TEST REPORT

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Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1804-0109
2. Customer
   - Name : LG Electronics MobileComm USA, Inc.
   - Address : 1000 Sylvan Ave., Englewood Cliffs, New Jersey, United States, 07632
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : Mobile Phone / LM-Q710GX
   FCC ID : ZNFQ710GX
5. Test Method Used : KDB971168 D01v03r01, ANSI/TIA-603-E-2016, ANSI C63.26-2015
   Test Specification : §2, §22, §27
6. Date of Test : 2018.03.13 ~ 2018.04.24
7. Testing Environment : Refer to appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : JaeHyeok Bang (Signature)	Reviewed by Name : Geunki Son (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2018 . 04 . 25 .

DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1804-0109	Apr. 25 2018	Initial issue

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1. GENERAL INFORMATION

Applicant Name : LG Electronics MobileComm USA, Inc.

Address : 1000 Sylvan Ave., Englewood Cliffs, New Jersey, United States, 07632

FCC ID : ZNFQ710GX

FCC Classification : PCS Licensed Transmitter held to ear (PCE)

EUT Type : Mobile Phone

Model Name : LM-Q710GX

Add Model Name : LMQ710GX, Q710GX

Supplying power : DC 3.85 V

Antenna Information : PIFA Antenna

Mode	TX Frequency (MHz)	Emission Designator	Modulation	ERP		EIRP	
				Max power (dBm)	Max power (W)	Max power (dBm)	Max power (W)
LTE Band 5	829 ~ 844	8M96G7D	QPSK	21.43	0.139	-	-
LTE Band 5	829 ~ 844	8M96W7D	16QAM	20.64	0.116	-	-
LTE Band 5	826.5 ~ 846.5	4M50G7D	QPSK	21.43	0.139	-	-
LTE Band 5	826.5 ~ 846.5	4M51W7D	16QAM	20.37	0.109	-	-
LTE Band 5	825.5 ~ 847.5	2M71G7D	QPSK	20.88	0.122	-	-
LTE Band 5	825.5 ~ 847.5	2M69W7D	16QAM	19.88	0.097	-	-
LTE Band 5	824.7 ~ 848.3	1M09G7D	QPSK	20.22	0.105	-	-
LTE Band 5	824.7 ~ 848.3	1M09W7D	16QAM	19.39	0.087	-	-
LTE Band 41	2506 ~ 2680	17M9G7D	QPSK	-	-	20.44	0.111
LTE Band 41	2506 ~ 2680	17M9W7D	16QAM	-	-	18.29	0.067
LTE Band 41	2503.5 ~ 2682.5	13M4G7D	QPSK	-	-	19.57	0.091
LTE Band 41	2503.5 ~ 2682.5	13M5W7D	16QAM	-	-	18.36	0.069
LTE Band 41	2501 ~ 2685	8M95G7D	QPSK	-	-	19.56	0.090
LTE Band 41	2501 ~ 2685	8M97W7D	16QAM	-	-	18.19	0.066
LTE Band 41	2498.5 ~ 2687.5	4M50G7D	QPSK	-	-	19.07	0.081
LTE Band 41	2498.5 ~ 2687.5	4M50W7D	16QAM	-	-	18.13	0.065

2. INTRODUCTION

2.1 EUT DESCRIPTION

The Equipment Under Test (EUT) supports GSM/WCDMA/LTE Phone with Bluetooth, WLAN, NFC.

2.2. EUT CAPABILITIES

This EUT contains the following capabilities:
850/1900 GSM/EDGE, 850/1900 WCDMA/HSUPA, Multi-band LTE, 802.11b/g/n WLAN(2.4GHz), Bluetooth(BDR, EDR, LE), NFC.

2.3. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+20 ℃ ~ +25 ℃
▪ Relative Humidity	41 % ~ 45 %

2.4 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014. All measurement uncertainty values are shown with a coverage factor of *k* = 2 to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Radiated Disturbance (Below 1 GHz)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated Disturbance (Above 18 GHz)	5.3 dB (The confidence level is about 95 %, k = 2)

2.6. TEST FACILITY

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.
The test site comply with the requirements of § 2.948 according to ANSI 63.4-2014.

- FCC MRA Accredited Test Firm No. : KR0034

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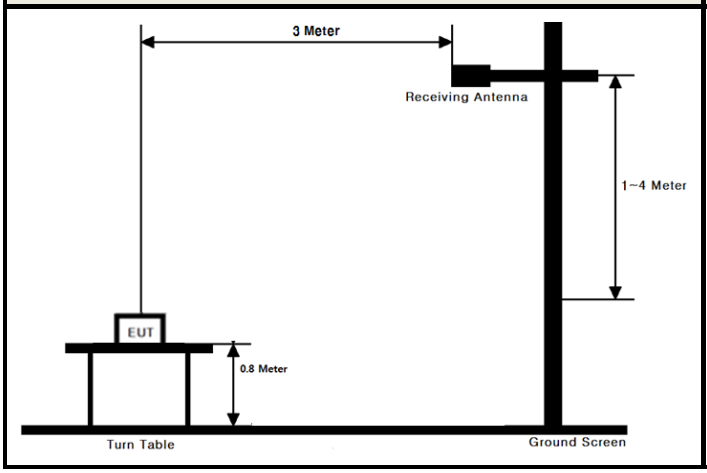
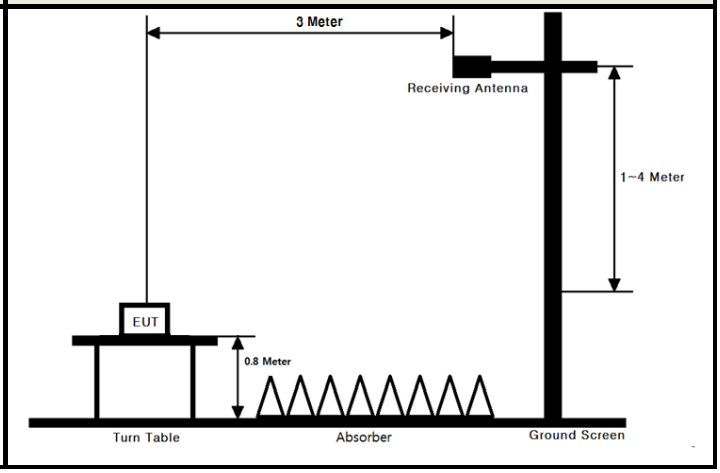
3. DESCRIPTION OF TESTS

3.1 ERP & EIRP (Effective Radiated Power & Equivalent Isotropic Radiated Power)

Test Set-up

Below 1GHz	Above 1GHz
	

These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 0.8-meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

Test Procedure

- **ANSI/TIA-603-E-2016 - Section 2.2.17**
- **KDB971168 D01v03r01 - Section 5.2.2**
- **ANSI C63.26-2015 – Section 5.2.4.4.1**

Test setting

1. Set span to 2 x to 3 x the OBW.
2. Set RBW = 1% to 5% of the OBW.
3. Set VBW ≥ 3 x RBW.
4. Set number of points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   1) Set = auto-couple, or
   2) Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6. Detector = power averaging (rms).
7. If the EUT can be configured to transmit continuously, then set the trigger to free run.
8. If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full-power transmissions).
9. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over multiple symbols, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.

10. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

The receiver antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminal of the substitute antenna is measured.

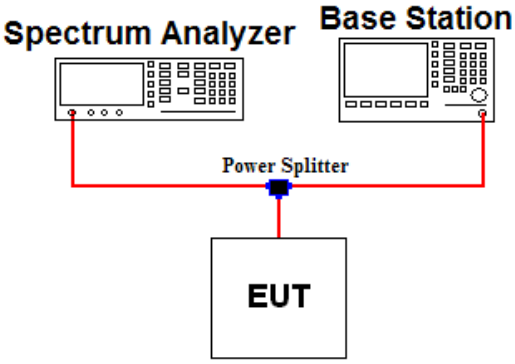
The ERP/EIRP is calculated using the following formula:

ERP/EIRP = The conducted power at the substitute antenna`s terminal [dBm] + Substitute Antenna gain [dBd for ERP , dBi for EIRP]

For readings above 1 GHz, the above procedure is repeated using horn antennas and the difference
Between the gain of the horn antenna and an isotropic antenna are taken into consideration.

3.2 PEAK TO AVERAGE RATIO

Test set-up



Test Procedure

- **KDB971168 D01v03r01 - Section 5.7.2**
- **ANSI C63.26-2015 – Section 5.2.3.4**

A peak to average ratio measurement is performed at the conducted port of the EUT.
The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The present of time the signal spends at or above the level defines the probability for that particular power level.

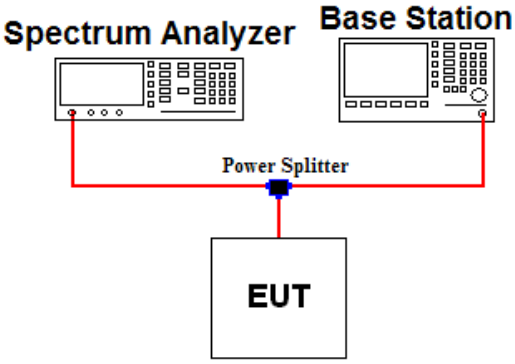
Test setting

The spectrum Analyzer`s CCDF measurement function is enabled.

1. Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.
2. Set the number of counts to a value that stabilizes the measured CCDF curve.
3. Set the measurement interval as follows:
   1) For continuous transmissions, set to the greater of [10 × (number of points in sweep) × (transmission symbol period)] or 1 ms.
   2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
   3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
4. Record the maximum PAPR level associated with a probability of 0.1%.
5. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.

3.3 OCCUPIED BANDWIDTH.

Test set-up



Test Procedure

- **KDB971168 D01v03r01 - Section 4.3**
- **ANSI C63.26-2015 – Section 5.4.4**

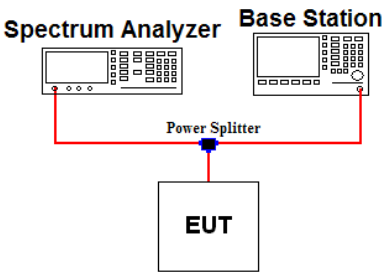
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

Test setting

1. The signal analyzer`s automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 ~ 5 % of the expected OBW & VBW ≥ 3 X RBW
3. Detector = Peak
4. Trance mode = Max hold
5. Sweep = Auto couple
6. The trace was allowed to stabilize
7. If necessary, step 2 ~ 6 were repeated after changing the RBW such that it would be within 1 ~ 5 % of the 99 % occupied bandwidth observed in step 6.

3.4 BAND EDGE EMISSIONS AT ANTENNA TERMINAL

Test set-up



Test Procedure

- **KDB971168 D01v03r01 - Section 6**
- **ANSI C63.26-2015 – Section 5.7**

All out of band emissions are measured by means of a calibrated spectrum analyzer. The EUT was setup to maximum output power at its lowest and highest channel with all bandwidths, modulations and RB configurations.

The power of any spurious emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB.

Test setting

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1 % of the emission bandwidth
4. VBW ≥ 3 X RBW
5. Detector = RMS & Trace mode = Max hold
6. Sweep time = Auto couple or 1 s for band edge
7. Number of sweep point ≥ 2 X span / RBW
8. The trace was allowed to stabilize

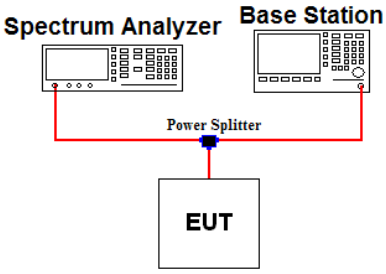
Note 1: Per Part 22.917(b)(1) / 24.238(b) / 27.53(h) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Note 2: For part 27.53(m)(4) 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)(6) 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.

Note 3: Per part 27.53(m)(6) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 MHz band is 2495-2496 MHz, in which case a resolution bandwidth of at least one percent may be employed.

