

FCC LTE REPORT

Certification

Applicant Name:

SAMSUNG Electronics Co., Ltd.

Date of Issue:

September 17, 2021

Location:

HCT CO., LTD.,
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Address:

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

Report No.: HCT-RF-2109-FC029

FCC ID: A3LSMG990E

APPLICANT: SAMSUNG Electronics Co., Ltd.

Model(s): SM-G990E/DS
 Additional Model(s): SM-G990E
 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)
Power Class 2	LTE – Band 41 (5)	2498.5 – 2687.5	4M52G7D	QPSK	0.278	24.44
			4M51W7D	16QAM	0.215	23.33
			4M52W7D	64QAM	0.159	22.03
			4M51W7D	256QAM	0.125	20.96
	LTE – Band 41 (10)	2501.0 – 2685.0	9M02G7D	QPSK	0.268	24.28
			8M97W7D	16QAM	0.212	23.26
			9M01W7D	64QAM	0.158	21.98
			8M98W7D	256QAM	0.126	21.02
	LTE – Band 41 (15)	2503.5 – 2682.5	13M5G7D	QPSK	0.265	24.23
			13M5W7D	16QAM	0.210	23.22
			13M5W7D	64QAM	0.150	21.77
			13M4W7D	256QAM	0.122	20.86
	LTE – Band 41 (20)	2506.0 – 2680.0	18M0G7D	QPSK	0.257	24.09
			17M9W7D	16QAM	0.205	23.11
			17M9W7D	64QAM	0.146	21.65
			17M9W7D	256QAM	0.120	20.78

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-2109-FC029

REVIEWED BY



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

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

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

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

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

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2109-FC029	September 17, 2021	- 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:	A3LSMG990E
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-G990E/DS
Additional Model(s):	SM-G990E
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:	August 18, 2021 ~ September 14, 2021
Serial number:	Radiated: R3CR903MSRT Conducted: R3CR80J2WQR

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 (HT20/40/80), Bluetooth, BT LE, NFC.

2.2. MEASURING INSTRUMENT CALIBRATION

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

2.3. TEST FACILITY

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

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

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

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

Test Settings

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

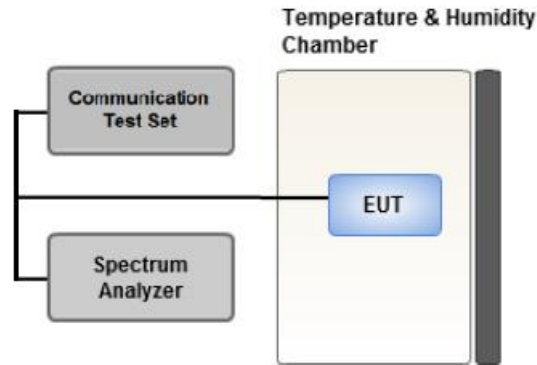
$$\text{Result}_{(\text{dBm})} = P_g_{(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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.

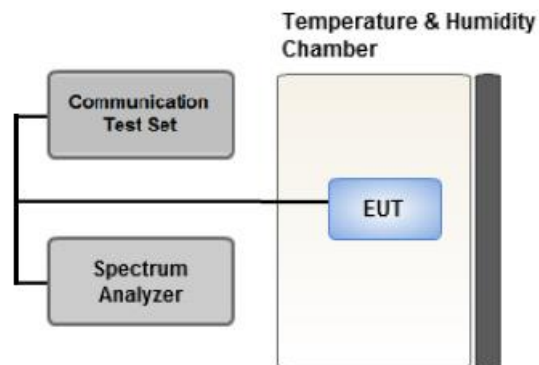
1. Set the RBW \geq OBW.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 2 \times$ OBW.
4. Sweep time $\geq 10 \times$ (number of points in sweep) \times (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to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

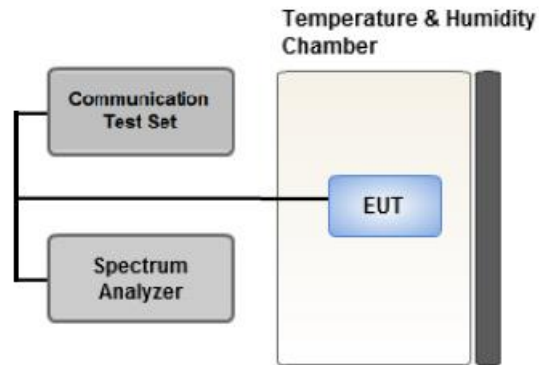
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

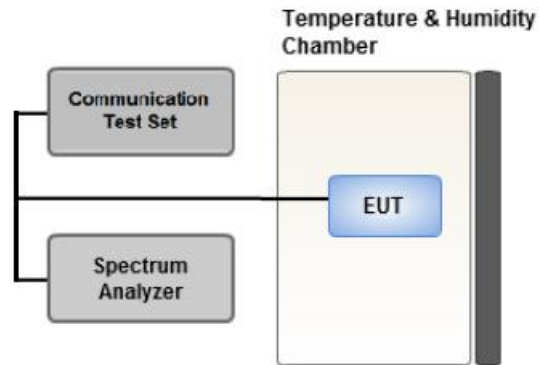
Test Overview

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 = Peak
4. Trace Mode = max hold
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.

