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

FCC LTE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

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

Date of Issue:
January 15, 2021

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

Report No.: HCT-RF-2101-FC029-R1

FCC ID:	**A3LSMA725M**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-A725M/DS
Additional Model(s):	SM-A725M
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	4M50G7D	QPSK	0.145	21.62
		4M49W7D	16QAM	0.118	20.71
		4M50W7D	64QAM	0.094	19.74
LTE – Band 41 (10)	2501.0 – 2685.0	8M97G7D	QPSK	0.148	21.70
		8M98W7D	16QAM	0.120	20.78
		8M95W7D	64QAM	0.096	19.83
LTE – Band 41 (15)	2503.5 – 2682.5	13M4G7D	QPSK	0.148	21.71
		13M4W7D	16QAM	0.120	20.79
		13M4W7D	64QAM	0.097	19.85
LTE – Band 41 (20)	2506.0 – 2680.0	18M0G7D	QPSK	0.160	22.04
		17M9W7D	16QAM	0.121	20.81
		17M9W7D	64QAM	0.097	19.86

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)

REVIEWED BY

Report prepared by : Jae Mun Do **Engineer of Telecommunication Testing Center**	**Report approved by : Jong Seok Lee** **Manager of Telecommunication Testing Center**

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2101-FC029	January 11, 2021	- First Approval Report
HCT-RF-2101-FC029-R1	January 15, 2021	- Delete overlap pages (Page 100)

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

Table of Contents

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:	A3LSMA725M
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-A725M/DS
Additional Model(s):	SM-A725M
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:	December 02, 2020 ~ January 6, 2021
Serial number:	Radiated: R38N901K40W Conducted: R38NA01D9VT

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

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

It also supports IEEE 802.11 a/b/g/n/ac (HT20/40/80), Bluetooth, BT LE, 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 NormalHz
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 NormalHz 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 10^{th} 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. For spurious 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 spurious emissions is calculated by the following formula;

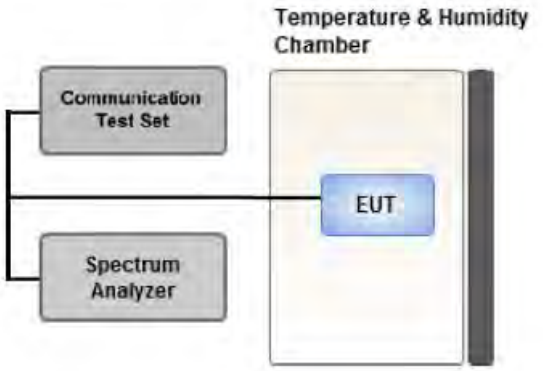
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

Where: $P_g$is the generator output power into the substitution antenna.

If the fundamental frequency is below 1GHz, RF output power has been converted to EIRP.

$$EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$$

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:

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

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 ≥ 3 × RBW.

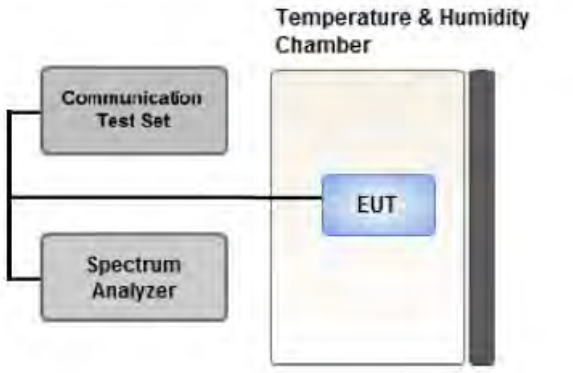
1. Set the RBW ≥ OBW.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 2 × OBW.
4. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

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.

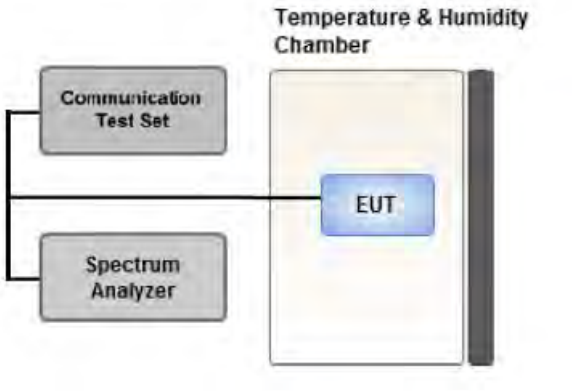
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

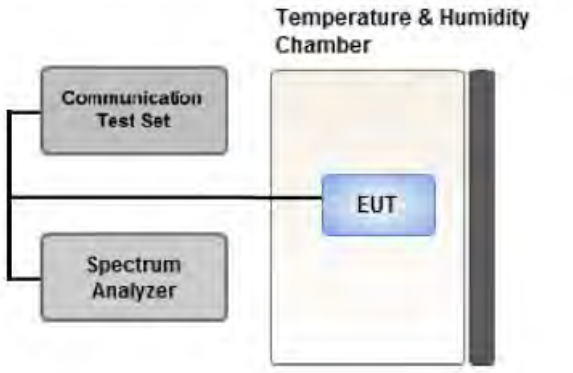
Test Overview

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 x 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.

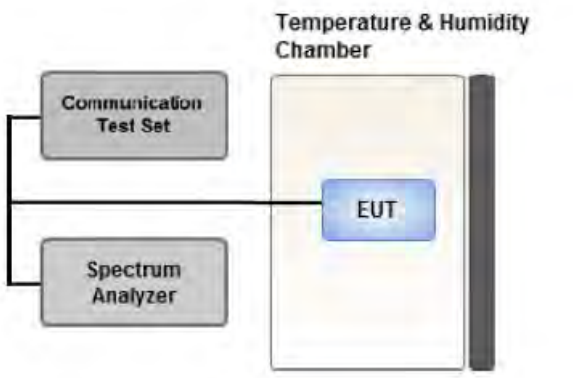
Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. Within 1MHz of the channel edge the RBW should be 2% of EBW, then 1 MHz after that.
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,
2. 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge.
3. 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge.
4. The attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz.
5. 55 + 10 log (P) dB at or below 2490.5 MHz.
6. X is the greater of 6MHz or the actual emission bandwidth
7. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer

3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

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

The frequency stability of the transmitter is measured by:

1. Temperature:

   The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

2. Primary Supply Voltage:

   .- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.

   .- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

3.9 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.
- All modes of operation were investigated and the worst case configuration results are reported.
- Please refer to the table below.
- SM-A725M/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-A725M/DS)

[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	Z

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.
- SM-A725M/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-A725M/DS)

[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 Radio	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
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/27/2020	Annual	04/27/2021
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
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	93008124	03/18/2020	Annual	03/18/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Keysight	PXA Signal Analyzer (2Hz~50GHz)	MY55480167	06/04/2020	Annual	06/04/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2020	Annual	06/04/2021
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2020	Annual	10/14/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	04/26/2019	Biennial	04/26/2021
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/12/2019	Biennial	03/12/2021
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/22/2020	Annual	01/22/2021
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
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.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

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)	5.05

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

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
40620	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

QAM 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	-23.79	13.39	10.70	2.49	V	< 2.00	0.144	21.60
		16-QAM	-24.68	12.50	10.70	2.49	V		0.118	20.71
		64-QAM	-25.65	11.53	10.70	2.49	V		0.094	19.74
2593.0		QPSK	-24.16	13.17	10.98	2.53	V		0.145	21.62
		16-QAM	-25.14	12.19	10.98	2.53	V		0.116	20.64
		64-QAM	-26.04	11.29	10.98	2.53	V		0.094	19.74
2687.5		QPSK	-25.96	11.65	11.10	2.59	V		0.104	20.16
		16-QAM	-26.96	10.65	11.10	2.59	V		0.082	19.16
		64-QAM	-27.87	9.74	11.10	2.59	V		0.067	18.25

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	-23.83	13.35	10.70	2.49	V	< 2.00	0.143	21.56
		16-QAM	-24.71	12.47	10.70	2.49	V		0.117	20.68
		64-QAM	-25.66	11.52	10.70	2.49	V		0.094	19.73
2593.0		QPSK	-24.08	13.25	10.98	2.53	V		0.148	21.70
		16-QAM	-25.00	12.33	10.98	2.53	V		0.120	20.78
		64-QAM	-25.95	11.38	10.98	2.53	V		0.096	19.83
2685.0		QPSK	-26.10	11.52	11.10	2.58	V		0.101	20.04
		16-QAM	-27.05	10.57	11.10	2.58	V		0.081	19.09
		64-QAM	-27.99	9.63	11.10	2.58	V		0.065	18.15

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	-23.68	13.50	10.70	2.49	V	< 2.00	0.148	21.71
		16-QAM	-24.60	12.58	10.70	2.49	V		0.120	20.79
		64-QAM	-25.54	11.64	10.70	2.49	V		0.097	19.85
2593.0		QPSK	-24.22	13.11	10.98	2.53	V		0.143	21.56
		16-QAM	-25.18	12.15	10.98	2.53	V		0.115	20.60
		64-QAM	-26.09	11.24	10.98	2.53	V		0.093	19.69
2682.5		QPSK	-25.70	11.92	11.10	2.57	V		0.111	20.45
		16-QAM	-26.66	10.96	11.10	2.57	V		0.089	19.49
		64-QAM	-27.60	10.02	11.10	2.57	V		0.072	18.55

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	-23.43	13.81	10.73	2.50	V	< 2.00	0.160	22.04
		16-QAM	-24.66	12.58	10.73	2.50	V		0.121	20.81
		64-QAM	-25.61	11.63	10.73	2.50	V		0.097	19.86
2593.0		QPSK	-23.79	13.54	10.98	2.53	V		0.158	21.99
		16-QAM	-25.05	12.28	10.98	2.53	V		0.118	20.73
		64-QAM	-25.99	11.34	10.98	2.53	V		0.095	19.79
2680.0		QPSK	-25.55	12.07	11.10	2.57	V		0.115	20.60
		16-QAM	-26.43	11.19	11.10	2.57	V		0.094	19.72
		64-QAM	-27.39	10.23	11.10	2.57	V		0.075	18.76

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY : 2506.0 MHz

▣ MEASURED OUTPUT POWER: 21.62 dBm = 0.145 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 46.62 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39675 (2498.5)	4 997.00	-46.74	12.70	-56.05	3.61	H	-46.96	68.58
	7 495.50	-44.42	11.20	-44.61	4.47	H	-37.88	59.49
	9 994.00	-50.62	10.89	-47.42	5.27	H	-41.80	63.41
	12 492.50	-56.69	13.88	-53.86	6.03	V	-46.01	67.62
40620 (2593.0)	5 186.00	-44.77	12.75	-53.48	3.70	H	-44.42	66.04
	7 779.00	-45.29	11.65	-46.44	4.54	H	-39.33	60.94
	10 372.00	-44.62	10.75	-39.90	5.45	H	-34.60	56.21
	12 965.00	-57.58	13.40	-50.52	6.13	H	-43.24	64.86
41565 (2687.5)	5 375.00	-41.13	13.52	-50.46	3.78	H	-40.71	62.33
	8 062.50	-43.57	10.93	-42.30	4.61	H	-35.98	57.60
	10 750.00	-43.11	10.90	-38.45	5.54	H	-33.09	54.71
	13 437.50	-54.04	12.63	-45.38	6.26	H	-39.01	60.63
	16 125.00	-56.33	17.20	-47.14	6.94	V	-36.88	58.49

▣ OPERATING FREQUENCY : 2506.0 MHz

▣ MEASURED OUTPUT POWER: 21.70 dBm = 0.148 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 46.70 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39700 (2501.0)	5 002.00	-48.51	12.70	-57.82	3.61	H	-48.73	70.43
	7 503.00	-44.97	11.20	-45.37	4.47	H	-38.64	60.34
	10 004.00	-50.19	10.94	-47.21	5.27	H	-41.54	63.23
40620 (2593.0)	5 186.00	-45.62	12.75	-54.33	3.70	H	-45.27	66.97
	7 779.00	-45.15	11.65	-46.30	4.54	H	-39.19	60.88
	10 372.00	-44.87	10.75	-40.15	5.45	H	-34.85	56.54
	12 965.00	-57.20	13.40	-50.14	6.13	H	-42.86	64.56
41540 (2685.0)	5 370.00	-42.13	13.25	-51.36	3.77	H	-41.88	63.58
	8 055.00	-45.35	10.92	-44.06	4.61	H	-37.75	59.44
	10 740.00	-42.80	10.90	-38.26	5.52	H	-32.88	54.58
	13 425.00	-55.27	12.65	-46.97	6.22	H	-40.54	62.24

▣ OPERATING FREQUENCY : 2506.0 MHz

▣ MEASURED OUTPUT POWER: 21.71 dBm = 0.148 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 46.71 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39725 (2503.5)	5 007.00	-48.54	12.65	-57.81	3.60	H	-48.76	70.46
	7 510.50	-44.88	11.25	-46.02	4.48	H	-39.25	60.95
	10 014.00	-50.46	11.02	-47.17	5.27	H	-41.42	63.13
40620 (2593.0)	5 186.00	-45.29	12.75	-54.00	3.70	H	-44.94	66.65
	7 779.00	-45.27	11.65	-46.42	4.54	H	-39.31	61.02
	10 372.00	-44.81	10.75	-40.09	5.45	H	-34.79	56.50
41515 (2682.5)	5 365.00	-40.86	13.27	-50.27	3.77	H	-40.76	62.47
	8 047.50	-45.09	10.90	-43.77	4.60	H	-37.47	59.18
	10 730.00	-43.73	10.90	-39.24	5.50	H	-33.84	55.55

▣ OPERATING FREQUENCY : 2506.0 MHz

▣ MEASURED OUTPUT POWER: 22.04 dBm = 0.160 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 47.04 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39750 (2506.0)	5 012.00	-47.44	12.65	-56.65	3.59	H	-47.59	69.63
	7 518.00	-44.73	11.30	-46.07	4.46	H	-39.23	61.27
	10 024.00	-50.05	11.05	-46.44	5.27	H	-40.66	62.70
40620 (2593.0)	5 186.00	-44.75	12.75	-53.46	3.70	H	-44.40	66.44
	7 779.00	-46.17	11.65	-47.32	4.54	H	-40.21	62.25
	10 372.00	-45.08	10.75	-40.36	5.45	H	-35.06	57.10
41490 (2680.0)	5 360.00	-41.86	13.28	-51.43	3.76	H	-41.91	63.95
	8 040.00	-45.70	10.93	-44.45	4.59	H	-38.11	60.16
	10 720.00	-43.50	10.90	-39.30	5.48	H	-33.88	55.92
	13 400.00	-58.19	12.70	-49.98	6.18	H	-43.46	65.50
	16 080.00	-56.23	17.30	-45.62	6.95	H	-35.27	57.31

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	4.49
			16-QAM			5.54
			64-QAM			6.10
	10 MHz		QPSK	50		4.70
			16-QAM			5.60
			64-QAM			6.21
	15 MHz		QPSK	75		4.30
			16-QAM			5.44
			64-QAM			6.12
	20 MHz		QPSK	100		4.46
			16-QAM			5.49
			64-QAM			6.16

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 68 ~ 79.

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	4.4974
			16-QAM			4.4882
			64-QAM			4.5009
	10 MHz		QPSK	50		8.9679
			16-QAM			8.9747
			64-QAM			8.9480
	15 MHz		QPSK	75		13.365
			16-QAM			13.380
			64-QAM			13.400
	20 MHz		QPSK	100		17.959
			16-QAM			17.918
			64-QAM			17.905

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 56 ~ 67.

