

# FCC LTE REPORT

## Certification

**Applicant Name:**  
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**Address:**  
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Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

**Date of Issue:**  
December 26, 2018

**Location:**  
HCT CO., LTD.,  
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Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

**Report No.:** HCT-RF-1812-FC023

**FCC ID:** A3LSMG887N

**APPLICANT:** SAMSUNG Electronics Co., Ltd.

Model(s): SM-G887N  
 EUT Type: Mobile Phone  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 FCC Rule Part(s): §27, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band4 (1.4)	1710.7 – 1754.3	1M09G7D	QPSK	0.081	19.07
		1M09W7D	16QAM	0.069	18.39
		1M09W7D	64QAM	0.055	17.39
LTE – Band4 (3)	1711.5 – 1753.5	2M71G7D	QPSK	0.081	19.10
		2M70W7D	16QAM	0.070	18.43
		2M71W7D	64QAM	0.055	17.43
LTE – Band4 (5)	1712.5 – 1752.5	4M51G7D	QPSK	0.083	19.18
		4M50W7D	16QAM	0.071	18.51
		4M51W7D	64QAM	0.057	17.53
LTE – Band4 (10)	1715.0 – 1750.0	9M01G7D	QPSK	0.081	19.08
		8M99W7D	16QAM	0.069	18.39
		9M00W7D	64QAM	0.054	17.36
LTE – Band4 (15)	1717.5 – 1747.5	13M4G7D	QPSK	0.082	19.14
		13M5W7D	16QAM	0.069	18.36
		13M4W7D	64QAM	0.055	17.37
LTE – Band4 (20)	1720.0 – 1745.0	17M9G7D	QPSK	0.081	19.10
		17M9W7D	16QAM	0.068	18.35
		17M9W7D	64QAM	0.054	17.34

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 : Jong Seok Lee**  
**Manager of Telecommunication Testing Center**

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1812-FC023	December 26, 2018	- First Approval Report

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# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

<b>Applicant Name:</b>	SAMSUNG Electronics Co., Ltd.
<b>Address:</b>	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
<b>FCC ID:</b>	A3LSMG887N
<b>Application Type:</b>	Certification
<b>FCC Classification:</b>	PCS Licensed Transmitter Held to Ear (PCE)
<b>FCC Rule Part(s):</b>	§27, §2
<b>EUT Type:</b>	Mobile Phone
<b>Model(s):</b>	SM-G887N
<b>Tx Frequency:</b>	1710.7 MHz – 1754.3 MHz (LTE – Band 4 (1.4 MHz)) 1711.5 MHz – 1753.5 MHz (LTE – Band 4 (3 MHz)) 1712.5 MHz – 1752.5 MHz (LTE – Band 4 (5 MHz)) 1715.0 MHz – 1750.0 MHz (LTE – Band 4 (10 MHz)) 1717.5 MHz – 1747.5 MHz (LTE – Band 4 (15 MHz)) 1720.0 MHz – 1745.0 MHz (LTE – Band 4 (20 MHz))
<b>Date(s) of Tests:</b>	November 28, 2018 ~ December 11, 2018

## **2. INTRODUCTION**

### **2.1. DESCRIPTION OF EUT**

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS and LTE.  
It also supports IEEE 802.11 a/b/g/n/ac, Bluetooth, BTLE, NFC & ANT+.

### **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 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – 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 v03r01 – 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 v03r01 – Section 5.2 & 5.8 - ANSI C63.26-2015 – Section 5.2 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - 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  $\geq 3 \times$  RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $> 2 \times$  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;

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

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**

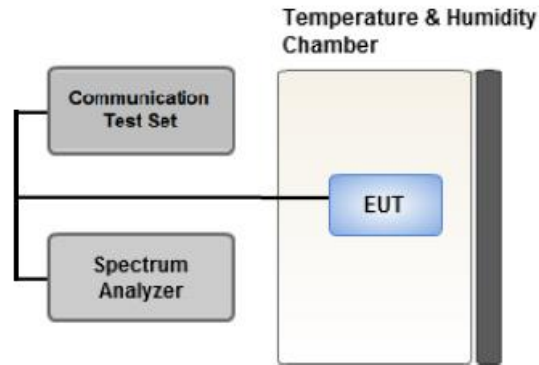
1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9.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

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

**Test Settings(Peak Power)**

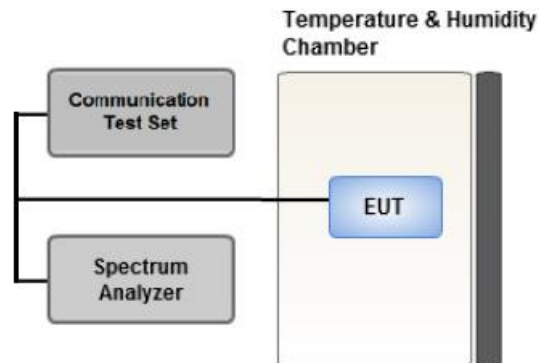
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW  $\geq 3 \times$  RBW.

1. Set the RBW  $\geq$  OBW.
2. Set VBW  $\geq 3 \times$  RBW.
3. Set span  $\geq 2 \times$  OBW.
4. Sweep time  $\geq 10 \times$  (number of points in sweep)  $\times$  (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  $2 \times$  to  $3 \times$  the OBW.
2. Set RBW  $\geq$  OBW.
3. Set VBW  $\geq 3 \times$  RBW.
4. Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
5. Sweep time:  
Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  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  $[10 \log (1/\text{duty cycle})]$  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.

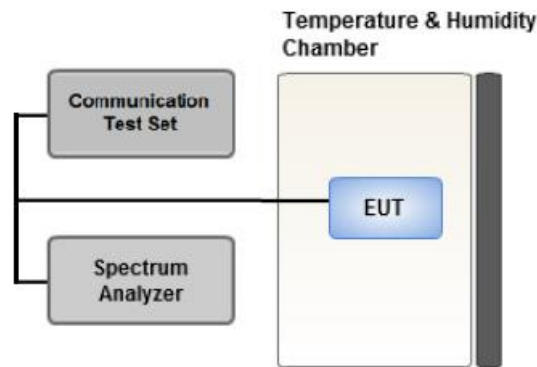
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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  $\geq$  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

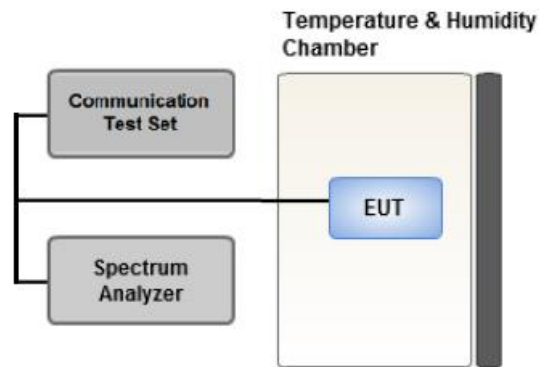
#### Test Overview

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  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep  $\geq$  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  $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

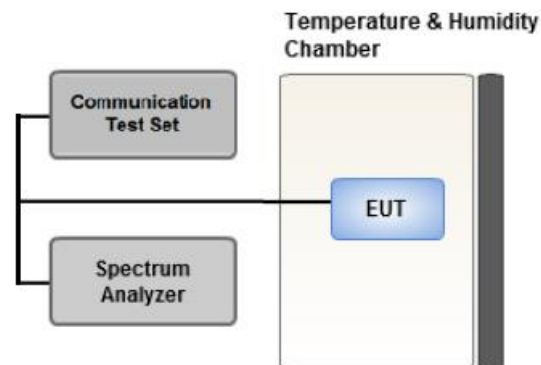
#### Test Notes

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.

### 3.8 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data.
- Please refer to the table below.

[ Worst case ]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM	1	0	X
Radiated Spurious and Harmonic Emissions	QPSK	1	0	X

**3.9 WORST CASE(CONDUCTED TEST)**

- Worst case : Of all modulation, We have tested modulation of the high Conducted Output Power.  
 Conducted Output Power value can be confirmed on the SAR report.

[ Worst case ]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM, 64QAM	1.4, 3, 5, 10, 15, 20	Low, Mid, High	Full RB	0
Band Edge	* QPSK	1.4	Low	1	0
			High	1	5
		3	Low	1	0
			High	1	14
		5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	49
		15	Low	1	0
			High	1	74
		20	Low	1	0
			High	1	99
		1.4, 3, 5, 10, 15, 20	Low, High	Full RB	0
Channel Edge	* QPSK	1.4, 3, 5, 10, 15, 20	Low, Mid, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	* QPSK	1.4, 3, 5, 10, 15, 20	Low, Mid, High	1	0



## 4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
REOHDE & SCHWARZ	SCU 18 / AMPLIFIER	10094	04/17/2018	Annual	04/17/2019
Wainwright	WHK1.2/15G-10EF/H.P.F	4	04/04/2018	Annual	04/04/2019
Wainwright	WHK3.3/18G-10EF/H.P.F	2	04/04/2018	Annual	04/04/2019
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	5001	06/07/2018	Annual	06/07/2019
Agilent	E3632A/DC Power Supply	KR75303243	05/09/2018	Annual	05/09/2019
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	08/07/2018	Annual	08/07/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	09/14/2018	Annual	09/14/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	10/04/2018	Annual	10/04/2019
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	06/08/2018	Annual	06/08/2019
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/21/2018	Annual	06/21/2019
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/22/2018	Annual	10/22/2019
Agilent	8960 (E5515C)/ Base Station	MY48360800	09/27/2018	Annual	09/27/2019
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	04/06/2017	Biennial	04/06/2019
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/13/2018	Annual	08/13/2019
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	02/08/2018	Annual	02/08/2019
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/19/2018	Annual	07/19/2019
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	07/27/2018	Annual	07/27/2019
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

**Note:**

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date

## **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  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

<b>Parameter</b>	<b>Expanded Uncertainty (<math>\pm</math>dB)</b>
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)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71

## 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, §27.53(h)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Peak- to- Average Ratio	27.50(d)(5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, § 27.54	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
Equivalent Isotropic Radiated Power	27.50(d)(4)	< 1 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(h)	< 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

#### 64QAM 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 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
1710.7	LTE B4/ 1.4 MHz	QPSK	-22.09	9.70	9.92	1.29	H	< 1.00	0.068	18.33
		16-QAM	-22.78	9.01	9.92	1.29	H		0.058	17.64
		64-QAM	-23.77	8.02	9.92	1.29	H		0.046	16.65
1732.5		QPSK	-21.77	10.05	10.00	1.28	H		0.075	18.77
		16-QAM	-22.58	9.24	10.00	1.28	H		0.063	17.96
		64-QAM	-23.55	8.27	10.00	1.28	H		0.050	16.99
1754.3		QPSK	-21.53	10.26	10.11	1.30	H		0.081	19.07
		16-QAM	-22.21	9.58	10.11	1.30	H		0.069	18.39
		64-QAM	-23.21	8.58	10.11	1.30	H		0.055	17.39

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1711.5	LTE B4/ 3 MHz	QPSK	-22.01	9.78	9.92	1.29	H	< 1.00	0.069	18.41
		16-QAM	-22.71	9.08	9.92	1.29	H		0.059	17.71
		64-QAM	-23.70	8.09	9.92	1.29	H		0.047	16.72
1732.5		QPSK	-21.68	10.14	10.00	1.28	H		0.077	18.86
		16-QAM	-22.51	9.31	10.00	1.28	H		0.064	18.03
		64-QAM	-23.48	8.34	10.00	1.28	H		0.051	17.06
1753.5		QPSK	-21.50	10.29	10.11	1.30	H		0.081	19.10
		16-QAM	-22.17	9.62	10.11	1.30	H		0.070	18.43
		64-QAM	-23.17	8.62	10.11	1.30	H		0.055	17.43

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1712.5	LTE B4/ 5 MHz	QPSK	-21.96	9.83	9.92	1.29	H	< 1.00	0.070	18.46
		16-QAM	-22.66	9.13	9.92	1.29	H		0.060	17.76
		64-QAM	-23.65	8.14	9.92	1.29	H		0.048	16.77
1732.5		QPSK	-21.63	10.19	10.00	1.28	H		0.078	18.91
		16-QAM	-22.45	9.37	10.00	1.28	H		0.064	18.09
		64-QAM	-23.43	8.39	10.00	1.28	H		0.051	17.11
1752.5		QPSK	-21.45	10.37	10.10	1.29	H		0.083	19.18
		16-QAM	-22.12	9.70	10.10	1.29	H		0.071	18.51
		64-QAM	-23.10	8.72	10.10	1.29	H		0.057	17.53

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1715.0	LTE B4/ 10 MHz	QPSK	-21.98	9.80	9.93	1.29	H	< 1.00	0.070	18.44
		16-QAM	-22.65	9.13	9.93	1.29	H		0.060	17.77
		64-QAM	-23.66	8.12	9.93	1.29	H		0.047	16.76
1732.5		QPSK	-21.61	10.21	10.00	1.28	H		0.078	18.93
		16-QAM	-22.33	9.49	10.00	1.28	H		0.066	18.21
		64-QAM	-23.35	8.47	10.00	1.28	H		0.052	17.19
1750.0		QPSK	-21.55	10.27	10.10	1.29	H		0.081	19.08
		16-QAM	-22.24	9.58	10.10	1.29	H		0.069	18.39
		64-QAM	-23.27	8.55	10.10	1.29	H		0.054	17.36

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP		
								W	W	dBm	
1717.5	LTE B4/ 15 MHz	QPSK	-21.77	10.00	9.94	1.28	H	< 1.00	0.073	18.66	
		16-QAM	-22.47	9.30	9.94	1.28	H			17.96	
		64-QAM	-23.48	8.29	9.94	1.28	H			16.95	
1732.5		QPSK	-21.58	10.24	10.00	1.28	H			0.079	18.96
		16-QAM	-22.27	9.55	10.00	1.28	H			0.067	18.27
		64-QAM	-23.26	8.56	10.00	1.28	H			0.053	17.28
1747.5		QPSK	-21.49	10.33	10.10	1.29	H			0.082	19.14
		16-QAM	-22.27	9.55	10.10	1.29	H			0.069	18.36
		64-QAM	-23.26	8.56	10.10	1.29	H			0.055	17.37

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP		
								W	W	dBm	
1720.0	LTE B4/ 20 MHz	QPSK	-21.78	9.99	9.94	1.28	H	< 1.00	0.073	18.65	
		16-QAM	-22.49	9.28	9.94	1.28	H			17.94	
		64-QAM	-23.48	8.29	9.94	1.28	H			16.95	
1732.5		QPSK	-21.54	10.28	10.00	1.28	H			0.079	19.00
		16-QAM	-22.19	9.63	10.00	1.28	H			0.068	18.35
		64-QAM	-23.20	8.62	10.00	1.28	H			0.054	17.34
1745.0		QPSK	-21.51	10.37	10.03	1.29	H			0.081	19.10
		16-QAM	-22.33	9.55	10.03	1.29	H			0.067	18.28
		64-QAM	-23.31	8.57	10.03	1.29	H			0.054	17.30



**8.2 RADIATED SPURIOUS EMISSIONS**

- ▣ OPERATING FREQUENCY: 1710.70 MHz
- ▣ MEASURED OUTPUT POWER: 19.07 dBm = 0.081 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 1.4 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.07 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
19957 (1710.7)	3,421.40	-56.48	12.70	-64.35	1.91	H	-53.56	72.63
	5,132.10	-56.10	12.68	-57.68	2.52	V	-47.52	66.59
	6,842.80	-54.26	12.58	-51.60	2.84	H	-41.86	60.94
20175 (1732.5)	3,465.00	-55.81	12.60	-63.40	1.97	H	-52.76	71.84
	5,197.50	-55.62	13.17	-57.53	2.54	H	-46.90	65.97
	6,930.00	-55.90	12.46	-52.57	2.83	H	-42.94	62.01
20393 (1754.3)	3,508.60	-57.06	12.43	-64.24	1.93	H	-53.74	72.81
	5,262.90	-54.65	13.48	-57.46	2.59	H	-46.57	65.64
	7,017.20	-54.07	12.16	-50.59	2.83	V	-41.26	60.33

- ▣ OPERATING FREQUENCY: 1711.50 MHz
- ▣ MEASURED OUTPUT POWER: 19.10 dBm = 0.081 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 3 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.10 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
19965 (1711.5)	3,423.00	-55.86	12.70	-63.73	1.91	H	-52.94	72.04
	5,134.50	-54.52	12.72	-56.16	2.52	H	-45.97	65.07
	6,846.00	-54.37	12.55	-51.66	2.83	H	-41.94	61.04
20175 (1732.5)	3,465.00	-56.68	12.60	-64.27	1.97	H	-53.63	72.74
	5,197.50	-56.17	13.17	-58.08	2.54	H	-47.45	66.55
	6,930.00	-55.68	12.46	-52.35	2.83	H	-42.72	61.82
20385 (1753.5)	3,507.00	-56.62	12.43	-63.80	1.93	H	-53.30	72.40
	5,260.50	-54.18	13.48	-56.99	2.59	H	-46.10	65.20
	7,014.00	-55.71	12.16	-52.23	2.83	H	-42.90	62.00

- ▣ OPERATING FREQUENCY: 1712.50 MHz
- ▣ MEASURED OUTPUT POWER: 19.18 dBm = 0.083 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.18 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
19975 (1712.5)	3,425.00	-57.26	12.69	-65.26	1.90	H	-54.47	73.65
	5,137.50	-55.53	12.75	-57.24	2.52	H	-47.01	66.19
	6,850.00	-55.13	12.52	-52.37	2.81	H	-42.66	61.84
20175 (1732.5)	3,465.00	-55.74	12.60	-63.33	1.97	H	-52.69	71.87
	5,197.50	-55.51	13.17	-57.42	2.54	H	-46.79	65.97
	6,930.00	-55.87	12.46	-52.54	2.83	H	-42.91	62.09
20375 (1752.5)	3,505.00	-56.01	12.44	-63.27	1.92	H	-52.74	71.92
	5,257.50	-55.50	13.48	-58.31	2.59	H	-47.42	66.60
	7,010.00	-55.82	12.21	-52.78	2.84	H	-43.41	62.59

- ▣ OPERATING FREQUENCY: 1715.00 MHz
- ▣ MEASURED OUTPUT POWER: 19.08 dBm = 0.081 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.08 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20000 (1715.0)	3,430.00	-56.43	12.68	-64.56	1.88	H	-53.76	72.84
	5,145.00	-55.54	12.79	-57.09	2.54	H	-46.83	65.91
	6,860.00	-55.65	12.54	-52.67	2.86	H	-42.99	62.07
20175 (1732.5)	3,465.00	-57.67	12.60	-65.26	1.97	H	-54.62	73.70
	5,197.50	-55.84	13.17	-57.75	2.54	H	-47.12	66.20
	6,930.00	-55.97	12.46	-52.64	2.83	H	-43.01	62.09
20350 (1750.0)	3,500.00	-57.35	12.45	-64.69	1.90	H	-54.14	73.22
	5,250.00	-55.37	13.47	-58.09	2.62	H	-47.24	66.32
	7,000.00	-55.61	12.27	-52.70	2.84	H	-43.27	62.35

- ▣ OPERATING FREQUENCY: 1717.50 MHz
- ▣ MEASURED OUTPUT POWER: 19.14 dBm = 0.082 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.14 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20025 (1717.5)	3,435.00	-56.81	12.67	-64.78	1.89	H	-54.01	73.15
	5,152.50	-55.63	12.83	-57.01	2.55	H	-46.73	65.87
	6,870.00	-54.07	12.56	-51.43	2.82	H	-41.69	60.83
20175 (1732.5)	3,465.00	-57.21	12.60	-64.80	1.97	H	-54.16	73.30
	5,197.50	-56.00	13.17	-57.91	2.54	H	-47.28	66.42
	6,930.00	-54.42	12.46	-51.09	2.83	H	-41.46	60.60
20325 (1747.5)	3,495.00	-56.76	12.48	-64.07	1.91	H	-53.50	72.64
	5,242.50	-56.46	13.40	-58.96	2.61	H	-48.17	67.31
	6,990.00	-55.38	12.26	-51.31	2.84	H	-41.89	61.03

- ▣ OPERATING FREQUENCY: 1720.00 MHz
- ▣ MEASURED OUTPUT POWER: 19.10 dBm = 0.081 W
- ▣ MODE: LTE B4
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT:  $43 + 10 \log_{10}(W) =$  32.10 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20050 (1720.0)	3,440.00	-55.87	12.65	-63.68	1.90	H	-52.93	72.03
	5,160.00	-54.69	12.87	-56.53	2.58	H	-46.24	65.35
	6,880.00	-54.68	12.60	-51.99	2.79	H	-42.18	61.28
20175 (1732.5)	3,465.00	-56.21	12.60	-63.80	1.97	H	-53.16	72.27
	5,197.50	-55.16	13.17	-57.07	2.54	H	-46.44	65.54
	6,930.00	-53.79	12.46	-50.46	2.83	H	-40.83	59.93
20300 (1745.0)	3,490.00	-56.90	12.50	-64.17	1.91	H	-53.58	72.68
	5,235.00	-55.83	13.36	-58.39	2.61	H	-47.64	66.74
	6,980.00	-53.95	12.25	-49.97	2.85	H	-40.57	59.67

**8.3 PEAK-TO-AVERAGE RATIO**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB )
4	1.4 MHz	1732.5	QPSK	6	0	4.86
			16-QAM			6.00
			64-QAM			6.75
	3 MHz		QPSK	15		4.80
			16-QAM			6.02
			64-QAM			6.67
	5 MHz		QPSK	25		4.95
			16-QAM			6.04
			64-QAM			6.69
	10 MHz		QPSK	50		5.00
			16-QAM			6.19
			64-QAM			6.56
	15 MHz		QPSK	75		4.90
			16-QAM			6.02
			64-QAM			6.68
20 MHz	QPSK	100	5.04			
	16-QAM		6.11			
	64-QAM		6.63			

**Note:**

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 71 ~ 88.

**8.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data ( MHz )
4	1.4 MHz	1732.5	QPSK	6	0	1.0917
			16-QAM			1.0886
			64-QAM			1.0932
	3 MHz		QPSK	15		2.7105
			16-QAM			2.7038
			64-QAM			2.7088
	5 MHz		QPSK	25		4.5129
			16-QAM			4.5012
			64-QAM			4.5101
	10 MHz		QPSK	50		9.0068
			16-QAM			8.9889
			64-QAM			8.9971
	15 MHz		QPSK	75		13.443
			16-QAM			13.482
			64-QAM			13.435
	20 MHz		QPSK	100		17.917
			16-QAM			17.902
			64-QAM			17.916

**Note:**

1. Plots of the EUT's Occupied Bandwidth are shown Page 53 ~ 70.



**8.5 CONDUCTED SPURIOUS EMISSIONS**

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
4	1.4	1710.7	3.4213	27.976	-76.485	-48.509	-13.00
		1732.5	3.4647	27.976	-75.945	-47.969	
		1754.3	3.7074	27.976	-77.138	-49.162	
	3	1711.5	3.4213	27.976	-76.544	-48.568	
		1732.5	3.4632	27.976	-75.665	-47.689	
		1753.5	3.5100	27.976	-76.596	-48.620	
	5	1712.5	3.4213	27.976	-76.006	-48.030	
		1732.5	3.4612	27.976	-75.745	-47.769	
		1752.5	3.5100	27.976	-76.147	-48.171	
	10	1715.0	3.4218	27.976	-76.010	-48.034	
		1732.5	3.4567	27.976	-76.092	-48.116	
		1750.0	3.5095	27.976	-76.649	-48.673	
	15	1717.5	3.4223	27.976	-76.221	-48.245	
		1732.5	3.4522	27.976	-75.279	-47.303	
		1747.5	3.5090	27.976	-75.940	-47.964	
	20	1720.0	3.4228	27.976	-75.677	-47.701	
		1732.5	3.4477	27.976	-75.559	-47.583	
		1745.0	3.5085	27.976	-76.551	-48.575	

**Note:**

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 125 ~ 160.
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

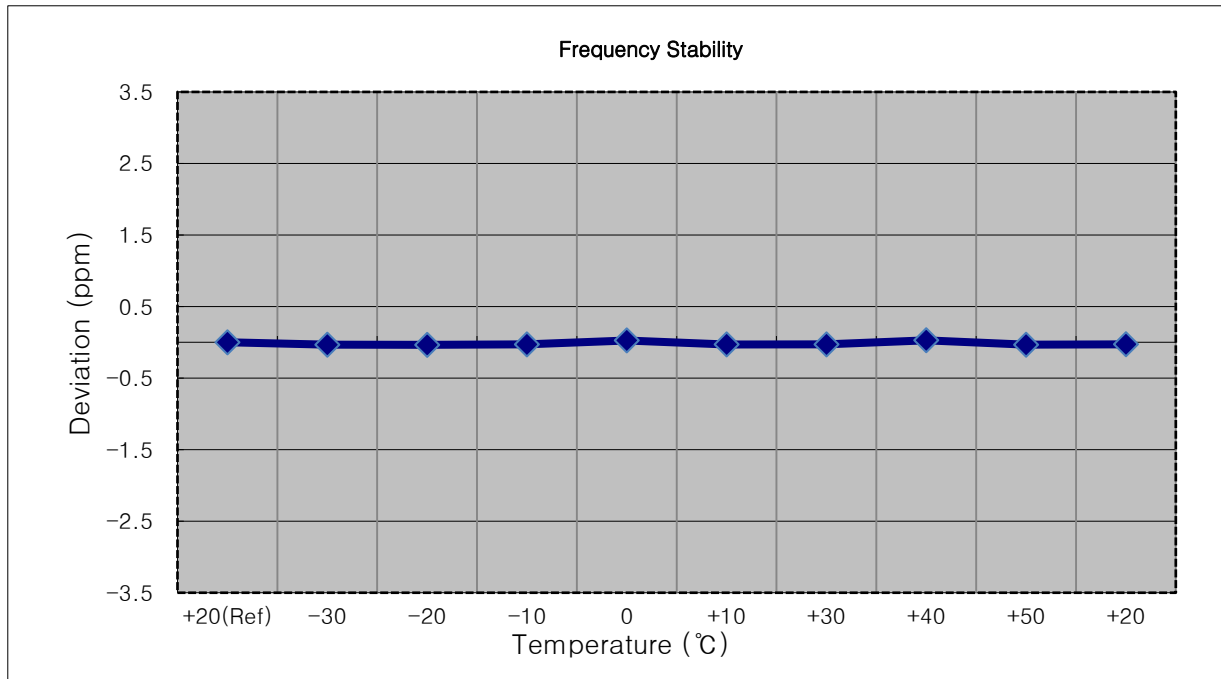
**8.6 BAND EDGE**

- Plots of the EUT's Band Edge are shown Page 89 ~ 124.

