

[256QAM]

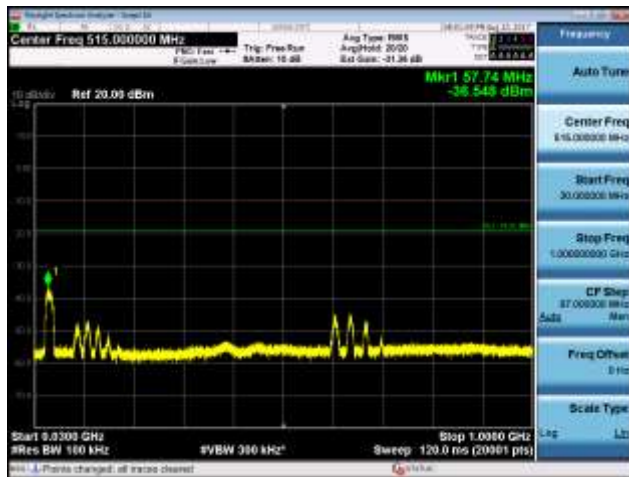
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 1000 MHz



1000 MHz - 2099 MHz



2099 MHz - 2109 MHz



2181 MHz - 2191 MHz



2191 MHz - 12.75 GHz



12.75 GHz - 26.5 GHz



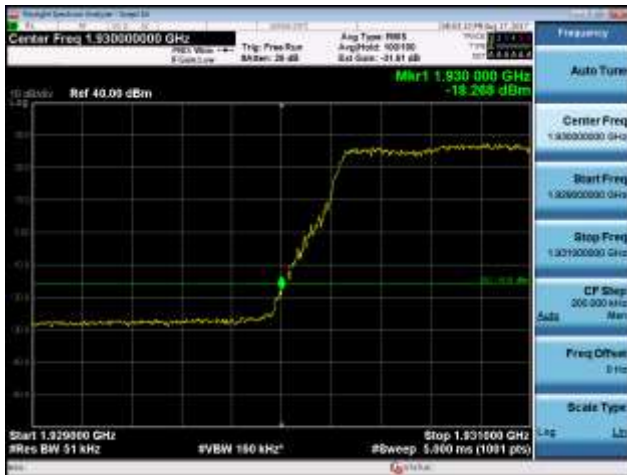
Test Plot at Band Edge

Band 2, BW 5MHz, Single carrier, 2TX

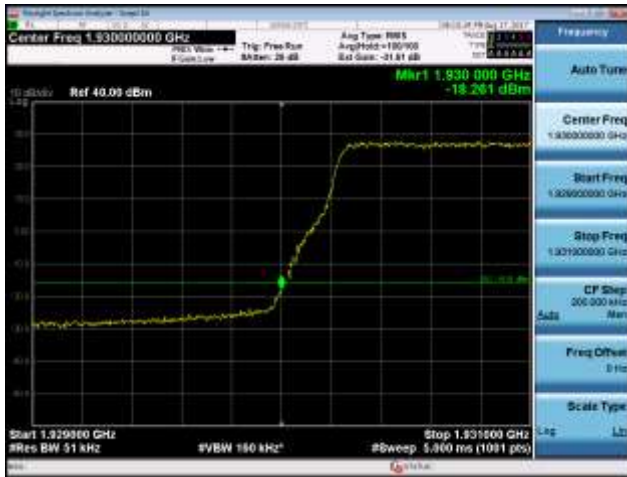
QPSK



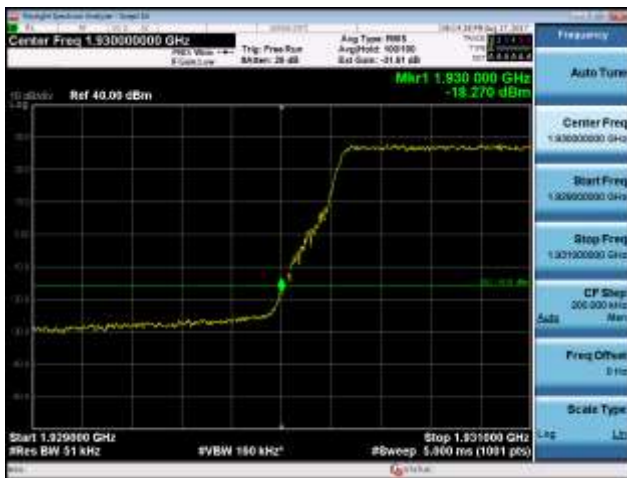
16QAM



64QAM



256QAM



Band 2, BW 5MHz, Single carrier, 4TX

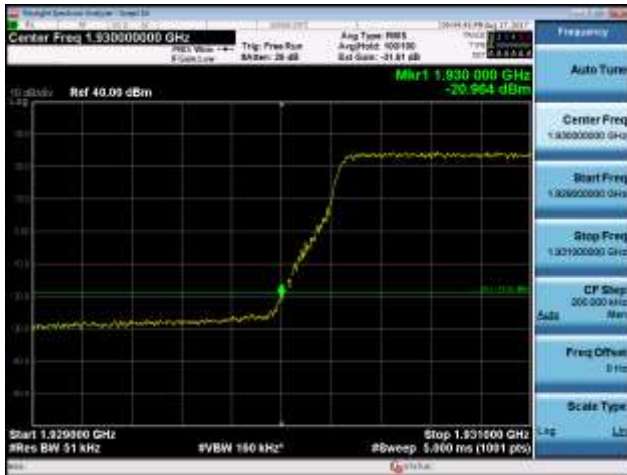
QPSK



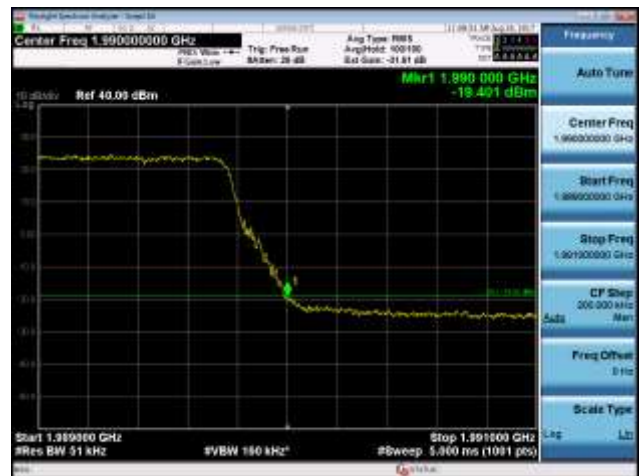
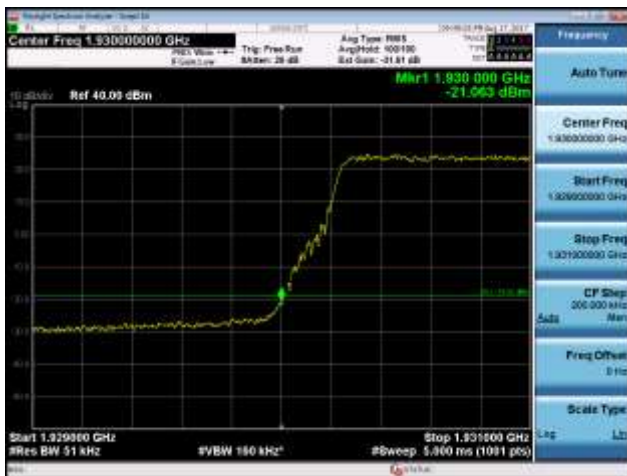
16QAM



64QAM

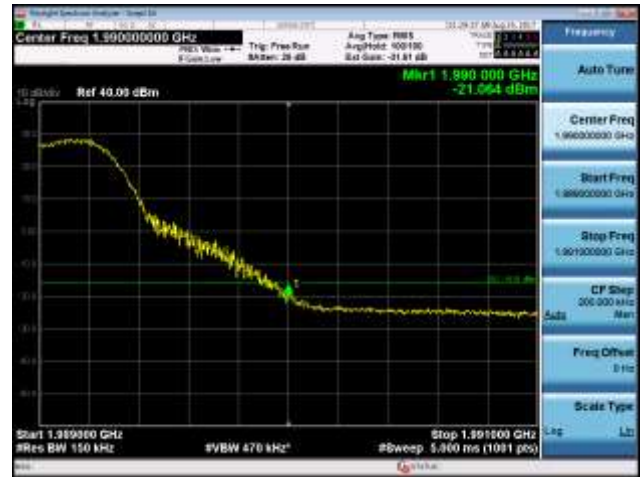


256QAM

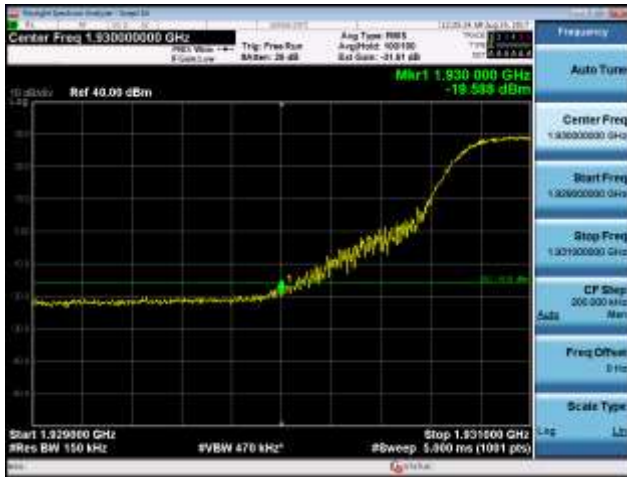


Band 2, BW 15MHz, Single carrier, 2TX

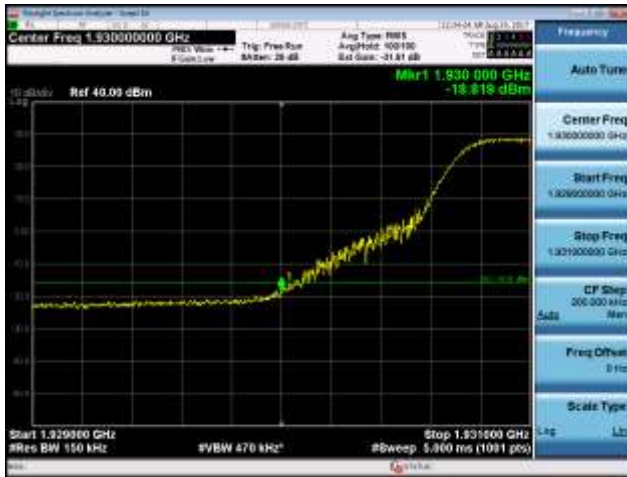
QPSK



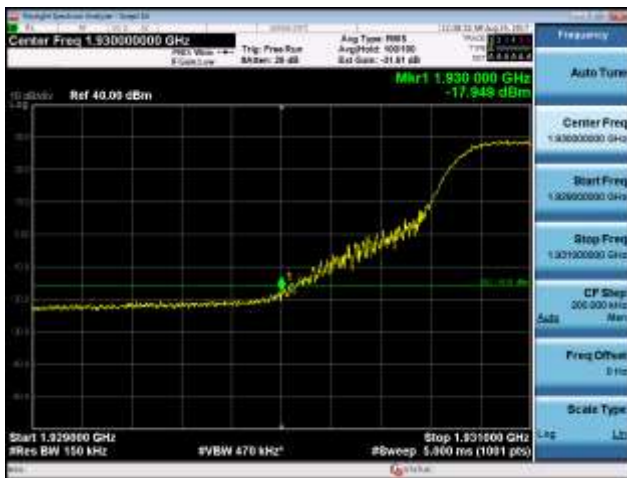
16QAM



64QAM

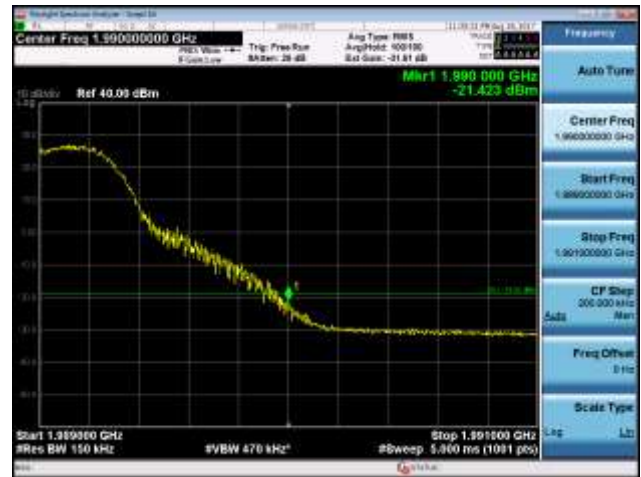
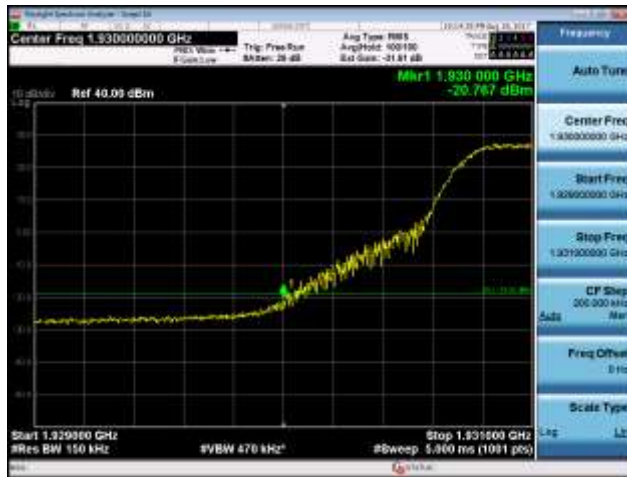


256QAM

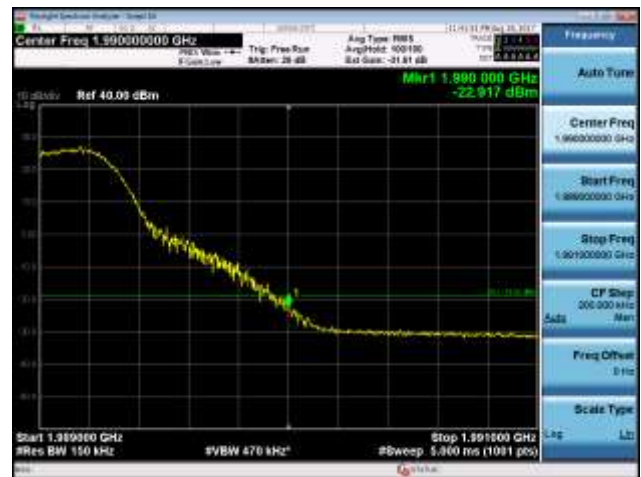
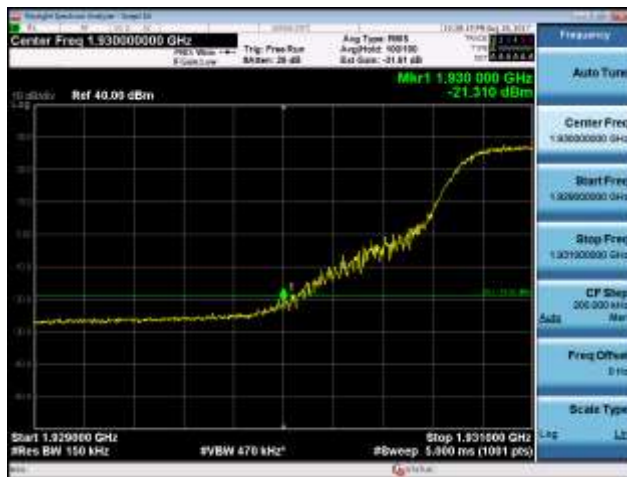


Band 2, BW 15MHz, Single carrier, 4TX

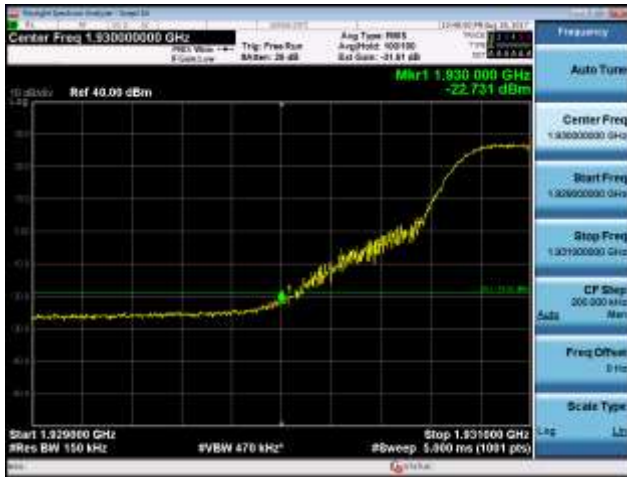
QPSK



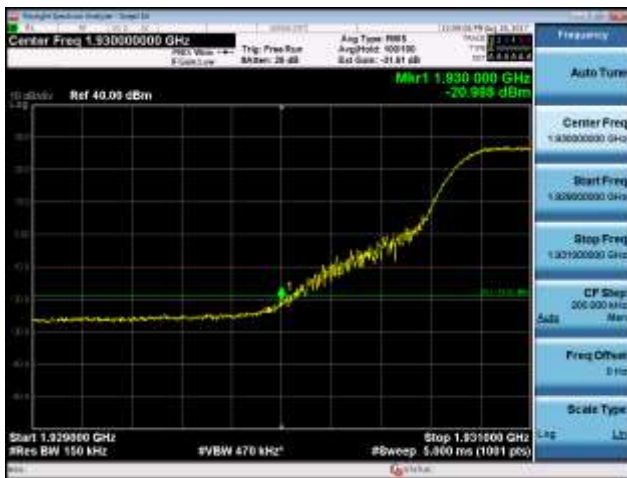
16QAM



64QAM



256QAM



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

QPSK



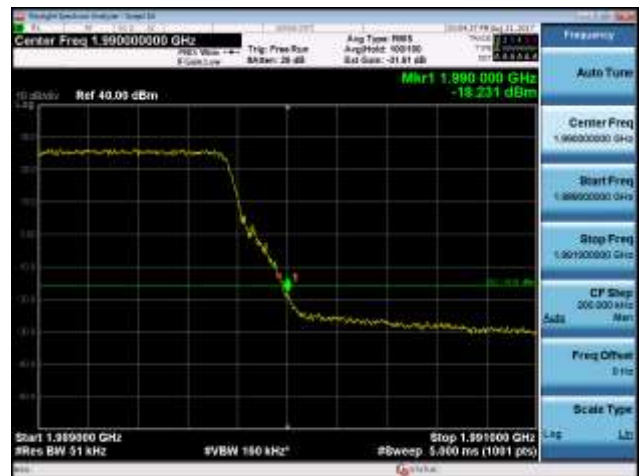
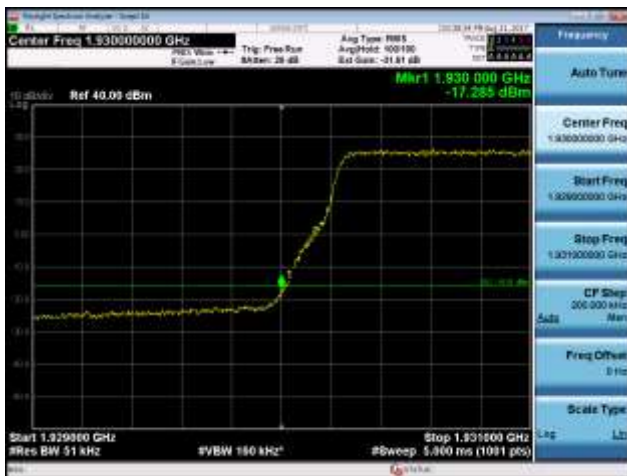
16QAM



64QAM



256QAM

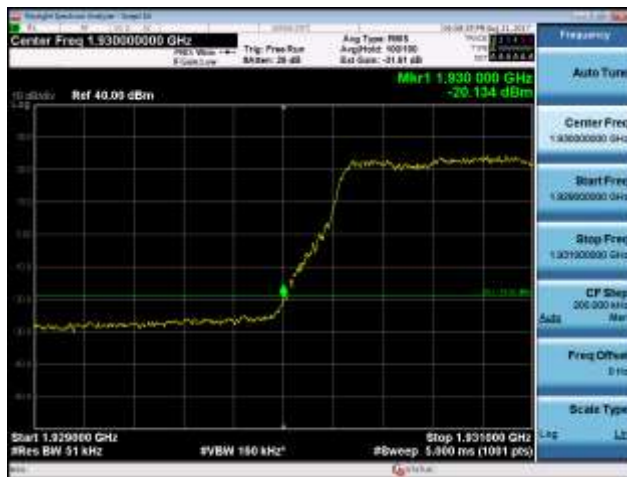


Band 2, BW 5MHz + BW 5MHz, Multi carrier(Contiguous), 4TX

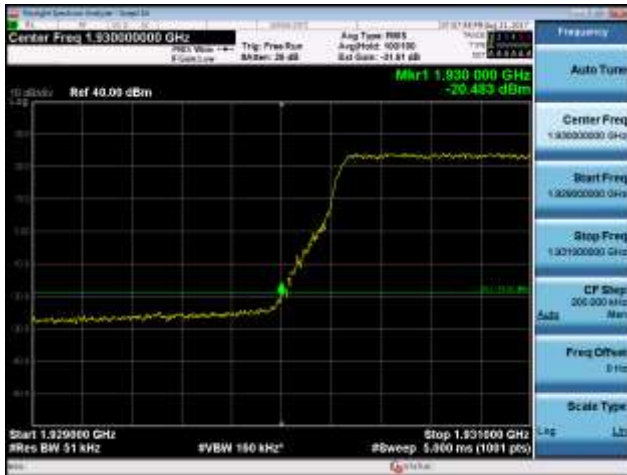
QPSK



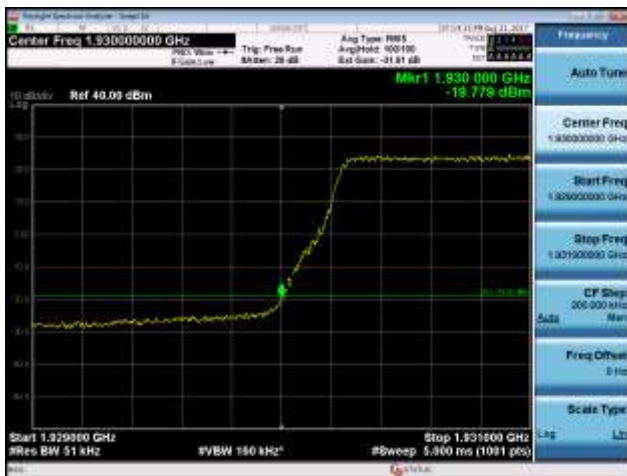
16QAM



64QAM

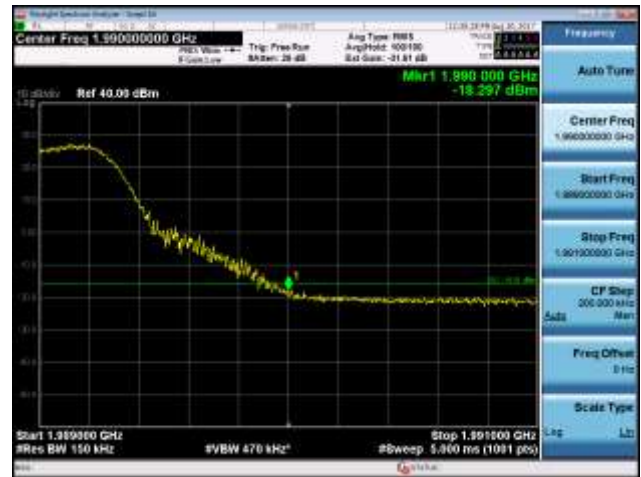


256QAM

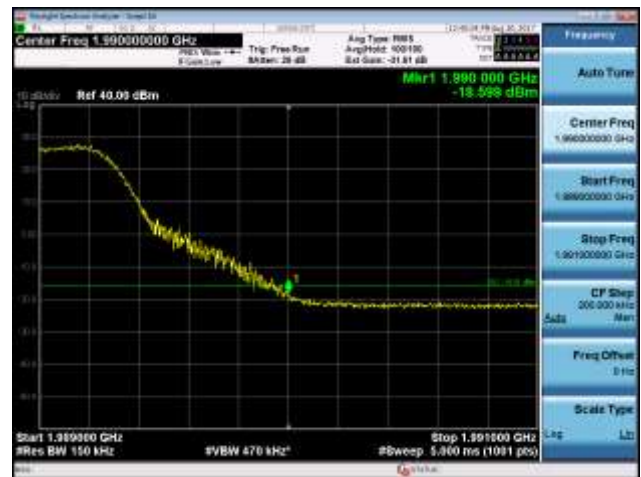
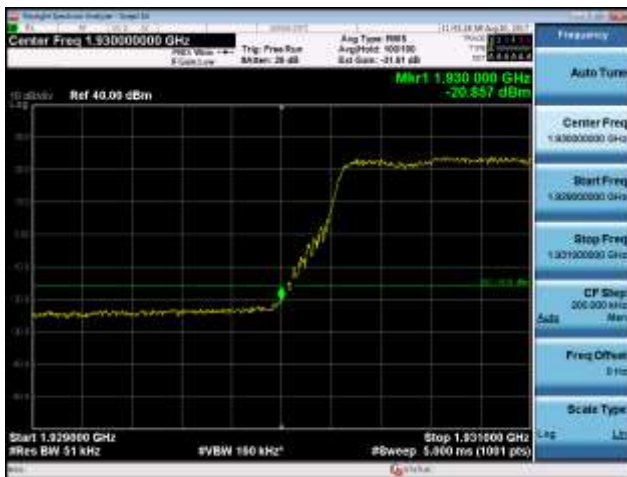


Band 2, BW 5MHz + BW 15MHz, Multi carrier(Contiguous), 2TX

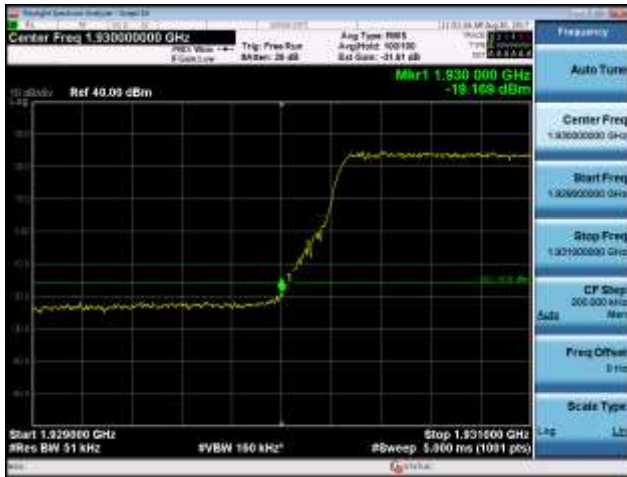
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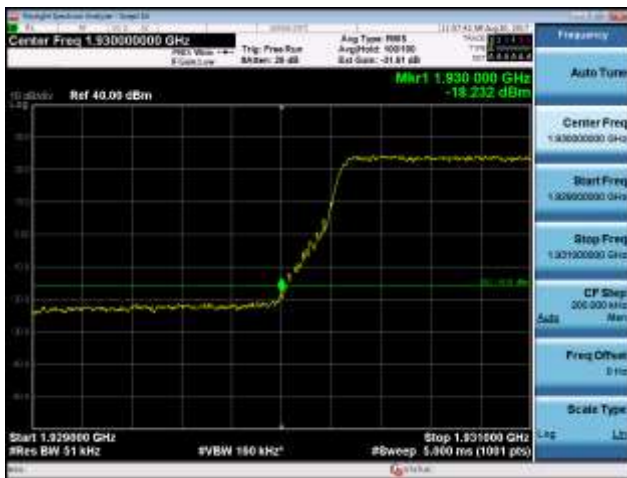
16QAM



64QAM



256QAM

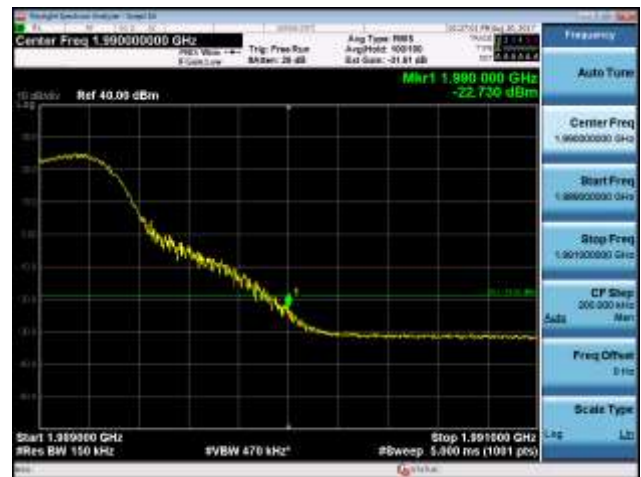


Band 2, BW 5MHz + BW 15MHz, Multi carrier(Contiguous), 4TX

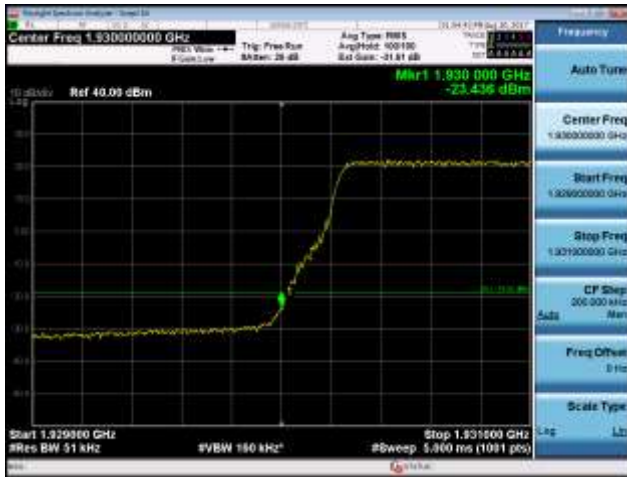
QPSK



16QAM



64QAM



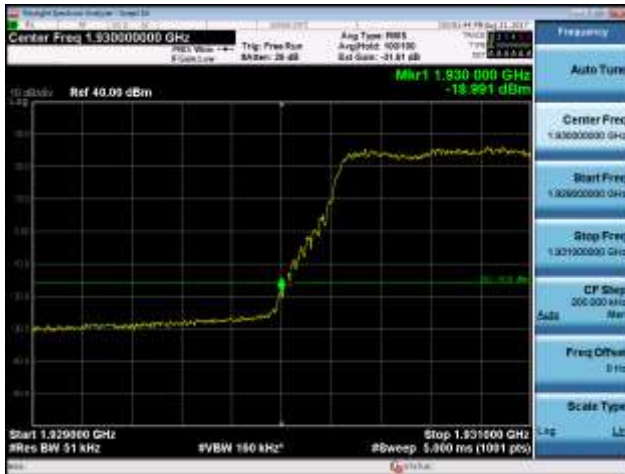
256QAM



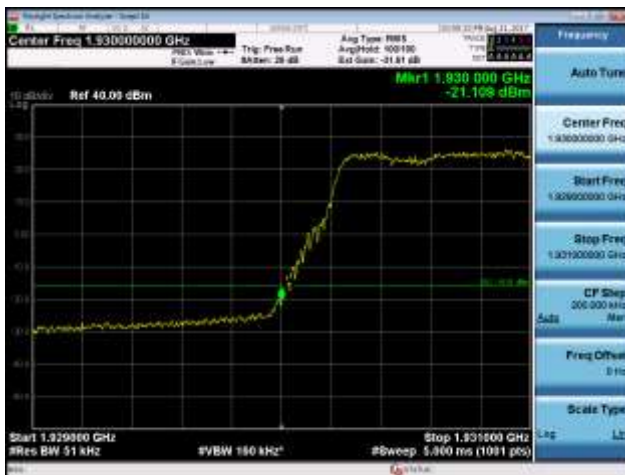
Band 2, BW 5MHz + BW 5MHz, Multi carrier(Non-contiguous), 2TX

QPSK

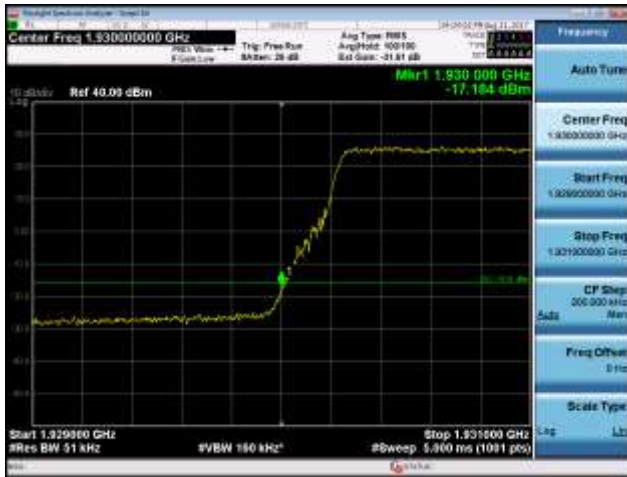
7



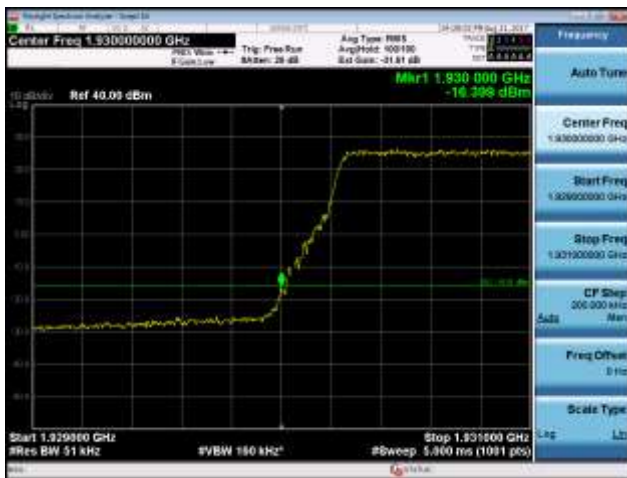
16QAM



64QAM



256QAM

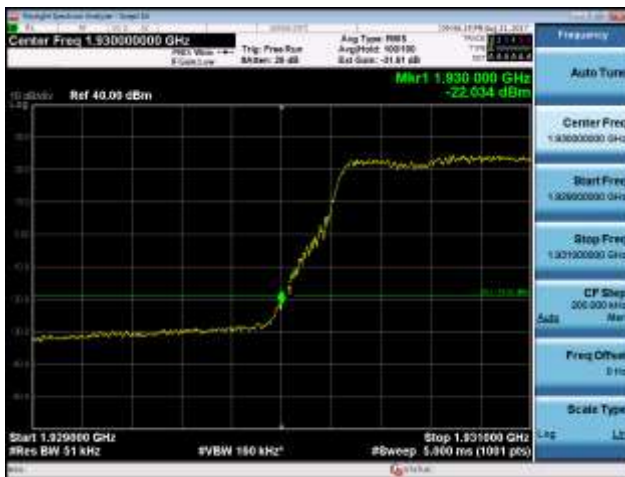


Band 2, BW 5MHz + BW 5MHz, Multi carrier(Non-contiguous), 4TX

QPSK



16QAM



64QAM

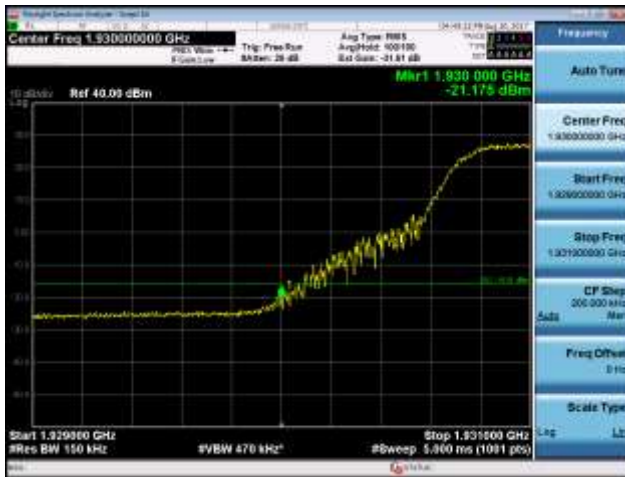


256QAM

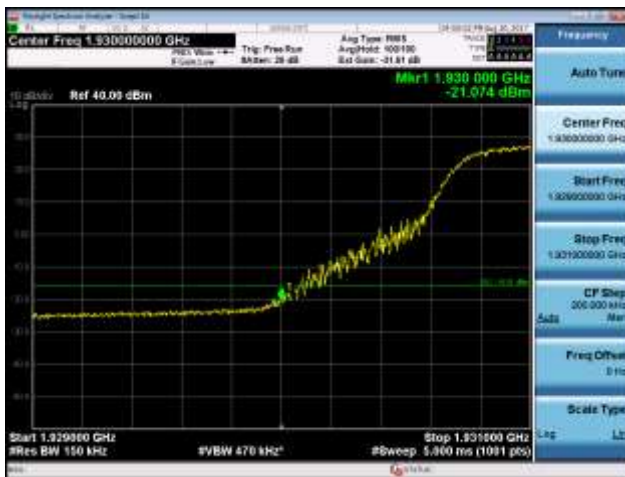


Band 2, BW 15MHz + BW 5MHz, Multi carrier(Non-contiguous), 2TX

QPSK



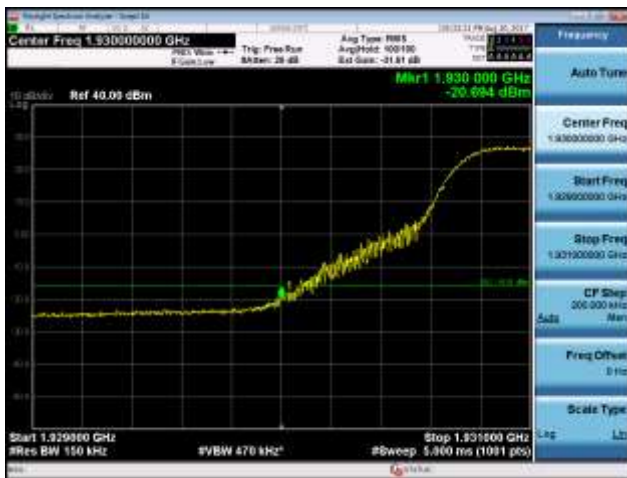
16QAM



64QAM



256QAM



Band 2, BW 15MHz + BW 5MHz, Multi carrier(Non-contiguous), 4TX

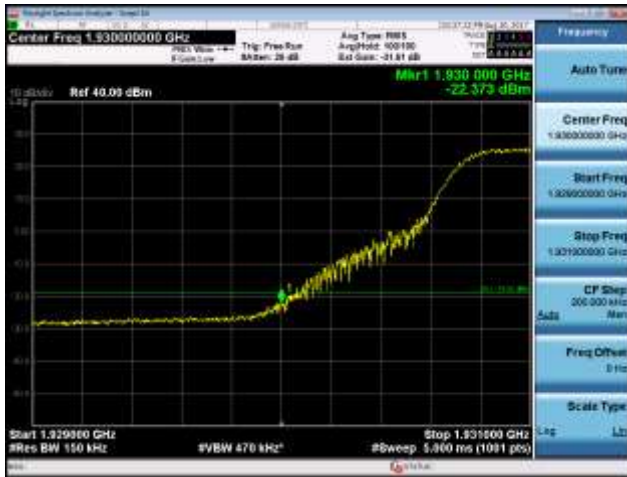
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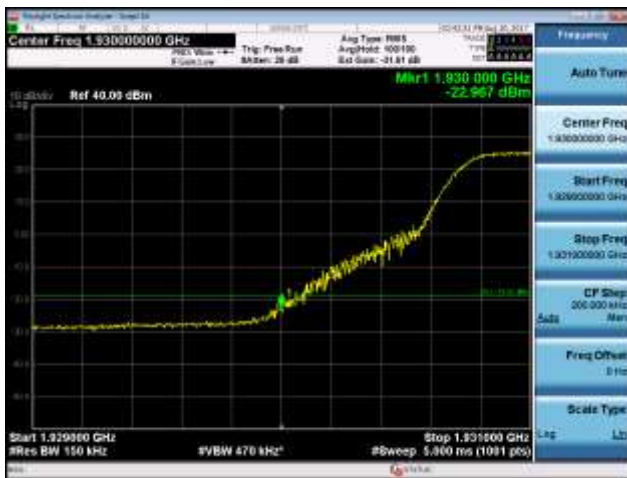
16QAM



64QAM



256QAM



Band 66, BW 5MHz, Single carrier, 2TX

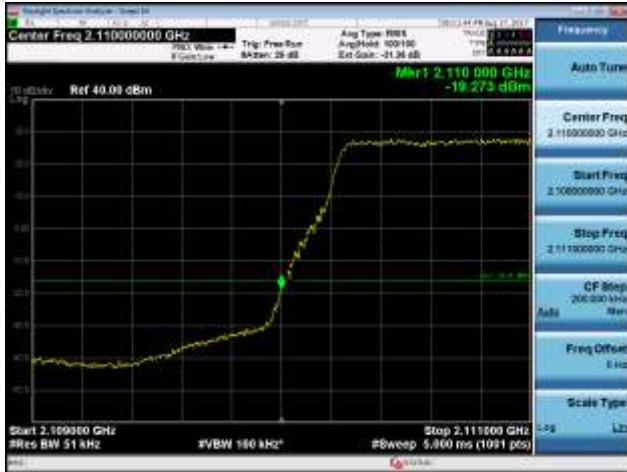
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16QAM



64QAM



256QAM

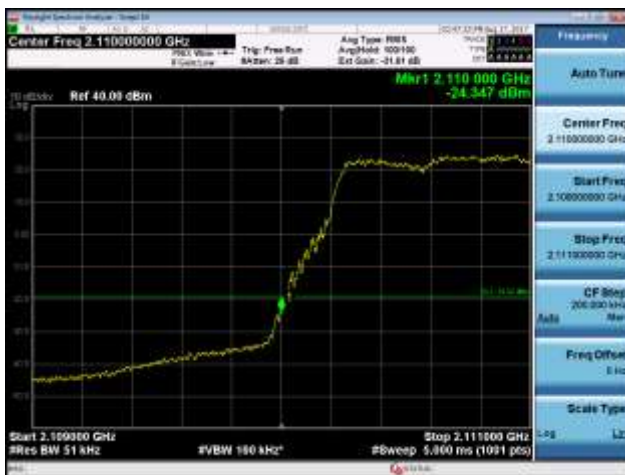


Band 66, BW 5MHz, Single carrier, 4TX

QPSK



16QAM



64QAM



256QAM

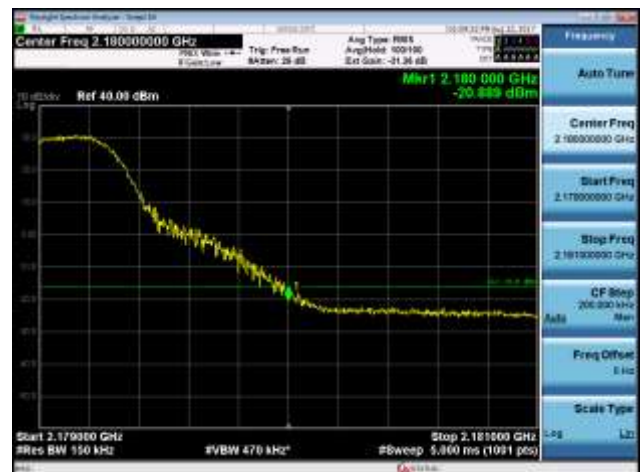
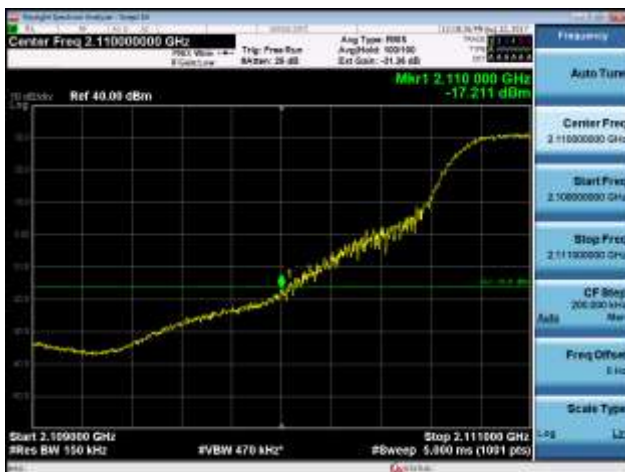


Band 66, BW 15MHz, Single carrier, 2TX

QPSK



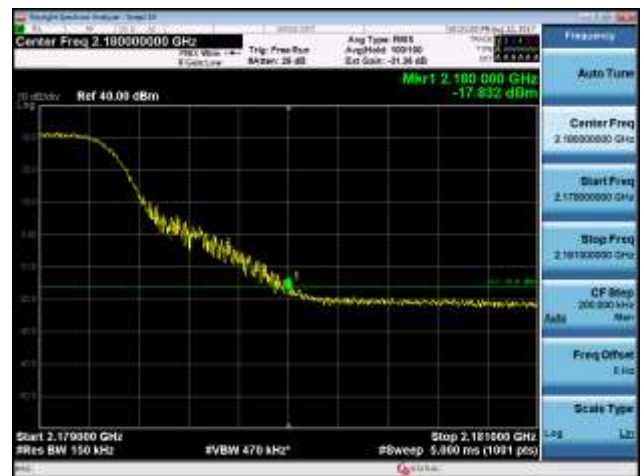
16QAM



64QAM



256QAM

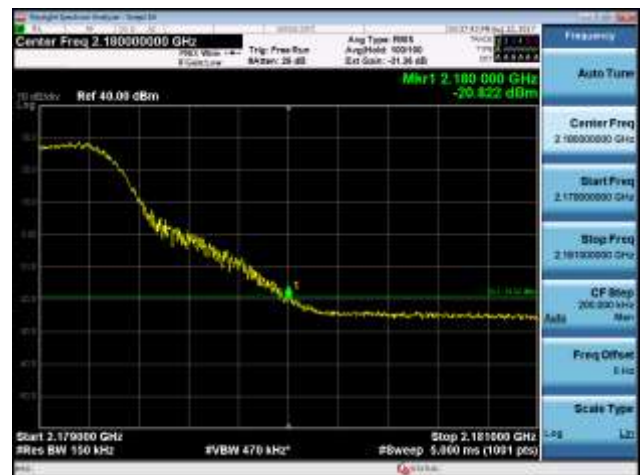


Band 66, BW 15MHz, Single carrier, 4TX

QPSK



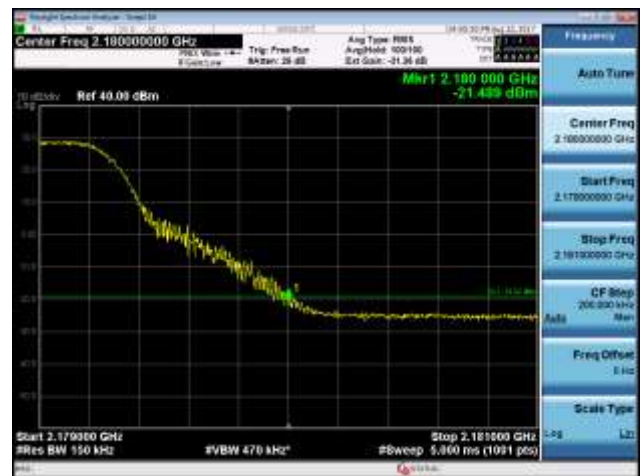
16QAM



64QAM



256QAM



Band 66, BW 5MHz + BW 5MHz, Multi carrier(Contiguous), 2TX

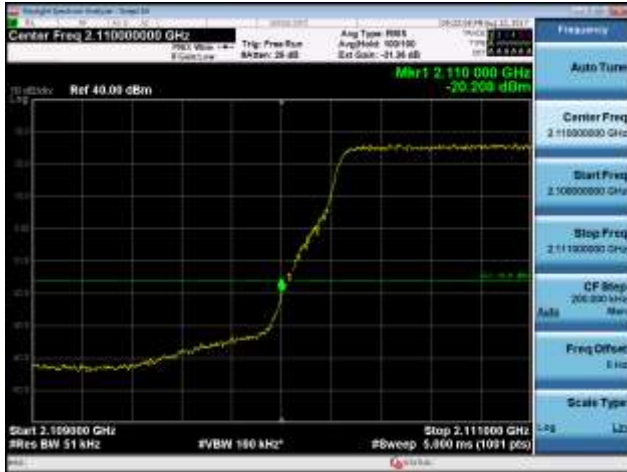
QPSK



16QAM



64QAM



256QAM



Band 66, BW 5MHz + BW 5MHz, Multi carrier(Contiguous), 4TX

QPSK



16QAM



64QAM



256QAM

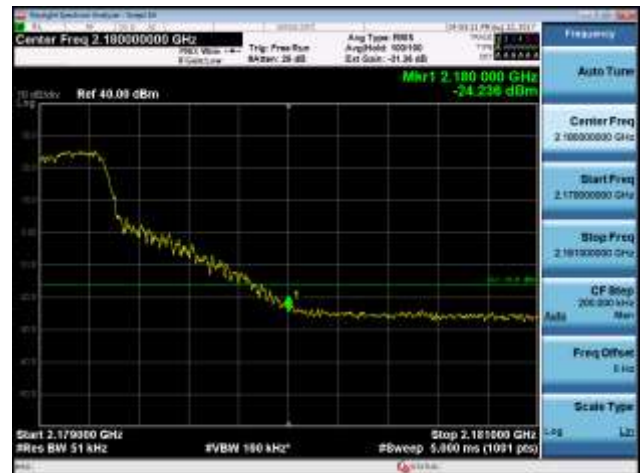
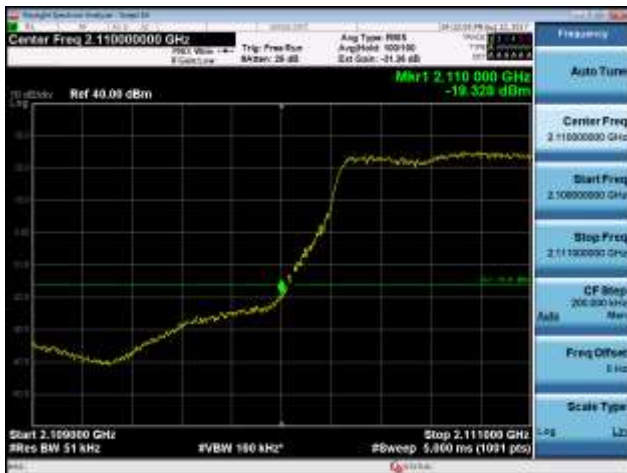


Band 66, BW 5MHz + BW 15MHz, Multi carrier(Contiguous), 2TX

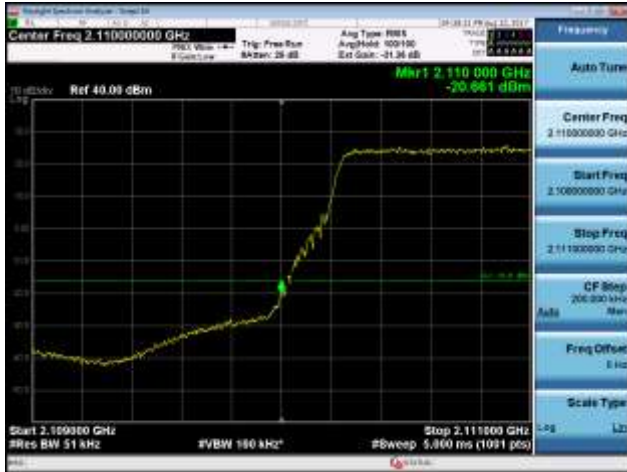
QPSK



16QAM



64QAM



256QAM

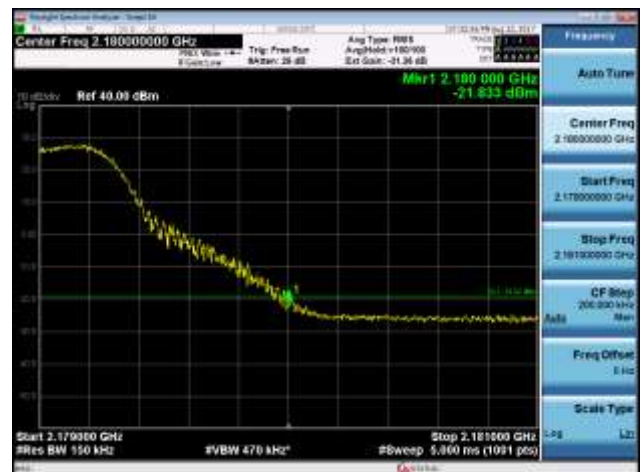
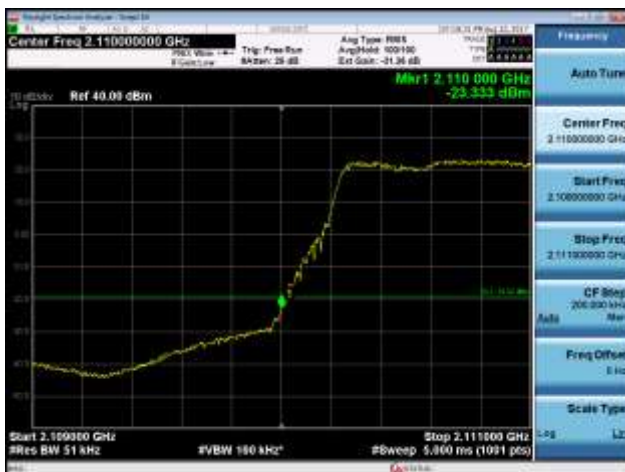


Band 66, BW 5MHz + BW 15MHz, Multi carrier(Contiguous), 4TX

QPSK



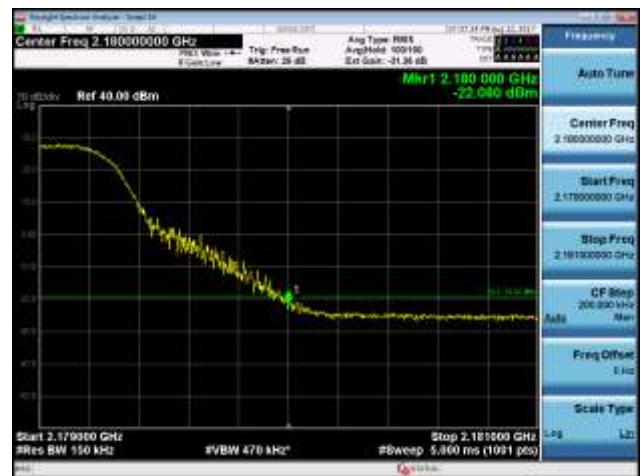
16QAM



64QAM



256QAM



Band 66, BW 5MHz + BW 5MHz, Multi carrier(Non-contiguous), 2TX

QPSK



16QAM



64QAM



256QAM

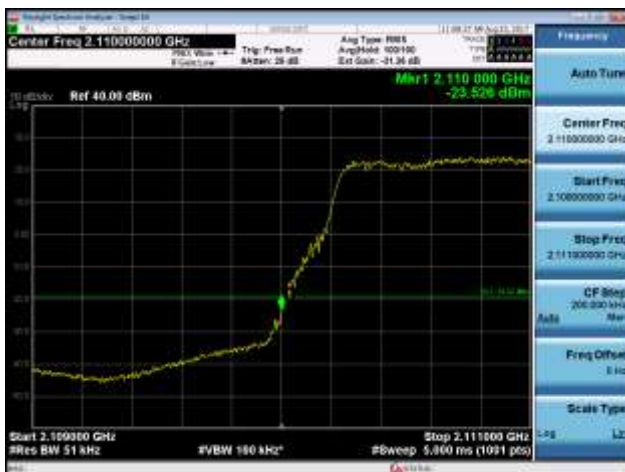


Band 66, BW 5MHz + BW 5MHz, Multi carrier(Non-contiguous), 4TX

QPSK



16QAM



64QAM

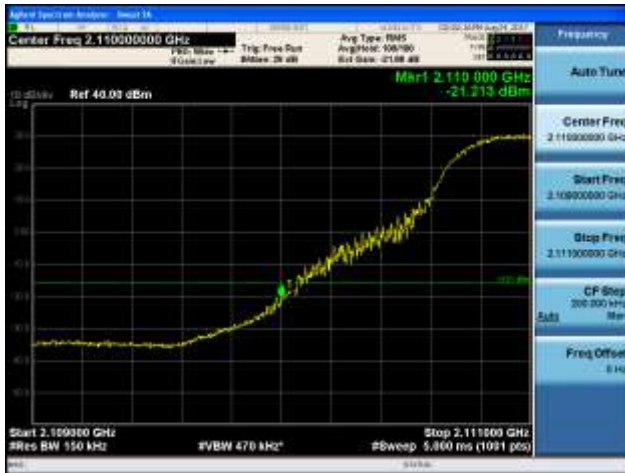


256QAM

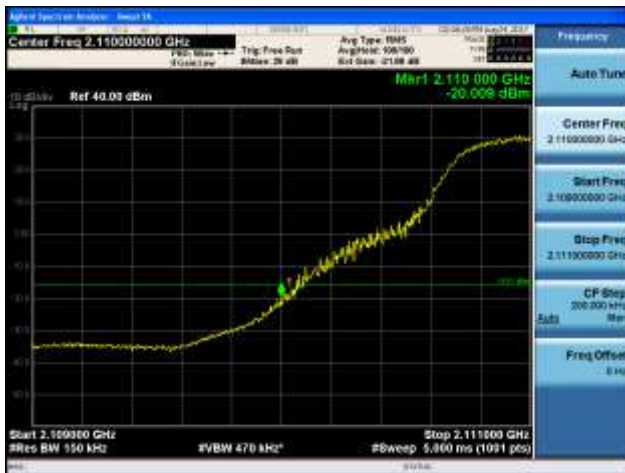


Band 66, BW 15MHz + BW 5MHz, Multi carrier(Non-contiguous), 2TX

QPSK



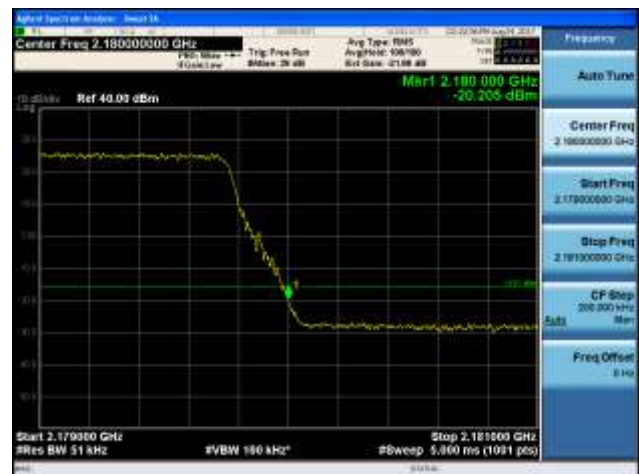
16QAM



64QAM



256QAM

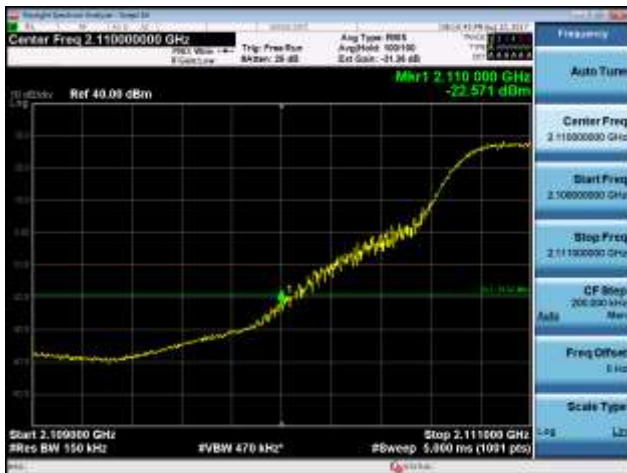


Band 66, BW 15MHz + BW 5MHz, Multi carrier(Non-contiguous), 4TX

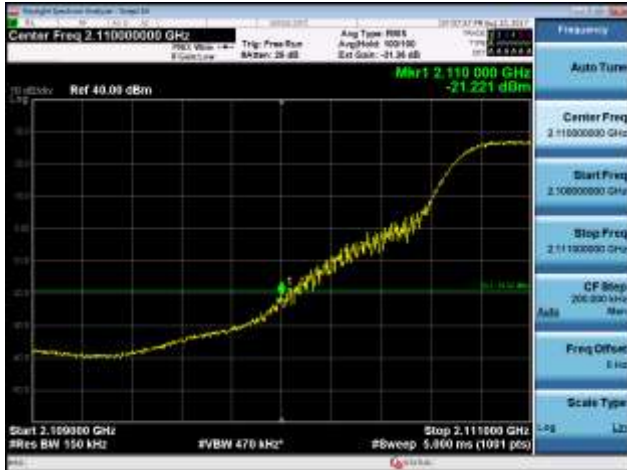
QPSK



16QAM



64QAM



256QAM



7. Radiated Spurious Emission

Test Requirements :

§ 2.1053 Measurements required : Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

§ 24.238 Emission limitations for Broadband PCS equipment

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

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

§ 27.53 Emission limits

(h) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB.

Test Procedures :

The EUT was placed on a non-conductive rotating platform 1 meters high in a fully anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna. The maximum emission was recorded from analyzer power level (LVL) from the 360 degrees rotation of the turntable.

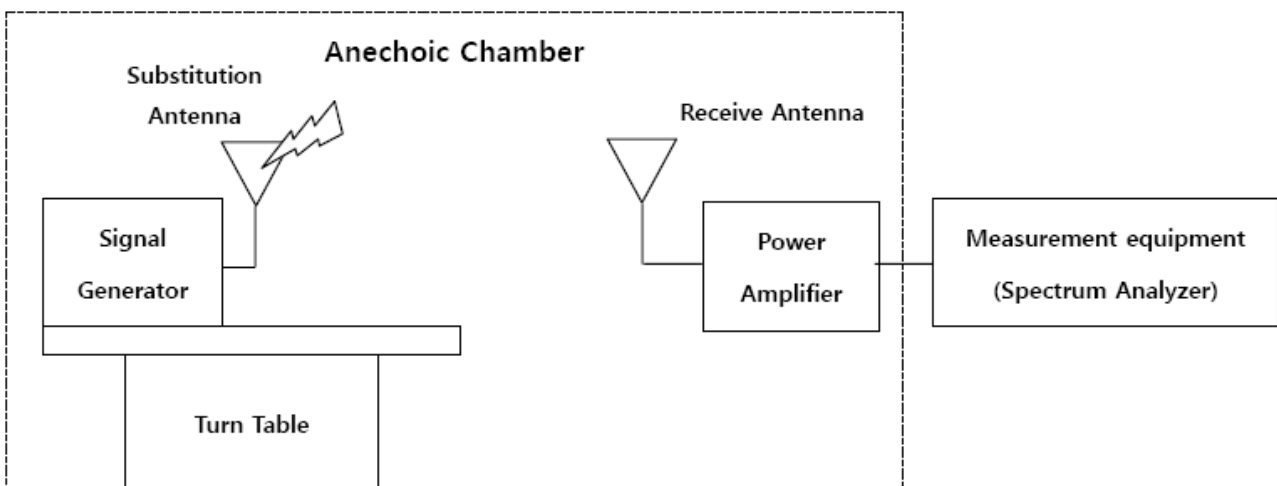
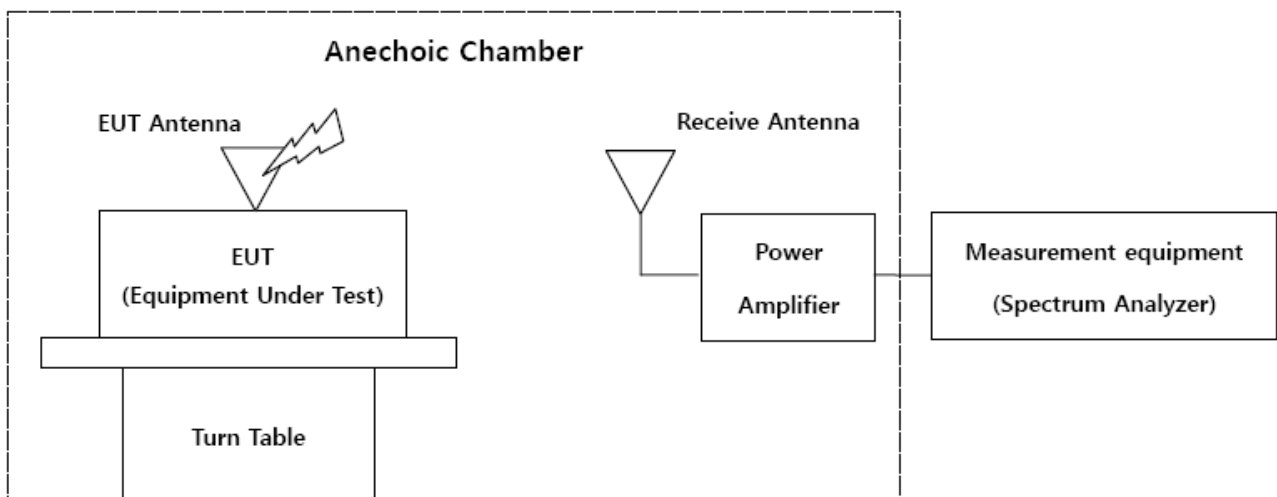
Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-C.

The EUT was replaced by substitution antenna at same location, and then a known power from S.G. was applied into the dipole antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna.

The space loss (in dB) = S.G. - Tx Cable loss + Substitution antenna gain - Analyzer reading.

The spectrum was searched from 30 MHz to 10th harmonic.

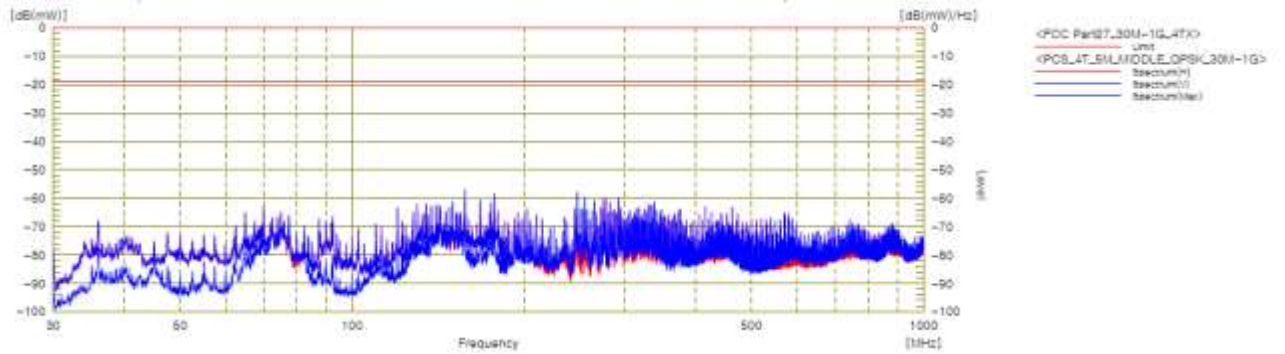
Test Setup :



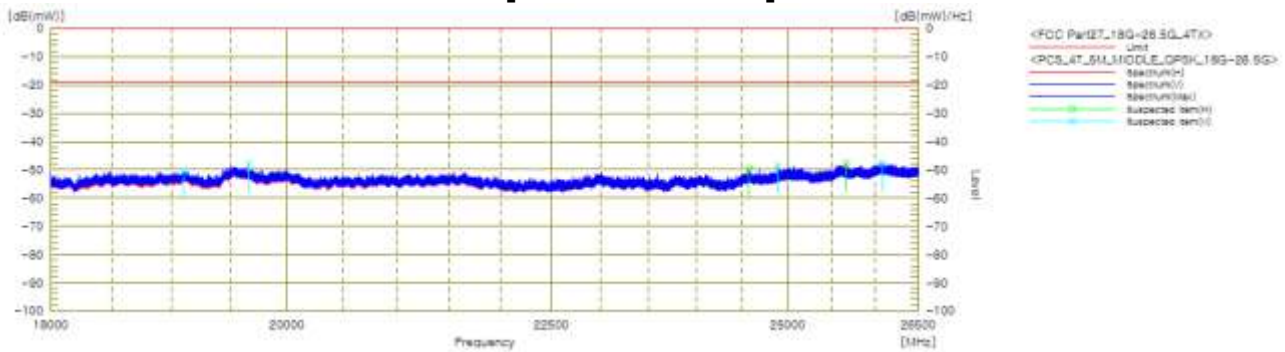
Test Results :

- * We have done all test case. Test data was only the worst case.
- * In all test cases, the measurement results in the following measurement bands are similar.
(30 MHz - 1 GHz, 18 GHz - 26.5 GHz)

[30 MHz - 1 GHz]

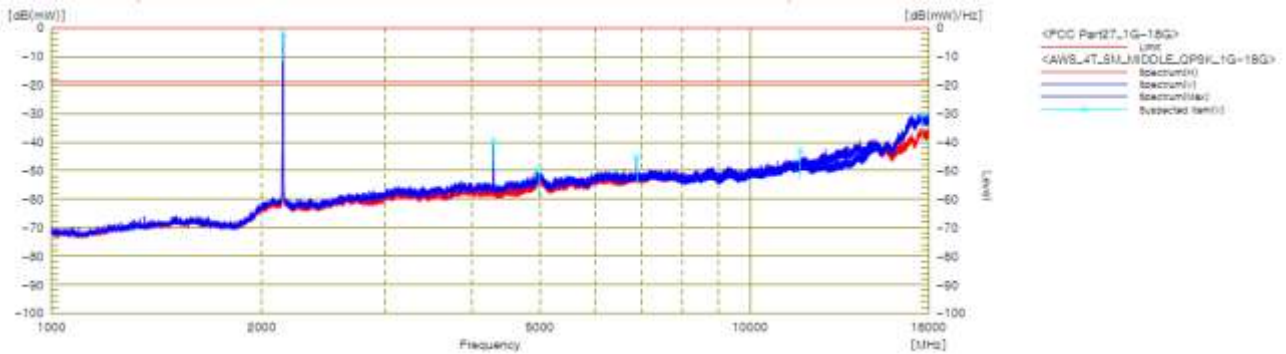


[18 GHz - 26.5 GHz]

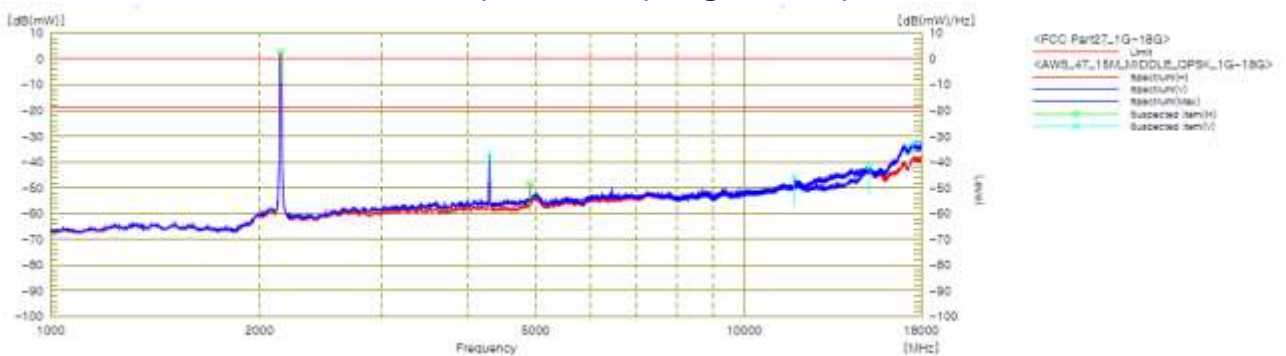


[1GHz - 18 GHz]

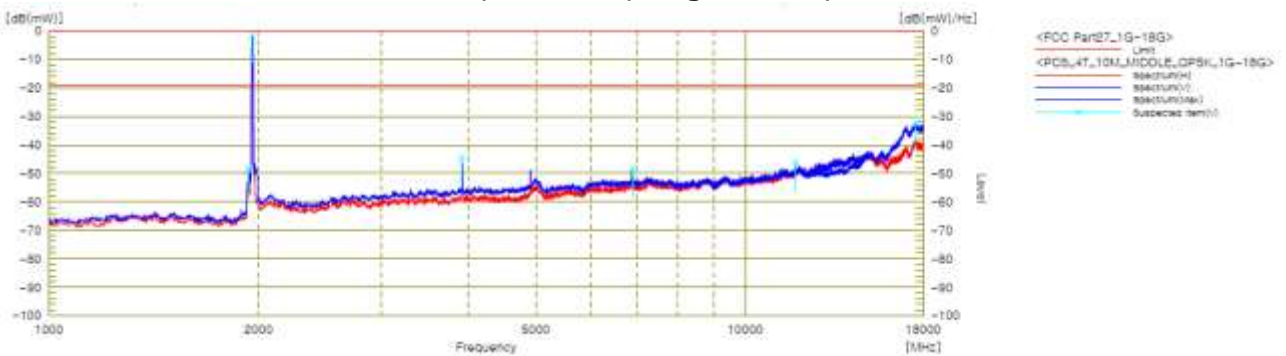
Band 66, BW 5MHz, Single carrier, 4TX



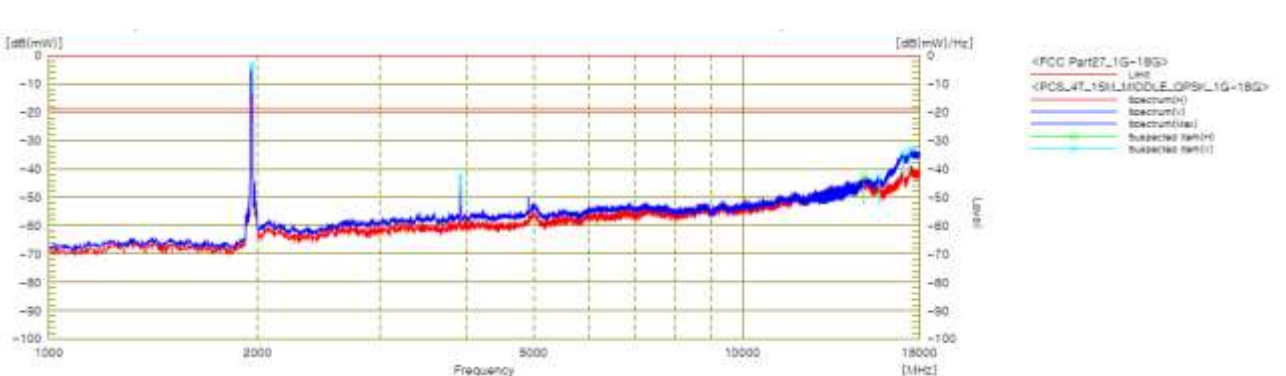
Band 66, BW 15MHz, Single carrier, 4TX



Band 2, BW 5MHz, Single carrier, 4TX



Band 2, BW 15MHz, Single carrier, 4TX



 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 Page (605) / (608) Pages	
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8. Frequency Stability

Test Requirements :

§ 2.1055 Measurements required : Frequency stability.

- (a) The frequency stability shall be measured with variation of ambient temperature as follows:
- (1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
 - (2) From -20° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
 - (3) From 0° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.
- (b) The frequency stability shall be measured with variation of primary supply voltage as follows:
- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

§ 27.54 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Test Procedures :

- (a) Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- (b) The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- (c) The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the $\pm 0.5^{\circ}\text{C}$ during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Test Results :

**Test Data at output Antenna Port 3
Band 66, BW 5MHz, Single carrier, 4TX**

Voltage (%)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100	+20	-899.28	-0.41924
	-30	-899.24	-0.41923
	-20	-899.14	-0.41918
	-10	-899.34	-0.41927
	0	-899.37	-0.41929
	+10	-899.47	-0.41933
	+30	-898.27	-0.41877
	+40	-899.11	-0.41917
	+50	-898.43	-0.41885
115	+20	-899.24	-0.41923
85	+20	-899.21	-0.41921

Band 66, BW 15MHz, Single carrier, 4TX

Voltage (%)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100	+20	-899.69	-0.41944
	-30	-899.08	-0.41915
	-20	-899.65	-0.41942
	-10	-899.15	-0.41918
	0	-899.26	-0.41924
	+10	-899.41	-0.41931
	+30	-900.65	-0.41988
	+40	-900.14	-0.41965
	+50	-901.49	-0.42028
115	+20	-899.71	-0.41945
85	+20	-899.63	-0.41941

Test Data at output Antenna Port 7
Band 2, BW 5MHz, Single carrier, 4TX

Voltage (%)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100	+20	-820.79	-0.38265
	-30	-820.85	-0.38268
	-20	-820.31	-0.38243
	-10	-820.64	-0.38258
	0	-821.44	-0.38296
	+10	-820.47	-0.38250
	+30	-822.36	-0.38338
	+40	-822.56	-0.38348
	+50	-823.17	-0.38376
115	+20	-820.44	-0.38249
85	+20	-820.69	-0.38261

Band 2, BW 15MHz, Single carrier, 4TX

Voltage (%)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)
100	+20	-822.09	-0.38326
	-30	-822.56	-0.38348
	-20	-822.63	-0.38351
	-10	-822.14	-0.38328
	0	-822.75	-0.38357
	+10	-822.17	-0.38330
	+30	-822.09	-0.38326
	+40	-821.98	-0.38321
	+50	-821.78	-0.38311
115	+20	-822.13	-0.38328
85	+20	-822.41	-0.38341

Note:

The results of the frequency stability test shown above the frequency deviation measured values are very small and similar trend for each port, so attached data was only the port 3, 7.

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY50510324	2018-02-03
2	EMI Test Receiver	R&S	ESCI7	100814	2017-11-01
3	MXA Signal Analyzer	Agilent	N9020A	MY48011598	2017-11-01
4	Bilog Antenna	Schaffner	CBL6111C	2551	2018-05-13
5	Biconical Antenna	SCHWARZBECK	VUBA 9117	9117-280	2018-11-11
6	6dB Attenuator	R&S	DNF	272.4110.50-1	2018-02-03
7	AMPLIFIER	SONOMA	310	291721	2018-02-02
8	Horn Antenna	ETS-Lindgren	3115	00078894	2017-09-02
9	Horn Antenna	ETS-Lindgren	3115	00078895	2019-04-25
10	Signal Generator	R&S	SMB100A	175528	2017-11-01
11	PREAMPLIFIER	Agilent	8449B	3008A02011	2017-12-01
12	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026689	2018-04-13
13	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026694	2018-03-07
14	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026760	2018-03-07
15	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026687	2018-03-07
16	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026743	2018-03-07
17	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026742	2018-03-07
18	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0026683	2018-03-07
19	Fixed Attenuator(30 dB, 300W)	BIRD	300-WA-MFN-30	0403007	2018-04-30
20	Temp & Humidity Chamber	Kunpoong	JT-TH-556-2	9QE5-003	2018-02-02
21	DC POWER SUPPLY	Agilent	6674A	MY41001323	2018-03-27
22	System Power Supply	HP	6032A	3440A-10521	2018-02-02
23	Horn Antenna	ETS-Lindgren	3116	00062916	2019-04-25