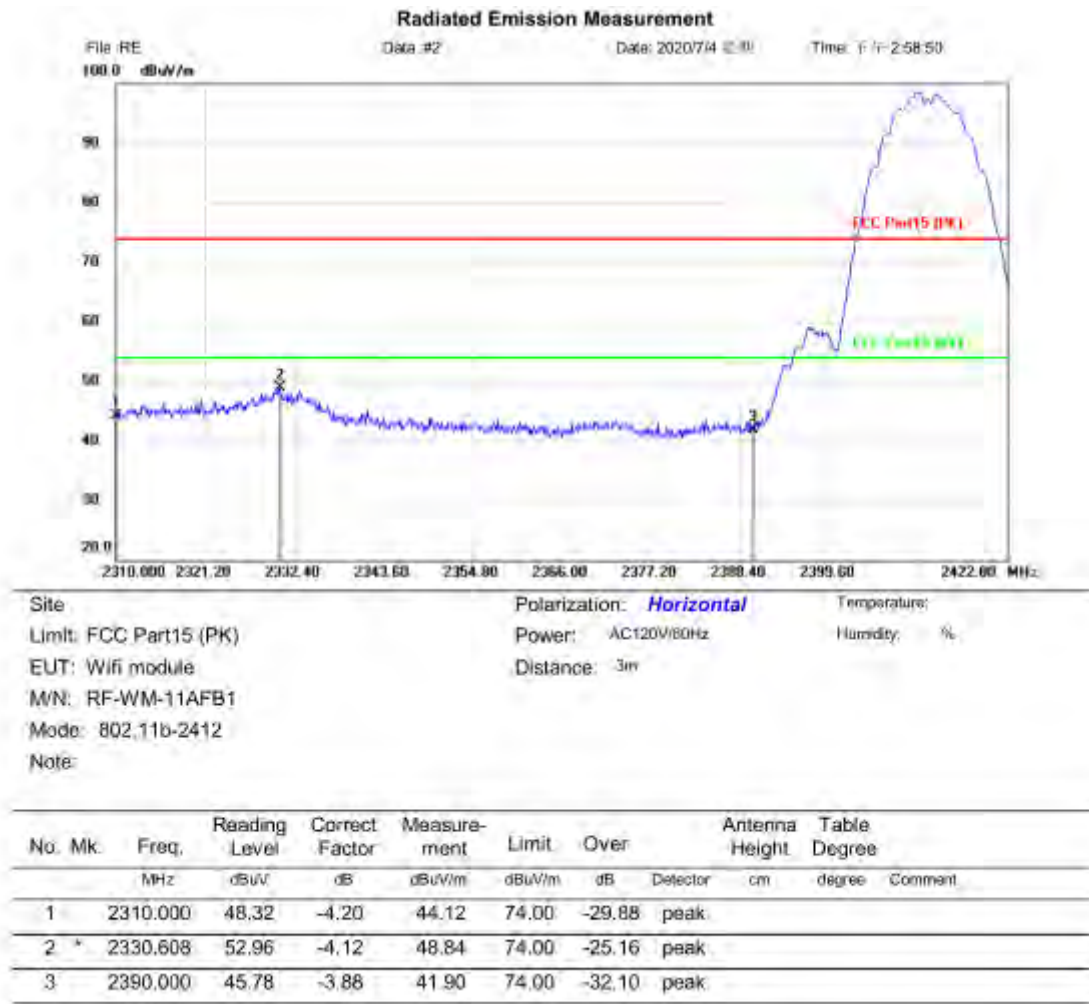
802.11b:Lowest channel
Peak value



Site: Polarization: **Vertical** Temperature:
 Limit: FCC Part15 (PK) Power: AC120V/60Hz Humidity: %
 EUT: Wifi module Distance: 3m
 M/N: RF-WM-11AFB1
 Mode: 802.11b-2412
 Note:

No.	Mk	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		2310.000	45.67	-4.49	41.18	74.00	-32.82	peak		
2		2352.448	50.25	-4.34	45.91	74.00	-28.09	peak		
3	*	2390.000	51.99	-4.21	47.78	74.00	-26.22	peak		





BLA

802.11b: Highest channel

Peak value

Radiated Emission Measurement

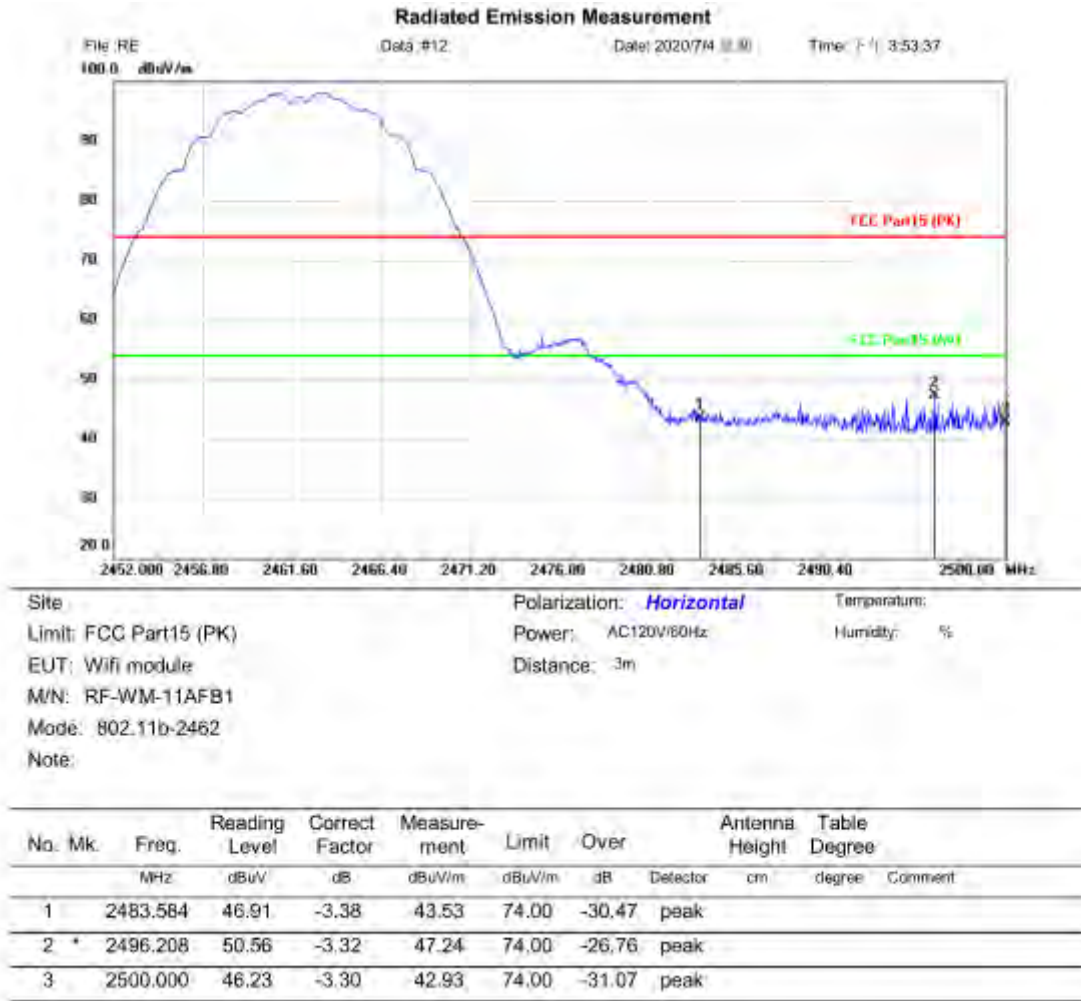


File: RE
100.0 dBuV/m
Data #11
Date: 2020/7/4 14:00
Time: 下午 3:50:45

Site: Polarization: **Vertical** Temperature:
Limit: FCC Part15 (PK) Power: AC120V/60Hz Humidity: %
EUT: Wifi module Distance: 3m
M/N: RF-WM-11AFB1
Mode: 802.11b-2462
Note:

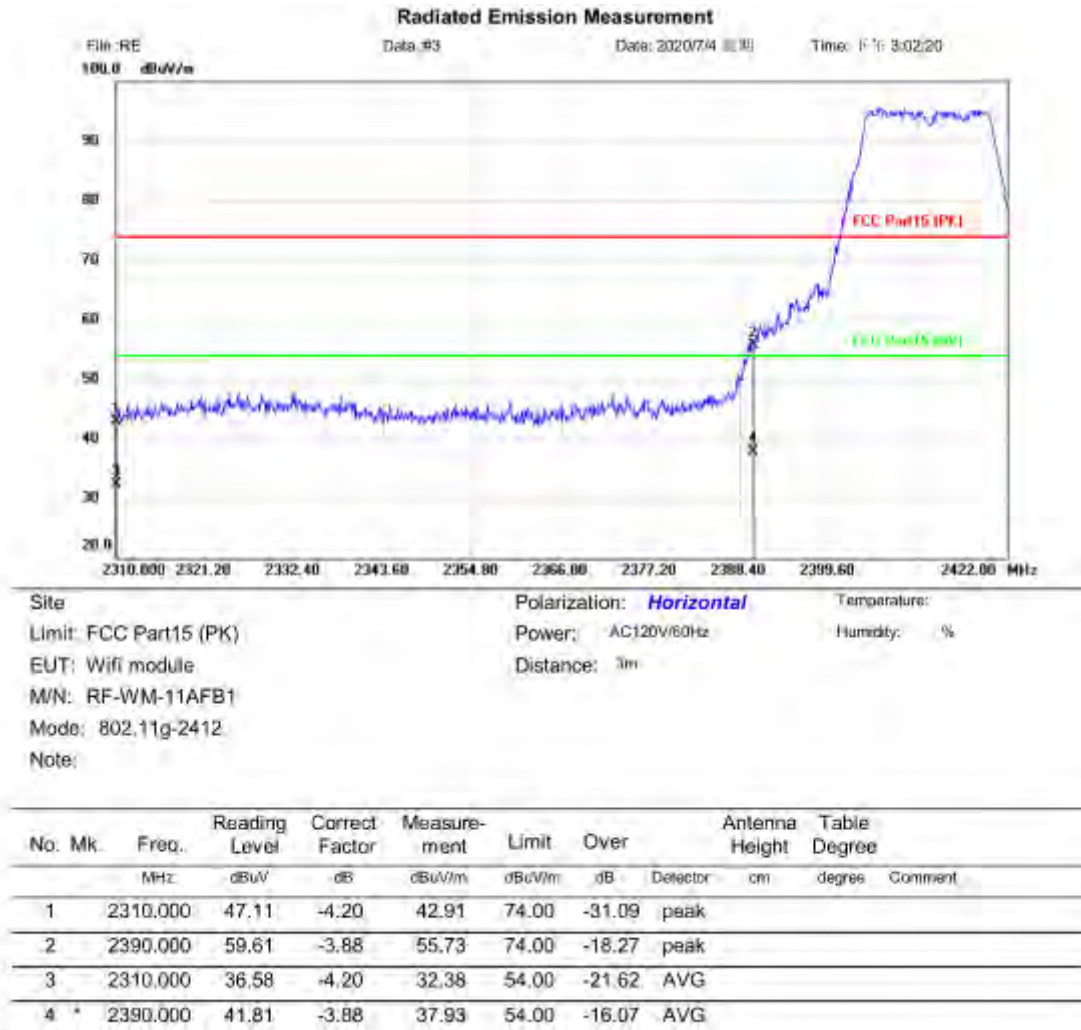
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		2500,000	45.30	-3.70	41.60	74.00	-32.40	peak		
2	*	2483,536	45.77	-3.77	42.00	74.00	-32.00	peak		