**8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE**

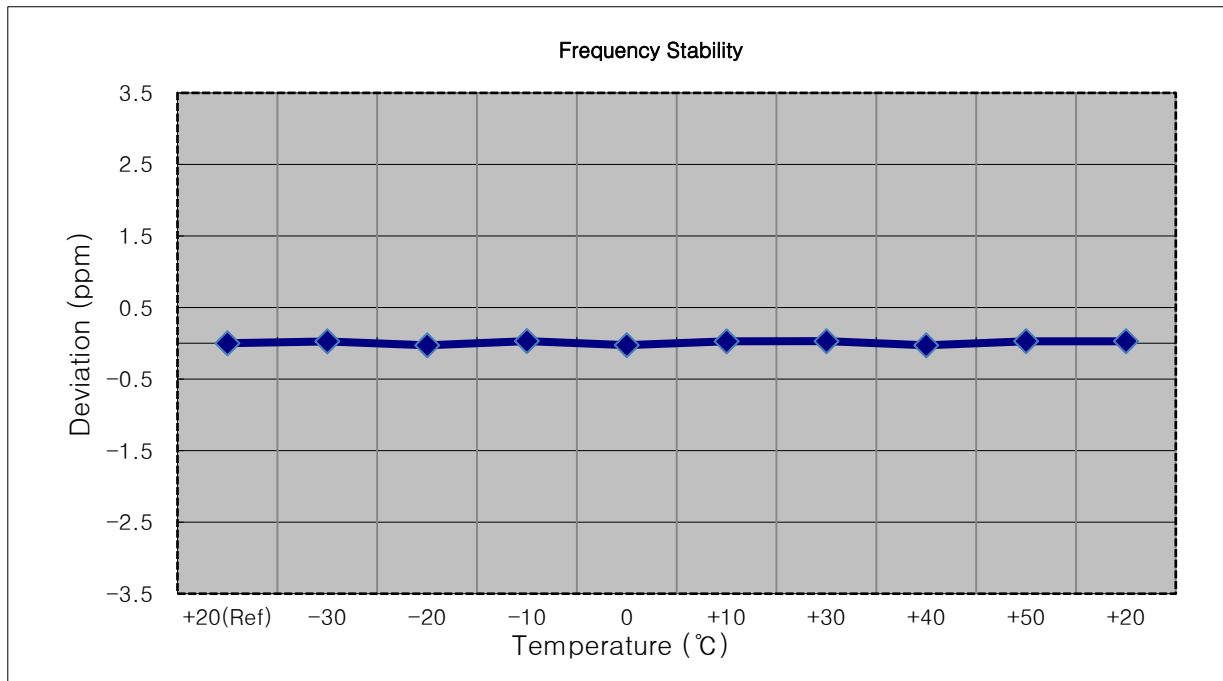
- MODE: LTE 4
- OPERATING FREQUENCY: 1710,700,000 Hz
- CHANNEL: 19957 (1.4 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1710 699 942	0.0	0.000 000	0.000
100%		-30	1710 699 886	-56.0	-0.000 003	-0.033
100%		-20	1710 699 882	-59.6	-0.000 003	-0.035
100%		-10	1710 699 892	-49.4	-0.000 003	-0.029
100%		0	1710 699 986	44.2	0.000 003	0.026
100%		+10	1710 699 892	-50.0	-0.000 003	-0.029
100%		+30	1710 699 892	-49.4	-0.000 003	-0.029
100%		+40	1710 699 990	48.2	0.000 003	0.028
100%		+50	1710 699 885	-56.7	-0.000 003	-0.033
Batt. Endpoint		3.600	+20	1710 699 895	-47.1	-0.000 003



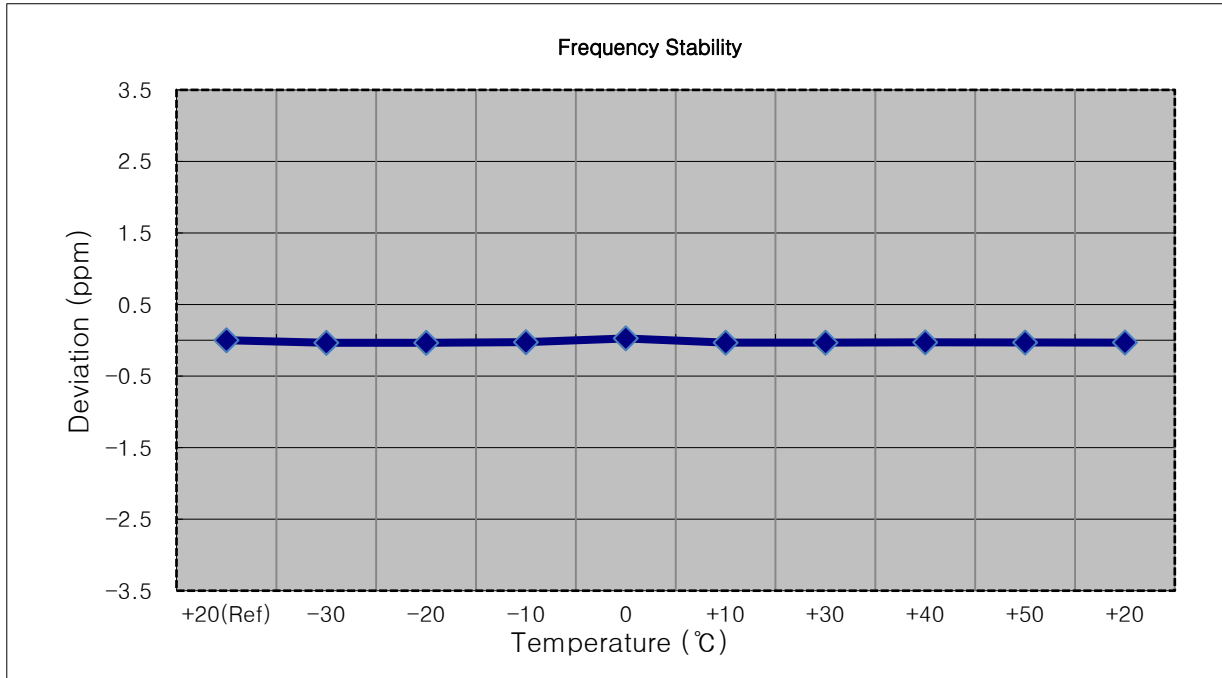
- MODE: LTE 4
- OPERATING FREQUENCY: 1711,500,000 Hz
- CHANNEL: 19965 (3 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1711 500 045	0.0	0.000 000	0.000
100%		-30	1711 500 090	44.5	0.000 003	0.026
100%		-20	1711 499 997	-48.1	-0.000 003	-0.028
100%		-10	1711 500 098	52.8	0.000 003	0.031
100%		0	1711 500 000	-45.7	-0.000 003	-0.027
100%		+10	1711 500 092	46.6	0.000 003	0.027
100%		+30	1711 500 096	50.7	0.000 003	0.030
100%		+40	1711 499 997	-48.4	-0.000 003	-0.028
100%		+50	1711 500 095	49.6	0.000 003	0.029
Batt. Endpoint	3.600	+20	1711 500 095	49.1	0.000 003	0.029



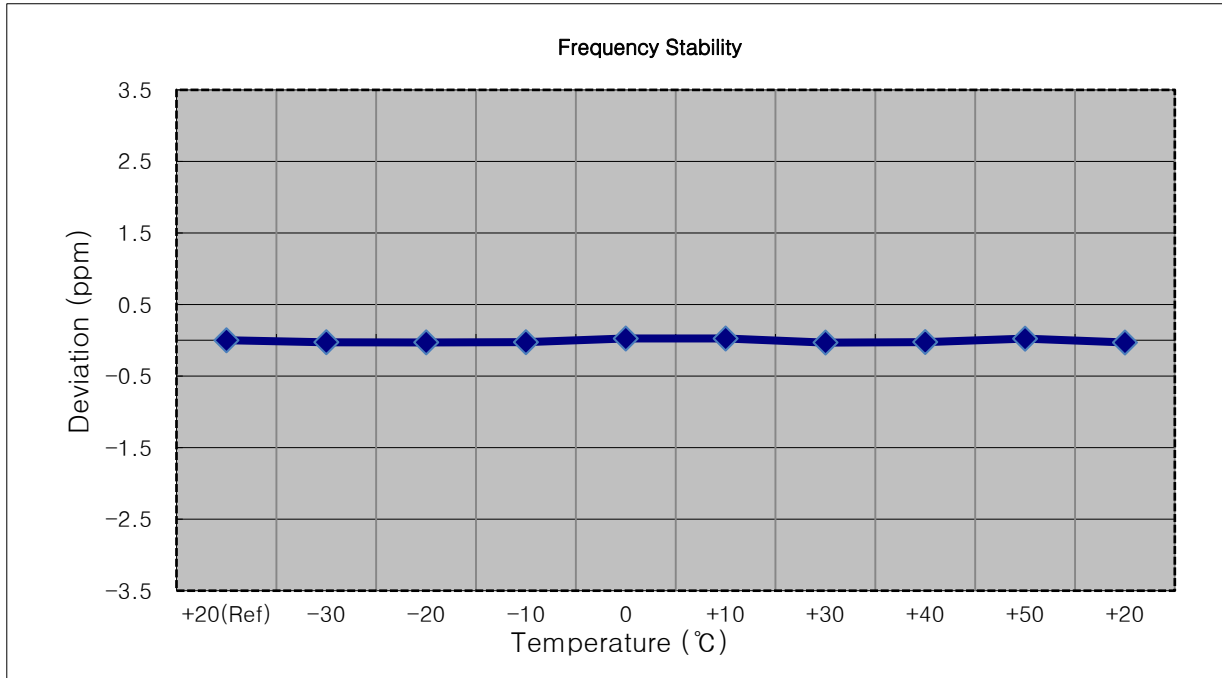
- MODE: LTE 4
- OPERATING FREQUENCY: 1712,500,000 Hz
- CHANNEL: 19975 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1712 499 952	0.0	0.000 000	0.000
100%		-30	1712 499 892	-60.8	-0.000 004	-0.036
100%		-20	1712 499 892	-60.9	-0.000 004	-0.036
100%		-10	1712 499 907	-45.4	-0.000 003	-0.027
100%		0	1712 499 997	44.7	0.000 003	0.026
100%		+10	1712 499 896	-56.4	-0.000 003	-0.033
100%		+30	1712 499 896	-56.5	-0.000 003	-0.033
100%		+40	1712 499 904	-48.0	-0.000 003	-0.028
100%		+50	1712 499 900	-52.6	-0.000 003	-0.031
Batt. Endpoint	3.600	+20	1712 499 897	-55.1	-0.000 003	-0.032



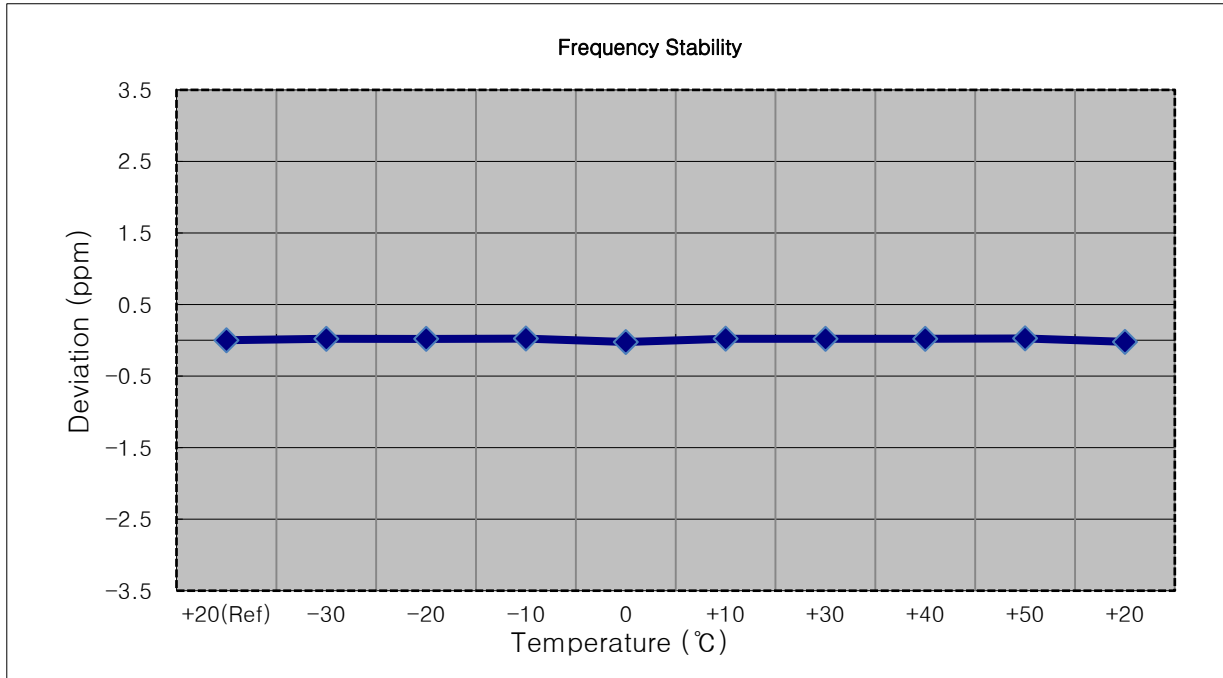
- MODE: LTE 4
- OPERATING FREQUENCY: 1715.000.000 Hz
- CHANNEL: 20000 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1715 000 041	0.0	0.000 000	0.000
100%		-30	1714 999 994	-46.7	-0.000 003	-0.027
100%		-20	1714 999 990	-50.3	-0.000 003	-0.029
100%		-10	1714 999 995	-46.0	-0.000 003	-0.027
100%		0	1715 000 083	42.3	0.000 002	0.025
100%		+10	1715 000 084	43.5	0.000 003	0.025
100%		+30	1714 999 986	-55.0	-0.000 003	-0.032
100%		+40	1714 999 997	-43.9	-0.000 003	-0.026
100%		+50	1715 000 079	38.7	0.000 002	0.023
Batt. Endpoint	3.600	+20	1714 999 987	-53.2	-0.000 003	-0.031



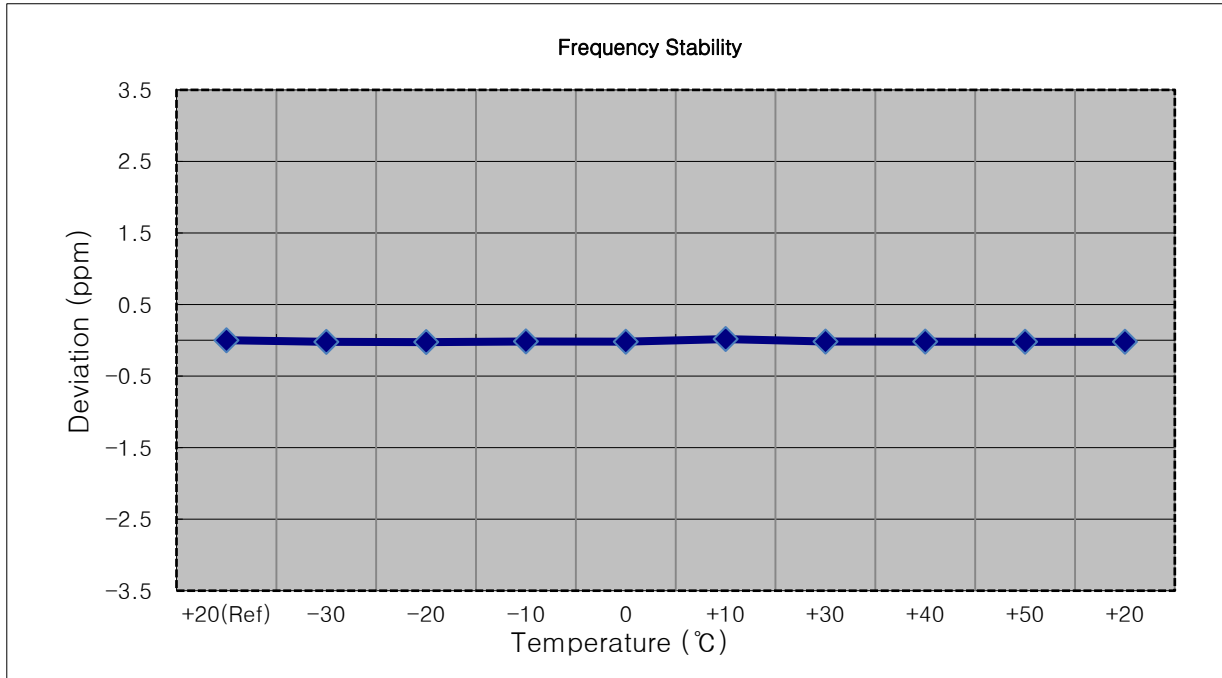
- MODE: LTE 4
- OPERATING FREQUENCY: 1717,500,000 Hz
- CHANNEL: 20025 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1717 500 038	0.0	0.000 000	0.000
100%		-30	1717 500 074	36.2	0.000 002	0.021
100%		-20	1717 500 072	34.5	0.000 002	0.020
100%		-10	1717 500 079	41.4	0.000 002	0.024
100%		0	1717 499 996	-41.6	-0.000 002	-0.024
100%		+10	1717 500 075	37.1	0.000 002	0.022
100%		+30	1717 500 073	35.4	0.000 002	0.021
100%		+40	1717 500 072	34.6	0.000 002	0.020
100%		+50	1717 500 083	45.7	0.000 003	0.027
Batt. Endpoint	3.600	+20	1717 500 000	-37.5	-0.000 002	-0.022



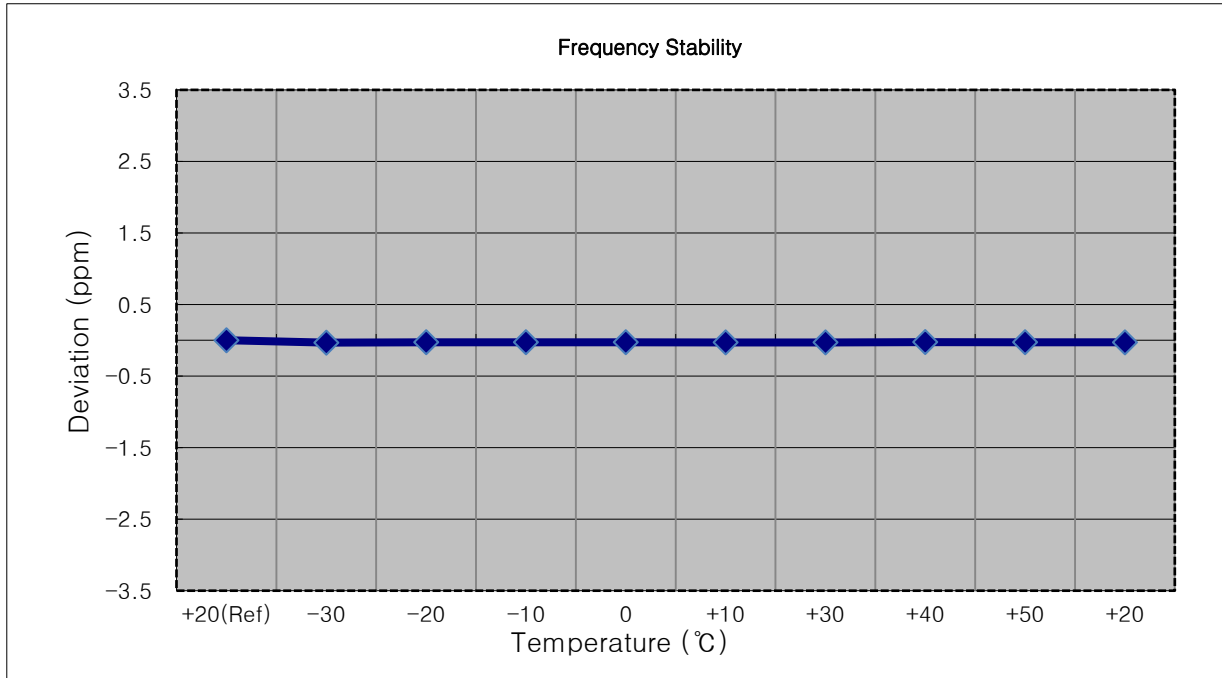
- MODE: LTE 4
- OPERATING FREQUENCY: 1720,000,000 Hz
- CHANNEL: 20050 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1719 999 964	0.0	0.000 000	0.000
100%		-30	1719 999 926	-38.1	-0.000 002	-0.022
100%		-20	1719 999 921	-42.8	-0.000 002	-0.025
100%		-10	1719 999 936	-27.9	-0.000 002	-0.016
100%		0	1719 999 931	-32.8	-0.000 002	-0.019
100%		+10	1719 999 993	29.4	0.000 002	0.017
100%		+30	1719 999 933	-30.8	-0.000 002	-0.018
100%		+40	1719 999 932	-31.8	-0.000 002	-0.018
100%		+50	1719 999 928	-36.4	-0.000 002	-0.021
Batt. Endpoint	3.600	+20	1719 999 928	-35.7	-0.000 002	-0.021



- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (1.4 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

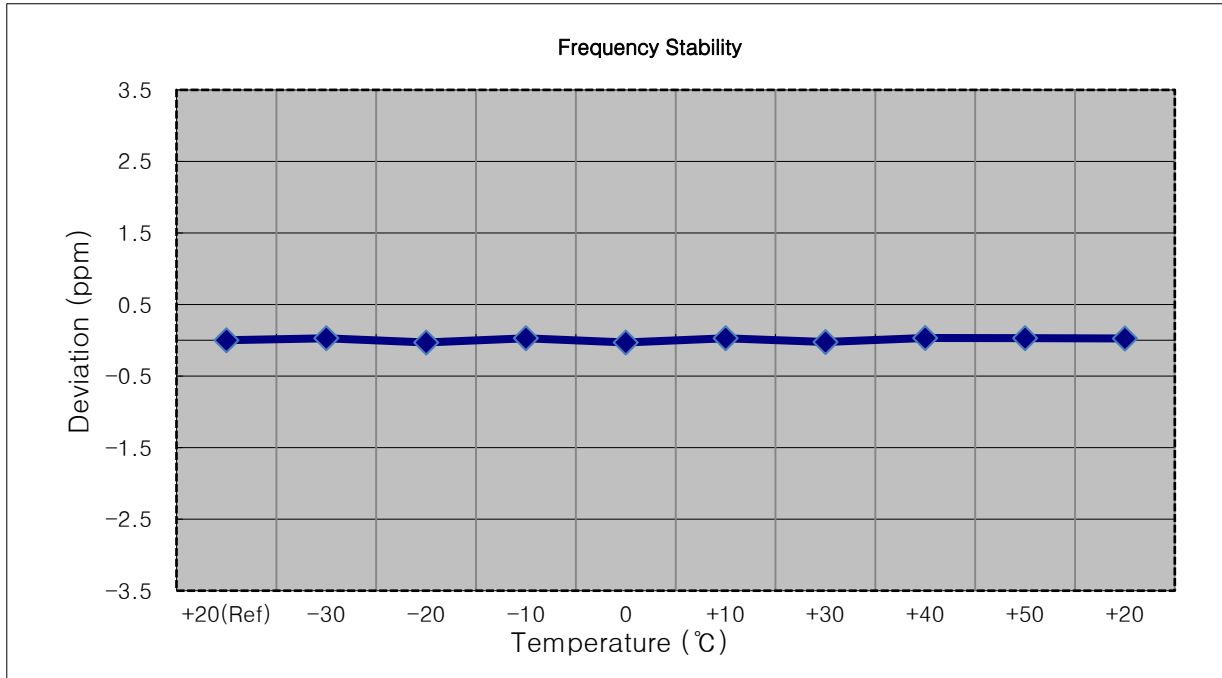
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 499 949	0.0	0.000 000	0.000
100%		-30	1732 499 891	-57.8	-0.000 003	-0.033
100%		-20	1732 499 901	-48.5	-0.000 003	-0.028
100%		-10	1732 499 902	-47.1	-0.000 003	-0.027
100%		0	1732 499 901	-47.7	-0.000 003	-0.028
100%		+10	1732 499 897	-52.1	-0.000 003	-0.030
100%		+30	1732 499 898	-51.6	-0.000 003	-0.030
100%		+40	1732 499 905	-44.4	-0.000 003	-0.026
100%		+50	1732 499 902	-47.4	-0.000 003	-0.027
Batt. Endpoint	3.600	+20	1732 499 899	-49.8	-0.000 003	-0.029





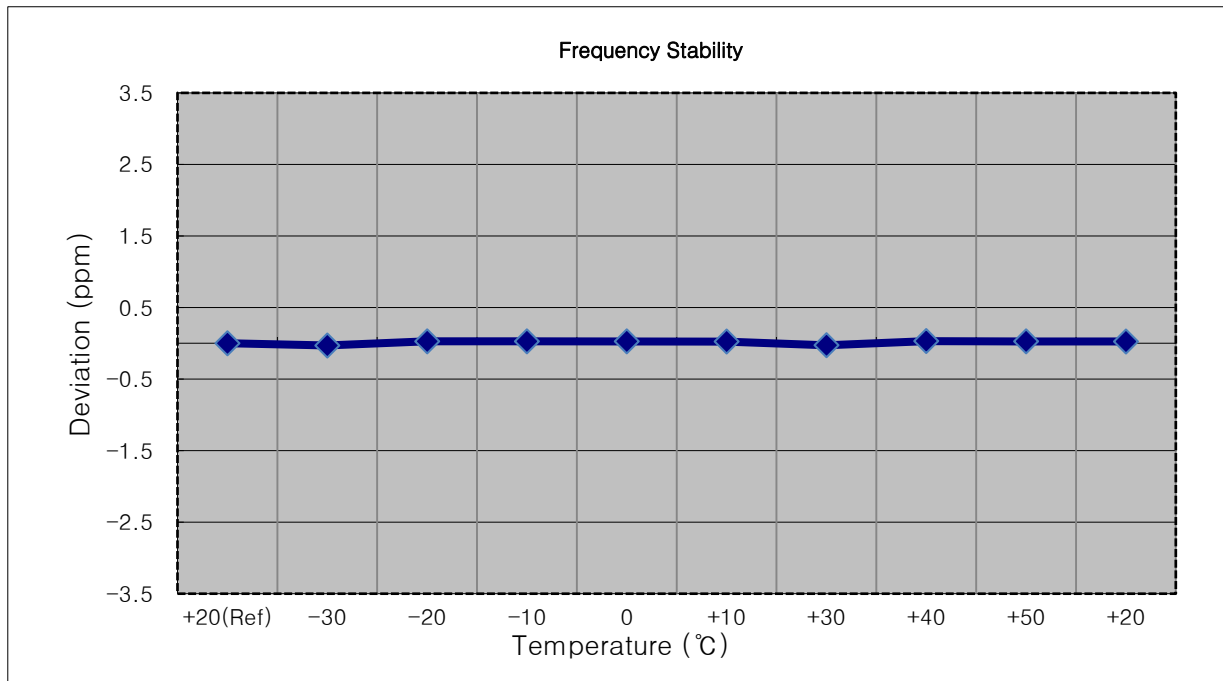
- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (3 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 499 957	0.0	0.000 000	0.000
100%		-30	1732 500 007	49.4	0.000 003	0.029
100%		-20	1732 499 905	-52.8	-0.000 003	-0.030
100%		-10	1732 500 007	49.8	0.000 003	0.029
100%		0	1732 499 903	-53.9	-0.000 003	-0.031
100%		+10	1732 500 007	49.4	0.000 003	0.029
100%		+30	1732 499 915	-42.4	-0.000 002	-0.024
100%		+40	1732 500 012	54.3	0.000 003	0.031
100%		+50	1732 500 008	50.9	0.000 003	0.029
Batt. Endpoint	3.600	+20	1732 500 001	43.7	0.000 003	0.025



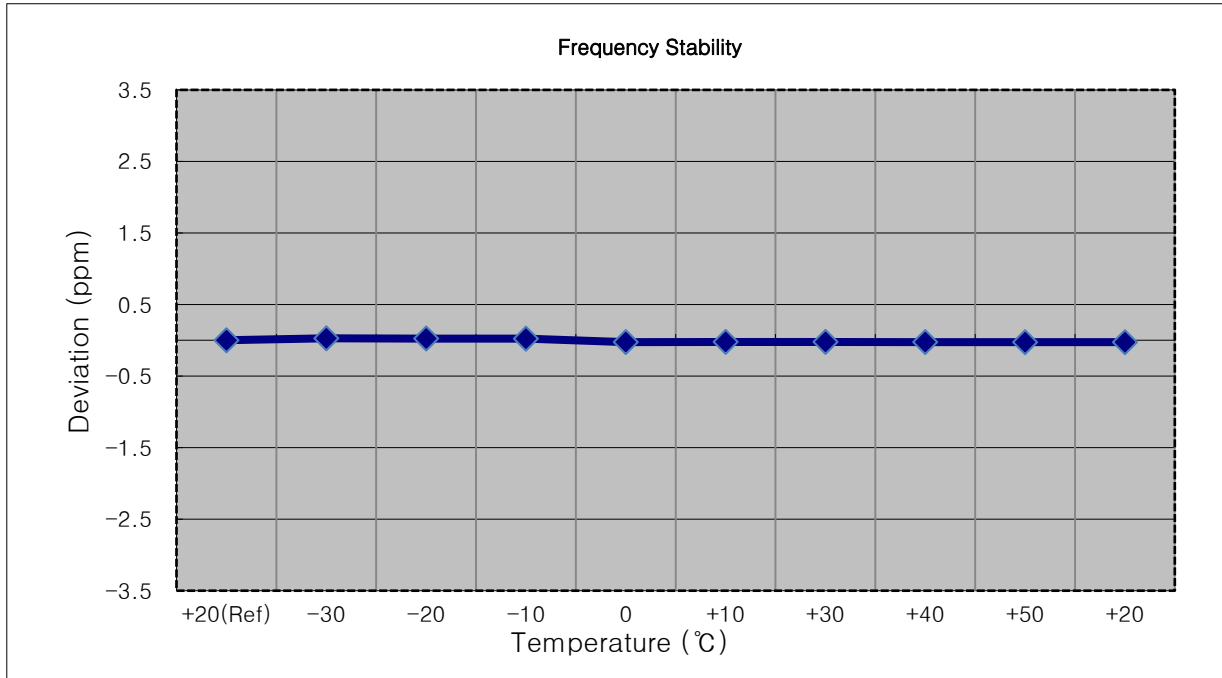
- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 500 042	0.0	0.000 000	0.000
100%		-30	1732 499 988	-53.9	-0.000 003	-0.031
100%		-20	1732 500 090	48.2	0.000 003	0.028
100%		-10	1732 500 089	46.8	0.000 003	0.027
100%		0	1732 500 086	44.6	0.000 003	0.026
100%		+10	1732 500 083	40.9	0.000 002	0.024
100%		+30	1732 499 994	-48.1	-0.000 003	-0.028
100%		+40	1732 500 096	53.8	0.000 003	0.031
100%		+50	1732 500 088	45.9	0.000 003	0.026
Batt. Endpoint	3.600	+20	1732 500 086	44.4	0.000 003	0.026



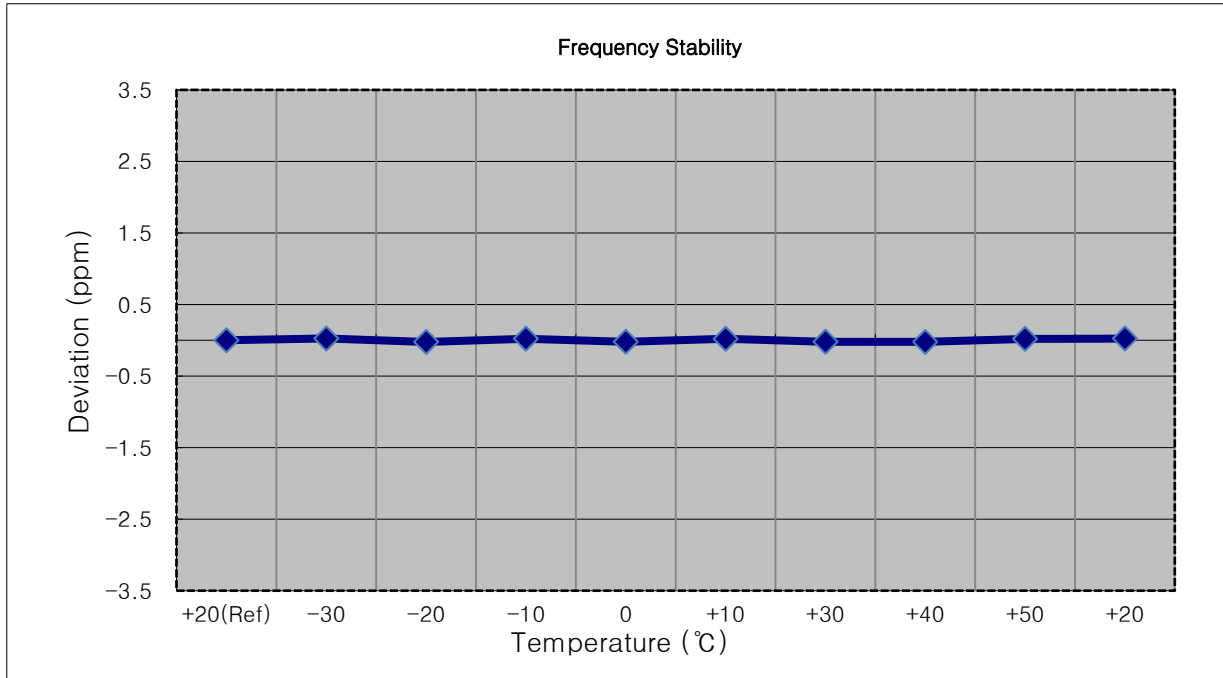
- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 500 047	0.0	0.000 000	0.000
100%		-30	1732 500 093	46.8	0.000 003	0.027
100%		-20	1732 500 087	40.7	0.000 002	0.023
100%		-10	1732 500 086	39.4	0.000 002	0.023
100%		0	1732 500 004	-43.0	-0.000 002	-0.025
100%		+10	1732 500 006	-40.6	-0.000 002	-0.023
100%		+30	1732 500 006	-40.6	-0.000 002	-0.023
100%		+40	1732 500 003	-43.5	-0.000 003	-0.025
100%		+50	1732 500 000	-46.2	-0.000 003	-0.027
Batt. Endpoint	3.600	+20	1732 500 001	-45.3	-0.000 003	-0.026



