TEST REPORT

Dt&C

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

1. Report No : DRTFCC1908-0220
2. Customer
   - Name : LG Electronics USA
   - Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : Telematics / TLVHE4IU-E
   FCC ID : BEJTLVHE4IU-E
5. Test Method Used : KDB971168 D01v03r01, ANSI/TIA-603-E-2016, ANSI C63.26-2015
   Test Specification : §2, §27
6. Date of Test : 2019.05.15 ~ 2019.05.24
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)

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2019 . 08 . 30 .

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
DRTFCC1908-0220	Aug. 30 2019	Initial issue

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1. GENERAL INFORMATION

Applicant Name : LG Electronics USA

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

FCC ID : BEJTLVHE4IU-E

FCC Classification : Licensed Non-Broadcast Station Transmitter (TNB)

EUT Type : Telematics

Model Name : TLVHW3IU-E

Add Model Name : TLVHE4IU-R

Supplying power : DC 12 V

Antenna Information : External Antenna

Mode	TX Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max power(dBm)	Max power(W)
LTE Band 7	2510 ~ 2560	17M9G7D	QPSK	20.32	0.108
LTE Band 7	2510 ~ 2560	17M9W7D	16QAM	19.23	0.084
LTE Band 7	2507.5 ~ 2562.5	13M4G7D	QPSK	20.52	0.113
LTE Band 7	2507.5 ~ 2562.5	13M4W7D	16QAM	19.68	0.093
LTE Band 7	2505 ~ 2565	8M96G7D	QPSK	21.02	0.126
LTE Band 7	2505 ~ 2565	8M94W7D	16QAM	19.76	0.095
LTE Band 7	2502.5 ~ 2567.5	4M50G7D	QPSK	20.63	0.116
LTE Band 7	2502.5 ~ 2567.5	4M49W7D	16QAM	19.87	0.097

2. INTRODUCTION

2.1 EUT DESCRIPTION

The Equipment Under Test (EUT) supports LTE.

2.2. EUT CAPABILITIES

This EUT contains the following capabilities: LTE single transmitting for band 7

2.3. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+21 ℃ ~ +25 ℃
▪ Relative Humidity	40 % ~ 46 %

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)

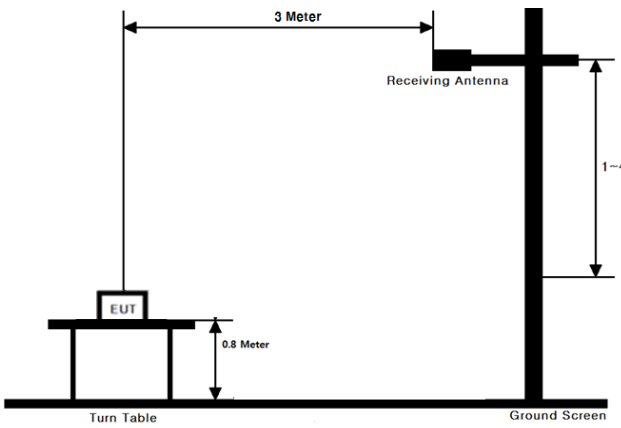
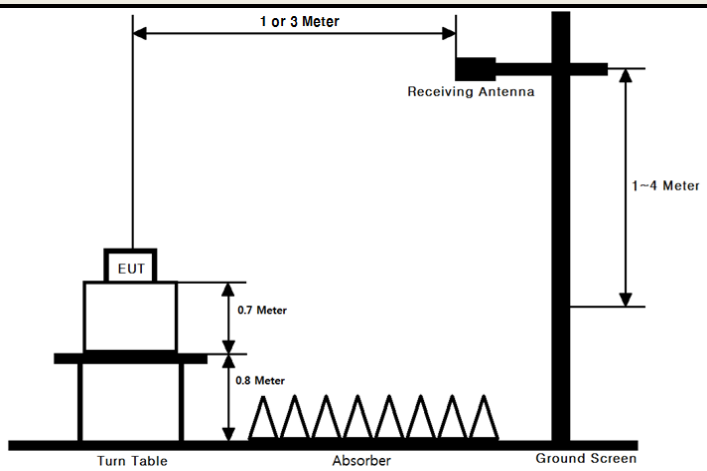
2.6. TEST FACILITY

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 complies with the requirements of § 2.948 according to ANSI 63.4-2014. **- FCC MRA Accredited Test Firm No. : KR0034**		
www.dtnc.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

Below 1GHz	Above 1GHz
	

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 ≥ 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.

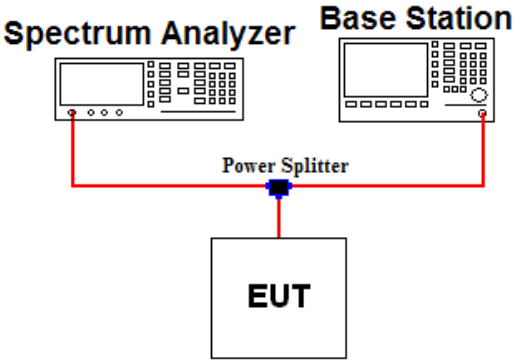
The ERP/EIRP is calculated using the following formula:

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 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.

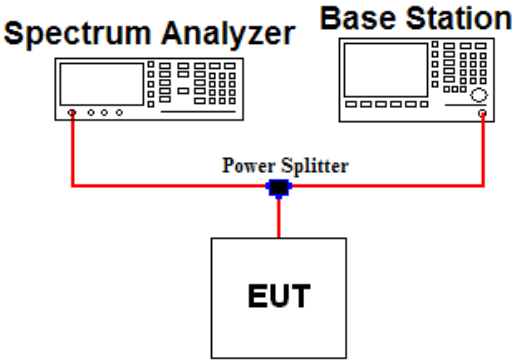
Test setting

The spectrum Analyzer`s CCDF measurement function is enabled.

1. Set resolution/measurement bandwidth ≥ 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 D01v03 - Section 4.3**
- **ANSI C63.26-2015 – Section 5.4.4**

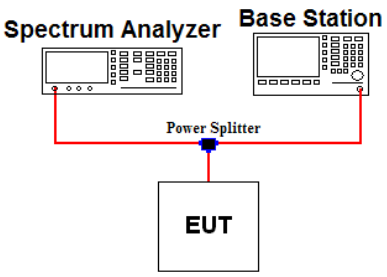
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

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 ~ 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 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

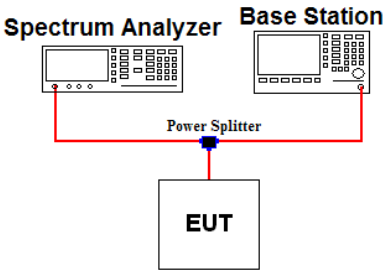
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1 % of the emission bandwidth
4. VBW ≥ 3 X RBW
5. Detector = RMS & Trace mode = Max hold
6. Sweep 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: 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 2: 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 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.

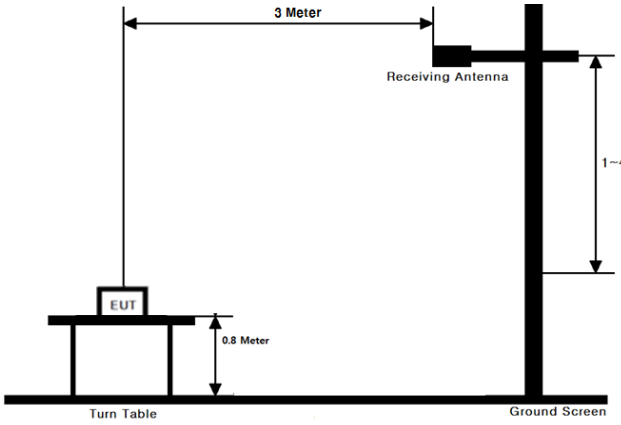
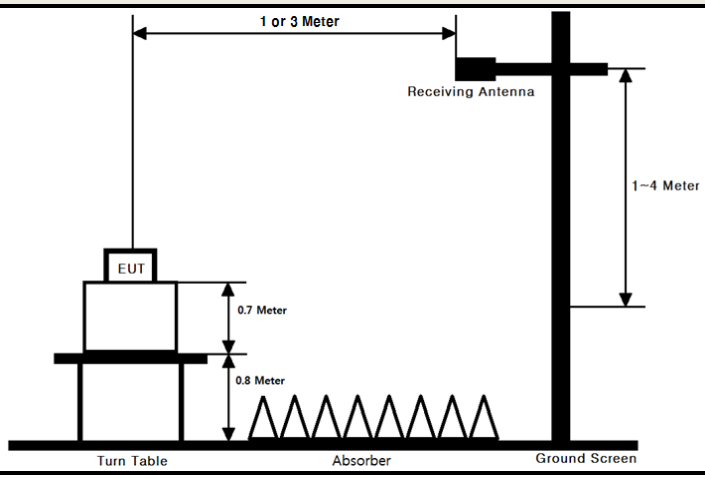
Test setting

1. RBW = 100 kHz(Below 1 GHz) or 1 MHz(Above 1 GHz) & VBW ≥ 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 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 ≥ 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.

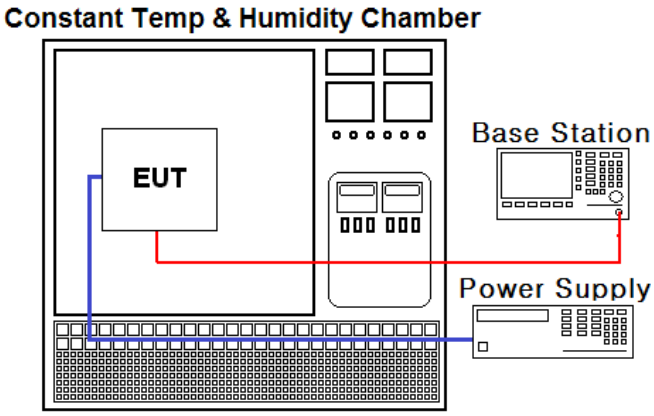
For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

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 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 ± 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	18/07/09	19/07/09	MY50410163
Spectrum Analyzer	Agilent Technologies	N9020A	18/07/09	19/07/09	MY46471251
DC power supply	Agilent Technologies	66332A	18/07/02	19/07/02	MY43001172
DC power supply	SMtechno	SDP30-5D	18/07/03	19/07/03	305DNF079
Multimeter	FLUKE	17B+	18/12/18	19/12/18	36390701WS
Power Splitter	Anritsu	K241B	18/12/19	19/12/19	016681
Temp & Humi	MG Indus	THP31R1	18/07/05	19/07/05	20131002-1
Radio Communication Analyzer	Anritsu	MT8820C	18/07/04	19/07/04	6201274519
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-1
Thermohygrometer	BODYCOM	BJ5478	18/12/27	19/12/27	120612-2
Signal Generator	Rohde Schwarz	SMBV100A	18/12/19	19/12/19	255571
Signal Generator	Rohde Schwarz	SMF100A	18/06/07	19/06/07	102341
Loop Antenna	Schwarzbeck	FMZB1513	18/01/30	20/01/30	1513-128
Bilog Antenna	Schwarzbeck	VULB 9160	18/07/13	20/07/13	3359
Dipole Antenna	Schwarzbeck	VHA9103	18/04/13	20/04/13	2117
Dipole Antenna	Schwarzbeck	UHA9105	18/04/13	20/04/13	2262
HORN ANT	ETS	3117	18/05/10	20/05/10	00140394
HORN ANT	A.H.Systems	SAS-574	17/07/31	19/07/31	155
PreAmplifier	H.P	8447D	18/12/18	19/12/18	2944A07774
PreAmplifier	Agilent	8449B	18/07/05	19/07/05	3008A02108
High-pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	18/07/05	19/07/05	3
High-pass filter	Wainwright	WHNX8.5/26.5G-6SS	18/07/03	19/07/03	1
Cable	DTNC	Cable	18/07/06	19/07/06	M-01
Cable	DTNC	Cable	18/07/06	19/07/06	M-04
Cable	Junkosha	MWX315	18/11/19	19/11/19	M-05
Cable	Junkosha	MWX221	18/11/19	19/11/19	M-06
Cable	DTNC	Cable	18/07/06	19/07/06	RF-84

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
2.1049	Occupied Bandwidth	N/A		C
27.50	Peak to Average Ratio	N/A		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 27.54	Frequency Stability	Fundamental emissions must stay within Authorized frequency block (Part 24, 27)		C
27.50(h.2)	Radiated Output Power(B7)	< 2 Watts max. EIRP	Radiated Note2	C
27.53(m)	Undesirable Emissions(B7)	> 55 + $10\log_{10}$ (P) dB for all out-of-band emissions		C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable
Note 2: The radiated items were tested under worst condition by using shorter cable between EUT and Antenna.

6. SAMPLE CALCULATION

A. Emission Designator

LTE Band 7(QPSK)

Emission Designator = **17M9G3D**

LTE OBW = 17.926 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 7(16QAM)

Emission Designator = **17M9W7D**

LTE OBW = 17.894 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

B. For substitution method

EIRP for Band 7

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 (dBi)	EIRP (dBm)	EIRP (W)
10	2565	QPSK	1/0	-27.48	X	V	15.08	5.94	21.02	0.126

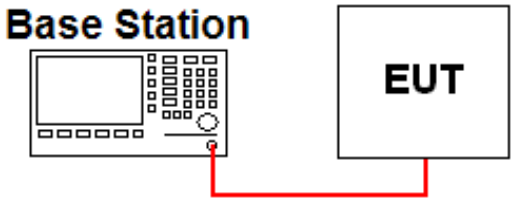
ERP or EIRP = Level @ Ant Terminal LEVEL(dBm) + Tx Ant. Gain

1) The EUT mounted on a non-conductive turntable is 1.5 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 CONDUCTED OUTPUT POWER

A base station simulator was used to establish communication with the EUT. The base station simulator parameters were set to produce the maximum power from the EUT. This device was tested under all configurations and the highest power is reported. Conducted Output Powers of EUT are reported below.



▪ Band 7

Conducted Power [dBm]									
RB Alloc			1 RB			MID RB			FULL RB
B.W(MHz)	Freq.(MHz)	Modulation	LOW	MID	HIGH	LOW	MID	HIGH	
20	2510	QPSK	21.81	21.77	21.74	20.71	20.82	20.79	20.76
		16QAM	21.18	21.21	21.10	19.73	19.81	19.80	19.74
	2535	QPSK	21.67	21.53	21.69	20.61	20.55	20.51	20.56
		16QAM	21.00	20.88	21.03	19.68	19.60	19.56	19.66
	2560	QPSK	21.63	21.52	21.52	20.43	20.54	20.59	20.53
		16QAM	21.11	20.83	20.88	19.47	19.57	19.67	19.52
15	2507.5	QPSK	21.65	21.80	21.84	20.77	20.84	20.79	20.76
		16QAM	21.07	21.15	21.19	19.72	19.84	19.78	19.75
	2535	QPSK	21.57	21.53	21.64	20.54	20.46	20.60	20.49
		16QAM	20.84	20.84	21.05	19.60	19.57	19.62	19.53
	2562.5	QPSK	21.47	21.61	21.45	20.44	20.54	20.51	20.45
		16QAM	20.75	20.88	20.80	19.46	19.57	19.53	19.46
10	2505	QPSK	22.04	21.69	21.99	20.66	20.48	20.61	20.73
		16QAM	21.11	20.93	21.23	19.68	19.54	19.59	19.70
	2535	QPSK	21.97	21.54	21.83	20.68	20.53	20.43	20.59
		16QAM	21.05	20.82	21.01	19.71	19.59	19.49	19.64
	2565	QPSK	21.94	21.50	21.88	20.51	20.57	20.53	20.56
		16QAM	21.05	20.68	21.00	19.49	19.55	19.53	19.56
5	2502.5	QPSK	21.68	21.78	21.53	20.53	20.51	20.51	20.49
		16QAM	20.88	20.90	20.66	19.59	19.59	19.56	19.57
	2535	QPSK	21.59	21.65	21.55	20.49	20.48	20.37	20.42
		16QAM	20.81	20.84	20.75	19.57	19.54	19.44	19.51
	2567.5	QPSK	21.56	21.58	21.40	20.43	20.42	20.37	20.40
		16QAM	20.73	20.74	20.63	19.46	19.50	19.42	19.43

