



RF MEASUREMENT REPORT

Applicant: Quectel Wireless Solutions Co., Ltd.

Address: Building 5, Shanghai Business Park Phase III (Area B),
No.1016 Tianlin Road, Minhang District, Shanghai
200233, China

Product: BT&WIFI Module

Model No.: FC905A

Brand Name: QUECTEL

Standard: Article 49.20 and the relevant articles of the Ordinance
Regulating Radio Equipment

Test Procedure: MIC Notice No.88 Annex 43

Product Category: Article 2, Paragraph 1, Item 19

Result: Complies

Received Date: 2023-04-12

Test Date: 2023-04-15 ~ 2023-05-09

Reviewed By:

Sunny Sun

Sunny Sun

Approved By:

Robin Wu

Robin Wu

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

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Revision History

Report No.	Version	Description	Issue Date	Note
2304RSU003-J2	V01	Initial Report	2023-05-24	Valid

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1. General Information

1.1. Applicant

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

1.2. Manufacturer

Quectel Wireless Solutions Co., Ltd.

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

1.3. Testing Facility

☒	Test Site – MRT Suzhou Laboratory Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China Laboratory Accreditations A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001 VCCI: ☐ R-20025 ☐ G-20034 ☐ C-20020 ☐ T-20020 ☐ R-20141 ☐ G-20134 ☐ C-20103 ☐ T-20104
☐	Test Site – MRT Shenzhen Laboratory Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China Laboratory Accreditations A2LA: 3628.02 CNAS: L10551 FCC: CN1284 ISED: CN0105
☐	Test Site – MRT Taiwan Laboratory Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) Laboratory Accreditations TAF: L3261-190725 FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name	BT&WIFI Module
Model No.	FC905A
Brand Name	QUECTEL
EUT Identification No.	20230412Sample#2
Wi-Fi Specification	802.11a/b/g/n/ac (Client Device)
Bluetooth Version	V5.0 (Dual mode)
Operating Temperature	-30 °C ~ +85 °C
Product Voltage	DC 3.13V~4.80V, Typical value is DC 3.6V
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	2402 ~ 2480MHz
Type of Modulation	GFSK
Data Rate	1Mbps
Declared Output Power	5mW
Antenna Type	Dipole Antenna
Antenna Gain	0.5 dBi

1.6. Working Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

1.7. Test Condition

The change of the measured voltage at the radio part of the EUT is below $\pm 1\%$, when input voltage from external power supply to the equipment under test is varied by $\pm 10\%$ (test EVB), thus the RF test is tested at rated voltage only.

Extreme Voltage	5.00V	4.50V	5.50V
Measure Voltage	1.103	1.103	1.103
Tolerance	-	0.0%	0.0%

2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by BLE-1Mbps
Mode 2: Receive by BLE-1Mbps

2.2. Test Software

The test utility software used during testing was “CyBluetool”, and the version was 0.1.107.1.

2.3. Test Condition

Because the EUT is just a module, the input voltage is the voltage at the radio part of the EUT, thus the RF test is tested at rated voltage only.

2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- MIC Notice No.88 Annex 43
- Article 49-20 and the relevant articles of the Ordinance Regulating Radio Equipment
- ARIB STD-T66 v3.7

3. Measuring Instrument

Conducted Test Equipment (SIP-TR1)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date	Cali. Body	Cali. Method
USB Power Sensor	Agilent	U2021XA	MRTSUE06030	1 year	2023-10-08	Ceprei	C
Signal Analyzer	Keysight	N9010B	MRTSUE06558	1 year	2023-06-01	Ceprei	C
Thermohygrometer	testo	608-H1	MRTSUE11022	1 year	2023-11-01	Ceprei	C

Note: All the above test equipment was used and kept valid calibration period during the testing.

Calibration Method:

- Calibration conducted by the National Institute of Information and Communications Technology (NICT) or a designated calibration agency under Article 102-18 paragraph.
- Correction conducted pursuant to the previous of Article 135 or Article 144 of the measurement Law (Law No. 51 of 1992), Japan calibration Service System
- Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph.

4. Decision Rules and Measurement Uncertainty

4.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2.
(Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.13dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 1.15dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 0.28%

5. Test Result

5.1. Summary

Test Description	Test Condition	Test Result
Output Power	Conducted	Pass
Output Power Tolerance		Pass
E.I.R.P.		Pass
Spread Bandwidth and Spread Factor		N/A
Occupied Bandwidth		Pass
Frequency Tolerance		Pass
Transmitter Spurious Emissions		Pass
Receiver Spurious Emissions		Pass
Carrier Sensing		N/A
Interference Prevention Function	Radiated	Pass

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) "N/A" means that this item is not applicable, and the detail information refers to relevant section.