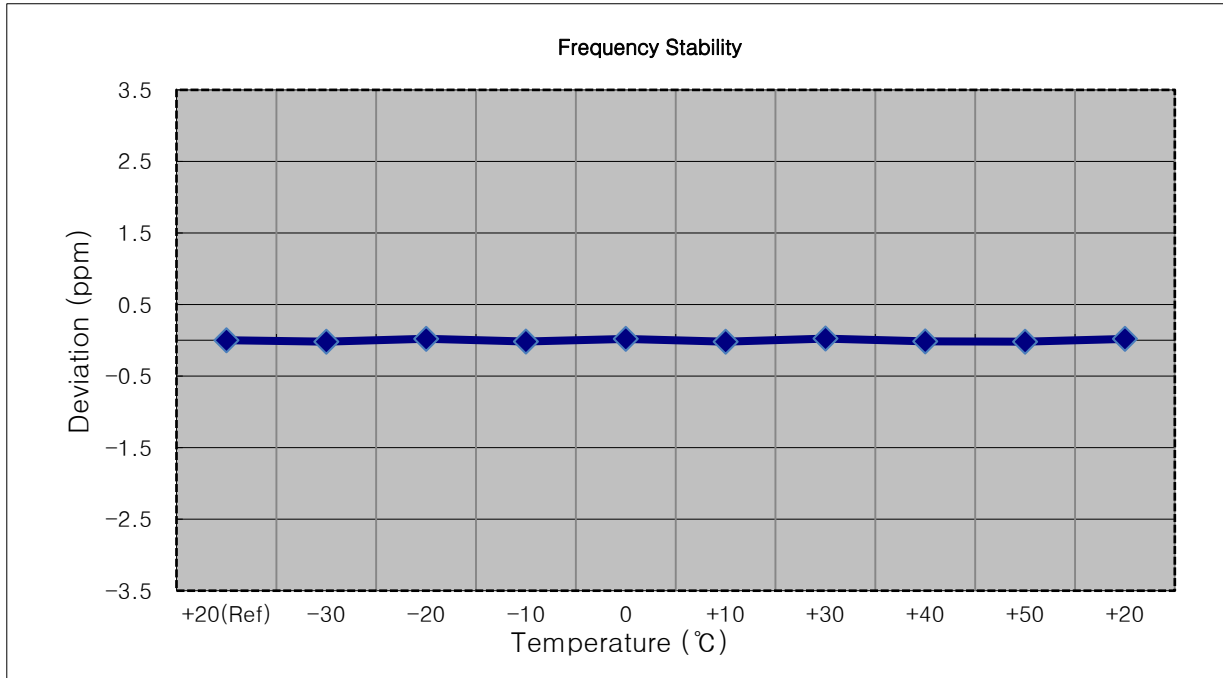
- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 499 959	0.0	0.000 000	0.000
100%		-30	1732 500 003	44.3	0.000 003	0.026
100%		-20	1732 499 918	-40.3	-0.000 002	-0.023
100%		-10	1732 499 997	38.7	0.000 002	0.022
100%		0	1732 499 922	-36.5	-0.000 002	-0.021
100%		+10	1732 499 995	36.0	0.000 002	0.021
100%		+30	1732 499 923	-35.8	-0.000 002	-0.021
100%		+40	1732 499 921	-38.0	-0.000 002	-0.022
100%		+50	1732 499 993	33.8	0.000 002	0.020
Batt. Endpoint	3.600	+20	1732 500 000	41.6	0.000 002	0.024



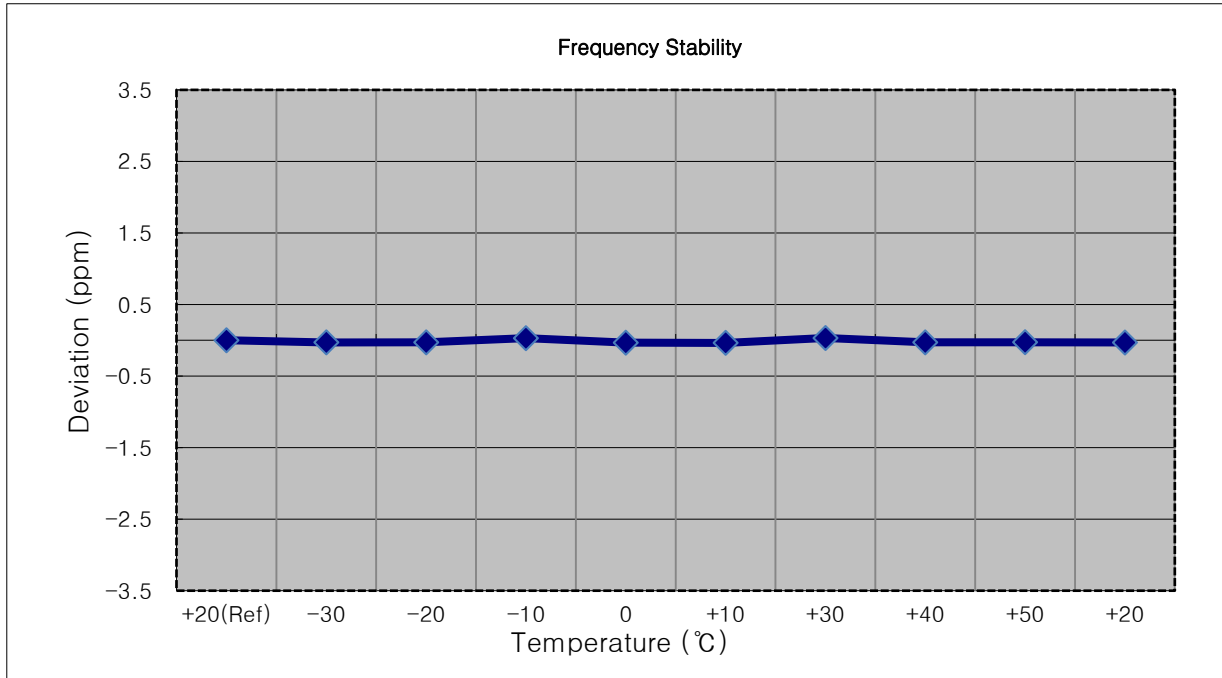
- MODE: LTE 4
- OPERATING FREQUENCY: 1732,500,000 Hz
- CHANNEL: 20175 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 499 967	0.0	0.000 000	0.000
100%		-30	1732 499 933	-33.7	-0.000 002	-0.019
100%		-20	1732 500 002	35.0	0.000 002	0.020
100%		-10	1732 499 937	-29.6	-0.000 002	-0.017
100%		0	1732 500 000	33.4	0.000 002	0.019
100%		+10	1732 499 933	-33.4	-0.000 002	-0.019
100%		+30	1732 500 008	41.2	0.000 002	0.024
100%		+40	1732 499 940	-26.9	-0.000 002	-0.016
100%		+50	1732 499 933	-34.3	-0.000 002	-0.020
Batt. Endpoint	3.600	+20	1732 500 002	34.8	0.000 002	0.020



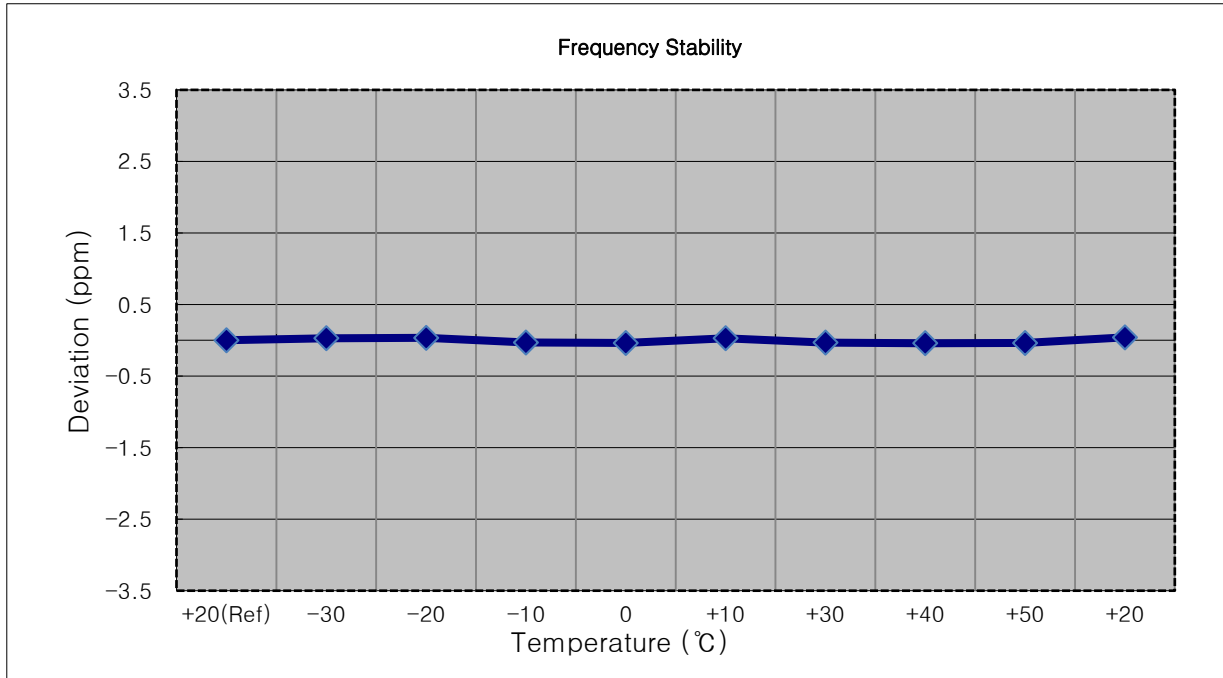
- MODE: LTE 4
- OPERATING FREQUENCY: 1754,300,000 Hz
- CHANNEL: 20393 (1.4 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1754 299 935	0.0	0.000 000	0.000
100%		-30	1754 299 883	-51.7	-0.000 003	-0.029
100%		-20	1754 299 885	-50.3	-0.000 003	-0.029
100%		-10	1754 299 988	52.7	0.000 003	0.030
100%		0	1754 299 878	-57.6	-0.000 003	-0.033
100%		+10	1754 299 871	-64.3	-0.000 004	-0.037
100%		+30	1754 299 990	55.3	0.000 003	0.032
100%		+40	1754 299 886	-49.4	-0.000 003	-0.028
100%		+50	1754 299 887	-48.0	-0.000 003	-0.027
Batt. Endpoint	3.600	+20	1754 299 882	-53.4	-0.000 003	-0.030



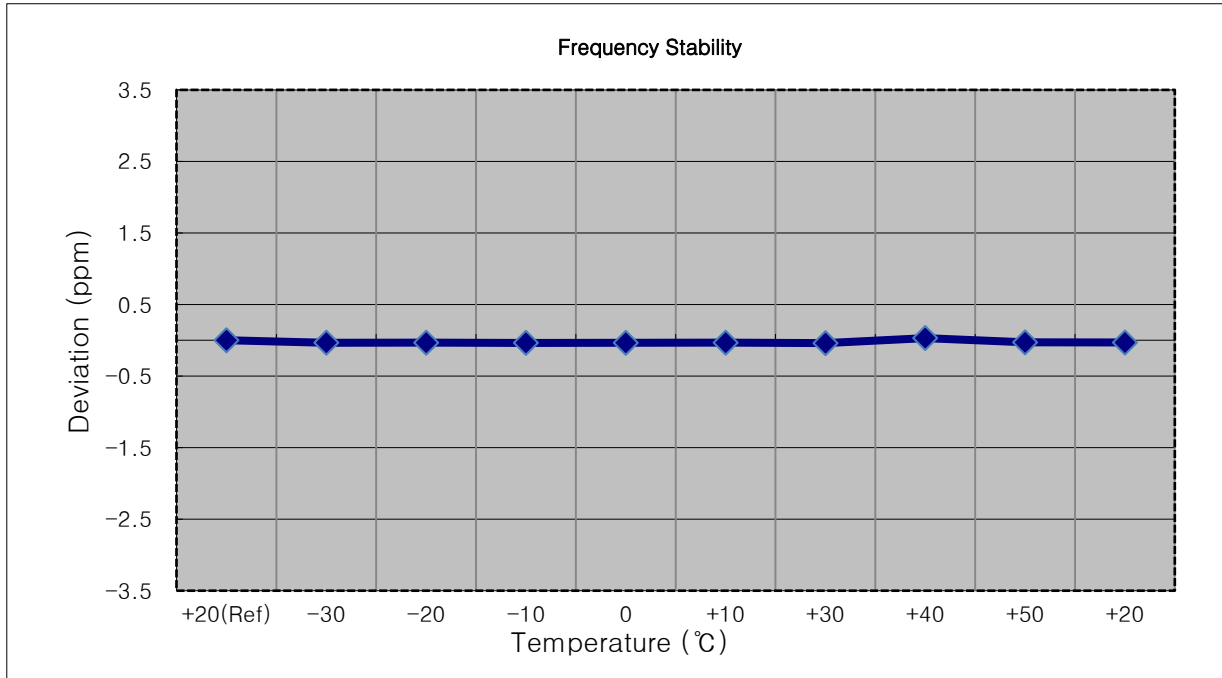
- MODE: LTE 4
- OPERATING FREQUENCY: 1753,500,000 Hz
- CHANNEL: 30385 (3 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1753 500 056	0.0	0.000 000	0.000
100%		-30	1753 500 106	50.2	0.000 003	0.029
100%		-20	1753 500 115	59.3	0.000 003	0.034
100%		-10	1753 500 001	-54.9	-0.000 003	-0.031
100%		0	1753 499 989	-66.3	-0.000 004	-0.038
100%		+10	1753 500 106	50.2	0.000 003	0.029
100%		+30	1753 499 999	-56.9	-0.000 003	-0.032
100%		+40	1753 499 985	-70.8	-0.000 004	-0.040
100%		+50	1753 499 990	-65.6	-0.000 004	-0.037
Batt. Endpoint	3.600	+20	1753 500 127	71.2	0.000 004	0.041



- MODE: LTE 4
- OPERATING FREQUENCY: 1752,500,000 Hz
- CHANNEL: 20375 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

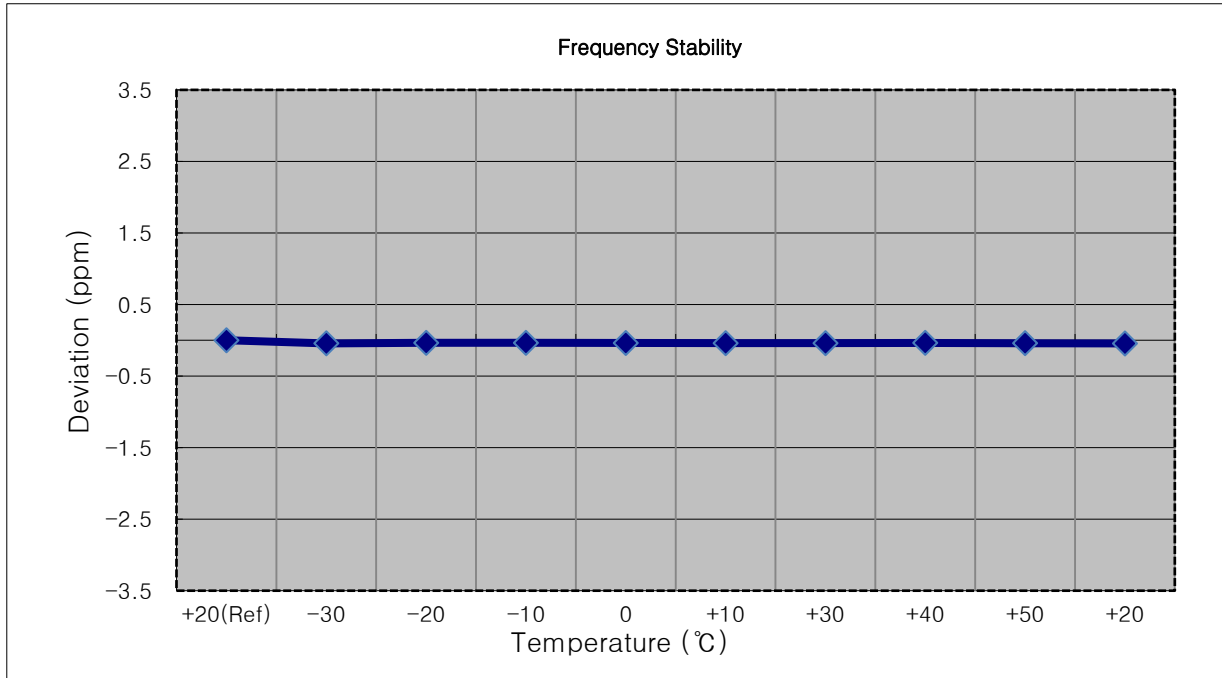
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1752 500 055	0.0	0.000 000	0.000
100%		-30	1752 499 996	-59.0	-0.000 003	-0.034
100%		-20	1752 499 997	-57.7	-0.000 003	-0.033
100%		-10	1752 499 990	-64.6	-0.000 004	-0.037
100%		0	1752 499 992	-62.1	-0.000 004	-0.035
100%		+10	1752 499 996	-58.3	-0.000 003	-0.033
100%		+30	1752 499 984	-70.1	-0.000 004	-0.040
100%		+40	1752 500 108	53.2	0.000 003	0.030
100%		+50	1752 500 004	-50.5	-0.000 003	-0.029
Batt. Endpoint	3.600	+20	1752 500 000	-54.2	-0.000 003	-0.031





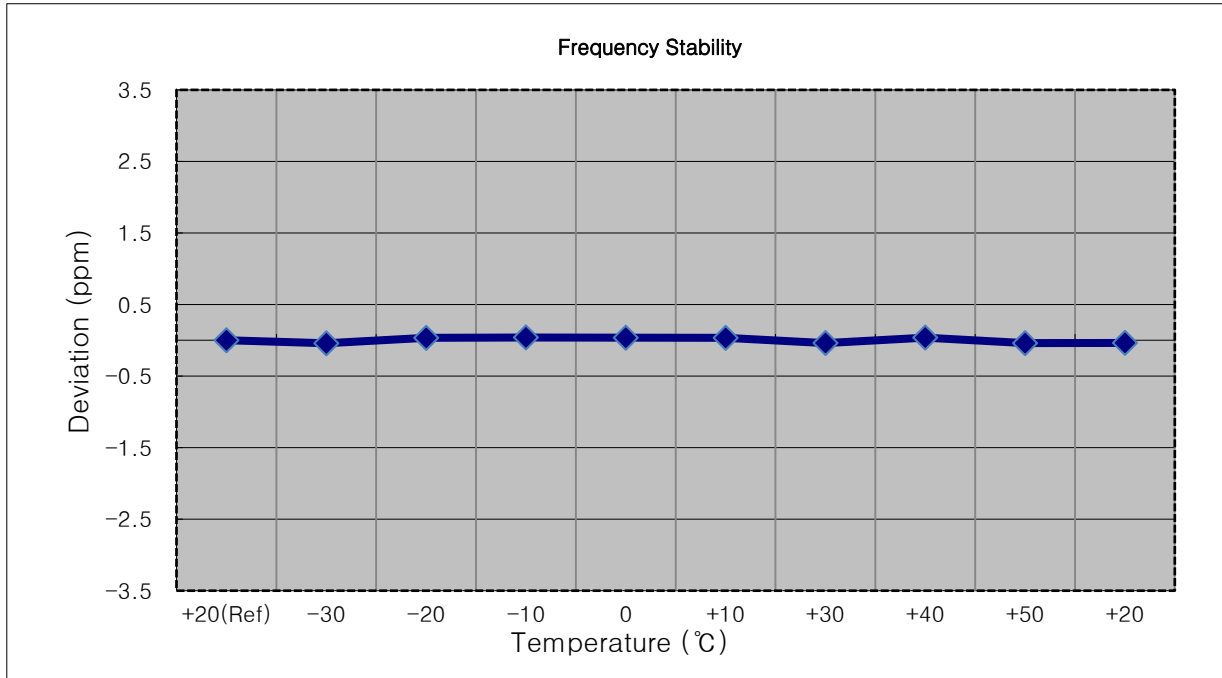
- MODE: LTE 4
- OPERATING FREQUENCY: 1750,000,000 Hz
- CHANNEL: 20350 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1749 999 938	0.0	0.000 000	0.000
100%		-30	1749 999 863	-75.6	-0.000 004	-0.043
100%		-20	1749 999 877	-61.0	-0.000 003	-0.035
100%		-10	1749 999 877	-61.7	-0.000 004	-0.035
100%		0	1749 999 873	-65.2	-0.000 004	-0.037
100%		+10	1749 999 868	-70.1	-0.000 004	-0.040
100%		+30	1749 999 869	-69.2	-0.000 004	-0.040
100%		+40	1749 999 874	-64.5	-0.000 004	-0.037
100%		+50	1749 999 867	-71.4	-0.000 004	-0.041
Batt. Endpoint	3.600	+20	1749 999 860	-77.9	-0.000 004	-0.045



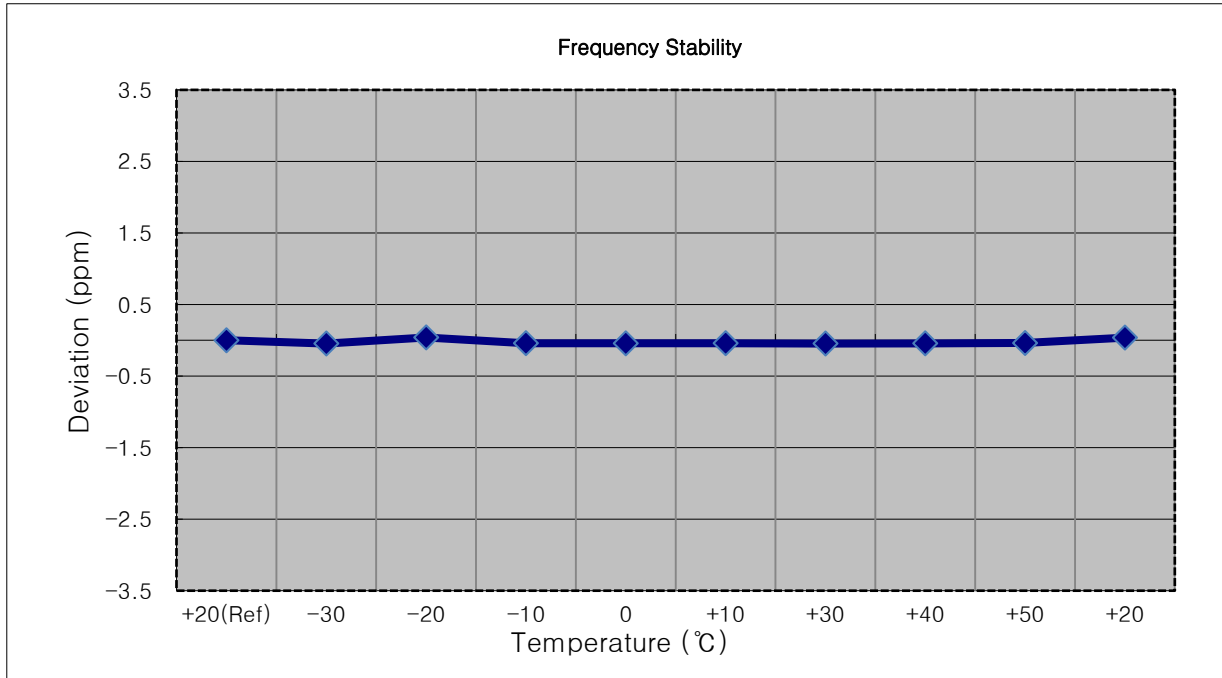
- MODE: LTE 4
- OPERATING FREQUENCY: 1747,500,000 Hz
- CHANNEL: 20325 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1747 499 935	0.0	0.000 000	0.000
100%		-30	1747 499 861	-73.7	-0.000 004	-0.042
100%		-20	1747 499 994	59.5	0.000 003	0.034
100%		-10	1747 500 004	69.7	0.000 004	0.040
100%		0	1747 499 998	63.3	0.000 004	0.036
100%		+10	1747 499 993	58.8	0.000 003	0.034
100%		+30	1747 499 868	-66.6	-0.000 004	-0.038
100%		+40	1747 499 999	64.9	0.000 004	0.037
100%		+50	1747 499 865	-70.0	-0.000 004	-0.040
Batt. Endpoint	3.600	+20	1747 499 871	-63.3	-0.000 004	-0.036



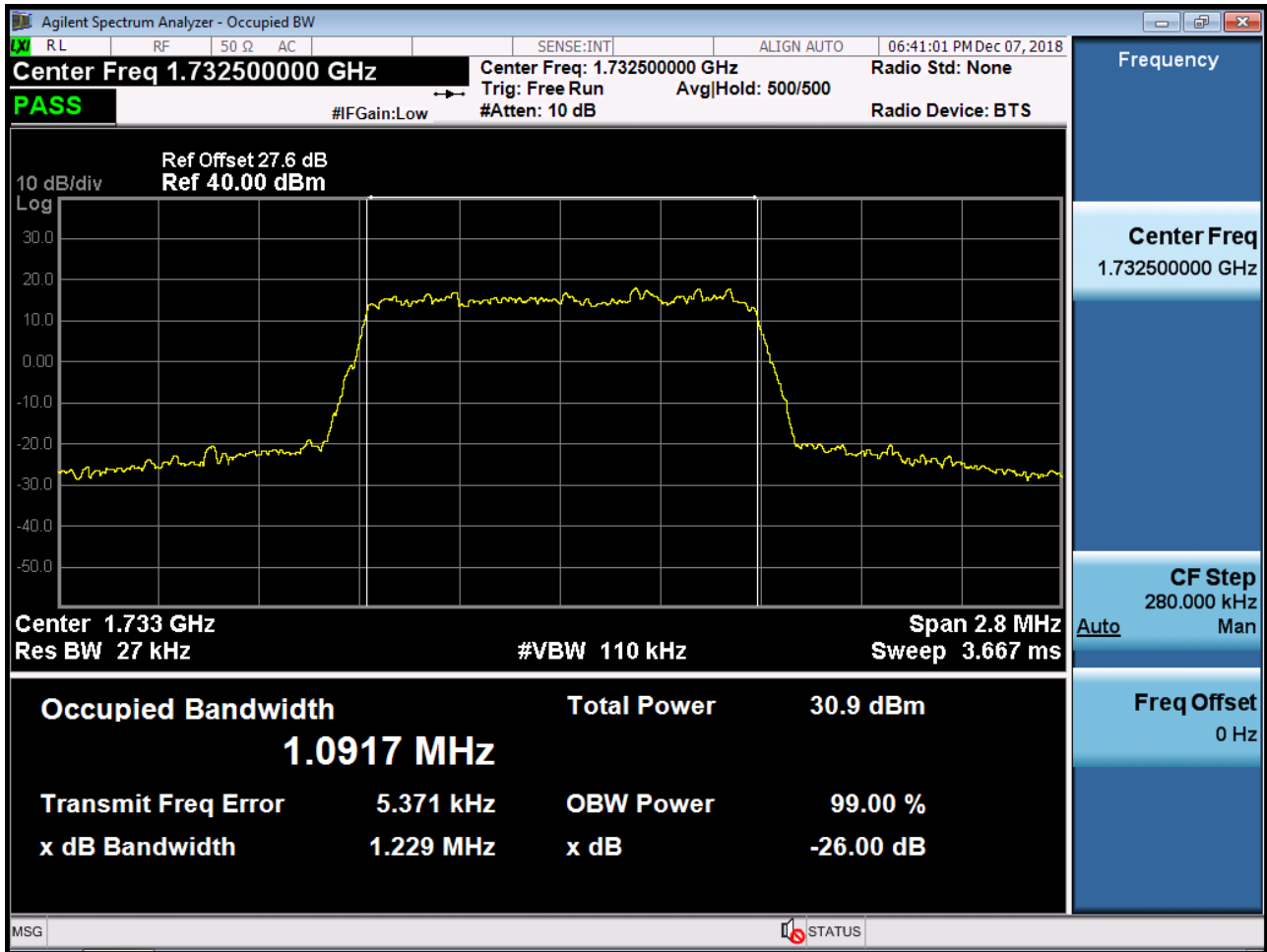
- MODE: LTE 4
- OPERATING FREQUENCY: 1745.000.000 Hz
- CHANNEL: 20300 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1744 999 928	0.0	0.000 000	0.000
100%		-30	1744 999 849	-78.9	-0.000 005	-0.045
100%		-20	1744 999 997	69.4	0.000 004	0.040
100%		-10	1744 999 857	-70.5	-0.000 004	-0.040
100%		0	1744 999 855	-73.1	-0.000 004	-0.042
100%		+10	1744 999 856	-71.6	-0.000 004	-0.041
100%		+30	1744 999 849	-79.2	-0.000 005	-0.045
100%		+40	1744 999 853	-75.1	-0.000 004	-0.043
100%		+50	1744 999 862	-66.0	-0.000 004	-0.038
Batt. Endpoint	3.600	+20	1744 999 994	65.7	0.000 004	0.038