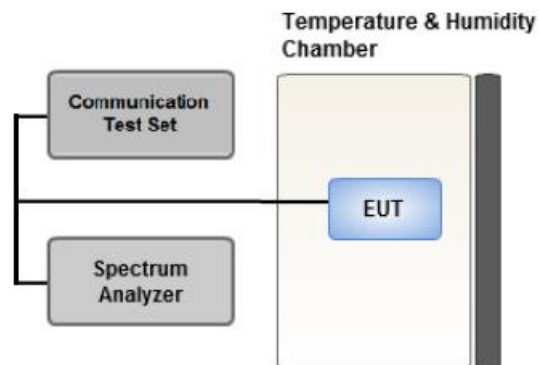
Test Settings

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 $\geq 2 \times \text{Span}/\text{RBW}$
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 power classes were tested, and the results were reported for the worst case PC2.
- Please refer to the table below.
- SM-G990E/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-G990E/DS)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM, 256QAM	1	0	Z
Radiated Spurious and Harmonic Emissions	QPSK	1	0	Z

3.10 WORST CASE(CONDUCTED TEST)

- All power classes were tested, and the results were reported for the worst case PC2.
- All modes of operation were investigated and the worst case configuration results are reported.
- SM-G990E/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-G990E/DS)

[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	0

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	-	03/02/2022	Annual
H.P.F	FBSR-02B(WHK3.3/18 G-10EF)	T&M SYSTEM	-	03/02/2022	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	11275	04/07/2022	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/28/2022	Annual
Dipole Antenna	UHAP	Schwarzbeck	557	04/05/2023	Biennial
Dipole Antenna	UHAP	Schwarzbeck	558	04/05/2023	Biennial
Chamber	SU-642	ESPEC	93008124	03/15/2022	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/30/2022	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/25/2021	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	10/13/2022	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	02/11/2022	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY50200093	11/17/2021	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	06/01/2022	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	10/14/2021	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/18/2022	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/19/2022	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	07/12/2022	Annual
Wideband Radio Communication Tester	MT8820C	Anritsu Corp.	6201026545	01/07/2022	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/05/2022	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	06/02/2022	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)	1.82 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05 (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"> ■ $< 40 + 10\log_{10} (P[\text{Watts}])$ at Channel edges ■ $< 43 + 10\log_{10} (P[\text{Watts}])$ between 5 and X MHz from Channel edges ■ $< 55 + 10\log_{10} (P[\text{Watts}])$ beyond X MHz beyond from Channel edges ■ $< 43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz 	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Frequency stability / variation of ambient temperature	§2.1055, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report

6.2 Test Condition : Radiated Test

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

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

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

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

- 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	-20.67	16.23	10.70	2.49	V	< 2.00	0.278	24.44	
		16-QAM	-21.78	15.12	10.70	2.49	V		0.215	23.33	
		64-QAM	-23.08	13.82	10.70	2.49	V		0.159	22.03	
		256-QAM	-24.15	12.75	10.70	2.49	V		0.125	20.96	
2593.0		QPSK	-23.19	14.13	10.62	2.53	V		0.167	22.22	
		16-QAM	-24.28	13.04	10.62	2.53	V		0.130	21.13	
		64-QAM	-25.56	11.76	10.62	2.53	V		0.097	19.85	
		256-QAM	-26.67	10.65	10.62	2.53	V		0.075	18.74	
2687.5		QPSK	-26.91	10.39	10.78	2.59	V		0.072	18.58	
		16-QAM	-27.86	9.44	10.78	2.59	V		0.058	17.63	
		64-QAM	-29.37	7.93	10.78	2.59	V		0.041	16.12	
		256-QAM	-30.31	6.99	10.78	2.59	V		0.033	15.18	

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	-20.83	16.07	10.70	2.49	V	< 2.00	0.268	24.28	
		16-QAM	-21.85	15.05	10.70	2.49	V		0.212	23.26	
		64-QAM	-23.13	13.77	10.70	2.49	V		0.158	21.98	
		256-QAM	-24.09	12.81	10.70	2.49	V		0.126	21.02	
2593.0		QPSK	-22.89	14.43	10.62	2.53	V		0.179	22.52	
		16-QAM	-23.73	13.59	10.62	2.53	V		0.147	21.68	
		64-QAM	-25.20	12.12	10.62	2.53	V		0.105	20.21	
		256-QAM	-26.14	11.18	10.62	2.53	V		0.085	19.27	
2685.0		QPSK	-26.86	10.64	10.77	2.58	V		0.076	18.83	
		16-QAM	-27.84	9.66	10.77	2.58	V		0.061	17.85	
		64-QAM	-29.29	8.21	10.77	2.58	V		0.044	16.40	
		256-QAM	-30.27	7.23	10.77	2.58	V		0.035	15.42	

