

FCC LTE REPORT

Certification

Applicant Name:

SAMSUNG Electronics Co., Ltd.

Date of Issue:

January 10, 2023

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-2301-FC018

FCC ID: A3LSMM546B

APPLICANT: SAMSUNG Electronics Co., Ltd.

Model(s): SM-M546B/DS
 EUT Type: Mobile phone
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
 FCC Rule Part(s): §27, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 41 (5)	2498.5 – 2687.5	4M51G7D	QPSK	0.167	22.22
		4M51W7D	16QAM	0.139	21.43
		4M54W7D	64QAM	0.109	20.36
		4M50W7D	256QAM	0.052	17.19
LTE – Band 41 (10)	2501.0 – 2685.0	8M99G7D	QPSK	0.175	22.43
		9M01W7D	16QAM	0.141	21.50
		9M01W7D	64QAM	0.111	20.46
		8M98W7D	256QAM	0.056	17.47
LTE – Band 41 (15)	2503.5 – 2682.5	13M4G7D	QPSK	0.167	22.22
		13M5W7D	16QAM	0.134	21.26
		13M5W7D	64QAM	0.111	20.44
		13M5W7D	256QAM	0.054	17.34
LTE – Band 41 (20)	2506.0 – 2680.0	18M0G7D	QPSK	0.209	23.21
		17M9W7D	16QAM	0.169	22.28
		18M0W7D	64QAM	0.136	21.34
		17M9W7D	256QAM	0.068	18.31

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 No.: HCT-RF-2301-FC018

REVIEWED BY

유권우



Report prepared by : Jin Woo Yu
Engineer of Telecommunication Testing Center

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

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

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

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2301-FC018	January 10, 2023	- First Approval Report

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

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMM546B
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile phone
Model(s):	SM-M546B/DS
Tx Frequency:	2498.5 – 2687.5 : 5 MHz 2501.0 – 2685.0 : 10 MHz 2503.5 – 2682.5 : 15 MHz 2506.0 – 2680.0 : 20 MHz
Date(s) of Tests:	November 29, 2022 ~ December 30, 2022
Serial number:	Radiated: R3CTA0CE0SK Conducted: R3CTA0CDNEA

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (20/40/80 MHz), Bluetooth, BT LE, NFC.

2.2. MEASURING INSTRUMENT CALIBRATION

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

2.3. TEST FACILITY

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

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Channel Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4
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 Normal Hz
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 1 GHz, 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 = 100 kHz for emissions below 1 GHz and Normal Hz for emissions above 1 GHz
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. For spurious emissions above 1 GHz, 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;

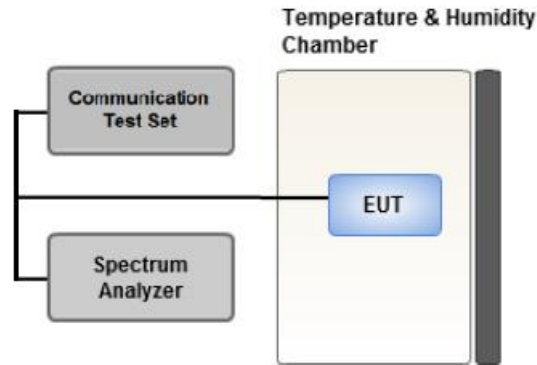
$$\text{Result}_{(\text{dBm})} = P_g_{(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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

If the fundamental frequency is below 1 GHz, 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.

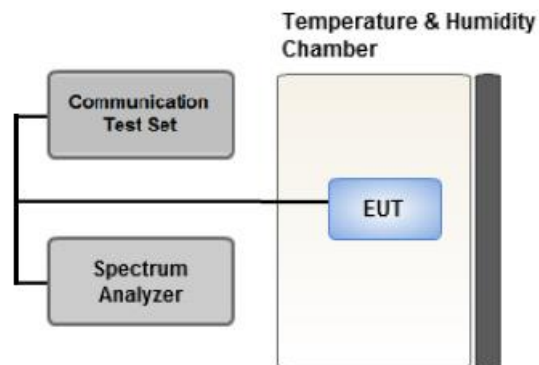
1. Set the RBW \geq OBW.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 2 \times$ OBW.
4. Sweep time $\geq 10 \times$ (number of points in sweep) \times (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to 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 $[10 \log (1/0.25)] = 6$ 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.

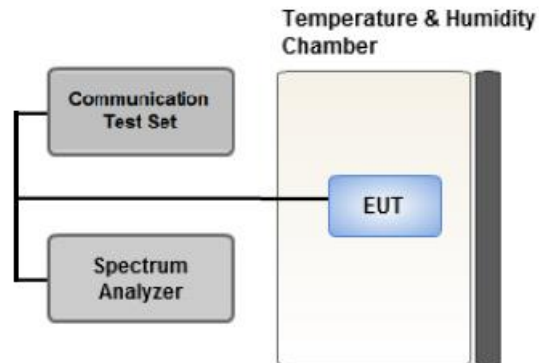
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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 26 dB 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 $\geq 3 \times$ 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

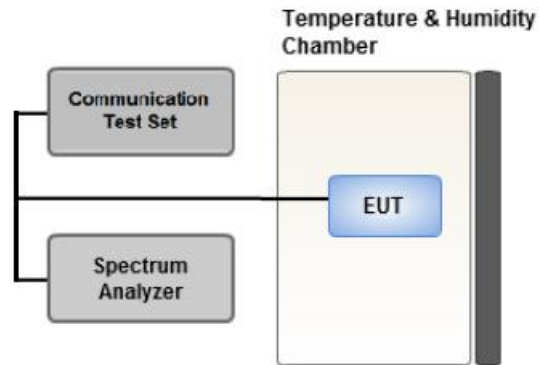
Test Overview

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

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

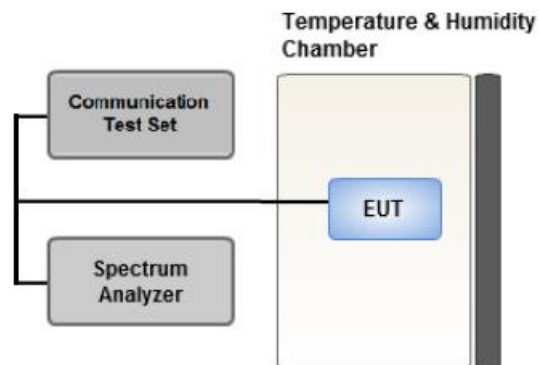
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. Within 1MHz of the channel edge the RBW should be 2 % of EBW, then 1 MHz after that.
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span/RBW}$
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

Where Margin < 1 dB the emission level is either corrected by $10 \log(1 \text{ MHz/ RB})$ or the emission is integrated over a 1 MHz bandwidth to determine the final result. When using the integration method the integration window is either centered on the emission or, for emissions at the band edge, centered by an offset of 500 kHz from the block edge so that the integration window is the 1 MHz adjacent to the block edge.

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.
 Mode : Stand alone, Stand alone + External accessories (Earphone, AC adapter, etc)
 Worst case : Stand alone
- We were performed the RSE test in condition of co-location.
 Mode : Stand alone, Simultaneous transmission scenarios
 Worst case : Stand alone
- 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	Bandwidth (MHz)	Frequency	RB size	RB offset	Axis			
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM, 256QAM	5	Low	1	24	Z			
			Mid, High	1	0				
		10	Low	1	49				
			Mid, High	1	0				
		15	Low	1	74				
			Mid, High	1	0				
		20	Low	1	99				
			Mid, High	1	1				
		Radiated Spurious and Harmonic Emissions	QPSK	5	Low		1	24	X
					Mid, High		1	0	
				10	Low		1	49	
					Mid, High		1	0	
15	Low			1	74				
	Mid, High			1	0				
20	Low			1	99				
	Mid, High			1	1				

3.10 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM, 64QAM, 256QAM	5, 10, 15, 20	Mid	Full RB	0
Peak-To-Average Ratio	QPSK, 16QAM, 64QAM, 256QAM	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

4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
H.P.F	FBSR-02B(WHK1.2/15 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
H.P.F	FBSR-02B(WHK3.3/18 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	11275	03/11/2023	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/21/2023	Annual
Dipole Antenna	UHAP	Schwarzbeck	557	04/05/2023	Biennial
Dipole Antenna	UHAP	Schwarzbeck	558	04/05/2023	Biennial
Chamber	SU-642	ESPEC	93008124	03/04/2023	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/30/2023	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/15/2023	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	04/12/2023	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	05/02/2023	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	05/18/2023	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	08/29/2023	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/18/2023	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/03/2023	Biennial
Hybrid Antenna	VULB9168	Schwarzbeck	760	02/22/2023	Biennial
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262116770	07/05/2023	Annual
Wideband Radio Communication Tester	MT8820C	Anritsu Corp.	6201026545	01/05/2023	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/05/2023	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/30/2023	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (\pm dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	2.00 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.40 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.51 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.92 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.48 (Confidence level about 95 %, $k=2$)

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 + 10log10 (P[Watts]) at Channel edges ■ < 43 + 10log10 (P[Watts]) between 5 and X MHz from Channel edges ■ < 55 + 10log10 (P[Watts]) beyond X MHz beyond from Channel edges ■ < 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz 	PASS
Conducted Output Power	§2.1046	N/A	<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 + 10log10 (P[Watts])	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

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

$$ERP = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 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

$$EIRP = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

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

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2498.5	LTE B41/ 5 MHz	QPSK	-22.70	13.99	10.70	2.47	H	< 2.00	0.167	22.22	
		16-QAM	-23.49	13.20	10.70	2.47	H		0.139	21.43	
		64-QAM	-24.56	12.13	10.70	2.47	H		0.109	20.36	
		256-QAM	-27.73	8.96	10.70	2.47	H		0.052	17.19	
2593.0		QPSK	-23.24	13.40	10.62	2.53	H		0.141	21.49	
		16-QAM	-24.17	12.47	10.62	2.53	H		0.114	20.56	
		64-QAM	-25.09	11.55	10.62	2.53	H		0.092	19.64	
		256-QAM	-28.13	8.51	10.62	2.53	H		0.046	16.60	
2687.5		QPSK	-25.92	11.24	10.78	2.63	H		0.087	19.39	
		16-QAM	-26.69	10.47	10.78	2.63	H		0.073	18.62	
		64-QAM	-27.65	9.51	10.78	2.63	H		0.058	17.66	
		256-QAM	-30.94	6.22	10.78	2.63	H		0.027	14.37	

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2501.0	LTE B41/ 10 MHz	QPSK	-22.49	14.20	10.70	2.47	H	< 2.00	0.175	22.43	
		16-QAM	-23.42	13.27	10.70	2.47	H		0.141	21.50	
		64-QAM	-24.46	12.23	10.70	2.47	H		0.111	20.46	
		256-QAM	-27.45	9.24	10.70	2.47	H		0.056	17.47	
2593.0		QPSK	-23.12	13.52	10.62	2.53	H		0.145	21.61	
		16-QAM	-23.89	12.75	10.62	2.53	H		0.121	20.84	
		64-QAM	-24.95	11.69	10.62	2.53	H		0.095	19.78	
		256-QAM	-27.93	8.71	10.62	2.53	H		0.048	16.80	
2685.0		QPSK	-26.04	11.22	10.77	2.63	H		0.086	19.36	
		16-QAM	-26.90	10.36	10.77	2.63	H		0.071	18.50	
		64-QAM	-27.80	9.46	10.77	2.63	H		0.058	17.60	
		256-QAM	-30.99	6.27	10.77	2.63	H		0.028	14.41	

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2503.5	LTE B41/ 15 MHz	QPSK	-22.69	14.00	10.70	2.48	H	< 2.00	0.167	22.22	
		16-QAM	-23.65	13.04	10.70	2.48	H		0.134	21.26	
		64-QAM	-24.47	12.22	10.70	2.48	H		0.111	20.44	
		256-QAM	-27.57	9.12	10.70	2.48	H		0.054	17.34	
2593.0		QPSK	-23.17	13.47	10.62	2.53	H		0.143	21.56	
		16-QAM	-24.07	12.57	10.62	2.53	H		0.116	20.66	
		64-QAM	-25.14	11.50	10.62	2.53	H		0.091	19.59	
		256-QAM	-28.06	8.58	10.62	2.53	H		0.046	16.67	
2682.5		QPSK	-25.56	11.79	10.76	2.63	H		0.098	19.92	
		16-QAM	-26.50	10.85	10.76	2.63	H		0.079	18.98	
		64-QAM	-27.52	9.83	10.76	2.63	H		0.063	17.96	
		256-QAM	-30.53	6.82	10.76	2.63	H		0.031	14.95	

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2506.0	LTE B41/ 20 MHz	QPSK	-21.70	14.99	10.70	2.48	H	< 2.00	0.209	23.21	
		16-QAM	-22.63	14.06	10.70	2.48	H		0.169	22.28	
		64-QAM	-23.57	13.12	10.70	2.48	H		0.136	21.34	
		256-QAM	-26.60	10.09	10.70	2.48	H		0.068	18.31	
2593.0		QPSK	-22.60	14.04	10.62	2.53	H		0.163	22.13	
		16-QAM	-23.56	13.08	10.62	2.53	H		0.131	21.17	
		64-QAM	-24.39	12.25	10.62	2.53	H		0.108	20.34	
		256-QAM	-27.46	9.18	10.62	2.53	H		0.053	17.27	
2680.0		QPSK	-25.40	11.95	10.76	2.63	H		0.102	20.08	
		16-QAM	-26.21	11.14	10.76	2.63	H		0.085	19.27	
		64-QAM	-27.17	10.18	10.76	2.63	H		0.068	18.31	
		256-QAM	-30.23	7.12	10.76	2.63	H		0.033	15.25	

8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY : 2506.0 MHz
- ▣ MEASURED OUTPUT POWER: 22.22 dBm = 0.167 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 47.22 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39675 (2498.5)	4 997.00	-50.28	12.60	-60.27	3.81	H	-51.48	73.71
	7 495.50	-45.63	10.80	-45.38	4.60	H	-39.17	61.39
	9 994.00	-59.03	11.19	-54.49	5.58	V	-48.88	71.10
40620 (2593.0)	5 186.00	-48.08	12.44	-57.41	3.74	H	-48.71	70.93
	7 779.00	-48.06	11.40	-47.74	4.68	H	-41.02	63.25
	10 372.00	-56.28	11.40	-50.75	5.71	V	-45.06	67.29
41565 (2687.5)	5 375.00	-47.69	13.00	-57.05	3.77	V	-47.82	70.04
	8 062.50	-52.27	10.80	-50.41	4.79	H	-44.40	66.62
	10 750.00	-57.36	11.20	-51.89	5.72	V	-46.41	68.63

- ▣ OPERATING FREQUENCY : 2506.0 MHz
- ▣ MEASURED OUTPUT POWER: 22.43 dBm = 0.175 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 47.43 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39700 (2501.0)	5 002.00	-47.73	12.60	-57.72	3.81	H	-48.93	71.37
	7 503.00	-43.90	10.80	-43.53	4.60	V	-37.33	59.76
	10 004.00	-58.43	11.21	-54.41	5.53	V	-48.73	71.16
40620 (2593.0)	5 186.00	-48.03	12.44	-57.36	3.74	V	-48.66	71.09
	7 779.00	-51.44	11.40	-51.12	4.68	H	-44.40	66.84
	10 372.00	-58.71	11.40	-53.18	5.71	V	-47.49	69.93
41540 (2685.0)	5 370.00	-49.66	13.00	-59.05	3.75	H	-49.80	72.23
	8 055.00	-55.98	10.80	-54.08	4.80	V	-48.08	70.51
	10 740.00	-55.46	11.22	-50.02	5.60	H	-44.40	66.83

- ▣ OPERATING FREQUENCY : 2506.0 MHz
- ▣ MEASURED OUTPUT POWER: 22.22 dBm = 0.167 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 47.22 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39725 (2503.5)	5 007.00	-46.83	12.58	-57.17	3.76	H	-48.35	70.57
	7 510.50	-44.17	10.82	-43.85	4.61	V	-37.64	59.86
	10 014.00	-57.27	11.23	-53.45	5.46	V	-47.68	69.90
40620 (2593.0)	5 186.00	-49.19	12.44	-58.52	3.74	V	-49.82	72.04
	7 779.00	-48.86	11.40	-48.54	4.68	V	-41.82	64.04
	10 372.00	-58.74	11.40	-53.21	5.71	H	-47.52	69.74
41515 (2682.5)	5 365.00	-49.78	13.00	-59.15	3.75	V	-49.89	72.11
	8 047.50	-54.46	10.80	-52.51	4.80	H	-46.51	68.73
	10 730.00	-58.47	11.24	-53.33	5.59	H	-47.68	69.90

- ▣ OPERATING FREQUENCY : 2506.0 MHz
- ▣ MEASURED OUTPUT POWER: 23.21 dBm = 0.209 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10} (W) =$ 48.21 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
39750 (2506.0)	5 012.00	-46.74	12.58	-57.08	3.76	H	-48.26	71.47
	7 518.00	-41.40	10.84	-41.32	4.61	V	-35.09	58.30
	10 024.00	-57.45	11.25	-53.53	5.41	H	-47.68	70.89
40620 (2593.0)	5 186.00	-50.15	12.44	-59.48	3.74	H	-50.78	73.99
	7 779.00	-49.23	11.40	-48.91	4.68	H	-42.19	65.40
	10 372.00	-58.73	11.40	-53.20	5.71	V	-47.51	70.72
41490 (2680.0)	5 360.00	-45.68	13.00	-55.02	3.74	H	-45.76	68.97
	8 040.00	-51.00	10.82	-49.16	4.79	V	-43.13	66.34
	10 720.00	-57.73	11.26	-52.83	5.68	H	-47.25	70.46

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
41	5 MHz	2593.0	QPSK	25	0	5.54
			16-QAM			6.24
			64-QAM			6.66
			256-QAM			7.02
	10 MHz		QPSK	50		5.70
			16-QAM			6.17
			64-QAM			6.57
			256-QAM			7.33
	15 MHz		QPSK	75		5.49
			16-QAM			6.07
			64-QAM			6.38
			256-QAM			6.54
	20 MHz		QPSK	100		5.60
			16-QAM			6.18
			64-QAM			6.42
			256-QAM			6.60

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 63 ~ 78.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
41	5 MHz	2593.0	QPSK	25	0	4.5062
			16-QAM			4.5055
			64-QAM			4.5443
			256-QAM			4.5017
	10 MHz		QPSK	50		8.9938
			16-QAM			9.0058
			64-QAM			9.0119
			256-QAM			8.9764
	15 MHz		QPSK	75		13.438
			16-QAM			13.452
			64-QAM			13.446
			256-QAM			13.453
	20 MHz		QPSK	100		17.950
			16-QAM			17.941
			64-QAM			17.953
			256-QAM			17.914

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 47 ~ 62.

8.5 CONDUCTED SPURIOUS EMISSIONS

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
41	5	2498.5	26.1704	34.110	-76.748	-42.638	-25.00
		2593.0	26.1729	34.110	-76.278	-42.168	
		2687.5	26.1419	34.110	-76.788	-42.678	
	10	2501.0	26.1598	34.110	-76.700	-42.590	
		2593.0	26.1649	34.110	-76.434	-42.324	
		2685.0	26.1262	34.110	-76.814	-42.704	
	15	2503.5	26.1483	34.110	-76.418	-42.308	
		2593.0	26.1228	34.110	-76.562	-42.452	
		2682.5	26.1330	34.110	-76.514	-42.404	
	20	2506.0	25.8129	34.110	-76.594	-42.484	
		2593.0	26.1270	34.110	-76.648	-42.538	
		2680.0	25.8372	34.110	-76.862	-42.752	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 107 ~ 130.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Duty Cycle factor already applied on the factor.
 - Duty Cycle factor(dB) = 3.979
 - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
 - Result(dBm) = Reading + Factor

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

8.6 CHANNEL EDGE

Band Width	Frequency (MHz)	Modulation	RB (Size/Offset)	2 495 MHz ~ 2 496 MHz	C.E ~ (C.E +1MHz)	2 490.5 MHz ~ 2 495 MHz	(C.E + 1 MHz) ~ (C.E + 5 MHz)	Below 2 490.5 MHz	(C.E + 5 MHz) ~ (C.E + X MHz)	Above (C.E + X MHz)
				Lower	Upper	Lower	Upper	Lower	Upper	Upper
5 MHz	2498.5	QPSK	25/0	-20.72	-20.35	-22.85	-21.29	-36.94	-36.12	-36.67
10 MHz	2501.0	QPSK	50/0	-24.06	-22.79	-23.33	-22.59	-29.64	-27.68	-40.86
15 MHz	2503.5	QPSK	75/0	-25.32	-25.16	-25.43	-24.54	-29.11	-27.90	-42.41
20 MHz	2506.0	QPSK	100/0	-27.03	-26.18	-26.21	-25.59	-29.52	-27.73	-43.80
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 ± 1 MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
					Lower	Upper	Lower	Upper
5 MHz	2593.0	QPSK	25	0	-20.17	-19.71	-23.31	-23.27
	2687.5	QPSK	25	0	-20.54	-20.24	-21.16	-20.94
10 MHz	2593.0	QPSK	50	0	-24.01	-24.02	-24.83	-24.69
	2685.0	QPSK	50	0	-22.78	-23.40	-22.59	-22.86
15 MHz	2593.0	QPSK	75	0	-25.84	-26.60	-26.68	-26.92
	2682.5	QPSK	75	0	-25.39	-25.29	-24.71	-24.35
20 MHz	2593.0	QPSK	100	0	-26.68	-27.39	-26.19	-26.65
	2680.0	QPSK	100	0	-25.59	-27.07	-25.34	-26.50
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	-35.51	-35.96	-36.13	-36.01
	2687.5	QPSK	25	0	-33.12	-32.37	-34.25	-33.06
10 MHz	2593.0	QPSK	50	0	-29.74	-29.95	-39.91	-41.10
	2685.0	QPSK	50	0	-27.08	-26.99	-37.86	-34.73
15 MHz	2593.0	QPSK	75	0	-29.80	-29.89	-41.50	-42.01
	2682.5	QPSK	75	0	-27.79	-28.03	-39.87	-37.02
20 MHz	2593.0	QPSK	100	0	-29.41	-30.19	-43.22	-43.34
	2680.0	QPSK	100	0	-27.70	-28.13	-41.79	-39.16
Limit					-13.0		-25.0	

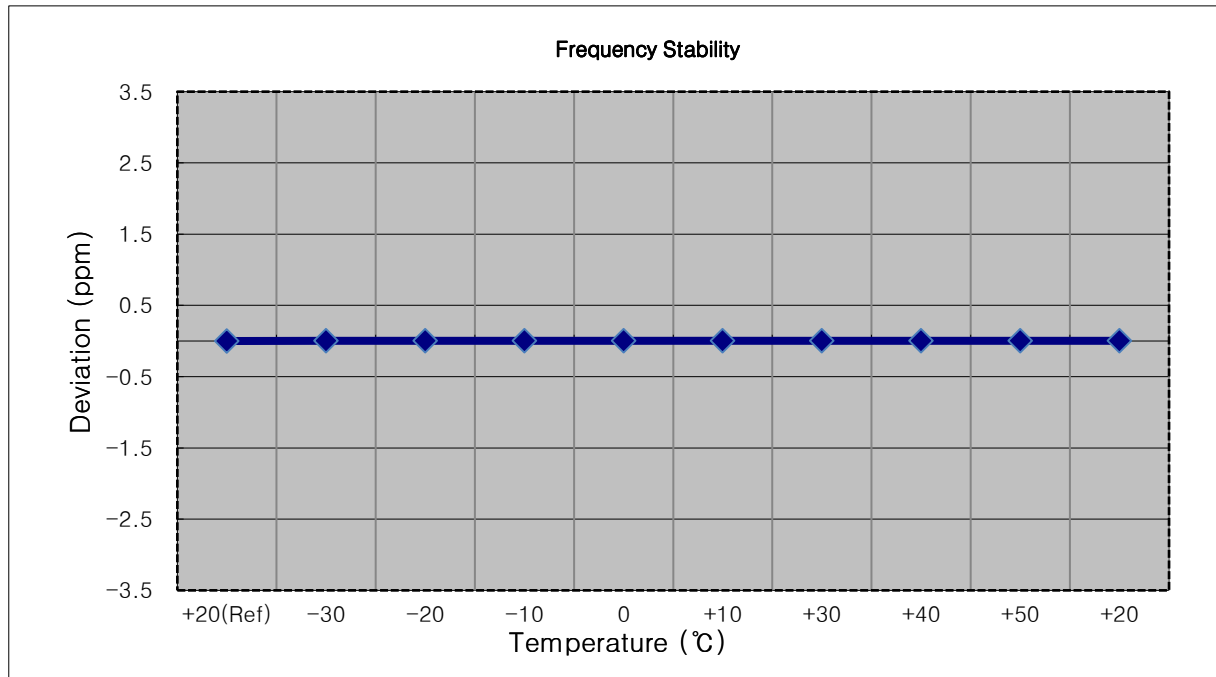
Note:

1. C.E = Channel Edge
2. X = X is the greater of 6 MHz or the actual emission bandwidth.
3. X = 6 MHz(5 MHz Bandwidth), 10 MHz(10 MHz Bandwidth), 15 MHz(15 MHz Bandwidth), 20 MHz(20 MHz Bandwidth)
4. RB = Resource Block
5. Duty Cycle factor already applied on the factor.
 - Factor(dB) = Duty Cycle factor + Cable Loss + Ext. Attenuator + Power Splitter
 - Result(dBm) = Reading + Factor
 - Duty Cycle Factor(dB) = 3.979
6. Plots of the EUT's Channel Edge are shown Page 79 ~ 106. (1RB & Full RB)

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

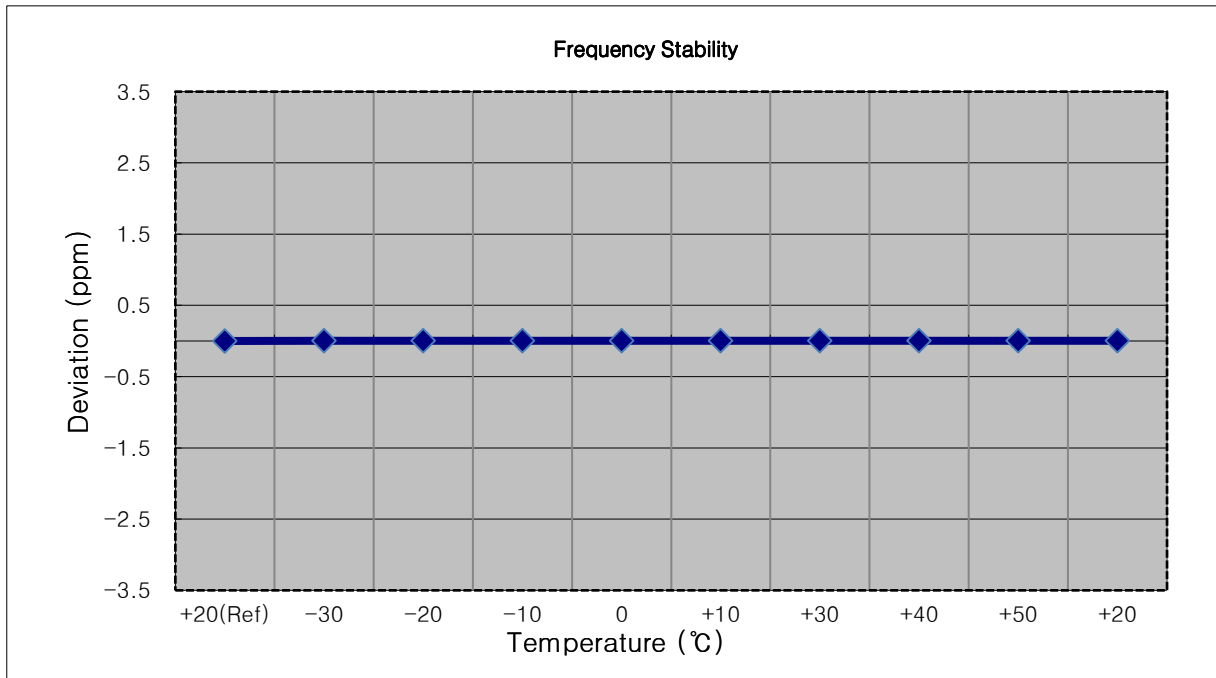
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2498,500,000 Hz
- ▣ BANDWIDTH: 39675 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2498 500 005	0.0	0.000 000	0.000
100 %		-30	2498 500 012	6.9	0.000 000	0.003
100 %		-20	2498 500 011	5.2	0.000 000	0.002
100 %		-10	2498 500 010	4.5	0.000 000	0.002
100 %		0	2498 500 012	6.3	0.000 000	0.003
100 %		+10	2498 500 014	8.1	0.000 000	0.003
100 %		+30	2498 500 012	6.2	0.000 000	0.002
100 %		+40	2498 500 012	6.1	0.000 000	0.002
100 %		+50	2498 500 011	6.0	0.000 000	0.002
Batt. Endpoint		3.300	+20	2498 500 011	5.1	0.000 000



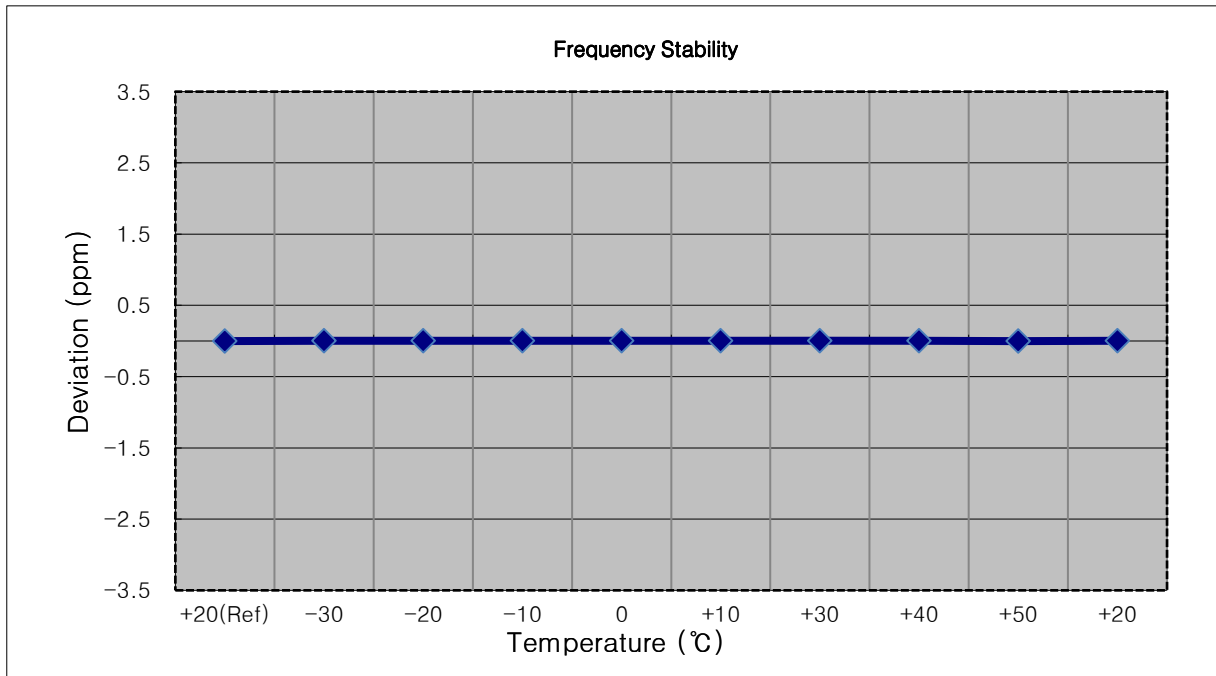
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2501,000,000 Hz
- ▣ BANDWIDTH: 39700 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2501 000 006	0.0	0.000 000	0.000
100 %		-30	2501 000 012	5.9	0.000 000	0.002
100 %		-20	2501 000 012	6.0	0.000 000	0.002
100 %		-10	2501 000 014	7.6	0.000 000	0.003
100 %		0	2501 000 012	5.9	0.000 000	0.002
100 %		+10	2501 000 013	6.4	0.000 000	0.003
100 %		+30	2501 000 011	4.5	0.000 000	0.002
100 %		+40	2501 000 013	6.8	0.000 000	0.003
100 %		+50	2501 000 011	4.7	0.000 000	0.002
Batt. Endpoint	3.300	+20	2501 000 012	6.1	0.000 000	0.002



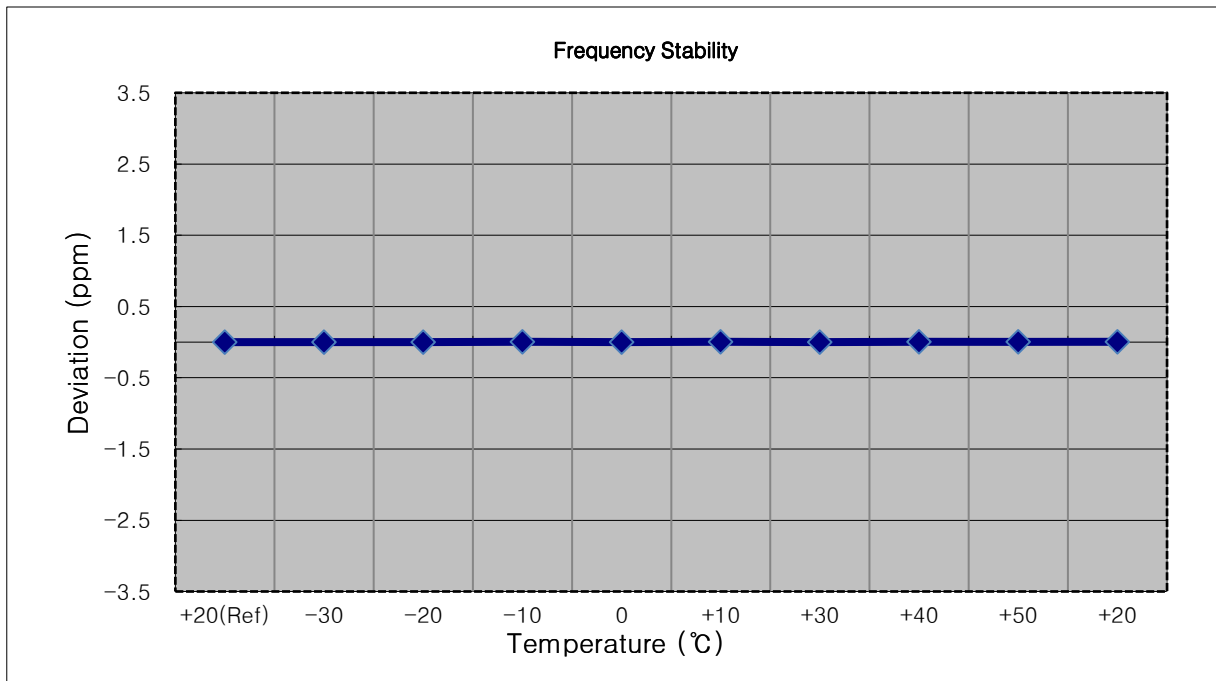
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2503,500,000 Hz
- ▣ BANDWIDTH: 39725 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2503 500 006	0.0	0.000 000	0.000
100 %		-30	2503 500 010	4.2	0.000 000	0.002
100 %		-20	2503 500 010	4.7	0.000 000	0.002
100 %		-10	2503 500 010	4.4	0.000 000	0.002
100 %		0	2503 500 010	4.3	0.000 000	0.002
100 %		+10	2503 500 012	6.9	0.000 000	0.003
100 %		+30	2503 500 014	8.9	0.000 000	0.004
100 %		+40	2503 500 009	3.0	0.000 000	0.001
100 %		+50	2503 500 001	2503 500 001	-5.0	0.000 000
Batt. Endpoint	3.300	+20	2503 500 011	5.0	0.000 000	0.002



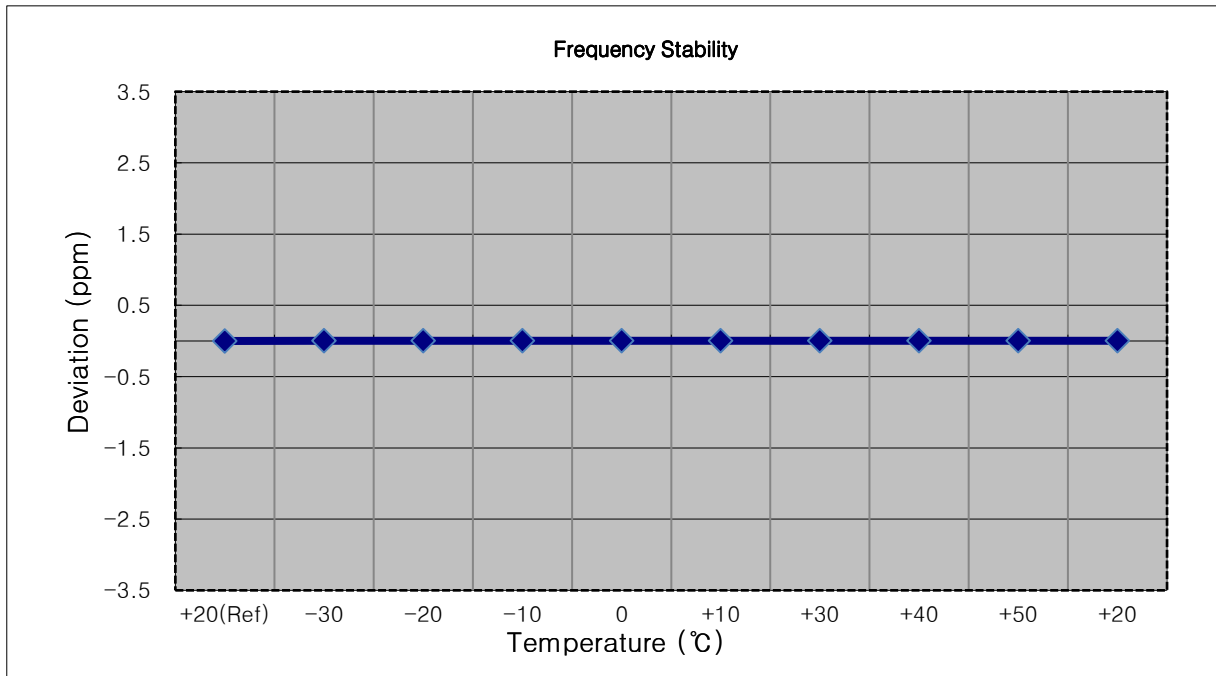
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2506,000,000 Hz
- ▣ BANDWIDTH: 39750 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2506 000 009	0.0	0.000 000	0.000
100 %		-30	2506 000 014	5.0	0.000 000	0.002
100 %		-20	2506 000 014	5.1	0.000 000	0.002
100 %		-10	2506 000 017	8.5	0.000 000	0.003
100 %		0	2506 000 015	5.9	0.000 000	0.002
100 %		+10	2506 000 016	7.0	0.000 000	0.003
100 %		+30	2506 000 015	5.8	0.000 000	0.002
100 %		+40	2506 000 016	7.5	0.000 000	0.003
100 %		+50	2506 000 018	9.3	0.000 000	0.004
Batt. Endpoint		3.300	+20	2506 000 016	7.5	0.000 000



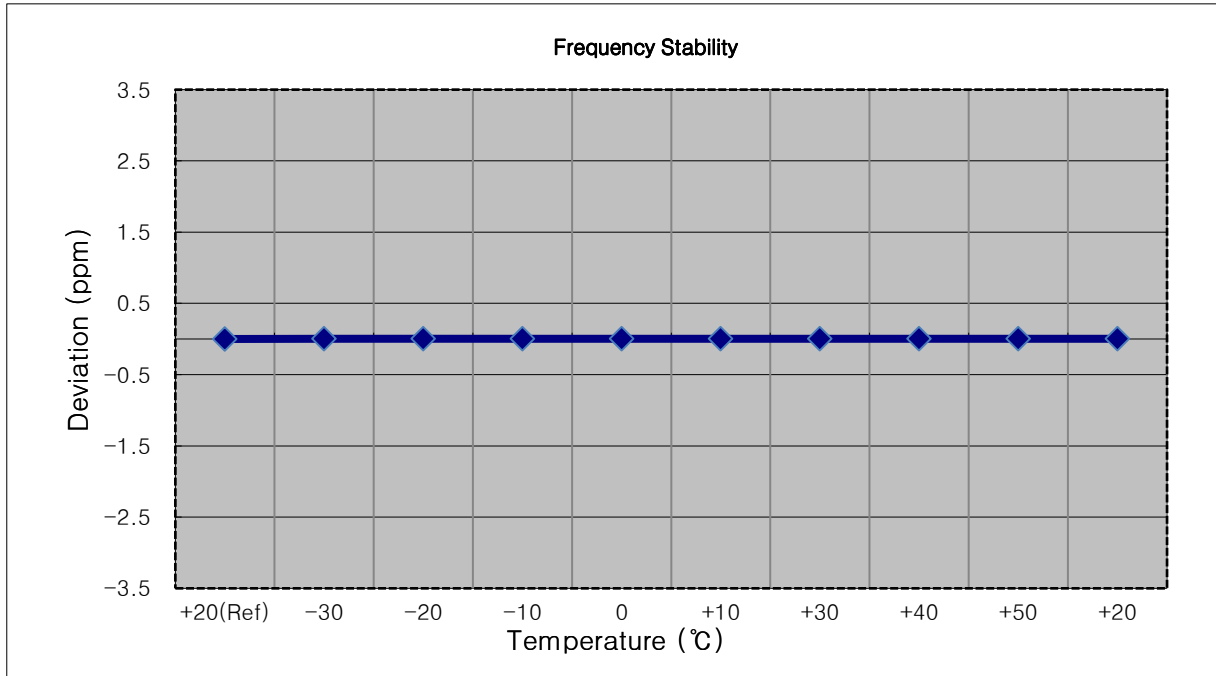
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2593 000 007	0.0	0.000 000	0.000
100 %		-30	2593 000 013	6.6	0.000 000	0.003
100 %		-20	2593 000 014	7.5	0.000 000	0.003
100 %		-10	2593 000 014	7.6	0.000 000	0.003
100 %		0	2593 000 012	4.9	0.000 000	0.002
100 %		+10	2593 000 012	5.5	0.000 000	0.002
100 %		+30	2593 000 012	5.4	0.000 000	0.002
100 %		+40	2593 000 015	8.1	0.000 000	0.003
100 %		+50	2593 000 014	7.0	0.000 000	0.003
Batt. Endpoint	3.300	+20	2593 000 013	6.0	0.000 000	0.002



