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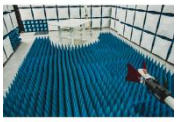

MEASUREMENT REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
06/01/2021 – 06/15/2021
Test Site/Location:
PCTEST KOREA Lab. Yongin-si, Gyeonggi-do, Korea
Test Report Serial No.:
8K21053102R1.A3L

FCC IC:	**A3LRFV01U-D1A**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Class II Permissive Change
Model:	RFV01U-D1A
EUT Type:	RRU(RFV01U)
FCC Classification:	PCS Licensed Transmitter
FCC Rule Part(s):	24 & 27
Test Procedure(s):	ANSI C63.26-2015, KDB 971168 D01 v03r01
Original Grant Date:	09/06/2017

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 §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Prepared by

Reviewed by

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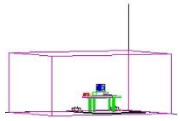
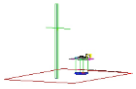


MEASUREMENT REPORT
FCC Part 24E & 27



Total Bandwidth	Band	FCC Rule Part	Tx Frequency (MHz)	Total Power		Emission Designator	Modulation
				Max. Power (W)	Max. Power (dBm)		
25 MHz (20MHz + 5MHz)	LTE Band 2	24E	1930.0 – 1990.0	169.37	52.29	23M7G7D	QPSK
	LTE Band 2	24E	1930.0 – 1990.0	173.31	52.39	23M7W7D	16QAM
	LTE Band 2	24E	1930.0 – 1990.0	175.63	52.45	23M7W7D	64QAM
	LTE Band 2	24E	1930.0 – 1990.0	175.32	52.44	23M7W7D	256QAM
35 MHz (15MHz + 10MHz + 10MHz)	LTE Band 66	27	2110.0 – 2180.0	261.27	54.17	33M6G7D	QPSK
	LTE Band 66	27	2110.0 – 2180.0	259.42	54.14	33M6W7D	16QAM
	LTE Band 66	27	2110.0 – 2180.0	247.04	53.93	33M6W7D	64QAM
	LTE Band 66	27	2110.0 – 2180.0	254.36	54.05	33M6W7D	256QAM
35 MHz (20MHz + 5MHz + 10MHz)	LTE Band 66	27	2110.0 – 2180.0	243.50	53.87	33M3G7D	QPSK
	LTE Band 66	27	2110.0 – 2180.0	245.78	53.91	33M4W7D	16QAM
	LTE Band 66	27	2110.0 – 2180.0	246.95	53.93	33M3W7D	64QAM
	LTE Band 66	27	2110.0 – 2180.0	245.07	53.89	33M3W7D	256QAM

EUT Overview

Notes:

Total Power shown in the table above are the full conducted average output power that will appear on the Grant of Authorization.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST KOREA Test Location

These measurement tests were conducted at the PCTEST KOREA CO., LTD. facility located at (#1407) 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do 16954, Korea.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST KOREA Lab located in Yongin-si, Gyeonggi, Korea.

- PCTEST KOREA is an ISO 17025:2005 accredited test facility under the National Institute of Standards and Technology (NIST) with Certificate number 600143-0 for Specific Absorption Rate (SAR), where applicable, and Electromagnetic Compatibility (EMC) testing for IC and Innovation, Science, and Economic Development Canada rules.

- PCTEST KOREA facility is accredited, designated and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.
  - Designation Number / CABID: KR0169
  - Test Firm Registration Number of FCC: 417945
  - Test Firm Registration Number of IC: 26168

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung RRU(RFV01U) FCC ID: A3LRFV01U-D1A**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 24 and 27.

The EUT is a 4-port device which supports single, two, and three carrier configurations (2CC, and 3CC). Each carrier operates using 5, 10, 15 or 20MHz bandwidth. It supports the following modulation schemes: QPSK, 16-QAM, 64-QAM and 256-QAM.

A class II permissive change on the original filing is being pursued to increase the maximum operating bandwidth up to 35MHz in Band 66 and 25MHz in Band 2.

Test Device Serial No.: S1810230015

2.2 Device Capabilites

This device contains the following capabilities: LTE B2 and B66.

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2.3 Test Configuration

The setup is as follows:

a) The EUT ("RRU(RFV01U)") and a Data Unit (DU) are each powered by -48V DC power supply.
b) The DU is connected to a test laptop via an ethernet cable acting as backhaul.
c) DU connects to the EUT through a fiber optic cable.
d) An RF cable connects the signal analyzer and the EUT Ports for respective measurement.

The EUT was tested per the guidance of ANSI C63.26-2015 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The following information is about configurations of carrier frequency and output power per port declared by the manufacturer.

Configuration	Operation	Channel	Carrier Configuration					
			1st Carrier		2nd Carrier		3rd Carrier	
			Fre.(MHz)	BW(MHz)	Fre.(MHz)	BW(MHz)	Fre.(MHz)	BW(MHz)
1 (LTE B66 - 3 multi carriers)	Contiguous	Lowest	2117.5	15	2130.0	10	2140.0	10
		Middle	2132.5	15	2145.0	10	2155.0	10
		Highest	2152.5	15	2165.0	10	2175.0	10
	Non-contiguous		2117.5	15	2145.0	10	2175.0	10
2 (LTE B66 - 3 multi carriers)	Contiguous	Lowest	2120.0	20	2132.5	5	2140.0	10
		Middle	2132.5	20	2145.0	5	2152.5	10
		Highest	2155.0	20	2167.5	5	2175.0	10
	Non-contiguous		2120.0	20	2145.0	5	2175.0	10
3 (LTE B2 - 2 multi carriers)	Contiguous	Lowest	1940.0	20	1952.5	5		
		Middle	1960.0	20	1972.5	5		
		Highest	1975.0	20	1987.5	5		
	N on-contiguous		1940.0	20	1987.5	5		

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled "American National Standard for Compliance Testing of Transmitter Used in Licensed Radio Service" (ANSI C63.26-2015) and the guidance provided in KDB 842590 D01 v01r01 were used in the measurement of the EUT.

Conducted Average Output Power:

KDB 971168 D01 v03r01 – Section 5
KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
ANSI C63.26-2015 – Section 5.2.4.4.1

Equivalent Isotropically Radiated Power (Power Spectral Density):

KDB 971168 D01 v03r01 – Section 5
KDB 662911 D01 v02r01 – Section E)2) In-Band Power Spectral Density (PSD) Measurements
b) Measure and sum spectral maxima across the outputs
ANSI C63.26-2015 – Section 5.2.4.5

Band Edge Emissions at Antenna Terminal
KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Spurious and Harmonic Emissions at Antenna Terminal
KDB 971168 D01 v03r01 – Section 6
KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
a) Absolute Emission Limits
iii) Measure and add 10 log(N_{ANT}) dB
ANSI C63.26-2015 – Section 5.7

Peak-to-Average Power Ratio:

KDB 971168 D01 v03r01 – Section 5.7
ANSI C63.26-2015 – Section 5.2.3.4

Occupied Bandwidth:

KDB 971168 D01 v03r01 – Section 4.2
ANSI C63.26-2015 – Section 5.4.3

Radiated unwanted emission

KDB 971168 D01 v03r01 – Section 7
ANSI C63.26-2015 – Section 5.8

3.2 Measurement Software

Test item	Name	Version
Conducted Measurement	Node B automation	1.0

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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.20
Radiated Disturbance (<1GHz)	3.01
Radiated Disturbance (>1GHz)	5.56
Radiated Disturbance (>18GHz)	3.16

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacture	Model	Description	Cal Date	Cal interval	Cal Due	Serial Number
KEYSIGHT	N9020B	PXA Signal Analyzer	02/16/2021	Annual	02/15/2022	MY57142018
Rohde & Schwarz	ESW	EMI Test Receiver	06/29/2020	Annual	06/28/2021	101761
KIKISUI	PWR1201ML	DC POWER SUPPLY	05/25/2021	Annual	05/24/2022	ZL000972
SUKSAN TECHNOLOGY	SE-CT-10	Temperature Chamber	09/17/2020	Annual	09/16/2021	191021
Rohde & Schwarz	TS-SFUNIT-Rx	Shielded Filter Unit	02/19/2021	Annual	02/18/2022	102131
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	07/09/2019	Biennial	07/08/2021	9162-217
Sunol sciences	DRH-118	Horn Antenna	08/09/2019	Biennial	08/08/2021	A102416-1
Schwarzbeck	BBHA 9170	Horn Antenna	09/02/2020	Biennial	09/01/2022	1037
Reachline	250W18N-40FF	Attenuator	03/17/2021	Annual	03/16/2022	PK0288
Reachline	250W18N-40FF	Attenuator	03/17/2021	Annual	03/16/2022	PK0289
Reachline	250W18N-40FF	Attenuator	03/17/2021	Annual	03/16/2022	PK0290
Reachline	250W18N-40FF	Attenuator	03/17/2021	Annual	03/16/2022	PK0291

Table 5-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

2. Equipment with a calibration date of “N/A” shown in this list was not used to make direct calibrated measurements.

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 35M30G7D

Occupied Bandwidth = 35.30 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 35M32W7D

Occupied Bandwidth = 35.32 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

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7.0 TEST RESULTS

7.1 Summary

Company Name: SAMSUNG Electronics Co., Ltd.

FCC ID: A3LRFV01U-D1A

FCC Classification: PCS Licensed Transmitter

Mode(s): LTE

FCC Part Section(s)	Test Description	Test Condition	Test Result	Reference
§ 2.1049	Occupied Bandwidth	CONDUCTED	PASS	Section 7.2
§ 2.1046	Conducted Average Output Power		PASS	
§ 2.1046, § 24.232, § 27.50(d)	Equivalent Isotropically Radiated Power (Power Spectral Density		PASS	
§ 2.1046, § 24.232, § 27.50(d)	Peak-to-average power ratio		PASS	
§ 2.1051, § 24.238, § 27.53(h)	Band Edge Emissions at Antenna Terminal		PASS	
§ 2.1051, § 24.238, § 27.53(h)	Spurious and Harmonic Emissions at Antenna Terminal		PASS	
§ 2.1051, § 24.238, § 27.53(h)	Radiated unwanted emission	RADIATED	PASS	

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The correction table was used to account for the losses of the cables and attenuators used to test the EUT at all frequencies of interest.
3) The analyzer plots were all taken with a correction table loaded into the analyzer.
4) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
5) This unit was tested while powered by a -48V DC power source.

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7.2 Occupied Bandwidth

§ 2.1049

Test Overview

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. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 4.2

ANSI C63.26-2015 – Section 5.4.3

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer setting were as follows:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

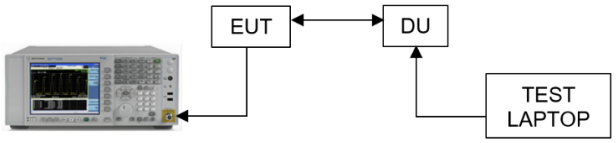

Figure 7-1. Test Instrument & Measurement Setup

Limit

The occupied bandwidth shall not exceed the equipment's channel bandwidth, which is declared by the manufacturer.

Test Notes

All the measurement has been tested but test table result, and test plots are referred from the highest of value of each of modulation of each antenna ports.

