HCT CO.,LTD.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
TEL: +82-31-645-6300 FAX: +82-31-645-6401

FCC LTE REPORT

Certification

Applicant Name:
LG Electronics MobileComm U.S.A., Inc.

Address:
1000 Sylvan Avenue, Englewood Cliffs NJ 07632

Date of Issue:
March 20, 2018

Location:
HCT CO., LTD.,
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1803-FC008

FCC ID: **ZNFQ610FA**

APPLICANT: **LG Electronics MobileComm U.S.A., Inc.**

Model(s): LM-Q610FAW

Additional Model(s): LMQ610FAW, Q610FAW, LM-Q610FA, LMQ610FA, Q610FA, LM-Q610RM, LMQ610RM, Q610RM, LM-Q610FM, LMQ610FM, Q610FM, LM-Q610RS, LMQ610RS, Q610RS, LM-Q610FS, LMQ610FS, Q610FS, LM-Q610FSW, LMQ610FSW, Q610FSW

EUT Type: GSM/WCDMA/LTE Phone with Bluetooth4.2LE, WIFI802.11 b/g/n

FCC Classification: Licensed Portable Transmitter Held to Ear (PCE)

FCC Rule Part(s): §22, §24, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band5 (1.4)	824.7 – 848.3	1M09G7D	QPSK	0.059	17.71
		1M09W7D	16QAM	0.050	16.95
LTE – Band5 (3)	825.5 – 847.5	2M70G7D	QPSK	0.062	17.90
		2M71W7D	16QAM	0.051	17.06
LTE – Band5 (5)	826.5 – 846.5	4M51G7D	QPSK	0.061	17.82
		4M52W7D	16QAM	0.050	17.01
LTE – Band5 (10)	829.0 – 844.0	8M99G7D	QPSK	0.062	17.94
		8M99W7D	16QAM	0.052	17.12

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band2 (1.4)	1850.7 - 1909.3	1M09G7D	QPSK	0.148	21.69
		1M10W7D	16QAM	0.122	20.87
LTE – Band2 (3)	1851.5 - 1908.5	2M70G7D	QPSK	0.153	21.84
		2M70W7D	16QAM	0.124	20.95
LTE – Band2 (5)	1852.5 - 1907.5	4M50G7D	QPSK	0.147	21.68
		4M53W7D	16QAM	0.120	20.80
LTE – Band2 (10)	1855.0 - 1905.0	8M99G7D	QPSK	0.138	21.40
		8M97W7D	16QAM	0.112	20.50
LTE – Band2 (15)	1857.5 - 1902.5	13M5G7D	QPSK	0.144	21.58
		13M5W7D	16QAM	0.119	20.74
LTE – Band2 (20)	1860.0 - 1900.0	17M9G7D	QPSK	0.149	21.73
		18M0W7D	16QAM	0.121	20.82

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Jae Ryang Do
Engineer of Telecommunication Testing Center

Report approved by : Kwon Jeong
Manager of Telecommunication Testing Center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1803-FC008	March 20, 2018	- First Approval Report

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	LG Electronics MobileComm U.S.A., Inc.
Address:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632
FCC ID:	ZNFQ610FA
Application Type:	Certification
FCC Classification:	Licensed Portable Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §2
EUT Type:	GSM/WCDMA/LTE Phone with Bluetooth4.2LE, WIFI802.11 b/g/n
Model(s):	LM-Q610FAW
Additional Model(s):	LMQ610FAW, Q610FAW, LM-Q610FA, LMQ610FA, Q610FA, LM-Q610RM, LMQ610RM, Q610RM, LM-Q610FM, LMQ610FM, Q610FM, LM-Q610RS, LMQ610RS, Q610RS, LM-Q610FS, LMQ610FS, Q610FS, LM-Q610FSW, LMQ610FSW, Q610FSW
Tx Frequency:	824.7 MHz – 848.3 MHz (LTE – Band 5 (1.4 MHz)) 825.5 MHz – 847.5 MHz (LTE – Band 5 (3 MHz)) 826.5 MHz – 846.5 MHz (LTE – Band 5 (5 MHz)) 829.0 MHz – 844.0 MHz (LTE – Band 5 (10 MHz))
	1850.7 MHz – 1909.3 MHz (LTE – Band2 (1.4 MHz)) 1851.5 MHz – 1908.5 MHz (LTE – Band2 (3 MHz)) 1852.5 MHz – 1907.5 MHz (LTE – Band2 (5 MHz)) 1855.0 MHz – 1905.0 MHz (LTE – Band2 (10 MHz)) 1857.5 MHz – 1902.5 MHz (LTE – Band2 (15 MHz)) 1860.0 MHz – 1900.0 MHz (LTE – Band2 (20 MHz))
Date(s) of Tests:	March 05, 2018 ~ March 19, 2018

2. INTRODUCTION

2.1. Description of EUT

The EUT supports GSM/WCDMA/LTE Phone with Bluetooth4.2LE, WIFI802.11 b/g/n.

2.2. 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.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03 – Section 4.2 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03 – Section 5.2 - ANSI C63.26-2015 – Section 5.2 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03 – Section 5.8 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

   The power is calculated by the following formula;

   $$P_{d(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dB)}$$

   Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.
3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value.

   These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

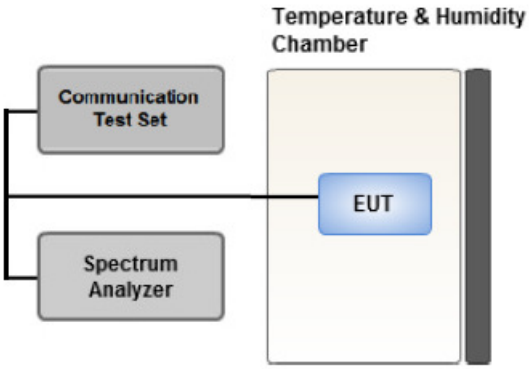
Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10th harmonics from 9 kHz.

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
   The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① **CCDF Procedure for PAPR**

Test Settings

1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:
   .- for continuous transmissions, set to 1 ms,
   .- or 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 and set the measurement interval to a time that is less than or equal to the burst duration.
4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{Pk}.

Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{Avg}. Determine the P.A.R. from:

$$P.A.R_{(dB)} = P_{Pk\ (dBm)} - P_{Avg\ (dBm)}\ (P_{Avg} = \text{Average Power + Duty cycle Factor})$$

Test Settings(Peak Power)

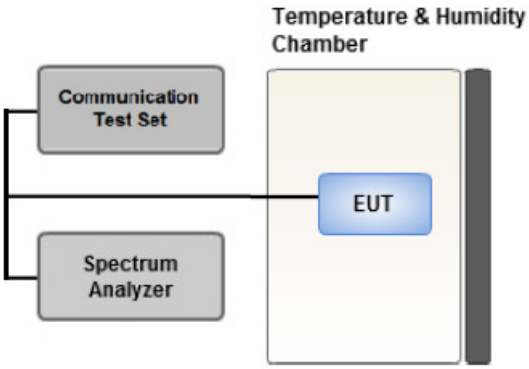
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

1. Set the RBW ≥ OBW.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 2 × OBW.
4. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

Test Settings(Average Power)

1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to “free run.”
8. 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 the on and off period of the transmitter, 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.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

3.5 OCCUPIED BANDWIDTH.



Test setup

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

The EUT makes a call to the communication simulator.

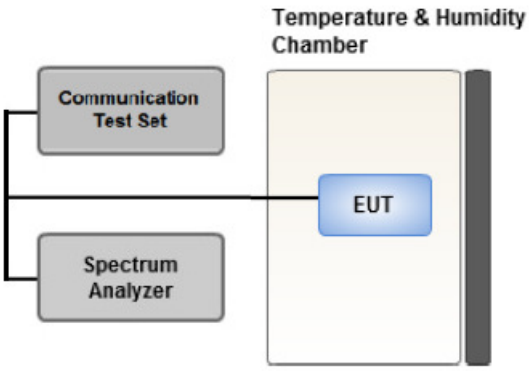
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

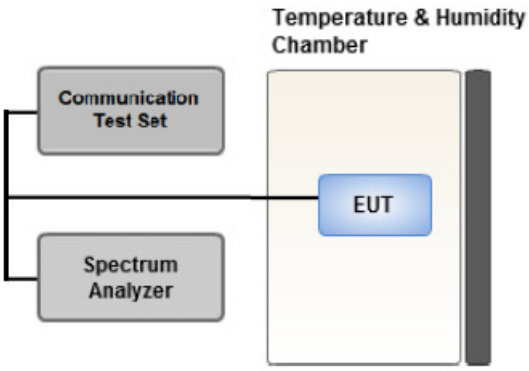
Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = Peak
4. Trace Mode = max hold
5. Sweep time = auto
6. Number of points in sweep ≥ 2 * Span / RBW

3.7 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

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
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

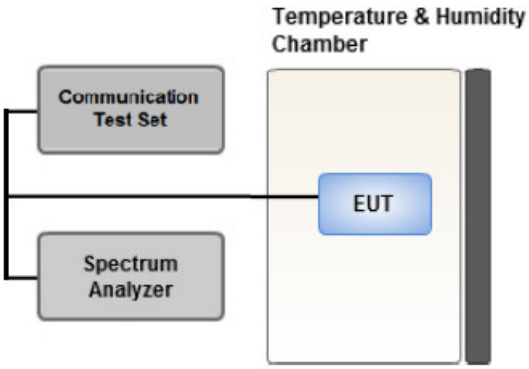
Test Notes

According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. 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.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:
   The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
2. Primary Supply Voltage:
   .- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.
   .- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

Test Settings

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 fifteen minutes 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

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
REOHDE & SCHWARZ	SCU 18 / AMPLIFIER	10094	04/24/2017	Annual	04/24/2018
Wainwright	WHK1.2/15G-10EF/H.P.F	4	04/10/2017	Annual	04/10/2018
Wainwright	WHK3.3/18G-10EF/H.P.F	2	04/10/2017	Annual	04/10/2018
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	05/04/2017	Annual	05/04/2018
Agilent	E3632A/DC Power Supply	KR75303243	07/18/2017	Annual	07/18/2018
Schwarzbeck	UHAP/ Dipole Antenna	557	03/31/2017	Biennial	03/31/2019
Schwarzbeck	UHAP/ Dipole Antenna	558	03/31/2017	Biennial	03/31/2019
ESPEC	SU-642 / Chamber	93000718	07/21/2017	Annual	07/21/2018
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	09/09/2016	Biennial	09/09/2018
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	10/14/2016	Biennial	10/14/2018
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/25/2017	Biennial	04/25/2019
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	04/25/2017	Biennial	04/25/2019
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY52090906	06/01/2017	Annual	06/01/2018
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/22/2017	Annual	06/22/2018
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/30/2017	Annual	10/30/2018
Agilent	8960 (E5515C)/ Base Station	MY48360800	09/26/2017	Annual	09/26/2018
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	04/19/2017	Biennial	04/19/2019
Schwarzbeck	VULB9160/ Bilog Antenna	3150	09/30/2016	Biennial	09/30/2018
Schwarzbeck	VULB9160/ Bilog Antenna	9360-3368	10/14/2016	Biennial	10/14/2018
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6200863156	02/13/2018	Annual	02/13/2019
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	02/08/2018	Annual	02/08/2019
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/18/2017	Annual	07/18/2018
REOHDE & SCHWARZ	FSV30/Spectrum Analyzer	100854	05/18/2017	Annual	05/18/2018
REOHDE & SCHWARZ	ESU / EMI TEST RECEIVER	100346	08/11/2017	Annual	08/11/2018
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	6.07

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §22.917(a), §24.238(a)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§2.1046	N/A	**See Note1**
Peak- to- Average Ratio	§24.232(d)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, §22.355	< 2.5 ppm	PASS
	§24.235	Emission must remain in band	PASS

Note:

1. See SAR Report

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS
Equivalent Isotropic Radiated Power	§24.232(c)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a), §24.238(a)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 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 Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 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 Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

16QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EFFECTIVE RADIATED POWER

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
824.7	LTE B5/ 1.4 MHz	QPSK	-32.72	29.50	-10.59	1.31	V	< 7.00	0.058	17.60
		16-QAM	-33.54	28.68	-10.59	1.31	V		0.048	16.78
836.5		QPSK	-32.99	29.57	-10.54	1.32	V		0.059	17.71
		16-QAM	-33.75	28.81	-10.54	1.32	V		0.050	16.95
848.3		QPSK	-33.14	28.92	-10.49	1.33	V		0.051	17.10
		16-QAM	-33.92	28.14	-10.49	1.33	V		0.043	16.32

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
825.5	LTE B5/ 3 MHz	QPSK	-32.55	29.72	-10.59	1.31	V	< 7.00	0.061	17.82
		16-QAM	-33.45	28.82	-10.59	1.31	V		0.049	16.92
836.5		QPSK	-32.80	29.76	-10.54	1.32	V		0.062	17.90
		16-QAM	-33.64	28.92	-10.54	1.32	V		0.051	17.06
847.5		QPSK	-32.99	29.10	-10.49	1.33	V		0.053	17.28
		16-QAM	-33.89	28.20	-10.49	1.33	V		0.043	16.38

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
826.5	LTE B5/ 5 MHz	QPSK	-32.63	29.68	-10.58	1.31	V	< 7.00	0.060	17.79
		16-QAM	-33.51	28.80	-10.58	1.31	V		0.049	16.91
836.5		QPSK	-32.88	29.68	-10.54	1.32	V		0.061	17.82
		16-QAM	-33.69	28.87	-10.54	1.32	V		0.050	17.01
846.5		QPSK	-33.05	29.08	-10.50	1.33	V		0.053	17.25
		16-QAM	-33.98	28.15	-10.50	1.33	V		0.043	16.32

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP	
								W	W	dBm
829.0	LTE B5/ 10 MHz	QPSK	-32.59	29.80	-10.57	1.31	V	< 7.00	0.062	17.92
		16-QAM	-33.49	28.90	-10.57	1.31	V		0.050	17.02
836.5		QPSK	-32.76	29.80	-10.54	1.32	V		0.062	17.94
		16-QAM	-33.58	28.98	-10.54	1.32	V		0.052	17.12
844.0		QPSK	-32.98	29.28	-10.51	1.33	V		0.055	17.44
		16-QAM	-33.91	28.35	-10.51	1.33	V		0.045	16.51

8.2 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1850.7	LTE B2/ 1.4 MHz	QPSK	-19.67	13.25	9.82	2.00	H	< 2.00	0.128	21.07
		16-QAM	-20.56	12.36	9.82	2.00	H		0.104	20.18
1880.0		QPSK	-19.18	13.80	9.91	2.02	H		0.148	21.69
		16-QAM	-20.00	12.98	9.91	2.02	H		0.122	20.87
1909.3		QPSK	-20.47	12.90	10.00	2.04	H		0.122	20.86
		16-QAM	-21.29	12.08	10.00	2.04	H		0.101	20.04

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1851.5	LTE B2/ 3 MHz	QPSK	-19.54	13.39	9.82	2.00	H	< 2.00	0.132	21.21
		16-QAM	-20.50	12.43	9.82	2.00	H		0.106	20.25
1880.0		QPSK	-19.03	13.95	9.91	2.02	H		0.153	21.84
		16-QAM	-19.92	13.06	9.91	2.02	H		0.124	20.95
1908.5		QPSK	-20.08	13.28	10.00	2.04	H		0.133	21.24
		16-QAM	-20.99	12.37	10.00	2.04	H		0.108	20.33

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1852.5	LTE B2/ 5 MHz	QPSK	-19.64	13.29	9.82	2.00	H	< 2.00	0.129	21.11
		16-QAM	-20.59	12.34	9.82	2.00	H		0.104	20.16
1880.0		QPSK	-19.19	13.79	9.91	2.02	H		0.147	21.68
		16-QAM	-20.07	12.91	9.91	2.02	H		0.120	20.80
1907.5		QPSK	-20.01	13.32	10.00	2.04	H		0.134	21.28
		16-QAM	-20.92	12.41	10.00	2.04	H		0.109	20.37

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1855.0	LTE B2/ 10 MHz	QPSK	-19.64	13.28	9.84	2.01	H	< 2.00	0.129	21.11
		16-QAM	-20.58	12.34	9.84	2.01	H		0.104	20.17
1880.0		QPSK	-19.49	13.49	9.91	2.02	H		0.137	21.38
		16-QAM	-20.37	12.61	9.91	2.02	H		0.112	20.50
1905.0		QPSK	-19.84	13.45	9.98	2.03	H		0.138	21.40
		16-QAM	-20.77	12.52	9.98	2.03	H		0.111	20.47

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1857.5	LTE B2/ 15 MHz	QPSK	-19.57	13.34	9.85	2.01	H	< 2.00	0.131	21.18
		16-QAM	-20.51	12.40	9.85	2.01	H		0.106	20.24
1880.0		QPSK	-19.29	13.69	9.91	2.02	H		0.144	21.58
		16-QAM	-20.13	12.85	9.91	2.02	H		0.119	20.74
1902.5		QPSK	-19.91	13.33	9.97	2.03	H		0.134	21.27
		16-QAM	-20.82	12.42	9.97	2.03	H		0.109	20.36

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1860.0	LTE B2/ 20 MHz	QPSK	-19.52	13.39	9.85	2.01	H	< 2.00	0.133	21.23
		16-QAM	-20.45	12.46	9.85	2.01	H		0.107	20.30
1880.0		QPSK	-19.19	13.79	9.91	2.02	H		0.147	21.68
		16-QAM	-20.05	12.93	9.91	2.02	H		0.121	20.82
1900.0		QPSK	-19.39	13.79	9.97	2.03	H		0.149	21.73
		16-QAM	-20.30	12.88	9.97	2.03	H		0.121	20.82

8.3 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENTY: 836.50 MHz

▣ MEASURED OUTPUT POWER: 17.71 dBm = 0.059 W

▣ MOD: LTE B5

▣ MODULATION SIGNAL: 1.4 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 $\log_{10}$ (W) = 30.71 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20407 (824.7)	1,649.40	-56.64	9.16	-69.06	1.88	H	-61.78	79.49
	2,474.10	-52.51	10.93	-61.50	2.33	V	-52.90	70.61
	3,298.80	-56.79	11.94	-66.06	2.72	V	-56.84	74.55
20525 (836.5)	1,673.00	-55.89	9.23	-68.36	1.90	V	-61.03	78.74
	2,509.50	-53.59	10.96	-62.85	2.36	V	-54.25	71.96
	3,346.00	-55.78	12.04	-65.35	2.74	V	-56.05	73.76
20643 (848.3)	1,696.60	-55.71	9.32	-68.17	1.91	V	-60.76	78.47
	2,544.90	-54.07	10.99	-63.06	2.39	H	-54.46	72.17
	3,393.20	-54.99	12.14	-64.46	2.77	H	-55.09	72.80

▣ OPERATING FREQUENTY: 836.50 MHz

▣ MEASURED OUTPUT POWER: 17.90 dBm = 0.062 W

▣ MOD: LTE B5

▣ MODULATION SIGNAL: 3 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 30.90 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20415 (825.5)	1,651.00	-55.92	9.16	-68.34	1.88	H	-61.06	78.96
	2,476.50	-56.70	10.92	-65.80	2.33	V	-57.21	75.11
	3,302.00	-56.89	11.94	-66.15	2.72	H	-56.93	74.83
20525 (836.5)	1,673.00	-57.01	9.23	-69.48	1.90	H	-62.15	80.05
	2,509.50	-56.29	10.96	-65.55	2.36	H	-56.95	74.85
	3,346.00	-57.13	12.03	-66.69	2.74	V	-57.40	75.30
20635 (847.5)	1,695.00	-56.42	9.30	-68.87	1.91	V	-61.48	79.38
	2,542.50	-54.85	10.98	-63.71	2.39	H	-55.12	73.02
	3,390.00	-56.94	12.13	-66.48	2.77	V	-57.12	75.02