3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

Test set-up



Test Procedure

- **KDB971168 D01v03r01 - Section 6**
- **ANSI C63.26-2015 – Section 5.7**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The EUT was setup to maximum output power at its low, middle, high channel with all bandwidths, modulations and RB configurations. The spectrum is scanned from 9 kHz up to a frequency including its 10th harmonic.

The power of any spurious emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log(P) dB.

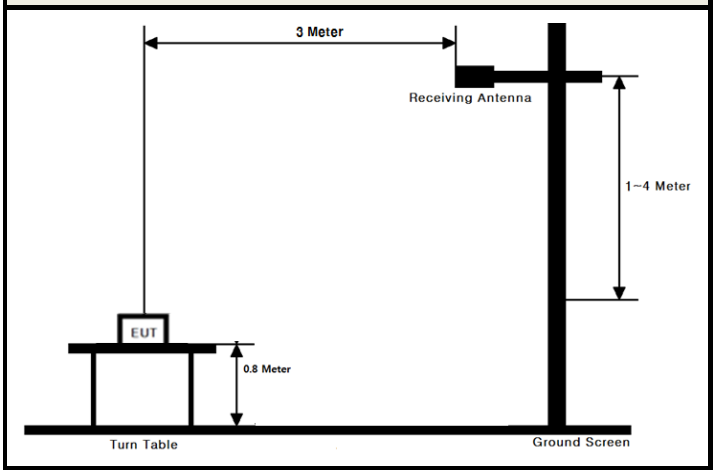
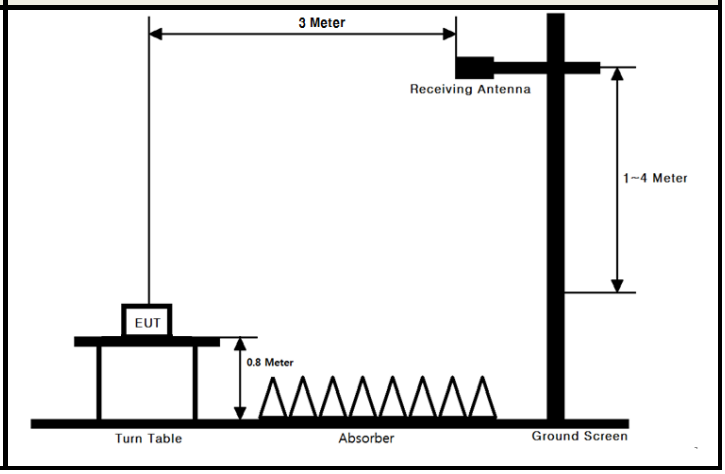
Test setting

1. RBW = 100 kHz(Below 1 GHz) or 1 MHz(Above 1 GHz) & VBW ≥ 3 X RBW (Refer to Note 1)
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point ≥ 2 X span / RBW
5. The trace was allowed to stabilize

Note 1: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1GHz and 1MHz or greater for frequencies greater than 1GHz.

3.6 UNDESIRABLE EMISSIONS

Test Set-up

Below 1GHz	Above 1GHz
	

These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 0.8-meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

Test Procedure

- **ANSI/TIA-603-E-2016 - Section 2.2.12**
- **KDB971168 D01v03r01 - Section 5.8**
- **ANSI C63.26-2015 – Section 5.5**

Test setting

1. RBW = 100 kHz for below 1 GHz and 1 MHz for above 1 GHz / VBW ≥ 3 X RBW
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point ≥ 2 X span / RBW
5. The trace was allowed to stabilize

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

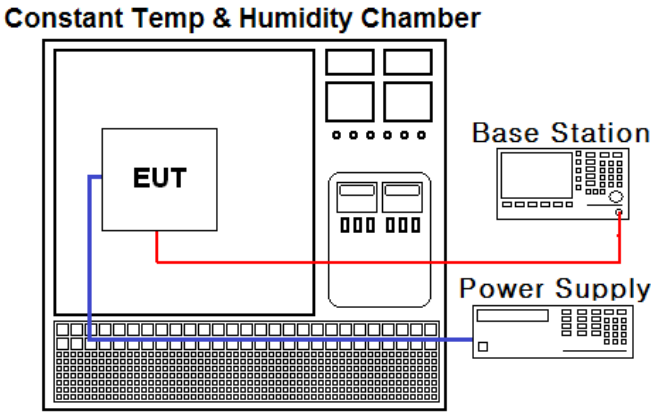
For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated power measurements above 1 GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration.

This measurement was performed with the EUT oriented in 3 orthogonal axis.

3.7 FREQUENCY STABILITY

Test Set-up



Test Procedure

- **ANSI/TIA-603-E-2016**
- **KDB971168 D01v03r01 - Section 9**

The frequency stability of the transmitter is measured by:

a.) **Temperature:**
The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.

b.) **Primary Supply Voltage:**
The primary supply voltage is varied from 85 % to 115 % of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification:

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block for Part 24, 27. The frequency stability of the transmitter shall be maintained within ± 0.000 25 % (± 2.5 ppm) of the center frequency for Part 22.

Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature.
(20 °C to provide a reference)

2. The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

3. Frequency measurements are made at 10 °C intervals ranging from -30 °C to +50 °C.
A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	17/09/05	18/09/05	MY46471251
Spectrum Analyzer	Agilent Technologies	N9020A	17/12/26	18/12/26	MY50200828
Spectrum Analyzer	Agilent Technologies	N9030A	17/09/07	18/09/07	MY53310140
DC Power Supply	Agilent Technologies	66332A	17/09/05	18/09/05	GB42110550
Multimeter	FLUKE	17B	17/12/26	18/12/26	26030065WS
Power Splitter	Anritsu	K241B	17/12/27	18/12/27	016681
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	17/12/28	18/12/28	SJ-TH-S50120203
Thermohygrometer	BODYCOM	BJ5478	18/01/03	19/01/03	120612-2
Radio Communication Analyzer	Anritsu	MT8820C	17/09/07	19/09/07	6201127429
Signal Generator	R&S	SMBV100A	17/12/28	18/12/28	255571
Signal Generator	R&S	SMF100A	17/12/27	18/12/27	102341
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
Bilog Antenna	Schwarzbeck	VULB9160	16/08/05	18/08/05	9160-3362
Dipole Antenna	Schwarzbeck	VHA9103	17/03/14	19/03/14	2116
Dipole Antenna	Schwarzbeck	VHA9103	16/04/15 18/04/13	18/04/15 18/04/13	2117
Dipole Antenna	Schwarzbeck	UHA9105	17/03/14	19/03/14	2261
Dipole Antenna	Schwarzbeck	UHA9105	16/04/15 18/04/13	18/04/15 18/04/13	2262
HORN ANT	ETS	3117	16/05/13	18/05/13	00140394
HORN ANT	ETS	3117	17/08/02	19/08/02	00154312
HORN ANT	A.H.Systems	SAS-574	17/04/25	19/04/25	154
HORN ANT	A.H.Systems	SAS-574	17/07/31	19/07/31	155
PreAmplifier	RFBAY.Inc	MPA-40-40	17/12/28	18/12/28	21151801
PreAmplifier	EMPOWER	BBS3Q7ELU	17/09/06	18/09/06	1020
PreAmplifier	TSJ	MLA-010K01-B01-27	18/03/05	19/03/05	1844539
Amplifier	Agilent	8449B	17/09/05	18/09/05	3008A02108
Amplifier	Agilent	PAM-1840VH	17/09/17	18/09/17	163
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	17/09/05	18/09/05	7
High-pass filter	Wainwright	WHK10-2700-3000-10000-40SS	17/09/06	18/09/06	3
High-pass filter	Wainwright	WHNX8.0/26.5-6SS	17/12/26	18/12/26	3
CABLE	DTNC	CABLE	NA	NA	C-016-4
CABLE	DTNC	CABLE	NA	NA	RF-81
CABLE	Radiall	TESTPRO3	NA	NA	RF-74
CABLE	DTNC	CABLE-RF	NA	NA	RF-76
CABLE	DTNC	CABLE-RF	NA	NA	RF-54
CABLE	DTNC	CABLE-RF	NA	NA	RF-32
CABLE	Radiall	TESTPRO3	NA	NA	RF-66
CABLE	HUBER+SUHNER	SUCOFLEX103	NA	NA	RF-75

Note: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

5. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Status Note 1
2.1046	Conducted Output Power	N/A	Conducted	C Note2
2.1049	Occupied Bandwidth	N/A		C
27.50(d.5)	Peak to Average Ratio	< 13dB		
2.1051 22.917(a)	Band Edge / Conducted Spurious Emissions	> 43 + 10log$_{10}$ (P) dB at Band edge and for all out-of-band emissions		C
27.53(m)	Band Edge / Conducted Spurious Emissions	> 40 + 10log10 (P) dB at channel edge and 5 MHz from the channel edge > 43 + 10log10 (P) dB at 5 MHz and X MHz from the channel edge > 55 + 10log10 (P) dB at all frequencies more than X MHz from the channel edge		C
2.1055 22.355 27.54	Frequency Stability	< 2.5 ppm (Part 22) Fundamental emissions must stay within Authorized frequency block (Part 27)		C
22.913(a.5)	Radiated Output Power (B5)	< 7 Watts max. ERP		C
27.50(h.2)	Radiated Output Power(B41)	< 2 Watts max. EIRP		C
2.1053 22.917(a)	Undesirable Emissions	> 43 + 10log$_{10}$ (P) dB for all out-of-band emissions		C
27.53(m)	Undesirable Emissions(B7)	> 55 + 10log$_{10}$ (P) dB for all out-of-band emissions		C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable
Note 2: Refer to RF Exposure Report (Test Report SAR)
Note 3: This test report includes the test data for FCC ID: ZNFQ710FA.
The spot-check measurement was performed for FCC ID: ZNFQ710GX and the RF characteristics of the two products was similar.
(FCC ID: ZNFQ710GX is same the printed circuit board and SW with FCC ID: ZNFQ710FA, and removed the LTE B2/4/7/12/17/66 and added the LTE B41 from FCC ID: ZNFQ710FA.)

6. SAMPLE CALCULATION

A. Emission Designator

LTE Band 5(QPSK)

Emission Designator = **8M96G7D**
LTE OBW = 8.963 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 5(16QAM)

Emission Designator = **8M96W7D**
LTE OBW = 8.959 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 41(QPSK)

Emission Designator = **17M9G7D**
LTE OBW = 17.940 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 41(16QAM)

Emission Designator = **17M9W7D**
LTE OBW = 17.899 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data Transmission

B. For substitution method

Channel Bandwidth (MHz)	Test Frequency (MHz)	Test Mode	RB Size/ Offset	Spectrum Reading Value(dBm)	EUT Axis	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain (dBd)	ERP (dBm)	ERP (W)
10	829	QPSK	1/0	-15.18	X	H	20.20	1.23	21.43	0.139

ERP or EIRP = Level @ Ant Terminal LEVEL(dBm) + Tx Ant. Gain

1) The EUT mounted on a non-conductive turntable is 0.8 meter above test site ground level.
2) During the test, the turn table is rotated until the maximum signal is found.
3) Record the field strength meter's level.
4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
6) The signal generator output level with substituted antenna gain is the rating of ERP, EIRP or Radiated spurious emission.

