


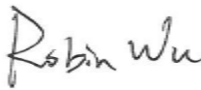
SPOT CHECK REPORT

FCC PART 27

FCC ID: XMR2020RM500QAE
Application: Quectel Wireless Solutions Company Limited

Application Type: Certification
Product: 5G Sub-6 GHz M.2 Module
Model No.: RM500Q-AE
Brand Name: Quectel
FCC Rule Part(s): Part 27 Subpart D
Test Procedure(s): ANSI C63.26: 2015
Test Date: December 09, 2020 ~ January 04, 2021

Reviewed By: 
Sunny Sun

Approved By: 
Robin Wu



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
2011RSU077-U5	Rev. 01	Initial Report	01-10-2021	Valid

Note: This application for certification is leveraging the data reuse procedures from KDB 484596 based on reference FCC ID: XMR2020RM502QAE to cover variant FCC ID: XMR2020RM500QAE.

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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

<input checked="" type="checkbox"/>	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
<input type="checkbox"/>	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
<input type="checkbox"/>	Test Site - MRT Taiwan Laboratory
	Laboratory Location (Taiwan) No. 38, Fuxing 2 nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
	Laboratory Accreditations
	TAF: L3261-190725
	FCC: 291082, TW3261 ISED: TW3261

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	5G Sub-6 GHz M.2 Module
Model No.:	RM500Q-AE
Brand Name:	Quectel
IMEI:	867197050003215
Operating Temperature:	-20 ~ 60 °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
Category:	Category 6
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_66C
Modulation:	UL & DL up to 256QAM
Category:	Category 18
5G NR Specification	
SA Band:	n2, n5, n7, n12, n25, n41, n66, n71, n77
SA UL MIMO Band:	n41
EN-DC Band:	DC_5A_n2A, DC_12A_n2, DC_13A_n2A, DC_2A_n5A DC_30A_n5A, DC_66A_n5A, DC_5A_n7A, DC_12A_n7A DC_2A_n12A, DC_12A_n25A, DC_2A_n41A, DC_25A_n41A DC_26A_n41A, DC_66A_n41A, DC_5A_n66A, DC_12A_n66A DC_13A_n66A, DC_14A_n66A, DC_71A_n66A, DC_2A_n71A DC_7A_n71A, DC_66A_n71A
HPUE Band:	n41, n77 (SA & UL MIMO)
SCS for NR cell:	FDD Band: 15kHz; TDD Band: 30kHz
Modulation:	UL & DL up to 256QAM

2.2. Product Specification Subjective to this Report

FDD T _x Frequency Range:	Band 30: 2305 ~ 2315 MHz
FDD R _x Frequency Range:	Band 30: 2350 ~ 2360 MHz

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.

2.3. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	MaxPeak Gain (dBi)
LTE Band 2	1850 ~ 1910	Dipole	0.25
LTE Band 4	1710 ~ 1755		1.47
LTE Band 5	824 ~ 849		2.68
LTE Band 7	2500 ~ 2570		0.55
LTE Band 12	699 ~ 716		-0.20
LTE Band 13	777 ~ 787		1.54
LTE Band 14	788 ~ 798		2.42
LTE Band 17	704~ 716		-0.20
LTE Band 25	1850 ~ 1915		0.25
LTE Band 26	814~849		2.68
LTE Band 30	2305 ~ 2315		-3.06
LTE Band 38	2570 ~ 2620		0.78
LTE Band 41	2496 ~ 2690		0.78
LTE Band 48	3550 ~ 3700		-4.29
LTE Band 66	1710 ~ 1780		1.47
LTE Band 71	663 ~ 698		1.22

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

2.4. Test Methodology

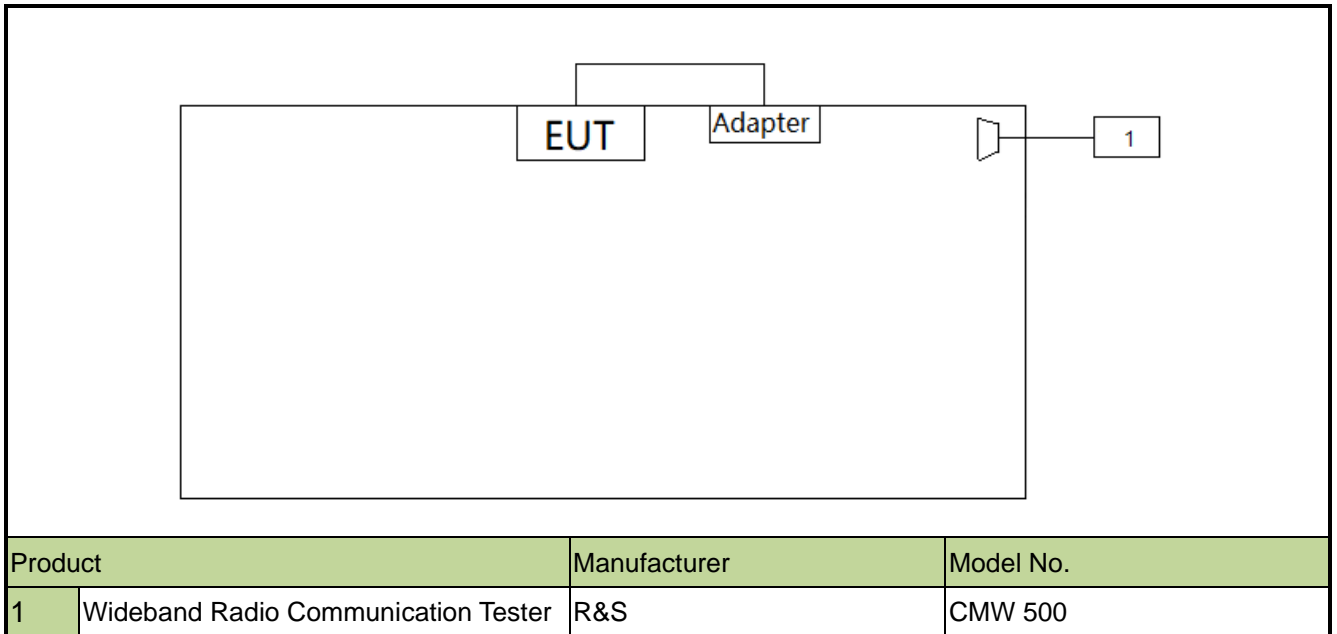
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26:2015
- FCC CFR 47 Part 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

2.5. EMI Suppression Device(s)/Modifications

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

2.6. Configuration of Tested System



2.7. Test Environment Condition

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

3. TEST EQUIPMENT CALIBRATION DATE

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	2021/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2021/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2021/04/15
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2021/11/18
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
True RMS Clamp Meter	Fluke	319	MRTSUE06080	1 year	2021/05/06
Directional Coupler	Agilent	87301D	MRTSUE06082	1 year	2021/03/25
Dual Directional Coupler	Agilent	7778D	MRTSUE06083	1 year	2021/03/25
Attenuator	MVE	6dB	MRTSUE06534	1 year	2021/12/12
Attenuator	MVE	10dB	MRTSUE06543	1 year	2021/12/12
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2021/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2021/08/08

4. 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 $k = 2$.

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

5. TEST RESULT

5.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
27.50(a)(3)	Equivalent Isotropic Radiated Power Density	< 250mW/5MHz	Conducted	Pass	Section5.2
2.1051, 27.53(a)(4)	Spurious Emission	<70 + 10log10 (P _[Watts])		Pass	Section5.3

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) The difference compared with the original report is only different DL CA bands. Output power and conducted spurious emissions verification worst test refer to original report.

5.2. Equivalent Isotropically Radiated Power Measurement

5.2.1. Test Limit

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth

5.2.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.2.4.4.2 & 5.2.5.5

5.2.3. Test Setting

When the fundamental condition for average power measurements cannot be realized (i.e., the EUT can not be configured to transmit at full-power on a continuous basis (i.e., duty cycle < 98%) and the instrumentation cannot be configured to measure only during active full-power transmissions), then the following procedure can be used if the EUT duty cycle is constant (i.e., duty cycle variations are less than or equal to $\pm 2\%$).

- a) Set span to $2 \times$ to $3 \times$ the OBW.
- b) Set RBW = 1% to 5% of the OBW.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- e) Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ for single sweep (automation-compatible) measurement.
- f) Detector = power averaging (rms).
- g) Set sweep trigger to "free run."
- h) 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.

i) Using the marker function to identify the maximum PSD.

j) Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission. For example, add $[10 \log (1/0.25)] = 6 \text{ dB}$ if the duty cycle is a constant 25%.

