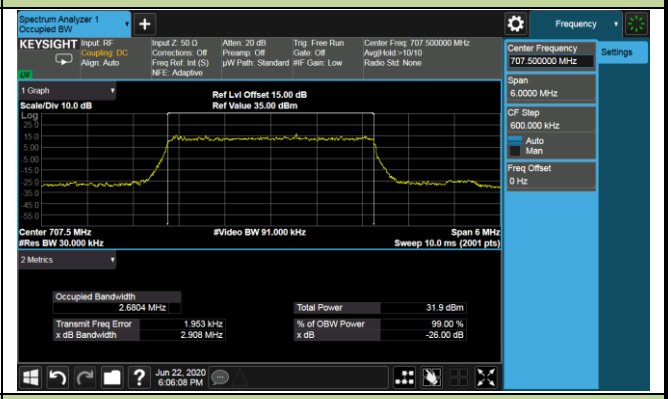
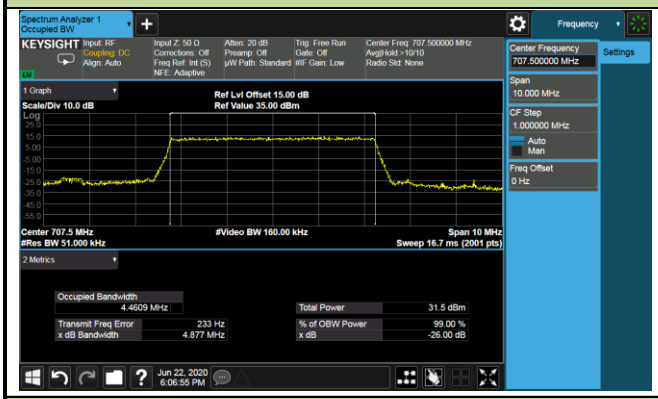
99% Bandwidth - QPSK

1.4MHz Channel Bandwidth

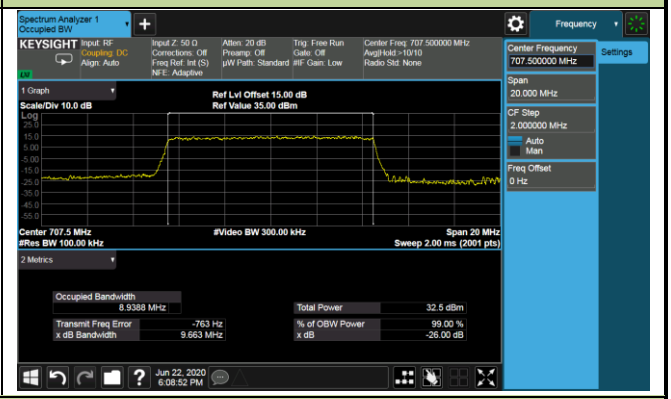
3MHz Channel Bandwidth



5MHz Channel Bandwidth

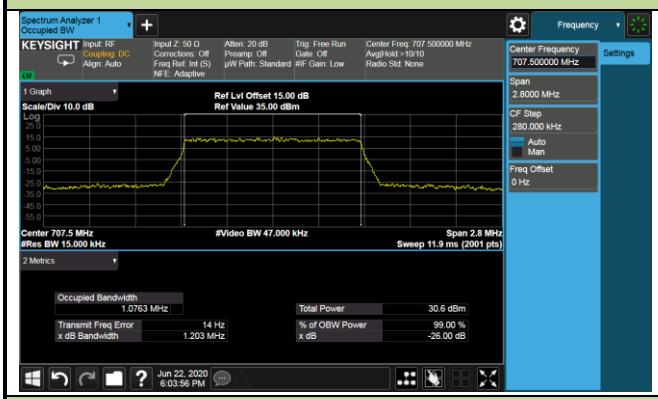


10MHz Channel Bandwidth

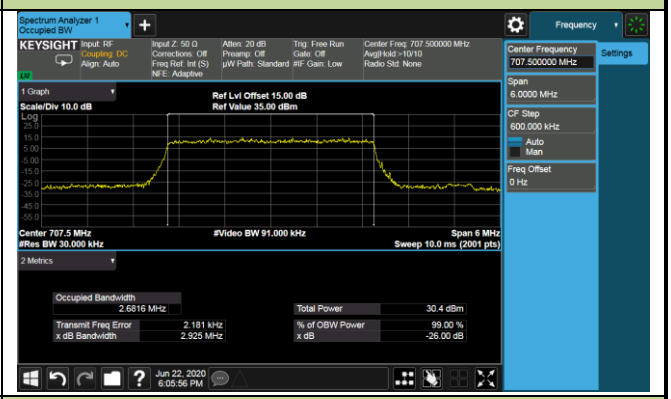


99% Bandwidth - 16QAM

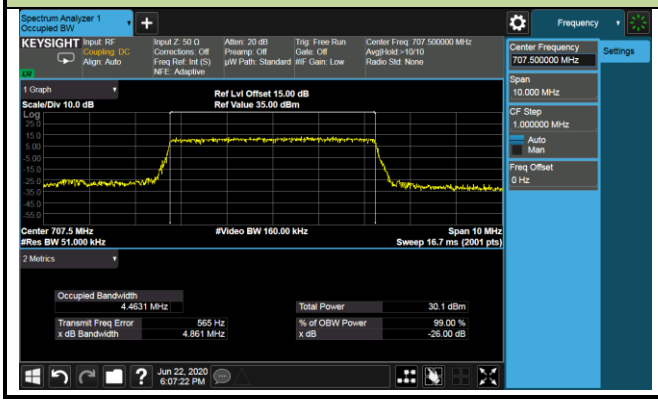
1.4MHz Channel Bandwidth



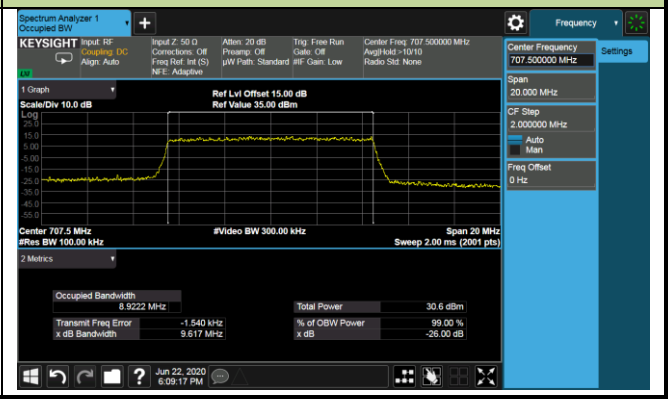
3MHz Channel Bandwidth

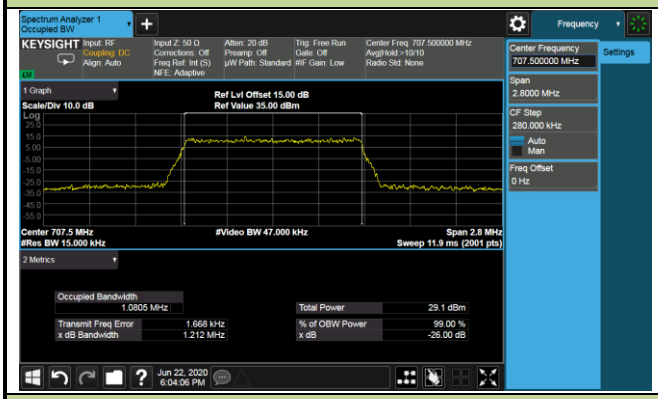
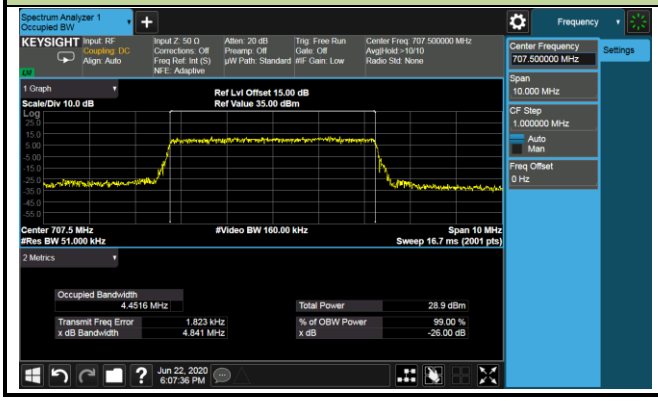
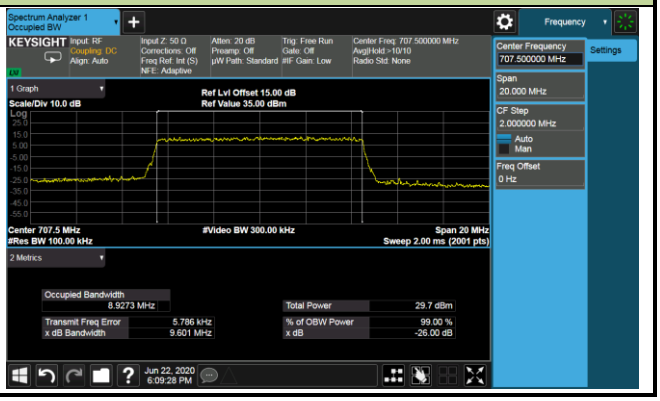