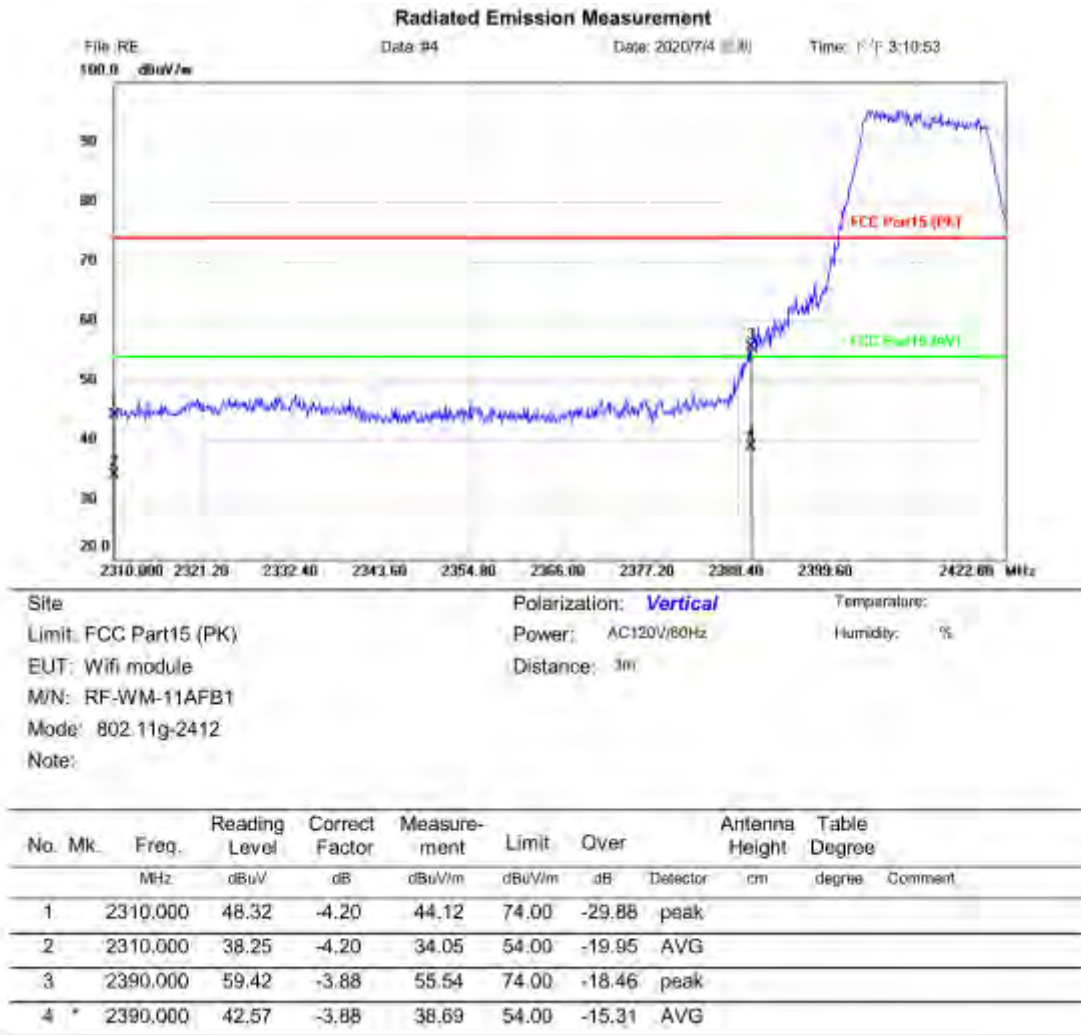
BLA



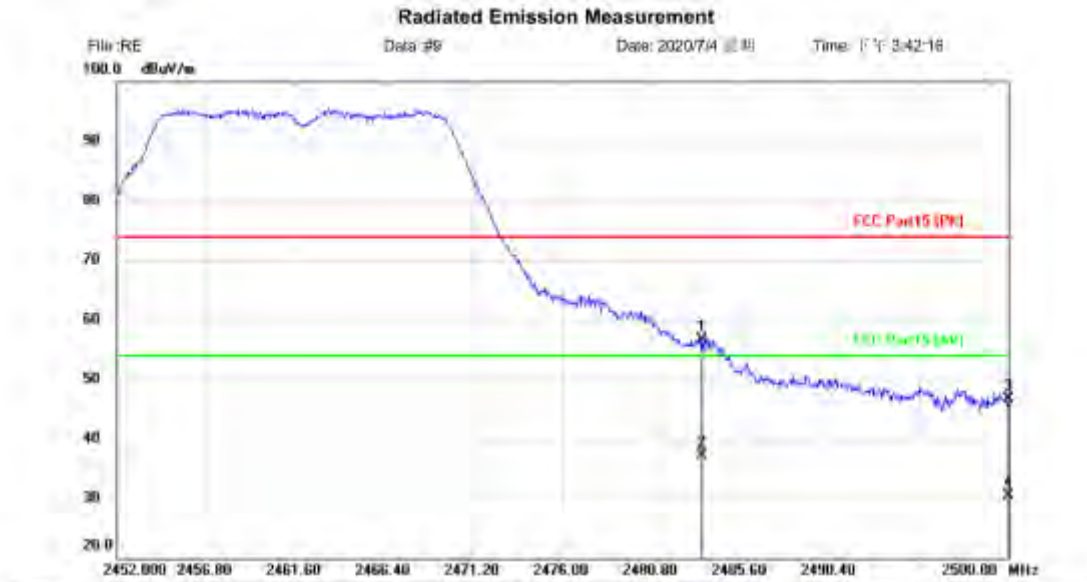
BLA

802.11g:Lowest channel
Peak value





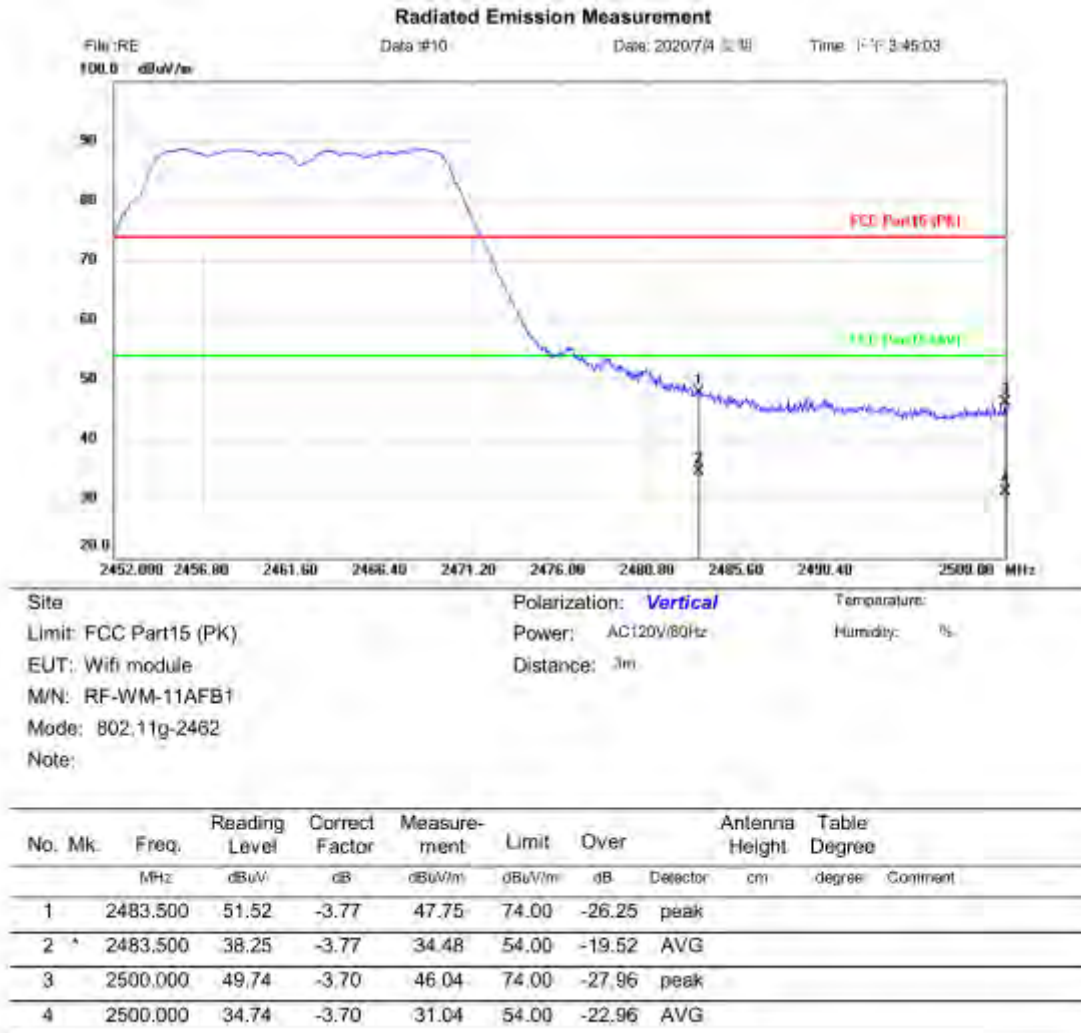
802.11g: Highest channel
Peak value



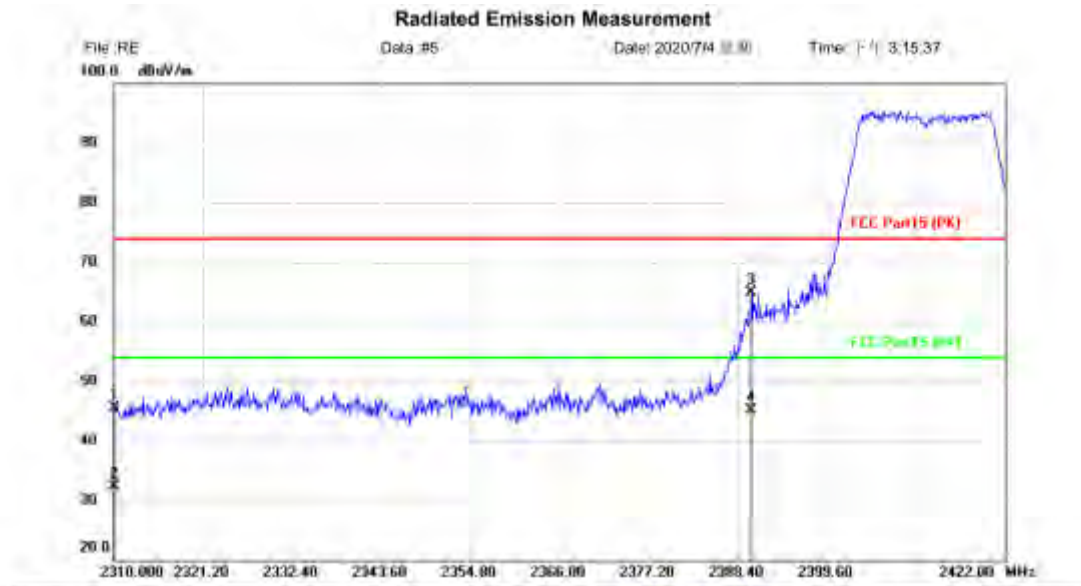
Site: Polarization: **Horizontal** Temperature:
Limit: FCC Part15 (PK) Power: AC120V/60Hz Humidity: %
EUT: Wifi module Distance: 3m
M/N: RF-WM-11AFB1
Mode: 802.11g-2462
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree
1		2483.500	60.12	-3.38	56.74	74.00	-17.26	peak	
2	*	2483.500	40.64	-3.38	37.26	54.00	-16.74	AVG	
3		2500.000	50.06	-3.30	46.76	74.00	-27.24	peak	
4		2500.000	33.78	-3.30	30.48	54.00	-23.52	AVG	





802.11n20:Lowest channel
Peak value

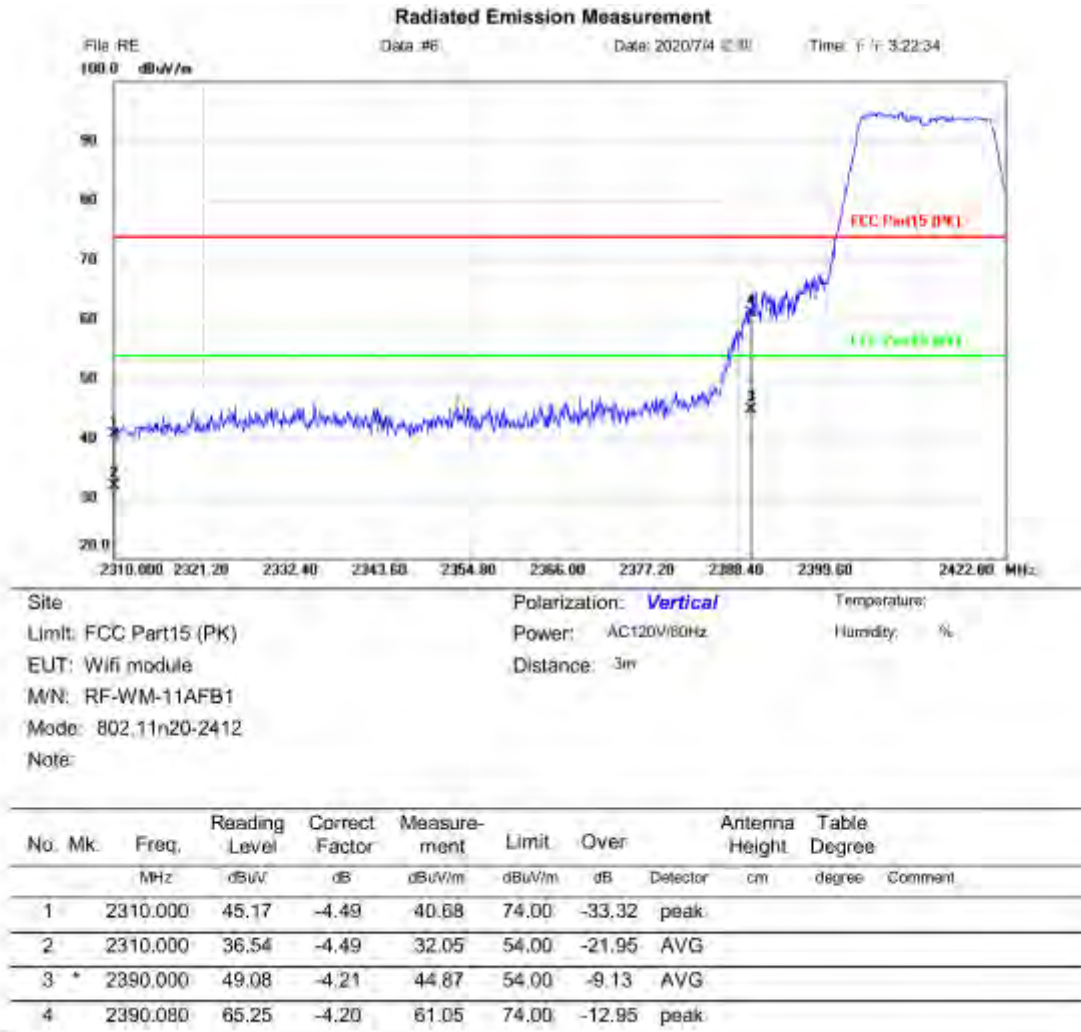


Site: Limit: FCC Part15 (PK) EUT: Wifi module M/N: RF-WM-11AFB1 Mode: 802.11n20-2412 Note:

Polarization: **Horizontal** Temperature: Power: AC120V/60Hz Humidity: % Distance: 3m

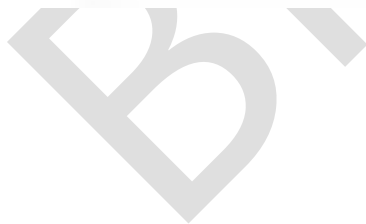
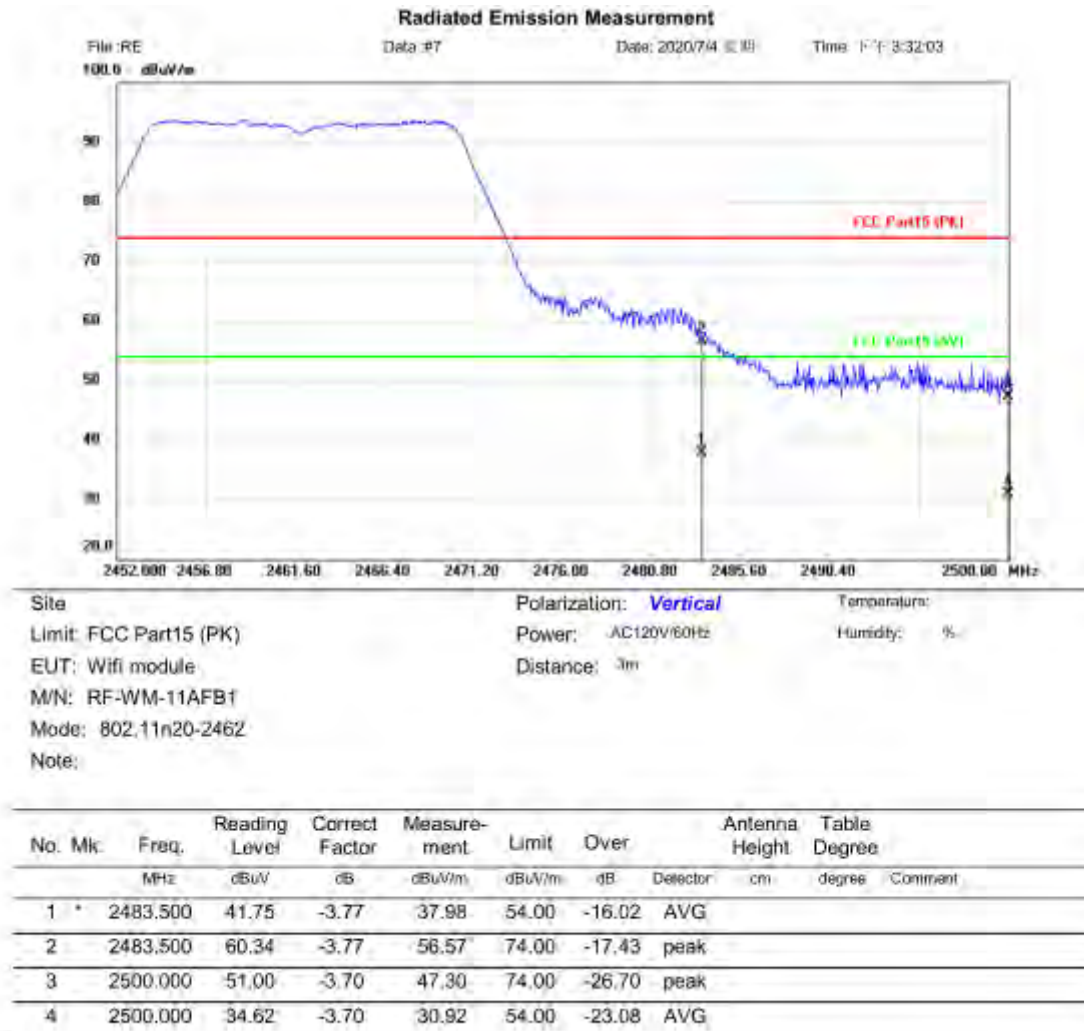
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2310.000	49.68	-4.20	45.48	74.00	-28.52			peak
2		2310.000	36.43	-4.20	32.23	54.00	-21.77			AVG
3		2390.000	68.87	-3.88	64.99	74.00	-9.01			peak
4	*	2390.000	49.05	-3.88	45.17	54.00	-8.83			AVG