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2503.5	LTE B41/ 15 MHz	QPSK	-20.88	16.02	10.70	2.49	V	< 2.00	0.265	24.23
		16-QAM	-21.89	15.01	10.70	2.49	V		0.210	23.22
		64-QAM	-23.34	13.56	10.70	2.49	V		0.150	21.77
		256-QAM	-24.25	12.65	10.70	2.49	V		0.122	20.86
2593.0		QPSK	-23.00	14.32	10.62	2.53	V		0.174	22.41
		16-QAM	-23.95	13.37	10.62	2.53	V		0.140	21.46
		64-QAM	-25.46	11.86	10.62	2.53	V		0.099	19.95
		256-QAM	-26.34	10.98	10.62	2.53	V		0.081	19.07
2682.5		QPSK	-25.66	12.03	10.76	2.57	V		0.105	20.22
		16-QAM	-26.67	11.02	10.76	2.57	V		0.083	19.21
		64-QAM	-28.03	9.66	10.76	2.57	V		0.061	17.85
		256-QAM	-29.19	8.50	10.76	2.57	V		0.047	16.69

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2506.0	LTE B41/ 20 MHz	QPSK	-21.07	15.89	10.70	2.50	V	< 2.00	0.257	24.09
		16-QAM	-22.05	14.91	10.70	2.50	V		0.205	23.11
		64-QAM	-23.51	13.45	10.70	2.50	V		0.146	21.65
		256-QAM	-24.38	12.58	10.70	2.50	V		0.120	20.78
2593.0		QPSK	-23.13	14.19	10.62	2.53	V		0.169	22.28
		16-QAM	-24.10	13.22	10.62	2.53	V		0.135	21.31
		64-QAM	-25.50	11.82	10.62	2.53	V		0.098	19.91
		256-QAM	-26.43	10.89	10.62	2.53	V		0.079	18.98
2680.0		QPSK	-25.90	11.79	10.76	2.57	V		0.100	19.98
		16-QAM	-26.89	10.80	10.76	2.57	V		0.079	18.99
		64-QAM	-28.36	9.33	10.76	2.57	V		0.056	17.52
		256-QAM	-29.30	8.39	10.76	2.57	V		0.045	16.58

8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY : 2498.5 MHz
- ▣ MEASURED OUTPUT POWER: 24.44 dBm = 0.278 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 49.44 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	-44.00	12.60	-53.44	3.61	V	-44.45	68.89
	7 495.50	-51.05	10.80	-51.88	4.47	V	-45.55	69.98
	9 994.00	-46.63	11.19	-42.28	5.27	V	-36.36	60.79
	14 991.00	-46.05	11.46	-36.04	6.69	H	-31.27	55.71
40620 (2593.0)	5 186.00	-39.90	12.44	-48.42	3.70	H	-39.67	64.11
	7 779.00	-52.72	11.40	-53.55	4.54	V	-46.69	71.13
	10 372.00	-42.70	11.40	-37.65	5.45	V	-31.70	56.14
	15 558.00	-47.93	14.92	-39.61	6.80	H	-31.49	55.93
41565 (2687.5)	5 375.00	-39.54	13.00	-48.68	3.78	H	-39.46	63.90
	8 062.50	-44.59	10.80	-43.04	4.61	V	-36.85	61.29
	10 750.00	-42.16	11.20	-37.01	5.54	V	-31.35	55.79
	13 437.50	-55.37	12.62	-45.75	6.26	H	-39.39	63.82
	16 125.00	-53.40	15.95	-44.18	6.94	H	-35.17	59.60

- ▣ OPERATING FREQUENCY : 2501.0 MHz
- ▣ MEASURED OUTPUT POWER: 24.28 dBm = 0.268 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 49.28 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	-45.36	12.60	-54.80	3.61	H	-45.81	70.09
	7 503.00	-56.27	10.80	-57.21	4.47	V	-50.88	75.16
	10 004.00	-44.28	11.21	-39.82	5.27	H	-33.87	58.15
	15 006.00	-45.44	10.52	-34.19	6.67	V	-30.34	54.61
40620 (2593.0)	5 186.00	-41.25	12.44	-49.77	3.70	V	-41.02	65.46
	7 779.00	-53.69	11.40	-54.52	4.54	H	-47.66	72.10
	10 372.00	-44.27	11.40	-39.22	5.45	V	-33.27	57.71
	15 558.00	-50.16	14.92	-41.84	6.80	V	-33.72	58.16
41540 (2685.0)	5 370.00	-43.12	13.00	-52.24	3.77	V	-43.01	67.29
	8 055.00	-47.85	10.80	-46.33	4.61	H	-40.13	64.41
	10 740.00	-43.72	11.22	-39.01	5.52	V	-33.31	57.59
	16 110.00	-54.85	15.92	-45.89	6.94	H	-36.91	61.19

- ▣ OPERATING FREQUENCY : 2503.5 MHz
- ▣ MEASURED OUTPUT POWER: 24.23 dBm = 0.265 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 49.23 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	-43.19	12.58	-52.94	3.59	H	-43.95	68.17
	7 510.50	-56.10	10.82	-56.97	4.48	H	-50.63	74.85
	10 014.00	-44.08	11.23	-39.60	5.27	H	-33.64	57.86
	15 021.00	-46.01	11.58	-35.48	6.67	V	-30.57	54.80
40620 (2593.0)	5 186.00	-44.08	12.44	-52.60	3.70	V	-43.85	68.29
	7 779.00	-45.41	11.40	-46.24	4.54	V	-39.38	63.82
	10 372.00	-42.35	11.40	-37.30	5.45	V	-31.35	55.79
	15 558.00	-50.84	14.92	-42.52	6.80	H	-34.40	58.84
41515 (2682.5)	5,365.00	-42.03	13.00	-51.21	3.77	V	-41.98	66.20
	8,047.50	-51.89	10.80	-50.40	4.60	H	-44.20	68.42
	10,730.00	-43.88	11.24	-39.64	5.50	H	-33.90	58.13
	13,412.50	-56.56	12.68	-47.60	6.19	H	-41.11	65.34
	16,095.00	-53.87	15.89	-45.28	6.95	H	-36.34	60.56