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	8.0120	32.570	-81.266	-48.696	-25.00
		2593.0	4.0773	31.955	-80.905	-48.950	
		2687.5	5.3794	32.570	-76.587	-44.017	
	10	2501.0	8.0110	32.570	-80.367	-47.797	
		2593.0	8.0120	32.570	-81.059	-48.489	
		2685.0	5.3784	32.570	-75.244	-42.674	
	15	2503.5	5.4836	32.570	-81.354	-48.784	
		2593.0	6.2468	32.570	-81.351	-48.781	
		2682.5	5.3779	32.570	-77.212	-44.642	
	20	2506.0	7.9895	32.570	-80.413	-47.843	
		2593.0	4.0200	31.955	-81.260	-49.305	
		2680.0	5.3779	32.570	-75.435	-42.865	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 108 ~ 131.
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. Duty Cycle factor already applied on the factor.
   - Duty Cycle factor(dB) = 3.98
   - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
   - Result(dBm) = Reading + Factor

Frequency Range (GHz)	Factor [dB]
0.03 – 1	29.250
1 – 5	31.956
5 – 10	32.571
10 – 15	33.096
15 – 20	33.469
Above 20(26.5)	34.111

Note: Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter

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	-20.57	-21.96	-19.32	-19.18	-31.15	-30.50	-33.26
10 MHz	2501.0	QPSK	50/0	-24.40	-24.96	-25.18	-24.88	-31.57	-27.40	-34.06
15 MHz	2503.5	QPSK	75/0	-24.96	-25.23	-25.51	-21.91	-30.94	-26.66	-36.88
20 MHz	2506.0	QPSK	100/0	-24.92	-23.63	-27.05	-24.97	-30.68	-27.06	-36.60
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	-21.55	-23.34	-19.92	-20.89
	2687.5	QPSK	25	0	-20.59	-22.44	-20.18	-21.82
10 MHz	2593.0	QPSK	50	0	-24.24	-25.40	-25.41	-25.14
	2685.0	QPSK	50	0	-24.03	-25.92	-24.48	-26.39
15 MHz	2593.0	QPSK	75	0	-24.59	-24.79	-25.63	-25.24
	2682.5	QPSK	75	0	-24.55	-26.15	-25.90	-27.93
20 MHz	2593.0	QPSK	100	0	-23.45	-23.74	-25.97	-25.63
	2680.0	QPSK	100	0	-24.95	-26.48	-26.00	-27.13
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	-31.33	-31.88	-34.06	-35.14
	2687.5	QPSK	25	0	-33.42	-35.13	-34.74	-27.05
10 MHz	2593.0	QPSK	50	0	-30.40	-30.01	-36.42	-37.63
	2685.0	QPSK	50	0	-29.81	-32.18	-28.85	-40.59
15 MHz	2593.0	QPSK	75	0	-28.58	-27.18	-37.91	-39.31
	2682.5	QPSK	75	0	-25.92	-30.97	-40.56	-43.34
20 MHz	2593.0	QPSK	100	0	-22.36	-28.50	-37.06	-38.26
	2680.0	QPSK	100	0	-28.01	-30.40	-32.01	-42.69
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 80 ~ 107. (1RB & Full RB)

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE 41

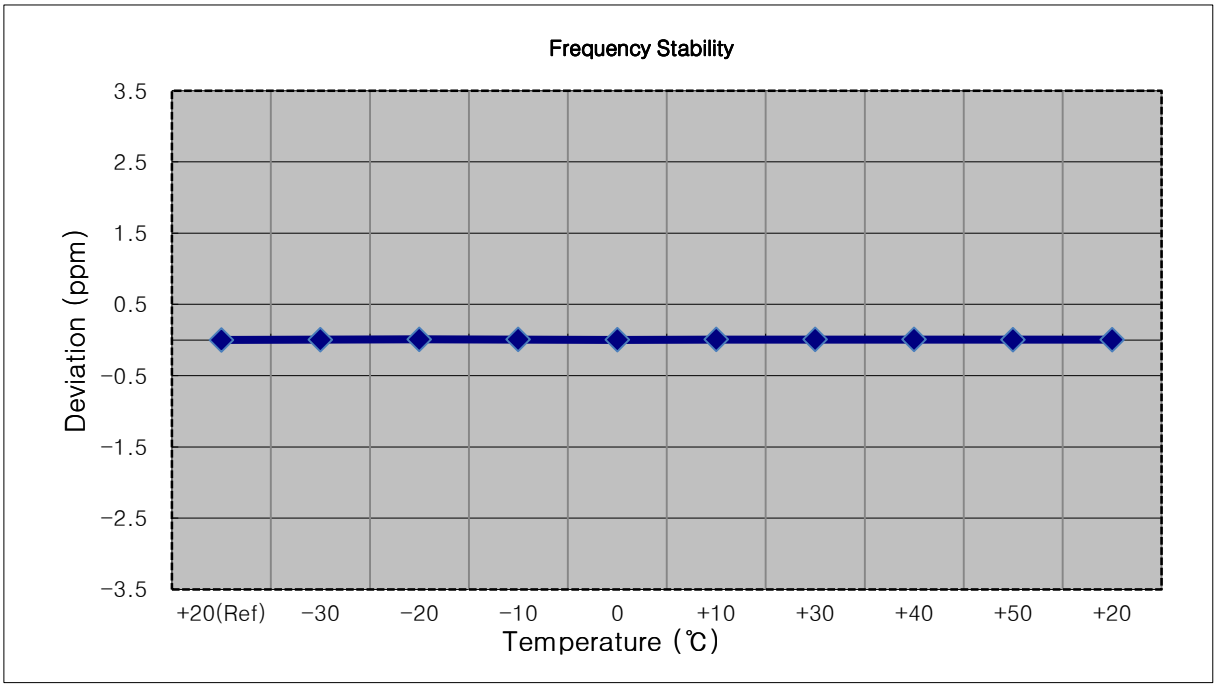
▣ OPERATING FREQUENCY: 2498,500,000 Hz

▣ 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 499 993	0.0	0.000 000	0.000
100%		-30	2498 500 004	11.7	0.000 000	0.005
100%		-20	2498 500 013	20.4	0.000 001	0.008
100%		-10	2498 500 007	14.2	0.000 001	0.006
100%		0	2498 500 000	7.3	0.000 000	0.003
100%		+10	2498 500 009	16.3	0.000 001	0.007
100%		+30	2498 500 010	17.4	0.000 001	0.007
100%		+40	2498 500 009	16.7	0.000 001	0.007
100%		+50	2498 500 002	9.7	0.000 000	0.004
Batt. Endpoint	3.370	+20	2498 500 004	10.9	0.000 000	0.004



▣ MODE: LTE 41

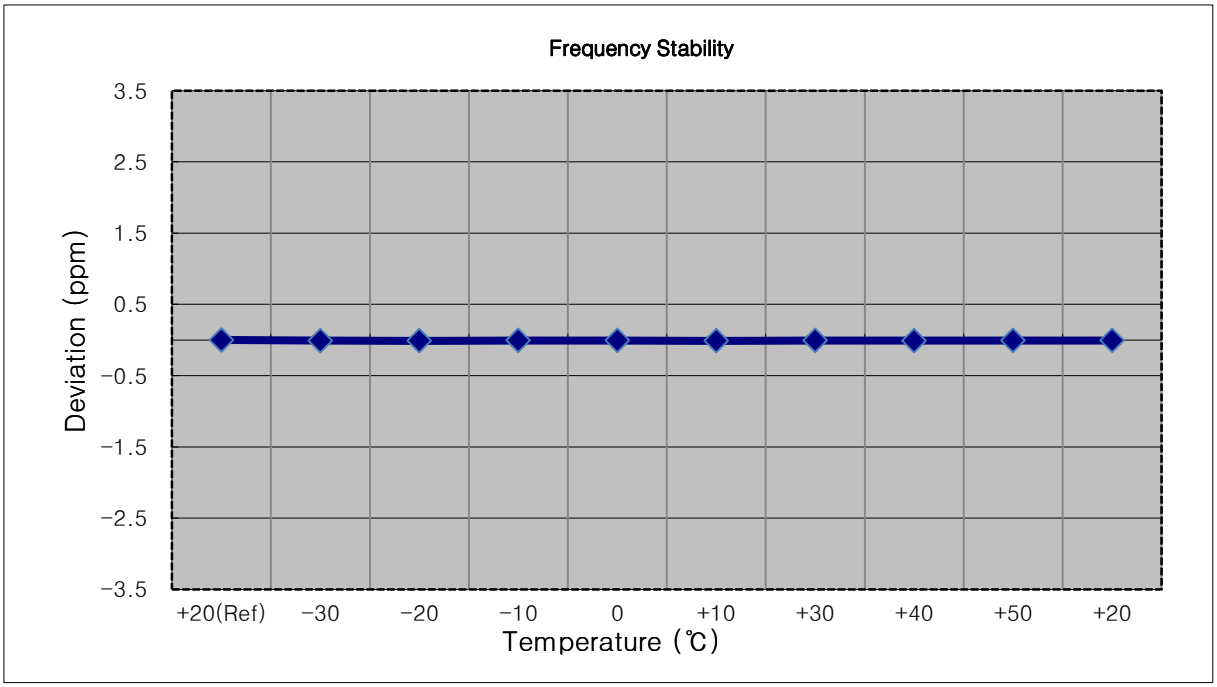
▣ OPERATING FREQUENCY: 2501,000,000 Hz

▣ 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)	2500 999 983	0.0	0.000 000	0.000
100%		-30	2500 999 960	-22.7	-0.000 001	-0.009
100%		-20	2500 999 953	-30.0	-0.000 001	-0.012
100%		-10	2500 999 965	-17.5	-0.000 001	-0.007
100%		0	2500 999 967	-16.1	-0.000 001	-0.006
100%		+10	2500 999 955	-28.3	-0.000 001	-0.011
100%		+30	2500 999 965	-17.9	-0.000 001	-0.007
100%		+40	2500 999 959	-23.9	-0.000 001	-0.010
100%		+50	2500 999 963	-19.7	-0.000 001	-0.008
Batt. Endpoint	3.370	+20	2500 999 962	-20.5	-0.000 001	-0.008



▣ MODE: LTE 41

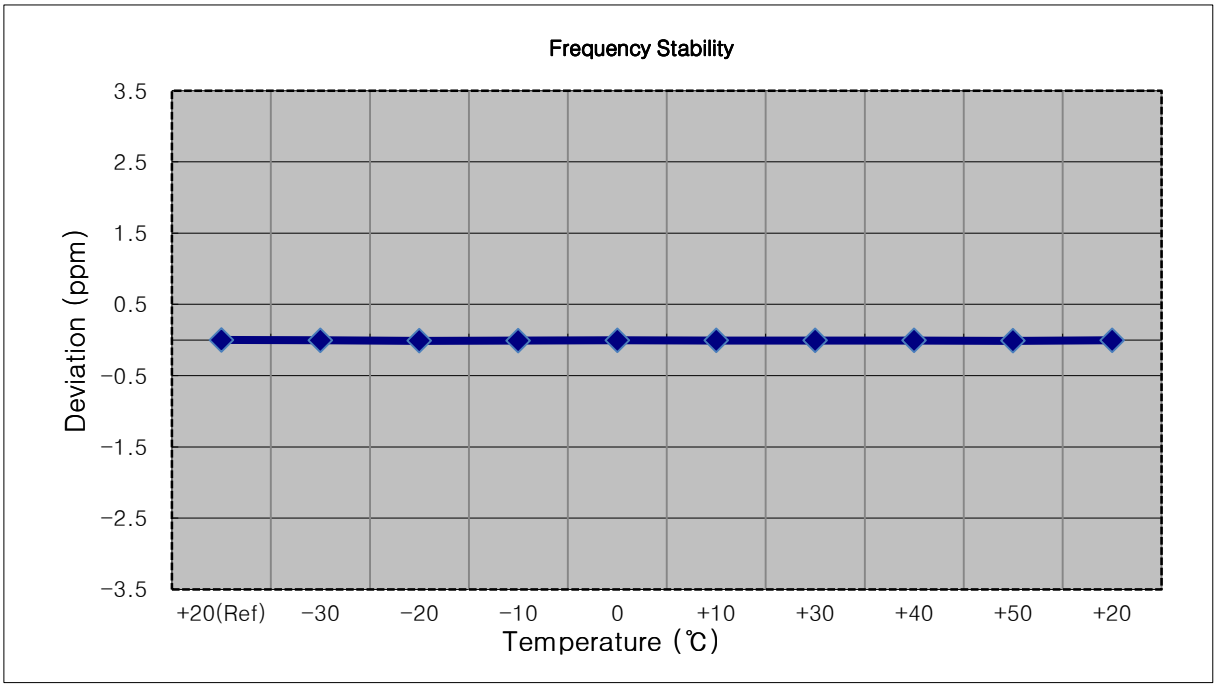
▣ OPERATING FREQUENCY: 2503,500,000 Hz

▣ 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 499 979	0.0	0.000 000	0.000
100%		-30	2503 499 965	-14.3	-0.000 001	-0.006
100%		-20	2503 499 952	-27.3	-0.000 001	-0.011
100%		-10	2503 499 954	-25.1	-0.000 001	-0.010
100%		0	2503 499 967	-12.4	0.000 000	-0.005
100%		+10	2503 499 964	-15.3	-0.000 001	-0.006
100%		+30	2503 499 964	-15.7	-0.000 001	-0.006
100%		+40	2503 499 959	-20.3	-0.000 001	-0.008
100%		+50	2503 499 952	-27.1	-0.000 001	-0.011
Batt. Endpoint	3.370	+20	2503 499 966	-13.5	-0.000 001	-0.005



▣ MODE: LTE 41

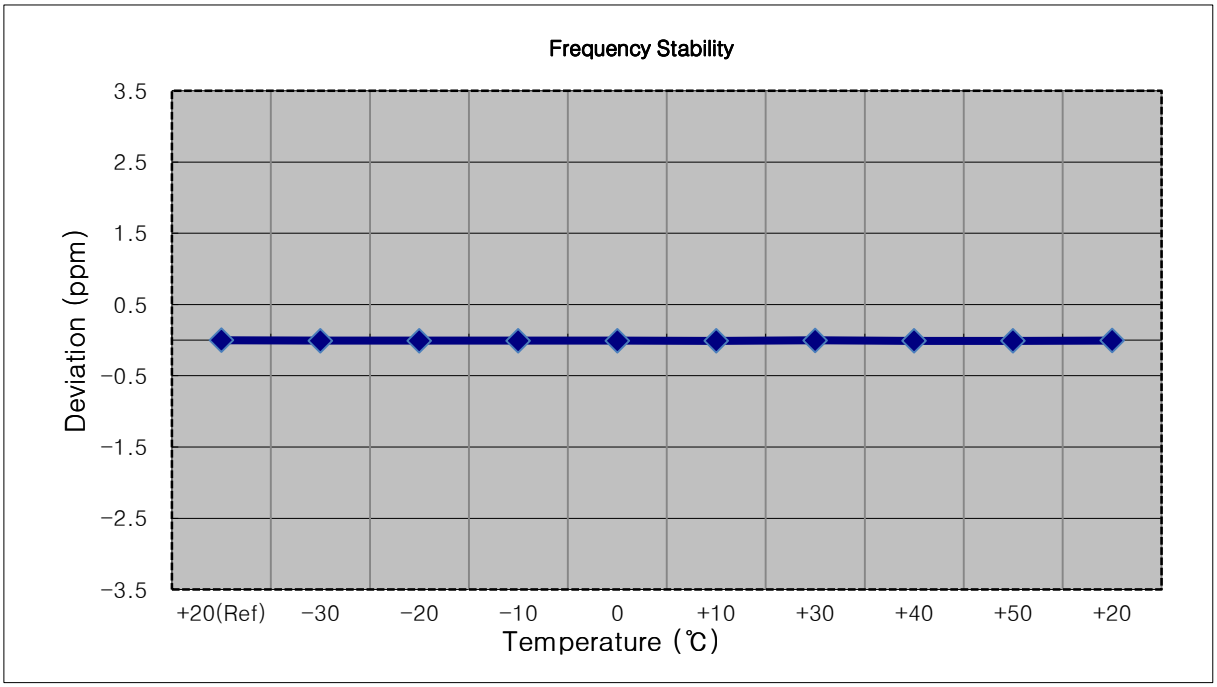
▣ OPERATING FREQUENCY: 2506,000,000 Hz

▣ 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)	2505 999 992	0.0	0.000 000	0.000
100%		-30	2505 999 974	-18.4	-0.000 001	-0.007
100%		-20	2505 999 973	-19.5	-0.000 001	-0.008
100%		-10	2505 999 971	-21.3	-0.000 001	-0.008
100%		0	2505 999 974	-18.2	-0.000 001	-0.007
100%		+10	2505 999 969	-23.0	-0.000 001	-0.009
100%		+30	2505 999 983	-9.0	0.000 000	-0.004
100%		+40	2505 999 967	-25.3	-0.000 001	-0.010
100%		+50	2505 999 969	-23.2	-0.000 001	-0.009
Batt. Endpoint	3.370	+20	2505 999 977	-15.0	-0.000 001	-0.006



