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FCC LTE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
April 29 2019

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

Report No.: HCT-RF-1904-FC041-R1

FCC ID: **A3LSMA202K**

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

Model(s): SM-A202K
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 – Band 41 (5)	2498.5 – 2687.5	4M53G7D	QPSK	0.121	20.81
		4M53W7D	16QAM	0.092	19.63
LTE – Band 41 (10)	2501.0 – 2685.0	8M98G7D	QPSK	0.119	20.75
		8M98W7D	16QAM	0.090	19.52
LTE – Band 41 (15)	2503.5 – 2682.5	13M5G7D	QPSK	0.112	20.48
		13M4W7D	16QAM	0.085	19.28
LTE – Band 41 (20)	2506.0 – 2680.0	17M9G7D	QPSK	0.114	20.57
		17M8W7D	16QAM	0.083	19.21

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-1904-FC043	April 26, 2019	- First Approval Report
HCT-RF-1904-FC043-R1	April 29, 2019	- Revised the Test Procedure Used on 6 page.

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMA202K
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile Phone
Model(s):	SM-A202K
Tx Frequency:	2498.5 – 2687.5 : 5 MHz 2501.0 – 2685.0 : 10 MHz 2503.5 – 2682.5 : 15 MHz 2506.0 – 2680.0 : 20 MHz
Date(s) of Tests:	April 05, 2019 ~ April 25, 2019

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 b/g/n, Bluetooth, BTLE, NFC.

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 ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

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

   The power is calculated by the following formula;

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

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

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

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

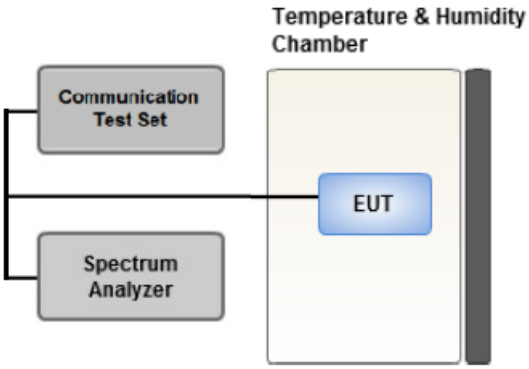
Test Settings

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

Test Note

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

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① **CCDF Procedure for PAPR**

Test Settings

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

② Alternate Procedure for PAPR

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

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

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

Test Settings(Peak Power)

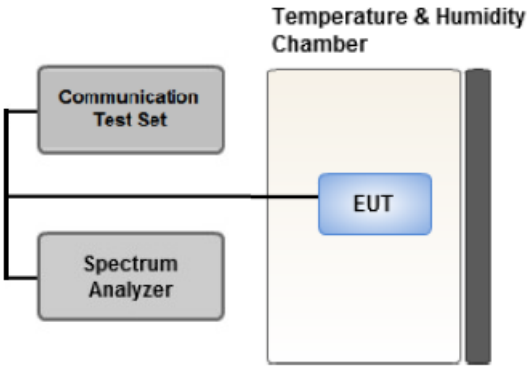
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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

Test Settings(Average Power)

1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to “free run.”
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

3.5 OCCUPIED BANDWIDTH.



Test setup

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

The EUT makes a call to the communication simulator.

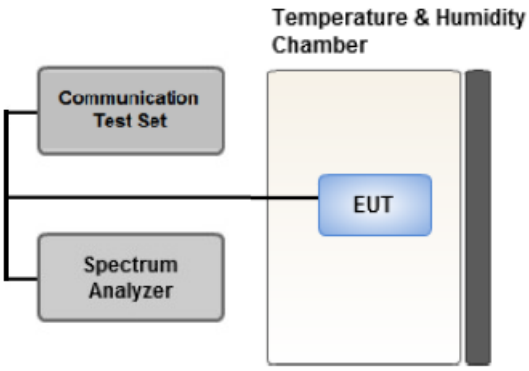
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

Test Settings

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

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

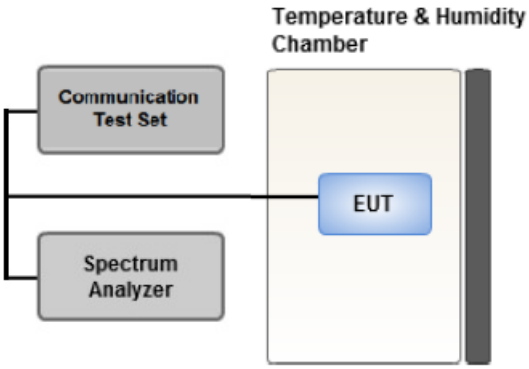
Test Overview

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

Test Settings

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

3.7 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.

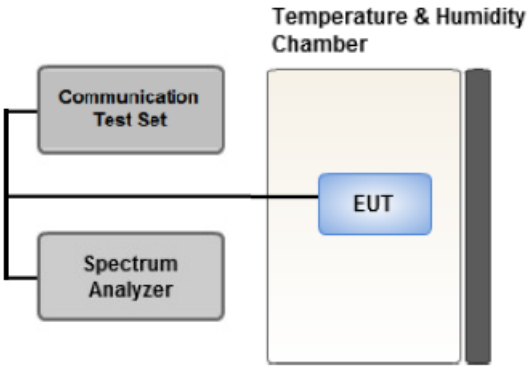
Test Settings

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 ≥ 2 x 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 that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.
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	1	0	Y
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	5, 10, 15, 20	Mid	Full RB	0
Peak-to-Average Ratio	QPSK, 16QAM	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)	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	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_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	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)	■ < 40 + 10log10 (P[Watts]) at Channel edges ■ < 43 + 10log10 (P[Watts]) between 5 and X MHz from Channel edges ■ < 55 + 10log10 (P[Watts]) beyond X MHz beyond from Channel edges ■ < 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz	PASS
Conducted Output Power	§2.1046	N/A	**See Note1**
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 + 10log10 (P[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
40740	2593.0	-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
2498.5	LTE B41/ 5 MHz	QPSK	-23.42	11.22	10.98	1.60	H	< 2.00	0.115	20.60
		16-QAM	-24.61	10.03	10.98	1.60	H		0.087	19.41
2593.0		QPSK	-23.90	10.85	11.06	1.63	H		0.107	20.28
		16-QAM	-25.06	9.69	11.06	1.63	H		0.082	19.12
2687.5		QPSK	-23.97	11.31	11.15	1.65	H		0.121	20.81
		16-QAM	-25.15	10.13	11.15	1.65	H		0.092	19.63

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2501.0	LTE B41/ 10 MHz	QPSK	-23.44	11.20	10.98	1.60	H	< 2.00	0.114	20.58
		16-QAM	-24.82	9.82	10.98	1.60	H		0.083	19.20
2593.0		QPSK	-23.95	10.80	11.06	1.63	H		0.105	20.23
		16-QAM	-25.15	9.60	11.06	1.63	H		0.080	19.03
2685.0		QPSK	-23.91	11.25	11.15	1.65	H		0.119	20.75
		16-QAM	-25.14	10.02	11.15	1.65	H		0.090	19.52

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2503.5	LTE B41/ 15 MHz	QPSK	-23.46	11.11	10.98	1.61	H	< 2.00	0.112	20.48
		16-QAM	-24.66	9.91	10.98	1.61	H		0.085	19.28
2593.0		QPSK	-23.92	10.83	11.06	1.63	H		0.106	20.26
		16-QAM	-25.17	9.58	11.06	1.63	H		0.080	19.01
2682.5		QPSK	-24.33	10.70	11.15	1.64	H		0.105	20.21
		16-QAM	-25.44	9.59	11.15	1.64	H		0.081	19.10

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2506.0	LTE B41/ 20 MHz	QPSK	-23.51	11.06	10.98	1.61	H	< 2.00	0.110	20.43
		16-QAM	-24.73	9.84	10.98	1.61	H		0.083	19.21
2593.0		QPSK	-24.40	10.35	11.06	1.63	H		0.095	19.78
		16-QAM	-25.65	9.10	11.06	1.63	H		0.071	18.53
2680.0		QPSK	-23.97	11.06	11.15	1.64	H		0.114	20.57
		16-QAM	-25.38	9.65	11.15	1.64	H		0.082	19.16

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY : 2687.50 MHz

▣ MEASURED OUTPUT POWER: 20.81 dBm = 0.121 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 $\log_{10}$ (W) = 45.81 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39675 (2498.5)	4,997.00	-40.33	12.89	-54.02	2.47	H	-43.60	64.42
	7,495.50	-41.93	11.51	-48.67	2.97	H	-40.13	60.94
	9,994.00	-39.57	11.21	-42.02	3.48	V	-34.29	55.11
	12,492.50	-49.73	14.20	-54.31	4.17	V	-44.28	65.10
40620 (2593.0)	5,186.00	-41.92	13.05	-54.52	2.58	V	-44.05	64.86
	7,779.00	-40.56	11.98	-48.08	2.93	H	-39.03	59.85
	10,372.00	-48.21	10.96	-51.20	3.62	V	-43.86	64.67
	12,965.00	-52.83	13.61	-55.43	4.08	V	-45.90	66.72
41565 (2687.5)	5,375.00	-37.64	13.49	-50.92	2.65	V	-40.08	60.90
	8,062.50	-46.42	11.46	-51.24	3.05	H	-42.83	63.64
	10,750.00	-46.87	10.99	-49.77	3.67	H	-42.45	63.26
	13,437.50	-53.05	13.01	-54.52	4.09	V	-45.60	66.42
	16,125.00	-51.72	17.38	-56.12	4.62	V	-43.36	64.18

▣ OPERATING FREQUENCY : 2685.00 MHz

▣ MEASURED OUTPUT POWER: 20.75 dBm = 0.119 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log_{10} (W) = 45.75 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39700 (2501.0)	5,002.00	-44.15	12.89	-57.84	2.47	V	-47.42	68.18
	7,503.00	-38.86	11.53	-45.29	2.92	V	-36.69	57.44
	10,004.00	-43.39	11.25	-46.23	3.41	V	-38.39	59.14
	12,505.00	-50.89	14.24	-55.47	3.99	V	-45.22	65.97
40620 (2593.0)	5,186.00	-47.24	13.05	-59.84	2.58	V	-49.37	70.12
	7,779.00	-39.57	11.98	-47.09	2.93	V	-38.04	58.79
	10,372.00	-48.58	10.96	-51.57	3.62	V	-44.23	64.98
	12,965.00	-53.24	13.61	-55.84	4.08	V	-46.31	67.06
41540 (2685.0)	5,370.00	-38.93	13.50	-52.51	2.65	V	-41.66	62.41
	8,055.00	-40.98	11.46	-45.87	3.05	V	-37.47	58.22
	10,740.00	-45.78	10.98	-48.59	3.62	V	-41.23	61.98
	13,425.00	-51.16	13.07	-52.75	4.18	V	-43.86	64.62
	16,110.00	-52.04	17.39	-56.07	4.54	V	-43.22	63.97

▣ OPERATING FREQUENCY : 2503.50 MHz

▣ MEASURED OUTPUT POWER: 20.48 dBm = 0.112 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log_{10} (W) = 45.48 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39725 (2503.5)	5,007.00	-43.92	12.86	-58.05	2.49	V	-47.68	68.16
	7,510.50	-42.33	11.54	-48.47	2.90	V	-39.83	60.31
	10,014.00	-40.82	11.27	-43.98	3.40	V	-36.12	56.59
	12,517.50	-48.16	14.23	-52.47	4.05	V	-42.29	62.77
40620 (2593.0)	5,186.00	-44.56	13.05	-57.16	2.58	V	-46.69	67.17
	7,779.00	-41.20	11.98	-48.72	2.93	V	-39.67	60.15
	10,372.00	-48.89	10.96	-51.88	3.62	V	-44.54	65.02
	12,965.00	-53.83	13.61	-56.43	4.08	V	-46.90	67.38
41515 (2682.5)	5,365.00	-38.96	13.51	-52.61	2.64	V	-41.74	62.22
	8,047.50	-41.61	11.45	-46.58	3.05	V	-38.18	58.66
	10,730.00	-45.90	10.98	-48.71	3.60	V	-41.33	61.81
	13,412.50	-53.03	13.09	-55.02	4.17	V	-46.10	66.58
	16,095.00	-50.24	17.41	-54.04	4.55	V	-41.18	61.66

▣ OPERATING FREQUENCY : 2680.00 MHz

▣ MEASURED OUTPUT POWER: 20.57 dBm = 0.114 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log_{10} (W) = 45.57 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39750 (2506.0)	5,012.00	-40.60	12.86	-54.73	2.49	V	-44.36	64.93
	7,518.00	-44.17	11.57	-49.48	2.93	V	-40.84	61.41
	10,024.00	-43.71	11.29	-46.54	3.48	V	-38.72	59.29
	12,530.00	-51.08	14.22	-55.73	4.17	V	-45.68	66.25
40620 (2593.0)	5,186.00	-45.59	13.05	-58.19	2.58	V	-47.72	68.29
	7,779.00	-41.33	11.98	-48.85	2.93	V	-39.80	60.37
	10,372.00	-48.38	10.96	-51.37	3.62	V	-44.03	64.60
	12,965.00	-53.75	13.61	-56.35	4.08	V	-46.82	67.39
41490 (2680.0)	5,360.00	-38.11	13.51	-51.83	2.63	V	-40.95	61.52
	8,040.00	-42.20	11.46	-47.10	3.06	V	-38.70	59.26
	10,720.00	-46.34	10.97	-48.97	3.66	V	-41.66	62.23
	13,400.00	-51.71	13.11	-53.23	4.16	V	-44.28	64.84
	16,080.00	-51.15	17.45	-55.86	4.64	V	-43.05	63.62

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
41	5 MHz	2593.0	QPSK	25	0	6.00
			16-QAM			6.80
	10 MHz		QPSK	50		5.94
			16-QAM			6.69
	15 MHz		QPSK	75		5.85
			16-QAM			6.70
	20 MHz		QPSK	100		5.76
			16-QAM			6.66

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 62 ~ 70.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
41	5 MHz	2593.0	QPSK	25	0	4.5314
			16-QAM			4.5320
	10 MHz		QPSK	50		8.9839
			16-QAM			8.9770
	15 MHz		QPSK	75		13.478
			16-QAM			13.406
	20 MHz		QPSK	100		17.866
			16-QAM			17.839

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 54 ~ 61.

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	2498.5	26.1110	30.131	-66.884	-36.753	-25.00
		2593.0	25.8701	30.131	-67.511	-37.380	
		2687.5	25.8977	30.131	-67.128	-36.997	
	10	2501.0	25.8734	30.131	-66.733	-36.602	
		2593.0	25.7942	30.131	-67.327	-37.196	
		2685.0	25.7100	30.131	-66.544	-36.413	
	15	2503.5	25.8565	30.131	-66.412	-36.281	
		2593.0	25.7810	30.131	-66.870	-36.739	
		2682.5	25.3833	30.131	-67.102	-36.971	
	20	2506.0	25.9468	30.131	-67.088	-36.957	
		2593.0	26.1271	30.131	-66.551	-36.420	
		2680.0	25.9245	30.131	-66.803	-36.672	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 98 ~ 125.
2. 26.5GHz – 27.0GHz : In order to simplify the report, attached plots were only the worst case channel.
3. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
4. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
5. 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 Width	Frequency (MHz)	Modulation	RB (Size/ Offset)	2 495 MHz ~ 2 496 MHz	C.E ~ (C.E +1MHz)	2 490.5 MHz ~ 2 495 MHz	(C.E + 1 MHz) ~ (C.E + 5 MHz)	Below 2 490.5 MHz	(C.E + 5 MHz) ~ (C.E + X MHz)	Above (C.E + X MHz)
				Lower	Upper	Lower	Upper	Lower	Upper	Upper
5 MHz	2498.5	QPSK	25/0	-23.52	-22.32	-25.05	-22.81	-38.69	-36.36	-37.73
10 MHz	2501.0	QPSK	50/0	-27.79	-25.16	-27.25	-23.59	-33.07	-29.43	-40.17
15 MHz	2503.5	QPSK	75/0	-27.40	-26.13	-28.24	-25.67	-32.94	-28.85	-42.71
20 MHz	2506.0	QPSK	100/0	-30.05	-28.88	-28.91	-27.50	-32.31	-29.43	-44.71
Limit				-13.0	-10.0	-13.0	-10.0	-25.0	-13.0	-25.0

Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resoure Block Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
					Lower	Upper	Lower	Upper
5 MHz	2593.0	QPSK	25	0	-20.90	-20.90	-20.49	-20.47
	2687.5	QPSK	25	0	-20.81	-22.28	-20.90	-21.28
10 MHz	2593.0	QPSK	50	0	-24.60	-24.58	-23.41	-23.02
	2685.0	QPSK	50	0	-24.23	-23.93	-23.28	-23.16
15 MHz	2593.0	QPSK	75	0	-26.70	-26.36	-25.26	-24.02
	2682.5	QPSK	75	0	-25.99	-26.07	-23.99	-24.16
20 MHz	2593.0	QPSK	100	0	-28.42	-27.31	-26.29	-24.83
	2680.0	QPSK	100	0	-26.73	-27.67	-24.33	-25.40
Limit					-10.0		-10.0	

Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resoure Block Offset	(C.E ± 5 MHz) ~ (C.E ± X MHz)		Above (C.E ± X MHz)	
					Lower	Upper	Lower	Upper
5 MHz	2593.0	QPSK	25	0	-32.70	-30.23	-34.40	-31.75
	2687.5	QPSK	25	0	-28.44	-28.87	-32.23	-32.26
10 MHz	2593.0	QPSK	50	0	-28.30	-24.86	-36.80	-32.00
	2685.0	QPSK	50	0	-27.27	-25.63	-33.61	-33.95
15 MHz	2593.0	QPSK	75	0	-28.66	-25.38	-41.03	-34.66
	2682.5	QPSK	75	0	-27.49	-26.40	-36.13	-38.10
20 MHz	2593.0	QPSK	100	0	-29.44	-26.17	-42.45	-36.20
	2680.0	QPSK	100	0	-27.05	-26.91	-37.80	-43.68
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 61 ~ 88. (1RB & Full RB)