7.TEST DATA

7.1 OCCUPIED BANDWIDTH

- Plots of the EUT's Occupied Bandwidth are shown in Clause 8.1

7.2 PEAK TO AVERAGE RATIO

- Plots of the EUT's Peak- to- Average Ratio are shown in Clause 8.2

7.3 BAND EDEG EMISSIONS (Conducted)

- Plots of the EUT's Band Edge Emissions are shown in Clause 8.3

7.4 SPURIOUS AND HARMONICS EMISSIONS (Conducted)

- Plots of the EUT's Spurious Emissions are shown in Clause 8.4

7.5 ERP & EIRP

7.5.1 LTE Band 5

Channel Bandwidth (MHz)	Test Frequency (MHz)	Test Mode	RB Size/ Offset	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain (dBd)	ERP (dBm)	ERP (W)
10	829	QPSK	1/0	H	20.20	1.23	21.43	0.139
		16QAM	1/0	H	19.41	1.23	20.64	0.116
	836.5	QPSK	1/49	H	18.97	1.22	20.19	0.104
		16QAM	1/49	H	17.84	1.22	19.06	0.081
	844	QPSK	1/49	H	18.53	1.21	19.74	0.094
		16QAM	1/49	H	17.51	1.21	18.72	0.074
5	826.5	QPSK	1/0	H	20.20	1.23	21.43	0.139
		16QAM	1/0	H	19.14	1.23	20.37	0.109
	836.5	QPSK	1/24	H	18.09	1.22	19.31	0.085
		16QAM	1/24	H	17.39	1.22	18.61	0.073
	846.5	QPSK	1/0	H	19.69	1.21	20.90	0.123
		16QAM	1/0	H	18.53	1.21	19.74	0.094
3	825.5	QPSK	1/0	H	19.65	1.23	20.88	0.122
		16QAM	1/0	H	18.65	1.23	19.88	0.097
	836.5	QPSK	1/0	H	18.34	1.22	19.56	0.090
		16QAM	1/0	H	17.19	1.22	18.41	0.069
	847.5	QPSK	1/0	H	19.41	1.21	20.62	0.115
		16QAM	1/0	H	18.35	1.21	19.56	0.090
1.4	824.7	QPSK	1/0	H	18.99	1.23	20.22	0.105
		16QAM	1/0	H	18.16	1.23	19.39	0.087
	836.5	QPSK	1/5	H	17.93	1.22	19.15	0.082
		16QAM	1/5	H	17.04	1.22	18.26	0.067
	848.3	QPSK	1/5	H	18.72	1.21	19.93	0.098
		16QAM	1/5	H	17.80	1.21	19.01	0.080

Note: This device was tested under all bandwidths, modulations and RB configurations and the worst case data are reported in the table above.

7.5.2 LTE Band 41

Channel Bandwidth (MHz)	Test Frequency (MHz)	Test Mode	RB Size/ Offset	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain (dBi)	EIRP (dBm)	EIRP (W)
20	2506	QPSK	1/0	H	11.14	6.19	17.33	0.054
		16QAM	1/0	H	10.78	6.19	16.97	0.050
	2593	QPSK	1/0	H	14.21	6.23	20.44	0.111
		16QAM	1/0	H	12.06	6.23	18.29	0.067
	2680	QPSK	1/0	H	7.73	6.49	14.22	0.026
		16QAM	1/0	H	6.76	6.49	13.25	0.021
15	2503.5	QPSK	1/0	H	11.83	6.19	18.02	0.063
		16QAM	1/0	H	10.67	6.19	16.86	0.049
	2593	QPSK	1/74	H	13.34	6.23	19.57	0.091
		16QAM	1/74	H	12.13	6.23	18.36	0.069
	2682.5	QPSK	1/0	H	8.52	6.50	15.02	0.032
		16QAM	1/0	H	7.53	6.50	14.03	0.025
10	2501	QPSK	1/0	H	11.50	6.19	17.69	0.059
		16QAM	1/0	H	10.40	6.19	16.59	0.046
	2593	QPSK	1/0	H	13.33	6.23	19.56	0.090
		16QAM	1/0	H	11.96	6.23	18.19	0.066
	2685	QPSK	1/0	H	8.58	6.51	15.09	0.032
		16QAM	1/0	H	7.71	6.51	14.22	0.026
5	2498.5	QPSK	1/0	H	11.67	6.19	17.86	0.061
		16QAM	1/0	H	10.68	6.19	16.87	0.049
	2593	QPSK	1/0	H	12.84	6.23	19.07	0.081
		16QAM	1/0	H	11.90	6.23	18.13	0.065
	2687.5	QPSK	1/0	H	9.05	6.52	15.57	0.036
		16QAM	1/0	H	8.00	6.52	14.52	0.028

Note: This device was tested under all bandwidths, modulations and RB configurations and the worst case data are reported in the table above.

7.6 UNDESIRABLE EMISSIONS (Radiated)

7.6.1 LTE Band 5

B.W (MHz)	Test Freq. (MHz)	RB Size/ Offset	Test Mode	Freq.(MHz)	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain(dBd)	Result		Limit (dBc)
								(dBm)	(dBc)	
10	829	1/0	QPSK	1649.87	H	-58.19	3.77	-54.42	75.85	34.43
			16QAM	1649.17	H	-58.71	3.77	-54.94	75.58	33.64
	836.5	1/49	QPSK	1681.56	H	-57.02	3.78	-53.24	73.43	33.19
			16QAM	1682.01	H	-57.18	3.78	-53.40	72.46	32.06
	844	1/49	QPSK	1696.84	H	-57.97	3.79	-54.18	73.92	32.74
			16QAM	1697.28	H	-58.14	3.79	-54.35	73.07	31.72
5	826.5	1/0	QPSK	1648.52	H	-58.04	3.77	-54.27	75.70	34.43
			16QAM	1648.28	H	-58.99	3.77	-55.22	75.59	33.37
	836.5	1/24	QPSK	1677.30	H	-57.05	3.78	-53.27	72.58	32.31
			16QAM	1677.60	H	-57.36	3.78	-53.58	72.19	31.61
	846.5	1/0	QPSK	1690.26	H	-57.49	3.79	-53.70	74.60	33.90
			16QAM	1690.99	H	-58.58	3.79	-54.79	74.53	32.74
3	825.5	1/0	QPSK	1648.43	H	-58.26	3.77	-54.49	75.37	33.88
			16QAM	1648.60	H	-58.53	3.77	-54.76	74.64	32.88
	836.5	1/0	QPSK	1670.42	H	-57.52	3.78	-53.74	73.30	32.56
			16QAM	1670.45	H	-57.61	3.78	-53.83	72.24	31.41
	847.5	1/0	QPSK	1692.40	H	-58.21	3.79	-54.42	75.04	33.62
			16QAM	1692.26	H	-58.77	3.79	-54.98	74.54	32.56
1.4	824.7	1/0	QPSK	1648.91	H	-58.68	3.77	-54.91	75.13	33.22
			16QAM	1648.76	H	-58.74	3.77	-54.97	74.36	32.39
	836.5	1/5	QPSK	1673.72	H	-57.27	3.78	-53.49	72.64	32.15
			16QAM	1674.43	H	-57.68	3.78	-53.90	72.16	31.26
	848.3	1/5	QPSK	1697.55	H	-56.96	3.79	-53.17	73.10	32.93
			16QAM	1697.51	H	-57.57	3.79	-53.78	72.79	32.01

Note 1: Limit Calculation = 43 + $10\log_{10}$ (P[Watts])

Note 2: This device was tested under all bandwidths, modulations and RB configurations and the worst case data are reported in the table above.

Note 3: The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

7.6.2 LTE Band 41

B.W (MHz)	Test Freq. (MHz)	RB Size/ Offset	Test Mode	Freq.(MHz)	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain(dBi)	Result		Limit (dBc)
								(dBm)	(dBc)	
20	2506	1/0	QPSK	4992.03	H	-53.41	10.10	-43.31	60.64	42.33
				-	-	-	-	-	-	
		1/0	16QAM	4992.13	H	-54.56	10.10	-44.46	61.43	41.97
				-	-	-	-	-	-	
	2593	1/0	QPSK	5168.28	H	-53.16	10.40	-42.76	63.20	45.44
				-	-	-	-	-	-	
		1/0	16QAM	5168.26	H	-54.92	10.40	-44.52	62.81	43.29
				-	-	-	-	-	-	
	2680	1/0	QPSK	5342.97	H	-53.37	10.55	-42.82	57.04	39.22
				-	-	-	-	-	-	
		1/0	16QAM	5342.97	H	-53.97	10.55	-43.42	56.67	38.25
				-	-	-	-	-	-	
15	2503.5	1/0	QPSK	4994.82	H	-51.73	10.10	-41.63	59.65	43.02
				-	-	-	-	-	-	
		1/0	16QAM	4994.91	H	-53.68	10.10	-43.58	60.44	41.86
				-	-	-	-	-	-	
	2593	1/74	QPSK	5201.89	H	-52.77	10.40	-42.37	61.94	44.57
				-	-	-	-	-	-	
		1/74	16QAM	5201.98	H	-54.30	10.40	-43.90	62.26	43.36
				-	-	-	-	-	-	
	2682.5	1/0	QPSK	5351.71	H	-53.38	10.55	-42.83	57.85	40.02
				-	-	-	-	-	-	
		1/0	16QAM	5351.76	H	-54.86	10.55	-44.31	58.34	39.03
				-	-	-	-	-	-	

B.W (MHz)	Test Freq. (MHz)	RB Size/ Offset	Test Mode	Freq.(MHz)	Ant Pol (H/V)	Level(dBm) @ Ant Terminal	TX Ant Gain(dBi)	Result		Limit (dBc)
								(dBm)	(dBc)	
10	2501	1/0	QPSK	4990.72	H	-52.76	10.09	-42.67	60.36	42.69
				-	-	-	-	-	-	
		1/0	16QAM	4990.69	H	-53.09	10.09	-43.00	59.59	41.59
				-	-	-	-	-	-	
	2593	1/0	QPSK	5179.72	H	-53.17	10.42	-42.75	62.31	44.56
				-	-	-	-	-	-	
		1/0	16QAM	5179.81	H	-53.95	10.42	-43.53	61.72	43.19
				-	-	-	-	-	-	
	2685	1/0	QPSK	5358.85	H	-52.33	10.56	-41.77	56.86	40.09
				-	-	-	-	-	-	
		1/0	16QAM	5358.90	H	-54.19	10.56	-43.63	57.85	39.22
				-	-	-	-	-	-	
5	2498.5	1/0	QPSK	4995.45	H	-53.08	10.10	-42.98	60.84	42.86
				-	-	-	-	-	-	
		1/0	16QAM	4995.56	H	-54.18	10.10	-44.08	60.95	41.87
				-	-	-	-	-	-	
	2593	1/0	QPSK	5182.14	H	-53.45	10.42	-43.03	62.10	44.07
				-	-	-	-	-	-	
		1/0	16QAM	5182.22	H	-56.05	10.42	-45.63	63.76	43.13
				-	-	-	-	-	-	
	2687.5	1/0	QPSK	5370.74	H	-52.87	10.56	-42.31	57.88	40.57
				-	-	-	-	-	-	
		1/0	16QAM	5370.82	H	-54.72	10.56	-44.16	58.68	39.52
				-	-	-	-	-	-	

Note 1: Limit Calculation = 55 + $10\log_{10}$ (P[Watts])

Note 2: This device was tested under all bandwidths, modulations and RB configurations and the worst case data are reported in the table above.

Note 3: The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

7.7 FREQUENCY STABILITY

7.7.1 LTE Band 5

OPERATING FREQUENCY : 836.5 MHz
REFERENCE VOLTAGE : 3.85 VDC
DEVIATION LIMIT : ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	3.85	+20(Ref)	836,500,005	+5	0.0060	0.000000598
100%		-30	836,500,003	+3	0.0036	0.000000359
100%		-20	836,500,004	+4	0.0048	0.000000478
100%		-10	836,500,005	+5	0.0060	0.000000598
100%		0	836,500,005	+5	0.0060	0.000000598
100%		+10	836,500,003	+3	0.0036	0.000000359
100%		+20	836,500,005	+5	0.0060	0.000000598
100%		+30	836,500,002	+2	0.0024	0.000000239
100%		+40	836,499,996	-4	-0.0048	-0.000000478
100%		+50	836,500,006	+6	0.0072	0.000000717
115%	4.43	+20	836,500,005	+5	0.0060	0.000000598
BATT.ENDPOINT	2.85	+20	836,499,997	-3	-0.0036	-0.000000359

7.7.2 LTE Band 41

OPERATING FREQUENCY : 2593 MHz
REFERENCE VOLTAGE 3.85 VDC
LIMIT : The frequency stability shall be sufficient to ensure that the fundamental emission stays wthin the authorized frequency block.

