

TEST REPORT



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1. Report No : DRTFCC1912-0325
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 / TLAHW3IU-W
FCC ID : BEJTLAHW3IU-W
5. Test Method Used : KDB971168 D01v03r01, ANSI/TIA-603-E-2016, ANSI C63.26-2015
Test Specification : §2, §22, §27
6. Date of Test : 2019.12.19 ~ 2019.12.23
7. Testing Environment : Refer to appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by		Reviewed by	
	Name : InHee Bae		Name : Geunki Son	

(Signature)

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2019 . 12 . 27 .

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	Tested by	Reviewed by
DRTFCC1912-0325	Dec. 27, 2019	Initial issue	InHee Bae	GeunKi Son

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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 : BEJTLAHW3IU-W
FCC Classification : PCS Licensed Transmitter (PCB)
EUT Type : Telematics
Model Name : TLAHW3IU-W
Add Model Name : NA
Supplying power : DC 12 V
Antenna Information : External antenna

Mode	TX Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max power (dBm)	Max power (W)
LTE Band 5	829 ~ 844	8M99G7D	QPSK	21.05	0.127
LTE Band 5	829 ~ 844	8M95W7D	16QAM	20.02	0.100
LTE Band 5	826.5 ~ 846.5	4M50G7D	QPSK	20.87	0.122
LTE Band 5	826.5 ~ 846.5	4M48W7D	16QAM	19.92	0.098
LTE Band 5	825.5 ~ 847.5	2M70G7D	QPSK	20.97	0.125
LTE Band 5	825.5 ~ 847.5	2M69W7D	16QAM	19.94	0.099
LTE Band 5	824.7 ~ 848.3	1M08G7D	QPSK	20.63	0.116
LTE Band 5	824.7 ~ 848.3	1M09W7D	16QAM	19.79	0.095
LTE Band 7	2510 ~ 2560	17M9G7D	QPSK	22.58	0.181
LTE Band 7	2510 ~ 2560	17M9W7D	16QAM	21.75	0.150
LTE Band 7	2507.5 ~ 2562.5	13M4G7D	QPSK	22.97	0.198
LTE Band 7	2507.5 ~ 2562.5	13M4W7D	16QAM	22.11	0.163
LTE Band 7	2505 ~ 2565	8M97G7D	QPSK	23.65	0.232
LTE Band 7	2505 ~ 2565	8M96W7D	16QAM	22.89	0.195
LTE Band 7	2502.5 ~ 2567.5	4M49G7D	QPSK	23.11	0.205
LTE Band 7	2502.5 ~ 2567.5	4M48W7D	16QAM	22.40	0.174

2. INTRODUCTION

2.1 EUT DESCRIPTION

The Equipment Under Test (EUT) supports GSM/WCDMA/LTE

2.2. EUT CAPABILITIES

This EUT contains the following capabilities:
850 WCDMA/HSUPA, Multi-band LTE.

2.3. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+22 °C ~ +24 °C
▪ Relative Humidity	41 % ~ 45 %

2.4 MEASURING INSTRUMENT CALIBRATION

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

2.5. MEASUREMENT UNCERTAINTY

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

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

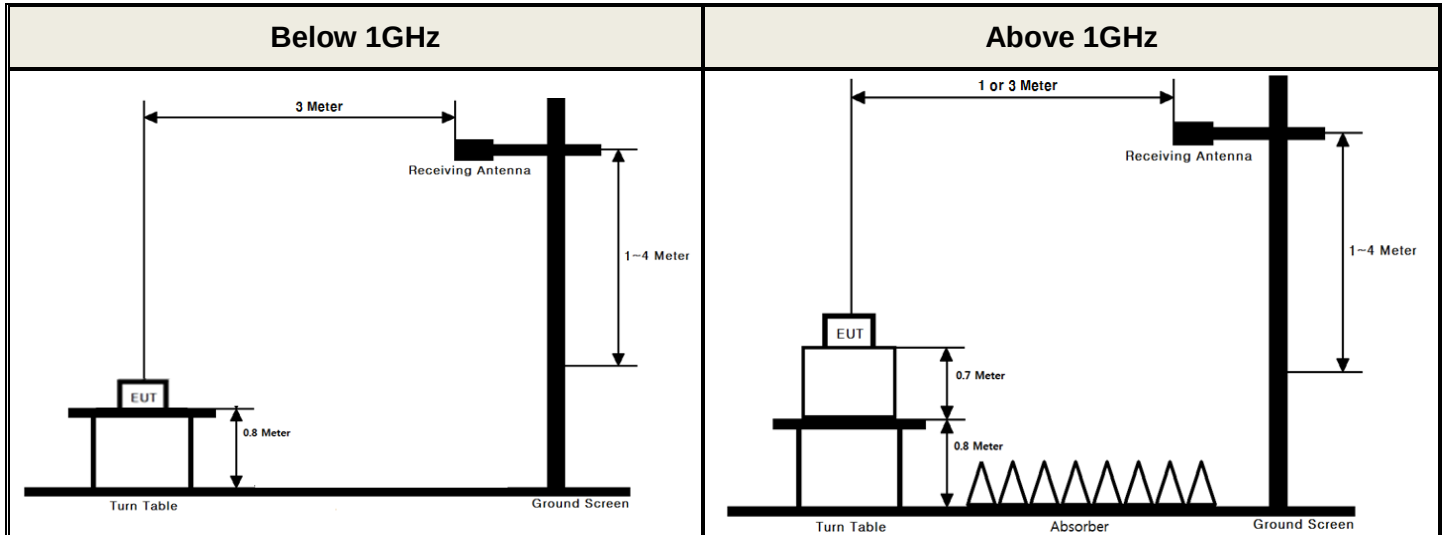
2.6. TEST FACILITY

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site comply with the requirements of § 2.948 according to ANSI 63.4-2014.		
- FCC MRA Accredited Test Firm No. : KR0034		
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 0.8 or 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 2.2.17
- 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 $\geq 3 \times$ RBW.
4. Set number of points in sweep $\geq 2 \times$ 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.

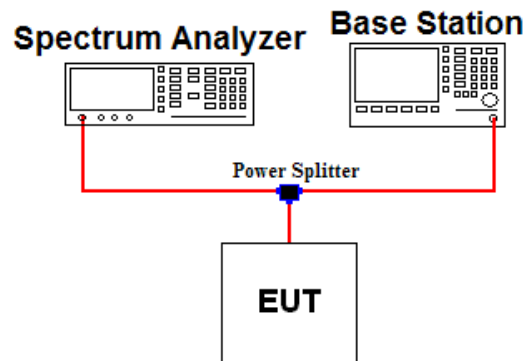
The ERP/EIRP is calculated using the following formula:

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.

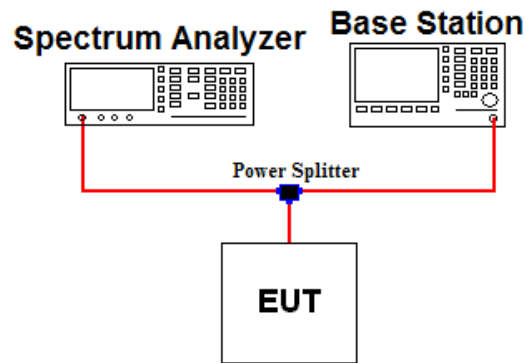
Test setting

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 from 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

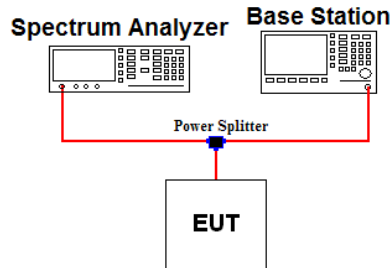
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

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 $\geq 1\%$ 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) / 24.238(b) / 27.53(h) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit.

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Note 2: 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.