- ▣ OPERATING FREQUENCY : 2506.0 MHz
- ▣ MEASURED OUTPUT POWER: 24.09 dBm = 0.257 W
- ▣ MODE: LTE B41
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 49.09 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	-46.64	12.58	-56.39	3.59	V	-47.40	71.49
	7 518.00	-57.13	10.84	-57.69	4.46	H	-51.31	75.40
	10 024.00	-49.02	11.25	-44.63	5.28	V	-38.66	62.75
	15 036.00	-50.60	11.64	-40.53	6.67	V	-35.56	59.65
40620 (2593.0)	5 186.00	-44.42	12.44	-52.94	3.70	V	-44.19	68.63
	7 779.00	-56.66	11.40	-57.49	4.54	V	-50.63	75.07
	10 372.00	-44.85	11.40	-39.80	5.45	V	-33.85	58.29
	15 558.00	-50.05	14.92	-41.73	6.80	H	-33.61	58.05
41490 (2680.0)	5 360.00	-44.31	13.00	-53.55	3.76	V	-44.31	68.40
	8 040.00	-53.63	10.80	-52.15	4.59	H	-45.94	70.03
	10 720.00	-42.32	11.26	-38.34	5.50	V	-32.58	56.67
	16 080.00	-54.25	15.86	-45.42	6.95	H	-36.51	60.60

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	5.69
			16-QAM			6.61
			64-QAM			6.77
			256-QAM			6.92
	10 MHz		QPSK	50		5.82
			16-QAM			6.26
			64-QAM			6.47
			256-QAM			6.99
	15 MHz		QPSK	75		5.53
			16-QAM			6.14
			64-QAM			6.44
			256-QAM			6.51
	20 MHz		QPSK	100		5.55
			16-QAM			6.13
			64-QAM			6.24
			256-QAM			6.34

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	4.5185
			16-QAM			4.5142
			64-QAM			4.5200
			256-QAM			4.5143
	10 MHz		QPSK	50		9.0241
			16-QAM			8.9657
			64-QAM			9.0070
			256-QAM			8.9801
	15 MHz		QPSK	75		13.483
			16-QAM			13.456
			64-QAM			13.458
			256-QAM			13.443
	20 MHz		QPSK	100		17.950
			16-QAM			17.884
			64-QAM			17.876
			256-QAM			17.857

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	26.1224	34.110	-76.231	-42.121	-25.00
		2593.0	26.1483	34.110	-76.645	-42.535	
		2687.5	26.1712	34.110	-76.879	-42.769	
	10	2501.0	26.1232	34.110	-76.898	-42.788	
		2593.0	26.1402	34.110	-76.832	-42.722	
		2685.0	25.8278	34.110	-76.841	-42.731	
	15	2503.5	26.1797	34.110	-76.646	-42.536	
		2593.0	26.4016	34.110	-76.742	-42.632	
		2682.5	26.1457	34.110	-76.353	-42.243	
	20	2506.0	26.4411	34.110	-76.679	-42.569	
		2593.0	26.1440	34.110	-76.730	-42.620	
		2680.0	26.1836	34.110	-76.500	-42.390	

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	-20.58	-20.38	-22.88	-22.95	-33.76	-31.11	-32.76
10 MHz	2501.0	QPSK	50/0	-23.99	-23.38	-24.20	-24.53	-28.82	-29.16	-33.12
15 MHz	2503.5	QPSK	75/0	-26.02	-26.27	-26.92	-28.10	-30.36	-30.28	-35.42
20 MHz	2506.0	QPSK	100/0	-27.22	-28.07	-26.69	-27.60	-29.90	-28.96	-36.54
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	-20.55	-20.70	-24.22	-24.07
	2687.5	QPSK	25	0	-20.65	-20.87	-25.29	-24.69
10 MHz	2593.0	QPSK	50	0	-25.00	-23.90	-26.33	-25.15
	2685.0	QPSK	50	0	-23.42	-23.78	-23.13	-23.60
15 MHz	2593.0	QPSK	75	0	-27.22	-25.62	-28.44	-26.81
	2682.5	QPSK	75	0	-25.53	-24.34	-23.92	-24.66
20 MHz	2593.0	QPSK	100	0	-29.59	-28.07	-29.34	-28.82
	2680.0	QPSK	100	0	-25.27	-25.28	-23.25	-23.53
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	-32.42	-30.77	-33.71	-32.12
	2687.5	QPSK	25	0	-33.95	-31.41	-34.26	-32.00
10 MHz	2593.0	QPSK	50	0	-31.22	-28.26	-36.79	-33.59
	2685.0	QPSK	50	0	-25.04	-27.02	-37.51	-31.53
15 MHz	2593.0	QPSK	75	0	-32.32	-29.87	-38.48	-34.67
	2682.5	QPSK	75	0	-25.88	-27.52	-37.93	-33.08
20 MHz	2593.0	QPSK	100	0	-32.28	-31.06	-39.81	-36.23
	2680.0	QPSK	100	0	-25.10	-26.16	-38.47	-35.92
Limit					-13.0		-25.0	