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

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_{\text{T}} \quad (1)$$

where

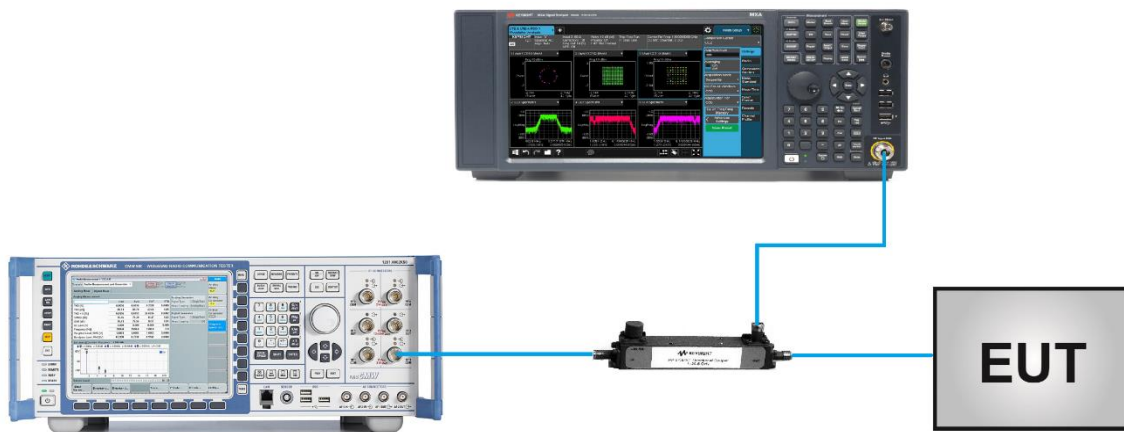
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas} , e.g., dBm or dBW)

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)

For devices utilizing multiple antennas, see 6.4 for guidance with respect to determining the effective array transmit antenna gain term to be used in the above equation.

5.2.4. Test Setup



5.2.5. Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Larry Yan	Test Date	2020/12/09 ~ 2020/12/30

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Power Density (dBm/5MHz)	EIRP Density (dBm/5MHz)	Limit (dBm /5MHz)
QPSK							
27685	2307.5	5	1	0	23.01	19.95	< 23.98
27710	2310.0				22.94	19.88	< 23.98
27735	2312.5				23.02	19.96	< 23.98
27685	2307.5	5	1	12	23.28	20.22	< 23.98
27710	2310.0				23.13	20.07	< 23.98
27735	2312.5				23.13	20.07	< 23.98
27685	2307.5	5	1	24	23.20	20.14	< 23.98
27710	2310.0				23.14	20.08	< 23.98
27735	2312.5				23.22	20.16	< 23.98
27685	2307.5	5	25	0	22.15	19.09	< 23.98
27710	2310.0				22.07	19.01	< 23.98
27735	2312.5				22.10	19.04	< 23.98
27710	2310.0	10	1	0	22.82	19.76	< 23.98
			1	24	23.04	19.98	< 23.98
			1	49	23.09	20.03	< 23.98
			50	0	21.97	18.91	< 23.98

Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)

5.3. Conducted Spurious Emissions

5.3.1. 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 lowest 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 lower than the transmitter power (P) by a factor of at least $70 + 10 \log (P)$ dB.

5.3.2. Test Procedure Used

ANSI C63.26-2015 - Section 5.7

5.3.3. Test Setting

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW $\geq 3 \cdot$ 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.

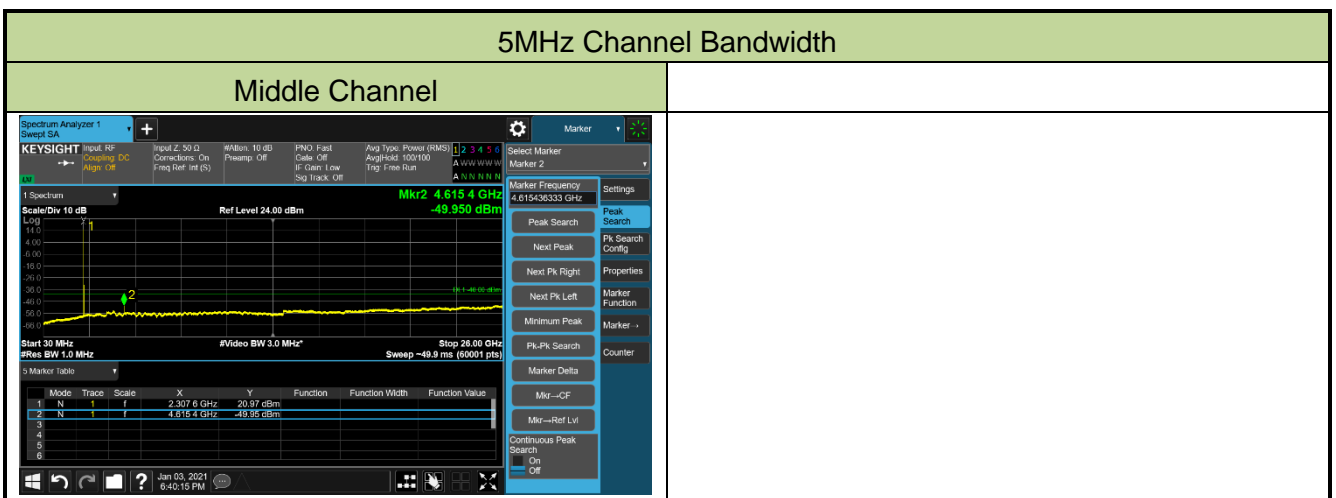
5.3.4. Test Setup



5.3.5. Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Edgar Ma	Test Date	2021/01/03

Channel	Frequency (MHz)	Channel Bandwidth (MHz)	Frequency Range (MHz)	Max Spurious Emissions (dBm)	Limit (dBm)	Result
QPSK						
27710	2310.0	5	30 ~ 25000	-49.95	≤ -40.00	Pass



6. CONCLUSION

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

Appendix A - Test Setup Photograph

Refer to "2011RSU077-UT" file.

Appendix B - EUT Photograph

Refer to "2011RSU077-UE" file.

Appendix C - Reference Test Report

MEASUREMENT REPORT

FCC PART 27

FCC ID: XMR2020RM502QAE
Application: Quectel Wireless Solutions Company Limited
Application Type: Certification
Product: 5G Sub-6 GHz M.2 Module
Model No.: RM502Q-AE
Brand Name: Quectel
FCC Rule Part(s): Part 27 Subpart D
Test Procedure(s): ANSI C63.26: 2015
Test Date: October 08 ~ November 15, 2020

Reviewed By: *Sunny Sun*
(Sunny Sun)
Approved By: *Robin Wu*
(Robin Wu)



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.

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Revision History

Report No.	Version	Description	Issue Date	Note
2010RSU005-U5	Rev. 01	Initial Report	11-16-2020	Valid

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2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name:	5G Sub-6 GHz M.2 Module
Model No.:	RM502Q-AE
Brand Name:	Quectel
IMEI:	Conducted Measurement: 867826050002666 Radiated Measurement: 867826050003060
Operating Temperature:	-20 ~ 60 °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
Category:	Category 6
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_66C
Modulation:	UL & DL up to 256QAM
Category:	Category 18
5G NR Specification	
SA Band:	n2, n5, n7, n12, n25, n41, n66, n71, n77
SA UL MIMO Band:	n41
EN-DC Band:	DC_5A_n2A, DC_12A_n2, DC_13A_n2A, DC_2A_n5A DC_30A_n5A, DC_66A_n5A, DC_5A_n7A, DC_12A_n7A DC_2A_n12A, DC_12A_n25A, DC_2A_n41A, DC_25A_n41A DC_26A_n41A, DC_66A_n41A, DC_5A_n66A, DC_12A_n66A DC_13A_n66A, DC_14A_n66A, DC_71A_n66A, DC_2A_n71A DC_7A_n71A, DC_66A_n71A
HPUE Band:	n41, n77 (SA & UL MIMO)
SCS for NR cell:	FDD Band: 15kHz; TDD Band: 30kHz
Modulation:	UL & DL up to 256QAM

2.2. Product Specification Subjective to this Report

FDD T _x Frequency Range:	Band 30: 2305 ~ 2315 MHz
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Note 1: For other features of this EUT, test report will be issued separately.

