RF MEASUREMENT REPORT

FCC ID:	XMR2023RG520NNA
Applicant:	Quectel Wireless Solutions Co., Ltd
Product:	5G Sub-6 GHz LGA Module
Model No.:	RG520N-NA
Brand Name:	Quectel
FCC Rule Part(s):	Part90 Subpart R
Test Procedure(s):	ANSI C63.26: 2015
Result:	Complies
Test Date:	2022-04-26 ~ 2022-06-15

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.

Revision History

Report No.	Version	Description	Issue Date	Note
2303RSU050-U3	Rev. 01	Initial Report	2023-04-24	Valid

Note: This application for certification is leveraging the data reuse procedures from KDB 484596 based on reference FCC ID: XMR2022RG520NNA to cover variant FCC ID: XMR2023RG520NNA, copied the MRT "2204RSU037-U7" report.

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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, China 200233

1.2. Manufacturer

Quectel Wireless Solutions Co., Ltd

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
		☐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	5G Sub-6 GHz LGA Module
Model No.	RG520N-NA
Brand Name	Quectel
IMEI	Conducted Measurement 1: 863109050007421 Conducted Measurement 2: 863109050005151 Radiated Measurement: 863109050007306
E-UTRA Band	Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 38, 41, 48, 66, 71
5G NR Band	n2, n5, n7, n12, n13, n14, n25, n26, n30, n38, n41, n48, n66, n71, n77, n78
Operating Temperature	-30 ~ 75 °C
Power Type	3.3 ~ 4.4Vdc, typical 3.8Vdc
Remark: 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.	

1.5. Radio Specification under Test

Single Band	n14
EN-DC Band	n14
FDD T_X Frequency Range	788 ~ 798 MHz
FDD R_X Frequency Range	758 ~ 768 MHz
Support Bandwidth	5, 10MHz
SCS for NR cell	FDD Band: 15kHz
Modulation	UL up to 256QAM, DL up to 256QAM
Remark: For other features of this EUT, test report will be issued separately.	

1.6. Description of Available Antennas

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
n2	1850 ~ 1910	Dipole	1.37
n5	824 ~ 849		1.18
n7	2500 ~ 2570		2.07
n12	699 ~ 716		1.18
n13	777 ~ 787		1.18
n14	788 ~ 798		1.37
n25	1850 ~ 1915		1.18
n26	814-849		1.11
n30	2305 ~ 2315		2.07
n38	2570 ~ 2620		1.37
n41	2496 ~ 2690		1.18
n66	1710 ~ 1780		1.37
n71	663 ~ 698		1.18
n77	3450 ~ 3550 3700 ~ 3980		0.58
n78	3300 ~ 3800		0.58

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 90
- 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. Device Capabilities

PI/2 BPSK modulation applied for 5G NR band frequencies and has the same tune up power as QPSK modulations.

The DFT-s-OFDM and CP-OFDM waveforms were investigated, and DFT-s-OFDM was found to be the worst case.

The worst-case scenario for all measurements is based on an engineering evaluation and QPSK was observed as the worst one and set for all conducted and radiated. Output power measurements were measured on PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM modulations.

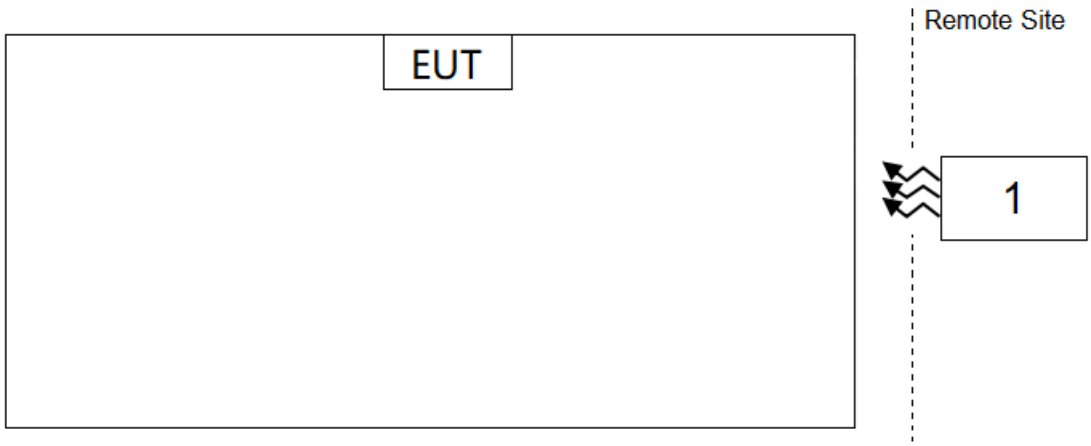
For EN-DC mode, 5G NR FR1 bands are tested in this report (Radiated Spurious Emissions), all the other RF bands are tested in the other reports separately.

2. Test Configuration

2.1. Test Mode

Test Item	Test Channel	Channel Bandwidth (MHz)	Modulation Type	RB#
Output Power & EIRP	L, M, H	5, 10	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Emission Bandwidth	M	5, 10	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	10	QPSK	Full RB
Band Edge / Mask	L, H	5, 10	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	5, 10	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	5	QPSK	1 RB

2.2. Test System Connection Diagram



Product		Manufacturer	Model No.
1	UXM 5G Wireless Test Platform	Keysight	E7515B

2.3. Test Environment Condition

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

3. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2022-12-09	SIP-SR1
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2023-06-01	SIP-SR1
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2022-10-31	SIP-SR1
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2022-09-07	SIP-SR1
Communication Tester	R&S	CMU 200	MRTSUE06009	1 year	2022-09-07	SIP-SR1
Communication Tester	R&S	CMW500	MRTSUE06243	1 year	2022-10-10	SIP-SR1
Signal Generator	Keysight	E8257D	MRTSUE06453	1 year	2023-06-01	SIP-SR1
Thermohygrometer	testo	622	MRTSUE06629	1 year	2023-01-06	SIP-SR1
5G Wireless Test Platform	Keysight	E7515B	MRTSUE06903	1 year	2022-11-23	SIP-SR1
Signal Generator	Keysight	E8257D	MRTSUE06904	1 year	2022-11-23	SIP-SR1
DC POWER MODULE	Keysight	N6743B	MRTSUE06905	N/A	N/A	SIP-SR1
DC POWER MODULE	Keysight	N6743B	MRTSUE06906	N/A	N/A	SIP-SR1
Low-Profile Modular Power System Mainframe	Keysight	N6700C	MRTSUE06907	N/A	N/A	SIP-SR1
FR1 Switching Unit	Keysight	C8880A	MRTSUE06908	N/A	N/A	SIP-SR1
Signal Analyzer	Keysight	N9021B	MRTSUE06915	1 year	2022-12-29	SIP-SR1
Temperature Chamber	BAOYT	BYG-80CL	MRTSUE06932	1 year	2023-02-27	SIP-SR1
Shielding Room	MIX-BEP	SIP-SR1	MRTSUE06948	N/A	N/A	SIP-SR1
Millimeter-Wave Transceiver for 5G	Keysight	M1740A	MRTSUE06954	3 years	2024-06-02	SIP-SR1
Millimeter-Wave Transceiver for 5G	Keysight	M1740A	MRTSUE06955	3 years	2024-06-02	SIP-SR1
5G Wireless Test Platform	Keysight	E7515B	MRTSUE06956	1 year	2023-06-01	SIP-SR1
Common Interface Unit	Keysight	E7770A	MRTSUE06957	N/A	N/A	SIP-SR1
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2023-06-08	SIP-AC3
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2022-12-29	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2023-06-01	SIP-AC3
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06598	1 year	2022-11-09	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2022-10-31	SIP-AC3
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2022-09-07	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2022-09-12	SIP-AC3
EMI Test Receiver	R&S	ESR3	MRTSUE06613	1 year	2023-06-01	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2022-11-02	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2022-11-28	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2023-01-13	SIP-AC3

Preamplifier	EMCI	EMC001330	MRTSUE06643	1 year	2023-01-13	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2022-08-26	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2022-12-23	SIP-AC3
Loop Antenna	Schwarzbeck	FMZB 1519 B	MRTSUE06937	1 year	2023-03-14	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE07028	1 year	2022-12-09	SIP-AC3
Directional Coupler	ar	DC7200A	MRTSUE06147	N/A	N/A	SIP
Directional Coupler	ar	DC6080A	MRTSUE06148	N/A	N/A	SIP
Directional Coupler	narda	4226-10	MRTSUE06564	1 year	2022-10-11	SIP
Directional Coupler	PULSAR	CS10-23-436/20	MRTSUE06846	1 year	2023-06-02	SIP
Directional Coupler	PULSAR	CS10-23-436/20	MRTSUE06848	1 year	2023-06-02	SIP
Attenuator	MVE	MVE2213	MRTSUE11055	1 year	2023-06-09	SIP
Attenuator	MVE	MVE2213	MRTSUE11056	1 year	2023-06-09	SIP
Attenuator	MVE	MVE2213	MRTSUE11057	1 year	2023-06-09	SIP
Attenuator	MVE	MVE2213	MRTSUE11058	1 year	2023-06-09	SIP
Attenuator	MVE	MVE2213	MRTSUE11059	1 year	2023-06-09	SIP
Attenuator	MVE	MVE2213	MRTSUE11060	1 year	2023-06-09	SIP

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software

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 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 Condition	Verdict
2.1049	Occupied Bandwidth	Conducted	Pass
2.1055,90.539(e)	Frequency Stability		Pass
90.542(a)(7)	Equivalent Radiated Power		Pass
2.1051, 90.543(e)(2)(3)	Band Edge		Pass
2.1051, 90.210(n)	Emission Mask		
2.1051, 90.543(e)(3)	Spurious Emission		
2.1053, 90.543(e)(3), 90.543(f)	Spurious Emissions	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) 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.

