RF MEASUREMENT REPORT

FCC ID:	XMR2022RG520NNA
Application:	Quectel Wireless Solutions Co., Ltd
Product:	5G Sub-6 GHz LGA Module
Model No.:	RG520N-NA
Brand Name:	Quectel
FCC Rule Part(s):	Part 2, 22 (H), 24 (E), 27
Test Procedure(s):	ANSI C63.26: 2015
Result:	Complies
Test Date:	2022-04-27 ~ 2022-08-18

Reviewed By: Sunny Sun

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2204RSU047-U6	Rev. 01	Initial Report	2022-08-18	Valid

CONTENTS

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	
☐	**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, 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	n2, n5, n7, n12, n13, n14, n25, n26, n30, n38, n41, n66, n71, n77, n78
SA UL MIMO Band	n38, n41, n77, n78
EN-DC Band	n2A, n5A, n7A, n12A, n14A, n25, n30A, n38, n41A, n66, n71, n77, n78
HPUE Band	n38, n41, n77, n78 (SA & UL MIMO)
FDD TX Frequency Range	n2: 1850 ~ 1910 MHz; n5: 824 ~ 849 MHz; n7: 2500 ~ 2570 MHz n12: 699 ~ 716 MHz; n13: 777 ~ 787 MHz; n14: 788 ~ 798 MHz n25: 1850 ~ 1915 MHz; n26: 814-849 MHz; n30: 2305 ~ 2315 MHz n66: 1710 ~ 1780 MHz; n71: 663 ~ 698MHz
FDD RX Frequency Range	n2: 1930 ~ 1990 MHz; n5: 869 ~ 894 MHz; n7: 2620 ~ 2690 MHz n12: 729 ~ 746 MHz; n13: 746 ~ 756 MHz; n14: 758 ~ 768 MHz n25: 1930 ~ 1995 MHz; n26: 859-849 MHz; n30: 2350 ~ 2360 MHz n66: 2110 ~ 2200 MHz; n71: 617 ~ 652MHz
TDD Frequency Range	n38: 2570 ~ 2620 MHz; n41: 2496 ~ 2690 MHz n77: 3700 ~ 3980MHz; n78: 3300 ~ 3800MHz
Support Bandwidth	n2, n5, n26, n71: 5, 10, 15, 20MHz; n7, n25: 5, 10, 15, 20, 25, 30, 40MHz n66: 5, 10, 15, 20, 30, 40MHz; n12: 5, 10, 15MHz; n13: 5, 10MHz n38: 10, 15, 20, 30, 40MHz; n41: 20, 30, 40, 50, 60, 70, 80, 90, 100MHz n77, n78: 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100MHz
SCS for NR cell	FDD Band: 15kHz; TDD Band: 30kHz
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	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 2, Part 22, Part 24, Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices
- FCC KDB 412172 D01 v01r01: Determining ERP and EIRP
- FCC KDB 662911 D01 v02r01: Multiple Transmitter Output

1.8. Device Capabilities

This device contains 5G NR SA & EN-DC the following capabilities:

Working on NR Band n2, n5, n7, n12, n13, n25, n26, n30, n38, n41, n66, n71, n77, n78.

n77 (3300 ~ 4200 MHz) overlaps the entire frequency range of n78 (3300 ~ 3800 MHz). Therefore, test data provided in this report covers n78 as well as n77.

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.

UL MIMO mode only support CP-OFDM.

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, and BPSK modulations.

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

2. Test Configuration

2.1. Test Mode

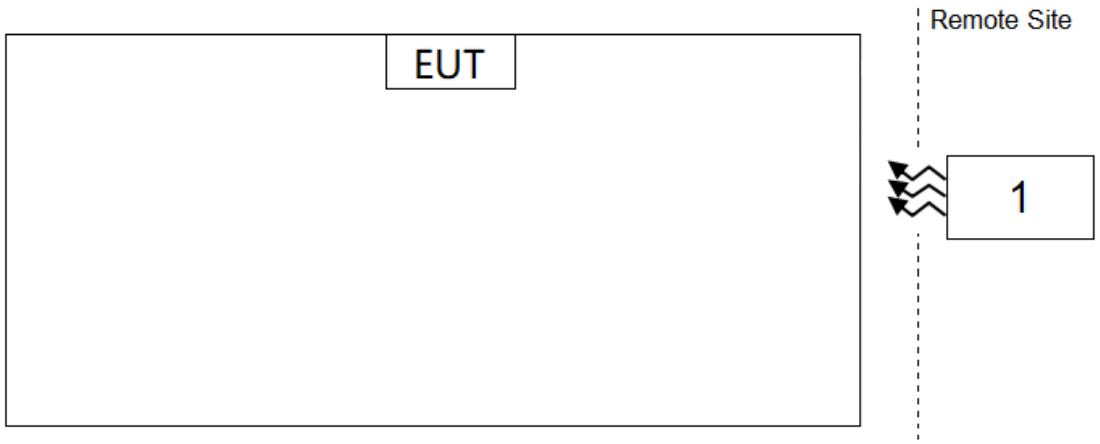
Test Item	Test Channel	Channel Bandwidth (MHz)	Modulation Type	RB#
n2, n5, n26, n71				
Output Power & EIRP	L, M, H	5, 10, 15, 20	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	20	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	5, 10, 15, 20	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	20	QPSK	Full RB
Band Edge Measurements	L, H	5, 10, 15, 20	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	5, 10, 15, 20	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	5	QPSK	1 RB
n7, n25				
Output Power & EIRP	L, M, H	5, 10, 15, 20, 25, 30, 40	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	5, 10, 15, 20, 25, 30, 40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	40	QPSK	Full RB
Band Edge Measurements	L, H	5, 10, 15, 20, 25, 30, 40	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	5, 10, 15, 20, 25, 30, 40	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	5	QPSK	1 RB

n12				
Output Power & EIRP	L, M, H	5, 10, 15	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	15	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	5, 10, 15	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	15	QPSK	Full RB
Band Edge Measurements	L, H	5, 10, 15	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	5, 10, 15	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	5	QPSK	1 RB
n13, n14, n30				
Output Power & EIRP	L, M, H	5, 10	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	10	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	10	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	10	QPSK	Full RB
Band Edge Measurements	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

n38				
Output Power & EIRP	L, M, H	10, 15, 20, 30, 40	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	40	QPSK	Full RB
Band Edge Measurements	L, H	10, 15, 20, 30, 40	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	10, 15, 20, 30, 40	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	10	QPSK	1 RB
n41				
Output Power & EIRP	L, M, H	20, 30, 40, 50, 60, 70, 80, 90, 100	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	100	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	100	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	100	QPSK	Full RB
Band Edge Measurements	L, H	20, 30, 40, 50, 60, 70, 80, 90, 100	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	20, 30, 40, 50, 60, 70, 80, 90, 100	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	20	QPSK	1 RB

n77				
Output Power & EIRP	L, M, H	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	100	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	100	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	100	QPSK	Full RB
Band Edge Measurements	L, H	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	10, 20, 30, 40, 50, 60, 70, 80, 90, 100	QPSK	1 RB
Radiated Spurious Emissions	L, M, H	10	QPSK	1 RB
n66				
Output Power & EIRP	L, M, H	5, 10, 15, 20, 30, 40	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	1/Half/Full RB
Peak to Average Ratio	M	40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Emission Bandwidth	M	5, 10, 15, 20, 30, 40	QPSK, 16QAM, 64QAM, 256QAM	Full RB
Frequency Stability	M	40	QPSK	Full RB
Band Edge Measurements	L, H	5, 10, 15, 20, 30, 40	QPSK	1 RB/Full RB
Conducted Spurious Emissions	L, M, H	5, 10, 15, 20, 30, 40	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	Test Result	Reference
2.1049	Occupied Bandwidth	Conducted	Pass	Section 5.2
2.1055, 22.355 24.235, 27.54	Frequency Stability		Pass	Section 5.3
27.50(b)(9), (c)(10) 22.913(a)(5)	Equivalent Radiated Power		Pass	Section 5.4
24.232(c), 27.50(d)(4),(h)(2),(j)(3)	Equivalent Isotropic Radiated Power			
24.232(d), 27.50(d)(5)	Peak to Average Ratio		Pass	Section 5.5
2.1051, 22.917(a) 24.238(a), 27.53(g),(h),(l)(2),(m)	Band Edge		Pass	Section 5.6, 5.7
2.1051, 22.917(a) 24.238(a), 27.53(g),(h),(l)(2), (m)	Spurious Emission			
2.1051, 22.917(a) 24.238(a), 27.53(g),(h),(l)(2), (m)	Spurious Emission	Radiated	Pass	Section 5.8

Notes:

1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
2) All supported modulation types were evaluated. The worst-case emission of modulation was selected. Therefore, the Frequency Stability, Channel Band Edge, Conducted & Radiated 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.