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2.3. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	MaxPeak Gain (dBi)
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LTE Band 4	1710 ~ 1755		1.47
LTE Band 5	824 ~ 849		2.68
LTE Band 7	2500 ~ 2570		0.55
LTE Band 12	699 ~ 716		-0.20
LTE Band 13	777 ~ 787		1.54
LTE Band 14	788 ~ 798		2.42
LTE Band 17	704~ 716		-0.20
LTE Band 25	1850 ~ 1915		0.25
LTE Band 26	814~849		2.68
LTE Band 30	2305 ~ 2315		-3.06
LTE Band 38	2570 ~ 2620		0.78
LTE Band 41	2496 ~ 2690		0.78
LTE Band 48	3550 ~ 3700		-4.29
LTE Band 66	1710 ~ 1780		1.47
LTE Band 71	663 ~ 698		1.22

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

2.4. 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 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

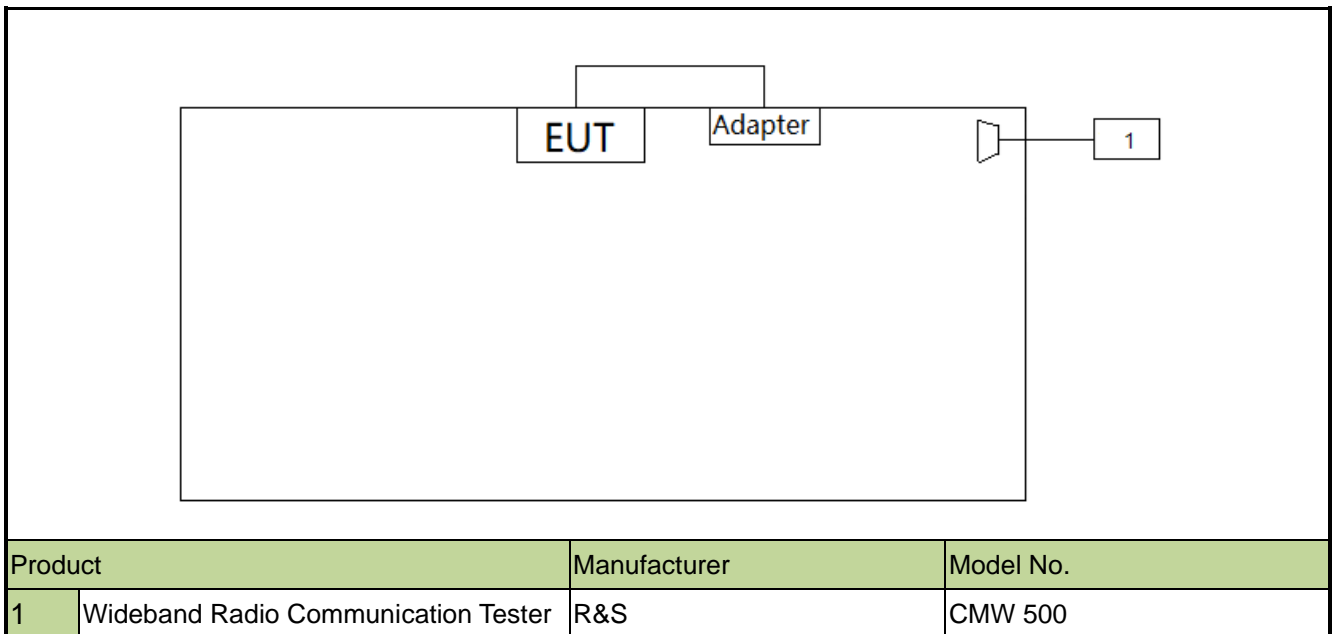
2.5. EMI Suppression Device(s)/Modifications

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

2.6. Maximum Power, Frequency Tolerance, and Emission Designator

LTE Band 30		QPSK			16QAM		
BW (MHz)	Feq. (MHz)	Designator	Tolerance (ppm)	Max Power (W)	Designator	Tolerance (ppm)	Max Power (W)
5	2305 ~ 2315	4M47G7D	-	0.2104	4M47W7D	-	0.1928
10	2310	8M94G7D	-0.0042	0.2056	8M93W7D	-	0.1766
LTE Band 30		64QAM			256QAM		
BW (MHz)	Feq. (MHz)	Designator	Tolerance (ppm)	Max Power (W)	Designator	Tolerance (ppm)	Max Power (W)
5	2305 ~ 2315	4M47W7D	-	0.1531	4M47W7D	-	0.0585
10	2310	8M92W7D	-	0.1327	8M94W7D	-	0.0585

2.7. Configuration of Tested System



2.8. Test Environment Condition

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

3. 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	2021/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2021/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2021/02/23
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	2021/04/30

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	2021/02/23
Broadband 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	2020/12/15
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2021/04/30

Conducted Test Equipment (WZ)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2021/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2021/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2021/04/15
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2021/11/07
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/18
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
True RMS Clamp Meter	Fluke	319	MRTSUE06080	1 year	2021/05/06
Directional Coupler	Agilent	87301D	MRTSUE06082	1 year	2021/03/25
Dual Directional Coupler	Agilent	7778D	MRTSUE06083	1 year	2021/03/25
Attenuator	MVE	6dB	MRTSUE06534	1 year	2020/12/12
Attenuator	MVE	10dB	MRTSUE06543	1 year	2020/12/12
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

4. 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

5. TEST RESULT

5.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	Conducted	Pass	Section5.2
2.1055, 27.54	Frequency Stability	Within the band		Pass	Section5.3
27.50(a)(3)	Equivalent Isotropic Radiated Power Density	< 250mW/5MHz		Pass	Section 5.4
2.1051, 27.53(a)(4)	Band Edge	Refer to section 5.5		Pass	Section 5.5, 5.6
2.1051, 27.53(a)(4)	Spurious Emission	<70 + 10log10 (P _[Watts])			
2.1053, 27.53(a)(4)	Spurious Emissions	<70 + 10log10 (P _[Watts])	Radiated	Pass	Section5.7

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, Occupied Bandwidth, Channel Band Edge, Radiated & Conducted Spurious Emission were presented worst-case in the test report.

5.2. Occupied Bandwidth

5.2.1. 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.

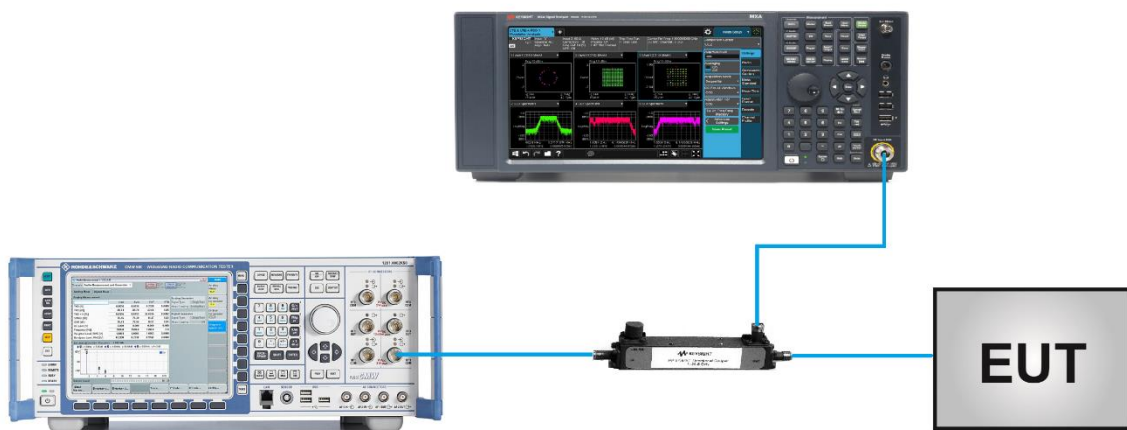
5.2.2. Test Procedure

ANSI C63.26-2015 - Section 5.4

5.2.3. 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 $\geq 3 \times$ 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.