Note 1: The conducted output power was measured using the Anritsu MT8820C

7.2 OCCUPIED BANDWIDTH

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

7.3 PEAK TO AVERAGE RATIO

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

7.4 BAND EDEG EMISSIONS (Conducted)

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

7.5 SPURIOUS AND HARMONICS EMISSIONS (Conducted)

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

7.6 ERP & EIRP

7.6.1 LTE Band 7

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)	Limit (W)
20	2510	QPSK	1/0	V	14.48	5.84	20.32	0.108	2.000
		16QAM	1/0	V	12.78	5.84	18.62	0.073	2.000
	2535	QPSK	1/99	V	13.90	5.89	19.79	0.095	2.000
		16QAM	1/99	V	13.34	5.89	19.23	0.084	2.000
	2560	QPSK	1/0	V	13.90	5.93	19.83	0.096	2.000
		16QAM	1/0	V	13.22	5.93	19.15	0.082	2.000
15	2507.5	QPSK	1/74	V	14.21	5.84	20.05	0.101	2.000
		16QAM	1/74	V	12.94	5.84	18.78	0.076	2.000
	2535	QPSK	1/74	V	14.63	5.89	20.52	0.113	2.000
		16QAM	1/74	V	13.79	5.89	19.68	0.093	2.000
	2562.5	QPSK	1/36	V	14.21	5.94	20.15	0.104	2.000
		16QAM	1/36	V	13.50	5.94	19.44	0.088	2.000
10	2505	QPSK	1/0	V	14.36	5.83	20.19	0.104	2.000
		16QAM	1/0	V	12.92	5.83	18.75	0.075	2.000
	2535	QPSK	1/0	V	14.88	5.89	20.77	0.119	2.000
		16QAM	1/0	V	13.82	5.89	19.71	0.094	2.000
	2565	QPSK	1/0	V	15.08	5.94	21.02	0.126	2.000
		16QAM	1/0	V	13.82	5.94	19.76	0.095	2.000
5	2502.5	QPSK	1/12	V	14.22	5.83	20.05	0.101	2.000
		16QAM	1/12	V	13.02	5.83	18.85	0.077	2.000
	2535	QPSK	1/12	V	14.74	5.89	20.63	0.116	2.000
		16QAM	1/12	V	13.92	5.89	19.81	0.096	2.000
	2567.5	QPSK	1/12	V	14.62	5.95	20.57	0.114	2.000
		16QAM	1/12	V	13.92	5.95	19.87	0.097	2.000

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

7.7 UNDESIRABLE EMISSIONS (Radiated)

7.7.1 LTE Band 7

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 (dBm)	Limit (dBm)
20	2510	1/0	QPSK	5002.20	H	-37.47	9.45	-28.02	-25
				7503.37	V	-43.30	11.43	-31.87	
			16QAM	5002.20	H	-38.45	9.45	-29.00	-25
				7503.19	V	-43.35	11.43	-31.92	
	2535	1/99	QPSK	5087.86	H	-38.27	9.41	-28.86	-25
				7631.67	V	-44.10	11.64	-32.46	
			16QAM	5087.86	H	-38.80	9.41	-29.39	-25
				7631.58	V	-44.32	11.64	-32.68	
	2560	1/0	QPSK	5102.22	H	-38.26	9.41	-28.85	-25
				7653.26	V	-46.27	11.68	-34.59	
			16QAM	5102.22	H	-38.57	9.41	-29.16	-25
				7653.15	V	-45.69	11.68	-34.01	
15	2507.5	1/74	QPSK	5028.28	H	-38.18	9.44	-28.74	-25
				7542.63	V	-43.59	11.49	-32.10	
			16QAM	5028.28	H	-38.77	9.44	-29.33	-25
				7542.51	V	-43.75	11.49	-32.26	
	2535	1/74	QPSK	5083.28	H	-38.29	9.42	-28.87	-25
				7624.96	V	-43.13	11.63	-31.50	
			16QAM	5083.28	H	-38.57	9.42	-29.15	-25
				7625.22	V	-43.49	11.63	-31.86	
	2562.5	1/36	QPSK	5124.56	H	-39.31	9.40	-29.91	-25
				7686.39	V	-44.61	11.74	-32.87	
			16QAM	5124.56	H	-39.95	9.40	-30.55	-25
				7686.79	V	-44.91	11.74	-33.17	

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

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 (dBm)	Limit (dBm)
10	2505	1/0	QPSK	5001.23	H	-39.06	9.45	-29.61	-25
				7501.79	V	-43.45	11.42	-32.03	
			16QAM	5001.23	H	-39.38	9.45	-29.93	-25
				7501.70	V	-42.51	11.42	-31.09	
	2535	1/0	QPSK	5061.33	H	-37.99	9.43	-28.56	-25
				7591.75	V	-44.05	11.58	-32.47	
			16QAM	5061.33	H	-38.92	9.43	-29.49	-25
				7591.77	V	-44.85	11.58	-33.27	
	2565	1/0	QPSK	5121.04	H	-39.38	9.40	-29.98	-25
				7681.81	V	-44.63	11.73	-32.90	
			16QAM	5121.20	H	-39.35	9.40	-29.95	-25
				7681.90	V	-45.55	11.73	-33.82	
5	2502.5	1/12	QPSK	5005.06	H	-37.94	9.45	-28.49	-25
				7507.43	V	-44.36	11.43	-32.93	
			16QAM	5005.06	H	-38.29	9.45	-28.84	-25
				7507.67	V	-44.99	11.43	-33.56	
	2535	1/12	QPSK	5070.06	H	-39.00	9.42	-29.58	-25
				7604.82	V	-43.70	11.60	-32.10	
			16QAM	5070.06	H	-40.19	9.42	-30.77	-25
				7604.93	V	-44.44	11.60	-32.84	
	2567.5	1/12	QPSK	5134.86	H	-39.02	9.40	-29.62	-25
				7702.45	V	-42.29	11.76	-30.53	
			16QAM	5134.86	H	-39.96	9.40	-30.56	-25
				7702.45	V	-42.54	11.76	-30.78	

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

7.8 FREQUENCY STABILITY

7.8.1 LTE Band 7

OPERATING FREQUENCY : 2535 MHz
REFERENCE VOLTAGE : 12 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%	12	+20(Ref)	2,535,000,005	5	0.0020	0.000000197
100%		-30	2,534,999,994	-6	-0.0024	-0.000000237
100%		-20	2,534,999,999	-1	-0.0004	-0.000000039
100%		-10	2,534,999,992	-8	-0.0032	-0.000000316
100%		0	2,535,000,003	3	0.0012	0.000000118
100%		+10	2,535,000,009	9	0.0036	0.000000355
100%		+20	2,535,000,005	5	0.0020	0.000000197
100%		+30	2,534,999,997	-3	-0.0012	-0.000000118
100%		+40	2,535,000,006	6	0.0024	0.000000237
100%		+50	2,535,000,002	2	0.0008	0.000000079
115%	13.80	+20	2,534,999,997	-3	-0.0012	-0.000000118
85%	10.20	+20	2,535,000,008	8	0.0032	0.000000316

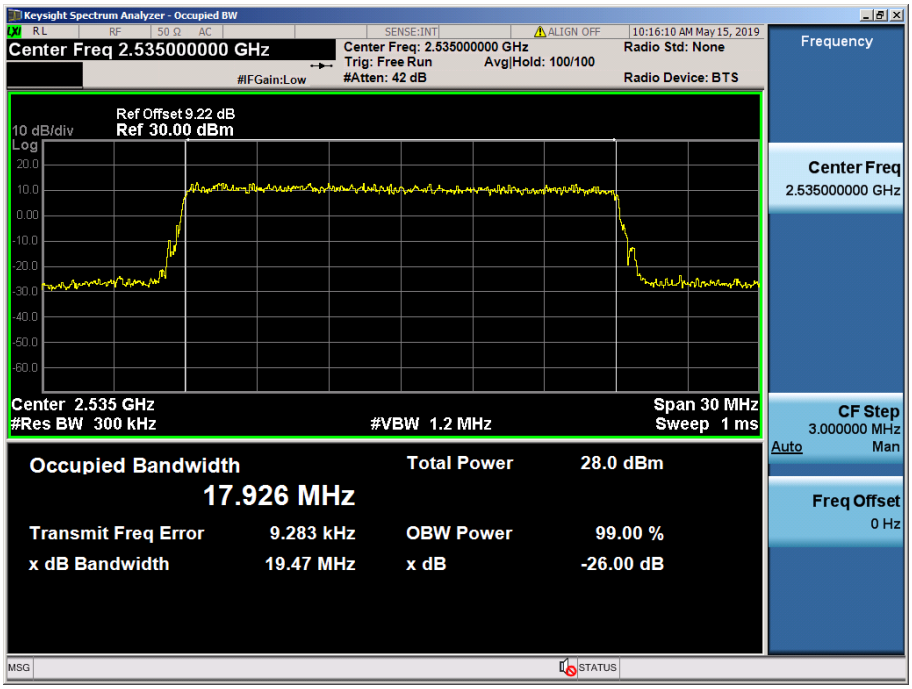
Note. Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain inband when the maximu m measured frequency deviation noted during the frequency stability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

8. TEST PLOTS

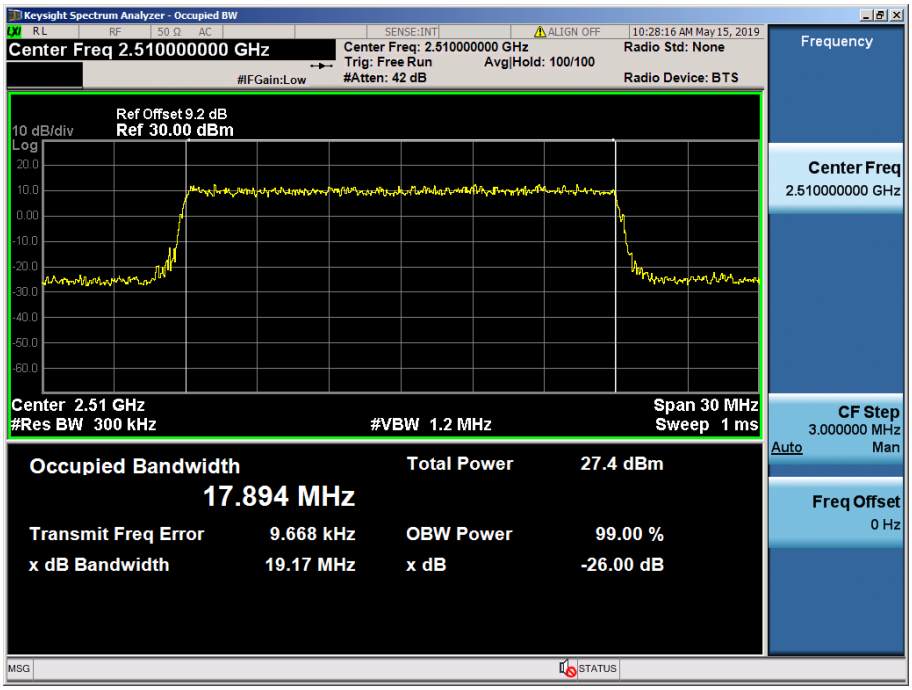
Note: All bandwidths, RB configurations, and modulations were investigated.
The worst case test results are reported.

8.1 OCCUPIED BANDWIDTH

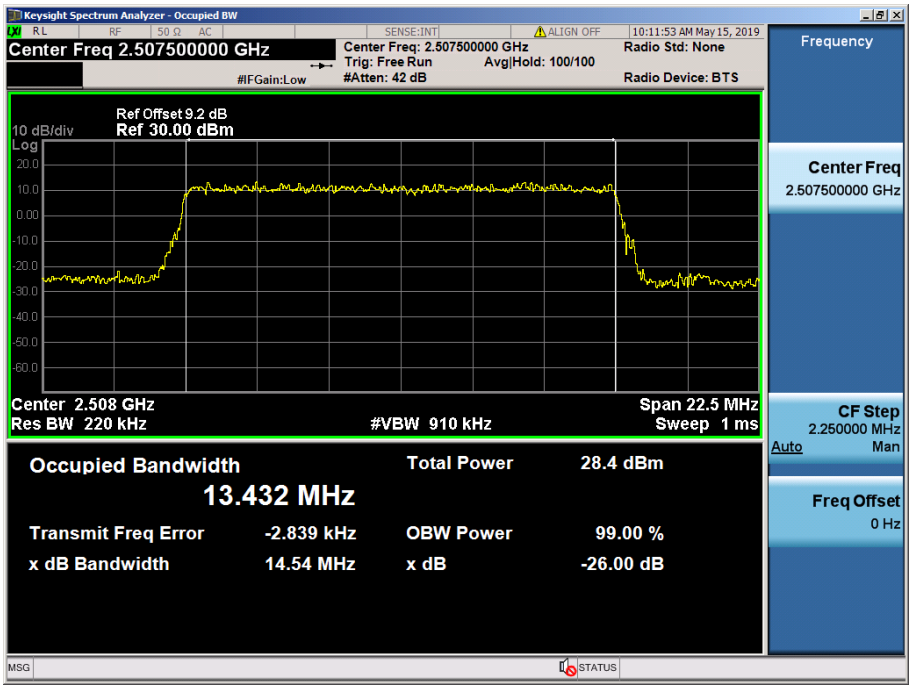
8.1.1 LTE Band 7



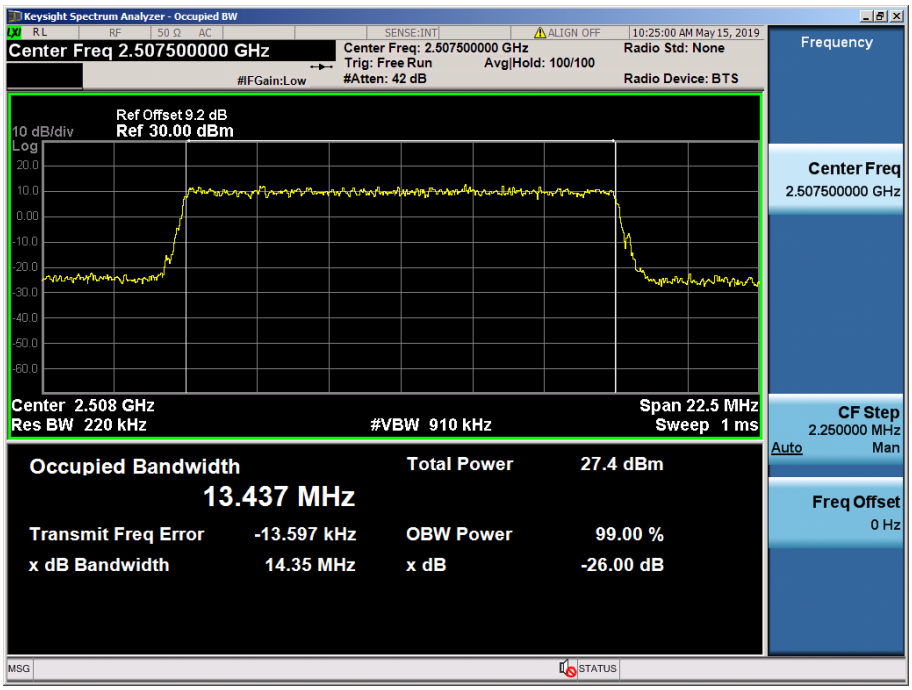
LTE Band 7 / 20 MHz / QPSK - RB Size 100



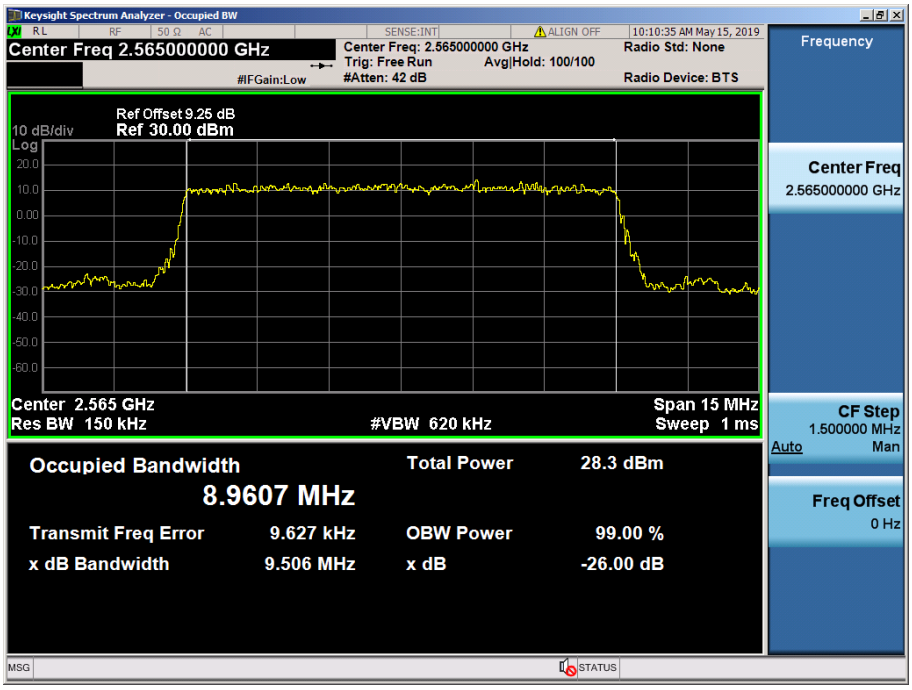
LTE Band 7 / 20 MHz / 16QAM - RB Size 100