▣ OPERATING FREQUENTY: 836.50 MHz

▣ MEASURED OUTPUT POWER: 17.82 dBm = 0.061 W

▣ MOD: LTE B5

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 30.82 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20425 (826.5)	1,653.00	-55.56	9.17	-68.02	1.88	H	-60.73	78.55
	2,479.50	-54.00	10.92	-63.26	2.33	V	-54.67	72.49
	3,306.00	-57.77	11.95	-67.04	2.72	V	-57.81	75.63
20525 (836.5)	1,673.00	-55.53	9.23	-68.00	1.90	H	-60.67	78.49
	2,509.50	-50.61	10.96	-59.87	2.36	V	-51.27	69.09
	3,346.00	-56.78	10.03	-64.34	2.74	H	-57.05	74.87
20625 (846.5)	1,693.00	-57.08	9.31	-69.56	1.91	V	-62.16	79.98
	2,539.50	-54.02	10.98	-62.80	2.38	V	-54.20	72.02
	3,386.00	-56.74	12.11	-66.28	2.77	V	-56.94	74.76

▣ OPERATING FREQUENTY: 836.50 MHz

▣ MEASURED OUTPUT POWER: 17.94 dBm = 0.062 W

▣ MOD: LTE B5

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 30.94 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20450 (829.0)	1,658.00	-56.86	9.18	-69.40	1.88	V	-62.10	80.04
	2,487.00	-54.37	10.93	-63.42	2.34	V	-54.83	72.77
	3,316.00	-57.34	11.96	-66.65	2.71	V	-57.40	75.34
20525 (836.5)	1,673.00	-56.15	9.23	-68.62	1.90	V	-61.29	79.23
	2,509.50	-53.53	10.96	-62.79	2.36	V	-54.19	72.13
	3,346.00	-56.62	10.03	-64.18	2.74	H	-56.89	74.83
20600 (844.0)	1,688.00	-57.35	9.28	-69.84	1.91	H	-62.47	80.41
	2,532.00	-55.55	10.98	-64.80	2.38	H	-56.20	74.14
	3,376.00	-57.15	12.10	-66.76	2.77	H	-57.43	75.37

▣ OPERATING FREQUENTY: 1880.00 MHz

▣ MEASURED OUTPUT POWER: 21.69 dBm = 0.148 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 1.4 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 $\log_{10}$ (W) = 34.69 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18607 (1850.7)	3,701.40	-56.84	12.52	-62.59	2.92	H	-52.99	74.68
	5,552.10	-56.05	13.29	-56.29	3.60	H	-46.60	68.29
	7,402.80	-56.00	11.72	-51.13	4.26	H	-43.67	65.36
18900 (1880.0)	3,760.00	-53.85	12.56	-59.35	2.91	H	-49.70	71.39
	5,640.00	-55.69	13.30	-55.57	3.64	H	-45.91	67.60
	7,520.00	-57.24	11.70	-52.27	4.09	H	-44.66	66.35
19193 (1909.3)	3,818.60	-52.42	12.60	-57.77	2.97	V	-48.14	69.83
	5,727.90	-56.85	13.31	-55.71	3.66	H	-46.06	67.75
	7,637.20	-58.09	11.62	-53.51	4.29	V	-46.18	67.87

▣ OPERATING FREQUENTY: 1880.00 MHz

▣ MEASURED OUTPUT POWER: 21.84 dBm = 0.153 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 3 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 34.84 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18615 (1851.5)	3,703.00	-57.38	12.52	-63.09	2.92	V	-53.49	75.33
	5,554.50	-54.88	13.29	-55.07	3.60	H	-45.38	67.22
	7,406.00	-56.48	11.72	-51.49	4.26	V	-44.03	65.87
18900 (1880.0)	3,760.00	-54.15	12.56	-59.65	2.91	H	-50.00	71.84
	5,640.00	-57.46	13.30	-57.34	3.64	H	-47.68	69.52
	7,520.00	-57.44	11.70	-52.47	4.09	H	-44.86	66.70
19185 (1908.5)	3,817.00	-57.31	12.60	-62.70	2.98	H	-53.08	74.92
	5,725.50	-57.15	13.31	-55.96	3.66	H	-46.31	68.15
	7,634.00	-56.69	11.62	-52.13	4.29	H	-44.80	66.64

▣ OPERATING FREQUENTY: 1880.00 MHz

▣ MEASURED OUTPUT POWER: 21.68 dBm = 0.147 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 $\log_{10}$ (W) = 34.68 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18625 (1852.5)	3,705.00	-56.37	12.52	-62.01	2.92	H	-52.41	74.09
	5,557.50	-55.87	13.29	-56.09	3.60	V	-46.40	68.08
	7,410.00	-56.78	11.72	-51.64	4.26	V	-44.18	65.86
18900 (1880.0)	3,760.00	-55.63	12.56	-61.13	2.91	H	-51.48	73.16
	5,640.00	-57.42	13.30	-57.30	3.64	H	-47.64	69.32
	7,520.00	-58.02	11.70	-53.05	4.09	H	-45.44	67.12
19175 (1907.5)	3,815.00	-58.04	12.60	-63.50	2.97	H	-53.87	75.55
	5,722.50	-57.12	13.31	-55.87	3.66	H	-46.22	67.90
	7,630.00	-57.79	11.62	-53.21	4.29	V	-45.88	67.56

▣ OPERATING FREQUENTY: 1905.00 MHz

▣ MEASURED OUTPUT POWER: 21.40 dBm = 0.138 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 34.40 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18650 (1855.0)	3,710.00	-56.37	12.52	-61.86	2.90	H	-52.24	73.64
	5,565.00	-57.29	13.29	-57.53	3.60	V	-47.84	69.24
	7,420.00	-57.23	11.72	-51.69	4.34	H	-44.31	65.71
18900 (1880.0)	3,760.00	-57.31	12.56	-62.81	2.91	V	-53.16	74.56
	5,640.00	-56.90	13.30	-56.78	3.64	V	-47.12	68.52
	7,520.00	-58.38	11.70	-53.41	4.09	V	-45.80	67.20
19150 (1905.0)	3,810.00	-57.09	12.60	-62.69	2.97	H	-53.06	74.46
	5,715.00	-57.50	13.31	-56.30	3.67	V	-46.66	68.06
	7,620.00	-57.45	11.62	-52.98	4.33	V	-45.69	67.09

▣ OPERATING FREQUENTY: 1880.00 MHz

▣ MEASURED OUTPUT POWER: 21.58 dBm = 0.144 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 34.58 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18675 (1857.5)	3,715.00	-57.34	12.52	-63.00	2.90	H	-53.38	74.96
	5,572.50	-55.01	13.29	-55.20	3.61	H	-45.52	67.10
	7,430.00	-57.09	11.72	-51.74	4.30	H	-44.32	65.90
18900 (1880.0)	3,760.00	-57.61	12.56	-63.11	2.91	H	-53.46	75.04
	5,640.00	-56.84	13.30	-56.72	3.64	V	-47.06	68.64
	7,520.00	-58.12	11.70	-53.15	4.09	V	-45.54	67.12
19125 (1902.5)	3,805.00	-56.63	12.59	-62.01	2.94	H	-52.36	73.94
	5,707.50	-56.55	13.31	-55.58	3.67	H	-45.94	67.52
	7,610.00	-56.84	11.63	-52.17	4.31	V	-44.85	66.43

▣ OPERATING FREQUENTY: 1900.00 MHz

▣ MEASURED OUTPUT POWER: 21.73 dBm = 0.149 W

▣ MOD: LTE B2

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log_{10} (W) = 34.73 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18700 (1860.0)	3,720.00	-57.46	12.53	-63.30	2.90	H	-53.67	75.40
	5,580.00	-57.04	13.29	-57.03	3.62	V	-47.36	69.09
	7,440.00	-58.20	11.72	-53.04	4.29	V	-45.61	67.34
18900 (1880.0)	3,760.00	-58.16	12.56	-63.66	2.91	V	-54.01	75.74
	5,640.00	-56.82	13.30	-56.70	3.64	H	-47.04	68.77
	7,520.00	-57.83	11.70	-52.86	4.09	H	-45.25	66.98
19100 (1900.0)	3,800.00	-56.95	12.59	-62.10	2.94	H	-52.45	74.18
	5,700.00	-57.19	13.31	-56.58	3.67	H	-46.94	68.67
	7,600.00	-58.11	11.64	-53.35	4.27	H	-45.98	67.71

8.4 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
2	1.4 MHz	1880.0	QPSK	6	0	5.49
			16-QAM	6	0	6.09
	3 MHz		QPSK	15	0	5.45
			16-QAM	15	0	6.20
	5 MHz		QPSK	25	0	5.38
			16-QAM	25	0	6.18
	10 MHz		QPSK	50	0	5.49
			16-QAM	50	0	6.14
	15 MHz		QPSK	75	0	5.44
			16-QAM	75	0	6.18
	20 MHz		QPSK	100	0	5.41
			16-QAM	100	0	6.15

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 61 ~ 66.

8.5 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
5	1.4 MHz	836.5	QPSK	6	0	1.0937
			16-QAM	6	0	1.0887
	3 MHz		QPSK	15	0	2.7029
			16-QAM	15	0	2.7089
	5 MHz		QPSK	25	0	4.5085
			16-QAM	25	0	4.5178
	10 MHz		QPSK	50	0	8.9910
			16-QAM	50	0	8.9929

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
2	1.4 MHz	1880.0	QPSK	6	0	1.0900
			16-QAM	6	0	1.0974
	3 MHz		QPSK	15	0	2.7007
			16-QAM	15	0	2.7008
	5 MHz		QPSK	25	0	4.5011
			16-QAM	25	0	4.5268
	10 MHz		QPSK	50	0	8.9862
			16-QAM	50	0	8.9693
	15 MHz		QPSK	75	0	13.488
			16-QAM	75	0	13.543
	20 MHz		QPSK	100	0	17.937
			16-QAM	100	0	18.004

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 51 ~ 60.

8.6 CONDUCTED SPURIOUS EMISSIONS

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
5	1.4	824.7	3.7069	27.976	-67.267	-39.291	-13.00
		836.5	3.7000	27.976	-67.174	-39.198	
		848.3	3.7005	27.976	-67.432	-39.456	
	3	825.5	3.7189	27.976	-67.313	-39.337	
		836.5	3.7044	27.976	-67.241	-39.265	
		847.5	3.6790	27.976	-67.513	-39.537	
	5	826.5	3.6785	27.976	-67.279	-39.303	
		836.5	3.7124	27.976	-67.294	-39.318	
		846.5	3.7149	27.976	-67.199	-39.223	
	10	829.0	3.7084	27.976	-67.022	-39.046	
		836.5	3.6905	27.976	-67.072	-39.096	
		844.0	3.6785	27.976	-67.239	-39.263	

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
2	1.4	1850.7	3.6925	27.976	-76.784	-48.808	-13.00
		1880.0	3.6885	27.976	-77.024	-49.048	
		1909.3	3.7064	27.976	-76.682	-48.706	
	3	1851.5	3.7005	27.976	-77.284	-49.308	
		1880.0	3.7104	27.976	-77.328	-49.352	
		1908.5	3.7104	27.976	-77.133	-49.157	
	5	1852.5	3.6810	27.976	-76.701	-48.725	
		1880.0	3.6775	27.976	-77.153	-49.177	
		1907.5	3.6955	27.976	-77.274	-49.298	
	10	1855.0	3.7104	27.976	-76.978	-49.002	
		1880.0	3.6940	27.976	-77.285	-49.309	
		1905.0	3.6780	27.976	-77.155	-49.179	
	15	1857.5	1.8246	27.976	-77.193	-49.217	
		1880.0	3.7209	27.976	-77.330	-49.354	
		1902.5	3.7024	27.976	-77.322	-49.346	
	20	1860.0	3.7154	27.976	-77.331	-49.355	
		1880.0	3.7214	27.976	-77.175	-49.199	
		1900.0	3.7124	27.976	-77.175	-49.199	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 97 ~ 120.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20	30.131

8.7 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 67 ~ 96.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE B5

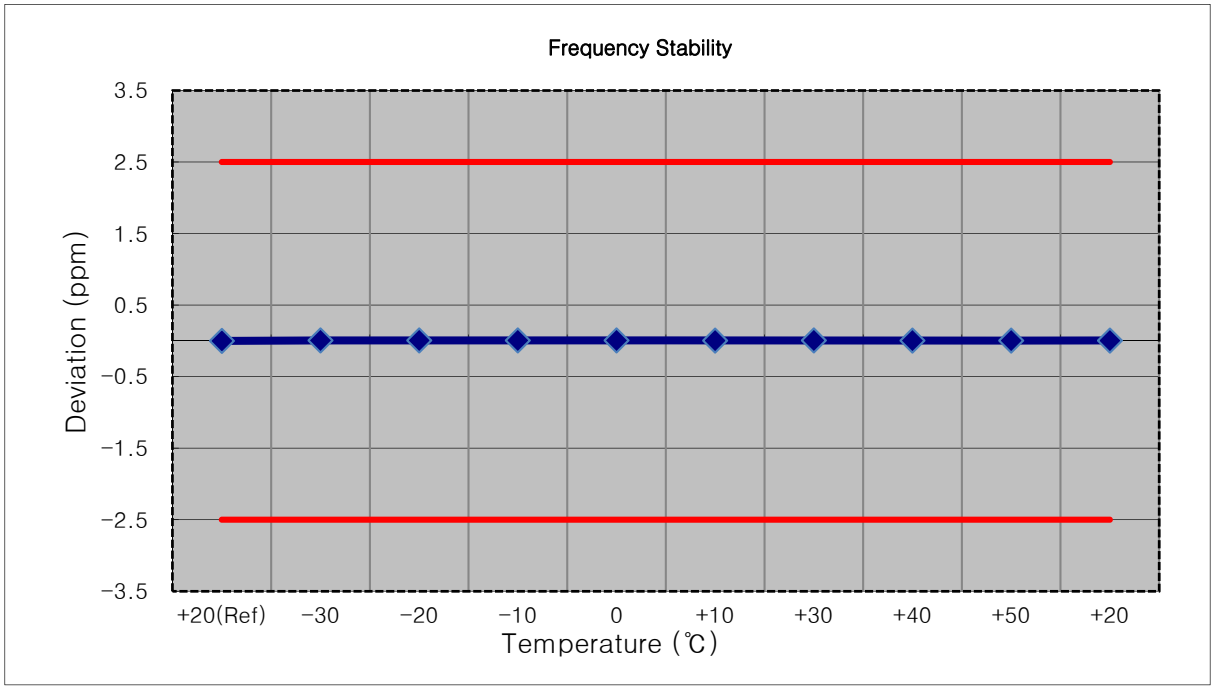
▣ OPERATING FREQUENCY: 836,500,000 Hz

▣ CHANNEL: 20525 (1.4 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	836 499 995	0.0	0.000 000	0.000
100%		-30	836 500 000	5.2	0.000 001	0.006
100%		-20	836 500 001	6.4	0.000 001	0.008
100%		-10	836 500 000	5.4	0.000 001	0.006
100%		0	836 500 000	5.1	0.000 001	0.006
100%		+10	836 500 000	4.8	0.000 001	0.006
100%		+30	836 500 000	5.0	0.000 001	0.006
100%		+40	836 499 999	3.6	0.000 000	0.004
100%		+50	836 499 999	3.7	0.000 000	0.004
Batt. Endpoint	3.70	+20	836 499 999	4.1	0.000 000	0.005



▣ MODE: LTE B5

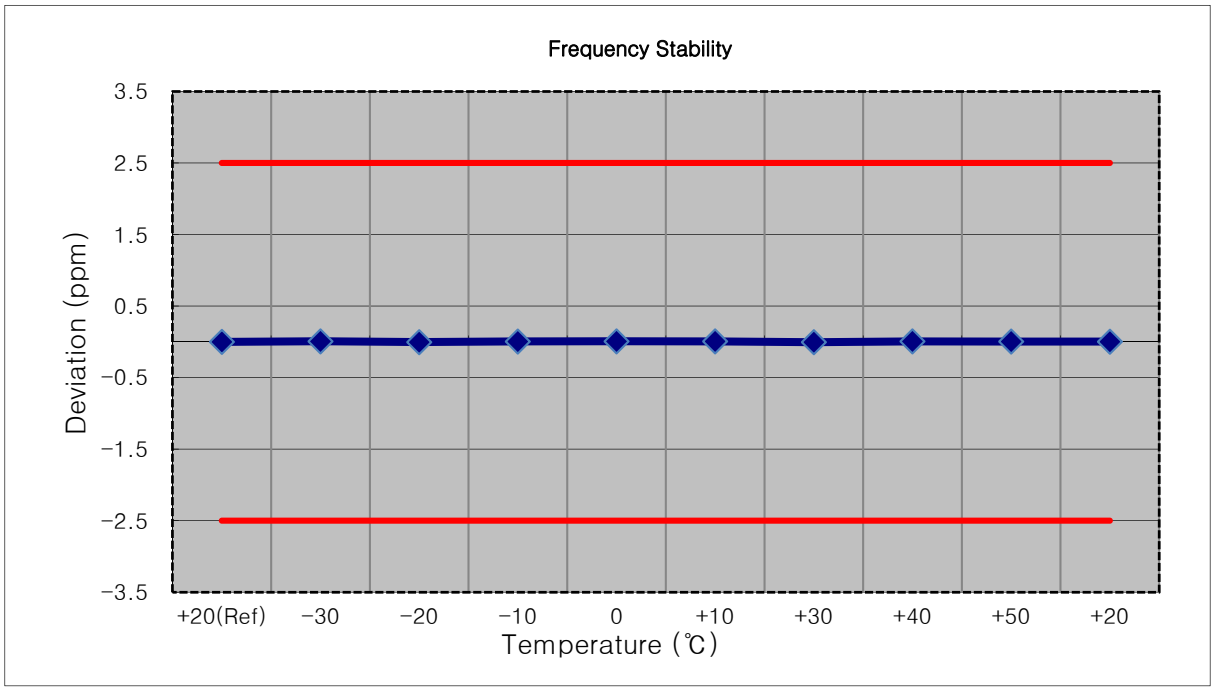
▣ OPERATING FREQUENCY: 836,500,000 Hz

▣ CHANNEL: 20525 (3 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	836 500 005	0.0	0.000 000	0.000
100%		-30	836 500 011	6.3	0.000 001	0.008
100%		-20	836 500 002	-2.7	0.000 000	-0.003
100%		-10	836 500 010	4.8	0.000 001	0.006
100%		0	836 500 012	6.8	0.000 001	0.008
100%		+10	836 500 010	5.0	0.000 001	0.006
100%		+30	836 500 001	-4.3	-0.000 001	-0.005
100%		+40	836 500 010	5.0	0.000 001	0.006
100%		+50	836 500 008	3.4	0.000 000	0.004
Batt. Endpoint	3.70	+20	836 500 008	2.9	0.000 000	0.003