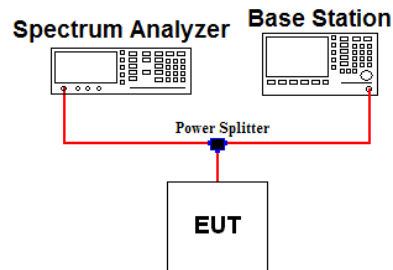
Note 3: Per Part 27.53(c.5) for operations in the 776-788 MHz band, compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

Note 4: Per Part 27.53(c.4) for all frequencies between 763-775 MHz and 793-805 MHz, the FCC limit is $65 + 10\log_{10}(P[\text{Watts}]) = -35\text{dBm}$ in a 6.25kHz bandwidth

Note 5: 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.

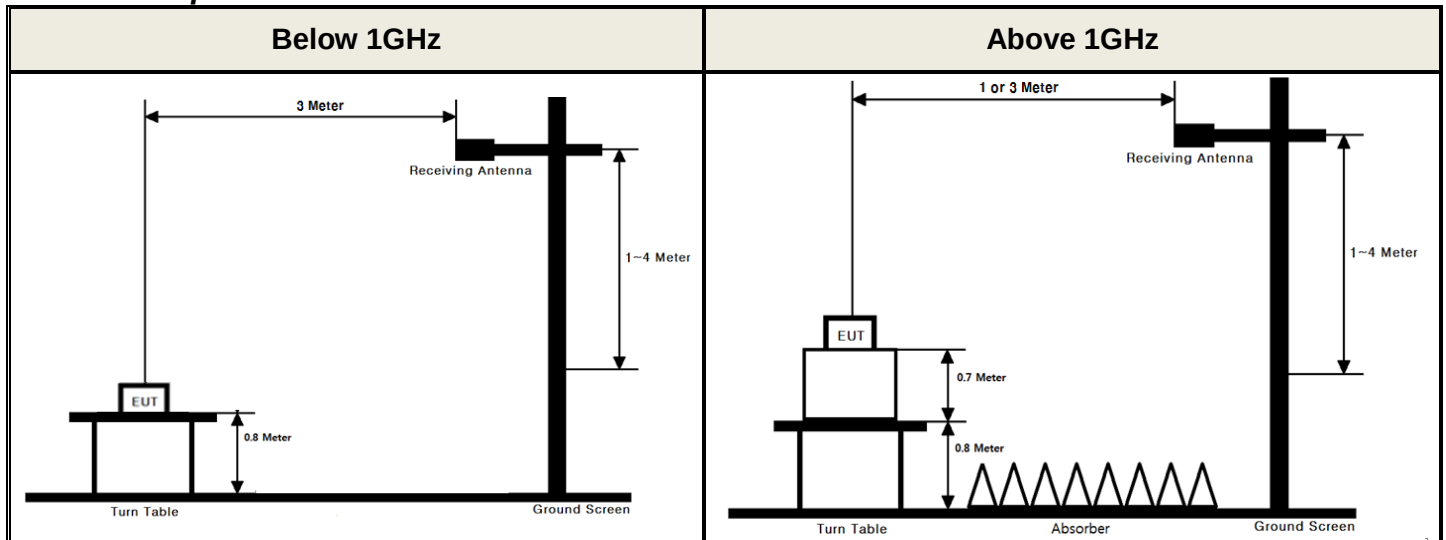
Test setting

1. RBW = 100 kHz(Below 1 GHz) or 1 MHz(Above 1 GHz) & VBW $\geq 3 \times$ 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 m test site. The equipment under test is placed on a non-conductive table 0.8 or 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

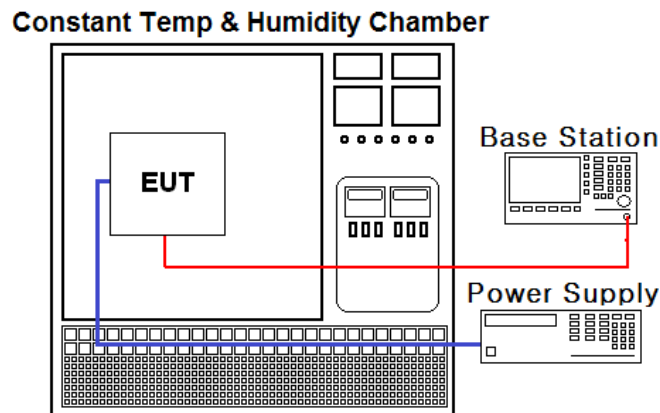
The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal 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	19/12/18	20/12/18	MY48010133
Spectrum Analyzer	Agilent Technologies	N9020A	19/06/26	20/06/26	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/18	20/12/18	MY49060056
DC power supply	Agilent Technologies	66332A	19/06/25	20/06/25	MY43001173
Multimeter	FLUKE	17B+	19/12/16	20/12/16	36390701WS
Power Splitter	Weinschel	WA1574	19/06/25	20/06/25	WA1574-4
Temp & Humi	ESPEC	SH-641	19/06/25	20/06/25	92003317
Radio Communication Analyzer	Anritsu	MT8820C	19/06/26	20/06/26	6201274519
Thermohygrometer	BODYCOM	BJ5478	19/12/16	20/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/16	20/12/16	120612-2
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/18	20/12/18	173501
Loop Antenna	ETS	6502	19/09/18	21/09/18	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
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	19/07/03	21/07/03	155
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
High-pass filter	Wainwright	WHKX10-2838-3300-18000-60SS	19/06/24	20/06/24	2
Cable	Radiall	TESTPRO3	19/01/16	20/01/16	M-01
Cable	DTNC	Cable	19/01/16	20/01/16	M-02
Cable	Junkosha	MWX315	19/01/16	20/01/16	M-05
Cable	Junkosha	MWX221	19/01/16	20/01/16	M-06
Cable	Radiall	TESTPRO3	19/01/16	20/01/16	RF-10

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	RSS-GEN[6.7]	Occupied Bandwidth	N/A		C
27.50(d.5)	RSS-132 [5.4] RSS-199 [4.4]	Peak to Average Ratio	< 13 dB		C
2.1051 22.917(a)	RSS-132 [5.5]	Band Edge / Conducted Spurious Emissions	> 43 + 10log ₁₀ (P) dB at Band edge and for all out-of-band emissions		C
2.1051 27.53(m)	RSS-199 [4.5]	Band Edge / Conducted Spurious Emissions	> 40 + 10log10 (P) dB at channel edge and 5 MHz from the channel edge > 43 + 10log10 (P) dB at 5 MHz and X MHz from the channel edge > 55 + 10log10 (P) dB at all frequencies more than X MHz from the channel edge		C
2.1055 22.355 27.54	RSS-132 [5.3] RSS-199 [4.3]	Frequency Stability	< 2.5 ppm (Part 22 & RSS-132) Fundamental emissions must stay within Authorized frequency block (Part 27 & RSS-199)		C
22.913(a.5)	RSS-132 [5.4]	Radiated Output Power (B5)	< 7 Watts max. ERP (FCC) < 11.5 Watts max. EIRP (IC)	Radiated	C
27.50(h.2)	RSS-199 [4.4]	Radiated Output Power (41)	< 2 Watts max. EIRP (FCC & IC)		C
24.232(c) 27.50(h.2)	RSS-133 [6.4]	Radiated Output Power(B2)	< 2 Watts max. EIRP		C
2.1053 22.917(a)	RSS-132 [5.5]	Band Edge / Conducted Spurious Emissions	> 43 + 10log ₁₀ (P) dB at Band edge and for all out-of-band emissions		C
2.1053 27.53(m)	RSS-199 [4.5]	Band Edge / Conducted Spurious Emissions	> 55 + 10log ₁₀ (P) dB at Band edge and for all out-of-band emissions		C
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable					

6. SAMPLE CALCULATION

A. Emission Designator

LTE Band 5(QPSK)

Emission Designator = **8M99G7D**

LTE OBW = 8.987 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 7(QPSK)

Emission Designator = **17M9G7D**

LTE OBW = 17.923 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 5(16QAM)

Emission Designator = **8M95W7D**

LTE OBW = 8.949 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data Transmission

LTE Band 7(16QAM)