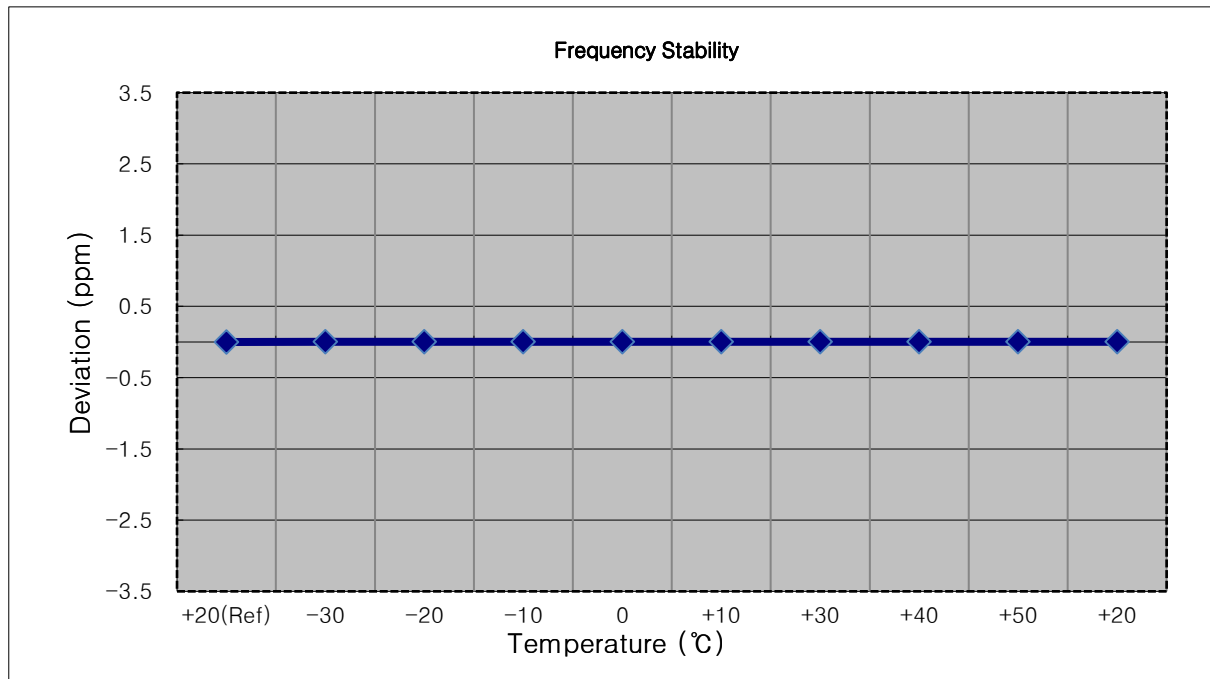
Note:

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

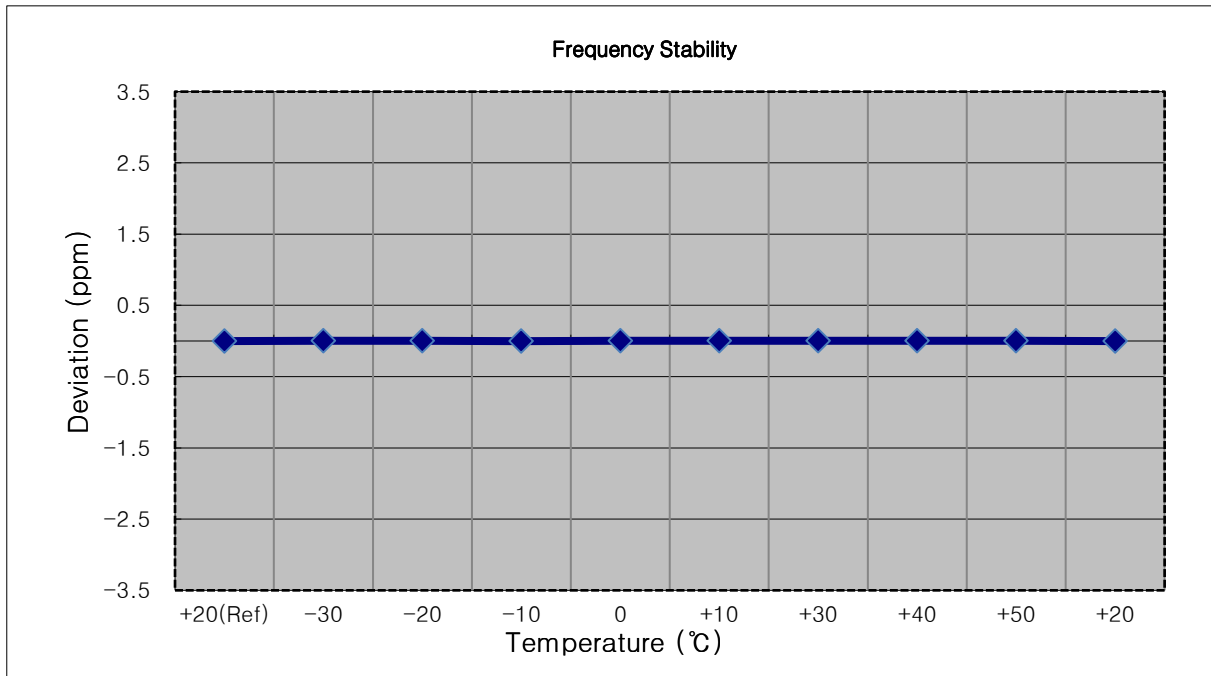
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2498,500,000 Hz
- ▣ BANDWIDTH: 39675 (5 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2498 500 004	0.0	0.000 000	0.000
100%		-30	2498 500 012	7.3	0.000 000	0.003
100%		-20	2498 500 008	3.6	0.000 000	0.001
100%		-10	2498 500 009	4.6	0.000 000	0.002
100%		0	2498 500 010	5.5	0.000 000	0.002
100%		+10	2498 500 010	5.5	0.000 000	0.002
100%		+30	2498 500 009	4.5	0.000 000	0.002
100%		+40	2498 500 009	5.0	0.000 000	0.002
100%		+50	2498 500 009	5.0	0.000 000	0.002
Batt. Endpoint		3.400	+20	2498 500 010	5.4	0.000 000