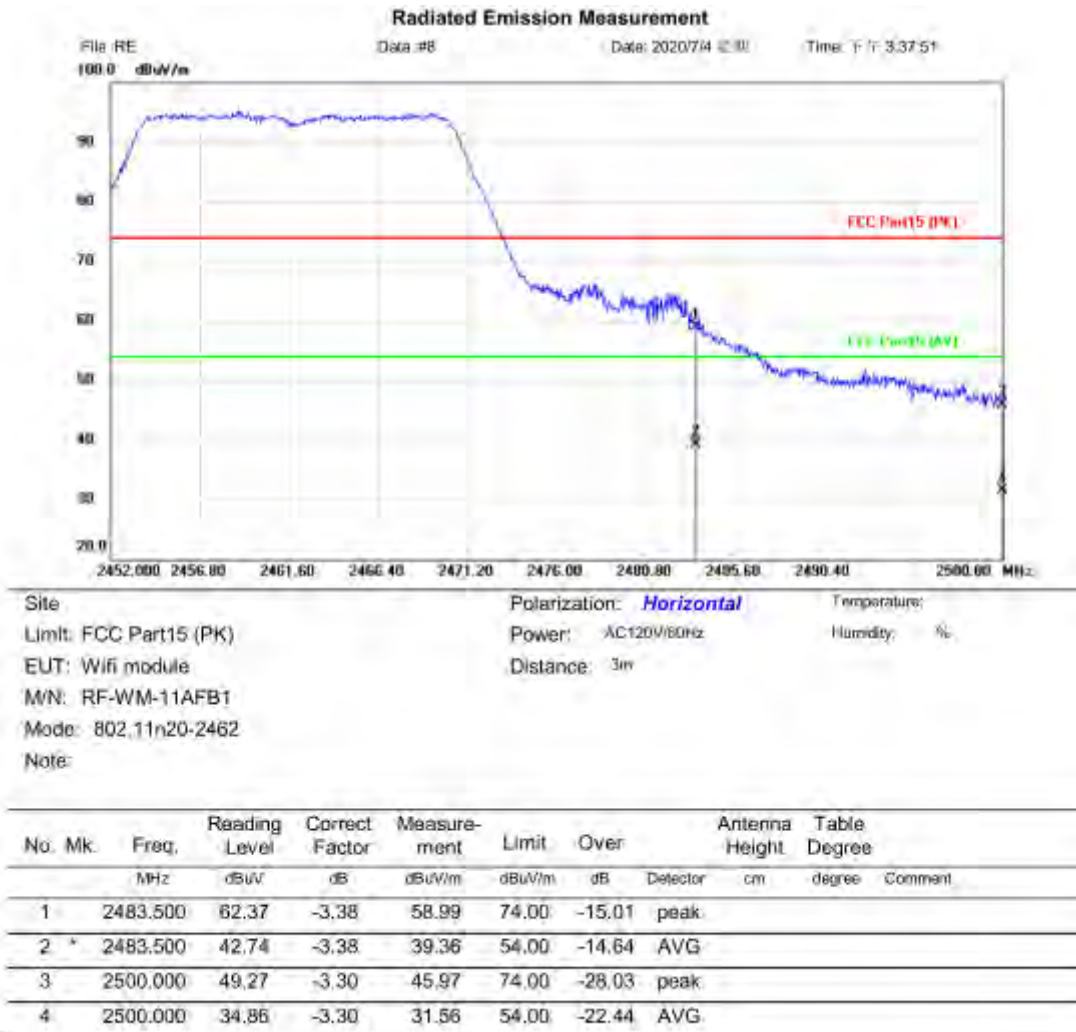




BLA

802.11n20: Highest channel
Peak value





10 APPENDIX

Appendix1

10.1 APPENDIXA: DTS BANDWIDTH

Test Result

TestMode	Antenna	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	8.120	2407.960	2416.080	>=0.5	PASS
		2437	8.600	2432.960	2441.560	>=0.5	PASS
		2462	9.120	2457.440	2466.560	>=0.5	PASS
11G	Ant1	2412	16.440	2403.800	2420.240	>=0.5	PASS
		2437	16.440	2428.760	2445.200	>=0.5	PASS
		2462	16.400	2453.800	2470.200	>=0.5	PASS
11N20SISO	Ant1	2412	17.440	2403.200	2420.640	>=0.5	PASS
		2437	17.600	2428.200	2445.800	>=0.5	PASS
		2462	17.400	2453.200	2470.600	>=0.5	PASS

Test Graphs





11G Ant1 2437



11G Ant1 2462



11N20SISO Ant1 2412



11N20SISO Ant1_2437



11N20SISO Ant1_2462

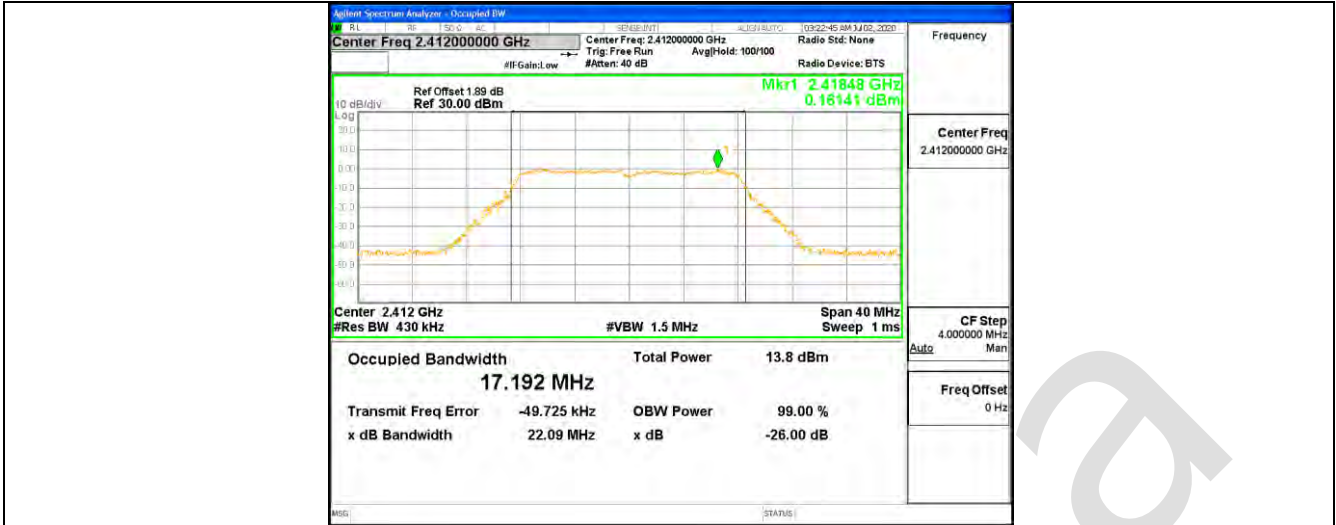


10.2 APPENDIX B: OCCUPIED CHANNEL BANDWIDTH
Test Result

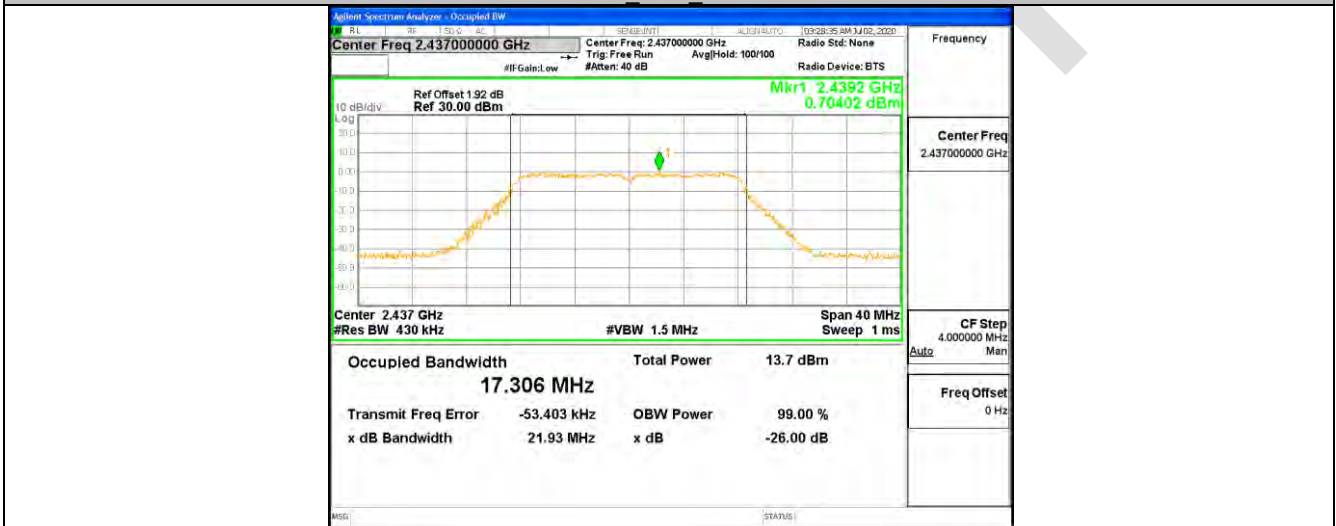
TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	Ant1	2412	13.260	2405.345	2418.605	---	PASS
		2437	13.334	2430.367	2443.701	---	PASS
		2462	13.316	2455.306	2468.622	---	PASS
11G	Ant1	2412	17.192	2403.354	2420.546	---	PASS
		2437	17.306	2428.294	2445.600	---	PASS
		2462	17.173	2453.380	2470.553	---	PASS
11N20SISO	Ant1	2412	18.015	2402.993	2421.008	---	PASS
		2437	18.026	2427.965	2445.991	---	PASS
		2462	18.051	2452.936	2470.987	---	PASS

Test Graphs

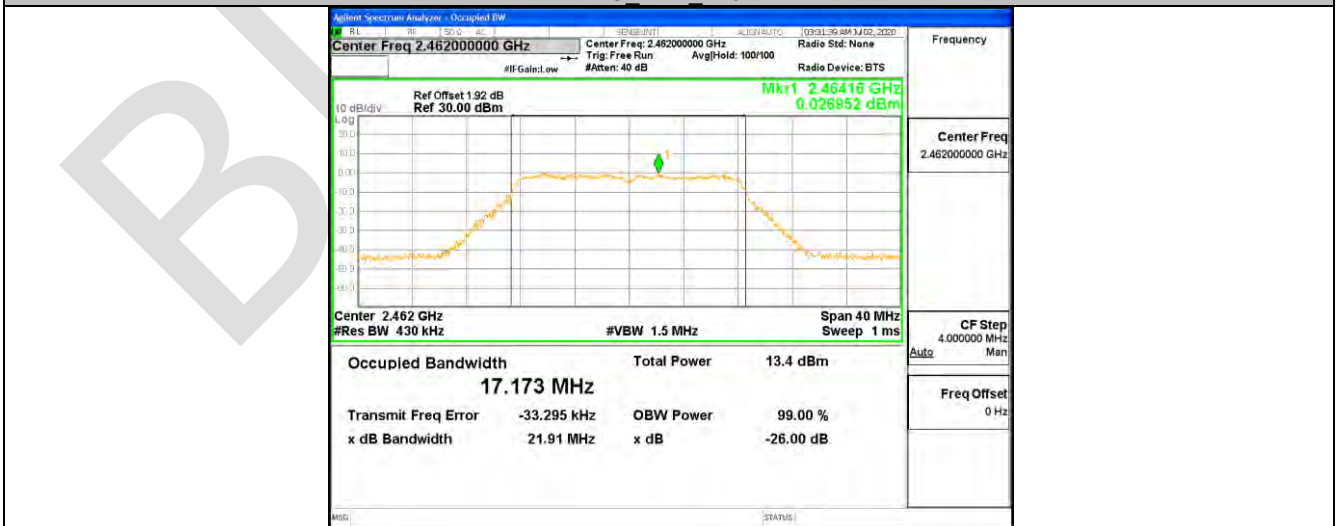




11G Ant1 2437



11G Ant1 2462



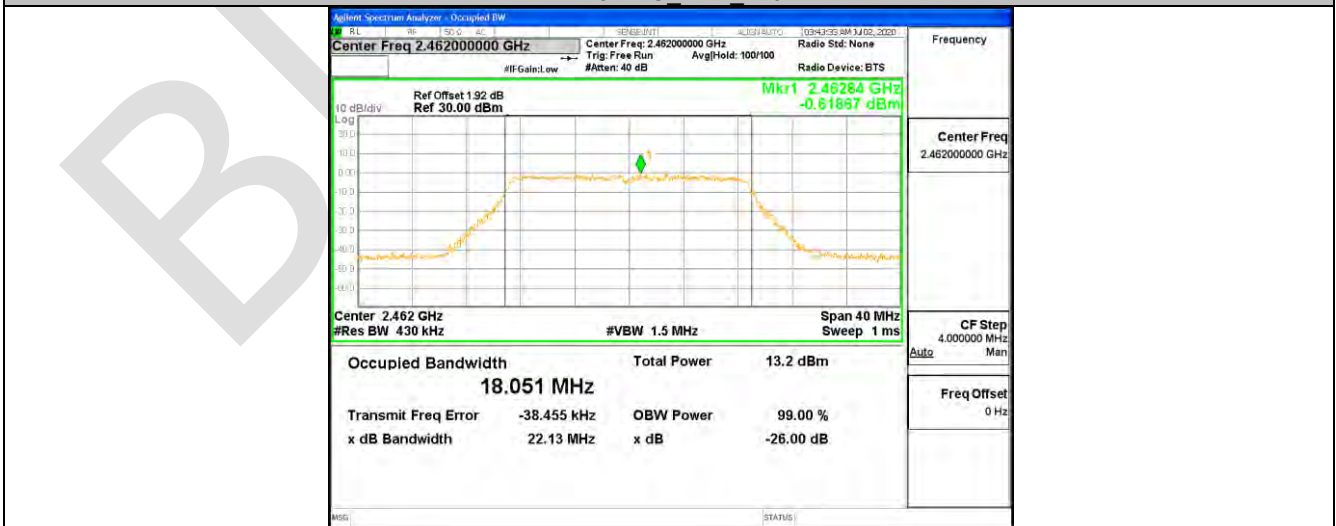
11N20SISO Ant1 2412



11N20SISO Ant1_2437



11N20SISO Ant1_2462



10.3 APPENDIXC: MAXIMUM CONDUCTED OUTPUT POWER

Test Result

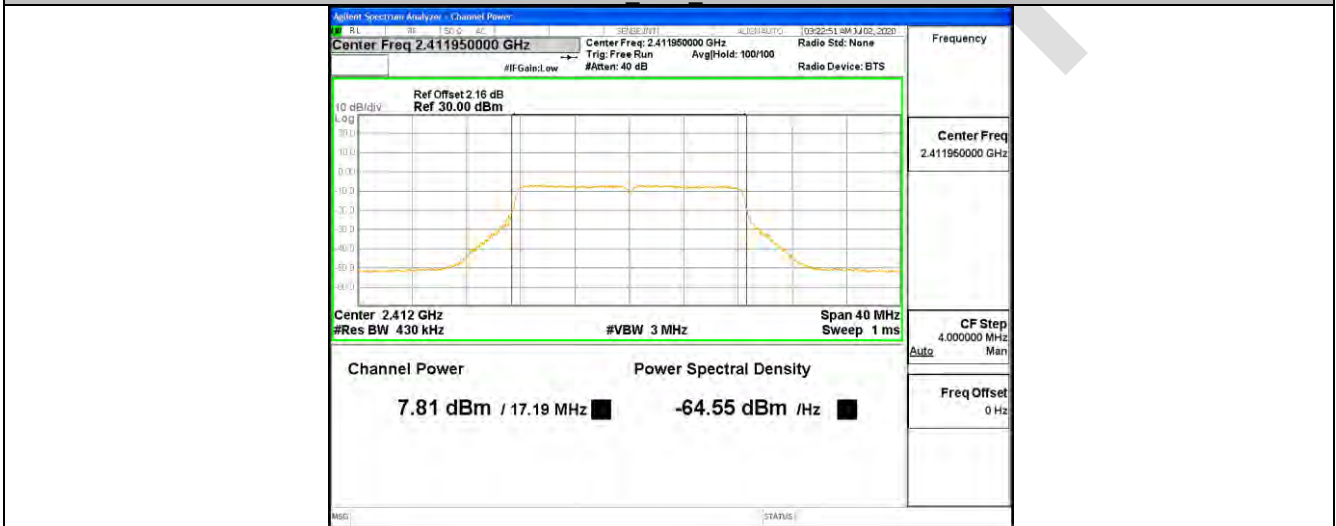
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	14.46	<=30	PASS
		2437	12.57	<=30	PASS
		2462	12.30	<=30	PASS
11G	Ant1	2412	7.81	<=30	PASS
		2437	7.75	<=30	PASS
		2462	7.37	<=30	PASS
11N20SISO	Ant1	2412	8.47	<=30	PASS
		2437	7.63	<=30	PASS
		2462	7.07	<=30	PASS

