

# FCC/IC LTE REPORT

## Certification

**Applicant Name:**  
 SAMSUNG Electronics Co., Ltd.

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

**Date of Issue:**  
 January 13, 2020

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

**Report No.:** HCT-RF-2001-FI019

<b>FCC ID:</b>	<b>A3LSMG715U</b>
<b>IC:</b>	<b>649E-SMG715W</b>
<b>APPLICANT:</b>	<b>SAMSUNG Electronics Co., Ltd.</b>

Model(s): SM-G715U1  
 Additional Model(s): SM-G715W  
 EUT Type: Mobile Phone  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 FCC Rule Part(s): §27, §2  
 IC Rule(s): RSS-Gen Issue5, RSS-199 Issue 3

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 38 (5)	2572.5 – 2617.5	4M53G7D	QPSK	0.151	21.80
		4M52W7D	16QAM	0.116	20.65
		4M50W7D	64QAM	0.095	19.78
LTE – Band 38 (10)	2575.0 – 2615.0	8M98G7D	QPSK	0.157	21.97
		8M98W7D	16QAM	0.124	20.93
		8M98W7D	64QAM	0.100	20.01
LTE – Band 38 (15)	2577.5 – 2612.5	13M5G7D	QPSK	0.156	21.94
		13M4W7D	16QAM	0.119	20.77
		13M4W7D	64QAM	0.100	20.00
LTE – Band 38 (20)	2580.0 – 2610.0	17M9G7D	QPSK	0.164	22.14
		17M9W7D	16QAM	0.125	20.98
		17M8W7D	64QAM	0.104	20.16

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 : Kwon Jeong  
 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-2001-FI019	January 13, 2020	- First Approval Report

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

This laboratory is not accredited for the test results marked \*.

The above Test Report is the accredited test result by KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.(HCT Accreditation No.: KT197)

## 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 PEAK- TO- AVERAGE RATIO.....	9
3.5 OCCUPIED BANDWIDTH. ....	11
3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL .....	12
3.7 CHANNEL EDGE.....	13
3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE .....	15
3.9 WORST CASE(RADIATED TEST).....	16
3.10 WORST CASE(CONDUCTED TEST) .....	17
4. LIST OF TEST EQUIPMENT .....	18
5. MEASUREMENT UNCERTAINTY .....	19
6. SUMMARY OF TEST RESULTS .....	20
7. SAMPLE CALCULATION.....	21
8. TEST DATA .....	23
8.1 EQUIVALENT ISOTROPIC RADIATED POWER.....	23
8.2 RADIATED SPURIOUS EMISSIONS .....	25
8.3 PEAK-TO-AVERAGE RATIO.....	29
8.4 OCCUPIED BANDWIDTH .....	30
8.5 CONDUCTED SPURIOUS EMISSIONS .....	31
8.6 CHANNEL EDGE.....	32
8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE .....	34
8.8 RECEIVER SPURIOUS EMISSIONS .....	46
9. TEST PLOTS.....	47
10. ANNEX A_ TEST SETUP PHOTO.....	116

# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

<b>Applicant Name:</b>	SAMSUNG Electronics Co., Ltd.
<b>Address:</b>	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
<b>FCC ID:</b>	A3LSMG715U
<b>IC</b>	649E-SMG715W
<b>Application Type:</b>	Certification
<b>FCC Classification:</b>	PCS Licensed Transmitter Held to Ear (PCE)
<b>FCC Rule Part(s):</b>	§27, §2
<b>IC Rule(s):</b>	RSS-Gen Issue5, RSS-199 Issue 3
<b>EUT Type:</b>	Mobile Phone
<b>Model(s):</b>	SM-G715U1
<b>Additional Model(s):</b>	SM-G715W
<b>Tx Frequency:</b>	2572.5 – 2617.5 : 5 MHz 2575.0 – 2615.0 : 10 MHz 2577.5 – 2612.5 : 15 MHz 2580.0 – 2610.0 : 20 MHz
<b>Date(s) of Tests:</b>	December 17, 2019 ~ January 08, 2020

## **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, NFC, ANT+.

### **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  $\geq$  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;

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

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

#### Test Note

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

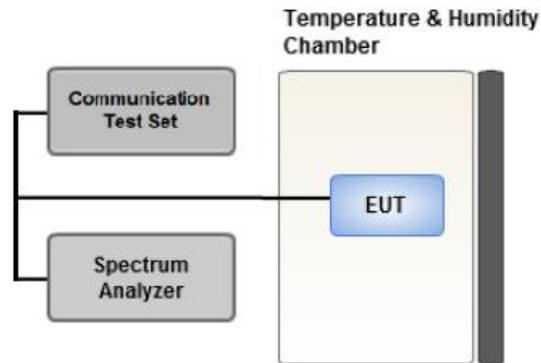
$$\text{Result}_{(\text{dBm})} = P_{g(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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

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

$$\text{EIRP}_{(\text{dBm})} = \text{ERP}_{(\text{dBm})} + 2.15$$

### 3.4 PEAK- TO- AVERAGE RATIO



**Test setup**

① CCDF Procedure for PAPR

**Test Settings**

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

② Alternate Procedure for PAPR

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

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

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

### **Test Settings(Peak Power)**

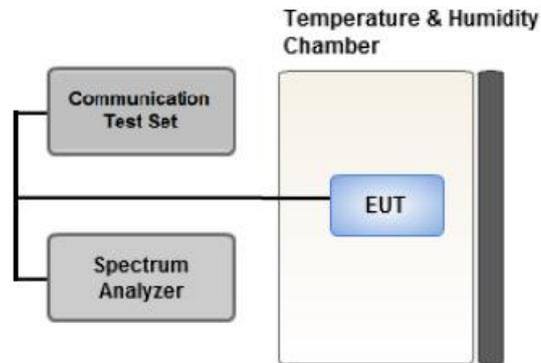
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW  $\geq 3 \times$  RBW.

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

### **Test Settings(Average Power)**

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

### 3.5 OCCUPIED BANDWIDTH.



#### Test setup

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

The EUT makes a call to the communication simulator.

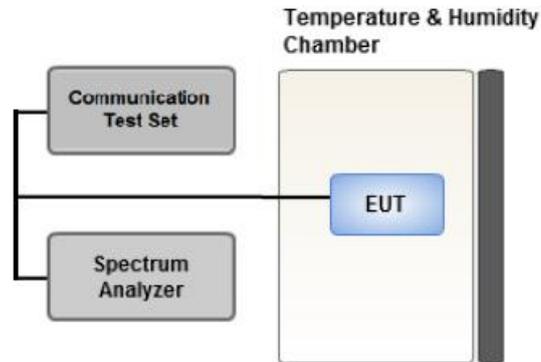
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

#### Test Settings

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

### 3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



**Test setup**

#### **Test Overview**

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

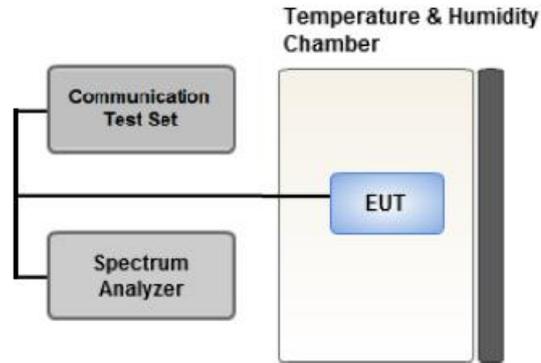
#### **Test Settings**

1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto
6. Number of points in sweep  $\geq$  2 x Span / RBW

#### **Test Notes**

1. Duty Cycle factor already applied on the factor.
  - Duty Cycle factor(dB) = 3.98
  - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
  - Result(dBm) = Reading + Factor

### 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.

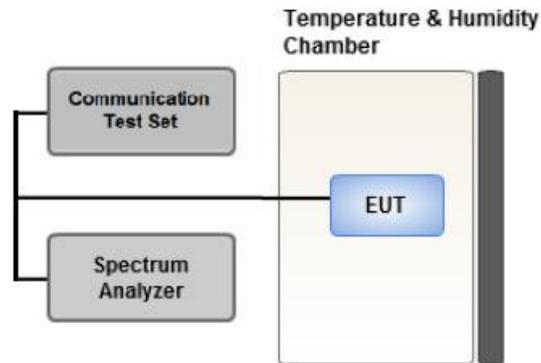
#### Test Settings

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  $\geq 2 \times \text{Span}/\text{RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

**Test Notes**

1. The attenuation factor shall be not less than  $40 + 10 \log (P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,
2.  $43 + 10 \log (P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge.
3.  $55 + 10 \log (P)$  dB on all frequencies more than X megahertz from the channel edge.
4. The attenuation factor shall not be less that  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz.
5.  $55 + 10 \log (P)$  dB at or below 2490.5 MHz.
6. X is the greater of 6MHz or the actual emission bandwidth
7. The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer

### 3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

#### Test Overview

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

The frequency stability of the transmitter is measured by:

1. Temperature:

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

2. Primary Supply Voltage:

- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.
- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

#### Test Settings

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

### 3.9 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data.
- Please refer to the table below.
- All modes of operation were investigated and the worst case configuration results are reported.
- Please refer to the table below.
- SM-G715U1 & additional models were tested and the worst case results are reported.

(Worst case : SM-G715U1)

[ Worst case ]

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

**3.10 WORST CASE(CONDUCTED TEST)**

- Worst case : Of all modulation, We have tested modulation of the high Conducted Output Power.

Conducted Output Power value can be confirmed on the SAR report.

- SM-G715U1 & additional models were tested and the worst case results are reported.

(Worst case : SM-G715U1)

[ Worst case ]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset		
Occupied Bandwidth	QPSK, 16QAM, 64QAM	5, 10, 15, 20	Mid	Full RB	0		
Peak-To-Average Ratio	QPSK, 16QAM, 64QAM	5, 10, 15, 20	Mid	Full RB	0		
Channel Edge	QPSK	5	Low	1	0		
			High	1	24		
		10	Low	1	0		
			High	1	49		
		15	Low	1	0		
			High	1	74		
		20	Low	1	0		
			High	1	99		
				5, 10, 15, 20	Low, Mid, High	Full RB	0
		Spurious and Harmonic Emissions at Antenna Terminal	QPSK	5, 10, 15, 20	Low, Mid, High	1	0

#### 4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibrati on Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
WAINWRIGHT INSTRUMENT	WHNX6.0/26.5G-6SS/H.P.F	1	03/20/2019	Annual	03/20/2020
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	05/03/2019	Annual	05/03/2020
Agilent	E3632A/DC Power Supply	MY40004326	07/01/2019	Annual	07/01/2020
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93000717	08/14/2019	Annual	08/14/2020
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	01/28/2019	Biennial	01/28/2021
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	05/08/2019	Annual	05/08/2020
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2019	Annual	06/04/2020
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2019	Annual	10/14/2020
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/27/2019	Annual	08/27/2020
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/09/2019	Annual	08/09/2020
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/30/2019	Annual	01/30/2020
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/15/2019	Annual	07/15/2020
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	05/17/2019	Annual	05/17/2020
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
- 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  $U_{\text{CISPR}}$  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)	5.05

## 6. SUMMARY OF TEST RESULTS

### 6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	IC Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	RSS Gen(6.7)	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(m)(4)	RSS-199(4.5)	<ul style="list-style-type: none"> <li>■ &lt; 40 + 10log10 (P[Watts]) at Channel edges</li> <li>■ &lt; 43 + 10log10 (P[Watts]) between 5 and X MHz from Channel edges</li> <li>■ &lt; 55 + 10log10 (P[Watts]) beyond X MHz beyond from Channel edges</li> <li>■ &lt; 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz</li> </ul>	PASS
Conducted Output Power	§2.1046	-	N/A	<u>See Note1</u>
Peak- to- Average Ratio	§27.50(d)(5)	RSS 199(4.4)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, §27.54	RSS-199(4.3)	Emission must remain in band	PASS

Note:

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

### 6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	IC Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§27.50(h)(2)	RSS-199(4.4)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(m)(4)	RSS-199(4.5)	< 55 + 10log10 (P[Watts])	PASS
Receiver Spurious Emissions	N/A	RSS Gen(7)	Section 8.8	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
38000	2595.0	-15.75	18.45	9.90	1.76	H	0.456	26.59

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

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

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW  
GSM BW = 249 kHz  
G = Phase Modulation  
X = Cases not otherwise covered  
W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W  
GSM BW = 249 kHz  
G = Phase Modulation  
7 = Quantized/Digital Info  
W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W  
WCDMA BW = 4.17 MHz  
F = Frequency Modulation  
9 = Composite Digital Info  
W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D  
LTE BW = 4.48 MHz  
G = Phase Modulation  
7 = Quantized/Digital Info  
D = Data transmission; telemetry; telecommand

16QAM Modulation

Emission Designator = 4M48W7D  
LTE BW = 4.48 MHz  
W = Amplitude/Angle Modulated  
7 = Quantized/Digital Info  
D = Data transmission; telemetry; telecommand

64QAM Modulation

Emission Designator = 4M48W7D  
LTE BW = 4.48 MHz  
W = Amplitude/Angle Modulated  
7 = Quantized/Digital Info  
D = Data transmission; telemetry; telecommand

## 8. TEST DATA

### 8.1 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2572.5	LTE B38/ 5 MHz	QPSK	-23.92	13.19	10.95	2.34	V	< 2.00	0.151	21.80
		16-QAM	-25.13	11.98	10.95	2.34	V		0.115	20.59
		64-QAM	-25.94	11.17	10.95	2.34	V		0.095	19.78
2595.0		QPSK	-23.69	13.07	10.99	2.35	V		0.148	21.71
		16-QAM	-24.77	11.99	10.99	2.35	V		0.116	20.63
		64-QAM	-25.77	10.99	10.99	2.35	V		0.092	19.63
2617.5		QPSK	-23.88	13.01	11.05	2.35	V		0.148	21.71
		16-QAM	-24.94	11.95	11.05	2.35	V		0.116	20.65
		64-QAM	-25.96	10.93	11.05	2.35	V		0.092	19.63

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2575.0	LTE B38/ 10 MHz	QPSK	-23.83	13.11	10.95	2.35	V	< 2.00	0.148	21.71
		16-QAM	-24.88	12.06	10.95	2.35	V		0.116	20.66
		64-QAM	-25.80	11.14	10.95	2.35	V		0.094	19.74
2595.0		QPSK	-23.46	13.30	10.99	2.35	V		0.156	21.94
		16-QAM	-24.47	12.29	10.99	2.35	V		0.124	20.93
		64-QAM	-25.40	11.36	10.99	2.35	V		0.100	20.00
2615.0		QPSK	-23.59	13.28	11.04	2.35	V		0.157	21.97
		16-QAM	-24.64	12.23	11.04	2.35	V		0.124	20.92
		64-QAM	-25.55	11.32	11.04	2.35	V		0.100	20.01

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2577.5	LTE B38/ 15 MHz	QPSK	-23.74	13.02	10.95	2.35	V	< 2.00	0.145	21.62
		16-QAM	-24.86	11.90	10.95	2.35	V		0.112	20.50
		64-QAM	-25.67	11.09	10.95	2.35	V		0.093	19.69
2595.0		QPSK	-23.46	13.30	10.99	2.35	V		0.156	21.94
		16-QAM	-24.63	12.13	10.99	2.35	V		0.119	20.77
		64-QAM	-25.40	11.36	10.99	2.35	V		0.100	20.00
2612.5		QPSK	-23.76	13.07	11.03	2.34	V		0.150	21.76
		16-QAM	-24.77	12.06	11.03	2.34	V		0.119	20.75
		64-QAM	-25.70	11.13	11.03	2.34	V		0.096	19.82

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2580.0	LTE B38/ 20 MHz	QPSK	-23.66	13.10	10.95	2.35	V	< 2.00	0.148	21.70
		16-QAM	-24.78	11.98	10.95	2.35	V		0.114	20.58
		64-QAM	-25.61	11.15	10.95	2.35	V		0.094	19.75
2595.0		QPSK	-23.36	13.40	10.99	2.35	V		0.160	22.04
		16-QAM	-24.47	12.29	10.99	2.35	V		0.124	20.93
		64-QAM	-25.24	11.52	10.99	2.35	V		0.104	20.16
2610.0		QPSK	-23.38	13.45	11.03	2.34	V		0.164	22.14
		16-QAM	-24.54	12.29	11.03	2.34	V		0.125	20.98
		64-QAM	-25.42	11.41	11.03	2.34	V		0.102	20.10

**8.2 RADIATED SPURIOUS EMISSIONS**

- ▣ OPERATING FREQUENCY : 2572.50 MHz
- ▣ MEASURED OUTPUT POWER: 21.80 dBm = 0.151 W
- ▣ MODE: LTE B38
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  46.80 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
37775 (2572.5)	5,145.00	-48.84	12.47	-58.23	3.40	V	-49.16	70.96
	7,717.50	-45.17	11.70	-46.99	4.35	V	-39.64	61.45
	10,290.00	-50.71	10.85	-47.25	5.15	H	-41.55	63.36
	12,862.50	-47.58	13.38	-43.15	5.75	H	-35.52	57.32
38000 (2595.0)	5,190.00	-48.68	12.80	-60.43	3.43	V	-51.06	72.86
	7,785.00	-43.43	11.64	-45.79	4.38	V	-38.53	60.33
	10,380.00	-47.82	10.75	-44.84	5.18	H	-39.27	61.07
	12,975.00	-48.56	13.40	-43.54	5.85	H	-35.99	57.79
38225 (2617.5)	5,235.00	-46.14	13.09	-57.28	3.46	V	-47.65	69.45
	7,852.50	-44.35	11.50	-46.69	4.38	H	-39.57	61.37
	10,470.00	-49.22	10.70	-46.44	5.23	H	-40.97	62.77
	13,087.50	-46.02	13.40	-41.44	5.80	V	-33.84	55.65

- ▣ OPERATING FREQUENCY : 2595.00 MHz
- ▣ MEASURED OUTPUT POWER: 21.97 dBm = 0.157 W
- ▣ MODE: LTE B38
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  46.97 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
37800 (2575.0)	5,150.00	-51.71	12.50	-61.39	3.40	H	-52.29	74.09
	7,725.00	-46.00	11.70	-47.83	4.35	V	-40.48	62.28
	10,300.00	-51.10	10.80	-47.66	5.15	H	-42.01	63.81
	12,875.00	-48.16	13.34	-43.48	5.77	H	-35.91	57.71
38000 (2595.0)	5,190.00	-52.97	12.80	-64.72	3.43	H	-55.35	77.15
	7,785.00	-48.84	11.64	-51.20	4.38	V	-43.94	65.74
	10,380.00	-49.72	10.75	-46.74	5.18	H	-41.17	62.97
	12,975.00	-48.72	13.40	-43.70	5.85	H	-36.15	57.95
38200 (2615.0)	5,230.00	-50.44	13.05	-61.58	3.45	V	-51.98	73.78
	7,845.00	-48.31	11.52	-50.48	4.38	V	-43.34	65.14
	10,460.00	-49.78	10.70	-46.89	5.18	H	-41.37	63.17
	13,075.00	-45.43	13.40	-41.06	5.84	V	-33.50	55.30

- ▣ OPERATING FREQUENCY : 2612.50 MHz
- ▣ MEASURED OUTPUT POWER: 21.94 dBm = 0.156 W
- ▣ MODE: LTE B38
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  46.94 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
37825 (2577.5)	5,155.00	-50.55	12.55	-60.69	3.41	V	-51.55	73.35
	7,732.50	-47.57	11.70	-49.97	4.35	V	-42.62	64.42
	10,310.00	-51.17	10.80	-47.65	5.14	H	-41.99	63.80
	12,887.50	-50.10	13.33	-45.40	5.81	H	-37.88	59.69
38000 (2595.0)	5,190.00	-52.10	12.80	-63.85	3.43	V	-54.48	76.28
	7,785.00	-43.79	11.64	-46.15	4.38	V	-38.89	60.69
	10,380.00	-50.79	10.75	-47.81	5.18	V	-42.24	64.04
	12,975.00	-49.48	13.40	-44.46	5.85	H	-36.91	58.71
38175 (2612.5)	5,225.00	-51.08	13.05	-62.27	3.45	V	-52.67	74.47
	7,837.50	-44.05	11.53	-46.04	4.37	H	-38.88	60.69
	10,450.00	-51.11	10.70	-48.13	5.15	V	-42.58	64.39
	13,062.50	-46.92	13.40	-42.12	5.83	H	-34.55	56.36

- ▣ OPERATING FREQUENCY : 2595.00 MHz
- ▣ MEASURED OUTPUT POWER: 22.14 dBm = 0.164 W
- ▣ MODE: LTE B38
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT:  $55 + 10 \log_{10}(W) =$  47.14 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
37850 (2580.0)	5,160.00	-49.97	12.60	-60.55	3.42	V	-51.37	73.18
	7,740.00	-43.73	11.70	-46.47	4.36	V	-39.13	60.94
	10,320.00	-53.16	10.80	-49.79	5.12	H	-44.11	65.91
	12,900.00	-48.77	13.30	-44.24	5.82	H	-36.76	58.56
38000 (2595.0)	5,190.00	-50.37	12.80	-62.12	3.43	V	-52.75	74.55
	7,785.00	-46.76	11.64	-49.12	4.38	V	-41.86	63.66
	10,380.00	-50.22	10.75	-47.24	5.18	H	-41.67	63.47
	12,975.00	-50.17	13.40	-45.15	5.85	V	-37.60	59.40
38150 (2610.0)	5,220.00	-51.23	13.05	-62.48	3.45	V	-52.88	74.68
	7,830.00	-44.93	11.55	-46.70	4.37	V	-39.52	61.33
	10,440.00	-51.48	10.70	-48.20	5.16	H	-42.66	64.46
	13,050.00	-47.64	13.40	-42.79	5.81	H	-35.20	57.00

**8.3 PEAK-TO-AVERAGE RATIO**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB )
38	5 MHz	2595.0	QPSK	25	0	5.76
			16-QAM			6.45
			64-QAM			6.93
	10 MHz		QPSK	50		5.88
			16-QAM			6.44
			64-QAM			6.59
	15 MHz		QPSK	75		5.75
			16-QAM			6.44
			64-QAM			6.72
	20 MHz		QPSK	100		5.67
			16-QAM			6.46
			64-QAM			6.72

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 60 ~ 71.

**8.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data ( MHz )
38	5 MHz	2595.0	QPSK	25	0	4.5321
			16-QAM			4.5158
			64-QAM			4.5029
	10 MHz		QPSK	50		8.9833
			16-QAM			8.9766
			64-QAM			8.9809
	15 MHz		QPSK	75		13.458
			16-QAM			13.396
			64-QAM			13.438
	20 MHz		QPSK	100		17.871
			16-QAM			17.861
			64-QAM			17.835

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 48 ~ 59.

**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)
38	5	2572.5	12.8521	33.096	-69.797	-36.701	-25.00
		2595.0	12.9647	33.096	-64.410	-31.314	
		2617.5	13.0988	33.096	-63.480	-30.384	
	10	2575.0	12.8533	33.096	-71.755	-38.659	
		2595.0	12.9536	33.096	-64.660	-31.564	
		2615.0	13.0975	33.096	-61.783	-28.687	
	15	2577.5	12.8546	33.096	-70.885	-37.789	
		2595.0	12.9424	33.096	-64.050	-30.954	
		2612.5	13.0963	33.096	-61.480	-28.384	
	20	2580.0	12.8558	33.096	-72.035	-38.939	
		2595.0	12.9309	33.096	-66.060	-32.964	
		2610.0	13.0951	33.096	-61.912	-28.816	

Note:

- Plots of the EUT's Conducted Spurious Emissions are shown Page 92 ~ 115.
- Duty Cycle factor already applied on the factor.
  - Duty Cycle factor(dB) = 3.98
  - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
  - Result(dBm) = Reading + Factor

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

**8.6 CHANNEL EDGE**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
						Lower	Upper	Lower	Upper
Band 38	5 MHz	2572.5	QPSK	25	0	-22.79	-21.09	-22.37	-24.57
		2595.0	QPSK	25	0	-22.91	-20.81	-21.99	-24.22
		2617.5	QPSK	25	0	-20.58	-22.95	-22.74	-25.01
	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
	10 MHz	2575.0	QPSK	50	0	-25.92	-25.76	-24.64	-26.96
		2595.0	QPSK	50	0	-25.96	-24.82	-23.03	-24.72
		2615.0	QPSK	50	0	-26.20	-24.51	-25.30	-26.33
	15 MHz	2577.5	QPSK	75	0	-26.72	-28.33	-25.15	-27.13
		2595.0	QPSK	75	0	-27.22	-27.52	-24.95	-26.35
		2612.5	QPSK	75	0	-26.36	-27.15	-26.10	-27.51
	20 MHz	2580.0	QPSK	100	0	-27.81	-29.32	-25.61	-27.84
		2595.0	QPSK	100	0	-27.54	-28.76	-25.19	-27.07
		2610.0	QPSK	100	0	-27.92	-28.69	-26.02	-27.84
	Limit						-10.0		-10.0

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	(C.E ± 5 MHz)		Above (C.E ± X MHz)	
						~			
						(C.E ± X MHz)		Lower	Upper
Band 38	5 MHz	2572.5	QPSK	25	0	-37.96	-38.23	-39.83	-40.40
		2595.0	QPSK	25	0	-37.46	-37.28	-39.56	-39.47
		2617.5	QPSK	25	0	-36.67	-36.23	-38.96	-38.46
	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	(C.E ± 5 MHz)		Above (C.E ± X MHz)	
						~			
						(C.E ± X MHz)		Lower	Upper
	10 MHz	2575.0	QPSK	50	0	-29.72	-32.26	-39.81	-40.92
		2595.0	QPSK	50	0	-29.64	-31.62	-40.27	-40.30
		2615.0	QPSK	50	0	-30.67	-32.20	-38.77	-38.68
	15 MHz	2577.5	QPSK	75	0	-29.38	-31.78	-42.45	-43.63
		2595.0	QPSK	75	0	-28.57	-30.90	-41.06	-41.22
		2612.5	QPSK	75	0	-29.54	-31.38	-40.34	-39.87
	20 MHz	2580.0	QPSK	100	0	-29.29	-32.26	-42.50	-43.98
		2595.0	QPSK	100	0	-29.00	-31.69	-41.65	-42.51
		2610.0	QPSK	100	0	-30.08	-31.73	-41.94	-41.97
Limit						-13.0		-25.0	

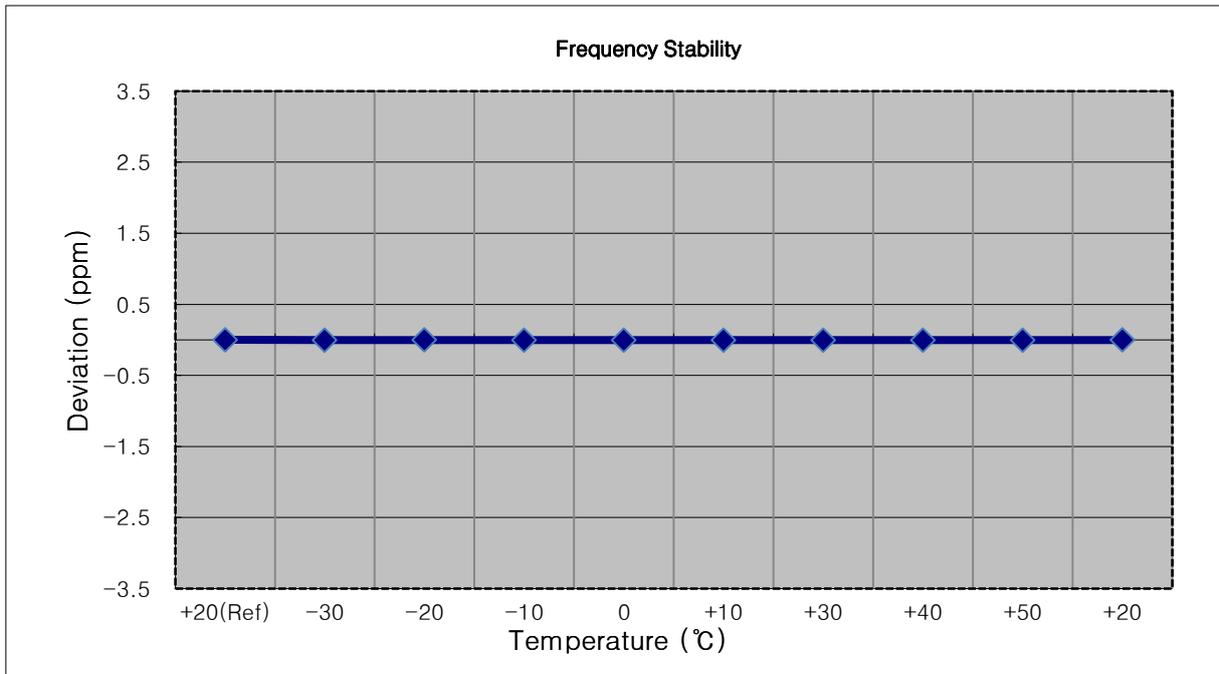
Note:

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 72 ~ 91. (1RB & Full RB)

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

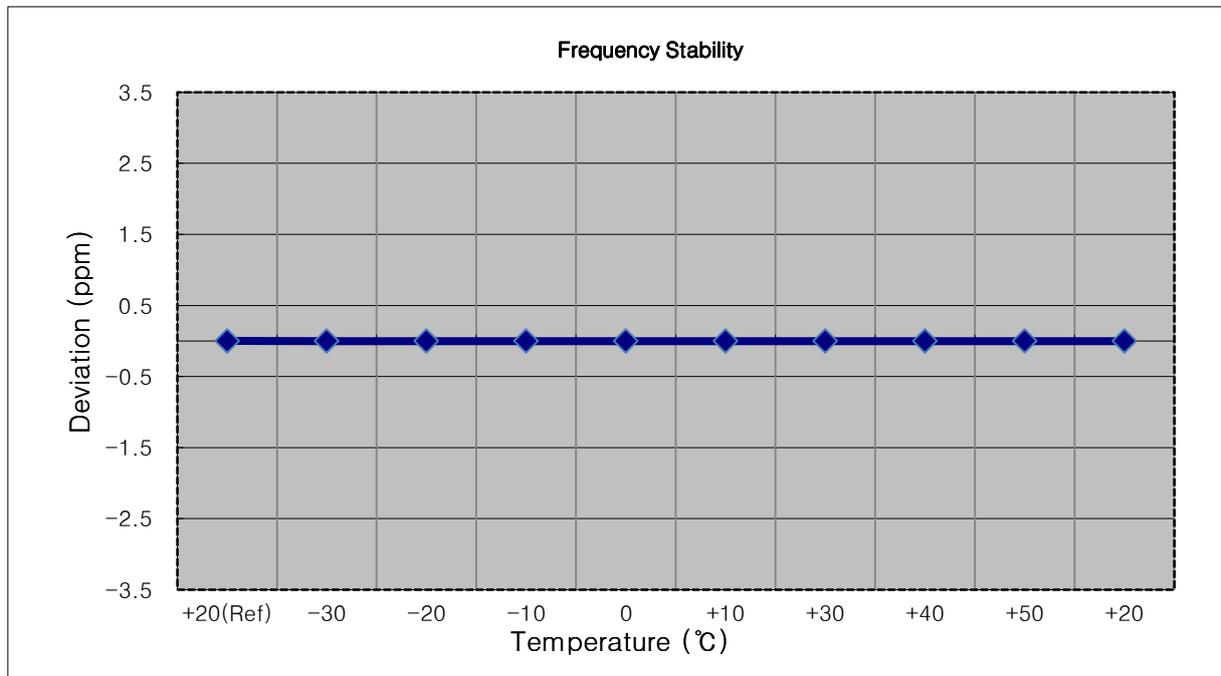
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2572.500.000 Hz
- ▣ BANDWIDTH: 37775 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2572 499 992	0.0	0.000 000	0.000
100%		-30	2572 499 980	-12.0	0.000 000	-0.005
100%		-20	2572 499 985	-7.4	0.000 000	-0.003
100%		-10	2572 499 981	-11.7	0.000 000	-0.005
100%		0	2572 499 983	-9.7	0.000 000	-0.004
100%		+10	2572 499 984	-8.3	0.000 000	-0.003
100%		+30	2572 499 983	-9.3	0.000 000	-0.004
100%		+40	2572 499 983	-9.4	0.000 000	-0.004
100%		+50	2572 499 981	-11.0	0.000 000	-0.004
85%		3.600	+20	2572 499 985	-7.7	0.000 000



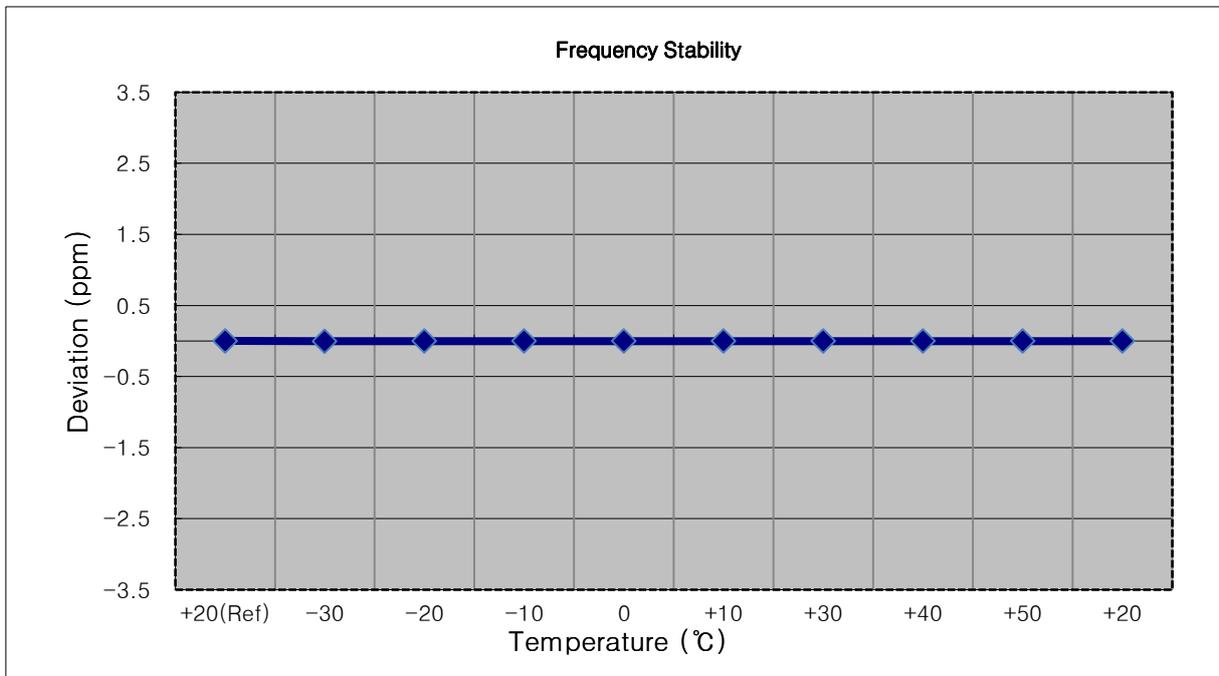
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2575,000,000 Hz
- ▣ BANDWIDTH: 37800 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2574 999 994	0.0	0.000 000	0.000
100%		-30	2574 999 988	-6.1	0.000 000	-0.002
100%		-20	2574 999 987	-6.6	0.000 000	-0.003
100%		-10	2574 999 988	-5.8	0.000 000	-0.002
100%		0	2574 999 987	-6.8	0.000 000	-0.003
100%		+10	2574 999 987	-6.6	0.000 000	-0.003
100%		+30	2574 999 987	-6.2	0.000 000	-0.002
100%		+40	2574 999 987	-6.7	0.000 000	-0.003
100%		+50	2574 999 989	-4.3	0.000 000	-0.002
85%	3.600	+20	2574 999 988	-5.7	0.000 000	-0.002