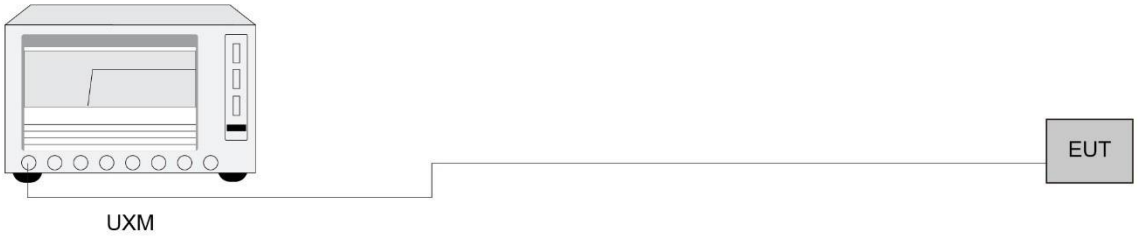
5.2.2. Test Procedure

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

5.3.2. Test Procedure

ANSI C63.26-2015 - Section 5.6

5.3.3. Test Setting

Frequency Stability Under Temperature Variations:

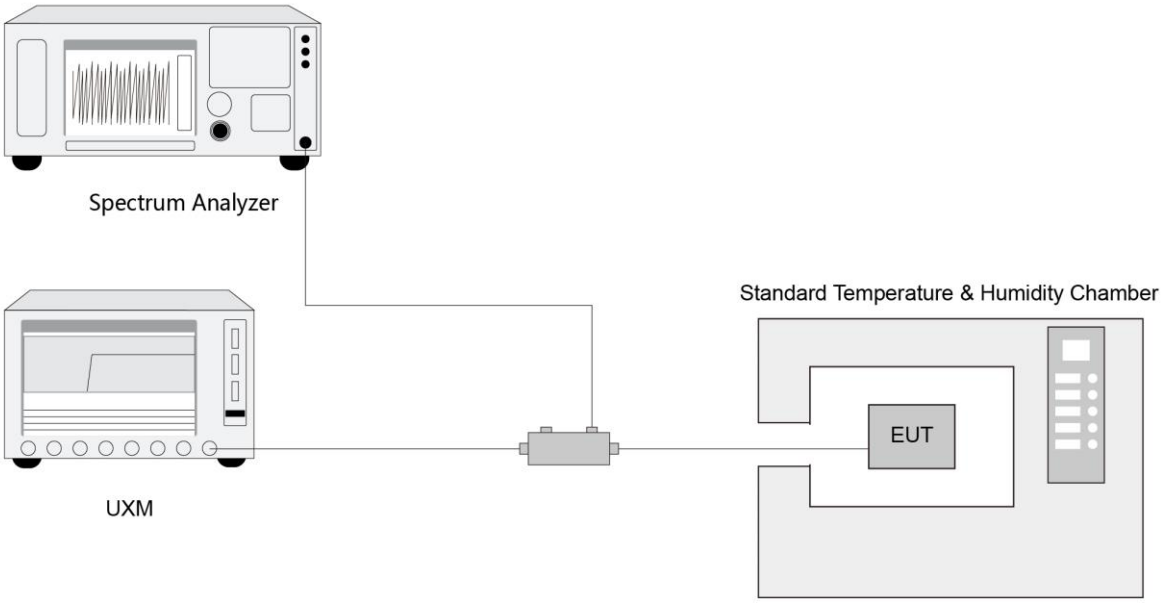
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain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

The ERP of mobile transmitters must not exceed 7 watts for n5 & n26.

The ERP of mobile transmitters must not exceed 30 watts for n13.

The ERP of mobile transmitters must not exceed 3 watts for n12 & n71.

The EIRP of mobile transmitters must not exceed 2 watts for n2 & n7 & n25 & n38 & n41.

The EIRP of mobile transmitters must not exceed 1 watt for n66 & n77.

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

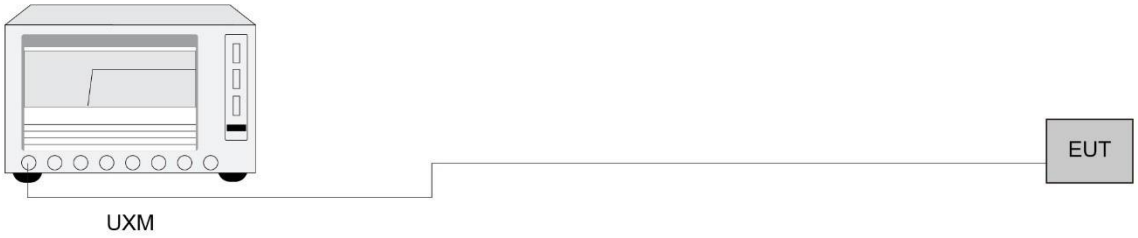
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

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. Peak to Average Ratio Measurement

5.5.1. Test Limit

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

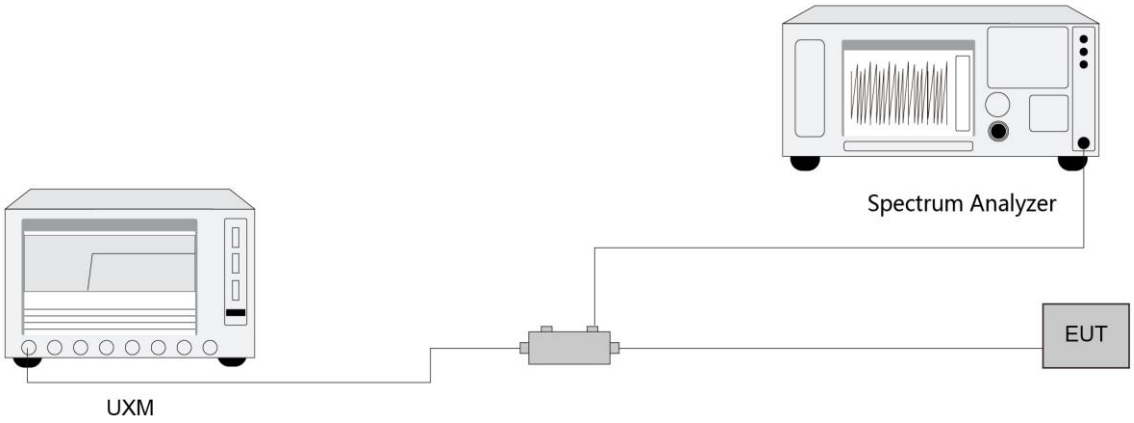
5.5.2. Test Procedure

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

5.5.3. Test Setting

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

5.5.4. Test Setup



5.5.5. Test Result

Refer to Appendix A.4.

5.6. Band Edge Measurement

5.6.1. Test Limit

22.917(a), 24.238 (a), 27.53 (g) (h) (l)(2)

The FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53(m)(4)

For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

5.6.2. Test Procedure

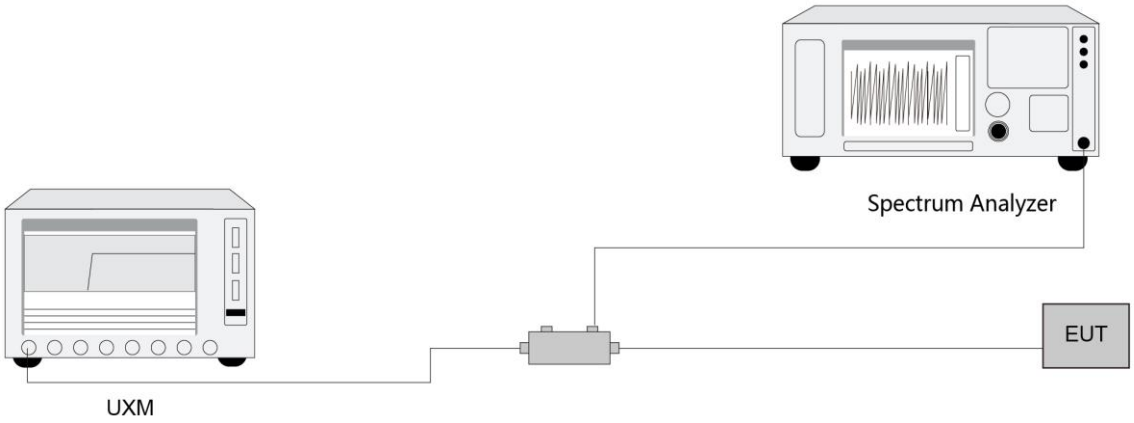
ANSI C63.26-2015 - Section 5.7

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.

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

For n7, n41 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 55 + 10 log(P) dB.

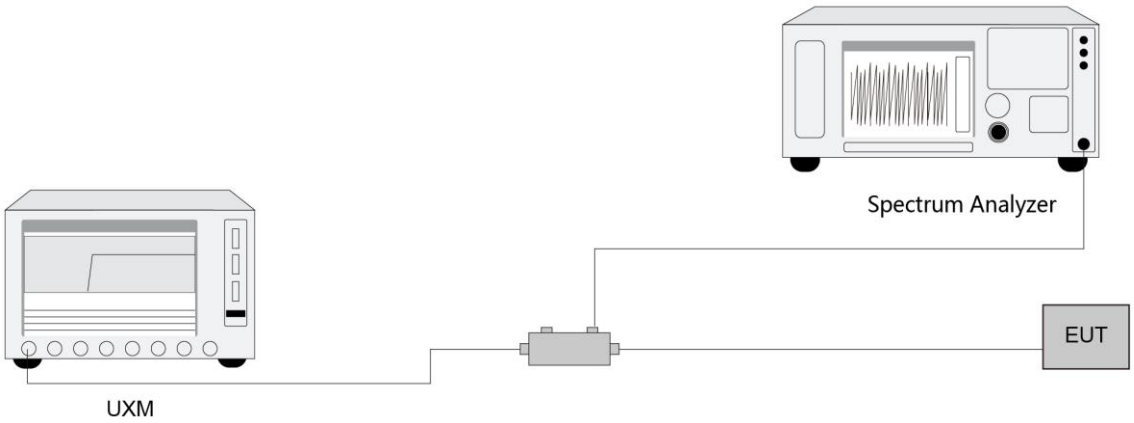
5.7.2. Test Procedure

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

For n7, n41, the powerof any emission outside of theauthorized operating frequency ranges must be attenuated below the transmitting power (P) by a factorof at least 55 + 10 log(P) dB. The emission limit equal to -25dBm.

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 70.3dBμV/m.

