

TEST REPORT



CTK Co., Ltd.
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Report No.:
CTK-2021-00289
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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey
- Date of Receipt : 2021-01-13

2. Manufacturer

- Name : Samsung Electronics Co., Ltd.
- Address : 416, Maetan 3-Dong, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea

3. Use of Report : For FCC Certification

4. Test Sample / Model: RFV01U-D2A

5. Date of Test : 2021-01-19 to 2021-01-23

6. Test Standard(method) used : FCC 47 CFR Part 2, 22

7. Testing Environment: Temp.: (24 ± 1) °C, Humidity: (42 ± 1) % R.H.

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by  Bong-jun, Jang: (Signature)	Technical Manager  Young-taek, Lee: (Signature)
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2021-01-26

Republic of KOREA **CTK Co., Ltd.**



CTK Co., Ltd.
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Yongin-si, Gyeonggi-do, Korea
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REPORT REVISION HISTORY

Date	Revision	Page No
2021-01-26	Issued (CTK-2021-00289)	All

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1. General Information

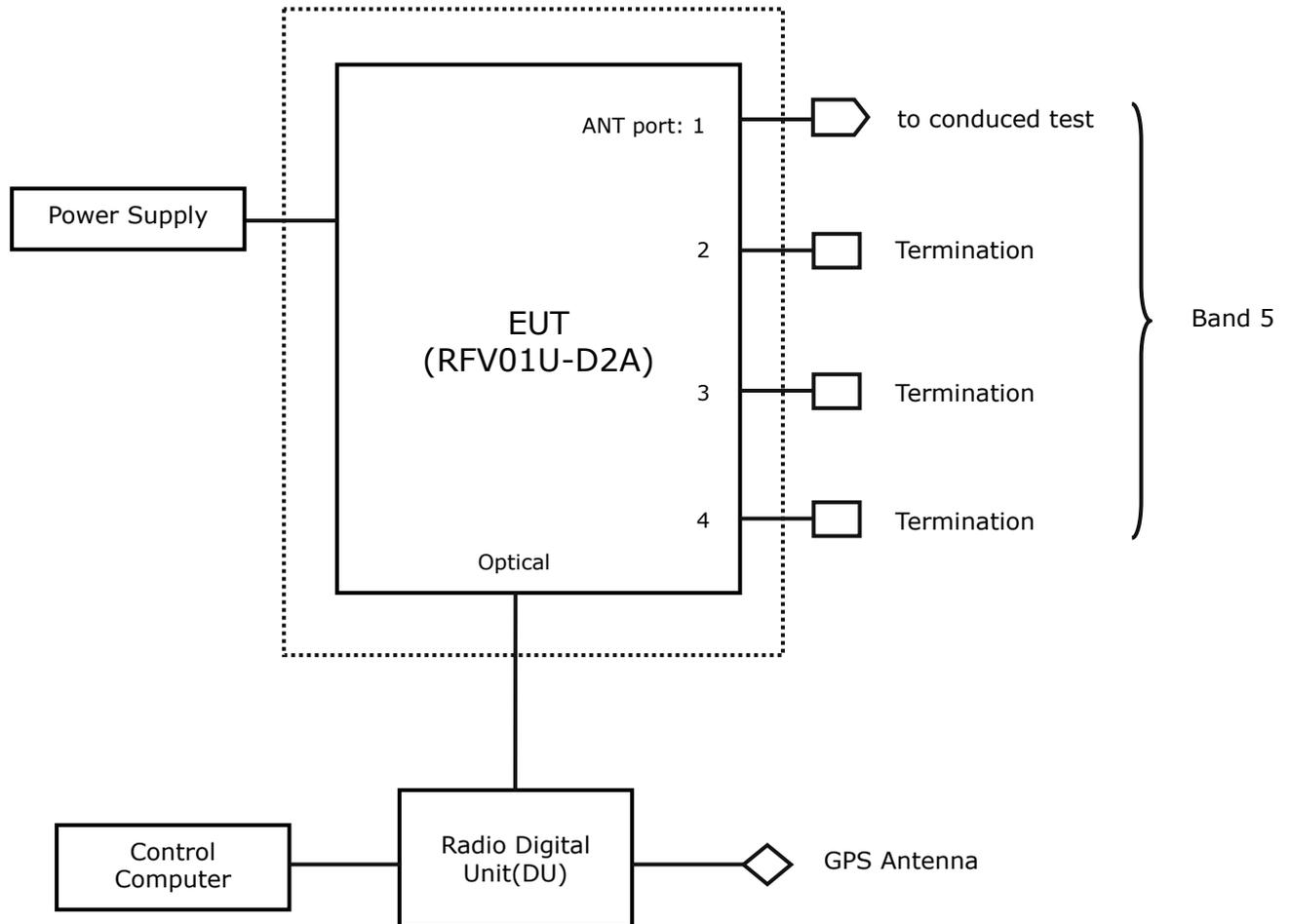
1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Contact Person	Name : Kim, Jong-in E-mail : jered.kim@samsung.com Tel : +82-31-279-3096

1.2 Product Information

FCC ID	A3LRFV01U-D2A
Product Description	RRU (RFV01U)
Model name	RFV01U-D2A
Power Supply	-48 Vdc
Operating Frequency	- Band 5 DL : 869 MHz- 894 MHz, UL 824 MHz - 849 MHz
RF Output Power	- Band 5 Multi(2 Carrier) 2Tx(Contiguous)BW 10 MHz + BW 5 MHz : 120 W(path 60 W *2) 4Tx(Contiguous)BW10 MHz + BW5 MHz : 160 W(path 40 W *4) 2Tx(Non-Contiguous)BW 10 MHz/BW 5 MHz : 120 W(path 60 W *2) 4Tx(Non-Contiguous)BW 10 MHz/BW 5 MHz : 160 W(path 40 W *4)
Channel Bandwidth	5 MHz, 10 MHz
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM
FCC Rule	Part 2 : FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS Part 22 : PUBLIC MOBILE SERVICES KDB Publication 662911 D01 Multiple Transmitter Output v02r01

1.3 Configurations





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2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



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3. Test Specifications

3.1 Standards

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 22.

Section	Test Items	Results
§2.1046, §22.913	RF output power	Compliant
§2.1049	Occupied bandwidth	Compliant
§2.1051, §22.917	Spurious Emissions at Antenna Terminals	Compliant
§2.1051, §22.917	Band edge	Compliant
§2.1053, §22.917	Spurious Radiated Emissions	Compliant
§2.1055(a)(1), §22.355	Frequency Stability over Temperature variation	Compliant
§2.1055(d), §22.355	Frequency Stability over Voltage variation	Compliant

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments. During at testing, system components were manipulated within the confines of typical usage to maximize each emission. All modulation(QPSK, 16QAM, 64QAM, 256QAM) modes were tests. The results are only attached worst cases.



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Operating band and Frequency range

Band 5	Transmit	869 MHz to 894 MHz
	Receive	824 MHz to 849 MHz

Operating Configurations

Supported configurations	Multi carrier
Spectrum Operation	Contiguous, Non-contiguous

Multi 2 carrier rated total output power as a sum of all carriers(10MHz + 5MHz)

Type	Bandwidth positions		1 st FA	2 nd FA	Power Sum	Output antenna port	Total (sum)
Contiguous	Bottom	Bandwidth	10 MHz	5 MHz			
		Frequency	874 MHz	881.5 MHz			
		Output Power	40 W	20 W	60 W	2Tx(1, 2)	120 W
			26.7 W	13.3 W	40 W	4Tx(1, 2, 3, 4)	160 W
	Middle	Bandwidth	10 MHz	5 MHz			
		Frequency	879 MHz	886.5 MHz			
		Output Power	40 W	20 W	60 W	2Tx(1, 2)	120 W
			26.7 W	13.3 W	40 W	4Tx(1, 2, 3, 4)	160 W
	Top	Bandwidth	10 MHz	5 MHz			
		Frequency	884 MHz	891.5 MHz			
		Output Power	40 W	20 W	60 W	2Tx(1, 2)	120 W
			26.7 W	13.3 W	40 W	4Tx(1, 2, 3, 4)	160 W
Non-Contiguous	Bottom / Top	Bandwidth	10 MHz	5 MHz			
		Frequency	874 MHz	891.5 MHz			
		Output Power	40 W	20 W	60 W	2Tx(1, 2)	120 W
			26.7 W	13.3 W	40 W	4Tx(1, 2, 3, 4)	160 W



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3.3 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor $k = 2$, Confidence levels of 95 %

Description	Uncertainty
Conducted RF output power	1.5 dB
Occupied bandwidth	0.1 MHz
Spurious emission at antenna terminals	3.0 dB
Radiated spurious emissions ($f \leq 1$ GHz)	4.0 dB
Radiated spurious emissions ($f > 1$ GHz)	5.0 dB
Frequency stability	0.1 kHz

3.4 Standards Environmental Test conditions

Temperature	+ 15 °C to + 35 °C
Relative humidity	30 % to 60 %
Air pressure	860 mbar to 1 060 mbar



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4. RF output power

Test Requirements :

§ 2.1046 Measurements required : RF power output :

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as follows. In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 22.913 Effective radiated power limits.