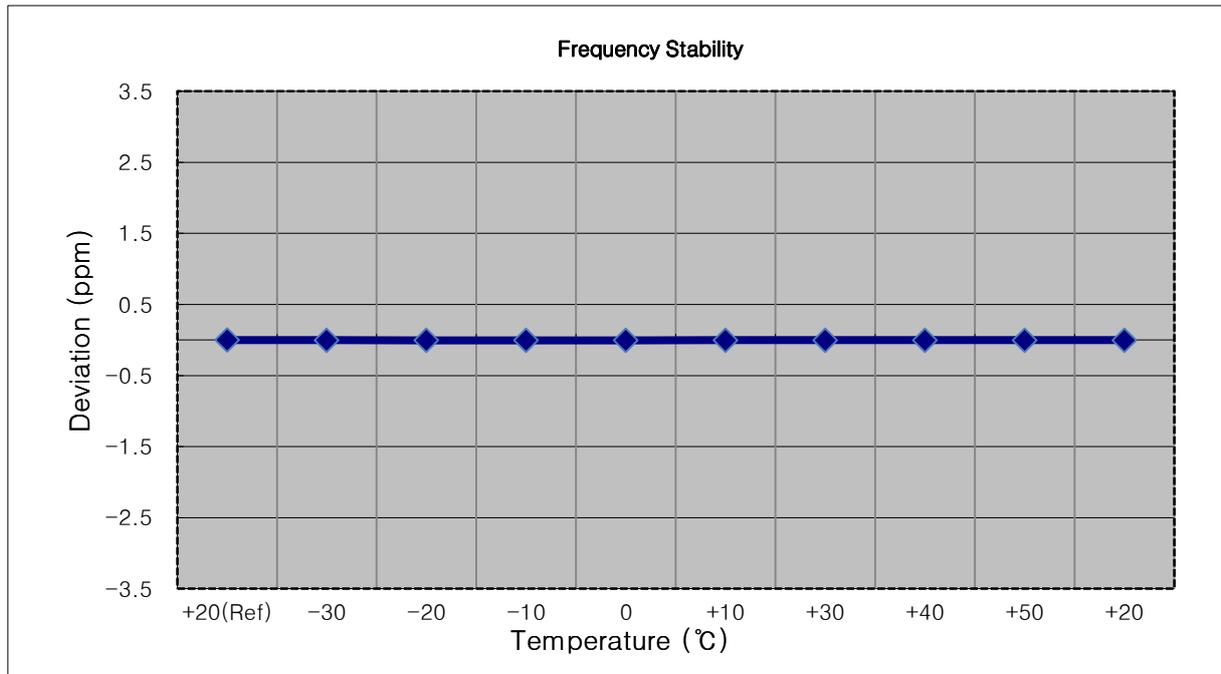
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2577,500,000 Hz
- ▣ BANDWIDTH: 37825 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2577 499 993	0.0	0.000 000	0.000
100%		-30	2577 499 985	-8.0	0.000 000	-0.003
100%		-20	2577 499 986	-6.3	0.000 000	-0.002
100%		-10	2577 499 986	-6.6	0.000 000	-0.003
100%		0	2577 499 985	-7.4	0.000 000	-0.003
100%		+10	2577 499 987	-6.2	0.000 000	-0.002
100%		+30	2577 499 986	-6.5	0.000 000	-0.003
100%		+40	2577 499 986	-6.9	0.000 000	-0.003
100%		+50	2577 499 987	-5.8	0.000 000	-0.002
85%	3.600	+20	2577 499 986	-6.4	0.000 000	-0.002



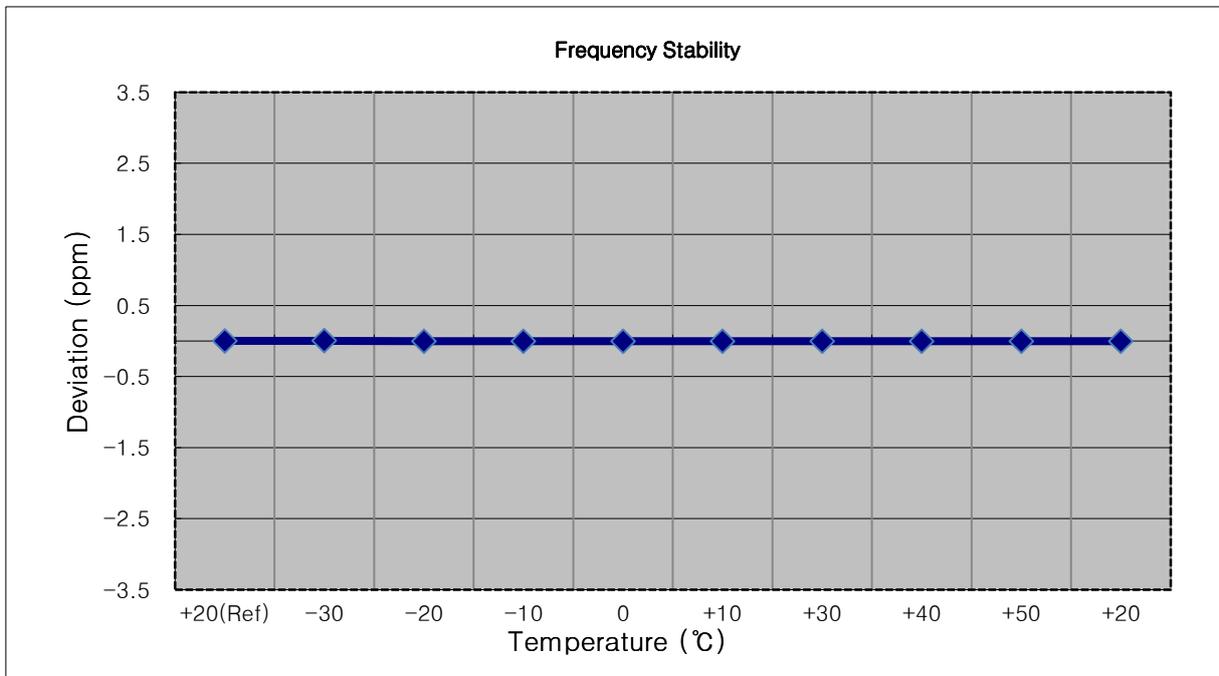
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2580.000.000 Hz
- ▣ BANDWIDTH: 37850 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2579 999 993	0.0	0.000 000	0.000
100%		-30	2579 999 985	-7.7	0.000 000	-0.003
100%		-20	2579 999 983	-9.9	0.000 000	-0.004
100%		-10	2579 999 983	-9.6	0.000 000	-0.004
100%		0	2579 999 984	-9.0	0.000 000	-0.003
100%		+10	2579 999 985	-7.8	0.000 000	-0.003
100%		+30	2579 999 986	-6.7	0.000 000	-0.003
100%		+40	2579 999 986	-7.1	0.000 000	-0.003
100%		+50	2579 999 985	-8.0	0.000 000	-0.003
85%		3.600	+20	2579 999 985	-7.8	0.000 000



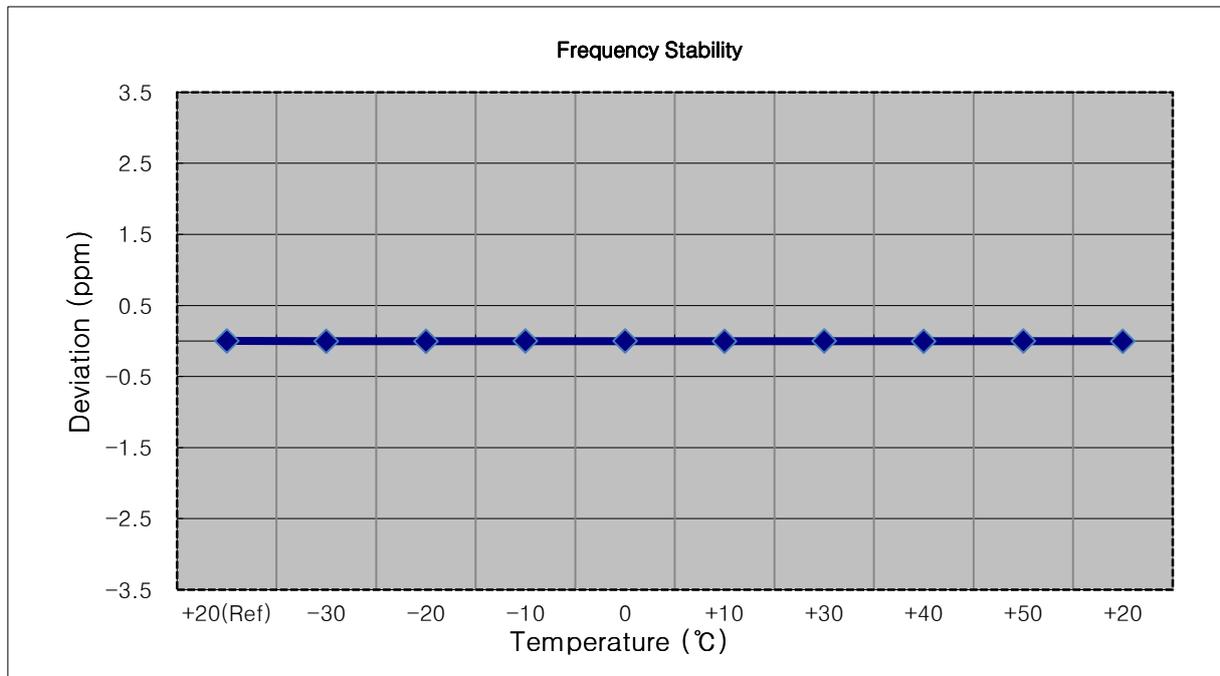
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2595,000,000 Hz
- ▣ BANDWIDTH: 38000 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2594 999 990	0.0	0.000 000	0.000
100%		-30	2594 999 999	8.9	0.000 000	0.003
100%		-20	2594 999 981	-8.7	0.000 000	-0.003
100%		-10	2594 999 978	-11.7	0.000 000	-0.005
100%		0	2594 999 981	-8.8	0.000 000	-0.003
100%		+10	2594 999 980	-9.7	0.000 000	-0.004
100%		+30	2594 999 981	-9.2	0.000 000	-0.004
100%		+40	2594 999 981	-9.3	0.000 000	-0.004
100%		+50	2594 999 979	-11.5	0.000 000	-0.004
85%	3.600	+20	2594 999 979	-11.4	0.000 000	-0.004



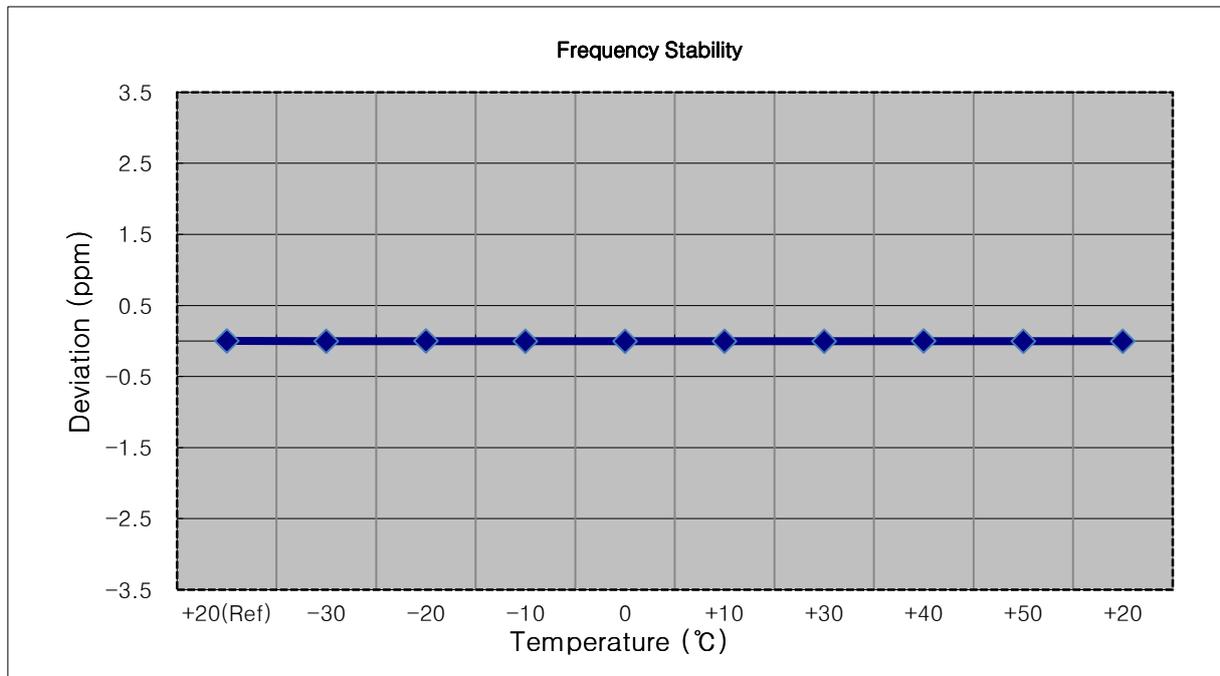
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2595,000,000 Hz
- ▣ BANDWIDTH: 38000 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2594 999 992	0.0	0.000 000	0.000
100%		-30	2594 999 983	-8.8	0.000 000	-0.003
100%		-20	2594 999 983	-8.7	0.000 000	-0.003
100%		-10	2594 999 985	-7.4	0.000 000	-0.003
100%		0	2594 999 984	-7.7	0.000 000	-0.003
100%		+10	2594 999 983	-8.5	0.000 000	-0.003
100%		+30	2594 999 985	-7.3	0.000 000	-0.003
100%		+40	2594 999 984	-8.2	0.000 000	-0.003
100%		+50	2594 999 984	-7.7	0.000 000	-0.003
85%	3.600	+20	2594 999 983	-9.2	0.000 000	-0.004



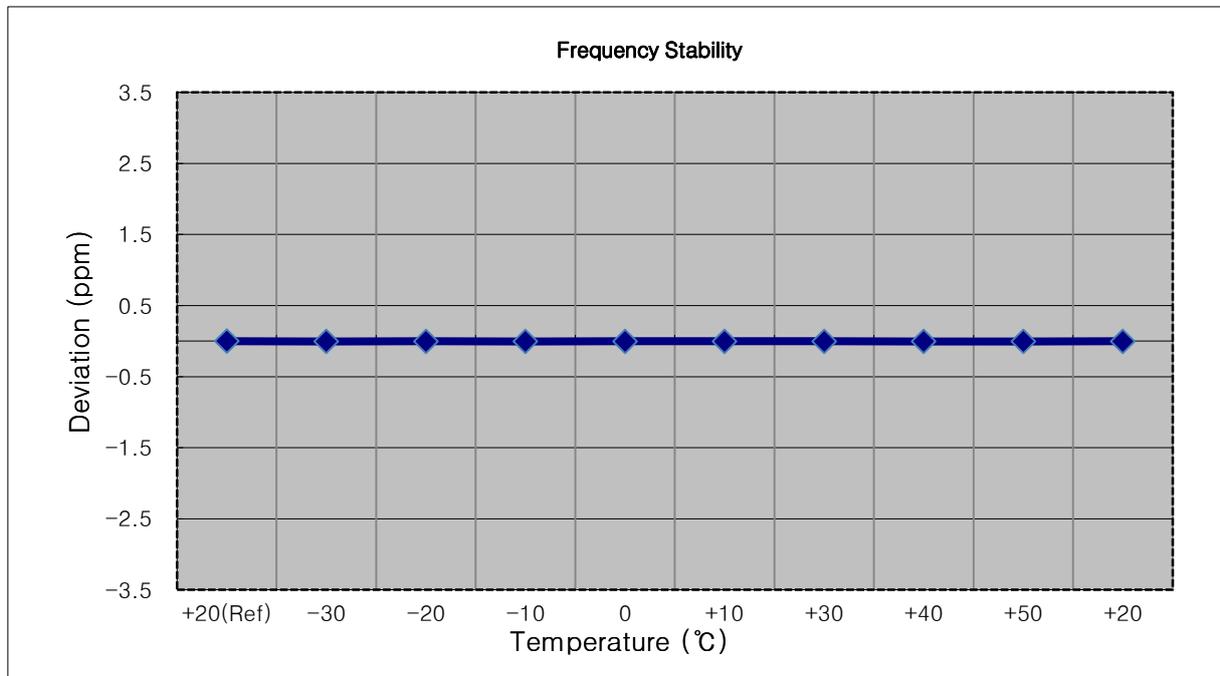
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2595,000,000 Hz
- ▣ BANDWIDTH: 38000 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2594 999 991	0.0	0.000 000	0.000
100%		-30	2594 999 982	-9.0	0.000 000	-0.003
100%		-20	2594 999 983	-8.0	0.000 000	-0.003
100%		-10	2594 999 982	-9.0	0.000 000	-0.003
100%		0	2594 999 980	-10.2	0.000 000	-0.004
100%		+10	2594 999 982	-8.3	0.000 000	-0.003
100%		+30	2594 999 980	-10.9	0.000 000	-0.004
100%		+40	2594 999 983	-7.9	0.000 000	-0.003
100%		+50	2594 999 982	-8.7	0.000 000	-0.003
85%	3.600	+20	2594 999 981	-9.6	0.000 000	-0.004



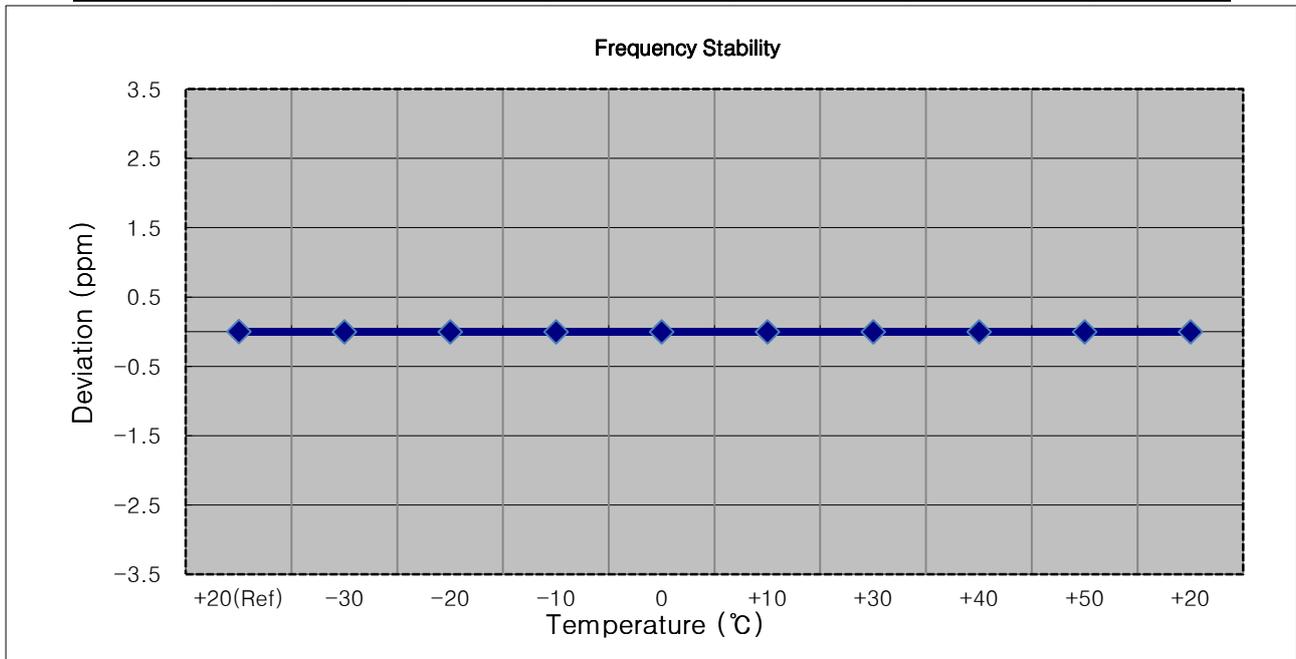
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2595.000.000 Hz
- ▣ BANDWIDTH: 38000 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2594 999 993	0.0	0.000 000	0.000
100%		-30	2594 999 984	-9.3	0.000 000	-0.004
100%		-20	2594 999 986	-7.4	0.000 000	-0.003
100%		-10	2594 999 984	-9.1	0.000 000	-0.004
100%		0	2594 999 986	-7.8	0.000 000	-0.003
100%		+10	2594 999 986	-7.6	0.000 000	-0.003
100%		+30	2594 999 986	-7.5	0.000 000	-0.003
100%		+40	2594 999 984	-9.7	0.000 000	-0.004
100%		+50	2594 999 983	-10.4	0.000 000	-0.004
85%	3.600	+20	2594 999 985	-8.1	0.000 000	-0.003



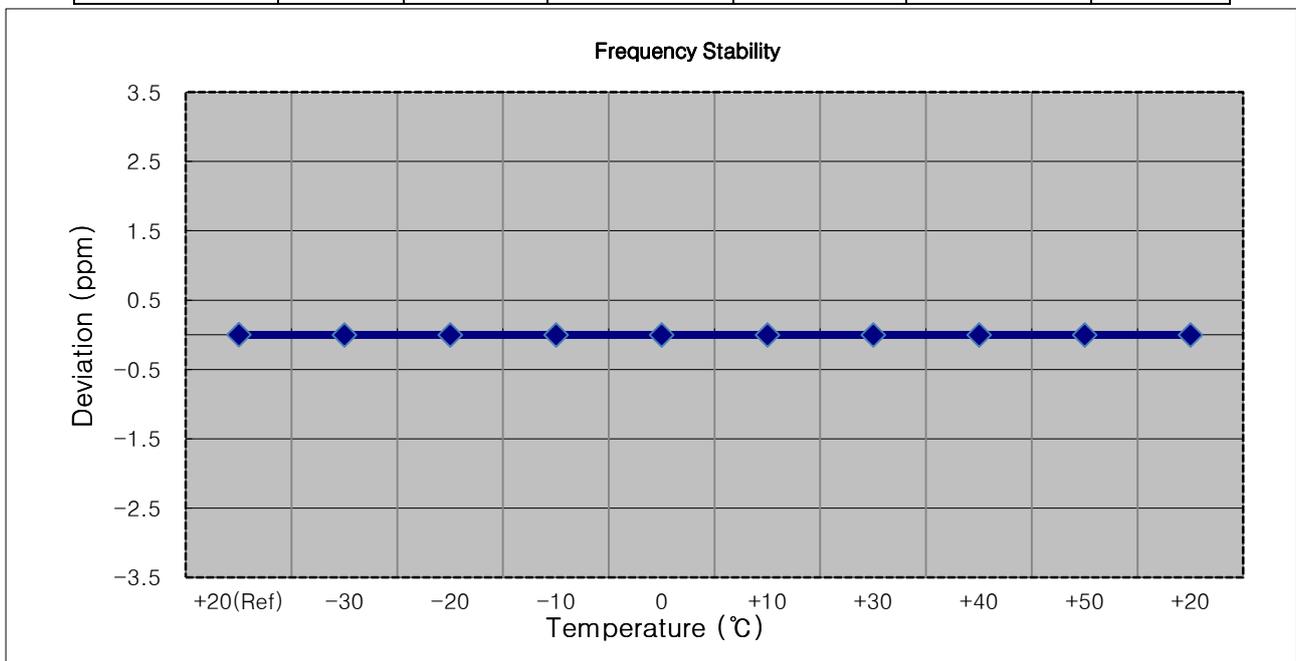
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2617,500,000 Hz
- ▣ BANDWIDTH: 38225 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2617 499 992	0.0	0.000 000	0.000
100%		-30	2617 499 985	-7.6	0.000 000	-0.003
100%		-20	2617 499 985	-7.3	0.000 000	-0.003
100%		-10	2617 499 985	-7.4	0.000 000	-0.003
100%		0	2617 499 984	-8.3	0.000 000	-0.003
100%		+10	2617 499 983	-9.1	0.000 000	-0.003
100%		+30	2617 499 985	-7.8	0.000 000	-0.003
100%		+40	2617 499 985	-7.7	0.000 000	-0.003
100%		+50	2617 499 983	-9.2	0.000 000	-0.004
85%		3.600	+20	2617 499 984	-8.3	0.000 000



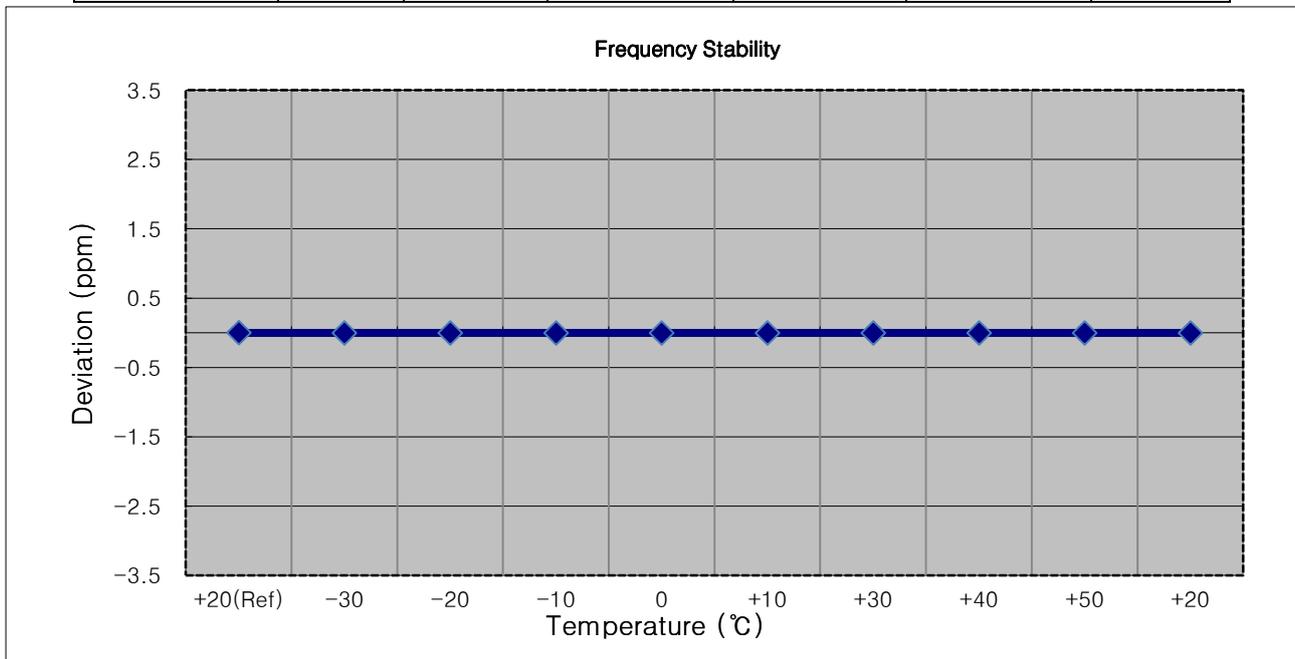
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2615,000,000 Hz
- ▣ BANDWIDTH: 38200 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2614 999 993	0.0	0.000 000	0.000
100%		-30	2614 999 985	-7.1	0.000 000	-0.003
100%		-20	2614 999 986	-6.8	0.000 000	-0.003
100%		-10	2614 999 986	-6.1	0.000 000	-0.002
100%		0	2614 999 984	-8.3	0.000 000	-0.003
100%		+10	2614 999 986	-6.8	0.000 000	-0.003
100%		+30	2614 999 986	-6.2	0.000 000	-0.002
100%		+40	2614 999 985	-7.9	0.000 000	-0.003
100%		+50	2614 999 985	-7.3	0.000 000	-0.003
85%	3.600	+20	2614 999 984	-8.3	0.000 000	-0.003



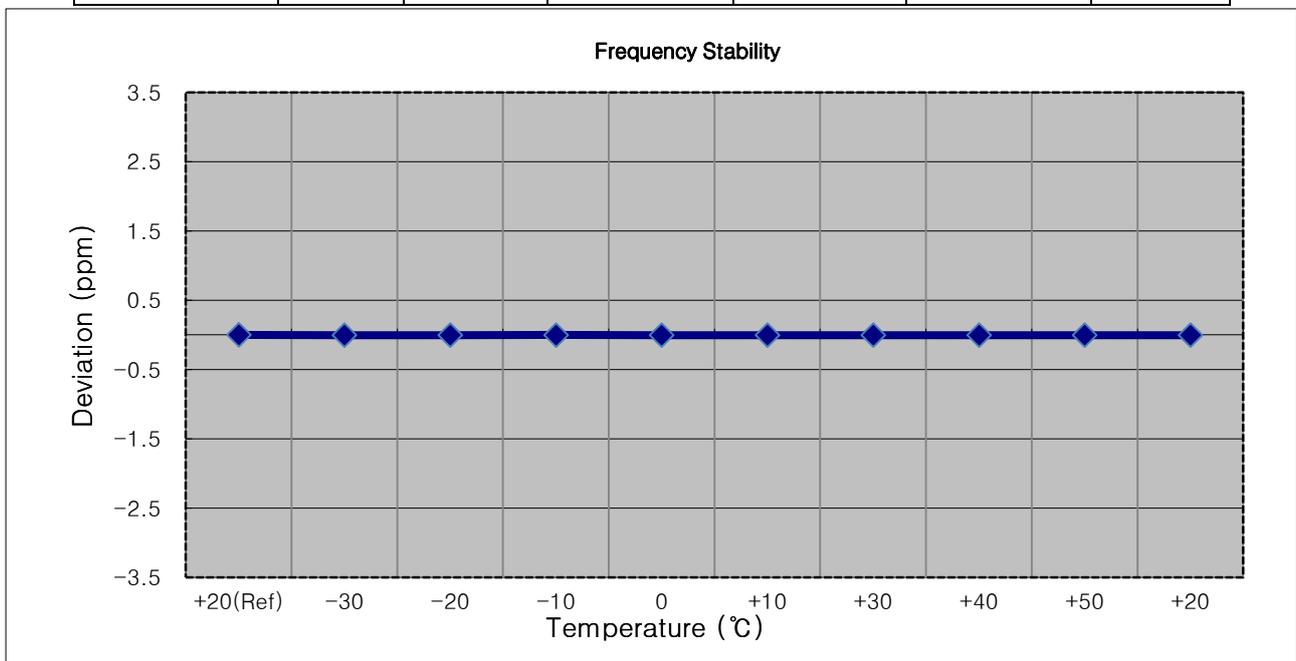
- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2612.500.000 Hz
- ▣ BANDWIDTH: 38175 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.85 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2612 499 994	0.0	0.000 000	0.000
100%		-30	2612 499 988	-6.4	0.000 000	-0.002
100%		-20	2612 499 986	-8.4	0.000 000	-0.003
100%		-10	2612 499 988	-6.8	0.000 000	-0.003
100%		0	2612 499 988	-6.1	0.000 000	-0.002
100%		+10	2612 499 986	-8.2	0.000 000	-0.003
100%		+30	2612 499 985	-9.1	0.000 000	-0.003
100%		+40	2612 499 988	-6.7	0.000 000	-0.003
100%		+50	2612 499 987	-7.8	0.000 000	-0.003
85%	3.600	+20	2612 499 987	-7.6	0.000 000	-0.003



- ▣ MODE: LTE 38
- ▣ OPERATING FREQUENCY: 2610.000.000 Hz
- ▣ BANDWIDTH: 38150 (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)	2609 999 992	0.0	0.000 000	0.000
100%		-30	2609 999 983	-8.9	0.000 000	-0.003
100%		-20	2609 999 984	-7.5	0.000 000	-0.003
100%		-10	2609 999 986	-6.0	0.000 000	-0.002
100%		0	2609 999 985	-6.6	0.000 000	-0.003
100%		+10	2609 999 985	-6.6	0.000 000	-0.003
100%		+30	2609 999 984	-8.1	0.000 000	-0.003
100%		+40	2609 999 981	-10.5	0.000 000	-0.004
100%		+50	2609 999 983	-8.8	0.000 000	-0.003
85%	3.600	+20	2609 999 984	-8.1	0.000 000	-0.003



**8.8 RECEIVER SPURIOUS EMISSIONS**

Frequency Range : 30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor+Cable loss- Amp Gain	Ant. POL	Total	Limit	Margin
MHz	dB $\mu$ V	dB /m	(H/V)	dB $\mu$ V/m	dB $\mu$ V/m	dB
No Peak Found						

Frequency Range : Above 1 GHz

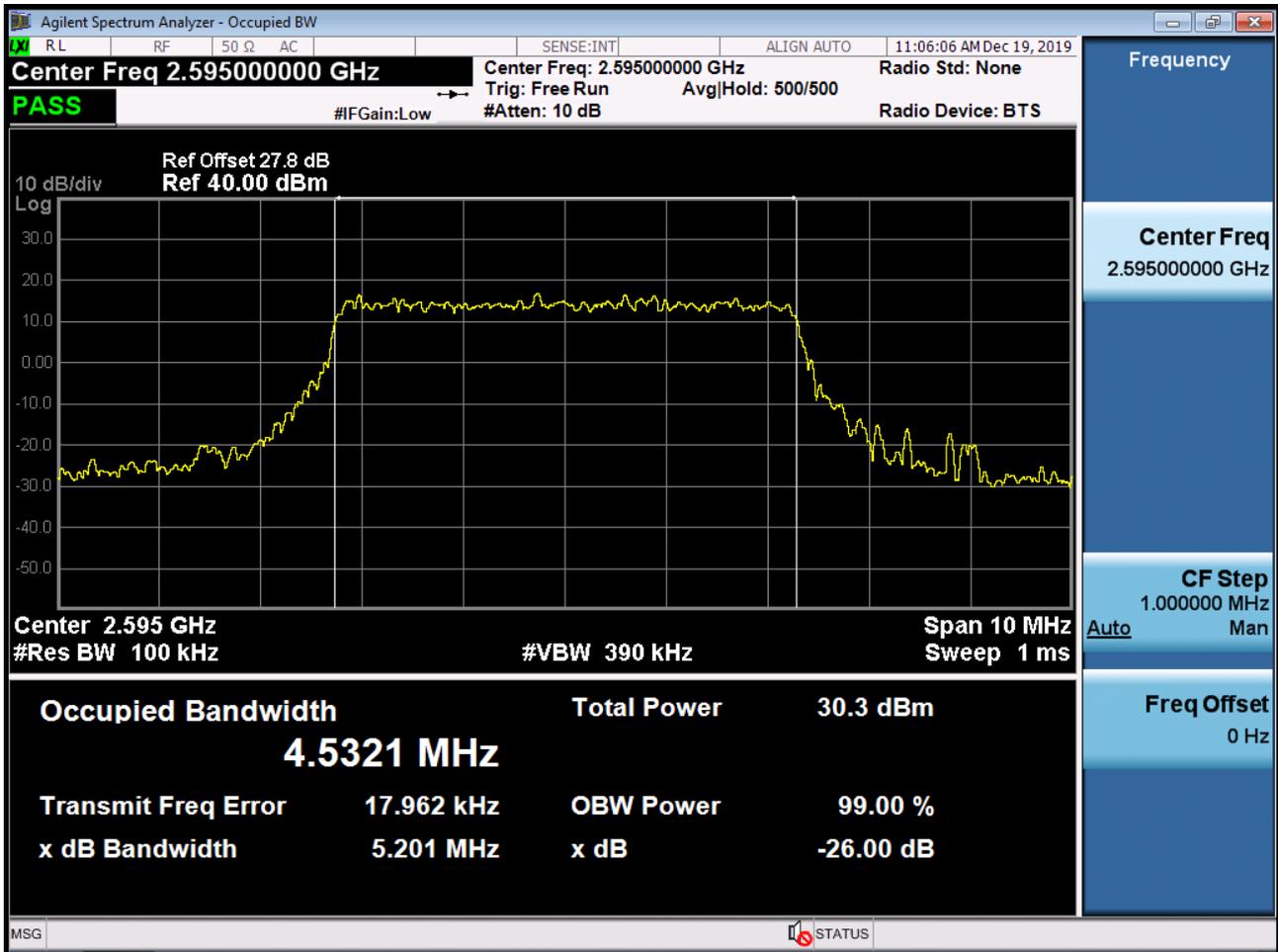
Frequency	Reading	Ant. factor+Cable loss- Amp Gain	Ant. POL	Total	Limit	Margin
MHz	dB $\mu$ V	dB /m	(H/V)	dB $\mu$ V/m	dB $\mu$ V/m	dB
No Peak Found						