▣ MODE: LTE B5

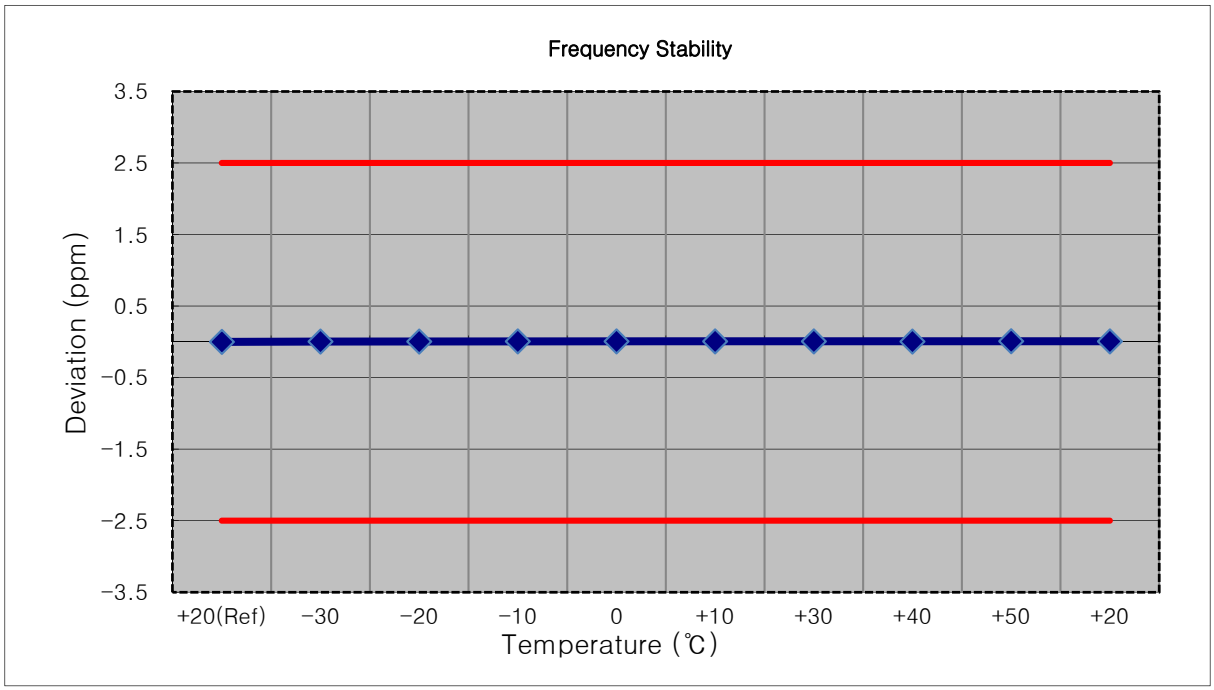
▣ OPERATING FREQUENCY: 836,500,000 Hz

▣ CHANNEL: 20525 (5 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	836 500 007	0.0	0.000 000	0.000
100%		-30	836 500 011	4.0	0.000 000	0.005
100%		-20	836 500 011	3.9	0.000 000	0.005
100%		-10	836 500 012	5.4	0.000 001	0.006
100%		0	836 500 014	6.7	0.000 001	0.008
100%		+10	836 500 013	6.3	0.000 001	0.008
100%		+30	836 500 013	6.2	0.000 001	0.007
100%		+40	836 500 011	4.3	0.000 001	0.005
100%		+50	836 500 014	7.4	0.000 001	0.009
Batt. Endpoint	3.70	+20	836 500 013	6.2	0.000 001	0.007



▣ MODE: LTE B5

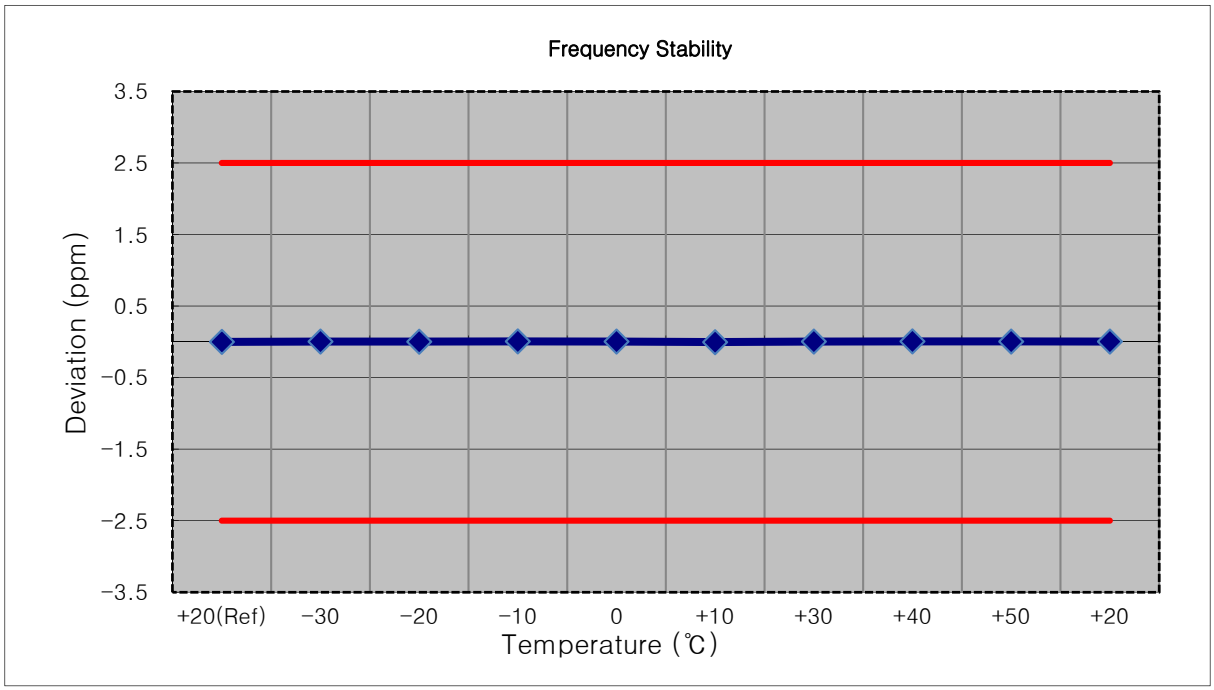
▣ OPERATING FREQUENCY: 836,500,000 Hz

▣ CHANNEL: 20525 (10 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	836 500 004	0.0	0.000 000	0.000
100%		-30	836 500 008	3.9	0.000 000	0.005
100%		-20	836 500 006	2.6	0.000 000	0.003
100%		-10	836 500 009	5.6	0.000 001	0.007
100%		0	836 500 007	3.4	0.000 000	0.004
100%		+10	836 500 001	-3.1	0.000 000	-0.004
100%		+30	836 500 007	3.8	0.000 000	0.005
100%		+40	836 500 009	5.3	0.000 001	0.006
100%		+50	836 500 008	4.4	0.000 001	0.005
Batt. Endpoint	3.70	+20	836 500 007	3.6	0.000 000	0.004



▣ MODE: LTE B2

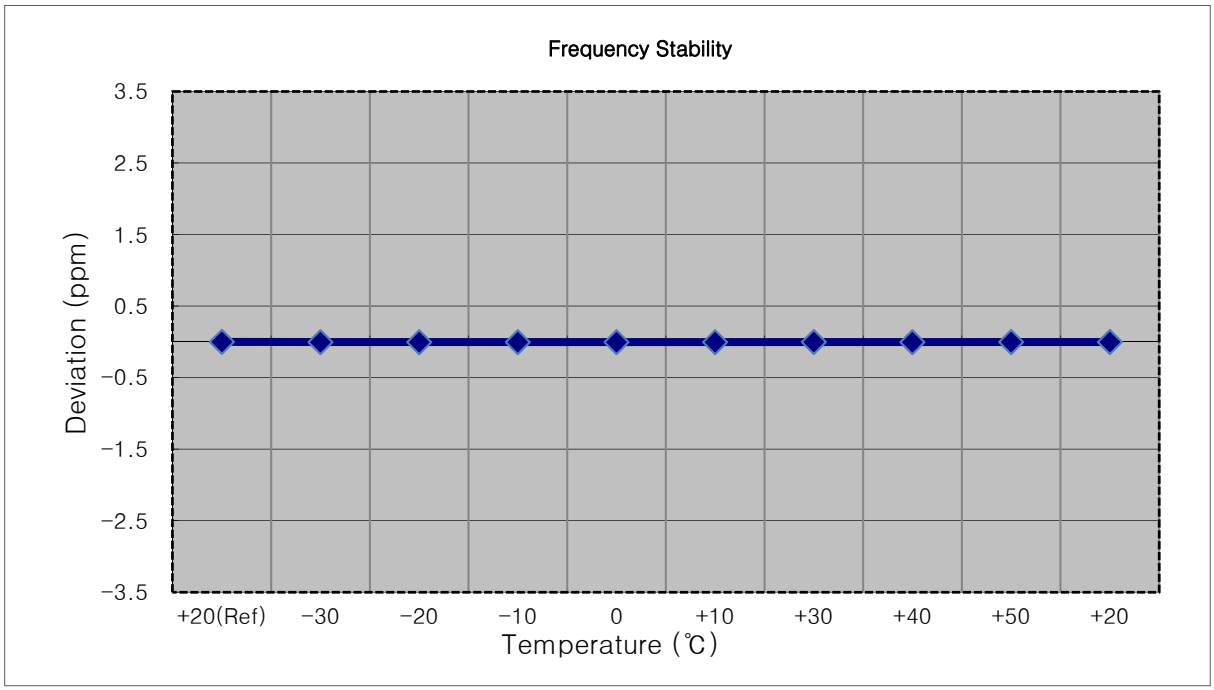
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (1.4 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1879 999 992	0.0	0.000 000	0.000
100%		-30	1879 999 985	-7.1	0.000 000	-0.004
100%		-20	1879 999 985	-7.2	0.000 000	-0.004
100%		-10	1879 999 983	-8.9	0.000 000	-0.005
100%		0	1879 999 985	-6.4	0.000 000	-0.003
100%		+10	1879 999 985	-6.8	0.000 000	-0.004
100%		+30	1879 999 987	-5.1	0.000 000	-0.003
100%		+40	1879 999 985	-7.2	0.000 000	-0.004
100%		+50	1879 999 987	-4.8	0.000 000	-0.003
Batt. Endpoint	3.70	+20	1879 999 988	-3.6	0.000 000	-0.002



▣ MODE: LTE B2

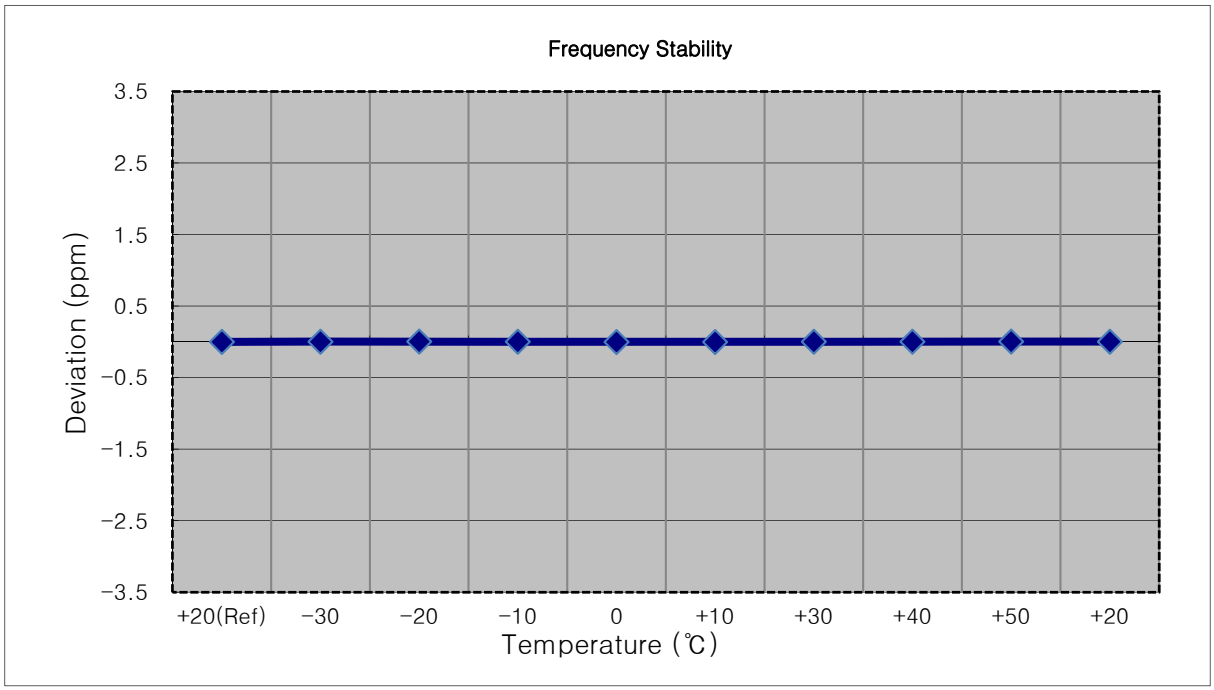
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (3 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1879 999 996	0.0	0.000 000	0.000
100%		-30	1880 000 002	5.5	0.000 000	0.003
100%		-20	1880 000 005	8.8	0.000 000	0.005
100%		-10	1880 000 001	5.3	0.000 000	0.003
100%		0	1879 999 991	-5.3	0.000 000	-0.003
100%		+10	1879 999 991	-4.6	0.000 000	-0.002
100%		+30	1880 000 002	5.8	0.000 000	0.003
100%		+40	1880 000 001	5.2	0.000 000	0.003
100%		+50	1880 000 003	7.4	0.000 000	0.004
Batt. Endpoint	3.70	+20	1880 000 002	5.5	0.000 000	0.003



▣ MODE: LTE B2

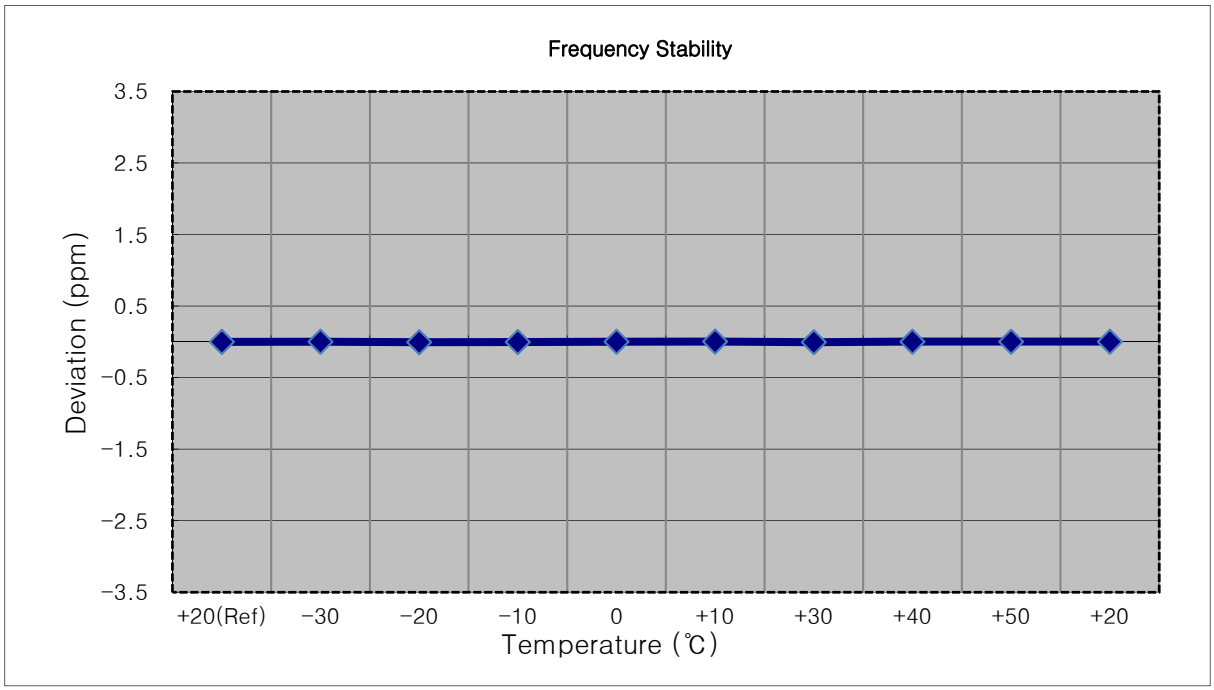
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (5 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1880 000 006	0.0	0.000 000	0.000
100%		-30	1880 000 010	4.3	0.000 000	0.002
100%		-20	1879 999 998	-7.9	0.000 000	-0.004
100%		-10	1880 000 001	-4.7	0.000 000	-0.002
100%		0	1880 000 010	4.1	0.000 000	0.002
100%		+10	1880 000 013	7.4	0.000 000	0.004
100%		+30	1879 999 996	-9.7	-0.000 001	-0.005
100%		+40	1880 000 012	6.2	0.000 000	0.003
100%		+50	1880 000 011	5.8	0.000 000	0.003
Batt. Endpoint	3.70	+20	1880 000 011	5.6	0.000 000	0.003



▣ MODE: LTE B2

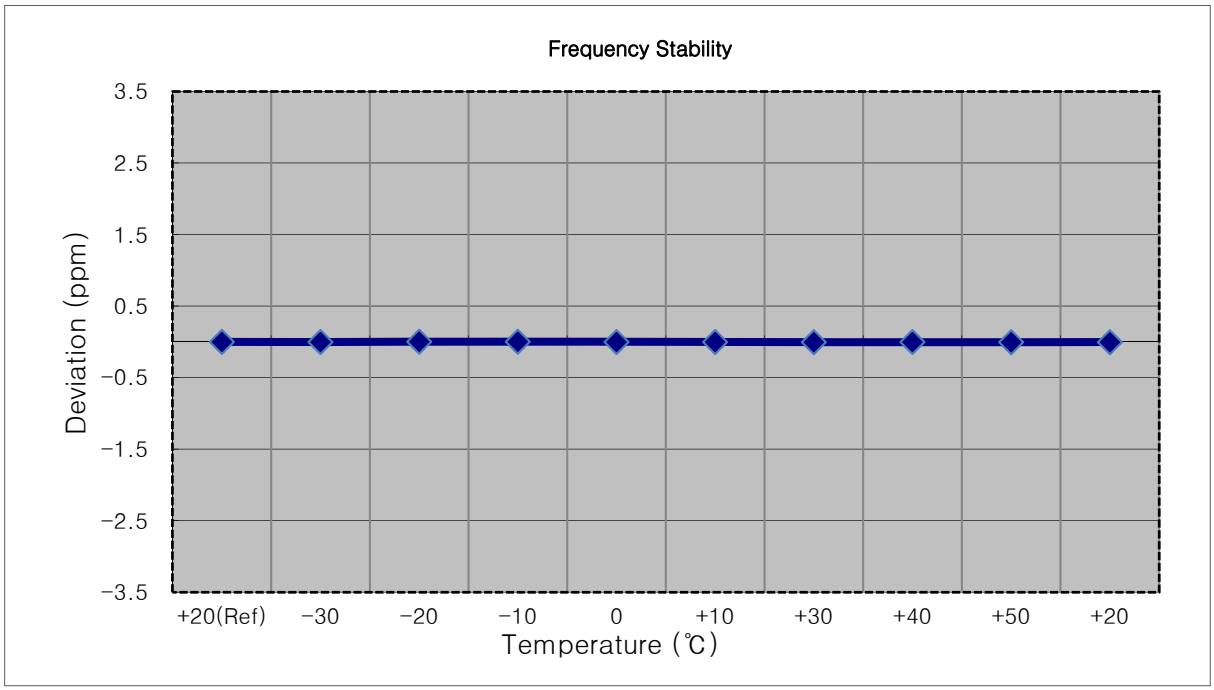
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (10 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1879 999 993	0.0	0.000 000	0.000
100%		-30	1879 999 988	-4.6	0.000 000	-0.002
100%		-20	1879 999 998	5.2	0.000 000	0.003
100%		-10	1879 999 998	5.0	0.000 000	0.003
100%		0	1879 999 990	-3.5	0.000 000	-0.002
100%		+10	1879 999 989	-3.7	0.000 000	-0.002
100%		+30	1879 999 986	-7.1	0.000 000	-0.004
100%		+40	1879 999 989	-3.9	0.000 000	-0.002
100%		+50	1879 999 983	-9.8	-0.000 001	-0.005
Batt. Endpoint	3.70	+20	1879 999 987	-6.0	0.000 000	-0.003



