

Northwest Instrument INC

RF TEST REPORT

Report Type:

FCC Part 15.247 & ISSED RSS-247 RF report

Model:

Carta

REPORT NUMBER:

190502535SHA-001

ISSUE DATE:

June 21, 2019

DOCUMENT CONTROL NUMBER:

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TEST REPORT

Applicant: Northwest Instrument INC
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Manufacturer: Northwest Instrument INC
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Manufacturing Site: Rosenberger Technology (kunshan)Co., Ltd
No. 6, Shen'an Rd., Dianshanhu, Kunshan, Suzhou, Jiangsu, China, 215345

Product Name: Smart Wheel

Type/Model: Carta

FCC ID: 2ADA6CARTA

IC: 12409A-CARTA

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2017): Radio Frequency Devices (Subpart C)

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

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Content

REVISION HISTORY.....	5
MEASUREMENT RESULT SUMMARY	6
1 GENERAL INFORMATION	7
1.1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	7
1.2 TECHNICAL SPECIFICATION	7
1.3 DESCRIPTION OF TEST FACILITY	8
2 TEST SPECIFICATIONS	9
2.1 STANDARDS OR SPECIFICATION	9
2.2 MODE OF OPERATION DURING THE TEST.....	9
2.3 TEST SOFTWARE LIST	10
2.4 TEST PERIPHERALS LIST	10
2.5 TEST ENVIRONMENT CONDITION:.....	10
2.6 INSTRUMENT LIST	11
2.7 MEASUREMENT UNCERTAINTY	12
3 MINIMUM 6DB BANDWIDTH	13
3.1 LIMIT	13
3.2 MEASUREMENT PROCEDURE	13
3.3 TEST CONFIGURATION	13
3.4 TEST RESULTS OF MINIMUM 6DB BANDWIDTH	13
4 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P.	14
4.1 LIMIT	14
4.2 MEASUREMENT PROCEDURE	14
4.3 TEST CONFIGURATION	14
4.4 TEST RESULTS OF MAXIMUM CONDUCTED OUTPUT POWER.....	14
5 POWER SPECTRUM DENSITY	15
5.1 LIMIT	15
5.2 MEASUREMENT PROCEDURE	15
5.3 TEST CONFIGURATION	15
5.4 TEST RESULTS OF POWER SPECTRUM DENSITY	15
6 EMISSION OUTSIDE THE FREQUENCY BAND.....	16
6.1 LIMIT	16
6.2 MEASUREMENT PROCEDURE	16
6.3 TEST CONFIGURATION	17
6.4 THE RESULTS OF EMISSION OUTSIDE THE FREQUENCY BAND.....	17
7 RADIATED EMISSIONS IN RESTRICTED FREQUENCY BANDS	18
7.1 LIMIT	18
7.2 MEASUREMENT PROCEDURE	18
7.3 TEST CONFIGURATION	20
7.4 TEST RESULTS OF RADIATED EMISSIONS	22
8 POWER LINE CONDUCTED EMISSION.....	25
8.1 LIMIT	25
8.2 TEST CONFIGURATION	25
8.3 MEASUREMENT PROCEDURE	26
8.4 TEST RESULTS OF POWER LINE CONDUCTED EMISSION.....	27

TEST REPORT

9	OCCUPIED BANDWIDTH	28
9.1	LIMIT	28
9.2	MEASUREMENT PROCEDURE	28
9.3	TEST CONFIGURATION	28
9.4	THE RESULTS OF OCCUPIED BANDWIDTH	28
10	ANTENNA REQUIREMENT	29

Revision History

Report No.	Version	Description	Issued Date
190502535SHA-001	Rev. 01	Initial issue of report	June 21, 2019

Measurement result summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-247 Issue 2 Clause 5.2	Pass
Maximum conducted output power and e.i.r.p.	15.247(b)(3)	RSS-247 Issue 2 Clause 5.4	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 2 Clause 5.2	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass
Radiated Emissions in restricted frequency bands	15.247(d), 15.205&15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207(a)	RSS-Gen Issue 5 Clause 8.8	NA
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.6	Tested
Antenna requirement	15.203	-	Pass

Notes:

1: NA =Not Applicable

2: Determination of the test conclusion is based on IEC Guide 115 in consideration of measurement uncertainty.

3: Additions, Deviations and Exclusions from Standards: None.

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Smart Wheel
Type/Model:	Carta
Description of EUT:	The EUT is a smart wheel which was installed a Bluetooth low energy module, there have only one model.
Rating:	DC4.5V
Category of EUT:	Class B
EUT type:	<input type="checkbox"/> Table top <input checked="" type="checkbox"/> Floor standing
Software Version:	/
Hardware Version:	/
Sample received date:	May 24, 2019
Date of test:	May 24, 2019 ~ June 21, 2019

1.2 Technical Specification

Frequency Range:	2400MHz ~ 2483.5MHz
Support Standards:	Bluetooth 4.2 (BLE)
Type of Modulation:	GFSK
Channel Number:	40 (0-39)
Data Rate:	1Mbps
Power Class:	Class II
Channel Separation:	2 MHz

Antenna information:			
No.	Antenna Type	Gain (dBi)	Note
1	Internal PCB antenna	3.3dBi	/

TEST REPORT

1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab CAB identifier.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2017)

ANSI C63.10 (2013)

RSS-247 Issue 2 (February 2017)

RSS-Gen Issue 5 (April 2018)

2.2 Mode of operation during the test

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)				2402 ~ 2480			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Data rate VS Power:

The test setting software is offered by the manufactory. The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

Test software and Power Setting parameter			
Test Software	nrfgostudio		
Working Mode	BLE		
Test Channel	2402MHz	2440MHz	2480MHz
Power Setting	0	0	0

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description

2.5 Test environment condition:

Test items	Temperature	Humidity
Minimum 6dB Bandwidth	23°C	52% RH
Maximum conducted output power and e.i.r.p.		
Power spectrum density		
Emission outside the frequency band		
Occupied bandwidth		
Power line conducted emission	22°C	53% RH
Radiated Emissions in restricted frequency bands	22°C	55% RH

TEST REPORT

2.6 Instrument list

Conducted Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESCS 30	EC 2107	2019-07-15
<input checked="" type="checkbox"/>	A.M.N.	R&S	ESH2-Z5	EC 3119	2019-11-29
<input checked="" type="checkbox"/>	Shielded room	Zhongyu	-	EC 2838	2020-01-13
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
<input checked="" type="checkbox"/>	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-12-10
<input checked="" type="checkbox"/>	Horn antenna	R&S	HF 906	EC 3049	2019-11-16
<input checked="" type="checkbox"/>	Horn antenna	ETS	3117	EC 4792-1	2020-02-25
<input checked="" type="checkbox"/>	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
<input checked="" type="checkbox"/>	Pre-amplifier	R&S	Pre-amp 18	EC5262	2020-06-11
<input checked="" type="checkbox"/>	Semi-anechoic chamber	Albatross project	-	EC 3048	2019-07-31
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2020-03-04
<input checked="" type="checkbox"/>	PXA Signal Analyzer	Keysight	N9030B	EC 6078	2020-6-11
<input checked="" type="checkbox"/>	Power sensor	Agilent	U2021XA	EC 5338-1	2020-03-04
<input checked="" type="checkbox"/>	Vector Signal Generator	Agilent	N5182B	EC 5175	2020-03-04
<input checked="" type="checkbox"/>	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2020-03-04
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
<input checked="" type="checkbox"/>	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2020-03-10
<input checked="" type="checkbox"/>	Pressure meter	YM3	Shanghai Mengde	EC 3320	2019-07-01

TEST REPORT

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	$\pm 0.74\text{dB}$
Radiated Emissions in restricted frequency bands below 1GHz	$\pm 4.90\text{dB}$
Radiated Emissions in restricted frequency bands above 1GHz	$\pm 5.02\text{dB}$
Emission outside the frequency band	$\pm 2.89\text{dB}$
Power line conducted emission	$\pm 3.19\text{dB}$

TEST REPORT

3 Minimum 6dB bandwidth

Test result: Pass

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Measurement Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3 Test Configuration



3.4 Test Results of Minimum 6dB bandwidth

Please refer to Appendix A.