5.2. Output Power, Output Power Tolerance and E.I.R.P Measurement

5.2.1. Test Limit

Output Power $\leq 10\text{mW}$

Output Power Tolerance: +20% to -80%

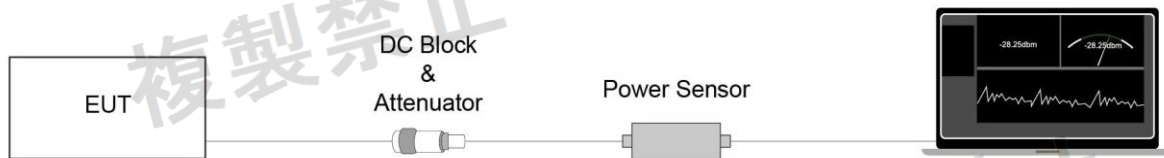
EIRP $\leq 12.14\text{dBm}$

5.2.2. Test Procedure

Measure the total power by Power Meter in a state of hopping mode (with Average Sensor).

If it's the burst wave, please measure the burst ratio. Then calculate the real total power by burst ratio.

5.2.3. Test Setup



5.2.4. Test Result

Test Site	SIP-TR1	Temperature	23.5 °C
Test Engineer	Nandy Zhang	Humidity	55.5 %RH
Test Date	2023-04-15	Test Item	Output Power

Data Rate (Mbps)	Frequency (MHz)	Reading Value (dBm)	Real Value (mW)	Limit (mW)	Result
1	2402	6.10	4.07	10	Pass
1	2440	6.58	4.55	10	Pass
1	2480	6.25	4.22	10	Pass

Note: Real Value (mW) = $10^{\text{Reading Value (dBm)}/10}$

Test Site	SIP-TR1	Temperature	23.5 °C
Test Engineer	Nandy Zhang	Humidity	55.5 %RH
Test Date	2023-04-15	Test Item	Output Power Tolerance

Data Rate (Mbps)	Frequency (MHz)	Output Power (mW)	Declared Output Power (mW)	Tolerance (%)	Limit (%)	Result
1	2402	4.07	5	-18.6	+20 ~ -80	Pass
1	2440	4.55	5	-9.0	+20 ~ -80	Pass
1	2480	4.22	5	-15.6	+20 ~ -80	Pass

Note: Tolerance = $(\text{Output Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$

Test Site	SIP-TR1	Temperature	23.5 °C
Test Engineer	Nandy Zhang	Humidity	55.5 %RH
Test Date	2023-04-15	Test Item	E.I.R.P.

Data Rate (Mbps)	Frequency (MHz)	Output Power (dBm)	E.I.R.P. (dBm)	Limit (dBm)	Result
1	2402	6.10	6.60	≤ 12.14	Pass
1	2440	6.58	7.08	≤ 12.14	Pass
1	2480	6.25	6.75	≤ 12.14	Pass

Note: E.I.R.P. (dBm) = Output Power (dBm) + Ant Gain (dBi).

5.3. Spread Bandwidth and Spread Factor Measurement

5.3.1. Test Limit

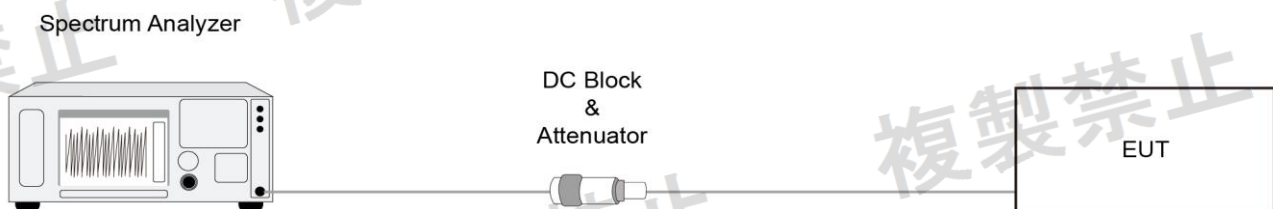
Spread Bandwidth ≥ 500 kHz

Spread Factor ≥ 5 for 2400 - 2483.5 MHz

5.3.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. A positive peak detector function must be used.
3. A measurement instrument with an integrated 90% power bandwidth function may be used to automate the test process.
4. The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
5. 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.3.3. Test Setup



5.3.4. Test Result

This test item is not applicable for Bluetooth LE device.

5.4. Occupied Bandwidth Measurement

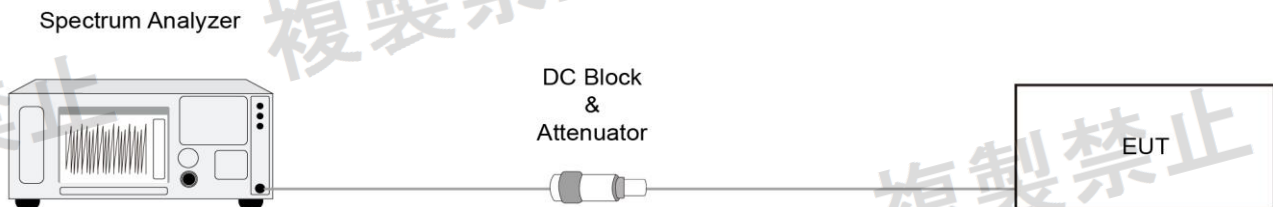
5.4.1. Test Limit

≤ 26 MHz

5.4.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. A positive peak detector function must be used.
3. A measurement instrument with an integrated 99% power bandwidth function may be used to automate the test process.
4. The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
5. 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