Emission Designator = **17M9W7D**

LTE OBW = 17.917 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	2535	QPSK	1/0	-26.37	X	V	17.76	5.89	23.65	0.232

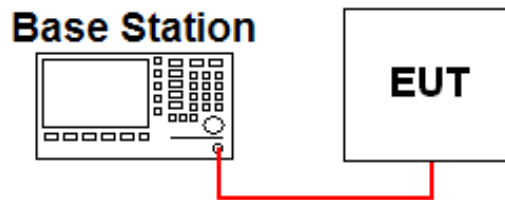
ERP or EIRP = Level @ Ant Terminal LEVEL(dBm) + Tx Ant. Gain

- 1) The EUT mounted on a non-conductive turntable is 0.8m(below 1GHz) or 1.5m(above 1GHz) 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 5

Conducted Power [dBm]									
RB Alloc			1 RB			MID RB			FULL RB
B.W(MHz)	Freq.(MHz)	Modulation	LOW	MID	HIGH	LOW	MID	HIGH	
10	829	QPSK	21.41	21.52	21.50	20.58	20.61	20.53	20.68
		16QAM	20.81	20.92	20.89	19.66	19.71	19.56	19.69
	836.5	QPSK	21.52	21.55	21.59	20.65	20.67	20.69	20.63
		16QAM	20.91	20.86	20.95	19.66	19.69	19.67	19.70
	844	QPSK	21.72	21.57	21.41	20.73	20.61	20.62	20.62
		16QAM	21.12	20.91	20.83	19.77	19.70	19.64	19.65
5	826.5	QPSK	21.55	21.65	21.62	20.56	20.68	20.61	20.58
		16QAM	20.87	21.01	20.97	19.60	19.74	19.66	19.67
	836.5	QPSK	21.55	21.63	21.67	20.59	20.62	20.61	20.68
		16QAM	20.90	21.00	21.01	19.69	19.70	19.70	19.73
	846.5	QPSK	21.54	21.56	21.37	20.61	20.55	20.55	20.52
		16QAM	20.86	20.91	20.77	19.67	19.62	19.64	19.57
3	825.5	QPSK	21.56	21.52	21.54	20.49	20.61	20.60	20.53
		16QAM	20.86	20.85	20.81	19.61	19.69	19.72	19.67
	836.5	QPSK	21.45	21.50	21.52	20.56	20.50	20.49	20.60
		16QAM	20.83	20.89	20.90	19.71	19.72	19.65	19.73
	847.5	QPSK	21.55	21.53	21.38	20.60	20.50	20.48	20.49
		16QAM	20.93	20.91	20.70	19.68	19.60	19.54	19.54
1.4	824.7	QPSK	21.55	21.53	21.50	21.46	21.45	21.43	20.49
		16QAM	20.83	20.79	20.72	20.45	20.51	20.43	19.53
	836.5	QPSK	21.43	21.53	21.54	21.50	21.52	21.51	20.63
		16QAM	20.67	20.78	20.79	20.50	20.50	20.54	19.62
	848.3	QPSK	21.49	21.48	21.37	21.44	21.43	21.41	20.45
		16QAM	20.73	20.66	20.68	20.52	20.53	20.48	19.52

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

▪ 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	21.65	21.39	21.47	20.37	20.50	20.42	20.55
		16QAM	20.89	20.83	20.88	19.35	19.27	19.46	19.35
	2535	QPSK	21.42	21.01	21.63	20.18	20.15	20.42	20.24
		16QAM	20.74	20.35	20.88	19.33	19.12	19.24	19.15
	2560	QPSK	21.35	21.13	21.49	20.36	20.29	20.39	20.42
		16QAM	20.82	20.67	20.98	19.30	19.27	19.37	19.40
15	2507.5	QPSK	21.31	21.15	20.94	20.24	20.26	20.42	20.63
		16QAM	20.67	20.51	20.31	19.20	19.41	19.25	19.27
	2535	QPSK	21.16	21.03	21.44	20.18	20.12	20.16	20.15
		16QAM	20.49	20.37	20.59	19.16	19.11	19.16	19.15
	2562.5	QPSK	21.24	21.15	21.38	20.25	20.31	20.34	20.37
		16QAM	20.58	20.68	20.70	19.21	19.29	19.42	19.42
10	2505	QPSK	22.01	21.42	20.93	20.61	20.61	20.58	20.77
		16QAM	21.06	20.93	20.25	19.58	19.52	19.60	19.61
	2535	QPSK	21.73	21.25	21.70	20.36	20.23	20.36	20.40
		16QAM	20.95	20.44	20.80	19.33	19.25	19.38	19.30
	2565	QPSK	21.77	21.31	22.08	20.41	20.32	20.36	20.36
		16QAM	20.79	20.40	20.92	19.39	19.24	19.33	19.30
5	2502.5	QPSK	21.63	21.58	21.68	20.42	20.46	20.38	20.44
		16QAM	20.86	20.71	20.96	19.41	19.45	19.36	19.49
	2535	QPSK	21.42	21.37	21.30	20.25	20.20	20.18	20.14
		16QAM	20.45	20.44	20.44	19.28	19.20	19.21	19.21
	2567.5	QPSK	21.47	21.51	21.57	20.23	20.28	20.24	20.20
		16QAM	20.46	20.47	20.55	19.25	19.28	19.27	19.21

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 EDGE 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 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	1/25	V	20.85	-0.67	20.18	0.104
		16QAM	1/25	V	20.28	-0.67	19.61	0.091
	836.5	QPSK	1/0	V	21.24	-0.74	20.50	0.112
		16QAM	1/0	V	20.48	-0.74	19.74	0.094
	844	QPSK	1/0	V	21.86	-0.81	21.05	0.127
		16QAM	1/0	V	20.83	-0.81	20.02	0.100
5	826.5	QPSK	1/24	V	21.52	-0.65	20.87	0.122
		16QAM	1/24	V	20.57	-0.65	19.92	0.098
	836.5	QPSK	1/0	V	21.45	-0.74	20.71	0.118
		16QAM	1/0	V	20.55	-0.74	19.81	0.096
	846.5	QPSK	1/0	V	19.92	-0.83	19.09	0.081
		16QAM	1/0	V	19.32	-0.83	18.49	0.071
3	825.5	QPSK	1/7	V	21.61	-0.64	20.97	0.125
		16QAM	1/7	V	20.58	-0.64	19.94	0.099
	836.5	QPSK	1/7	V	21.17	-0.74	20.43	0.110
		16QAM	1/7	V	20.25	-0.74	19.51	0.089
	847.5	QPSK	1/0	V	19.93	-0.84	19.09	0.081
		16QAM	1/0	V	19.08	-0.84	18.24	0.067
1.4	824.7	QPSK	1/3	V	21.26	-0.63	20.63	0.116
		16QAM	1/3	V	20.42	-0.63	19.79	0.095
	836.5	QPSK	1/3	V	20.77	-0.74	20.03	0.101
		16QAM	1/3	V	19.81	-0.74	19.07	0.081
	848.3	QPSK	1/0	V	19.66	-0.85	18.81	0.076
		16QAM	1/0	V	19.15	-0.85	18.30	0.068