4 Maximum conducted output power and e.i.r.p.

Test result: Pass

4.1 Limit

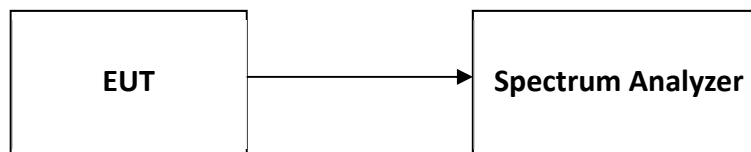
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 W. (The e.i.r.p. shall not exceed 4 W)

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 30dBm and 30+ (6 –antenna gain-beam forming gain).

4.2 Measurement Procedure

- a) Set the RBW \geq DTS bandwidth.
- b) Set VBW $\geq 3 \times$ RBW.
- c) Set span $\geq 3 \times$ RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

4.3 Test Configuration



4.4 Test Results of Maximum conducted output power

Please refer to Appendix A.

TEST REPORT

5 Power spectrum density

Test result: Pass

5.1 Limit

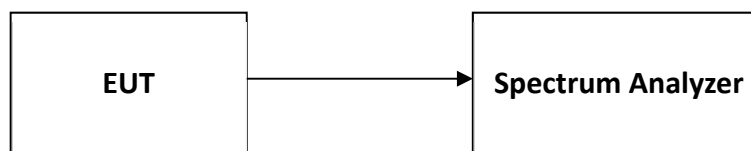
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and $8 + (6 - \text{antenna gain} - \text{beam forming gain})$.

5.2 Measurement Procedure

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 Test Configuration



5.4 Test Results of Power spectrum density

Please refer to Appendix A.

6 Emission outside the frequency band

Test result: Pass

6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

6.2 Measurement Procedure

Reference level measurement

Establish a reference level by using the following procedure:

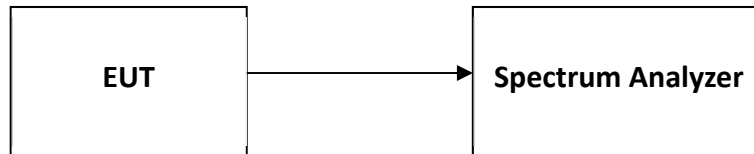
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

6.3 Test Configuration



6.4 The results of Emission outside the frequency band

Please refer to Appendix A.

7 Radiated Emissions in restricted frequency bands

Test result: Pass

7.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

Frequencies (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

7.2 Measurement Procedure

For Radiated emission below 30MHz:

- The EUT was placed on the top of a rotating table 0.8 meters (0.1 meters for floor standing) above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Both X and Y axes of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

TEST REPORT**For Radiated emission above 30MHz:**

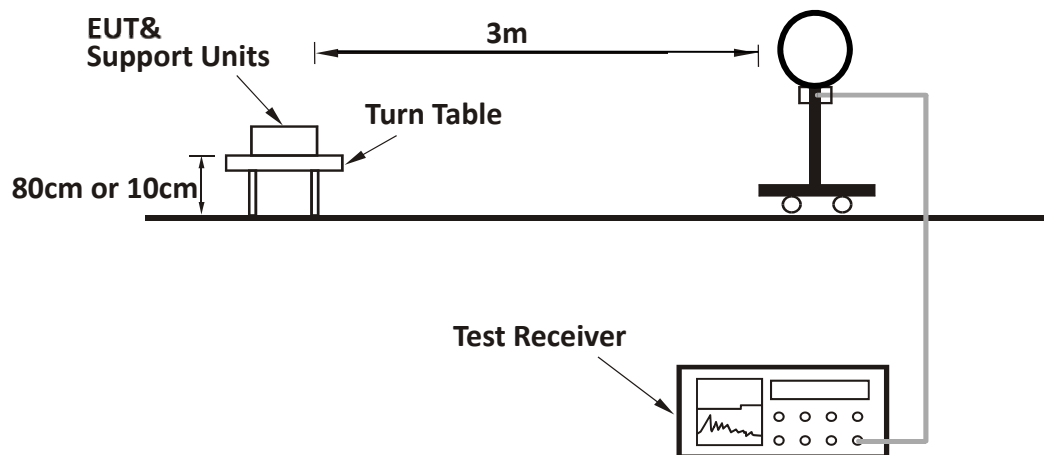
- a) The EUT was placed on the top of a rotating table 0.8 meters (0.1 meters for floor standing) (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna 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.
- d) 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

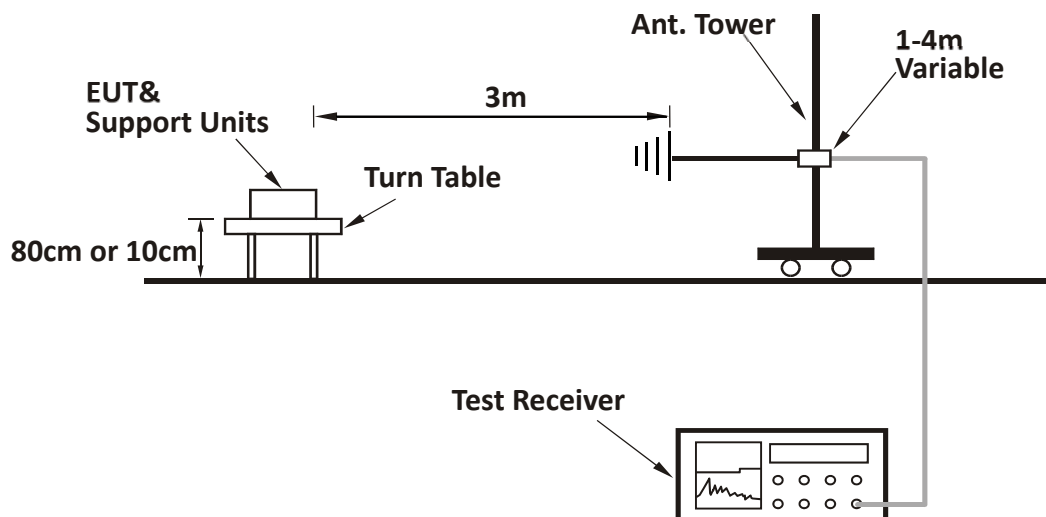
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 3 x RBW (Duty cycle \geq 98%) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported

7.3 Test Configuration

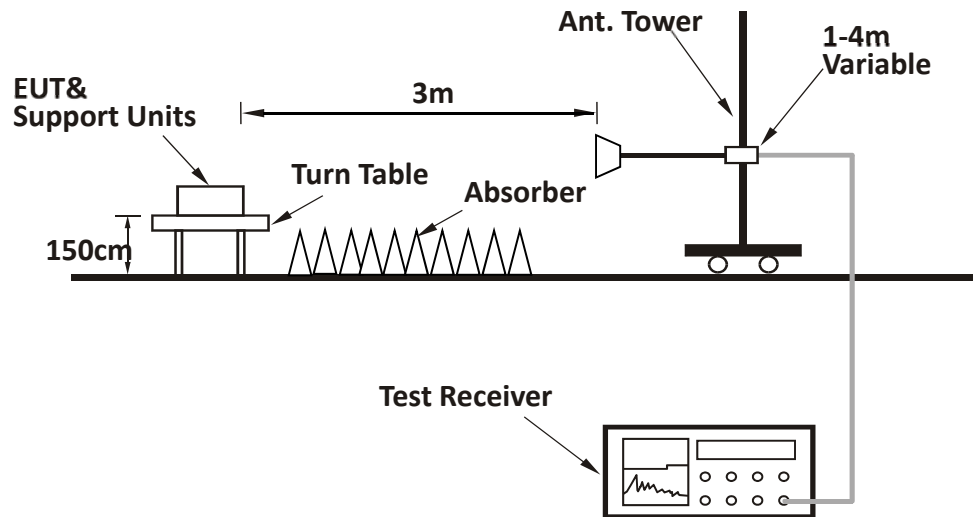
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



For Radiated emission above 1GHz:

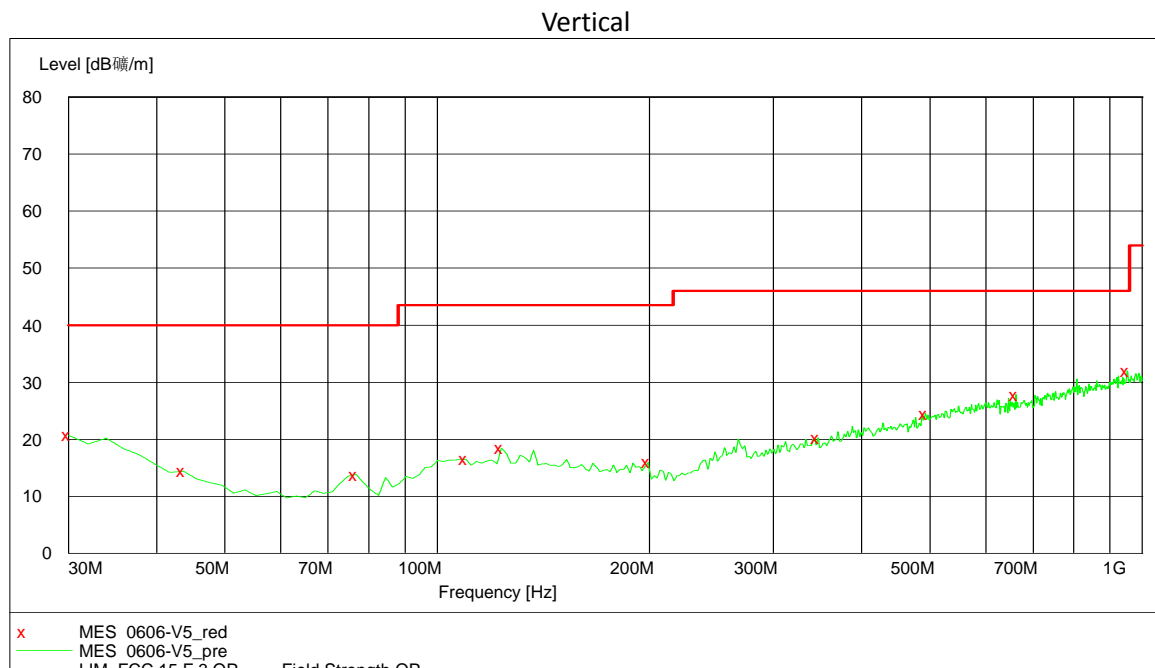
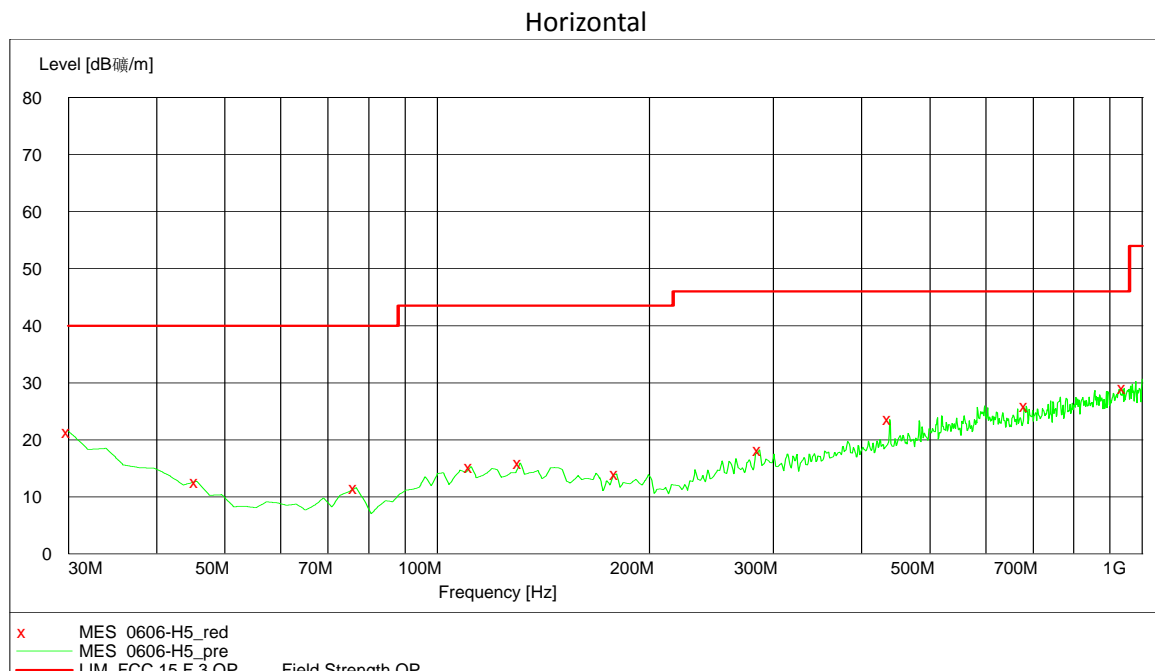


TEST REPORT

7.4 Test Results of Radiated Emissions

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:



TEST REPORT

Test data 30MHz~1GHz:

Polarization	Frequency (MHz)	Measured level (dB μ V/m)	Correct Factor (dB/m)	Limits (dB μ V/m)	Margin (dB)	Detector
H	30.00	21.40	18.90	40.00	18.60	PK
	45.55	12.70	10.90	40.00	27.30	PK
	76.65	11.60	7.60	40.00	28.40	PK
	111.64	15.30	13.10	43.50	28.20	PK
	131.08	15.90	13.20	43.50	27.60	PK
	179.68	14.00	10.90	43.50	29.50	PK
	286.59	18.30	15.10	46.00	27.70	PK
	438.22	23.60	19.00	46.00	22.40	PK
	685.09	25.90	22.00	46.00	20.10	PK
	943.63	29.10	24.90	46.00	16.90	PK
V	30.00	20.70	18.90	40.00	19.30	PK
	43.61	14.40	11.80	40.00	25.60	PK
	76.65	13.80	7.60	40.00	26.20	PK
	109.70	16.50	13.00	43.50	27.00	PK
	123.31	18.50	13.50	43.50	25.00	PK
	199.12	16.00	11.40	43.50	27.50	PK
	346.85	20.20	16.70	46.00	25.80	PK
	492.65	24.50	20.00	46.00	21.50	PK
	661.76	27.80	21.90	46.00	18.20	PK
	951.40	32.00	24.90	46.00	14.00	PK

Test result above 1GHz:

The emission was conducted from 1GHz to 25GHz

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector
L	H	2402.00	30.70	96.10	Fundamental	/	PK
	V	2402.00	30.70	95.60	Fundamental	/	PK
	H	2390.00	30.30	48.50	74.00	25.50	PK
	H	2390.00	30.30	43.30	54.00	10.70	AV
	H	4804.00	-1.50	45.60	74.00	28.40	PK
	H	7206.00	3.50	44.60	74.00	29.40	PK
	V	2390.00	30.30	46.70	74.00	27.30	PK
	V	2390.00	30.30	41.60	54.00	12.40	AV

TEST REPORT

	V	4804.00	-1.50	43.70	74.00	30.30	PK
	V	7206.00	3.50	44.60	74.00	29.40	PK
M	H	2440.00	30.70	96.30	Fundamental	/	PK
	V	2440.00	30.70	94.20	Fundamental	/	PK
	H	4880.00	-1.10	44.60	74.00	29.40	PK
	H	7320.00	3.60	45.20	74.00	28.80	PK
	V	4880.00	-1.10	44.70	74.00	29.30	PK
	V	7320.00	3.60	45.20	74.00	28.80	PK
H	H	2480.00	30.70	96.20	Fundamental	/	PK
	V	2480.00	30.70	93.50	Fundamental	/	PK
	H	2483.50	30.80	46.20	74.00	27.80	PK
	H	2483.50	30.80	42.30	54.00	11.70	AV
	V	2483.50	30.80	45.20	74.00	28.80	PK
	V	2483.50	30.80	42.10	54.00	11.90	AV
	H	4960.00	-0.80	44.70	74.00	29.30	PK
	H	7440.00	3.80	46.70	74.00	27.30	PK
	V	4960.00	-0.80	45.40	74.00	28.60	PK
	V	7440.00	3.80	46.20	74.00	27.80	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplicifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

8 Power line conducted emission

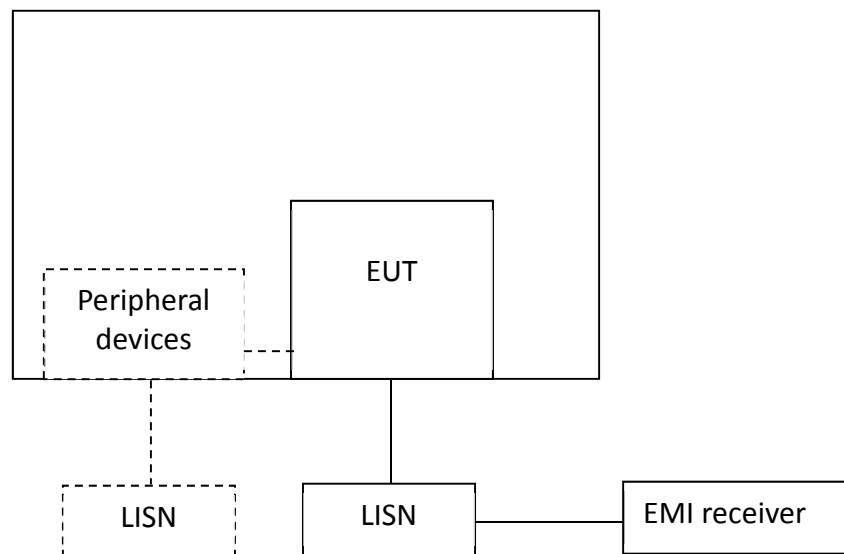
Test result: NA

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.

8.2 Test Configuration



TEST REPORT**8.3 Measurement Procedure**

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

TEST REPORT

8.4 Test Results of Power line conducted emission

Test Curve:

Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

TEST REPORT

9 Occupied Bandwidth

Test result: **Tested**

9.1 Limit

None

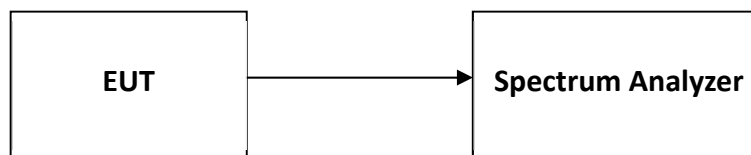
9.2 Measurement Procedure

The occupied bandwidth per RSS-Gen Issue 5 Clause 6.7 was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

9.3 Test Configuration



9.4 The results of Occupied Bandwidth

Please refer to Appendix A

10 Antenna requirement

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 a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Result:

EUT uses used permanently attached antenna from antenna to the intentional radiator, so it can comply with the provisions of this section.

