74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
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FCC LTE REPORT

Class II Permissive Change

Applicant Name:
SAMSUNG Electronics Co., Ltd.

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

Date of Issue:
June 08, 2021

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

Report No.: HCT-RF-2106-FC001

FCC ID:	**A3LSMM325FV**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s): SM-M325FV/DS
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	4M49G7D	QPSK	0.088	19.46
		4M49W7D	16QAM	0.089	19.49
		4M49W7D	64QAM	0.089	19.48
LTE – Band 41 (10)	2501.0 – 2685.0	8M95G7D	QPSK	0.087	19.39
		8M98W7D	16QAM	0.087	19.41
		8M96W7D	64QAM	0.086	19.37
LTE – Band 41 (15)	2503.5 – 2682.5	13M4G7D	QPSK	0.087	19.37
		13M4W7D	16QAM	0.087	19.39
		13M5W7D	64QAM	0.087	19.37
LTE – Band 41 (20)	2506.0 – 2680.0	18M0G7D	QPSK	0.085	19.30
		17M9W7D	16QAM	0.086	19.34
		17M9W7D	64QAM	0.086	19.32

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 Ryang 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)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2106-FC001	June 08, 2021	- First Approval Report

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:	A3LSMM325FV
Application Type:	Class II Permissive Change
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile phone
Model(s):	SM-M325FV/DS
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:	May 24, 2021 ~ June 08, 2021
Serial number:	Radiated: R38R400D4WW Conducted: R38R400D4TP

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;

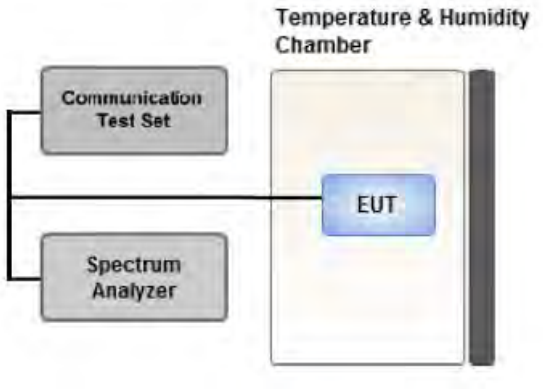
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   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.

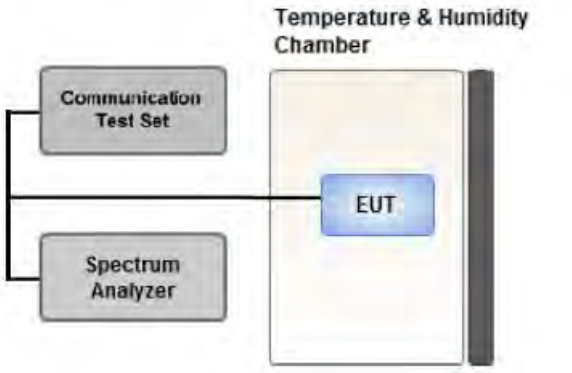
1. Set the RBW ≥ OBW.
2. Set VBW ≥ 3 × RBW.
3. Set span ≥ 2 × OBW.
4. Sweep time ≥ 10 × (number of points in sweep) × (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

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.

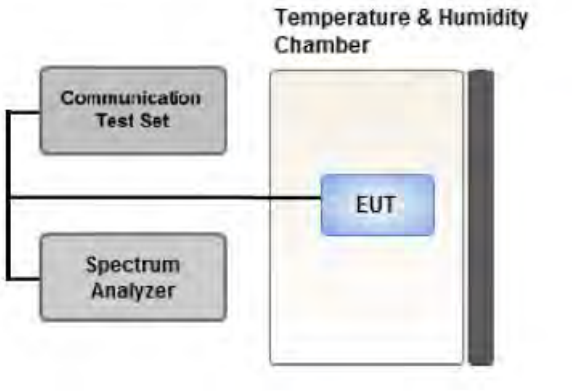
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

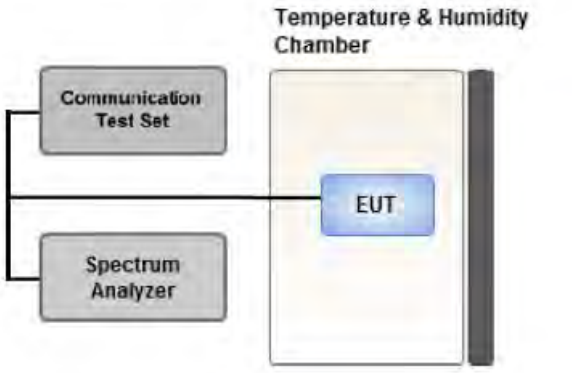
Test Overview

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.

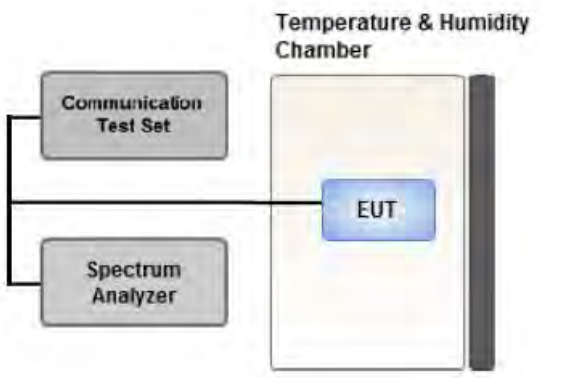
Test Settings

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.
- MCC : 310, MNC : 120 code were applied to test.
- Please refer to the table below.

[Worst case]

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

3.10 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.
- MCC : 310, MNC : 120 code were applied to test.

[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
Wainwright Instruments	WHKX10-900-1000-15000-40SS/ High Pass Filter	5	07/13/2020	Annual	07/13/2021
Wainwright Instruments	WHKX10-2700-3000-18000-40SS/ High Pass Filter	145	09/03/2020	Annual	09/03/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/07/2021	Annual	04/07/2022
CERNEX	LOW NOISE AMP (100MHz ~ 18GHz)	26822	05/26/2021	Annual	05/26/2022
CERNEX	CBL18265035 / Power Amplifier	22966	12/04/2020	Annual	12/04/2021
CERNEX	CBL26405040 / Power Amplifier	25956	03/23/2021	Annual	03/23/2022
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP / Precision Dipole Antenna	01273	05/30/2020	Biennial	05/30/2022
Schwarzbeck	UHAP / Precision Dipole Antenna	01274	05/30/2020	Biennial	05/30/2022
ESPEC	SU-642 / Chamber	93008124	03/15/2021	Annual	03/15/2022
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	02289	05/08/2020	Biennial	05/08/2022
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1299	05/04/2020	Biennial	05/04/2022
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	10/13/2020	Biennial	10/13/2022
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	04/22/2021	Annual	04/22/2022
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/01/2021	Annual	06/01/2022
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	101436	03/02/2021	Annual	03/02/2022
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Rohde & Schwarz	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	05/18/2020	Biennial	05/18/2022
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/03/2021	Biennial	03/03/2023
Schwarzbeck	VULB9160/ Hybrid Antenna	760	02/22/2021	Biennial	02/22/2023
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/07/2021	Annual	01/07/2022
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/02/2021	Annual	06/02/2022
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	-23.46	11.55	10.20	2.29	H	< 2.00	0.088	19.46
		16-QAM	-23.43	11.58	10.20	2.29	H		0.089	19.49
		64-QAM	-23.44	11.57	10.20	2.29	H		0.089	19.48
2593.0		QPSK	-25.10	10.14	10.42	2.33	H		0.066	18.23
		16-QAM	-25.02	10.22	10.42	2.33	H		0.068	18.31
		64-QAM	-25.03	10.21	10.42	2.33	H		0.068	18.30
2687.5		QPSK	-27.14	8.06	10.42	2.39	H		0.041	16.09
		16-QAM	-27.08	8.12	10.42	2.39	H		0.041	16.15
		64-QAM	-27.09	8.11	10.42	2.39	H		0.041	16.14

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	-23.53	11.48	10.20	2.29	H	< 2.00	0.087	19.39
		16-QAM	-23.51	11.50	10.20	2.29	H		0.087	19.41
		64-QAM	-23.55	11.46	10.20	2.29	H		0.086	19.37
2593.0		QPSK	-25.09	10.15	10.42	2.33	H		0.067	18.24
		16-QAM	-24.98	10.26	10.42	2.33	H		0.068	18.35
		64-QAM	-25.02	10.22	10.42	2.33	H		0.068	18.31
2685.0		QPSK	-26.95	8.30	10.38	2.40	H		0.042	16.28
		16-QAM	-26.87	8.38	10.38	2.40	H		0.043	16.36
		64-QAM	-26.90	8.35	10.38	2.40	H		0.043	16.33

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	-23.58	11.42	10.24	2.29	H	< 2.00	0.087	19.37
		16-QAM	-23.56	11.44	10.24	2.29	H		0.087	19.39
		64-QAM	-23.58	11.42	10.24	2.29	H		0.087	19.37
2593.0		QPSK	-24.88	10.36	10.42	2.33	H		0.070	18.45
		16-QAM	-24.78	10.46	10.42	2.33	H		0.072	18.55
		64-QAM	-24.80	10.44	10.42	2.33	H		0.071	18.53
2682.5		QPSK	-26.83	8.46	10.34	2.40	H		0.044	16.40
		16-QAM	-26.78	8.51	10.34	2.40	H		0.044	16.45
		64-QAM	-26.80	8.49	10.34	2.40	H		0.044	16.43

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	-23.65	11.35	10.24	2.29	H	< 2.00	0.085	19.30
		16-QAM	-23.61	11.39	10.24	2.29	H		0.086	19.34
		64-QAM	-23.63	11.37	10.24	2.29	H		0.086	19.32
2593.0		QPSK	-24.98	10.26	10.42	2.33	H		0.068	18.35
		16-QAM	-24.89	10.35	10.42	2.33	H		0.070	18.44
		64-QAM	-24.91	10.33	10.42	2.33	H		0.069	18.42
2680.0		QPSK	-26.62	8.67	10.34	2.40	H		0.046	16.61
		16-QAM	-26.51	8.78	10.34	2.40	H		0.047	16.72
		64-QAM	-26.54	8.75	10.34	2.40	H		0.047	16.69

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY : 2498.5 MHz

▣ MEASURED OUTPUT POWER: 19.49 dBm = 0.089W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 44.49 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	-46.51	10.90	-49.38	3.29	H	-41.77	61.26
	7 495.50	-61.77	11.49	-54.76	4.09	V	-47.36	66.85
	9 994.00	-63.41	11.80	-55.33	4.74	V	-48.27	67.76
40620 (2593.0)	5 186.00	-48.24	11.47	-50.32	3.39	H	-42.24	61.73
	7 779.00	-64.19	11.28	-57.19	4.21	H	-50.12	69.61
	10 372.00	-63.65	11.80	-53.82	4.95	V	-46.97	66.46
41565 (2687.5)	5 375.00	-51.26	11.85	-53.77	3.45	H	-45.37	64.86
	8 062.50	-59.94	11.30	-52.65	4.31	H	-45.66	65.15
	10 750.00	-62.19	11.70	-51.48	5.03	V	-44.81	64.30

▣ OPERATING FREQUENCY : 2501.0 MHz

▣ MEASURED OUTPUT POWER: 19.41 dBm = 0.087 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 44.41 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	-48.01	10.90	-50.88	3.29	H	-43.27	62.68
	7 503.00	-60.75	11.51	-53.87	4.11	H	-46.47	65.88
	10 004.00	-62.98	11.78	-54.81	4.75	H	-47.78	67.19
40620 (2593.0)	5 186.00	-50.90	11.47	-52.98	3.39	H	-44.90	64.31
	7 779.00	-64.67	11.28	-57.67	4.21	H	-50.60	70.01
	10 372.00	-64.26	11.80	-54.43	4.95	H	-47.58	66.99
41540 (2685.0)	5 370.00	-48.76	11.84	-51.21	3.45	H	-42.82	62.23
	8 055.00	-63.40	11.30	-55.95	4.31	H	-48.96	68.37
	10 740.00	-64.42	11.70	-53.62	4.99	H	-46.91	66.32

▣ OPERATING FREQUENCY : 2503.5 MHz

▣ MEASURED OUTPUT POWER: 19.39 dBm = 0.087 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 44.39 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	-47.45	10.91	-50.36	3.28	H	-42.73	62.12
	7 510.50	-64.88	11.52	-58.00	4.12	H	-50.60	69.99
	10 014.00	-62.03	11.77	-53.67	4.75	H	-46.65	66.04
40620 (2593.0)	5 186.00	-51.71	11.47	-53.79	3.39	H	-45.71	65.10
	7 779.00	-64.70	11.28	-57.70	4.21	H	-50.63	70.02
	10 372.00	-64.42	11.80	-54.59	4.95	H	-47.74	67.14
41515 (2682.5)	5 365.00	-49.41	11.83	-51.86	3.45	H	-43.48	62.88
	8 047.50	-60.41	11.30	-53.12	4.31	H	-46.13	65.52
	10 730.00	-64.43	11.70	-53.58	4.94	H	-46.82	66.21

▣ OPERATING FREQUENCY : 2506.0 MHz

▣ MEASURED OUTPUT POWER: 19.34 dBm = 0.086 W

▣ MODE: LTE B41

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 44.34 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	-47.40	10.92	-50.33	3.28	H	-42.69	62.04
	7 518.00	-64.41	11.54	-57.46	4.12	H	-50.04	69.39
	10 024.00	-62.18	11.75	-53.58	4.78	H	-46.61	65.95
40620 (2593.0)	5 186.00	-49.85	11.47	-51.93	3.39	H	-43.85	63.19
	7 779.00	-65.76	11.28	-58.76	4.21	H	-51.69	71.03
	10 372.00	-63.56	11.80	-53.73	4.95	H	-46.88	66.23
41490 (2680.0)	5 360.00	-48.99	11.82	-51.45	3.45	H	-43.08	62.42
	8 040.00	-62.03	11.28	-54.83	4.31	H	-47.86	67.20
	10 720.00	-63.51	11.70	-52.57	4.91	H	-45.78	65.12

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	5.64
			16-QAM			6.79
			64-QAM			6.74
	10 MHz		QPSK	50		5.84
			16-QAM			6.42
			64-QAM			7.03
	15 MHz		QPSK	75		5.72
			16-QAM			6.57
			64-QAM			6.96
	20 MHz		QPSK	100		5.68
			16-QAM			6.26
			64-QAM			6.67

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 96 ~ 107.

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	4.4932
			16-QAM			4.4864
			64-QAM			4.4884
	10 MHz		QPSK	50		8.9507
			16-QAM			8.9829
			64-QAM			8.9587
	15 MHz		QPSK	75		13.436
			16-QAM			13.436
			64-QAM			13.452
	20 MHz		QPSK	100		17.968
			16-QAM			17.903
			64-QAM			17.902

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 84 ~ 95.

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	26.1938	34.110	-76.720	-42.610	-25.00
		2593.0	26.1389	34.110	-76.730	-42.620	
		2687.5	26.4309	34.110	-76.626	-42.516	
	10	2501.0	26.1542	34.110	-76.634	-42.524	
		2593.0	26.1559	34.110	-76.708	-42.598	
		2685.0	25.8648	34.110	-76.560	-42.450	
	15	2503.5	26.1479	34.110	-76.581	-42.471	
		2593.0	26.1151	34.110	-76.686	-42.576	
		2682.5	26.1632	34.110	-76.420	-42.310	
	20	2506.0	26.1772	34.110	-76.528	-42.418	
		2593.0	26.1534	34.110	-76.712	-42.602	
		2680.0	26.1202	34.110	-76.536	-42.426	

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. Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
5. Duty Cycle Factor(dB) = 3.979

Frequency Range (GHz)	Factor [dB]
0.03 – 1	29.249
1 – 5	31.955
5 – 10	32.570
10 – 15	33.095
15 – 20	33.468
Above 20	34.110

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	-33.40	-32.16	-30.43	-29.58	-39.62	-38.14	-39.64
10 MHz	2501.0	QPSK	50/0	-37.08	-36.14	-34.92	-33.31	-38.00	-36.34	-41.85
15 MHz	2503.5	QPSK	75/0	-38.40	-37.11	-36.56	-34.55	-39.31	-37.52	-43.26
20 MHz	2506.0	QPSK	100/0	-39.74	-37.68	-37.83	-35.91	-39.69	-37.66	-43.87
Limit				-13.0	-10.0	-13.0	-10.0	-25.0	-13.0	-25.0

Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
					Lower	Upper	Lower	Upper
5 MHz	2593.0	QPSK	25	0	-33.43	-33.61	-31.54	-33.52
	2687.5	QPSK	25	0	-31.97	-31.67	-28.41	-30.19
10 MHz	2593.0	QPSK	50	0	-36.47	-35.94	-34.00	-34.08
	2685.0	QPSK	50	0	-33.28	-33.05	-28.63	-29.00
15 MHz	2593.0	QPSK	75	0	-37.84	-37.88	-36.22	-36.06
	2682.5	QPSK	75	0	-32.76	-33.73	-30.63	-30.99
20 MHz	2593.0	QPSK	100	0	-39.48	-37.97	-37.82	-36.95
	2680.0	QPSK	100	0	-34.60	-34.45	-32.13	-32.59
Limit					-10.0		-10.0	

Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	(C.E ± 5 MHz) ~ (C.E ± X MHz)		Above (C.E ± X MHz)	
					Lower	Upper	Lower	Upper
5 MHz	2593.0	QPSK	25	0	-38.23	-38.11	-39.70	-39.75
	2687.5	QPSK	25	0	-35.86	-36.01	-37.45	-37.88
10 MHz	2593.0	QPSK	50	0	-37.16	-36.75	-42.64	-42.95
	2685.0	QPSK	50	0	-32.23	-32.24	-40.54	-40.04
15 MHz	2593.0	QPSK	75	0	-37.99	-38.23	-43.98	-44.25
	2682.5	QPSK	75	0	-32.87	-32.77	-42.18	-42.01
20 MHz	2593.0	QPSK	100	0	-39.34	-38.80	-44.93	-45.44
	2680.0	QPSK	100	0	-34.44	-34.24	-42.76	-43.38
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. RB = Resource Block
5. Duty Cycle factor already applied on the factor.
   - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
   - Result(dBm) = Reading + Factor
   - Duty Cycle Factor(dB) = 3.979
6. Plots of the EUT's Channel Edge are shown Page 56 ~ 83. (1RB & Full RB)

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE 41

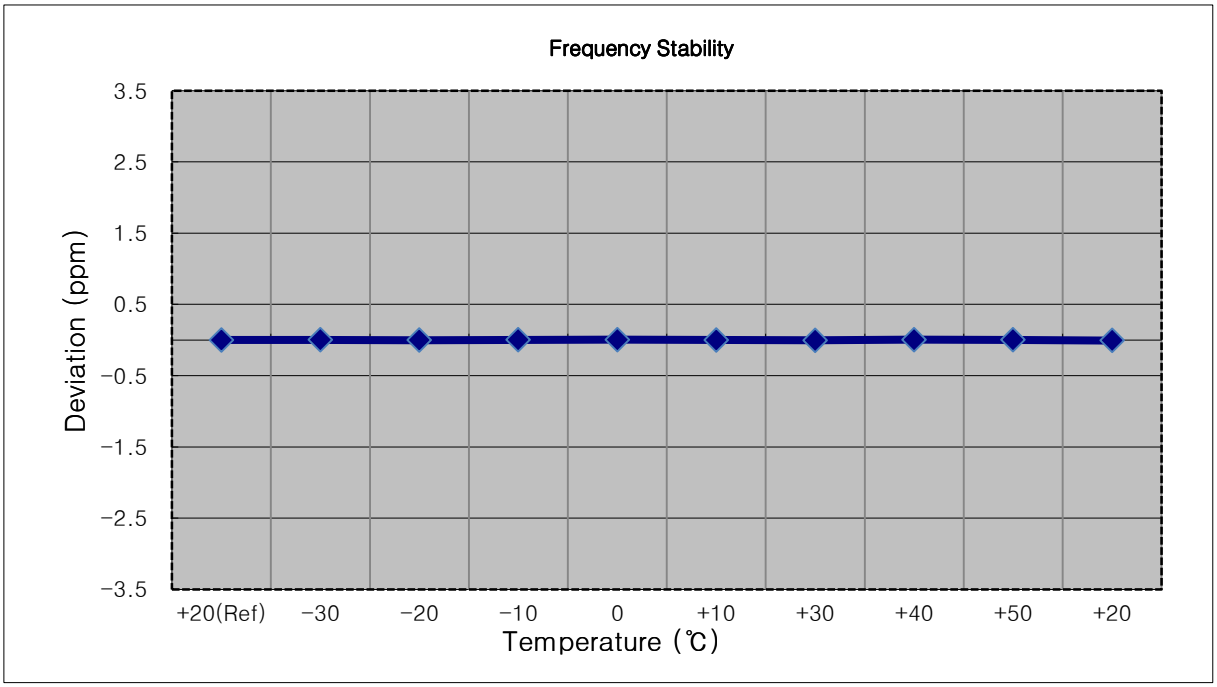
▣ OPERATING FREQUENCY: 2498,500,000 Hz

▣ BANDWIDTH: 39675 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2498 499 986	0.0	0.000 000	0.000
100%		-30	2498 499 989	3.2	0.000 000	0.001
100%		-20	2498 499 980	-5.6	0.000 000	-0.002
100%		-10	2498 499 989	2.6	0.000 000	0.001
100%		0	2498 499 994	8.1	0.000 000	0.003
100%		+10	2498 499 982	-3.6	0.000 000	-0.001
100%		+30	2498 499 975	-10.6	0.000 000	-0.004
100%		+40	2498 499 995	8.7	0.000 000	0.003
100%		+50	2498 499 991	4.6	0.000 000	0.002
Batt. Endpoint	3.400	+20	2498 499 971	-15.0	-0.000 001	-0.006



▣ MODE: LTE 41

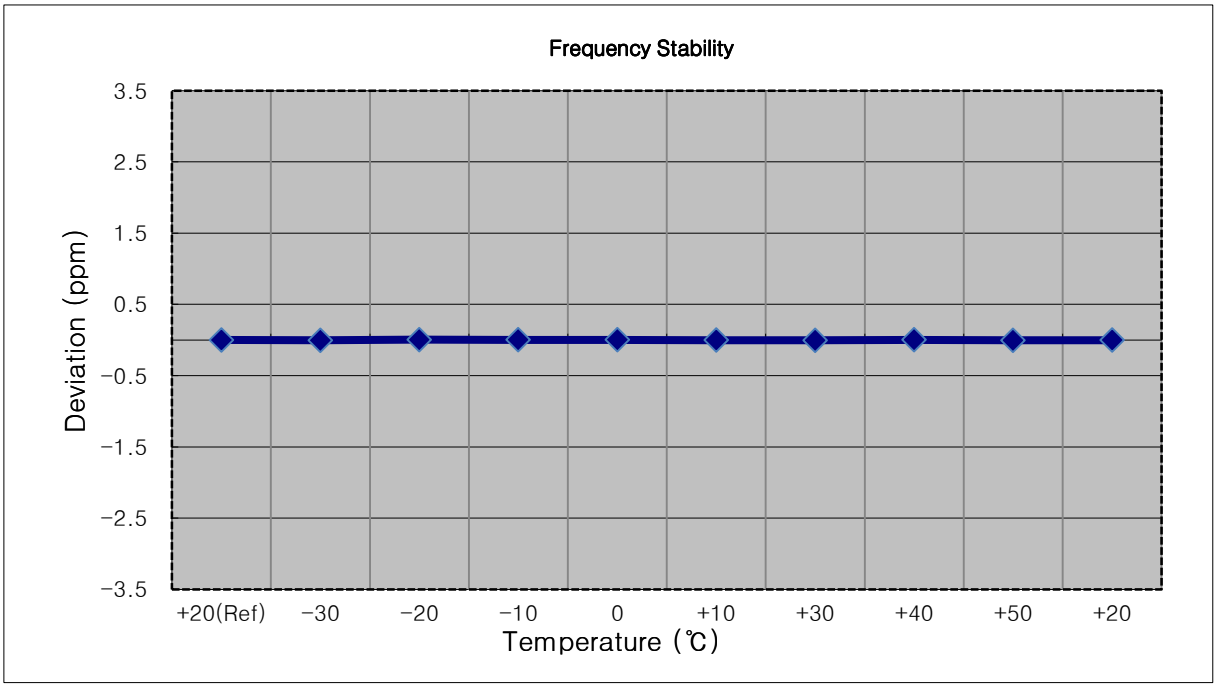
▣ OPERATING FREQUENCY: 2501,000,000 Hz

▣ BANDWIDTH: 39700 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2500 999 988	0.0	0.000 000	0.000
100%		-30	2500 999 978	-9.8	0.000 000	-0.004
100%		-20	2500 999 997	8.7	0.000 000	0.003
100%		-10	2500 999 995	6.9	0.000 000	0.003
100%		0	2500 999 993	5.0	0.000 000	0.002
100%		+10	2500 999 980	-7.5	0.000 000	-0.003
100%		+30	2500 999 977	-10.7	0.000 000	-0.004
100%		+40	2500 999 992	4.1	0.000 000	0.002
100%		+50	2500 999 974	-14.3	-0.000 001	-0.006
Batt. Endpoint	3.400	+20	2500 999 982	-5.7	0.000 000	-0.002