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

7.6.2 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)
20	2510	QPSK	1/0	V	16.30	5.95	22.25	0.168
		16QAM	1/0	V	15.07	5.95	21.02	0.126
	2535	QPSK	1/0	V	16.69	5.89	22.58	0.181
		16QAM	1/0	V	15.86	5.89	21.75	0.150
	2560	QPSK	1/0	V	15.49	5.86	21.35	0.136
		16QAM	1/0	V	14.44	5.86	20.30	0.107
15	2507.5	QPSK	1/0	V	16.13	5.96	22.09	0.162
		16QAM	1/0	V	15.28	5.96	21.24	0.133
	2535	QPSK	1/0	V	17.08	5.89	22.97	0.198
		16QAM	1/0	V	16.22	5.89	22.11	0.163
	2562.5	QPSK	1/0	V	15.90	5.87	21.77	0.150
		16QAM	1/0	V	14.45	5.87	20.32	0.108
10	2505	QPSK	1/0	V	16.91	5.97	22.88	0.194
		16QAM	1/0	V	16.31	5.97	22.28	0.169
	2535	QPSK	1/0	V	17.76	5.89	23.65	0.232
		16QAM	1/0	V	17.00	5.89	22.89	0.195
	2565	QPSK	1/0	V	16.28	5.87	22.15	0.164
		16QAM	1/0	V	15.52	5.87	21.39	0.138
5	2502.5	QPSK	1/0	V	16.71	5.97	22.68	0.185
		16QAM	1/0	V	15.58	5.97	21.55	0.143
	2535	QPSK	1/0	V	17.22	5.89	23.11	0.205
		16QAM	1/0	V	16.51	5.89	22.40	0.174
	2537.5	QPSK	1/0	V	15.77	5.88	21.65	0.146
		16QAM	1/0	V	14.91	5.88	20.79	0.120

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 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 (dBm)	Limit (dBm)	Margin (dB)
10	829	1/25	QPSK	1658.24	H	-46.87	3.85	-43.02	-13.00	30.02
				2473.87	V	-41.34	3.79	-37.55	-13.00	24.55
			16QAM	1658.29	H	-47.22	3.85	-43.37	-13.00	30.37
				2473.67	V	-40.89	3.79	-37.10	-13.00	24.10
	836.5	1/0	QPSK	1664.34	H	-45.95	3.87	-42.08	-13.00	29.08
				2496.26	V	-36.72	3.82	-32.90	-13.00	19.90
			16QAM	1664.18	H	-46.04	3.87	-42.17	-13.00	29.17
				2496.38	V	-36.28	3.82	-32.46	-13.00	19.46
	844	1/0	QPSK	1679.15	H	-47.57	3.91	-43.66	-13.00	30.66
				2518.73	V	-33.90	3.78	-30.12	-13.00	17.12
			16QAM	1679.12	H	-48.43	3.91	-44.52	-13.00	31.52
				2518.67	V	-33.38	3.78	-29.60	-13.00	16.60
3	825.5	1/7	QPSK	1650.98	H	-47.57	3.82	-43.75	-13.00	30.75
				2476.25	V	-40.14	3.79	-36.35	-13.00	23.35
			16QAM	1650.83	H	-47.19	3.82	-43.37	-13.00	30.37
				2476.33	V	-39.66	3.79	-35.87	-13.00	22.87

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.

7.7.2 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)	Margin (dB)
20	2510	1/0	QPSK	5037.83	H	-47.77	10.07	-37.70	-25.00	12.70
				7530.05	H	-47.38	11.96	-35.42	-25.00	10.42
			16QAM	5037.55	H	-50.37	10.07	-40.30	-25.00	15.30
				7530.43	H	-47.01	11.96	-35.05	-25.00	10.05
	2535	1/0	QPSK	5087.83	H	-47.06	10.23	-36.83	-25.00	11.83
				7604.60	H	-50.79	12.14	-38.65	-25.00	13.65
			16QAM	5087.79	H	-46.95	10.23	-36.72	-25.00	11.72
				7605.00	H	-50.74	12.15	-38.59	-25.00	13.59
	2560	1/0	QPSK	5137.56	H	-51.94	10.26	-41.68	-25.00	16.68
				7680.41	H	-49.21	12.23	-36.98	-25.00	11.98
			16QAM	5138.15	H	-51.25	10.26	-40.99	-25.00	15.99
				7680.10	H	-49.65	12.23	-37.42	-25.00	12.42
10	2535	1/0	QPSK	5078.84	H	-47.83	10.19	-37.64	-25.00	12.64
				7617.93	H	-47.13	12.16	-34.97	-25.00	9.97
			16QAM	5079.01	H	-47.93	10.19	-37.74	-25.00	12.74
				7618.49	H	-47.43	12.16	-35.27	-25.00	10.27

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

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.

7.8 FREQUENCY STABILITY

7.8.1 LTE Band 5

OPERATING FREQUENCY : 836.5 MHz
 REFERENCE VOLTAGE : 12 VDC
 DEVIATION LIMIT : ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (V DC)	TEMP (°C)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	12	+20(Ref)	836,500,006	6	0.0072	0.000000717
100%		-30	836,499,996	-4	-0.0048	-0.000000478
100%		-20	836,500,003	3	0.0036	0.000000359
100%		-10	836,499,998	-2	-0.0024	-0.000000239
100%		0	836,500,002	2	0.0024	0.000000239
100%		+10	836,499,996	-4	-0.0048	-0.000000478
100%		+20	836,500,006	6	0.0072	0.000000717
100%		+30	836,500,003	3	0.0036	0.000000359
100%		+40	836,500,004	4	0.0048	0.000000478
100%		+50	836,499,999	-1	-0.0012	-0.000000120
115%	13.80	+20	836,500,001	1	0.0012	0.000000120
85%	10.20	+20	836,500,001	1	0.0012	0.000000120

7.8.2 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 within the authorized frequency block.

VOLTAGE (%)	POWER (V DC)	TEMP (°C)	FREQUENCY (Hz)	FREQ.Dev (Hz)	Deviation	
					(ppm)	(%)
100%	12	+20(Ref)	2,535,000,002	2	0.0008	0.000000079
100%		-30	2,534,999,996	-4	-0.0016	-0.000000158
100%		-20	2,534,999,997	-3	-0.0012	-0.000000118
100%		-10	2,535,000,003	3	0.0012	0.000000118
100%		0	2,535,000,004	4	0.0016	0.000000158
100%		+10	2,535,000,004	4	0.0016	0.000000158
100%		+20	2,535,000,002	2	0.0008	0.000000079
100%		+30	2,534,999,997	-3	-0.0012	-0.000000118
100%		+40	2,535,000,004	4	0.0016	0.000000158
100%		+50	2,535,000,002	2	0.0008	0.000000079
115%	13.80	+20	2,535,000,006	6	0.0024	0.000000237
85%	10.20	+20	2,534,999,998	-2	-0.0008	-0.000000079

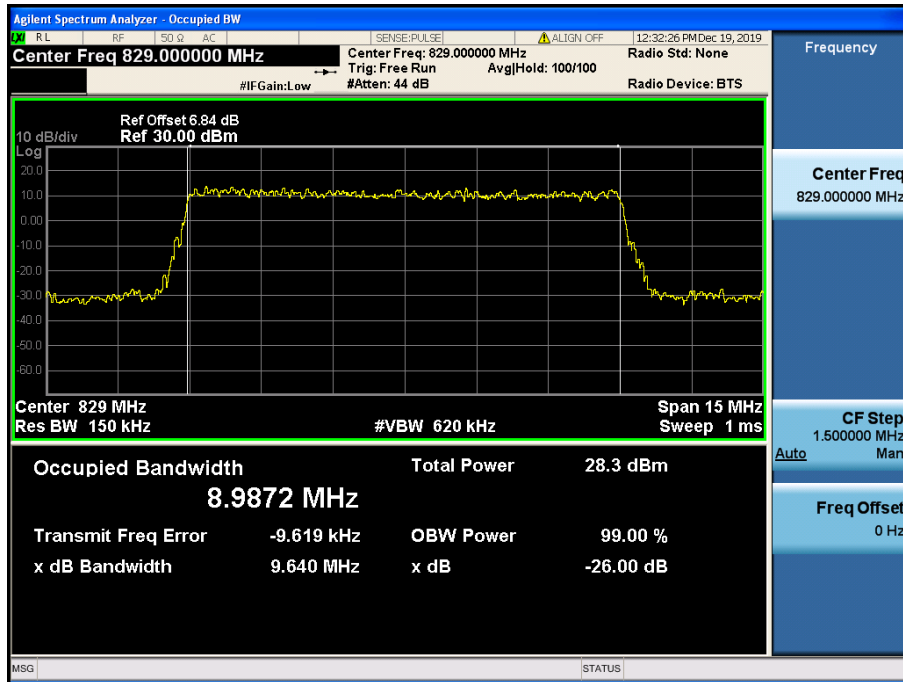
Note. Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain inband when the maximum measured frequency deviation noted during the frequency stability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