5MHz Channel Bandwidth



10MHz Channel Bandwidth



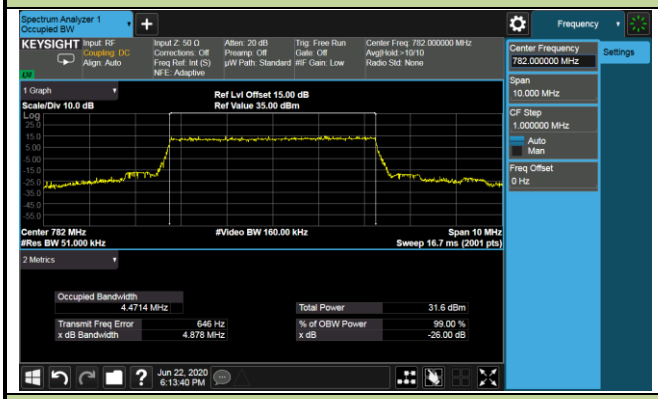
99% Bandwidth - 64QAM	
1.4MHz Channel Bandwidth	3MHz Channel Bandwidth
	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	

Product	LTE-A Cat 16 M.2 Module	Test Engineer	Candy Luo
Test Date	2020/06/22	Test Site	SR6
Test Band	LTE Band 13		

Modulation	Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
QPSK	782	5	4.47
		10	8.94
16QAM	782	5	4.47
		10	8.93
64QAM	782	5	4.47
		10	8.94

99% Bandwidth - QPSK

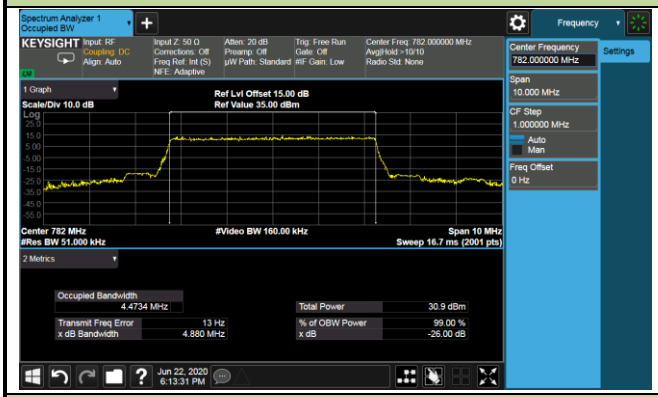
5MHz Channel Bandwidth



10MHz Channel Bandwidth

99% Bandwidth - 16QAM

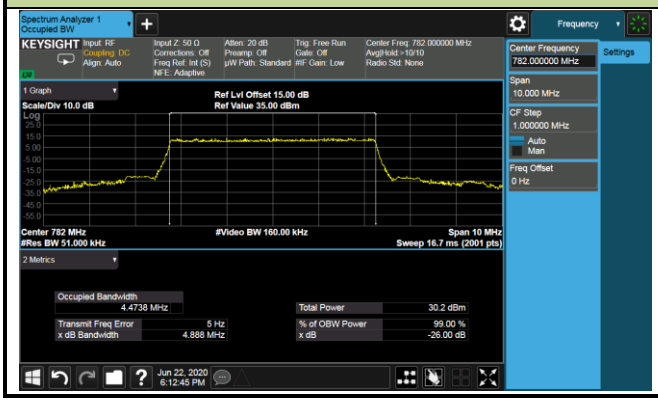
5MHz Channel Bandwidth



10MHz Channel Bandwidth

99% Bandwidth - 64QAM

5MHz Channel Bandwidth



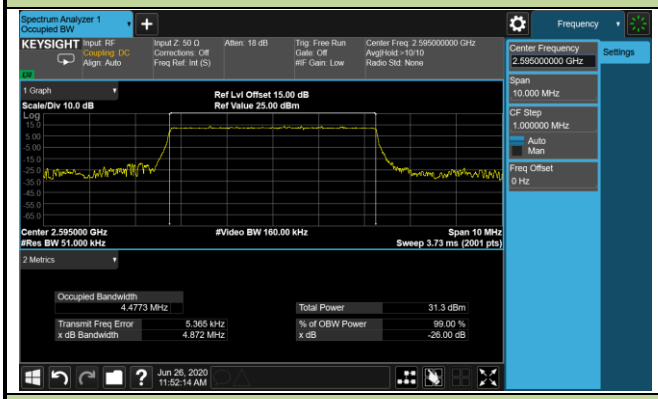
10MHz Channel Bandwidth

Product	LTE-A Cat 16 M.2 Module	Test Engineer	Candy Luo
Test Date	2020/06/26	Test Site	SR6
Test Band	LTE Band 38/41		

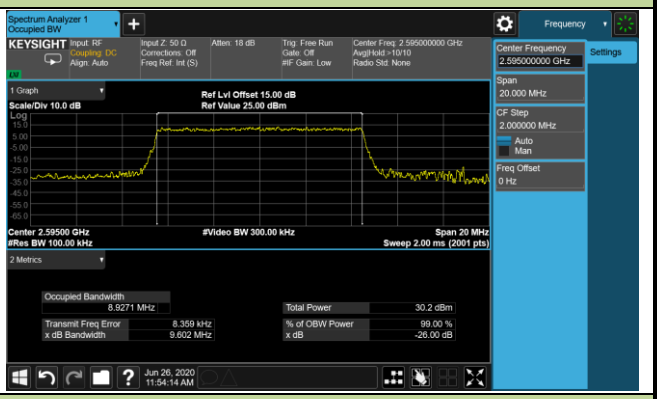
Modulation	Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
QPSK	2595.0	5	4.48
		10	8.93
		15	13.40
		20	17.86
16QAM	2595.0	5	4.46
		10	8.93
		15	13.41
		20	17.83
64QAM	2595.0	5	4.46
		10	8.93
		15	13.42
		20	17.90