5.2. Occupied Bandwidth Measurement

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.

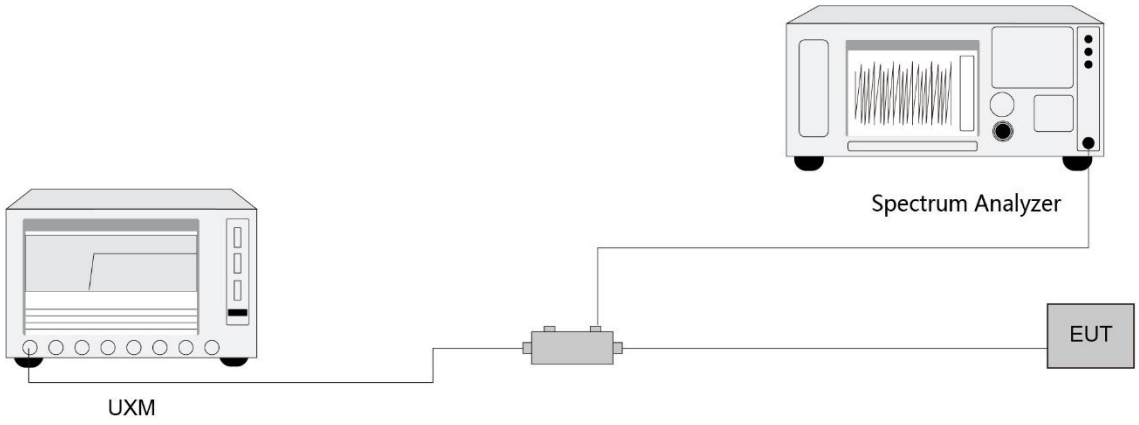
5.2.2. Test Procedure

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 ≥ 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.

5.2.4. Test Setup



5.2.5. Test Result

Refer to Appendix A.1.

5.3. Frequency Stability Measurement

5.3.1. Test Limit

The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked

5.3.2. Test Procedure

ANSI C63.26-2015 - Section 5.6

5.3.3. Test Setting

Frequency Stability Under Temperature Variations:

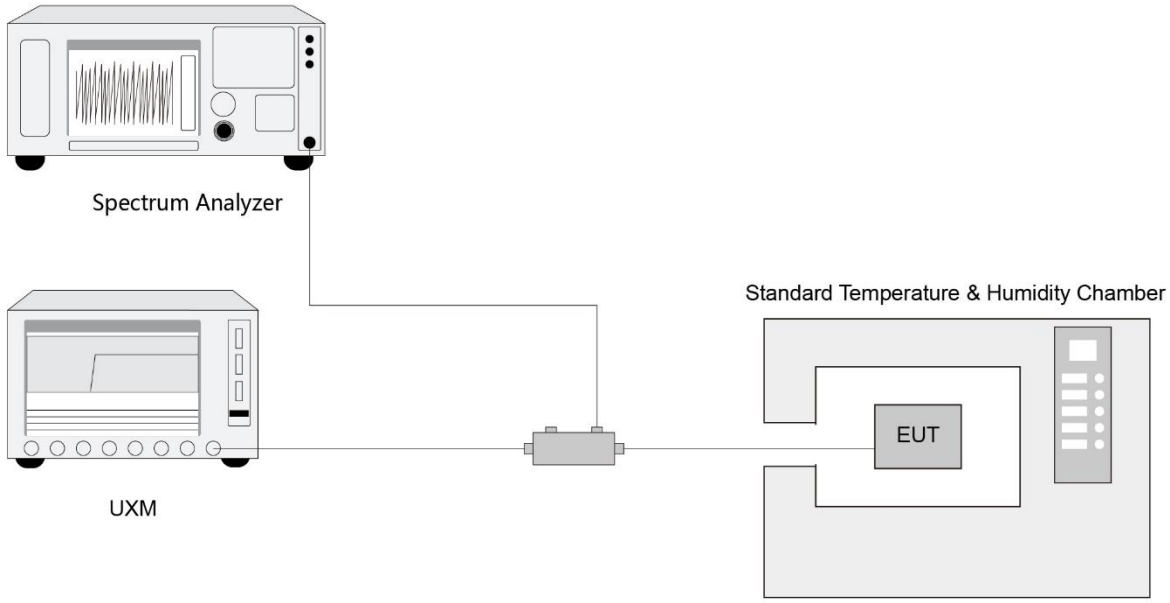
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain 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 inputvoltage to specify extreme voltage variation (±15%) and end point, record the maximum frequency change.

5.3.4. Test Setup



5.3.5. Test Result

Refer to Appendix A.2.

5.4. Equivalent Isotropically Radiated Power Measurement

5.4.1. Test Limit

Control stations and mobile stations transmitting in the 758-768 MHz band and the788-798 MHz band are limited to 30 watts ERP.

5.4.2. Test Procedure

ANSI C63.26-2015 - Section 5.2

5.4.3. 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

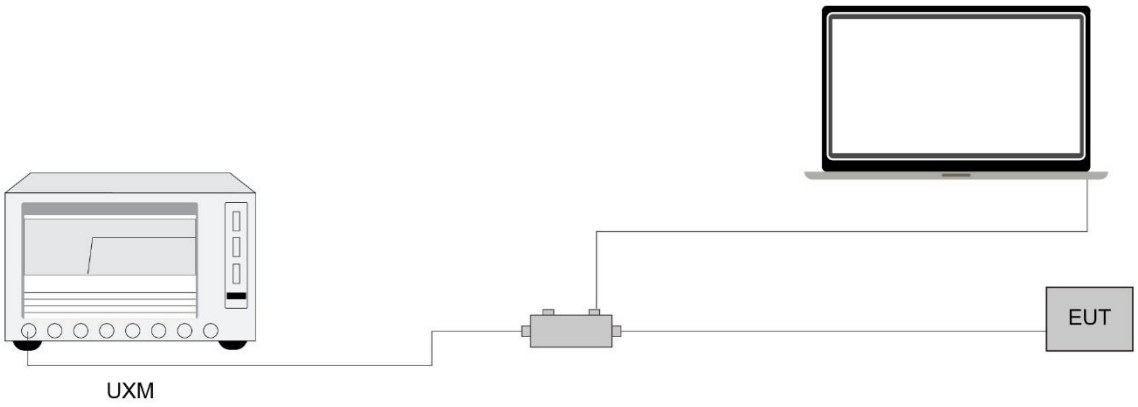
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

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

5.4.4. Test Setup



5.4.5. Test Result

Refer to Appendix A.3.

5.5. Band Edge Measurement

5.5.1. Test Limit

For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

(2) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, byat least 43 + 10 log (P) dB.

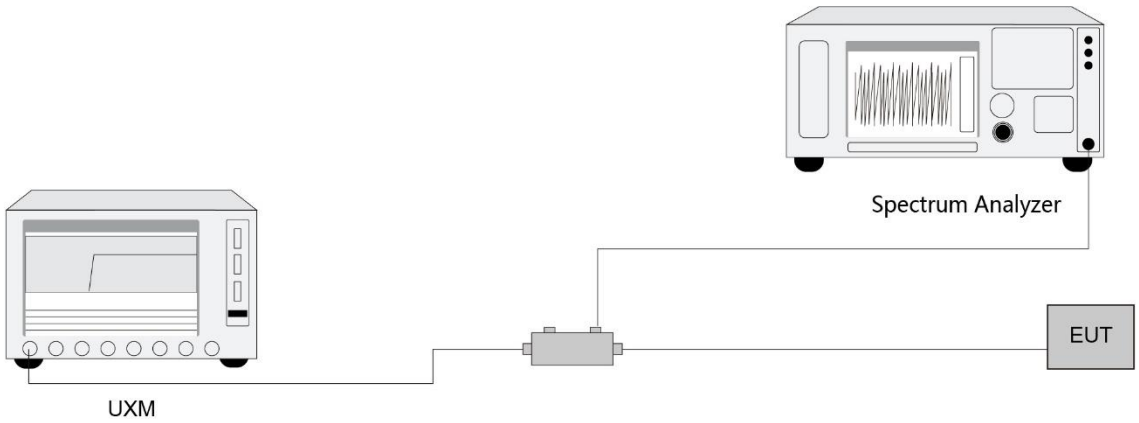
5.5.2. Test Procedure

ANSI C63.26-2015 - Section5.7

5.5.3. 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.

5.5.4. Test Setup



5.5.5. Test Result

Refer to Appendix A.4.

