



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd.

FCC ID XMR201707BG96

Product LTE Cat M1 & Cat NB1 & EGPRS Module

Brand Quectel

Model BG96, BG96 MINIPCIE

Marketing Quectel BG96, Quectel BG96 MINIPCIE

Report No. R2007A0435-R6

Issue Date August 18, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR47 Part 27C (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	RF power output	2.1046	Refer to the Original
2	Effective Isotropic Radiated power	27.50(d)(4) /27.50(b)(10) /27.50(c)(10)	Refer to the Original
3	Occupied Bandwidth	2.1049	Refer to the Original
4	Band Edge Compliance	27.53(h) /27.53(g)	Only test LTE Band
5	Peak-to-Average Power Ratio	27.50(d)/KDB971168 D01(5.7)	Refer to the Original
6	Frequency Stability	2.1055 / 27.54	Refer to the Original
7	Spurious Emissions at Antenna Terminals	2.1051 /27.53(h)/27.53(g)/27.53(f)	Refer to the Original
8	Radiates Spurious Emission	2.1053 /27.53(h)/27.53(g)/27.53(f)	Refer to the Original

Date of Testing: June 24, 2017~ July 3, 2017 and August10, 2020 ~ August12, 2020

Note: PASS: The EUT complies with the essential requirements in the standard.

FAIL: The EUT does not comply with the essential requirements in the standard.

All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.

BG96, BG96 MINIPCIE (Report No.: R2007A0435-R6) is a variant model of BG96, BG96 MINIPCIE (Report No.: R1811A0536-R3). Test values partial duplicated from original for variant. There is only tested Band Edge Compliance of LTE Band for variant in this report. The detailed product change description please refers to the Statement letter_BG96.

BG96, BG96 MINIPCIE (Report No: R1811A0536-R3) is a variant model of BG96 (Report No: RXA1706-0199RF03R1).The detailed product change description please refers to the ANNEX A.

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

1.2 Test facility

FCC (recognition number is 428261)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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2 General Description of Equipment under Test

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd.
Applicant address	7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer address	7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China

General information

EUT Description			
Model:	BG96, BG96 MINIPCIE		
IMEI:	866425038291656		
Hardware Version:	R1.2		
Software Version:	BG96MAR04A01M1G		
Power Supply:	External power supply		
Antenna Type:	The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna)		
Test Mode(s):	LTE Band 4; LTE Band 12, LTE Band 13;		
Test Modulation	QPSK 16QAM;		
LTE Category	M1		
Maximum E.I.R.P./ E.R.P.	LTE Band 4:	29.98dBm	
	LTE Band 12:	27.79dBm	
	LTE Band 13:	27.17dBm	
Rated Power Supply Voltage:	3.8V		
Extreme Voltage:	Minimum: 3.3V Maximum: 4.3V		
Extreme Temperature:	Lowest: -40°C Highest: +85°C		
Frequency Range(s)	Mode	Tx (MHz)	Rx (MHz)
	LTE Band 4	1710 ~1755	2110~2155
	LTE Band 12	699 ~ 716	729 ~ 746
	LTE Band 13	777 ~ 787	746 ~ 756
Note: 1. The information of the EUT is declared by the manufacturer.			

The series model number is: BG96 MINIPCIE. The difference of these models are have different marketing requirement.



3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 27C(2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4 Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT lie-down stand-up position (X, Y axis), lie-down position (Z axis),. Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, vertical polarization) and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated.

Subsequently, only the worst case emissions are reported.

The following testing in LTE is set based on the maximum RF Output Power.

The following testing in different Bandwidth is set to detail in the following table:

Test modes are chosen to be reported as the worst case configuration below for LTE Band 4/12/13:

Test items	Modes	Bandwidth (MHz)						Modulation		RB			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
RF power output	LTE 4	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	O	O	O	O	O	O
	LTE 13	-	-	O	O	-	-	O	O	O	O	O	O	O	O
Effective Isotropic Radiated power	LTE 4	O	O	O	O	O	O	O	O	-	-	O	O	O	O
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	O	O	O
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	O	O	O
Occupied Bandwidth	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Band Edge Compliance	LTE 4	O	O	O	O	O	O	O	O	O	-	O	O	-	O
	LTE 12	O	O	O	O	-	-	O	O	O	-	O	O	-	O
	LTE 13	-	-	O	O	-	-	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Frequency Stability	LTE 4	O	O	O	O	O	O	O	O	-	-	O	-	O	-
	LTE 12	O	O	O	O	-	-	O	O	-	-	O	-	O	-
	LTE 13	-	-	O	O	-	-	O	O	-	-	O	-	O	-
Spurious Emissions at Antenna Terminals	LTE 4	O	O	O	O	O	O	O	-	O	-	-	O	O	O
	LTE 12	O	O	O	O	-	-	O	-	O	-	-	O	O	O
	LTE 13	-	-	O	O	-	-	O	-	O	-	-	O	O	O



Radiates Spurious Emission	LTE 4	-	-	-	-	-	O	O	-	O	-	-	O	O	O
	LTE 12	-	-	-	O	-	-	O	-	O	-	-	O	O	O
	LTE 13	-	-	-	O	-	-	O	-	O	-	-	O	O	O
Note	1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.														

5 Test Information

5.1 RF Power Output

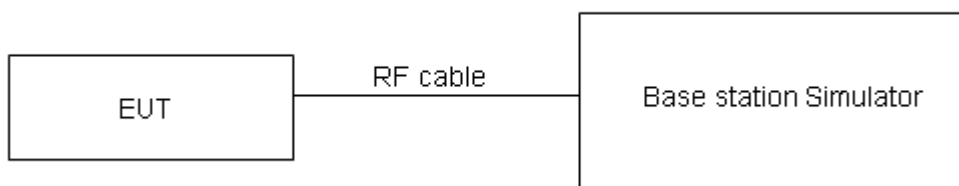
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.

Limits

No specific RF power output requirements in part 2.1046.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=0.4$ dB.

Test Results

Mode	Bandwidth	Channel/ Frequency(MHz)	Index	RB# RBstart	Conducted Power (dBm)	
					QPSK	16QAM
Band4	1.4MHz	19957/1710.7	0	1#0	22.38	21.94
			0	6#0	22.13	22.06
		20175/1732.5	0	1#0	22.31	22.02
			0	6#0	22.09	22.03
		20393/1754.3	0	1#5	22.37	22.13
			0	6#0	22.23	22.21
	3MHz	19965/1711.5	0	1#0	22.40	21.97
			0	6#0	22.16	22.09
		20175/1732.5	0	1#0	22.35	22.04
			0	6#0	22.13	22.07
		20385/1753.5	1	1#5	22.40	22.16
			1	6#0	22.26	22.24
	5MHz	19975/1712.5	3	1#0	22.37	21.94
			0	6#0	22.14	22.07
		20175/1732.5	0	1#0	22.33	22.00
			0	6#0	22.12	22.03
		20375/1752.5	0	1#5	22.36	22.13
			3	6#0	22.24	22.19
	10MHz	20000/1715	3	1#0	22.39	21.96
			0	4#0	22.22	22.10
		20175/1732.5	0	1#0	22.34	22.03
			0	4#0	22.14	22.08
		20350/1750	4	1#5	22.39	22.15
			7	4#2	22.28	22.23
	15MHz	20025/1717.5	3	1#0	22.38	21.91
			0	6#0	22.20	22.07
		20175/1732.5	0	1#0	22.30	22.01
			0	6#0	22.10	22.03
		20325/1747.5	8	1#5	22.37	22.13
			11	6#0	22.23	22.19
	20MHz	20050/1720	3	1#0	22.35	21.89
			0	6#0	22.17	22.05
		20175/1732.5	0	1#0	22.26	21.97
			0	6#0	22.05	21.99
		20300/1745	12	1#5	22.34	22.08
			15	6#0	22.19	22.16

Mode	Bandwidth	Channel/ Frequency(MHz)	Index	RB# RBstart	Conducted Power (dBm)	
					QPSK	16QAM
Band12	1.4MHz	23017/699.7	0	1#0	22.74	23.23
			0	6#0	22.48	22.71
		23095/707.5	0	1#0	23.12	22.81
			0	6#0	22.66	22.90
		23173/715.3	0	1#5	23.37	23.02
			0	6#0	22.64	22.79
	3MHz	23025/700.5	0	1#0	22.76	23.25
			0	6#0	22.56	22.74
		23095/707.5	0	1#0	23.13	22.84
			0	6#0	22.68	22.95
		23165/714.5	1	1#5	23.40	23.04
			1	6#0	22.68	22.83
	5MHz	23035/701.5	3	1#0	22.75	23.20
			0	6#0	22.54	22.71
		23095/707.5	0	1#0	23.09	22.82
			0	6#0	22.64	22.90
		23155/713.5	0	1#5	23.38	23.02
			3	6#0	22.63	22.79
	10MHz	23060/704	3	1#0	22.72	23.18
			0	4#0	22.51	22.69
		23095/707.5	0	1#0	23.05	22.78
			0	4#0	22.59	22.86
		23130/711	4	1#5	23.35	22.97
			7	4#2	22.59	22.76

Mode	Bandwidth	Channel/ Frequency(MHz)	Index	RB# RBstart	Conducted Power (dBm)	
					QPSK	16QAM
Band13	5MHz	23205/779.5	3	1#0	23.10	23.81
			0	6#0	22.80	21.84
		23230/782	0	1#0	23.32	23.14
			0	6#0	22.68	22.19
		23255/784.5	0	1#5	23.11	23.72
			3	6#0	22.67	21.93
	10MHz	23230/782	0	1#0	23.07	23.70
			0	4#0	22.77	22.95

5.2 Effective Isotropic Radiated Power

Ambient condition

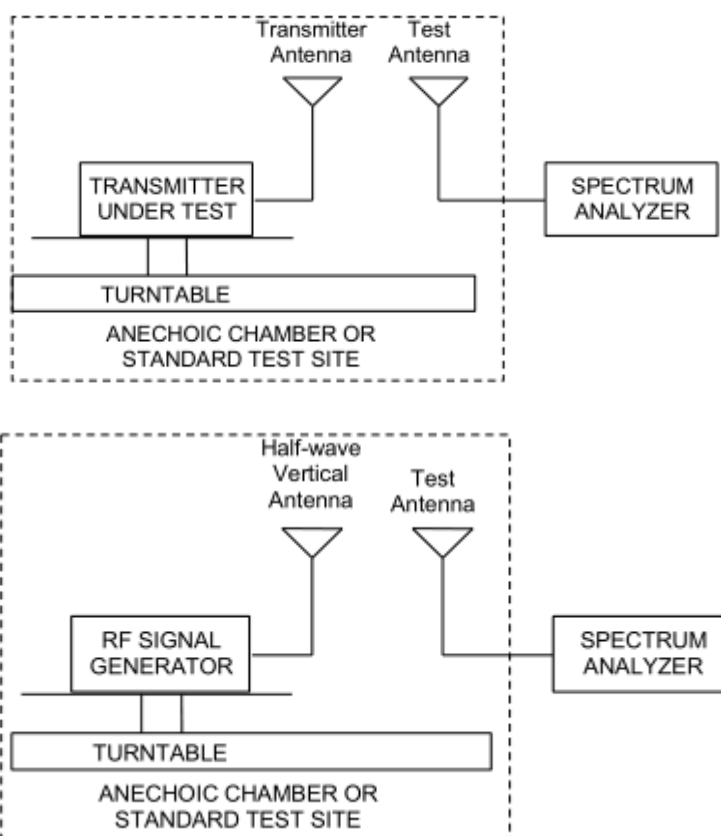
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).
 - a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.
 - b) Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).
 - c) Replace the transmitter under test with a vertically polarized half-wavedipole (or an antenna whose gain is known relative to an ideal half-wavedipole). The center of the antenna should be at the same location as the center of the antenna under test.
 - d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$
 - e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$
 - f) The maximum ERP is the maximum value determined in the preceding step.
 - g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g. transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:
 $EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$
 where: dBd refers to gain relative to an ideal dipole.
 $EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$

The RB allocation refers to section 5.1, using the maximum output power configuration.

Test setup



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

Limits

Rule Part 27.50(b) (10) specifies that “Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP”

Rule Part 27.50(c) (10) specifies that “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”

Rule Part 27.50(d) (4) specifies that “Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”

Part 27.50(b)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(c)(10)Limit	$\leq 3 \text{ W}$ (34.77 dBm)
Part 27.50(d)(4)Limit	$\leq 1 \text{ W}$ (30 dBm)

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 1.19 \text{ dB}$

Test Results

The measurement is performed for both of horizontal and vertical antenna Polarization, and only the data of worst mode is recorded in this report.