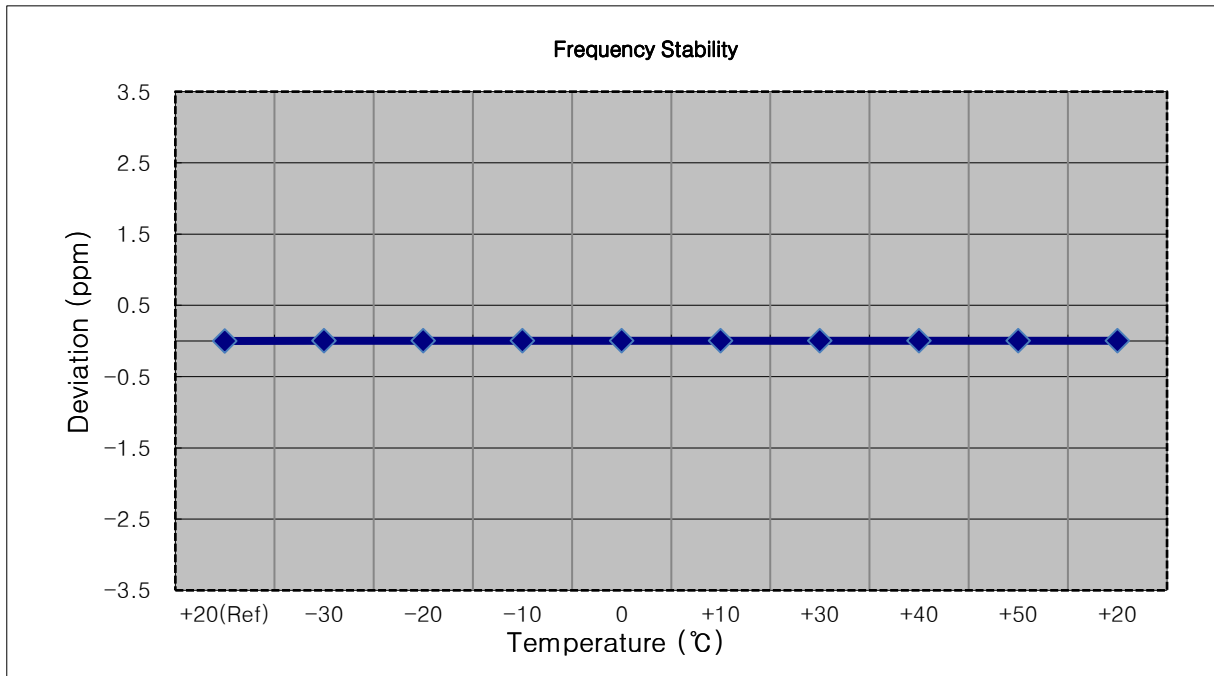
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2593 000 006	0.0	0.000 000	0.000
100 %		-30	2593 000 011	5.3	0.000 000	0.002
100 %		-20	2593 000 014	8.6	0.000 000	0.003
100 %		-10	2593 000 009	3.4	0.000 000	0.001
100 %		0	2593 000 014	8.3	0.000 000	0.003
100 %		+10	2593 000 012	6.0	0.000 000	0.002
100 %		+30	2593 000 010	4.7	0.000 000	0.002
100 %		+40	2593 000 012	6.7	0.000 000	0.003
100 %		+50	2593 000 011	5.3	0.000 000	0.002
Batt. Endpoint	3.300	+20	2593 000 013	7.3	0.000 000	0.003



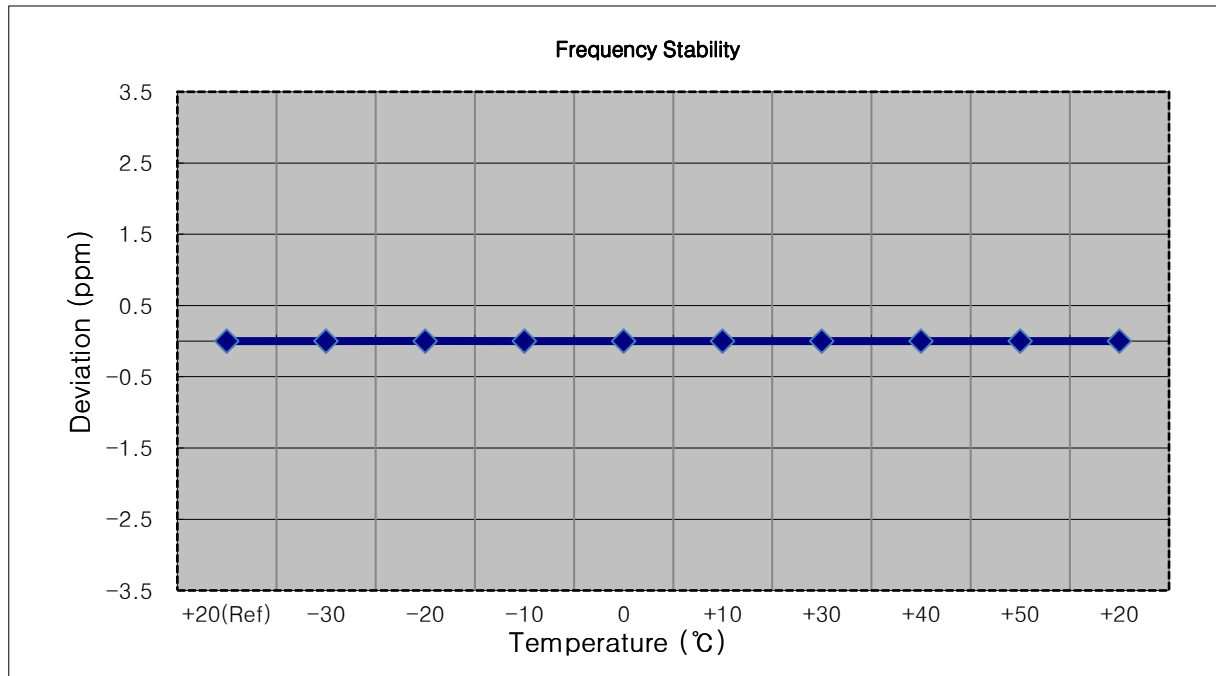
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2593 000 007	0.0	0.000 000	0.000
100 %		-30	2593 000 012	4.6	0.000 000	0.002
100 %		-20	2593 000 012	5.3	0.000 000	0.002
100 %		-10	2593 000 014	6.8	0.000 000	0.003
100 %		0	2593 000 012	4.8	0.000 000	0.002
100 %		+10	2593 000 012	5.3	0.000 000	0.002
100 %		+30	2593 000 013	5.7	0.000 000	0.002
100 %		+40	2593 000 014	6.5	0.000 000	0.003
100 %		+50	2593 000 012	4.8	0.000 000	0.002
Batt. Endpoint	3.300	+20	2593 000 015	7.7	0.000 000	0.003



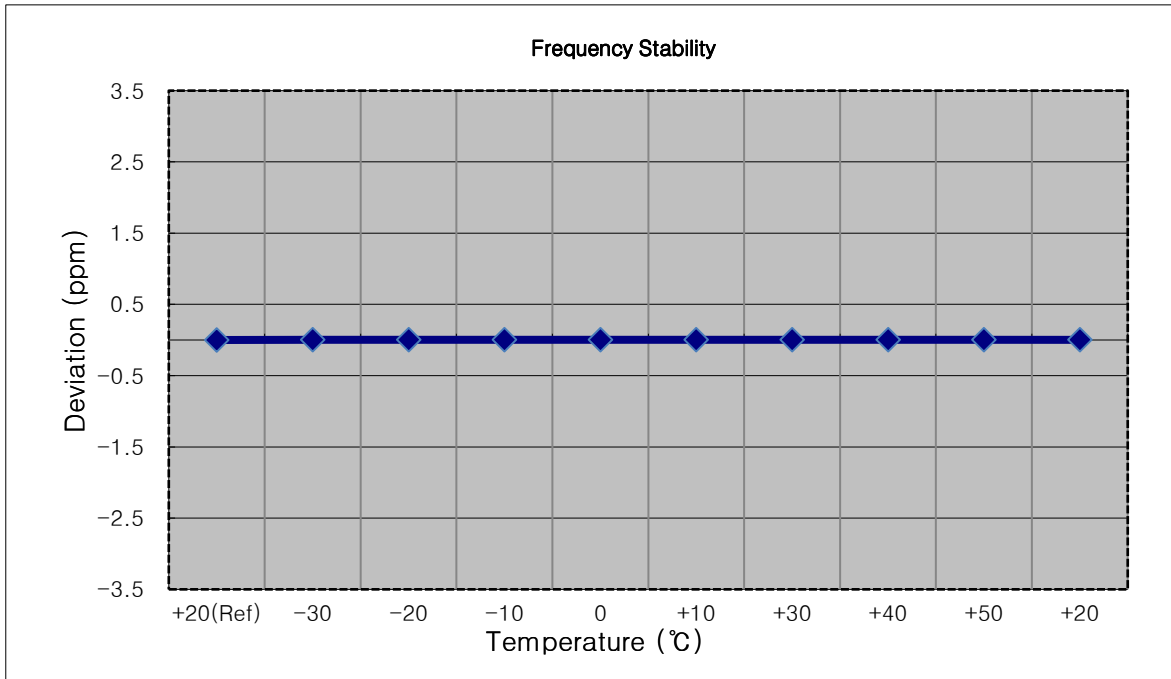
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2593 000 006	0.0	0.000 000	0.000
100 %		-30	2593 000 013	6.5	0.000 000	0.003
100 %		-20	2593 000 013	6.7	0.000 000	0.003
100 %		-10	2593 000 011	4.9	0.000 000	0.002
100 %		0	2593 000 012	5.3	0.000 000	0.002
100 %		+10	2593 000 012	5.5	0.000 000	0.002
100 %		+30	2593 000 010	4.0	0.000 000	0.002
100 %		+40	2593 000 013	6.2	0.000 000	0.002
100 %		+50	2593 000 012	5.5	0.000 000	0.002
Batt. Endpoint	3.300	+20	2593 000 012	5.5	0.000 000	0.002



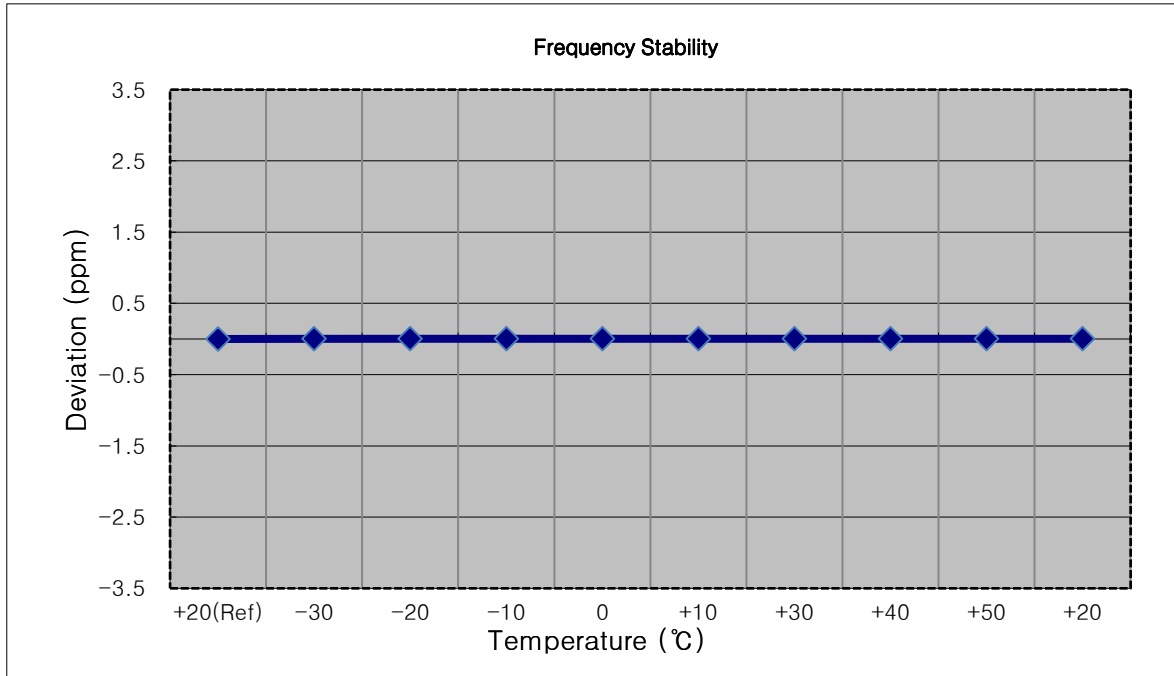
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2687,500,000 Hz
- ▣ BANDWIDTH: 41565 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2687 500 005	0.0	0.000 000	0.000
100 %		-30	2687 500 010	5.4	0.000 000	0.002
100 %		-20	2687 500 008	3.8	0.000 000	0.001
100 %		-10	2687 500 008	3.1	0.000 000	0.001
100 %		0	2687 500 008	3.8	0.000 000	0.001
100 %		+10	2687 500 010	5.4	0.000 000	0.002
100 %		+30	2687 500 010	5.2	0.000 000	0.002
100 %		+40	2687 500 009	4.6	0.000 000	0.002
100 %		+50	2687 500 009	4.4	0.000 000	0.002
Batt. Endpoint		3.300	+20	2687 500 010	5.7	0.000 000



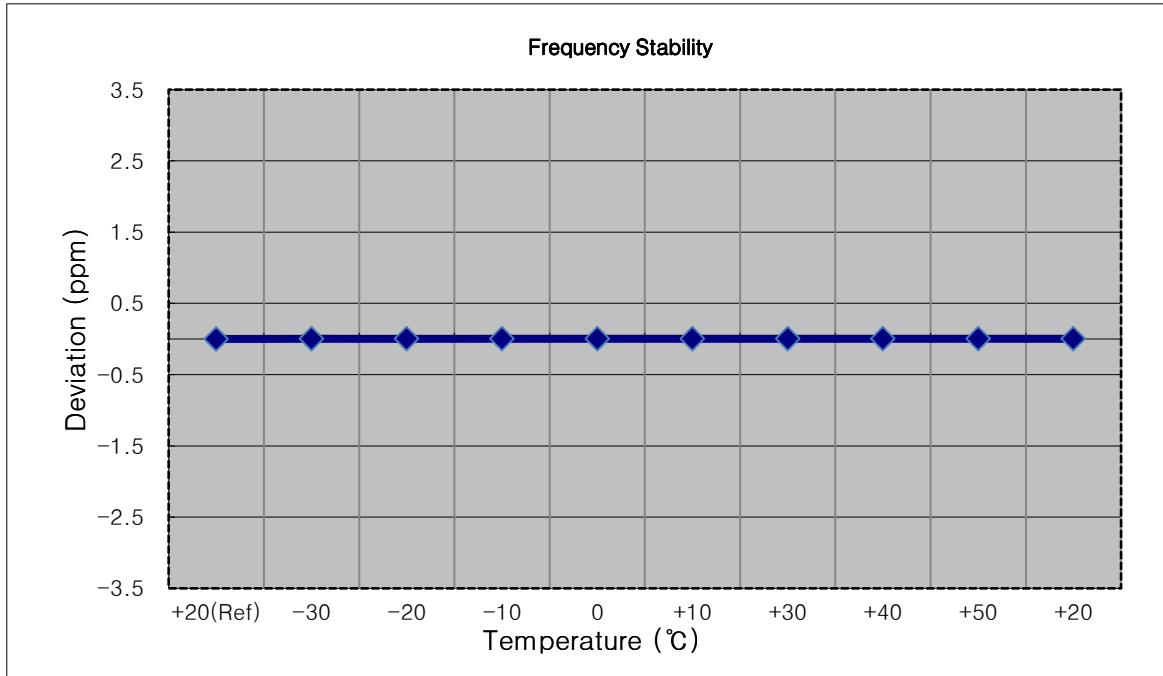
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2685,000,000 Hz
- ▣ BANDWIDTH: 41540 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2685 000 004	0.0	0.000 000	0.000
100 %		-30	2685 000 011	6.3	0.000 000	0.002
100 %		-20	2685 000 009	4.9	0.000 000	0.002
100 %		-10	2685 000 009	4.2	0.000 000	0.002
100 %		0	2685 000 010	6.0	0.000 000	0.002
100 %		+10	2685 000 009	5.0	0.000 000	0.002
100 %		+30	2685 000 009	4.7	0.000 000	0.002
100 %		+40	2685 000 009	4.8	0.000 000	0.002
100 %		+50	2685 000 009	4.2	0.000 000	0.002
Batt. Endpoint	3.300	+20	2685 000 010	5.3	0.000 000	0.002



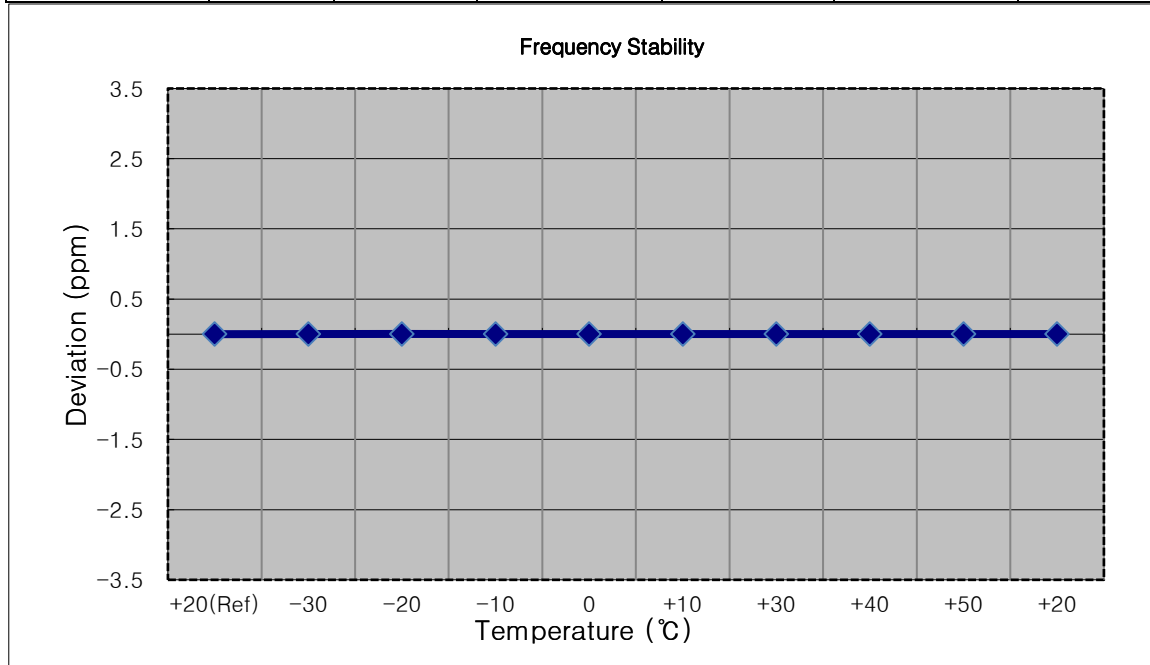
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2682,500,000 Hz
- ▣ BANDWIDTH: 41515 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2682 500 004	0.0	0.000 000	0.000
100 %		-30	2682 500 009	4.6	0.000 000	0.002
100 %		-20	2682 500 010	5.9	0.000 000	0.002
100 %		-10	2682 500 008	3.7	0.000 000	0.001
100 %		0	2682 500 010	5.4	0.000 000	0.002
100 %		+10	2682 500 010	5.4	0.000 000	0.002
100 %		+30	2682 500 010	5.8	0.000 000	0.002
100 %		+40	2682 500 009	5.1	0.000 000	0.002
100 %		+50	2682 500 009	4.6	0.000 000	0.002
Batt. Endpoint	3.300	+20	2682 500 009	4.3	0.000 000	0.002



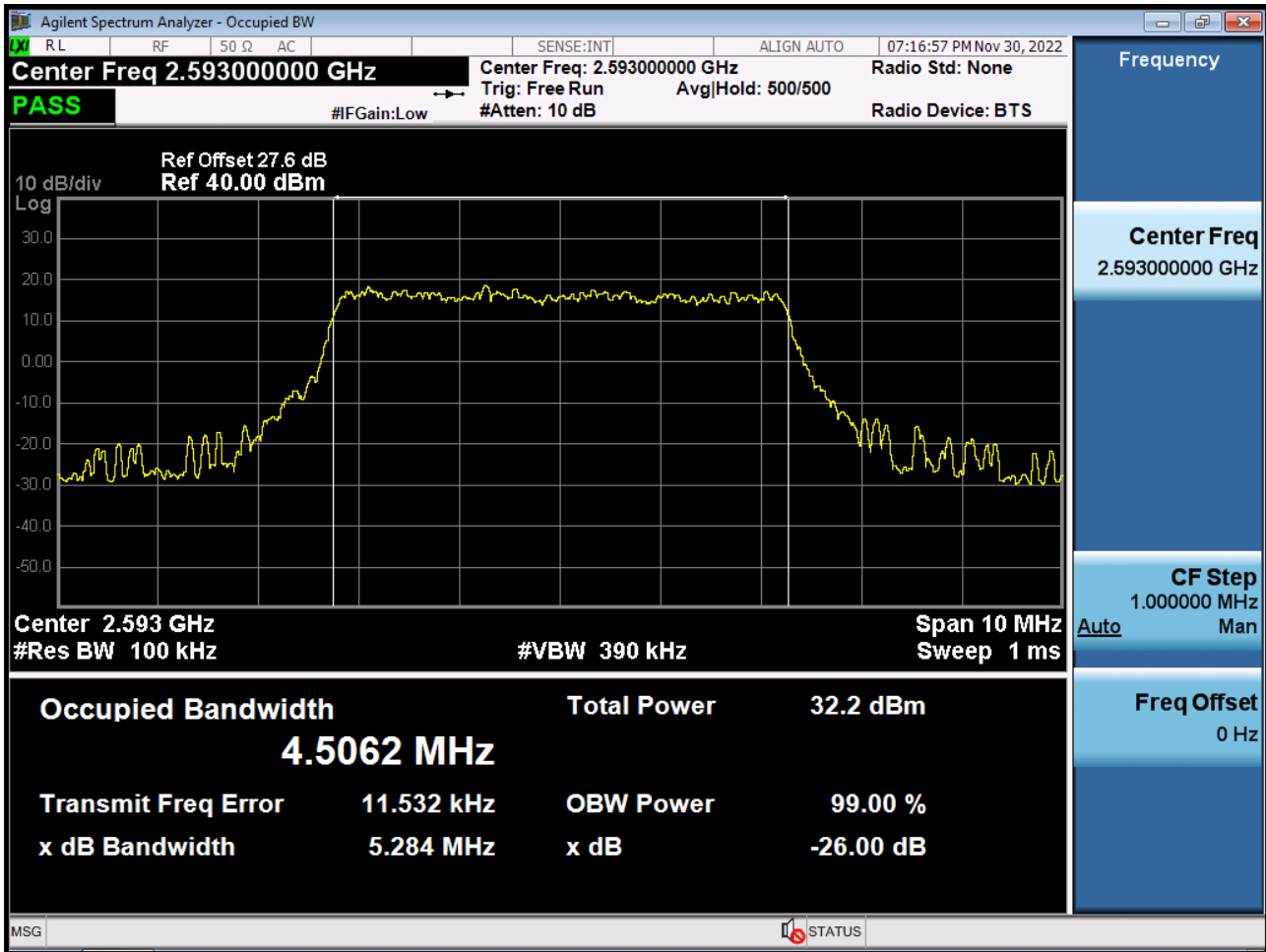
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2680,000,000 Hz
- ▣ BANDWIDTH: 41490 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2680 000 005	0.0	0.000 000	0.000
100 %		-30	2680 000 011	5.6	0.000 000	0.002
100 %		-20	2680 000 014	8.5	0.000 000	0.003
100 %		-10	2680 000 011	5.8	0.000 000	0.002
100 %		0	2680 000 012	6.7	0.000 000	0.002
100 %		+10	2680 000 011	5.6	0.000 000	0.002
100 %		+30	2680 000 013	8.3	0.000 000	0.003
100 %		+40	2680 000 012	7.4	0.000 000	0.003
100 %		+50	2680 000 010	5.4	0.000 000	0.002
Batt. Endpoint	3.300	+20	2680 000 012	6.6	0.000 000	0.002

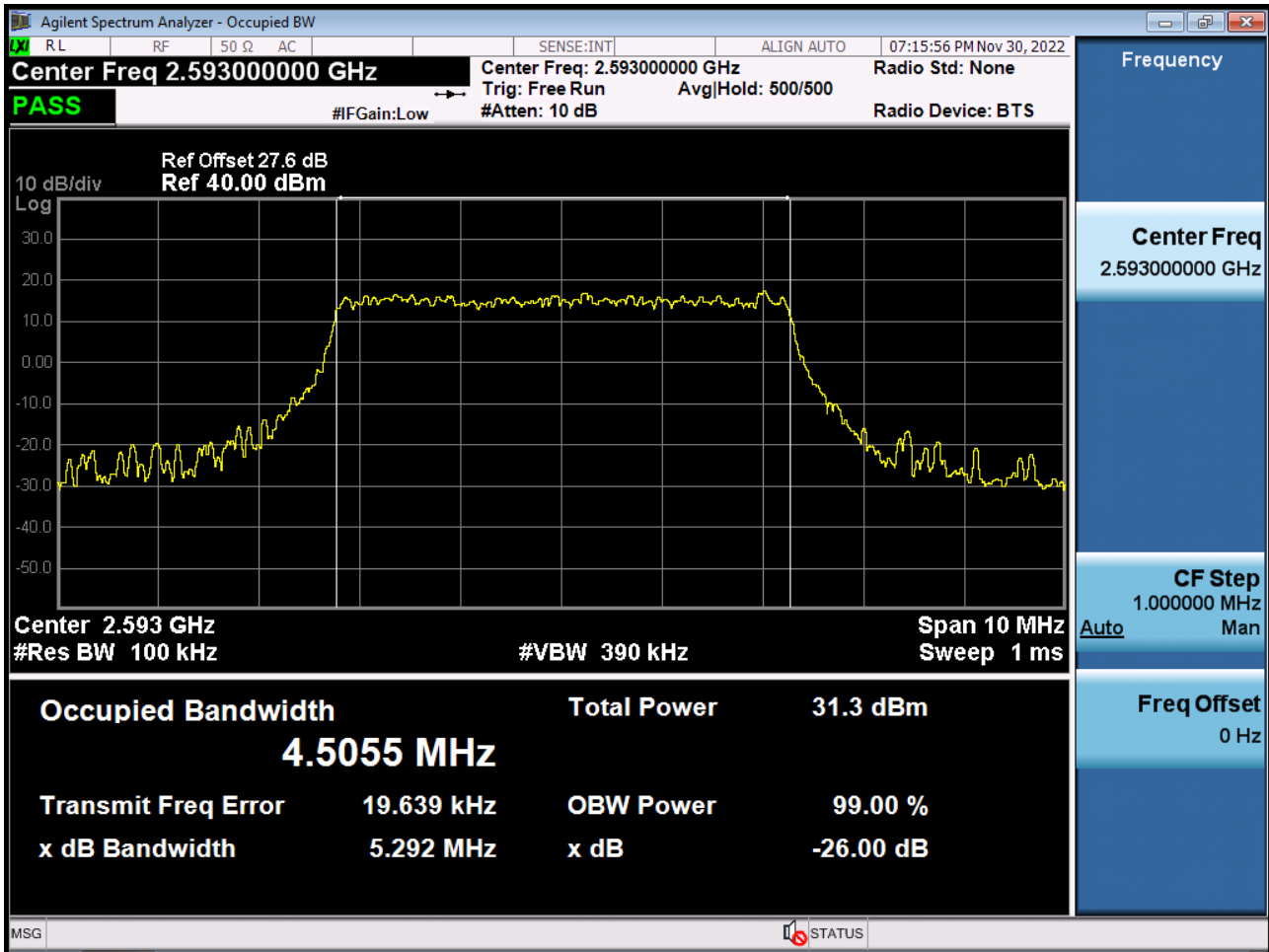


9. TEST PLOTS

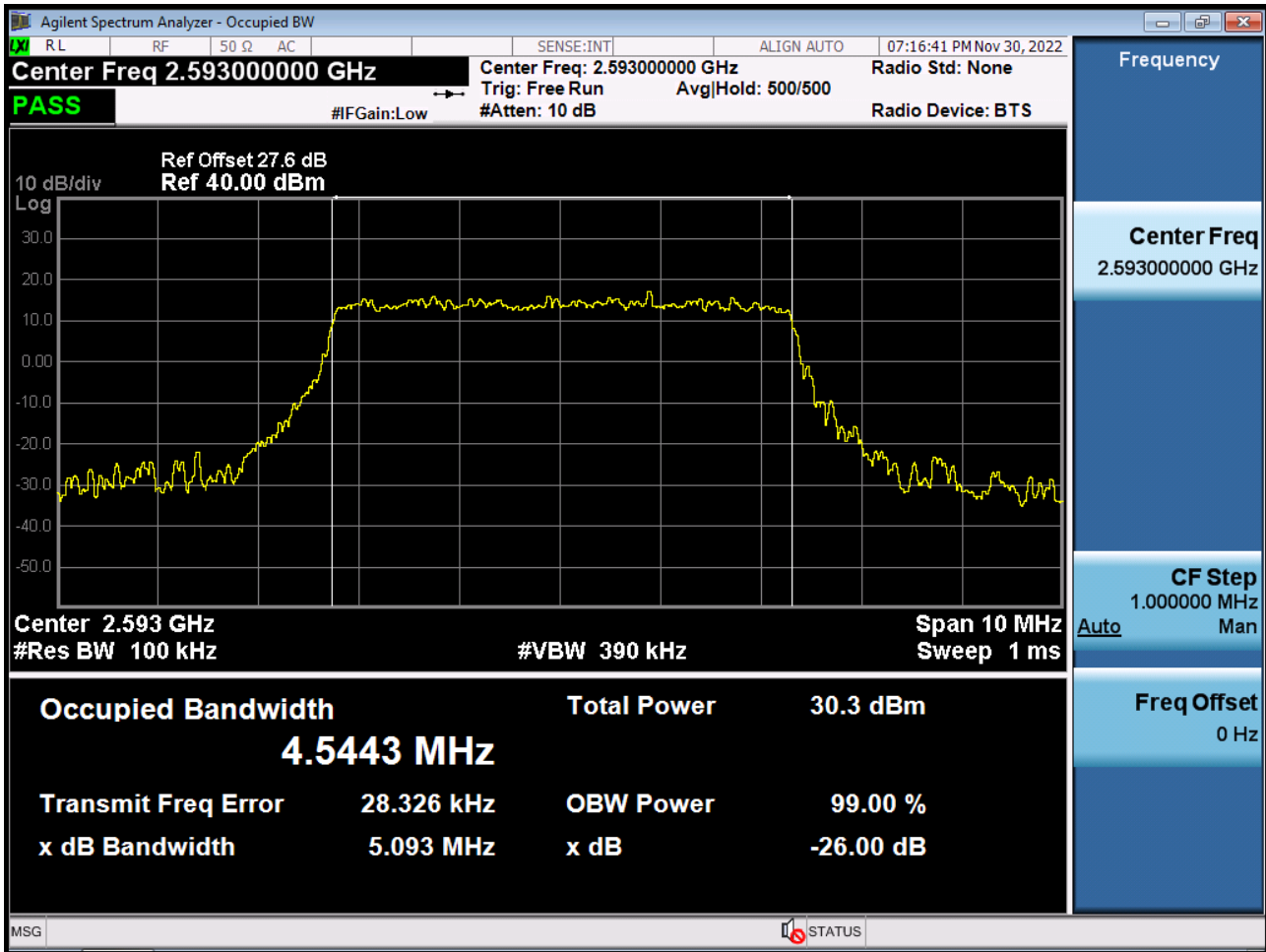
Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25)



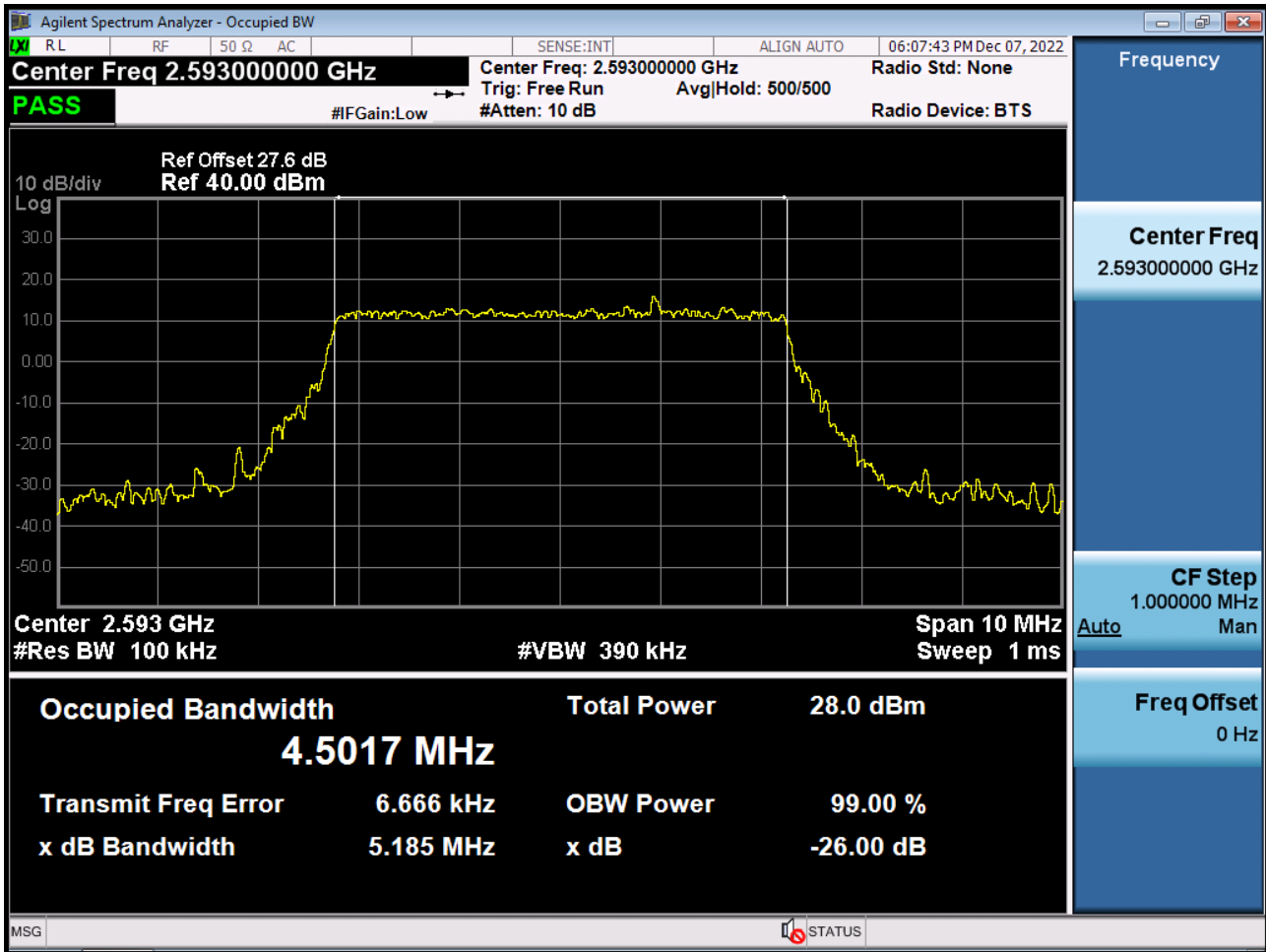
Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25)



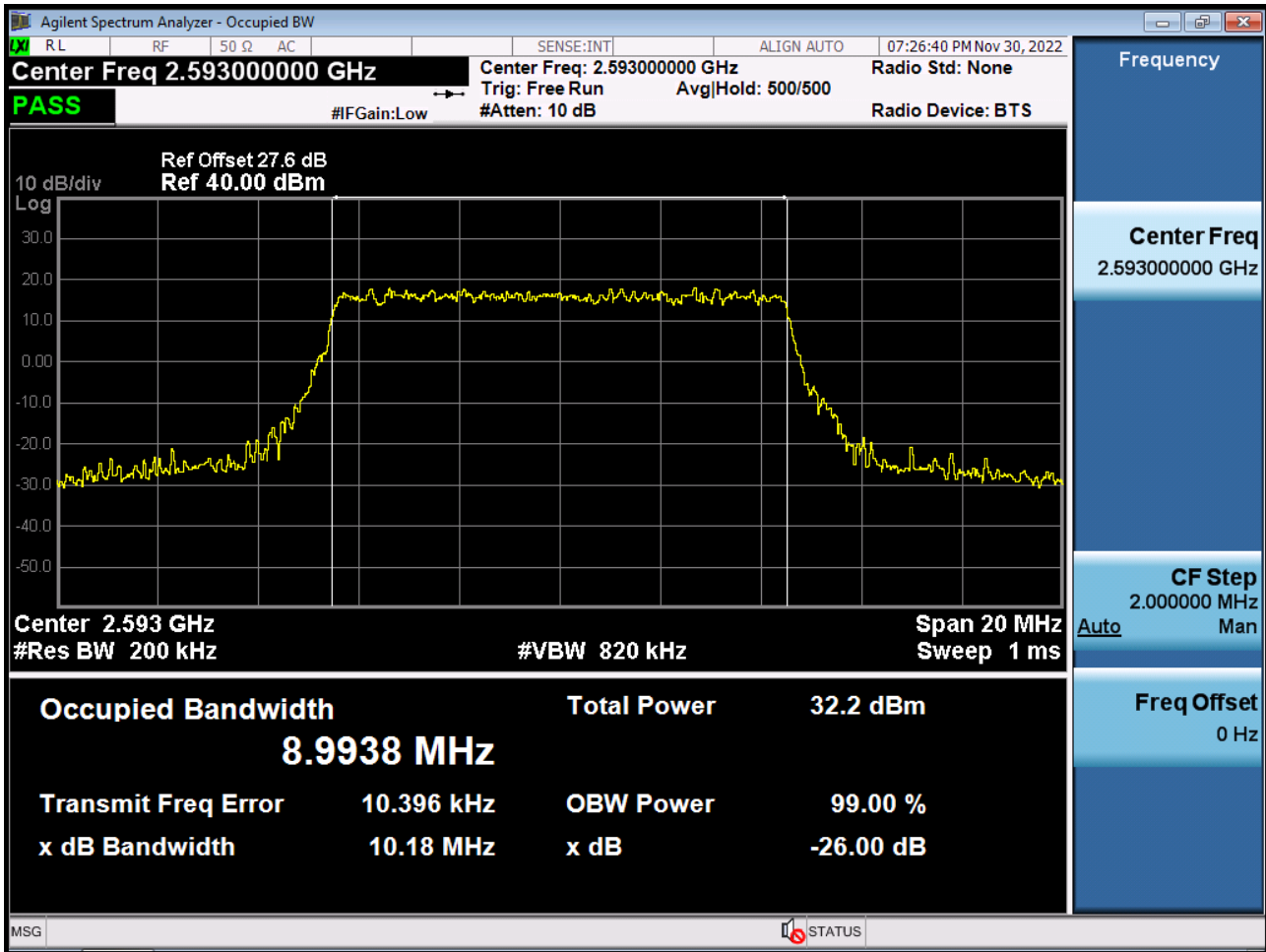
Occupied Bandwidth Plot (5 MHz Ch.40620 64-QAM RB 25)



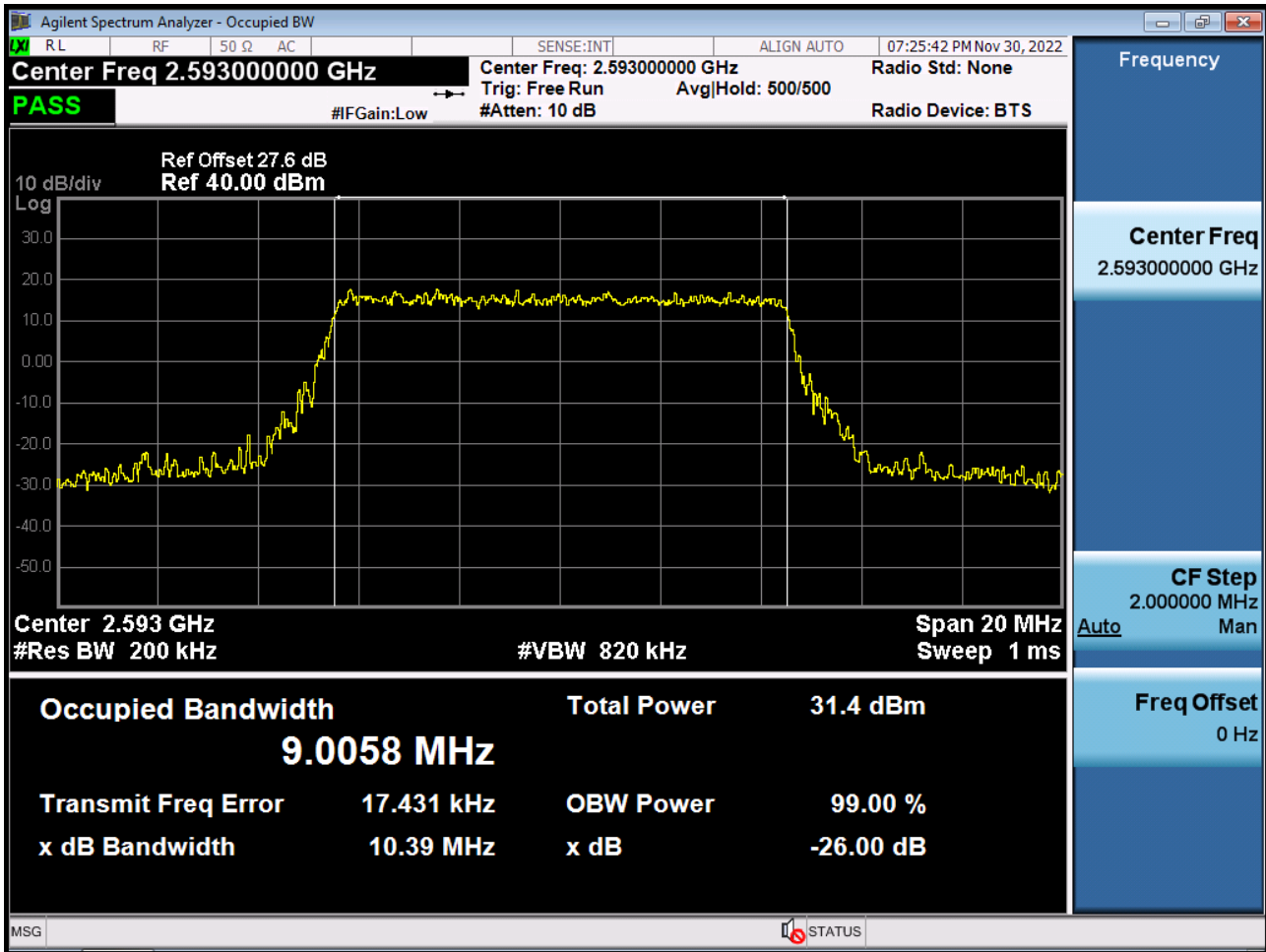
Occupied Bandwidth Plot (5 MHz Ch.40620 256-QAM RB 25)