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE 41

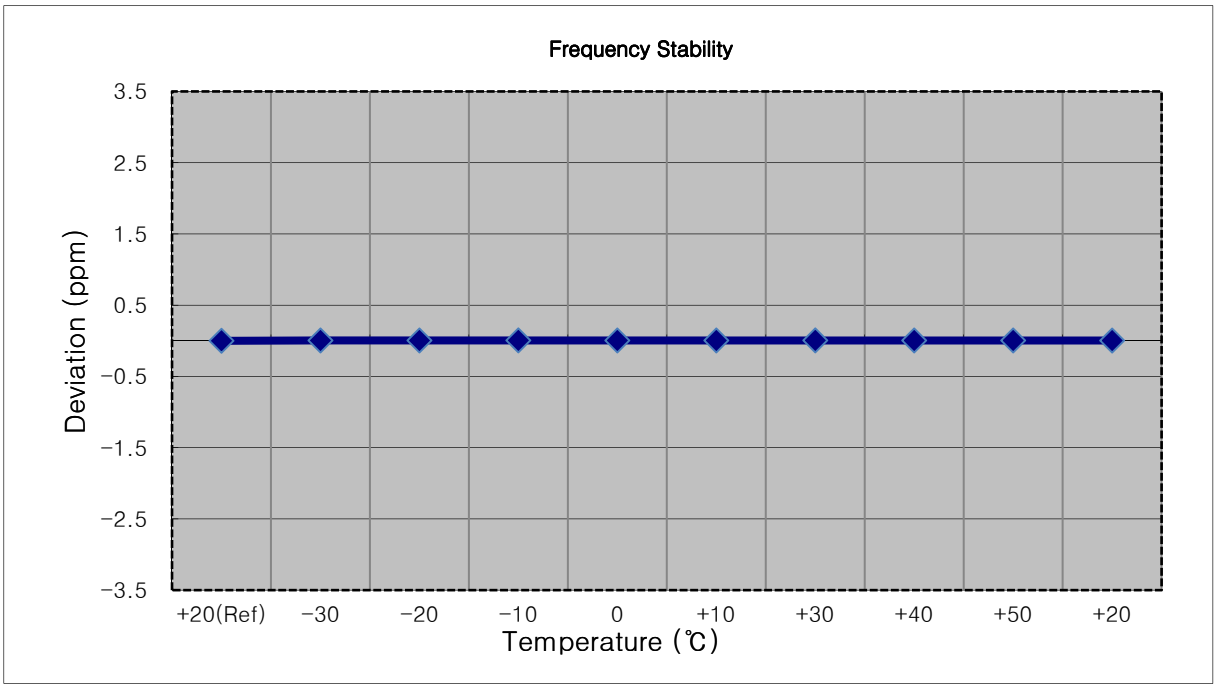
▣ OPERATING FREQUENCY: 2498,500,000 Hz

▣ BANDWIDTH: 39675 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2498 500 011	0.0	0.000 000	0.000
100%		-30	2498 500 022	11.7	0.000 000	0.005
100%		-20	2498 500 022	11.0	0.000 000	0.004
100%		-10	2498 500 026	15.3	0.000 001	0.006
100%		0	2498 500 021	10.3	0.000 000	0.004
100%		+10	2498 500 021	10.6	0.000 000	0.004
100%		+30	2498 500 024	13.3	0.000 001	0.005
100%		+40	2498 500 022	11.3	0.000 000	0.005
100%		+50	2498 500 022	11.4	0.000 000	0.005
85%	3.400	+20	2498 500 020	9.2	0.000 000	0.004



▣ MODE: LTE 41

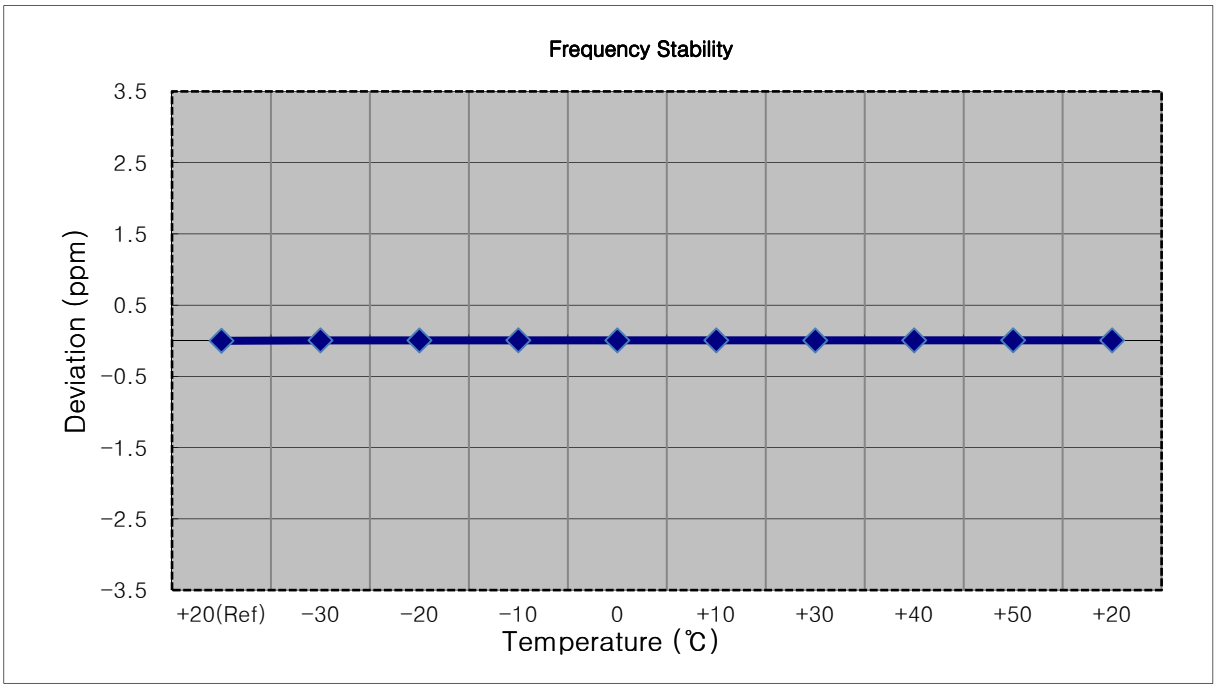
▣ OPERATING FREQUENCY: 2501,000,000 Hz

▣ BANDWIDTH: 39700 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2501 000 015	0.0	0.000 000	0.000
100%		-30	2501 000 028	13.4	0.000 001	0.005
100%		-20	2501 000 027	12.3	0.000 000	0.005
100%		-10	2501 000 031	16.5	0.000 001	0.007
100%		0	2501 000 030	15.0	0.000 001	0.006
100%		+10	2501 000 030	15.0	0.000 001	0.006
100%		+30	2501 000 027	12.3	0.000 000	0.005
100%		+40	2501 000 030	15.2	0.000 001	0.006
100%		+50	2501 000 031	16.5	0.000 001	0.007
85%	3.400	+20	2501 000 030	15.0	0.000 001	0.006



▣ MODE: LTE 41

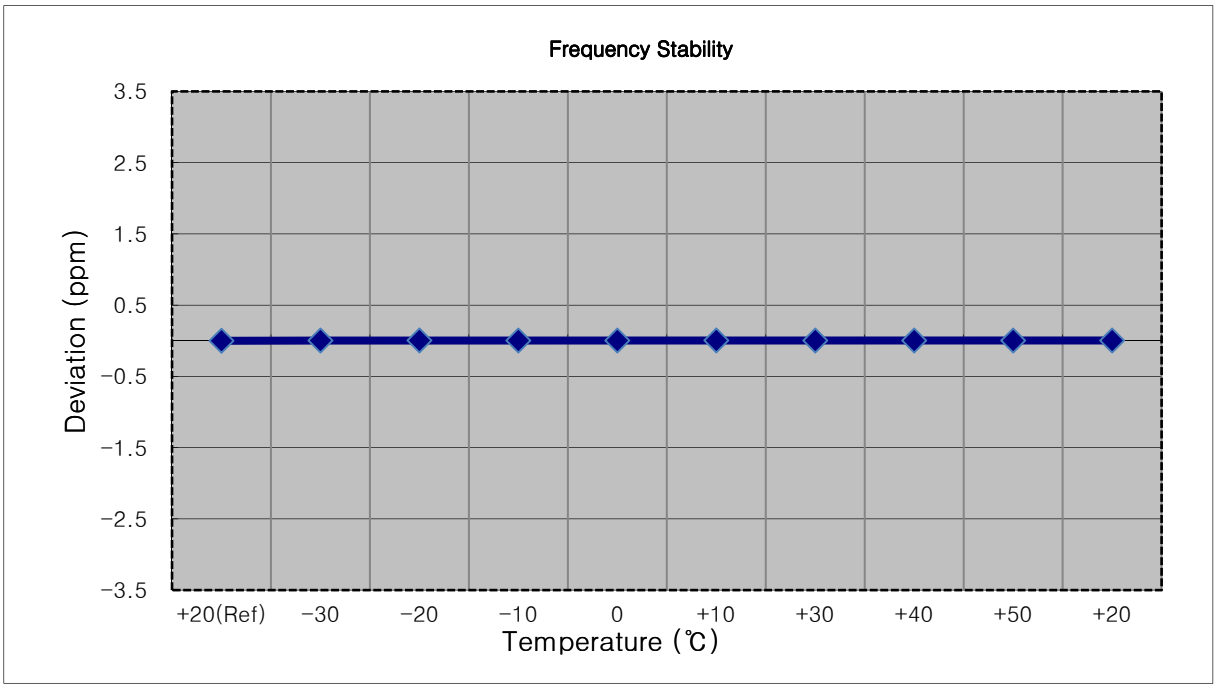
▣ OPERATING FREQUENCY: 2503,500,000 Hz

▣ BANDWIDTH: 39725 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2503 500 007	0.0	0.000 000	0.000
100%		-30	2503 500 015	8.2	0.000 000	0.003
100%		-20	2503 500 017	10.5	0.000 000	0.004
100%		-10	2503 500 014	7.9	0.000 000	0.003
100%		0	2503 500 014	7.7	0.000 000	0.003
100%		+10	2503 500 019	12.8	0.000 001	0.005
100%		+30	2503 500 015	8.6	0.000 000	0.003
100%		+40	2503 500 015	8.5	0.000 000	0.003
100%		+50	2503 500 016	9.9	0.000 000	0.004
85%	3.400	+20	2503 500 016	9.4	0.000 000	0.004



▣ MODE: LTE 41

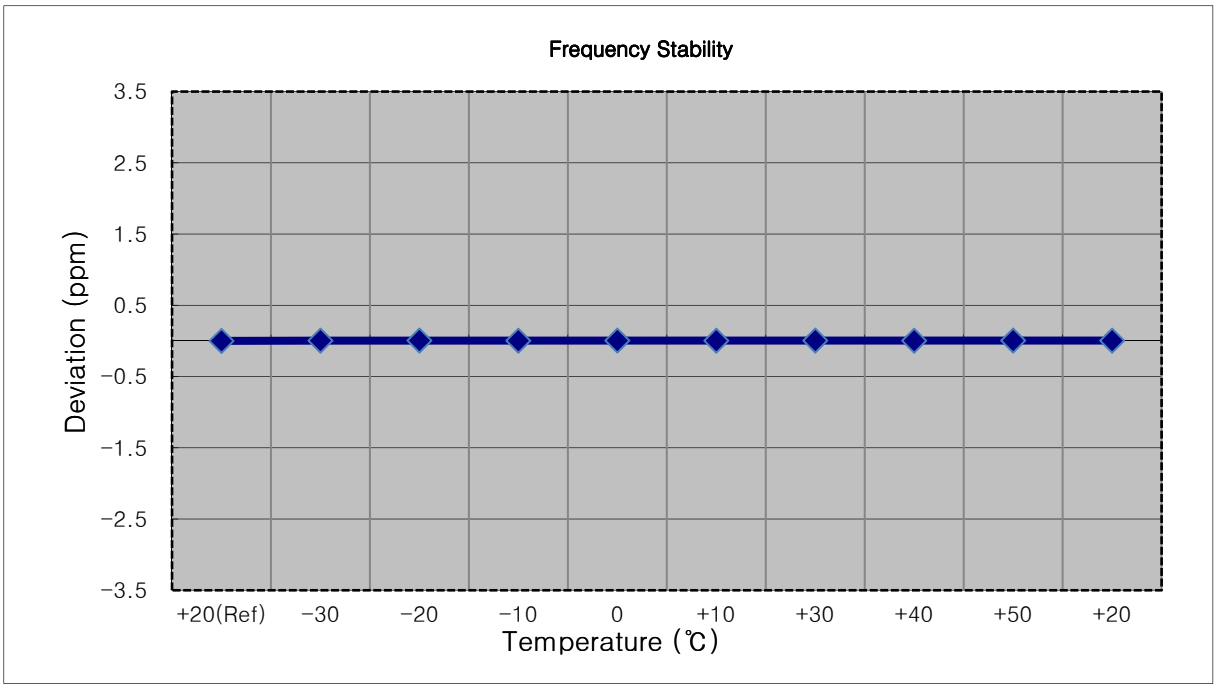
▣ OPERATING FREQUENCY: 2506,000,000 Hz

▣ BANDWIDTH: 39750 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2506 000 012	0.0	0.000 000	0.000
100%		-30	2506 000 022	10.7	0.000 000	0.004
100%		-20	2506 000 025	13.3	0.000 001	0.005
100%		-10	2506 000 021	9.3	0.000 000	0.004
100%		0	2506 000 025	13.1	0.000 001	0.005
100%		+10	2506 000 021	9.2	0.000 000	0.004
100%		+30	2506 000 027	14.8	0.000 001	0.006
100%		+40	2506 000 021	9.3	0.000 000	0.004
100%		+50	2506 000 025	12.9	0.000 001	0.005
85%	3.400	+20	2506 000 023	11.4	0.000 000	0.005



▣ MODE: LTE 41

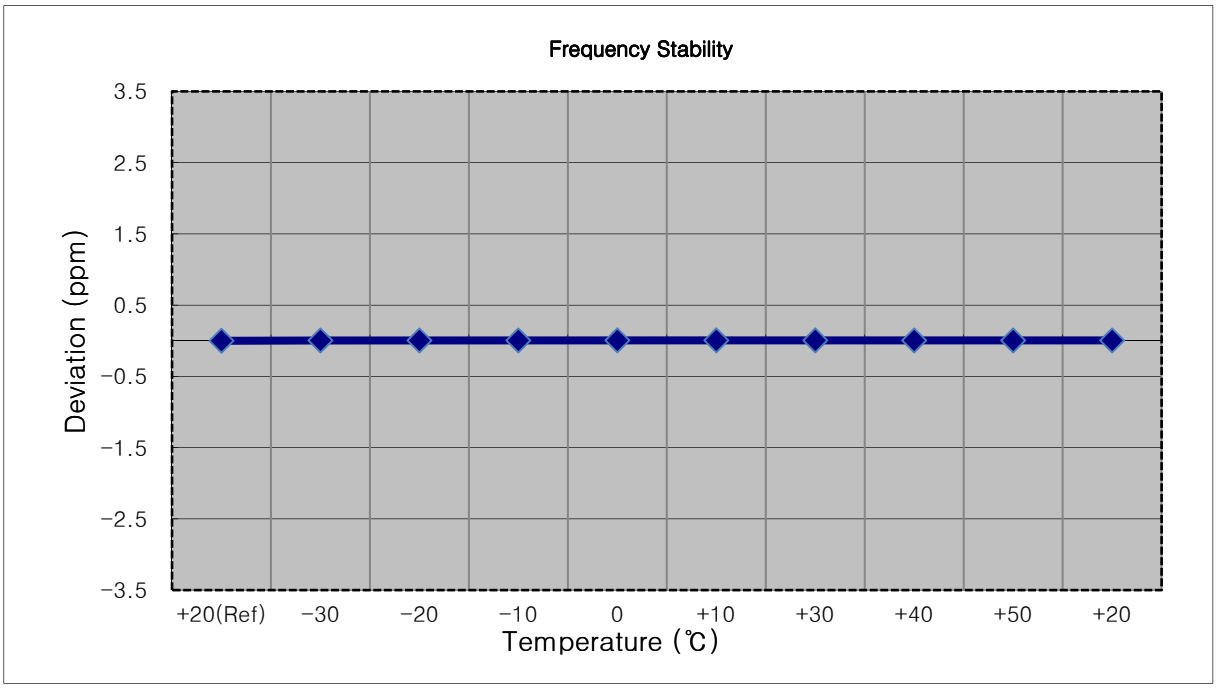
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 015	0.0	0.000 000	0.000
100%		-30	2593 000 027	11.6	0.000 000	0.004
100%		-20	2593 000 027	11.8	0.000 000	0.005
100%		-10	2593 000 028	13.2	0.000 001	0.005
100%		0	2593 000 031	16.0	0.000 001	0.006
100%		+10	2593 000 029	14.2	0.000 001	0.005
100%		+30	2593 000 030	15.0	0.000 001	0.006
100%		+40	2593 000 027	11.6	0.000 000	0.004
100%		+50	2593 000 028	12.6	0.000 000	0.005
85%	3.400	+20	2593 000 027	12.5	0.000 000	0.005