**Limit**

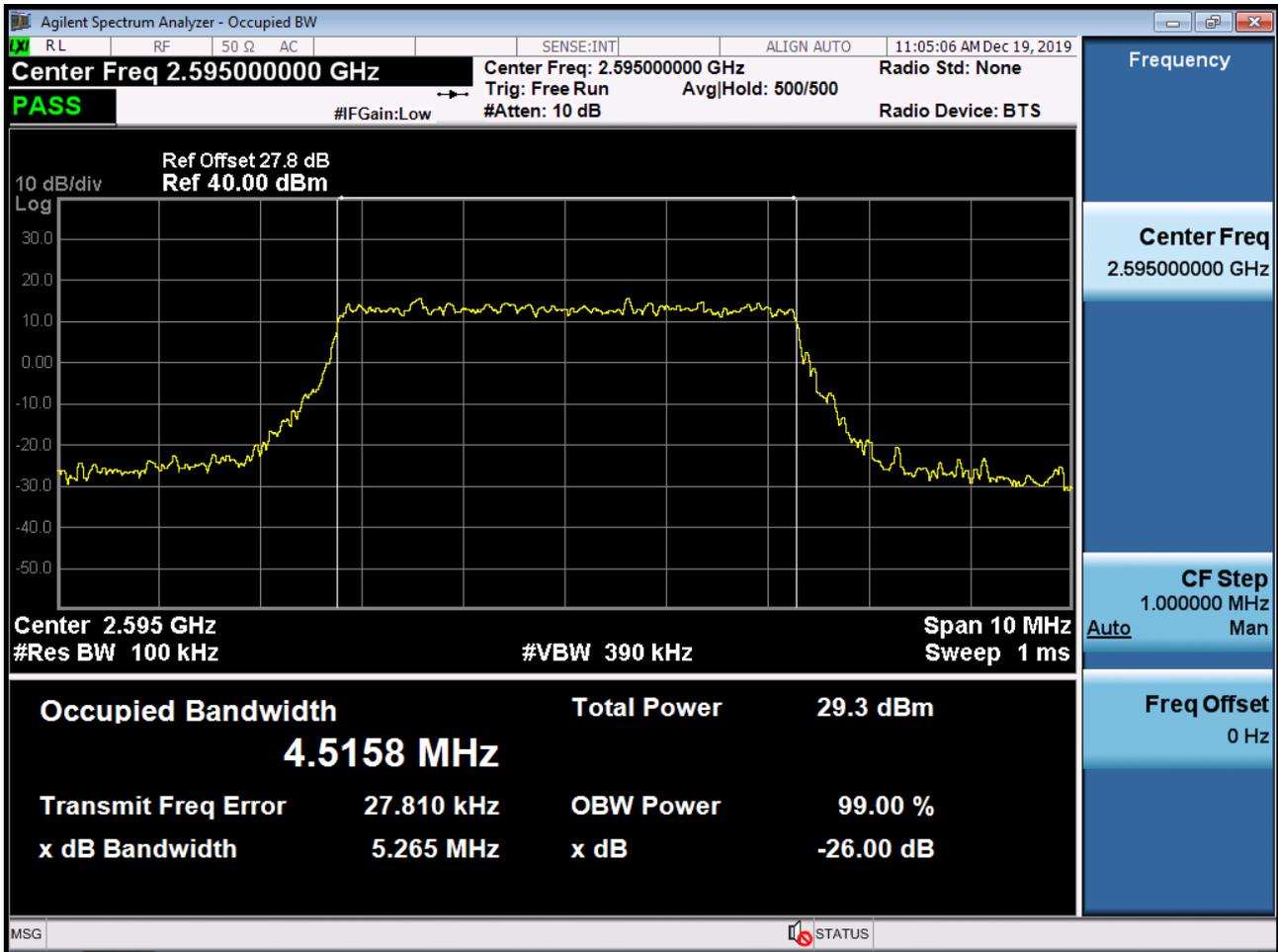
Frequency (MHz)	Field Strength ( $\mu$ v/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

## 9. TEST PLOTS

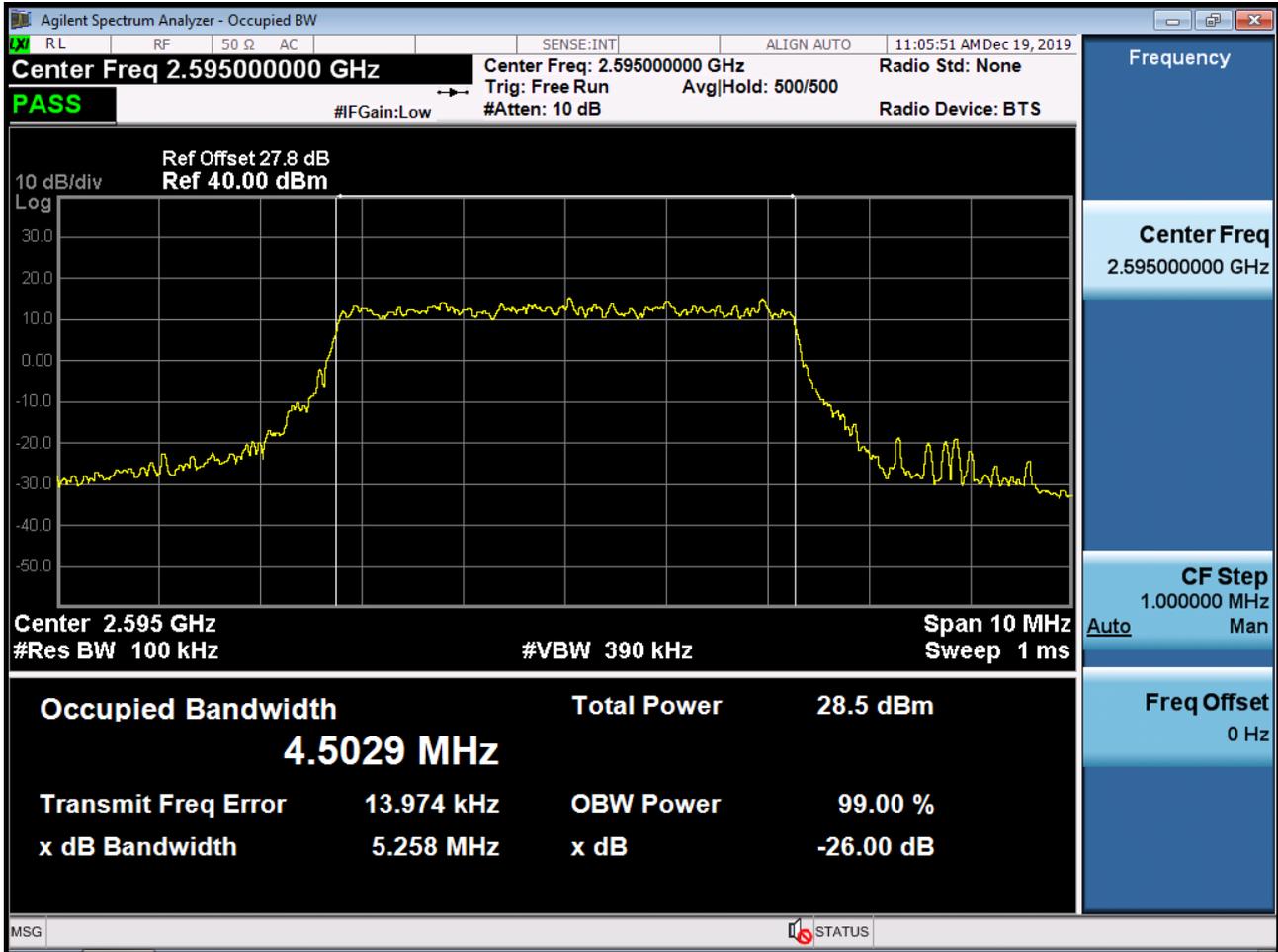
BAND 38. Occupied Bandwidth Plot (5 MHz Ch.38000 QPSK RB 25)



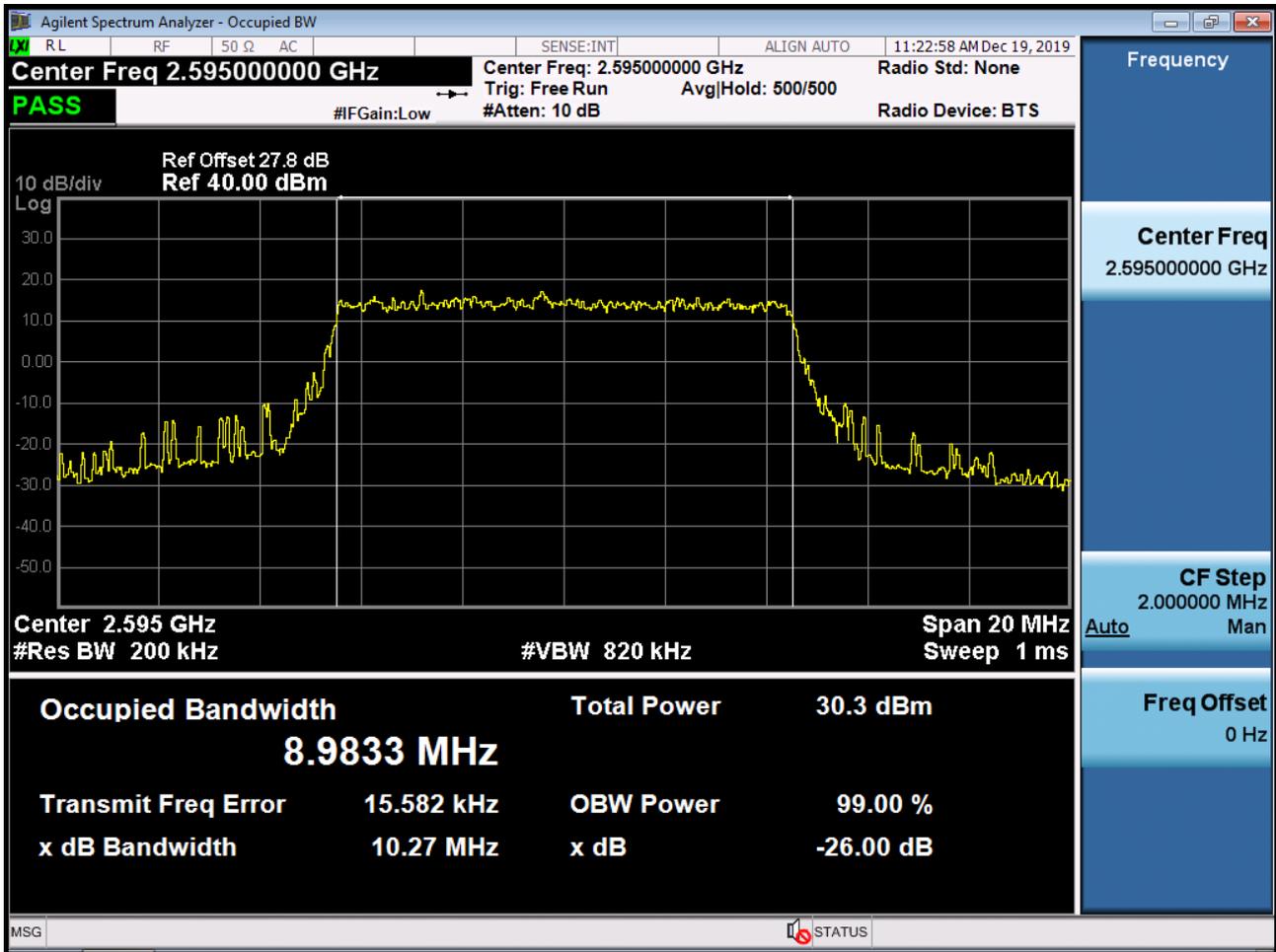
BAND 38. Occupied Bandwidth Plot (5 MHz Ch.38000 16-QAM RB 25)



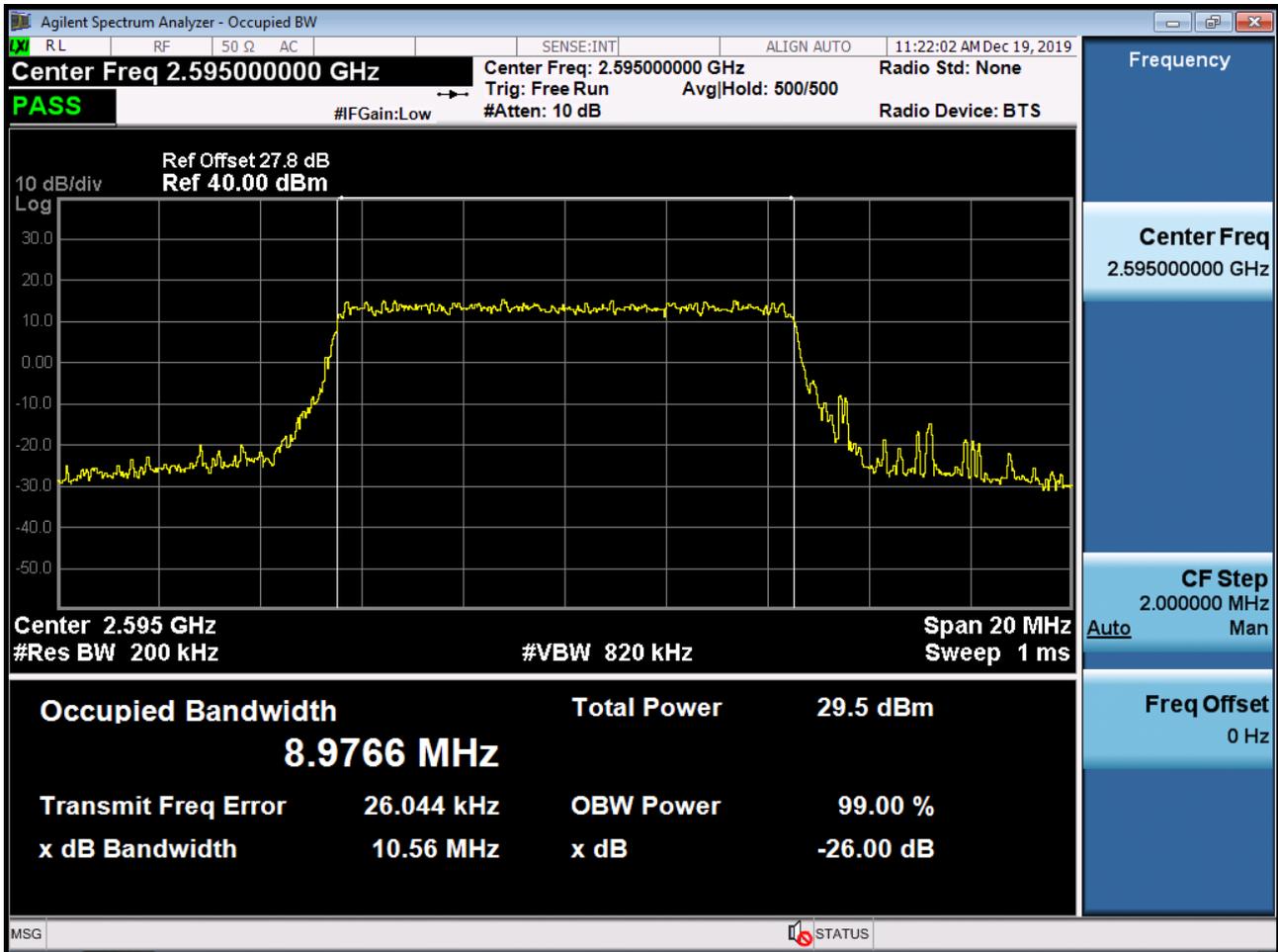
BAND 38. Occupied Bandwidth Plot (5 MHz Ch.38000 64-QAM RB 25)



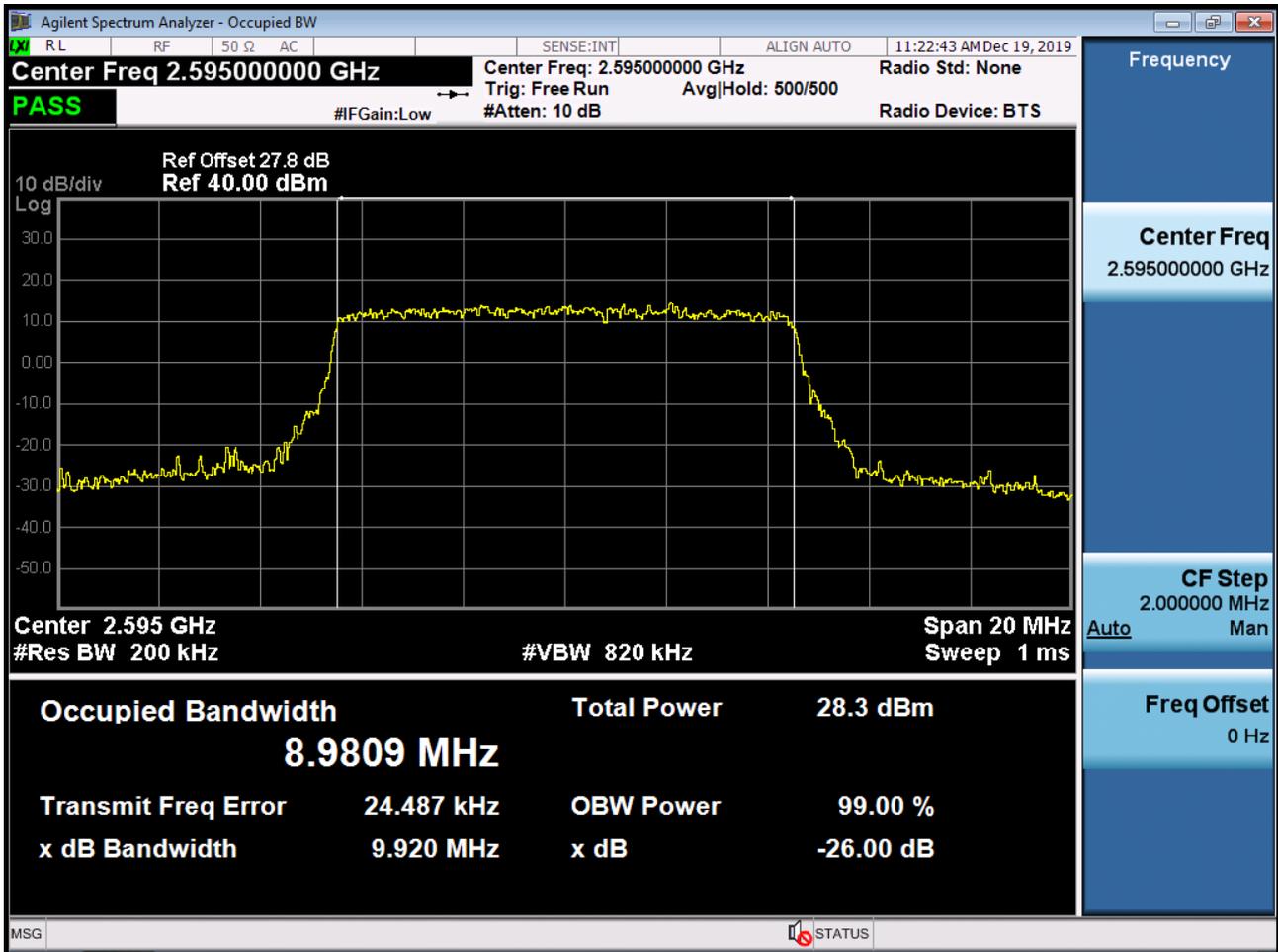
BAND 38. Occupied Bandwidth Plot (10 MHz Ch.38000 QPSK RB 50)



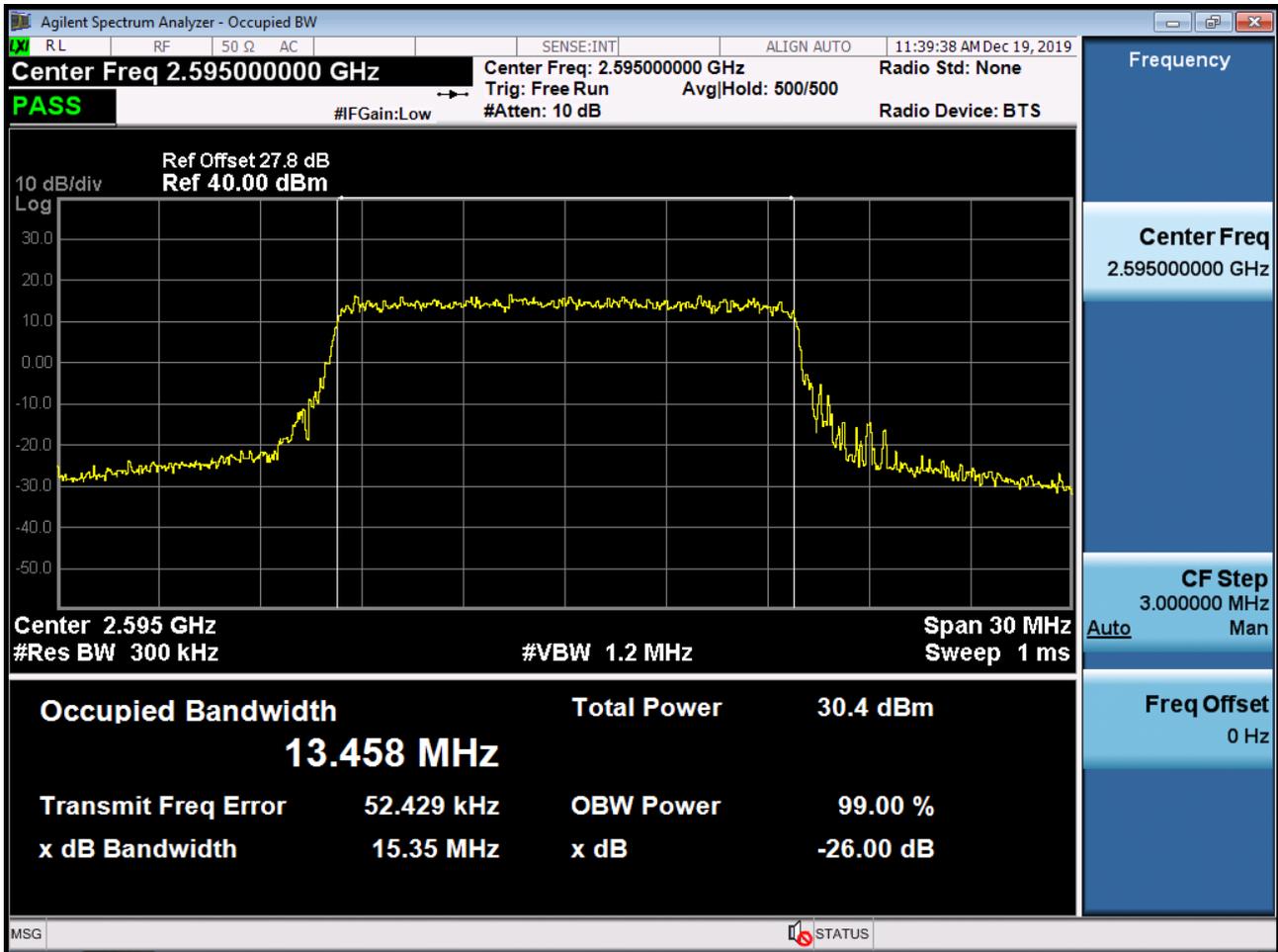
BAND 38. Occupied Bandwidth Plot (10 MHz Ch.38000 16-QAM RB 50)



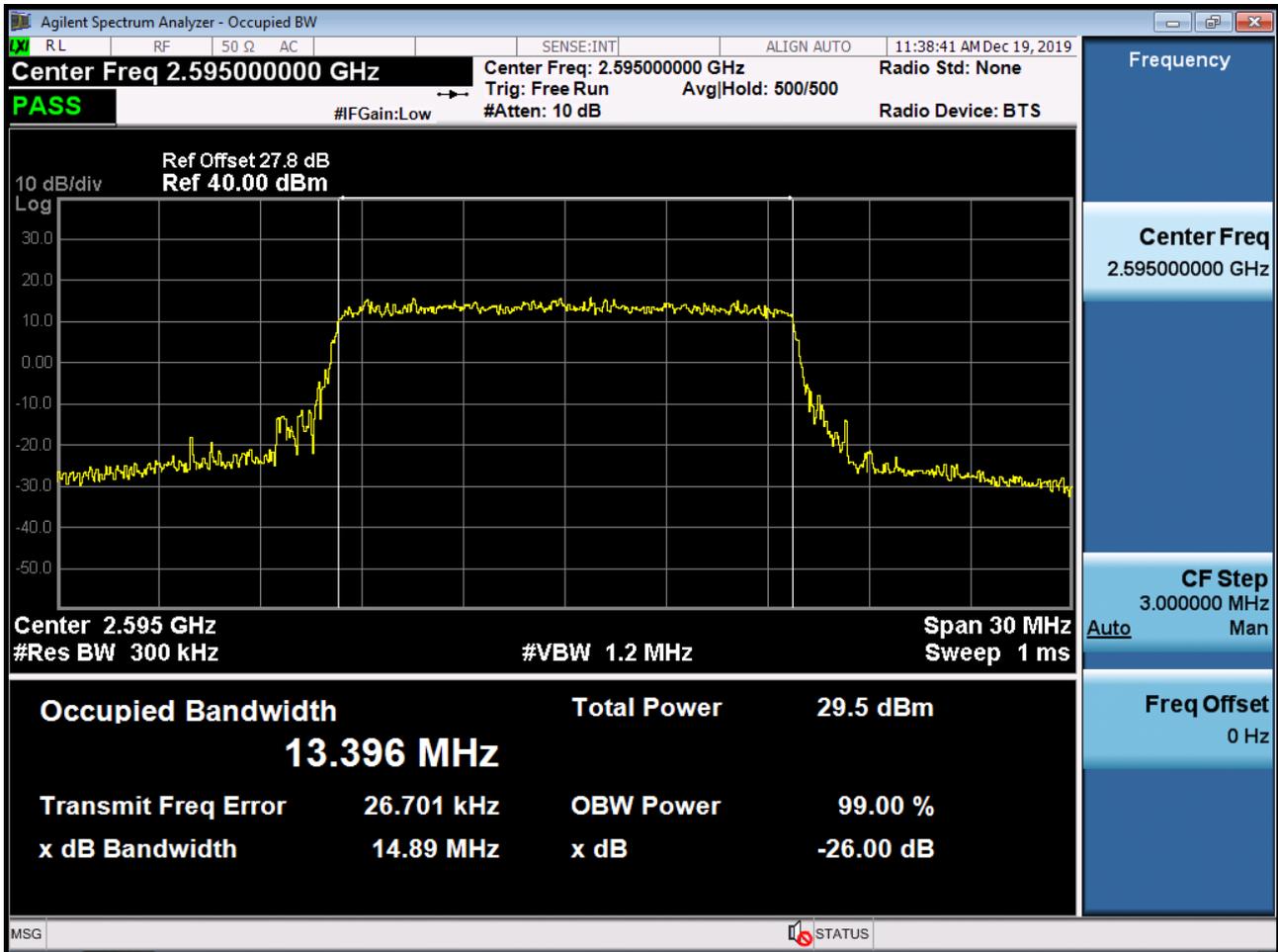
BAND 38. Occupied Bandwidth Plot (10 MHz Ch.38000 64-QAM RB 50)



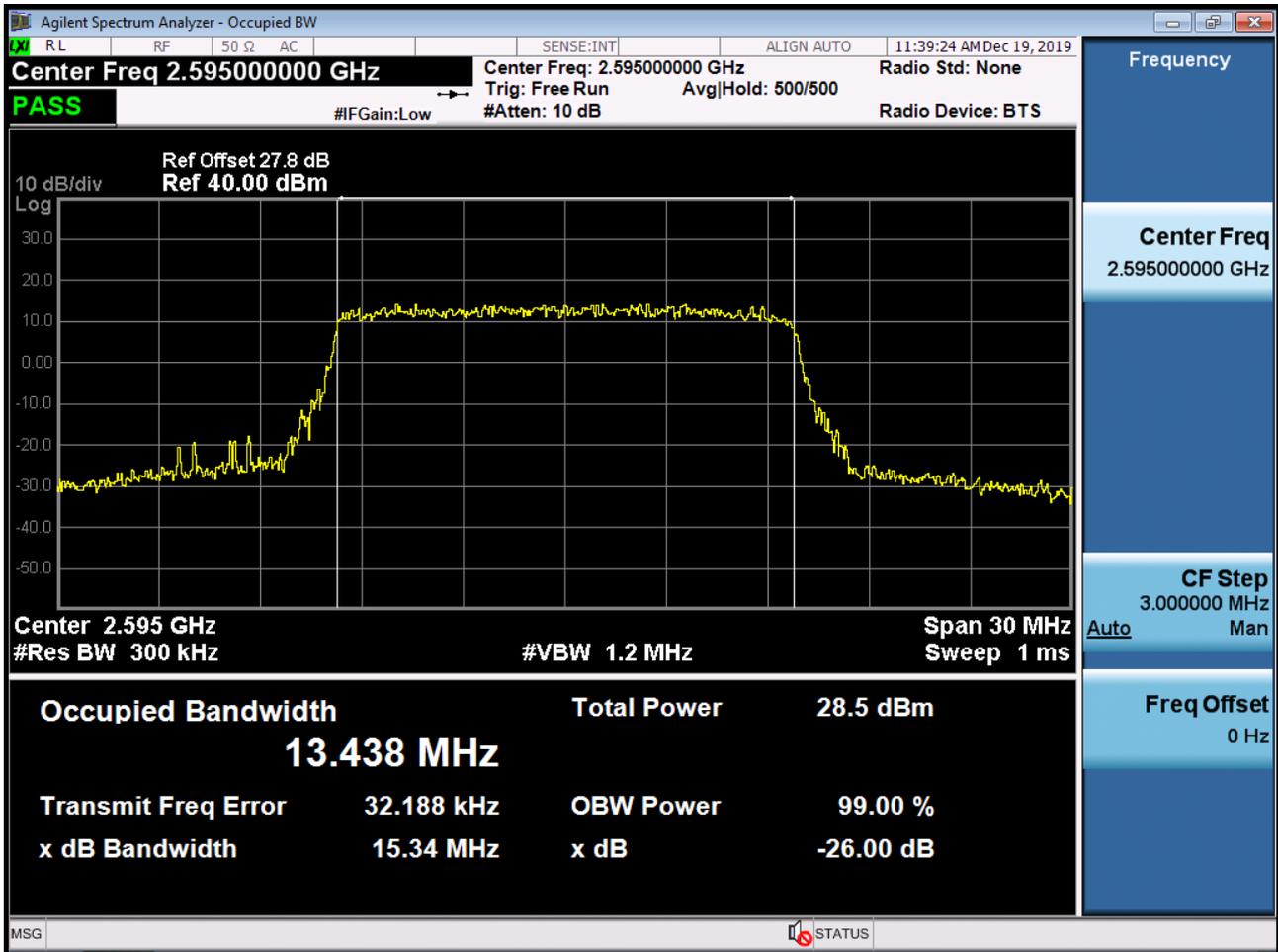
BAND 38. Occupied Bandwidth Plot (15 MHz Ch.38000 QPSK RB 75)



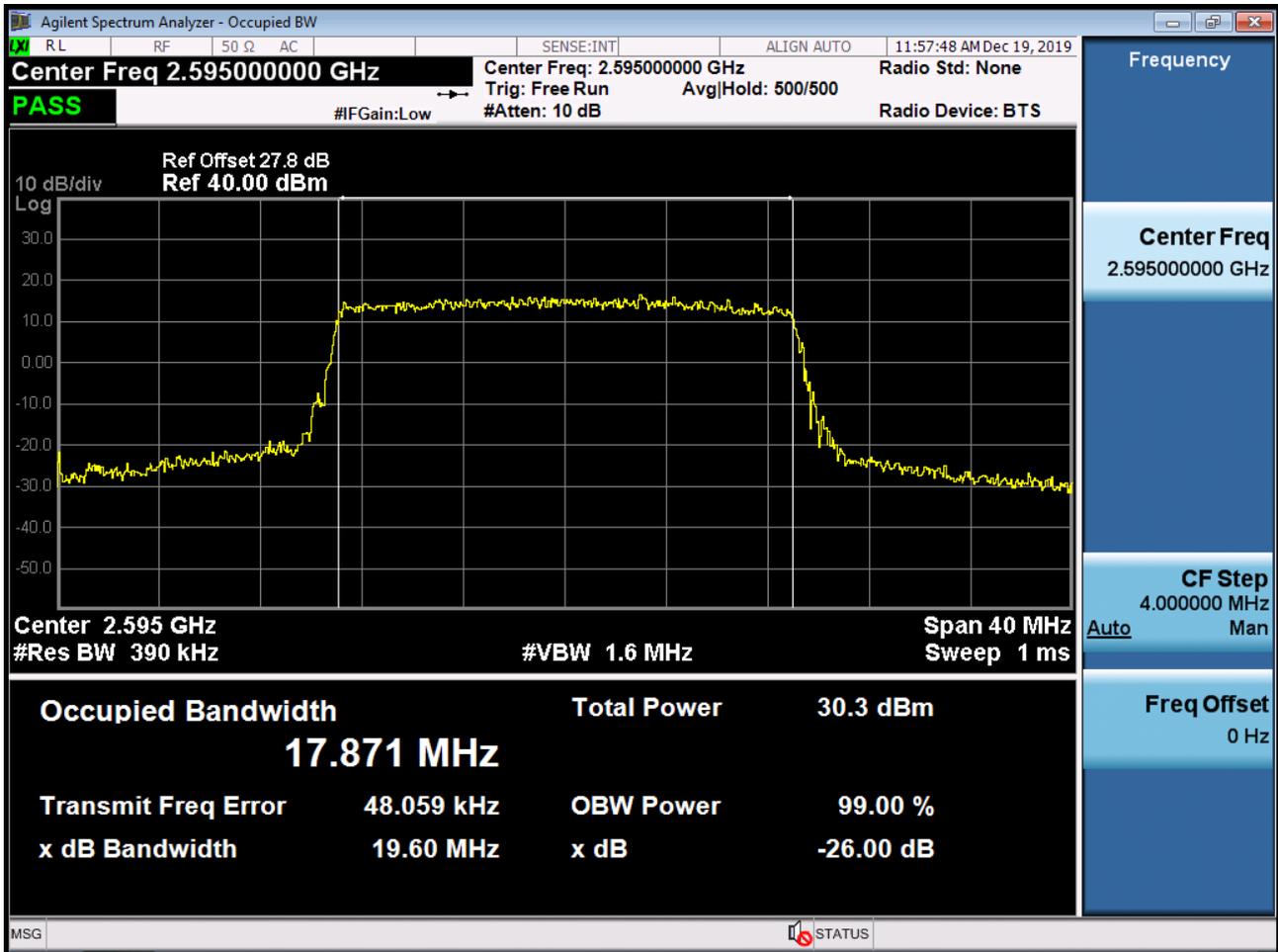
BAND 38. Occupied Bandwidth Plot (15 MHz Ch.38000 16-QAM RB 75)