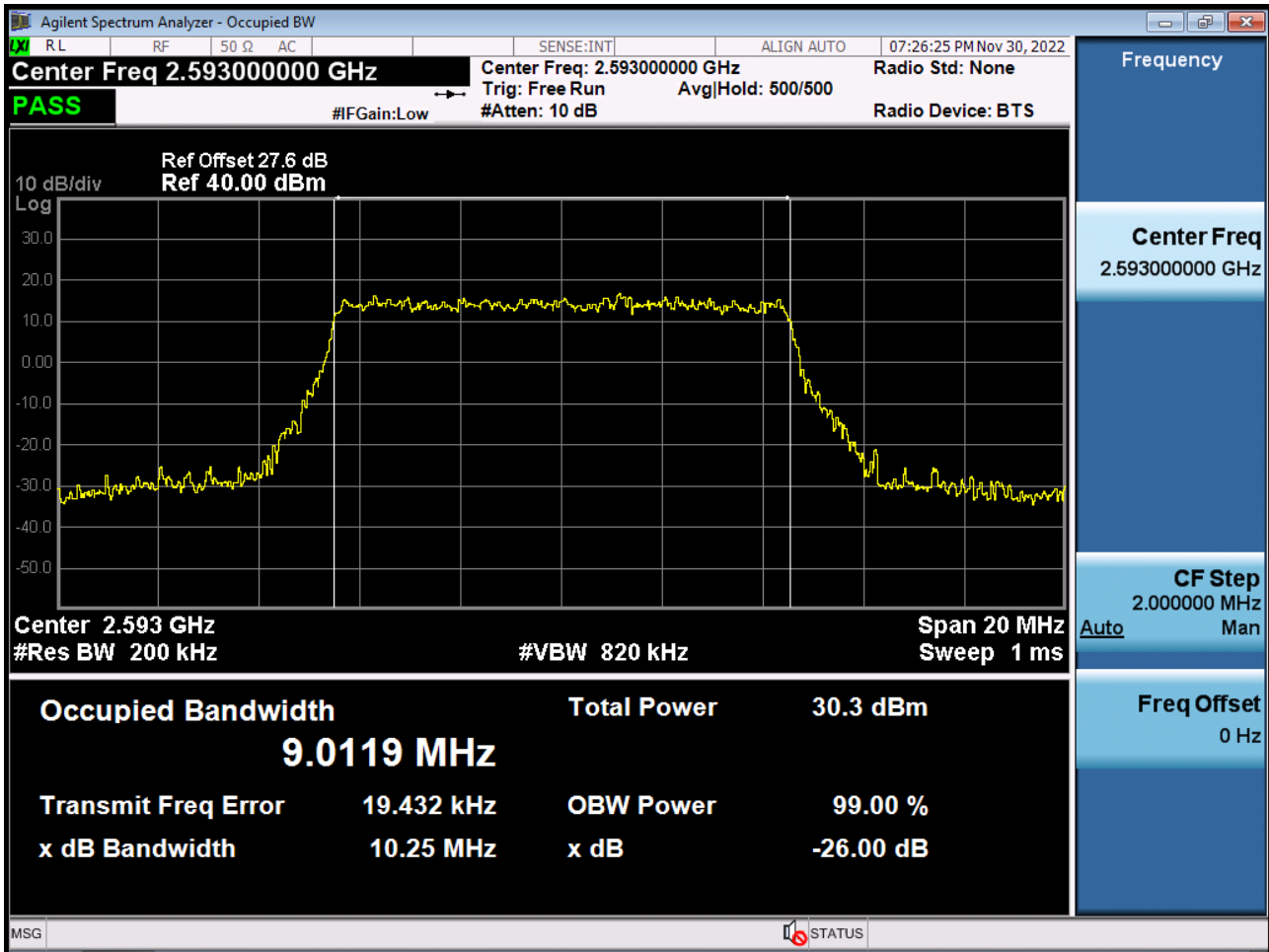
Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50)



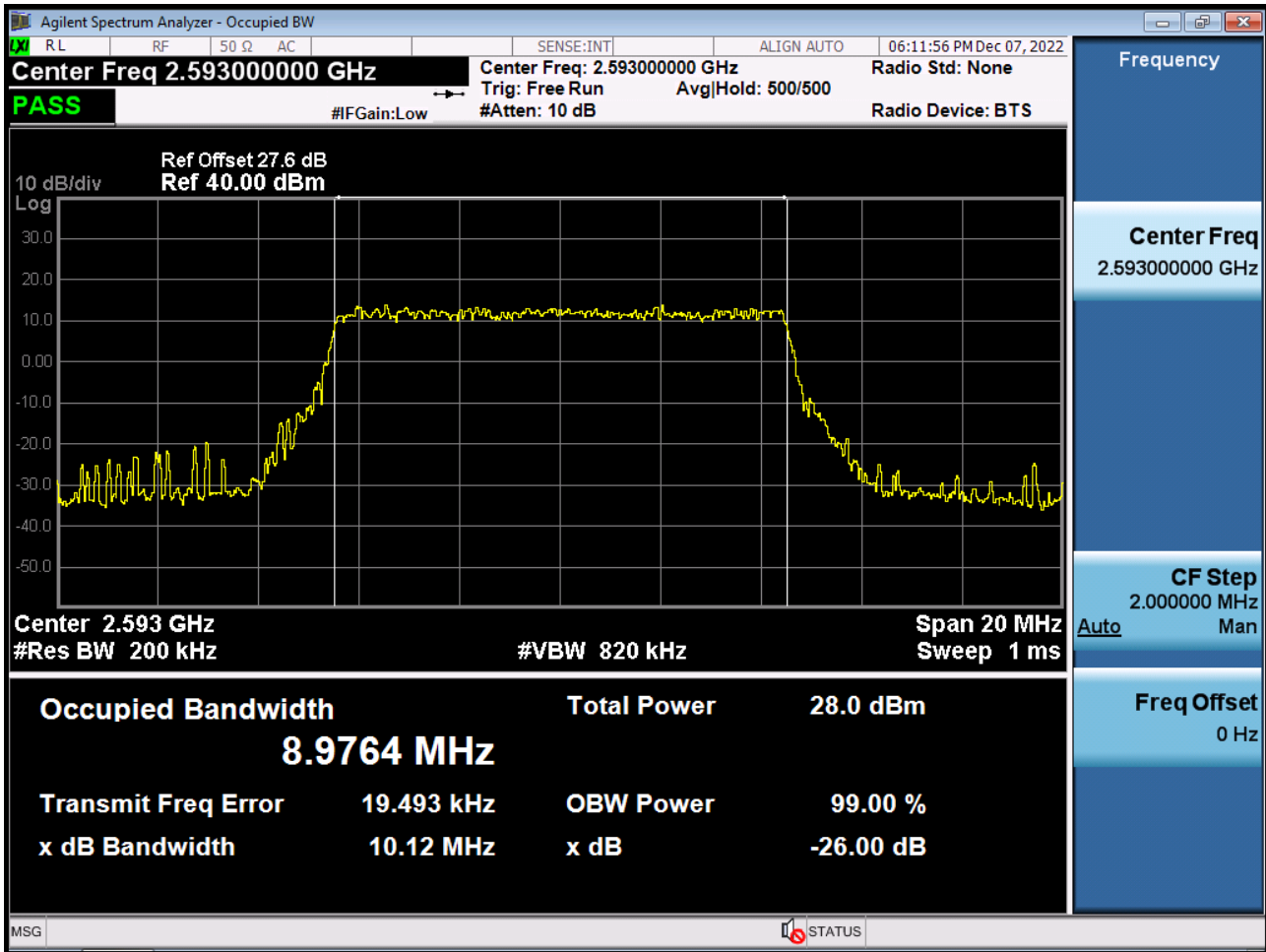
Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50)



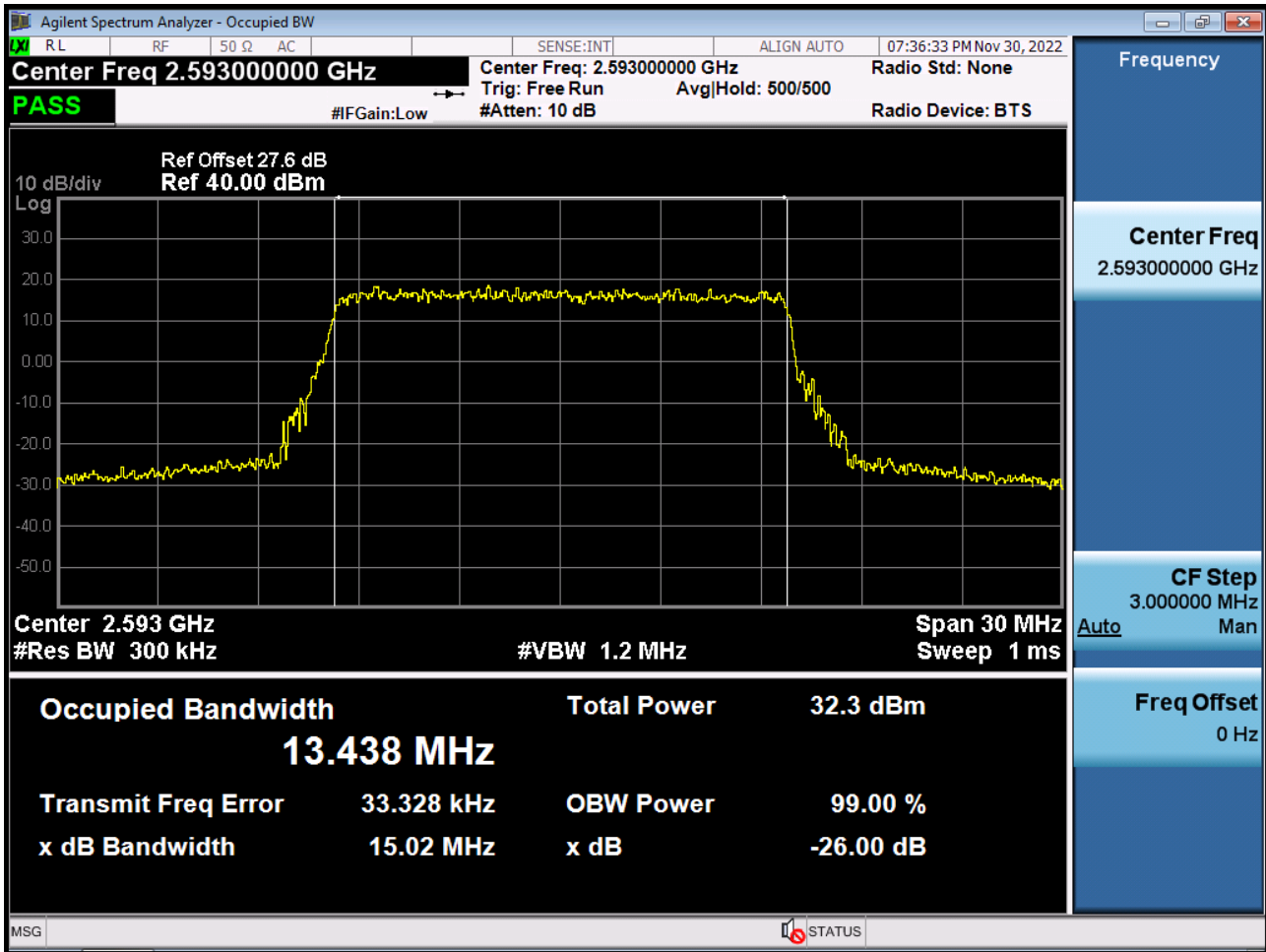
Occupied Bandwidth Plot (10 MHz Ch.40620 64-QAM RB 50)



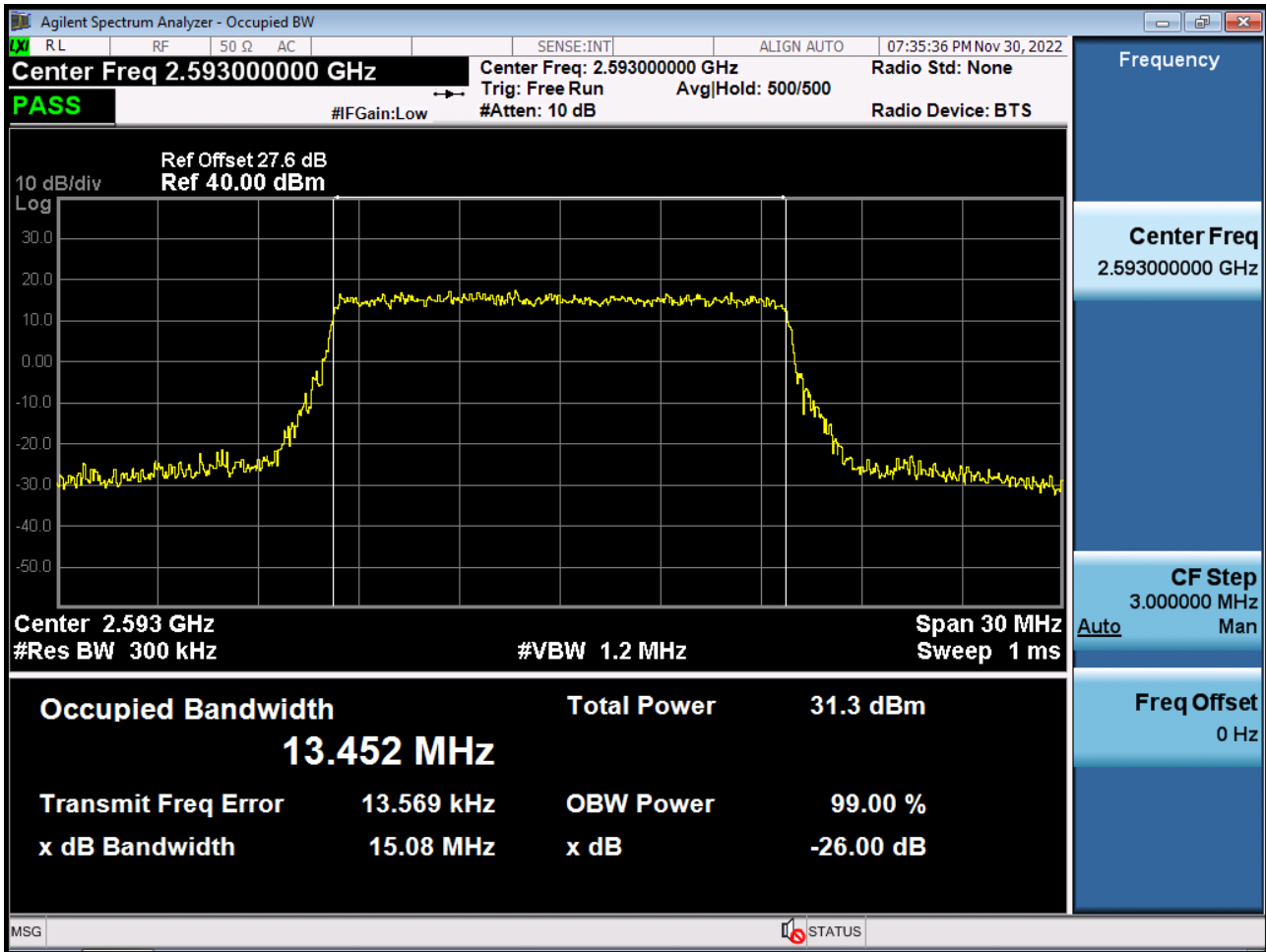
Occupied Bandwidth Plot (10 MHz Ch.40620 256-QAM RB 50)



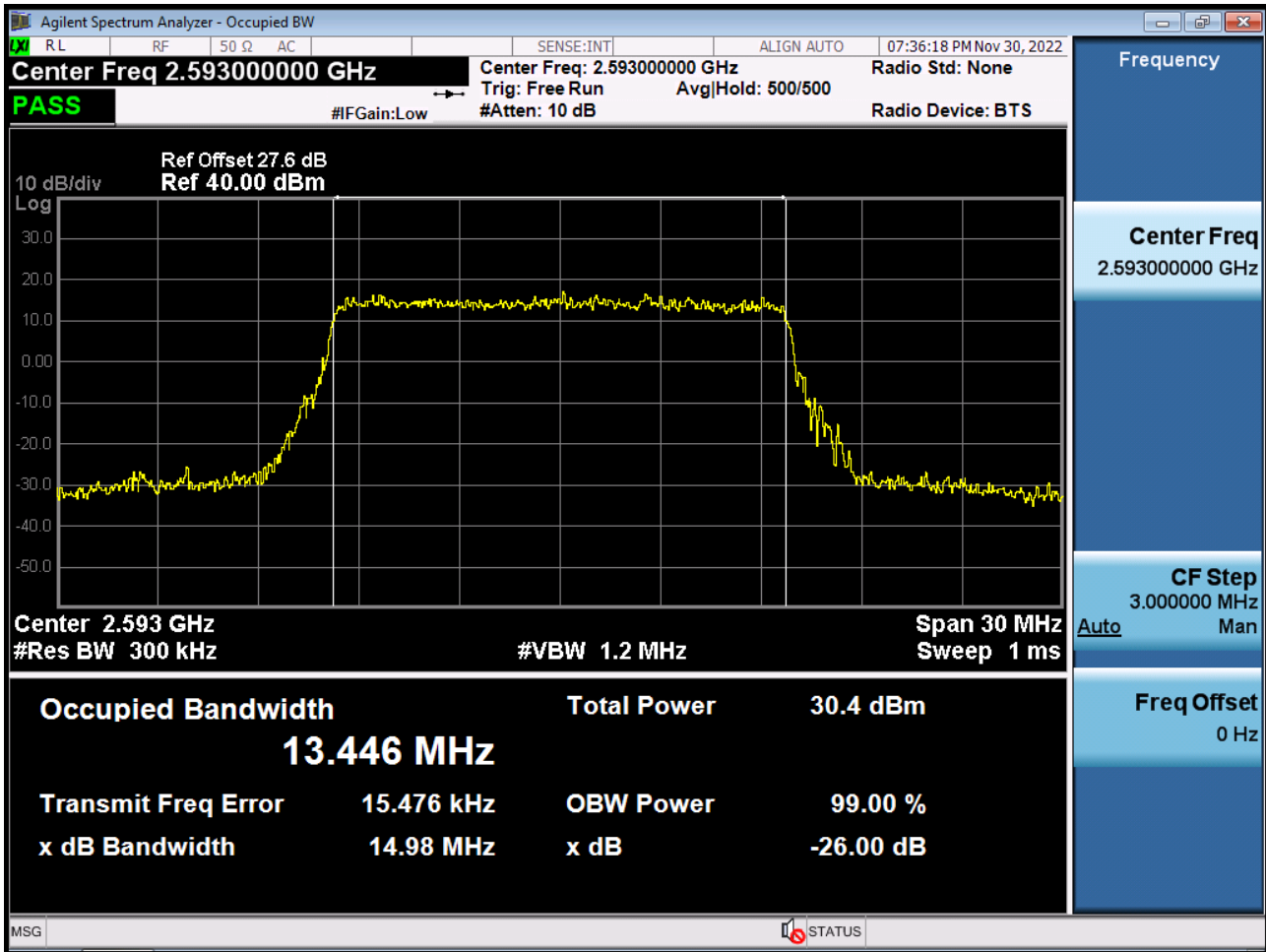
Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75)



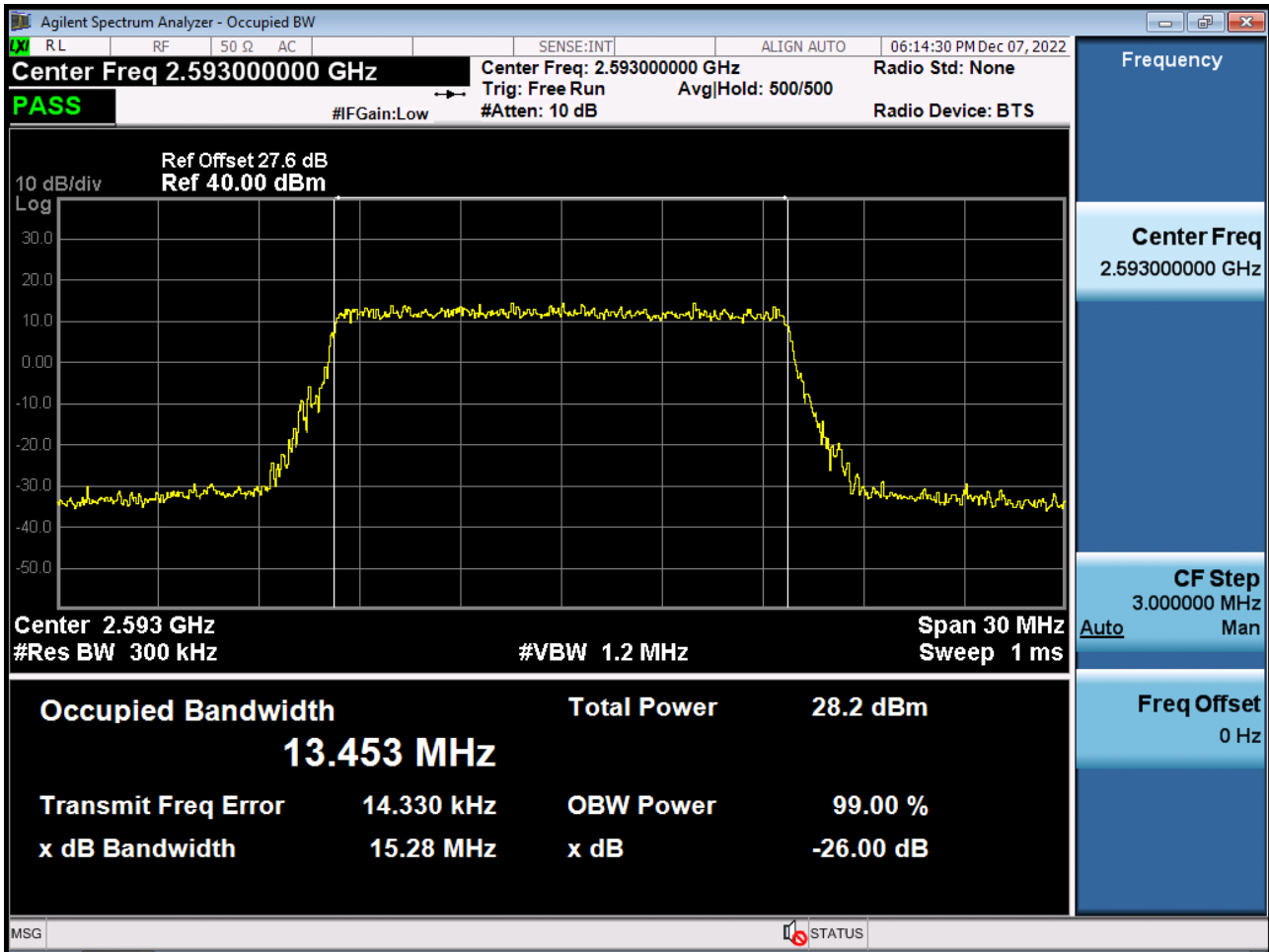
Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75)



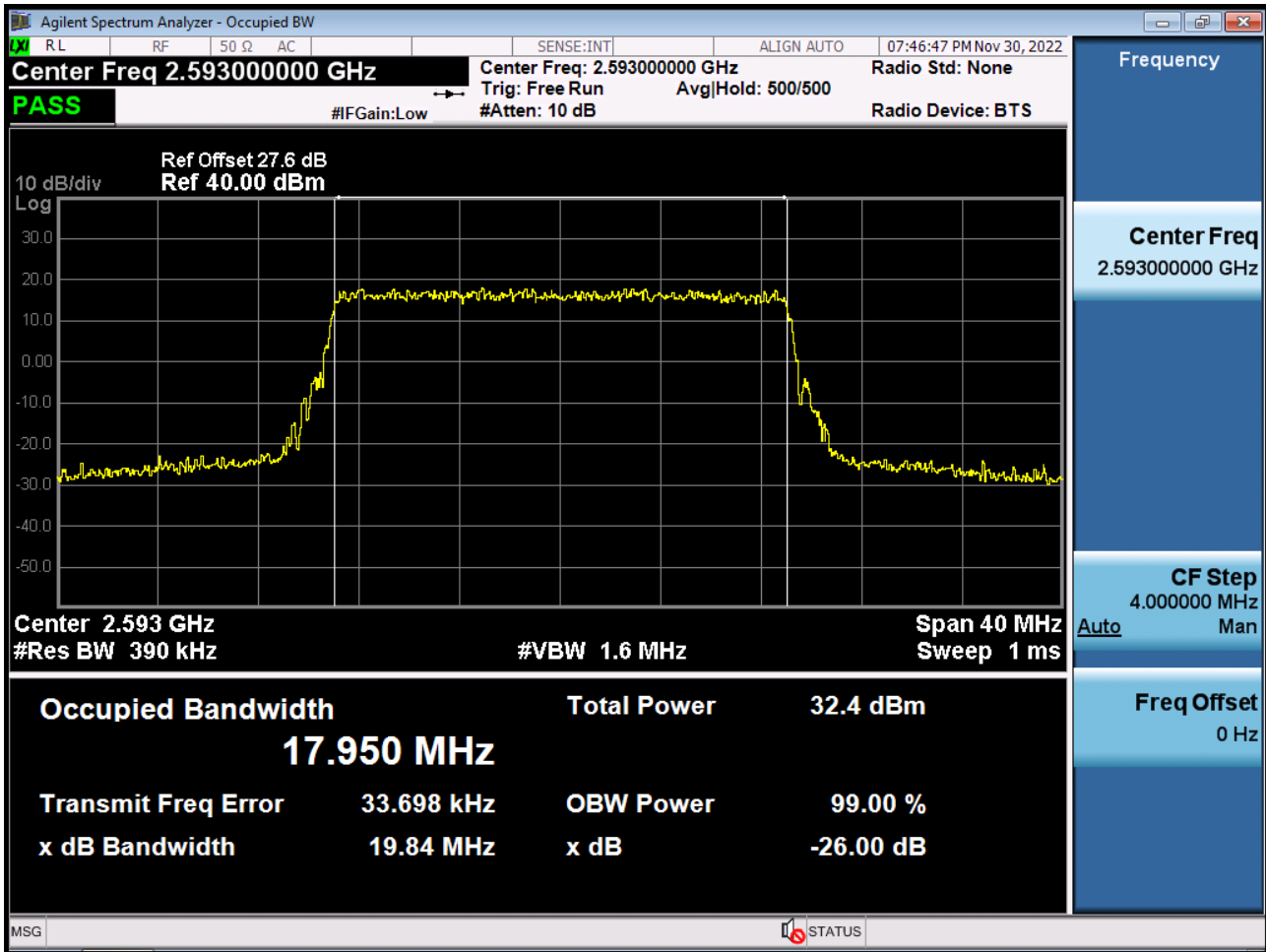
Occupied Bandwidth Plot (15 MHz Ch.40620 64-QAM RB 75)



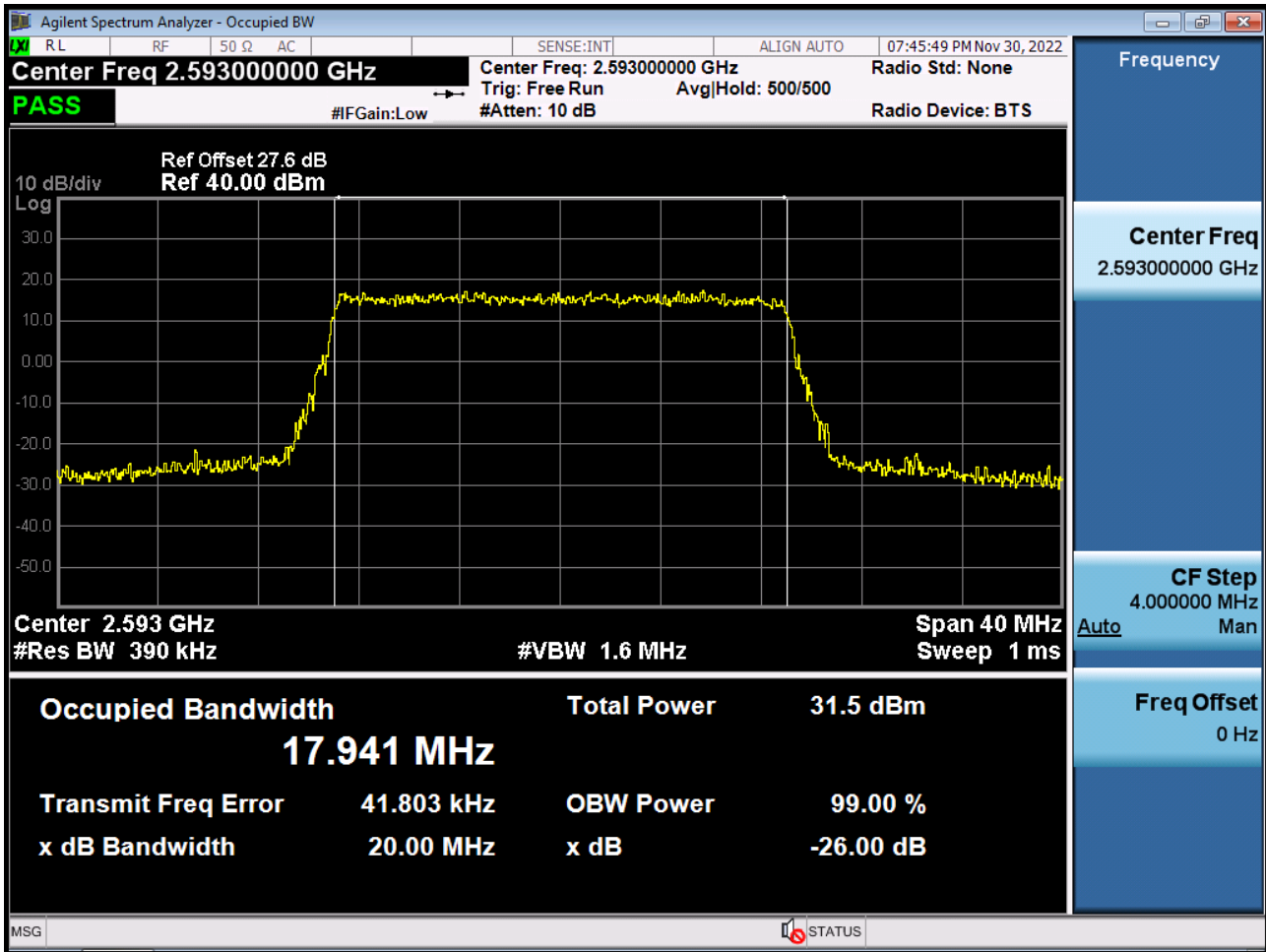
Occupied Bandwidth Plot (15 MHz Ch.40620 256-QAM RB 75)



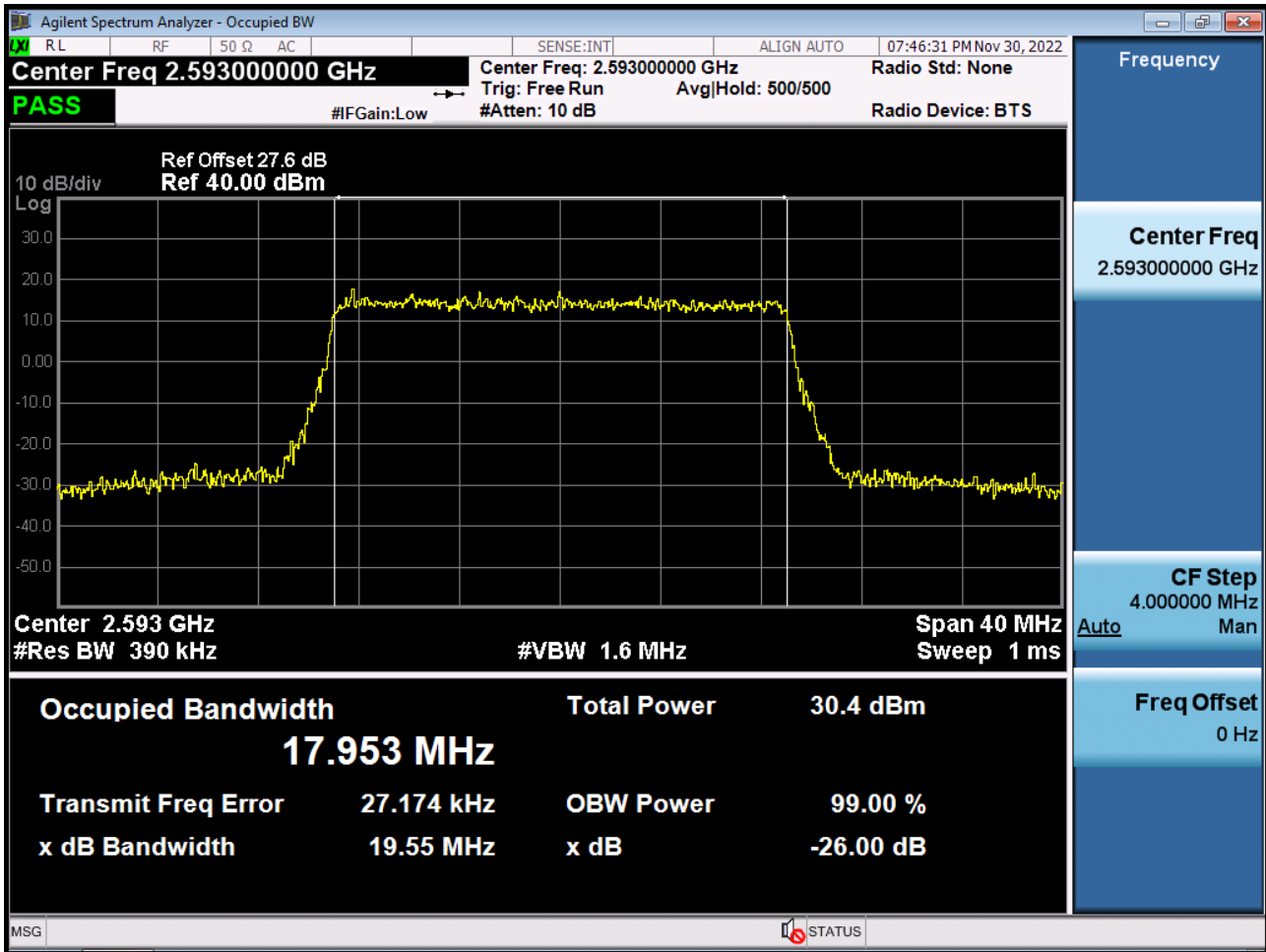
Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100)



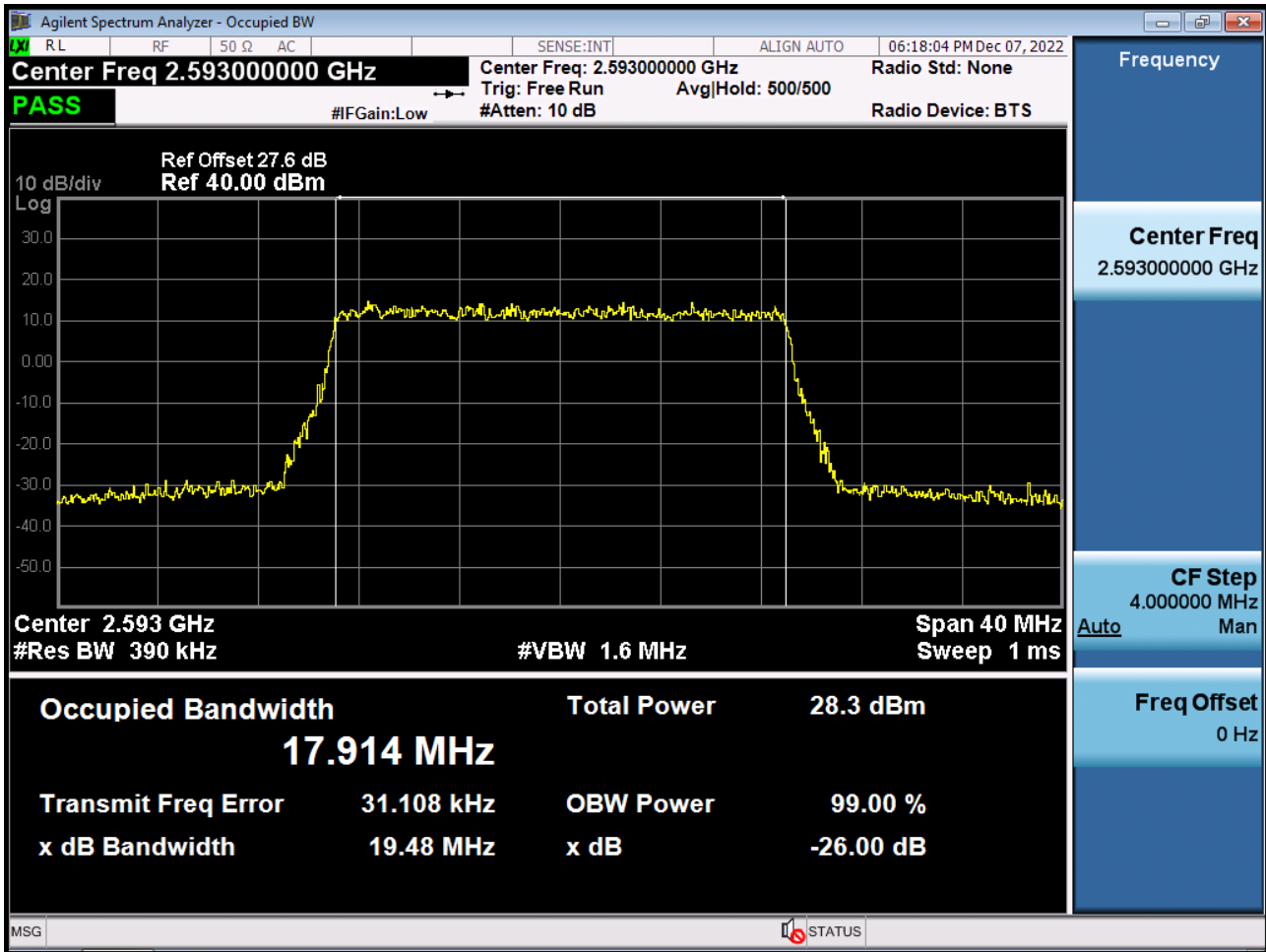
Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100)



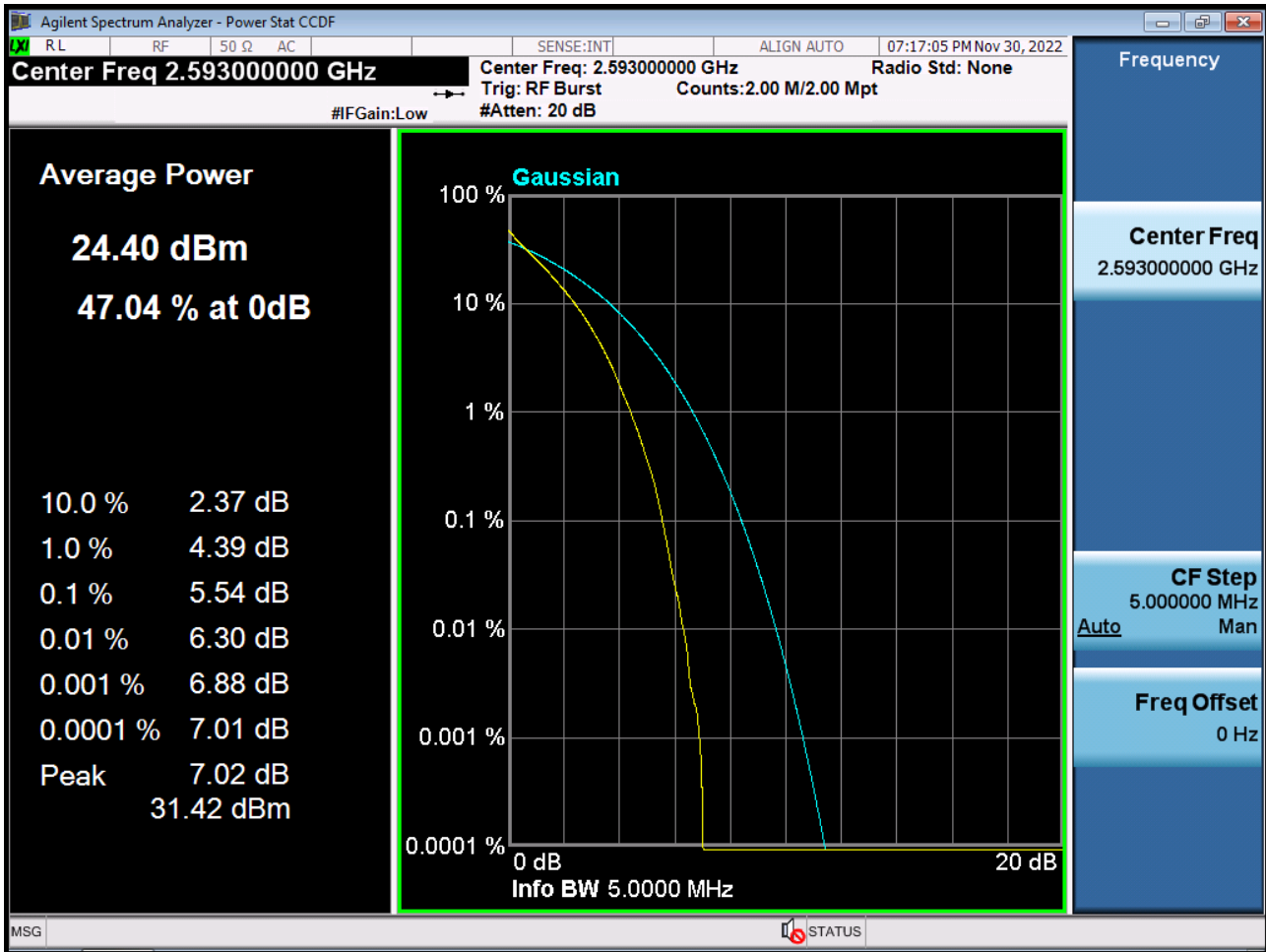
Occupied Bandwidth Plot (20 MHz Ch.40620 64-QAM RB 100)