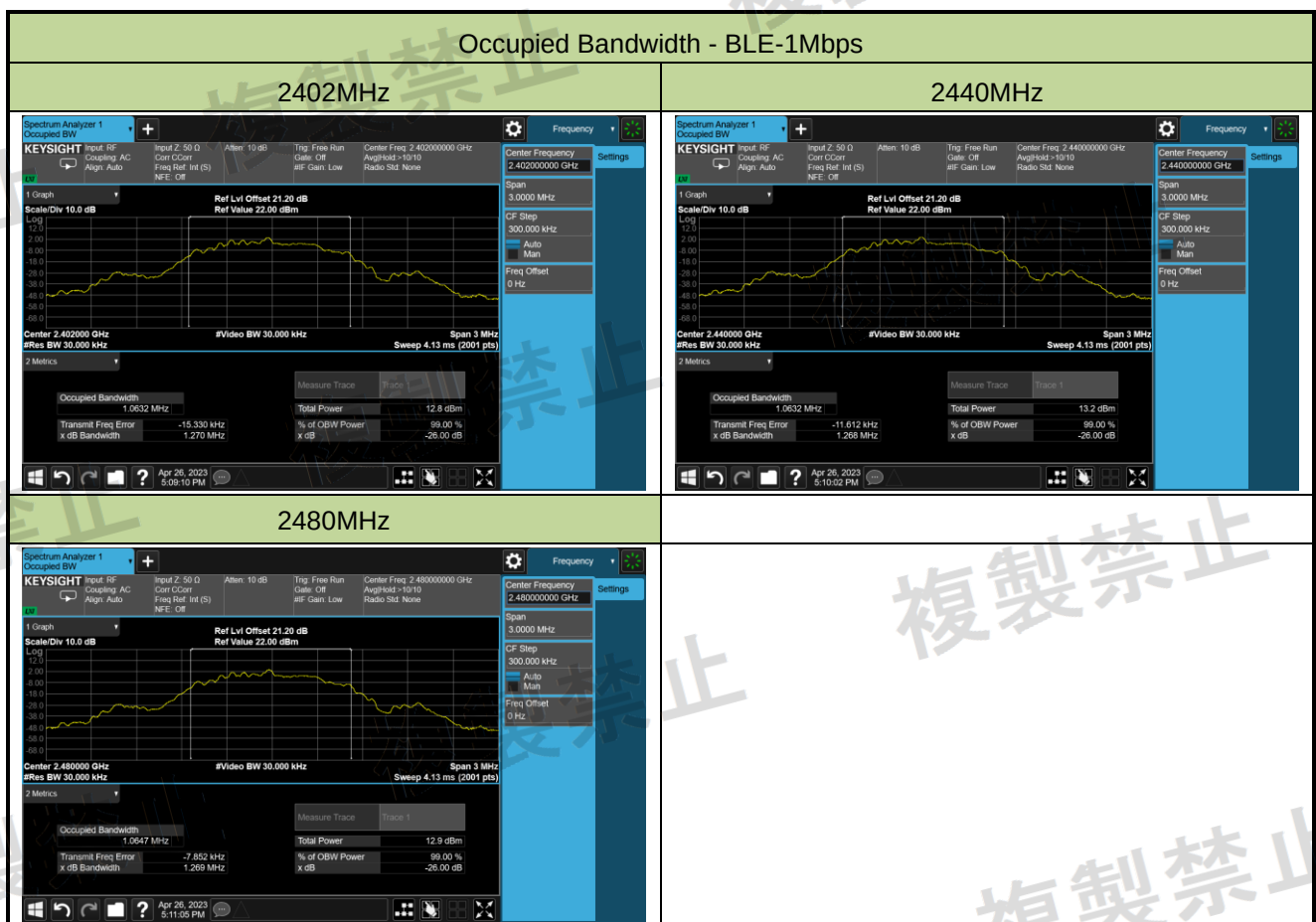
5.4.3. Test Setup



5.4.4. Test Result

Test Site	SIP-TR1	Temperature	20.6 °C
Test Engineer	Nandy Zhang	Humidity	54.7 %RH
Test Date	2023-04-26		

Data Rate (Mbps)	Frequency (MHz)	Occupied Bandwidth (MHz)	Limit (MHz)	Result
1	2402	1.0632	≤ 26.00	Pass
1	2440	1.0632	≤ 26.00	Pass
1	2480	1.0647	≤ 26.00	Pass



5.5. Frequency Tolerance Measurement

5.5.1. Test Limit

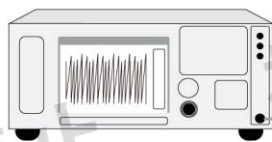
-50ppm ~ +50ppm

5.5.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. A positive peak detector function must be used.
3. The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
4. 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.5.3. Test Setup

