MEASUREMENT REPORT

FCC PART 2 & 22 & 24 & 27

FCC ID: XMR2021RM502QGL

Application: Quectel Wireless Solutions Company Limited

Application Type: Certification

Product: 5G Sub-6 GHz M.2 Module

Model No.: RM502Q-GL

Brand Name: Quectel

FCC Rule Part(s): Part 2, 22 (H), 24 (E), 27

Test Procedure(s): ANSI C63.26: 2015

Test Date: February 01 ~ April 06, 2021

Reviewed By: Sunny Sun

Approved By: Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2101RSU049-U7	Rev. 01	Initial Report	05-19-2021	Valid

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1. GENERAL INFORMATION

1.1. Applicant

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

1.2. Manufacturer

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

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	
☐	**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	5G Sub-6 GHz M.2 Module
Model No.	RM502Q-GL
Brand Name	Quectel
IMEI	Conducted Measurement: 355878110939501 Radiated Measurement: 865776040001173
Operating Temperature	-30 ~ 70 °C
Power Type	3.135 ~ 4.4Vdc, typical 3.7Vdc
UMTS Specification	
Single Band	Band 2, 4, 5
Modulation	Uplink up to 16QAM, Downlink up to 64QAM
E-UTRA Specification	
Single Band	Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 38, 41, 48, 66, 71
Intra-Band	CA_2C, CA_5B, CA_7C, CA_38C, CA_41C, CA_48C, CA_66C
HPUE Band	Band 41
Modulation	UL & DL up to 256QAM
5G NR Specification	
SA Band	n2, n7, n5, n12, n25, n41, n66, n71, n77
SA UL MIMO Band	n41, n77
EN-DC Band	DC_25A_n41A, DC_26A_n41A, DC_2A_n41A, DC_66A_n41A DC_4A_n41A, DC_2A_n77A, DC_7A_n77A, DC_12A_n77A, DC_41A_n77A, DC_66A_n77A
HPUE Band	n41, n77 (SA & UL MIMO)
SCS for NR cell	FDD Band: 15kHz; TDD Band: 30kHz
Modulation	UL & DL up to 256QAM

1.5. Radio Specification under Test

T_X Frequency Range:	Band II: 1850 ~ 1910MHz, Band IV: 1710 ~ 1755MHz Band V: 824 ~ 849MHz
R_X Frequency Range:	Band II: 1930 ~ 1990MHz, Band IV: 2110 ~ 2155MHz Band V: 869 ~ 894MHz

Note 1: For other features of this EUT, test report will be issued separately.

Note 2: The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1.6. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
WCDMA Band II	1850 ~ 1910	Dipole	0.25
WCDMA Band IV	1710 ~ 1755		1.47
WCDMA Band V	824 ~ 849		2.68

Note: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

1.7. Test Methodology

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

- ANSI C63.26:2015
- FCC CFR 47 Part 22, Part 24, Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01: Determining ERP and EIRP

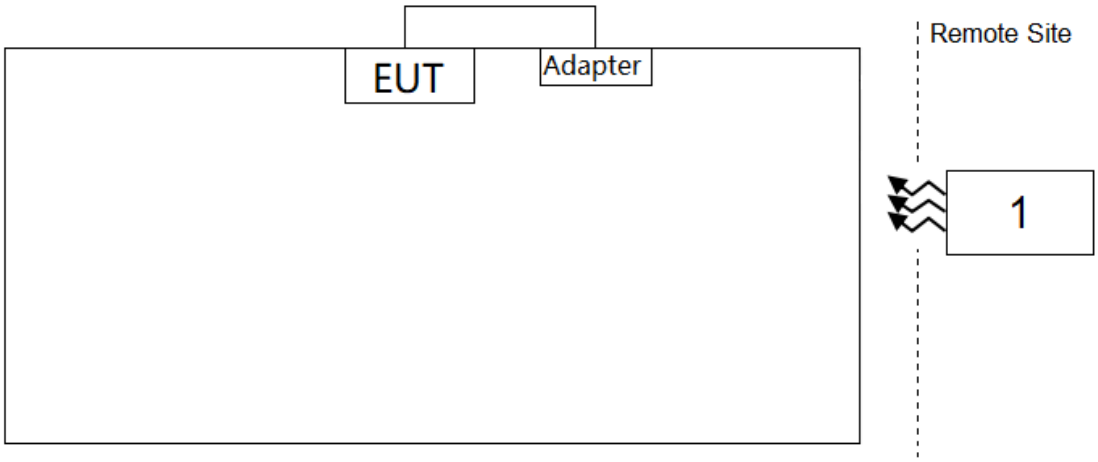
1.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

1.9. Maximum Power, Frequency Tolerance, and Emission Designator

System	Modulation	Maximum Power (W)	Frequency Tolerance (ppm)	Emission Designator
WCDMA Band II RMC 12.2Kbps	BPSK	0.1644	0.0076	4M15F9W
WCDMA Band IV RMC 12.2Kbps	BPSK	0.1560	0.0064	4M14F9W
WCDMA Band V RMC 12.2Kbps	BPSK	0.1542	0.0156	4M14F9W

1.10. Configuration of Tested System



Product		Manufacturer	Model No.
1	Wideband Radio Communication Tester	R&S	CMW 500

1.11. Test Environment Condition

Ambient Temperature	15 ~ 35°C
Relative Humidity	20% ~ 75%RH

2. TEST EQUIPMENT CALIBRATION DATE

Radiated Emission (WZ-AC1)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2021/08/01
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2021/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2022/03/30
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2021/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2022/02/22
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2021/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2021/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2022/04/29

Radiated Emission (WZ-AC2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2021/08/01
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2021/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2021/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2022/02/22
Broad Band Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2021/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2021/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2021/12/14
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2022/04/29

Conducted Test Equipment (WZ-SR6, WZ-TR3)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2022/04/14
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2021/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2022/04/14
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2021/11/17
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
True RMS Clamp Meter	Fluke	319	MRTSUE06080	1 year	2022/05/05
Directional Coupler	Agilent	87301D	MRTSUE06082	1 year	2022/03/24
Dual Directional Coupler	Agilent	7778D	MRTSUE06083	1 year	2022/03/24
Attenuator	MVE	6dB	MRTSUE06534	1 year	2021/12/11
Attenuator	MVE	10dB	MRTSUE06543	1 year	2021/12/11
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2021/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2021/08/08

Software	Version	Function
EMI Software	V3	EMI Test Software

3. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Radiated Spurious Emissions
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 9kHz ~ 300MHz: 5.04dB 300MHz ~ 1GHz: 4.95dB 1GHz ~ 40GHz: 6.40dB Vertical: 9kHz ~ 300MHz: 5.24dB 300MHz ~ 1GHz: 6.03dB 1GHz ~ 40GHz: 6.40dB
Conducted Spurious Emissions
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
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%
Frequency Stability
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 76.2Hz

4. TEST RESULT

4.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	Conducted	Pass	Section 5.2
2.1055, 22.355 24.235, 27.54	Frequency Stability	< 2.5 ppm		Pass	Section 5.3
22.913(a)(5)	Equivalent Radiated Power (B5)	< 7 Watts Max ERP		Pass	Section 5.4
27.50(d)(4)	Equivalent Isotropic Radiated Power (B4)	< 1 Watts Max EIRP		Pass	Section 5.4
24.232(c)	Equivalent Isotropic Radiated Power (B2)	< 2 Watts Max EIRP		Pass	Section 5.4
2.1051, 22.917(a) 24.238(a), 27.53(h)	Band Edge	< 43 + 10log10 ($P_{[Watts]}$)		Pass	Section 5.5
2.1051, 22.917(a) 24.238(a), 27.53(h)	Peak to Average Ratio	< 13dB		Pass	Section 5.6
24.232(d), 27.50(d)(5)	Spurious Emission	< 43 + 10log10 ($P_{[Watts]}$)		Pass	Section 5.7
2.1053, 22.917(a) 24.238(a), 27.53(h)	Spurious Emission	< 43 + 10log10 ($P_{[Watts]}$)	Radiated	Pass	Section 5.8

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) All supported modulation types were evaluated. The worst-case emission of modulation was selected. Therefore, the Frequency Stability, Channel Band Edge, Radiated & Conducted Spurious Emission were presented worst-case in the test report.

