

# FCC LTE REPORT

## Certification

<b>Applicant Name:</b> SAMSUNG Electronics Co., Ltd.	<b>Date of Issue:</b> May 07, 2019
<b>Address:</b> 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea	<b>Location:</b> HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
	<b>Report No.:</b> HCT-RF-1904-FC047-R1

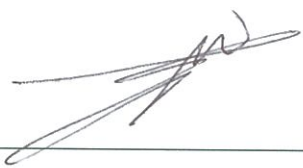
<b>FCC ID:</b>	<b>A3LSMT725C</b>
<b>APPLICANT:</b>	<b>SAMSUNG Electronics Co., Ltd.</b>

**Model(s):** SM-T725C  
**EUT Type:** Tablet  
**FCC Classification:** PCS Licensed Transmitter (PCB)  
**FCC Rule Part(s):** §27, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 41 (5)	2557.5 – 2652.5	4M50G7D	QPSK	0.175	22.44
		4M51W7D	16QAM	0.141	21.50
		4M51W7D	64QAM	0.113	20.54
LTE – Band 41 (10)	2560.0 – 2650.0	8M98G7D	QPSK	0.183	22.62
		8M96W7D	16QAM	0.149	21.74
		8M98W7D	64QAM	0.120	20.80
LTE – Band 41 (15)	2562.5 – 2647.5	13M4G7D	QPSK	0.176	22.45
		13M4W7D	16QAM	0.143	21.55
		13M4W7D	64QAM	0.117	20.67
LTE – Band 41 (20)	2565.0 – 2645.0	17M9G7D	QPSK	0.181	22.59
		17M9W7D	16QAM	0.148	21.70
		17M9W7D	64QAM	0.123	20.89

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 : Kwon Jeong**  
**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-1904-FC047	April 29, 2019	- First Approval Report
HCT-RF-1904-FC047-R1	May 07, 2019	- Added the geo-location mechanism.

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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>	A3LSMT725C
<b>Application Type:</b>	Certification
<b>FCC Classification:</b>	PCS Licensed Transmitter (PCB)
<b>FCC Rule Part(s):</b>	§27, §2
<b>EUT Type:</b>	Tablet
<b>Model(s):</b>	SM-T725C
<b>Tx Frequency:</b>	2557.5 – 2652.5 : 5 MHz 2560.0 – 2650.0 : 10 MHz 2562.5 – 2647.5 : 15 MHz 2565.0 – 2645.0 : 20 MHz
<b>Date(s) of Tests:</b>	April 22, 2019 ~ May 07, 2019

## **2. INTRODUCTION**

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

The EUT was a Tablet with GSM/GPRS/EGPRS/UMTS and LTE.

It also supports IEEE 802.11 a/b/g/n/ac (HT20/40/80), ANT+, Bluetooth, BT LE.

### **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
Channel 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/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**

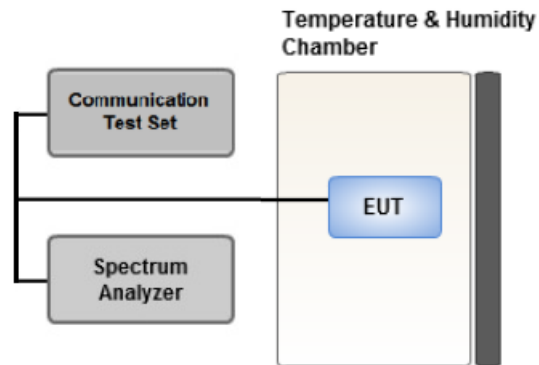
1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9.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

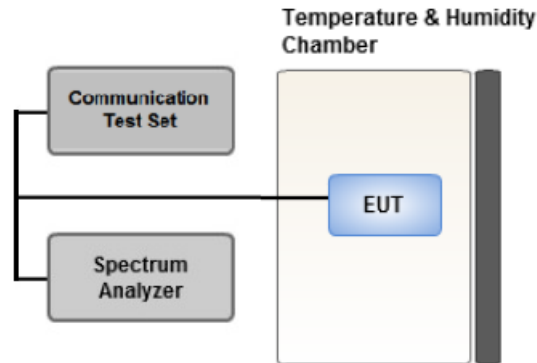
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW  $\geq 3 \times$  RBW.

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.

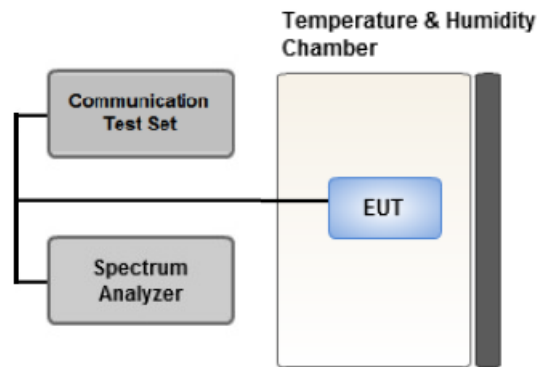
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

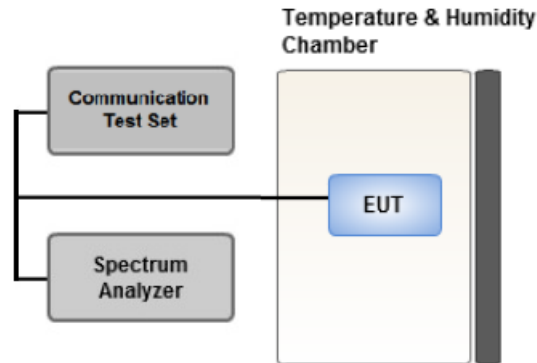
#### Test Overview

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 = Peak
4. Trace Mode = max hold
5. Sweep time = auto
6. Number of points in sweep  $\geq$  2 \* Span / RBW

### 3.7 CHANNEL 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.

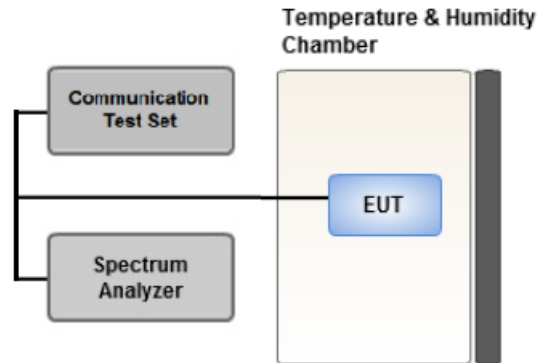
#### **Test Settings**

1. Start and stop frequency were set such that the channel 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 > 2% 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**

1. The attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge. In addition, the attenuation factor shall not be less than  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz.
2. All measurements were done at 3 channels.
3. The channel 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.

### 3.9 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	Z
Radiated Spurious and Harmonic Emissions	QPSK	1	0	Y

**3.10 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	5, 10, 15, 20	Mid	Full RB	0
Peak-to-Average Ratio	QPSK, 16QAM, 64QAM	5, 10, 15, 20	Mid	Full RB	0
Channel Edge	QPSK	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
		5, 10, 15, 20	Low, Mid, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	QPSK	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	04/16/2019	Annual	04/16/2020
Wainwright	WHK1.2/15G-10EF/H.P.F	4	04/02/2019	Annual	04/02/2020
Wainwright	WHK3.3/18G-10EF/H.P.F	2	04/02/2019	Annual	04/02/2020
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	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
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)	BBHA9170541	12/04/2017	Biennial	12/04/2019
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	01/28/2019	Biennial	01/28/2021
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	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/13/2018	Annual	08/13/2019
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/30/2019	Annual	01/30/2020
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(m)(4)	<ul style="list-style-type: none"> <li>■ <math>&lt; 40 + 10\log_{10} (P[\text{Watts}])</math> at Channel edges</li> <li>■ <math>&lt; 43 + 10\log_{10} (P[\text{Watts}])</math> between 5 and X MHz from Channel edges</li> <li>■ <math>&lt; 55 + 10\log_{10} (P[\text{Watts}])</math> beyond X MHz beyond from Channel edges</li> <li>■ <math>&lt; 43 + 10 \log (P)</math> dB on all frequencies between 2490.5 MHz and 2496 MHz</li> </ul>	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Frequency stability / variation of ambient temperature	§2.1055, §27.54	Emission must remain in band	PASS

**Note:**

1. See SAR Report
2. The same samples were used for SAR and EMC

### 6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§27.50(h)(2)	$< 2$ Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(m)(4)	$< 55 + 10\log_{10} (P[\text{Watts}])$	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
40620	2605.0	-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)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2557.5	LTE B41/ 5 MHz	QPSK	-21.88	12.96	11.02	1.62	H	< 2.00	0.172	22.36
		16-QAM	-22.81	12.03	11.02	1.62	H		0.139	21.43
		64-QAM	-23.72	11.12	11.02	1.62	H		0.113	20.52
2605.0		QPSK	-21.81	13.01	11.07	1.64	H		0.175	22.44
		16-QAM	-22.75	12.07	11.07	1.64	H		0.141	21.50
		64-QAM	-23.71	11.11	11.07	1.64	H		0.113	20.54
2652.5		QPSK	-22.14	12.71	11.15	1.66	H		0.166	22.20
		16-QAM	-23.05	11.80	11.15	1.66	H		0.135	21.29
		64-QAM	-24.04	10.81	11.15	1.66	H		0.107	20.30

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2560.0	LTE B41/ 10 MHz	QPSK	-21.95	12.89	11.02	1.62	H	< 2.00	0.170	22.29
		16-QAM	-22.79	12.05	11.02	1.62	H		0.140	21.45
		64-QAM	-23.73	11.11	11.02	1.62	H		0.113	20.51
2605.0		QPSK	-21.63	13.19	11.07	1.64	H		0.183	22.62
		16-QAM	-22.51	12.31	11.07	1.64	H		0.149	21.74
		64-QAM	-23.45	11.37	11.07	1.64	H		0.120	20.80
2650.0		QPSK	-21.94	12.91	11.15	1.66	H		0.174	22.40
		16-QAM	-22.79	12.06	11.15	1.66	H		0.143	21.55
		64-QAM	-23.75	11.10	11.15	1.66	H		0.114	20.59

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2562.5	LTE B41/ 15 MHz	QPSK	-21.91	12.93	11.02	1.62	H	< 2.00	0.171	22.33
		16-QAM	-22.85	11.99	11.02	1.62	H		0.138	21.39
		64-QAM	-23.67	11.17	11.02	1.62	H		0.114	20.57
2605.0		QPSK	-21.85	12.96	11.07	1.64	H		0.173	22.39
		16-QAM	-22.75	12.06	11.07	1.64	H		0.141	21.49
		64-QAM	-23.66	11.15	11.07	1.64	H		0.114	20.58
2647.5		QPSK	-21.89	12.96	11.15	1.66	H		0.176	22.45
		16-QAM	-22.79	12.06	11.15	1.66	H		0.143	21.55
		64-QAM	-23.67	11.18	11.15	1.66	H		0.117	20.67

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2565.0	LTE B41/ 20 MHz	QPSK	-21.99	12.85	11.02	1.63	H	< 2.00	0.168	22.24
		16-QAM	-22.86	11.98	11.02	1.63	H		0.137	21.37
		64-QAM	-23.68	11.16	11.02	1.63	H		0.114	20.55
2605.0		QPSK	-22.22	12.59	11.07	1.64	H		0.159	22.02
		16-QAM	-23.12	11.69	11.07	1.64	H		0.129	21.12
		64-QAM	-23.94	10.87	11.07	1.64	H		0.107	20.30
2645.0		QPSK	-21.79	13.11	11.13	1.65	H		0.181	22.59
		16-QAM	-22.68	12.22	11.13	1.65	H		0.148	21.70
		64-QAM	-23.49	11.41	11.13	1.65	H		0.123	20.89

**8.2 RADIATED SPURIOUS EMISSIONS**

- ▣ OPERATING FREQUENCY : 2605.0 MHz
- ▣ MEASURED OUTPUT POWER: 22.44 dBm = 0.175 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  47.44 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40265 (2557.5)	5,115.00	-43.22	12.58	-56.53	2.55	H	-46.50	68.93
	7,672.50	-43.82	12.04	-51.37	2.95	H	-42.28	64.72
	10,230.00	-49.14	11.19	-52.30	3.60	V	-44.71	67.15
	12,787.50	-54.47	13.71	-58.41	4.27	H	-48.97	71.40
40740 (2605.0)	5,210.00	-43.60	13.21	-57.51	2.55	H	-46.85	69.28
	7,815.00	-43.51	11.93	-49.38	2.99	V	-40.44	62.88
	10,420.00	-49.19	10.92	-50.87	3.58	H	-43.53	65.97
41215 (2652.5)	5,305.00	-40.03	13.58	-53.88	2.63	H	-42.93	65.37
	7,957.50	-45.37	11.57	-51.14	3.00	V	-42.57	65.01
	10,610.00	-49.03	10.74	-51.20	3.58	H	-44.04	66.47



- ▣ OPERATING FREQUENCY : 2605.0 MHz
- ▣ MEASURED OUTPUT POWER: 22.62 dBm = 0.183 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  47.62 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40290 (2560.0)	5,120.00	-44.14	12.60	-57.68	2.54	H	-47.62	70.24
	7,680.00	-43.30	12.04	-51.33	2.94	H	-42.23	64.85
	10,240.00	-50.39	11.13	-53.59	3.59	H	-46.05	68.67
40740 (2605.0)	5,210.00	-42.98	13.21	-56.89	2.55	H	-46.23	68.84
	7,815.00	-44.01	11.93	-49.88	2.99	H	-40.94	63.56
	10,420.00	-48.83	10.92	-50.51	3.58	H	-43.17	65.79
41190 (2650.0)	5,300.00	-40.42	13.58	-54.26	2.61	H	-43.29	65.91
	7,950.00	-46.06	11.58	-51.05	3.01	H	-42.48	65.10
	10,600.00	-49.14	10.73	-52.03	3.58	H	-44.88	67.50

- ▣ OPERATING FREQUENCY : 2647.50 MHz
- ▣ MEASURED OUTPUT POWER: 22.45 dBm = 0.176 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  47.45 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40315 (2562.5)	5,125.00	-45.11	12.64	-58.73	2.53	H	-48.62	71.07
	7,687.50	-43.57	12.04	-51.50	2.98	H	-42.44	64.88
	10,250.00	-49.25	11.06	-52.49	3.58	H	-45.01	67.45
40740 (2605.0)	5,210.00	-42.75	13.21	-56.66	2.55	H	-46.00	68.44
	7,815.00	-45.39	11.93	-51.26	2.99	H	-42.32	64.77
	10,420.00	-48.04	10.92	-49.72	3.58	H	-42.38	64.83
41165 (2647.5)	5,295.00	-41.26	13.57	-54.98	2.61	H	-44.02	66.47
	7,942.50	-44.91	11.62	-50.30	2.98	H	-41.66	64.11
	10,590.00	-48.56	10.73	-51.72	3.58	H	-44.57	67.02

- ▣ OPERATING FREQUENCY : 2645.00 MHz
- ▣ MEASURED OUTPUT POWER: 22.59 dBm = 0.181 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  47.59 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
40340 (2565.0)	5,130.00	-45.08	12.68	-58.79	2.52	H	-48.63	71.21
	7,695.00	-44.55	12.04	-52.06	3.00	H	-43.01	65.60
	10,260.00	-49.32	11.06	-52.69	3.53	H	-45.16	67.74
40740 (2605.0)	5,210.00	-43.90	13.21	-57.81	2.55	H	-47.15	69.73
	7,815.00	-46.48	11.93	-52.35	2.99	H	-43.41	66.00
	10,420.00	-48.83	10.92	-50.51	3.58	H	-43.17	65.76
41140 (2645.0)	5,290.00	-42.58	13.55	-56.18	2.60	H	-45.23	67.82
	7,935.00	-46.74	11.65	-52.05	2.99	H	-43.40	65.98
	10,580.00	-48.13	10.72	-50.94	3.60	H	-43.82	66.40

**8.3 PEAK-TO-AVERAGE RATIO**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB )
41	5 MHz	2605.0	QPSK	25	0	4.81
			16-QAM			5.97
			64-QAM			6.70
	10 MHz		QPSK	50		4.88
			16-QAM			6.00
			64-QAM			6.61
	15 MHz		QPSK	75		4.72
			16-QAM			5.93
			64-QAM			6.42
	20 MHz		QPSK	100		4.70
			16-QAM			5.85
			64-QAM			6.50

**Note:**

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 66 ~ 77.