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	3.85	+20(Ref)	2,592,999,986	-14	-0.0054	-0.000000540
100%		-30	2,593,000,006	6	0.0023	0.000000231
100%		-20	2,592,999,997	-3	-0.0012	-0.000000116
100%		-10	2,592,999,997	-3	-0.0012	-0.000000116
100%		0	2,592,999,995	-5	-0.0019	-0.000000193
100%		+10	2,592,999,996	-4	-0.0015	-0.000000154
100%		+20	2,592,999,986	-14	-0.0054	-0.000000540
100%		+30	2,592,999,995	-5	-0.0019	-0.000000193
100%		+40	2,592,999,998	-2	-0.0008	-0.000000077
100%		+50	2,592,999,996	-4	-0.0015	-0.000000154
115%	4.43	+20	2,593,000,003	3	0.0012	0.000000116
BATT.ENDPOINT	2.85	+20	2,593,000,004	4	0.0015	0.000000154

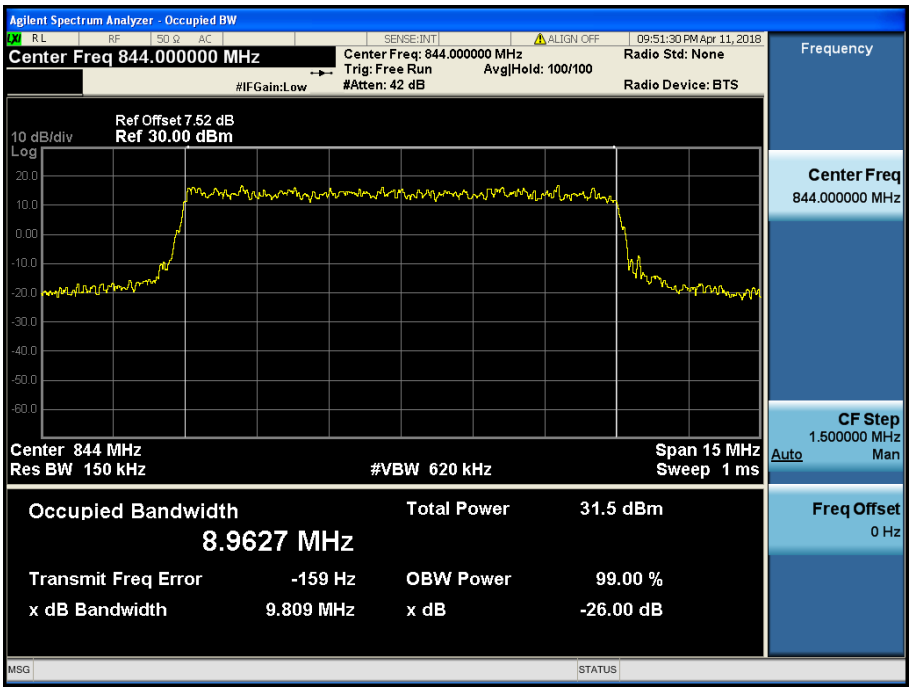
Note. Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. as such it is determined that the channels at the band edge would remain inband when the maximum measured frequency deviation noted during the frequency stability tests is applied. therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

8. TEST PLOTS

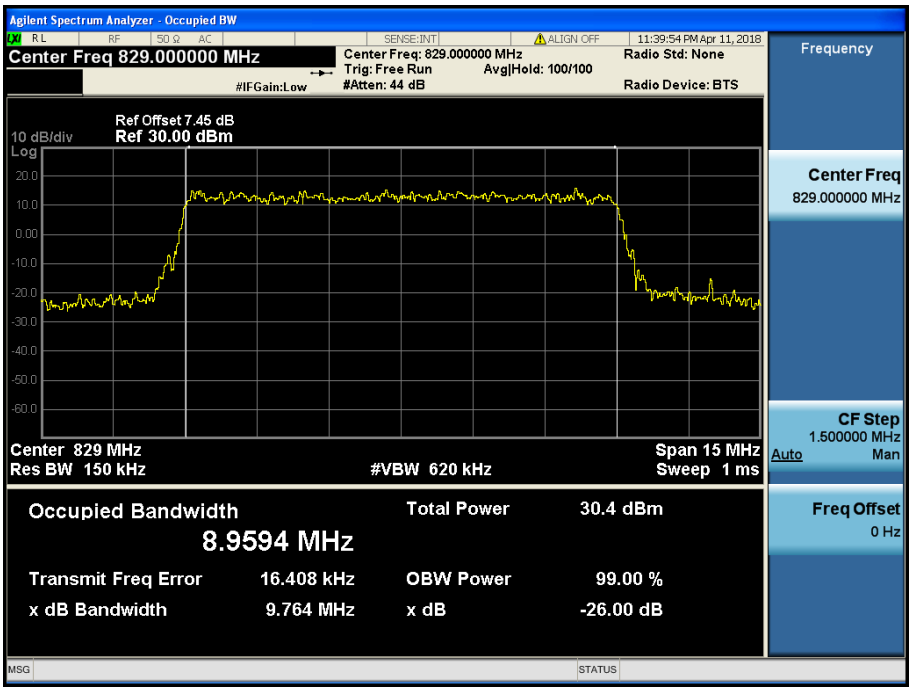
Note: All bandwidths, RB configurations, and modulations were investigated.
The worst case test results are reported.

8.1 OCCUPIED BANDWIDTH

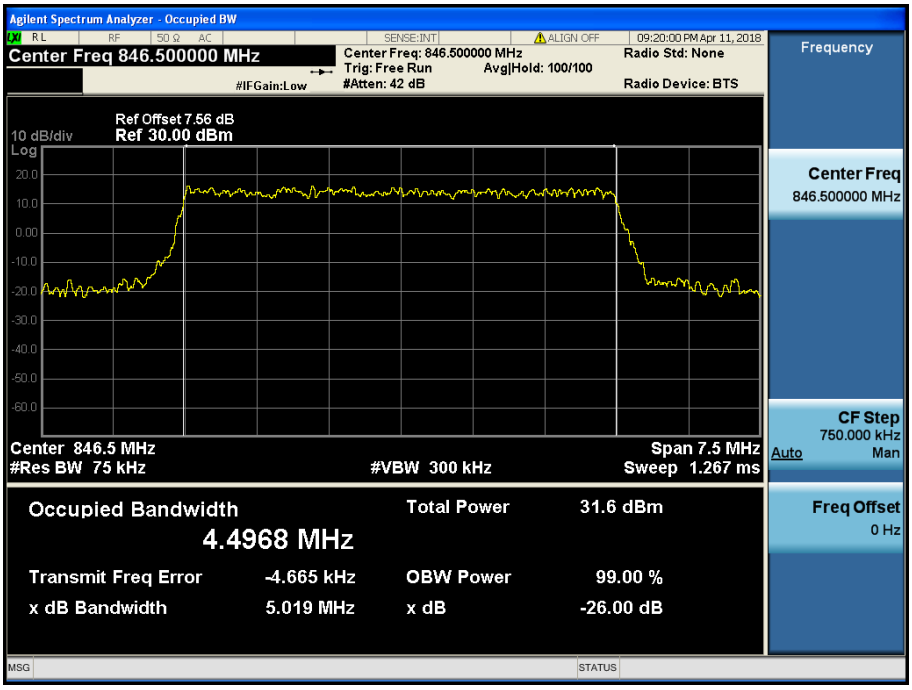
8.1.1 LTE Band 5



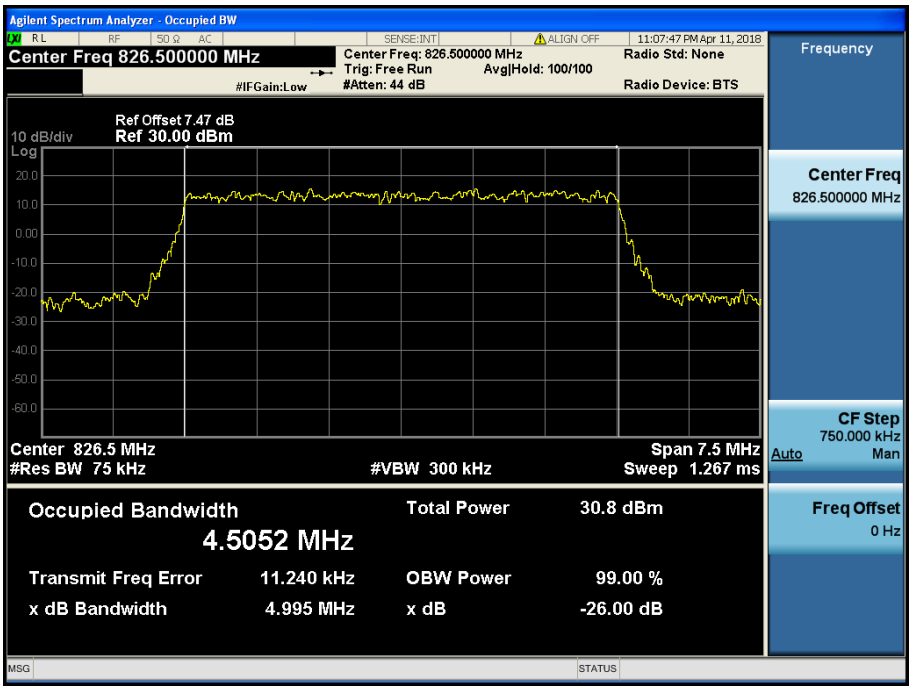
LTE Band 5 / 10 MHz / QPSK - RB Size 50



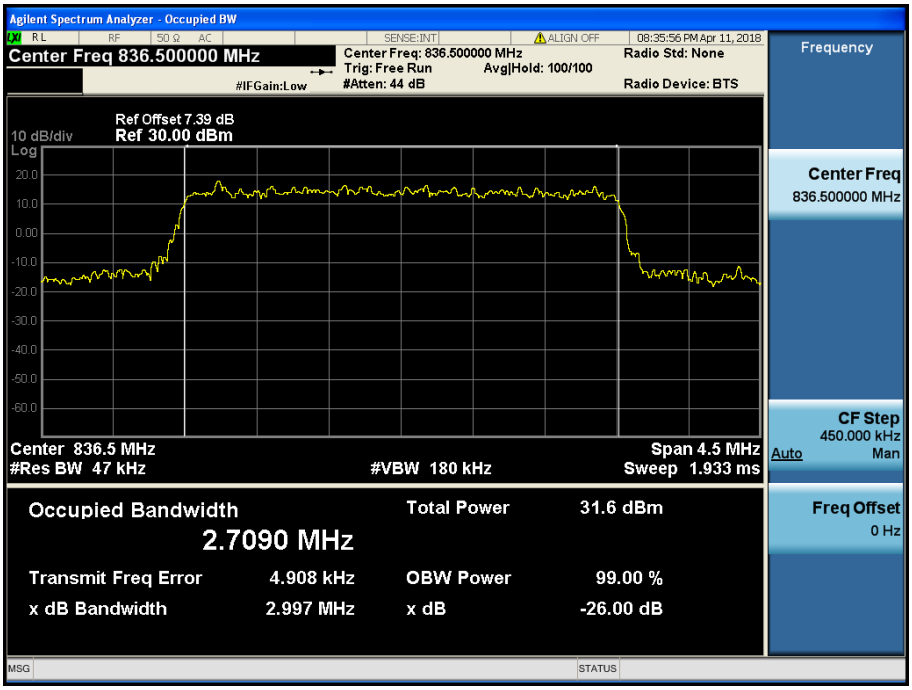
LTE Band 5 / 10 MHz / 16QAM - RB Size 50