▣ MODE: LTE 41

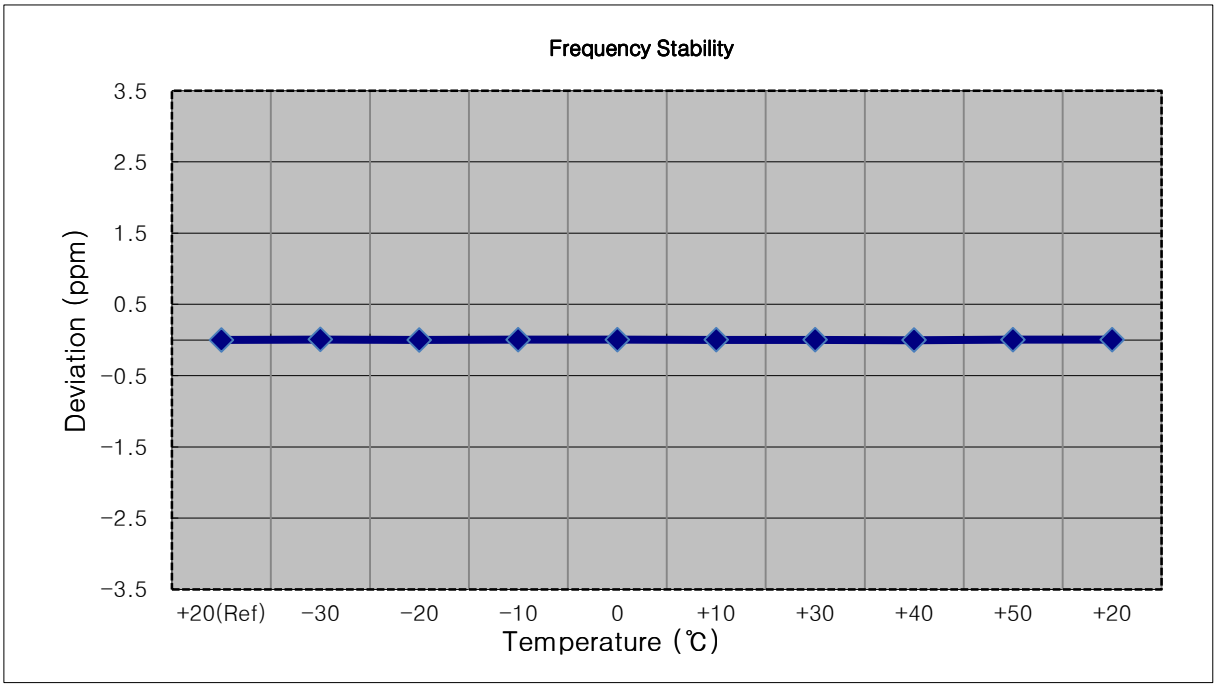
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ 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)	2592 999 995	0.0	0.000 000	0.000
100%		-30	2593 000 009	13.6	0.000 001	0.005
100%		-20	2592 999 993	-2.4	0.000 000	-0.001
100%		-10	2593 000 004	8.8	0.000 000	0.003
100%		0	2593 000 008	12.6	0.000 000	0.005
100%		+10	2592 999 999	3.9	0.000 000	0.002
100%		+30	2592 999 998	2.7	0.000 000	0.001
100%		+40	2592 999 990	-5.2	0.000 000	-0.002
100%		+50	2593 000 004	8.6	0.000 000	0.003
Batt. Endpoint	3.370	+20	2593 000 006	10.6	0.000 000	0.004



▣ MODE: LTE 41

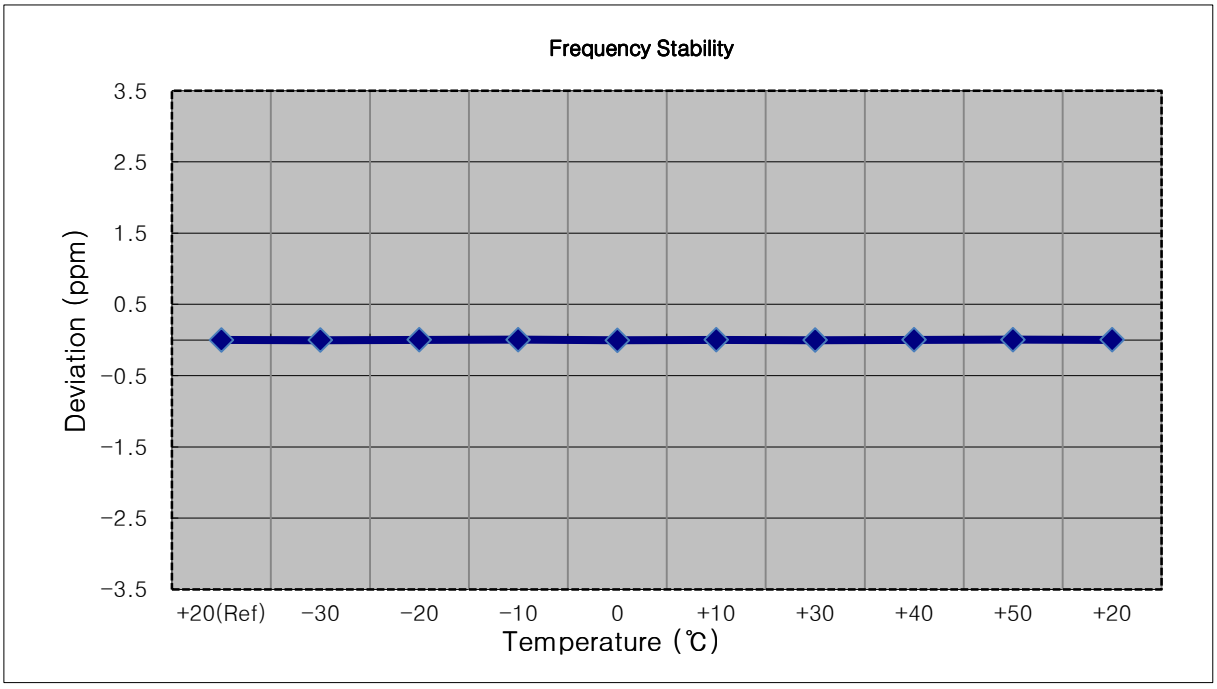
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ 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 000 005	0.0	0.000 000	0.000
100%		-30	2593 000 000	-4.9	0.000 000	-0.002
100%		-20	2593 000 012	7.2	0.000 000	0.003
100%		-10	2593 000 014	9.7	0.000 000	0.004
100%		0	2592 999 992	-12.3	0.000 000	-0.005
100%		+10	2593 000 010	4.8	0.000 000	0.002
100%		+30	2592 999 998	-7.1	0.000 000	-0.003
100%		+40	2593 000 012	7.1	0.000 000	0.003
100%		+50	2593 000 016	11.3	0.000 000	0.004
Batt. Endpoint	3.370	+20	2593 000 009	3.8	0.000 000	0.001



▣ MODE: LTE 41

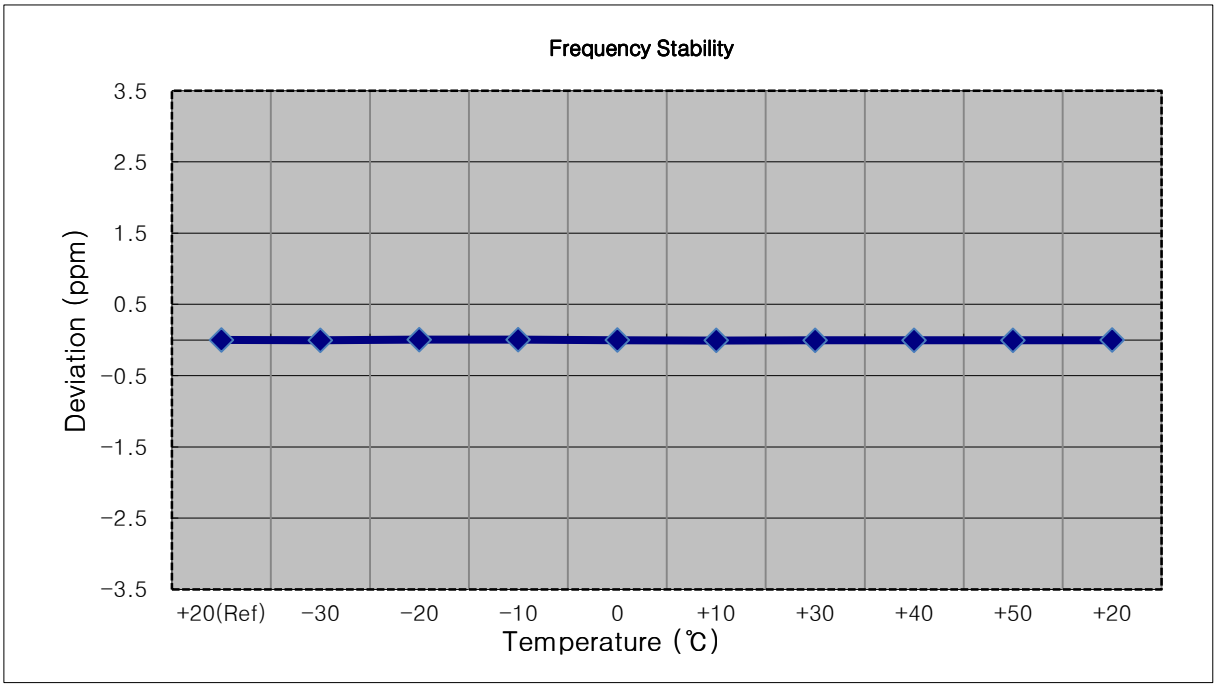
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ 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 000 005	0.0	0.000 000	0.000
100%		-30	2592 999 995	-10.2	0.000 000	-0.004
100%		-20	2593 000 014	9.1	0.000 000	0.004
100%		-10	2593 000 013	8.5	0.000 000	0.003
100%		0	2592 999 997	-7.9	0.000 000	-0.003
100%		+10	2592 999 989	-16.0	-0.000 001	-0.006
100%		+30	2592 999 993	-12.4	0.000 000	-0.005
100%		+40	2592 999 993	-12.3	0.000 000	-0.005
100%		+50	2592 999 995	-10.3	0.000 000	-0.004
Batt. Endpoint	3.370	+20	2592 999 999	-6.4	0.000 000	-0.002



▣ MODE: LTE 41

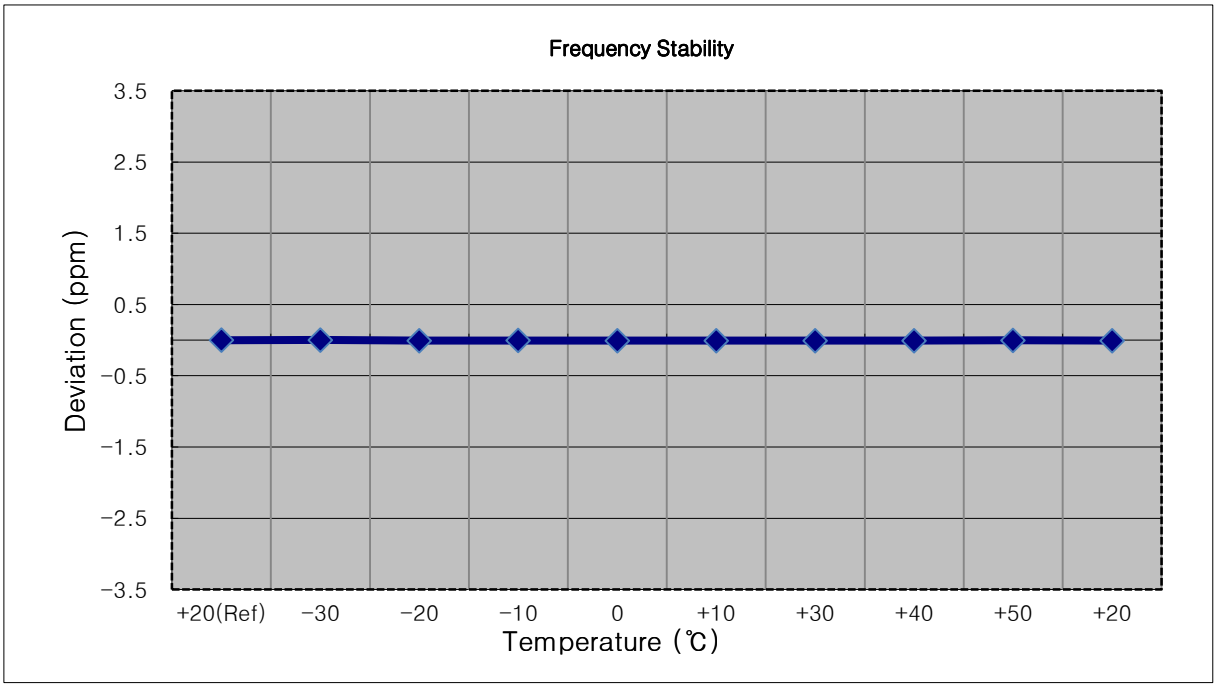
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ 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)	2592 999 991	0.0	0.000 000	0.000
100%		-30	2592 999 996	4.9	0.000 000	0.002
100%		-20	2592 999 973	-18.7	-0.000 001	-0.007
100%		-10	2592 999 978	-13.5	-0.000 001	-0.005
100%		0	2592 999 973	-18.3	-0.000 001	-0.007
100%		+10	2592 999 975	-16.9	-0.000 001	-0.007
100%		+30	2592 999 970	-21.5	-0.000 001	-0.008
100%		+40	2592 999 972	-19.2	-0.000 001	-0.007
100%		+50	2592 999 986	-5.9	0.000 000	-0.002
Batt. Endpoint	3.370	+20	2592 999 975	-16.6	-0.000 001	-0.006



▣ MODE: LTE 41

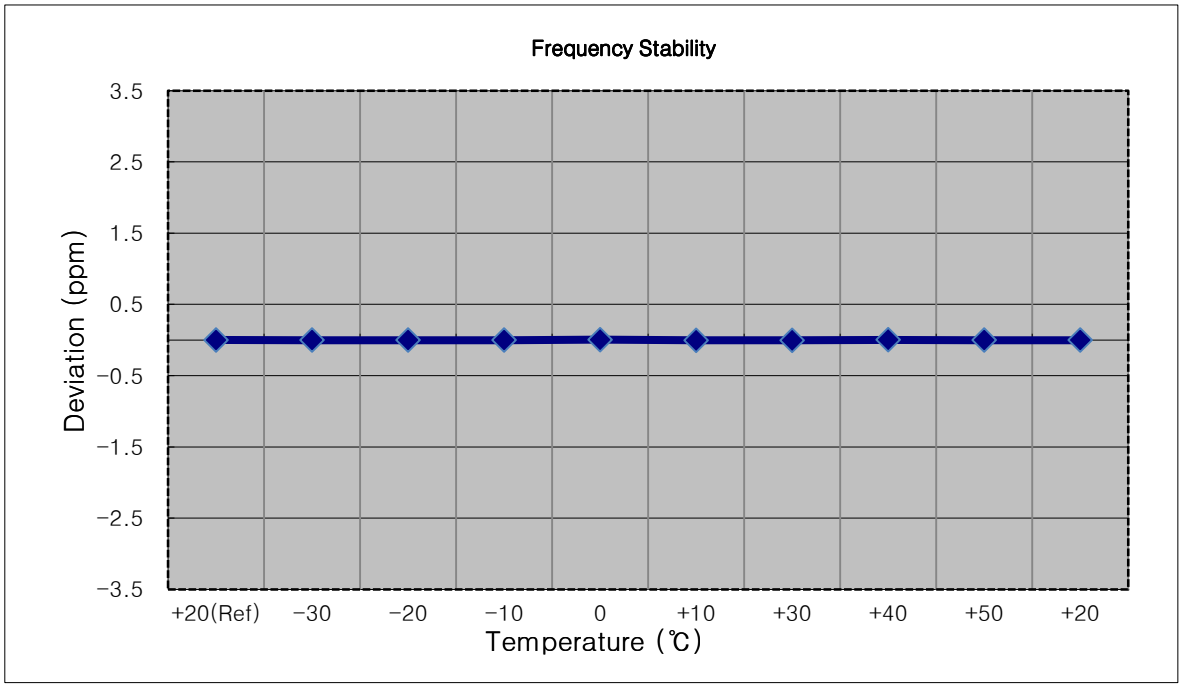
▣ OPERATING FREQUENCY: 2687,500,000 Hz

▣ 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 500 009	0.0	0.000 000	0.000
100%		-30	2687 500 000	-8.9	0.000 000	-0.003
100%		-20	2687 500 002	-6.7	0.000 000	-0.002
100%		-10	2687 500 002	-7.2	0.000 000	-0.003
100%		0	2687 500 017	8.2	0.000 000	0.003
100%		+10	2687 499 995	-14.4	-0.000 001	-0.005
100%		+30	2687 499 998	-11.4	0.000 000	-0.004
100%		+40	2687 500 014	5.2	0.000 000	0.002
100%		+50	2687 500 004	-5.5	0.000 000	-0.002
Batt. Endpoint	3.370	+20	2687 500 002	-7.3	0.000 000	-0.003