LTE Band 4					
Band width	Channel/Frequency(MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	19957/1710.7	Horizontal	29.04	30	pass
	20175/1732.5	Horizontal	29.25	30	pass
	20393/1754.3	Horizontal	29.52	30	pass
3MHz (QPSK)	19965/1711.5	Horizontal	29.25	30	pass
	20175/1732.5	Horizontal	29.98	30	pass
	20385/1753.5	Horizontal	29.32	30	pass
5MHz (QPSK)	19975/1712.5	Horizontal	29.73	30	pass
	20175/1732.5	Horizontal	29.18	30	pass
	20375/1752.5	Horizontal	29.29	30	pass
10MHz (QPSK)	20000/1715	Horizontal	29.05	30	pass
	20175/1732.5	Horizontal	29.24	30	pass
	20350/1750	Horizontal	29.47	30	pass
15MHz (QPSK)	20025/1717.5	Horizontal	27.28	30	pass
	20175/1732.5	Horizontal	27.80	30	pass
	20325/1747.5	Horizontal	27.93	30	pass
20MHz (QPSK)	20050/1720	Horizontal	26.65	30	pass
	20175/1732.5	Horizontal	26.95	30	pass
	20300/1745	Horizontal	26.06	30	pass
1.4MHz (16QAM)	19957/1710.7	Horizontal	29.72	30	pass
	20175/1732.5	Horizontal	29.94	30	pass
	20393/1754.3	Horizontal	29.21	30	pass
3MHz (16QAM)	19965/1711.5	Horizontal	29.95	30	pass
	20175/1732.5	Horizontal	29.66	30	pass
	20385/1753.5	Horizontal	29.01	30	pass
5MHz (16QAM)	19975/1712.5	Horizontal	29.41	30	pass
	20175/1732.5	Horizontal	29.55	30	pass
	20375/1752.5	Horizontal	29.00	30	pass
10MHz (16QAM)	20000/1715	Horizontal	28.70	30	pass
	20175/1732.5	Horizontal	28.92	30	pass
	20350/1750	Horizontal	29.15	30	pass
15MHz (16QAM)	20025/1717.5	Horizontal	26.97	30	pass
	20175/1732.5	Horizontal	27.50	30	pass
	20325/1747.5	Horizontal	27.62	30	pass
20MHz (16QAM)	20050/1720	Horizontal	26.32	30	pass
	20175/1732.5	Horizontal	26.63	30	pass
	20300/1745	Horizontal	25.75	30	pass

LTE Band 12					
Band width	Channel/Frequency(MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	23017/699.7	Horizontal	25.51	34.7	pass
	23095/707.5	Horizontal	26.10	34.7	pass
	23173/715.3	Horizontal	26.92	34.7	pass
3MHz (QPSK)	23025/700.5	Horizontal	25.50	34.7	pass
	23095/707.5	Horizontal	26.79	34.7	pass
	23165/714.5	Horizontal	27.79	34.7	pass
5MHz (QPSK)	23035/701.5	Horizontal	25.36	34.7	pass
	23095/707.5	Horizontal	26.32	34.7	pass
	23155/713.5	Horizontal	27.30	34.7	pass
10MHz (QPSK)	23060/704	Horizontal	24.70	34.7	pass
	23095/707.5	Horizontal	25.44	34.7	pass
	23130/711	Horizontal	25.97	34.7	pass
1.4MHz (16QAM)	23017/699.7	Horizontal	25.18	34.7	pass
	23095/707.5	Horizontal	25.80	34.7	pass
	23173/715.3	Horizontal	27.60	34.7	pass
3MHz (16QAM)	23025/700.5	Horizontal	25.17	34.7	pass
	23095/707.5	Horizontal	26.45	34.7	pass
	23165/714.5	Horizontal	27.47	34.7	pass
5MHz (16QAM)	23035/701.5	Horizontal	25.07	34.7	pass
	23095/707.5	Horizontal	26.00	34.7	pass
	23155/713.5	Horizontal	26.98	34.7	pass
10MHz (16QAM)	23060/704	Horizontal	24.40	34.7	pass
	23095/707.5	Horizontal	25.10	34.7	pass
	23130/711	Horizontal	25.66	34.7	pass



LTE Band 13					
Band width	Channel/Frequency(MHz)	Polarization	EIRP (dBm)	Limit (dBm)	Conclusion
5MHz(QPSK)	23205/779.5	Horizontal	27.00	34.7	pass
	23230/782	Horizontal	26.97	34.7	pass
	23255/784.5	Horizontal	27.00	34.7	pass
10MHz(QPSK)	23230/782	Horizontal	26.86	34.7	pass
5MHz(16QAM)	23035/701.5	Horizontal	26.99	34.7	pass
	23095/707.5	Horizontal	26.96	34.7	pass
	23155/713.5	Horizontal	27.17	34.7	pass
10MHz(16QAM)	23230/782	Horizontal	26.55	34.7	pass

Note:1. EIRP= E.R.P+2.15

5.3 Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

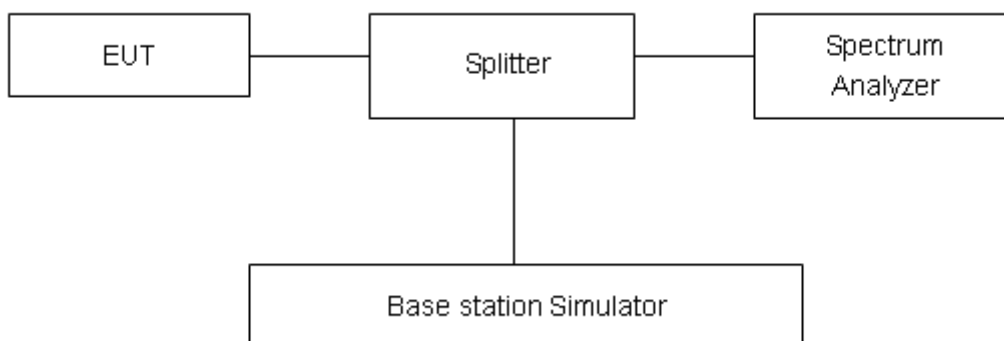
Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to 51 kHz, VBW is set to 160 kHz for LTE Band 4/12/13 .

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=624\text{Hz}$.

Test Result

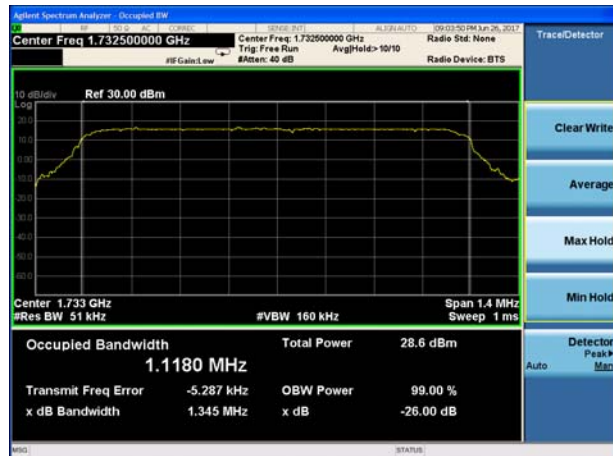
Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
Band4	1.4MHz	QPSK	20175/1732.5	1.1180	1.345
		16QAM	20175/1732.5	0.93883	1.215
	3MHz	QPSK	20175/1732.5	1.15040	1.655
		16QAM	20175/1732.5	0.98073	1.337
	5MHz	QPSK	20175/1732.5	1.13010	1.472
		16QAM	20175/1732.5	1.0162	1.496
	10MHz	QPSK	20175/1732.5	1.1840	1.796
		16QAM	20175/1732.5	1.0660	1.795
	15MHz	QPSK	20175/1732.5	1.1955	1.894
		16QAM	20175/1732.5	1.0578	1.889
	20MHz	QPSK	20175/1732.5	1.2079	1.782
		16QAM	20175/1732.5	1.1125	1.862

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
Band12	1.4MHz	QPSK	23095/707.5	1.1082	1.332
		16QAM	23095/707.5	0.93878	1.195
	3MHz	QPSK	23095/707.5	1.1525	1.66
		16QAM	23095/707.5	0.98517	1.343
	5MHz	QPSK	23095/707.5	1.1445	1.506
		16QAM	23095/707.5	0.97604	1.423
	10MHz	QPSK	23095/707.5	1.2051	1.738
		16QAM	23095/707.5	1.0835	1.731

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
Band13	5MHz	QPSK	23230/782	1.149	1.481
		16QAM	23230/782	0.97695	1.356
	10MHz	QPSK	23230/782	1.1775	1.721
		16QAM	23230/782	1.0331	1.537



LTE Band 4 QPSK 1.4MHz CH-Middle



LTE Band 4 16QAM 1.4MHz CH-Middle



LTE Band 4 QPSK 3MHz CH-Middle



LTE Band 4 16QAM 3MHz CH-Middle



LTE Band 4 QPSK 5MHz CH-Middle



LTE Band 4 16QAM 5MHz CH-Middle





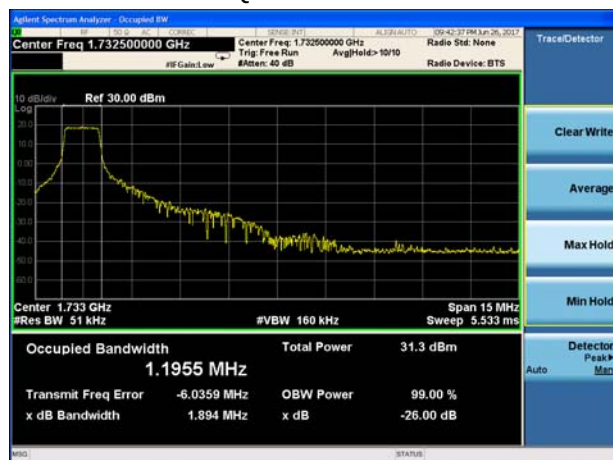
LTE Band 4 QPSK 10MHz CH-Middle



LTE Band 4 16QAM 10MHz CH-Middle



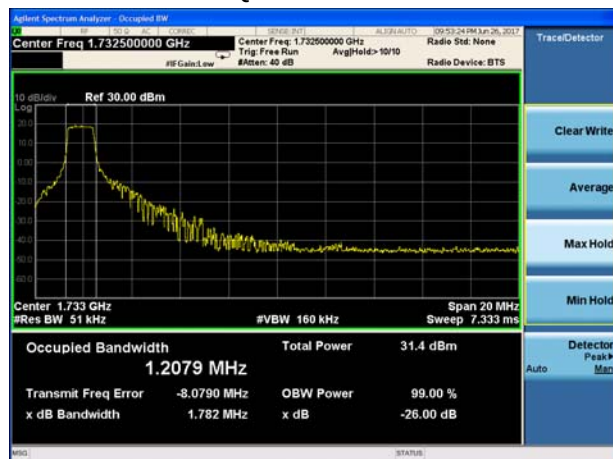
LTE Band 4 QPSK 15MHz CH-Middle



LTE Band 4 16QAM 15MHz CH-Middle



LTE Band 4 QPSK 20MHz CH-Middle

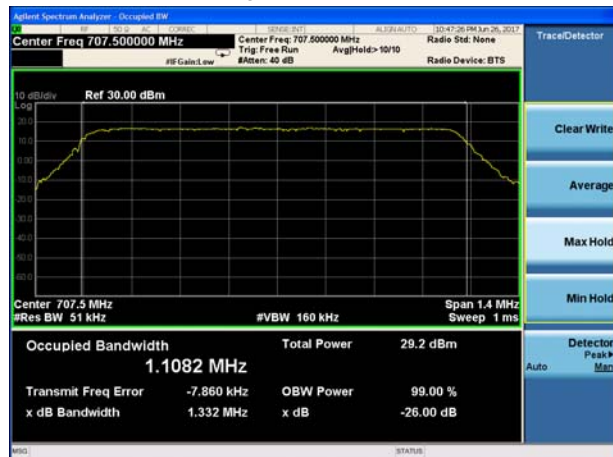


LTE Band 4 16QAM 20MHz CH-Middle





LTE Band 12 QPSK 1.4MHz CH-Middle



LTE Band 12 16QAM 1.4MHz CH-Middle



LTE Band 12 QPSK 3MHz CH-Middle



LTE Band 12 16QAM 3MHz CH-Middle



LTE Band 12 QPSK 5MHz CH-Middle



LTE Band 12 16QAM 5MHz CH-Middle





LTE Band 12 QPSK 10MHz CH-Middle



LTE Band 12 16QAM 10MHz CH-Middle



LTE Band 13 QPSK 5MHz CH-Middle



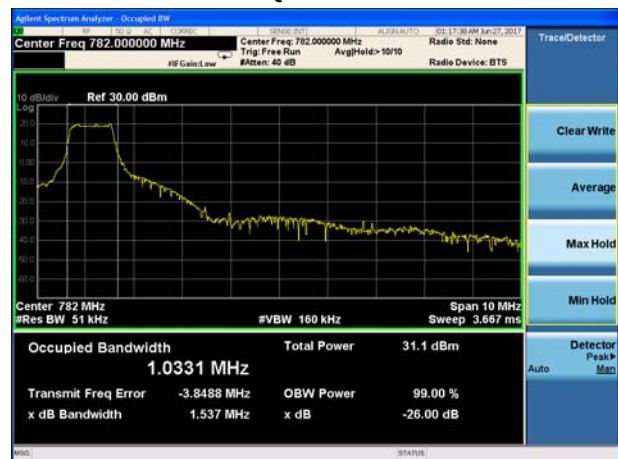
LTE Band 13 16QAM 5MHz CH-Middle



LTE Band 13 QPSK 10MHz CH-Middle



LTE Band 13 16QAM 10MHz CH-Middle



5.4 Band Edge Compliance

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured.

The testing follows KDB 971168 D01 v03r01 Section 6.0

The EUT was connected to spectrum analyzer and system simulator via a power divider.

The band edges of low and high channels for the highest RF powers were measured.

RBW is set to 51 kHz, VBW is set to 160 kHz for LTE Band 4/12.

RBW is set to 200 kHz, VBW is set to 3x RBW for LTE Band 13 (777MHz~788MHz).

RBW is set to 100 kHz, VBW is set to 3x RBW for LTE Band 13 (788MHz~793MHz).