***** END *****

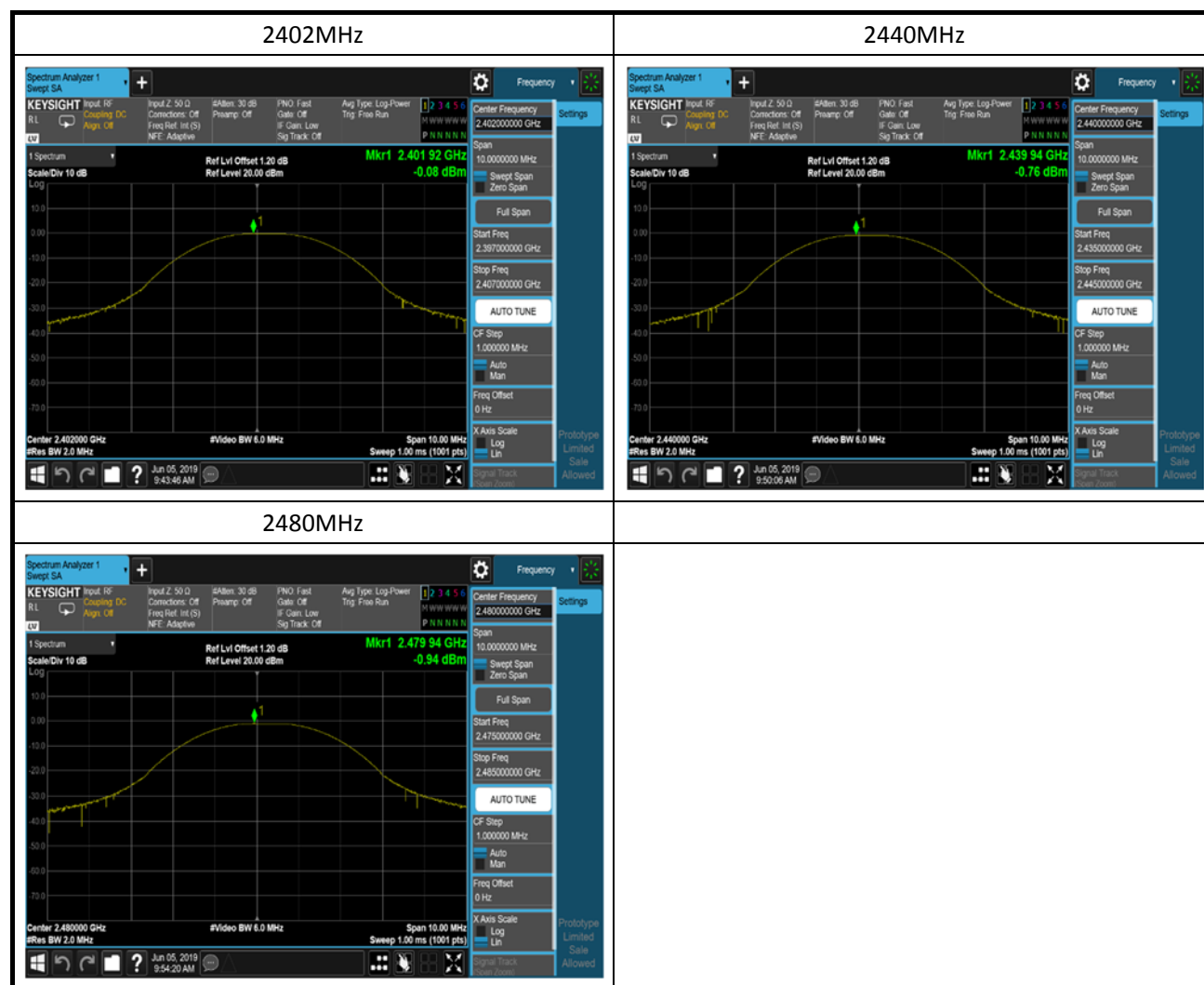
Appendix A: Transmitter Test results

1.1 RF Output Power

1.1.1 Test Result and Data

BLE Maximum Output Power		
Test Frequency (MHz)	Power (dBm)	Result
2402	-0.08	Pass
2440	-0.76	Pass
2480	-0.94	Pass

The maximum EIRP = $-0.08\text{dBm} + 3.3\text{dBi} = 3.22\text{dBm} = 0.002\text{W}$ which is lower than the limit of 4W listed in RSS-247.

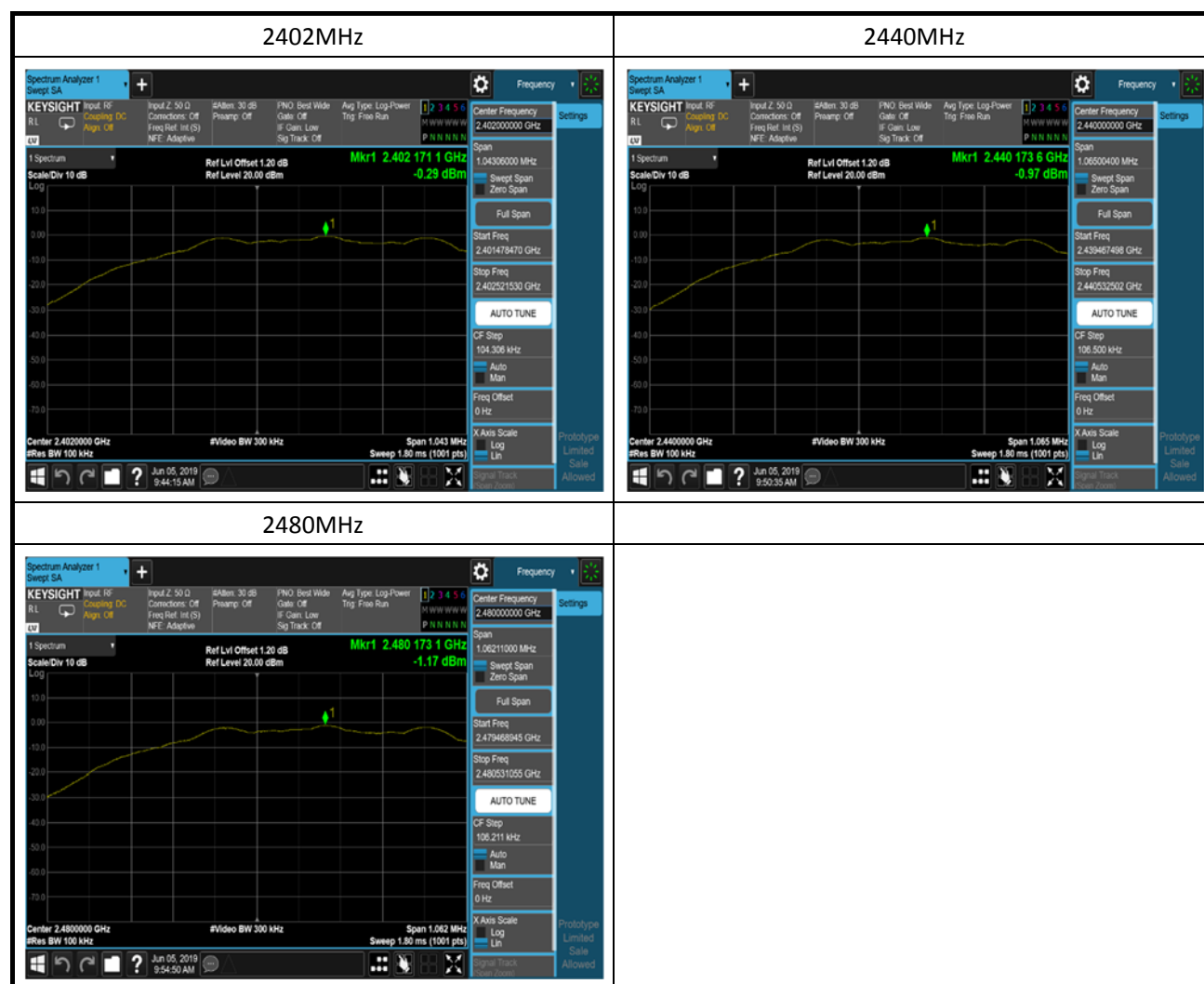


TEST REPORT

1.2 Power Spectral Density

1.2.1 Test Result and Data

BLE Peak Power Spectral Density		
Test Frequency (MHz)	PSD (dBm/100kHz)	Result
2402	-0.29	Pass
2440	-0.97	Pass
2480	-1.16	Pass