Spectrum Analyzer



DC Block
&
Attenuator



EUT

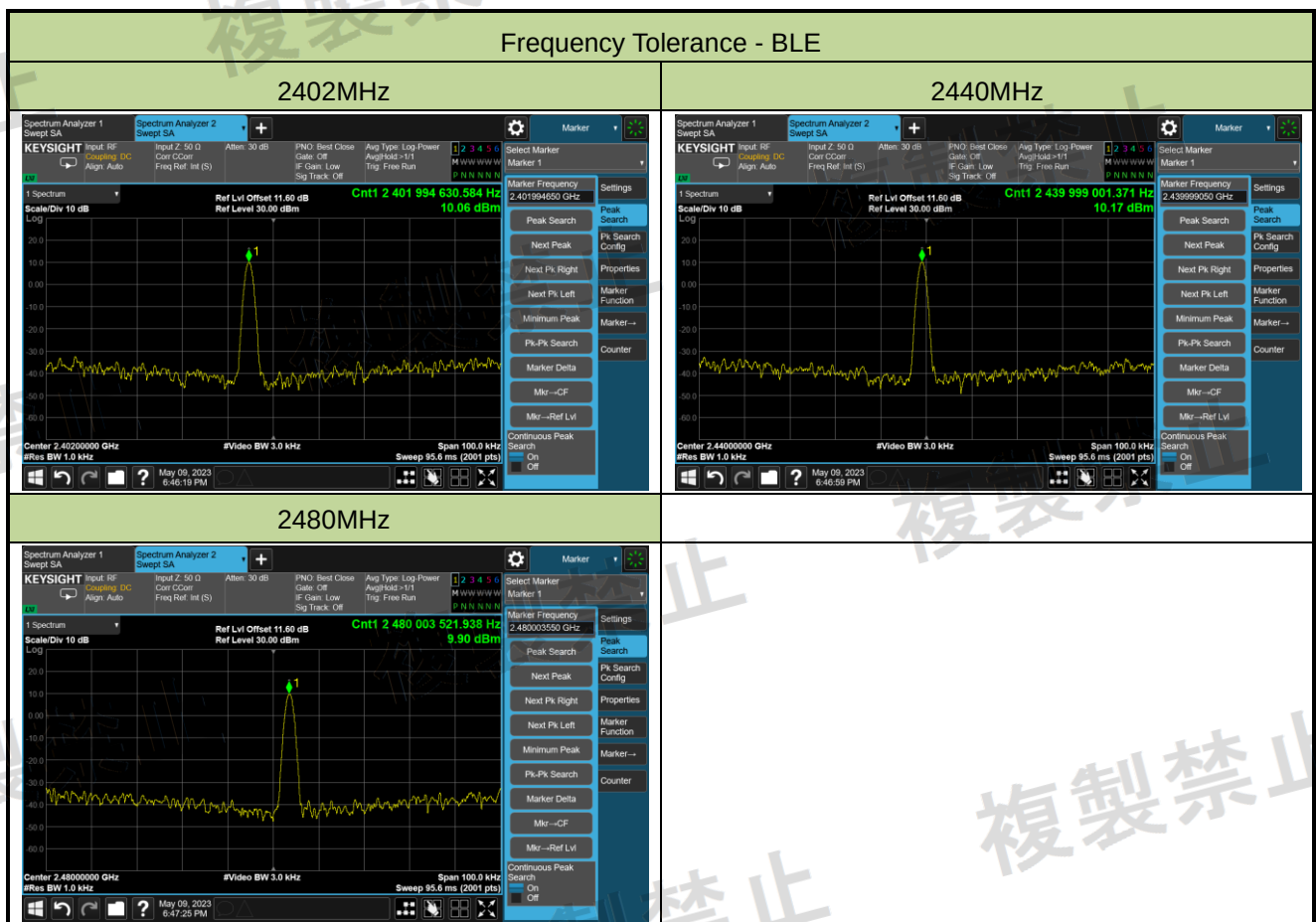


5.5.4. Test Result

Test Site	SIP-TR1	Temperature	22.5 °C
Test Engineer	Nandy Zhang	Humidity	50.4 %RH
Test Date	2023-05-09		

Test Mode	Center Frequency (MHz)	Measurement Frequency (MHz)	Frequency Tolerance (ppm)	Limit (ppm)	Result
Carrier Wave	2402	2401.994631	-2.235	-50 ~ +50	Pass
	2440	2439.999001	-0.409	-50 ~ +50	Pass
	2480	2480.003522	1.420	-50 ~ +50	Pass