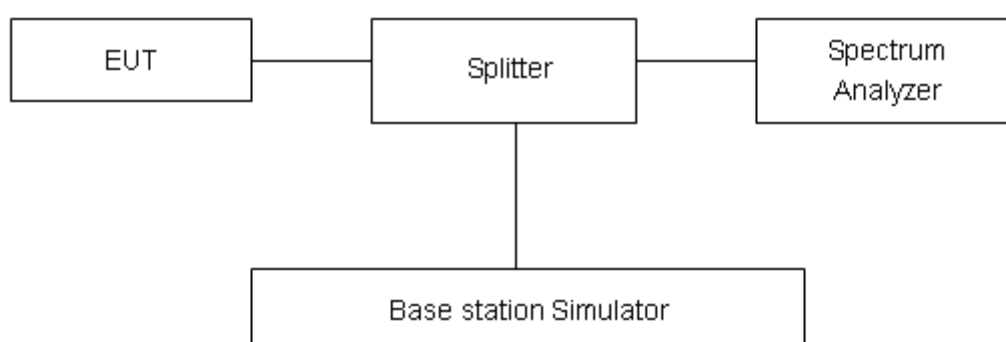
on spectrum analyzer.

Set spectrum analyzer with RMS detector.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Checked that all the results comply with the emission limit line.

Test Setup



Limits

Rule Part 27.53(h) specifies that “ 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”

Rule Part 27.53(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Rule Part 27.53(m) (4)/ specifies that “for BRS and EBS stations. For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(4) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Example:

The limit line is derived from $43 + 10 \log (P)$ dB below the transmitter power P(Watts)

= $P(W) - [43 + 10 \log(P)]$ (dB)

= $[30 + 10 \log (P)]$ (dBm) - $[43 + 10 \log(P)]$ (dB) = -13dBm.

Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Rule Part 27.53 (c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;
- (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB;



- (3) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $76 + 10 \log$ (P) dB in a 6.25 kHz band segment, for base and fixed stations;
- (4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than $65 + 10 \log$ (P) dB in a 6.25 kHz band segment, for mobile and portable stations;
- (5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

Measurement Uncertainty

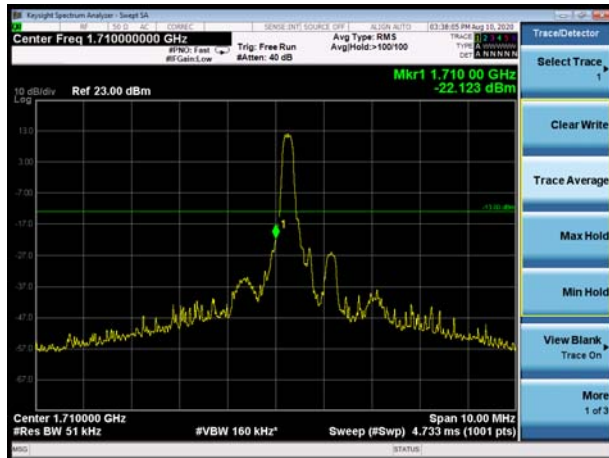
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=0.684\text{dB}$.

Test Result

All the test traces in the plots shows the test results clearly.

Variant

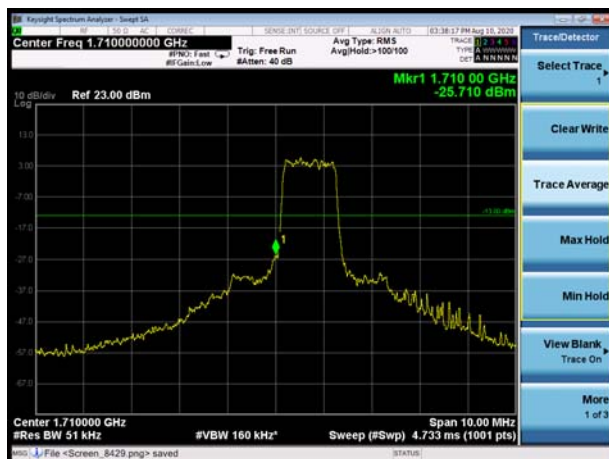
LTE Band 4 QPSK 1.4MHz CH-Low, 1 RB



LTE Band 4 QPSK 1.4MHz CH-High, 1 RB



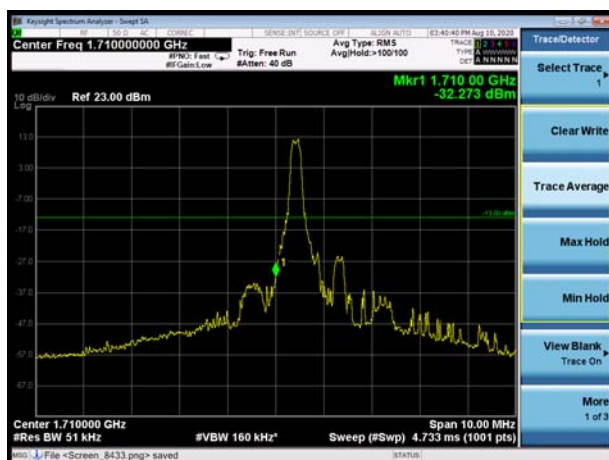
LTE Band 4 QPSK 1.4MHz CH-Low, 100%RB



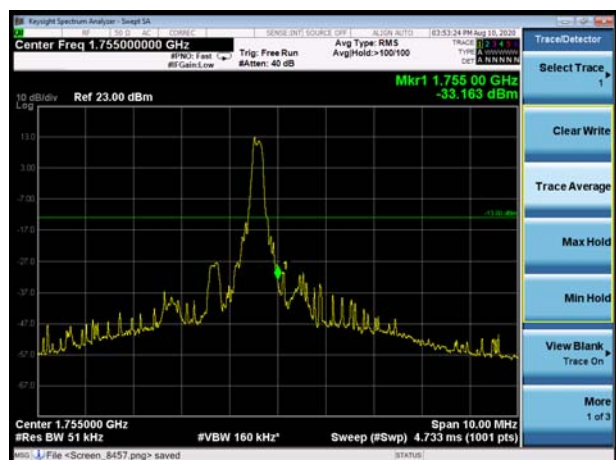
LTE Band 4 QPSK 1.4MHz CH-High, 100%RB



LTE Band 4 QPSK 3MHz CH-Low, 1 RB



LTE Band 4 QPSK 3MHz CH-High, 1 RB





LTE Band 4 QPSK 3MHz CH-Low, 100%RB



LTE Band 4 QPSK 3MHz CH-High, 100%RB



LTE Band 4 QPSK 5MHz CH-Low, 1 RB



LTE Band 4 QPSK 5MHz CH-High, 1 RB



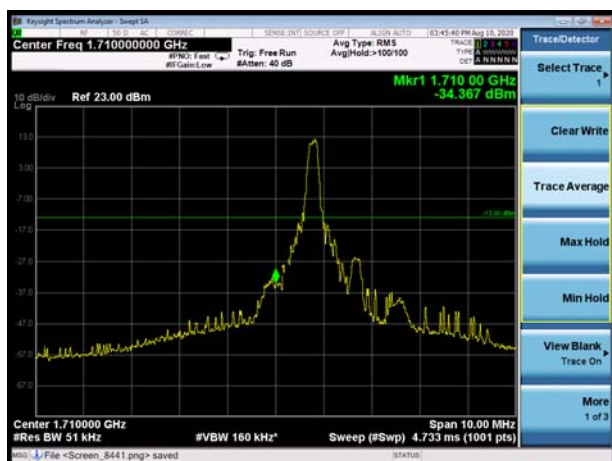
LTE Band 4 QPSK 5MHz CH-Low, 100%RB



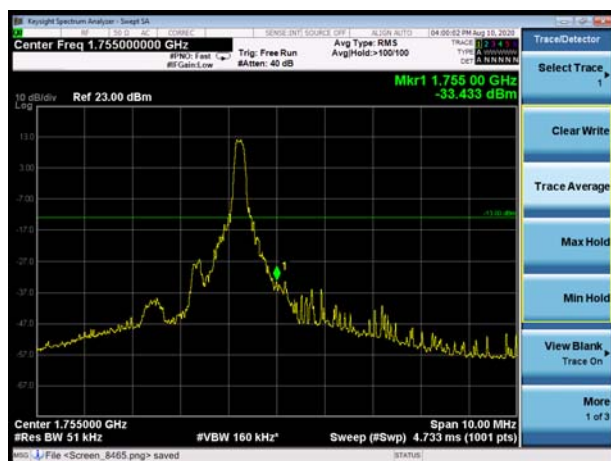
LTE Band 4 QPSK 5MHz CH-High, 100%RB



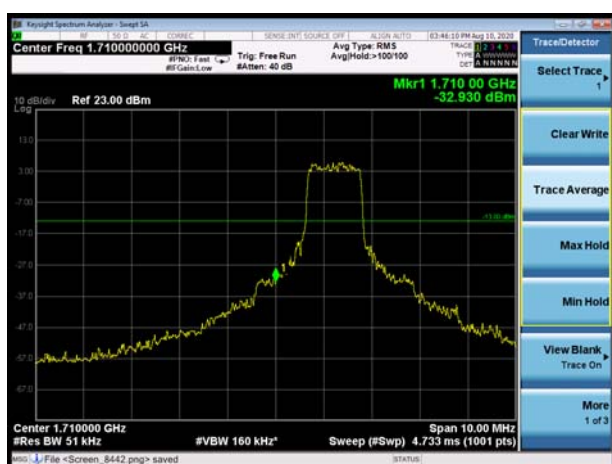
LTE Band 4 QPSK 10MHz CH-Low, 1 RB



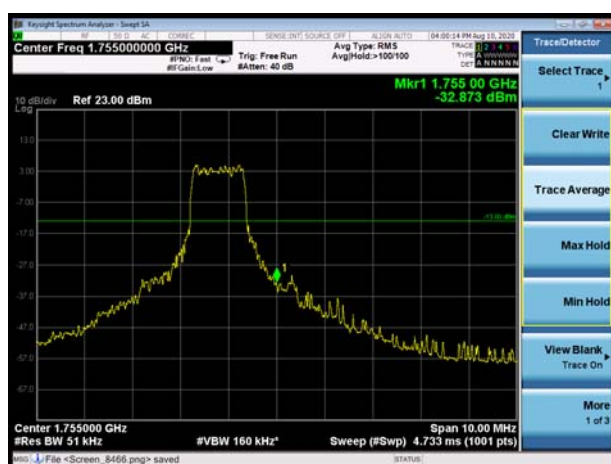
LTE Band 4 QPSK 10MHz CH-High, 1 RB



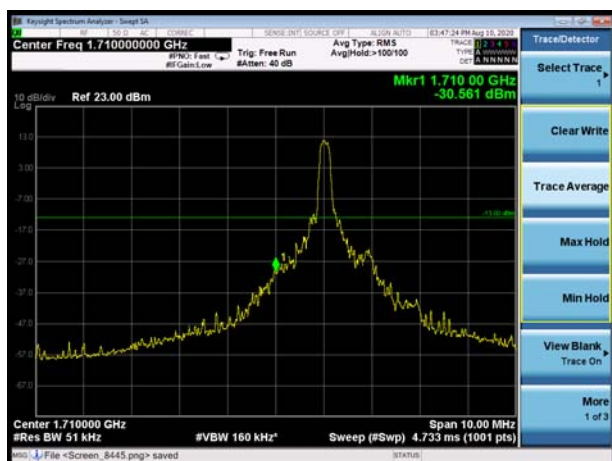
LTE Band 4 QPSK 10MHz CH-Low, 100%RB



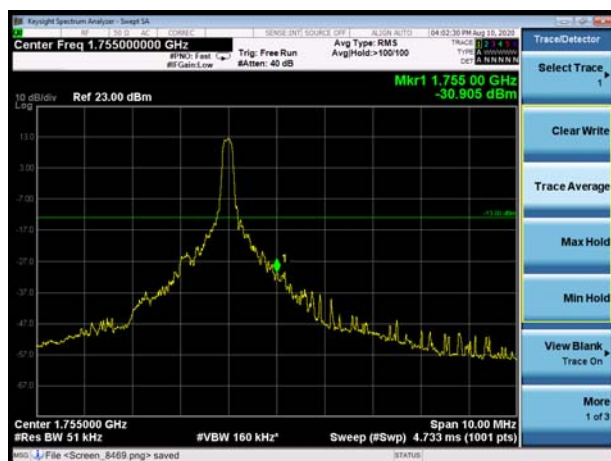
LTE Band 4 QPSK 10MHz CH-High, 100%RB



LTE Band 4 QPSK 15MHz CH-Low, 1 RB



LTE Band 4 QPSK 15MHz CH-High, 1 RB

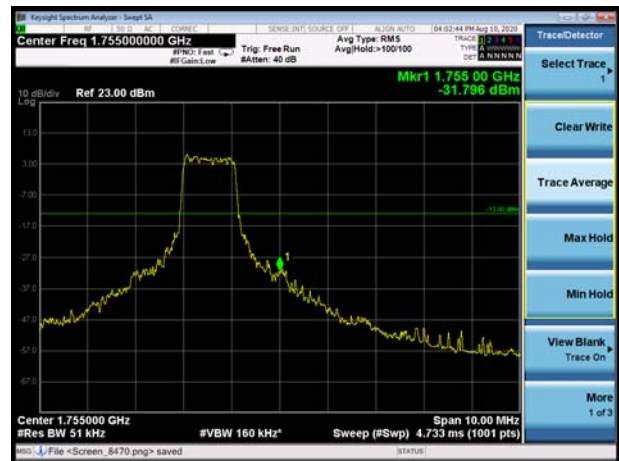




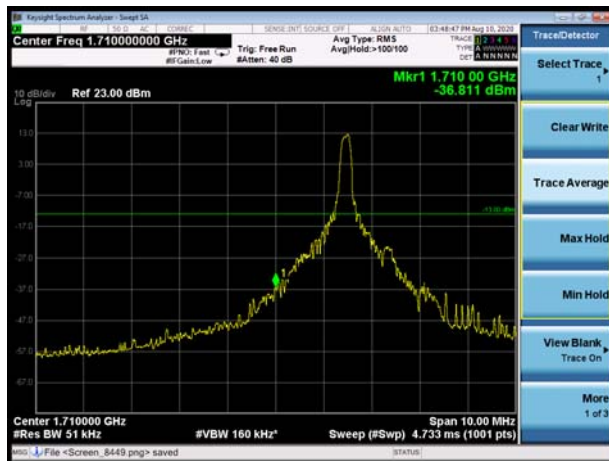
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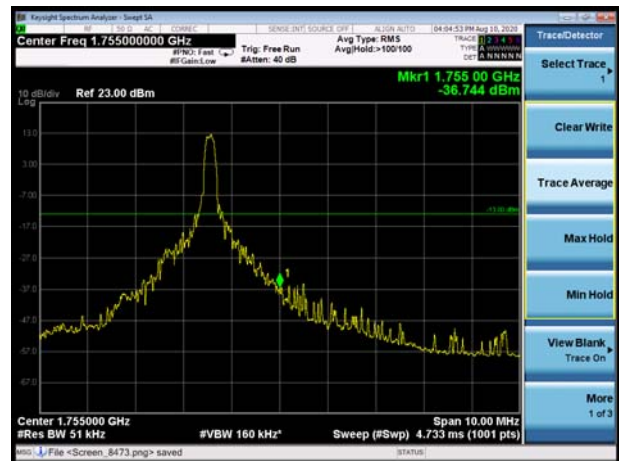
LTE Band 4 QPSK 15MHz CH-High, 100%RB