▣ MODE: LTE 41

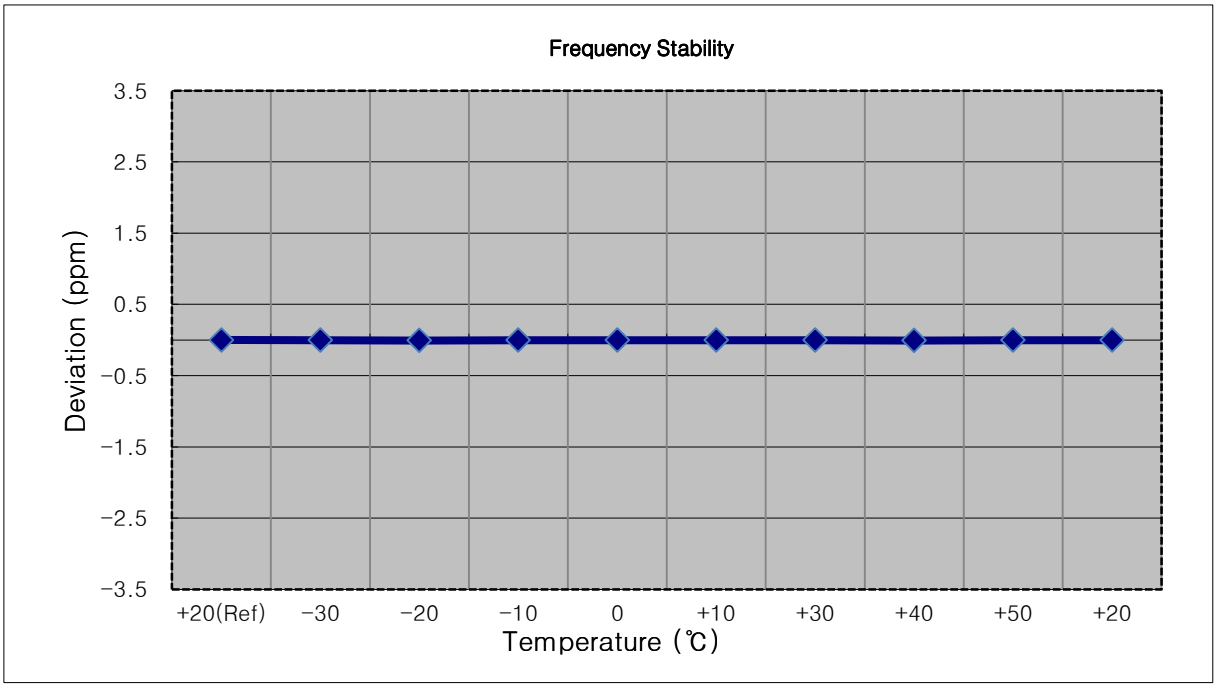
▣ OPERATING FREQUENCY: 2503,500,000 Hz

▣ BANDWIDTH: 39725 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2503 499 990	0.0	0.000 000	0.000
100%		-30	2503 499 982	-8.1	0.000 000	-0.003
100%		-20	2503 499 971	-19.9	-0.000 001	-0.008
100%		-10	2503 499 981	-9.2	0.000 000	-0.004
100%		0	2503 499 982	-8.5	0.000 000	-0.003
100%		+10	2503 499 982	-8.4	0.000 000	-0.003
100%		+30	2503 499 984	-6.3	0.000 000	-0.003
100%		+40	2503 499 971	-19.6	-0.000 001	-0.008
100%		+50	2503 499 985	-5.9	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2503 499 983	-7.8	0.000 000	-0.003



▣ MODE: LTE 41

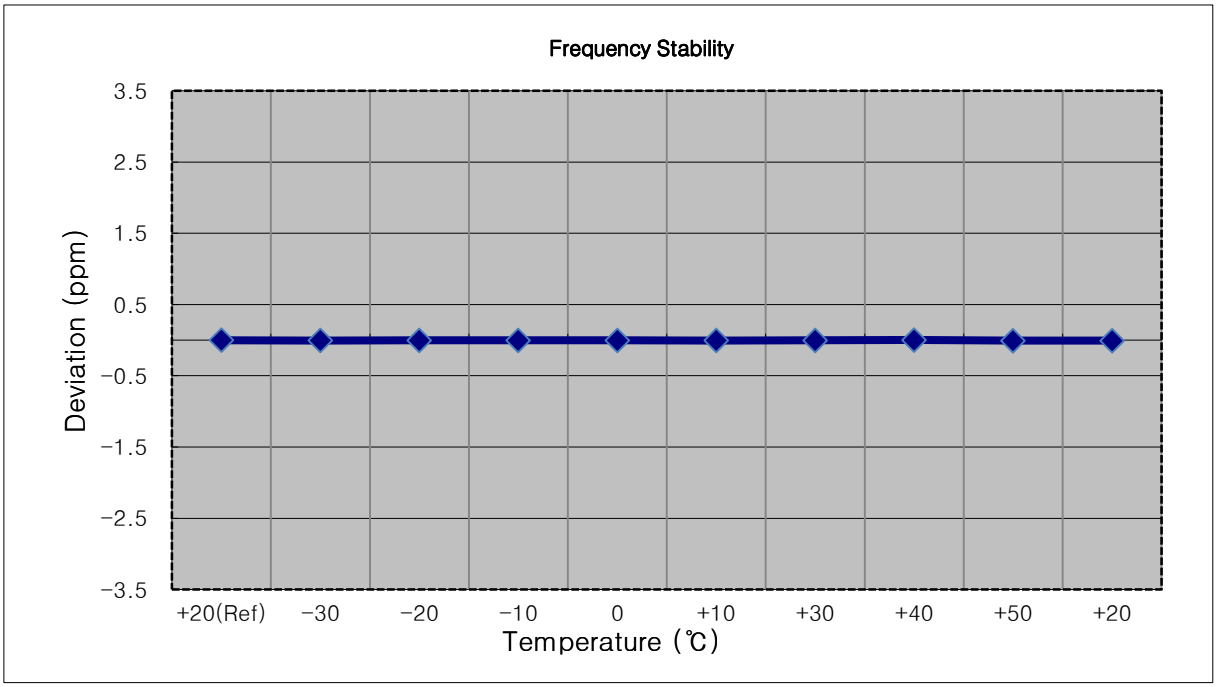
▣ OPERATING FREQUENCY: 2506,000,000 Hz

▣ BANDWIDTH: 39750 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2505 999 998	0.0	0.000 000	0.000
100%		-30	2505 999 986	-12.1	0.000 000	-0.005
100%		-20	2505 999 990	-7.7	0.000 000	-0.003
100%		-10	2505 999 989	-9.3	0.000 000	-0.004
100%		0	2505 999 991	-7.2	0.000 000	-0.003
100%		+10	2505 999 985	-13.5	-0.000 001	-0.005
100%		+30	2505 999 990	-8.1	0.000 000	-0.003
100%		+40	2506 000 002	4.0	0.000 000	0.002
100%		+50	2505 999 981	-17.0	-0.000 001	-0.007
Batt. Endpoint	3.400	+20	2505 999 978	-20.0	-0.000 001	-0.008



▣ MODE: LTE 41

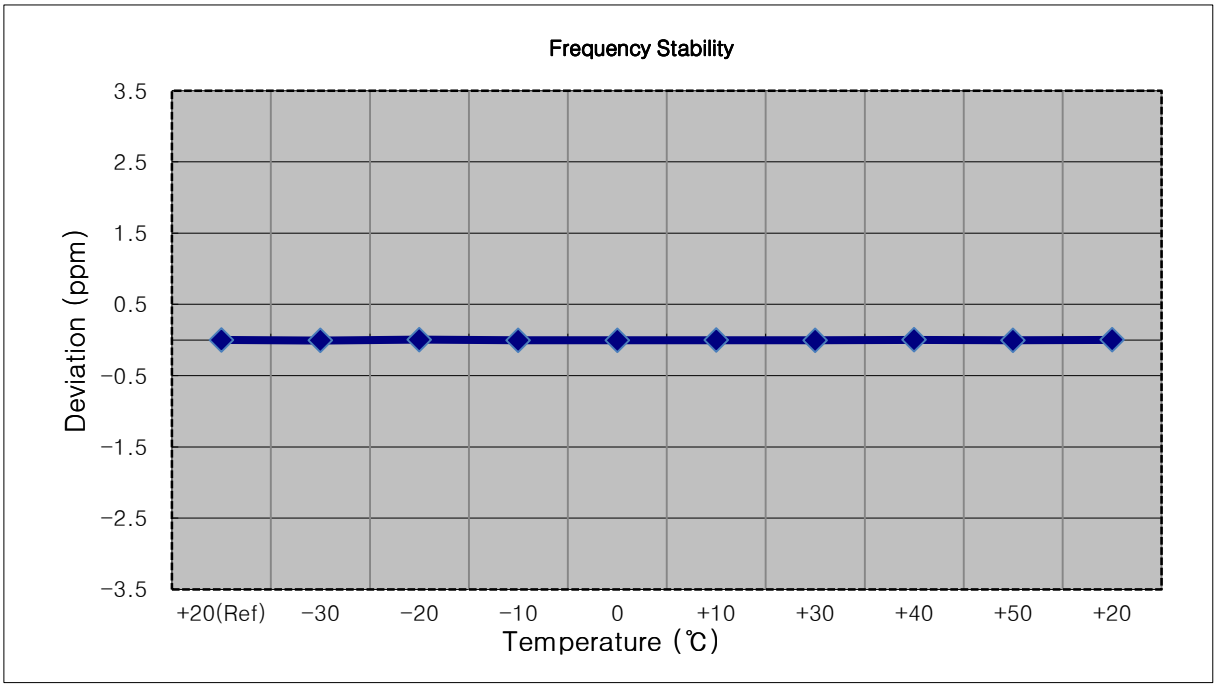
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2592 999 985	0.0	0.000 000	0.000
100%		-30	2592 999 969	-15.7	-0.000 001	-0.006
100%		-20	2592 999 993	8.1	0.000 000	0.003
100%		-10	2592 999 973	-11.2	0.000 000	-0.004
100%		0	2592 999 973	-11.6	0.000 000	-0.004
100%		+10	2592 999 980	-4.2	0.000 000	-0.002
100%		+30	2592 999 971	-13.6	-0.000 001	-0.005
100%		+40	2592 999 991	6.8	0.000 000	0.003
100%		+50	2592 999 974	-10.1	0.000 000	-0.004
Batt. Endpoint	3.400	+20	2592 999 990	5.1	0.000 000	0.002



▣ MODE: LTE 41

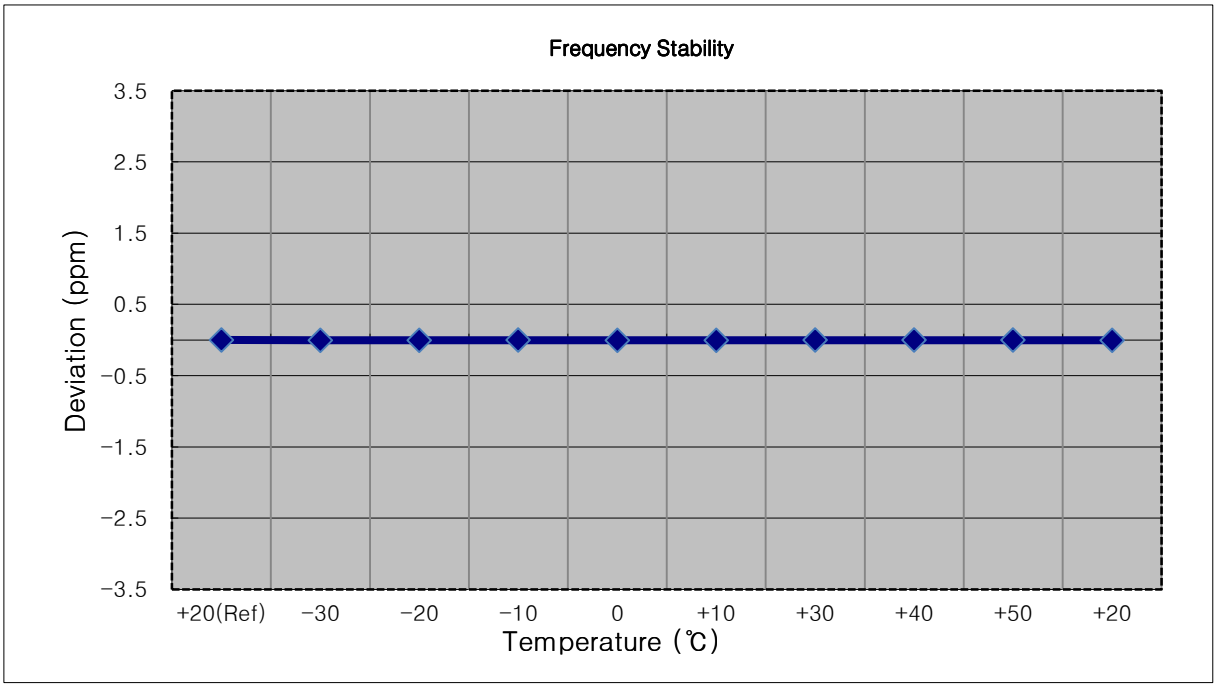
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2592 999 988	0.0	0.000 000	0.000
100%		-30	2592 999 977	-11.0	0.000 000	-0.004
100%		-20	2592 999 975	-12.9	0.000 000	-0.005
100%		-10	2592 999 984	-4.3	0.000 000	-0.002
100%		0	2592 999 978	-10.1	0.000 000	-0.004
100%		+10	2592 999 976	-12.0	0.000 000	-0.005
100%		+30	2592 999 981	-7.4	0.000 000	-0.003
100%		+40	2592 999 982	-5.9	0.000 000	-0.002
100%		+50	2592 999 980	-8.1	0.000 000	-0.003
Batt. Endpoint	3.400	+20	2592 999 978	-10.1	0.000 000	-0.004



▣ MODE: LTE 41

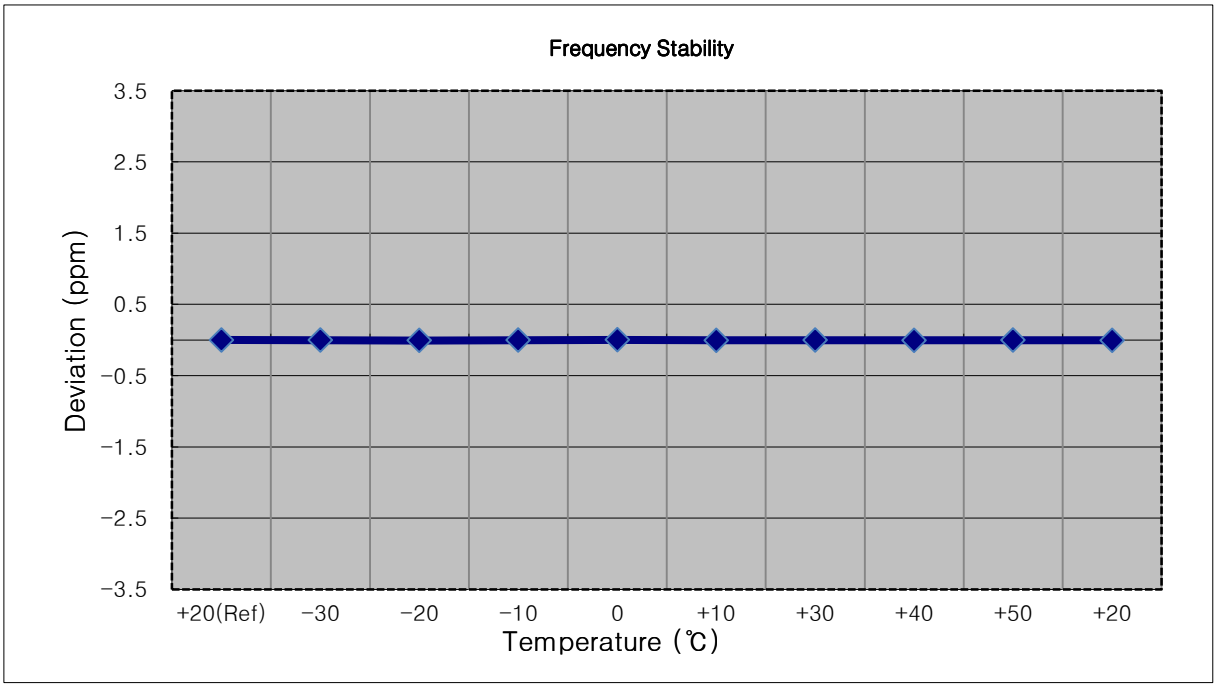
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2593 000 007	0.0	0.000 000	0.000
100%		-30	2593 000 000	-6.4	0.000 000	-0.002
100%		-20	2592 999 989	-17.5	-0.000 001	-0.007
100%		-10	2592 999 999	-8.0	0.000 000	-0.003
100%		0	2593 000 014	6.8	0.000 000	0.003
100%		+10	2592 999 995	-11.8	0.000 000	-0.005
100%		+30	2593 000 003	-4.0	0.000 000	-0.002
100%		+40	2592 999 992	-14.7	-0.000 001	-0.006
100%		+50	2593 000 002	-4.7	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2592 999 992	-14.6	-0.000 001	-0.006



▣ MODE: LTE 41

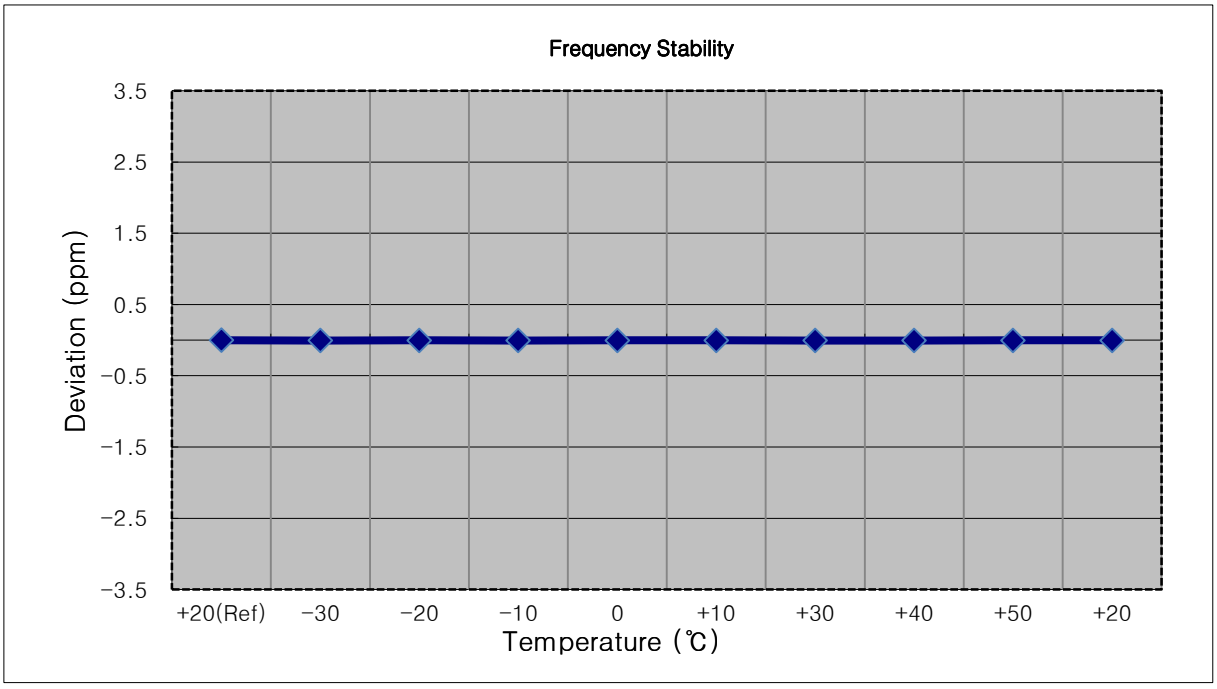
▣ OPERATING FREQUENCY: 2593,000,000 Hz

▣ BANDWIDTH: 40620 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2592 999 990	0.0	0.000 000	0.000
100%		-30	2592 999 978	-11.1	0.000 000	-0.004
100%		-20	2592 999 982	-7.1	0.000 000	-0.003
100%		-10	2592 999 976	-13.7	-0.000 001	-0.005
100%		0	2592 999 980	-9.5	0.000 000	-0.004
100%		+10	2592 999 981	-9.0	0.000 000	-0.003
100%		+30	2592 999 973	-16.5	-0.000 001	-0.006
100%		+40	2592 999 977	-12.8	0.000 000	-0.005
100%		+50	2592 999 982	-7.5	0.000 000	-0.003
Batt. Endpoint	3.400	+20	2592 999 984	-5.1	0.000 000	-0.002



▣ MODE: LTE 41

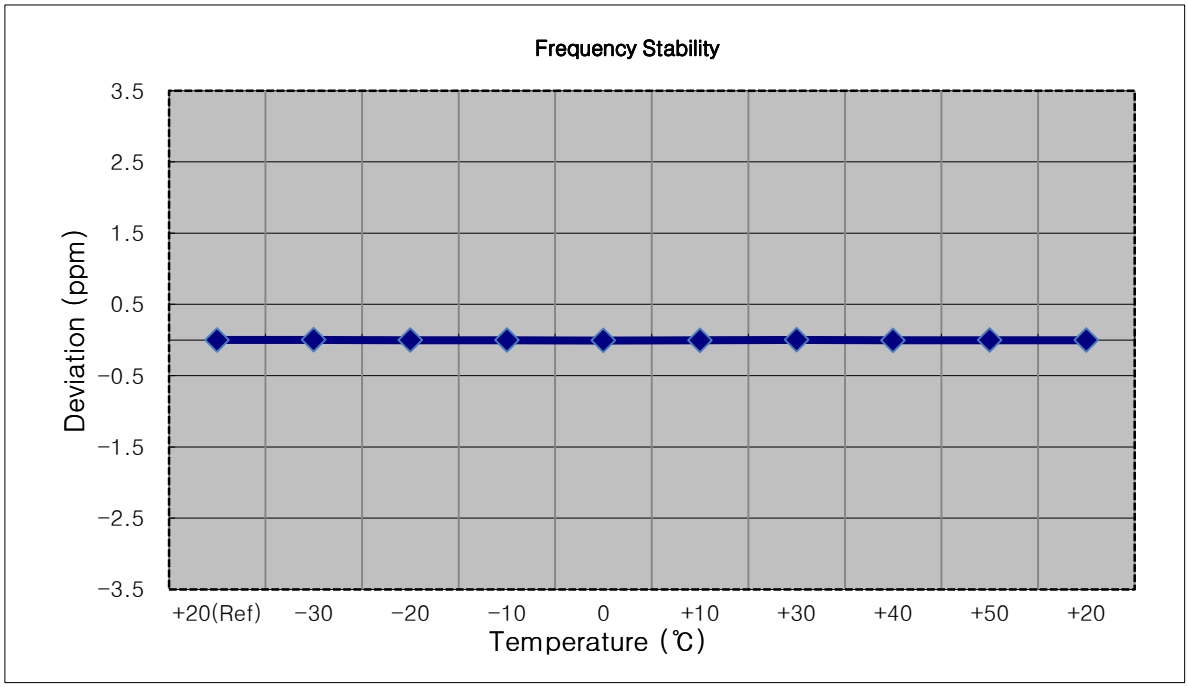
▣ OPERATING FREQUENCY: 2687,500,000 Hz

▣ BANDWIDTH: 41565 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2687 499 993	0.0	0.000 000	0.000
100%		-30	2687 500 000	7.1	0.000 000	0.003
100%		-20	2687 499 987	-5.9	0.000 000	-0.002
100%		-10	2687 499 986	-7.3	0.000 000	-0.003
100%		0	2687 499 975	-18.4	-0.000 001	-0.007
100%		+10	2687 499 980	-12.9	0.000 000	-0.005
100%		+30	2687 499 998	5.1	0.000 000	0.002
100%		+40	2687 499 983	-10.3	0.000 000	-0.004
100%		+50	2687 499 988	-5.0	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2687 499 986	-7.2	0.000 000	-0.003



▣ MODE: LTE 41

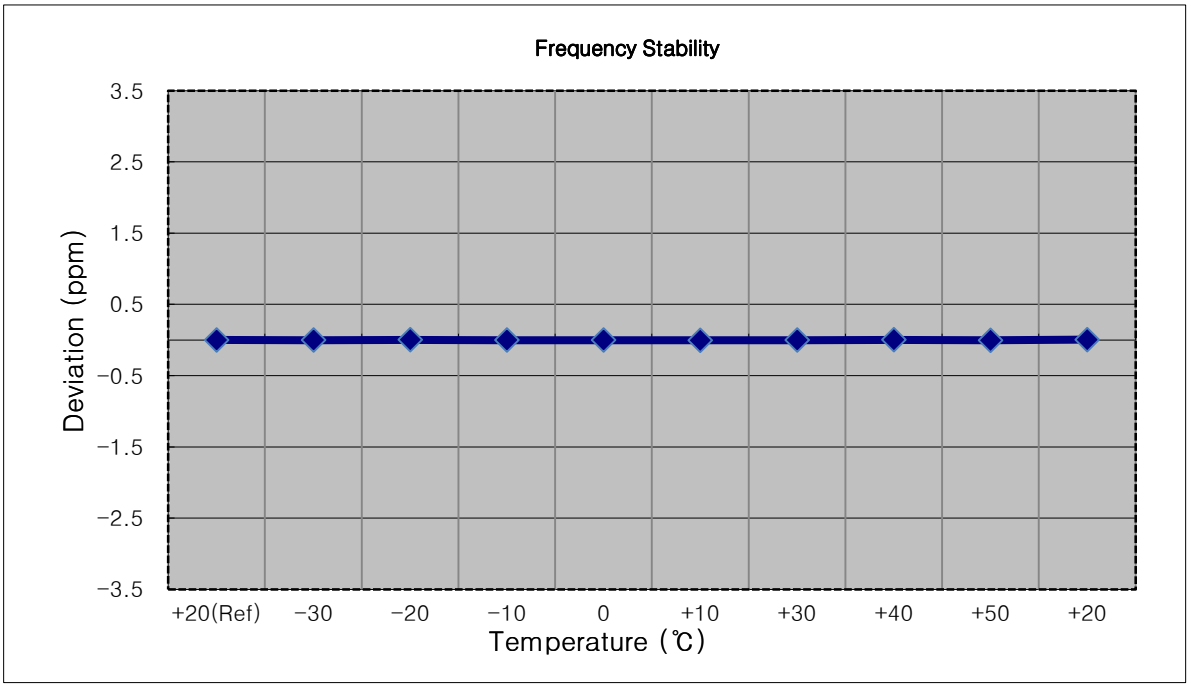
▣ OPERATING FREQUENCY: 2685,000,000 Hz

▣ BANDWIDTH: 41540 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2684 999 996	0.0	0.000 000	0.000
100%		-30	2684 999 986	-9.9	0.000 000	-0.004
100%		-20	2685 000 000	4.5	0.000 000	0.002
100%		-10	2684 999 986	-9.4	0.000 000	-0.004
100%		0	2684 999 989	-6.4	0.000 000	-0.002
100%		+10	2684 999 986	-10.3	0.000 000	-0.004
100%		+30	2684 999 992	-4.1	0.000 000	-0.002
100%		+40	2685 000 000	4.4	0.000 000	0.002
100%		+50	2684 999 980	-15.8	-0.000 001	-0.006
Batt. Endpoint	3.400	+20	2685 000 006	9.7	0.000 000	0.004