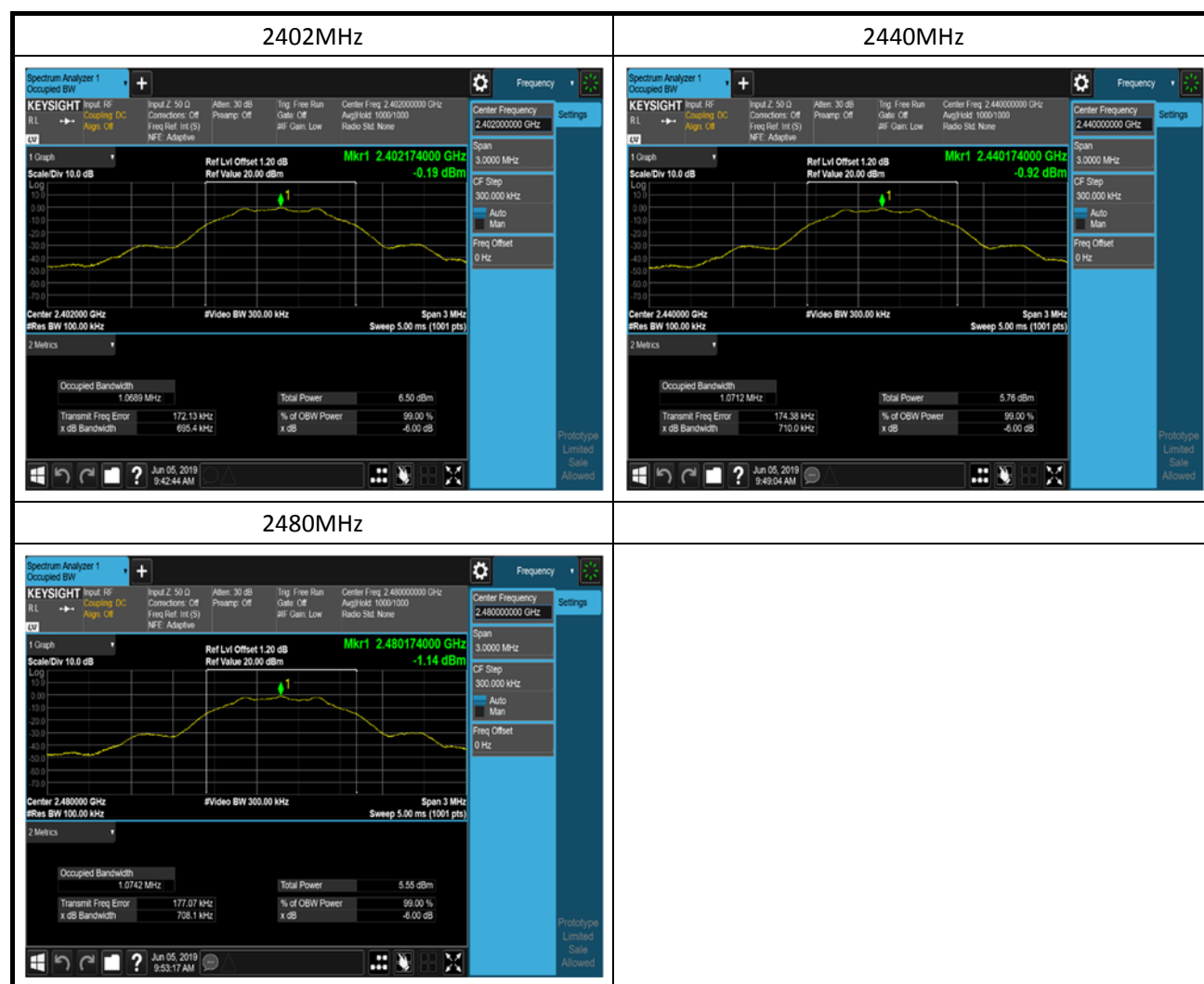


TEST REPORT

1.3 6dB BandWidth

1.3.1 Test Result and Data

BLE Occupied 6dB Bandwidth			
Test Frequency (MHz)	Occupied Bandwidth (kHz)	Min Limit (kHz)	Result
2402	695.4	500	Pass
2440	710.0	500	Pass
2480	708.1	500	Pass

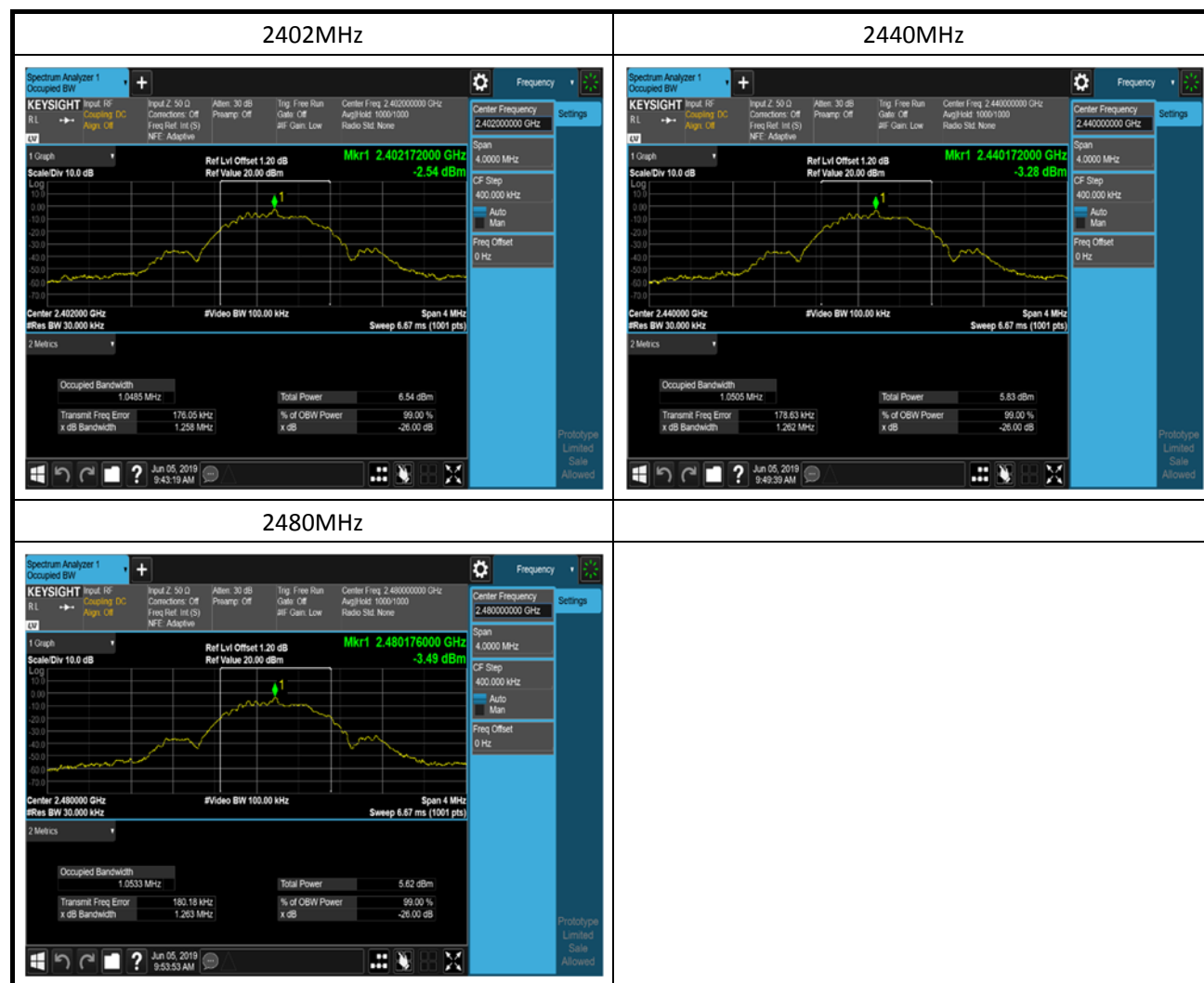


TEST REPORT

1.4 99% BandWidth

1.4.1 Test Result and Data

BLE 99% Occupied Bandwidth		
Test Frequency (MHz)	99% Occupied Bandwidth (MHz)	Result
2402	1.0485	Pass
2440	1.0505	Pass
2480	1.0533	Pass