5.8.2. Test Procedure

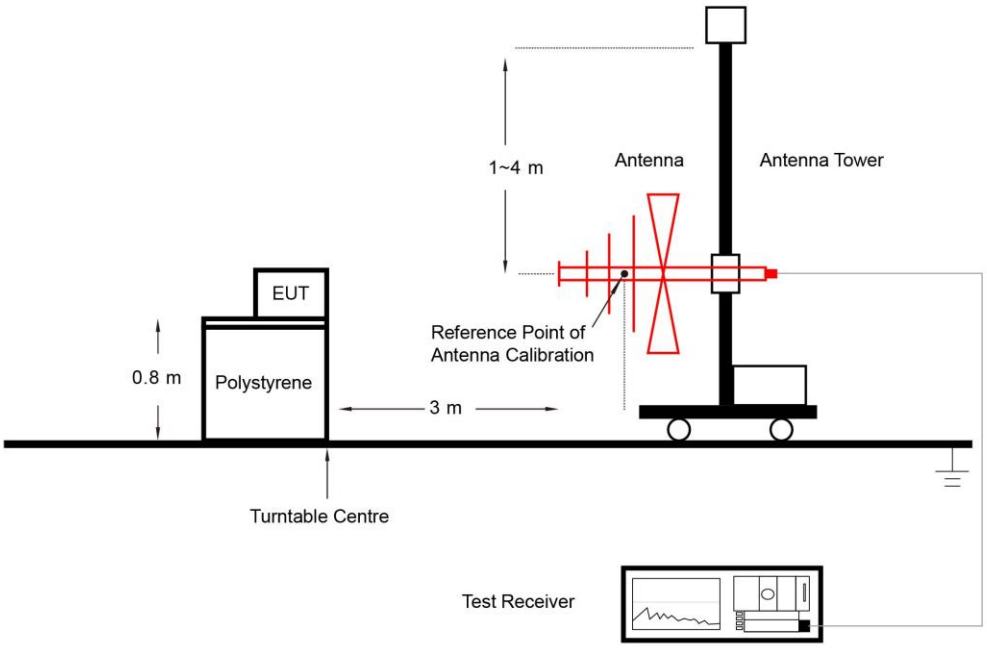
ANSI C63.26-2015 - Section 5.2.7 & 5.5

5.8.3. Test Setting

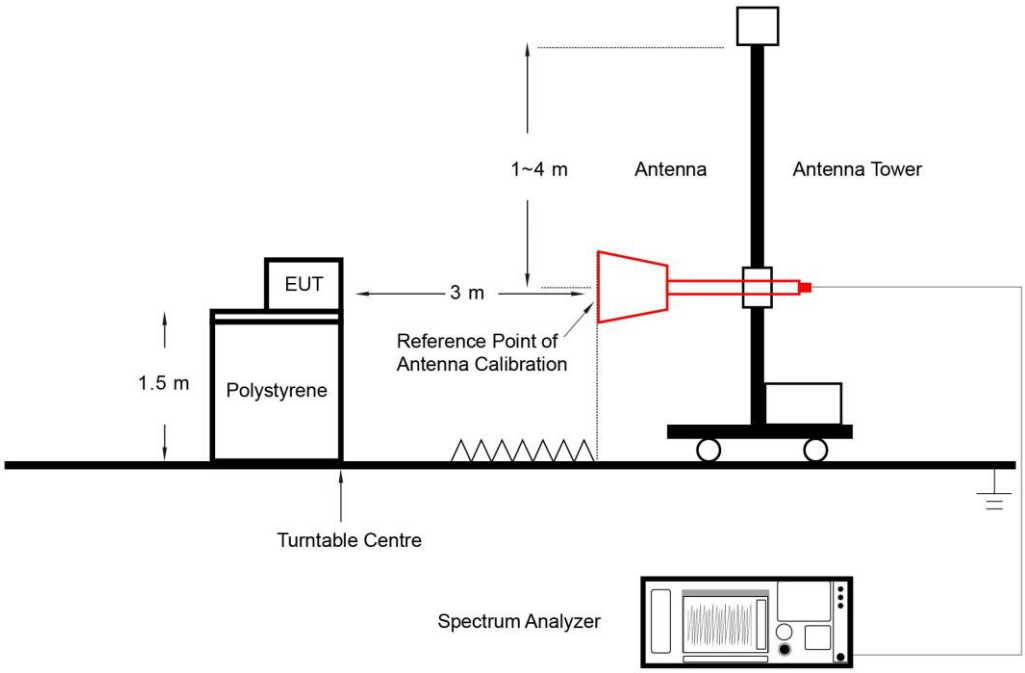
1. RBW = 1MHz
2. VBW≥ 3*RBW
3. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period)
4. Detector = Peak
5. Trace mode = max hold
6. The trace was allowed to stabilize

5.8.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



5.8.5. Test Result

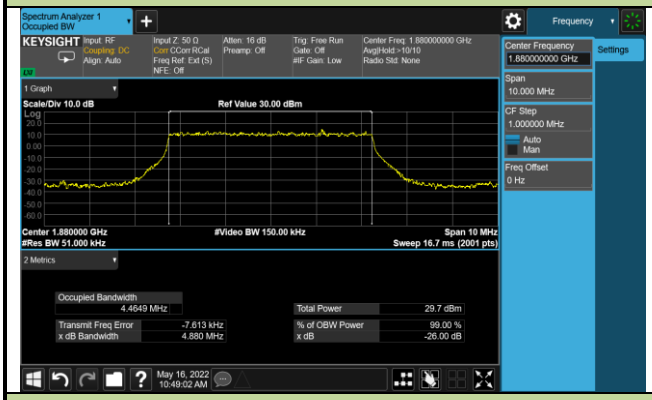
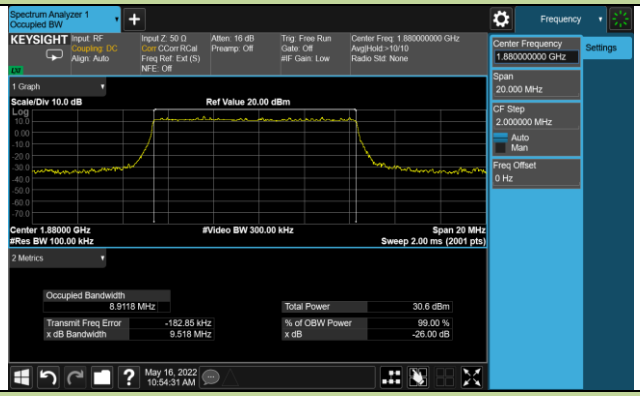
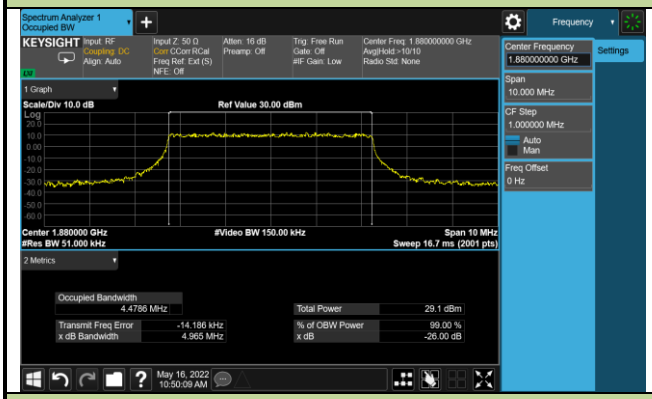
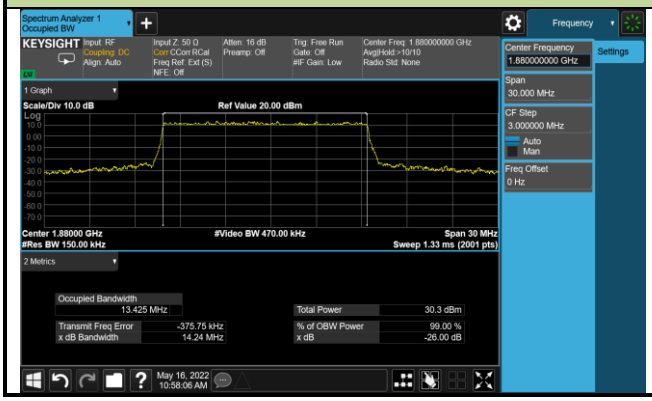
Refer to Appendix A.7.