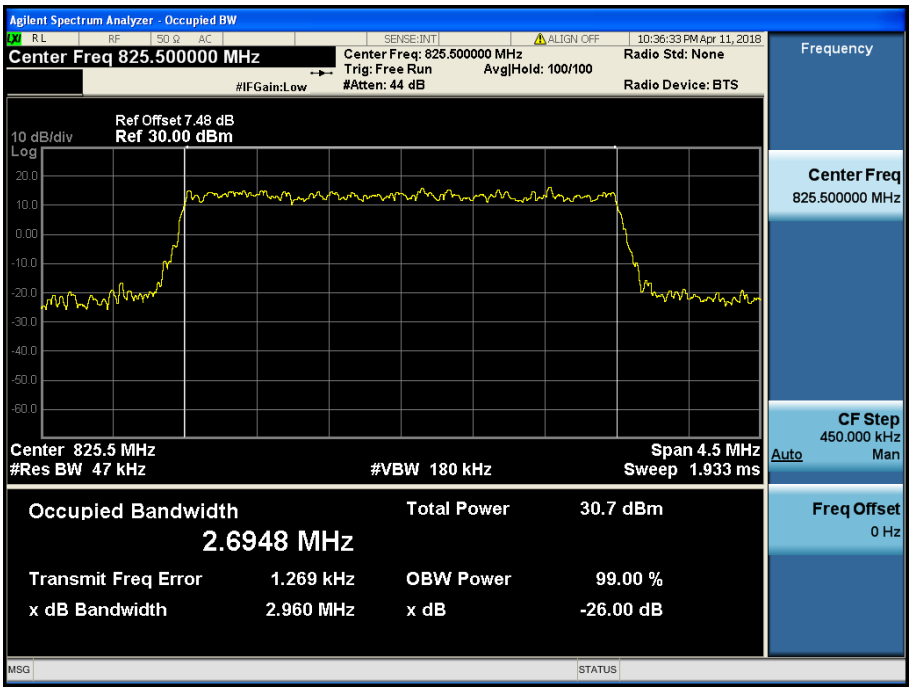
LTE Band 5 / 5 MHz / QPSK - RB Size 25



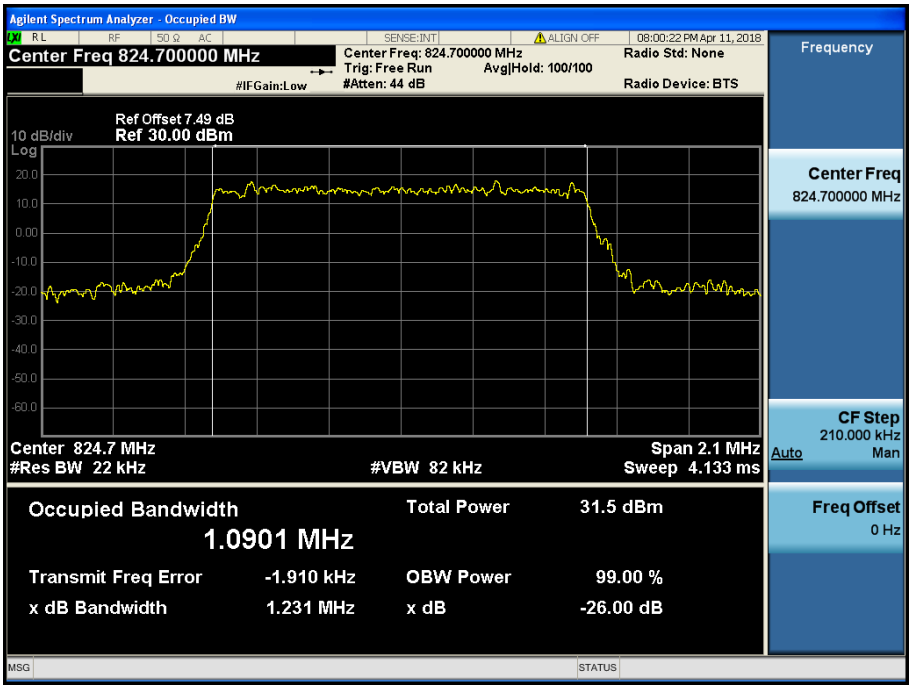
LTE Band 5 / 5 MHz / 16QAM - RB Size 25



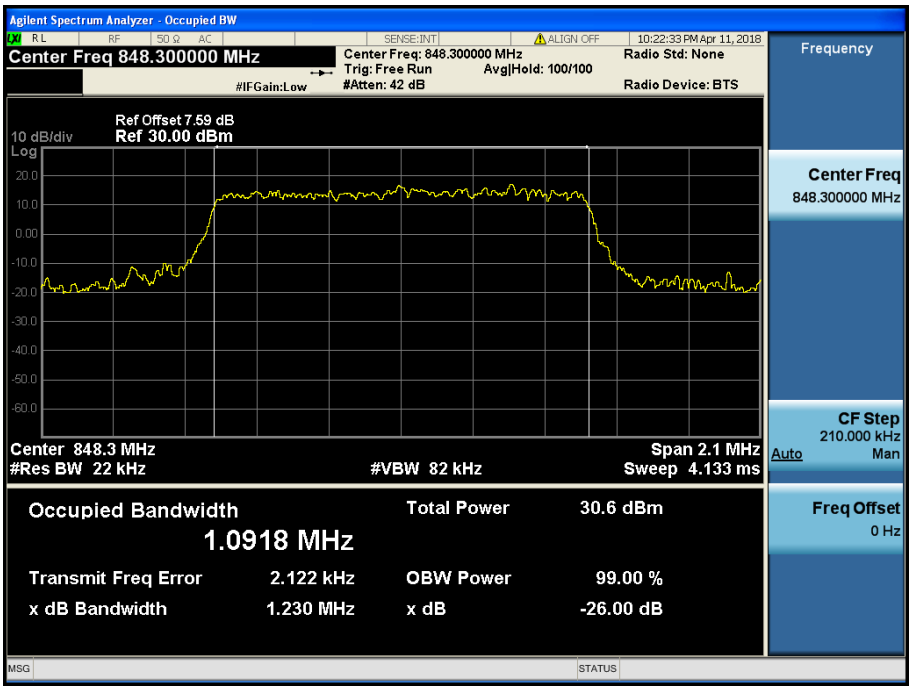
LTE Band 5 / 3 MHz / QPSK - RB Size 15



LTE Band 5 / 3 MHz / 16QAM - RB Size 15

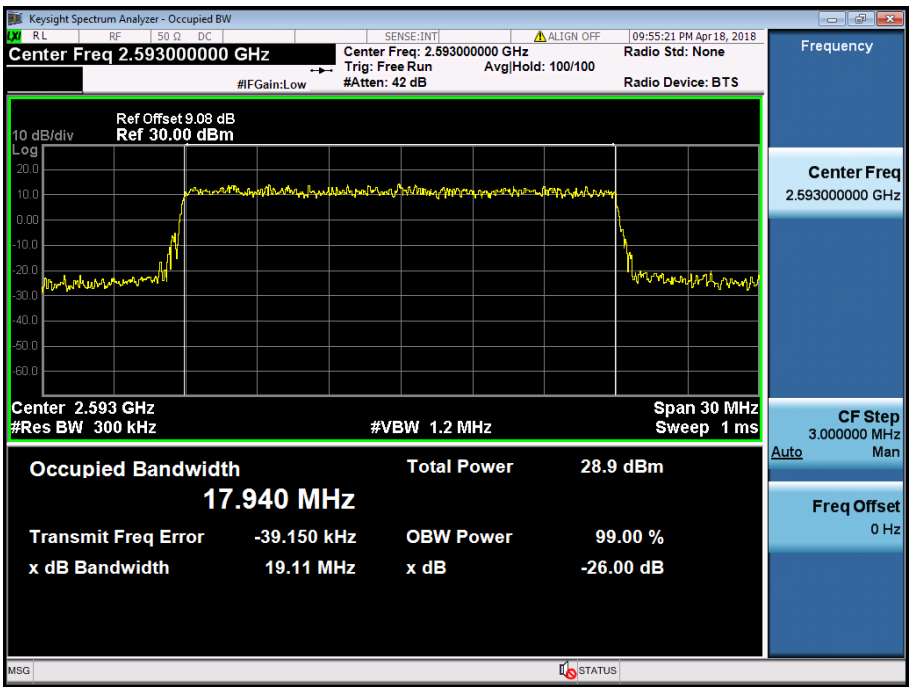


LTE Band 5 / 1.4 MHz / QPSK - RB Size 6

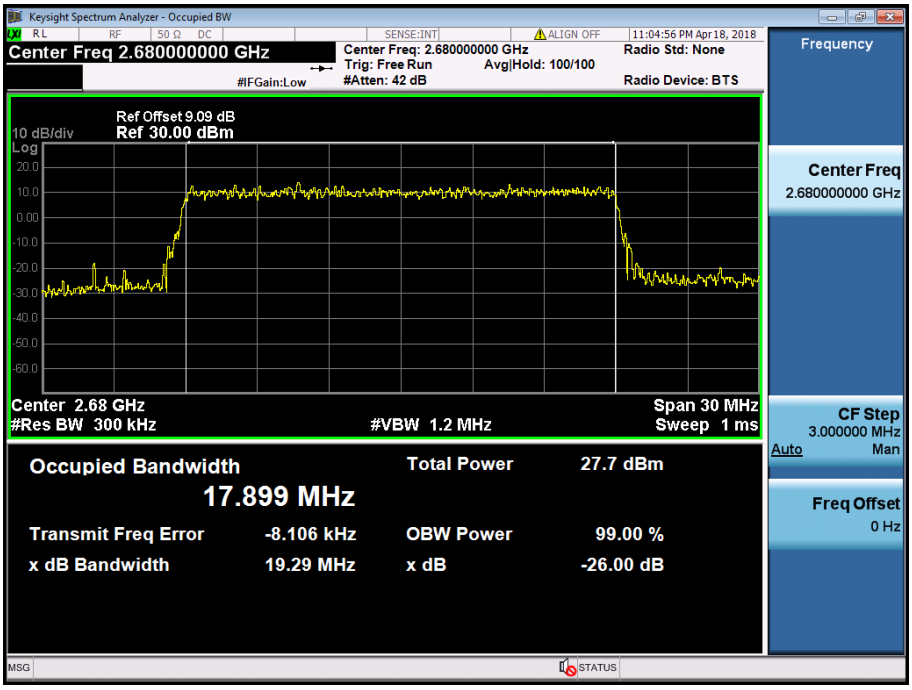


LTE Band 5 / 1.4 MHz / 16QAM - RB Size 6