5.2.4. Test Setup



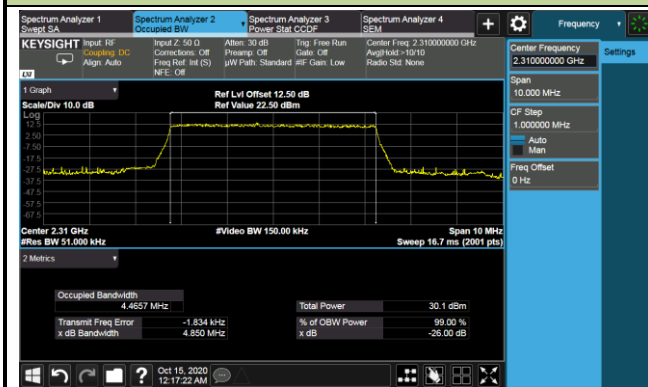
5.2.5. Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Candy Luo	Test Date	2020/10/15 ~ 2020/11/15

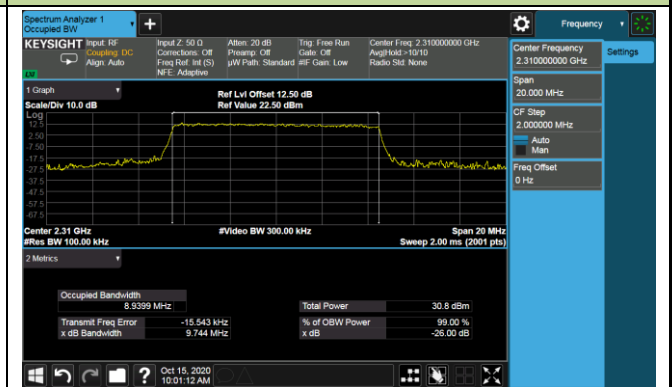
Modulation	Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
QPSK	2310	5	4.47
		10	8.94
16QAM	2310	5	4.47
		10	8.93
64QAM	2310	5	4.47
		10	8.92
256QAM	2310	5	4.47
		10	8.94

99% Bandwidth - QPSK

5MHz Channel Bandwidth

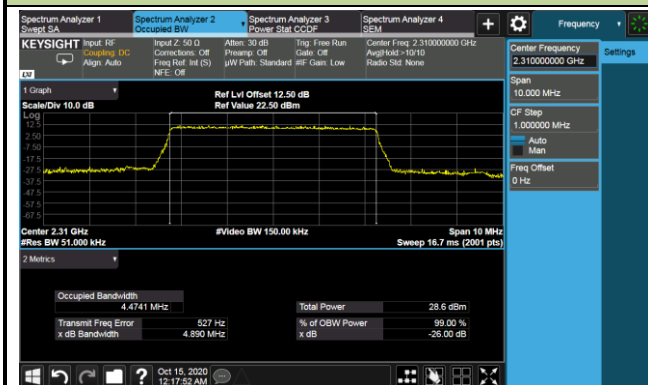


10MHz Channel Bandwidth

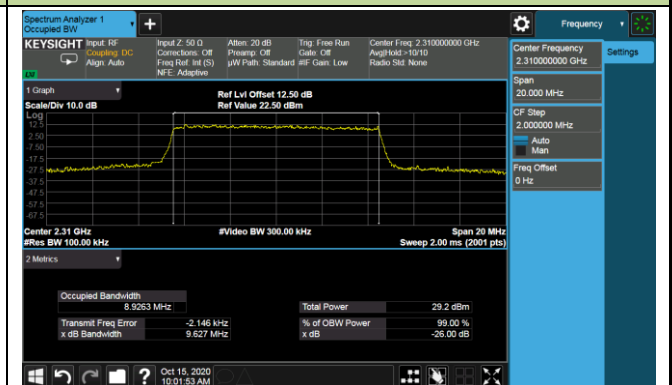


99% Bandwidth - 16QAM

5MHz Channel Bandwidth

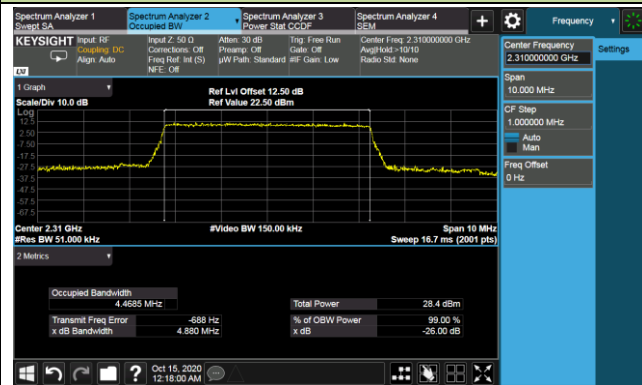


10MHz Channel Bandwidth

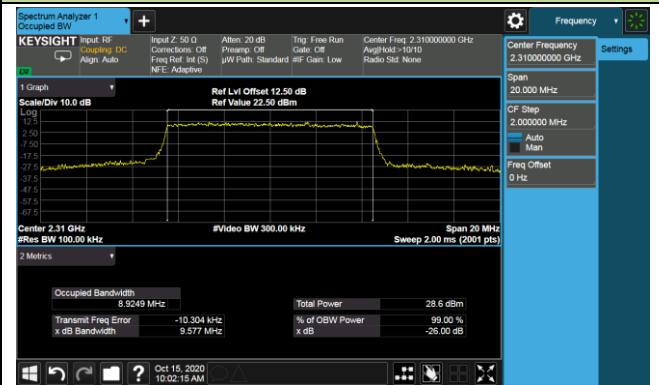


99% Bandwidth - 64QAM

5MHz Channel Bandwidth

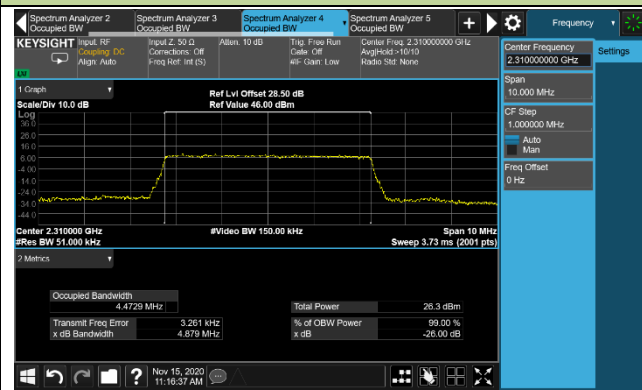


10MHz Channel Bandwidth

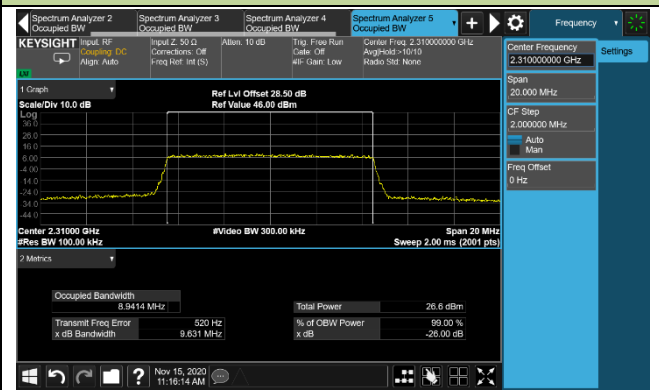


99% Bandwidth - 256QAM

5MHz Channel Bandwidth



10MHz Channel Bandwidth



5.3. Frequency Stability Measurement

5.3.1. Test Limit

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

5.3.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.6

5.3.3. Test Setting

Frequency Stability Under Temperature Variations:

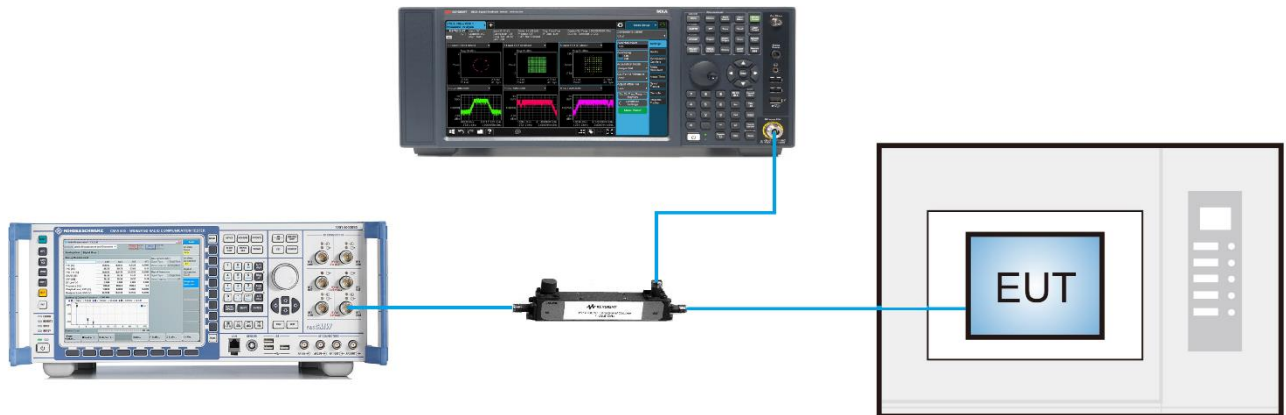
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest 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 ($\pm 15\%$) and endpoint, record the maximum frequency change.