Test Graphs

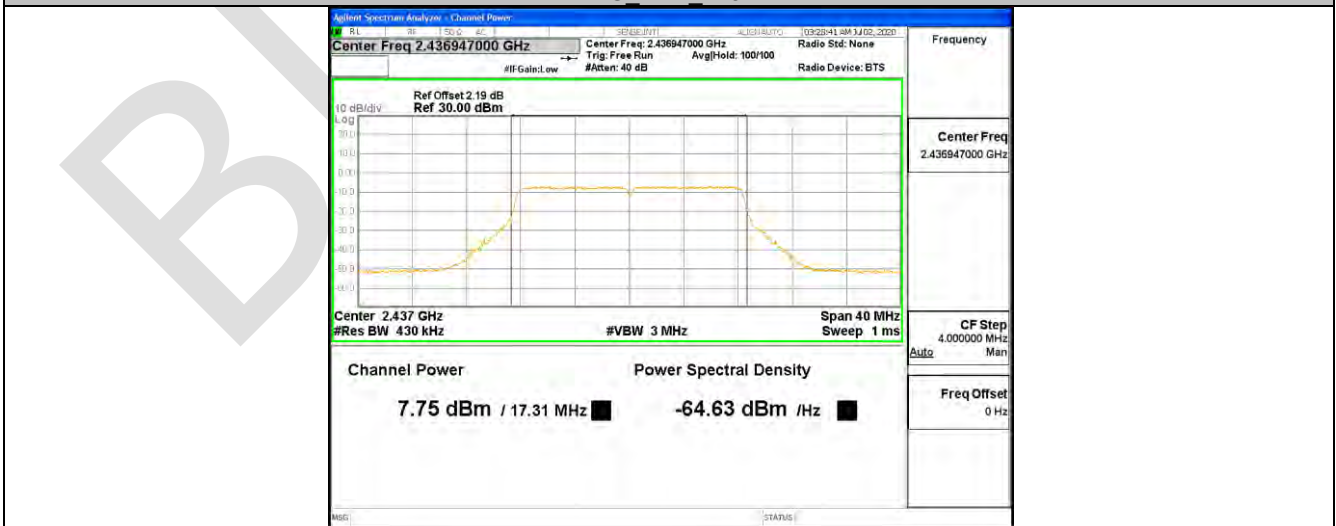




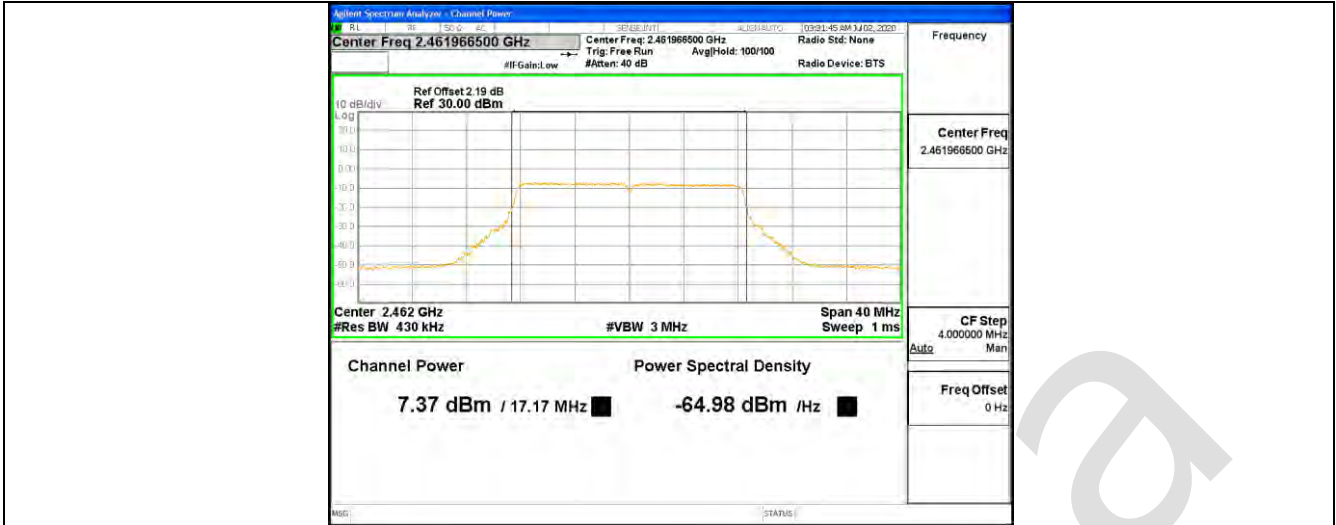
11G Ant1 2412



11G Ant1 2437



11G Ant1 2462



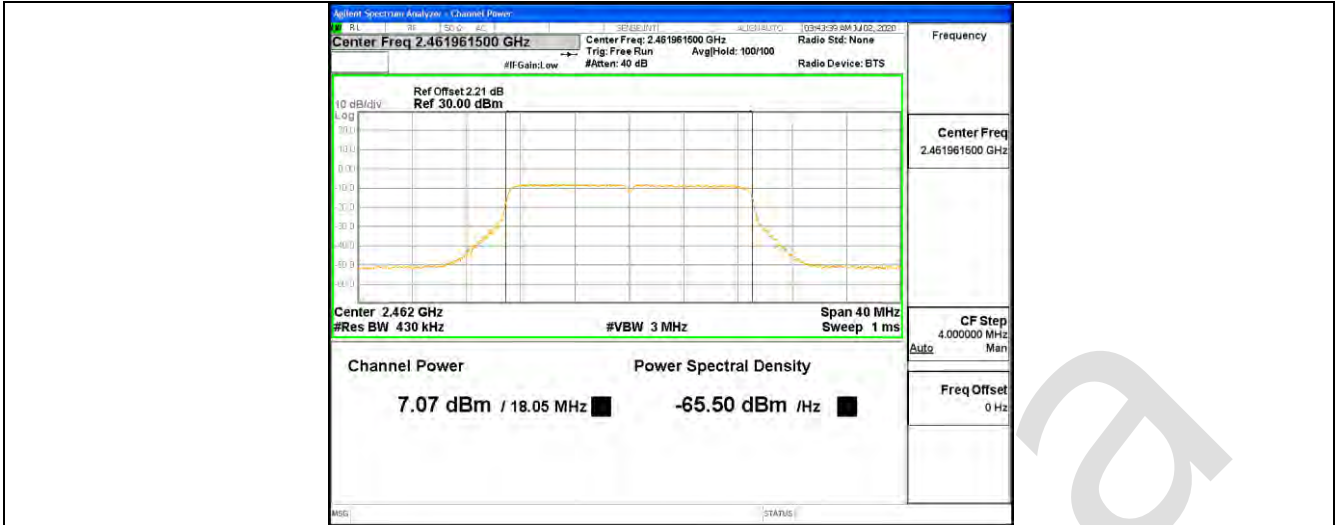
11N20SISO Ant1_2412



11N20SISO Ant1_2437



11N20SISO Ant1_2462



10.4 APPENDIXD: MAXIMUM POWER SPECTRAL DENSITY

Test Result

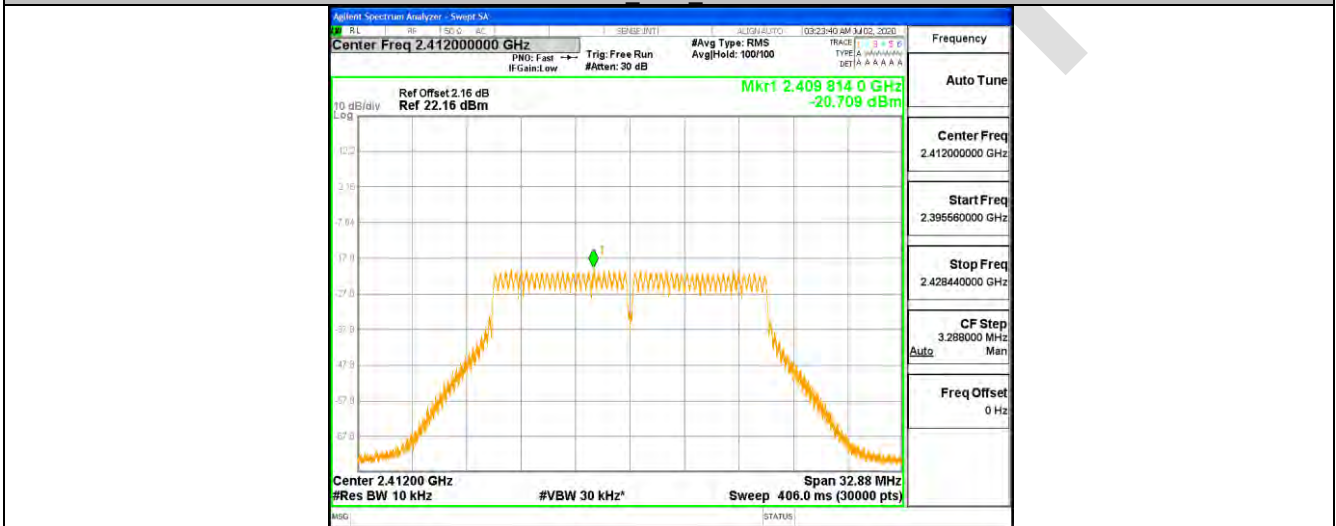
TestMode	Antenna	Channel	Result[dBm/3-100kHz]	Limit[dBm/3kHz]	Verdict
11B	Ant1	2412	-11.85	<=8	PASS
		2437	-12.89	<=8	PASS
		2462	-13.92	<=8	PASS
11G	Ant1	2412	-20.71	<=8	PASS
		2437	-20.67	<=8	PASS
		2462	-20.88	<=8	PASS
11N20SISO	Ant1	2412	-20.7	<=8	PASS
		2437	-21.71	<=8	PASS
		2462	-21.94	<=8	PASS

Test Graphs

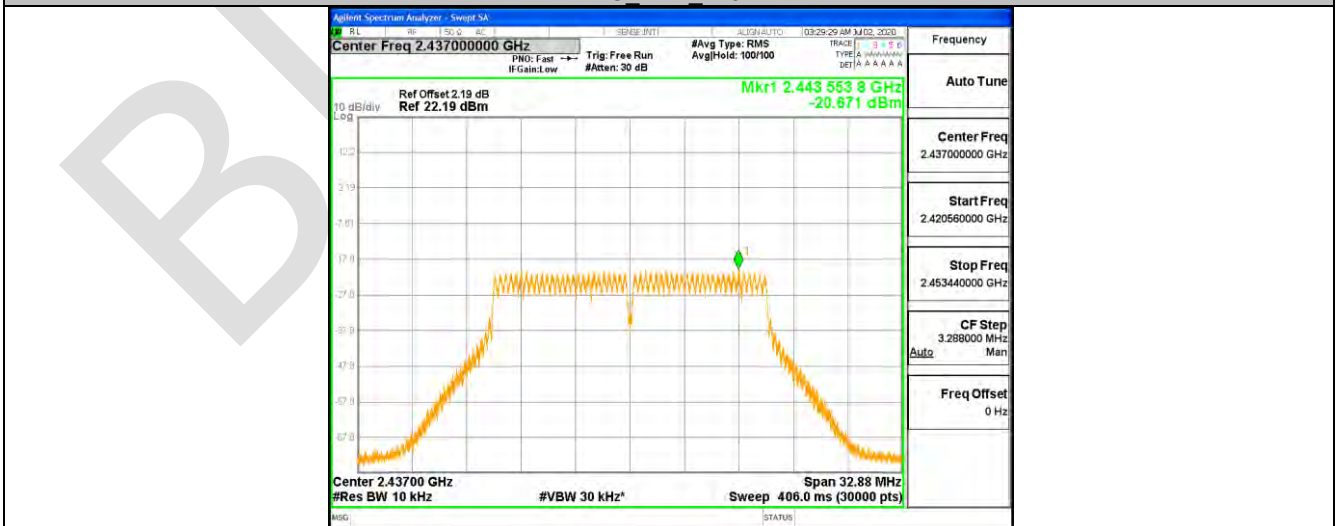




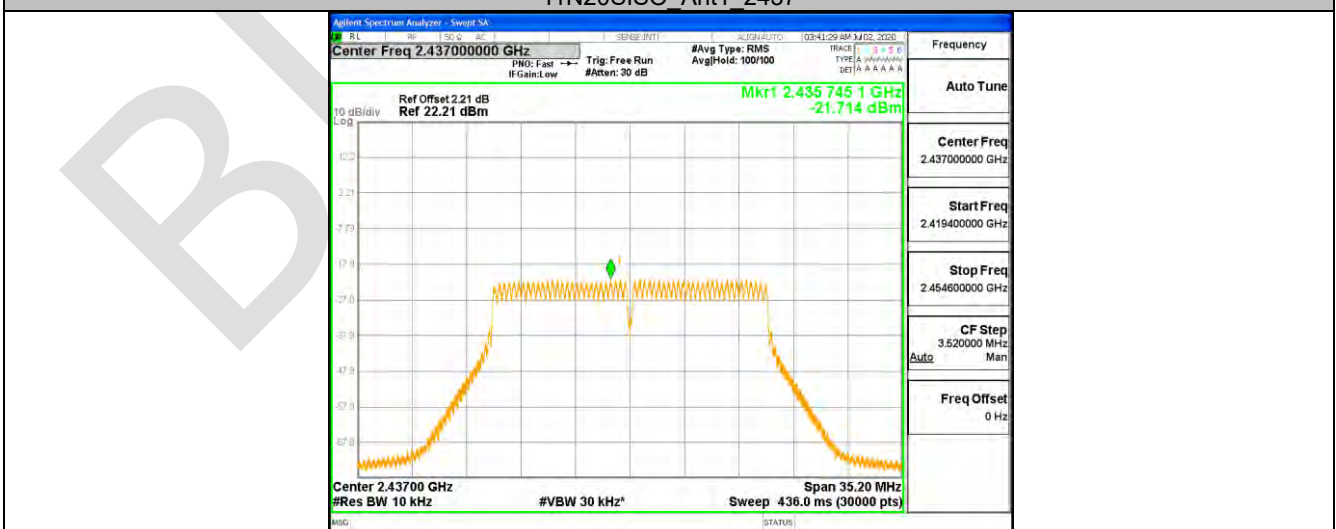
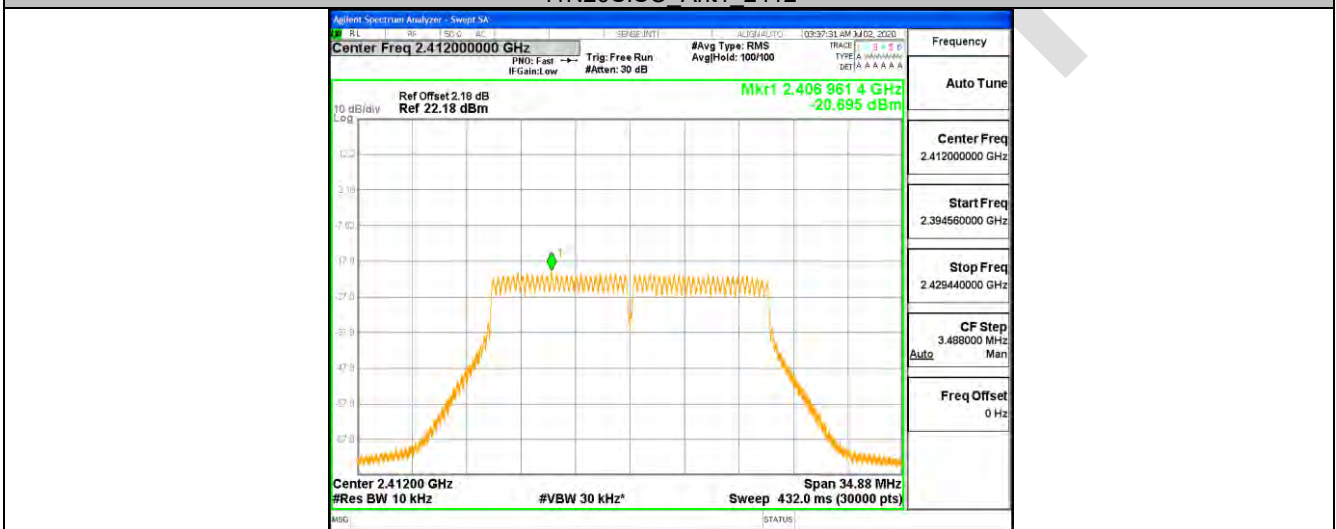
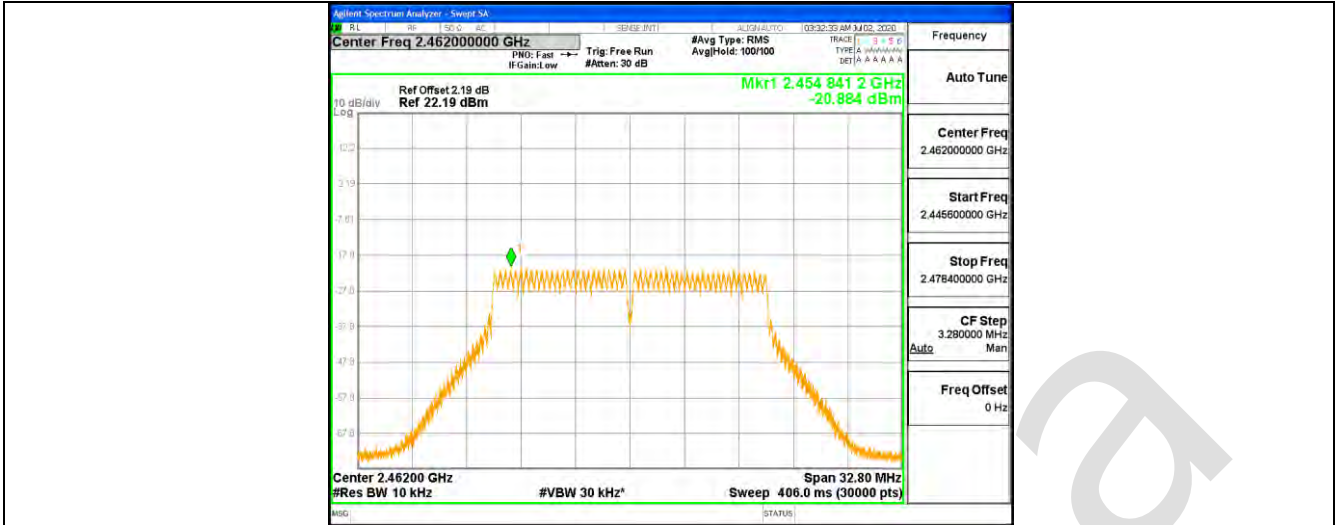
11G Ant1 2412

