

TEST REPORT



CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu,
Yongin-si, Gyeonggi-do, Korea
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Report No.:
CTK-2017-01618-2
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1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey
- Date of Receipt : 2017-07-27

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-D1A

5. Date of Test : 2017-07-28 to 2017-09-04

6. Test Standard(method) used : FCC 47 CFR Part 2, 24, 27

7. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (45 ± 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	Technical Manager
	Bong-jun, Jang:  (Signature)	Young-taek, Lee:  (Signature)

2017-09-07

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

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REPORT REVISION HISTORY

Date	Revision	Page No
2017-08-28	Issued (CTK-2017-01618)	All
2017-09-07	Issued (CTK-2017-01618-2) Addition of Bandwidth(Band 2 Single/Multi Carrier)	All

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1. General Information

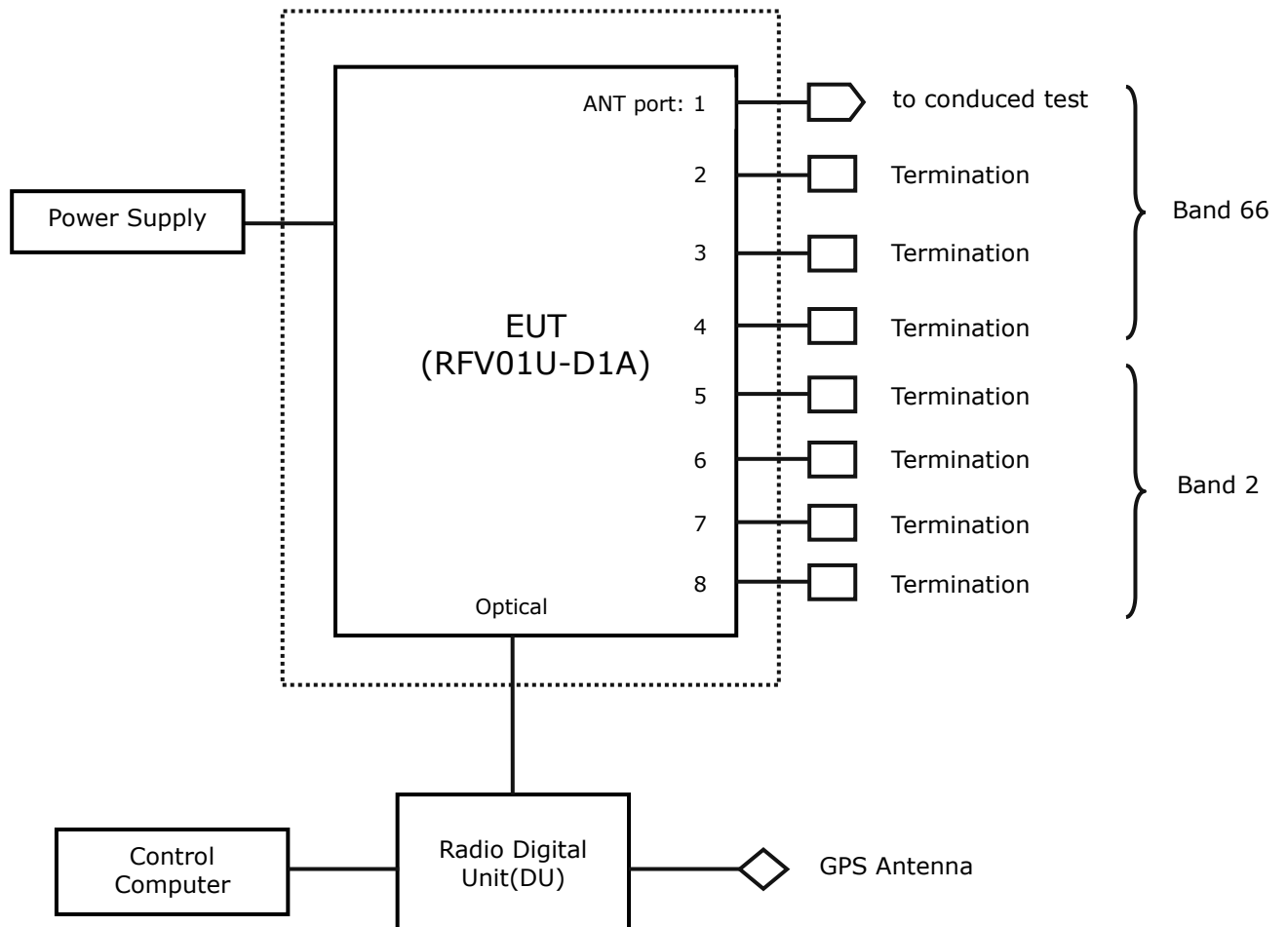
1.1 Client Information

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-D1A
Product Description	RRU (RFV01U)
Model name	RFV01U-D1A
Power Supply	-48 Vdc
Operating Frequency	- Band 66 DL : 2110 MHz- 2180 MHz, UL 1710 MHz - 1780 MHz - Band 2 DL : 1930 MHz- 1990 MHz, UL 1850 MHz - 1910 MHz
RF Output Power	- Band 2 Single(1 Carrier) 2T(Single)_BW 10 MHz : 60 W / path(Total 120 W) 2T(Single)_BW 20 MHz : 60 W / path(Total 120 W) 4T(Single)_BW 10 MHz : 40 W / path(Total 160 W) 4T(Single)_BW 20 MHz : 40 W / path(Total 160 W) Multi(2 Carrier) 2T(Multi_Contiguous)_BW 5 MHz+10 MHz : 60 W / path(Total 120 W) 2T(Multi_Contiguous)_BW 10 MHz+10 MHz : 60 W / path(Total 120 W) 4T(Multi_Contiguous)_BW 5 MHz+10 MHz : 39 W / path(Total 156 W) 4T(Multi_Contiguous)_BW 10 MHz+10 MHz : 40 W / path(Total 160 W) 2T(Multi_Non-Contiguous)_BW 10 MHz+10 MHz : 60 W / path(Total 120 W) 2T(Multi_Non-Contiguous)_BW 10 MHz+5 MHz : 60 W / path(Total 120 W) 4T(Multi_Non-Contiguous)_BW 10 MHz+10 MHz : 40 W / path(Total 160 W) 4T(Multi_Non-Contiguous)_BW 10 MHz+5 MHz : 39 W / path(Total 156 W)
Channel Bandwidth	5 MHz, 10 MHz, 15 MHz, 20 MHz
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM
Antenna Specification	Antenna type : Sector Peak Gain : 19.7 dBi
FCC Rule	Part 2 : FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS Part 24 : PERSONAL COMMUNICATIONS SERVICES Part 27 : MISCELLANEOUS WIRELESS COMMUNICATIONS 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	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	IC	IC EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	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.

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 24, part 27.

Section	Test Items	Results
§2.1046, §24.232(a)(2), §27.50(d)(2)	RF output power	Compliant
§2.1049	Occupied bandwidth	Compliant
§2.1051, §24.238, §27.53(h)	Spurious Emissions at Antenna Terminals	Compliant
§2.1051, §24.238, §27.53(h)	Band edge	Compliant
§2.1051, §24.238, §27.53(h)	Spurious Radiated Emissions	Compliant
§2.1055(a)(1), §24.235, §27.54	Frequency Stability over Temperature variation	Compliant
§2.1055(d), §24.235, §27.54	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.

Operating band and Frequency range

Band 2	Transmit	1 930 MHz to 1 990 MHz
	Receive	1 850 MHz to 1 910 MHz
Band 66	Transmit	2 110 MHz to 2 180 MHz
	Receive	1 710 MHz to 1 780 MHz

Operating Configurations

Supported configurations	Single carrier, Multi carrier
Spectrum Operation	Contiguous, Non-contiguous

Single carrier rated total output power as a sum of all carriers

Band type	Bandwidth	Positions	Frequency	Power	Output port	Total Power(sum)
Band 2	10 MHz	Bottom	1935.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W
		Middle	1960.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W
		Top	1985.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W
	20 MHz	Bottom	1940.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W
		Middle	1960.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W
		Top	1980.0 MHz	60 W	2TX(5, 6)	120 W
				40 W	4TX(5, 6, 7, 8)	160 W

Multi carrier rated total output power as a sum of all carriers

Type	Bandwidth positions		1 st FA	2 nd FA	Power Sum	Output port	Total (sum)
Band 2	Contiguous	Bottom	Bandwidth	5 MHz	10 MHz		
			Frequency	1932.5 MHz	1940.0 MHz		
			Output Power	20 W	40 W	60 W	2TX(5, 6)
				13 W	26 W	39 W	4TX(5, 6, 7, 8)
		Top	Bandwidth	5 MHz	10 MHz		
			Frequency	1977.5 MHz	1985.0 MHz		
			Output Power	20 W	40 W	60 W	2TX(5, 6)
				13 W	26 W	39 W	4TX(5, 6, 7, 8)
		Bottom	Bandwidth	10 MHz	10 MHz		
			Frequency	1935.0 MHz	1945.0 MHz		
			Output Power	30 W	30 W	60 W	2TX(5, 6)
				20 W	20 W	40 W	4TX(5, 6, 7, 8)
		Top	Bandwidth	10 MHz	10 MHz		
			Frequency	1975.0 MHz	1985.0 MHz		
			Output Power	30 W	30 W	60 W	2TX(5, 6)
				20 W	20 W	40 W	4TX(5, 6, 7, 8)

Multi carrier rated total output power as a sum of all carriers

Type	Bandwidth positions		1 st FA	2 nd FA	Power Sum	Output port	Total (sum)
Band 2	Non-Contiguous	Bottom + Top	Bandwidth	10 MHz	10 MHz		
			Frequency	1935.0 MHz	1985.0 MHz		
			Output Power	30 W	30 W	60 W	2TX(5, 6)
				20 W	20 W	40 W	4TX(5, 6, 7, 8)
		Bottom + Top	Bandwidth	10 MHz	5 MHz		
			Frequency	1935.0 MHz	1987.5 MHz		
			Output Power	40 W	20 W	60 W	2TX(5, 6)
				26 W	13 W	39 W	4TX(5, 6, 7, 8)

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.

§ 24.232 Power and antenna height limits.

- (a)(1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.
- (2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

§ 27.50 Power limits and duty cycle.

- (d)(2) The power of each fixed or base station transmitting in the 1995-2000 MHz, the 2110-2155 MHz 2155-2180 MHz band, or 2180-2200 MHz band and situated in any geographic location other than that described in paragraph (d)(1) of this section is limited to:
- (i) An equivalent isotropically radiated power (EIRP) of 1640 watts when transmitting with an emission bandwidth of 1 MHz or less;
 - (ii) An EIRP of 1640 watts/MHz when transmitting with an emission bandwidth greater than 1 MHz.

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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. (100 mW = 50 mW * 2 Ports)

Note 1 : If applicable, the EIRP[W] = $10^{(\text{channel power[dBm]} + \text{Antenna Gain[dBi]}/10)} / 10^{-3}$

Note 2: EIRP does not exceed the reference value even if the maximum antenna gain is applied according to Note 1.

Note 3 : PSD(Power Spectral Density) dBm/MHz = dBm/Hz + 10log(10⁶)

Test Results :

Test Data : Band 2, BW 10MHz, Single carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz	Single	Bottom	5	2TX	QPSK	47.64	37.64	50.64	40.64
					16QAM	47.65	37.65	50.65	40.65
					64QAM	47.70	37.70	50.70	40.70
					256QAM	47.67	37.67	50.67	40.67
		Middle	5	2TX	QPSK	47.71	37.71	50.71	40.71
					16QAM	47.76	37.76	50.76	40.76
					64QAM	47.69	37.69	50.69	40.69
					256QAM	47.70	37.70	50.70	40.70
		Top	5	2TX	QPSK	47.66	37.66	50.66	40.66
					16QAM	47.71	37.71	50.71	40.71
					64QAM	47.73	37.73	50.73	40.73
					256QAM	47.73	37.73	50.73	40.73

Test Data : Band 2, BW 10MHz, Single carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 66 BW 10MHz	Single	Bottom	7	4TX	QPSK	45.79	35.79	51.79	41.79
					16QAM	45.90	35.90	51.90	41.90
					64QAM	45.77	35.77	51.77	41.77
					256QAM	45.75	35.75	51.75	41.75
		Middle	7	4TX	QPSK	45.70	35.70	51.70	41.70
					16QAM	45.75	35.75	51.75	41.75
					64QAM	45.70	35.70	51.70	41.70
					256QAM	45.72	35.72	51.72	41.72
		Top	7	4TX	QPSK	45.47	35.47	51.47	41.47
					16QAM	45.74	35.74	51.74	41.74
					64QAM	45.70	35.70	51.70	41.70
					256QAM	45.67	35.67	51.67	41.67

Test Data : Band 2, BW 20MHz, Single carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 20MHz	Single	Bottom	5	2TX	QPSK	47.50	34.49	50.50	37.49
					16QAM	47.56	34.55	50.56	37.55
					64QAM	47.60	34.59	50.60	37.59
					256QAM	47.63	34.62	50.63	37.62
		Middle	5	2TX	QPSK	47.61	34.60	50.61	37.60
					16QAM	47.69	34.68	50.69	37.68
					64QAM	47.63	34.62	50.63	37.62
					256QAM	47.63	34.62	50.63	37.62
		Top	5	2TX	QPSK	47.63	34.62	50.63	37.62
					16QAM	47.67	34.66	50.67	37.66
					64QAM	47.65	34.64	50.65	37.64
					256QAM	47.66	34.65	50.66	37.65

Test Data : Band 2, BW 20MHz, Single carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 20MHz	Single	Bottom	7	4TX	QPSK	45.65	32.64	51.65	38.64
					16QAM	45.68	32.67	51.68	38.67
					64QAM	45.67	32.66	51.67	38.66
					256QAM	45.72	32.71	51.72	38.71
		Middle	7	4TX	QPSK	45.72	32.71	51.72	38.71
					16QAM	45.73	32.72	51.73	38.72
					64QAM	45.70	32.69	51.70	38.69
					256QAM	45.72	32.70	51.72	38.70
		Top	7	4TX	QPSK	45.69	32.68	51.69	38.68
					16QAM	45.69	32.68	51.69	38.68
					64QAM	45.73	32.72	51.73	38.72
					256QAM	45.72	32.71	51.72	38.71

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 5MHz + BW 10MHz	Multi/ Contiguous	Bottom	5	2TX	QPSK	47.13	35.37	50.13	38.37
					16QAM	47.22	35.46	50.22	38.46
					64QAM	47.24	35.48	50.24	38.48
					256QAM	47.38	35.62	50.38	38.62
		Top	5	2TX	QPSK	47.37	35.61	50.37	38.61
					16QAM	47.34	35.57	50.34	38.57
					64QAM	47.45	35.69	50.45	38.69
					256QAM	47.49	35.73	50.49	38.73

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 5MHz + BW 10MHz	Multi/ Contiguous	Bottom	7	4TX	QPSK	45.37	33.60	51.37	39.60
					16QAM	45.42	33.66	51.42	39.66
					64QAM	45.45	33.69	51.45	39.69
					256QAM	45.45	33.69	51.45	39.69
		Top	7	4TX	QPSK	45.29	33.53	51.29	39.53
					16QAM	45.31	33.55	51.31	39.55
					64QAM	45.30	33.54	51.30	39.54
					256QAM	45.31	33.55	51.31	39.55

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Contiguous	Bottom	5	2TX	QPSK	47.52	34.51	50.52	37.51
					16QAM	47.52	34.51	50.52	37.51
					64QAM	47.54	34.53	50.54	37.53
					256QAM	47.53	34.52	50.53	37.52
		Top	5	2TX	QPSK	47.37	34.36	50.37	37.36
					16QAM	47.36	34.35	50.36	37.35
					64QAM	47.39	34.38	50.39	37.38
					256QAM	47.44	34.43	50.44	37.43

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Contiguous	Bottom	7	4TX	QPSK	45.65	32.64	51.65	38.64
					16QAM	45.64	32.63	51.64	38.63
					64QAM	45.71	32.70	51.71	38.70
					256QAM	45.67	32.66	51.67	38.66
		Top	7	4TX	QPSK	45.40	32.39	51.40	38.39
					16QAM	45.38	32.37	51.38	38.37
					64QAM	45.41	32.40	51.41	38.40
					256QAM	45.42	32.41	51.42	38.41

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Non- Contiguous	Bottom	5	2TX	QPSK	44.56	34.56	47.56	37.56
					16QAM	44.69	34.69	47.69	37.69
					64QAM	44.49	34.49	47.49	37.49
					256QAM	44.56	34.56	47.56	37.56
		Top	5	2TX	QPSK	44.36	34.36	47.36	37.36
					16QAM	44.36	34.36	47.36	37.36
					64QAM	44.29	34.29	47.29	37.29
					256QAM	44.32	34.32	47.32	37.32

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Non- Contiguous	Bottom	7	4TX	QPSK	42.51	32.51	48.51	38.51
					16QAM	42.61	32.61	48.61	38.61
					64QAM	42.58	32.58	48.58	38.58
					256QAM	42.59	32.59	48.59	38.59
		Top	7	4TX	QPSK	42.35	32.35	48.35	38.35
					16QAM	42.35	32.35	48.35	38.35
					64QAM	42.41	32.41	48.41	38.41
					256QAM	42.43	32.43	48.43	38.43

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 5MHz	Multi/ Non- Contiguous	Bottom	5	2TX	QPSK	45.56	35.56	48.56	38.56
					16QAM	45.62	35.62	48.62	38.62
					64QAM	45.69	35.69	48.69	38.69
					256QAM	45.73	35.73	48.73	38.73
		Top	5	2TX	QPSK	42.46	35.47	45.46	38.47
					16QAM	42.50	35.51	45.50	38.51
					64QAM	42.55	35.56	45.55	38.56
					256QAM	42.58	35.59	45.58	38.59

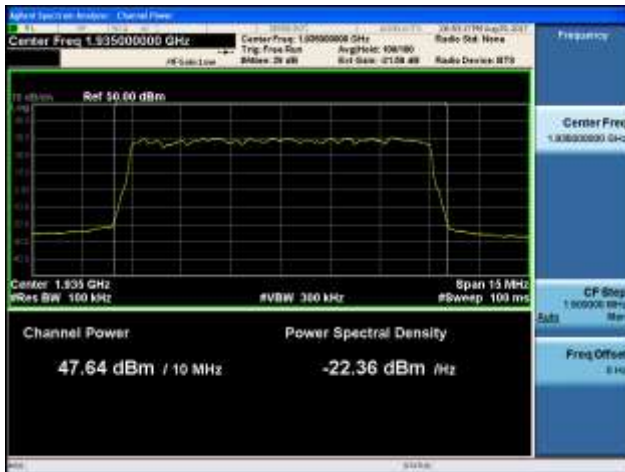
Test Data : Band 2, BW 10MHz + BW 5MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Output Power		Total Power	
						Channel Power (dBm)	PSD (dBm/MHz)	Channel Power (dBm)	PSD (dBm/MHz)
Band 2 BW 10MHz + BW 5MHz	Multi/ Non- Contiguous	Bottom	7	4TX	QPSK	43.70	33.70	49.70	39.70
					16QAM	43.66	33.66	49.66	39.66
					64QAM	43.69	33.69	49.69	39.69
					256QAM	43.70	33.70	49.70	39.70
		Top	7	4TX	QPSK	40.54	33.55	46.54	39.55
					16QAM	40.56	33.57	46.56	39.57
					64QAM	40.51	33.52	46.51	39.52
					256QAM	40.47	33.48	46.47	39.48

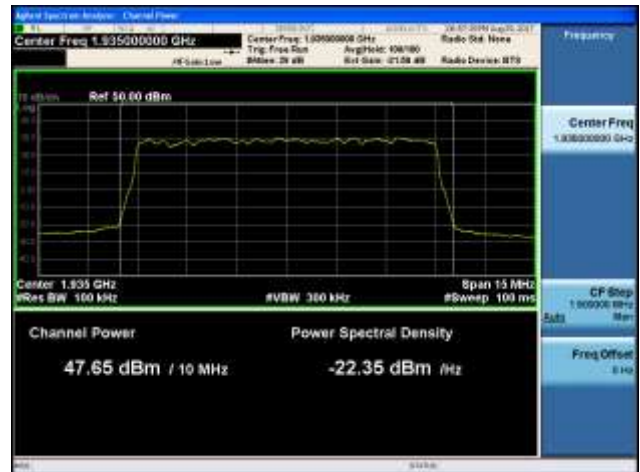
Test Plot at Output Power

Band 2, BW 10MHz, Single carrier, 2TX, Bottom

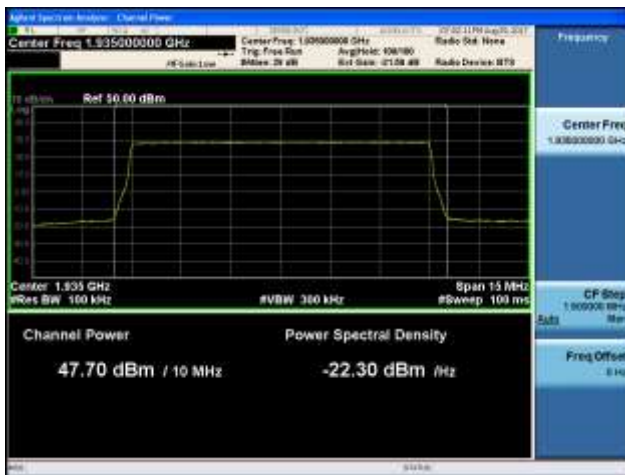
QPSK



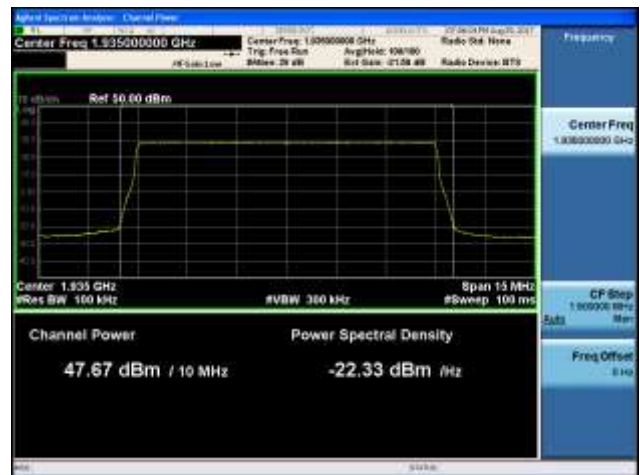
16QAM



64QAM

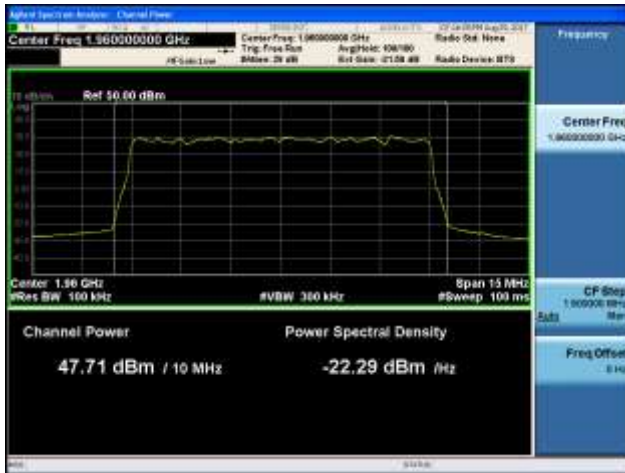


256QAM

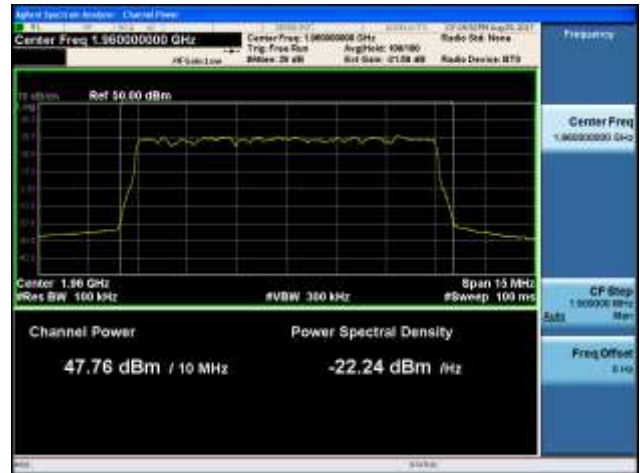


Band 2, BW 10MHz, Single carrier, 2TX, Middle

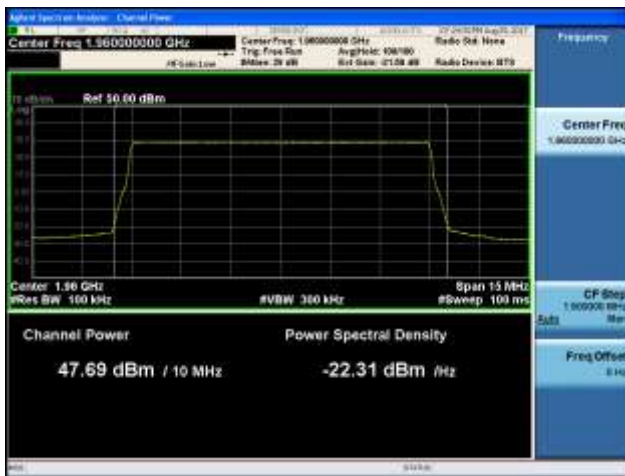
QPSK



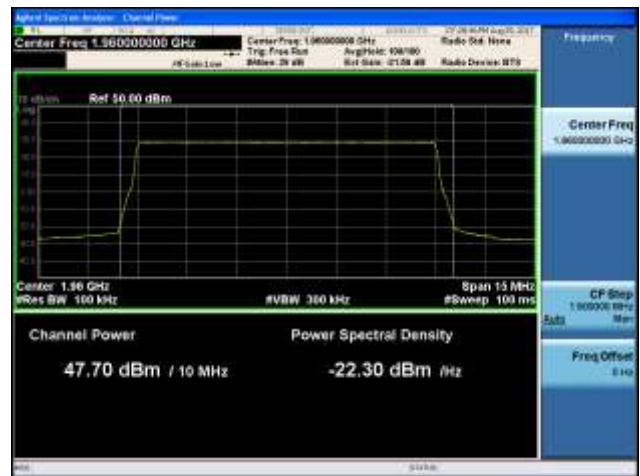
16QAM



64QAM

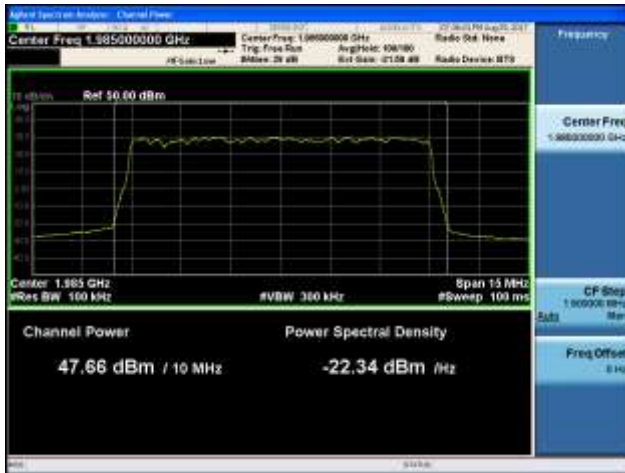


256QAM

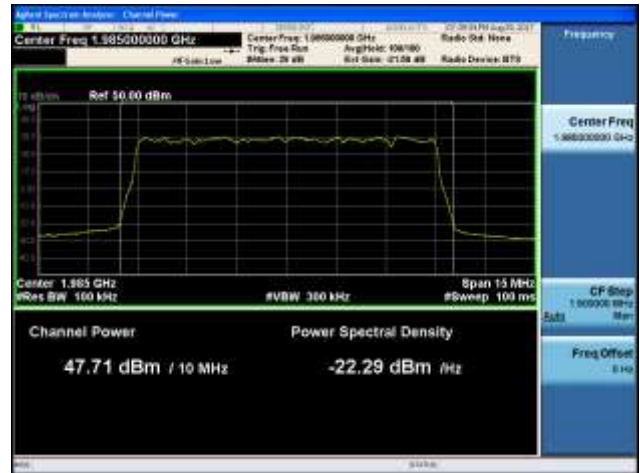


Band 2, BW 10MHz, Single carrier, 2TX, Top

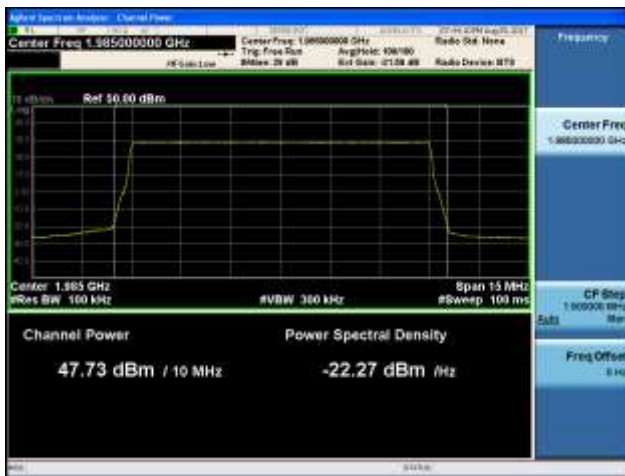
QPSK



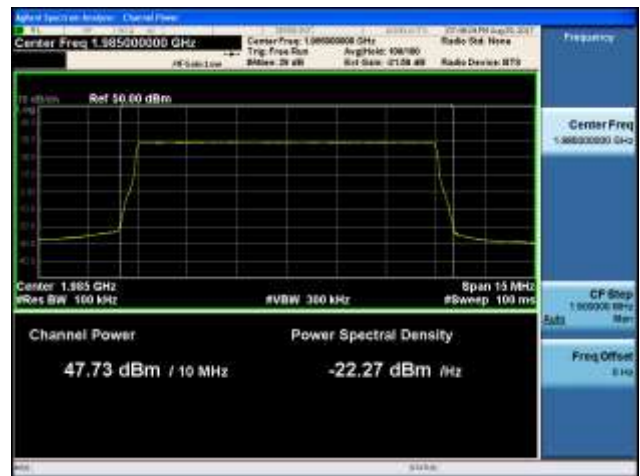
16QAM



64QAM

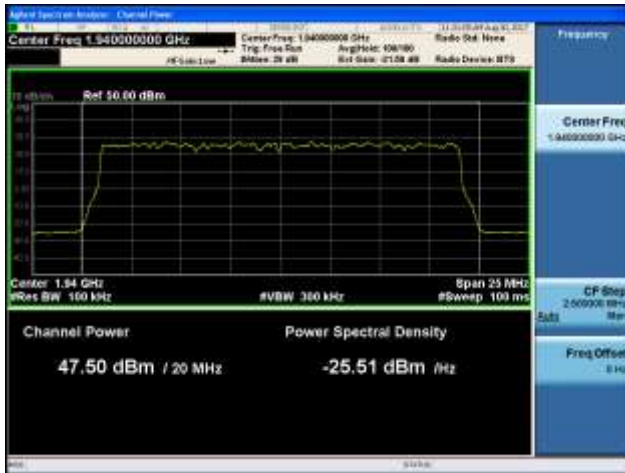


256QAM

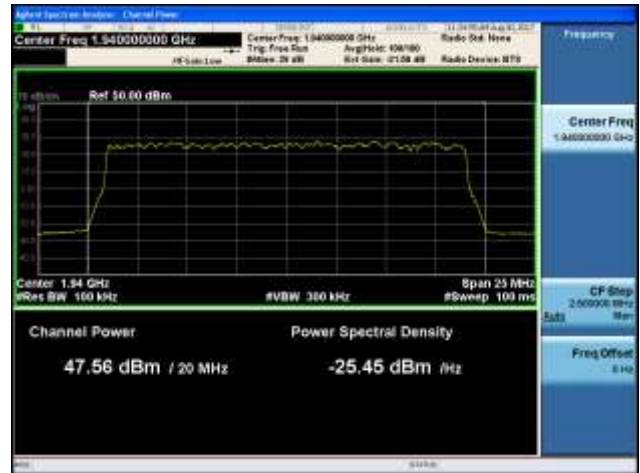


Band 2, BW 20MHz, Single carrier, 2TX, Bottom

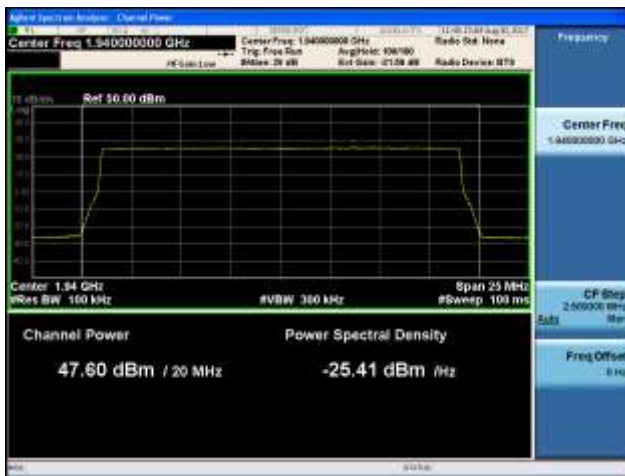
QPSK



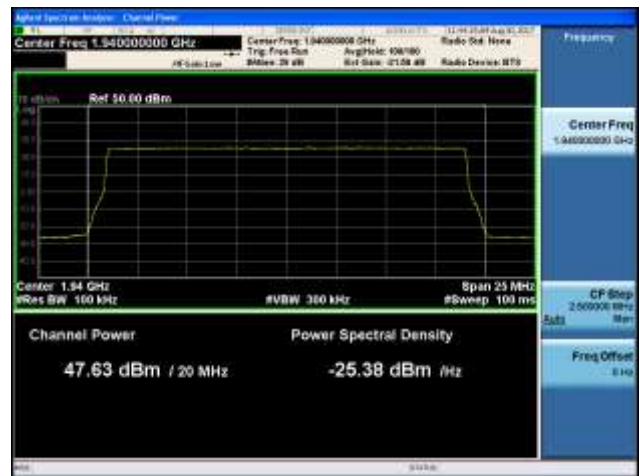
16QAM



64QAM

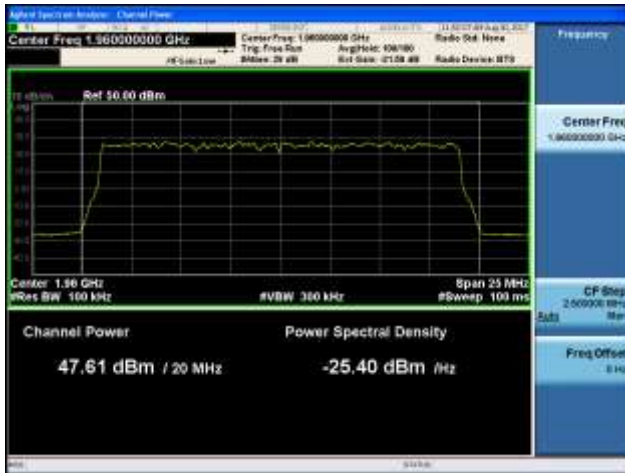


256QAM

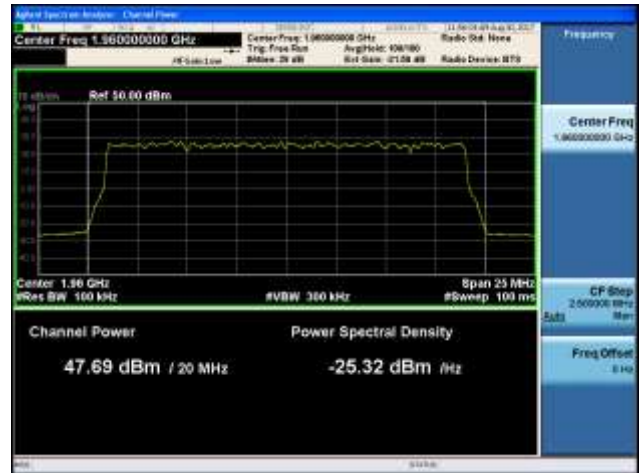


Band 2, BW 20MHz, Single carrier, 2TX, Middle

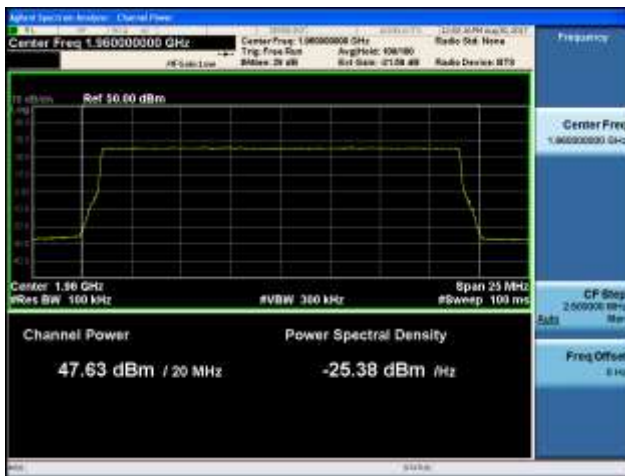
QPSK



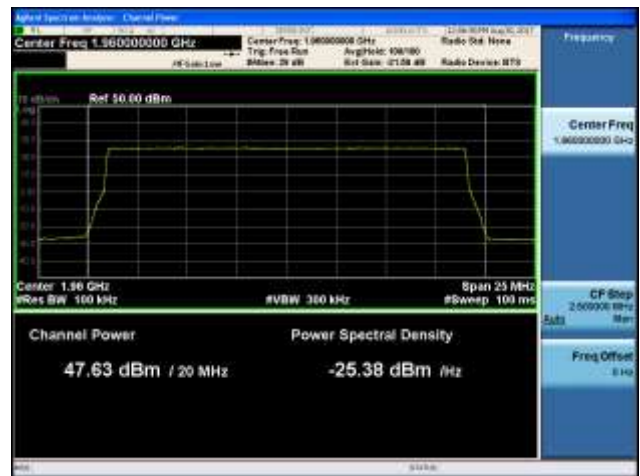
16QAM



64QAM

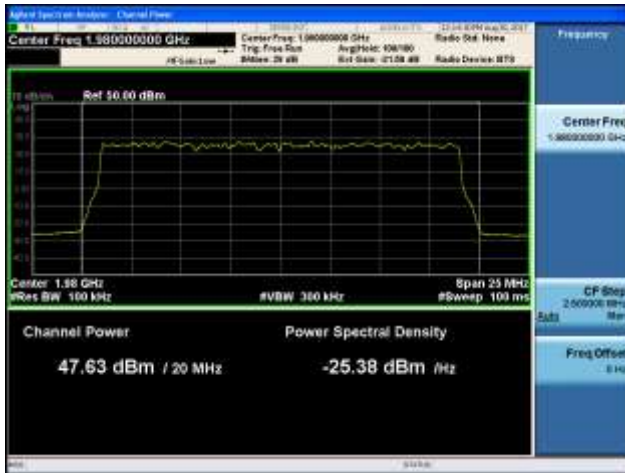


256QAM

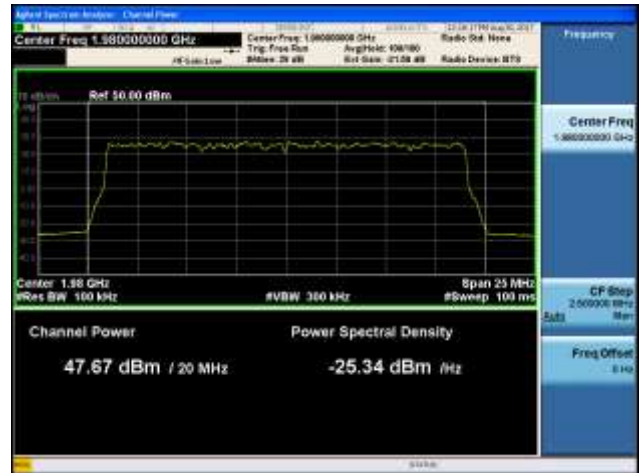


Band 2, BW 20MHz, Single carrier, 2TX, Top

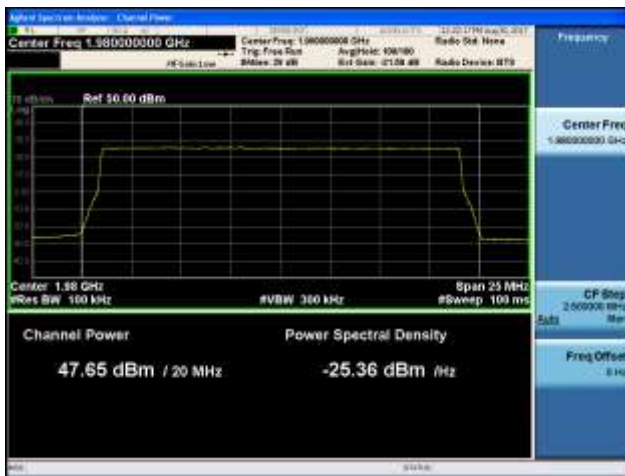
QPSK



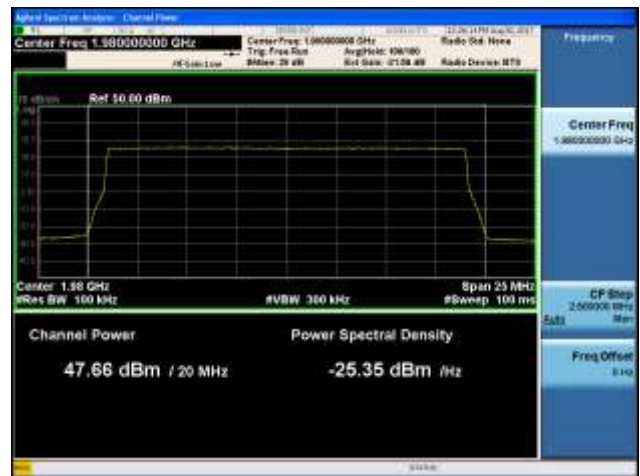
16QAM



64QAM

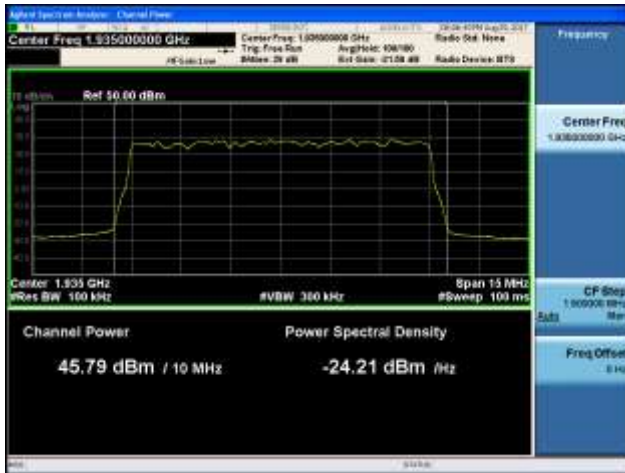


256QAM

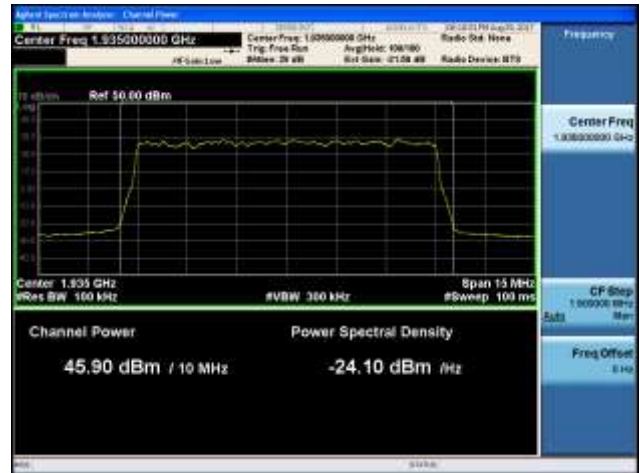


Band 2, BW 10MHz, Single carrier, 4TX, Bottom

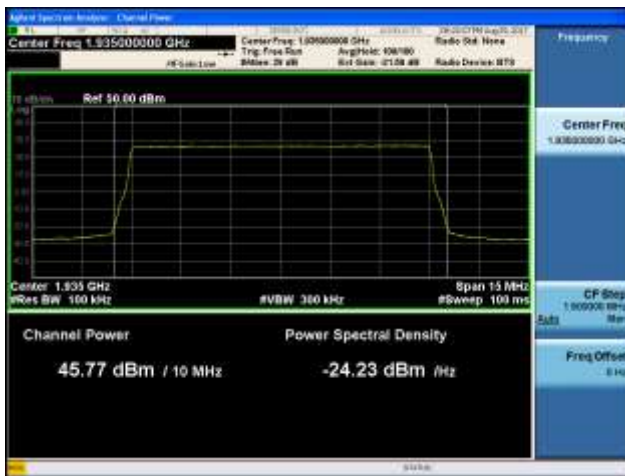
QPSK



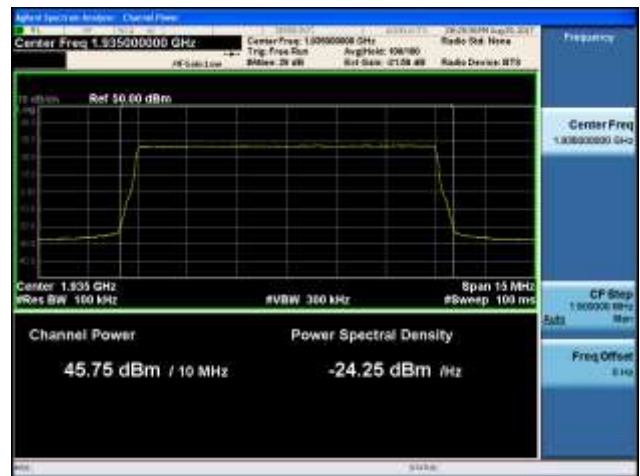
16QAM



64QAM

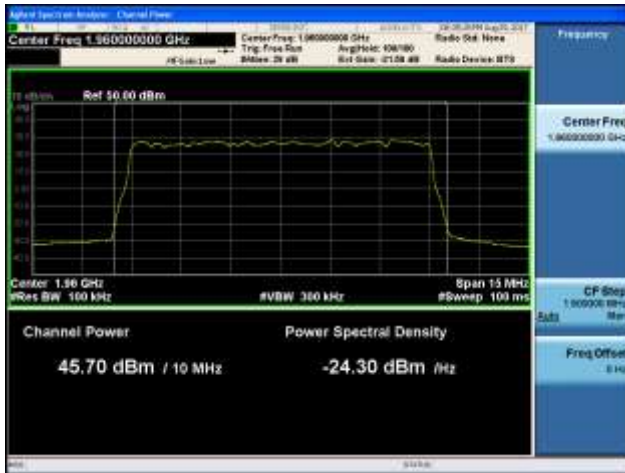


256QAM

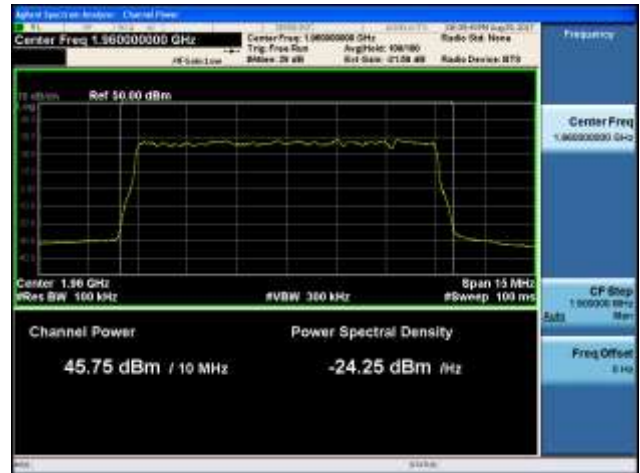


Band 2, BW 10MHz, Single carrier, 4TX, Middle

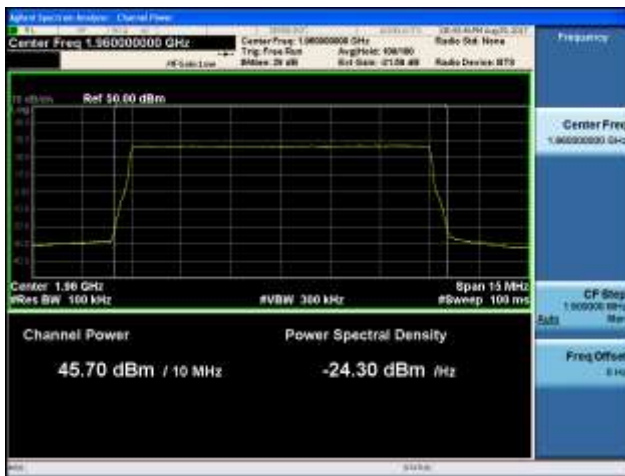
QPSK



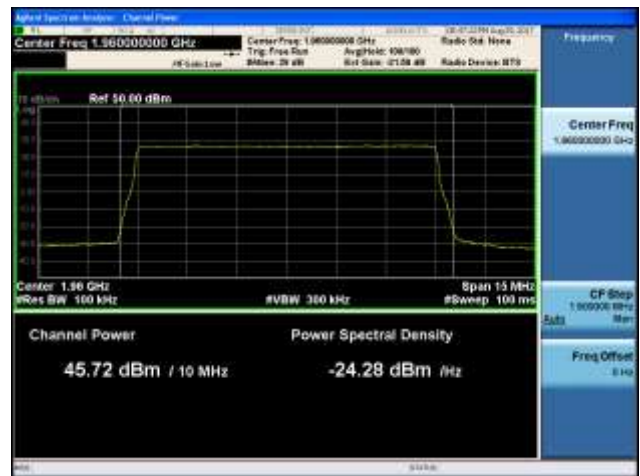
16QAM



64QAM

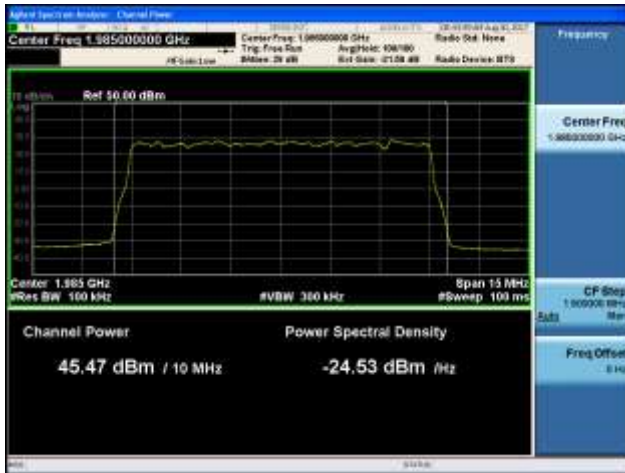


256QAM

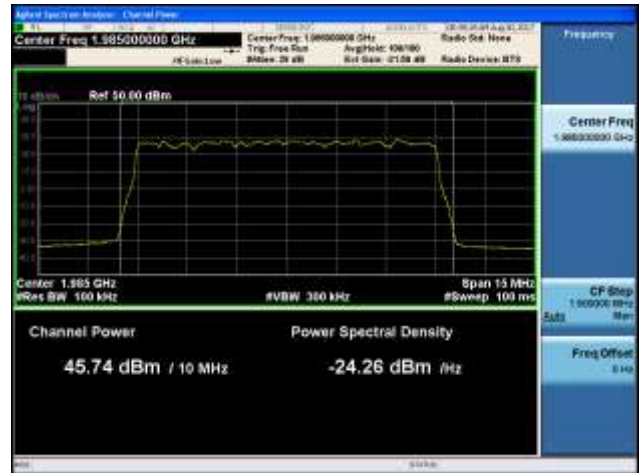


Band 2, BW 10MHz, Single carrier, 4TX Top

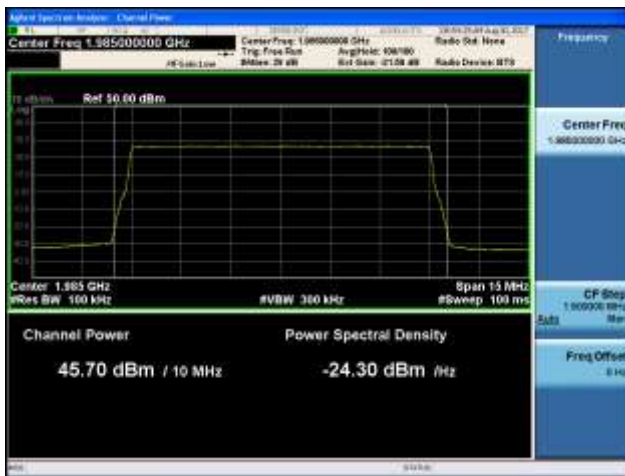
QPSK



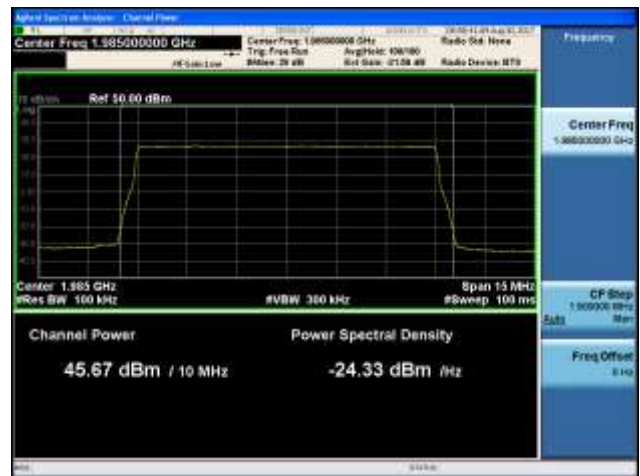
16QAM



64QAM

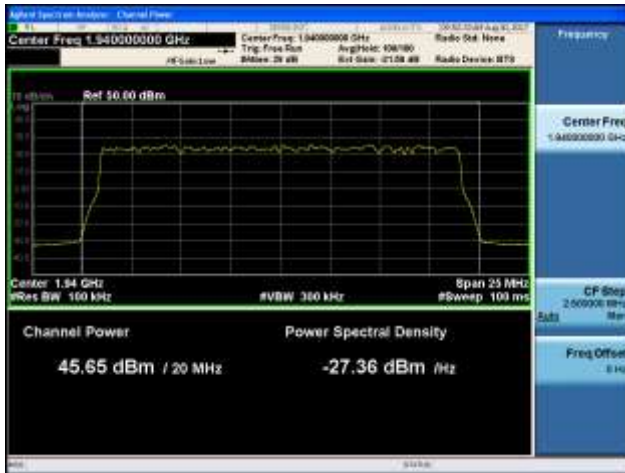


256QAM

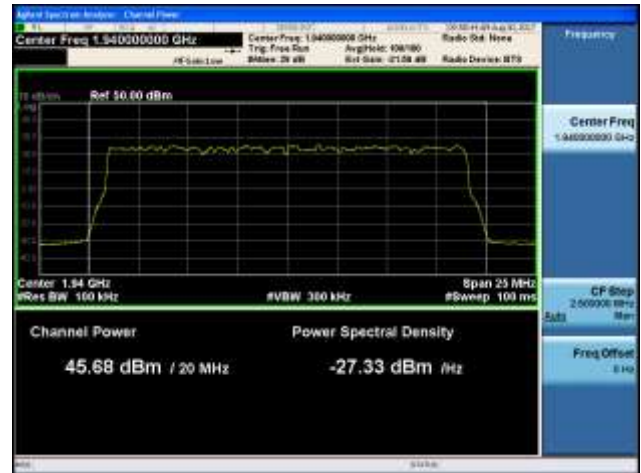


Band 2, BW 20MHz, Single carrier, 4TX, Bottom

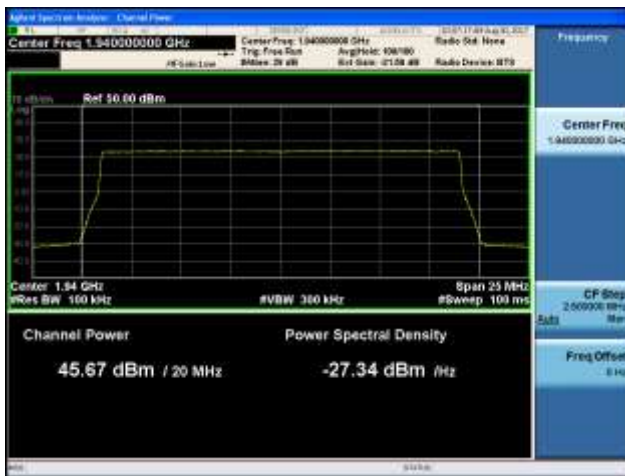
QPSK



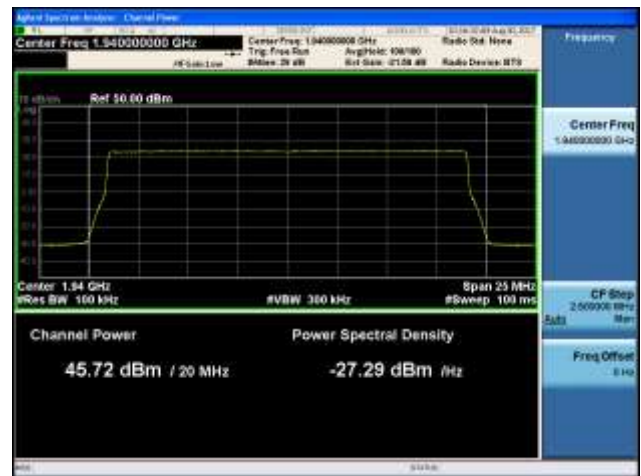
16QAM



64QAM

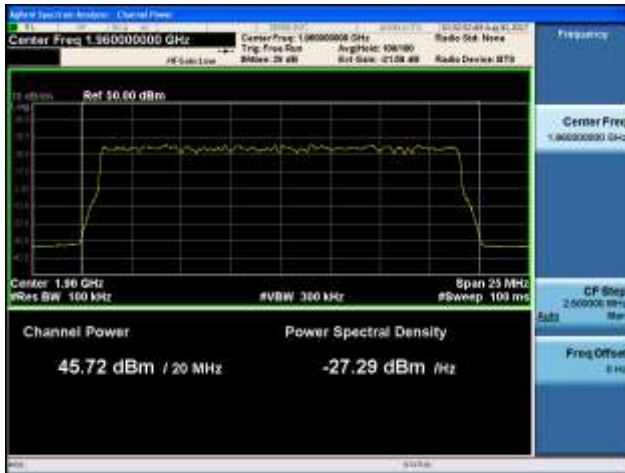


256QAM

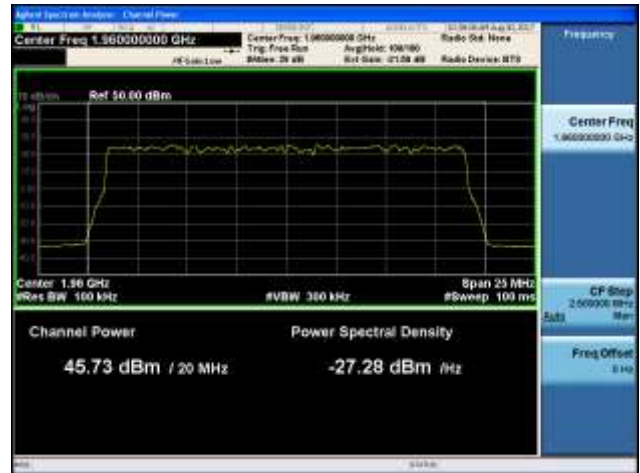


Band 2, BW 20MHz, Single carrier, 4TX, Middle

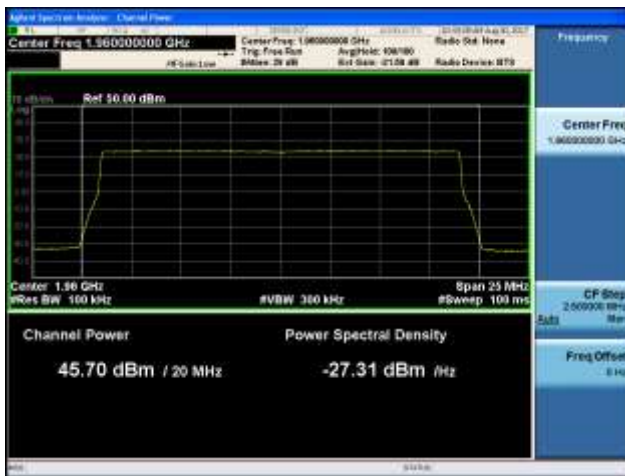
QPSK



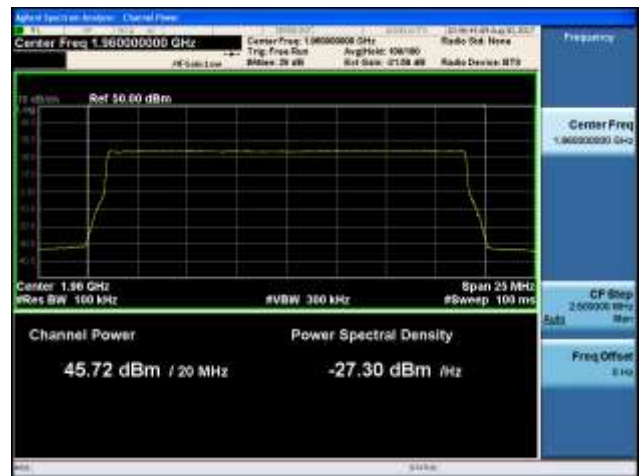
16QAM



64QAM

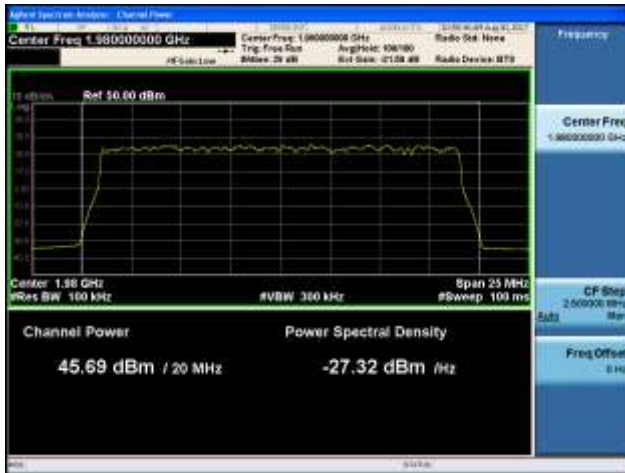


256QAM

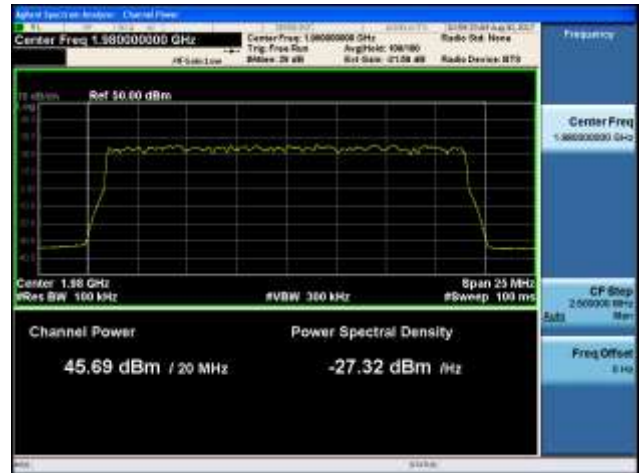


Band 2, BW 20MHz, Single carrier, 4TX Top

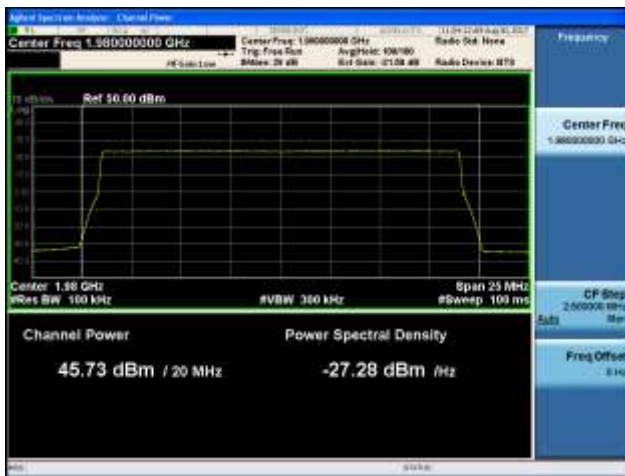
QPSK



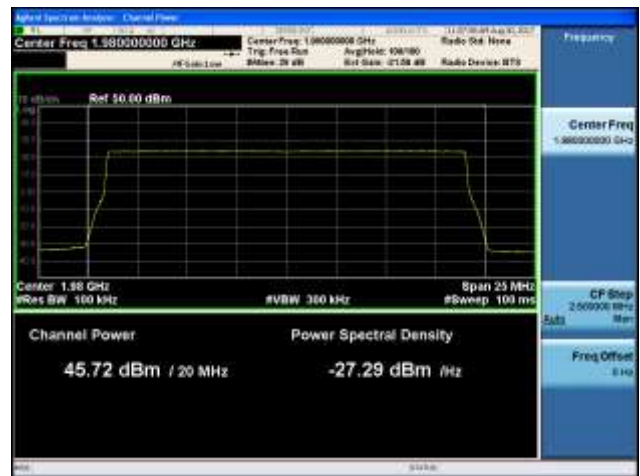
16QAM



64QAM

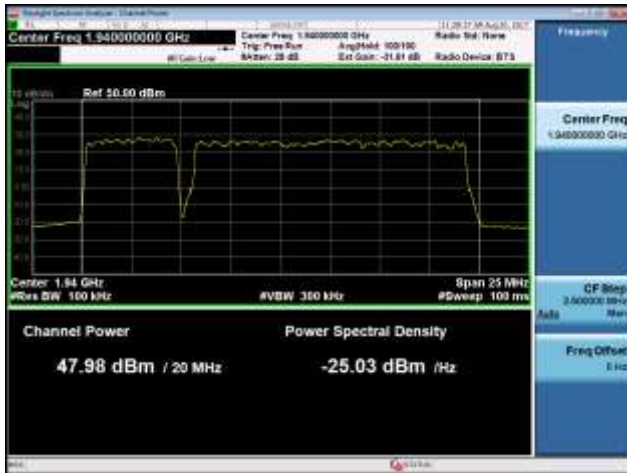


256QAM

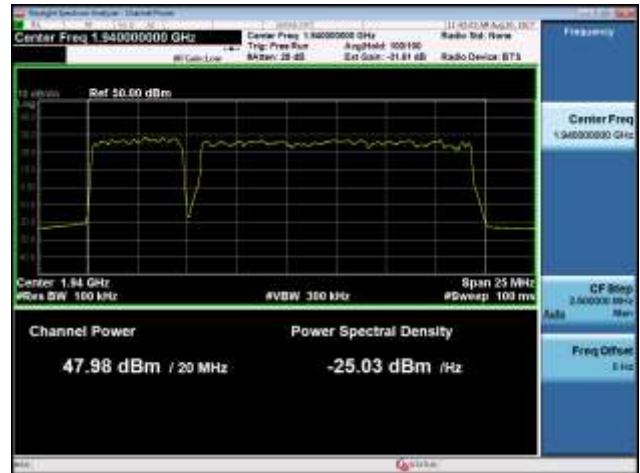


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Bottom

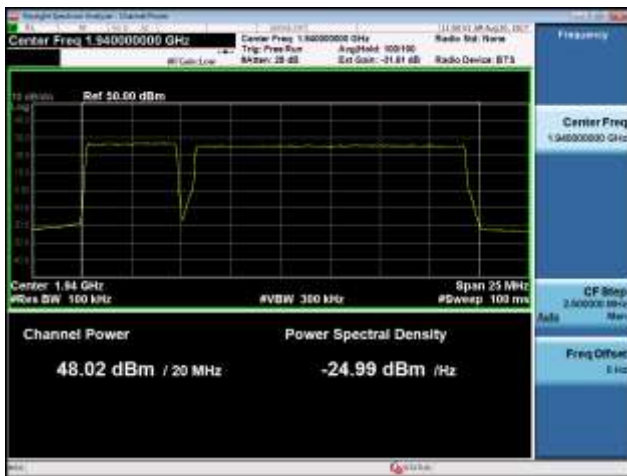
QPSK



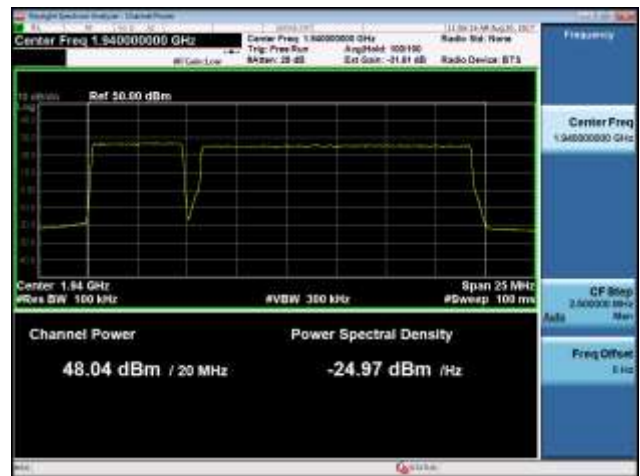
16QAM



64QAM

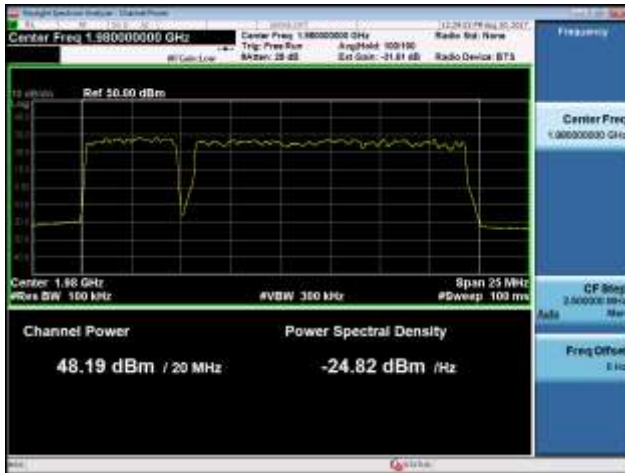


256QAM

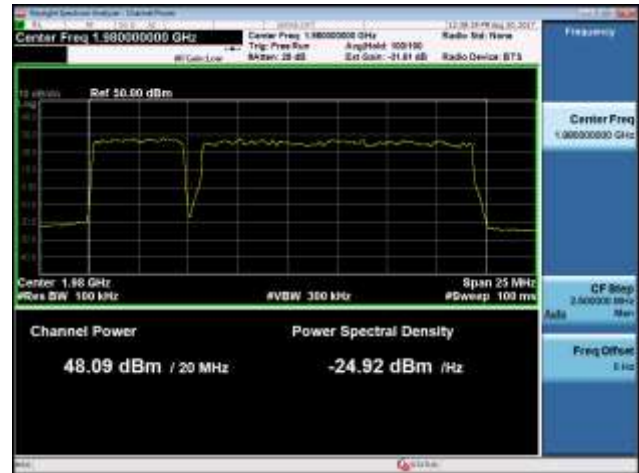


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Top

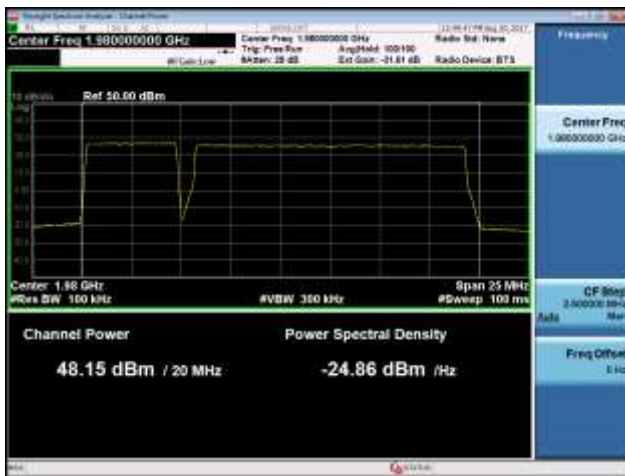
QPSK



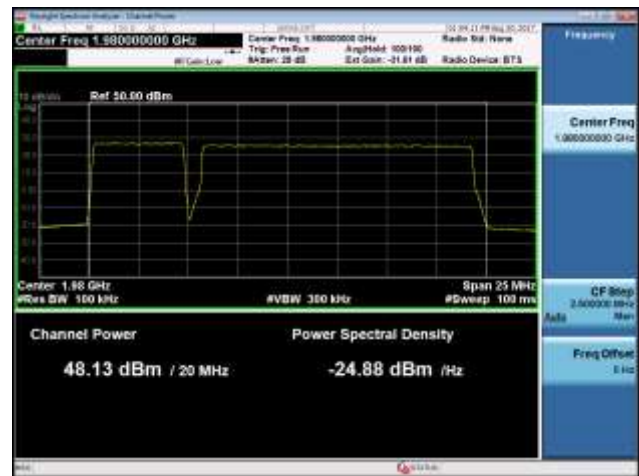
16QAM



64QAM

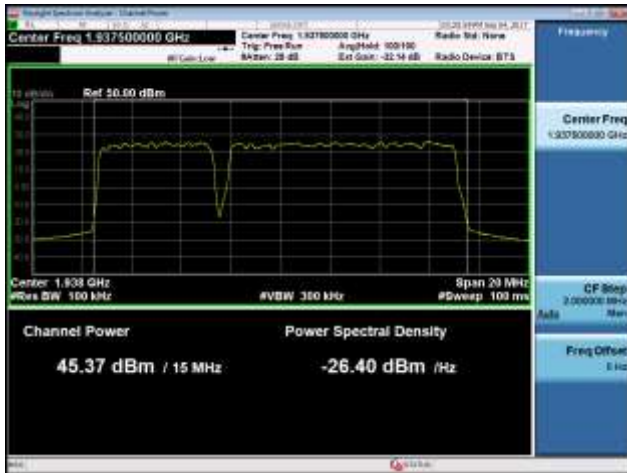


256QAM

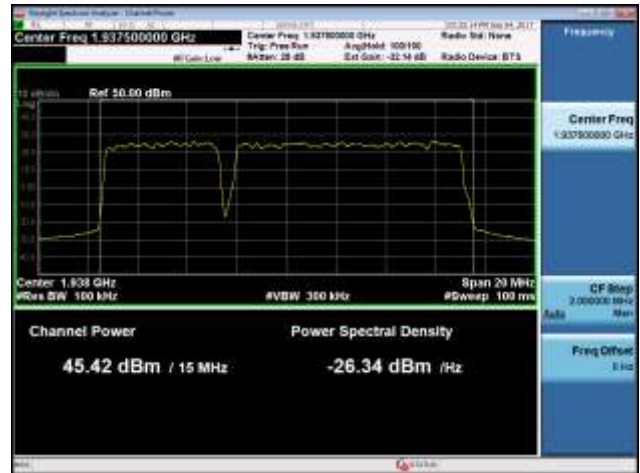


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Bottom

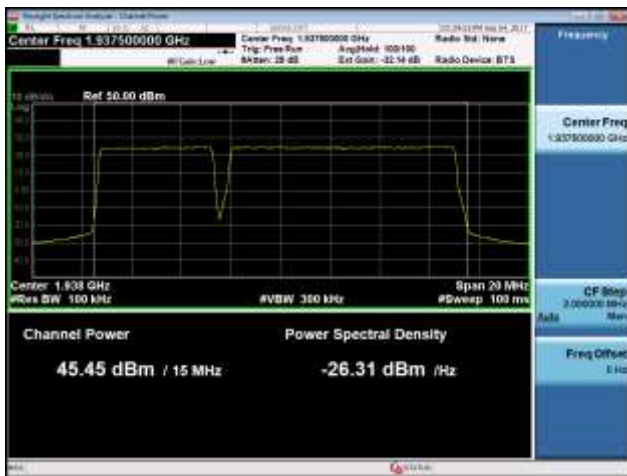
QPSK



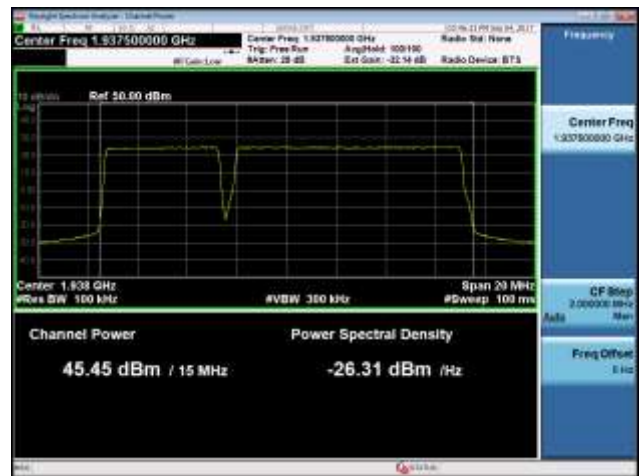
16QAM



64QAM

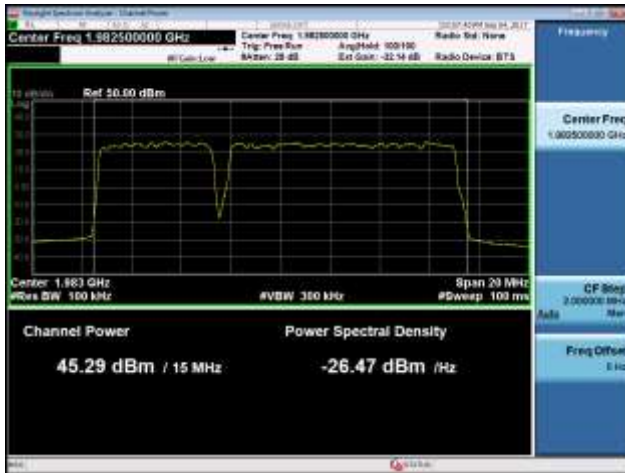


256QAM

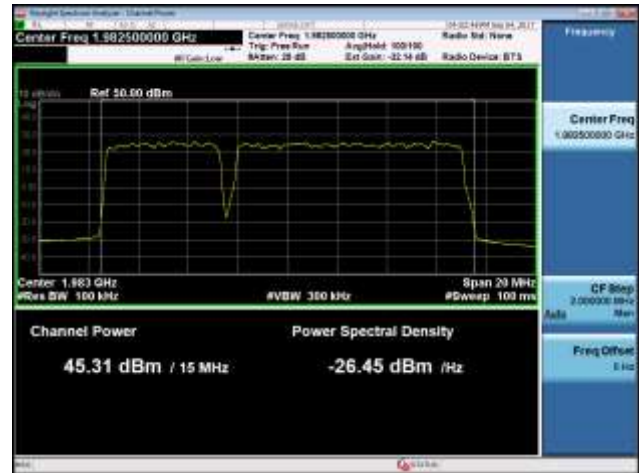


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Top

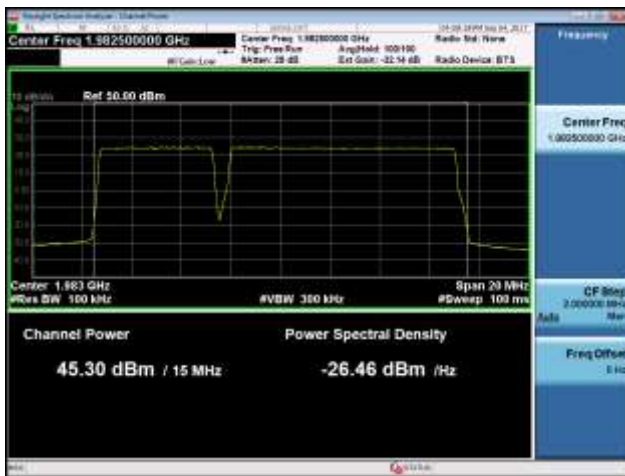
QPSK



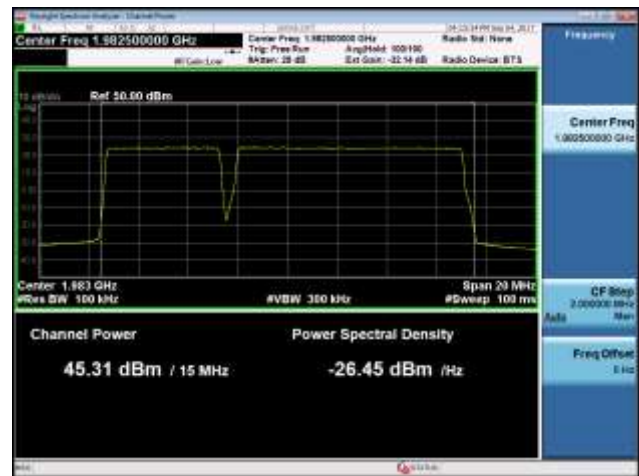
16QAM



64QAM

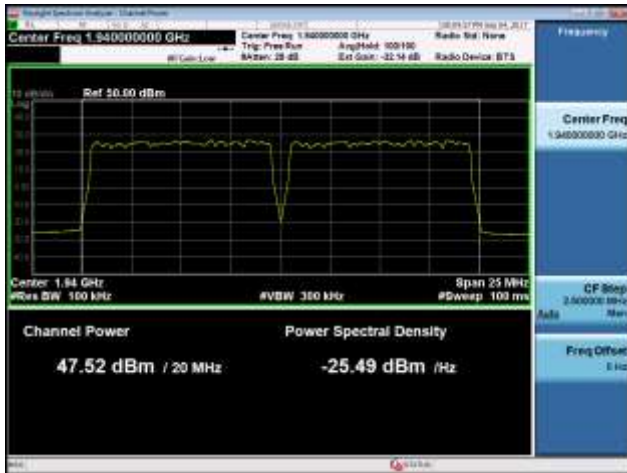


256QAM

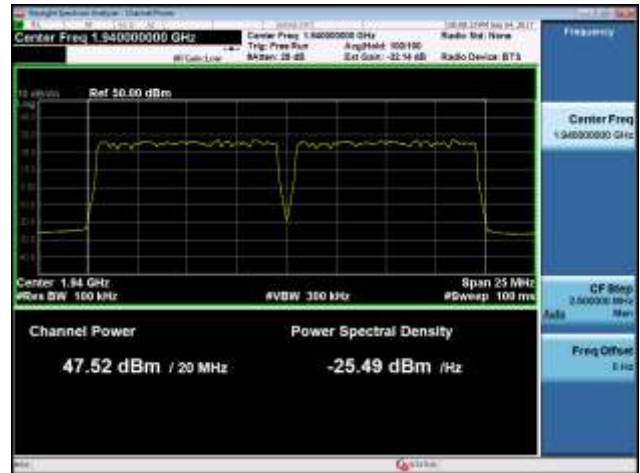


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Bottom

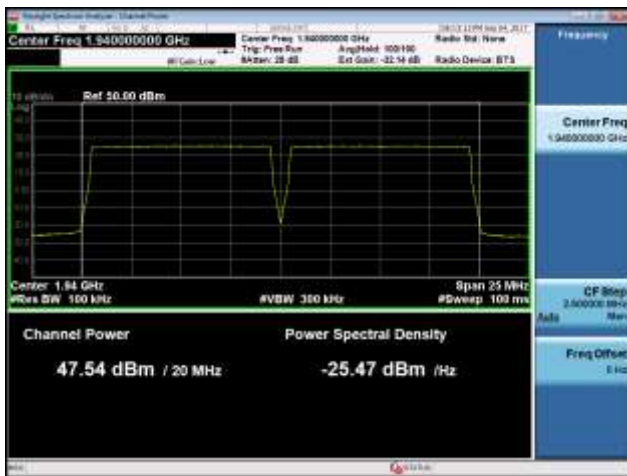
QPSK



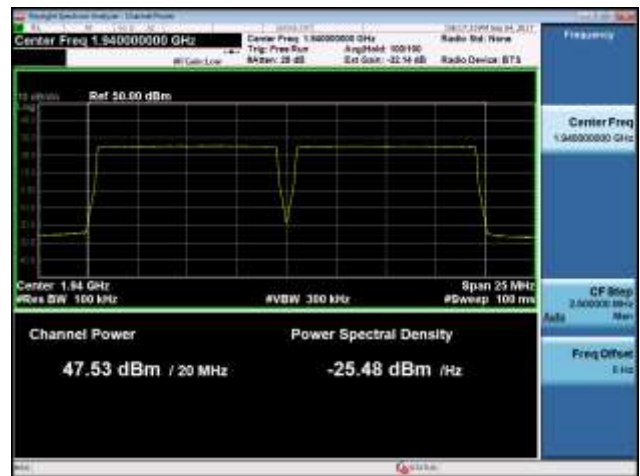
16QAM



64QAM

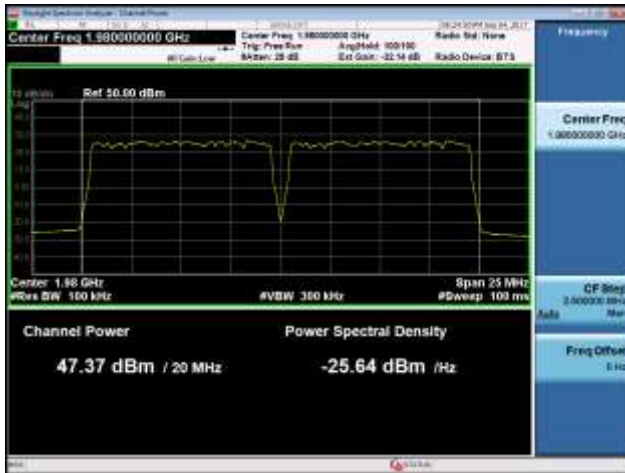


256QAM

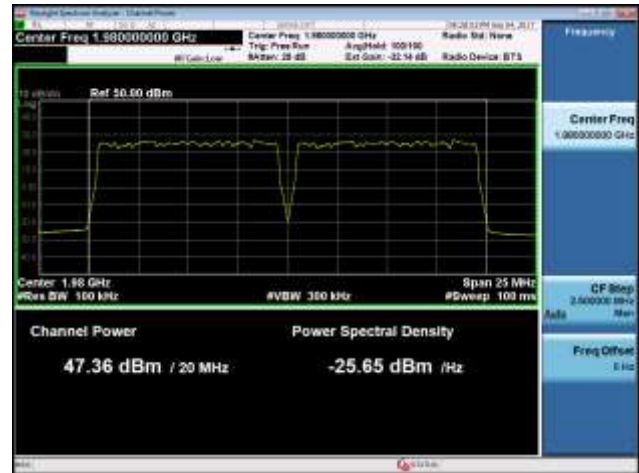


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Top

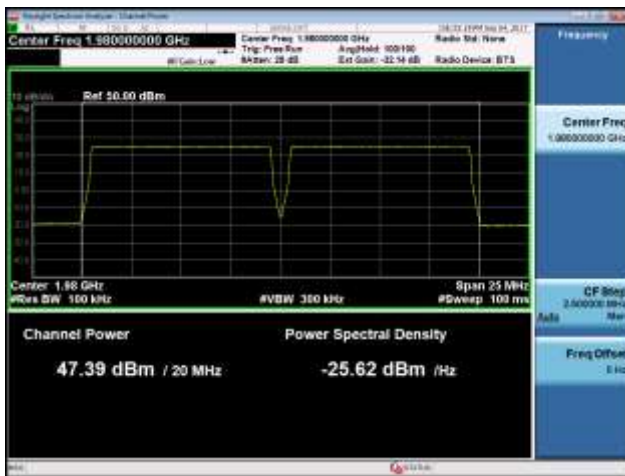
QPSK



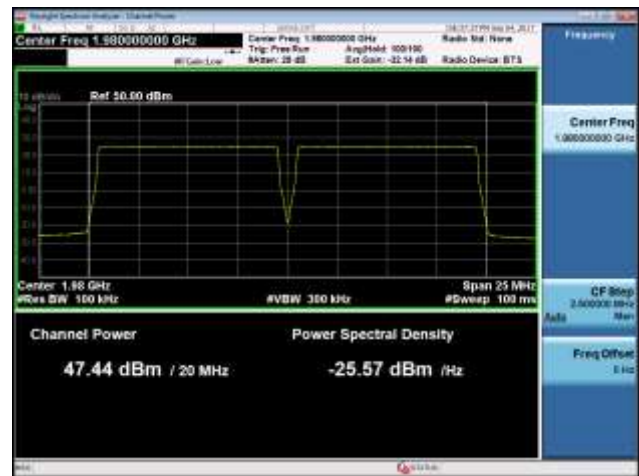
16QAM



64QAM

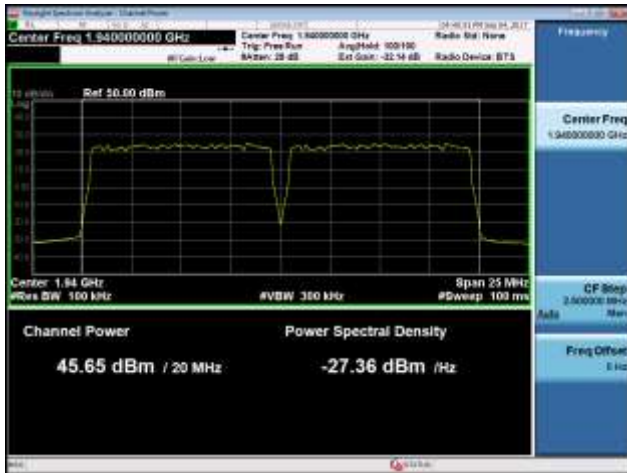


256QAM

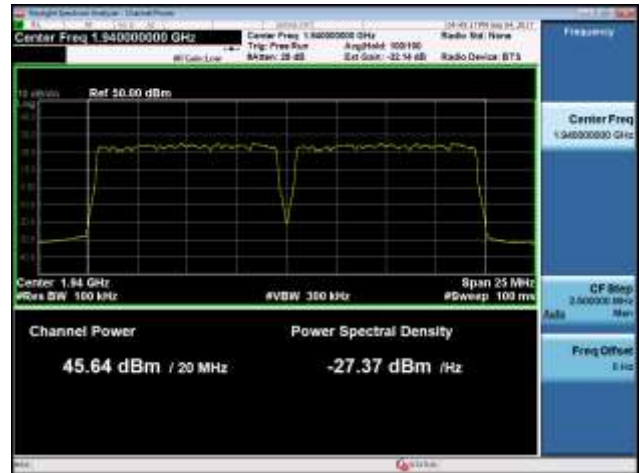


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Bottom

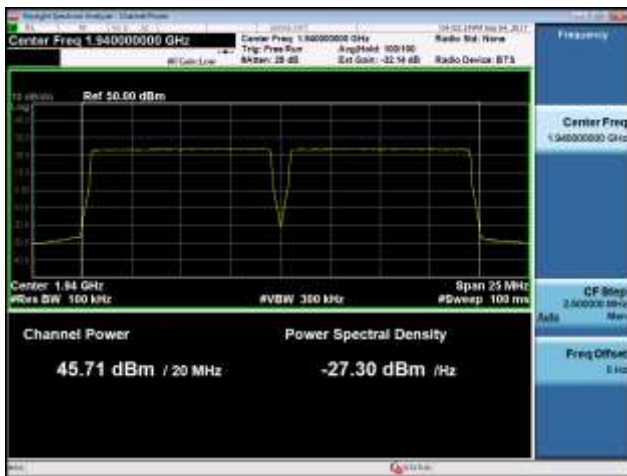
QPSK



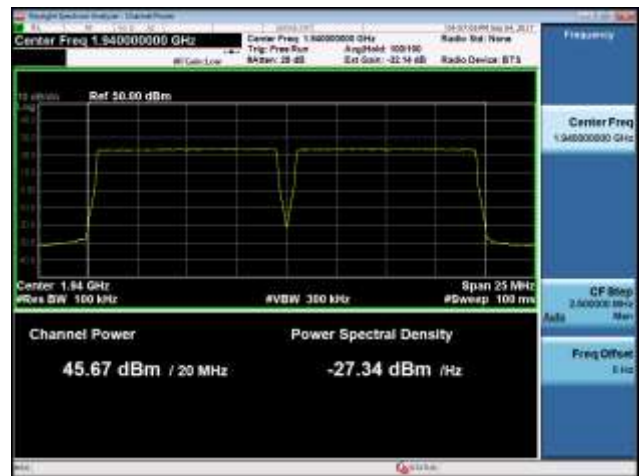
16QAM



64QAM

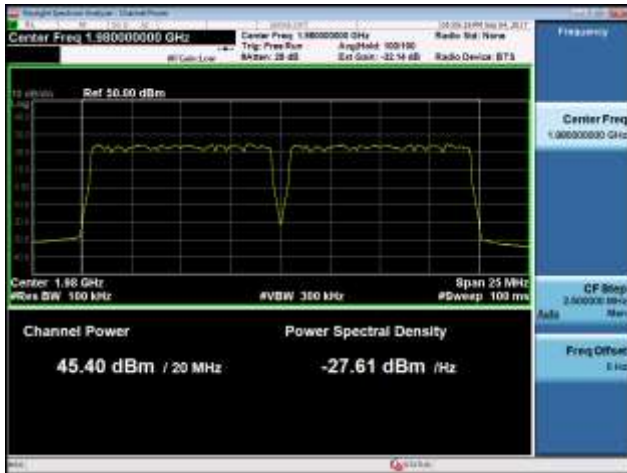


256QAM

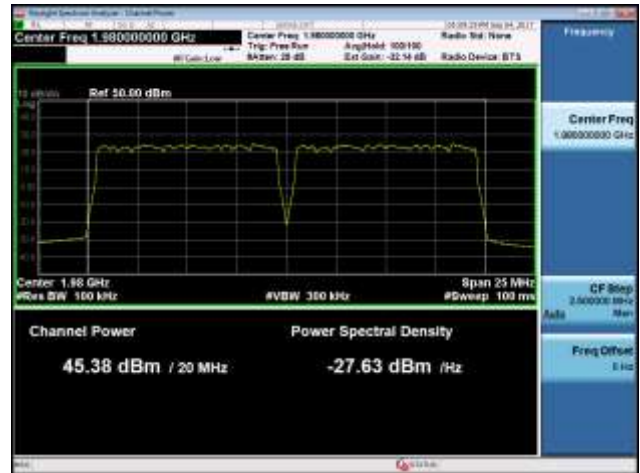


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Top

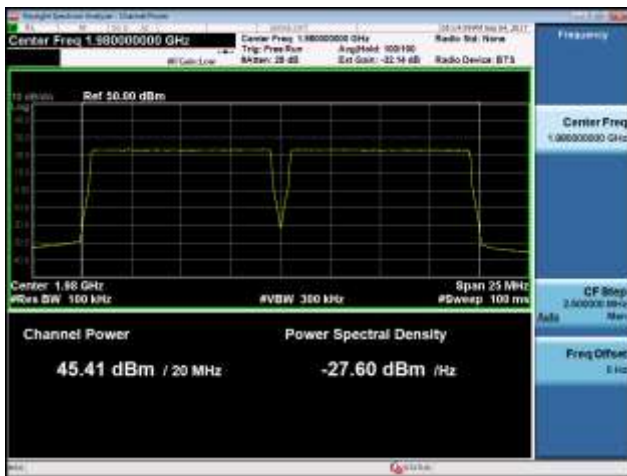
QPSK



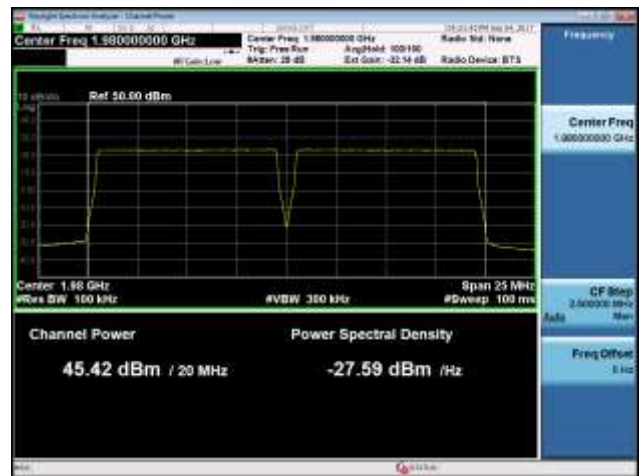
16QAM



64QAM

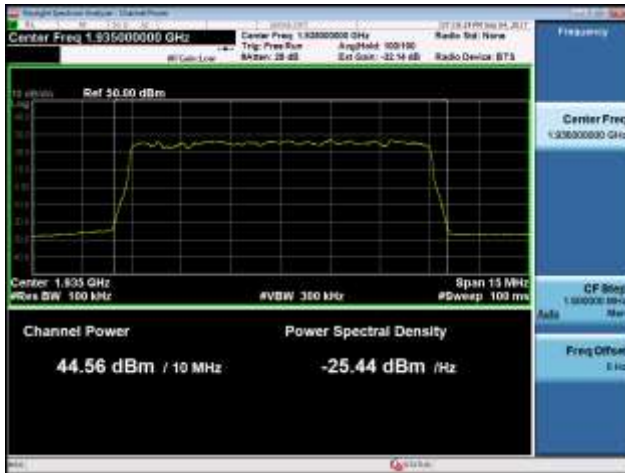


256QAM

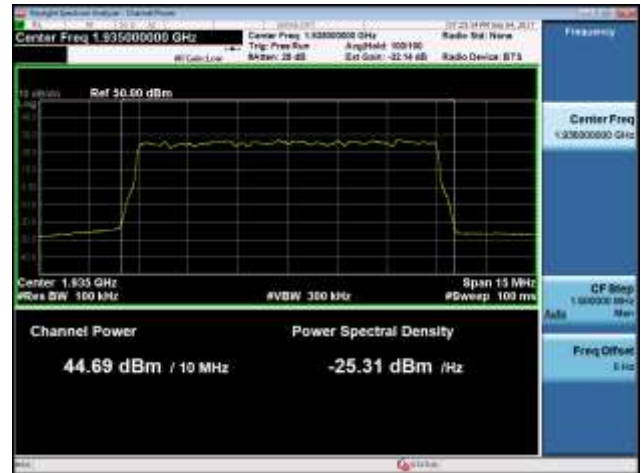


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 2TX, Bottom

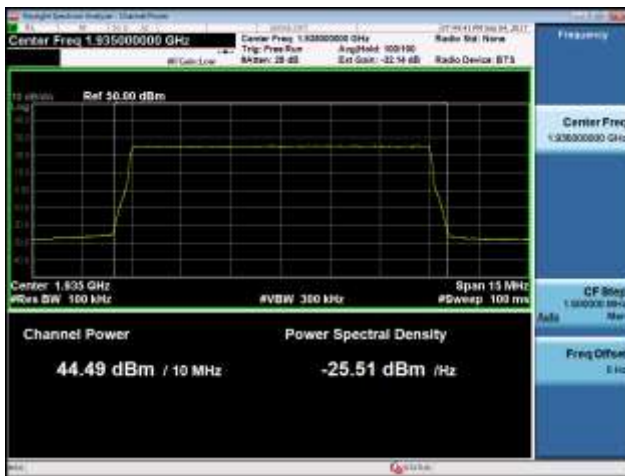
QPSK



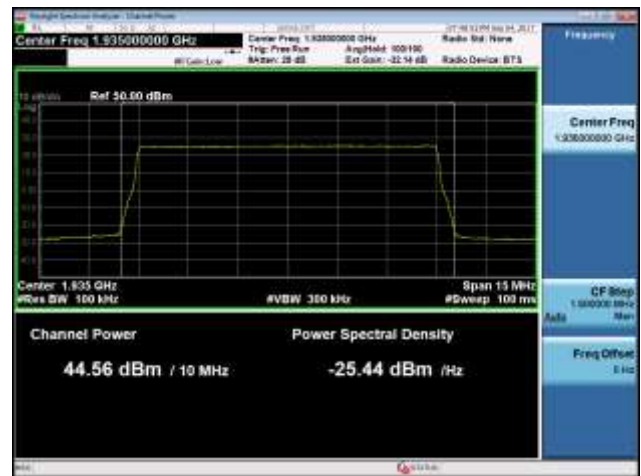
16QAM



64QAM

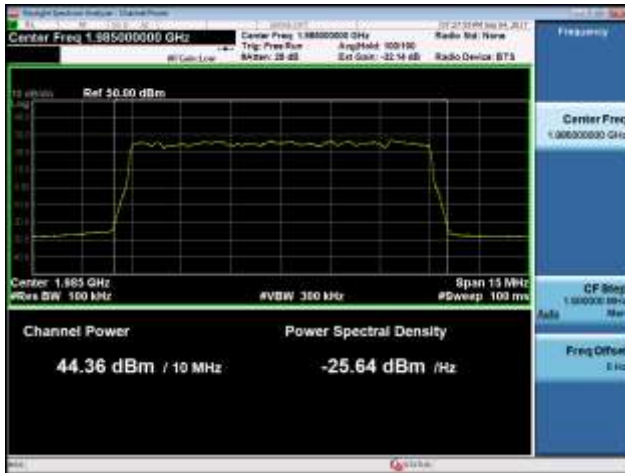


256QAM

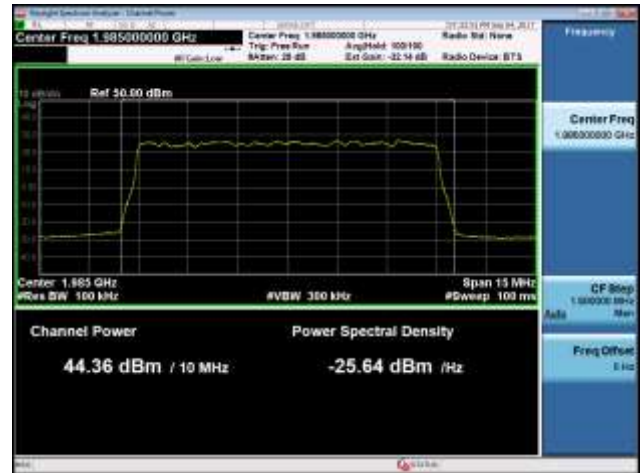


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 2TX, Top

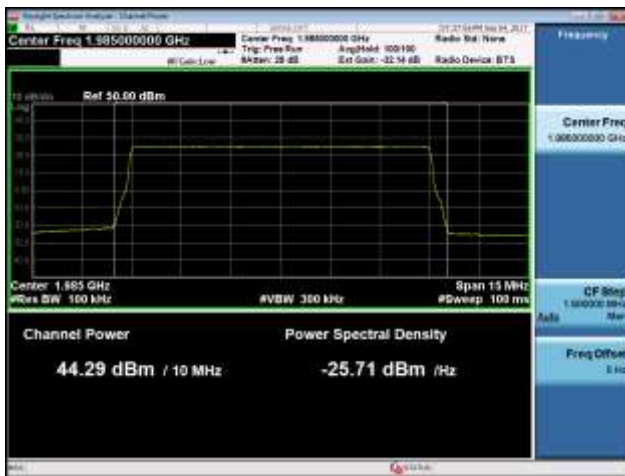
QPSK



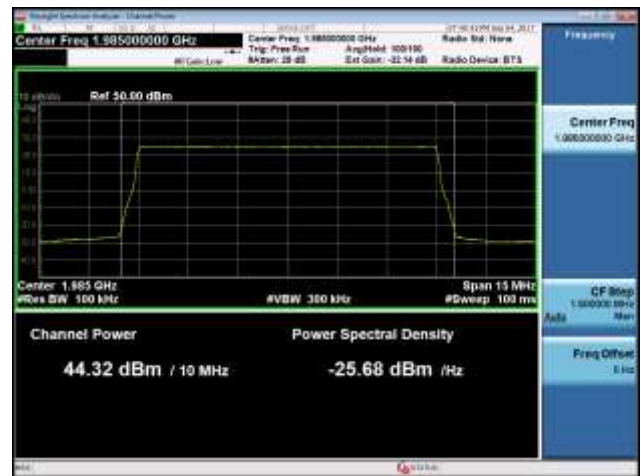
16QAM



64QAM

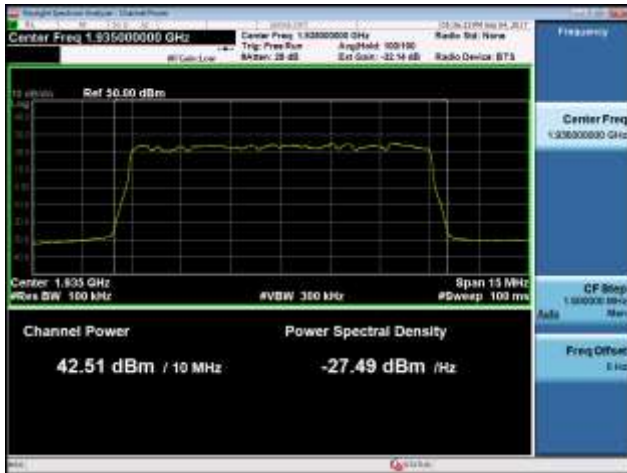


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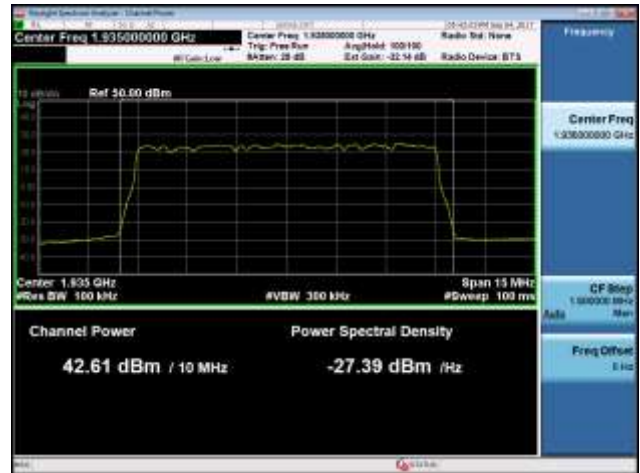


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 4TX, Bottom

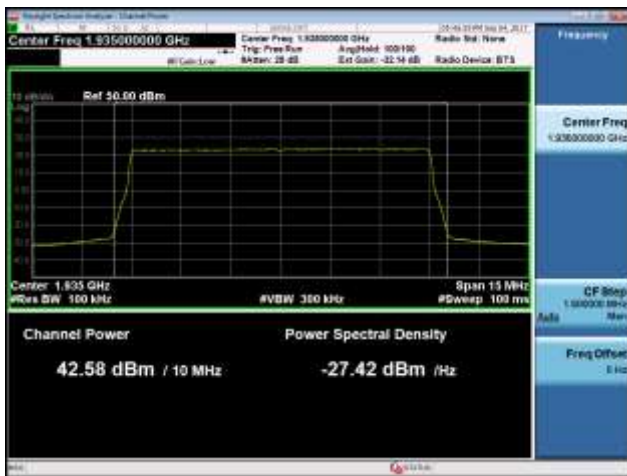
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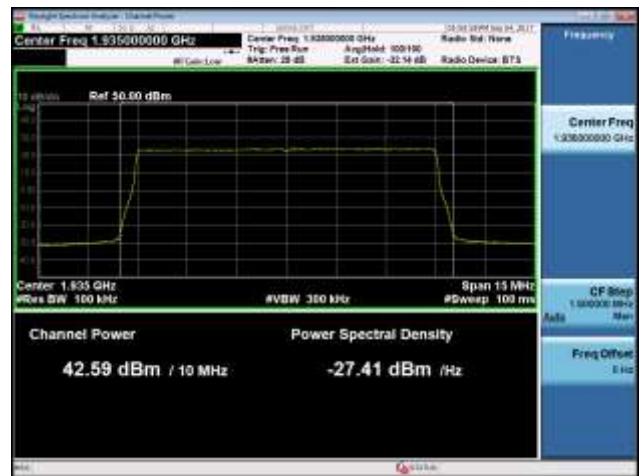
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64QAM

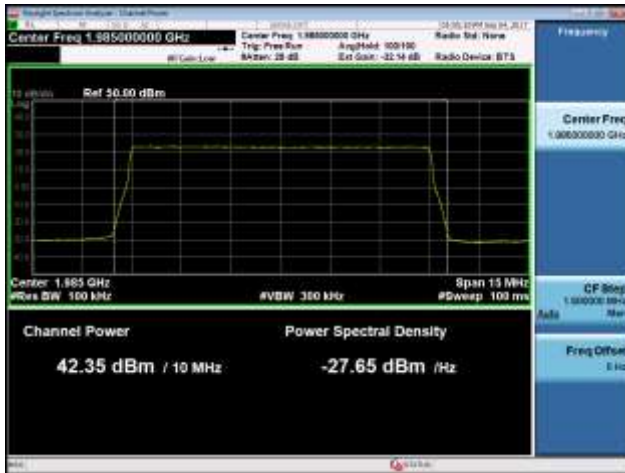


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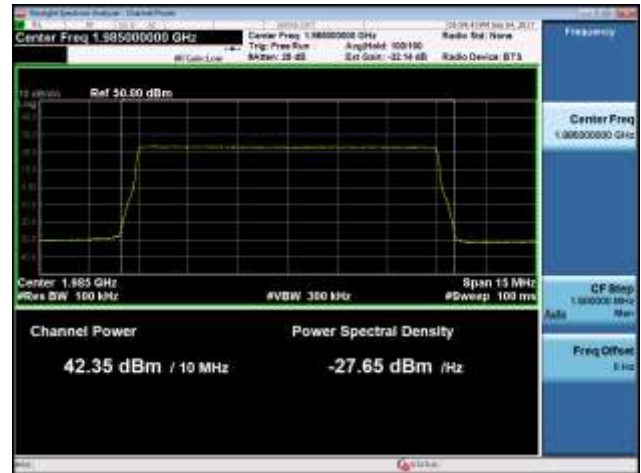


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 4TX, Top

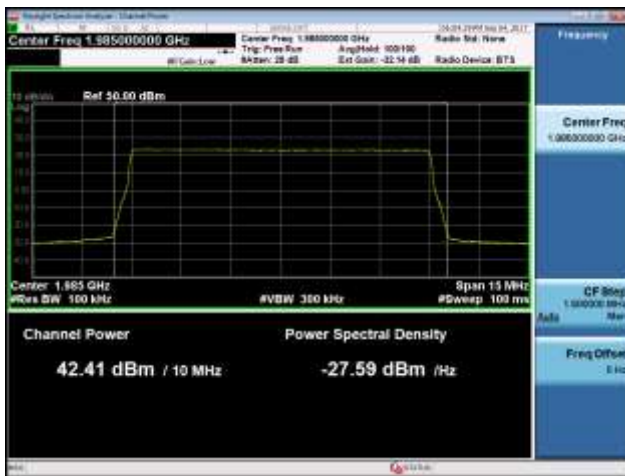
QPSK



16QAM



64QAM

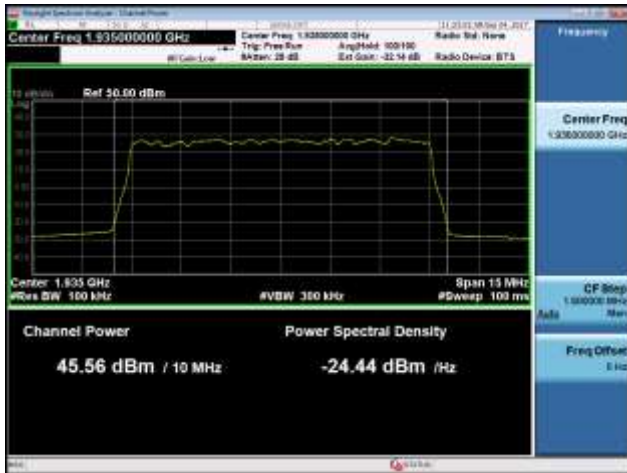


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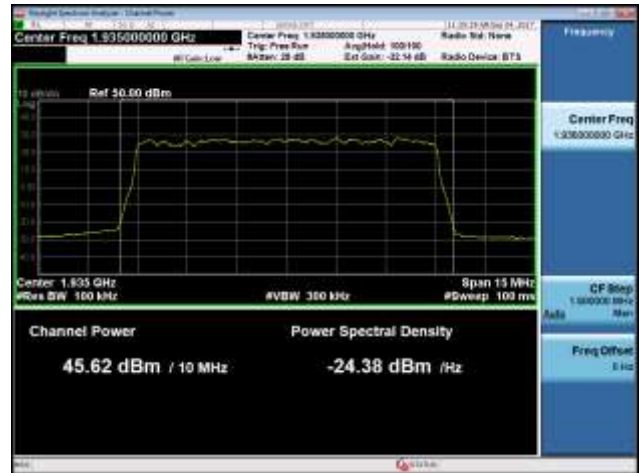


Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 2TX, Bottom

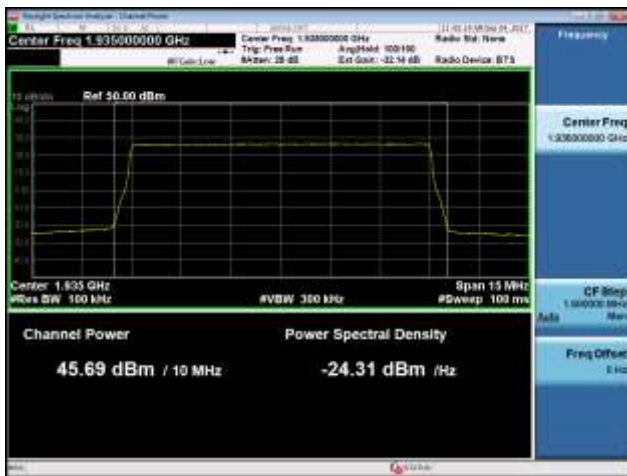
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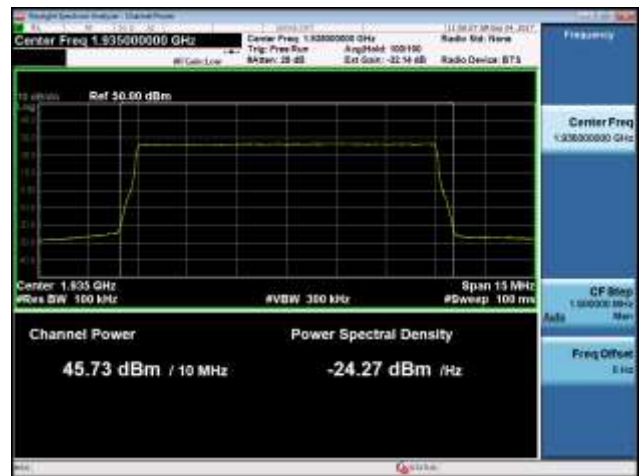
16QAM



64QAM

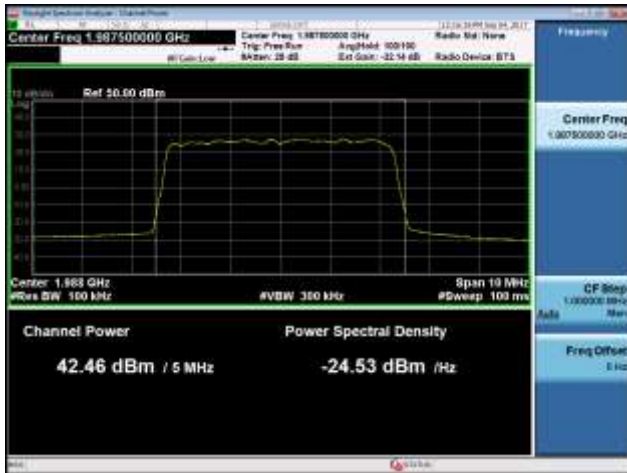


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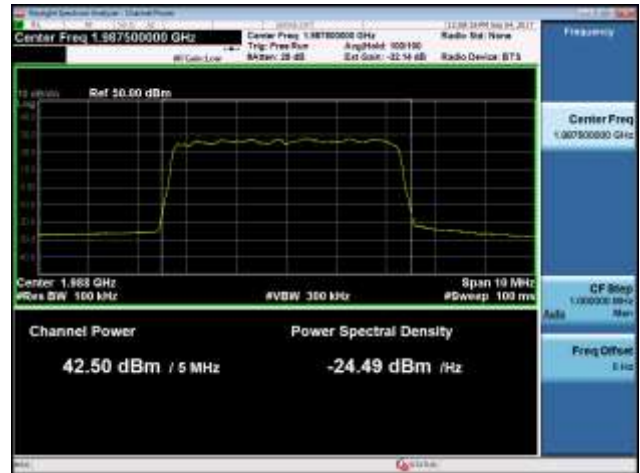


Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 2TX, Top

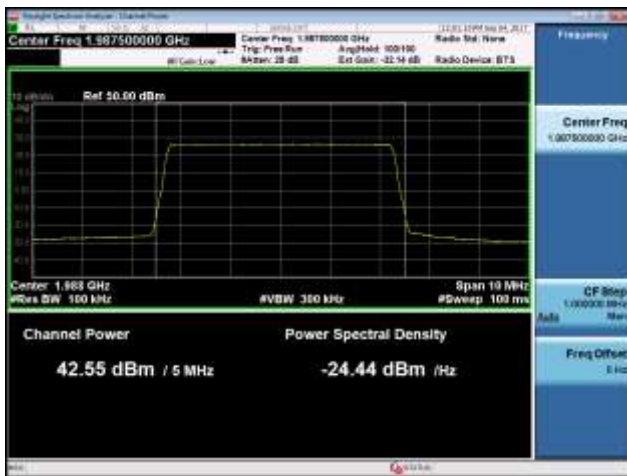
QPSK



16QAM



64QAM

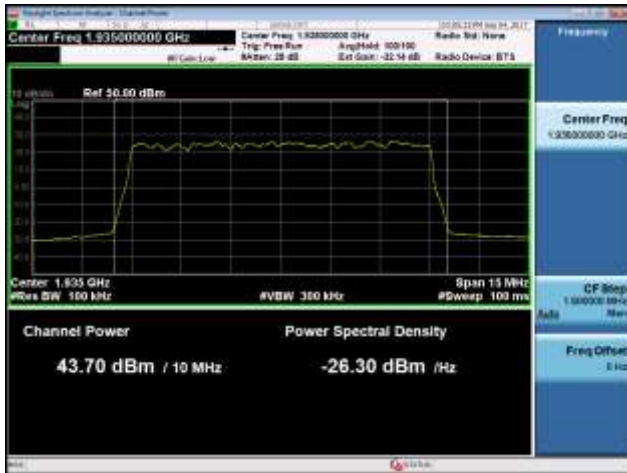


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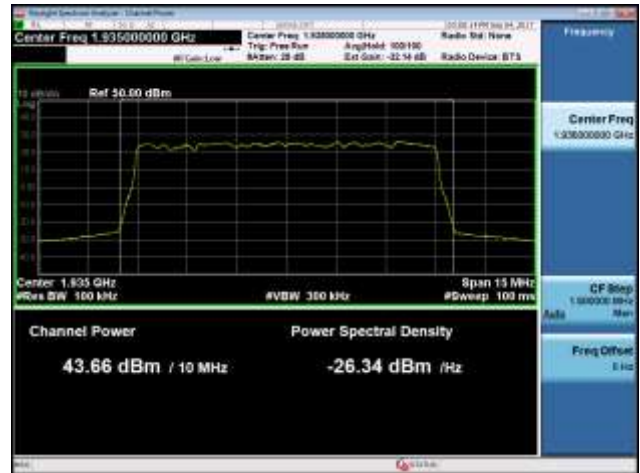


Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 4TX, Bottom

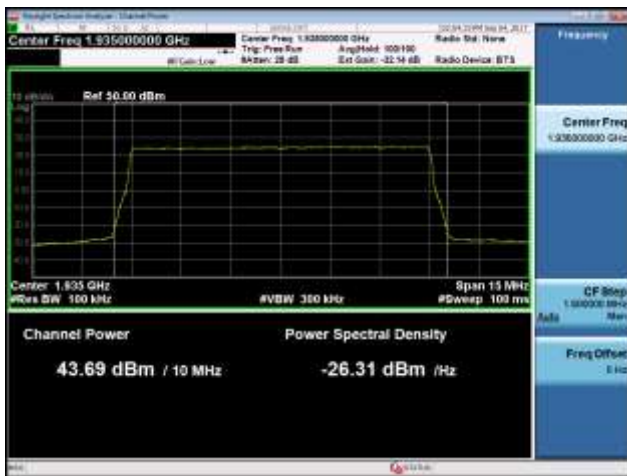
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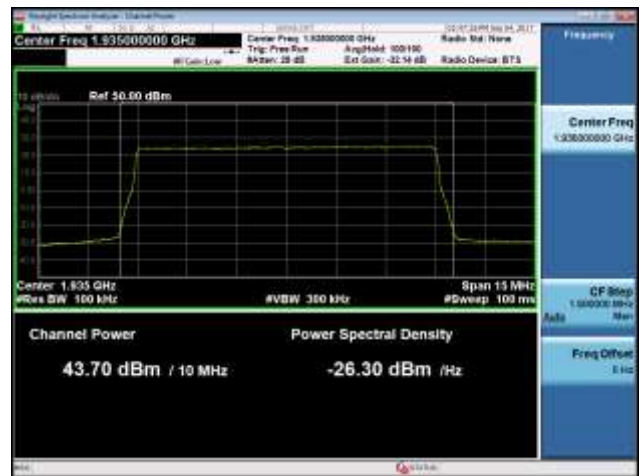
16QAM



64QAM

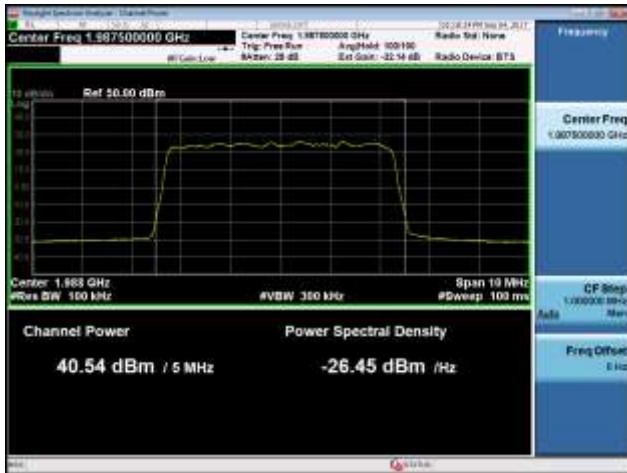


256QAM

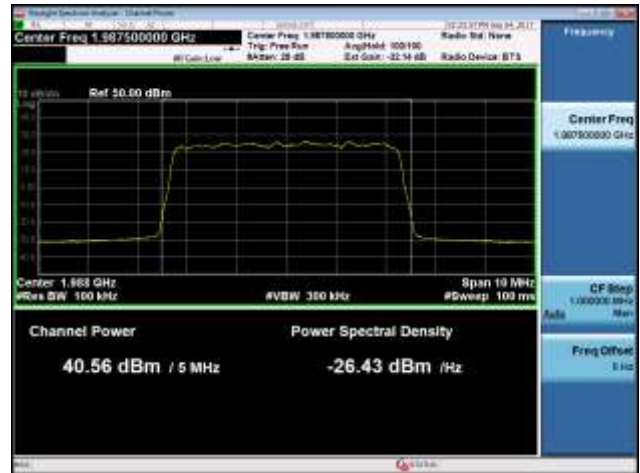


Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 4TX, Top

QPSK



16QAM



64QAM

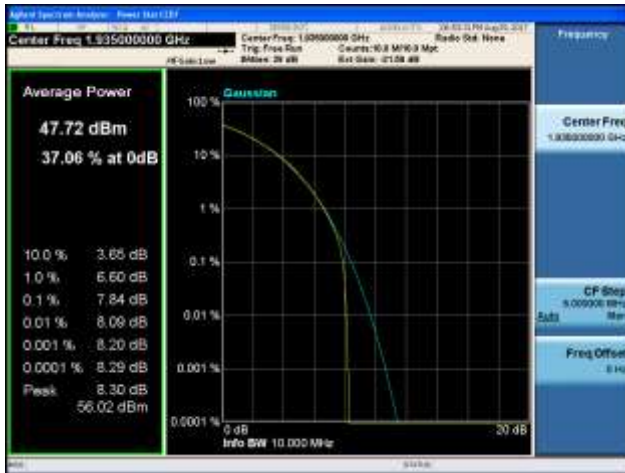


256QAM



Band 2, BW 10MHz, Single carrier, 2TX, Bottom

QPSK



16QAM



64QAM

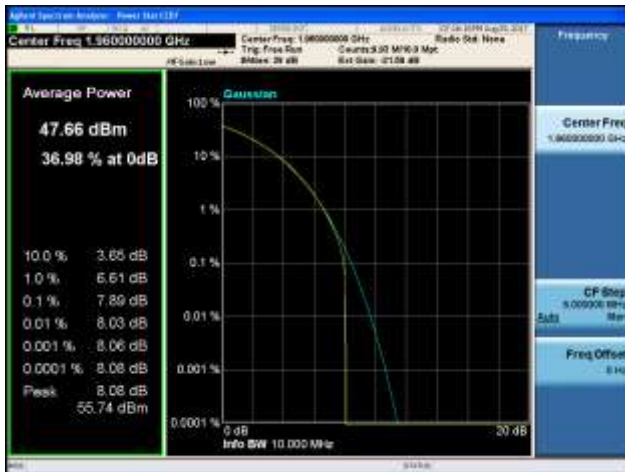


256QAM



Band 2, BW 10MHz, Single carrier, 2TX, Middle

QPSK



16QAM



64QAM

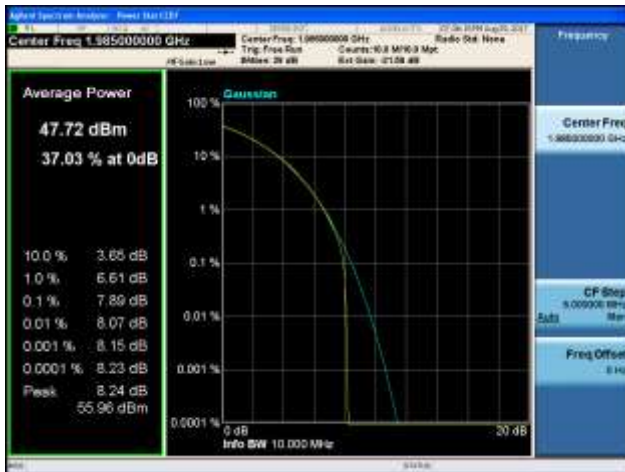


256QAM



Band 2, BW 10MHz, Single carrier, 2TX, Top

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz, Single carrier, 4TX, Bottom

QPSK



16QAM



64QAM

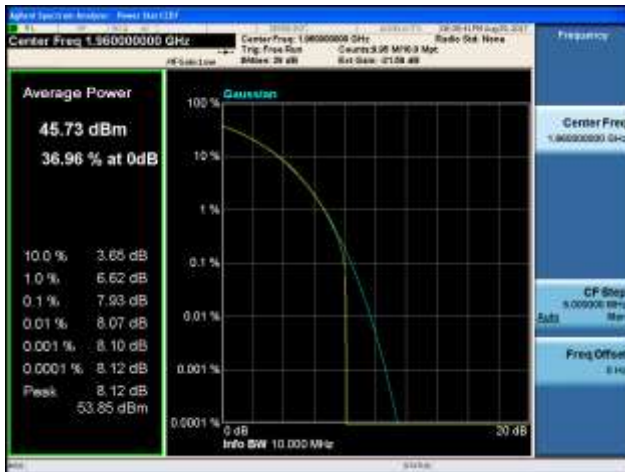


256QAM



Band 2, BW 10MHz, Single carrier, 4TX, Middle

QPSK



16QAM



64QAM

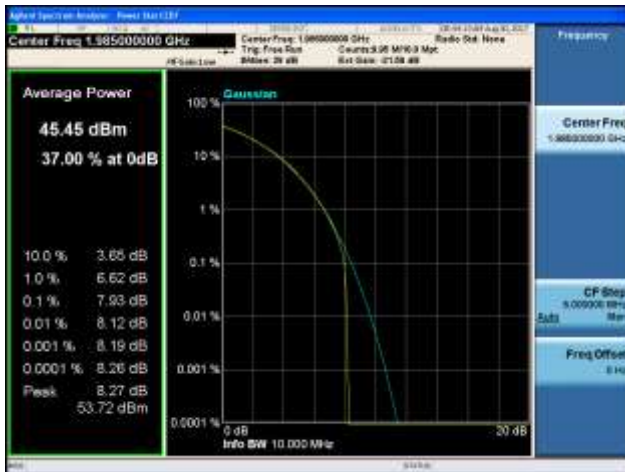


256QAM



Band 2, BW 10MHz, Single carrier, 4TX, Top

QPSK



16QAM



64QAM



256QAM



Band 2, BW 20MHz, Single carrier, 2TX, Bottom

QPSK



16QAM



64QAM

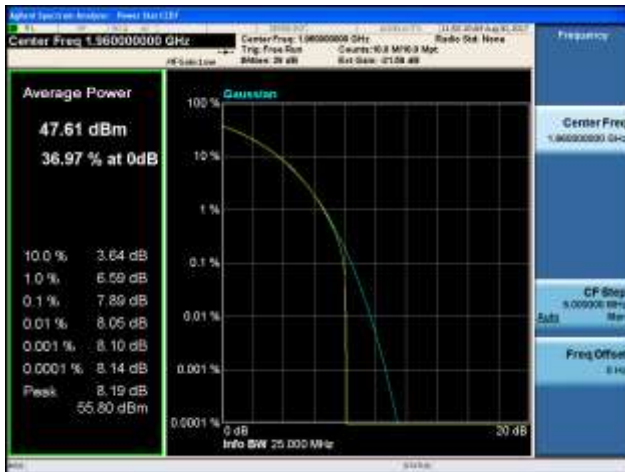


256QAM



Band 2, BW 20MHz, Single carrier, 2TX, Middle

QPSK



16QAM



64QAM



256QAM



Band 2, BW 20MHz, Single carrier, 2TX Top

QPSK



16QAM



64QAM

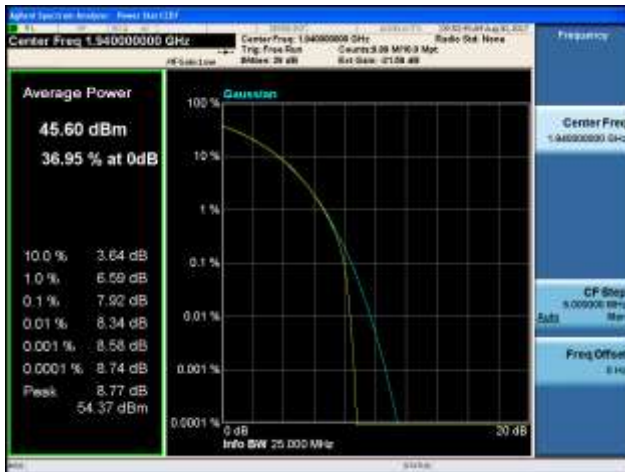


256QAM



Band 2, BW 20MHz, Single carrier, 4TX, Bottom

QPSK



16QAM



64QAM



256QAM



Band 2, BW 20MHz, Single carrier, 4TX, Middle

QPSK



16QAM



64QAM



256QAM



Band 2, BW 20MHz, Single carrier, 4TX Top

QPSK



16QAM



64QAM



256QAM



 CTK Co., Ltd. The First Look of Global Regulatory Compliance	CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2017-01618-2 Page (56) / (282) Pages	
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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.

Test Results :

Test Data : Band 2, BW 10MHz, Single carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz	Single	Bottom	5	2TX	QPSK	8.91
					16QAM	8.92
					64QAM	8.93
					256QAM	8.93
		Middle	5	2TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.94
					256QAM	8.94
		Top	5	2TX	QPSK	8.92
					16QAM	8.91
					64QAM	8.93
					256QAM	8.93

Test Data : Band 2, BW 10MHz, Single carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz	Single	Bottom	7	4TX	QPSK	8.91
					16QAM	8.91
					64QAM	8.93
					256QAM	8.93
		Middle	7	4TX	QPSK	8.92
					16QAM	8.91
					64QAM	8.94
					256QAM	8.94
		Top	7	4TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.93
					256QAM	8.93

Test Data : Band 2, BW 20MHz, Single carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 20MHz	Single	Bottom	5	2TX	QPSK	17.79
					16QAM	17.80
					64QAM	17.83
					256QAM	17.83
		Middle	5	2TX	QPSK	17.77
					16QAM	17.78
					64QAM	17.83
					256QAM	17.83
		Top	5	2TX	QPSK	17.79
					16QAM	17.79
					64QAM	17.83
					256QAM	17.83

Test Data : Band 2, BW 20MHz, Single carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 20MHz	Single	Bottom	7	4TX	QPSK	17.79
					16QAM	17.80
					64QAM	17.83
					256QAM	17.83
		Middle	7	4TX	QPSK	17.78
					16QAM	17.79
					64QAM	17.83
					256QAM	17.83
		Top	7	4TX	QPSK	17.79
					16QAM	17.81
					64QAM	17.83
					256QAM	17.83

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 5MHz + BW 10MHz	Multi/ Contiguous	Bottom	5	2TX	QPSK	14.11
					16QAM	14.10
					64QAM	14.12
					256QAM	14.11
		Top	5	2TX	QPSK	14.10
					16QAM	14.11
					64QAM	14.13
					256QAM	14.13

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 66 BW 5MHz + BW 10MHz	Multi/ Contiguous	Bottom	7	4TX	QPSK	14.10
					16QAM	14.10
					64QAM	14.13
					256QAM	14.13
		Top	7	4TX	QPSK	14.08
					16QAM	14.10
					64QAM	14.13
					256QAM	14.13

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Contiguous	Bottom	5	2TX	QPSK	18.80
					16QAM	18.80
					64QAM	18.83
					256QAM	18.83
		Top	5	2TX	QPSK	18.81
					16QAM	18.82
					64QAM	18.84
					256QAM	18.84

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 66 BW 10MHz + BW 10MHz	Multi/ Contiguous	Bottom	7	4TX	QPSK	18.80
					16QAM	18.81
					64QAM	18.83
					256QAM	18.83
		Top	7	4TX	QPSK	18.82
					16QAM	18.81
					64QAM	18.84
					256QAM	18.84

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 2TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Non- Contiguous	Bottom	5	2TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.93
					256QAM	8.93
		Top	5	2TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.93
					256QAM	8.93

Test Data : Band 2, BW 10MHz + BW 10MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz + BW 10MHz	Multi/ Non- Contiguous	Bottom	7	4TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.93
					256QAM	8.94
		Top	7	4TX	QPSK	8.94
					16QAM	8.93
					64QAM	8.94
					256QAM	8.93

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

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz + BW 5MHz	Multi/ Non- Contiguous	Bottom	5	2TX	QPSK	8.92
					16QAM	8.92
					64QAM	8.93
					256QAM	8.94
		Top	5	2TX	QPSK	4.47
					16QAM	4.46
					64QAM	4.49
					256QAM	4.49

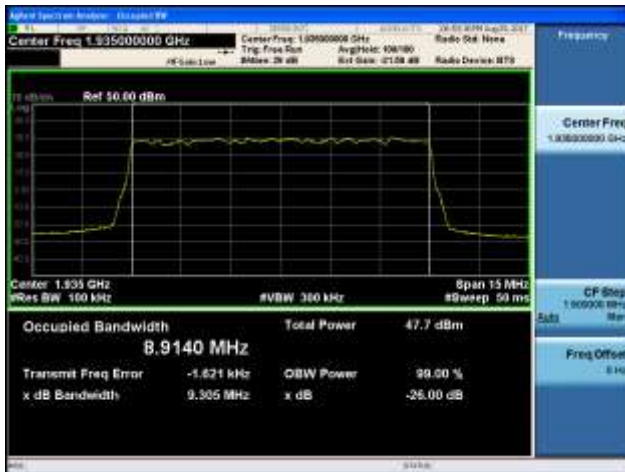
Test Data : Band 2, BW 10MHz + BW 5MHz, Multi carrier, 4TX

Type	Carrier	Channel	Test Ant. port	Output port	Modulation	Occupied Bandwidth(MHz)
Band 2 BW 10MHz + BW 5MHz	Multi/ Non- Contiguous	Bottom	7	4TX	QPSK	8.93
					16QAM	8.92
					64QAM	8.93
					256QAM	8.93
		Top	7	4TX	QPSK	4.45
					16QAM	4.46
					64QAM	4.49
					256QAM	4.49

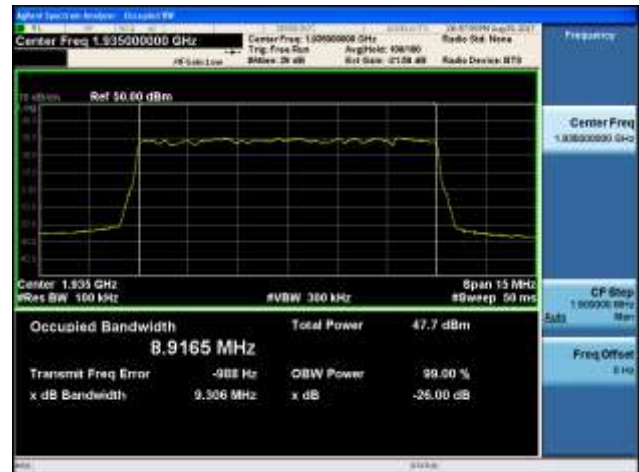
Test Plot at Occupied Bandwidth

Band 2, BW 10MHz, Single carrier, 2TX, Bottom

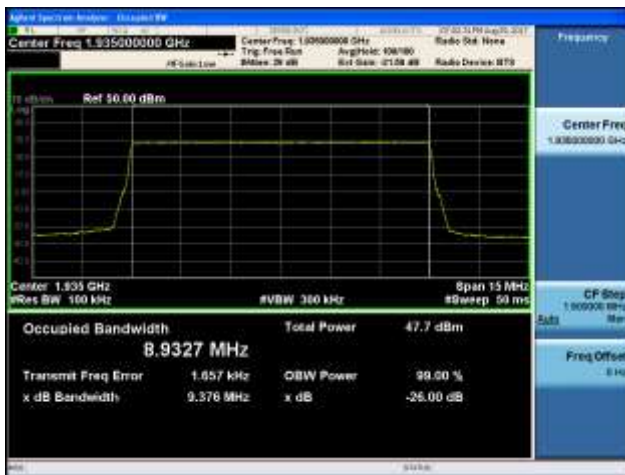
QPSK



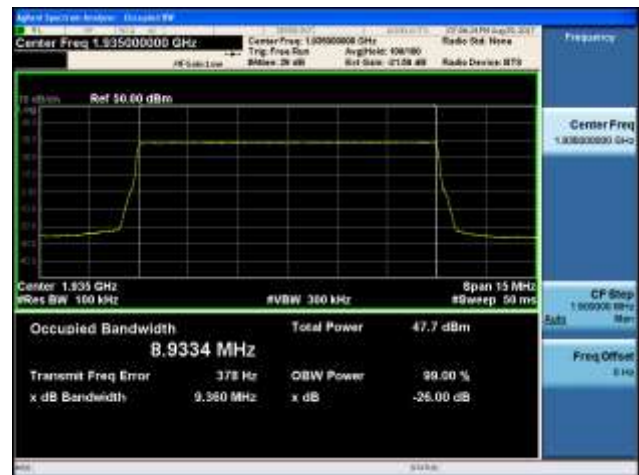
16QAM



64QAM

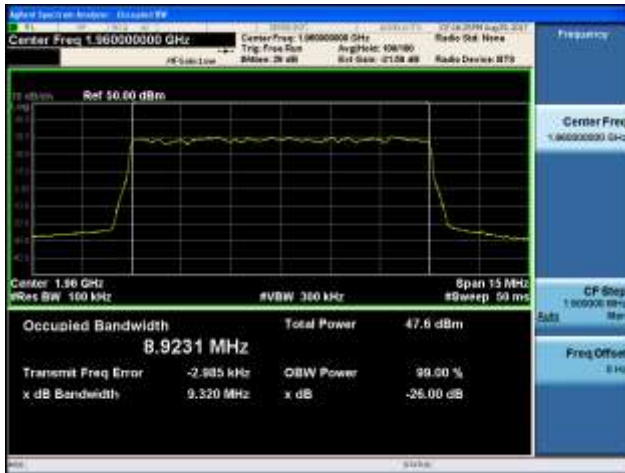


256QAM



Band 2, BW 10MHz, Single carrier, 2TX, Middle

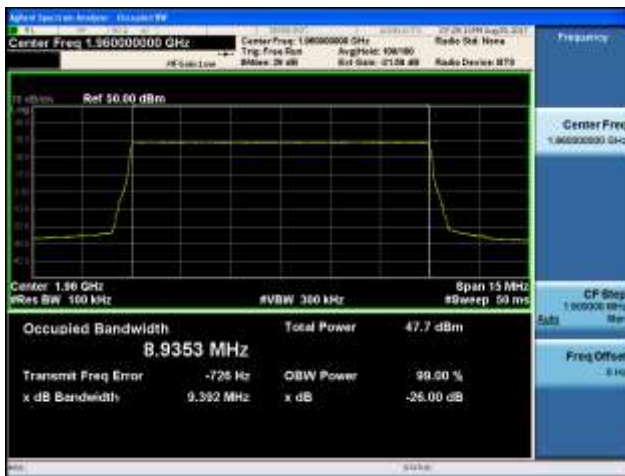
QPSK



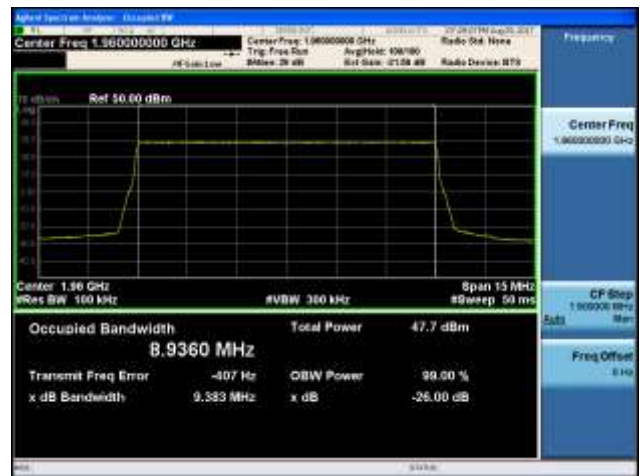
16QAM



64QAM

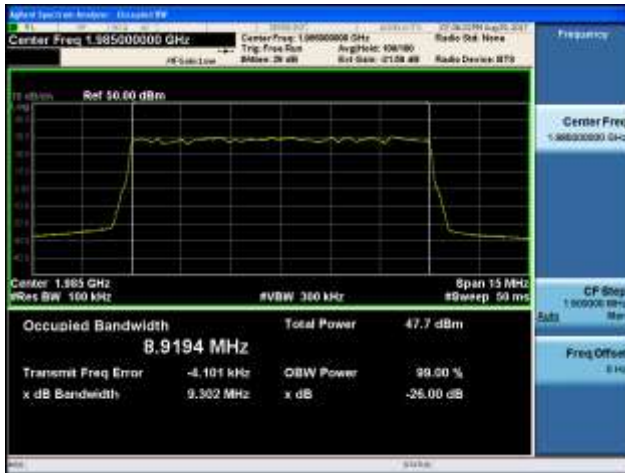


256QAM

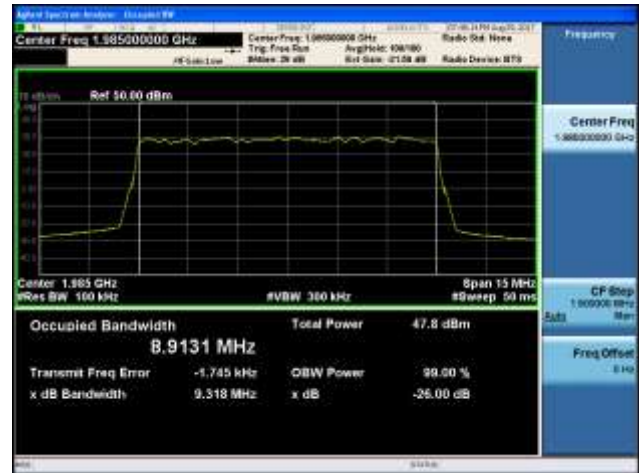


Band 2, BW 10MHz, Single carrier, 2TX, Top

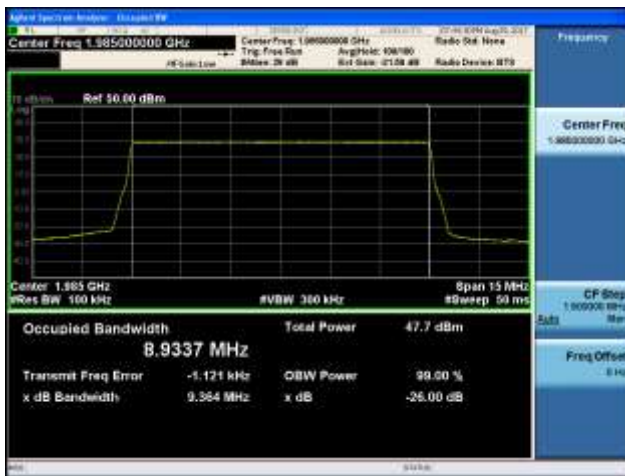
QPSK



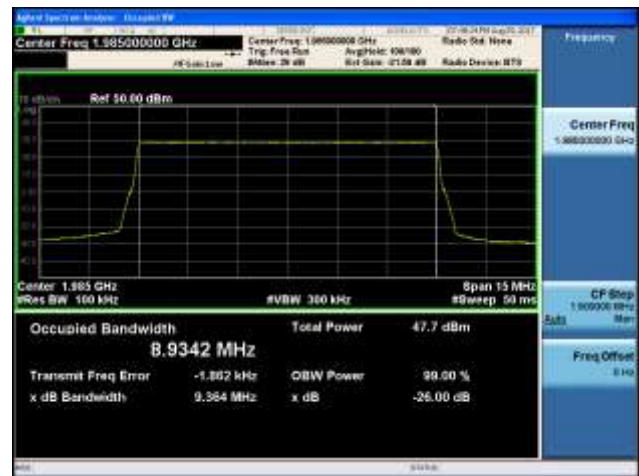
16QAM



64QAM

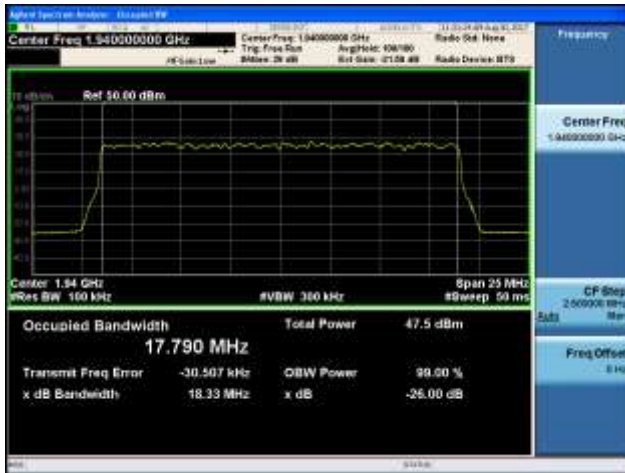


256QAM

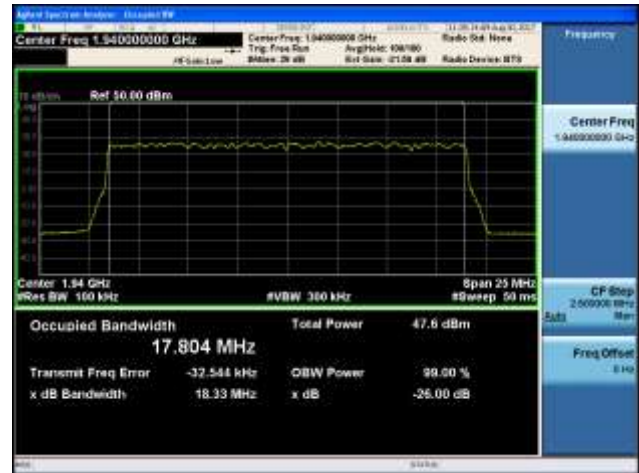


Band 2, BW 20MHz, Single carrier, 2TX, Bottom

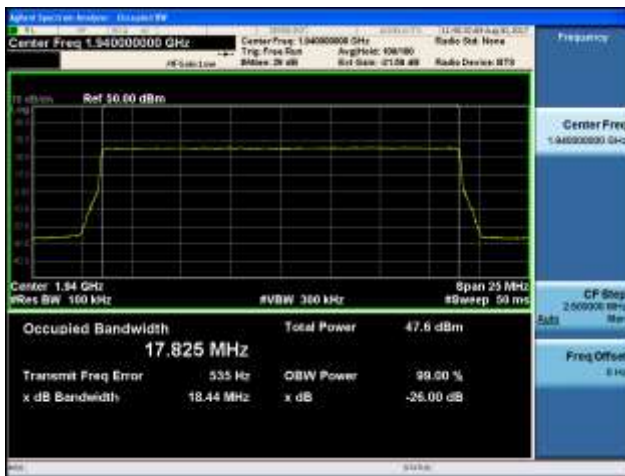
QPSK



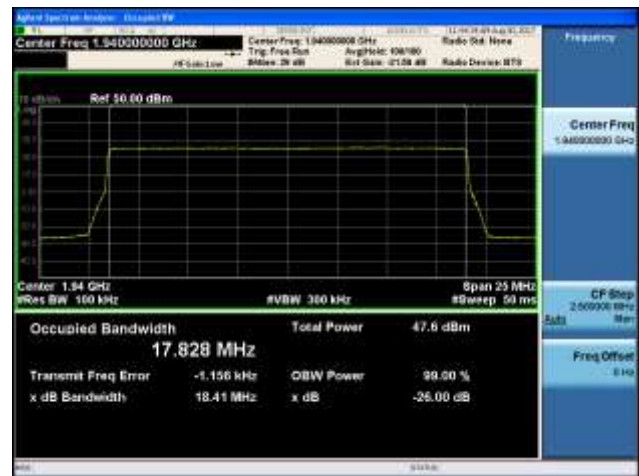
16QAM



64QAM

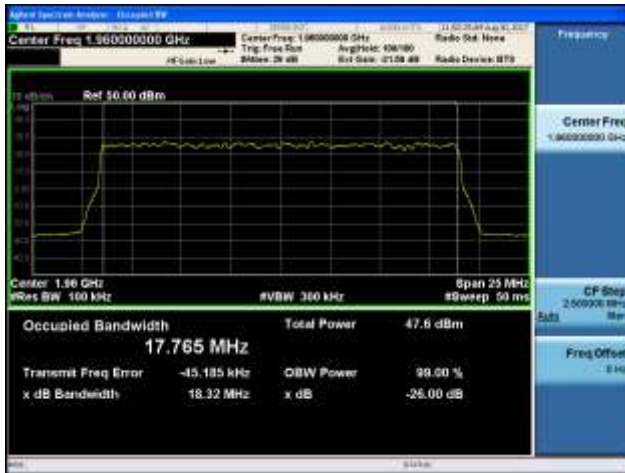


256QAM



Band 2, BW 20MHz, Single carrier, 2TX, Middle

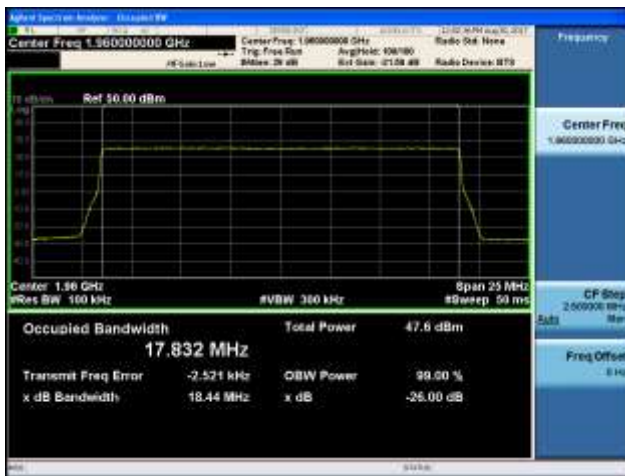
QPSK



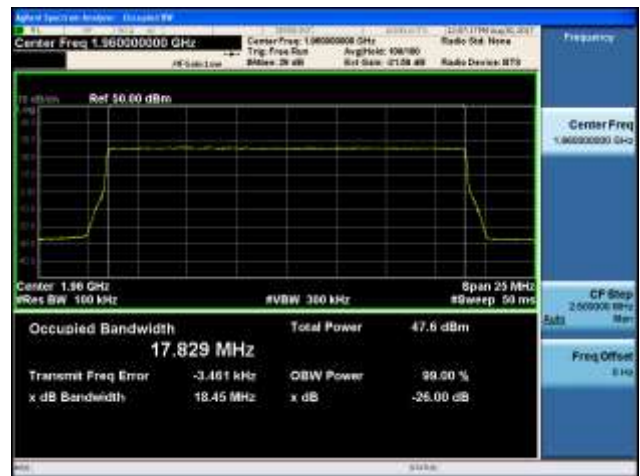
16QAM



64QAM

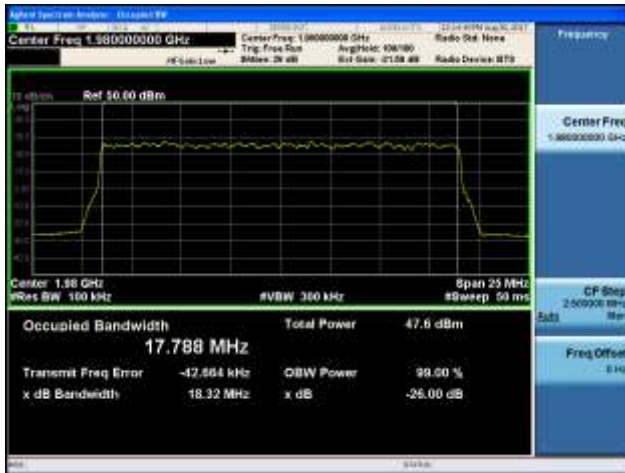


256QAM

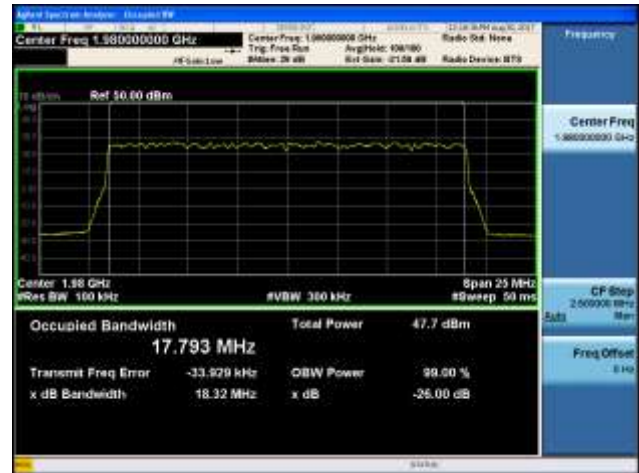


Band 2, BW 20MHz, Single carrier, 2TX, Top

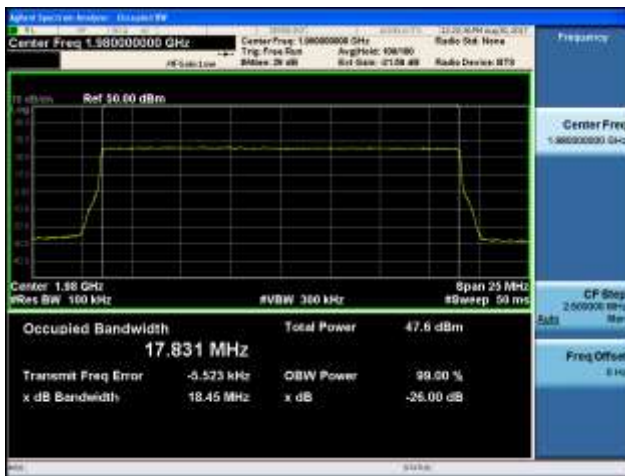
QPSK



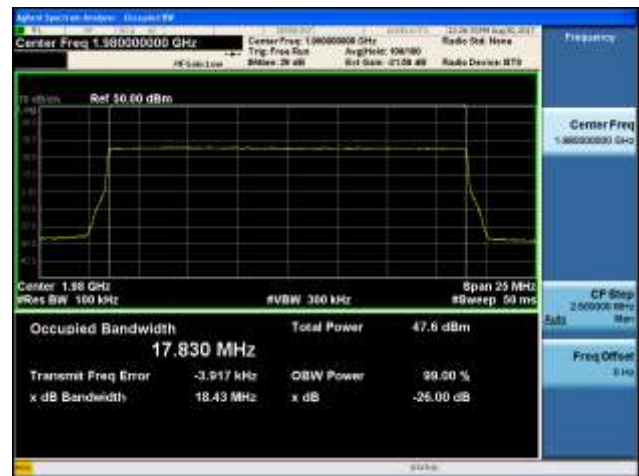
16QAM



64QAM

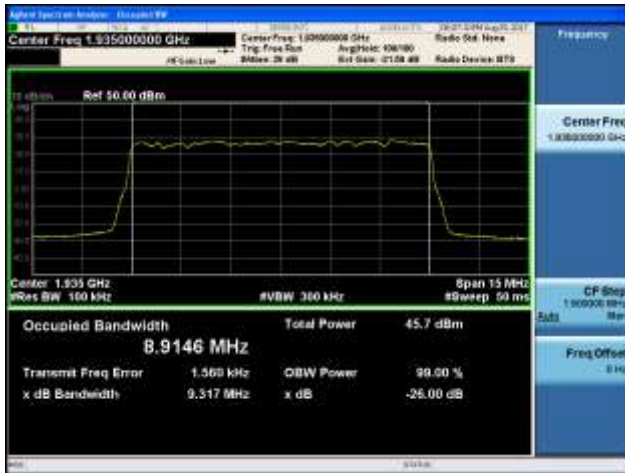


256QAM

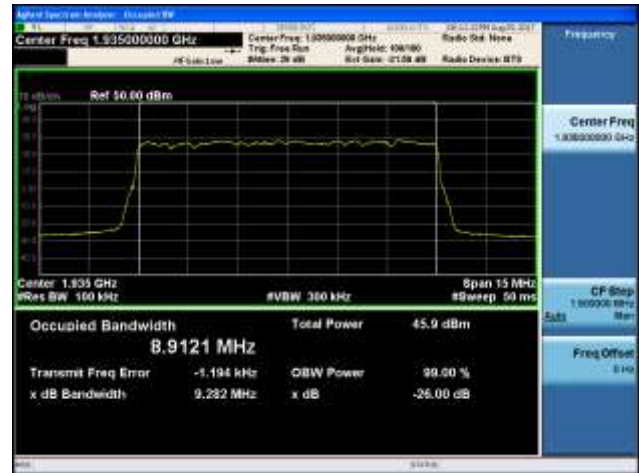


Band 2, BW 10MHz, Single carrier, 4TX, Bottom

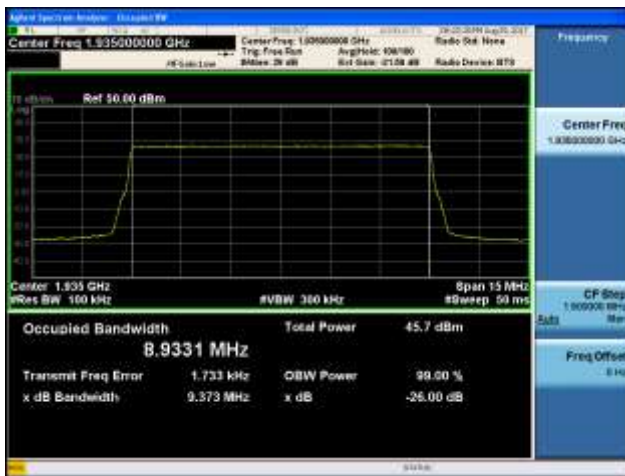
QPSK



16QAM



64QAM

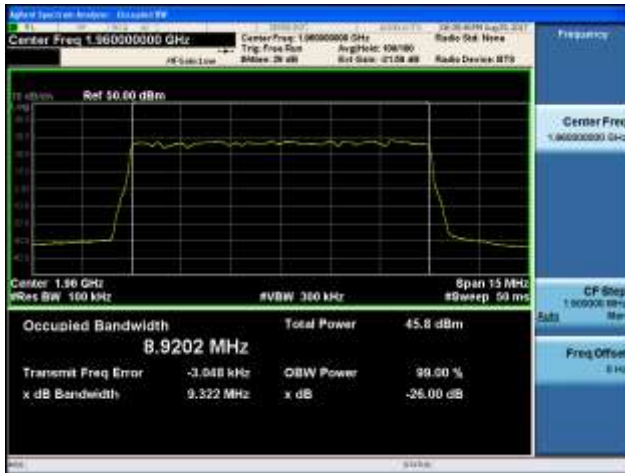


256QAM

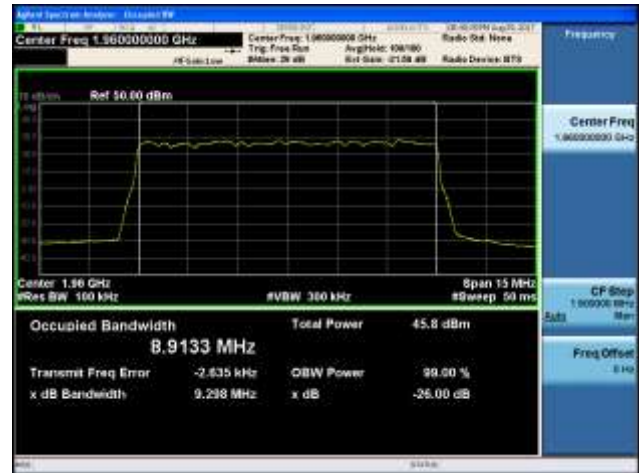


Band 2, BW 10MHz, Single carrier, 4TX, Middle

QPSK



16QAM



64QAM



256QAM

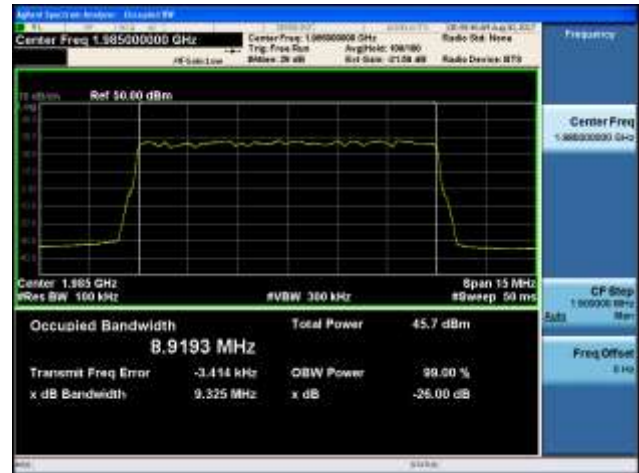


Band 2, BW 10MHz, Single carrier, 4TX Top

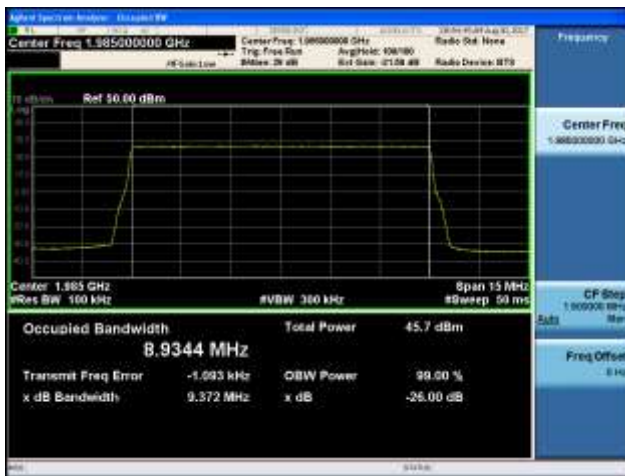
QPSK



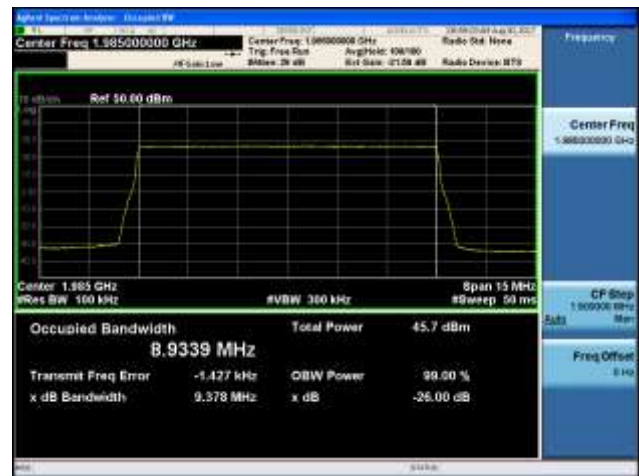
16QAM



64QAM

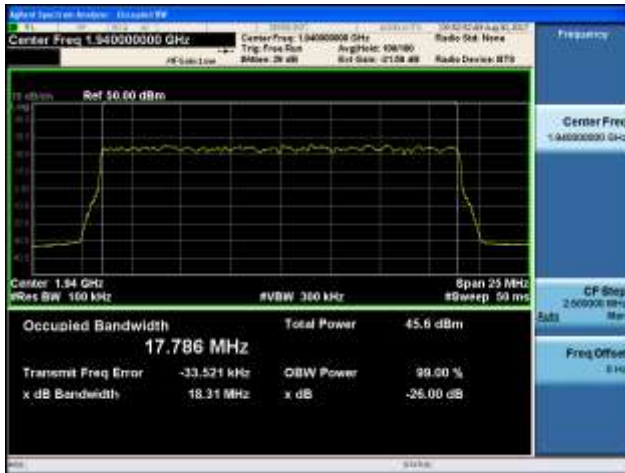


256QAM

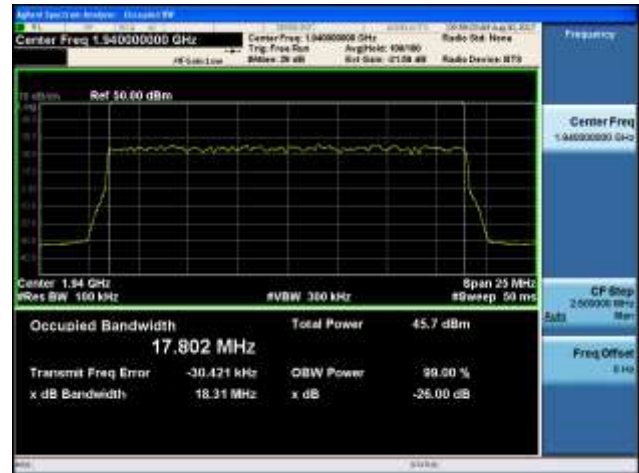


Band 2, BW 20MHz, Single carrier, 4TX, Bottom

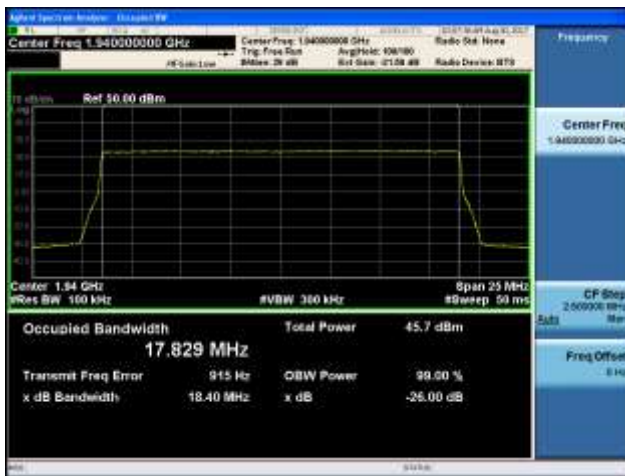
QPSK



16QAM



64QAM

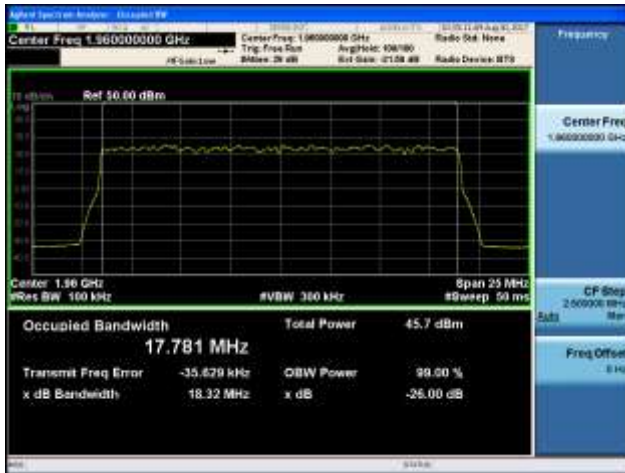


256QAM

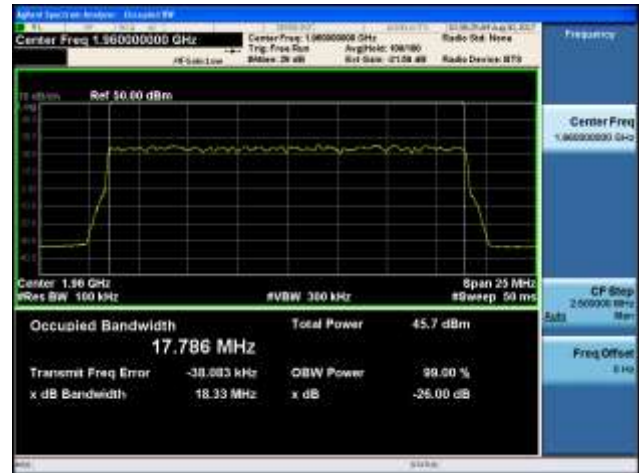


Band 2, BW 20MHz, Single carrier, 4TX, Middle

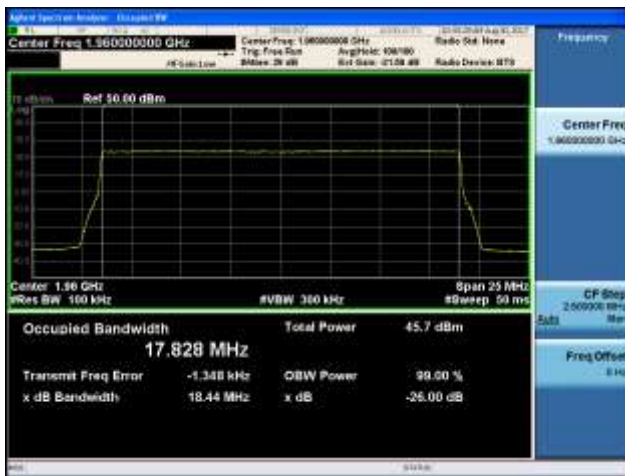
QPSK



16QAM



64QAM

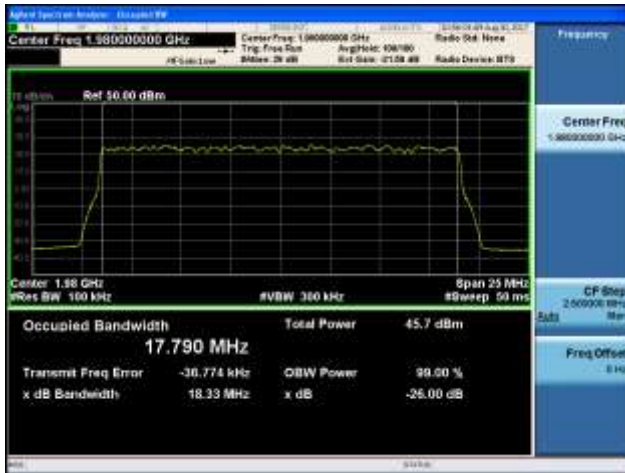


256QAM

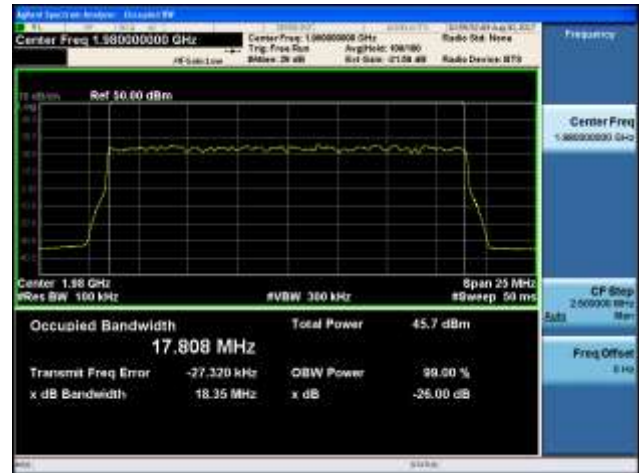


Band 2, BW 20MHz, Single carrier, 4TX, Top

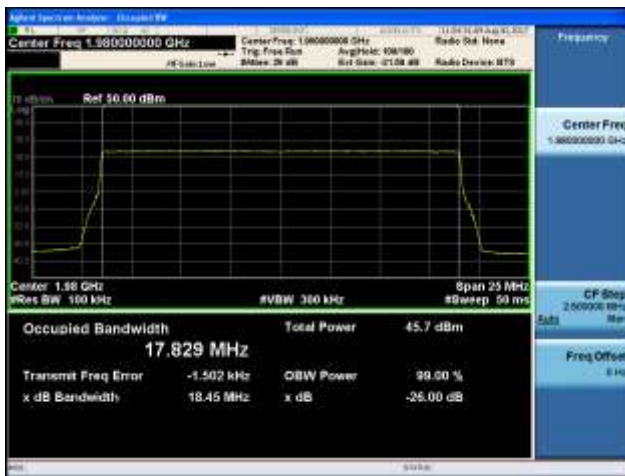
QPSK



16QAM



64QAM

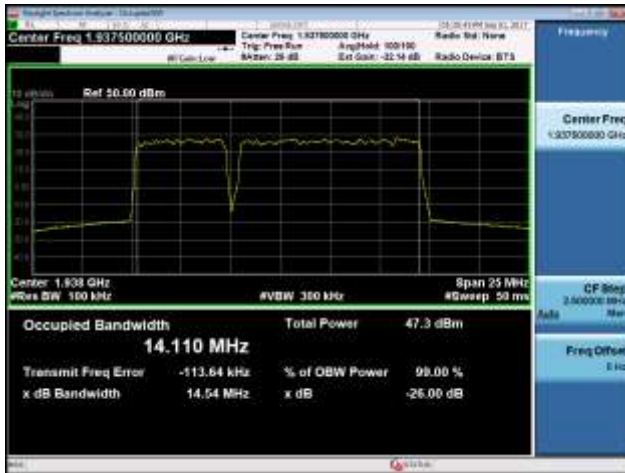


256QAM



Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Bottom

QPSK



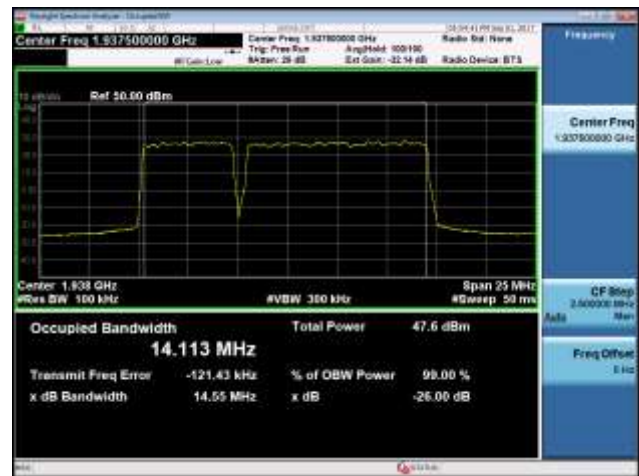
16QAM



64QAM



256QAM

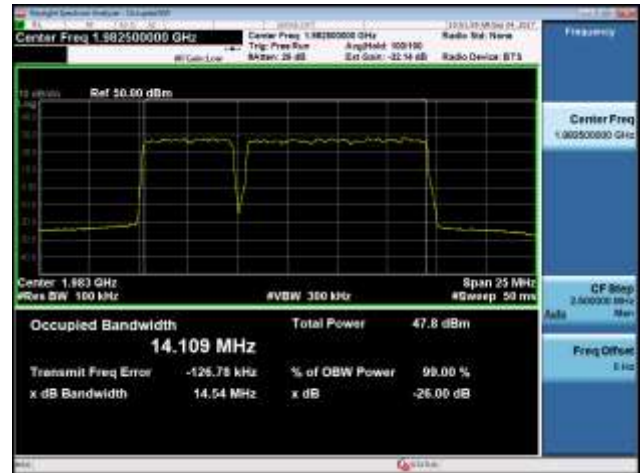


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Top

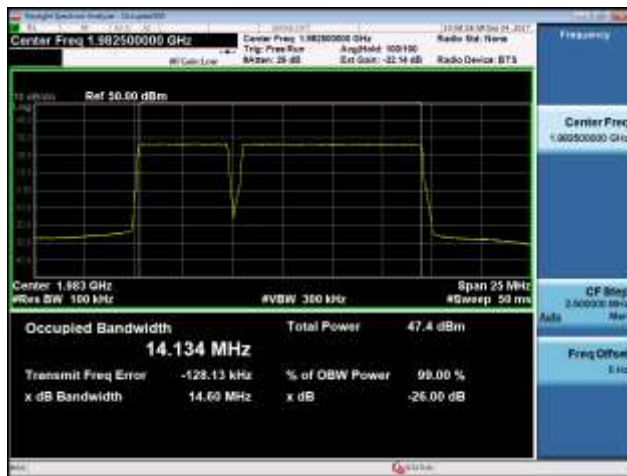
QPSK



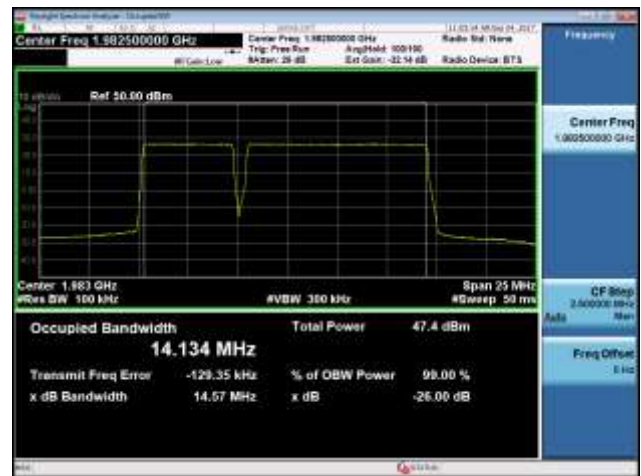
16QAM



64QAM



256QAM

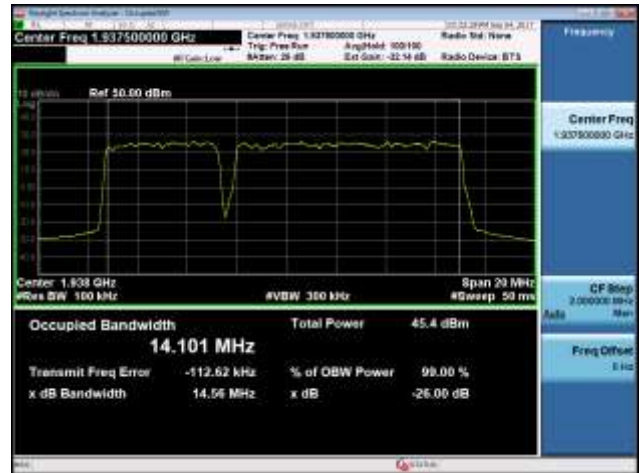


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Bottom

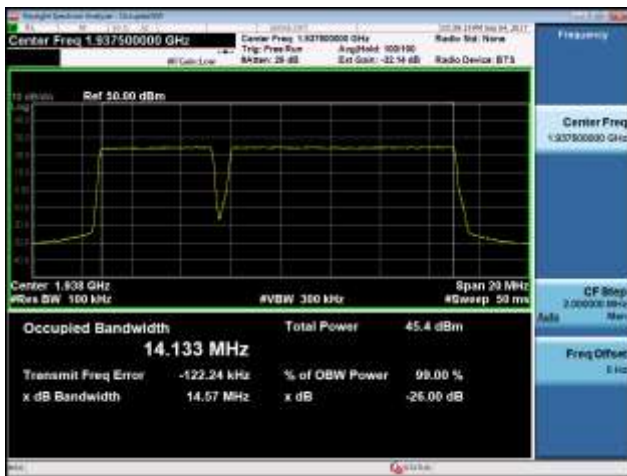
QPSK



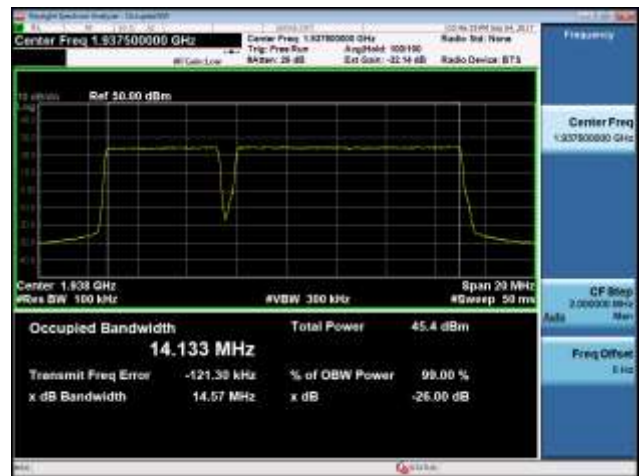
16QAM



64QAM



256QAM

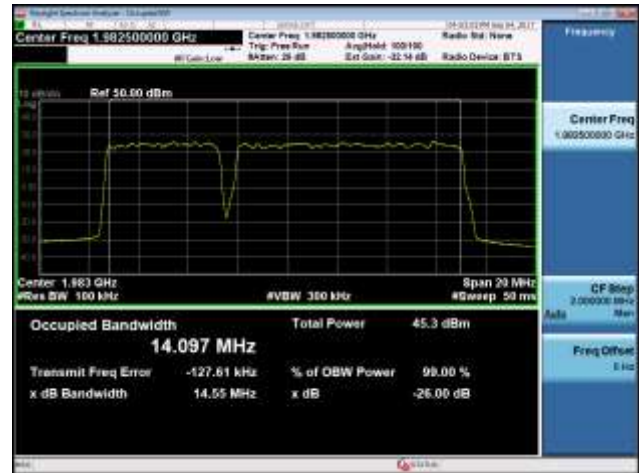


Band 2, BW 5MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Top

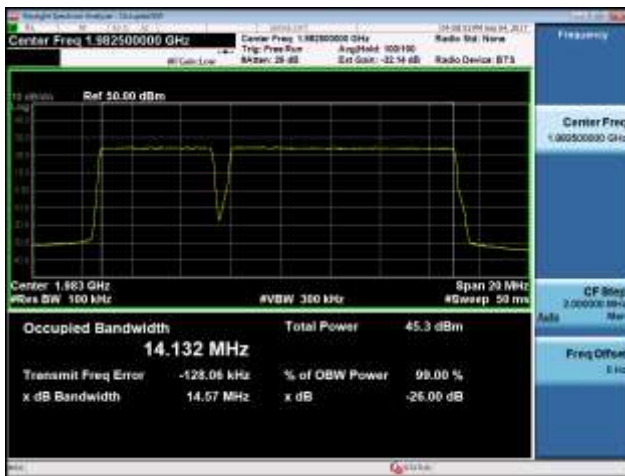
QPSK



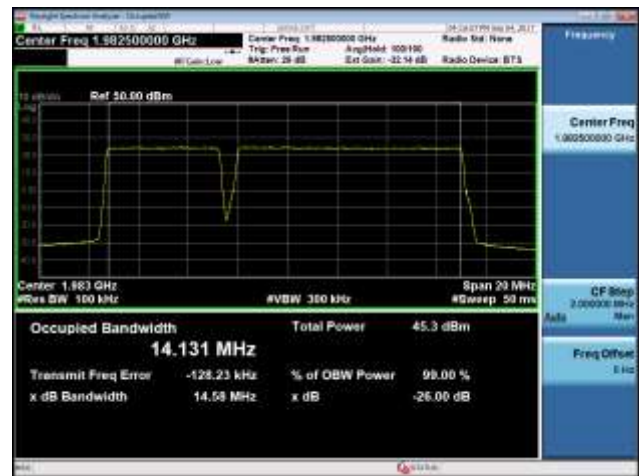
16QAM



64QAM

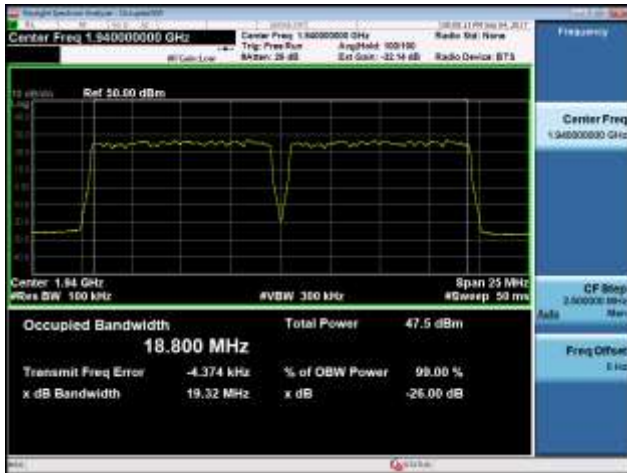


256QAM

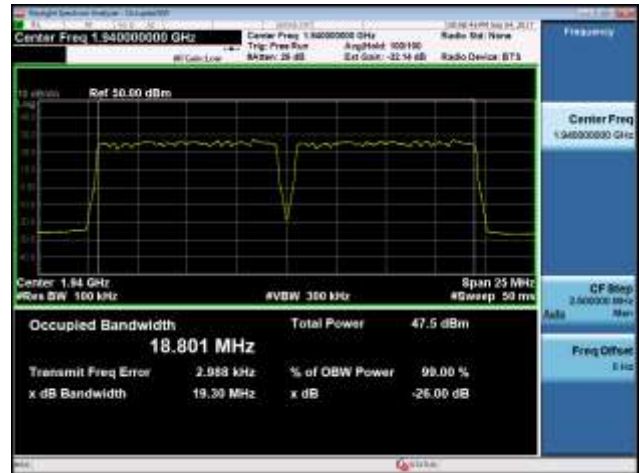


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Bottom

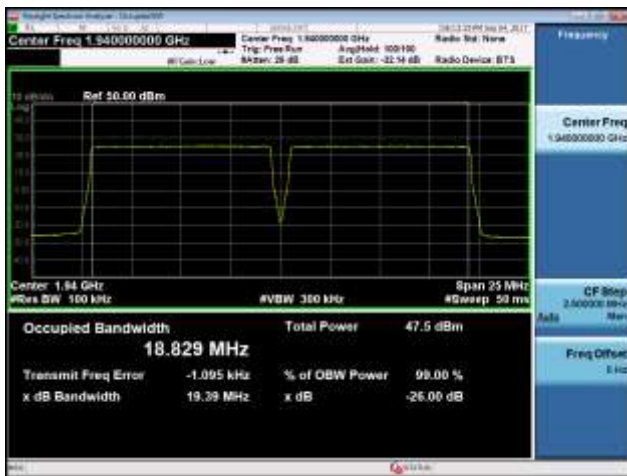
QPSK



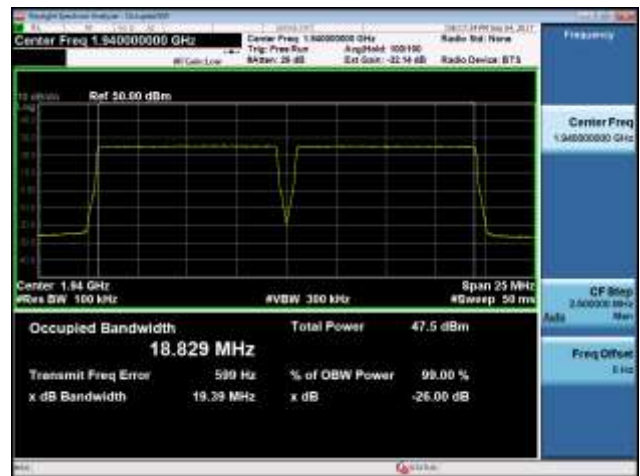
16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 2TX, Top

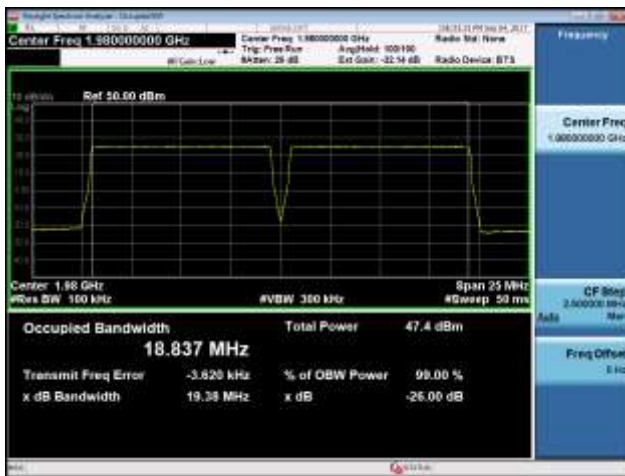
QPSK



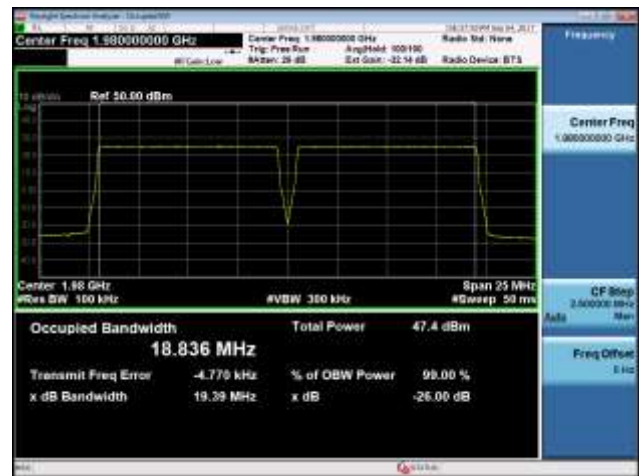
16QAM



64QAM



256QAM

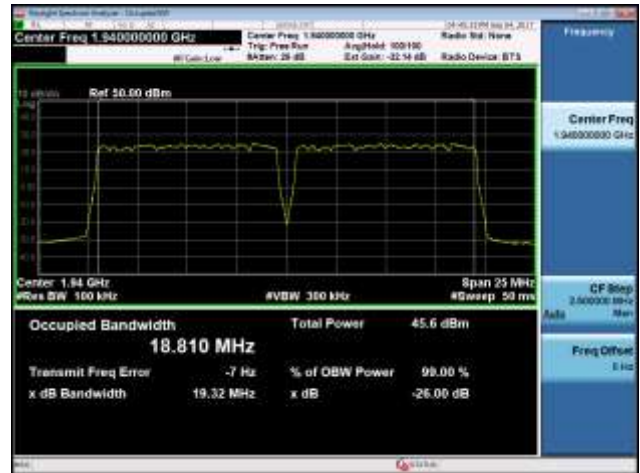


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Bottom

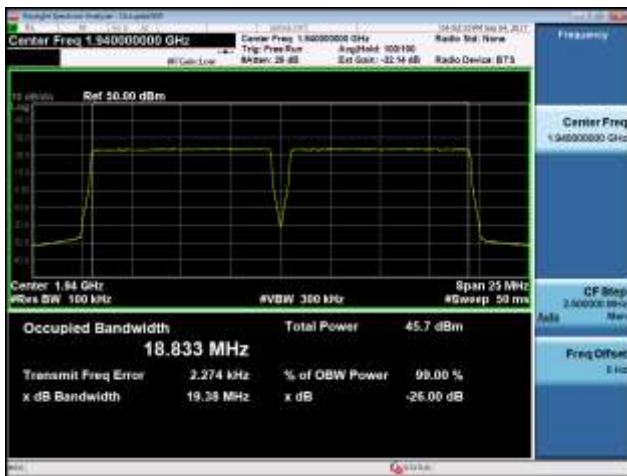
QPSK



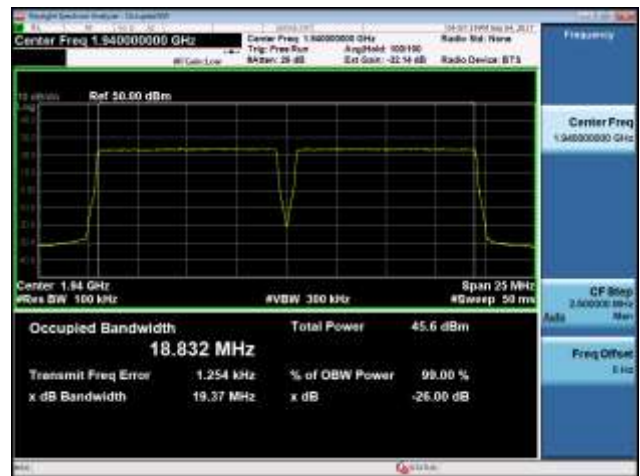
16QAM



64QAM

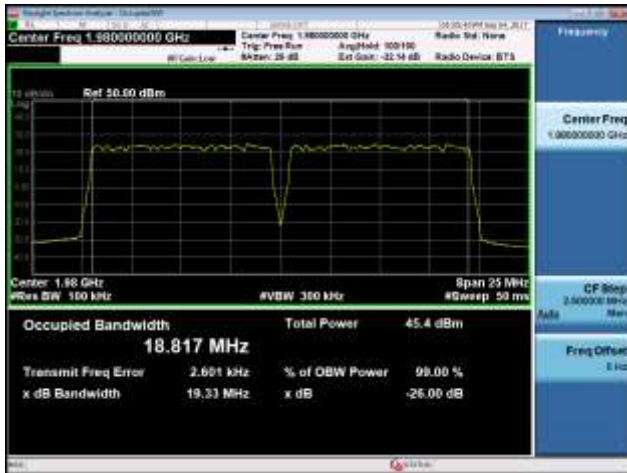


256QAM

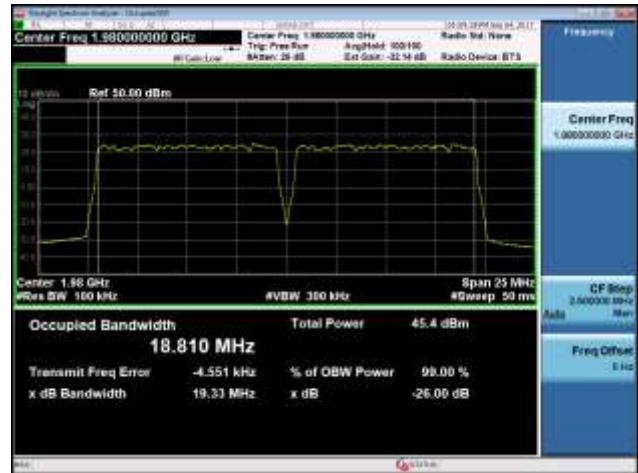


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Contiguous), 4TX, Top

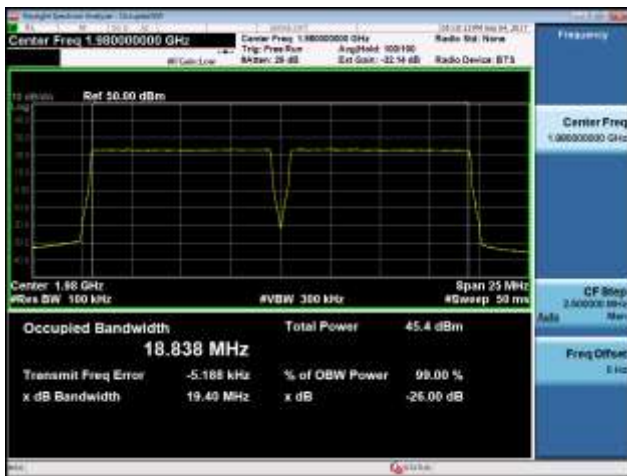
QPSK



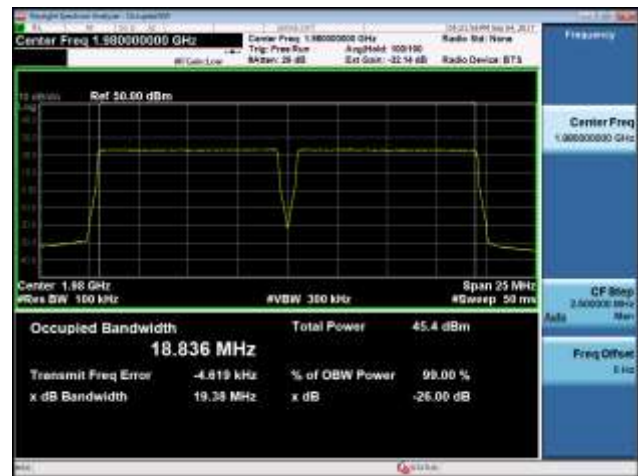
16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 2TX, Bottom

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 2TX, Top

QPSK



16QAM



64QAM

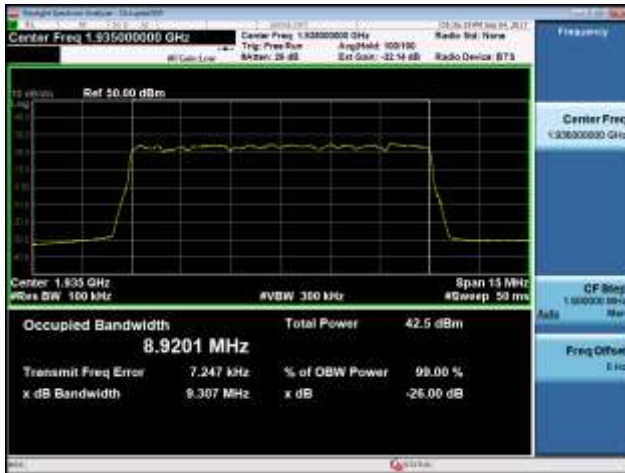


256QAM

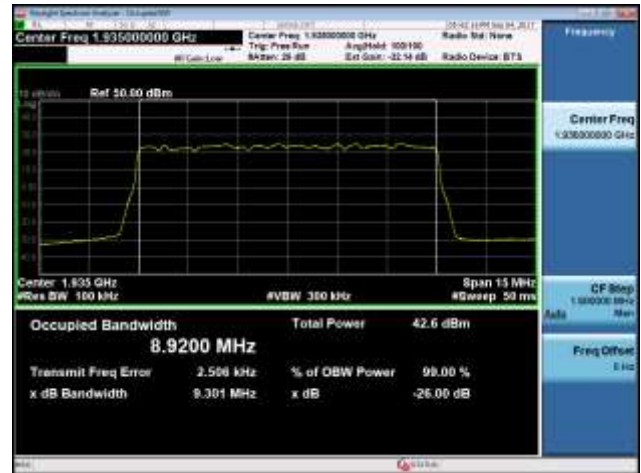


Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 4TX, Bottom

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 10MHz, Multi carrier(Non-Contiguous), 4TX, Top

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 2TX, Bottom

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 2TX, Top

QPSK



16QAM



64QAM



256QAM

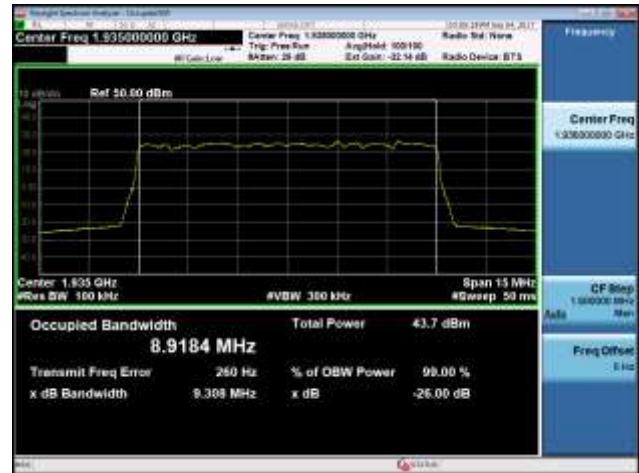


Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 4TX, Bottom

QPSK



16QAM



64QAM



256QAM



Band 2, BW 10MHz + BW 5MHz, Multi carrier(Non-Contiguous), 4TX, Top

QPSK



16QAM



64QAM



256QAM