8. TEST PLOTS

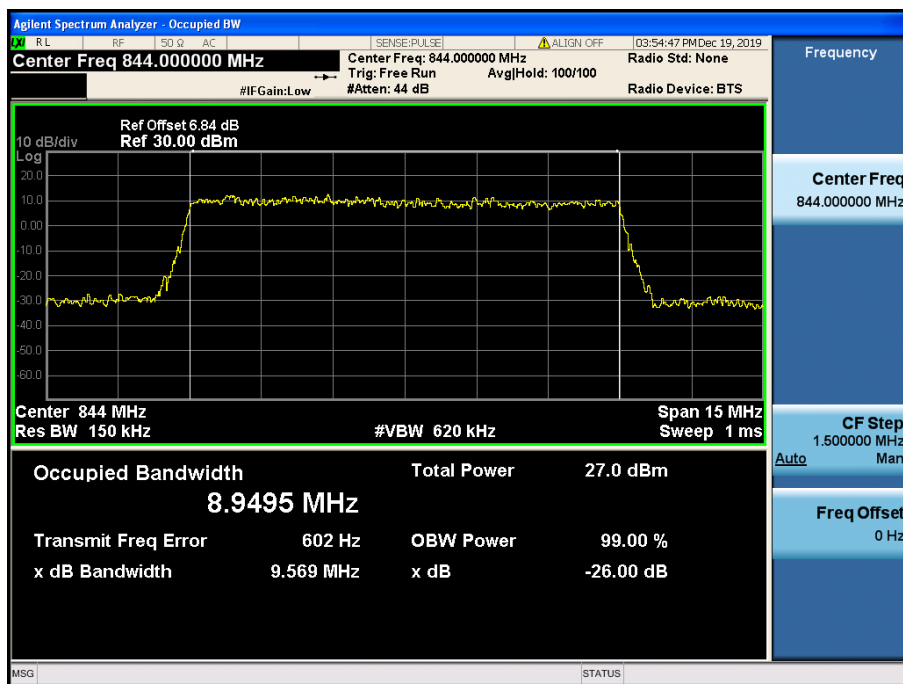
Note: All bandwidths, RB configurations, and modulations were investigated.
The worst case test results are reported.

8.1 OCCUPIED BANDWIDTH

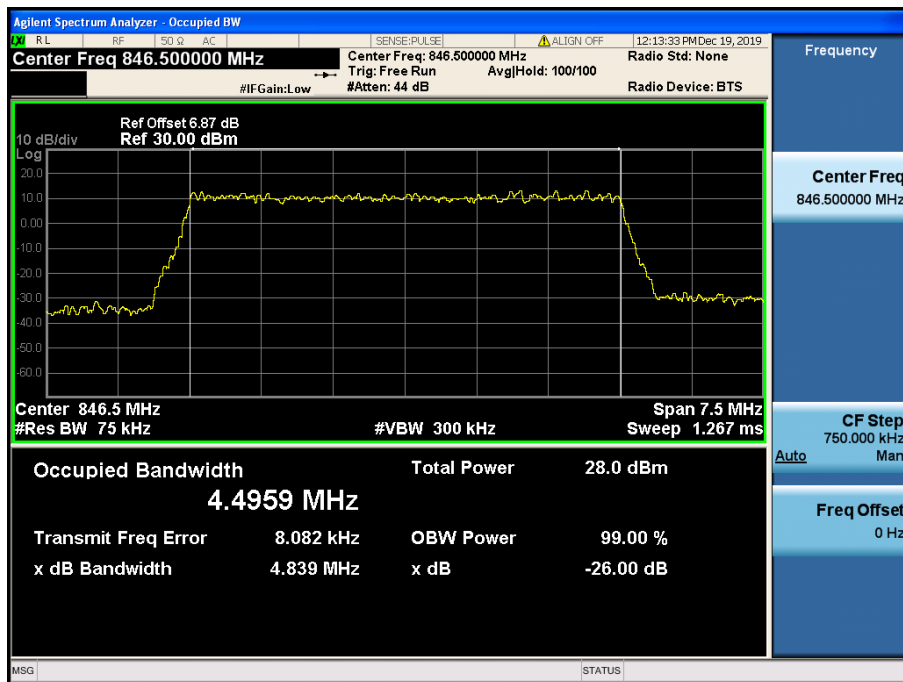
8.1.1 LTE Band 5



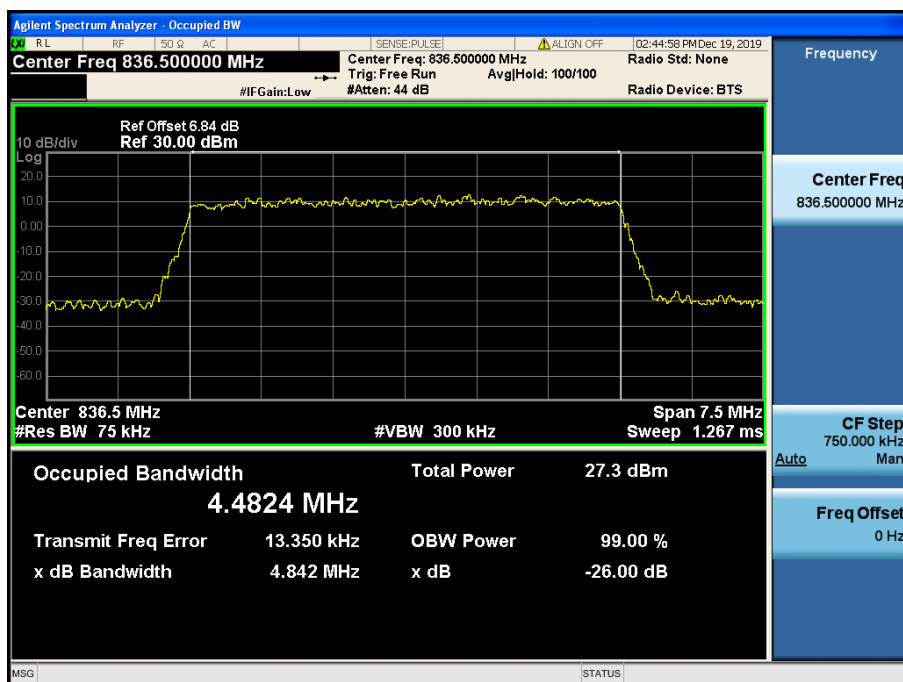
LTE Band 5 / 10 MHz / QPSK - RB Size 50



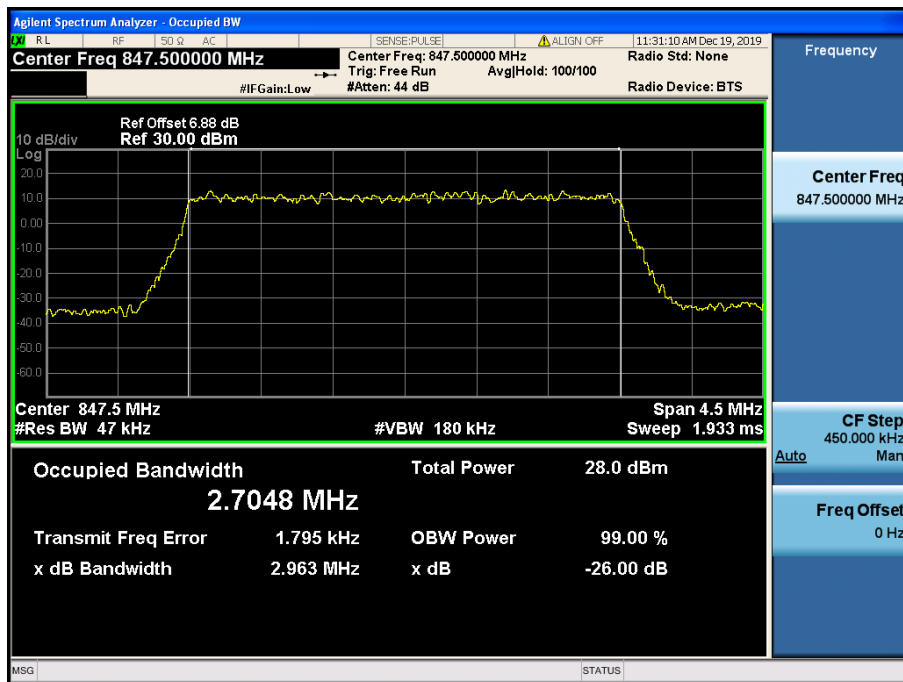
LTE Band 5 / 10 MHz / 16QAM - RB Size 50



