

FCC LTE REPORT

Certification

Applicant Name: SAMSUNG Electronics Co., Ltd.	Date of Issue: February 12, 2019
Address: 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea	Location: HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
	Report No.: HCT-RF-1902-FC013

FCC ID: A3LSMM105G

APPLICANT: SAMSUNG Electronics Co., Ltd.

According to the Evaluation report, all of the data contained herein is reused from the reference FCC ID : A3LSMM105F report.

[Exceptions : Added MCC Blocking test was Fully perform for LTE B7]

Model(s): SM-M105G/DS
Additional Model: SM-M105G
EUT Type: Mobile Phone
FCC Classification: Licensed Non-Broadcast Transmitter Held to Ear (TNE)
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	4M54G7D	QPSK	0.075	18.76
		4M51W7D	16QAM	0.054	17.28
LTE – Band 41 (10)	2501.0 – 2685.0	8M97G7D	QPSK	0.076	18.78
		9M01W7D	16QAM	0.054	17.32
LTE – Band 41 (15)	2503.5 – 2682.5	13M5G7D	QPSK	0.071	18.53
		13M5W7D	16QAM	0.050	16.98
LTE – Band 41 (20)	2506.0 – 2680.0	17M9G7D	QPSK	0.076	18.81
		17M9W7D	16QAM	0.054	17.35

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S. C. 853(a)




Report prepared by : Jae Ryang Do
Engineer of Telecommunication Testing Center

Report approved by : Jong Seok Lee
Manager of Telecommunication Testing Center

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1902-FC013	February 12, 2019	- First Approval Report

Table of Contents

1. GENERAL INFORMATION	4
2. INTRODUCTION	5
2.1. DESCRIPTION OF EUT.....	5
2.2. MEASURING INSTRUMENT CALIBRATION.....	5
2.3. TEST FACILITY	5
3. DESCRIPTION OF TESTS.....	6
3.1 TEST PROCEDURE	6
3.2 RADIATED POWER	7
3.3 RADIATED SPURIOUS EMISSIONS	8
3.4 OCCUPIED BANDWIDTH.	9
3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL.....	10
3.6 CHANNEL EDGE.....	11
3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE	12
3.8 WORST CASE(RADIATED TEST).....	13
3.9 WORST CASE(CONDUCTED TEST)	14
4. LIST OF TEST EQUIPMENT	15
5. MEASUREMENT UNCERTAINTY	16
6. SUMMARY OF TEST RESULTS	17
7. SAMPLE CALCULATION	18
8. TEST DATA	20
8.1 EQUIVALENT ISOTROPIC RADIATED POWER	20
8.2 RADIATED SPURIOUS EMISSIONS	22
8.3 OCCUPIED BANDWIDTH	26
8.4 CONDUCTED SPURIOUS EMISSIONS	27
8.5 CHANNEL EDGE	28
8.6 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE	29
8.7 GEO-LOCATION MECHANISM	41
9. TEST PLOTS.....	50
10. APPENDIX A_ TEST SETUP PHOTO	115

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:	A3LSMM105G
Application Type:	Certification
FCC Classification:	Licensed Non-Broadcast Transmitter Held to Ear (TNE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile Phone
Model(s):	SM-M105G/DS
Additional Model:	SM-M105G
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 10, 2018 ~ December 17, 2018 MCC Blocking : February 04, 2019 ~ February 05, 2019

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

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

It also supports IEEE 802.11/b/g/n (HT20), Bluetooth.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI C63.26-2015 – Section 5.2 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW \geq 3 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;

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

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value.

These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

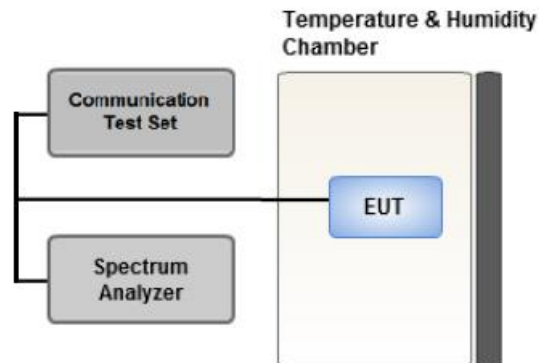
Test Settings

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

Test Note

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

3.4 OCCUPIED BANDWIDTH.



Test setup

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

The EUT makes a call to the communication simulator.

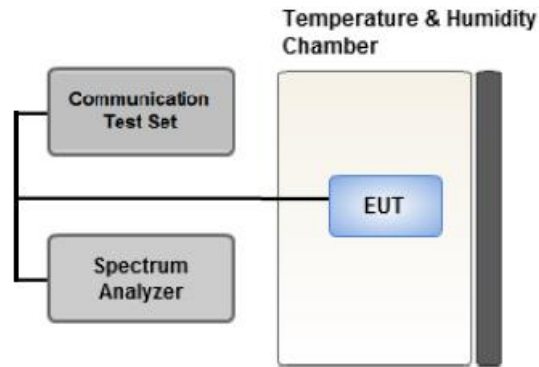
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

Test Settings

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

3.5 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

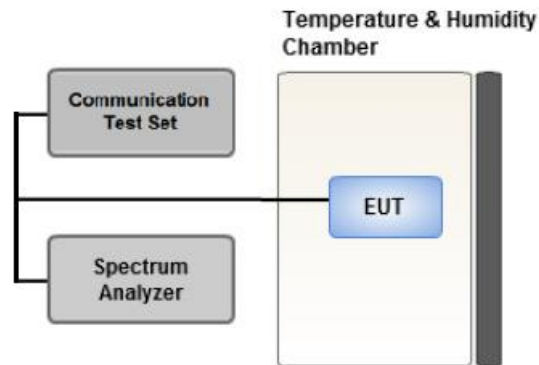
Test Overview

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

Test Settings

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

3.6 CHANNEL EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

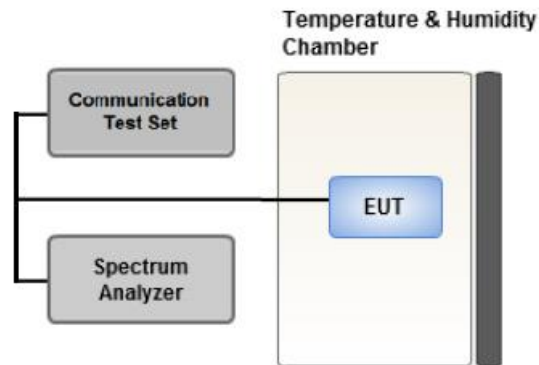
Test Settings

1. Start and stop frequency were set such that the channel edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 2% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Notes

1. The attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz.
2. All measurements were done at 3 channels.
3. The channel edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

3.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

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

The frequency stability of the transmitter is measured by:

1. Temperature:

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

2. Primary Supply Voltage:

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

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

Test Settings

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

3.8 WORST CASE(RADIATED TEST)

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

[Worst case]

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

Note:

1. SM-M105FDS & SM-M105GDS were tested and the worst case results are reported.

(Worst case : SM- M105FDS)

3.9 WORST CASE(CONDUCTED TEST)

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM	5, 10, 15, 20	Mid	Full RB	0
Band 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	* QPSK	Low, High	Full RB	0	
		Low, Mid, High	Full RB	0	
Channel Edge	* QPSK	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

* 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.

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
REOHDE & SCHWARZ	SCU 18 / AMPLIFIER	10094	04/17/2018	Annual	04/17/2019
Wainwright	WHK1.2/15G-10EF/H.P.F	4	04/04/2018	Annual	04/04/2019
Wainwright	WHK3.3/18G-10EF/H.P.F	2	04/04/2018	Annual	04/04/2019
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	5001	06/07/2018	Annual	06/07/2019
Agilent	E3632A/DC Power Supply	KR75303243	05/09/2018	Annual	05/09/2019
Schwarzbeck	UHAP/ Dipole Antenna	557	03/31/2017	Biennial	03/31/2019
Schwarzbeck	UHAP/ Dipole Antenna	558	03/31/2017	Biennial	03/31/2019
ESPEC	SU-642 / Chamber	93000718	08/07/2018	Annual	08/07/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	09/14/2018	Annual	09/14/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	10/04/2018	Annual	10/04/2019
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/25/2017	Biennial	04/25/2019
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	04/25/2017	Biennial	04/25/2019
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY52090906	06/08/2018	Annual	06/08/2019
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/21/2018	Annual	06/21/2019
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/22/2018	Annual	10/22/2019
Agilent	8960 (E5515C)/ Base Station	MY48360800	09/27/2018	Annual	09/27/2019
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	04/06/2017	Biennial	04/06/2019
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/13/2018	Annual	08/13/2019
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	02/08/2018	Annual	02/08/2019
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/19/2018	Annual	07/19/2019
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	07/27/2018	Annual	07/27/2019
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

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

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{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 (\pm dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.71

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(m)(4)	<ul style="list-style-type: none"> ■ $< 40 + 10\log_{10} (P[\text{Watts}])$ at Channel edges ■ $< 43 + 10\log_{10} (P[\text{Watts}])$ between 5 and X MHz from Channel edges ■ $< 55 + 10\log_{10} (P[\text{Watts}])$ 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	<u>See Note1</u>
Frequency stability / variation of ambient temperature	§2.1055, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§27.50(h)(2)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(m)(4)	$< 55 + 10\log_{10} (P[\text{Watts}])$	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter’s level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter’s level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
40620	2593.0	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter’s level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter’s level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

16QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

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	-26.11	8.53	10.98	1.60	V	< 2.00	0.062	17.91
		16-QAM	-27.32	7.32	10.98	1.60	V		0.047	16.70
2593.0		QPSK	-26.82	7.93	11.06	1.63	V		0.054	17.36
		16-QAM	-27.91	6.84	11.06	1.63	V		0.042	16.27
2687.5		QPSK	-26.02	9.26	11.15	1.65	V		0.075	18.76
		16-QAM	-27.50	7.78	11.15	1.65	V		0.054	17.28

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	-26.32	8.32	10.98	1.60	V	< 2.00	0.059	17.70
		16-QAM	-27.62	7.02	10.98	1.60	V		0.044	16.40
2593.0		QPSK	-26.79	7.96	11.06	1.63	V		0.055	17.39
		16-QAM	-28.13	6.62	11.06	1.63	V		0.040	16.05
2685.0		QPSK	-25.88	9.28	11.15	1.65	V		0.076	18.78
		16-QAM	-27.34	7.82	11.15	1.65	V		0.054	17.32

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	-26.31	8.26	10.98	1.61	V	< 2.00	0.058	17.63
		16-QAM	-27.58	6.99	10.98	1.61	V		0.043	16.36
2593.0		QPSK	-26.69	8.06	11.06	1.63	V		0.056	17.49
		16-QAM	-27.98	6.77	11.06	1.63	V		0.042	16.20
2682.5		QPSK	-26.01	9.02	11.15	1.64	V		0.071	18.53
		16-QAM	-27.56	7.47	11.15	1.64	V		0.050	16.98

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	-26.27	8.30	10.98	1.61	V	< 2.00	0.058	17.67
		16-QAM	-27.61	6.96	10.98	1.61	V		0.043	16.33
2593.0		QPSK	-27.03	7.72	11.06	1.63	V		0.052	17.15
		16-QAM	-28.48	6.27	11.06	1.63	V		0.037	15.70
2680.0		QPSK	-25.73	9.30	11.15	1.64	V		0.076	18.81
		16-QAM	-27.19	7.84	11.15	1.64	V		0.054	17.35

8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY : 2593.00 MHz
- ▣ MEASURED OUTPUT POWER: 18.76 dBm = 0.075 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 43.76 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39675 (2498.5)	4,997.00	-51.11	12.89	-64.80	2.47	H	-54.38	73.15
	7,495.50	-42.53	11.51	-49.27	2.97	H	-40.73	59.49
	9,994.00	-53.37	11.21	-55.82	3.48	V	-48.09	66.86
40620 (2593.0)	5,186.00	-50.02	13.05	-62.62	2.58	H	-52.15	70.91
	7,779.00	-45.11	11.98	-52.63	2.93	H	-43.58	62.35
	10,372.00	-52.07	10.96	-55.06	3.62	V	-47.72	66.48
	12,965.00	-52.51	13.61	-55.11	4.08	H	-45.58	64.35
41565 (2687.5)	5,375.00	-43.50	13.49	-56.78	2.65	H	-45.94	64.71
	8,062.50	-41.53	11.46	-46.35	3.05	V	-37.94	56.70
	10,750.00	-48.24	10.99	-51.14	3.67	V	-43.82	62.58
	13,437.50	-52.33	13.01	-53.80	4.09	H	-44.88	63.65
	16,125.00	-49.31	17.38	-53.71	4.62	V	-40.95	59.72

- ▣ OPERATING FREQUENCY : 2593.00 MHz
- ▣ MEASURED OUTPUT POWER: 18.78 dBm = 0.076 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 43.78 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39700 (2501.0)	5,002.00	-51.59	12.89	-65.28	2.47	H	-54.86	73.65
	7,503.00	-45.39	11.53	-51.82	2.92	H	-43.22	62.00
	10,004.00	-53.50	11.25	-56.34	3.41	V	-48.50	67.28
40620 (2593.0)	5,186.00	-50.65	13.05	-63.25	2.58	H	-52.78	71.56
	7,779.00	-42.86	11.98	-50.38	2.93	H	-41.33	60.11
	10,372.00	-48.39	10.96	-51.38	3.62	H	-44.04	62.82
41540 (2685.0)	5,370.00	-43.42	13.50	-57.00	2.65	H	-46.15	64.93
	8,055.00	-41.41	11.46	-46.30	3.05	H	-37.90	56.68
	10,740.00	-50.25	10.98	-53.06	3.62	V	-45.70	64.48
	13,425.00	-53.40	13.07	-54.99	4.18	H	-46.10	64.89

- ▣ OPERATING FREQUENCY : 2593.00 MHz
- ▣ MEASURED OUTPUT POWER: 18.53 dBm = 0.071 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 43.53 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39725 (2503.5)	5,007.00	-51.87	12.86	-66.00	2.49	H	-55.63	74.16
	7,510.50	-53.08	11.54	-59.22	2.90	H	-50.58	69.11
	10,014.00	-57.84	11.27	-61.00	3.40	H	-53.14	71.66
40620 (2593.0)	5,186.00	-47.66	13.05	-60.26	2.58	V	-49.79	68.32
	7,779.00	-49.12	11.98	-56.64	2.93	H	-47.59	66.12
	10,372.00	-46.86	10.96	-49.85	3.62	H	-42.51	61.04
41515 (2682.5)	5,365.00	-43.34	13.51	-56.99	2.64	H	-46.12	64.65
	8,047.50	-41.50	11.45	-46.47	3.05	V	-38.07	56.60
	10,730.00	-52.48	10.98	-55.29	3.60	H	-47.91	66.44
	13,412.50	-51.34	13.09	-53.33	4.17	H	-44.41	62.94

- ▣ OPERATING FREQUENCY : 2593.00 MHz
- ▣ MEASURED OUTPUT POWER: 18.81 dBm = 0.076 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 43.81 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
39750 (2506.0)	5,012.00	-51.00	12.86	-65.13	2.49	H	-54.76	73.57
	7,518.00	-53.45	11.57	-58.76	2.93	H	-50.12	68.93
	10,024.00	-54.68	11.29	-57.51	3.48	V	-49.69	68.50
40620 (2593.0)	5,186.00	-49.32	13.05	-61.92	2.58	H	-51.45	70.26
	7,779.00	-47.98	11.98	-55.50	2.93	V	-46.45	65.26
	10,372.00	-47.91	10.96	-50.90	3.62	V	-43.56	62.37
41490 (2680.0)	5,360.00	-43.65	13.51	-57.37	2.63	H	-46.49	65.30
	8,040.00	-45.77	11.46	-50.67	3.06	H	-42.27	61.07
	10,720.00	-54.57	10.97	-57.20	3.66	V	-49.89	68.70
	13,400.00	-53.82	13.11	-55.34	4.16	V	-46.39	65.19

8.3 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
41	5 MHz	2593.0	QPSK	25	0	4.5362
			16-QAM			4.5129
	10 MHz		QPSK	50		8.9693
			16-QAM			9.0087
	15 MHz		QPSK	75		13.506
			16-QAM			13.494
	20 MHz		QPSK	100		17.914
			16-QAM			17.932

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 51 ~ 58.

8.4 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	9.9865	28.591	-59.030	-30.439	-25.00
		2593.0	7.7732	28.591	-67.074	-38.483	
		2687.5	2.2199	27.976	-60.875	-32.899	
	10	2501.0	7.4906	28.591	-59.804	-31.213	
		2593.0	7.7662	28.591	-61.186	-32.595	
		2685.0	8.0688	28.591	-61.465	-32.874	
	15	2503.5	9.9880	28.591	-61.624	-33.033	
		2593.0	7.7592	28.591	-57.446	-28.855	
		2682.5	8.0683	28.591	-59.766	-31.175	
	20	2506.0	6.2581	28.591	-67.056	-38.465	
		2593.0	7.7533	28.591	-59.547	-30.956	
		2680.0	8.0673	28.591	-60.404	-31.813	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 87 ~ 114.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20	30.131

8.5 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	-22.32	-23.20	-22.99	-22.46	-38.35	-36.24	-37.77
10 MHz	2501.0	QPSK	50/0	-25.05	-24.46	-26.79	-23.55	-32.90	-29.55	-39.24
15 MHz	2503.5	QPSK	75/0	-26.83	-26.96	-28.08	-26.42	-32.49	-30.41	-38.93
20 MHz	2506.0	QPSK	100/0	-29.57	-28.85	-28.89	-28.18	-33.52	-30.08	-39.18
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	-22.40	-23.42	-23.39	-23.05
	2687.5	QPSK	25	0	-20.08	-20.95	-15.87	-15.25
10 MHz	2593.0	QPSK	50	0	-27.66	-26.12	-25.33	-24.95
	2685.0	QPSK	50	0	-22.16	-22.48	-18.61	-17.88
15 MHz	2593.0	QPSK	75	0	-26.93	-29.04	-28.44	-29.79
	2682.5	QPSK	75	0	-24.56	-24.66	-20.98	-21.93
20 MHz	2593.0	QPSK	100	0	-28.69	-31.28	-29.33	-31.21
	2680.0	QPSK	100	0	-25.34	-26.35	-23.19	-24.43
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	-38.87	-40.03	-40.36	-41.90
	2687.5	QPSK	25	0	-33.34	-34.31	-36.70	-37.02
10 MHz	2593.0	QPSK	50	0	-31.98	-31.82	-42.94	-44.55
	2685.0	QPSK	50	0	-24.61	-24.06	-38.42	-40.20
15 MHz	2593.0	QPSK	75	0	-32.63	-34.49	-43.77	-43.71
	2682.5	QPSK	75	0	-25.50	-26.22	-39.07	-43.11
20 MHz	2593.0	QPSK	100	0	-33.81	-35.94	-45.83	-42.96
	2680.0	QPSK	100	0	-26.74	-28.02	-40.45	-48.94
Limit					-13.0		-25.0	

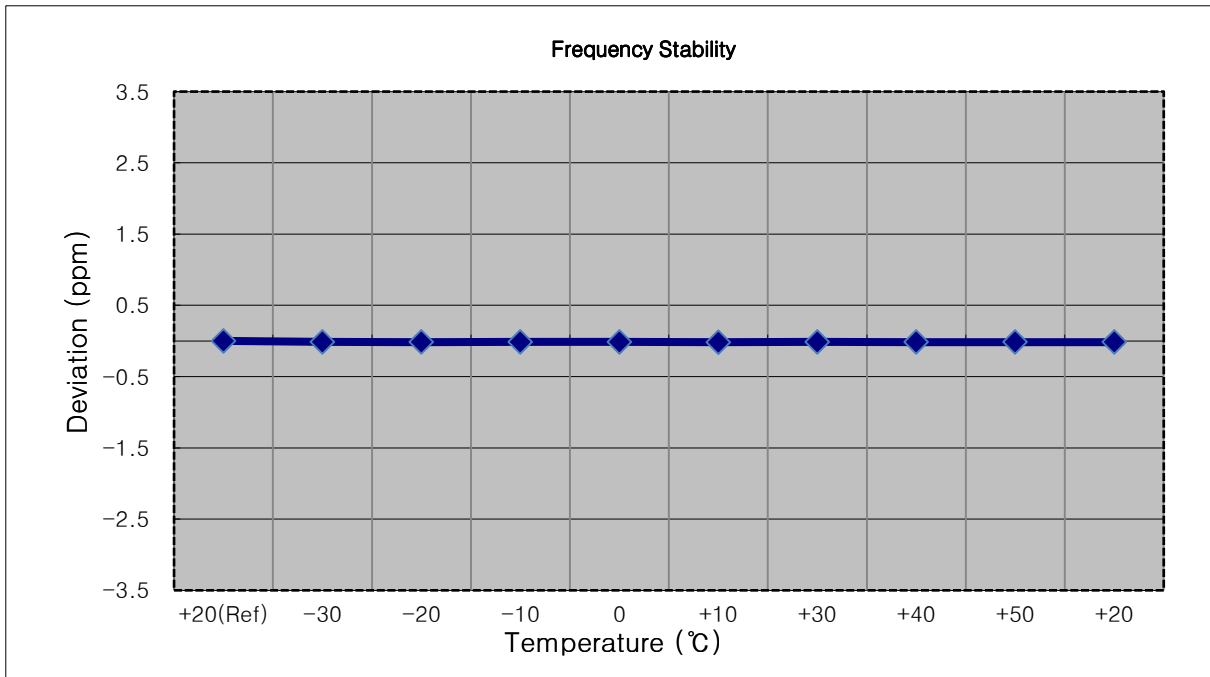
Note:

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 59 ~ 74.