**8.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data ( MHz )
41	5 MHz	2605.0	QPSK	25	0	4.4983
			16-QAM			4.5061
			64-QAM			4.5076
	10 MHz		QPSK	50		8.9820
			16-QAM			8.9567
			64-QAM			8.9836
	15 MHz		QPSK	75		13.424
			16-QAM			13.419
			64-QAM			13.439
	20 MHz		QPSK	100		17.900
			16-QAM			17.857
			64-QAM			17.859

**Note:**

1. Plots of the EUT's Occupied Bandwidth are shown Page 54 ~ 65.

**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)
41	5	2557.5	25.9509	30.131	-67.185	-37.054	-25.00
		2605.0	25.7344	30.131	-66.681	-36.550	
		2652.5	26.4814	30.131	-65.451	-35.320	
	10	2560.0	25.7752	30.131	-66.660	-36.529	
		2605.0	26.1539	30.131	-66.899	-36.768	
		2650.0	25.8326	30.131	-67.023	-36.892	
	15	2562.5	26.4196	30.131	-66.172	-36.041	
		2605.0	25.5677	30.131	-66.399	-36.268	
		2647.5	25.9184	30.131	-66.838	-36.707	
	20	2565.0	26.0805	30.131	-66.311	-36.180	
		2605.0	25.9138	30.131	-66.444	-36.313	
		2645.0	26.0995	30.131	-66.662	-36.531	

**Note:**

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 98 ~ 125.
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 CHANNEL EDGE**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
						Lower	Upper	Lower	Upper
Band 41	5 MHz	2557.5	QPSK	25	0	-24.85	-25.42	-24.91	-24.41
		2605.0	QPSK	25	0	-26.17	-25.86	-30.02	-28.60
		2652.5	QPSK	25	0	-24.92	-25.75	-24.81	-24.51
	10 MHz	2560.0	QPSK	50	0	-26.89	-26.17	-26.42	-25.92
		2605.0	QPSK	50	0	-26.49	-25.50	-31.48	-29.84
		2650.0	QPSK	50	0	-25.85	-25.54	-25.37	-24.71
	15 MHz	2562.5	QPSK	75	0	-27.15	-26.25	-28.60	-27.46
		2605.0	QPSK	75	0	-28.26	-27.11	-32.41	-31.32
		2647.5	QPSK	75	0	-25.30	-25.07	-24.74	-24.54
	20 MHz	2565.0	QPSK	100	0	-26.64	-25.64	-29.22	-27.71
		2605.0	QPSK	100	0	-27.99	-26.56	-32.10	-30.91
		2645.0	QPSK	100	0	-25.08	-24.41	-25.64	-25.40
Limit						-10.0		-10.0	
Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	(C.E ± 5 MHz) ~ (C.E ± X MHz)		Above (C.E ± X MHz)	
						Lower	Upper	Lower	Upper
Band 41	5 MHz	2557.5	QPSK	25	0	-35.73	-36.46	-35.55	-36.18
		2605.0	QPSK	25	0	-36.73	-36.44	-36.52	-36.13
		2652.5	QPSK	25	0	-40.92	-42.28	-42.40	-44.24
	10 MHz	2560.0	QPSK	50	0	-32.28	-31.80	-38.69	-39.91
		2605.0	QPSK	50	0	-35.28	-34.05	-39.19	-39.17
		2650.0	QPSK	50	0	-28.59	-29.45	-42.41	-45.49
	15 MHz	2562.5	QPSK	75	0	-31.58	-30.29	-39.93	-42.42
		2605.0	QPSK	75	0	-35.53	-33.04	-41.29	-41.83
		2647.5	QPSK	75	0	-28.11	-28.35	-42.51	-46.54
	20 MHz	2565.0	QPSK	100	0	-31.12	-29.43	-39.53	-43.55
		2605.0	QPSK	100	0	-35.28	-32.99	-41.99	-43.55
		2645.0	QPSK	100	0	-27.94	-27.97	-42.76	-46.33
Limit						-13.0		-25.0	

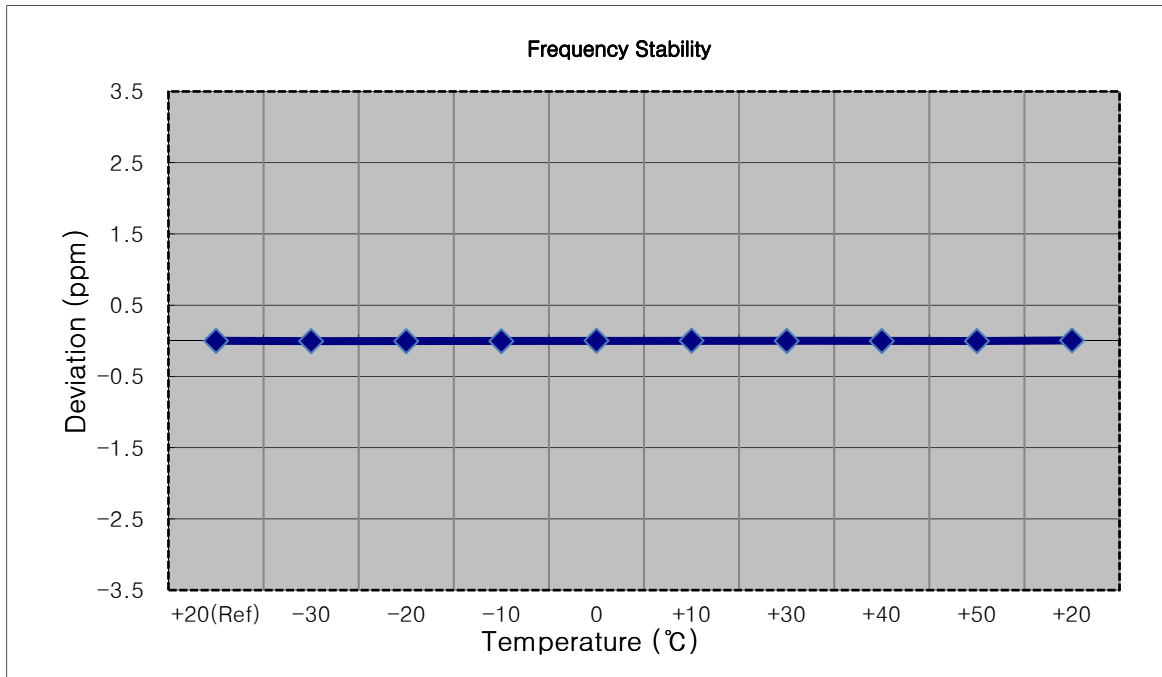
**Note:**

1. C.E = Channel Edge
2. X = X is the greater of 6MHz or the actual emission bandwidth.
3. X = 6MHz(5MHz Bandwidth), 10MHz(10MHz Bandwidth), 15MHz(15MHz Bandwidth), 20MHz(20MHz Bandwidth)
4. Plots of the EUT's Channel Edge are shown Page 78 ~ 97. (1RB & Full RB)

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

- MODE: LTE 41
- OPERATING FREQUENCY: 2557,500,000 Hz
- BANDWIDTH: 40265 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

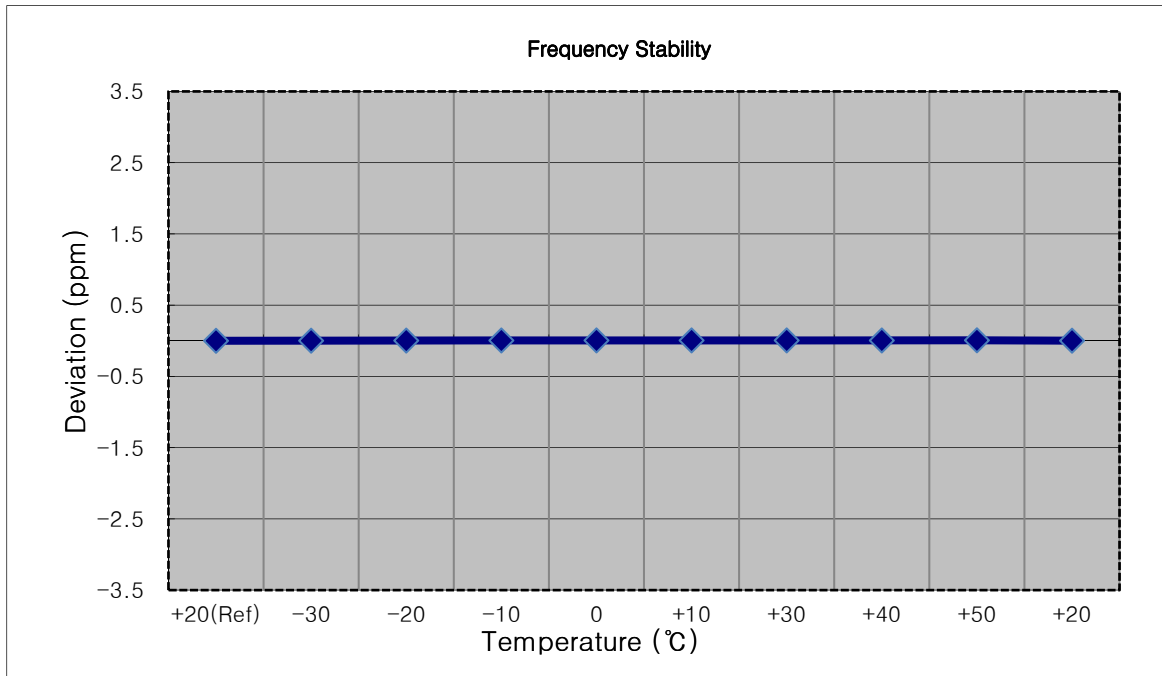
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2557 499 990	0.0	0.000 000	0.000
100%		-30	2557 499 979	-10.7	0.000 000	-0.004
100%		-20	2557 499 977	-12.7	0.000 000	-0.005
100%		-10	2557 499 978	-11.9	0.000 000	-0.005
100%		0	2557 499 995	5.8	0.000 000	0.002
100%		+10	2557 499 995	5.8	0.000 000	0.002
100%		+30	2557 499 984	-5.8	0.000 000	-0.002
100%		+40	2557 499 982	-7.3	0.000 000	-0.003
100%		+50	2557 499 981	-8.6	0.000 000	-0.003
Batt. Endpoint		3.400	+20	2557 500 003	13.0	0.000 001





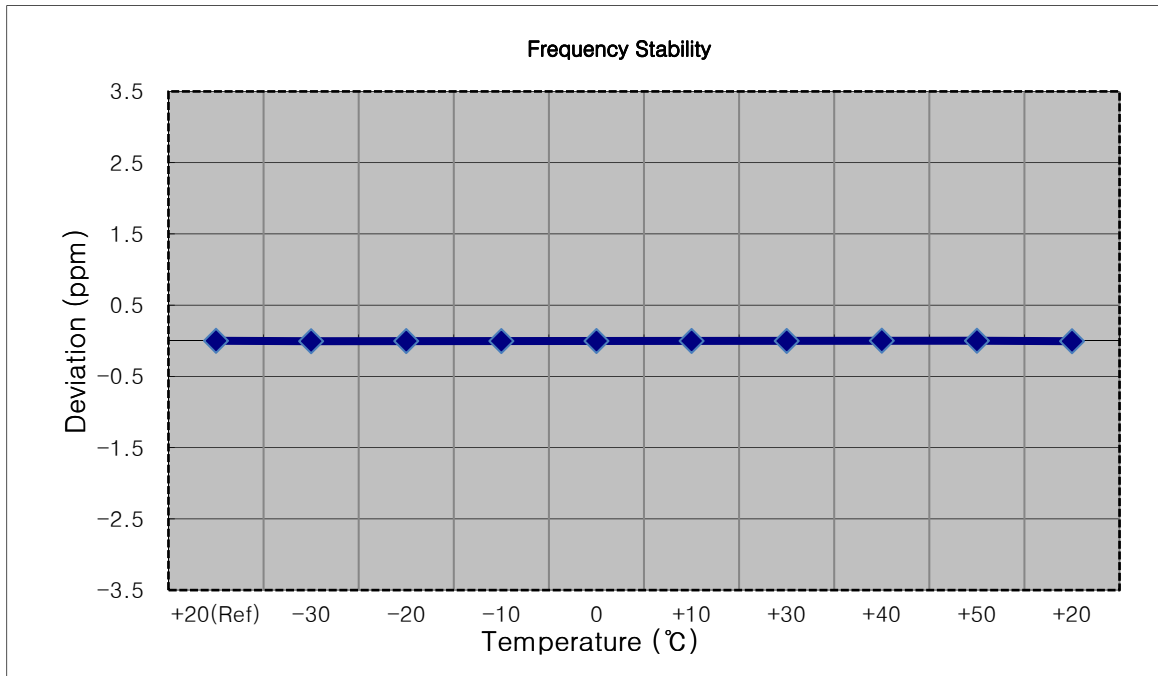
- MODE: LTE 41
- OPERATING FREQUENCY: 2560,000,000 Hz
- BANDWIDTH: 40290 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2560 000 003	0.0	0.000 000	0.000
100%		-30	2560 000 006	3.4	0.000 000	0.001
100%		-20	2560 000 011	7.9	0.000 000	0.003
100%		-10	2560 000 015	11.7	0.000 000	0.005
100%		0	2560 000 015	12.6	0.000 000	0.005
100%		+10	2560 000 015	12.5	0.000 000	0.005
100%		+30	2560 000 016	13.4	0.000 001	0.005
100%		+40	2560 000 015	11.8	0.000 000	0.005
100%		+50	2560 000 020	17.5	0.000 001	0.007
Batt. Endpoint	3.400	+20	2560 000 007	4.6	0.000 000	0.002