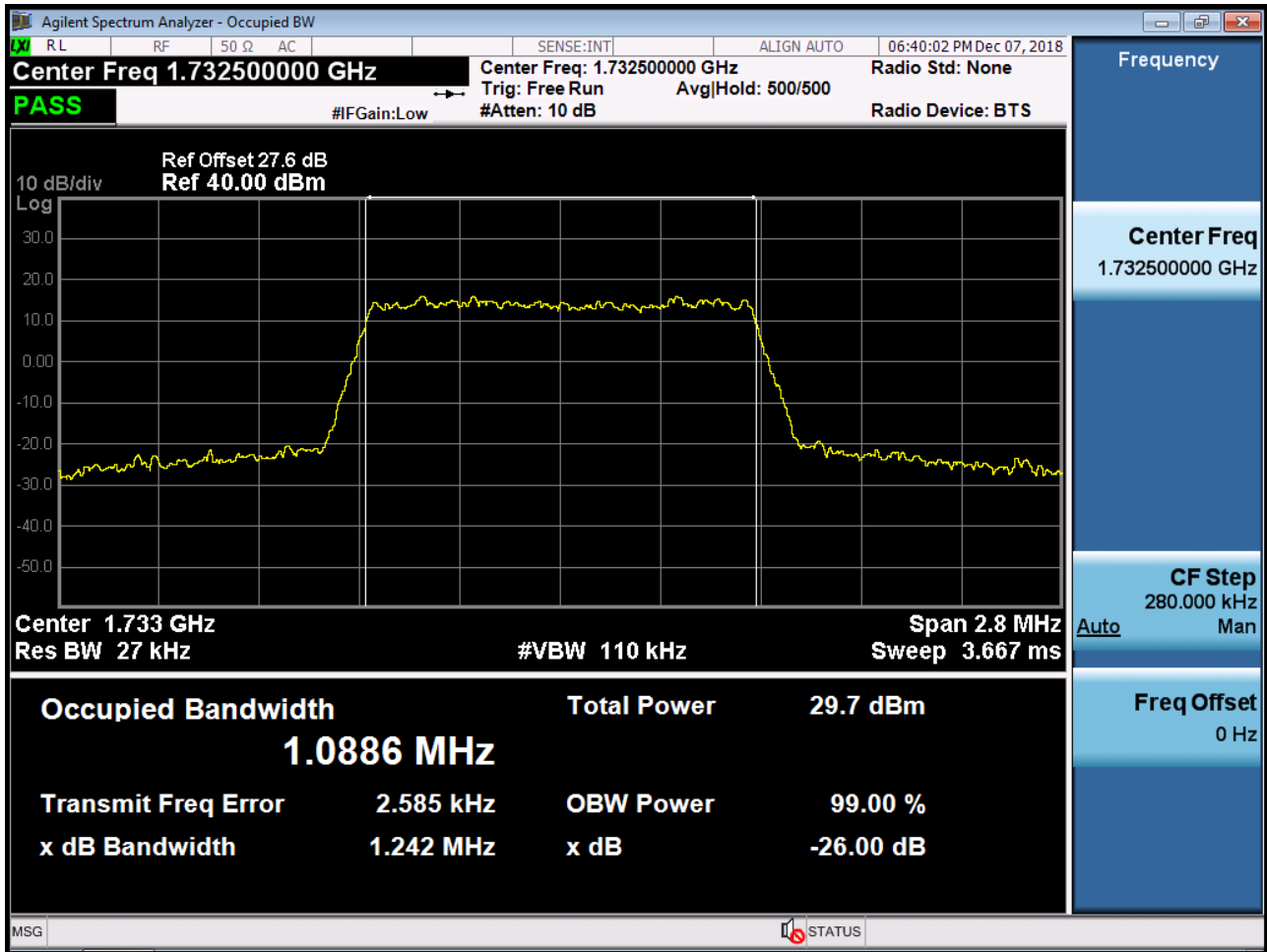


## **9. TEST PLOTS**

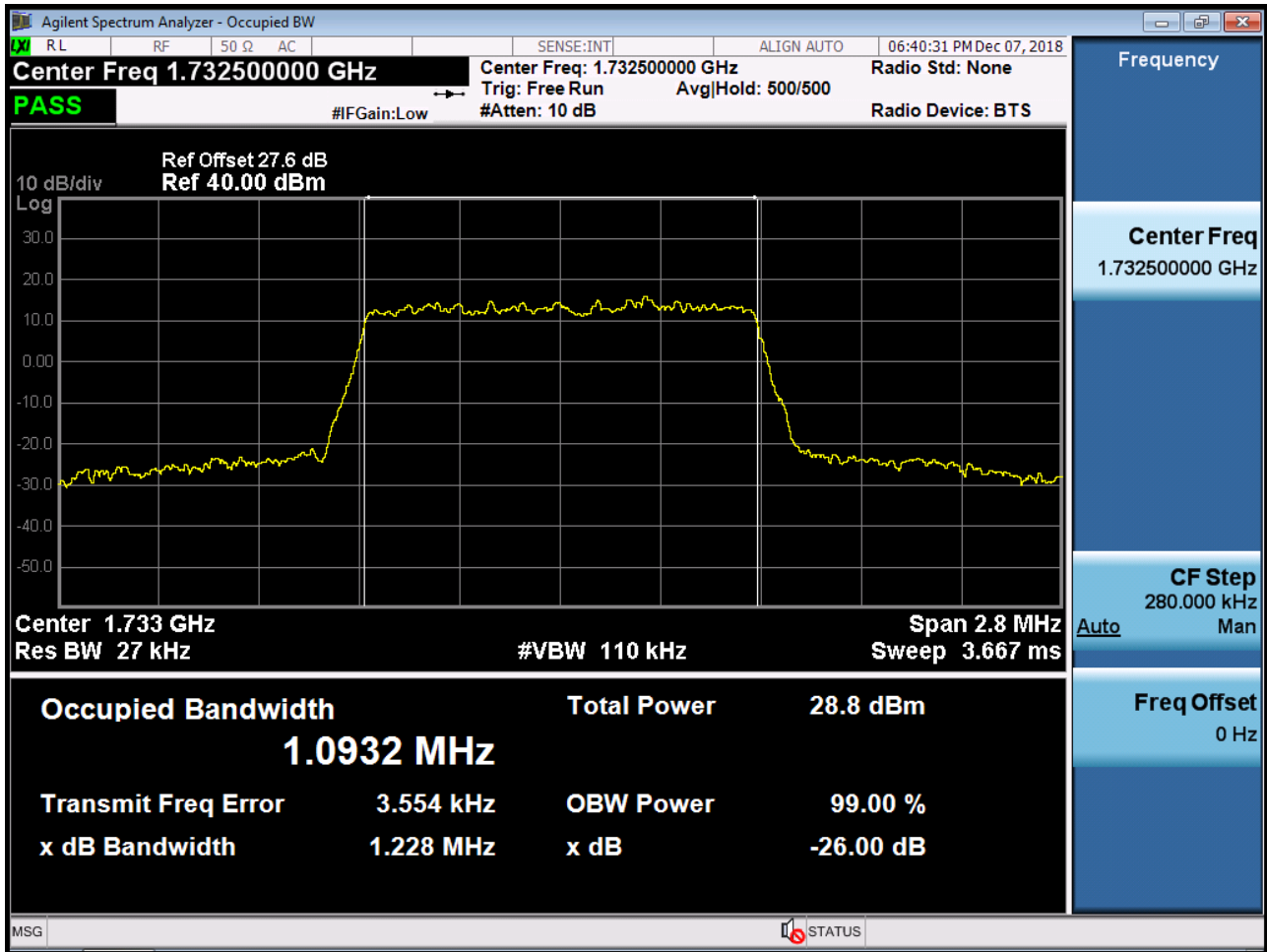
BAND 4. Occupied Bandwidth Plot (1.4M BW Ch.20175 QPSK RB 6)



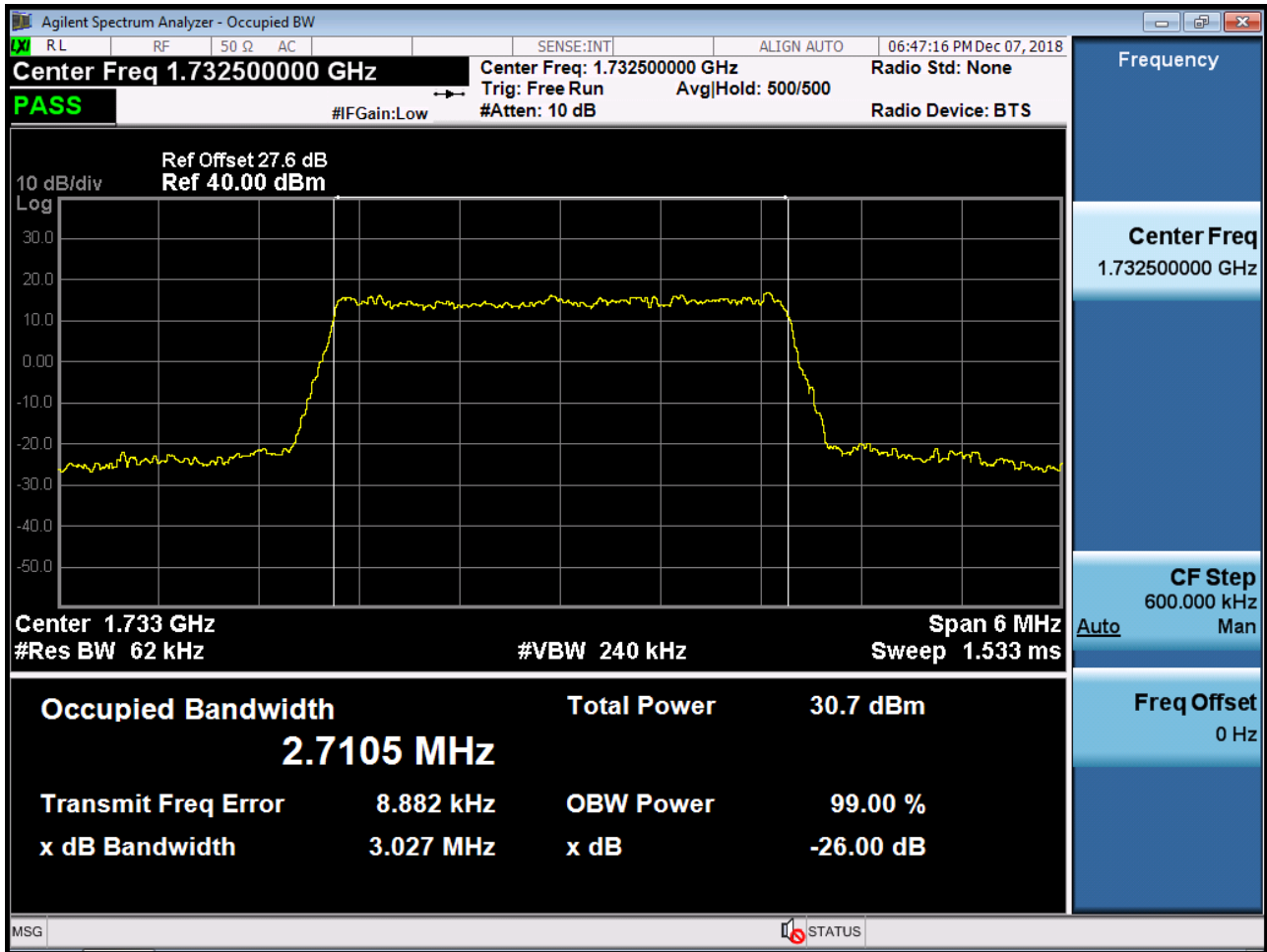
BAND 4. Occupied Bandwidth Plot (1.4M BW Ch.20175 16QAM RB 6)



BAND 4. Occupied Bandwidth Plot (1.4M BW Ch.20175 64QAM RB 6)

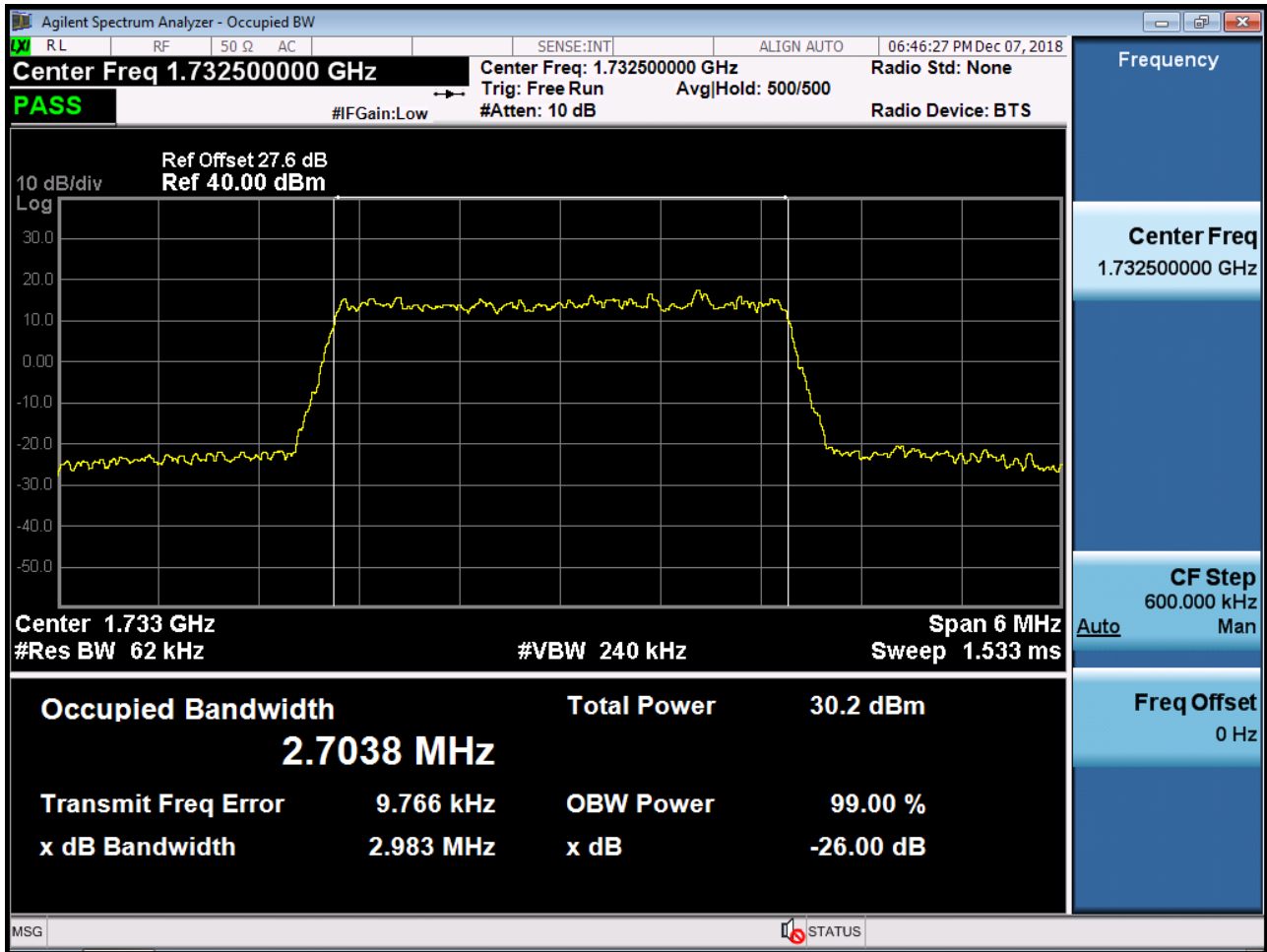


BAND 4. Occupied Bandwidth Plot (3M BW Ch.20175 QPSK RB 15)

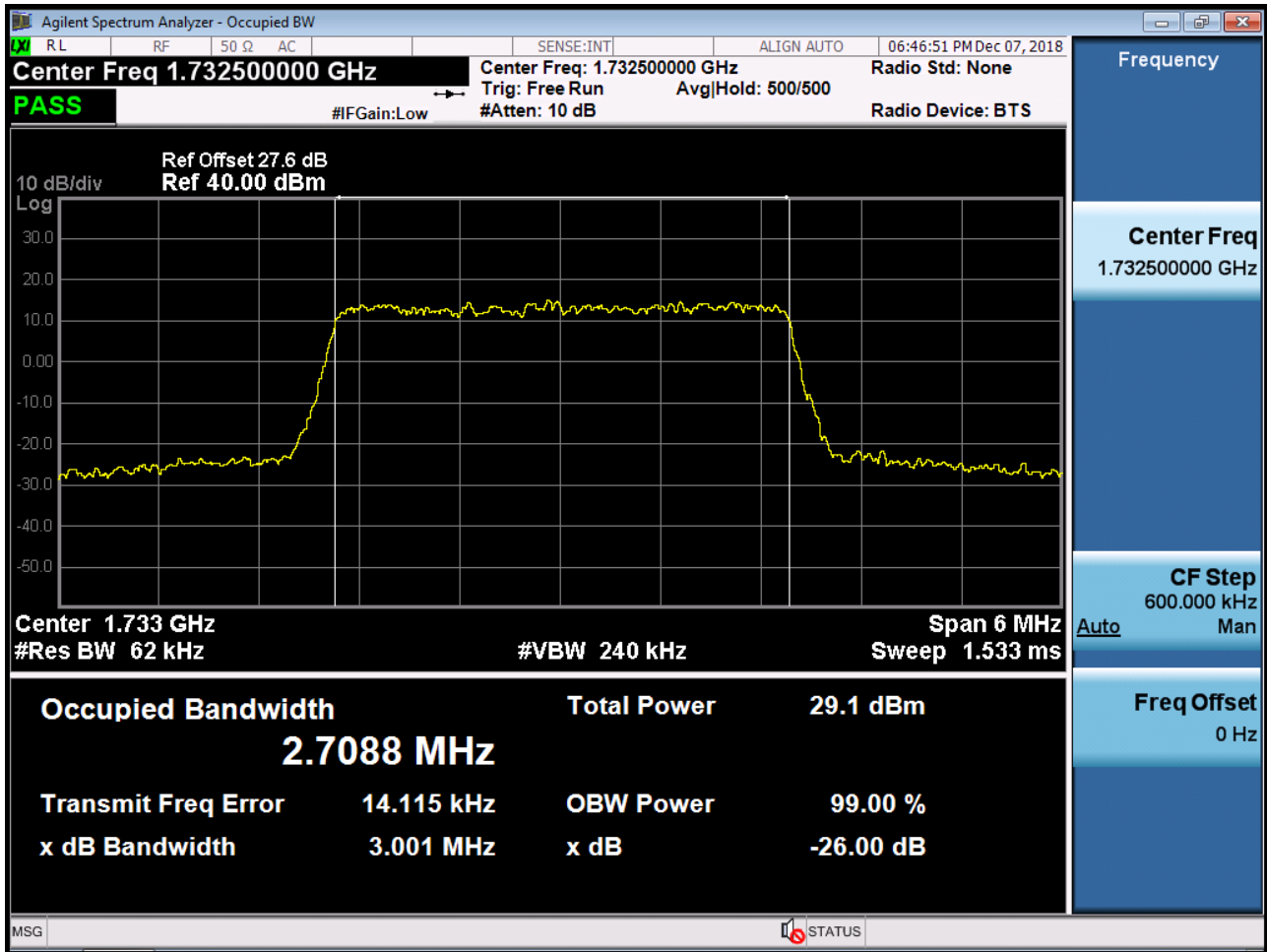




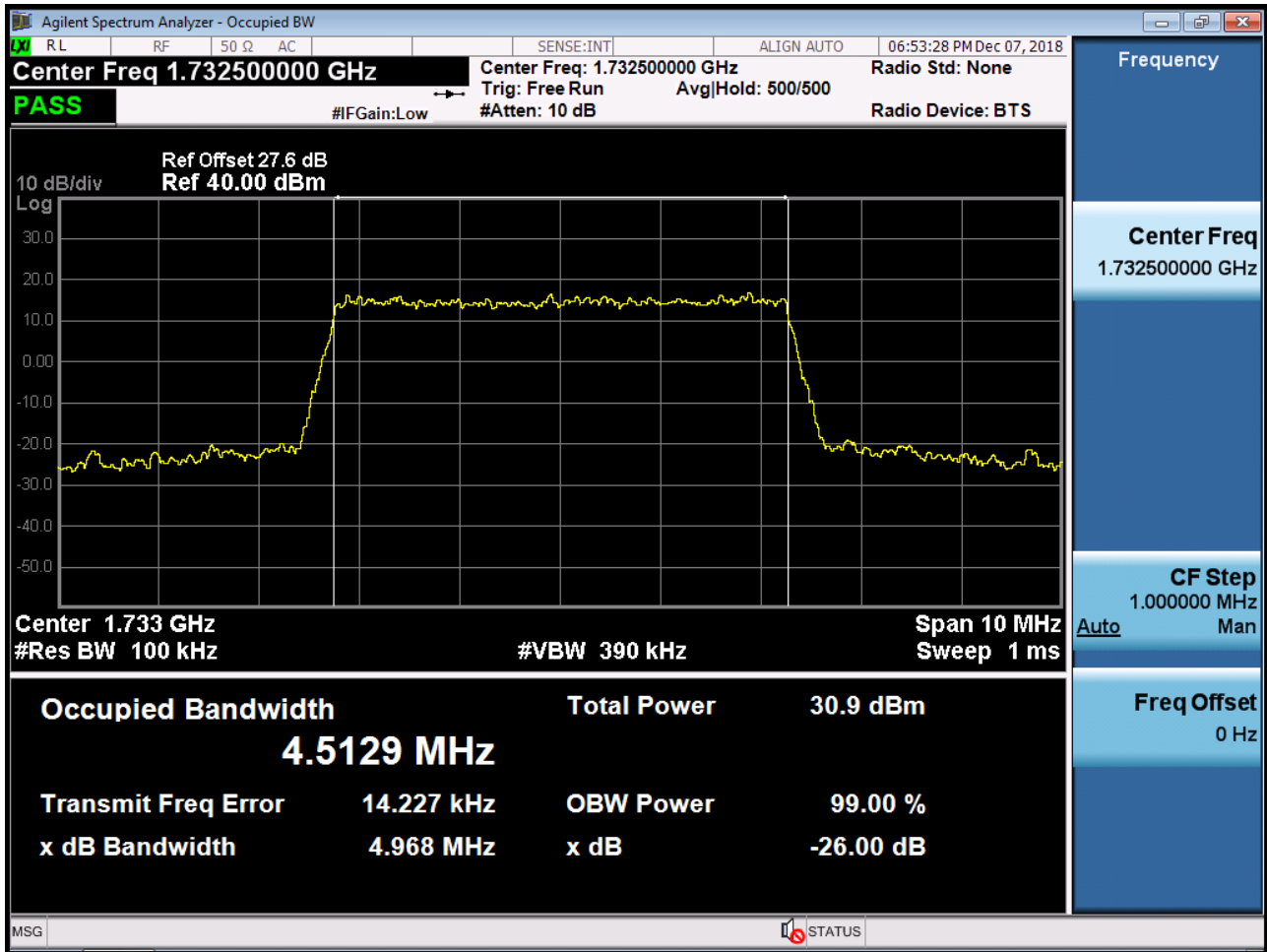
BAND 4. Occupied Bandwidth Plot (3M BW Ch.20175 16QAM RB 15)



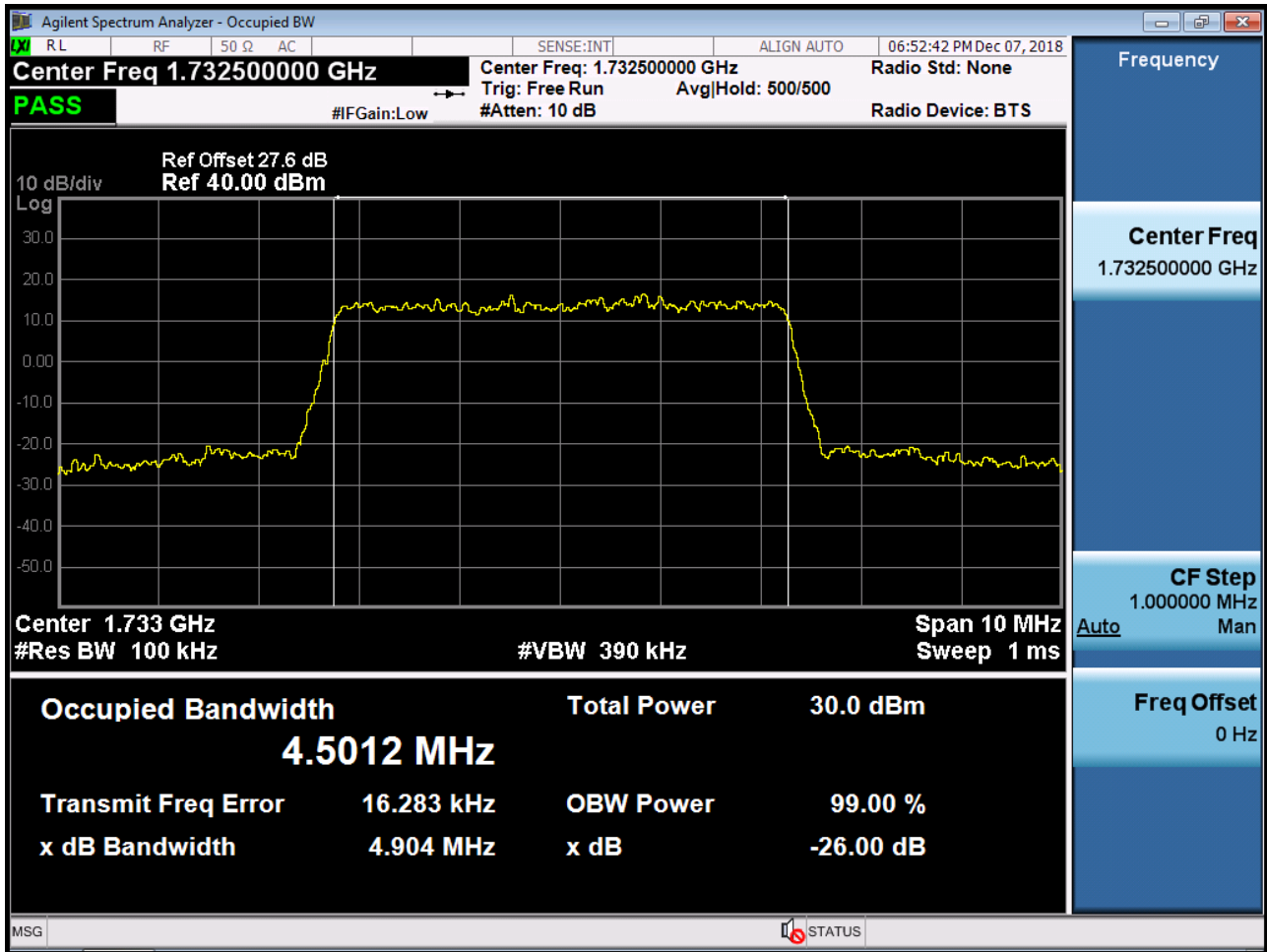
BAND 4. Occupied Bandwidth Plot (3M BW Ch.20175 64QAM RB 15)



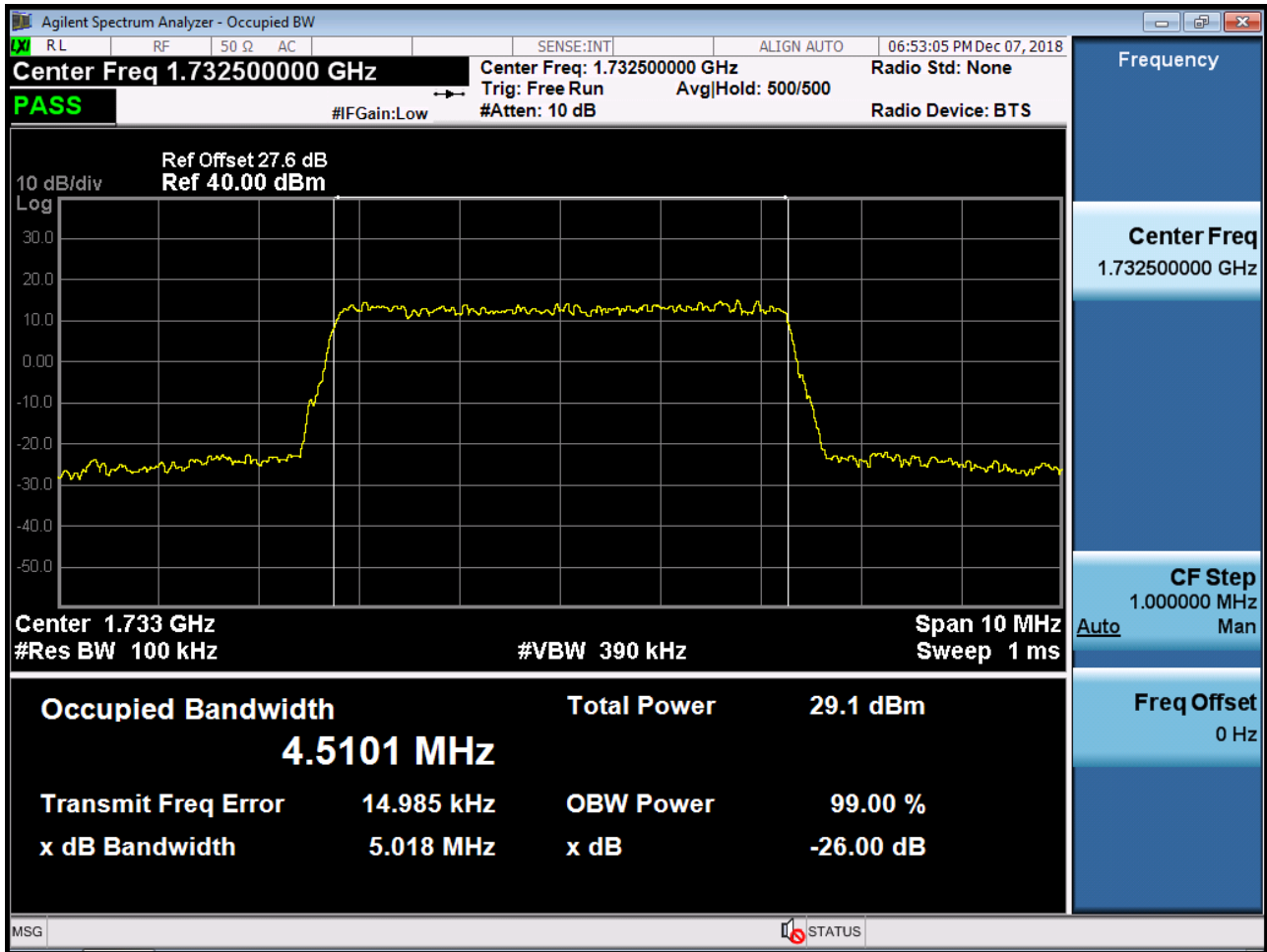
BAND 4. Occupied Bandwidth Plot (5M BW Ch.20175 QPSK RB 25)



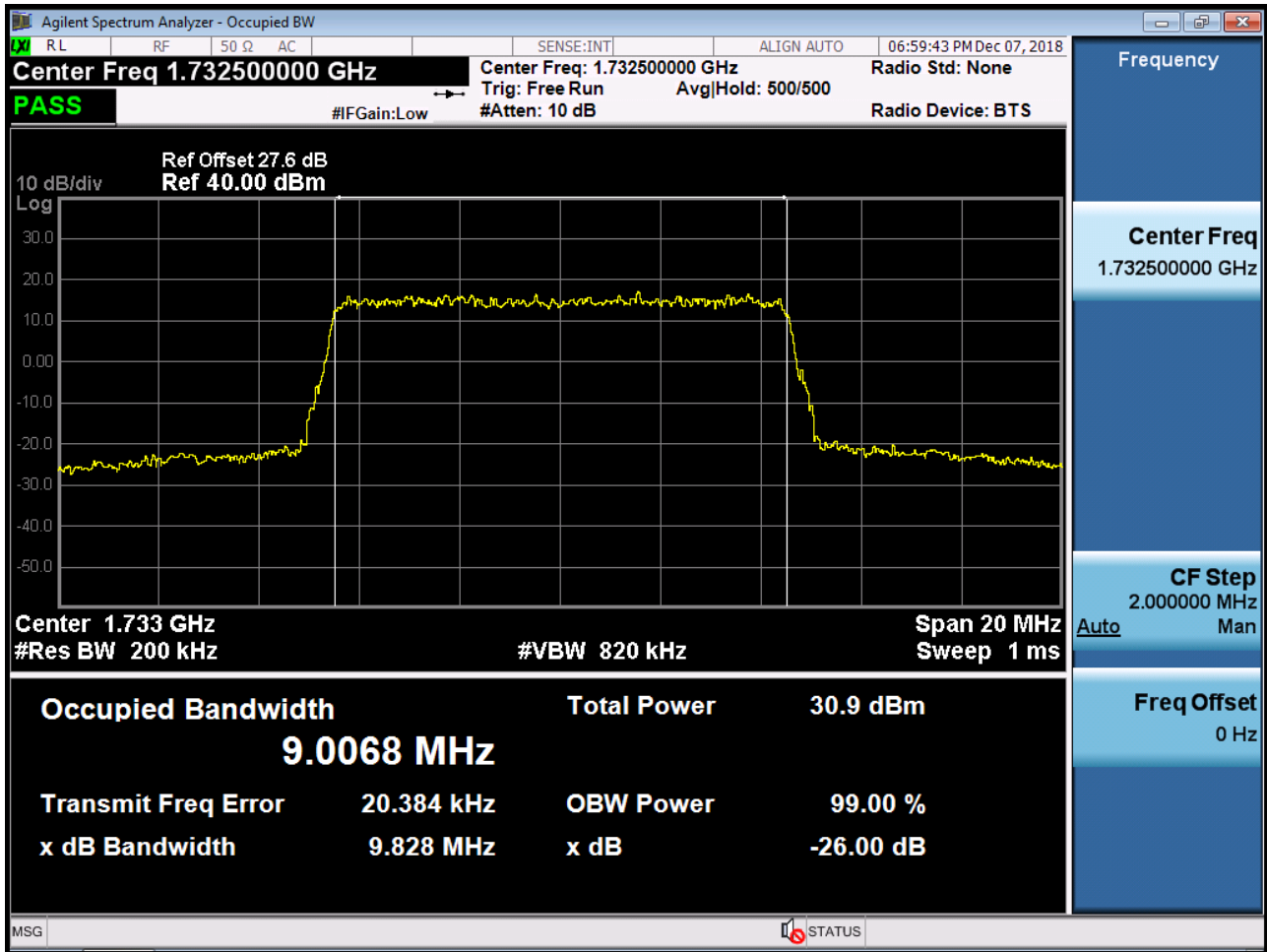
BAND 4. Occupied Bandwidth Plot (5M BW Ch.20175 16QAM RB 25)