5.3.4. Test Setup



5.3.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-TR3
Test Engineer	Candy Luo	Test Date	2020/10/19

Power (Vdc)	Temp. (°C)	Frequency Tolerance (ppm)
3.7	- 30	-0.0015
	- 20	-0.0026
	- 10	0.0023
	0	-0.0042
	+ 10	-0.0005
	+ 20 (Ref)	-0.0016
	+ 30	-0.0006
	+ 40	0.0006
	+ 50	0.0000
4.4	+ 20	-0.0014
3.135	+ 20	0.0002

5.4. Equivalent Isotropically Radiated Power Measurement

5.4.1. Test Limit

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth

5.4.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.2.4.4.2 & 5.2.5.5

5.4.3. Test Setting

When the fundamental condition for average power measurements cannot be realized (i.e., the EUT can not be configured to transmit at full-power on a continuous basis (i.e., duty cycle < 98%) and the instrumentation cannot be configured to measure only during active full-power transmissions), then the following procedure can be used if the EUT duty cycle is constant (i.e., duty cycle variations are less than or equal to $\pm 2\%$).

- a) Set span to $2 \times$ to $3 \times$ the OBW.
- b) Set RBW = 1% to 5% of the OBW.
- c) Set VBW $\geq 3 \times$ RBW.
- d) Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
- e) Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ for single sweep (automation-compatible) measurement.
- f) Detector = power averaging (rms).
- g) Set sweep trigger to "free run."
- h) 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.

i) Using the marker function to identify the maximum PSD.

j) Add $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission. For example, add $[10 \log (1/0.25)] = 6 \text{ dB}$ if the duty cycle is a constant 25%.

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

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_{\text{T}} \quad (1)$$

where

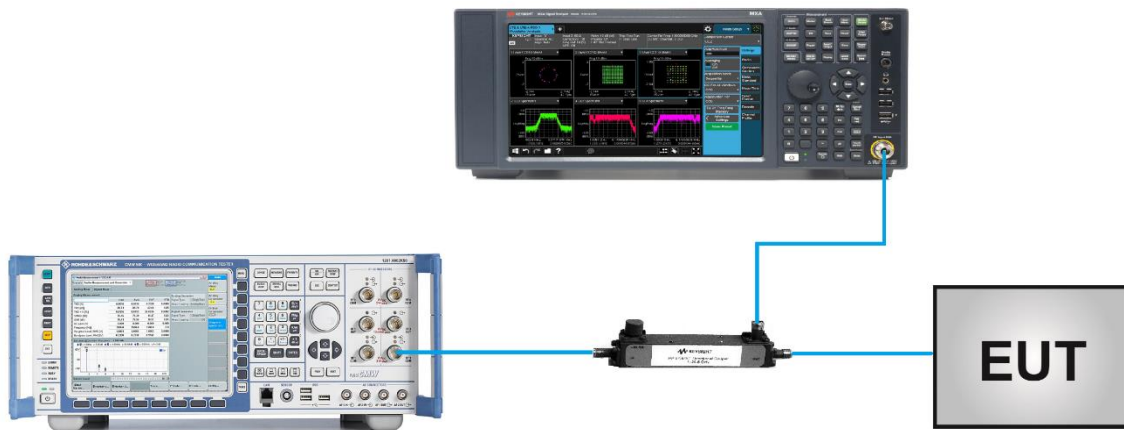
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas} , e.g., dBm or dBW)

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)

For devices utilizing multiple antennas, see 6.4 for guidance with respect to determining the effective array transmit antenna gain term to be used in the above equation.

5.4.4. Test Setup



5.4.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Candy Luo	Test Date	2020/10/17 ~ 2020/11/15

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Power Density (dBm/5MHz)	EIRP Density (dBm/5MHz)	Limit (dBm /5MHz)
QPSK							
27685	2307.5	5	1	0	23.06	20.00	< 23.98
27710	2310.0				23.08	20.02	< 23.98
27735	2312.5				23.16	20.10	< 23.98
27685	2307.5	5	1	12	23.15	20.09	< 23.98
27710	2310.0				23.23	20.17	< 23.98
27735	2312.5				23.23	20.17	< 23.98
27685	2307.5	5	1	24	23.19	20.13	< 23.98
27710	2310.0				23.23	20.17	< 23.98
27735	2312.5				23.17	20.11	< 23.98
27685	2307.5	5	25	0	22.20	19.14	< 23.98
27710	2310.0				22.20	19.14	< 23.98
27735	2312.5				22.23	19.17	< 23.98
27710	2310.0	10	1	0	23.12	20.06	< 23.98
			1	24	23.13	20.07	< 23.98
			1	49	23.13	20.07	< 23.98
			50	0	22.05	18.99	< 23.98

Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Power Density (dBm/5MHz)	EIRP Density (dBm/5MHz)	Limit (dBm /5MHz)
16QAM							
27685	2307.5	5	1	0	22.20	19.14	< 23.98
27710	2310.0				22.32	19.26	< 23.98
27735	2312.5				22.26	19.20	< 23.98
27685	2307.5	5	1	12	22.41	19.35	< 23.98
27710	2310.0				22.85	19.79	< 23.98
27735	2312.5				22.37	19.31	< 23.98
27685	2307.5	5	1	24	22.41	19.35	< 23.98
27710	2310.0				22.58	19.52	< 23.98
27735	2312.5				22.34	19.28	< 23.98
27685	2307.5	5	25	0	21.25	18.19	< 23.98
27710	2310.0				21.15	18.09	< 23.98
27735	2312.5				21.25	18.19	< 23.98
27710	2310.0	10	1	0	22.47	19.41	< 23.98
			1	24	22.37	19.31	< 23.98
			1	49	22.38	19.32	< 23.98
			50	0	21.06	18.00	< 23.98
Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)							

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Power Density (dBm/5MHz)	EIRP Density (dBm/5MHz)	Limit (dBm /5MHz)
64QAM							
27685	2307.5	5	1	0	21.39	18.33	< 23.98
27710	2310.0				21.69	18.63	< 23.98
27735	2312.5				21.13	18.07	< 23.98
27685	2307.5	5	1	12	21.58	18.52	< 23.98
27710	2310.0				21.85	18.79	< 23.98
27735	2312.5				21.18	18.12	< 23.98
27685	2307.5	5	1	24	21.57	18.51	< 23.98
27710	2310.0				21.82	18.76	< 23.98
27735	2312.5				21.19	18.13	< 23.98
27685	2307.5	5	25	0	20.23	17.17	< 23.98
27710	2310.0				20.17	17.11	< 23.98
27735	2312.5				20.24	17.18	< 23.98
27710	2310.0	10	1	0	21.18	18.12	< 23.98
			1	24	21.23	18.17	< 23.98
			1	49	21.07	18.01	< 23.98
			50	0	20.91	17.85	< 23.98
Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)							

Channel No.	Frequency (MHz)	Channel Bandwidth (MHz)	RB Size	RB Offset	Power Density (dBm/5MHz)	EIRP Density (dBm/5MHz)	Limit (dBm /5MHz)
256QAM							
27685	2307.5	5	1	0	16.95	13.89	< 23.98
27710	2310.0				16.49	13.43	< 23.98
27735	2312.5				17.51	14.45	< 23.98
27685	2307.5	5	1	12	17.04	13.98	< 23.98
27710	2310.0				17.64	14.58	< 23.98
27735	2312.5				17.52	14.46	< 23.98
27685	2307.5	5	1	24	17.21	14.15	< 23.98
27710	2310.0				16.48	13.42	< 23.98
27735	2312.5				17.67	14.61	< 23.98
27685	2307.5	5	25	0	17.62	14.56	< 23.98
27710	2310.0				17.24	14.18	< 23.98
27735	2312.5				17.28	14.22	< 23.98
27710	2310.0	10	1	0	17.32	14.26	< 23.98
			1	24	17.61	14.55	< 23.98
			1	49	17.67	14.61	< 23.98
			50	0	17.12	14.06	< 23.98
Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)							

5.5. Band Edge Measurement

5.5.1. Test Limit

For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360MHz bands:

- (1) By a factor of not less than: $43 + 10 \log (P)$ dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than $55 + 10 \log (P)$ dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than $61 + 10 \log (P)$ dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than $67 + 10 \log (P)$ dB on all frequencies between 2328 and 2337 MHz;
- (2) By a factor of not less than $43 + 10 \log (P)$ dB on all frequencies between 2300 and 2305 MHz, $55 + 10 \log (P)$ dB on all frequencies between 2296 and 2300 MHz, $61 + 10 \log (P)$ dB on all frequencies between 2292 and 2296 MHz, $67 + 10 \log (P)$ dB on all frequencies between 2288 and 2292 MHz, and $70 + 10 \log (P)$ dB below 2288 MHz;
- (3) By a factor of not less than $43 + 10 \log (P)$ dB on all frequencies between 2360 and 2365 MHz, and not less than $70 + 10 \log (P)$ dB above 2365 MHz.