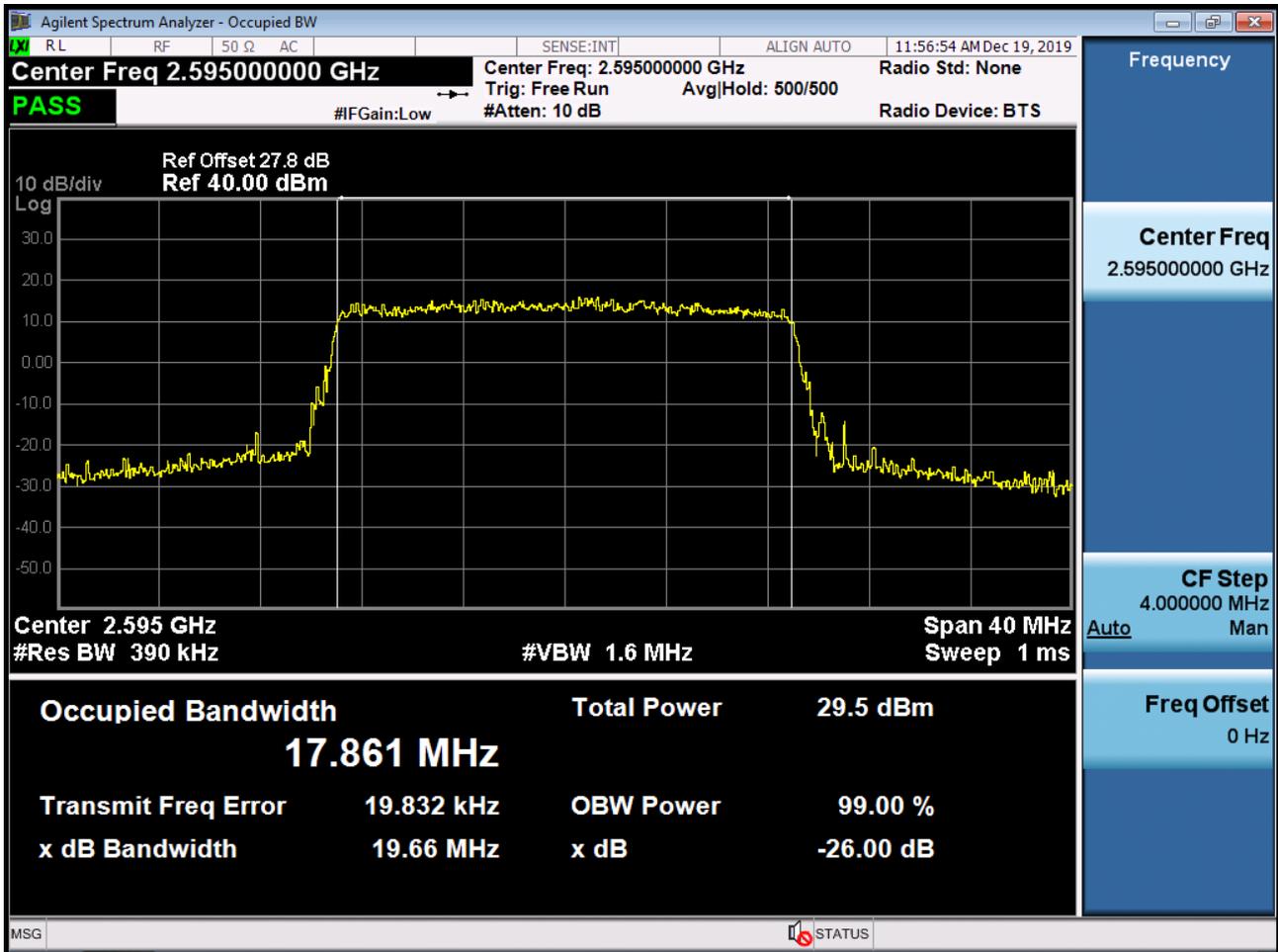
BAND 38. Occupied Bandwidth Plot (15 MHz Ch.38000 64-QAM RB 75)



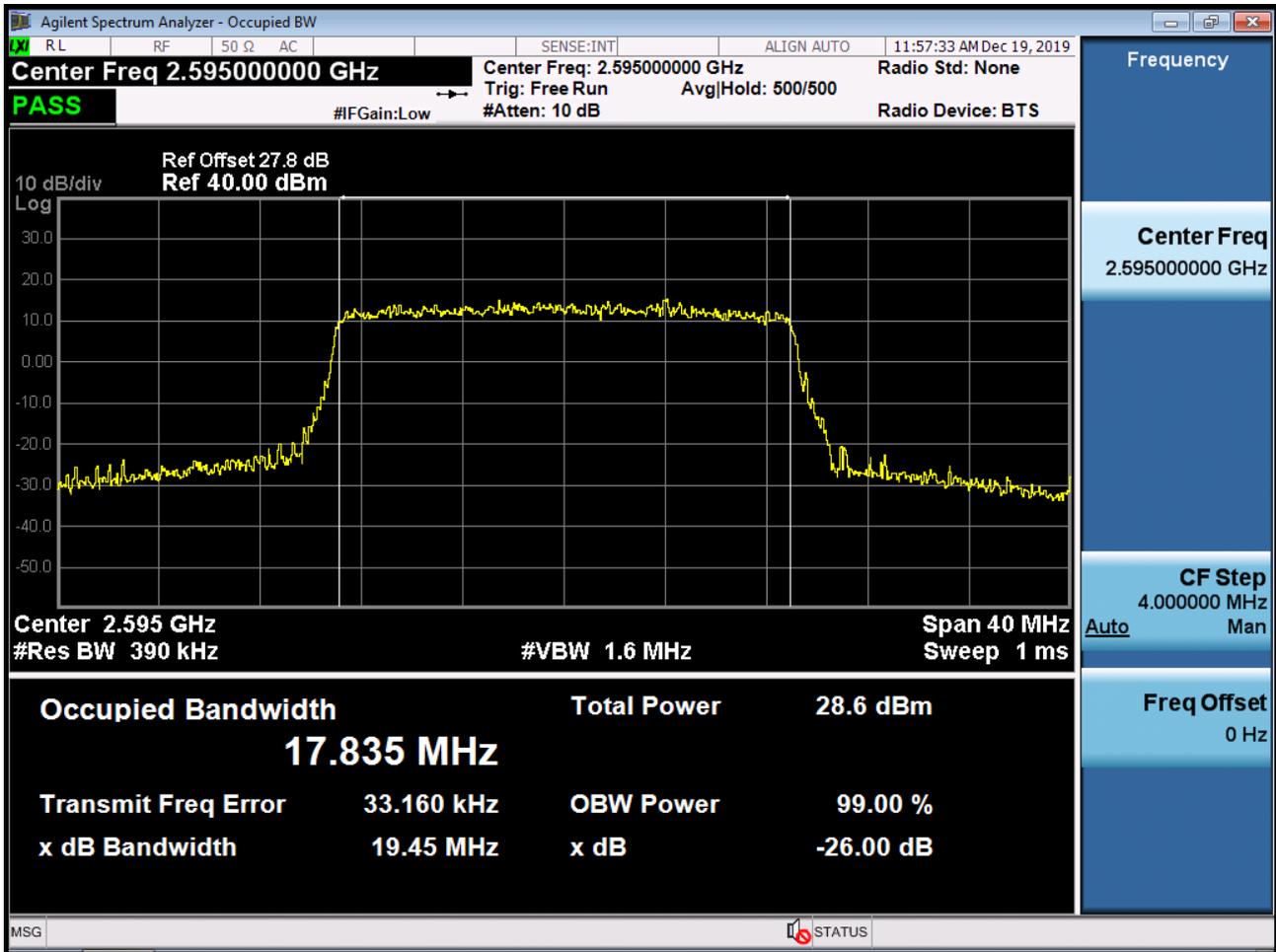
BAND 38. Occupied Bandwidth Plot (20 MHz Ch.38000 QPSK RB 100)



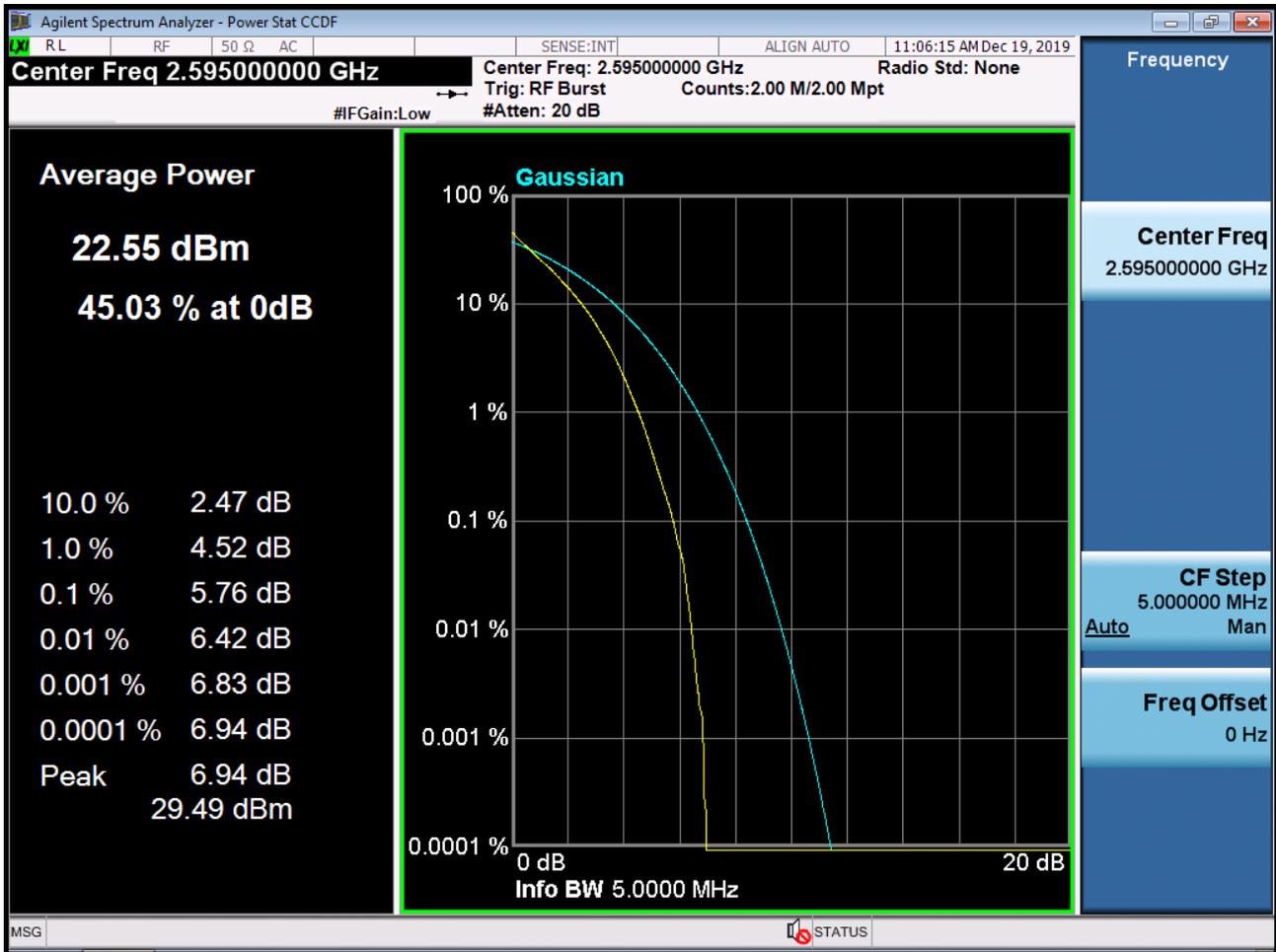
BAND 38. Occupied Bandwidth Plot (20 MHz Ch.38000 16-QAM RB 100)



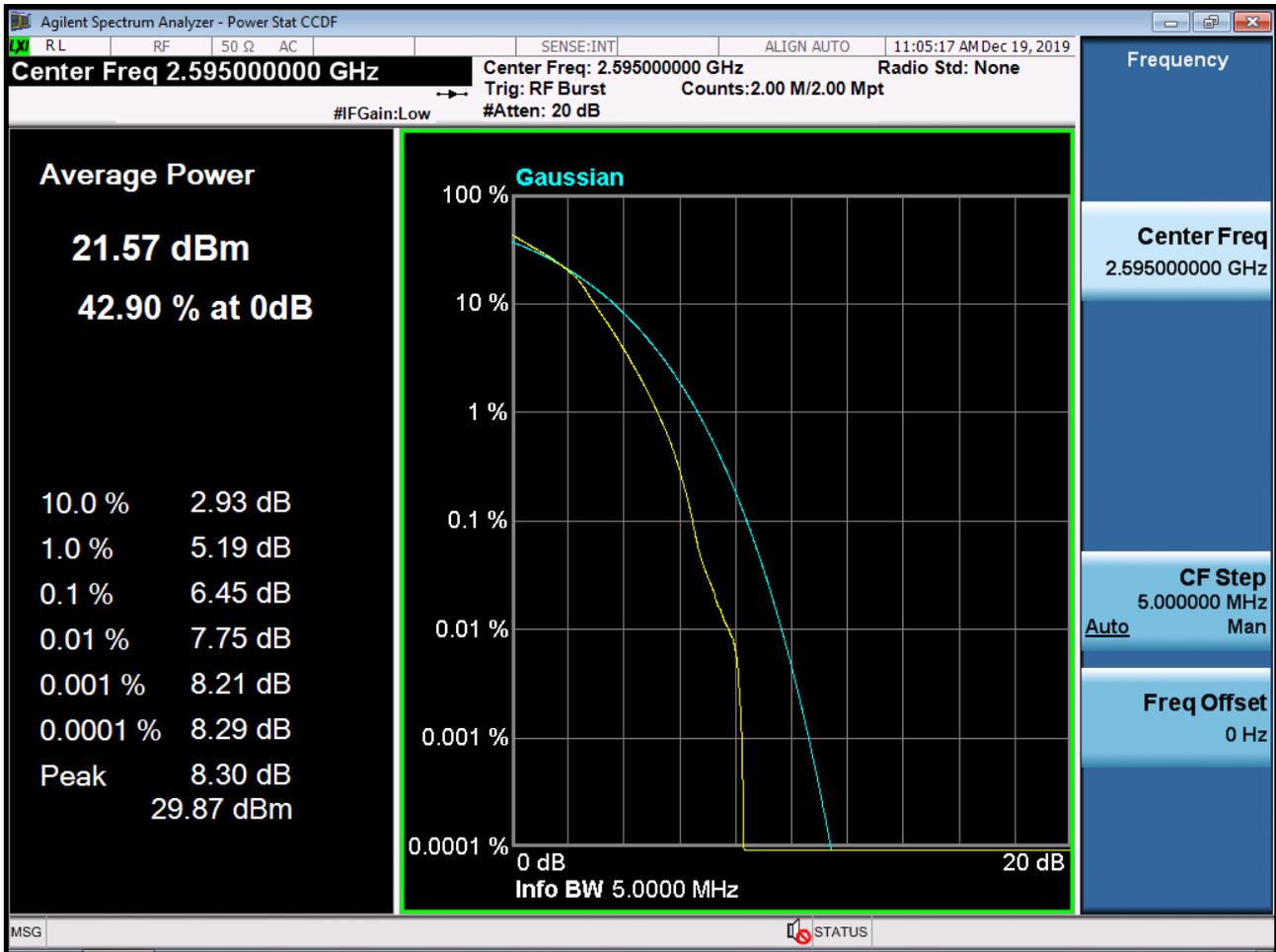
BAND 38. Occupied Bandwidth Plot (20 MHz Ch.38000 64-QAM RB 100)



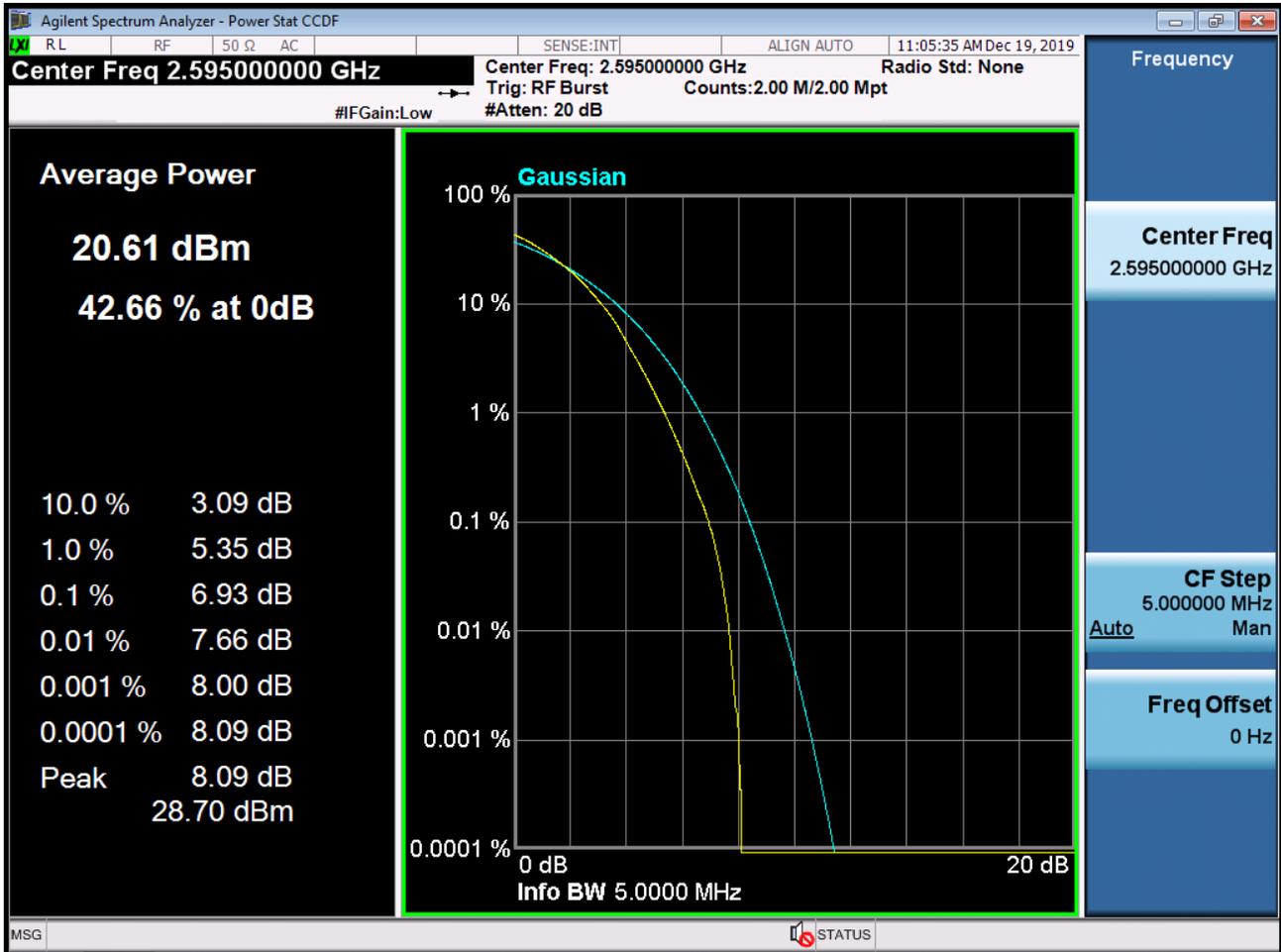
BAND 38. PAR Plot (5M BW\_Ch.38000\_QPSK\_RB25\_0)



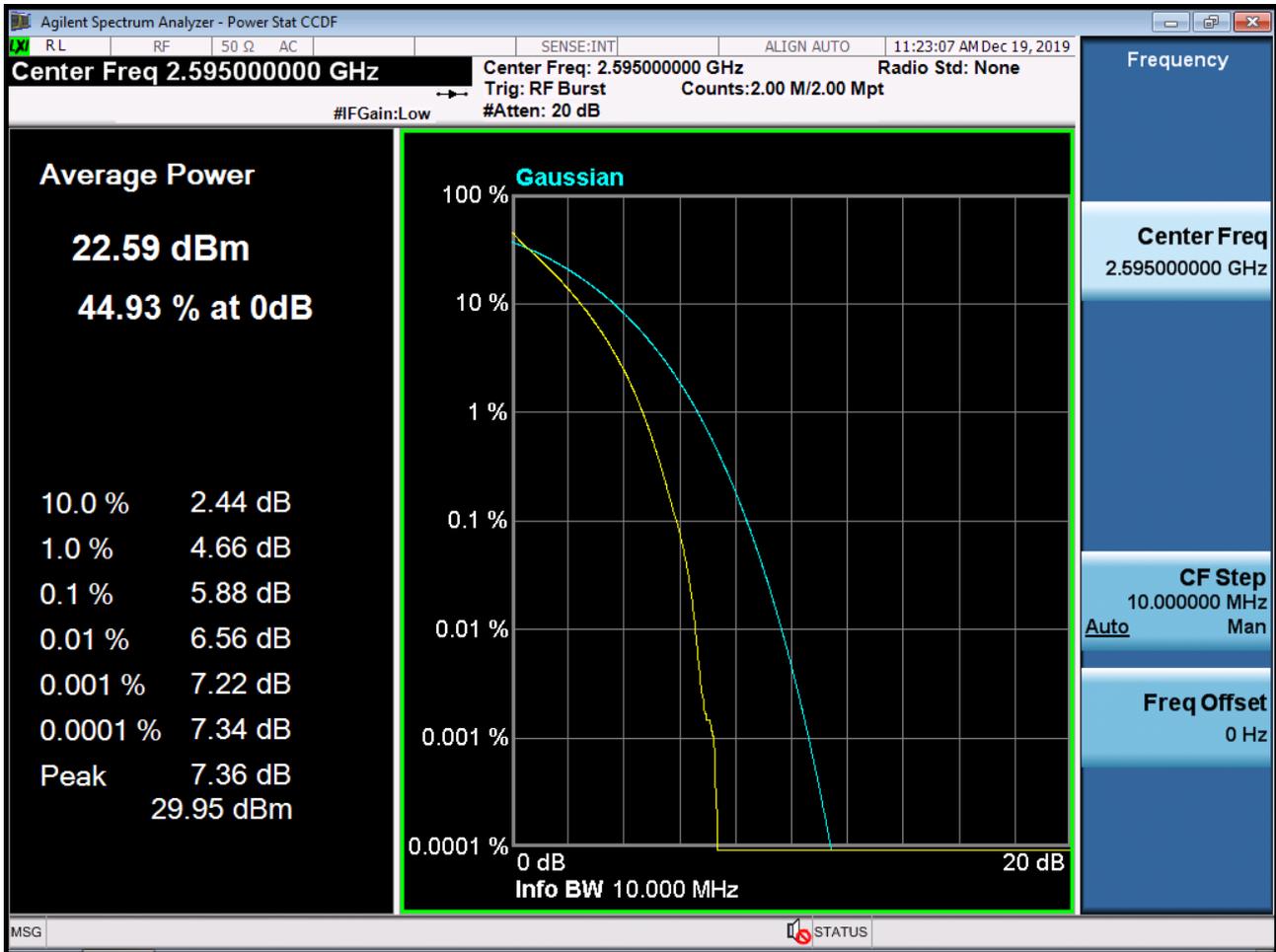
BAND 38. PAR Plot (5M BW\_Ch.38000\_16QAM\_RB25\_0)



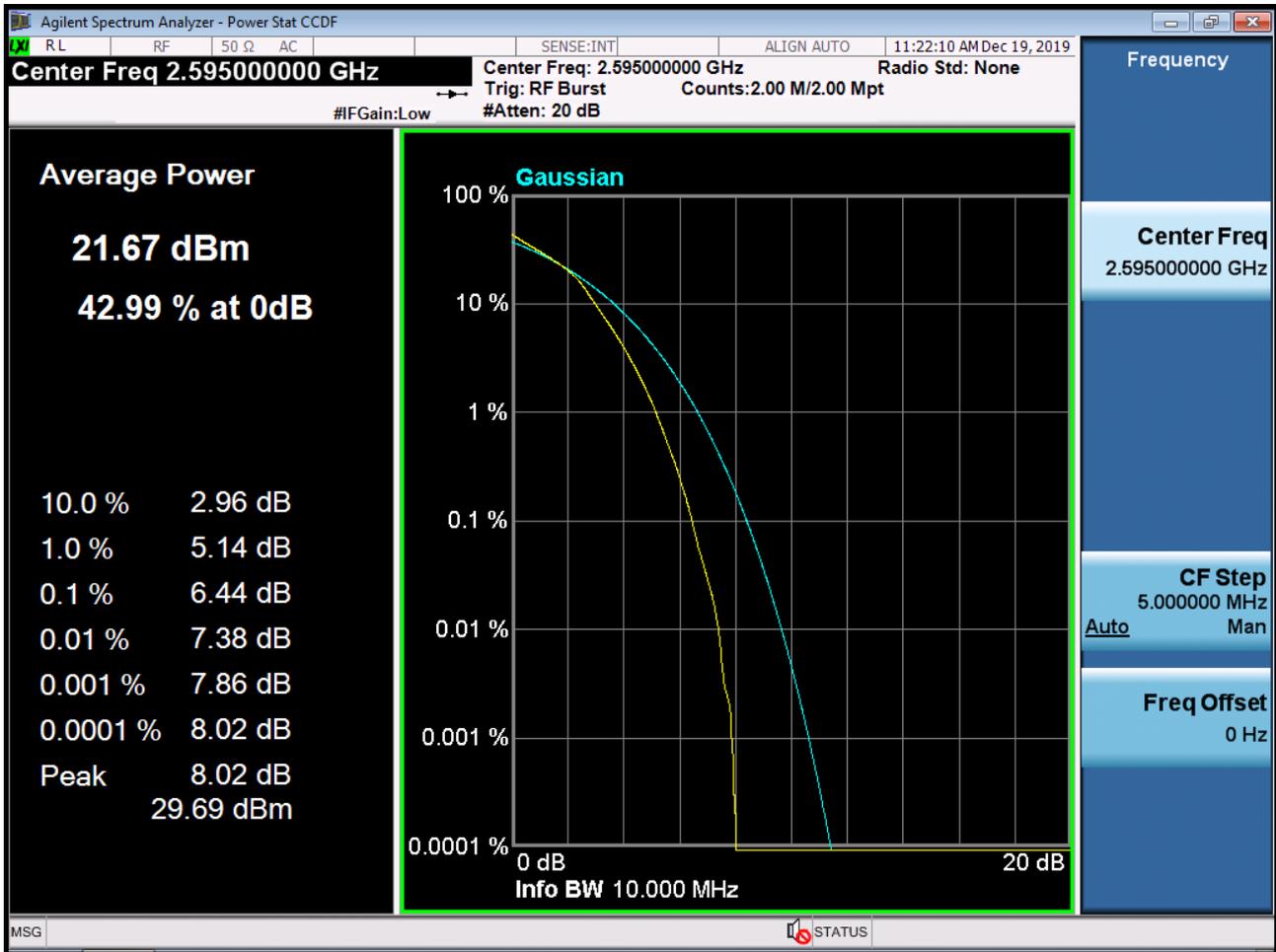
BAND 38. PAR Plot (5M BW\_Ch.38000\_64QAM\_RB25\_0)



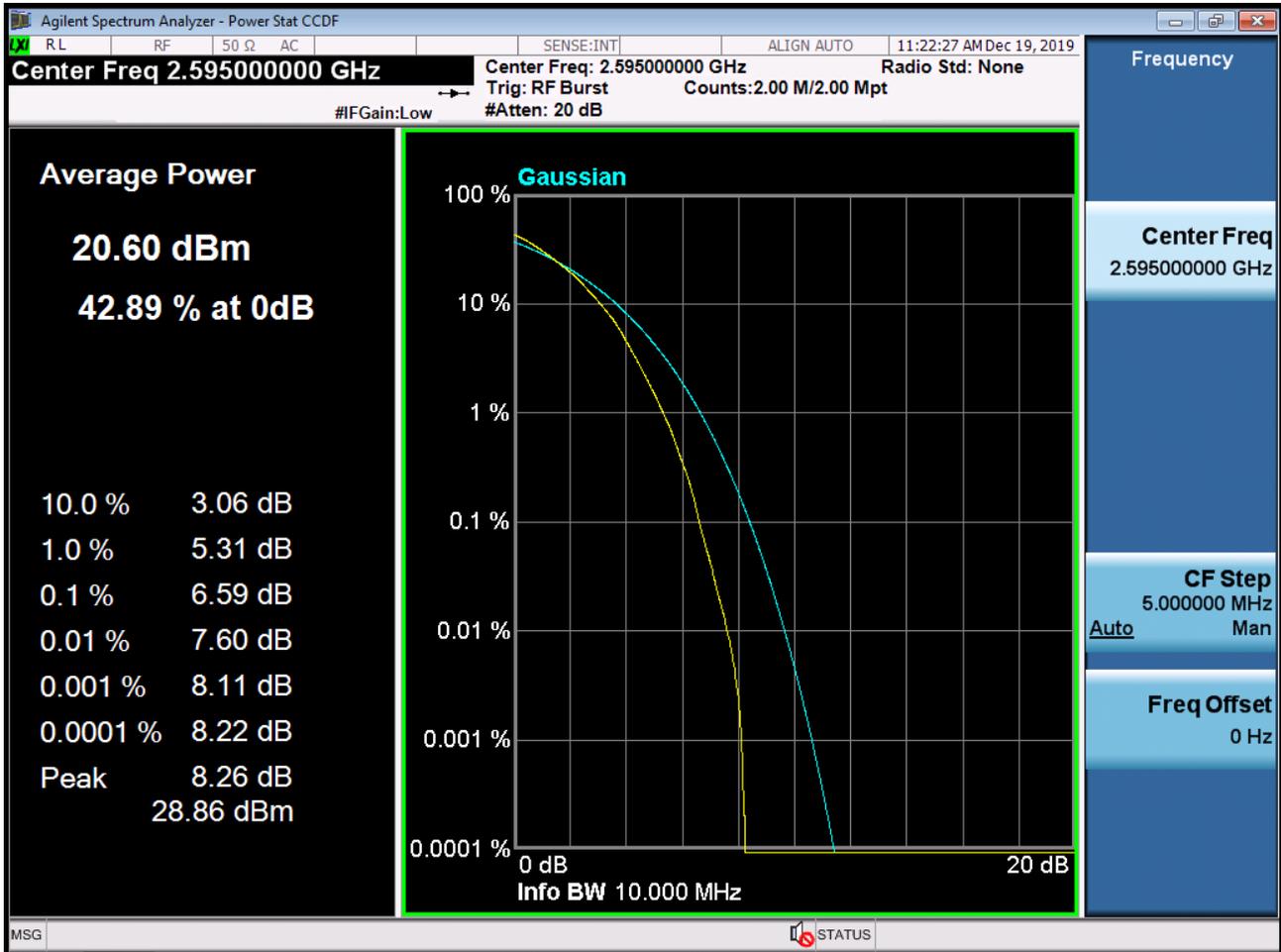
BAND 38. PAR Plot (10M BW\_Ch.38000\_QPSK\_RB50\_0)



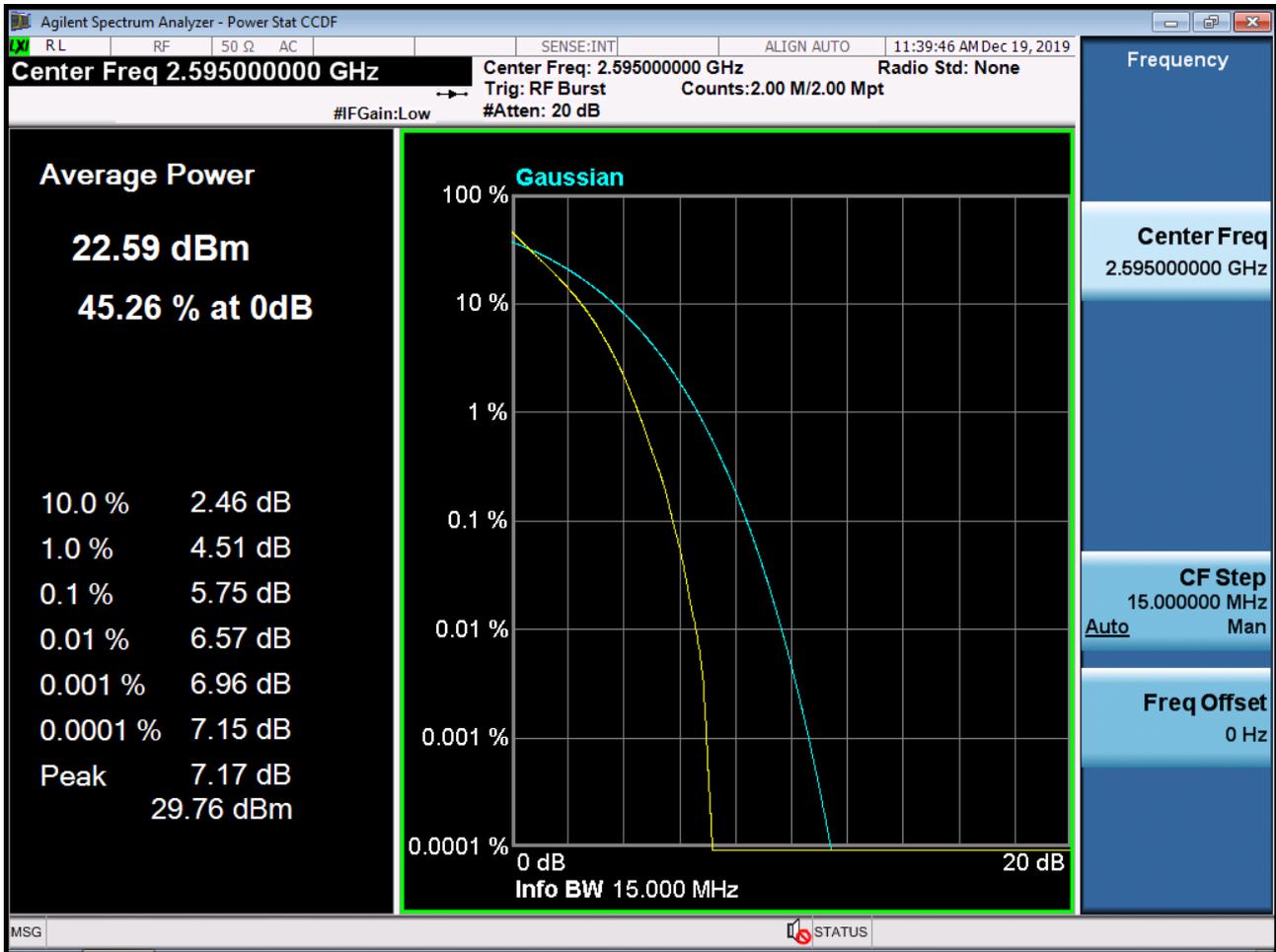
BAND 38. PAR Plot (10M BW\_Ch.38000\_16QAM\_RB50\_0)