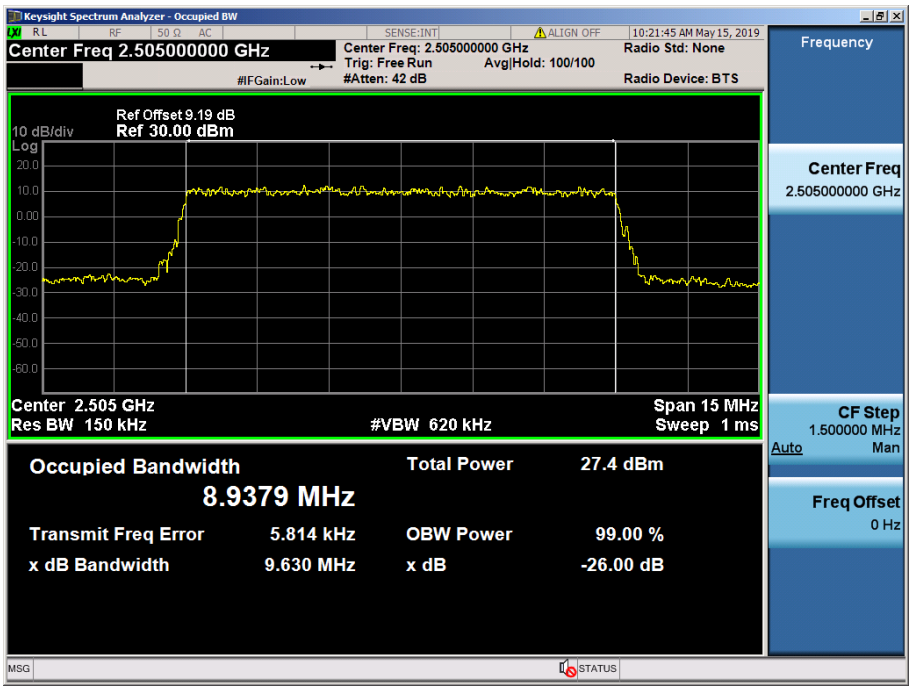
LTE Band 7 / 15 MHz / QPSK - RB Size 75



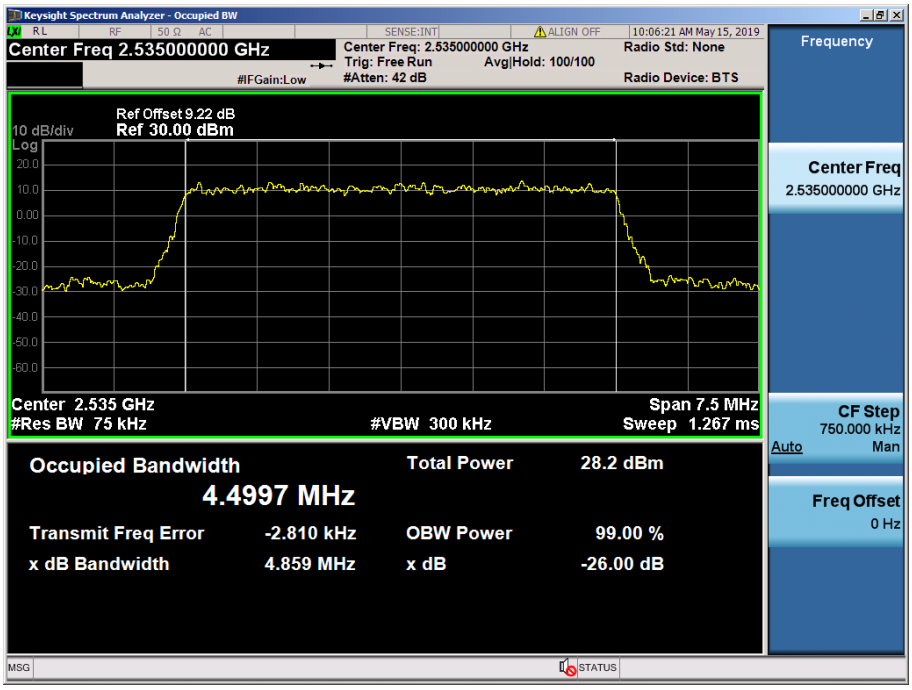
LTE Band 7 / 15 MHz / 16QAM - RB Size 75



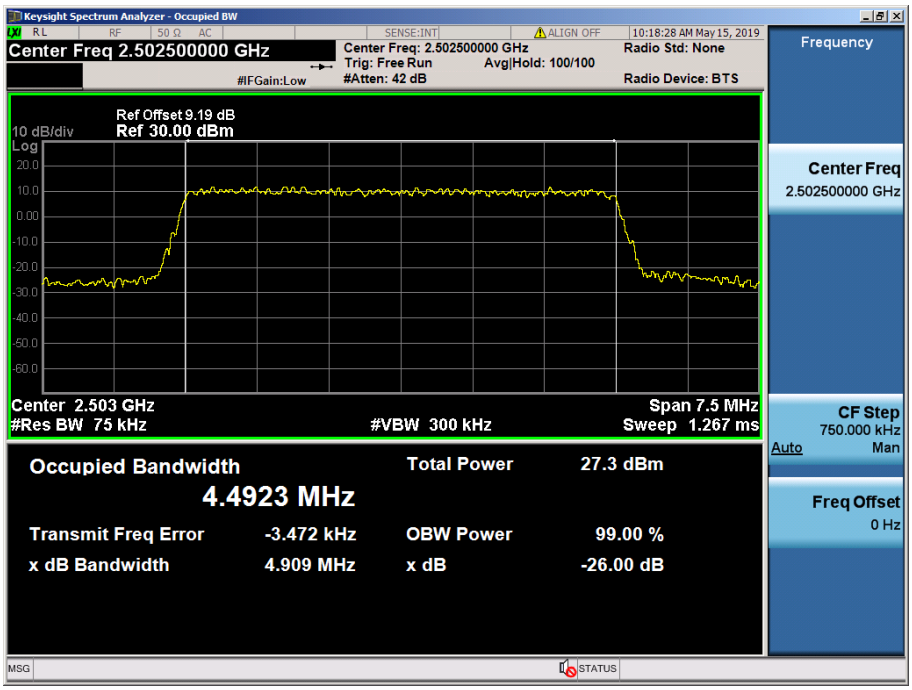
LTE Band 7 / 10 MHz / QPSK - RB Size 50



LTE Band 7 / 10 MHz / 16QAM - RB Size 50



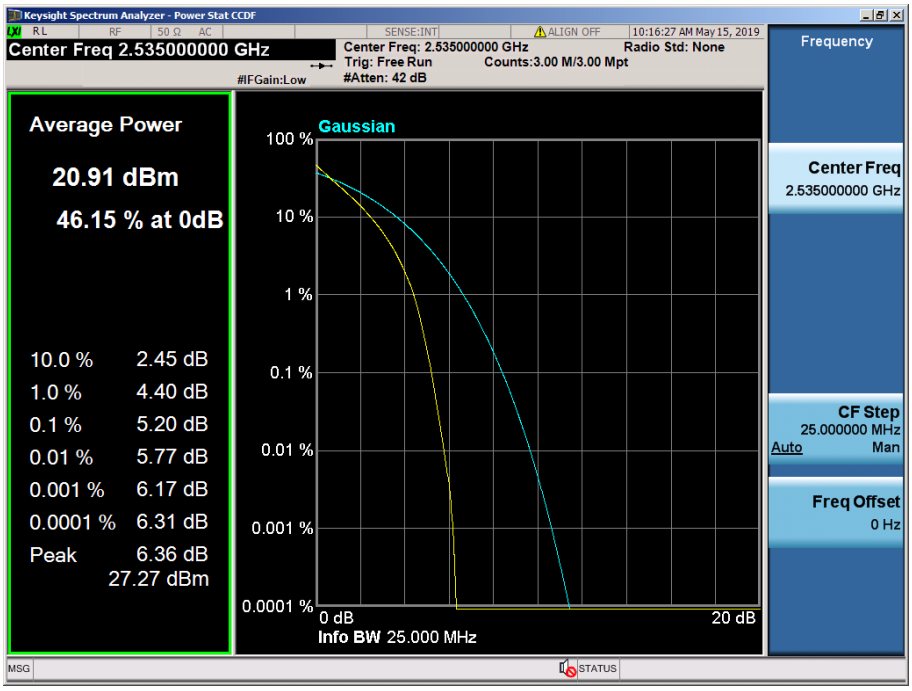
LTE Band 7 / 5 MHz / QPSK - RB Size 25



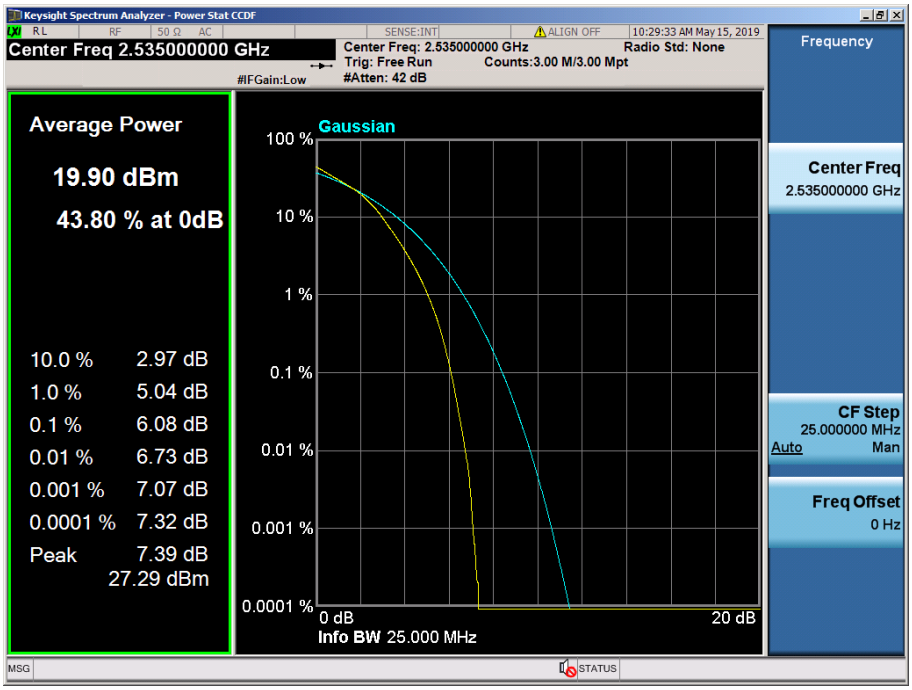
LTE Band 7 / 5 MHz / 16QAM - RB Size 25

8.2 PEAK TO AVERAGE RATIO

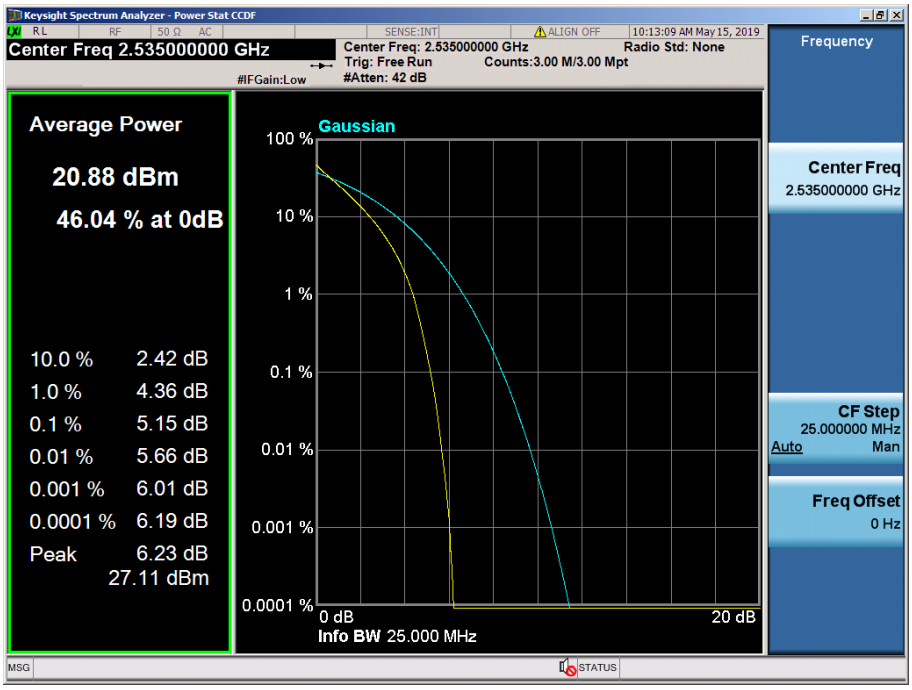
8.2.1 LTE Band 7



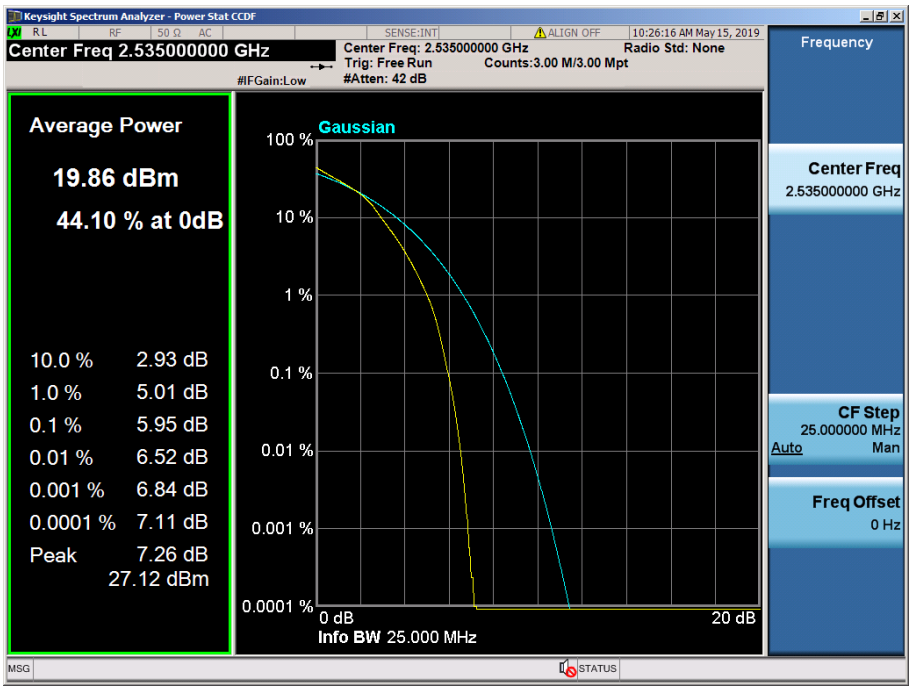
LTE Band 7 / 20 MHz / QPSK - RB Size 100



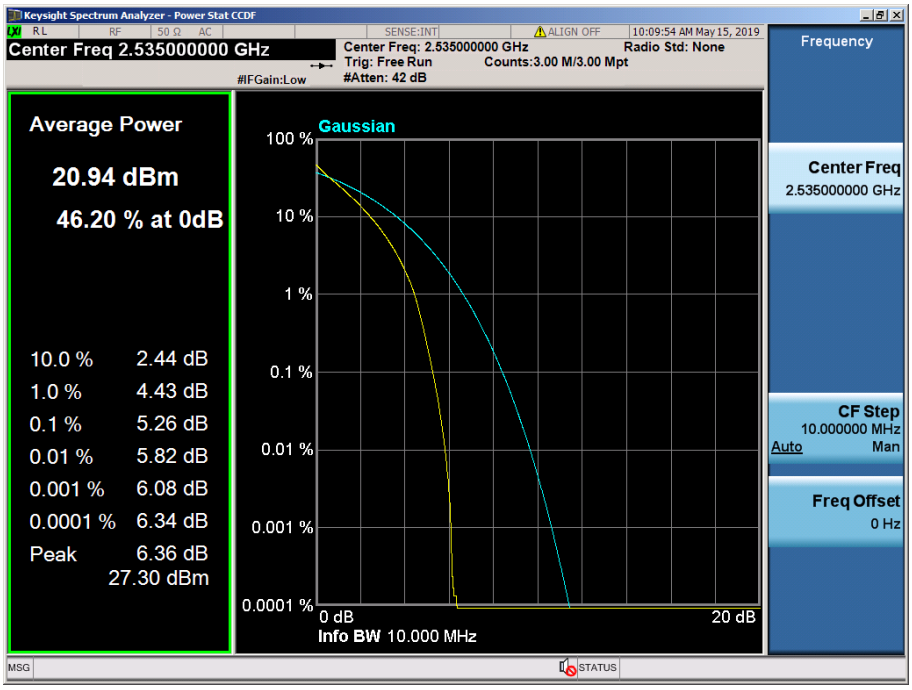
LTE Band 7 / 20 MHz / 16QAM - RB Size 100