▣ MODE: LTE 41

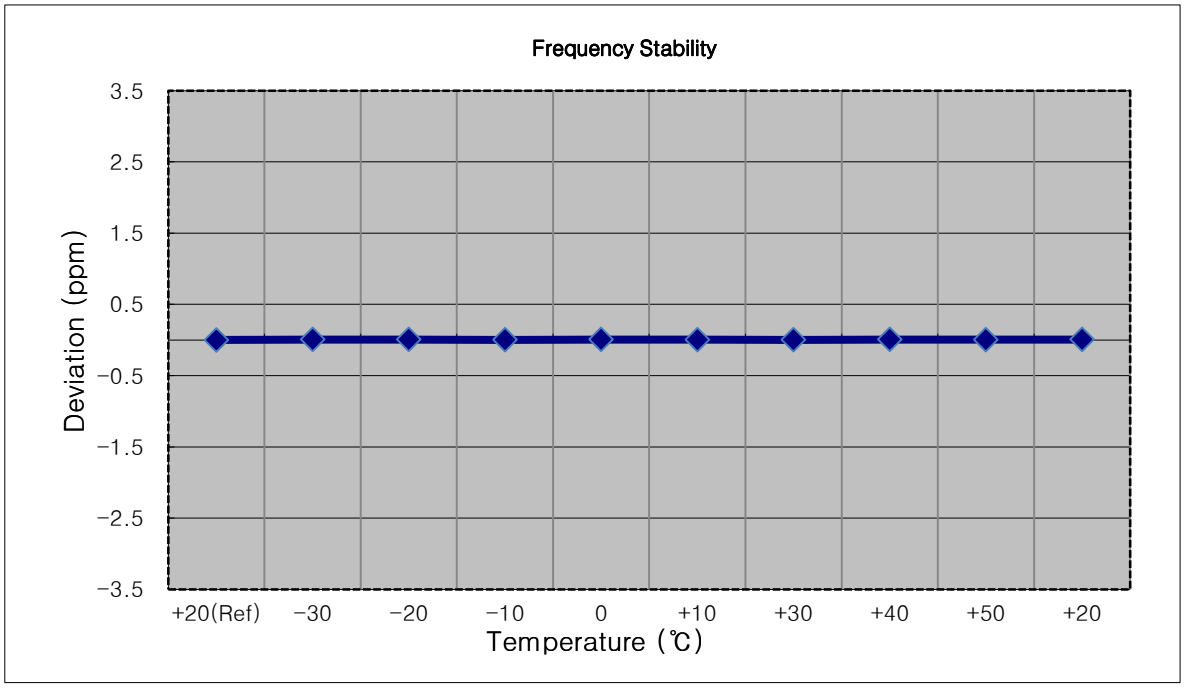
▣ OPERATING FREQUENCY: 2685,000,000 Hz

▣ 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 000 015	0.0	0.000 000	0.000
100%		-30	2685 000 030	14.9	0.000 001	0.006
100%		-20	2685 000 030	15.3	0.000 001	0.006
100%		-10	2685 000 021	6.6	0.000 000	0.002
100%		0	2685 000 030	15.1	0.000 001	0.006
100%		+10	2685 000 027	12.4	0.000 000	0.005
100%		+30	2685 000 020	5.6	0.000 000	0.002
100%		+40	2685 000 032	17.0	0.000 001	0.006
100%		+50	2685 000 029	13.9	0.000 001	0.005
Batt. Endpoint	3.370	+20	2685 000 029	14.7	0.000 001	0.005



▣ MODE: LTE 41

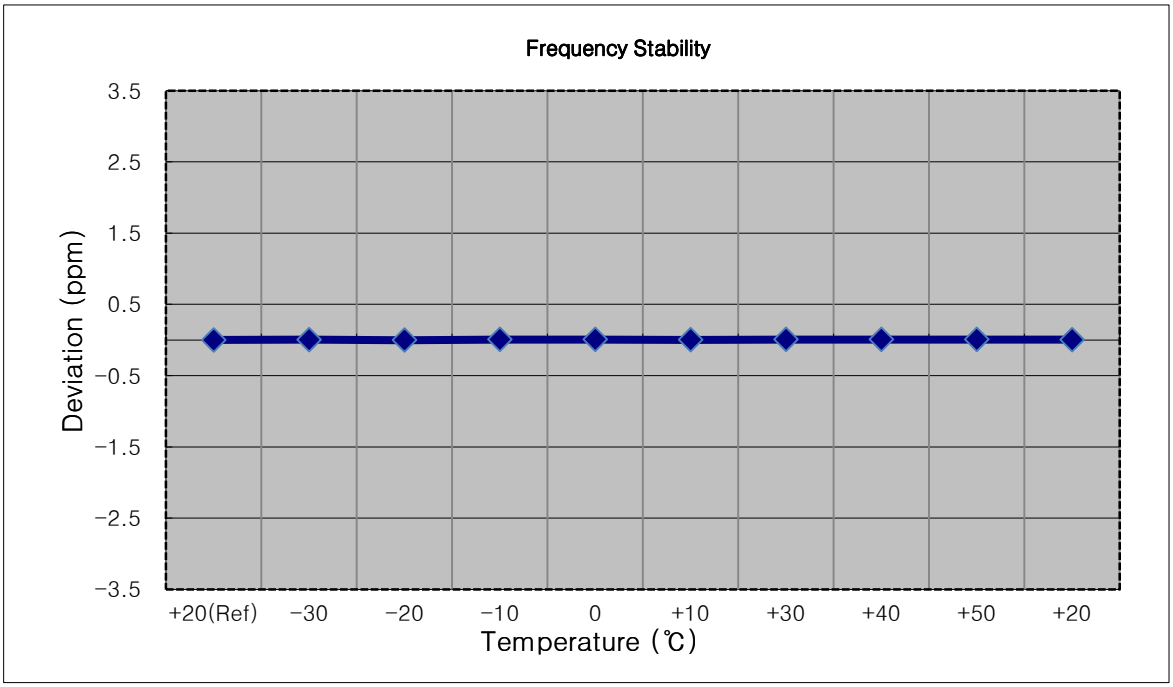
▣ OPERATING FREQUENCY: 2682,500,000 Hz

▣ 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 500 018	0.0	0.000 000	0.000
100%		-30	2682 500 029	11.2	0.000 000	0.004
100%		-20	2682 500 011	-6.8	0.000 000	-0.003
100%		-10	2682 500 037	19.1	0.000 001	0.007
100%		0	2682 500 033	15.4	0.000 001	0.006
100%		+10	2682 500 025	7.3	0.000 000	0.003
100%		+30	2682 500 033	14.7	0.000 001	0.005
100%		+40	2682 500 034	16.0	0.000 001	0.006
100%		+50	2682 500 035	17.4	0.000 001	0.006
Batt. Endpoint	3.370	+20	2682 500 031	12.7	0.000 000	0.005



▣ MODE: LTE 41

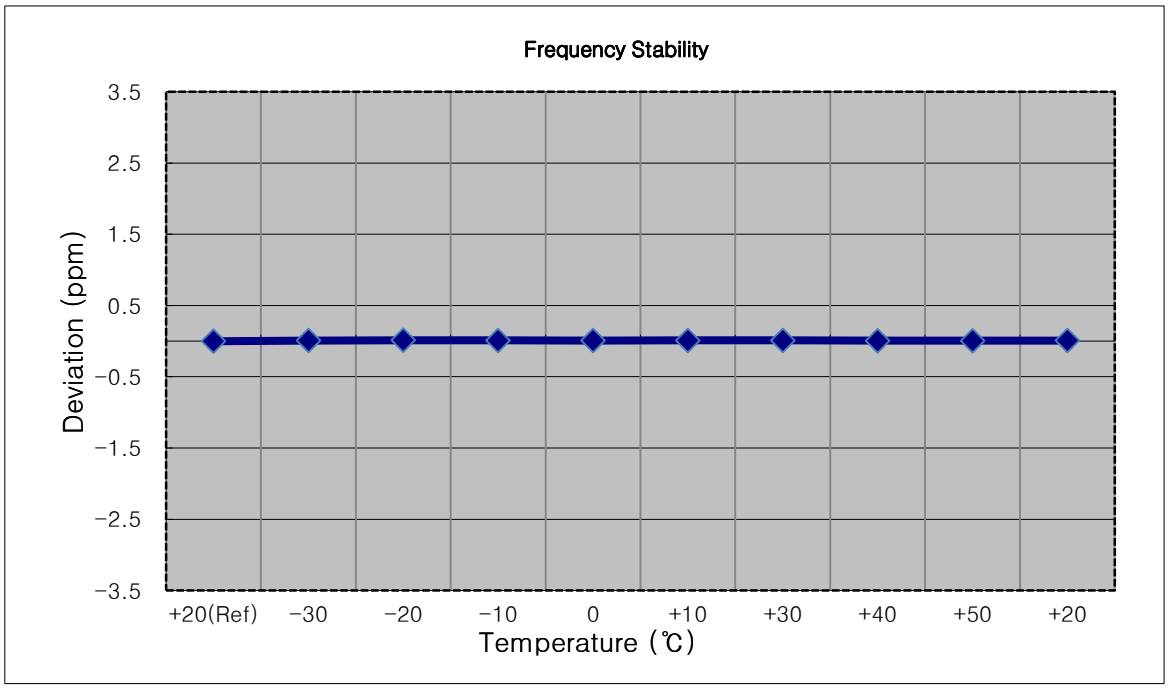
▣ OPERATING FREQUENCY: 2680,000,000 Hz

▣ 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 000 032	0.0	0.000 000	0.000
100%		-30	2680 000 055	22.9	0.000 001	0.009
100%		-20	2680 000 065	33.6	0.000 001	0.013
100%		-10	2680 000 058	26.6	0.000 001	0.010
100%		0	2680 000 056	23.8	0.000 001	0.009
100%		+10	2680 000 062	29.9	0.000 001	0.011
100%		+30	2680 000 059	27.6	0.000 001	0.010
100%		+40	2680 000 051	18.8	0.000 001	0.007
100%		+50	2680 000 049	17.1	0.000 001	0.006
Batt. Endpoint	3.370	+20	2680 000 053	21.3	0.000 001	0.008



8.8 GEO-LOCATION MECHANISM

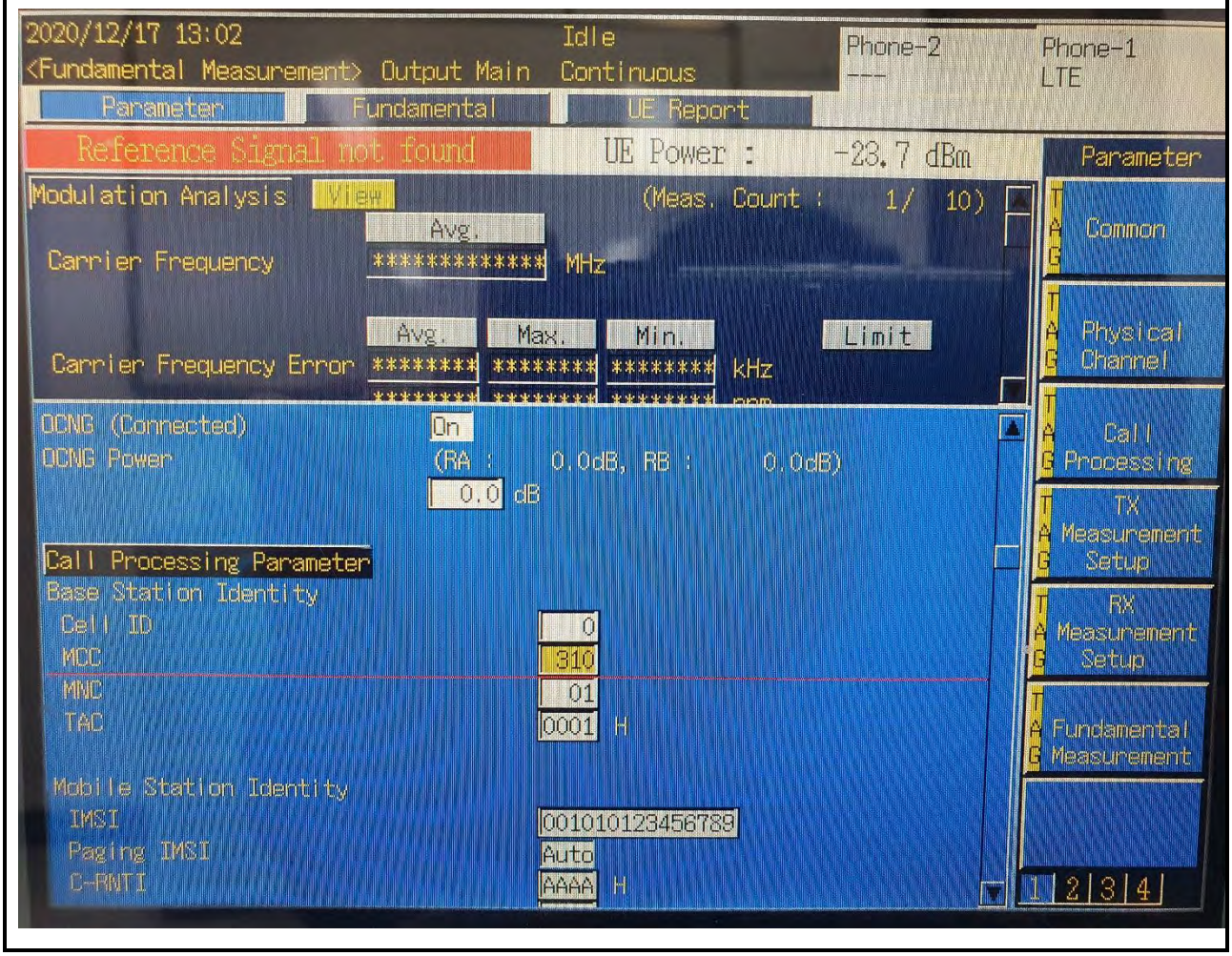
The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

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, US)

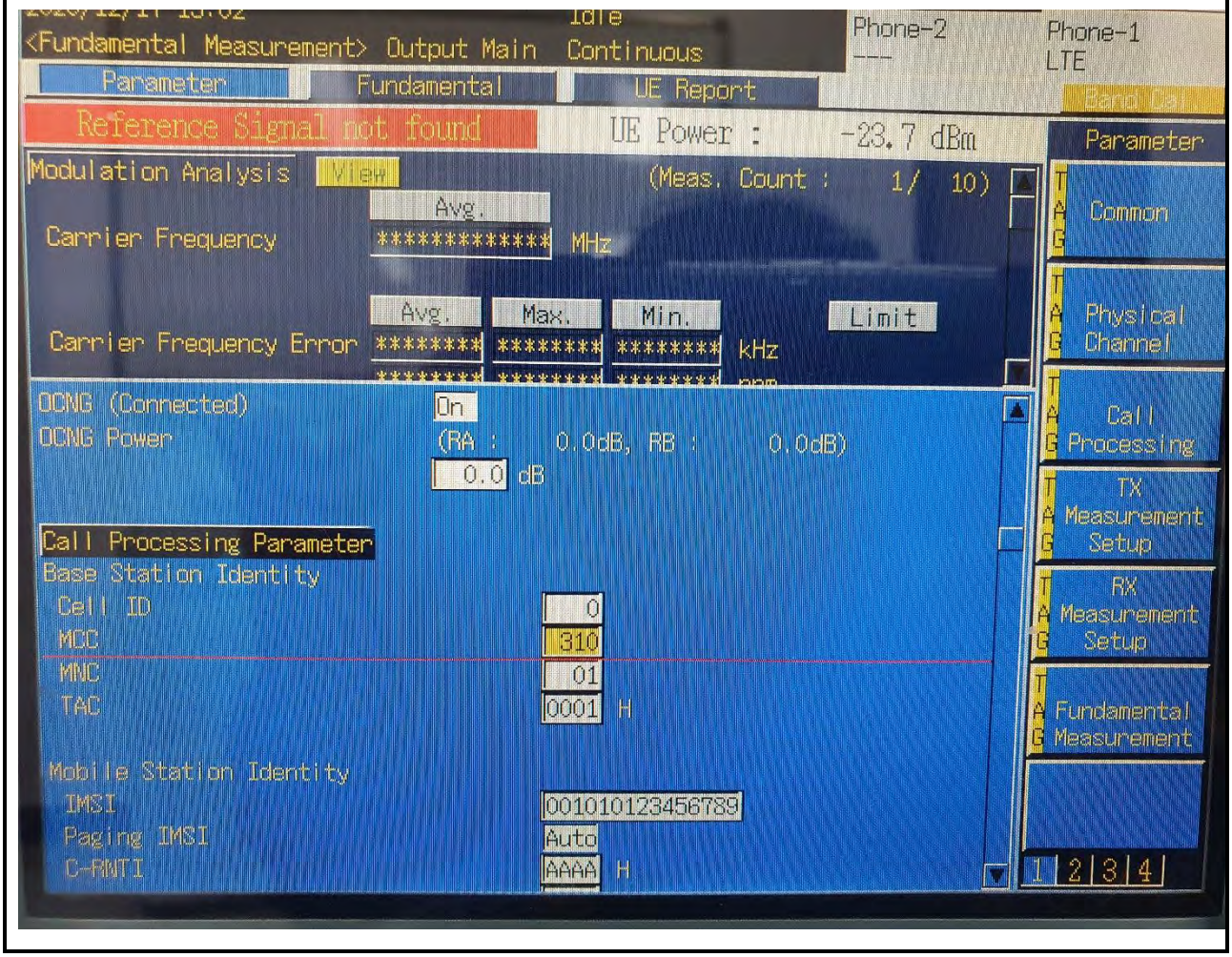
The verification tests confirmed the operational of the geo-location mechanism.