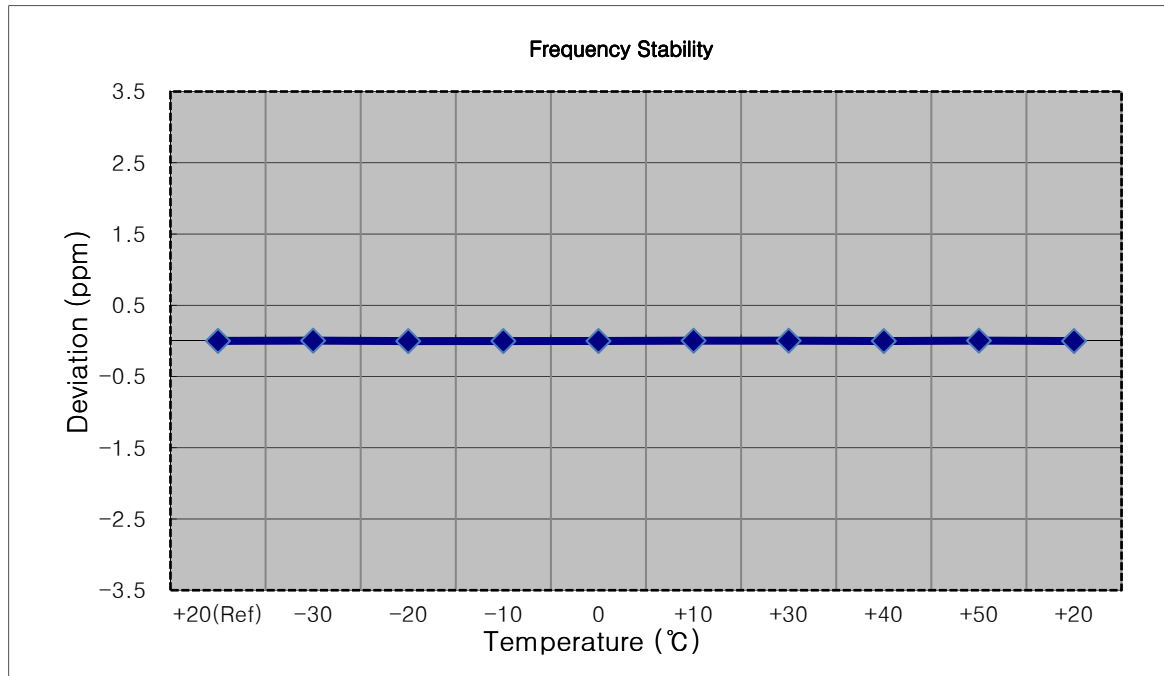
- MODE: LTE 41
- OPERATING FREQUENCY: 2562,500,000 Hz
- BANDWIDTH: 40315 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2562 499 989	0.0	0.000 000	0.000
100%		-30	2562 499 974	-15.1	-0.000 001	-0.006
100%		-20	2562 499 979	-9.9	0.000 000	-0.004
100%		-10	2562 499 980	-9.4	0.000 000	-0.004
100%		0	2562 499 981	-8.6	0.000 000	-0.003
100%		+10	2562 499 983	-5.8	0.000 000	-0.002
100%		+30	2562 499 984	-5.1	0.000 000	-0.002
00%		+40	2562 499 992	3.1	0.000 000	0.001
100%		+50	2562 499 992	2.8	0.000 000	0.001
Batt. Endpoint		3.400	+20	2562 499 974	-14.9	-0.000 001



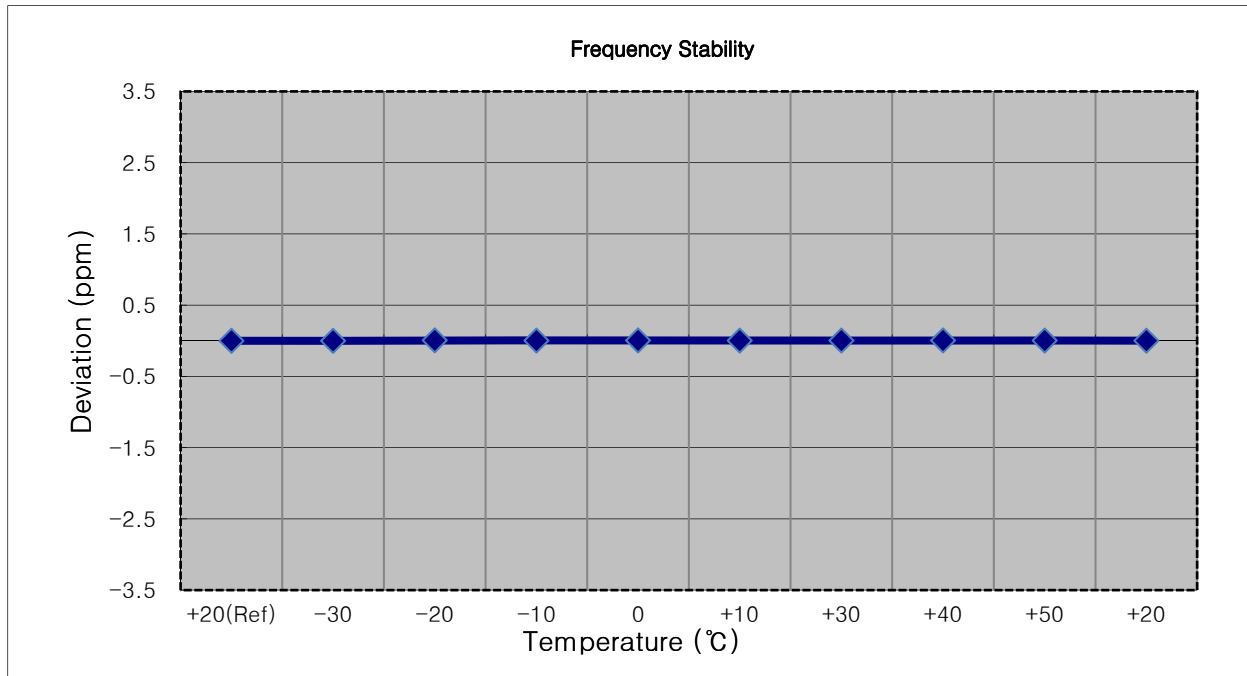
- MODE: LTE 41
- OPERATING FREQUENCY: 2565,000,000 Hz
- BANDWIDTH: 40340 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2565 000 003	0.0	0.000 000	0.000
100%		-30	2565 000 012	9.1	0.000 000	0.004
100%		-20	2564 999 996	-7.1	0.000 000	-0.003
100%		-10	2564 999 997	-5.9	0.000 000	-0.002
100%		0	2565 000 000	-3.1	0.000 000	-0.001
100%		+10	2565 000 011	8.1	0.000 000	0.003
100%		+30	2565 000 011	7.3	0.000 000	0.003
100%		+40	2564 999 998	-5.3	0.000 000	-0.002
100%		+50	2565 000 013	10.2	0.000 000	0.004
Batt. Endpoint	3.400	+20	2564 999 998	-5.4	0.000 000	-0.002



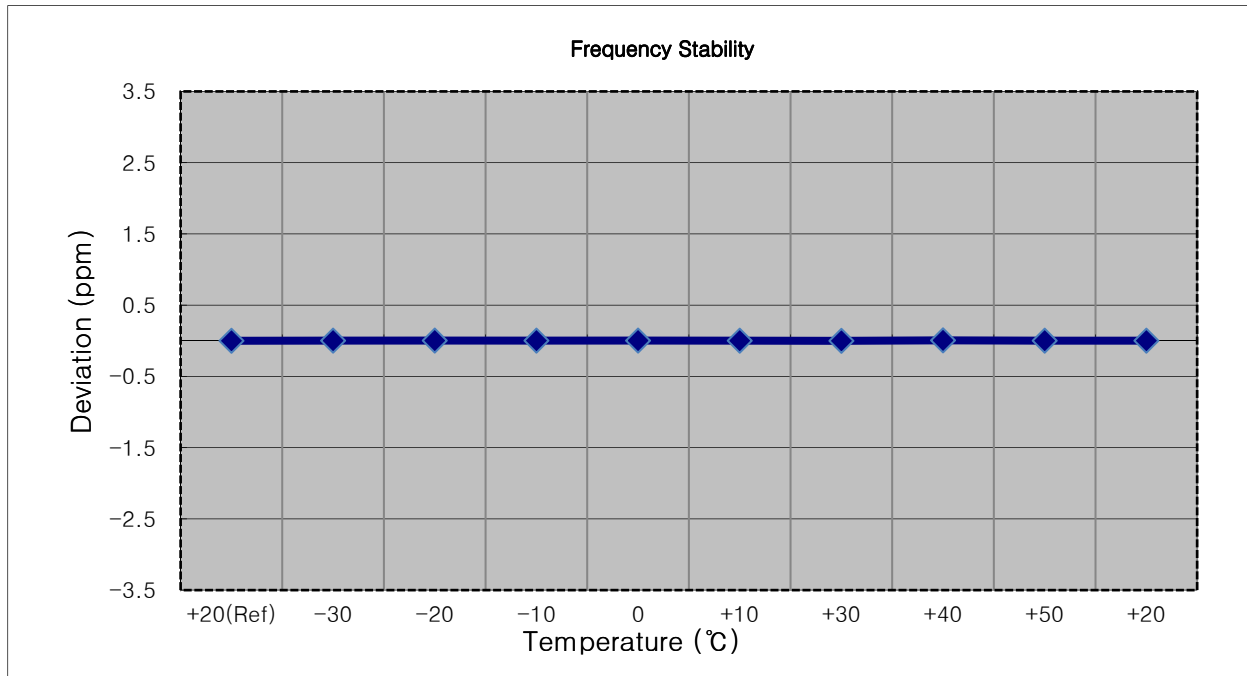
- MODE: LTE 41
- OPERATING FREQUENCY: 2605,000,000 Hz
- BANDWIDTH: 40740 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2604 999 994	0.0	0.000 000	0.000
100%		-30	2604 999 991	-2.9	0.000 000	-0.001
100%		-20	2605 000 011	16.6	0.000 001	0.006
100%		-10	2605 000 002	7.8	0.000 000	0.003
100%		0	2605 000 007	13.0	0.000 000	0.005
100%		+10	2605 000 003	8.7	0.000 000	0.003
100%		+30	2605 000 005	10.3	0.000 000	0.004
100%		+40	2605 000 007	12.7	0.000 000	0.005
100%		+50	2605 000 004	9.6	0.000 000	0.004
Batt. Endpoint	3.400	+20	2604 999 998	4.1	0.000 000	0.002



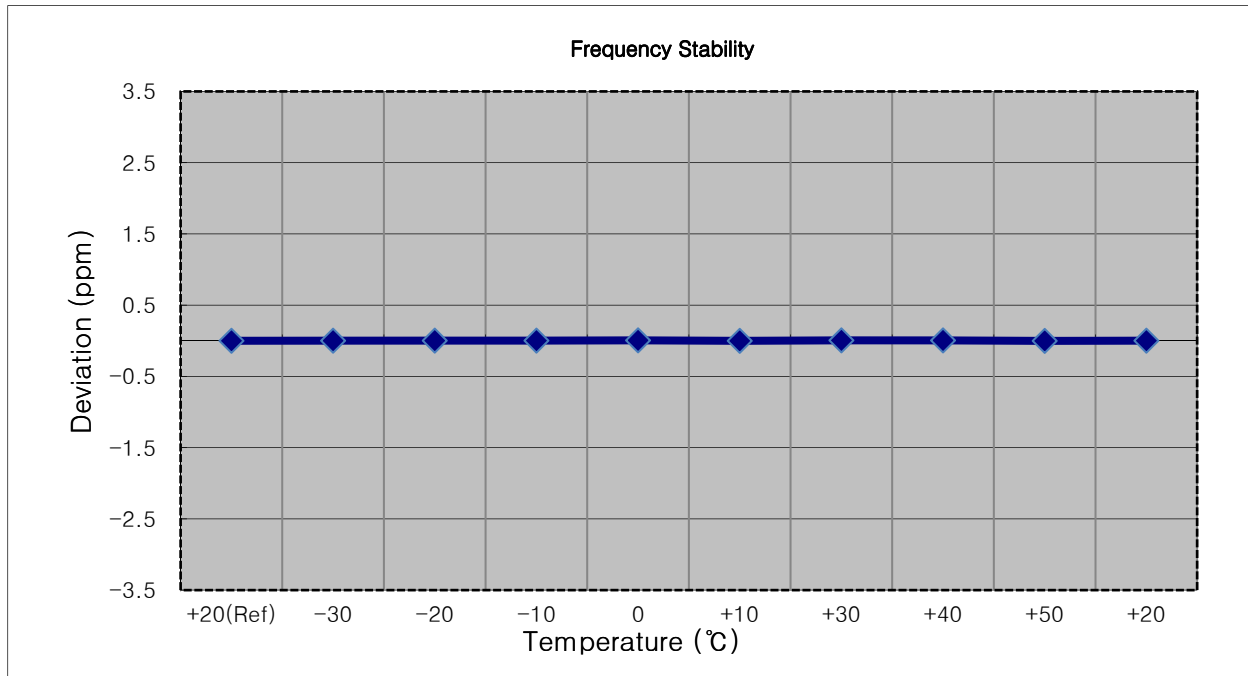
- MODE: LTE 41
- OPERATING FREQUENCY: 2605,000,000 Hz
- BANDWIDTH: 40740 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2605 000 009	0.0	0.000 000	0.000
100%		-30	2605 000 014	5.4	0.000 000	0.002
100%		-20	2605 000 017	8.3	0.000 000	0.003
100%		-10	2605 000 016	6.5	0.000 000	0.002
100%		0	2605 000 017	8.1	0.000 000	0.003
100%		+10	2605 000 012	3.1	0.000 000	0.001
100%		+30	2605 000 006	-2.8	0.000 000	-0.001
100%		+40	2605 000 025	15.7	0.000 001	0.006
100%		+50	2605 000 013	3.7	0.000 000	0.001
Batt. Endpoint	3.400	+20	2605 000 013	4.0	0.000 000	0.002



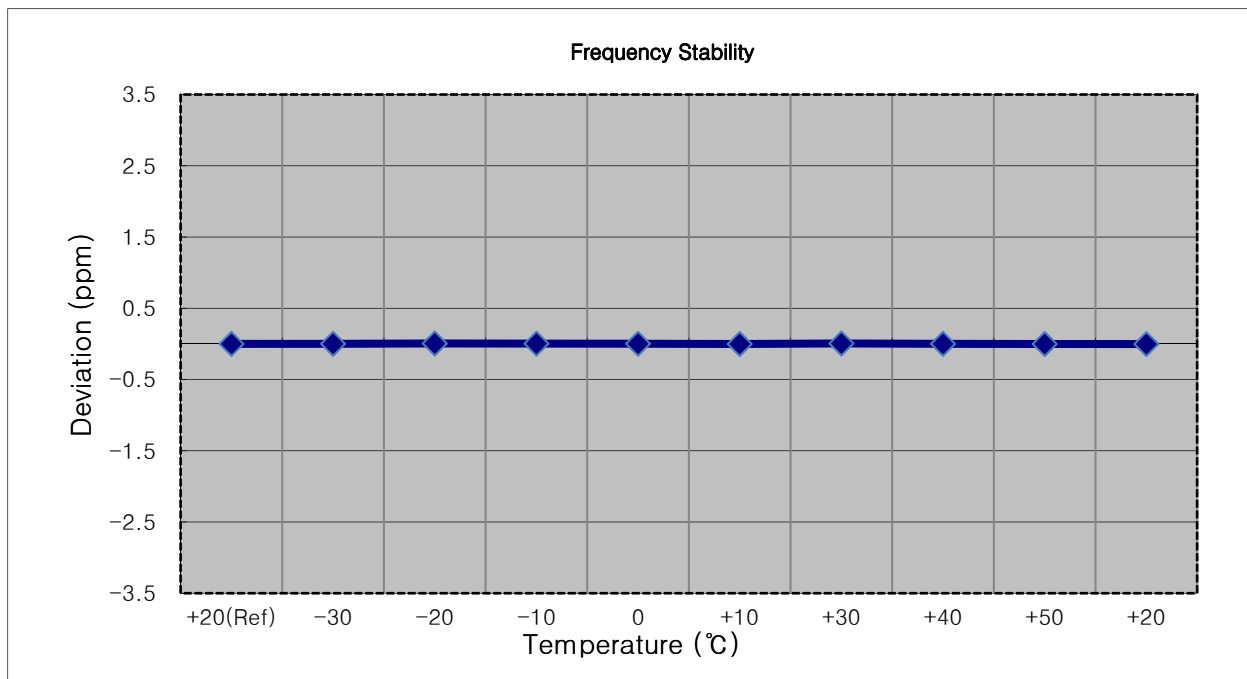
- MODE: LTE 41
- OPERATING FREQUENCY: 2605,000,000 Hz
- BANDWIDTH: 40740 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2605 000 010	0.0	0.000 000	0.000
100%		-30	2605 000 015	4.6	0.000 000	0.002
100%		-20	2605 000 015	5.3	0.000 000	0.002
100%		-10	2605 000 015	5.4	0.000 000	0.002
100%		0	2605 000 026	16.3	0.000 001	0.006
100%		+10	2605 000 008	-1.8	0.000 000	-0.001
100%		+30	2605 000 026	15.5	0.000 001	0.006
100%		+40	2605 000 024	14.4	0.000 001	0.006
100%		+50	2605 000 005	-4.8	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2605 000 014	3.8	0.000 000	0.001