▣ MODE: LTE 41

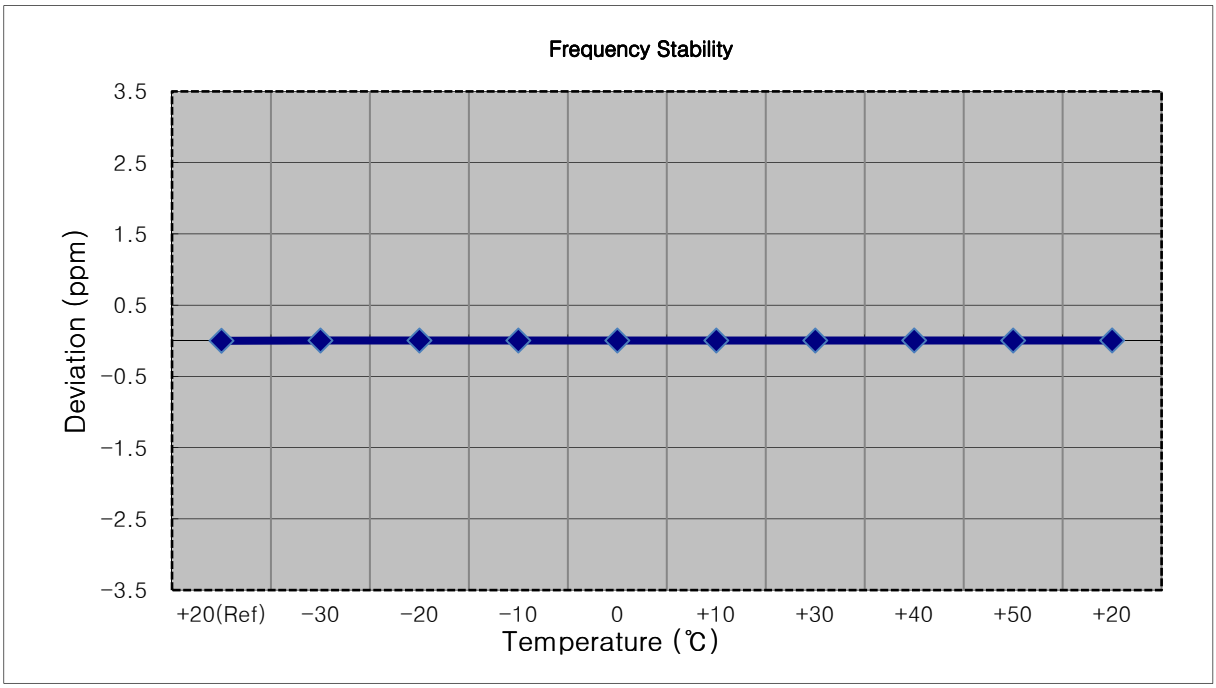
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 010	0.0	0.000 000	0.000
100%		-30	2593 000 020	10.2	0.000 000	0.004
100%		-20	2593 000 019	9.0	0.000 000	0.003
100%		-10	2593 000 019	8.7	0.000 000	0.003
100%		0	2593 000 020	10.0	0.000 000	0.004
100%		+10	2593 000 018	8.6	0.000 000	0.003
100%		+30	2593 000 020	10.4	0.000 000	0.004
100%		+40	2593 000 023	13.5	0.000 001	0.005
100%		+50	2593 000 020	9.7	0.000 000	0.004
85%	3.400	+20	2593 000 022	11.8	0.000 000	0.005



▣ MODE: LTE 41

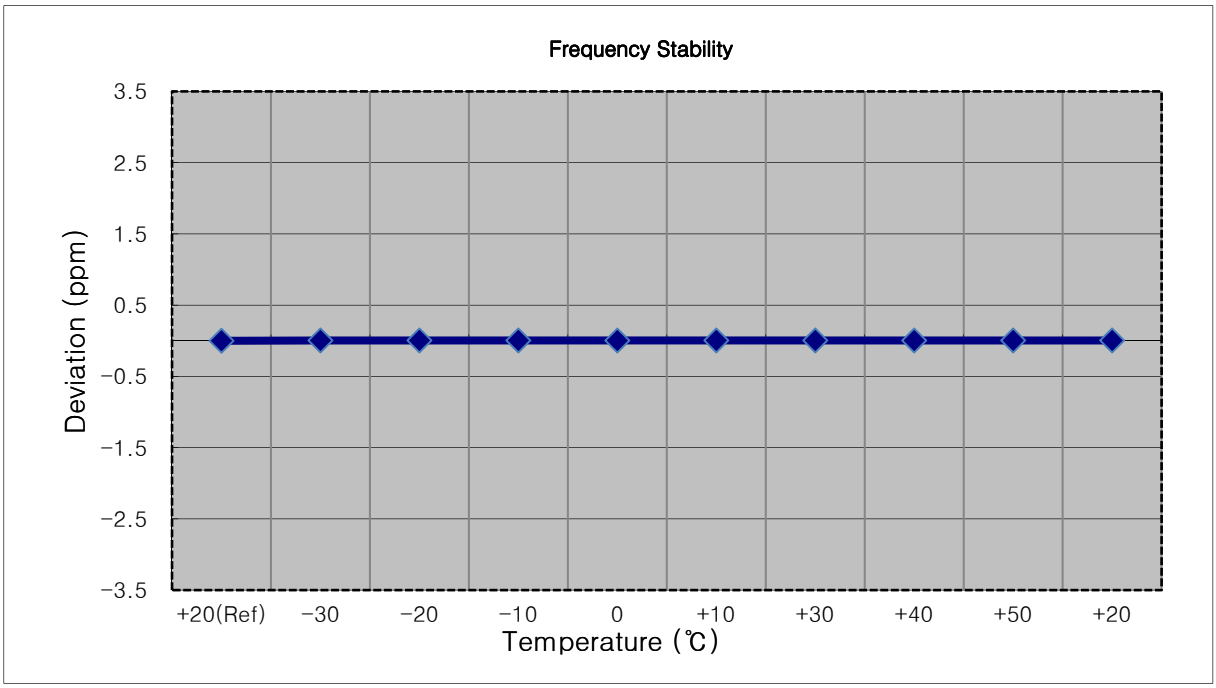
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 015	0.0	0.000 000	0.000
100%		-30	2593 000 026	11.0	0.000 000	0.004
100%		-20	2593 000 028	12.4	0.000 000	0.005
100%		-10	2593 000 029	13.2	0.000 001	0.005
100%		0	2593 000 026	10.4	0.000 000	0.004
100%		+10	2593 000 027	11.9	0.000 000	0.005
100%		+30	2593 000 027	11.3	0.000 000	0.004
100%		+40	2593 000 026	10.5	0.000 000	0.004
100%		+50	2593 000 027	12.1	0.000 000	0.005
85%	3.400	+20	2593 000 027	11.9	0.000 000	0.005



▣ MODE: LTE 41

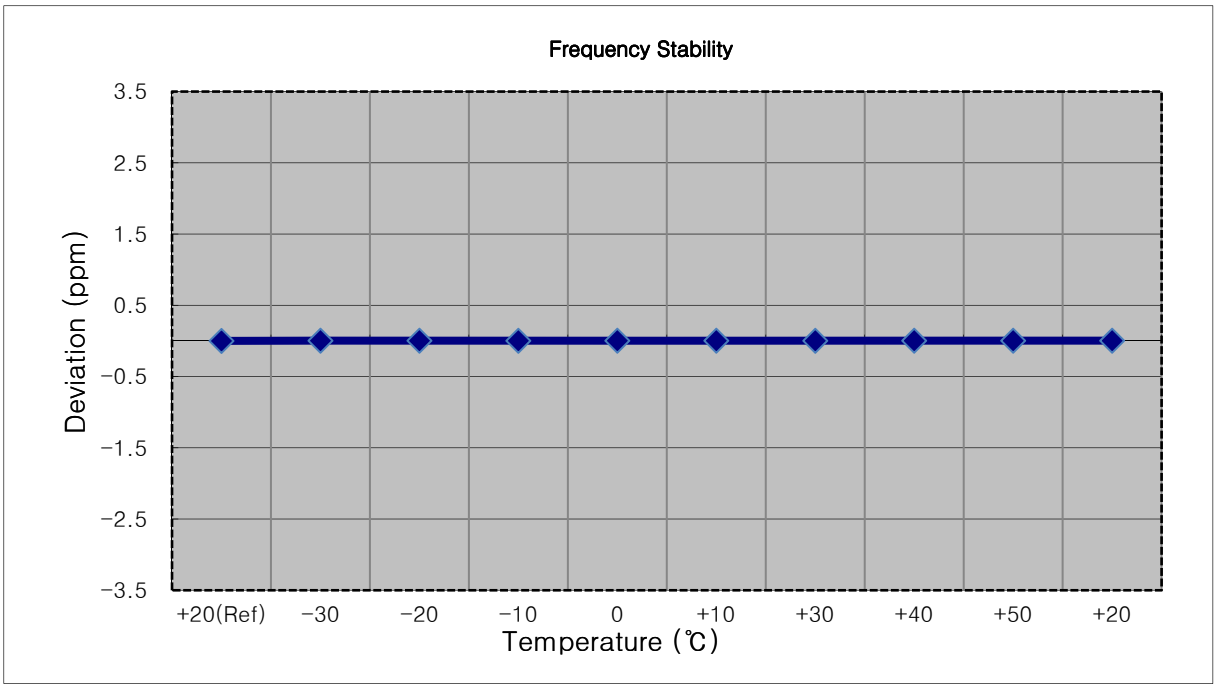
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2593 000 008	0.0	0.000 000	0.000
100%		-30	2593 000 016	8.9	0.000 000	0.003
100%		-20	2593 000 017	9.0	0.000 000	0.003
100%		-10	2593 000 014	6.3	0.000 000	0.002
100%		0	2593 000 015	7.7	0.000 000	0.003
100%		+10	2593 000 017	9.7	0.000 000	0.004
100%		+30	2593 000 014	6.6	0.000 000	0.003
100%		+40	2593 000 016	8.4	0.000 000	0.003
100%		+50	2593 000 016	8.6	0.000 000	0.003
85%	3.400	+20	2593 000 016	8.4	0.000 000	0.003



▣ MODE: LTE 41

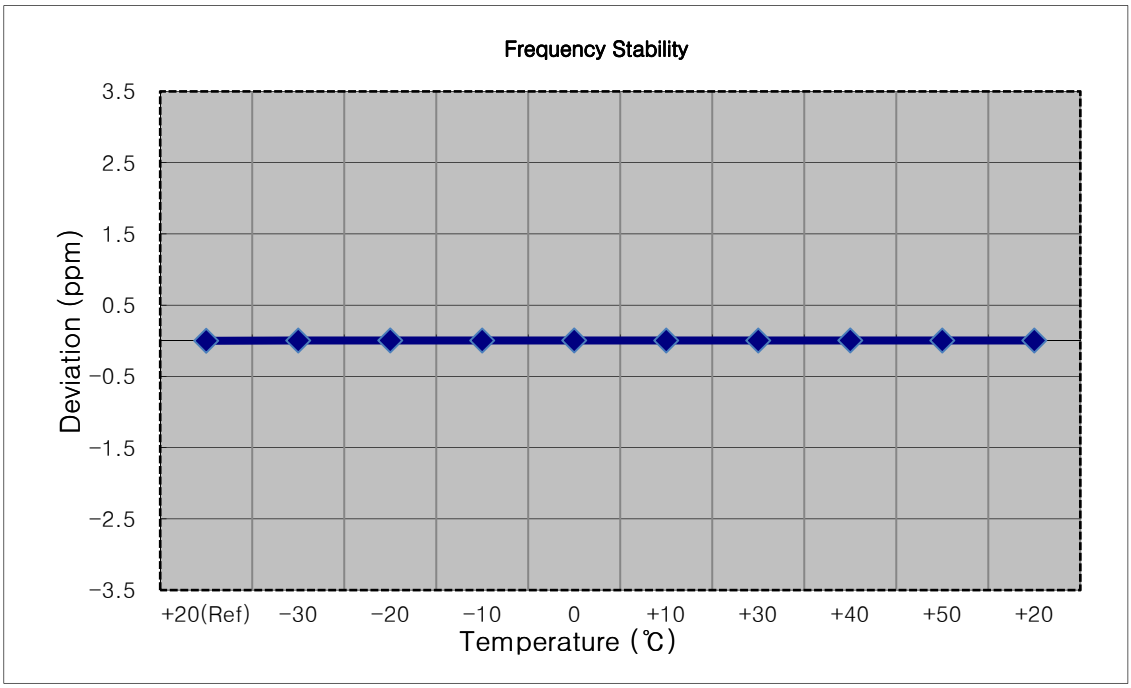
▣ OPERATING FREQUENCY: 2687,500,000 Hz

▣ BANDWIDTH: 41565 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2687 500 011	0.0	0.000 000	0.000
100%		-30	2687 500 021	10.4	0.000 000	0.004
100%		-20	2687 500 023	11.8	0.000 000	0.004
100%		-10	2687 500 022	10.5	0.000 000	0.004
100%		0	2687 500 023	11.5	0.000 000	0.004
100%		+10	2687 500 022	10.9	0.000 000	0.004
100%		+30	2687 500 021	10.2	0.000 000	0.004
100%		+40	2687 500 023	11.8	0.000 000	0.004
100%		+50	2687 500 021	9.9	0.000 000	0.004
85%	3.400	+20	2687 500 021	10.1	0.000 000	0.004



▣ MODE: LTE 41

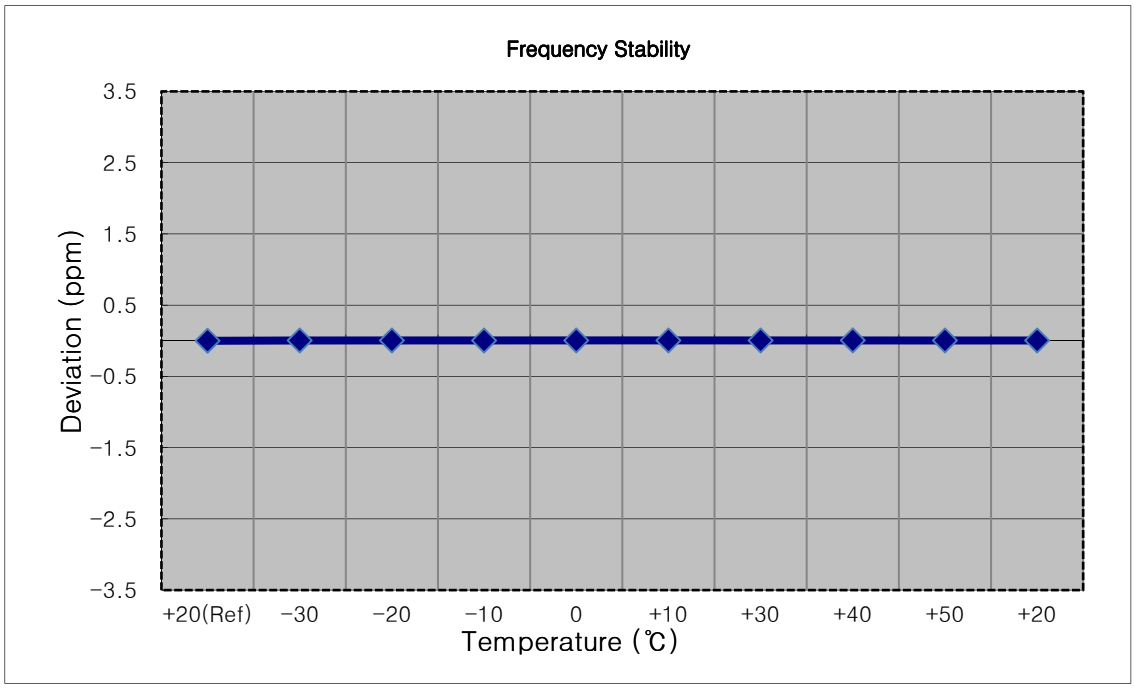
▣ OPERATING FREQUENCY: 2685,000,000 Hz

▣ BANDWIDTH: 41540 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2685 000 013	0.0	0.000 000	0.000
100%		-30	2685 000 026	12.5	0.000 000	0.005
100%		-20	2685 000 026	13.1	0.000 000	0.005
100%		-10	2685 000 024	10.4	0.000 000	0.004
100%		0	2685 000 026	12.5	0.000 000	0.005
100%		+10	2685 000 026	12.6	0.000 000	0.005
100%		+30	2685 000 027	13.5	0.000 001	0.005
100%		+40	2685 000 029	15.6	0.000 001	0.006
100%		+50	2685 000 025	11.8	0.000 000	0.004
85%	3.400	+20	2685 000 025	12.1	0.000 000	0.005