5.6. Emisson Mask Measurement

5.6.1. Test Limit

Emission Mask B.For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

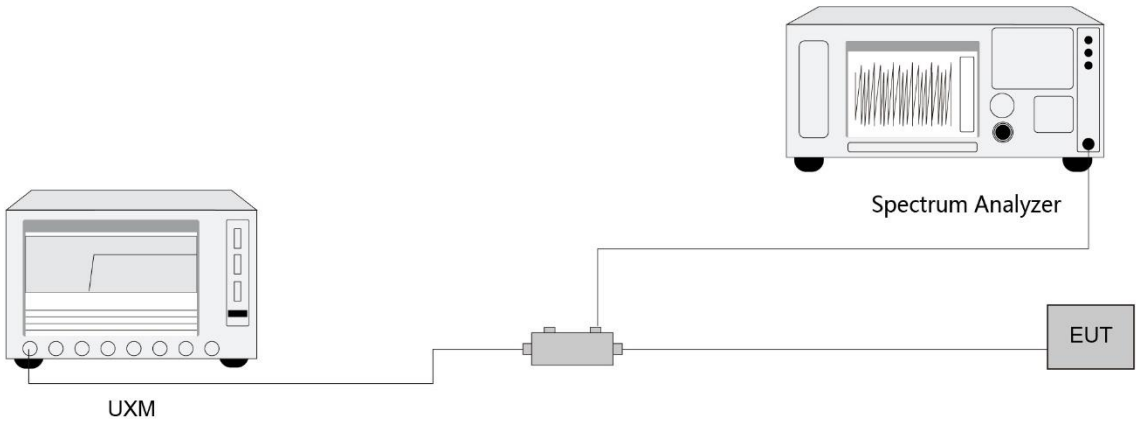
5.6.2. Test Procedure

ANSI C63.26-2015 - Section5.7

5.6.3. 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.

5.6.4. Test Setup



5.6.5. Test Result

Refer to Appendix A.5.

5.7. Conducted Spurious Emissions Measurement

5.7.1. 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 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.

On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least 43 + 10 log (P) dB.

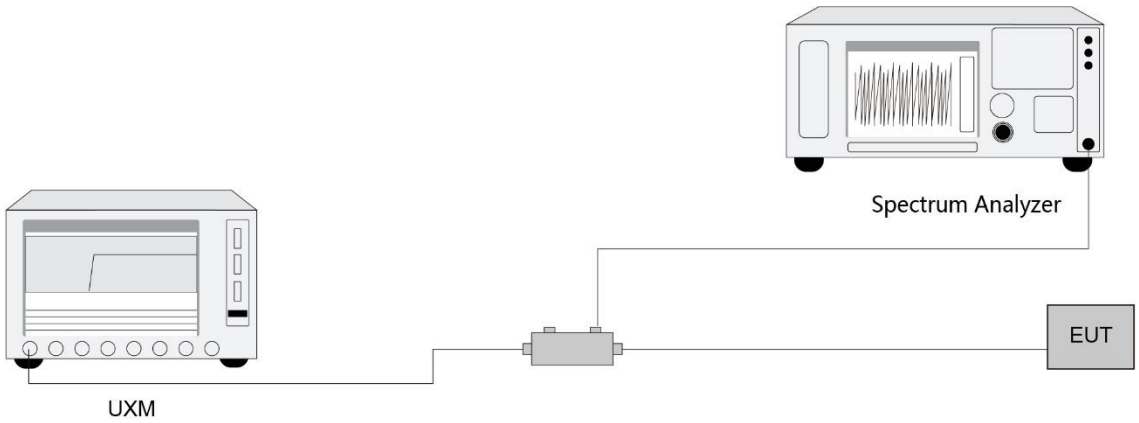
5.7.2. Test Procedure

ANSI C63.26-2015 - Section 5.7

5.7.3. 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.

5.7.4. Test Setup



5.7.5. Test Result

Refer to Appendix A.6.

5.8. Radiated Spurious Emissions Measurement

5.8.1. Test Limit

Out of band emissions: The powerof any emission outside of the authorized 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.

For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to −70 dBW/MHz(-40dBm/MHz) equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW (-50dBm) EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, atransmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

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 or 55.3dBμV/m.

5.8.2. Test Procedure

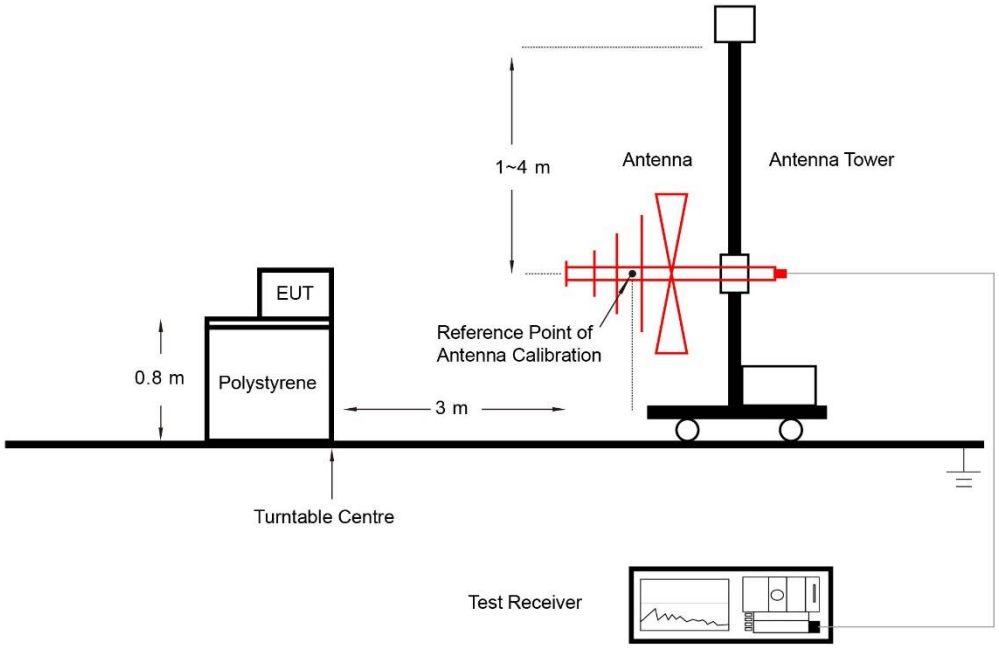
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.8.3. Test Setting

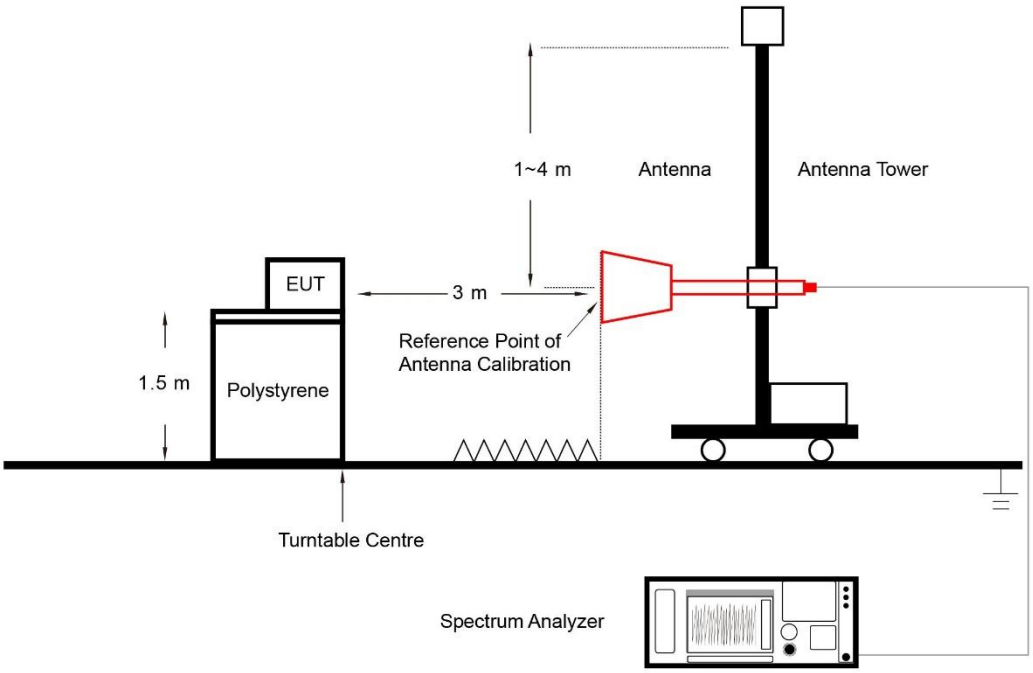
1. RBW = 1MHz
2. VBW ≥ 3*RBW
3. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.8.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.8.5. Test Result