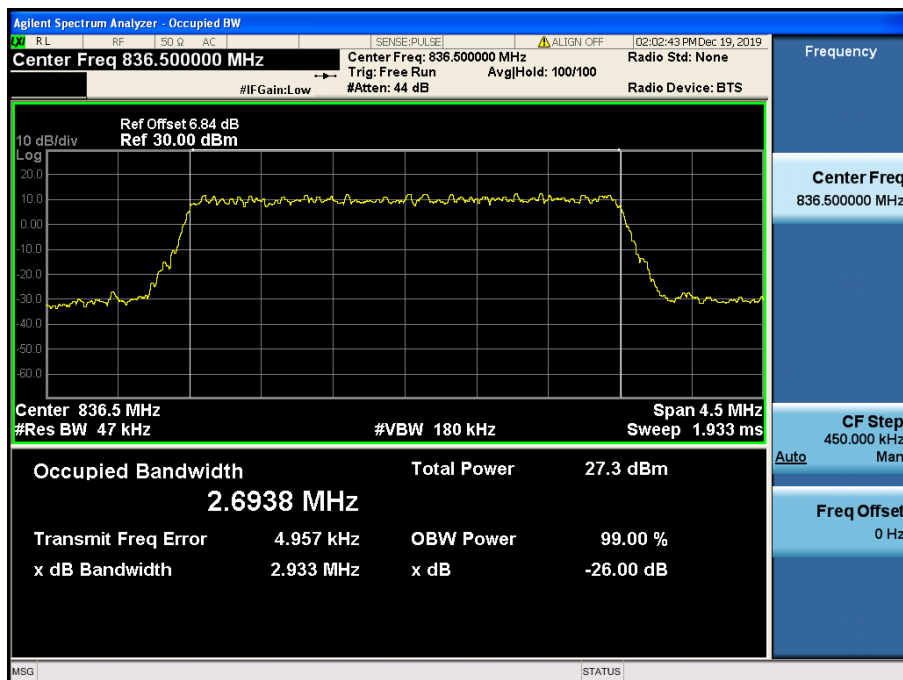
LTE Band 5 / 5 MHz / QPSK - RB Size 25



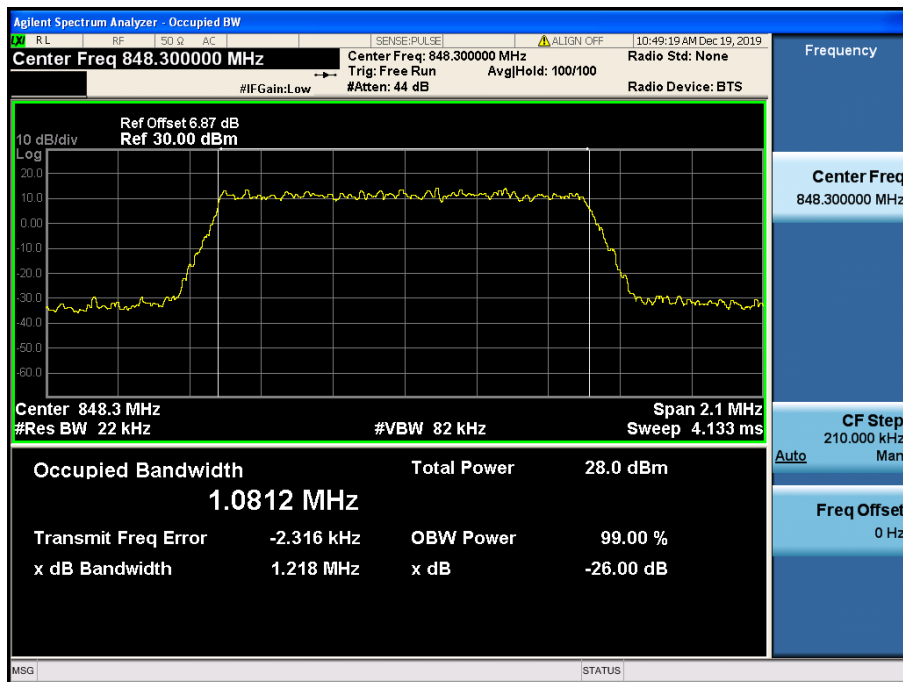
LTE Band 5 / 5 MHz / 16QAM - RB Size 25



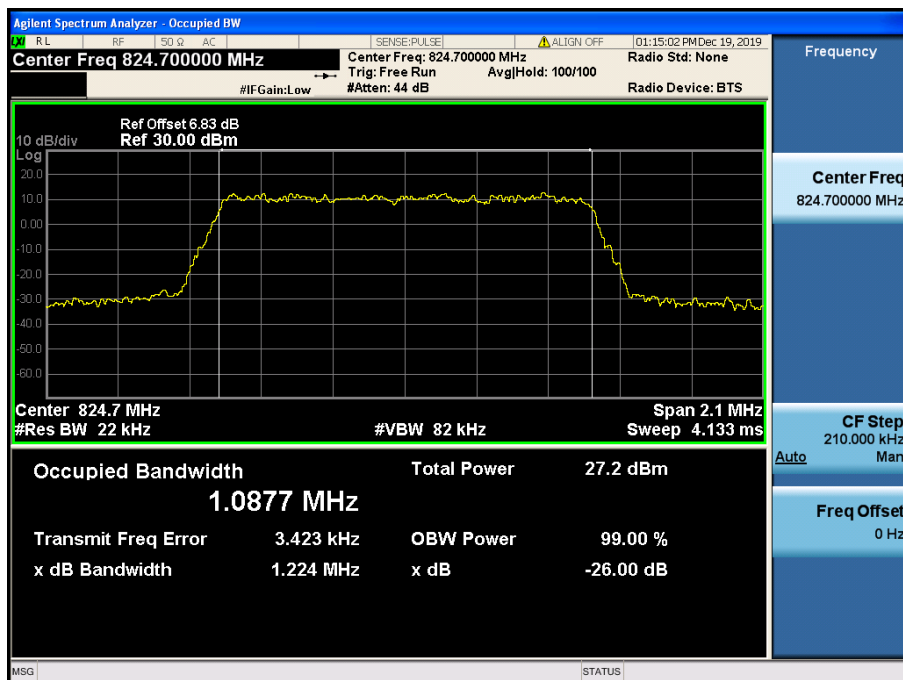
LTE Band 5 / 3 MHz / QPSK - RB Size 15



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