▣ MODE: LTE 41

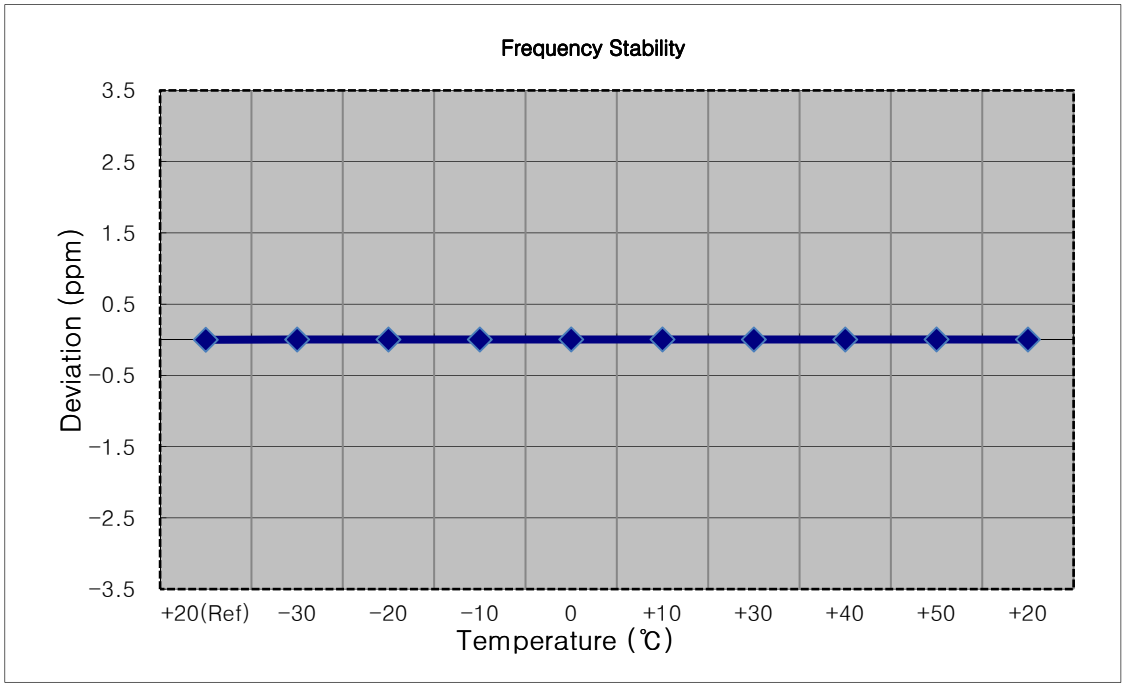
▣ OPERATING FREQUENCY: 2682,500,000 Hz

▣ BANDWIDTH: 41515 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2682 500 010	0.0	0.000 000	0.000
100%		-30	2682 500 020	10.1	0.000 000	0.004
100%		-20	2682 500 018	8.1	0.000 000	0.003
100%		-10	2682 500 021	10.8	0.000 000	0.004
100%		0	2682 500 022	11.4	0.000 000	0.004
100%		+10	2682 500 022	11.9	0.000 000	0.004
100%		+30	2682 500 021	10.8	0.000 000	0.004
100%		+40	2682 500 021	10.7	0.000 000	0.004
100%		+50	2682 500 023	12.2	0.000 000	0.005
85%	3.400	+20	2682 500 019	8.6	0.000 000	0.003



▣ MODE: LTE 41

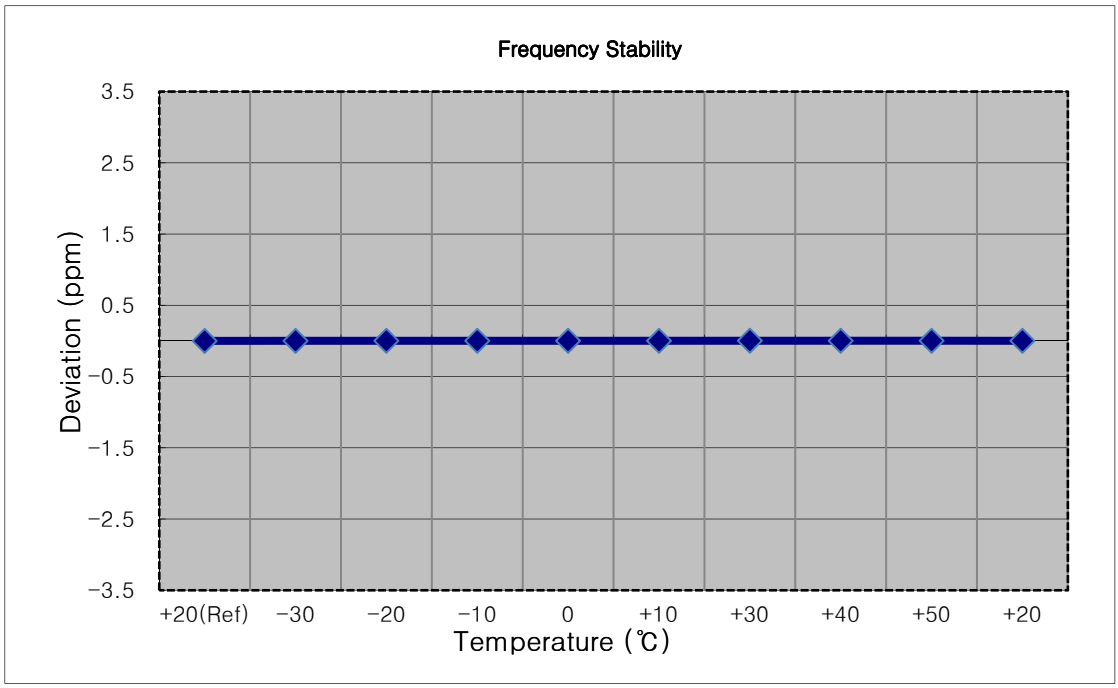
▣ OPERATING FREQUENCY: 2680,000,000 Hz

▣ BANDWIDTH: 41490 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2680 000 006	0.0	0.000 000	0.000
100%		-30	2680 000 009	3.0	0.000 000	0.001
100%		-20	2680 000 011	4.6	0.000 000	0.002
100%		-10	2680 000 011	5.1	0.000 000	0.002
100%		0	2680 000 011	5.5	0.000 000	0.002
100%		+10	2680 000 013	6.7	0.000 000	0.002
100%		+30	2680 000 014	8.0	0.000 000	0.003
100%		+40	2680 000 011	4.6	0.000 000	0.002
100%		+50	2680 000 012	6.4	0.000 000	0.002
85%	3.400	+20	2680 000 011	4.8	0.000 000	0.002



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.

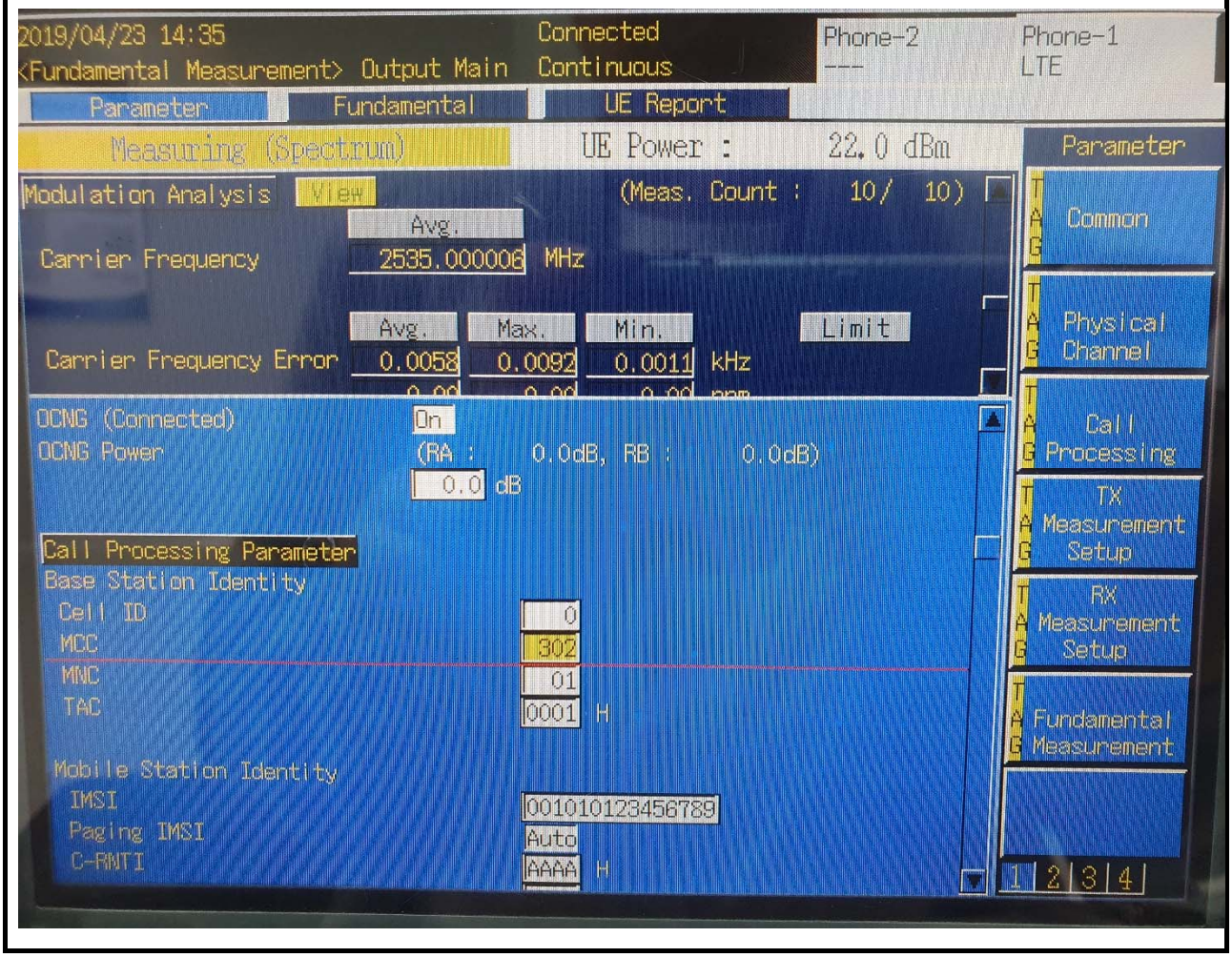
Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)
38	Did not connect	Connected (Canada)
40	Did not connect	Connected (Canada)
41	Connected	Connected (Canada)

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

Verification test

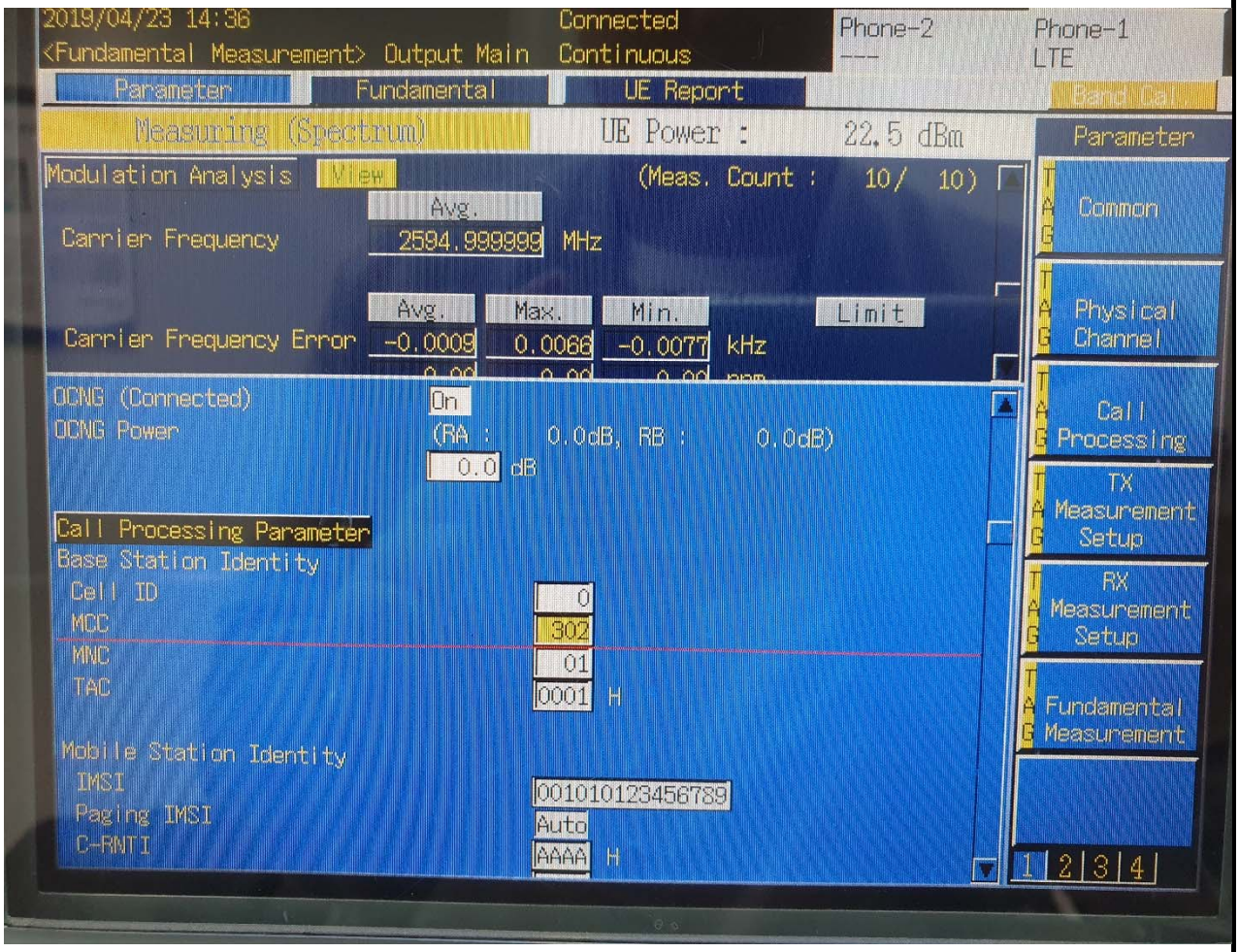
Connected(LTE B7)

(MCC = Canada)

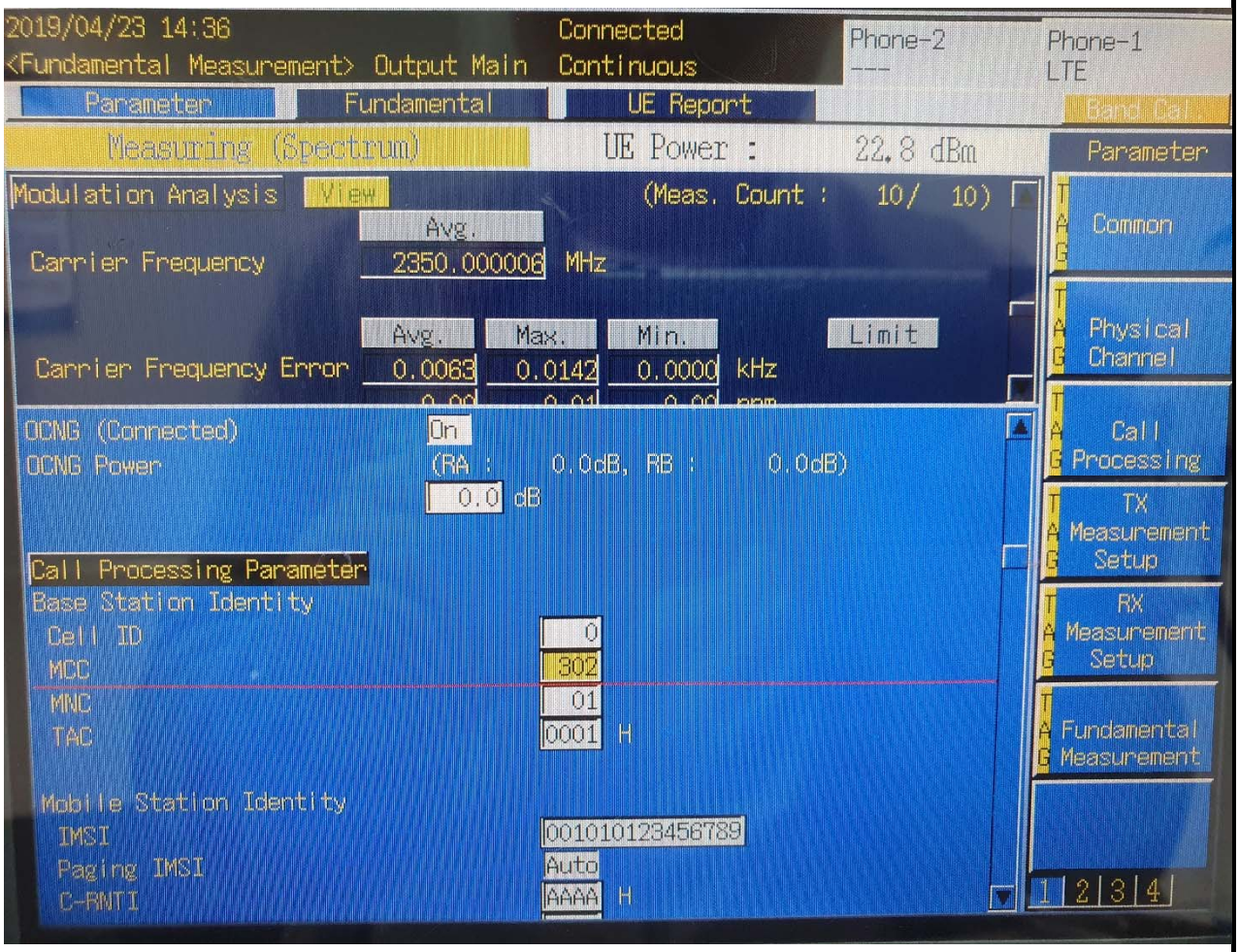


Connected(LTE B38)

(MCC = Canada)