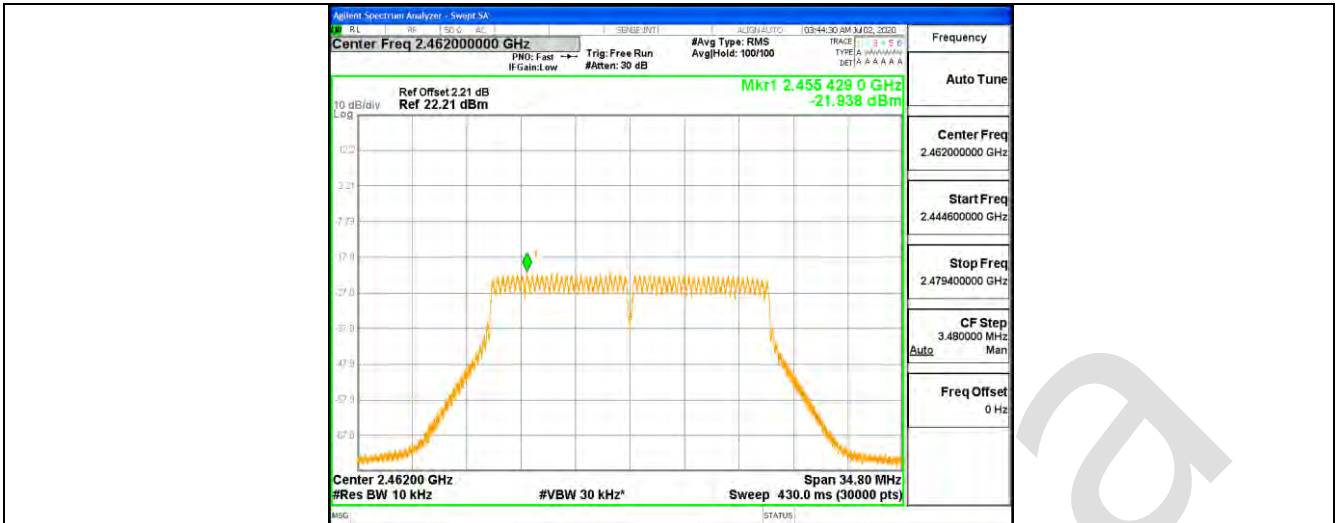


11G Ant1 2437



11G Ant1 2462





10.5 APPENDIXE: BAND EDGE MEASUREMENTS

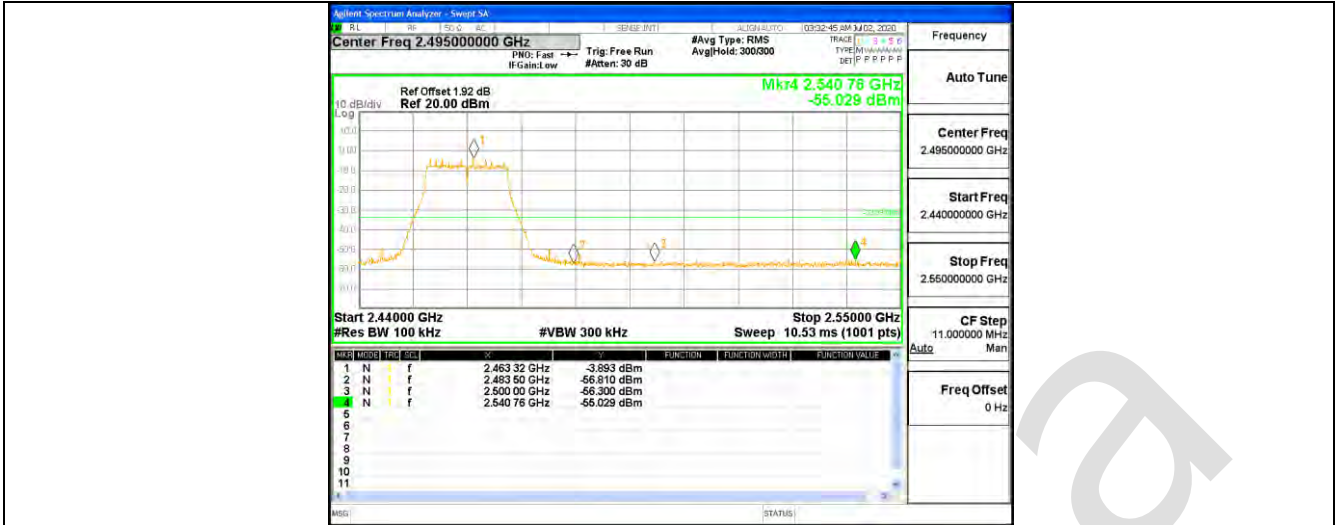
Test Result

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	Low	2412	5.11	-54.63	<=-24.89	PASS
		High	2462	3.31	-54.59	<=-26.7	PASS
11G	Ant1	Low	2412	-3.62	-54.67	<=-33.62	PASS
		High	2462	-3.89	-55.03	<=-33.89	PASS
11N20SISO	Ant1	Low	2412	-3.52	-55.35	<=-33.52	PASS
		High	2462	-4.11	-54.46	<=-34.11	PASS

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Test Graphs





11N20SISO Ant1 Low 2412



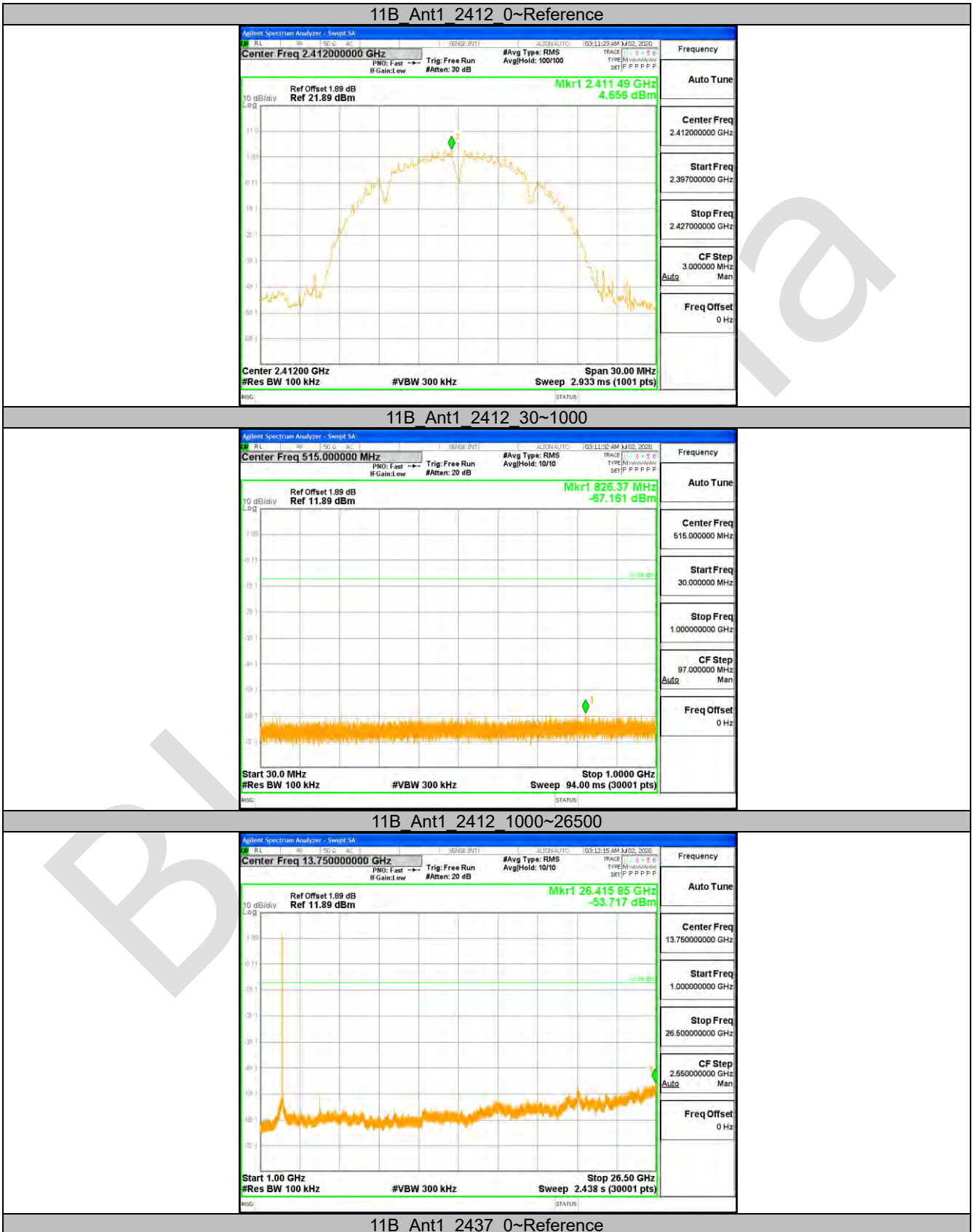
11N20SISO Ant1 High 2462



10.6 APPENDIX F: CONDUCTED SPURIOUS EMISSION
Test Result

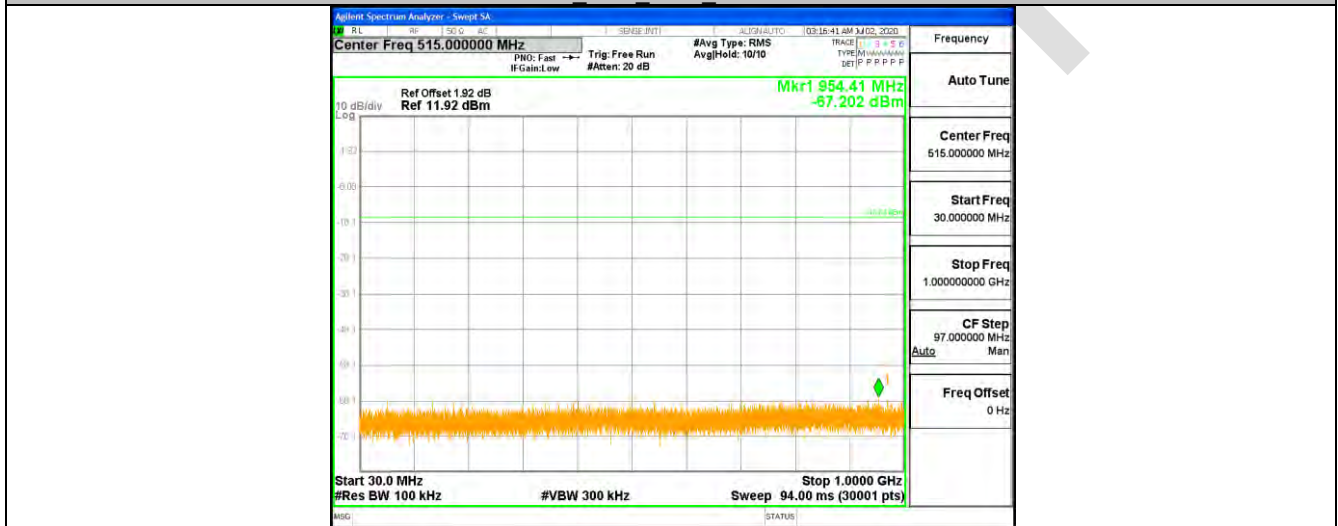
TestMode	Antenna	Channel	FreqRange [Mhz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Ant1	2412	Reference	4.66	4.66	---	PASS
			30~1000	30~1000	-67.161	<=-15.344	PASS
			1000~26500	1000~26500	-53.717	<=-15.344	PASS
		2437	Reference	3.37	3.37	---	PASS
			30~1000	30~1000	-67.202	<=-16.633	PASS
			1000~26500	1000~26500	-53.508	<=-16.633	PASS
		2462	Reference	3.18	3.18	---	PASS
			30~1000	30~1000	-67.259	<=-16.825	PASS
			1000~26500	1000~26500	-53.719	<=-16.825	PASS
11G	Ant1	2412	Reference	-3.43	-3.43	---	PASS
			30~1000	30~1000	-67.417	<=-23.428	PASS
			1000~26500	1000~26500	-53.652	<=-23.428	PASS
		2437	Reference	-4.05	-4.05	---	PASS
			30~1000	30~1000	-67.159	<=-24.048	PASS
			1000~26500	1000~26500	-53.313	<=-24.048	PASS
		2462	Reference	-4.42	-4.42	---	PASS
			30~1000	30~1000	-65.568	<=-24.42	PASS
			1000~26500	1000~26500	-53.764	<=-24.42	PASS
11N20SISO	Ant1	2412	Reference	-3.79	-3.79	---	PASS
			30~1000	30~1000	-66.49	<=-23.792	PASS
			1000~26500	1000~26500	-53.611	<=-23.792	PASS
		2437	Reference	-4.35	-4.35	---	PASS
			30~1000	30~1000	-66.733	<=-24.35	PASS
			1000~26500	1000~26500	-53.361	<=-24.35	PASS
		2462	Reference	-4.38	-4.38	---	PASS
			30~1000	30~1000	-64.762	<=-24.383	PASS
			1000~26500	1000~26500	-53.789	<=-24.383	PASS