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- B66_15M+10M+10M_Contiguous_2T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	33.55	33.52	**33.58**	**33.54**
	1	**33.58**	**33.53**	33.52	33.53
Middle	0	33.59	**33.61**	33.53	**33.58**
	1	**33.60**	33.58	**33.59**	33.54
High	0	**33.59**	**33.67**	33.54	**33.56**
	1	33.56	33.61	**33.57**	33.53

Table 7-2. Occupied Bandwidth Summary Data (B66_15M+10M+10M_Contiguous_2T)

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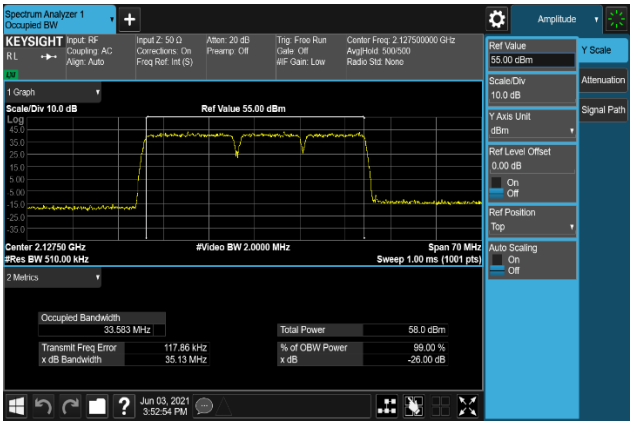
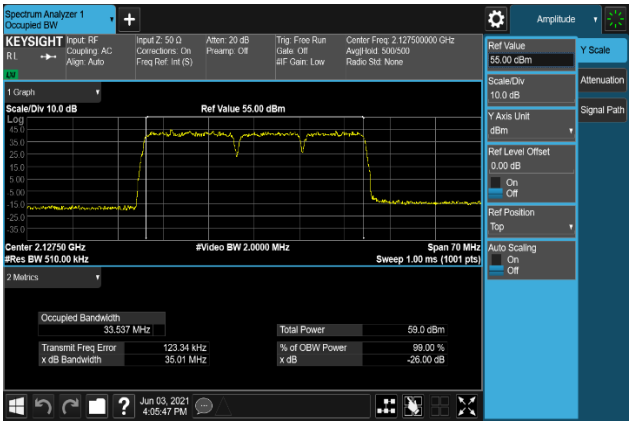
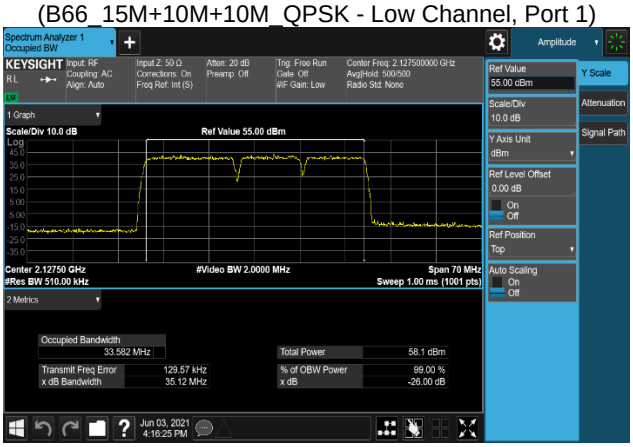


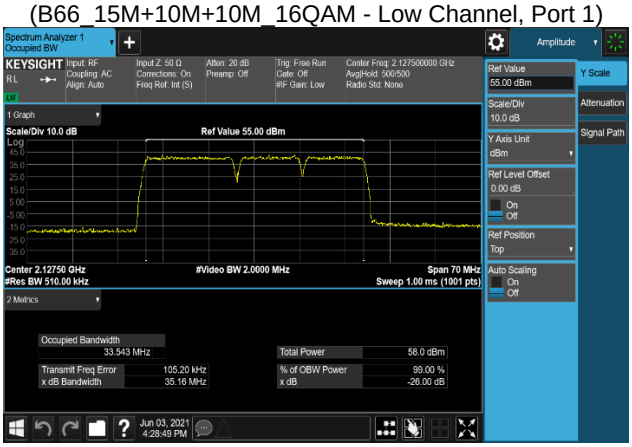
Plot 7-1. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - Low Channel, Port 1)



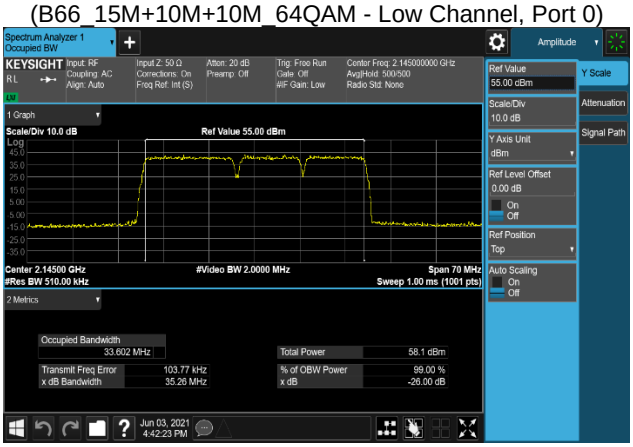
Plot 7-2. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - Low Channel, Port 1)



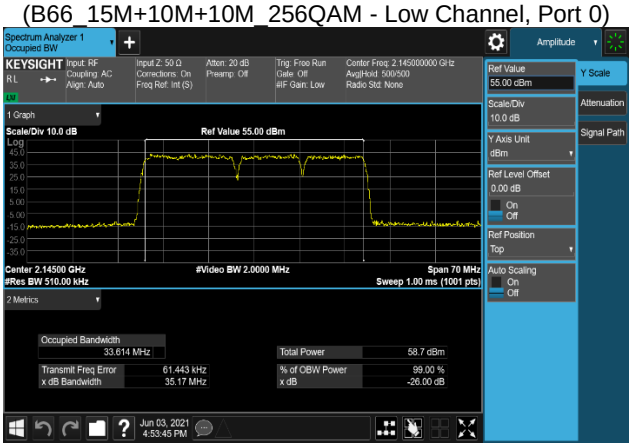
Plot 7-3. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - Low Channel, Port 0)



Plot 7-4. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - Low Channel, Port 0)



Plot 7-5. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - Middle Channel, Port 1)



Plot 7-6. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - Middle Channel, Port 0)

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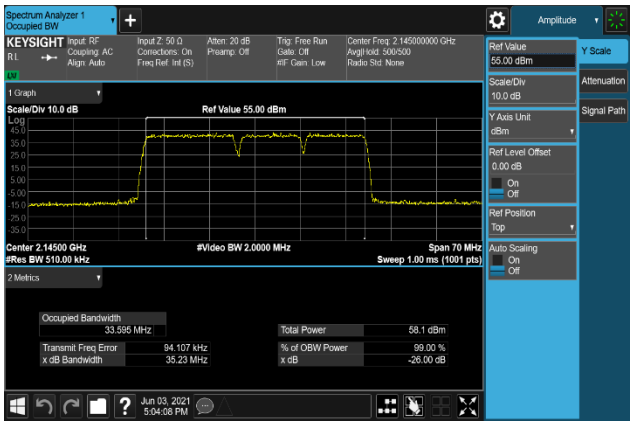
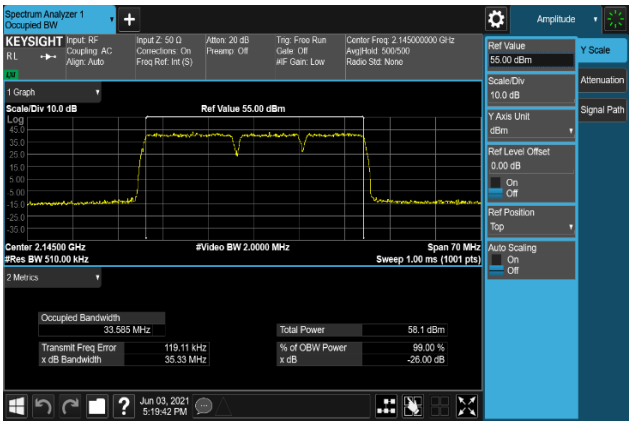
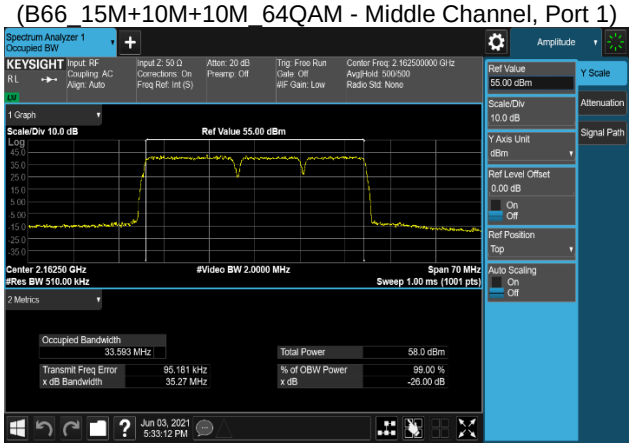


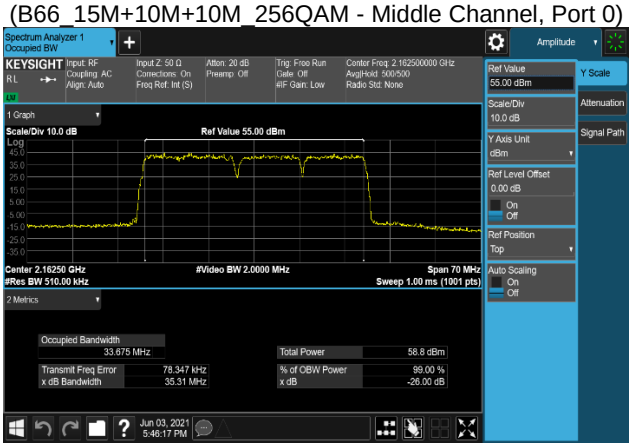
Plot 7-7. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - Middle Channel, Port 1)



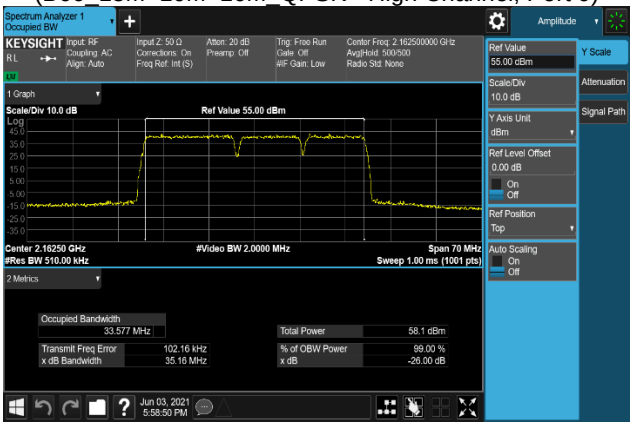
Plot 7-8. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - Middle Channel, Port 0)