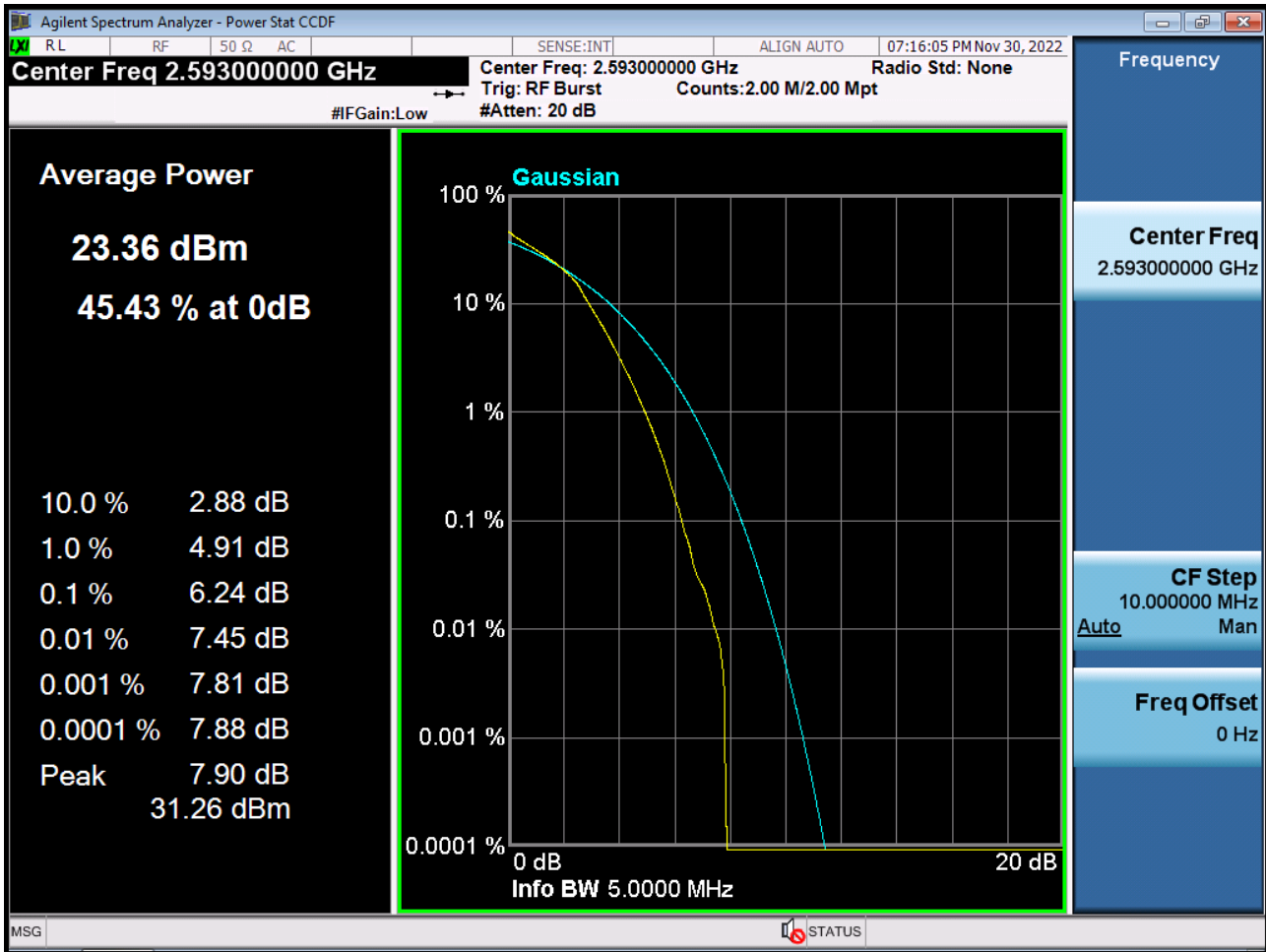
Occupied Bandwidth Plot (20 MHz Ch.40620 256-QAM RB 100)



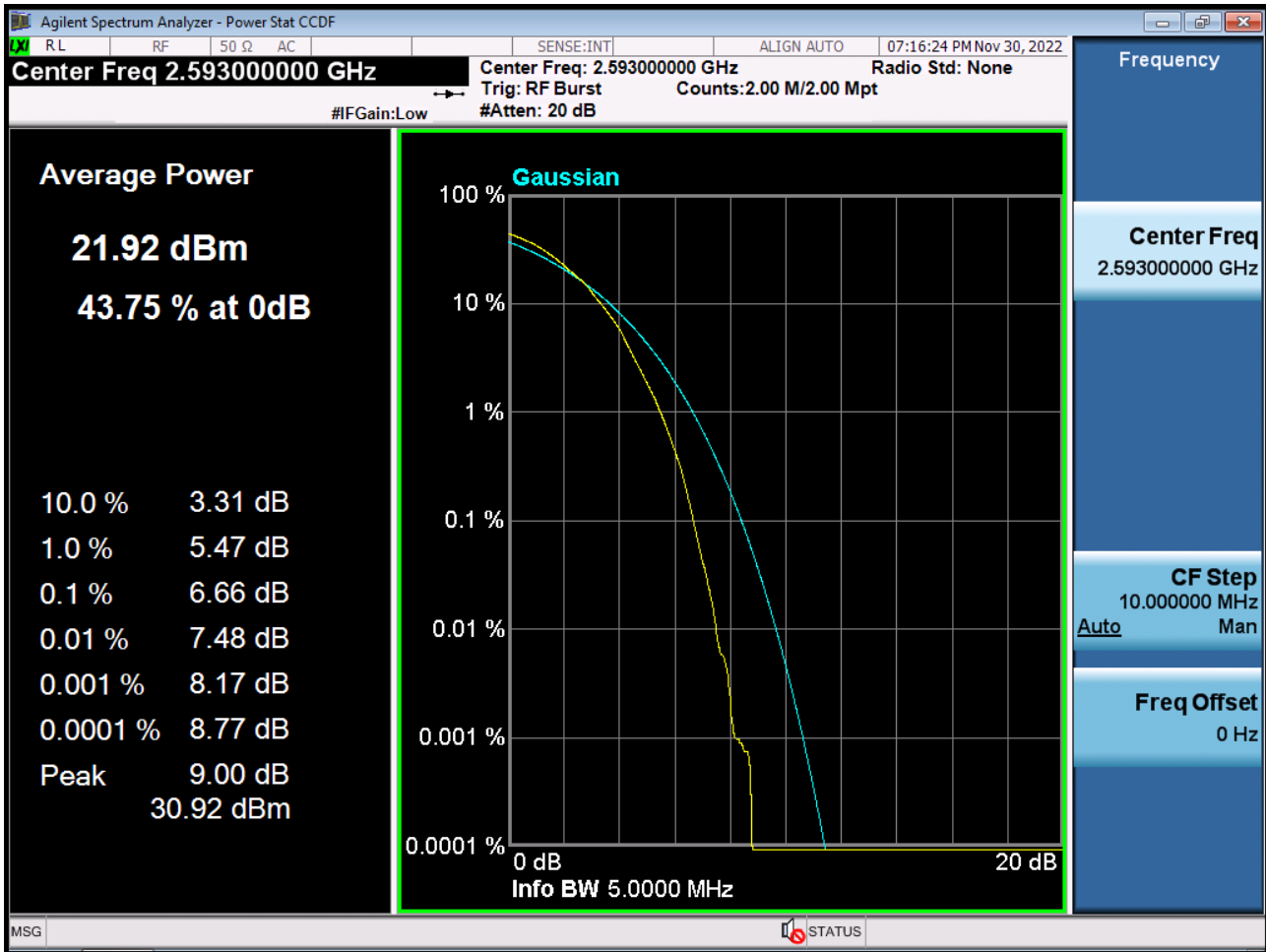
PAR Plot (5 M BW_Ch.40620_QPSK_RB25_0)



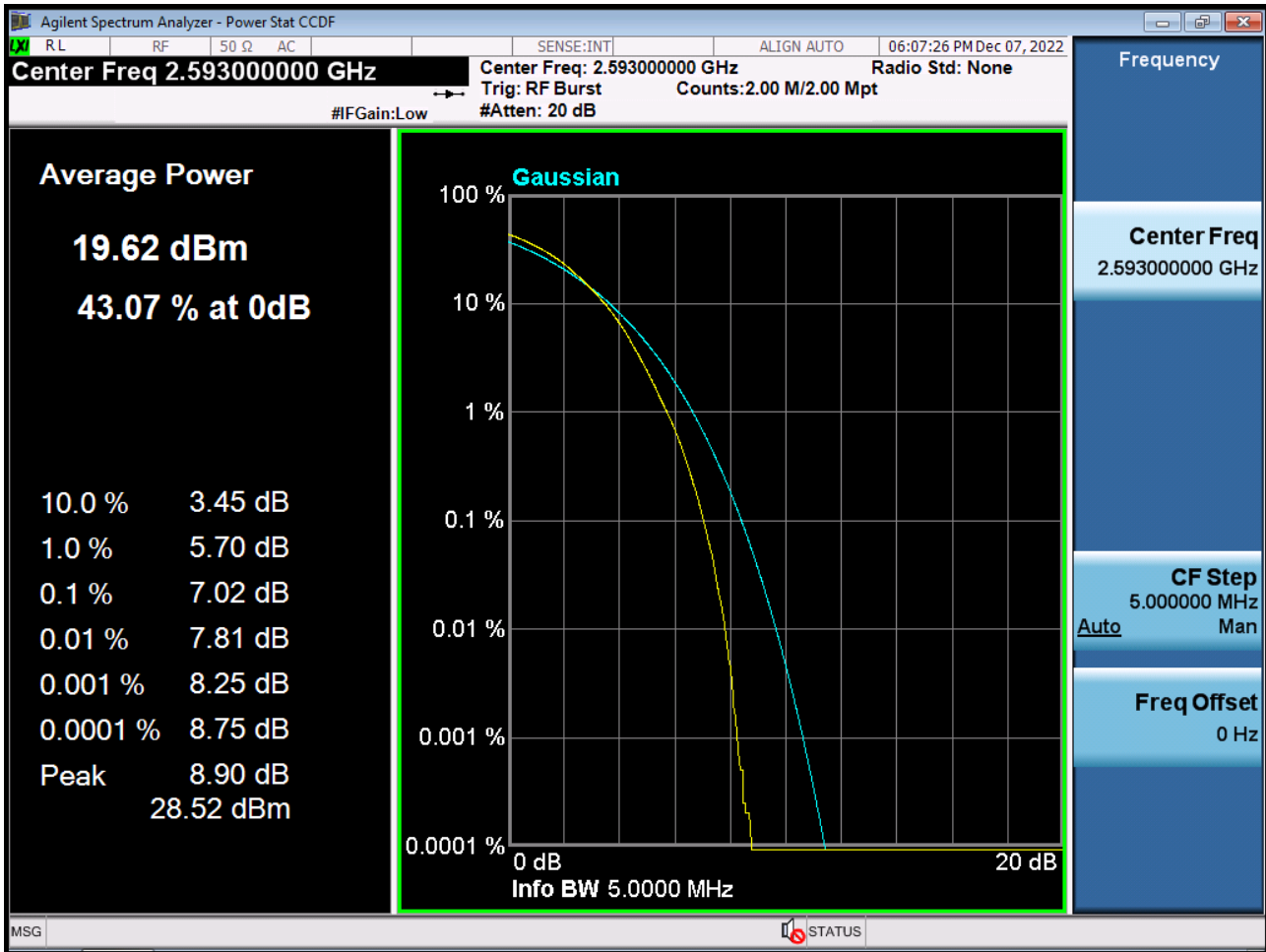
PAR Plot (5 M BW_Ch.40620_16QAM_RB25_0)



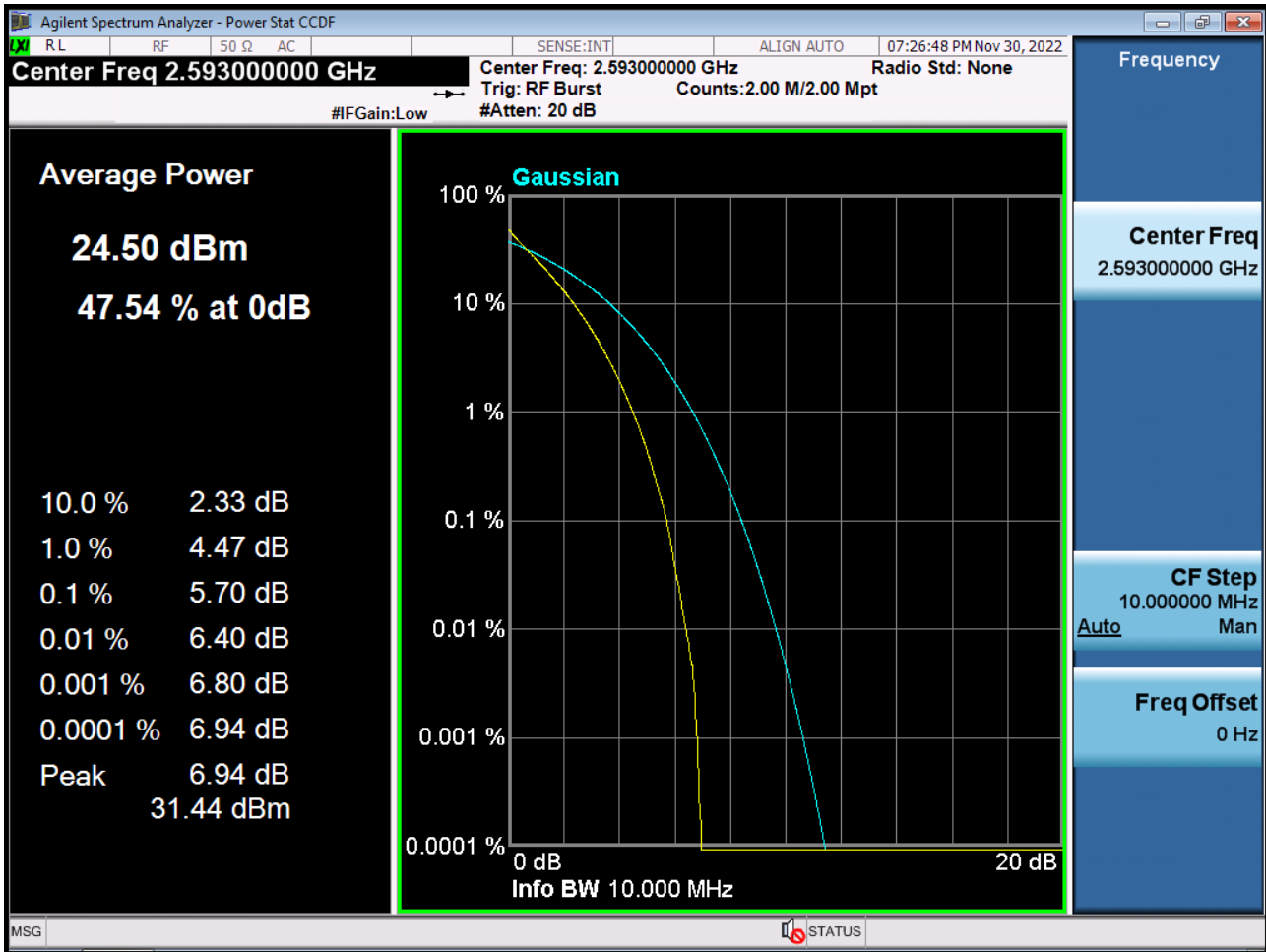
PAR Plot (5 M BW_Ch.40620_64QAM_RB25_0)



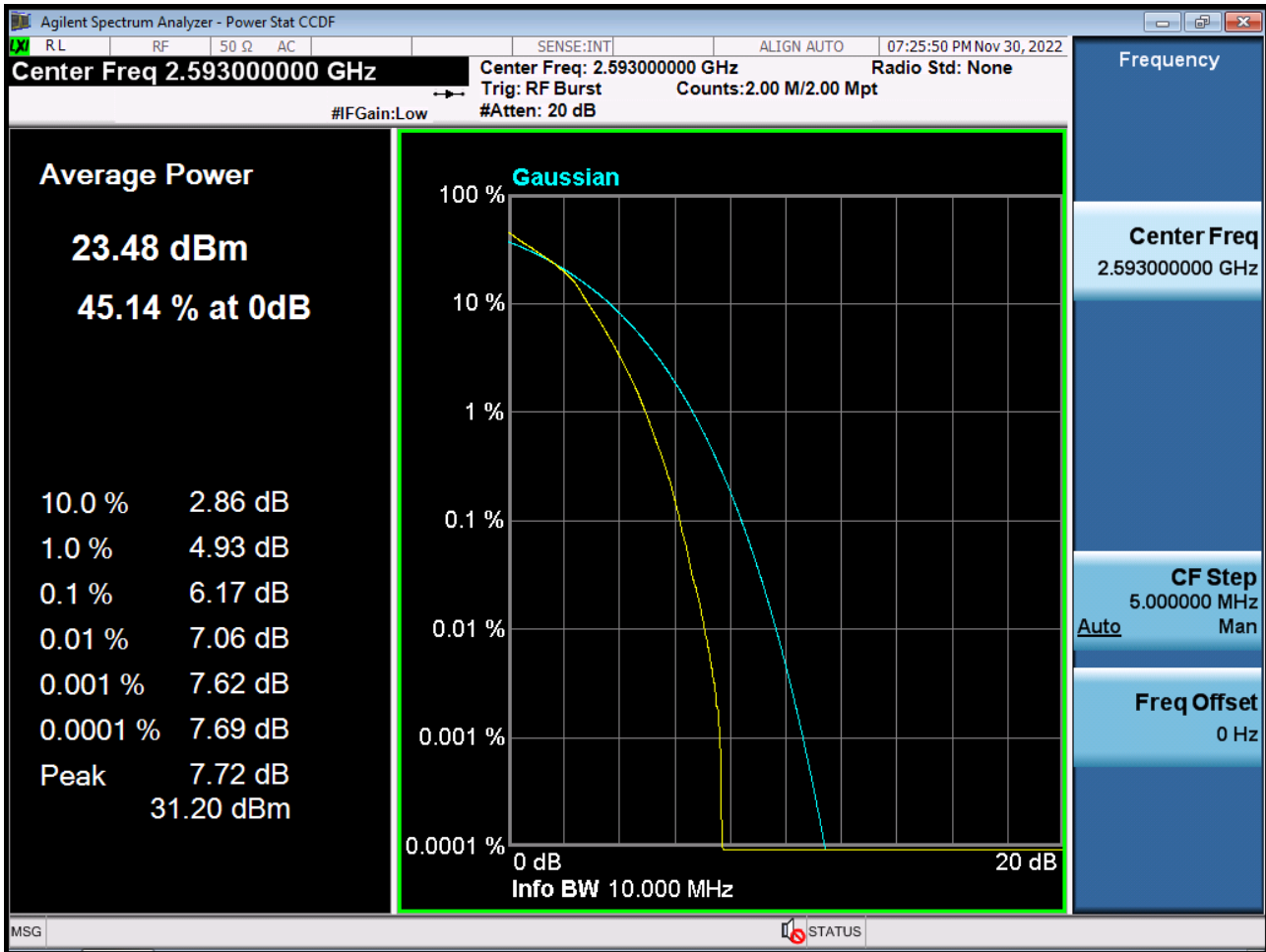
PAR Plot (5 M BW_Ch.40620_256QAM_RB25_0)



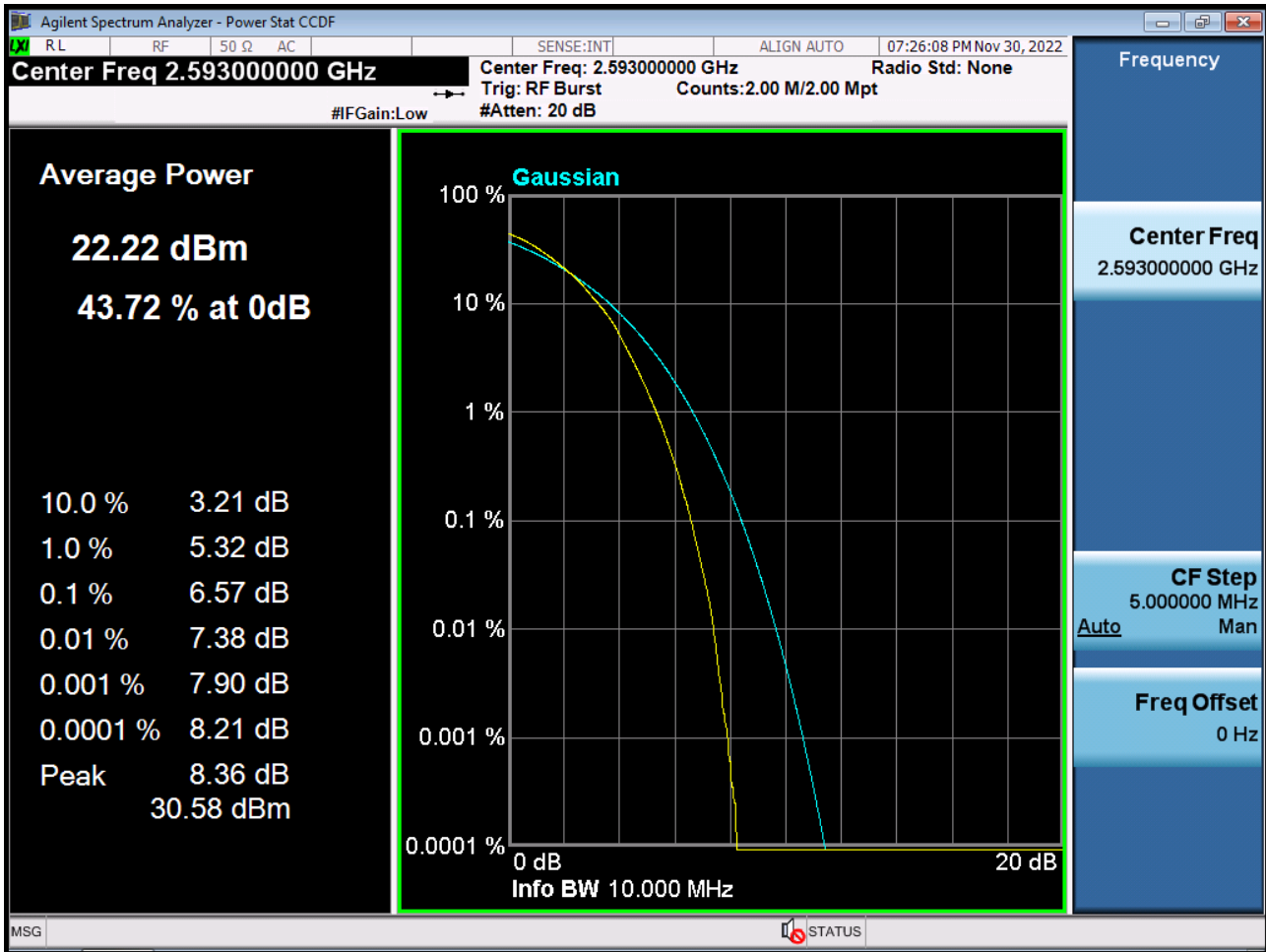
PAR Plot (10 M BW_Ch.40620_QPSK_RB50_0)



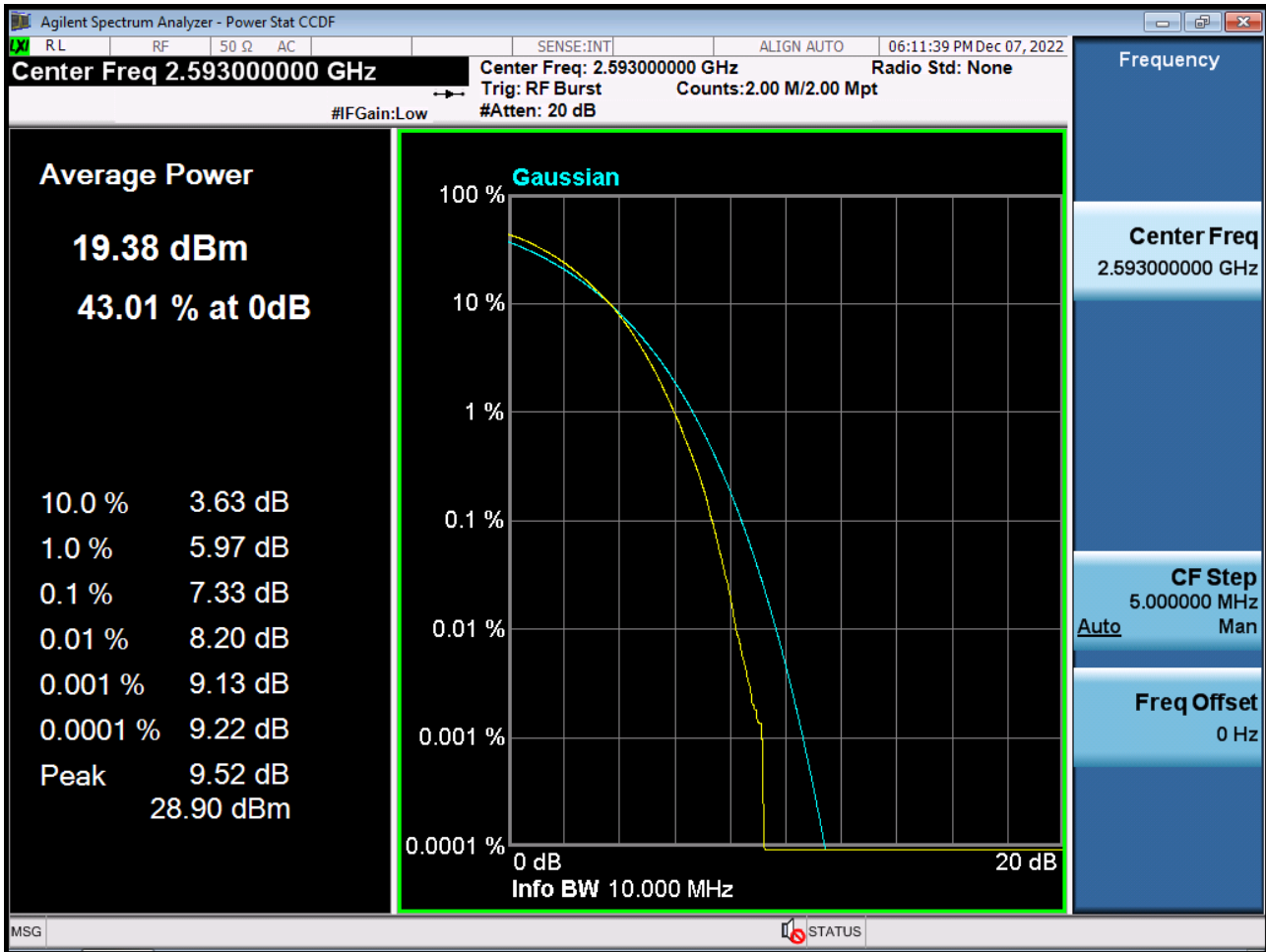
PAR Plot (10 M BW_Ch.40620_16QAM_RB50_0)



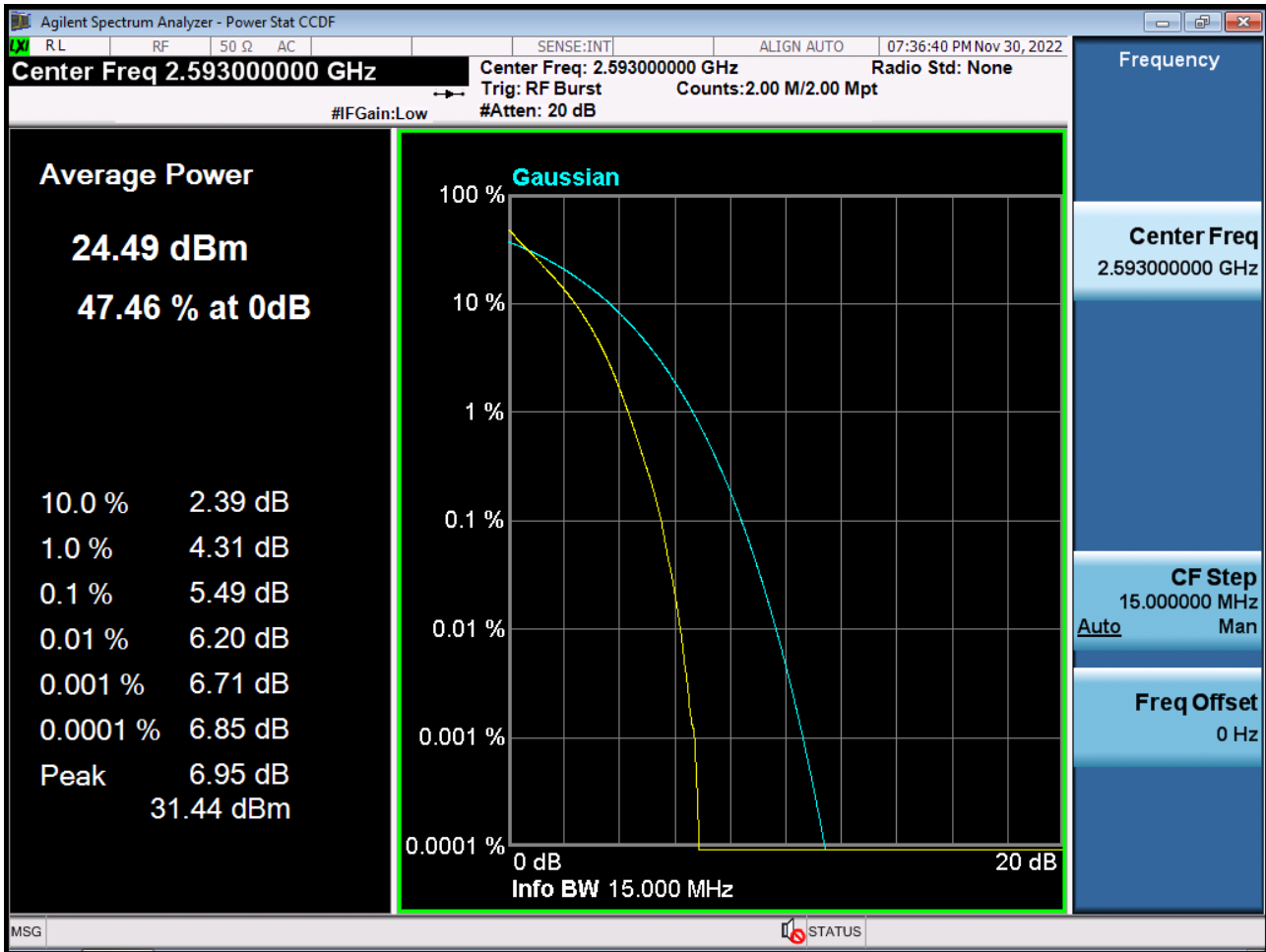
PAR Plot (10 M BW_Ch.40620_64QAM_RB50_0)



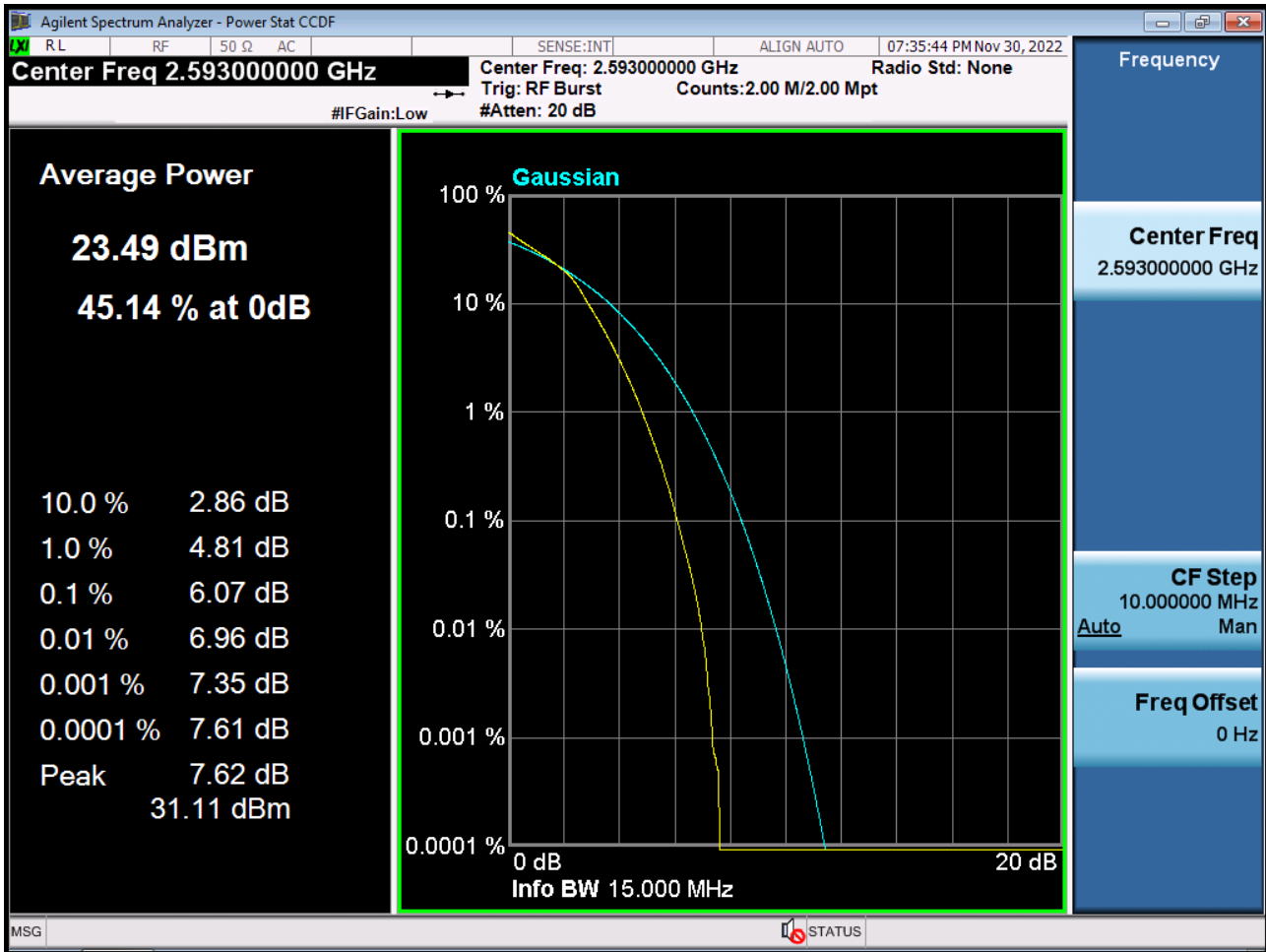
PAR Plot (10 M BW_Ch.40620_256QAM_RB50_0)



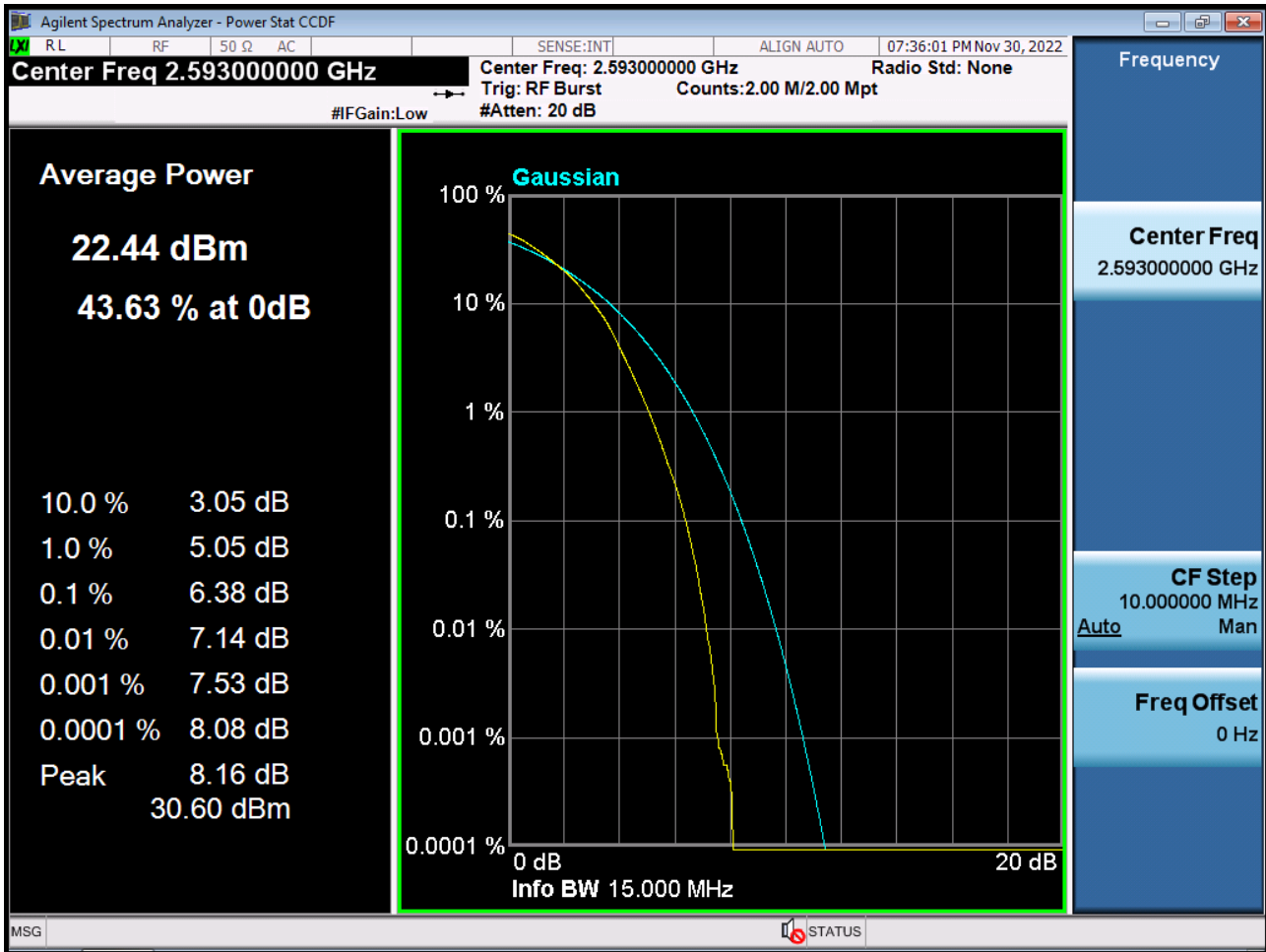
PAR Plot (15 M BW_Ch.40620_QPSK_RB75_0)



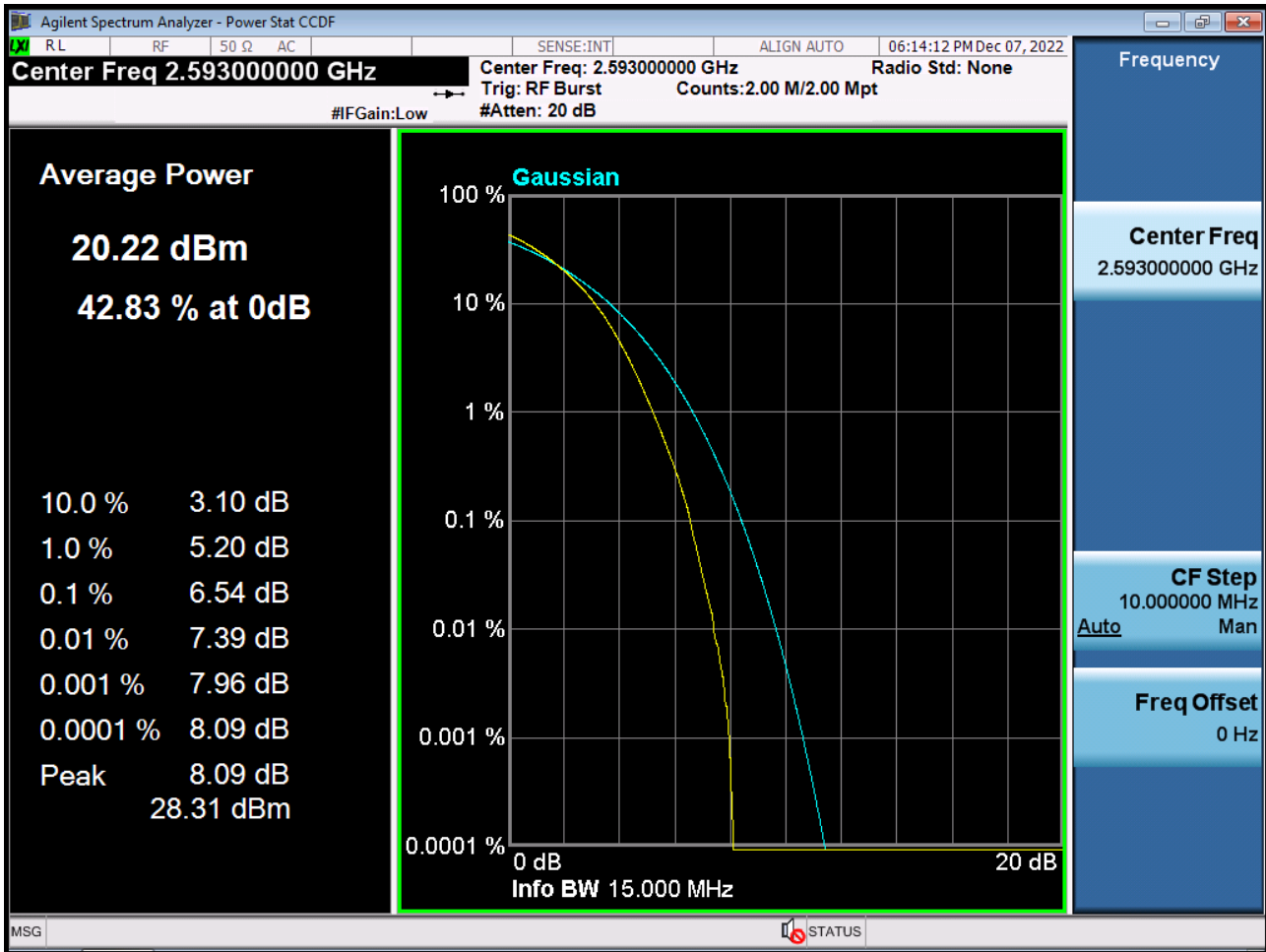
PAR Plot (15 M BW_Ch.40620_16QAM_RB75_0)