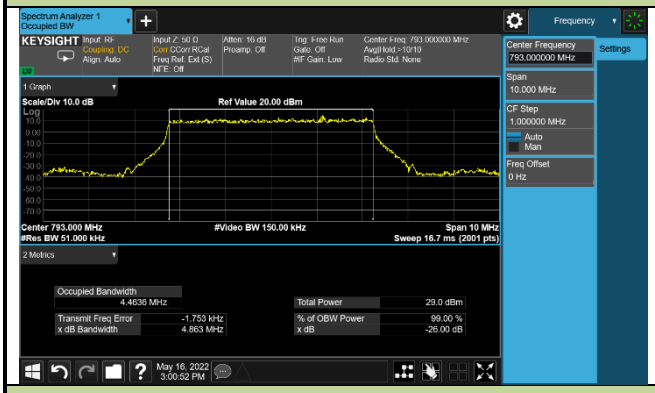
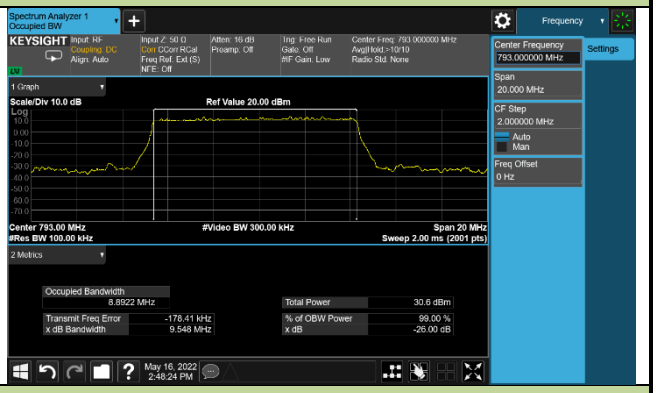
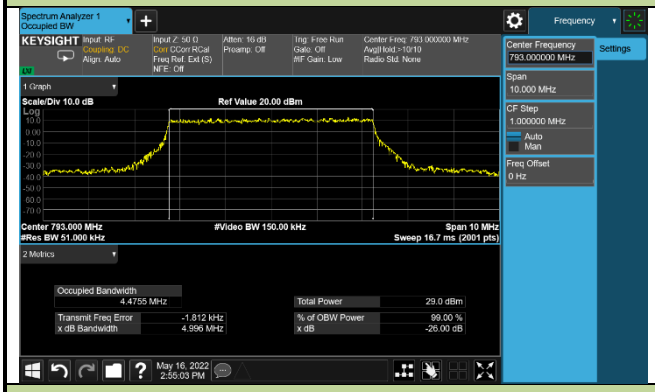
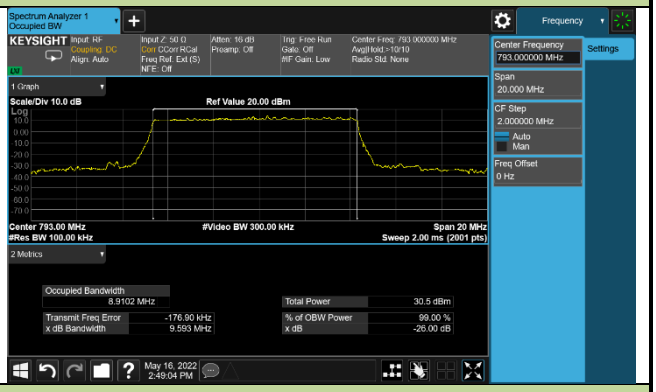
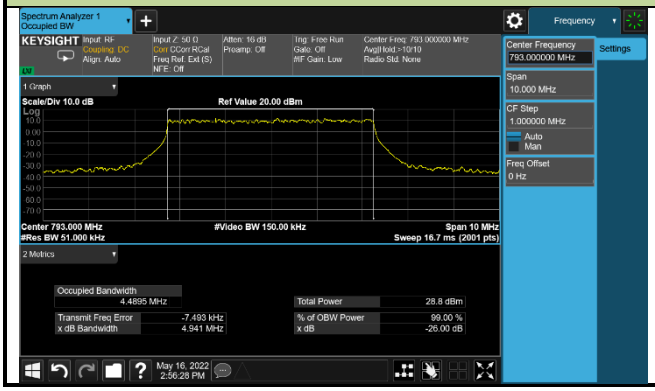
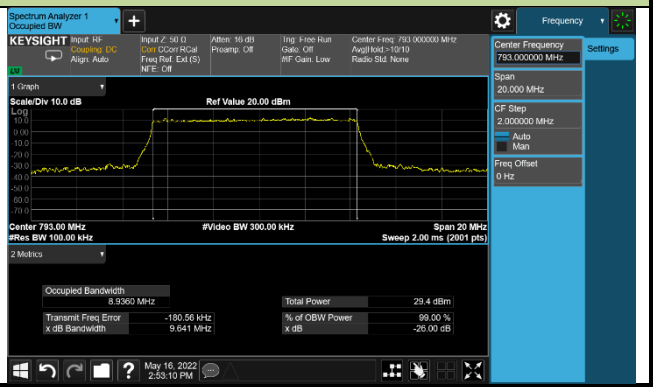
Refer to Appendix A.7.

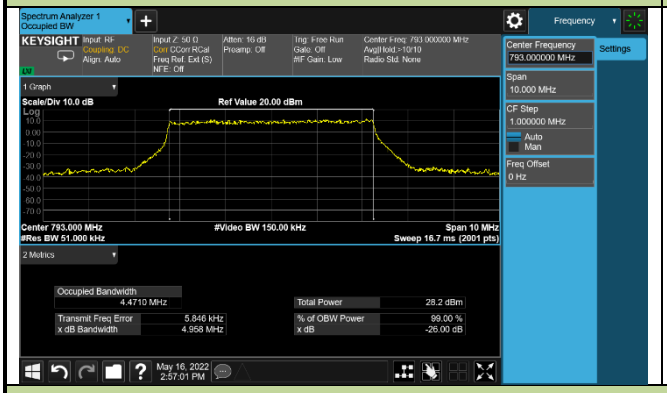
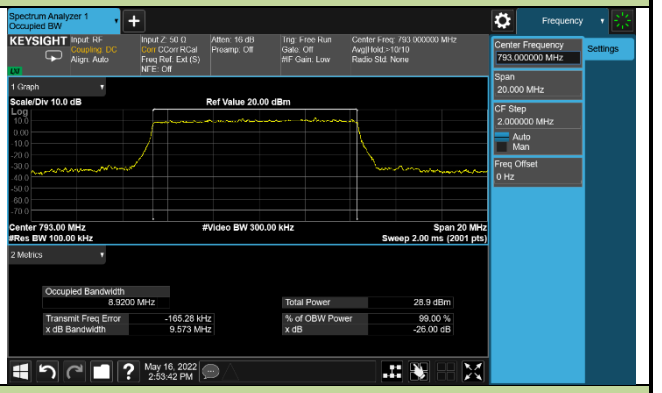
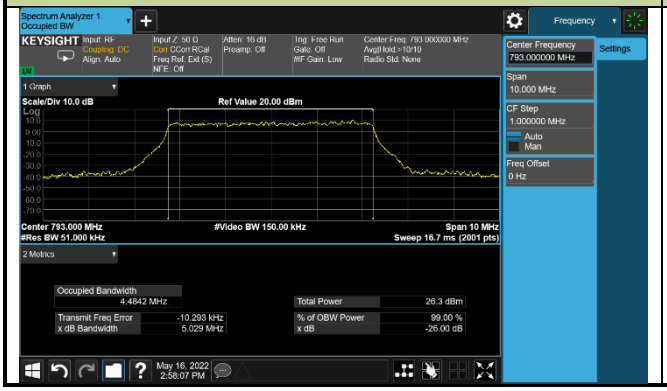
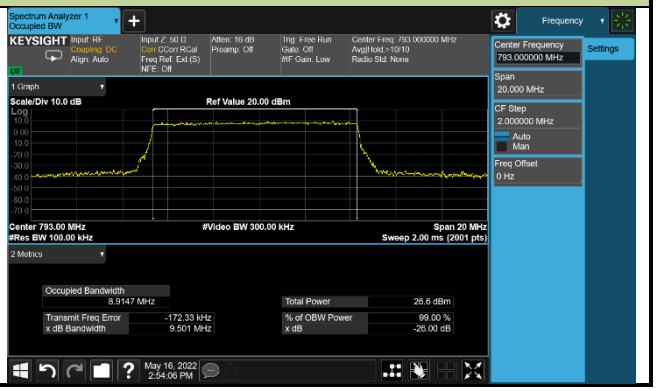
Appendix A - Test Result

A.1 Occupied Bandwidth Test Result

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/16	Test Band	NR n14

Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
PI/2 BPSK		
793.0	5	4.46
793.0	10	8.89
QPSK		
793.0	5	4.48
793.0	10	8.91
16QAM		
793.0	5	4.49
793.0	10	8.94
64QAM		
793.0	5	4.47
793.0	10	8.92
256QAM		
793.0	5	4.48
793.0	10	8.91

99% Bandwidth - PI/2 BPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
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
	

A.2 Frequency Stability Test Result

Test Site	SIP-TR1	Test Engineer	Candy Luo
Test Date	2022/05/06 ~ 2022/05/09	Test Band	NR n14

Power (Vdc)	Temp. (°C)	Frequency Tolerance (ppm)
3.8	- 30	0.0031
	- 20	0.0020
	- 10	-0.0030
	0	-0.0239
	+ 10	-0.0035
	+ 20	-0.0227
	+ 30	-0.0119
	+ 40	-0.0172
	+ 50	-0.0116
4.4	+ 20	-0.0239
3.3	+ 20	-0.0174