Test Graphs

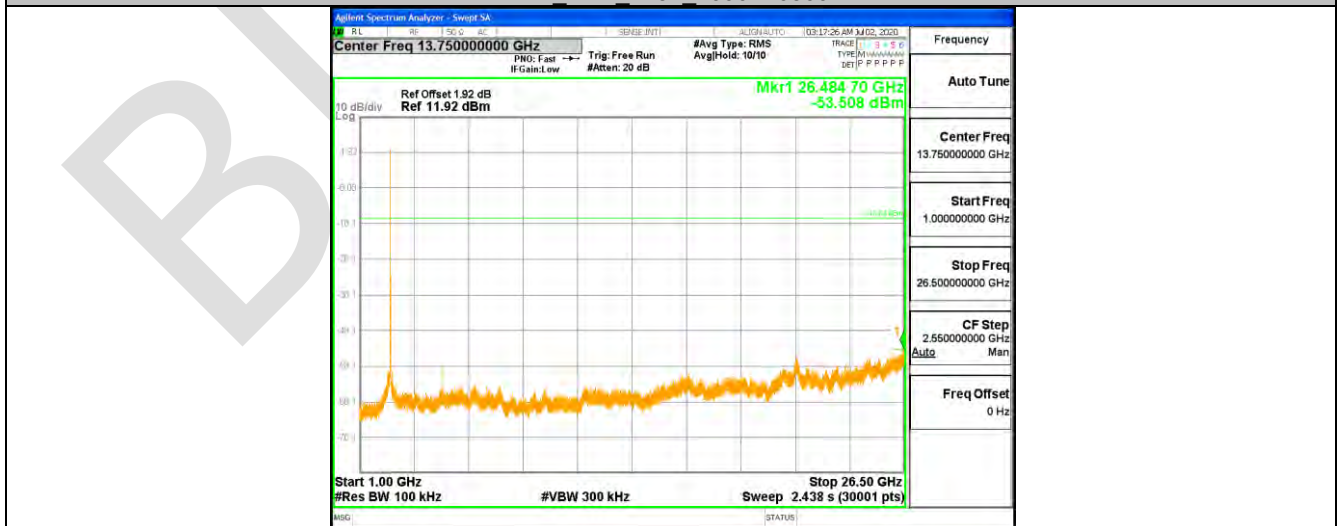




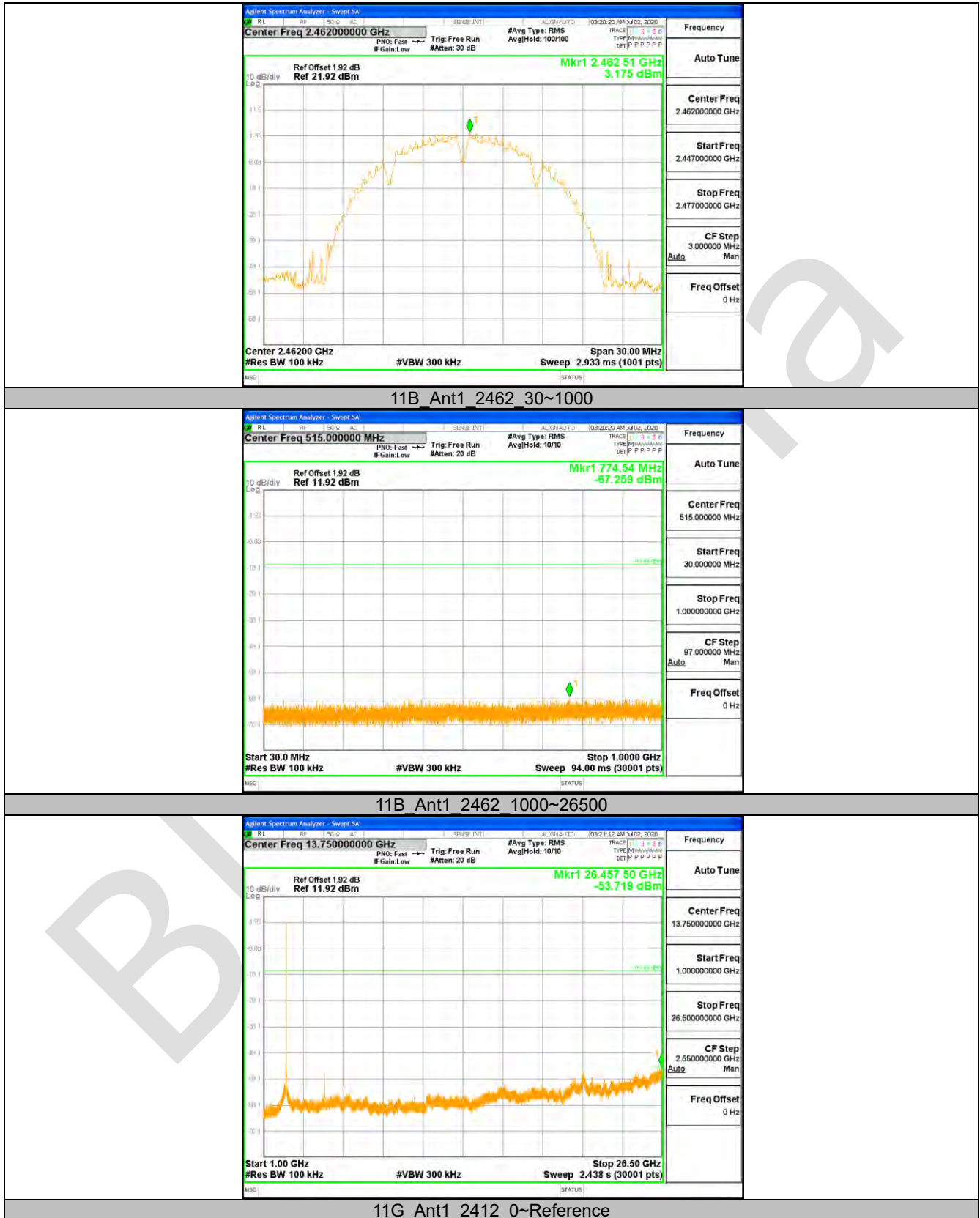
11B Ant1 2437 30~1000

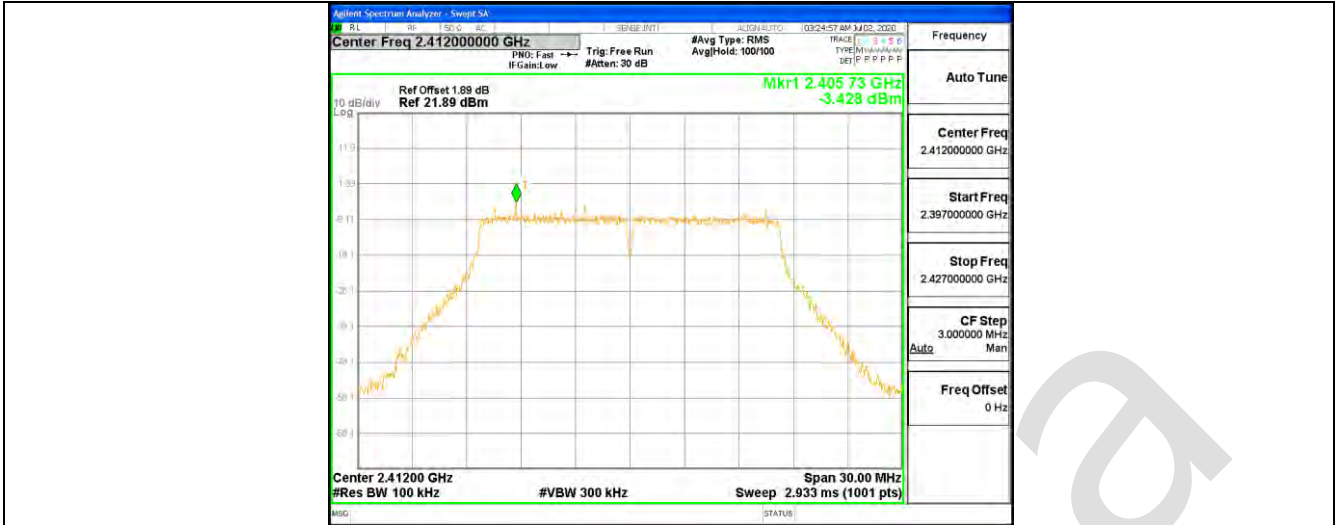


11B Ant1 2437 1000~26500

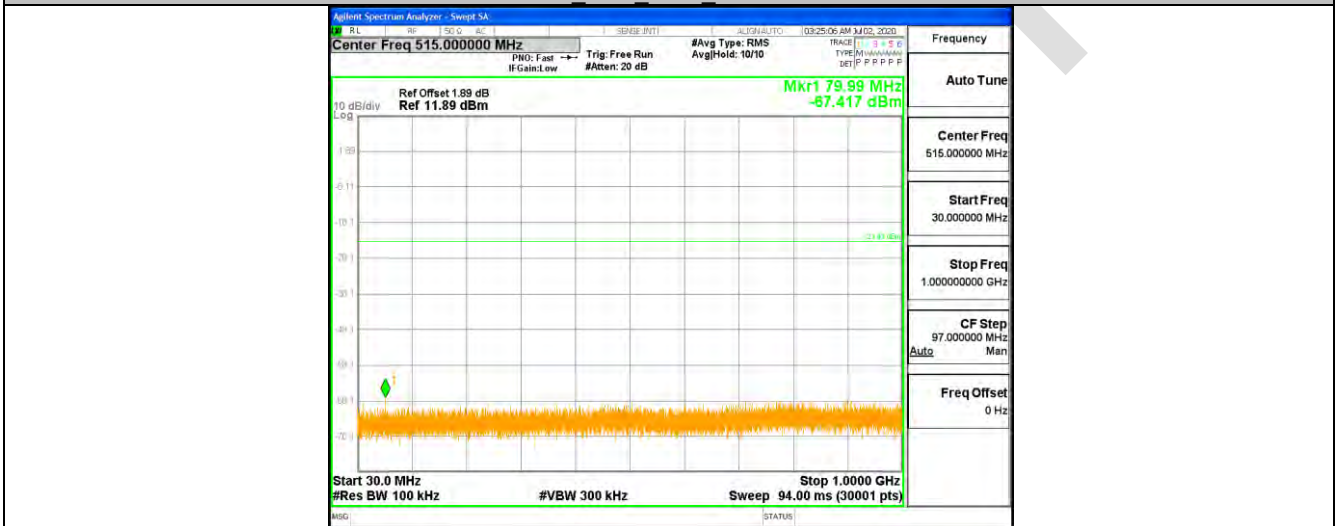


11B Ant1 2462 0~Reference

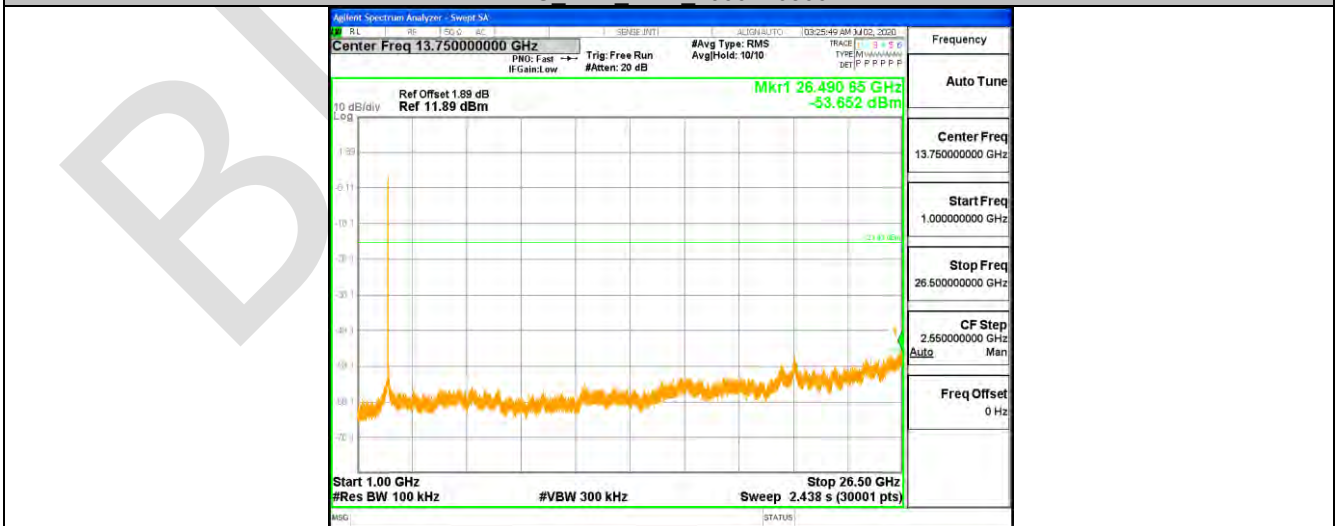




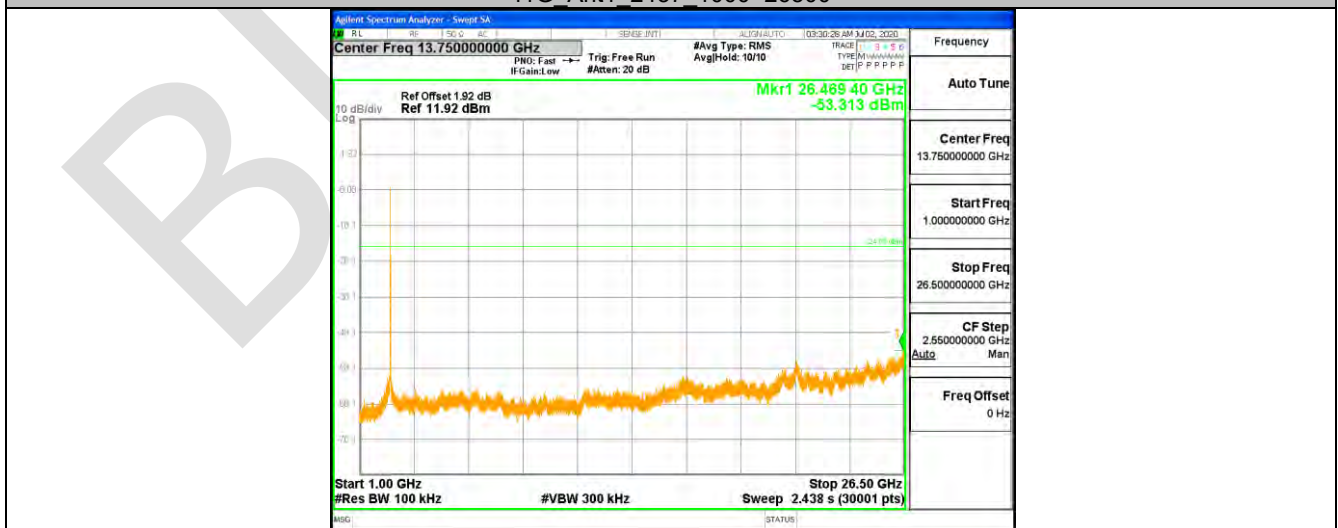
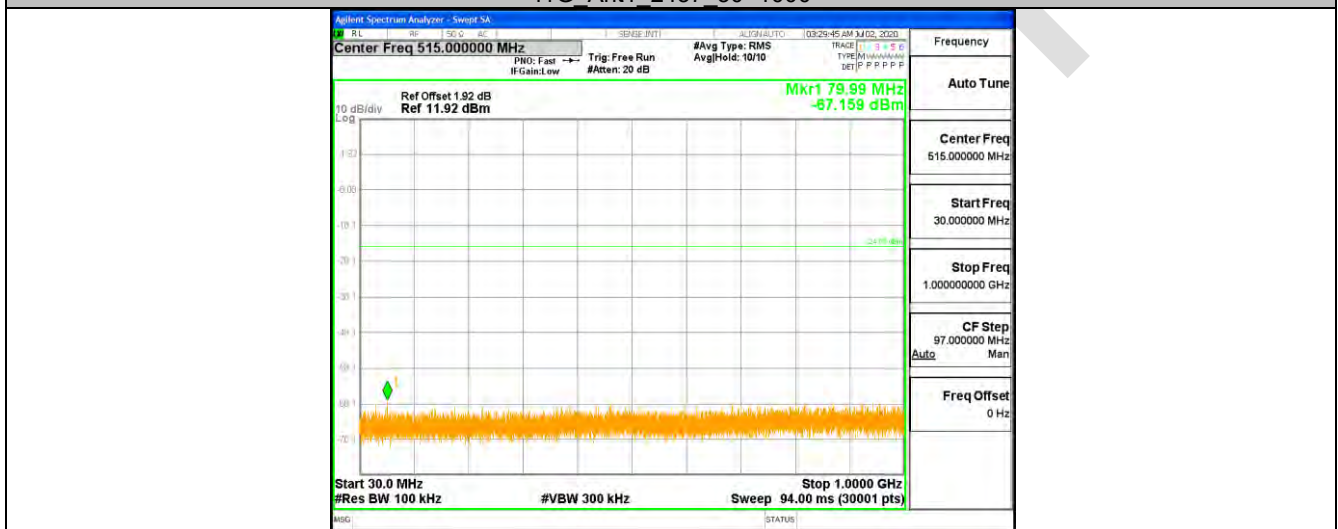
11G Ant1_2412_30~1000