99% Bandwidth - QPSK

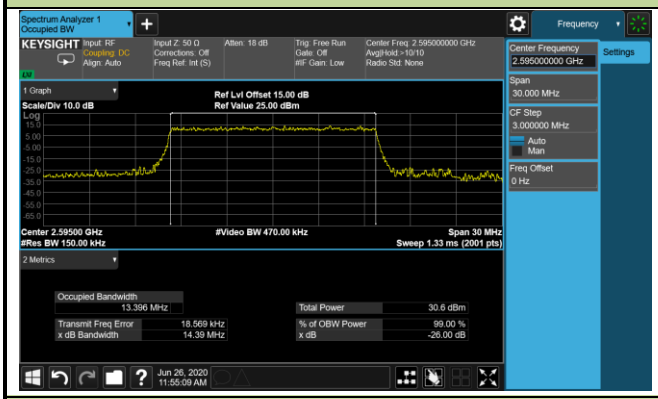
5MHz Channel Bandwidth



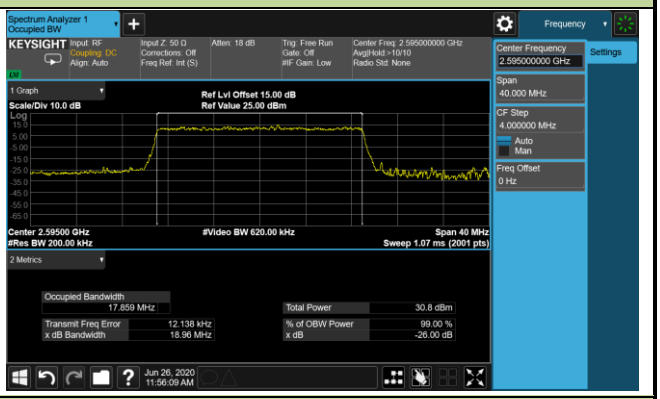
10MHz Channel Bandwidth



15MHz Channel Bandwidth

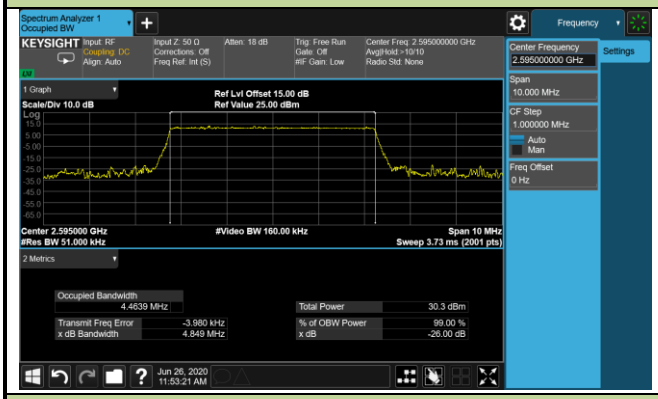


20MHz Channel Bandwidth

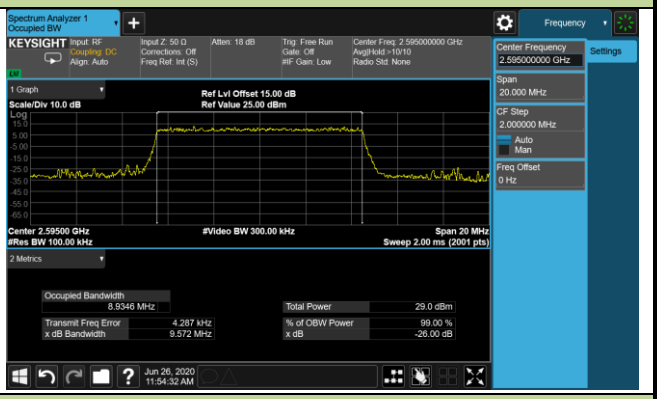


99% Bandwidth - 16QAM

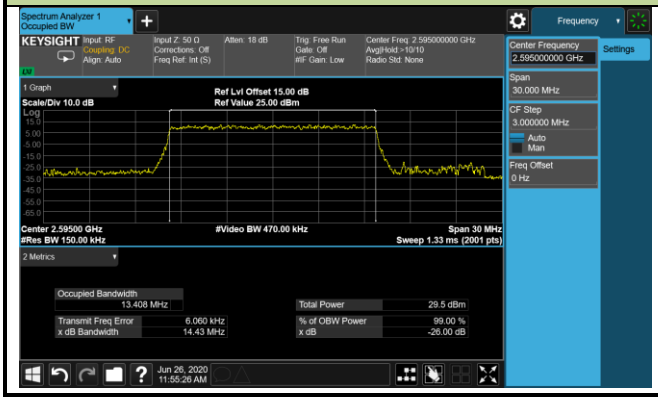
5MHz Channel Bandwidth



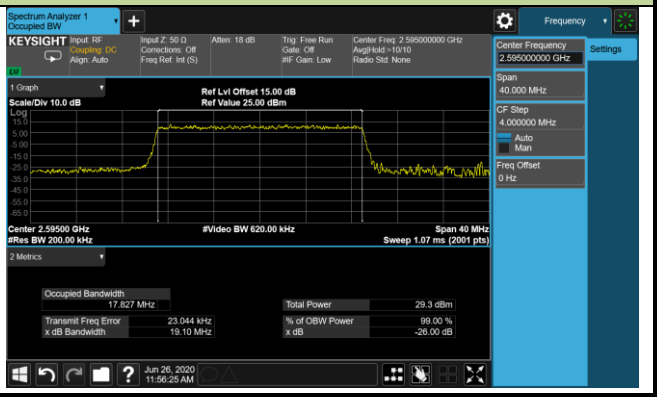
10MHz Channel Bandwidth

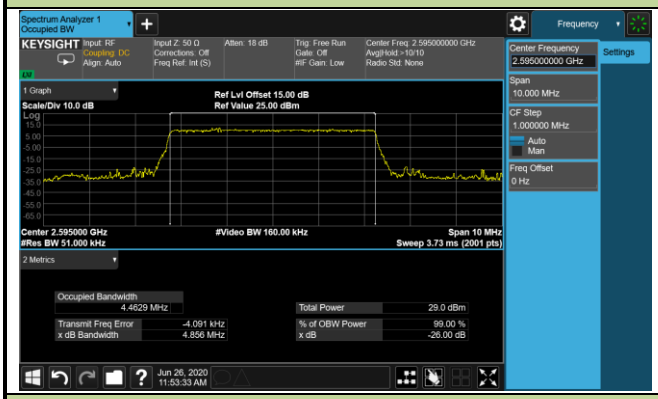
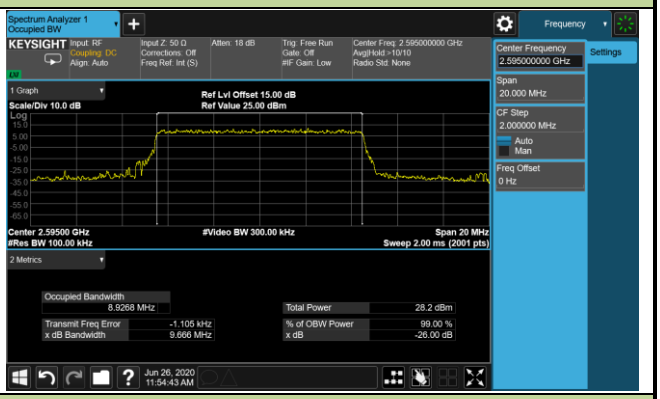
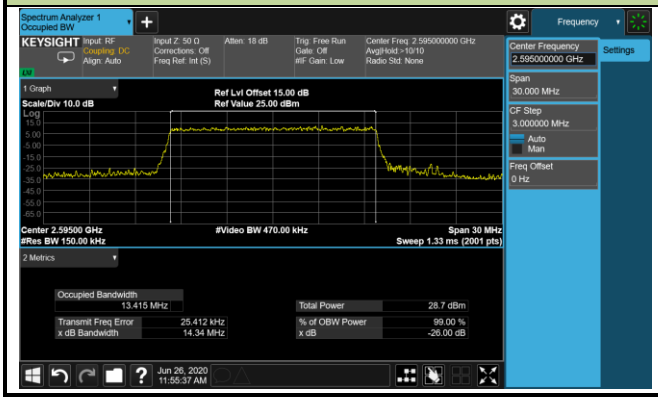
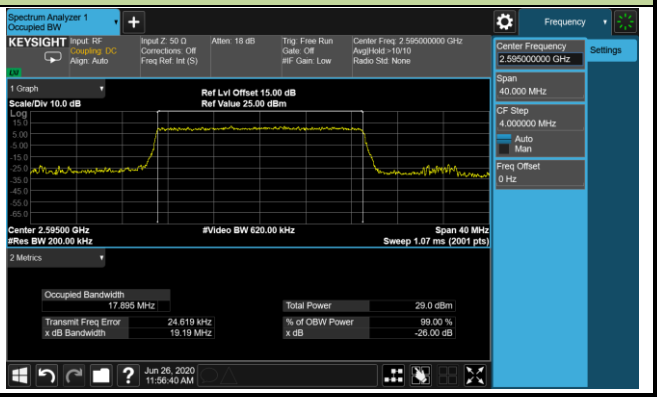


15MHz Channel Bandwidth



20MHz Channel Bandwidth



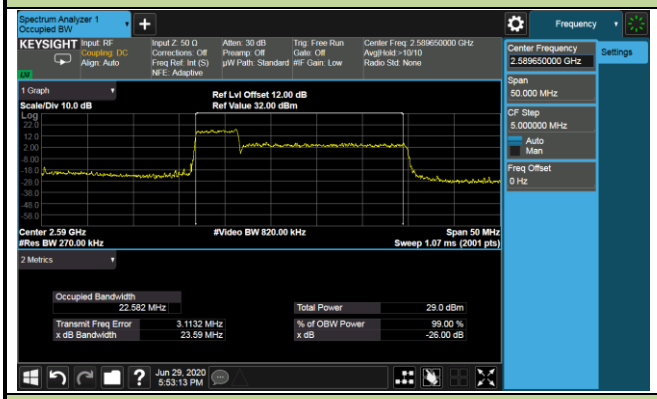
99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

Product	LTE-A Cat 16 M.2 Module	Test Engineer	Candy Luo
Test Date	2020/06/29	Test Site	SR6
Test Band	Intra-Band CA_41C		