A.3 Equivalent Isotropically Radiated Power Test Result

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/04/29	Test Band	NR n14

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
DFT-s-OFDM PI/2 BPSK						
5	790.5	12	6	23.38	22.41	<44.77
		1	1	23.34	22.37	<44.77
		1	23	23.36	22.39	<44.77
		25	0	23.29	22.32	<44.77
		1	24	23.27	22.30	<44.77
		1	6	23.24	22.27	<44.77
	793.0	12	6	23.41	22.44	<44.77
		1	1	23.33	22.36	<44.77
		1	23	23.20	22.23	<44.77
		25	0	23.32	22.35	<44.77
		1	24	23.29	22.32	<44.77
		1	6	23.42	22.45	<44.77
	795.5	12	6	23.41	22.44	<44.77
		1	1	23.43	22.46	<44.77
		1	23	23.26	22.29	<44.77
		25	0	23.44	22.47	<44.77
		1	24	23.29	22.32	<44.77
		1	6	23.28	22.31	<44.77
10	793	25	12	23.33	22.36	<44.77
		1	1	23.30	22.33	<44.77
		1	50	23.20	22.23	<44.77
		50	0	23.42	22.45	<44.77
		1	51	23.18	22.21	<44.77
		1	0	23.35	22.38	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
DFT-s-OFDM QPSK						
5	790.5	12	6	23.36	22.39	<44.77
		1	1	23.34	22.37	<44.77
		1	23	23.22	22.25	<44.77
		25	0	23.34	22.37	<44.77
		1	24	23.29	22.32	<44.77
		1	6	23.36	22.39	<44.77
	793.0	12	6	23.47	22.50	<44.77
		1	1	23.55	22.58	<44.77
		1	23	23.49	22.52	<44.77
		25	0	23.40	22.43	<44.77
		1	24	23.41	22.44	<44.77
		1	6	23.53	22.56	<44.77
	795.5	12	6	23.43	22.46	<44.77
		1	1	23.37	22.40	<44.77
		1	23	23.39	22.42	<44.77
		25	0	23.32	22.35	<44.77
		1	24	23.27	22.30	<44.77
		1	6	23.39	22.42	<44.77
10	793	25	12	23.41	22.44	<44.77
		1	1	23.56	22.59	<44.77
		1	50	23.35	22.38	<44.77
		50	0	23.36	22.39	<44.77
		1	51	23.39	22.42	<44.77
		1	0	23.56	22.59	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
DFT-s-OFDM 16QAM						
5	790.5	12	6	23.45	22.48	<44.77
		1	1	23.15	22.18	<44.77
		1	23	23.50	22.53	<44.77
		25	0	22.26	21.29	<44.77
		1	24	22.03	21.06	<44.77
		1	6	22.58	21.61	<44.77
	793.0	12	6	23.27	22.30	<44.77
		1	1	23.23	22.26	<44.77
		1	23	23.29	22.32	<44.77
		25	0	22.34	21.37	<44.77
		1	24	22.54	21.57	<44.77
		1	6	22.61	21.64	<44.77
	795.5	12	6	23.23	22.26	<44.77
		1	1	23.66	22.69	<44.77
		1	23	23.19	22.22	<44.77
		25	0	22.25	21.28	<44.77
		1	24	22.46	21.49	<44.77
		1	6	22.49	21.52	<44.77
10	793	25	12	23.43	22.46	<44.77
		1	1	23.43	22.46	<44.77
		1	50	23.23	22.26	<44.77
		50	0	22.37	21.40	<44.77
		1	51	22.50	21.53	<44.77
		1	0	22.65	21.68	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
DFT-s-OFDM 64QAM						
5	790.5	12	6	21.94	20.97	<44.77
		1	1	21.89	20.92	<44.77
		1	23	21.79	20.82	<44.77
		25	0	21.81	20.84	<44.77
		1	24	21.74	20.77	<44.77
		1	6	21.88	20.91	<44.77
	793.0	12	6	21.96	20.99	<44.77
		1	1	21.89	20.92	<44.77
		1	23	21.86	20.89	<44.77
		25	0	21.92	20.95	<44.77
		1	24	21.88	20.91	<44.77
		1	6	21.94	20.97	<44.77
	795.5	12	6	21.81	20.84	<44.77
		1	1	22.07	21.10	<44.77
		1	23	21.91	20.94	<44.77
		25	0	21.96	20.99	<44.77
		1	24	22.02	21.05	<44.77
		1	6	22.14	21.17	<44.77
10	793	25	12	21.91	20.94	<44.77
		1	1	22.11	21.14	<44.77
		1	50	21.88	20.91	<44.77
		50	0	21.91	20.94	<44.77
		1	51	21.91	20.94	<44.77
		1	0	22.07	21.10	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
DFT-s-OFDM 256QAM						
5	790.5	12	6	19.86	18.89	<44.77
		1	1	19.46	18.49	<44.77
		1	23	19.41	18.44	<44.77
		25	0	19.84	18.87	<44.77
		1	24	19.47	18.50	<44.77
		1	6	19.39	18.42	<44.77
	793.0	12	6	19.88	18.91	<44.77
		1	1	19.50	18.53	<44.77
		1	23	19.45	18.48	<44.77
		25	0	19.79	18.82	<44.77
		1	24	19.53	18.56	<44.77
		1	6	19.53	18.56	<44.77
	795.5	12	6	19.83	18.86	<44.77
		1	1	19.60	18.63	<44.77
		1	23	19.51	18.54	<44.77
		25	0	19.78	18.81	<44.77
		1	24	19.51	18.54	<44.77
		1	6	19.59	18.62	<44.77
10	793	25	12	19.83	18.86	<44.77
		1	1	19.38	18.41	<44.77
		1	50	19.39	18.42	<44.77
		50	0	19.82	18.85	<44.77
		1	51	19.35	18.38	<44.77
		1	0	19.36	18.39	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
CP-OFDM QPSK						
5	790.5	13	6	22.88	21.91	<44.77
		1	1	22.74	21.77	<44.77
		1	23	22.75	21.78	<44.77
		25	0	21.36	20.39	<44.77
		1	24	21.27	20.30	<44.77
		1	0	21.41	20.44	<44.77
	793.0	13	6	22.80	21.83	<44.77
		1	1	22.91	21.94	<44.77
		1	23	22.73	21.76	<44.77
		25	0	21.34	20.37	<44.77
		1	24	21.50	20.53	<44.77
		1	0	21.38	20.41	<44.77
	795.5	13	6	22.87	21.90	<44.77
		1	1	23.16	22.19	<44.77
		1	23	23.16	22.19	<44.77
		25	0	21.33	20.36	<44.77
		1	24	21.29	20.32	<44.77
		1	0	21.40	20.43	<44.77
10	793	26	13	22.84	21.87	<44.77
		1	1	22.84	21.87	<44.77
		1	50	22.71	21.74	<44.77
		52	0	21.37	20.40	<44.77
		1	51	21.27	20.30	<44.77
		1	0	21.41	20.44	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

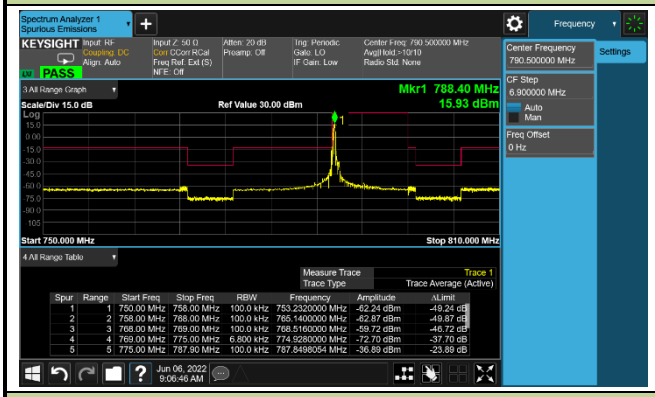
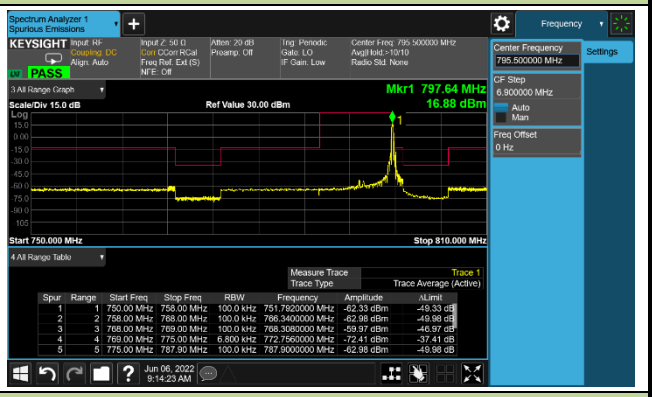
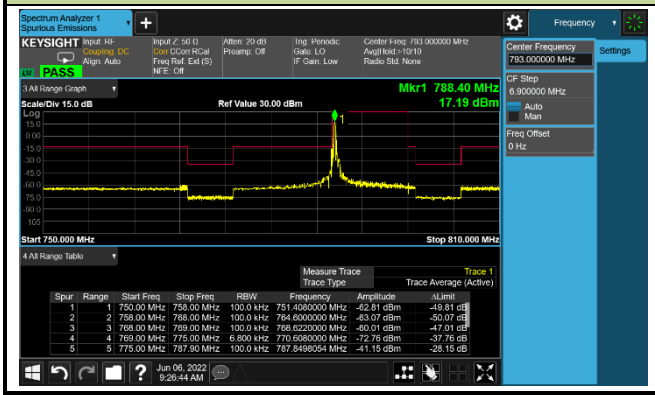
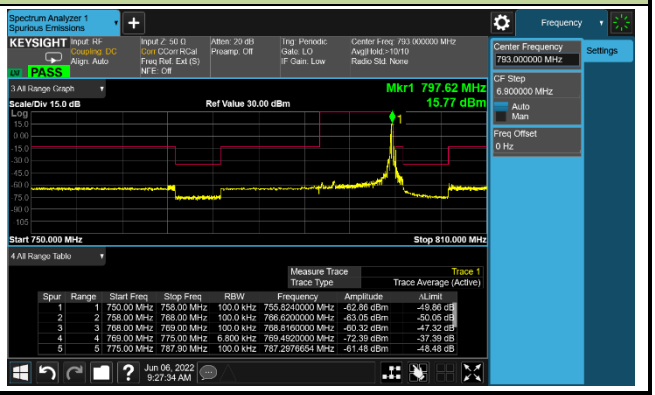
Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
CP-OFDM 16QAM						
5	790.5	13	6	22.39	21.42	<44.77
		1	1	22.57	21.60	<44.77
		1	23	22.46	21.49	<44.77
		25	0	21.36	20.39	<44.77
		1	24	21.64	20.67	<44.77
		1	0	21.73	20.76	<44.77
	793.0	13	6	22.52	21.55	<44.77
		1	1	22.55	21.58	<44.77
		1	23	22.49	21.52	<44.77
		25	0	21.35	20.38	<44.77
		1	24	21.64	20.67	<44.77
		1	0	21.77	20.80	<44.77
	795.5	13	6	22.45	21.48	<44.77
		1	1	22.72	21.75	<44.77
		1	23	22.60	21.63	<44.77
		25	0	21.46	20.49	<44.77
		1	24	21.23	20.26	<44.77
		1	0	21.23	20.26	<44.77
10	793	26	13	22.41	21.44	<44.77
		1	1	22.54	21.57	<44.77
		1	50	22.52	21.55	<44.77
		52	0	21.29	20.32	<44.77
		1	51	21.48	20.51	<44.77
		1	0	21.60	20.63	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