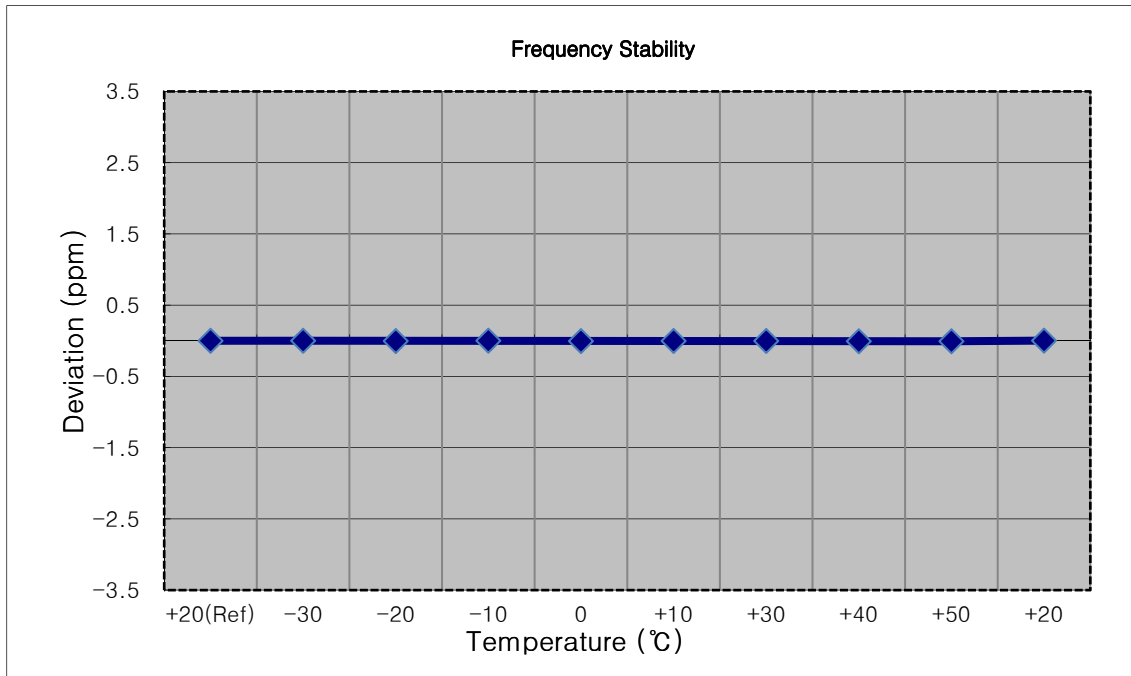
- MODE: LTE 41
- OPERATING FREQUENCY: 2605,000,000 Hz
- BANDWIDTH: 40740 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2605 000 014	0.0	0.000 000	0.000
100%		-30	2605 000 016	2.0	0.000 000	0.001
100%		-20	2605 000 029	15.6	0.000 001	0.006
100%		-10	2605 000 024	10.5	0.000 000	0.004
100%		0	2605 000 019	5.4	0.000 000	0.002
100%		+10	2605 000 011	-2.8	0.000 000	-0.001
100%		+30	2605 000 030	15.7	0.000 001	0.006
100%		+40	2605 000 017	3.1	0.000 000	0.001
100%		+50	2605 000 011	-2.7	0.000 000	-0.001
Batt. Endpoint	3.400	+20	2605 000 009	-4.8	0.000 000	-0.002



- MODE: LTE 41
- OPERATING FREQUENCY: 2652,500,000 Hz
- BANDWIDTH: 41215 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

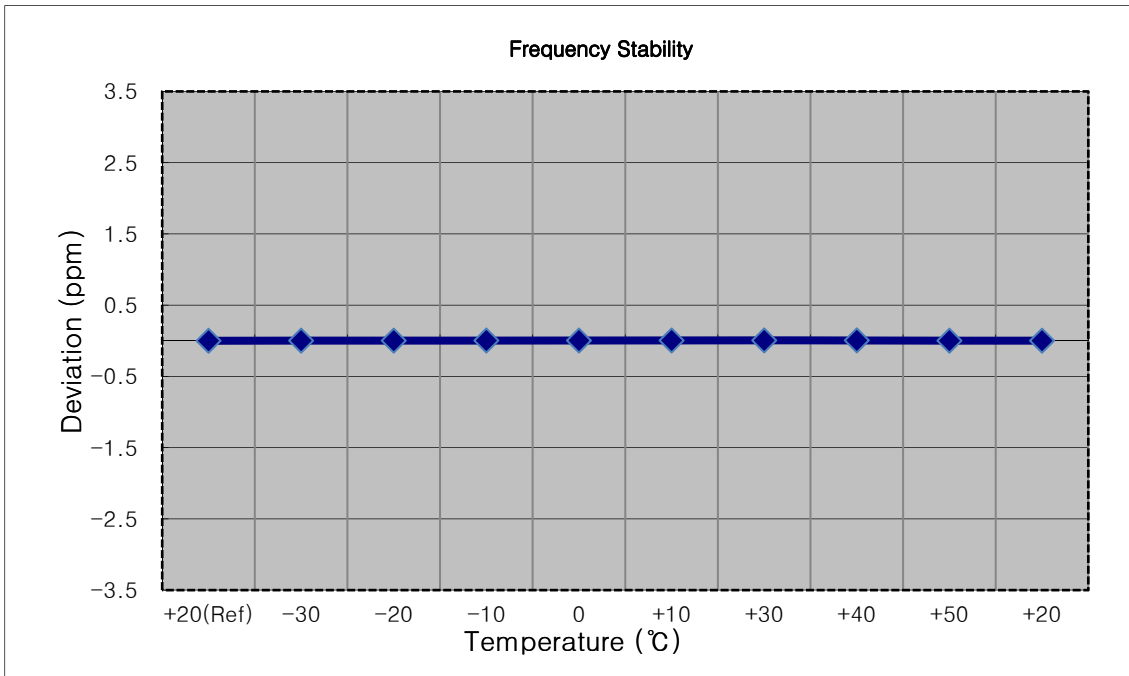
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2652 499 996	0.0	0.000 000	0.000
100%		-30	2652 499 999	2.7	0.000 000	0.001
100%		-20	2652 499 986	-10.6	0.000 000	-0.004
100%		-10	2652 500 001	4.8	0.000 000	0.002
100%		0	2652 499 985	-11.2	0.000 000	-0.004
100%		+10	2652 499 990	-5.7	0.000 000	-0.002
100%		+30	2652 499 989	-6.7	0.000 000	-0.003
100%		+40	2652 499 979	-17.1	-0.000 001	-0.006
100%		+50	2652 499 979	-17.5	-0.000 001	-0.007
Batt. Endpoint	3.400	+20	2652 500 002	6.1	0.000 000	0.002





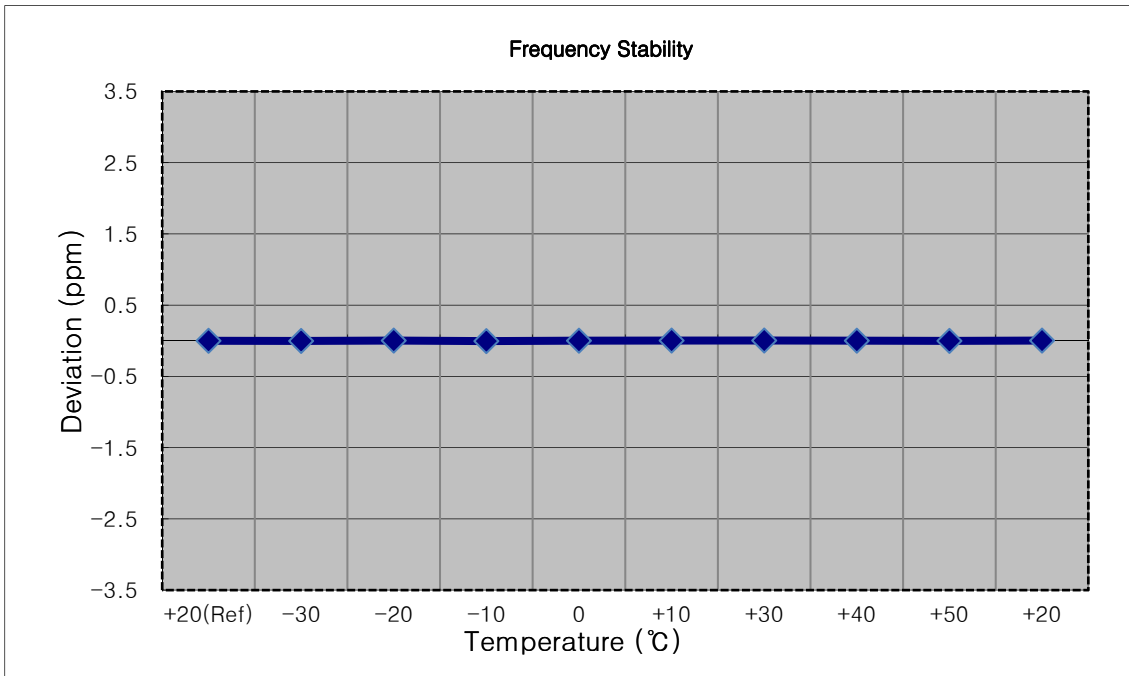
- MODE: LTE 41
- OPERATING FREQUENCY: 2650,000,000 Hz
- BANDWIDTH: 41190 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2650 000 005	0.0	0.000 000	0.000
100%		-30	2650 000 011	5.3	0.000 000	0.002
100%		-20	2650 000 012	6.8	0.000 000	0.003
100%		-10	2650 000 015	9.5	0.000 000	0.004
100%		0	2650 000 014	9.0	0.000 000	0.003
100%		+10	2650 000 018	12.4	0.000 000	0.005
100%		+30	2650 000 019	14.0	0.000 001	0.005
100%		+40	2650 000 022	16.6	0.000 001	0.006
100%		+50	2650 000 009	3.7	0.000 000	0.001
Batt. Endpoint	3.400	+20	2650 000 010	4.7	0.000 000	0.002



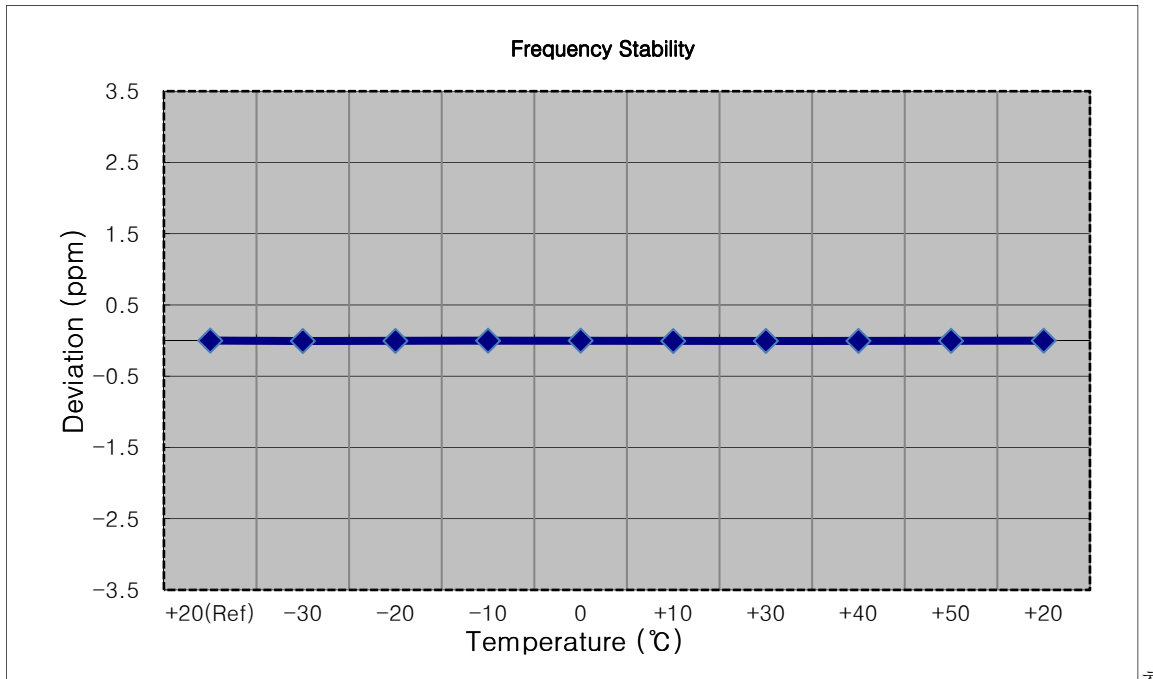
- MODE: LTE 41
- OPERATING FREQUENCY: 2647,500,000 Hz
- BANDWIDTH: 41165 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2647 500 007	0.0	0.000 000	0.000
100%		-30	2647 500 000	-6.6	0.000 000	-0.002
100%		-20	2647 500 014	7.7	0.000 000	0.003
100%		-10	2647 499 996	-11.0	0.000 000	-0.004
100%		0	2647 500 010	3.0	0.000 000	0.001
100%		+10	2647 500 015	8.1	0.000 000	0.003
100%		+30	2647 500 016	9.1	0.000 000	0.003
100%		+40	2647 500 011	4.2	0.000 000	0.002
100%		+50	2647 500 002	-4.9	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2647 500 015	8.6	0.000 000	0.003



- MODE: LTE 41
- OPERATING FREQUENCY: 2645,000,000 Hz
- BANDWIDTH: 41140 (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)	2644 999 992	0.0	0.000 000	0.000
100%		-30	2644 999 976	-15.8	-0.000 001	-0.006
100%		-20	2644 999 980	-11.9	0.000 000	-0.004
100%		-10	2644 999 988	-3.9	0.000 000	-0.001
100%		0	2644 999 990	-2.0	0.000 000	-0.001
100%		+10	2644 999 976	-15.5	-0.000 001	-0.006
100%		+30	2644 999 980	-11.9	0.000 000	-0.004
100%		+40	2644 999 981	-11.0	0.000 000	-0.004
100%		+50	2644 999 983	-8.6	0.000 000	-0.003
Batt. Endpoint	3.400	+20	2644 999 989	-2.9	0.000 000	-0.001