Note: Tolerance = (Measurement Frequency - Frequency) / Frequency * 10⁶



5.6. Transmitter Spurious Emissions Measurement

5.6.1. Test Limit

$\leq 2.5\mu\text{W}/\text{MHz}$ for 30 ~ 2387MHz

$\leq 25\mu\text{W}/\text{MHz}$ for 2387 ~ 2400MHz

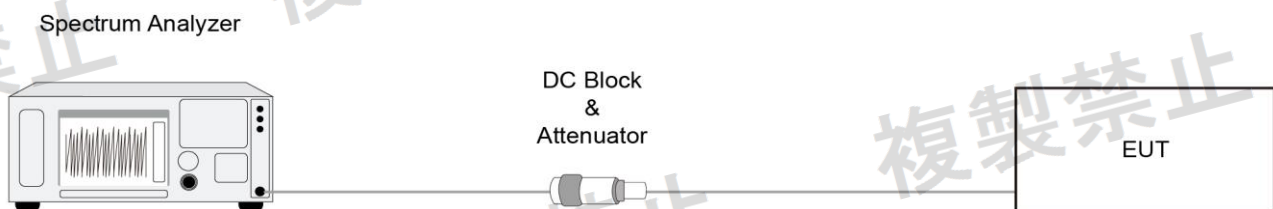
$\leq 25\mu\text{W}/\text{MHz}$ for 2483.5 ~ 2496.5MHz

$\leq 2.5\mu\text{W}/\text{MHz}$ for 2496.5 ~ 12500MHz

5.6.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. A positive peak detector function must be used.
3. The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
4. 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.6.3. Test Setup



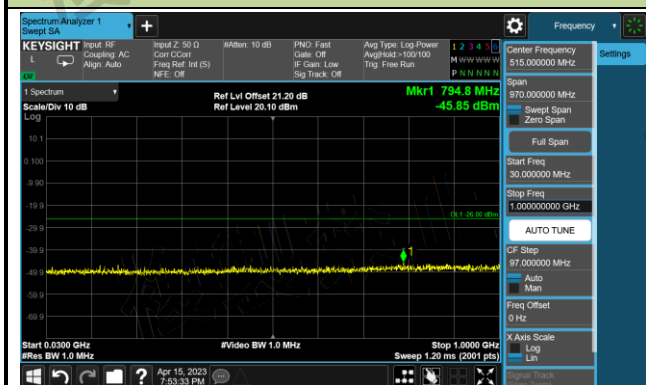
5.6.4. Test Result

Test Site	SIP-TR1	Temperature	23.5 °C
Test Engineer	Nandy Zhang	Humidity	55.5 %RH
Test Date	2023-04-15		

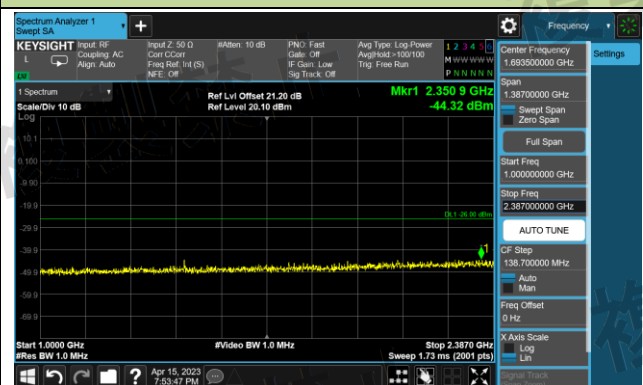
Test Frequency	Frequency Range (MHz)	Measured Freq (MHz)	Max Reading Level		Limit (μW/MHz)	Result
			(dBm/MHz)	(μW/MHz)		
BLE-1Mbps						
2402MHz	30 ~1000	794.8	-45.85	0.03	2.5	Pass
	1000 ~ 2387	2350.9	-44.32	0.04	2.5	Pass
	2387 ~ 2400	2400.0	-22.74	5.32	25	Pass
	2483.5 ~ 2496.5	2495.0	-45.71	0.03	25	Pass
	2496.5 ~ 8000	3685.3	-43.38	0.05	2.5	Pass
	8000 ~ 12500	12380.8	-42.76	0.05	2.5	Pass
2440MHz	30 ~1000	769.6	-46.02	0.03	2.5	Pass
	1000 ~ 2387	2352.3	-43.71	0.04	2.5	Pass
	2387 ~ 2400	2391.0	-46.56	0.02	25	Pass
	2483.5 ~ 2496.5	2494.6	-46.29	0.02	25	Pass
	2496.5 ~ 8000	3905.4	-42.70	0.05	2.5	Pass
	8000 ~ 12500	10587.5	-43.00	0.05	2.5	Pass
2480MHz	30 ~1000	828.3	-45.42	0.03	2.5	Pass
	1000 ~ 2387	2253.8	-44.30	0.04	2.5	Pass
	2387 ~ 2400	2396.3	-46.44	0.02	25	Pass
	2483.5 ~ 2496.5	2484.0	-45.70	0.03	25	Pass
	2496.5 ~ 8000	6811.2	-42.66	0.05	2.5	Pass
	8000 ~ 12500	12277.3	-42.80	0.05	2.5	Pass