TEST REPORT

1.5 Transmitter Spurious Emission

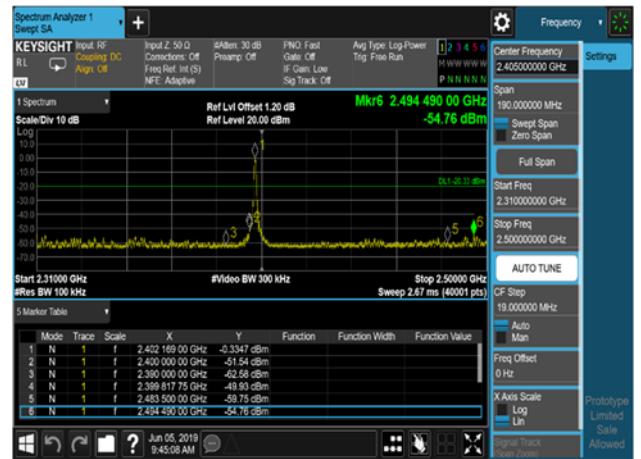
1.5.1 Test Result and Data

BLE Transmitter Spurious Emission			
Test Frequency (MHz)	Test Range	Power (dBm)	Result
2402	1MHz~2310MHz	-48.88	Pass
2402	2500MHz~5000MHz	-51.03	Pass
2402	5000MHz~25000MHz	-41.64	Pass
2402	Band Edge	-49.93	Pass
2402	Reference Level	-0.33	Pass
2440	1MHz~2310MHz	-52.45	Pass
2440	2500MHz~5000MHz	-49.99	Pass
2440	5000MHz~25000MHz	-40.81	Pass
2440	Band Edge	-49.41	Pass
2440	Reference Level	-0.99	Pass
2480	1MHz~2310MHz	-56.29	Pass
2480	2500MHz~5000MHz	-51.04	Pass
2480	5000MHz~25000MHz	-41.68	Pass
2480	Band Edge	-49.26	Pass
2480	Reference Level	-1.17	Pass