4.2. Occupied Bandwidth Measurement

4.2.1.Test Limit

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

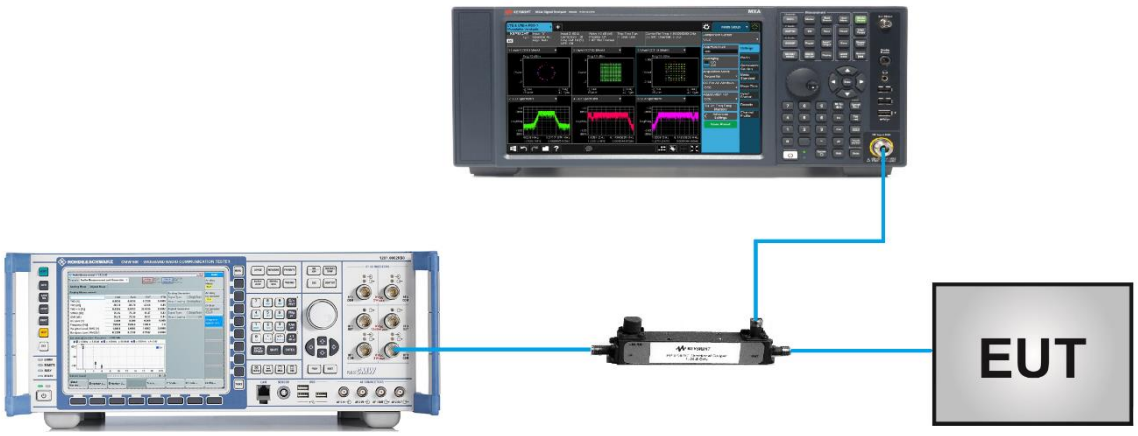
4.2.2.Test Procedure

ANSI C63.26-2015 - Section 5.4

4.2.3.Test Setting

1. Set center frequency to the nominal EUT channel center frequency
2. RBW = The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

4.2.4.Test Setup



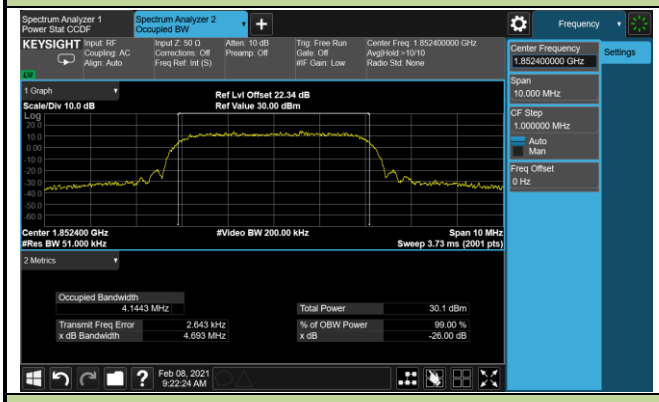
4.2.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band II		

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	1852.4	4.14
Middle	1880.0	4.15
High	1907.6	4.14

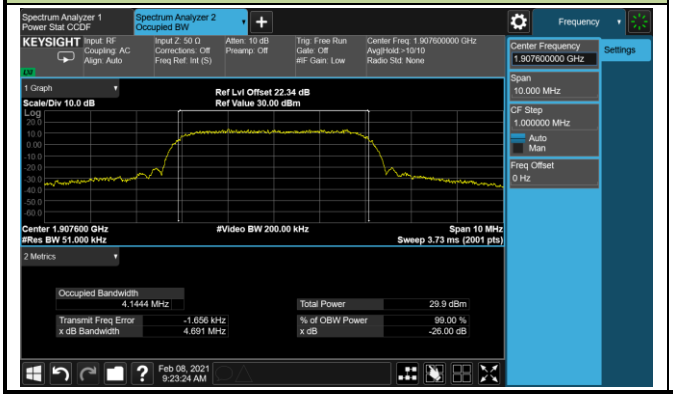
99% Bandwidth

Low Channel



Middle Channel

High Channel

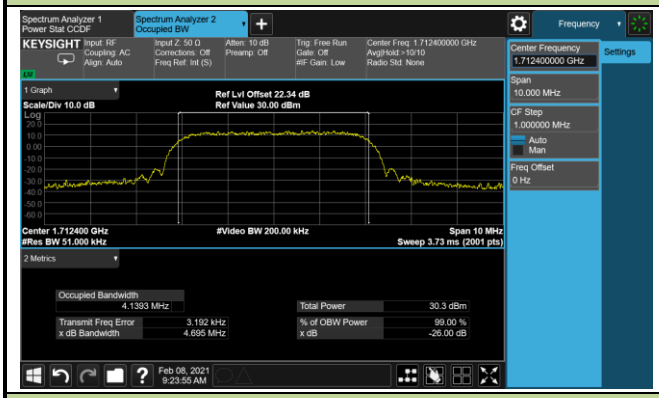


Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band IV		

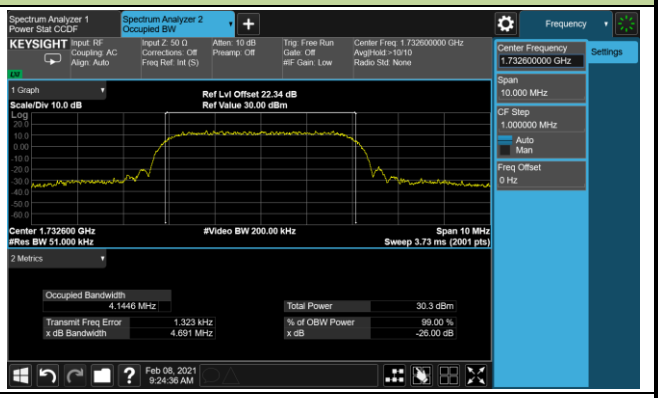
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	1712.4	4.14
Middle	1732.4	4.14
High	1752.6	4.14

99% Bandwidth

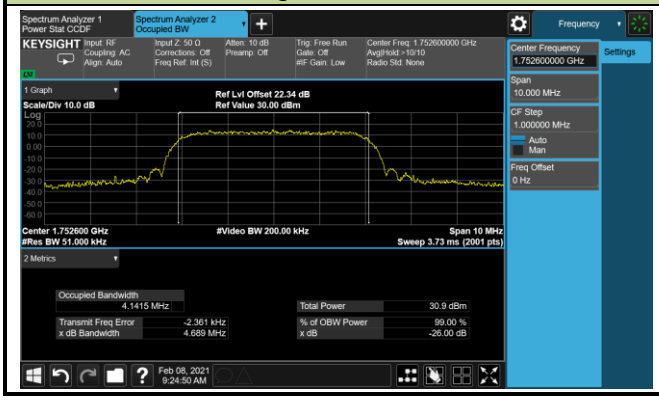
Low Channel



Middle Channel



High Channel

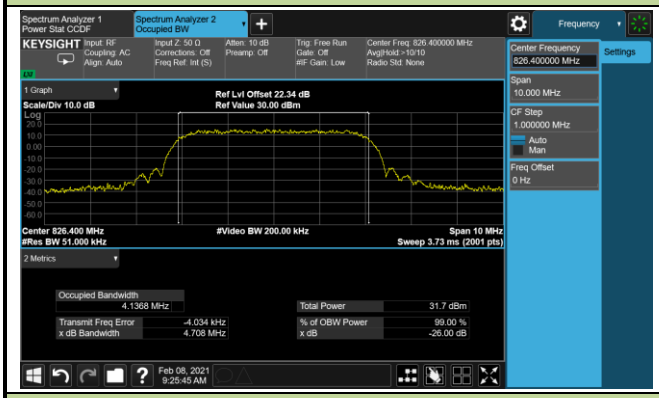


Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band V		

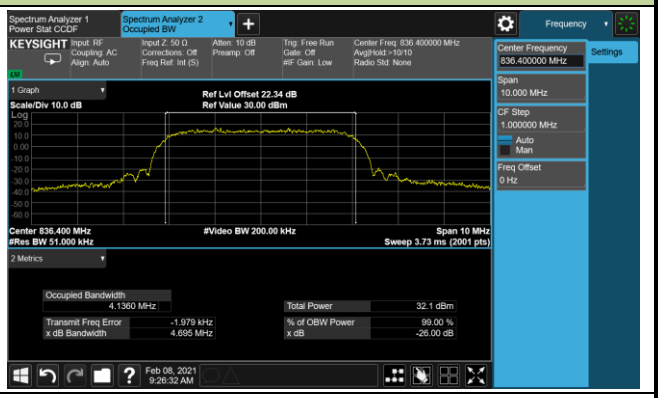
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	826.4	4.14
Middle	836.4	4.14
High	846.6	4.14

99% Bandwidth

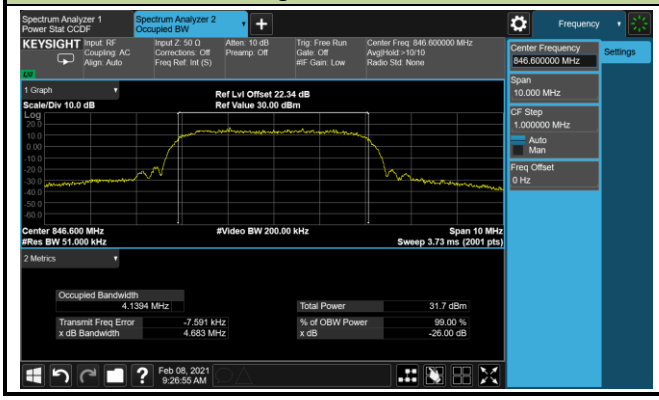
Low Channel



Middle Channel



High Channel



4.3. Frequency Stability Measurement

4.3.1.Test Limit

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

4.3.2.Test Procedure

ANSI C63.26-2015 - Section 5.6

4.3.3.Test Setting

Frequency Stability Under Temperature Variations:

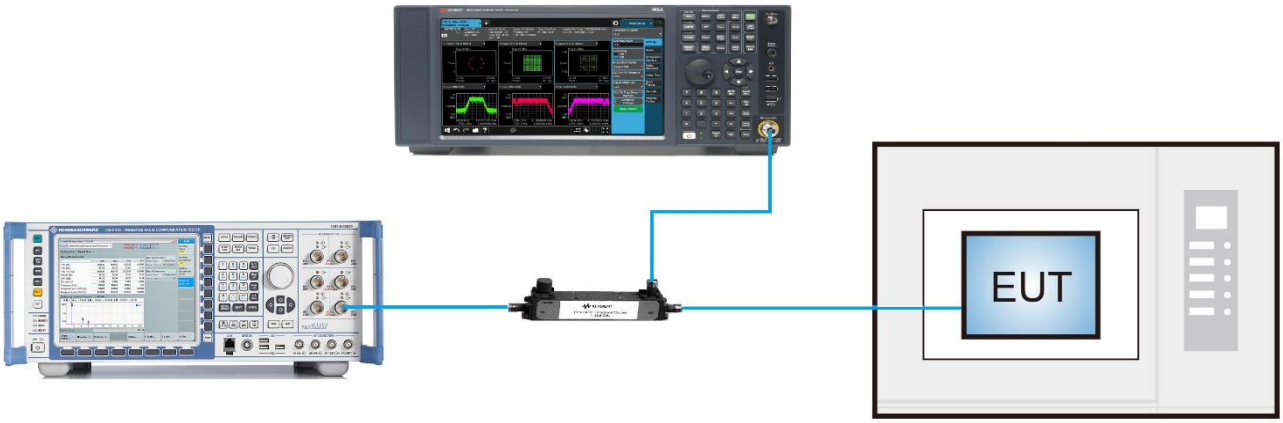
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to High. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the Low temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, recordthe maximum frequency change.

4.3.4.Test Setup



4.3.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band II		

Power (Vdc)	Temp. (°C)	Frequency Tolerance (ppm)
3.7	- 30	0.0076
	- 20	0.0073
	- 10	0.0071
	0	0.0069
	+ 10	0.0054
	+ 20	0.0061
	+ 30	0.0054
	+ 40	0.0045
	+ 50	0.0050
4.4	+ 20	0.0055
3.135	+ 20	0.0051

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band IV		

Power (Vdc)	Temp. (°C)	Frequency Tolerance (ppm)
3.7	- 30	0.0039
	- 20	0.0056
	- 10	0.0064
	0	0.0061
	+ 10	0.0045
	+ 20	0.0034
	+ 30	0.0022
	+ 40	0.0001
	+ 50	-0.0014
4.4	+ 20	0.0029
3.135	+ 20	0.0029

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band V		

Power (Vdc)	Temp. (°C)	Frequency Tolerance (ppm)
3.7	- 30	-0.0002
	- 20	0.0156
	- 10	0.0000
	0	0.0009
	+ 10	0.0000
	+ 20	-0.0002
	+ 30	0.0001
	+ 40	-0.0003
	+ 50	-0.0009
4.4	+ 20	-0.0021
3.135	+ 20	-0.0012

4.4. Equivalent Isotropically Radiated Power Measurement

4.4.1.Test Limit

Band 2:

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

Band 4:

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Band 5:

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

4.4.2.Test Procedure

ANSI C63.26-2015 - Section 5.2

4.4.3.Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation (1) as follows:

ERP or EIRP = $P_{Meas} + G_T$

where

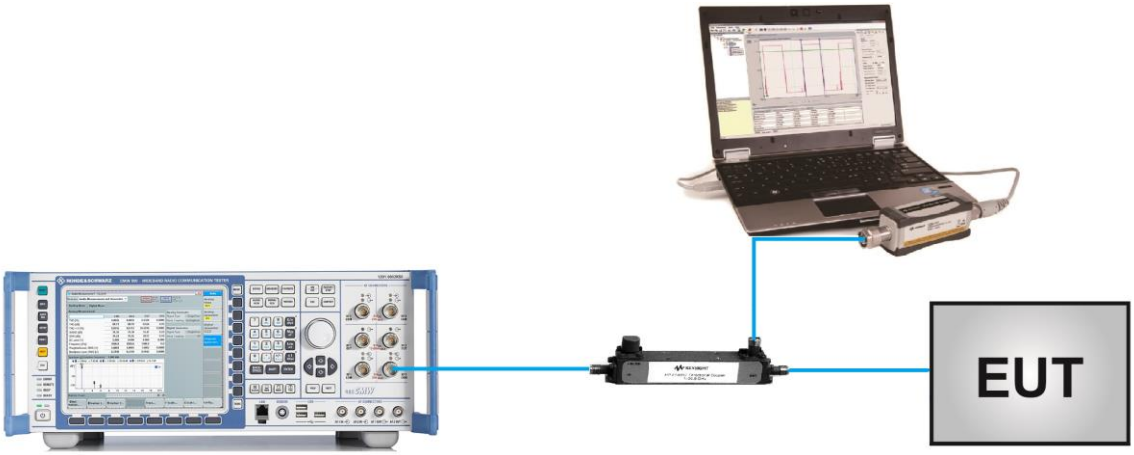
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

ERP = EIRP -2.15

4.4.4.Test Setup



4.4.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band II		

Mode	3GPP Subtest	Conducted Power (dBm)			Antenna Gain (dBi)	EIRP (dBm)		
		Band II Channel				Band II Channel		
		9262	9400	9538		9262	9400	9538
WCDMA R99	1	22.00	22.16	21.90	0.25	22.25	22.41	22.15
HSDPA	1	21.39	21.60	21.47	0.25	21.64	21.85	21.72
	2	21.41	21.58	21.34	0.25	21.66	21.83	21.59
	3	20.91	21.07	20.98	0.25	21.16	21.32	21.23
	4	20.91	20.87	20.99	0.25	21.16	21.12	21.24
HSUPA	1	21.36	21.58	21.53	0.25	21.61	21.83	21.78
	2	19.34	19.55	19.46	0.25	19.59	19.80	19.71
	3	20.35	20.52	20.47	0.25	20.60	20.77	20.72
	4	19.43	19.58	19.46	0.25	19.68	19.83	19.71
	5	21.41	21.64	21.52	0.25	21.66	21.89	21.77
Limit	33.01dBm							

Note: The EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band IV		

Mode	3GPP Subtest	Conducted Power (dBm)			Antenna Gain (dBi)	EIRP (dBm)		
		Band IV Channel				Band IV Channel		
		1312	1412	1513		1312	1412	1513
WCDMA R99	1	21.82	21.89	21.93	1.47	23.29	23.36	23.40
HSDPA	1	21.33	21.41	21.30	1.47	22.80	22.88	22.77
	2	21.31	21.39	21.31	1.47	22.78	22.86	22.78
	3	20.83	20.94	20.84	1.47	22.30	22.41	22.31
	4	20.86	20.92	20.85	1.47	22.33	22.39	22.32
HSUPA	1	21.21	21.33	21.18	1.47	22.68	22.80	22.65
	2	19.24	19.34	19.28	1.47	20.71	20.81	20.75
	3	20.26	20.38	20.23	1.47	21.73	21.85	21.70
	4	19.25	19.33	19.31	1.47	20.72	20.80	20.78
	5	21.29	21.38	21.28	1.47	22.76	22.85	22.75
Limit	30.00dBm							

Note: The EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi)

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/01
Test Band	WCDMA Band V		

Mode	3GPP Subtest	Conducted Power (dBm)			Antenna Gain (dBi)	ERP (dBm)		
		Band V Channel				Band V Channel		
		4132	4182	4233		4132	4182	4233
WCDMA R99	1	21.88	21.56	21.77	2.68	22.41	22.09	22.30
HSDPA	1	21.36	21.35	21.28	2.68	21.89	21.88	21.81
	2	21.35	21.31	21.27	2.68	21.88	21.84	21.80
	3	20.86	20.82	20.80	2.68	21.39	21.35	21.33
	4	20.87	20.86	20.81	2.68	21.40	21.39	21.34
HSUPA	1	21.28	21.24	21.31	2.68	21.81	21.77	21.84
	2	19.36	19.31	19.27	2.68	19.89	19.84	19.80
	3	20.31	20.32	20.25	2.68	20.84	20.85	20.78
	4	19.37	19.30	19.26	2.68	19.90	19.83	19.79
	5	21.38	21.29	21.30	2.68	21.91	21.82	21.83
Limit	38.45dBm							

Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) – 2.15

4.5. Band Edge Measurement

4.5.1.Test Limit

For operations in the 824 ~ 849 MHz, 1850 ~ 1910 MHz, 1930 ~ 1990 MHz, 698 ~ 746 MHz and 1710 ~ 1755 MHz, the FCC limit is 43 + 10log10($P[_{Watts}]$) dB below the transmitter power P(Watts) in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

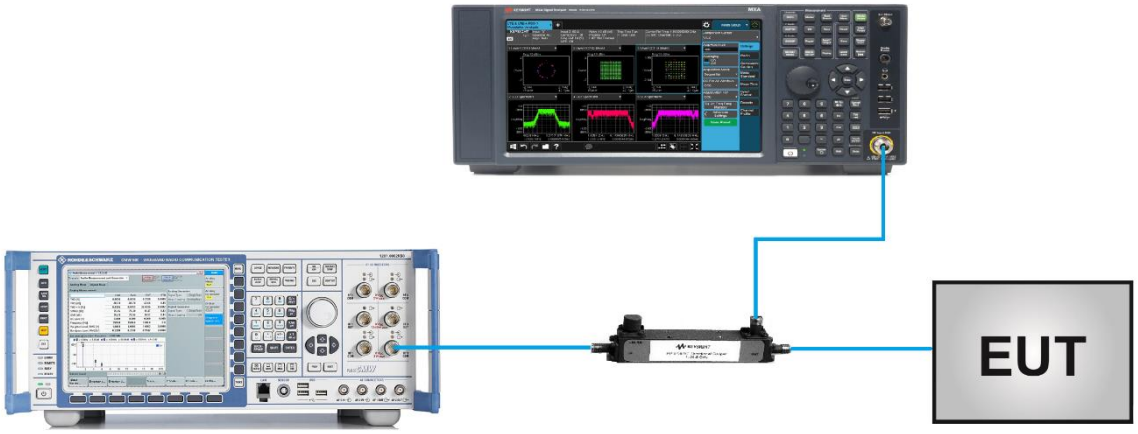
4.5.2.Test Procedure

ANSI C63.26-2015 - Section 5.7

4.5.3.Test Setting

1. Set the analyzer frequency to low or high channel
2. RBW ≥ The nominal RBW shall be in the range of 1% of the anticipated OBW (in the 1MHz band immediately outside and adjacent to the band edge). For improvement of the accuracy in the measurement of the average power of a noise-like emission, a RBW narrower than the specified reference bandwidth can be used (generally limited to no less than 1% of the OBW), provided that a subsequent integration is performed over the full required measurement bandwidth. This integration should be performed using the spectrum analyzer’s band power functions.
3. VBW ≥ 3*RBW
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to “free run.”
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

4.5.4.Test Setup



4.5.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band II, IV, V		

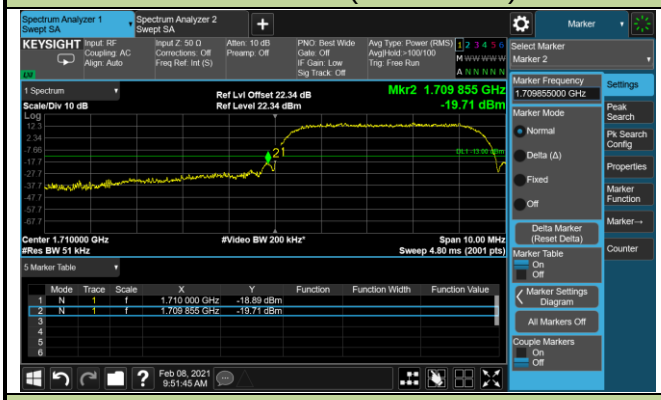
WCDMA Band II

Channel 9262 (1852.4MHz)

Channel 9538 (1907.6MHz)

WCDMA Band IV

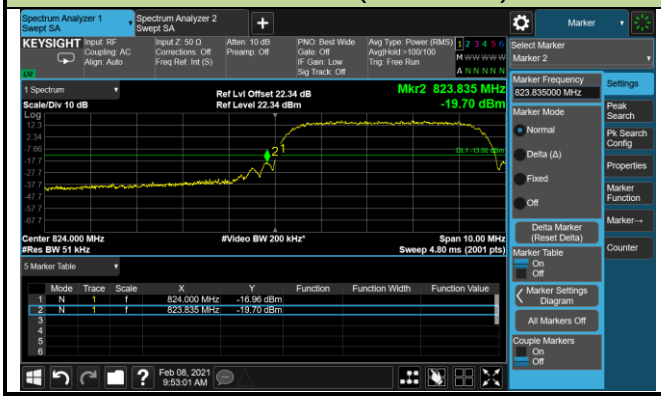
Channel 1312 (1712.4MHz)



Channel 1513 (1752.6MHz)

WCDMA Band V

Channel 4132 (826.4MHz)



Channel 4233 (846.6MHz)

4.6. Peak to Average Ratio Measurement

4.6.1.Test Limit

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

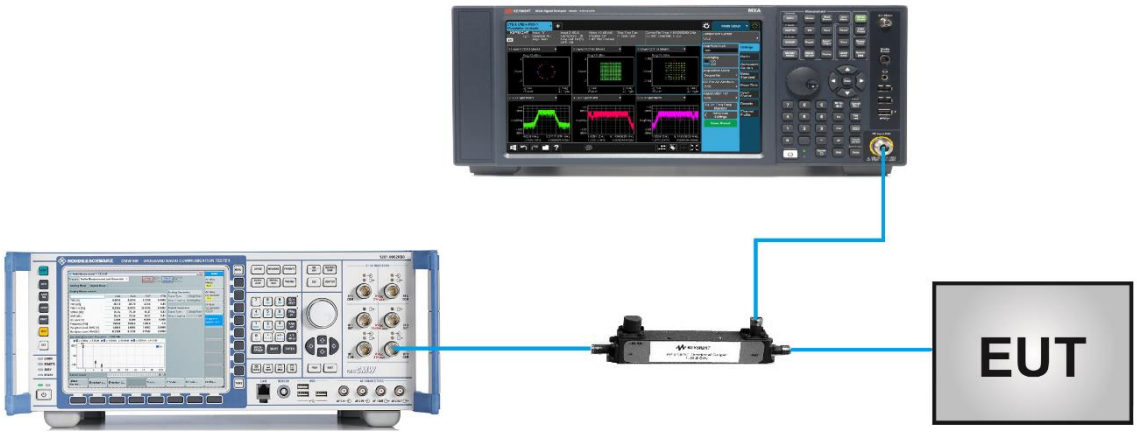
4.6.2.Test Procedure

ANSI C63.26-2015 - Section 5.2.3.4 (CCDF).

4.6.3.Test Setting

1. Set the resolution / measurement bandwidth ≥ signal's occupied bandwidth
2. Set the number of counts to a value that stabilizes the measured CCDF curve
3. Record the maximum PARR level associated with a probability of 0.1%

4.6.4.Test Setup



4.6.5.Test Result

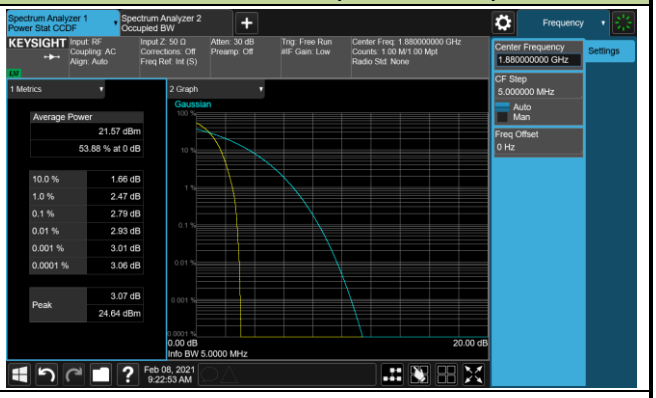
Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band II, IV, V		

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	Peak to Average Ratio (dB)	Limit (dB)	Result
Band II					
9262	1852.5	5	2.87	≤ 13.00	Pass
9400	1880.0	5	2.79	≤ 13.00	Pass
9538	1907.6	5	2.82	≤ 13.00	Pass
Band IV					
1312	1712.4	5	2.92	≤ 13.00	Pass
1412	1732.4	5	2.89	≤ 13.00	Pass
1513	1752.6	5	2.78	≤ 13.00	Pass
Band V (Report Only)					
4132	826.4	5	2.85	≤ 13.00	Pass
4183	836.4	5	2.79	≤ 13.00	Pass
4233	846.6	5	2.82	≤ 13.00	Pass