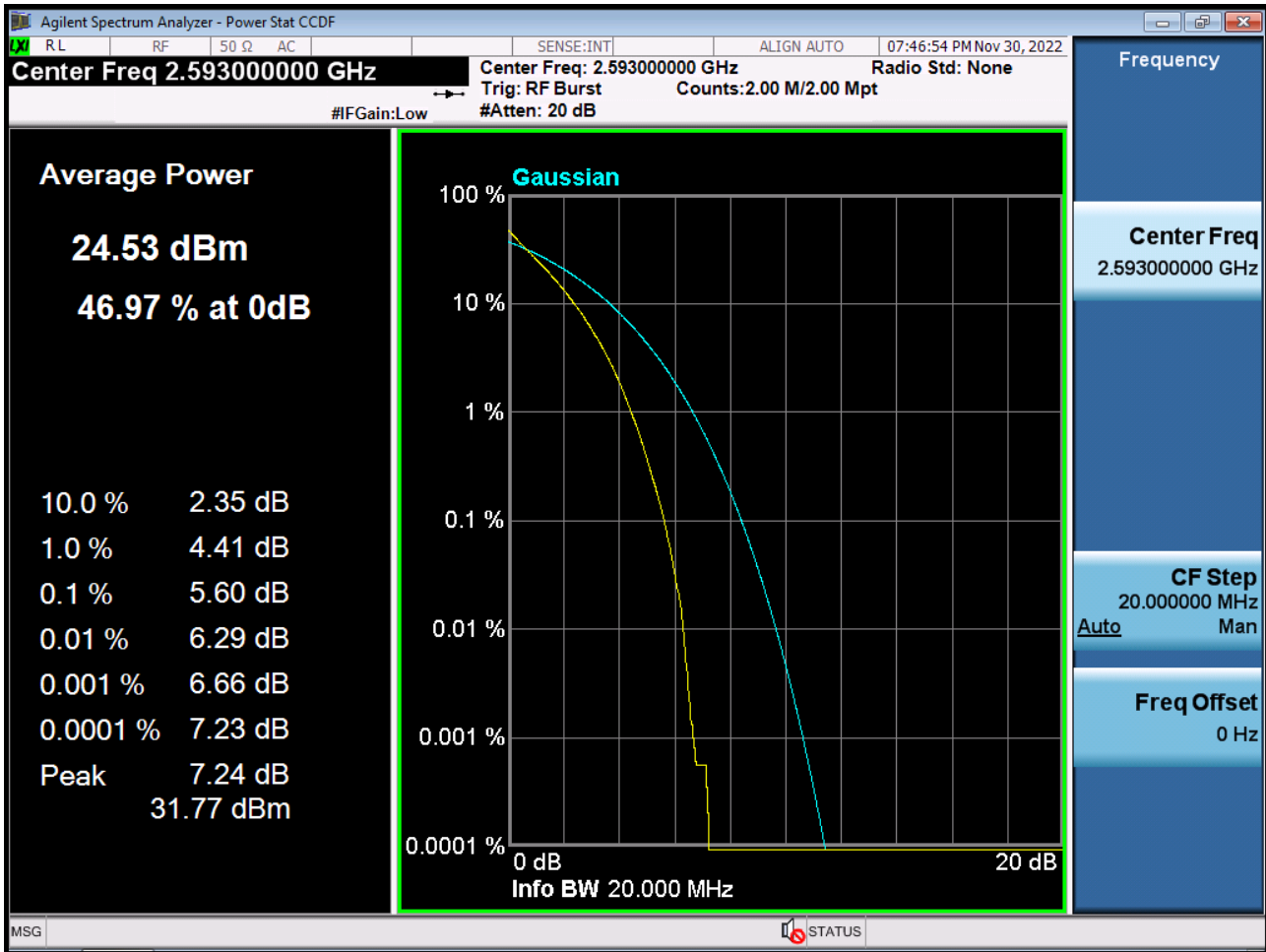
PAR Plot (15 M BW_Ch.40620_64QAM_RB75_0)



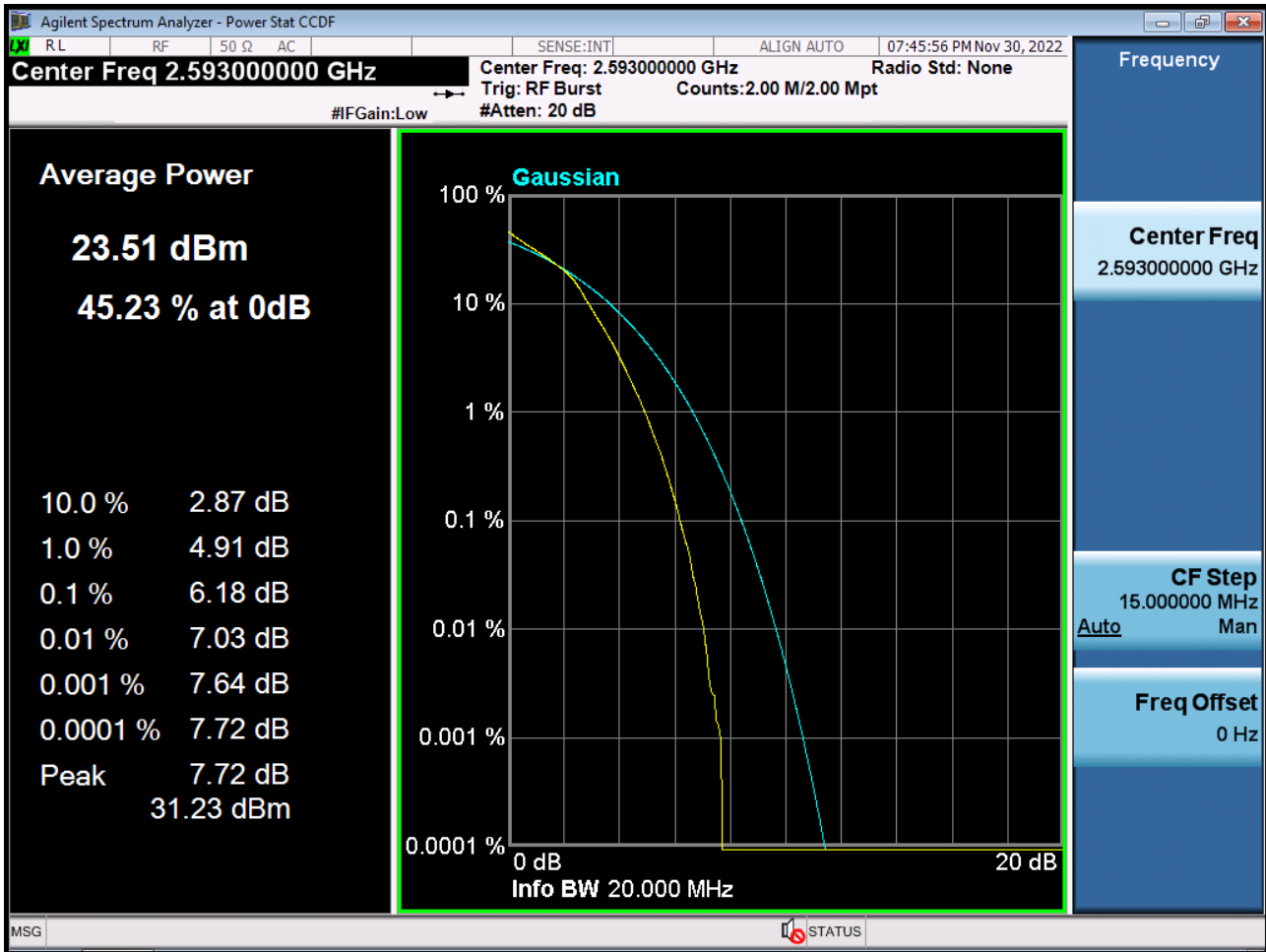
PAR Plot (15 M BW_Ch.40620_256QAM_RB75_0)



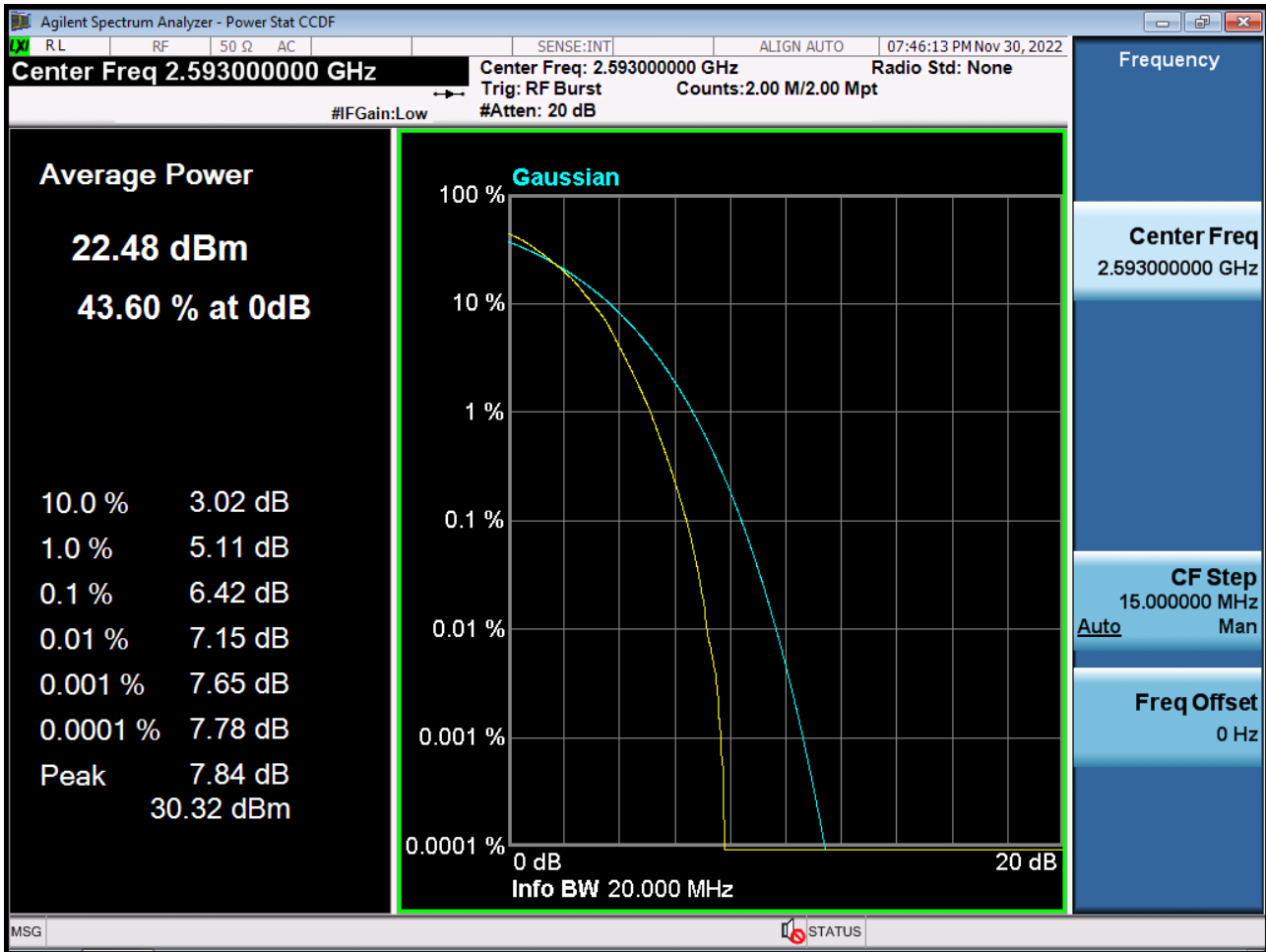
PAR Plot (20 M BW_Ch.40620_QPSK_RB100_0)



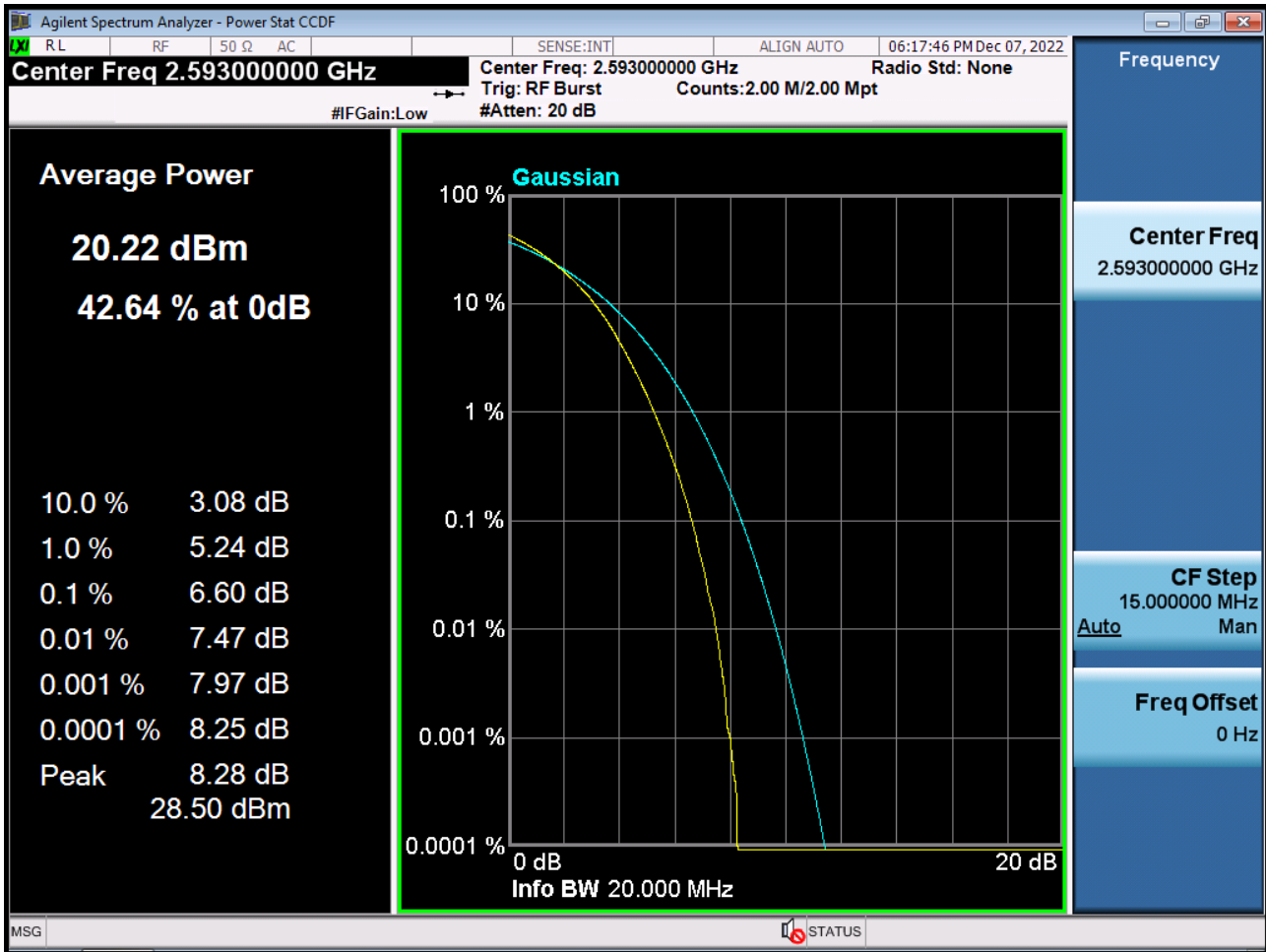
PAR Plot (20 M BW_Ch.40620_16QAM_RB100_0)



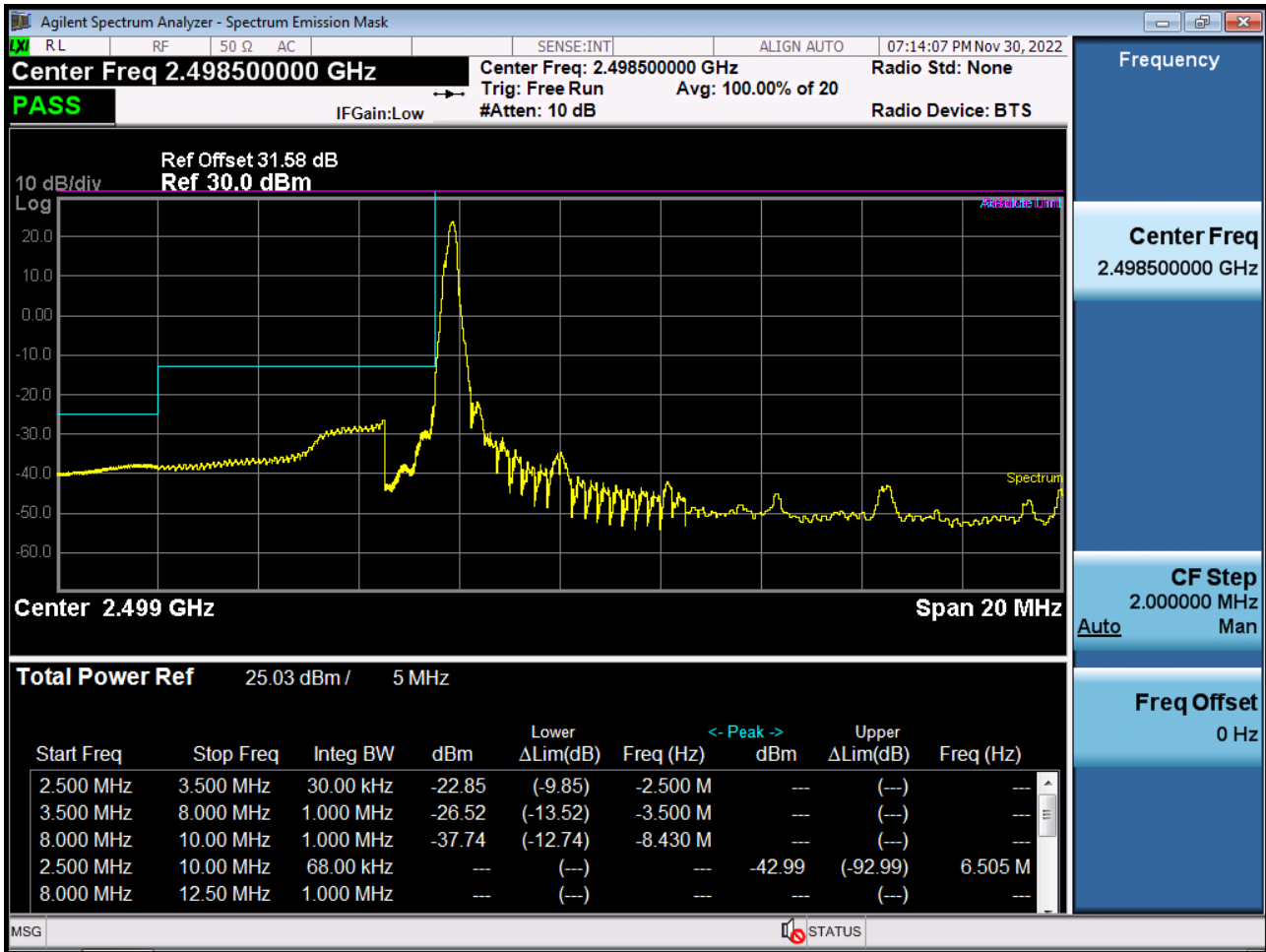
PAR Plot (20 M BW_Ch.40620_64QAM_RB100_0)



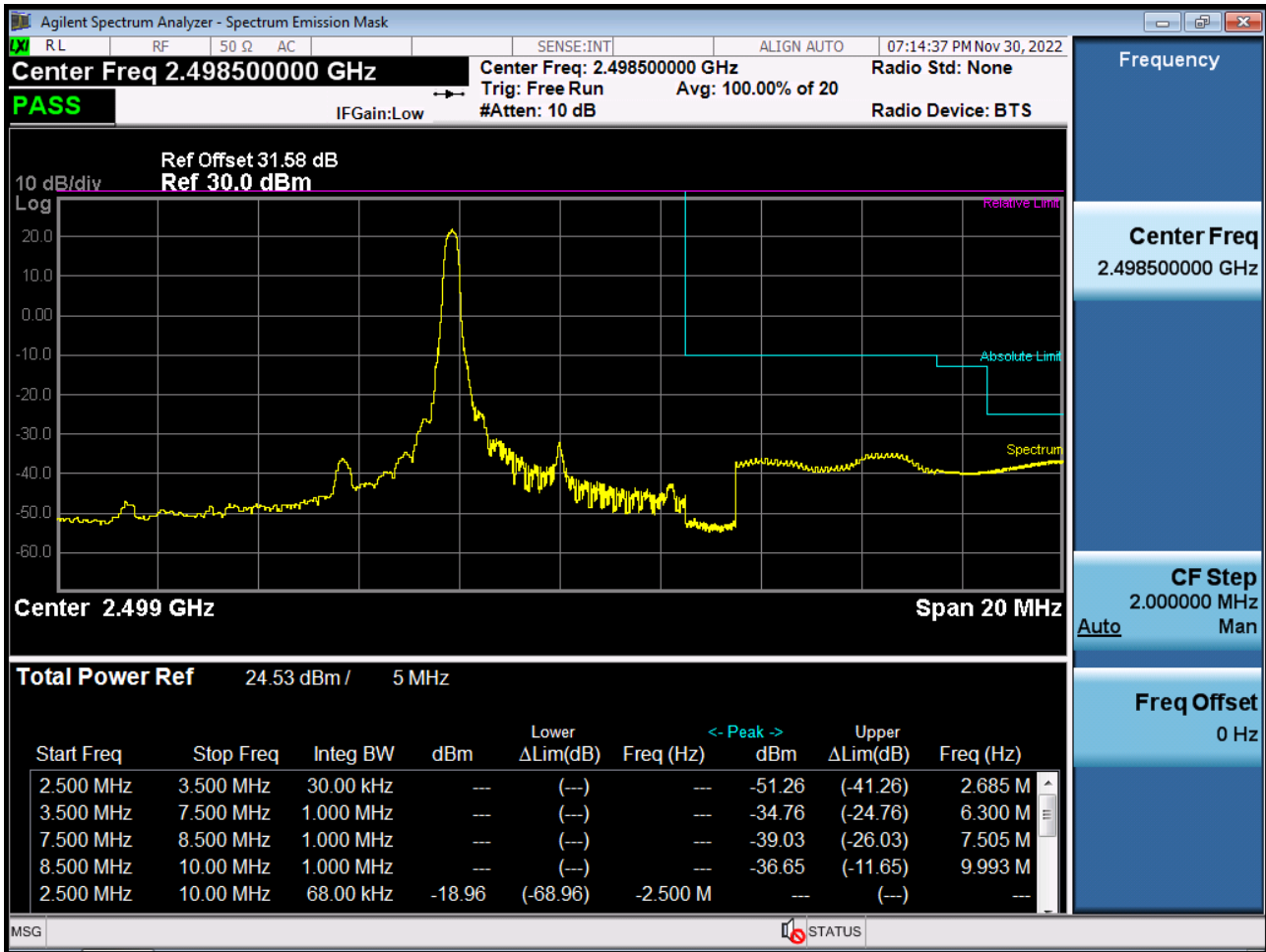
PAR Plot (20 M BW_Ch.40620_256QAM_RB100_0)



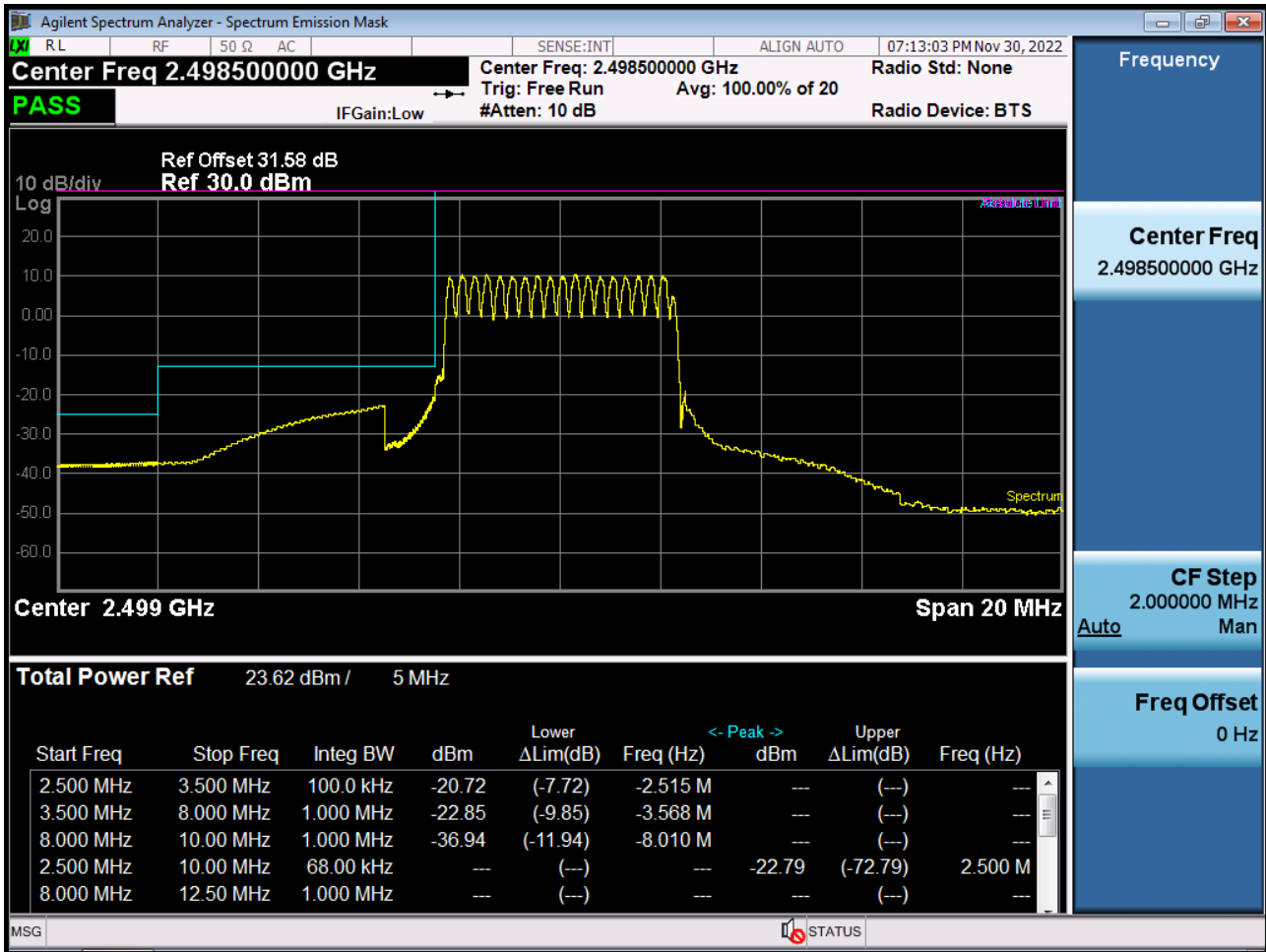
Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-1



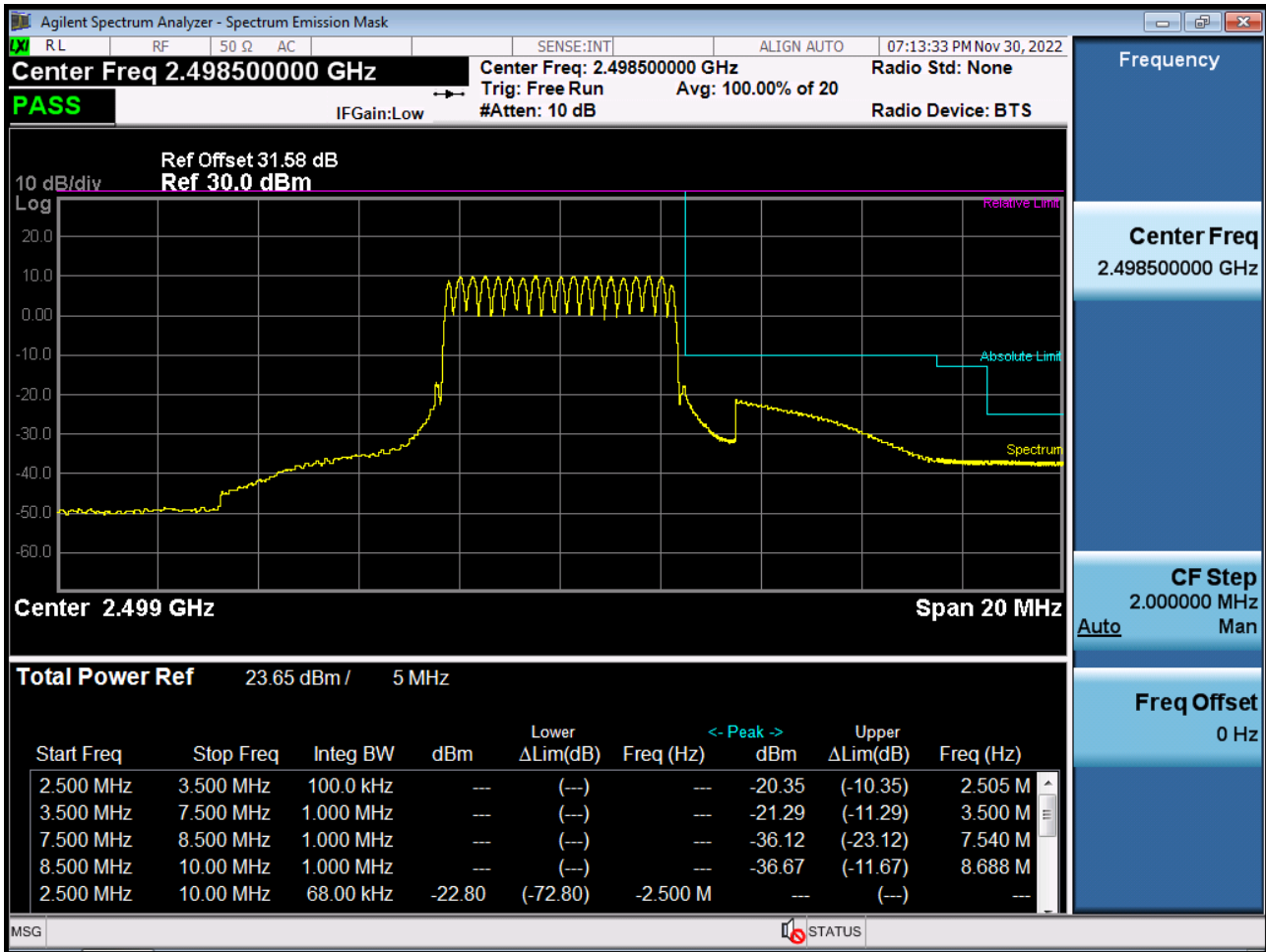
Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-2



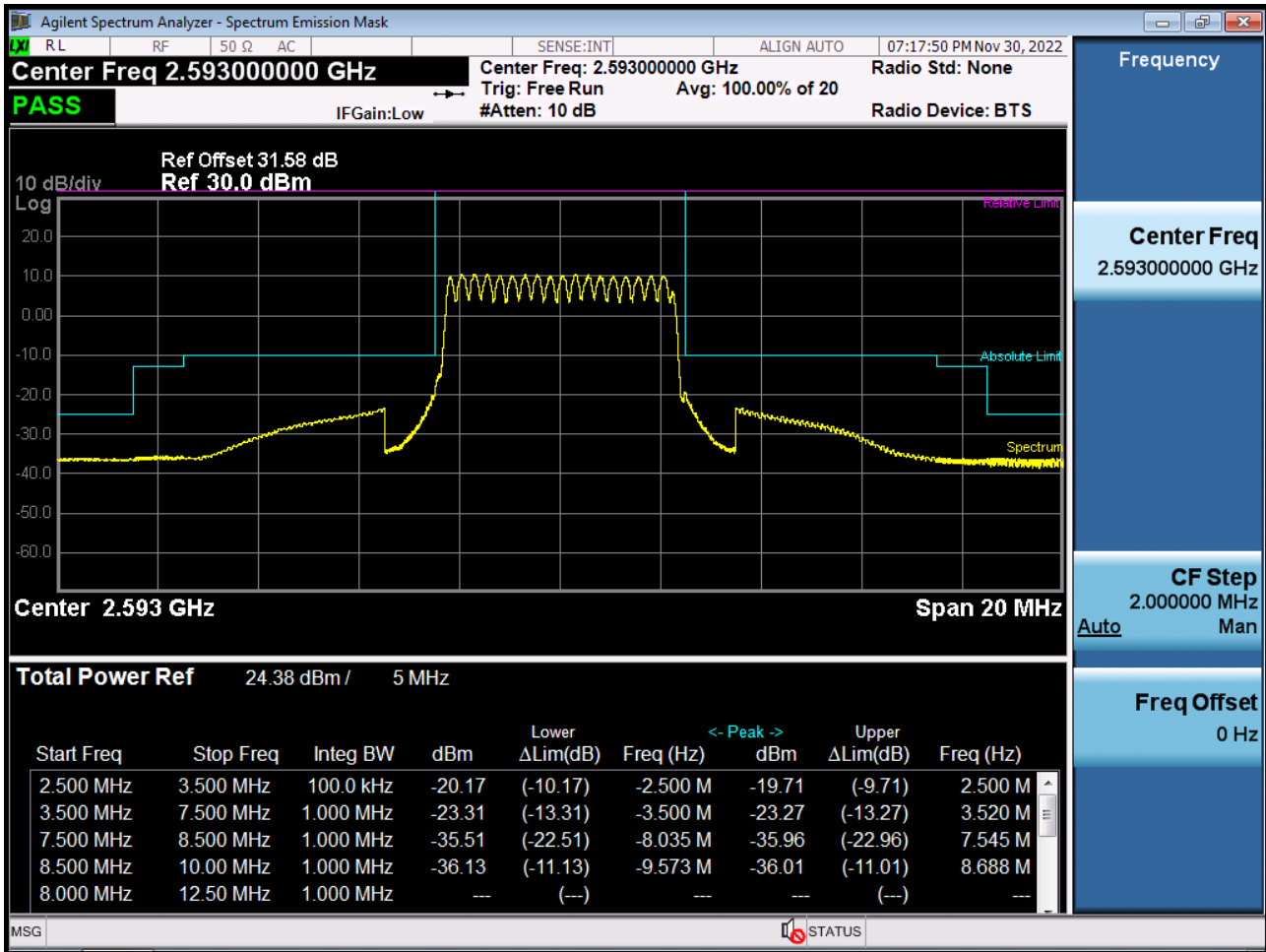
Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-1



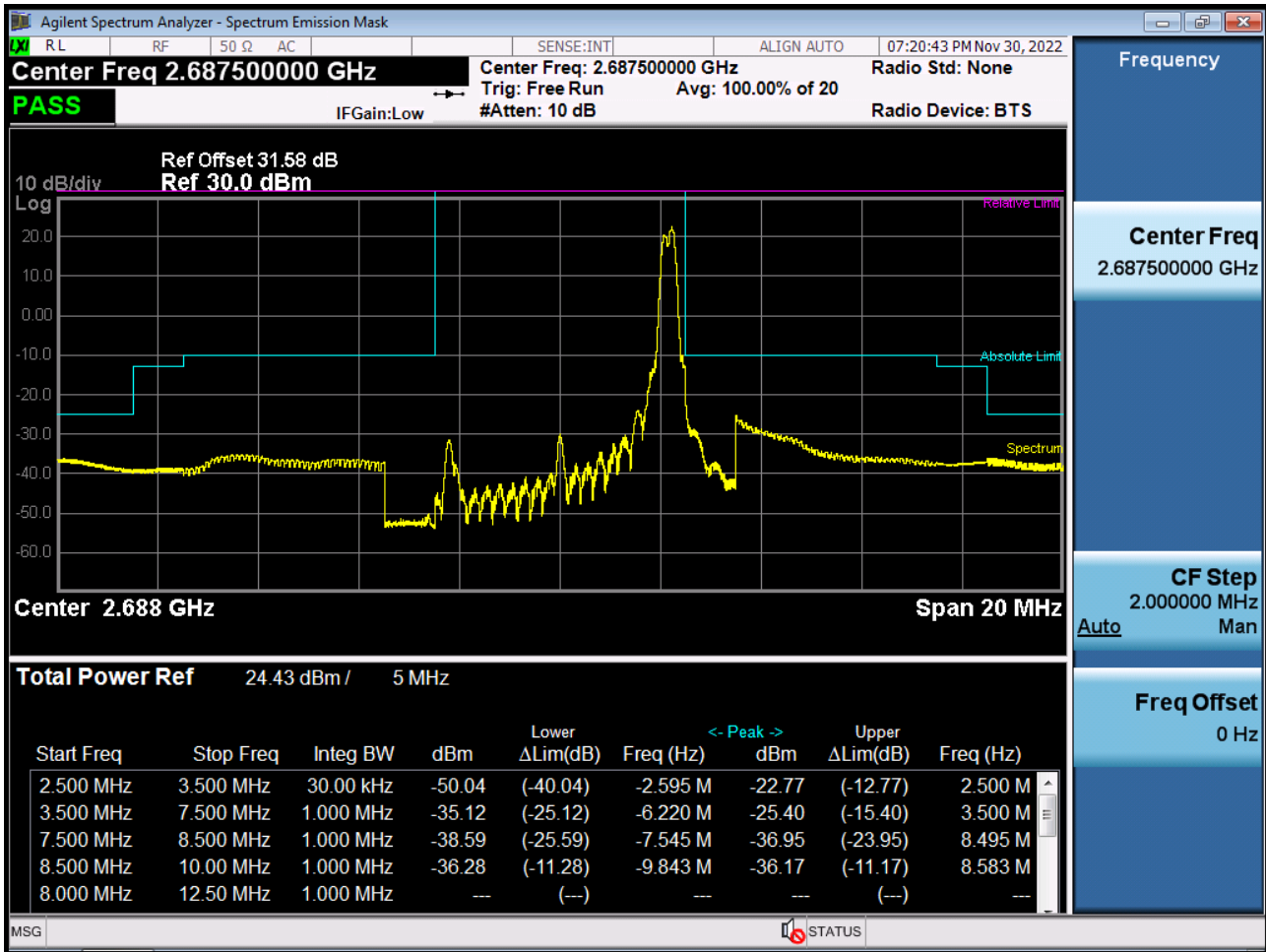
Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-2



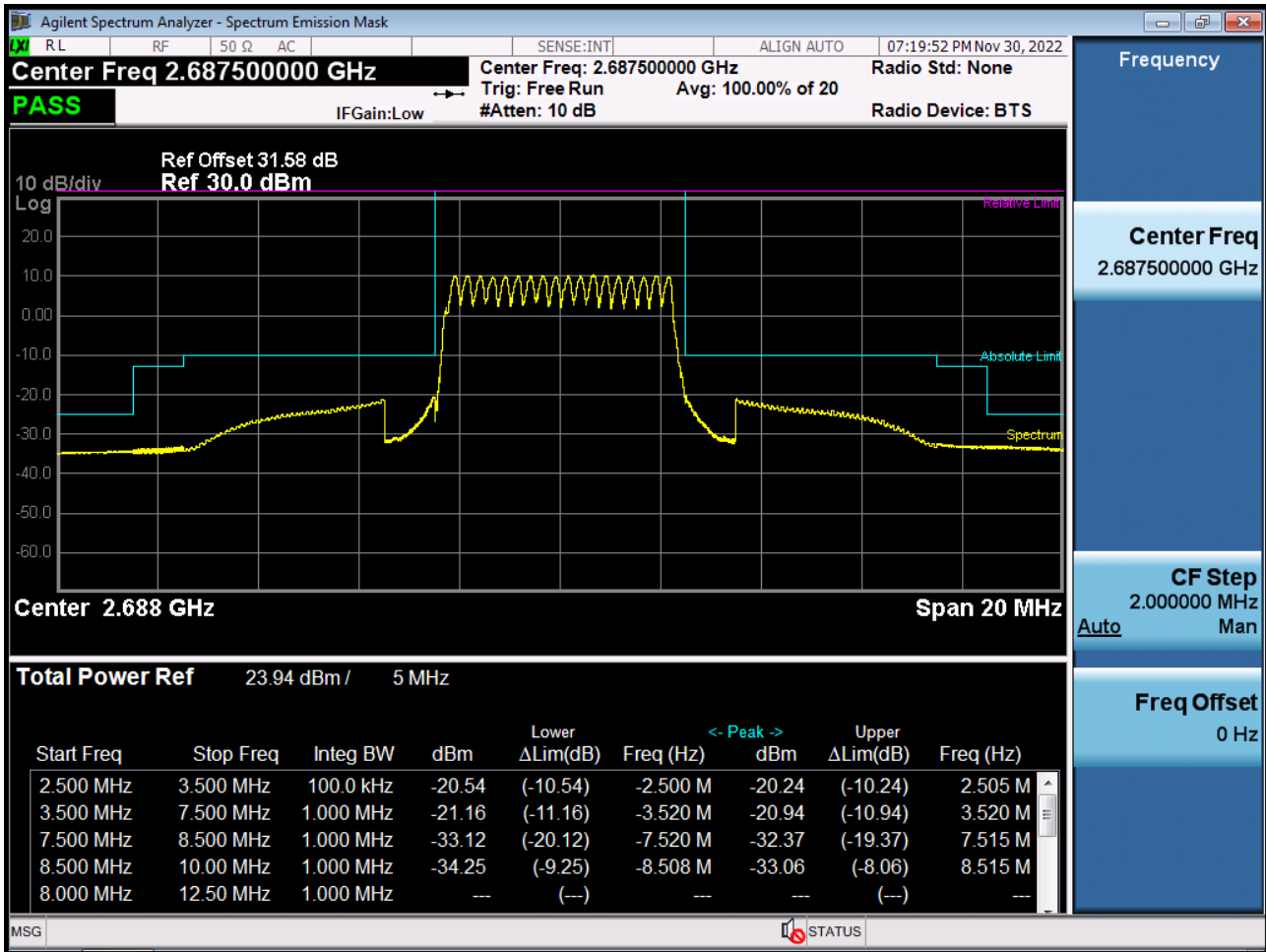
Mid Channel Edge Plot (5 MHz Ch.40620 QPSK RB 25)



