

TEST REPORT



CTK Co., Ltd.
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Report No.:
CTK-2017-00947
Page (1) / (124) Pages

1. Client

- Name : Samsung Electronics Co., Ltd.
- Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey
- Date of Receipt : 2017-05-10

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: RFD01P-13A

5. Date of Test : 2017-05-10 to 2017-05-30

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

2017-05-31

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



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REPORT REVISION HISTORY

Date	Revision	Page No
2017-05-31	Issued (CTK-2017-00947)	all

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1. General Information

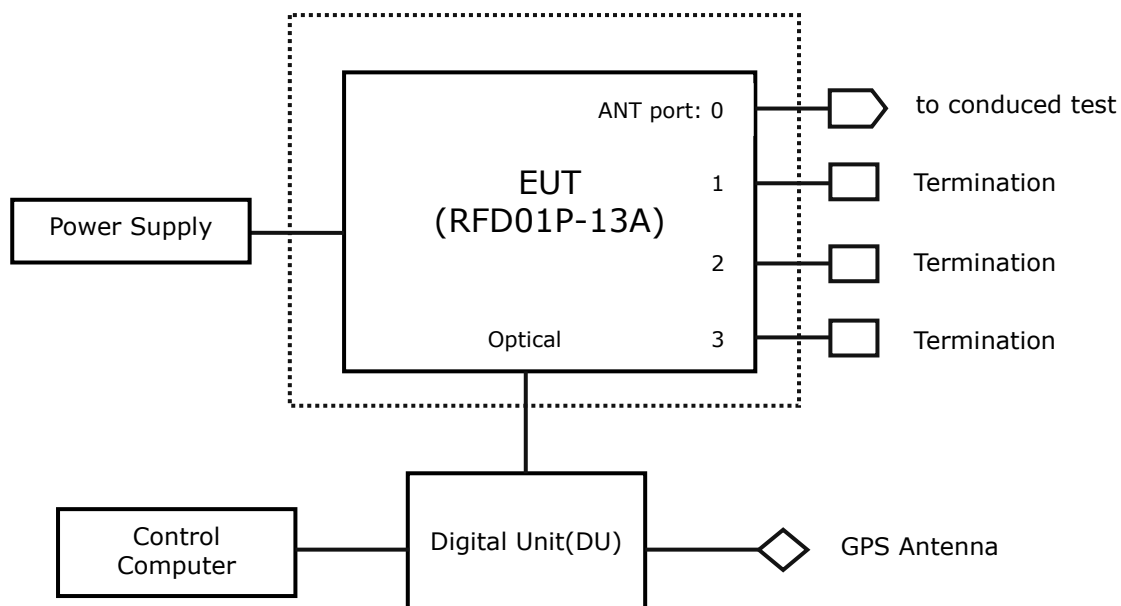
1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Contact Person	Name : JONG-KYU YOON E-mail : analog.yoon@samsung.com Tel : +81-31-279-3222 Fax : +82-31-279-0476

1.2 Product Information

FCC ID	A3LRFD01P-13A
Product Description	RRU (RFD01P) Base Station
Model name	RFD01P-13A
Power Supply	-48 Vdc
Operating Frequency	DL : 746 MHz- 756 MHz, UL 777 MHz - 787 MHz (Band 13)
RF Output Power	- 4T: 40 W / path (Total 160W) - 2T(path 0 & path 1): 60 W / path (Total 120 W)
Channel Bandwidth	10 MHz
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM
Antenna Specification	Manufacturer : COMMSCOPE Antenna type : Sector Peak Gain : 14.9 dBi
FCC Rule	Part 27 : MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

1.3 Configurations



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 27.

Section	Test Items	Results
§2.1046, §27.50(b)	Conducted Output Power	Compliant
§2.1049	Occupied Bandwidth	Compliant
§2.1051, §27.53(c)(f)	Spurious Emissions at Antenna Terminals	Compliant
§2.1051, §27.53(c)	Band edge	Compliant
§2.1053, §27.53(c)	Spurious Radiated Emissions	Compliant
§2.1055(a)(1), §27.54	Frequency Stability over Temperature variation	Compliant
§2.1055(d), §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.

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. Conducted 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.

§ 27.50 Power limits and duty cycle.

- (b) The following power and antenna height limits apply to transmitters operating in the 746-758 MHz, 775-788 MHz and 805-806 MHz bands:
 - (4) Fixed and base stations transmitting a signal in the 746-757 MHz and 776-787 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section.

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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)

Test Results :

Test Data at output Port 0(4T)

Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	46.23	41.98	46.28	42.46	46.29	42.56	46.18	41.50

Test Data at output Port 1(4T)

Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	46.11	40.83	46.13	41.02	45.95	39.36	45.33	34.12

Test Data at output Port 2(4T)

Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	45.96	39.45	45.83	38.28	45.87	38.64	45.43	34.91

Test Data at output Port 3(4T)

Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	45.81	38.11	45.73	37.41	45.86	38.55	45.98	39.63

Sum Data at output Port 0 and Port 1 and Port 2 and Port 3(4T)

Frequency (MHz)	Output Power			
	QPSK	16QAM	64QAM	256QAM
	(W)	(W)	(W)	(W)
751.00	160.37	159.17	159.11	150.16

Test Data at output Port 0(2T)

Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	47.72	59.16	47.74	59.43	47.83	60.67	47.53	56.62

Test Data at output Port 1(2T)

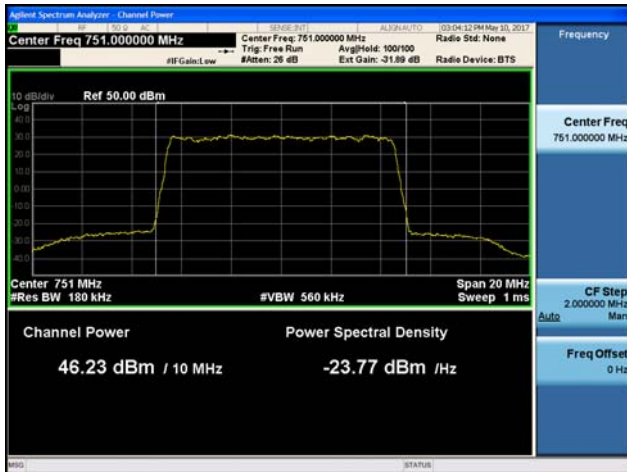
Frequency (MHz)	Output Power							
	QPSK		16QAM		64QAM		256QAM	
	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
751.00	47.68	58.61	47.84	60.81	47.87	61.24	47.67	58.48

Sum Data at output Port 0 and Port 1 (2T)

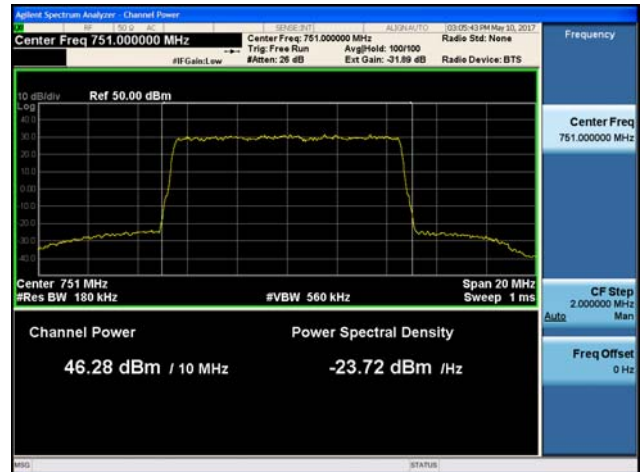
Frequency (MHz)	Output Power			
	QPSK	16QAM	64QAM	256QAM
	(W)	(W)	(W)	(W)
751.00	117.77	120.24	121.91	115.10

Test Plot at Output Port 0(4T)

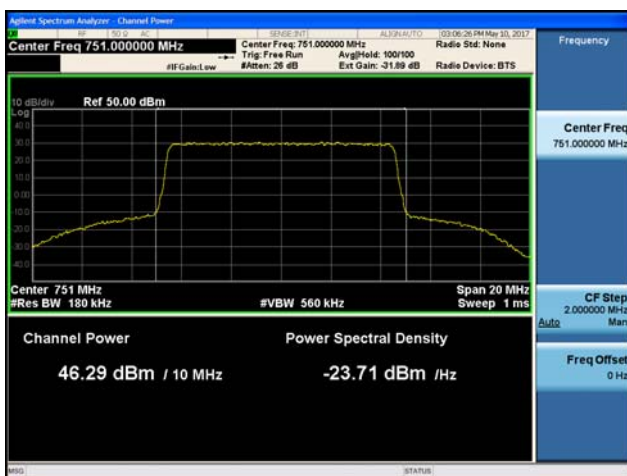
QPSK



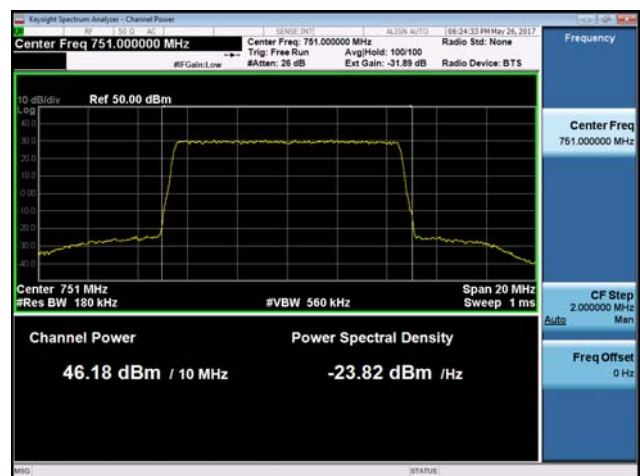
16QAM



64QAM

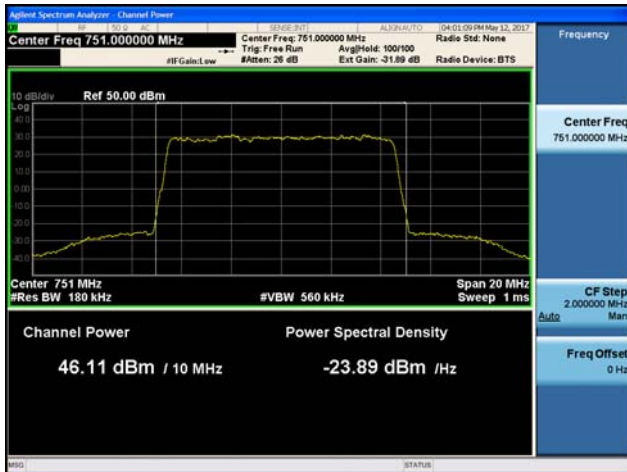


256QAM

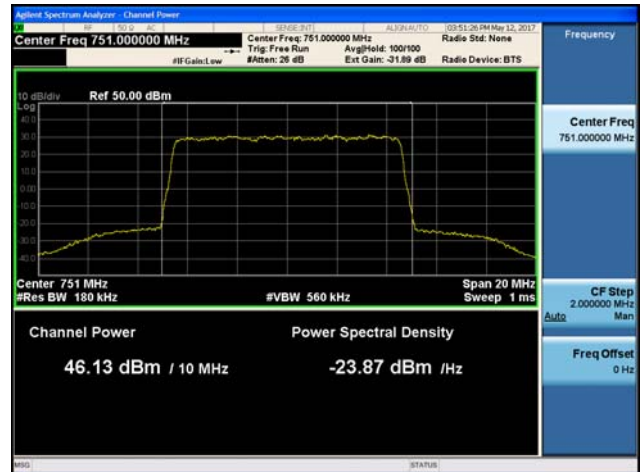


Test Plot at Output Port 1(4T)

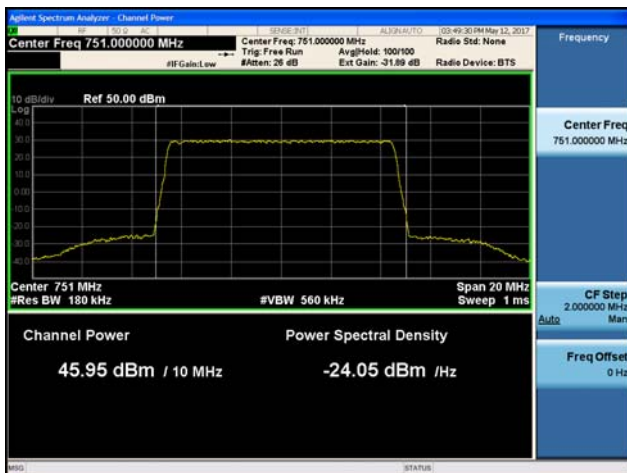
QPSK



16QAM



64QAM

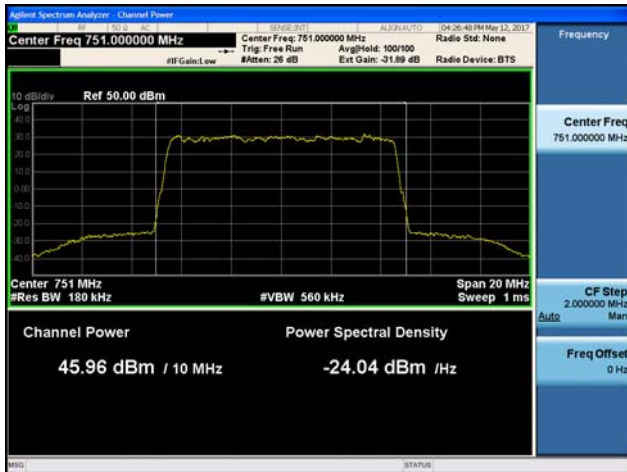


256QAM

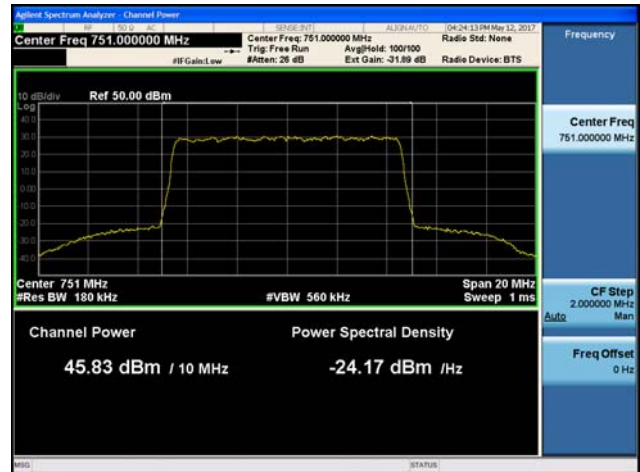


Test Plot at Output Port 2(4T)

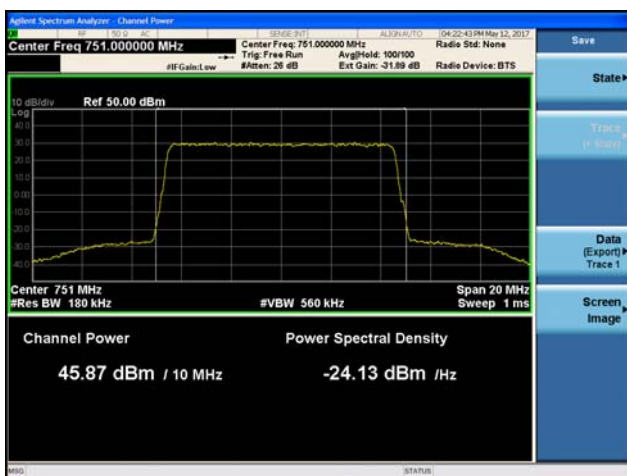
QPSK



16QAM



64QAM

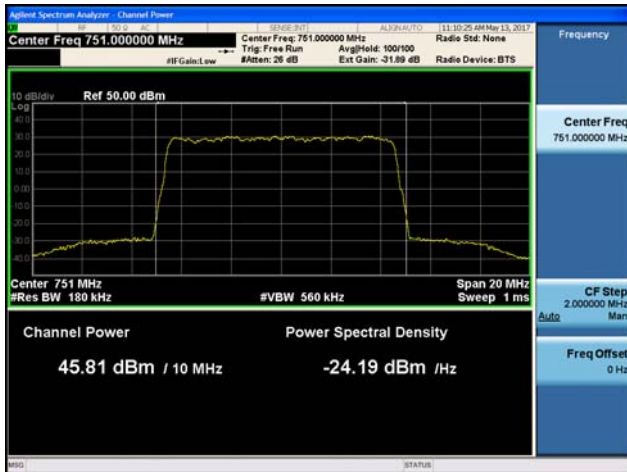


256QAM

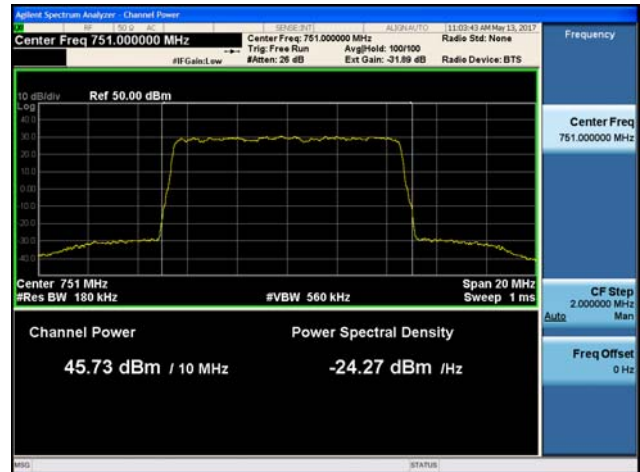


Test Plot at Output Port 3(4T)

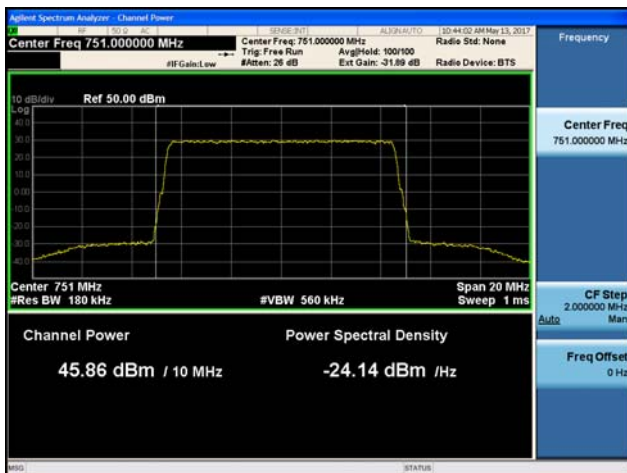
QPSK



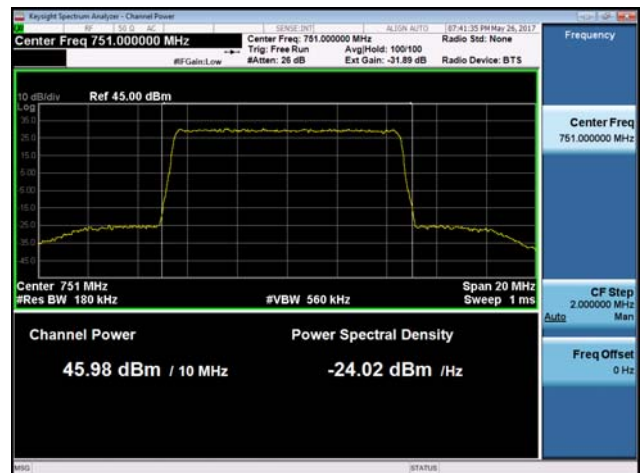
16QAM



64QAM

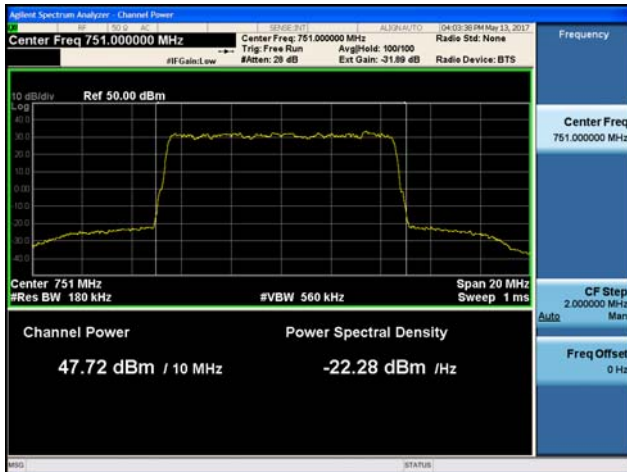


256QAM

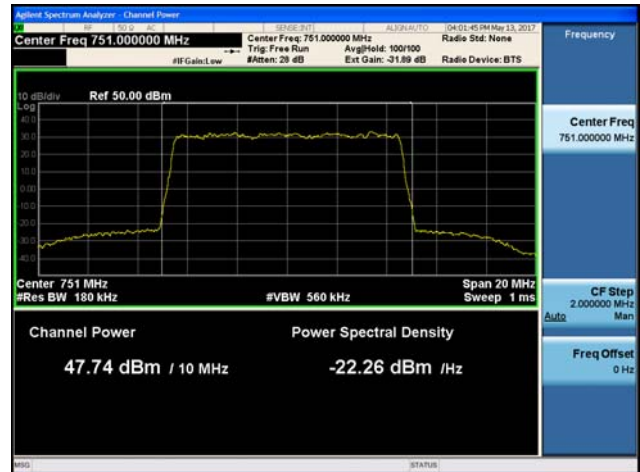


Test Plot at Output Port 0(2T)

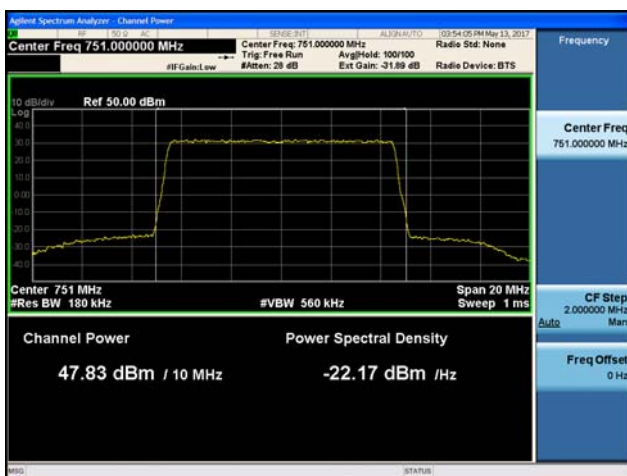
QPSK



16QAM



64QAM

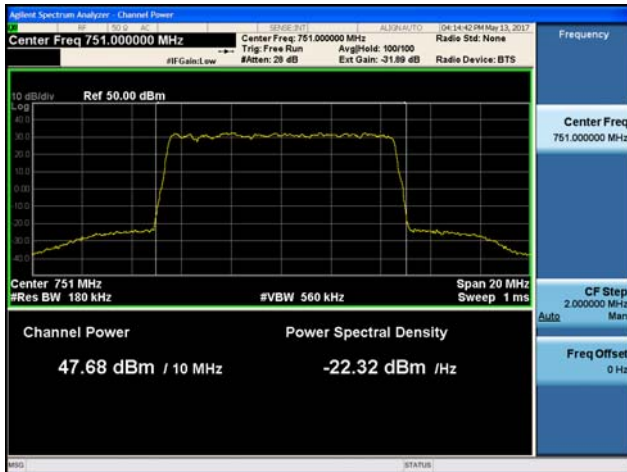


256QAM

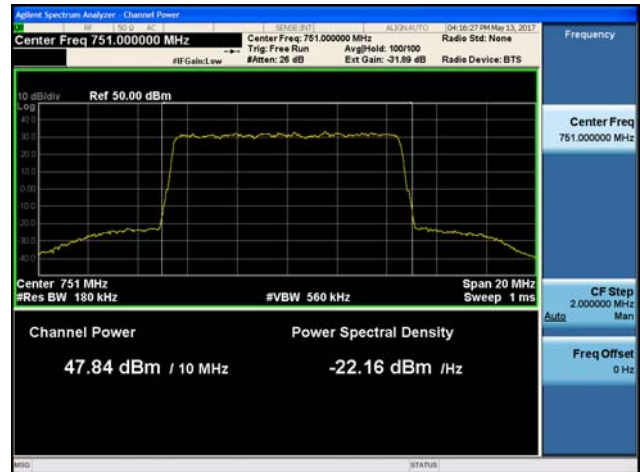


Test Plot at Output Port 1(2T)

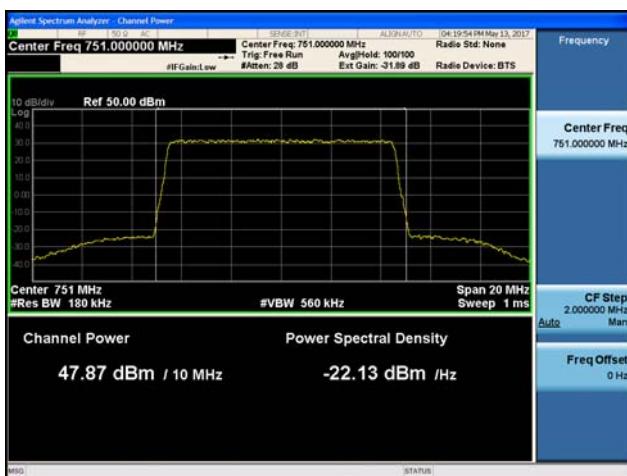
QPSK



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.

Test Results :

Test Data at output Port 0(4T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.94	8.96	8.97	8.97

Test Data at output Port 1(4T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.95	8.96	8.97	8.95

Test Data at output Port 2(4T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.94	8.96	8.97	8.98

Test Data at output Port 3(4T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.96	8.99	8.98	8.97

Test Data at output Port 0(2T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.95	8.95	8.97	8.97

Test Data at output Port 1(2T)

Frequency (MHz)	Occupied Bandwidth (MHz)			
	QPSK	16QAM	64QAM	256QAM
751.00	8.91	8.97	8.97	8.96

Test Plot at Output Port 0(4T)

QPSK



16QAM



64QAM



256QAM



Test Plot at Output Port 1(4T)

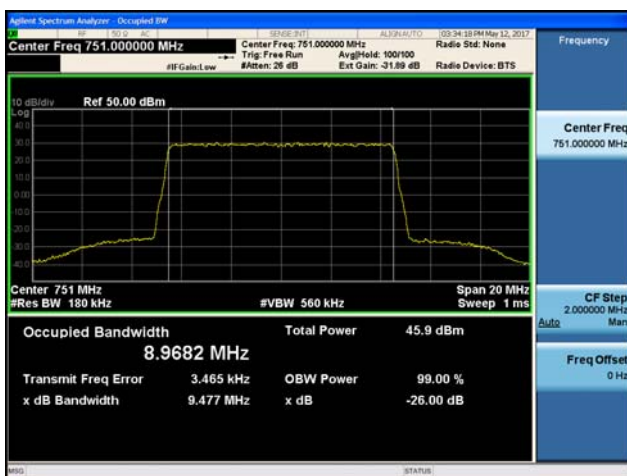
QPSK



16QAM



64QAM



256QAM



Test Plot at Output Port 2(4T)

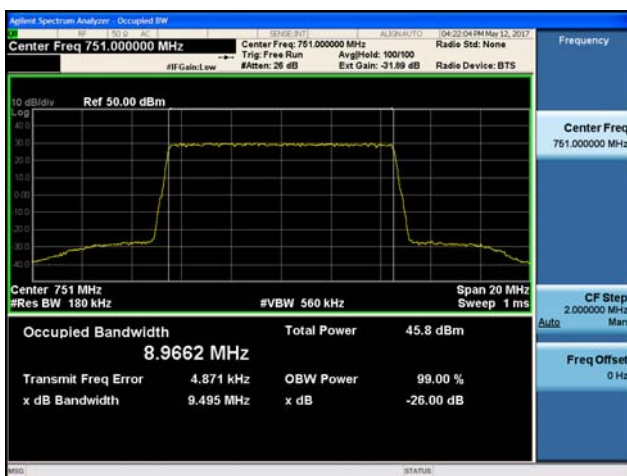
QPSK



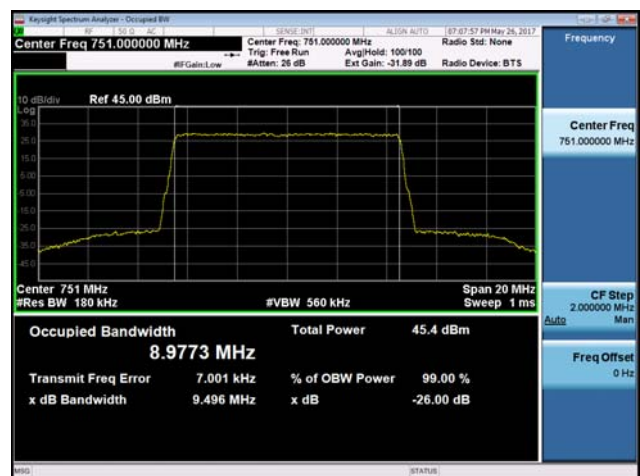
16QAM



64QAM



256QAM

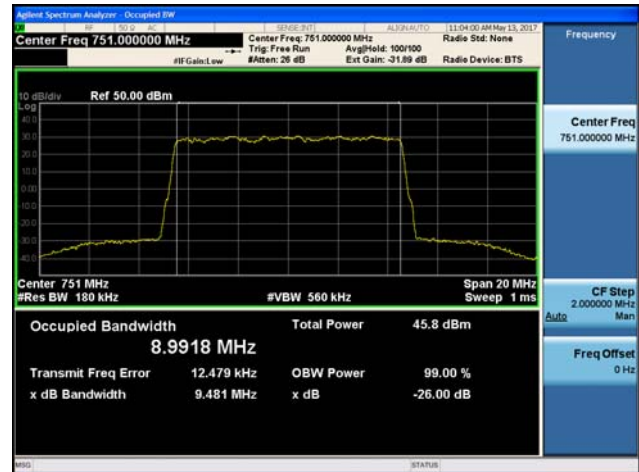


Test Plot at Output Port 3(4T)

QPSK



16QAM



64QAM



256QAM



Test Plot at Output Port 0(2T)

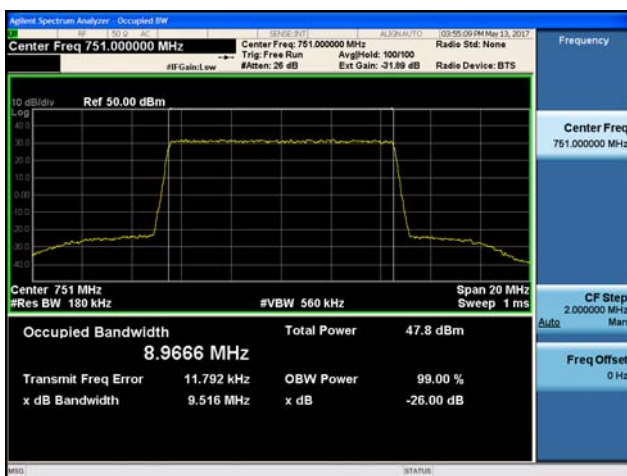
QPSK



16QAM



64QAM



256QAM



Test Plot at Output Port 1(2T)

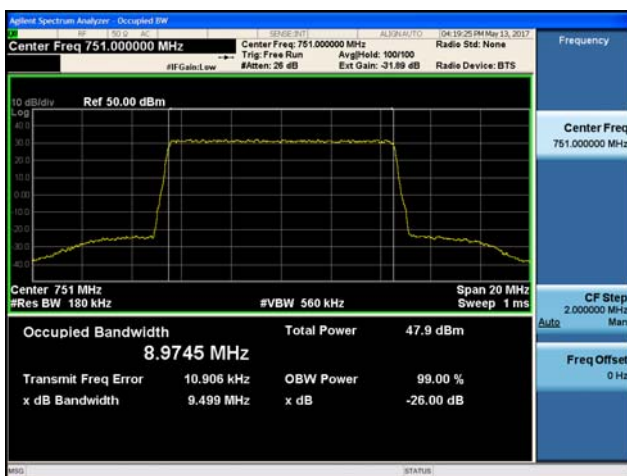
QPSK



16QAM



64QAM



256QAM