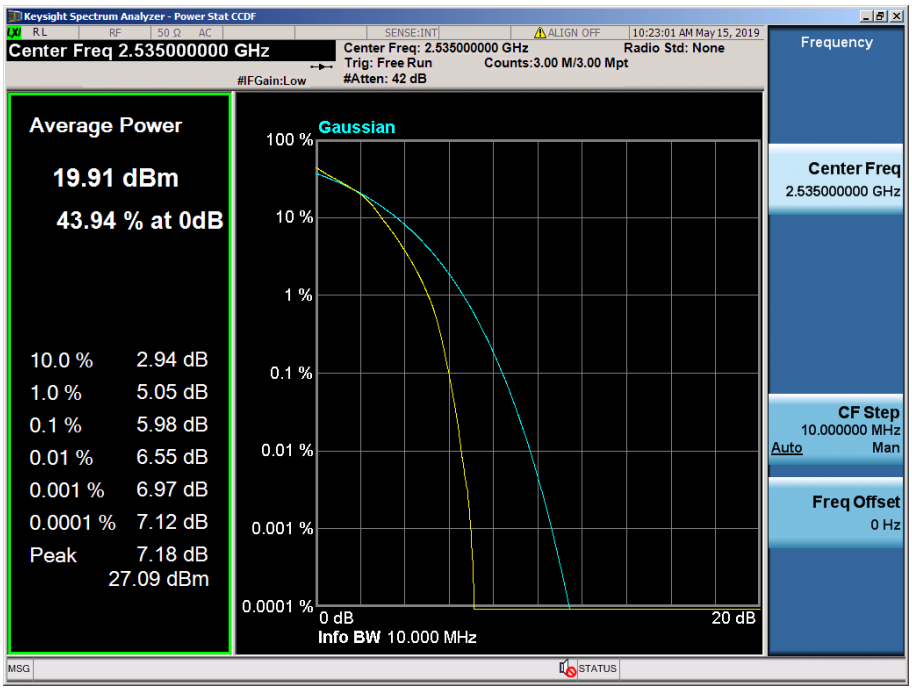
LTE Band 7 / 15 MHz / QPSK - RB Size 75



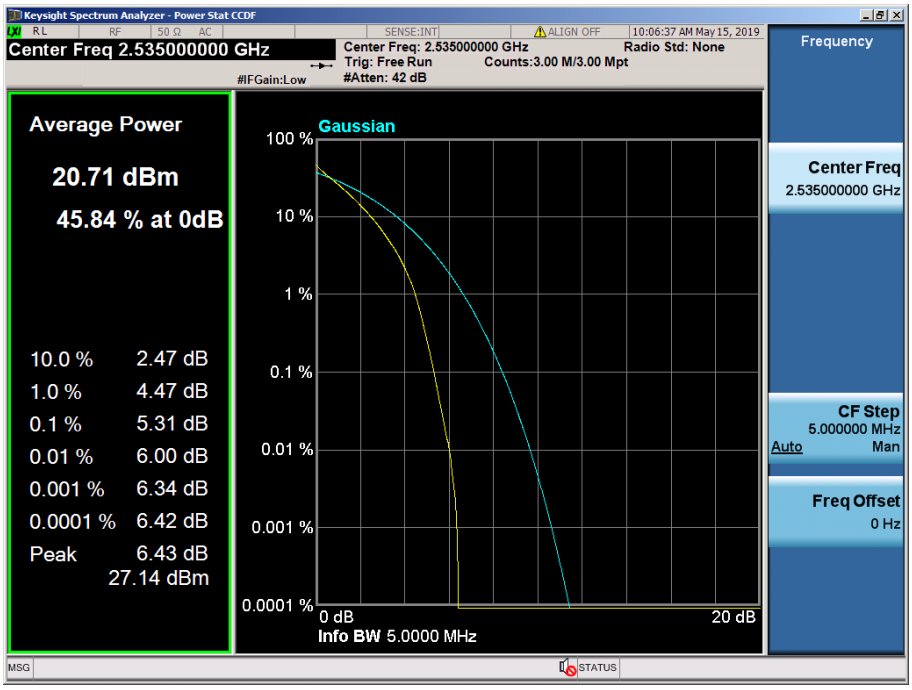
LTE Band 7 / 15 MHz / 16QAM - RB Size 75



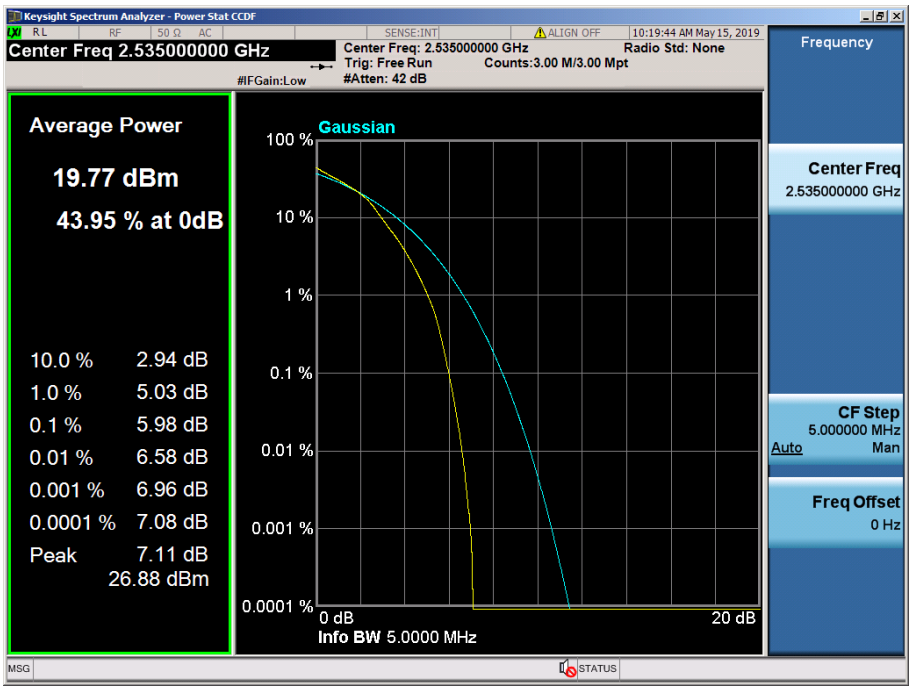
LTE Band 7 / 10 MHz / QPSK - RB Size 50



LTE Band 7 / 10 MHz / 16QAM - RB Size 50



LTE Band 7 / 5 MHz / QPSK - RB Size 25

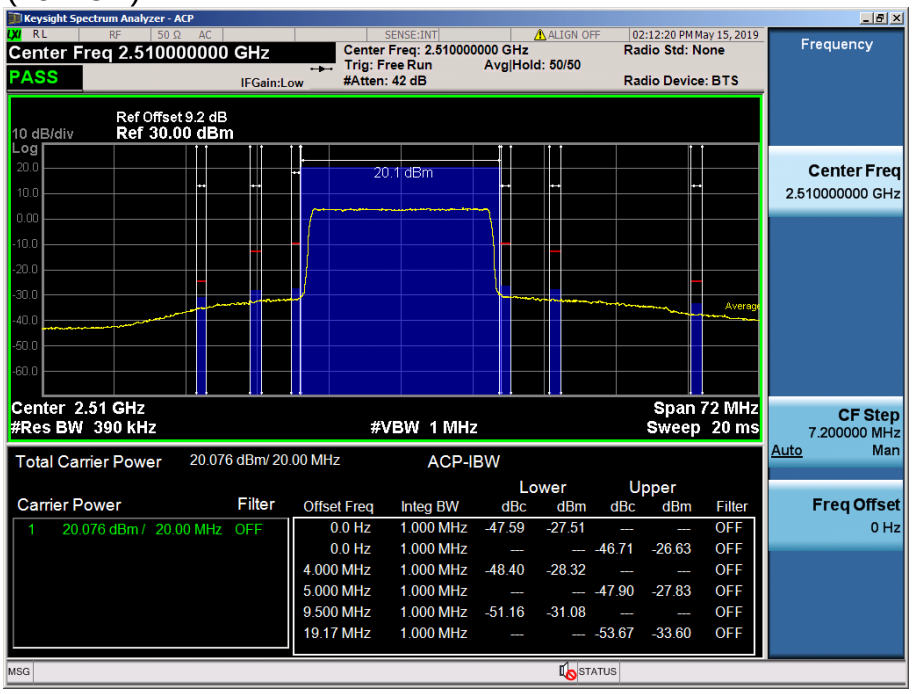


LTE Band 7 / 5 MHz / 16QAM - RB Size 25

8.3 BAND EDGE EMISSIONS(Conducted)

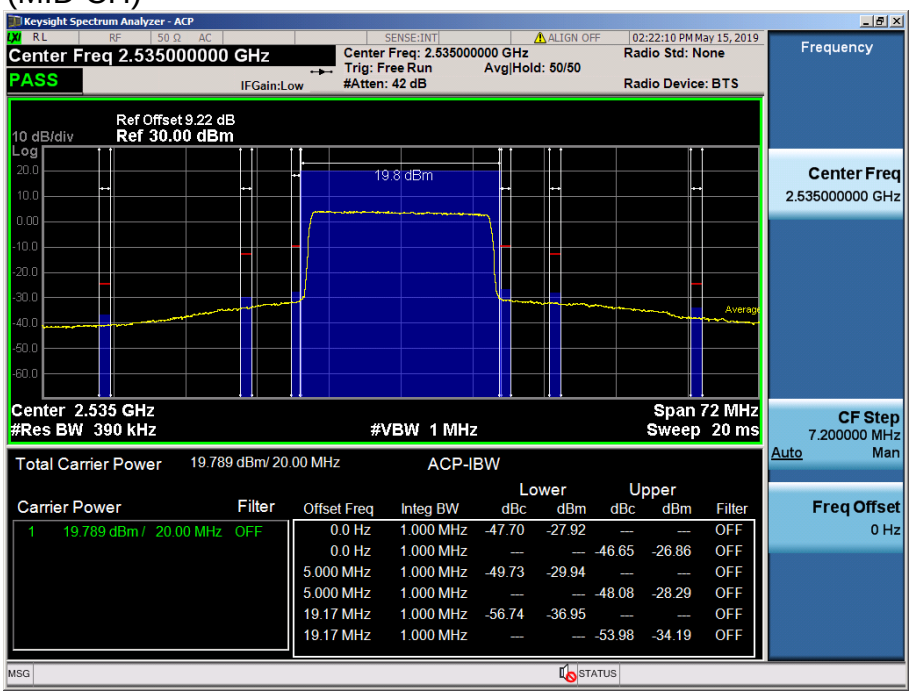
8.3.1 LTE Band 7

- Band Edge (Low CH)



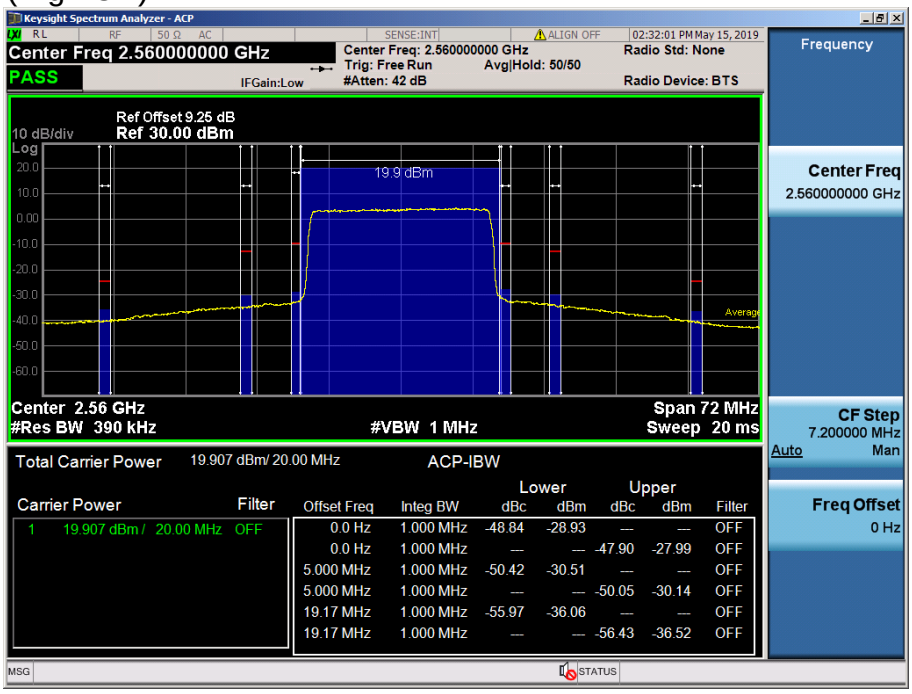
LTE Band 7 / 20MHz / 16QAM - RB Size/Offset (100/0)

- Band Edge (MID CH)



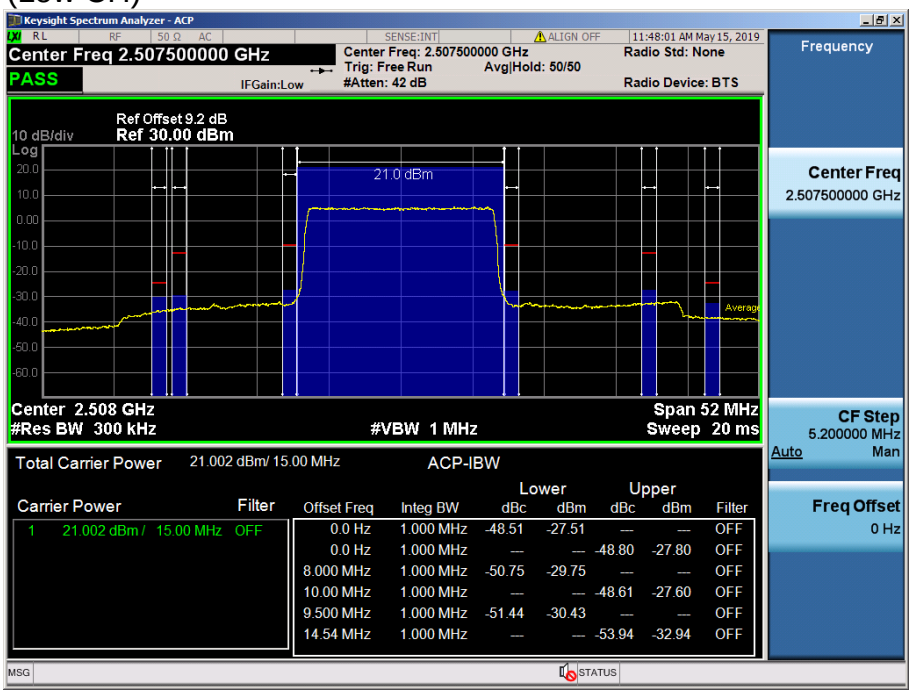
LTE Band 7 / 20MHz / 16QAM - RB Size/Offset (100/0)

- Band Edge (High CH)