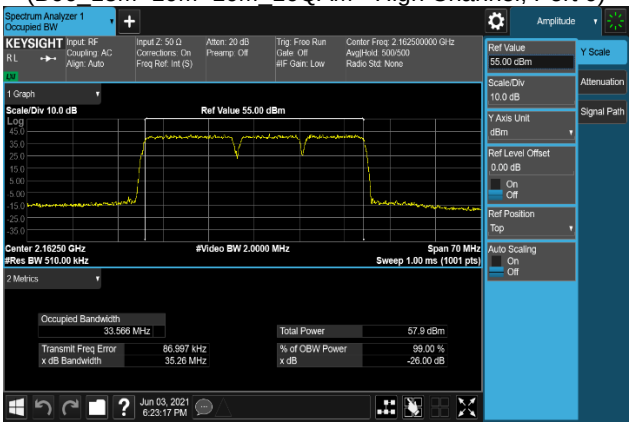
Plot 7-9. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - High Channel, Port 0)



Plot 7-10. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - High Channel, Port 0)



Plot 7-11. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - High Channel, Port 1)



Plot 7-12. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - High Channel, Port 0)

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- B66_20M+5M+10M_Contiguous_2T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	**33.31**	**33.40**	33.26	**33.34**
	1	33.30	33.39	**33.31**	33.27
Middle	0	**33.28**	**33.40**	**33.33**	33.29
	1	33.28	33.38	33.29	**33.30**
High	0	33.29	**33.41**	**33.34**	33.28
	1	**33.30**	33.36	33.33	**33.29**

Table 7-3. Occupied Bandwidth Summary Data (B66_20M+5M+10M_Contiguous_2T)

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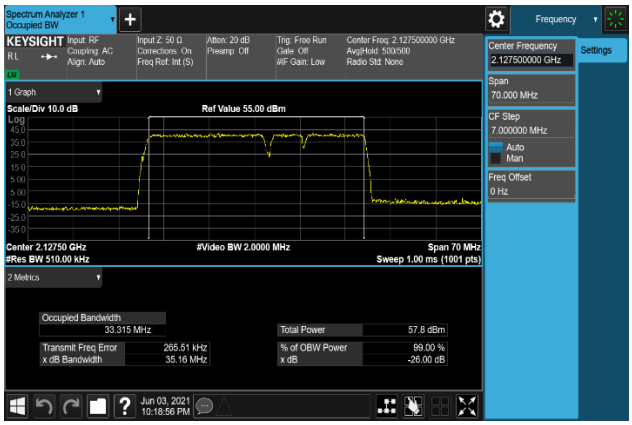
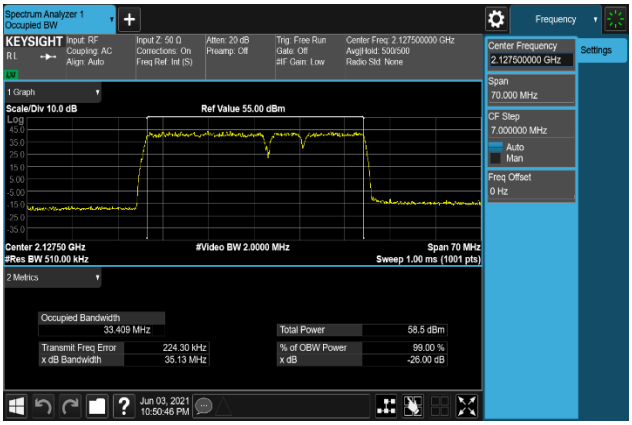
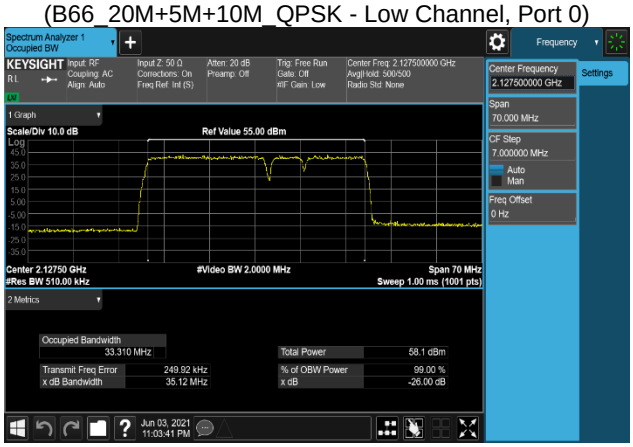


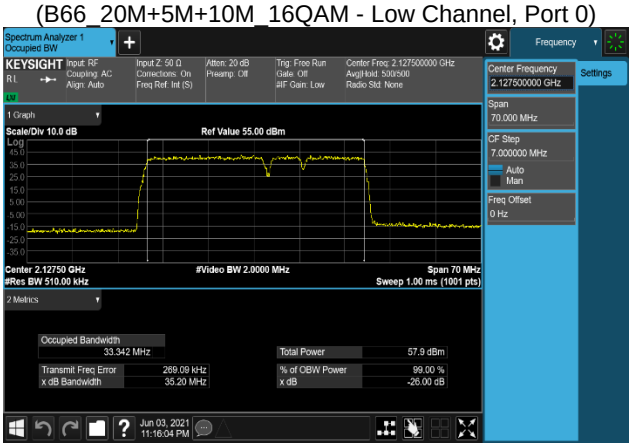
Plot 7-13. Occupied Bandwidth Plot
(B66_20M+5M+10M_QPSK - Low Channel, Port 0)



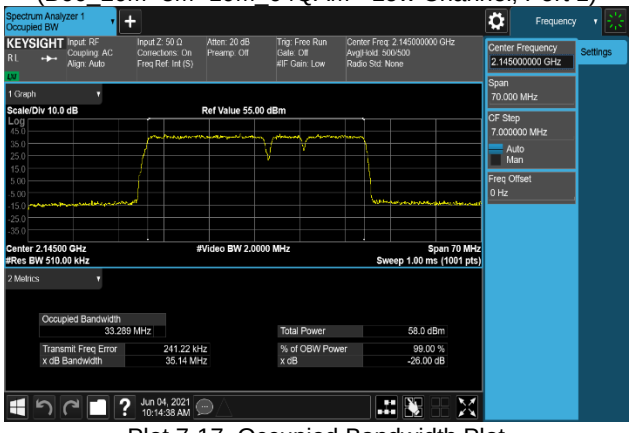
Plot 7-14. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - Low Channel, Port 0)



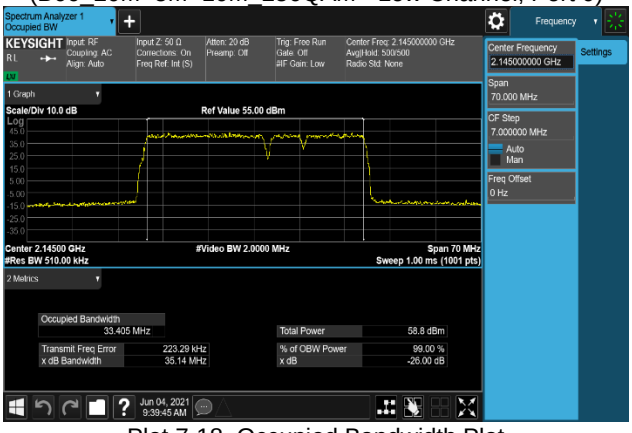
Plot 7-15. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - Low Channel, Port 1)



Plot 7-16. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - Low Channel, Port 0)



Plot 7-17. Occupied Bandwidth Plot
(B66_20M+5M+10M_QPSK - Middle Channel, Port 0)



Plot 7-18. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - Middle Channel, Port 0)

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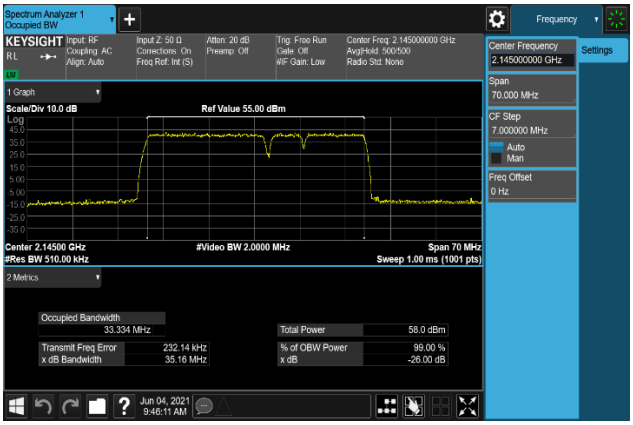
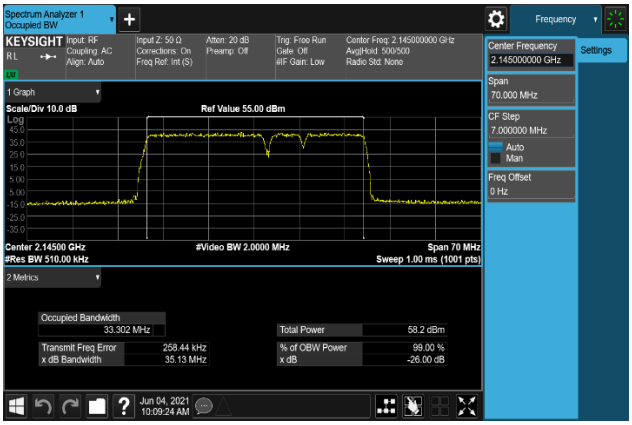
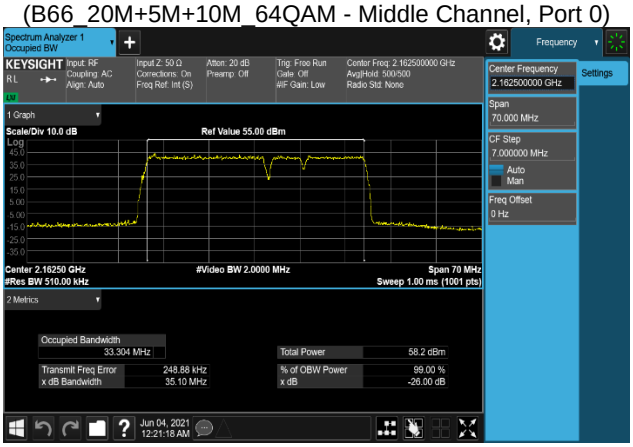


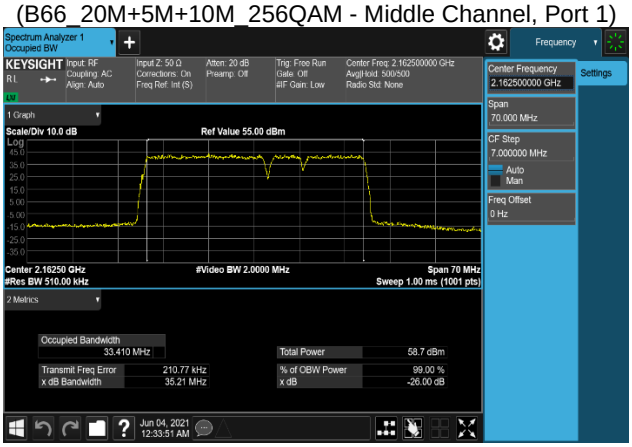
Plot 7-19. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - Middle Channel, Port 0)



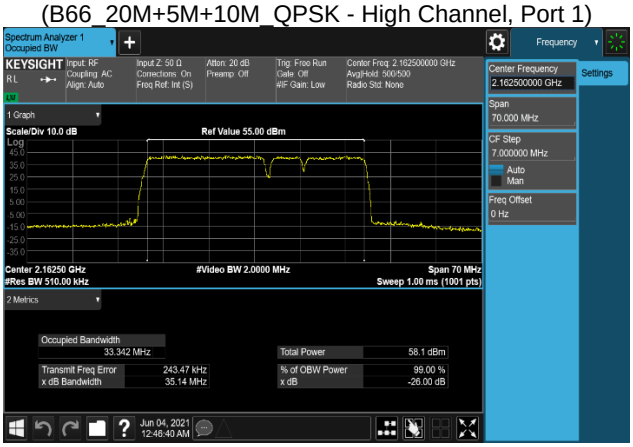
Plot 7-20. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - Middle Channel, Port 1)