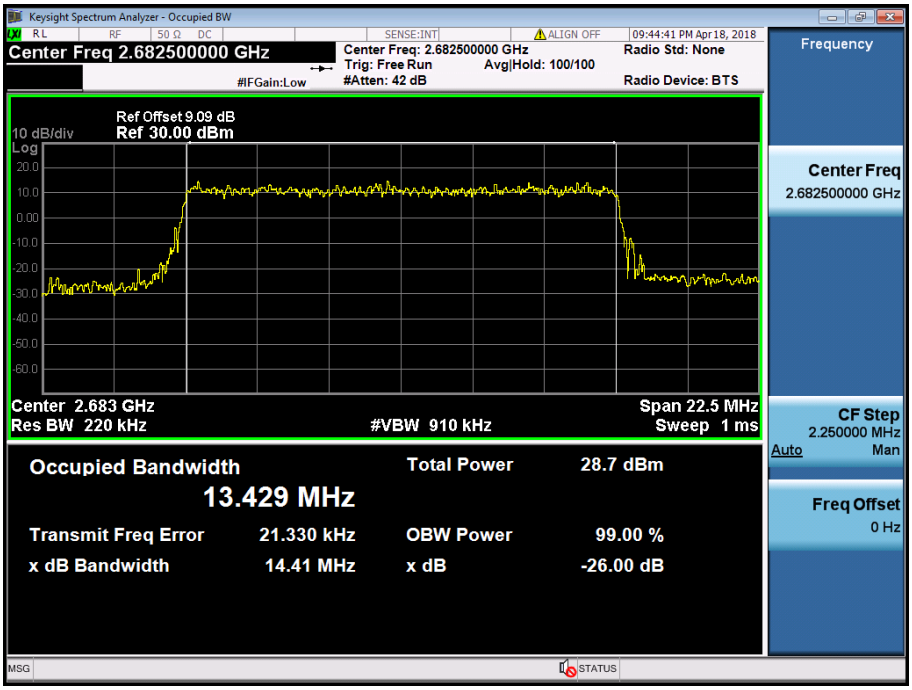
8.1.2 LTE Band 41



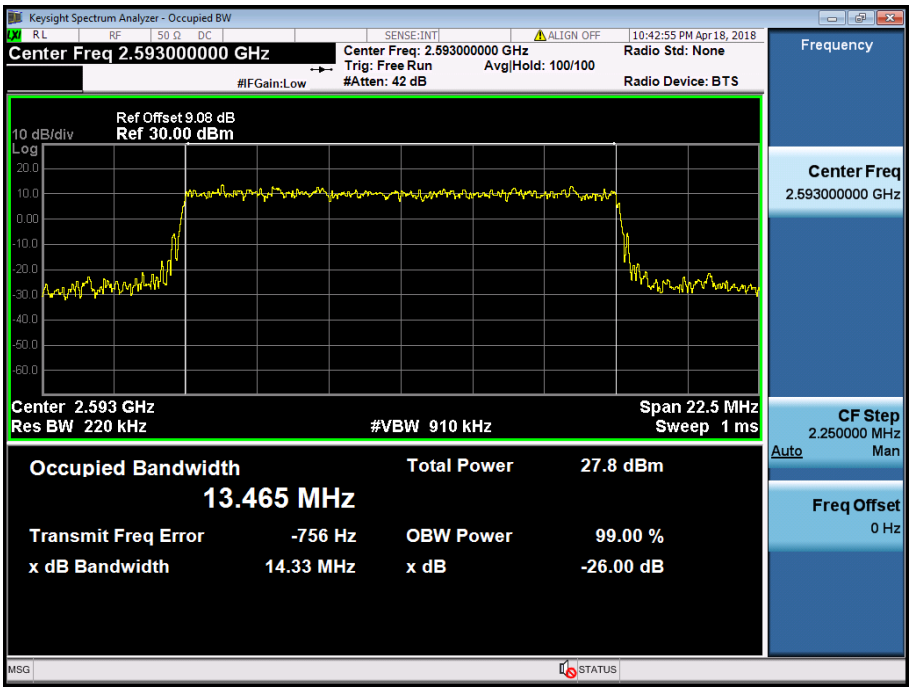
LTE Band 41 / 20 MHz / QPSK - RB Size 100



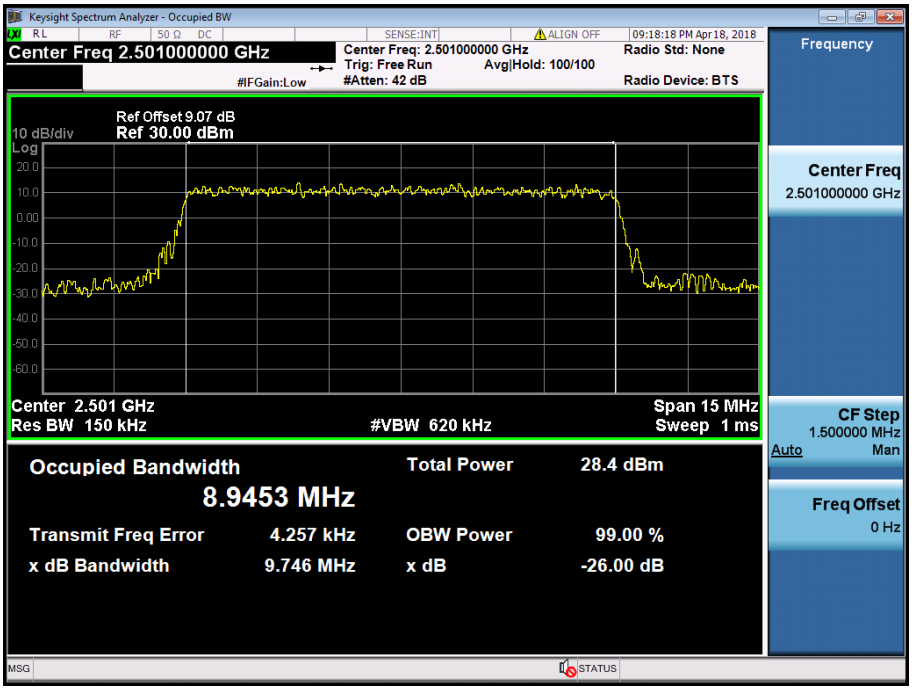
LTE Band 41 / 20 MHz / 16QAM - RB Size 100



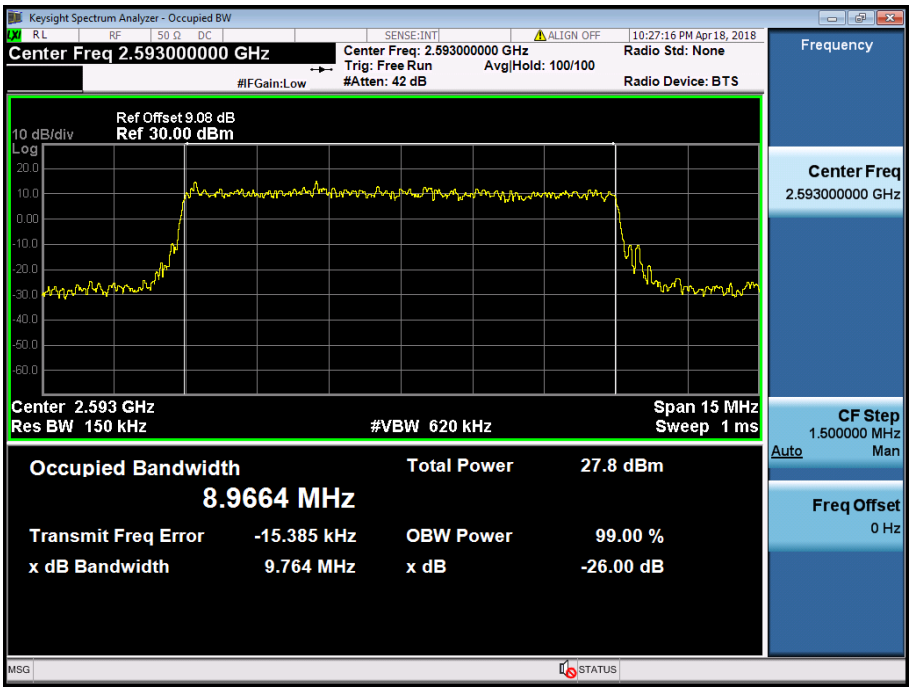
LTE Band 41 / 15 MHz / QPSK - RB Size 75



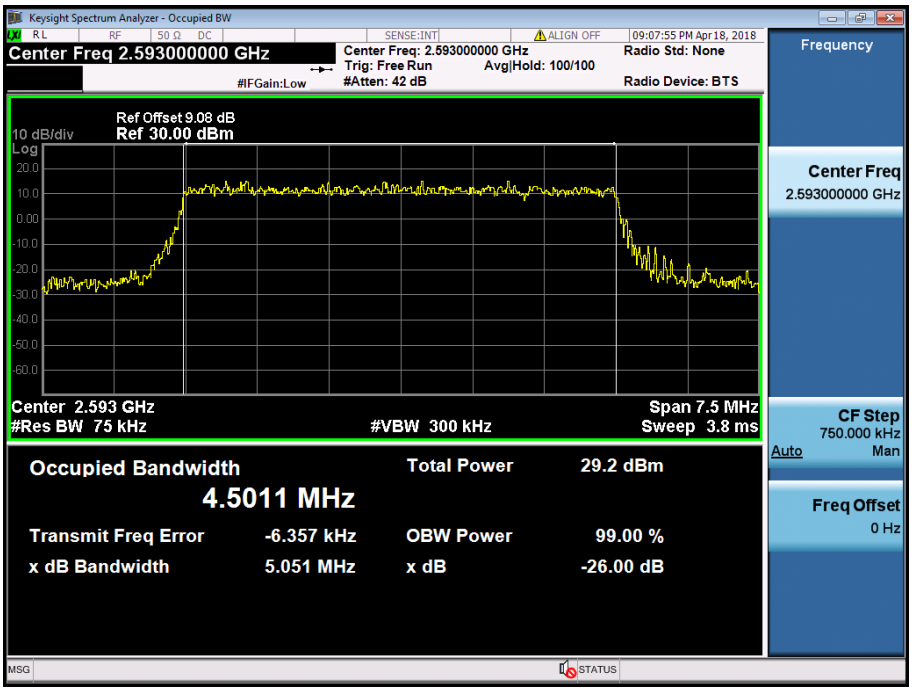
LTE Band 41 / 15 MHz / 16QAM - RB Size 75



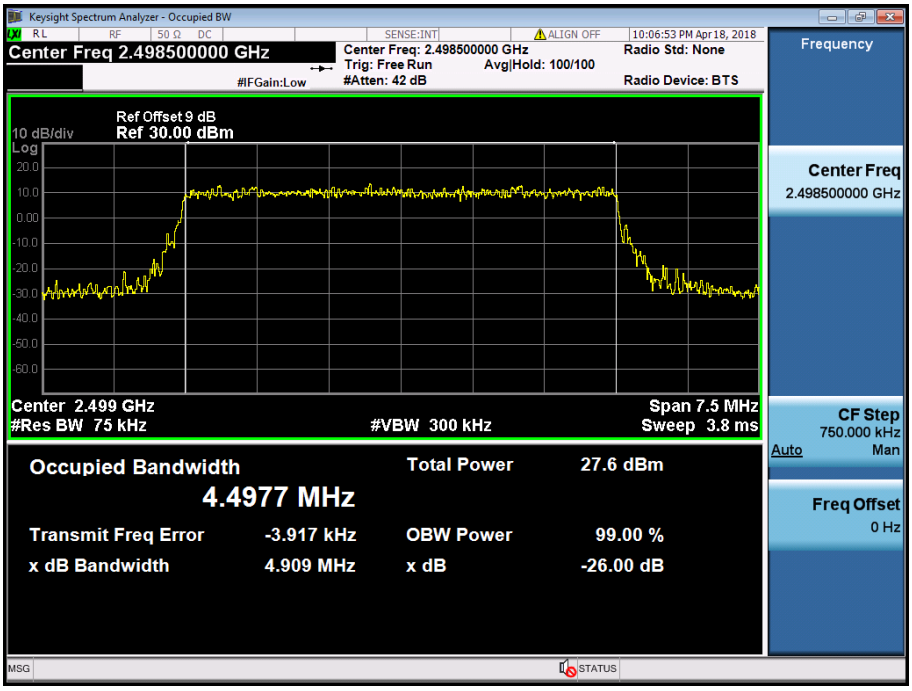
LTE Band 41 / 10 MHz / QPSK - RB Size 50