Licensees in the Cellular Radiotelephone Service are subject to the effective radiated power (ERP) limits and other requirements in this Section. *See also* §22.169.

(a) *Maximum ERP.* The ERP of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.

(1) Except as described in paragraphs (a)(2), (3), and (4) of this section, the ERP of base stations and repeaters must not exceed—

- (i) 500 watts per emission; or
- (ii) 400 watts/MHz (PSD) per sector.

(2) Except as described in paragraphs (a)(3) and (4) of this section, for systems operating in areas more than 72 kilometers (45 miles) from international borders that:

- (i) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or
- (ii) Extend coverage into Unserved Area on a secondary basis (*see* §22.949), the ERP of base transmitters and repeaters must not exceed—

- (A) 1000 watts per emission; or
- (B) 800 watts/MHz (PSD) per sector.

(3) Provided that they also comply with paragraphs (b) and (c) of this section, licensees are permitted to operate their base transmitters and repeaters with an ERP greater than 400 watts/MHz (PSD) per



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sector, up to a maximum ERP of 1000 watts/MHz (PSD) per sector unless they meet the conditions in paragraph (a)(4) of this section.

(4) Provided that they also comply with paragraphs (b) and (c) of this section, licensees of systems operating in areas more than 72 kilometers (45 miles) from international borders that:

(i) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or

(ii) Extend coverage into Unserved Area on a secondary basis (*see* §22.949), are permitted to operate base transmitters and repeaters with an ERP greater than 800 watts/MHz (PSD) per sector, up to a maximum of 2000 watts/MHz (PSD) per sector.

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



Test Procedures :

According to FCC §2.1046 (a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c). The electrical characteristics of the radio frequency load attached to the output terminals when this is made shall be stated.

- 1) The radio frequency load attached to the EUT antenna terminal was 50 Ohm. The loss of the cables the test system is calibrated to correct the reading.
- 2) The spectrum analyzer was set to RMS Detector function and Average mode.
- 3) The resolution bandwidth of the spectrum analyzer was comparable to the emission bandwidth.
- 4) The conducted emission level is measured at each antenna port and then summed mathematically to determine the total emission level from the device.

Note 1 : The conducted emission level is measured at each antenna port and then summed mathematically to determine the total emission level from the device.

Note 2: Maximum ERP is sufficient level to pass the limit.

Note 3 : Sum data is in a tolerance of specification provided from manufacturer.

Note 4 : If applicable, the EIRP[W] = $10^{((\text{channel power[dBm]} + \text{Antenna Gain[dBi]})/10)} / 10^{-3}$

Note 5: EIRP does not exceed the reference value even if the maximum antenna gain is applied according to Note 1.

Maximum output power for one port :

BW 10 MHz+5 MHz : **2Tx : 47.782 dBm (Path 60 W)**

4Tx : 46.021 dBm (Path 40 W)

Maximum output sum power :

BW 10 MHz+5 MHz : **2Tx : 50.792 dBm (Path 60W * 2=120 W),**

4Tx : 52.041 dBm (Path 40W * 4=160 W)

Measured sum maximum power : **51.97 dBm (157.50 W)**



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Test Results :

Test Data : BW 10 MHz + 5 MHz, Multi 2carrier, 2Tx

Type	Channel	Modulation	Output Power [dBm]				Total Power	
			Test antenna port				[dBm]	[W]
			1	2	3	4		
Contiguous	Bottom	QPSK	47.84	47.65			50.76	119.03
		16QAM	47.89	47.68			50.80	120.13
		64QAM	48.03	47.63			50.84	121.48
		256QAM	47.90	47.70			50.81	120.55
	Middle	QPSK	47.77	47.61			50.70	117.52
		16QAM	47.80	47.58			50.70	117.54
		64QAM	47.78	47.59			50.70	117.39
		256QAM	47.75	47.73			50.75	118.86
	Top	QPSK	47.86	47.58			50.73	118.38
		16QAM	47.88	47.56			50.73	118.39
		64QAM	47.87	47.58			50.74	118.52
		256QAM	47.99	47.69			50.85	121.70

Type	Channel	Modulation	Output Power [dBm]				Total Power	
			Test antenna port				[dBm]	[W]
			1	2	3	4		
Non-Contiguous	Bottom	QPSK	46.27	45.98			49.14	81.99
		16QAM	46.28	45.95			49.13	81.82
		64QAM	46.26	45.94			49.11	81.53
		256QAM	46.25	45.92			49.10	81.26
	Top	QPSK	43.20	42.94			46.08	40.57
		16QAM	43.23	42.90			46.08	40.54
		64QAM	43.17	42.89			46.04	40.20
		256QAM	43.19	42.90			46.06	40.35
	Bottom + Top	QPSK					50.88	122.57
	Bottom + Top	16QAM					50.88	122.36
	Bottom + Top	64QAM					50.85	121.74
	Bottom + Top	256QAM					50.85	121.60



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Test Data : BW 10 MHz + 5 MHz, Multi 2carrier, 4Tx

Type	Channel	Modulation	Output Power [dBm]				Total Power	
			Test antenna port				[dBm]	[W]
			1	2	3	4		
Contiguous	Bottom	QPSK	46.13	46.01	45.91	45.75	51.97	157.50
		16QAM	46.08	45.84	45.78	45.67	51.87	153.66
		64QAM	46.20	45.98	45.90	45.65	51.96	156.95
		256QAM	46.22	45.98	45.88	45.67	51.96	157.13
	Middle	QPSK	46.15	45.92	45.79	45.63	51.90	154.78
		16QAM	46.08	45.90	45.78	45.62	51.87	153.78
		64QAM	45.98	45.92	45.79	45.62	51.85	153.12
		256QAM	46.05	45.90	45.77	45.63	51.86	153.49
	Top	QPSK	46.15	45.94	45.85	45.65	51.92	155.66
		16QAM	46.18	45.83	45.73	45.52	51.84	152.83
		64QAM	46.17	45.95	45.85	45.64	51.93	155.86
		256QAM	46.16	45.95	45.83	45.62	51.92	155.42

Type	Channel	Modulation	Output Power [dBm]				Total Power	
			Test antenna port				[dBm]	[W]
			1	2	3	4		
Non-Contiguous	Bottom	QPSK	44.40	44.18	44.13	43.83	50.16	103.76
		16QAM	44.40	44.19	44.12	43.90	50.18	104.15
		64QAM	44.39	44.17	44.12	43.89	50.17	103.91
		256QAM	44.39	44.16	44.10	43.88	50.16	103.68
	Top	QPSK	41.20	41.06	40.95	40.74	47.01	50.25
		16QAM	41.19	41.07	40.97	40.80	47.03	50.47
		64QAM	41.18	41.04	40.93	40.77	47.00	50.16
		256QAM	41.19	41.05	40.94	40.79	47.02	50.30
	Bottom + Top	QPSK					51.88	154.01
	Bottom + Top	16QAM					51.89	154.63
	Bottom + Top	64QAM					51.88	154.07
	Bottom + Top	256QAM					51.87	153.98



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Test Plot at Output Power

**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Bottom
 ANT 1**

QPSK



16QAM



64QAM



256QAM





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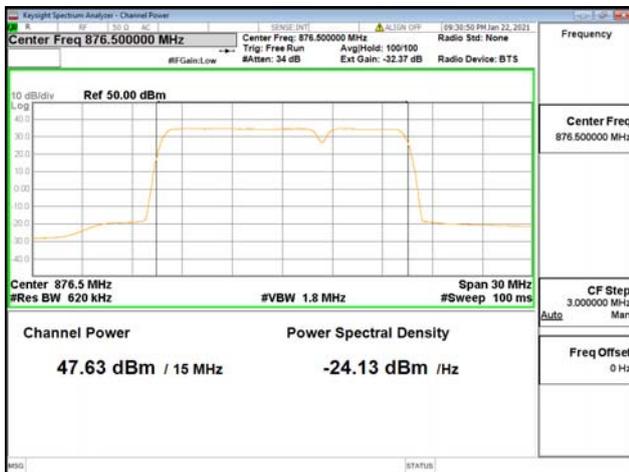
QPSK



16QAM



64QAM



256QAM





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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Middle
 ANT 1**

QPSK



16QAM



64QAM



256QAM





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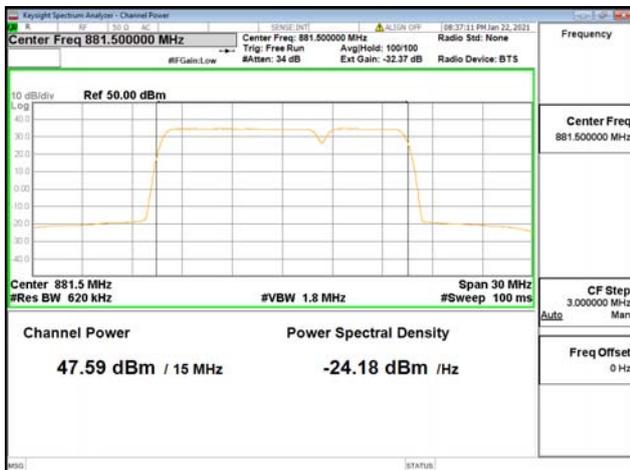
QPSK