Verification test

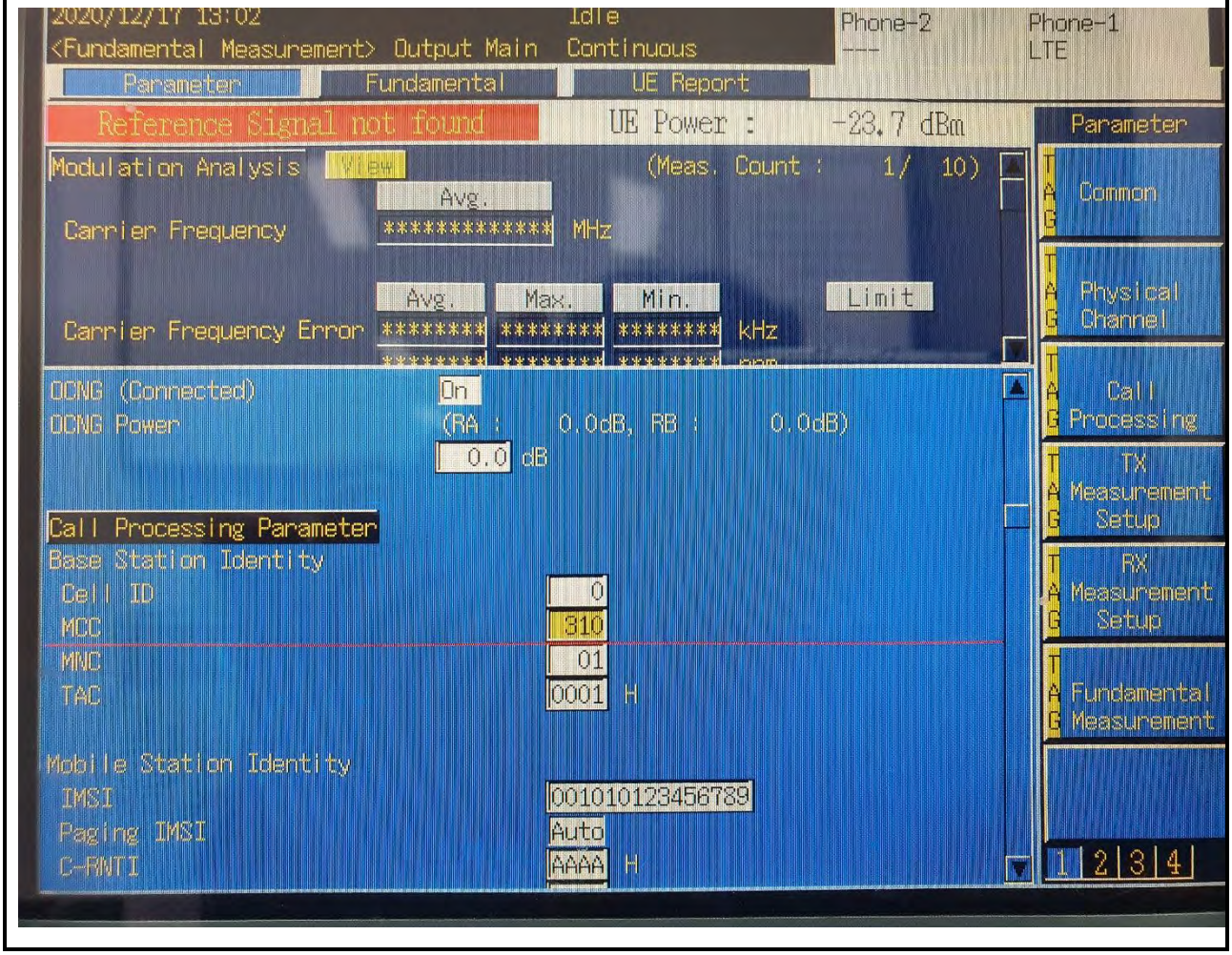
Did not connect (LTE B7) (MCC = US)


Did not connect (LTE B38)

(MCC = US)

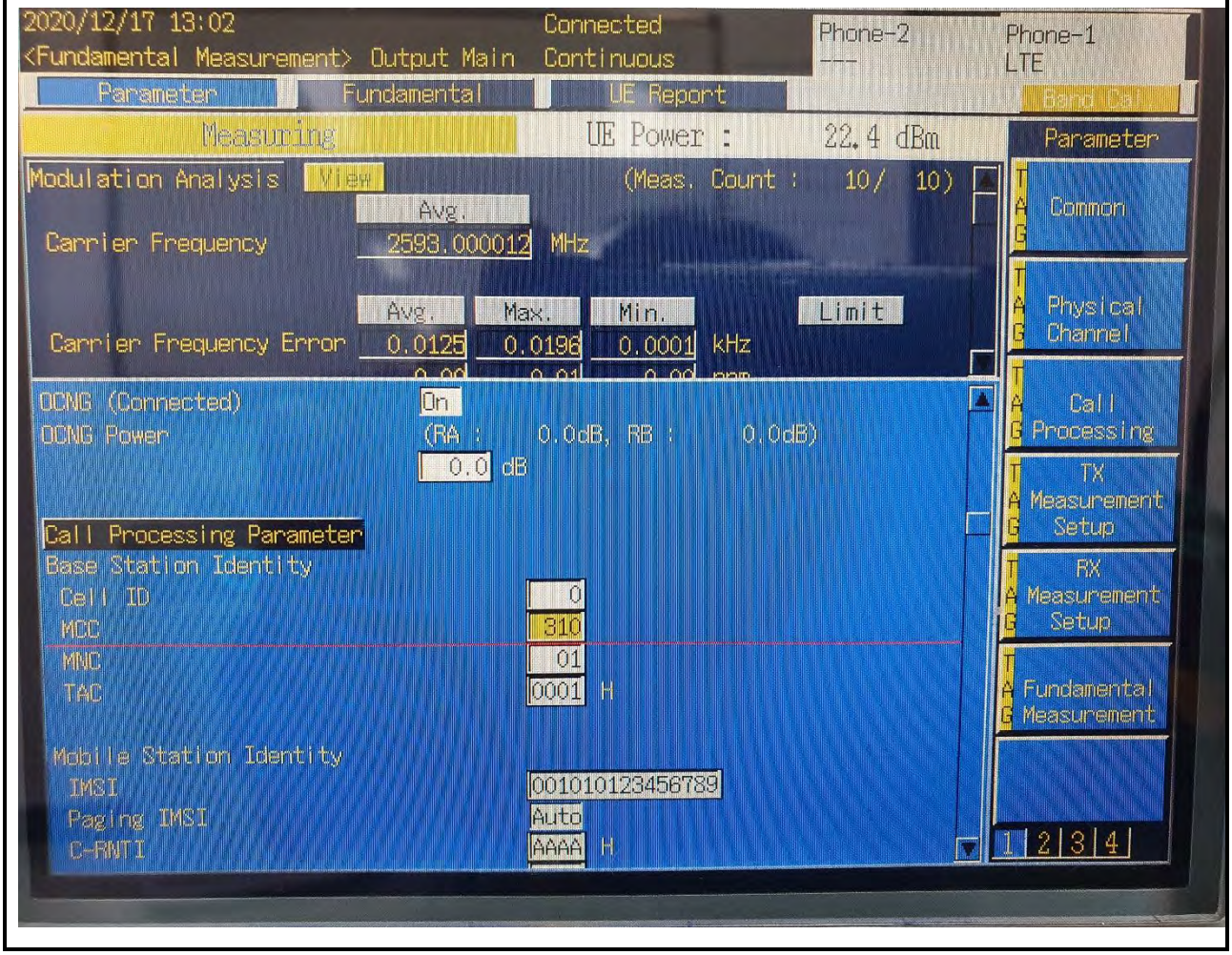


Did not connect (LTE B40) (MCC = US)



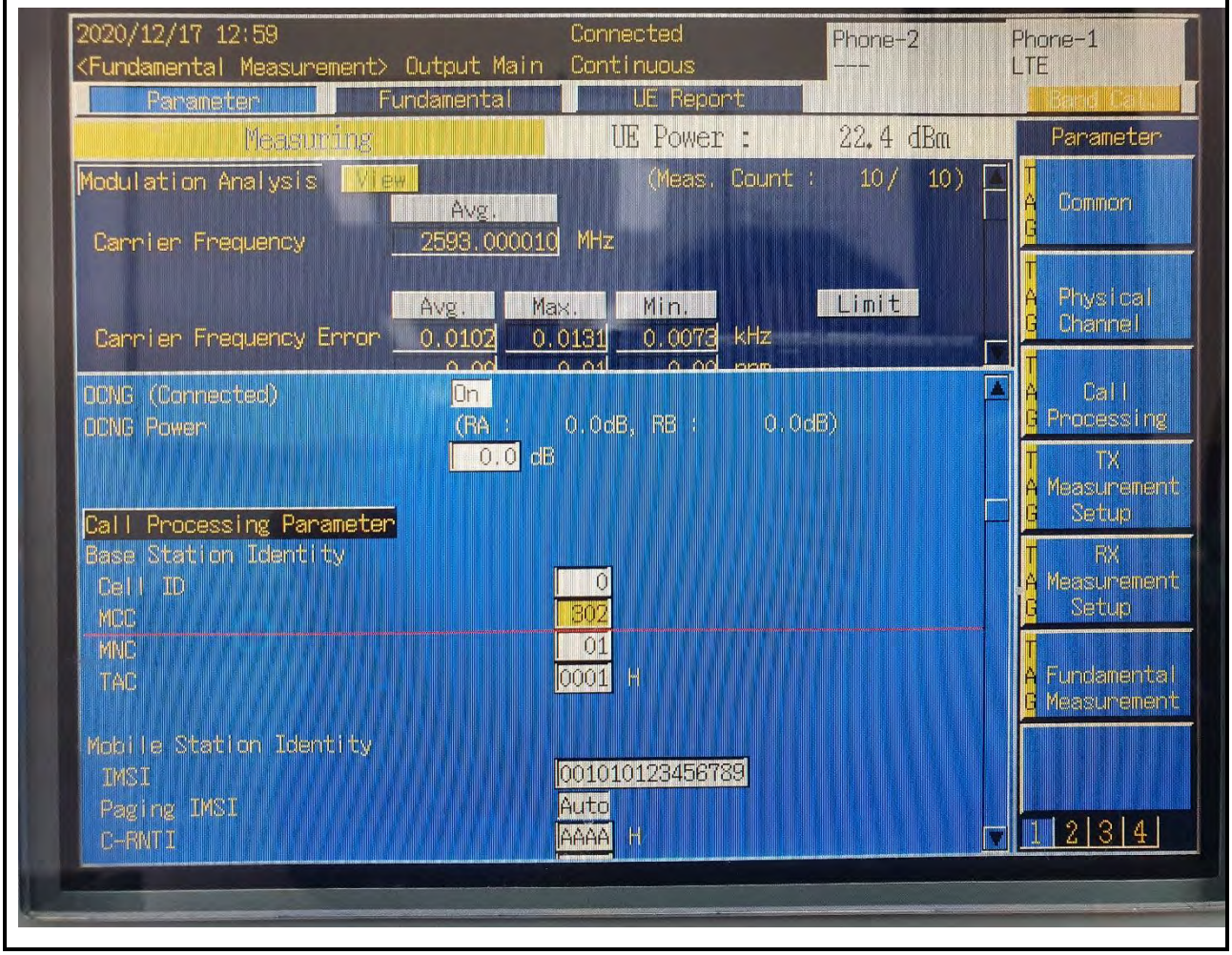
Connected(LTE B41)

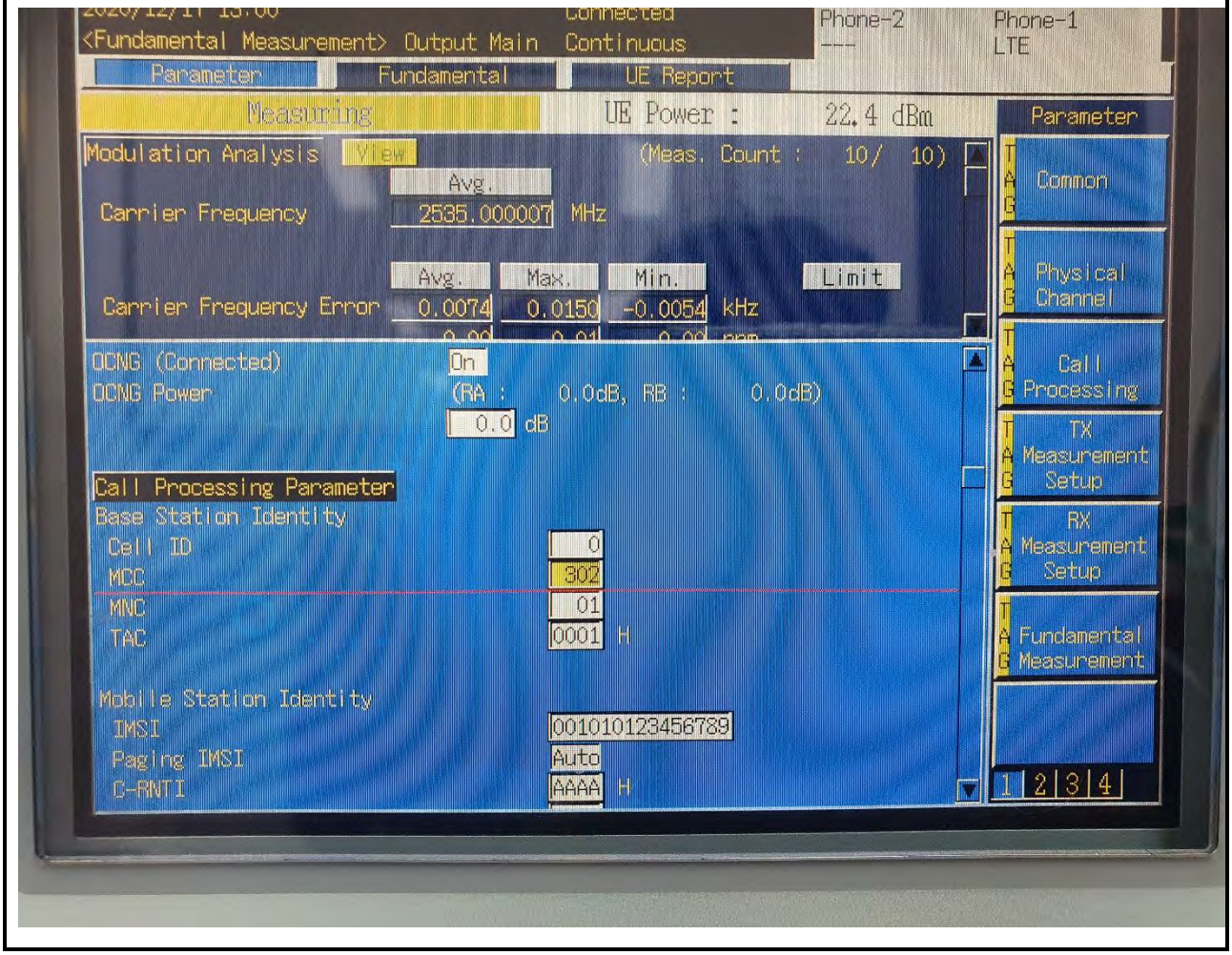
(MCC = US)



Connected(LTE B41)