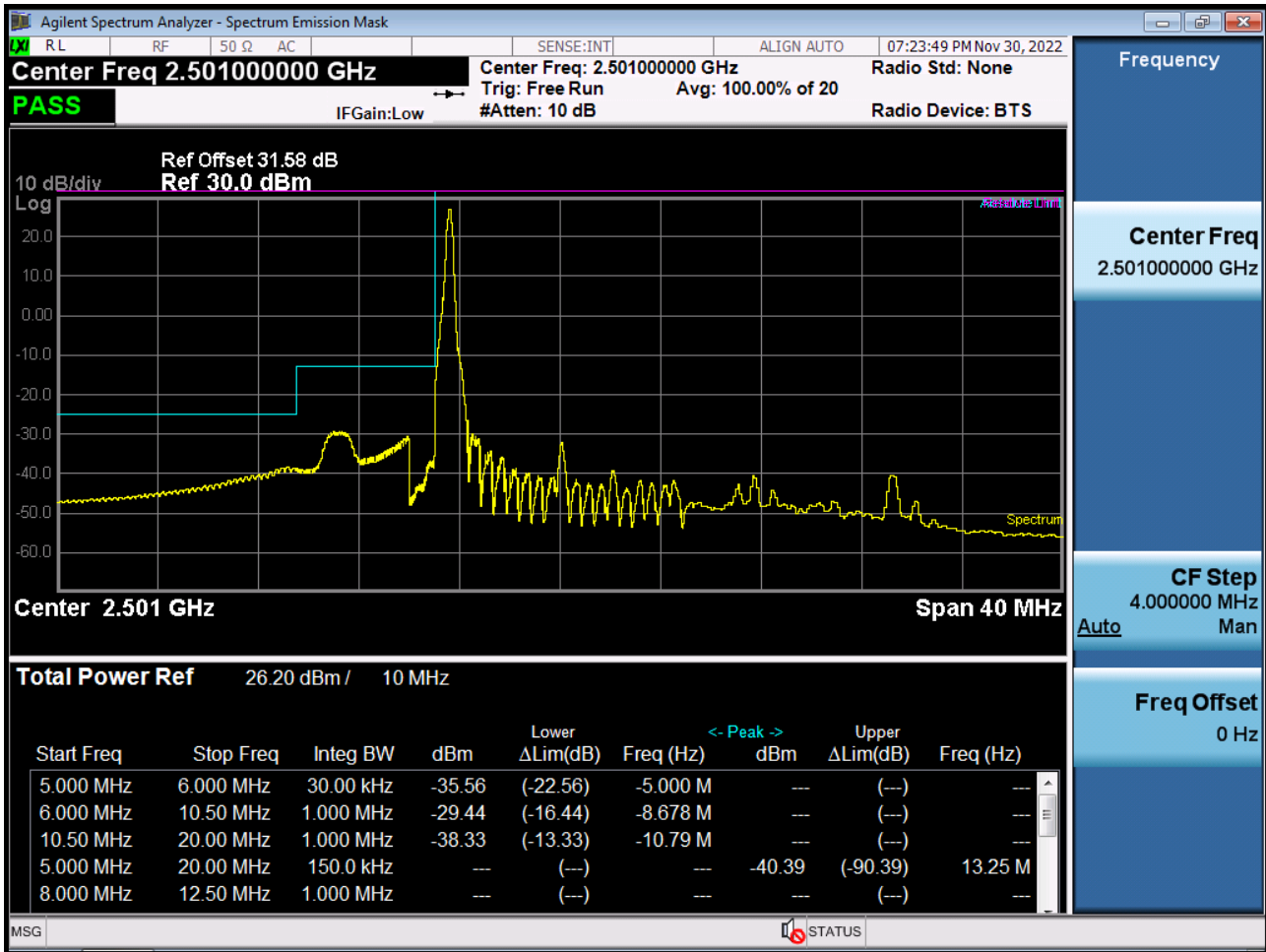
High Channel Edge Plot (5 MHz Ch.41565 QPSK RB 1, Offset 24)



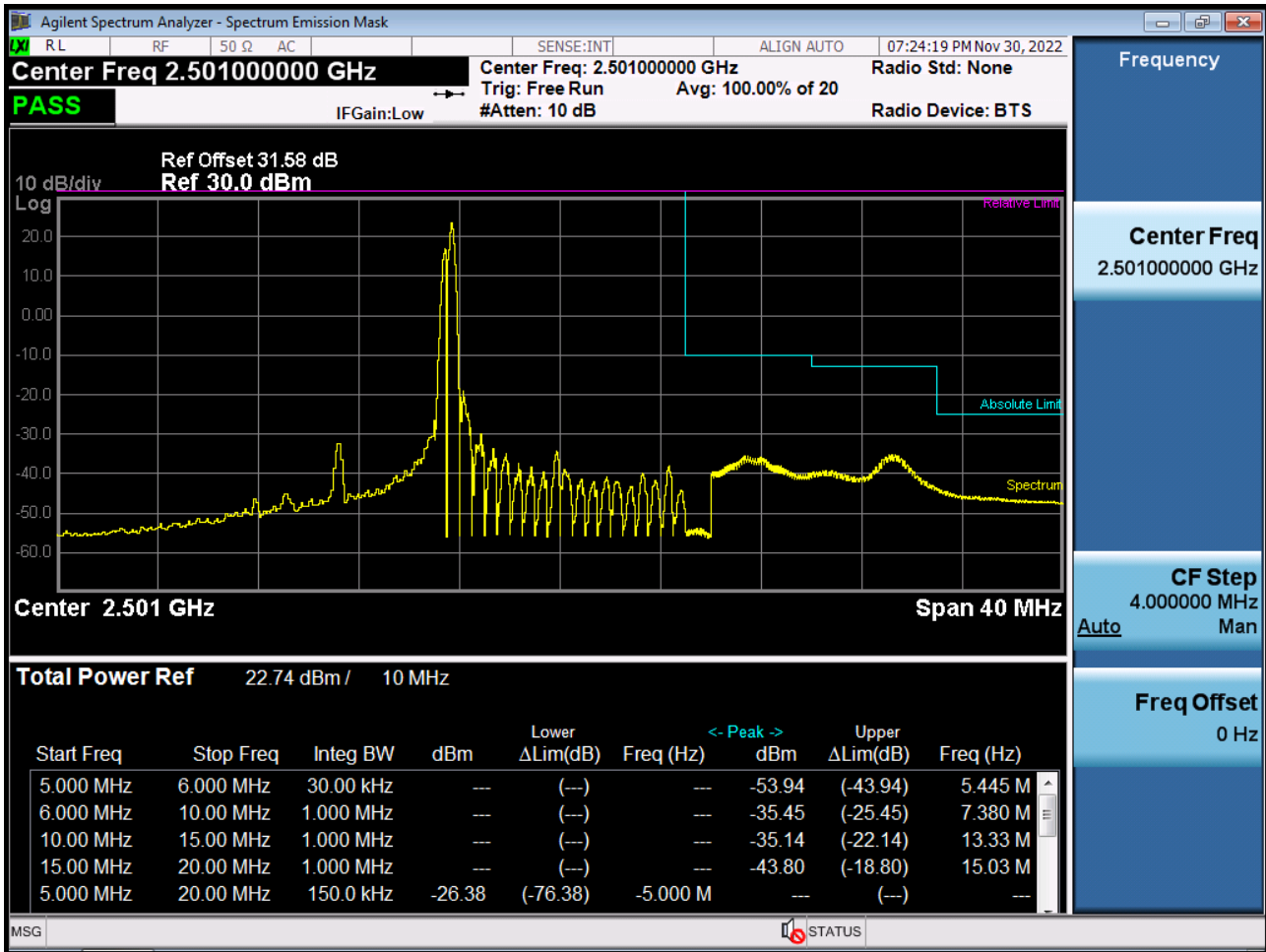
High Channel Edge Plot (5 MHz Ch.41565 QPSK_RB25_Offset 0)



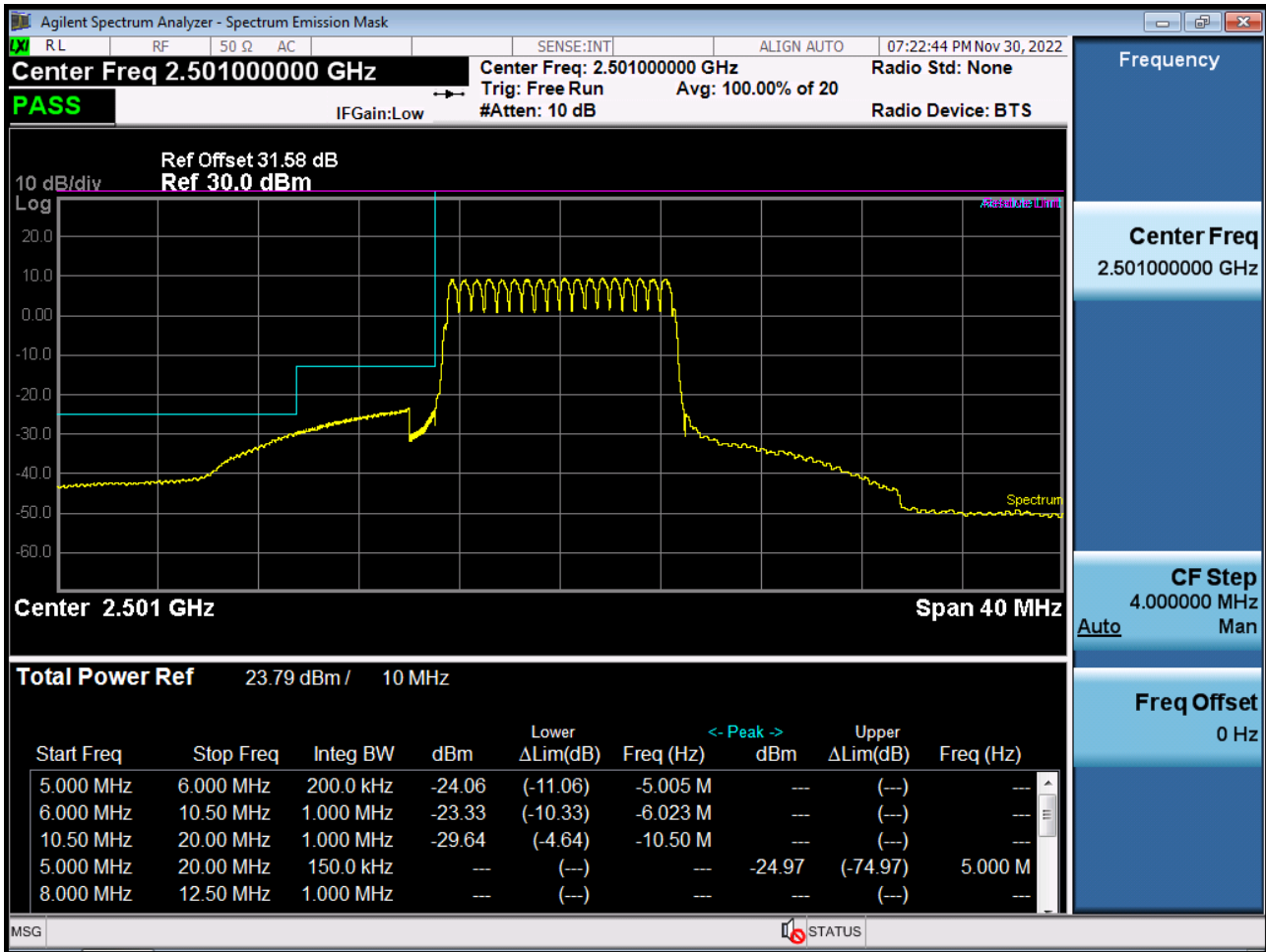
Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-1



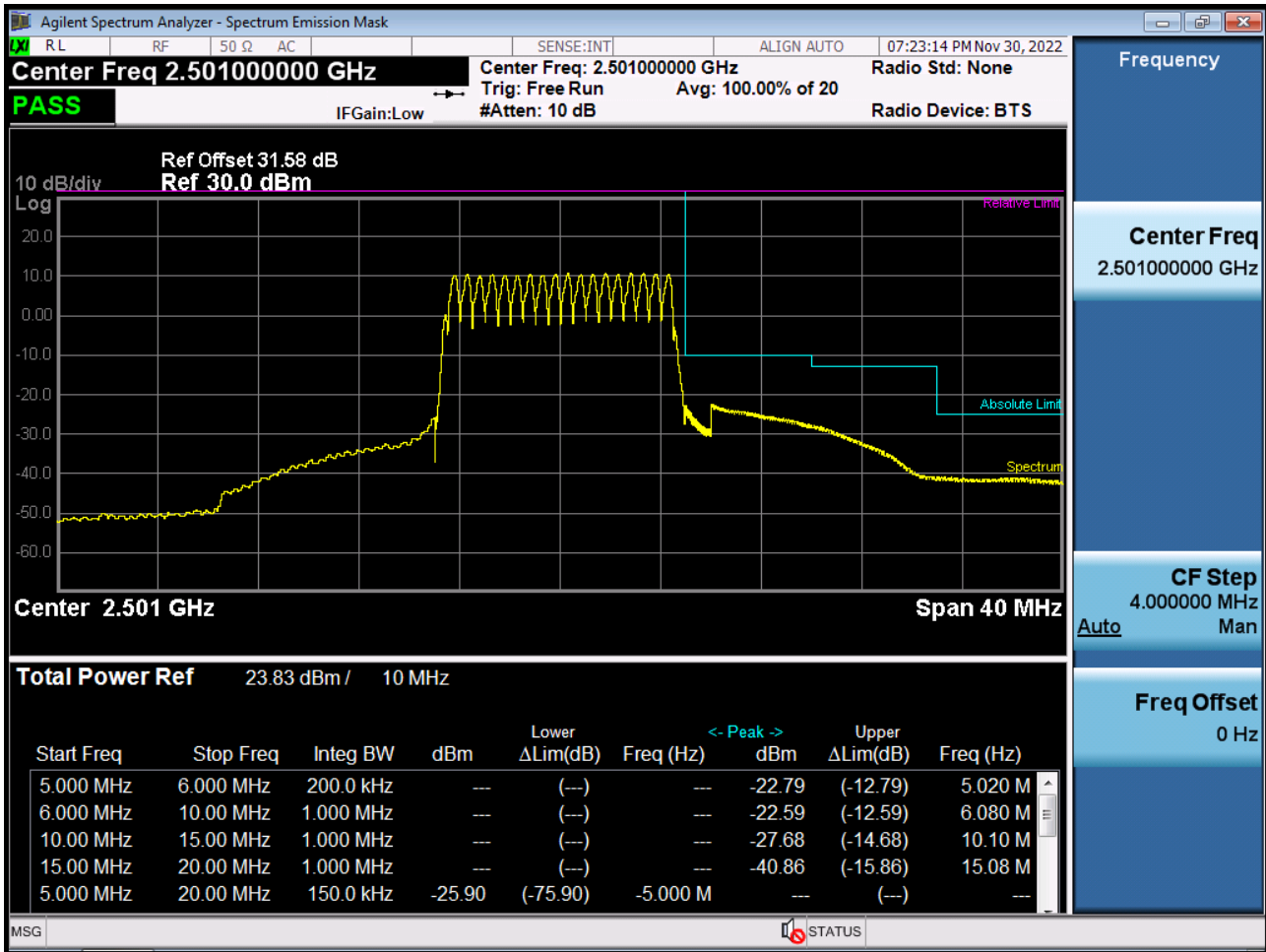
Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-2



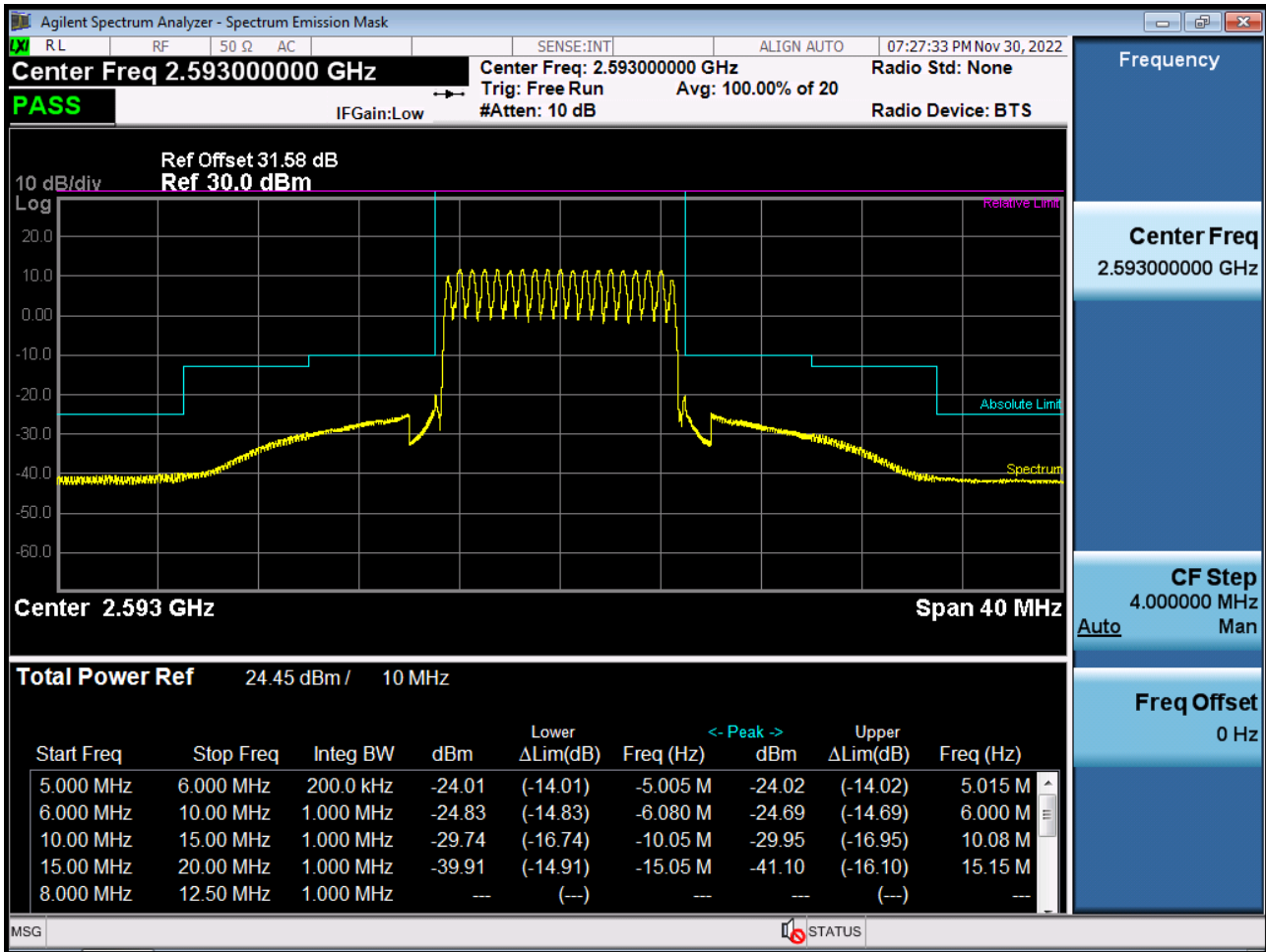
Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-1



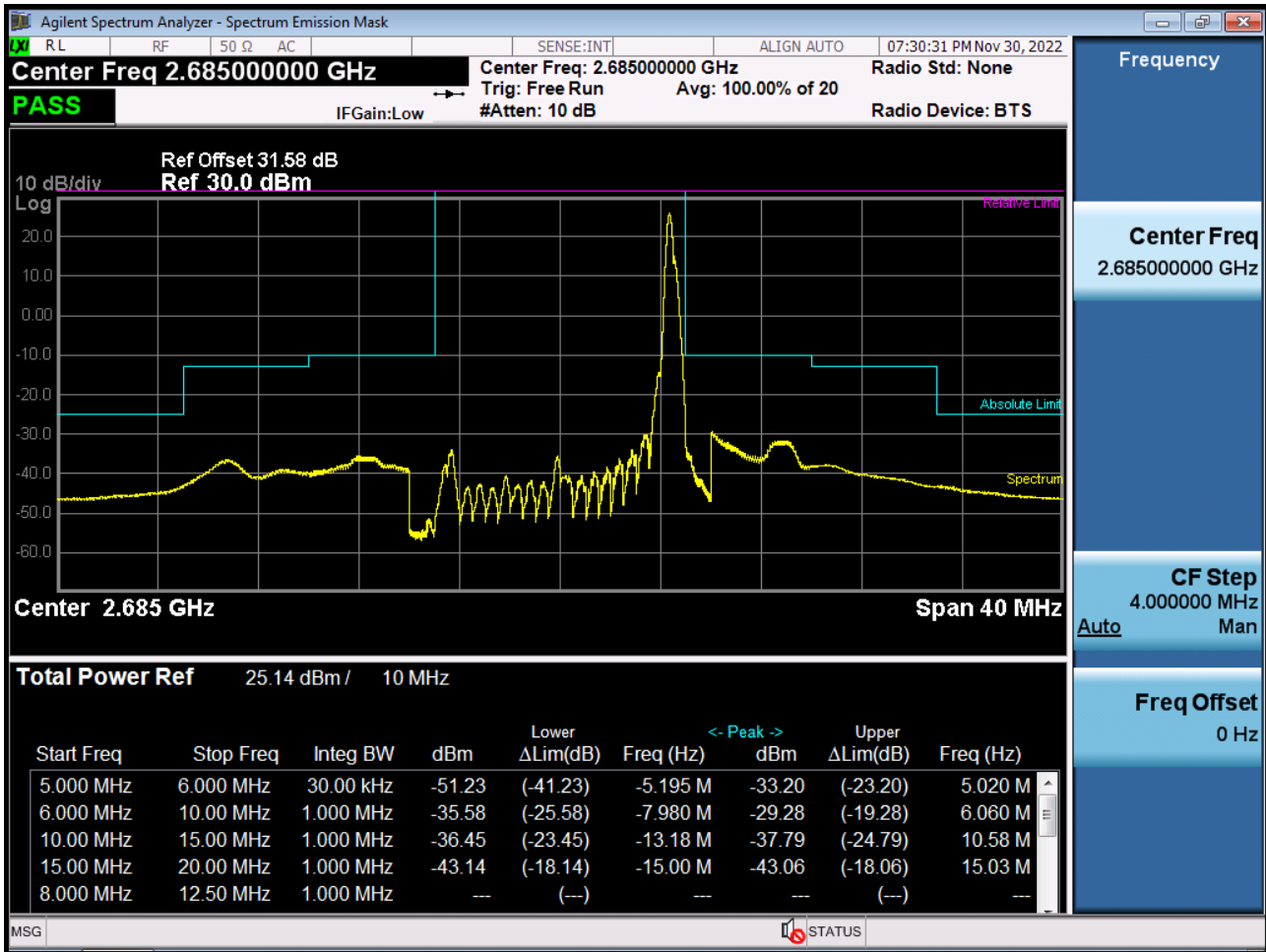
Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-2



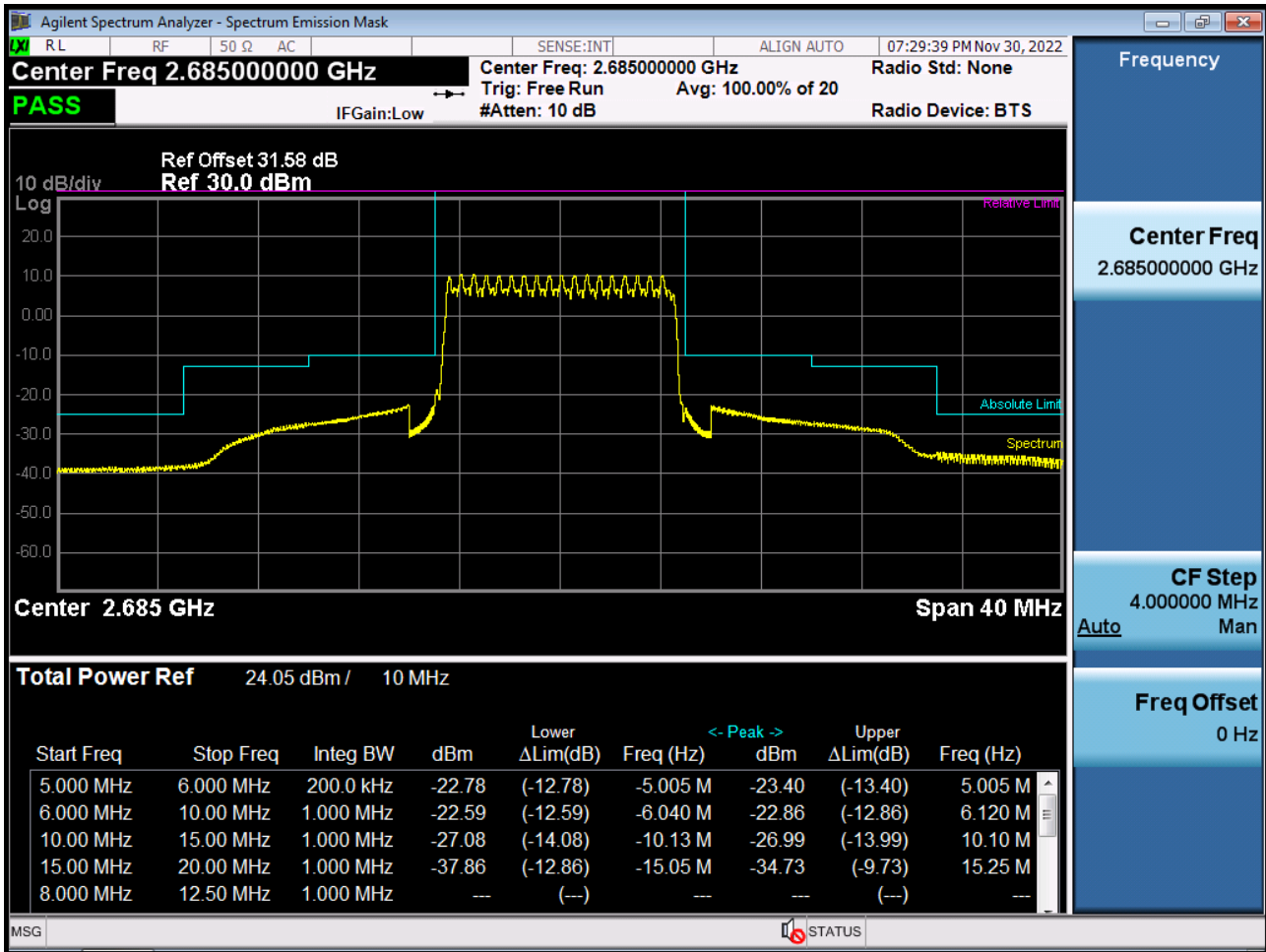
Mid Channel Edge Plot (10 MHz Ch.40620 QPSK RB 50)



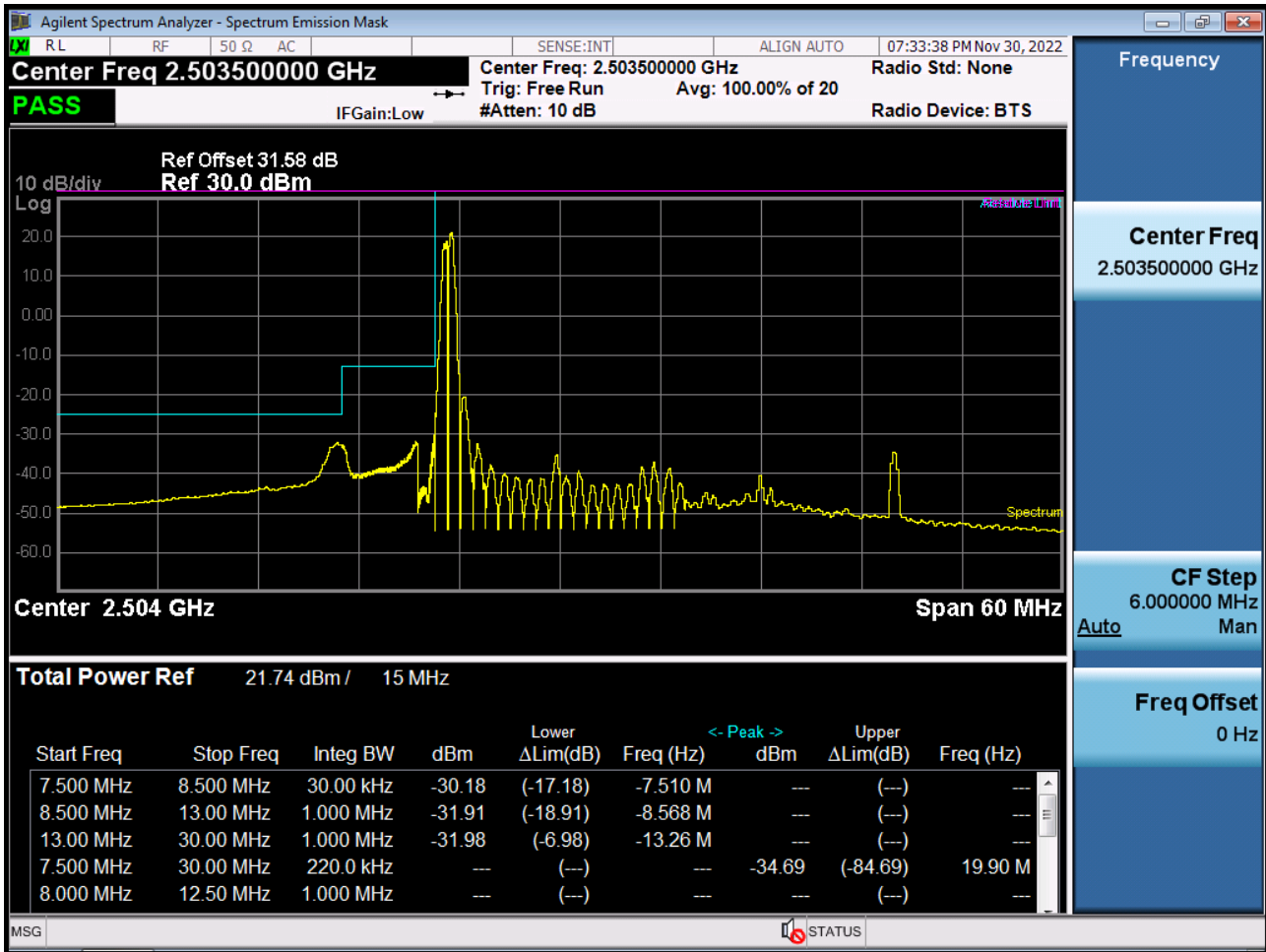
High Channel Edge Plot (10 MHz Ch.41540 QPSK RB 1, Offset 24)



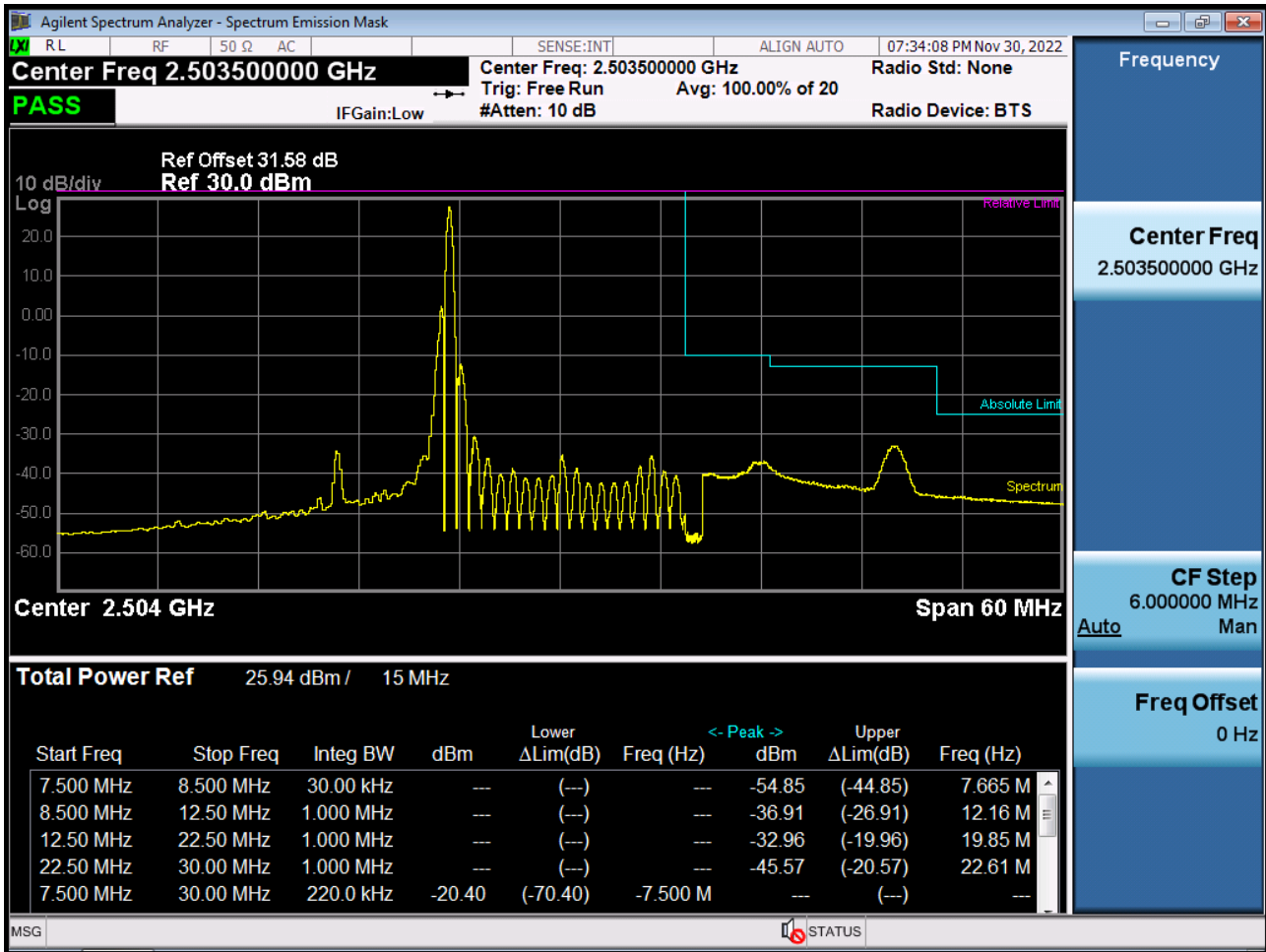
High Channel Edge Plot (10 MHz Ch.41540 QPSK_RB50_Offset 0)



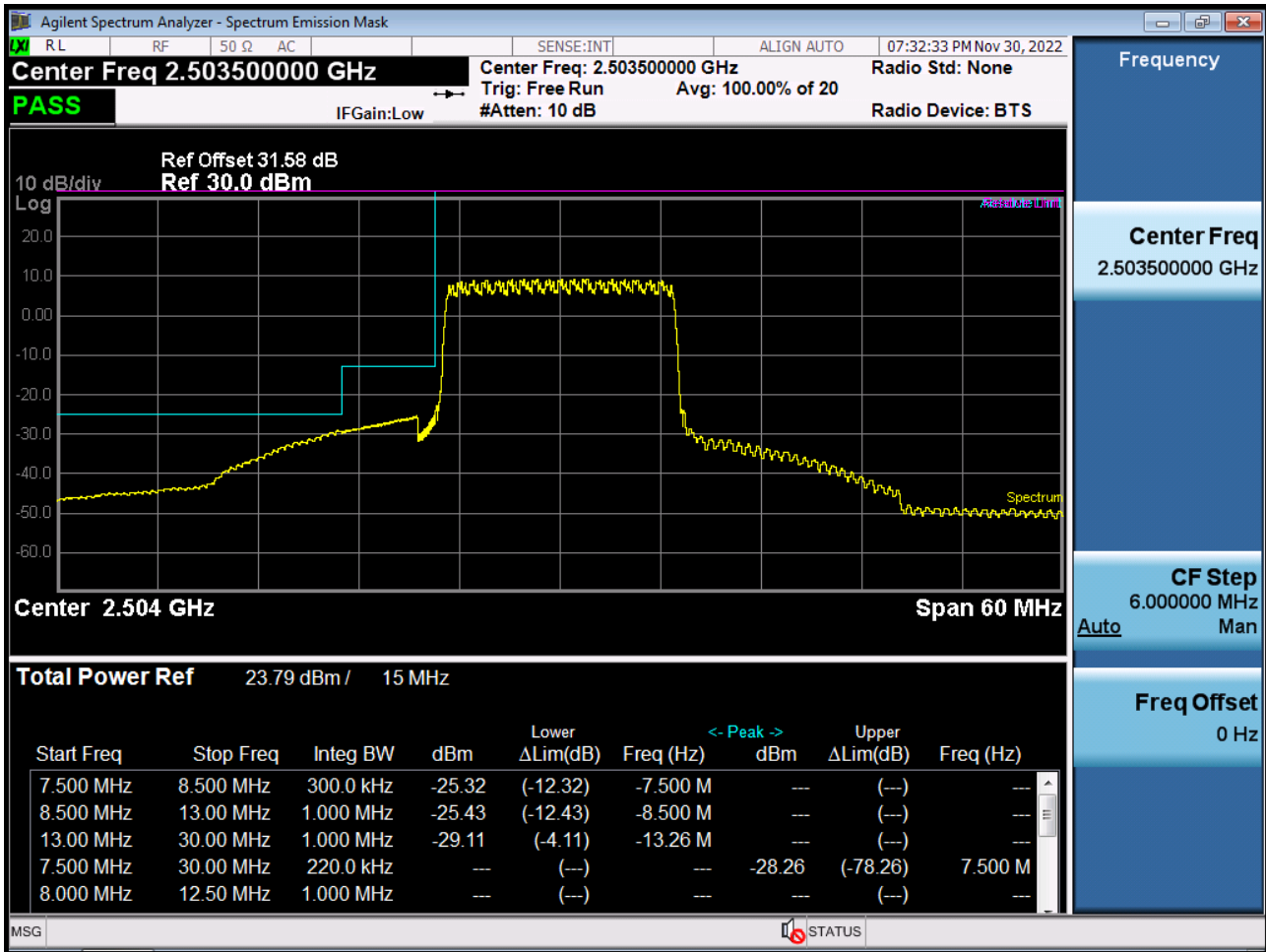
Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-1



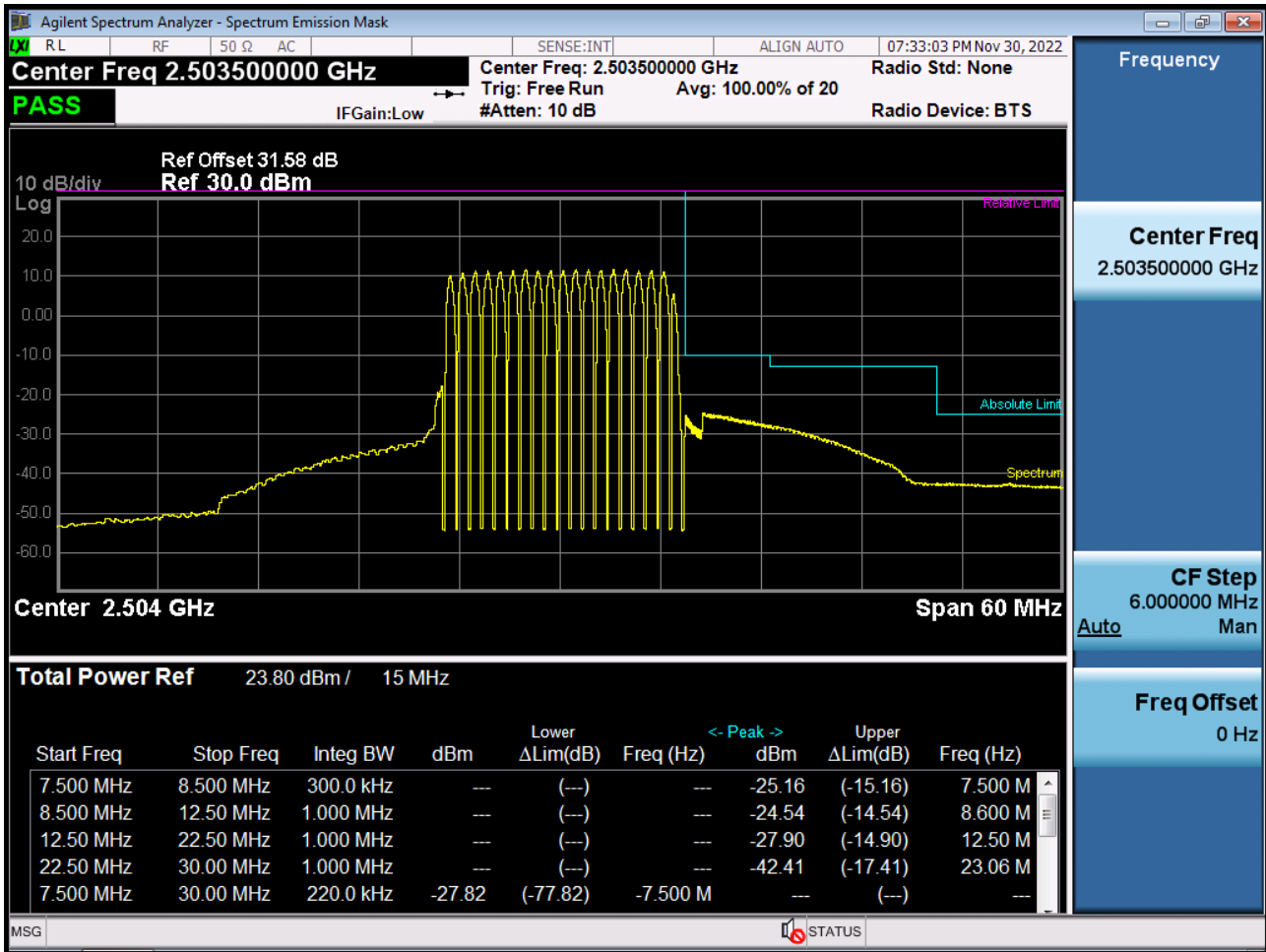
Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-2