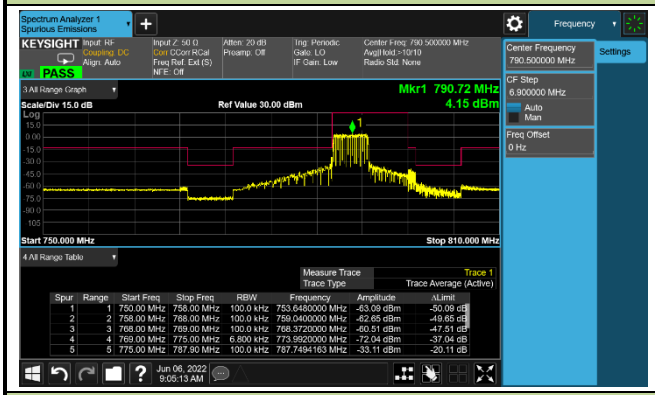
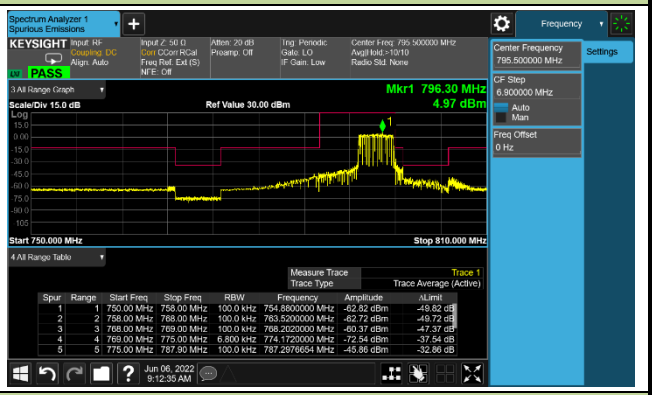
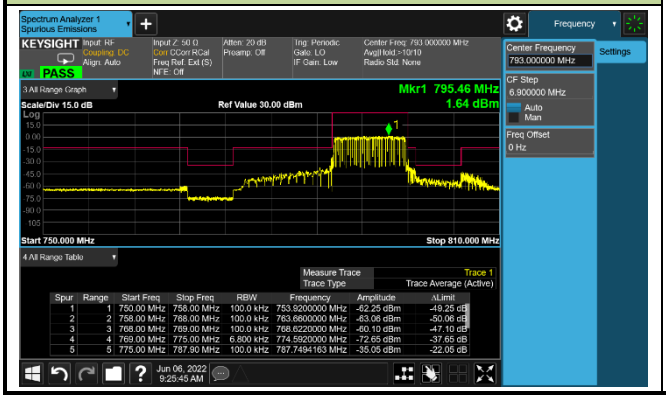
Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
CP-OFDM 64QAM						
5	790.5	13	6	20.92	19.95	<44.77
		1	1	20.98	20.01	<44.77
		1	23	20.99	20.02	<44.77
		25	0	20.76	19.79	<44.77
		1	24	20.93	19.96	<44.77
		1	0	21.05	20.08	<44.77
	793.0	13	6	21.03	20.06	<44.77
		1	1	21.11	20.14	<44.77
		1	23	20.95	19.98	<44.77
		25	0	20.77	19.80	<44.77
		1	24	20.92	19.95	<44.77
		1	0	21.08	20.11	<44.77
	795.5	13	6	20.93	19.96	<44.77
		1	1	20.62	19.65	<44.77
		1	23	20.50	19.53	<44.77
		25	0	20.76	19.79	<44.77
		1	24	20.69	19.72	<44.77
		1	0	20.91	19.94	<44.77
10	793	26	13	20.94	19.97	<44.77
		1	1	21.01	20.04	<44.77
		1	50	20.87	19.90	<44.77
		52	0	20.81	19.84	<44.77
		1	51	20.89	19.92	<44.77
		1	0	21.03	20.06	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

Channel Bandwidth (MHz)	Frequency (MHz)	RB Size	RB Offset	Output Power (dBm)	ERP (dBm)	Limit (dBm)
CP-OFDM 256QAM						
5	790.5	13	6	17.99	17.02	<44.77
		1	1	17.48	16.51	<44.77
		1	23	17.44	16.47	<44.77
		25	0	17.84	16.87	<44.77
		1	24	17.49	16.52	<44.77
		1	0	17.48	16.51	<44.77
	793.0	13	6	18.17	17.20	<44.77
		1	1	17.53	16.56	<44.77
		1	23	17.50	16.53	<44.77
		25	0	17.84	16.87	<44.77
		1	24	17.61	16.64	<44.77
		1	0	17.56	16.59	<44.77
	795.5	13	6	18.09	17.12	<44.77
		1	1	17.78	16.81	<44.77
		1	23	17.64	16.67	<44.77
		25	0	17.88	16.91	<44.77
		1	24	17.64	16.67	<44.77
		1	0	17.80	16.83	<44.77
10	793	26	13	17.85	16.88	<44.77
		1	1	17.47	16.50	<44.77
		1	50	17.65	16.68	<44.77
		52	0	17.87	16.90	<44.77
		1	51	17.58	16.61	<44.77
		1	0	17.45	16.48	<44.77
Note: The ERP (dBm) = Output Power (dBm) + Antenna Gain (dBi) - 2.15						

A.4 Band Edge Test Result

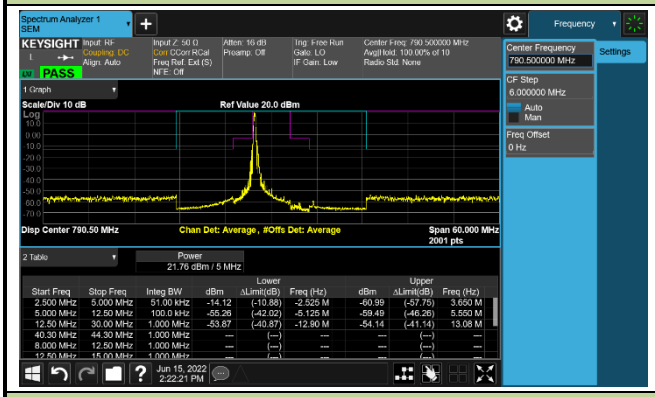
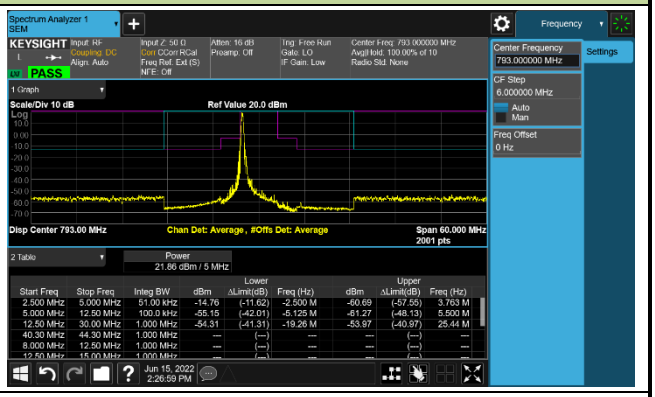
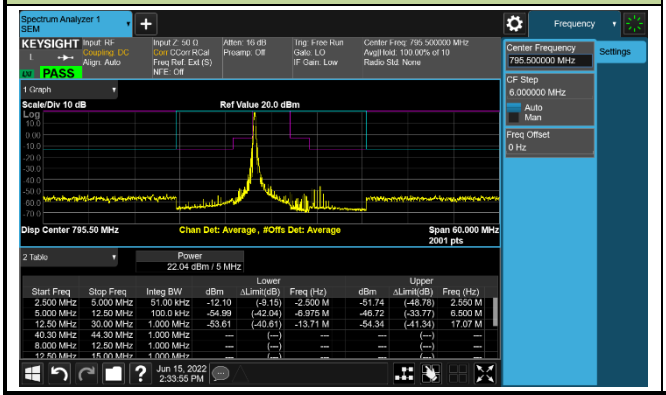
Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/06/06	Test Band	NR n14