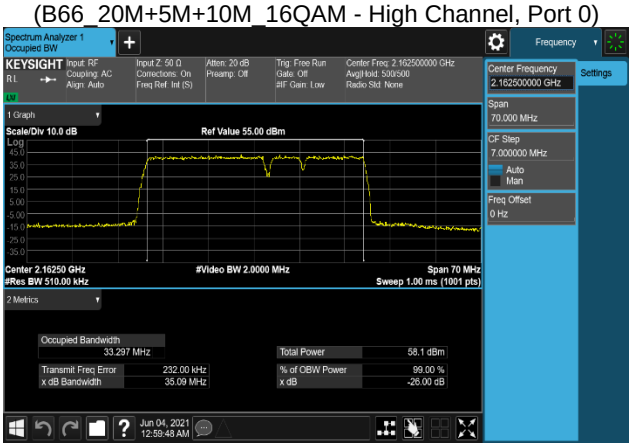
Plot 7-21. Occupied Bandwidth Plot
(B66_20M+5M+10M_QPSK - High Channel, Port 1)



Plot 7-22. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - High Channel, Port 0)



Plot 7-23. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - High Channel, Port 0)



Plot 7-24. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - High Channel, Port 1)

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- B66_15M+10M+10M_Contiguous_4T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	33.55	**33.61**	**33.58**	33.52
	1	**33.59**	33.58	33.56	33.55
	2	33.55	33.59	33.51	33.55
	3	33.53	33.53	33.54	**33.58**
Middle	0	33.60	33.58	33.56	33.53
	1	**33.61**	33.61	33.56	33.59
	2	33.56	**33.65**	33.56	**33.61**
	3	33.58	33.65	**33.62**	33.53
High	0	**33.61**	33.60	**33.58**	**33.61**
	1	33.53	**33.61**	33.57	33.59
	2	33.56	33.61	33.55	33.56
	3	33.59	33.54	33.58	33.55

Table 7-4. Occupied Bandwidth Summary Data (B66_15M+10M+10M_Contiguous_4T)

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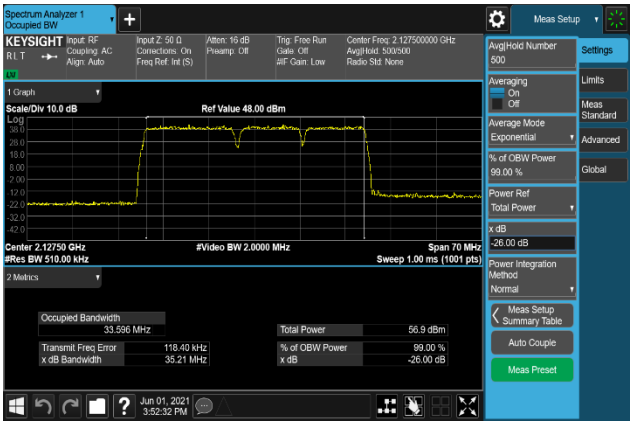
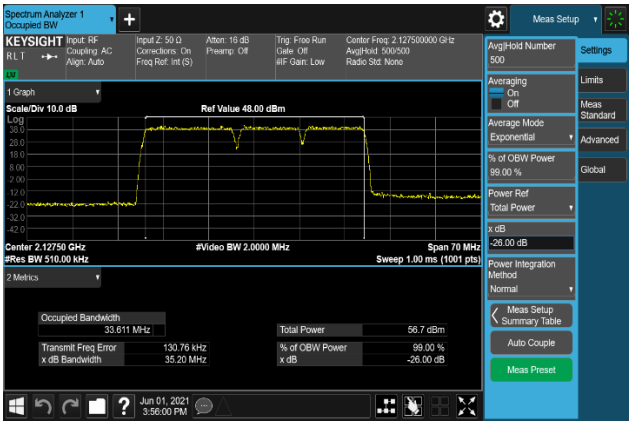
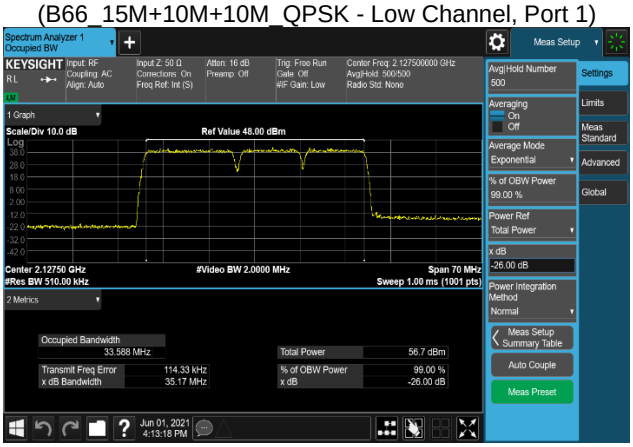


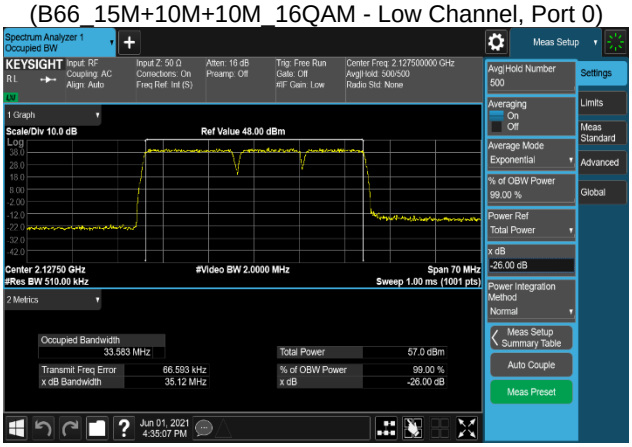
Plot 7-25. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - Low Channel, Port 1)



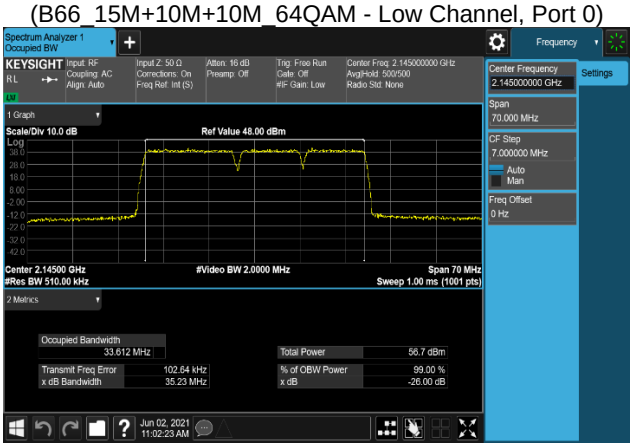
Plot 7-26. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - Low Channel, Port 0)



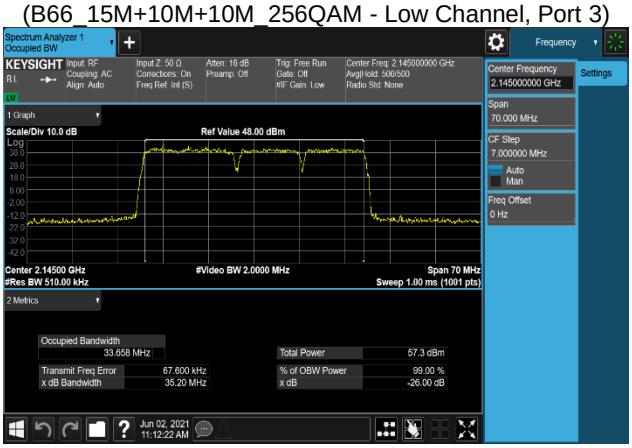
Plot 7-27. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - Low Channel, Port 0)



Plot 7-28. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - Low Channel, Port 3)



Plot 7-29. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - Middle Channel, Port 1)



Plot 7-30. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - Middle Channel, Port 2)

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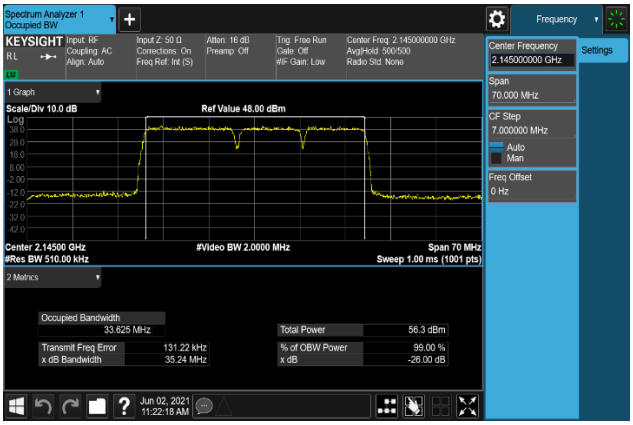
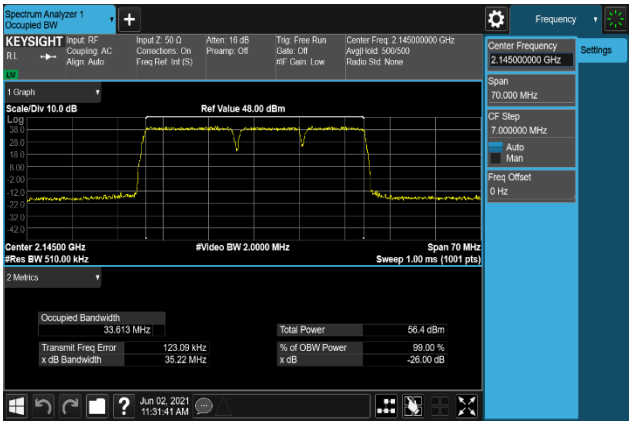
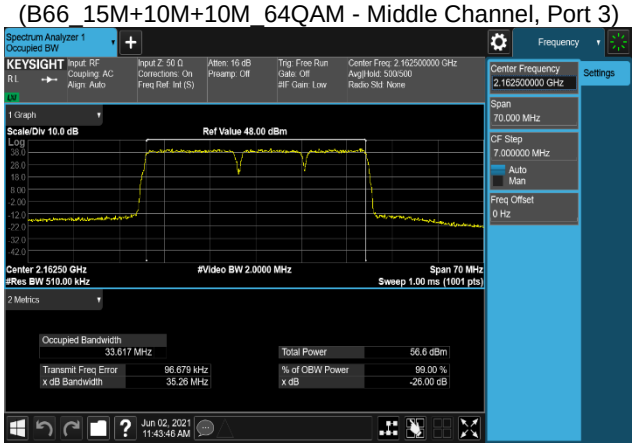