16QAM



64QAM



256QAM





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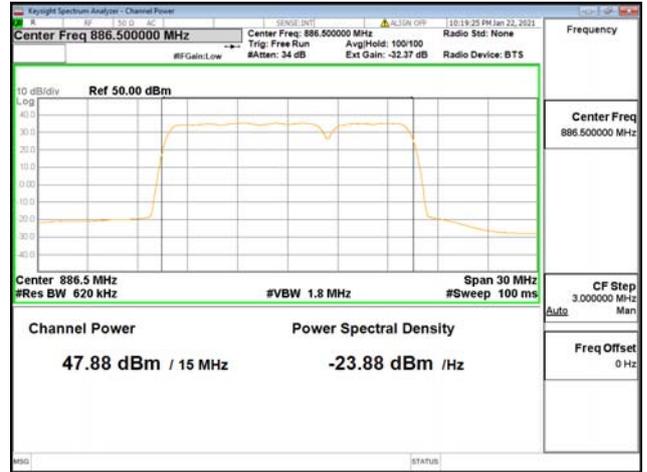
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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Top
 ANT 1**

QPSK



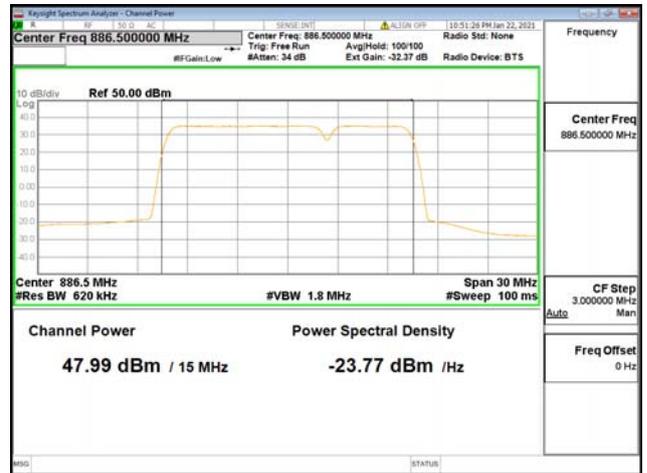
16QAM



64QAM



256QAM





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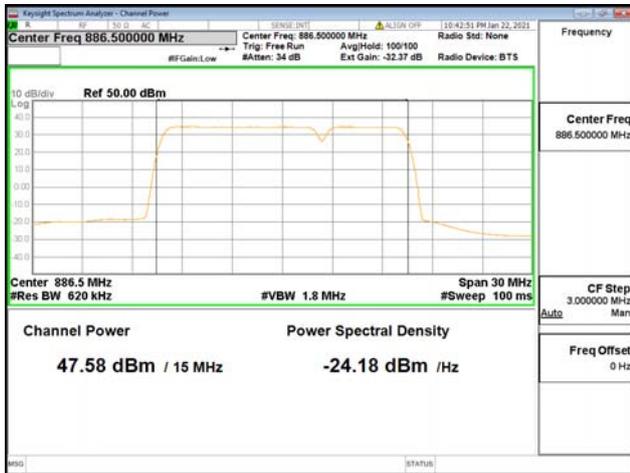
QPSK



16QAM



64QAM



256QAM





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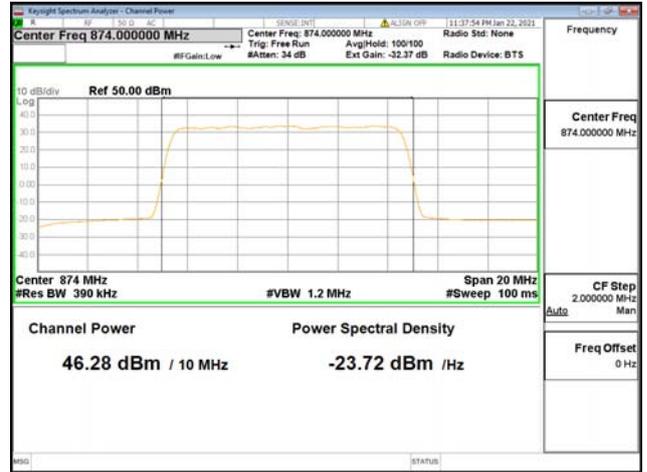
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**BW 10MHz+5MHz, Multi 2 carrier(Non-Contiguous), 2Tx, Bottom
 ANT 1**

QPSK



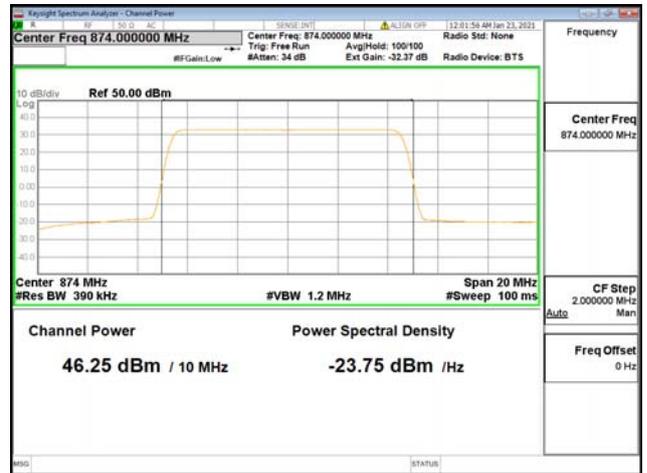
16QAM



64QAM



256QAM





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QPSK



16QAM



64QAM



256QAM





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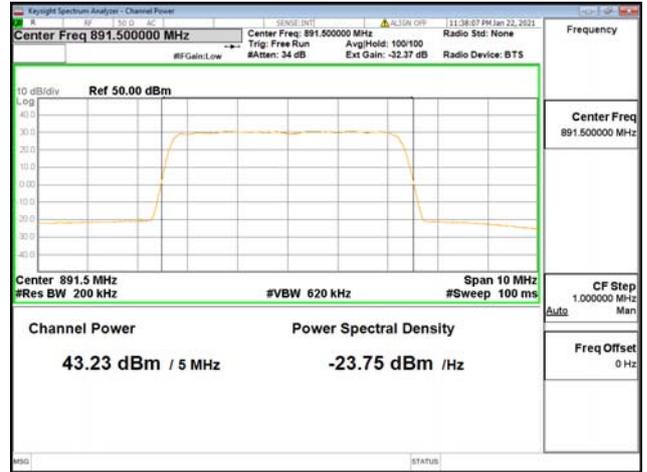
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**BW 10MHz+5MHz, Multi 2 carrier(Non-Contiguous), 2Tx, Top
 ANT 1**

QPSK



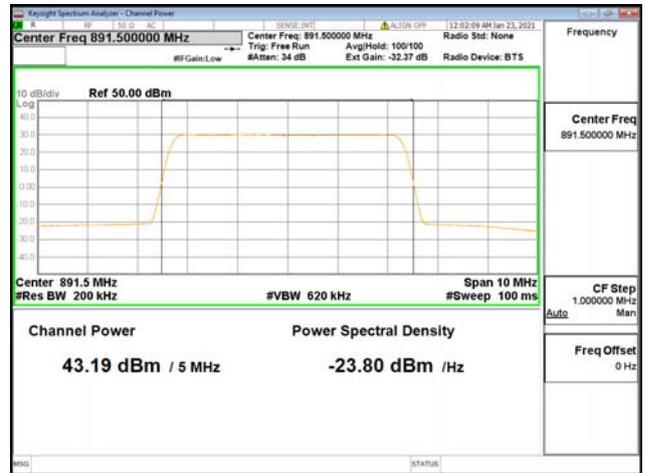
16QAM



64QAM



256QAM





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ANT 2

QPSK



16QAM



64QAM



256QAM





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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 4Tx, Bottom
ANT 1**

QPSK



16QAM



64QAM



256QAM





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ANT 2

QPSK



16QAM



64QAM



256QAM





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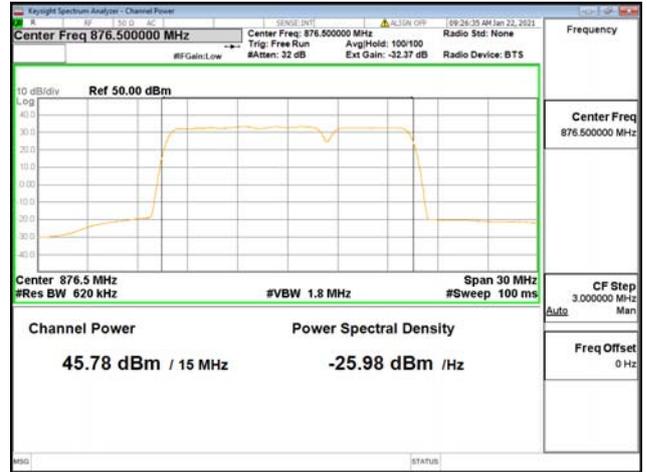
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ANT 3