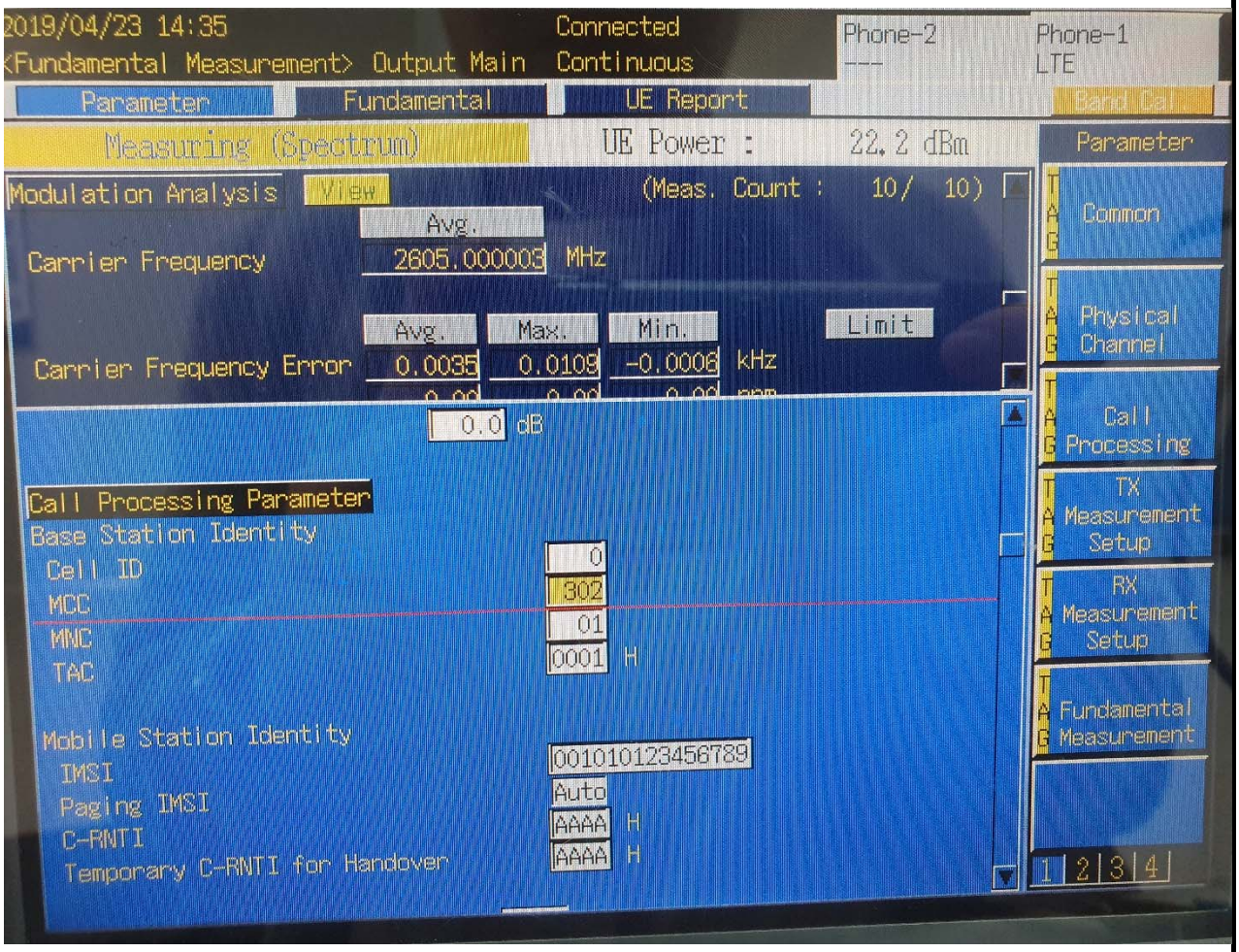


Connected(LTE B40)
(MCC = Canada)



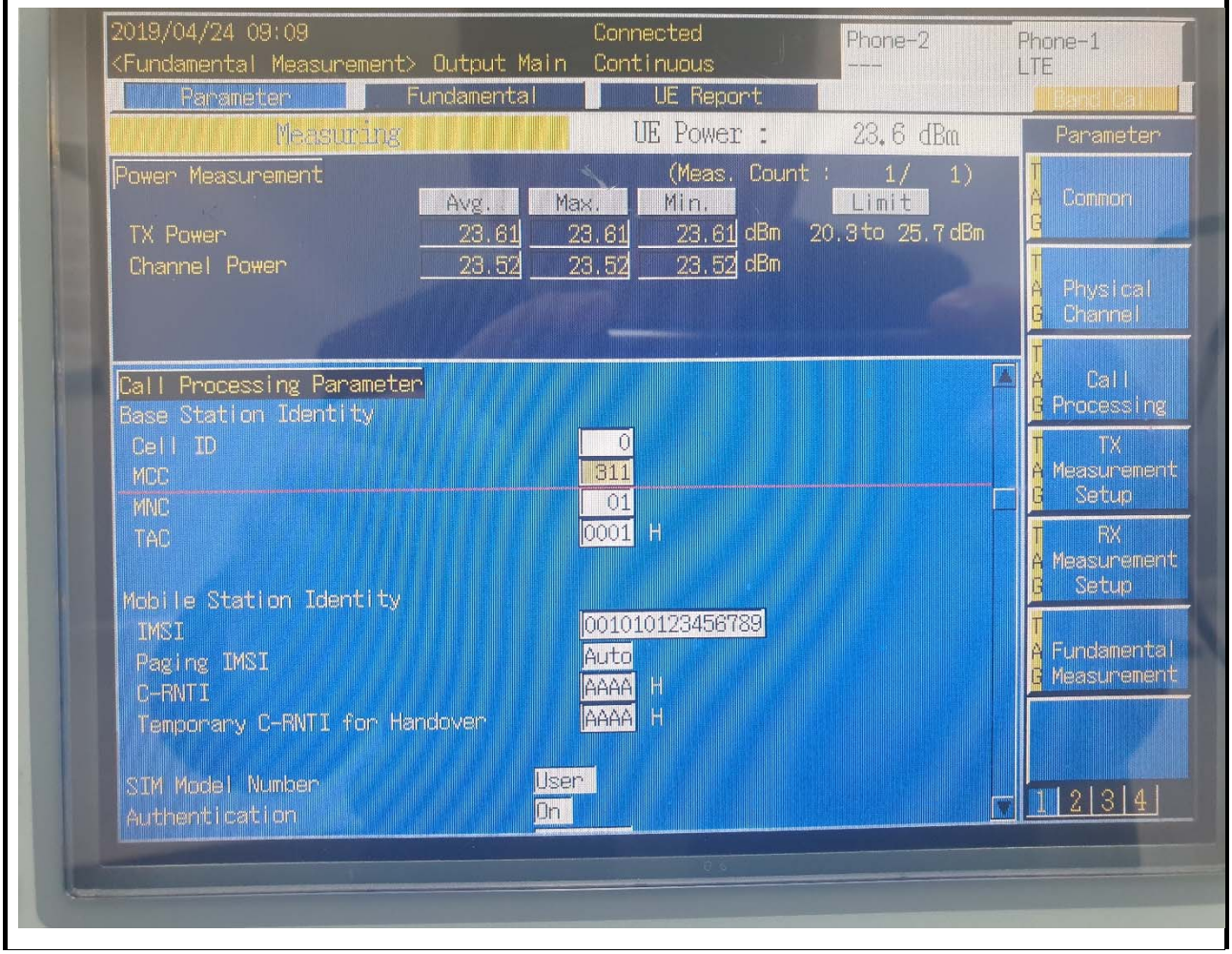
Connected(LTE B41)

(MCC = Canada)



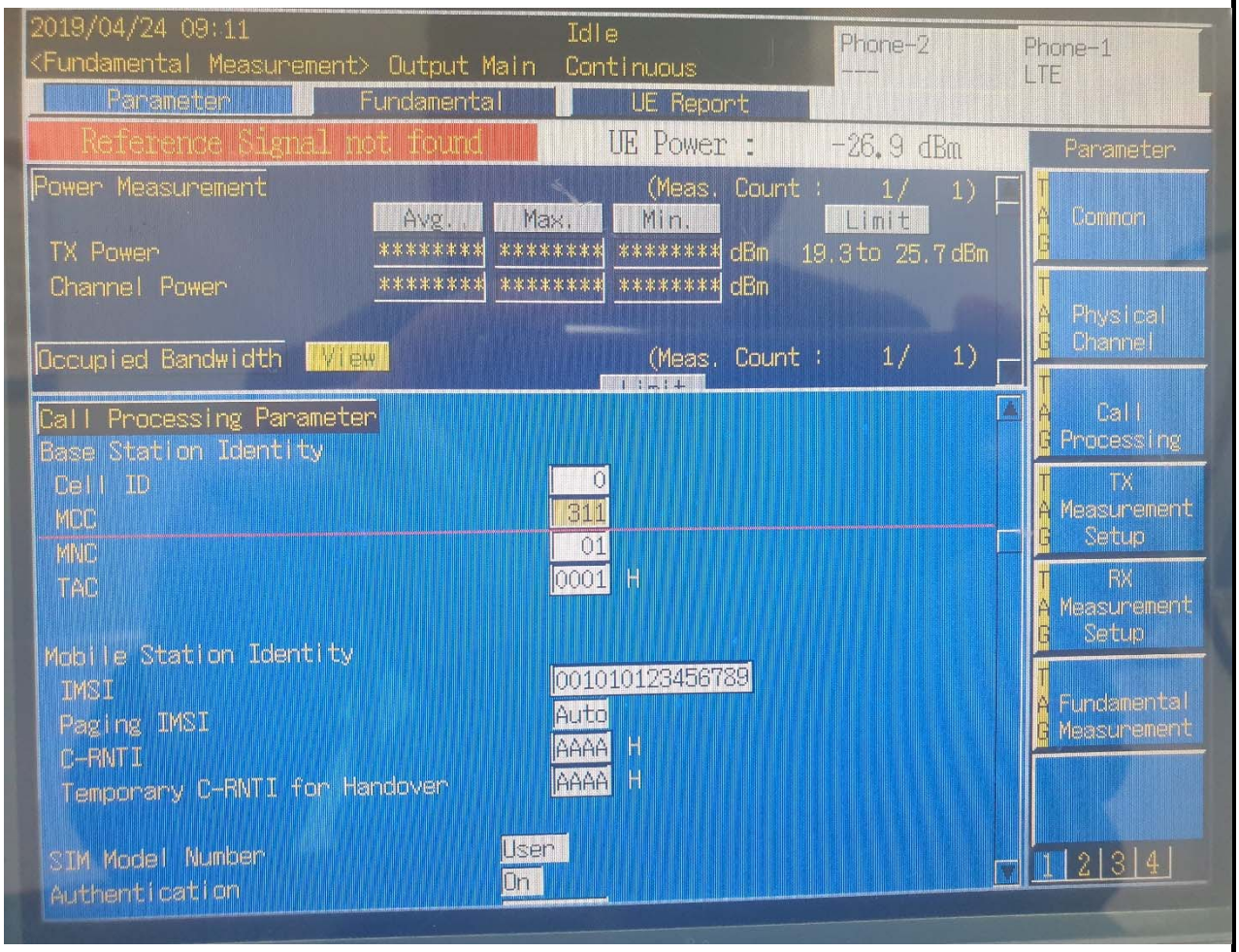
Connected(LTE B41)

(MCC = US)



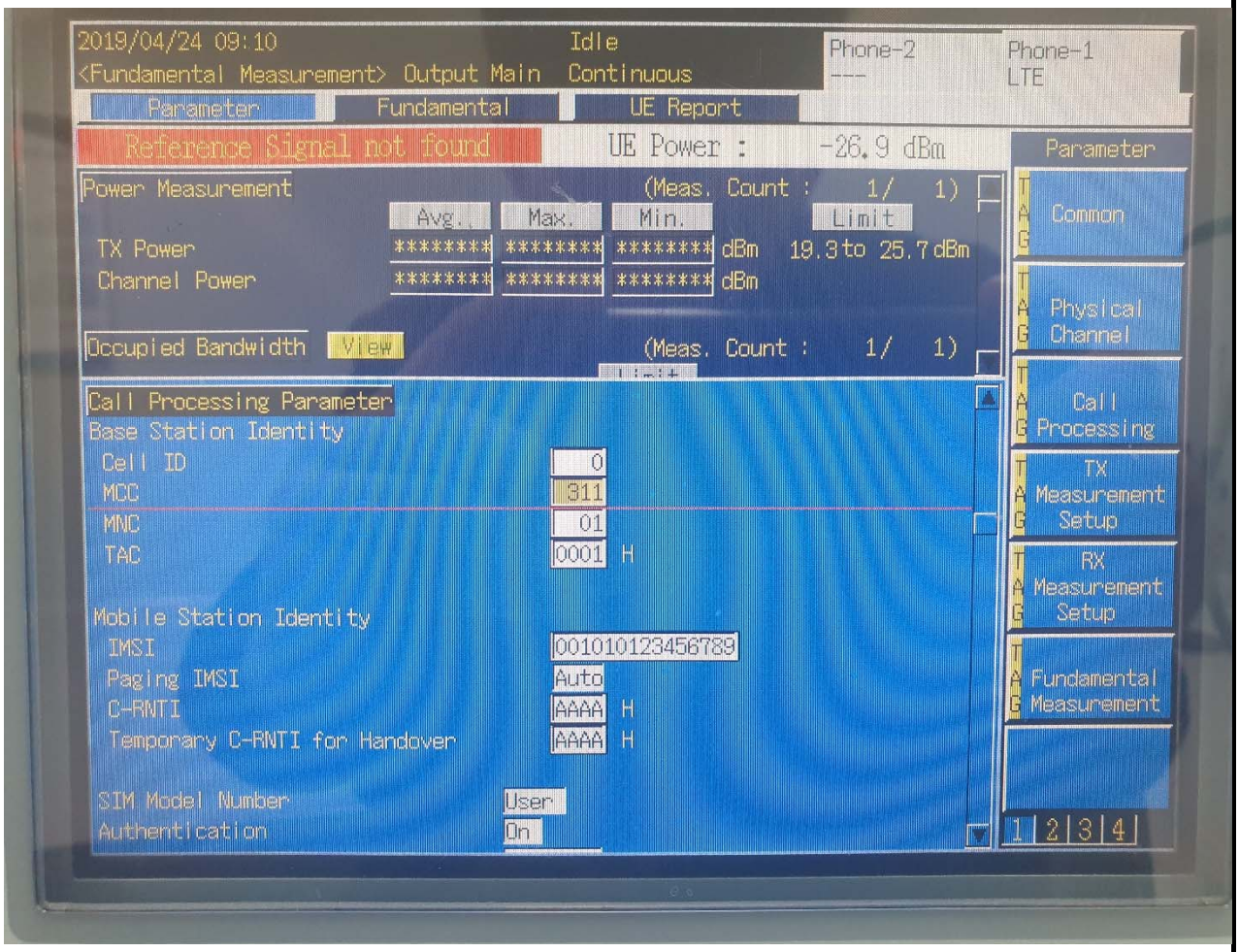
Did not connect (LTE B7)

(MCC = US)



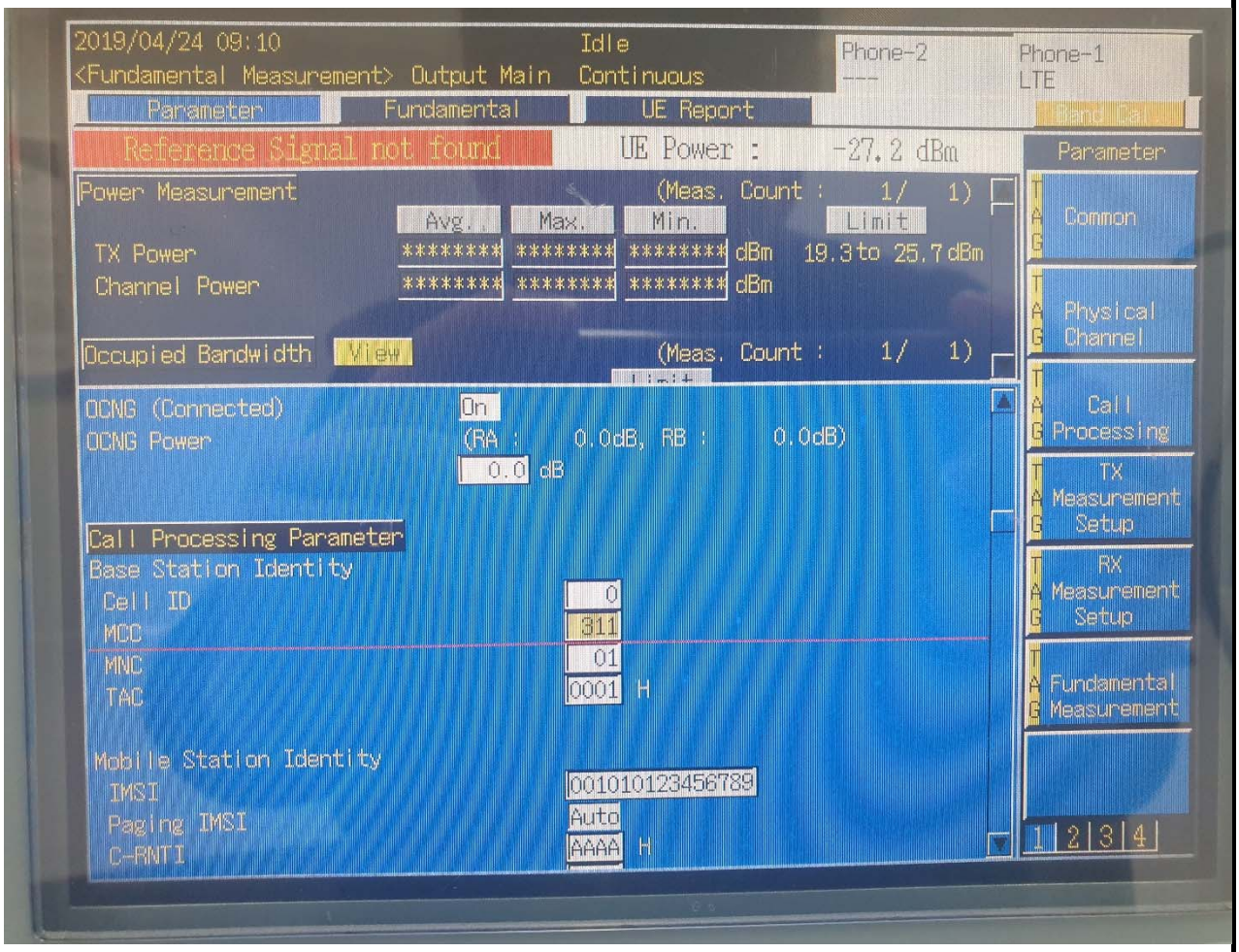
Did not connect (LTE B38)