WCDMA Band II

Channel 9262 (1852.4MHz)

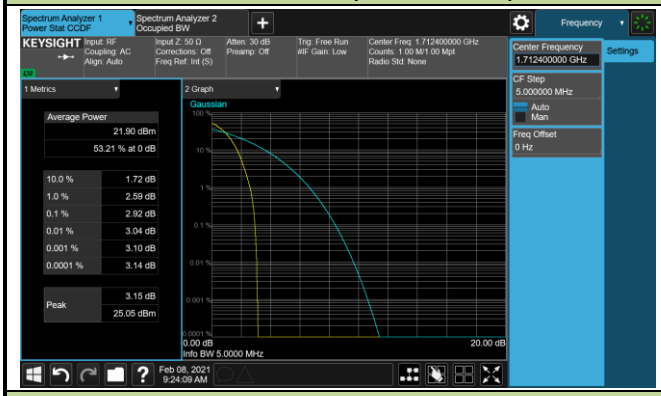
Channel 9400 (1880.0MHz)



Channel 9538 (1907.6MHz)

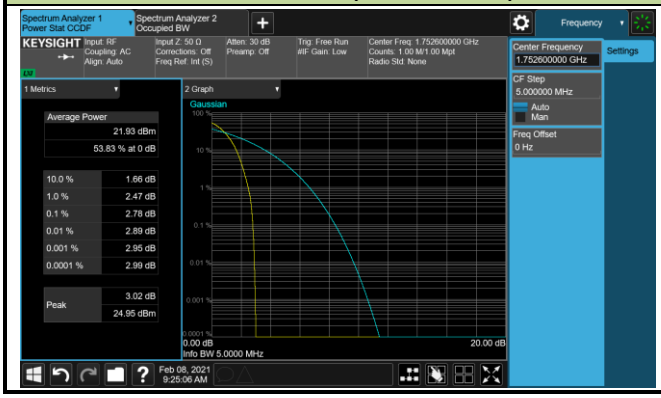
WCDMA Band IV

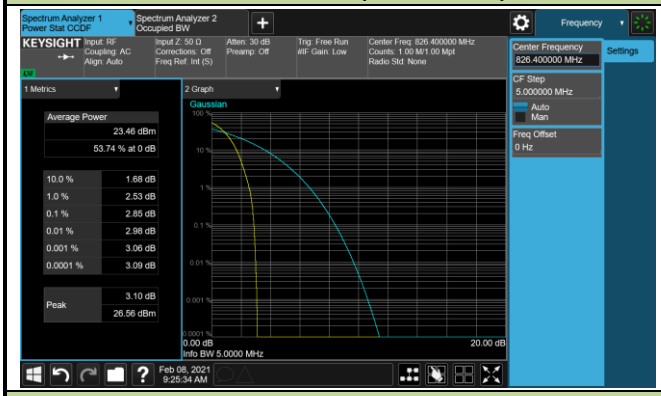
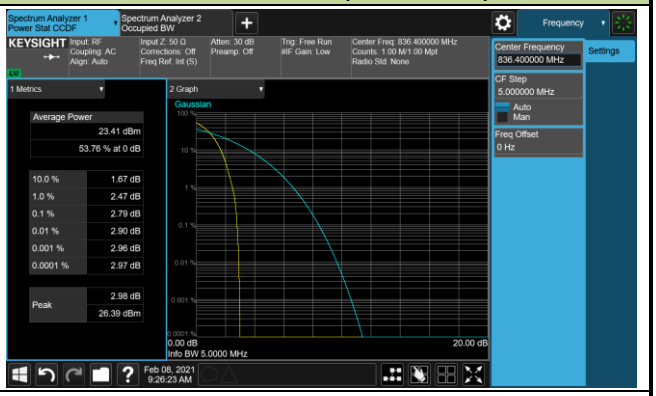
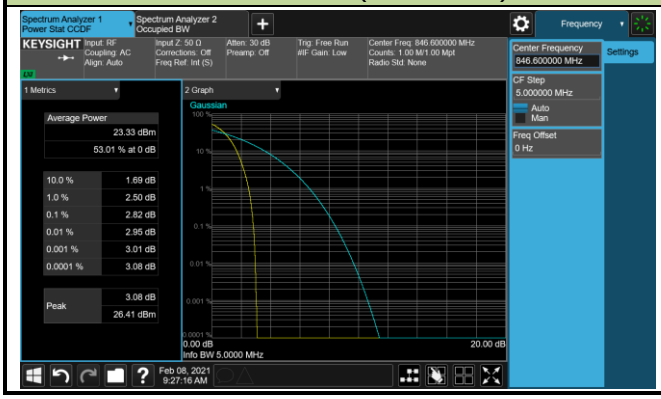
Channel 1312 (1712.4MHz)



Channel 1412 (1732.4MHz)

Channel 1513 (1752.6MHz)



WCDMA Band V	
Channel 4132 (826.4MHz)	Channel 4183 (836.4MHz)
	
Channel 4233 (846.6MHz)	
	

4.7. Conducted Spurious Emission Measurement

4.7.1.Test Limit

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the Low frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

4.7.2.Test Procedure

ANSI C63.26-2015 - Section 5.7

4.7.3.Test Setting

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW ≥ 3*RBW
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to “free run.”
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power.
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

4.7.4.Test Setup

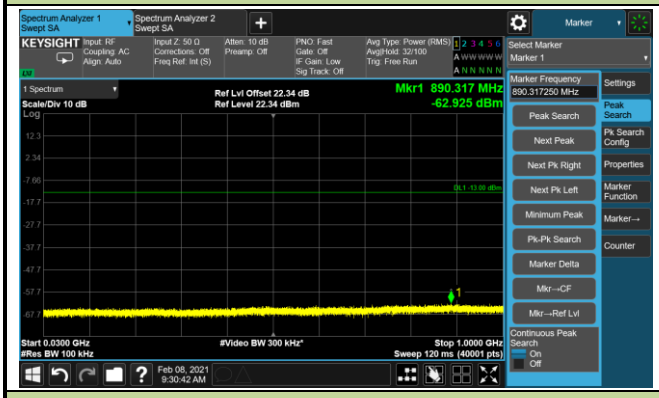
4.7.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	SIP-SR5
Test Engineer	Candy Luo	Test Date	2021/02/08
Test Band	WCDMA Band II, IV, V		

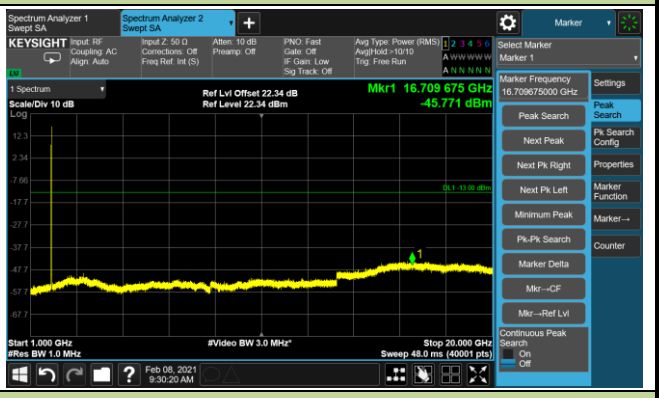
Mode	Frequency (MHz)	Frequency Range (MHz)	Max Spurious Emissions (dBm)	Limit (dBm)	Result
WCDMA Band II	1852.4	30 ~ 1000	-62.93	≤ -13.00	Pass
		1000 ~ 20000	-45.77	≤ -13.00	Pass
	1880.0	30 ~ 1000	-64.25	≤ -13.00	Pass
		1000 ~ 20000	-45.13	≤ -13.00	Pass
	1907.6	30 ~ 1000	-64.27	≤ -13.00	Pass
		1000 ~ 20000	-44.74	≤ -13.00	Pass
WCDMA Band IV	1712.4	30 ~ 1000	-64.31	≤ -13.00	Pass
		1000 ~ 20000	-45.52	≤ -13.00	Pass
	1732.4	30 ~ 1000	-63.77	≤ -13.00	Pass
		1000 ~ 20000	-45.50	≤ -13.00	Pass
	1752.6	30 ~ 1000	-64.17	≤ -13.00	Pass
		1000 ~ 20000	-45.45	≤ -13.00	Pass
WCDMA Band V	826.4	30 ~ 1000	-65.60	≤ -13.00	Pass
		1000 ~ 10000	-40.58	≤ -13.00	Pass
	836.4	30 ~ 1000	-65.74	≤ -13.00	Pass
		1000 ~ 10000	-40.27	≤ -13.00	Pass
	846.6	30 ~ 1000	-66.13	≤ -13.00	Pass
		1000 ~ 10000	-39.16	≤ -13.00	Pass