LTE Band 4 QPSK 20MHz CH-Low, 1 RB



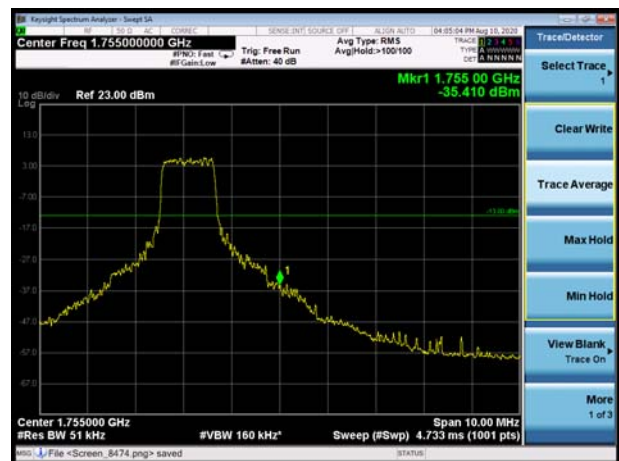
LTE Band 4 QPSK 20MHz CH-High, 1 RB



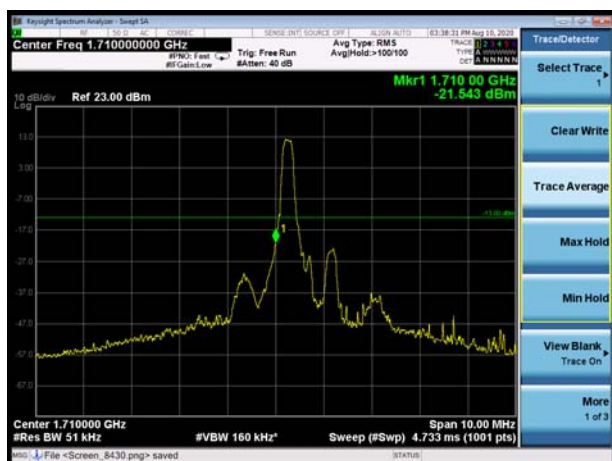
LTE Band 4 QPSK 20MHz CH-Low, 100%RB



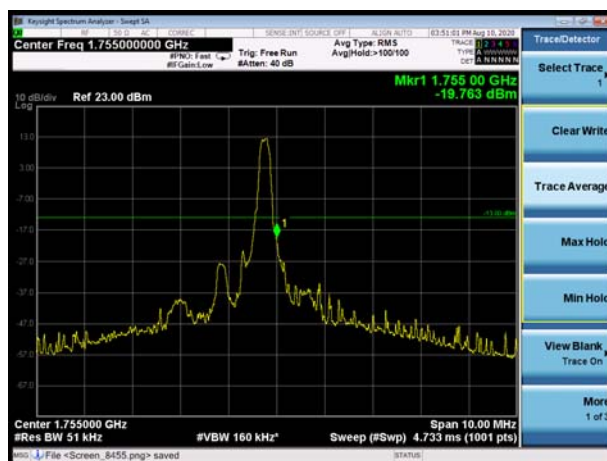
LTE Band 4 QPSK 20MHz CH-High, 100%RB



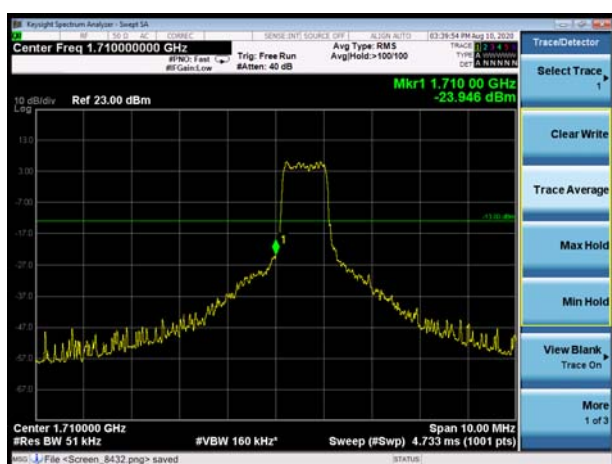
LTE Band 4 16QAM 1.4MHz CH-Low, 1 RB



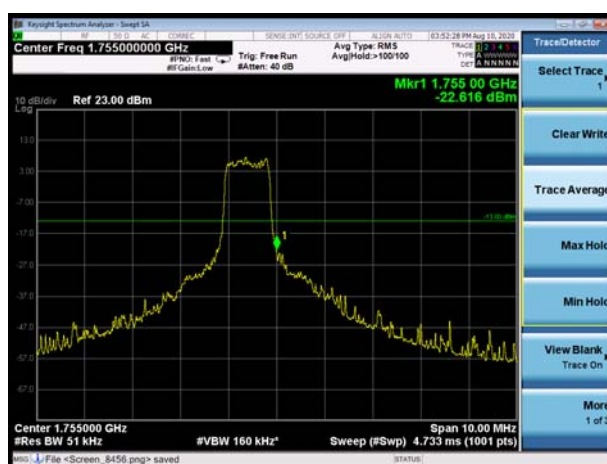
LTE Band 4 16QAM 1.4MHz CH-High, 1 RB



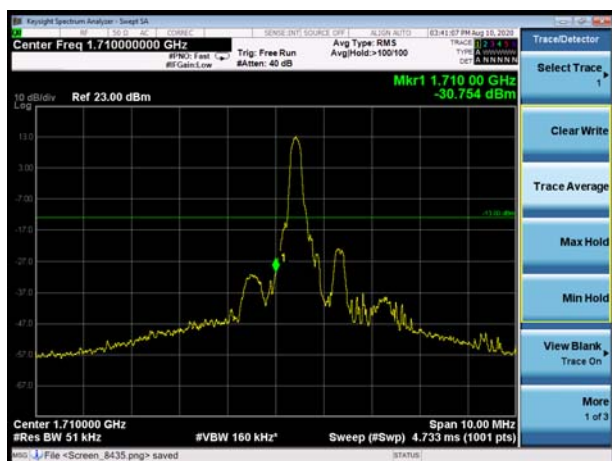
LTE Band 4 16QAM 1.4MHz CH-Low, 100%RB



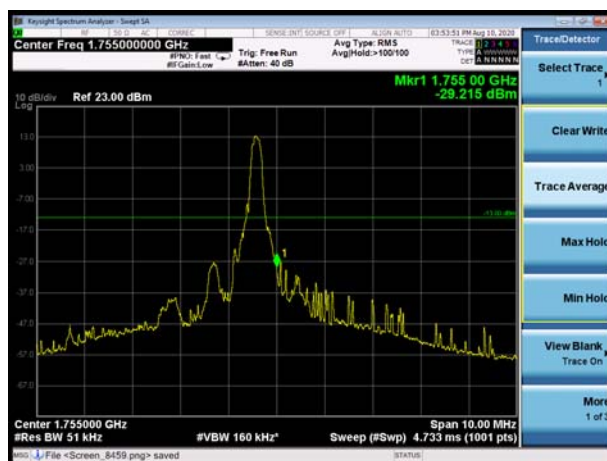
LTE Band 4 16QAM 1.4MHz CH-High, 100%RB



LTE Band 4 16QAM 3MHz CH-Low, 1 RB



LTE Band 4 16QAM 3MHz CH-High, 1 RB

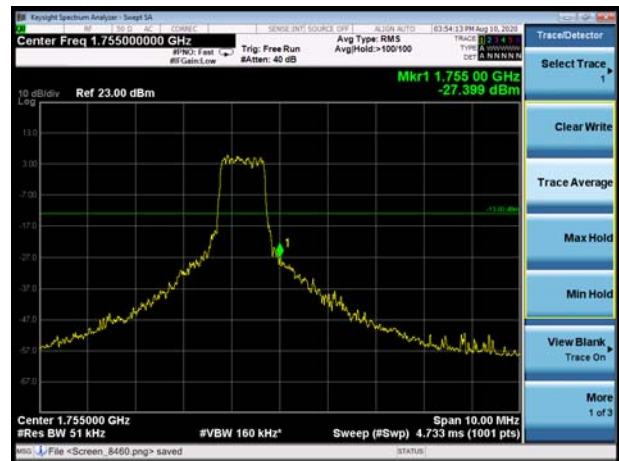




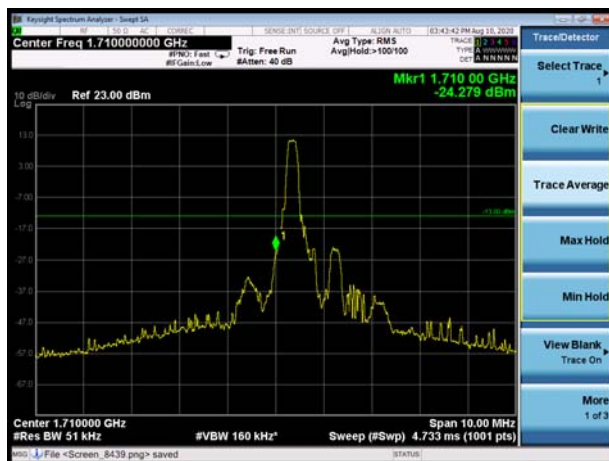
LTE Band 4 16QAM 3MHz CH-Low, 100%RB



LTE Band 4 16QAM 3MHz CH-High, 100%RB



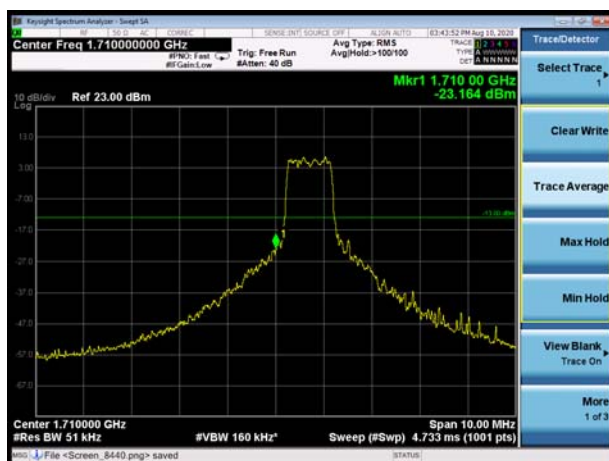
LTE Band 4 16QAM 5MHz CH-Low, 1 RB



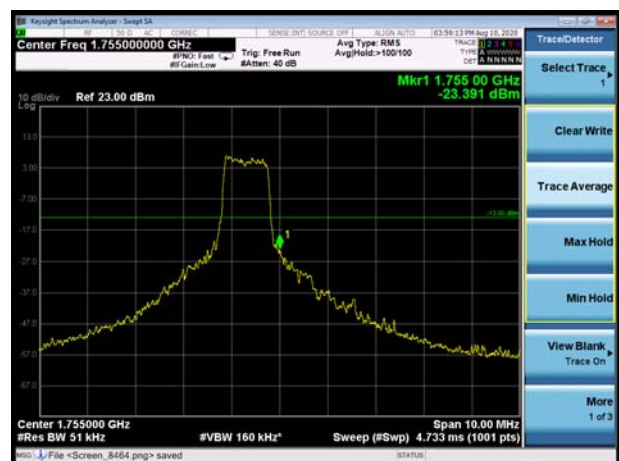
LTE Band 4 16QAM 5MHz CH-High, 1 RB



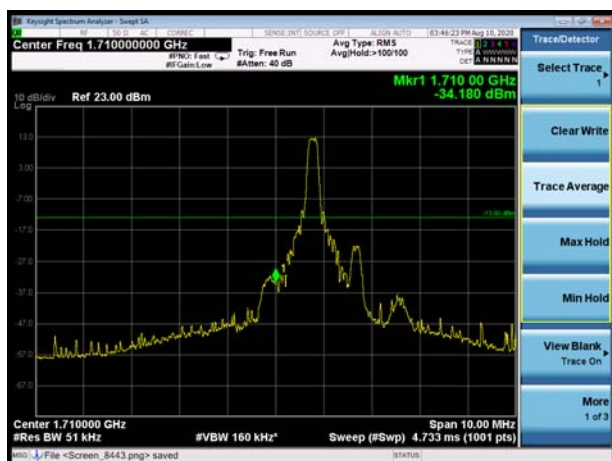
LTE Band 4 16QAM 5MHz CH-Low, 100%RB



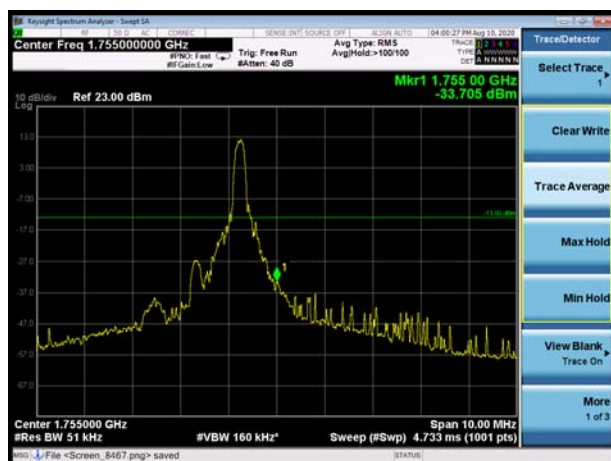
LTE Band 4 16QAM 5MHz CH-High, 100%RB



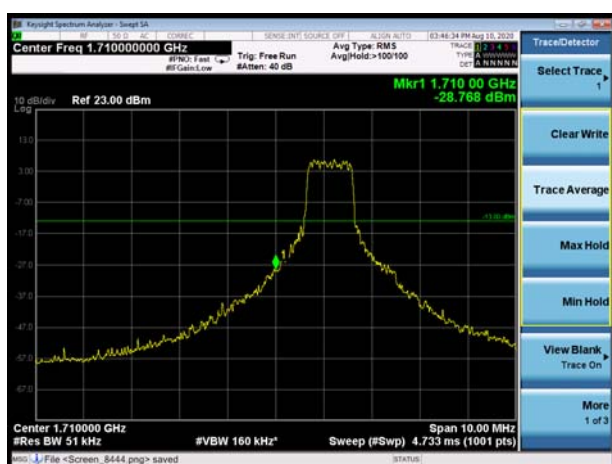
LTE Band 4 16QAM 10MHz CH-Low, 1 RB