(MCC = US)



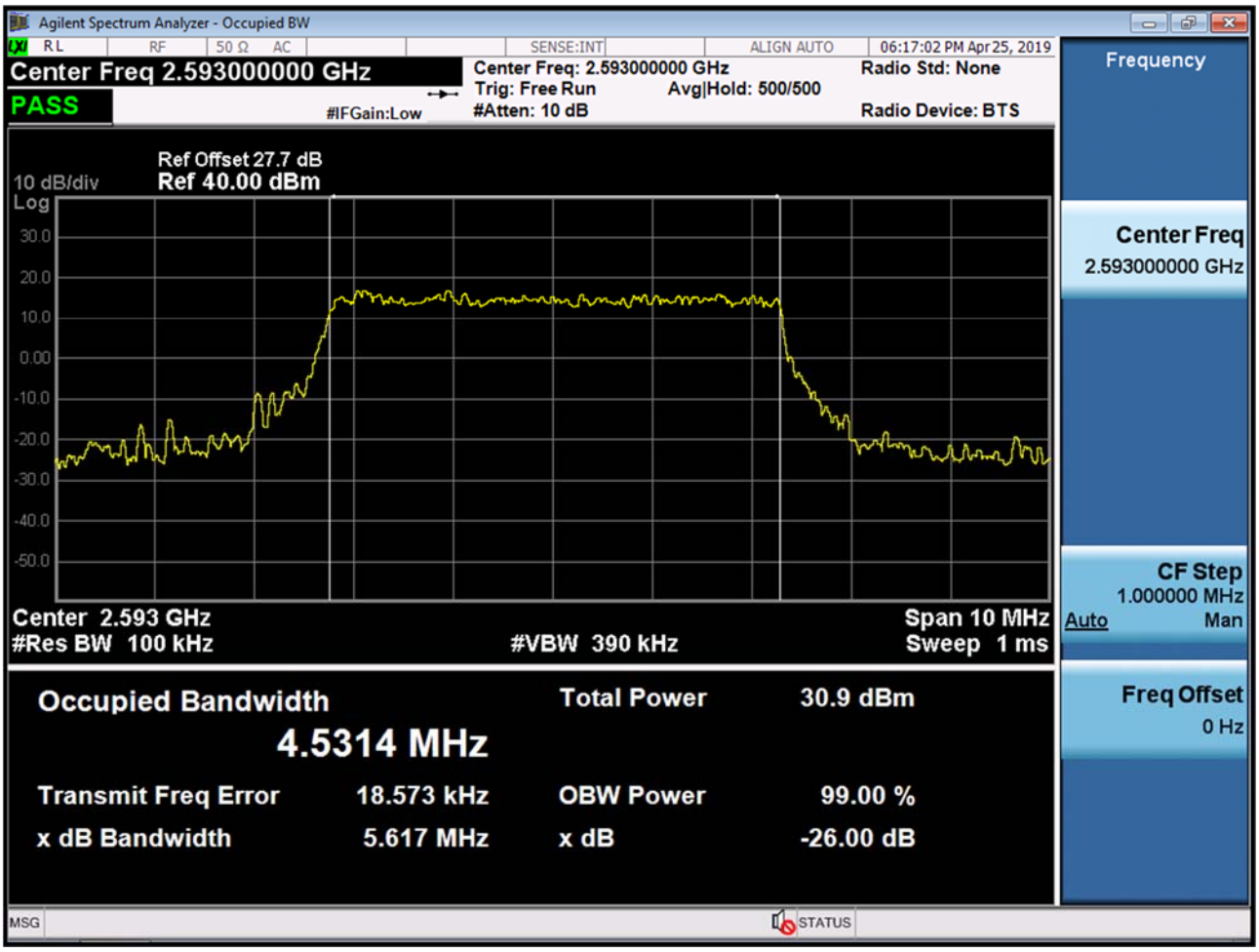
Did not connect (LTE B40)

(MCC = US)

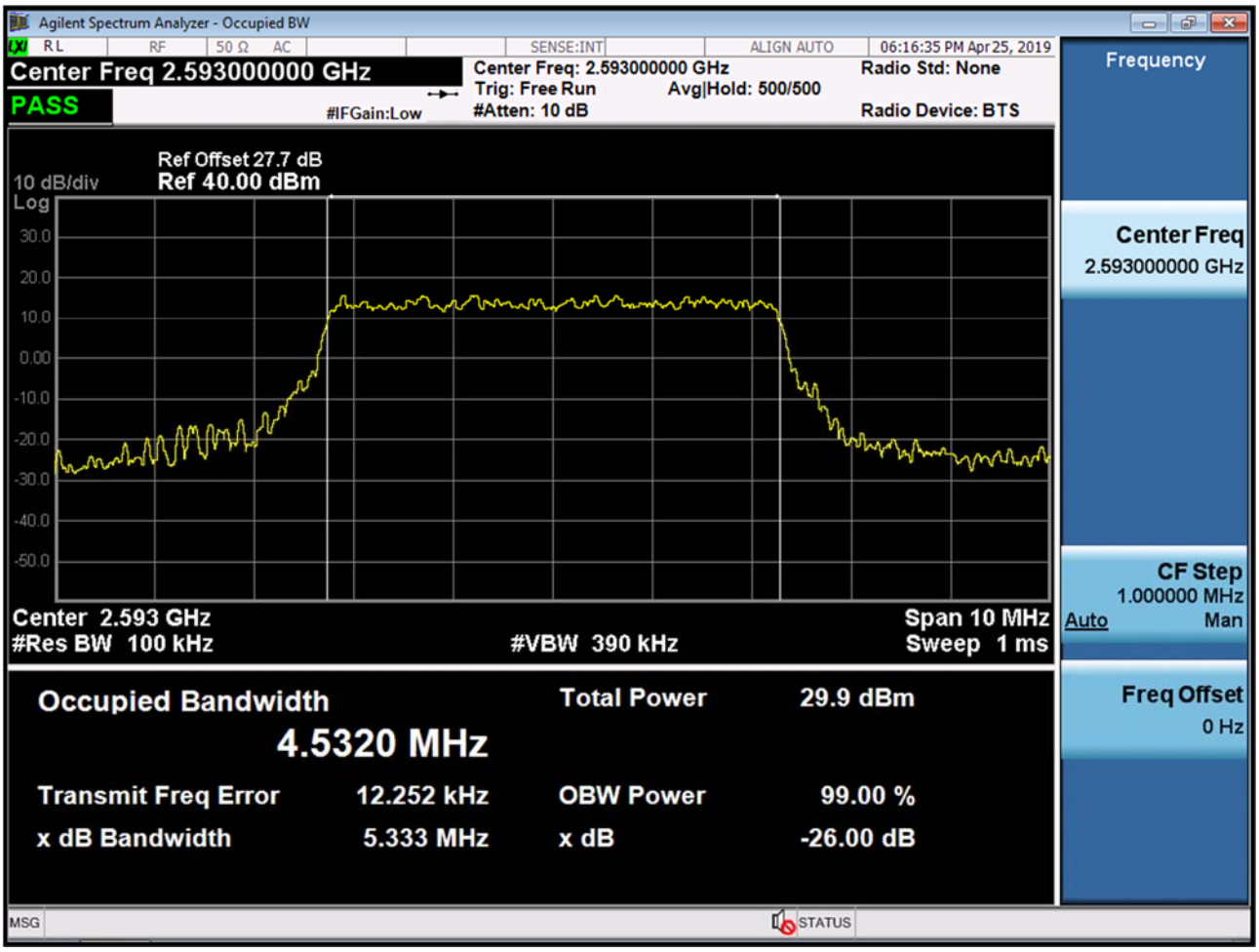


9. TEST PLOTS

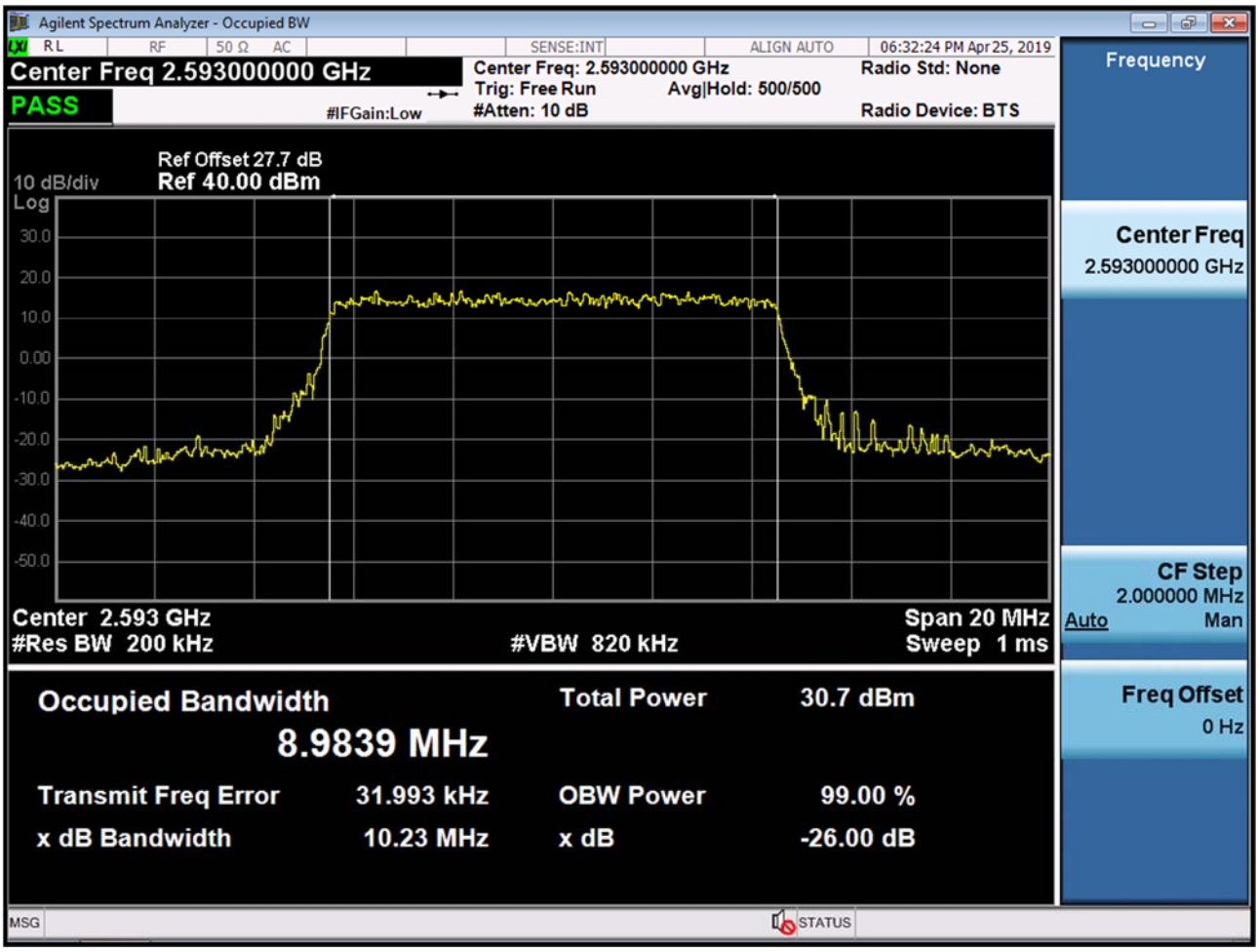
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25)



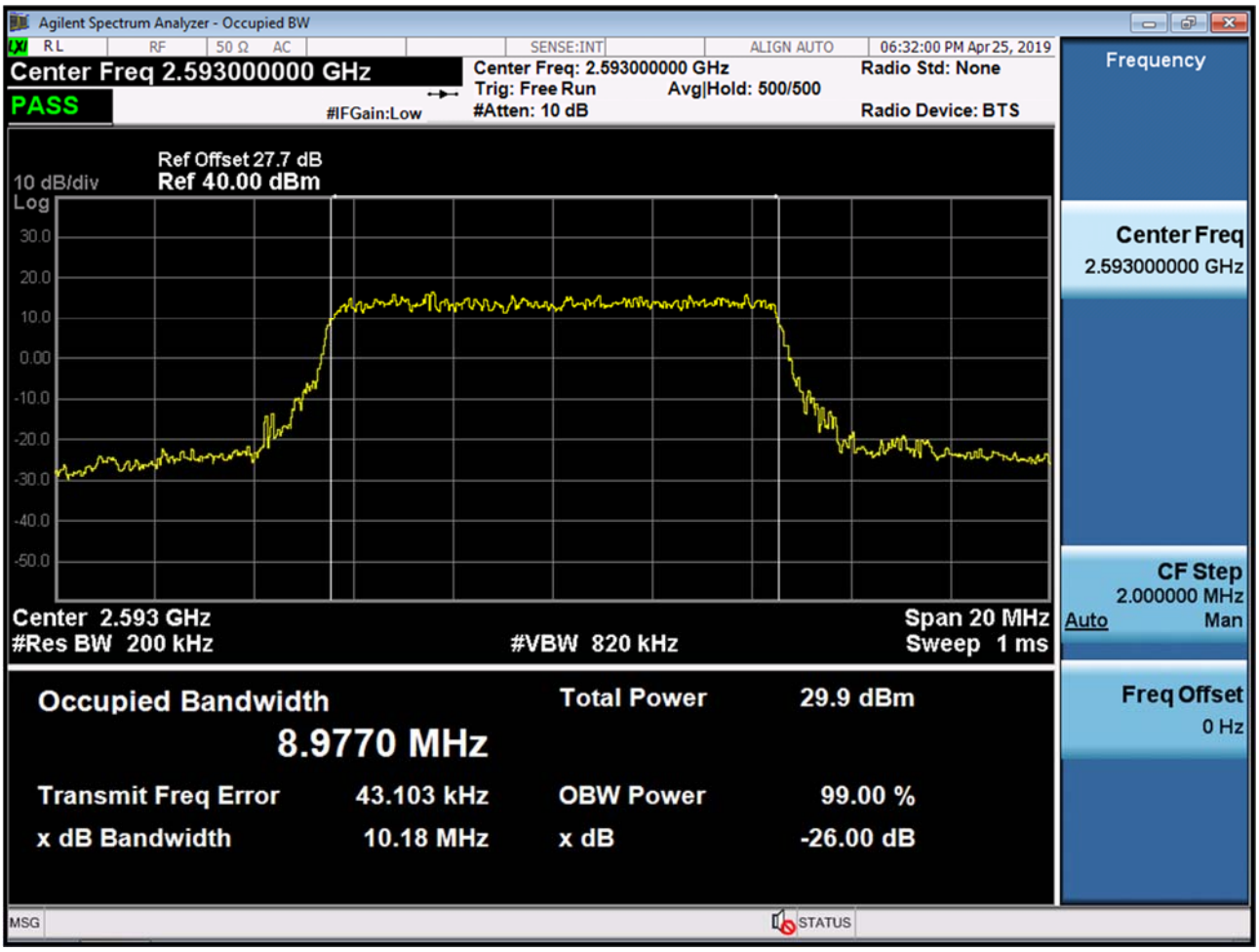
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25)



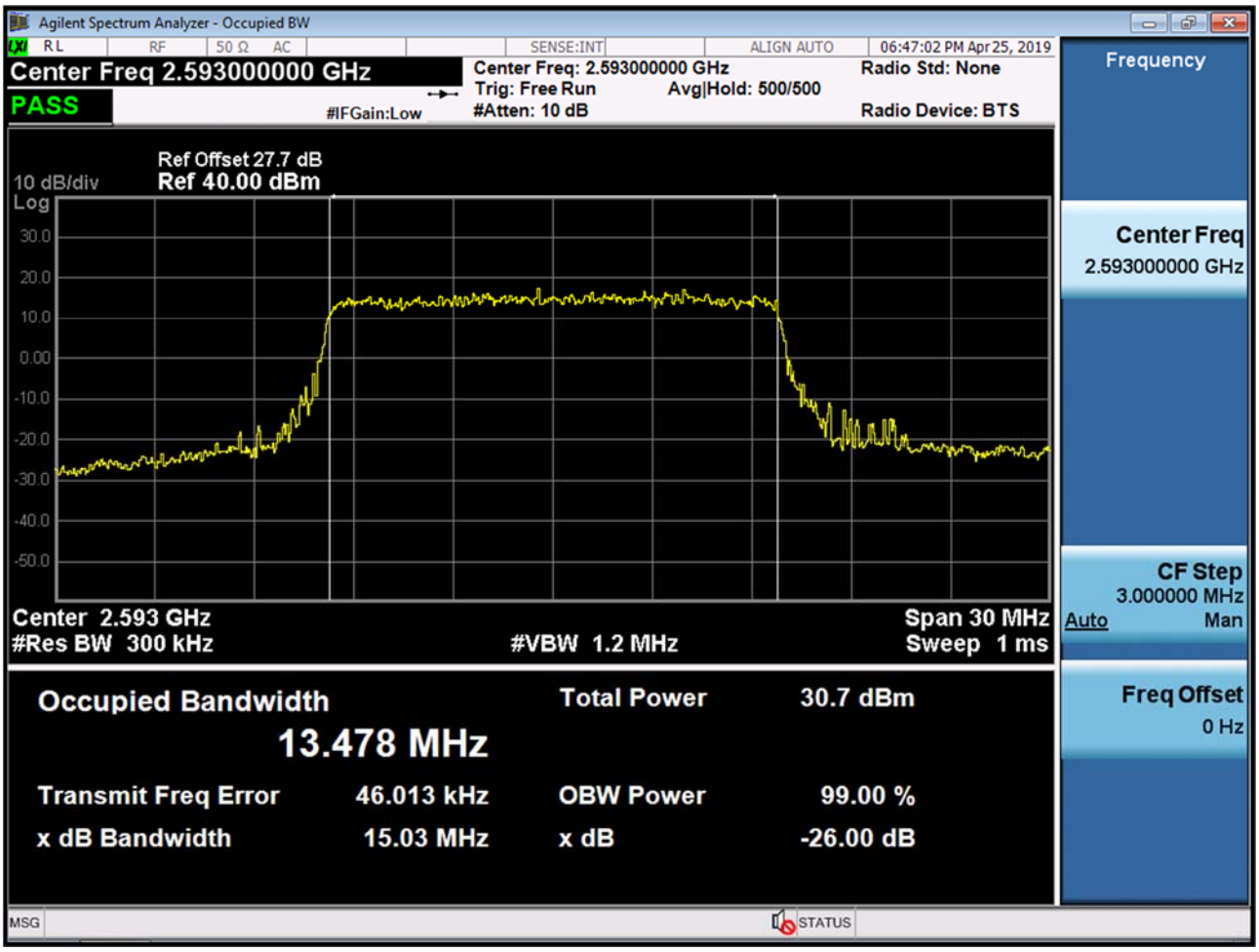
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50)