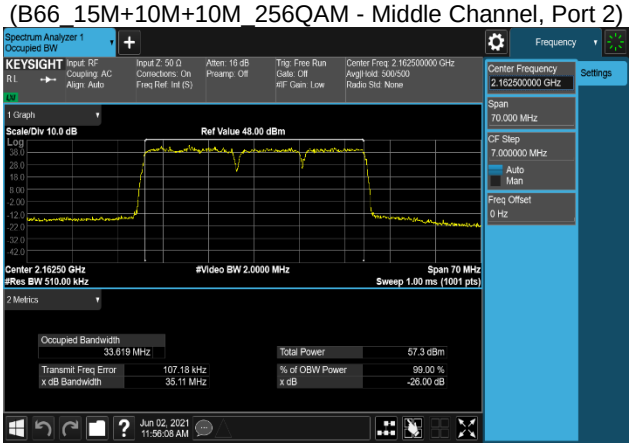
Plot 7-31. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - Middle Channel, Port 3)



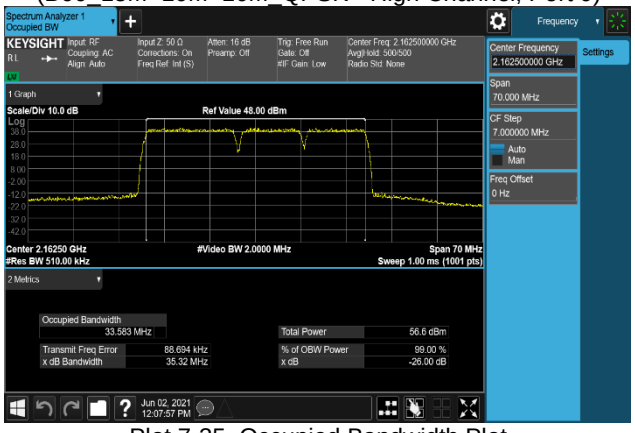
Plot 7-32. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - Middle Channel, Port 2)



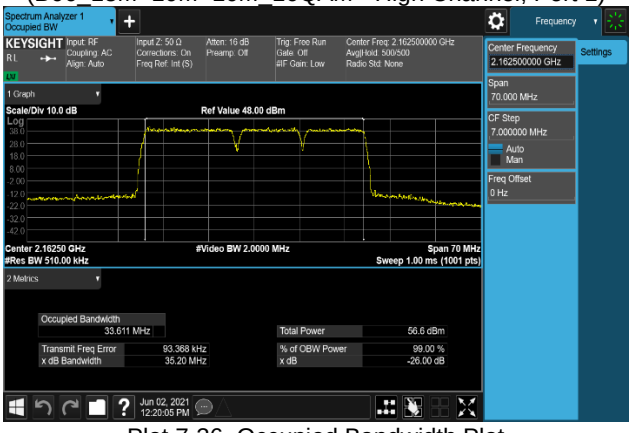
Plot 7-33. Occupied Bandwidth Plot
(B66_15M+10M+10M_QPSK - High Channel, Port 0)



Plot 7-34. Occupied Bandwidth Plot
(B66_15M+10M+10M_16QAM - High Channel, Port 1)



Plot 7-35. Occupied Bandwidth Plot
(B66_15M+10M+10M_64QAM - High Channel, Port 0)



Plot 7-36. Occupied Bandwidth Plot
(B66_15M+10M+10M_256QAM - High Channel, Port 0)

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- B66_20M+5M+10M_Contiguous_4T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	33.29	33.35	**33.35**	**33.25**
	1	33.32	33.30	33.27	33.23
	2	33.31	**33.39**	33.24	33.23
	3	**33.33**	33.37	33.22	33.22
Middle	0	33.33	33.38	33.29	33.29
	1	33.32	33.37	33.29	33.23
	2	33.31	33.37	33.29	33.24
	3	**33.36**	**33.40**	**33.33**	**33.30**
High	0	33.30	33.34	**33.33**	33.29
	1	33.28	33.36	33.26	33.28
	2	**33.33**	33.36	33.33	**33.30**
	3	33.31	**33.42**	33.30	33.30

Table 7-5. Occupied Bandwidth Summary Data (B66_20M+5M+10M_Contiguous_4T)

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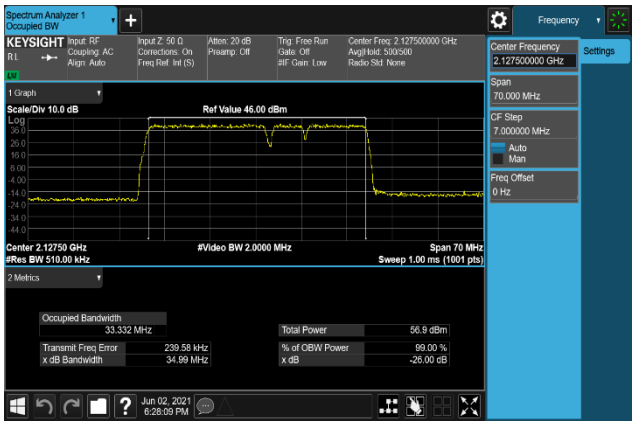
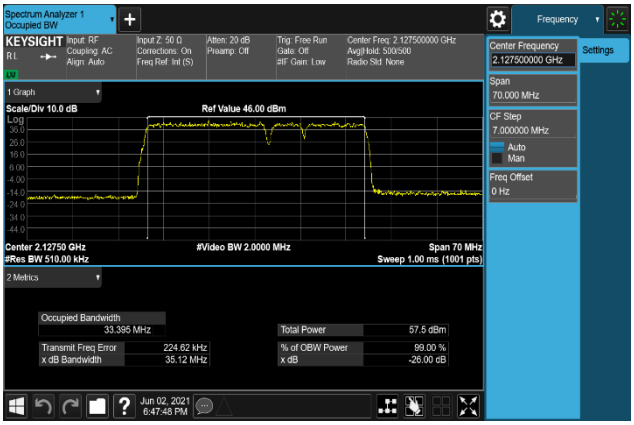
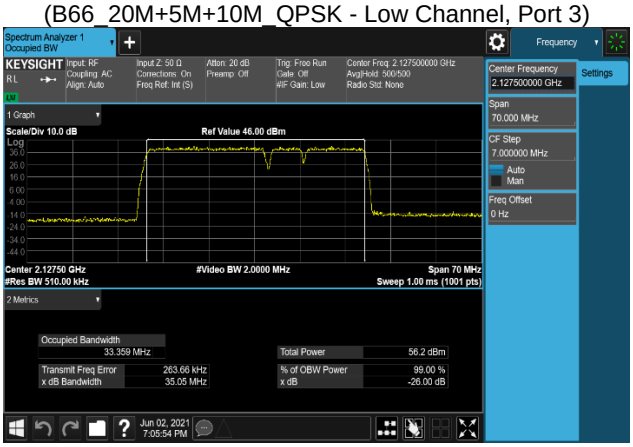


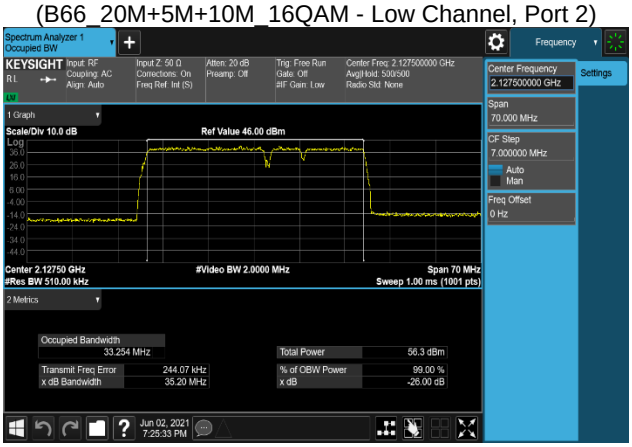
Plot 7-37. Occupied Bandwidth Plot
(B66_20M+5M+10M_QPSK - Low Channel, Port 3)



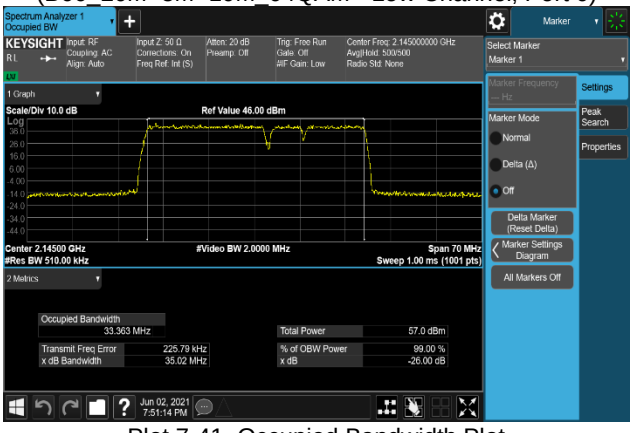
Plot 7-38. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - Low Channel, Port 2)



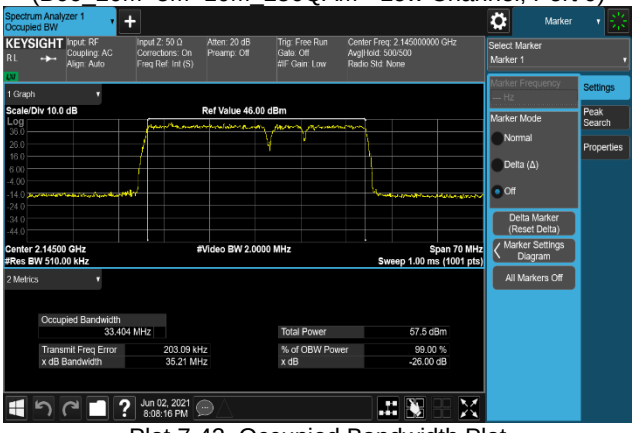
Plot 7-39. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - Low Channel, Port 0)



Plot 7-40. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - Low Channel, Port 0)



Plot 7-41. Occupied Bandwidth Plot
(B66_20M+5M+10M_QPSK - Middle Channel, Port 3)



Plot 7-42. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - Middle Channel, Port 3)

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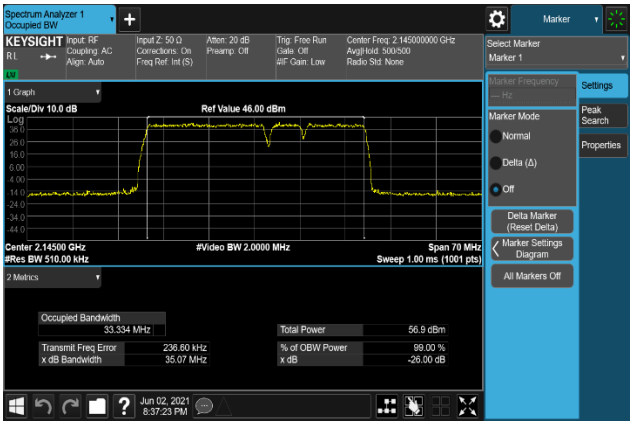
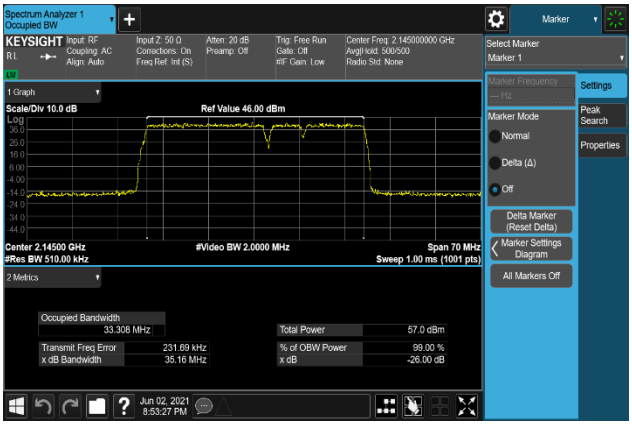
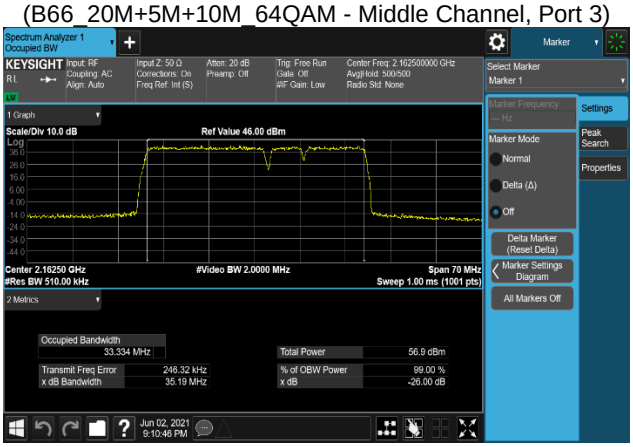