▣ MODE: LTE 41

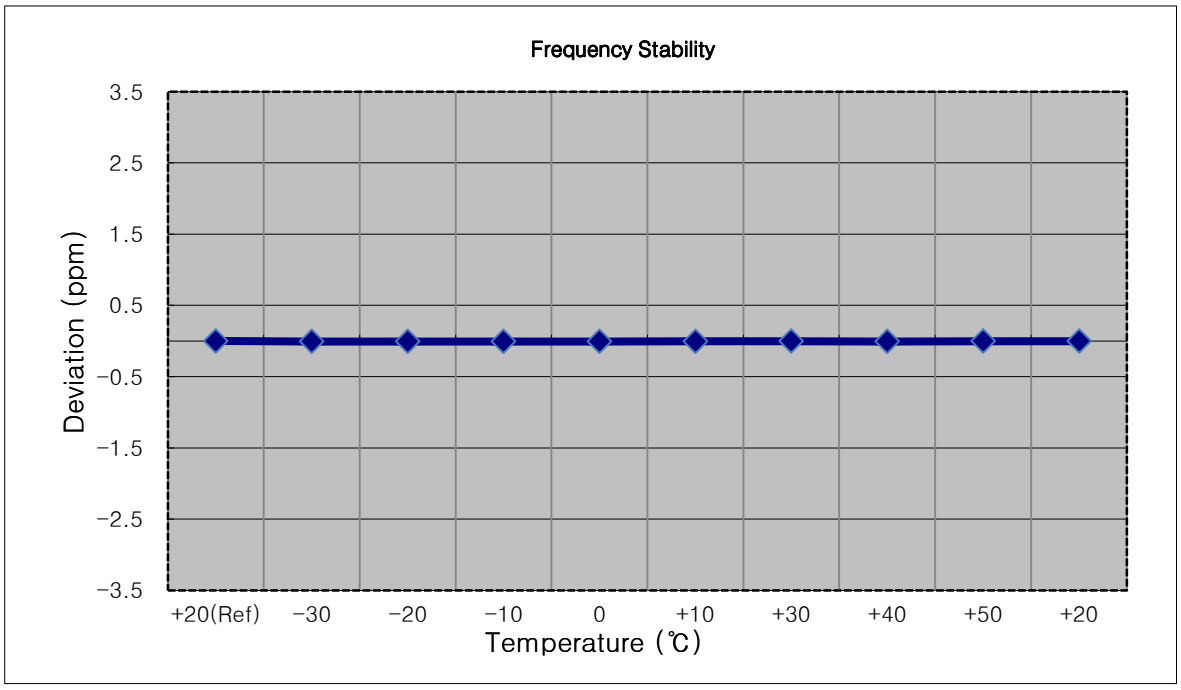
▣ OPERATING FREQUENCY: 2682,500,000 Hz

▣ BANDWIDTH: 41515 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2682 499 994	0.0	0.000 000	0.000
100%		-30	2682 499 974	-20.6	-0.000 001	-0.008
100%		-20	2682 499 978	-16.1	-0.000 001	-0.006
100%		-10	2682 499 978	-16.6	-0.000 001	-0.006
100%		0	2682 499 978	-16.6	-0.000 001	-0.006
100%		+10	2682 499 981	-13.4	0.000 000	-0.005
100%		+30	2682 499 987	-7.5	0.000 000	-0.003
100%		+40	2682 499 975	-19.5	-0.000 001	-0.007
100%		+50	2682 499 985	-9.0	0.000 000	-0.003
Batt. Endpoint	3.400	+20	2682 499 985	-9.4	0.000 000	-0.004



▣ MODE: LTE 41

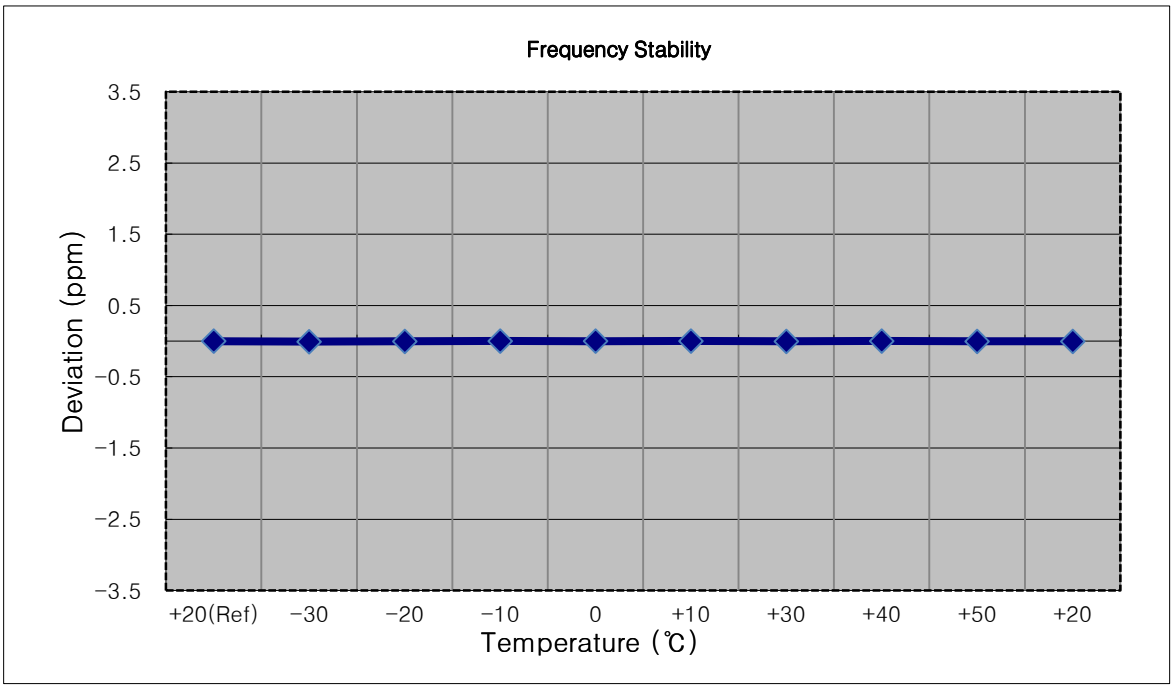
▣ OPERATING FREQUENCY: 2680,000,000 Hz

▣ BANDWIDTH: 41490 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	2679 999 986	0.0	0.000 000	0.000
100%		-30	2679 999 967	-19.3	-0.000 001	-0.007
100%		-20	2679 999 976	-9.9	0.000 000	-0.004
100%		-10	2679 999 990	3.7	0.000 000	0.001
100%		0	2679 999 982	-3.6	0.000 000	-0.001
100%		+10	2679 999 991	4.7	0.000 000	0.002
100%		+30	2679 999 980	-5.7	0.000 000	-0.002
100%		+40	2679 999 989	2.9	0.000 000	0.001
100%		+50	2679 999 980	-5.9	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2679 999 977	-8.8	0.000 000	-0.003



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.

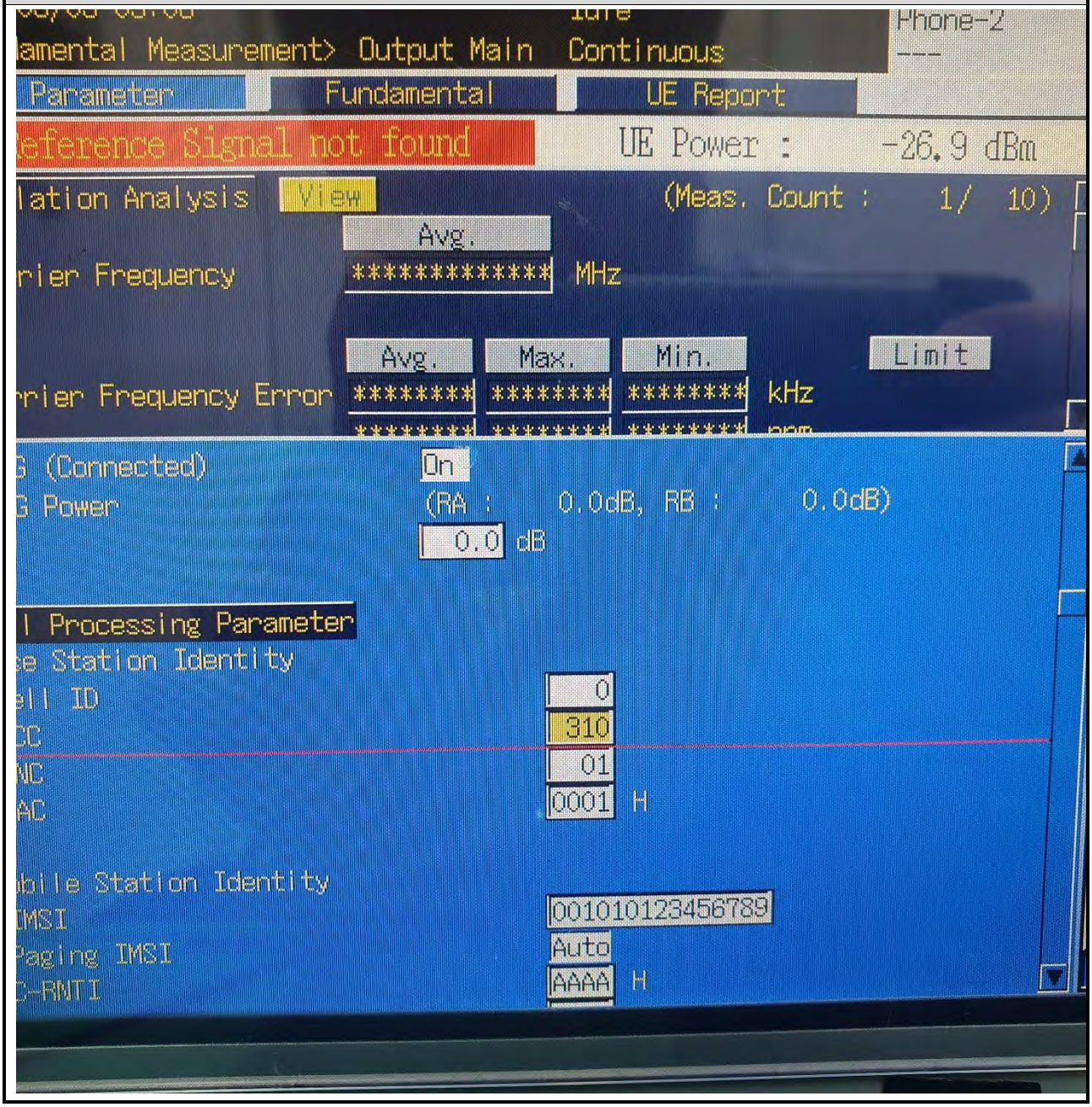
Band	MCC = USA	MCC = non US
7	Did not connect	Connected (Canada)
38	Did not connect	Connected (Canada)
40	Did not connect	Connected (Canada)
41	Connected (US)	Connected (Canada)

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

Verification test

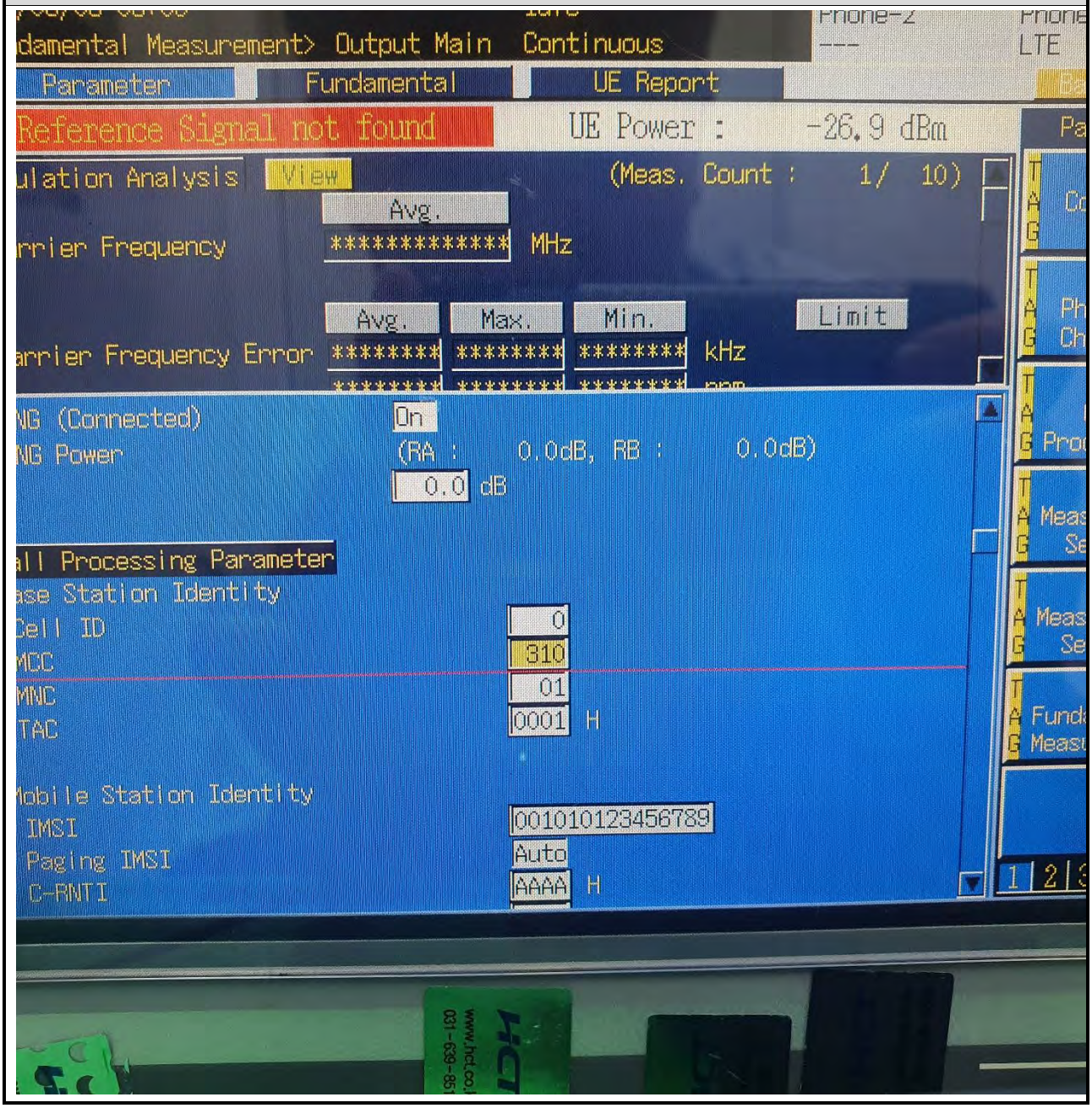
Did not connect (LTE B7)

(MCC = US)



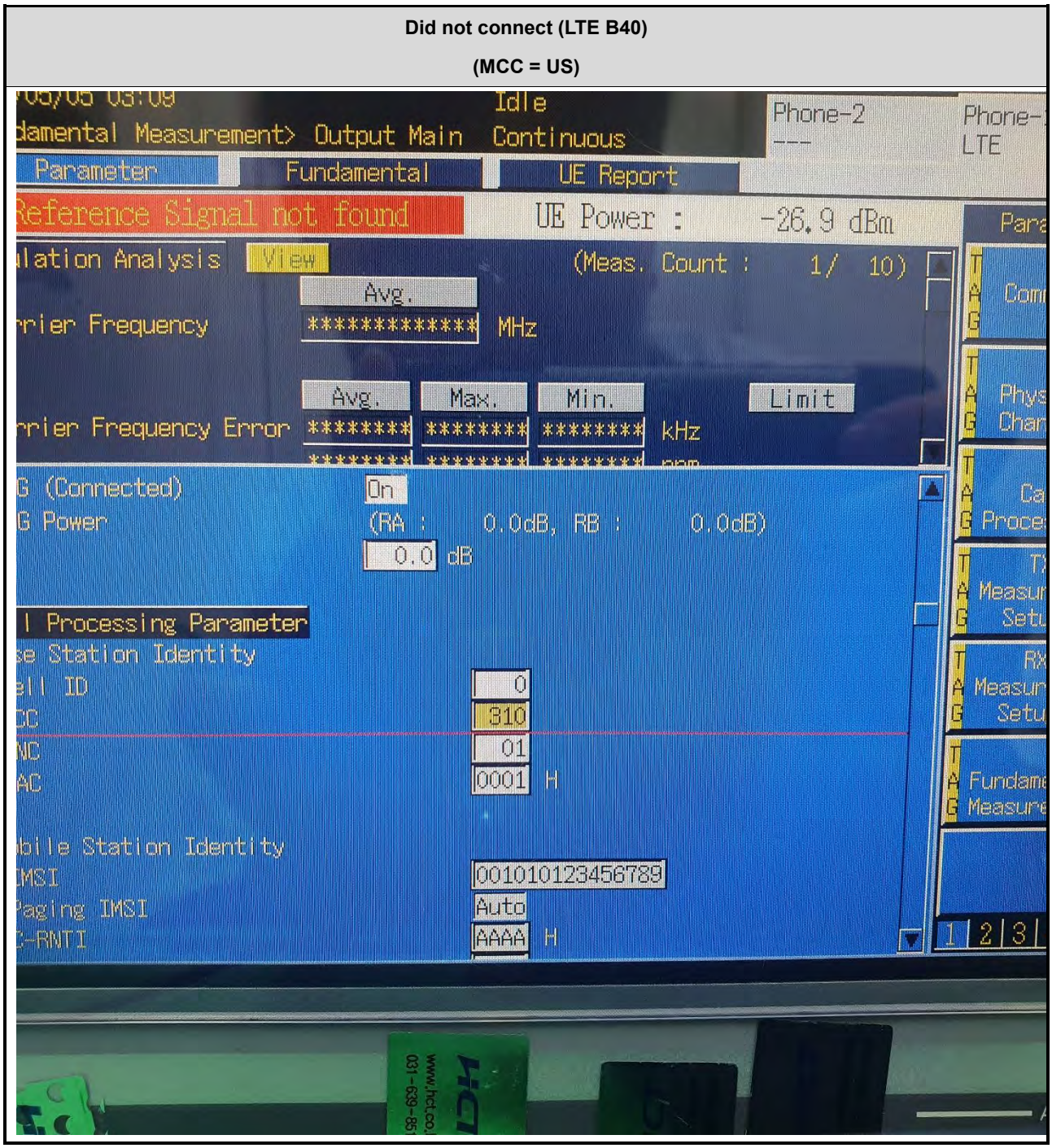
Did not connect (LTE B38)

(MCC = US)



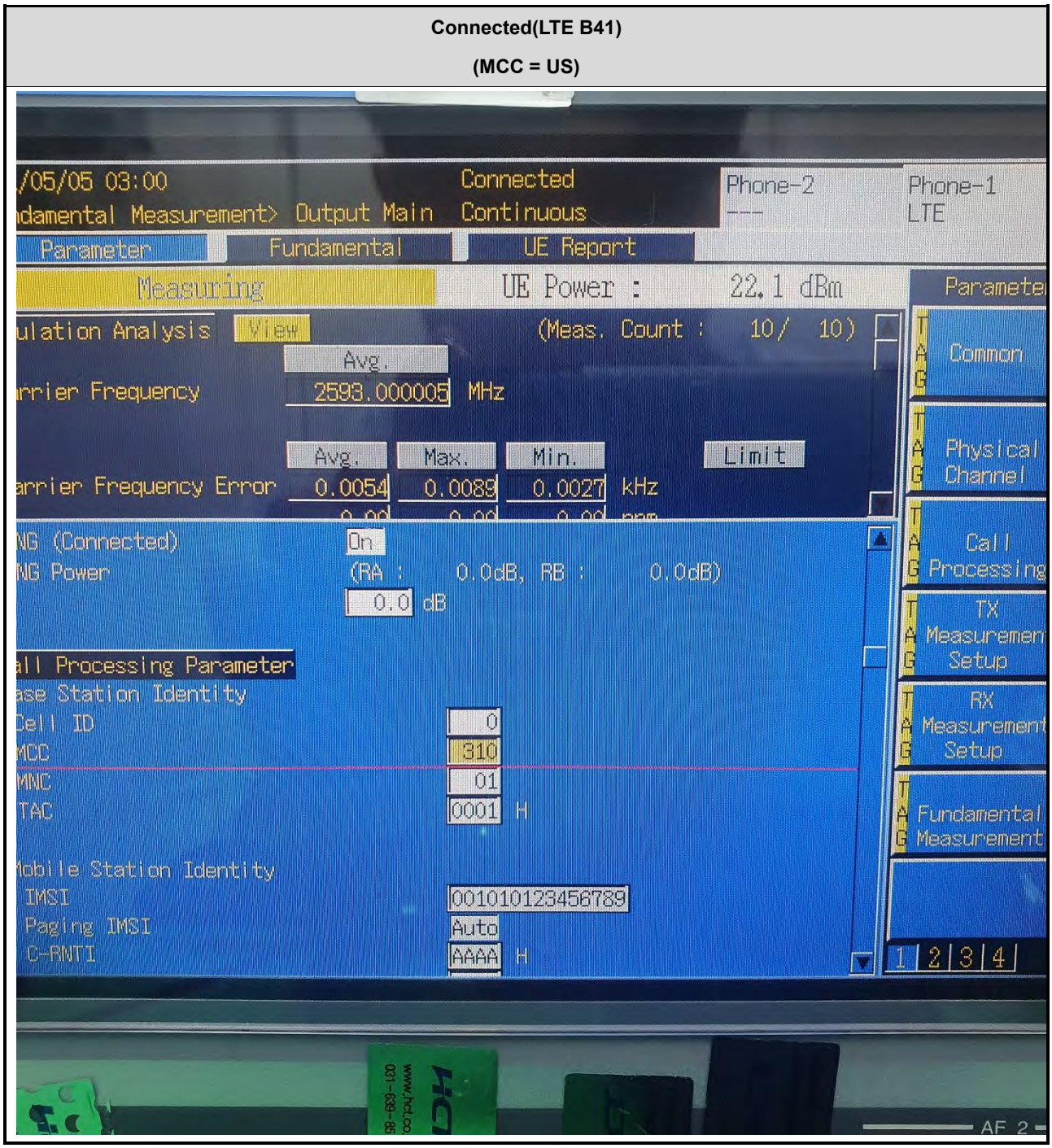
Did not connect (LTE B40)

(MCC = US)

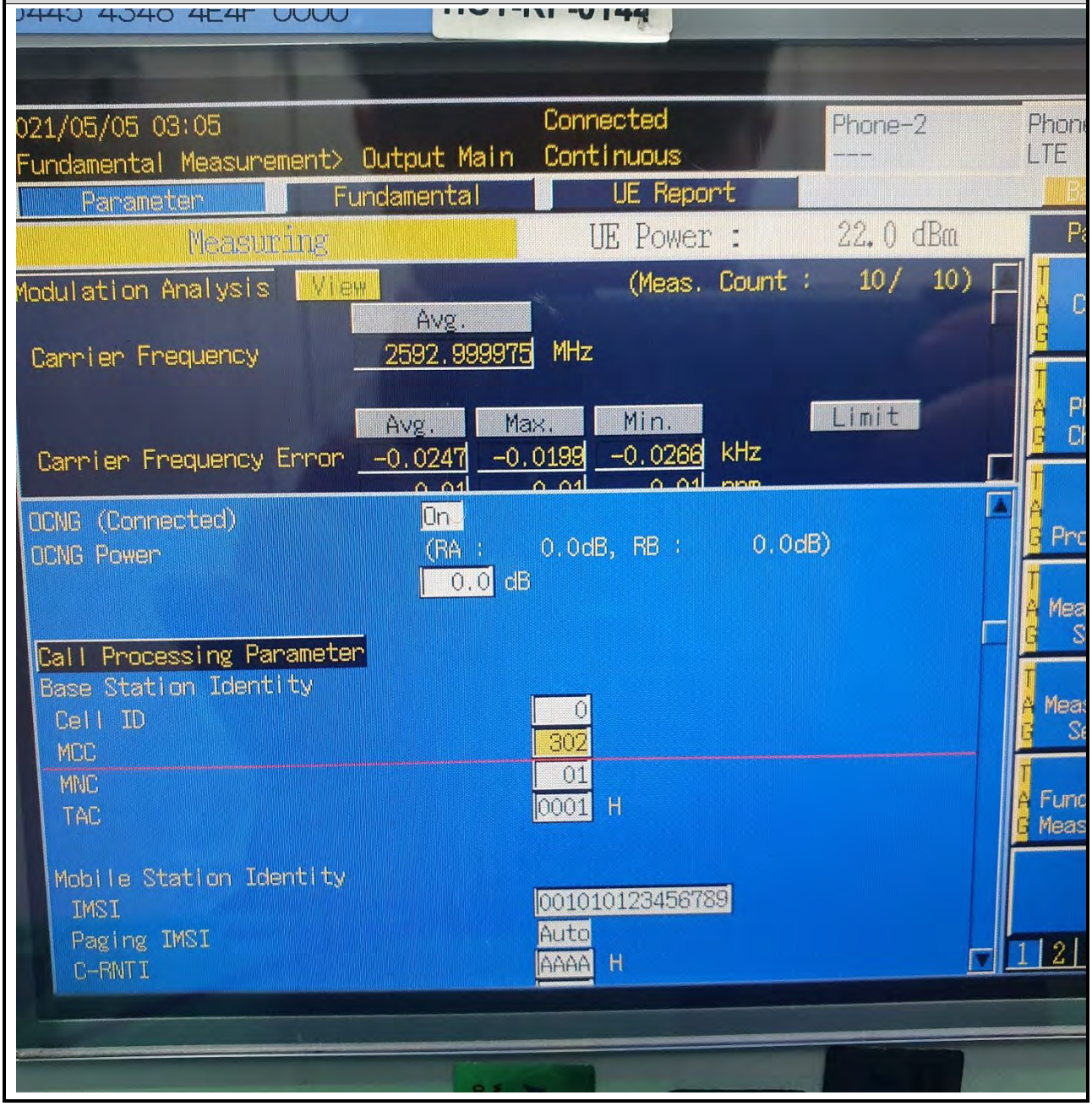


Connected(LTE B41)

(MCC = US)