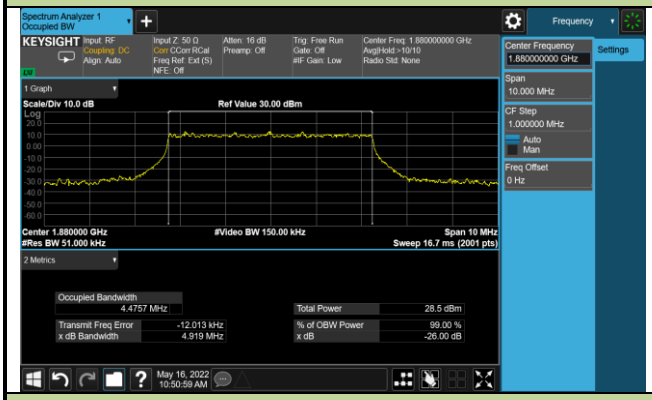
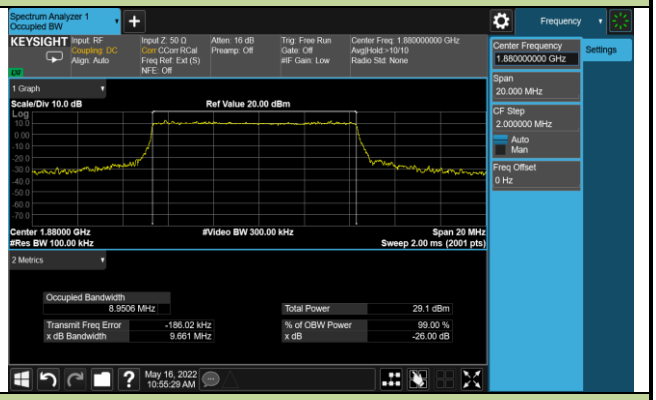
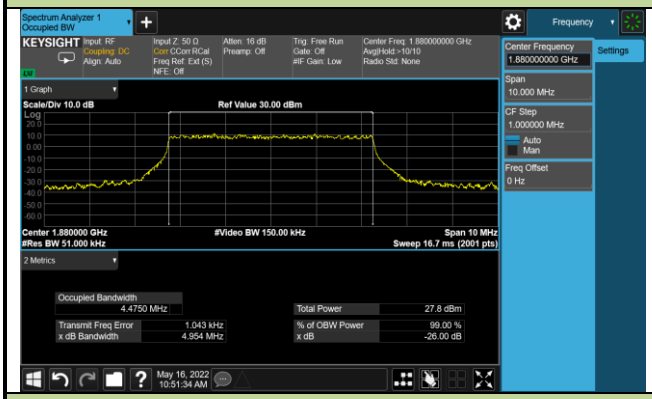
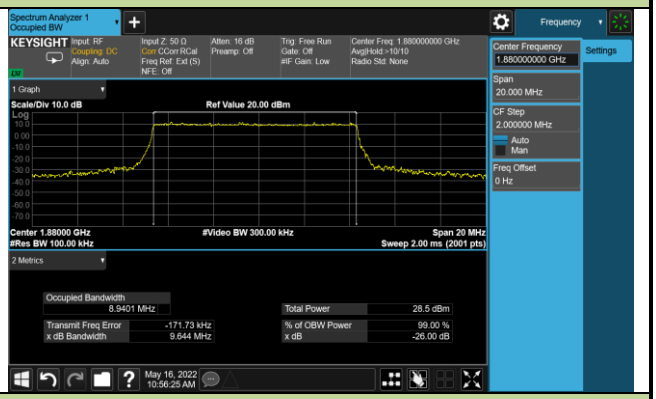
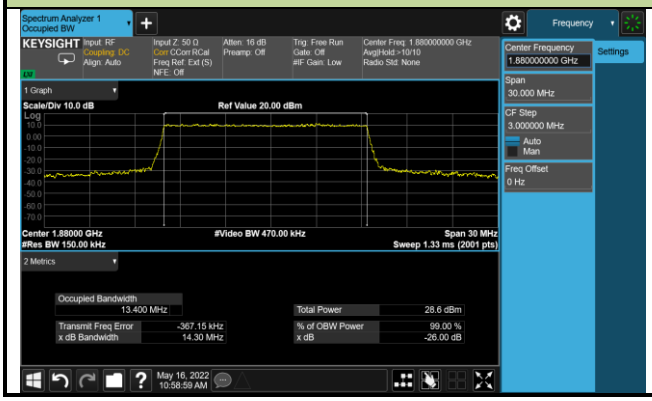
Appendix A - Test Result

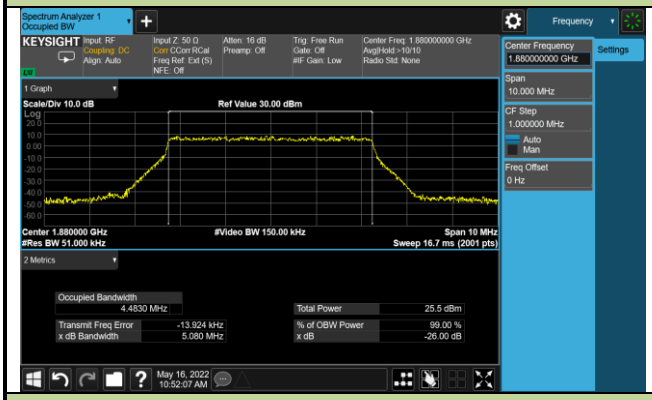
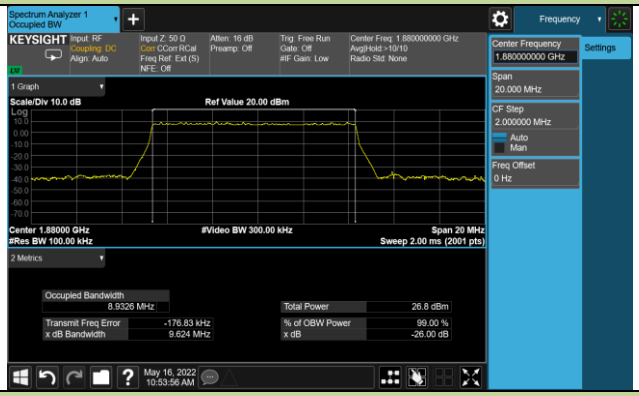
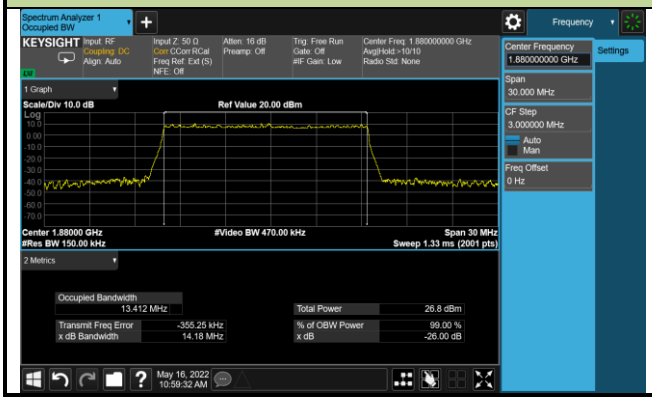
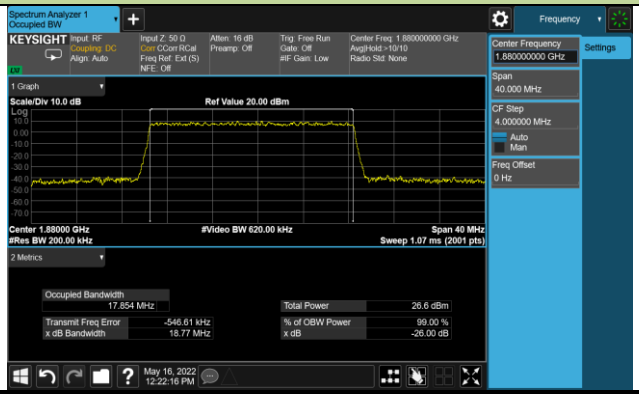
A.1 Occupied Bandwidth Test Result

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/16	Test Band	n2

Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
PI/2 BPSK		
1882.5	5	4.46
1882.5	10	8.91
1882.5	15	13.39
1882.5	20	17.86
QPSK		
1882.5	5	4.48
1882.5	10	8.91
1882.5	15	13.43
1882.5	20	17.87
16QAM		
1882.5	5	4.48
1882.5	10	8.95
1882.5	15	13.40
1882.5	20	17.88
64QAM		
1882.5	5	4.48
1882.5	10	8.94
1882.5	15	13.40
1882.5	20	17.85
256QAM		
1882.5	5	4.48
1882.5	10	8.93
1882.5	15	13.41
1882.5	20	17.85

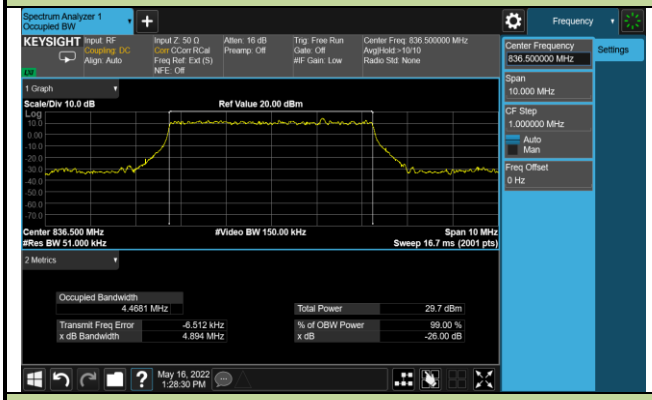
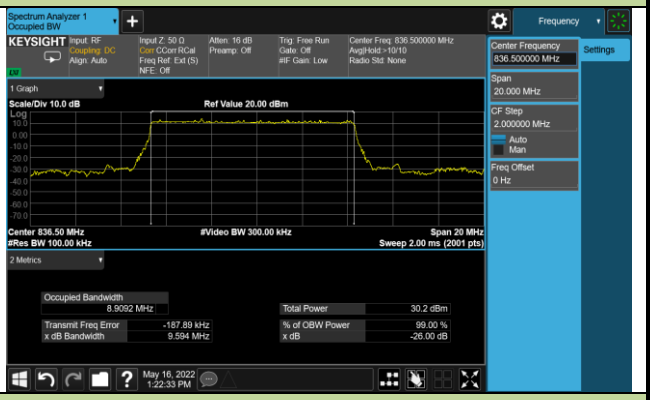
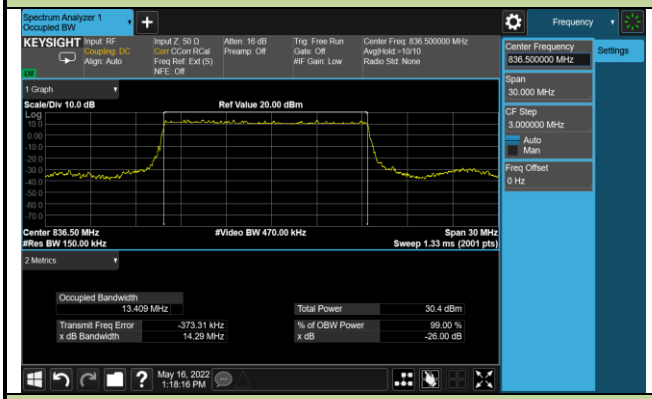
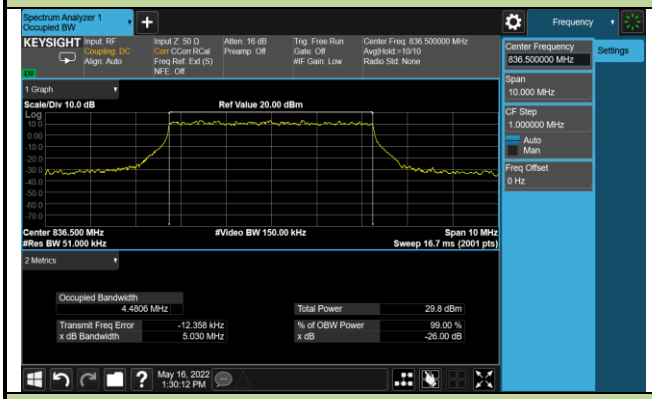
99% Bandwidth - PI/2 BPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
99% Bandwidth - QPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