8.6 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

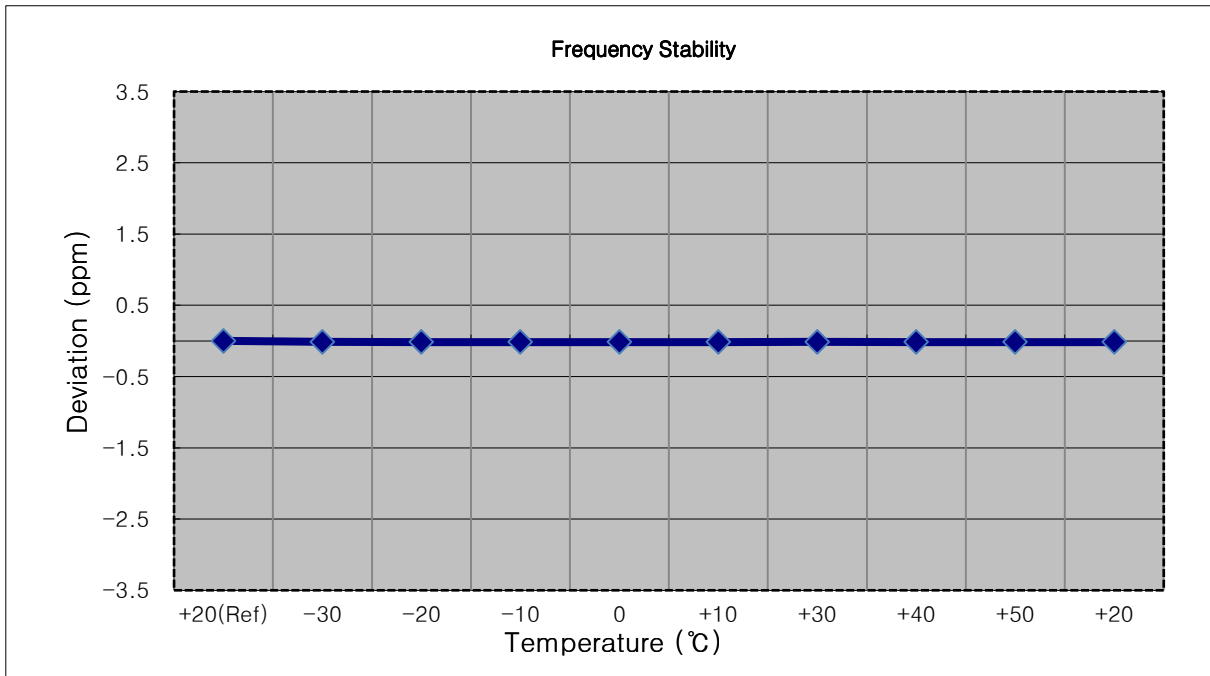
- MODE: LTE 41
- OPERATING FREQUENCY: 2498,500,000 Hz
- BANDWIDTH: 39675 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2498 499 967	0.0	0.000 000	0.000
100%		-30	2498 499 932	-35.6	-0.000 001	-0.014
100%		-20	2498 499 926	-41.0	-0.000 002	-0.016
100%		-10	2498 499 931	-36.0	-0.000 001	-0.014
100%		0	2498 499 931	-36.0	-0.000 001	-0.014
100%		+10	2498 499 924	-43.4	-0.000 002	-0.017
100%		+30	2498 499 930	-36.8	-0.000 001	-0.015
100%		+40	2498 499 929	-38.4	-0.000 002	-0.015
100%		+50	2498 499 928	-38.8	-0.000 002	-0.016
Batt. Endpoint		3.600	+20	2498 499 928	-39.1	-0.000 002



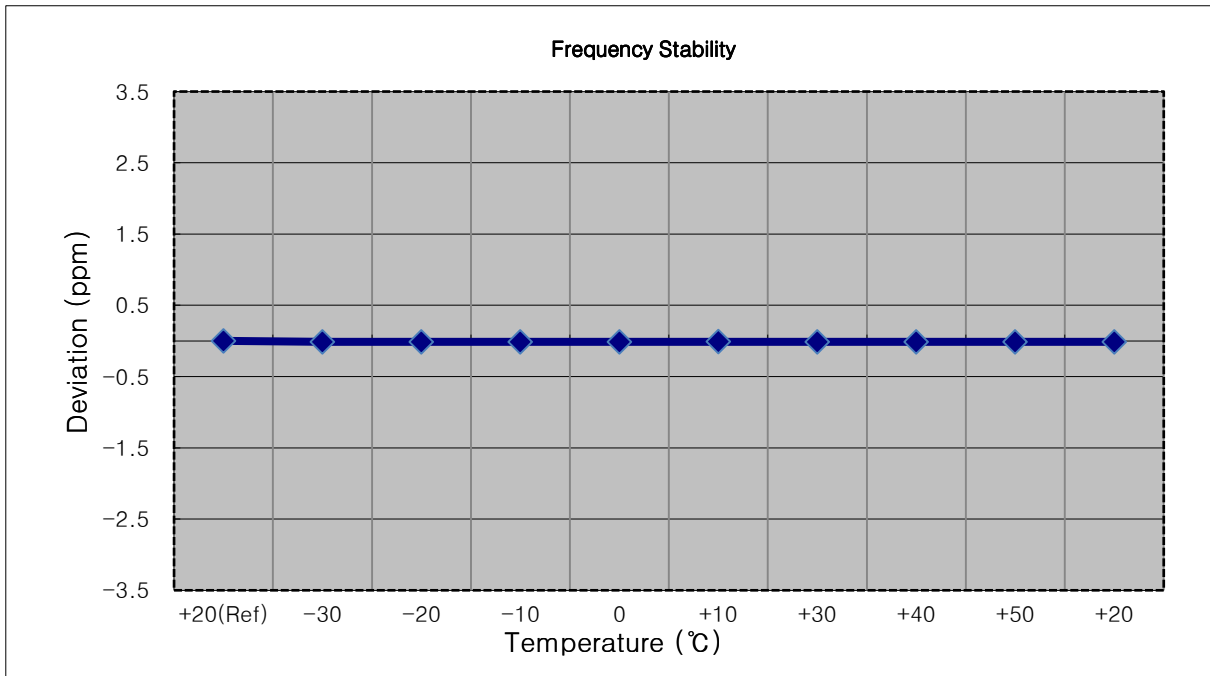
- MODE: LTE 41
- OPERATING FREQUENCY: 2501,000,000 Hz
- BANDWIDTH: 39700 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2500 999 962	0.0	0.000 000	0.000
100%		-30	2500 999 926	-36.7	-0.000 001	-0.015
100%		-20	2500 999 924	-38.9	-0.000 002	-0.016
100%		-10	2500 999 923	-39.0	-0.000 002	-0.016
100%		0	2500 999 922	-40.9	-0.000 002	-0.016
100%		+10	2500 999 924	-38.0	-0.000 002	-0.015
100%		+30	2500 999 926	-36.6	-0.000 001	-0.015
100%		+40	2500 999 923	-39.3	-0.000 002	-0.016
100%		+50	2500 999 925	-37.8	-0.000 002	-0.015
Batt. Endpoint	3.600	+20	2500 999 924	-38.1	-0.000 002	-0.015



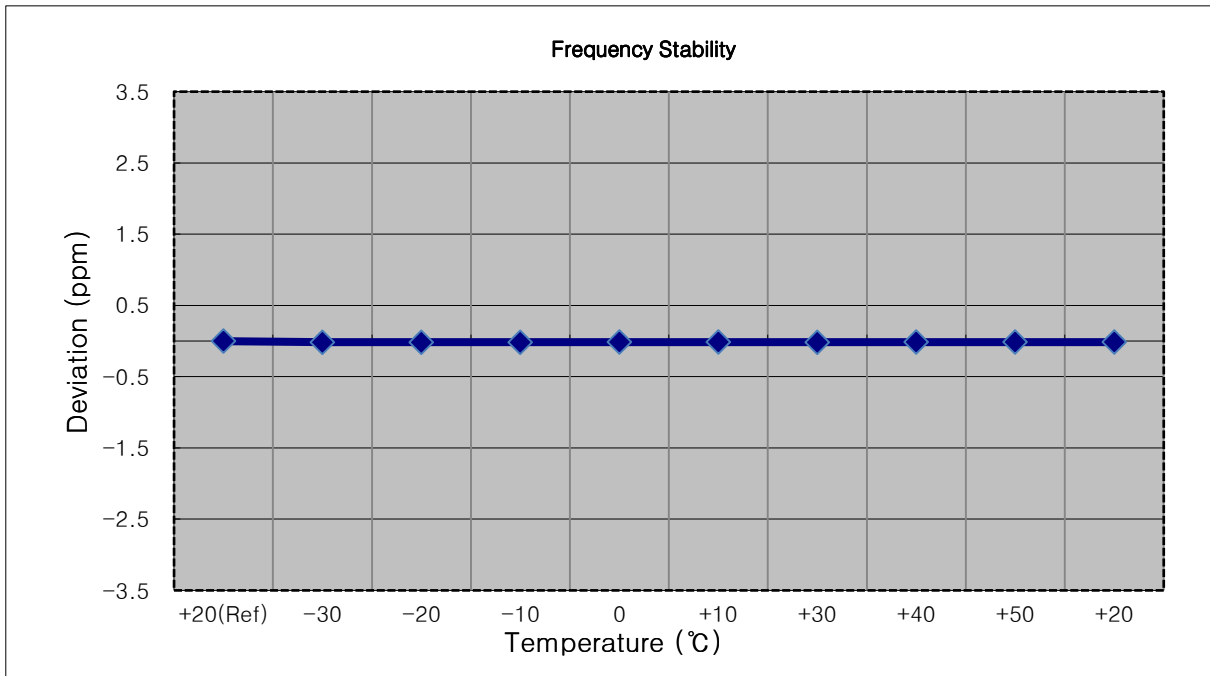
- MODE: LTE 41
- OPERATING FREQUENCY: 2503,500,000 Hz
- BANDWIDTH: 39725 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2503 499 966	0.0	0.000 000	0.000
100%		-30	2503 499 932	-33.8	-0.000 001	-0.014
100%		-20	2503 499 932	-34.3	-0.000 001	-0.014
100%		-10	2503 499 930	-36.3	-0.000 001	-0.014
100%		0	2503 499 932	-34.6	-0.000 001	-0.014
100%		+10	2503 499 935	-30.8	-0.000 001	-0.012
100%		+30	2503 499 932	-34.3	-0.000 001	-0.014
100%		+40	2503 499 933	-33.1	-0.000 001	-0.013
100%		+50	2503 499 932	-34.6	-0.000 001	-0.014
Batt. Endpoint	3.600	+20	2503 499 929	-36.8	-0.000 001	-0.015



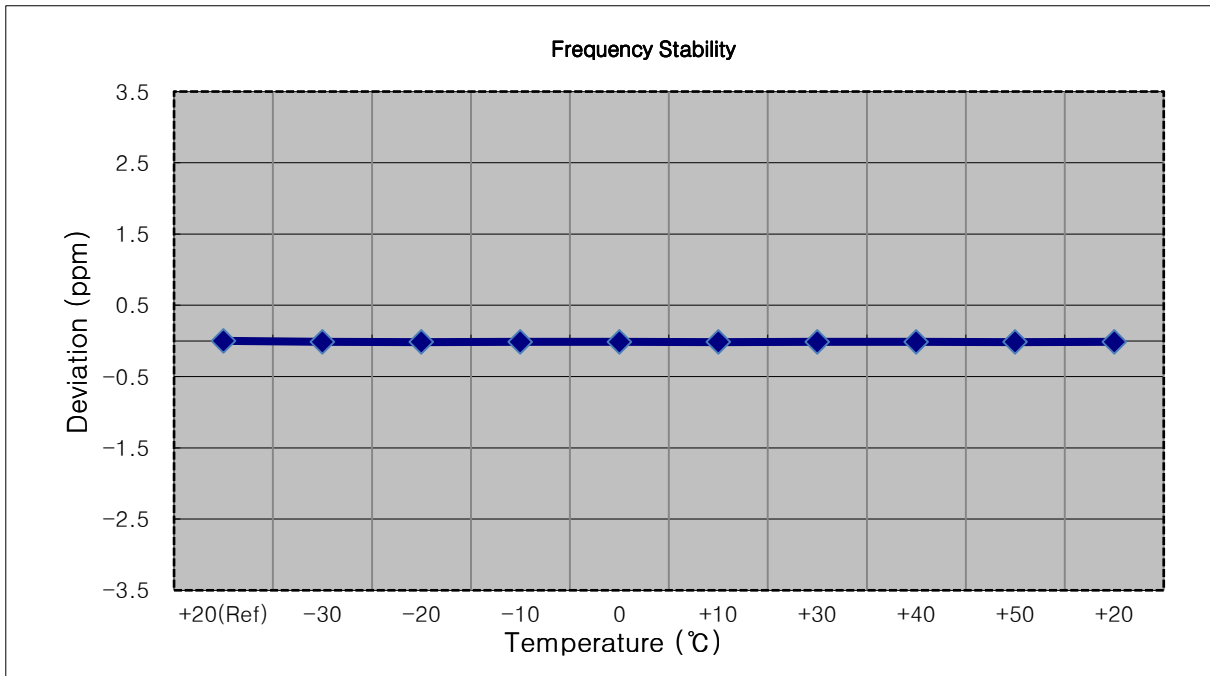
- MODE: LTE 41
- OPERATING FREQUENCY: 2506, 00,000 Hz
- BANDWIDTH: 39750 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2505 999 964	0.0	0.000 000	0.000
100%		-30	2505 999 924	-40.1	-0.000 002	-0.016
100%		-20	2505 999 924	-39.7	-0.000 002	-0.016
100%		-10	2505 999 925	-39.4	-0.000 002	-0.016
100%		0	2505 999 925	-38.8	-0.000 002	-0.015
100%		+10	2505 999 926	-37.6	-0.000 002	-0.015
100%		+30	2505 999 922	-42.5	-0.000 002	-0.017
100%		+40	2505 999 926	-37.6	-0.000 002	-0.015
100%		+50	2505 999 927	-37.3	-0.000 001	-0.015
Batt. Endpoint	3.600	+20	2505 999 927	-36.8	-0.000 001	-0.015



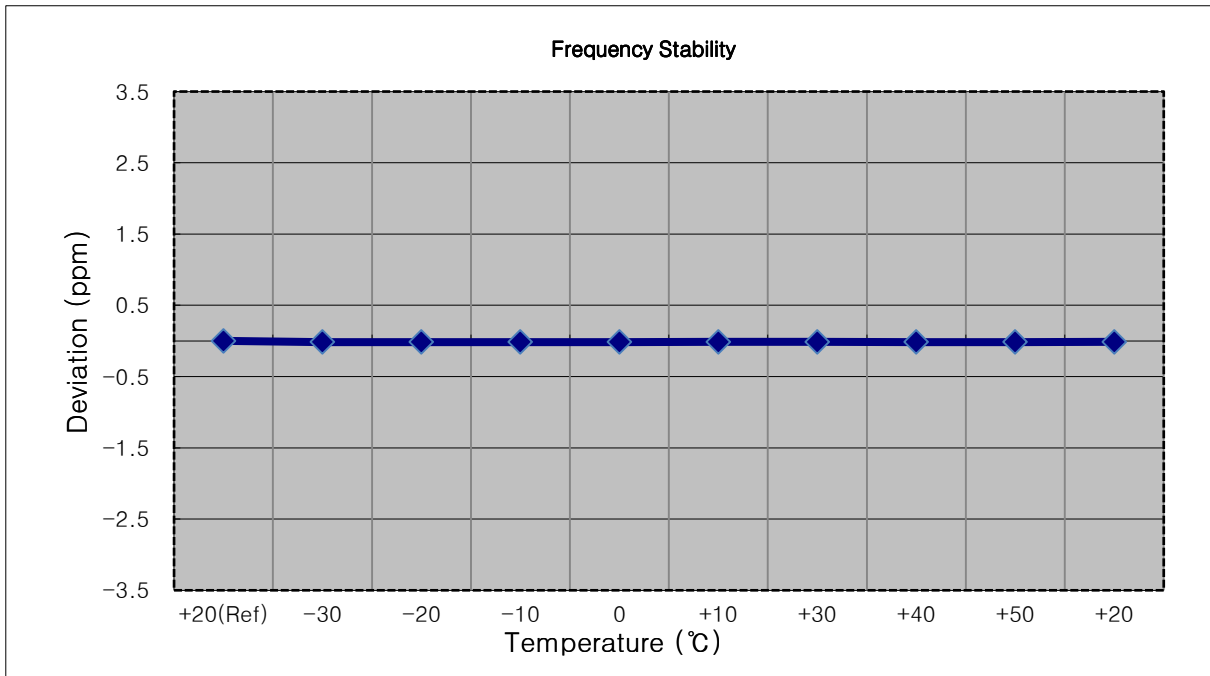
- MODE: LTE 41
- OPERATING FREQUENCY: 2593,000,000 Hz
- BANDWIDTH: 40620 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 961	0.0	0.000 000	0.000
100%		-30	2592 999 923	-37.6	-0.000 001	-0.015
100%		-20	2592 999 921	-40.1	-0.000 002	-0.015
100%		-10	2592 999 927	-34.0	-0.000 001	-0.013
100%		0	2592 999 924	-37.1	-0.000 001	-0.014
100%		+10	2592 999 922	-39.4	-0.000 002	-0.015
100%		+30	2592 999 924	-36.7	-0.000 001	-0.014
100%		+40	2592 999 922	-38.8	-0.000 001	-0.015
100%		+50	2592 999 922	-39.2	-0.000 002	-0.015
Batt. Endpoint	3.600	+20	2592 999 926	-34.8	-0.000 001	-0.013



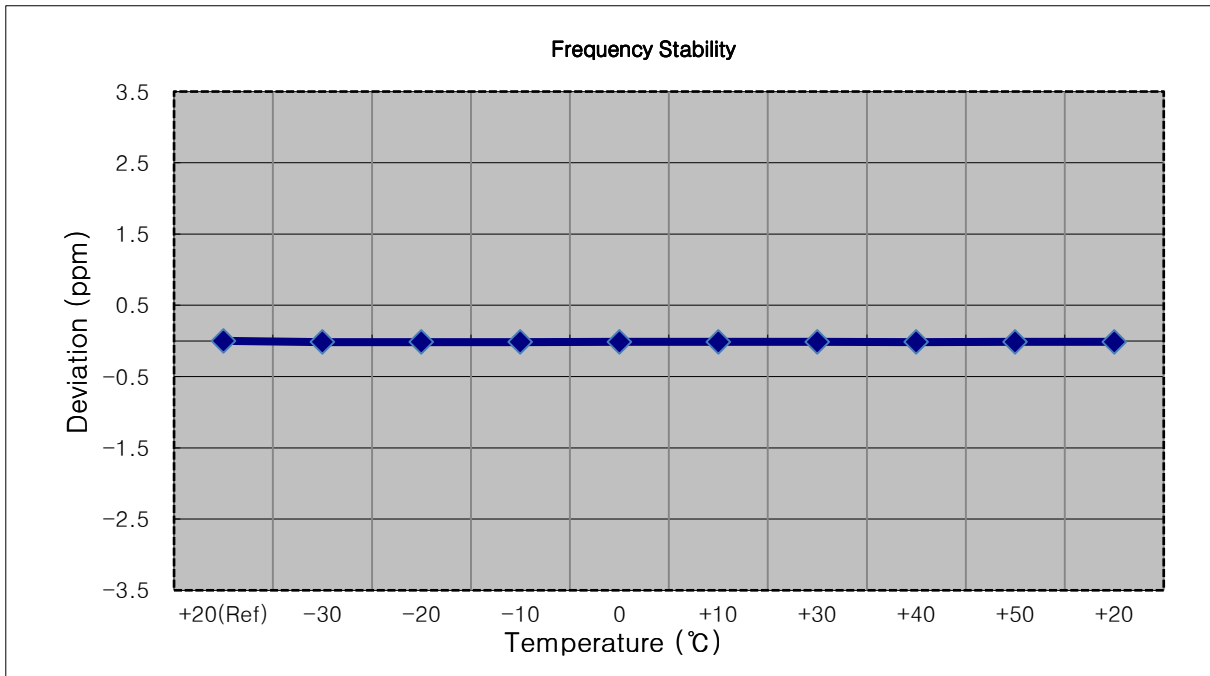
- MODE: LTE 41
- OPERATING FREQUENCY: 2593,000,000 Hz
- BANDWIDTH: 40620 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 963	0.0	0.000 000	0.000
100%		-30	2592 999 922	-41.2	-0.000 002	-0.016
100%		-20	2592 999 924	-38.9	-0.000 002	-0.015
100%		-10	2592 999 922	-41.2	-0.000 002	-0.016
100%		0	2592 999 923	-40.3	-0.000 002	-0.016
100%		+10	2592 999 925	-38.4	-0.000 001	-0.015
100%		+30	2592 999 925	-38.1	-0.000 001	-0.015
100%		+40	2592 999 922	-41.5	-0.000 002	-0.016
100%		+50	2592 999 923	-40.5	-0.000 002	-0.016
Batt. Endpoint	3.600	+20	2592 999 927	-36.1	-0.000 001	-0.014



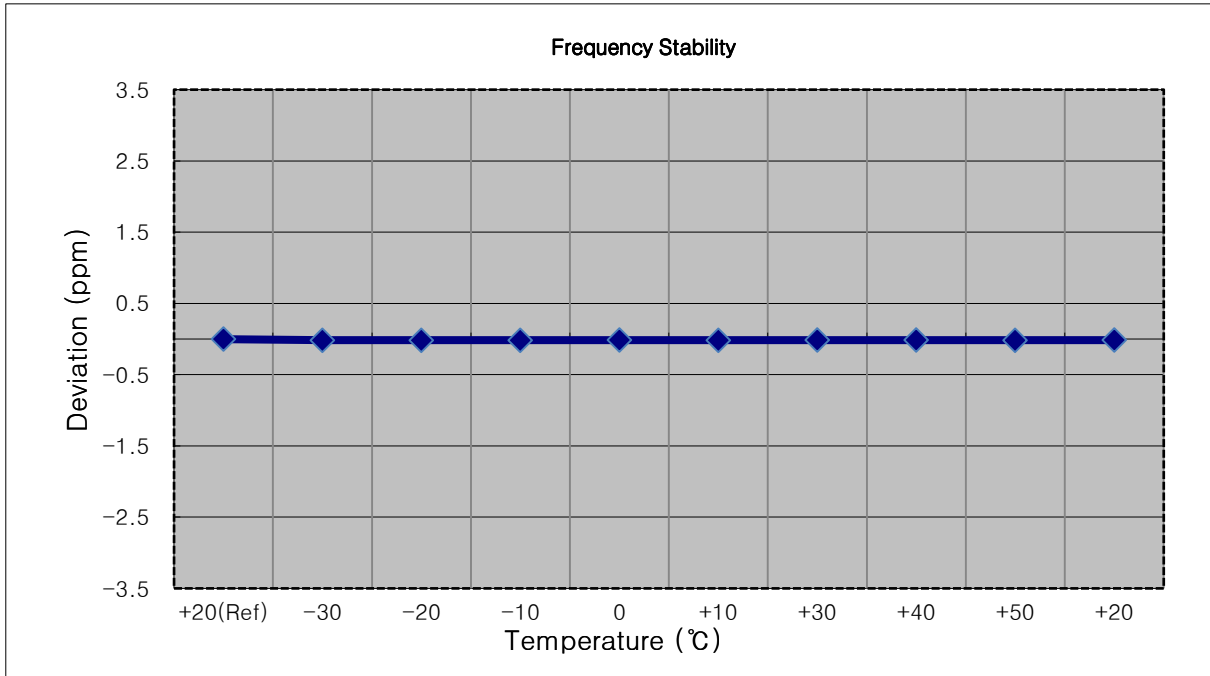
- MODE: LTE 41
- OPERATING FREQUENCY: 2593,000,000 Hz
- BANDWIDTH: 40620 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 958	0.0	0.000 000	0.000
100%		-30	2592 999 917	-41.5	-0.000 002	-0.016
100%		-20	2592 999 918	-40.3	-0.000 002	-0.016
100%		-10	2592 999 917	-41.5	-0.000 002	-0.016
100%		0	2592 999 921	-37.3	-0.000 001	-0.014
100%		+10	2592 999 921	-37.1	-0.000 001	-0.014
100%		+30	2592 999 920	-38.2	-0.000 001	-0.015
100%		+40	2592 999 918	-40.2	-0.000 002	-0.016
100%		+50	2592 999 919	-38.7	-0.000 001	-0.015
Batt. Endpoint	3.600	+20	2592 999 920	-38.2	-0.000 001	-0.015



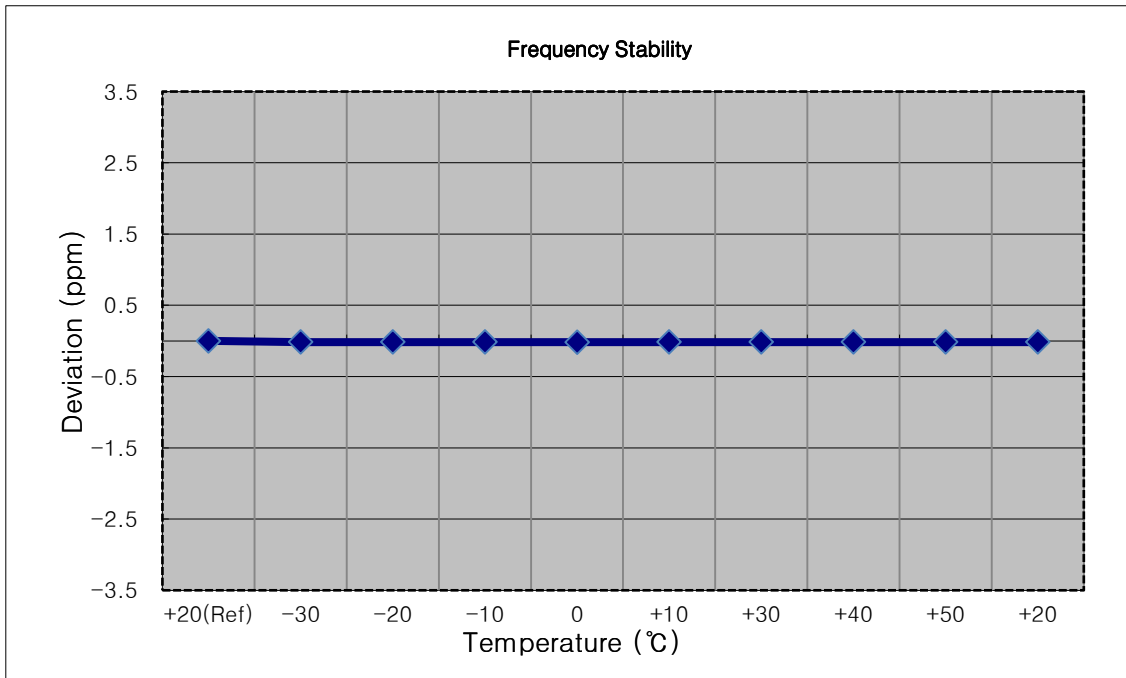
- MODE: LTE 41
- OPERATING FREQUENCY: 2593,000,000 Hz
- BANDWIDTH: 40620 (20 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2592 999 961	0.0	0.000 000	0.000
100%		-30	2592 999 920	-41.9	-0.000 002	-0.016
100%		-20	2592 999 920	-41.3	-0.000 002	-0.016
100%		-10	2592 999 919	-42.2	-0.000 002	-0.016
100%		0	2592 999 922	-39.2	-0.000 002	-0.015
100%		+10	2592 999 918	-43.6	-0.000 002	-0.017
100%		+30	2592 999 922	-39.7	-0.000 002	-0.015
100%		+40	2592 999 922	-39.7	-0.000 002	-0.015
100%		+50	2592 999 920	-41.5	-0.000 002	-0.016
Batt. Endpoint	3.600	+20	2592 999 922	-39.7	-0.000 002	-0.015



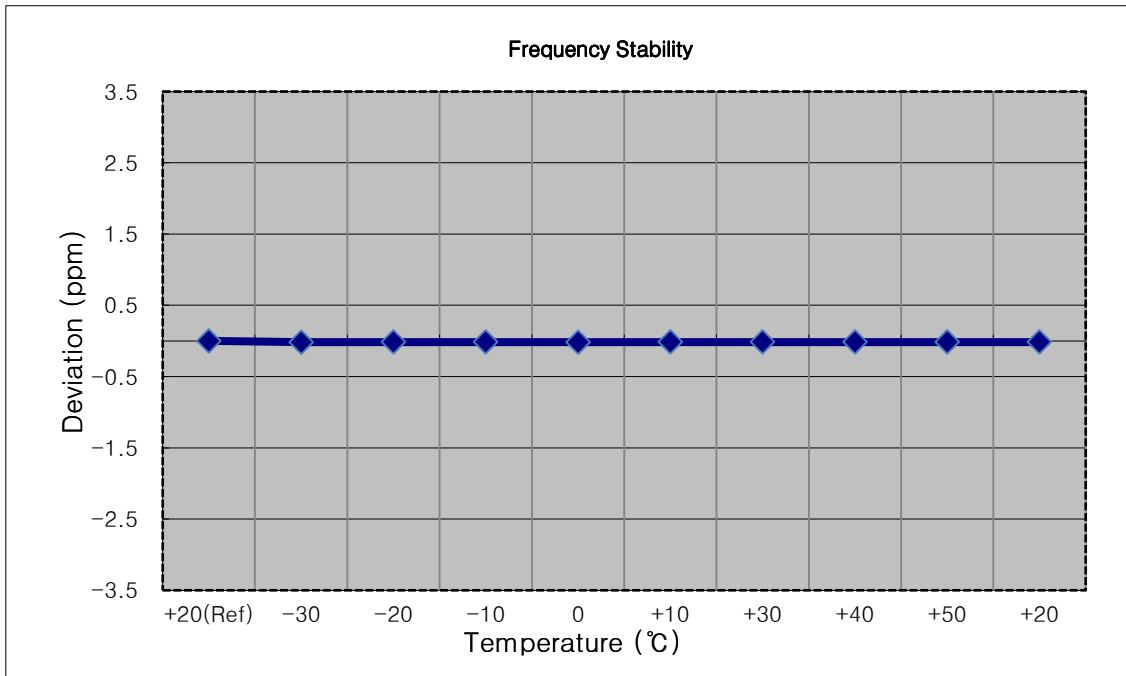
- MODE: LTE 41
- OPERATING FREQUENCY: 2687,500,000 Hz
- BANDWIDTH: 41565 (5 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2687 499 955	0.0	0.000 000	0.000
100%		-30	2687 499 913	-41.9	-0.000 002	-0.016
100%		-20	2687 499 910	-44.7	-0.000 002	-0.017
100%		-10	2687 499 914	-41.0	-0.000 002	-0.015
100%		0	2687 499 908	-46.5	-0.000 002	-0.017
100%		+10	2687 499 913	-41.4	-0.000 002	-0.015
100%		+30	2687 499 912	-42.6	-0.000 002	-0.016
100%		+40	2687 499 911	-44.0	-0.000 002	-0.016
100%		+50	2687 499 909	-46.1	-0.000 002	-0.017
Batt. Endpoint	3.600	+20	2687 499 914	-41.2	-0.000 002	-0.015



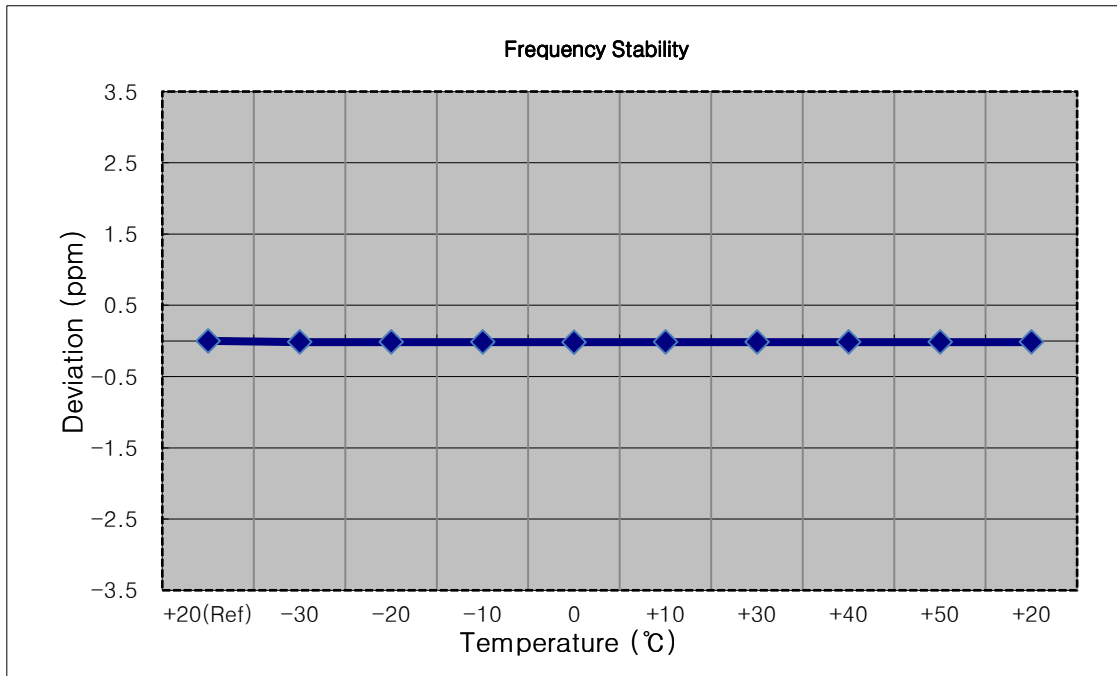
- MODE: LTE 41
- OPERATING FREQUENCY: 2685,000,000 Hz
- BANDWIDTH: 41540 (10 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2684 999 954	0.0	0.000 000	0.000
100%		-30	2684 999 906	-47.2	-0.000 002	-0.018
100%		-20	2684 999 909	-44.6	-0.000 002	-0.017
100%		-10	2684 999 910	-43.4	-0.000 002	-0.016
100%		0	2684 999 905	-48.9	-0.000 002	-0.018
100%		+10	2684 999 910	-44.0	-0.000 002	-0.016
100%		+30	2684 999 911	-43.1	-0.000 002	-0.016
100%		+40	2684 999 911	-42.3	-0.000 002	-0.016
100%		+50	2684 999 910	-43.2	-0.000 002	-0.016
Batt. Endpoint	3.600	+20	2684 999 909	-44.5	-0.000 002	-0.017



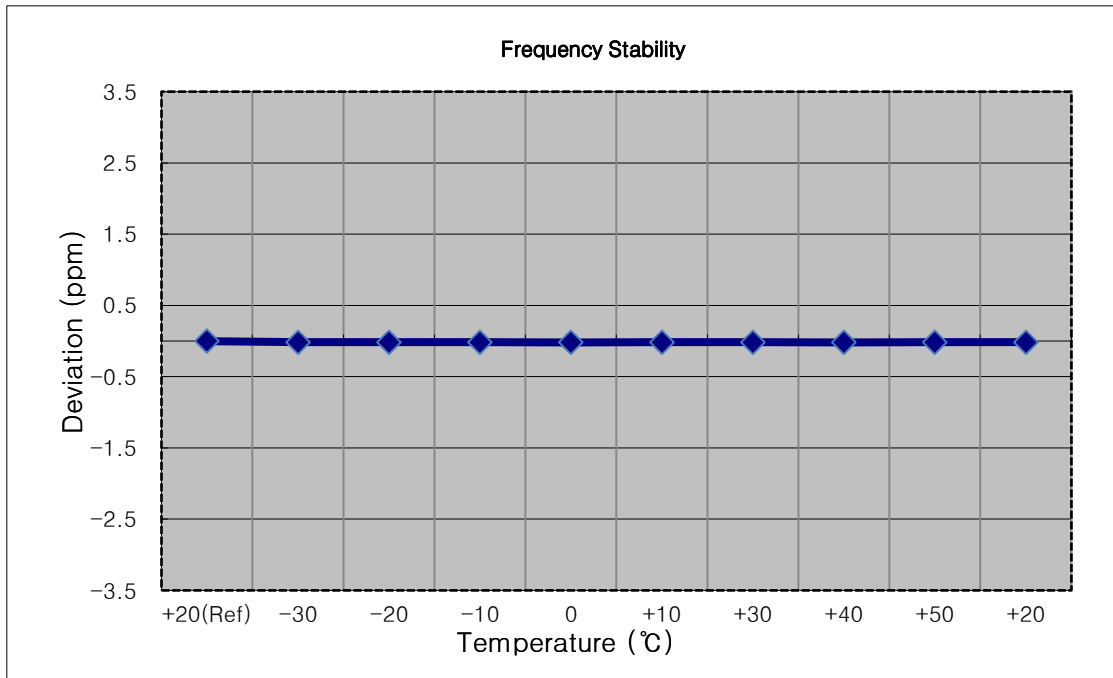
- MODE: LTE 41
- OPERATING FREQUENCY: 2682,500,000 Hz
- BANDWIDTH: 41515 (15 MHz)
- REFERENCE VOLTAGE: 3.85 VDC
- DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2682 499 953	0.0	0.000 000	0.000
100%		-30	2682 499 911	-42.8	-0.000 002	-0.016
100%		-20	2682 499 909	-44.1	-0.000 002	-0.016
100%		-10	2682 499 911	-42.7	-0.000 002	-0.016
100%		0	2682 499 907	-46.3	-0.000 002	-0.017
100%		+10	2682 499 910	-43.7	-0.000 002	-0.016
100%		+30	2682 499 912	-41.7	-0.000 002	-0.016
100%		+40	2682 499 913	-40.7	-0.000 002	-0.015
100%		+50	2682 499 909	-44.8	-0.000 002	-0.017
Batt. Endpoint	3.600	+20	2682 499 910	-43.4	-0.000 002	-0.016



- 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. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2679 999 955	0.0	0.000 000	0.000
100%		-30	2679 999 907	-47.6	-0.000 002	-0.018
100%		-20	2679 999 907	-47.7	-0.000 002	-0.018
100%		-10	2679 999 913	-42.4	-0.000 002	-0.016
100%		0	2679 999 906	-48.6	-0.000 002	-0.018
100%		+10	2679 999 910	-45.4	-0.000 002	-0.017
100%		+30	2679 999 911	-43.7	-0.000 002	-0.016
100%		+40	2679 999 903	-51.5	-0.000 002	-0.019
100%		+50	2679 999 908	-47.1	-0.000 002	-0.018
Batt. Endpoint	3.600	+20	2679 999 909	-45.8	-0.000 002	-0.017



8.7 GEO-LOCATION MECHANISM

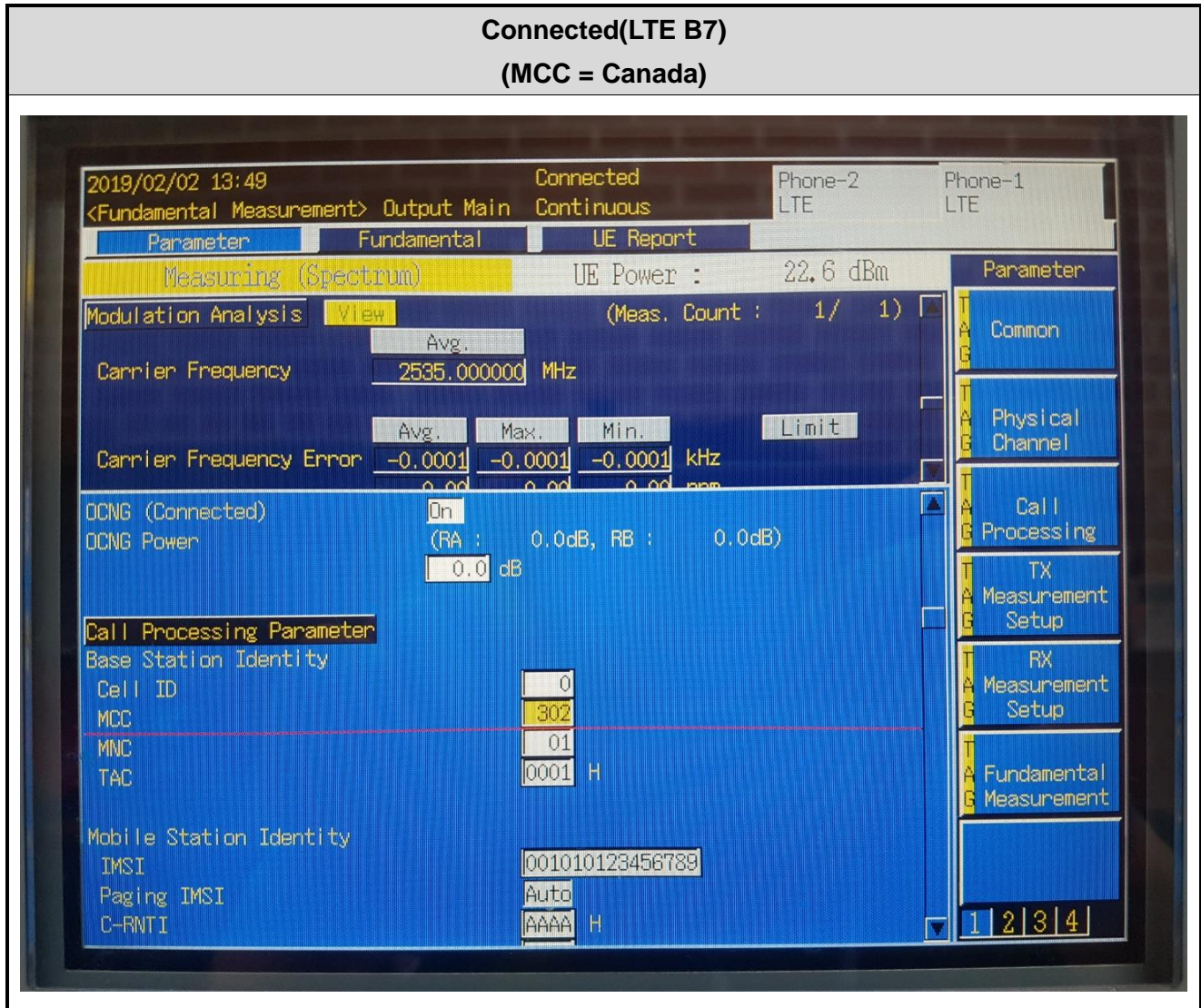
The device uses a geo-location mechanism based on the cellular MCC codes in order to only enable certain LTE bands when the device is not in the USA.

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)

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

Verification test



Connected(LTE B38)
(MCC = Canada)

2018/12/18 11:18 Connected Phone-2 Phone-1
 <Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report Band Ca

Measuring UE Power : 22.3 dBm

Modulation Analysis View (Meas. Count : 10 / 10)

Carrier Frequency Avg. 2594.999978 MHz

Carrier Frequency Error Avg. Max. Min. Limit

 -0.0218 -0.0165 -0.0352 kHz

DCNG (Connected) On

DCNG Power (RA : 0.0dB, RB : 0.0dB)

 0.0 dB

Call Processing Parameter

Base Station Identity

Cell ID 0

MCC 302

MNC 01

TAC 0001 H

Mobile Station Identity

IMSI 001010123456789

Paging IMSI Auto

C-RNTI AAAA H

Parameter

Common

Physical Channel

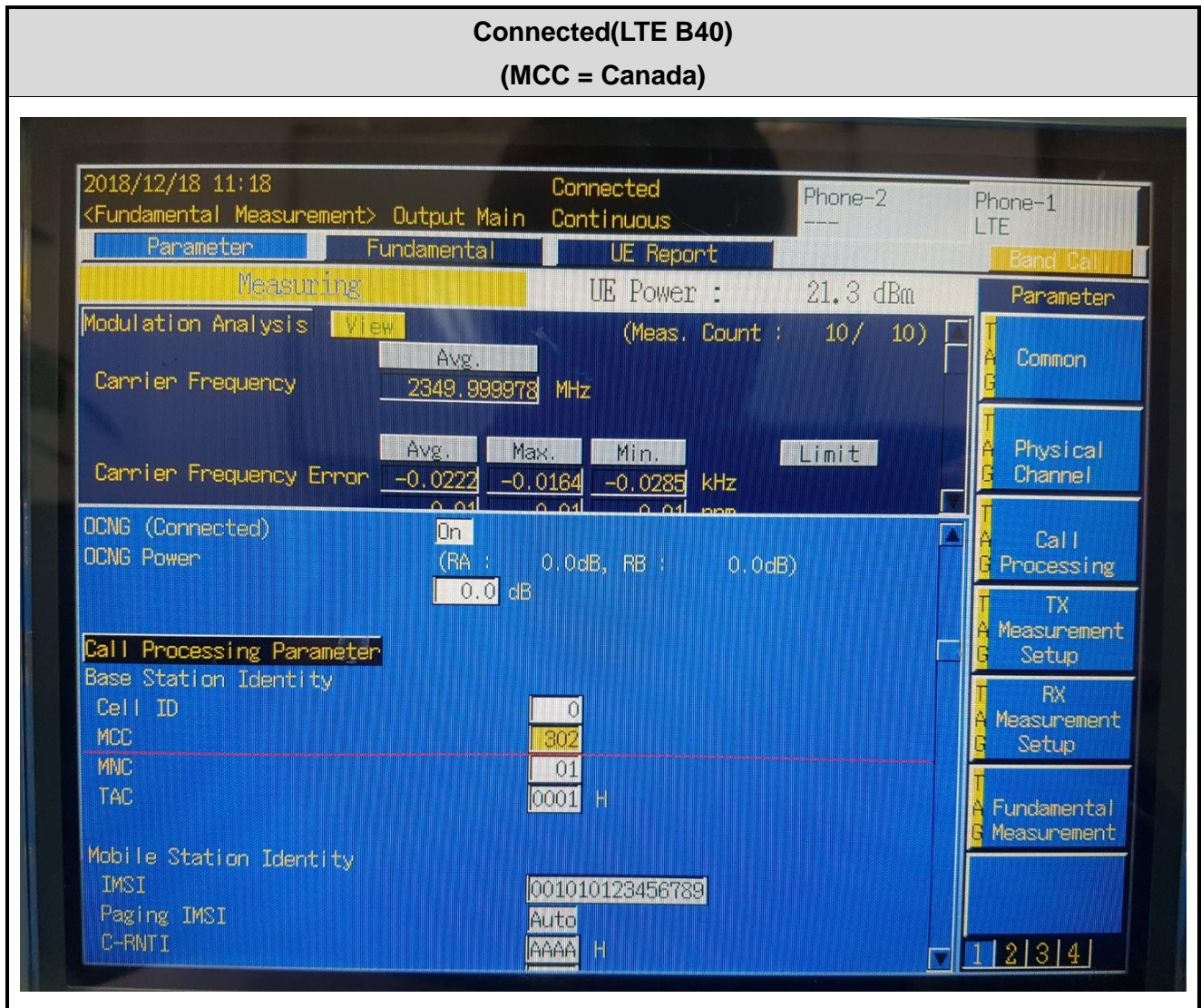
Call Processing

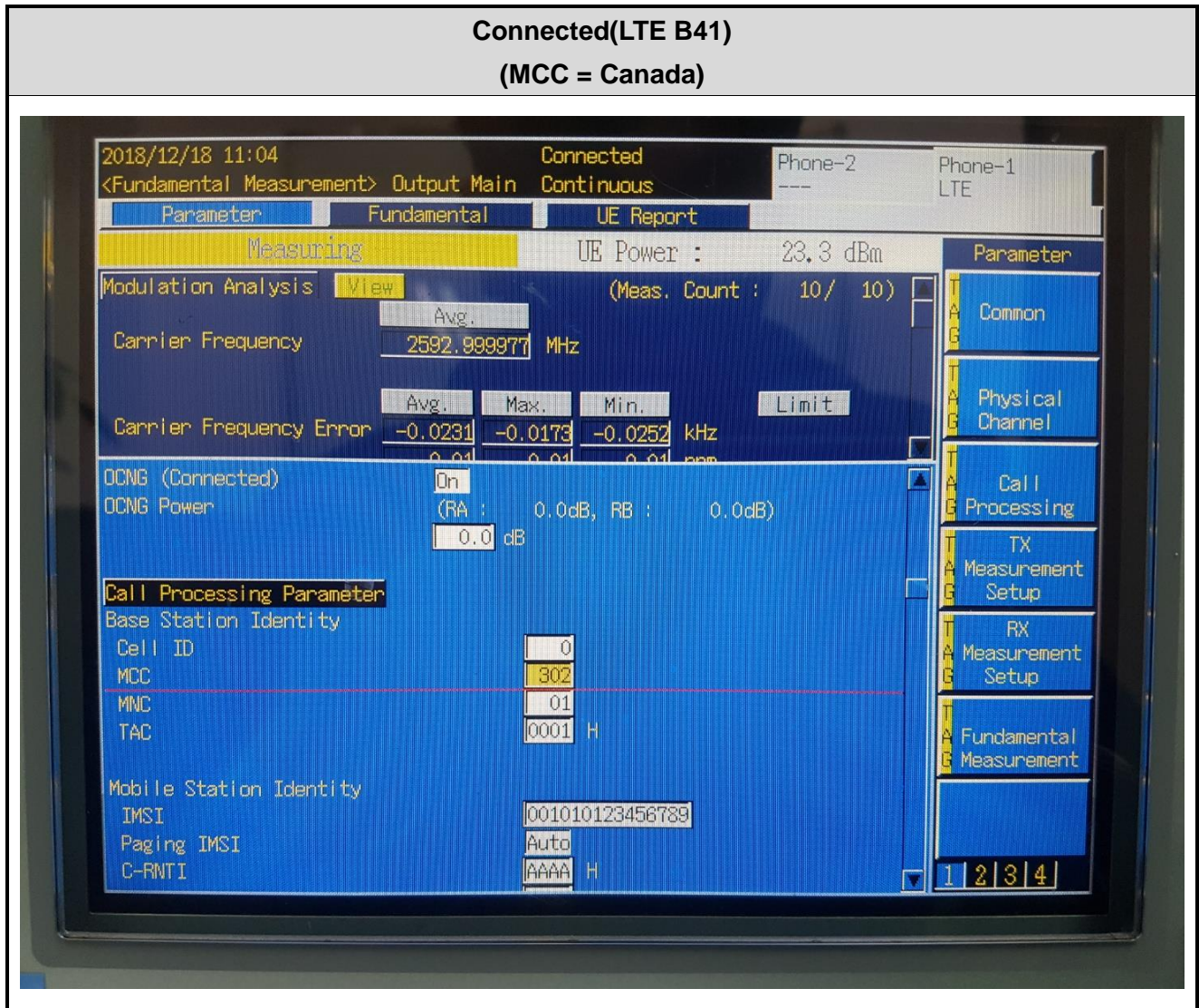
TX Measurement Setup

RX Measurement Setup

Fundamental Measurement

1 | 2 | 3 | 4





Connected(LTE B41)
(MCC = US)

2018/12/18 11:21 Connected Phone-2 Phone-1
<Fundamental Measurement> Output Main Continuous --- LTE

Parameter Fundamental UE Report Band Cal.

Measuring UE Power : 21.9 dBm
(Meas. Count : 10 / 10)

Modulation Analysis View

Carrier Frequency Avg. 2592.999978 MHz

Carrier Frequency Error	Avg.	Max.	Min.	Limit
	-0.0221	-0.0131	-0.0321	kHz
	0.01	0.01	0.01	ppm

DCNG (Connected) On
DCNG Power (RA : 0.0dB, RB : 0.0dB) 0.0 dB

Call Processing Parameter

Base Station Identity

Cell ID	0
MCC	311
MNC	01
TAC	0001 H

Mobile Station Identity

IMSI	001010123456789
Paging IMSI	Auto
C-RNTI	AAAA H

Parameter

- Common
- Physical Channel
- Call Processing
- TX Measurement Setup
- RX Measurement Setup
- Fundamental Measurement

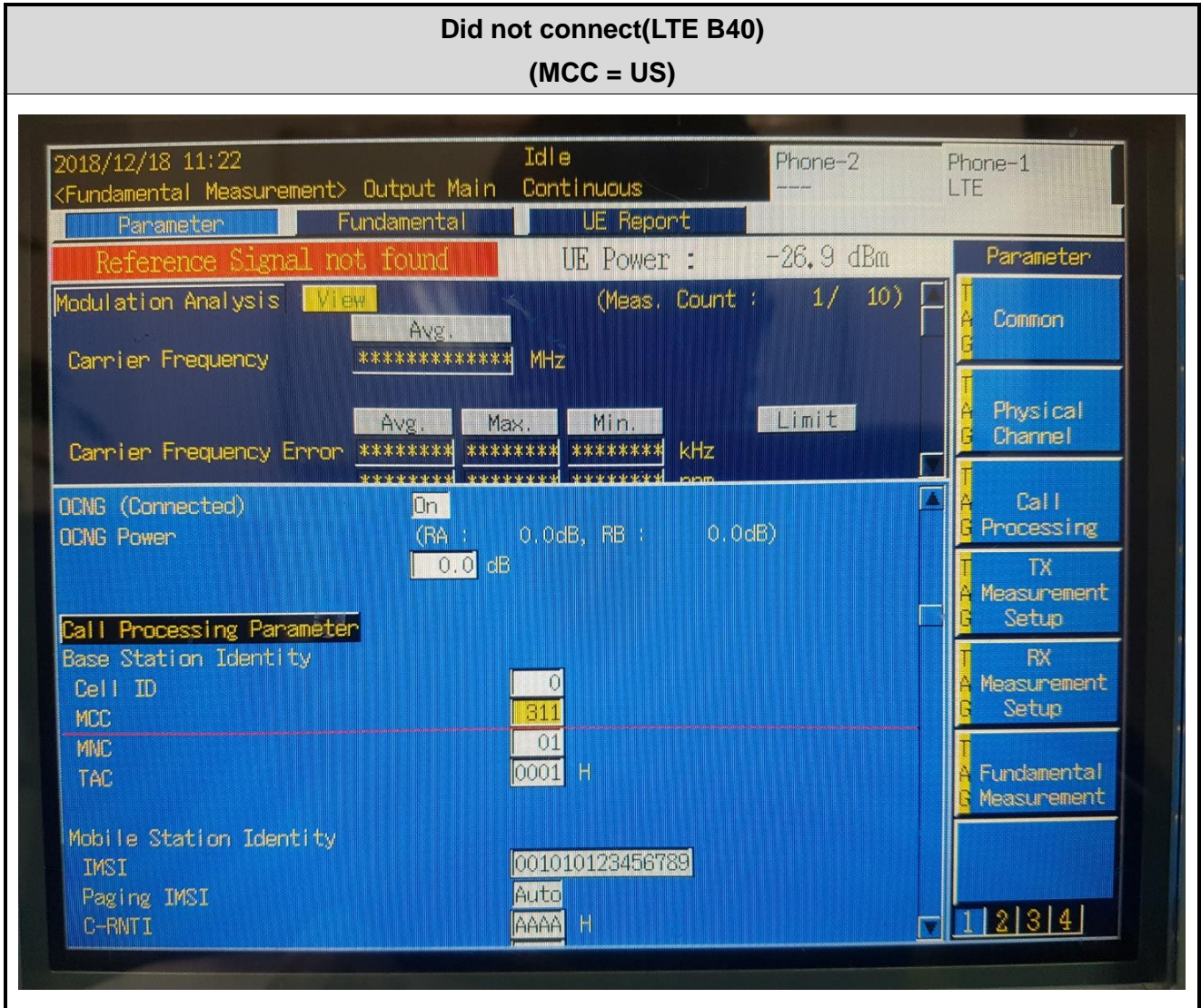
1 | 2 | 3 | 4

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

The screenshot displays the following information:

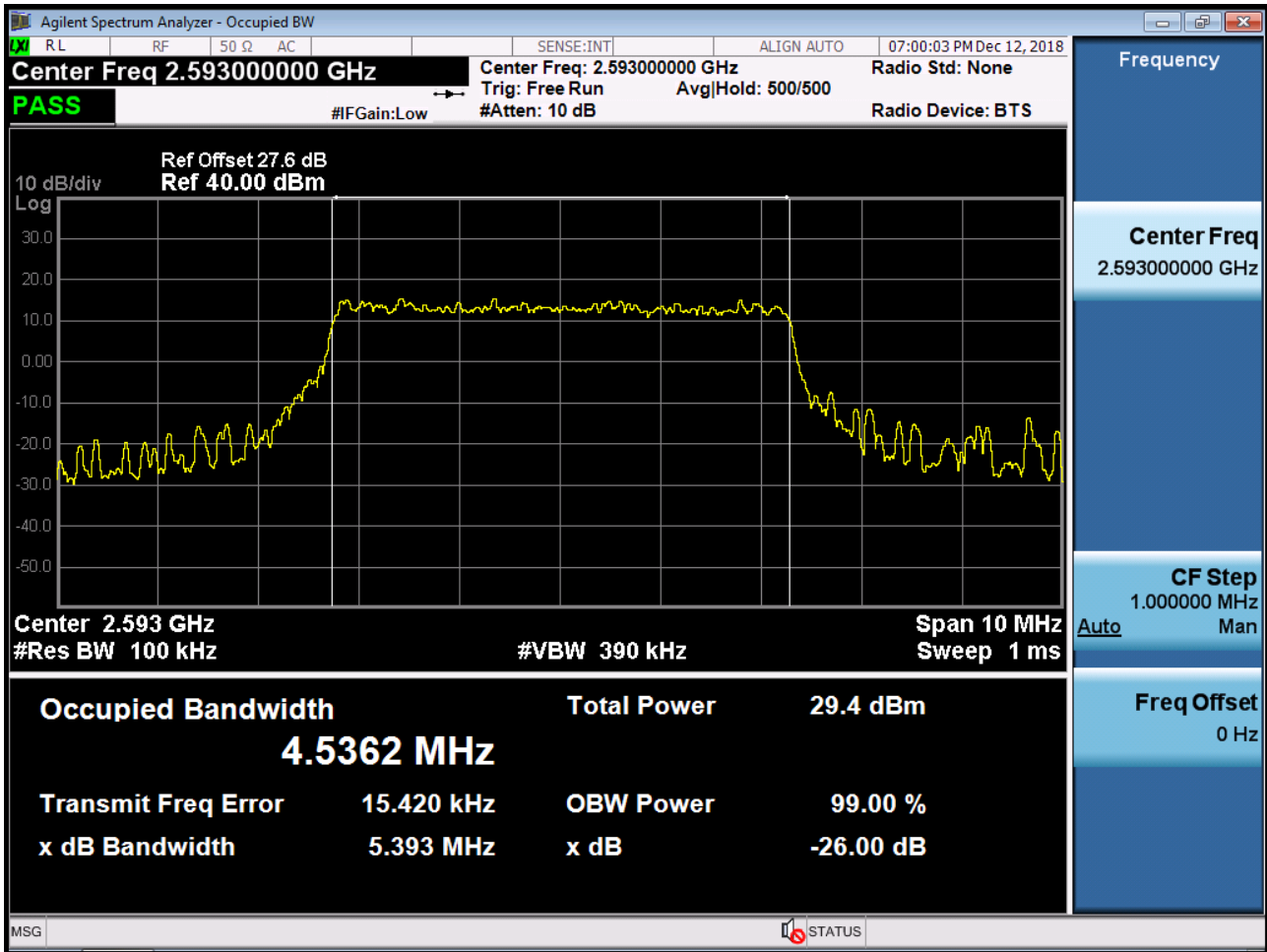
- Time:** 2019/02/02 13:53
- Mode:** Idle
- Phone-2:** LTE
- Phone-1:** LTE
- Measurement Mode:** Fundamental
- Output:** Main
- UE Report:** Continuous
- Reference Signal:** Reference Signal not found
- UE Power:** -13.0 dBm
- Modulation Analysis:** View (Meas. Count: 1/1)
- Carrier Frequency:** [Redacted] MHz
- Carrier Frequency Error:** [Redacted] kHz
- OCNG (Connected):** On
- OCNG Power:** (RA: 0.0dB, RB: 0.0dB) 0.0 dB
- Call Processing Parameter:**
 - Base Station Identity:
 - Cell ID: 0
 - MCC: 311
 - MNC: 01
 - TAC: 0001 H
 - Mobile Station Identity:
 - IMSI: 001010123456789
 - Paging IMSI: Auto
 - C-RNTI: AAAA H



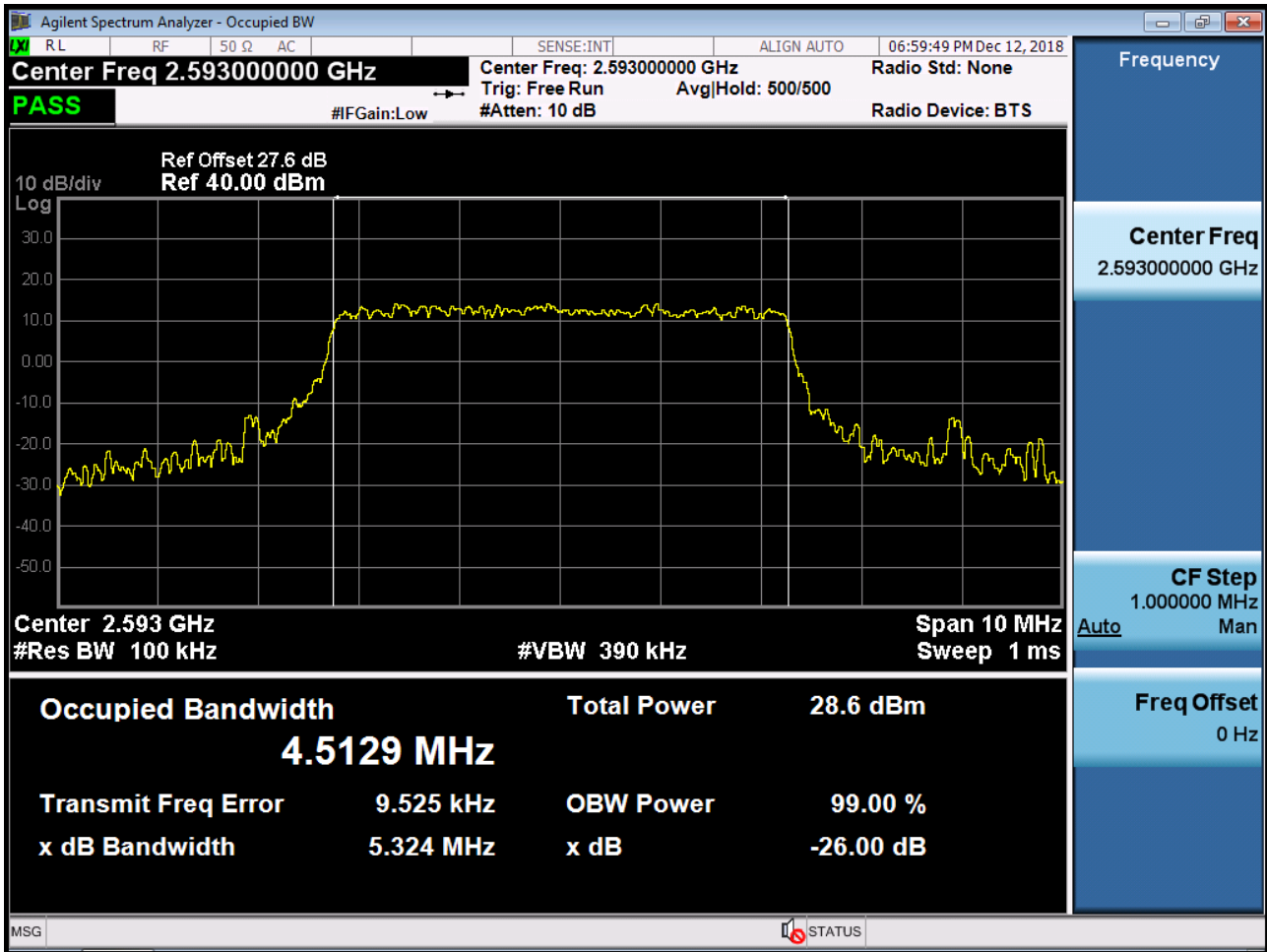


9. TEST PLOTS

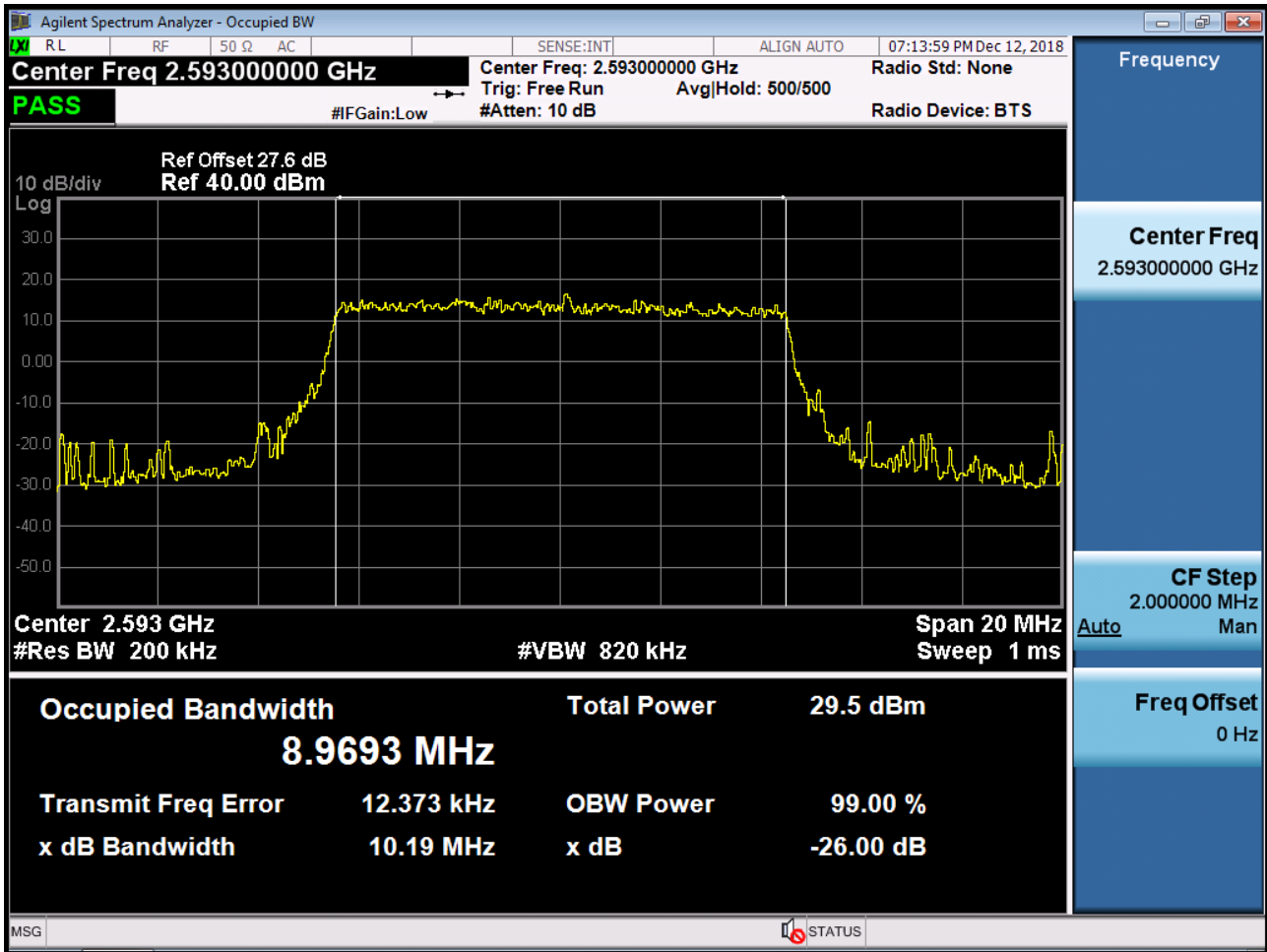
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25)



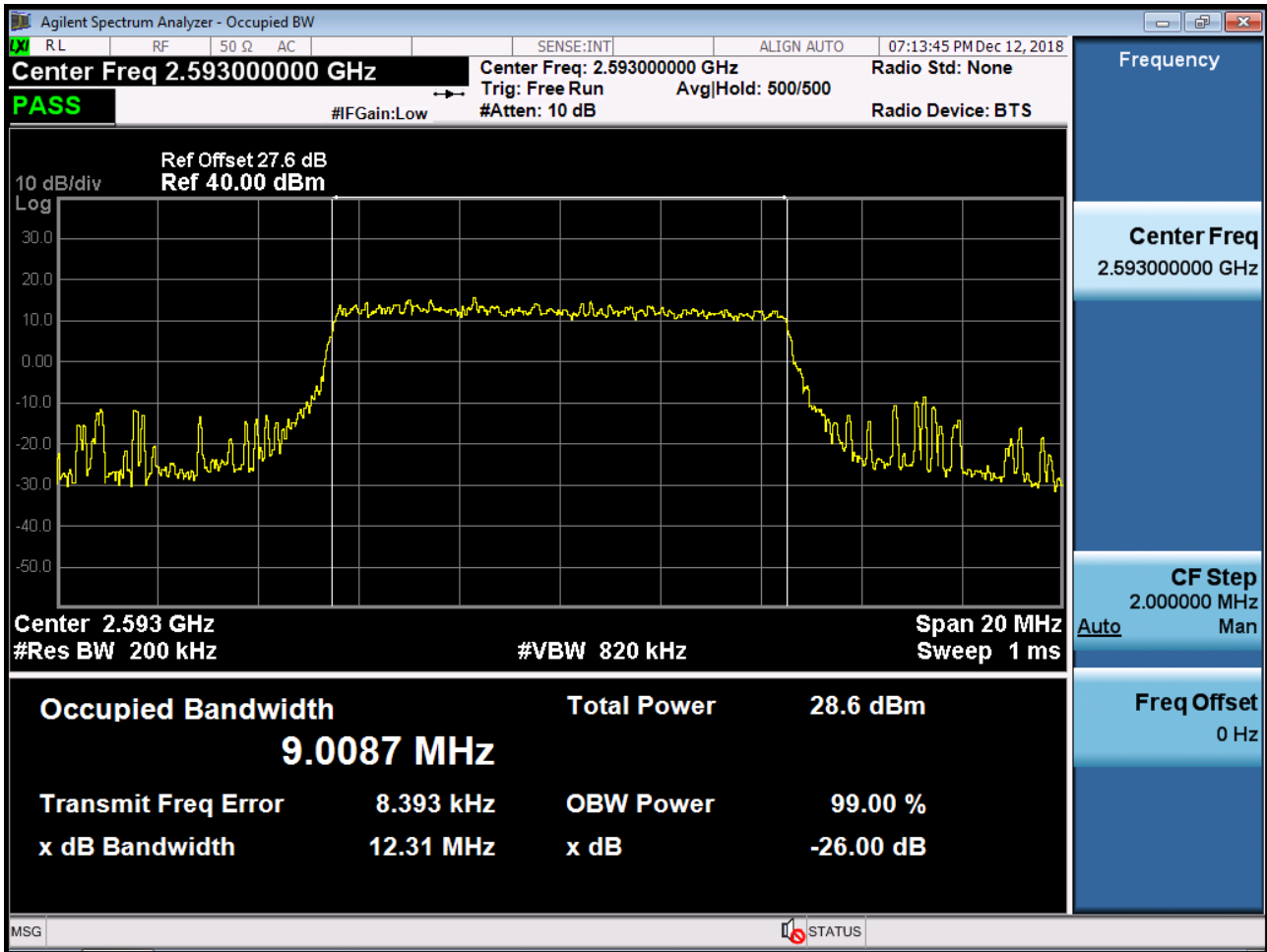
BAND 41. Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25)



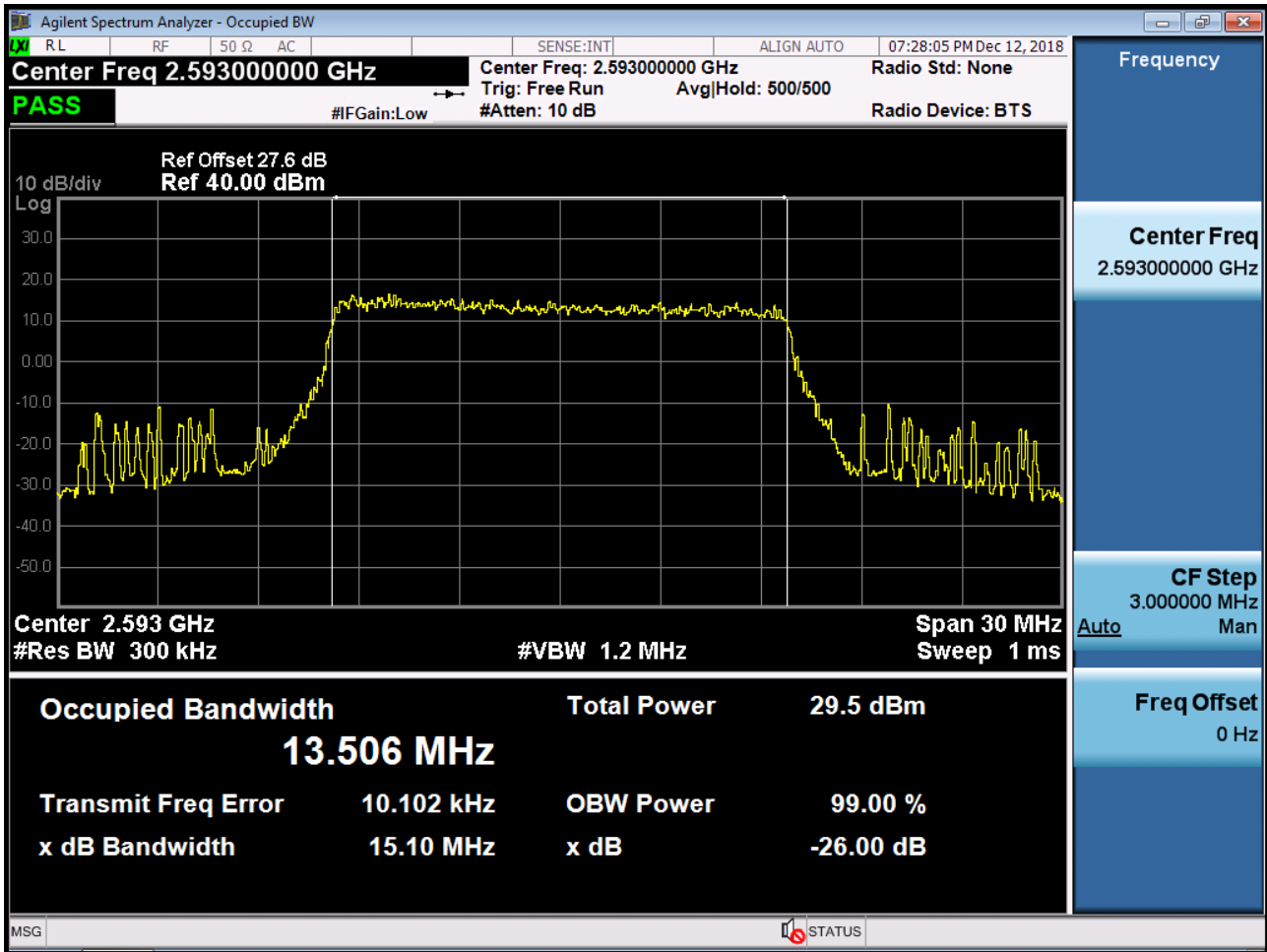
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50)



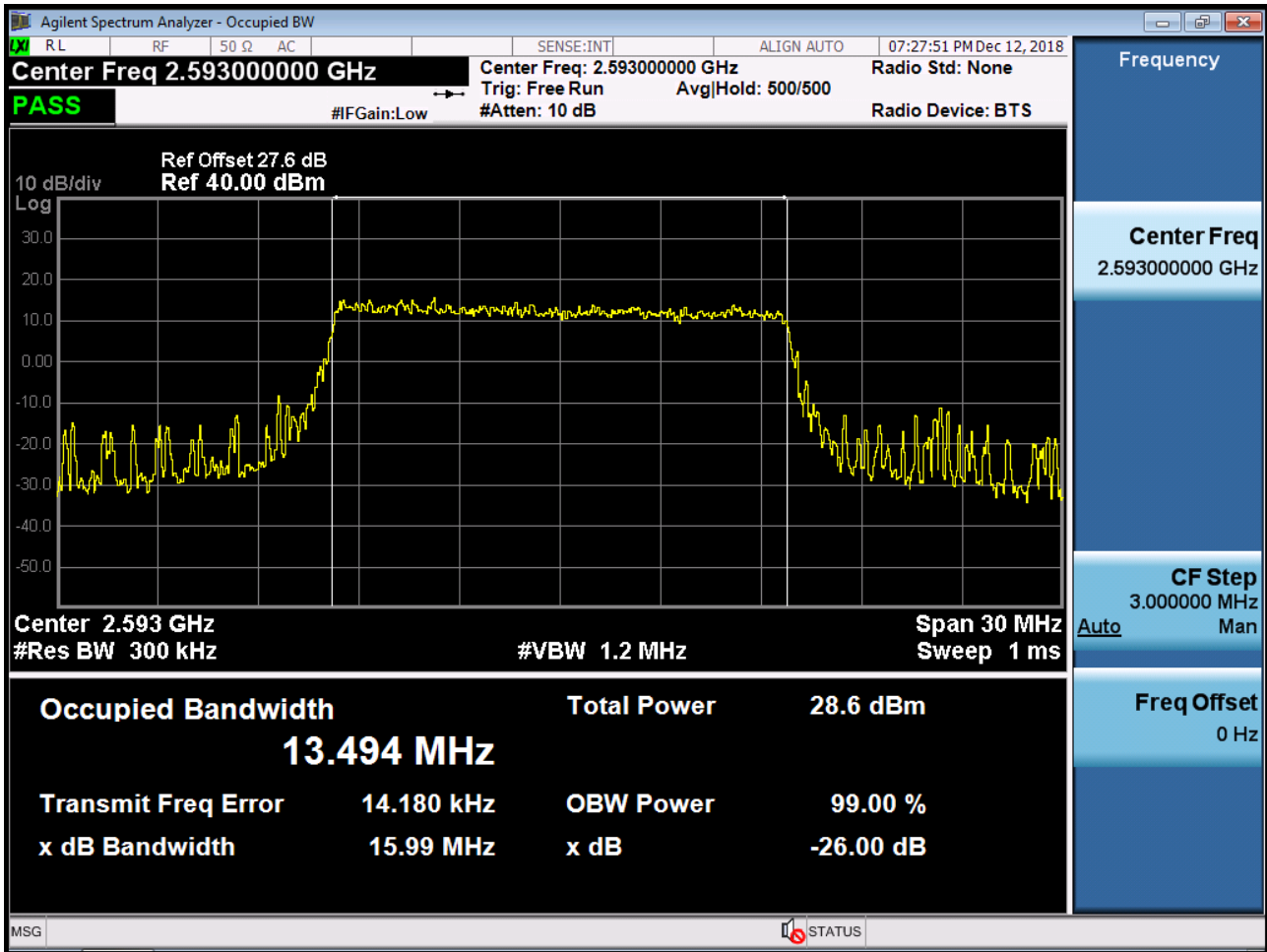
BAND 41. Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50)



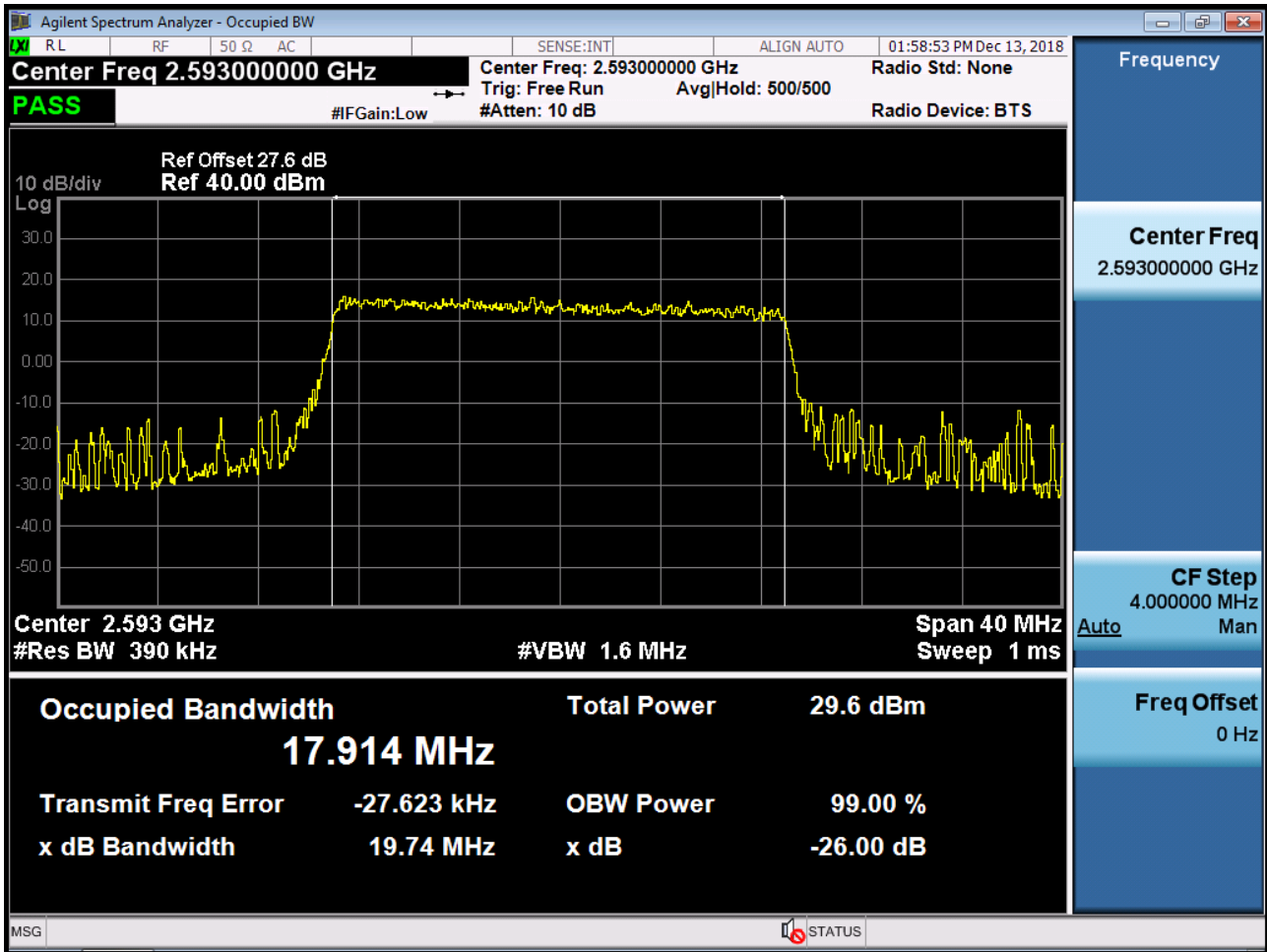
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75)



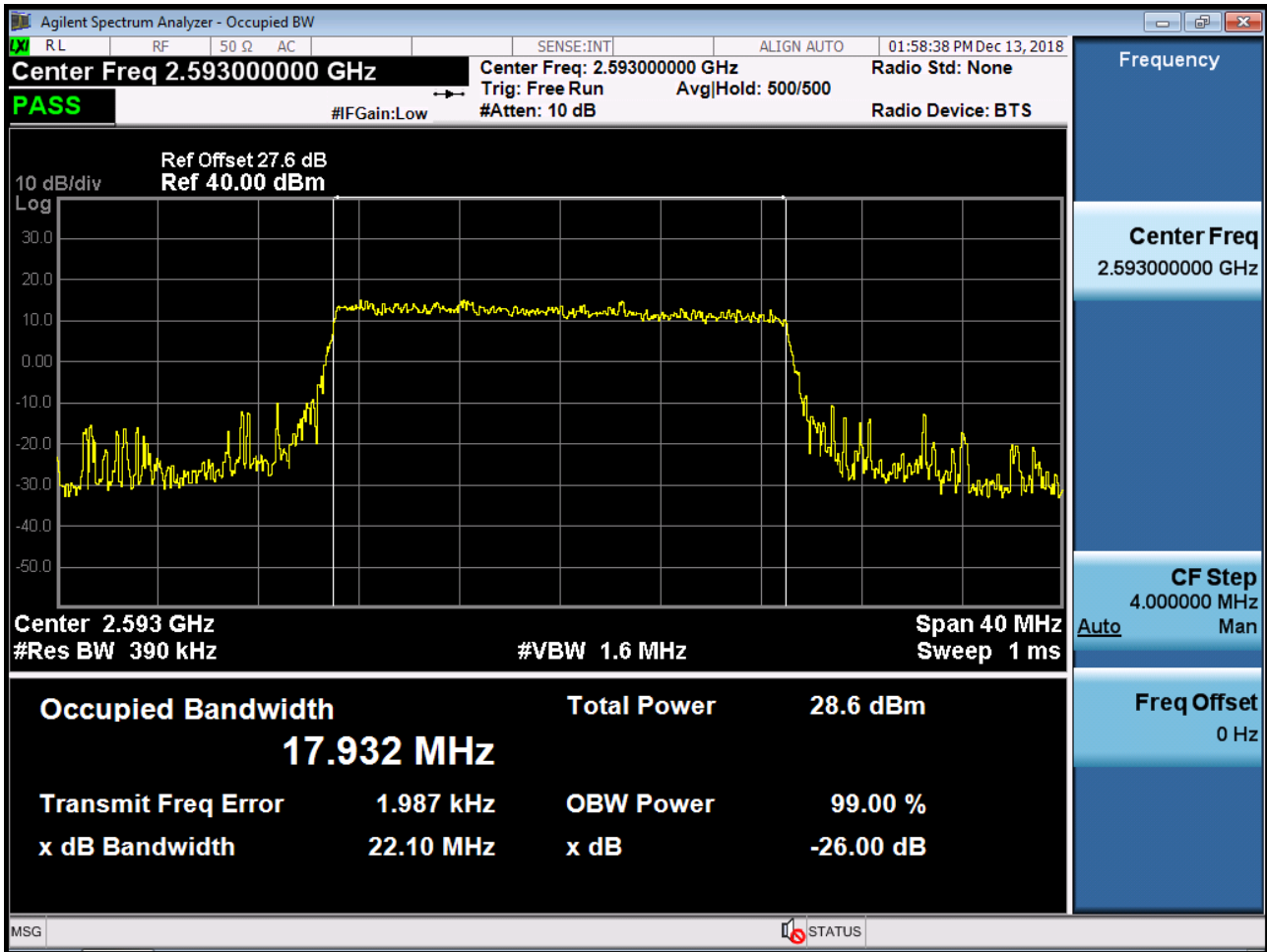
BAND 41. Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)



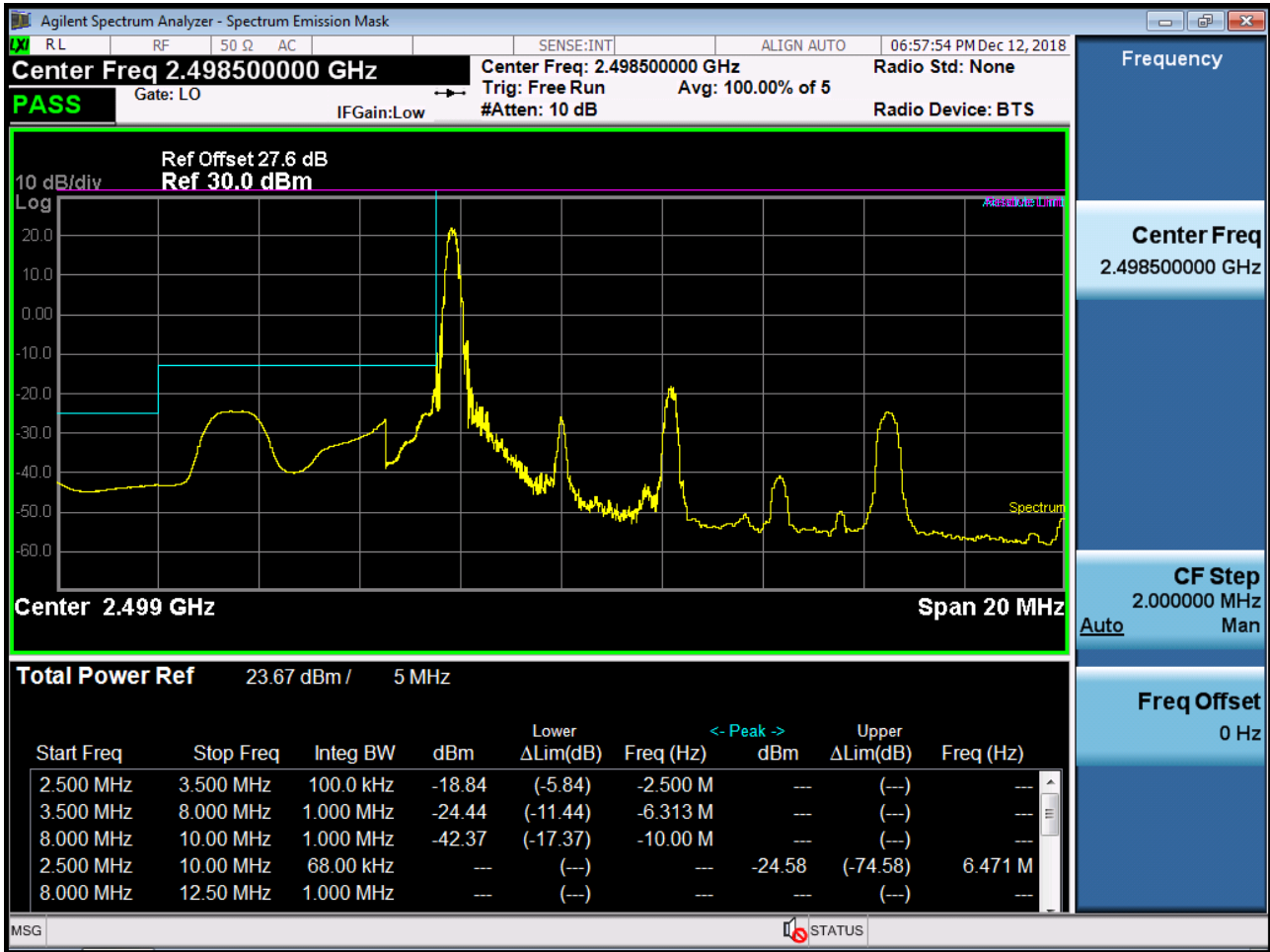
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)



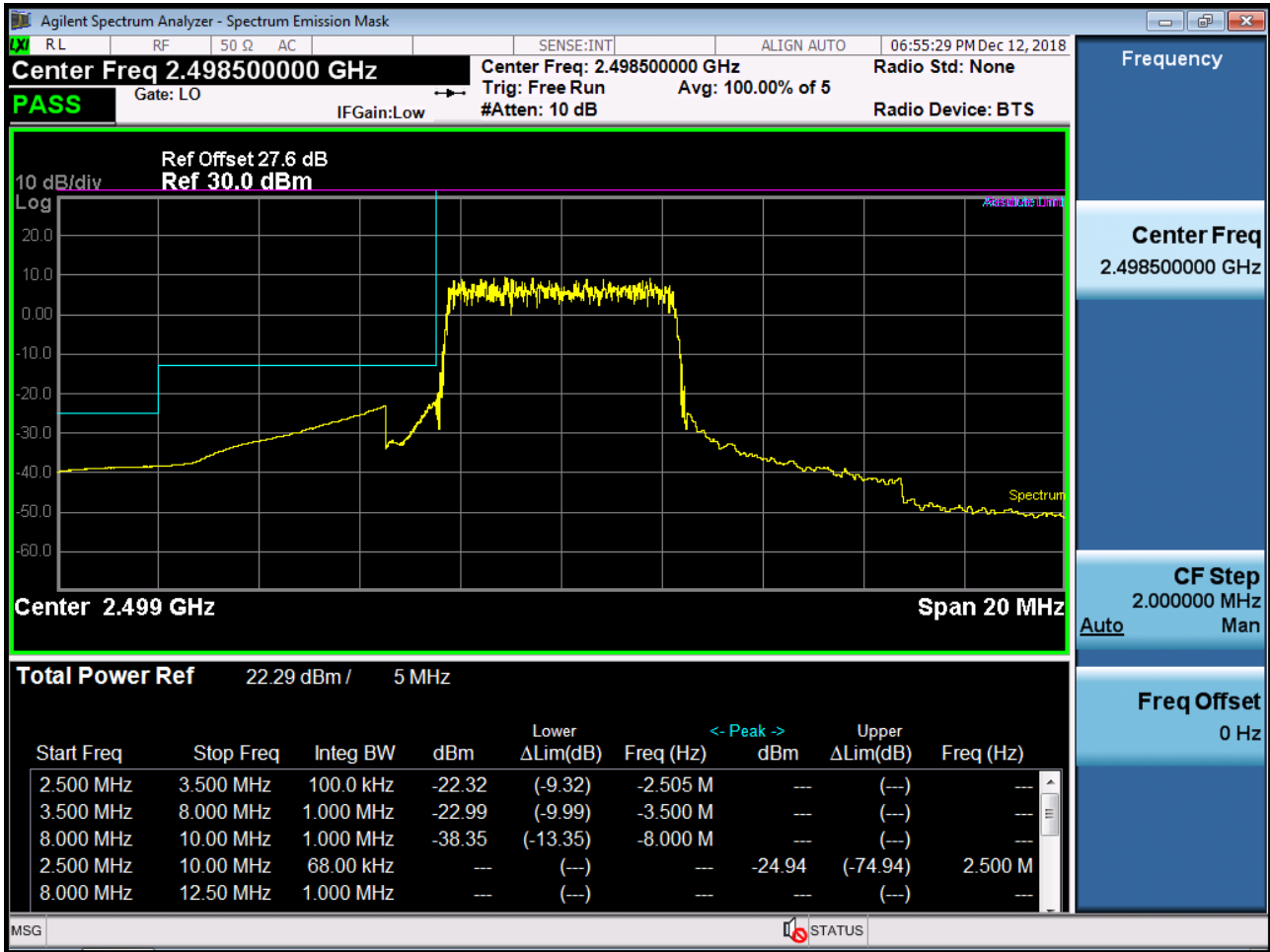
BAND 41. Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100)



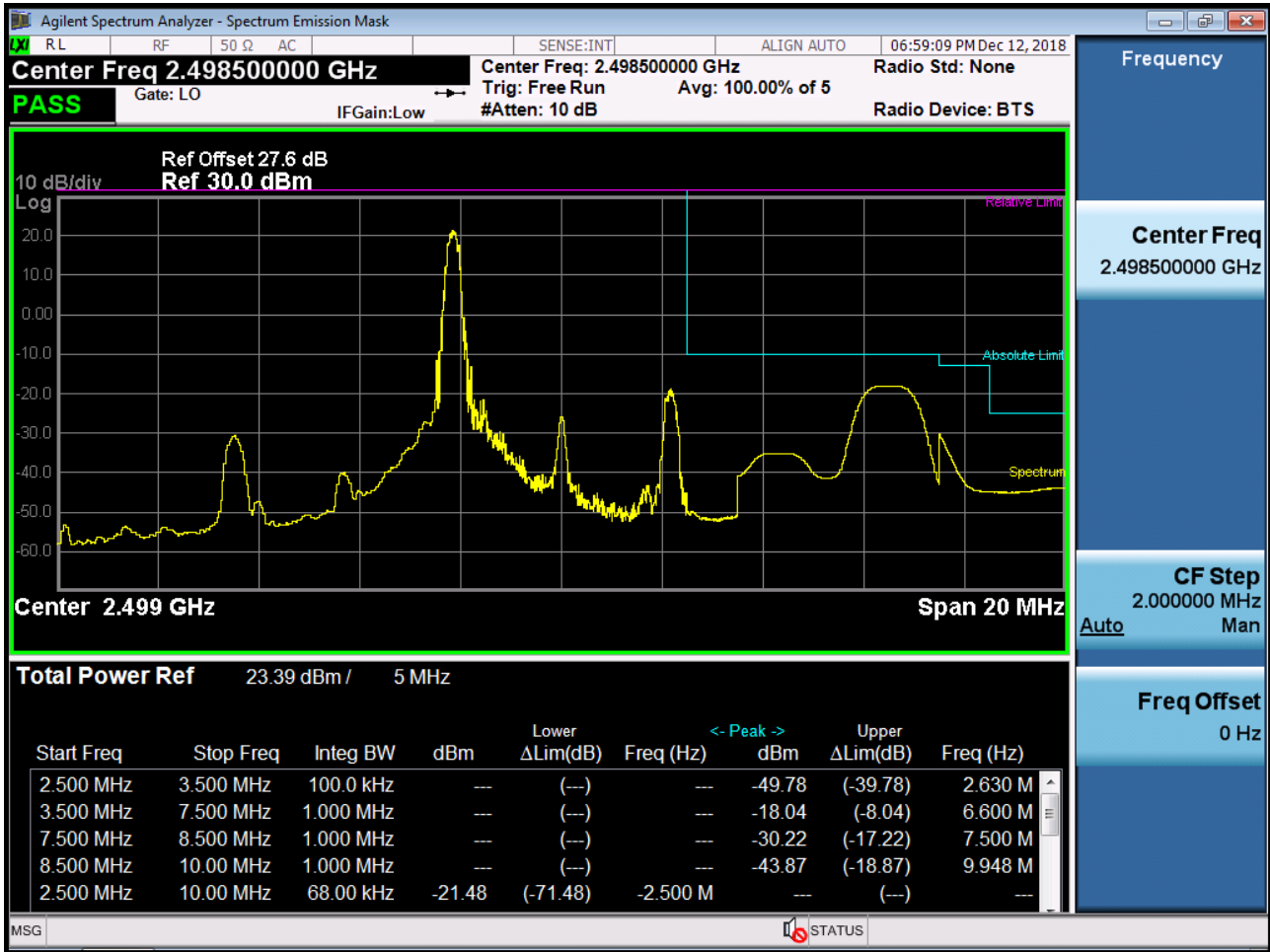
BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-1



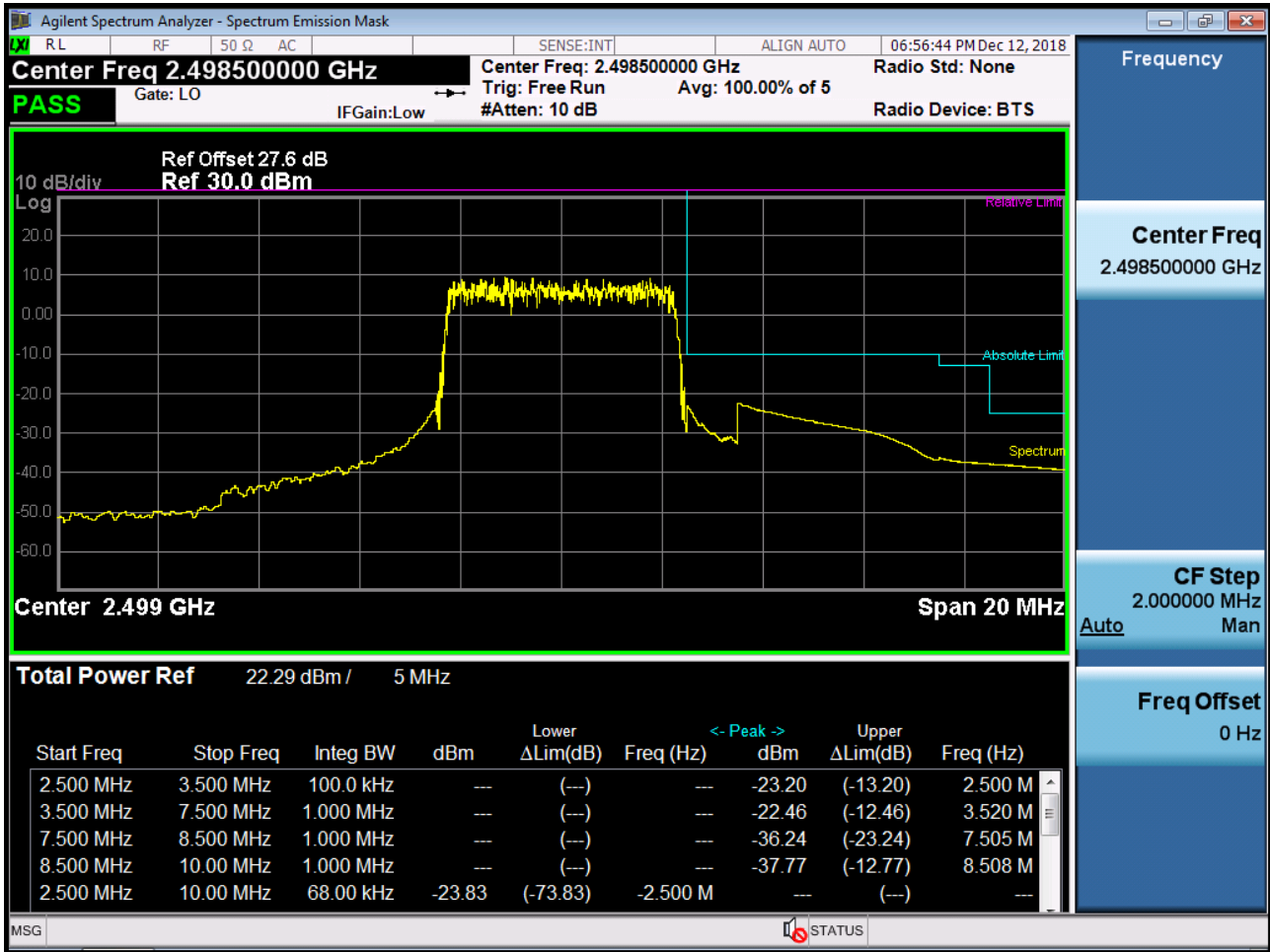
BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-2



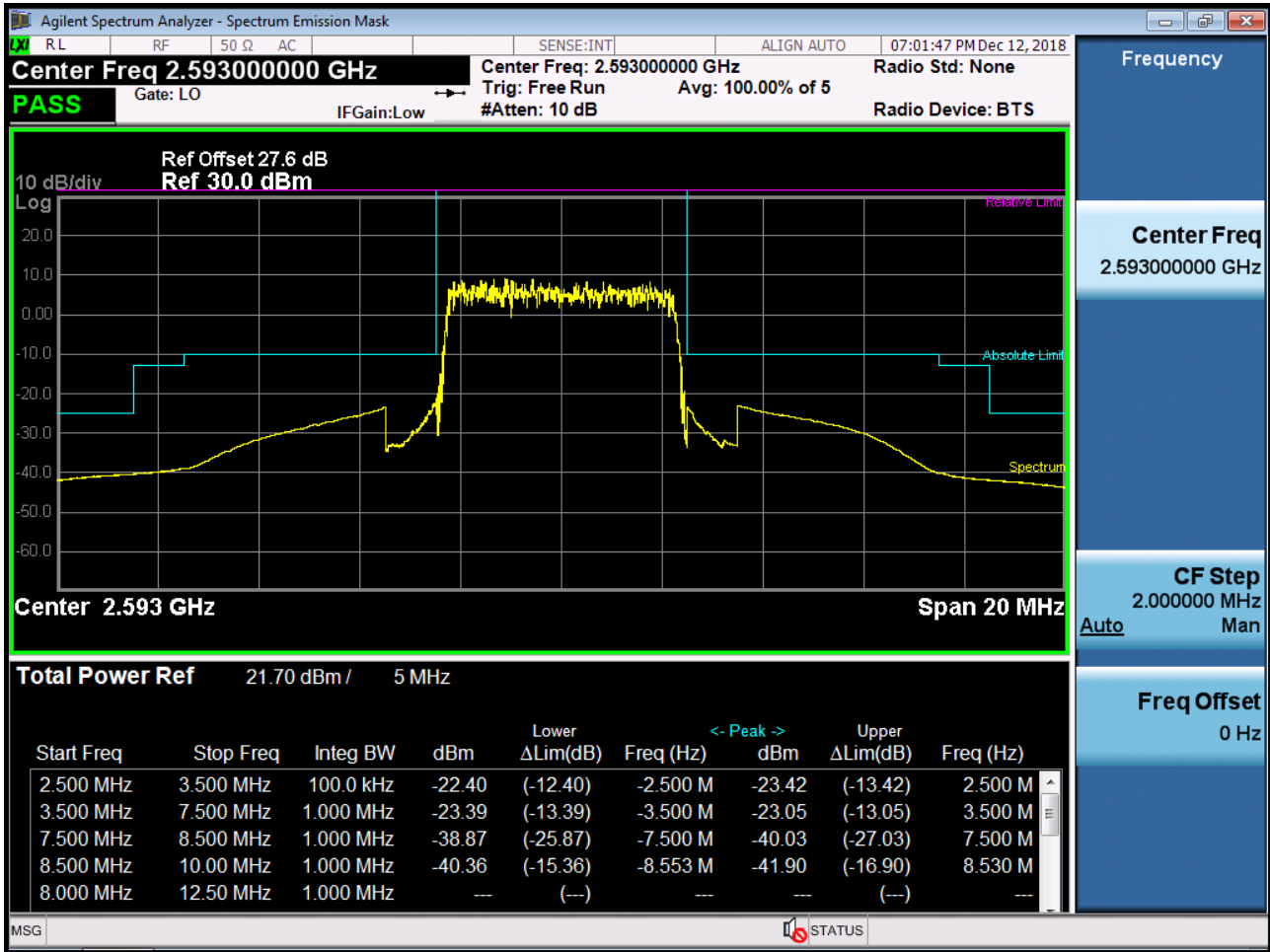
BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-1



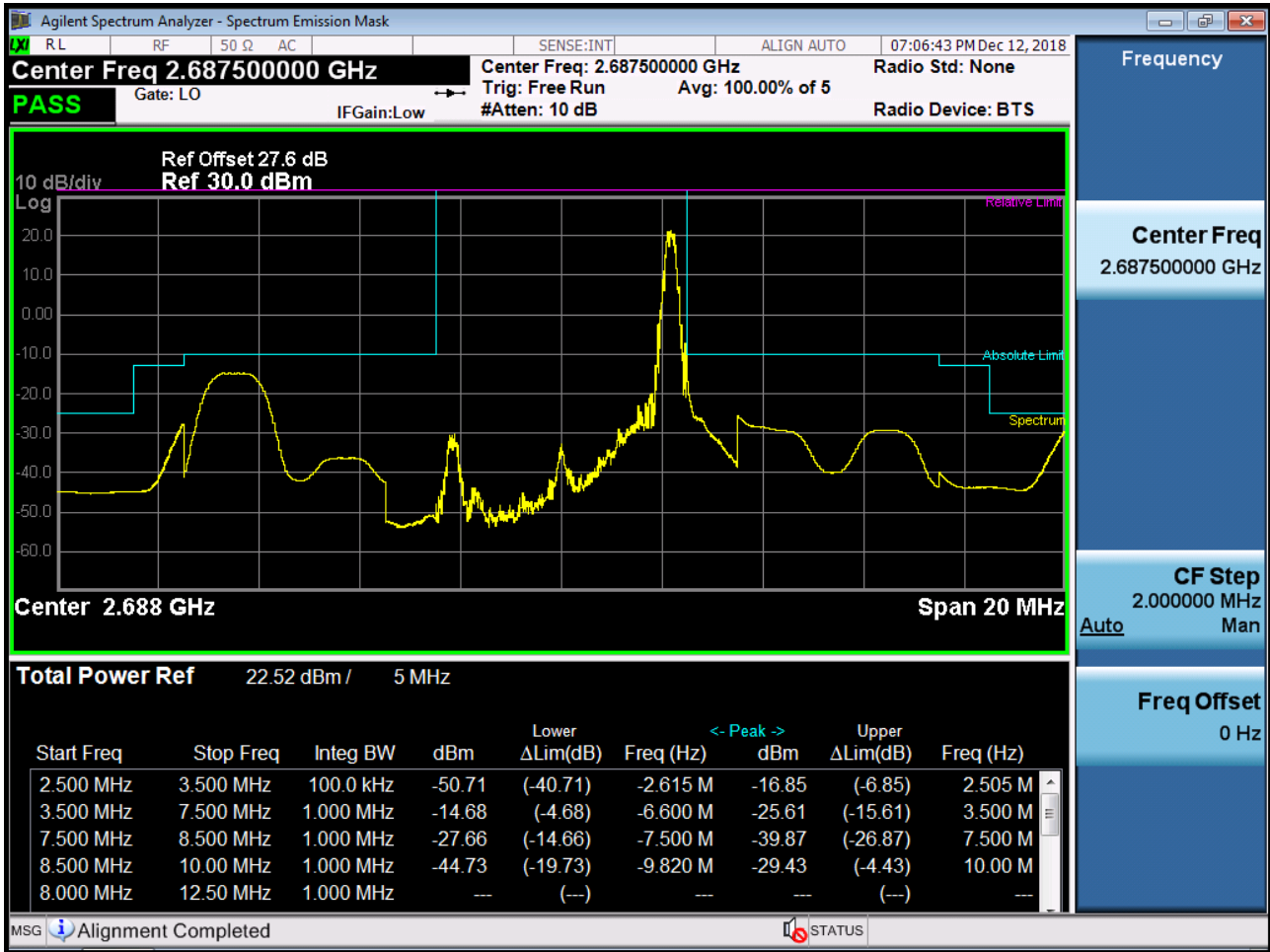
BAND 41. Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-2



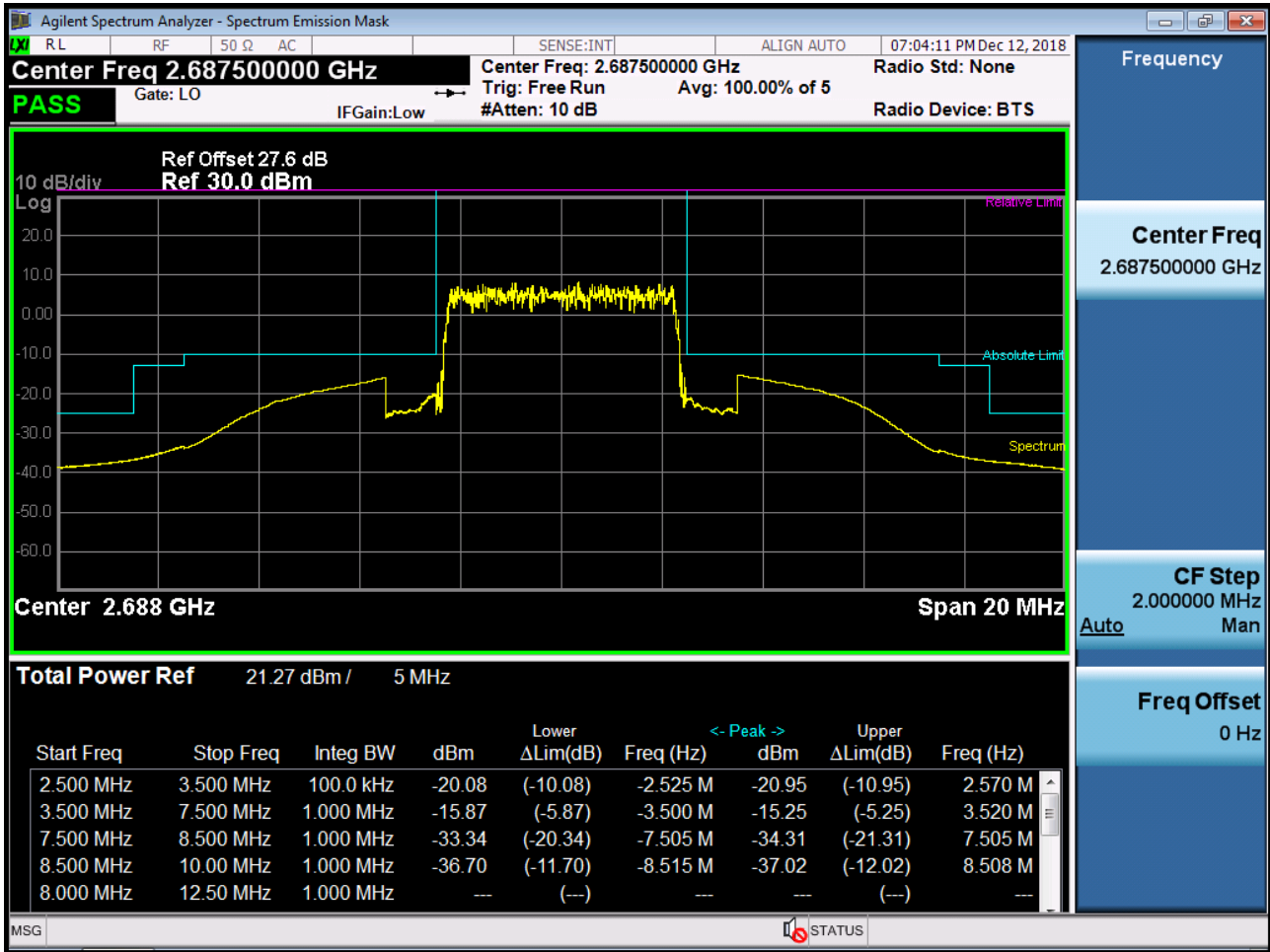
BAND 41. Mid Channel Edge Plot (5 MHz Ch.40620 QPSK RB 25)



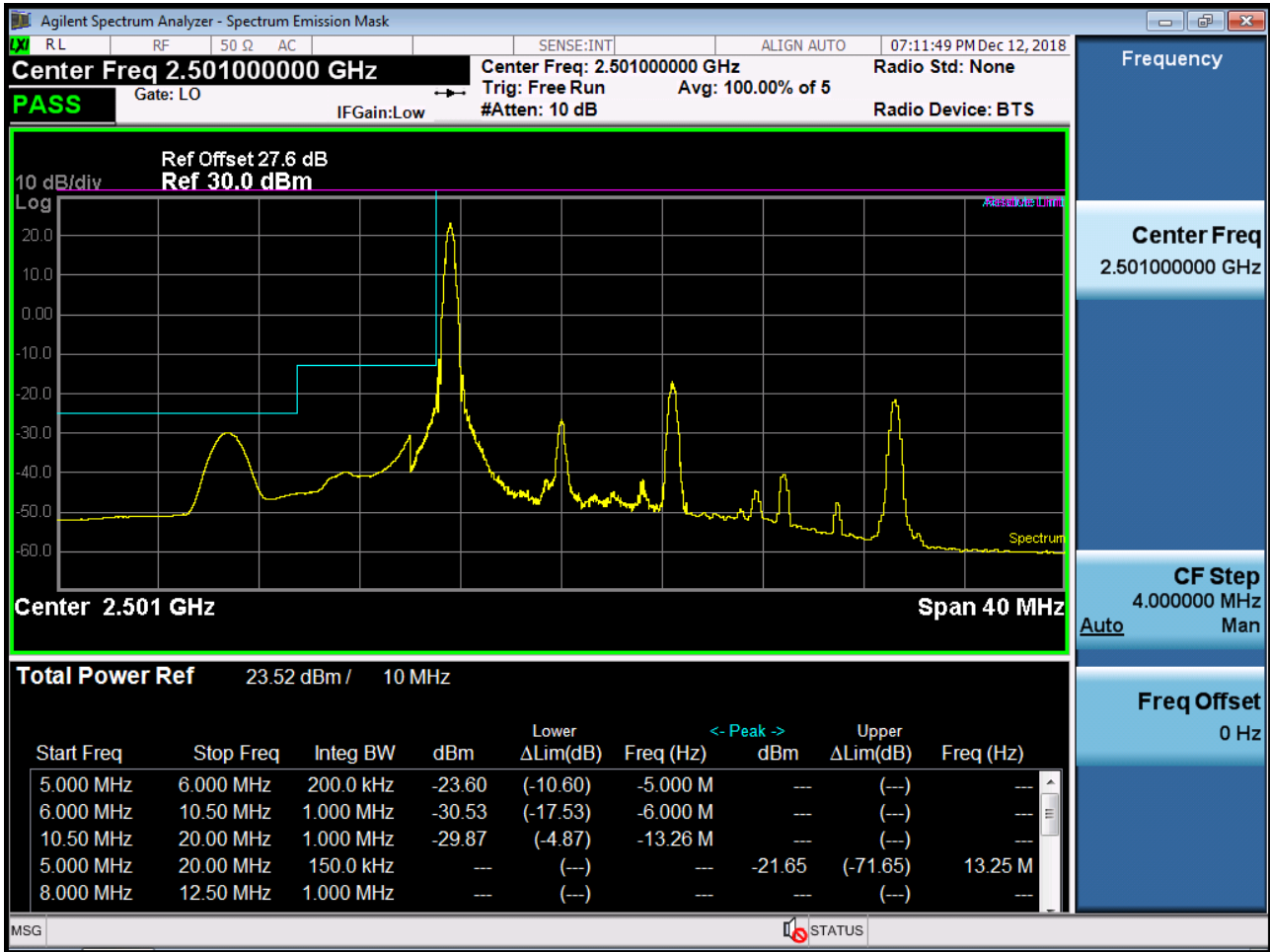
BAND 41. High Channel Edge Plot (5 MHz Ch.41565 QPSK RB 1, Offset 0)



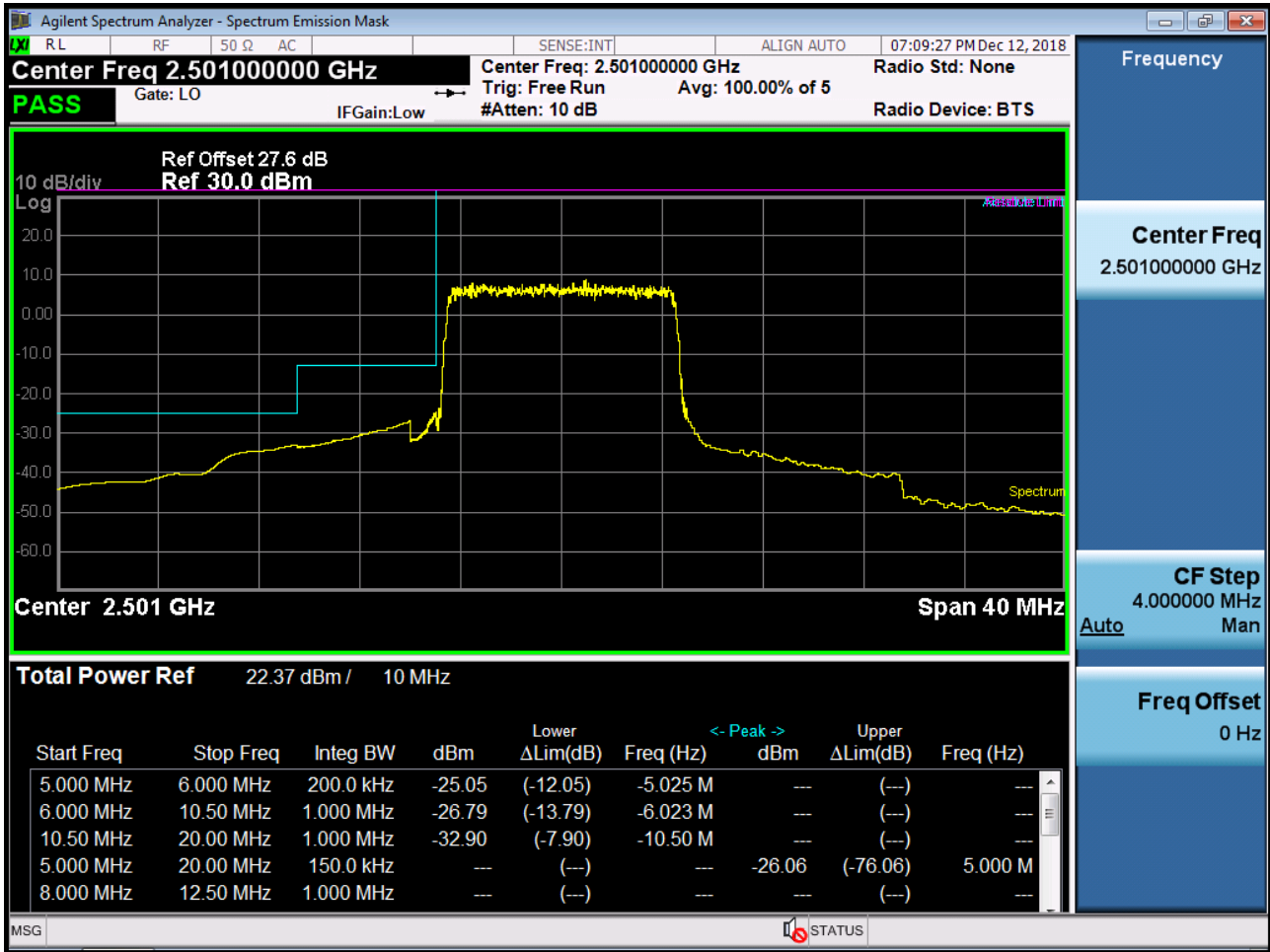
BAND 41. High Channel Edge Plot (5 MHz Ch.41565 QPSK_RB25_Offset 0)



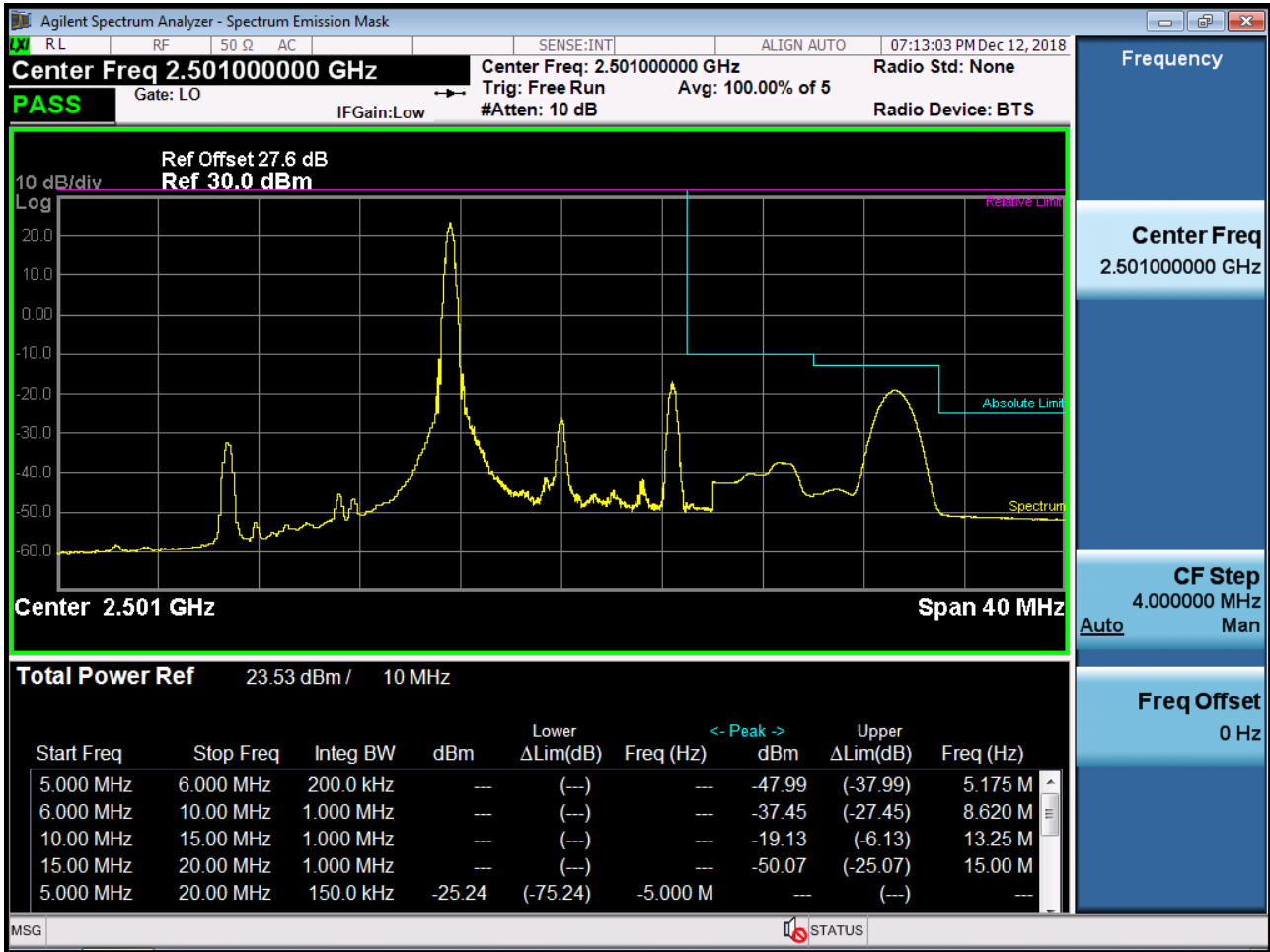
BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-1



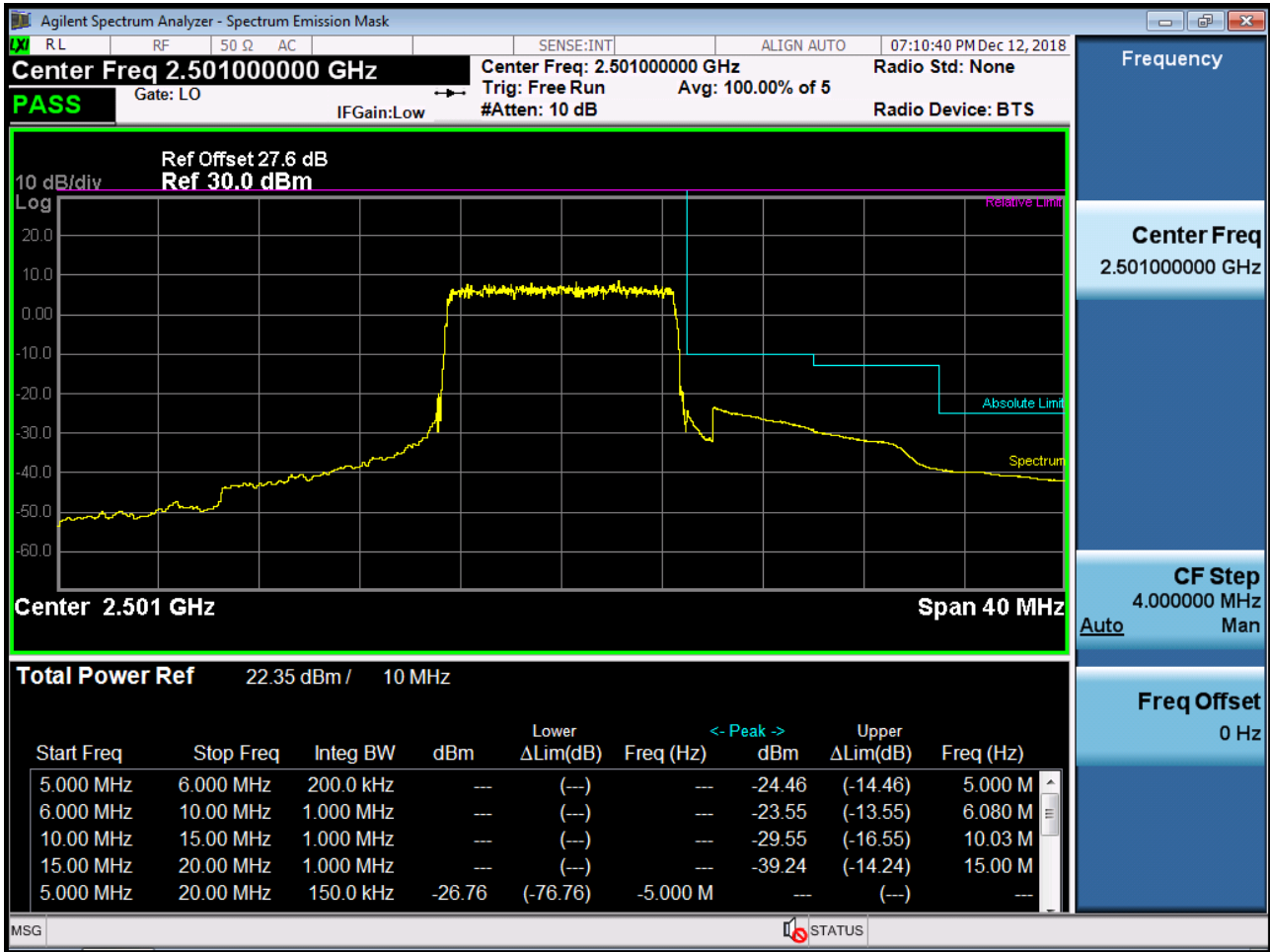
BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-2



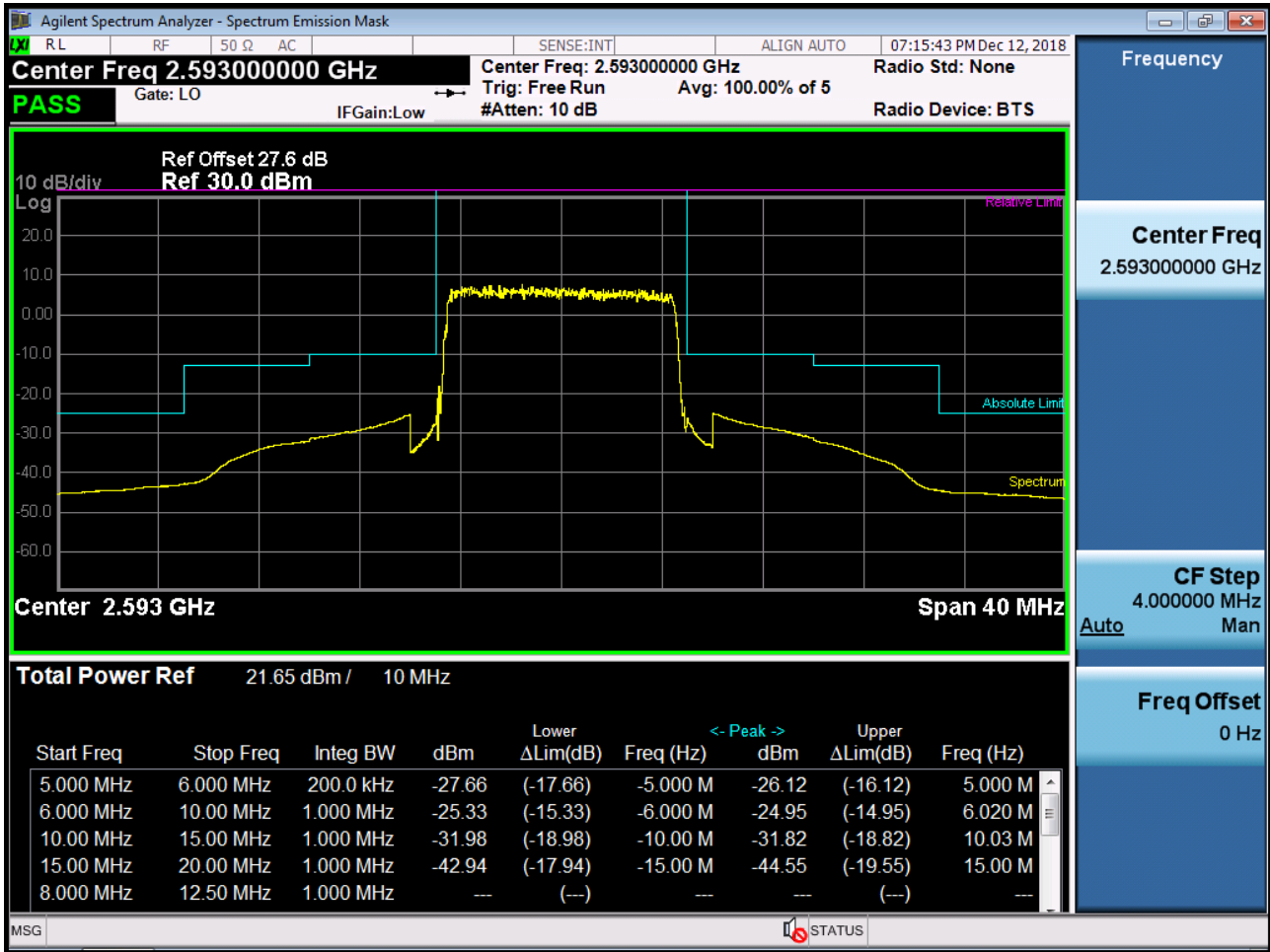
BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-1



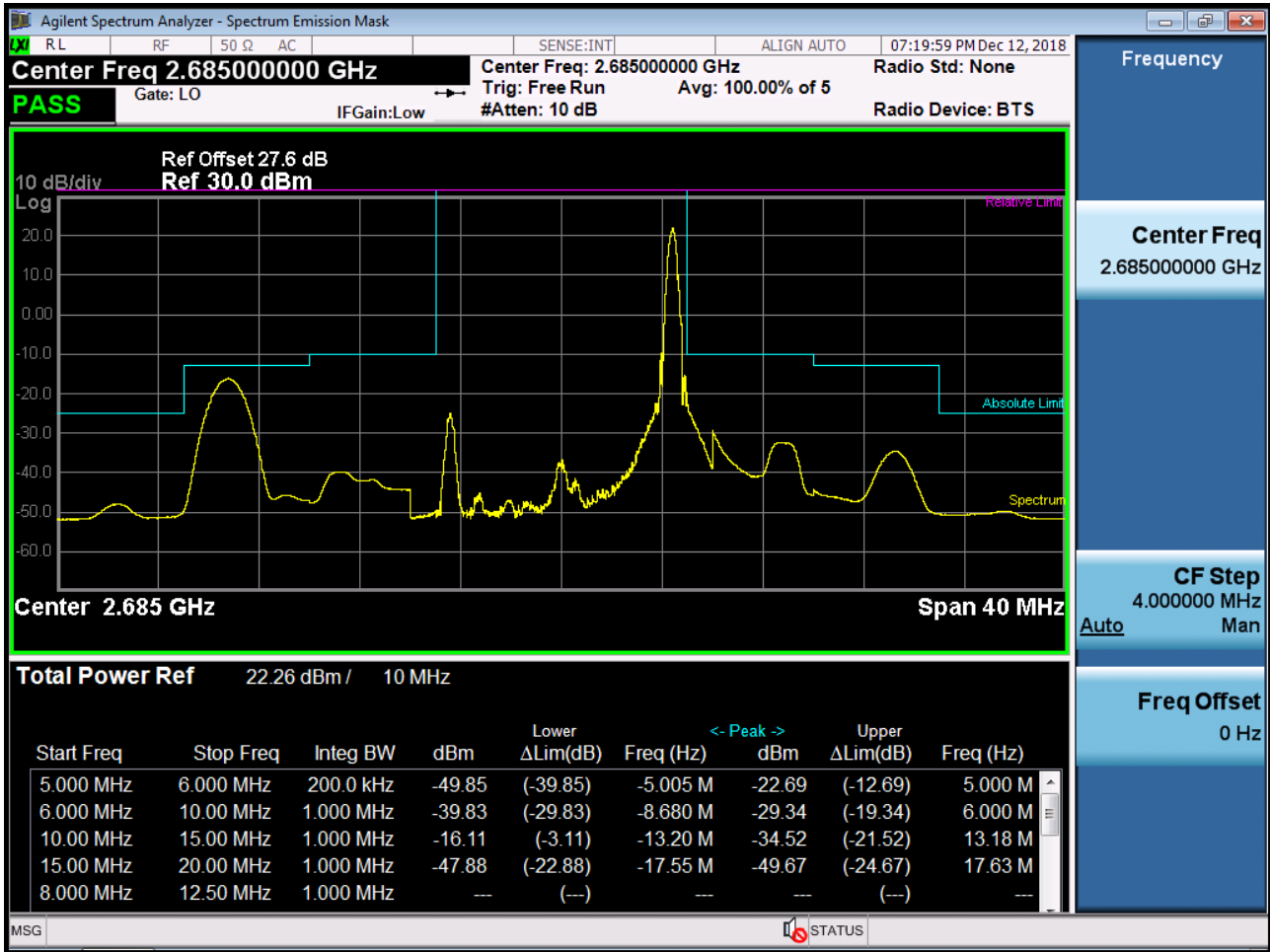
BAND 41. Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-2



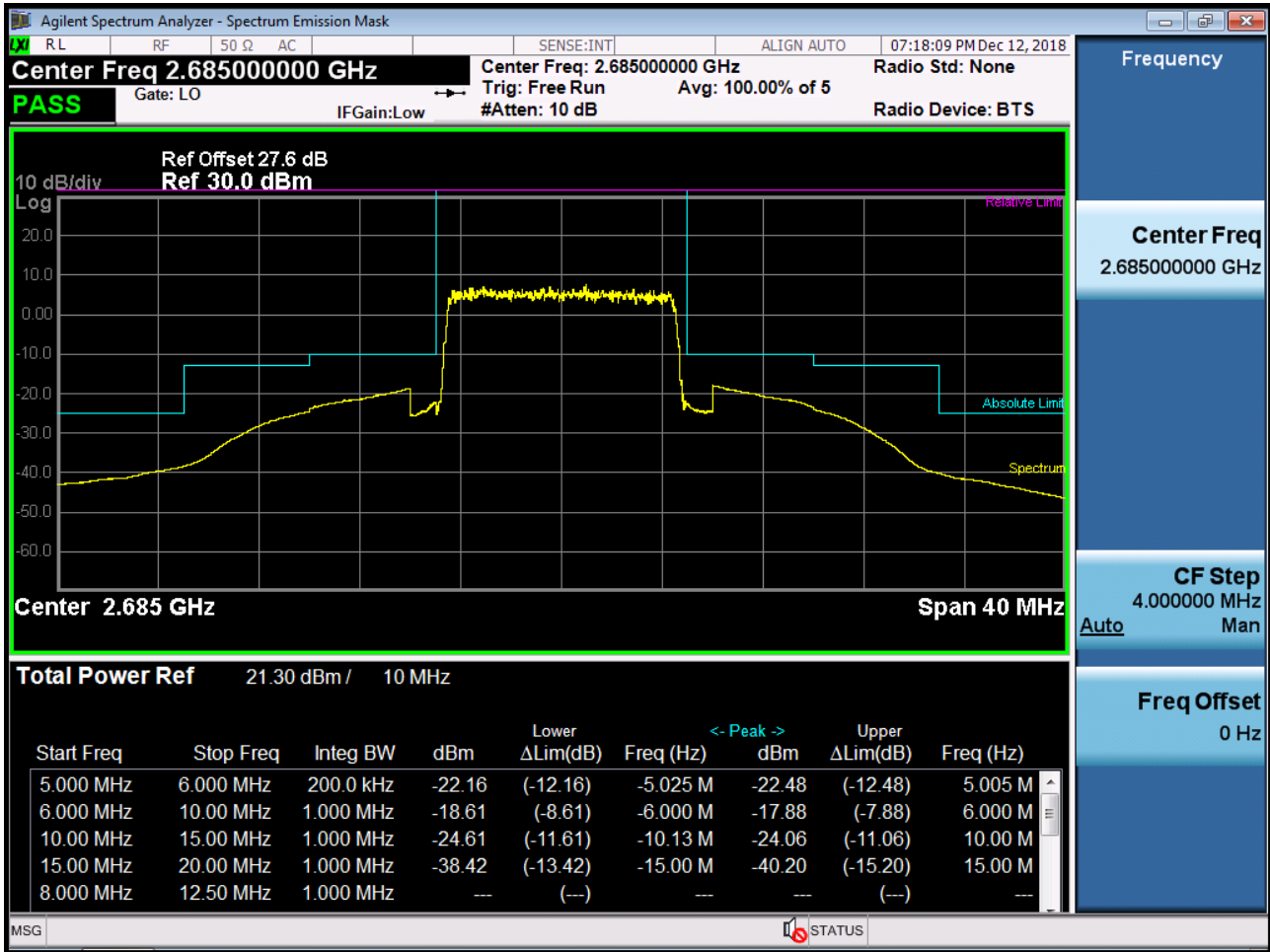
BAND 41. Mid Channel Edge Plot (10 MHz Ch.40620 QPSK RB 50)



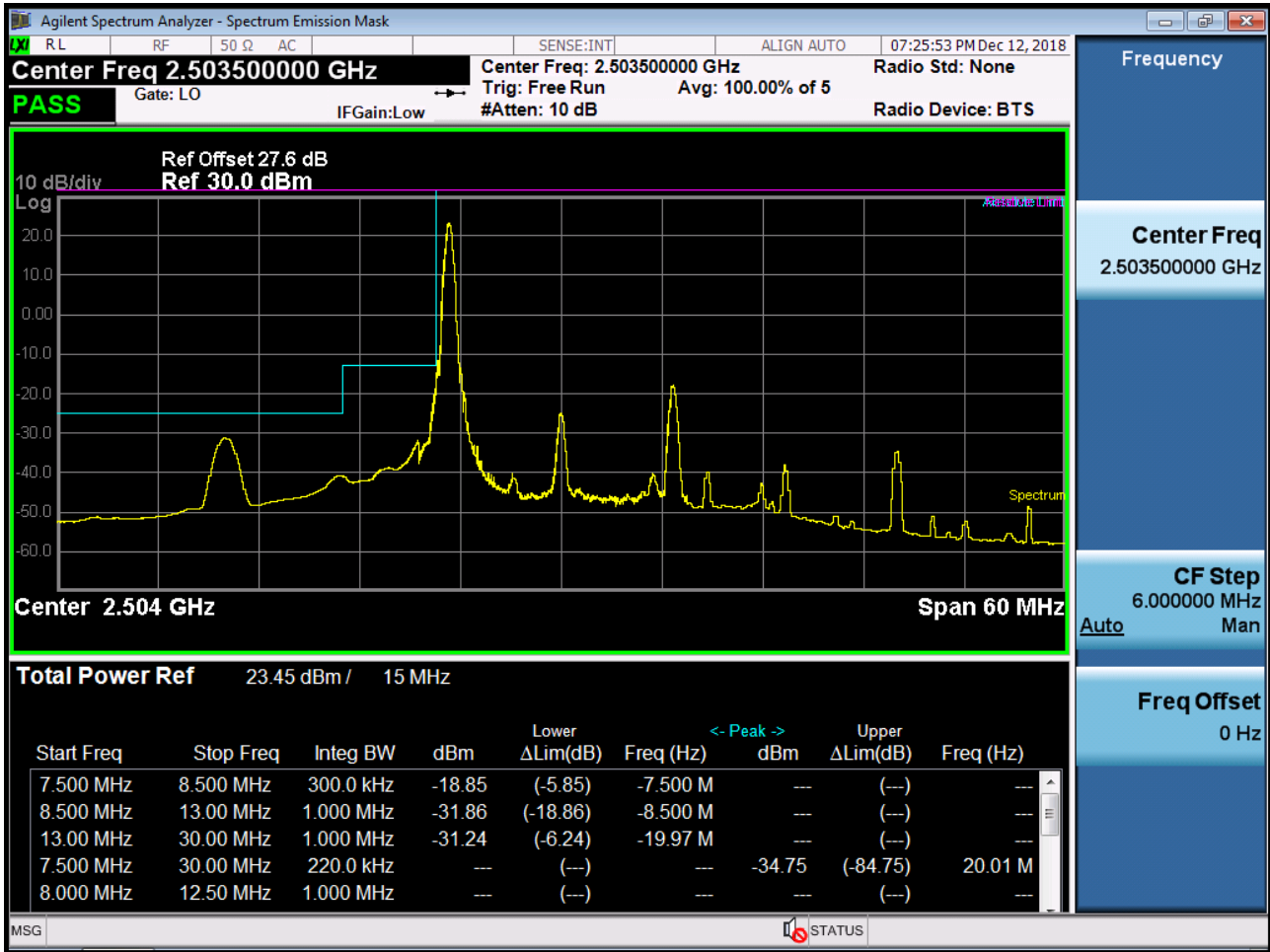
BAND 41. High Channel Edge Plot (10 MHz Ch.41540 QPSK RB 1, Offset 0)



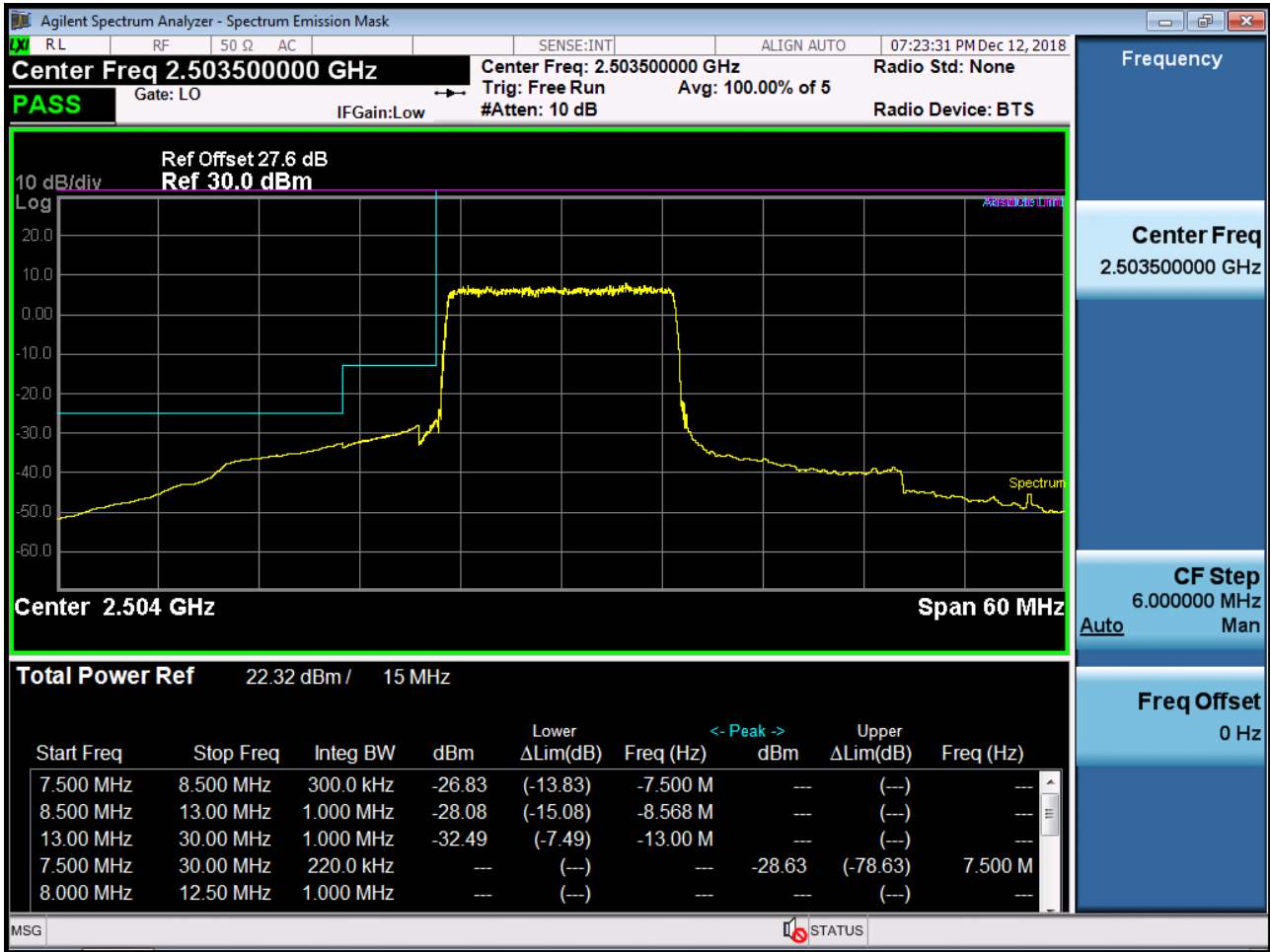
BAND 41. High Channel Edge Plot (10 MHz Ch.41540 QPSK_RB50_Offset 0)



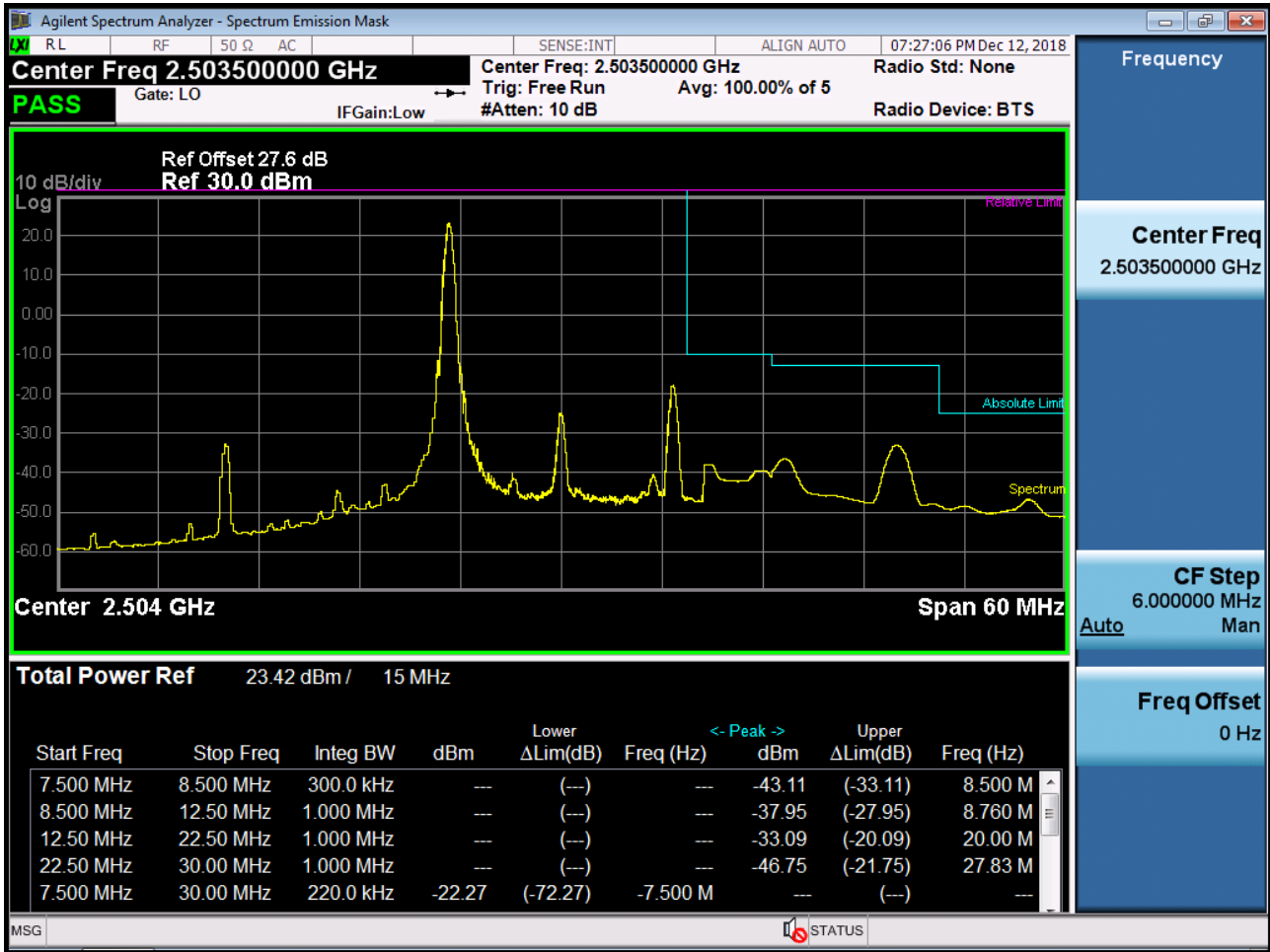
BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-1



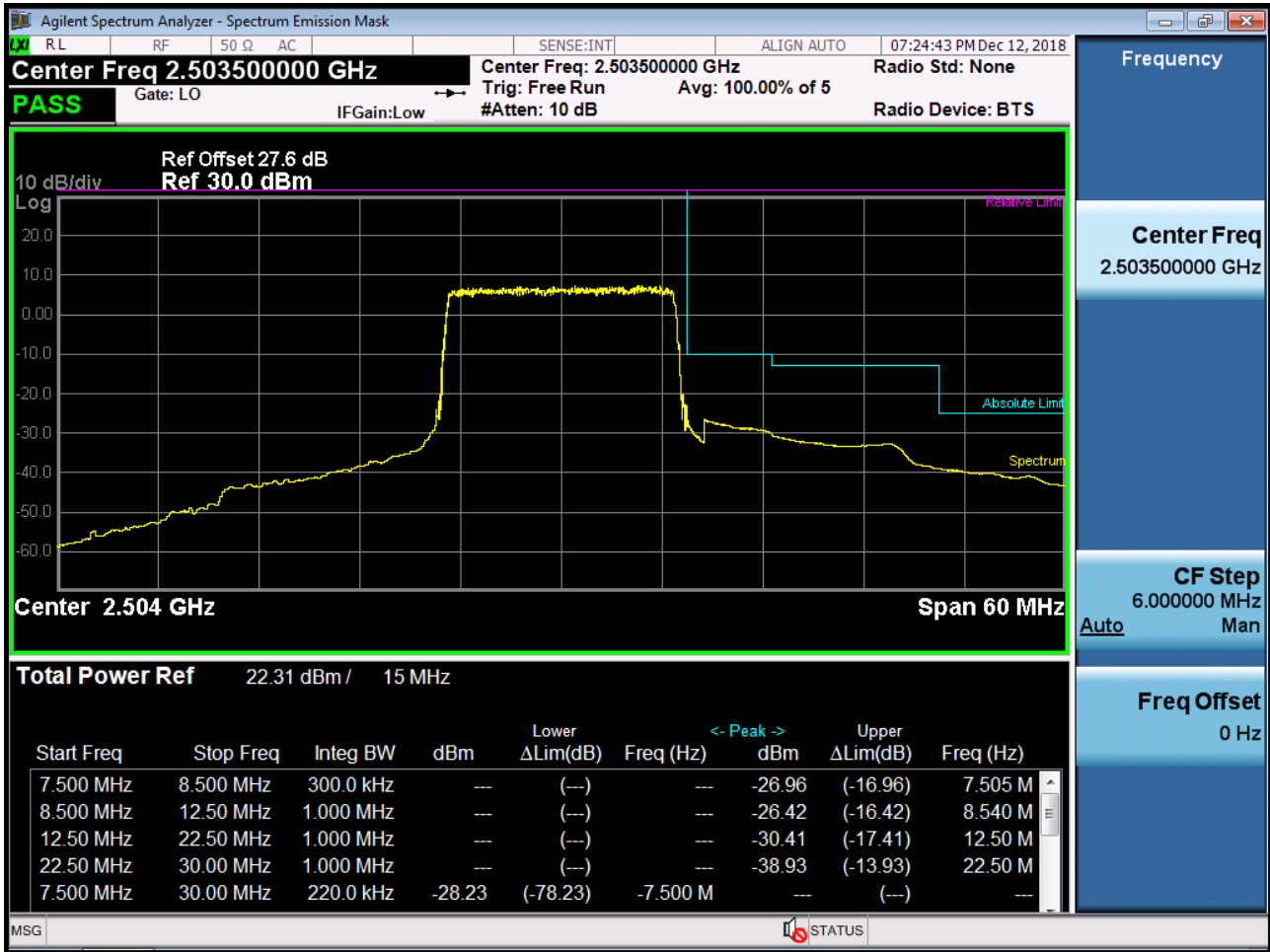
BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-2



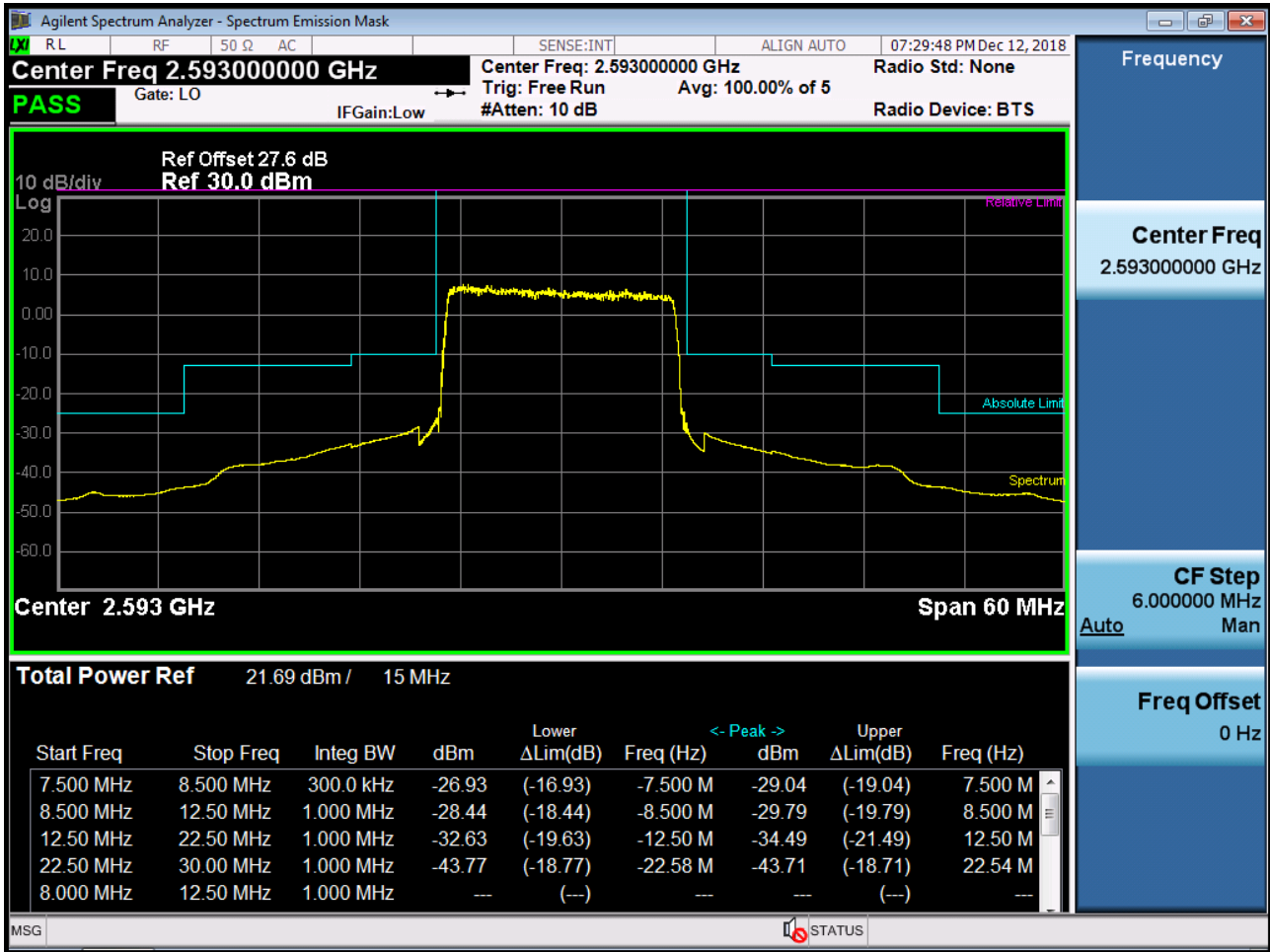
BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-1



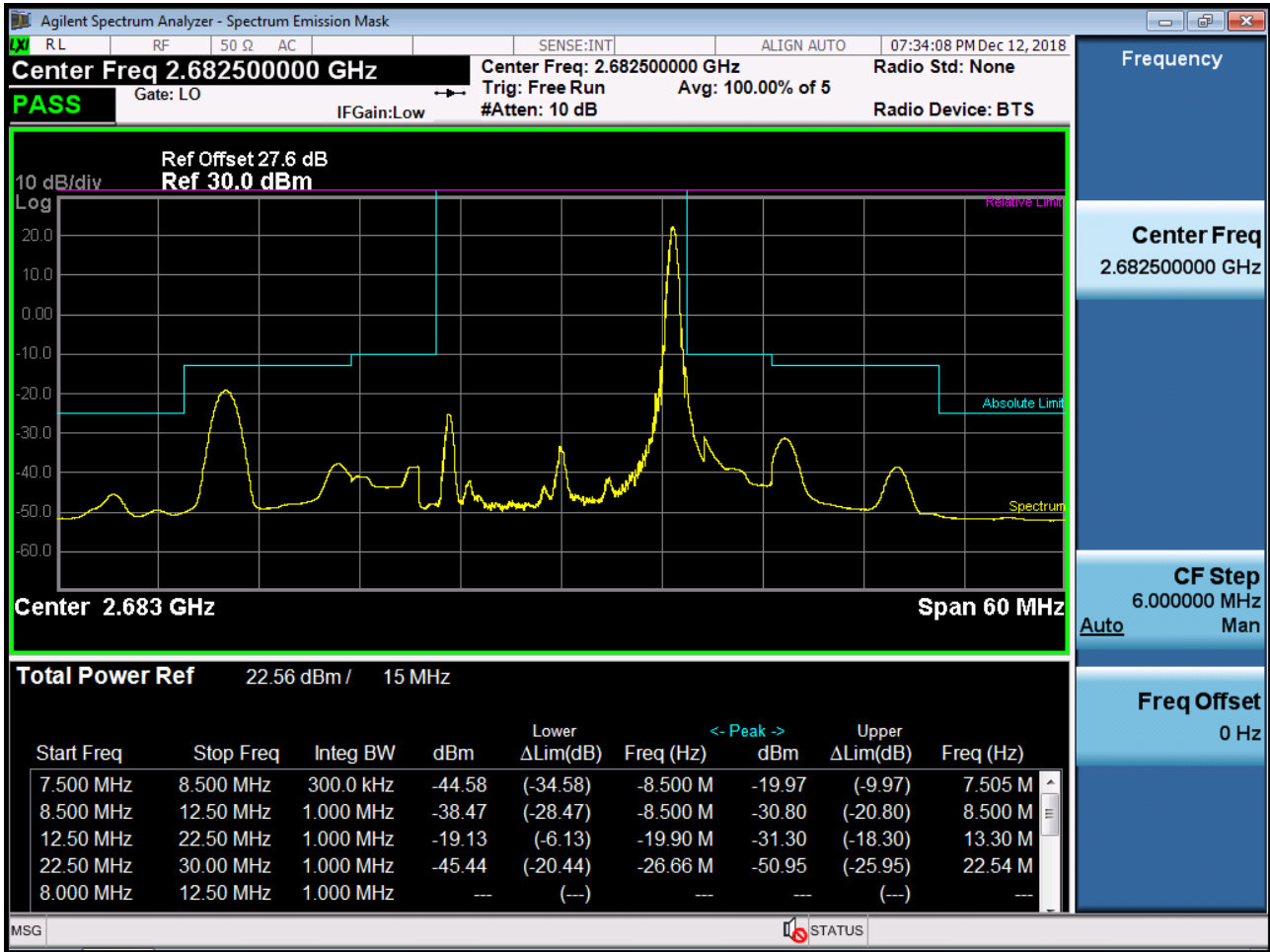
BAND 41. Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-2



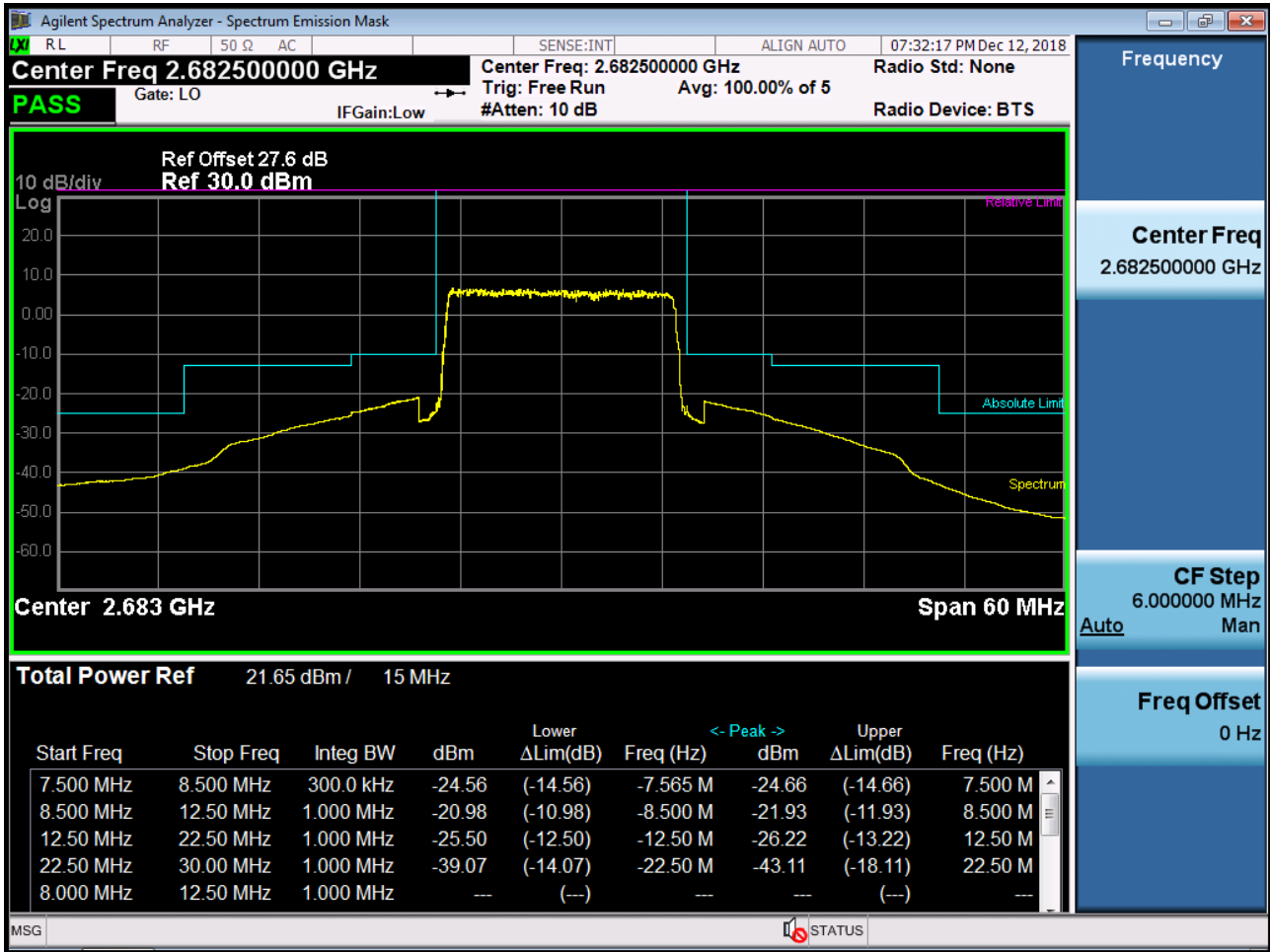
BAND 41. Mid Channel Edge Plot (15 MHz Ch.40620 QPSK RB 75)



BAND 41. High Channel Edge Plot (15 MHz Ch.41515 QPSK RB 1, Offset 0)



BAND 41. High Channel Edge Plot (15 MHz Ch.41515 QPSK_RB75_Offset 0)



BAND 41. Low Channel Edge Plot (20 MHz Ch.39750 QPSK RB 1, Offset 0)-1