WCDMA Band II

Low Channel 30 ~ 1000MHz

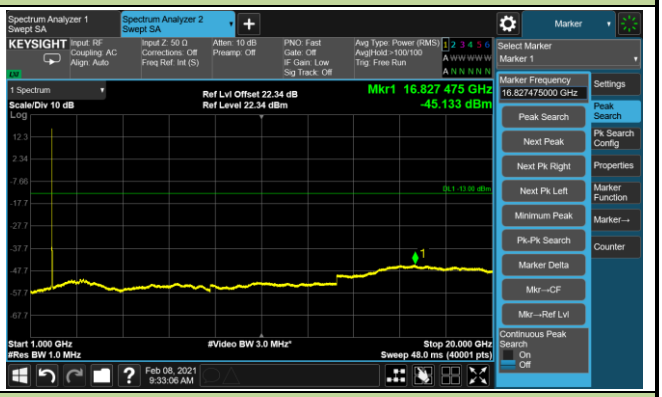


Low Channel 1000 ~ 20000MHz

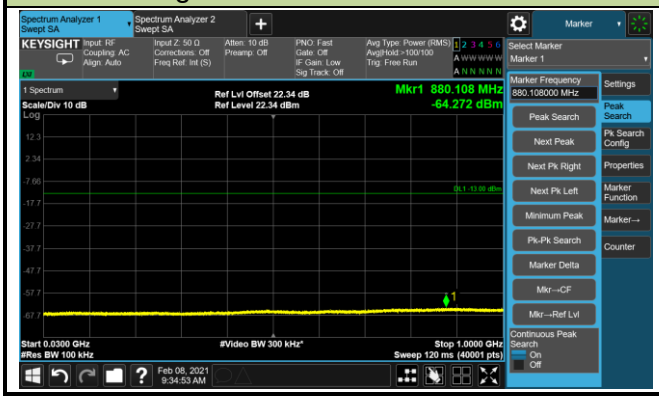


Middle Channel 30 ~ 1000MHz

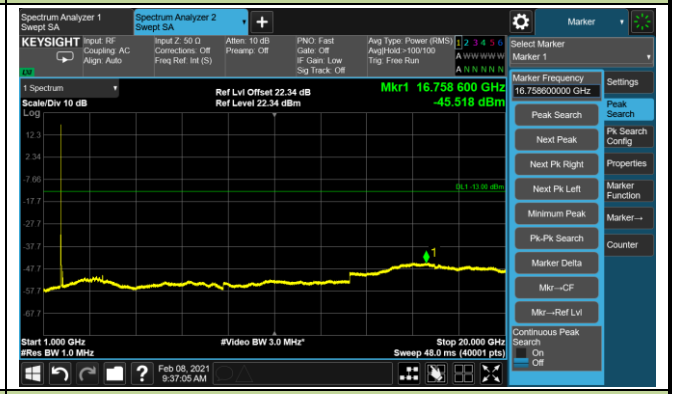
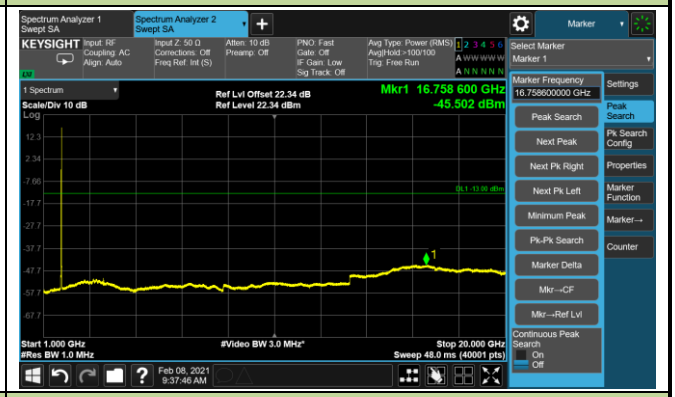
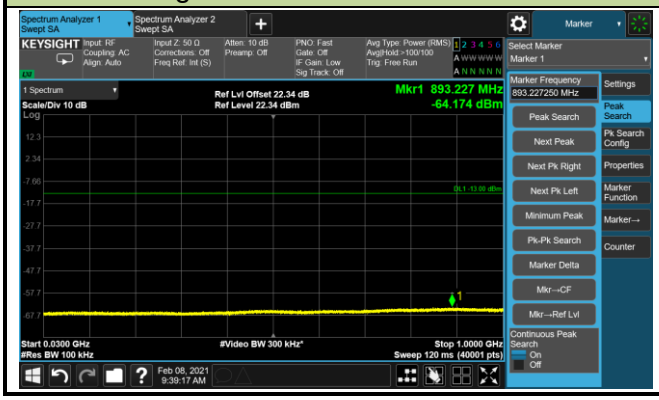
Middle Channel 1000 ~ 20000MHz



High Channel 30 ~ 1000MHz



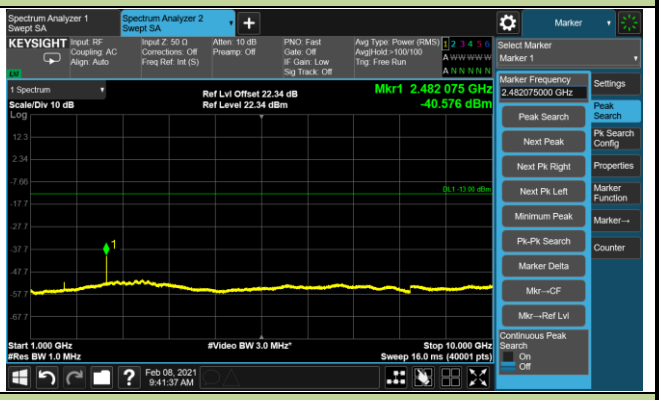
High Channel 1000 ~ 20000MHz

WCDMA Band IV	
Low Channel 30 ~ 1000MHz	Low Channel 1000 ~ 20000MHz
	
Middle Channel 30 ~ 1000MHz	Middle Channel 1000 ~ 20000MHz
	
High Channel 30 ~ 1000MHz	High Channel 1000 ~ 20000MHz
	

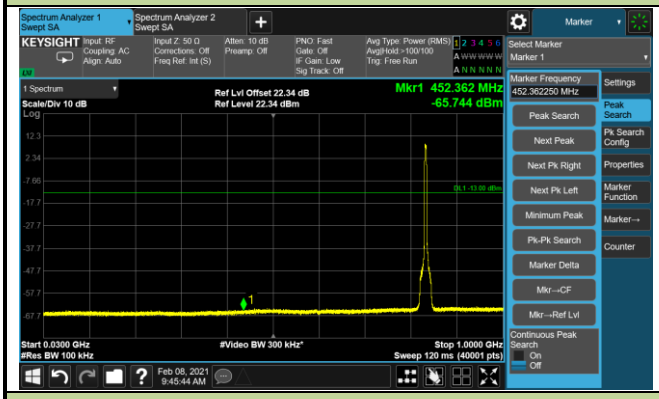
WCDMA Band V

Low Channel 30 ~ 1000MHz

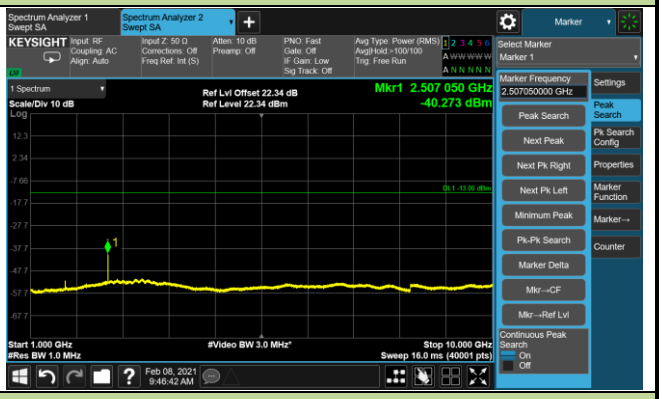
Low Channel 1000 ~ 10000MHz



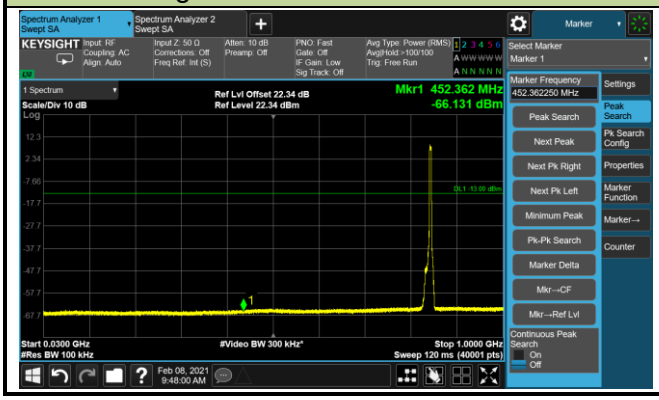
Middle Channel 30 ~ 1000MHz



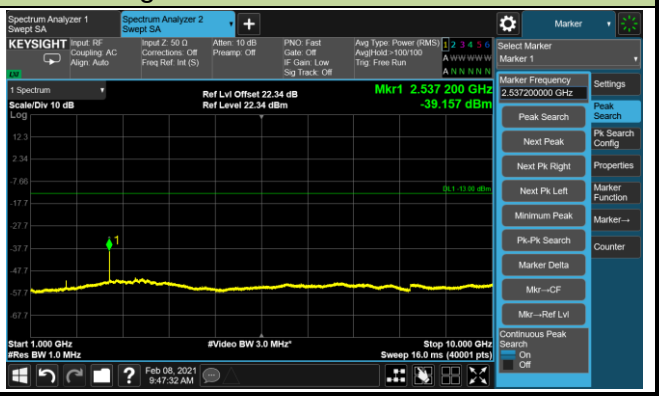
Middle Channel 1000 ~ 10000MHz



High Channel 30 ~ 1000MHz



High Channel 1000 ~ 10000MHz



4.8. Radiated Spurious Emission Measurement

4.8.1.Test Limit

Out of band emissions: The powerof any emission outside of theauthorized operating frequency ranges must be attenuated below the transmitting power (P) by a factorof at least 43 + 10 log(P) dB. The emission limit equal to -13dBm.