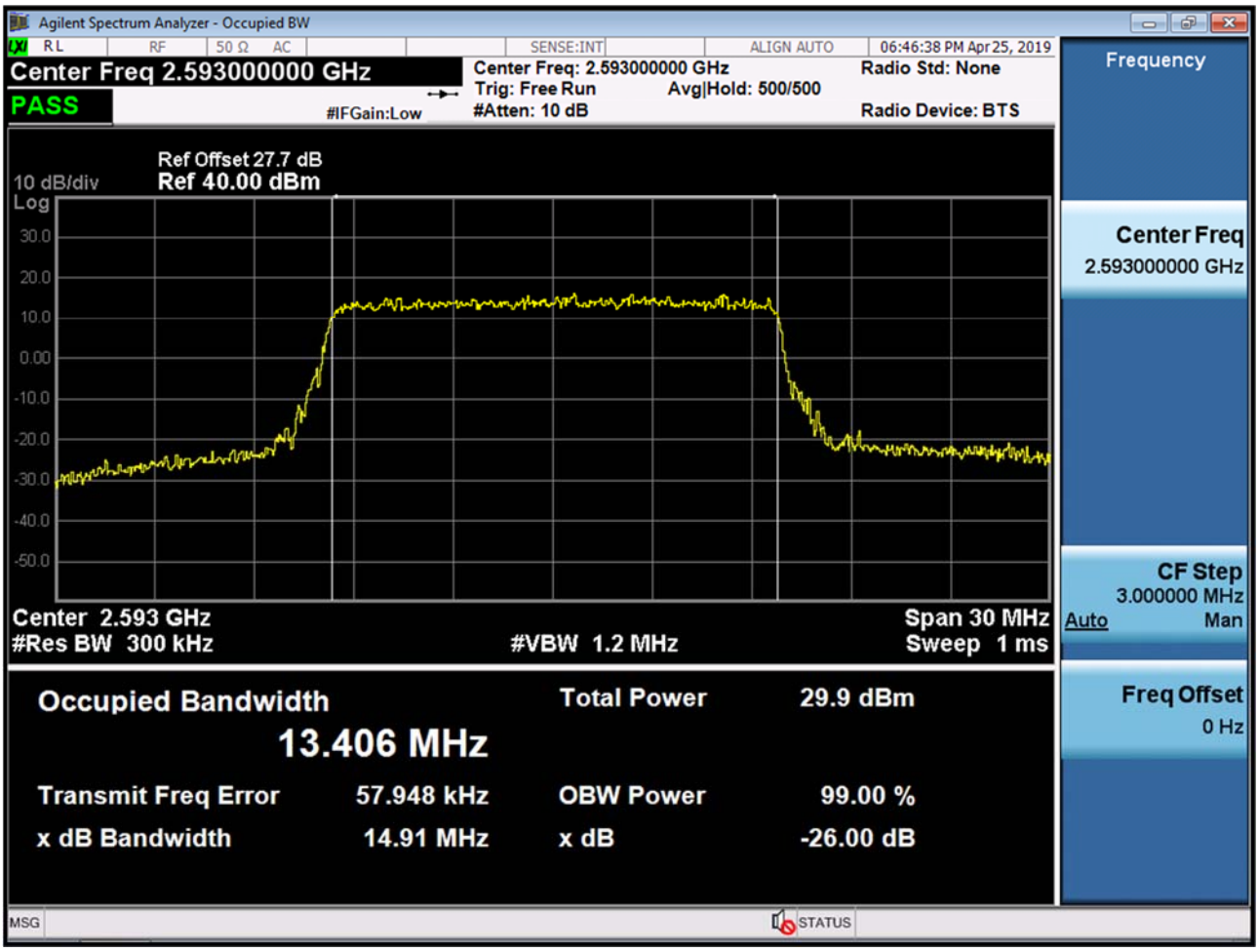
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50)



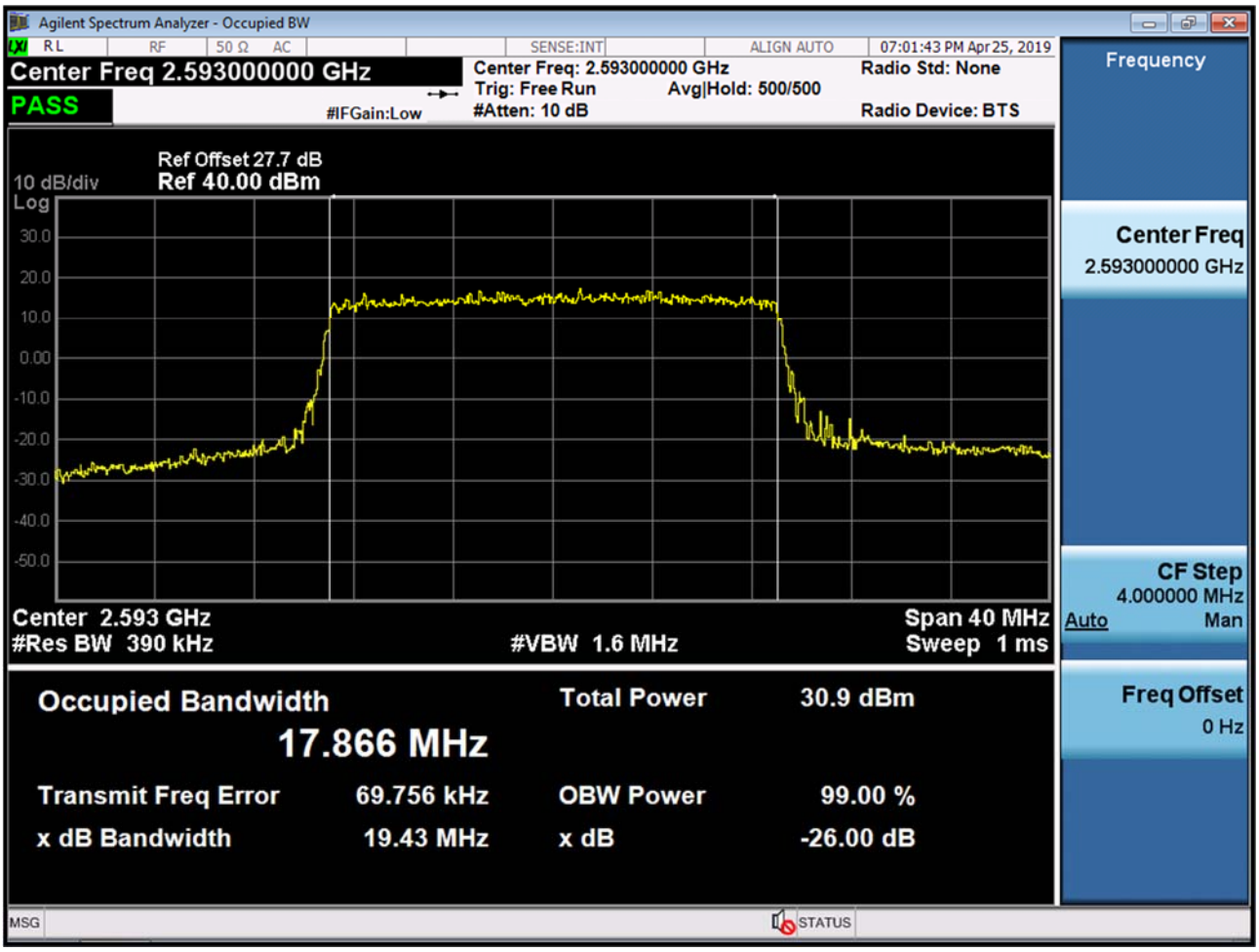
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75)



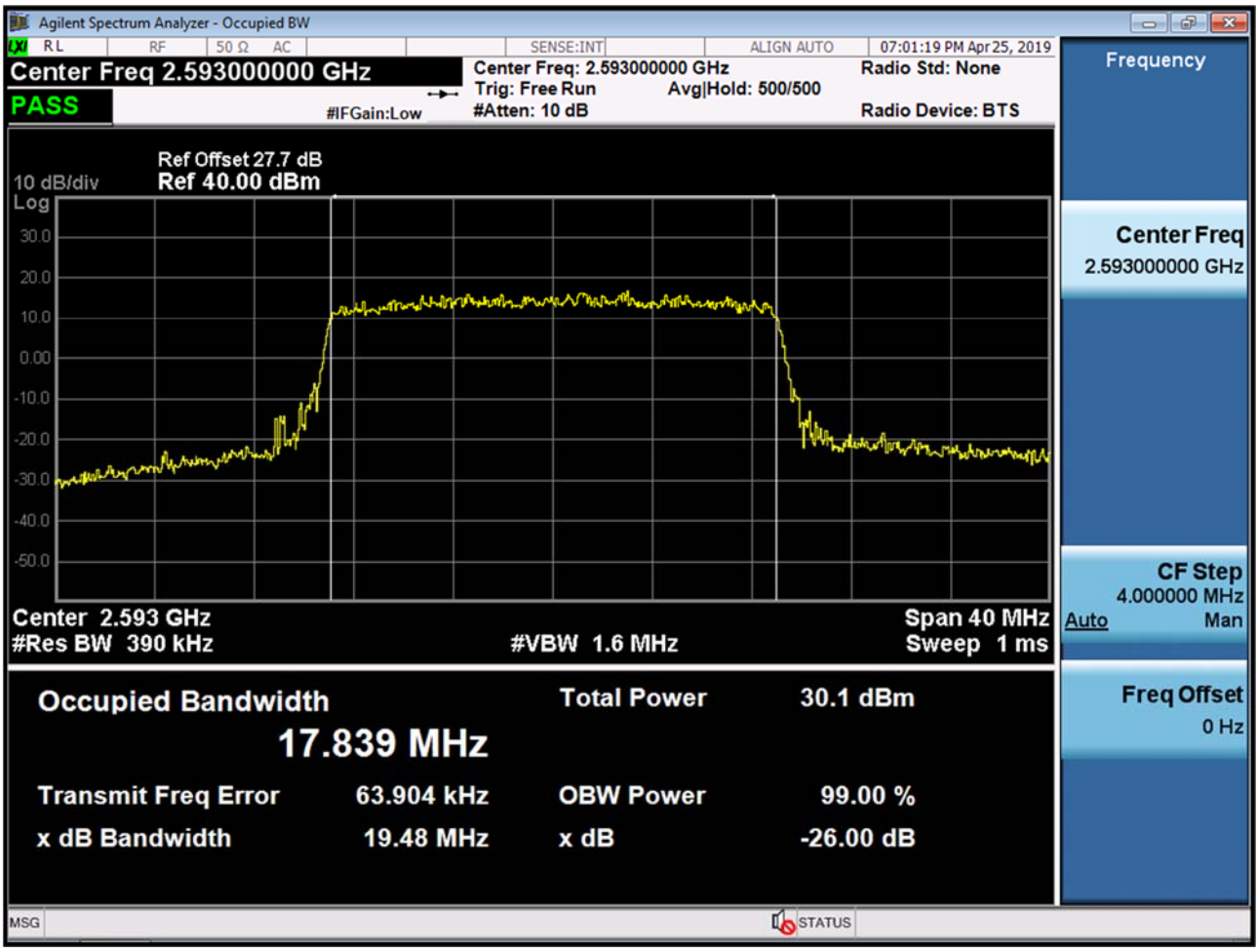
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)



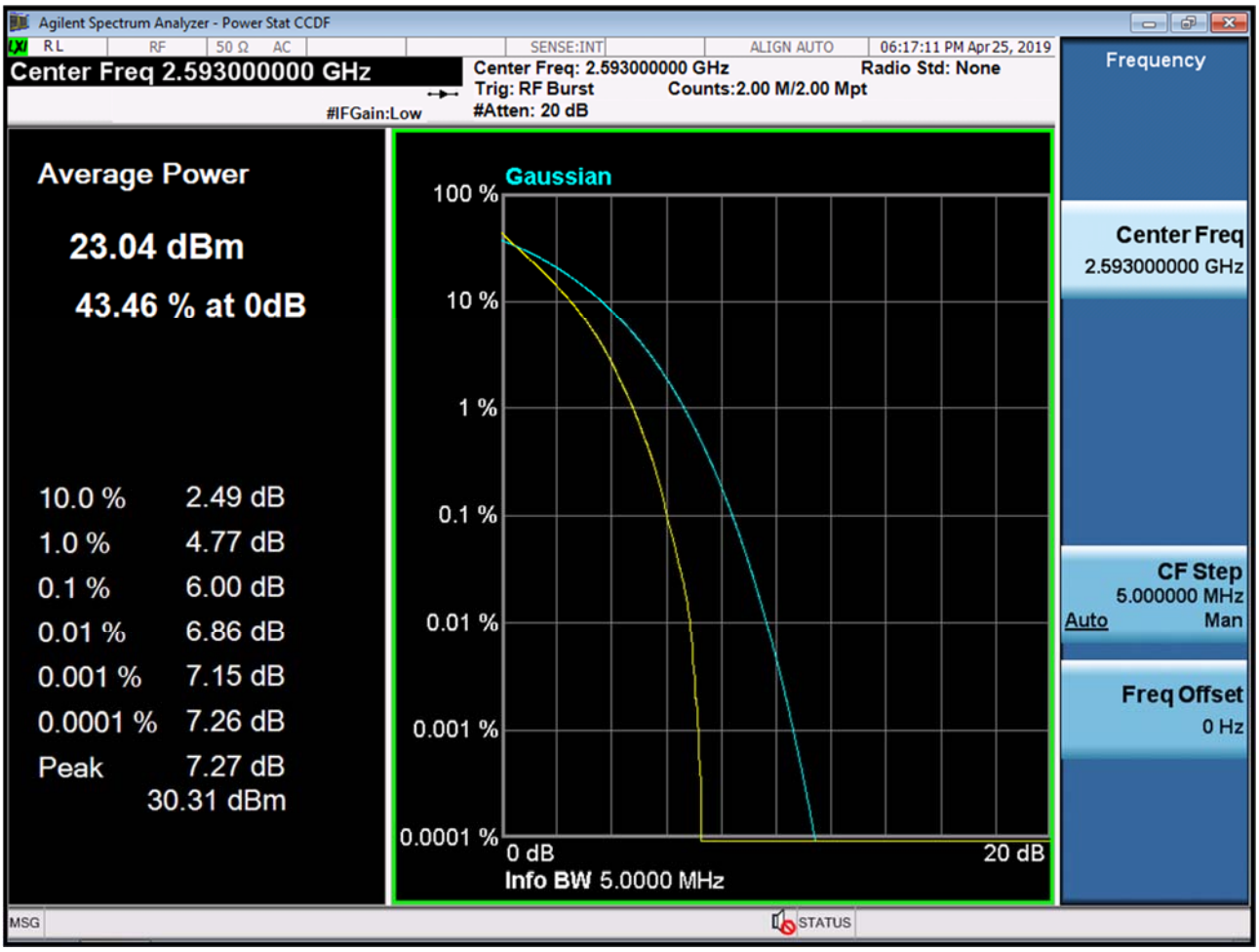
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)