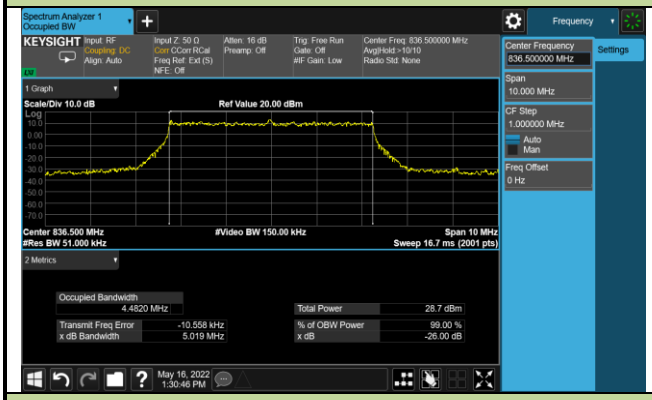
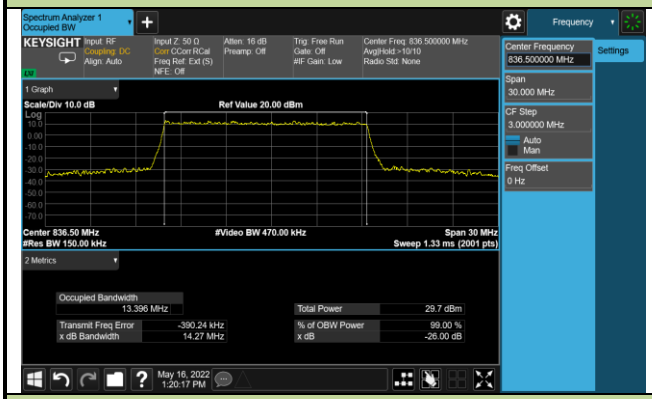
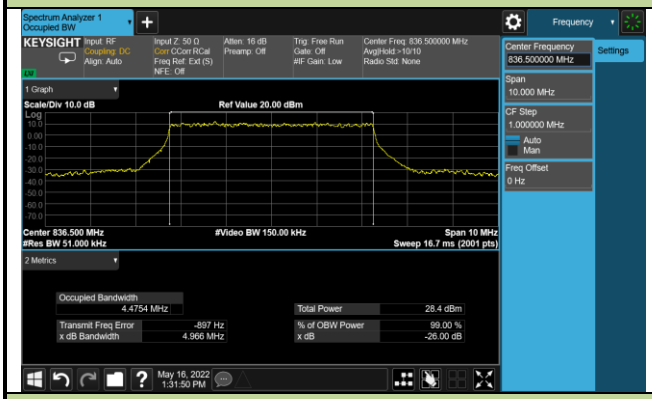
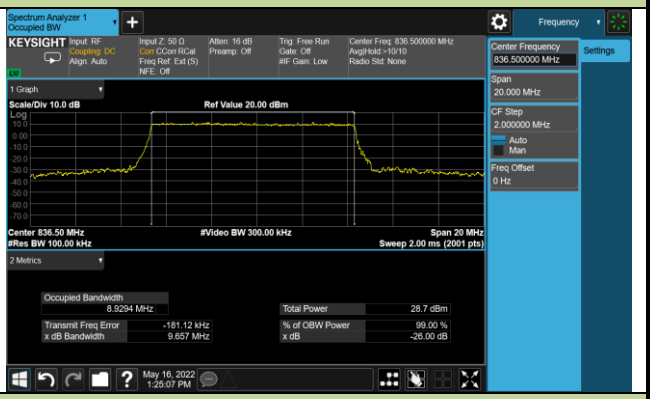
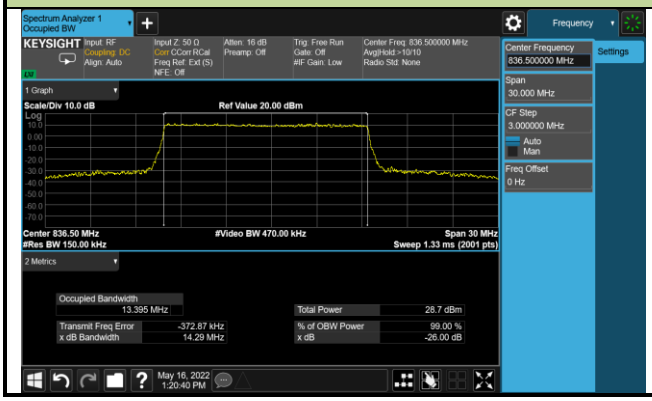
99% Bandwidth - 16QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

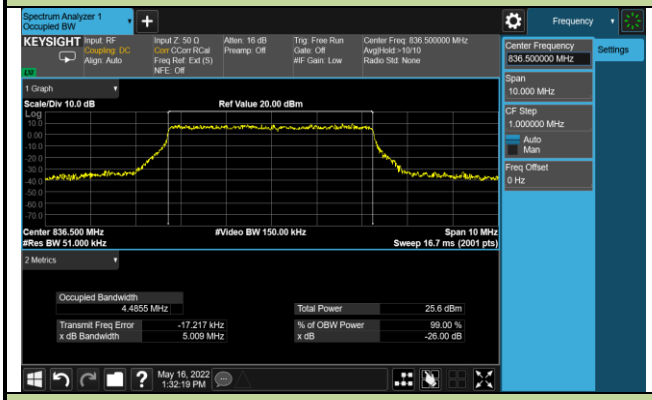
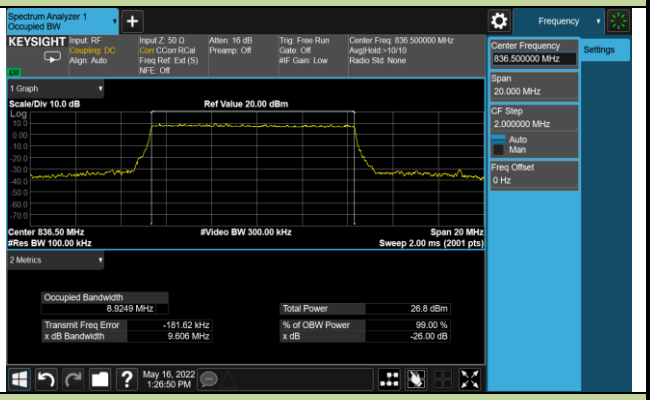
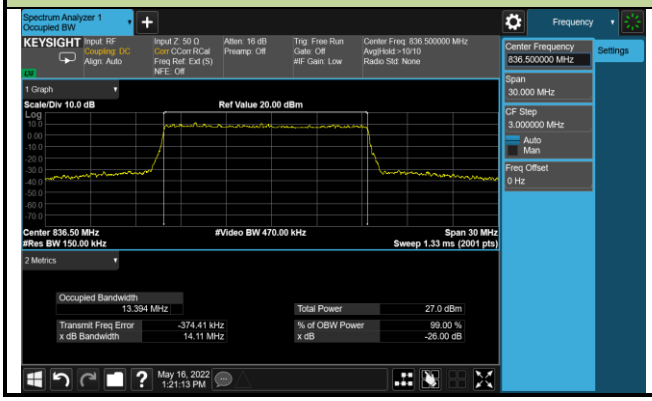
99% Bandwidth - 256QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/16	Test Band	n5

Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
PI/2 BPSK		
836.5	5	4.47
836.5	10	8.91
836.5	15	13.41
836.5	20	17.84
QPSK		
836.5	5	4.48
836.5	10	8.93
836.5	15	13.39
836.5	20	17.84
16QAM		
836.5	5	4.48
836.5	10	8.95
836.5	15	13.40
836.5	20	17.82
64QAM		
836.5	5	4.48
836.5	10	8.93
836.5	15	13.40
836.5	20	17.83
256QAM		
836.5	5	4.49
836.5	10	8.92
836.5	15	13.39
836.5	20	17.83

99% Bandwidth - PI/2 BPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
99% Bandwidth - QPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