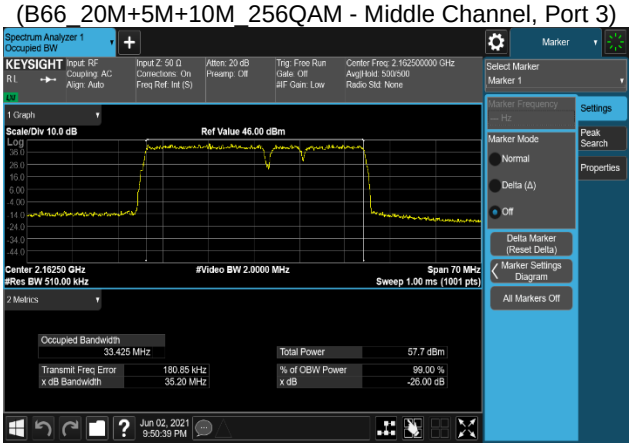
Plot 7-43. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - Middle Channel, Port 3)



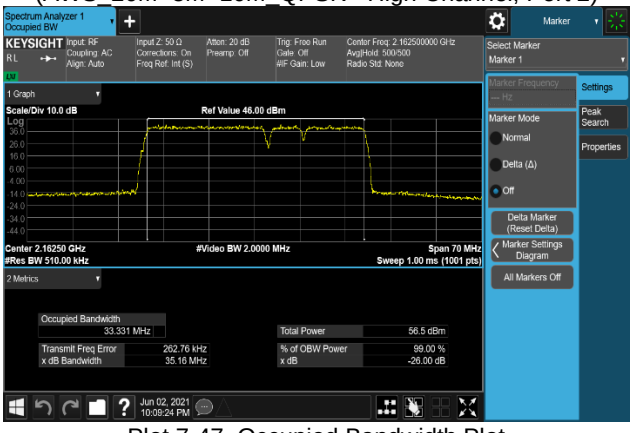
Plot 7-44. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - Middle Channel, Port 3)



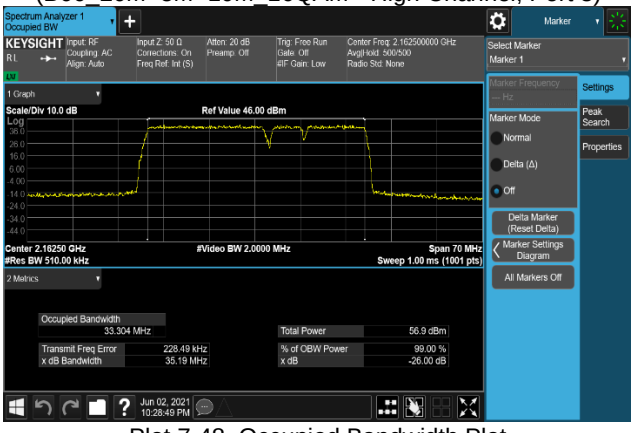
Plot 7-45. Occupied Bandwidth Plot
(AWS_20M+5M+10M_QPSK - High Channel, Port 2)



Plot 7-46. Occupied Bandwidth Plot
(B66_20M+5M+10M_16QAM - High Channel, Port 3)



Plot 7-47. Occupied Bandwidth Plot
(B66_20M+5M+10M_64QAM - High Channel, Port 0)



Plot 7-48. Occupied Bandwidth Plot
(B66_20M+5M+10M_256QAM - High Channel, Port 2)

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- B2_20M+5M_Contiguous_2T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	**23.69**	**23.67**	**23.69**	23.67
	1	23.65	23.66	23.68	**23.69**
Middle	0	**23.72**	23.63	**23.73**	**23.71**
	1	23.68	**23.64**	23.70	23.68
High	0	**23.70**	23.63	**23.71**	23.67
	1	23.68	**23.66**	23.66	**23.72**

Table 7-6. Occupied Bandwidth Summary Data (B2_20M+5M_Contiguous_2T)

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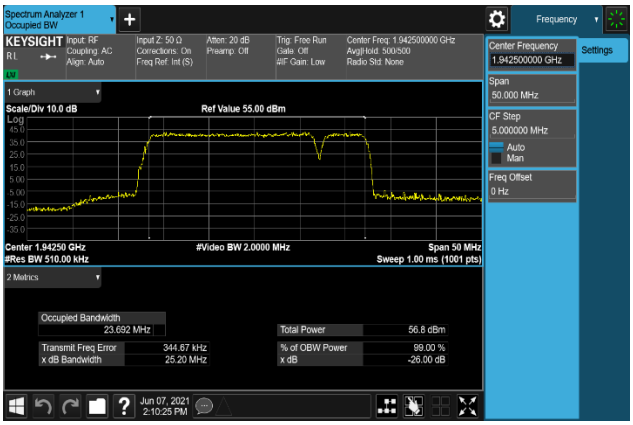
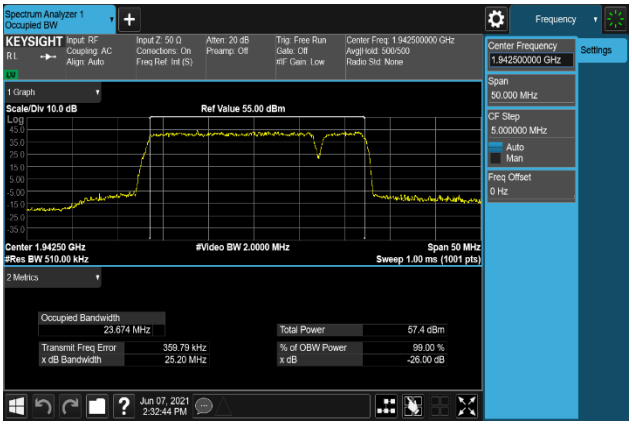
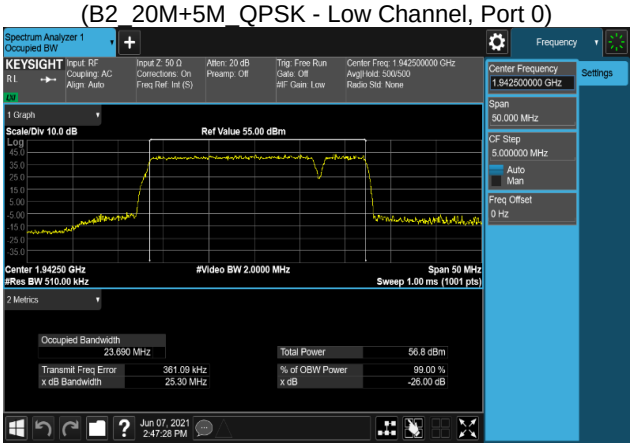


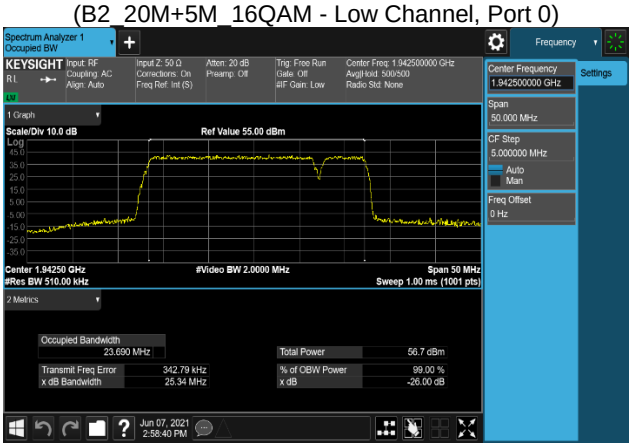
Plot 7-49. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - Low Channel, Port 0)



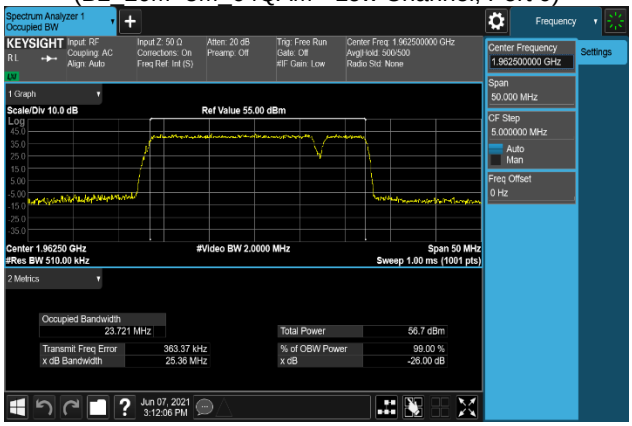
Plot 7-50. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - Low Channel, Port 0)



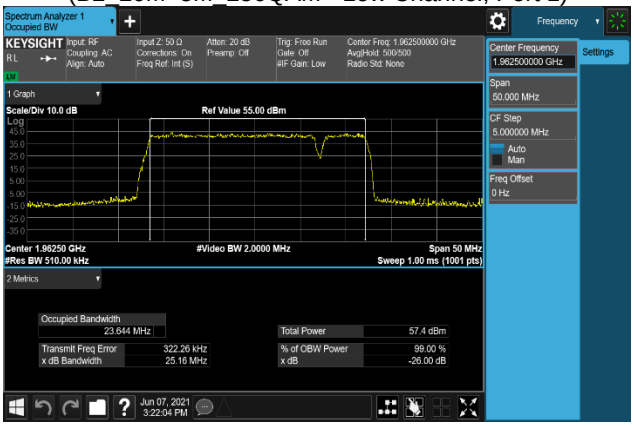
Plot 7-51. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - Low Channel, Port 0)



Plot 7-52. Occupied Bandwidth Plot
(B2_20M+5M_256QAM - Low Channel, Port 1)



Plot 7-53. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - Middle Channel, Port 0)



Plot 7-54. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - Middle Channel, Port 1)