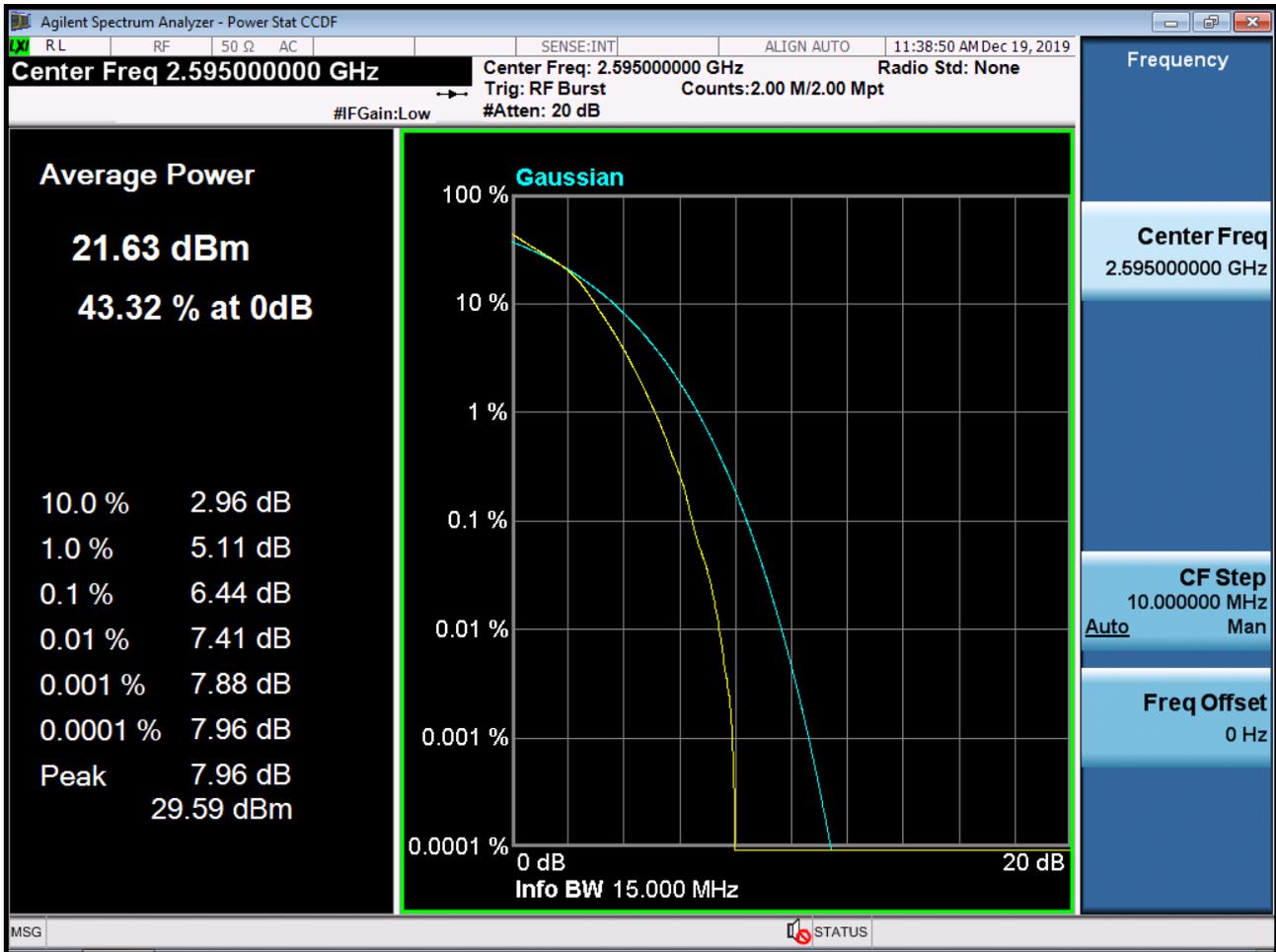
BAND 38. PAR Plot (10M BW\_Ch.38000\_64QAM\_RB50\_0)



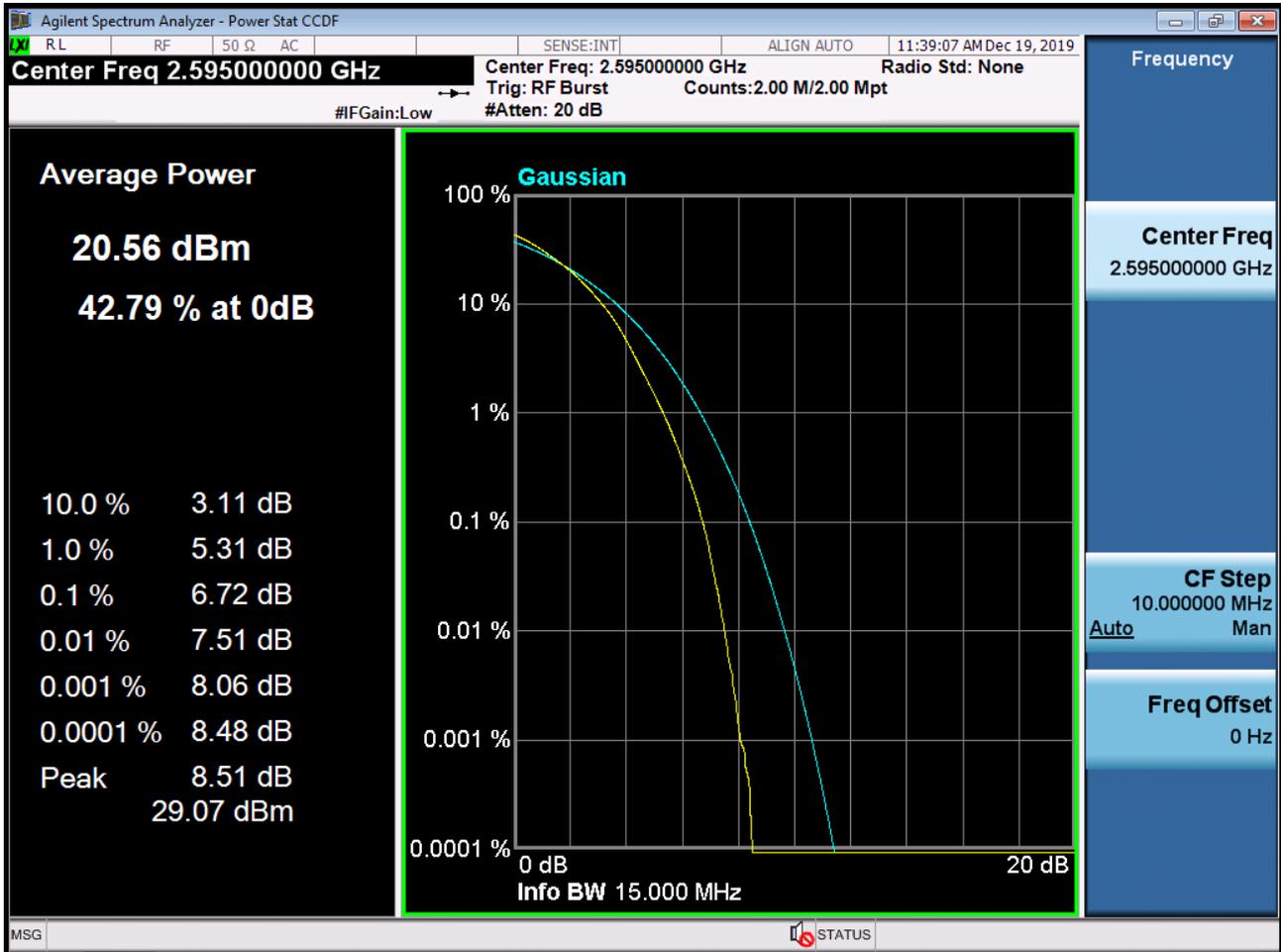
BAND 38. PAR Plot (15M BW\_Ch.38000\_QPSK\_RB75\_0)



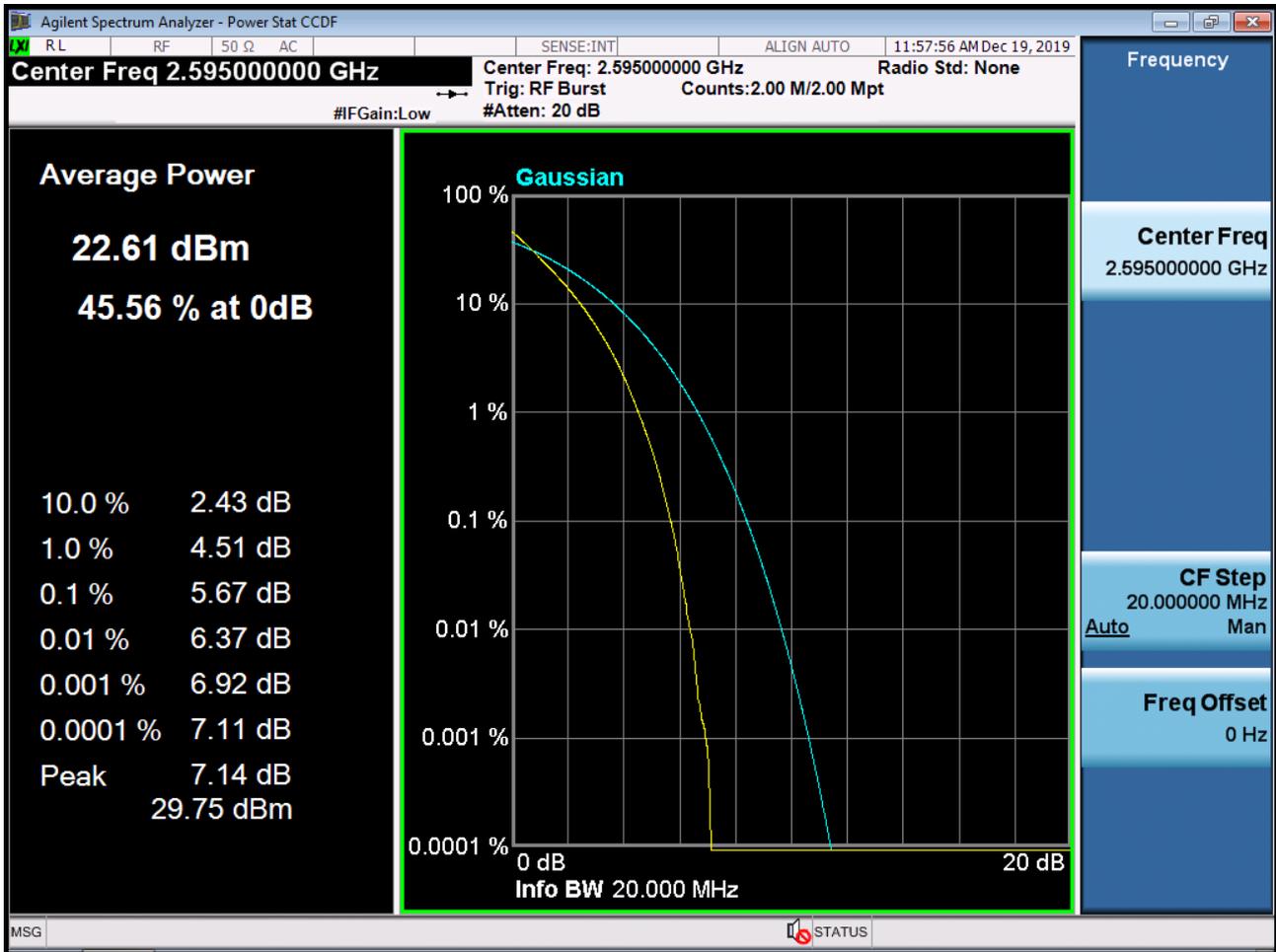
BAND 38. PAR Plot (15M BW\_Ch.38000\_16QAM\_RB75\_0)



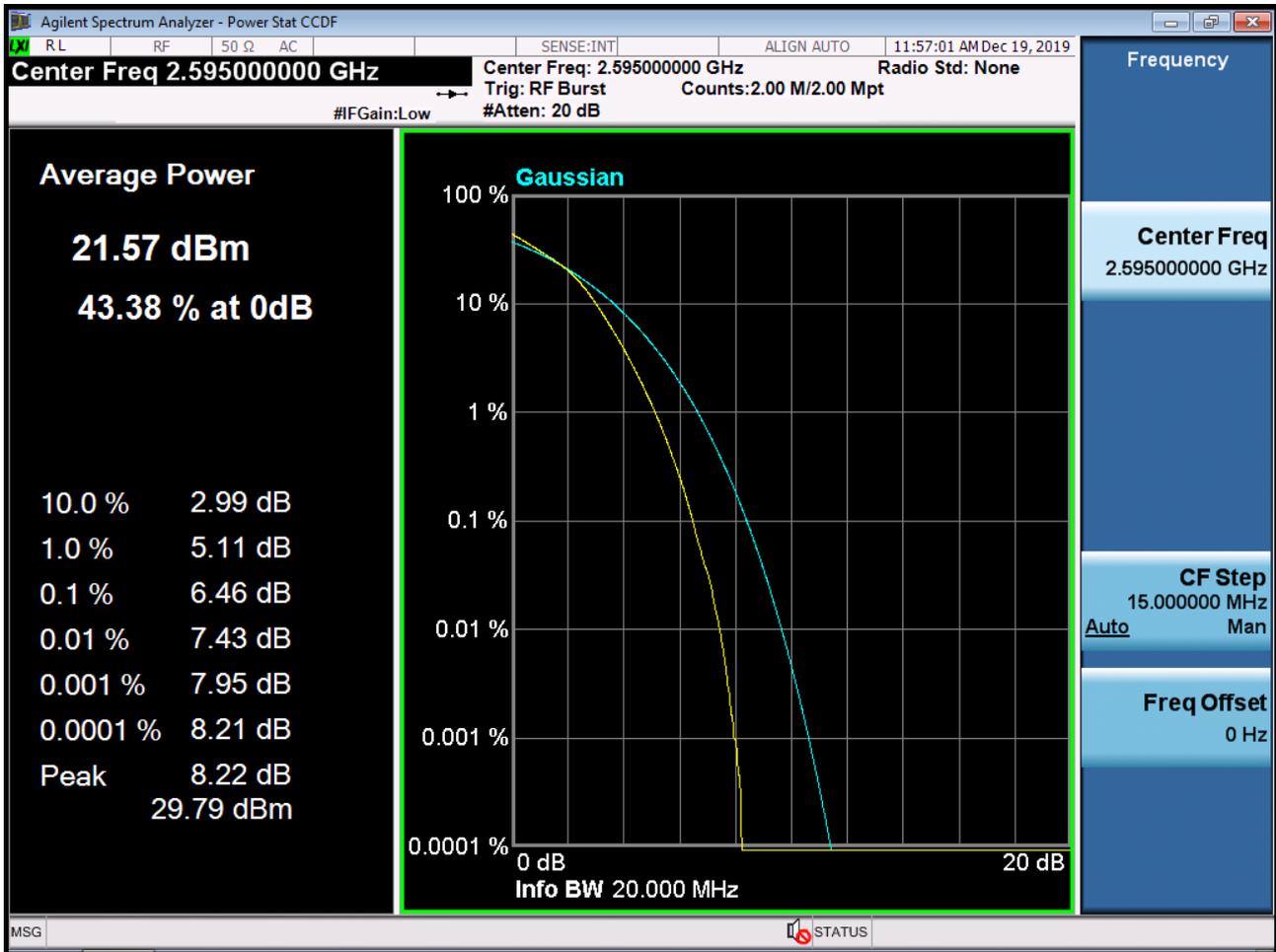
BAND 38. PAR Plot (15M BW\_Ch.38000\_64QAM\_RB75\_0)



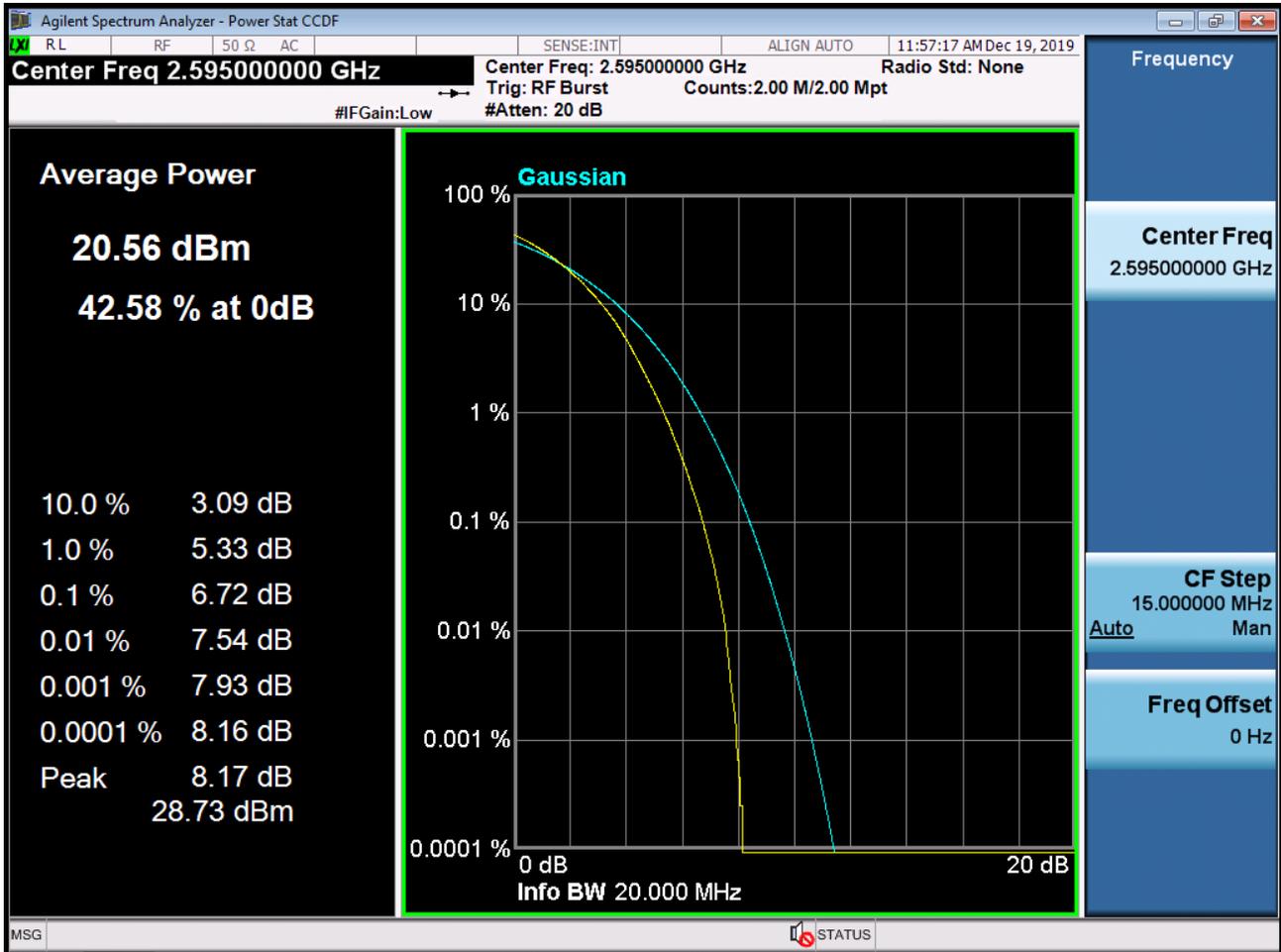
BAND 38. PAR Plot (20M BW\_Ch.38000\_QPSK\_RB100\_0)



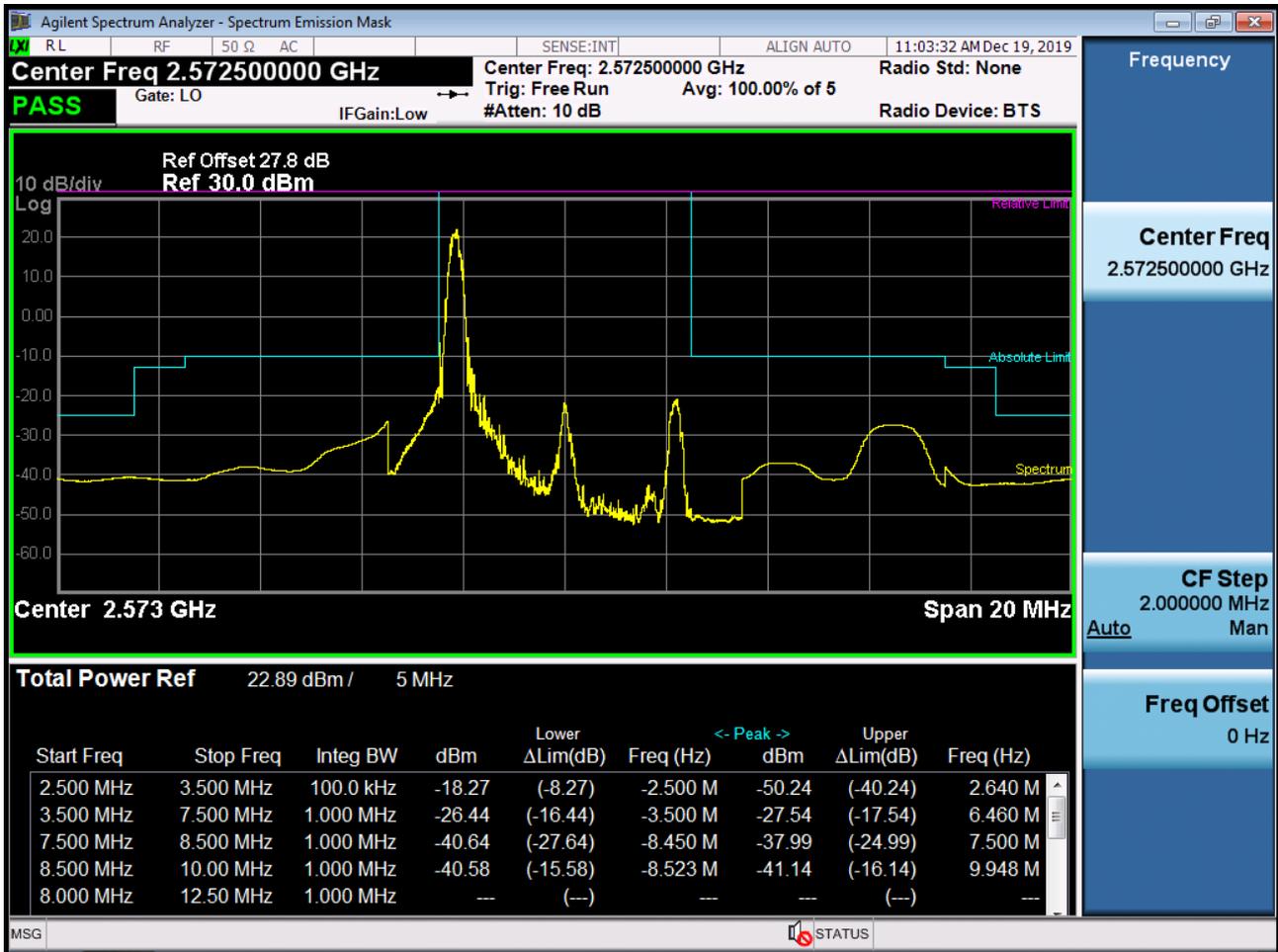
BAND 38. PAR Plot (20M BW\_Ch.38000\_16QAM\_RB100\_0)



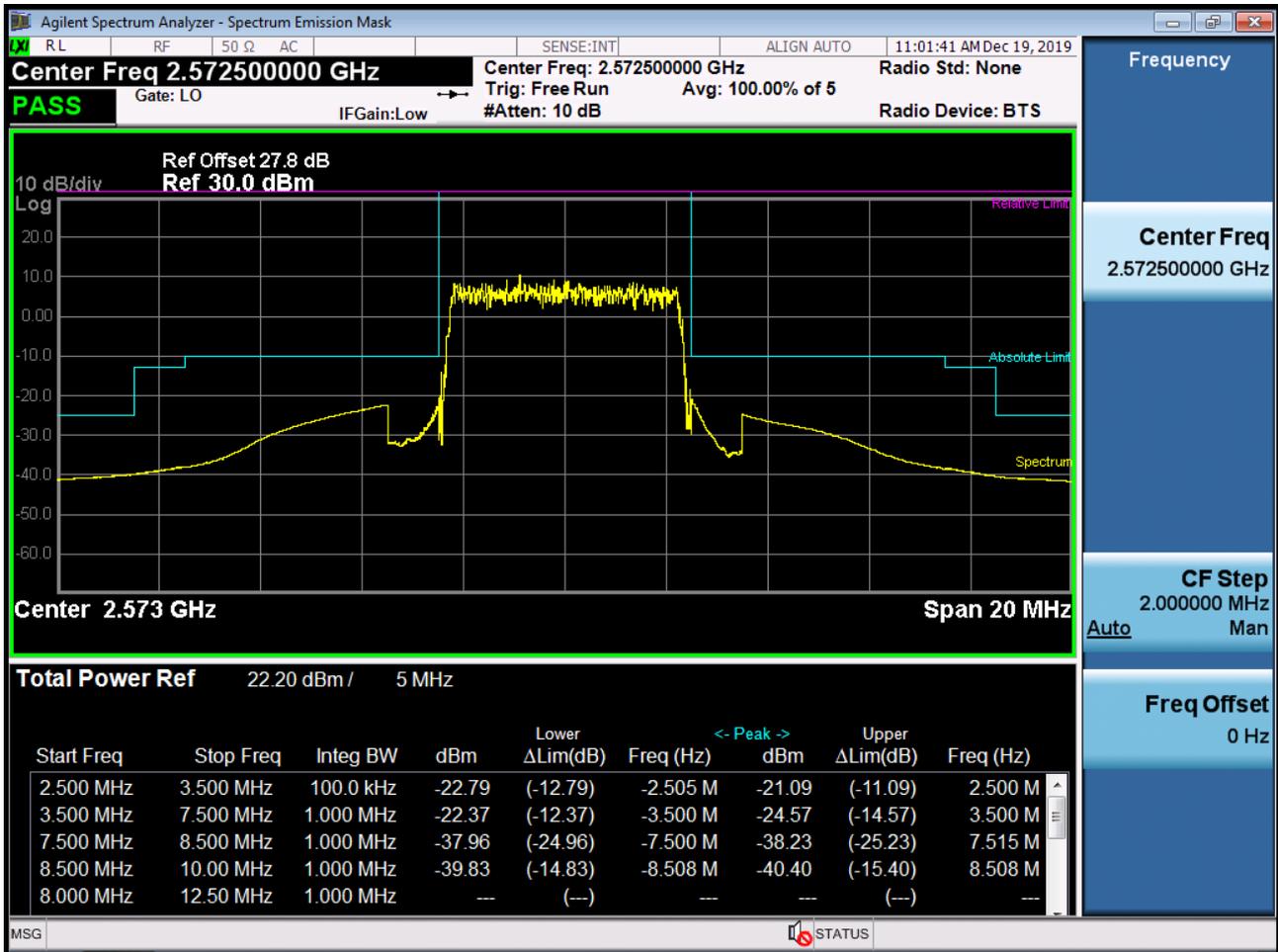
BAND 38. PAR Plot (20M BW\_Ch.38000\_64QAM\_RB100\_0)



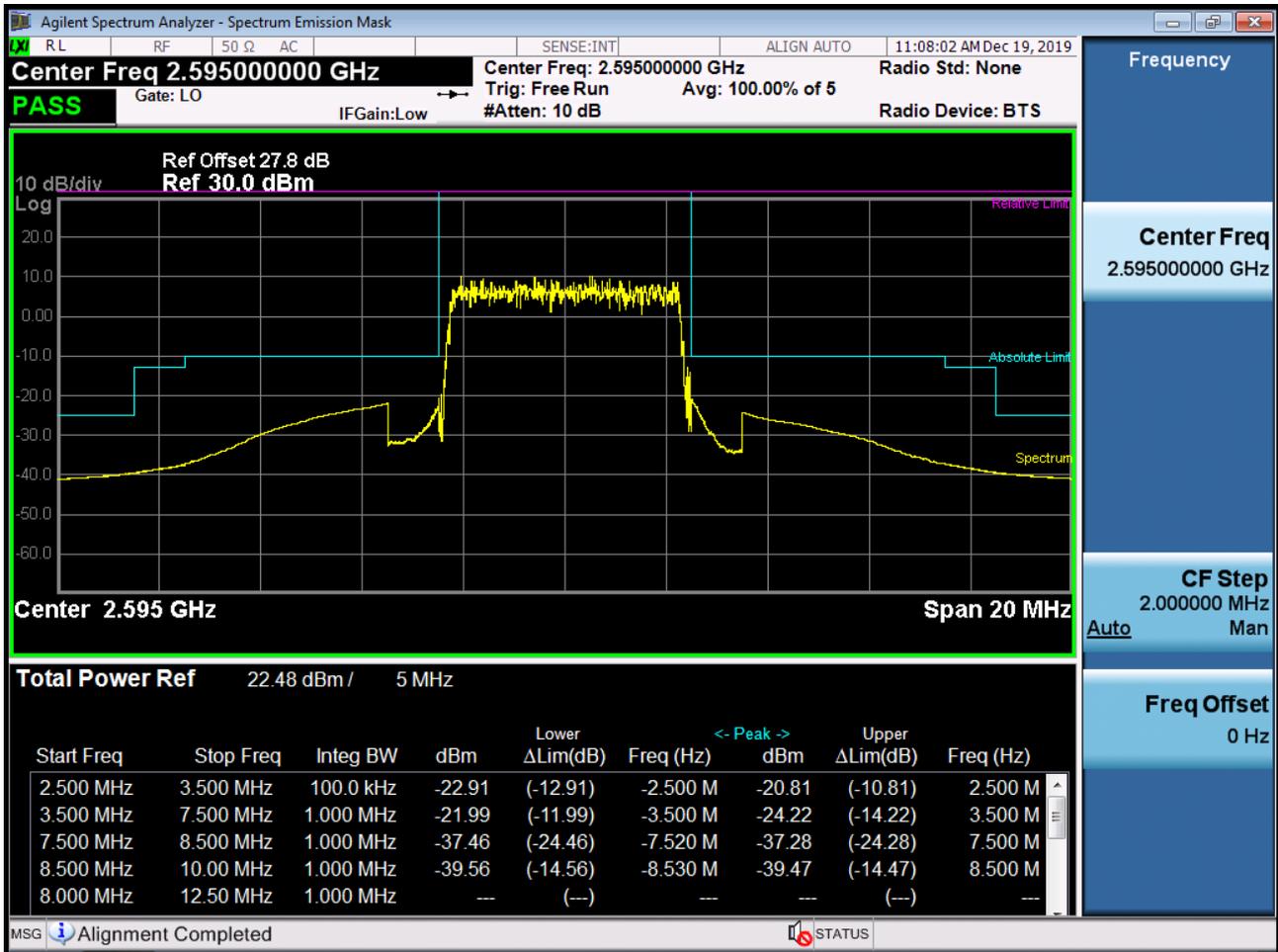
BAND 38. Low Channel Edge Plot (5 MHz Ch.37775 QPSK RB 1, Offset 0)



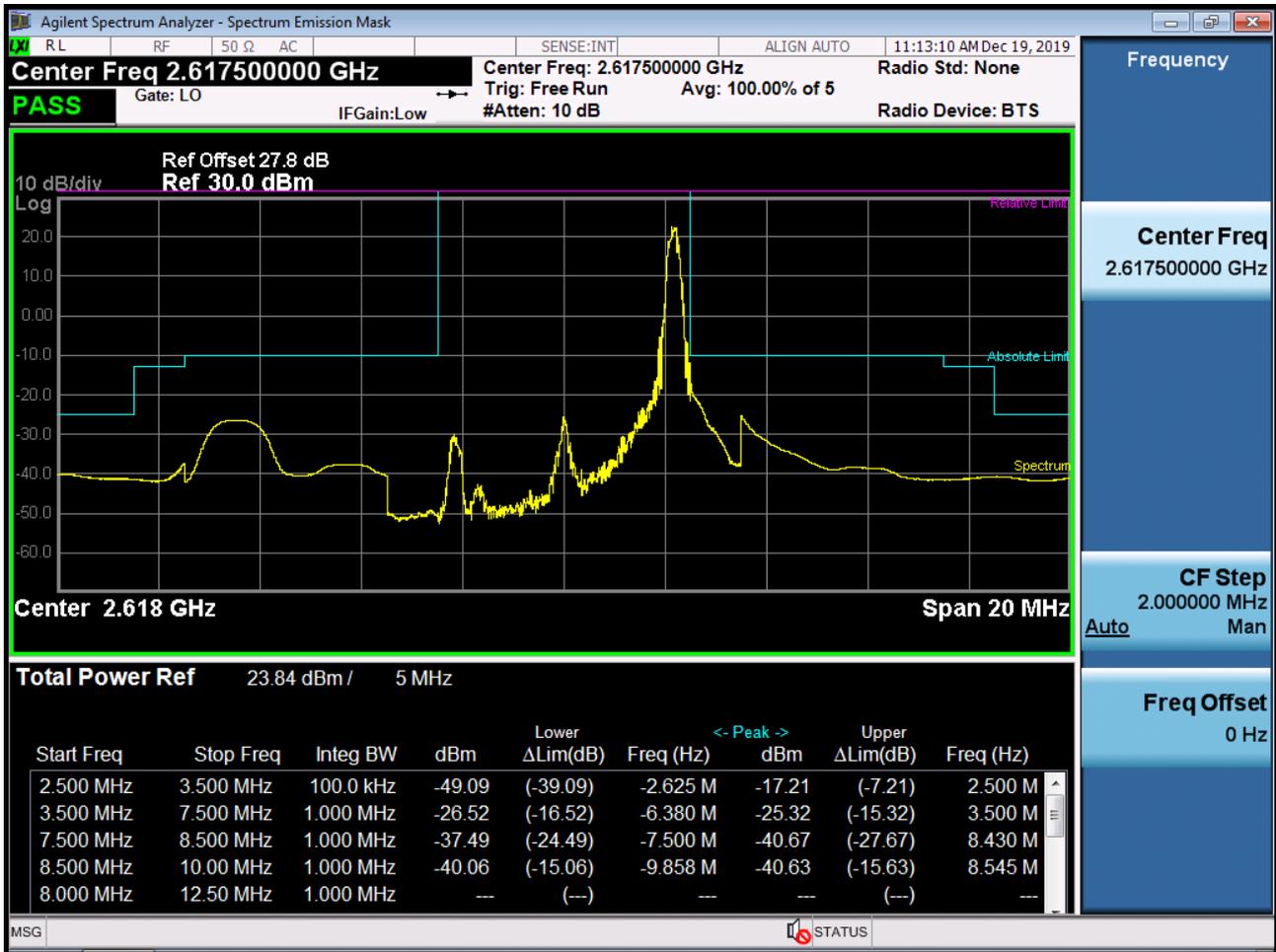
BAND 38. Low Channel Edge Plot (5 MHz Ch.37775 QPSK RB 25, Offset 0)



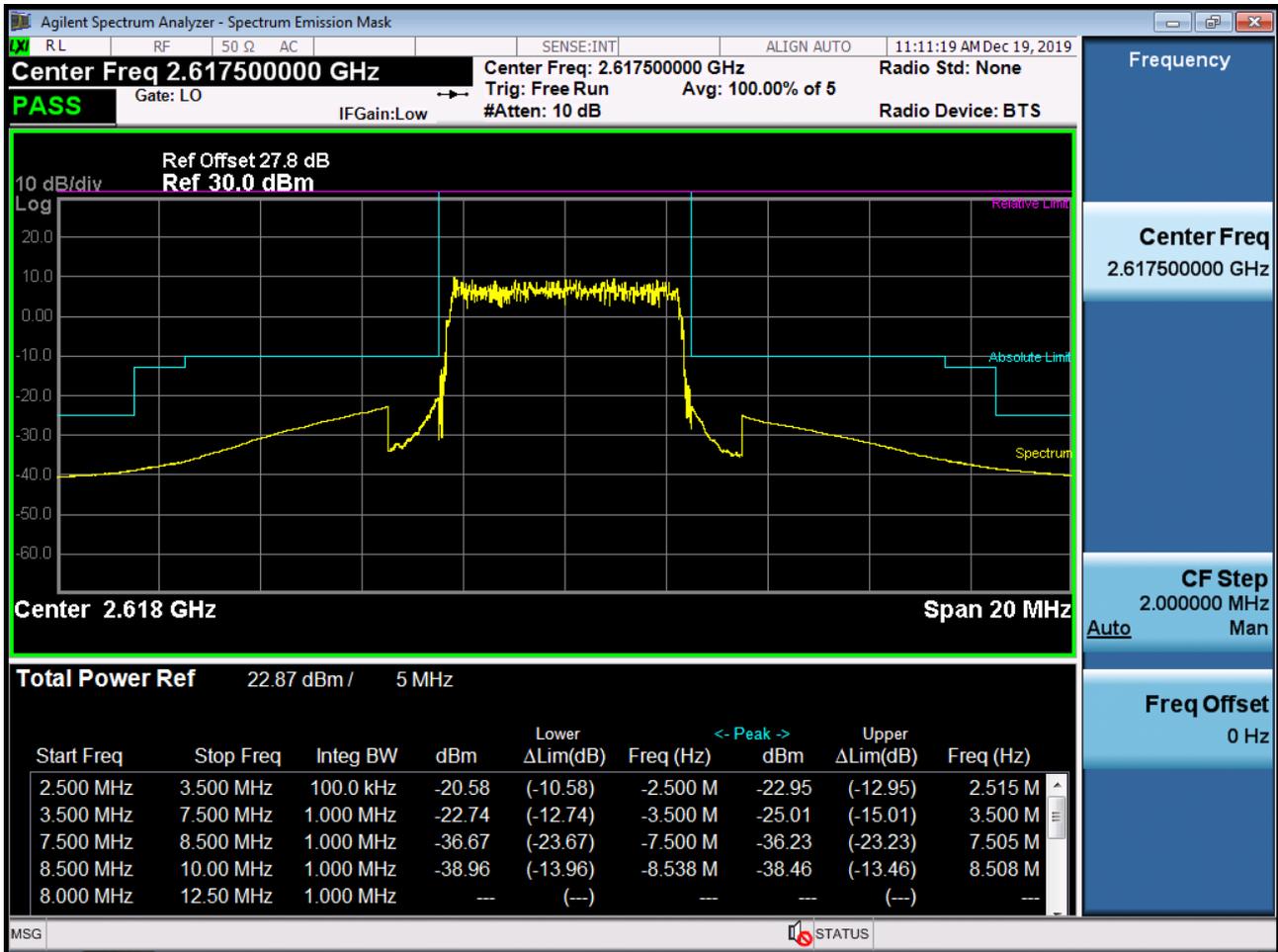
BAND 38. Mid Channel Edge Plot (5 MHz Ch.38000 QPSK RB 25)