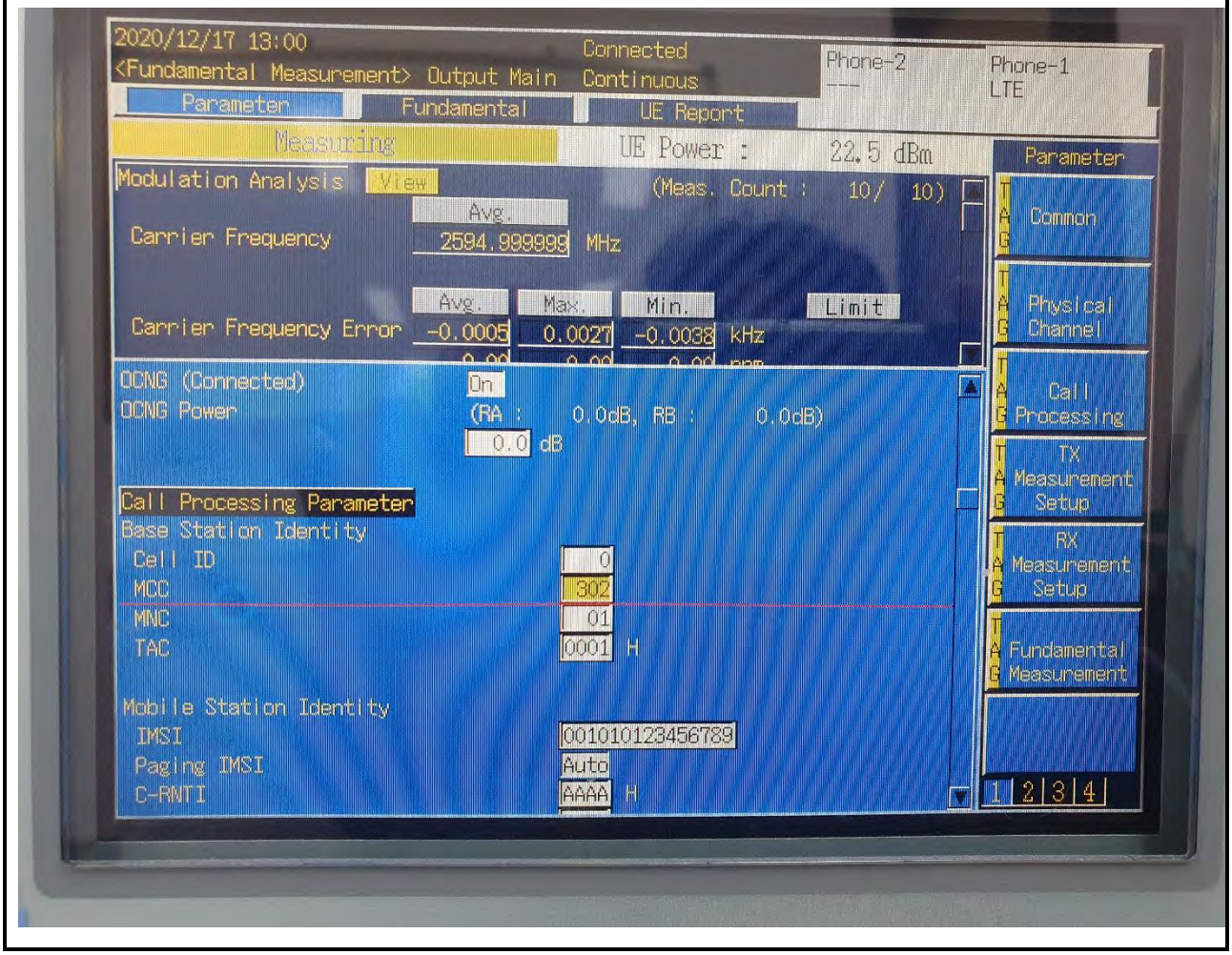
(MCC = Canada)

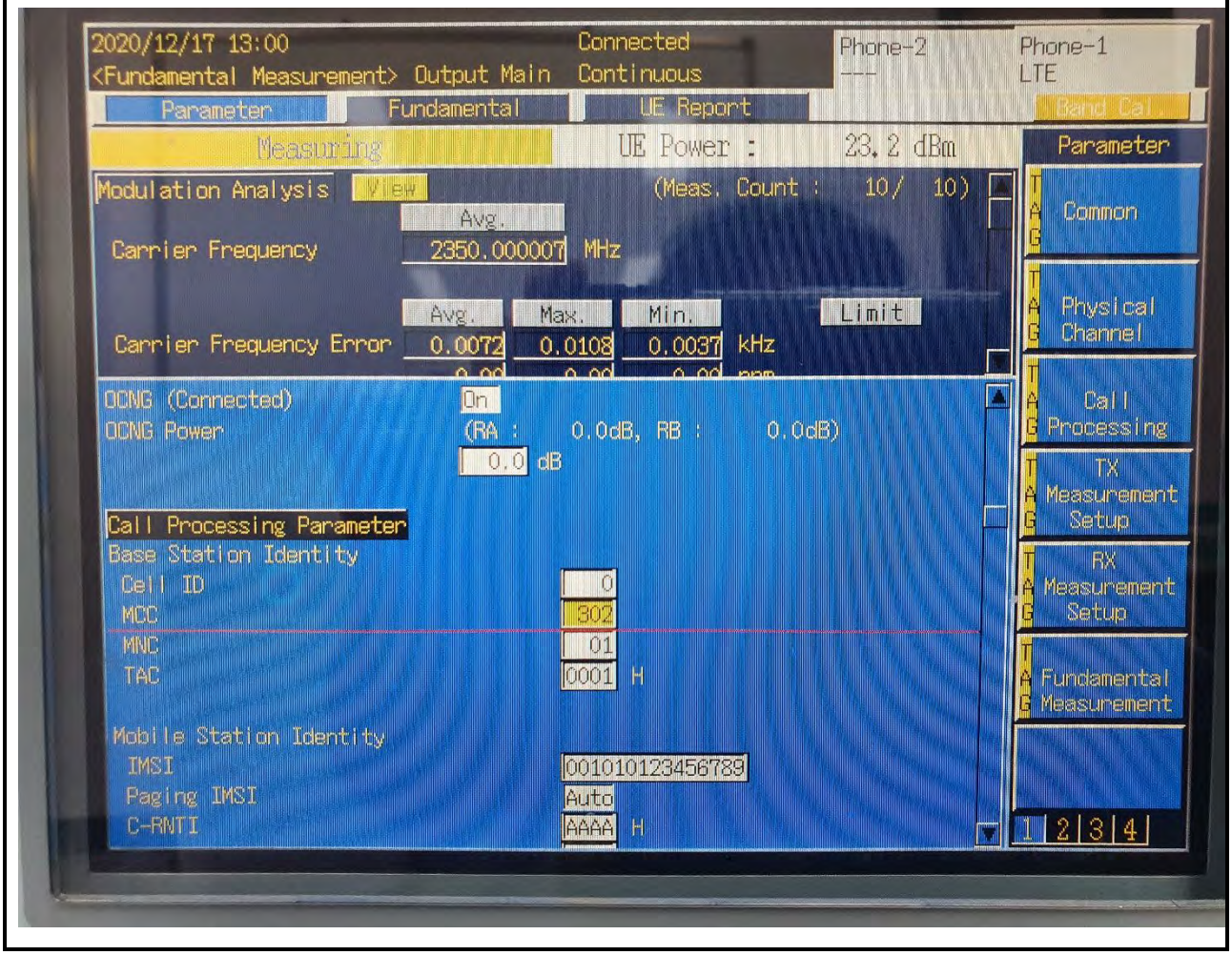


Connected (LTE B7) (MCC = Canada)


Connected (LTE B38)

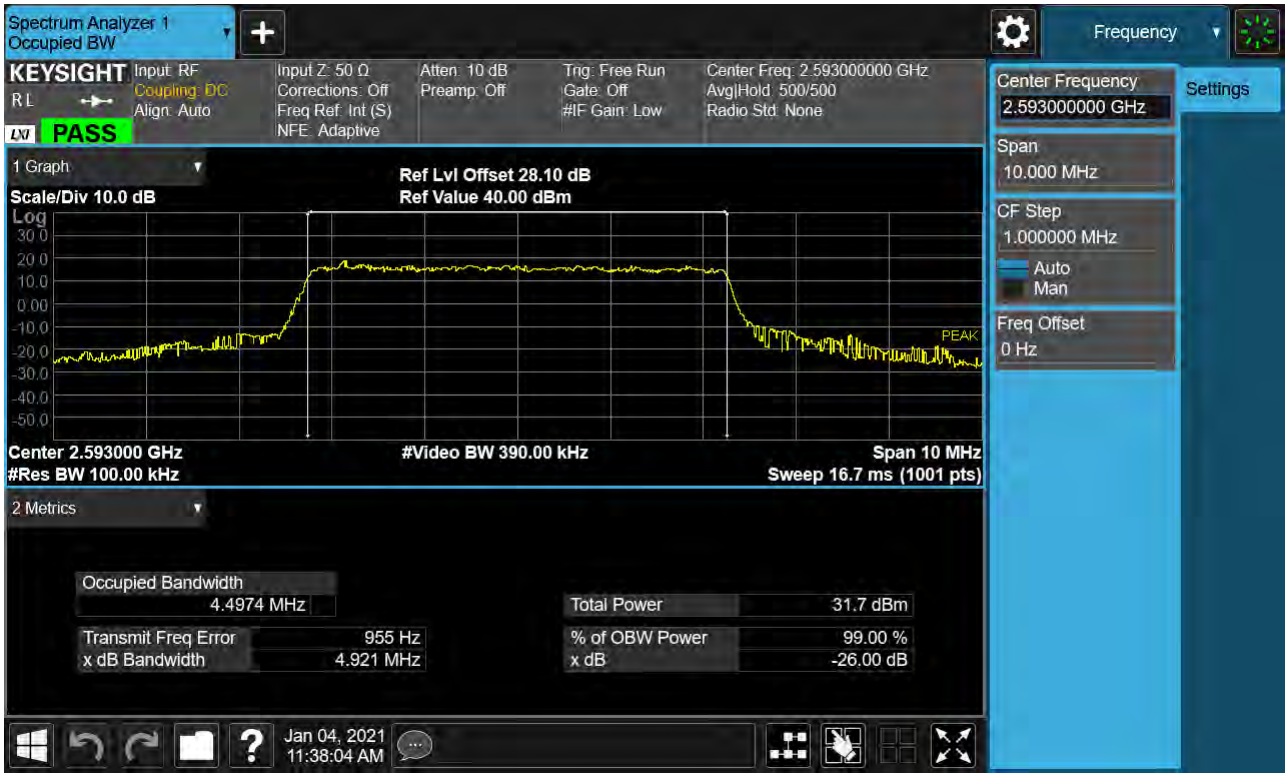
(MCC = Canada)



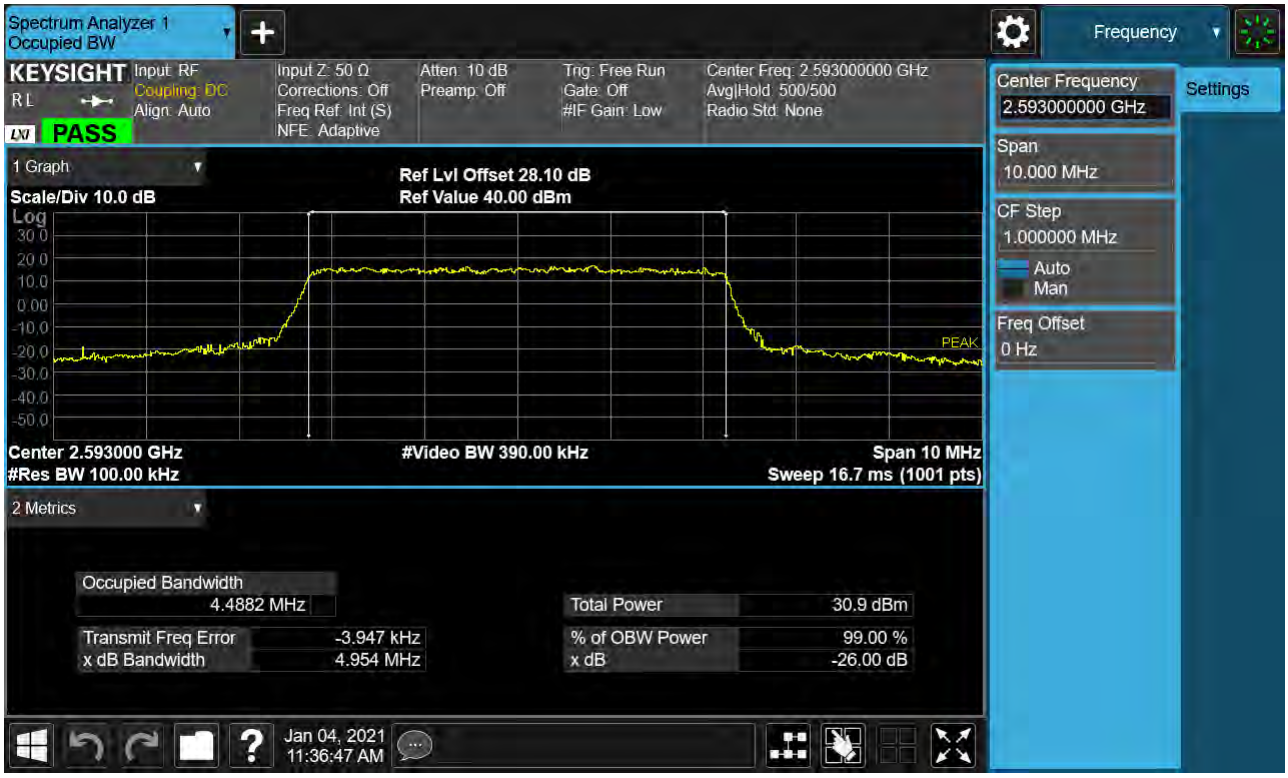
Connected (LTE B40) (MCC = Canada)


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)

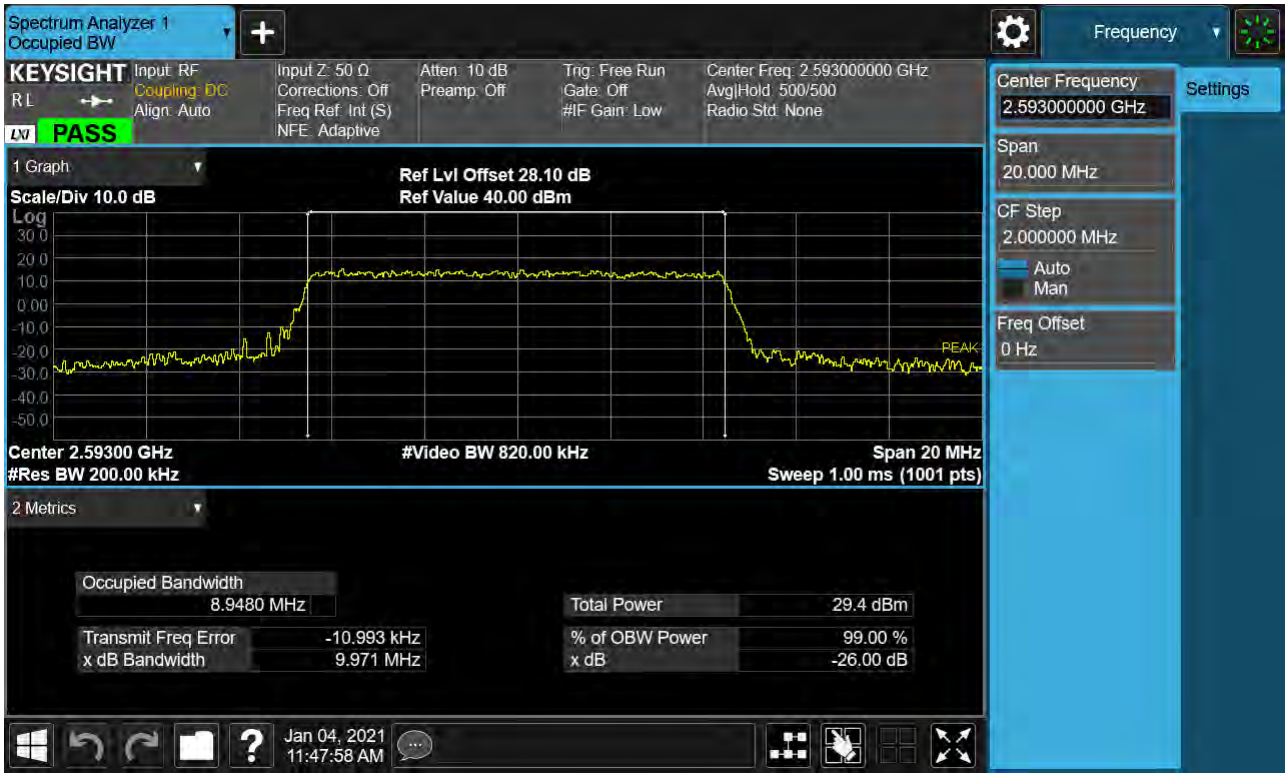


BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 64-QAM RB 25)

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 (10 MHz Ch.40620 64-QAM RB 50)