LTE Band 41 / 10 MHz / 16QAM - RB Size 50



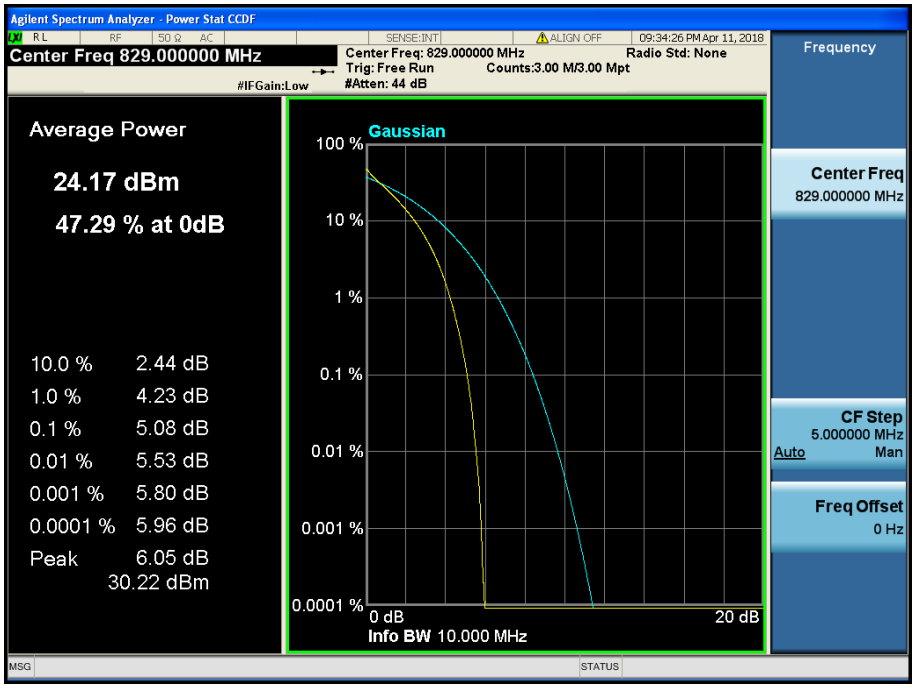
LTE Band 41 / 5 MHz / QPSK - RB Size 25



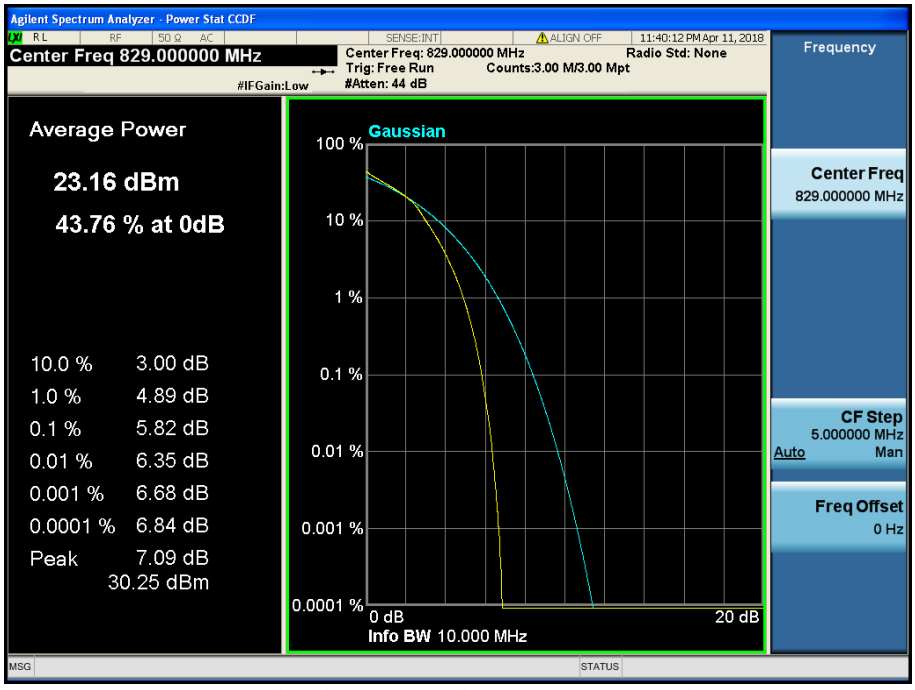
LTE Band 41 / 5 MHz / 16QAM - RB Size 25

8.2 PEAK TO AVERAGE RATIO

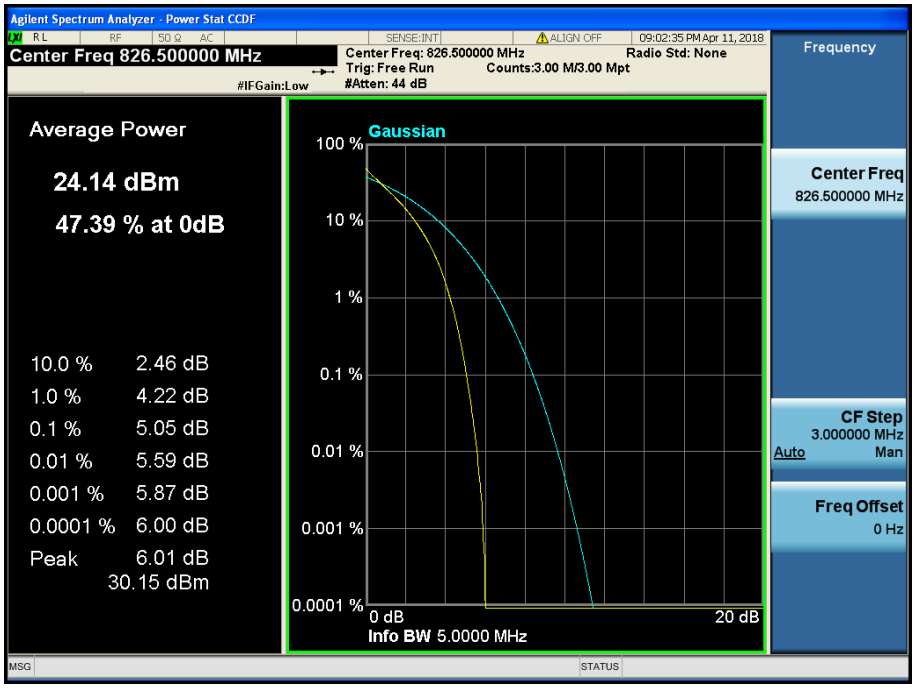
8.2.1 LTE Band 5



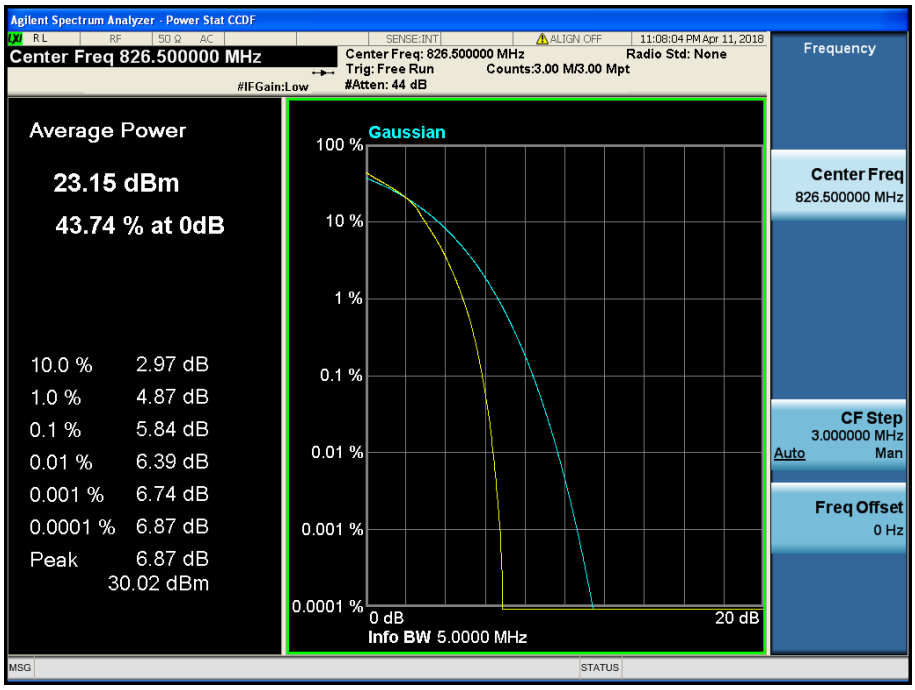
LTE Band 5 / 10 MHz / QPSK - RB Size 50



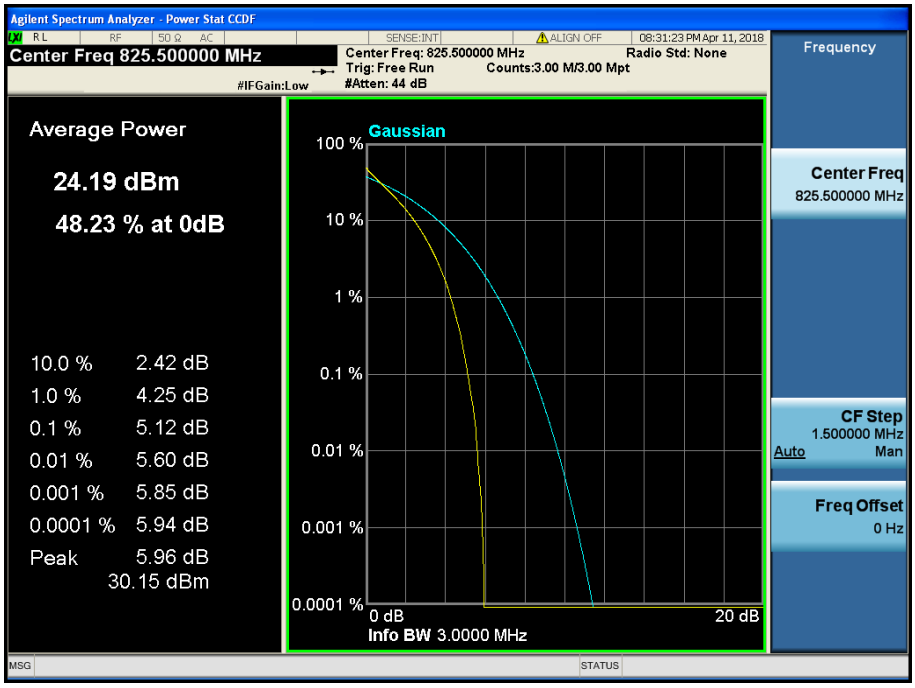
LTE Band 5 / 10 MHz / 16QAM - RB Size 50