Transmitter Spurious Emissions -2402 MHz - BLE-1Mbps

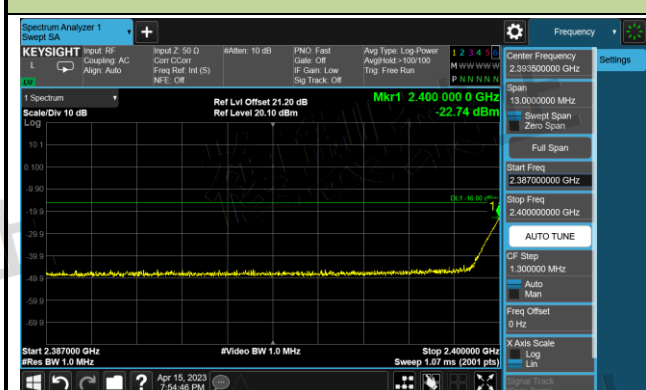
30 ~ 1000MHz



1000 ~ 2387MHz



2387 ~ 2400MHz



2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz

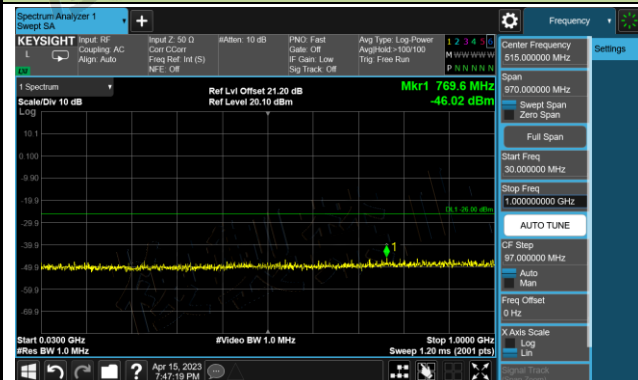


8000 ~ 12500MHz

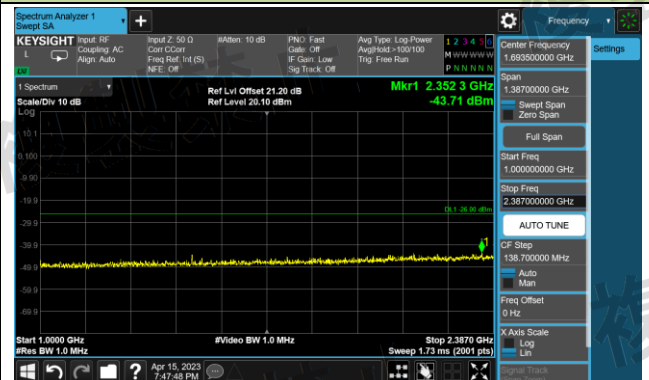


Transmitter Spurious Emissions -2440 MHz - BLE-1Mbps

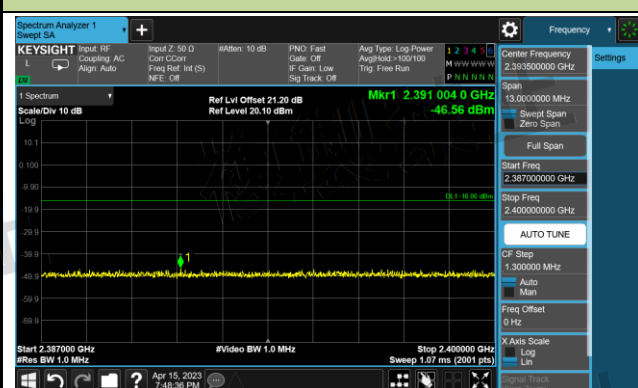
30 ~ 1000MHz



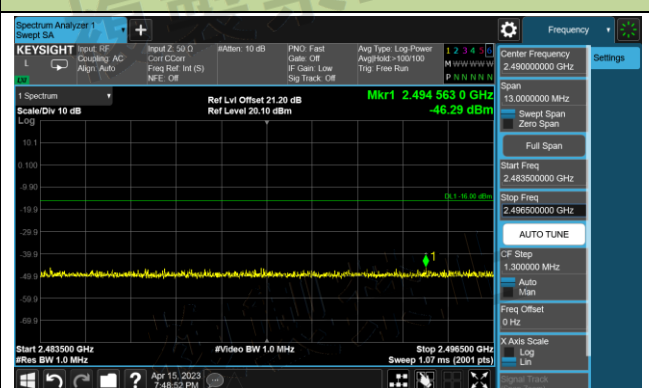
1000 ~ 2387MHz



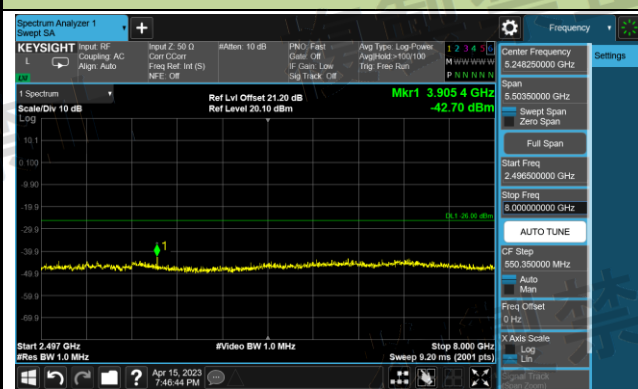
2387 ~ 2400MHz



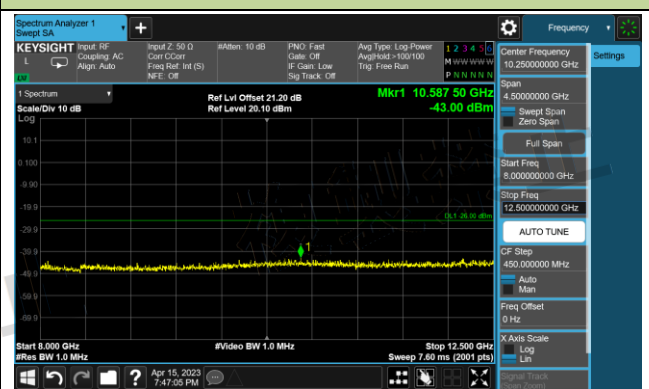
2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz

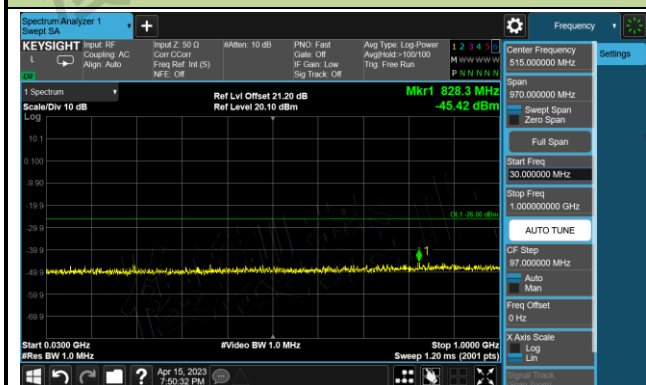


8000 ~ 12500MHz

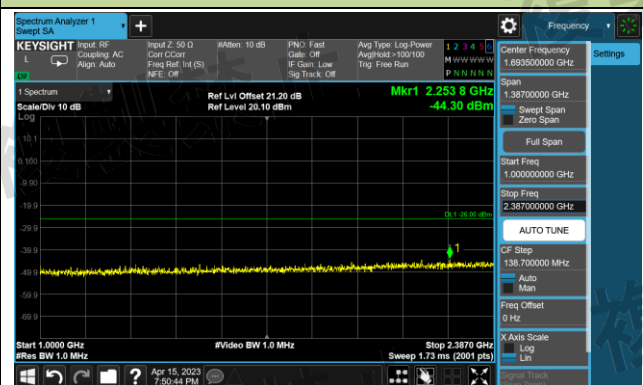


Transmitter Spurious Emissions -2480 MHz - BLE-1Mbps

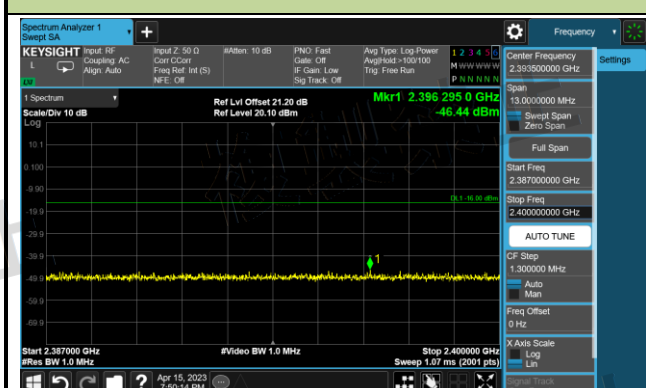
30 ~ 1000MHz



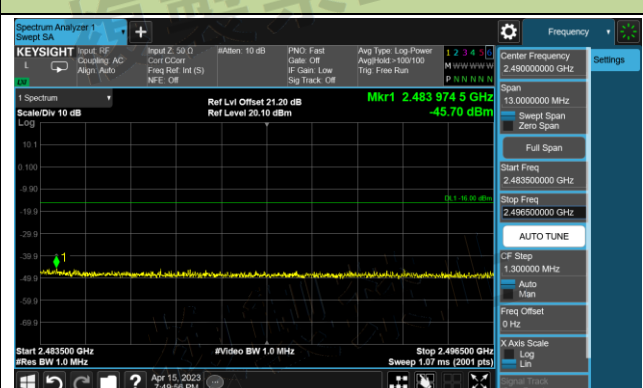
1000 ~ 2387MHz



2387 ~ 2400MHz



2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz



8000 ~ 12500MHz



5.7. Receiver Spurious Emissions Measurement

5.7.1. Test Limit

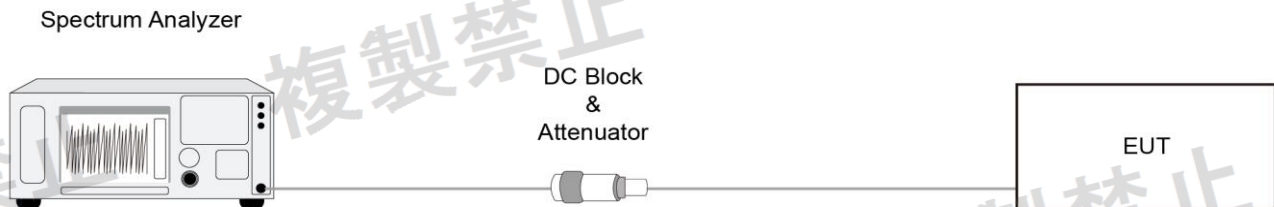
$\leq 4\text{nW}$ for 30 - 1000 MHz

$\leq 20\text{nW}$ for 1000 - 12500 MHz

5.7.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. A positive peak detector function must be used.
3. The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
4. 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.7.3. Test Setup



5.7.4. Test Result

Test Site	SIP-TR1	Temperature	23.5 °C
Test Engineer	Nandy Zhang	Humidity	55.5 %RH
Test Date	2023-04-15		

Test Frequency (MHz)	Frequency Range (MHz)	Measured Freq (MHz)	Max Reading Level		Limit (nW)	Result
			(dBm)	(nW)		
2402	30 ~ 1000	873.4	-79.24	0.012	4	Pass
	1000 ~ 12500	12178.0	-65.93	0.255	20	Pass
2440	30 ~ 1000	908.3	-78.65	0.014	4	Pass
	1000 ~ 12500	12195.3	-66.12	0.244	20	Pass
2480	30 ~ 1000	808.4	-78.95	0.013	4	Pass
	1000 ~ 12500	3294.3	-65.86	0.259	20	Pass

Receiver Spurious Emissions - 2402MHz



Receiver Spurious Emissions - 2440MHz



Receiver Spurious Emissions - 2480MHz



5.8. Carrier Sensing Measurement

5.8.1. Test Limit

Stop transmission while carrier detecting.