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

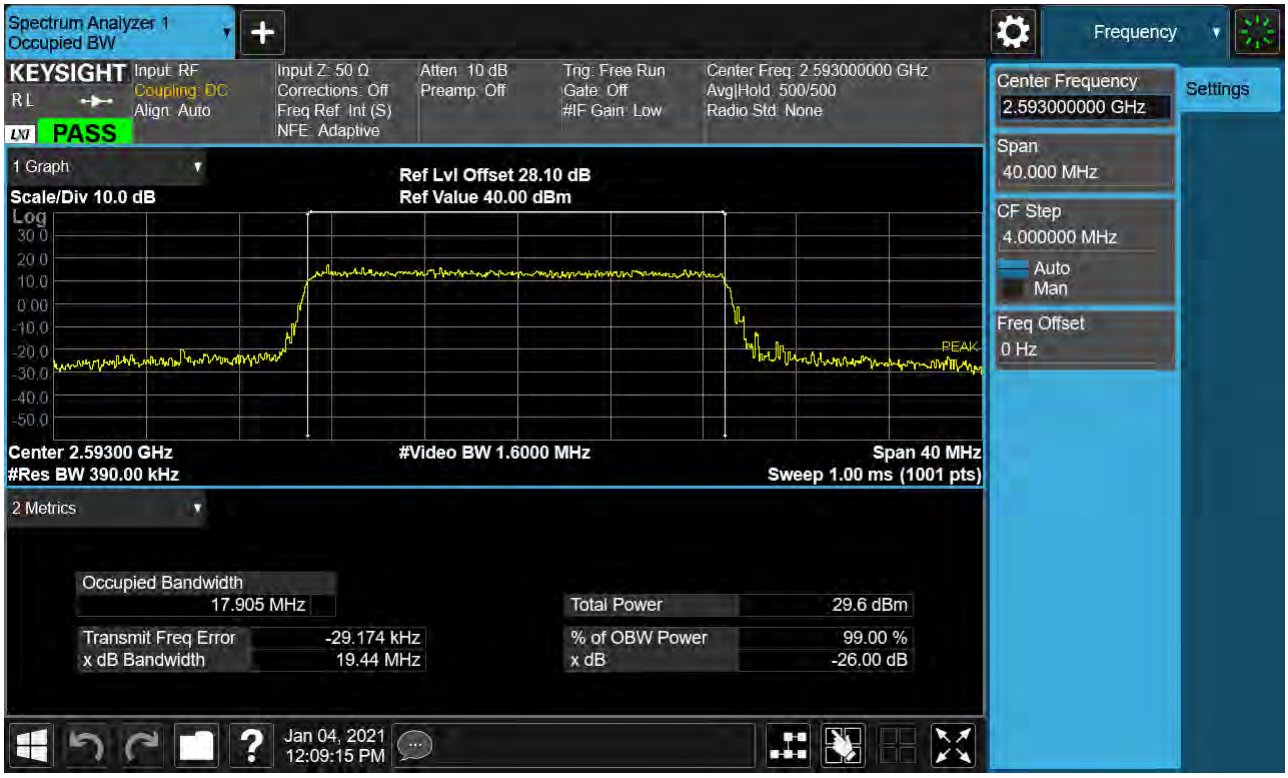
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)

BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 64-QAM RB 75)

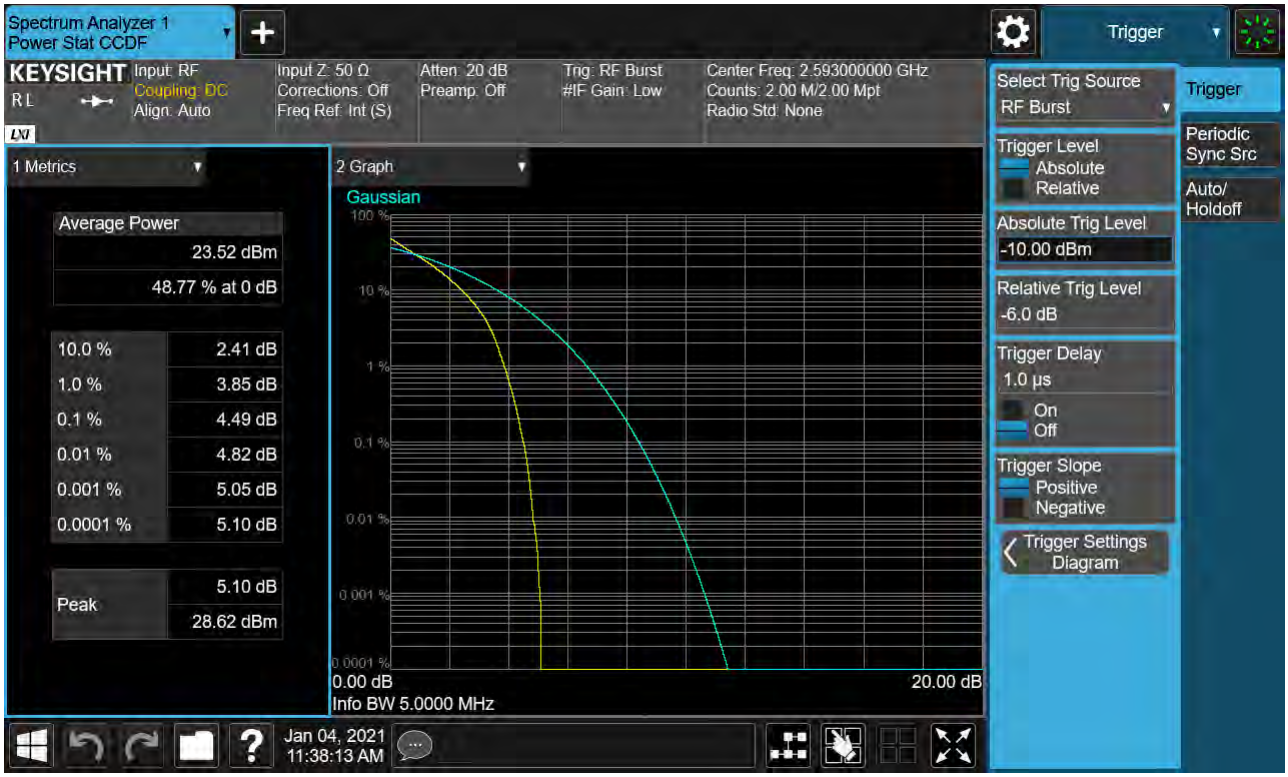
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)

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

BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 64-QAM RB 100)



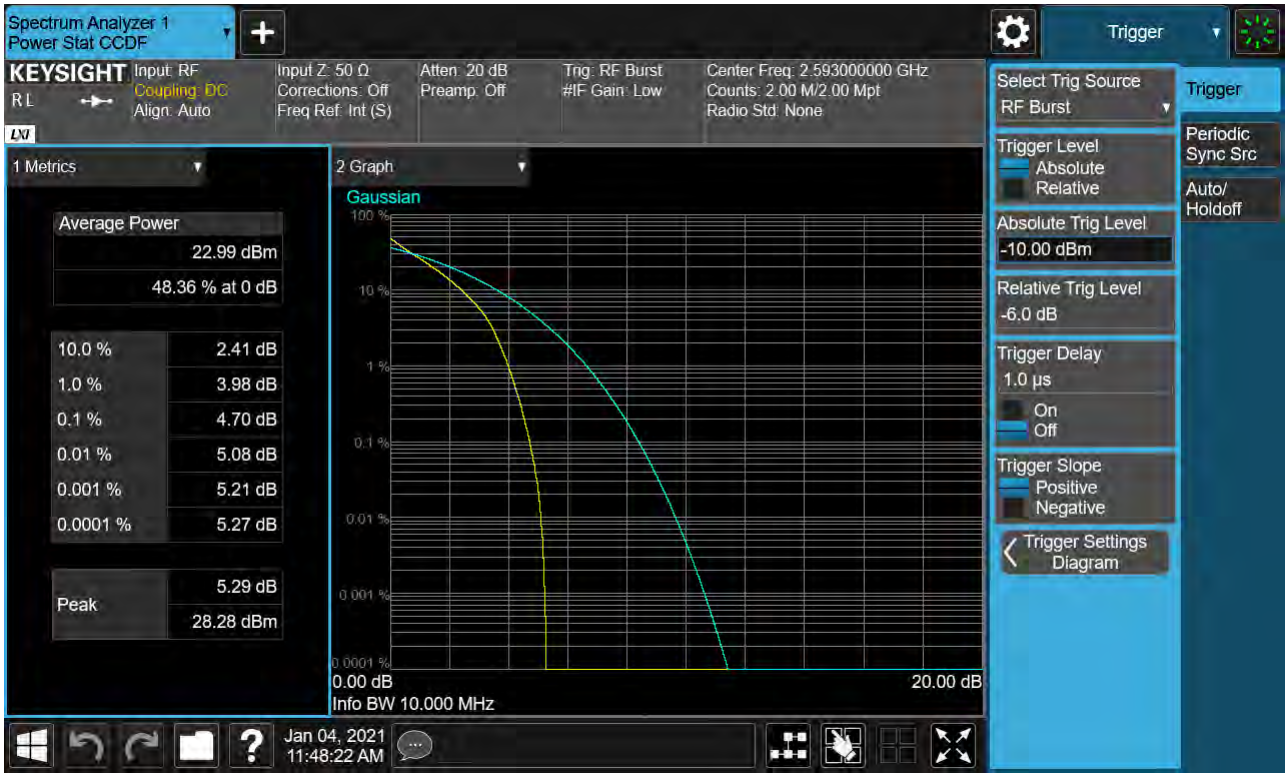
BAND 41. PAR Plot (5M BW_Ch.40620_QPSK_RB25_0)



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

BAND 41. PAR Plot (5M BW_Ch.40620_64QAM_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 (10M BW_Ch.40620_64QAM_RB50_0)

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

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

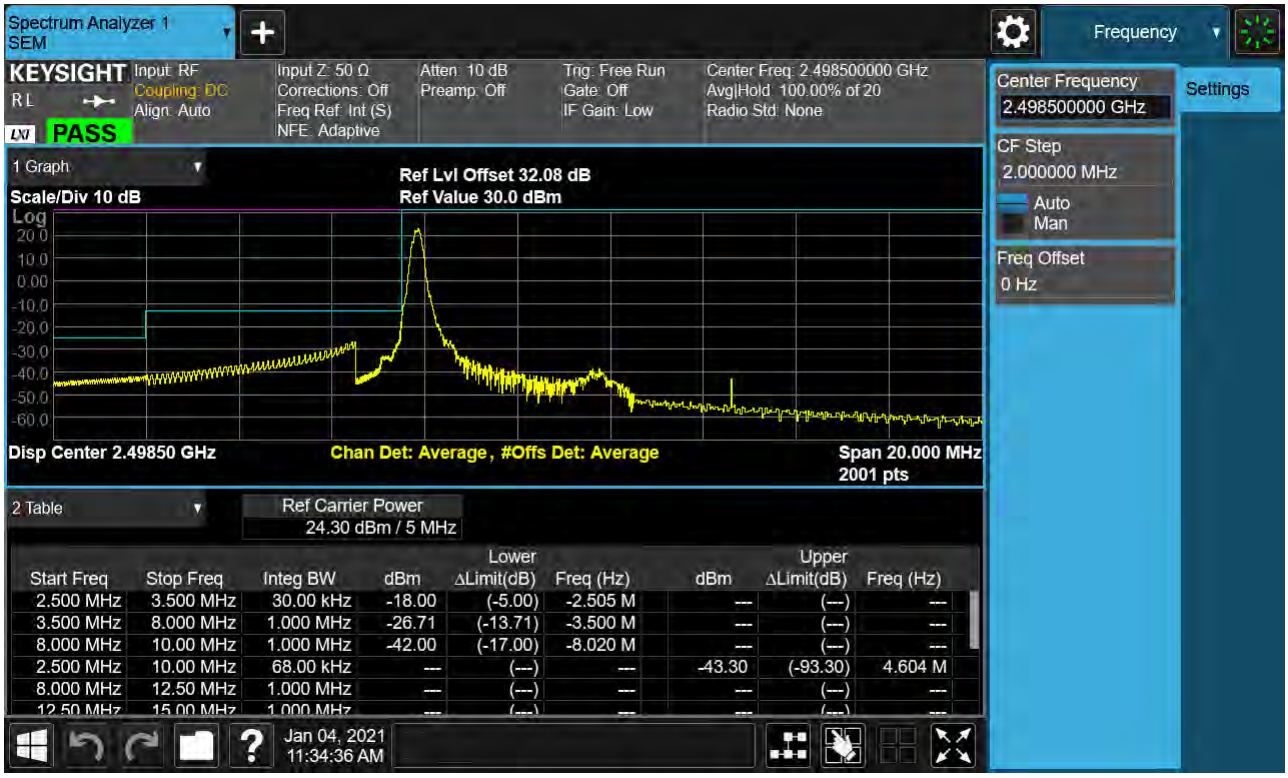
BAND 41. PAR Plot (15M BW_Ch.40620_64QAM_RB75_0)

BAND 41. PAR Plot (20M BW_Ch.40620_QPSK_RB100_0)

BAND 41. PAR Plot (20M BW_Ch.40620_16QAM_RB100_0)

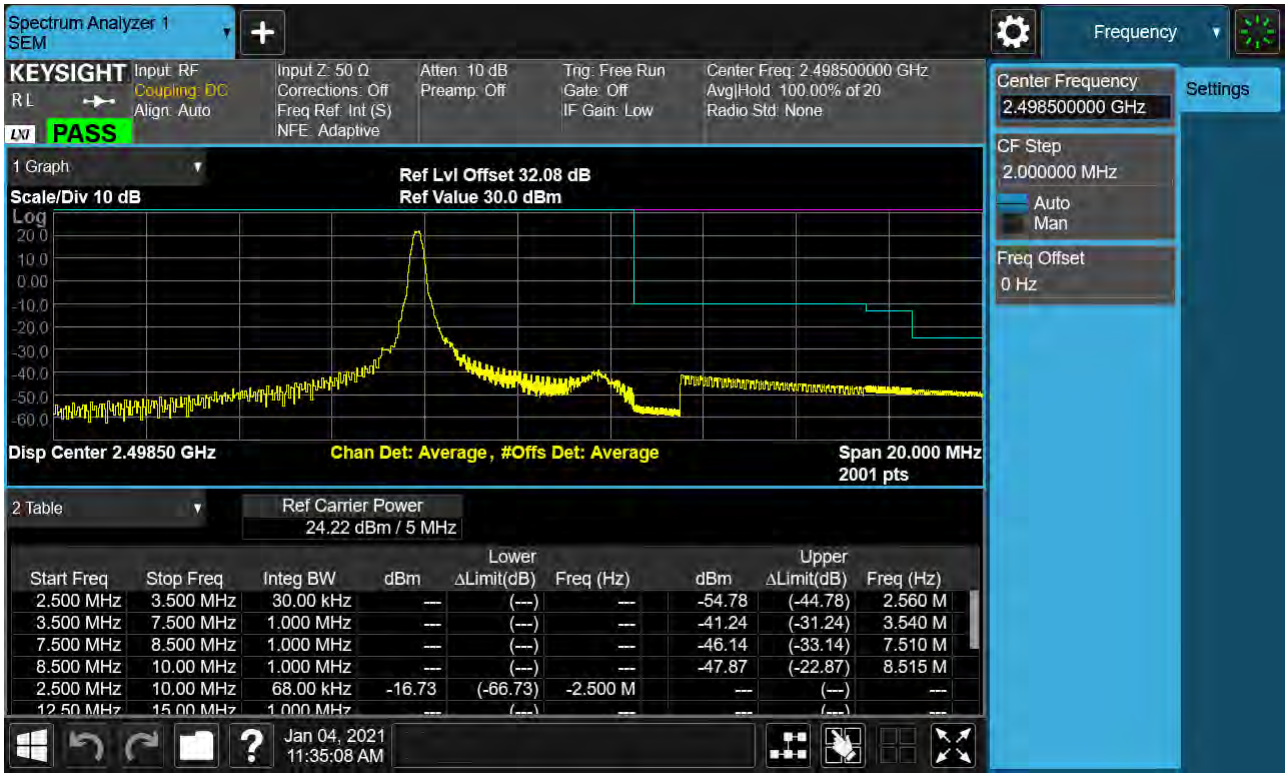
BAND 41. PAR Plot (20M BW_Ch.40620_64QAM_RB100_0)

BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-1



BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 25, Offset 0)-1

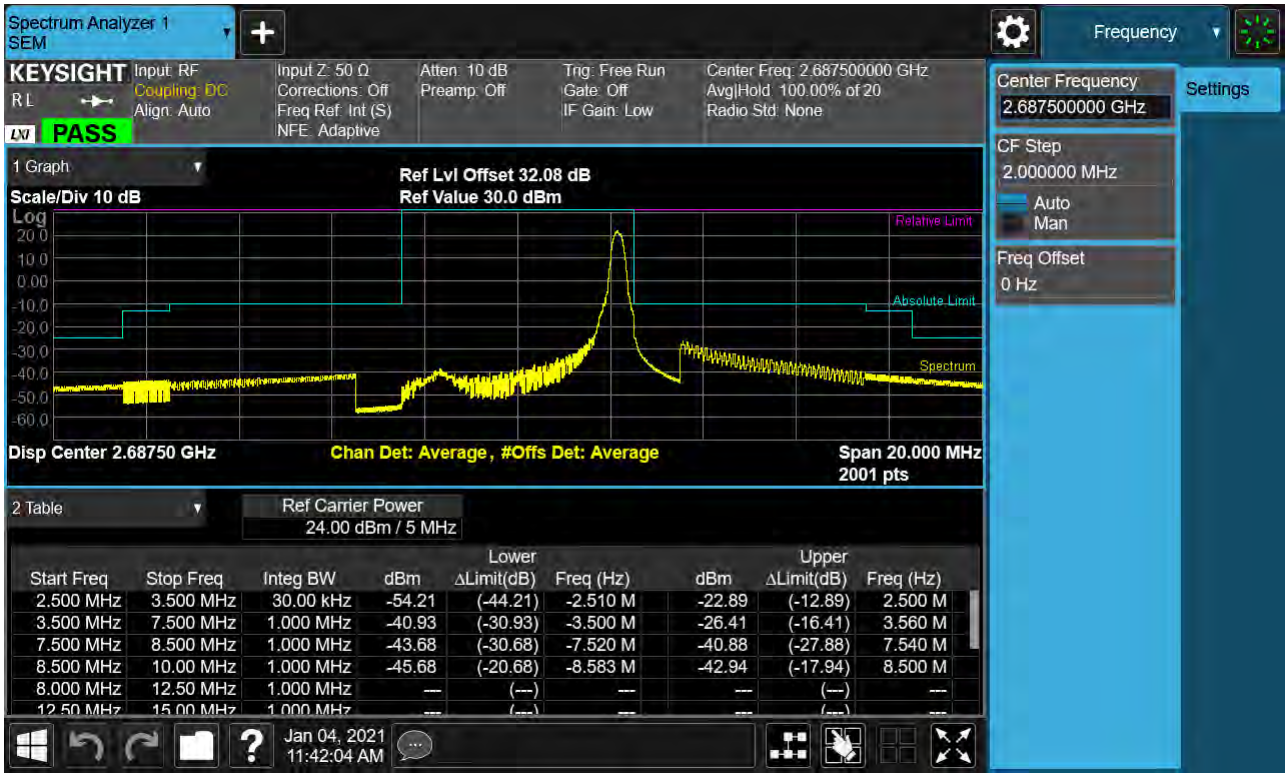
BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB1_Offset 0)-2



BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-2

BAND 41. Mid Channel Edge Plot (5 MHz Ch.40620 QPSK RB 25)

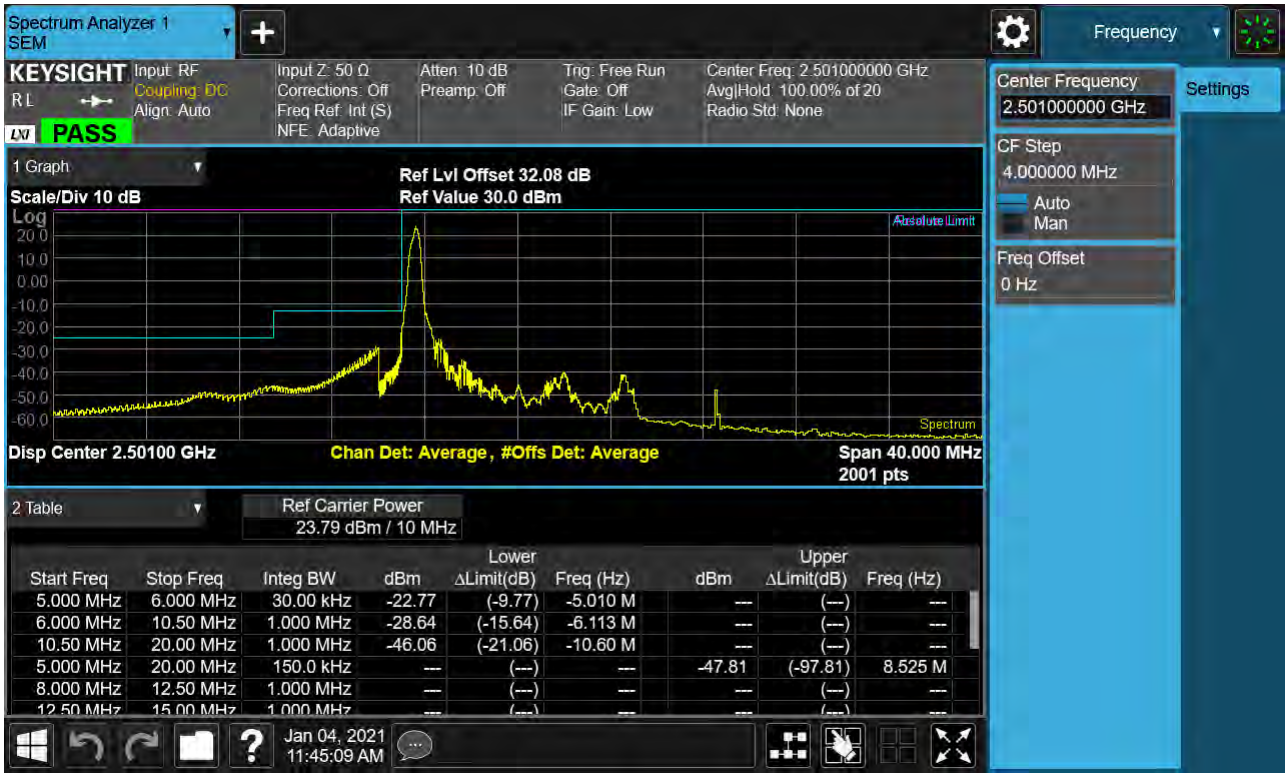
BAND 41. High Channel Edge Plot (5 MHz Ch.41565 QPSK RB 1, Offset 24)



			Lower			Upper		
Start Freq	Stop Freq	Integ BW	dBm	ΔLimit(dB)	Freq (Hz)	dBm	ΔLimit(dB)	Freq (Hz)
2.500 MHz	3.500 MHz	30.00 kHz	-54.21	(-44.21)	-2.510 M	-22.89	(-12.89)	2.500 M
3.500 MHz	7.500 MHz	1.000 MHz	-40.93	(-30.93)	-3.500 M	-26.41	(-16.41)	3.560 M
7.500 MHz	8.500 MHz	1.000 MHz	-43.68	(-30.68)	-7.520 M	-40.88	(-27.88)	7.540 M
8.500 MHz	10.00 MHz	1.000 MHz	-45.68	(-20.68)	-8.583 M	-42.94	(-17.94)	8.500 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

BAND 41. High Channel Edge Plot (5 MHz Ch.41565 QPSK_RB25_Offset 0)

BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-1



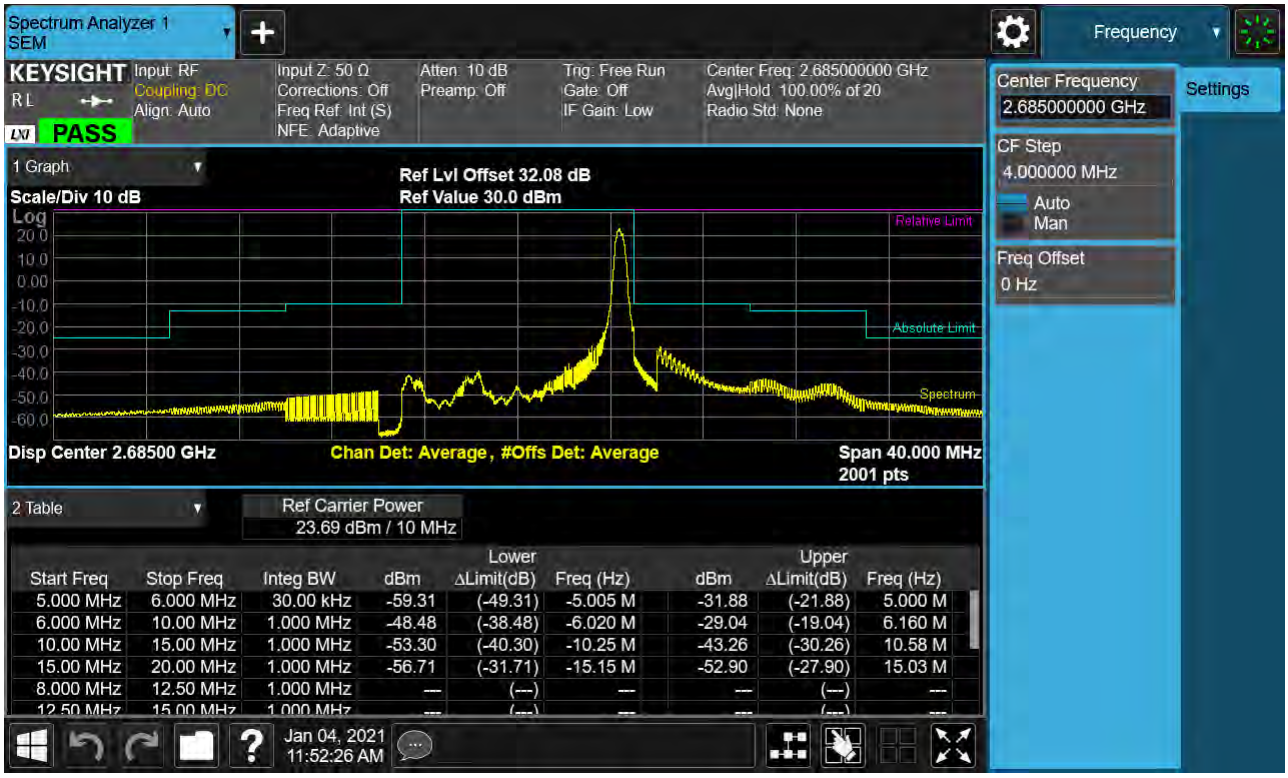
BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 25, Offset 0)-1

BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB1_Offset 0)-2

BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-2

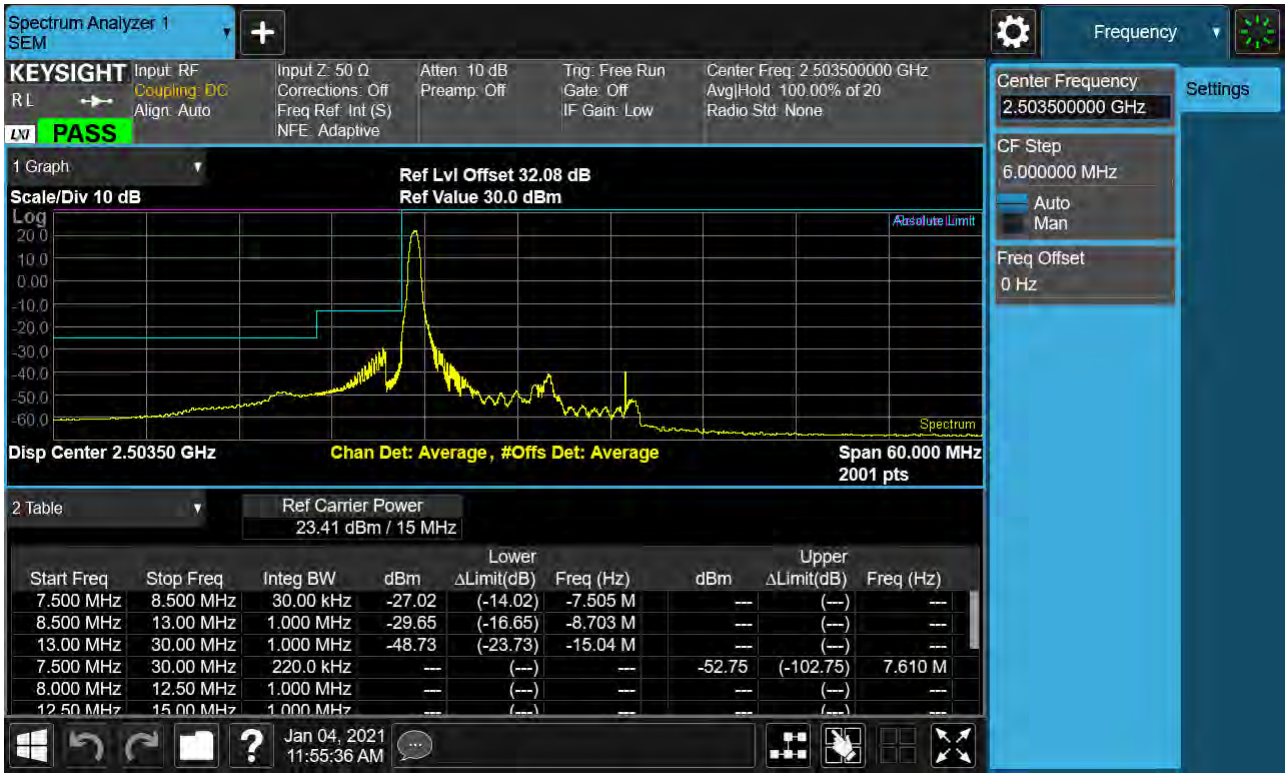
BAND 41. Mid Channel Edge Plot (10 MHz Ch.40620 QPSK RB 50)

BAND 41. High Channel Edge Plot (10 MHz Ch.41540 QPSK RB 1, Offset 49)



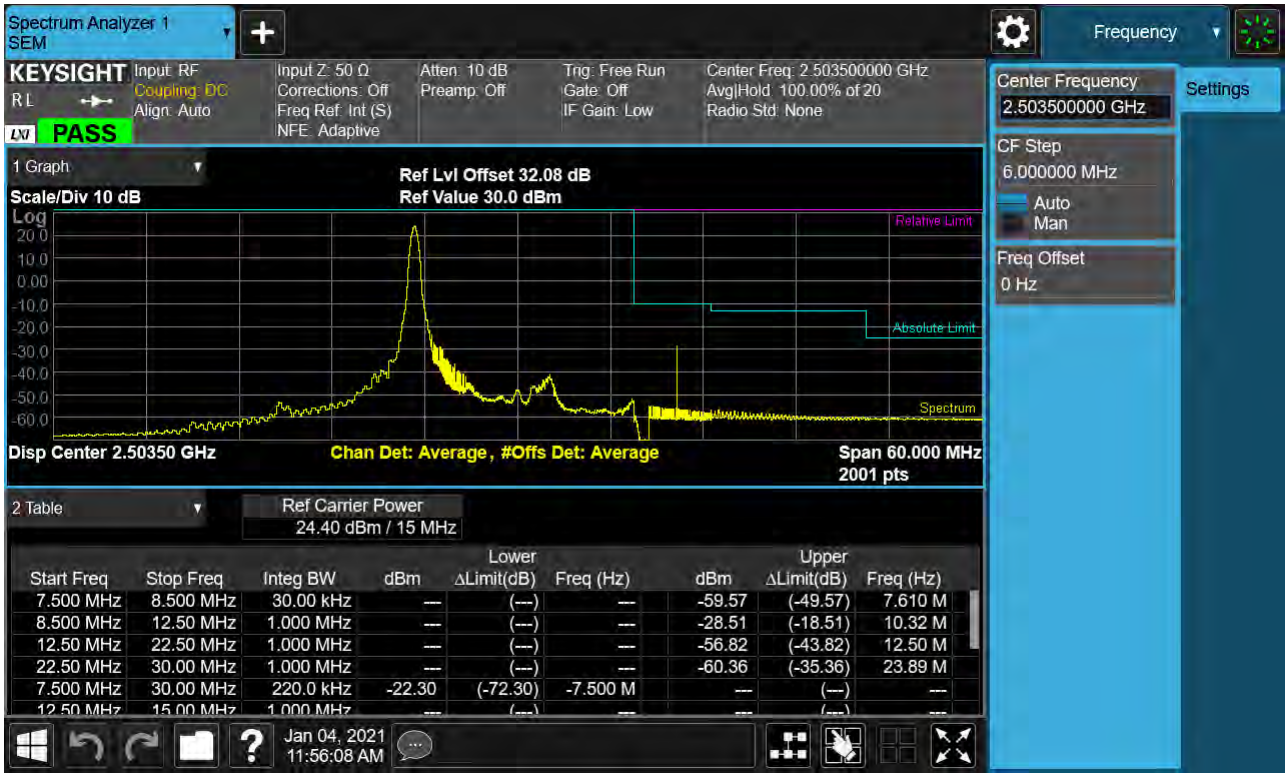
BAND 41. High Channel Edge Plot (10 MHz Ch.41540 QPSK_RB50_Offset 0)

BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-1



BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 75, Offset 0)-1

BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB1_Offset 0)-2



BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-2

BAND 41. Mid Channel Edge Plot (15 MHz Ch.40620 QPSK RB 75)

BAND 41. High Channel Edge Plot (15 MHz Ch.41515 QPSK RB 1, Offset 74)