## 8.8 GEO-LOCATION MECHANISM

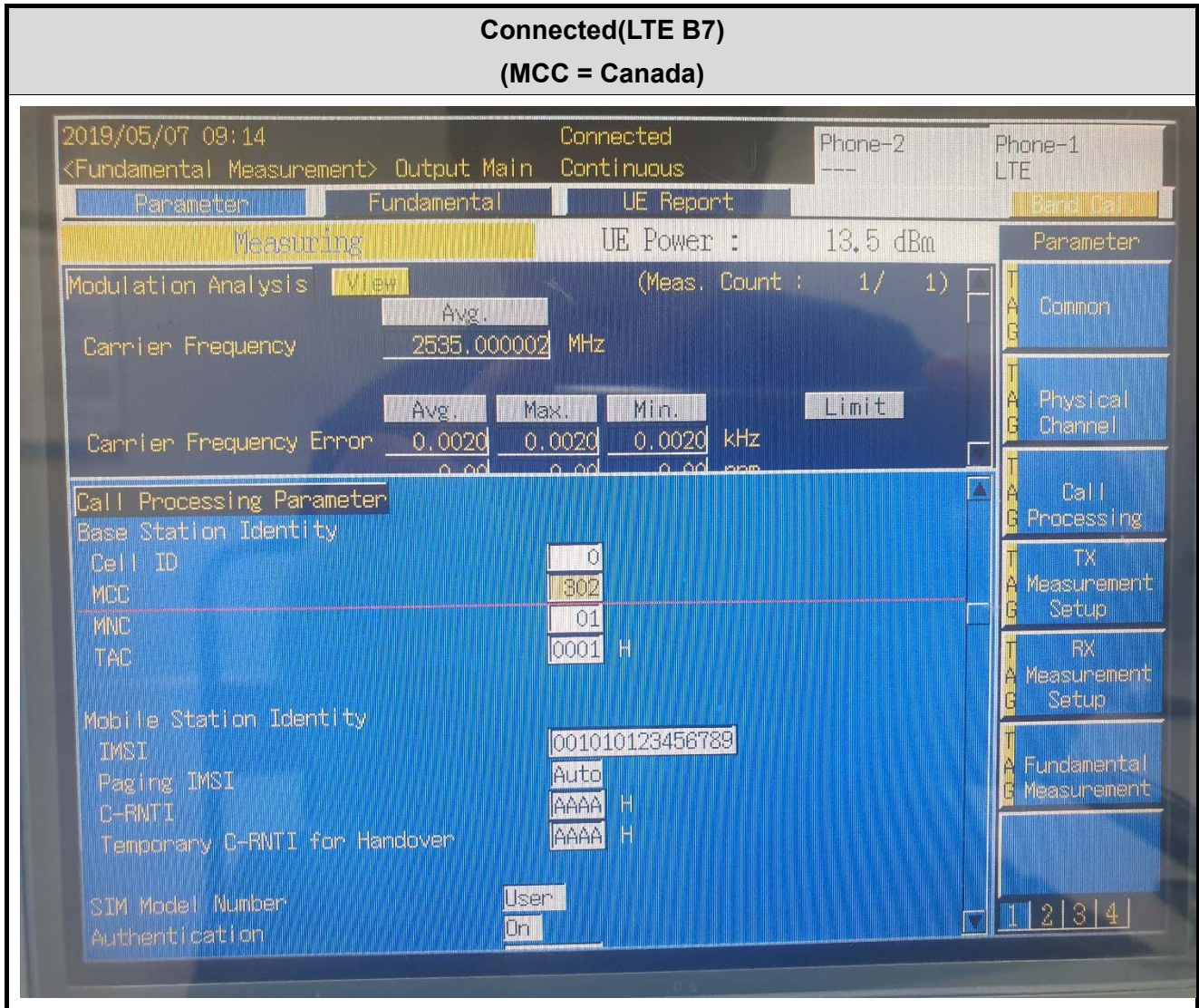
The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

The validation of this mechanism is provided below. The device was configured for cellular communications to a test set and the MCC code was adjusted on the test set between the US MCC and then an MCC code valid for a country where the LTE band is supported.

Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)
38	Did not connect	Connected (Canada)
40	Did not connect	Connected (Canada)
41	Connected	Connected (Canada)

The verification tests confirmed the operational of the geo-location mechanism.

**Verification test**





**Connected(LTE B38)**  
**(MCC = Canada)**

2019/05/07 09:13      Connected      Phone-2      Phone-1  
<Fundamental Measurement> Output Main      Continuous      ---      LTE

Parameter      Fundamental      UE Report

Measuring      UE Power :      13.3 dBm      Parameter

Modulation Analysis      View      (Meas. Count :      1/      1)

Carrier Frequency      Avg.      2594.999996      MHz

	Avg.	Max.	Min.	Limit
Carrier Frequency Error	-0.0036	-0.0036	-0.0036	kHz
	0.00	0.00	0.00	ppm

**Call Processing Parameter**

Base Station Identity

Cell ID	0
MCC	302
MNC	01
TAC	0001 H

Mobile Station Identity

IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H
Temporary C-RNTI for Handover	AAAA H

SIM Model Number      User

Authentication      On

1 | 2 | 3 | 4

**Connected(LTE B40)**  
**(MCC = Canada)**

2019/05/07 09:13      Connected      Phone-2      Phone-1  
<Fundamental Measurement> Output Main Continuous --- LTE

Parameter      Fundamental      UE Report

Measuring      UE Power : 13.3 dBm      Parameter

Modulation Analysis View      (Meas. Count : 1/ 1)

Carrier Frequency      Avg.      2350.000003 MHz

	Avg.	Max.	Min.	Limit
Carrier Frequency Error	0.0029	0.0029	0.0029	kHz
	0.00	0.00	0.00	ppm

**Call Processing Parameter**

Base Station Identity

Cell ID      0

MCC      302

MNC      01

TAC      0001 H

Mobile Station Identity

IMSI      001010123456789

Paging IMSI      Auto

C-RNTI      AAAA H

Temporary C-RNTI for Handover      AAAA H

SIM Model Number      User

Authentication      On

1 | 2 | 3 | 4



**Connected(LTE B41)**  
**(MCC = Canada)**

2019/05/07 09:12      Connected      Phone-2      Phone-1  
<Fundamental Measurement> Output Main      Continuous      ---      LTE

Parameter      Fundamental      UE Report

Measuring      UE Power :      13.5 dBm      Parameter

Modulation Analysis      View      (Meas. Count :      1/      1)

Carrier Frequency      Avg.      2593.000000      MHz

Carrier Frequency Error      Avg.      Max.      Min.      Limit

   -0.0004      -0.0004      -0.0004      kHz

**Call Processing Parameter**

Base Station Identity

Cell ID      0

MCC      302

MNC      01

TAC      0001      H

Mobile Station Identity

IMSI      001010123456789

Paging IMSI      Auto

C-RNTI      AAAA      H

Temporary C-RNTI for Handover      AAAA      H

SIM Model Number      User

Authentication      On

1 | 2 | 3 | 4



**Connected(LTE B41)**  
**(MCC = US)**

2019/05/07 09:16 Connected Phone-2 Phone-1  
<Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report Band Cal

Measuring UE Power : 13.5 dBm

Modulation Analysis View (Meas. Count : 1/ 1)

Carrier Frequency Avg. 2593.000001 MHz

Carrier Frequency Error Avg. Max. Min. Limit  
0.0010 0.0010 0.0010 kHz

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 311

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAAA H

Temporary C-RNTI for Handover AAAAA H

SIM Model Number User

Authentication On

Parameter

Common

Physical Channel

Call Processing

TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1 | 2 | 3 | 4

**Did not connect (LTE B7)**  
**(MCC = US)**

The screenshot displays the following information:

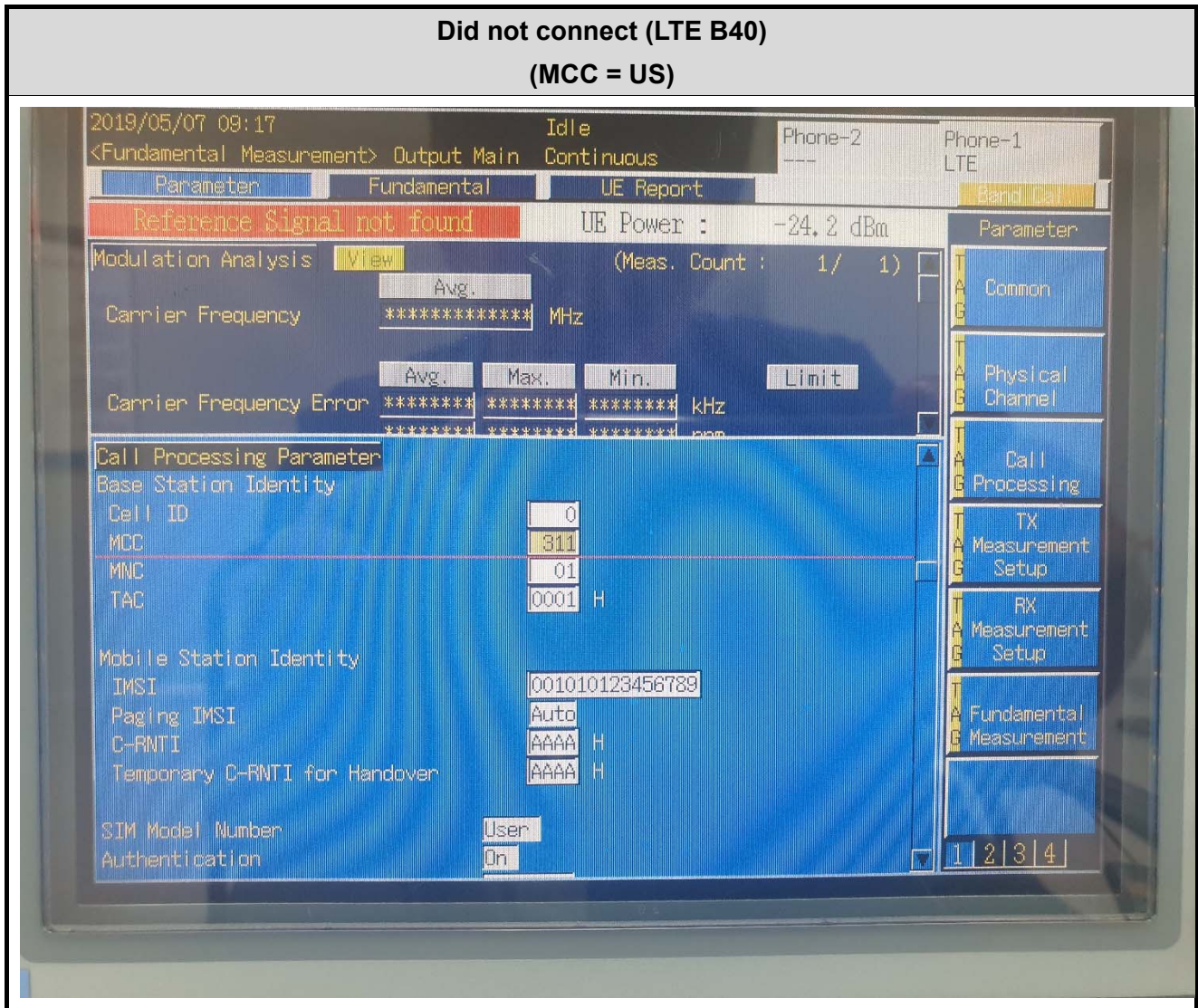
- Time:** 2019/05/07 09:19
- Mode:** Idle
- Output:** <Fundamental Measurement> Output Main
- Measurement Type:** Continuous
- Phone-2:** ---
- Phone-1:** LTE
- Parameter:** Fundamental, UE Report
- Reference Signal:** Reference Signal not found
- UE Power:** -24.3 dBm
- Modulation Analysis:** View (Meas. Count: 1/1)
- Carrier Frequency:** \*\*\*\*\* MHz
- Carrier Frequency Error:** \*\*\*\*\* kHz
- Call Processing Parameter:**
  - Base Station Identity:
    - Cell ID: 0
    - MCC: 811
    - MNC: 01
    - TAC: 0001 H
  - Mobile Station Identity:
    - IMSI: 001010123456789
    - Paging IMSI: Auto
    - C-RNTI: AAAA H
    - Temporary C-RNTI for Handover: AAAA H
  - SIM Model Number: User
  - Authentication: On
- Navigation Panel (Right):** Common, Physical Channel, Call Processing, TX Measurement Setup, RX Measurement Setup, Fundamental Measurement
- Bottom Bar:** 1 | 2 | 3 | 4



**Did not connect (LTE B38)**  
**(MCC = US)**

The screenshot displays the following information:

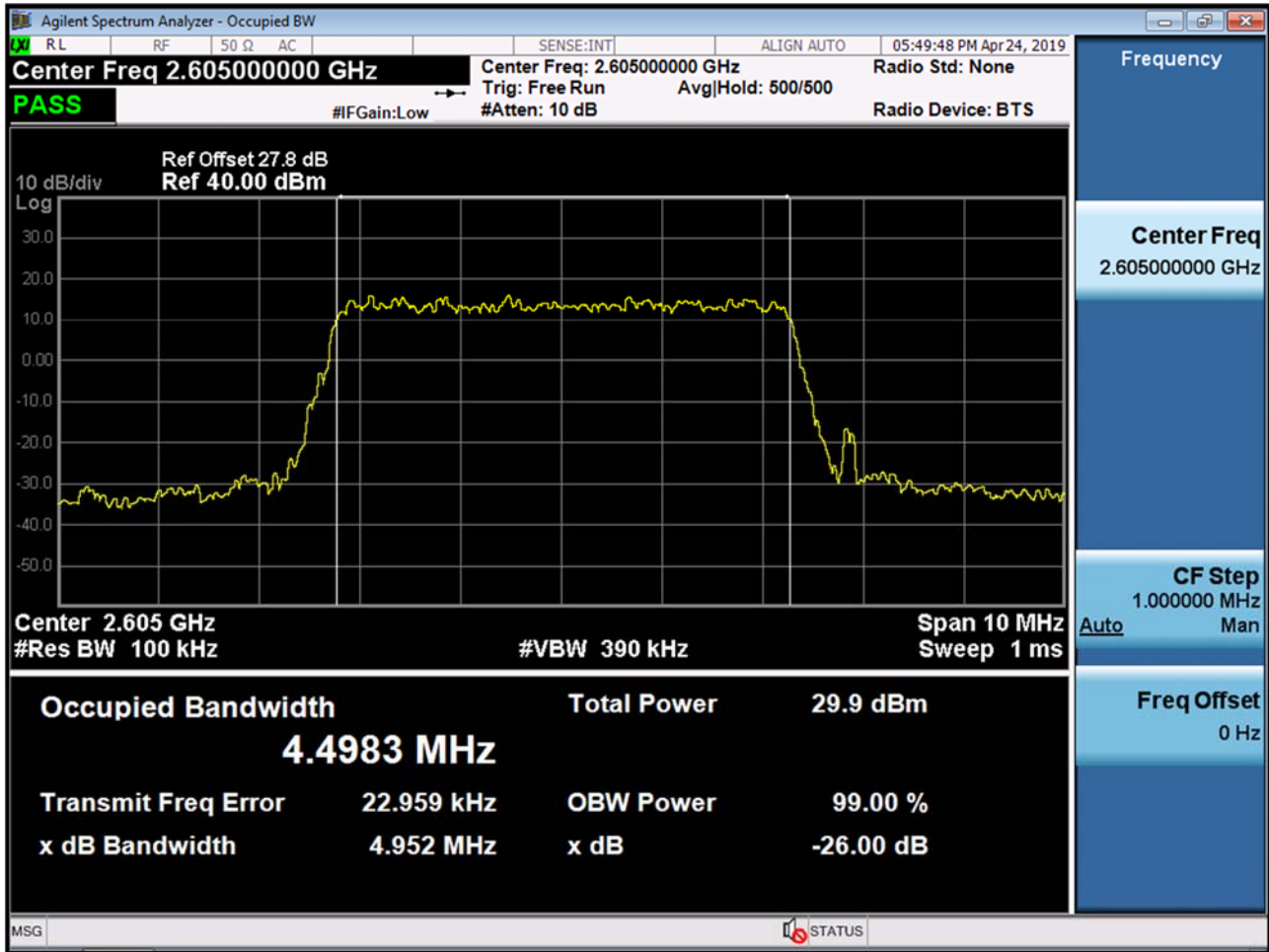
- Time:** 2019/05/07 09:17
- Mode:** Idle
- Phone-2:** ---
- Phone-1:** LTE
- Measurement Type:** <Fundamental Measurement> Output Main Continuous
- Reference Signal:** Reference Signal not found
- UE Power:** -24.6 dBm
- Modulation Analysis:** (Meas. Count : 1 / 1)
- Carrier Frequency:** \*\*\*\*\* MHz
- Carrier Frequency Error:** \*\*\*\*\* kHz
- Call Processing Parameter:**
  - Base Station Identity:
    - Cell ID: 0
    - MCC: 311
    - MNC: 01
    - TAC: 0001 H
  - Mobile Station Identity:
    - IMSI: 001010123456789
    - Paging IMSI: Auto
    - C-RNTI: AAAA H
    - Temporary C-RNTI for Handover: AAAA H
  - SIM Model Number: User
  - Authentication: On
- Right Panel:** Parameter menu with options: Common, Physical Channel, Call Processing, TX Measurement Setup, RX Measurement Setup, Fundamental Measurement.