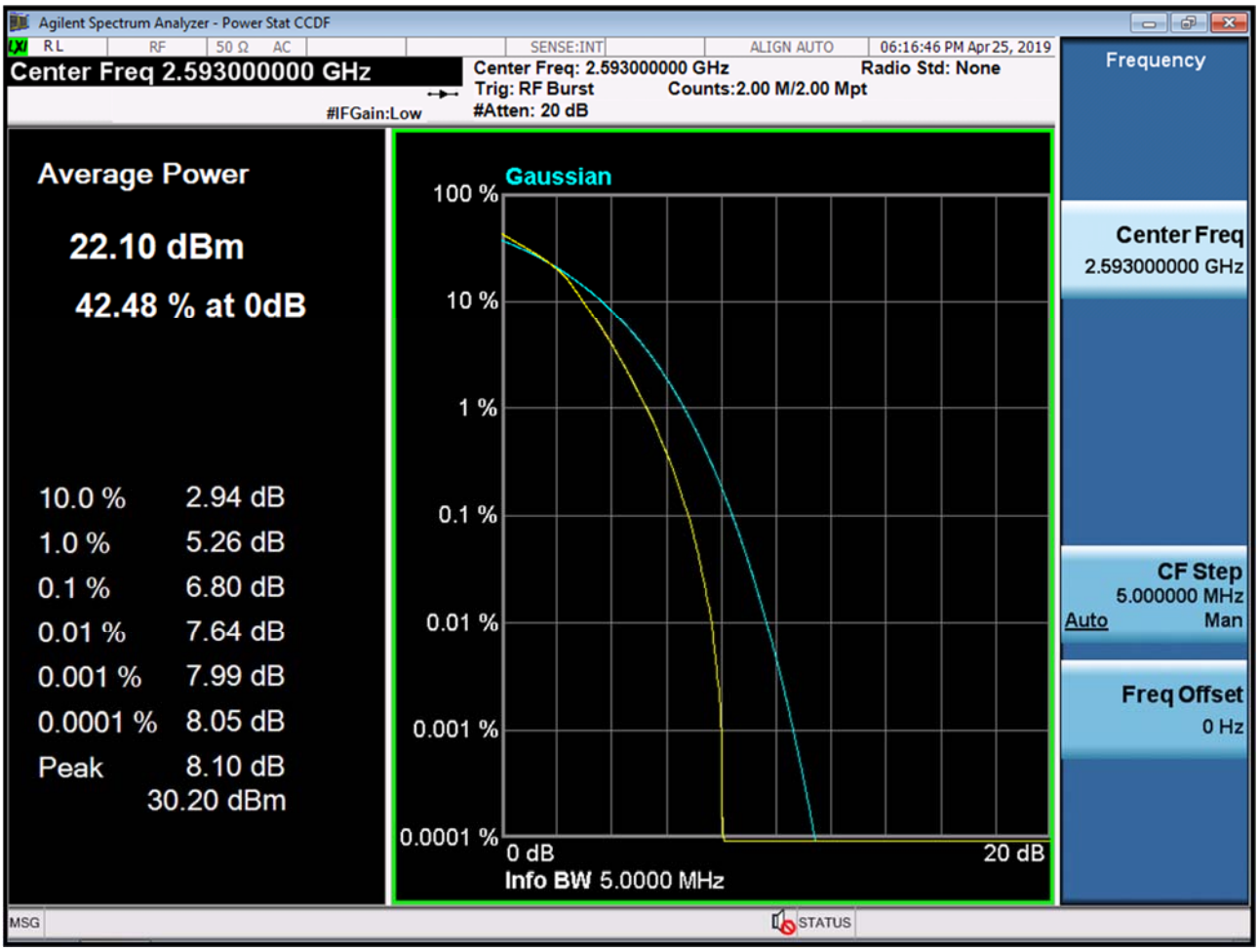
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100)



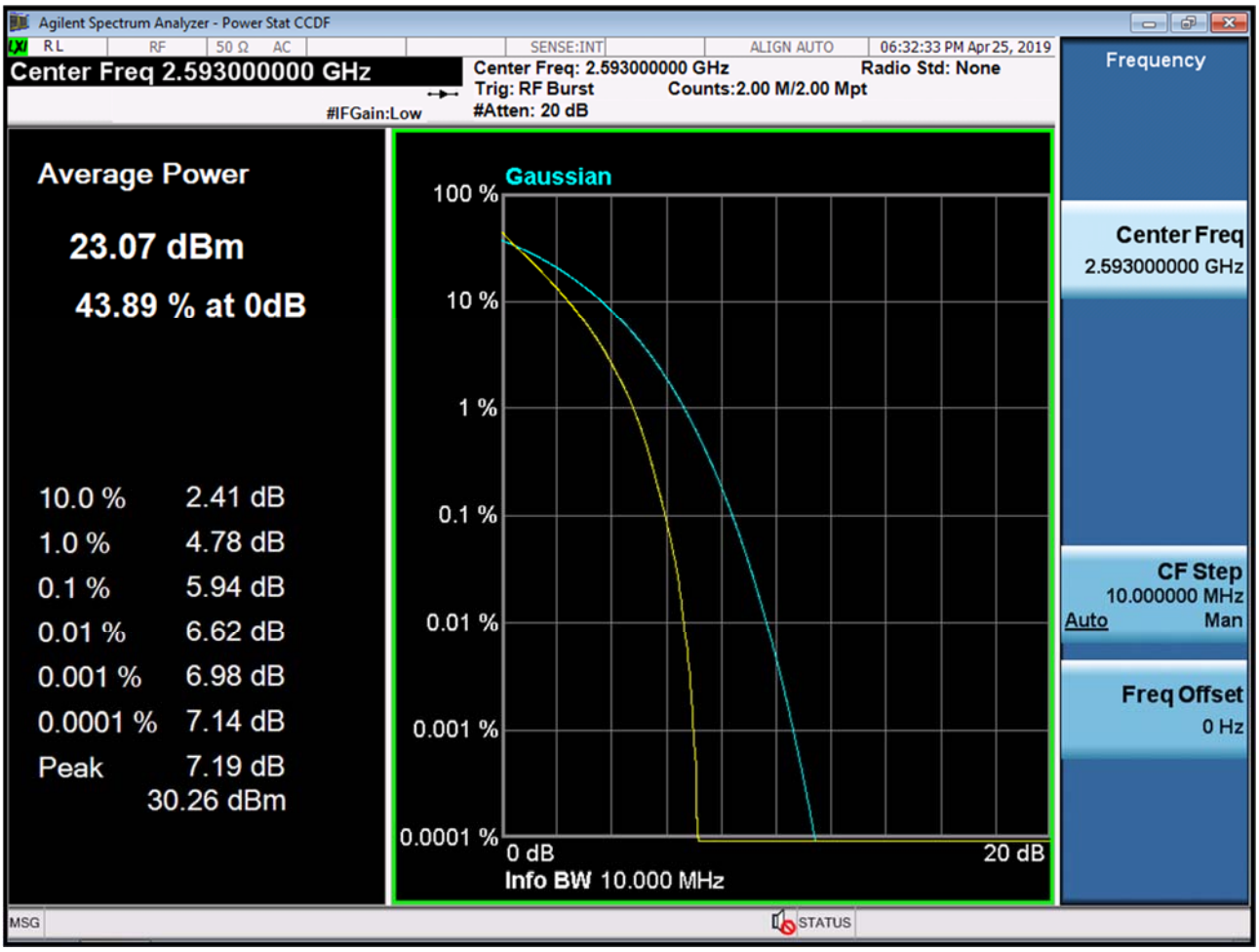
BAND 41. PAR Plot (5M BW_Ch.40620_QPSK_RB25_0)



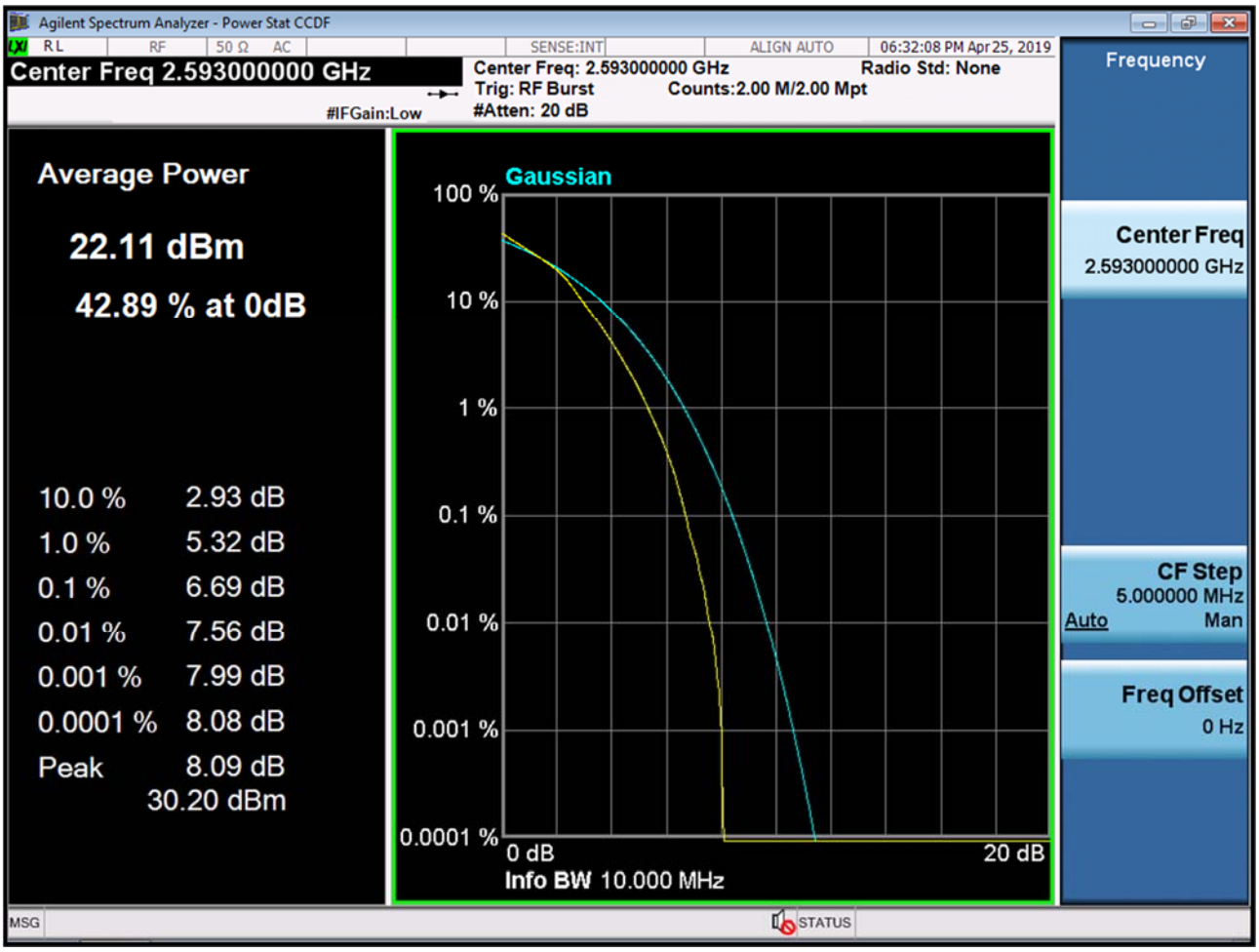
BAND 41. PAR Plot (5M BW_Ch.40620_16QAM_RB25_0)



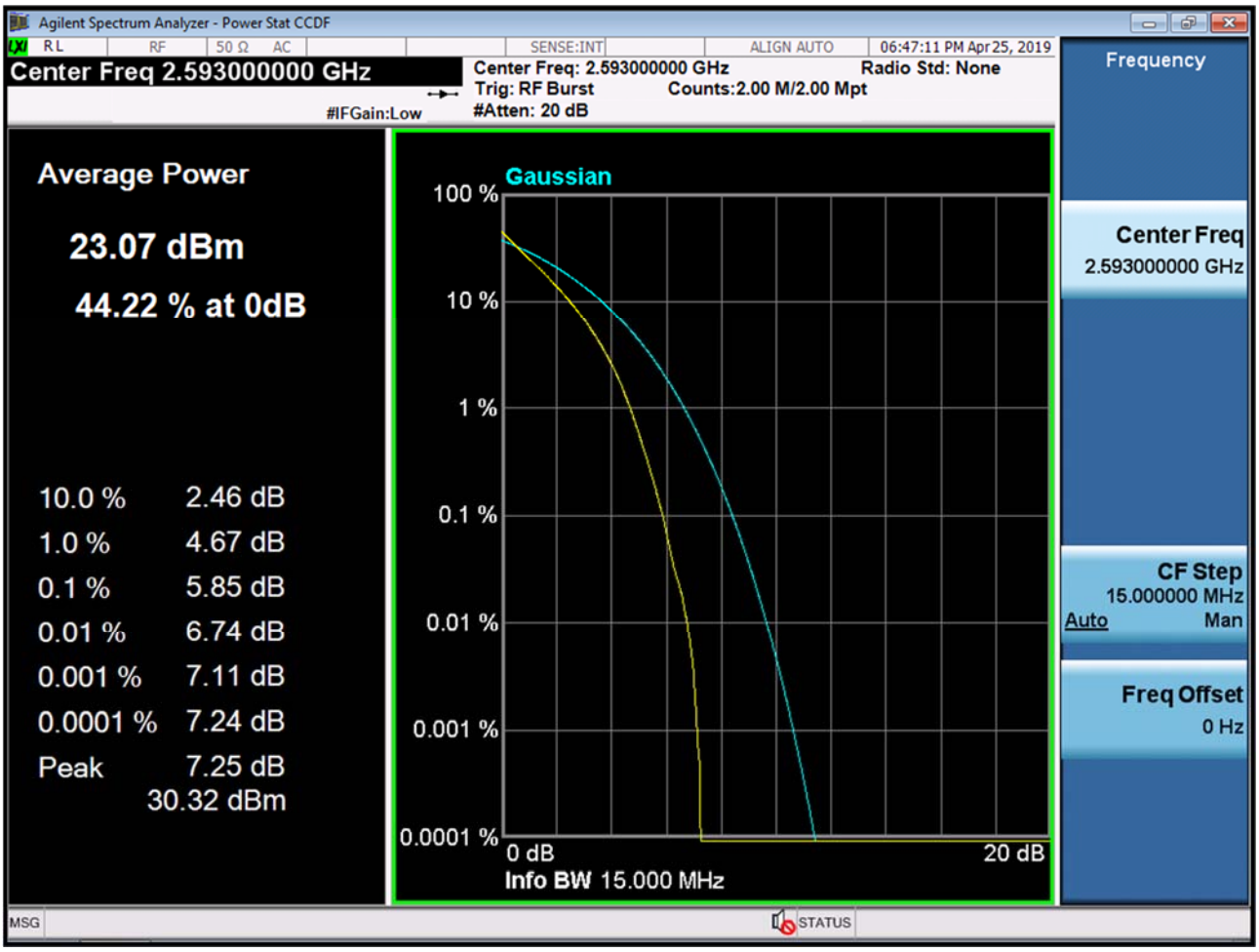
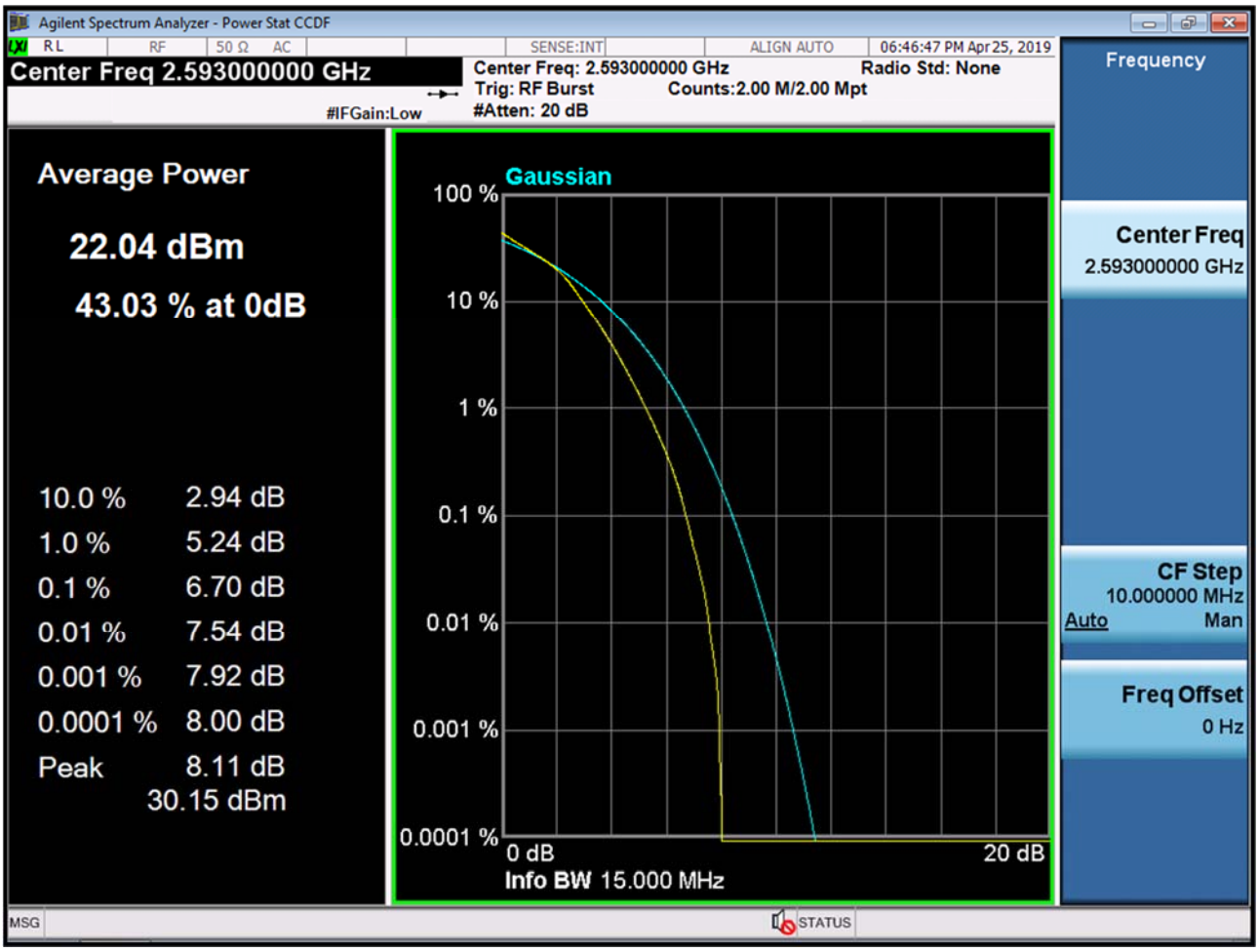
BAND 41. PAR Plot (10M BW_Ch.40620_QPSK_RB50_0)



BAND 41. PAR Plot (10M BW_Ch.40620_16QAM_RB50_0)



BAND 41. PAR Plot (15M BW_Ch.40620_QPSK_RB75_0)



BAND 41. PAR Plot (15M BW_Ch.40620_16QAM_RB75_0)