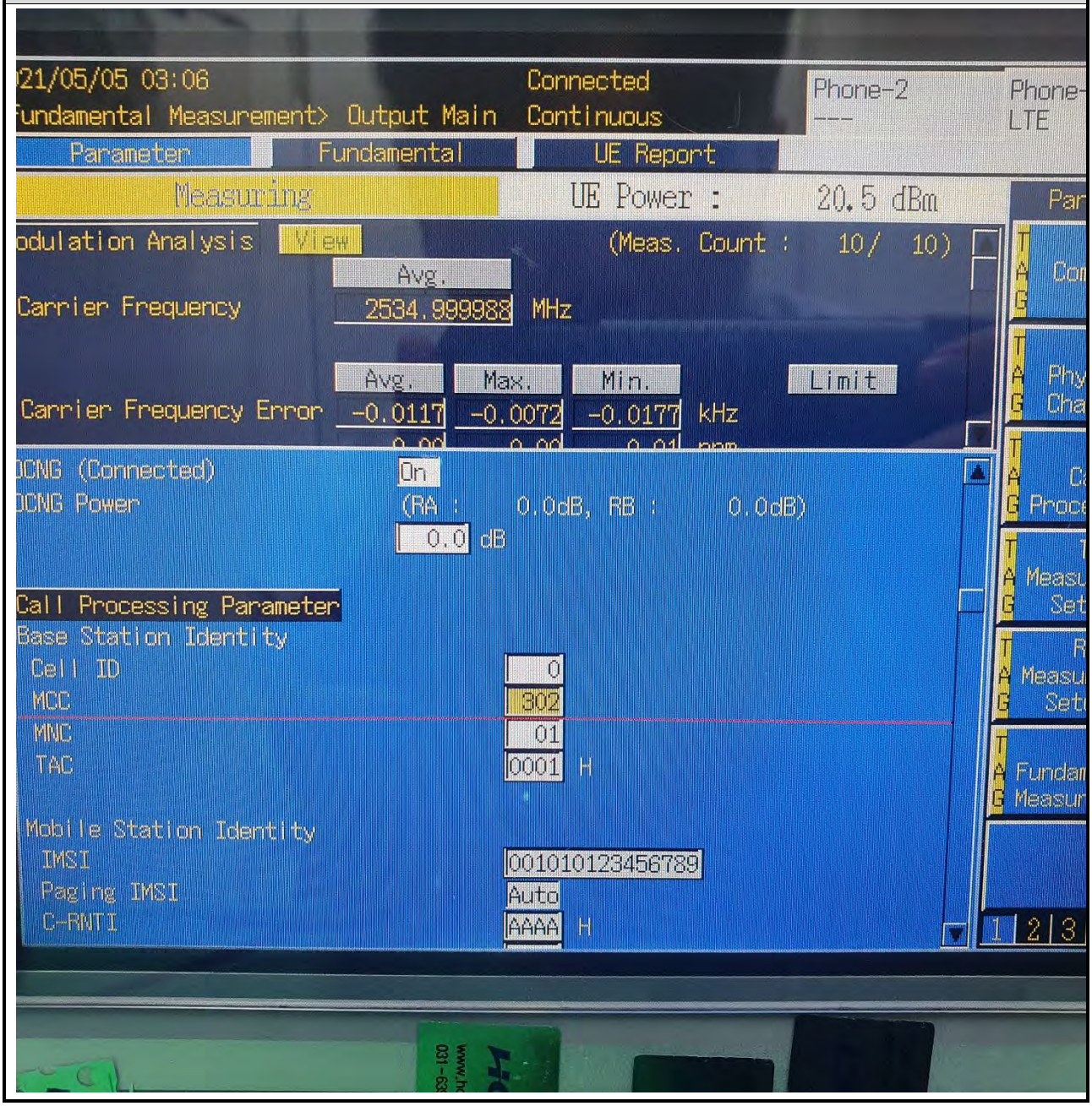


Connected(LTE B41) (MCC = Canada)



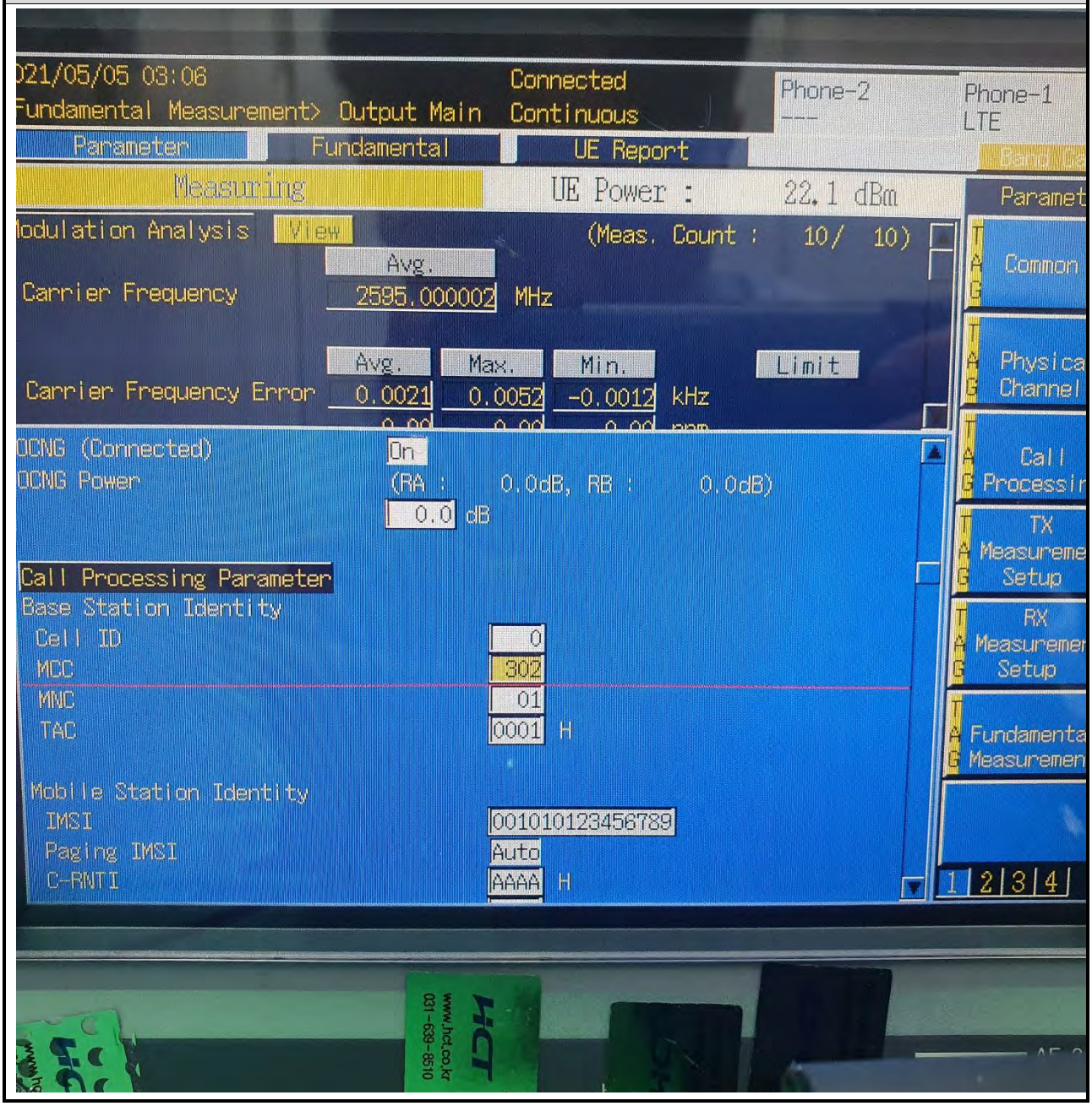
Connected (LTE B7)

(MCC = Canada)



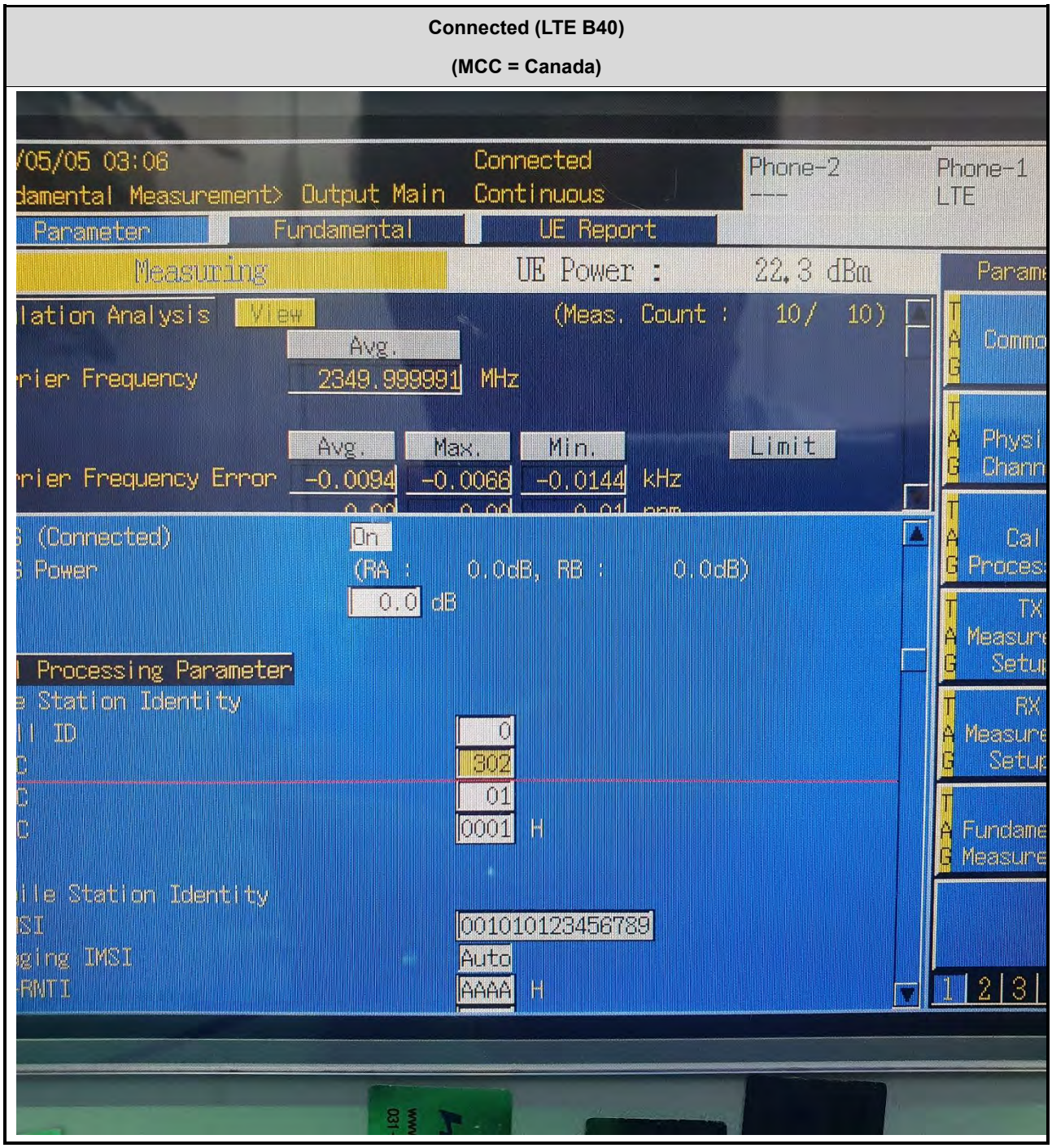
Connected (LTE B38)

(MCC = Canada)



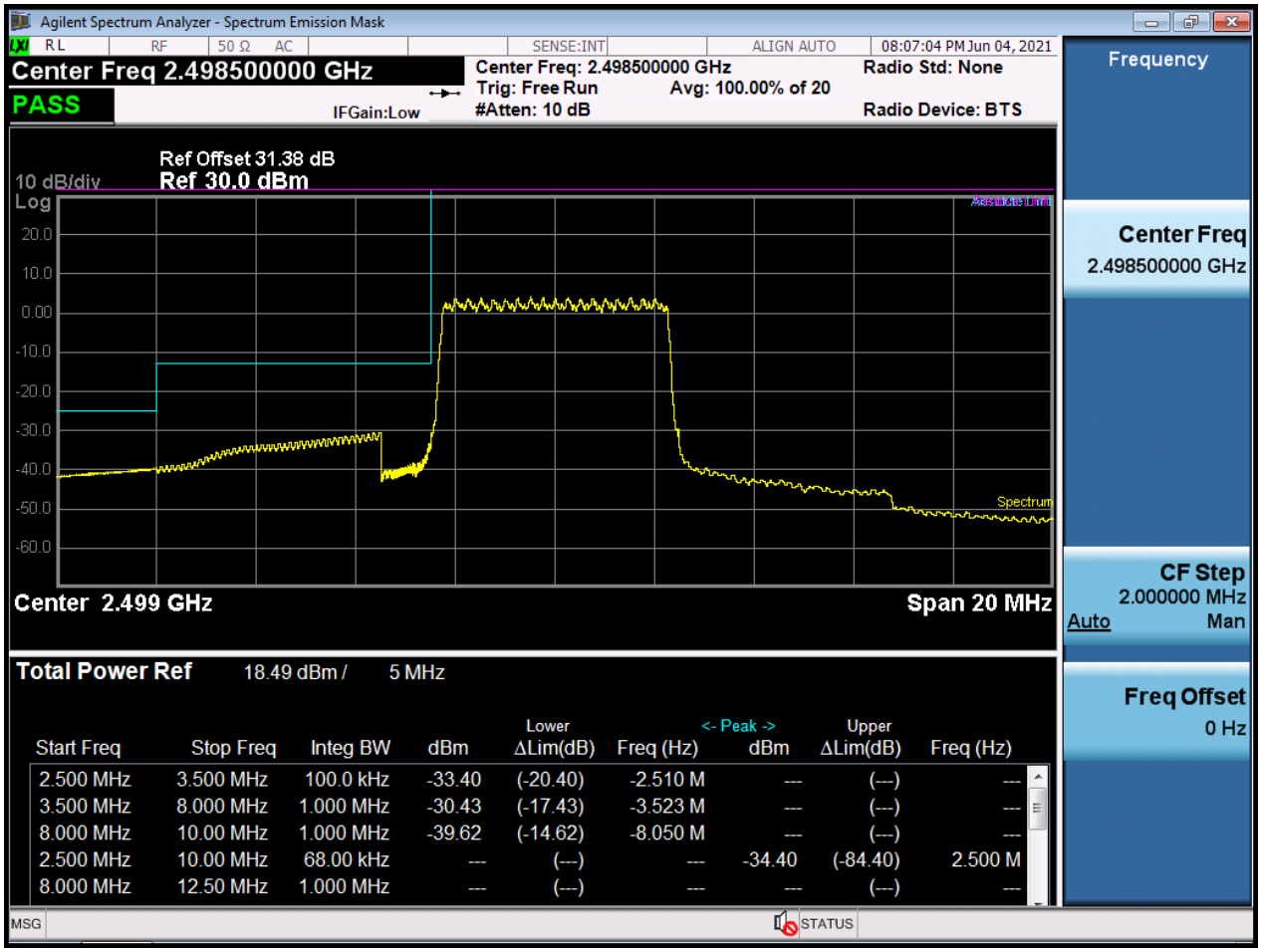
Connected (LTE B40)

(MCC = Canada)

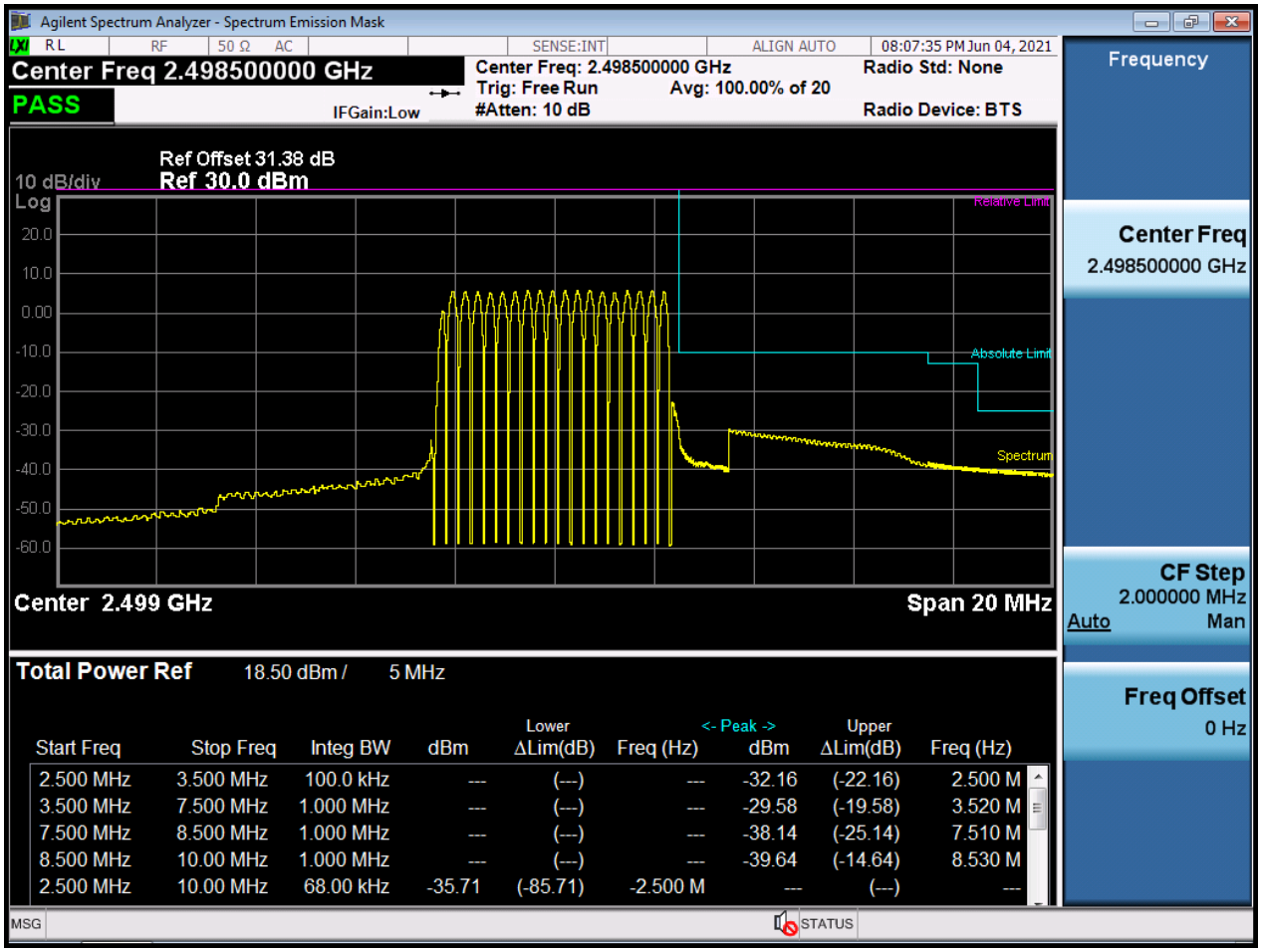


9. TEST PLOTS

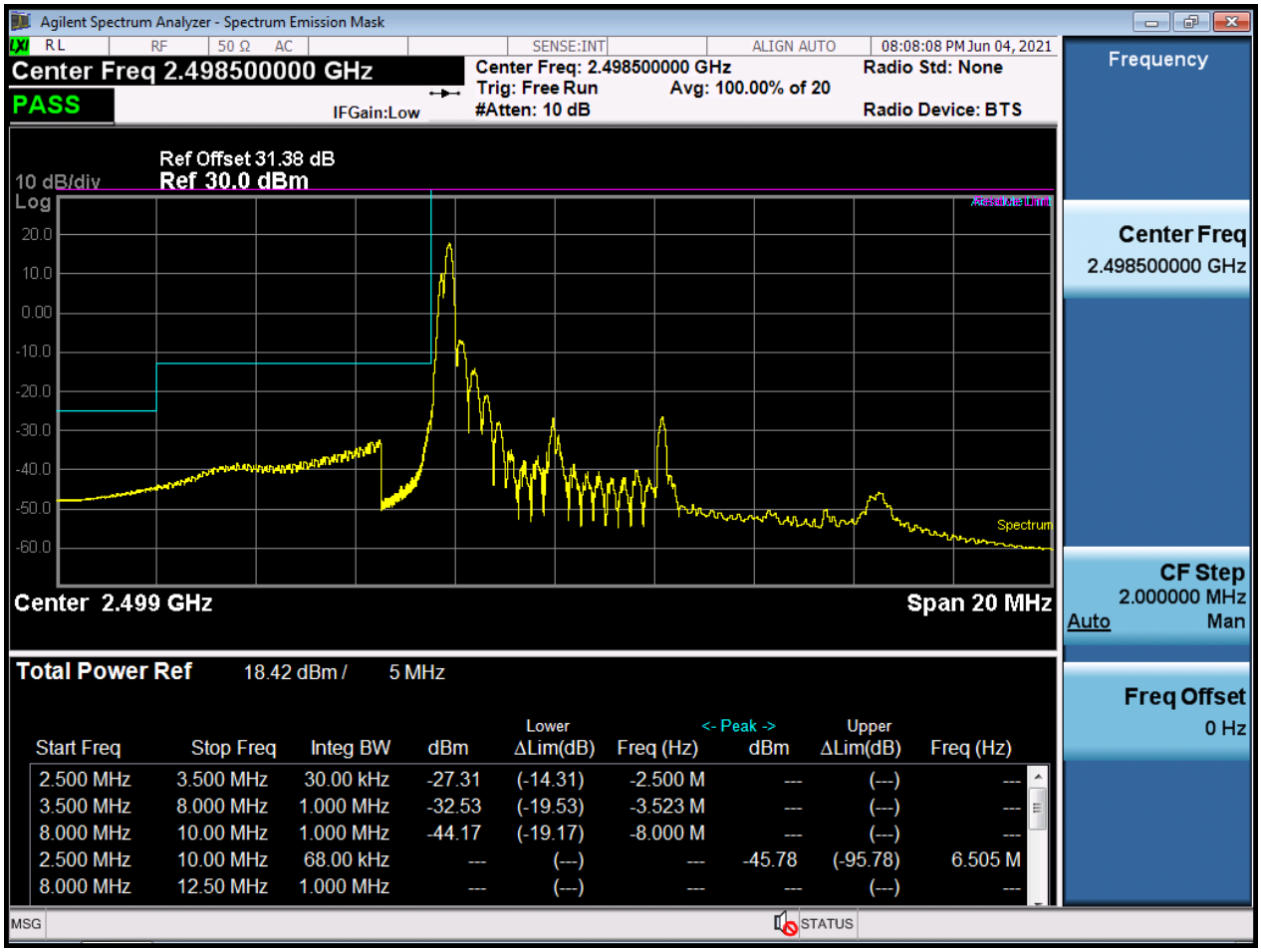
LTE41_5M_BandEdge_Lower_Low_2498.5MHz_QPSK_FullRB



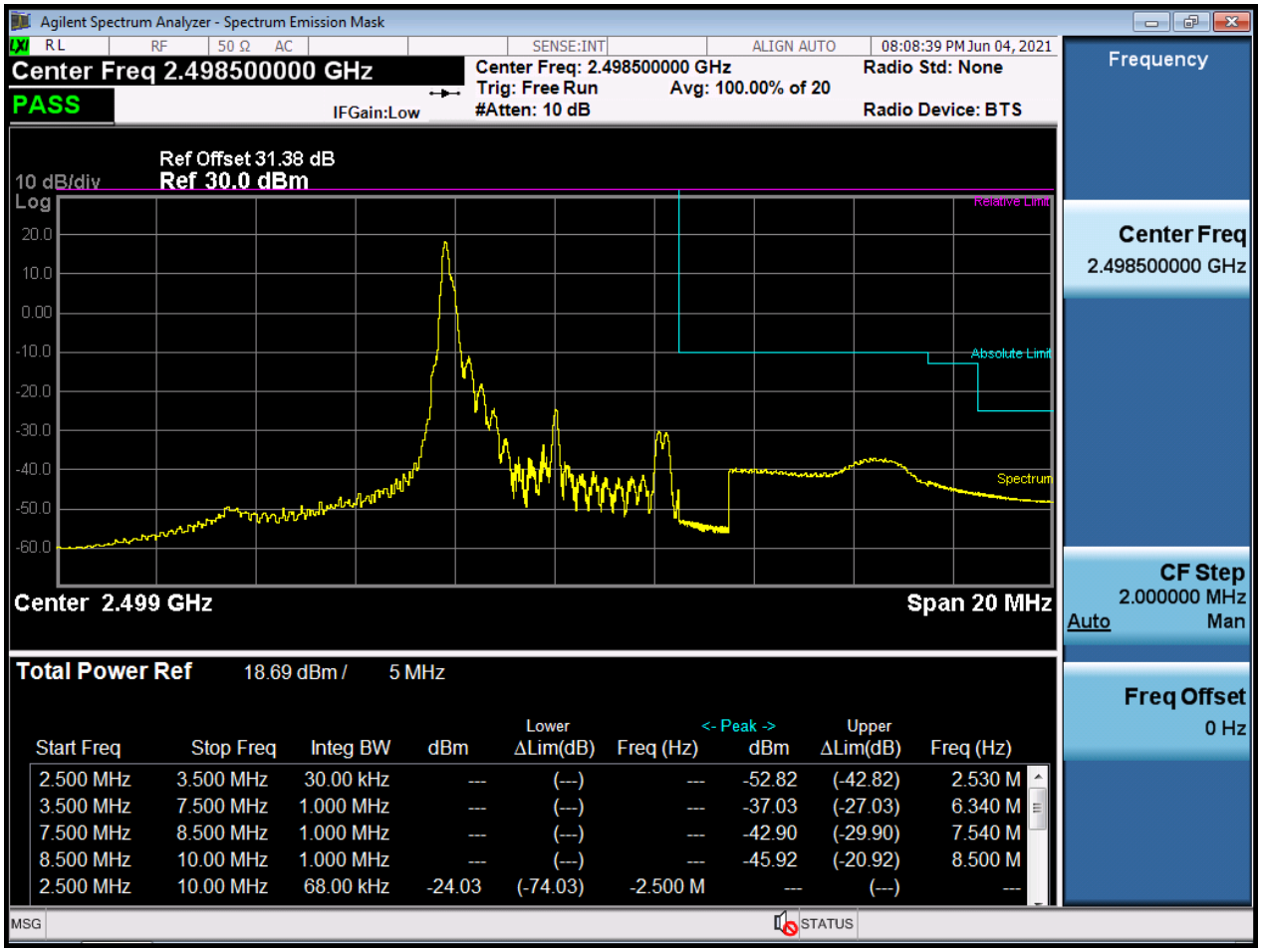
LTE41_5M_BandEdge_Upper_Low_2498.5MHz_QPSK_FullRB



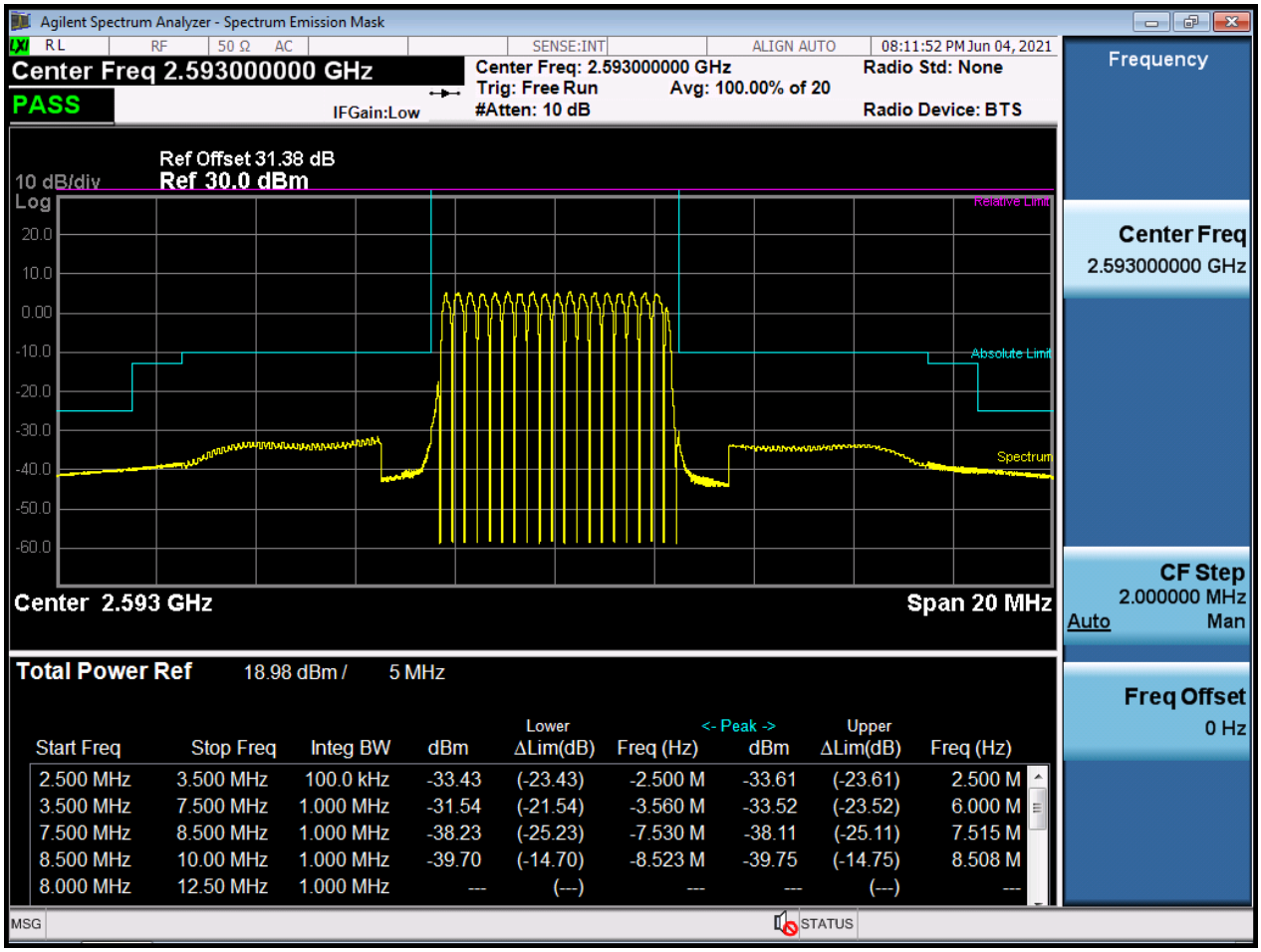
LTE41_5M_BandEdge_Lower_Low_2498.5MHz_QPSK_1RB



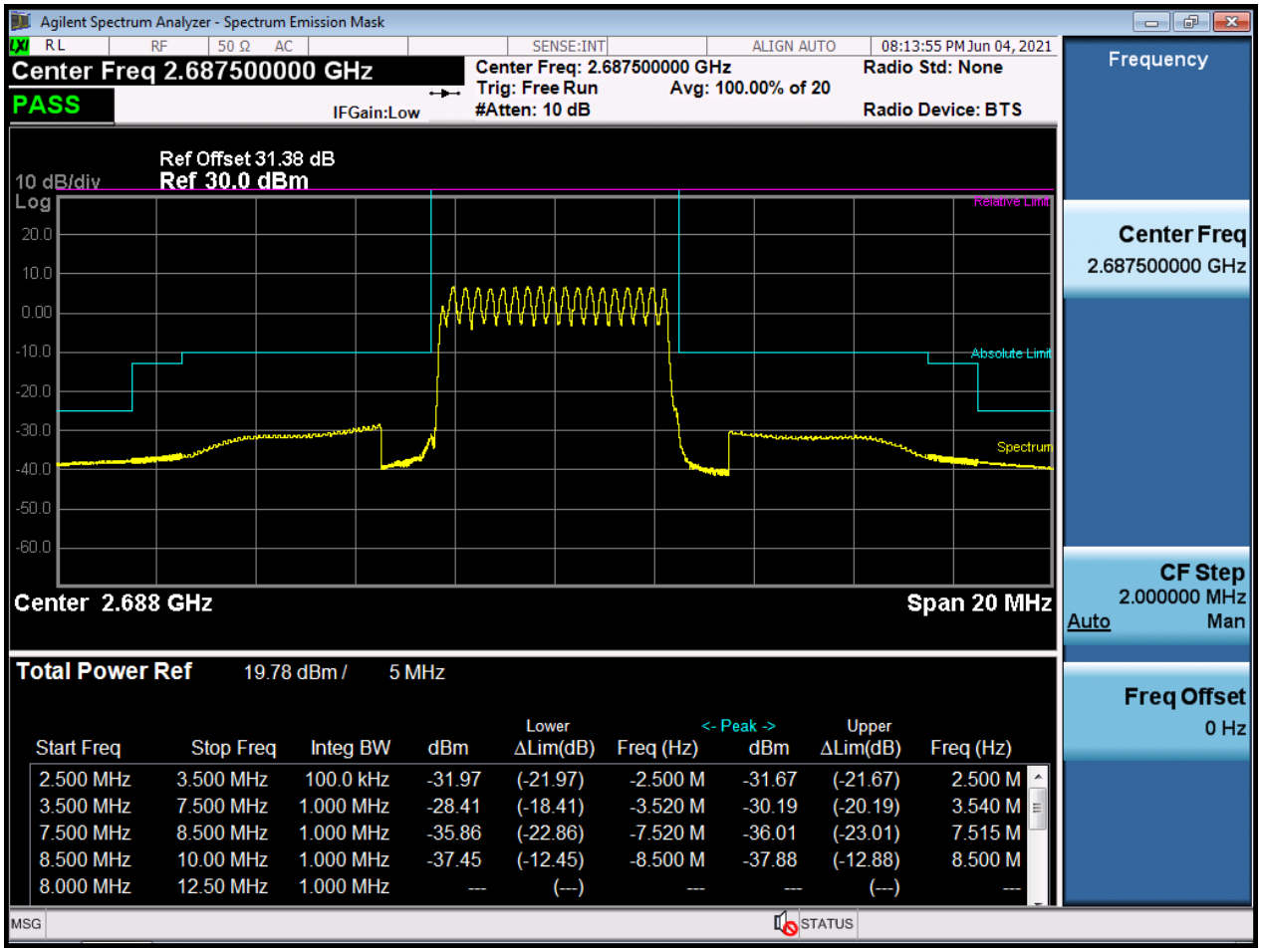
LTE41_5M_BandEdge_Upper_Low_2498.5MHz_QPSK_1RB



LTE41_5M_BandEdge_Mid_2593MHz_QPSK_FullRB

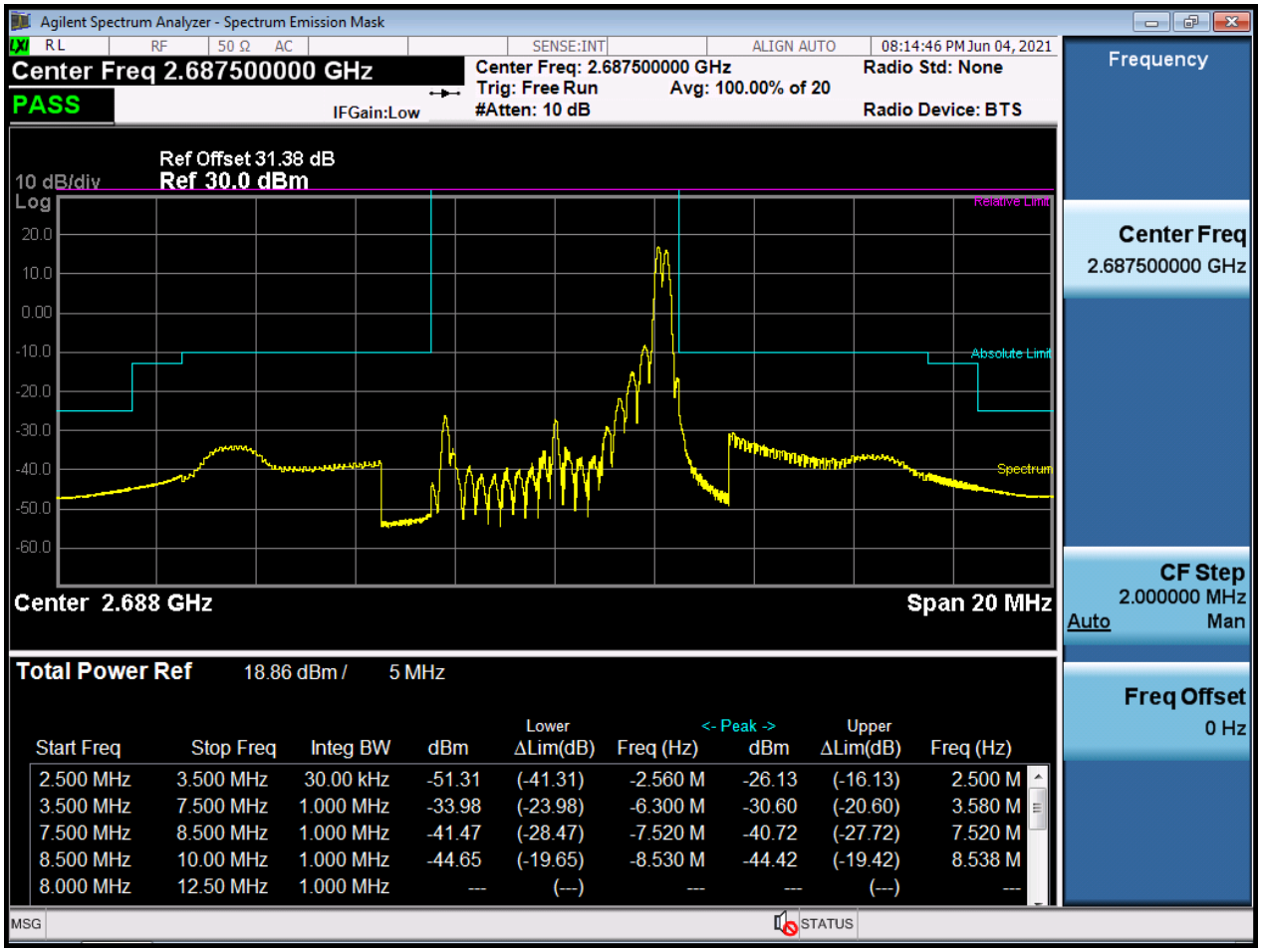


LTE41_5M_BandEdge_High_2687.5MHz_QPSK_FullRB



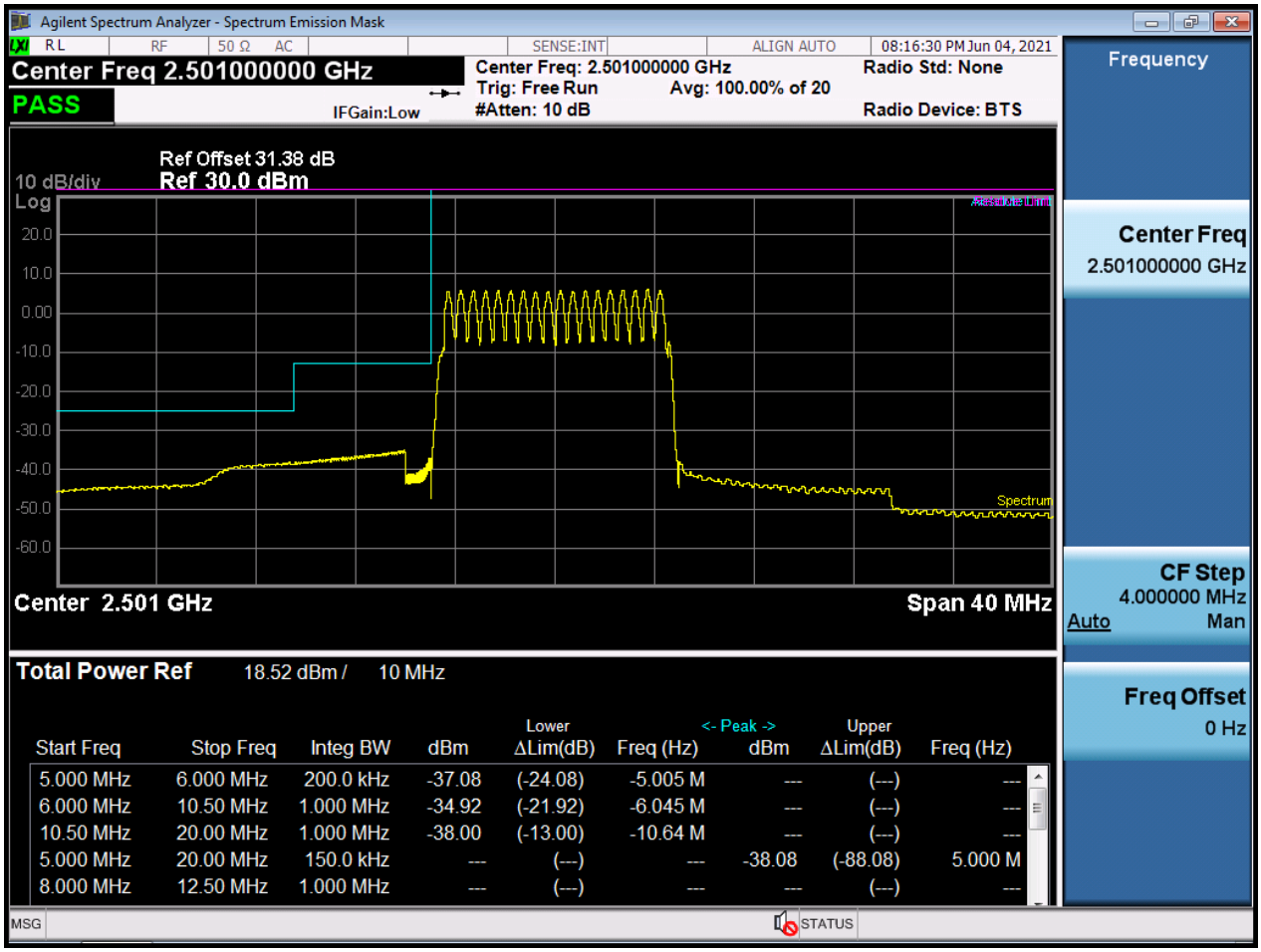
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
2.500 MHz	3.500 MHz	100.0 kHz	-31.97	(-21.97)	-2.500 M	-31.67	(-21.67)	2.500 M
3.500 MHz	7.500 MHz	1.000 MHz	-28.41	(-18.41)	-3.520 M	-30.19	(-20.19)	3.540 M
7.500 MHz	8.500 MHz	1.000 MHz	-35.86	(-22.86)	-7.520 M	-36.01	(-23.01)	7.515 M
8.500 MHz	10.00 MHz	1.000 MHz	-37.45	(-12.45)	-8.500 M	-37.88	(-12.88)	8.500 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

LTE41_5M_BandEdge_High_2687.5MHz_QPSK_1RB



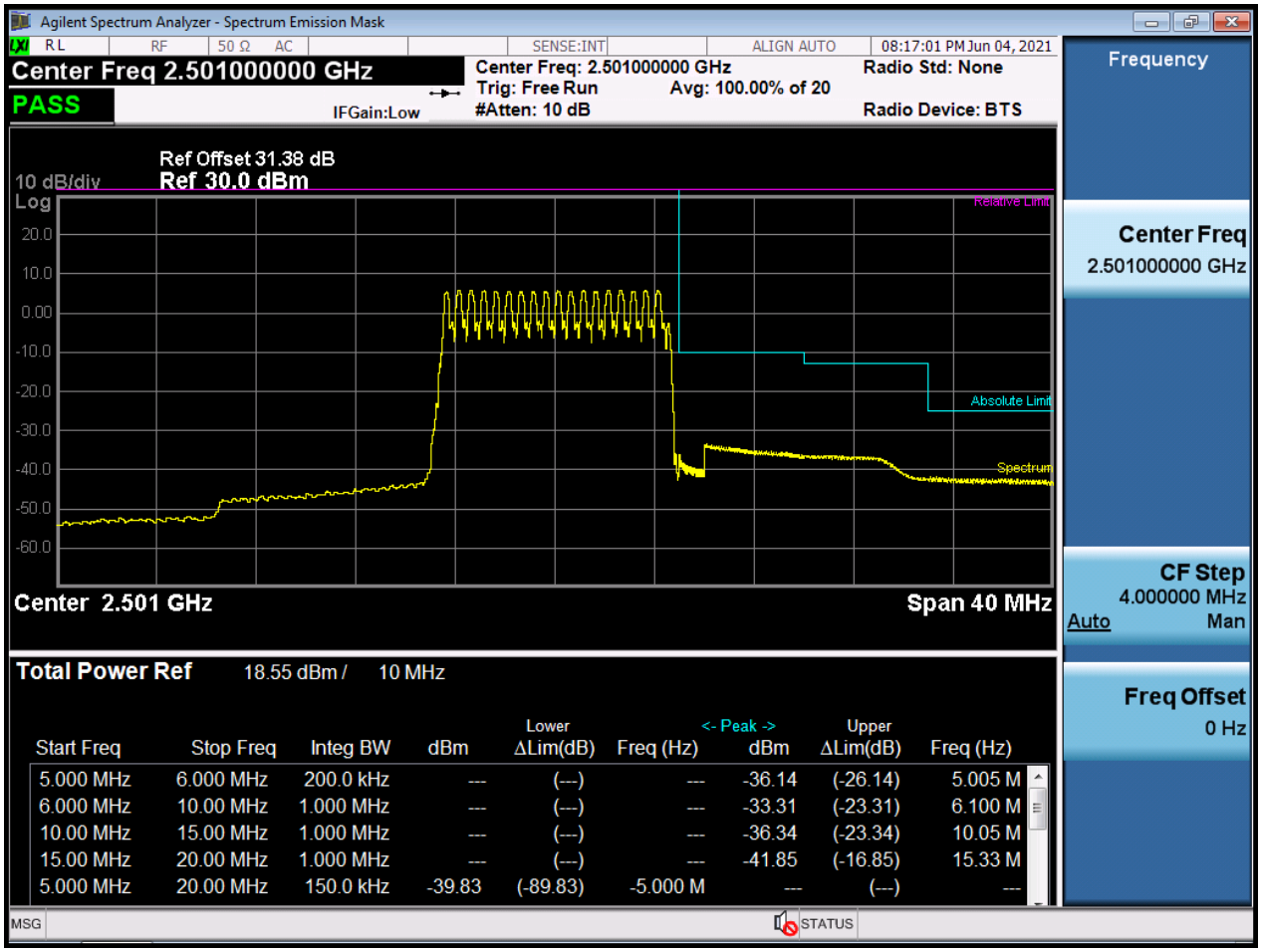
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
2.500 MHz	3.500 MHz	30.00 kHz	-51.31	(-41.31)	-2.560 M	-26.13	(-16.13)	2.500 M
3.500 MHz	7.500 MHz	1.000 MHz	-33.98	(-23.98)	-6.300 M	-30.60	(-20.60)	3.580 M
7.500 MHz	8.500 MHz	1.000 MHz	-41.47	(-28.47)	-7.520 M	-40.72	(-27.72)	7.520 M
8.500 MHz	10.00 MHz	1.000 MHz	-44.65	(-19.65)	-8.530 M	-44.42	(-19.42)	8.538 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

LTE41_10M_BandEdge_Lower_Low_2501MHz_QPSK_FullRB

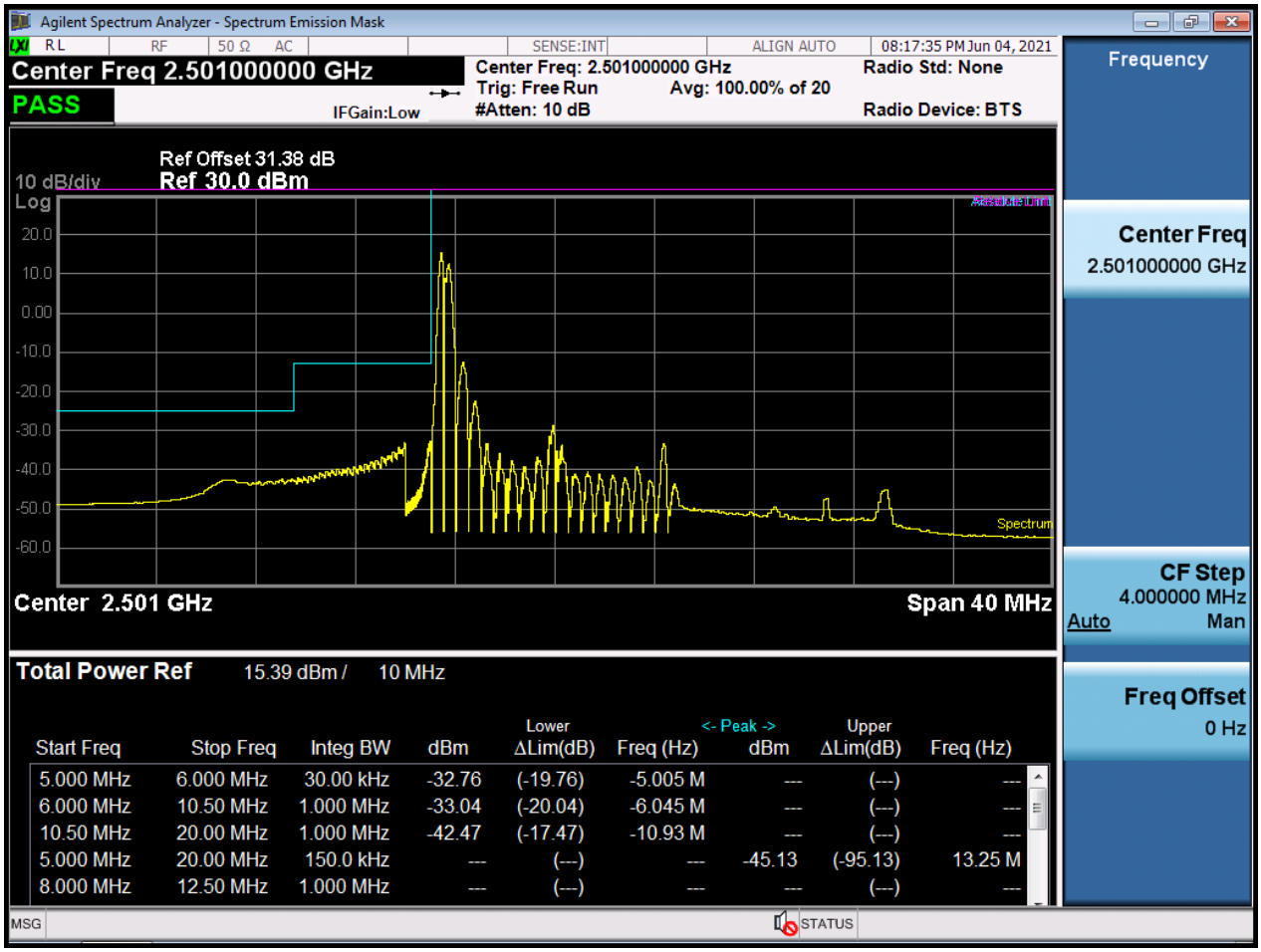


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
5.000 MHz	6.000 MHz	200.0 kHz	-37.08	(-24.08)	-5.005 M	---	(---)	---
6.000 MHz	10.50 MHz	1.000 MHz	-34.92	(-21.92)	-6.045 M	---	(---)	---
10.50 MHz	20.00 MHz	1.000 MHz	-38.00	(-13.00)	-10.64 M	---	(---)	---
5.000 MHz	20.00 MHz	150.0 kHz	---	(---)	---	-38.08	(-88.08)	5.000 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

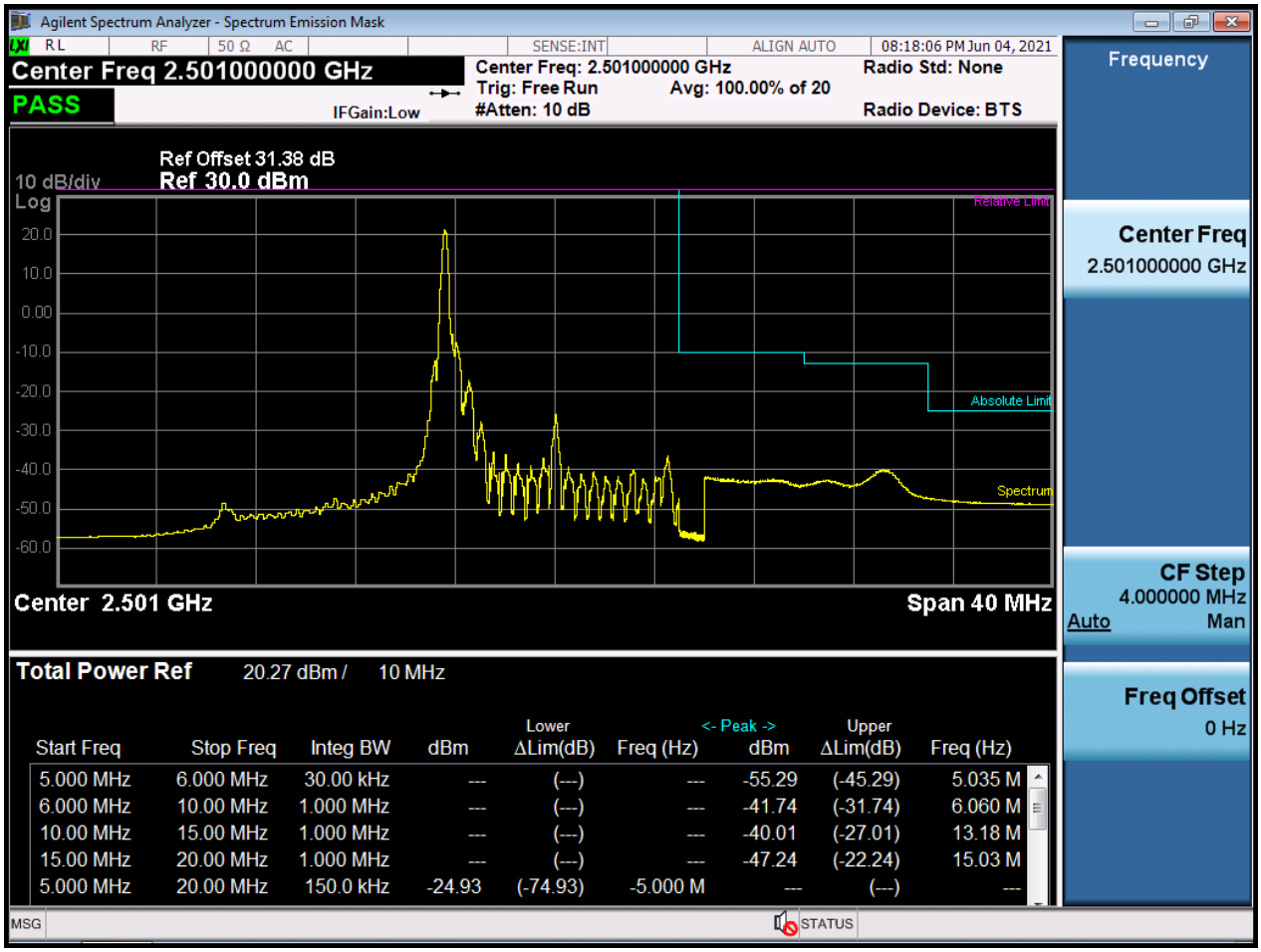
LTE41_10M_BandEdge_Upper_Low_2501MHz_QPSK_FullRB



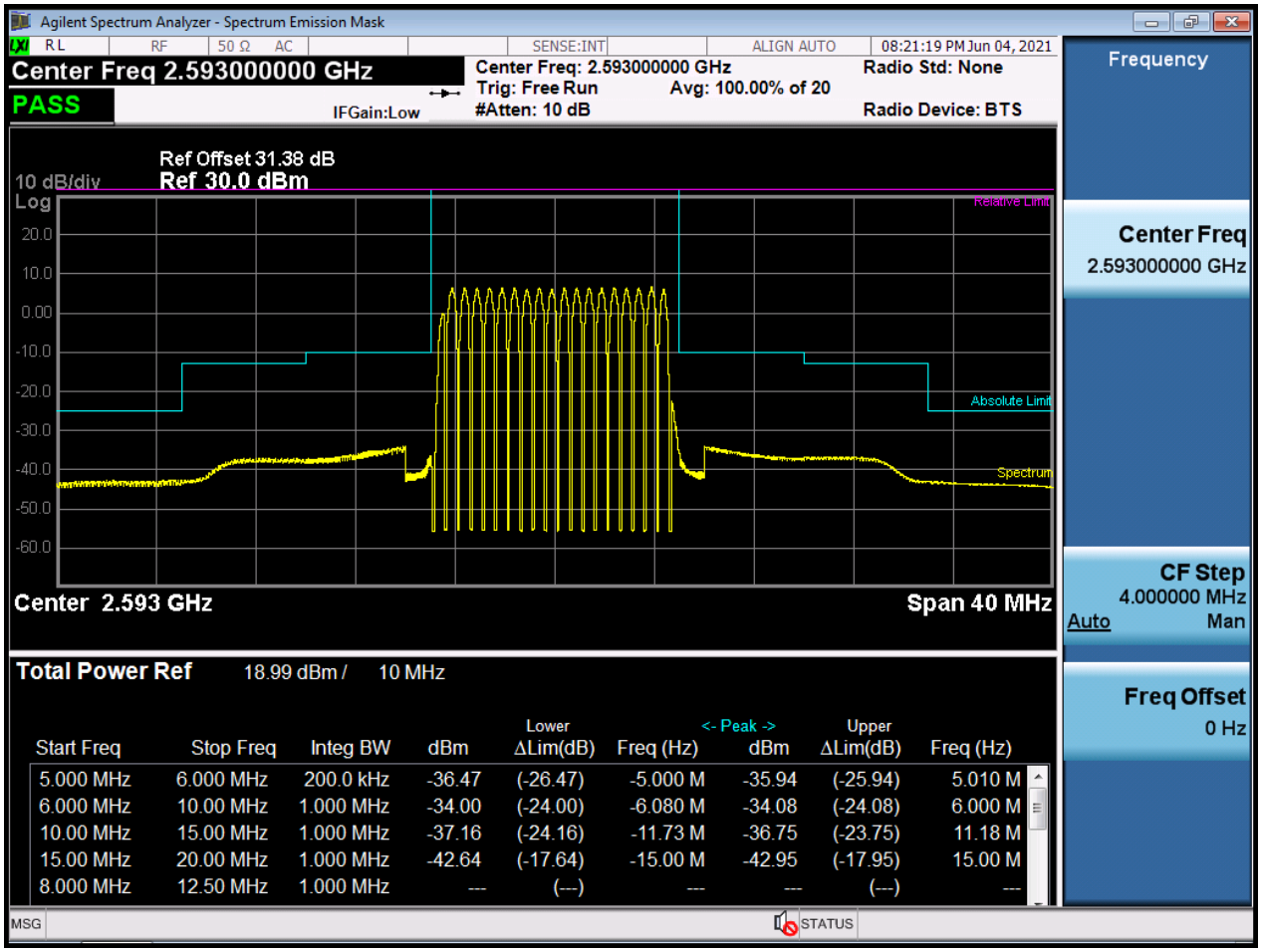
LTE41_10M_BandEdge_Lower_Low_2501MHz_QPSK_1RB



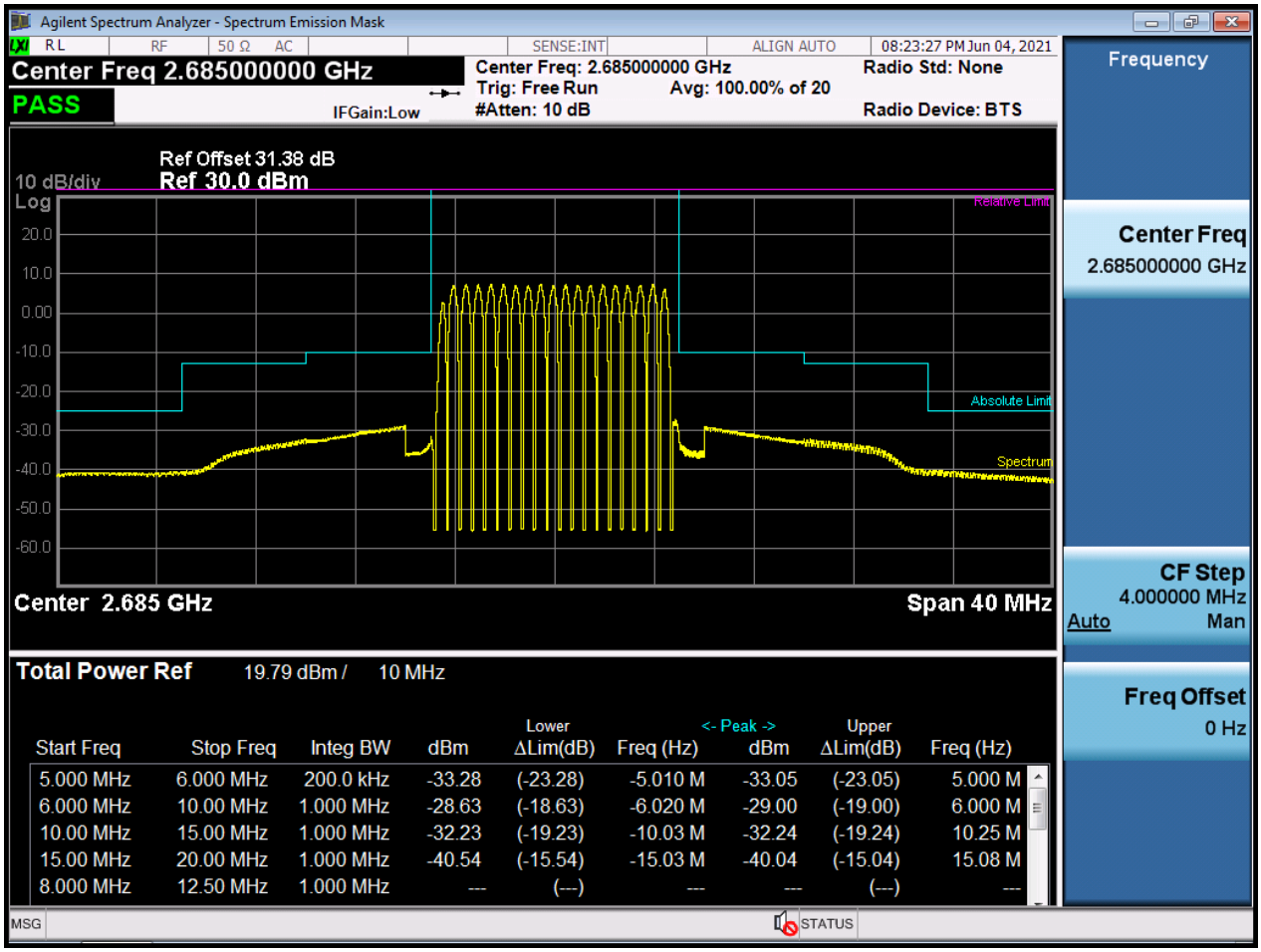
LTE41_10M_BandEdge_Upper_Low_2501MHz_QPSK_1RB



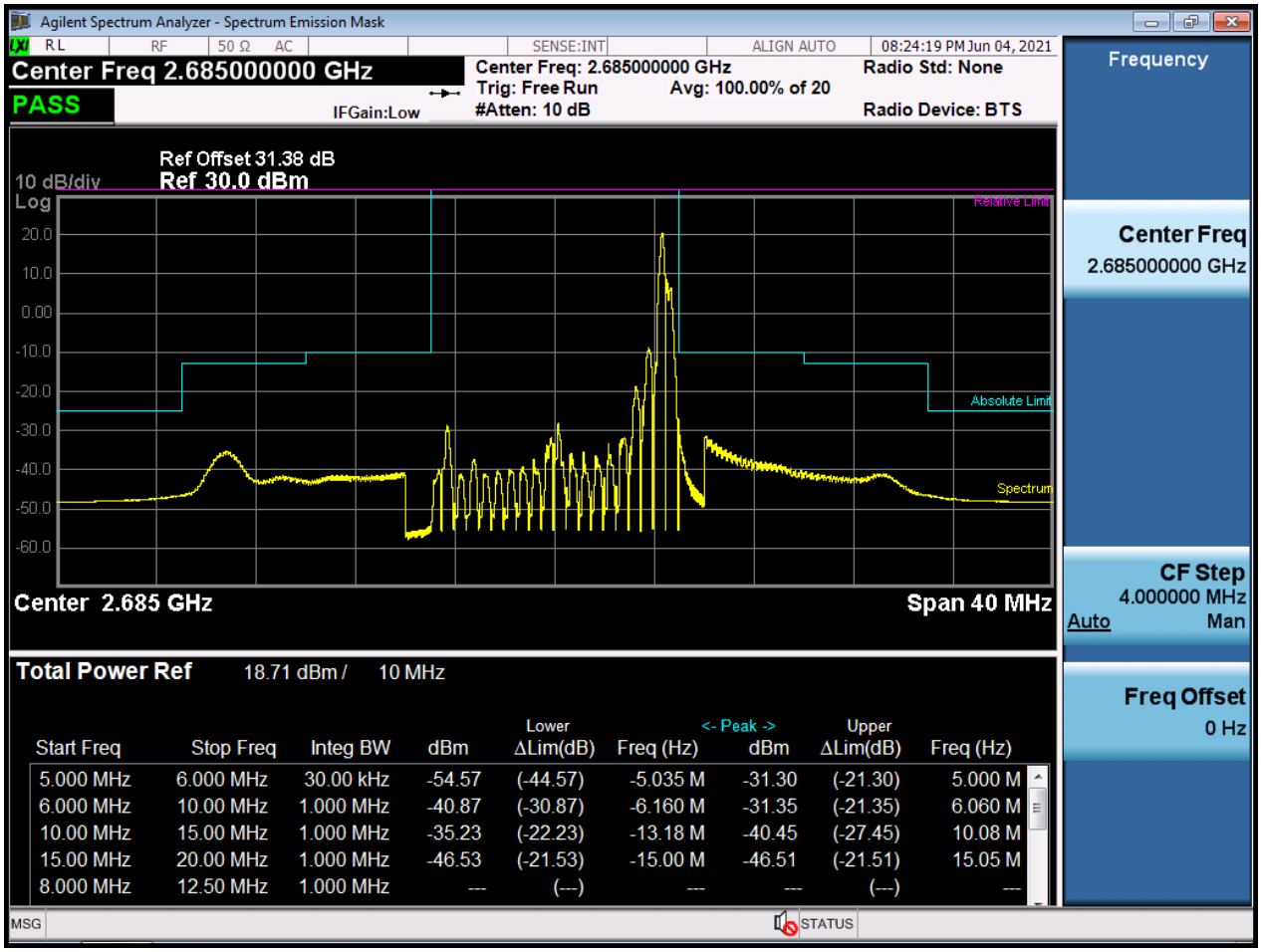
LTE41_10M_BandEdge_Mid_2593MHz_QPSK_FullRB



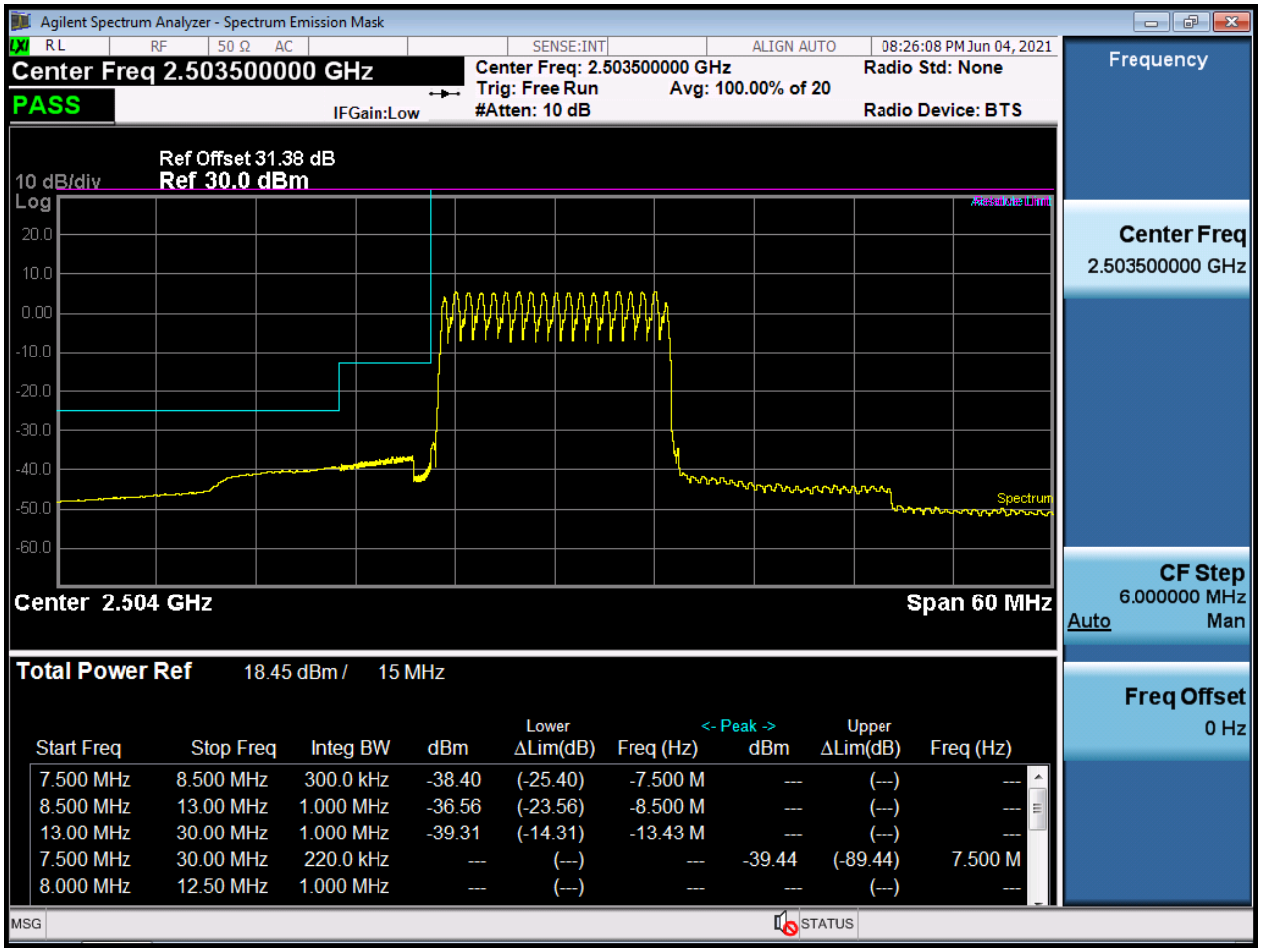
LTE41_10M_BandEdge_High_2685MHz_QPSK_FullRB



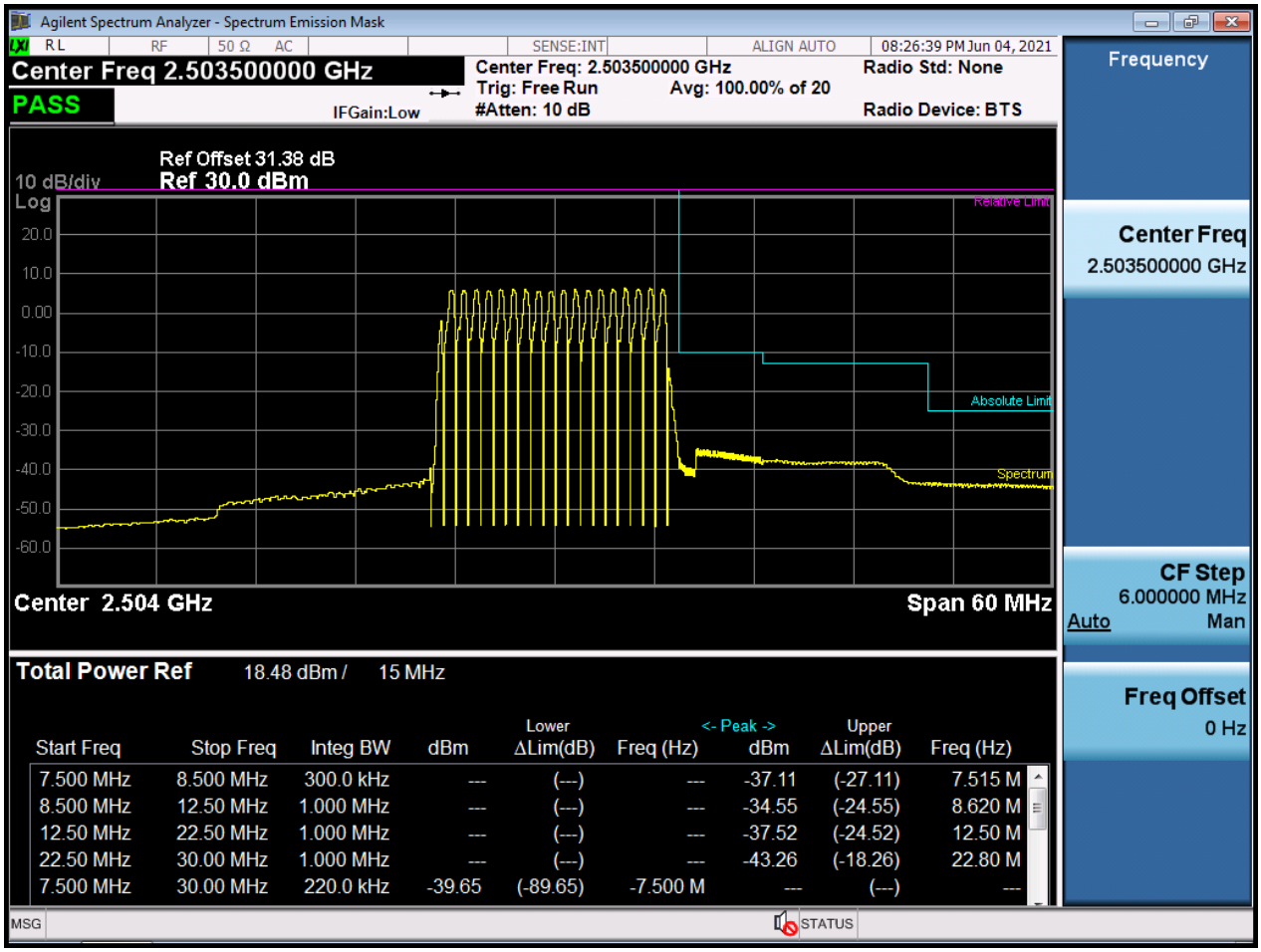
LTE41_10M_BandEdge_High_2685MHz_QPSK_1RB



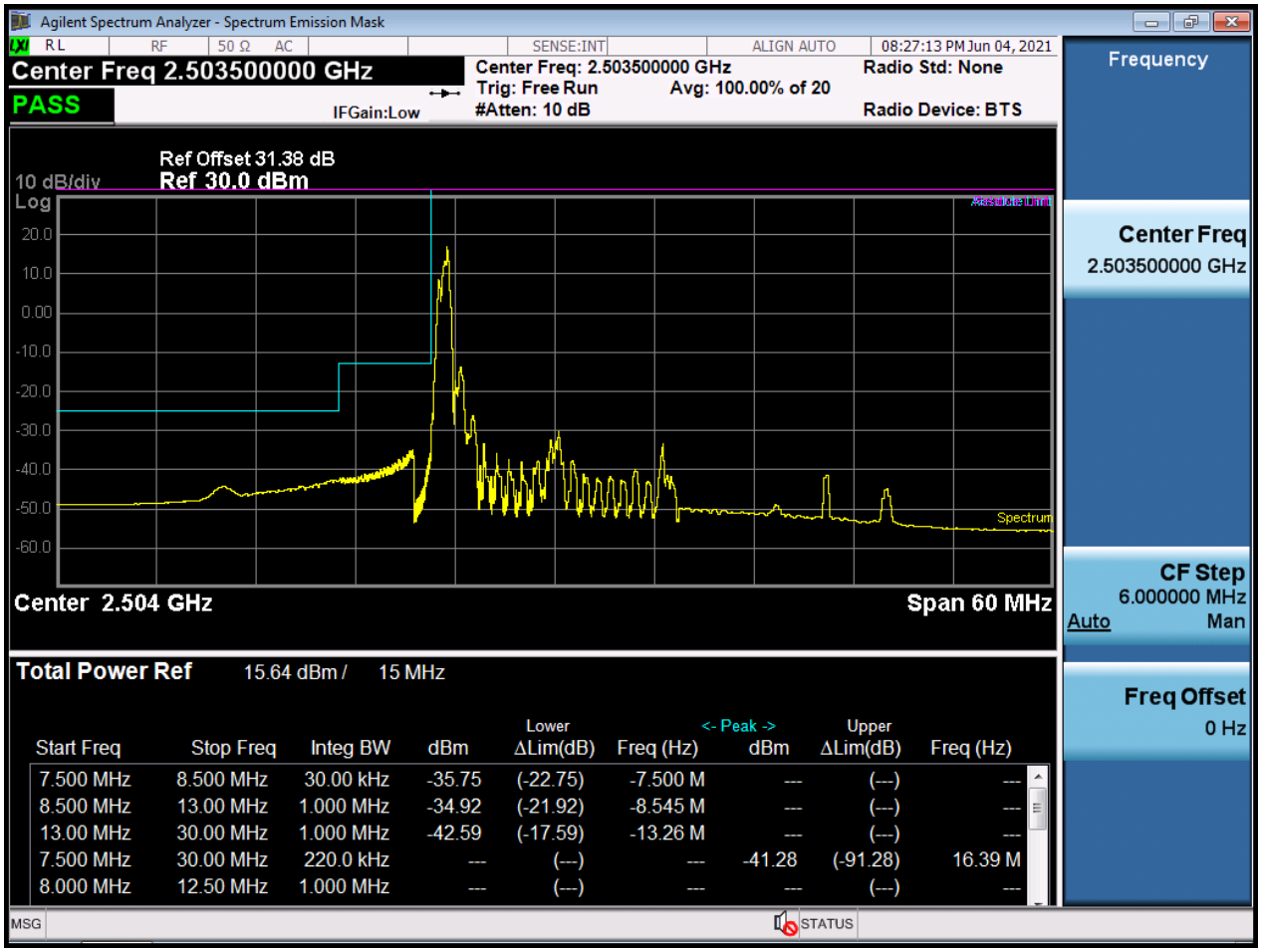
LTE41_15M_BandEdge_Lower_Low_2503.5MHz_QPSK_FullRB



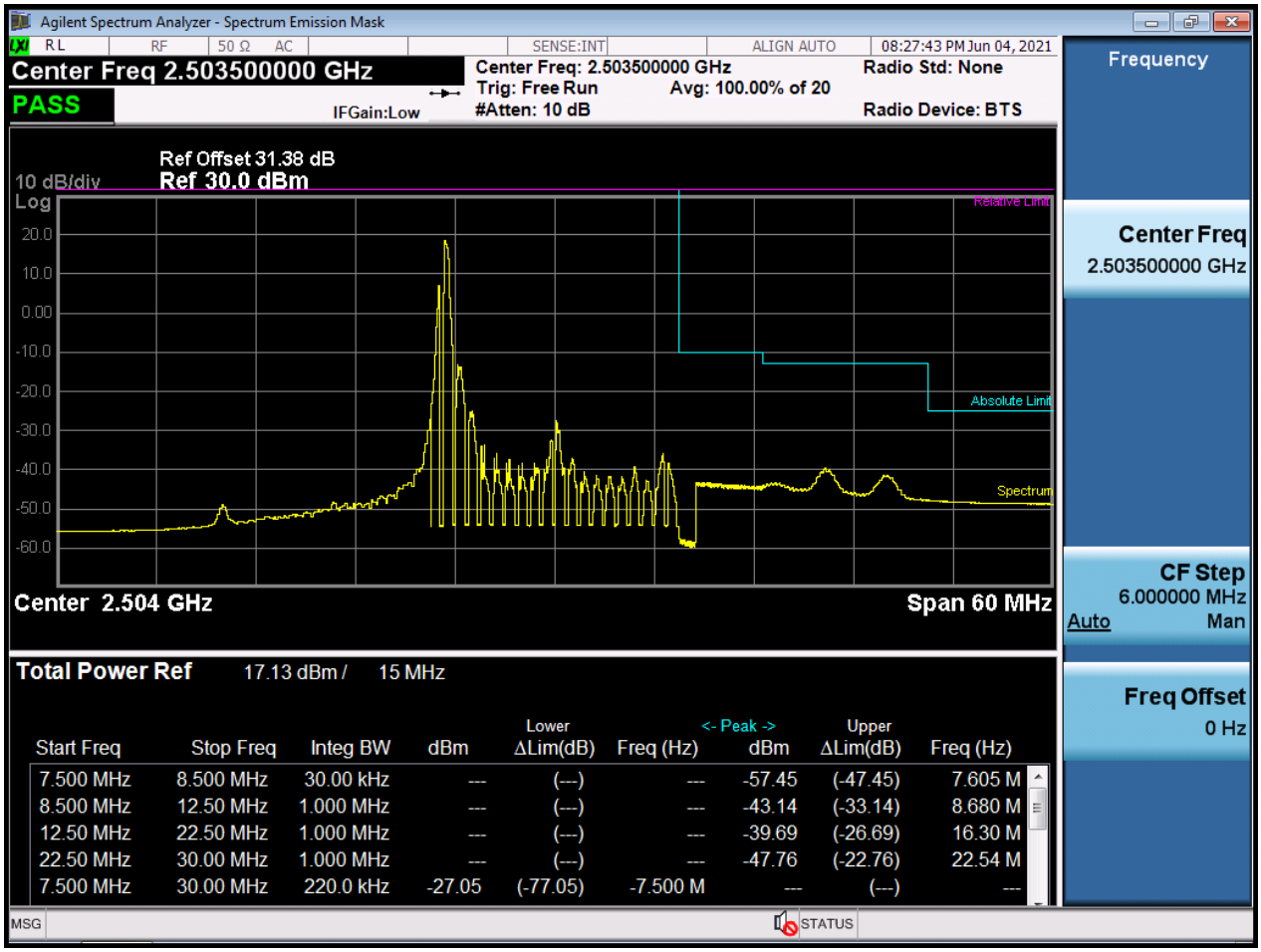
LTE41_15M_BandEdge_Upper_Low_2503.5MHz_QPSK_FullRB



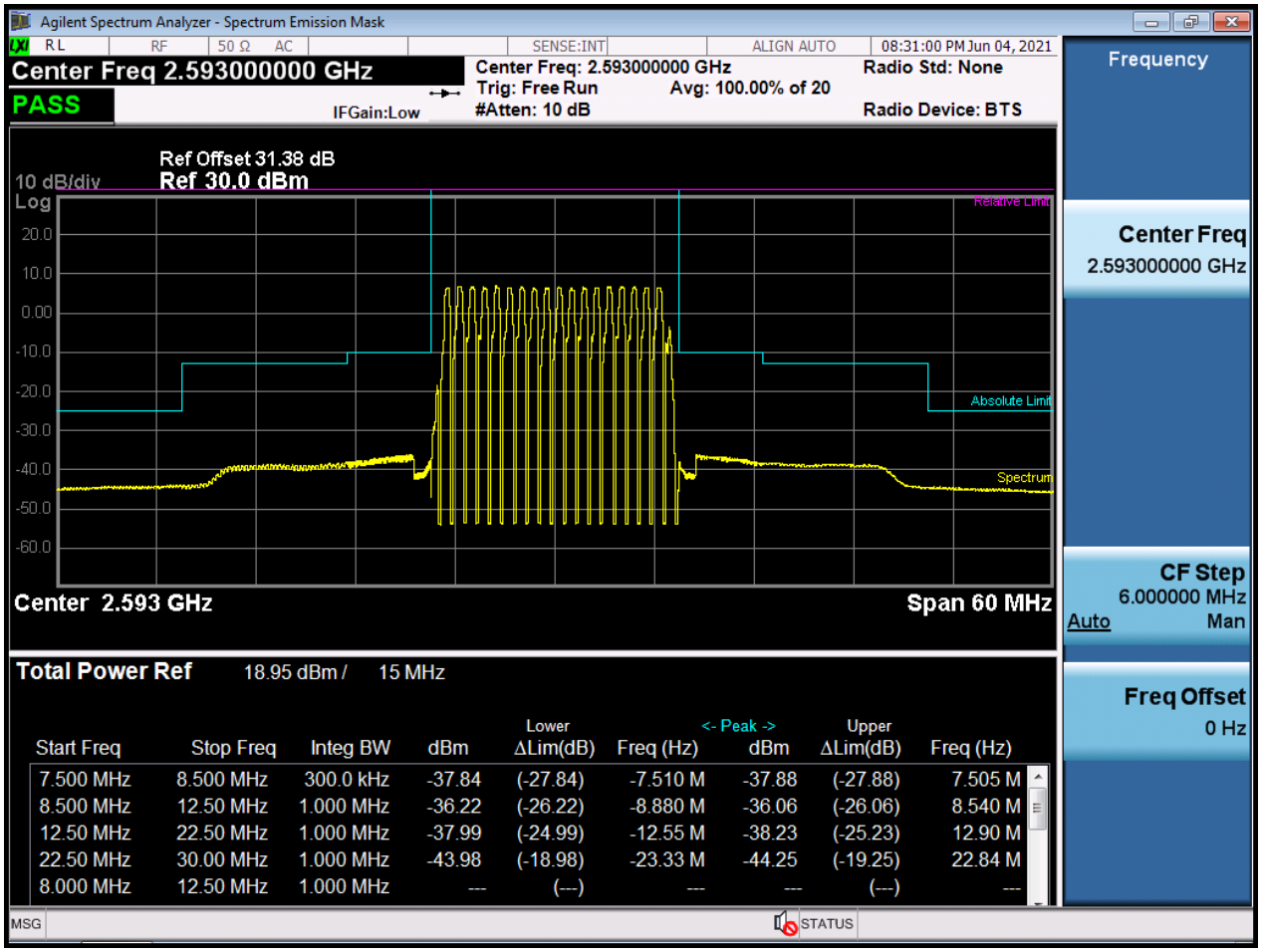
LTE41_15M_BandEdge_Lower_Low_2503.5MHz_QPSK_1RB



LTE41_15M_BandEdge_Upper_Low_2503.5MHz_QPSK_1RB

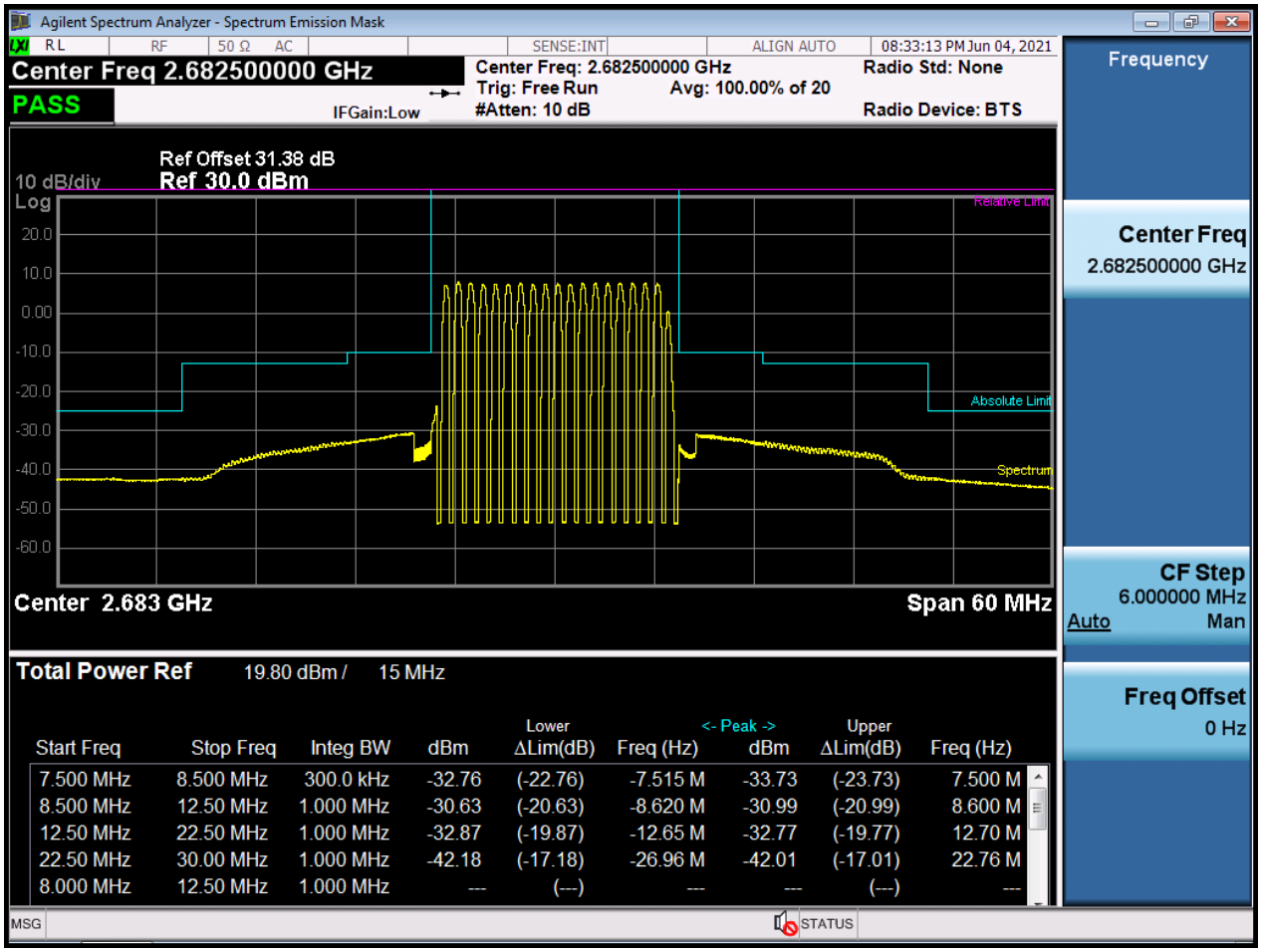


LTE41_15M_BandEdge_Mid_2593MHz_QPSK_FullRB



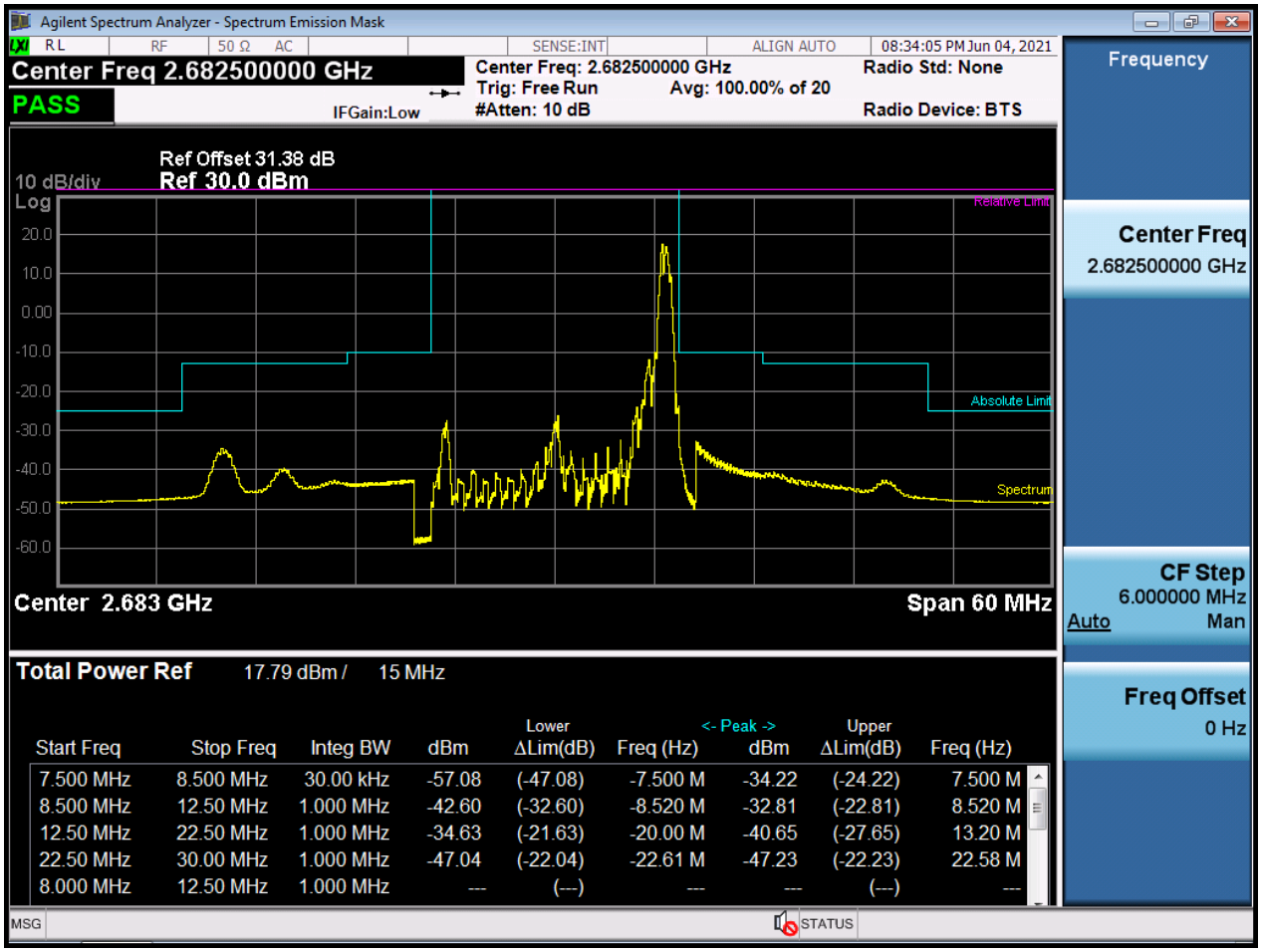
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
7.500 MHz	8.500 MHz	300.0 kHz	-37.84	(-27.84)	-7.510 M	-37.88	(-27.88)	7.505 M
8.500 MHz	12.50 MHz	1.000 MHz	-36.22	(-26.22)	-8.880 M	-36.06	(-26.06)	8.540 M
12.50 MHz	22.50 MHz	1.000 MHz	-37.99	(-24.99)	-12.55 M	-38.23	(-25.23)	12.90 M
22.50 MHz	30.00 MHz	1.000 MHz	-43.98	(-18.98)	-23.33 M	-44.25	(-19.25)	22.84 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

LTE41_15M_BandEdge_High_2682.5MHz_QPSK_FullRB



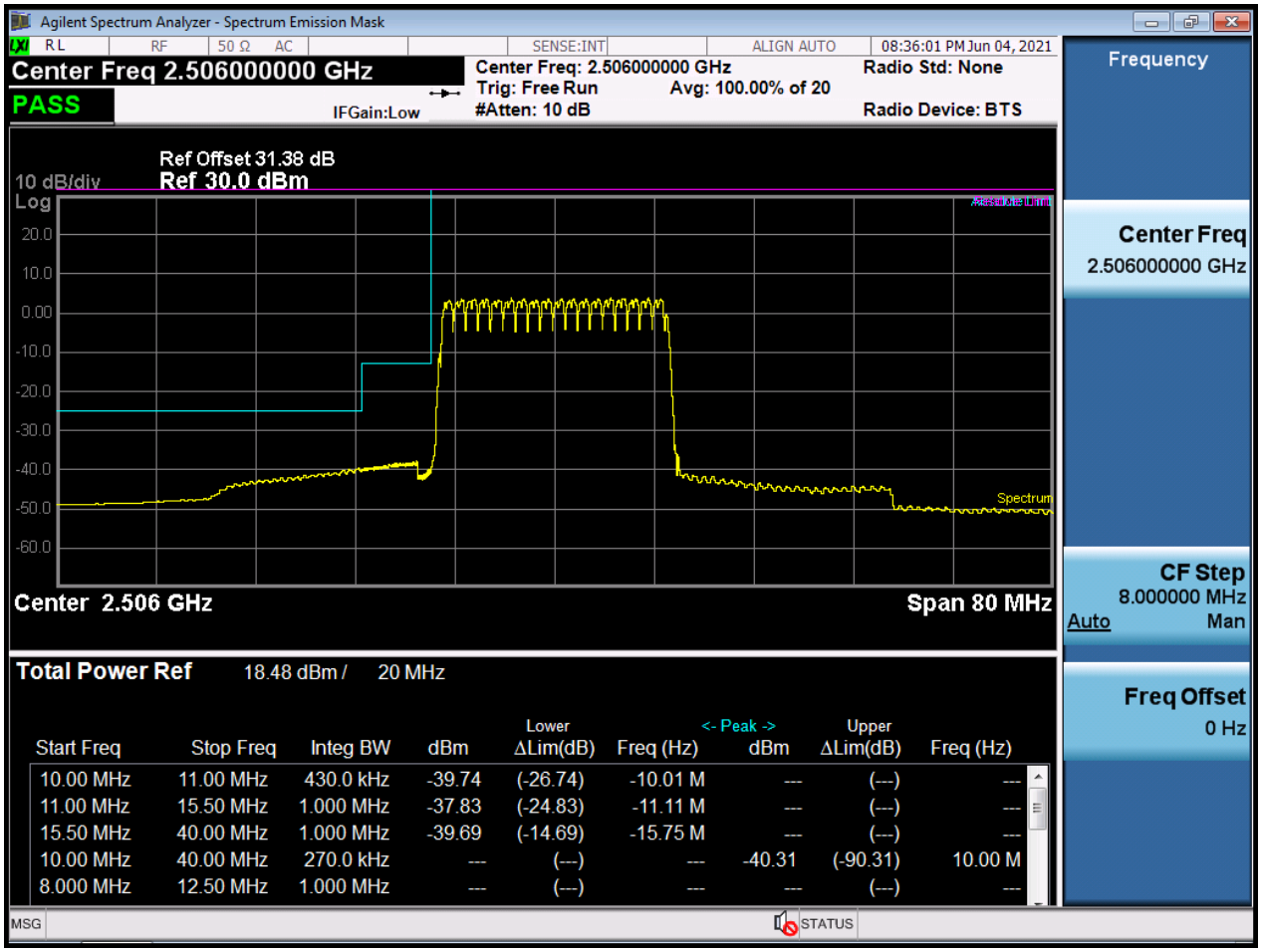
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
7.500 MHz	8.500 MHz	300.0 kHz	-32.76	(-22.76)	-7.515 M	-33.73	(-23.73)	7.500 M
8.500 MHz	12.50 MHz	1.000 MHz	-30.63	(-20.63)	-8.620 M	-30.99	(-20.99)	8.600 M
12.50 MHz	22.50 MHz	1.000 MHz	-32.87	(-19.87)	-12.65 M	-32.77	(-19.77)	12.70 M
22.50 MHz	30.00 MHz	1.000 MHz	-42.18	(-17.18)	-26.96 M	-42.01	(-17.01)	22.76 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

LTE41_15M_BandEdge_High_2682.5MHz_QPSK_1RB

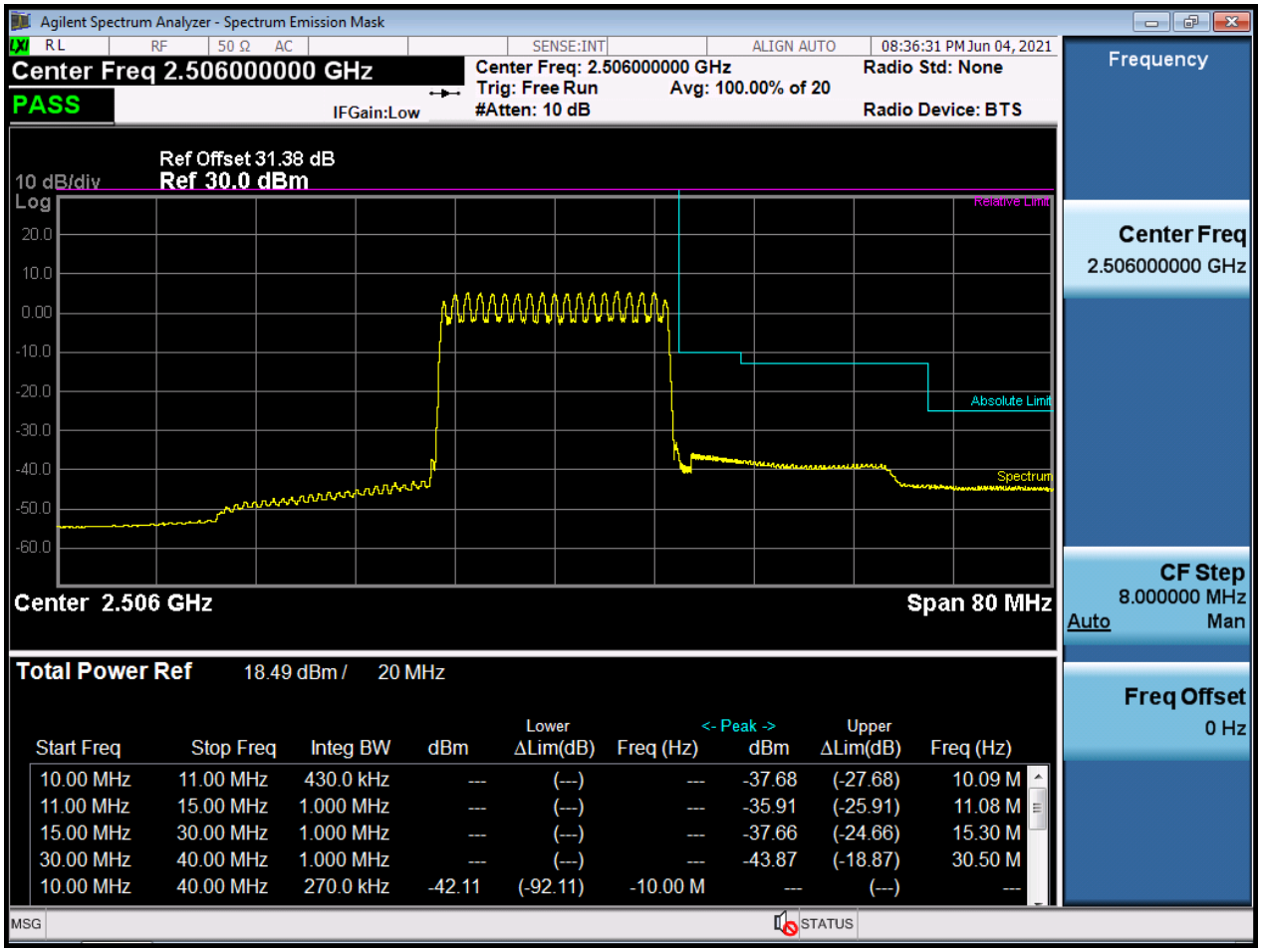


Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
7.500 MHz	8.500 MHz	30.00 kHz	-57.08	(-47.08)	-7.500 M	-34.22	(-24.22)	7.500 M
8.500 MHz	12.50 MHz	1.000 MHz	-42.60	(-32.60)	-8.520 M	-32.81	(-22.81)	8.520 M
12.50 MHz	22.50 MHz	1.000 MHz	-34.63	(-21.63)	-20.00 M	-40.65	(-27.65)	13.20 M
22.50 MHz	30.00 MHz	1.000 MHz	-47.04	(-22.04)	-22.61 M	-47.23	(-22.23)	22.58 M
8.000 MHz	12.50 MHz	1.000 MHz	---	(---)	---	---	(---)	---

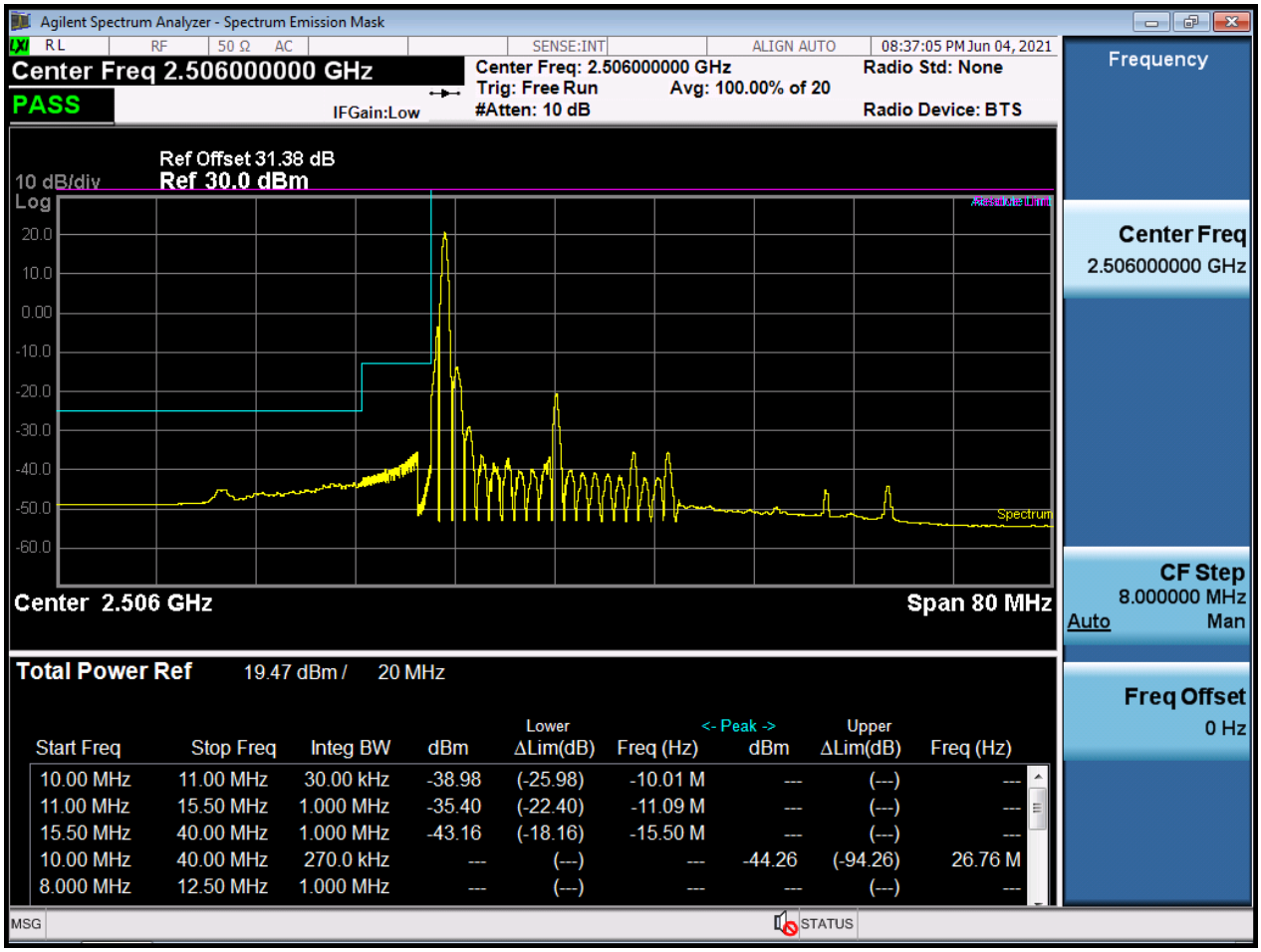
LTE41_20M_BandEdge_Lower_Low_2506MHz_QPSK_FullRB



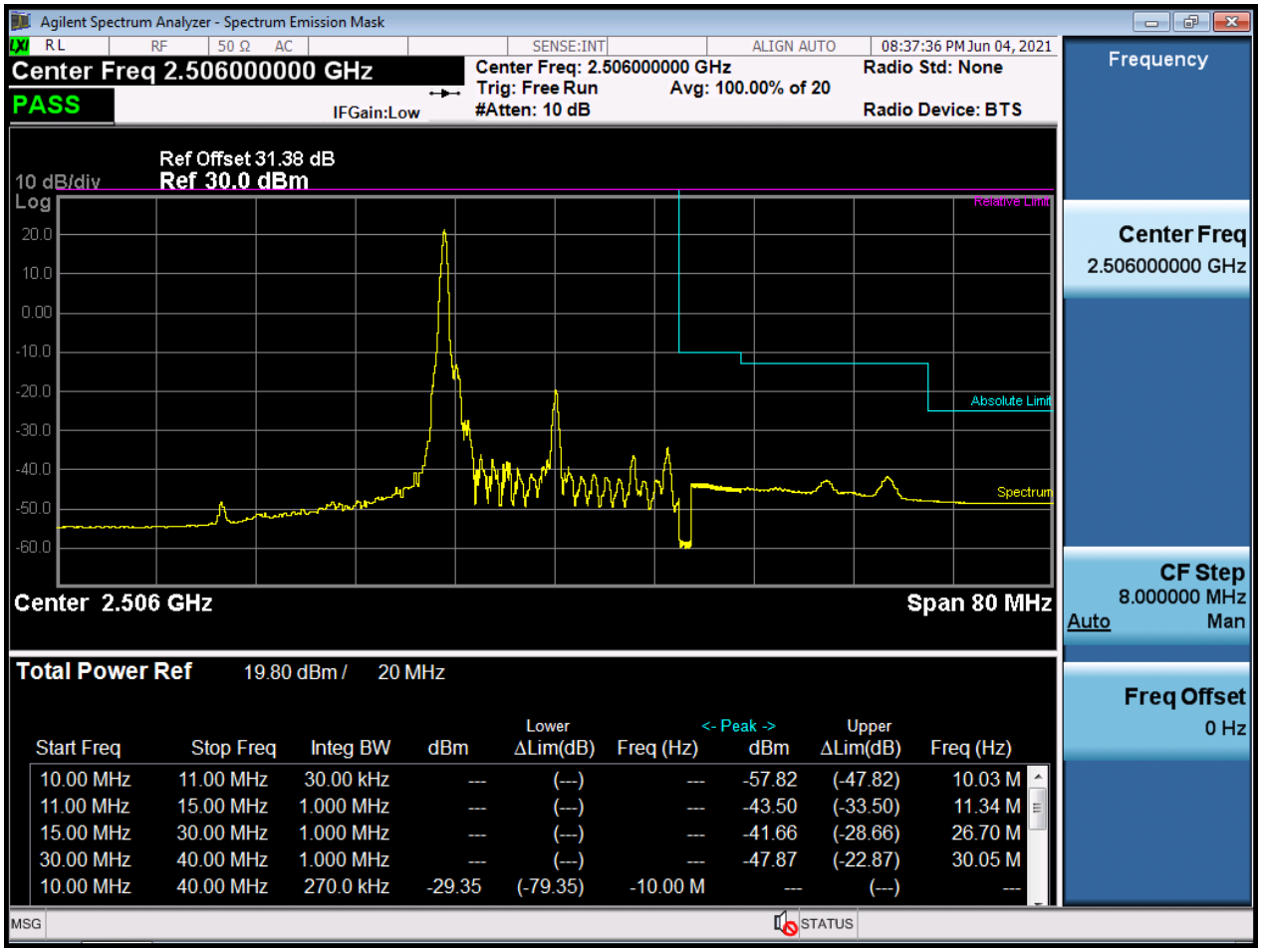
LTE41_20M_BandEdge_Upper_Low_2506MHz_QPSK_FullRB



LTE41_20M_BandEdge_Lower_Low_2506MHz_QPSK_1RB

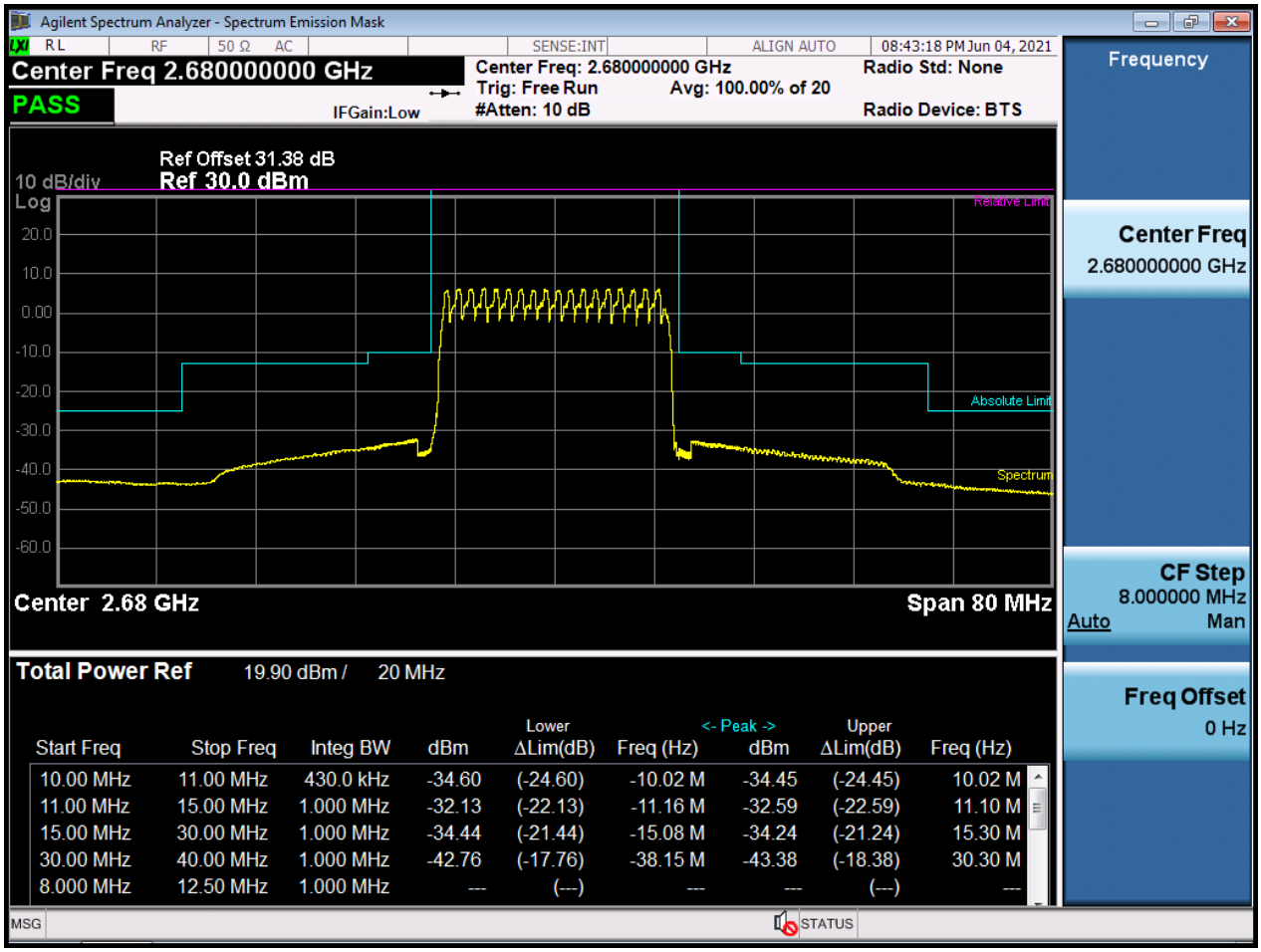


LTE41_20M_BandEdge_Upper_Low_2506MHz_QPSK_1RB

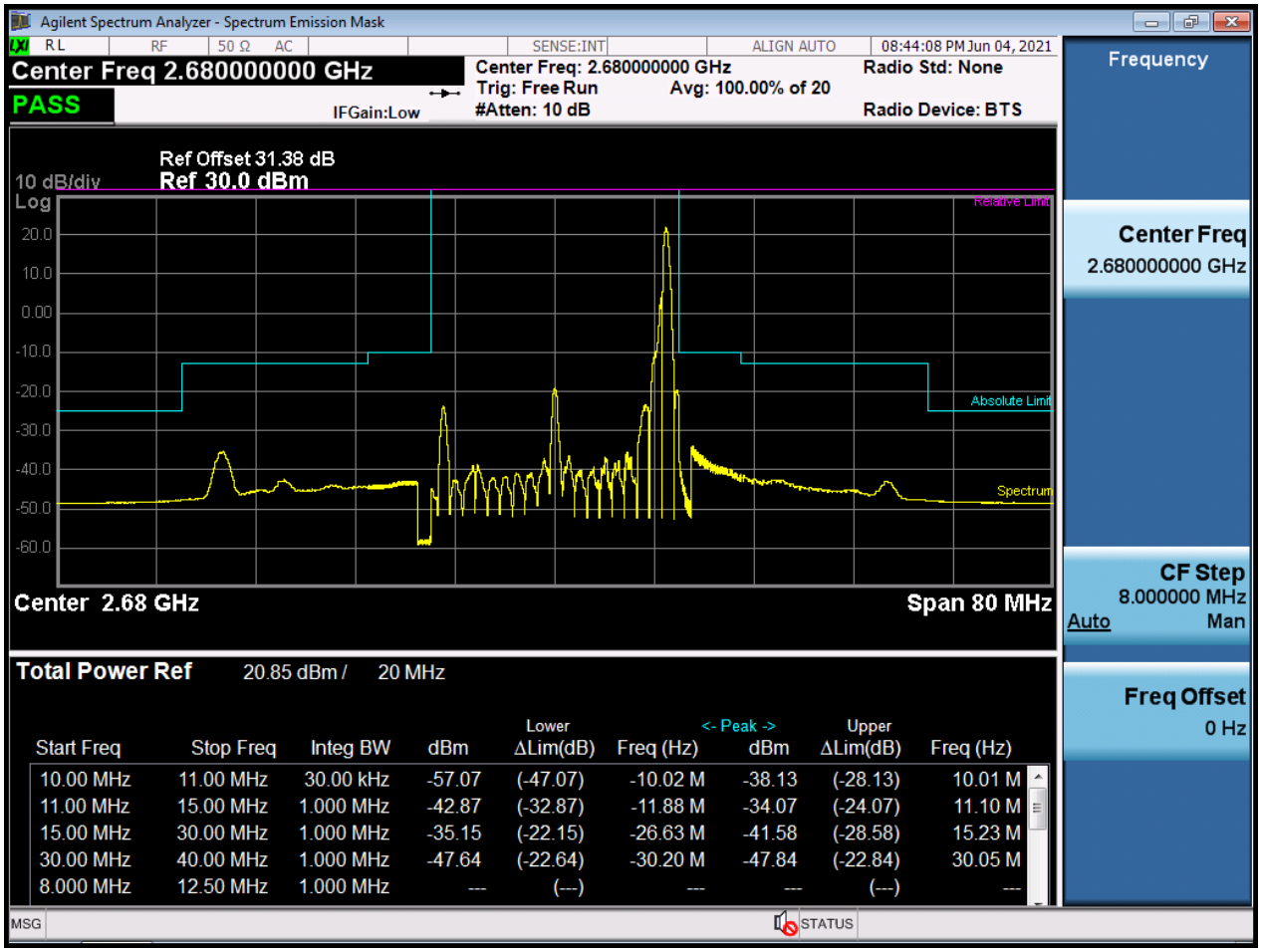


LTE41_20M_BandEdge_Mid_2593MHz_QPSK_FullRB

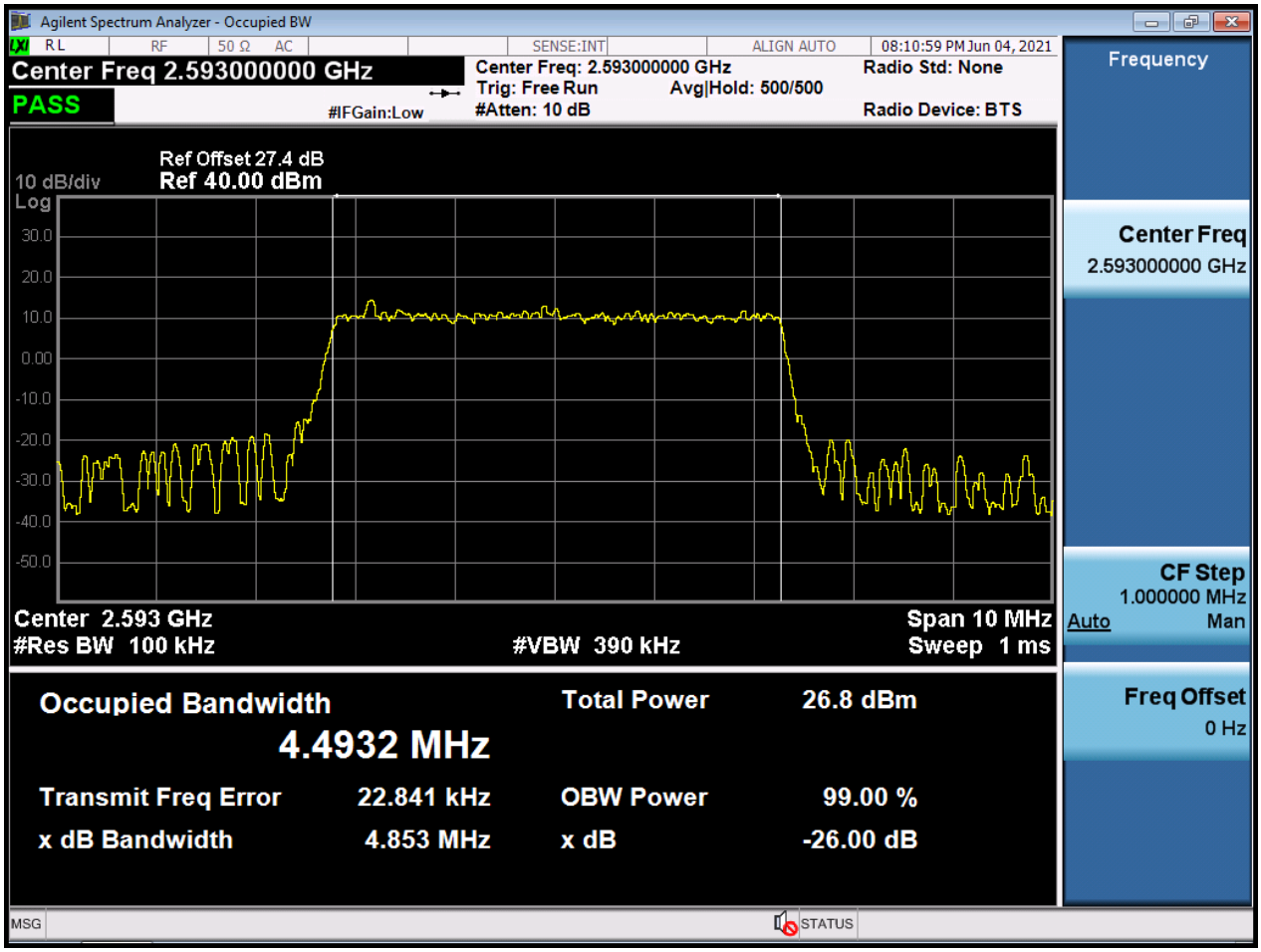
LTE41_20M_BandEdge_High_2680MHz_QPSK_FullRB



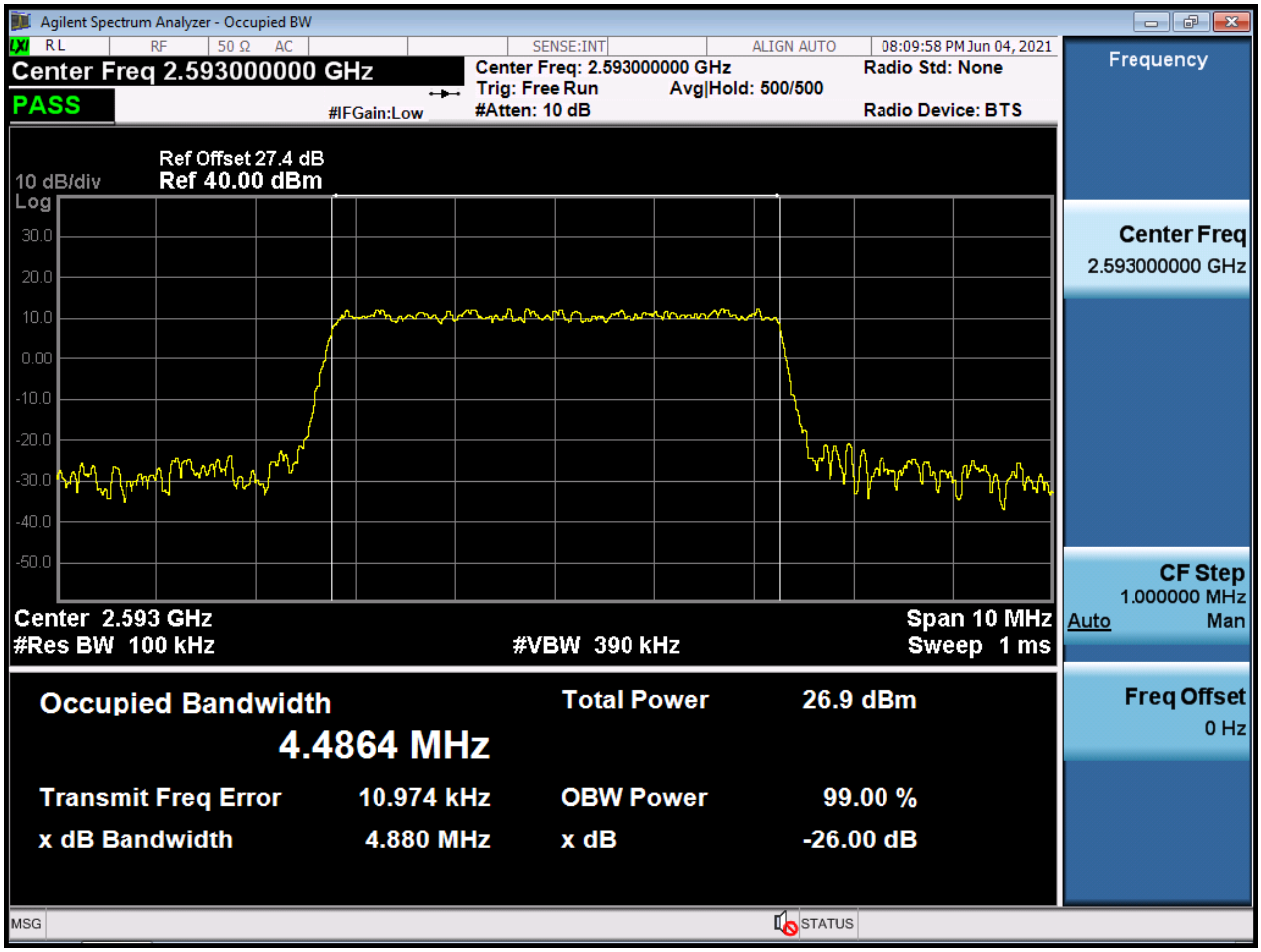
LTE41_20M_BandEdge_High_2680MHz_QPSK_1RB



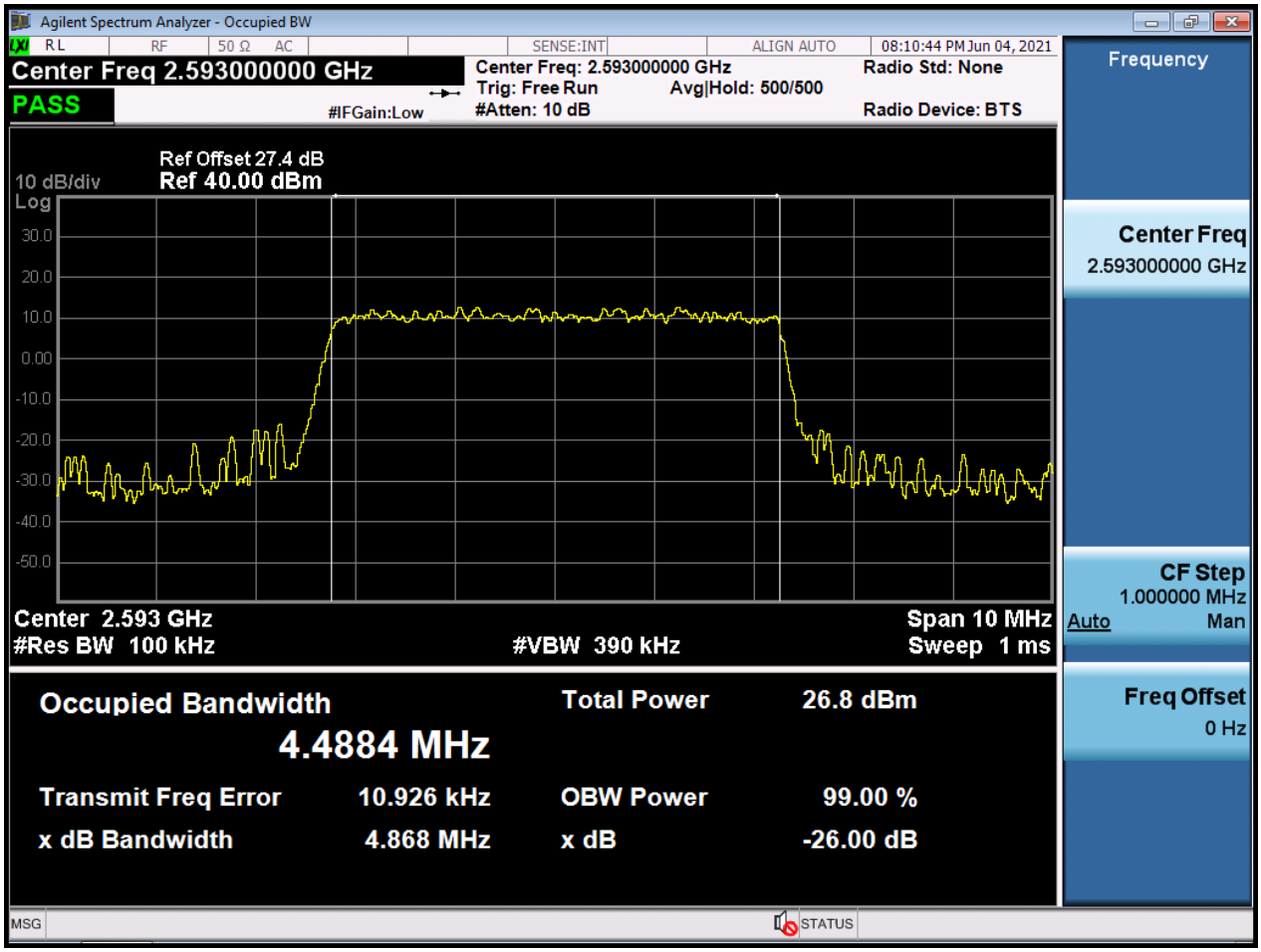
LTE41_5M_OBW_Mid Channel_QPSK_FullRB



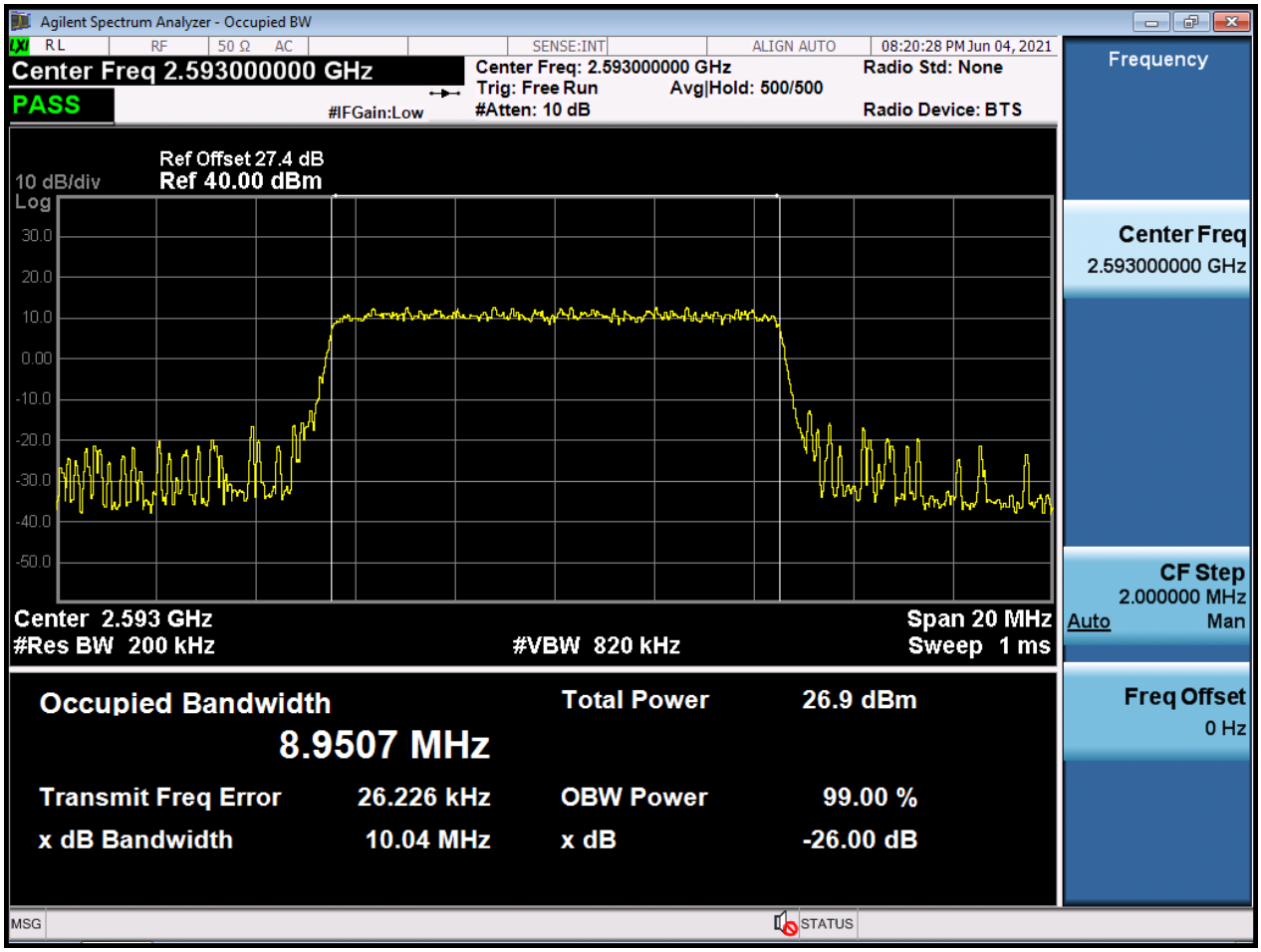
LTE41_5M_OBW_Mid Channel_16QAM_FullRB



LTE41_5M_OBW_Mid Channel_64QAM_FullRB



LTE41_10M_OBW_Mid Channel_QPSK_FullRB



LTE41_10M_OBW_Mid Channel_16QAM_FullRB