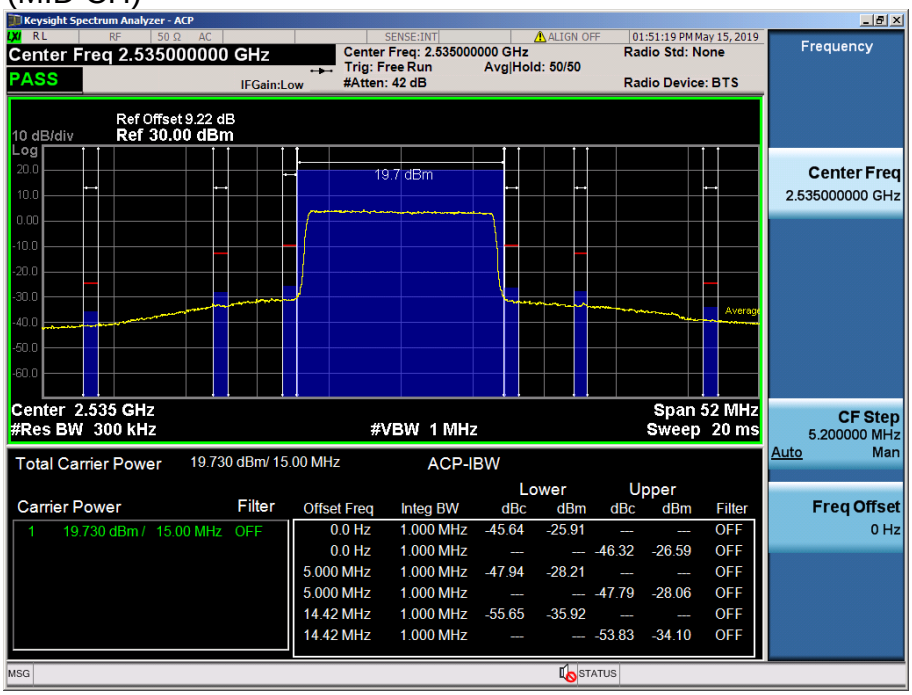
LTE Band 7 / 20MHz / 16QAM - RB Size/Offset (100/0)

- Band Edge (Low CH)



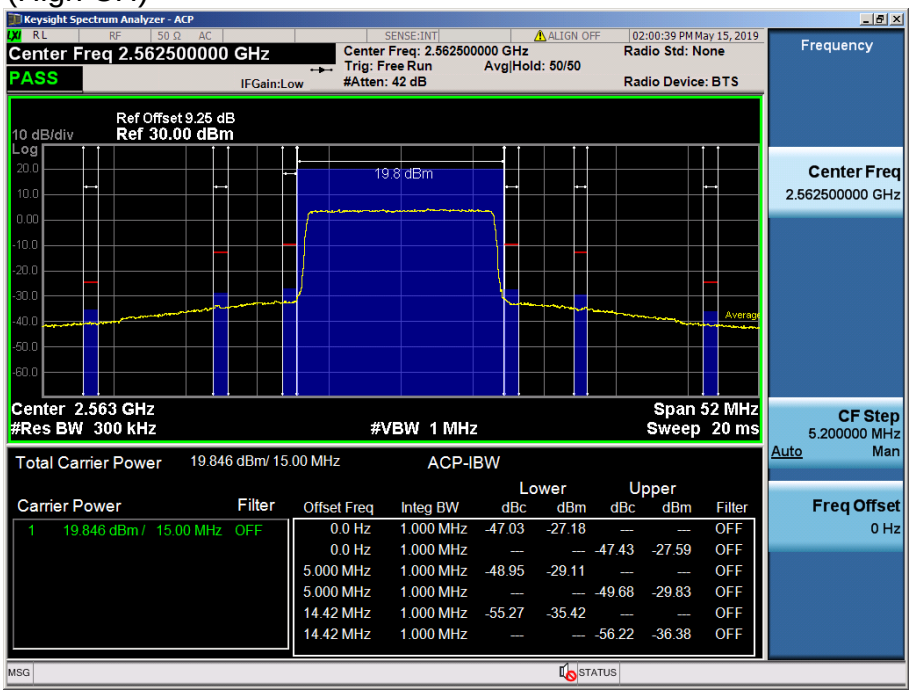
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (75/0)

- Band Edge (MID CH)



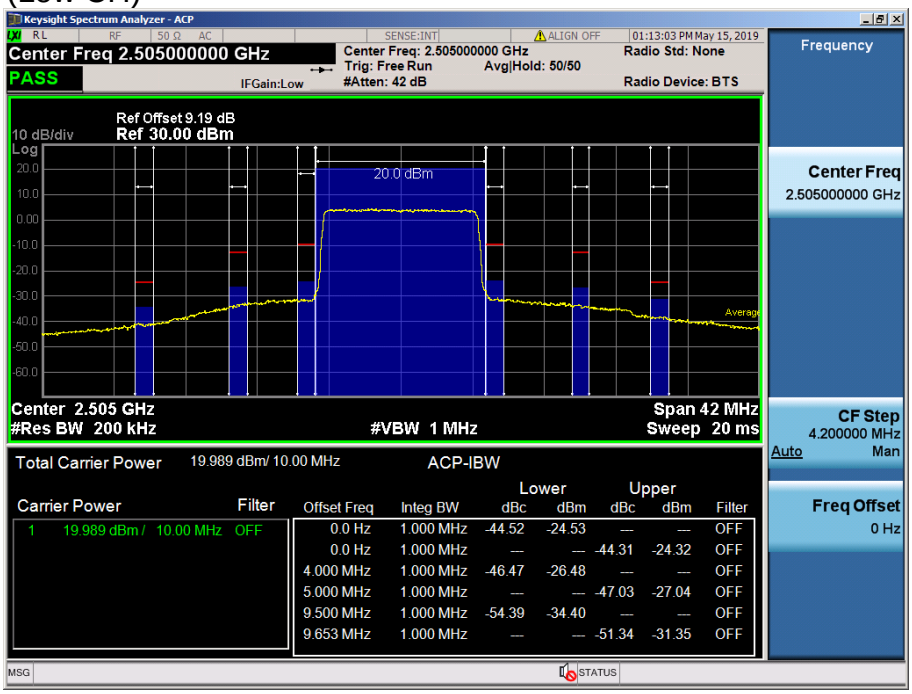
LTE Band 7 / 15MHz / 16QAM - RB Size/Offset (75/0)

- Band Edge (High CH)



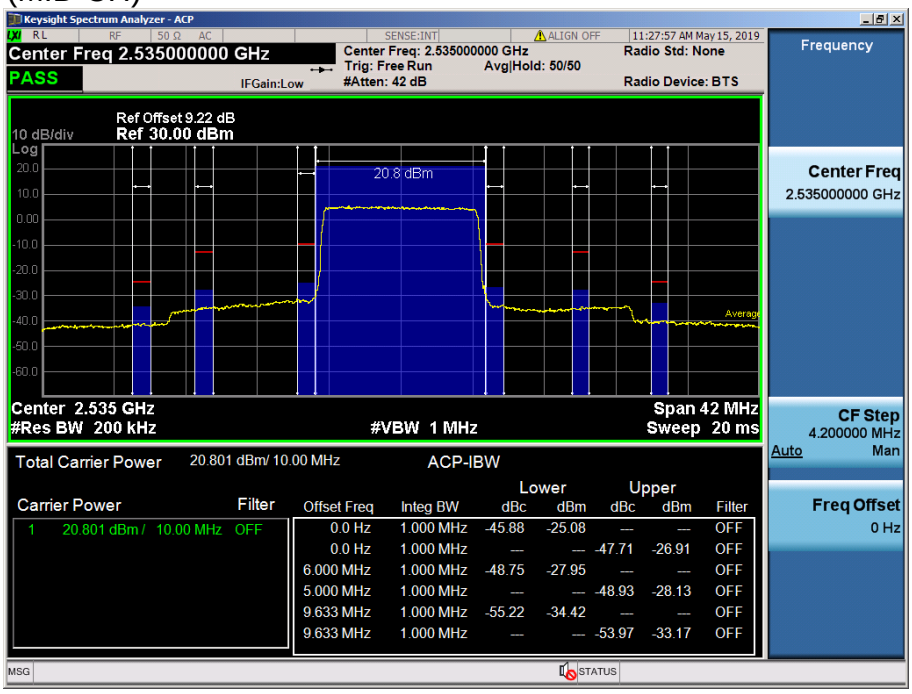
LTE Band 7 / 15MHz / 16QAM - RB Size/Offset (75/0)

- Band Edge (Low CH)



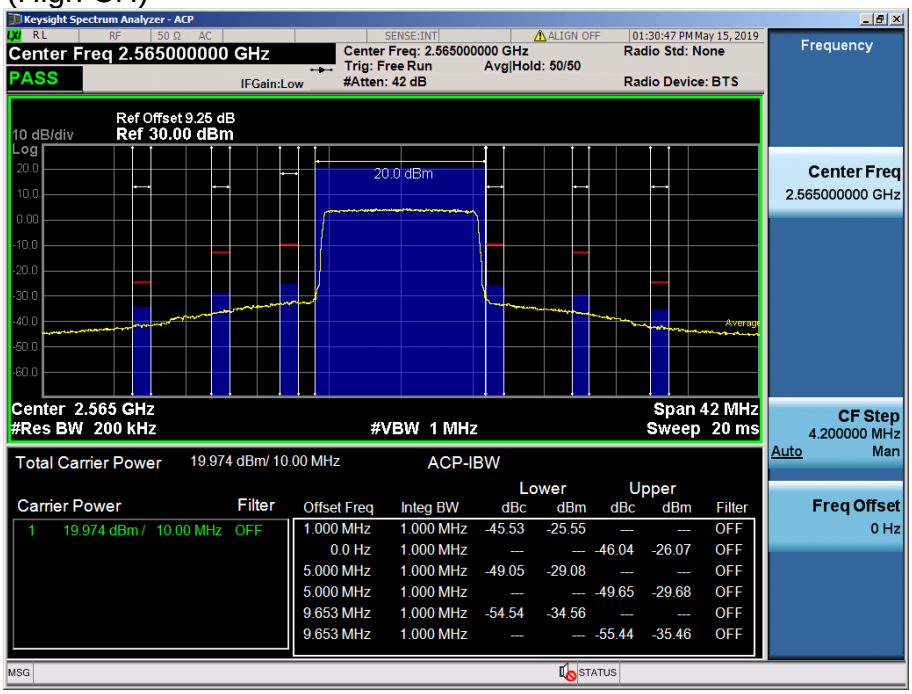
LTE Band 7 / 10MHz / 16QAM - RB Size/Offset (50/0)

- Band Edge (MID CH)



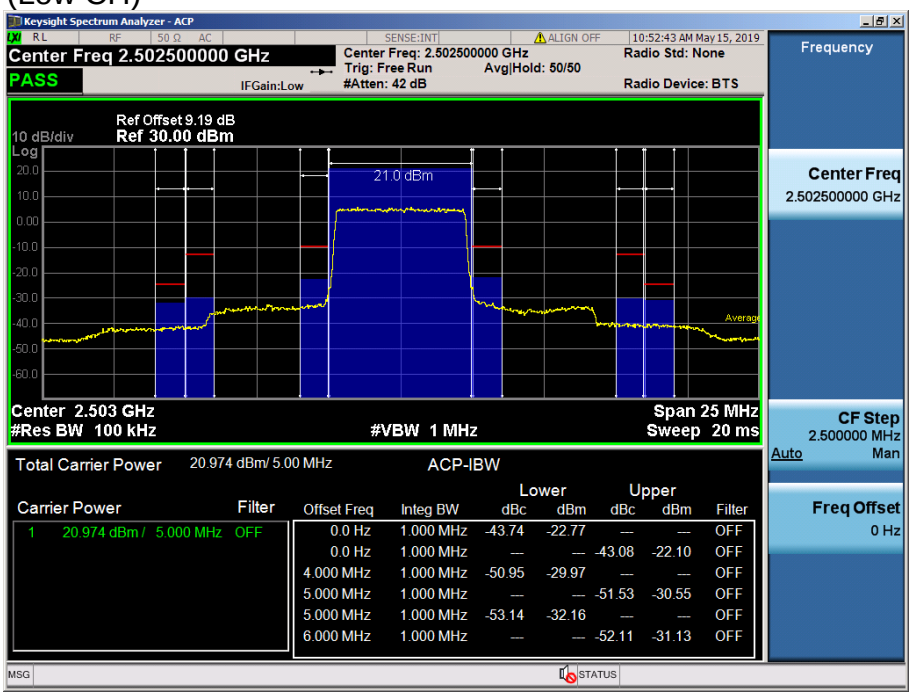
LTE Band 7 / 10MHz / QPSK - RB Size/Offset (50/0)

- Band Edge (High CH)



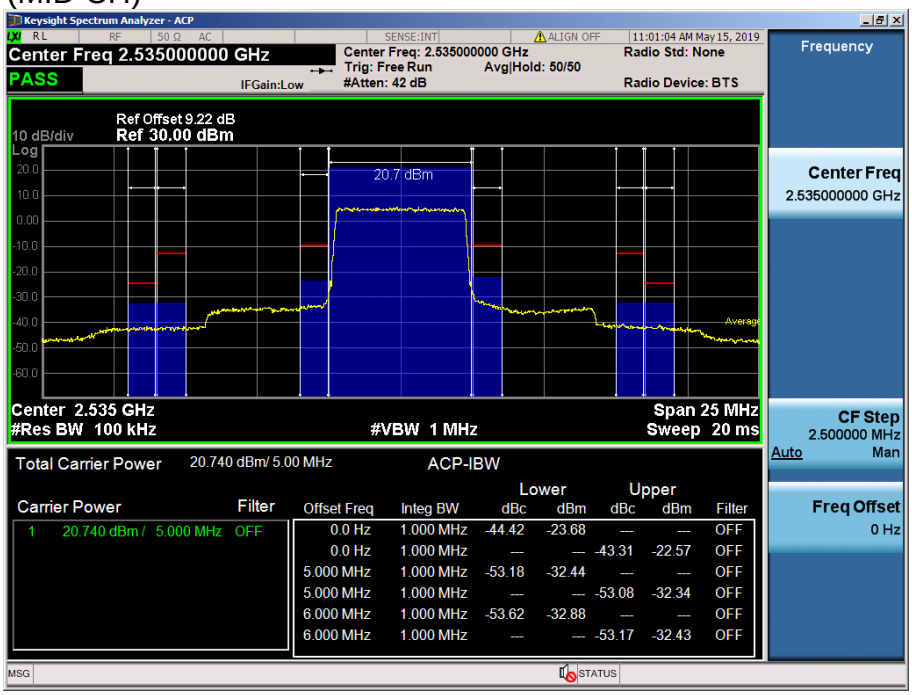
LTE Band 7 / 10MHz / 16QAM - RB Size/Offset (50/0)

- Band Edge (Low CH)



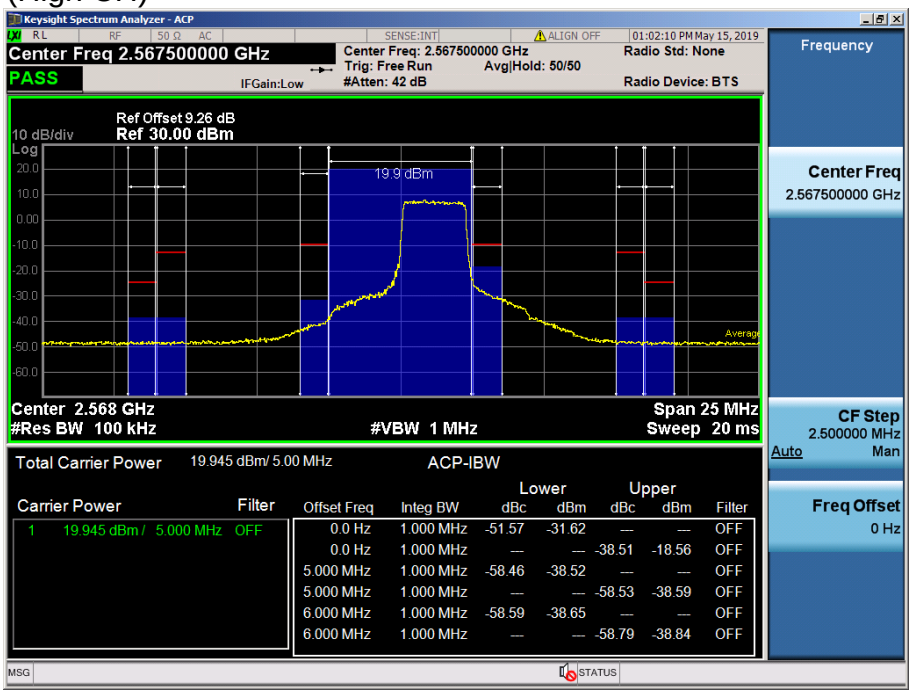
LTE Band 7 / 5MHz / QPSK - RB Size/Offset (25/0)

- Band Edge (MID CH)



LTE Band 7 / 5MHz / QPSK - RB Size/Offset (25/0)