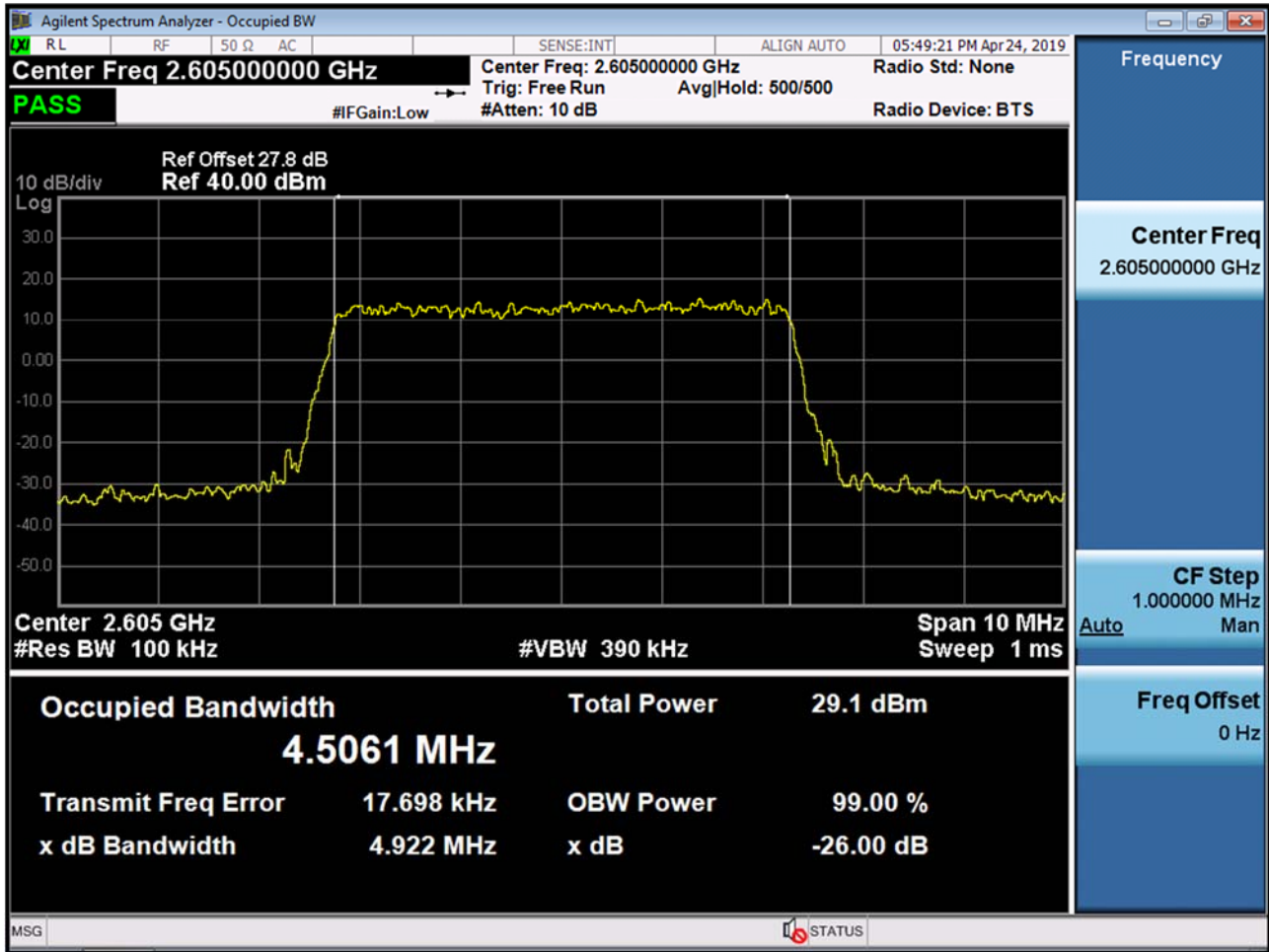
## **9. TEST PLOTS**



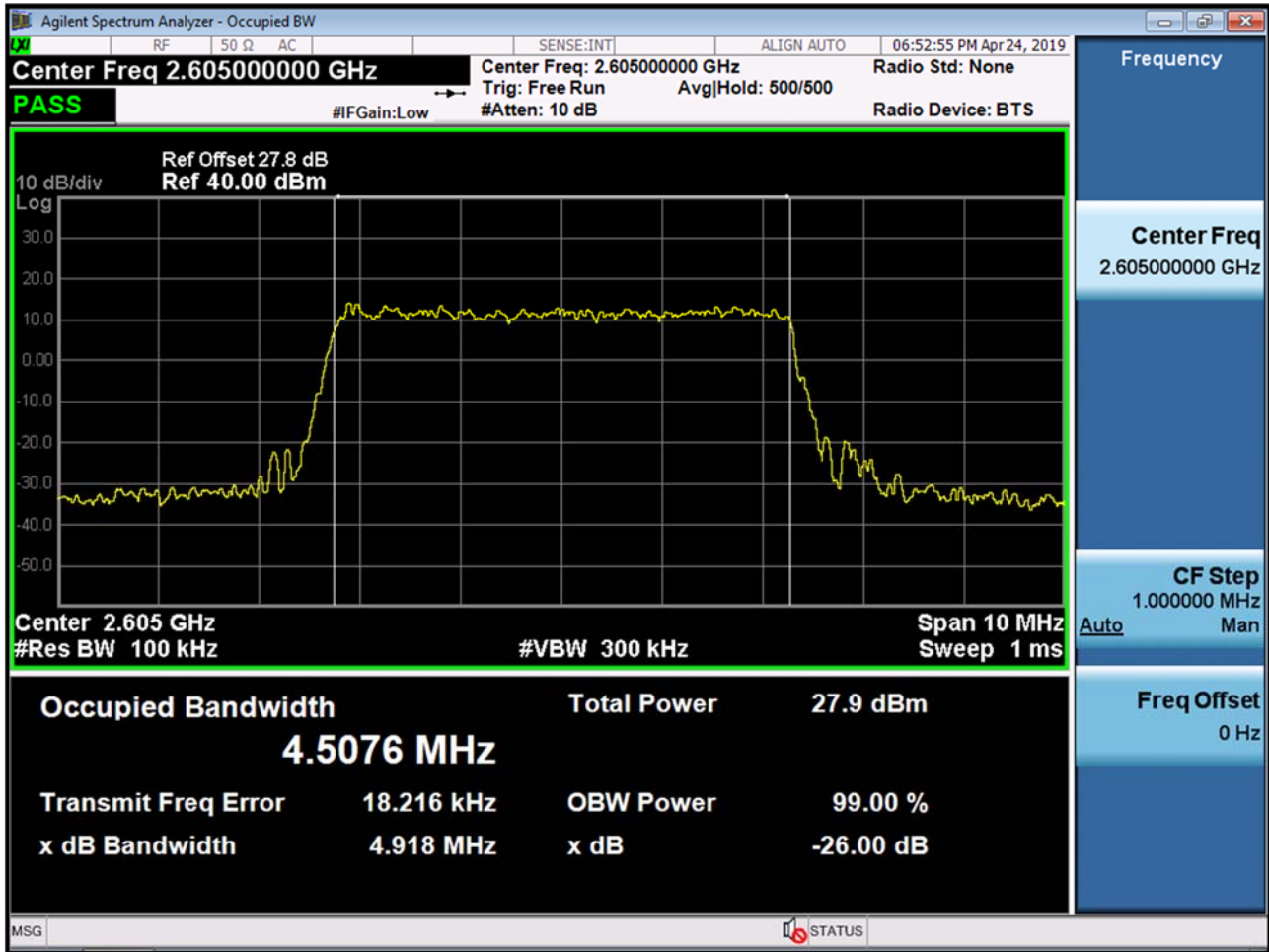
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40740 QPSK RB 25)



BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40740 16-QAM RB 25)

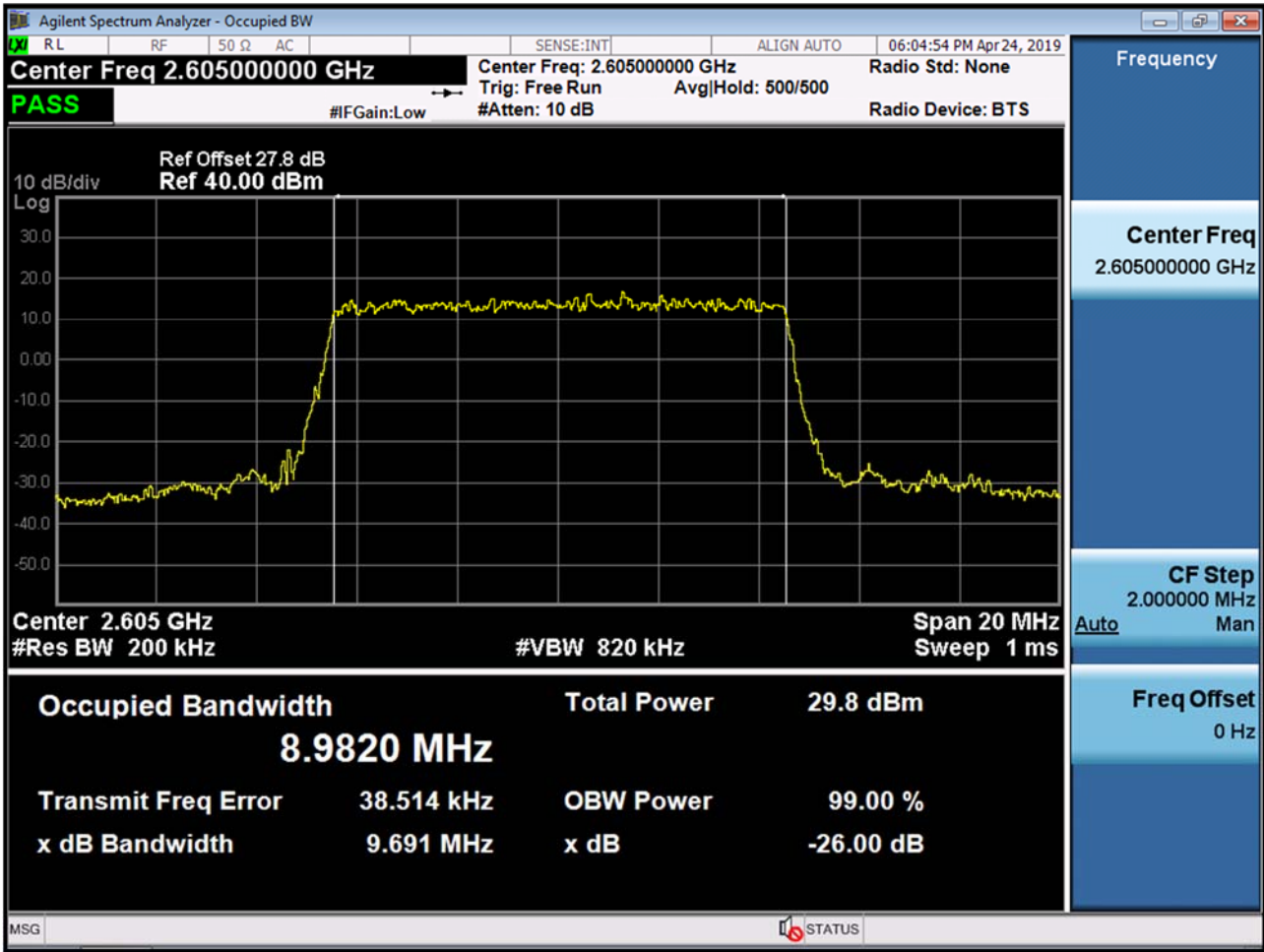


BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40740 64-QAM RB 25)