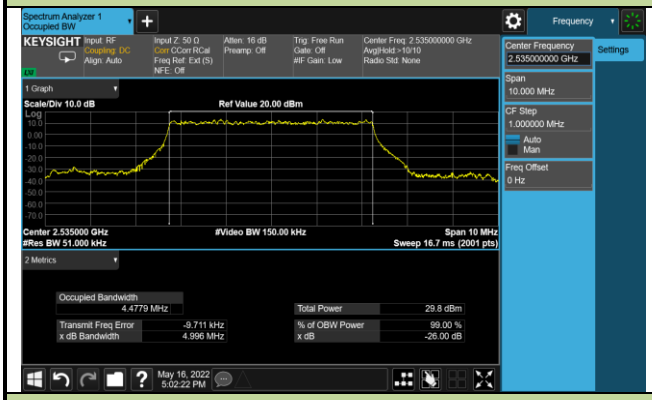
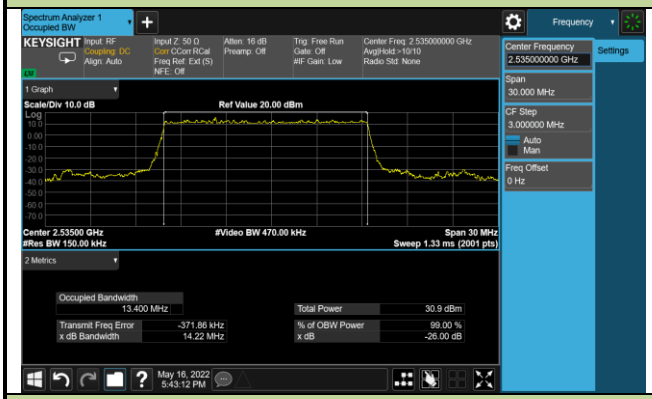
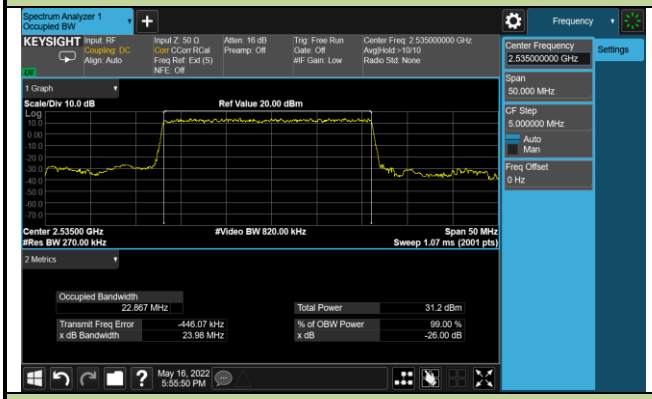
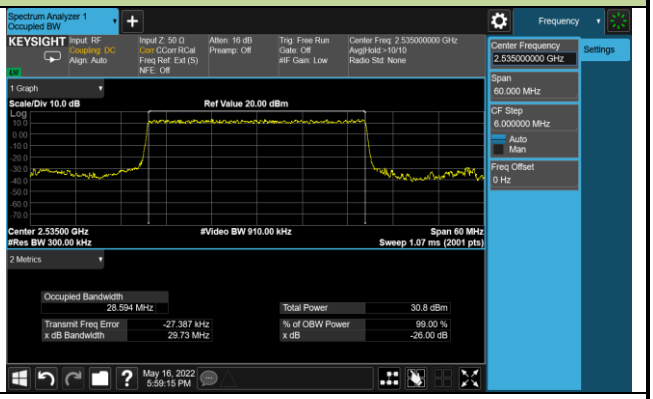
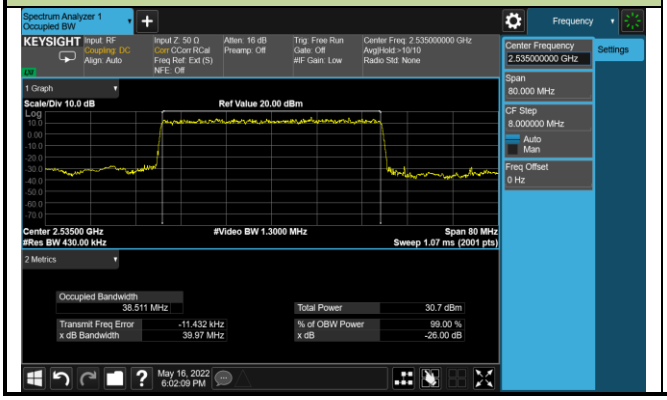
99% Bandwidth - 16QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

99% Bandwidth - 256QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/16	Test Band	n7

Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
PI/2 BPSK		
2535.0	5	4.48
2535.0	10	8.96
2535.0	15	13.40
2535.0	20	17.89
2535.0	25	22.87
2535.0	30	28.59
2535.0	40	38.51
QPSK		
2535.0	5	4.49
2535.0	10	8.91
2535.0	15	13.40
2535.0	20	17.85
2535.0	25	22.93
2535.0	30	28.57
2535.0	40	38.49
16QAM		
2535.0	5	4.48
2535.0	10	8.92
2535.0	15	13.40
2535.0	20	17.88
2535.0	25	22.89
2535.0	30	28.56
2535.0	40	38.60
64QAM		
2535.0	5	4.47
2535.0	10	8.93
2535.0	15	13.42
2535.0	25	17.85
2535.0	30	22.86
2535.0	40	28.62
2535.0	20	38.55

256QAM		
2535.0	5	4.48
2535.0	10	8.93
2535.0	15	13.41
2535.0	20	17.85
2535.0	25	22.83
2535.0	30	28.55
2535.0	40	38.53

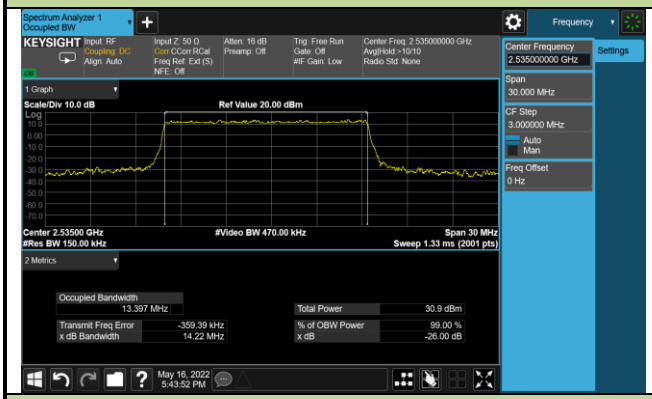
99% Bandwidth - PI/2 BPSK	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
25MHz Channel Bandwidth	30MHz Channel Bandwidth
	