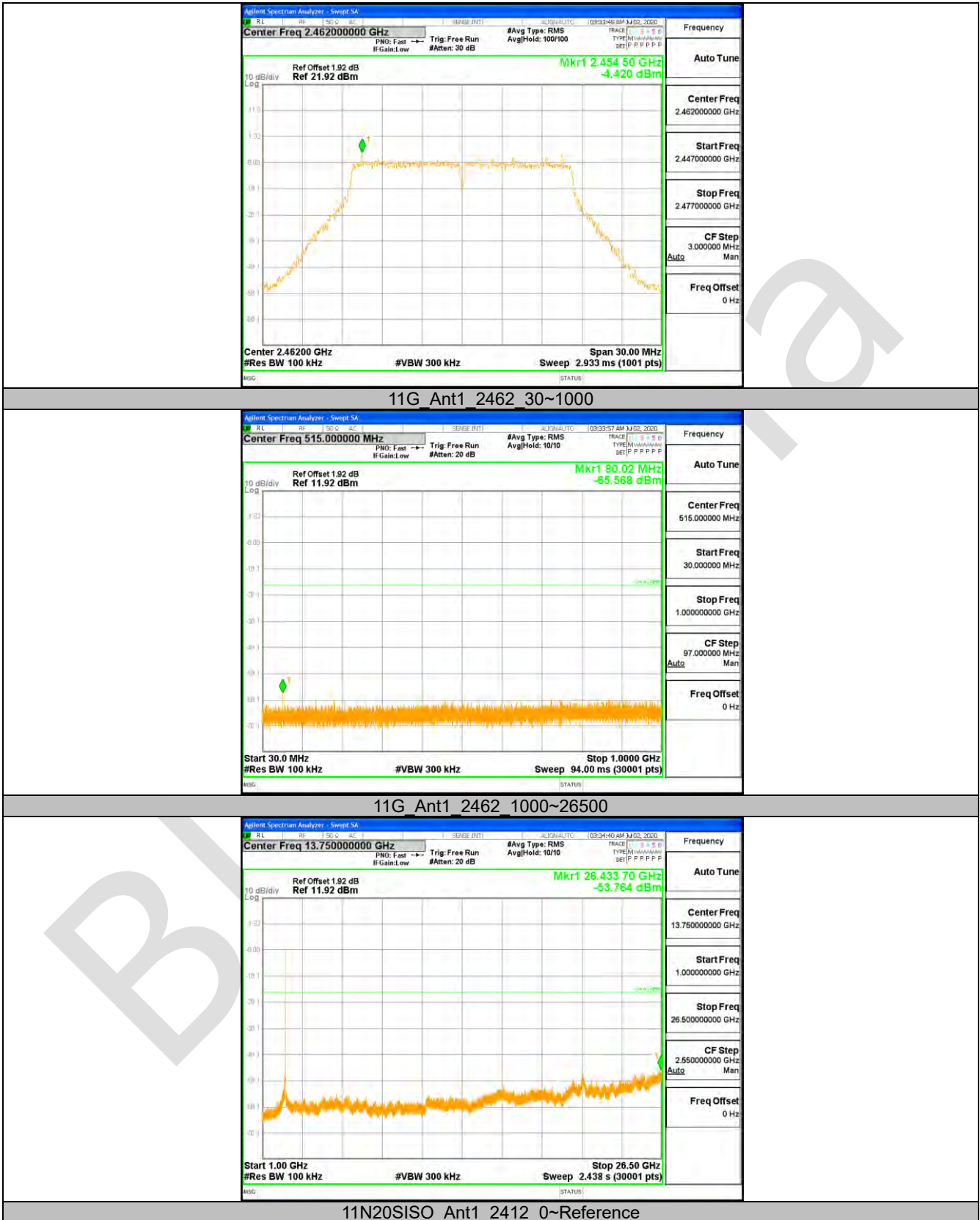


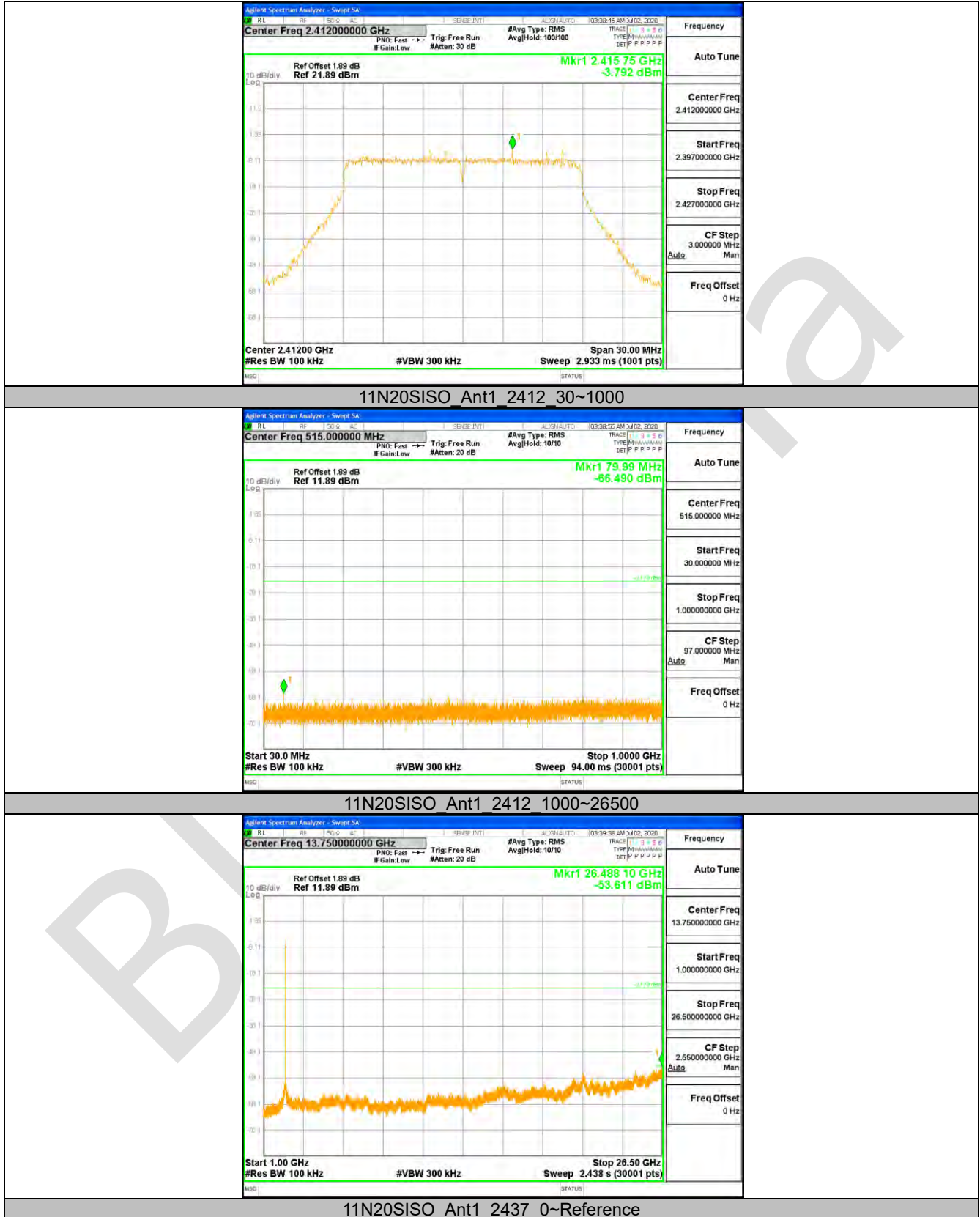
11G Ant1_2412_1000~26500

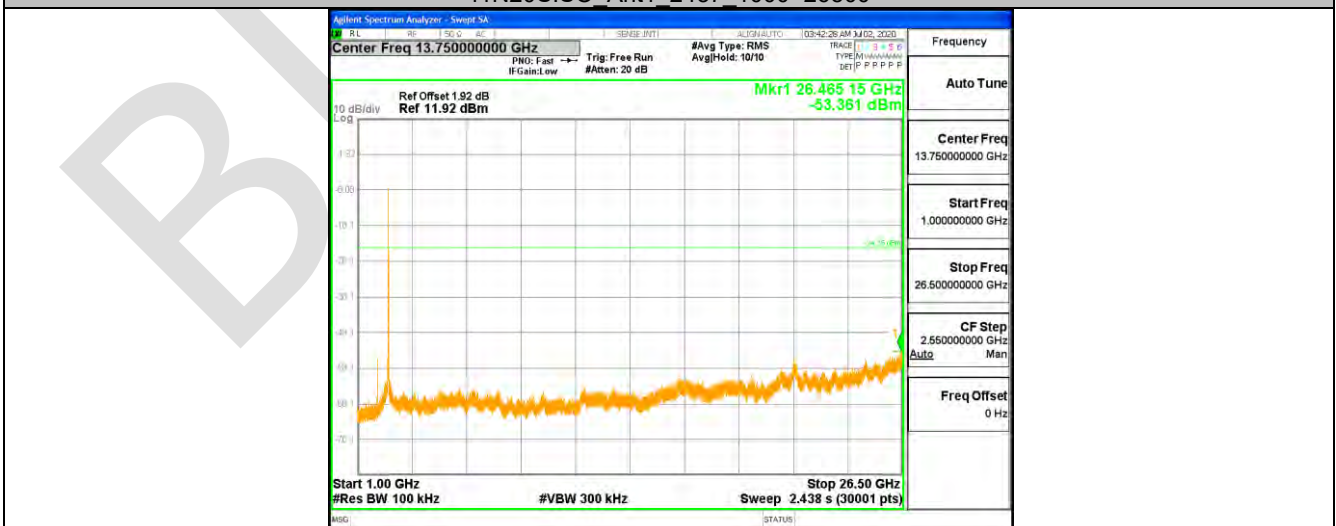
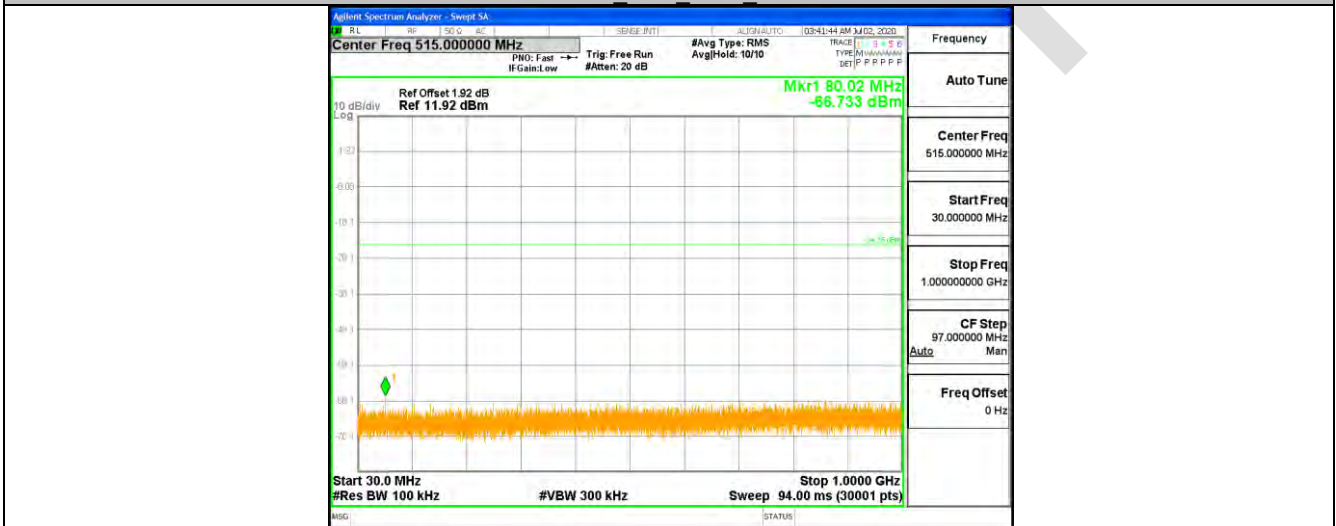
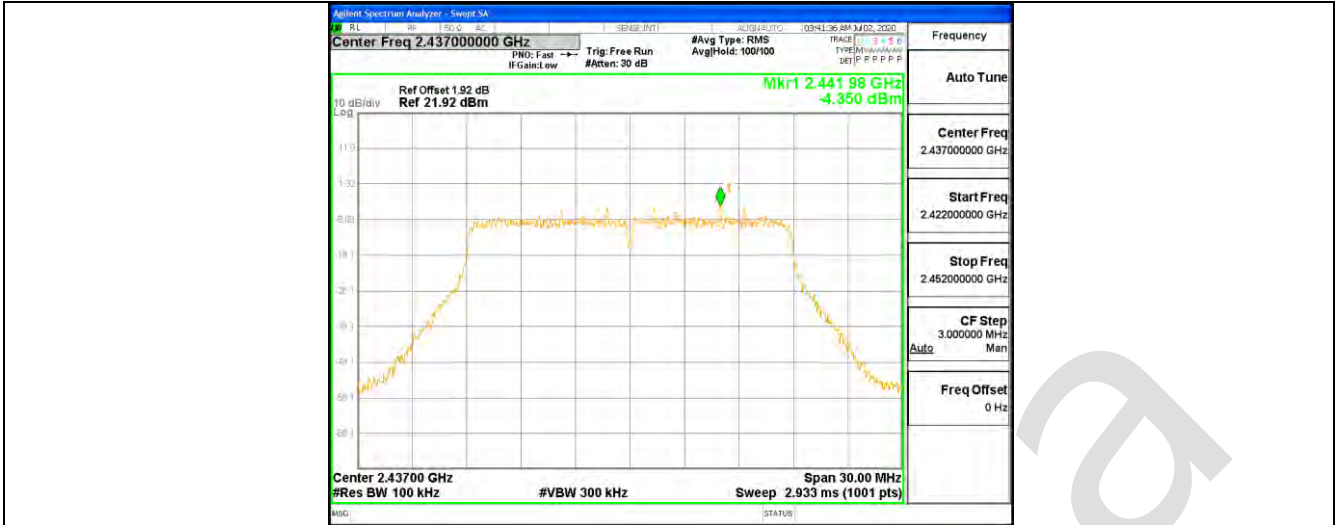