5.5.2. Test Procedure Used

ANSI C63.26-2015 - Section 5.7

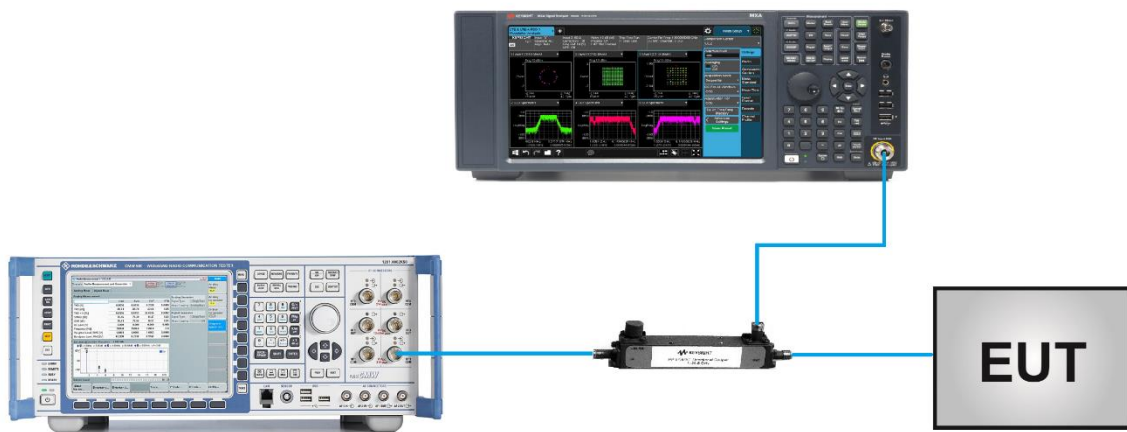
5.5.3. Test Setting

1. Set the analyzer frequency to low or high channel
2. $RBW \geq$ 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. $VBW \geq 3 * RBW$
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

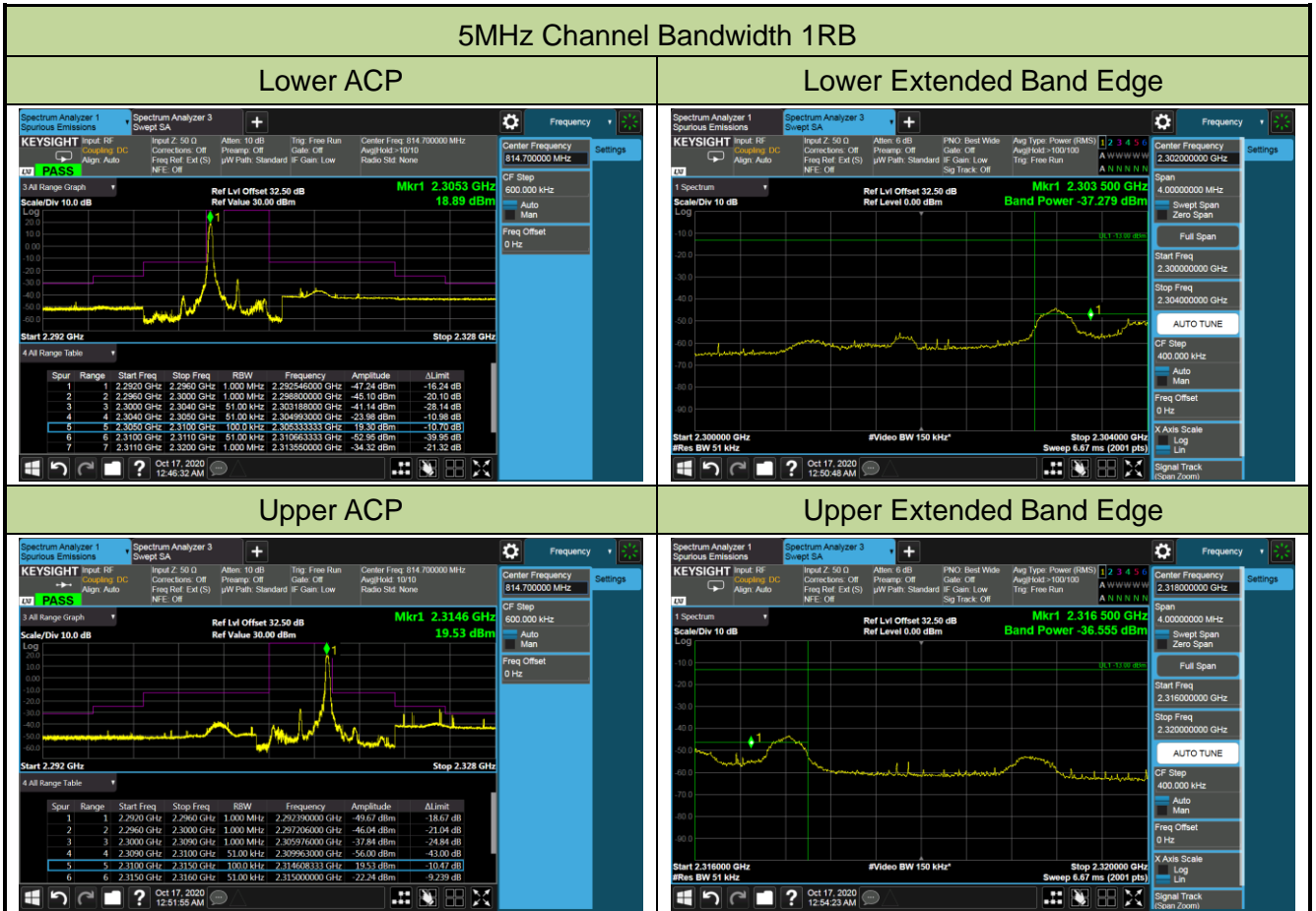
- Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

5.5.4.Test Setup



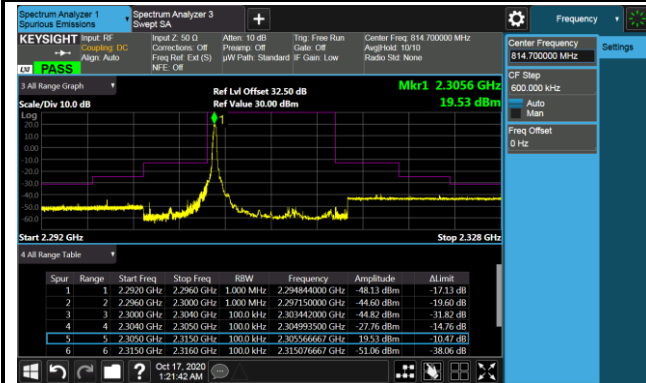
5.5.5. Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Gordon Qi	Test Date	2020/10/17