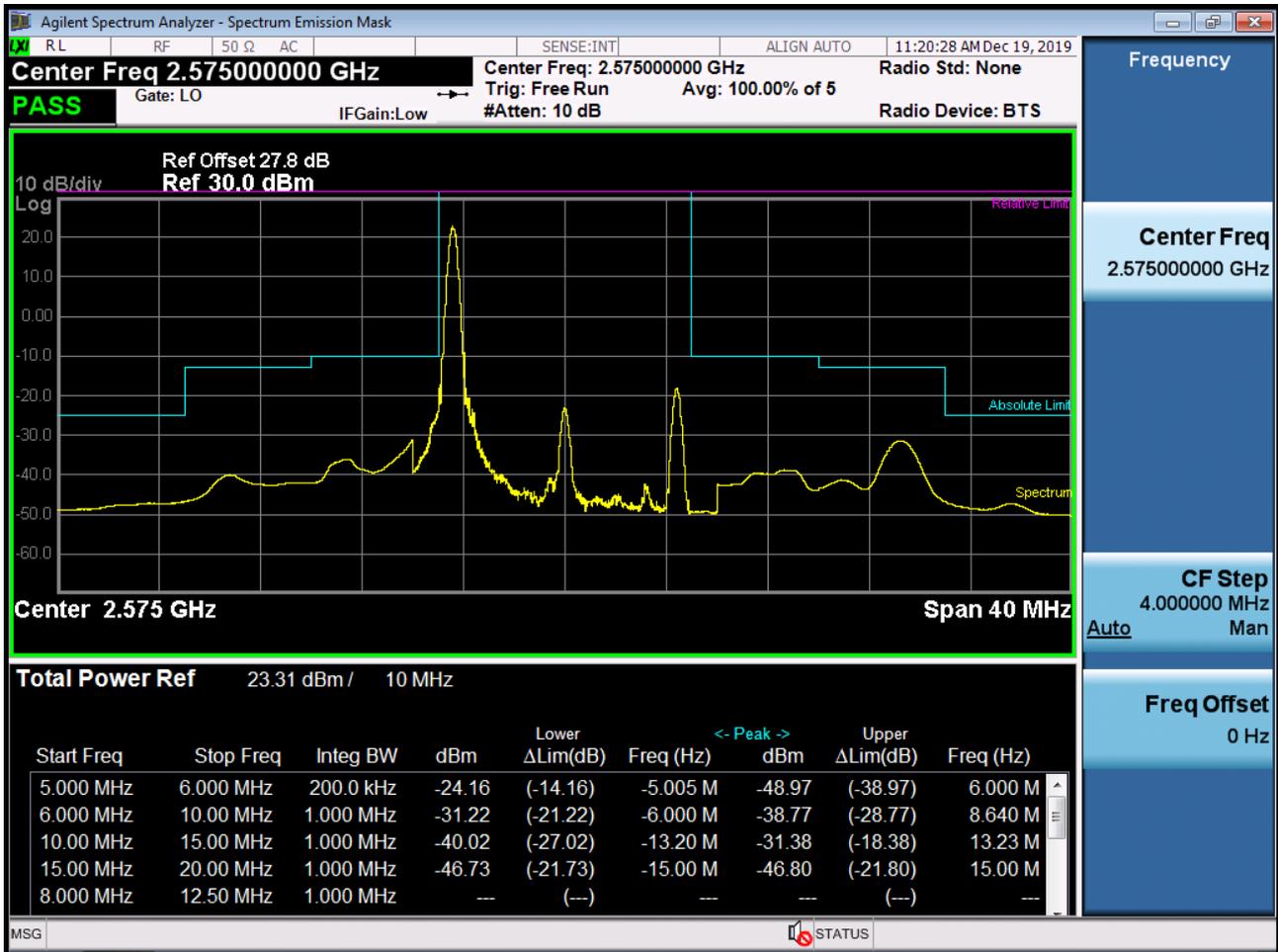
BAND 38. High Channel Edge Plot (5 MHz Ch.38225 QPSK RB 1, Offset 0)



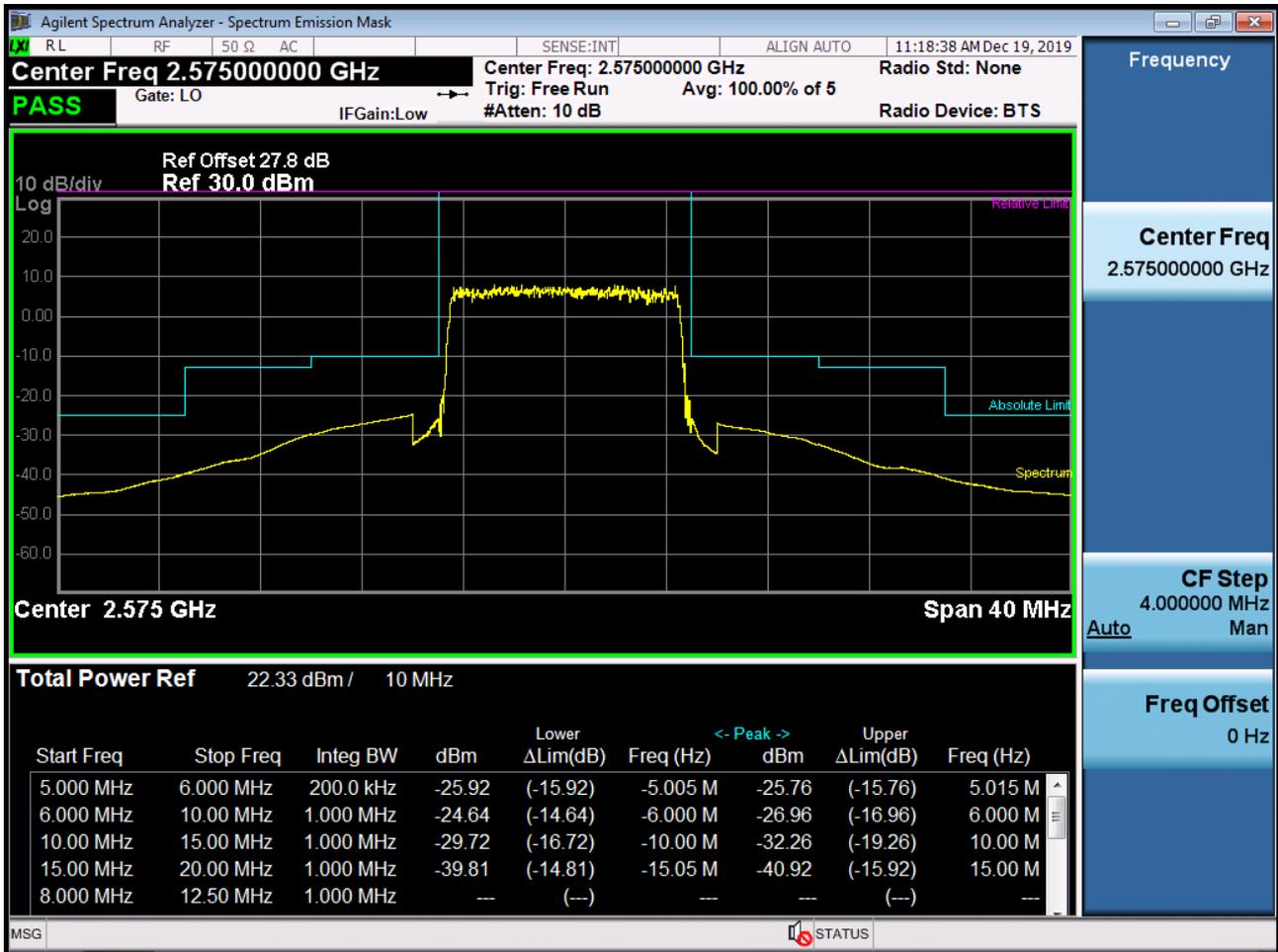
BAND 38. High Channel Edge Plot (5 MHz Ch.38225 QPSK\_RB25\_Offset 0)



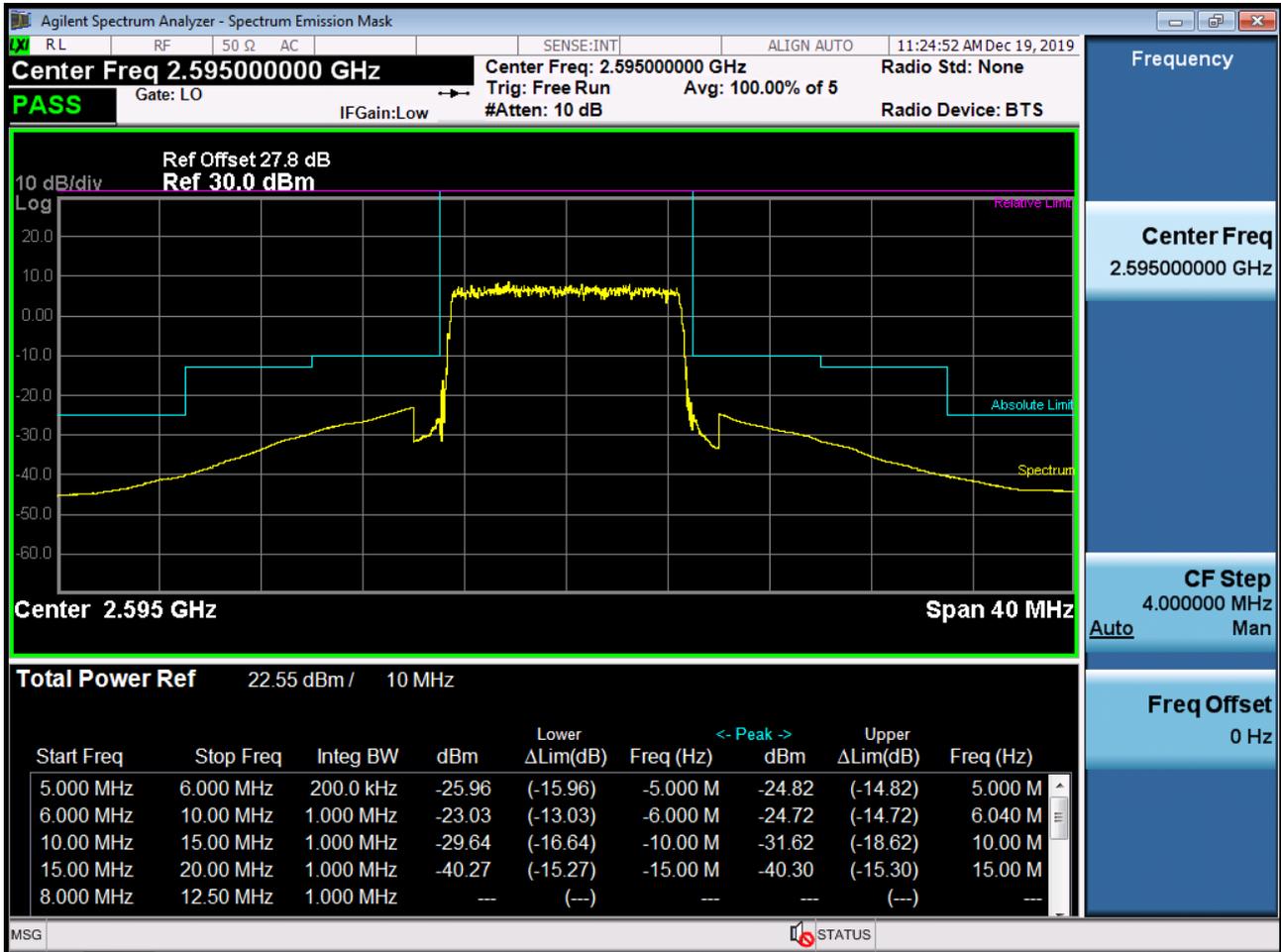
BAND 38. Low Channel Edge Plot (10 MHz Ch.37800 QPSK RB 1, Offset 0)



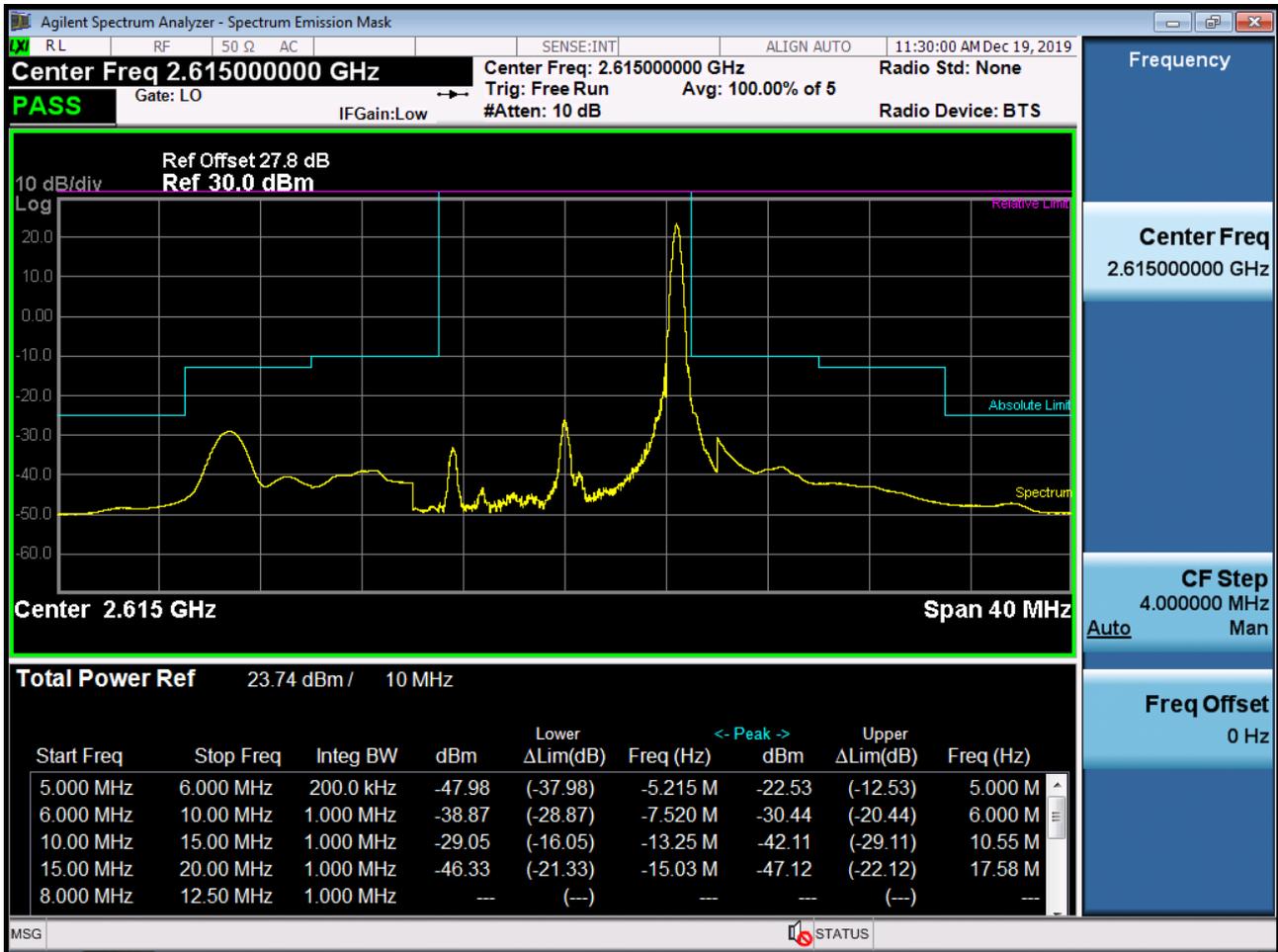
BAND 38. Low Channel Edge Plot (10 MHz Ch.37800 QPSK RB 25, Offset 0)



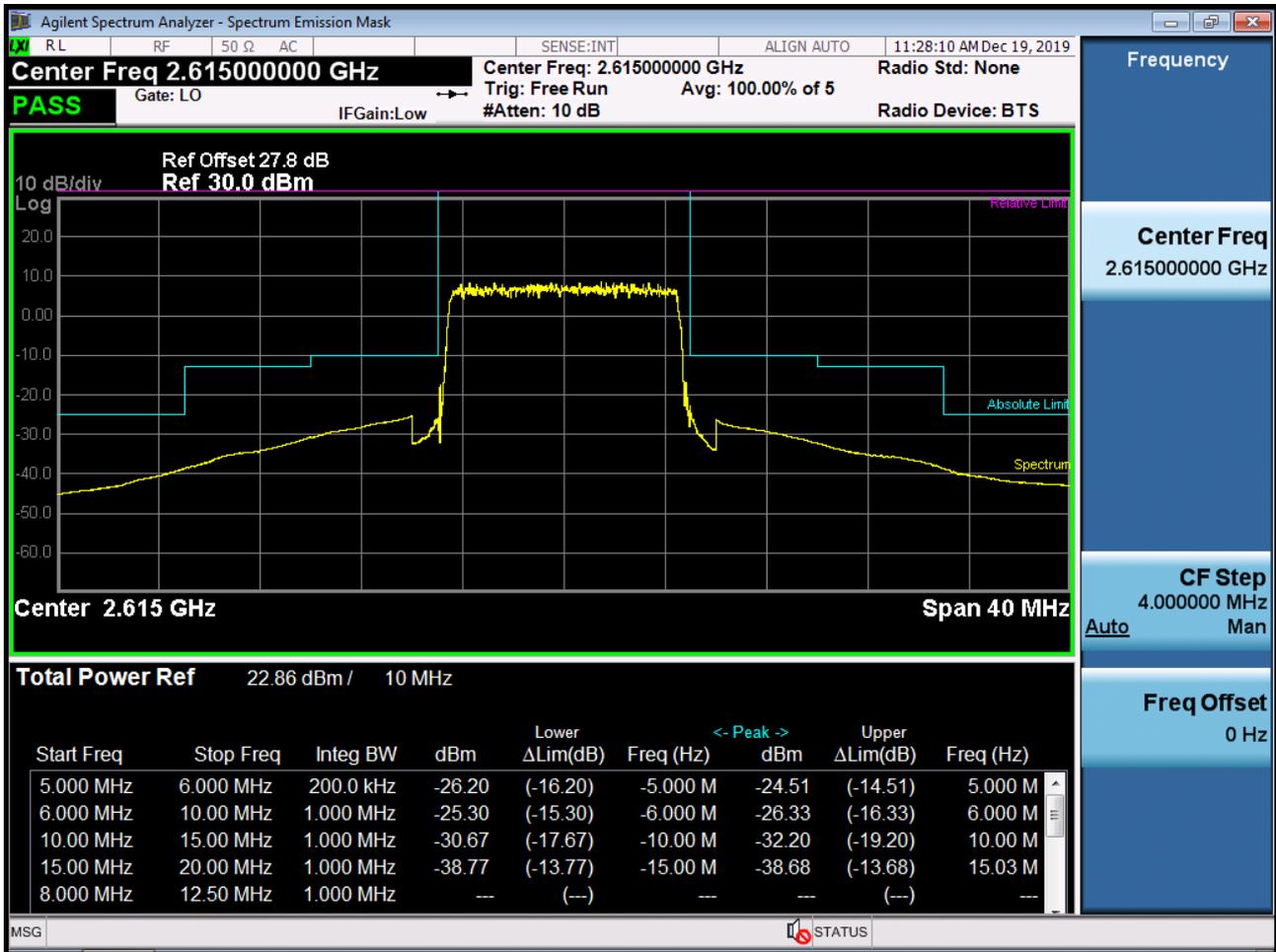
BAND 38. Mid Channel Edge Plot (10 MHz Ch.38000 QPSK RB 50)



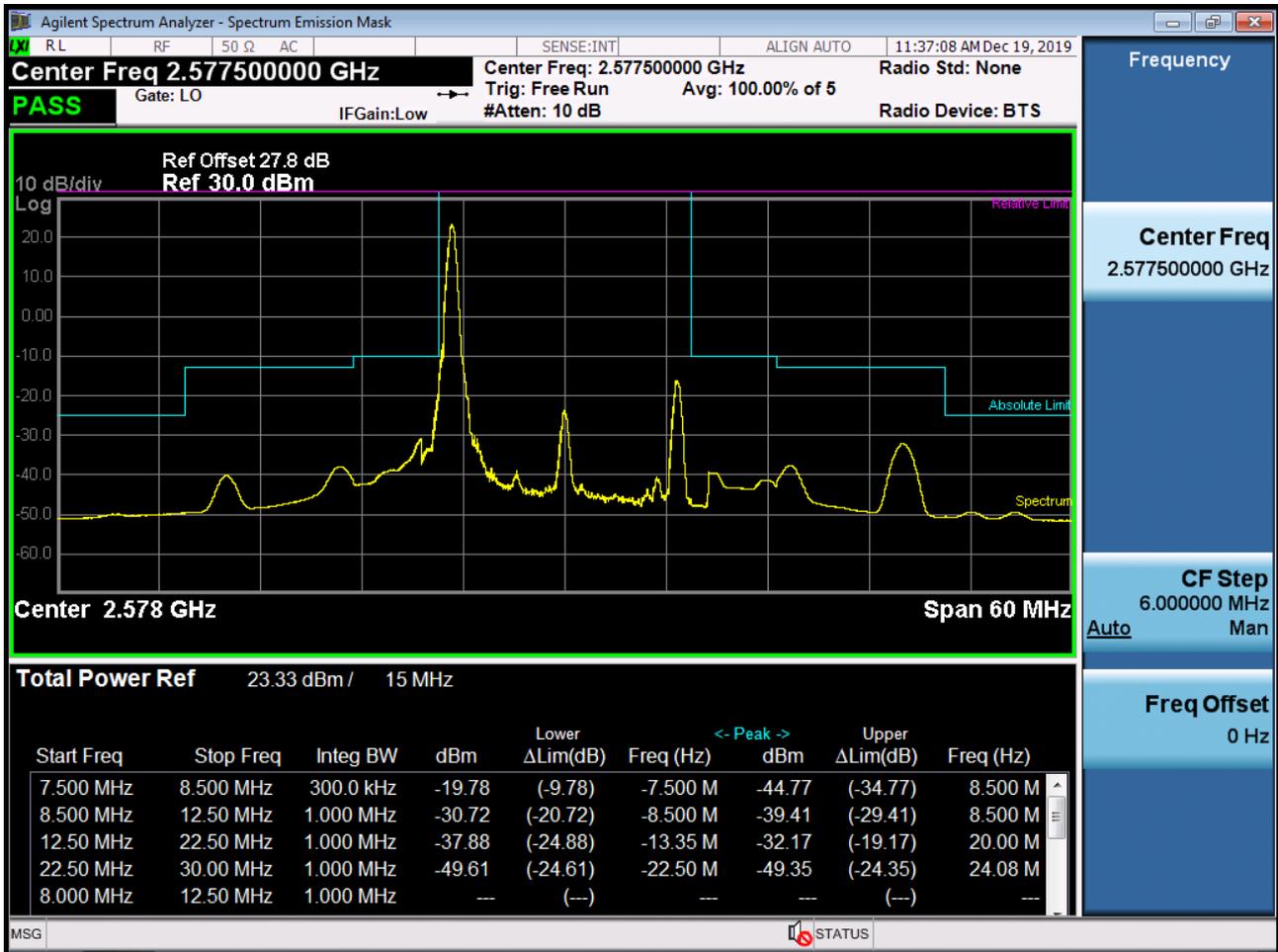
BAND 38. High Channel Edge Plot (10 MHz Ch.38200 QPSK RB 1, Offset 0)



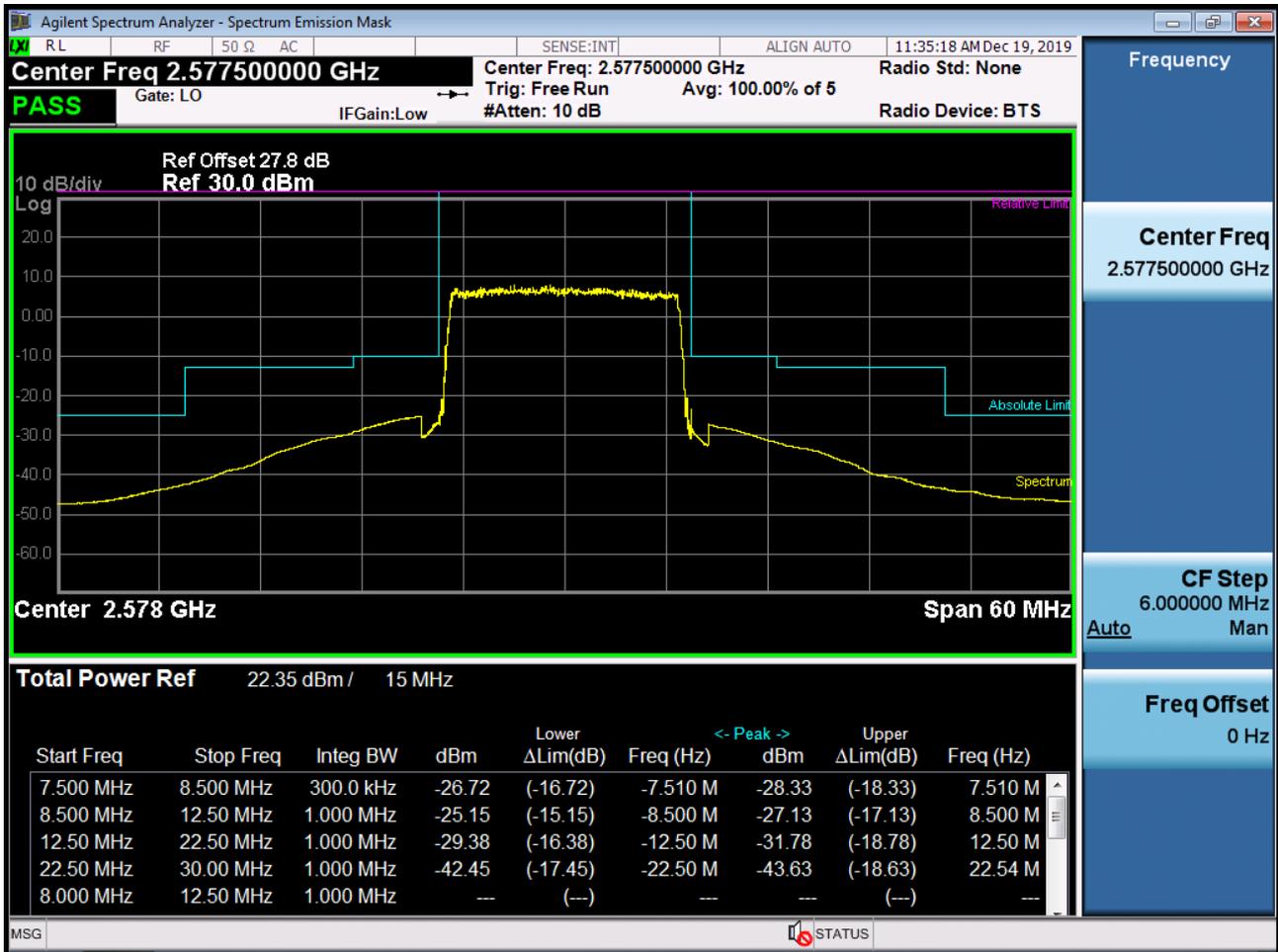
BAND 38. High Channel Edge Plot (10 MHz Ch.38200 QPSK\_RB50\_Offset 0)



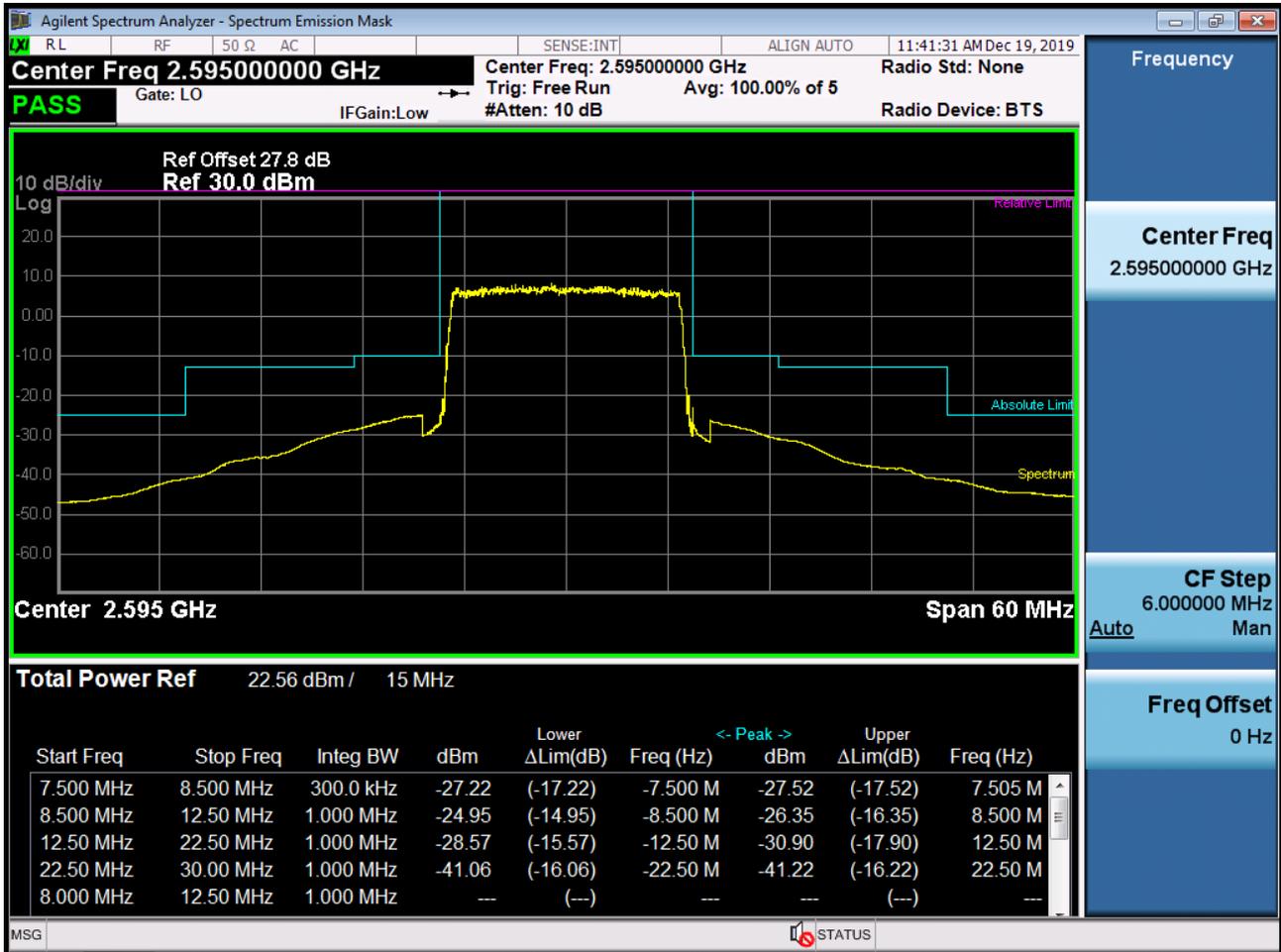
BAND 38. Low Channel Edge Plot (15 MHz Ch.37825 QPSK RB 1, Offset 0)



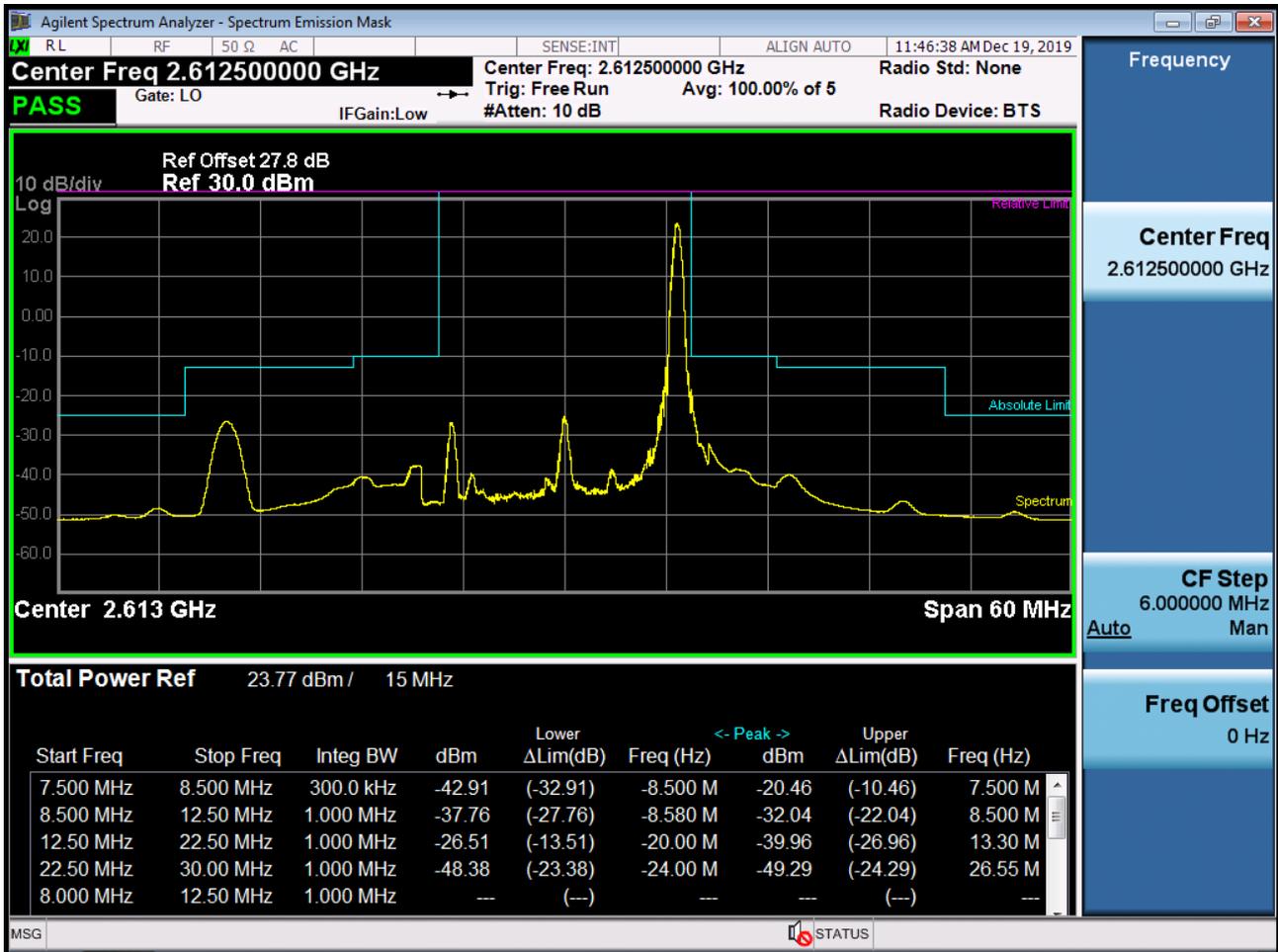
BAND 38. Low Channel Edge Plot (15 MHz Ch.37825 QPSK RB 75, Offset 0)