QPSK



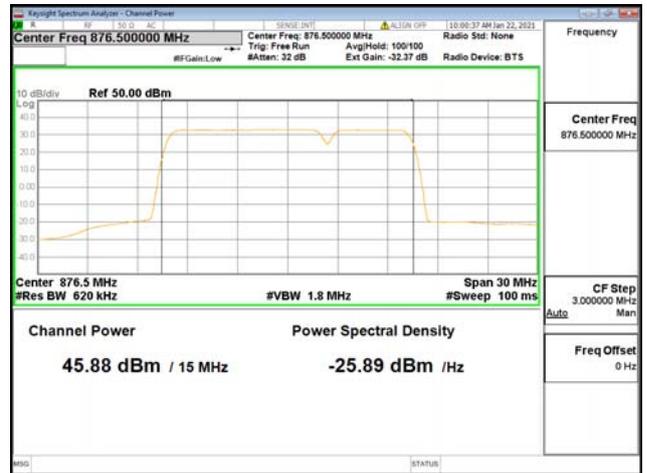
16QAM



64QAM



256QAM





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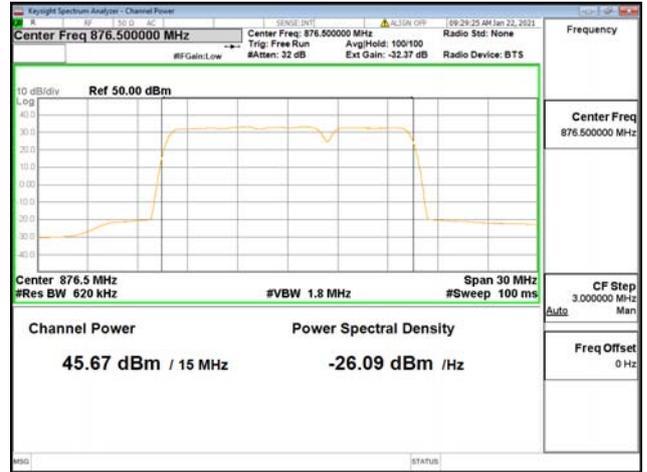
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ANT 4

QPSK



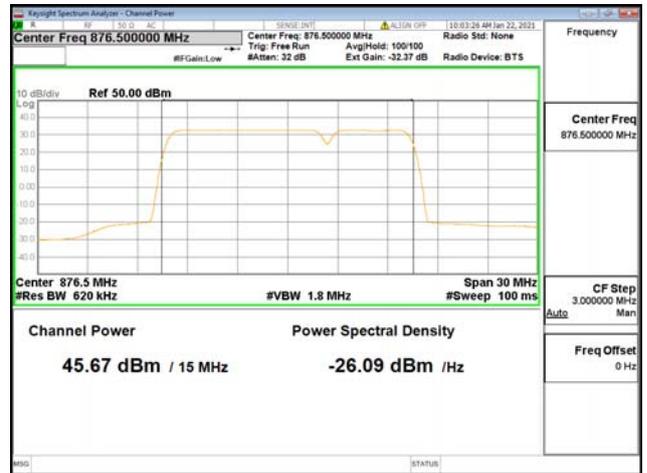
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64QAM



256QAM



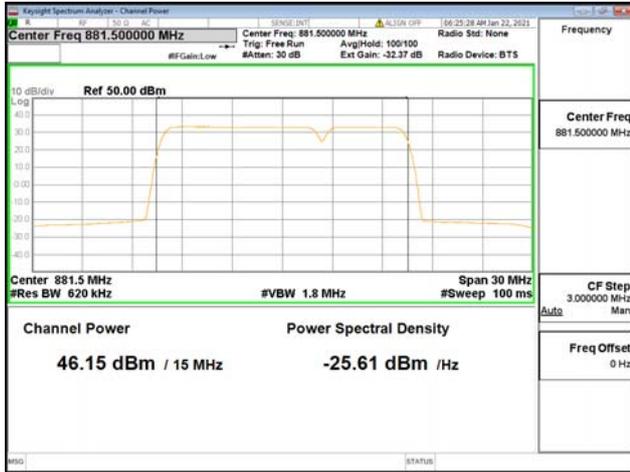


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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 4Tx, Middle
 ANT 1**

QPSK



16QAM



64QAM



256QAM





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QPSK



16QAM



64QAM



256QAM





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ANT 3

QPSK



16QAM



64QAM



256QAM





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QPSK



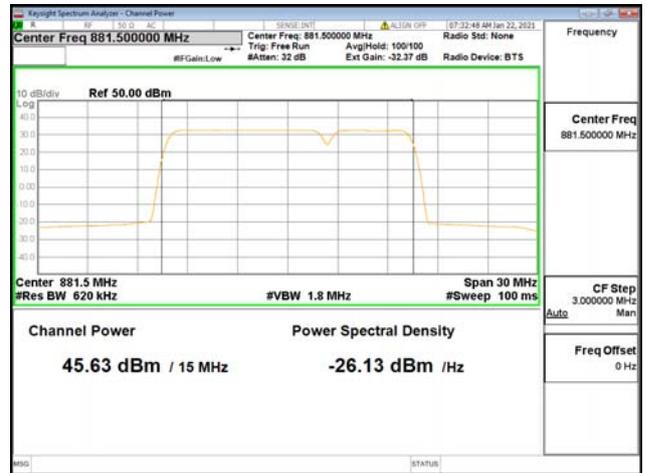
16QAM



64QAM



256QAM





**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 4Tx, Top
 ANT 1**

QPSK



16QAM



64QAM



256QAM





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QPSK



16QAM



64QAM



256QAM





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QPSK



16QAM



64QAM



256QAM





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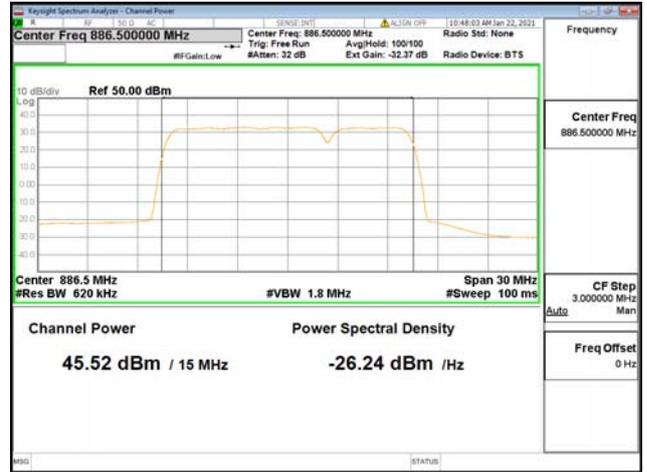
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ANT 4

QPSK



16QAM



64QAM



256QAM





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**BW 10MHz+5MHz, Multi 2 carrier(Non-Contiguous), 4Tx, Bottom
 ANT 1**

QPSK



16QAM



64QAM



256QAM





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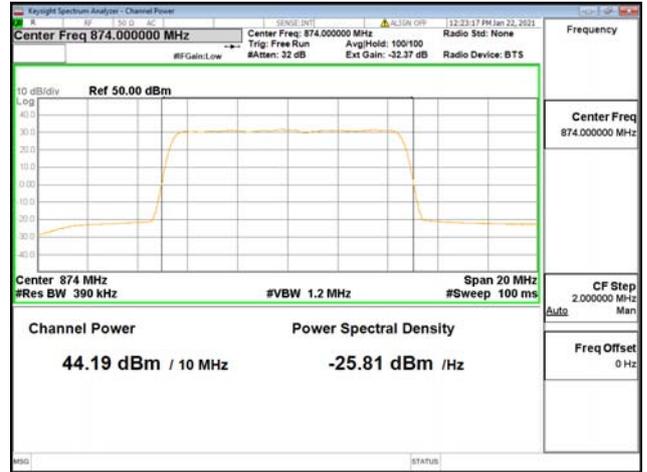
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QPSK