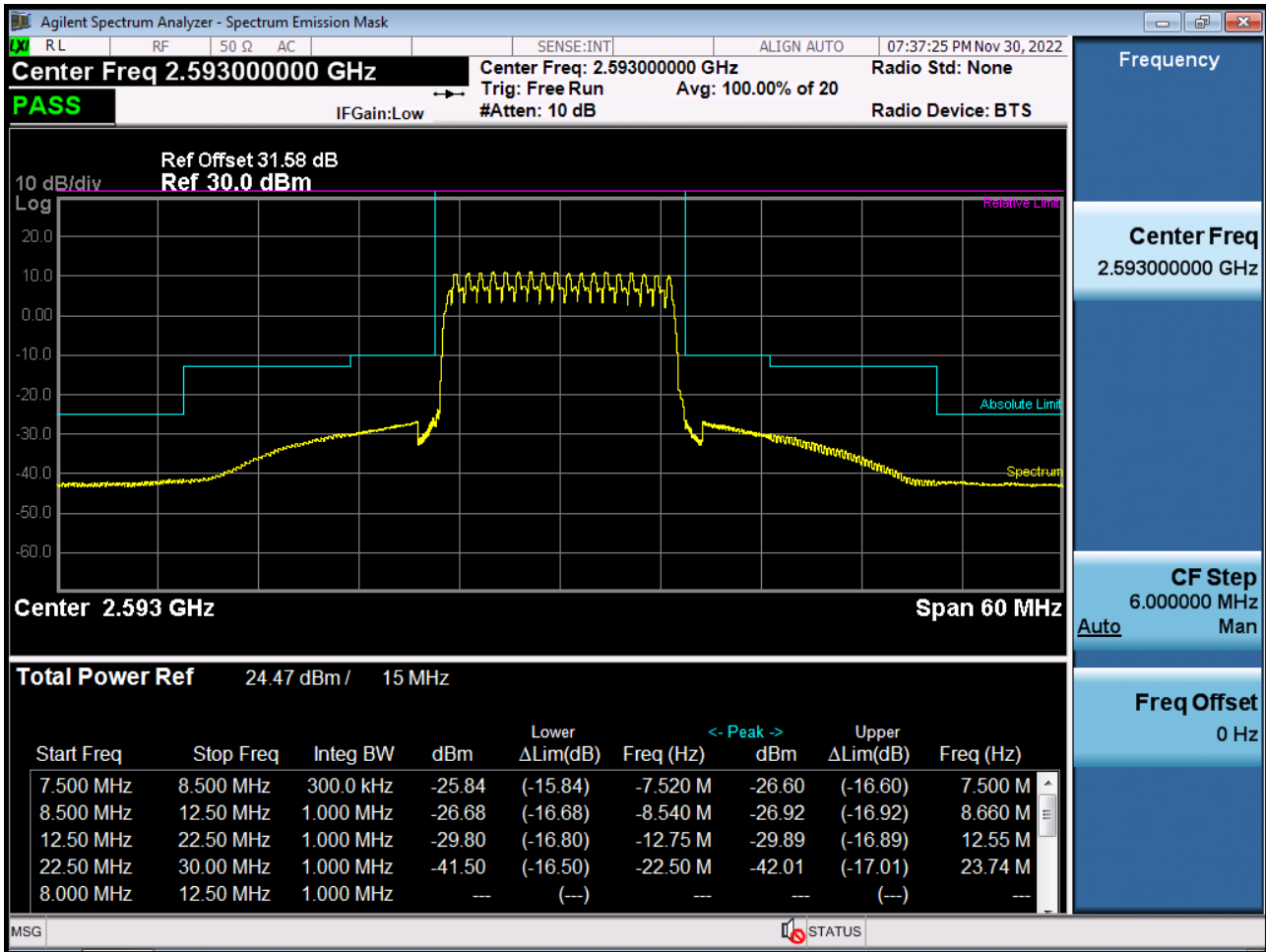
Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-1



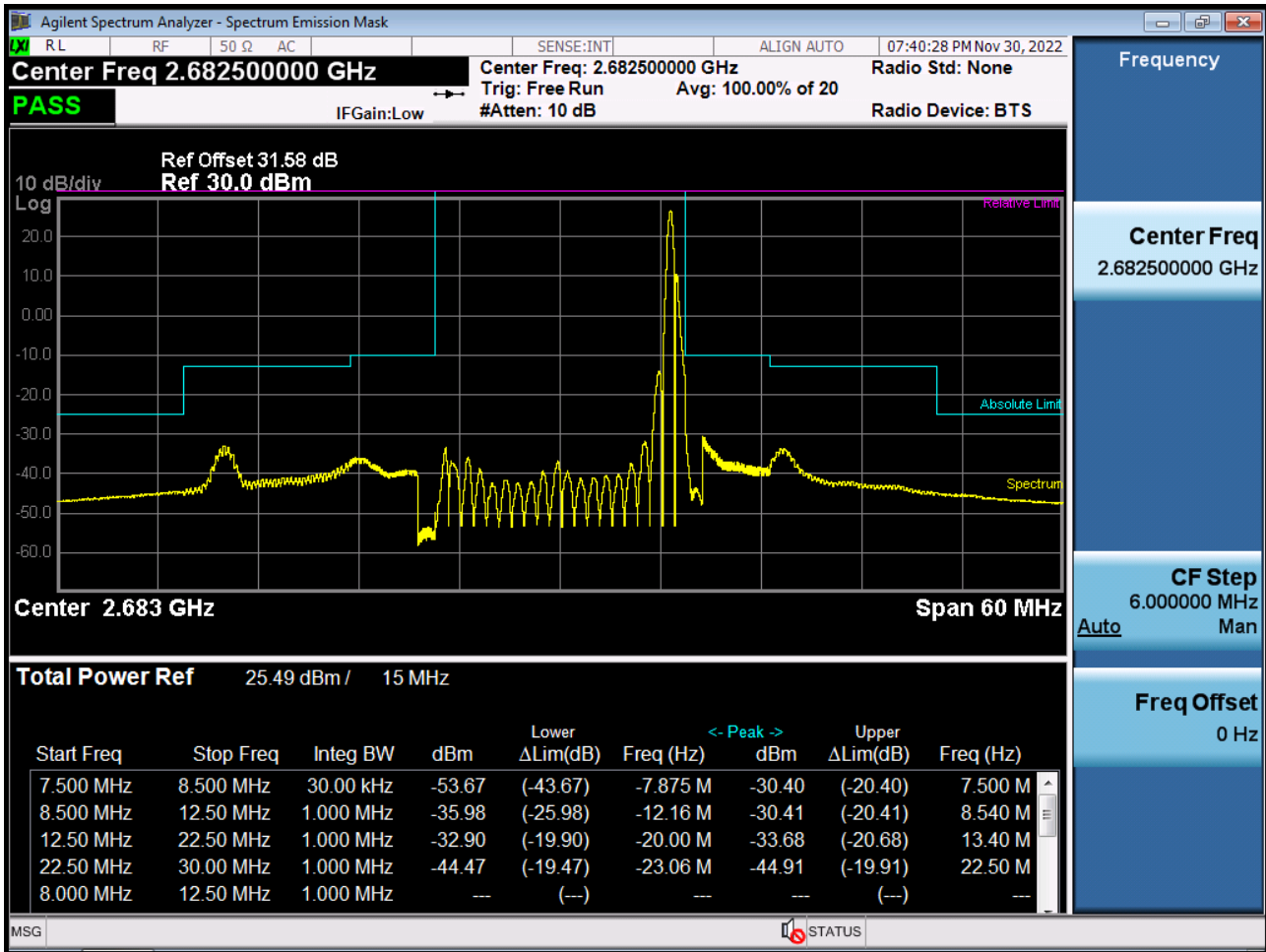
Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-2



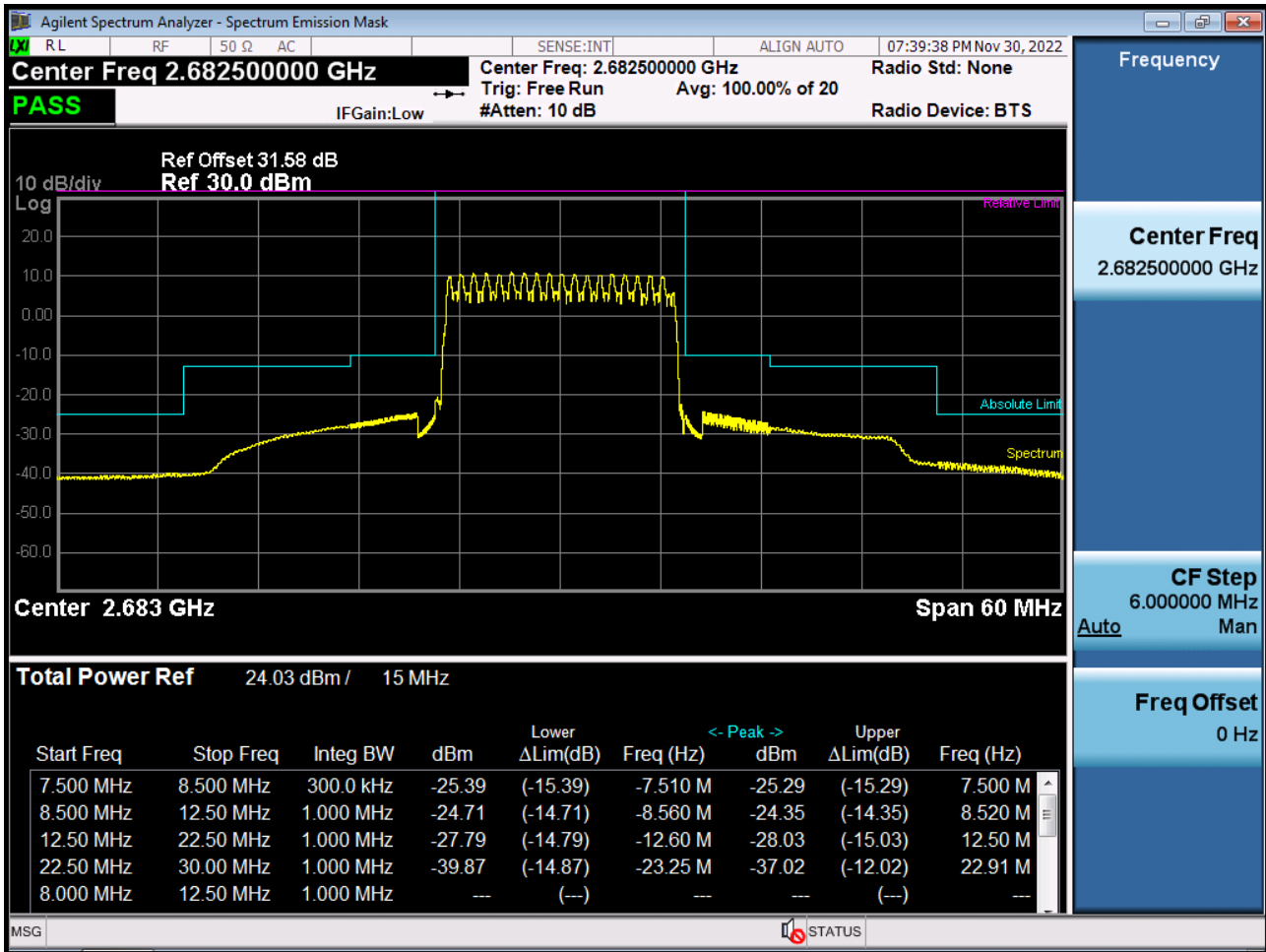
Mid Channel Edge Plot (15 MHz Ch.40620 QPSK RB 75)



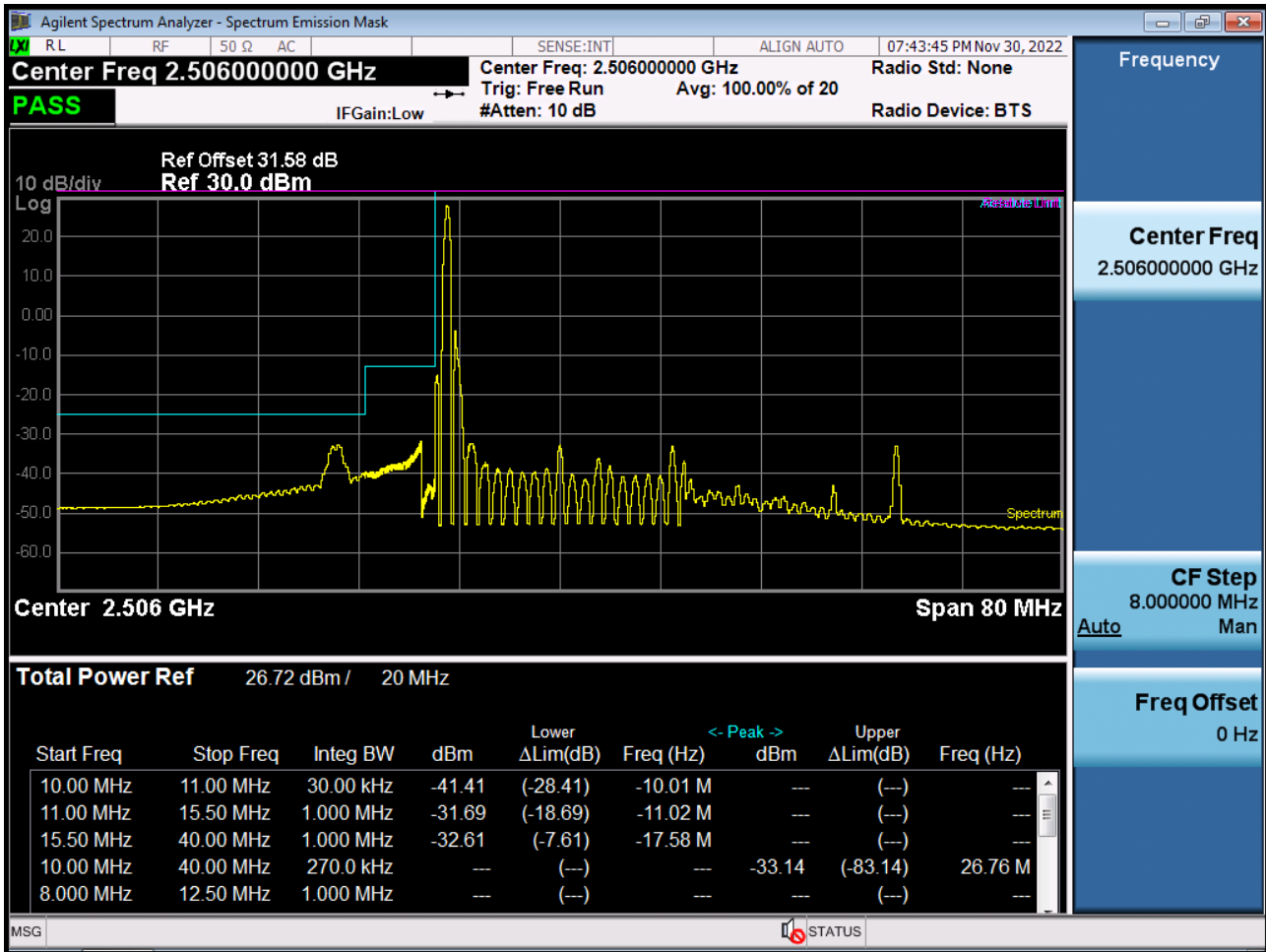
High Channel Edge Plot (15 MHz Ch.41515 QPSK RB 1, Offset 74)



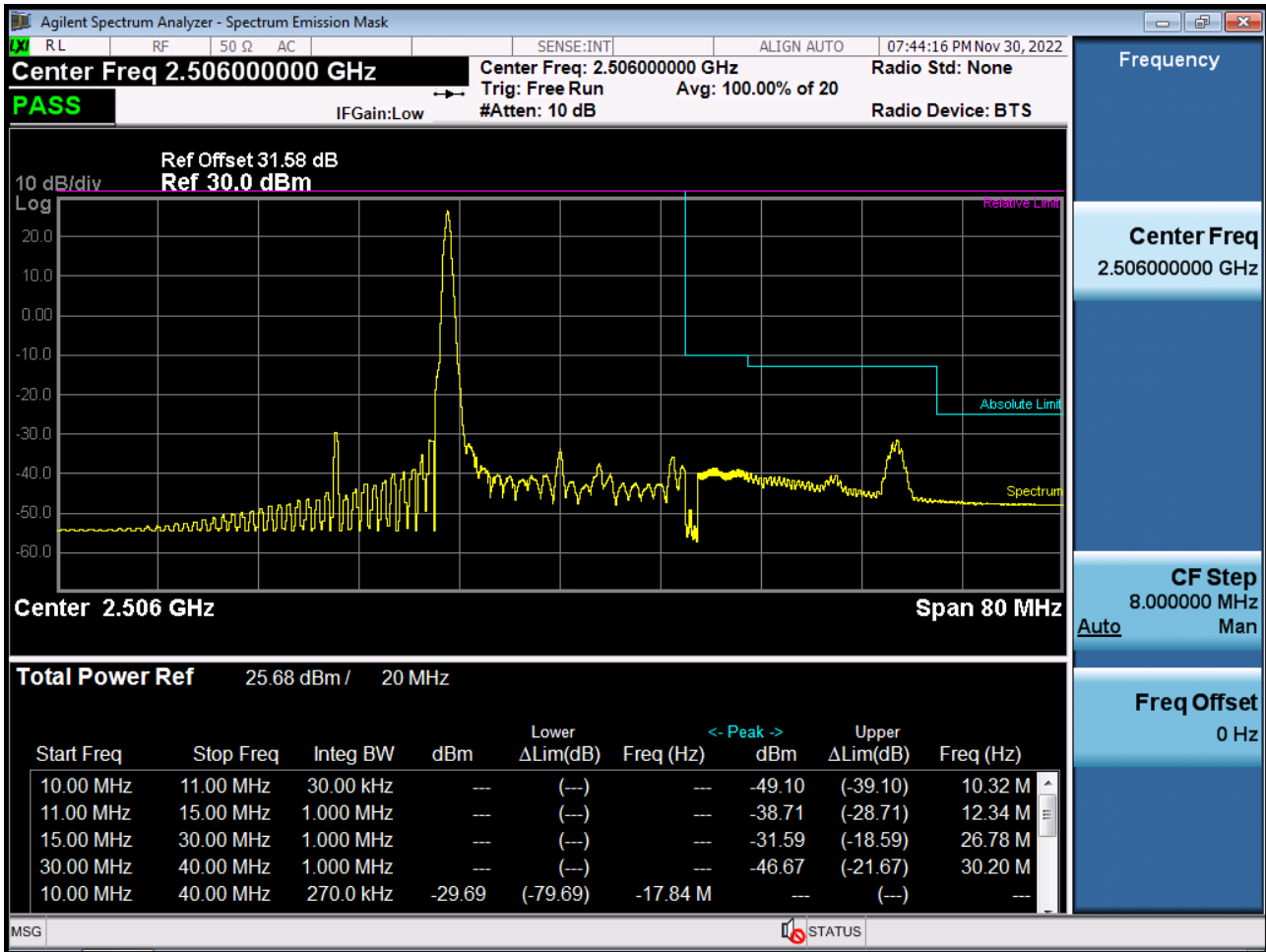
High Channel Edge Plot (15 MHz Ch.41515 QPSK_RB75_Offset 0)



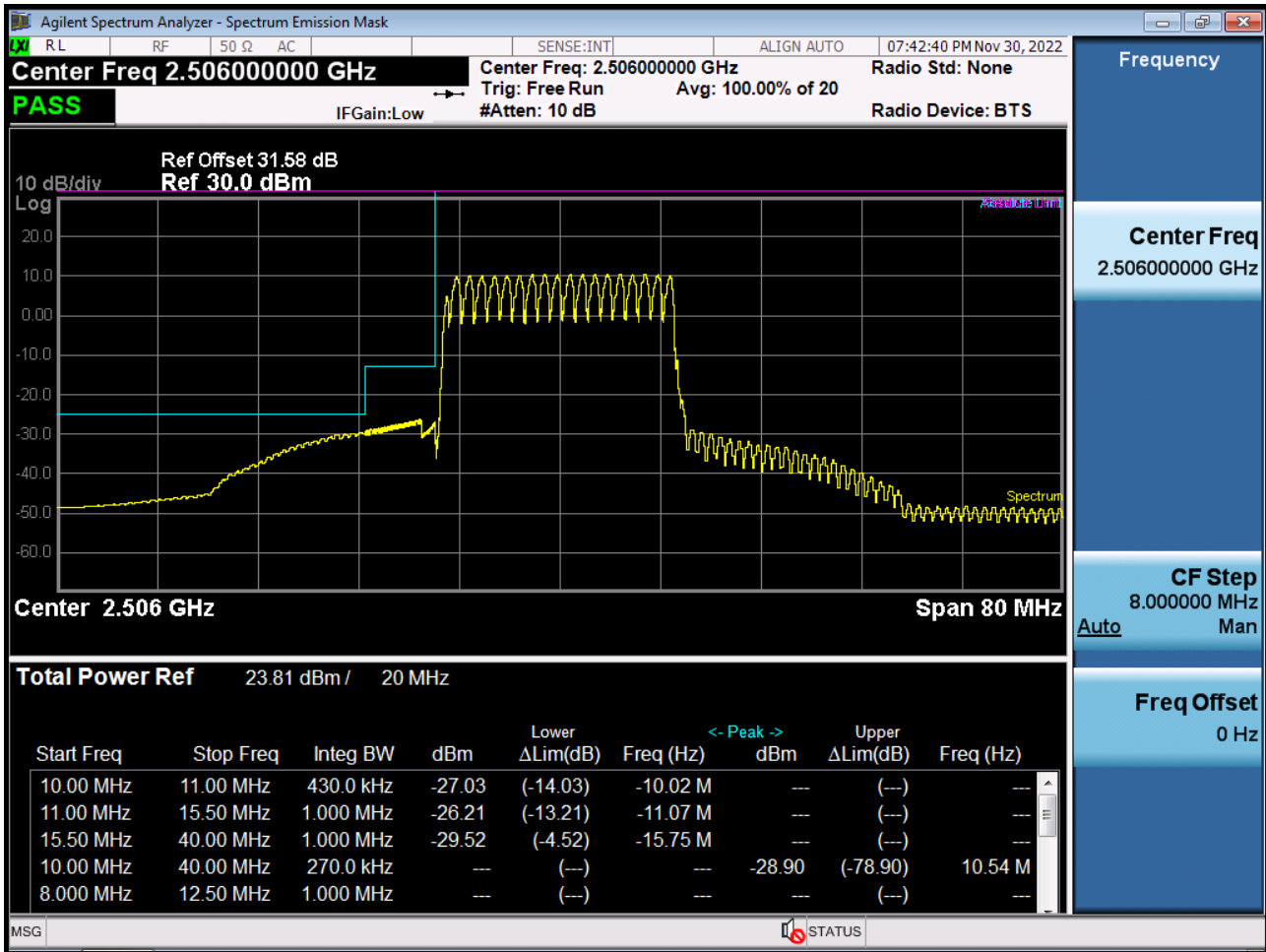
Low Channel Edge Plot (20 MHz Ch.39750 QPSK RB 1, Offset 0)-1



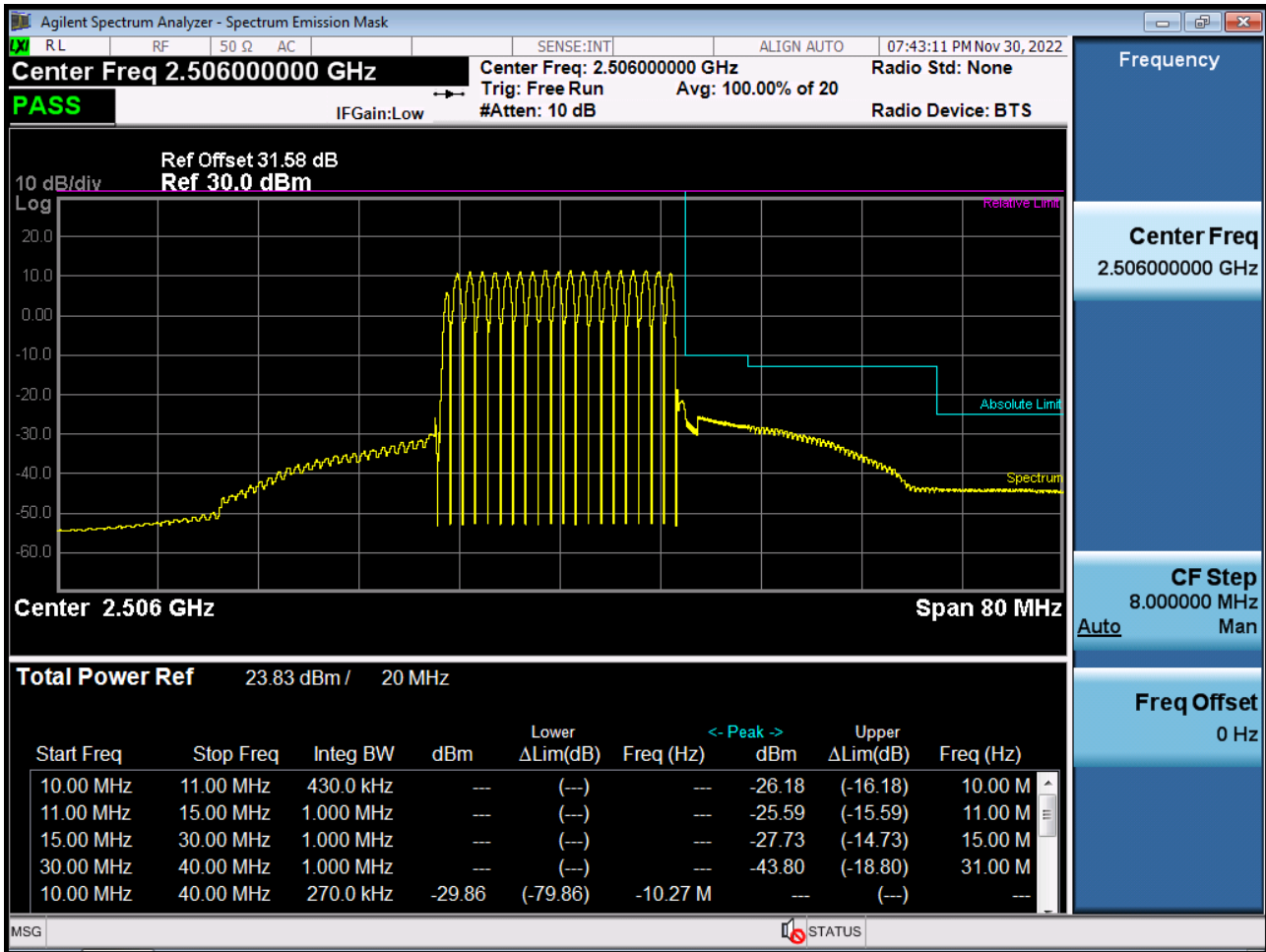
Low Channel Edge Plot (20 MHz Ch.39750 QPSK RB 1, Offset 0)-2



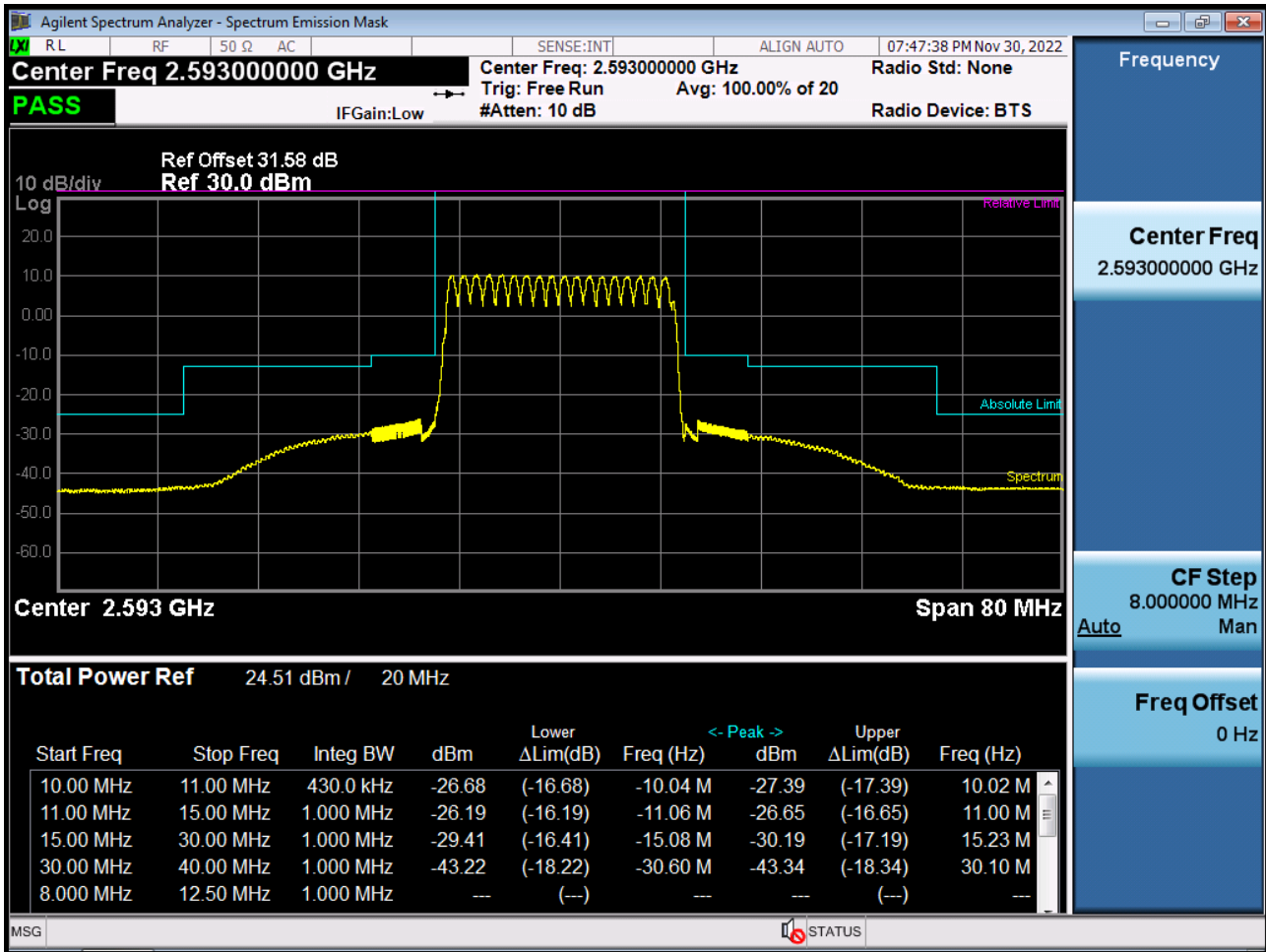
Low Channel Edge Plot (20 MHz Ch.39750 QPSK_RB100_Offset 0)-1



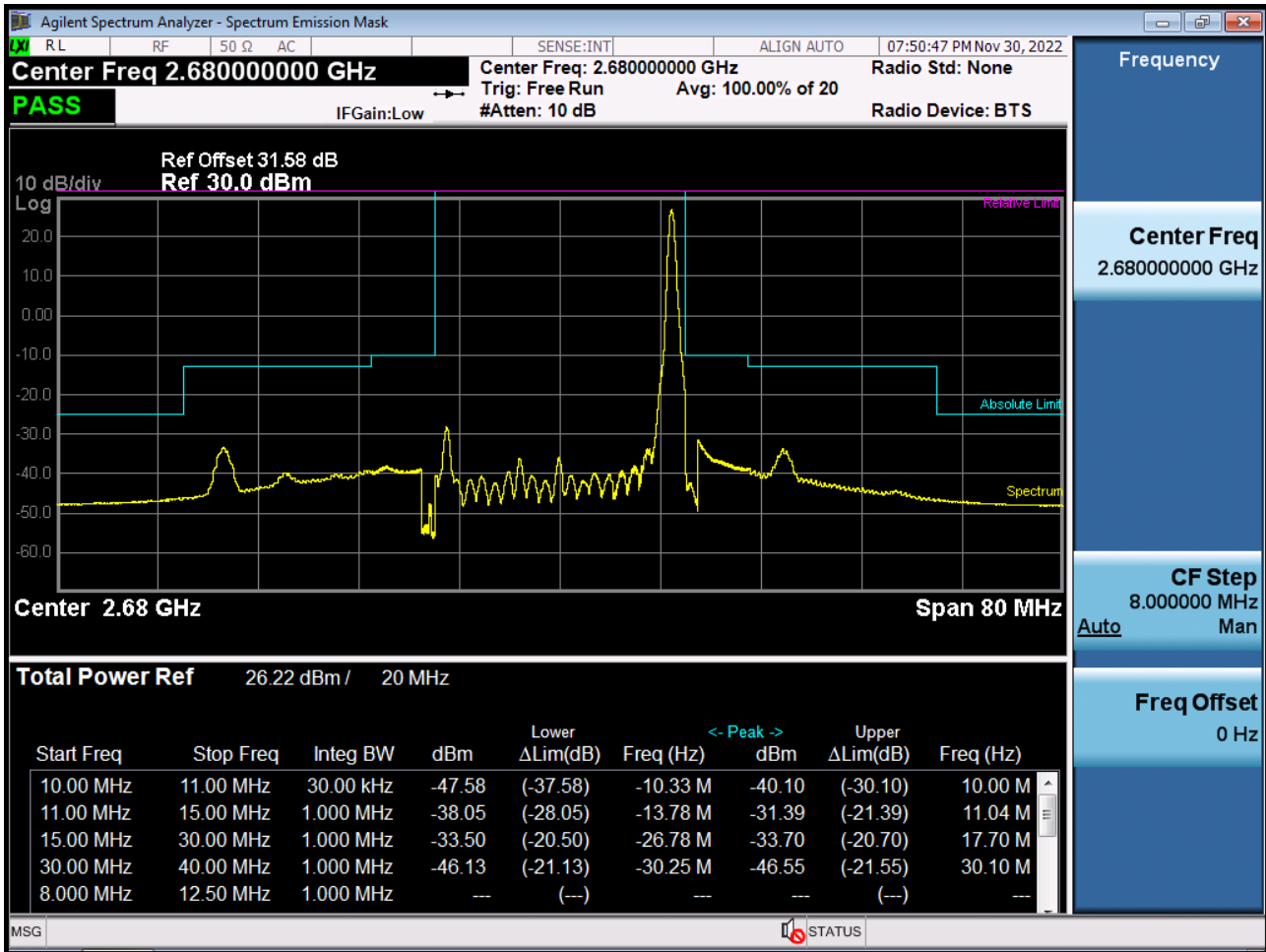
Low Channel Edge Plot (20 MHz Ch.39750 QPSK_RB100_Offset 0)-2



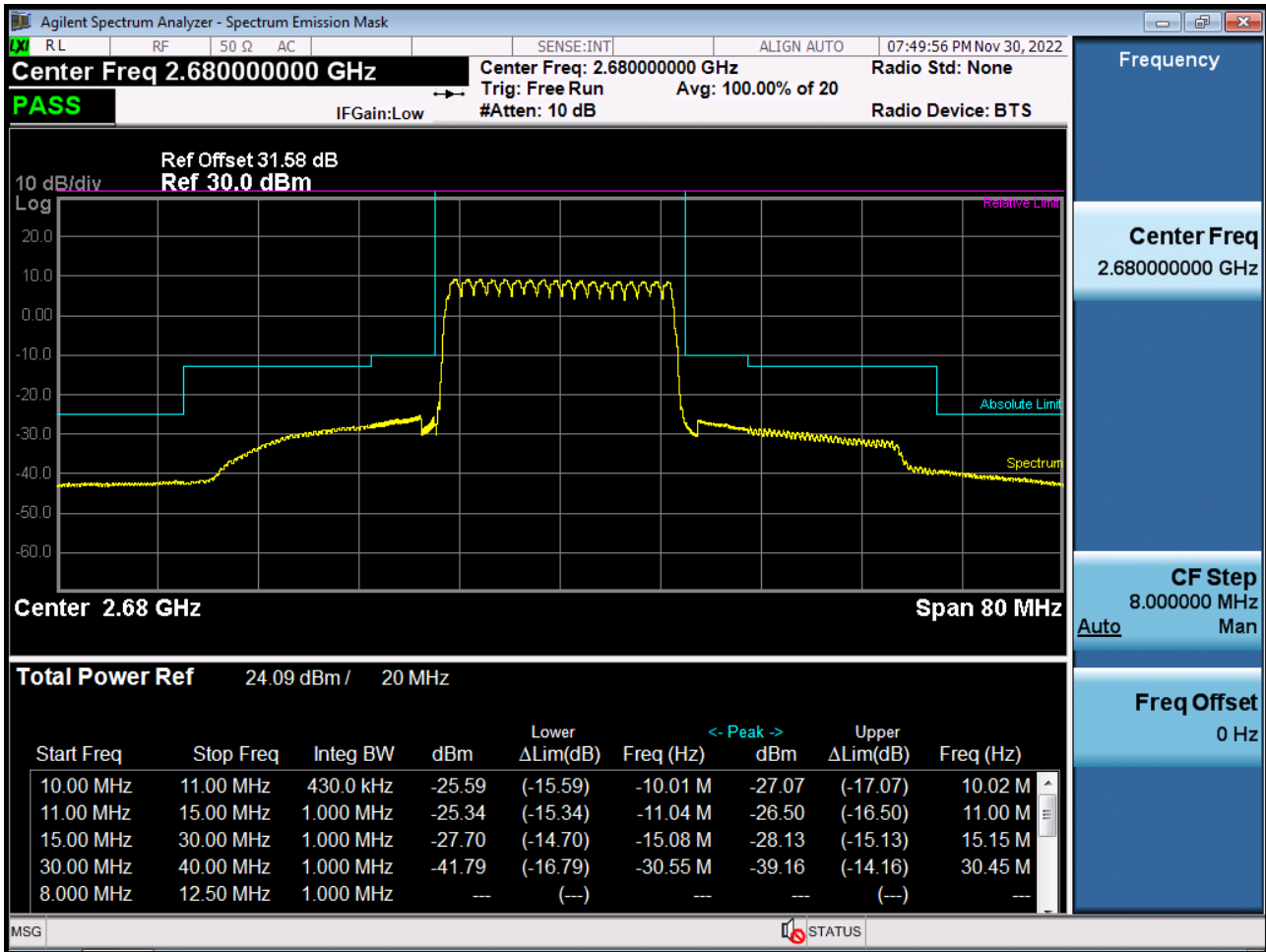
Mid Channel Edge Plot (20 MHz Ch.40620 QPSK RB 100)



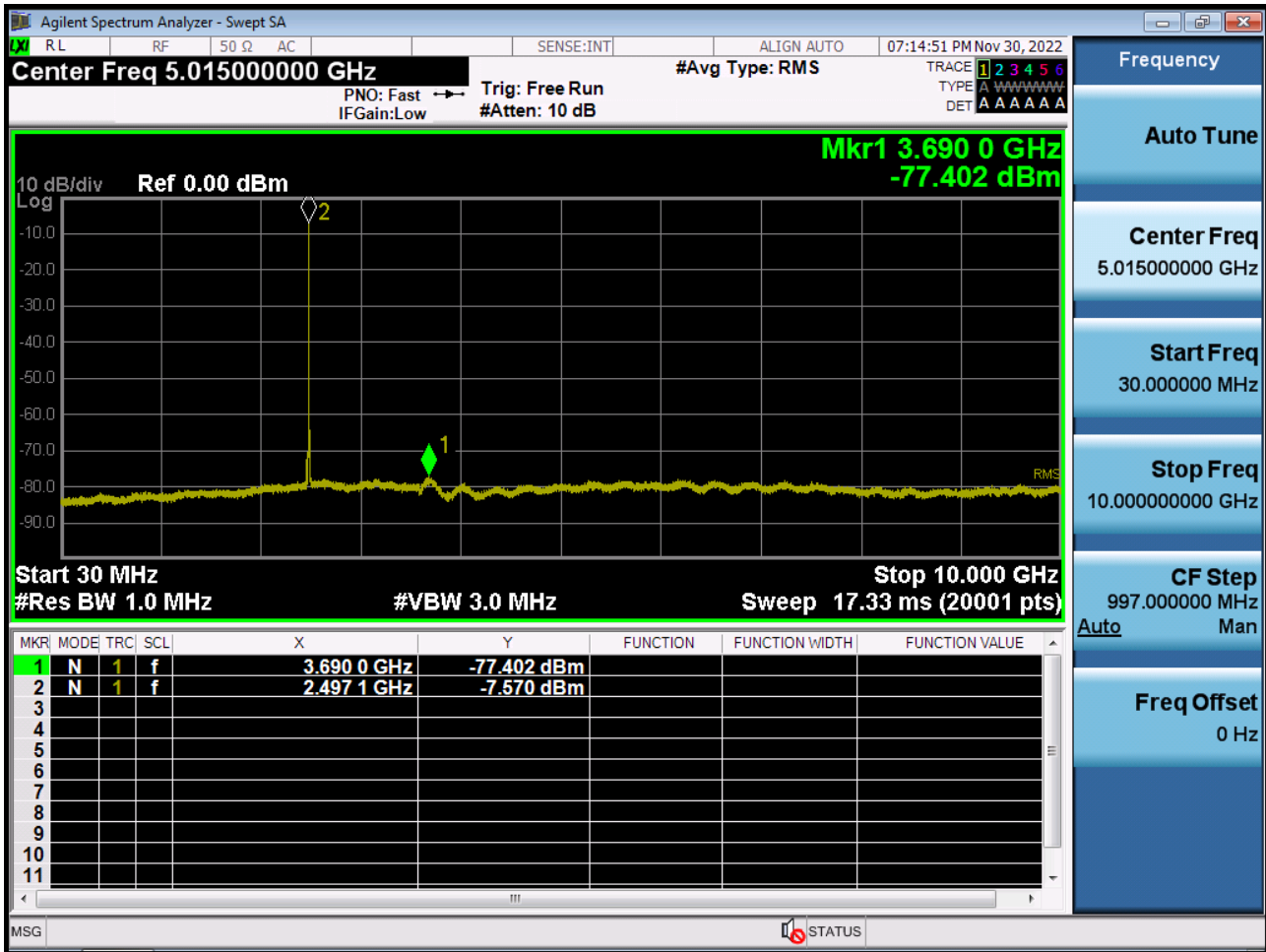
High Channel Edge Plot (20 MHz Ch.41490 QPSK RB 1, Offset 99)



High Channel Edge Plot (20 MHz Ch.41490 QPSK_RB100_Offset 0)