E (dBμV/m) = EIRP (dBm) - 20 log D + 104.8; where D is the measurement distance in meters. The emission limit equal to 82.3dBμV/m.

4.8.2.Test Procedure

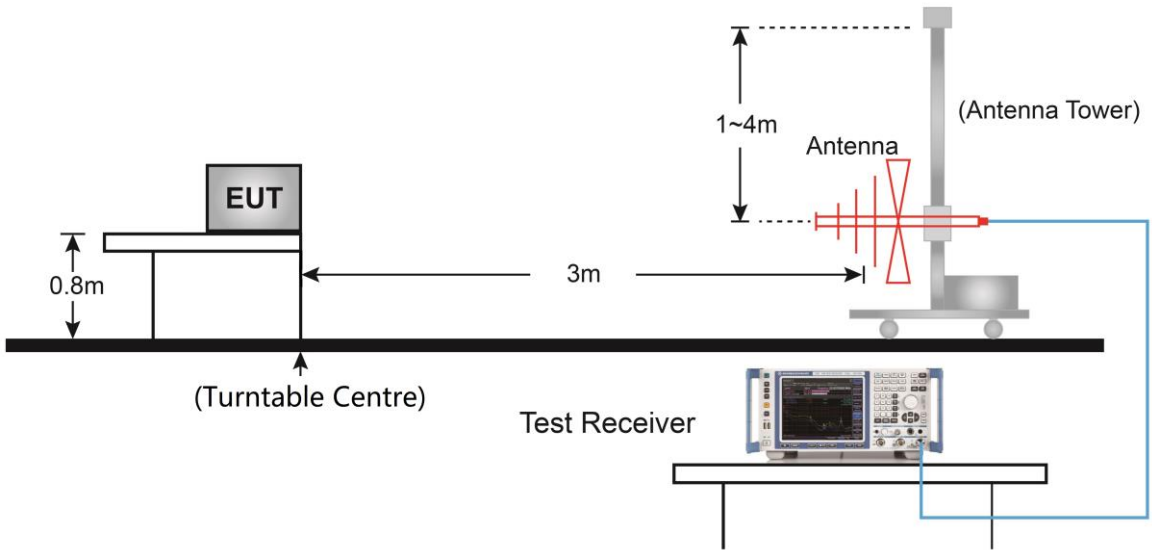
ANSI C63.26-2015 - Section 5.2.7 & 5.5

4.8.3.Test Setting

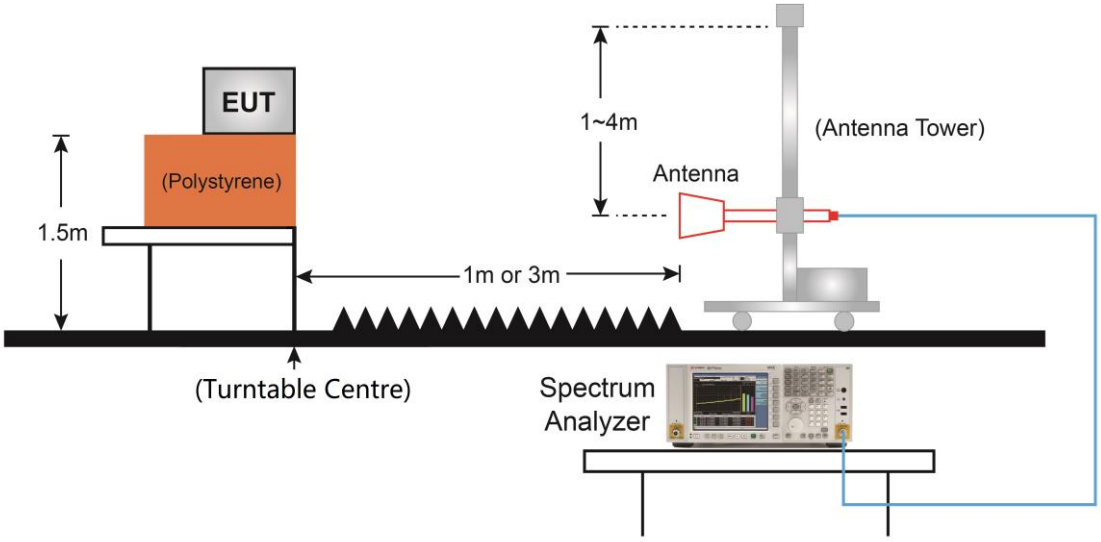
1. RBW = 1MHz
2. VBW ≥ 3*RBW
3. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

4.8.4.Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.8.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-AC1
Test Engineer	Buter Shi	Test Date	2021/02/05
Test Band	WCDMA Band II		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
10571.0	37.9	15.2	53.0	82.3	-29.3	Peak	Horizontal
14719.0	37.4	17.6	55.0	82.3	-27.4	Peak	Horizontal
10834.5	37.7	15.4	53.1	82.3	-29.2	Peak	Vertical
14761.5	37.7	17.6	55.3	82.3	-27.0	Peak	Vertical
Middle Channel							
11489.0	37.3	15.6	52.9	82.3	-29.4	Peak	Horizontal
14489.5	37.6	17.7	55.3	82.3	-27.1	Peak	Horizontal
10537.0	37.3	15.4	52.7	82.3	-29.6	Peak	Vertical
14549.0	37.4	17.6	54.9	82.3	-27.4	Peak	Vertical
High Channel							
11778.0	37.4	15.0	52.4	82.3	-29.9	Peak	Horizontal
14829.5	37.1	17.5	54.6	82.3	-27.7	Peak	Horizontal
11565.5	37.0	15.2	52.2	82.3	-30.1	Peak	Vertical
14515.0	36.8	17.7	54.5	82.3	-27.9	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).							

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-AC1
Test Engineer	Buter Shi	Test Date	2021/02/05
Test Band	WCDMA Band IV		