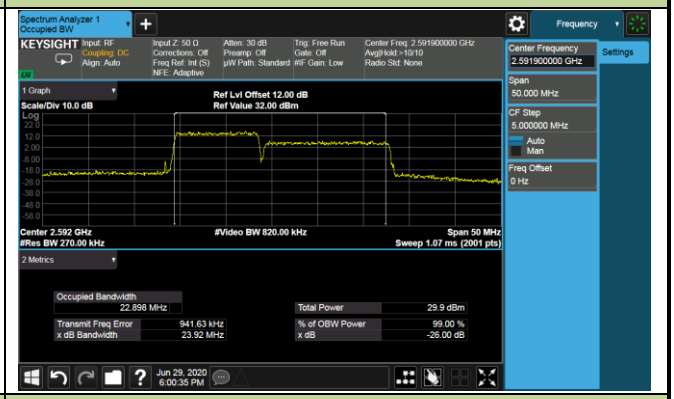
Modulation	Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
QPSK	2593.025	5+20	22.58
	2593.025	10+15	22.90
	2593.050	10+20	27.53
	2592.975	15+10	22.90
	2593.000	15+15	28.07
	2592.975	15+20	32.35
	2592.975	20+5	22.79
	2593.050	20+10	27.58
	2593.025	20+15	32.40
	2593.000	20+20	37.37
16QAM	2593.025	5+20	22.51
	2593.025	10+15	22.92
	2593.050	10+20	27.51
	2592.975	15+10	22.93
	2593.000	15+15	28.08
	2592.975	15+20	32.29
	2592.975	20+5	22.77
	2593.050	20+10	27.57
	2593.025	20+15	32.40
	2593.000	20+20	37.24
64QAM	2593.025	5+20	22.53
	2593.025	10+15	22.86
	2593.050	10+20	27.41
	2592.975	15+10	23.07
	2593.000	15+15	28.11
	2592.975	15+20	32.37
	2592.975	20+5	22.76
	2593.050	20+10	27.54
	2593.025	20+15	32.43
	2593.000	20+20	37.17

99% Bandwidth - QPSK

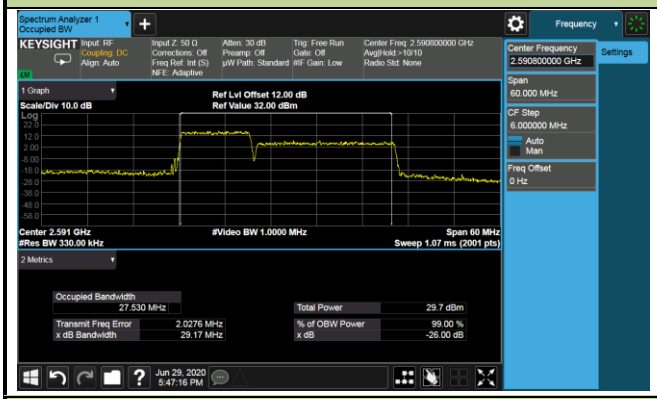
5+20MHz Channel Bandwidth



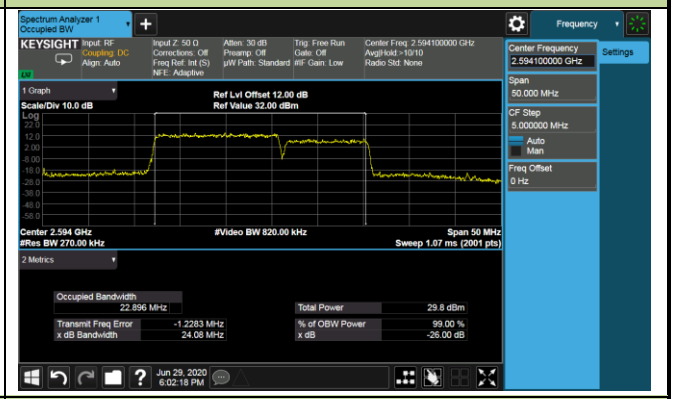
10+15MHz Channel Bandwidth



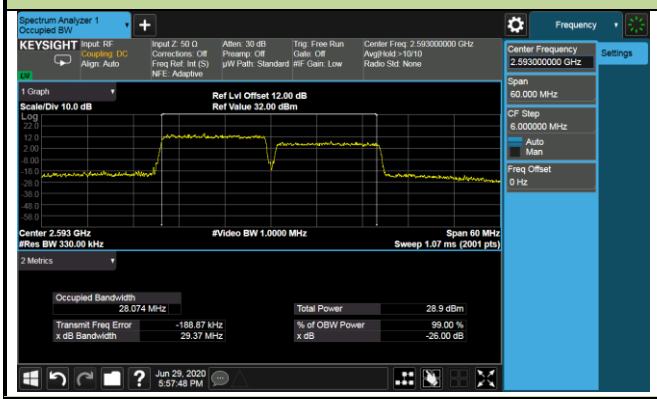
10+20MHz Channel Bandwidth



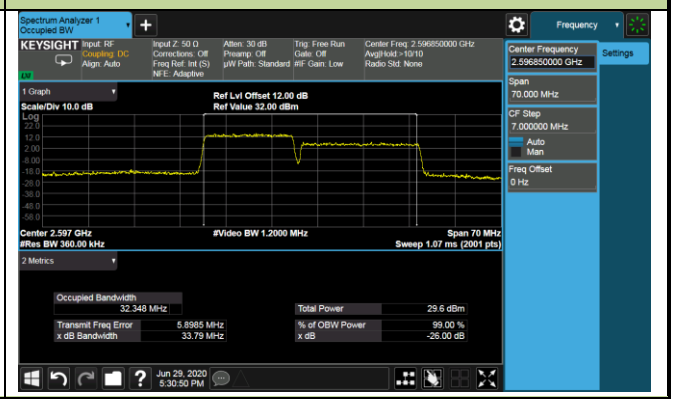
15+10MHz Channel Bandwidth



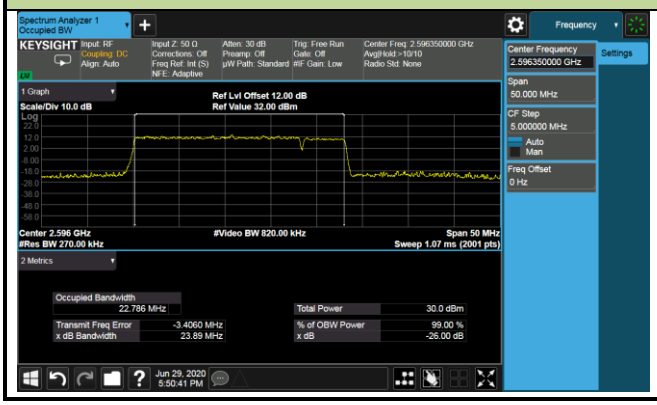
15+15MHz Channel Bandwidth



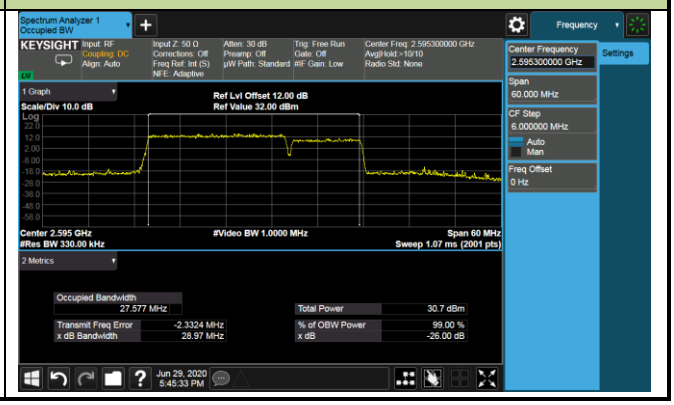
15+20MHz Channel Bandwidth

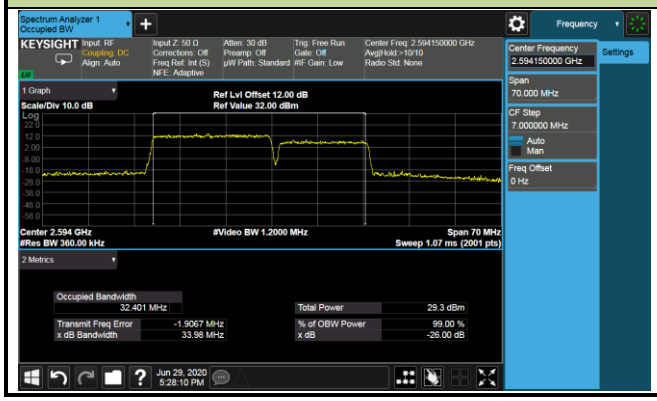
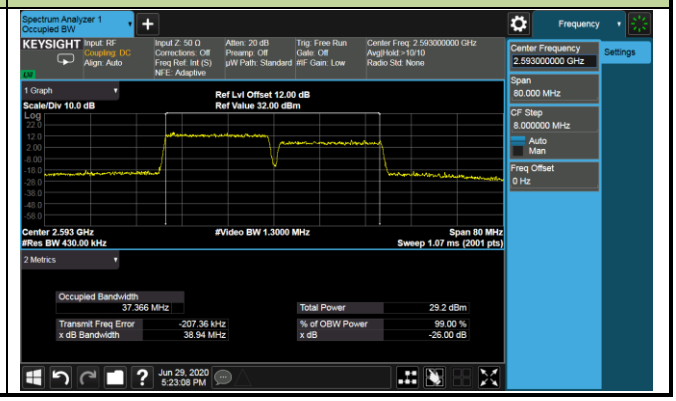