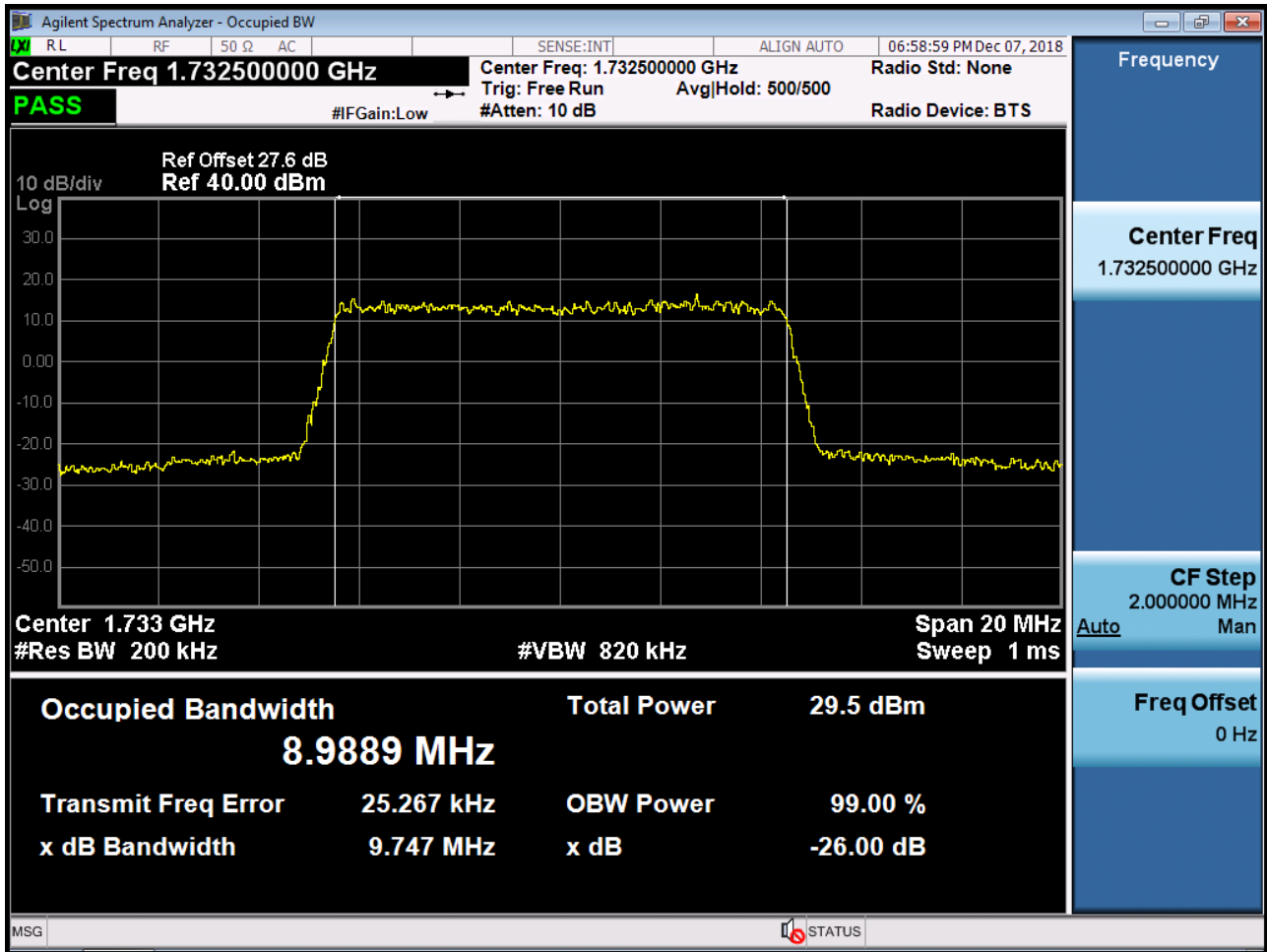
BAND 4. Occupied Bandwidth Plot (5M BW Ch.20175 64QAM RB 25)



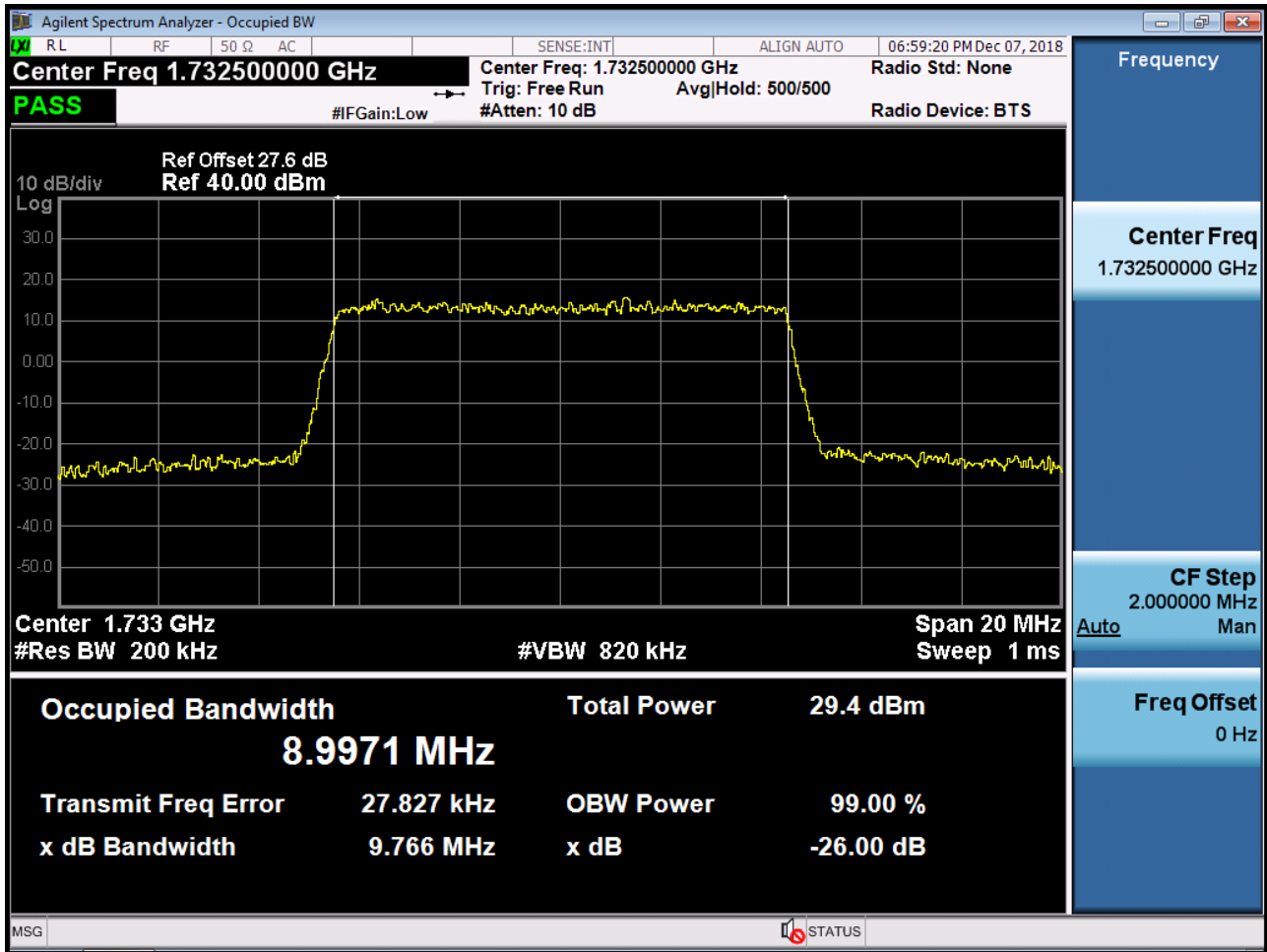
BAND 4. Occupied Bandwidth Plot (10M BW Ch.20175 QPSK RB 50)



BAND 4. Occupied Bandwidth Plot (10M BW Ch.20175 16QAM RB 50)

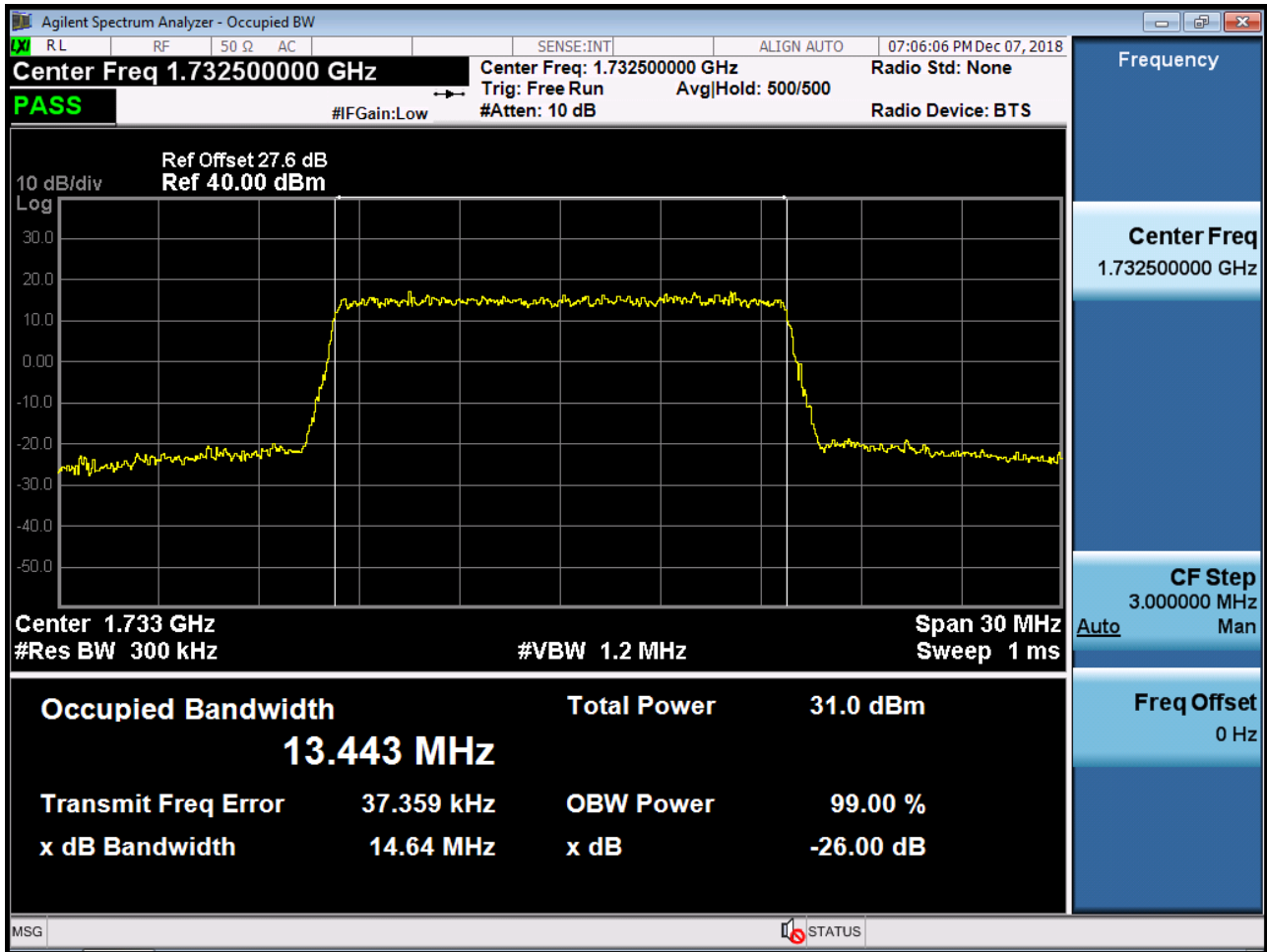


BAND 4. Occupied Bandwidth Plot (10M BW Ch.20175 64QAM RB 50)

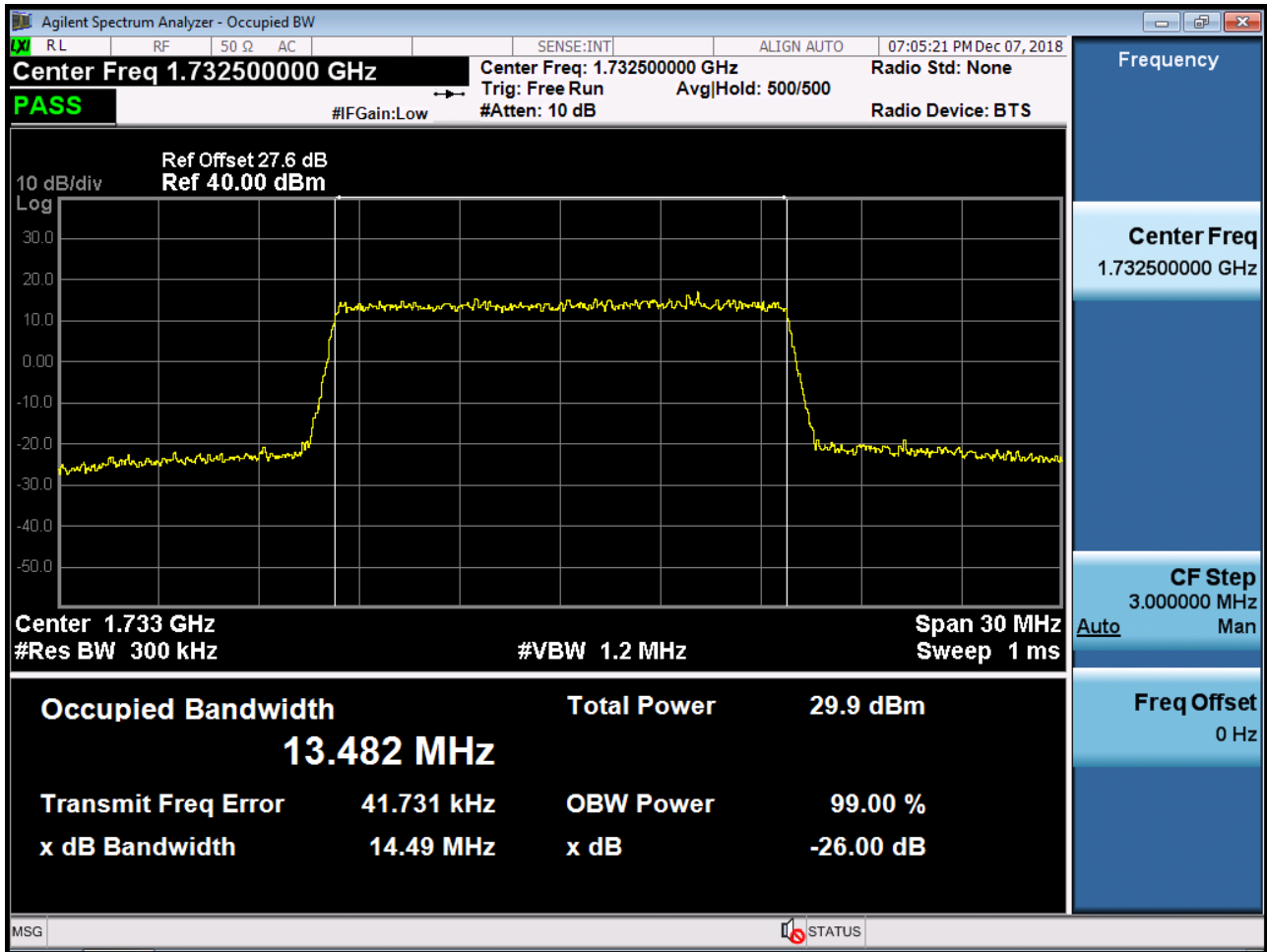




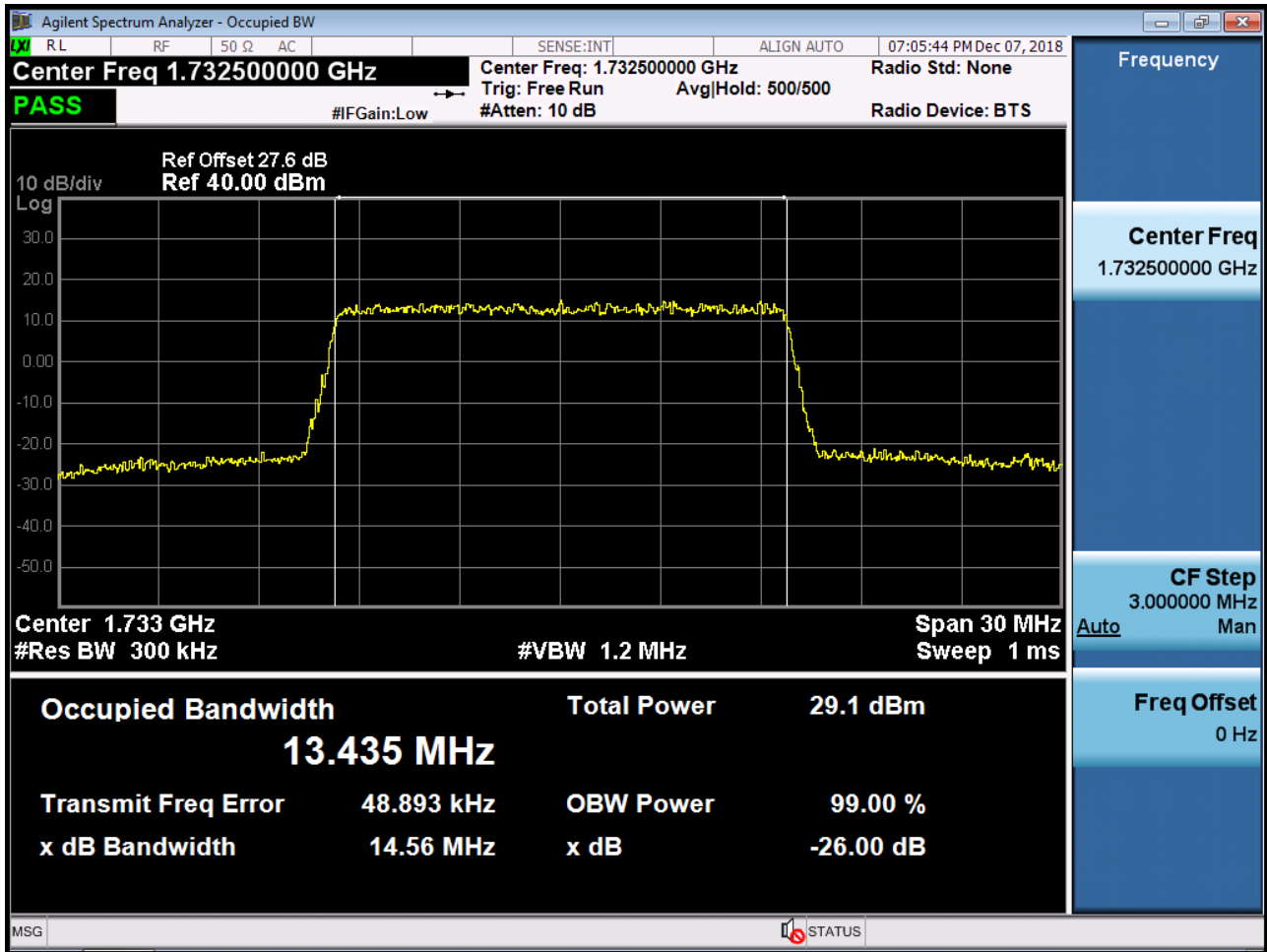
BAND 4. Occupied Bandwidth Plot (15M BW Ch.20175 QPSK RB 75)



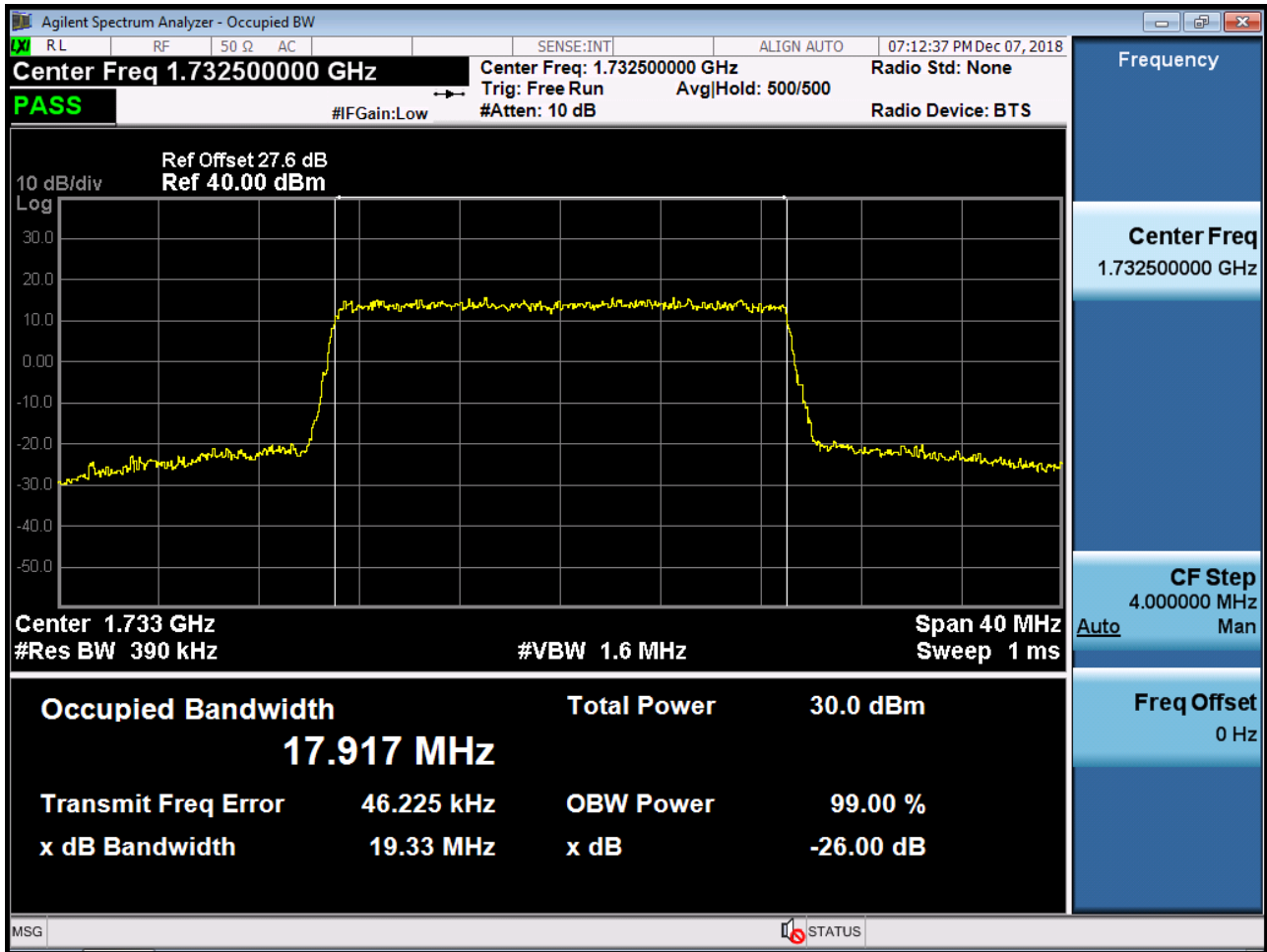
BAND 4. Occupied Bandwidth Plot (15M BW Ch.20175 16QAM RB 75)



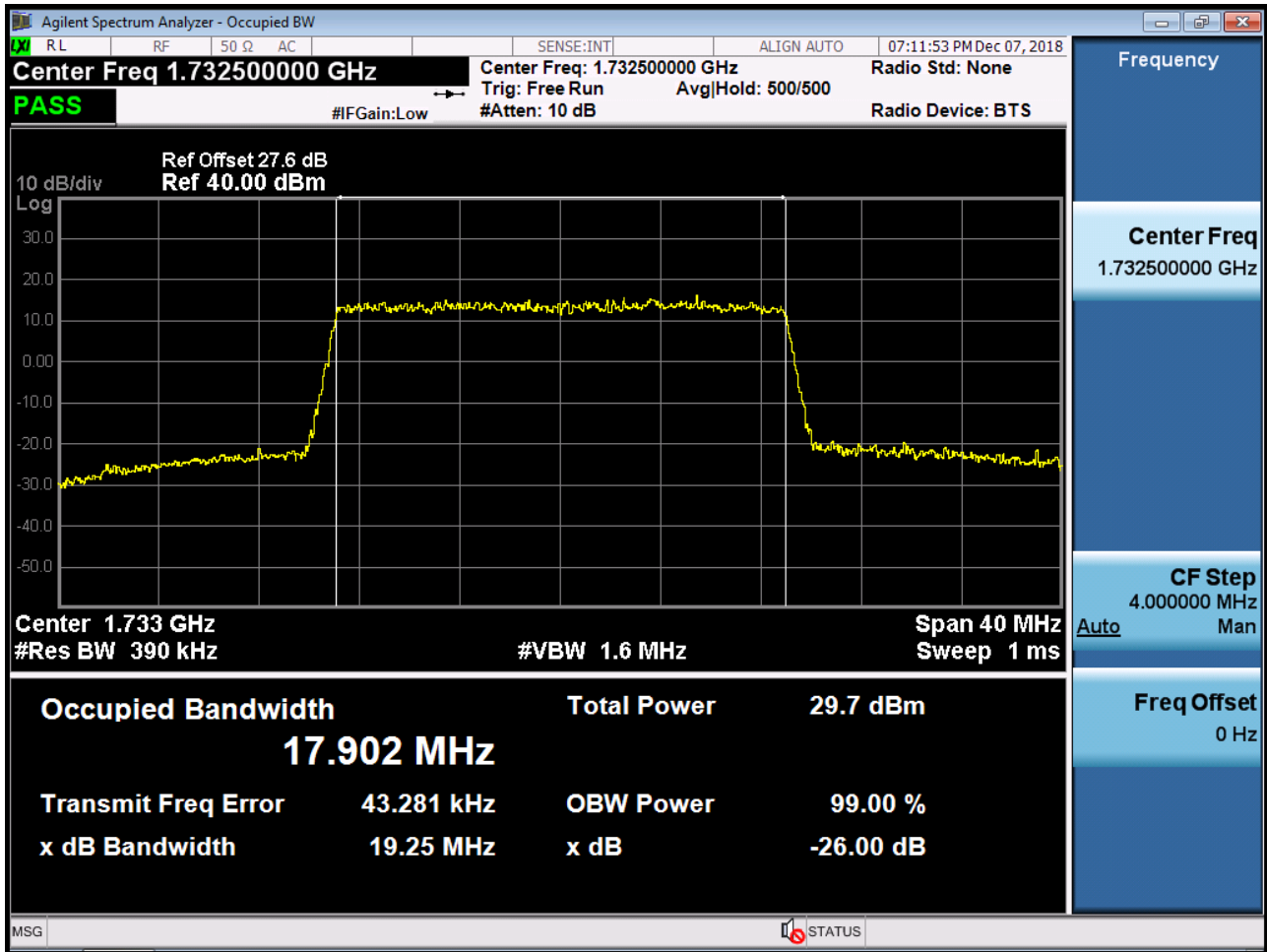
BAND 4. Occupied Bandwidth Plot (15M BW Ch.20175 64QAM RB 75)