10MHz Channel Bandwidth 1RB

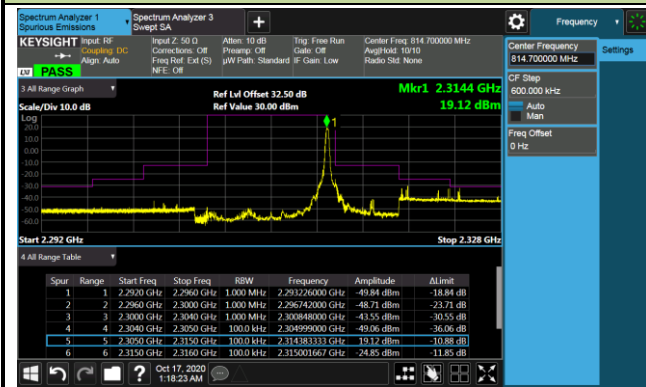
Lower ACP



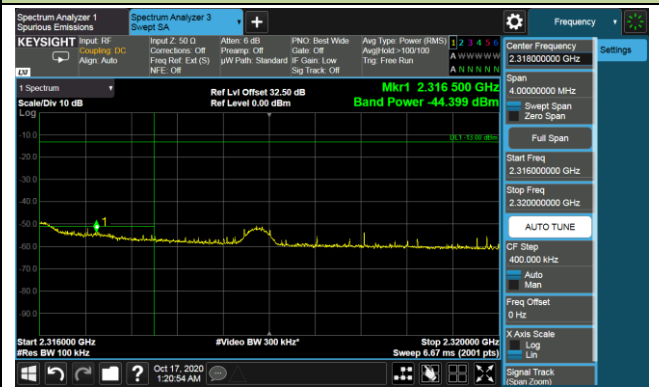
Lower Extended Band Edge



Upper ACP

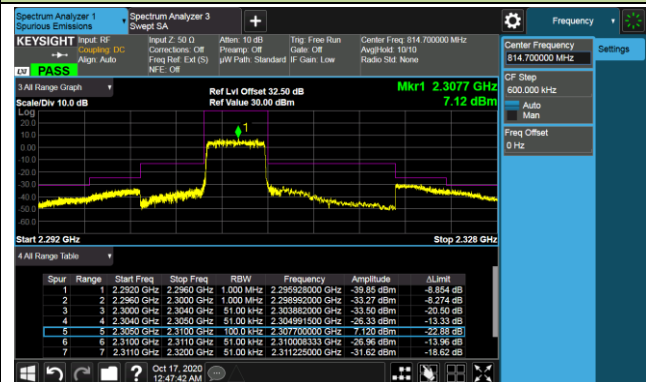


Upper Extended Band Edge



5MHz Channel Bandwidth Full RB

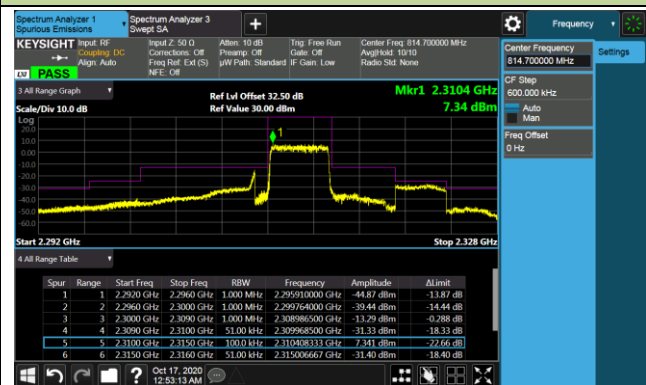
Lower ACP



Lower Extended Band Edge



Upper ACP

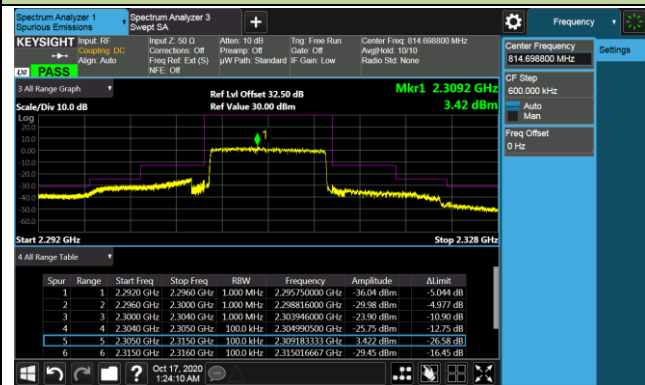


Upper Extended Band Edge



10MHz Channel Bandwidth Full RB

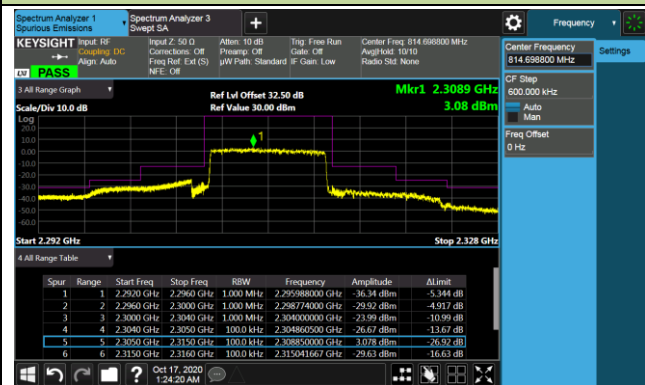
Lower ACP



Lower Extended Band Edge



Upper ACP



Upper Extended Band Edge



5.6. Conducted Spurious Emissions

5.6.1. 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 lowest 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 lower than the transmitter power (P) by a factor of at least $70 + 10 \log (P)$ dB.

5.6.2. Test Procedure Used

ANSI C63.26-2015 - Section 5.7

5.6.3. Test Setting

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW $\geq 3 \cdot$ 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.

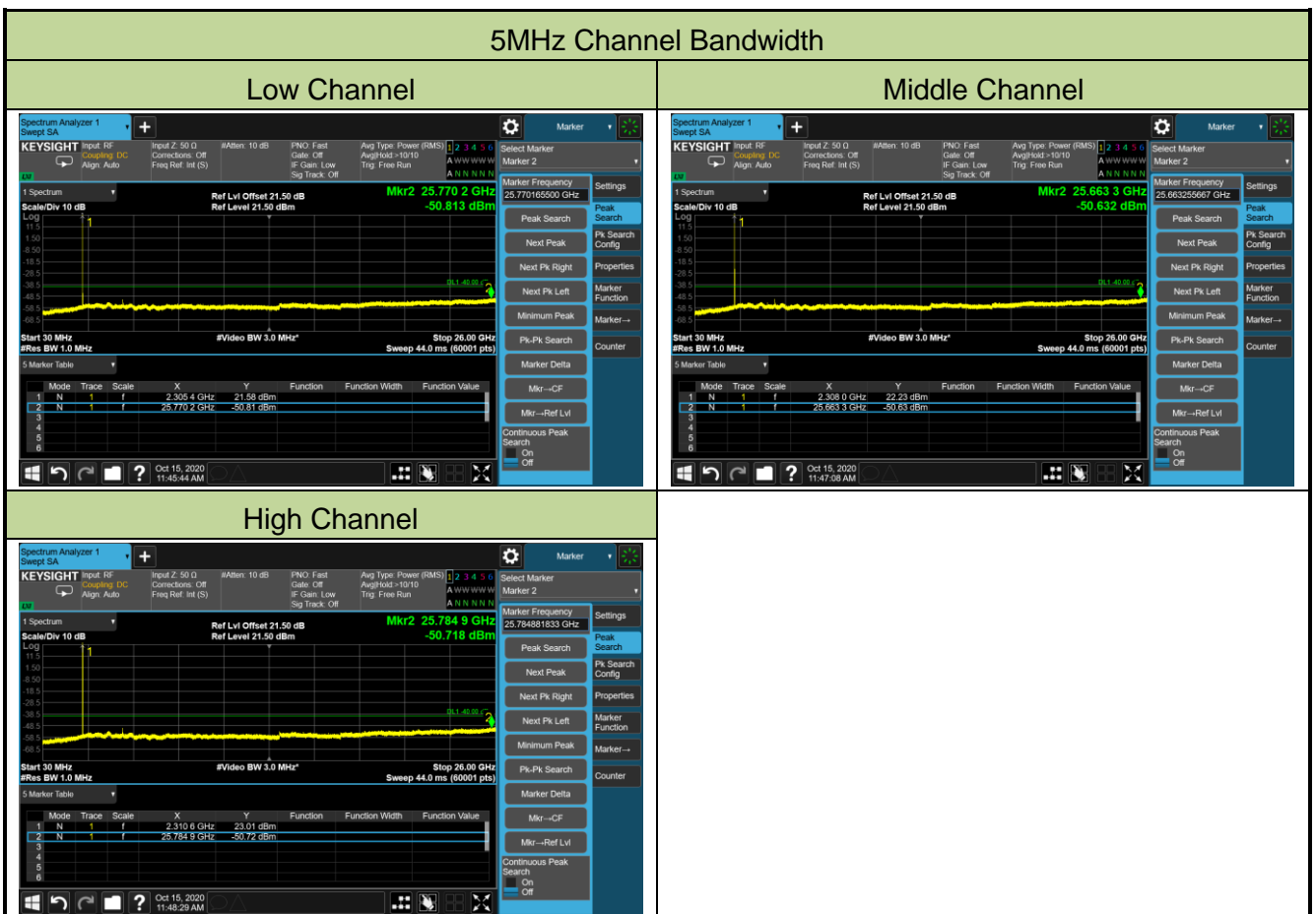
5.6.4.Test Setup

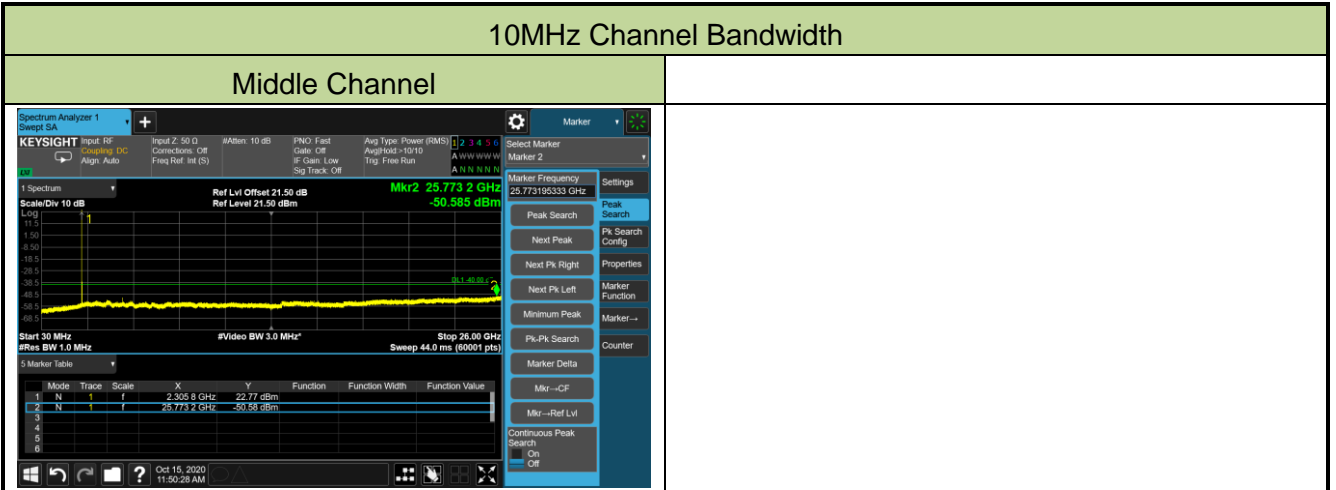


5.6.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	WZ-SR6
Test Engineer	Gordon Qi	Test Date	2020/10/15