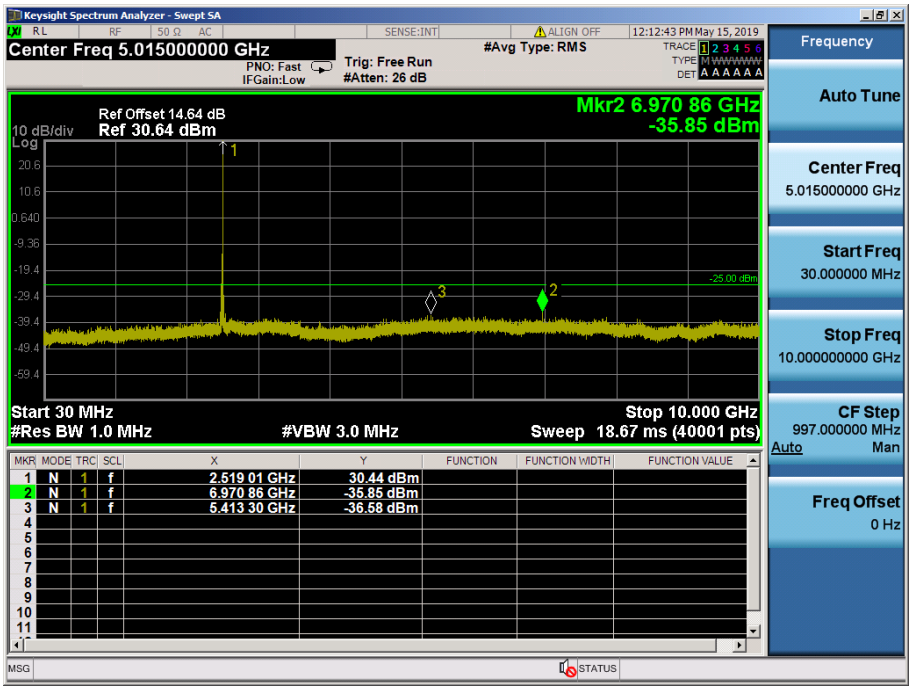
- Band Edge (High CH)



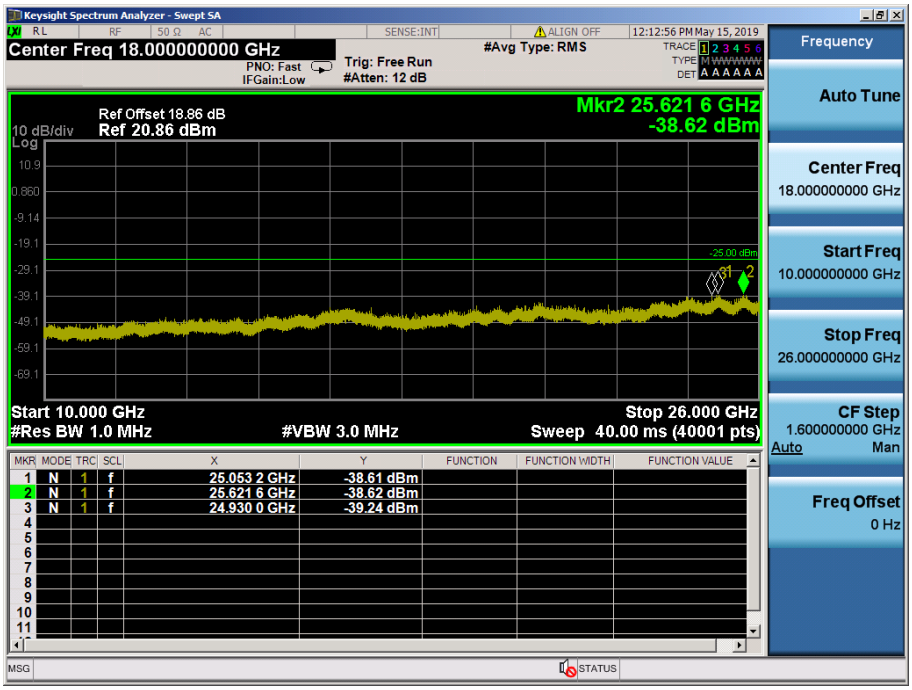
LTE Band 7 / 5MHz / 16QAM - RB Size/Offset (12/13)

8.4 SPURIOUS AND HARMONICS EMISSIONS(Conducted)

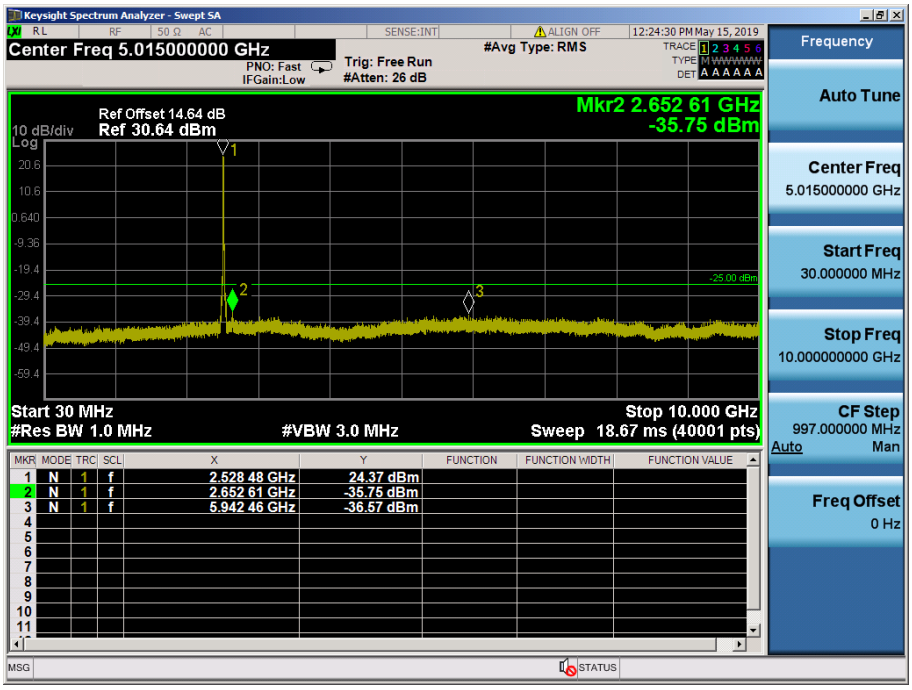
8.4.1 LTE Band 7



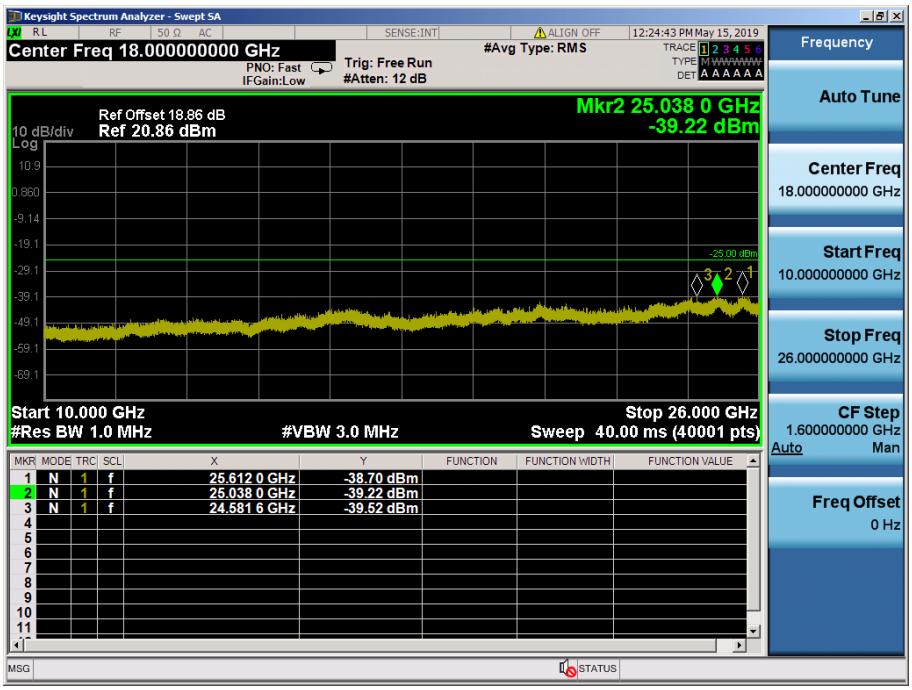
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (1/99) – Low Channel



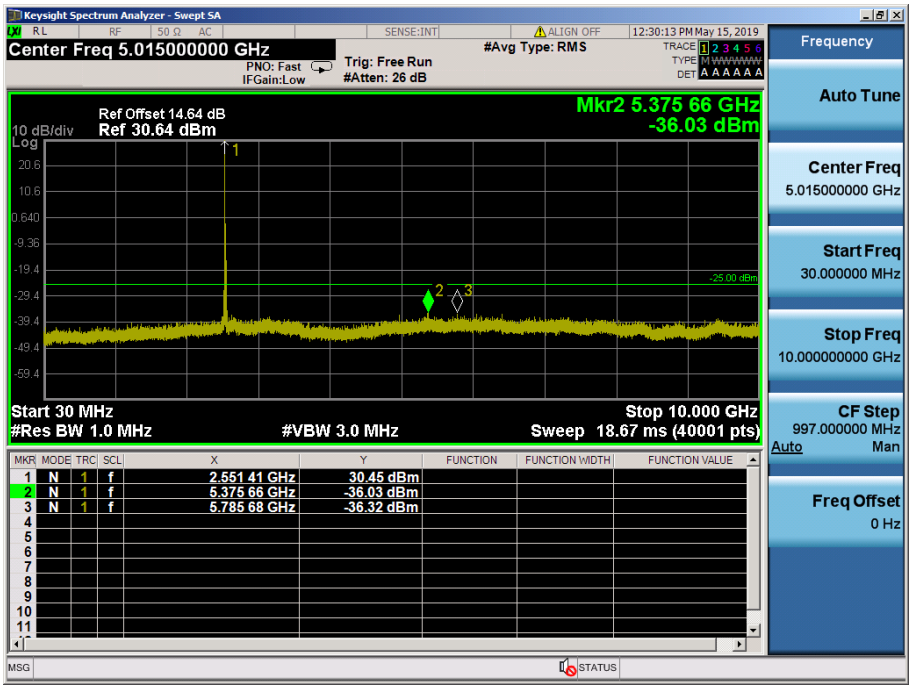
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (1/99) – Low Channel



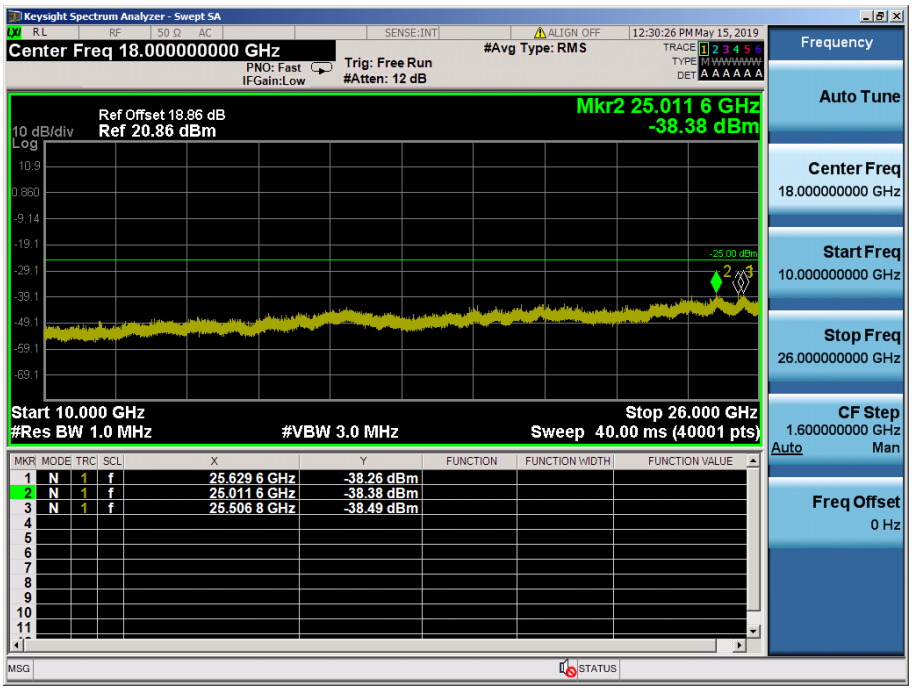
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (50/0) – Mid Channel



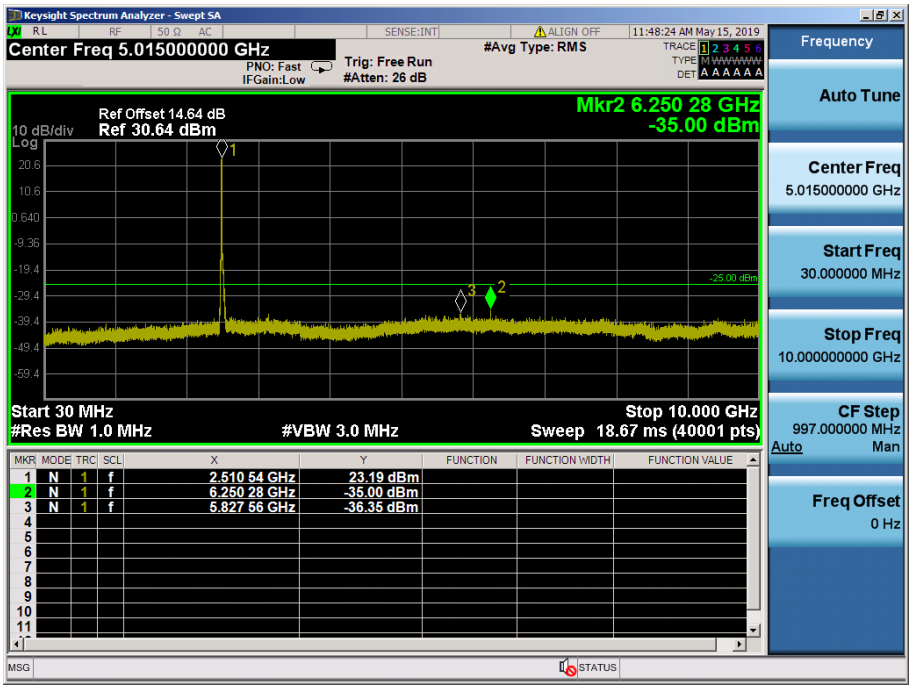
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (50/0) – Mid Channel



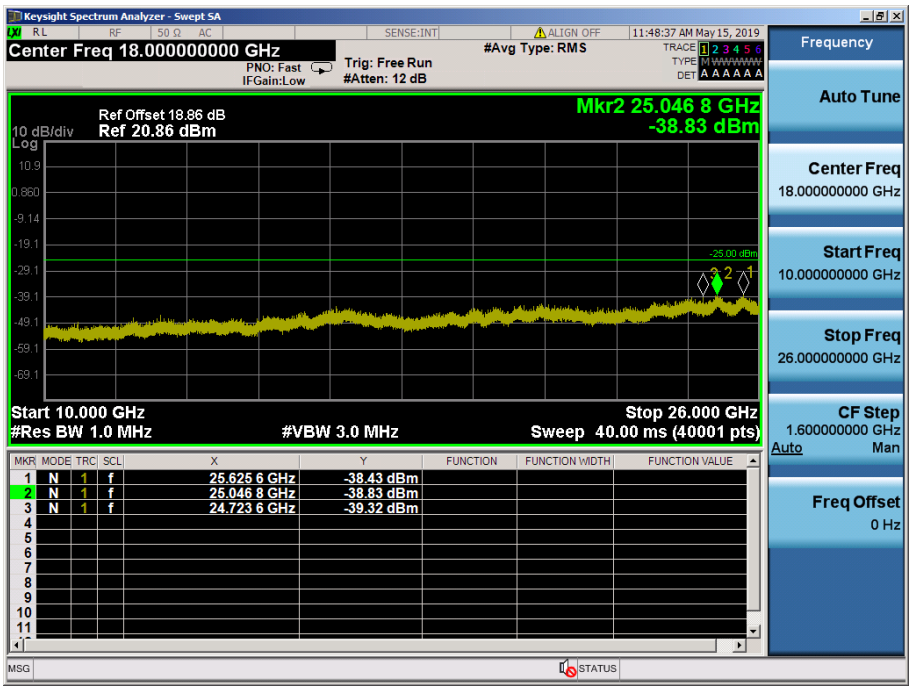
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (1/0) – High Channel