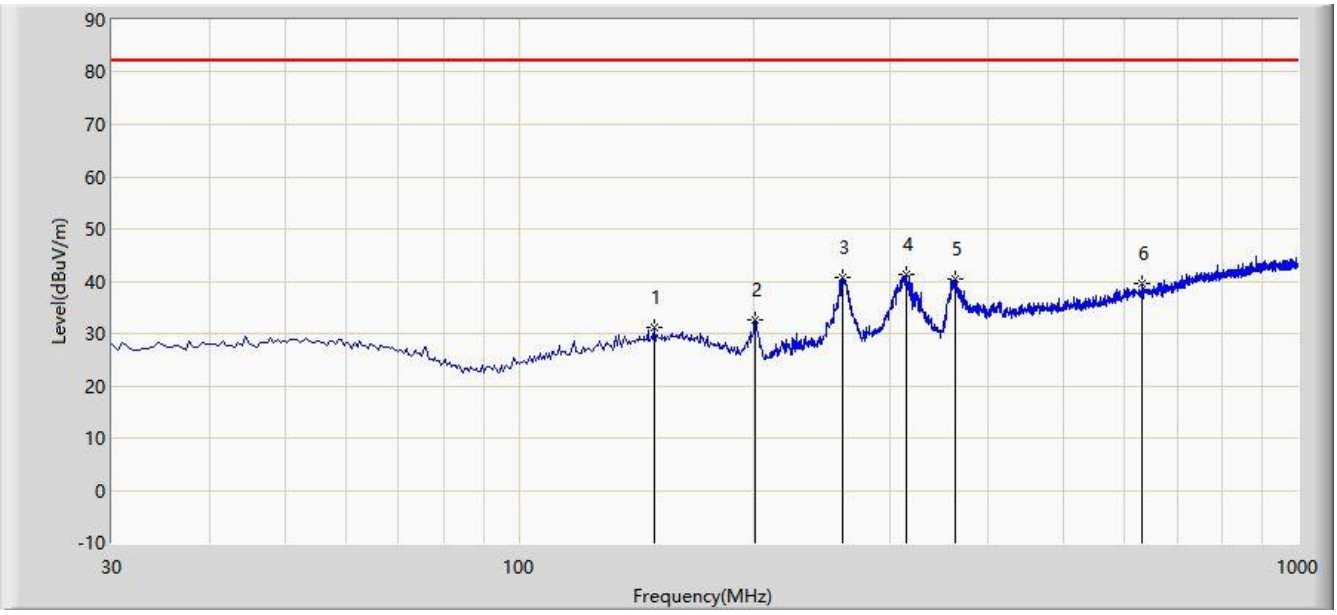
Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
11514.5	37.4	15.2	52.6	82.3	-29.7	Peak	Horizontal
15127.0	37.9	16.7	54.6	82.3	-27.7	Peak	Horizontal
9194.0	37.4	13.3	50.7	82.3	-31.6	Peak	Vertical
14311.0	37.8	17.8	55.6	82.3	-26.7	Peak	Vertical
Middle Channel							
10945.0	36.8	15.8	52.6	82.3	-29.7	Peak	Horizontal
14455.5	37.3	17.9	55.2	82.3	-27.1	Peak	Horizontal
10528.5	36.7	15.3	52.1	82.3	-30.2	Peak	Vertical
14421.5	36.8	17.9	54.7	82.3	-27.6	Peak	Vertical
High Channel							
10885.5	36.9	15.7	52.6	82.3	-29.7	Peak	Horizontal
14345.0	37.9	17.6	55.4	82.3	-26.9	Peak	Horizontal
11072.5	36.8	15.3	52.1	82.3	-30.2	Peak	Vertical
14736.0	37.2	17.6	54.8	82.3	-27.5	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).							

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-AC1
Test Engineer	Buter Shi	Test Date	2021/02/05
Test Band	WCDMA Band V		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
262.8	23.7	17.2	41.0	82.3	-41.3	Peak	Horizontal
315.7	24.5	19.2	43.7	82.3	-38.6	Peak	Horizontal
312.8	15.8	19.1	34.9	82.3	-47.4	Peak	Vertical
363.2	19.5	20.2	39.7	82.3	-42.7	Peak	Vertical
5581.5	39.4	6.2	45.6	82.3	-36.7	Peak	Horizontal
14115.5	37.1	17.3	54.4	82.3	-27.9	Peak	Horizontal
9194.0	38.5	13.3	51.7	82.3	-30.6	Peak	Vertical
14464.0	37.8	17.9	55.8	82.3	-26.6	Peak	Vertical
Middle Channel							
259.9	22.8	17.1	39.9	82.3	-42.4	Peak	Horizontal
317.6	23.9	19.2	43.1	82.3	-39.2	Peak	Horizontal
309.9	15.9	19.0	34.9	82.3	-47.4	Peak	Vertical
360.8	19.1	20.1	39.2	82.3	-43.1	Peak	Vertical
9780.5	37.5	14.3	51.8	82.3	-30.5	Peak	Horizontal
14464.0	36.9	17.9	54.8	82.3	-27.5	Peak	Horizontal
10945.0	36.7	15.8	52.5	82.3	-29.8	Peak	Vertical
14770.0	37.2	17.6	54.9	82.3	-27.4	Peak	Vertical
High Channel							
260.9	23.0	17.2	40.1	82.3	-42.2	Peak	Horizontal
311.8	25.1	19.0	44.1	82.3	-38.2	Peak	Horizontal
312.3	23.3	19.1	42.3	82.3	-40.0	Peak	Vertical
360.8	25.0	20.1	45.1	82.3	-37.2	Peak	Vertical
10715.5	36.9	15.2	52.1	82.3	-30.2	Peak	Horizontal
14455.5	37.7	17.9	55.6	82.3	-26.7	Peak	Horizontal
10622.0	37.0	15.2	52.1	82.3	-30.2	Peak	Vertical
14642.5	37.3	17.7	54.9	82.3	-27.4	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).							

The Worst Case of Radiated Emission below 1GHz:

Site: WZ-AC1	Time: 2021/02/14 - 17:48
Limit: FCC_Part 24_RSE (3m)	Engineer: Antony Yang
Probe: WZ-AC1_VULB 9168 _30-1000MHz	Polarity: Horizontal
EUT: 5G Sub-6 GHz M.2 Module	Power: AC 120V/60Hz



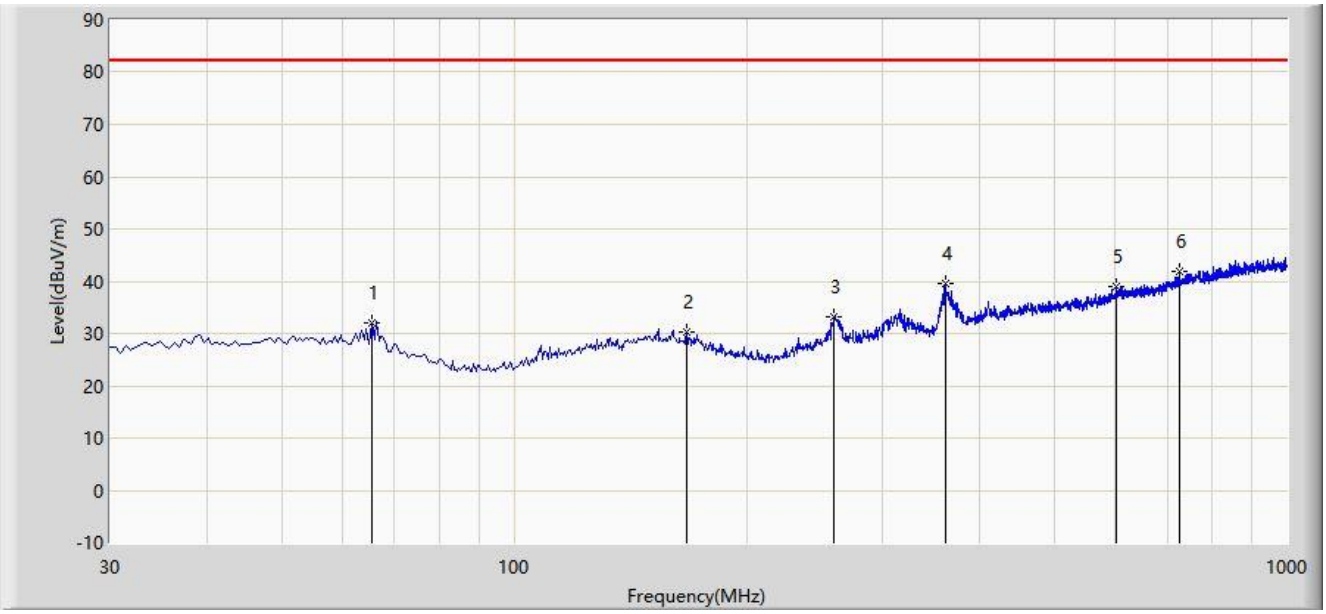
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			149.310	31.028	12.800	-51.272	82.300	18.228	PK
2			201.205	32.710	17.778	-49.590	82.300	14.932	PK
3			260.860	40.842	23.683	-41.458	82.300	17.159	PK
4			313.725	41.426	22.311	-40.874	82.300	19.115	PK
5			363.680	40.393	20.190	-41.907	82.300	20.203	PK
6		*	630.430	39.493	13.167	-42.807	82.300	26.326	PK

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of radiated emissions (frequency range from 18GHz to 40GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: WZ-AC1	Time: 2021/02/14 - 17:49
Limit: FCC_Part 24_RSE (3m)	Engineer: Antony Yang
Probe: WZ-AC1_VULB 9168 _30-1000MHz	Polarity: Vertical
EUT: 5G Sub-6 GHz M.2 Module	Power: AC 120V/60Hz



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	65.405	32.168	15.379	-50.132	82.300	16.789	PK
2			167.255	30.374	12.613	-51.926	82.300	17.760	PK
3			259.405	33.171	16.063	-49.129	82.300	17.108	PK
4			361.740	39.641	19.528	-42.659	82.300	20.113	PK
5			600.845	38.927	13.042	-43.373	82.300	25.885	PK
6			726.945	41.946	14.037	-40.354	82.300	27.909	PK

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The amplitude of radiated emissions (frequency range from 18GHz to 40GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

5. CONCLUSION

The data collected relate only the item(s) tested and show that unit is compliance with FCC Rules.

The End

Appendix A - Test Setup Photograph

Refer to “2101RSU049-UT” file.

Appendix B - EUT Photograph

Refer to “2101RSU049-UE” file.