40MHz Channel Bandwidth	
	

99% Bandwidth - QPSK

5MHz Channel Bandwidth

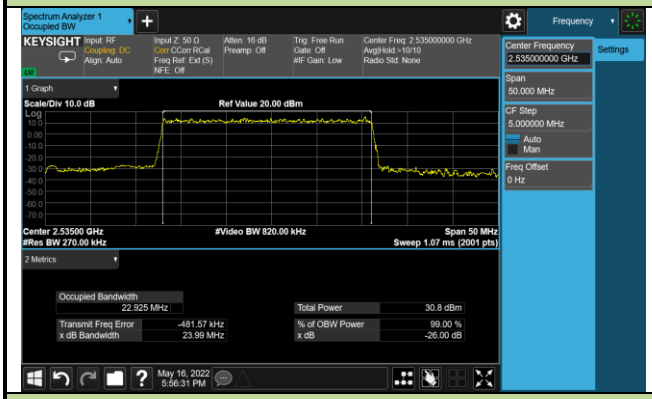
10MHz Channel Bandwidth

15MHz Channel Bandwidth

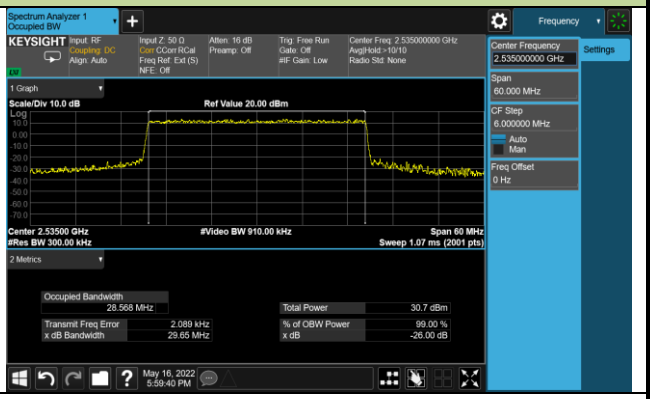


20MHz Channel Bandwidth

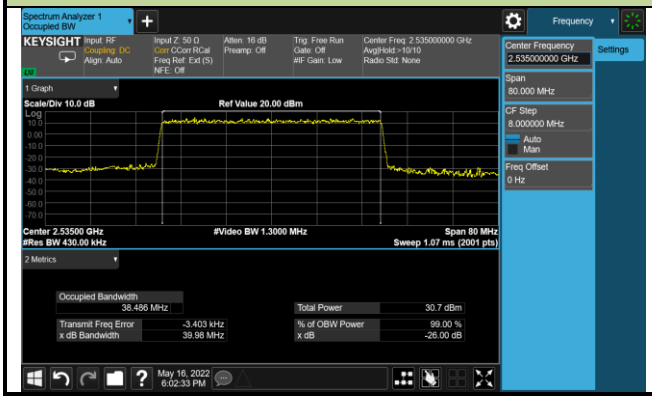
25MHz Channel Bandwidth

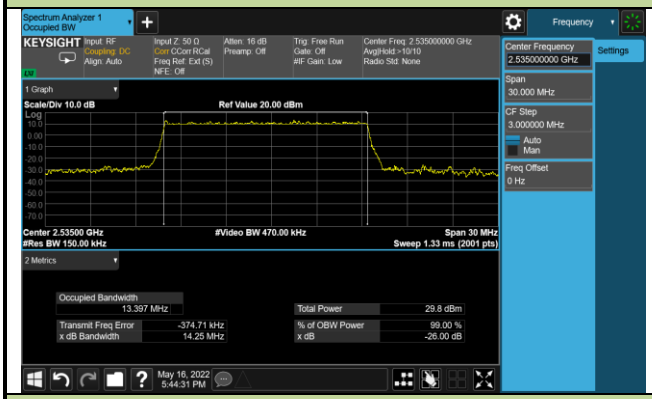
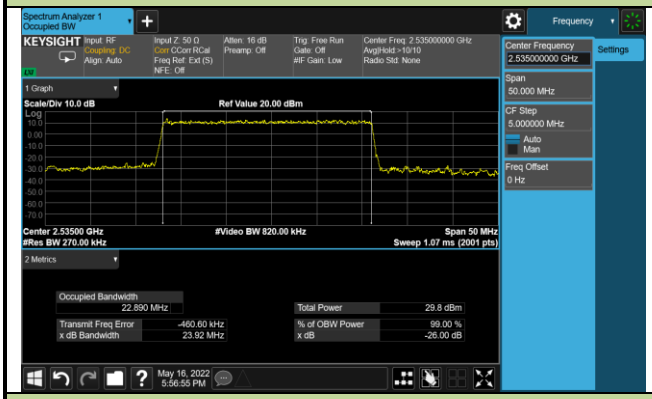
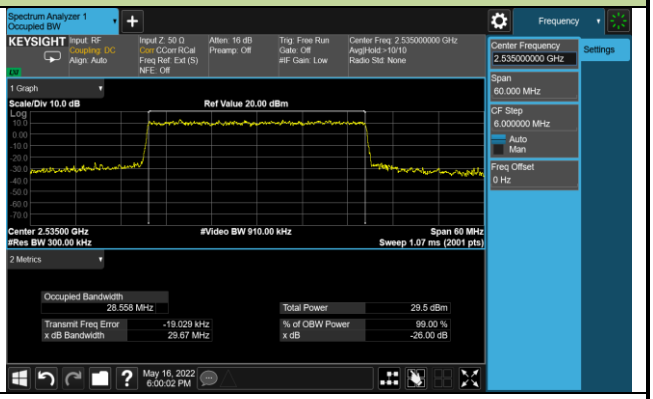
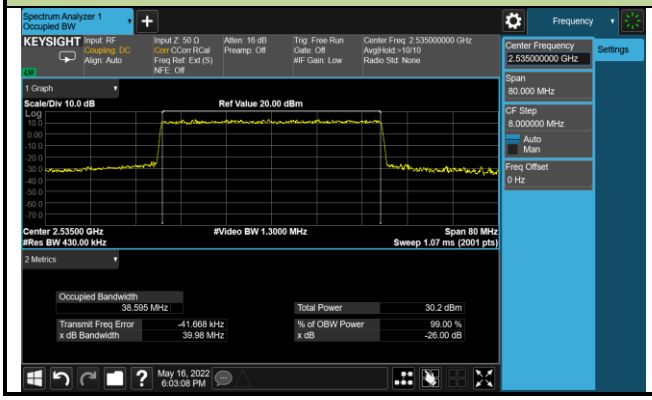


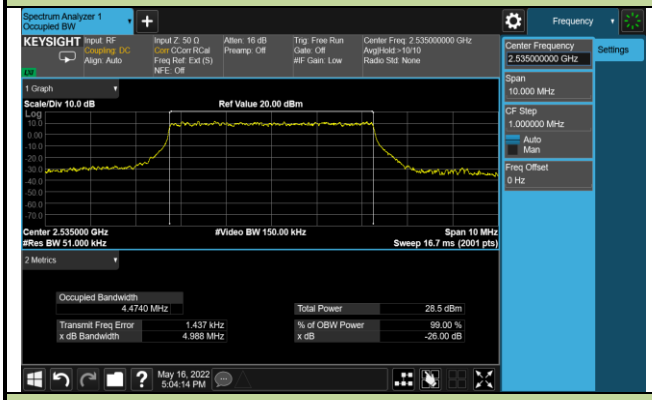
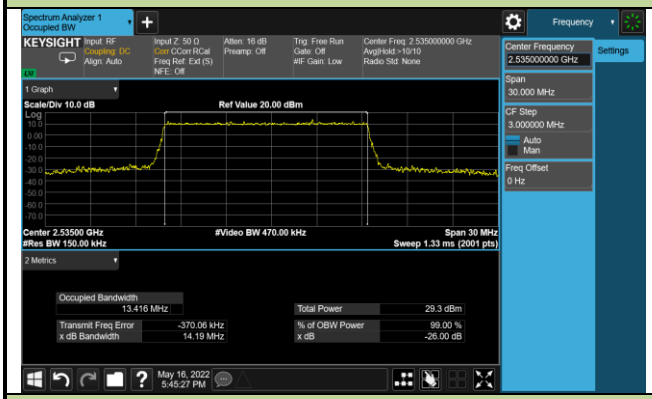
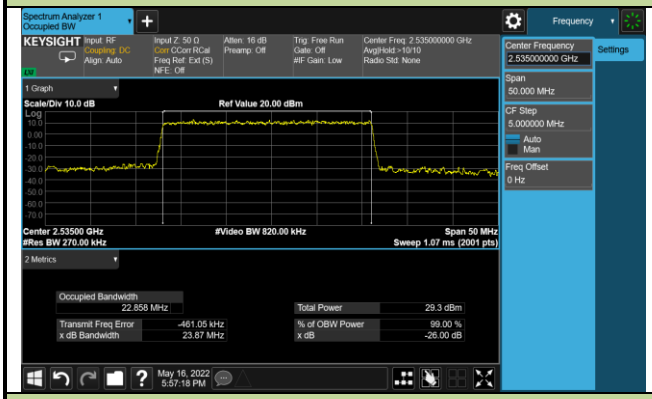
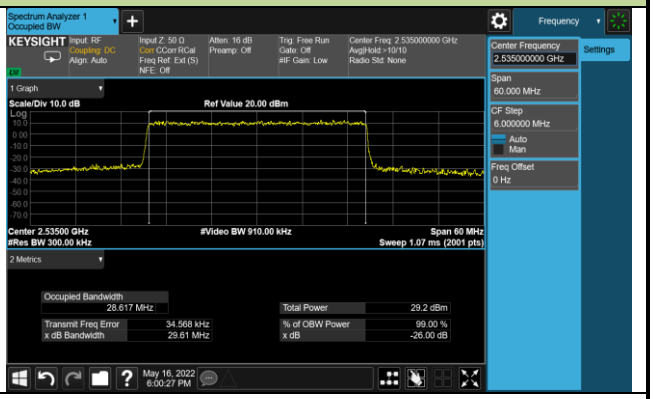
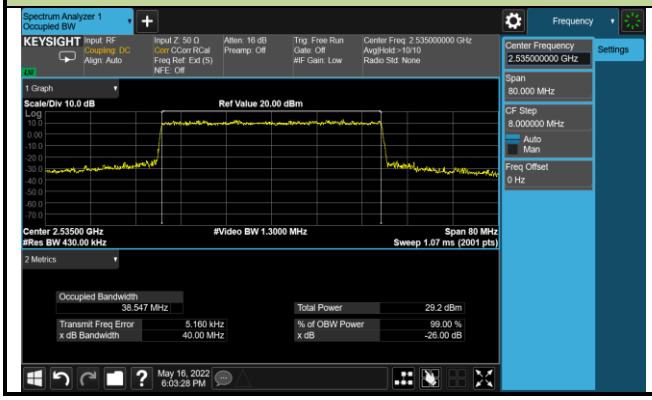
30MHz Channel Bandwidth