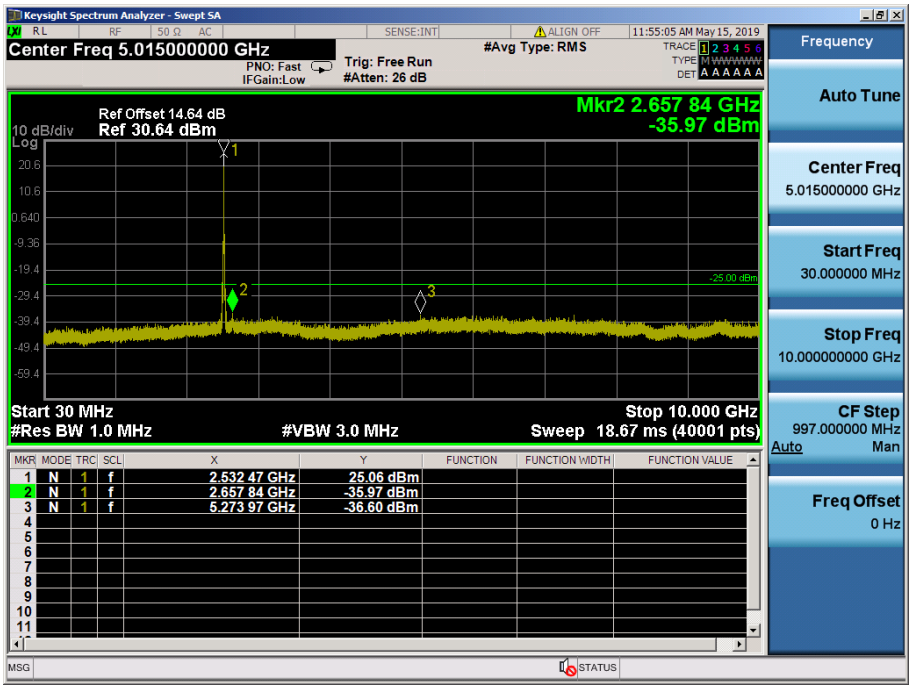
LTE Band 7 / 20MHz / QPSK - RB Size/Offset (1/0) – High Channel



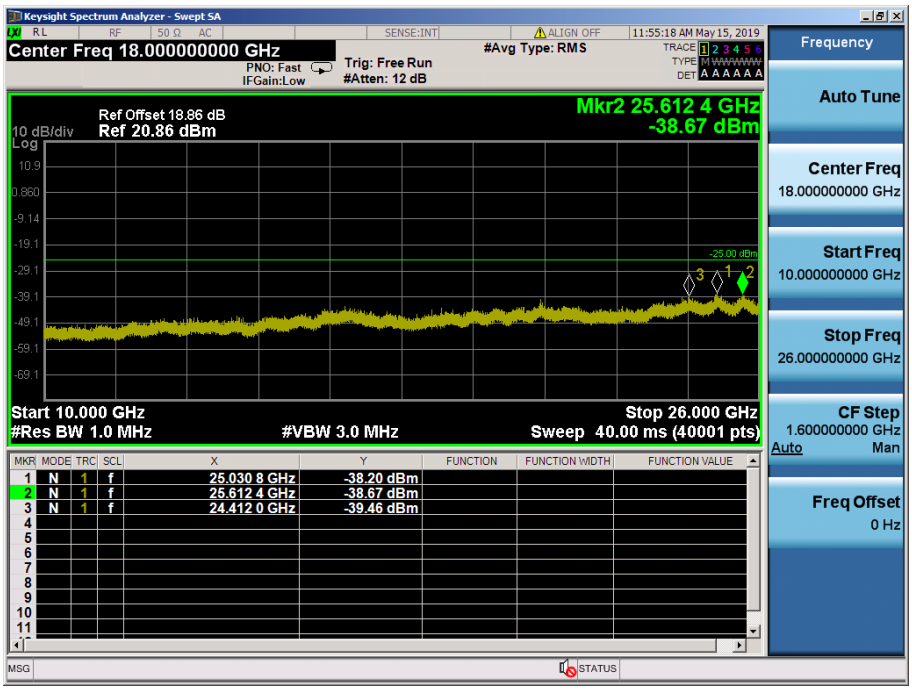
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (75/0) – Low Channel



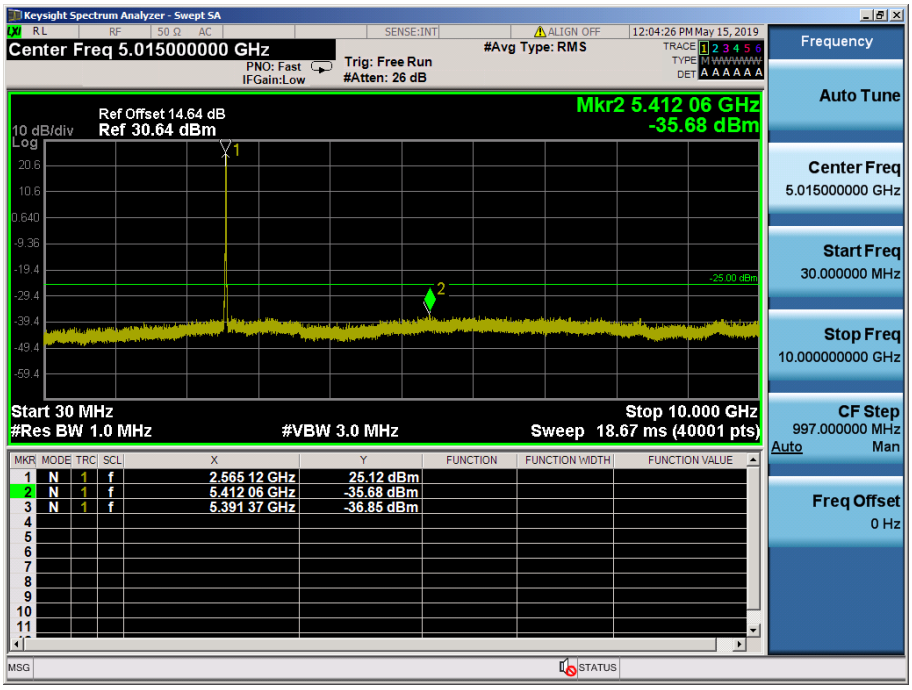
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (75/0) – Low Channel



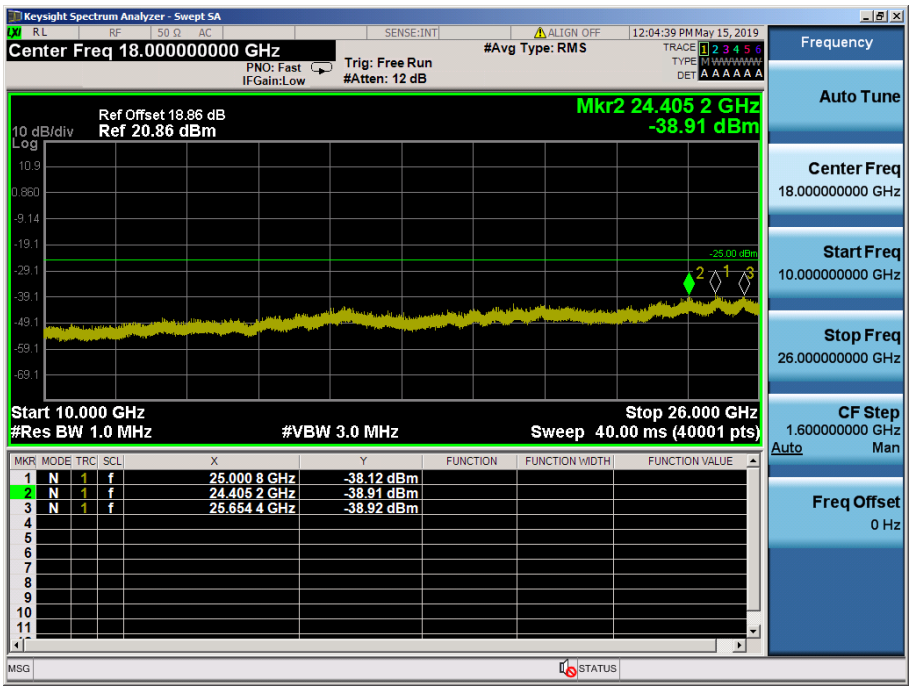
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (36/18) – Mid Channel



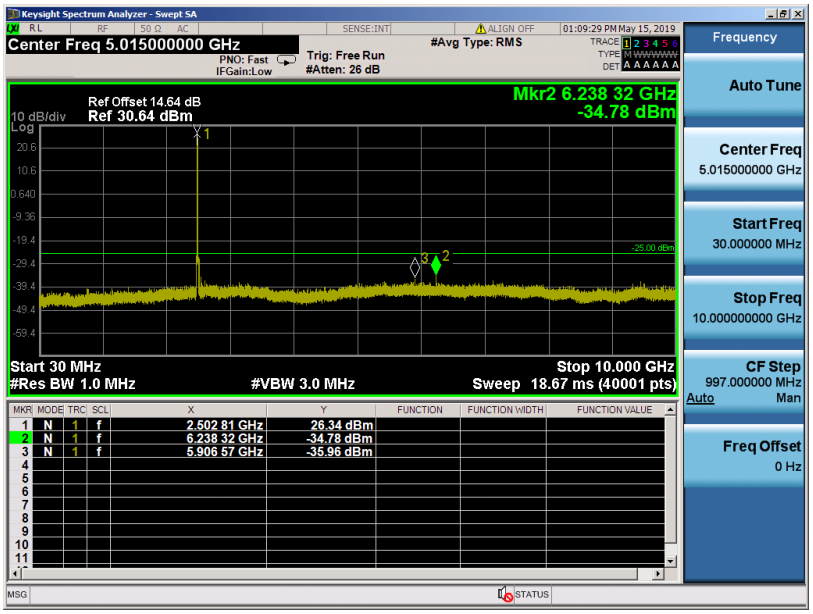
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (36/18) – Mid Channel



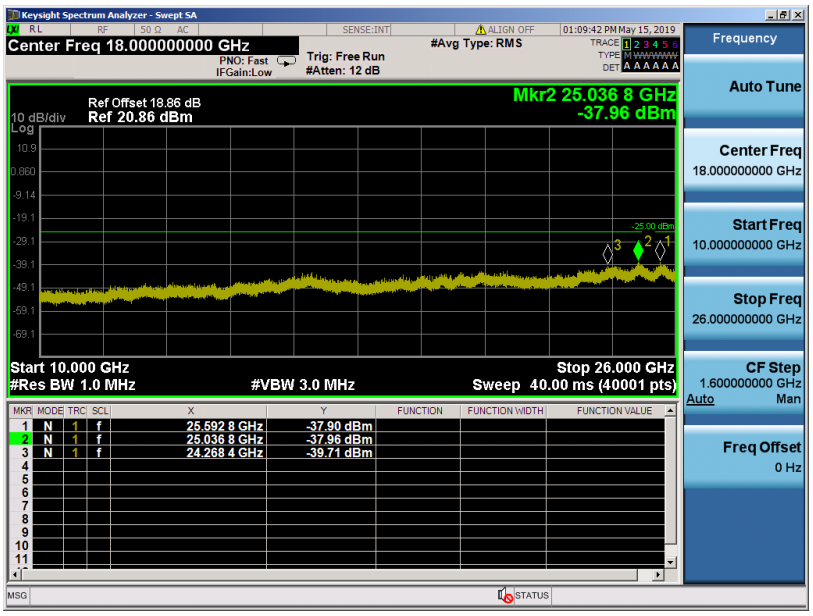
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (36/18) – High Channel



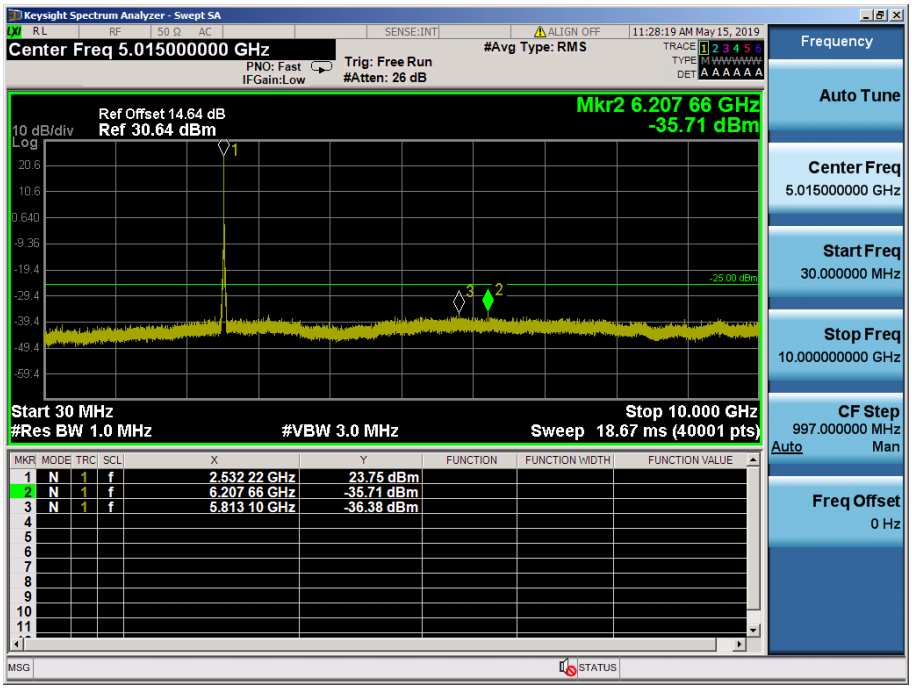
LTE Band 7 / 15MHz / QPSK - RB Size/Offset (36/18) – High Channel



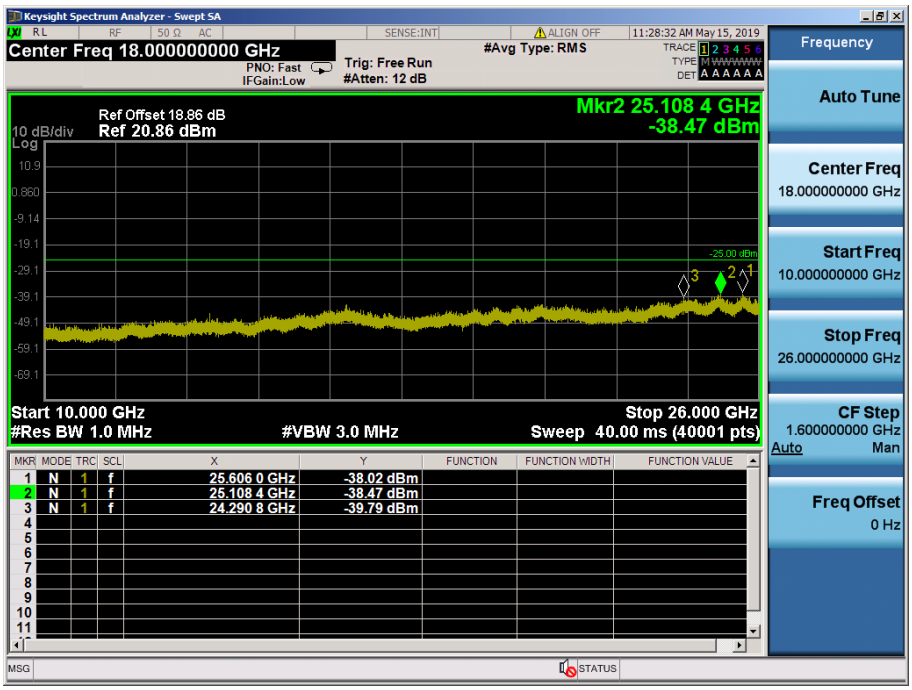
LTE Band 7 / 10MHz / 16QAM - RB Size/Offset (25/0) – Low Channel