Channel	Frequency (MHz)	Channel Bandwidth (MHz)	Frequency Range (MHz)	Max Spurious Emissions (dBm)	Limit (dBm)	Result
QPSK						
27685	2307.5	5	30 ~ 25000	-50.81	≤ -40.00	Pass
27710	2310.0	5	30 ~ 25000	-50.63	≤ -40.00	Pass
27735	2312.5	5	30 ~ 25000	-50.72	≤ -40.00	Pass
27710	2310.0	10	30 ~ 25000	-50.59	≤ -40.00	Pass





5.7. Radiated Spurious Emissions Measurements

5.7.1. Test Limit

Out of band emissions: The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $70 + 10 \log (P)$ dB.

E (dB μ V/m) = EIRP (dBm) - $20 \log D$ + 104.8; where D is the measurement distance in meters. The emission limit equal to 55.3dB μ V/m.

5.7.2. Test Procedure Used

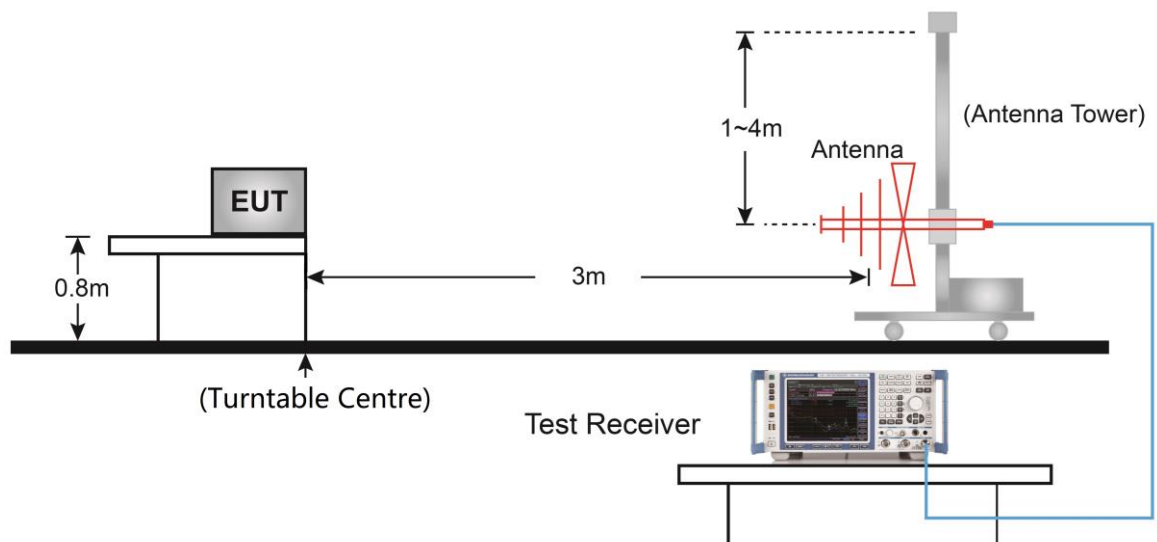
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.7.3. Test Setting

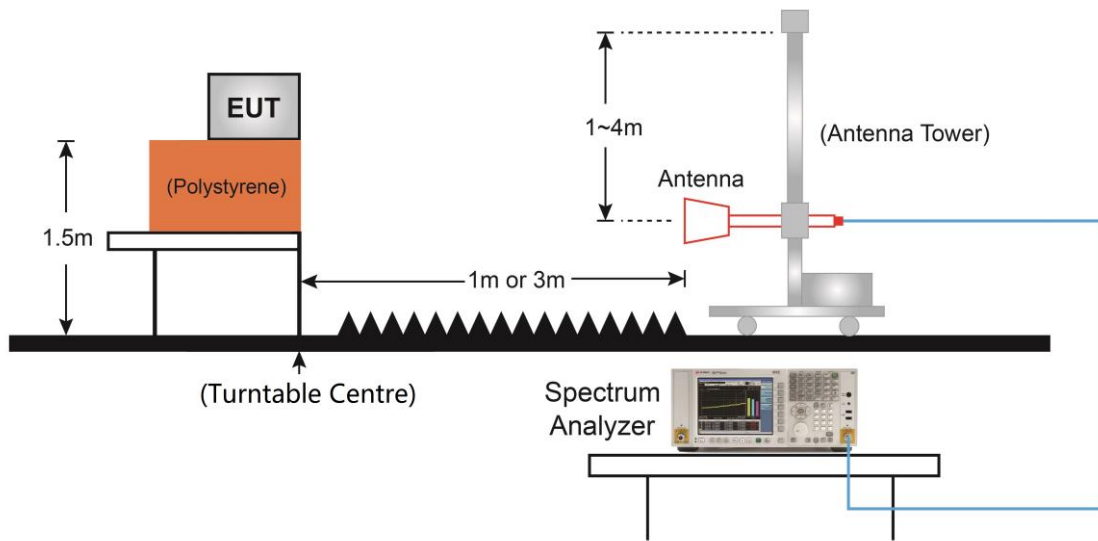
1. RBW = 1MHz
2. VBW $\geq 3 \times$ RBW
3. Sweep time $\geq 10 \times$ (number of points in sweep) \times (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.7.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.7.5.Test Result

Product	5G Sub-6 GHz M.2 Module	Test Site	AC2
Test Engineer	Jason Gao	Test Date	2020/10/14
Test Band	LTE Band 30, 5MHz, 1RB		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
193.4	25.7	17.9	43.6	55.3	-11.7	Peak	Horizontal
237.1	27.1	19.1	46.2	55.3	-9.1	Peak	Horizontal
353.5	30.3	22.6	52.9	55.3	-2.4	Peak	Vertical
373.9	28.9	21.8	50.7	55.3	-4.6	Peak	Vertical
6703.5	34.3	8.2	42.5	55.3	-12.8	Peak	Horizontal
10673.0	31.6	16.1	47.7	55.3	-7.6	Peak	Horizontal
3890.0	37.2	0.7	37.9	55.3	-17.4	Peak	Vertical
7222.0	32.3	10.9	43.2	55.3	-12.1	Peak	Vertical
Middle Channel							
192.5	25.8	17.8	43.6	55.3	-11.7	Peak	Horizontal
434.5	22.2	22.9	45.2	55.3	-10.1	Peak	Horizontal
192.5	26.8	17.8	44.6	55.3	-10.7	Peak	Vertical
226.4	22.4	18.7	41.1	55.3	-14.2	Peak	Vertical
4595.5	35.7	2.6	38.3	55.3	-17.0	Peak	Horizontal
8029.5	32.5	11.2	43.7	55.3	-11.6	Peak	Horizontal
7545.0	32.8	10.8	43.6	55.3	-11.7	Peak	Vertical
13945.5	30.2	22.4	52.6	55.3	-2.7	Peak	Vertical
High Channel							
192.5	25.7	17.8	43.5	55.3	-11.8	Peak	Horizontal
414.1	24.2	22.9	47.1	55.3	-8.2	Peak	Horizontal
194.4	27.0	18.1	45.1	55.3	-10.2	Peak	Vertical
434.5	22.8	22.9	45.8	55.3	-9.5	Peak	Vertical
5114.0	34.8	3.6	38.4	55.3	-16.9	Peak	Horizontal
7638.5	32.7	10.6	43.3	55.3	-12.0	Peak	Horizontal
9126.0	32.4	13.0	45.4	55.3	-9.9	Peak	Vertical
13937.0	29.5	22.7	52.2	55.3	-3.1	Peak	Vertical

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

6. CONCLUSION

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

Appendix A - Test Setup Photograph

Refer to "2010RSU005-UT" file.

Appendix B - EUT Photograph

Refer to "2010RSU005-UE" file.