▣ MODE: LTE B2

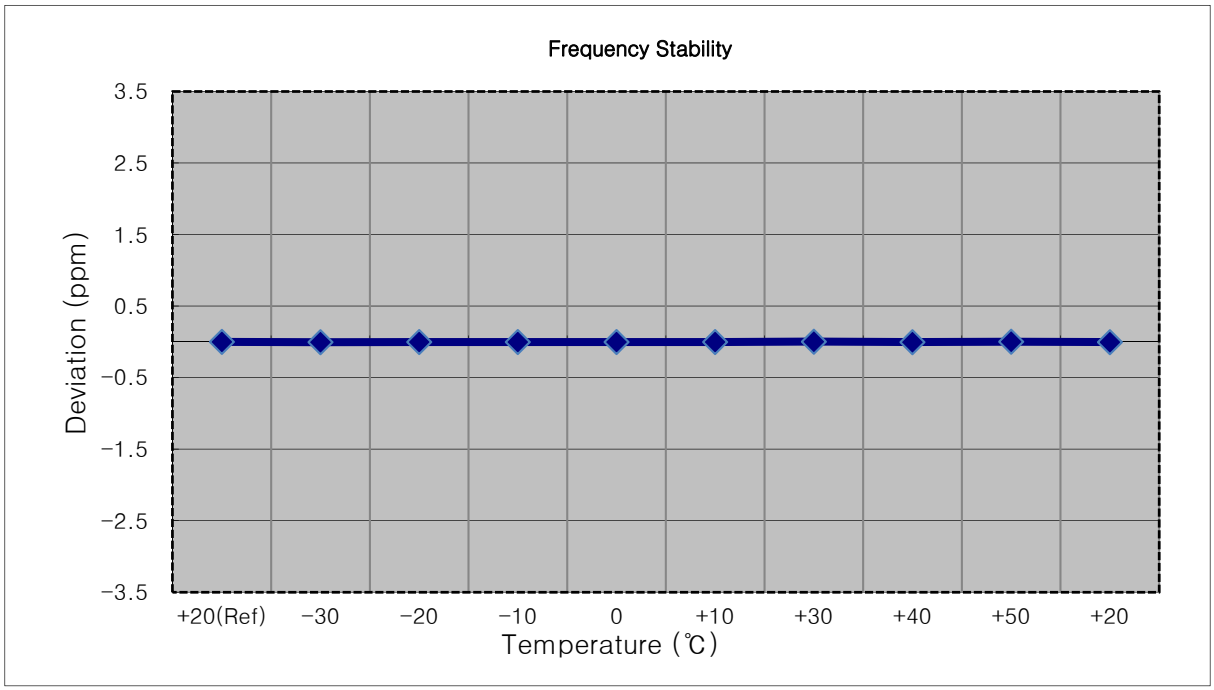
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (15 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1879 999 996	0.0	0.000 000	0.000
100%		-30	1879 999 986	-9.2	0.000 000	-0.005
100%		-20	1879 999 992	-4.1	0.000 000	-0.002
100%		-10	1879 999 991	-4.3	0.000 000	-0.002
100%		0	1879 999 991	-5.1	0.000 000	-0.003
100%		+10	1879 999 991	-4.8	0.000 000	-0.003
100%		+30	1880 000 002	6.3	0.000 000	0.003
100%		+40	1879 999 990	-6.0	0.000 000	-0.003
100%		+50	1880 000 000	3.9	0.000 000	0.002
Batt. Endpoint	3.70	+20	1879 999 989	-7.0	0.000 000	-0.004



▣ MODE: LTE B2

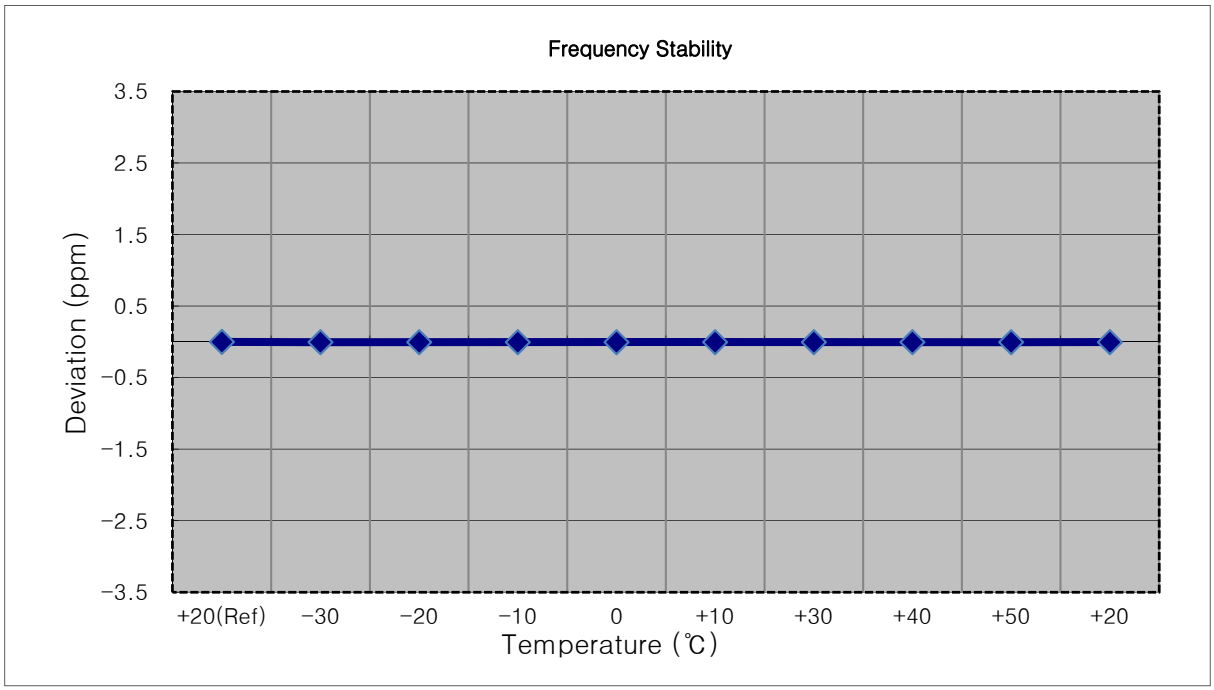
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (20 MHz)

▣ REFERENCE VOLTAGE: 4.00 VDC

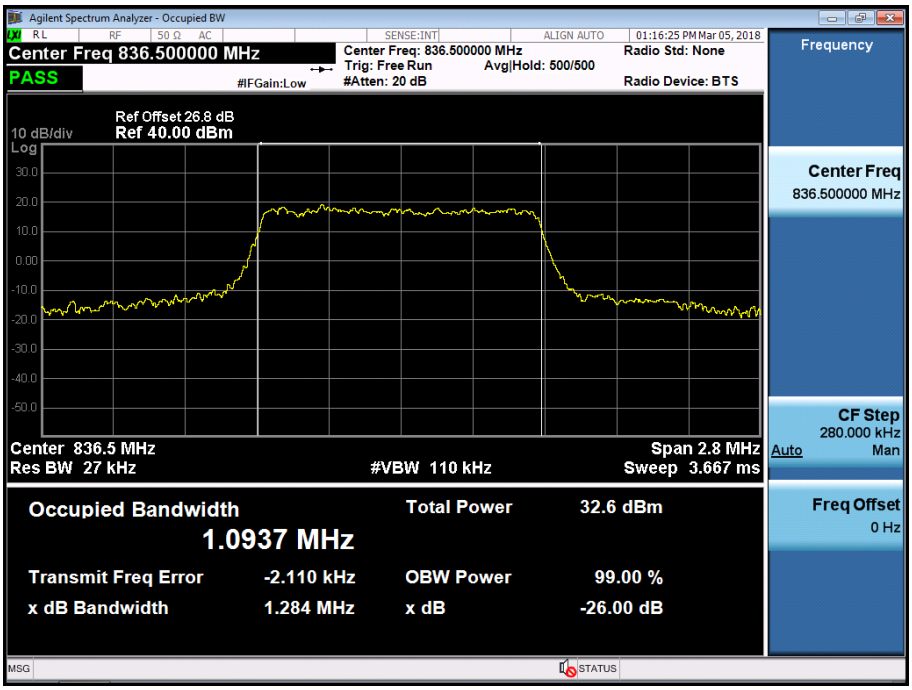
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.00	+20(Ref)	1879 999 995	0.0	0.000 000	0.000
100%		-30	1879 999 986	-8.9	0.000 000	-0.005
100%		-20	1879 999 988	-7.4	0.000 000	-0.004
100%		-10	1879 999 988	-7.1	0.000 000	-0.004
100%		0	1879 999 988	-7.3	0.000 000	-0.004
100%		+10	1879 999 986	-9.1	0.000 000	-0.005
100%		+30	1879 999 989	-6.2	0.000 000	-0.003
100%		+40	1879 999 989	-6.4	0.000 000	-0.003
100%		+50	1879 999 987	-7.9	0.000 000	-0.004
Batt. Endpoint	3.70	+20	1879 999 989	-6.3	0.000 000	-0.003

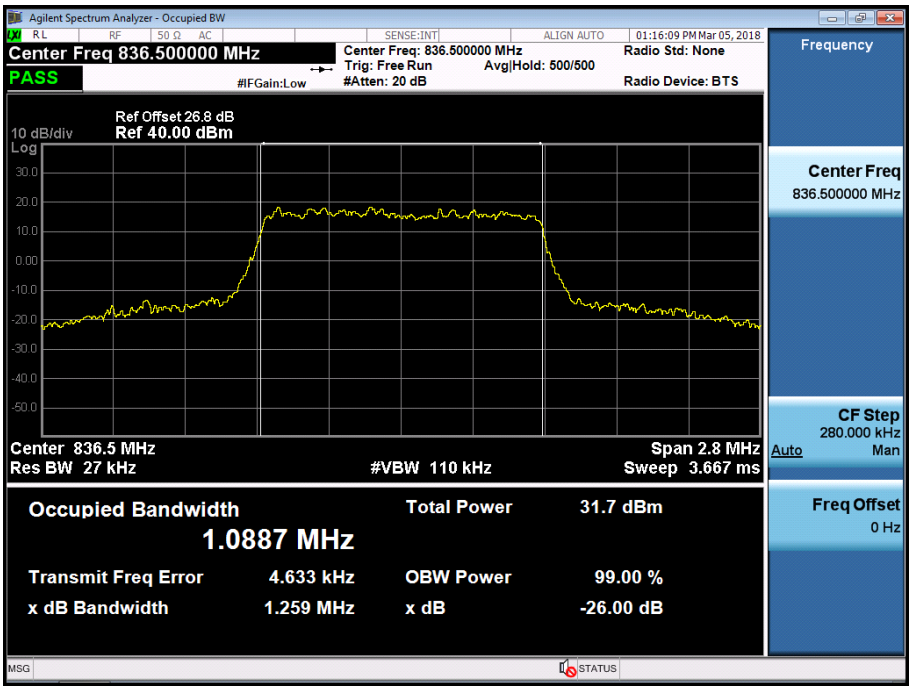


9. TEST PLOTS

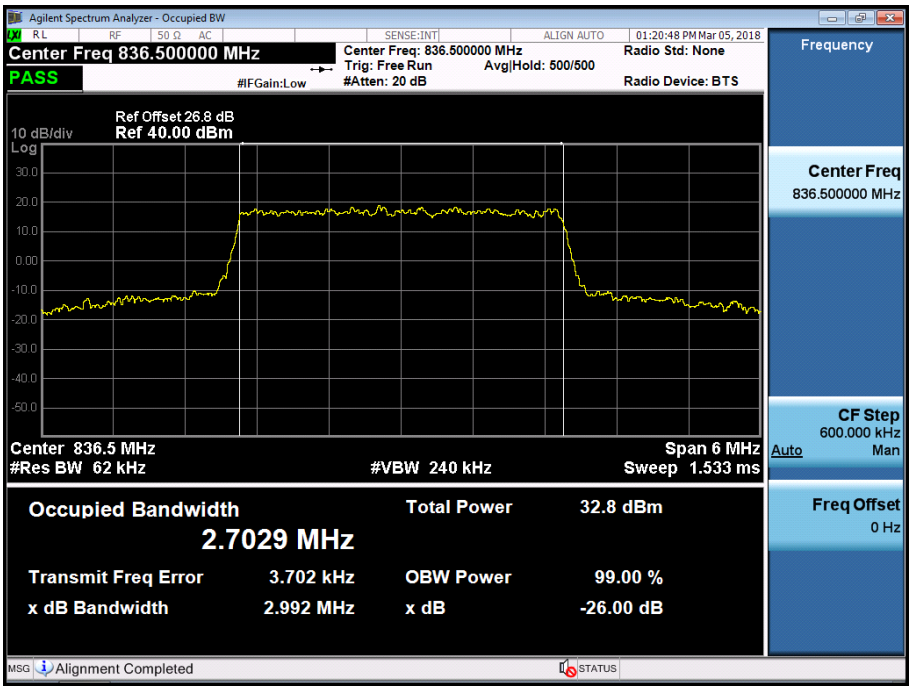
BAND 5. Occupied Bandwidth Plot (1.4M BW Ch.20525 QPSK_RB6_0)



BAND 5. Occupied Bandwidth Plot (1.4M BW Ch.20525 16QAM_RB6_0)



BAND 5. Occupied Bandwidth Plot (3M BW Ch.20525 QPSK_RB15_0)



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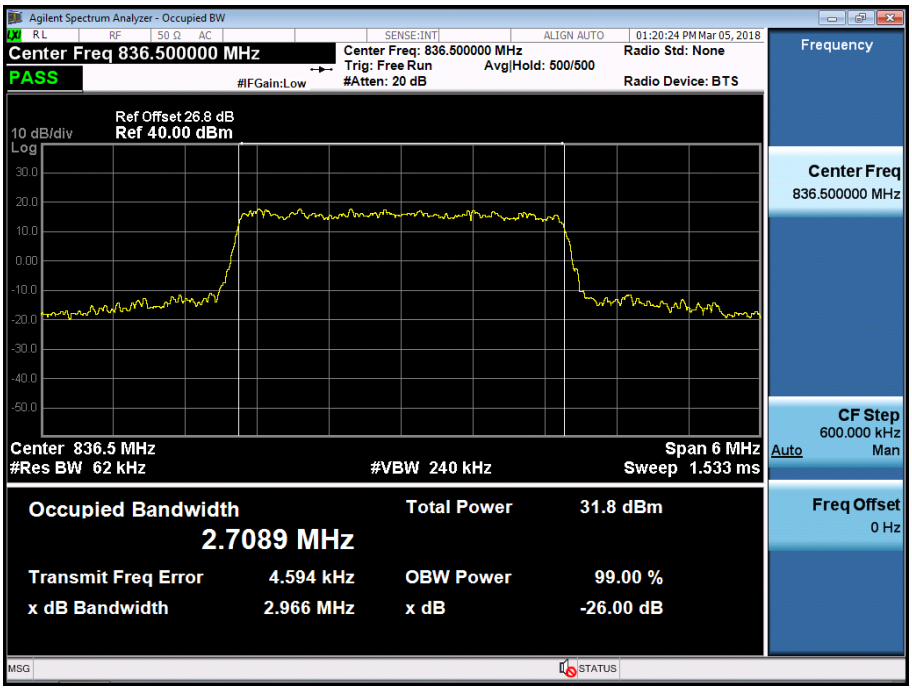

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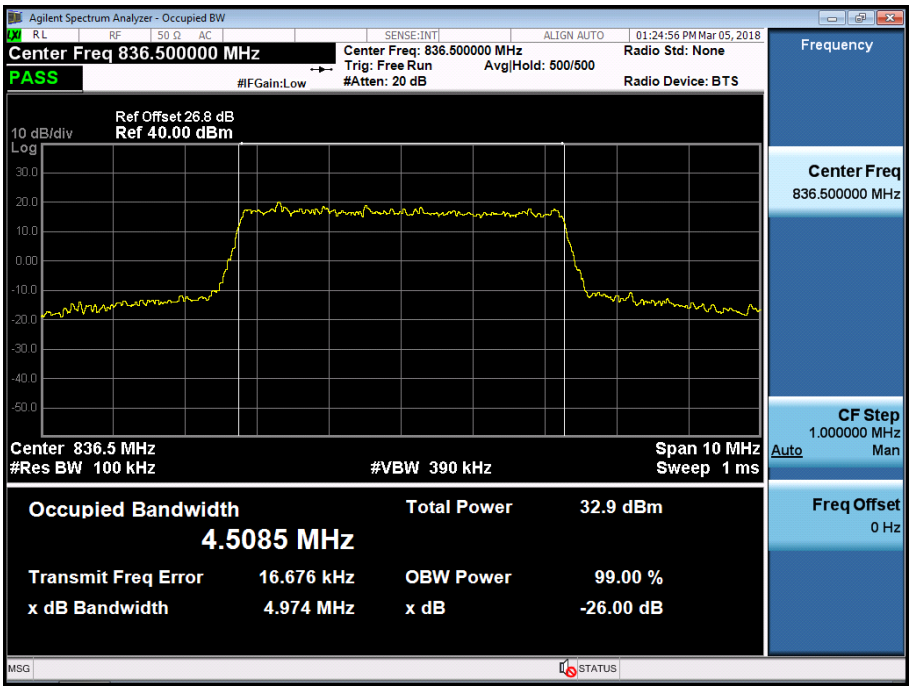

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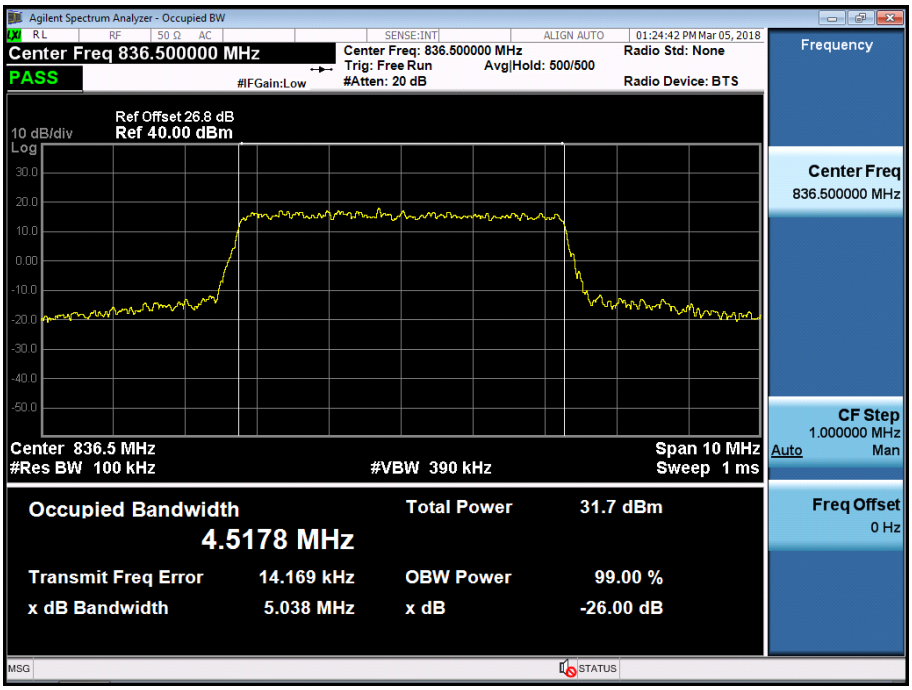
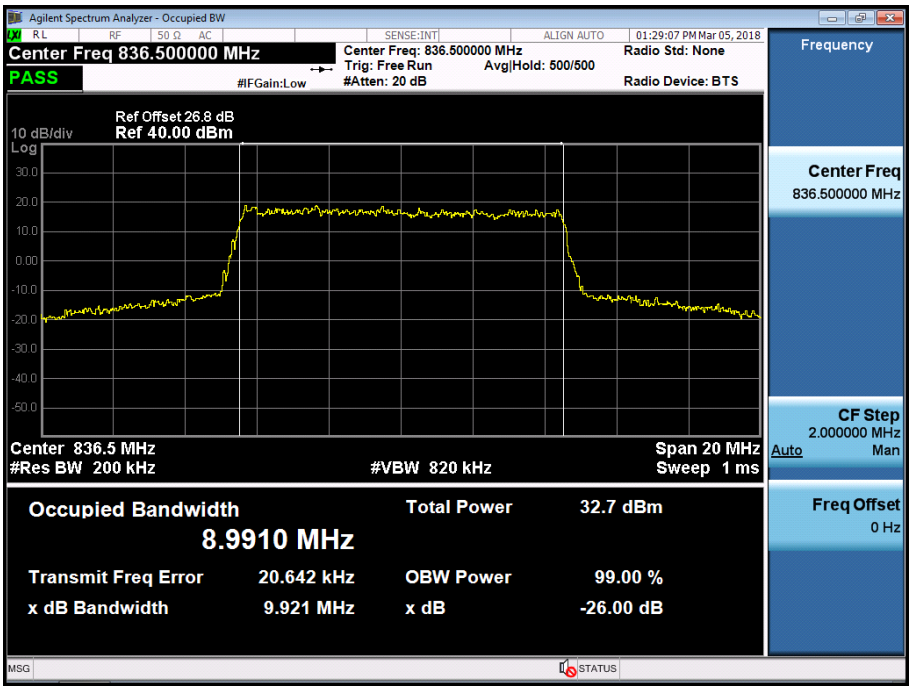