20+5MHz Channel Bandwidth



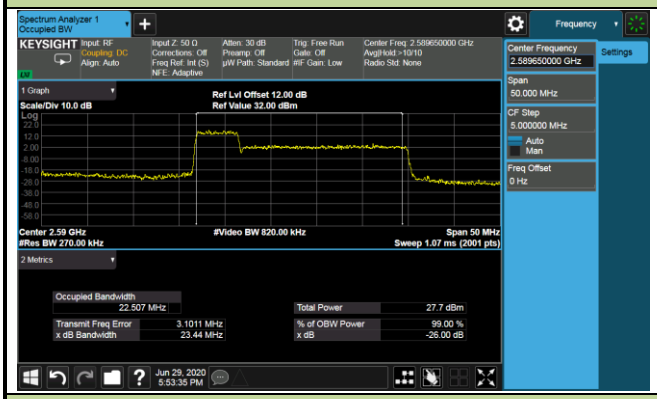
20+10MHz Channel Bandwidth



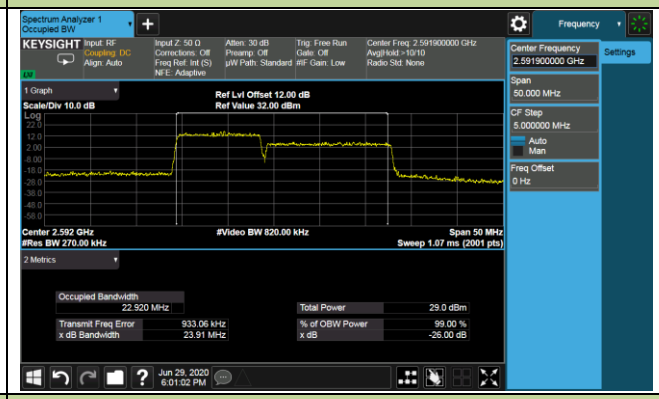
99% Bandwidth - QPSK	
20+15MHz Channel Bandwidth	20+20MHz Channel Bandwidth
	

99% Bandwidth - 16QAM

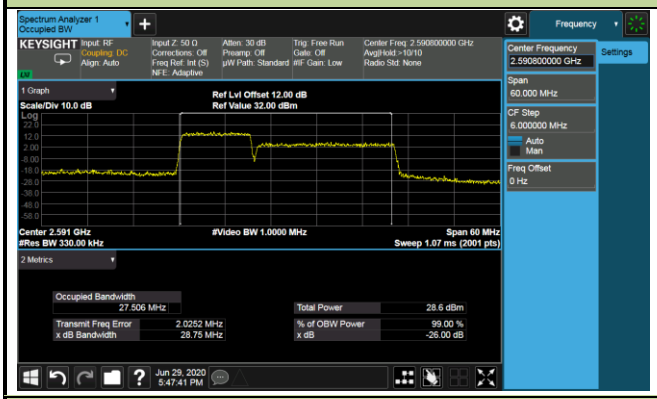
5+20MHz Channel Bandwidth



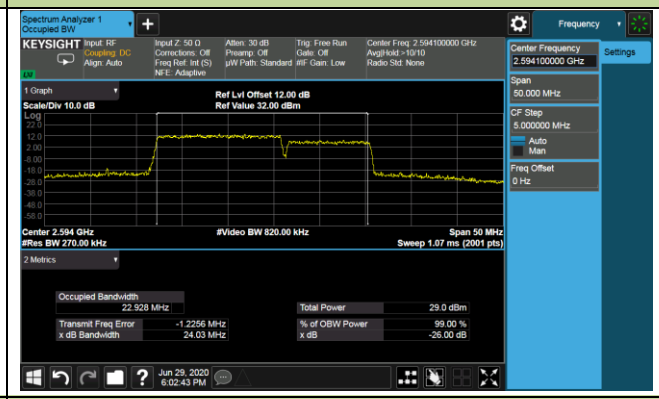
10+15MHz Channel Bandwidth



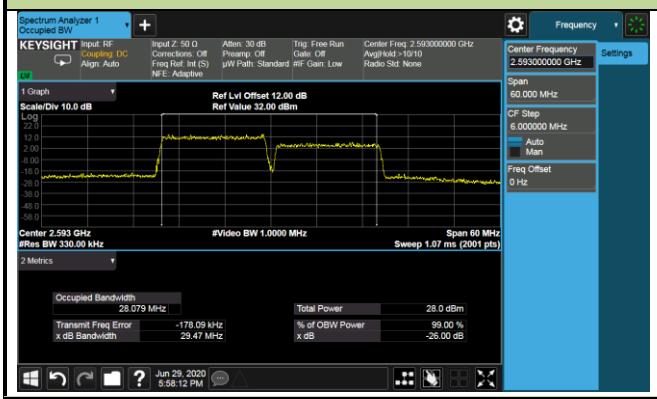
10+20MHz Channel Bandwidth



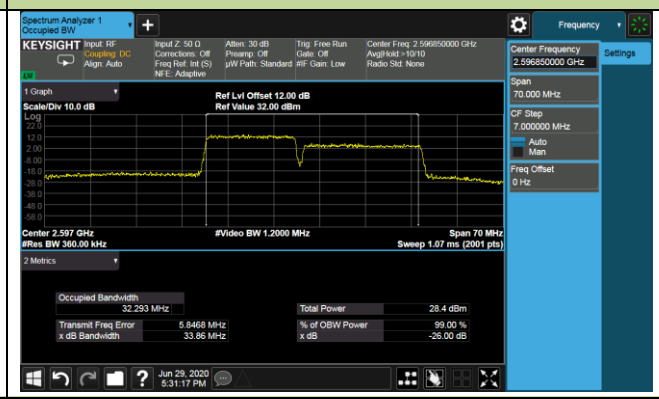
15+10MHz Channel Bandwidth



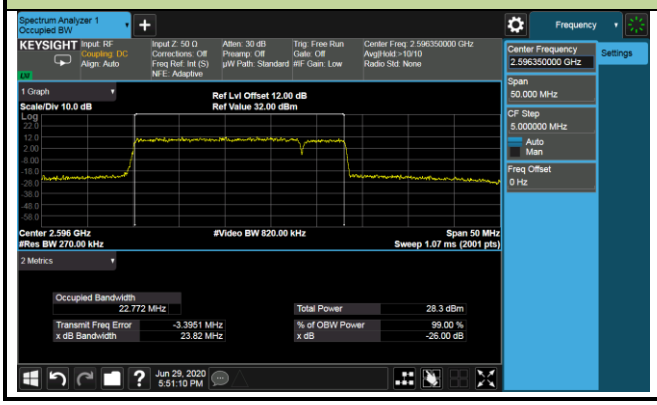
15+15MHz Channel Bandwidth



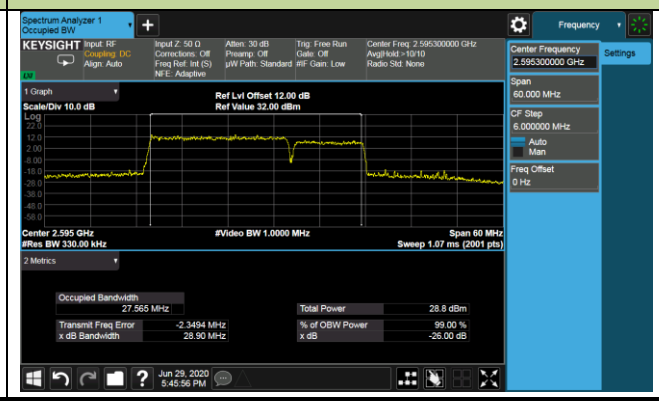
15+20MHz Channel Bandwidth

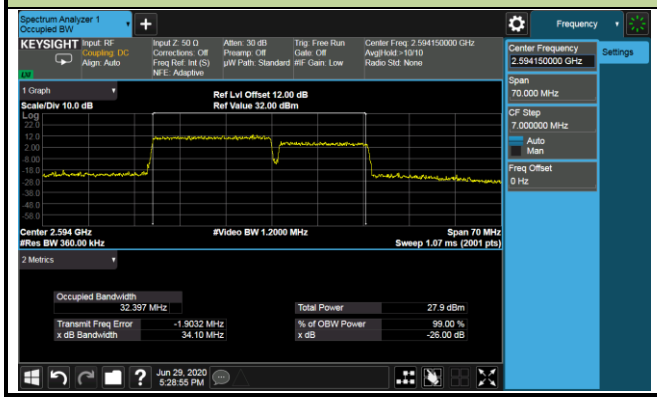
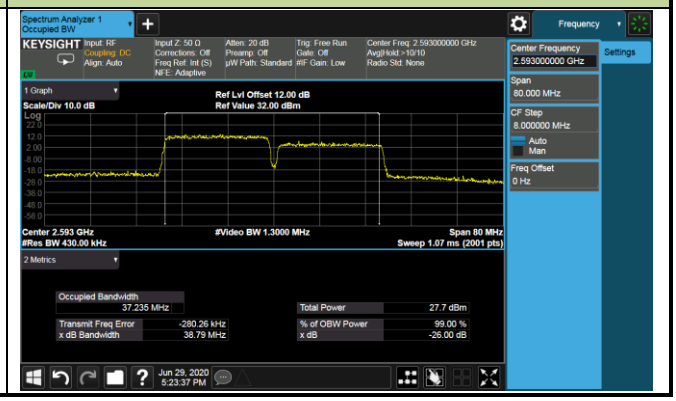