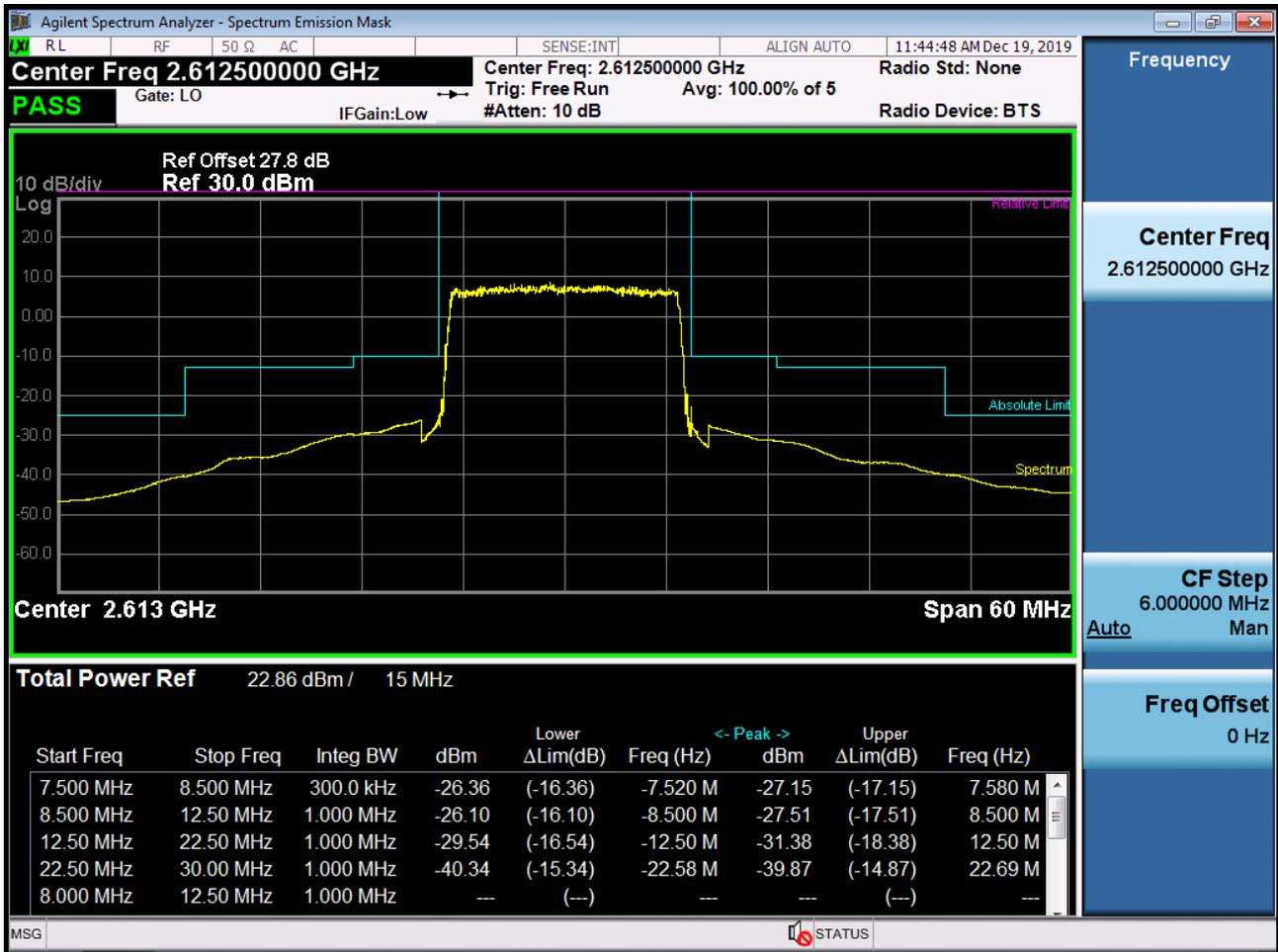
BAND 38. Mid Channel Edge Plot (15 MHz Ch.38000 QPSK RB 75)



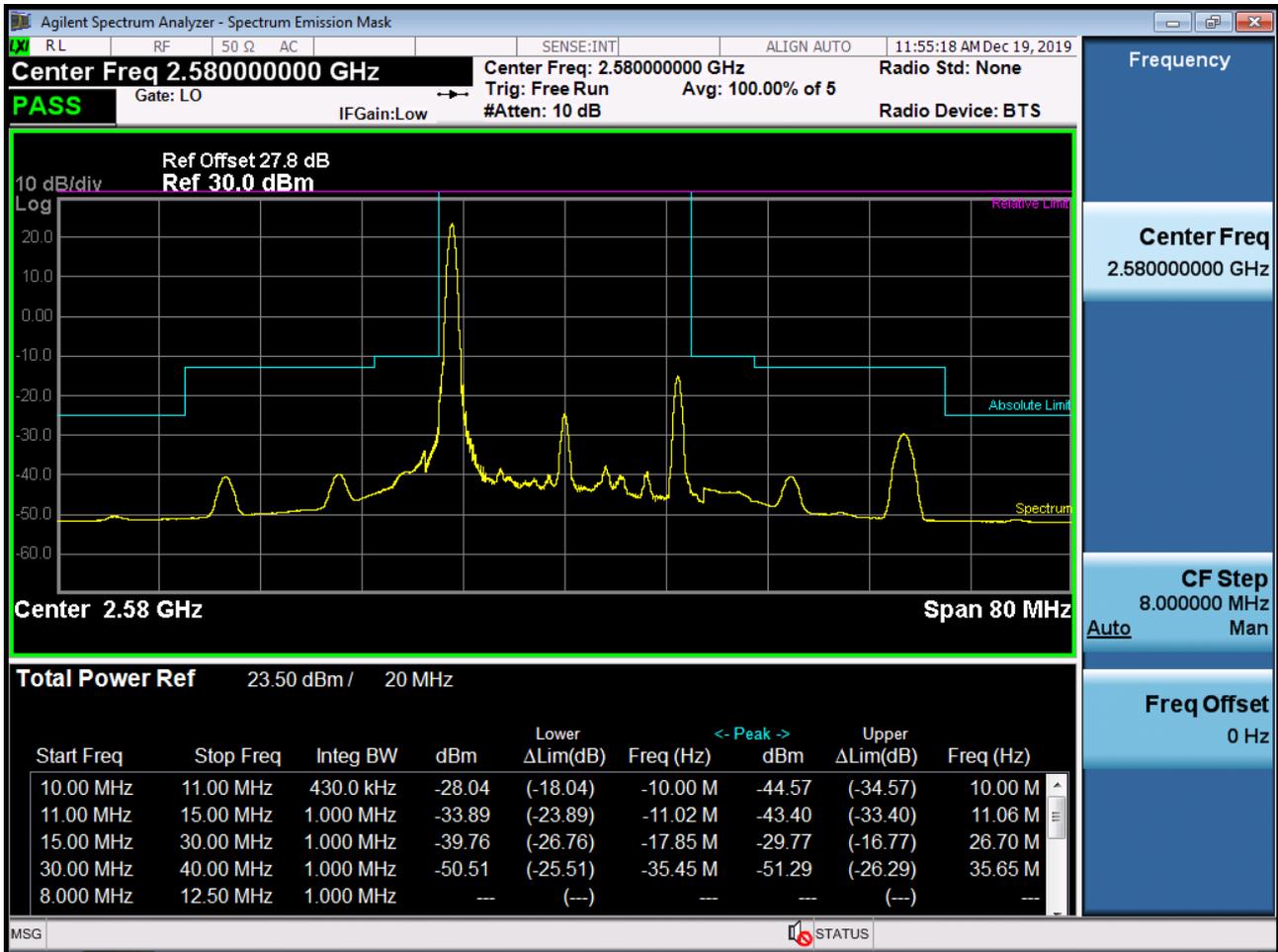
BAND 38. High Channel Edge Plot (15 MHz Ch.38175 QPSK RB 1, Offset 0)



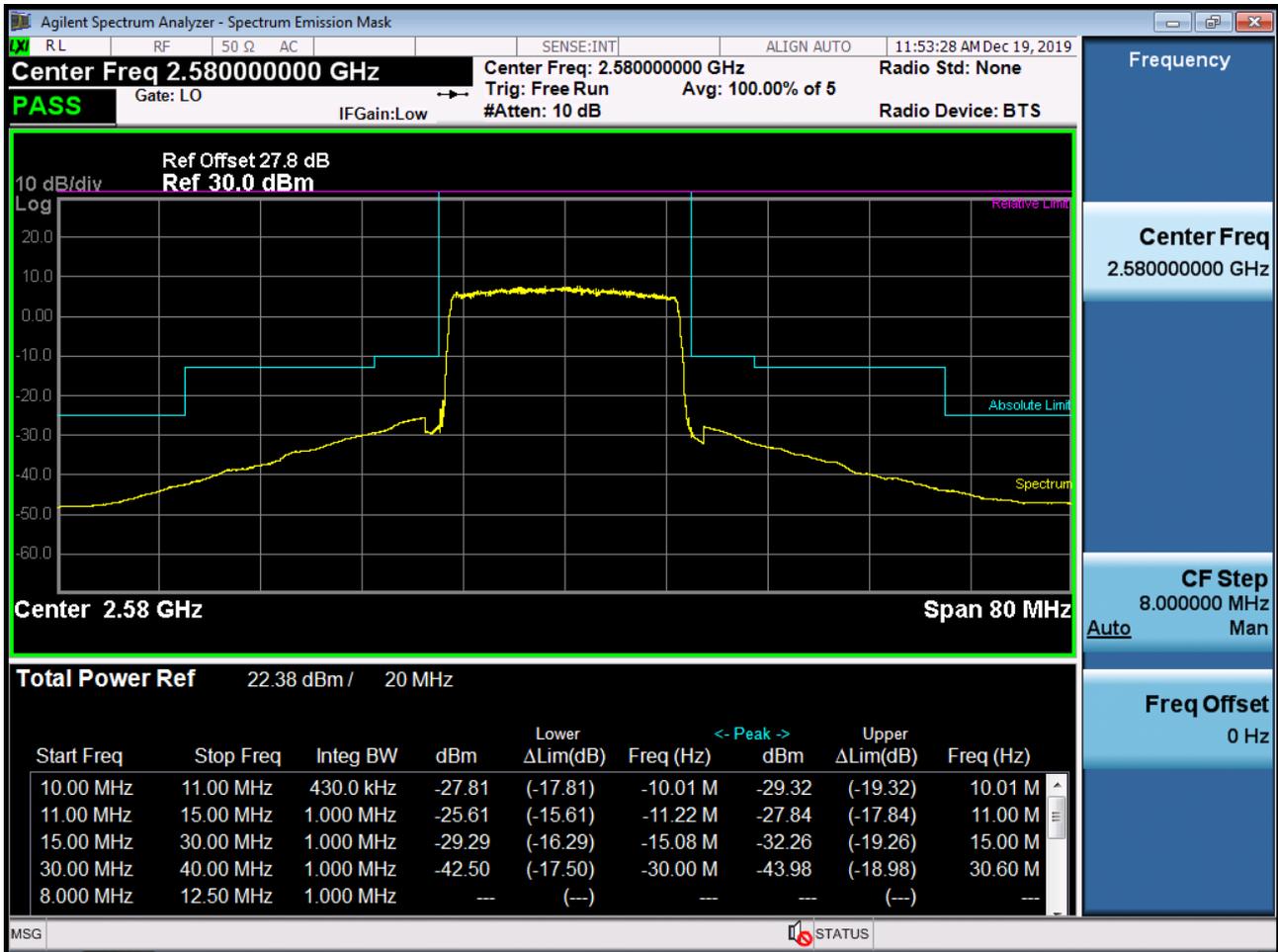
BAND 38. High Channel Edge Plot (15 MHz Ch.38175 QPSK\_RB75\_Offset 0)



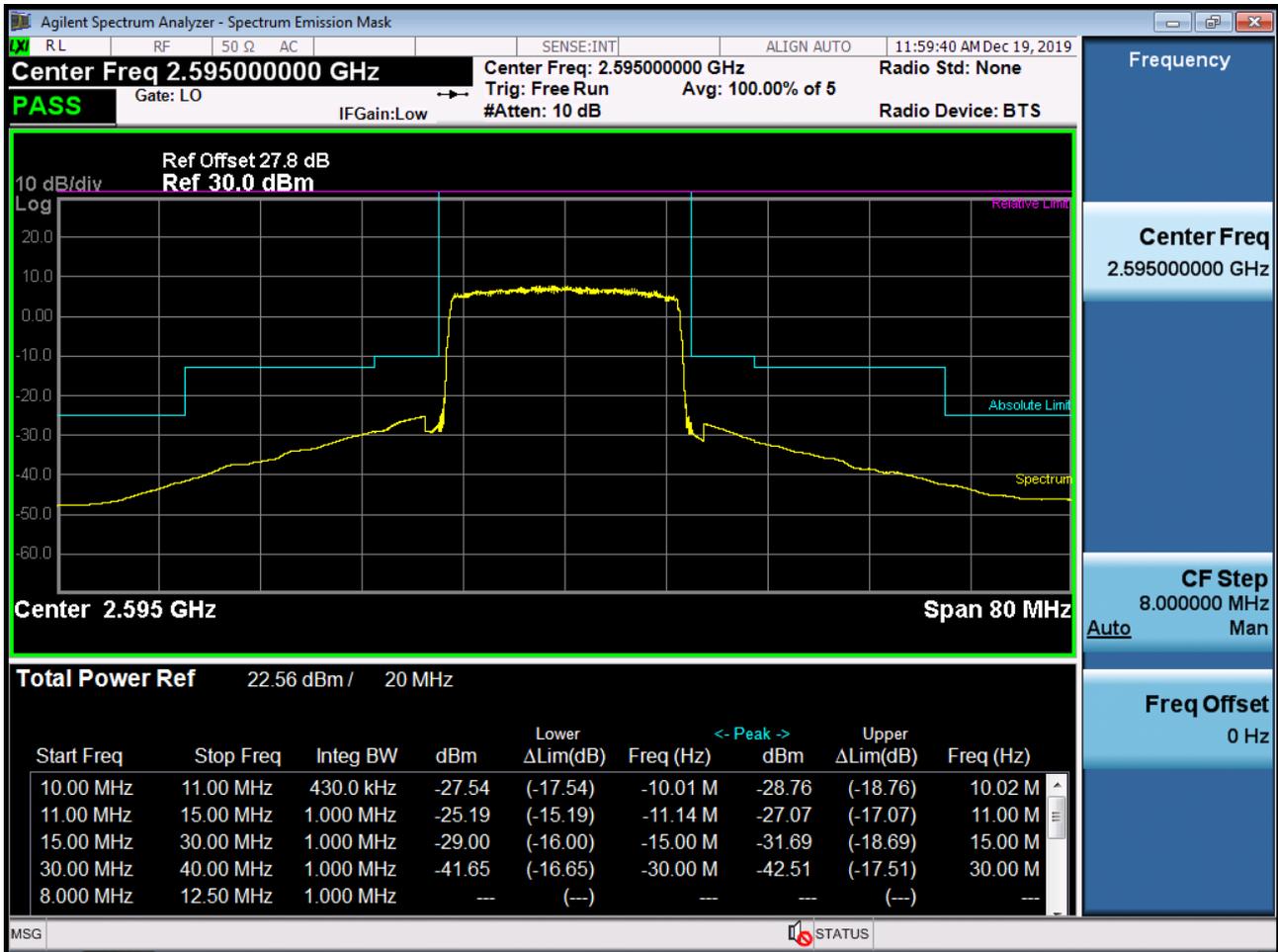
BAND 38. Low Channel Edge Plot (20 MHz Ch.37850 QPSK RB 1, Offset 0)



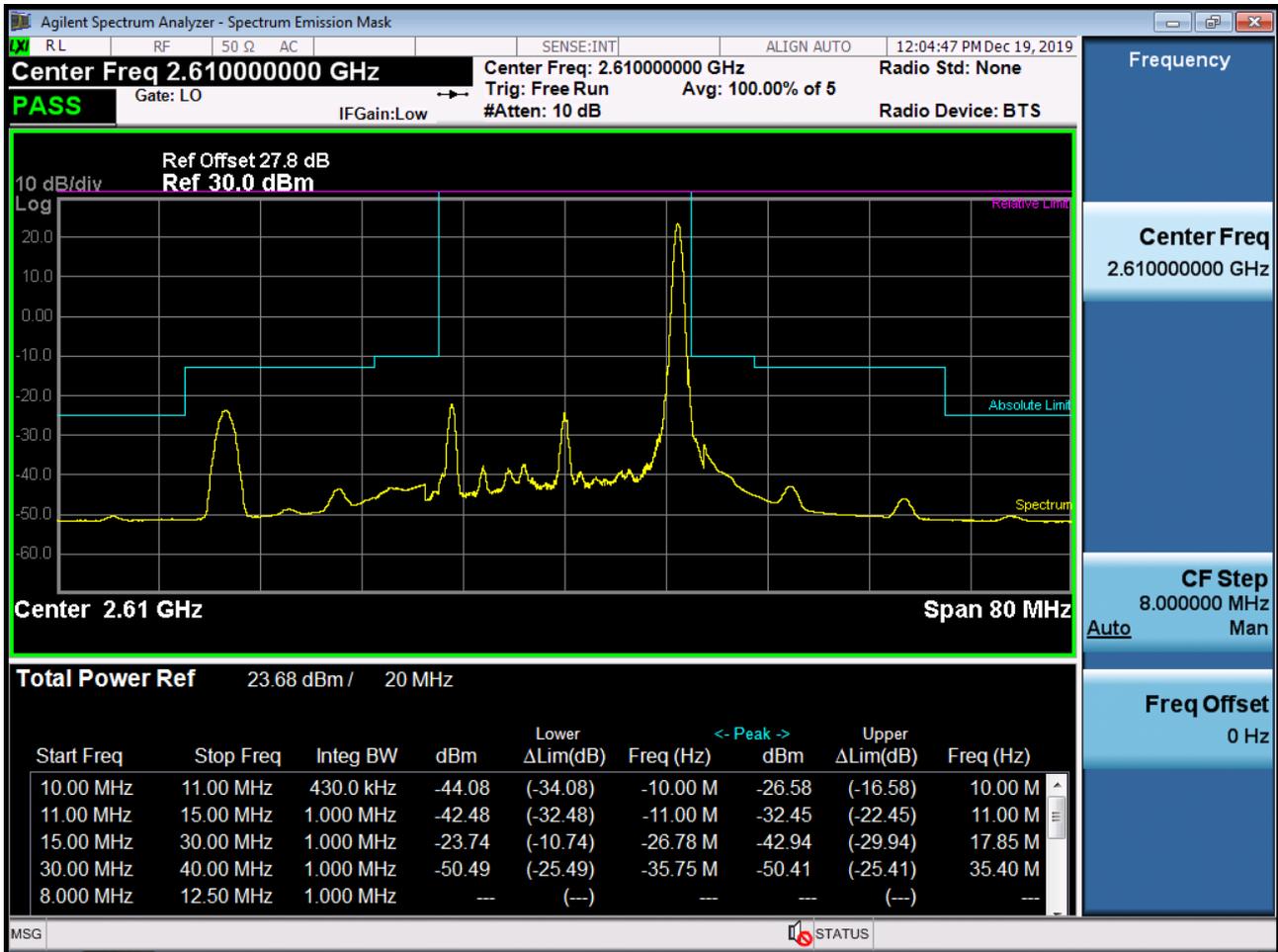
BAND 38. Low Channel Edge Plot (20 MHz Ch.37850 QPSK RB 25, Offset 0)



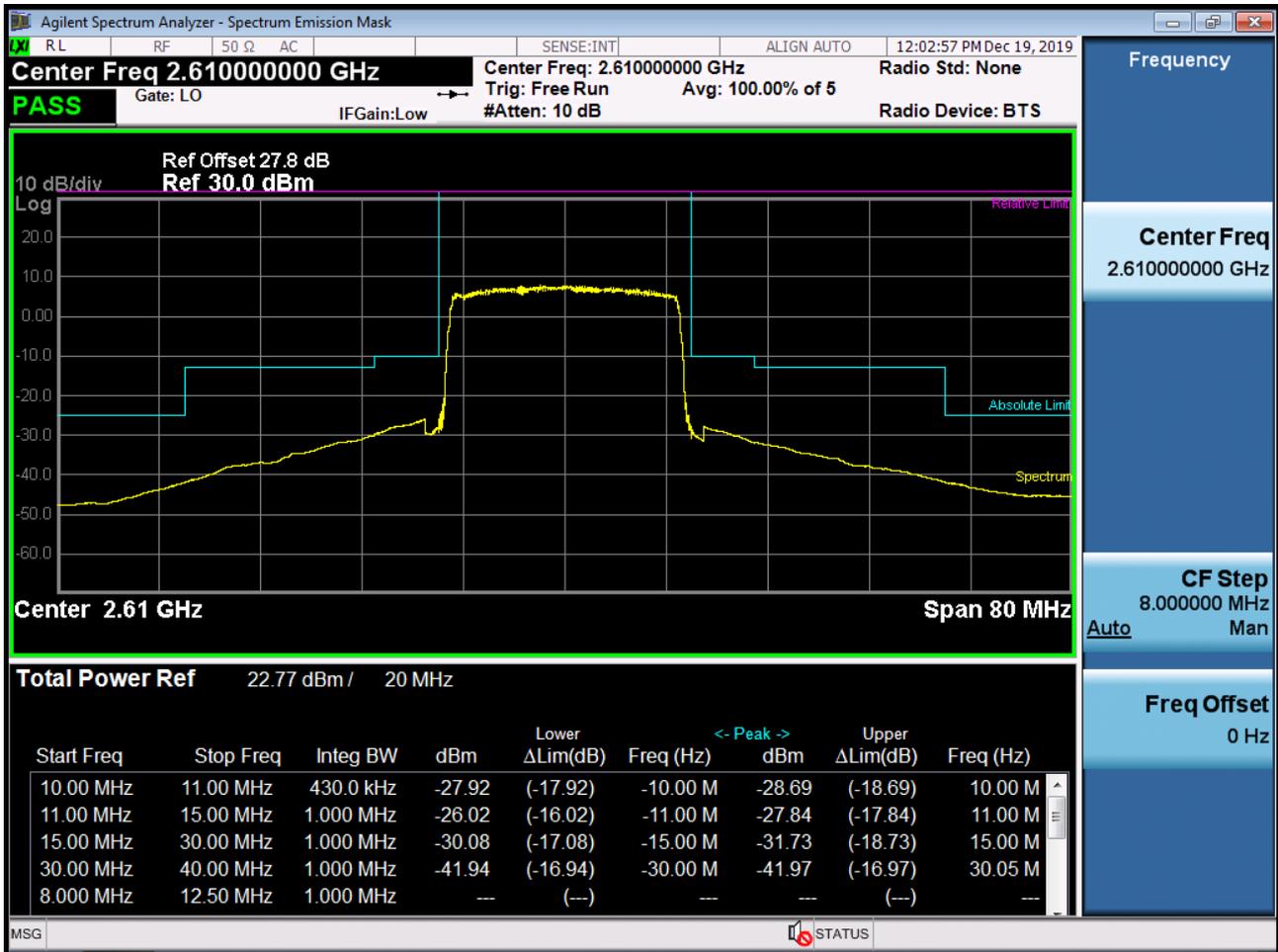
BAND 38. Mid Channel Edge Plot (20 MHz Ch.38000 QPSK RB 100)



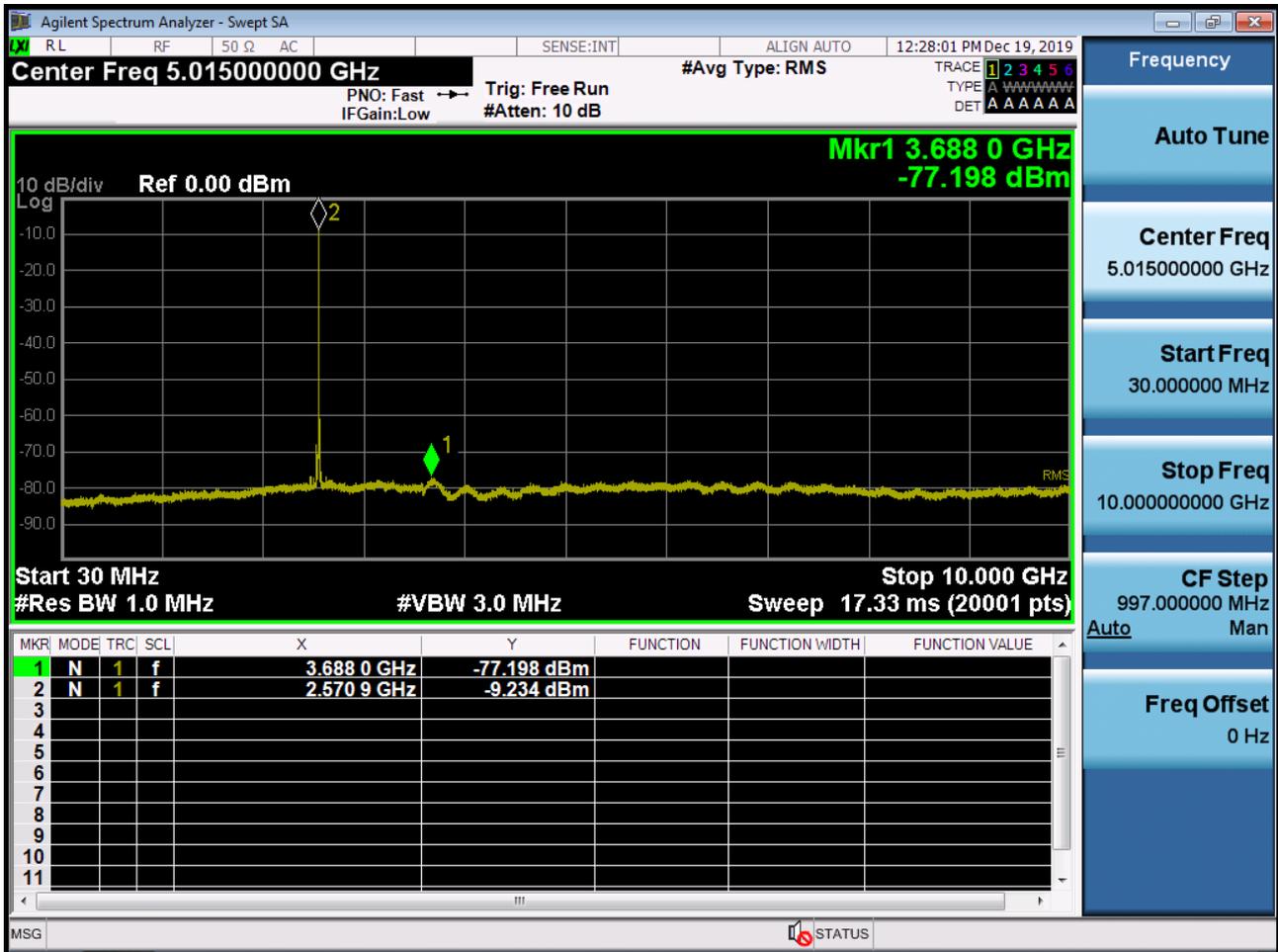
BAND 38. High Channel Edge Plot (20 MHz Ch.38150 QPSK RB 1, Offset 0)



BAND 38. High Channel Edge Plot (20 MHz Ch.38150 QPSK\_RB100\_Offset 0)



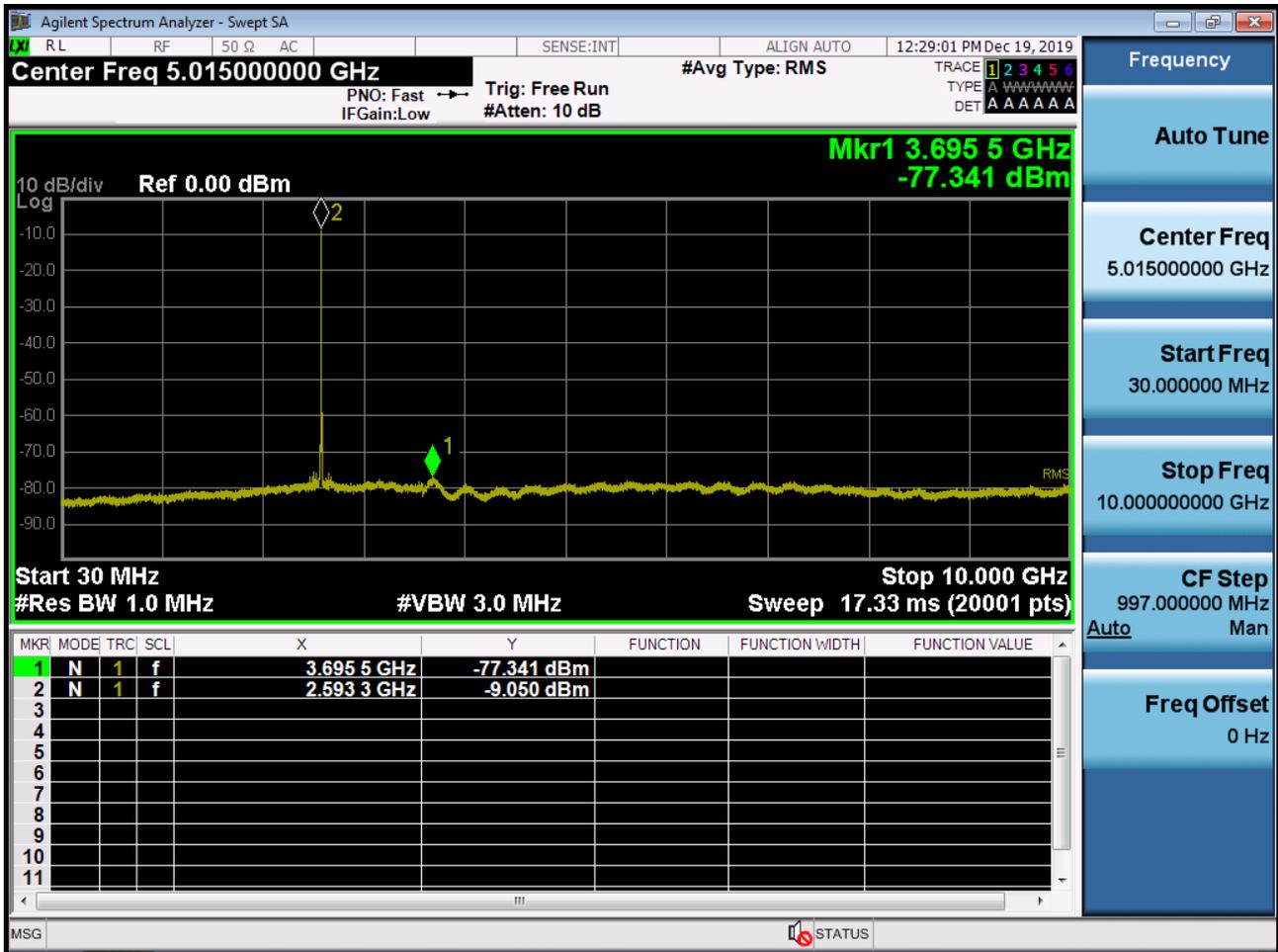
BAND 38. Conducted Spurious Plot 1 (5 MHz Ch.37775 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (5 MHz Ch. 37775 QPSK RB 1, Offset 0)



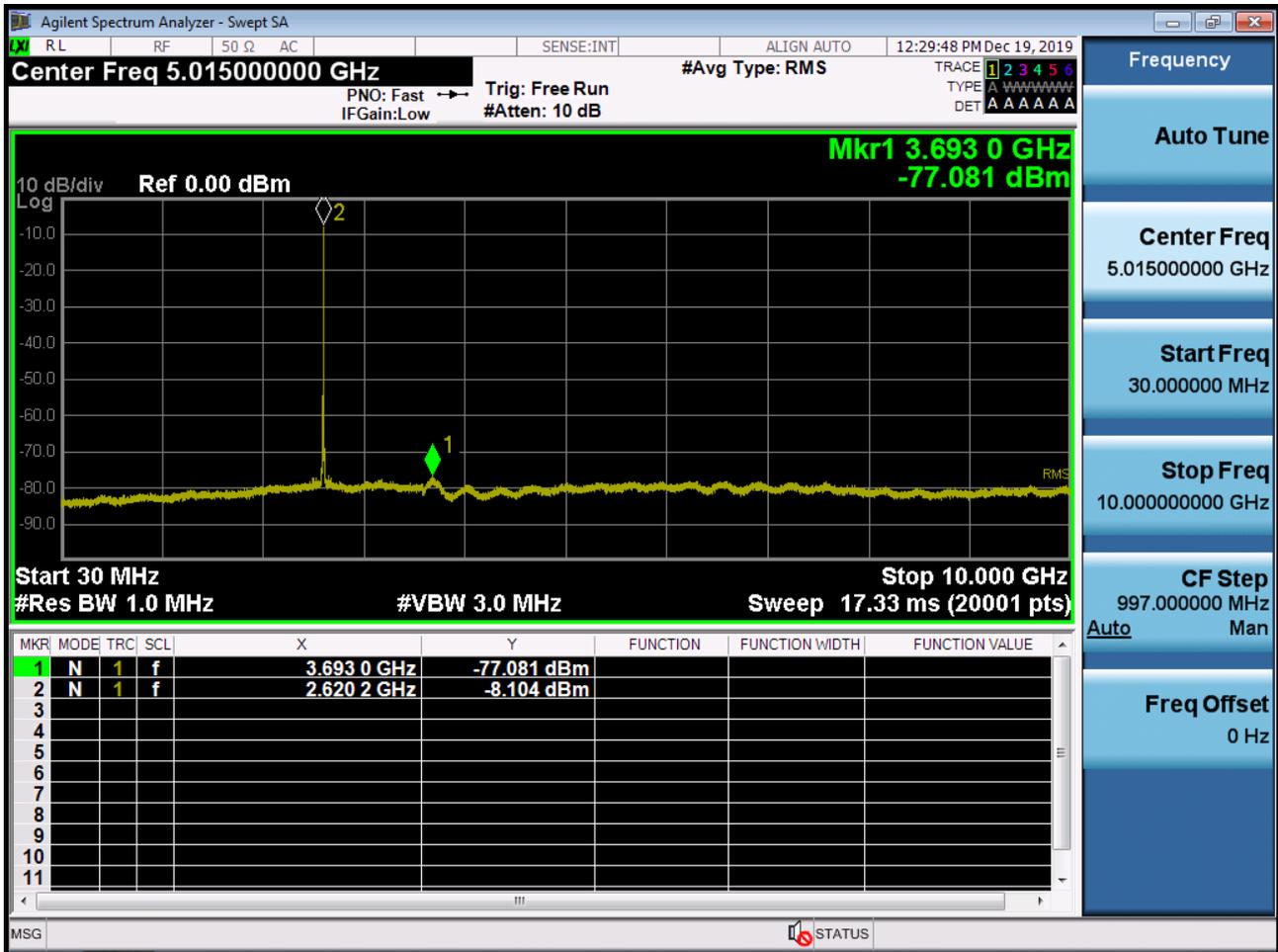
BAND 38. Conducted Spurious Plot 1 (5 MHz Ch.38000 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (5 MHz Ch. 38000 QPSK RB 1, Offset 0)