16QAM



64QAM



256QAM





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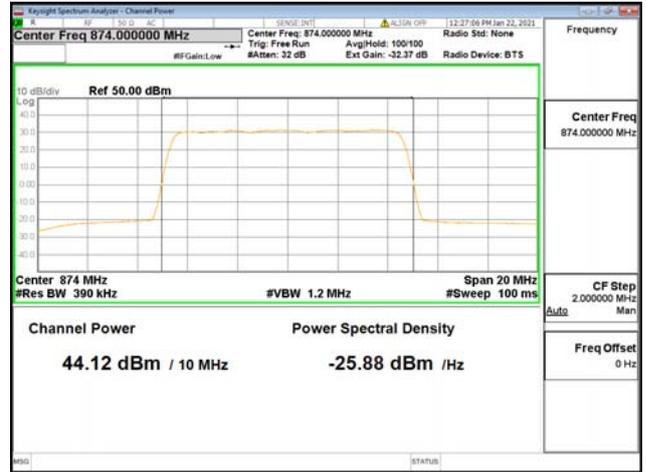
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QPSK



16QAM



64QAM



256QAM





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ANT 4

QPSK



16QAM



64QAM



256QAM





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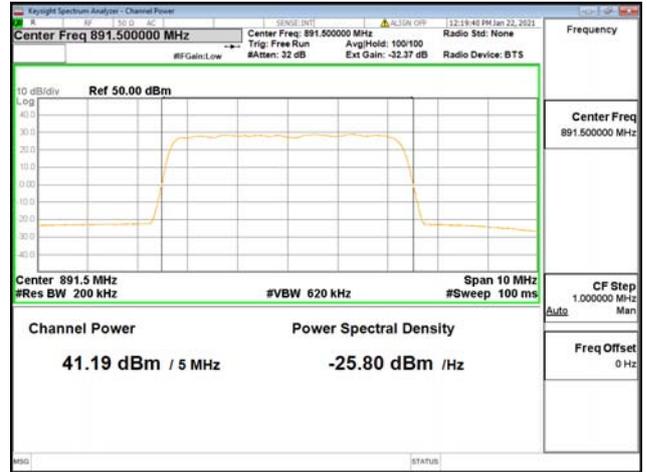
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**BW 10MHz+5MHz, Multi 2 carrier(Non-Contiguous), 4Tx, Top
 ANT 1**

QPSK



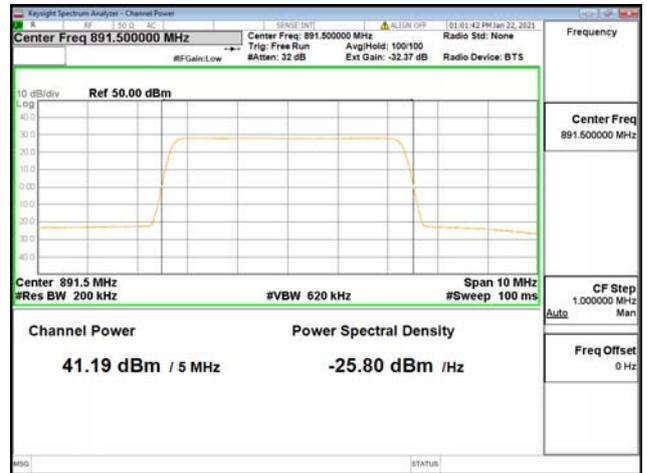
16QAM



64QAM



256QAM





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QPSK



16QAM



64QAM



256QAM





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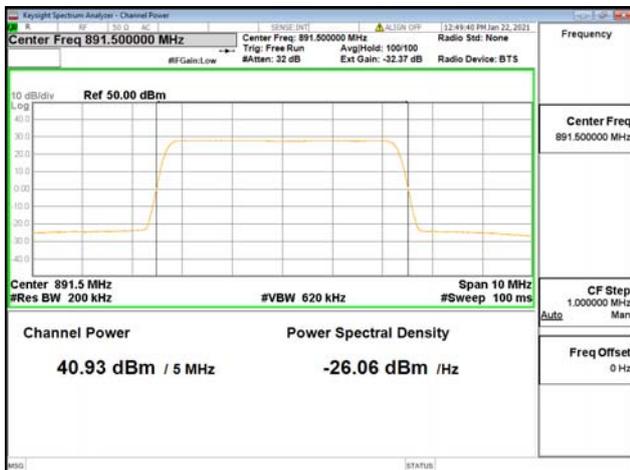
QPSK



16QAM



64QAM



256QAM





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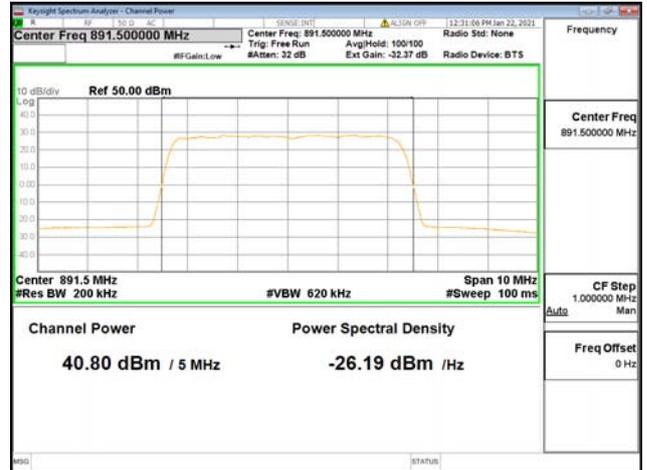
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ANT 4

QPSK



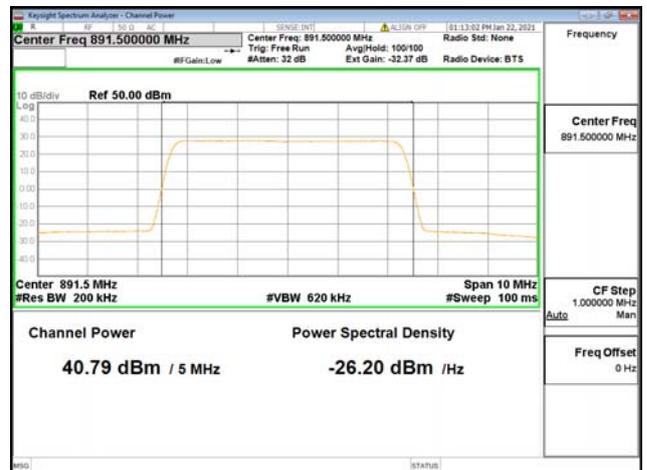
16QAM



64QAM



256QAM



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5. Occupied Bandwidth

Test Requirements :

§ 2.1049 Measurements required : Occupied bandwidth

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 under the specified conditions of § 2.1049(a) through (i) as applicable.

Test Procedures :

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation. The EUT was connected to a spectrum analyzer enabled with an occupied bandwidth in accordance with FCC Part 2.1049. The occupied bandwidth was measured from the fundamental emission at the bottom, middle and top channels. The occupied bandwidth was measured using the built in occupied bandwidth function of the spectrum analyzer. It was set to measure the bandwidth where 99% of the signal power was contained. The analyzer automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.



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Test Results :

Test Data : BW 10MHz+5MHz, Multi 2 carrier , 2Tx

Type	Channel	Modulation	Occupied Bandwidth(MHz)			
			Test antenna port			
			1	2	3	4
Contiguous	Bottom	QPSK	14.43	14.43		
		16QAM	14.38	14.38		
		64QAM	14.43	14.43		
		256QAM	14.43	14.43		
	Middle	QPSK	14.43	14.43		
		16QAM	14.37	14.37		
		64QAM	14.43	14.43		
		256QAM	14.43	14.43		
	Top	QPSK	14.43	14.43		
		16QAM	14.37	14.35		
		64QAM	14.43	14.43		
		256QAM	14.43	14.43		
Non-Contiguous	Bottom	QPSK	9.11	9.11		
		16QAM	9.10	9.11		
		64QAM	9.11	9.16		
		256QAM	9.11	9.11		
	Top	QPSK	4.57	4.57		
		16QAM	4.54	4.52		
		64QAM	4.57	4.57		
		256QAM	4.57	4.57		

Test Data : BW 10MHz+5MHz, Multi 2 carrier , 4Tx

Type	Channel	Modulation	Occupied Bandwidth(MHz)			
			Test antenna port			
			1	2	3	4
Contiguous	Bottom	QPSK	14.43	14.43	14.42	14.42
		16QAM	14.41	14.40	14.40	14.40
		64QAM	14.43	14.43	14.43	14.43
		256QAM	14.43	14.43	14.43	14.42
	Middle	QPSK	14.43	14.43	14.42	14.43
		16QAM	14.36	14.37	14.36	14.37
		64QAM	14.43	14.43	14.42	14.43
		256QAM	14.43	14.43	14.42	14.43
	Top	QPSK	14.43	14.43	14.42	14.42
		16QAM	14.36	14.35	14.37	14.37
		64QAM	14.43	14.43	14.43	14.42
		256QAM	14.43	14.43	14.42	14.43
Non-Contiguous	Bottom	QPSK	9.11	9.11	9.11	9.11
		16QAM	9.09	9.10	9.09	9.09
		64QAM	9.11	9.11	9.11	9.11
		256QAM	9.11	9.11	9.11	9.11
	Top	QPSK	4.57	4.57	4.57	4.57
		16QAM	4.54	4.53	4.54	4.54
		64QAM	4.57	4.57	4.57	4.57
		256QAM	4.57	4.57	4.57	4.57