BAND 5. Occupied Bandwidth Plot (10M BW Ch.20525 QPSK_RB50_0)



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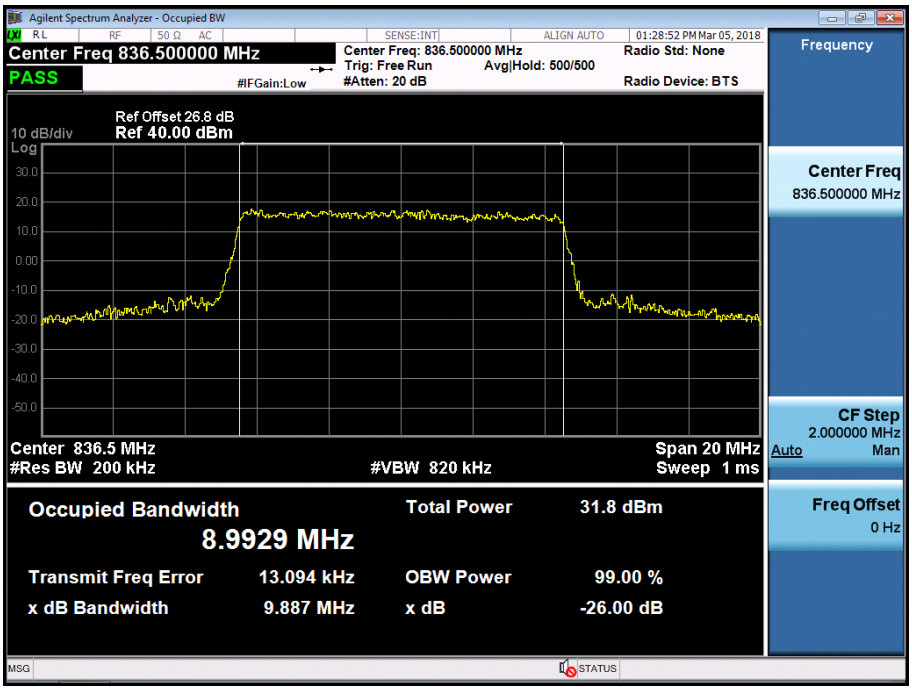
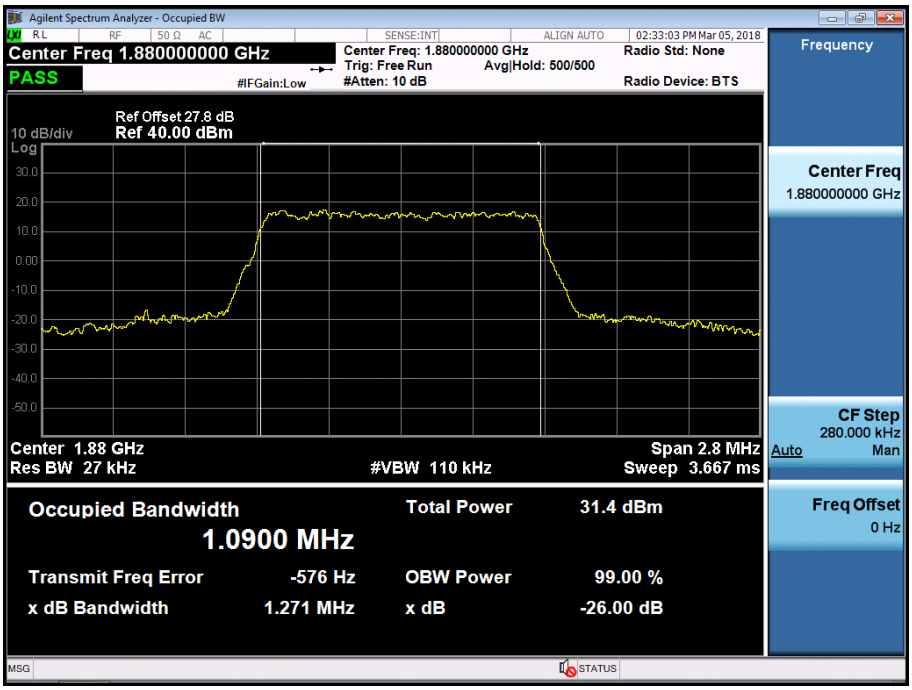
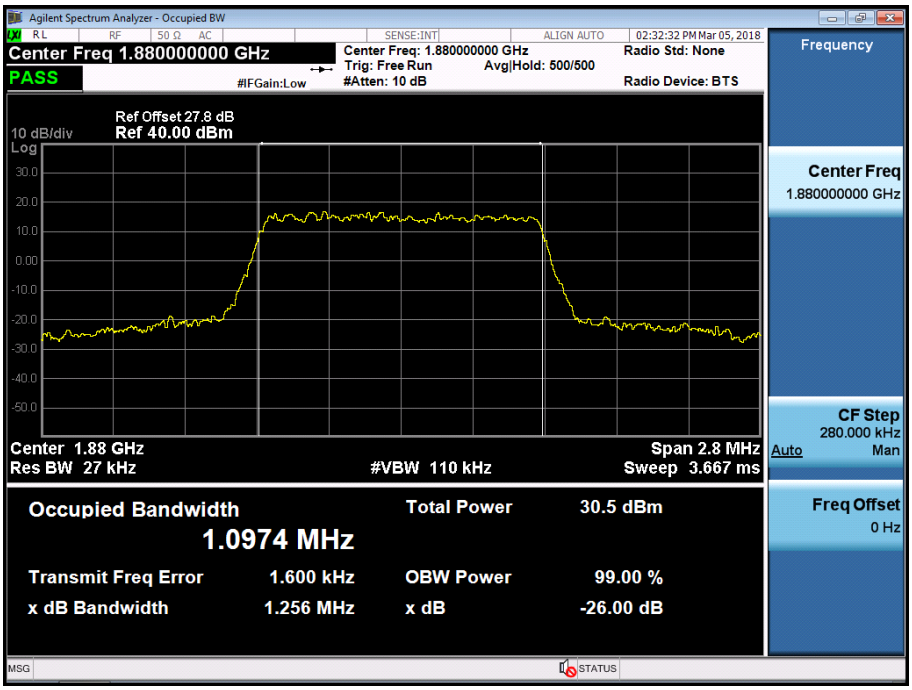


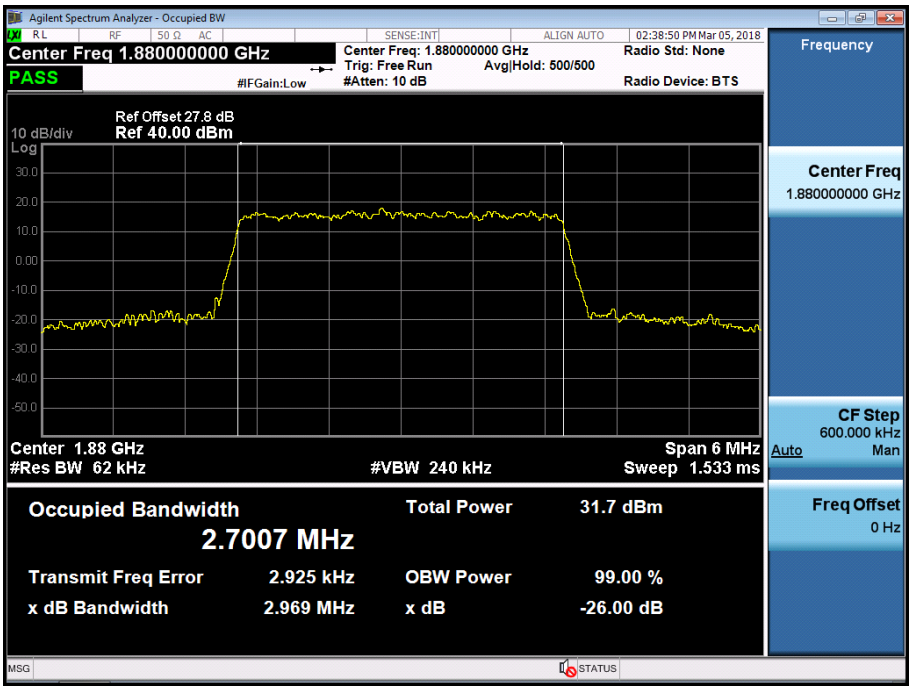
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 QPSK RB 6_0)



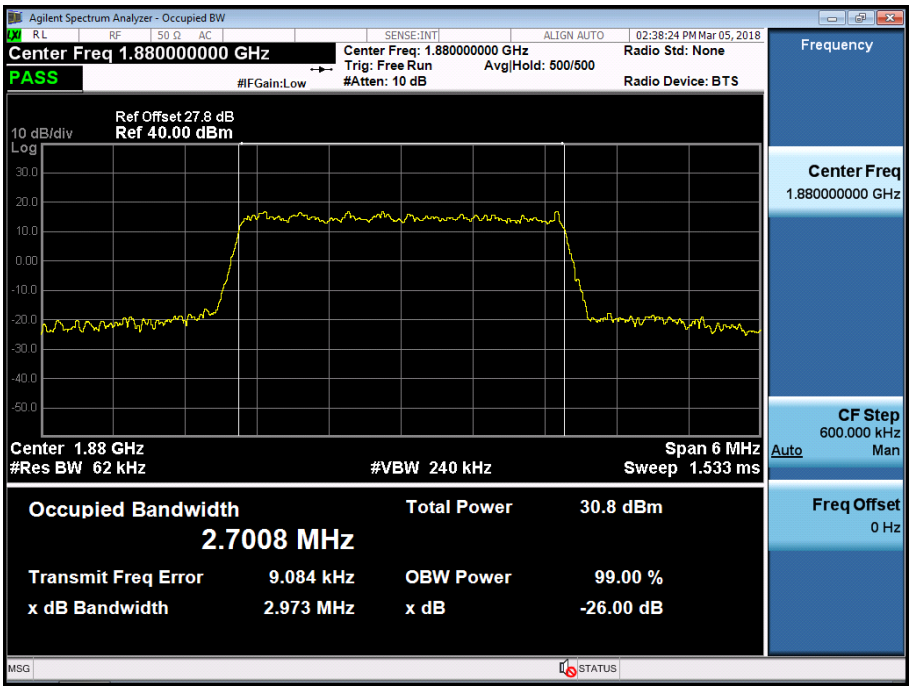
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 16QAM RB 6_0)



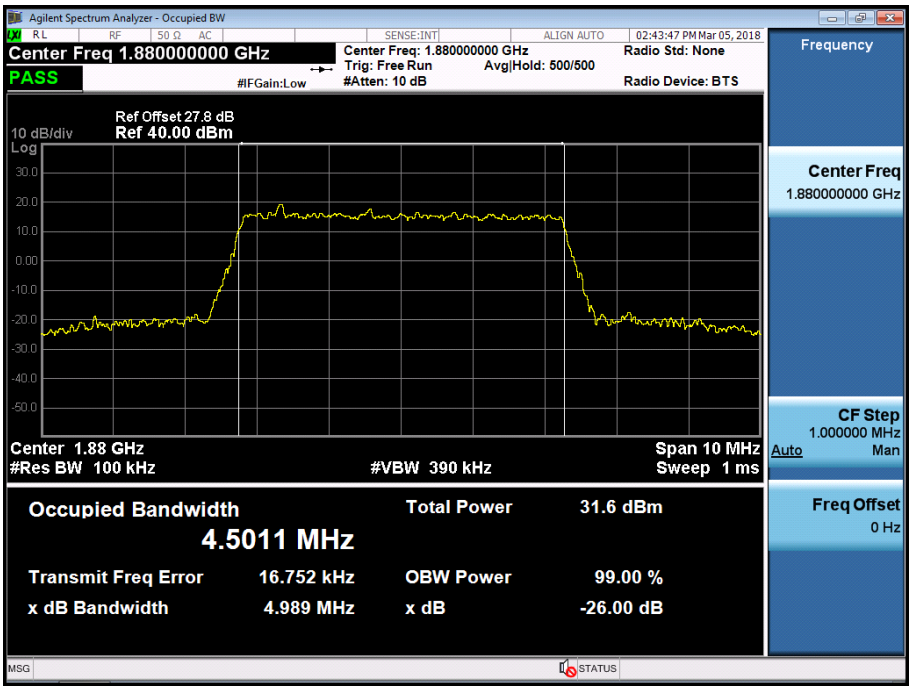
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 QPSK RB 15_0)



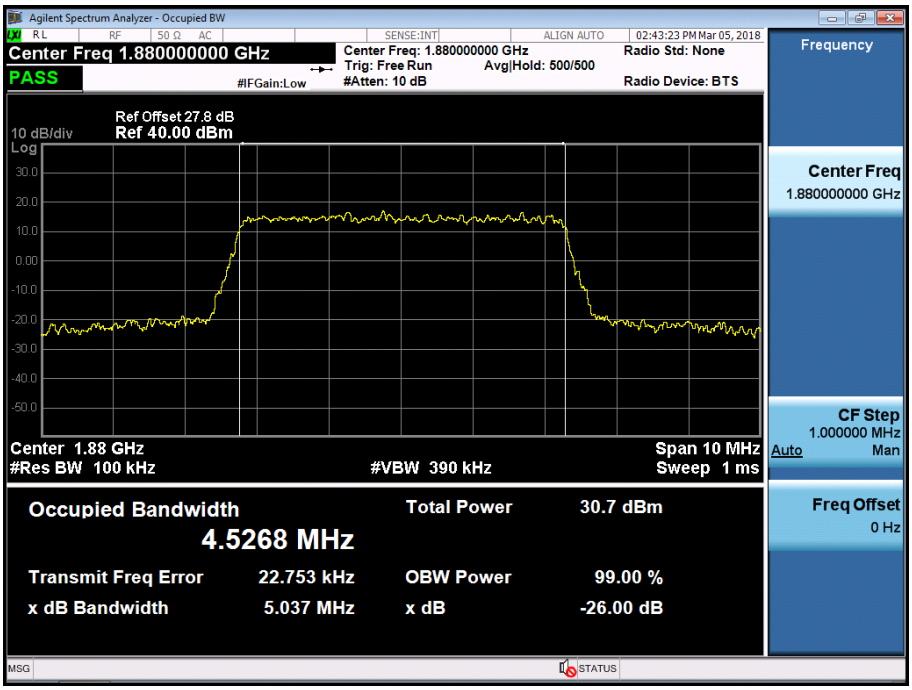
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 16QAM RB 15_0)



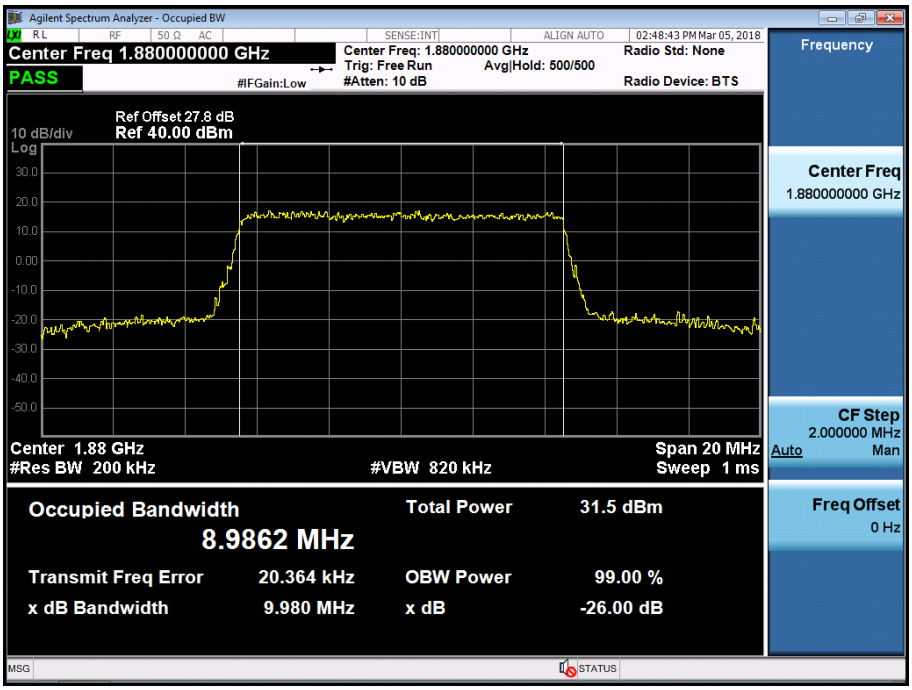
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 QPSK RB 25_0)



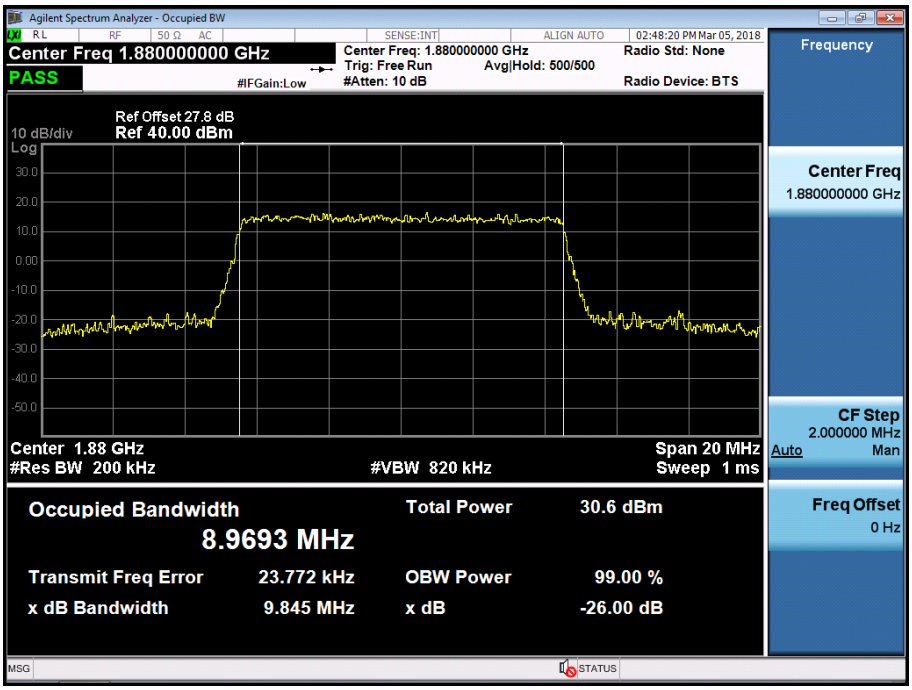
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 16QAM RB 25_0)