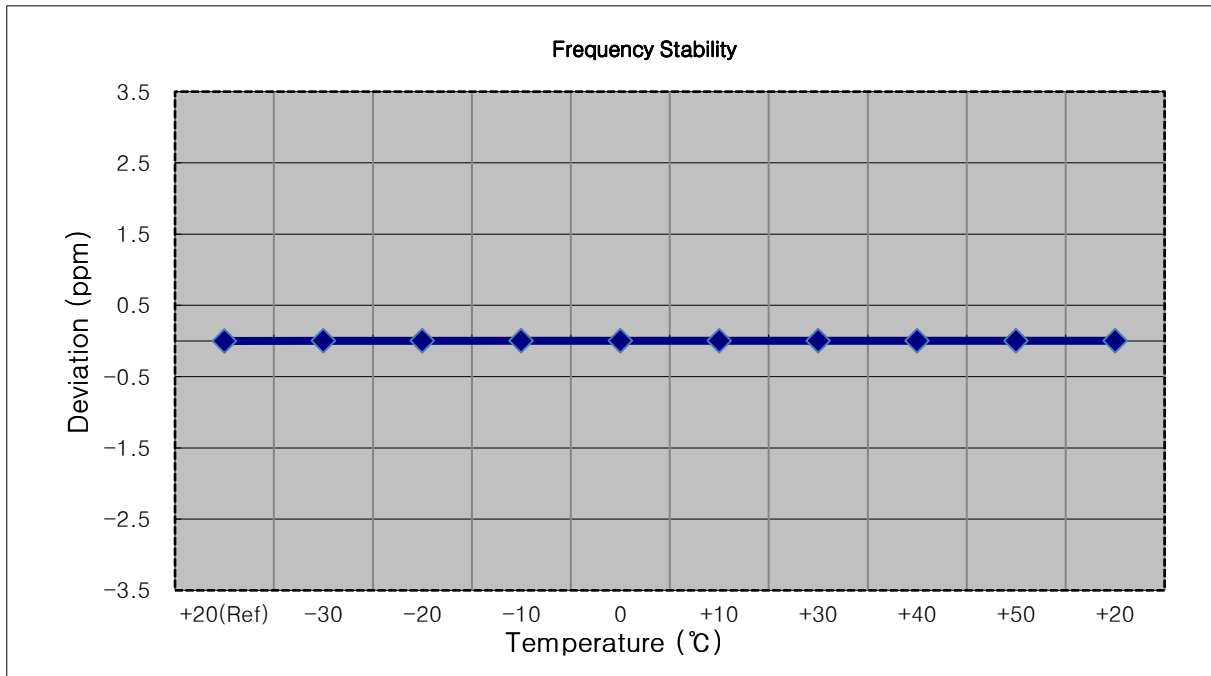
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2501,000,000 Hz
- ▣ BANDWIDTH: 39700 (10 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2501 000 006	0.0	0.000 000	0.000
100%		-30	2501 000 009	3.4	0.000 000	0.001
100%		-20	2501 000 012	6.2	0.000 000	0.002
100%		-10	2501 000 001	-5.4	0.000 000	-0.002
100%		0	2501 000 011	5.1	0.000 000	0.002
100%		+10	2501 000 008	2.1	0.000 000	0.001
100%		+30	2501 000 011	4.9	0.000 000	0.002
100%		+40	2501 000 010	3.8	0.000 000	0.002
100%		+50	2501 000 010	3.8	0.000 000	0.002
Batt. Endpoint	3.400	+20	2501 000 004	-2.3	0.000 000	-0.001