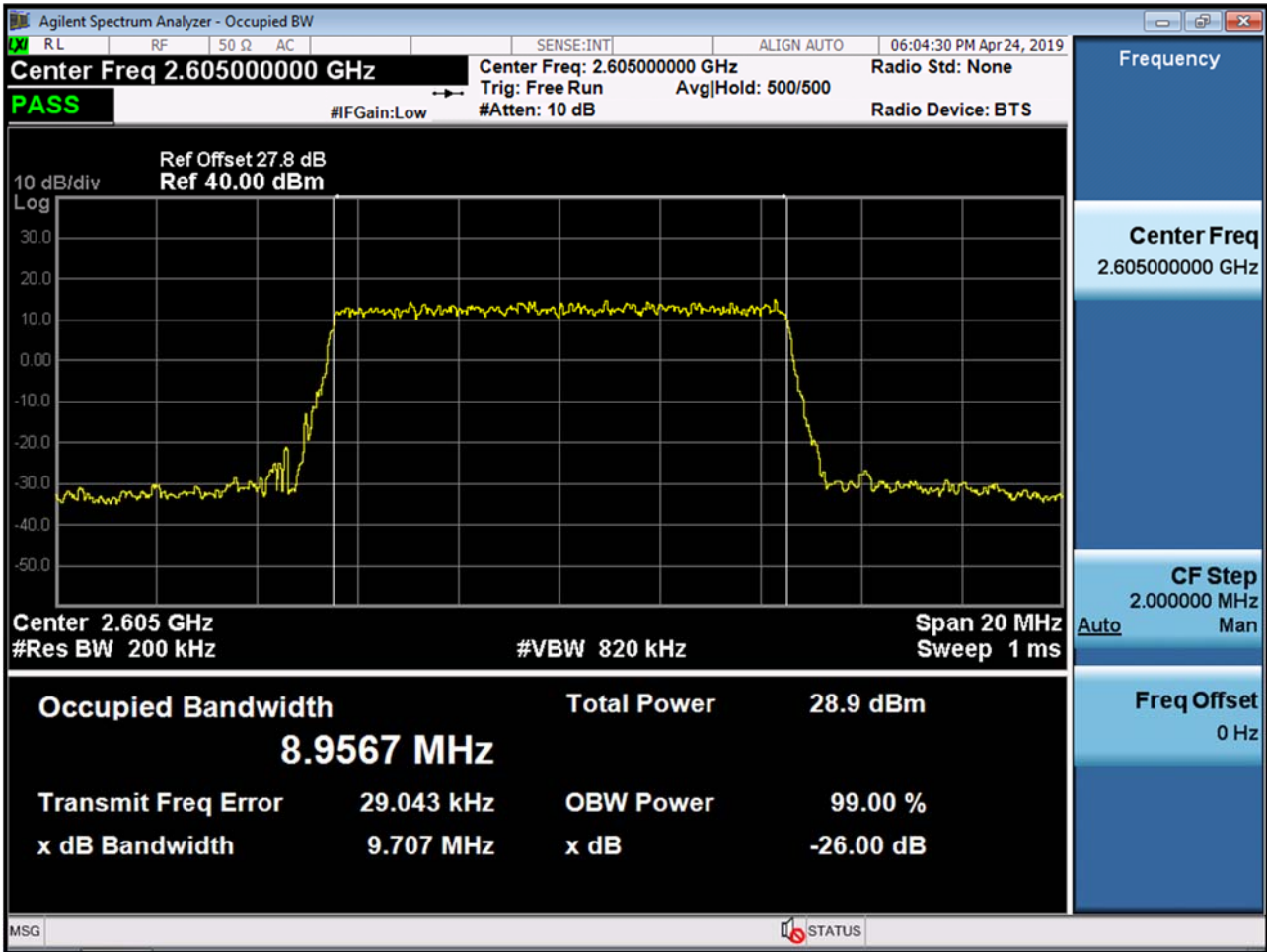




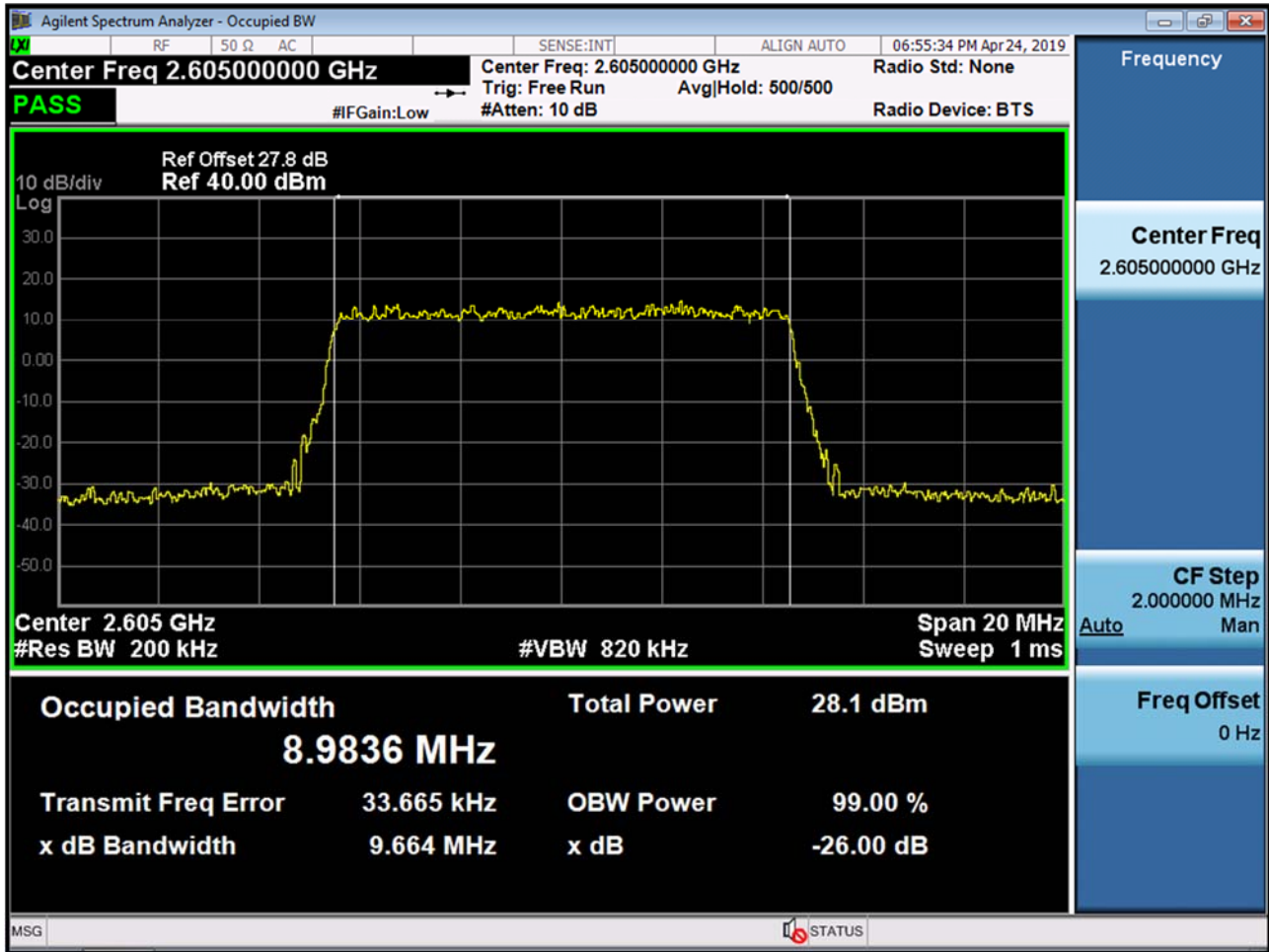
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40740 QPSK RB 50)



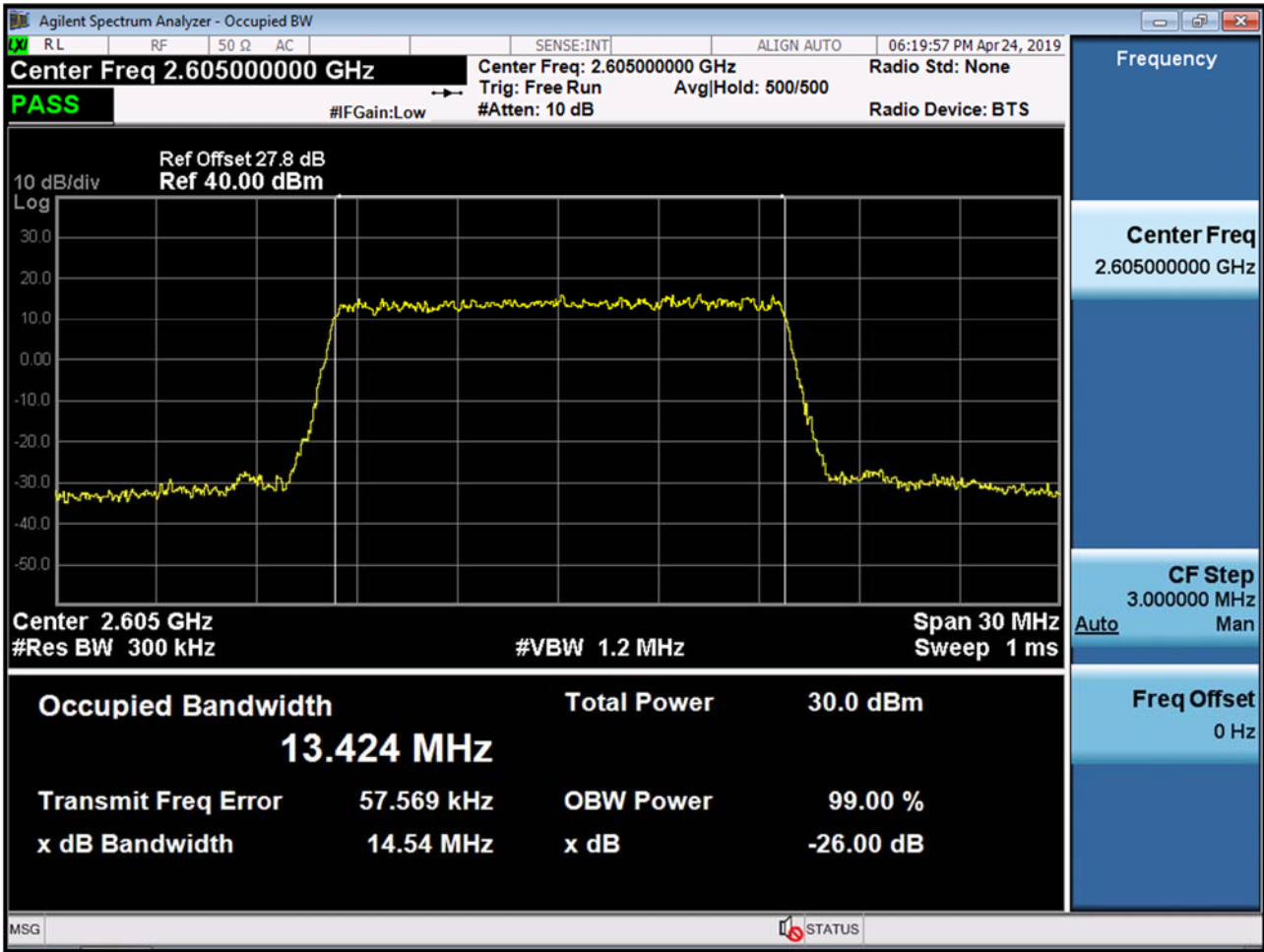
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40740 16-QAM RB 50)



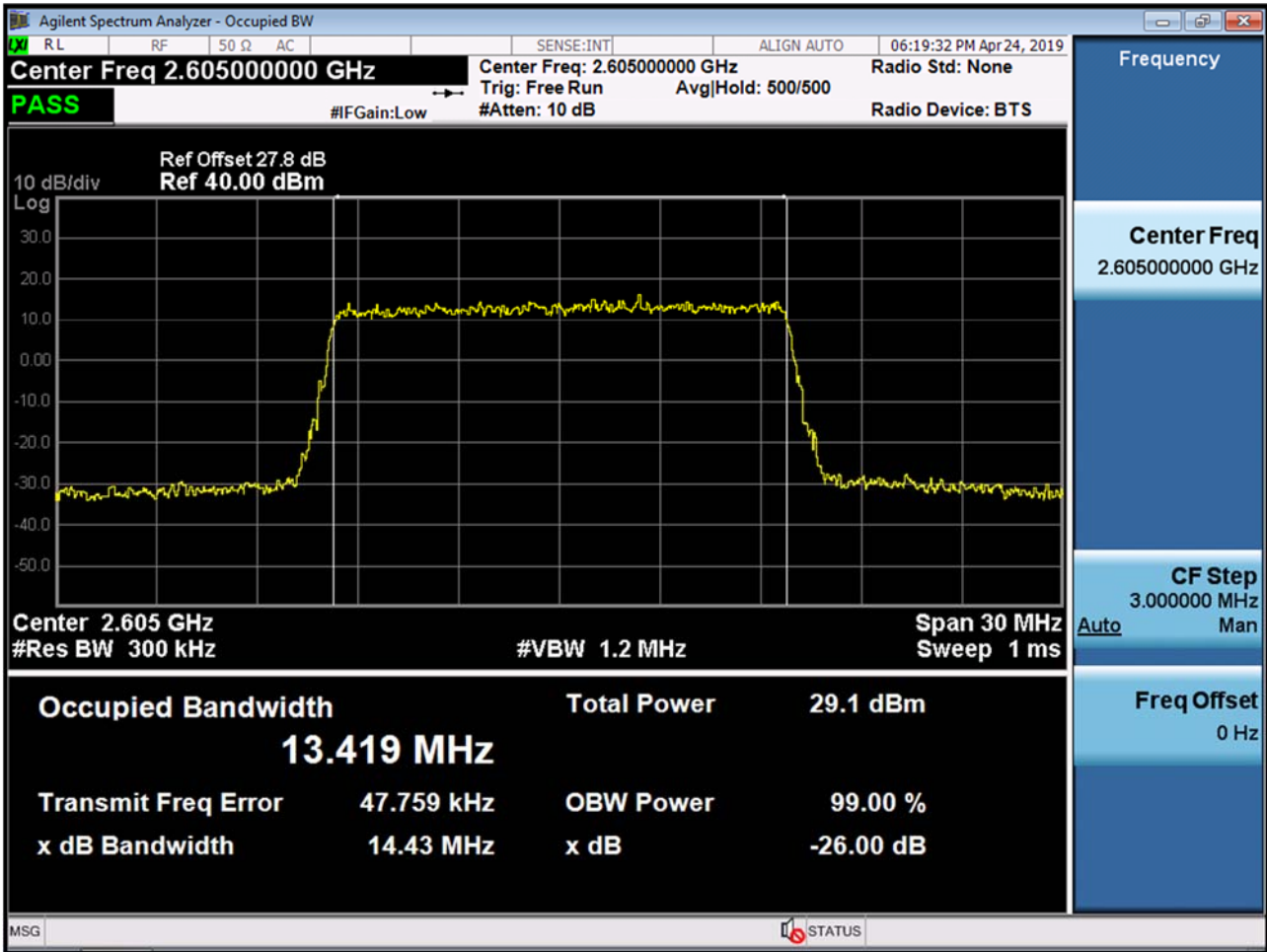
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40740 64-QAM RB 50)



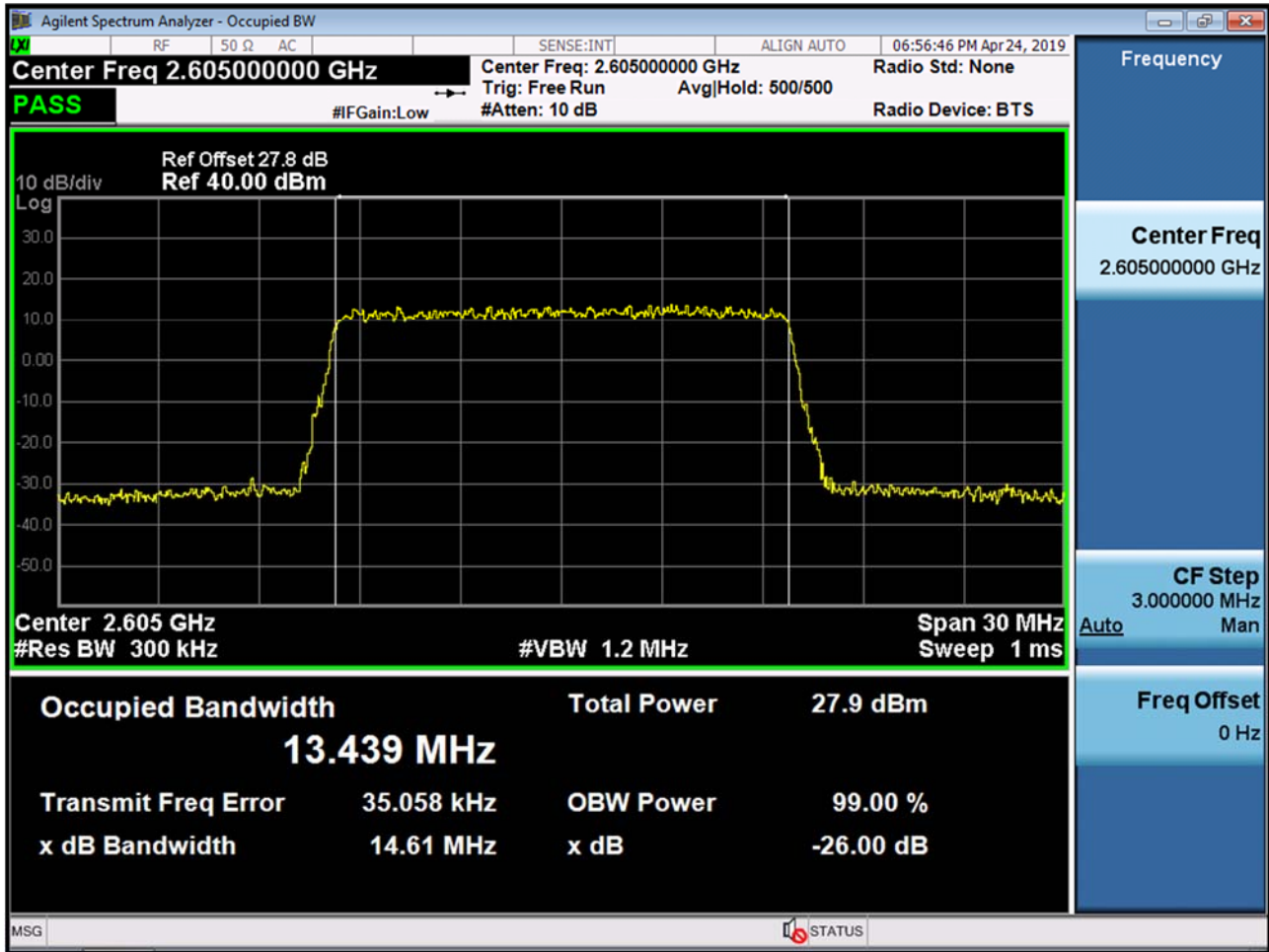
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40740 QPSK RB 75)



BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40740 16-QAM RB 75)

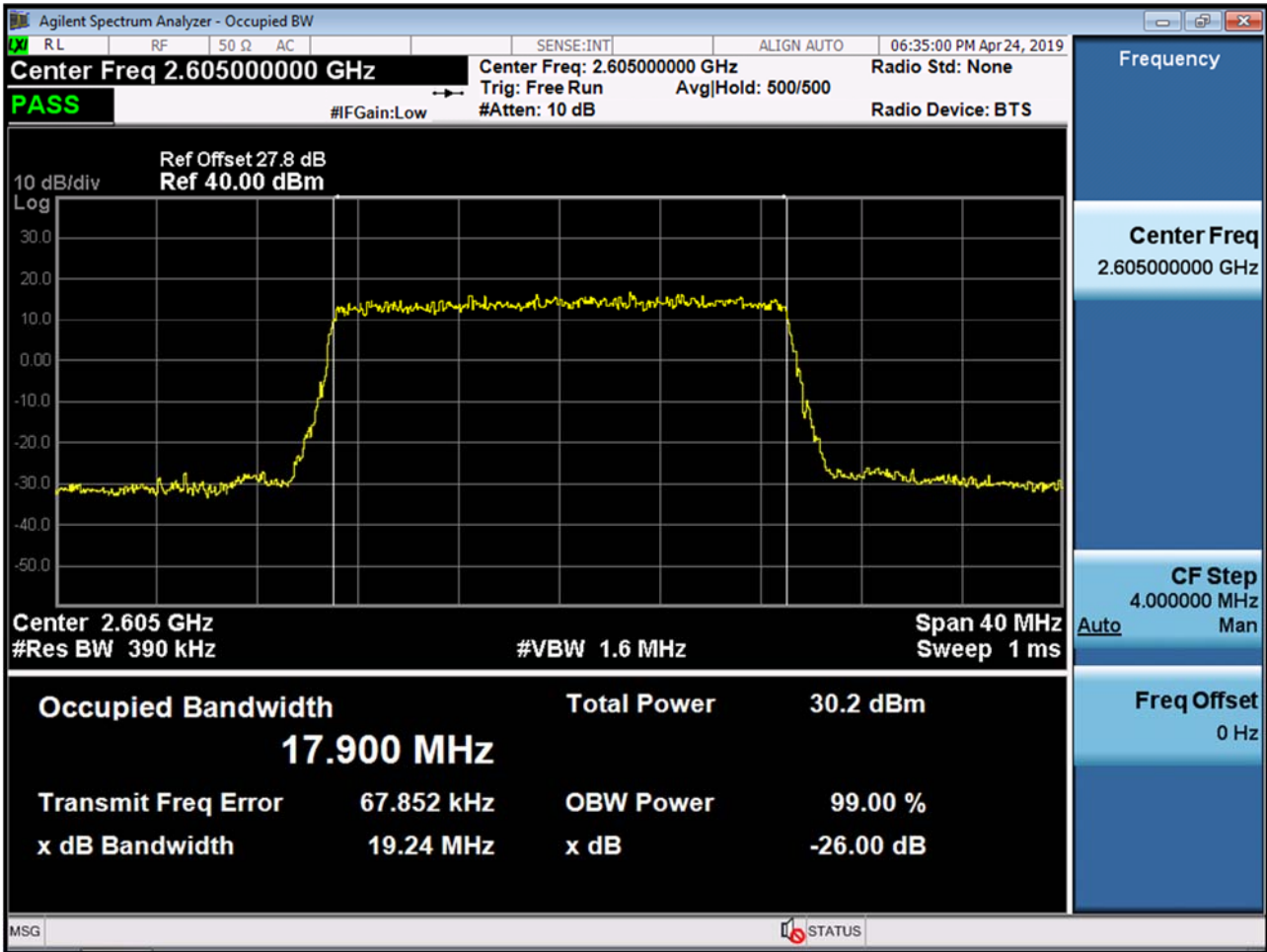


BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40740 64-QAM RB 75)

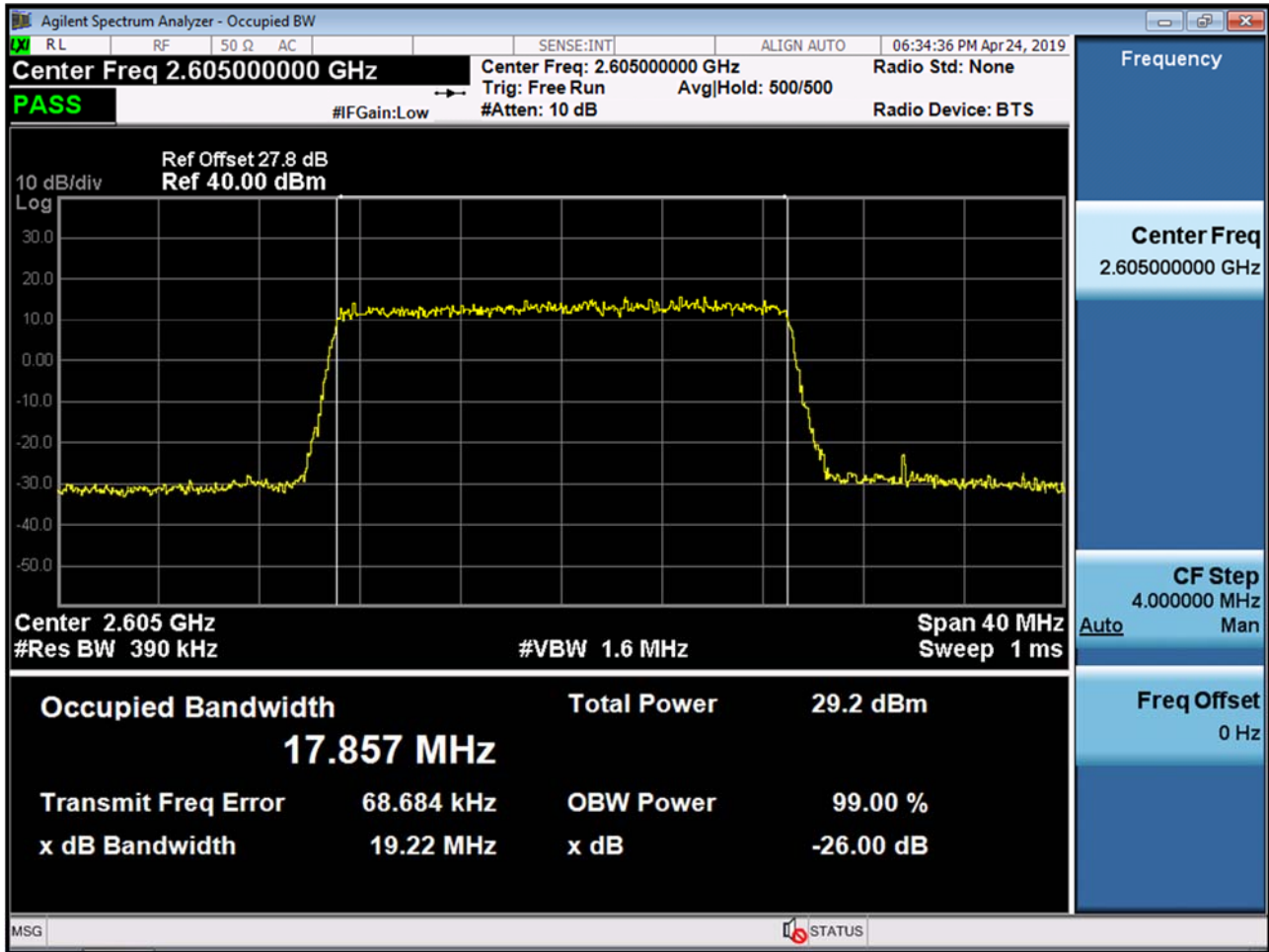




BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40740 QPSK RB 100)

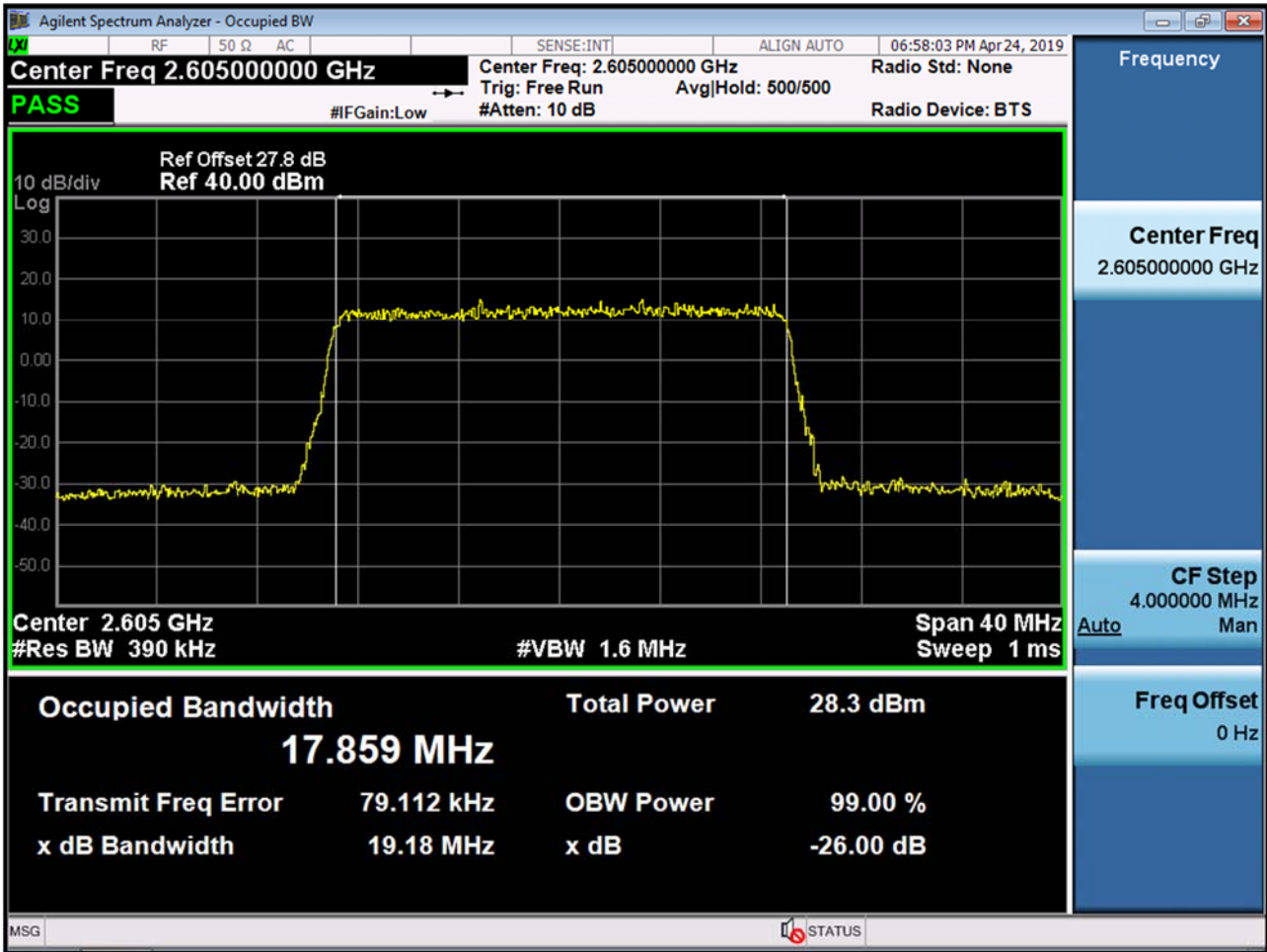


BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40740 16-QAM RB 100)

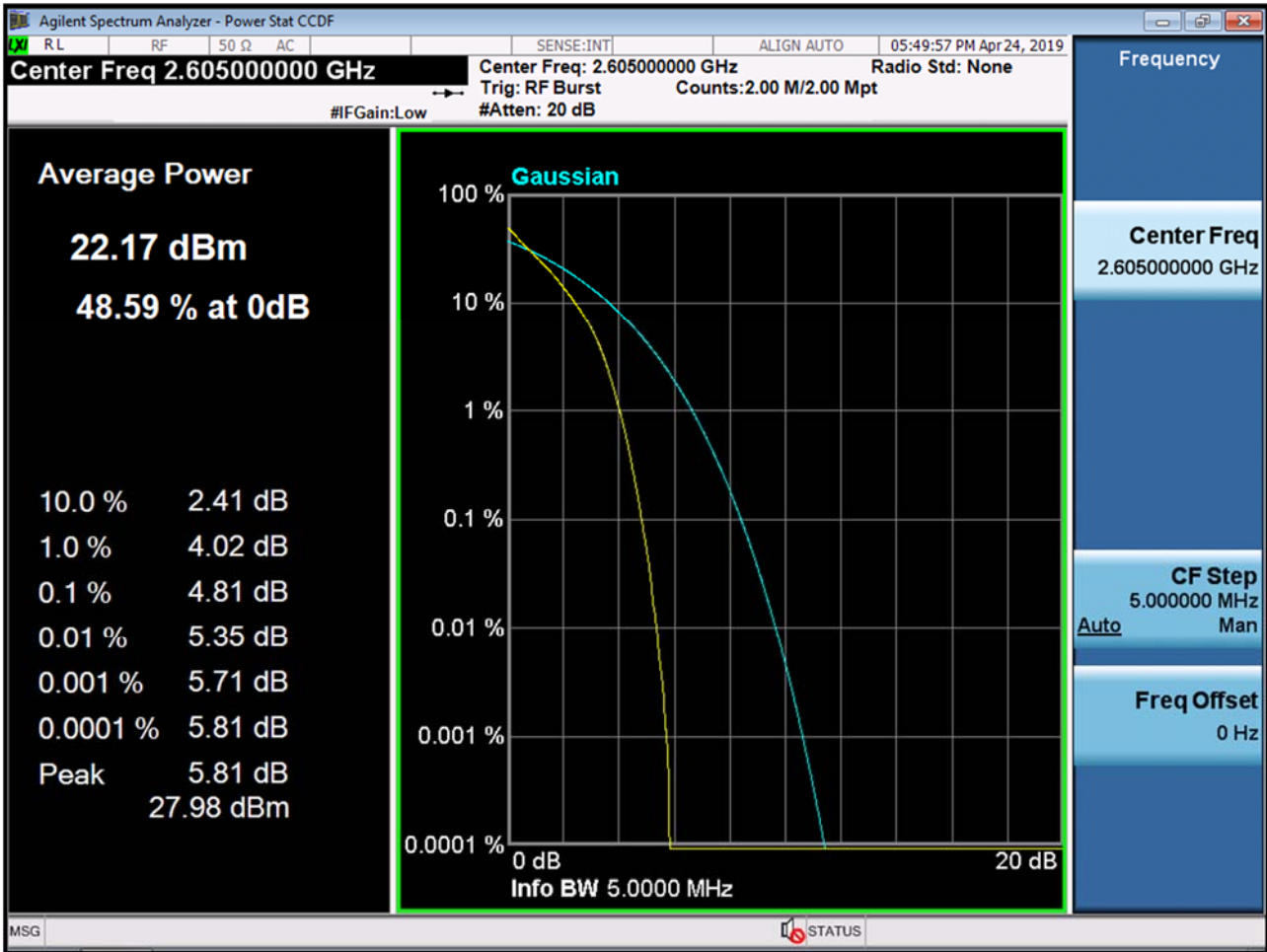




BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40740 64-QAM RB 100)



BAND 41. PAR Plot (5M BW\_Ch.40740\_QPSK\_RB25\_0)



BAND 41. PAR Plot (5M BW\_Ch. 40740\_16QAM\_RB25\_0)