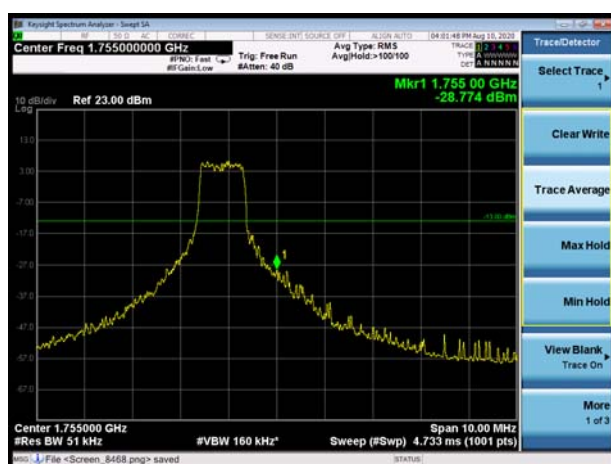
LTE Band 4 16QAM 10MHz CH-High, 1 RB



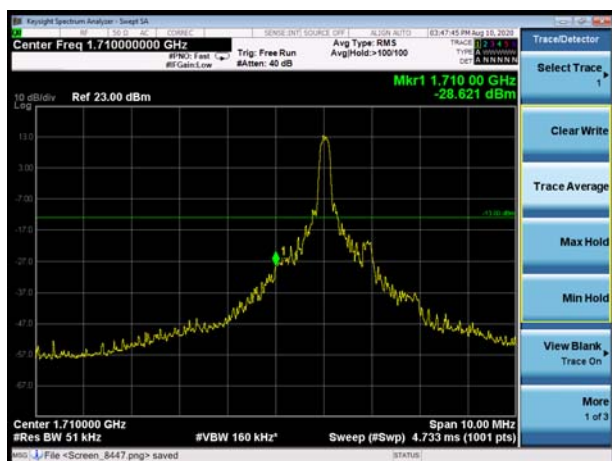
LTE Band 4 16QAM 10MHz CH-Low, 100%RB



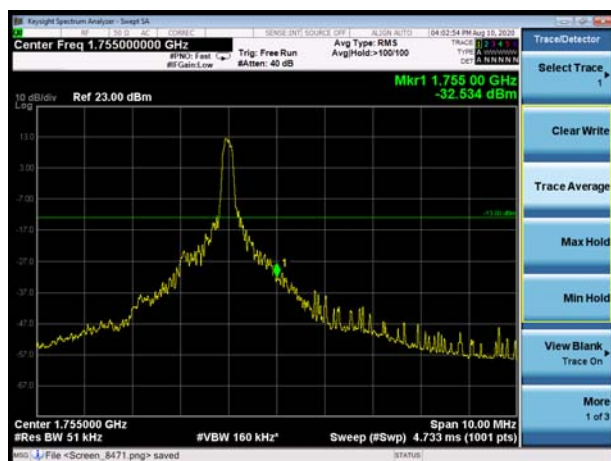
LTE Band 4 16QAM 10MHz CH-High, 100%RB



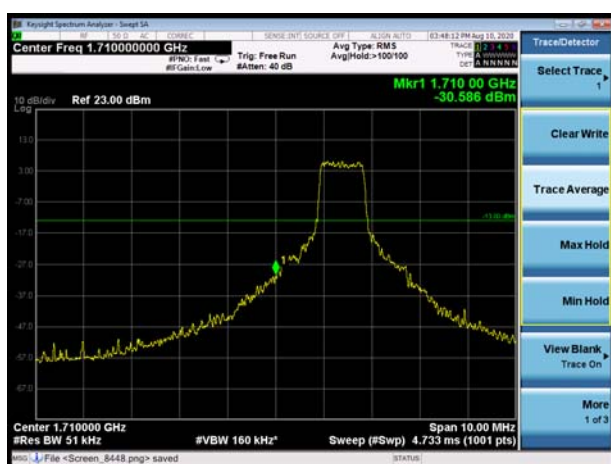
LTE Band 4 16QAM 15MHz CH-Low, 1 RB



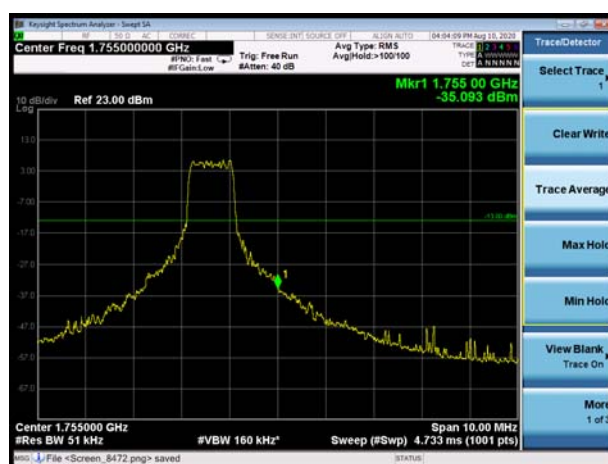
LTE Band 4 16QAM 15MHz CH-High, 1 RB



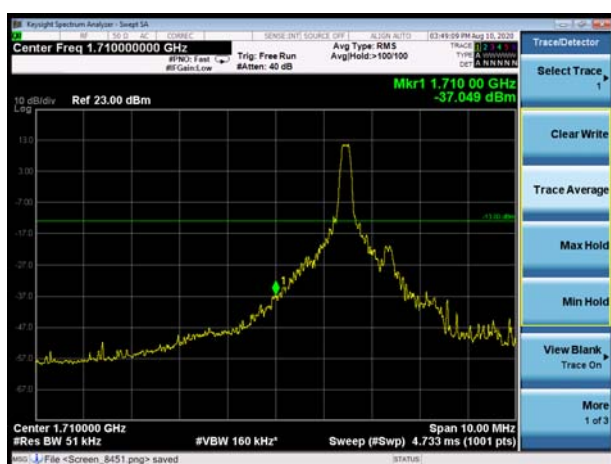
LTE Band 4 16QAM 15MHz CH-Low, 100%RB



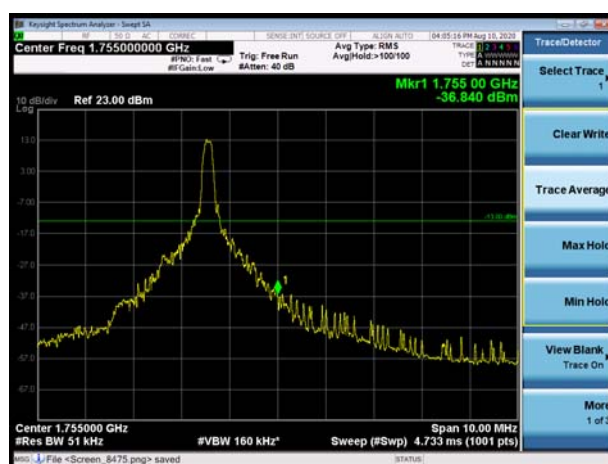
LTE Band 4 16QAM 15MHz CH-High, 100%RB



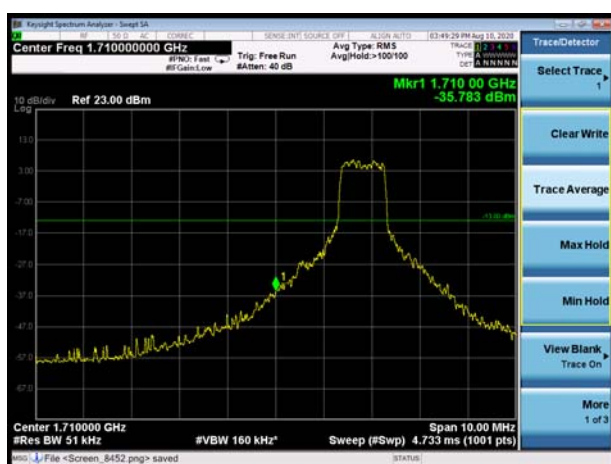
LTE Band 4 16QAM 20MHz CH-Low, 1 RB



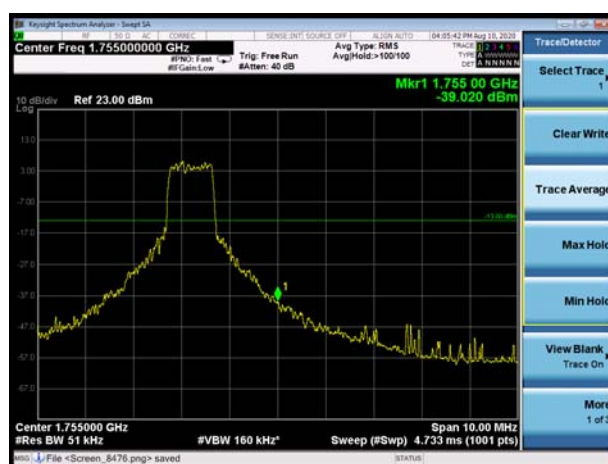
LTE Band 4 16QAM 20MHz CH-High, 1 RB



LTE Band 4 16QAM 20MHz CH-Low, 100%RB

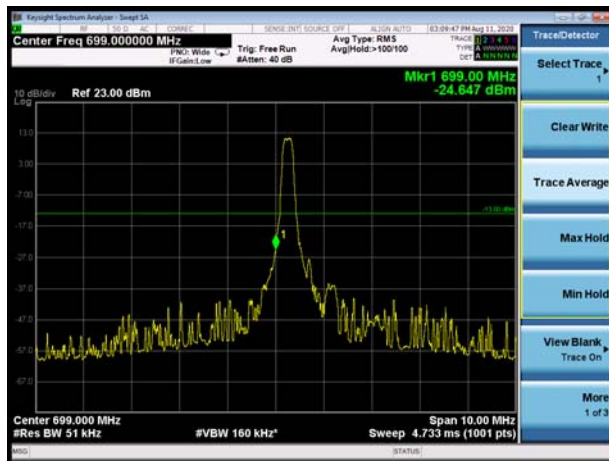


LTE Band 4 16QAM 20MHz CH-High, 100%RB

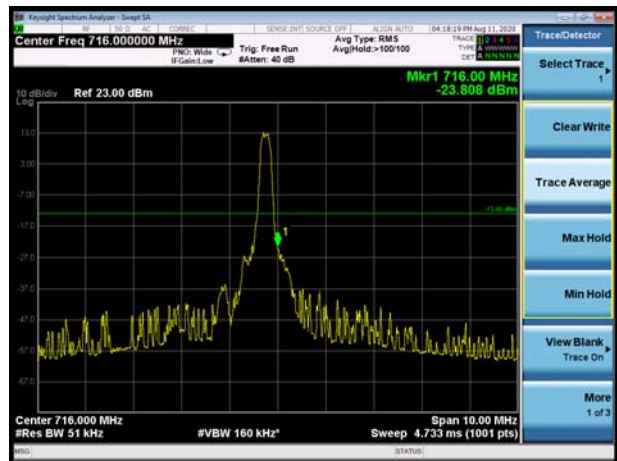




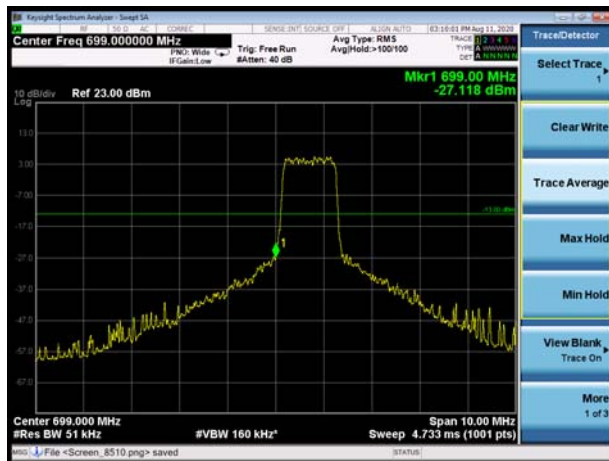
LTE Band 12 QPSK 1.4MHz CH-Low, 1 RB



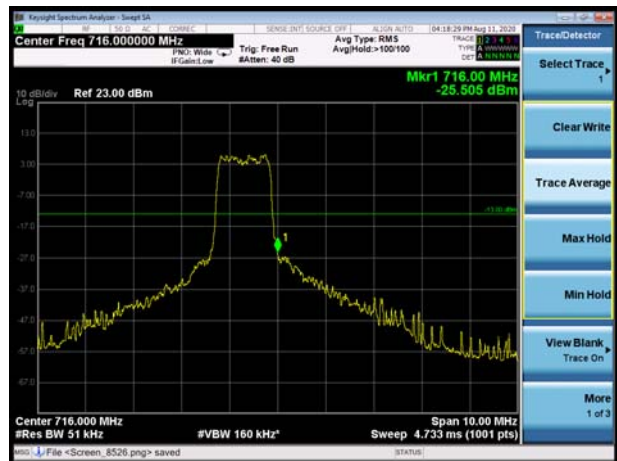
LTE Band 12 QPSK 1.4MHz CH-High, 1 RB



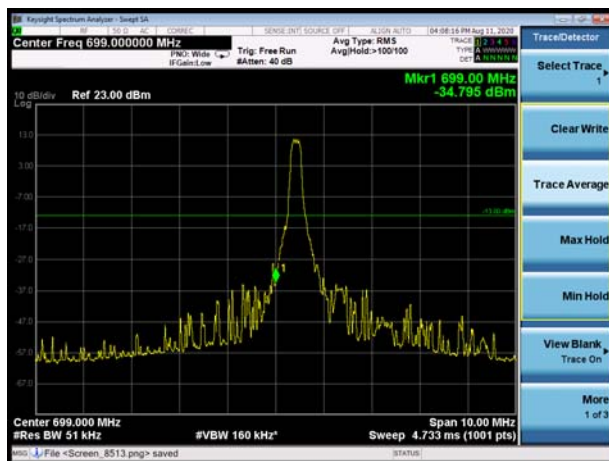
LTE Band 12 QPSK 1.4MHz CH-Low, 100%RB



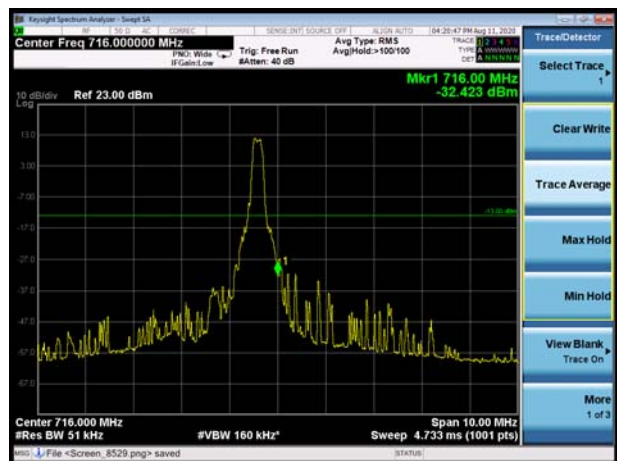
LTE Band 12 QPSK 1.4MHz CH-High, 100%RB