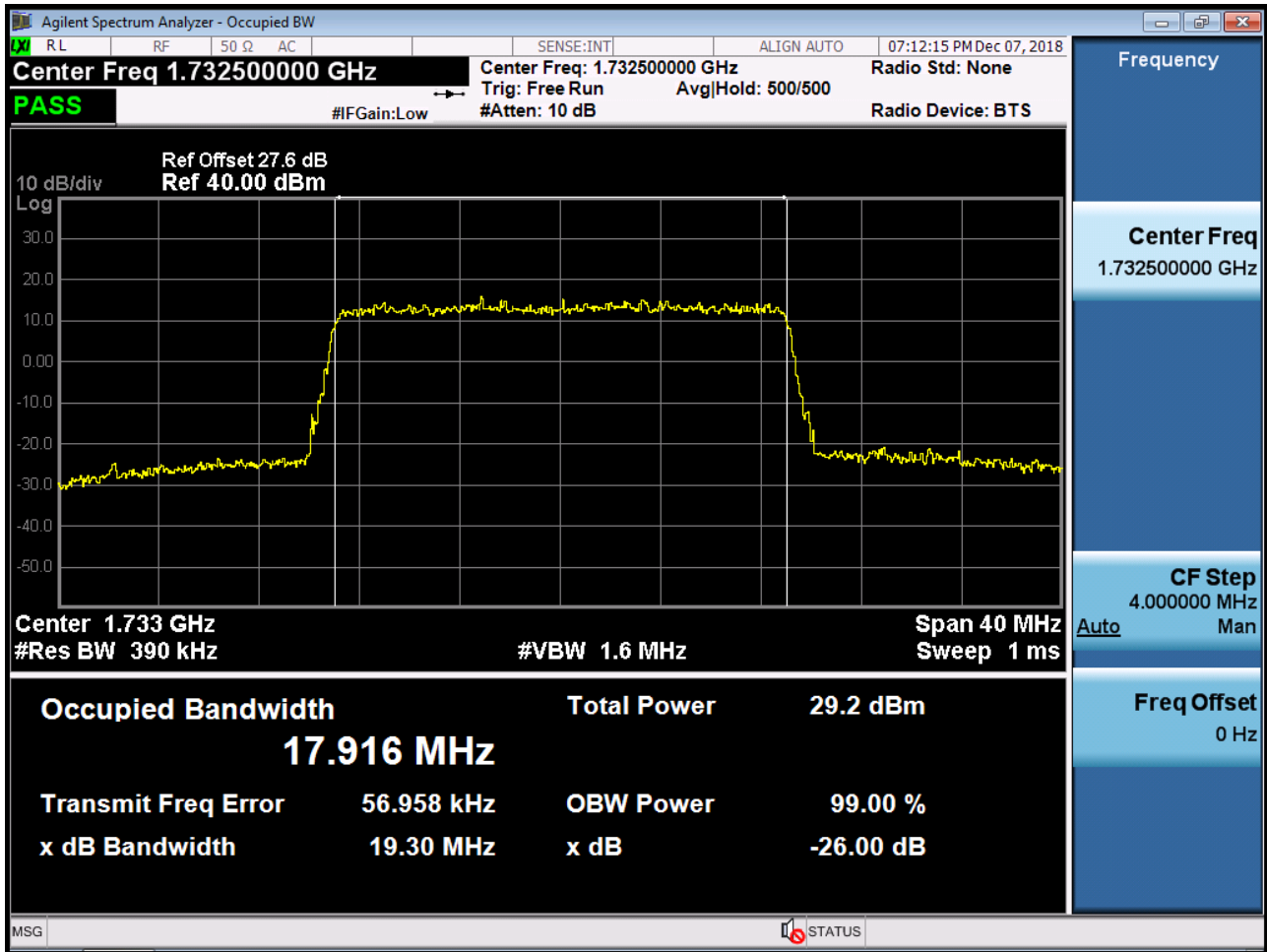
BAND 4. Occupied Bandwidth Plot (20M BW Ch.20175 QPSK RB 100)



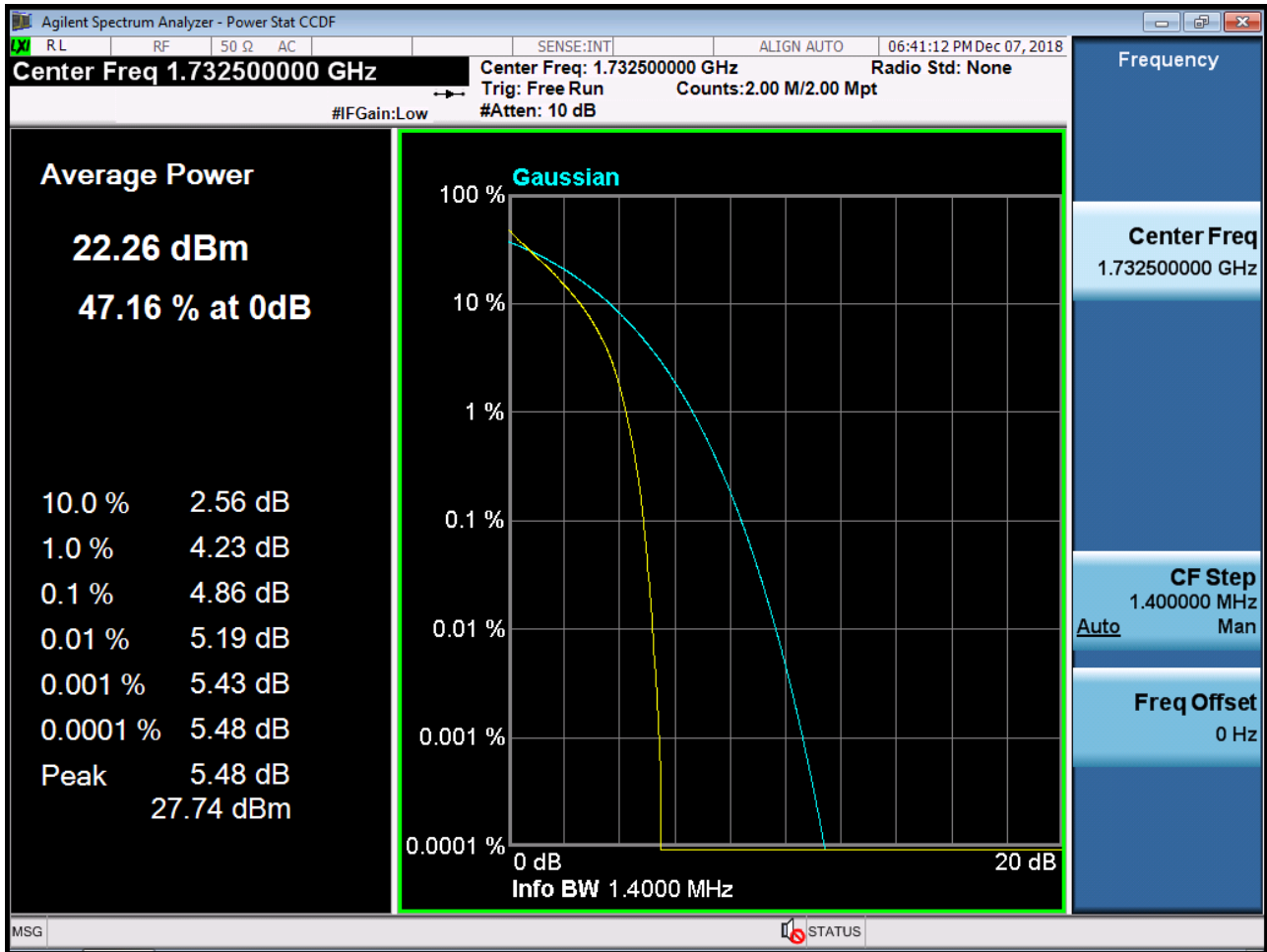
BAND 4. Occupied Bandwidth Plot (20M BW Ch.20175 16QAM RB 100)



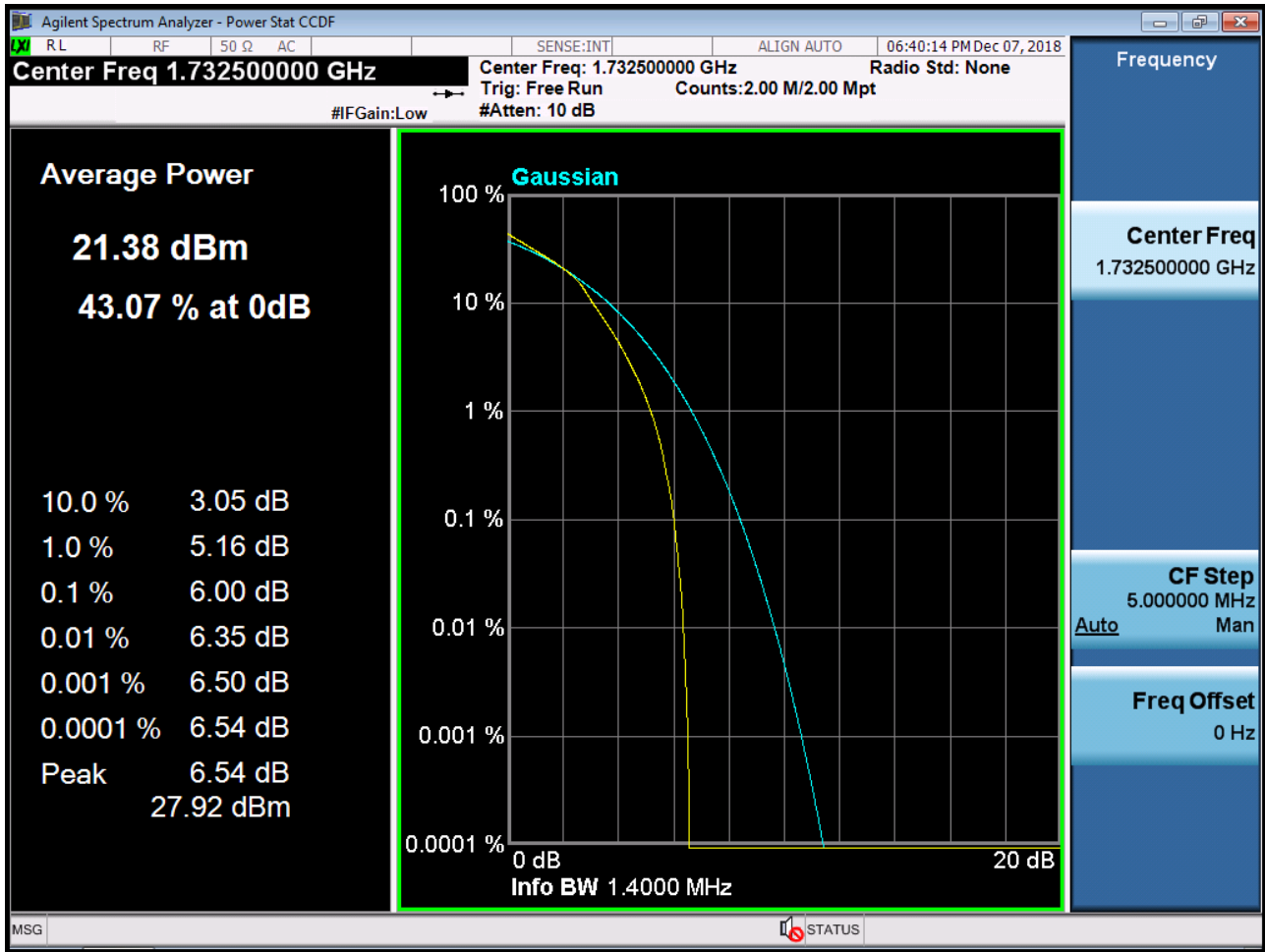
BAND 4. Occupied Bandwidth Plot (20M BW Ch.20175 64QAM RB 100)



BAND 4. PAR Plot (1.4M BW\_Ch.20175\_QPSK\_RB6\_0)

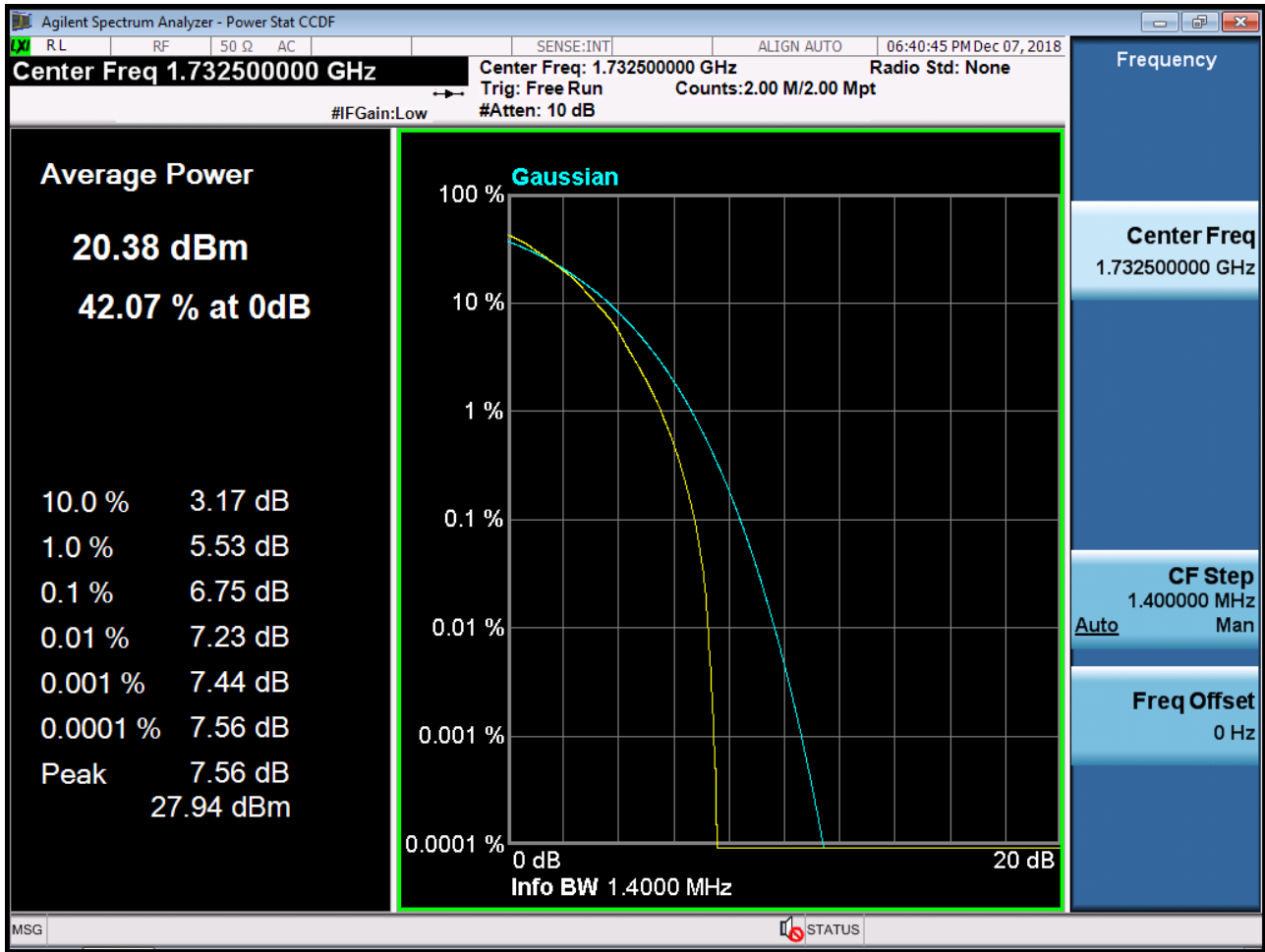


BAND 4. PAR Plot (1.4M BW\_Ch.20175\_16QAM\_RB6\_0)

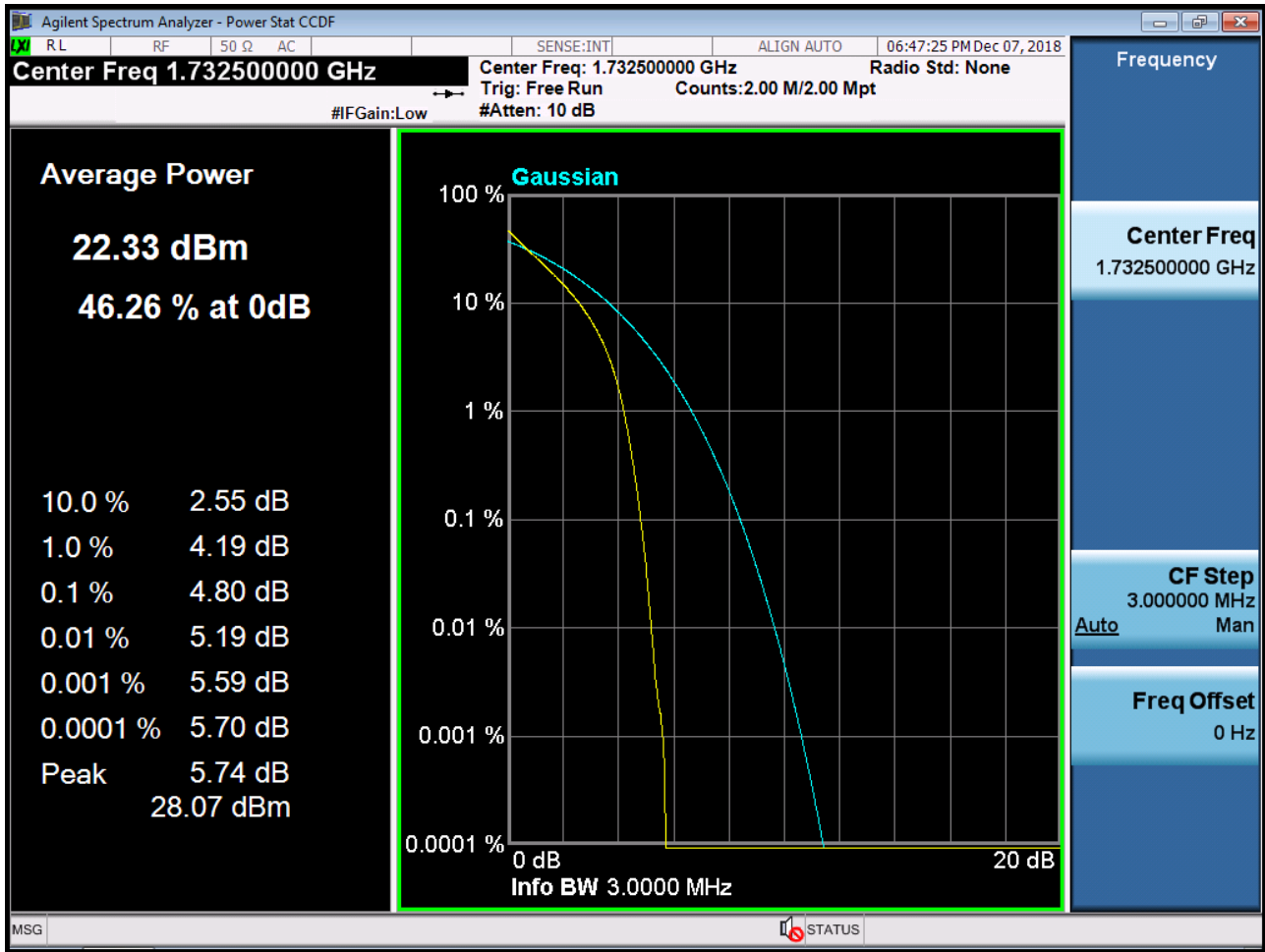




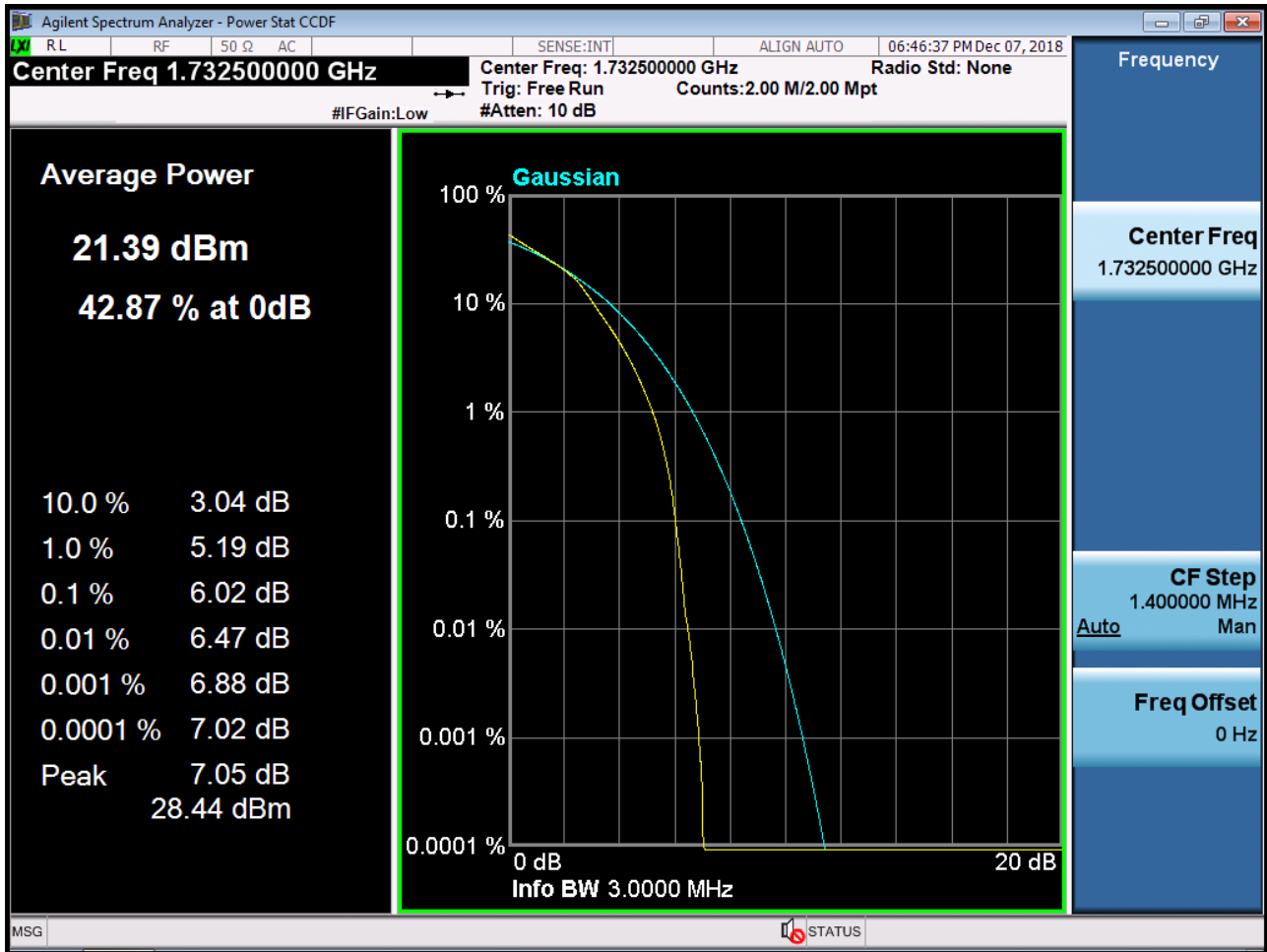
BAND 4. PAR Plot (1.4M BW\_Ch.20175\_64QAM\_RB6\_0)



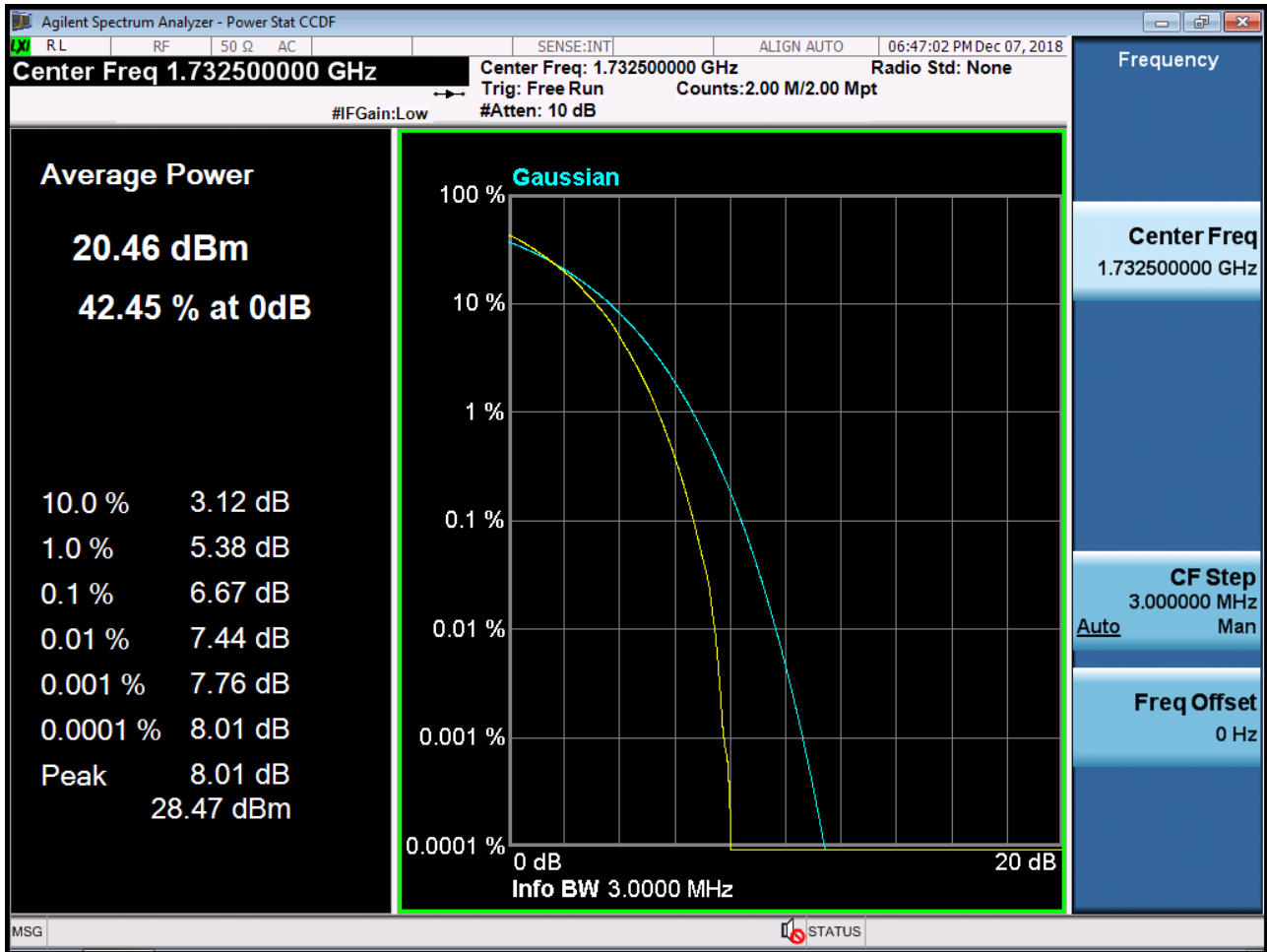
BAND 4. PAR Plot (3M BW\_Ch.20175\_QPSK\_RB15\_0)



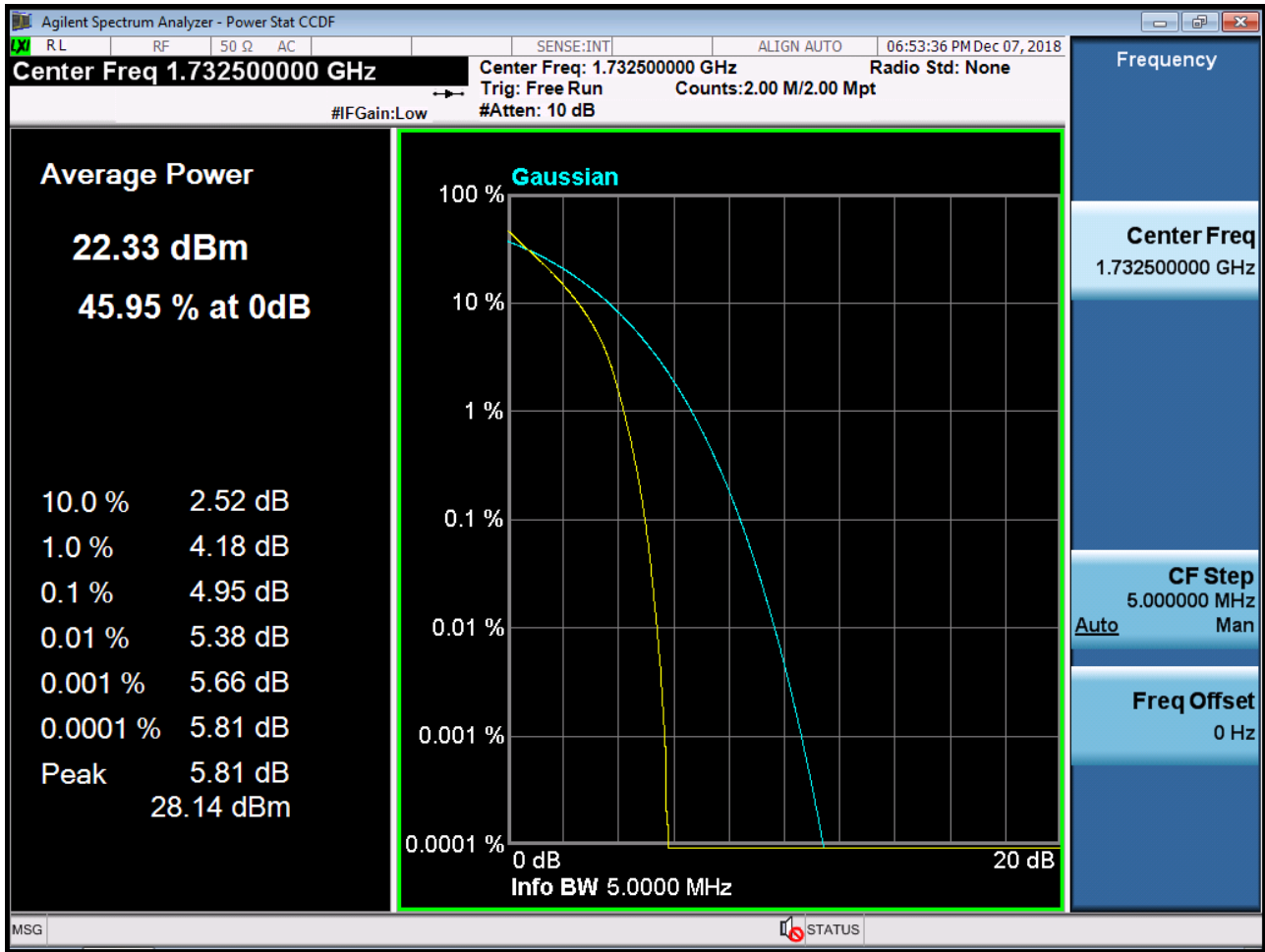
BAND 4. PAR Plot (3M BW\_Ch.20175\_16QAM\_RB15\_0)