20+5MHz Channel Bandwidth



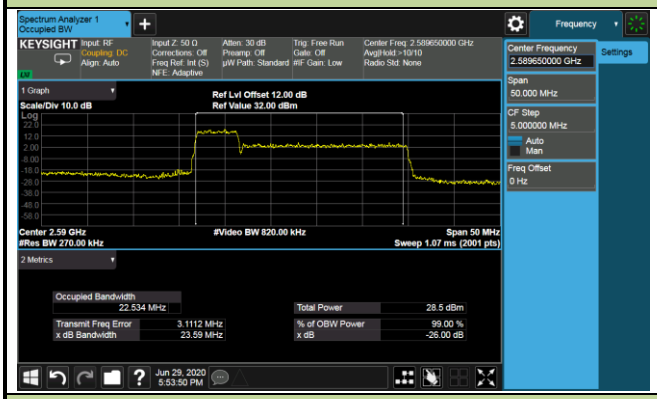
20+10MHz Channel Bandwidth



99% Bandwidth - 16QAM	
20+15MHz Channel Bandwidth	20+20MHz Channel Bandwidth
	

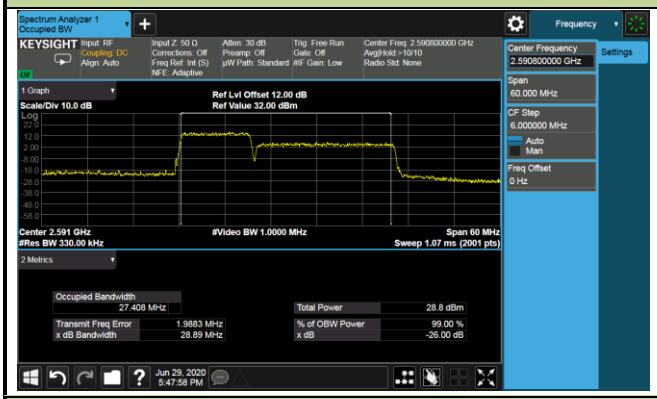
99% Bandwidth - 64QAM

5+20MHz Channel Bandwidth

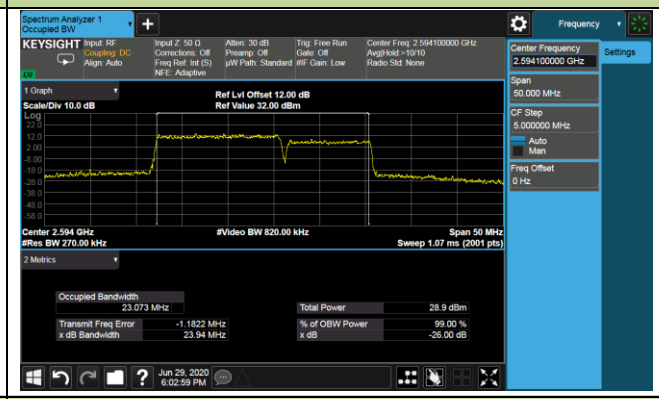


10+15MHz Channel Bandwidth

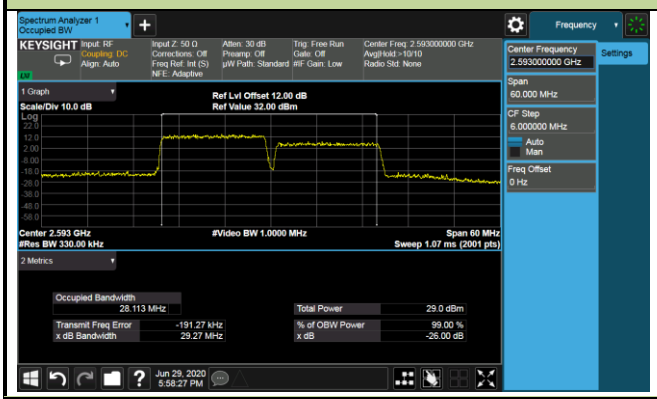
10+20MHz Channel Bandwidth



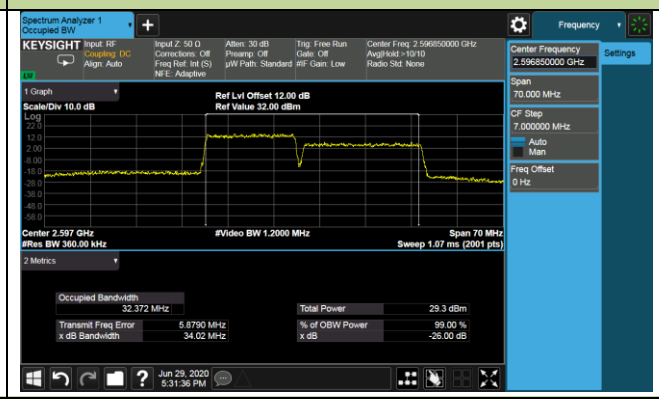
15+10MHz Channel Bandwidth



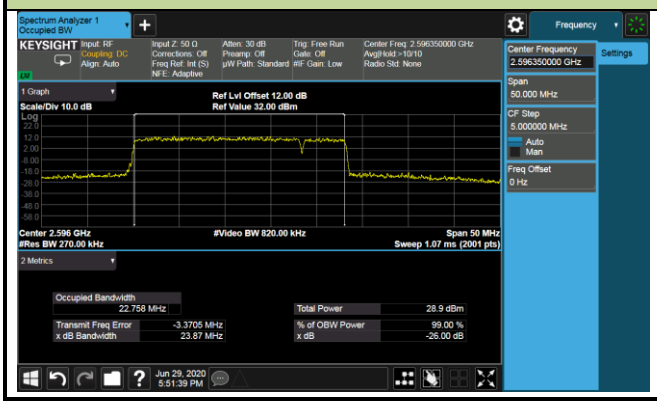
15+15MHz Channel Bandwidth



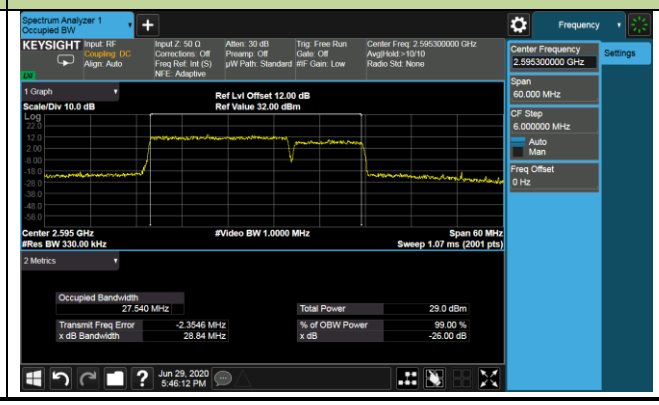
15+20MHz Channel Bandwidth

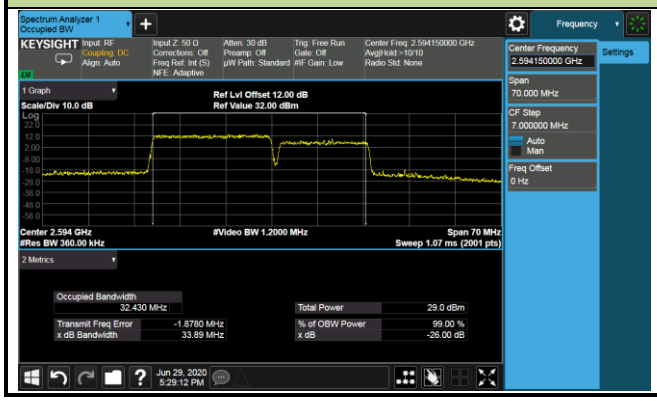
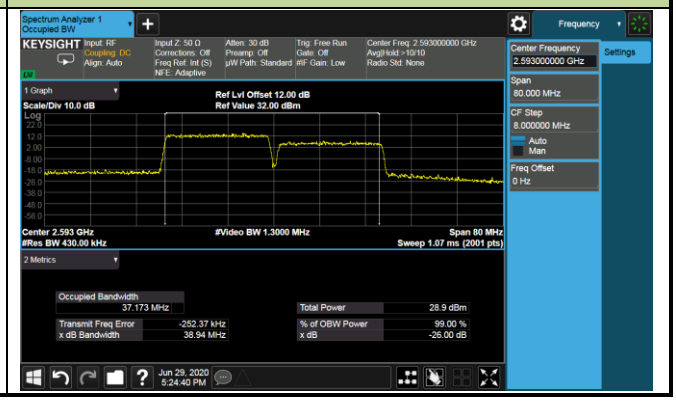