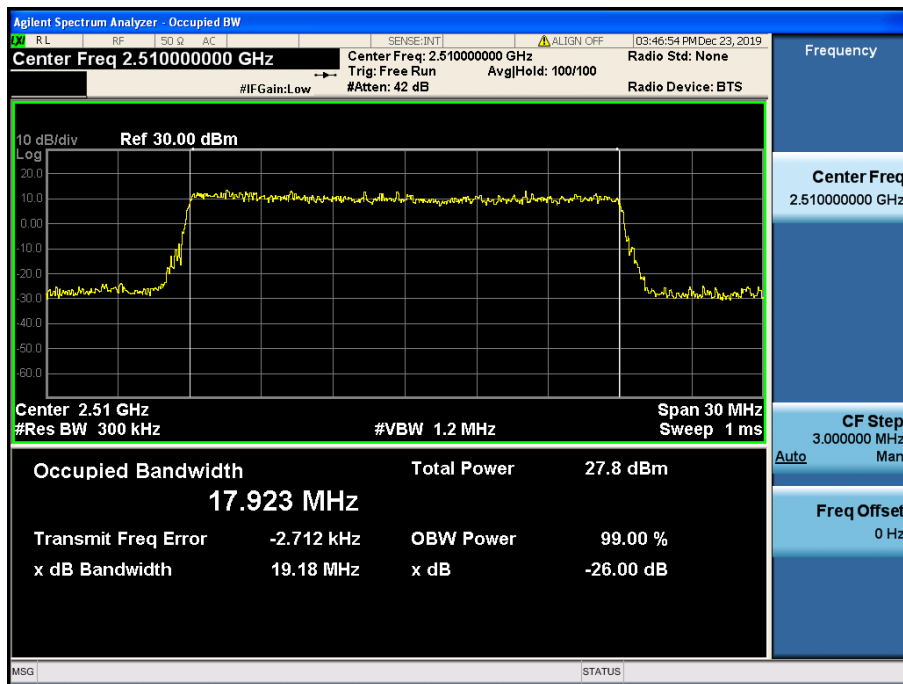


LTE Band 5 / 1.4 MHz / QPSK - RB Size 6

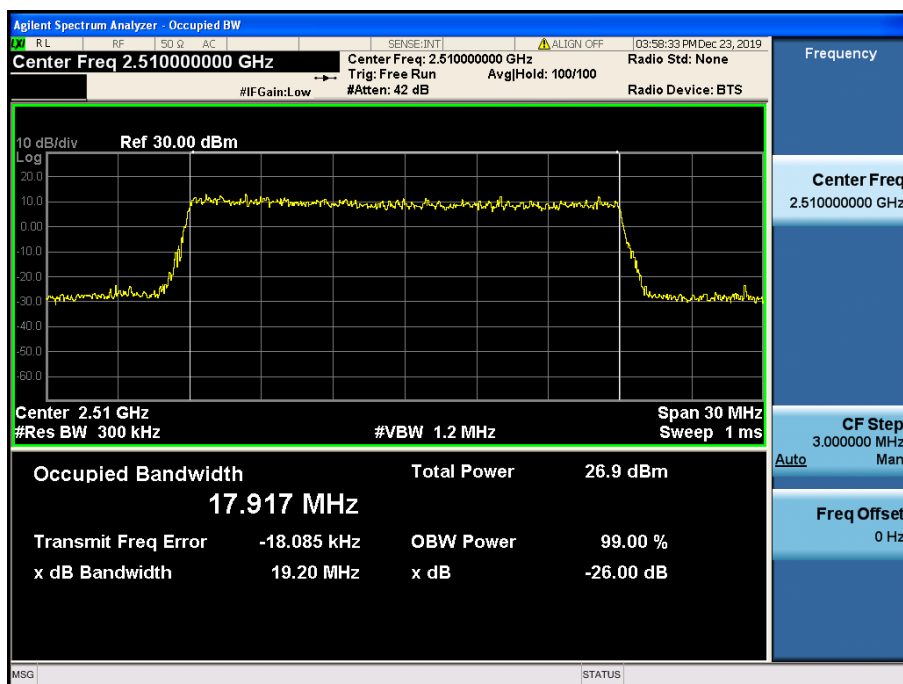


LTE Band 5 / 1.4 MHz / 16QAM - RB Size 6

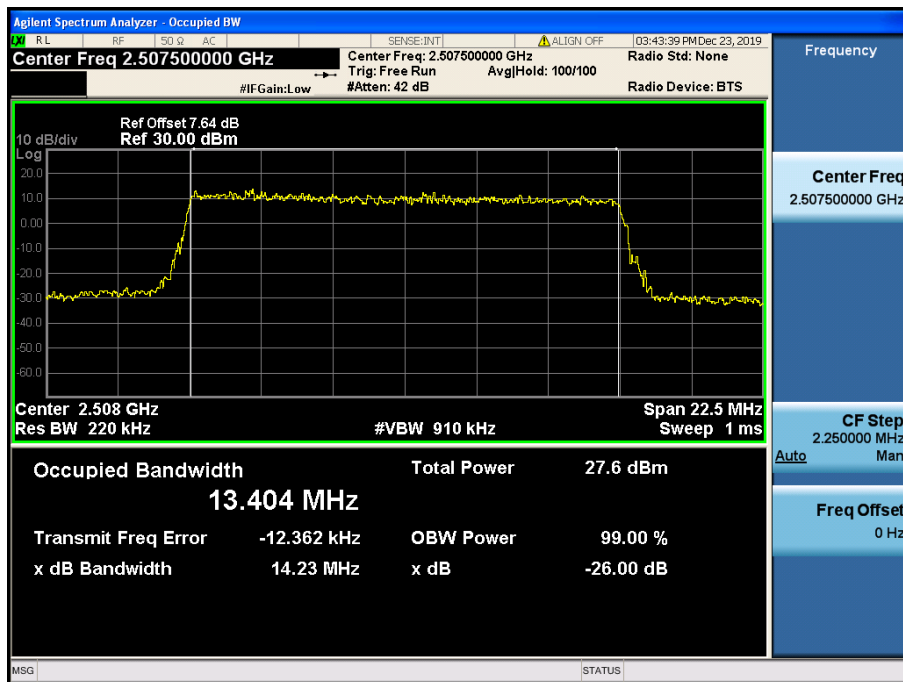
8.1.2 LTE Band 7



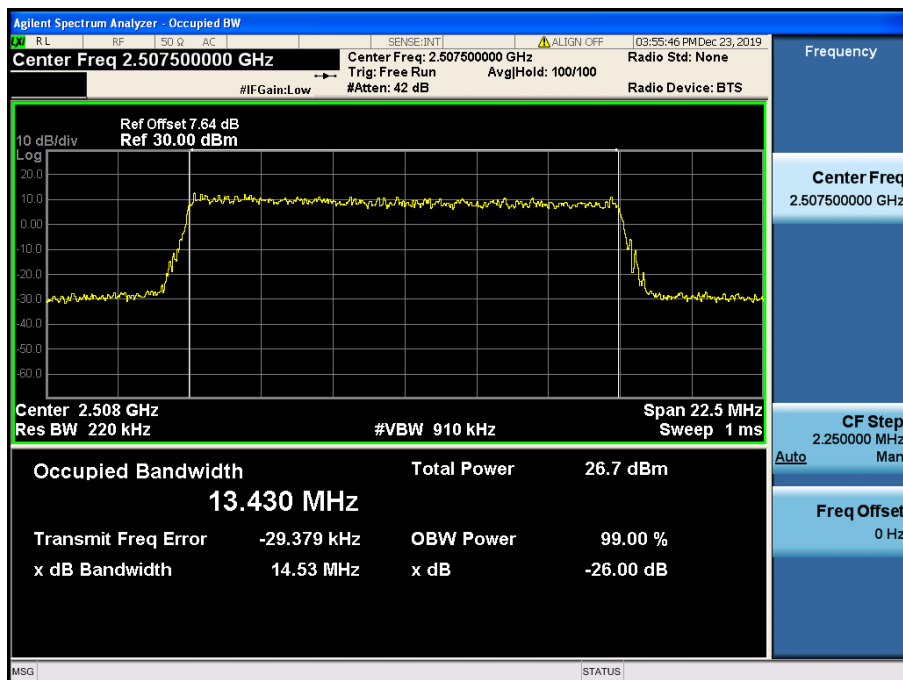
LTE Band 7 / 20 MHz / QPSK - RB Size 100