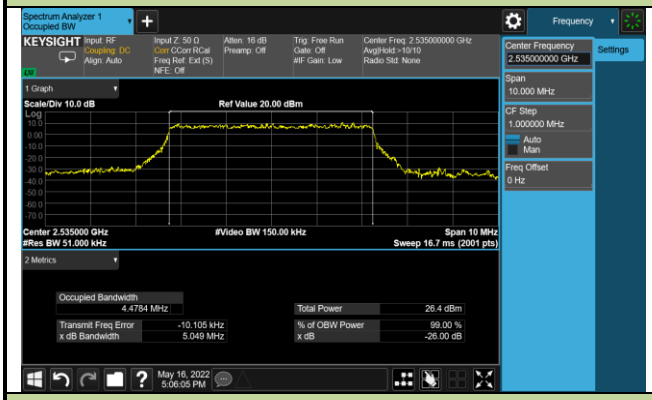
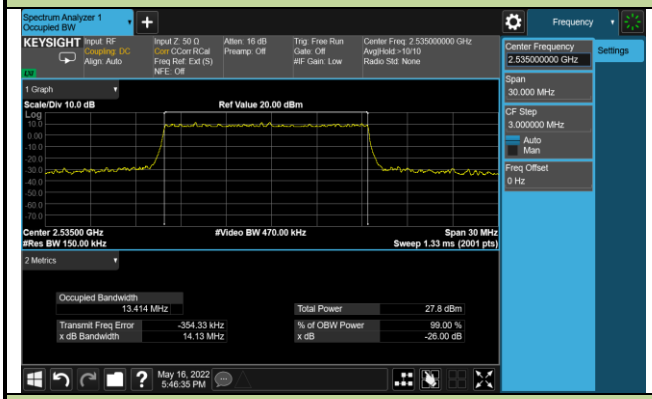
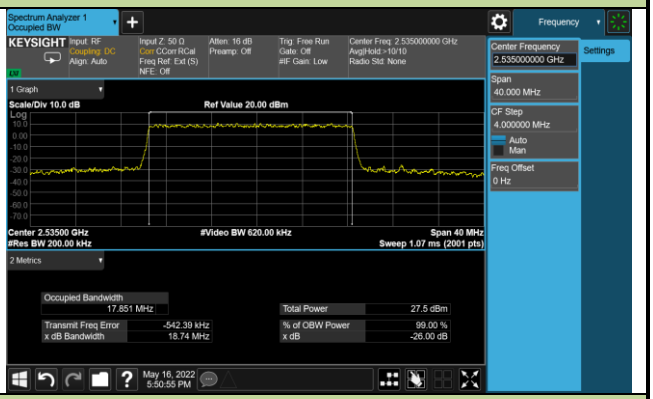
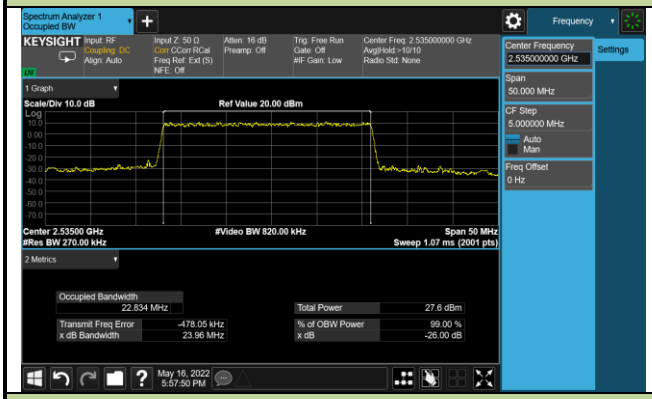
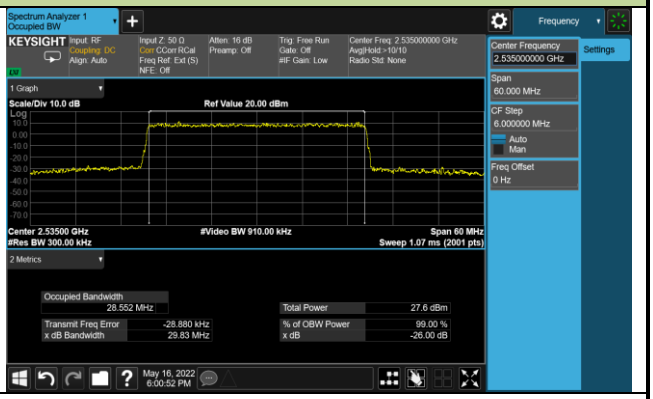
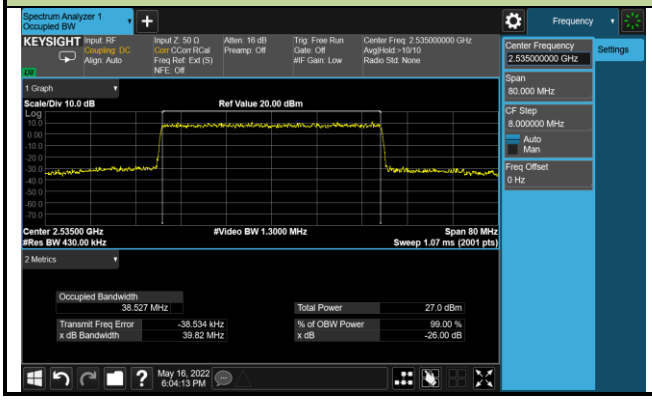


40MHz Channel Bandwidth



99% Bandwidth - 16QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
25MHz Channel Bandwidth	30MHz Channel Bandwidth
	
40MHz Channel Bandwidth	
	

99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
25MHz Channel Bandwidth	30MHz Channel Bandwidth
	
40MHz Channel Bandwidth	
	

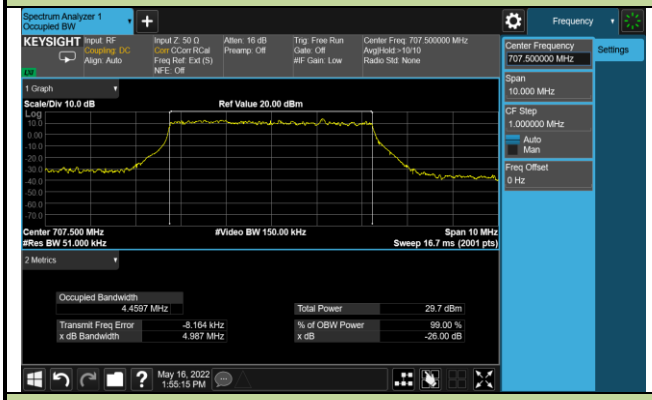
99% Bandwidth - 256QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	
25MHz Channel Bandwidth	30MHz Channel Bandwidth
	
40MHz Channel Bandwidth	
	

Test Site	SIP-SR1	Test Engineer	Candy Luo
Test Date	2022/05/16	Test Band	n12

Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
PI/2 BPSK		
707.5	5	4.46
707.5	10	8.89
707.5	15	13.37
QPSK		
707.5	5	4.47
707.5	10	8.91
707.5	15	13.39
16QAM		
707.5	5	4.48
707.5	10	8.94
707.5	15	13.39
64QAM		
707.5	5	4.47
707.5	10	8.92
707.5	15	13.36
256QAM		
707.5	5	4.48
707.5	10	8.91
707.5	15	13.38

99% Bandwidth - PI/2 BPSK

5MHz Channel Bandwidth

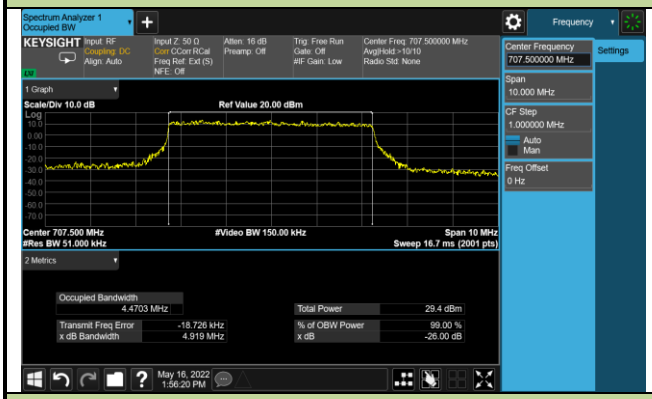


10MHz Channel Bandwidth

15MHz Channel Bandwidth

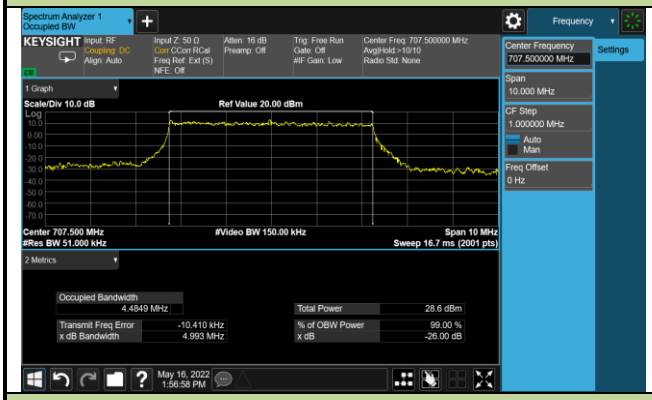
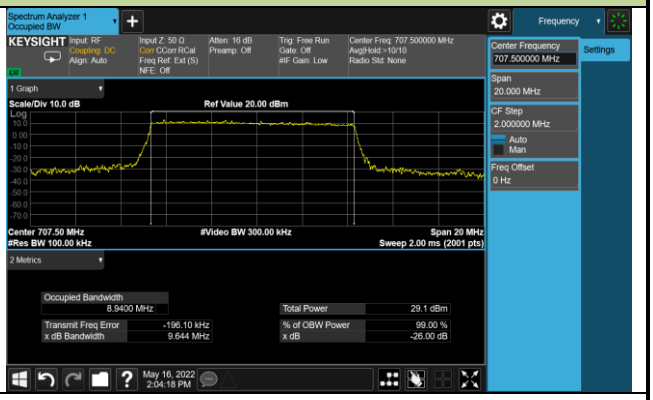
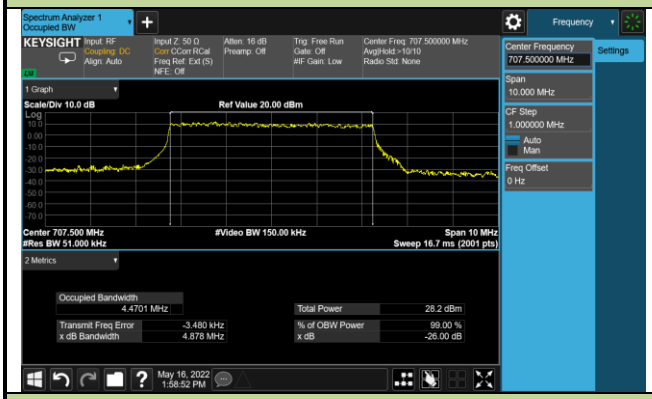
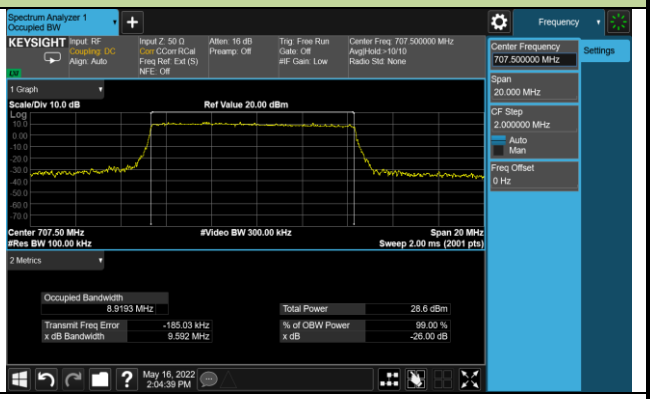
99% Bandwidth - QPSK

5MHz Channel Bandwidth



10MHz Channel Bandwidth

15MHz Channel Bandwidth

99% Bandwidth - 16QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	
	
99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth