

TEST REPORT



DT&C Co., Ltd.

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1. Report No : DRTFCC2003-0058
2. Customer
 - Name : LG Electronics 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 / OA2006
FCC ID : ZNFOA2006
5. Test Method Used : KDB971168 D01v03, ANSI/TIA-603-E-2016, ANSI C63.26-2015
Test Specification : §2, §22, §27
6. Date of Test : 2020.02.10 ~ 2020.02.21
7. Testing Environment : Refer to appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Reviewed by
	Name : JungWoo Kim 	Name : GeunKi Son  (Signature)

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2020 . 03. 05 .

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	Revised by	Reviewed by
DRTFCC2003-0058	Mar. 05, 2020	Initial issue	JungWoo Kim	GeunKi Son

Table of Contents

1. GENERAL INFORMATION	5
2. INTRODUCTION	6
2.1 EUT DESCRIPTION	6
2.2. EUT CAPABILITIES	6
2.3. TESTING ENVIRONMENT	6
2.4 MEASURING INSTRUMENT CALIBRATION.....	6
2.5. MEASUREMENT UNCERTAINTY	6
2.6. TEST FACILITY.....	6
3. DESCRIPTION OF TESTS.....	7
3.1 ERP & EIRP (Effective Radiated Power & Equivalent Isotropic Radiated Power)	7
3.2 PEAK TO AVERAGE RATIO	9
3.3 OCCUPIED BANDWIDTH.	10
3.4 BAND EDGE EMISSIONS AT ANTENNA TERMINAL	11
3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL	12
3.6 UNDESIRABLE EMISSIONS	13
3.7 FREQUENCY STABILITY	14
4. LIST OF TEST EQUIPMENT	15
5. SUMMARY OF TEST RESULTS	16
6. SAMPLE CALCULATION	17
7.TEST DATA.....	19
7.1 OCCUPIED BANDWIDTH.....	19
7.2 PEAK TO AVERAGE RATIO	19
7.3 BAND EDEG EMISSIONS (Conducted).....	19
7.4 SPURIOUS AND HARMONICS EMISSIONS (Conducted)	19
7.5 ERP	20
7.5.1 LTE Band 12.....	20
7.5.2 LTE Band 5.....	21
7.6 UNDESIRABLE EMISSIONS (Radiated).....	22
7.6.1 LTE Band 12.....	22
7.6.2 LTE Band 5.....	23
7.7 FREQUENCY STABILITY	24
7.7.1 LTE Band 12.....	24
7.8.2 LTE Band 5.....	25
8. TEST PLOTS	26
8.1 OCCUPIED BANDWIDTH.....	26
8.1.1 LTE Band 12.....	26
8.1.2 LTE Band 5.....	34
8.2 PEAK TO AVERAGE RATIO	42
8.2.1 LTE Band 12.....	42

8.2.2 LTE Band 5.....	50
8.3 BAND EDGE EMISSIONS(Conducted).....	58
8.3.1 LTE Band 12.....	58
8.3.2 LTE Band 5.....	66
8.4 SPURIOUS AND HARMONICS EMISSIONS(Conducted)	74
8.4.1 LTE Band 12.....	74
8.4.2 LTE Band 5.....	81

1. GENERAL INFORMATION

Applicant Name : LG Electronics USA, Inc.
Address : 1000 Sylvan Ave. Englewood Cliffs, New Jersey, United States 07632
FCC ID : ZNFOA2006
FCC Classification : PCS Licensed Transmitter held to ear (PCE)
EUT Type : Mobile Phone
Model Name : OA2006
Add Model Name : NA
Supplying power : DC 3.87 V
Antenna Information : PIFA Antenna

Mode	TX Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max power (dBm)	Max power (W)
LTE Band 12	704 ~ 711	8M95G7D	QPSK	18.72	0.074
LTE Band 12	704 ~ 711	8M93W7D	16QAM	17.77	0.060
LTE Band 12	704 ~ 711	8M95W7D	64QAM	17.55	0.057
LTE Band 12	701.5 ~ 713.5	4M50G7D	QPSK	18.61	0.073
LTE Band 12	701.5 ~ 713.5	4M49W7D	16QAM	17.97	0.063
LTE Band 12	701.5 ~ 713.5	4M49W7D	64QAM	17.52	0.056
LTE Band 12	700.5 ~ 714.5	2M71G7D	QPSK	18.44	0.070
LTE Band 12	700.5 ~ 714.5	2M70W7D	16QAM	17.73	0.059
LTE Band 12	700.5 ~ 714.5	2M70W7D	64QAM	17.54	0.057
LTE Band 12	699.7 ~ 715.3	1M09G7D	QPSK	18.10	0.065
LTE Band 12	699.7 ~ 715.3	1M09W7D	16QAM	17.26	0.053
LTE Band 12	699.7 ~ 715.3	1M09W7D	64QAM	16.34	0.043
LTE Band 5	829 ~ 844	8M97G7D	QPSK	18.47	0.070
LTE Band 5	829 ~ 844	8M96W7D	16QAM	17.69	0.059
LTE Band 5	829 ~ 844	8M96W7D	64QAM	16.53	0.045
LTE Band 5	826.5 ~ 846.5	4M49G7D	QPSK	18.10	0.065
LTE Band 5	826.5 ~ 846.5	4M48W7D	16QAM	17.33	0.054
LTE Band 5	826.5 ~ 846.5	4M49W7D	64QAM	16.37	0.043
LTE Band 5	825.5 ~ 847.5	2M69G7D	QPSK	18.25	0.067
LTE Band 5	825.5 ~ 847.5	2M69W7D	16QAM	17.58	0.057
LTE Band 5	825.5 ~ 847.5	2M70W7D	64QAM	16.57	0.045
LTE Band 5	824.7 ~ 848.3	1M09G7D	QPSK	18.07	0.064
LTE Band 5	824.7 ~ 848.3	1M09W7D	16QAM	17.16	0.052
LTE Band 5	824.7 ~ 848.3	1M09W7D	64QAM	16.24	0.042

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, 850 WCDMA/HSUPA, Multi-band LTE, 802.11b/g/n/ac WLAN(2.4GHz)
802.11a/n/ac WLAN(5GHz), Bluetooth(BDR, EDR, LE), NFC.

2.3. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+21 °C ~ +25 °C
▪ Relative Humidity	39 % ~ 44 %

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 %, $k = 2$)

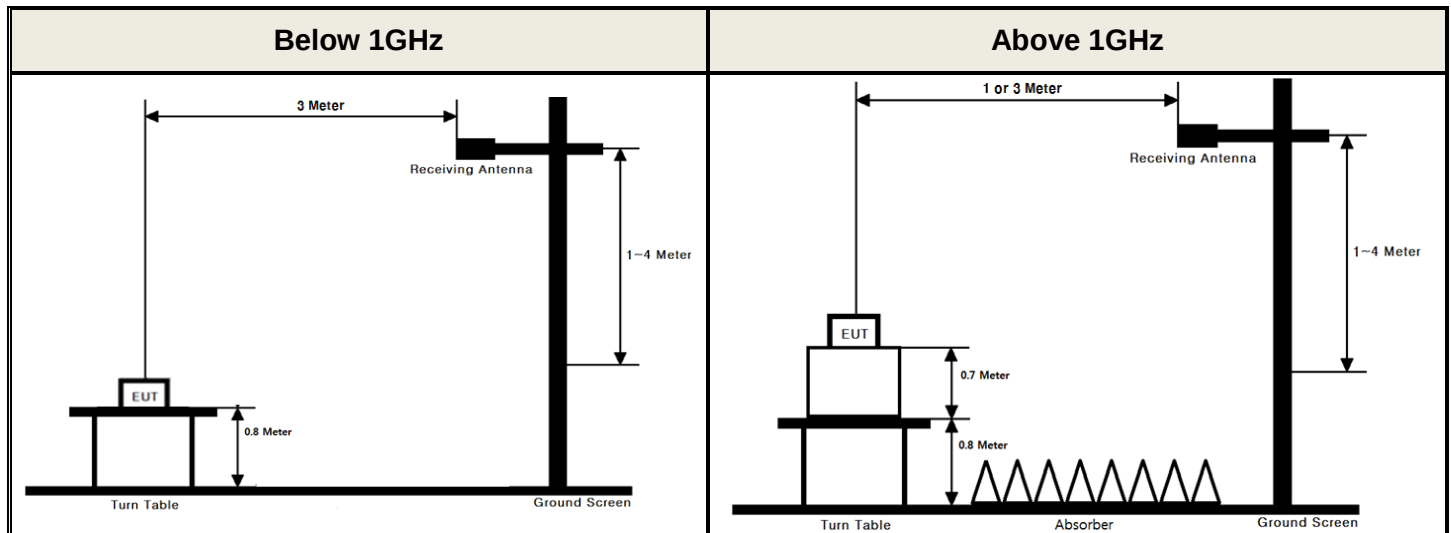
2.6. TEST FACILITY

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		
www.dtnet.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

3. DESCRIPTION OF TESTS

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

Test Set-up



These measurements were performed at 3 m test site. The equipment under test is placed on a non-conductive table 1.5-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 D01v03 - 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 $\geq$ 3 x RBW.
4. Set number of points in sweep $\geq$ 2 x span / RBW.
5. Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq$ $[10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$ 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.

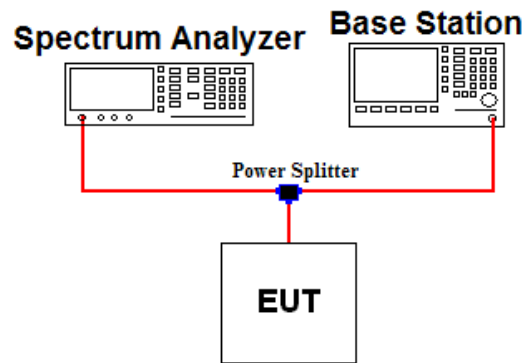
The ERP/EIRP is calculated using the following formula:

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 D01v03 - 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.

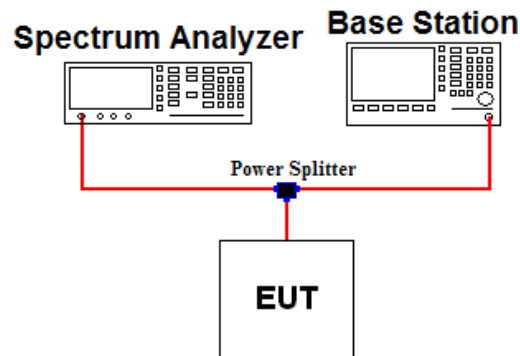
Test setting

The spectrum Analyzer's CCDF measurement function is enabled.

1. Set resolution/measurement bandwidth $\geq$ 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 $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ 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 D01v03 - Section 4.3
- ANSI C63.26-2015 – Section 5.4.4

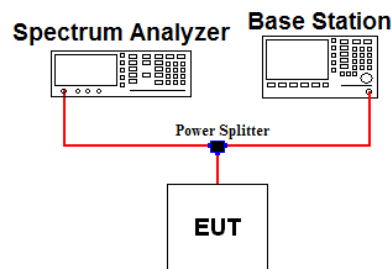
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

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. $RBW = 1 \sim 5 \%$ of the expected OBW & $VBW \geq 3 \times RBW$
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 D01v03 - 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 $\geq 3 \times$ RBW
5. Detector = RMS & Trace mode = Max hold
6. Sweep time = Auto couple or 1 s for band edge
7. Number of sweep point $\geq 2 \times$ span / RBW
8. The trace was allowed to stabilize

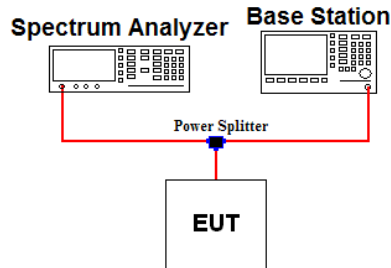
Note 1: Per Part 22.917(b)(1) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit.

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: Per Part 27(g) for operations in the 600 MHz band and the 698-746 MHz band, 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.

3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

Test set-up



Test Procedure

- KDB971168 D01v03 - 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.

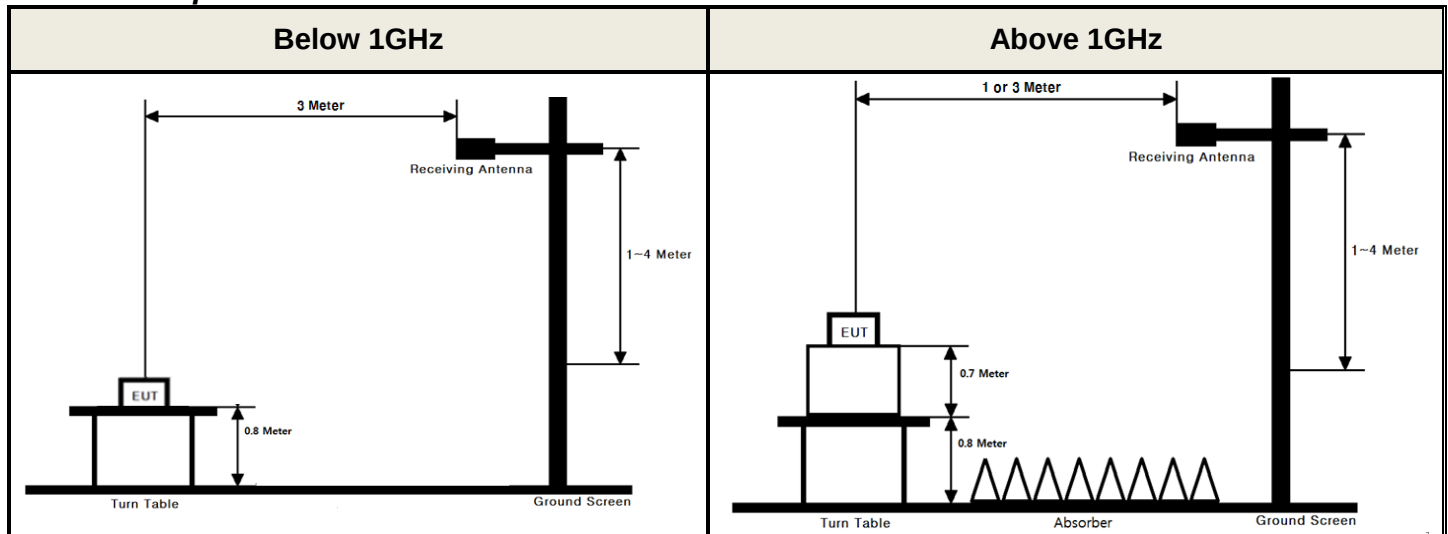
Test setting

1. RBW = 100 kHz(Below 1 GHz) or 1 MHz(Above 1 GHz) & VBW $\geq 3 \times$ RBW (Refer to Note 1)
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point $\geq 2 \times$ 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



These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 1.5-meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1 GHz 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 D01v03 - 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 $\geq 3 \times$ RBW
2. Detector = RMS & Trace mode = Max hold
3. Sweep time = Auto couple
4. Number of sweep point $\geq 2 \times$ 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.

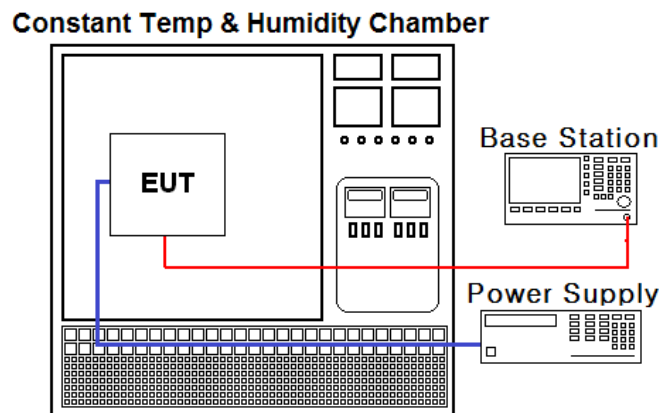
For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

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 D01v03 - 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 $\pm 0.00025\%$ (± 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	19/12/16	20/12/16	MY48010133
Spectrum Analyzer	Agilent Technologies	N9020A	19/06/26	20/06/26	US47360812
DC power supply	Agilent Technologies	66332A	19/06/25	20/06/25	MY43001172
Multimeter	FLUKE	17B+	19/12/16	20/12/16	36390701WS
Power Divider	Weinschel	1515-1	19/12/16	20/12/16	TW493
Temp & Humi	SJ Science	SJ-TH-S50	19/06/25	20/06/25	U5542113
Radio Communication Analyzer	Anritus	MT8820C	19/06/26	20/06/26	6201127429
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Loop Antenna	ETS-Lindgren	6502	19/09/18	21/09/18	00226186
Bilog Antenna	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Dipole Antenna	Schwarzbeck	VHA9103	19/02/28	21/02/28	2116
Dipole Antenna	Schwarzbeck	VHA9103	18/04/13	20/04/13	2117
Dipole Antenna	Schwarzbeck	UHA9105	19/02/28	21/02/28	2261
Dipole Antenna	Schwarzbeck	UHA9105	18/04/13	20/04/13	2262
HORN ANT	ETS	3117	18/05/10	20/05/10	00140394
HORN ANT	ETS	3117	18/03/26	20/03/26	00152145
HORN ANT	A.H.Systems	SAS-574	19/04/23	21/04/23	154
HORN ANT	A.H.Systems	SAS-574	19/07/03	21/07/03	155
Amplifier	EMPOWER	BBS3Q7ELU	19/06/24	20/06/24	1020
PreAmplifier	H.P	8447D	19/12/16	20/12/16	2944A07774
PreAmplifier	Agilent	8449B	19/06/27	20/06/27	3008A02108
High-pass filter	Wainwright	WHKX12-935-1000-15000-40SS	19/06/24	20/06/24	7
Cable	DTNC	Cable	20/01/16	21/01/16	M-01
Cable	DTNC	Cable	20/01/16	21/01/16	M-02
Cable	Junkosha	MWX315	20/01/16	21/01/16	M-05
Cable	Junkosha	MWX221	20/01/16	21/01/16	M-06
Cable	DTNC	Cable	20/01/16	21/01/16	RF-09

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

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	< 13 dB		C
2.1051 22.917(a) 27.53(g)	Band Edge / Conducted Spurious Emissions	> 43 + 10log ₁₀ (P) dB at Band edge and for all out-of-band emissions		C
2.1055 22.355 27.54	Frequency Stability	< 2.5 ppm (Part 22) Fundamental emissions must stay within Authorized frequency block (Part 24, 27)		C
27.50(c.10)	Radiated Output Power (B12)	< 3 Watts max. ERP	Radiated	C Note3
22.913(a.5)	Radiated Output Power (B5)	< 7 Watts max. ERP		C Note3
2.1053 22.917(a) 27.53(g)	Undesirable Emissions	> 43 + 10log ₁₀ (P) dB for all out-of-band emissions		C Note3
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 item was performed in each axis and the worst case data was reported.				

6. SAMPLE CALCULATION

A. Emission Designator

LTE Band 12(QPSK)

Emission Designator = **8M95G7D**

LTE OBW = 8.951 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 12(16QAM)

Emission Designator = **8M93W7D**

LTE OBW = 8.925 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 12(64QAM)

Emission Designator = **8M95W7D**

LTE OBW = 8.945 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 5(QPSK)

Emission Designator = **8M97G7D**

LTE OBW = 8.968 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 5(16QAM)

Emission Designator = **8M96W7D**

LTE OBW = 8.960 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 5(64QAM)

Emission Designator = **8M96W7D**

LTE OBW = 8.959 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

B. For substitution method

- 1) The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1 GHz respectively above ground.
- 2) The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
- 3) During the test, the turn table is rotated until the maximum signal is found.
- 4) Record the field strength meter's level. (ex. Spectrum reading level is -8.5 dBm)
- 5) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 6) Increase the signal generator output till the field strength meter's level is equal to the item (4).
(ex. Signal generator level is -18.04 dBm)
- 7) The gain of the cable and amplifier between the signal generator and terminals of substituted antenna is 46.92 dB at test frequency.
- 8) Record the level at substituted antenna terminal. (ex. 28.88dBm)
- 9) The result is calculated as below;

$$\text{EIRP(dBm)} = \text{LEVLE@ANTENNA TERMINAL} + \text{TX Antenna Gain (dBi)}$$

$$\text{ERP(dBm)} = \text{LEVLE@ANTENNA TERMINAL} + \text{TX Antenna Gain (dBd)}$$

$$\text{Where, TX Antenna Gain (dBd)} = \text{TX Antenna Gain (dBi)} - 2.15 \text{ dB}$$

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

7.5.1 LTE Band 12

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	704	QPSK	1/25	V	19.05	-0.65	18.40	0.069
		16QAM	1/25	V	18.42	-0.65	17.77	0.060
		64QAM	1/25	V	18.00	-0.65	17.35	0.054
	711	QPSK	1/0	V	19.35	-0.63	18.72	0.074
		16QAM	1/0	V	18.25	-0.63	17.62	0.058
		64QAM	1/0	V	18.18	-0.63	17.55	0.057
5	701.5	QPSK	1/24	V	18.75	-0.66	18.09	0.064
		16QAM	1/24	V	17.93	-0.66	17.27	0.053
		64QAM	1/24	V	17.59	-0.66	16.93	0.049
	707.5	QPSK	1/0	V	19.25	-0.64	18.61	0.073
		16QAM	1/0	V	18.61	-0.64	17.97	0.063
		64QAM	1/0	V	18.16	-0.64	17.52	0.056
	713.5	QPSK	1/0	V	18.40	-0.62	17.78	0.060
		16QAM	1/0	V	17.50	-0.62	16.88	0.049
		64QAM	1/0	V	17.20	-0.62	16.58	0.045
3	700.5	QPSK	1/7	V	18.52	-0.66	17.86	0.061
		16QAM	1/7	V	17.58	-0.66	16.92	0.049
		64QAM	1/7	V	17.40	-0.66	16.74	0.047
	707.5	QPSK	1/0	V	19.08	-0.64	18.44	0.070
		16QAM	1/0	V	18.37	-0.64	17.73	0.059
		64QAM	1/0	V	18.18	-0.64	17.54	0.057
	714.5	QPSK	1/0	V	18.24	-0.62	17.62	0.058
		16QAM	1/0	V	17.32	-0.62	16.70	0.047
		64QAM	1/0	V	16.92	-0.62	16.30	0.043
1.4	699.7	QPSK	1/0	V	18.31	-0.66	17.65	0.058
		16QAM	1/0	V	17.41	-0.66	16.75	0.047
		64QAM	1/0	V	16.43	-0.66	15.77	0.038
	707.5	QPSK	1/2	V	18.74	-0.64	18.10	0.065
		16QAM	1/2	V	17.90	-0.64	17.26	0.053
		64QAM	1/2	V	16.98	-0.64	16.34	0.043
	715.3	QPSK	1/0	V	17.75	-0.62	17.13	0.052
		16QAM	1/0	V	17.08	-0.62	16.46	0.044
		64QAM	1/0	V	15.99	-0.62	15.37	0.034

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 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	1/49	H	18.13	-0.67	17.46	0.056
		16QAM	1/49	H	17.60	-0.67	16.93	0.049
		64QAM	1/49	H	16.58	-0.67	15.91	0.039
	836.5	QPSK	1/25	H	18.84	-0.74	18.10	0.065
		16QAM	1/25	H	18.01	-0.74	17.27	0.053
		64QAM	1/25	H	17.18	-0.74	16.44	0.044
	844	QPSK	1/0	H	19.28	-0.81	18.47	0.070
		16QAM	1/0	H	18.50	-0.81	17.69	0.059
		64QAM	1/0	H	17.34	-0.81	16.53	0.045
5	826.5	QPSK	1/0	H	17.43	-0.65	16.78	0.048
		16QAM	1/0	H	16.89	-0.65	16.24	0.042
		64QAM	1/0	H	15.71	-0.65	15.06	0.032
	836.5	QPSK	1/12	H	18.84	-0.74	18.10	0.065
		16QAM	1/12	H	18.07	-0.74	17.33	0.054
		64QAM	1/12	H	17.11	-0.74	16.37	0.043
	846.5	QPSK	1/0	H	18.43	-0.83	17.60	0.058
		16QAM	1/0	H	17.48	-0.83	16.65	0.046
		64QAM	1/0	H	16.64	-0.83	15.81	0.038
3	825.5	QPSK	1/14	H	17.57	-0.64	16.93	0.049
		16QAM	1/14	H	16.77	-0.64	16.13	0.041
		64QAM	1/14	H	15.89	-0.64	15.25	0.033
	836.5	QPSK	1/7	H	18.99	-0.74	18.25	0.067
		16QAM	1/7	H	18.32	-0.74	17.58	0.057
		64QAM	1/7	H	17.31	-0.74	16.57	0.045
	847.5	QPSK	1/0	H	17.90	-0.84	17.06	0.051
		16QAM	1/0	H	17.07	-0.84	16.23	0.042
		64QAM	1/0	H	16.02	-0.84	15.18	0.033
1.4	824.7	QPSK	1/5	H	16.93	-0.63	16.30	0.043
		16QAM	1/5	H	16.11	-0.63	15.48	0.035
		64QAM	1/5	H	15.20	-0.63	14.57	0.029
	836.5	QPSK	1/0	H	18.81	-0.74	18.07	0.064
		16QAM	1/0	H	17.90	-0.74	17.16	0.052
		64QAM	1/0	H	16.98	-0.74	16.24	0.042
	848.3	QPSK	1/2	H	17.76	-0.85	16.91	0.049
		16QAM	1/2	H	16.97	-0.85	16.12	0.041
		64QAM	1/2	H	15.86	-0.85	15.01	0.032

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 12

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	704	1/25	QPSK	1408.36	V	-57.42	2.78	-54.64	73.04	31.40
			16QAM	1409.08	V	-57.62	2.78	-54.84	72.61	30.77
			64QAM	1409.11	V	-57.32	2.78	-54.54	71.89	30.35
	711	1/0	QPSK	1412.79	V	-57.81	2.82	-54.99	73.71	31.72
			16QAM	1413.05	V	-58.07	2.82	-55.25	72.87	30.62
			64QAM	1412.57	V	-57.91	2.82	-55.09	72.64	30.55

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

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 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	1/49	QPSK	1666.50	H	-56.90	3.87	-53.03	70.49	30.46
			16QAM	1666.53	H	-56.98	3.87	-53.11	70.04	29.93
			64QAM	1666.29	H	-57.36	3.87	-53.49	69.40	28.91
	836.5	1/25	QPSK	1673.22	H	-56.78	3.89	-52.89	70.99	31.10
			16QAM	1673.42	H	-55.52	3.89	-51.63	68.90	30.27
			64QAM	1673.29	H	-56.91	3.89	-53.02	69.46	29.44
	844	1/0	QPSK	1678.62	H	-56.17	3.91	-52.26	70.73	31.47
			16QAM	1679.11	H	-56.65	3.91	-52.74	70.43	30.69
			64QAM	1679.20	H	-56.57	3.91	-52.66	69.19	29.53

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

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 12

OPERATING FREQUENCY : 707.5 MHz
 REFERENCE VOLTAGE : 3.87 VDC
 LIMIT : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

VOLTAGE (%)	POWER (V DC)	TEMP (°C)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	3.87	+20(Ref)	707,499,995	-5	-0.0071	-0.000000707
100%		-30	707,500,003	3	0.0042	0.000000424
100%		-20	707,500,007	7	0.0099	0.000000989
100%		-10	707,500,001	1	0.0014	0.000000141
100%		0	707,499,987	-13	-0.0184	-0.000001837
100%		+10	707,499,997	-3	-0.0042	-0.000000424
100%		+20	707,499,995	-5	-0.0071	-0.000000707
100%		+30	707,499,993	-7	-0.0099	-0.000000989
100%		+40	707,500,004	4	0.0057	0.000000565
100%		+50	707,500,003	3	0.0042	0.000000424
115%	4.45	+20	707,499,997	-3	-0.0042	-0.000000424
BATT.ENDPOINT	2.90	+20	707,500,007	7	0.0099	0.000000989

Note 1: 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.

7.8.2 LTE Band 5

OPERATING FREQUENCY : 836.5 MHz
 REFERENCE VOLTAGE : 3.87 VDC
 DEVIATION LIMIT : $\pm 0.00025\%$ or 2.5 ppm

VOLTAGE (%)	POWER (V DC)	TEMP (°C)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	3.87	+20(Ref)	836,500,011	11	0.0132	0.000001315
100%		-30	836,500,005	5	0.0060	0.000000598
100%		-20	836,500,006	6	0.0072	0.000000717
100%		-10	836,499,993	-7	-0.0084	-0.000000837
100%		0	836,500,003	3	0.0036	0.000000359
100%		+10	836,500,001	1	0.0012	0.000000120
100%		+20	836,500,011	11	0.0132	0.000001315
100%		+30	836,500,007	7	0.0084	0.000000837
100%		+40	836,499,997	-3	-0.0036	-0.000000359
100%		+50	836,500,004	4	0.0048	0.000000478
115%	4.45	+20	836,500,006	6	0.0072	0.000000717
BATT.ENDPOINT	2.90	+20	836,499,995	-5	-0.0060	-0.000000598

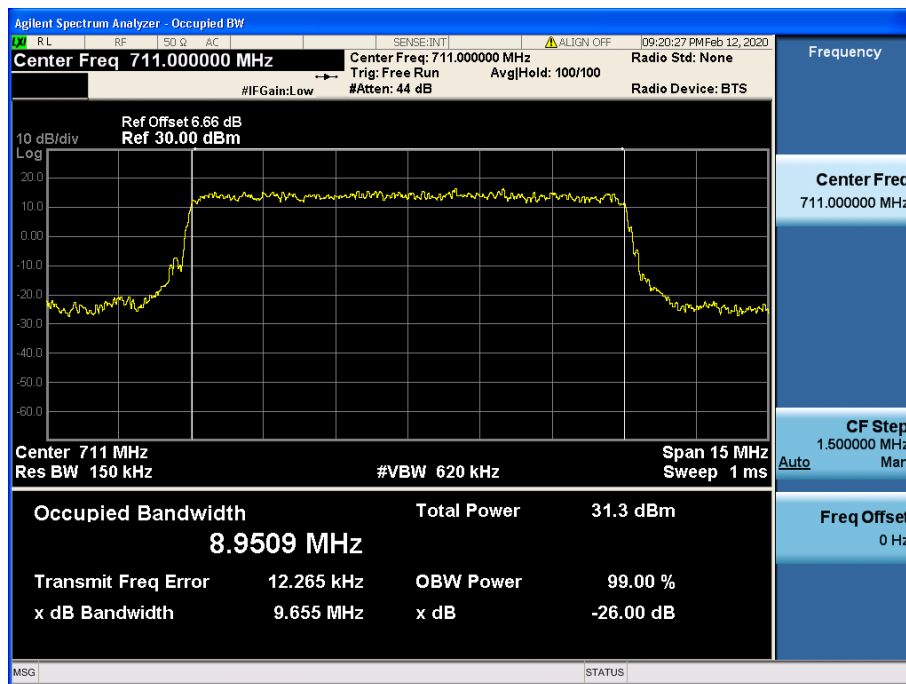
Note. Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. as such it is determined that the channels at the band edge would remain inband when the maximum measured frequency deviation noted during the frequency stability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

8. TEST PLOTS

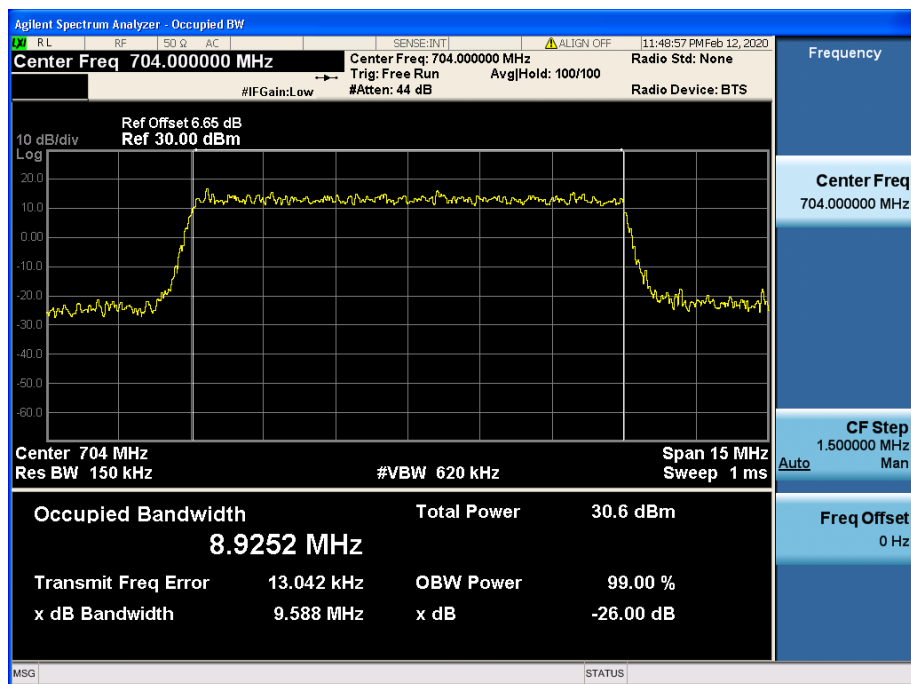
Note: All bandwidths, RB configurations, and modulations were investigated.
The worst case test results are reported.

8.1 OCCUPIED BANDWIDTH

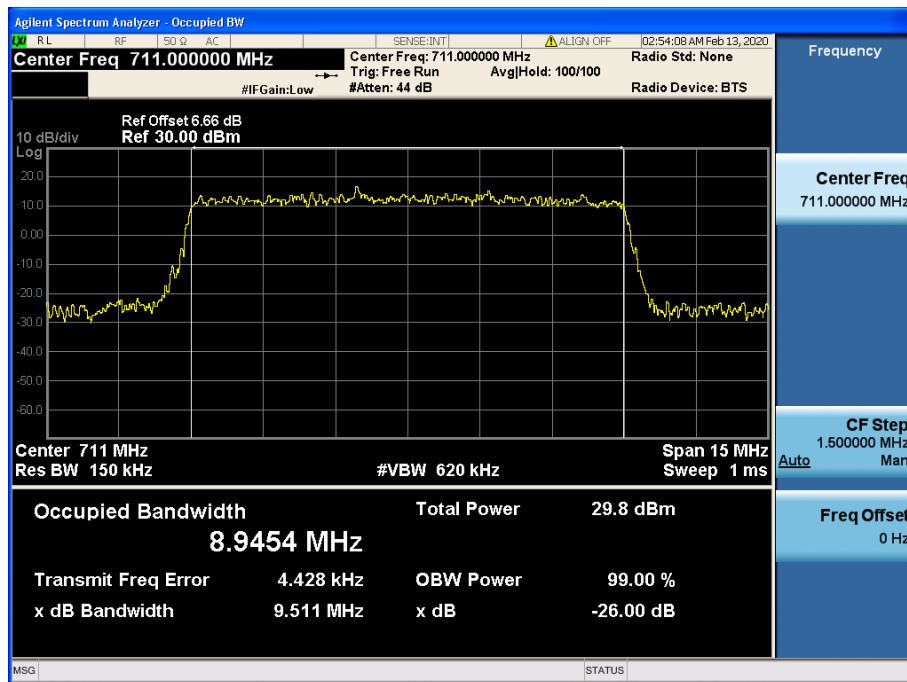
8.1.1 LTE Band 12



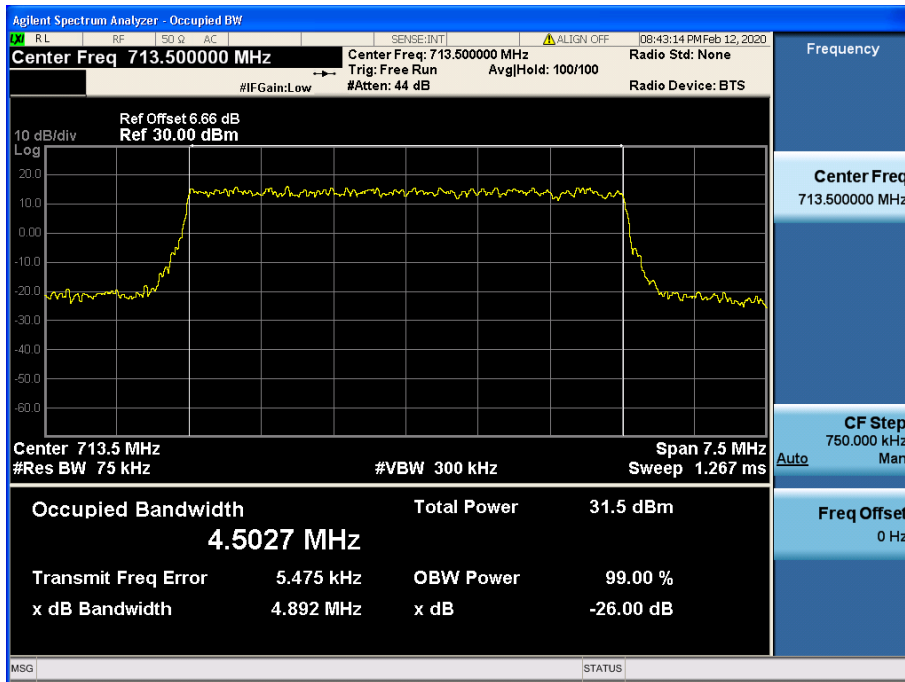
LTE Band 12 / 10 MHz / QPSK - RB Size 50



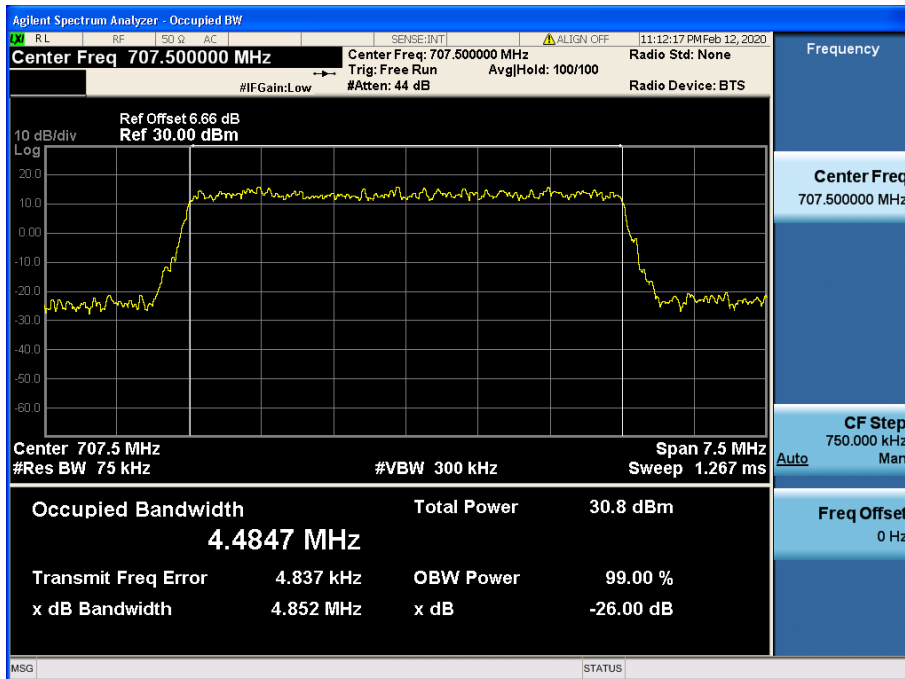
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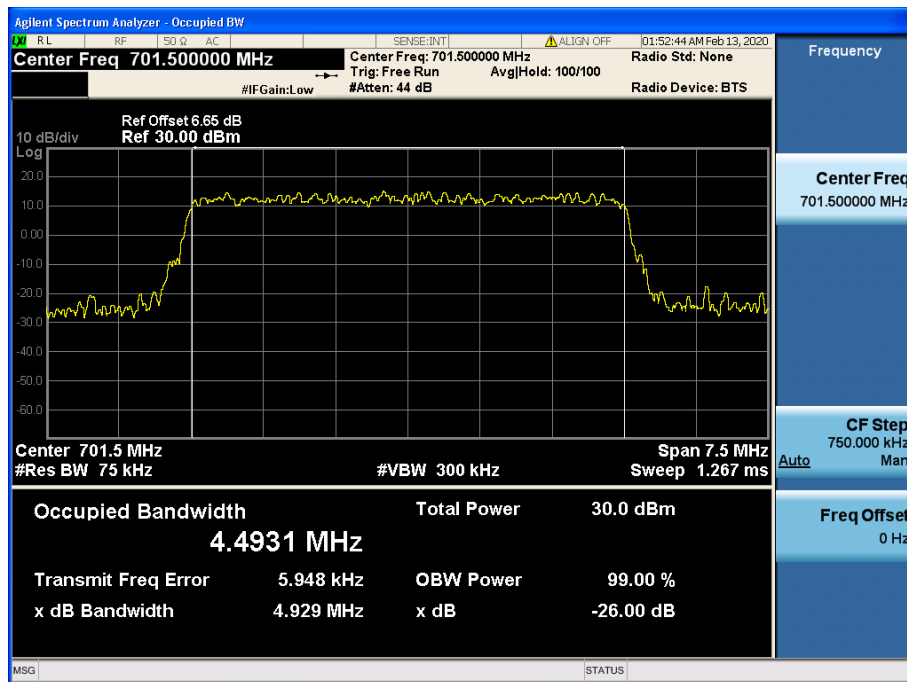
LTE Band 12 / 10 MHz / 64QAM- RB Size 50



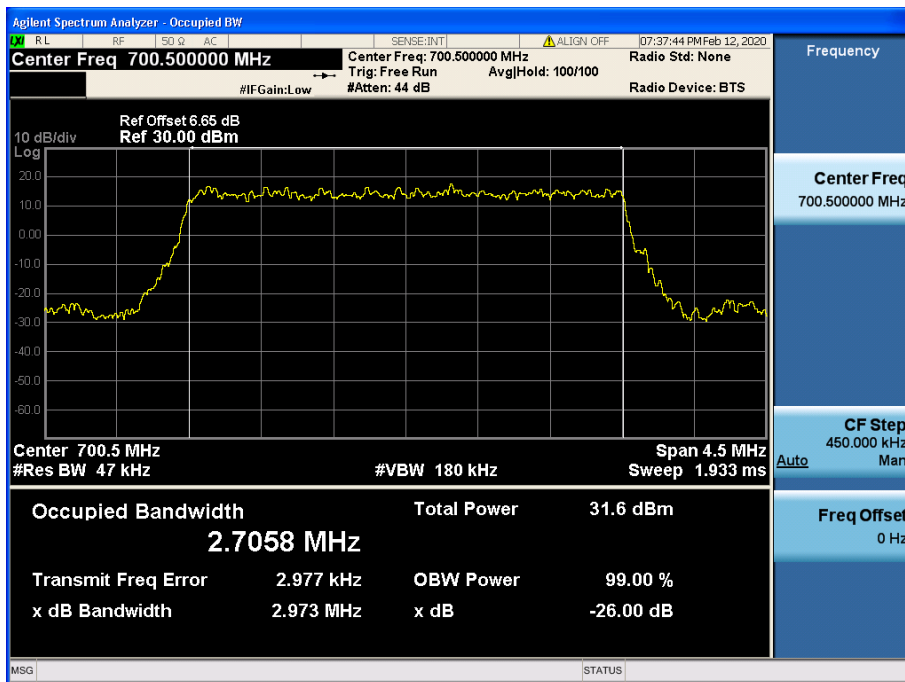
LTE Band 12 / 5 MHz / QPSK - RB Size 25



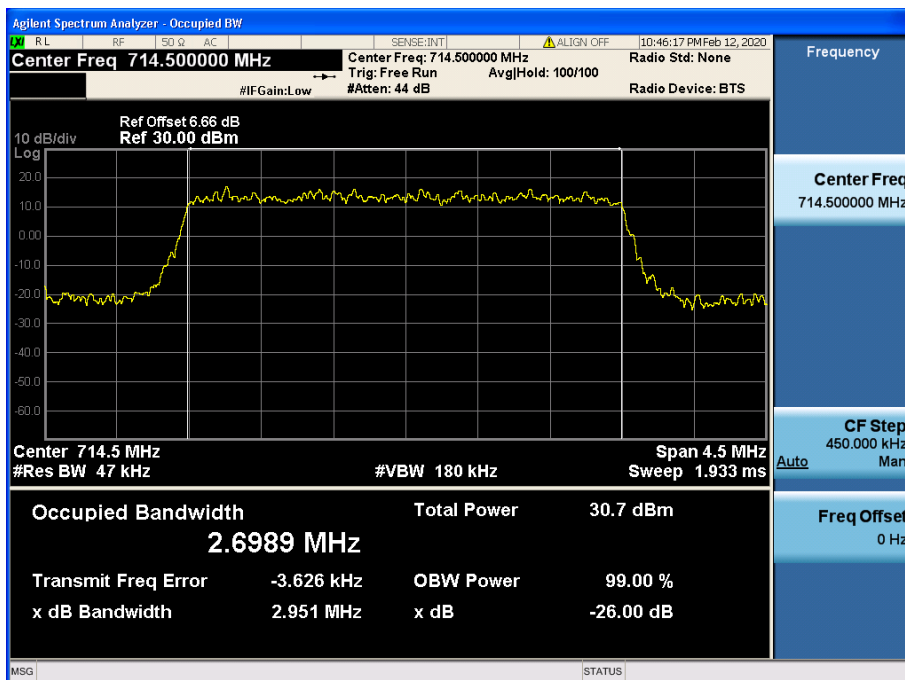
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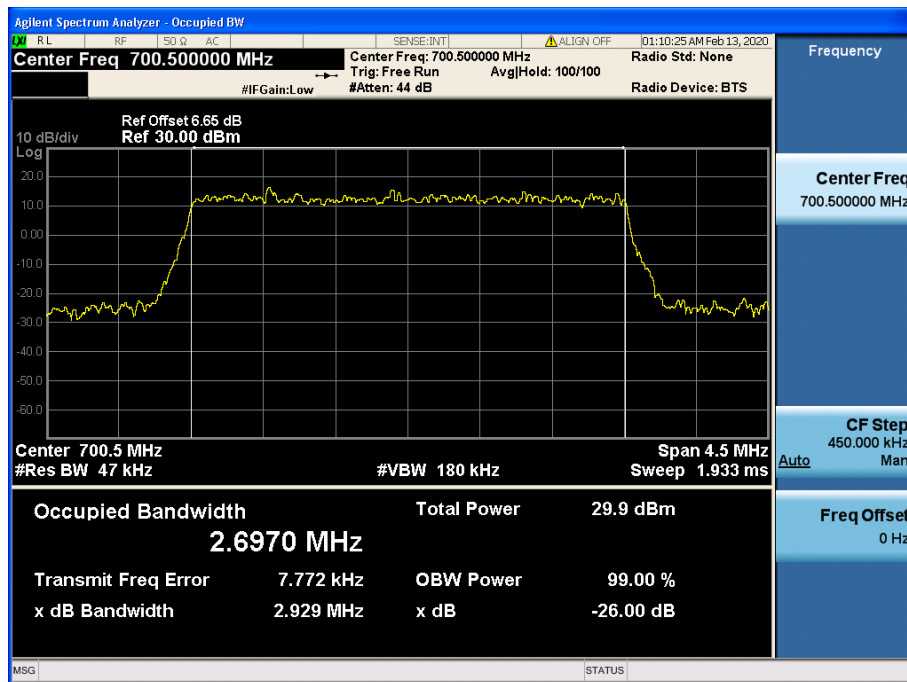
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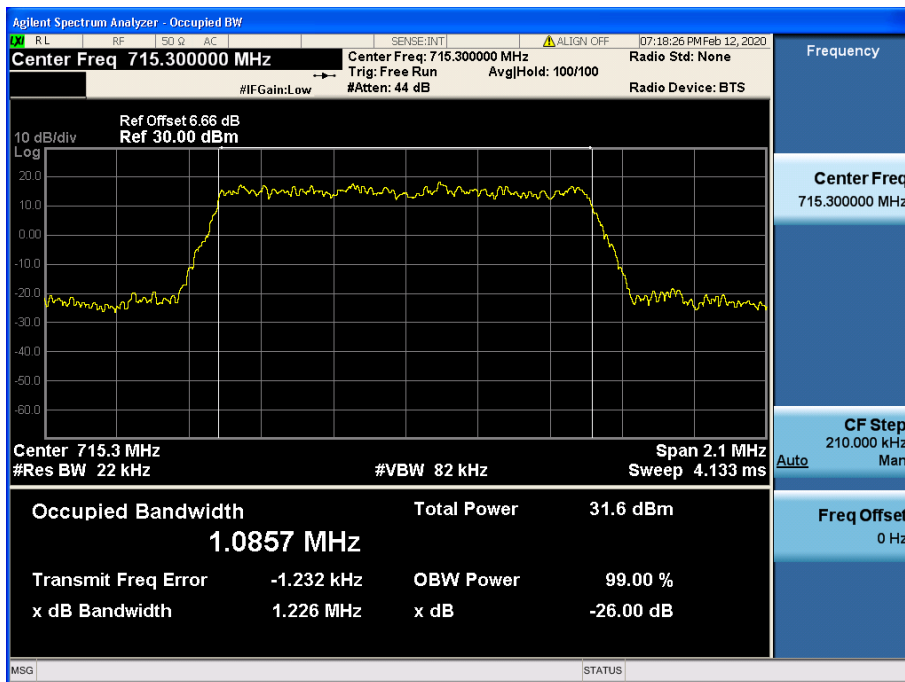
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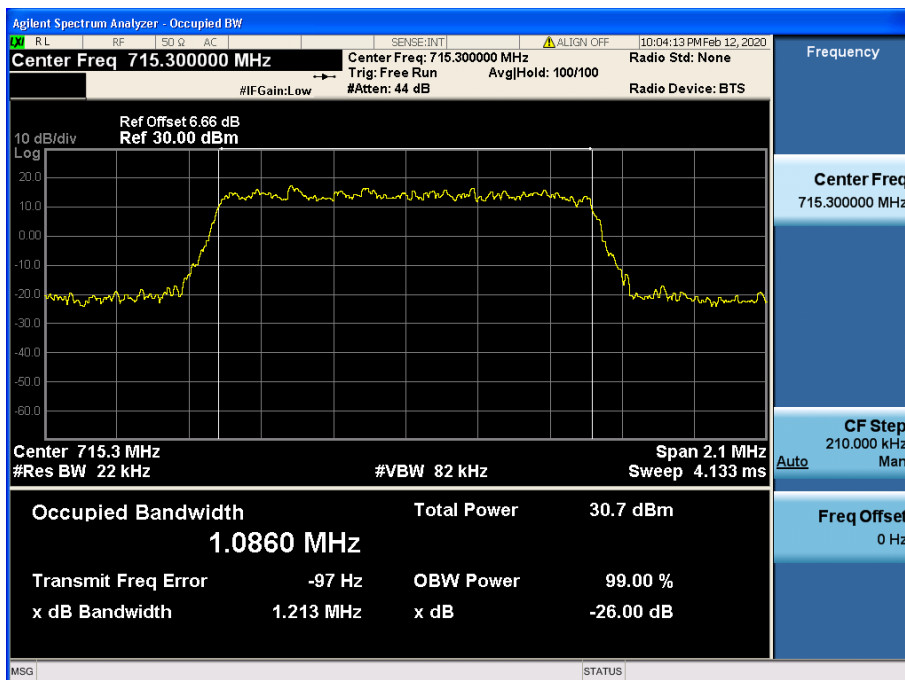
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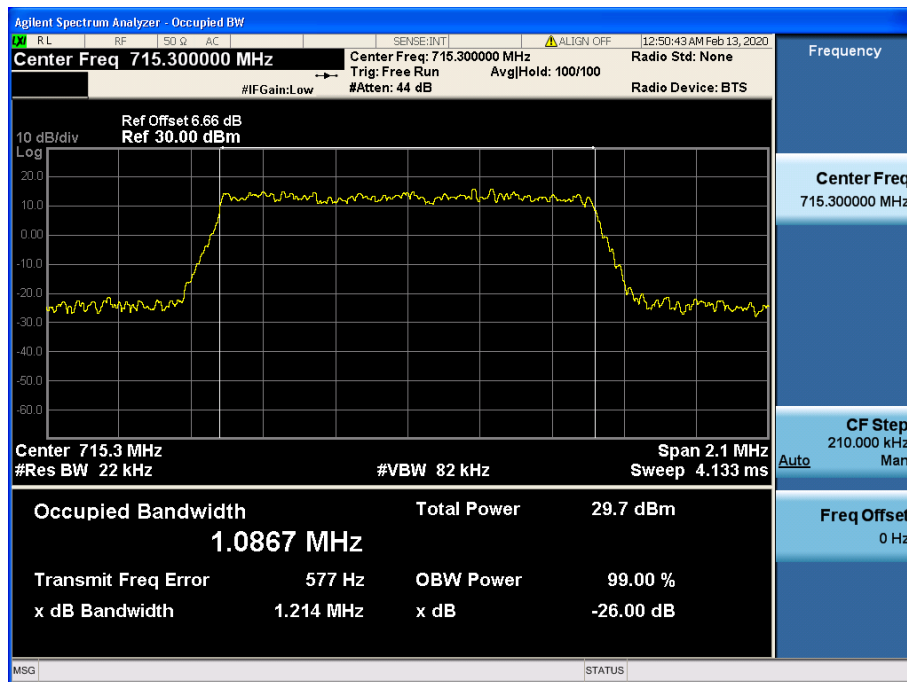
LTE Band 12 / 3 MHz / 64QAM - RB Size 15



LTE Band 12 / 1.4 MHz / QPSK - RB Size 6

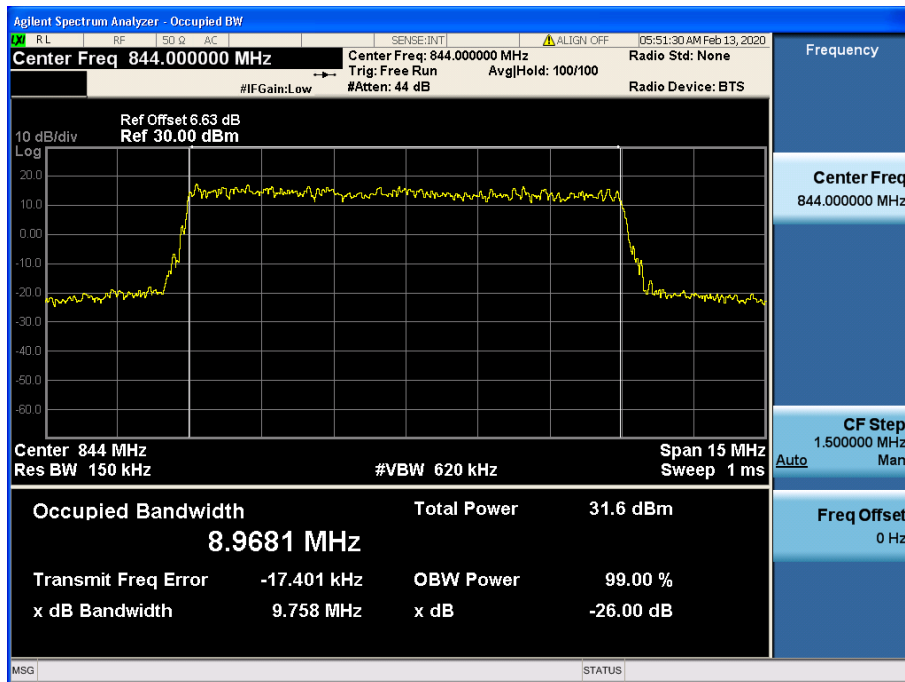


LTE Band 12 / 1.4 MHz / 16QAM - RB Size 6

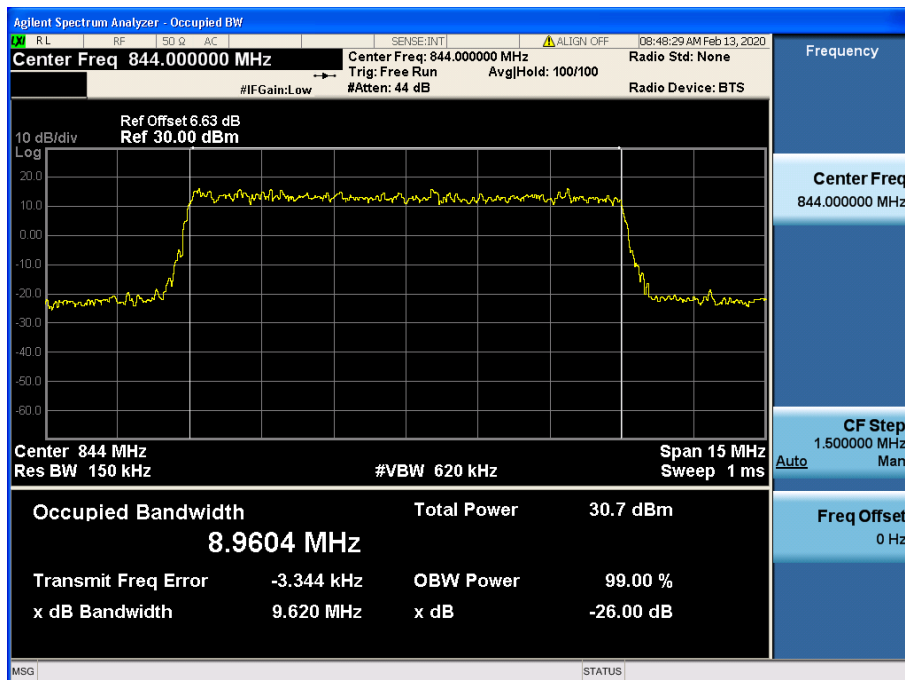


LTE Band 12 / 1.4 MHz / 64QAM - RB Size 6

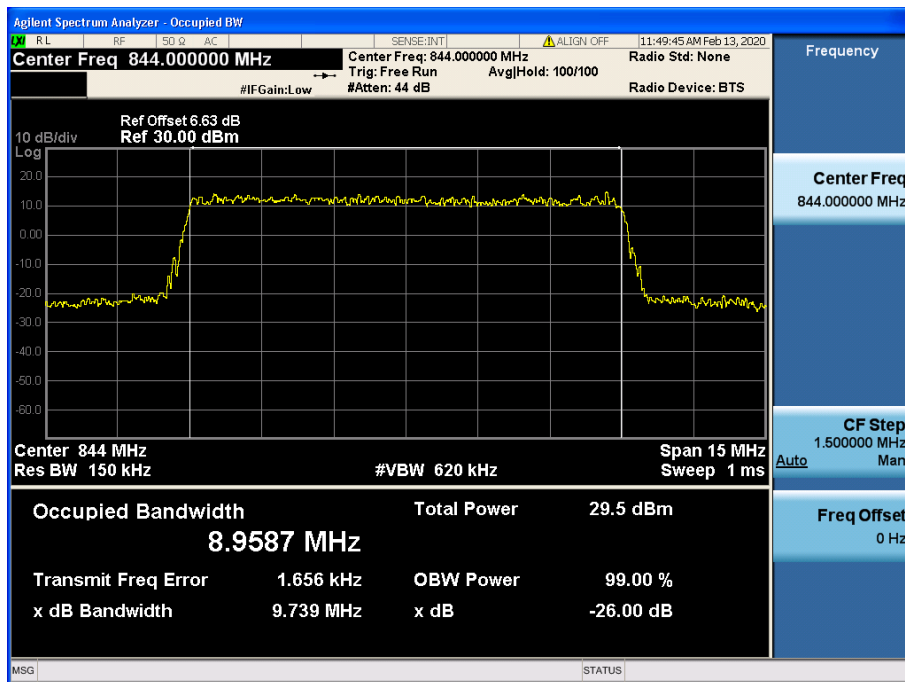
8.1.2 LTE Band 5



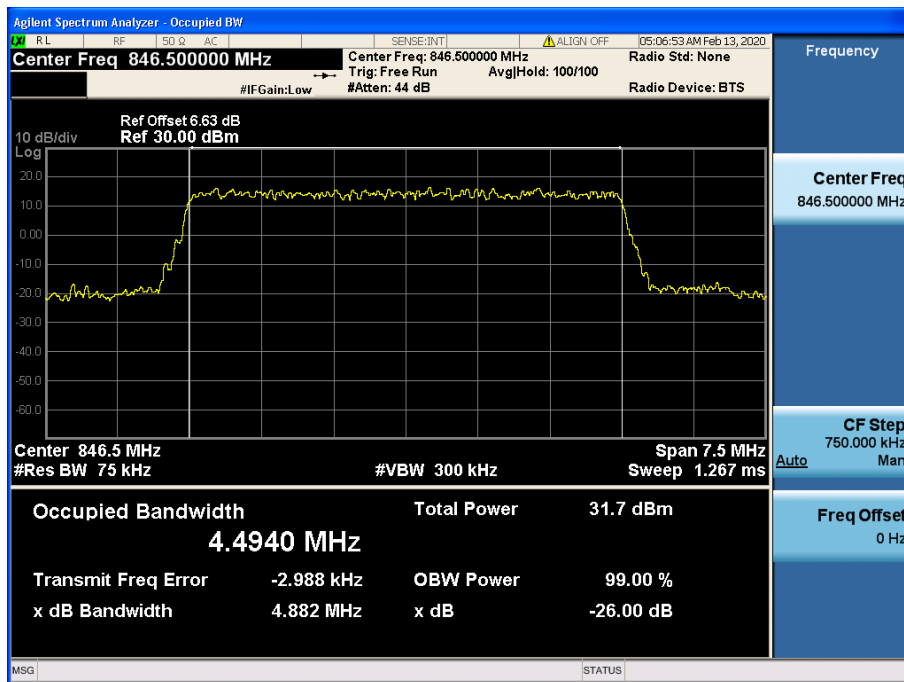
LTE Band 5 / 10 MHz / QPSK - RB Size 50



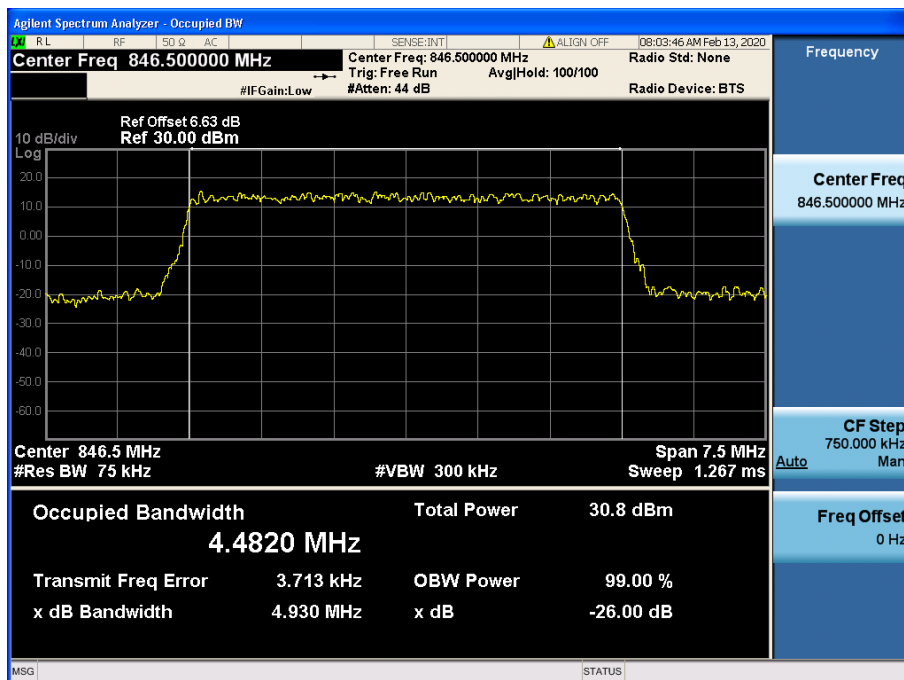
LTE Band 5 / 10 MHz / 16QAM - RB Size 50



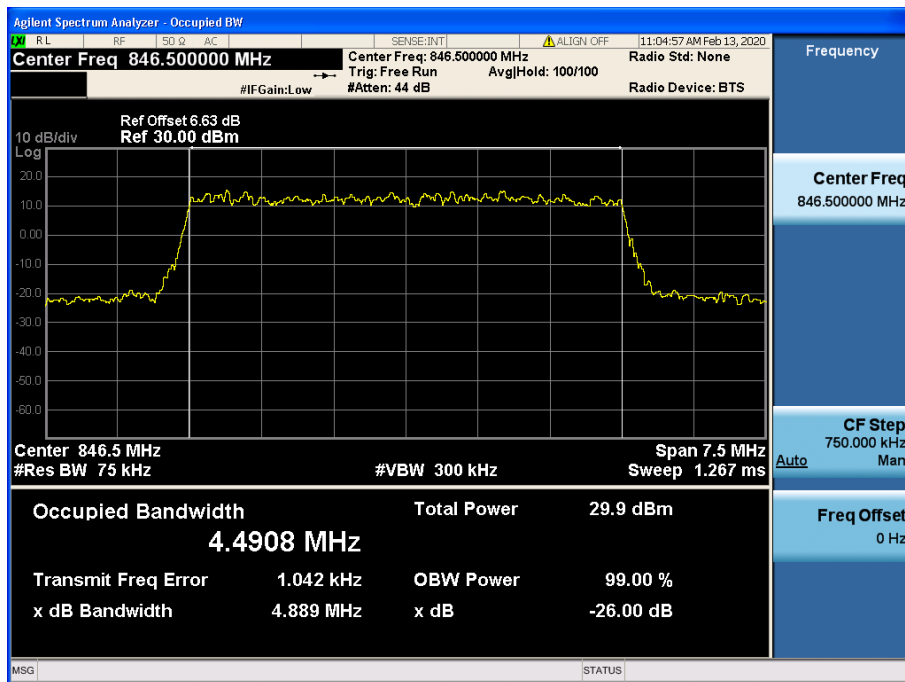
LTE Band 5 / 10 MHz / 64QAM - RB Size 50

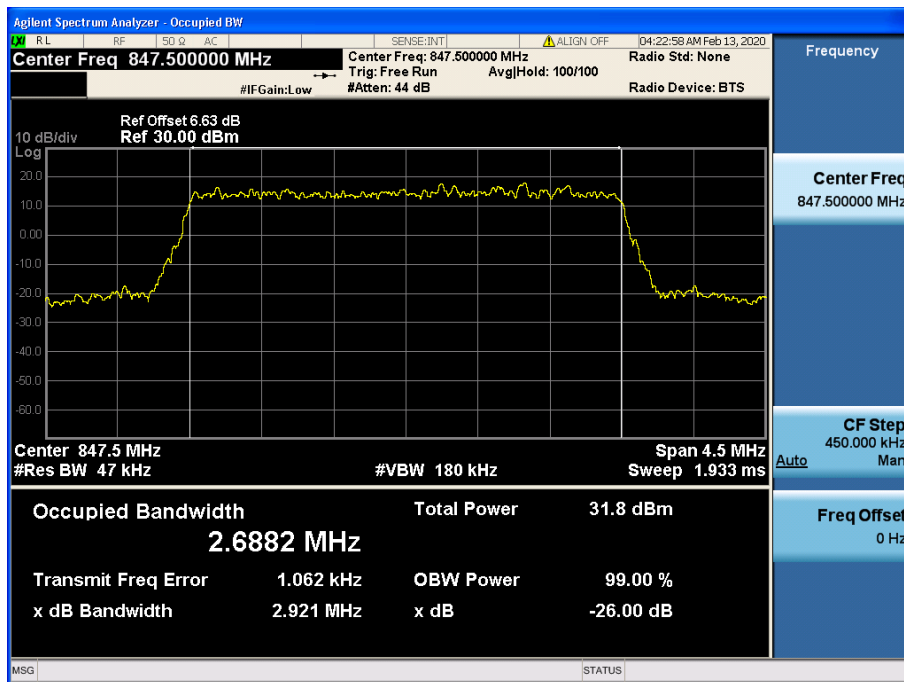


LTE Band 5 / 5 MHz / QPSK - RB Size 25

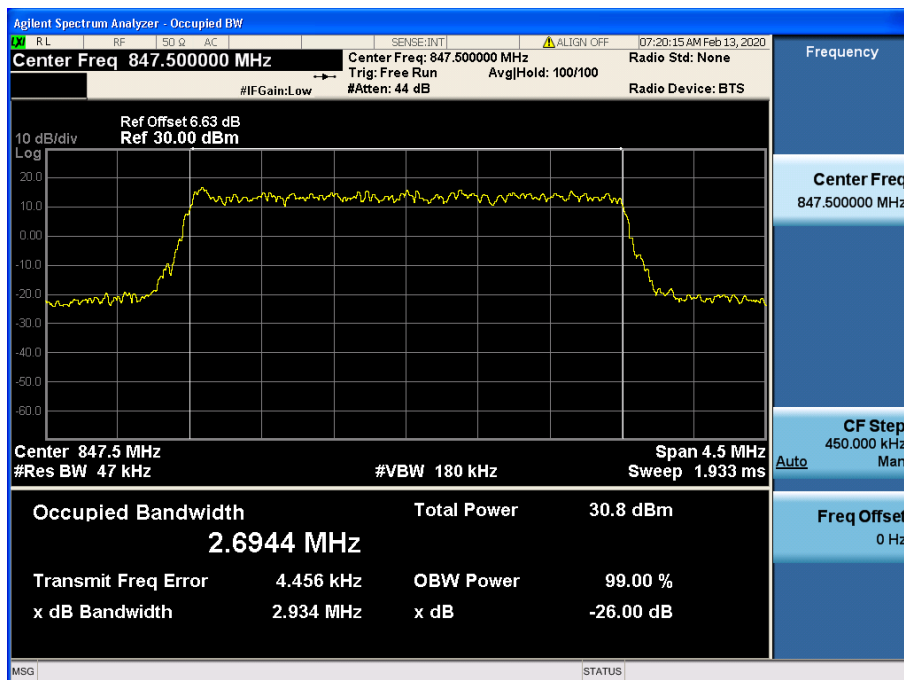


LTE Band 5 / 5 MHz / 16QAM - RB Size 25

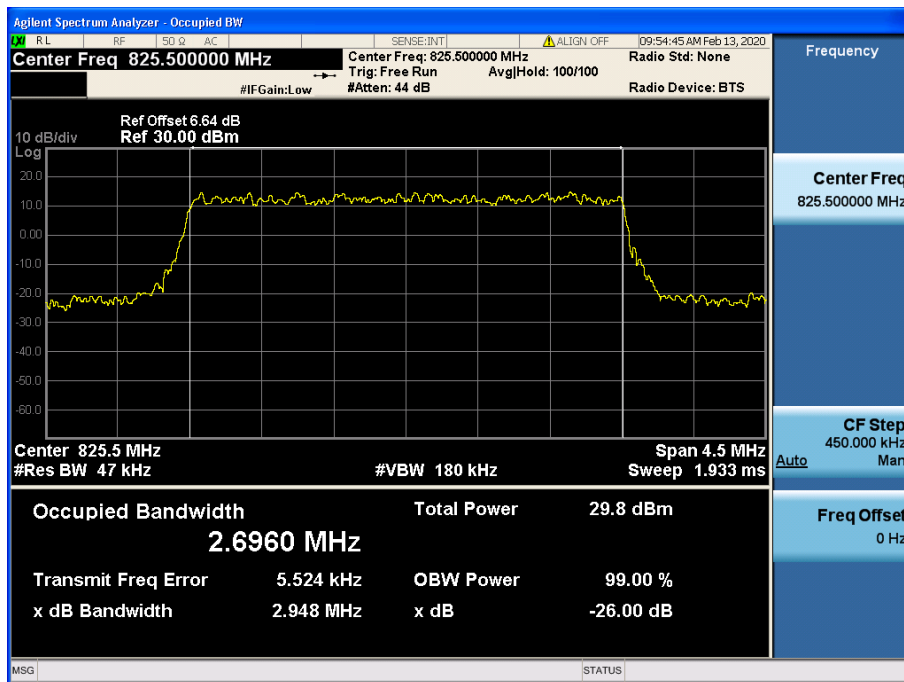




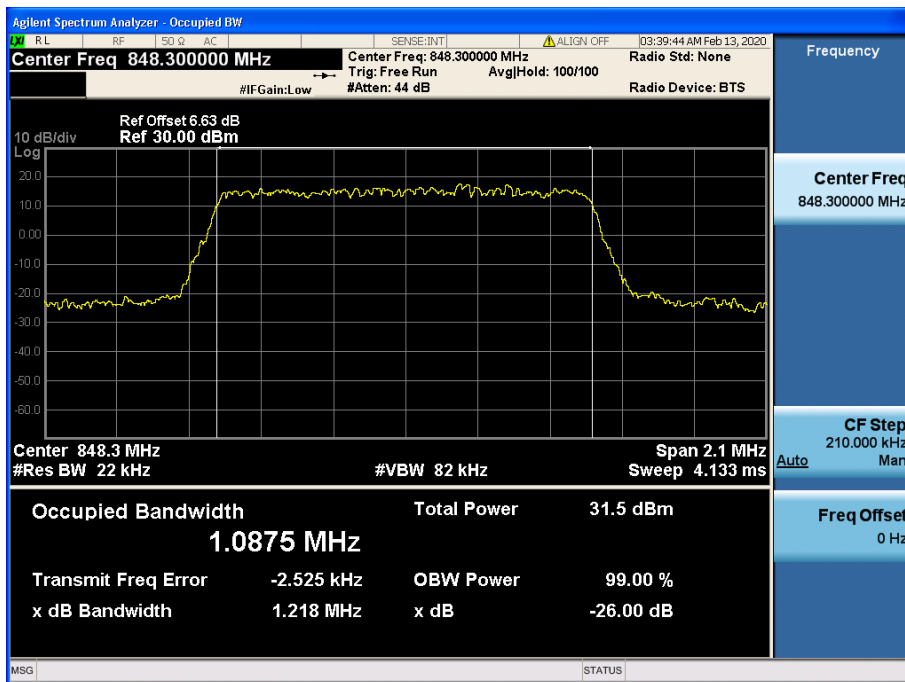
LTE Band 5 / 3 MHz / QPSK - RB Size 15



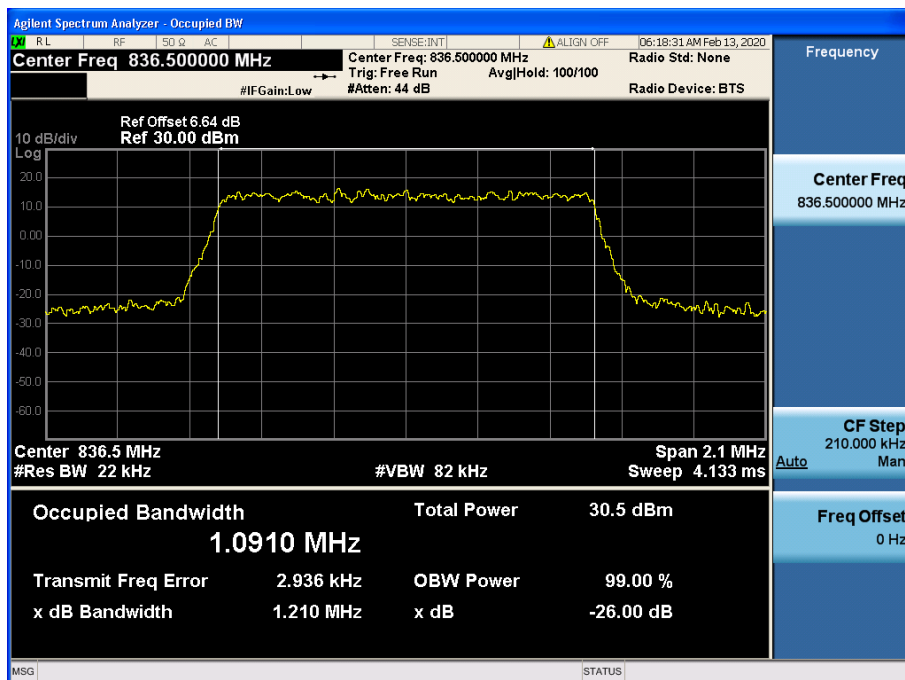
LTE Band 5 / 3 MHz / 16QAM - RB Size 15



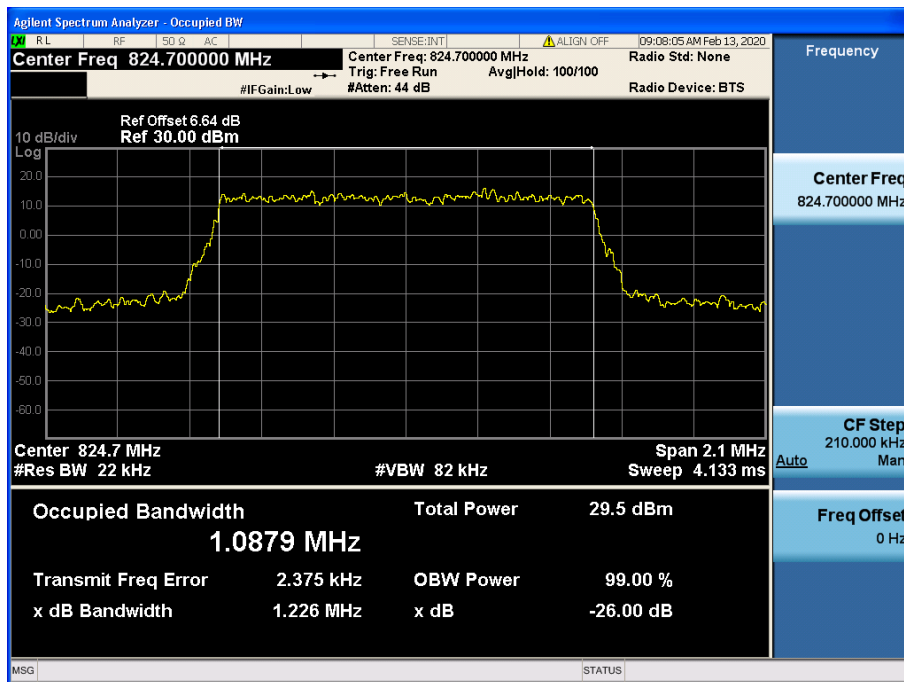
LTE Band 5 / 3 MHz / 64QAM - RB Size 15



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



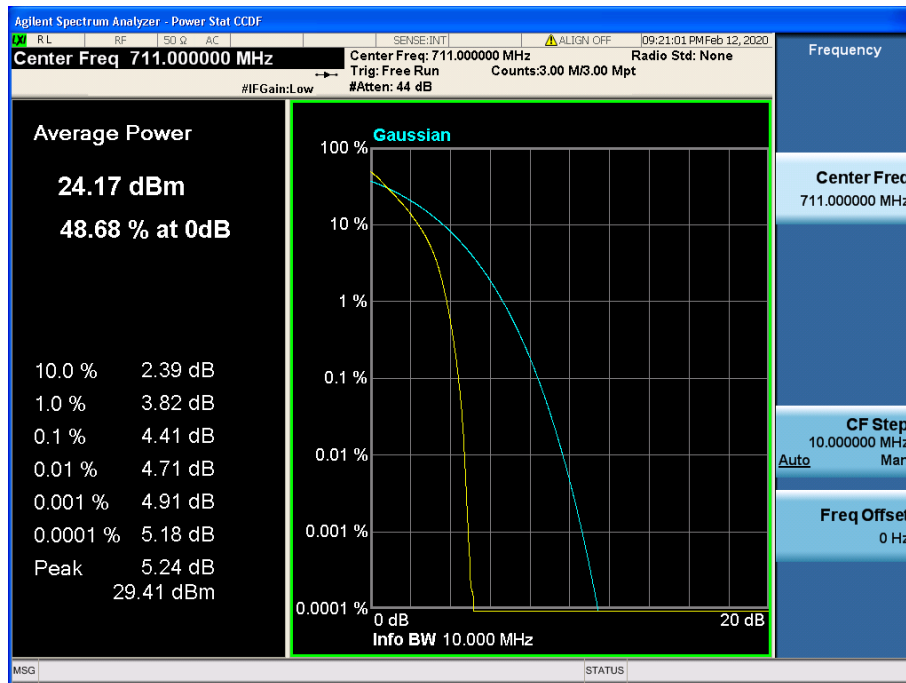
LTE Band 5 / 1.4 MHz / 16QAM - RB Size 6



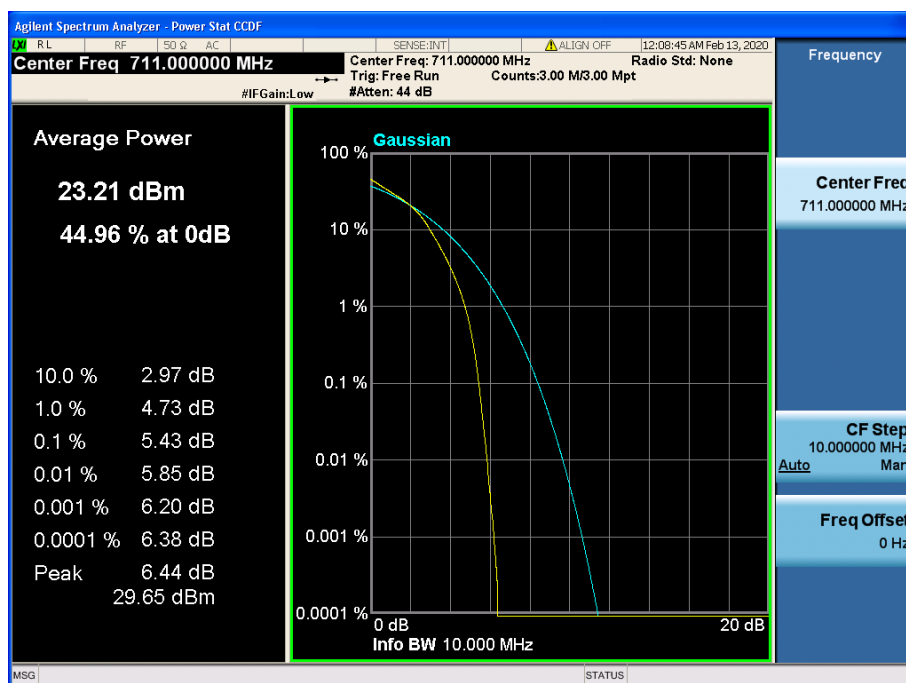
LTE Band 5 / 1.4 MHz / 64QAM - RB Size 6

8.2 PEAK TO AVERAGE RATIO

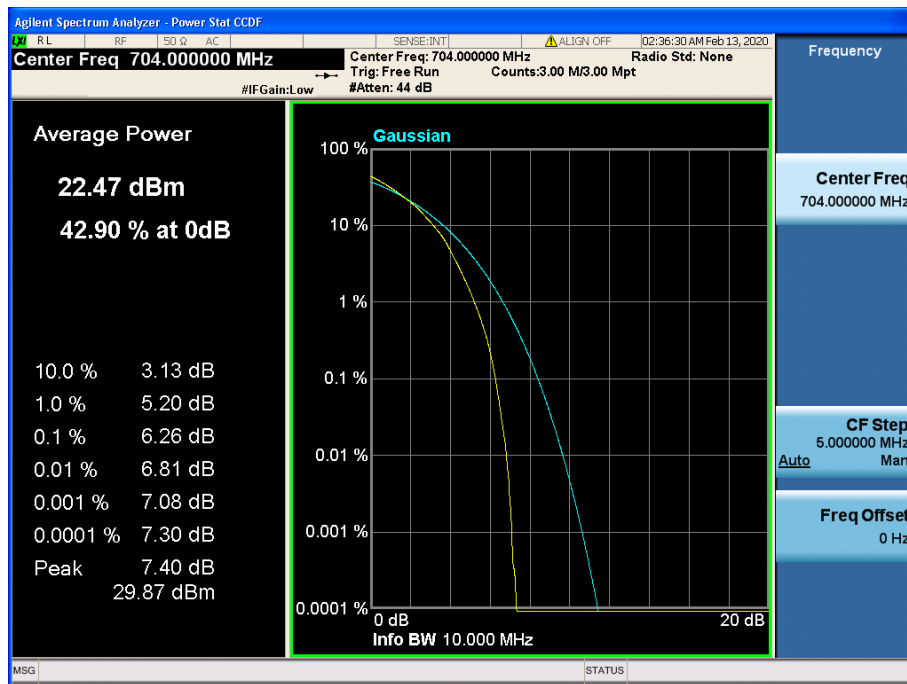
8.2.1 LTE Band 12



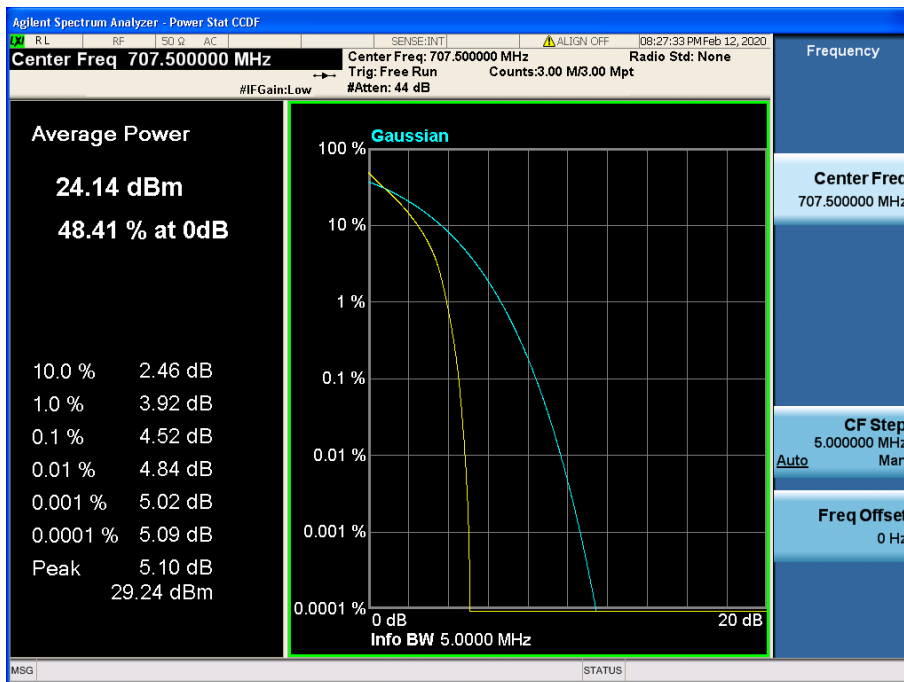
LTE Band 12 / 10 MHz / QPSK - RB Size 50



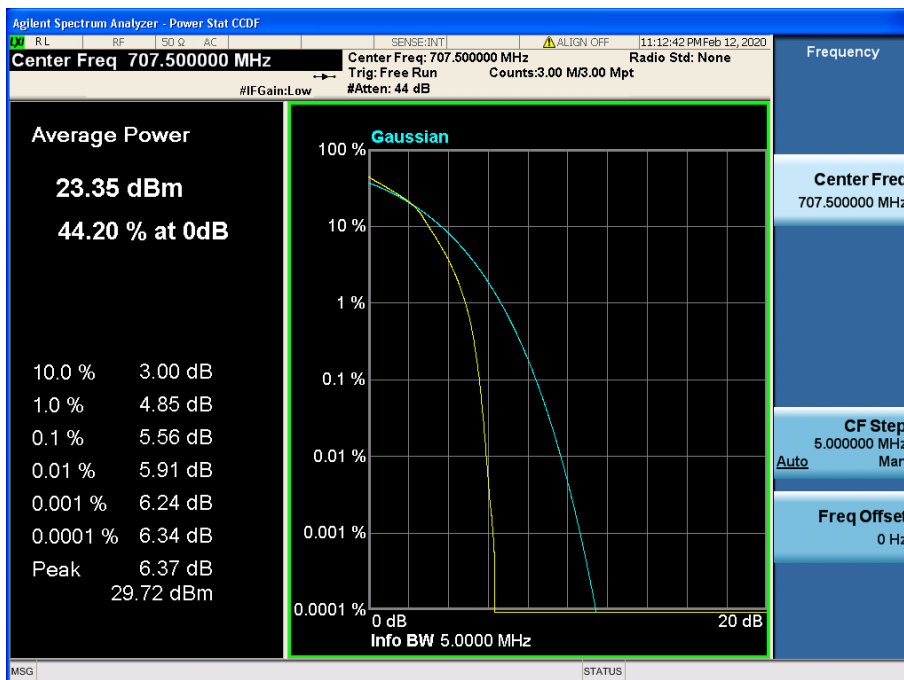
LTE Band 12 / 10 MHz / 16QAM - RB Size 50



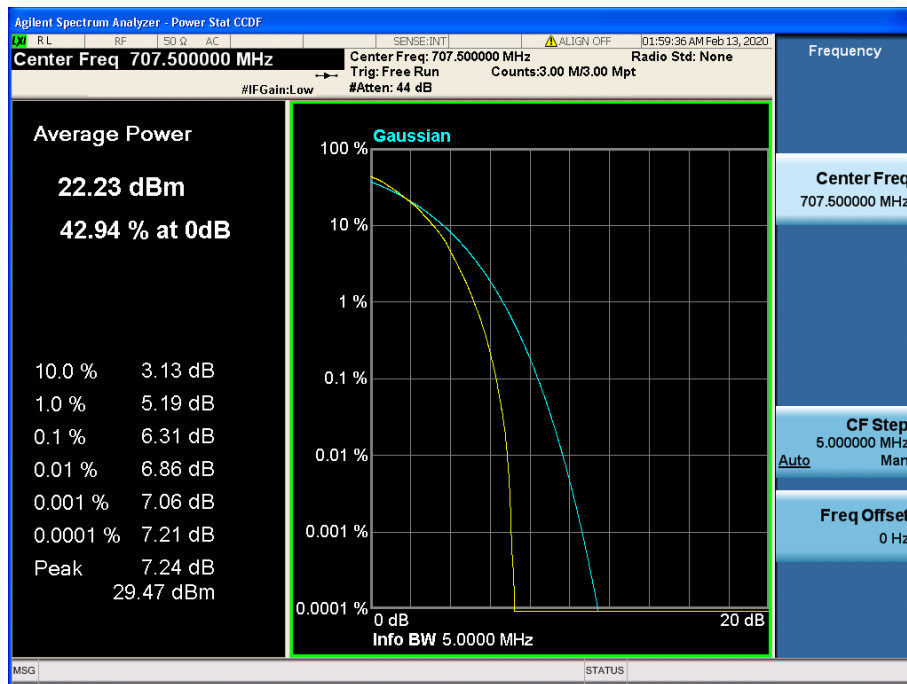
LTE Band 12 / 10 MHz / 64QAM - RB Size 50



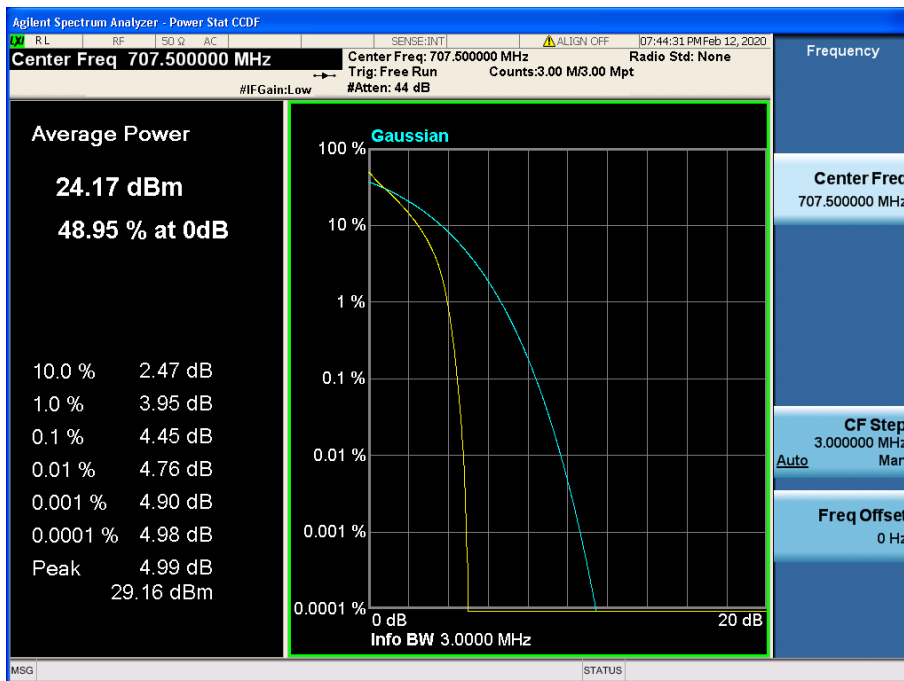
LTE Band 12 / 5 MHz / QPSK - RB Size 25



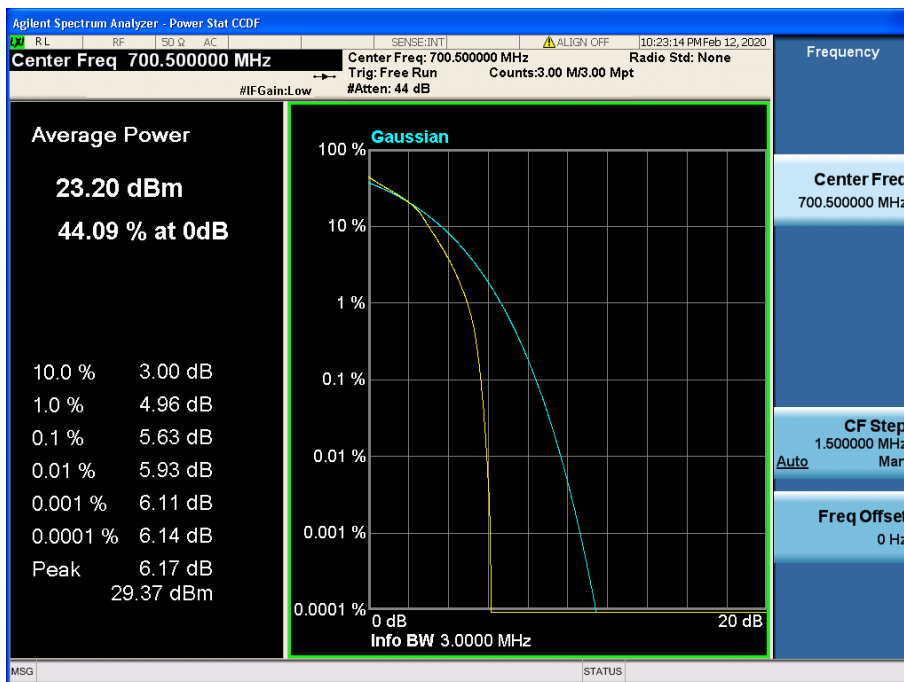
LTE Band 12 / 5 MHz / 16QAM - RB Size 25



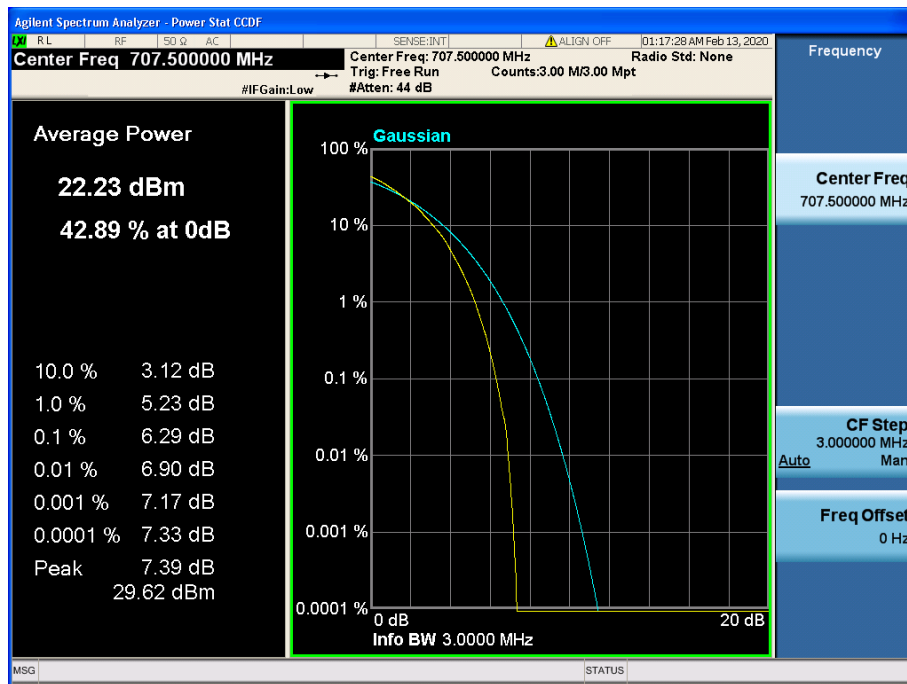
LTE Band 12 / 5 MHz / 64QAM - RB Size 25



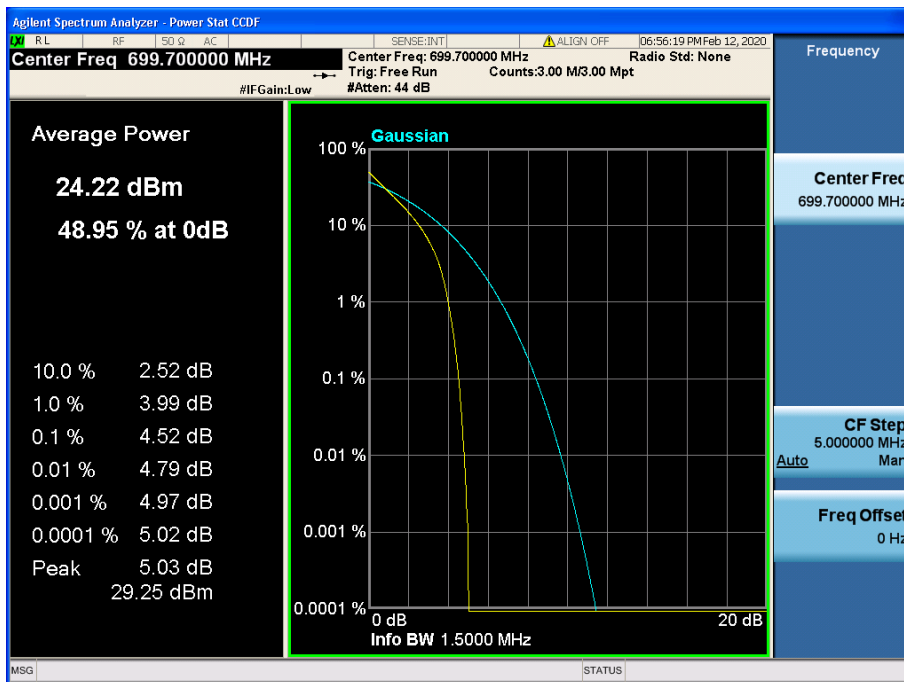
LTE Band 12 / 3 MHz / QPSK - RB Size 15



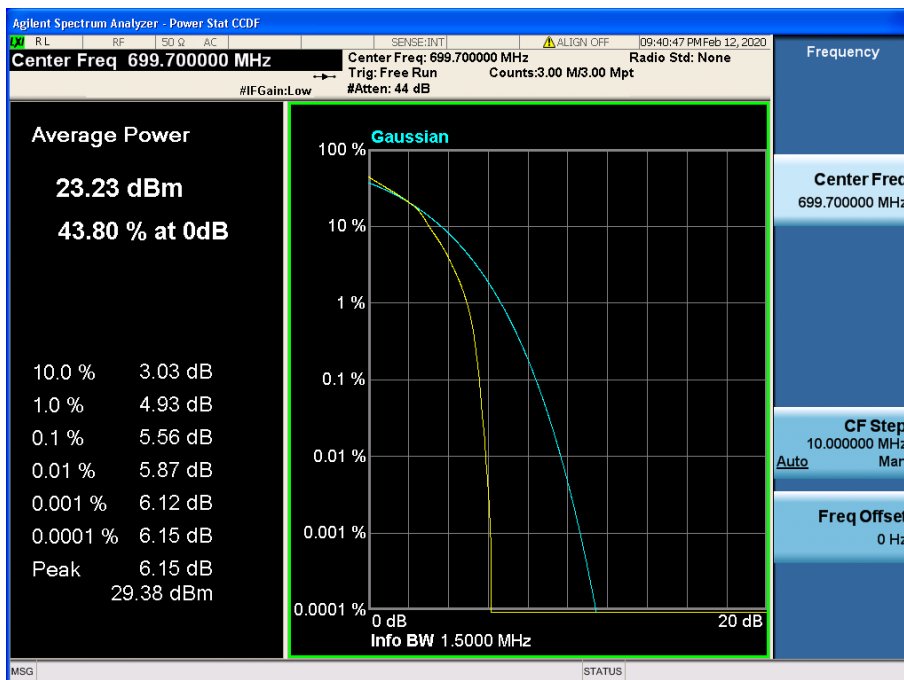
LTE Band 12 / 3 MHz / 16QAM - RB Size 15



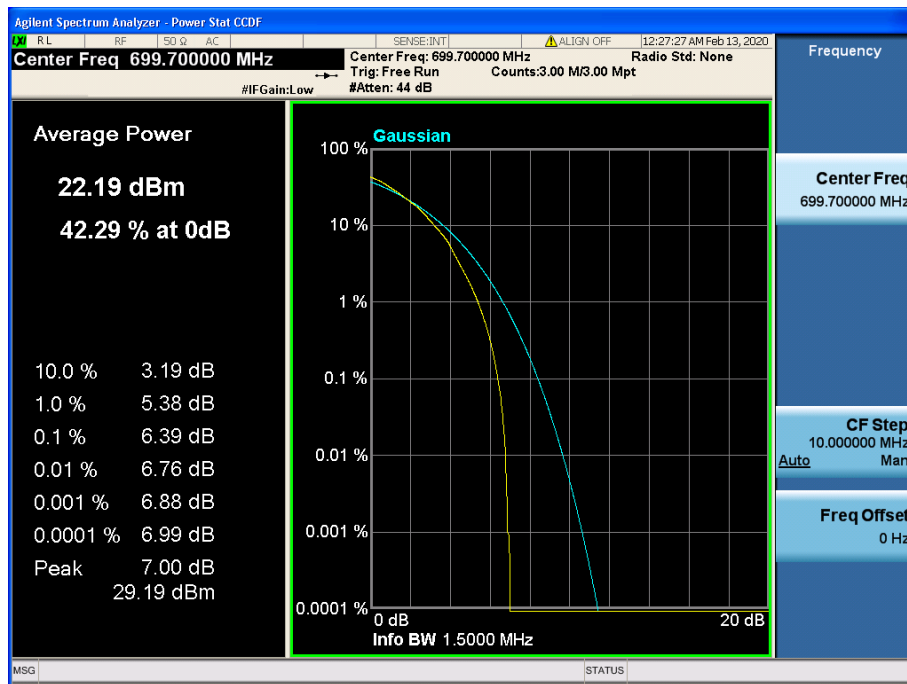
LTE Band 12 / 3 MHz / 64QAM - RB Size 15



LTE Band 12 / 1.4 MHz / QPSK - RB Size 6

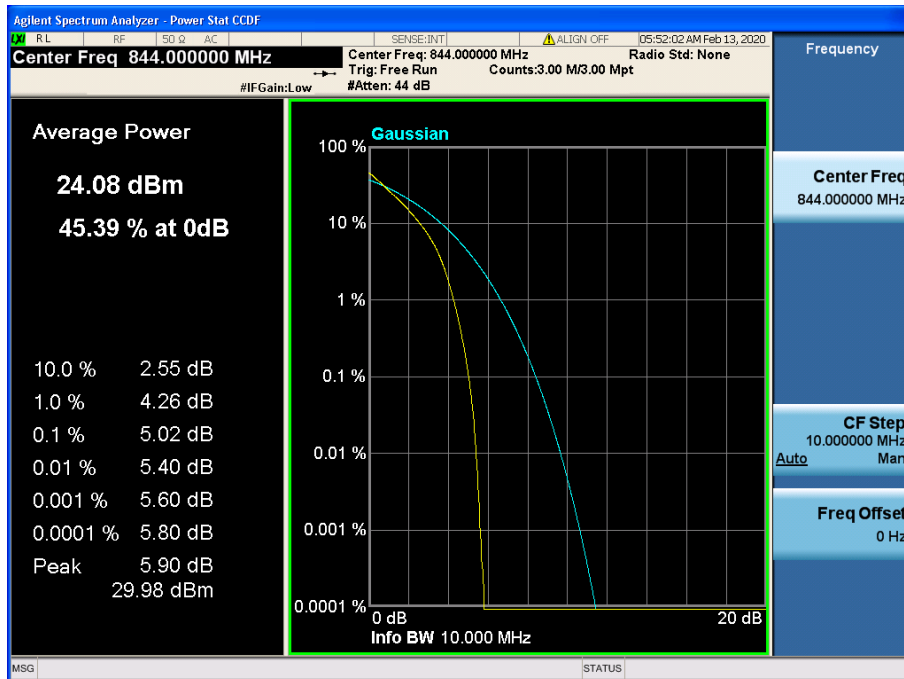


LTE Band 12 / 1.4 MHz / 16QAM - RB Size 6

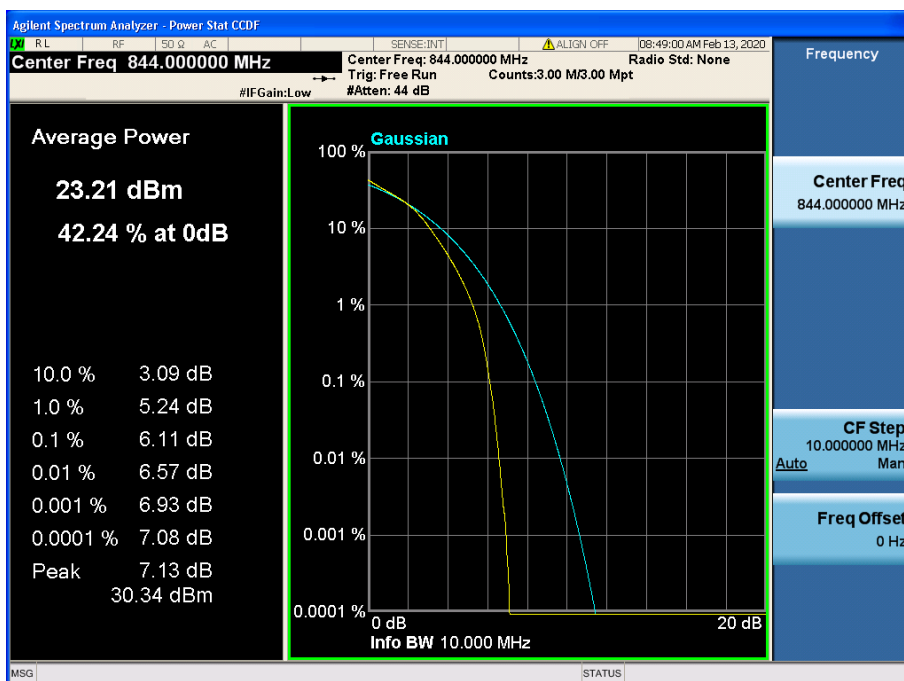


LTE Band 12 / 1.4 MHz / 64QAM - RB Size 6

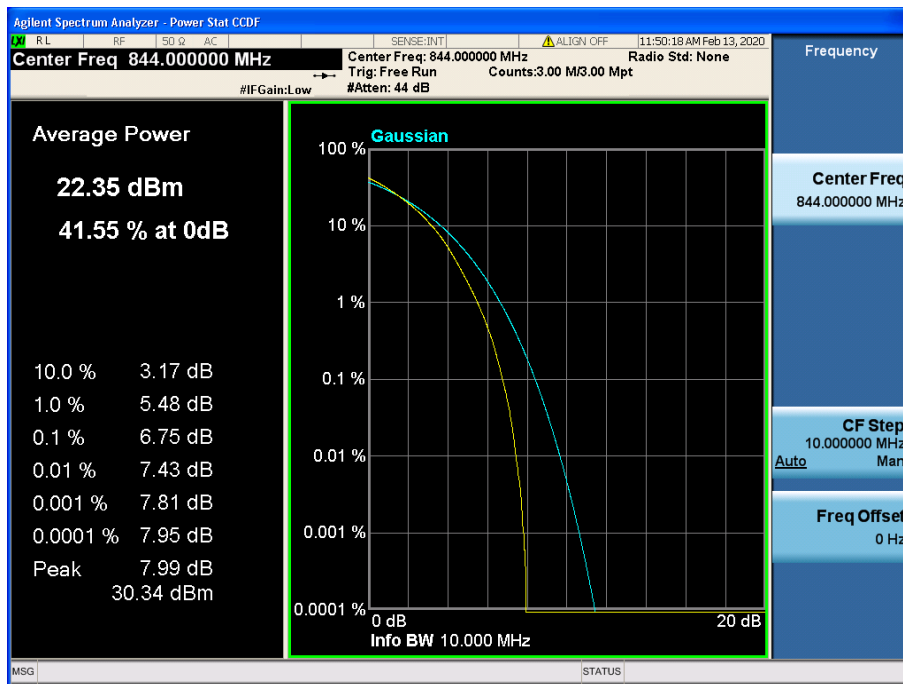
8.2.2 LTE Band 5



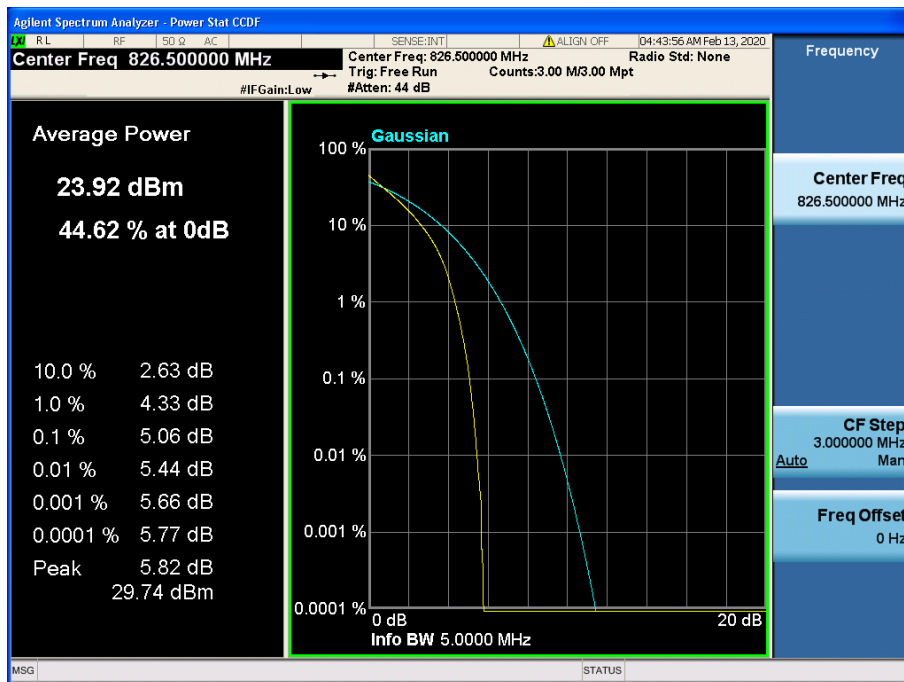
LTE Band 5 / 10 MHz / QPSK - RB Size 50



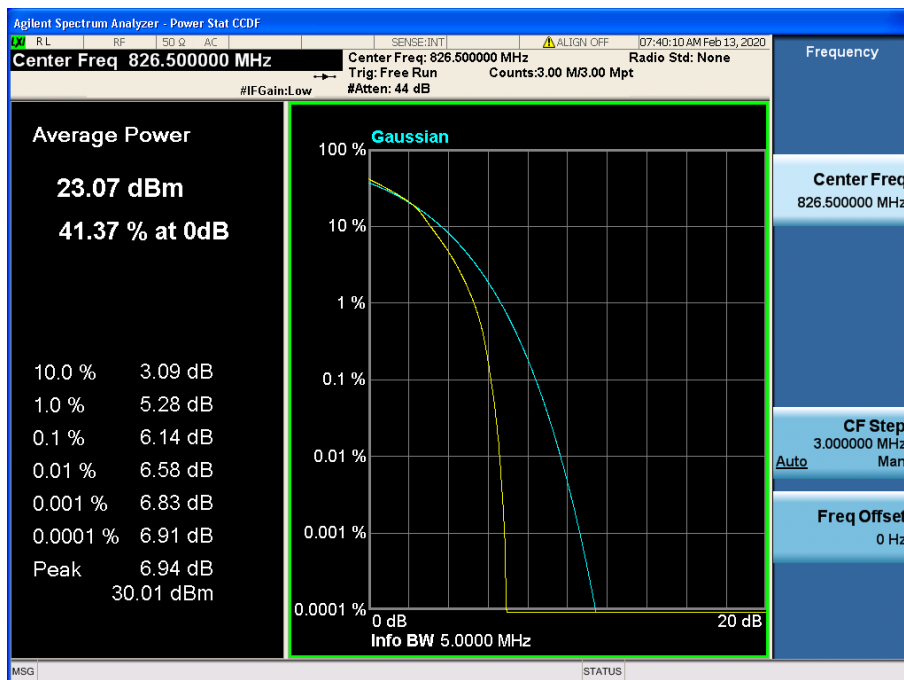
LTE Band 5 / 10 MHz / 16QAM - RB Size 50



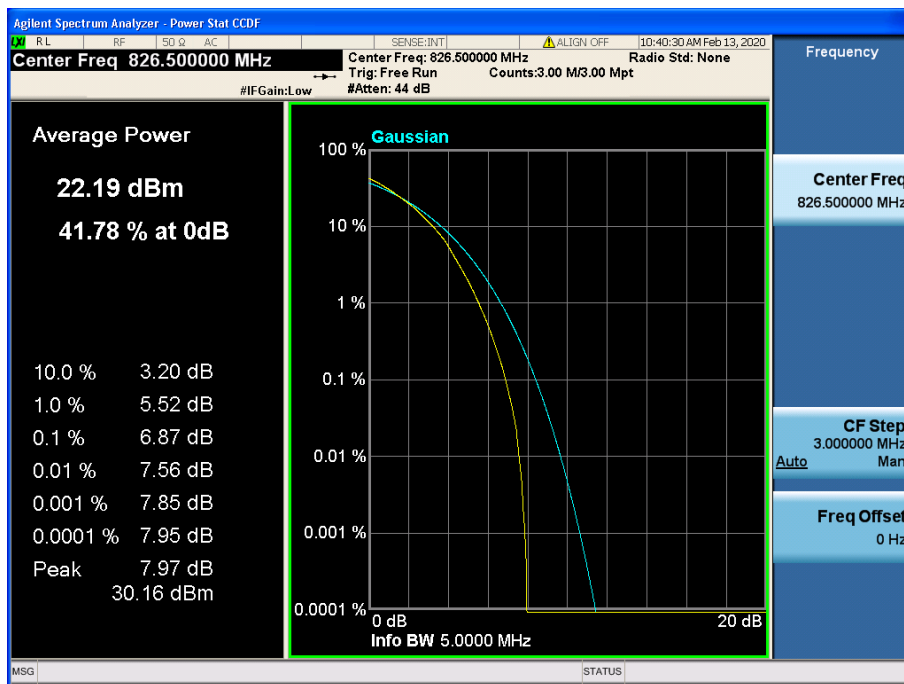
LTE Band 5 / 10 MHz / 64QAM - RB Size 50



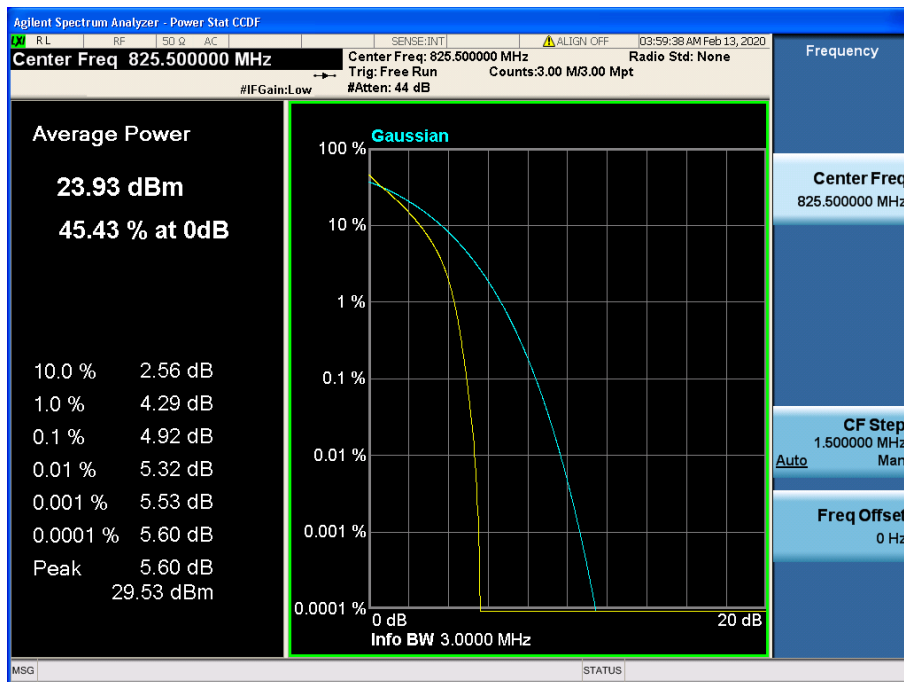
LTE Band 5 / 5 MHz / QPSK - RB Size 25



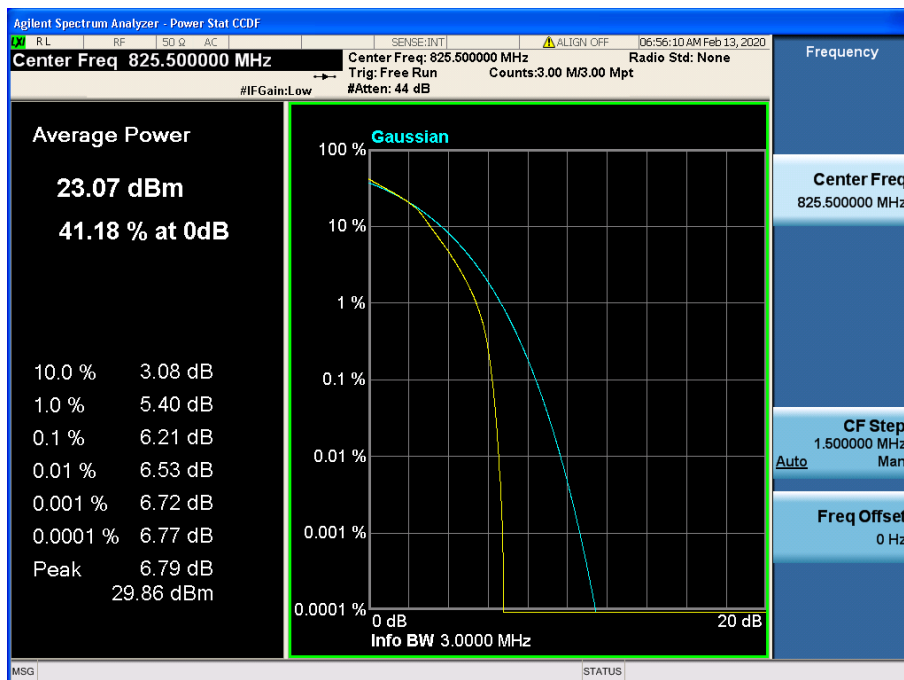
LTE Band 5 / 5 MHz / 16QAM - RB Size 25



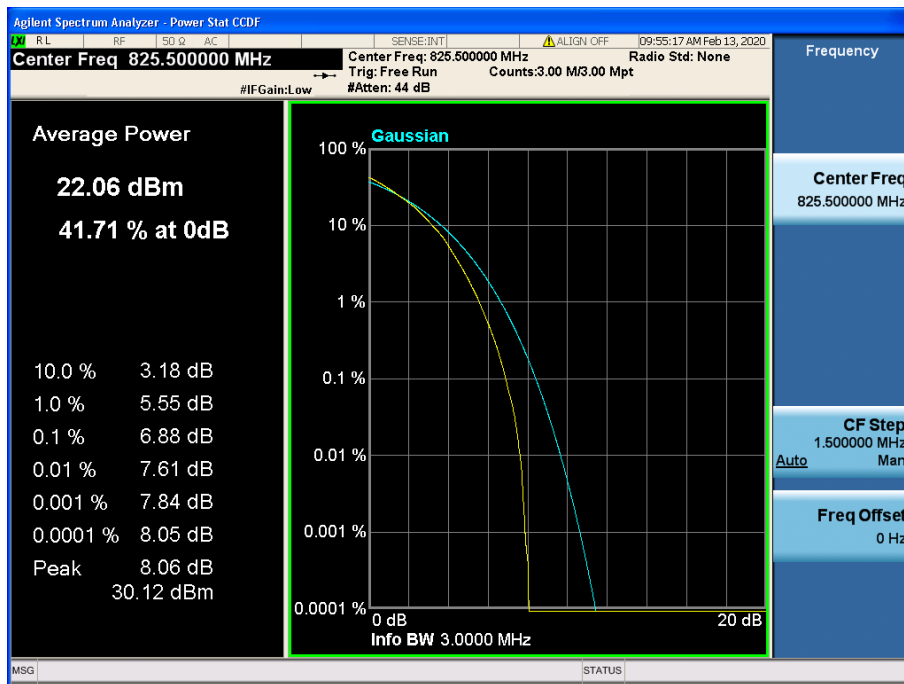
LTE Band 5 / 5 MHz / 64QAM - RB Size 25



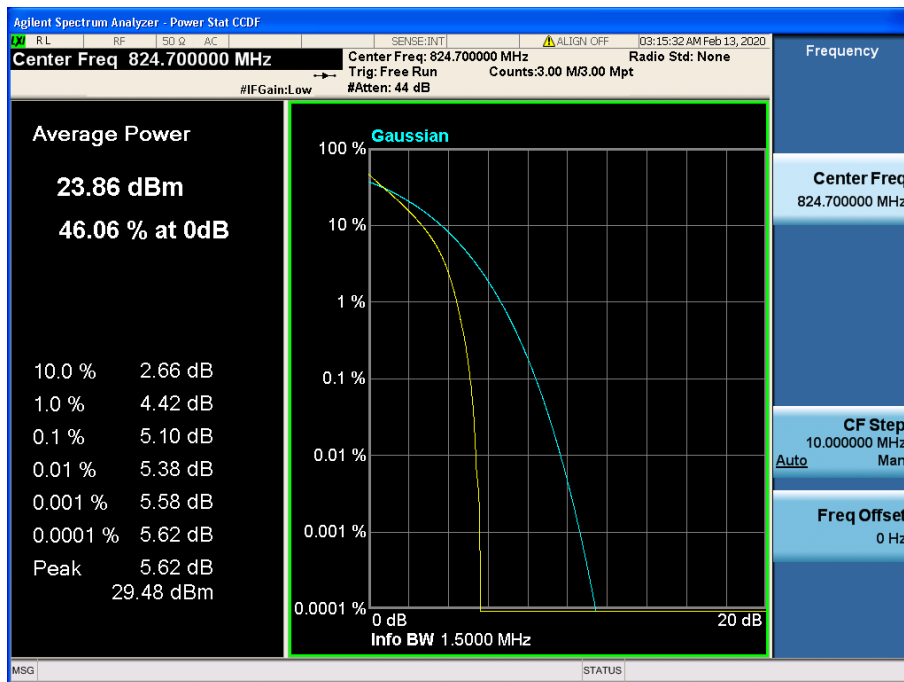
LTE Band 5 / 3 MHz / QPSK - RB Size 15



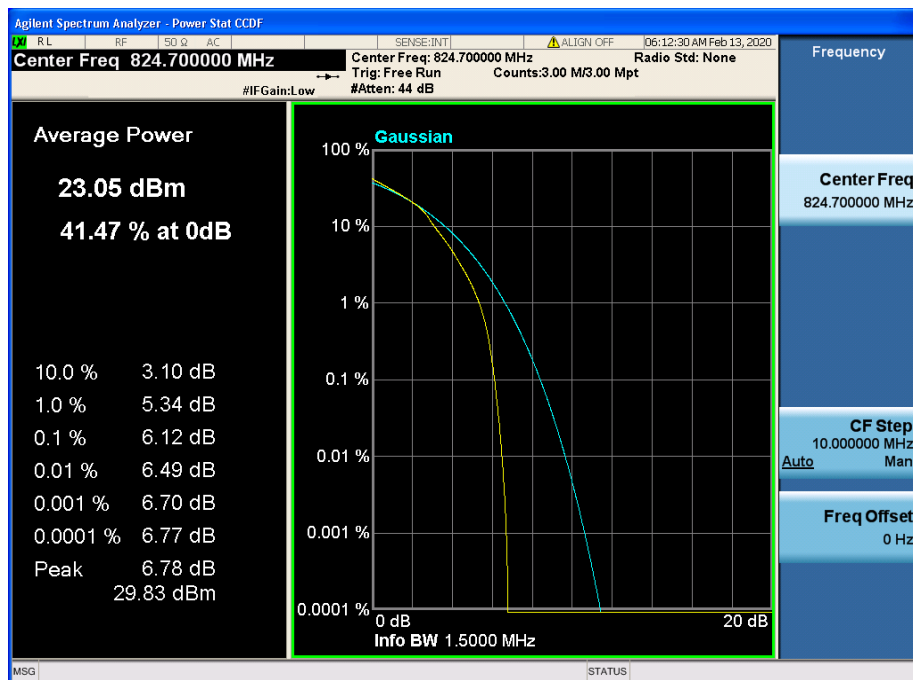
LTE Band 5 / 3 MHz / 16QAM - RB Size 15



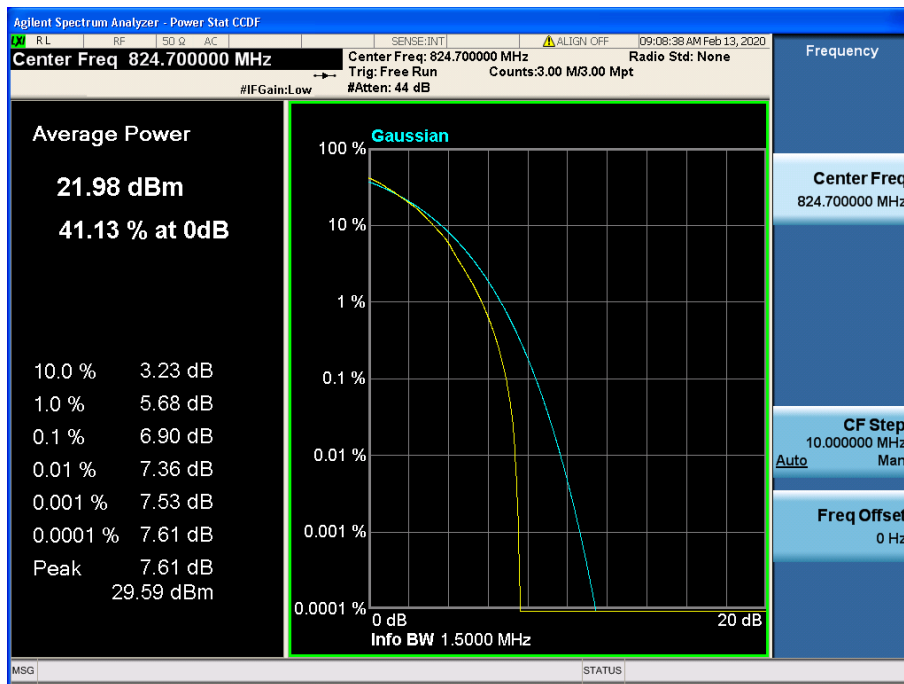
LTE Band 5 / 3 MHz / 64QAM - RB Size 15



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



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

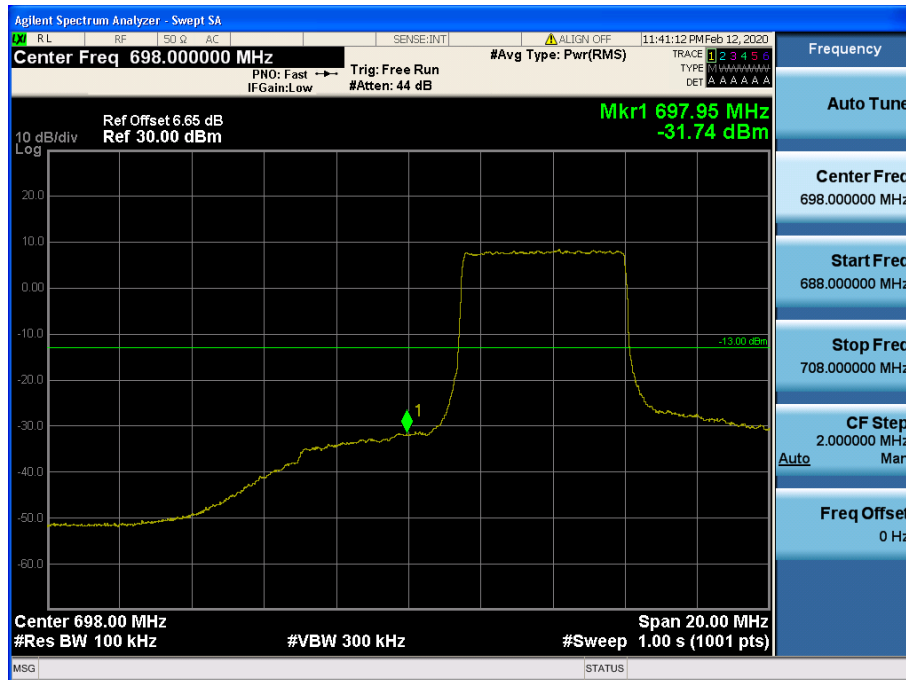


LTE Band 5 / 1.4 MHz / 64QAM - RB Size 6

8.3 BAND EDGE EMISSIONS(Conducted)

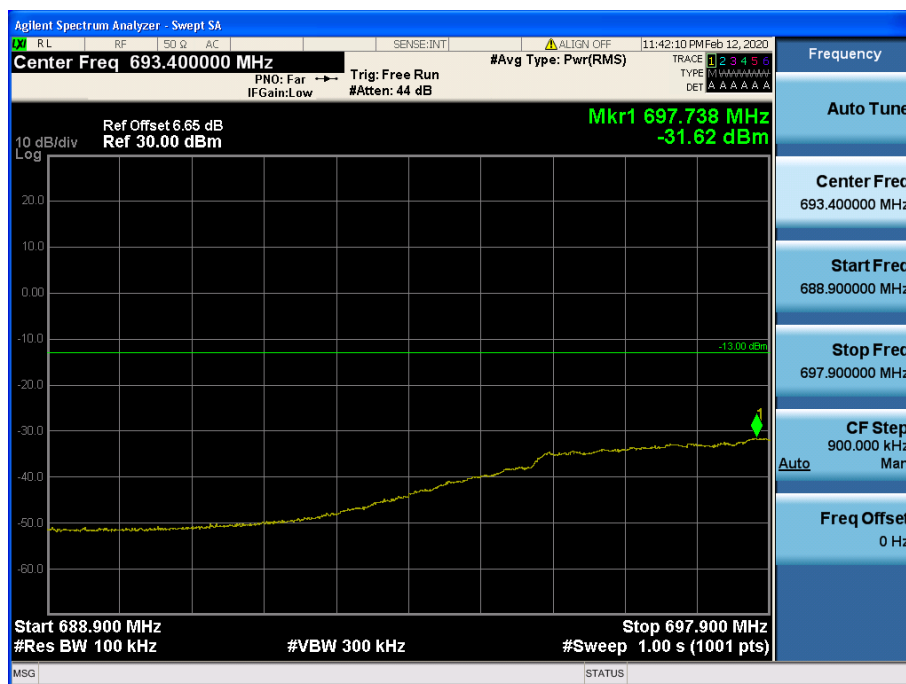
8.3.1 LTE Band 12

- Lower Band Edge



LTE Band 12 / 10MHz / 16QAM - RB Size/Offset (25/0)

- Lower Extended Band Edge



LTE Band 12 / 10MHz / 16QAM - RB Size/Offset (25/0)

- Upper Band Edge



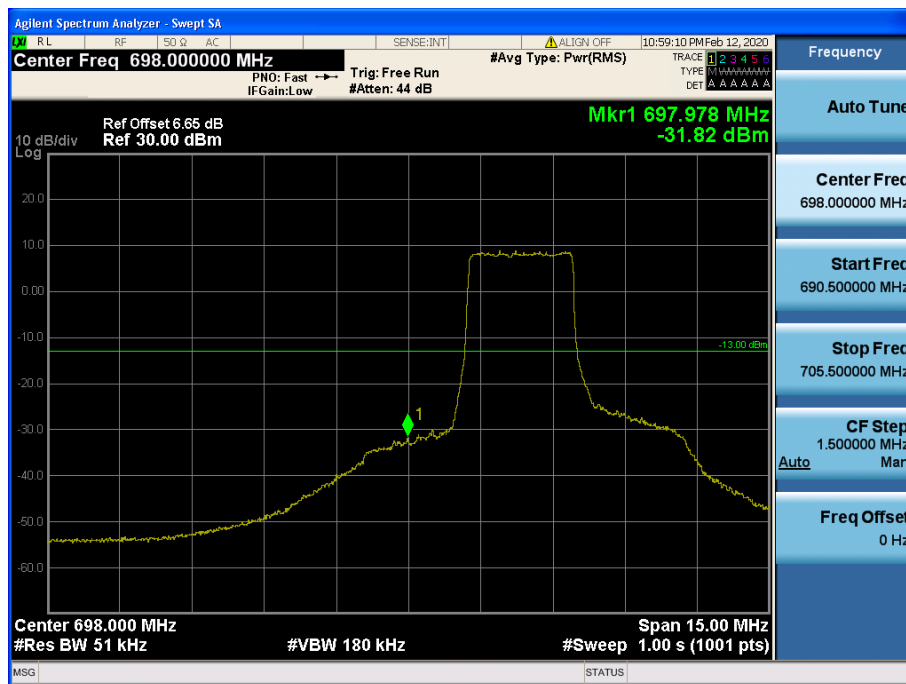
LTE Band 12 / 10MHz / QPSK - RB Size/Offset (25/25)

- Upper Extended Band Edge



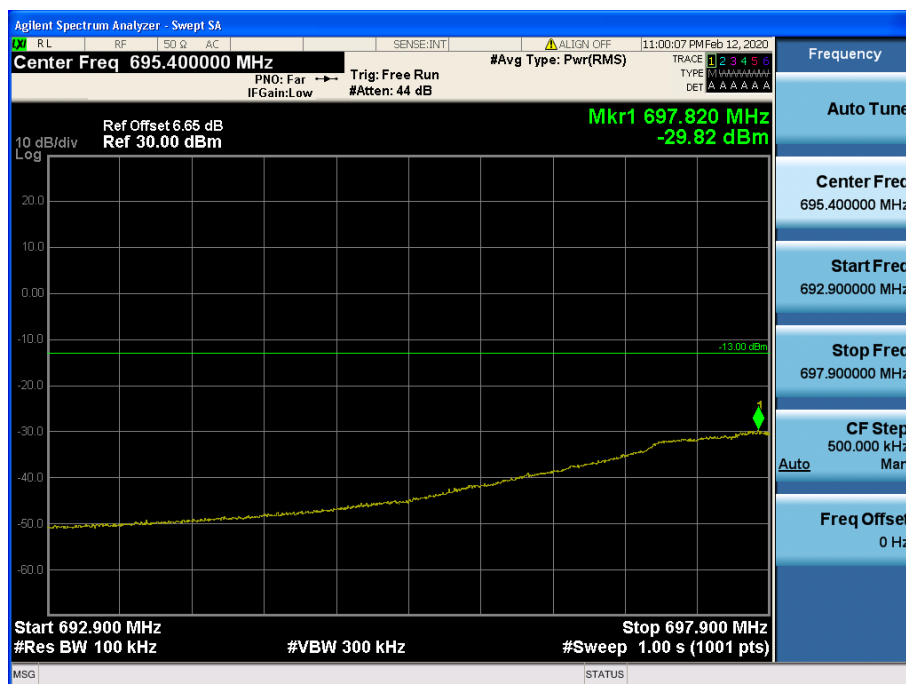
LTE Band 12 / 10MHz / QPSK - RB Size/Offset (25/25)

- Lower Band Edge



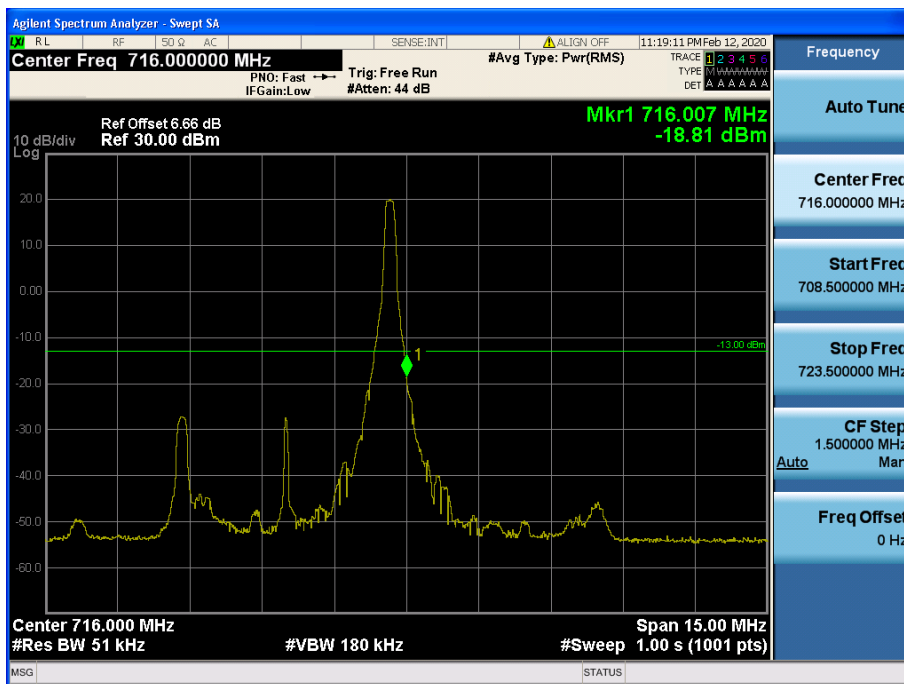
LTE Band 12 / 5MHz / 16QAM - RB Size/Offset (12/0)

- Lower Extended Band Edge



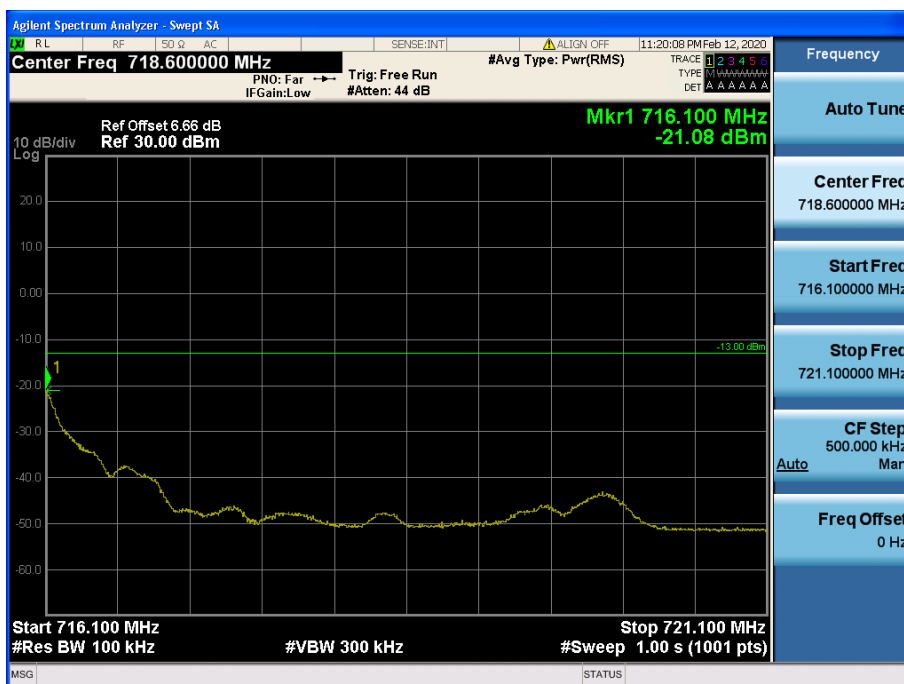
LTE Band 12 / 5MHz / 16QAM - RB Size/Offset (12/0)

- Upper Band Edge



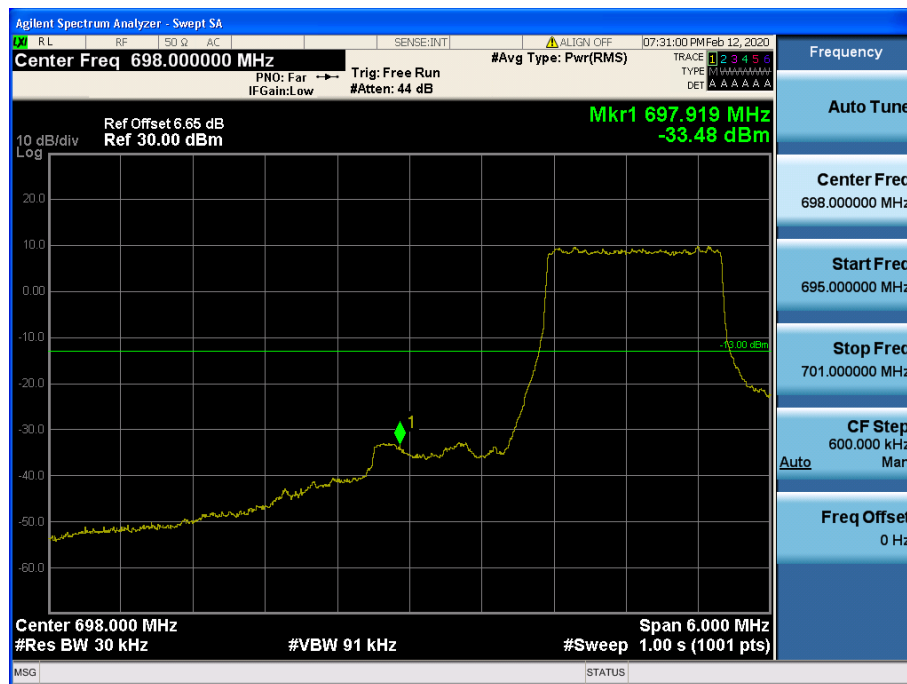
LTE Band 12 / 5MHz / 16QAM - RB Size/Offset (1/24)

- Upper Extended Band Edge



LTE Band 12 / 5MHz / 16QAM - RB Size/Offset (1/24)

- Lower Band Edge



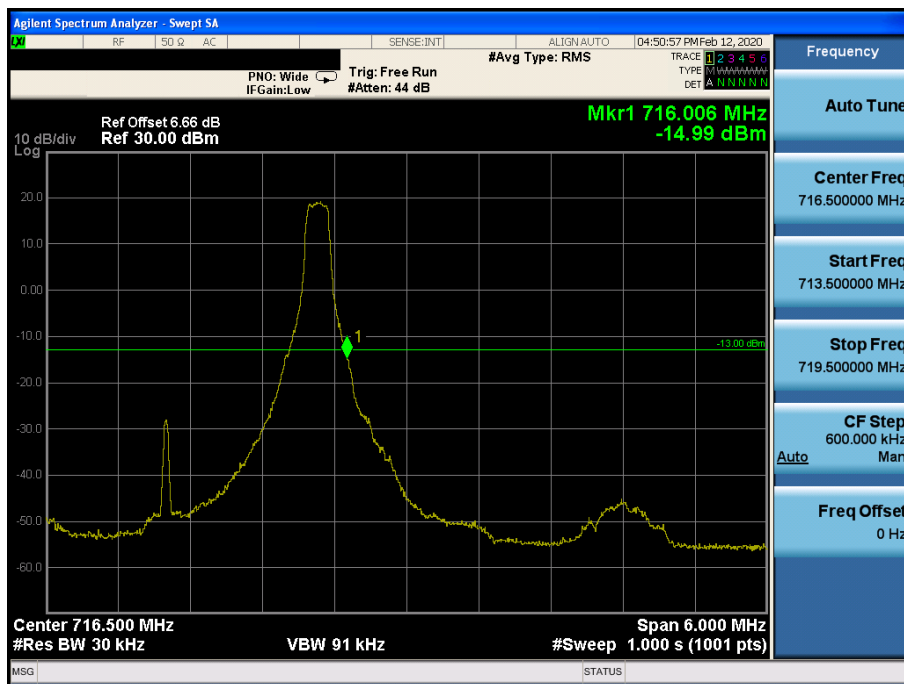
LTE Band 12 / 3MHz / QPSK - RB Size/Offset (8/0)

- Lower Extended Band Edge



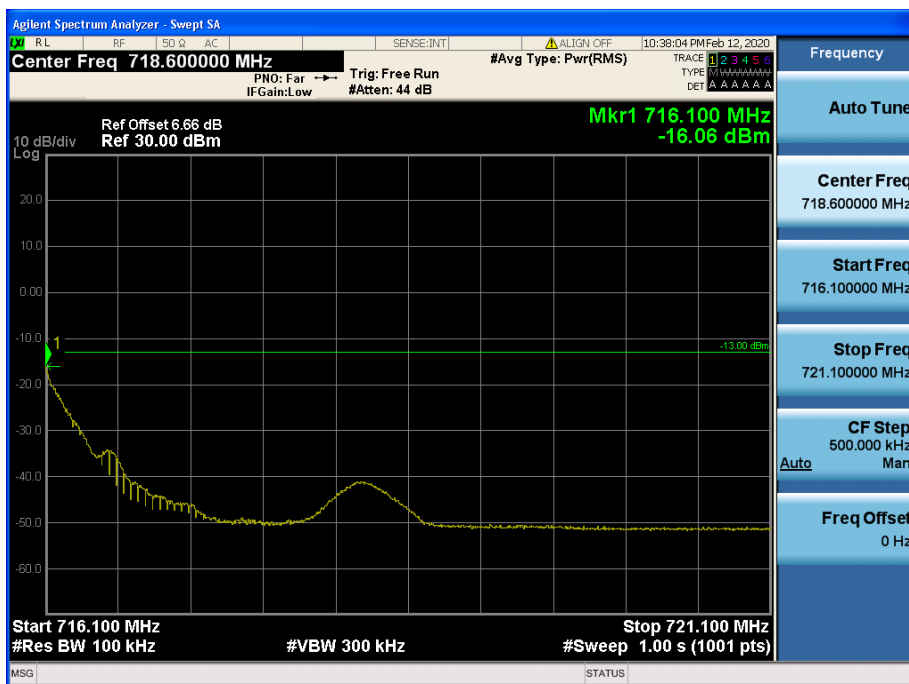
LTE Band 12 / 3MHz / QPSK - RB Size/Offset (8/0)

- Upper Band Edge



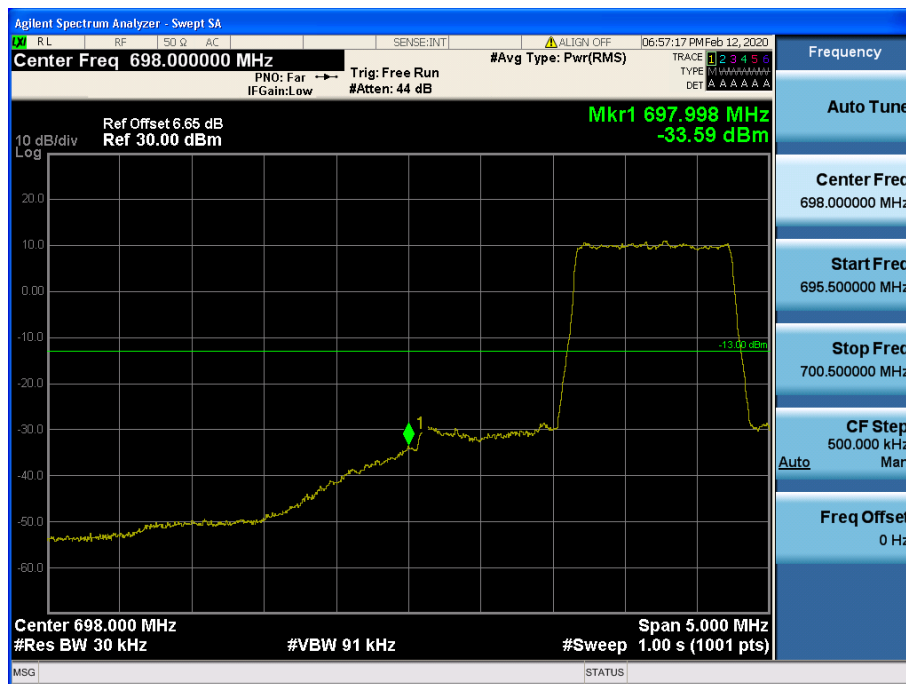
LTE Band 12 / 3MHz / QPSK - RB Size/Offset (1/14)

- Upper Extended Band Edge



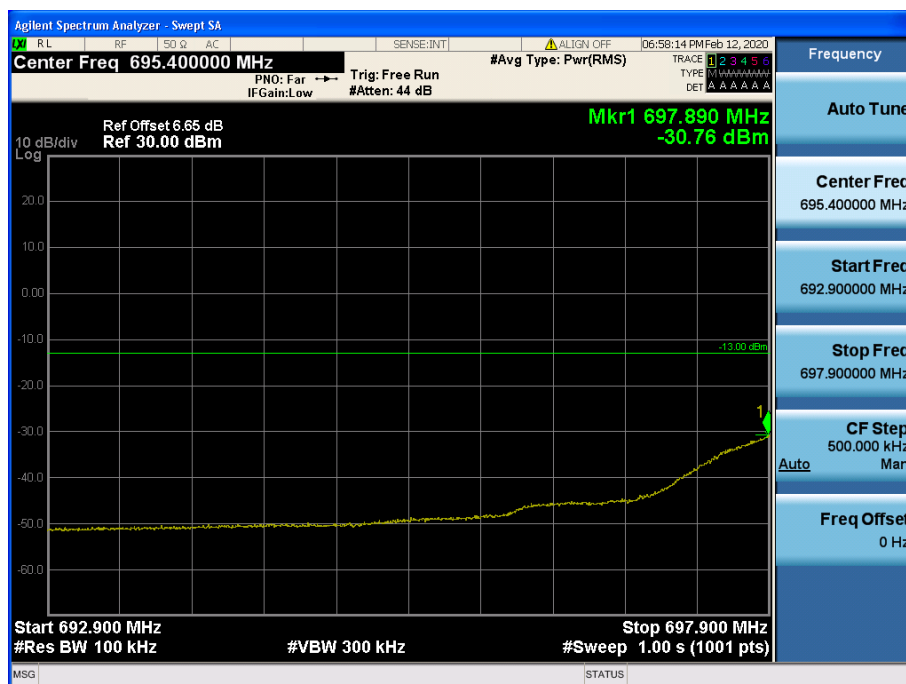
LTE Band 12 / 3MHz / 16QAM - RB Size/Offset (1/14)

- Lower Band Edge



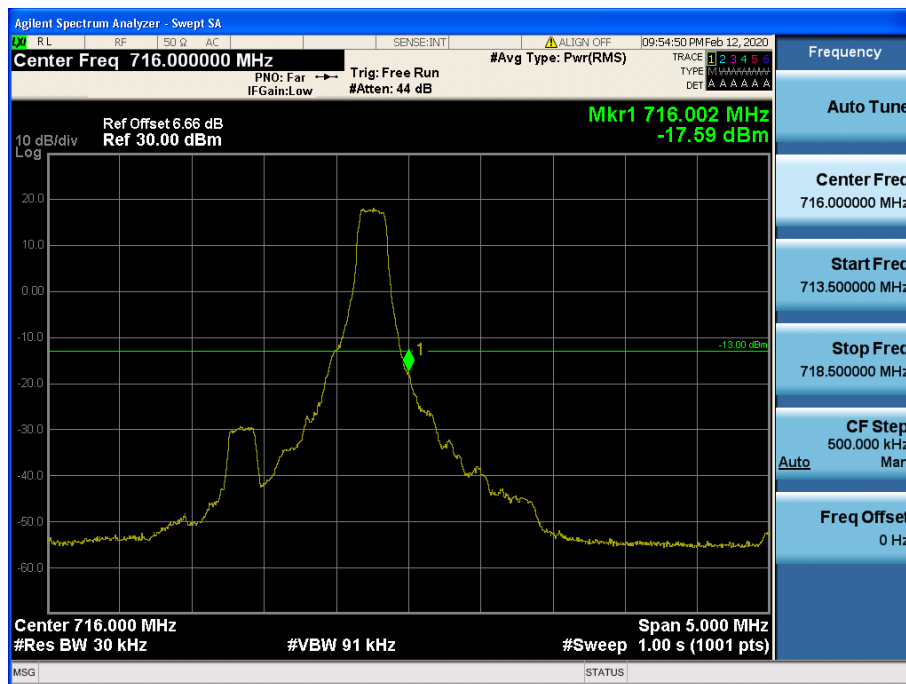
LTE Band 12 / 1.4MHz / QPSK - RB Size/Offset (6/0)

- Lower Extended Band Edge



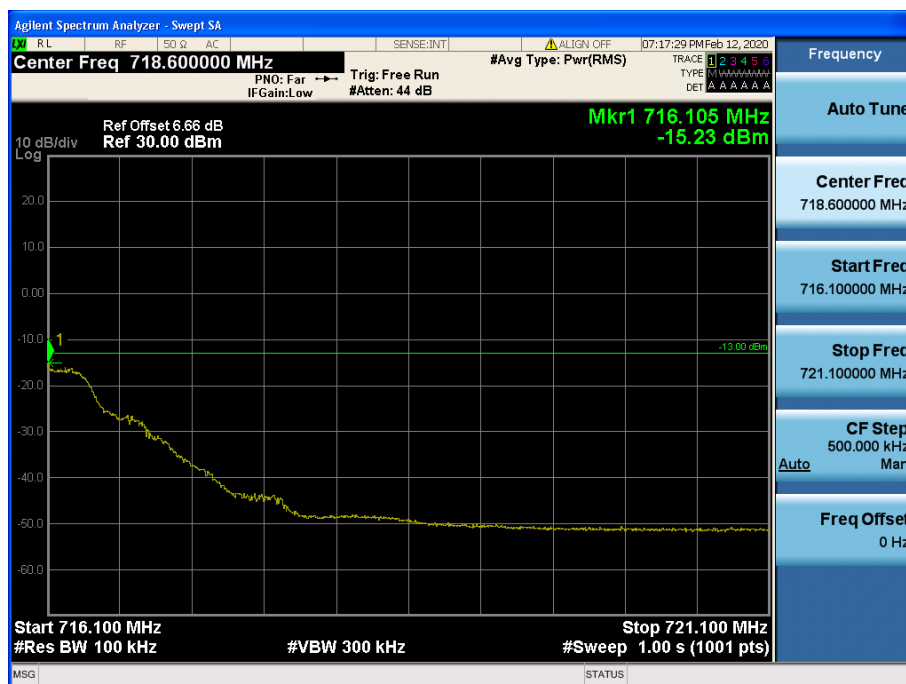
LTE Band 12 / 1.4MHz / QPSK - RB Size/Offset (6/0)

- Upper Band Edge



LTE Band 12 / 1.4MHz / 16QAM - RB Size/Offset (1/5)

- Upper Extended Band Edge



LTE Band 12 / 1.4MHz / QPSK - RB Size/Offset (3/3)

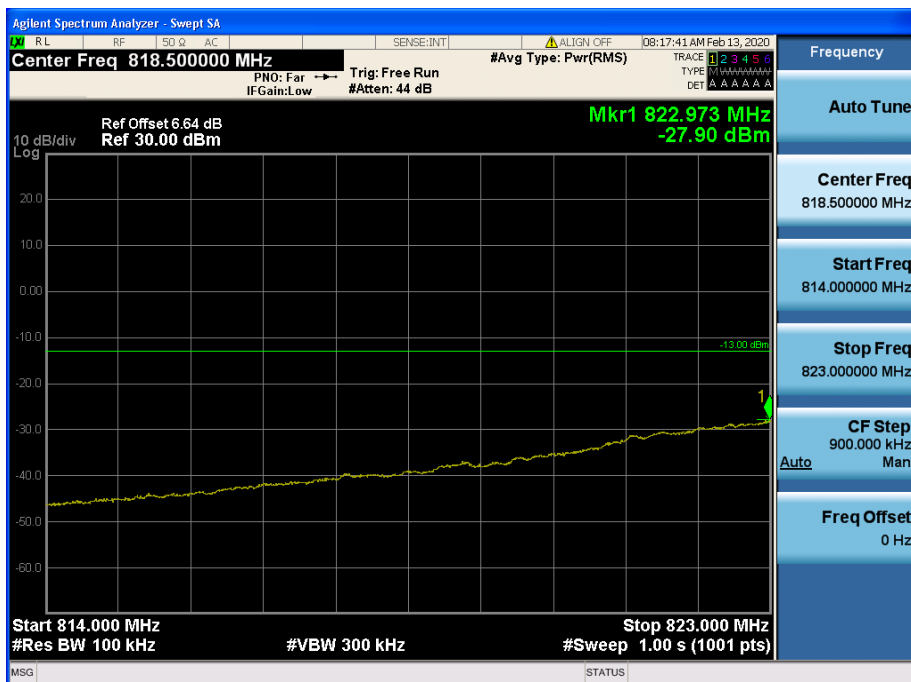
8.3.2 LTE Band 5

- Lower Band Edge



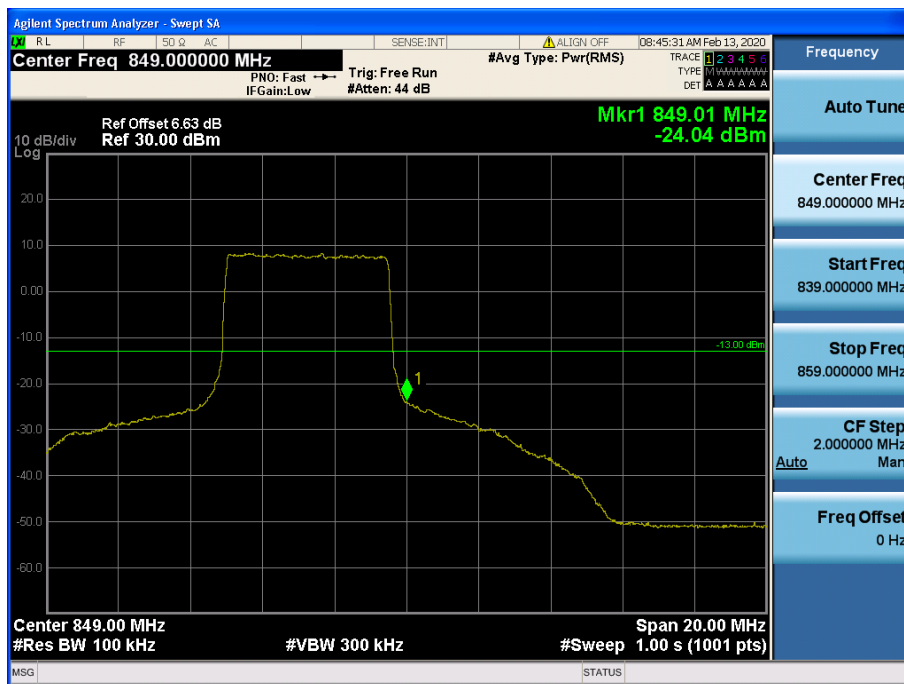
LTE Band 5 / 10MHz / 16QAM - RB Size/Offset (25/0)

- Lower Extended Band Edge



LTE Band 5 / 10MHz / 16QAM - RB Size/Offset (25/0)

- Upper Band Edge



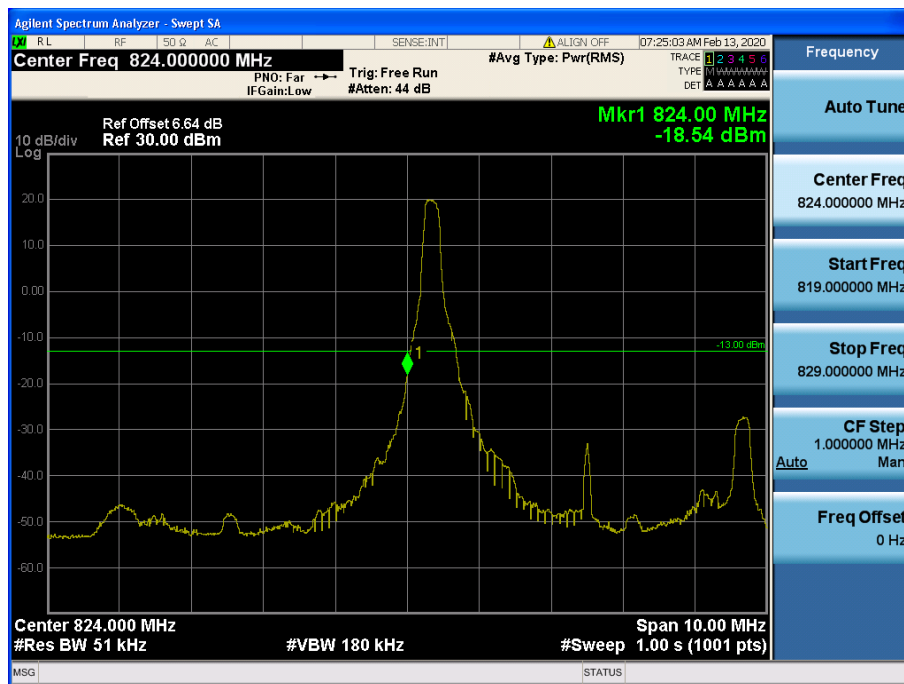
LTE Band 5 / 10MHz / 16QAM - RB Size/Offset (25/25)

- Upper Extended Band Edge



LTE Band 5 / 10MHz / QPSK - RB Size/Offset (25/25)

- Lower Band Edge



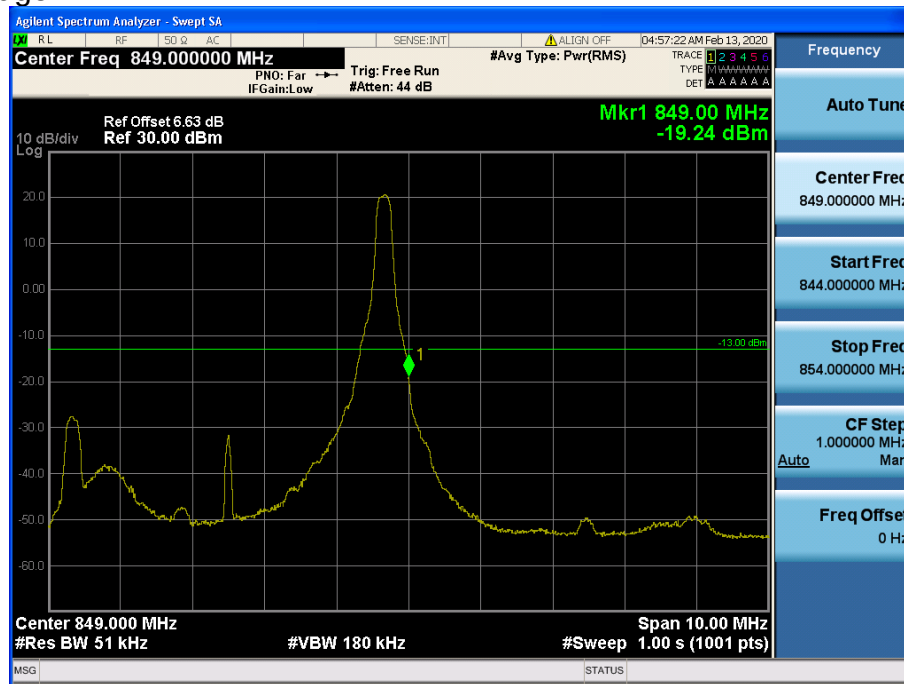
LTE Band 5 / 5MHz / 16QAM - RB Size/Offset (1/0)

- Lower Extended Band Edge



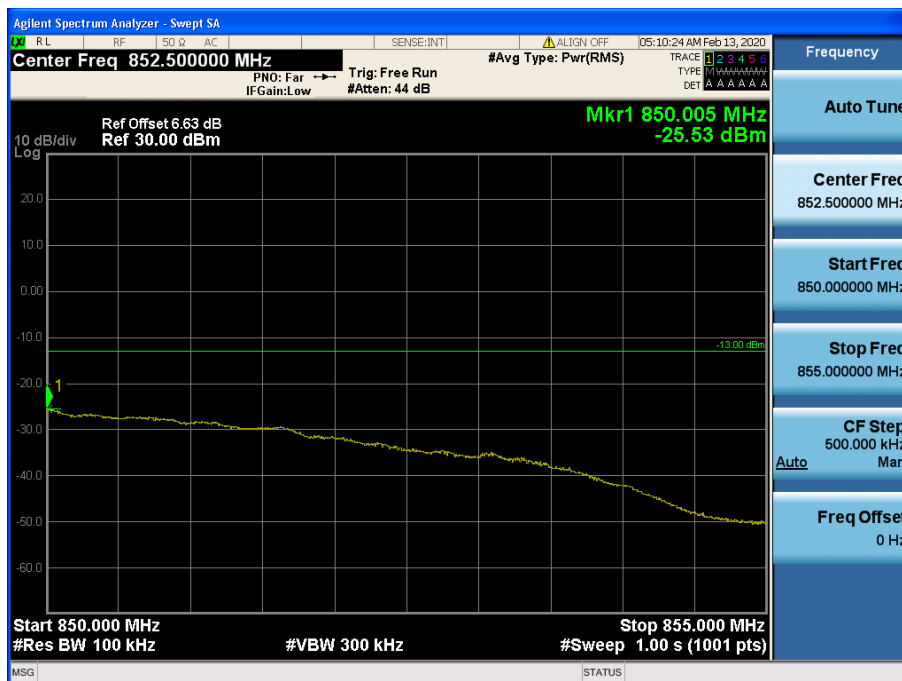
LTE Band 5 / 5MHz / QPSK - RB Size/Offset (25/0)

- Upper Band Edge



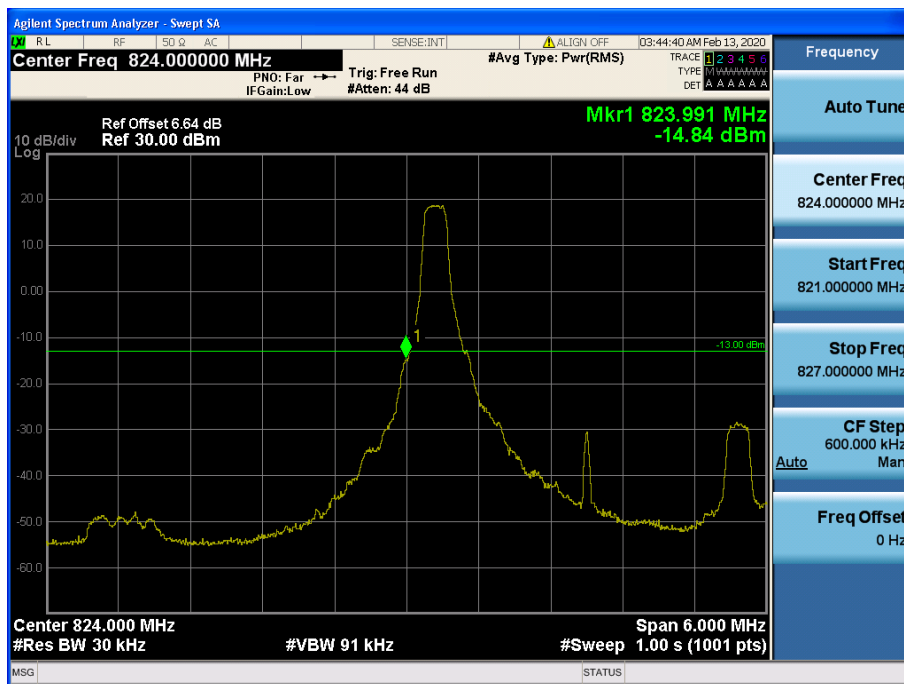
LTE Band 5 / 5MHz / QPSK - RB Size/Offset (1/24)

- Upper Extended Band Edge



LTE Band 5 / 5MHz / QPSK - RB Size/Offset (25/0)

- Lower Band Edge



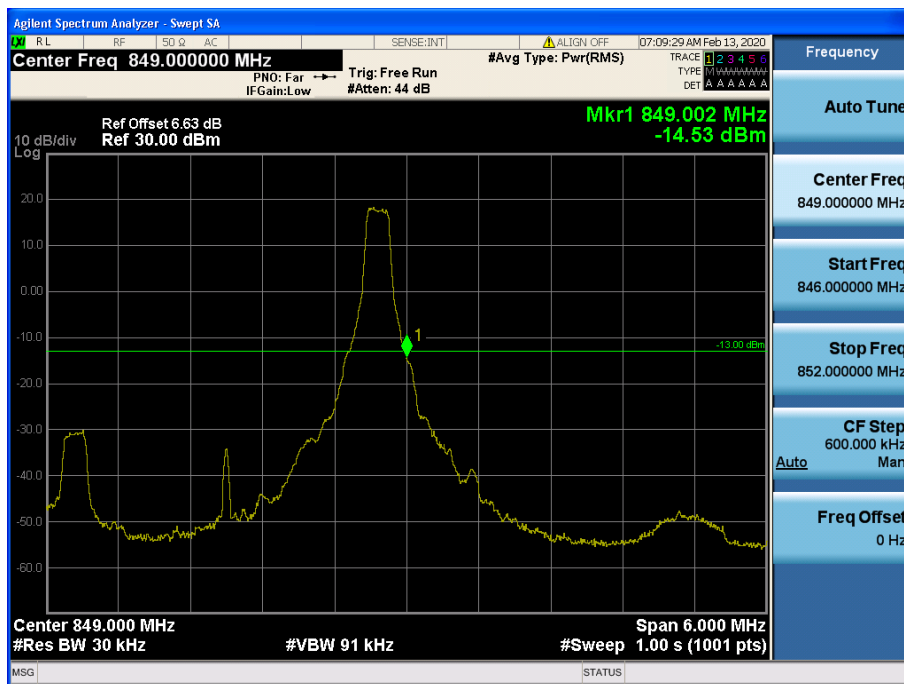
LTE Band 5 / 3MHz / QPSK - RB Size/Offset (1/0)

- Lower Extended Band Edge



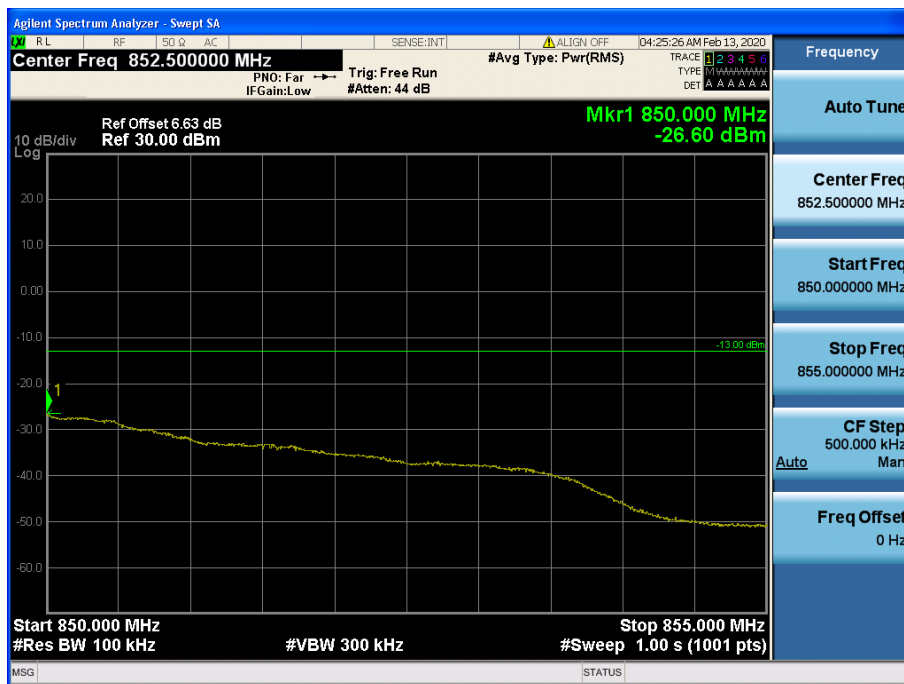
LTE Band 5 / 3MHz / QPSK - RB Size/Offset (15/0)

- Upper Band Edge



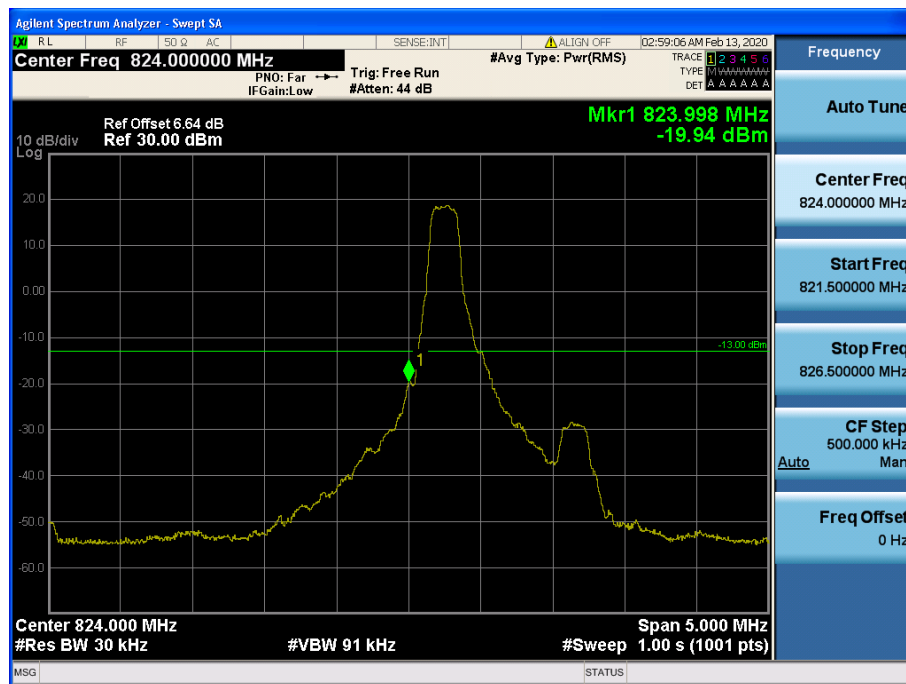
LTE Band 5 / 3MHz / 16QAM - RB Size/Offset (1/14)

- Upper Extended Band Edge



LTE Band 5 / 3MHz / QPSK - RB Size/Offset (15/0)

- Lower Band Edge



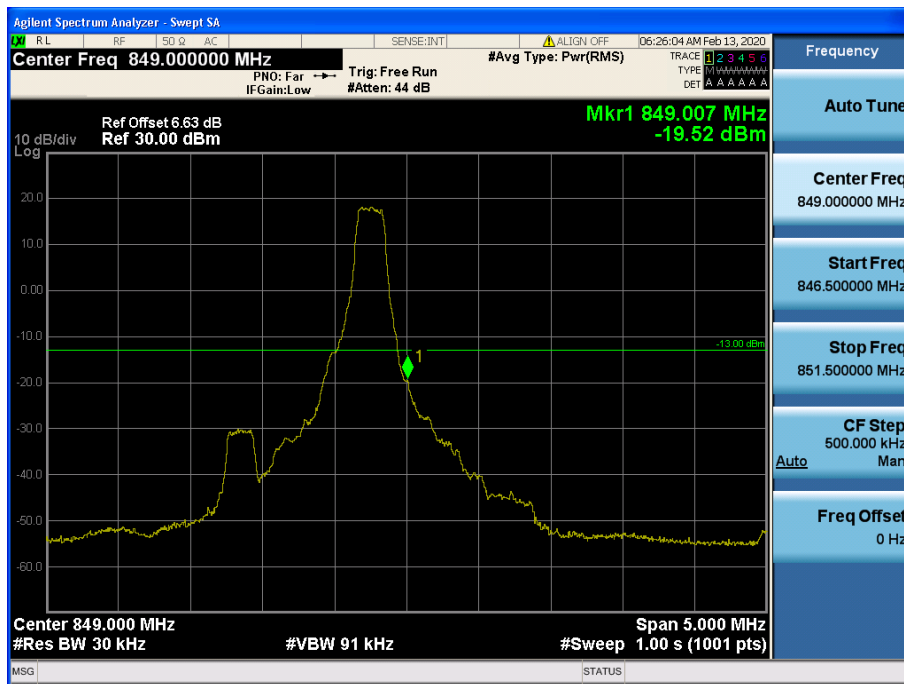
LTE Band 5 / 1.4MHz / QPSK - RB Size/Offset (1/0)

- Lower Extended Band Edge



LTE Band 5 / 1.4MHz / 16QAM - RB Size/Offset (6/0)

- Upper Band Edge



LTE Band 5 / 1.4MHz / 16QAM - RB Size/Offset (1/5)

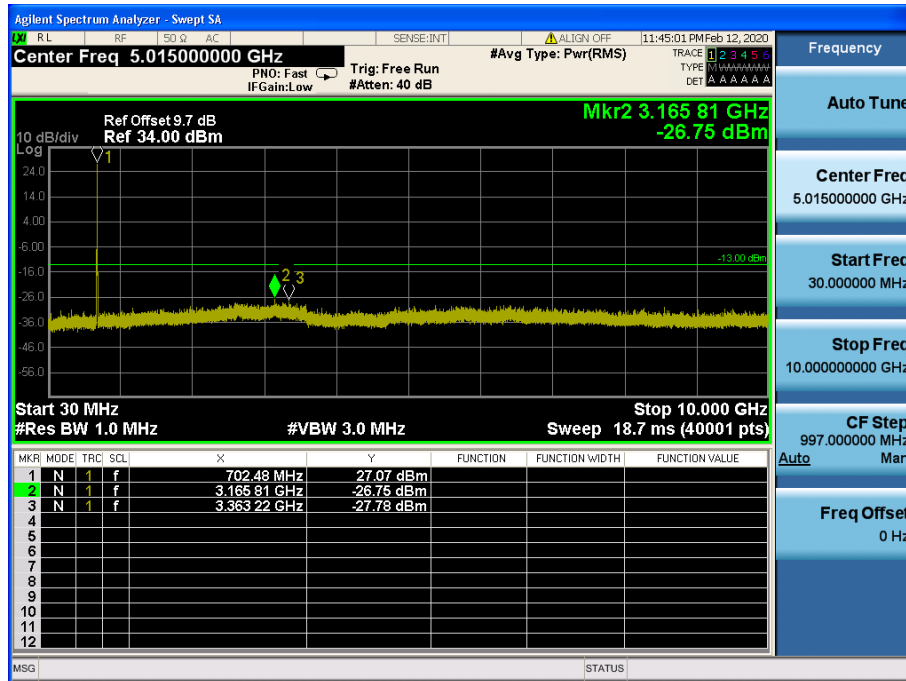
- Upper Extended Band Edge



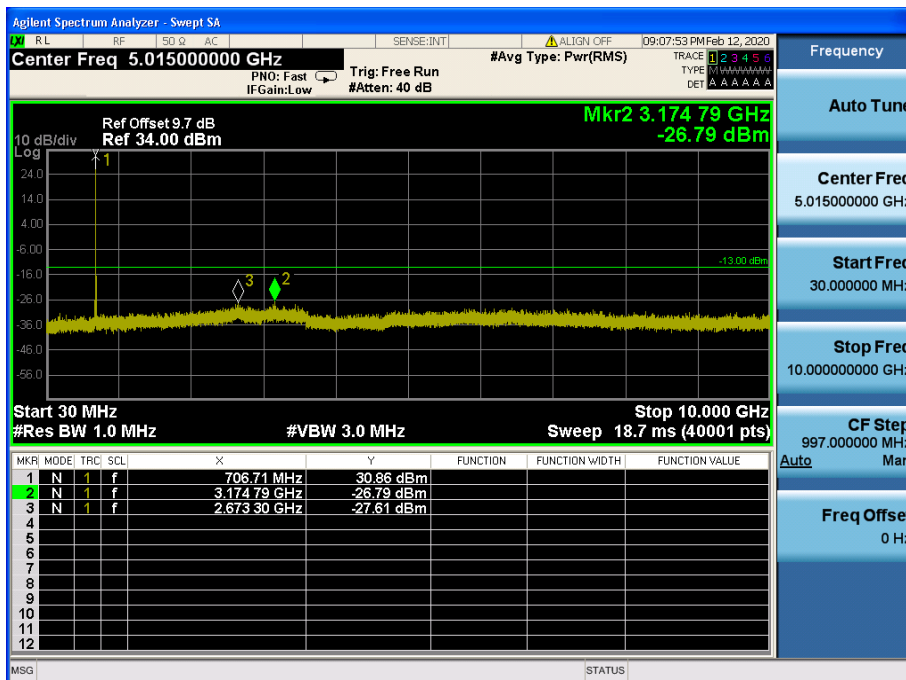
LTE Band 5 / 1.4MHz / QPSK - RB Size/Offset (6/0)

8.4 SPURIOUS AND HARMONICS EMISSIONS(Conducted)

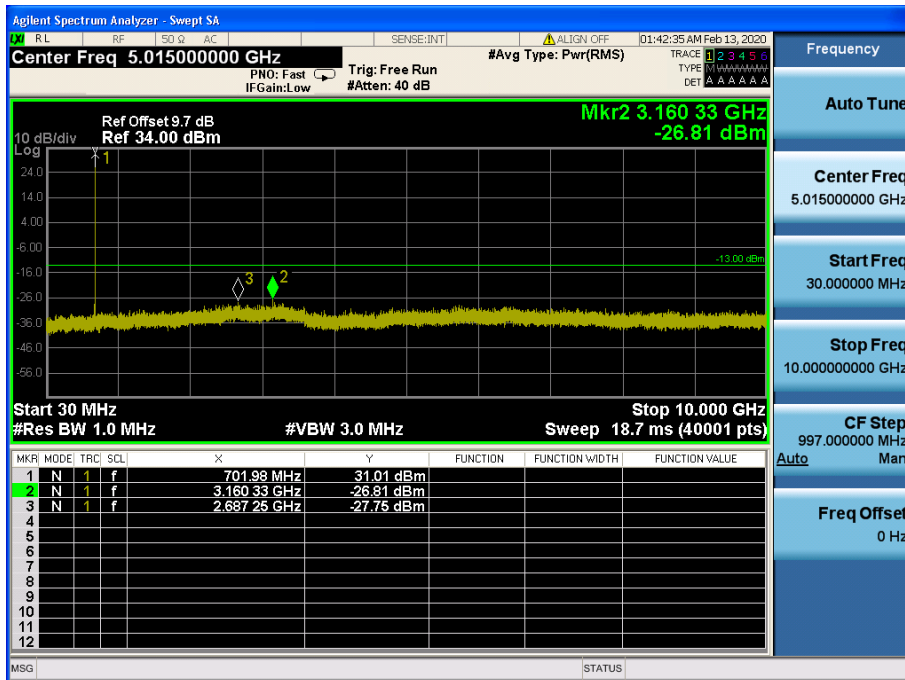
8.4.1 LTE Band 12



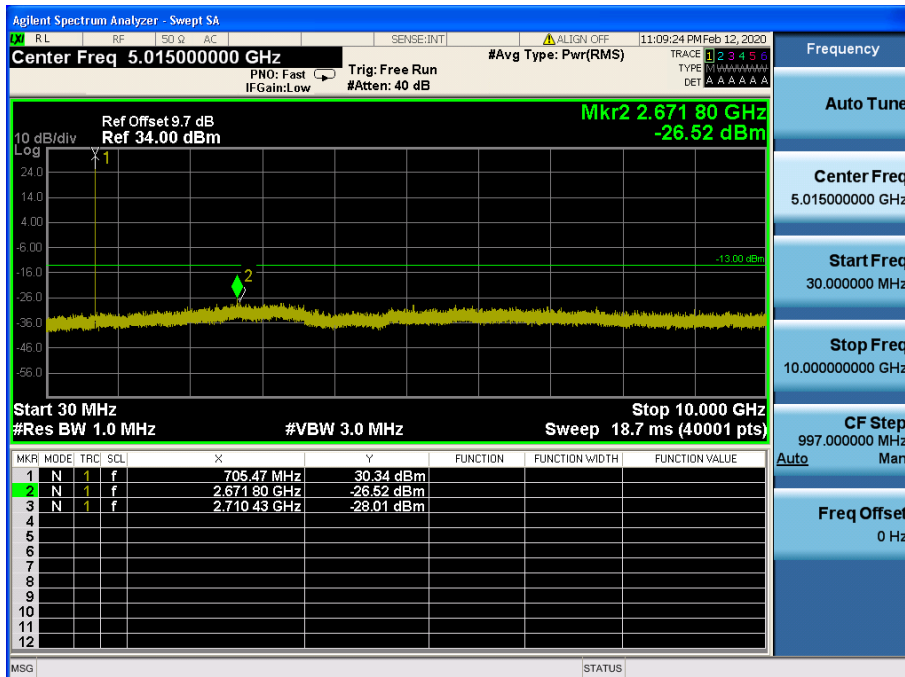
LTE Band 12 / 10MHz / 16QAM - RB Size/Offset (25/12) – Low Channel



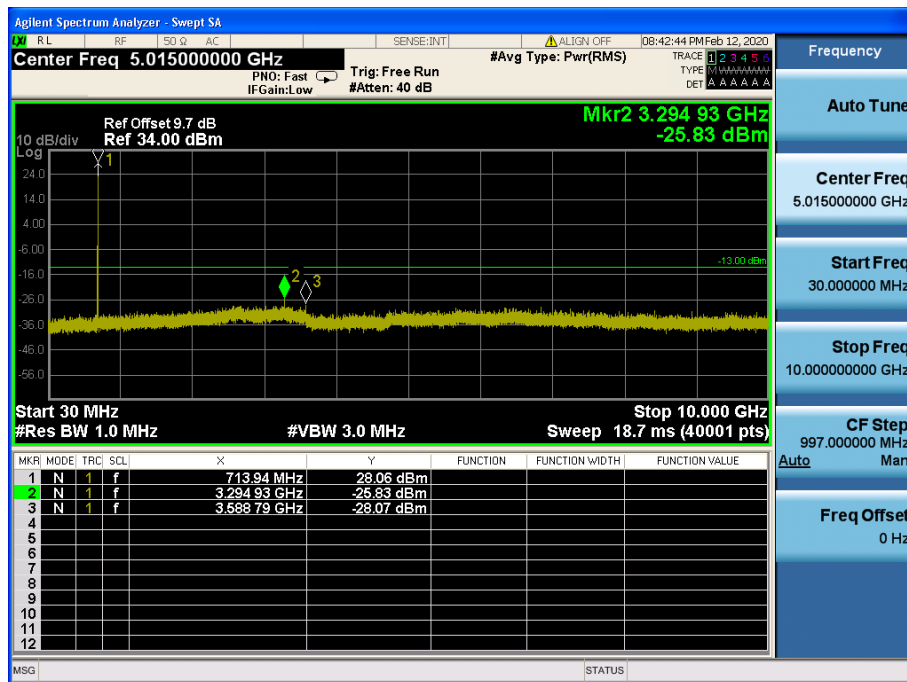
LTE Band 12 / 10MHz / QPSK - RB Size/Offset (1/0) – High Channel



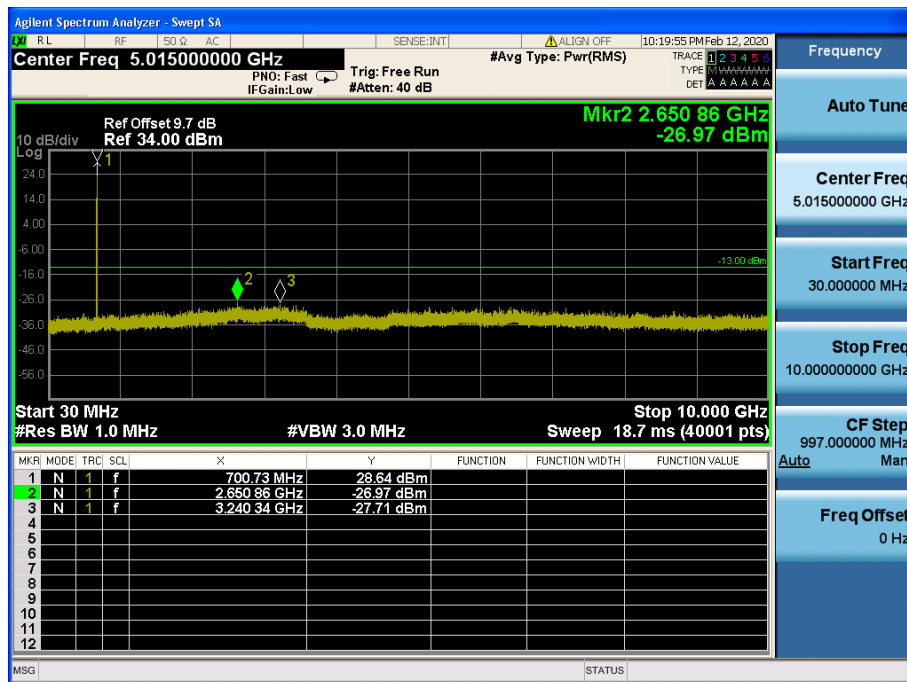
LTE Band 12 / 5MHz / 64QAM - RB Size/Offset (1/12) – Low Channel



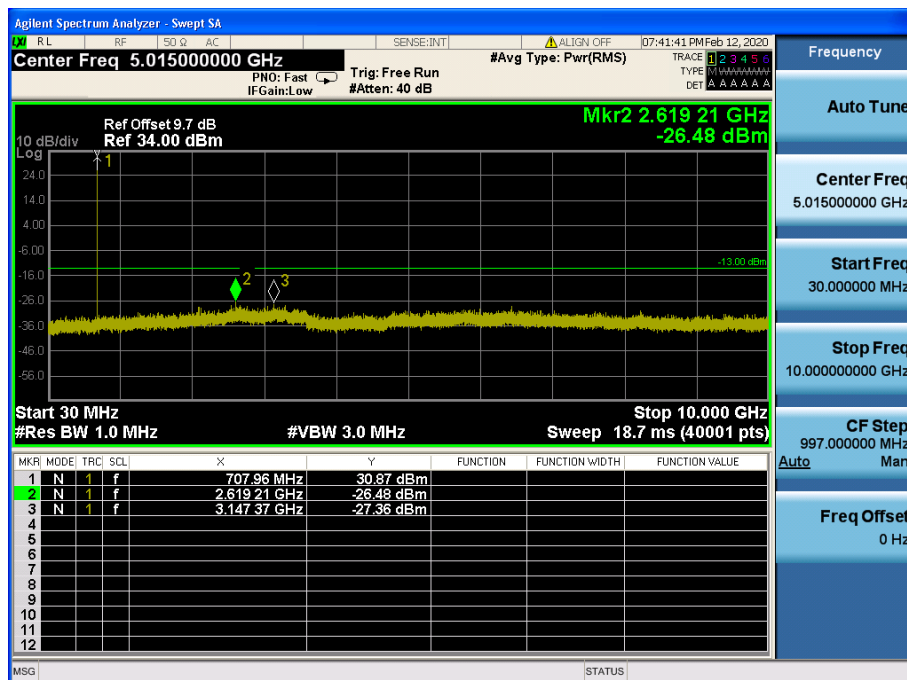
LTE Band 12 / 5MHz / 16QAM - RB Size/Offset (1/0) – Mid Channel



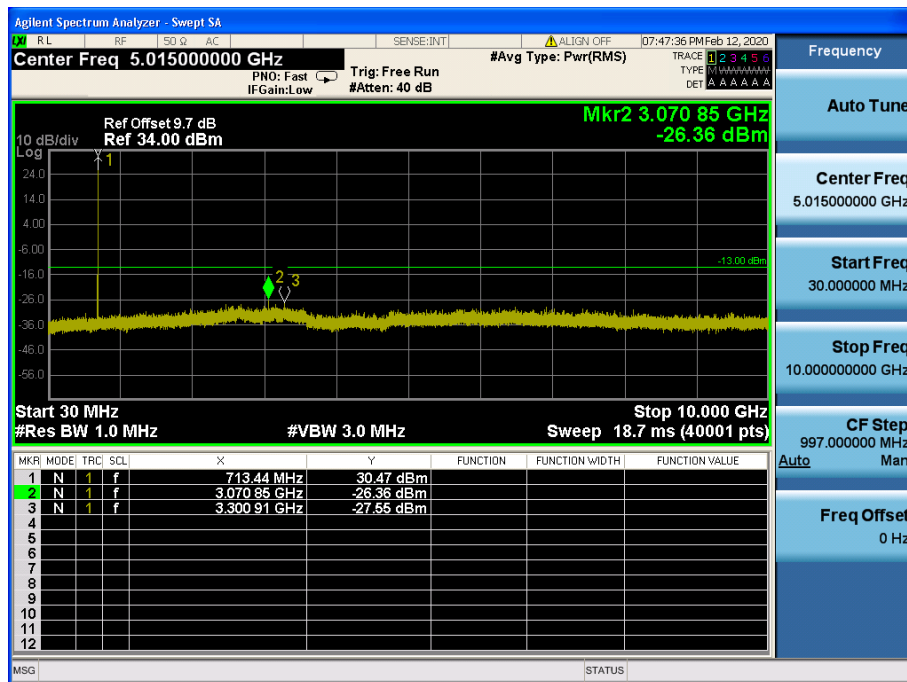
LTE Band 12 / 5MHz / QPSK - RB Size/Offset (12/13) – High Channel



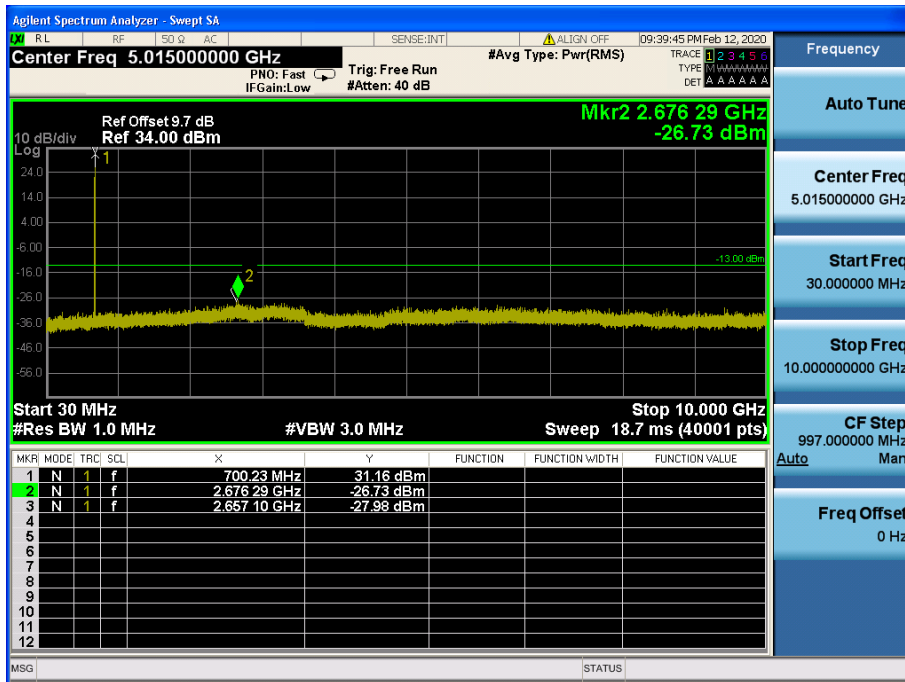
LTE Band 12 / 3MHz / 16QAM - RB Size/Offset (8/4) – Low Channel



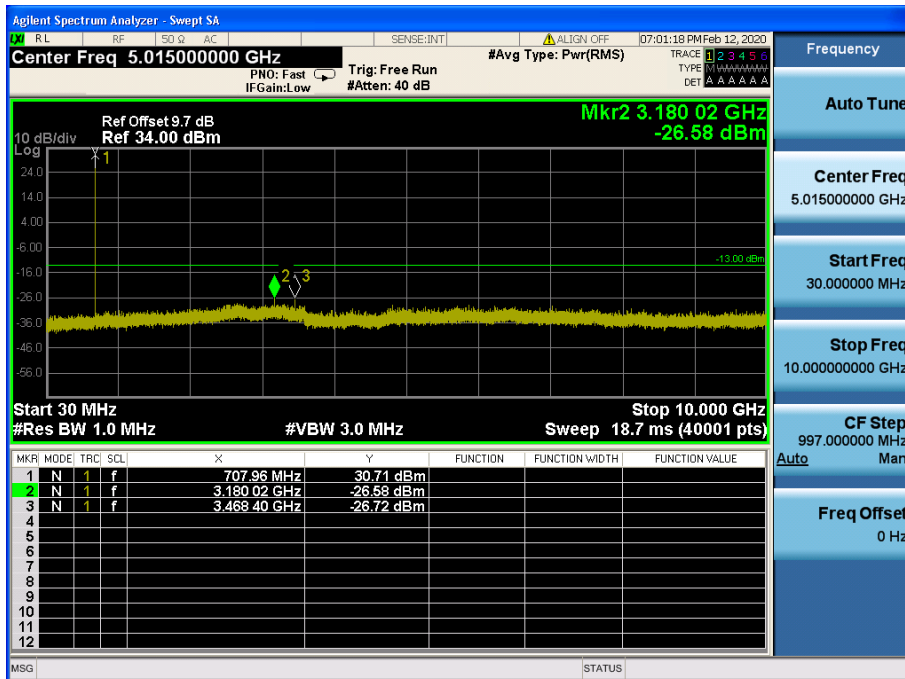
LTE Band 12 / 3MHz / QPSK - RB Size/Offset (1/7) – Mid Channel



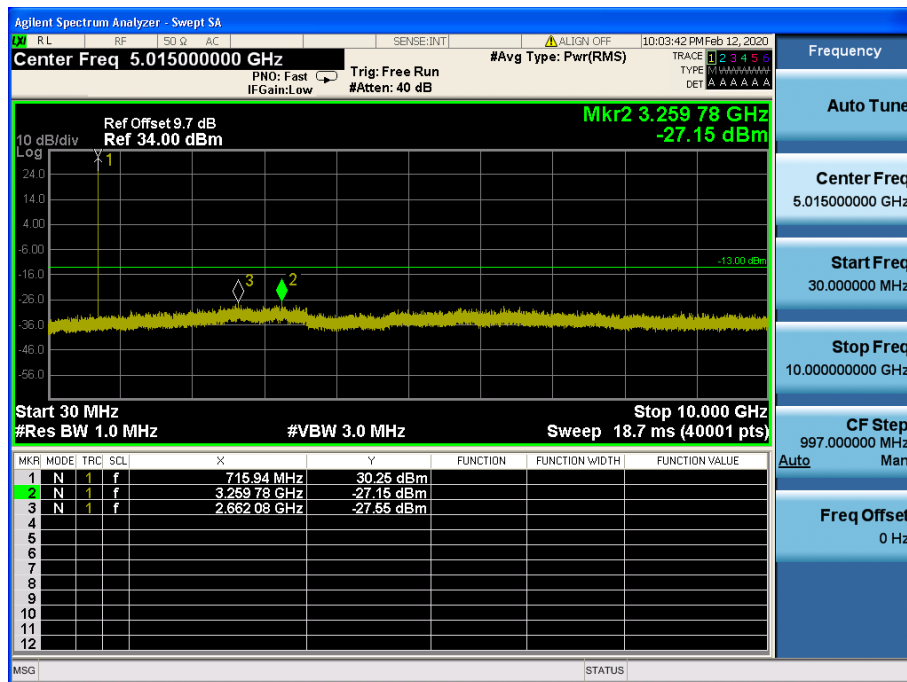
LTE Band 12 / 3MHz / QPSK - RB Size/Offset (1/0) – High Channel



LTE Band 12 / 1.4MHz / 16QAM - RB Size/Offset (3/3) – Low Channel

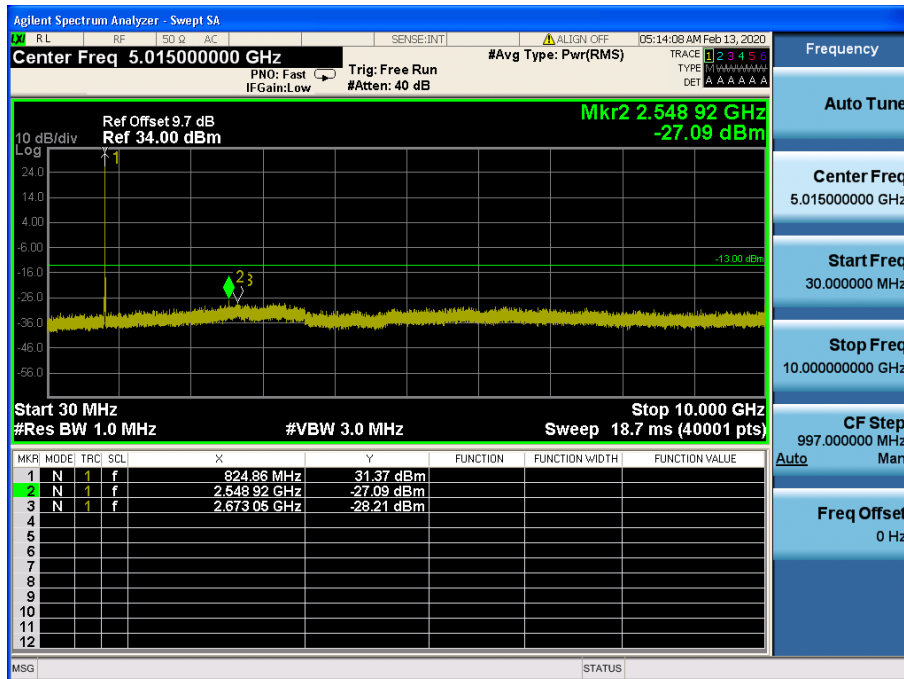


LTE Band 12 / 1.4MHz / QPSK - RB Size/Offset (3/2) – Mid Channel

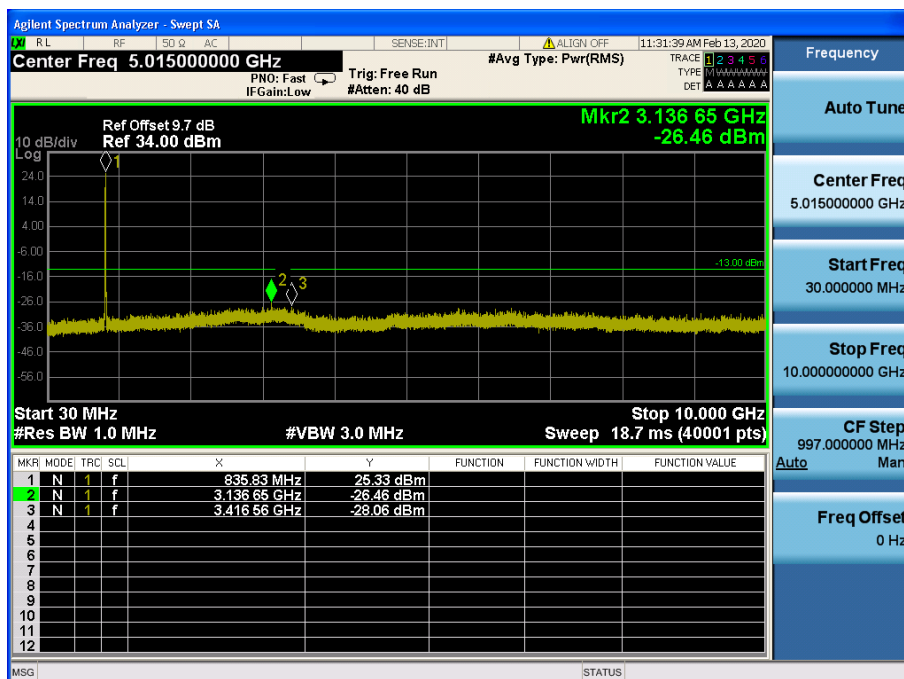


LTE Band 12 / 1.4MHz / 16QAM - RB Size/Offset (3/3) – High Channel

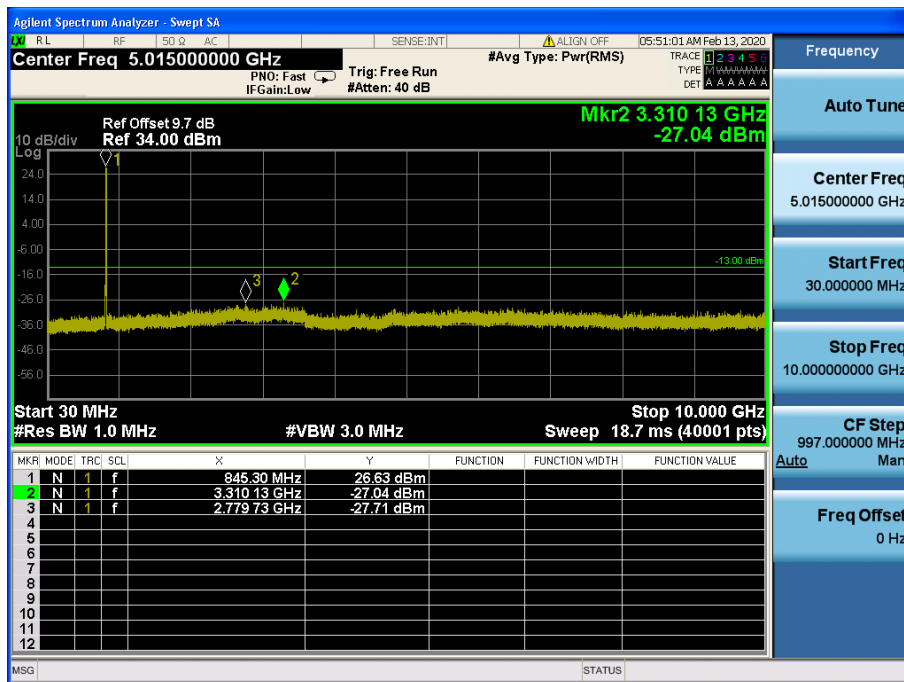
8.4.2 LTE Band 5



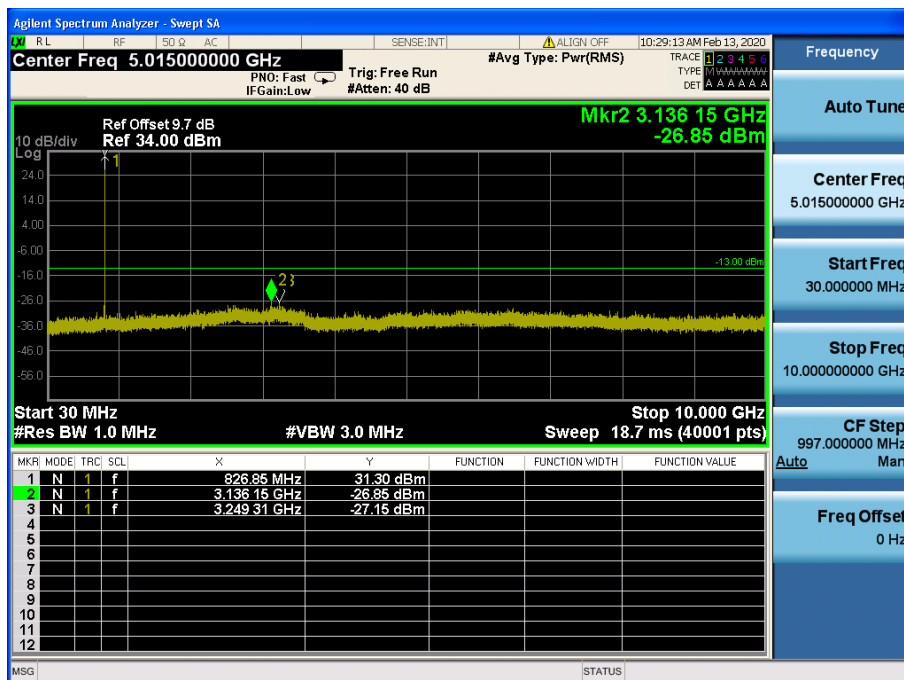
LTE Band 5 / 10MHz / QPSK - RB Size/Offset (1/0) – Low Channel



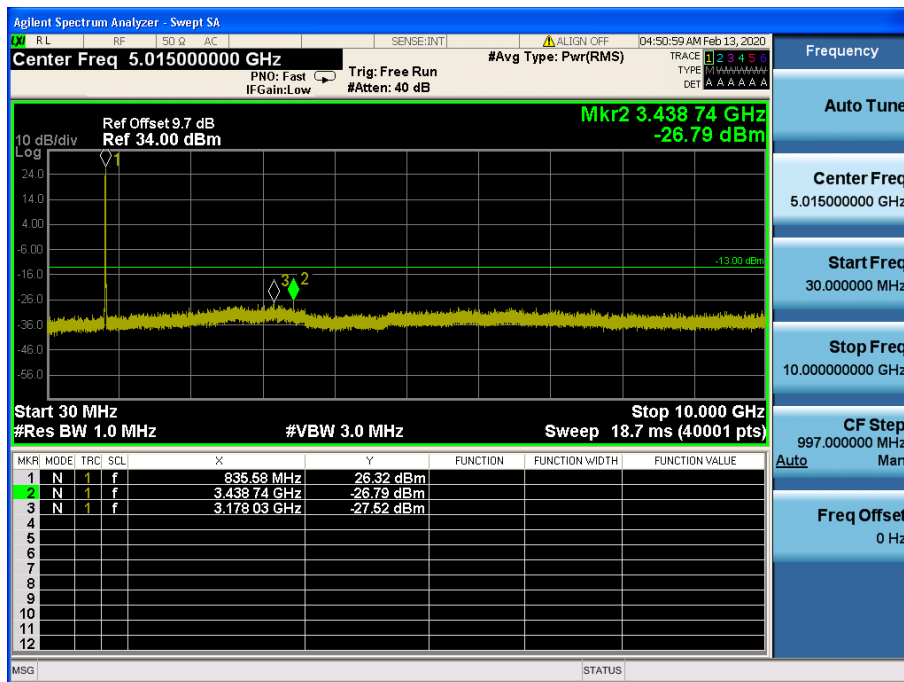
LTE Band 5 / 10MHz / 64QAM - RB Size/Offset (25/12) – Mid Channel



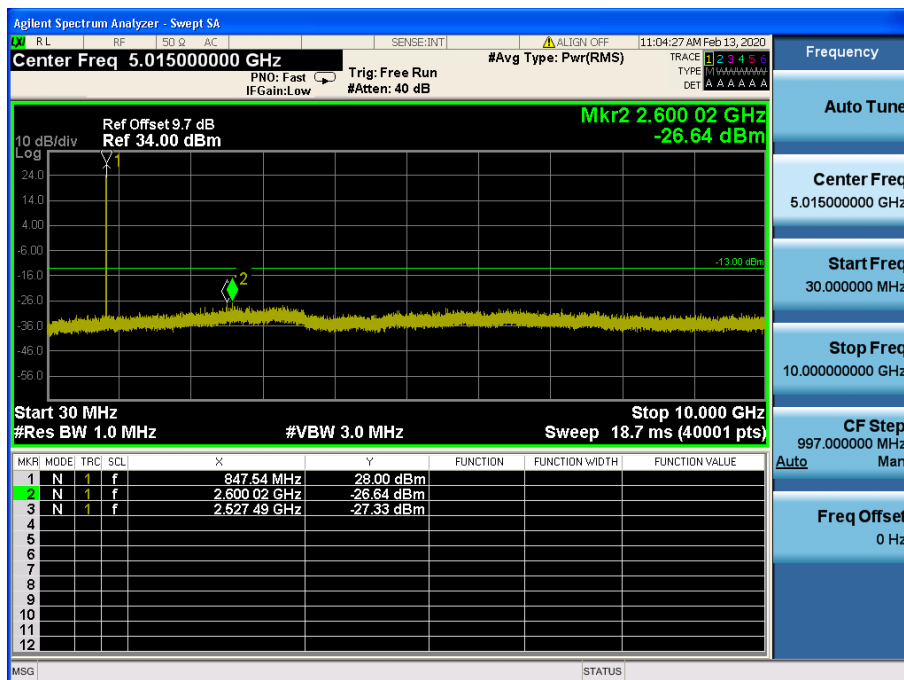
LTE Band 5 / 10MHz / QPSK - RB Size/Offset (25/25) – High Channel



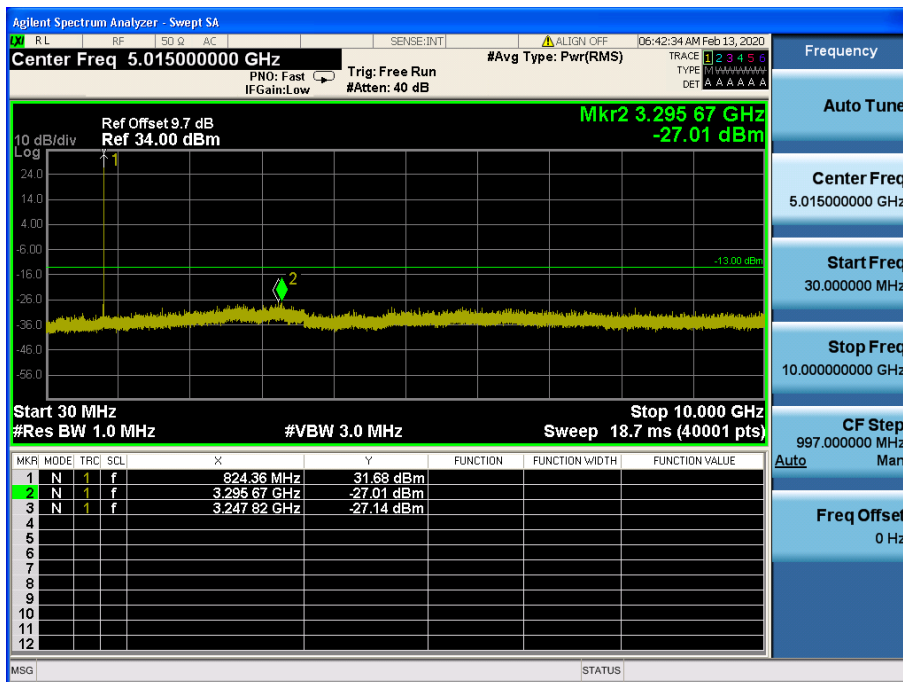
LTE Band 5 / 5MHz / 64QAM - RB Size/Offset (1/12) – Low Channel



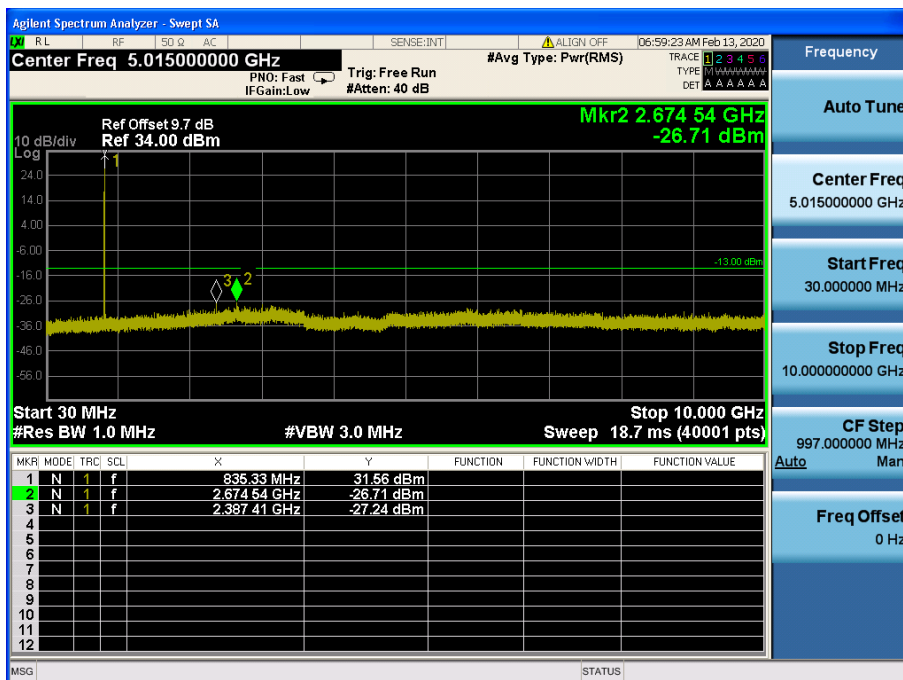
LTE Band 5 / 5MHz / QPSK - RB Size/Offset (25/0) – Mid Channel



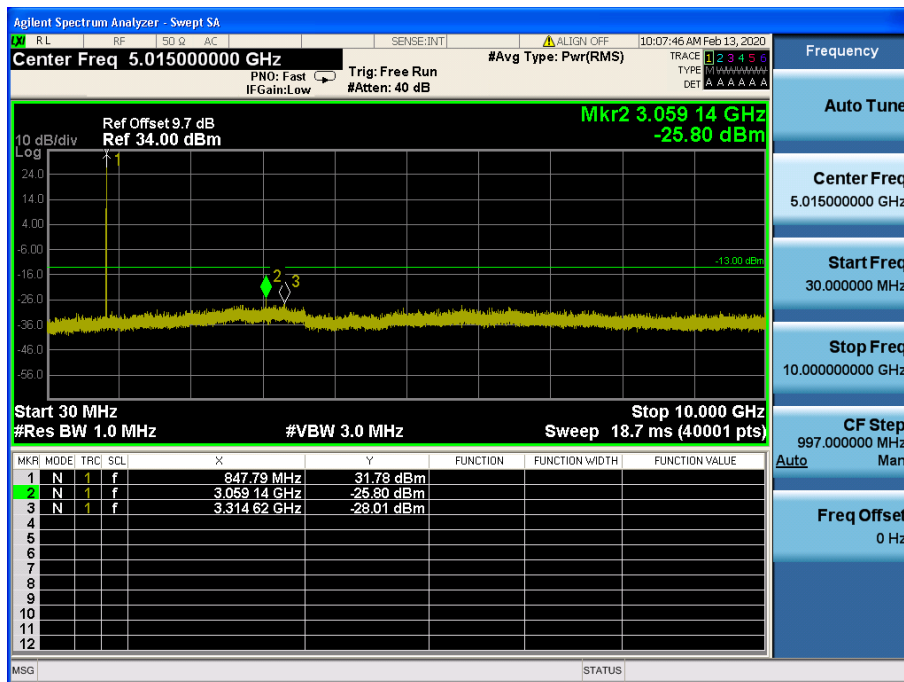
LTE Band 5 / 5MHz / 64QAM - RB Size/Offset (12/13) – High Channel



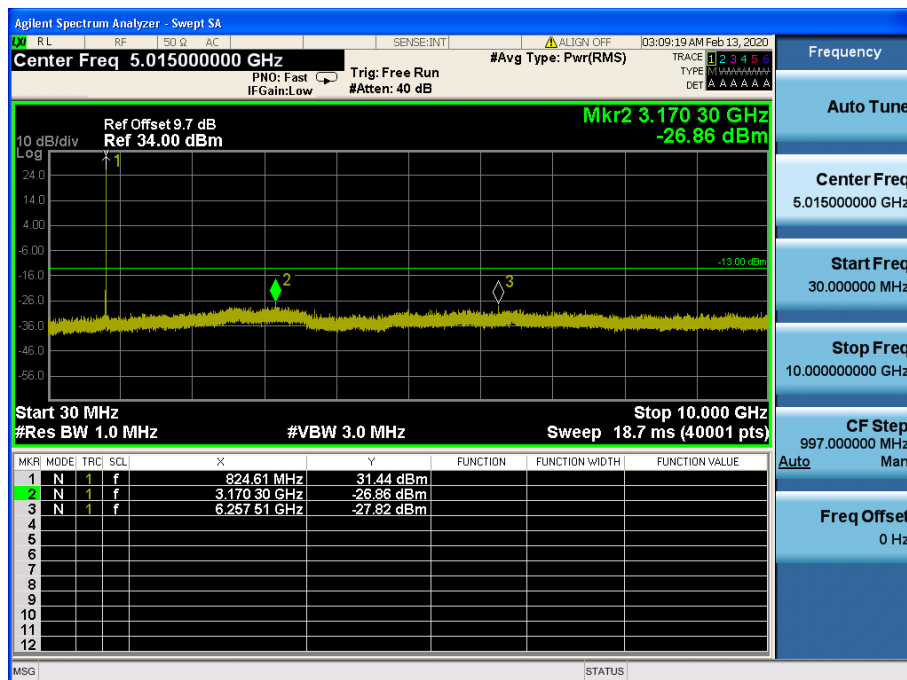
LTE Band 5 / 3MHz / 16QAM - RB Size/Offset (1/0) – Low Channel



LTE Band 5 / 3MHz / 16QAM - RB Size/Offset (1/0) – Mid Channel



LTE Band 5 / 3MHz / 64QAM - RB Size/Offset (1/7) – High Channel



LTE Band 5 / 1.4MHz / QPSK - RB Size/Offset (3/0) – Low Channel