5MHz Channel Bandwidth 1RB	
Lower ACP	Upper ACP
	
10MHz Channel Bandwidth 1RB	
Lower ACP	Upper ACP
	

5MHz Channel Bandwidth Full RB	
Lower ACP	Upper ACP
	
10MHz Channel Bandwidth Full RB	
Middle ACP	
	

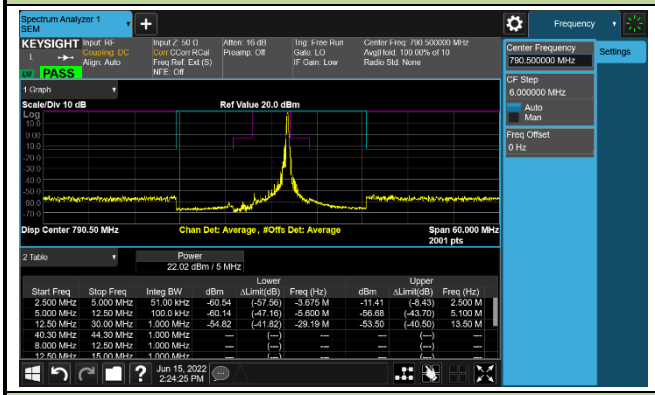
A.5 Emisson Mask Test Result

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/06/15	Test Band	NR n14

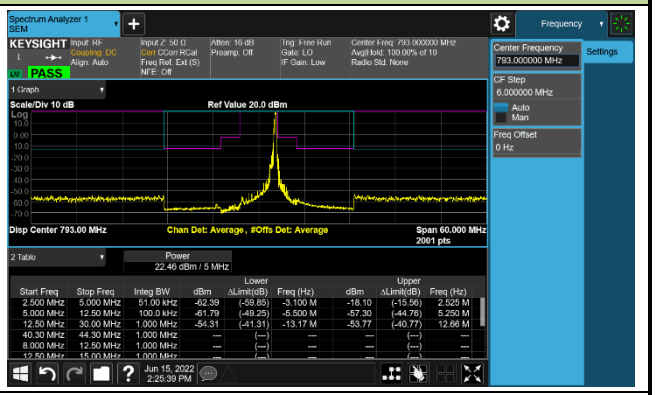
5MHz Channel Bandwidth 1RB@0	
Low Channel	Middle Channel
	
High Channel	
	

5MHz Channel Bandwidth 1RB@24

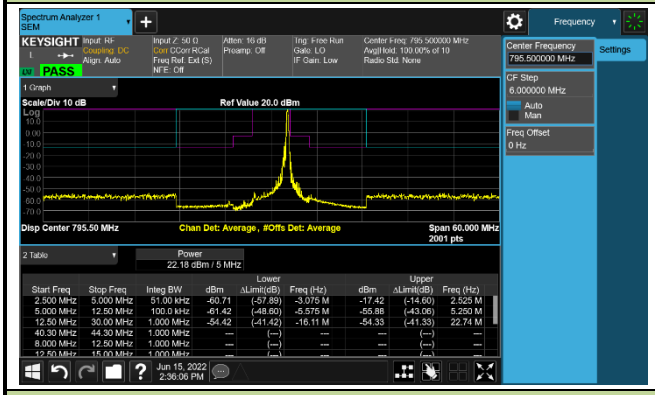
Low Channel



Middle Channel

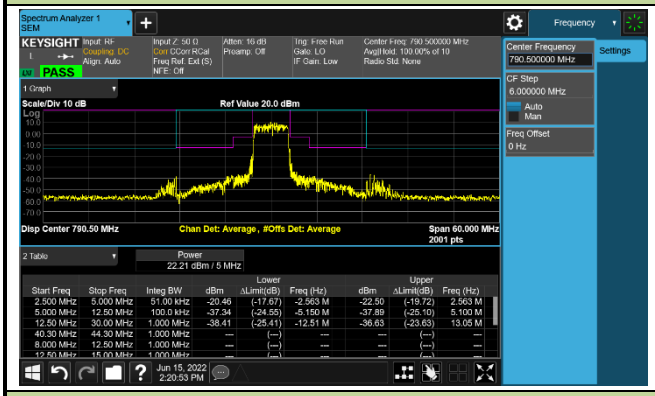


High Channel

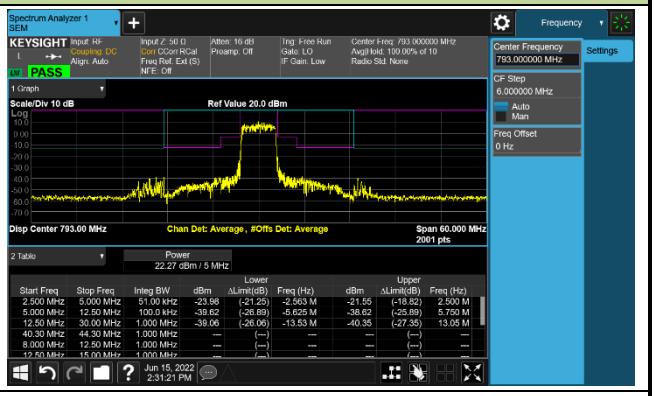


5MHz Channel Bandwidth Full RB

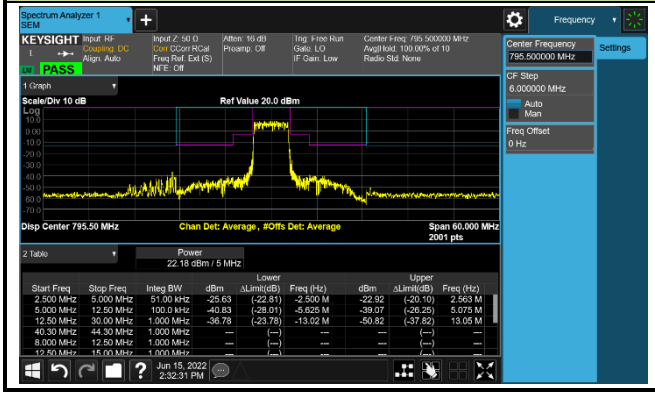
Low Channel

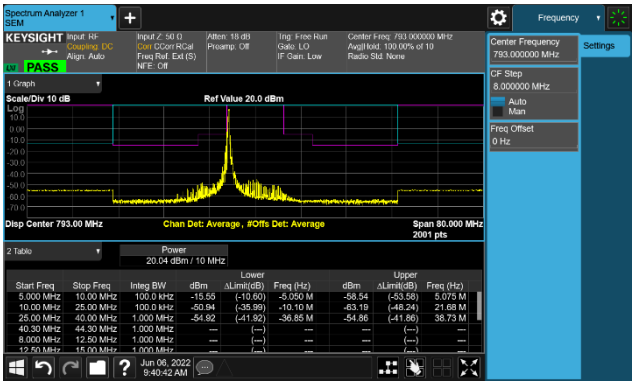
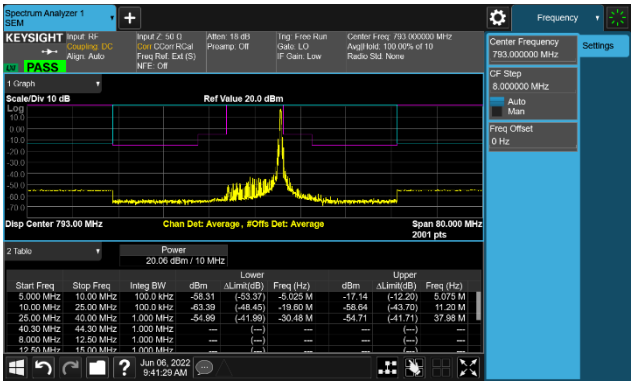
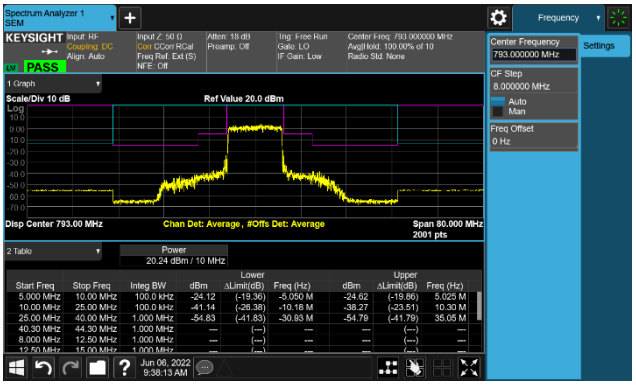


Middle Channel



High Channel



10MHz Channel Bandwidth 1RB@0	10MHz Channel Bandwidth 1RB@49
	
10MHz Channel Bandwidth Full RB	
	

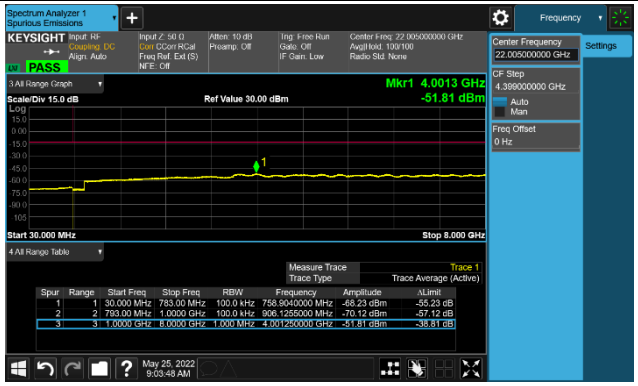
A.6 Conducted Supurious Emissions Test Result