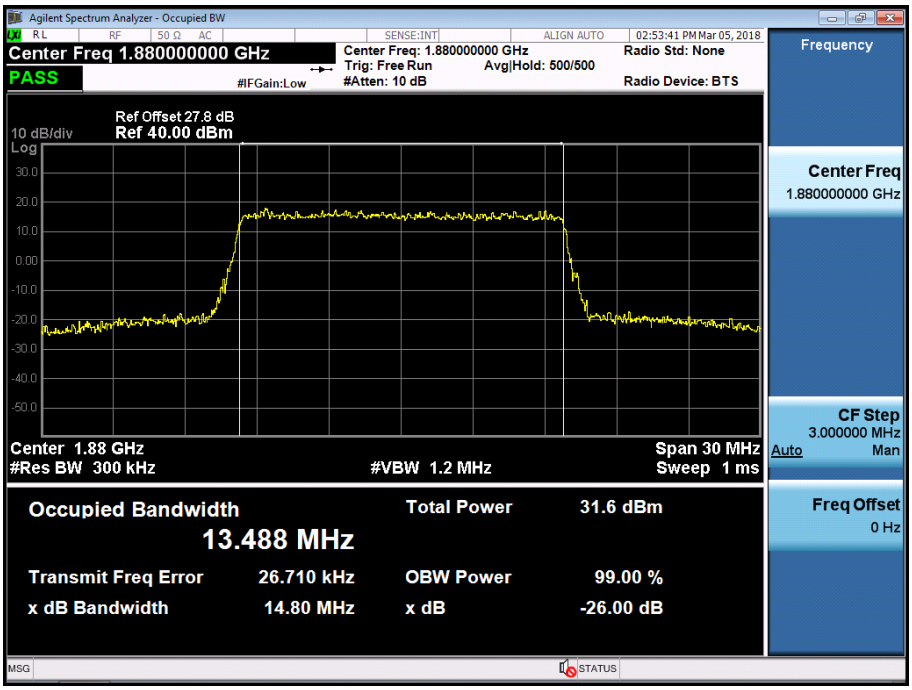
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 QPSK RB 50_0)



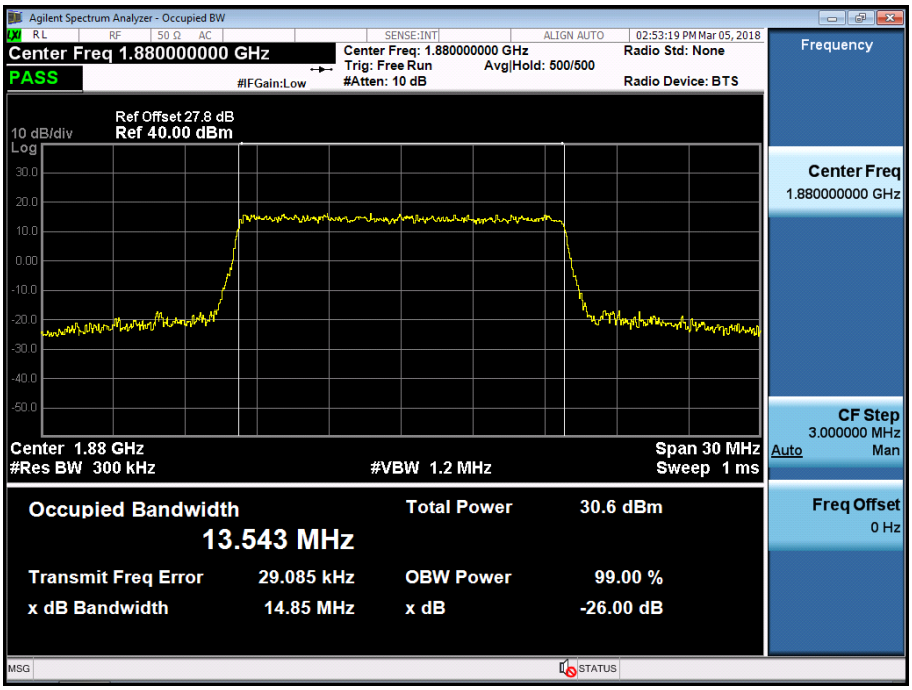
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 16QAM RB 50_0)



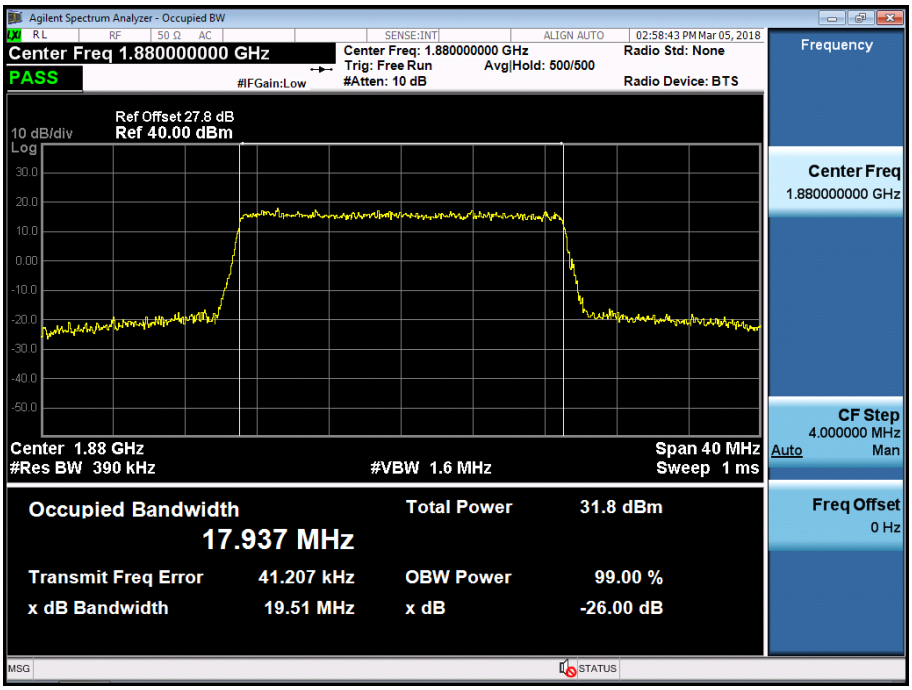
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 QPSK RB 75_0)



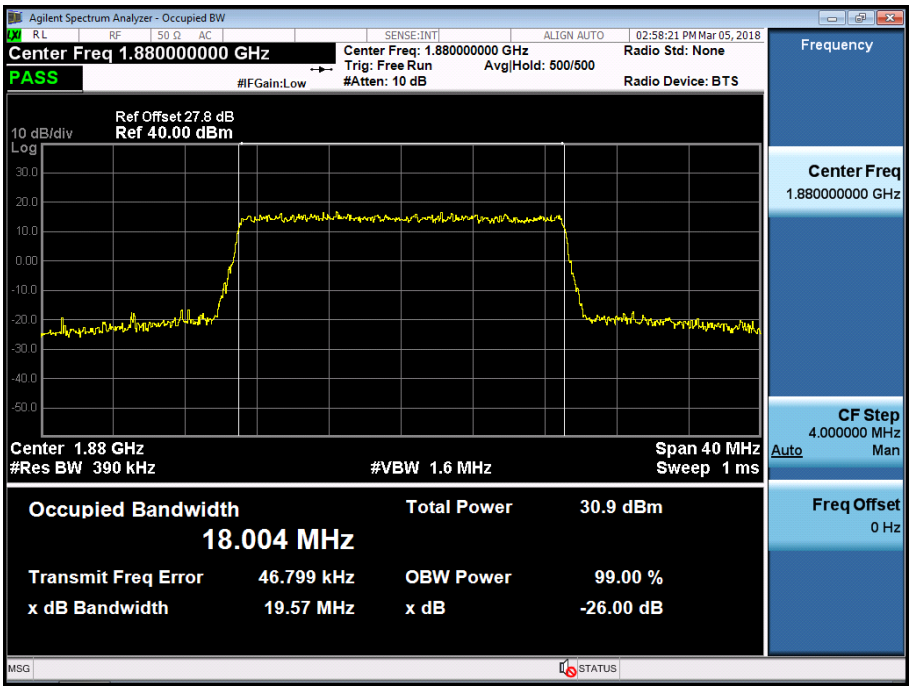
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 16QAM RB 75_0)



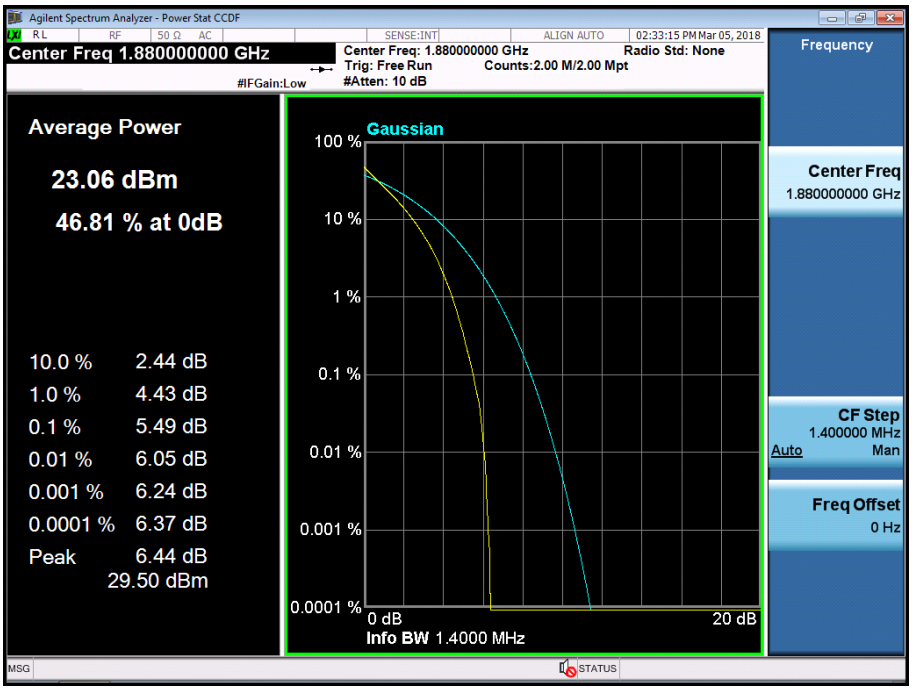
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 QPSK RB 100_0)



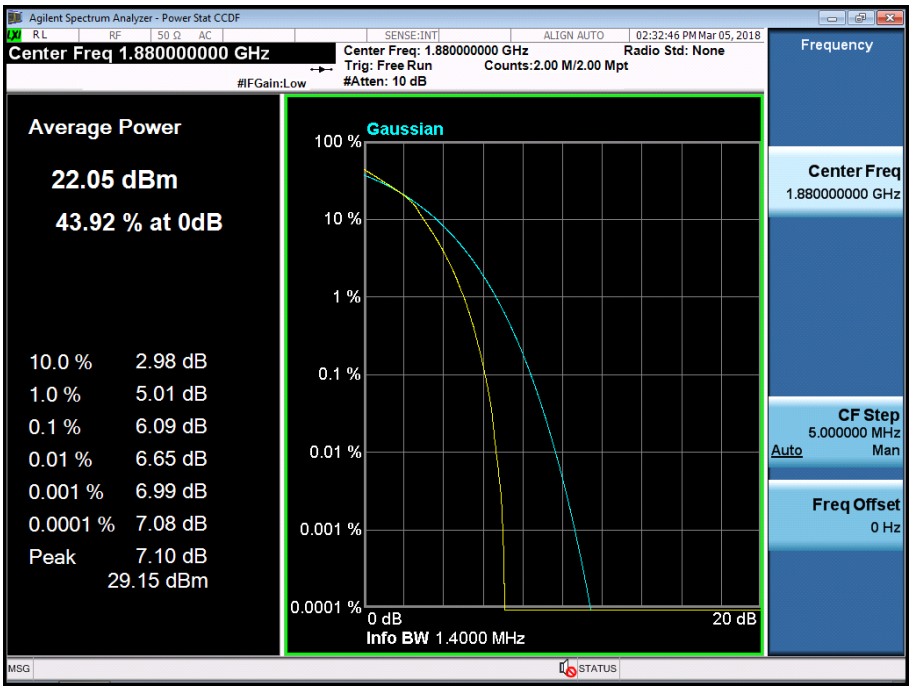
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 16QAM RB 100_0)



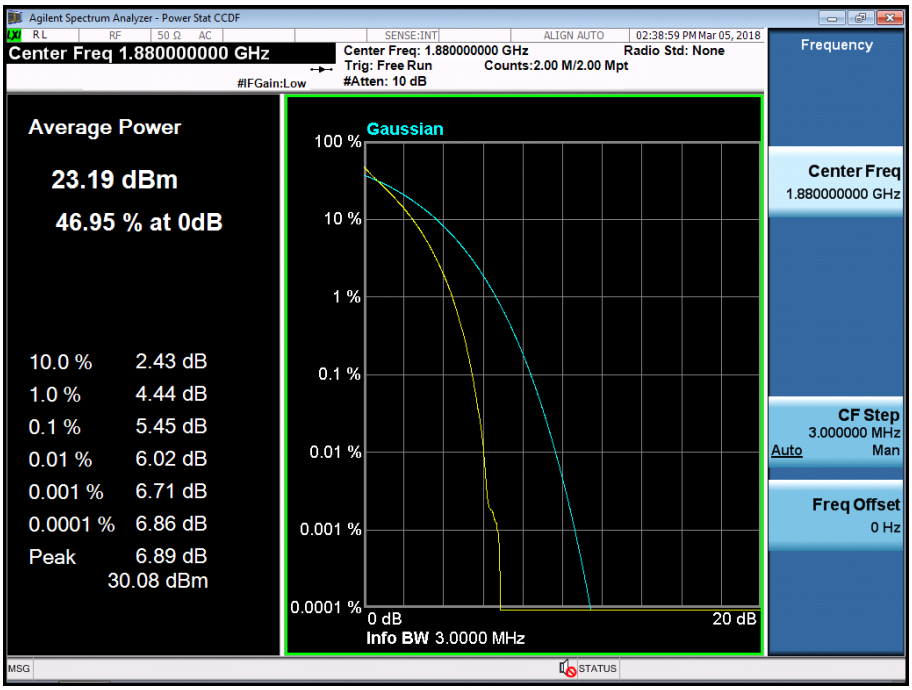
BAND 2. PAR Plot (1.4M BW Ch.18900 QPSK RB 6_0)



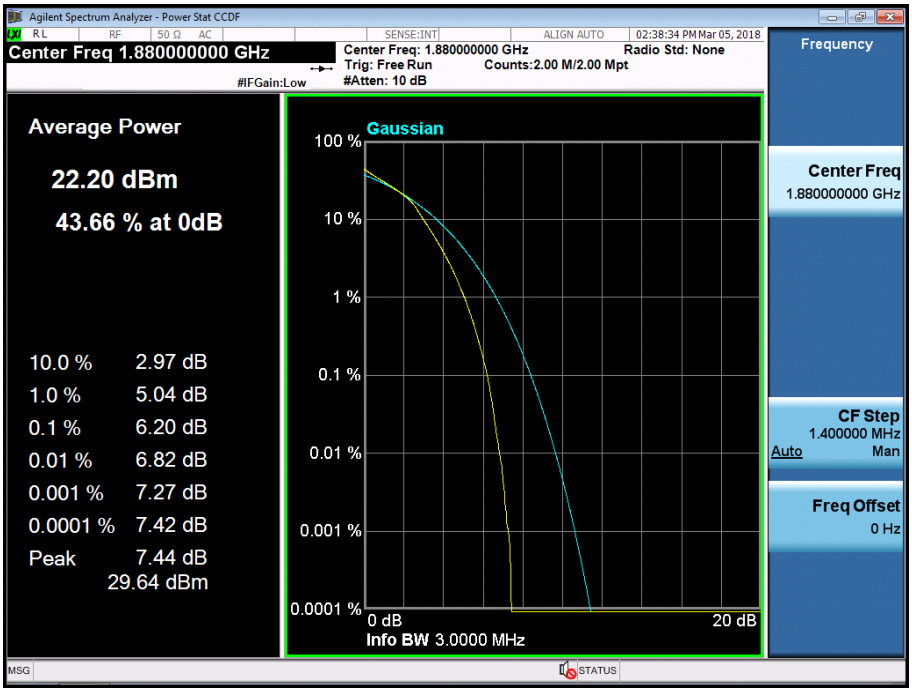
BAND 2. PAR Plot (1.4M BW Ch.18900 16QAM RB 6_0)



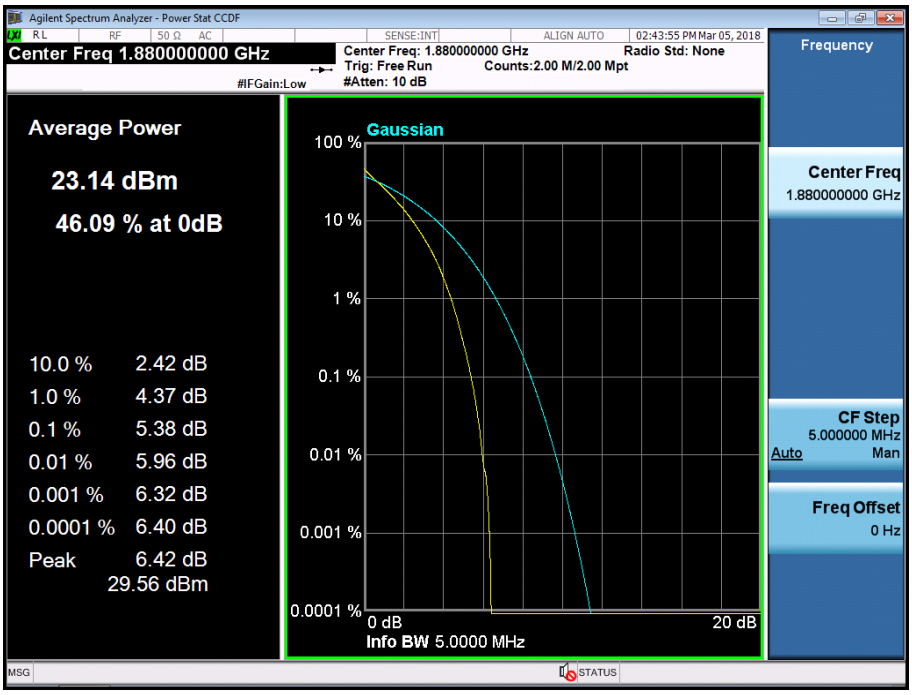
BAND 2. PAR Plot (3M BW Ch.18900 QPSK RB 15_0)