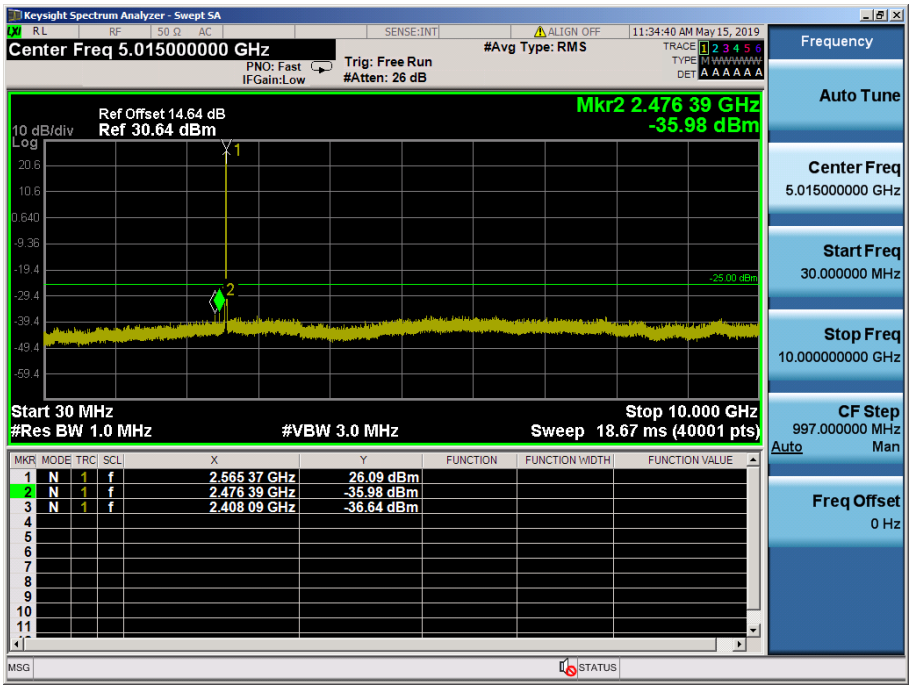
LTE Band 7 / 10MHz / 16QAM - RB Size/Offset (25/0) – Low Channel



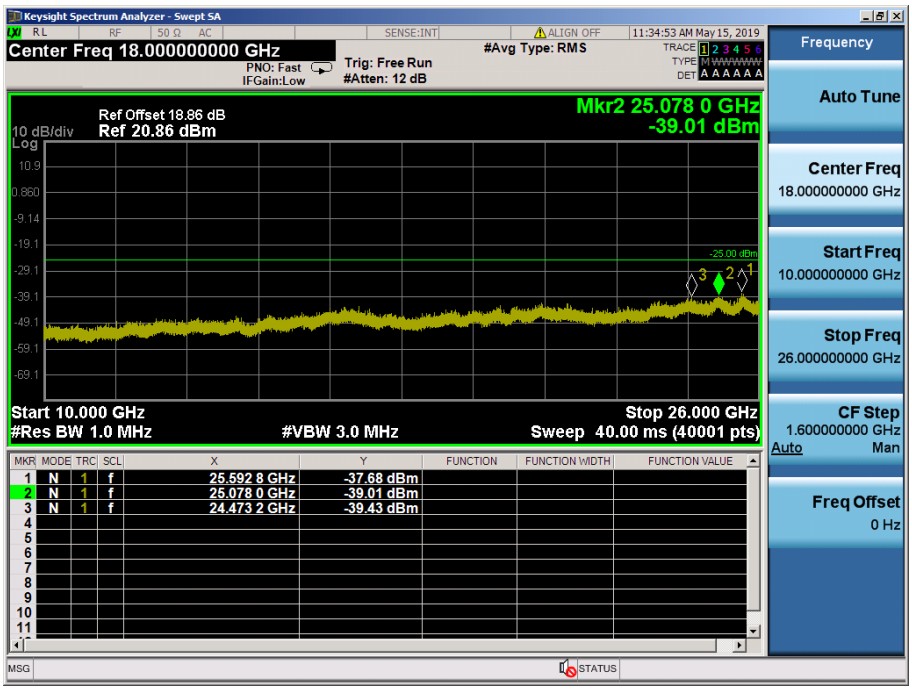
LTE Band 7 / 10MHz / QPSK - RB Size/Offset (50/0) – Mid Channel



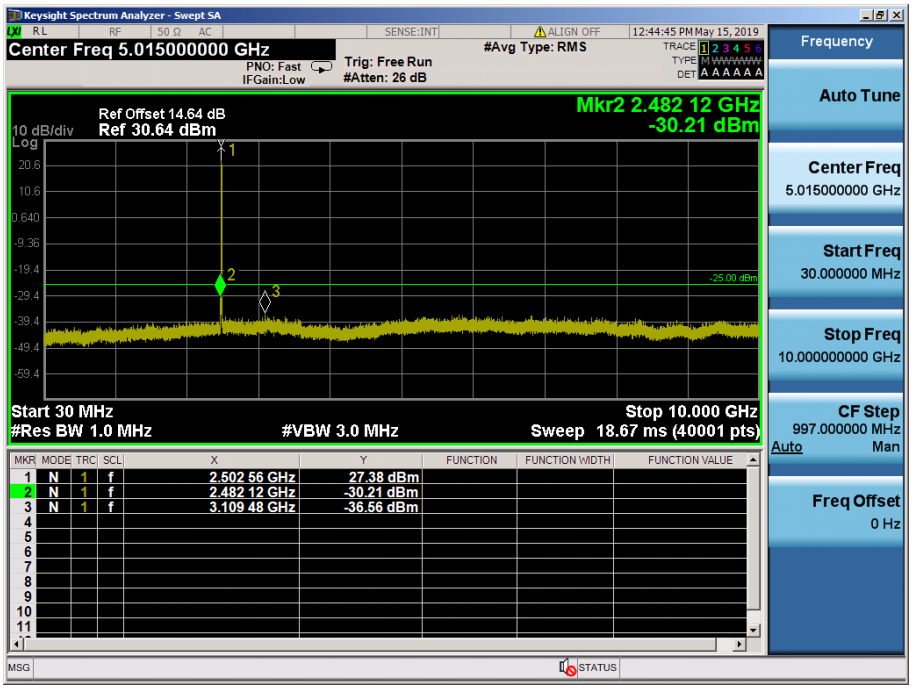
LTE Band 7 / 10MHz / QPSK - RB Size/Offset (25/25) – Mid Channel



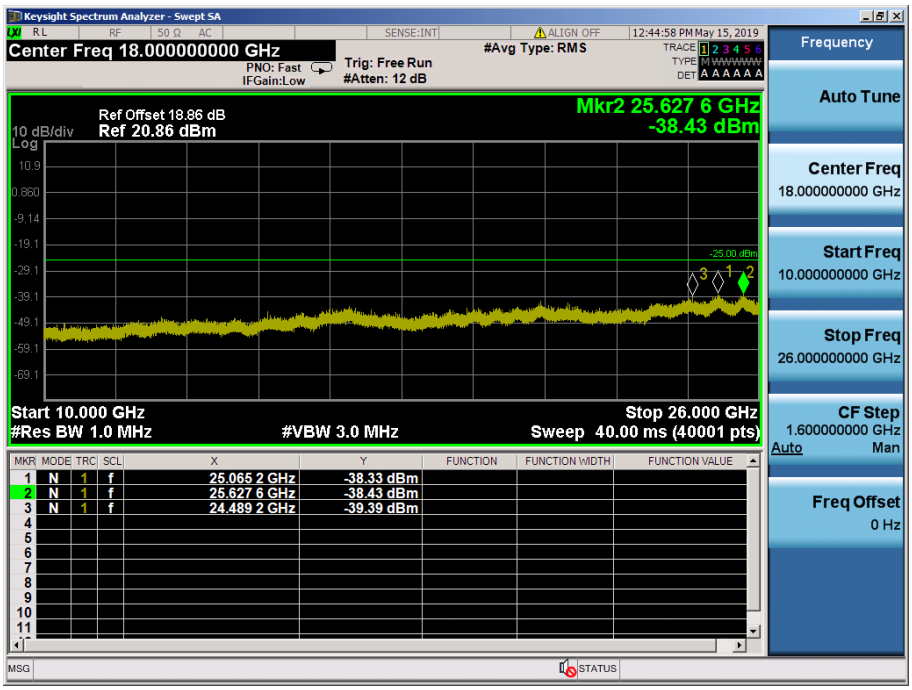
LTE Band 7 / 10MHz / QPSK - RB Size/Offset (25/12) – High Channel



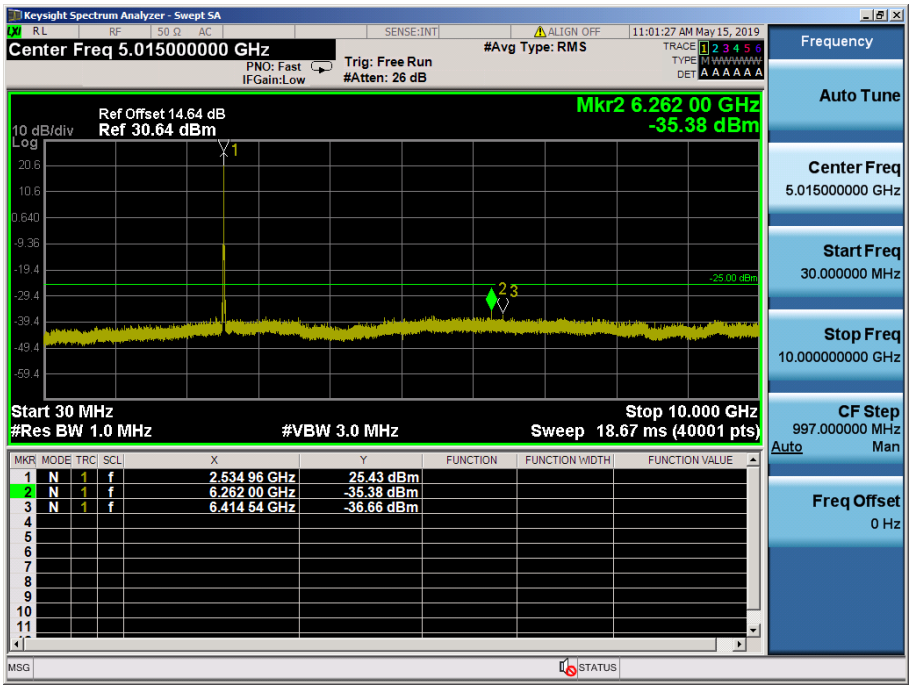
LTE Band 7 / 10MHz / QPSK - RB Size/Offset (25/12) – High Channel



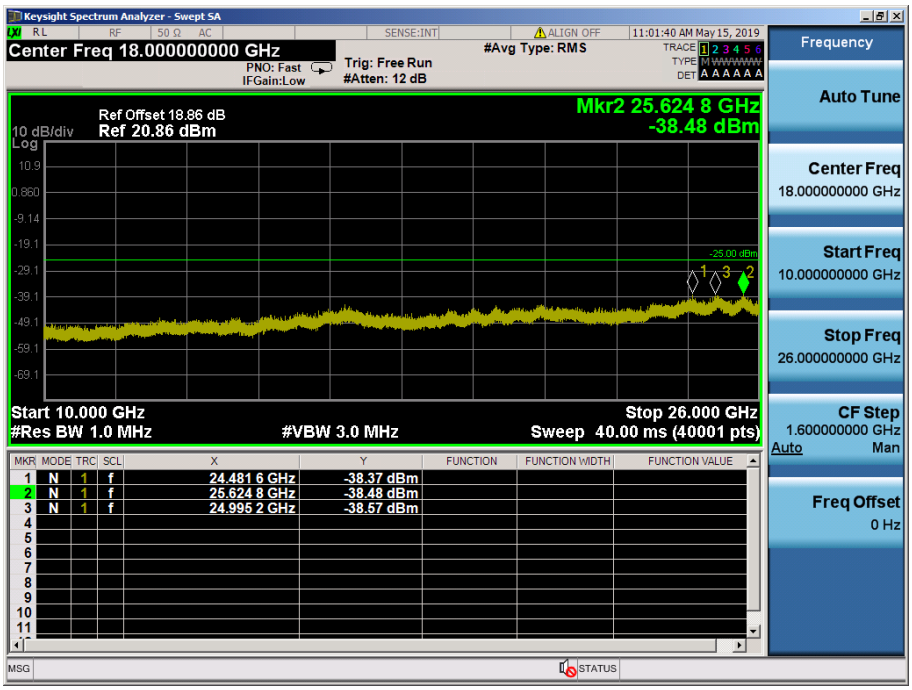
LTE Band 7 / 5MHz / 16QAM - RB Size/Offset (12/6) – Low Channel



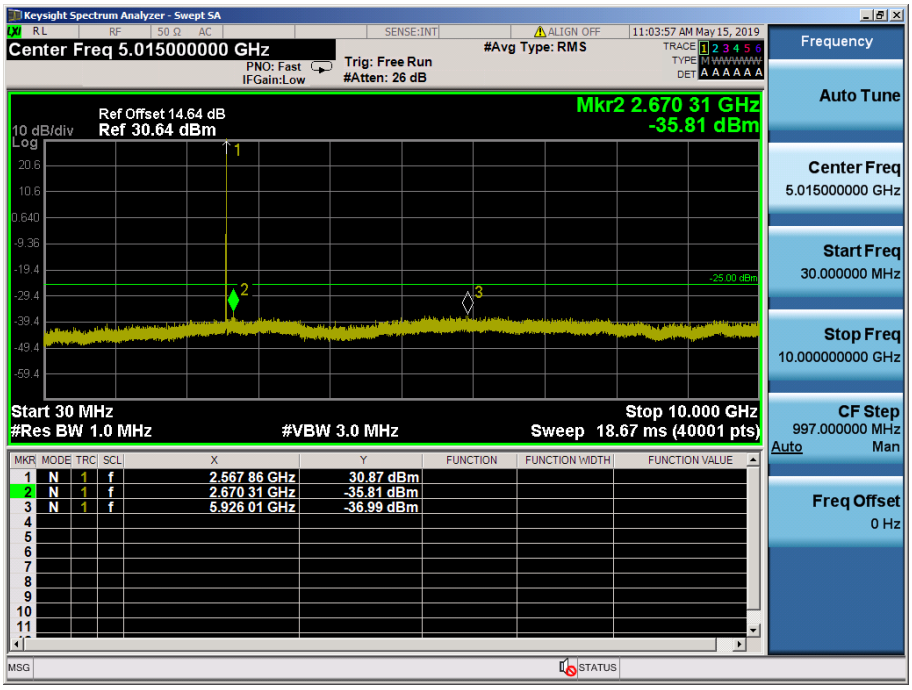
LTE Band 7 / 5MHz / 16QAM - RB Size/Offset (12/6) – Low Channel



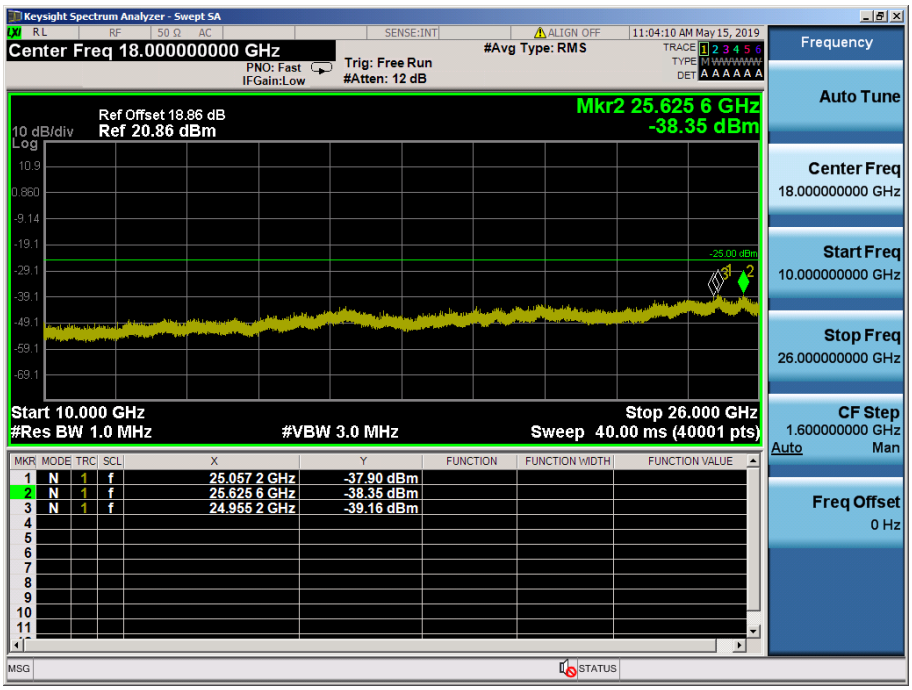
LTE Band 7 / 5MHz / QPSK - RB Size/Offset (25/0) – Mid Channel



LTE Band 7 / 5MHz / QPSK - RB Size/Offset (25/0) – Mid Channel



LTE Band 7 / 5MHz / QPSK - RB Size/Offset (1/12) – High Channel



LTE Band 7 / 5MHz / QPSK - RB Size/Offset (1/12) – High Channel