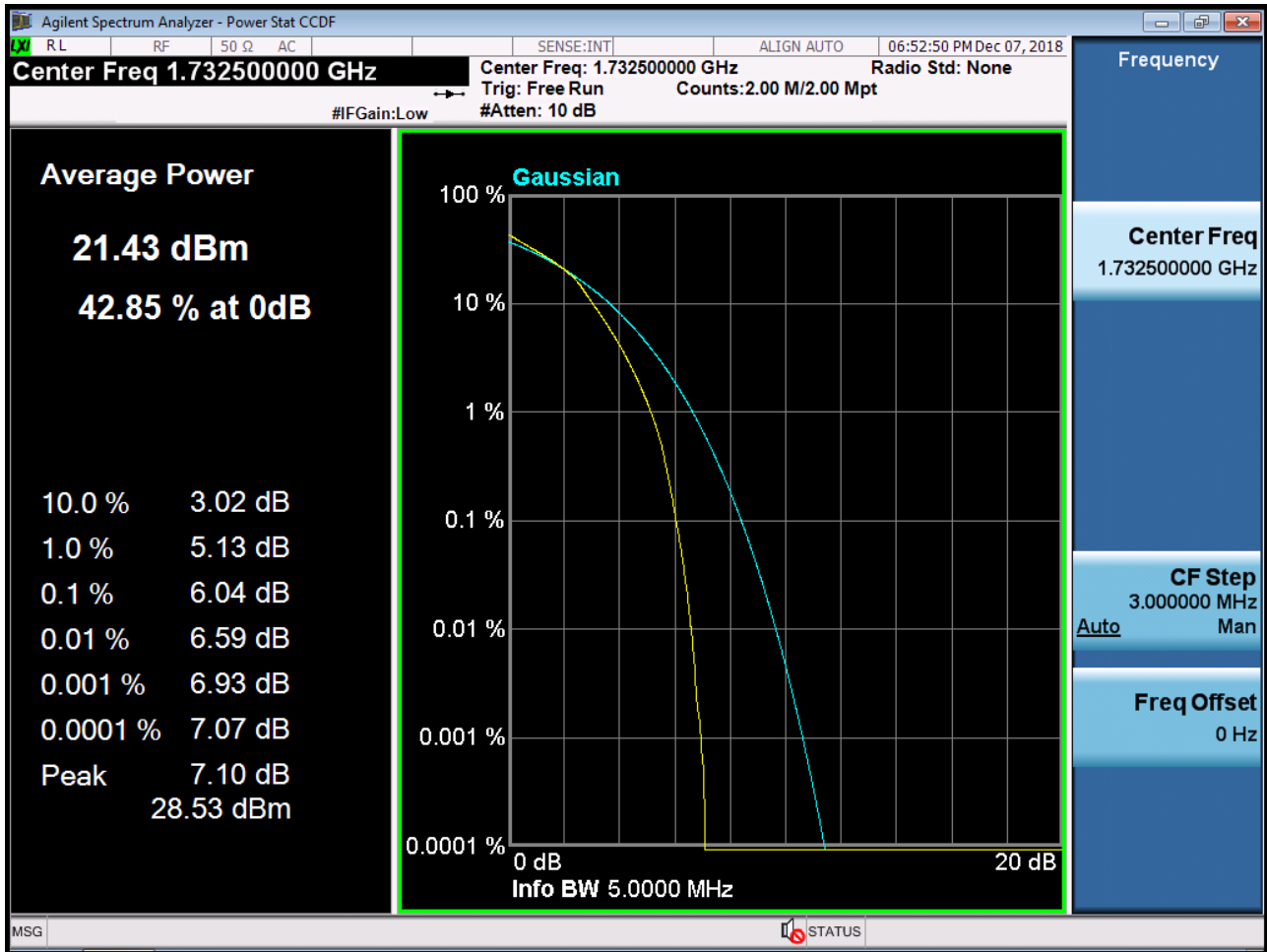
BAND 4. PAR Plot (3M BW\_Ch.20175\_64QAM\_RB15\_0)



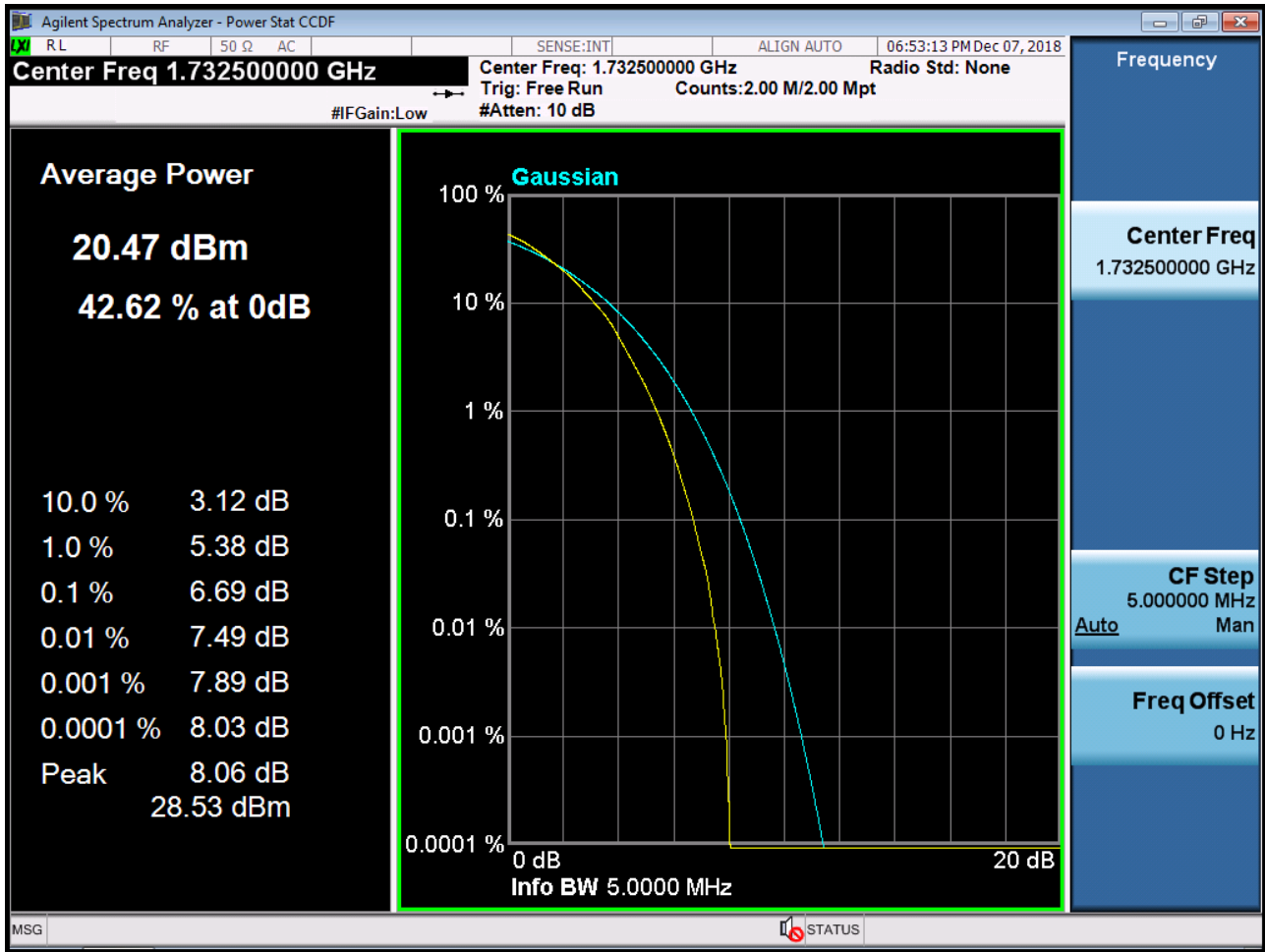
BAND 4. PAR Plot (5M BW\_Ch.20175\_QPSK\_RB25\_0)



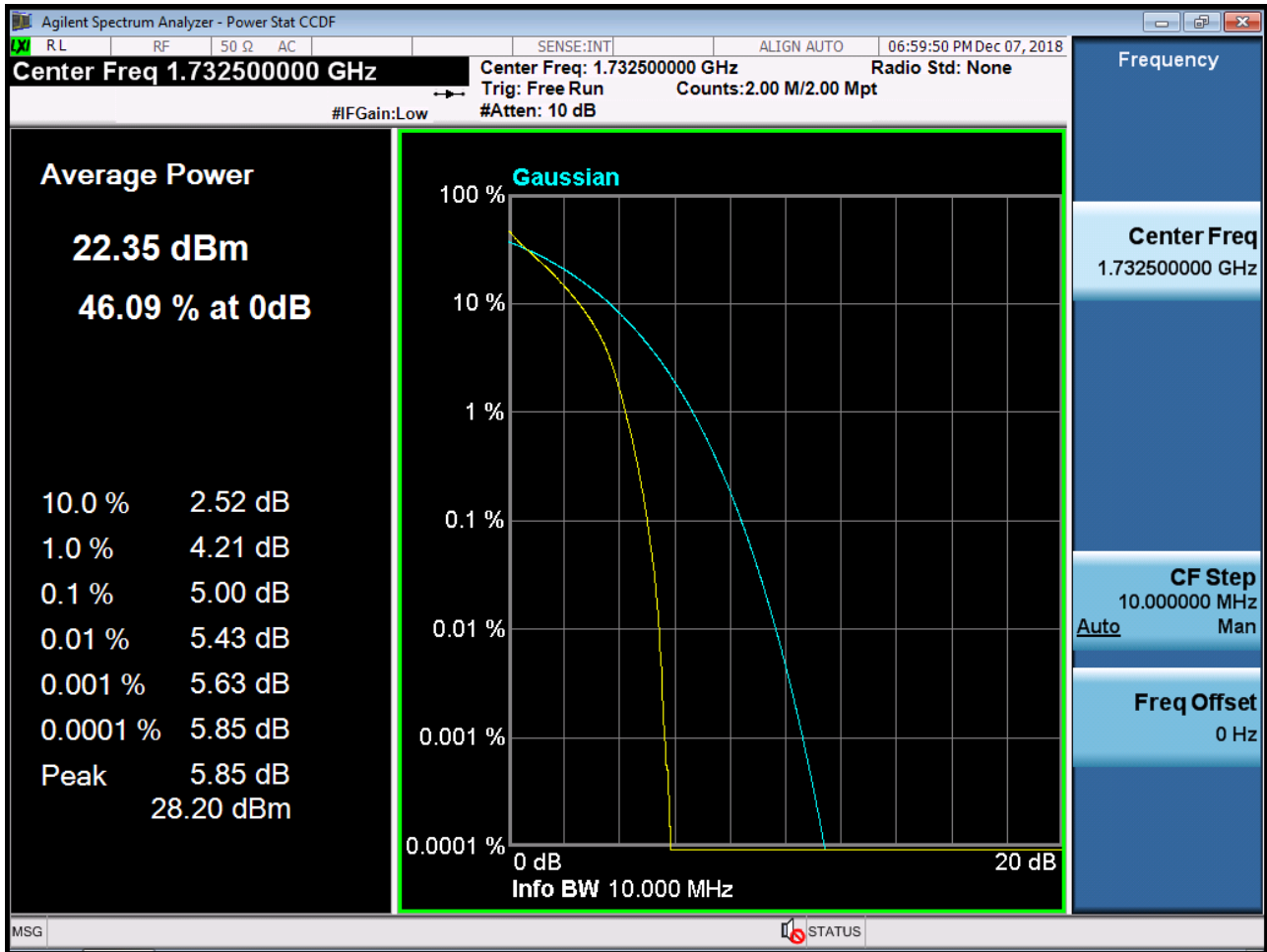
BAND 4. PAR Plot (5M BW\_Ch.20175\_16QAM\_RB25\_0)



BAND 4. PAR Plot (5M BW\_Ch.20175\_64QAM\_RB25\_0)

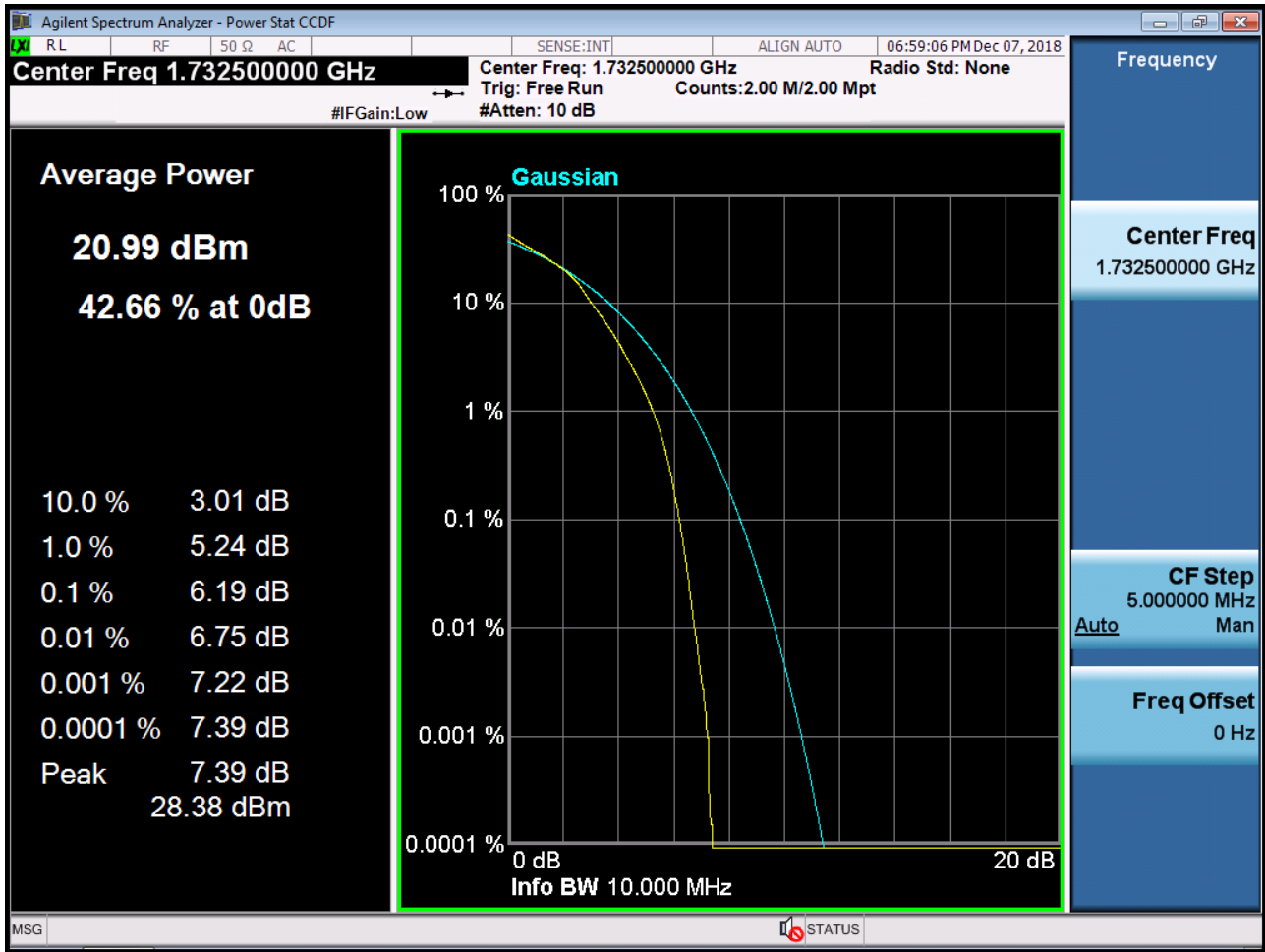


BAND 4. PAR Plot (10M BW\_Ch.20175\_QPSK\_RB50\_0)

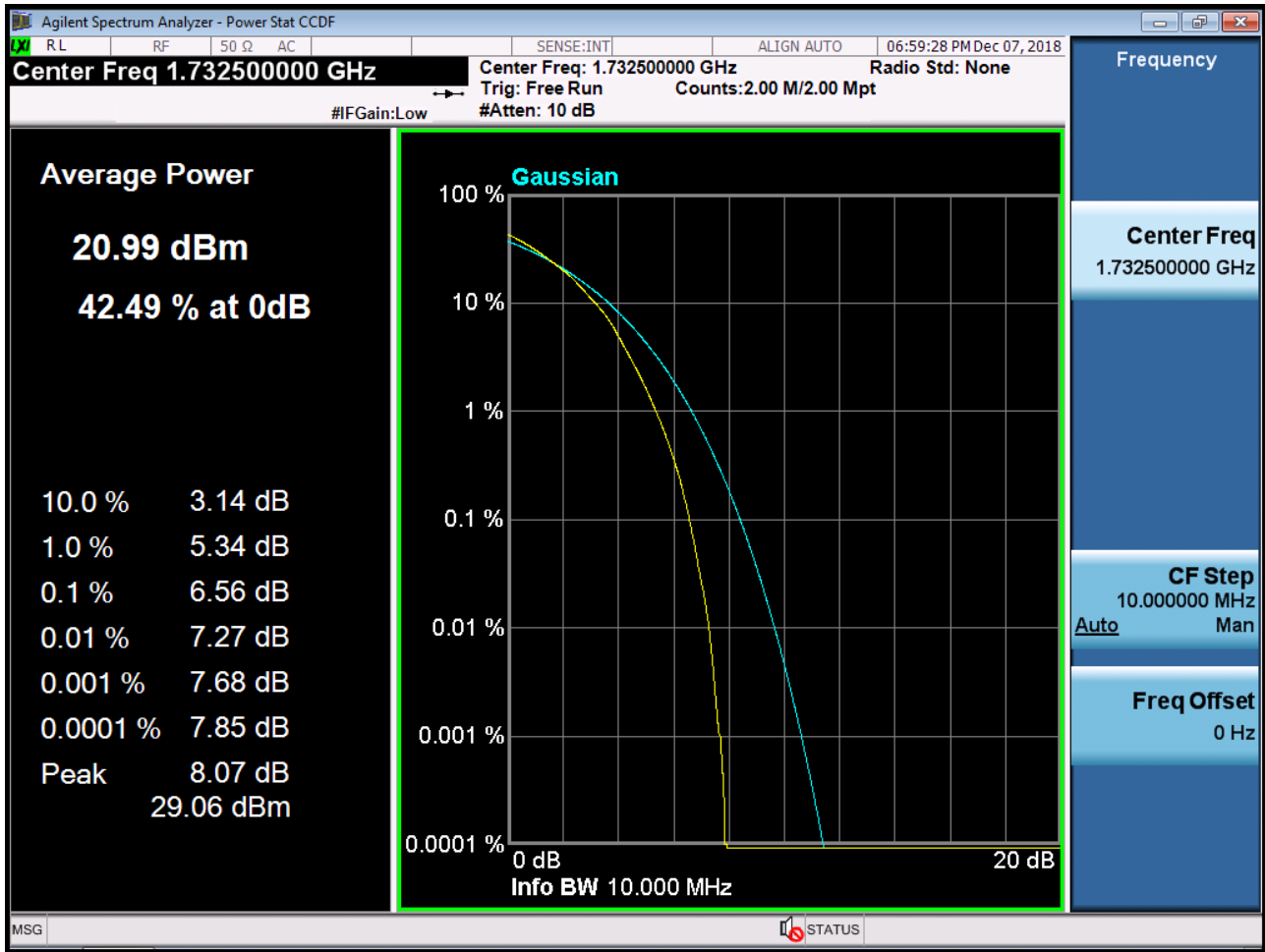




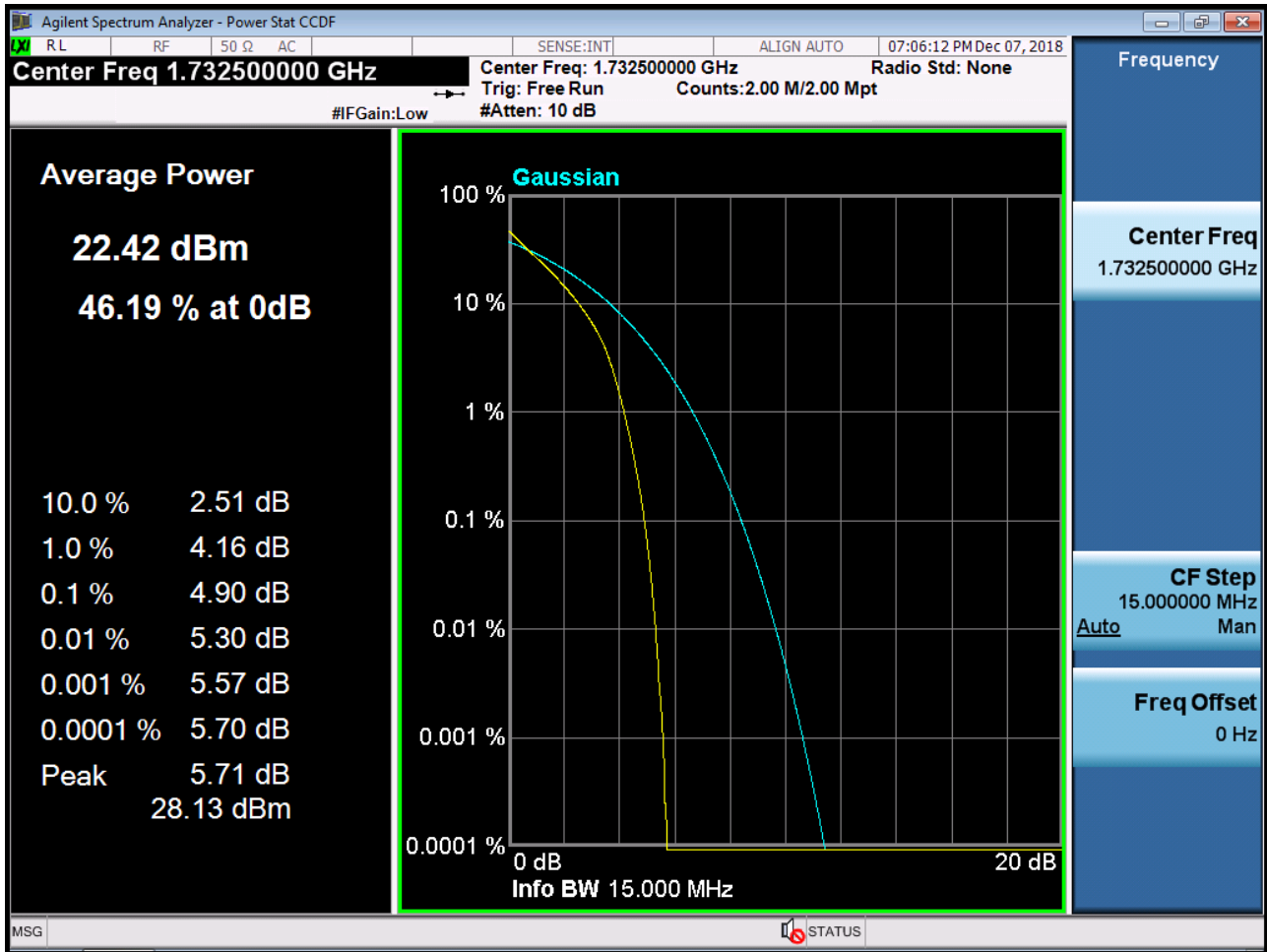
BAND 4. PAR Plot (10M BW\_Ch.20175\_16QAM\_RB50\_0)



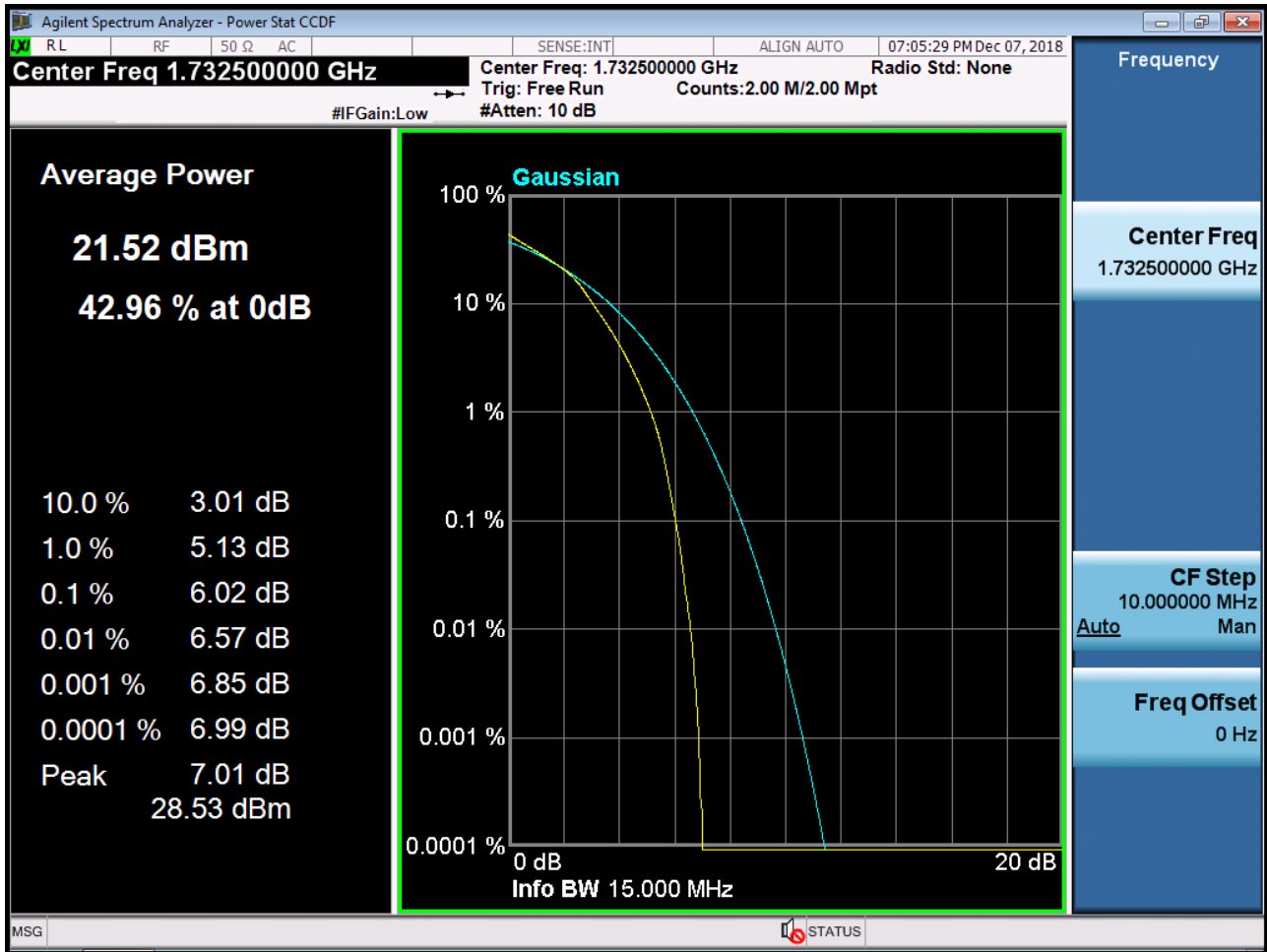
BAND 4. PAR Plot (10M BW\_Ch.20175\_64QAM\_RB50\_0)



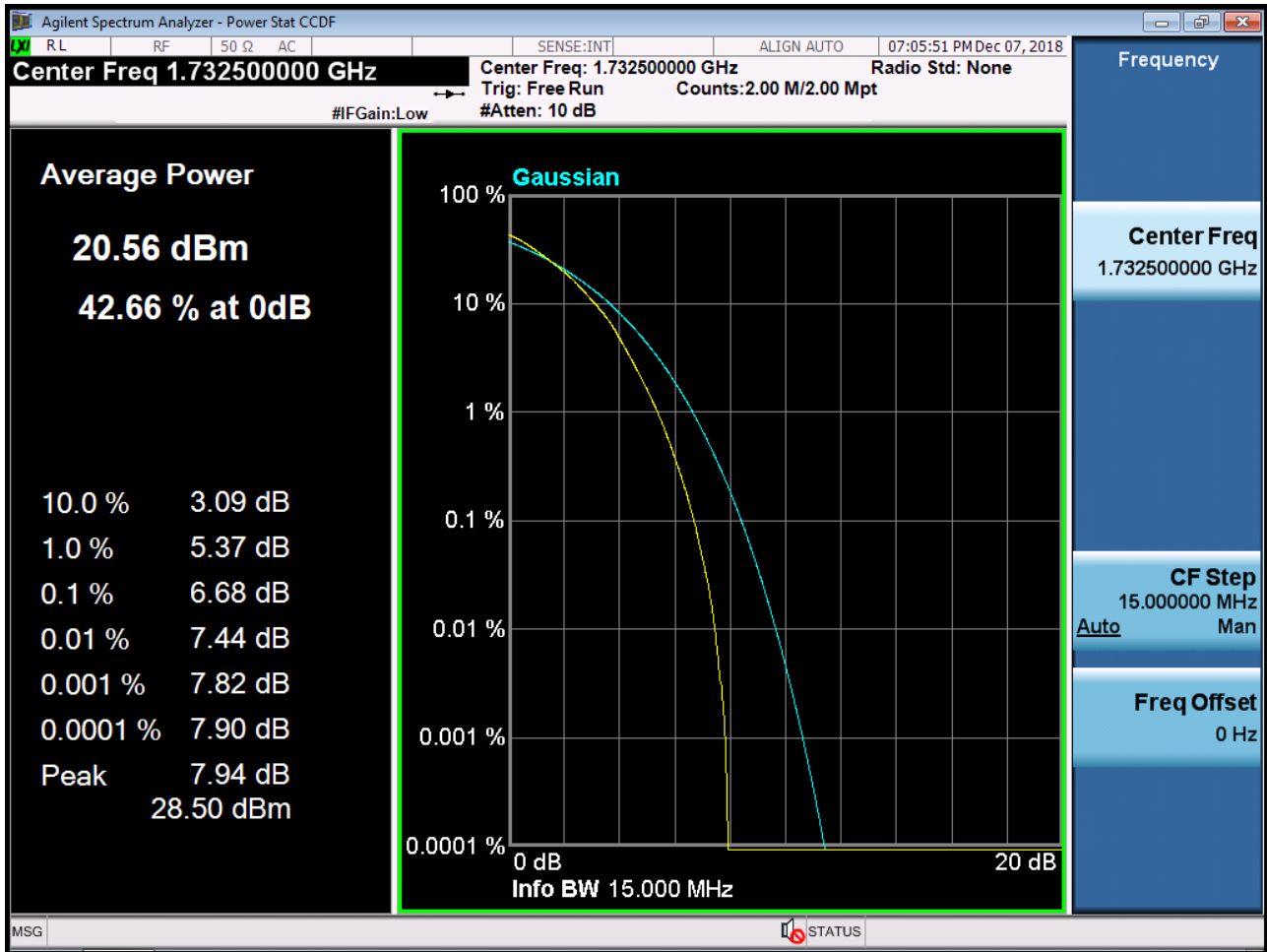
BAND 4. PAR Plot (15M BW\_Ch.20175\_QPSK\_RB75\_0)