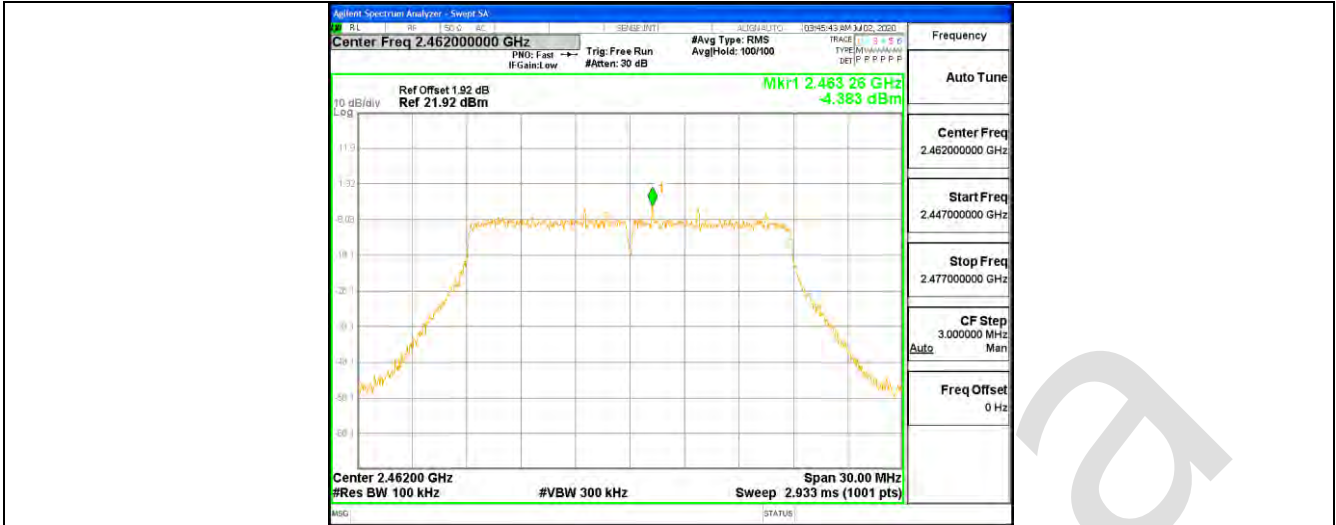
11G Ant1_2437_0~Reference



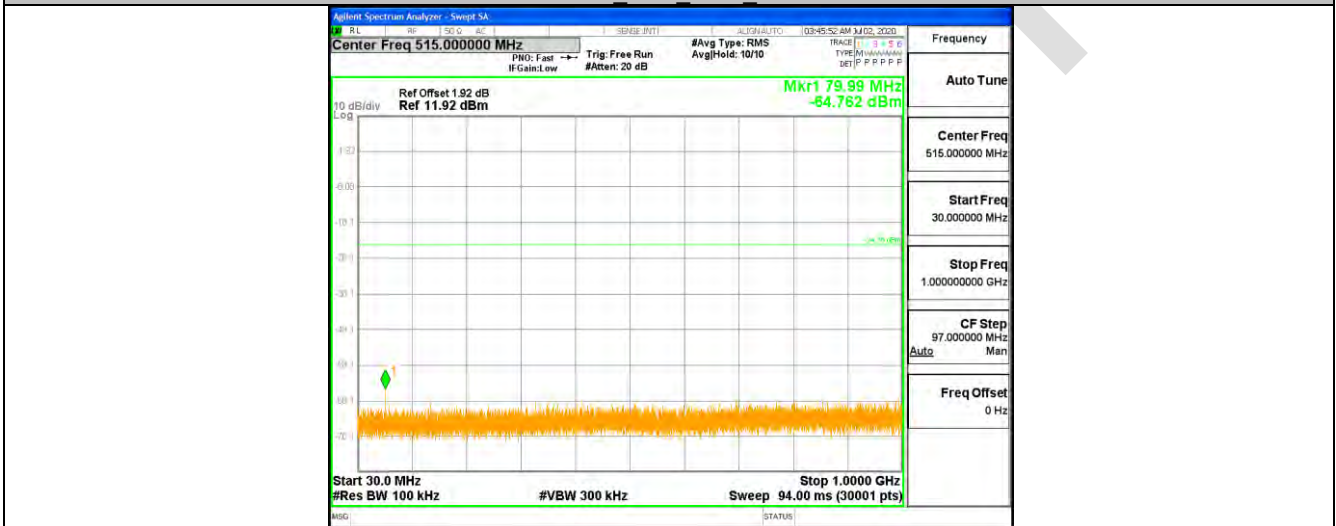




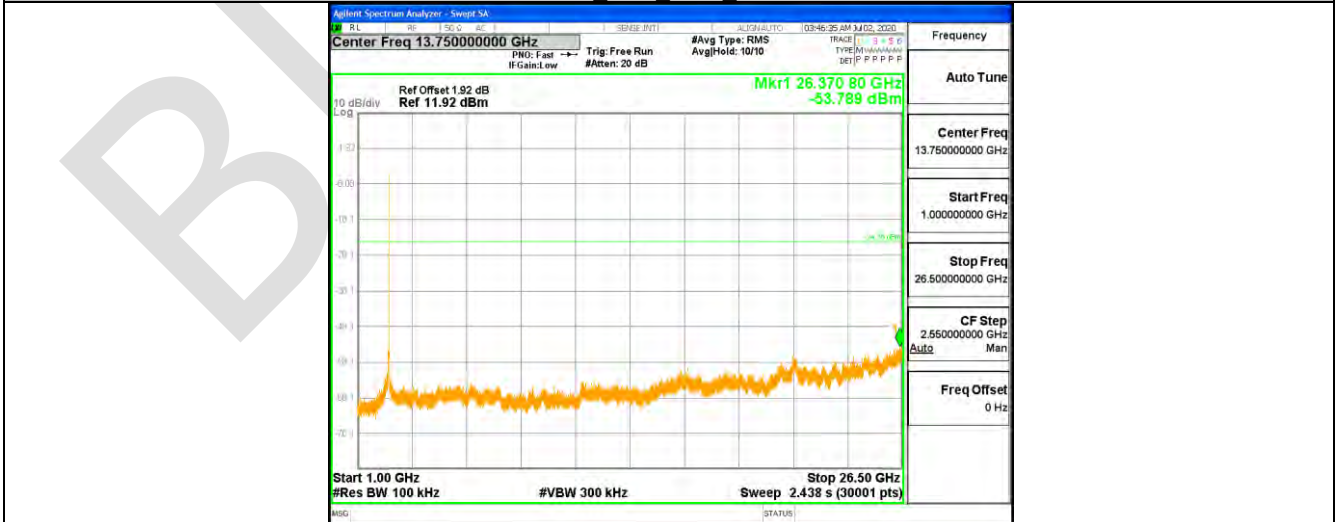




11N20SISO Ant1 2462 30~1000

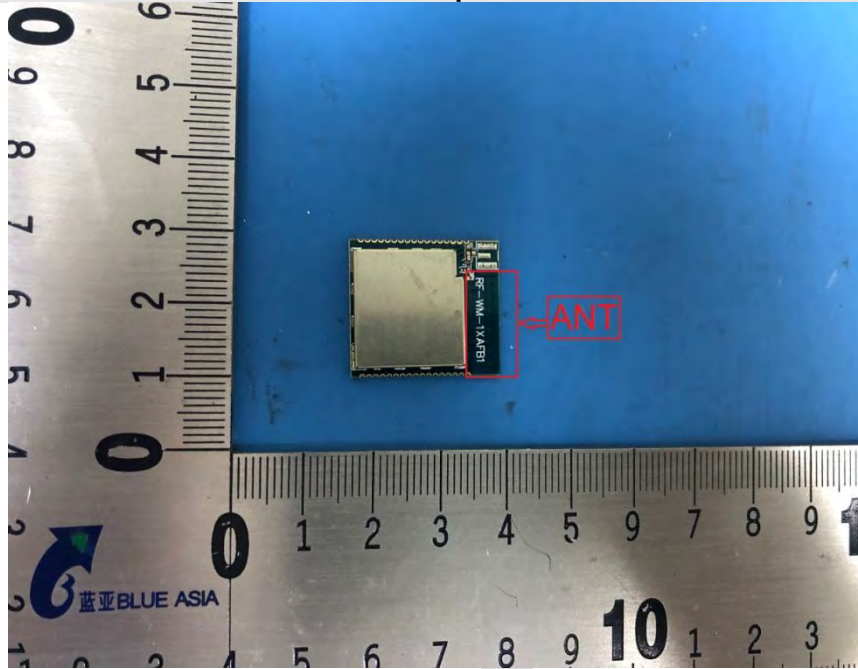


11N20SISO Ant1 2462 1000~26500



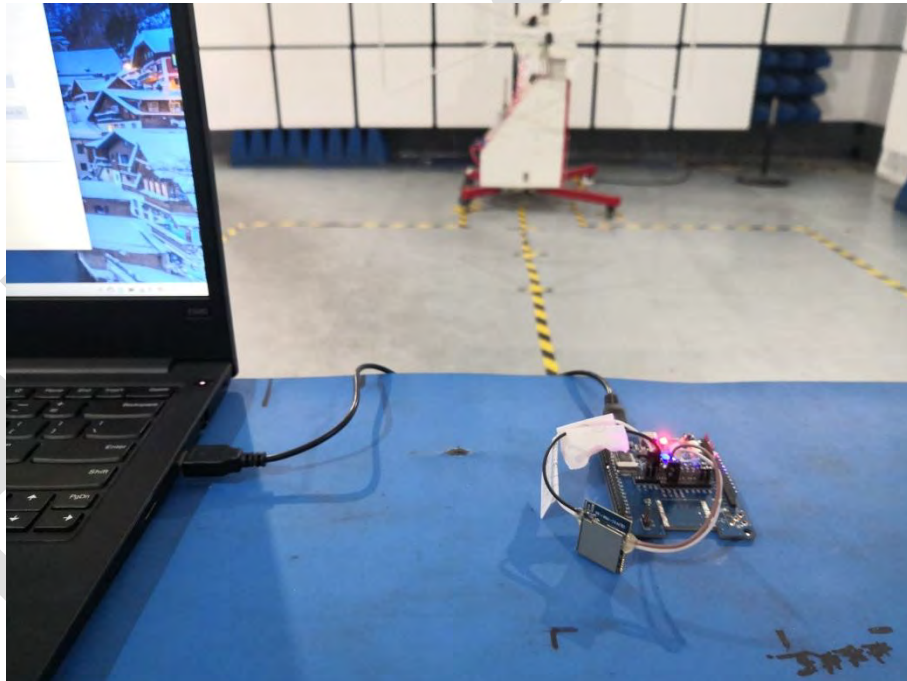
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

Antenna Requirement

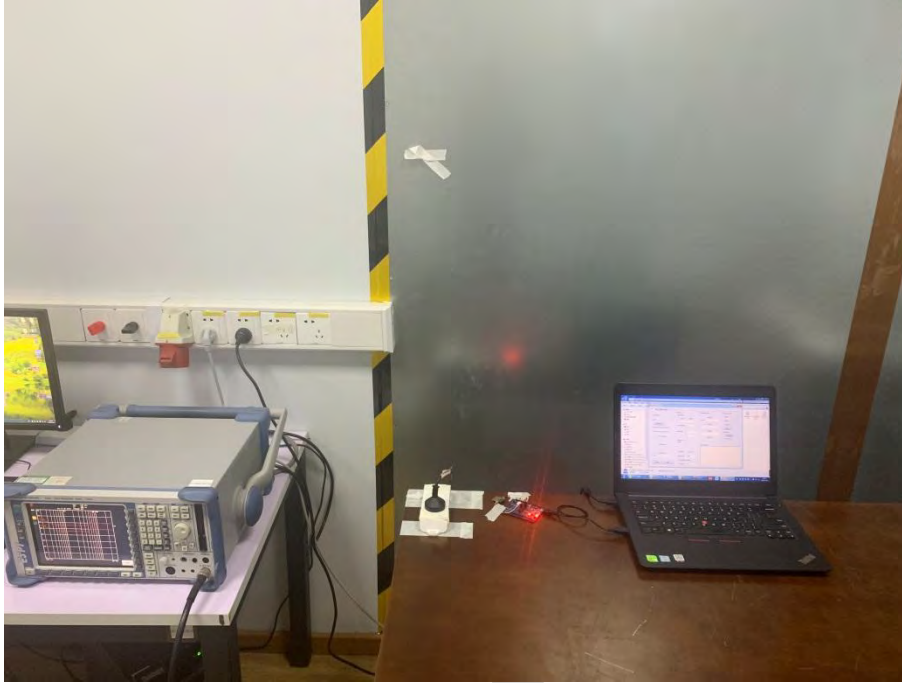


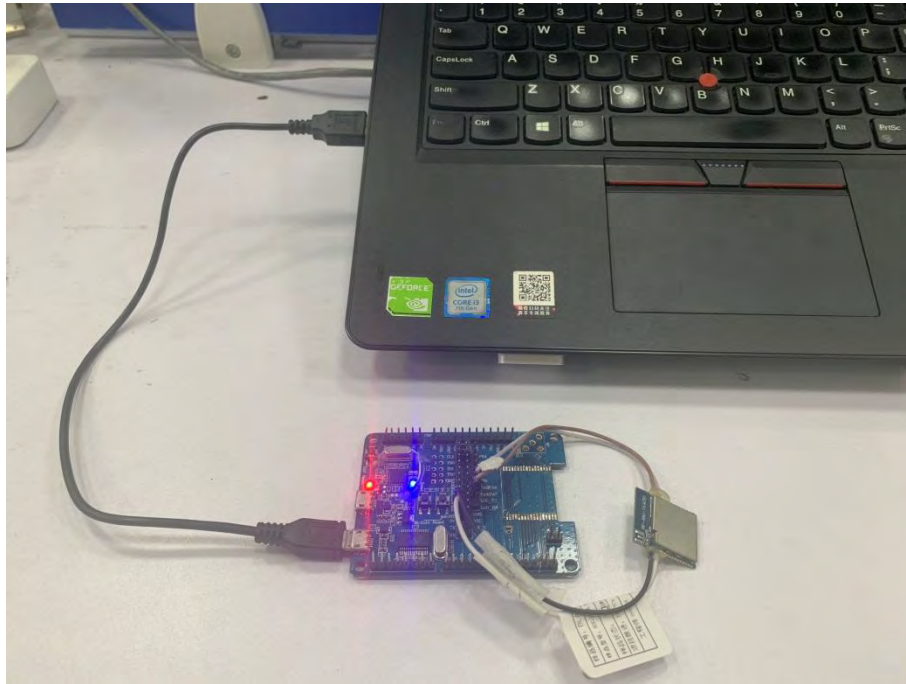
Radiated Spurious Emissions



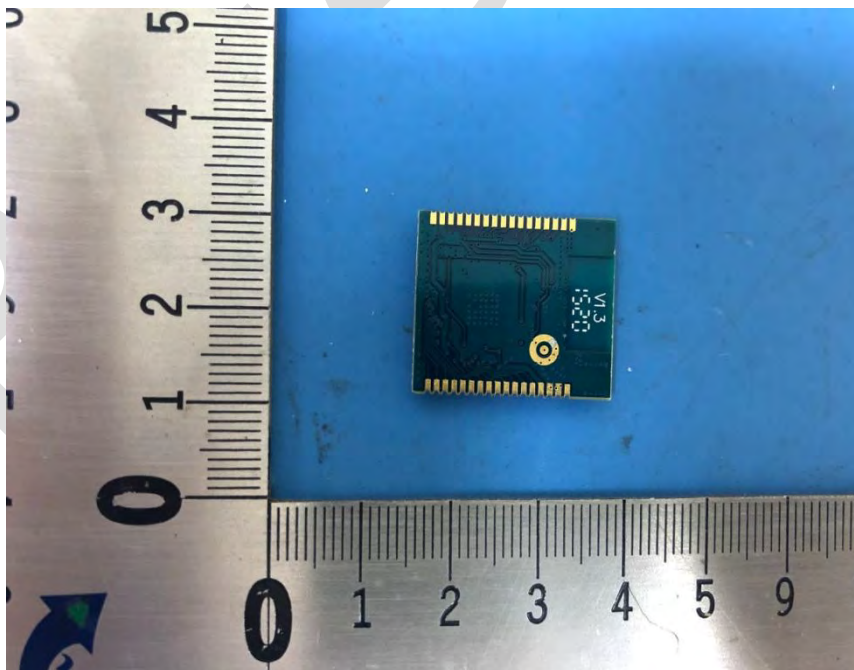
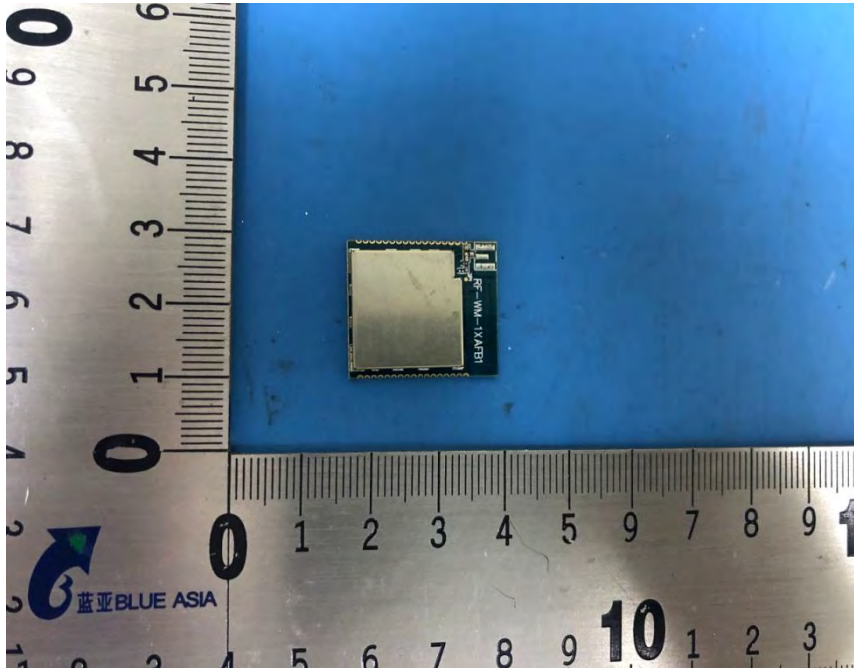


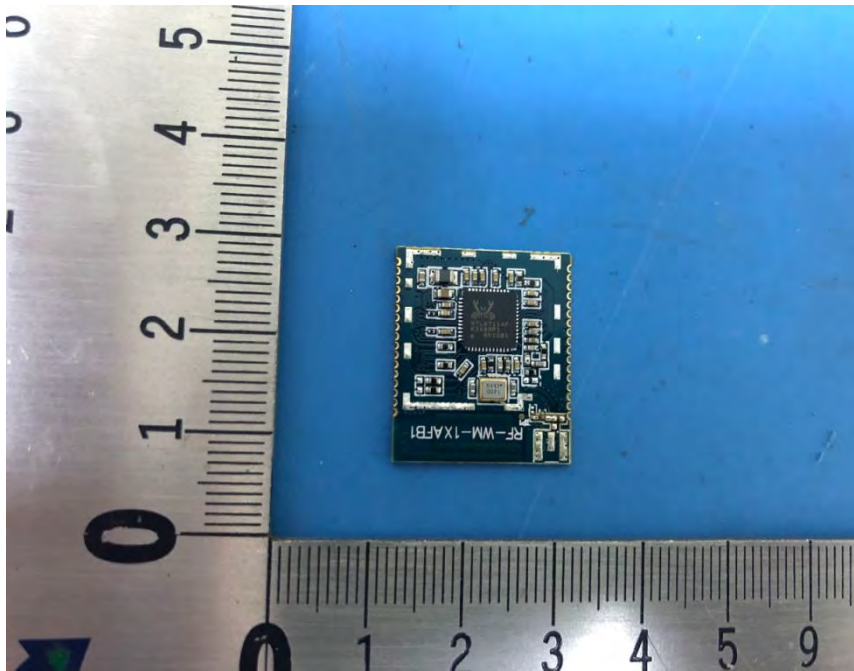
Conducted Emissions





APPENDIX B: PHOTOGRAPHS OF EUT





----END OF REPORT----

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