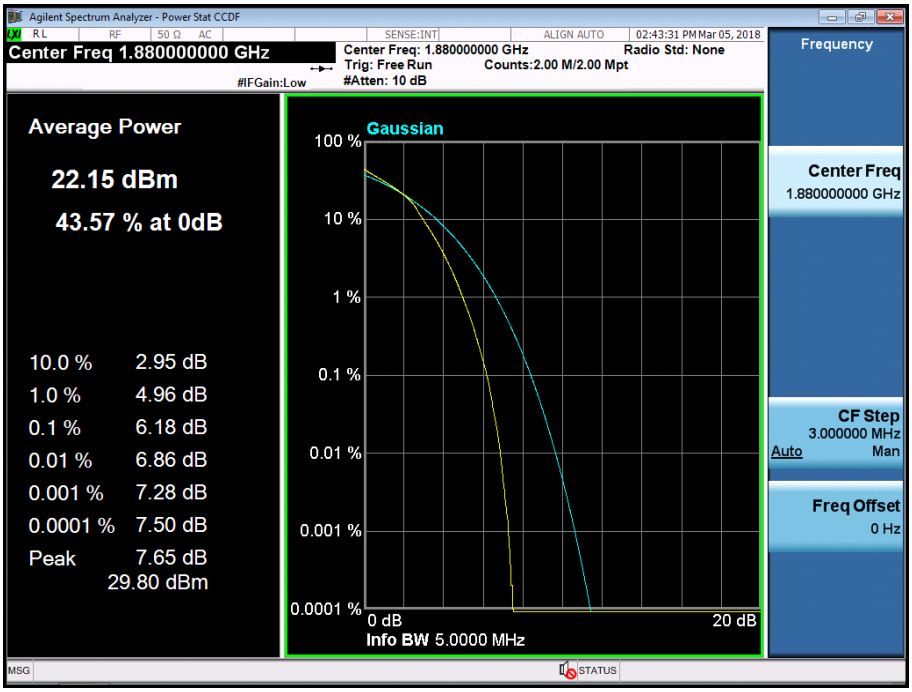
BAND 2. PAR Plot (3M BW Ch.18900 16QAM RB 15_0)



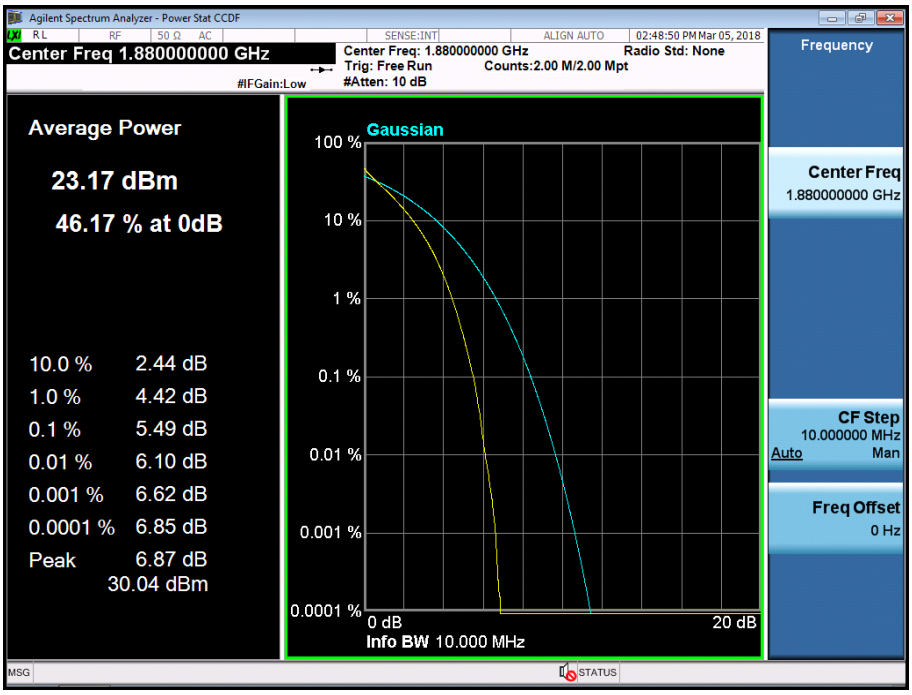
BAND 2. PAR Plot (5M BW Ch.18900 QPSK RB 25_0)



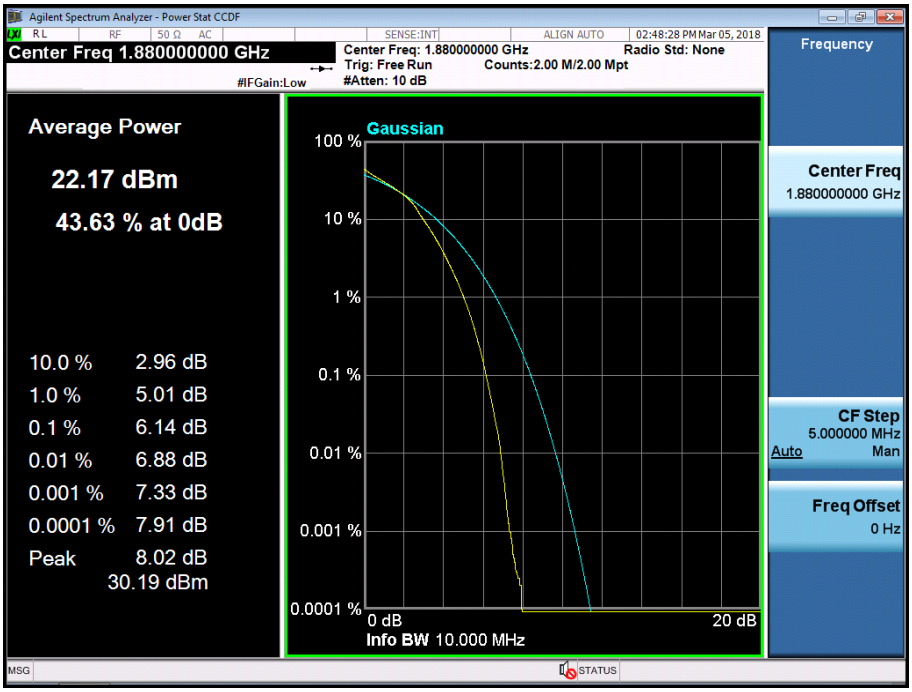
BAND 2. PAR Plot (5M BW Ch.18900 16QAM RB 25_0)



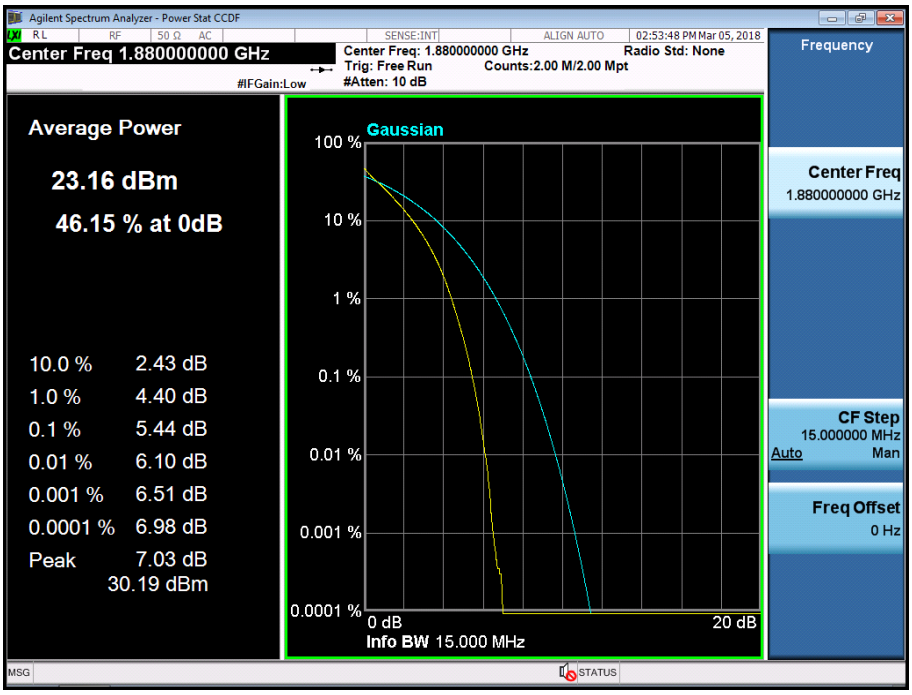
BAND 2. PAR Plot (10M BW Ch.18900 QPSK RB 50_0)



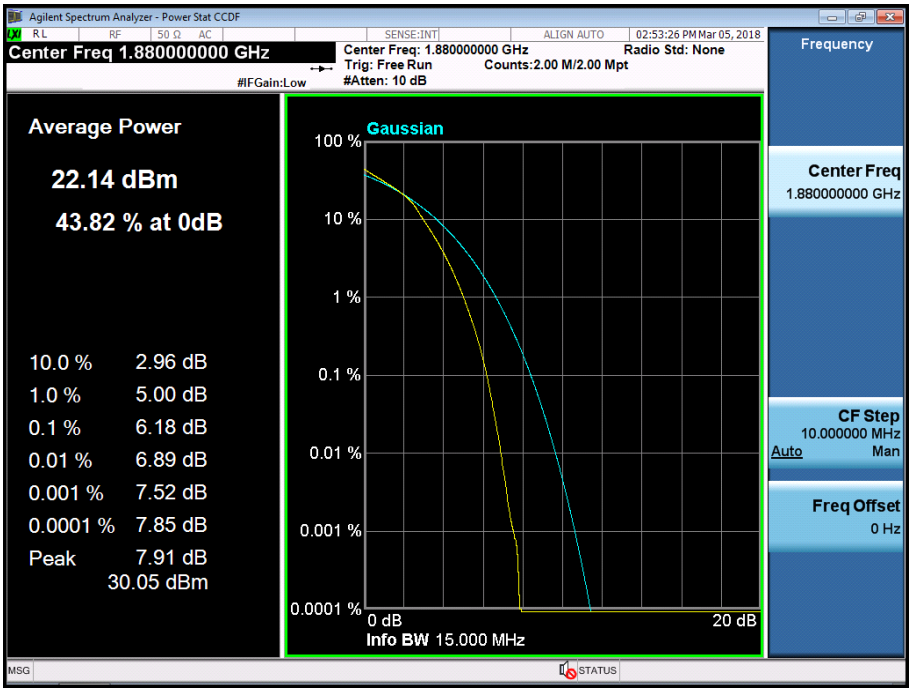
BAND 2. PAR Plot (10M BW Ch.18900 16QAM RB 50_0)



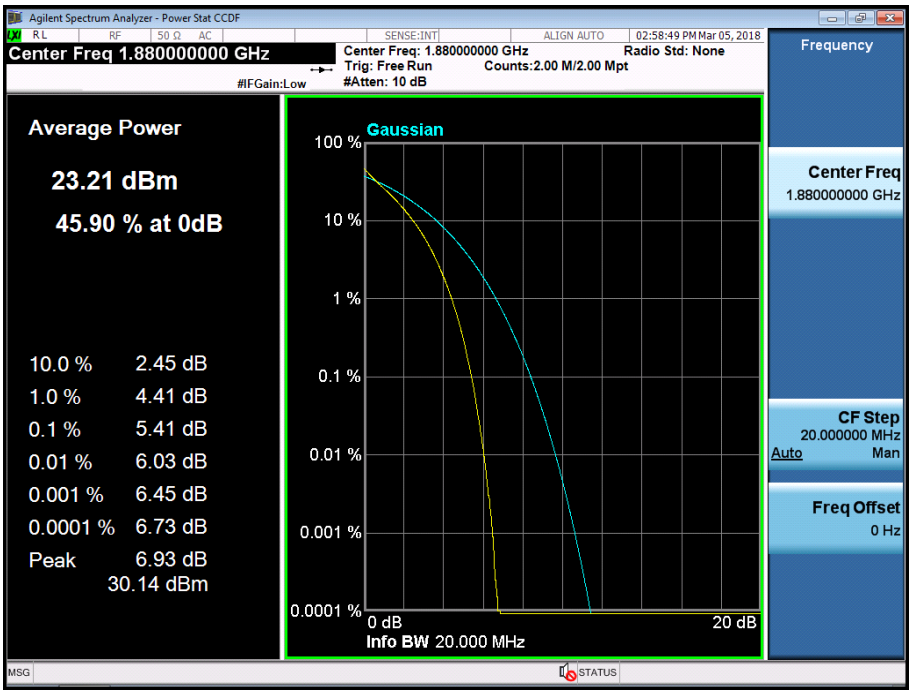
BAND 2. PAR Plot (15M BW Ch.18900 QPSK RB 75_0)



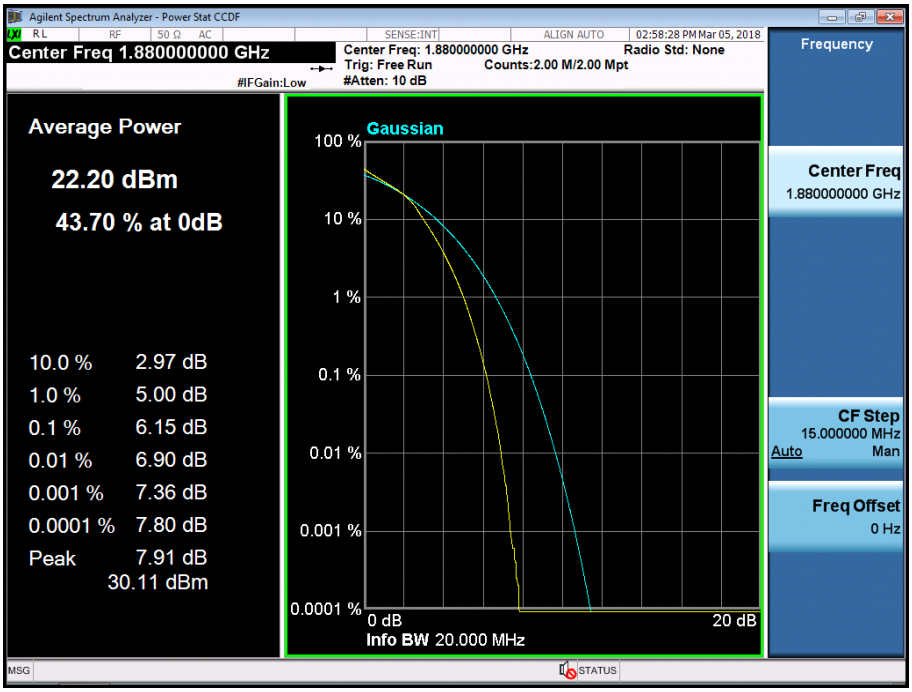
BAND 2. PAR Plot (15M BW Ch.18900 16QAM RB 75_0)



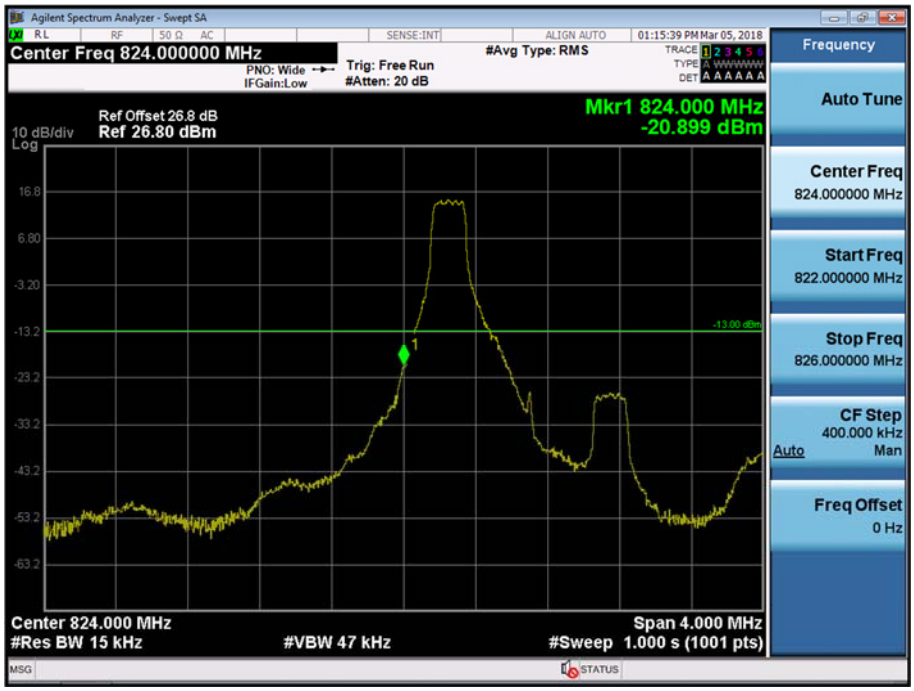
BAND 2. PAR Plot (20M BW Ch.18900 QPSK RB 100_0)



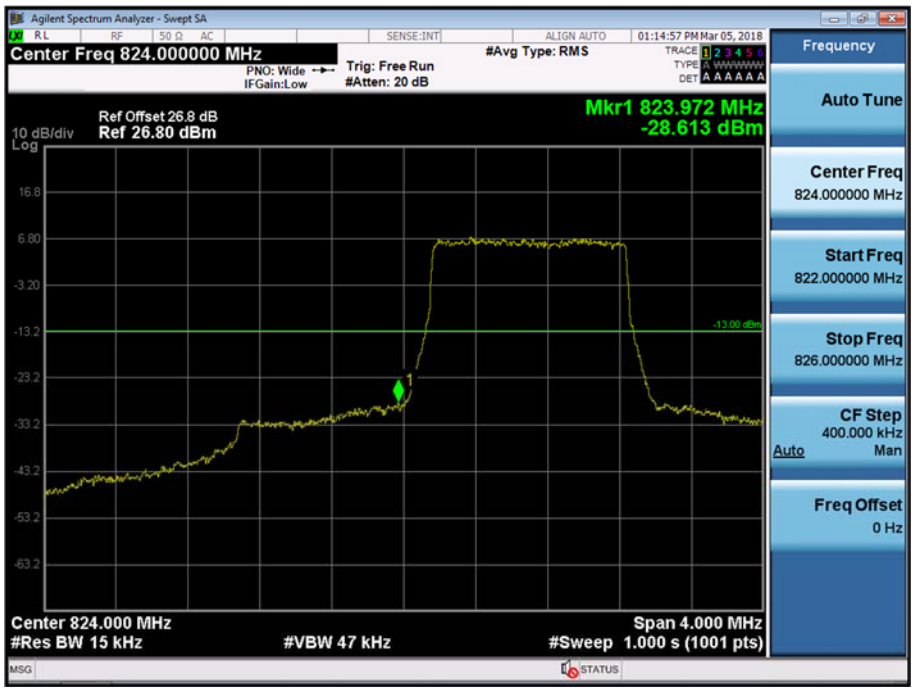
BAND 2. PAR Plot (20M BW Ch.18900 16QAM RB 100_0)



BAND 5. Lower Band Edge Plot (1.4M BW Ch.20407 QPSK_RB1_Offset 0)



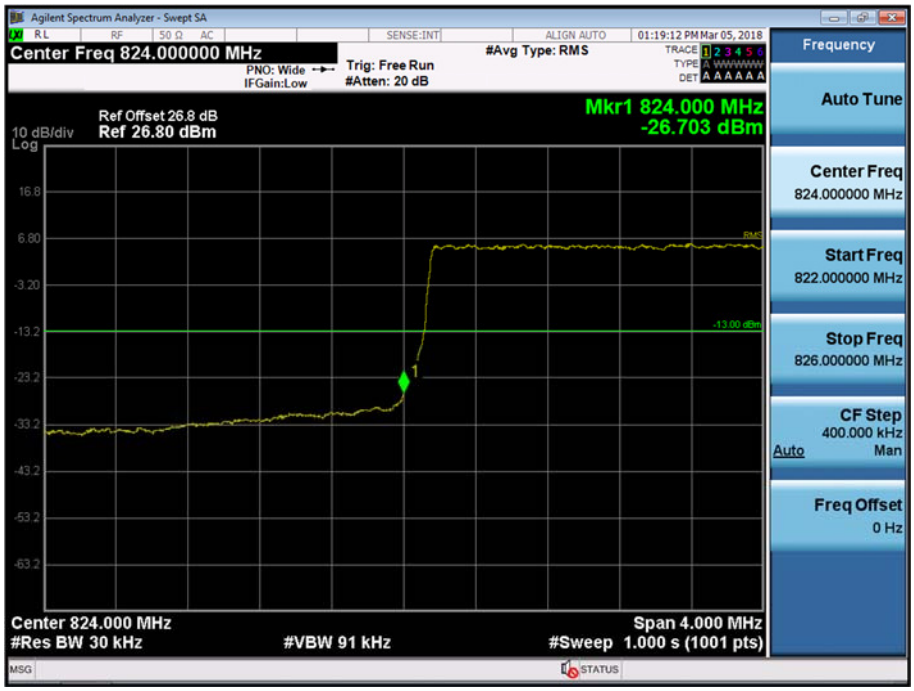
BAND 5. Lower Band Edge Plot (1.4M BW Ch.20407 QPSK_RB6_Offset 0)