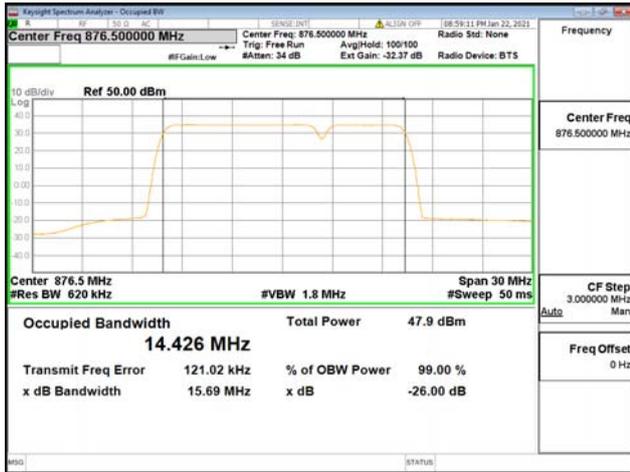
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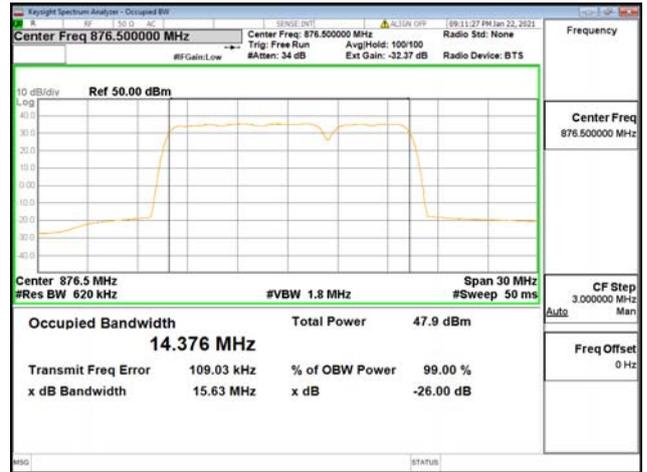
Test Plot at Occupied Bandwidth

**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Bottom
 ANT 1**

QPSK



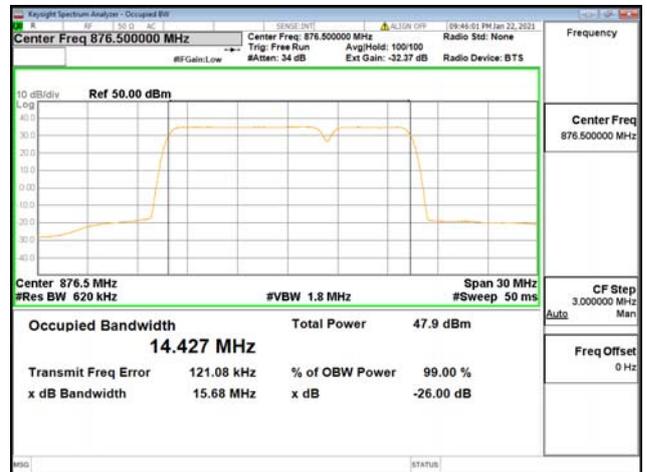
16QAM



64QAM



256QAM



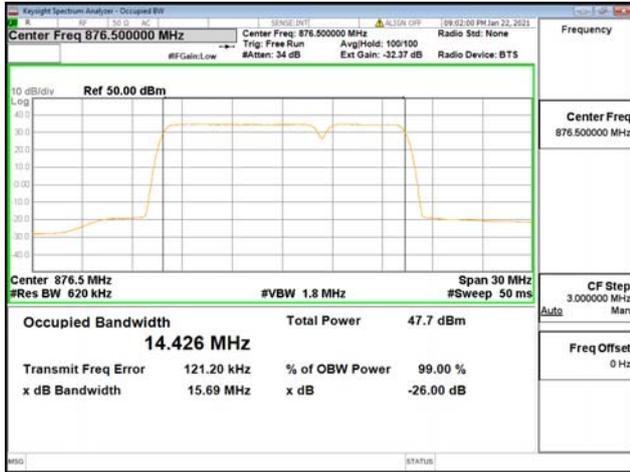


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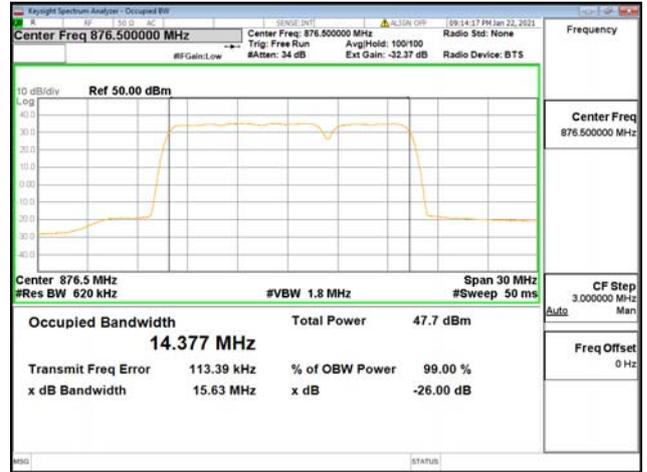
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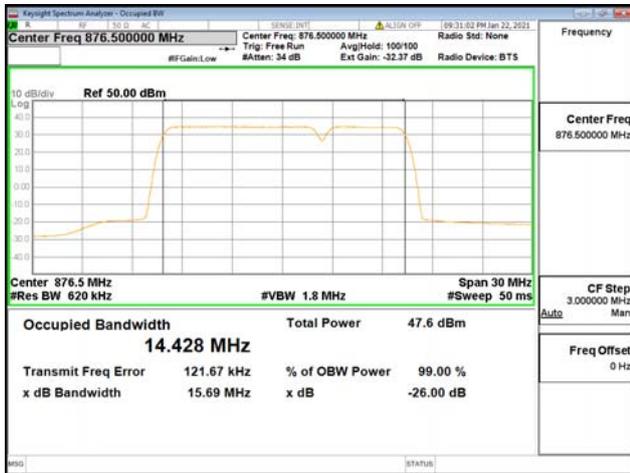
QPSK



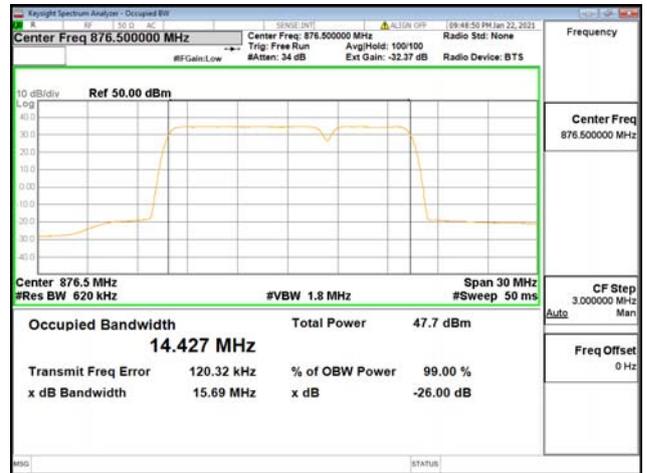
16QAM



64QAM



256QAM



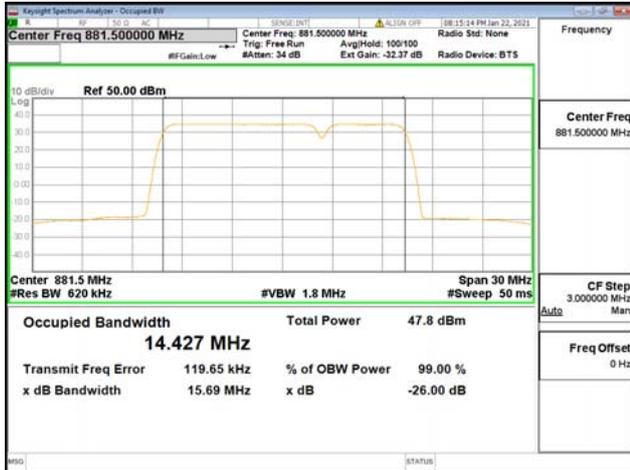


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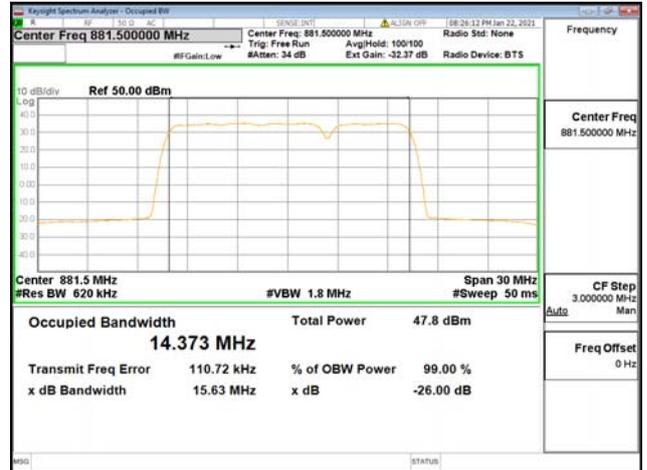
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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Middle
 ANT 1**

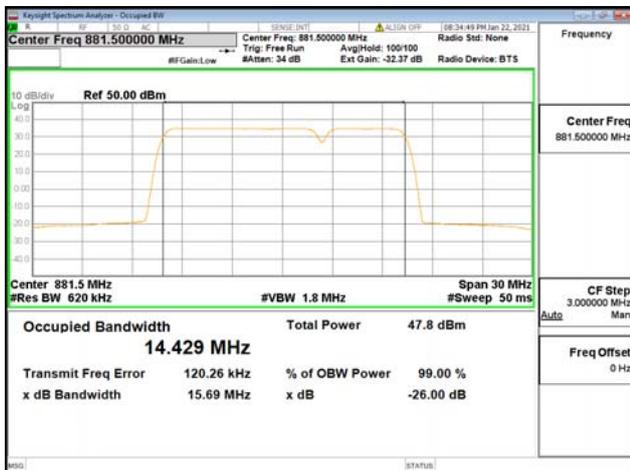
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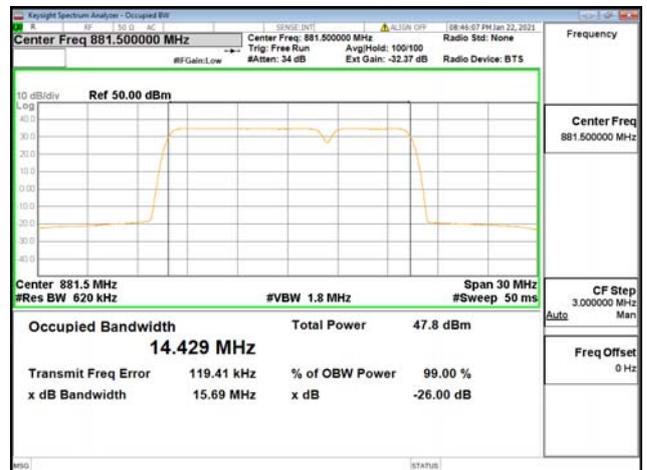
16QAM



64QAM



256QAM



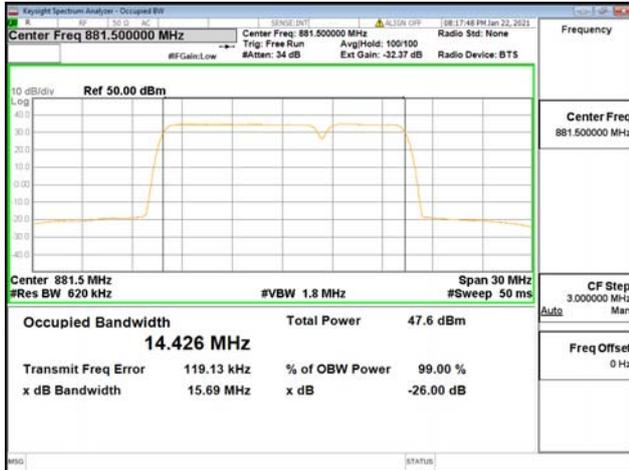


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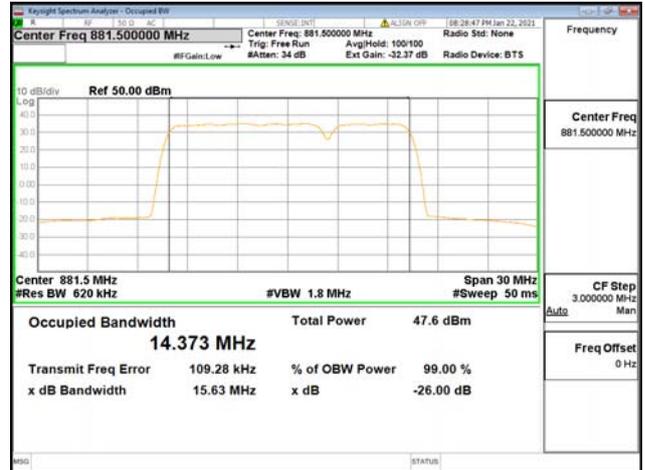
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ANT 2

QPSK



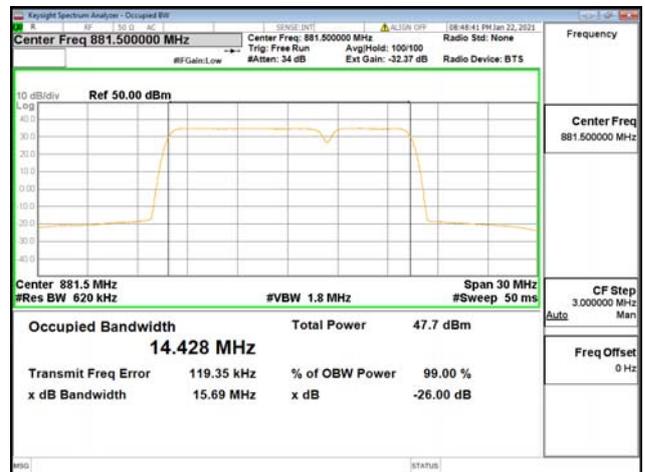
16QAM



64QAM



256QAM



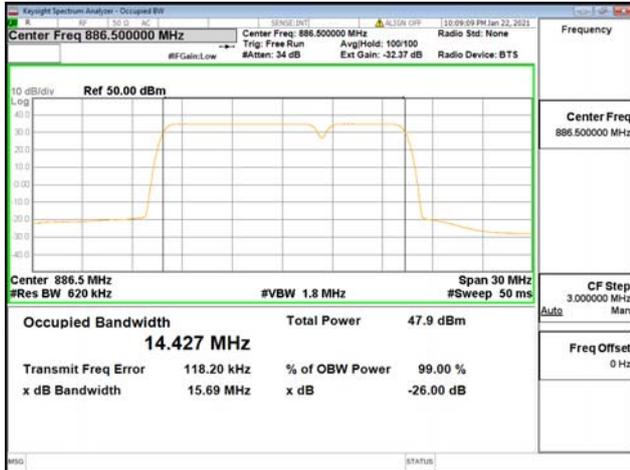


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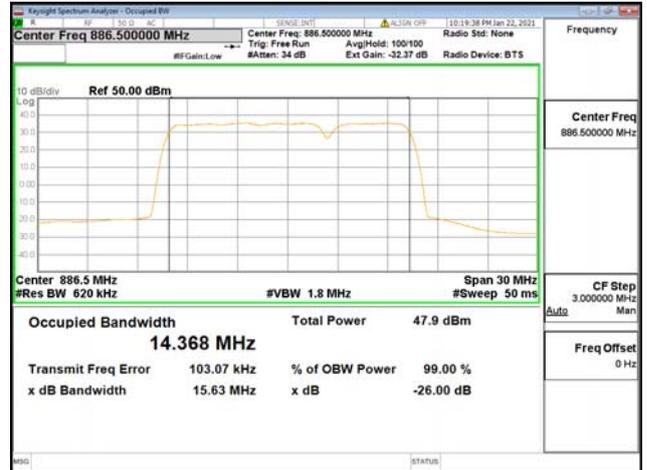
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**BW 10MHz+5MHz, Multi 2 carrier(Contiguous), 2Tx, Top
 ANT 1**

QPSK



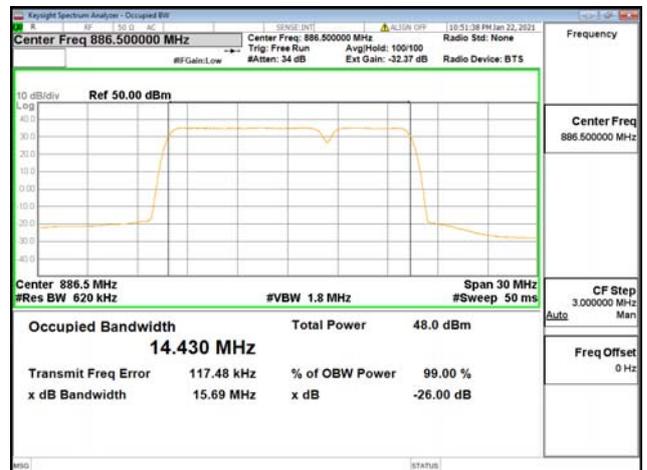
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64QAM



256QAM



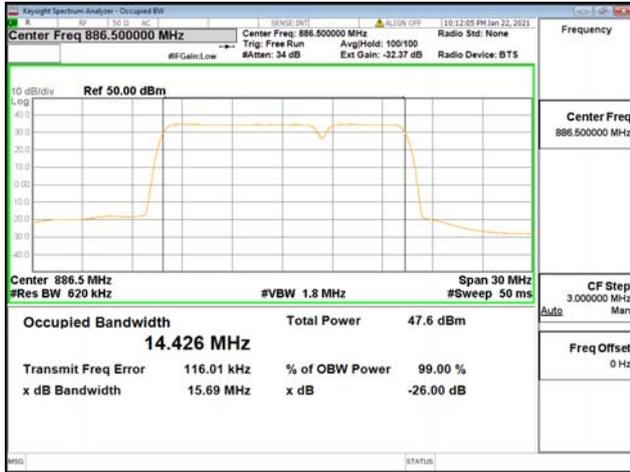


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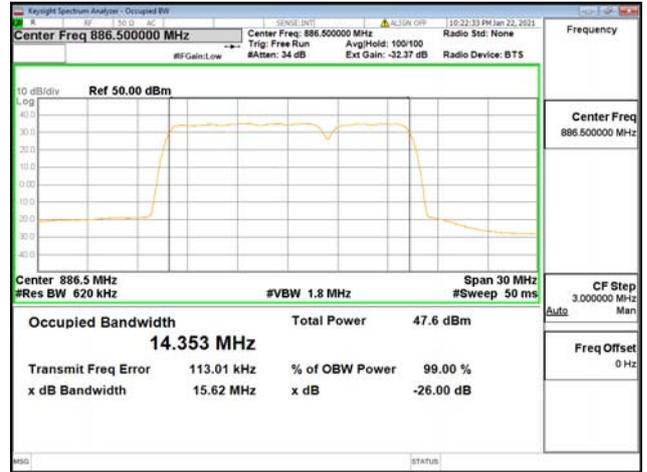
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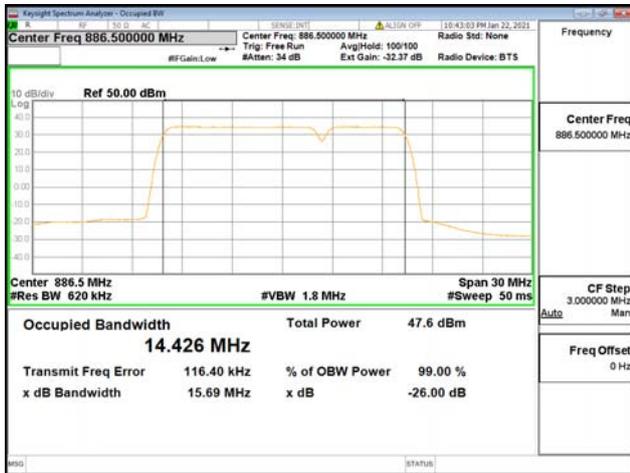
QPSK



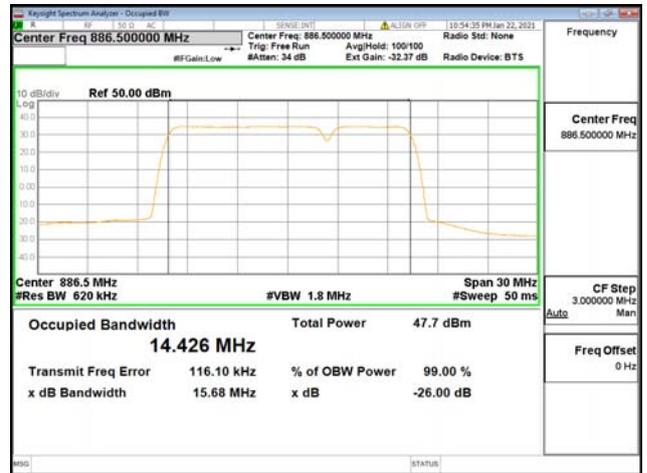
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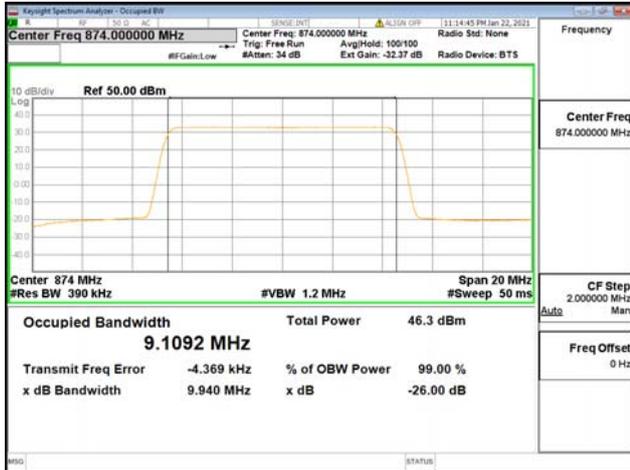


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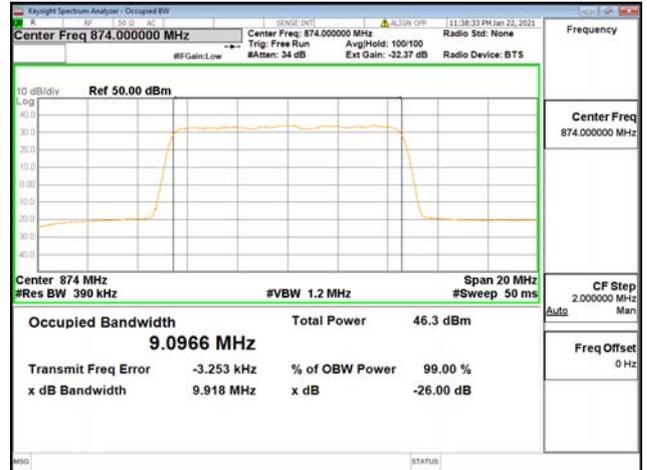
Report No.:
 CTK-2021-00289
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 Pages

**BW 10MHz+5MHz, Multi 2 carrier(Non-Contiguous), 2Tx, Bottom
 ANT 1**

QPSK



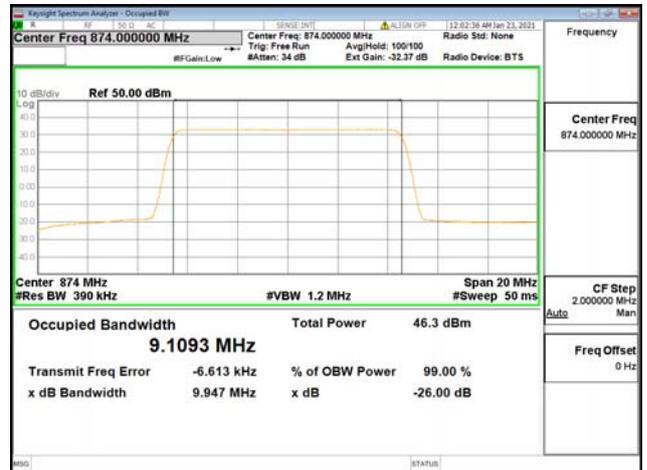
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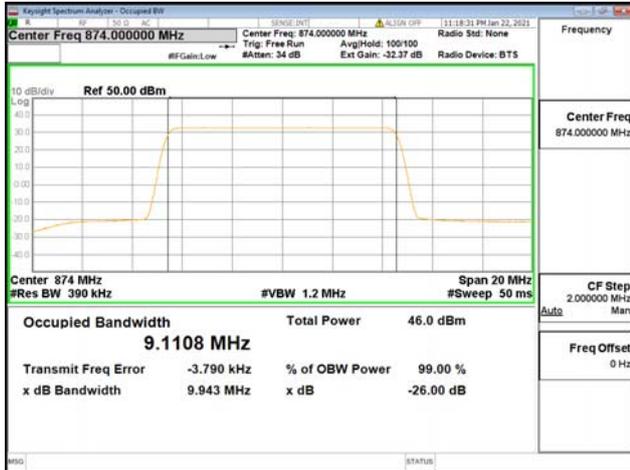
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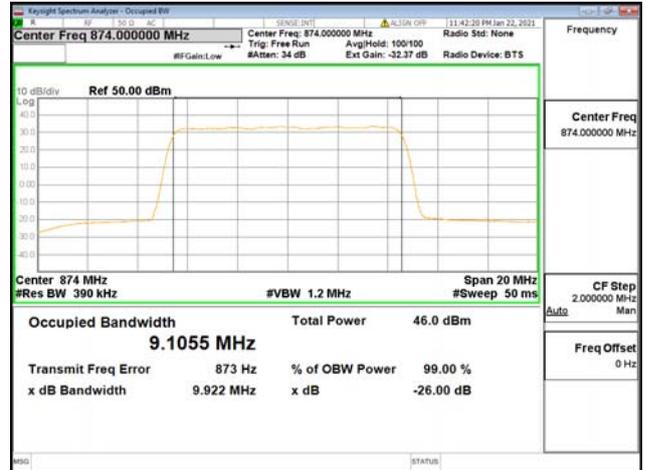


ANT 2

QPSK



16QAM



64QAM



256QAM