LTE Band 12 QPSK 3MHz CH-Low, 1 RB

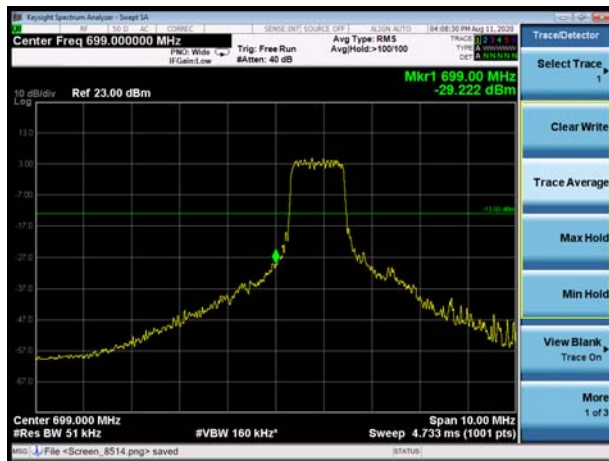


LTE Band 12 QPSK 3MHz CH-High, 1 RB

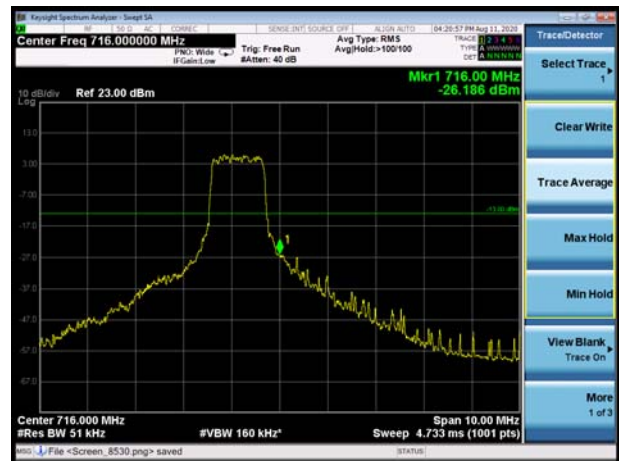




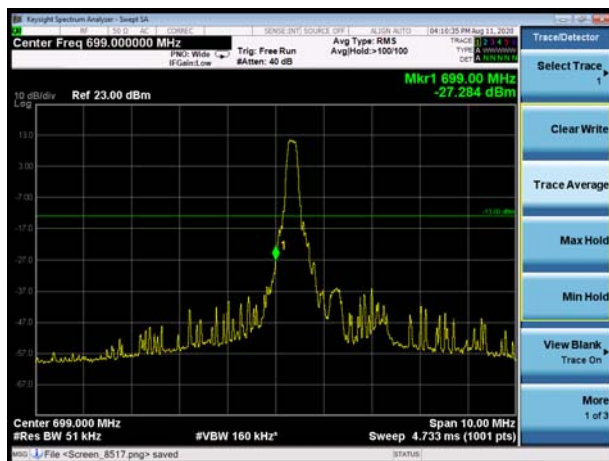
LTE Band 12 QPSK 3MHz CH-Low, 100%RB



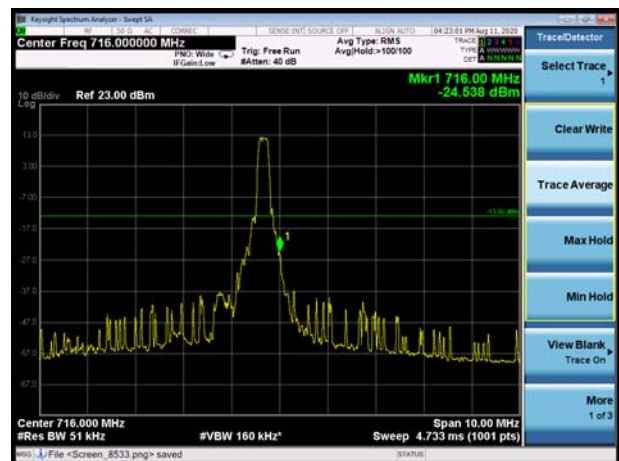
LTE Band 12 QPSK 3MHz CH-High, 100%RB



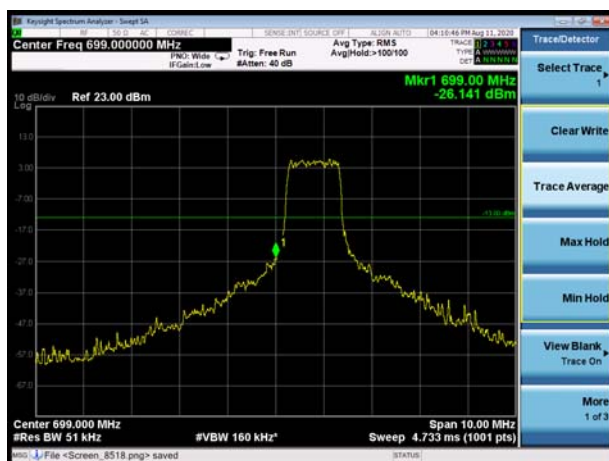
LTE Band 12 QPSK 5MHz CH-Low, 1 RB



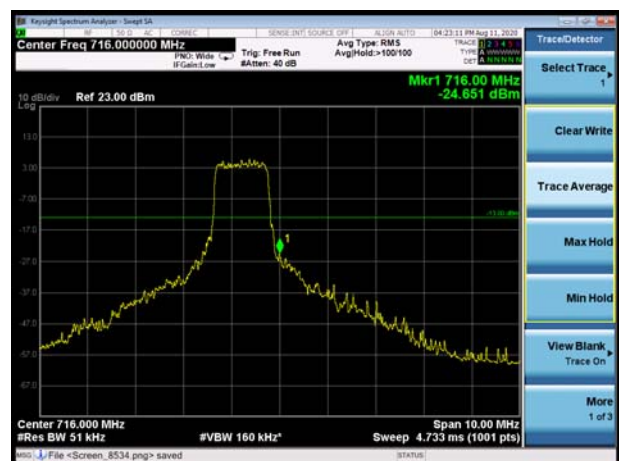
LTE Band 12 QPSK 5MHz CH-High, 1 RB



LTE Band 12 QPSK 5MHz CH-Low, 100%RB

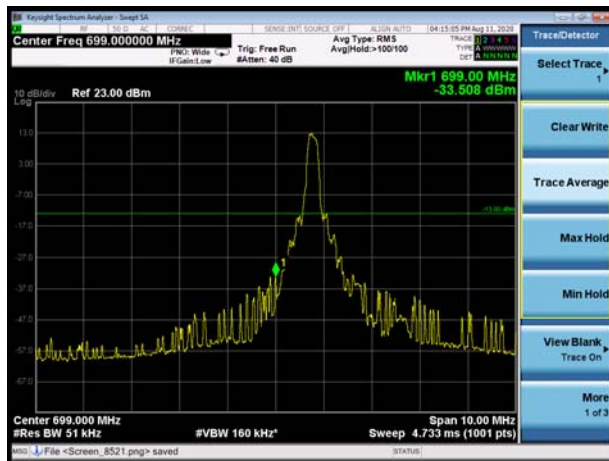


LTE Band 12 QPSK 5MHz CH-High, 100%RB

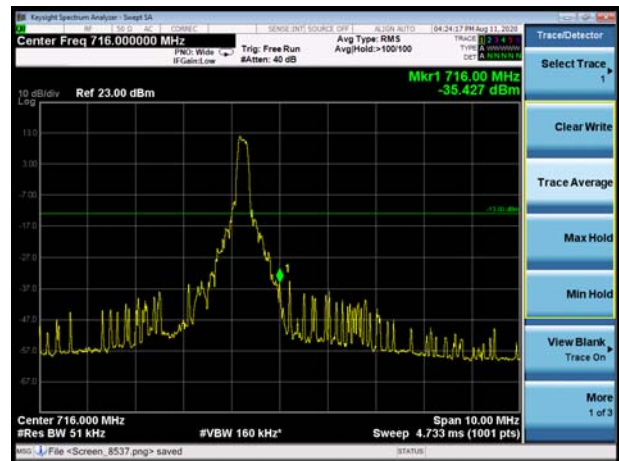




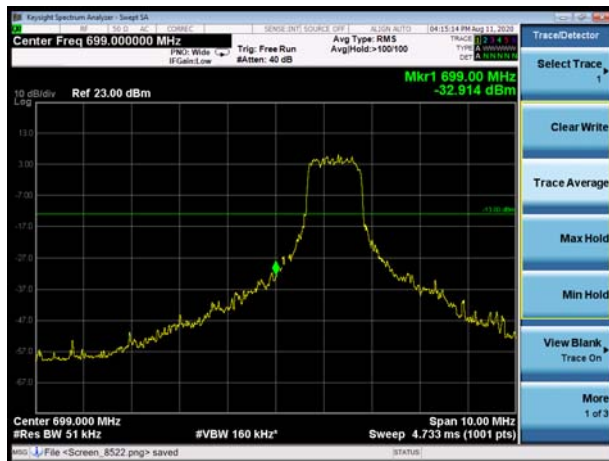
LTE Band 12 QPSK 10MHz CH-Low, 1 RB



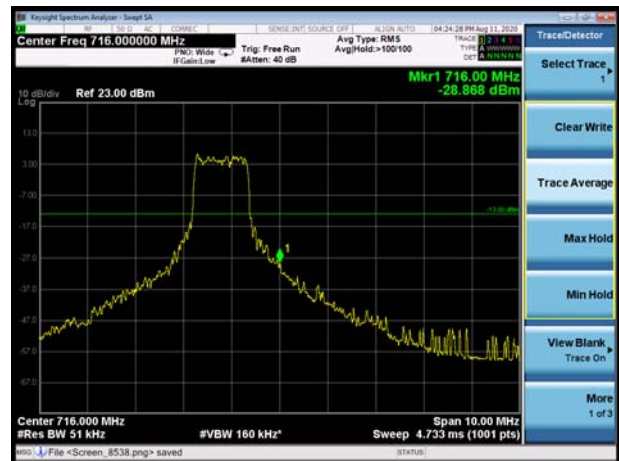
LTE Band 12 QPSK 10MHz CH-High, 1 RB



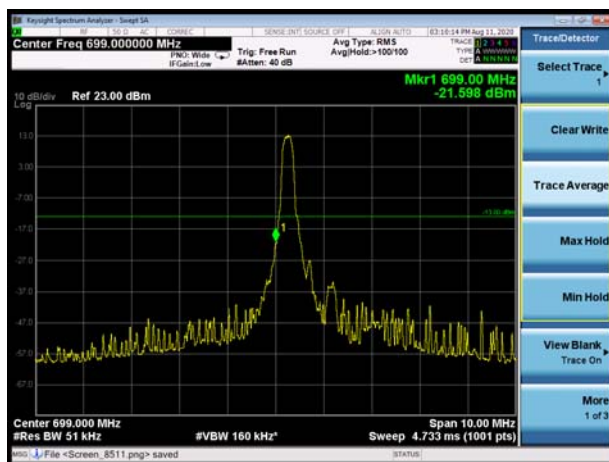
LTE Band 12 QPSK 10MHz CH-Low, 100%RB



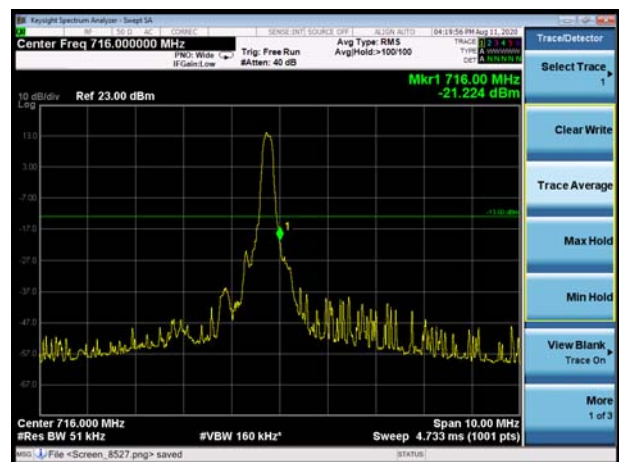
LTE Band 12 QPSK 10MHz CH-High, 100%RB



LTE Band 12 16QAM 1.4MHz CH-Low, 1 RB

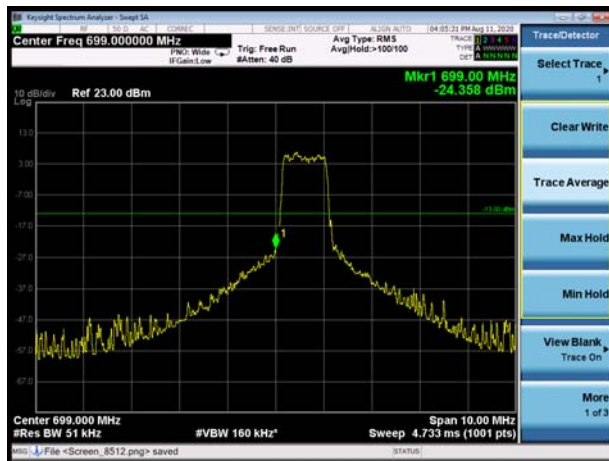


LTE Band 12 16QAM 1.4MHz CH-High, 1 RB

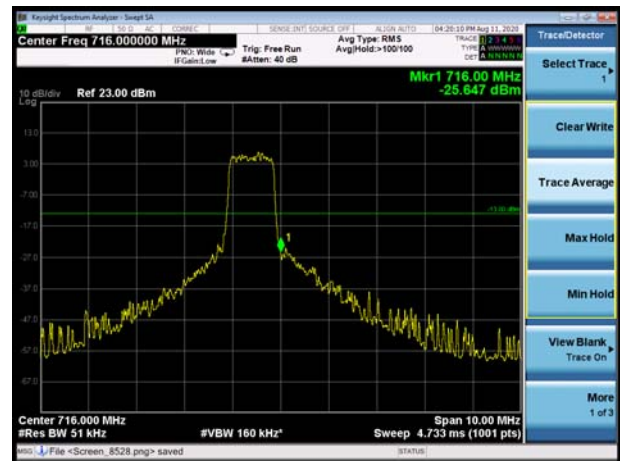




LTE Band 12 16QAM 1.4MHz CH-Low, 100%RB



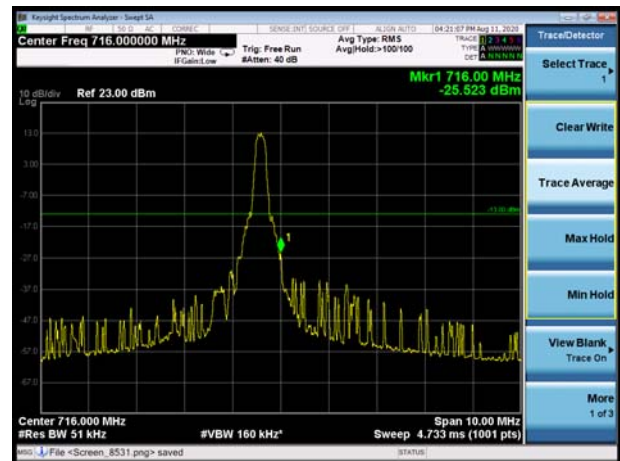
LTE Band 12 16QAM 1.4MHz CH-High, 100%RB