BAND 5. Lower Extended Band Edge Plot (1.4M BW Ch.20407 QPSK_RB6_0)

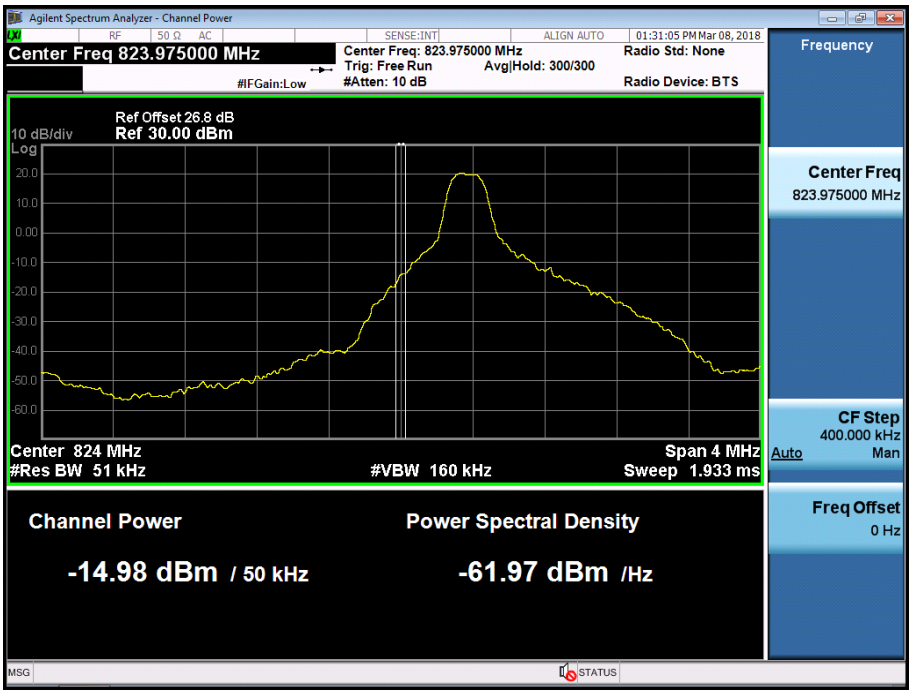
BAND 5. Lower Band Edge Plot (3M BW Ch.20415 QPSK_RB1_Offset 0)

BAND 5. Lower Band Edge Plot (3M BW Ch.20415 QPSK_RB15_Offset 0)



BAND 5. Lower Extended Band Edge Plot (3M BW Ch.20415 QPSK_RB15_0)

BAND 5. Lower Band Edge Plot (5M BW Ch.20425 QPSK_RB1_Offset 0)

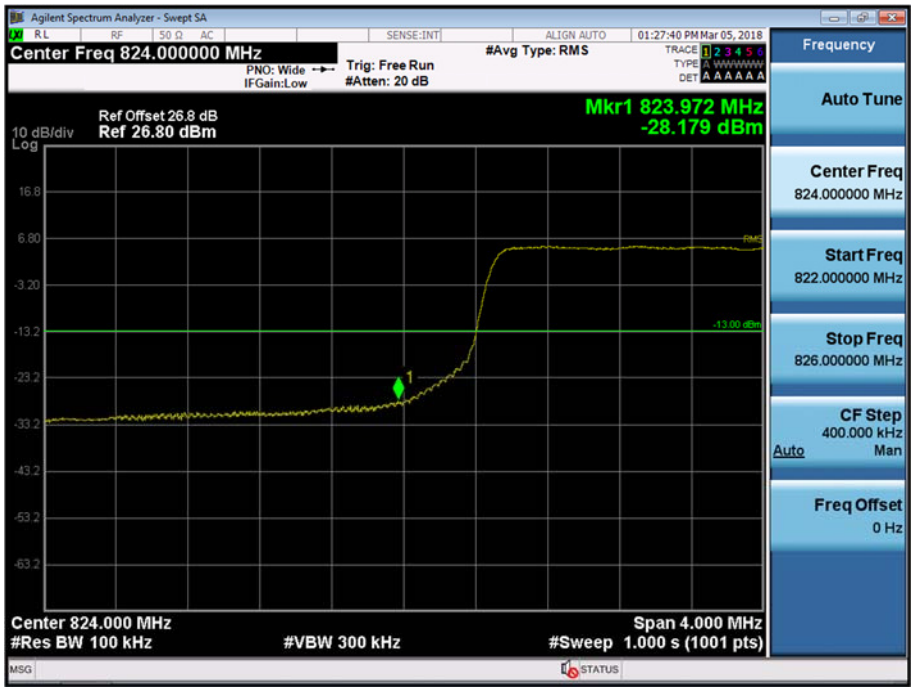


BAND 5. Lower Band Edge Plot (5M BW Ch.20425 QPSK_RB25_Offset 0)

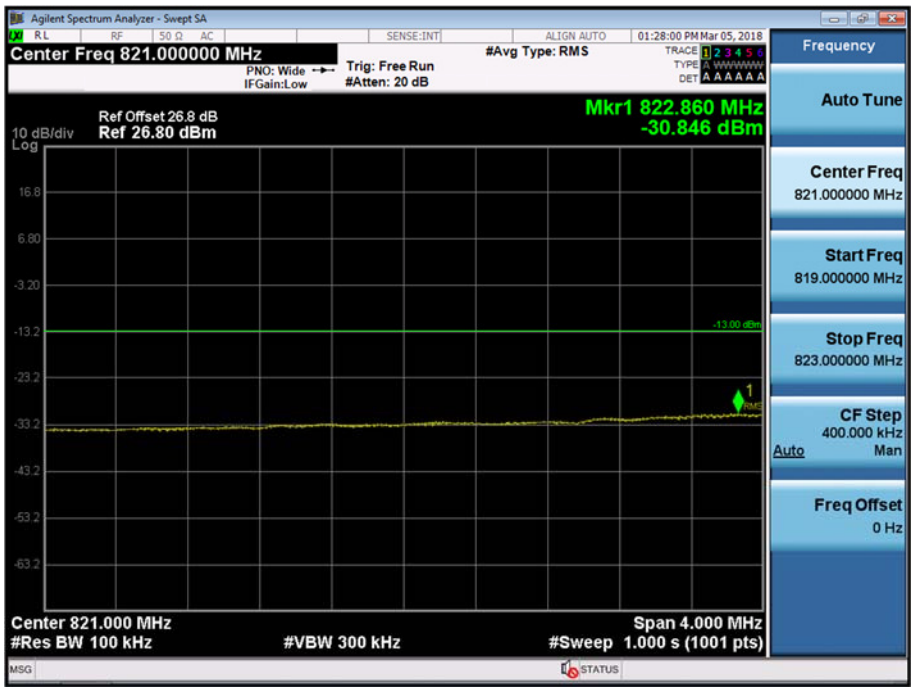
BAND 5. Lower Extended Band Edge Plot (5M BW Ch.20425 QPSK_RB25_0)

BAND 5. Lower Band Edge Plot (10M BW Ch.20450 QPSK_RB1_Offset 0)

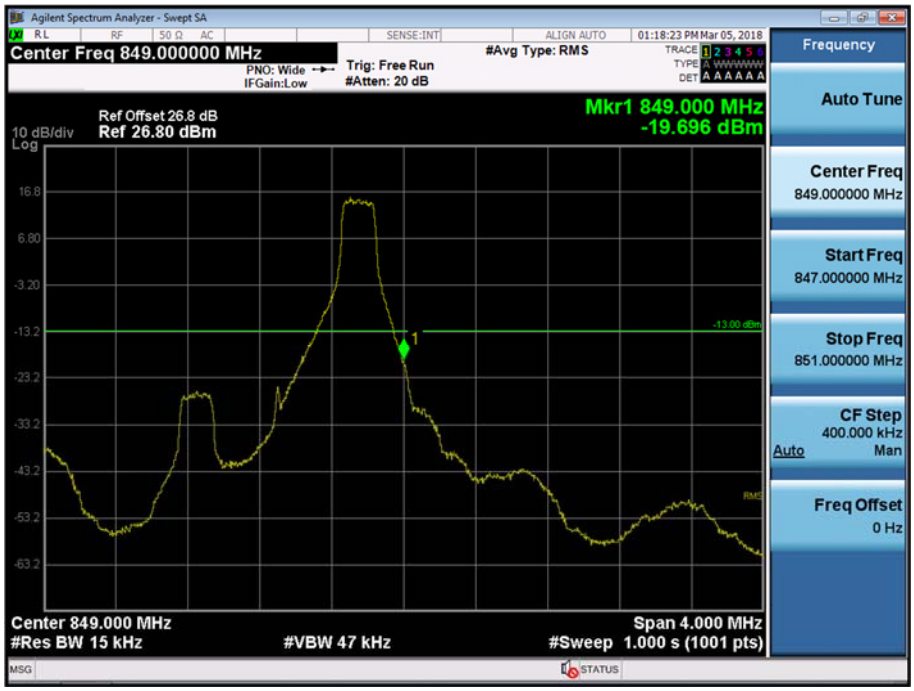
BAND 5. Lower Band Edge Plot (10M BW Ch.20450 QPSK_RB50_Offset 0)



BAND 5. Lower Extended Band Edge Plot (10M BW Ch.20450 QPSK_RB50_0)



BAND 5. Upper Band Edge Plot (1.4M BW Ch.20643 QPSK_RB1_Offset 5)



BAND 5. Upper Band Edge Plot (1.4M BW Ch.20643 QPSK_RB6_Offset 0)

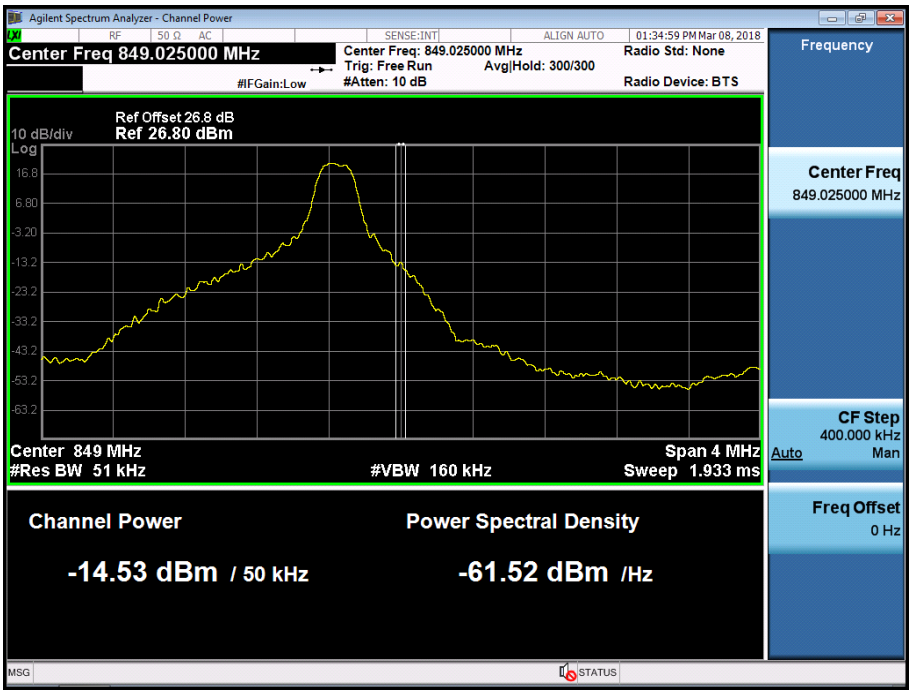
BAND 5. Upper Extended Band Edge Plot (1.4M BW Ch.20643 QPSK_RB6_0)

BAND 5. Upper Band Edge Plot (3M BW Ch.20635 QPSK_RB1_Offset 14)

BAND 5. Upper Band Edge Plot (3M BW Ch.20635 QPSK_RB15_Offset 0)

BAND 5. Upper Extended Band Edge Plot (3M BW Ch.20635 QPSK_RB15_0)

BAND 5. Upper Band Edge Plot (5M BW Ch.20625 QPSK_RB1_Offset 24)



BAND 5. Upper Band Edge Plot (5M BW Ch.20625 QPSK_RB25_Offset 0)

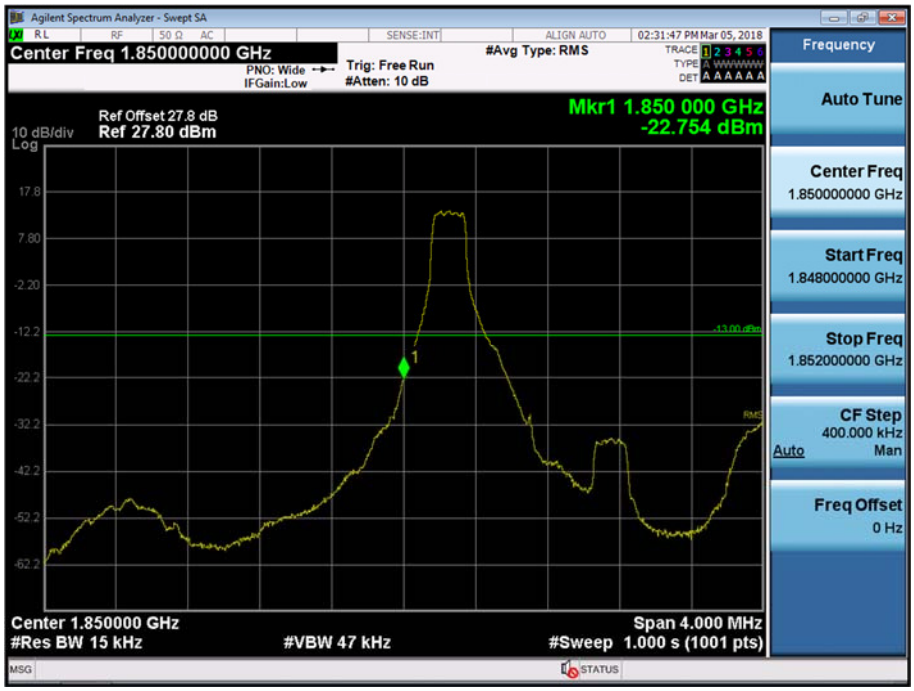
BAND 5. Upper Extended Band Edge Plot (5M BW Ch.20625 QPSK_RB25_0)

BAND 5. Upper Band Edge Plot (10M BW Ch.20600 QPSK_RB1_Offset 49)

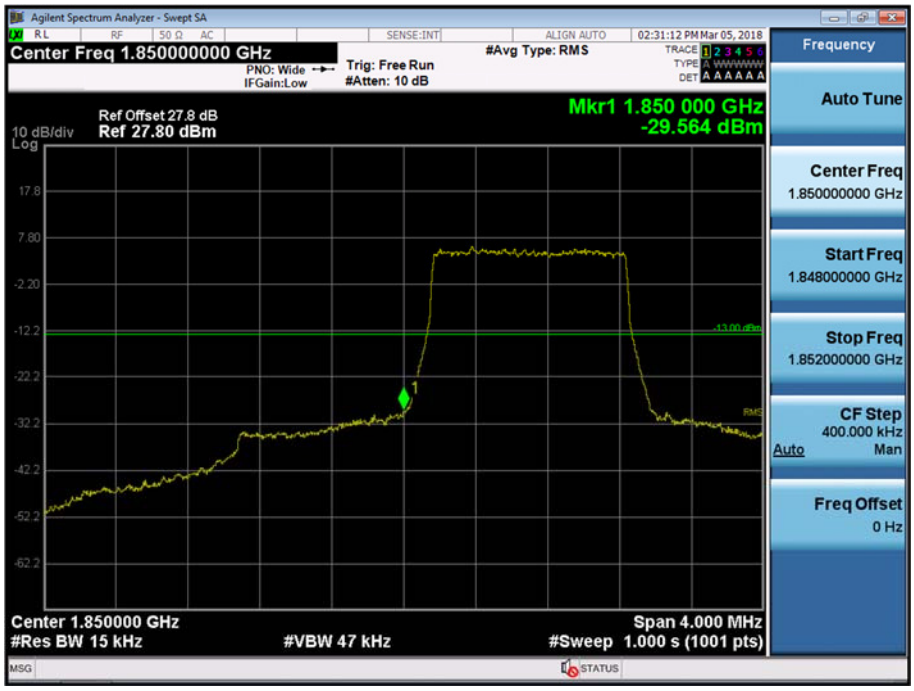
BAND 5. Upper Band Edge Plot (10M BW Ch.20600 QPSK_RB50_Offset 0)

BAND 5. Upper Extended Band Edge Plot (10M BW Ch.20600 QPSK_RB50_0)

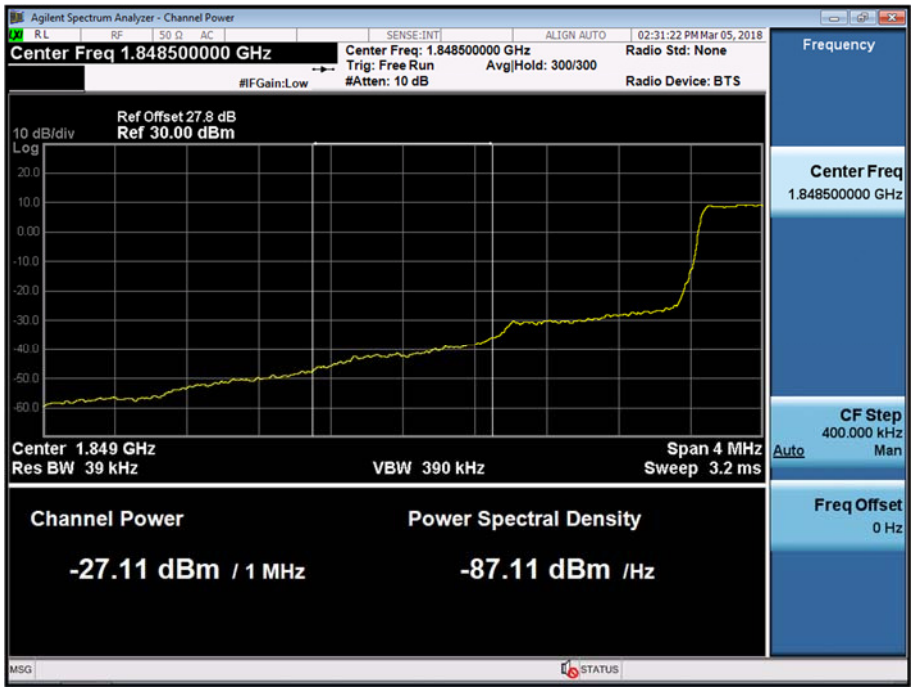
BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB1_Offset 0) -1



BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB6_Offset 0) -2



BAND 2. Lower Extended Band Edge Plot (1.4M BW Ch.18607 QPSK_RB6_0) -3



BAND 2. Lower Band Edge Plot (3M BW Ch.18615 QPSK_RB1_Offset 0) -1