20+5MHz Channel Bandwidth



20+10MHz Channel Bandwidth



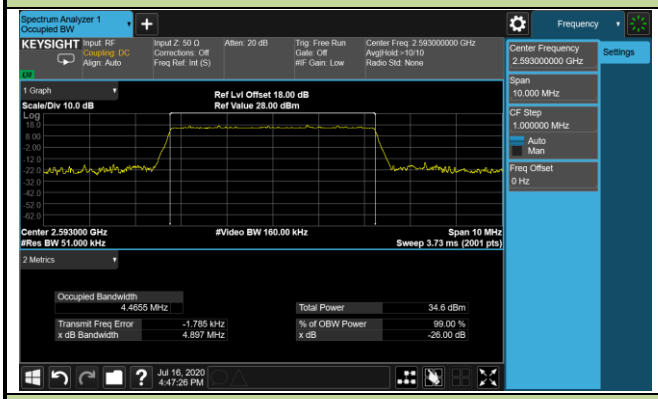
99% Bandwidth - 64QAM	
20+15MHz Channel Bandwidth	20+20MHz Channel Bandwidth
	

Product	LTE-A Cat 16 M.2 Module	Test Engineer	Candy Luo
Test Date	2020/07/16	Test Site	SR6
Test Band	LTE Band 41 For HPUE		

Modulation	Frequency (MHz)	Bandwidth (MHz)	99% Bandwidth (MHz)
QPSK	2595.0	5	4.47
		10	8.95
		15	13.41
		20	17.86
16QAM	2595.0	5	4.46
		10	8.95
		15	13.43
		20	17.88
64QAM	2595.0	5	4.48
		10	8.94
		15	13.41
		20	17.85