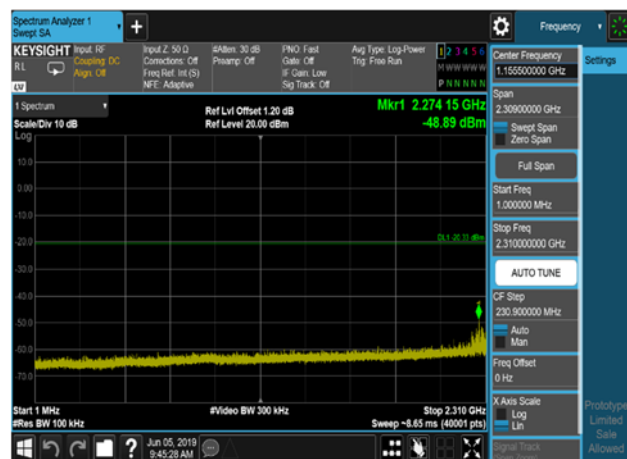
2402MHz,Plot 1,Reference Level



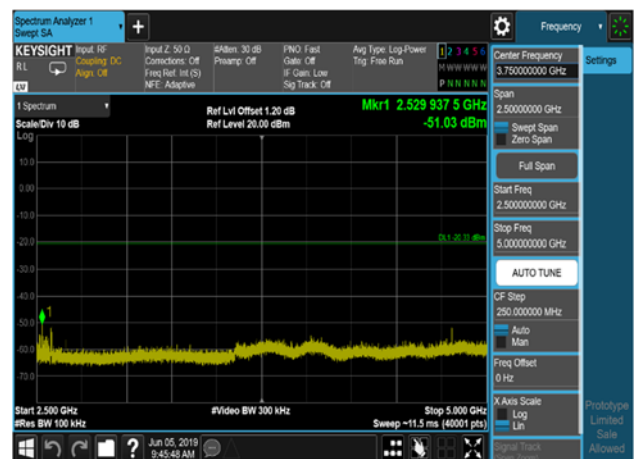
2402MHz,Plot 2,Band Edge



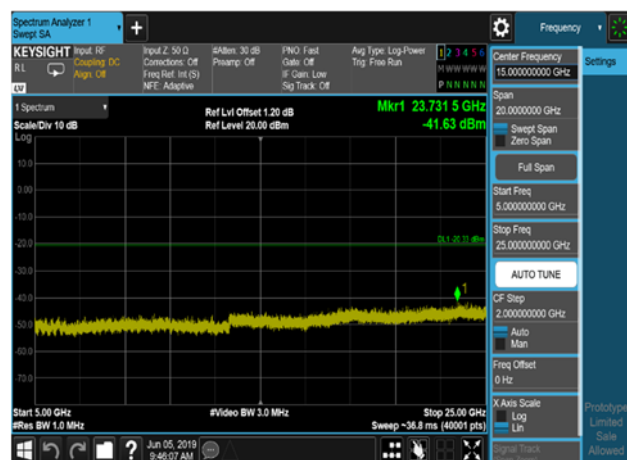
2402MHz,Plot 3,1MHz~2310MHz



2402MHz,Plot 4,2500MHz~5000MHz



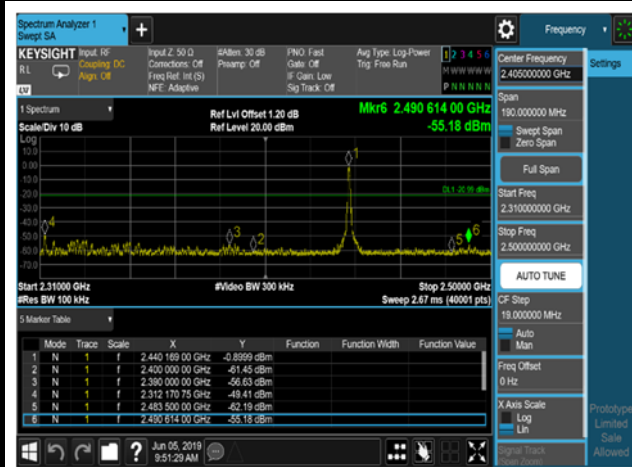
2402MHz,Plot 5,5000MHz~25000MHz



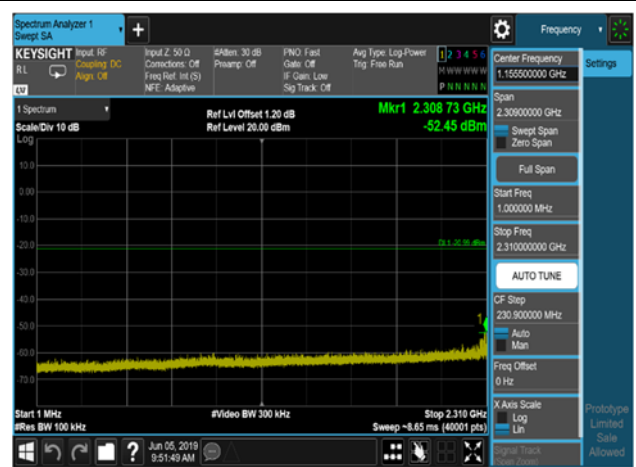
2440MHz,Plot 1,Reference Level



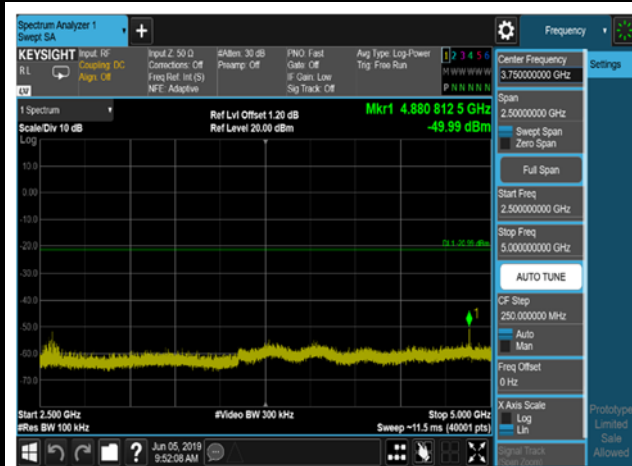
2440MHz,Plot 2,Band Edge



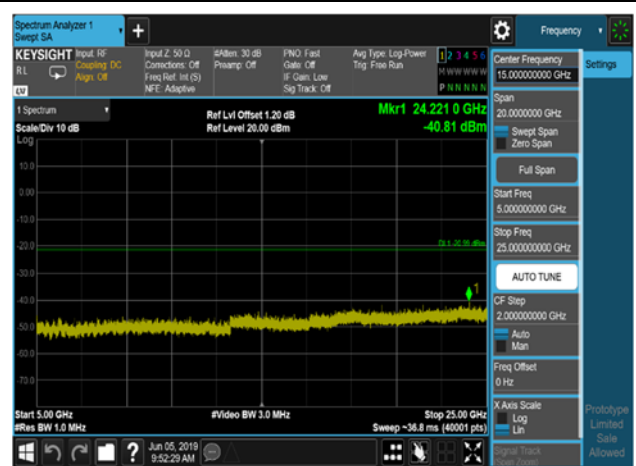
2440MHz,Plot 3,1MHz~2310MHz



2440MHz,Plot 4,2500MHz~5000MHz



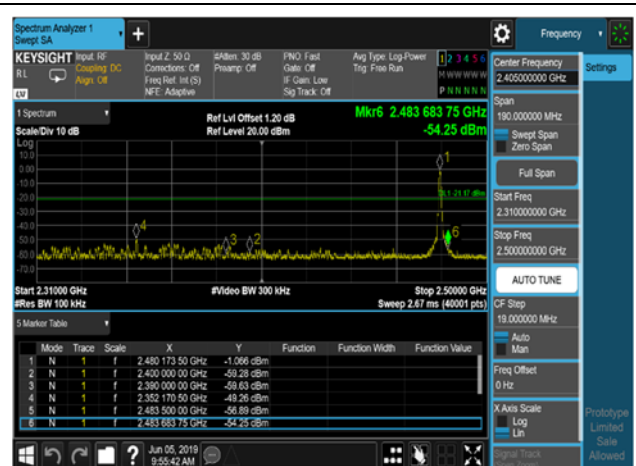
2440MHz,Plot 5,5000MHz~25000MHz



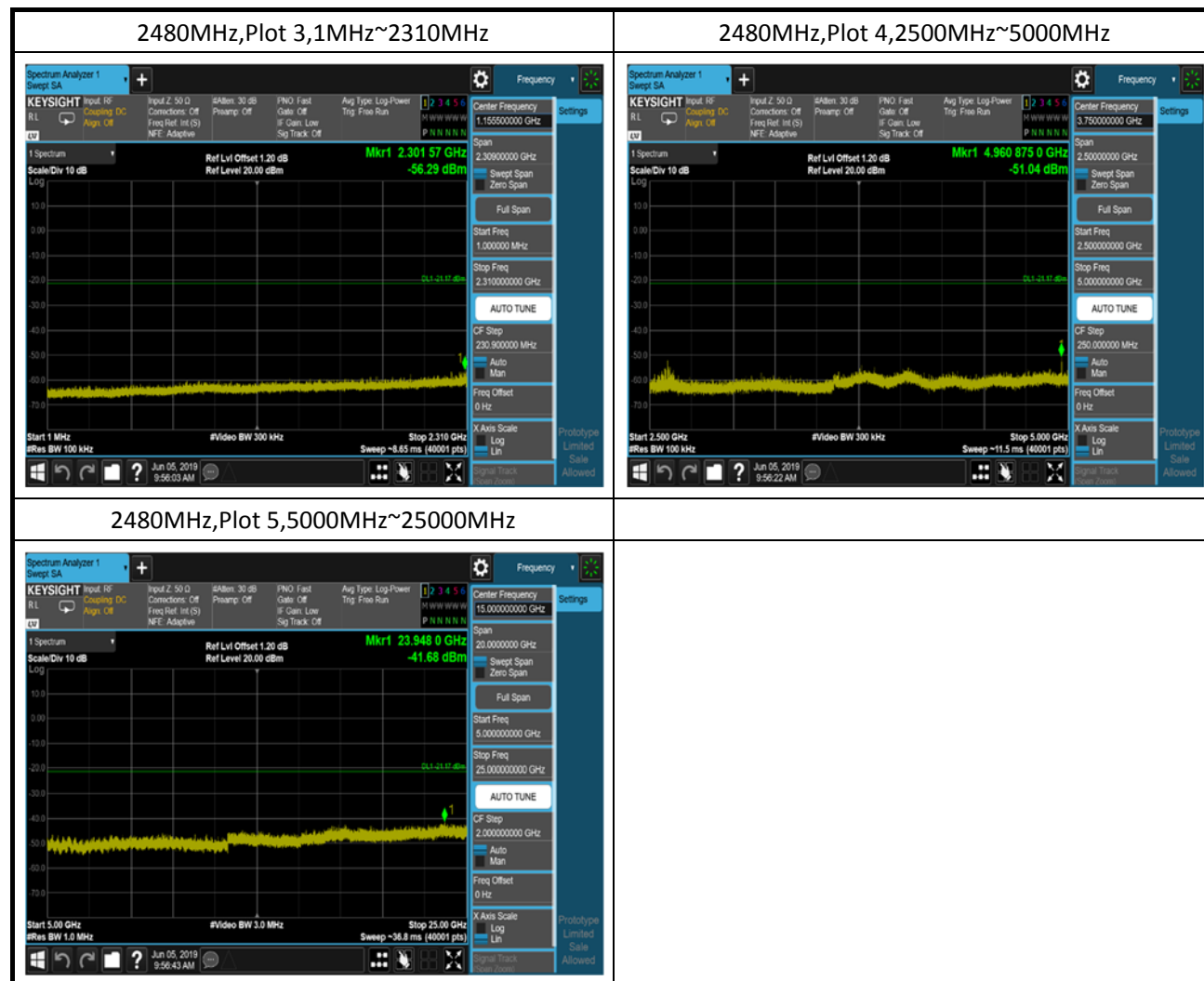
2480MHz,Plot 1,Reference Level



2480MHz,Plot 2,Band Edge



TEST REPORT



***** END *****