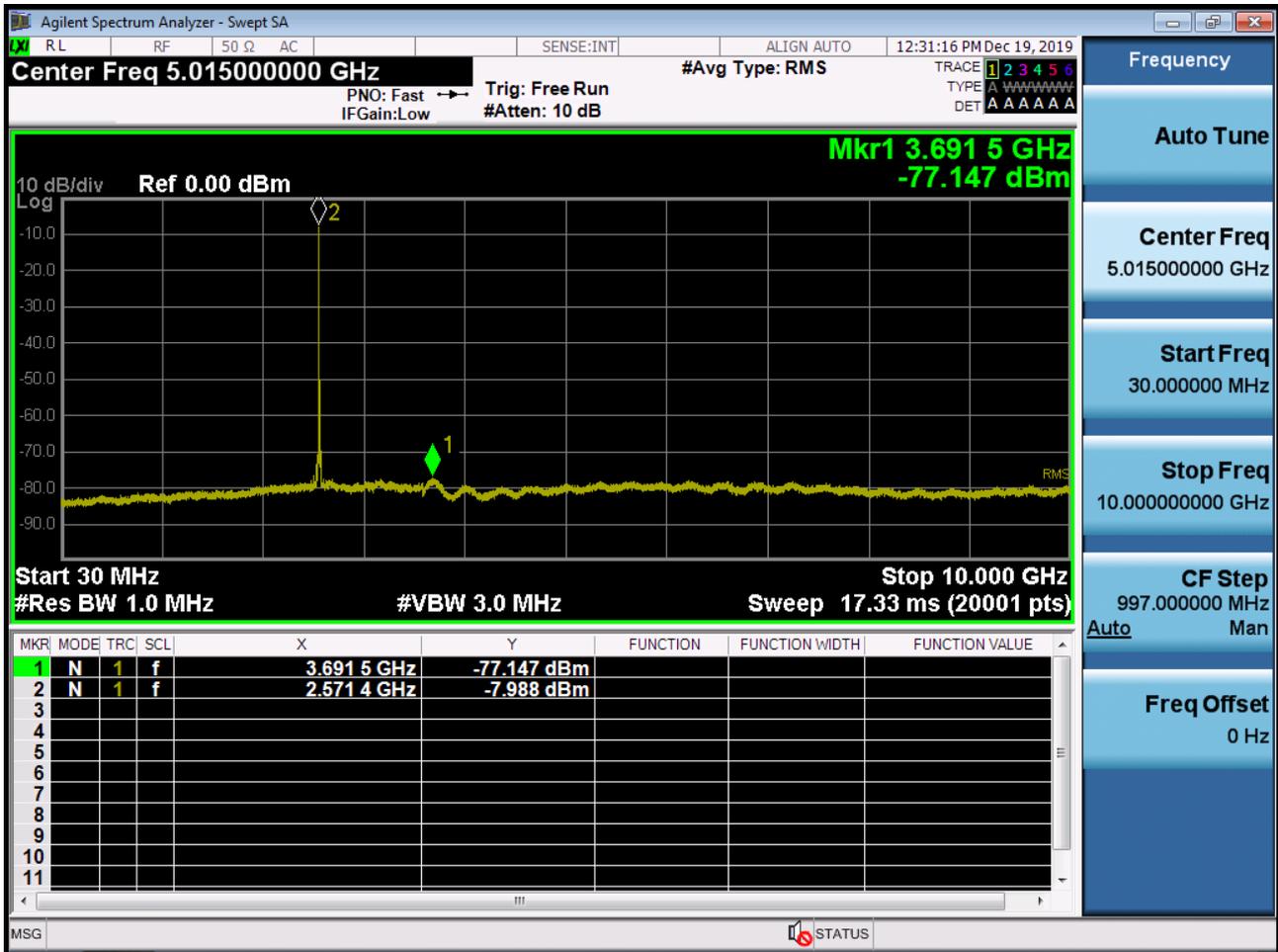
BAND 38. Conducted Spurious Plot 1 (5 MHz Ch.38225 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (5 MHz Ch. 38225 QPSK RB 1, Offset 0)



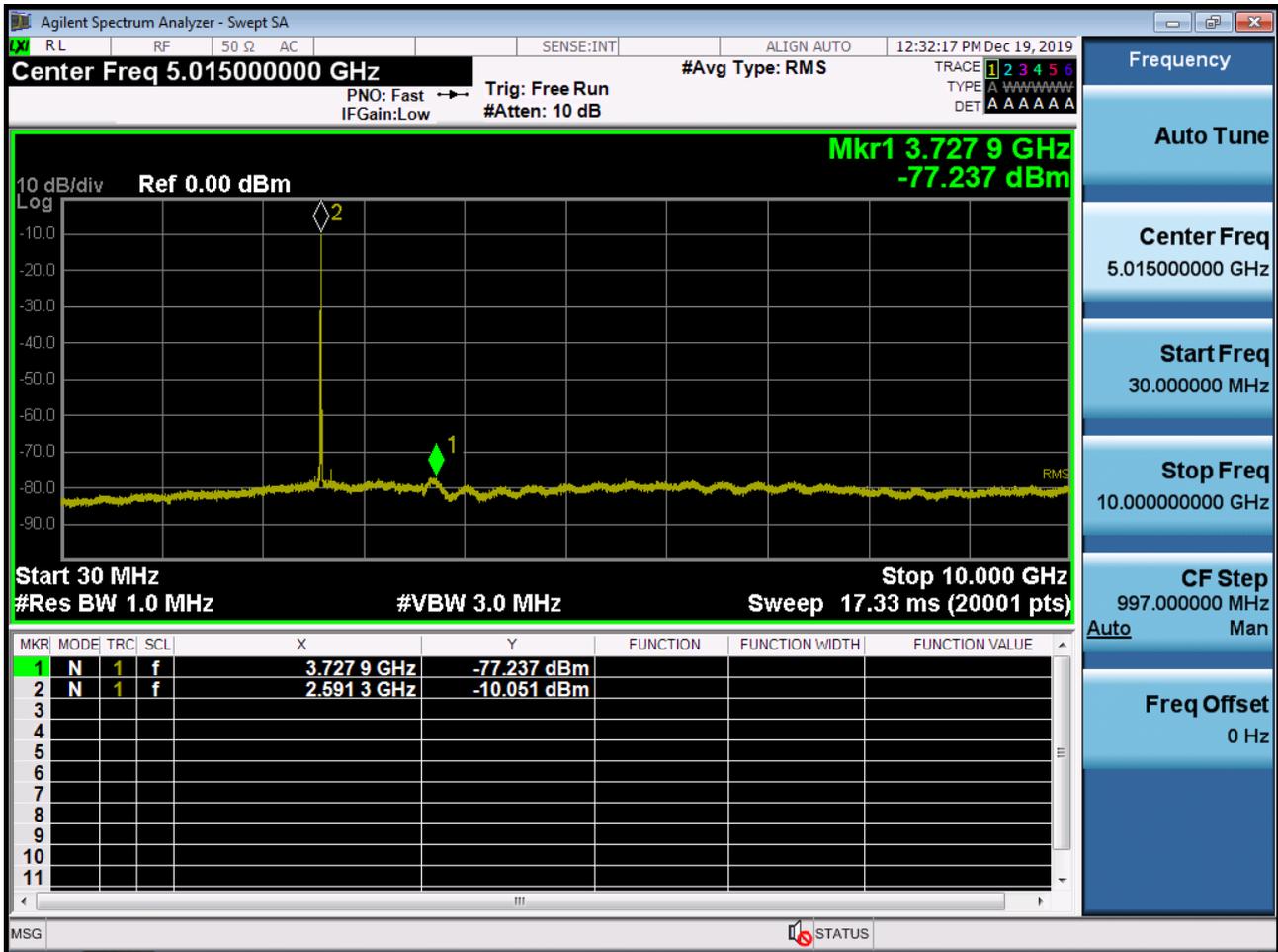
BAND 38. Conducted Spurious Plot 1 (10 MHz Ch.37800 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (10 MHz Ch. 37800 QPSK RB 1, Offset 0)



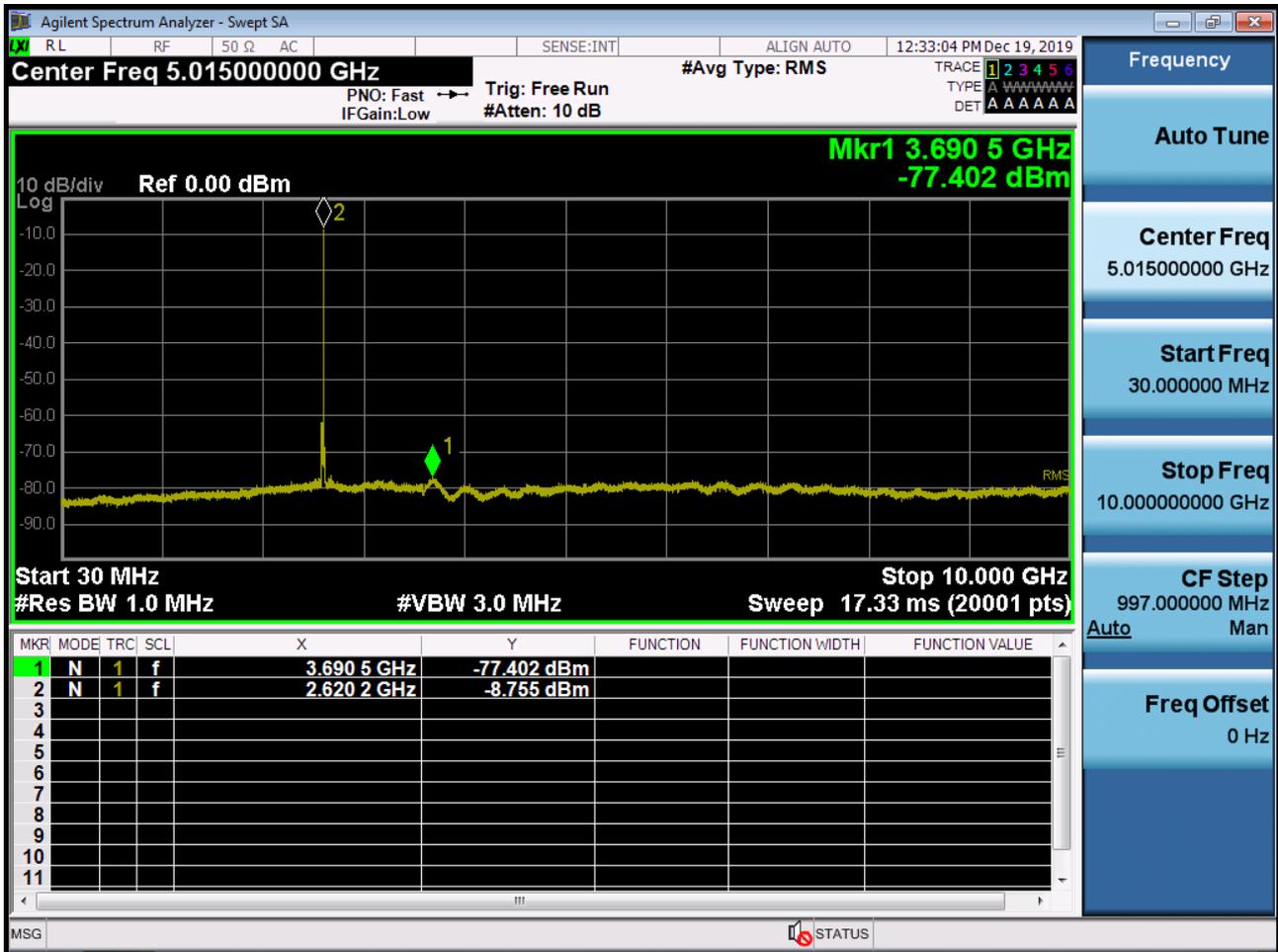
BAND 38. Conducted Spurious Plot 1 (10 MHz Ch.38000 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (10 MHz Ch. 38000 QPSK RB 1, Offset 0)



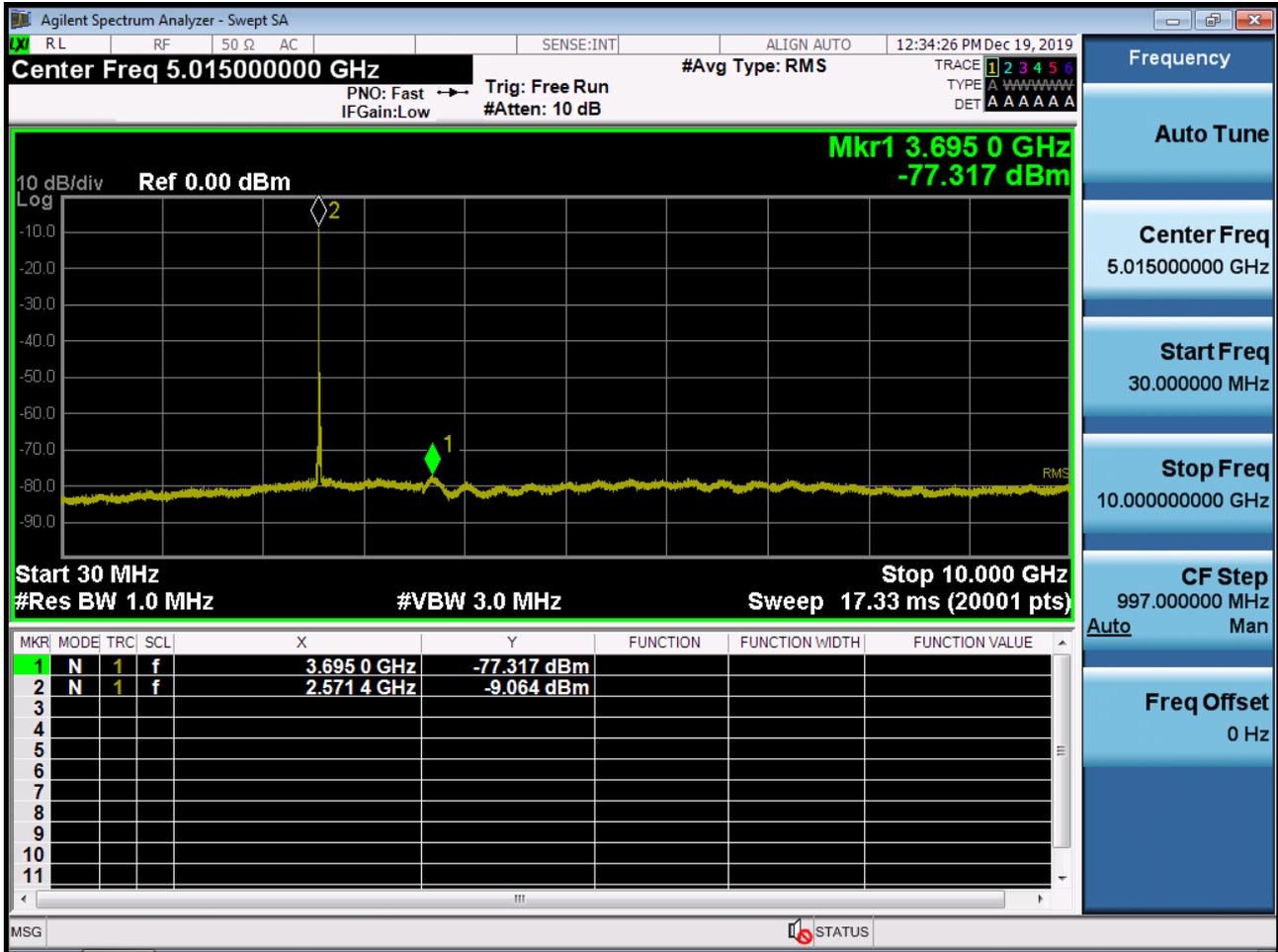
BAND 38. Conducted Spurious Plot 1 (10 MHz Ch. 38200 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (10 MHz Ch. 38200 QPSK RB 1, Offset 0)



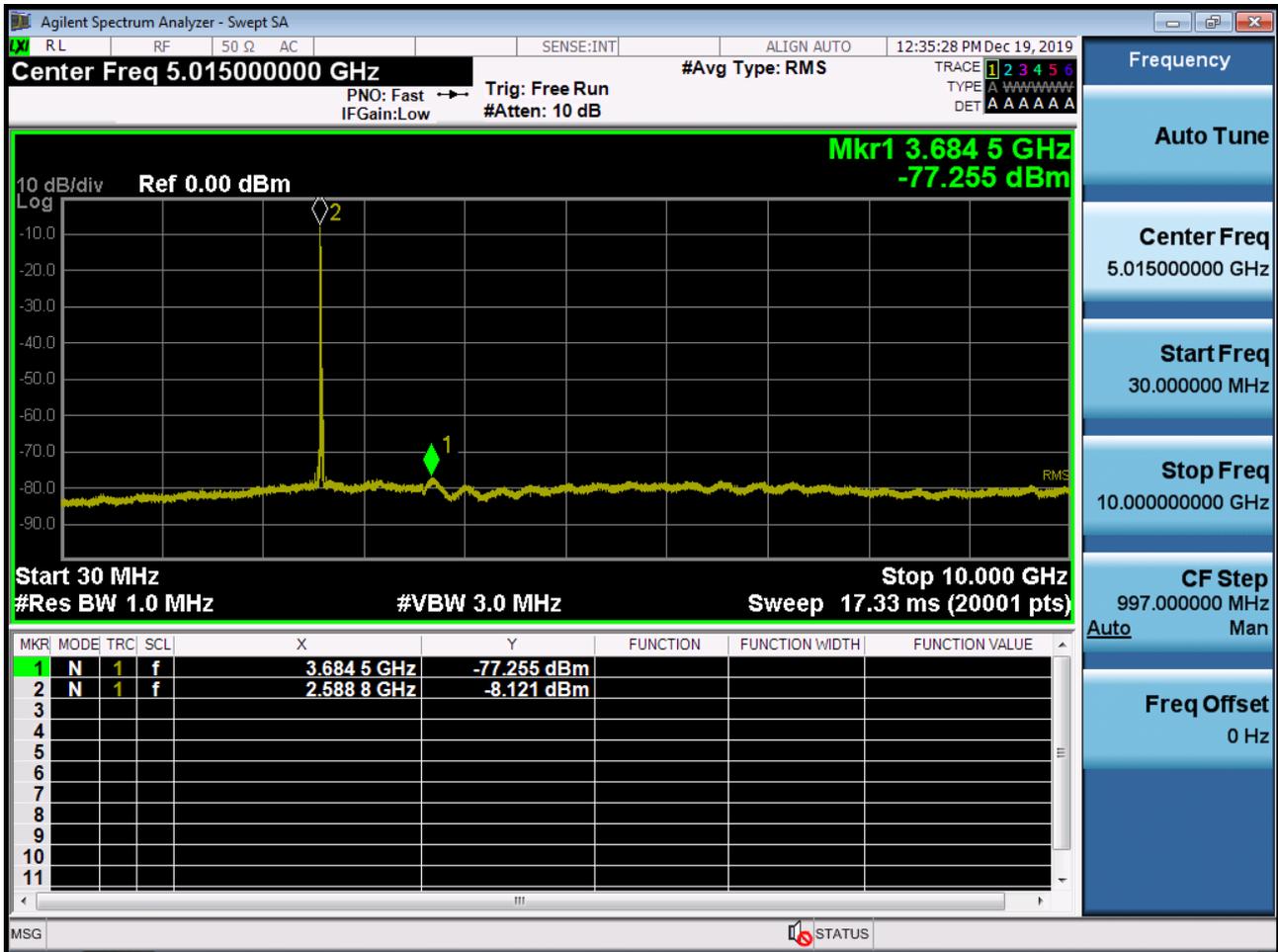
BAND 38. Conducted Spurious Plot 1 (15 MHz Ch.37825 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (15 MHz Ch. 37825 QPSK RB 1, Offset 0)



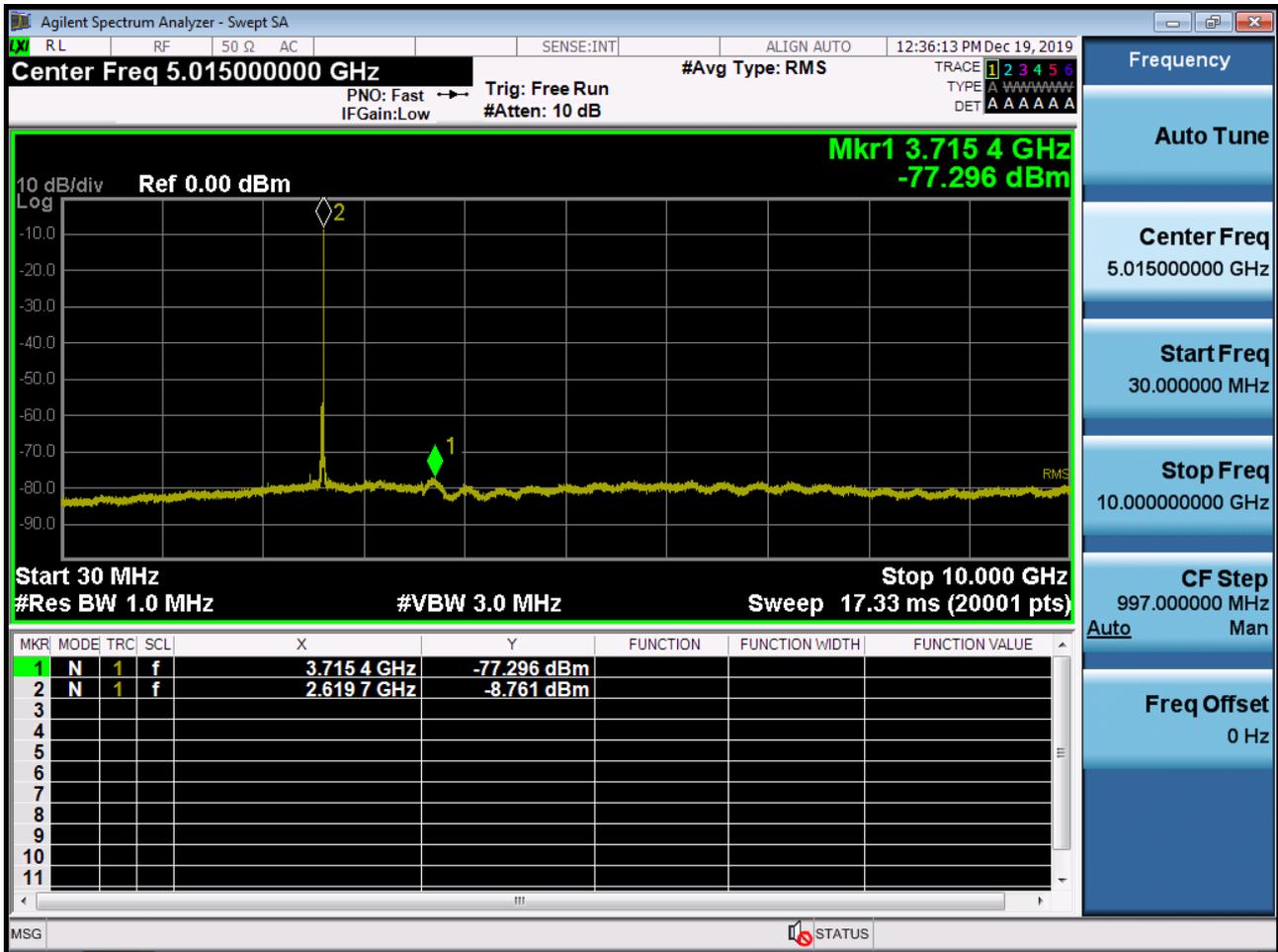
BAND 38. Conducted Spurious Plot 1 (15 MHz Ch.38000 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (15 MHz Ch. 38000 QPSK RB 1, Offset 0)



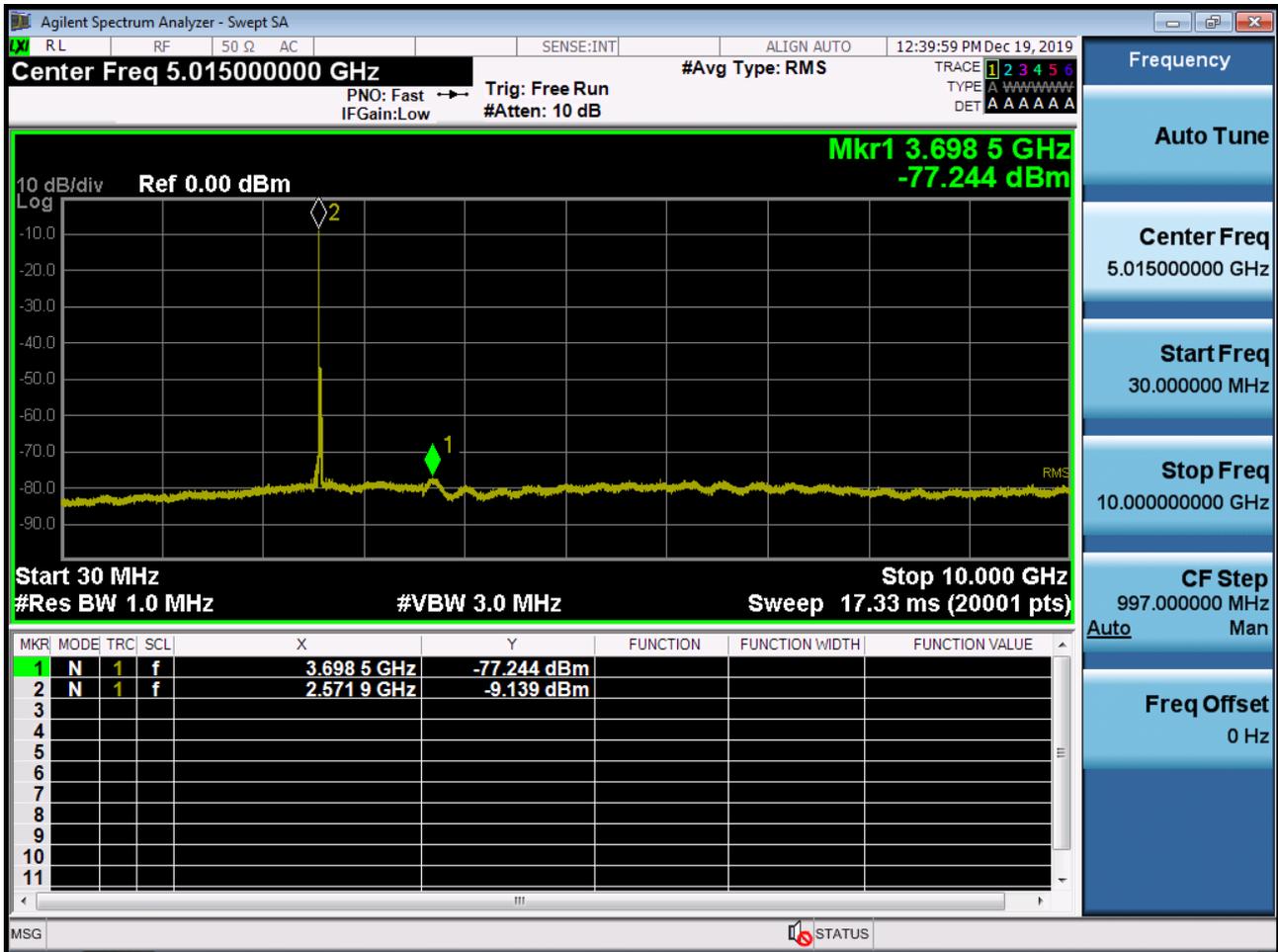
BAND 38. Conducted Spurious Plot 1 (15 MHz Ch.38175 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (15 MHz Ch. 38175 QPSK RB 1, Offset 0)



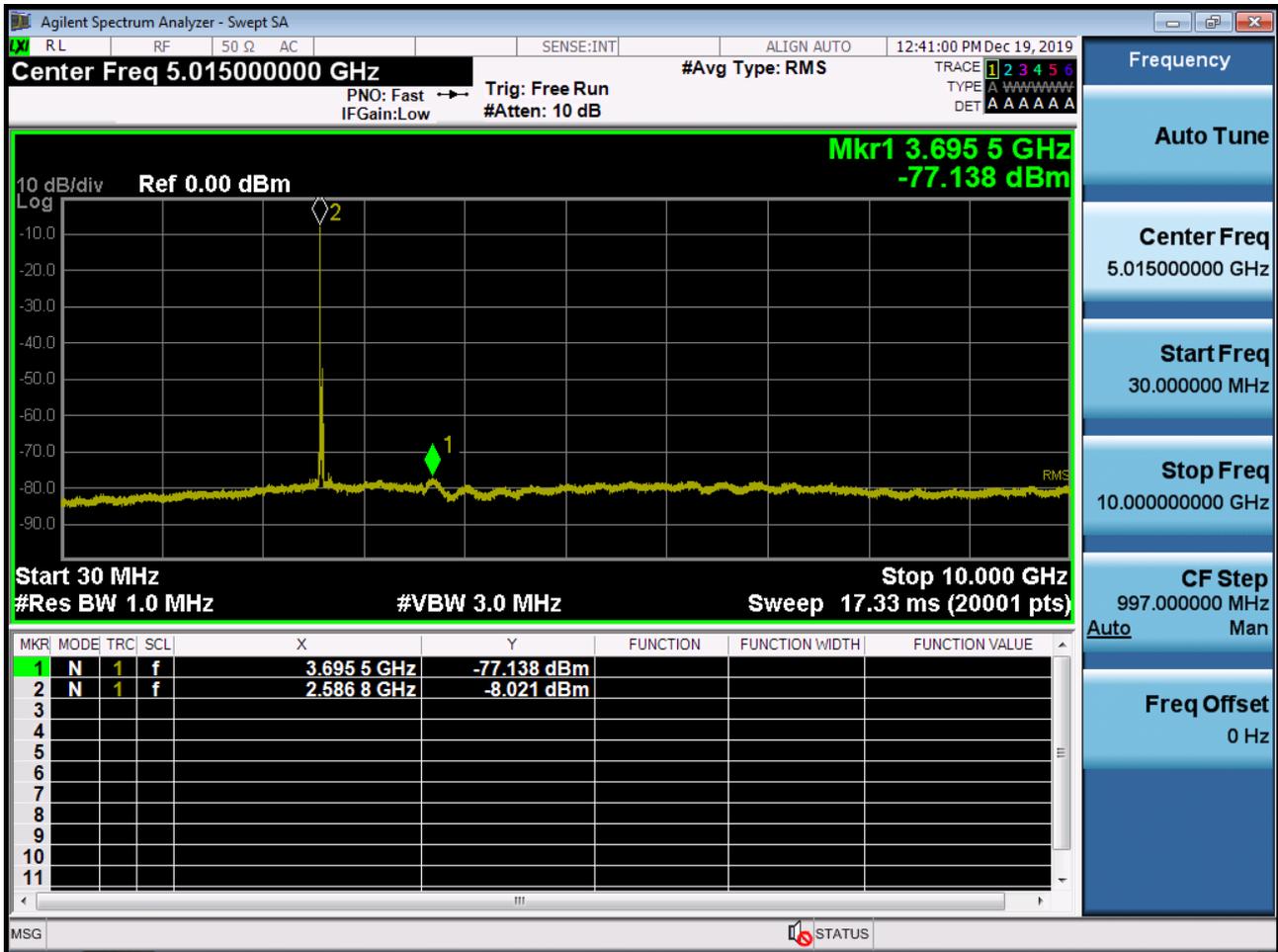
BAND 38. Conducted Spurious Plot 1 (20 MHz Ch.37850 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (20 MHz Ch. 37850 QPSK RB 1, Offset 0)



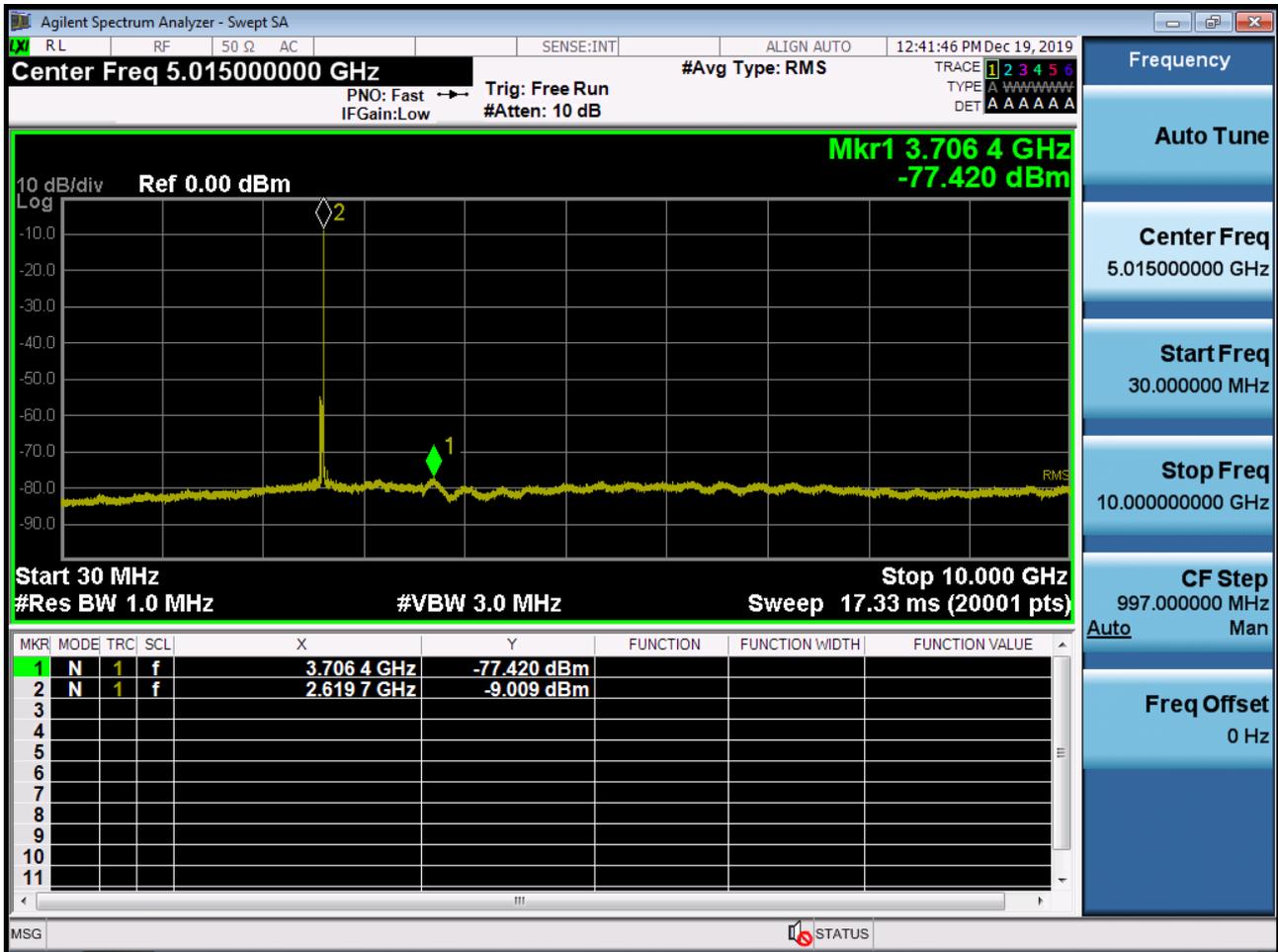
BAND 38. Conducted Spurious Plot 1 (20 MHz Ch.38000 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (20 MHz Ch. 38000 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 1 (20 MHz Ch.38150 QPSK RB 1, Offset 0)



BAND 38. Conducted Spurious Plot 2 (20 MHz Ch. 38150 QPSK RB 1, Offset 0)



## 10. ANNEX A\_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2001-FI019-P