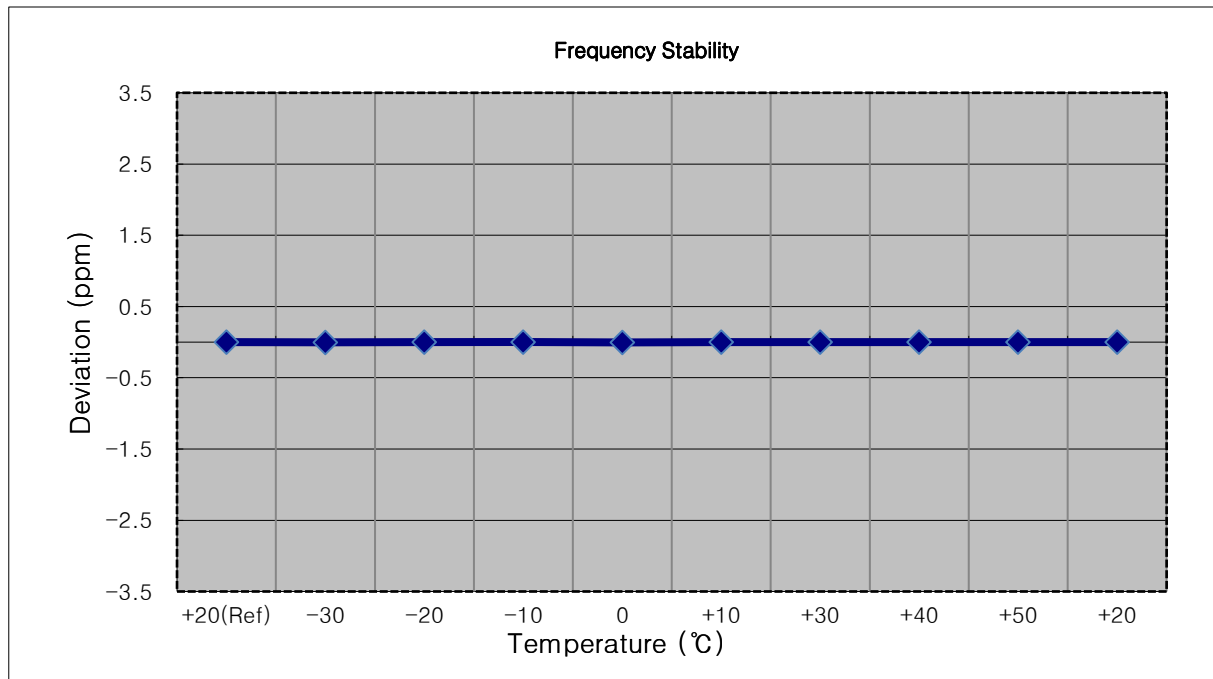
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2503,500,000 Hz
- ▣ BANDWIDTH: 39725 (15 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2503 500 005	0.0	0.000 000	0.000
100%		-30	2503 500 011	6.0	0.000 000	0.002
100%		-20	2503 500 011	6.0	0.000 000	0.002
100%		-10	2503 500 009	4.9	0.000 000	0.002
100%		0	2503 500 009	4.7	0.000 000	0.002
100%		+10	2503 500 009	4.8	0.000 000	0.002
100%		+30	2503 500 010	5.9	0.000 000	0.002
100%		+40	2503 500 007	2.6	0.000 000	0.001
100%		+50	2503 500 010	5.6	0.000 000	0.002
Batt. Endpoint	3.400	+20	2503 500 010	5.2	0.000 000	0.002