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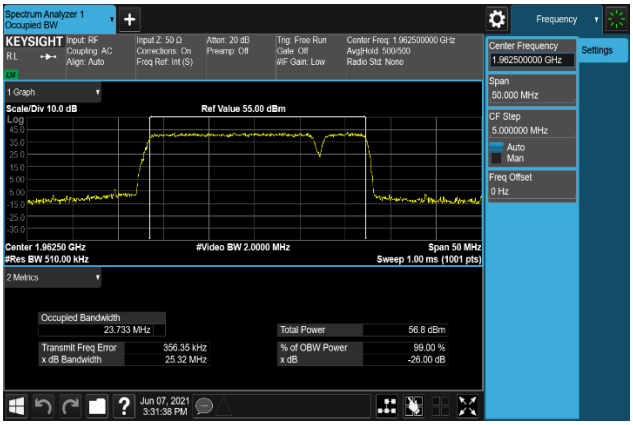
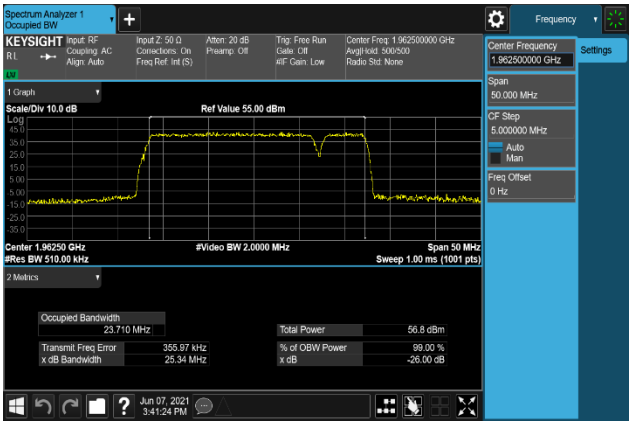
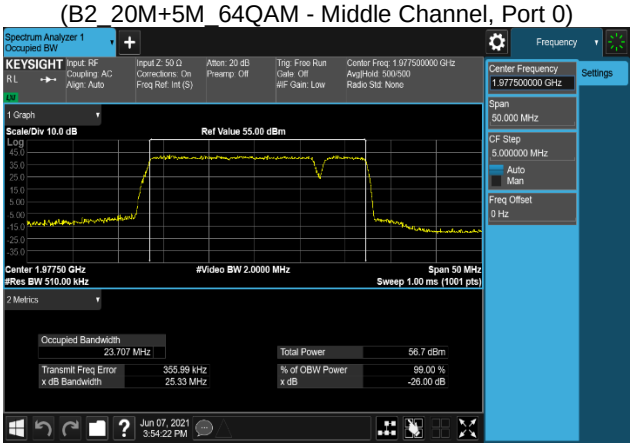


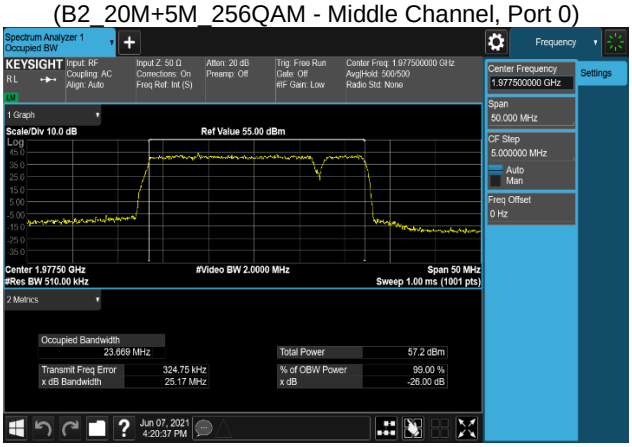
Plot 7-55. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - Middle Channel, Port 0)



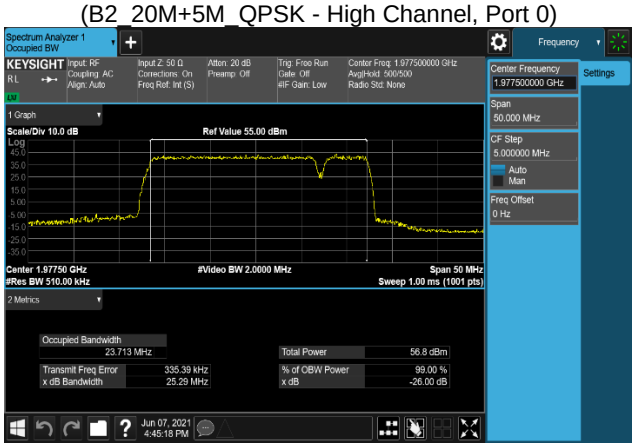
Plot 7-56. Occupied Bandwidth Plot
(B2_20M+5M_256QAM - Middle Channel, Port 0)



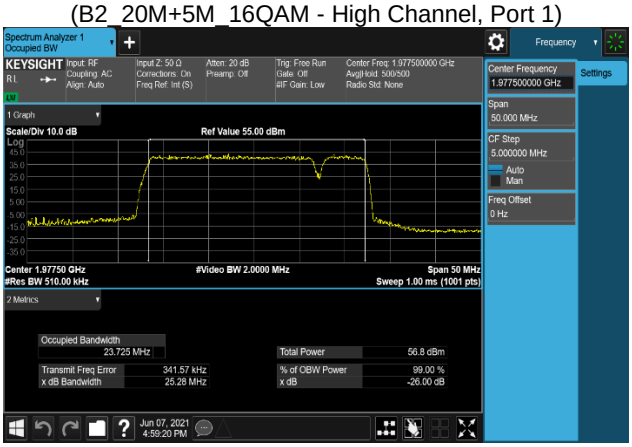
Plot 7-57. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - High Channel, Port 0)



Plot 7-58. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - High Channel, Port 1)



Plot 7-59. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - High Channel, Port 0)



Plot 7-60. Occupied Bandwidth Plot
(B2_20M+5M_256QAM - High Channel, Port 1)

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- B2_20M+5M_Contiguous_4T

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	23.64	**23.71**	23.69	23.67
	1	**23.65**	23.65	23.66	23.62
	2	23.62	23.68	**23.71**	23.69
	3	23.62	23.67	23.70	**23.74**
Middle	0	**23.72**	23.69	**23.70**	23.66
	1	23.71	23.66	23.68	23.69
	2	23.68	**23.71**	23.70	**23.70**
	3	23.70	23.69	23.70	23.70
High	0	23.67	23.67	**23.75**	**23.67**
	1	23.65	23.67	23.67	23.66
	2	23.71	23.67	23.70	23.66
	3	**23.72**	**23.68**	23.70	23.67

Table 7-7. Occupied Bandwidth Summary Data (B2_20M+5M_Contiguous_4T)

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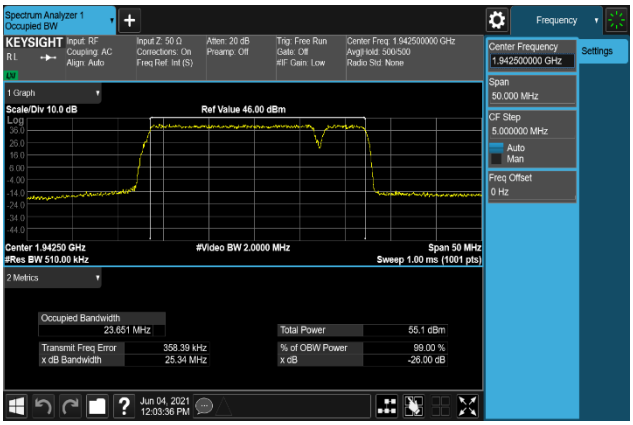
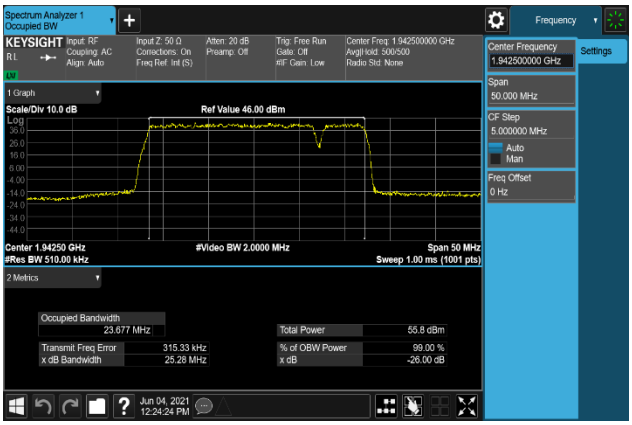
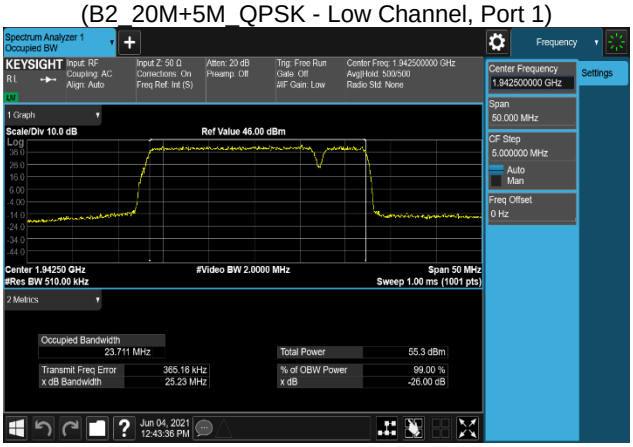


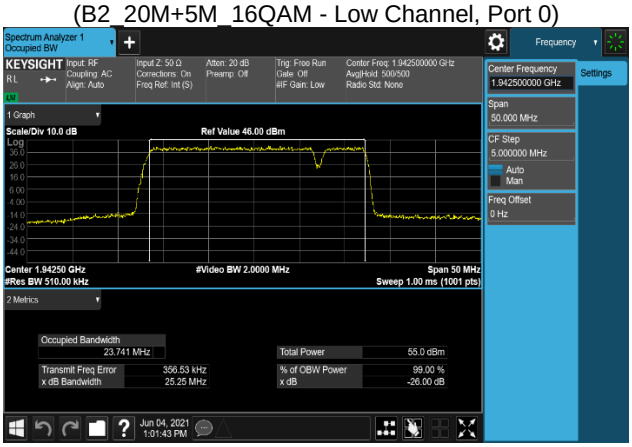
Plot 7-61. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - Low Channel, Port 1)



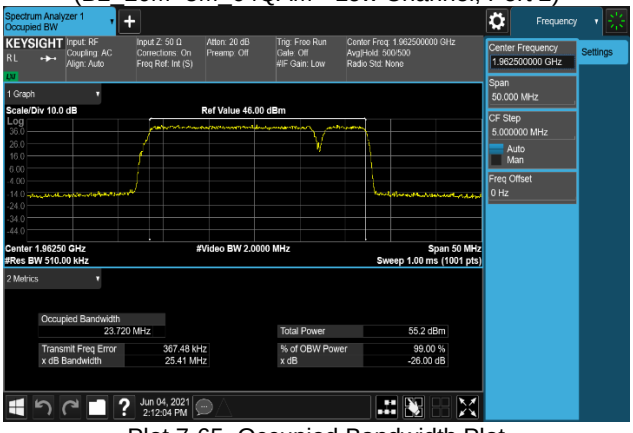
Plot 7-62. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - Low Channel, Port 0)