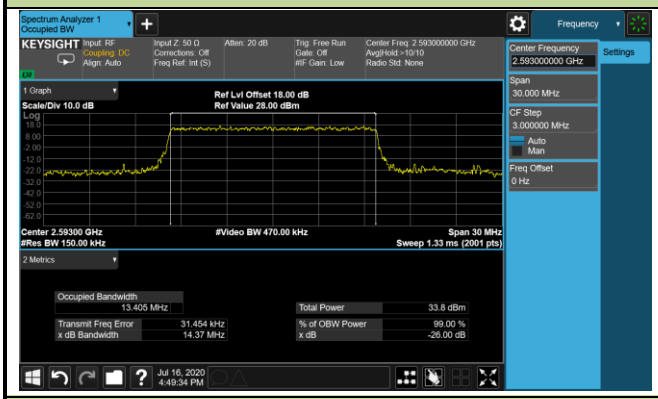
99% Bandwidth - QPSK

5MHz Channel Bandwidth

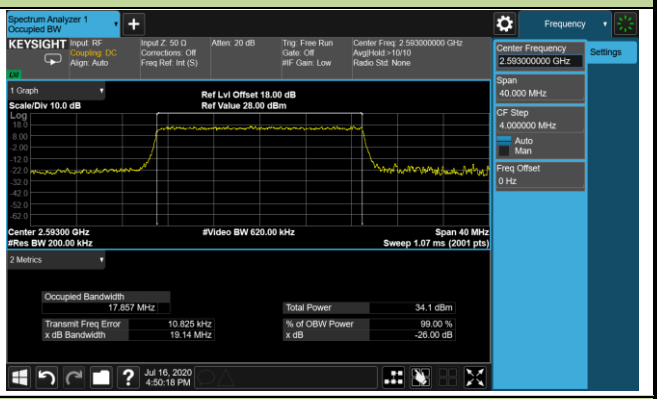


10MHz Channel Bandwidth

15MHz Channel Bandwidth

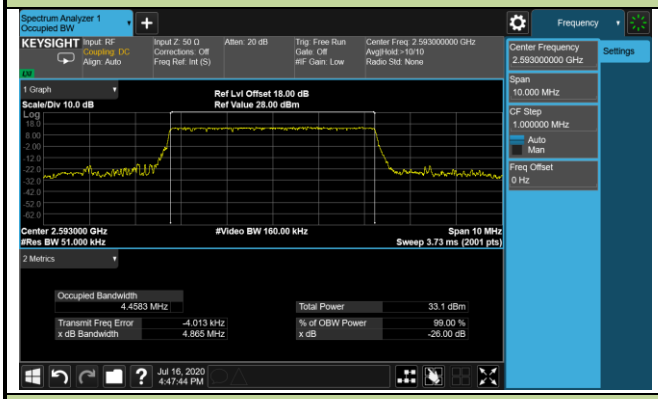


20MHz Channel Bandwidth

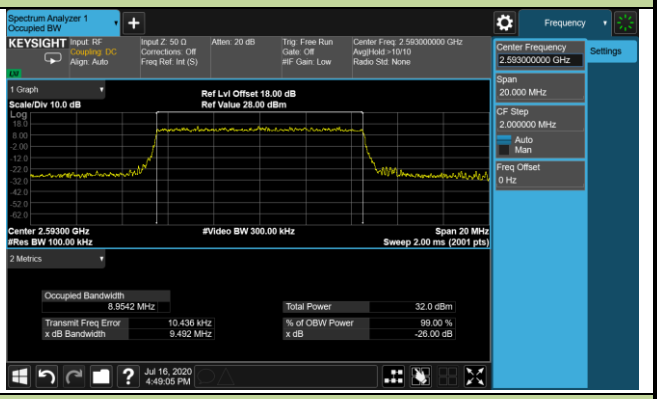


99% Bandwidth - 16QAM

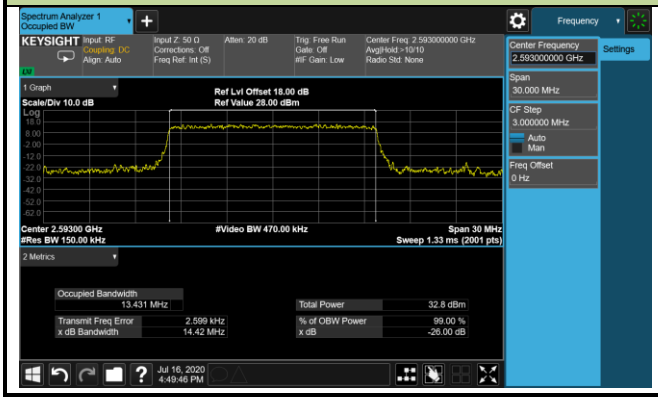
5MHz Channel Bandwidth



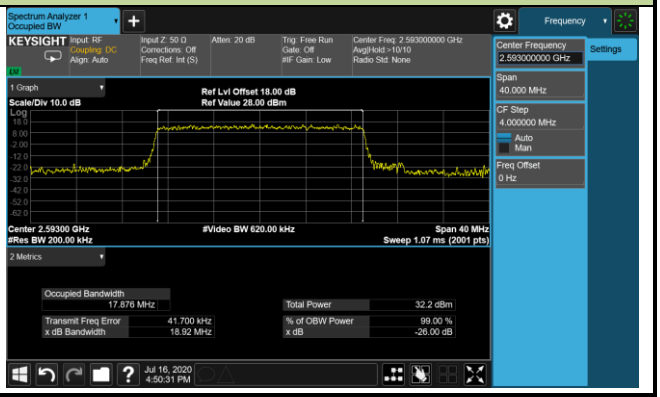
10MHz Channel Bandwidth

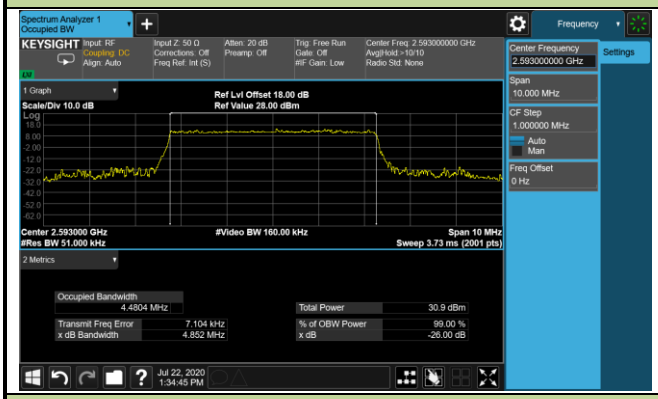
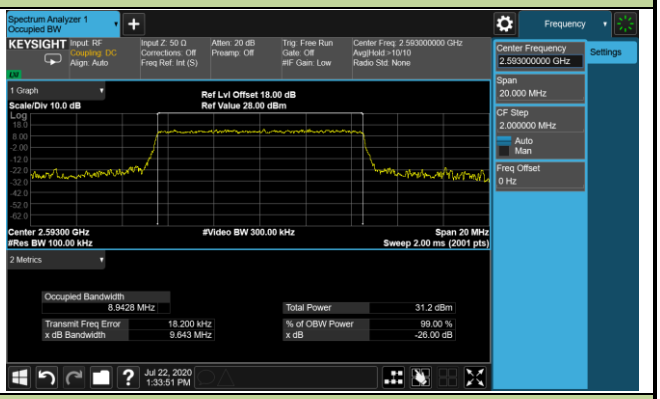
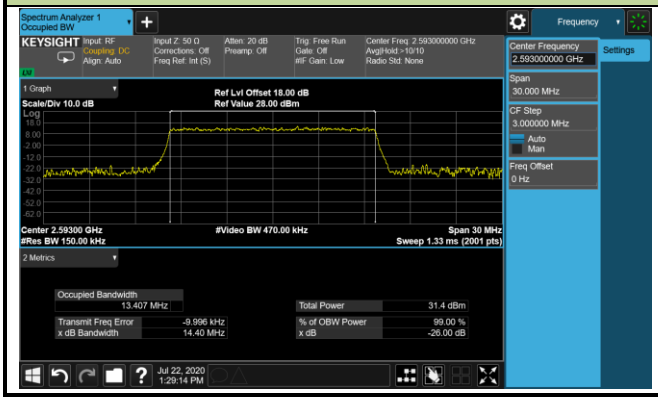
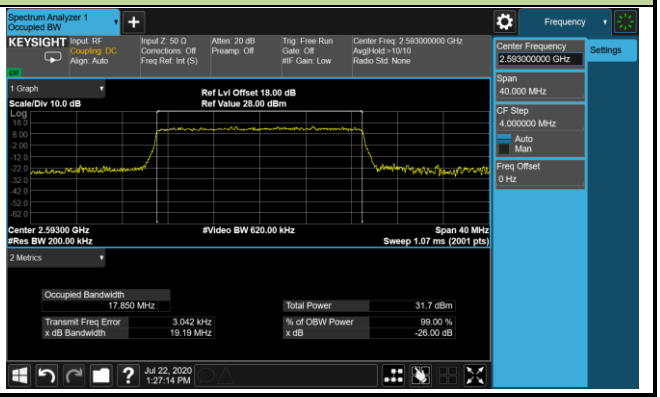


15MHz Channel Bandwidth



20MHz Channel Bandwidth



99% Bandwidth - 64QAM	
5MHz Channel Bandwidth	10MHz Channel Bandwidth
	
15MHz Channel Bandwidth	20MHz Channel Bandwidth
	

5.3. Frequency Stability Measurement

5.3.1. Test Limit

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

5.3.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.6

5.3.3. Test Setting

Frequency Stability Under Temperature Variations:

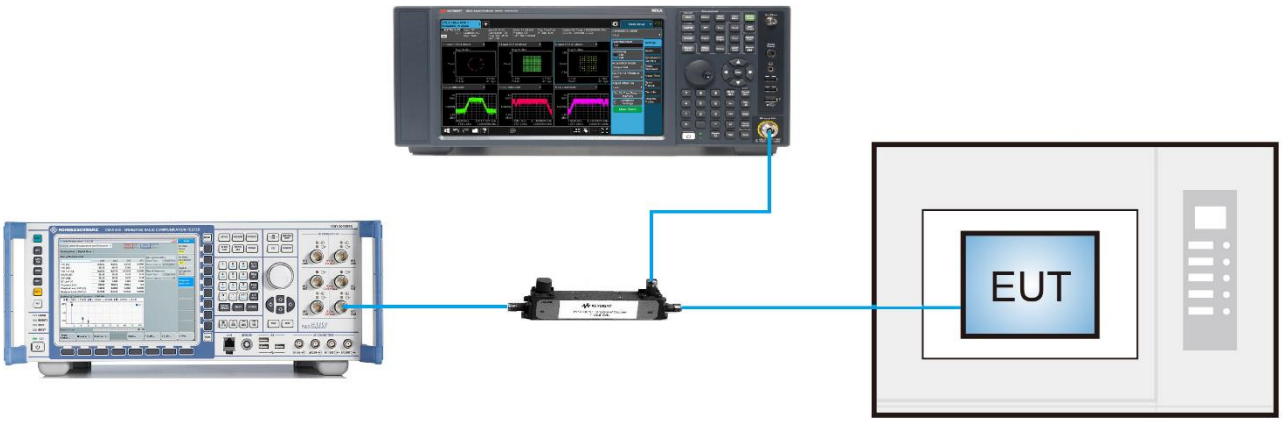
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, recordthe maximum frequency change.

5.3.4. Test Setup



5.3.5. Test Result

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	TR3	Test Date	2020/07/15
Test Band	LTE Band 2/25		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	-0.1882
		- 20	-0.1967
		- 10	-0.1941
		0	-0.1971
		+ 10	-0.1920
		+ 20 (Ref)	-0.1978
		+ 30	-0.1943
		+ 40	-0.1941
		+ 50	-0.1972
115%	4.2	+ 20	-0.1951
85%	3.1	+ 20	-0.1937

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	TR3	Test Date	2020/07/15
Test Band	LTE Band 4/66		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	-0.1960
		- 20	-0.1968
		- 10	-0.1980
		0	-0.1964
		+ 10	-0.1870
		+ 20 (Ref)	-0.2012
		+ 30	-0.1939
		+ 40	-0.1917
		+ 50	-0.1821
115%	4.2	+ 20	-0.1701
85%	3.1	+ 20	-0.1895

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	TR3	Test Date	2020/07/15
Test Band	LTE Band 5/26		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	-0.1960
		- 20	-0.1968
		- 10	-0.1980
		0	-0.1964
		+ 10	-0.1870
		+ 20 (Ref)	-0.1884
		+ 30	-0.1969
		+ 40	-0.1908
		+ 50	-0.1952
115%	4.2	+ 20	-0.1965
85%	3.1	+ 20	-0.1869

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	SR6	Test Date	2020/07/15
Test Band	LTE Band 7		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	0.0041
		- 20	0.0042
		- 10	0.0039
		0	0.0039
		+ 10	0.0045
		+ 20 (Ref)	0.0038
		+ 30	0.0037
		+ 40	0.0031
		+ 50	0.0035
115%	4.2	+ 20	0.0025
85%	3.1	+ 20	0.0041

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	SR6	Test Date	2020/07/15
Test Band	LTE Band 12		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	0.0067
		- 20	0.0087
		- 10	0.0075
		0	0.0094
		+ 10	0.0078
		+ 20 (Ref)	0.0030
		+ 30	0.0063
		+ 40	0.0062
		+ 50	0.0079
115%	4.2	+ 20	0.0060
85%	3.1	+ 20	0.0092

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	SR6	Test Date	2020/07/15
Test Band	LTE Band 13		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	0.0074
		- 20	0.0074
		- 10	0.0069
		0	0.0070
		+ 10	0.0056
		+ 20 (Ref)	0.0057
		+ 30	0.0068
		+ 40	0.0050
		+ 50	0.0040
115%	4.2	+ 20	0.0059
85%	3.1	+ 20	0.0073

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	TR3	Test Date	2020/07/15
Test Band	LTE Band 38/41		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	0.0032
		- 20	0.0039
		- 10	0.0033
		0	0.0040
		+ 10	0.0034
		+ 20 (Ref)	0.0034
		+ 30	0.0031
		+ 40	0.0037
		+ 50	0.0029
115%	4.2	+ 20	0.0035
85%	3.1	+ 20	0.0037

Product	LTE-A Cat 16 M.2 Module	Temperature	-30 ~ 50°C
Test Engineer	Candy Luo	Relative Humidity	52%
Test Site	TR3	Test Date	2020/07/17
Test Band	LTE Band 41 For HPUE		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency Tolerance (ppm)
100%	3.7	- 30	0.0038
		- 20	0.0031
		- 10	0.0030
		0	0.0028
		+ 10	0.0026
		+ 20 (Ref)	0.0034
		+ 30	0.0029
		+ 40	0.0029
		+ 50	0.0029
115%	4.2	+ 20	0.0035
85%	3.1	+ 20	0.0033

5.4. Equivalent Isotropically Radiated Power Measurement

5.4.1. Test Limit

Band 5/26:

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

Band 12, 13

Control stations and mobile stations transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands and fixed stations transmitting in the 787-788 MHz and 805-806MHz bands are limited to 30 watts ERP.

Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP.

Band 2/25, 7, 38/41:

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

Band 4/66:

Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

5.4.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.2

5.4.3. Test Setting

Average power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation (1) as follows:

ERP or EIRP = $P_{Meas} + G_T$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, e.g., dBm or dBW)

P_{Meas} measured transmitter output power or PSD, in dBm or dBW

G_T gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

ERP = EIRP -2.15