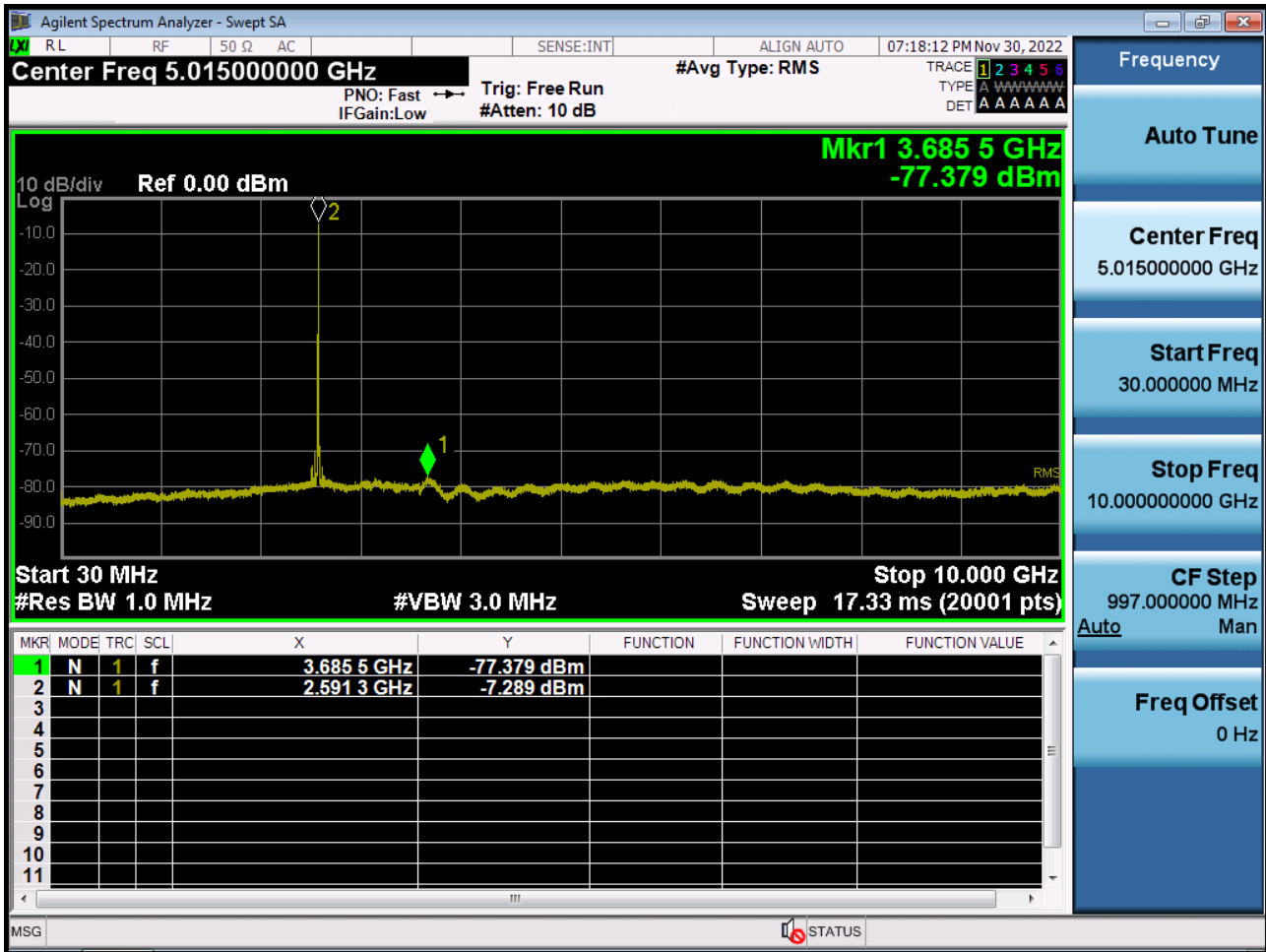
Conducted Spurious Plot 1 (5 MHz Ch.39675 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (5 MHz Ch. 39675 QPSK RB 1, Offset 0)



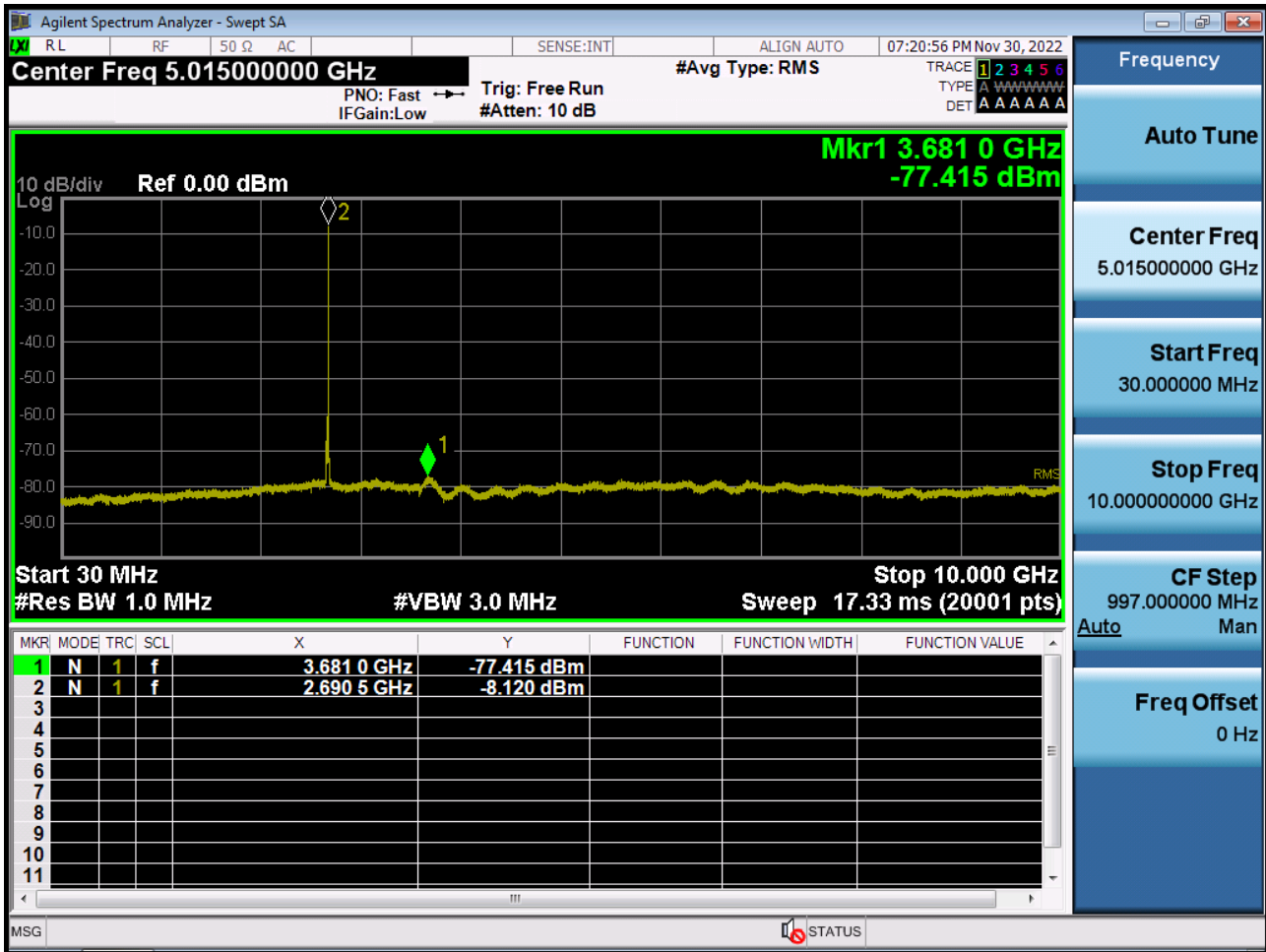
Conducted Spurious Plot 1 (5 MHz Ch.40620 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (5 MHz Ch. 40620 QPSK RB 1, Offset 0)



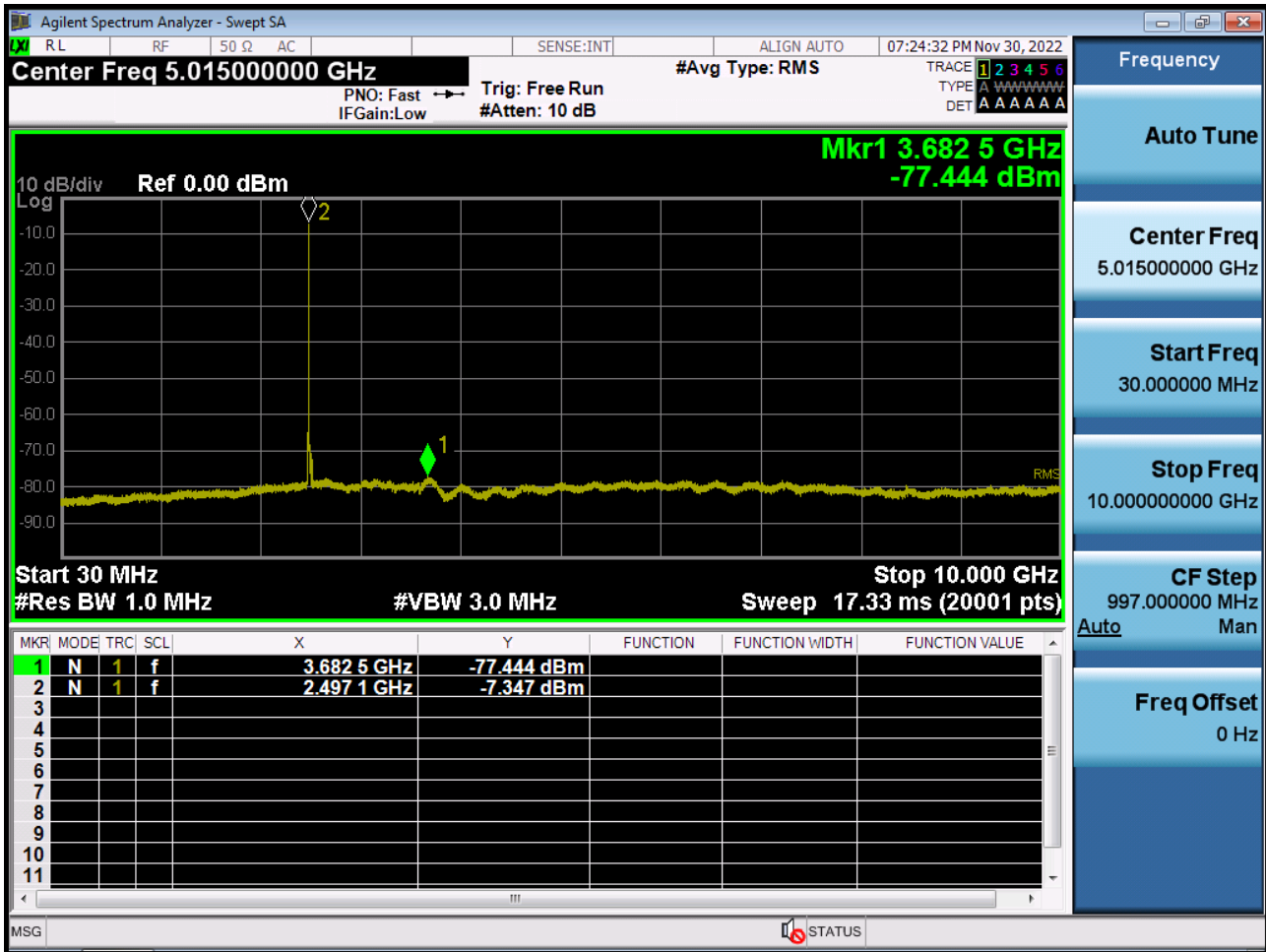
Conducted Spurious Plot 1 (5 MHz Ch.41565 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (5 MHz Ch. 41565 QPSK RB 1, Offset 0)



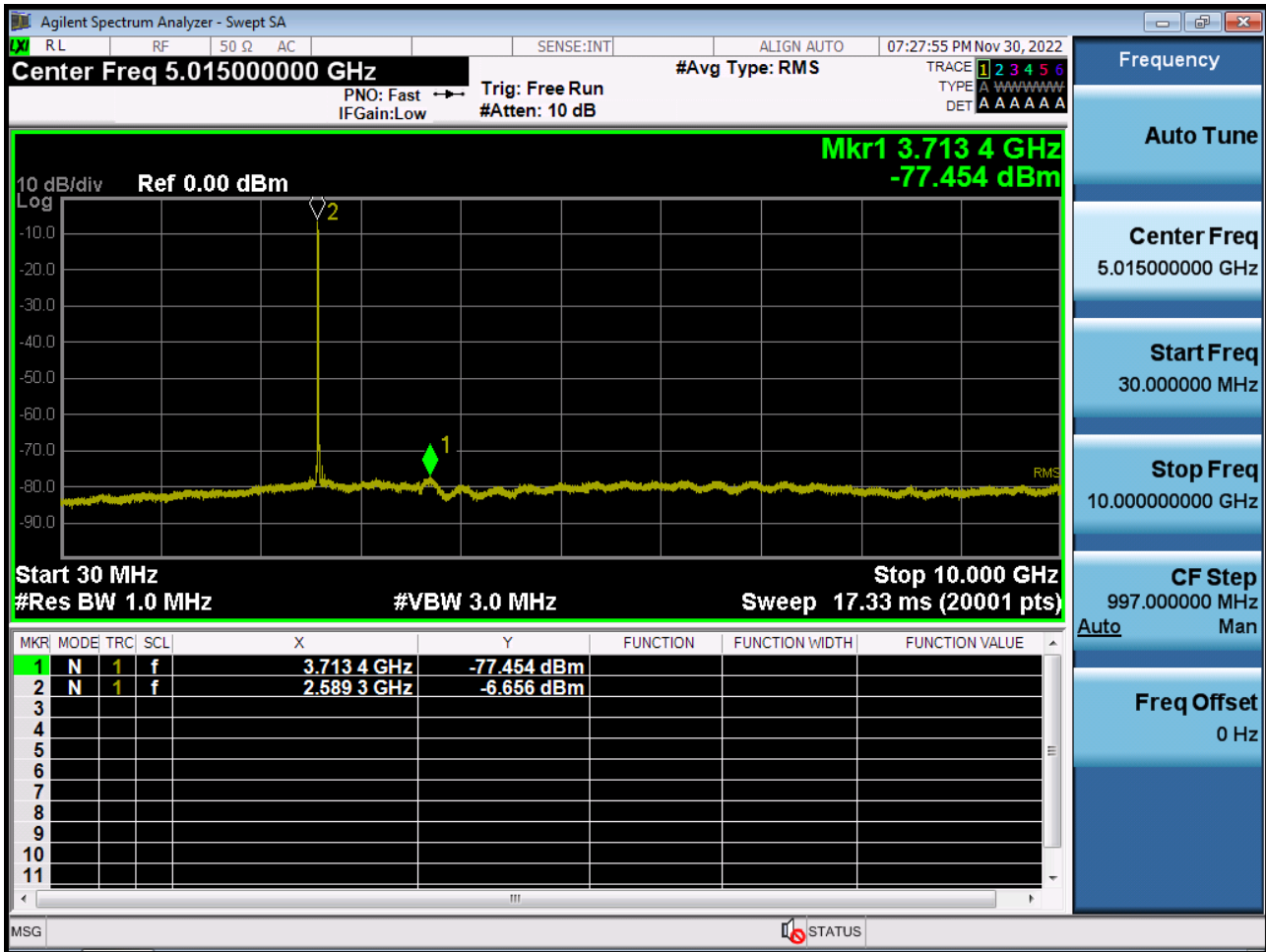
Conducted Spurious Plot 1 (10 MHz Ch.39700 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (10 MHz Ch. 39700 QPSK RB 1, Offset 0)



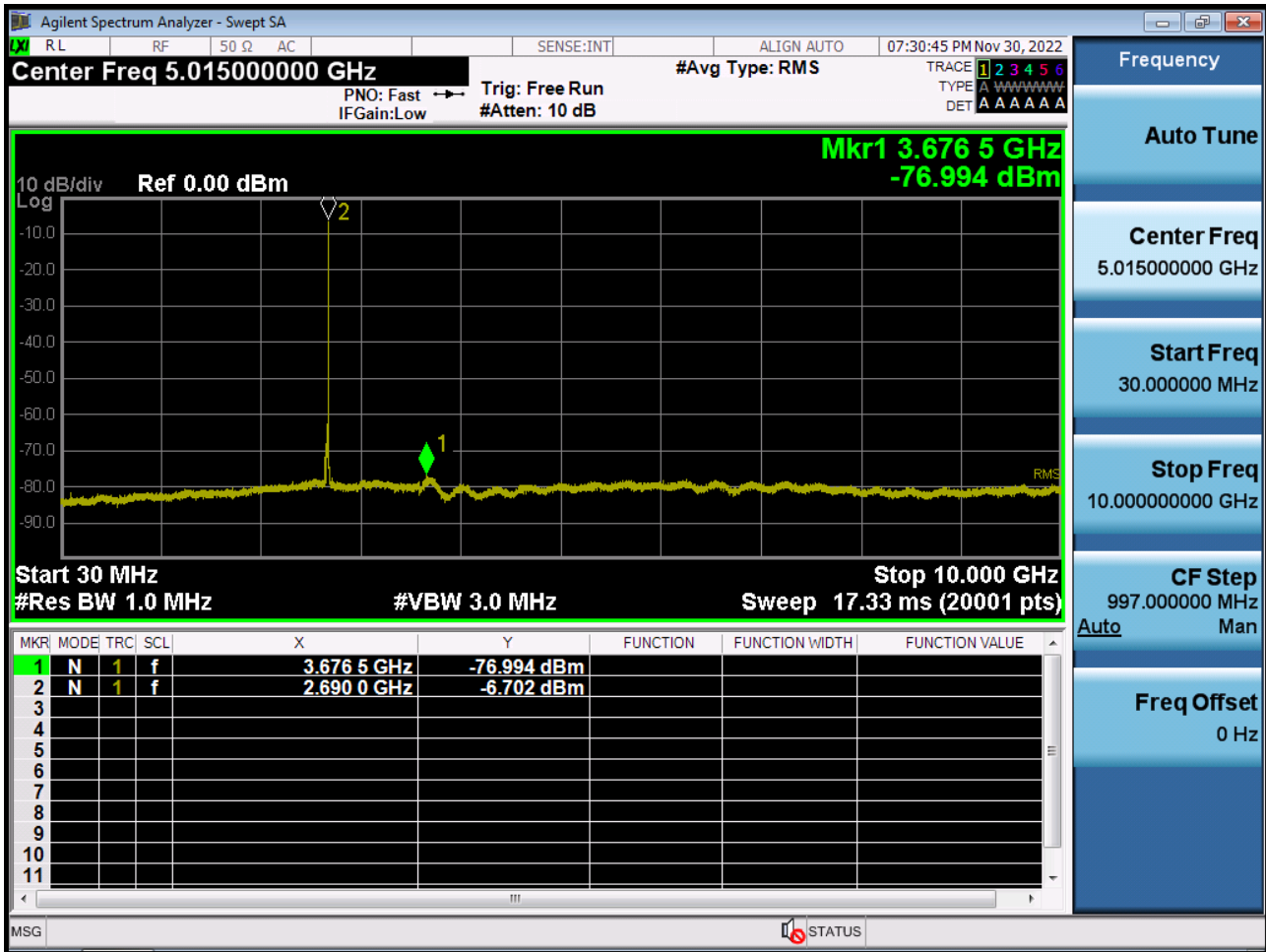
Conducted Spurious Plot 1 (10 MHz Ch.40620 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (10 MHz Ch. 40620 QPSK RB 1, Offset 0)



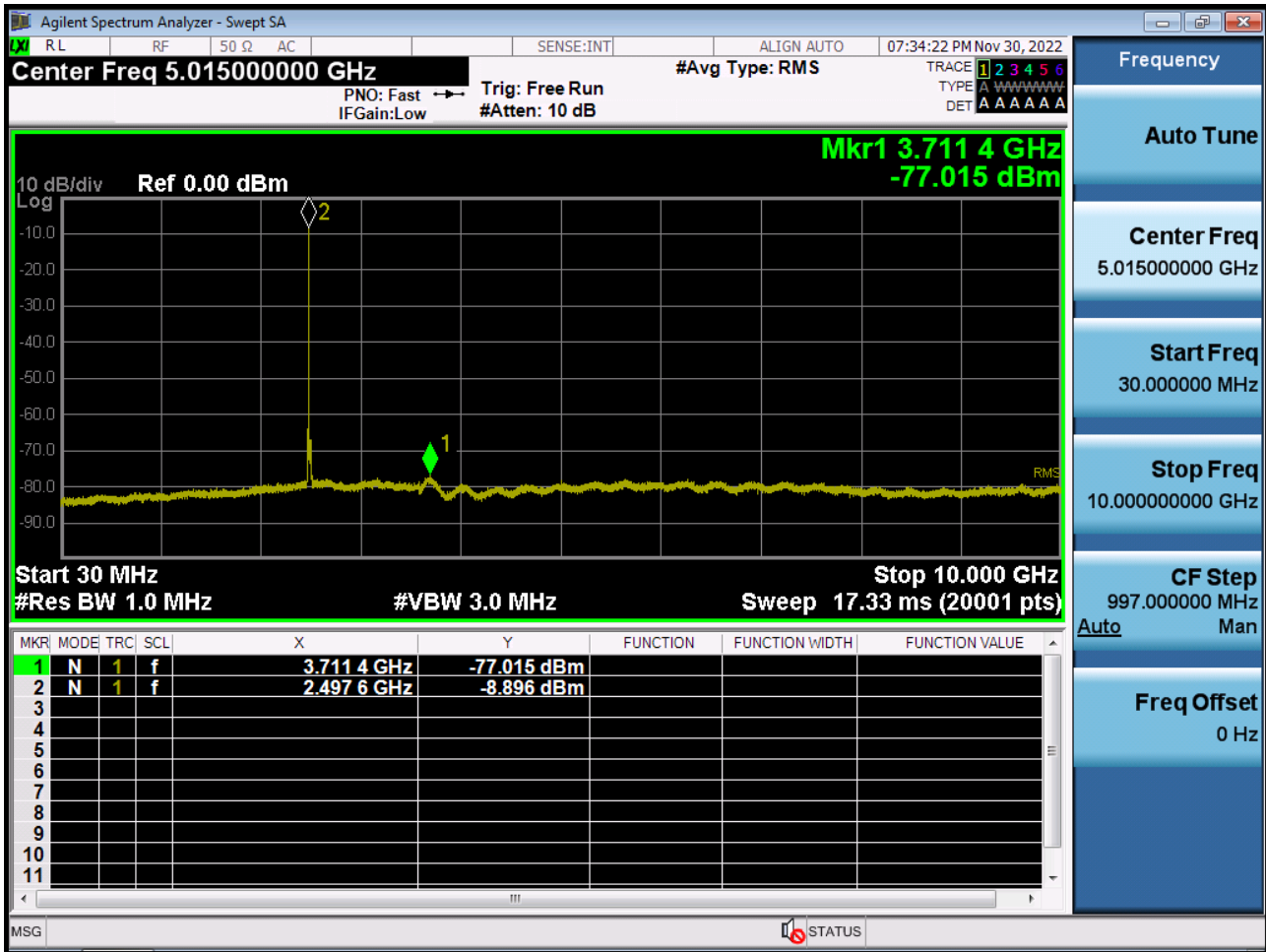
Conducted Spurious Plot 1 (10 MHz Ch. 41540 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (10 MHz Ch. 41540 QPSK RB 1, Offset 0)



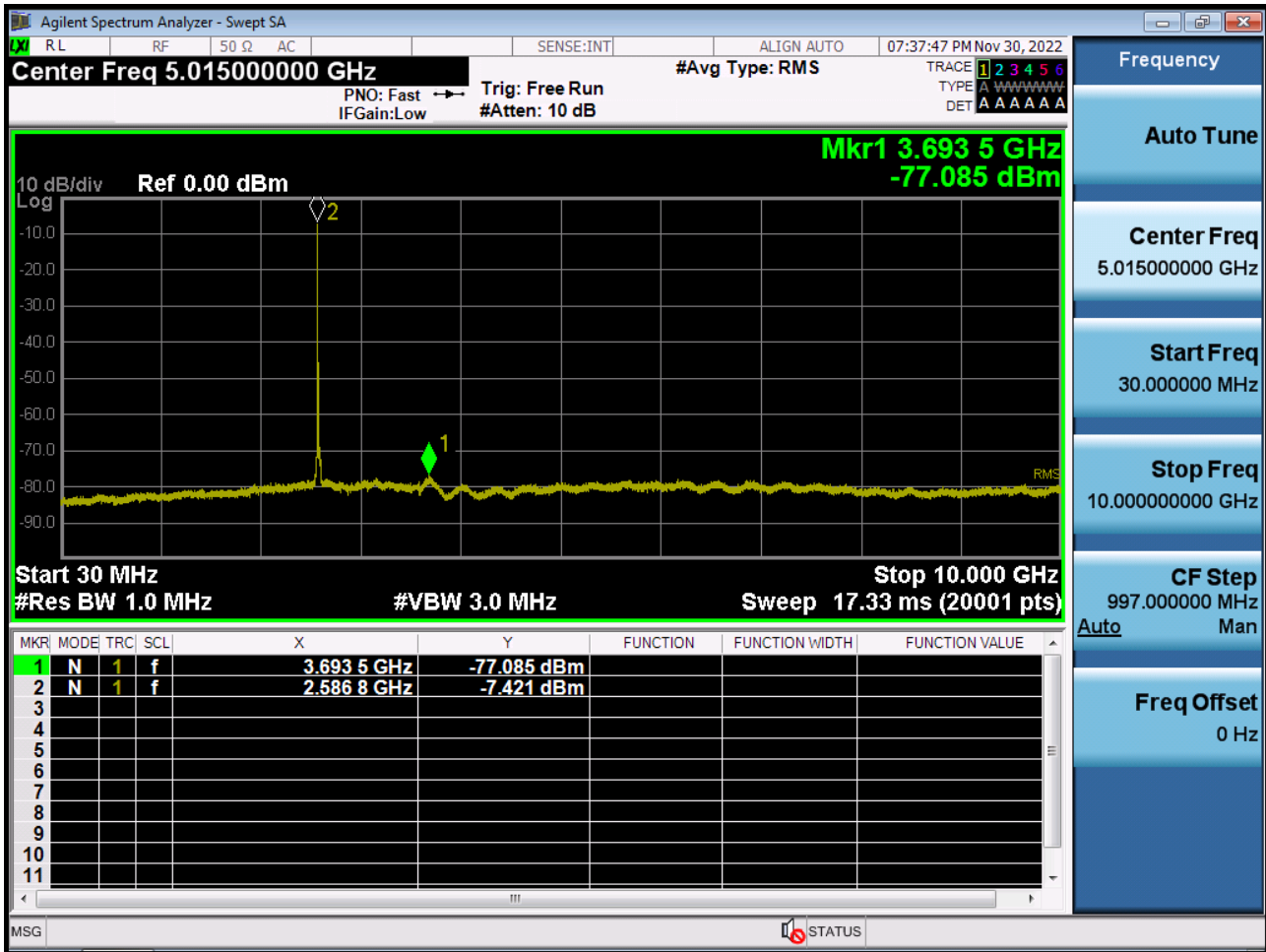
Conducted Spurious Plot 1 (15 MHz Ch.39725 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (15 MHz Ch. 39725 QPSK RB 1, Offset 0)



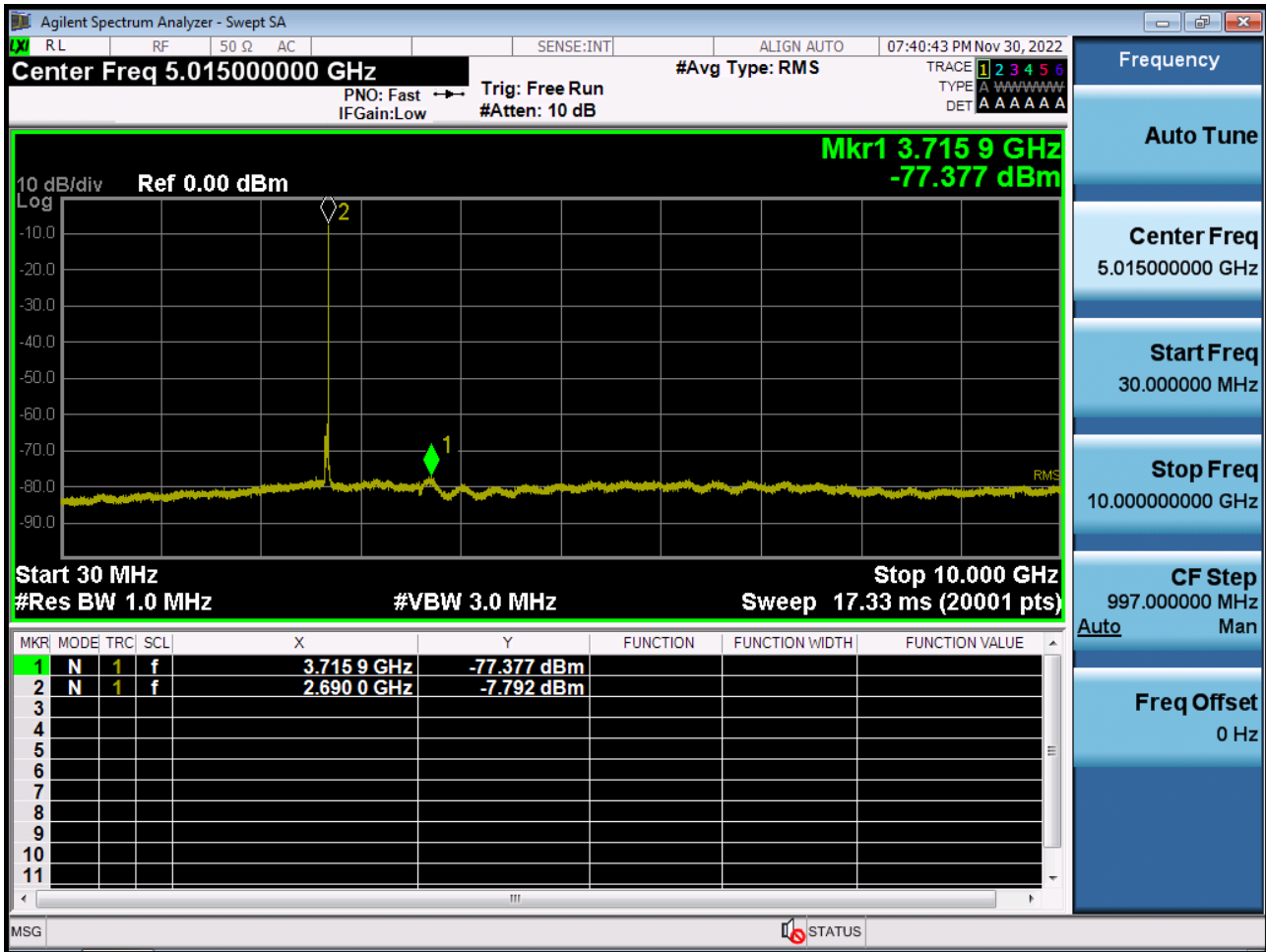
Conducted Spurious Plot 1 (15 MHz Ch.40620 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (15 MHz Ch. 40620 QPSK RB 1, Offset 0)



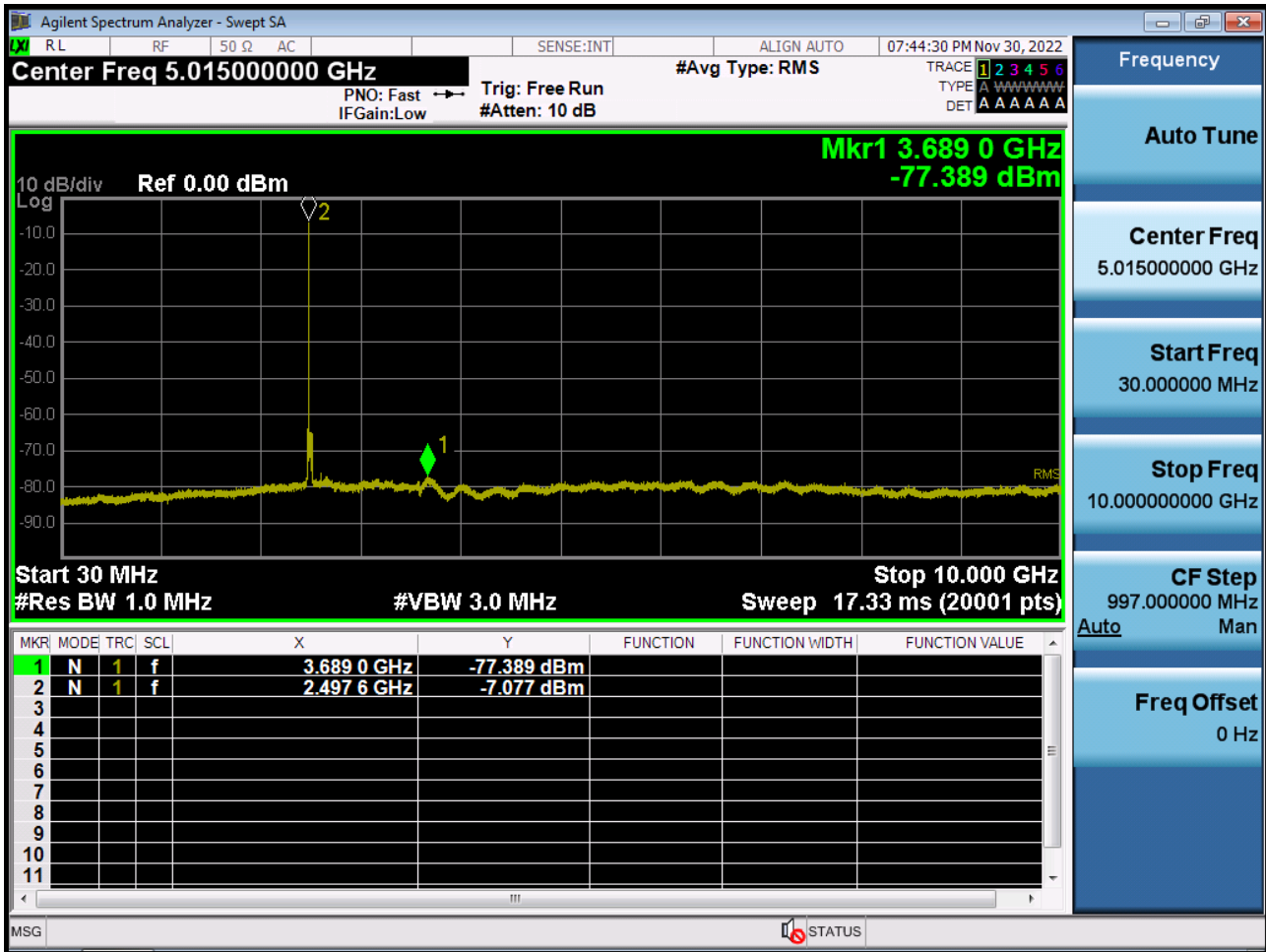
Conducted Spurious Plot 1 (15 MHz Ch.41515 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (15 MHz Ch. 41515 QPSK RB 1, Offset 0)



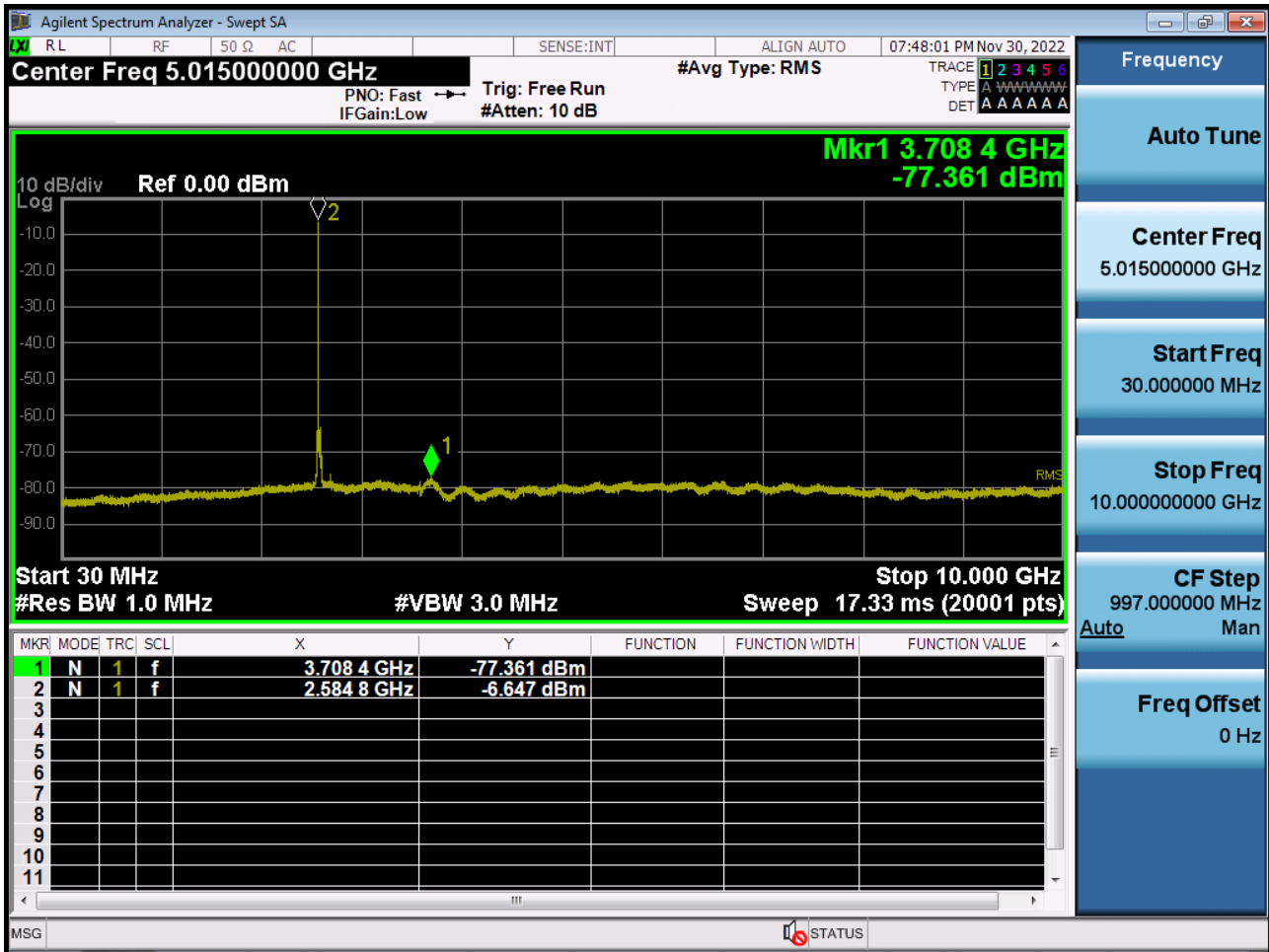
Conducted Spurious Plot 1 (20 MHz Ch.39750 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (20 MHz Ch. 39750 QPSK RB 1, Offset 0)



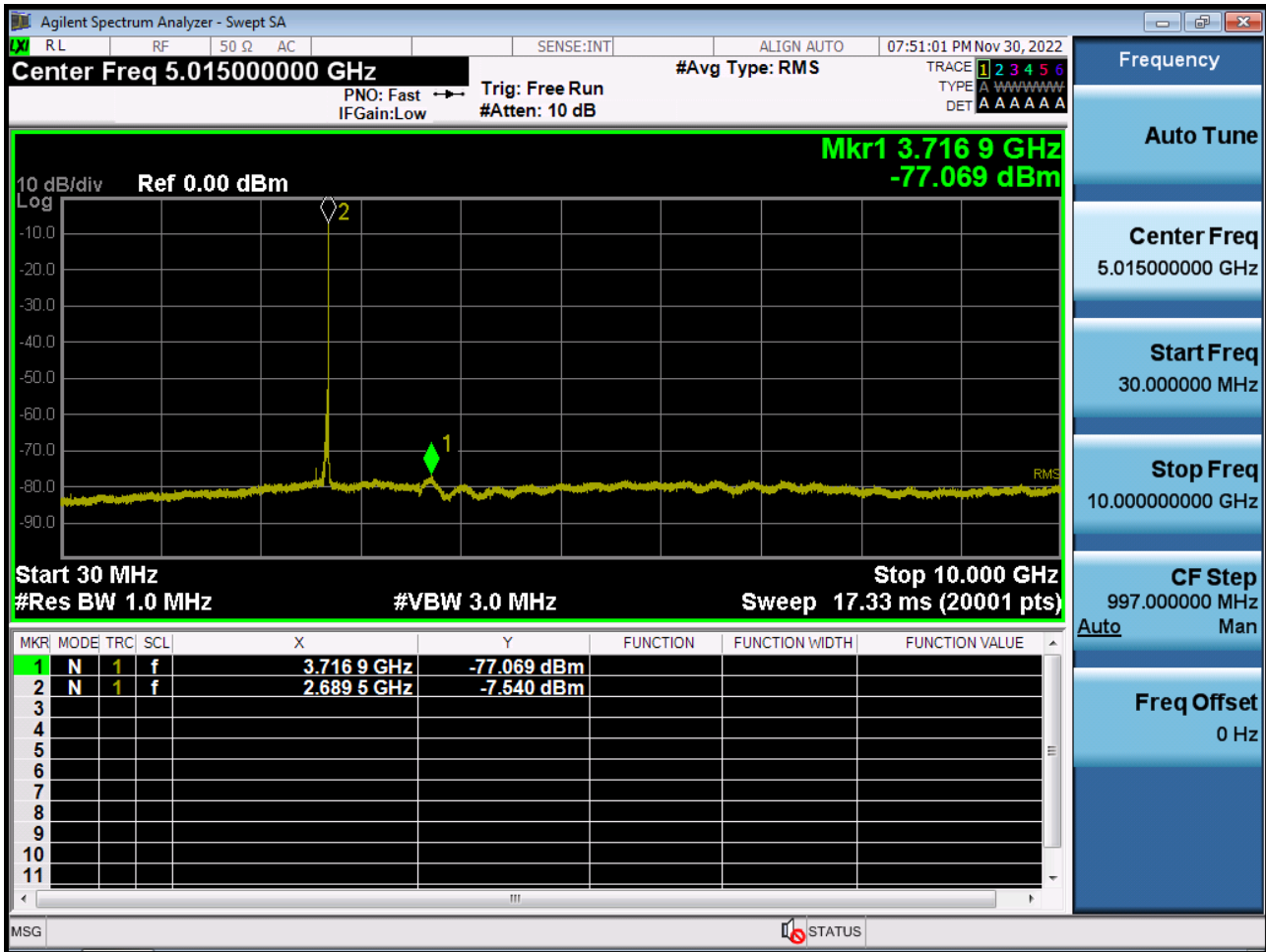
Conducted Spurious Plot 1 (20 MHz Ch.40620 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (20 MHz Ch. 40620 QPSK RB 1, Offset 0)



Conducted Spurious Plot 1 (20 MHz Ch.41490 QPSK RB 1, Offset 0)



Conducted Spurious Plot 2 (20 MHz Ch. 41490 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-2301-FC018-P