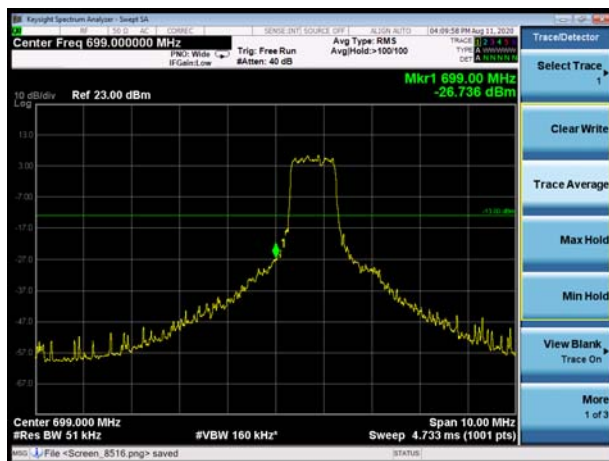
LTE Band 12 16QAM 3MHz CH-Low, 1 RB



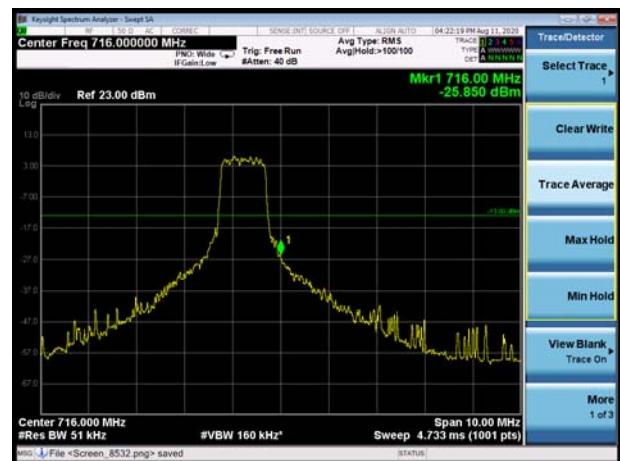
LTE Band 12 16QAM 3MHz CH-High, 1 RB



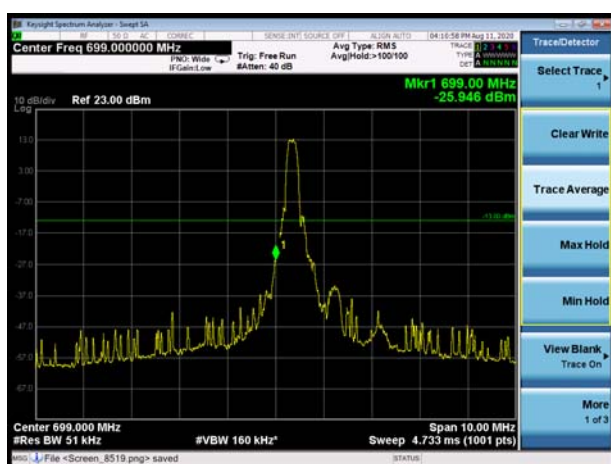
LTE Band 12 16QAM 3MHz CH-Low, 100%RB



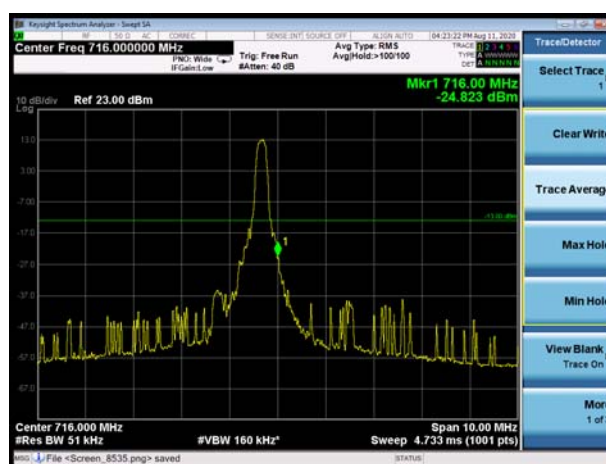
LTE Band 12 16QAM 3MHz CH-High, 100%RB



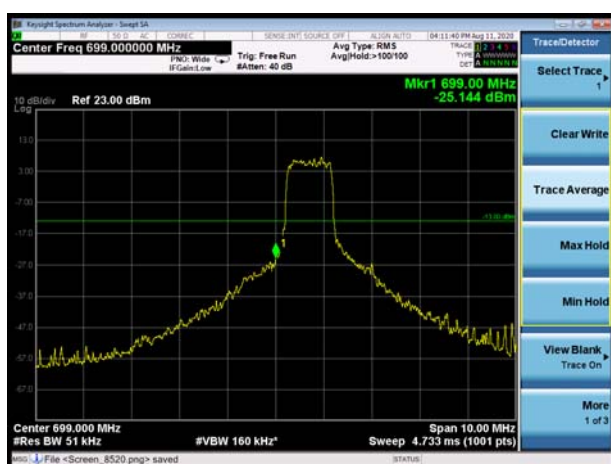
LTE Band 12 16QAM 5MHz CH-Low, 1 RB



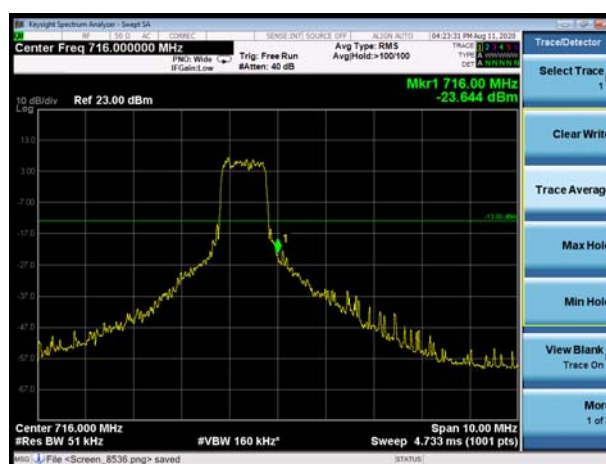
LTE Band 12 16QAM 5MHz CH-High, 1 RB



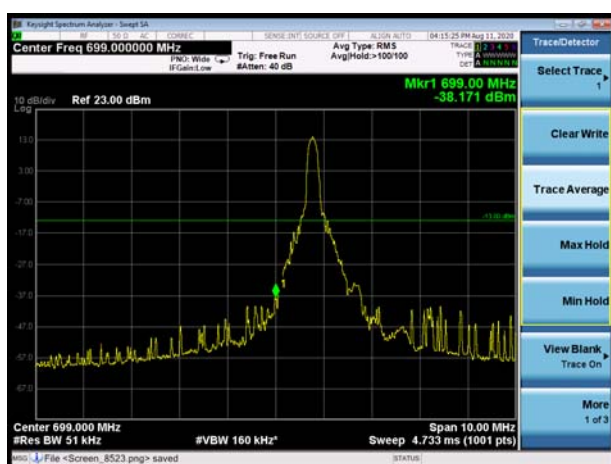
LTE Band 12 16QAM 5MHz CH-Low, 100%RB



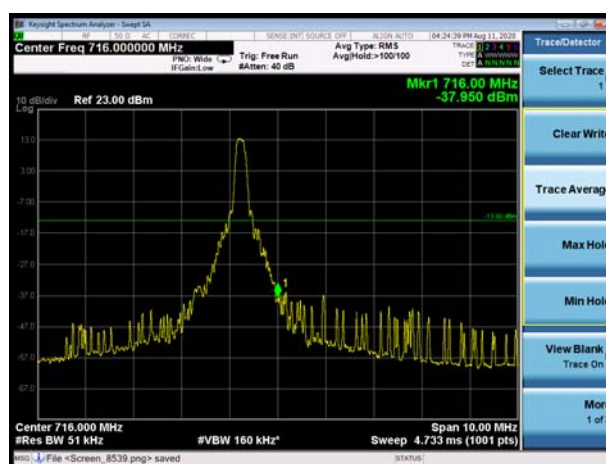
LTE Band 12 16QAM 5MHz CH-High, 100%RB



LTE Band 12 16QAM 10MHz CH-Low, 1 RB

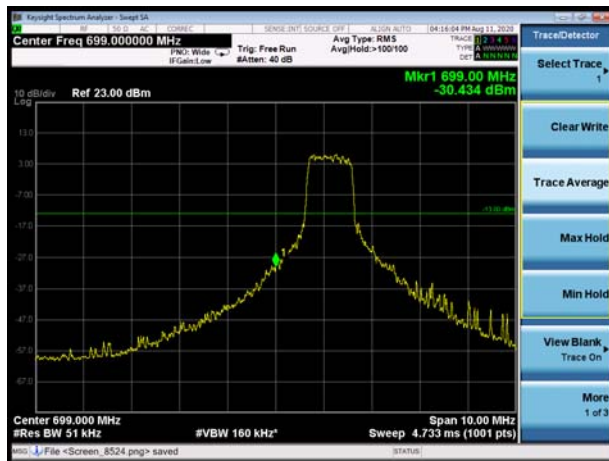


LTE Band 12 16QAM 10MHz CH-High, 1 RB

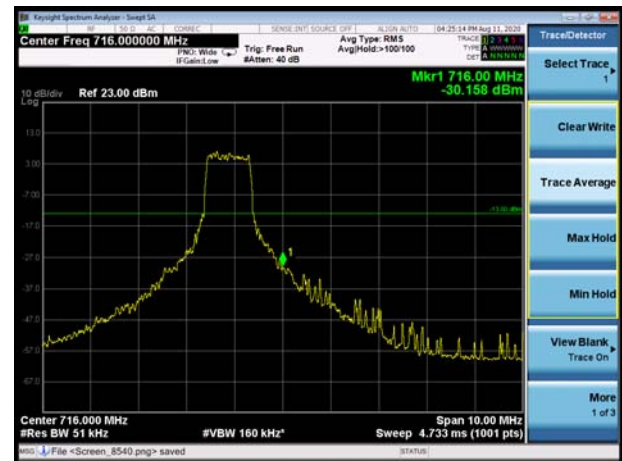




LTE Band 12 16QAM 10MHz CH-Low, 100%RB



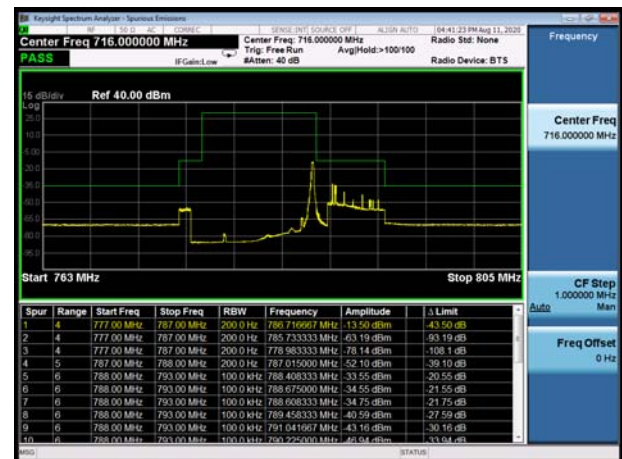
LTE Band 12 16QAM 10MHz CH-High, 100%RB



LTE Band 13 QPSK 5MHz CH-Low, 1 RB



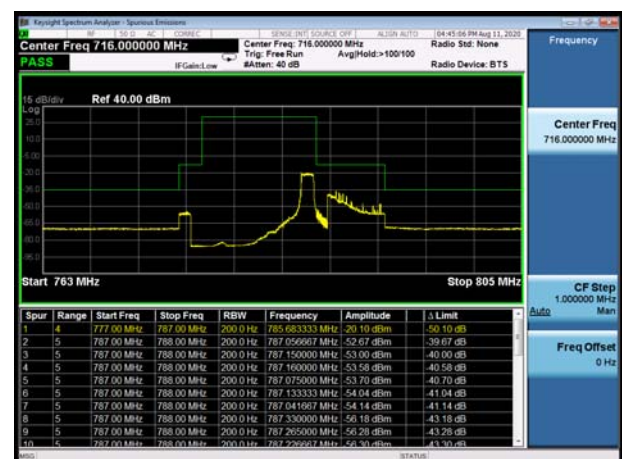
LTE Band 13 QPSK 5MHz CH-High, 1 RB



LTE Band 13 QPSK 5MHz CH-Low, 100%RB



LTE Band 13 QPSK 5MHz CH-High, 100%RB

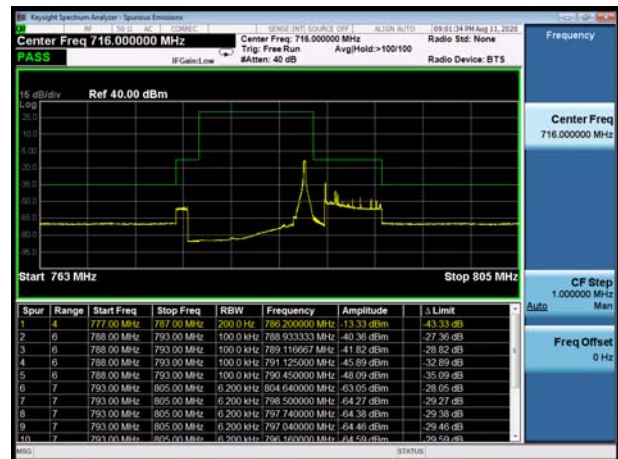




LTE Band 13 QPSK 10MHz CH-Low, 1 RB



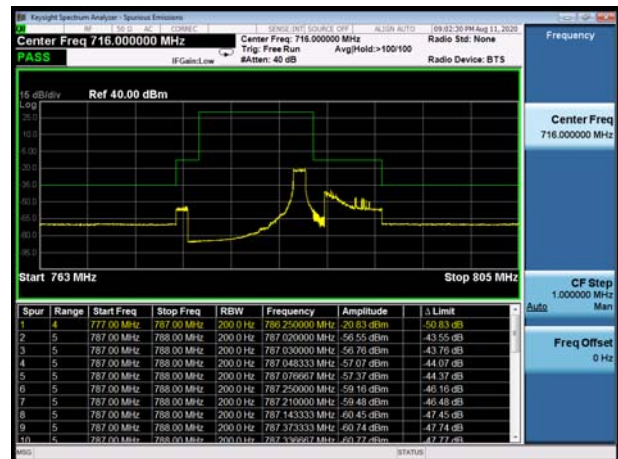
LTE Band 13 QPSK 10MHz CH-High, 1 RB



LTE Band 13 QPSK 10MHz CH-Low, 100%RB



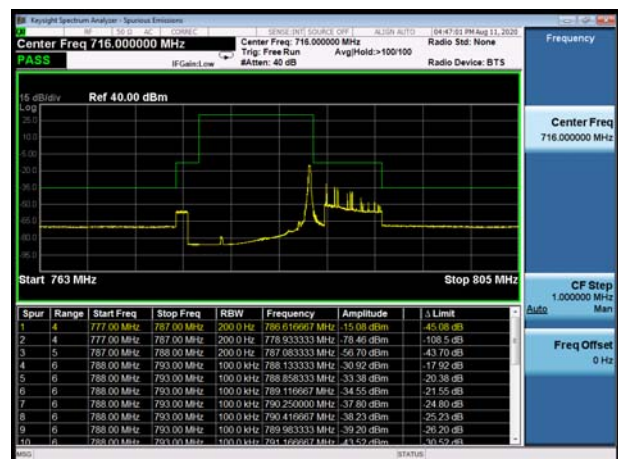
LTE Band 13 QPSK 10MHz CH-High, 100%RB



LTE Band 13 16QAM 5MHz CH-Low, 1RB



LTE Band 13 16QAM 5MHz CH-High, 1RB

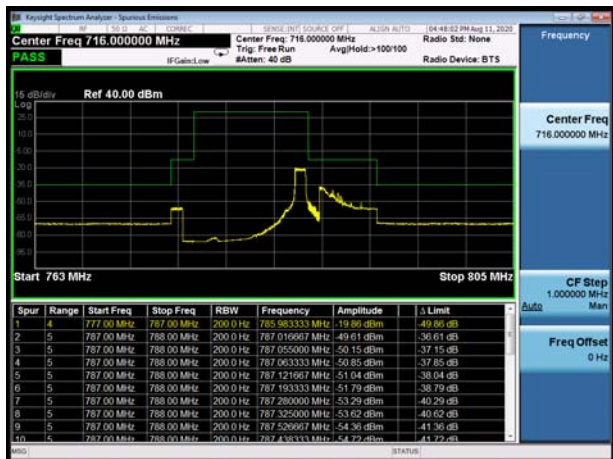




LTE Band 13 16QAM 5MHz CH- Low, 100%RB



LTE Band 13 16QAM 5MHz CH-High, 100%RB



LTE Band 13 16QAM 10MHz CH-Low, 1RB



LTE Band 13 16QAM 10MHz CH-High, 1RB



LTE Band 13 16QAM 10MHz CH- Low, 100%RB



LTE Band 13 16QAM 10MHz CH-High, 100%RB



5.5 Peak-to-Average Power Ratio (PAPR)

Ambient condition