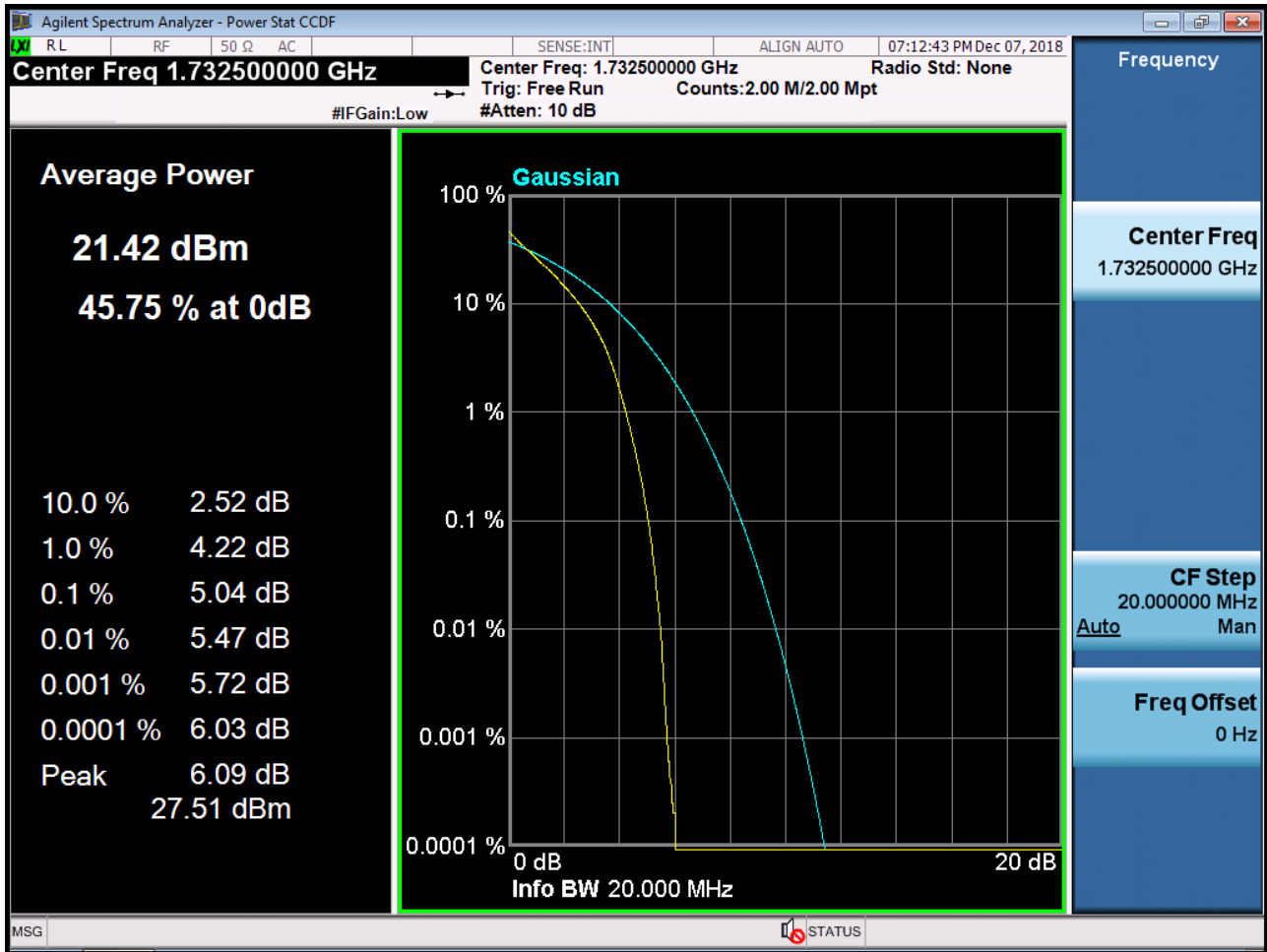
BAND 4. PAR Plot (15M BW\_Ch.20175\_16QAM\_RB75\_0)



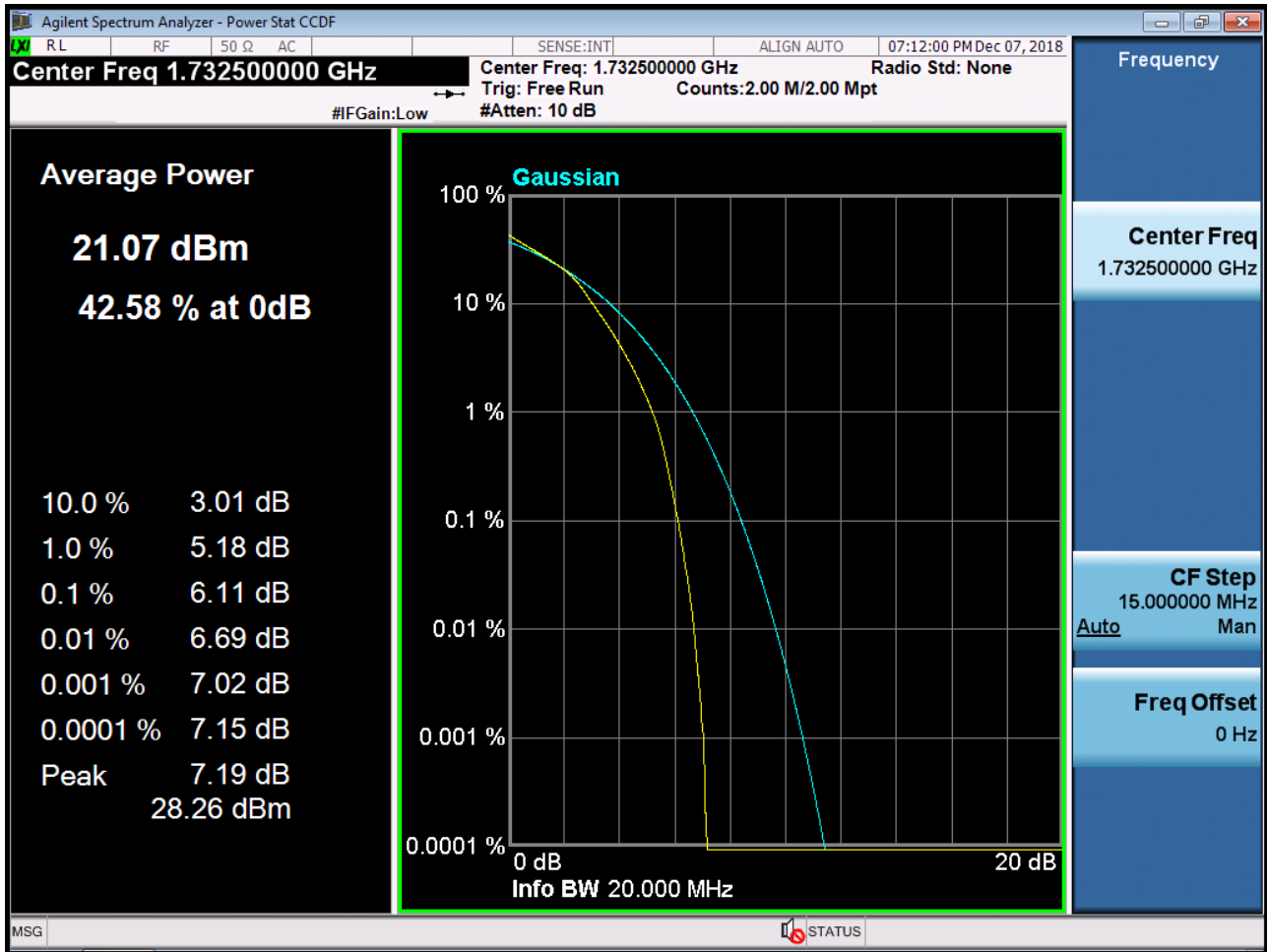
BAND 4. PAR Plot (15M BW\_Ch.20175\_64QAM\_RB75\_0)



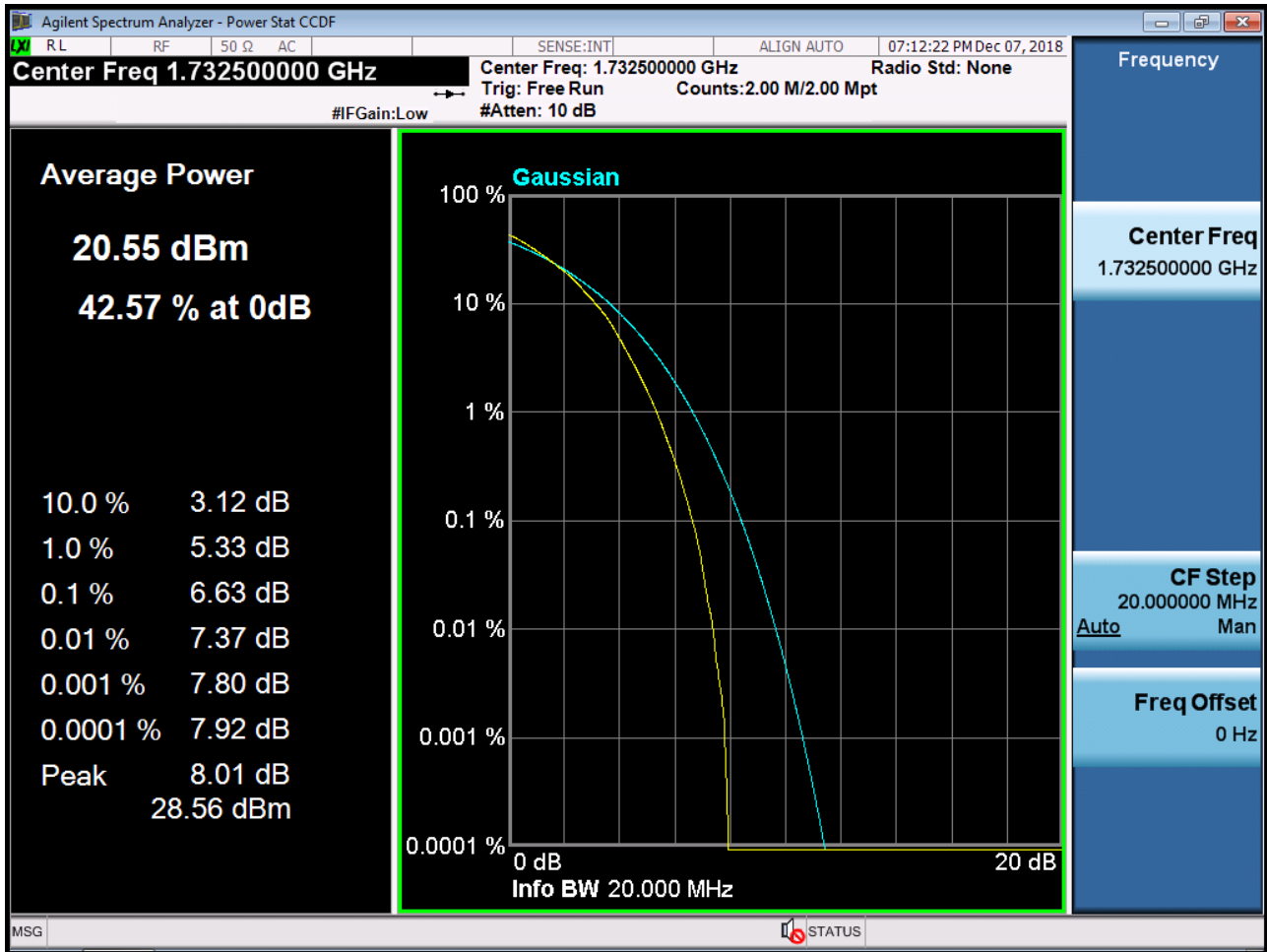
BAND 4. PAR Plot (20M BW\_Ch.20175\_QPSK\_RB100\_0)



BAND 4. PAR Plot (20M BW\_Ch.20175\_16QAM\_RB100\_0)



BAND 4. PAR Plot (20M BW\_Ch.20175\_64QAM\_RB100\_0)





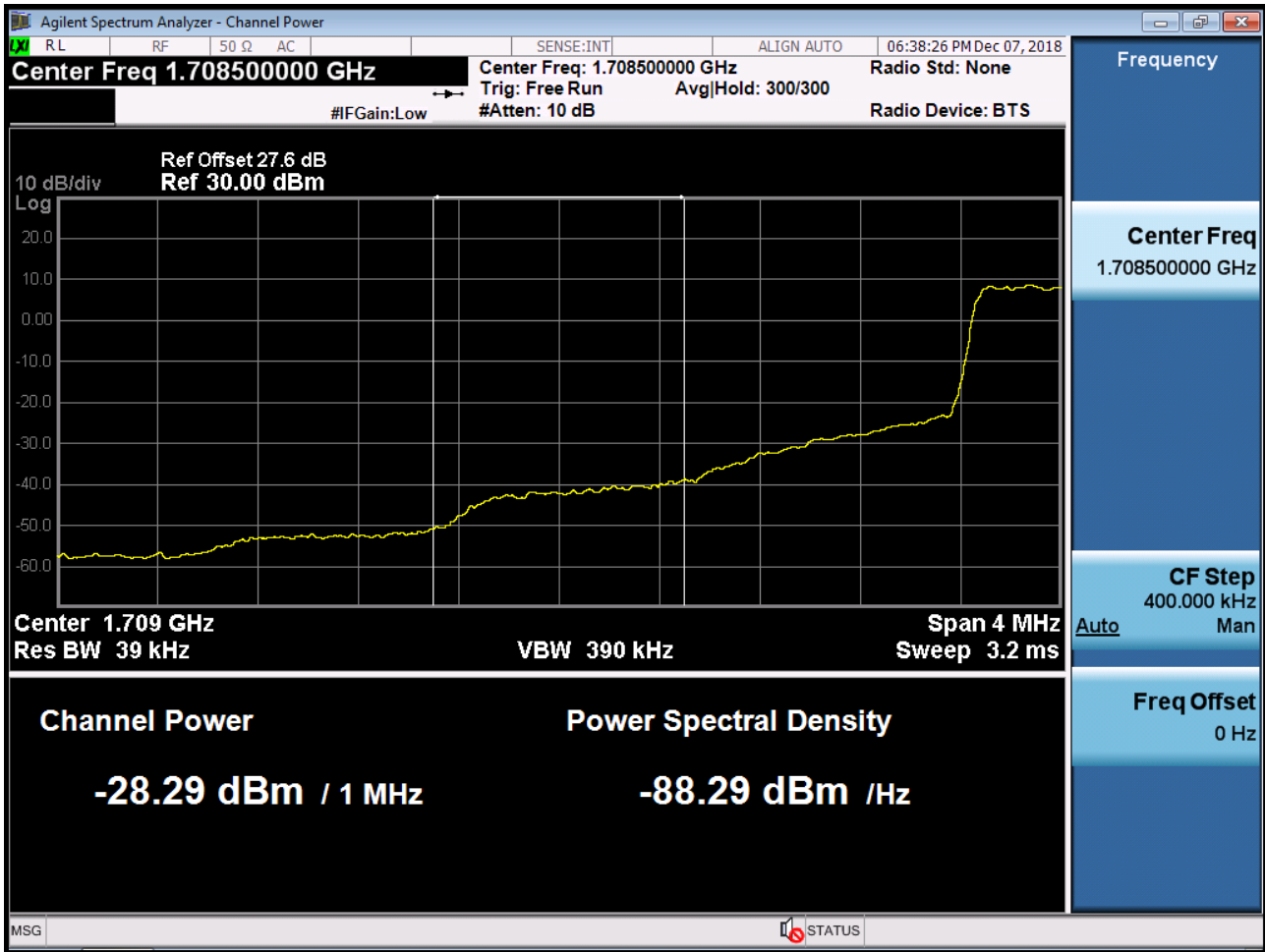
BAND 4. Lower Band Edge Plot (1.4M BW Ch.19957 QPSK RB 1, Offset 0) -1



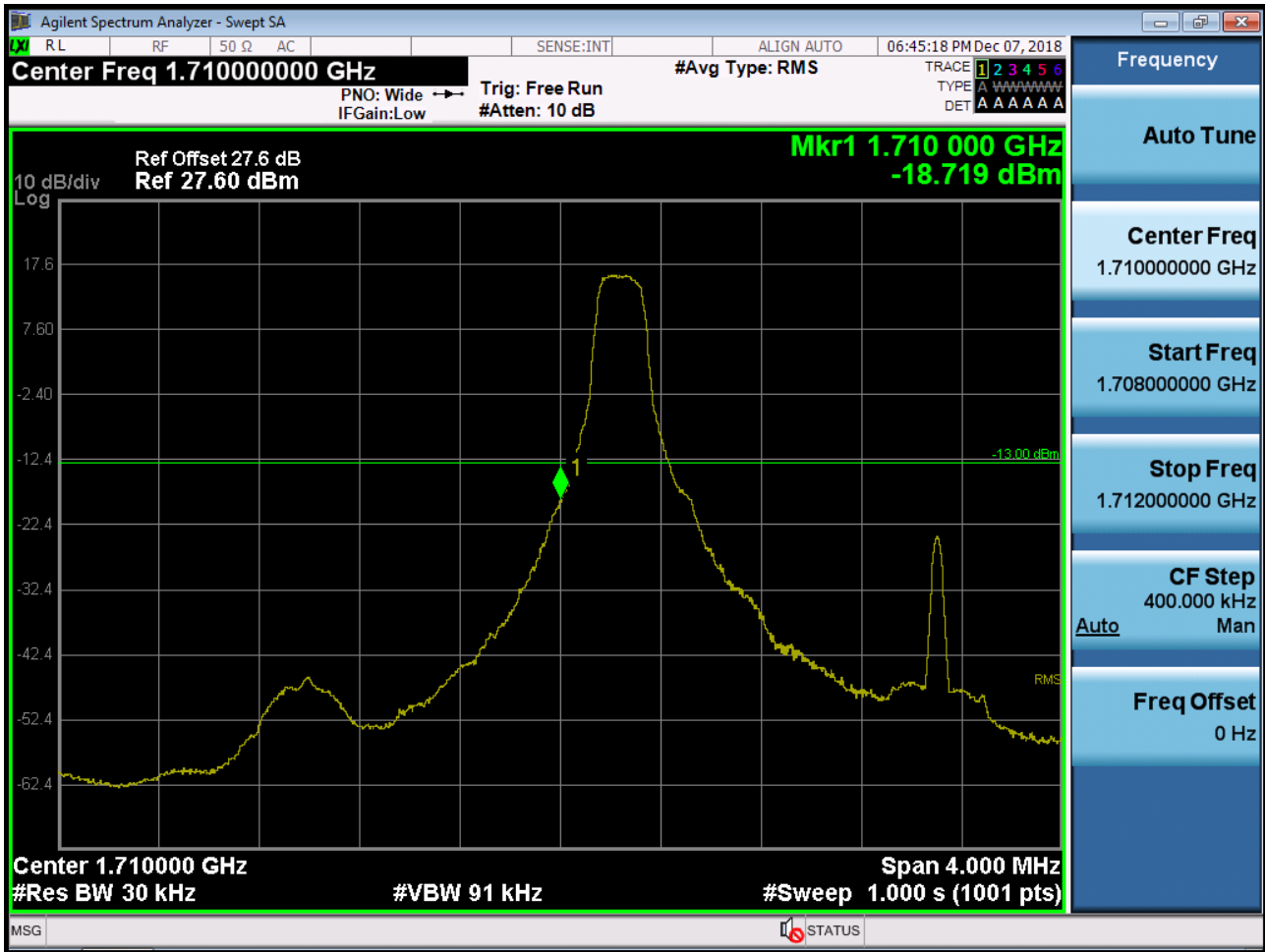
BAND 4. Lower Band Edge Plot (1.4M BW Ch.19957 QPSK RB 6) -2



BAND 4. Lower Extended Band Edge Plot (1.4M BW Ch.19957 QPSK\_RB6\_0) -3



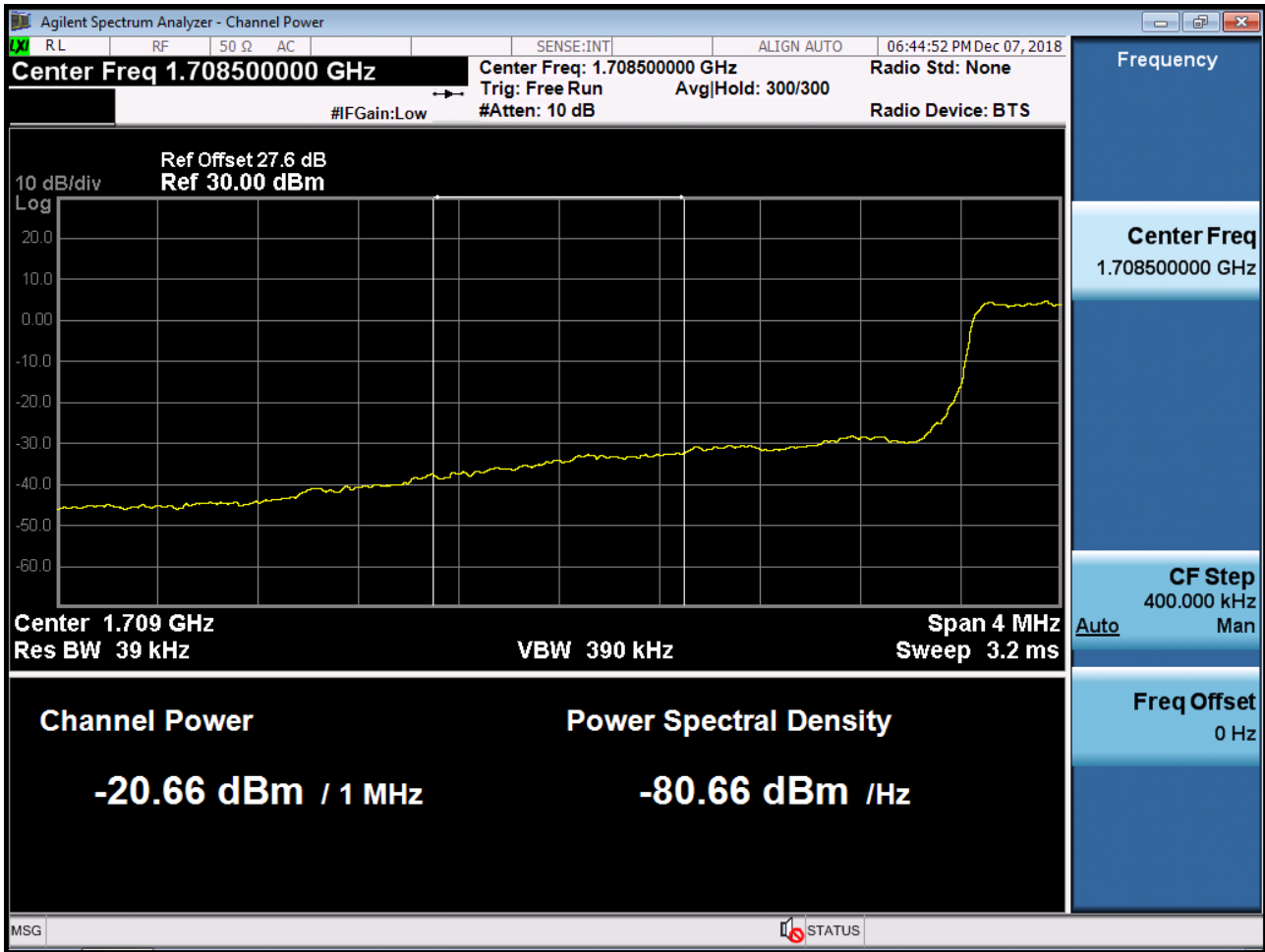
BAND 4. Lower Band Edge Plot (3M BW Ch.19965 QPSK RB 1, Offset 0) -1



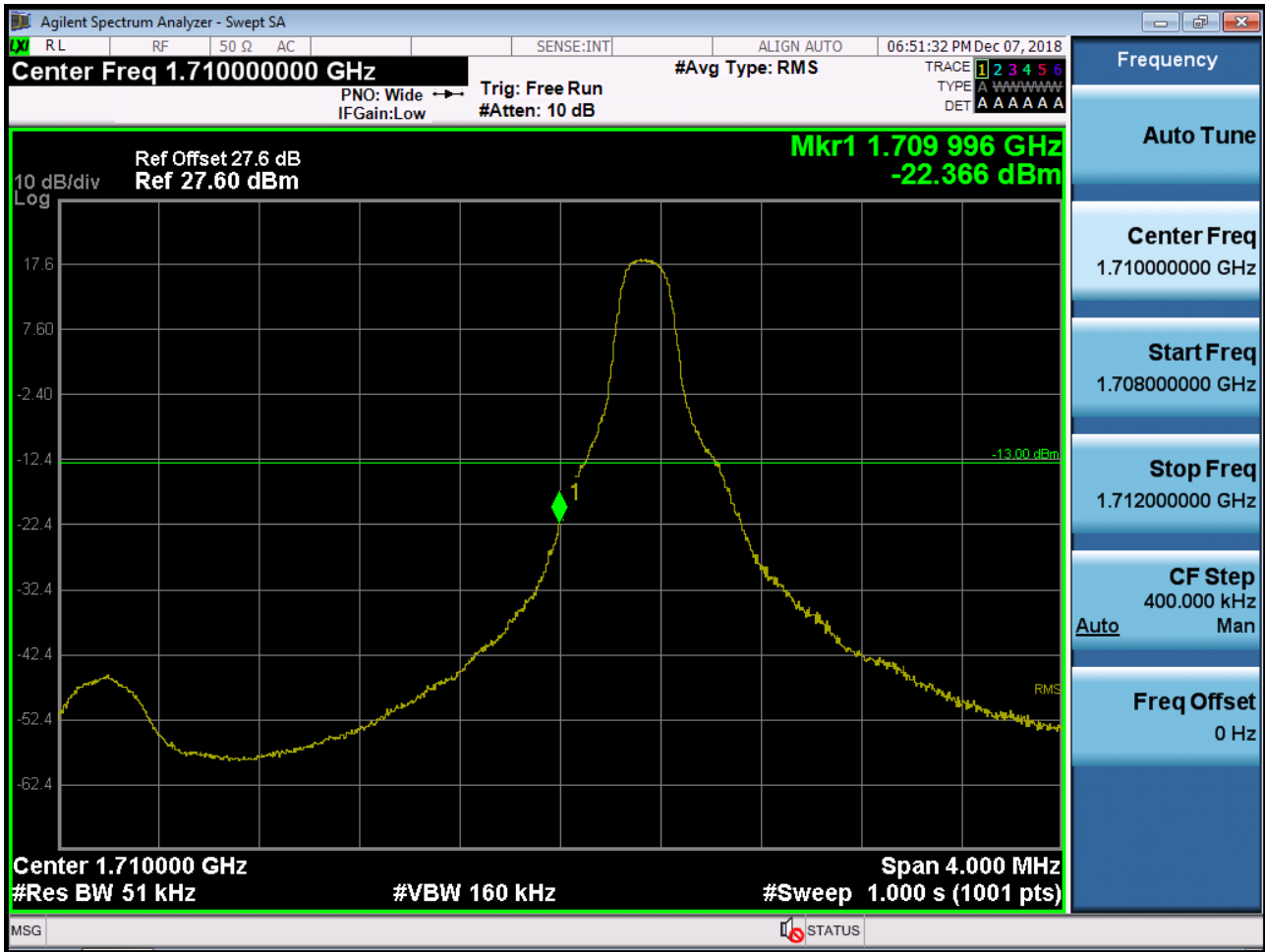
BAND 4. Lower Band Edge Plot (3M BW Ch.19965 QPSK RB 15) -2



BAND 4. Lower Extended Band Edge Plot (3M BW Ch.19965 QPSK\_RB15\_0) -3



BAND 4. Lower Band Edge Plot (5M BW Ch.19975 QPSK RB 1, Offset 0) -1

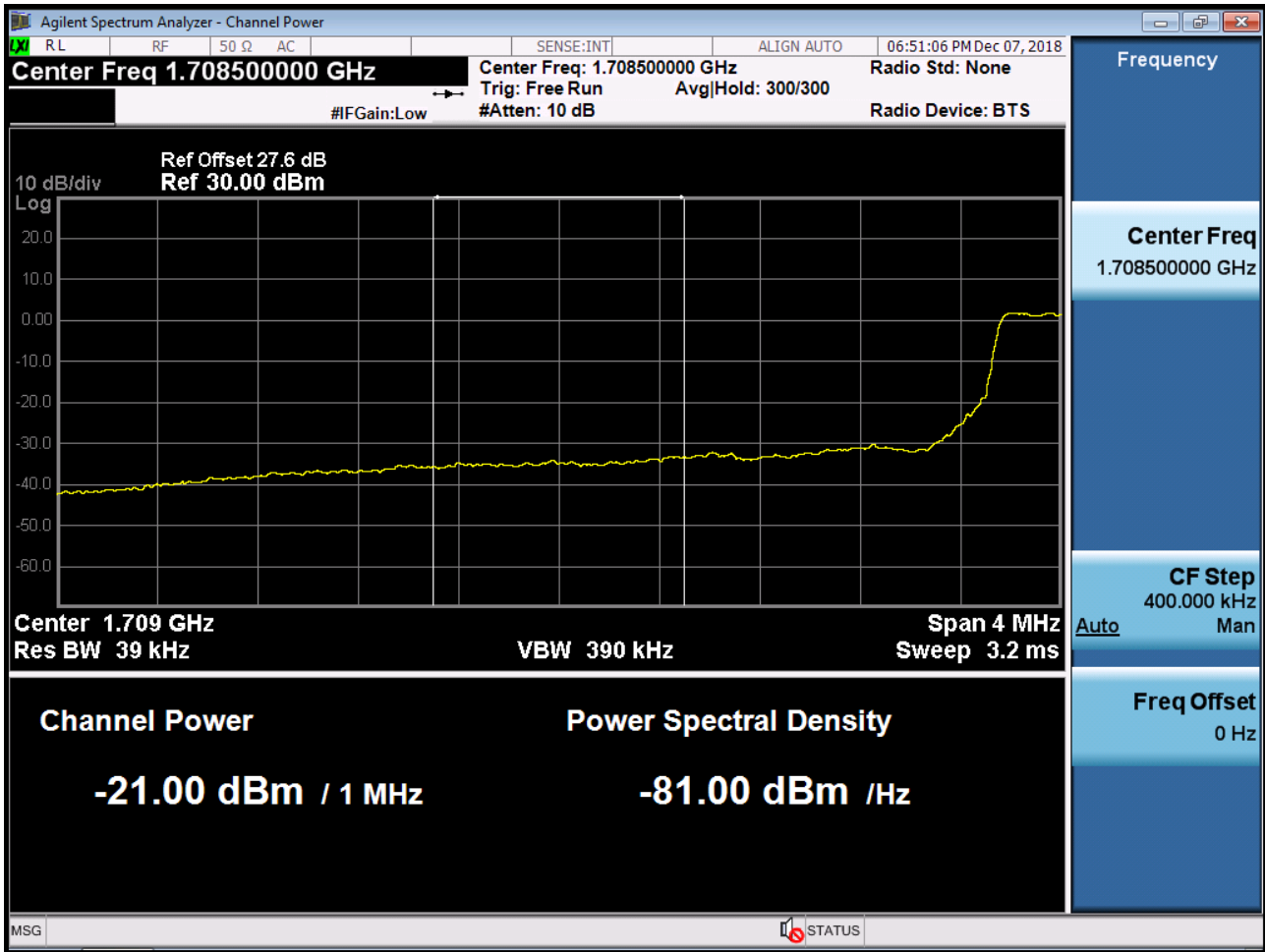


BAND 4. Lower Band Edge Plot (5M BW Ch.19975 QPSK RB 25) -2





BAND 4. Lower Extended Band Edge Plot (5M BW Ch.19975 QPSK\_RB25\_0) -3



BAND 4. Lower Band Edge Plot (10M BW Ch.20000 QPSK RB 1, Offset 0) -1



BAND 4. Lower Band Edge Plot (10M BW Ch.20000 QPSK RB 50) -2



BAND 4. Lower Extended Band Edge Plot (10M BW Ch.20000 QPSK\_RB50\_0) -3