Field intensity in the direction of the maximum gain of a receiving antenna: 100mV/m (It's a radiated testing detection threshold level).

The conducted detection threshold level shows as below:

(6)式の電界強度 E を既定値の 100mV/m (100dB μ V/m) とし、 λ (m)を F (MHz) に変換し、 P を dBm 単位で表すと (7) 式を得る。

$$P[\text{dBm}] = 22.79 + G - 20\log F \quad (7)$$

P : 受信機のアンテナ端子に入力される受信電力 [dBm]

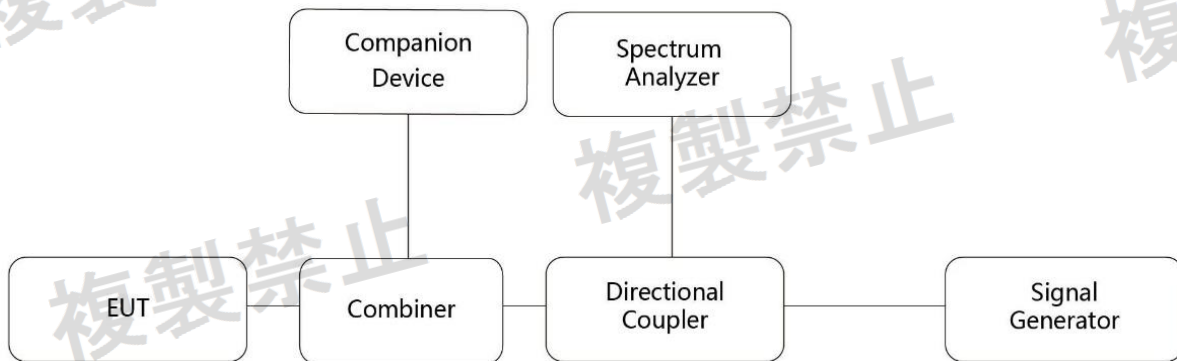
G : 受信アンテナの絶対利得 [dBi]

F : キャリア周波数 [MHz]

5.8.2. Test Procedure

1. A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.
2. Link EUT and Access Point to Directional Coupler input port.
3. Link Signal Generator and Spectrum Analyzer to test port and output port in the Directional Coupler separately.
4. A positive Peak Detector function in Spectrum Analyzer must be used.
5. Set the Span to Zero.
6. Press the Signal Generator on and it will output the Carrier Signal. When the Link breaks off, wait a minute and press the Signal Generator off. After a while, reset the Link and done the test.

5.8.3. Test Setup



5.8.4. Test Result

This test item is not applicable for Bluetooth LE, only apply for OFDM modulation with OBW>26MHz.

5.9. Interference Protection Function Measurement

When the EUT work on normal operation, we can read this EUT address from EUT's Setting interface.

So the EUT can have Interference Prevention Function.



Appendix A - EUT Photograph

Refer to “2304RSU003-JE” file.

Appendix B - Test Setup Photograph

Refer to “2304RSU003-JT” file.