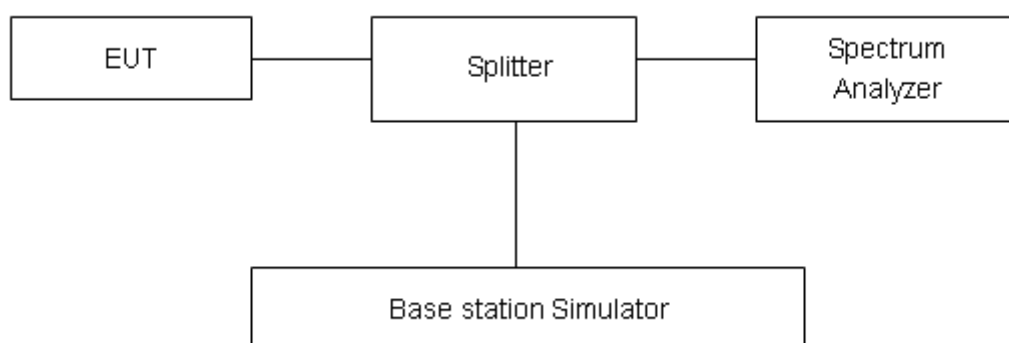
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as PPK. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$\text{PAPR (dB)} = \text{PPk (dBm)} - \text{PAvg (dBm)}.$$

Test Setup



Limits

Rule Part 27.50(d)(5) Equipment employed must be authorized in accordance with the provisions of 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB.

Test Results

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak (dBm)	Avg (dBm)	PAPR (dB)		
LTE Band 4	1.4MHz	QPSK	20175/1732.5	33.37	22.09	11.28	≤13	PASS
		16QAM	20175/1732.5	34.13	22.03	12.10	≤13	PASS
	3MHz	QPSK	20175/1732.5	33.56	22.13	11.43	≤13	PASS
		16QAM	20175/1732.5	33.94	22.07	11.87	≤13	PASS
	5MHz	QPSK	20175/1732.5	32.06	22.12	9.94	≤13	PASS
		16QAM	20175/1732.5	32.62	22.03	10.59	≤13	PASS
	10MHz	QPSK	20175/1732.5	31.69	22.14	9.55	≤13	PASS
		16QAM	20175/1732.5	32.14	22.08	10.06	≤13	PASS
	15MHz	QPSK	20175/1732.5	30.77	22.10	8.67	≤13	PASS
		16QAM	20175/1732.5	30.68	22.03	8.65	≤13	PASS
	20MHz	QPSK	20175/1732.5	30.92	22.05	8.87	≤13	PASS
		16QAM	20175/1732.5	31.17	21.99	9.18	≤13	PASS

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak (dBm)	Avg (dBm)	PAPR (dB)		
LTE Band1 2	1.4MHz	QPSK	23095/707.5	32.63	22.66	9.97	≤13	PASS
		16QAM	23095/707.5	34.21	22.90	11.31	≤13	PASS
	3MHz	QPSK	23095/707.5	32.56	22.68	9.88	≤13	PASS
		16QAM	23095/707.5	33.51	22.95	10.56	≤13	PASS
	5MHz	QPSK	23095/707.5	32.27	22.64	9.63	≤13	PASS
		16QAM	23095/707.5	33.75	22.90	10.85	≤13	PASS
	10MHz	QPSK	23095/707.5	31.88	22.59	9.29	≤13	PASS
		16QAM	23095/707.5	32.03	22.86	9.17	≤13	PASS

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak (dBm)	Avg (dBm)	PAPR (dB)		
LTE Band13	5MHz	QPSK	23230/782	32.64	22.68	9.96	≤13	PASS
		16QAM	23230/782	32.23	22.19	10.04	≤13	PASS
	10MHz	QPSK	23230/782	32.46	22.77	9.69	≤13	PASS
		16QAM	23230/782	32.68	22.95	9.73	≤13	PASS