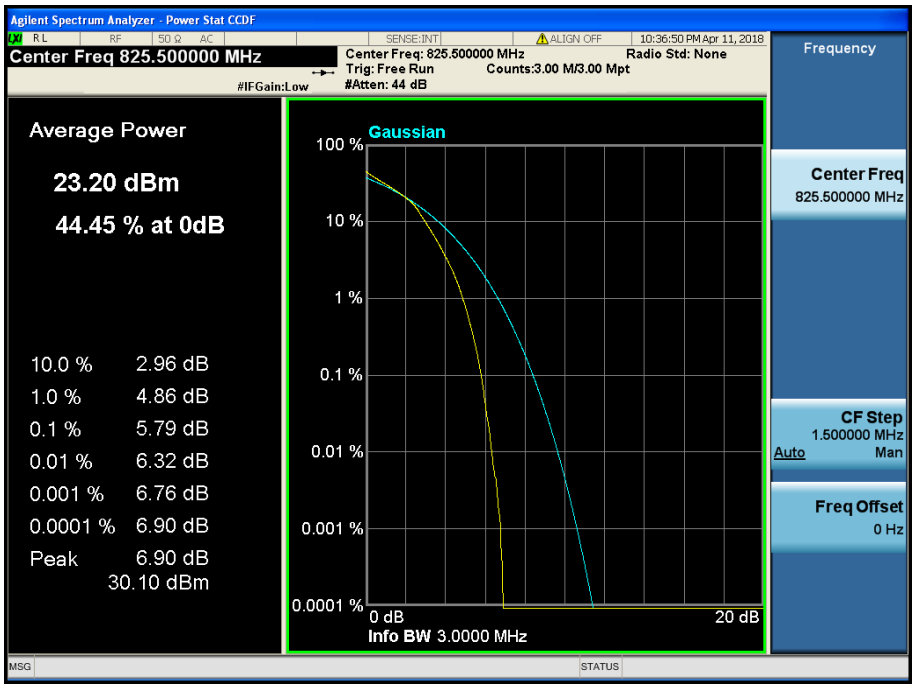
LTE Band 5 / 5 MHz / QPSK - RB Size 25



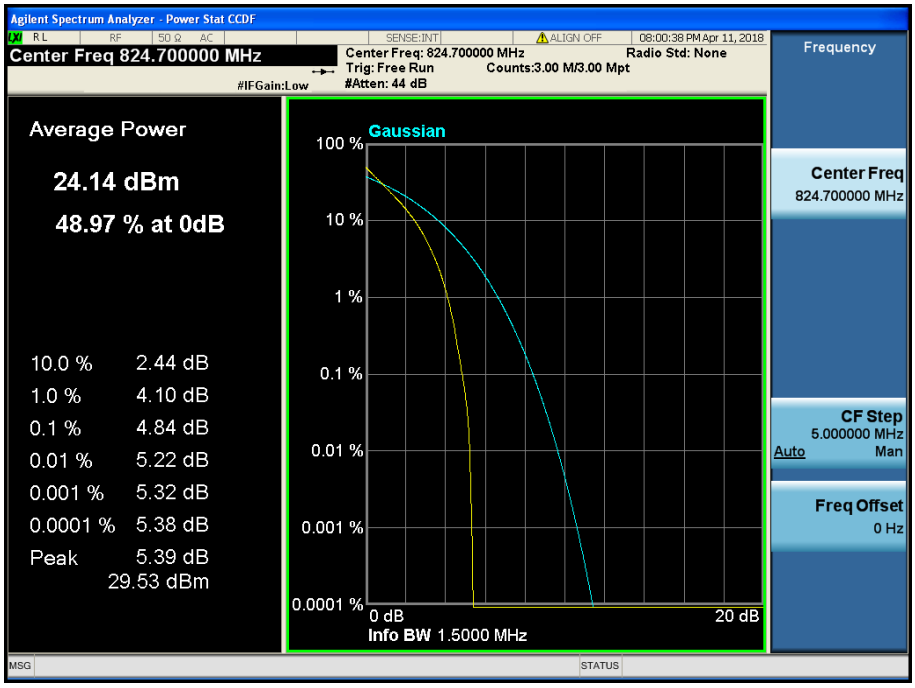
LTE Band 5 / 5 MHz / 16QAM - RB Size 25



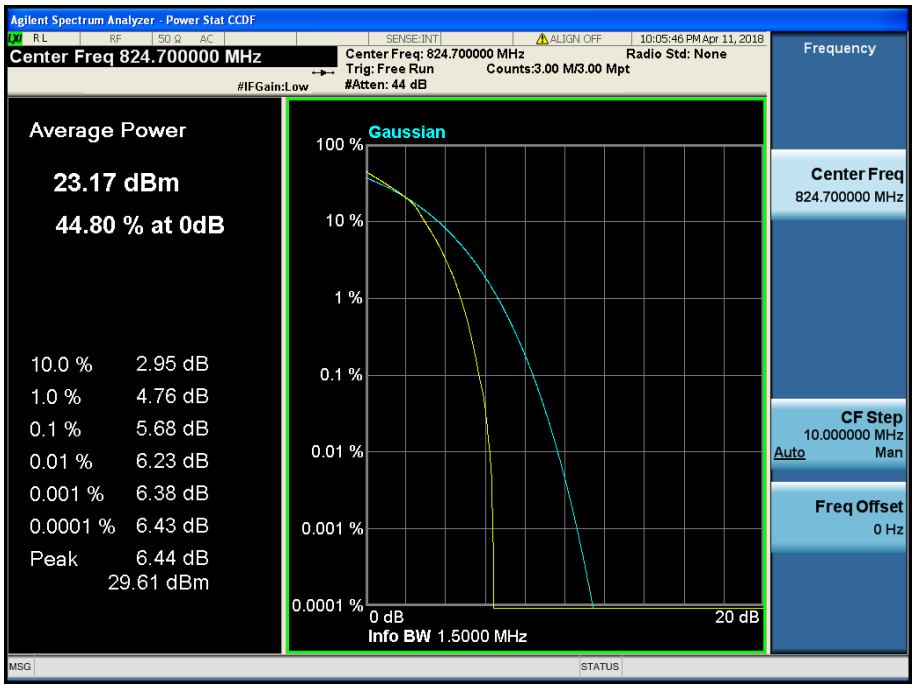
LTE Band 5 / 3 MHz / QPSK - RB Size 15



LTE Band 5 / 3 MHz / 16QAM - RB Size 15

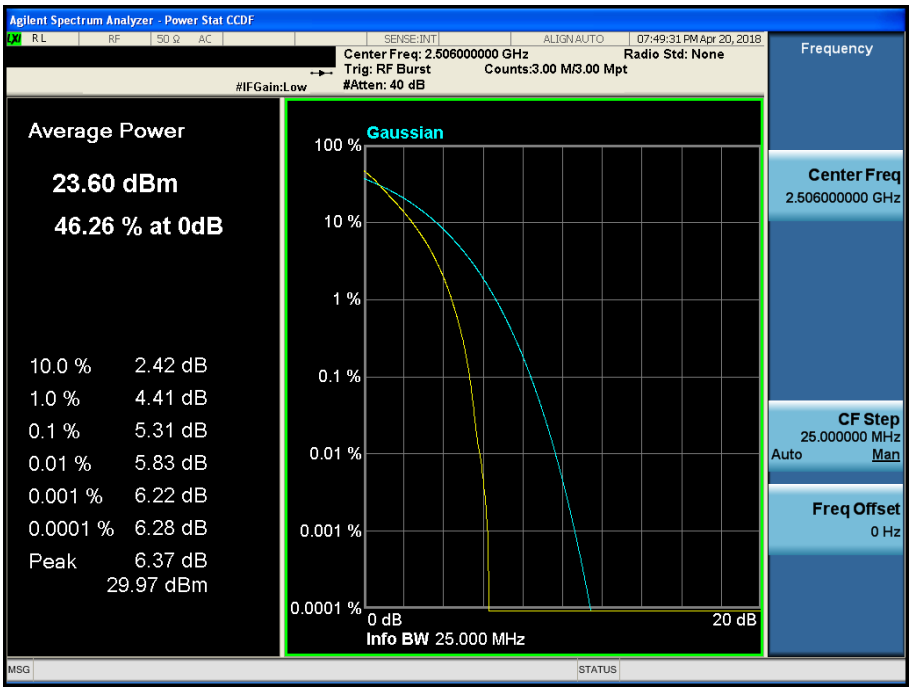


LTE Band 5 / 1.4 MHz / QPSK - RB Size 6

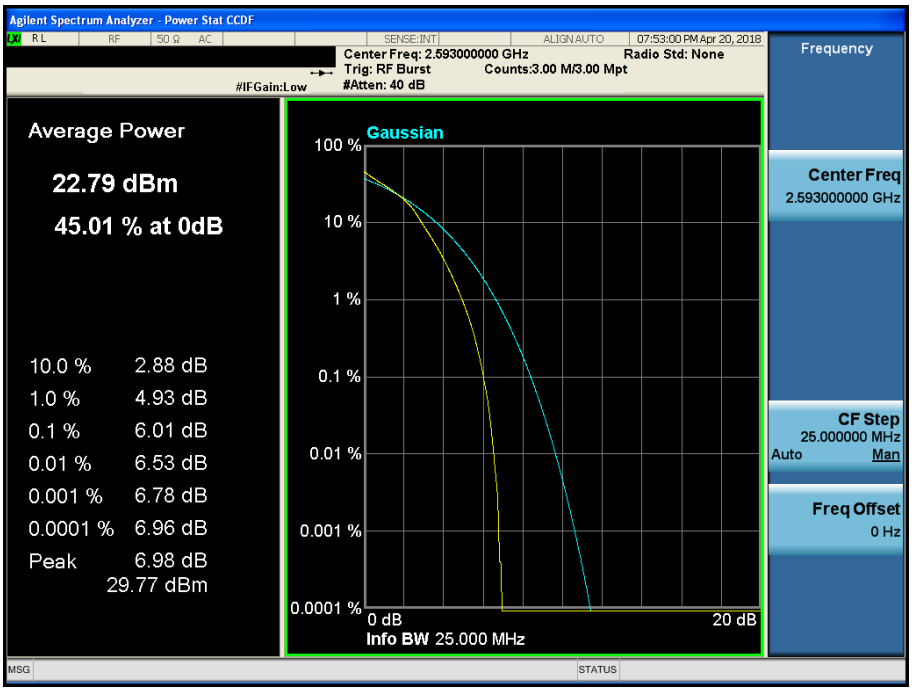


LTE Band 5 / 1.4 MHz / 16QAM - RB Size 6

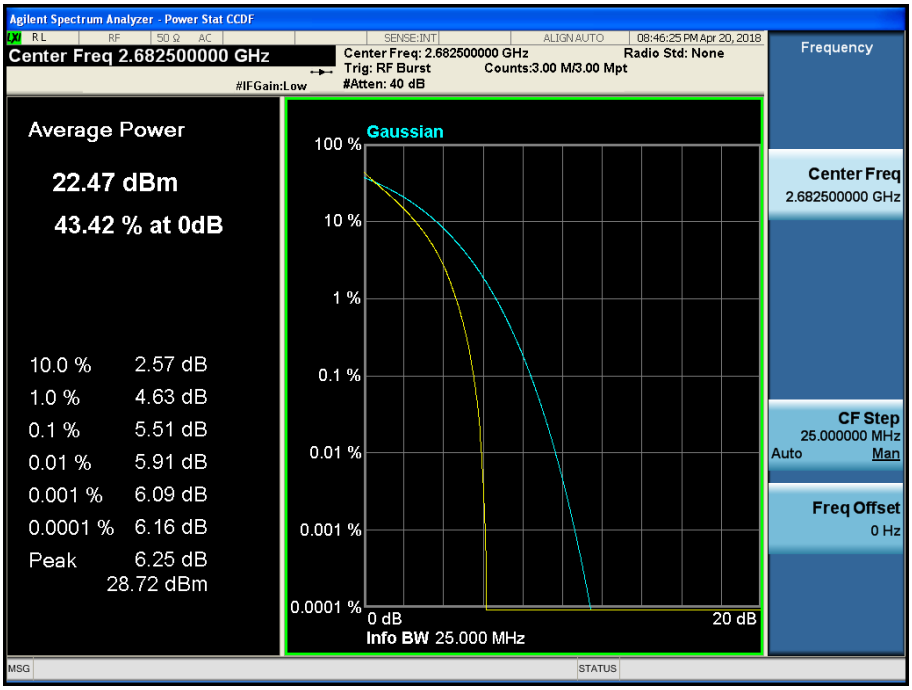
8.2.2 LTE Band 41



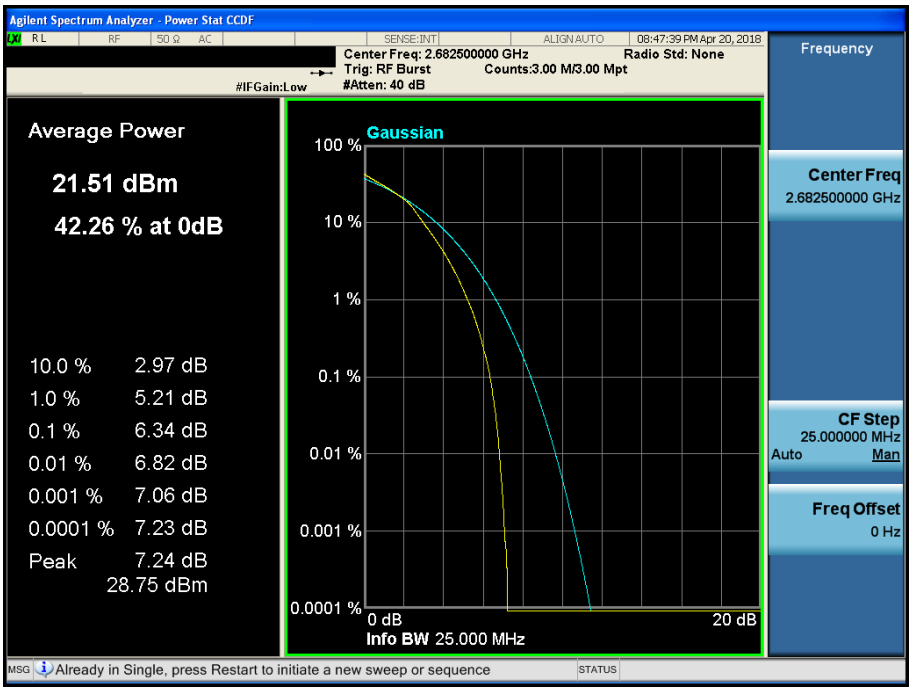
LTE Band 41 / 20 MHz / QPSK - RB Size 100



LTE Band 41 / 20 MHz / 16QAM - RB Size 100



LTE Band 41 / 15 MHz / QPSK - RB Size 75



LTE Band 41 / 15 MHz / 16QAM - RB Size 75