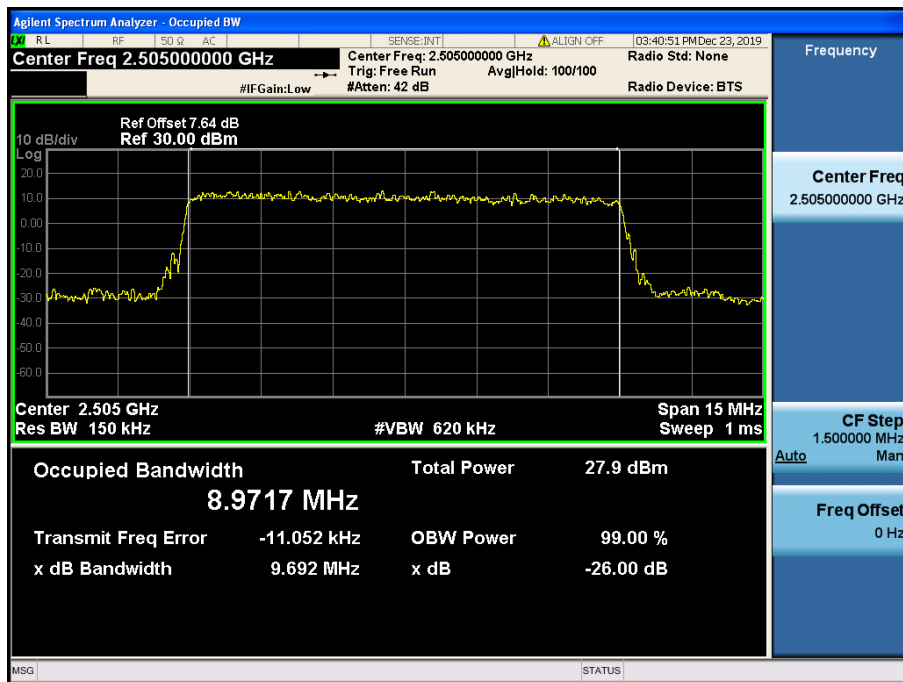
LTE Band 7 / 20 MHz / 16QAM - RB Size 100



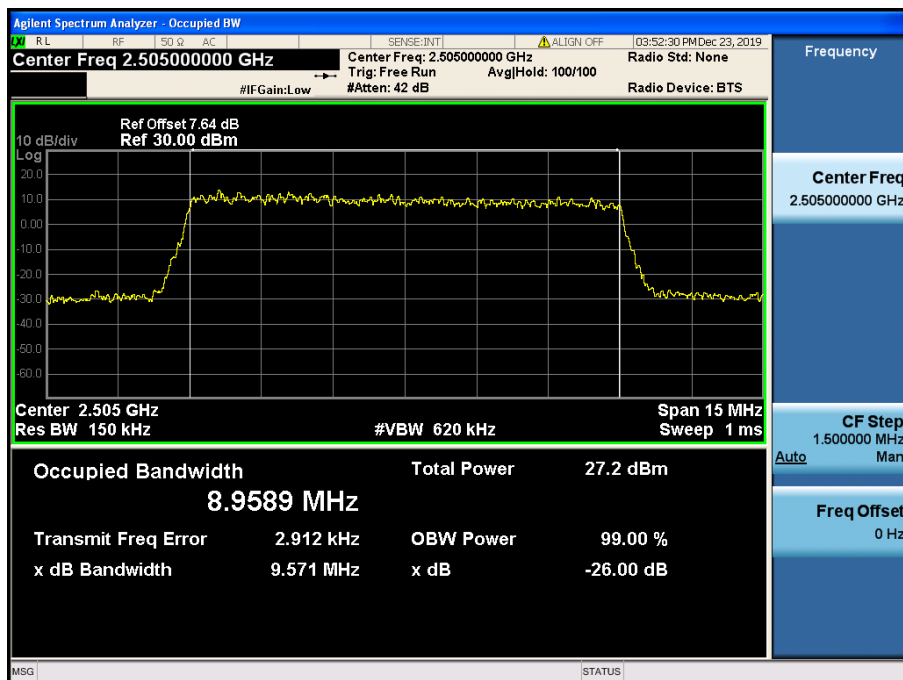
LTE Band 7 / 15 MHz / QPSK - RB Size 75



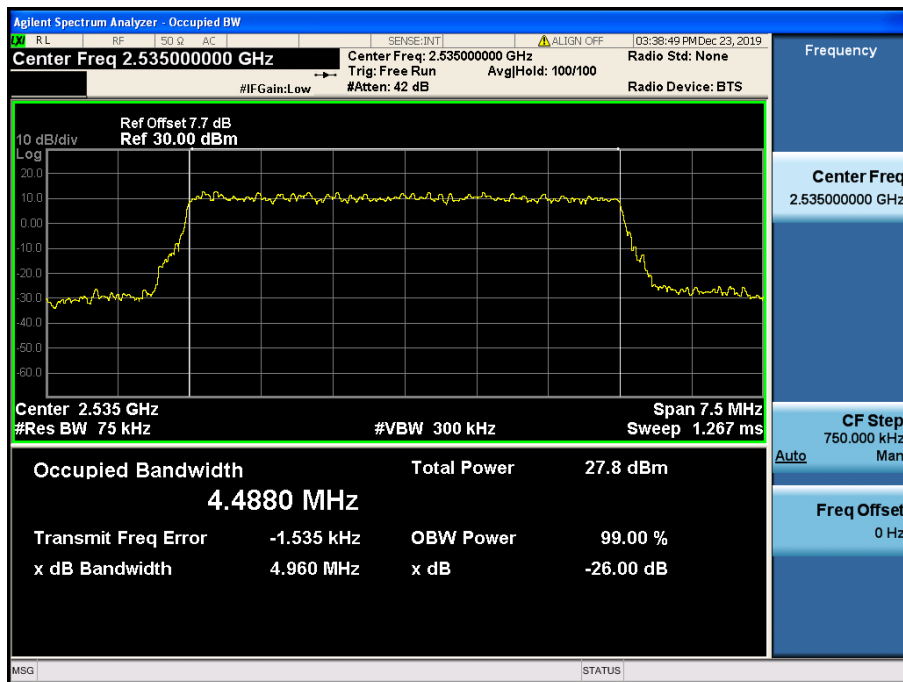
LTE Band 7 / 15 MHz / 16QAM - RB Size 75



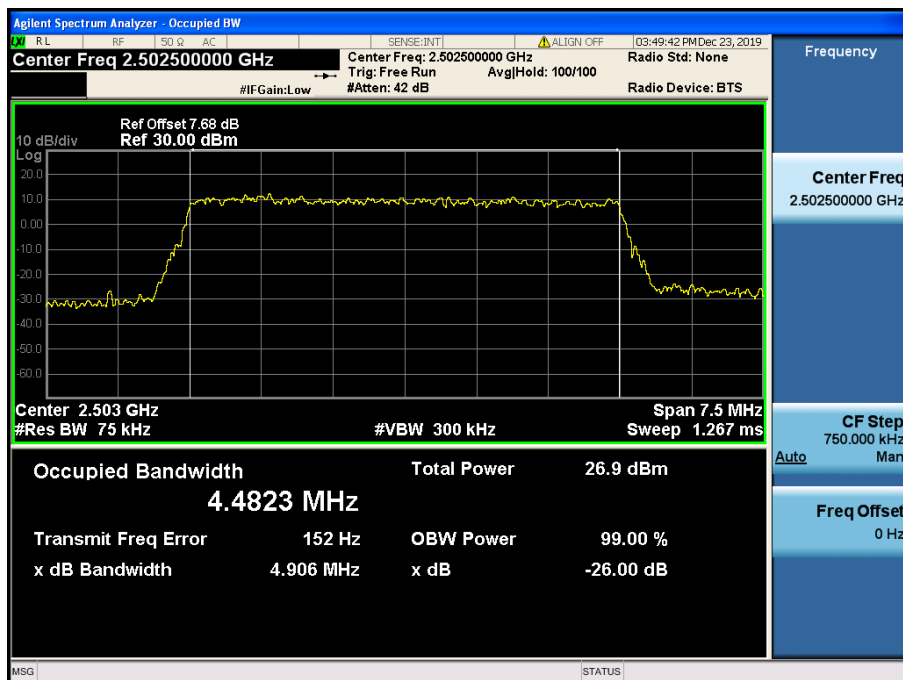
LTE Band 7 / 10 MHz / QPSK - RB Size 50



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