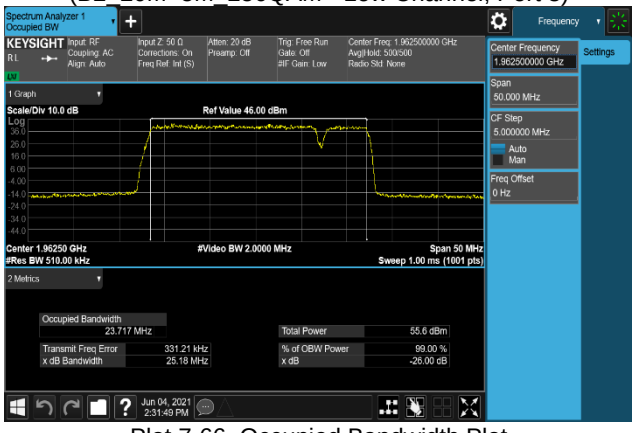
Plot 7-63. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - Low Channel, Port 2)



Plot 7-64. Occupied Bandwidth Plot
(B2_20M+5M_256QAM - Low Channel, Port 3)



Plot 7-65. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - Middle Channel, Port 0)



Plot 7-66. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - Middle Channel, Port 2)

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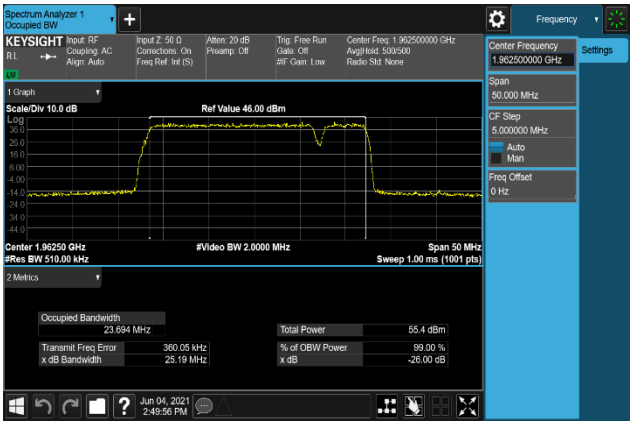
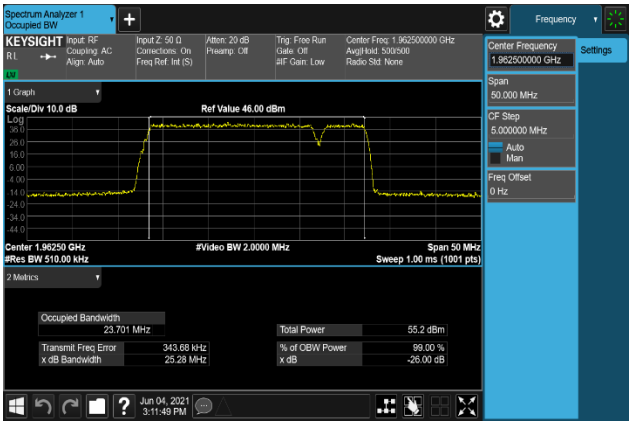
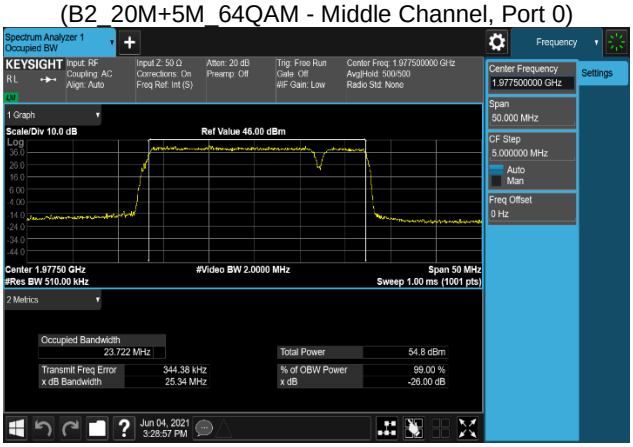


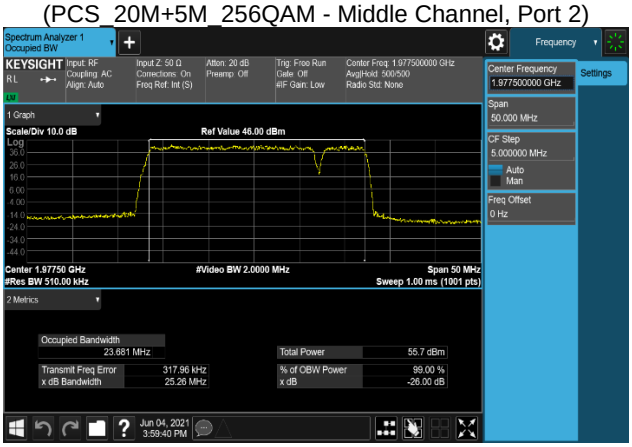
Plot 7-67. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - Middle Channel, Port 0)



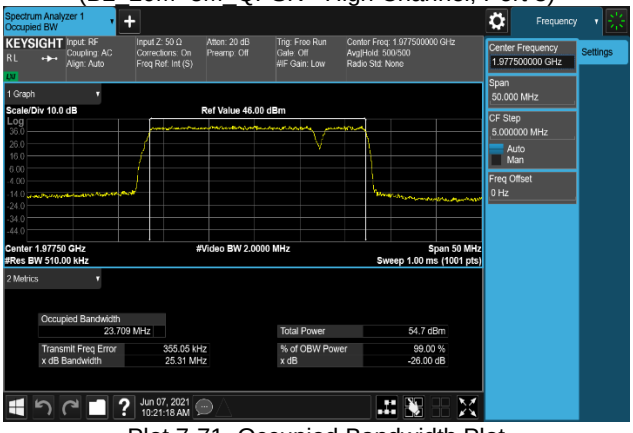
Plot 7-68. Occupied Bandwidth Plot
(PCS_20M+5M_256QAM - Middle Channel, Port 2)



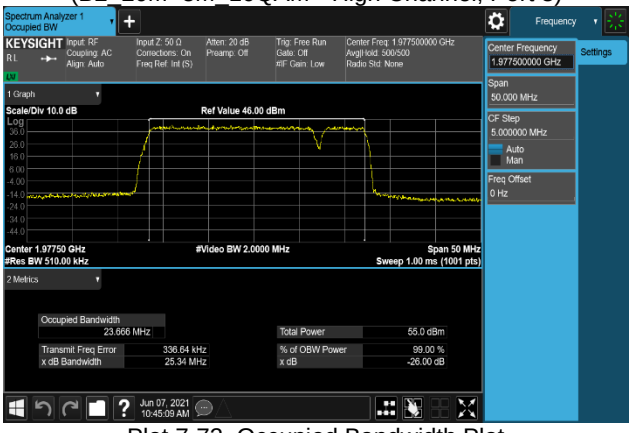
Plot 7-69. Occupied Bandwidth Plot
(B2_20M+5M_QPSK - High Channel, Port 3)



Plot 7-70. Occupied Bandwidth Plot
(B2_20M+5M_16QAM - High Channel, Port 3)



Plot 7-71. Occupied Bandwidth Plot
(B2_20M+5M_64QAM - High Channel, Port 0)



Plot 7-72. Occupied Bandwidth Plot
(B2_20M+5M_256QAM - High Channel, Port 0)

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7.3 Conducted Average Output Power

§ 2.1046

Test Overview

A transmitter port of EUT is connected to the input of a signal analyzer. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5

KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements

ANSI C63.26-2015 – Section 5.2.4.4.1

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer settings were as follows:

1. Conducted average output power measurements are performed using the signal analyzer's "channel power mode" measurement capability for signals with continuous operation.
2. Set span to 2 × to 3 × the OBW.
3. Set RBW = 1 – 5% of the expected OBW
4. Set VBW ≥ 3 × RBW.
5. Set number of measurement points in sweep ≥ 2 × span / RBW.
6. Sweep time:
   a) Set ≥ auto-couple, and enable trace averaging, or
   b) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] and enable a single sweep (automation-compatible) measurement. The sweep time should never be faster than the auto-coupled sweep time.
7. Detector = power averaging (rms).
8. Set sweep trigger to "free run.".
9. 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.
10. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges.

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

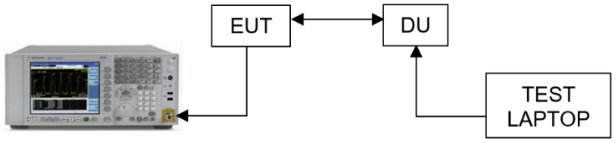

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

1. All the measurement has been tested but test plots are referred from the highest of value of each of modulation of each antenna ports.
2. Consider the following factors for MIMO Output Power:
   a) Conducted power for each port is measured in dBm.
   b) Powers are summed up in linear using the measure-and-sum technique defined in KDB 662911 D01 v02r01-Section D.
   c) Conducted power per port (dBm) is converted to a linear value (mW). A summation of linear powers for all ports gives us the total MIMO conducted power in milliWatts (mW). We convert this back to logarithmic scale (dBm).
3. Sample MIMO Calculation:
   a. Conducted Average Power for Antenna 1: 45.21 dBm
      Conducted Average Power for Antenna 2: 45.13 dBm
      Conducted Average Power for Antenna 3: 44.82 dBm
      Conducted Average Power for Antenna 4: 44.69 dBm
   b. (45.21 dBm + 45.13 dBm + 44.82 dBm + 44.69 dBm) = (33189.4 mW + 32583.7 mW + 30338.9 mW + 29444.2 mW) = 125556.24 mW = 50.99 dBm
   c. Total MIMO Conducted Power as 125556.24 milliWatts.

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- B66_15M+10M+10M_Contiguous_2T

Low Channel	Port	QPSK	16QAM	64QAM	256QAM
Conducted Average Power (dBm)	**0**	49.17	49.18	49.14	49.11
	1	**49.28**	**49.29**	**49.31**	**49.29**
Total MIMO Conducted Power (mW)		167326.54	167712.26	167345.17	166388.48
Total MIMO Conducted Power (dBm)		52.24	52.25	52.24	52.21

Table 7-8. Conducted Average Output Power Table (B66_15M+10M+10M _Contiguous - Low Channel)

Middle Channel	Port	QPSK	16QAM	64QAM	256QAM
Conducted Average Power (dBm)	**0**	49.18	49.14	49.18	49.17
	1	**49.24**	**49.30**	**49.31**	**49.28**
Total MIMO Conducted Power (mW)		166740.22	167148.96	168104.23	167326.54
Total MIMO Conducted Power (dBm)		52.22	52.23	52.26	52.24

Table 7-9. Conducted Average Output Power Table (B66_15M+10M+10M_Contiguous - Middle Channel)

High Channel	Port	QPSK	16QAM	64QAM	256QAM
Conducted Average Power (dBm)	**0**	49.22	49.16	49.19	49.15
	1	**49.28**	**49.28**	**49.30**	**49.28**
Total MIMO Conducted Power (mW)		168283.04	167136.55	168098.88	166947.01
Total MIMO Conducted Power (dBm)		52.26	52.23	52.26	52.23

Table 7-10. Conducted Average Output Power Table (B66_15M+10M+10M_Contiguous - High Channel)

- AWS_15M+10M+10M_Non-Contiguous_2T

Low Channel	Port	QPSK	16QAM	64QAM	256QAM
Conducted Average Power (dBm)	**0**	49.17	49.12	49.12	49.11
	1	**49.33**	**49.32**	**49.35**	**49.34**

Table 7-11. Conducted Average Output Power Table (B66_15M+10M+10M_Non-Contiguous - Low Channel)

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