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/25	Test Band	NR n14

Frequency (MHz)	Channel Bandwidth (MHz)	Frequency Range (MHz)	Max Spurious Emissions (dBm)	Limit (dBm)	Result
QPSK					
790.5	5	30 ~ 8000	-51.81	≤ -13.00	Pass
793.0	5	30 ~ 8000	-44.17	≤ -13.00	Pass
795.5	5	30 ~ 8000	-41.03	≤ -13.00	Pass
793.0	10	30 ~ 8000	-59.00	≤ -13.00	Pass

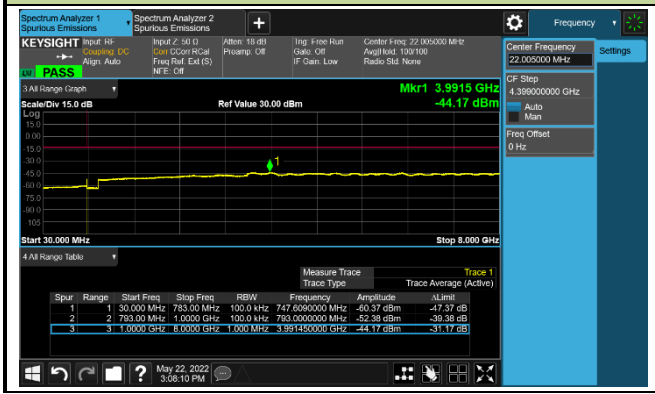
5MHz Channel Bandwidth

Low Channel

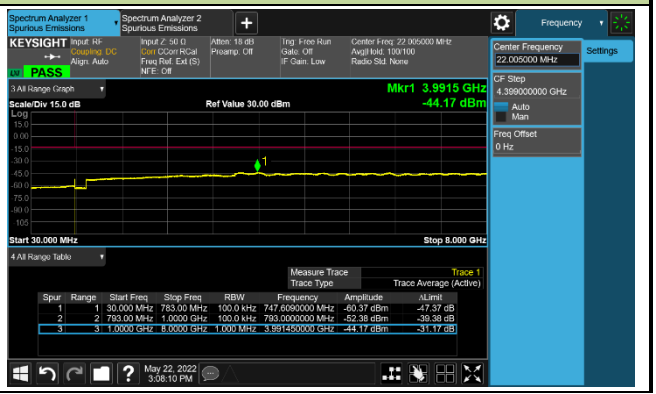


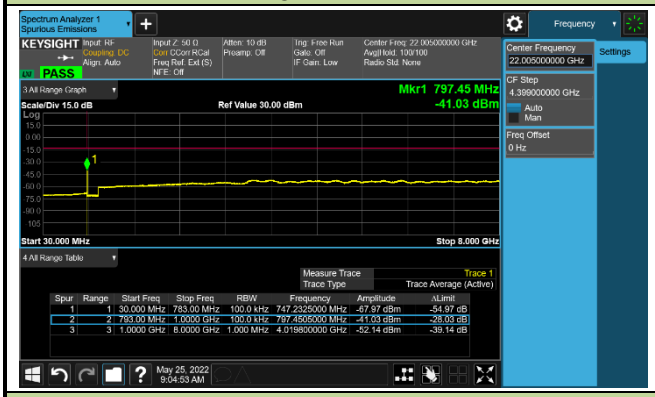
1559 - 1610MHz

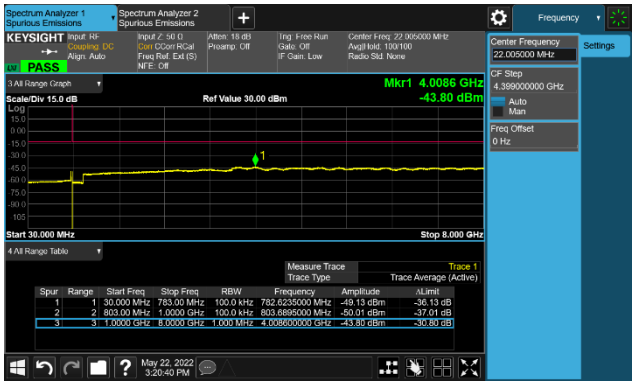
Middle Channel



1559 - 1610MHz



High Channel	1559 - 1610MHz
	

10MHz Channel Bandwidth	
Middle Channel	1559 - 1610MHz
	

A.7 Radiated Spurious Emissions Test Result

Test Site	WZ-AC2	Test Engineer	Lucas Wang
Test Date	2022/05/22	Test Band	NR n14, 5MHz, 1RB

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
54.7	14.3	20.3	34.6	82.3	-47.7	Peak	Horizontal
870.5	15.6	31.1	46.7	82.3	-35.6	Peak	Horizontal
53.3	14.9	20.5	35.4	82.3	-46.9	Peak	Vertical
888.0	15.6	31.1	46.7	82.3	-35.6	Peak	Vertical
1603.5	39.3	-5.8	33.5	55.3	-21.8	Peak	Horizontal
14336.5	33.2	19.7	52.9	82.3	-29.4	Peak	Horizontal
1603.5	39.7	-5.8	33.9	55.3	-21.4	Peak	Vertical
14838.0	34.1	20.2	54.3	82.3	-28.0	Peak	Vertical
Middle Channel							
48.9	14.1	20.7	34.8	82.3	-47.5	Peak	Horizontal
686.7	17.6	28.5	46.1	82.3	-36.2	Peak	Horizontal
32.4	20.9	17.5	38.4	82.3	-43.9	Peak	Vertical
576.6	16.5	26.6	43.1	82.3	-39.2	Peak	Vertical
1603.5	39.5	-5.8	33.7	55.3	-21.6	Peak	Horizontal
14625.5	34.8	19.6	54.4	82.3	-27.9	Peak	Horizontal
1595	39.9	-5.8	34.1	55.3	-21.2	Peak	Vertical
1782	50.4	-5.8	44.6	82.3	-37.7	Peak	Vertical
High Channel							
51.8	14.2	20.7	34.9	82.3	-47.4	Peak	Horizontal
956.4	15.9	31.4	47.3	82.3	-35.0	Peak	Horizontal
44.1	13.4	20.5	33.9	82.3	-48.4	Peak	Vertical
867.1	15.3	31.1	46.4	82.3	-35.9	Peak	Vertical
1586.5	37.5	-5.7	31.8	55.3	-23.5	Peak	Horizontal
14863.5	33.6	20.2	53.8	82.3	-28.5	Peak	Horizontal
1603.5	39.5	-5.8	33.7	55.3	-21.6	Peak	Vertical
14872.0	33.6	20.0	53.6	82.3	-28.7	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).							

Test Site	WZ-AC2	Test Engineer	Lucas Wang
Test Date	2022/05/22	Test Band	NR n14_ENDC, 5MHz, 1RB

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
Low Channel							
59.1	3.5	22.4	25.9	82.3	-56.4	Peak	Horizontal
871.0	4.2	28.8	33.0	82.3	-49.3	Peak	Horizontal
60.6	12.7	20.6	33.3	82.3	-49.0	Peak	Vertical
898.2	4.5	22.5	27.0	82.3	-55.3	Peak	Vertical
9194.0	35.2	4.3	39.5	55.3	-15.8	Peak	Horizontal
14574.5	36.4	17.5	53.9	82.3	-28.4	Peak	Horizontal
7315.5	35.2	5.3	40.5	55.3	-14.8	Peak	Vertical
14897.5	37.2	20.4	57.6	82.3	-24.7	Peak	Vertical
Middle Channel							
60.1	2.8	22.4	25.2	82.3	-57.1	Peak	Horizontal
615.9	3.4	30.8	34.2	82.3	-48.1	Peak	Horizontal
60.1	11.2	22.5	33.7	82.3	-48.6	Peak	Vertical
824.9	4.3	30.8	35.1	82.3	-47.2	Peak	Vertical
7528.0	35.6	0.3	35.9	55.3	-19.4	Peak	Horizontal
14863.5	36.3	19.7	56.0	82.3	-26.3	Peak	Horizontal
7052.0	35.7	-1.5	34.2	55.3	-21.1	Peak	Vertical
14702.0	36.4	20.2	56.6	82.3	-25.7	Peak	Vertical
High Channel							
52.3	3.9	22.3	26.2	82.3	-56.1	Peak	Horizontal
811.3	4.8	30.3	35.1	82.3	-47.2	Peak	Horizontal
32.4	13.2	22.5	35.7	82.3	-46.6	Peak	Vertical
60.1	11.0	31.1	42.1	82.3	-40.2	Peak	Vertical
8021.0	34.9	4.4	39.3	55.3	-16.0	Peak	Horizontal
14846.5	36.3	20.2	56.5	82.3	-25.8	Peak	Horizontal
7060.5	35.8	-0.9	34.9	55.3	-20.4	Peak	Vertical
14115.5	35.6	20.4	56.0	82.3	-26.3	Peak	Vertical
Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).							

Appendix B - Test Setup Photograph

Refer to “2303RSU050-UT” file.

Appendix C - EUT Photograph

Refer to “2303RSU050-UE” file.

The End