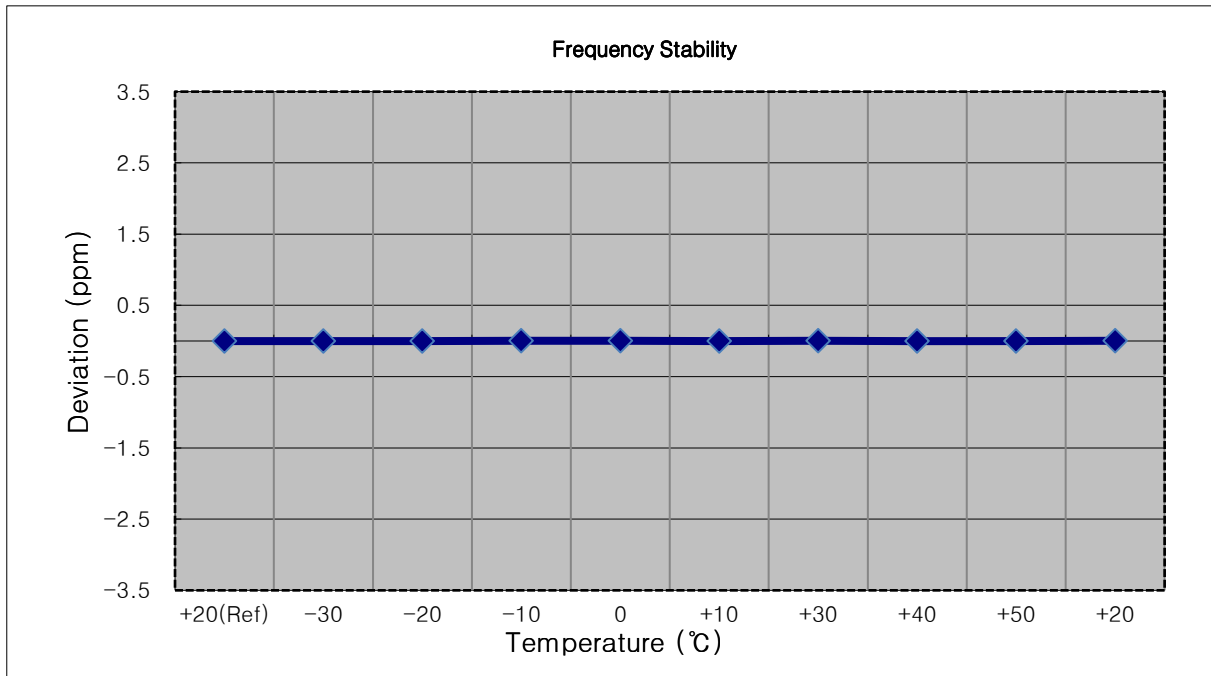
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2506,000,000 Hz
- ▣ BANDWIDTH: 39750 (20 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2506 000 004	0.0	0.000 000	0.000
100%		-30	2505 999 998	-6.2	0.000 000	-0.002
100%		-20	2506 000 000	-4.5	0.000 000	-0.002
100%		-10	2506 000 009	4.7	0.000 000	0.002
100%		0	2505 999 998	-6.0	0.000 000	-0.002
100%		+10	2506 000 001	-3.2	0.000 000	-0.001
100%		+30	2506 000 001	-3.2	0.000 000	-0.001
100%		+40	2506 000 009	4.4	0.000 000	0.002
100%		+50	2506 000 009	4.3	0.000 000	0.002
Batt. Endpoint		3.400	+20	2506 000 007	3.0	0.000 000



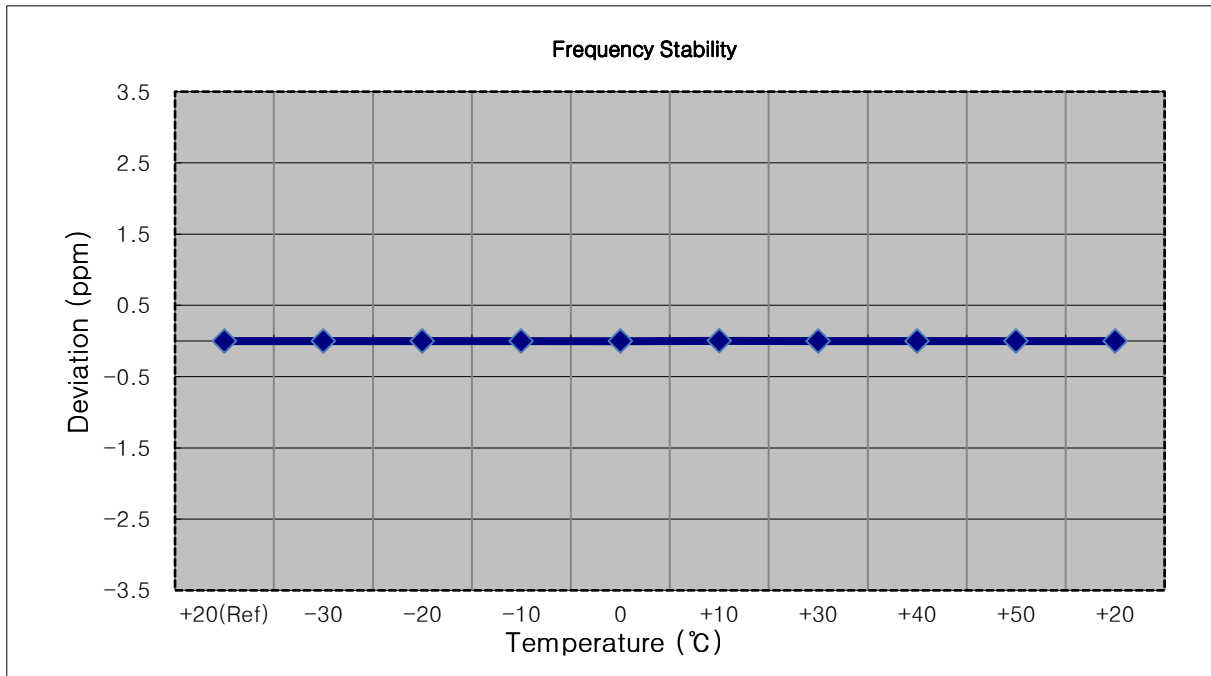
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (5 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2592 999 996	0.0	0.000 000	0.000
100%		-30	2592 999 990	-5.6	0.000 000	-0.002
100%		-20	2592 999 991	-4.6	0.000 000	-0.002
100%		-10	2592 999 999	3.3	0.000 000	0.001
100%		0	2592 999 999	3.9	0.000 000	0.002
100%		+10	2592 999 990	-5.3	0.000 000	-0.002
100%		+30	2593 000 003	7.3	0.000 000	0.003
100%		+40	2592 999 990	-5.7	0.000 000	-0.002
100%		+50	2592 999 991	-4.6	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2592 999 999	3.2	0.000 000	0.001



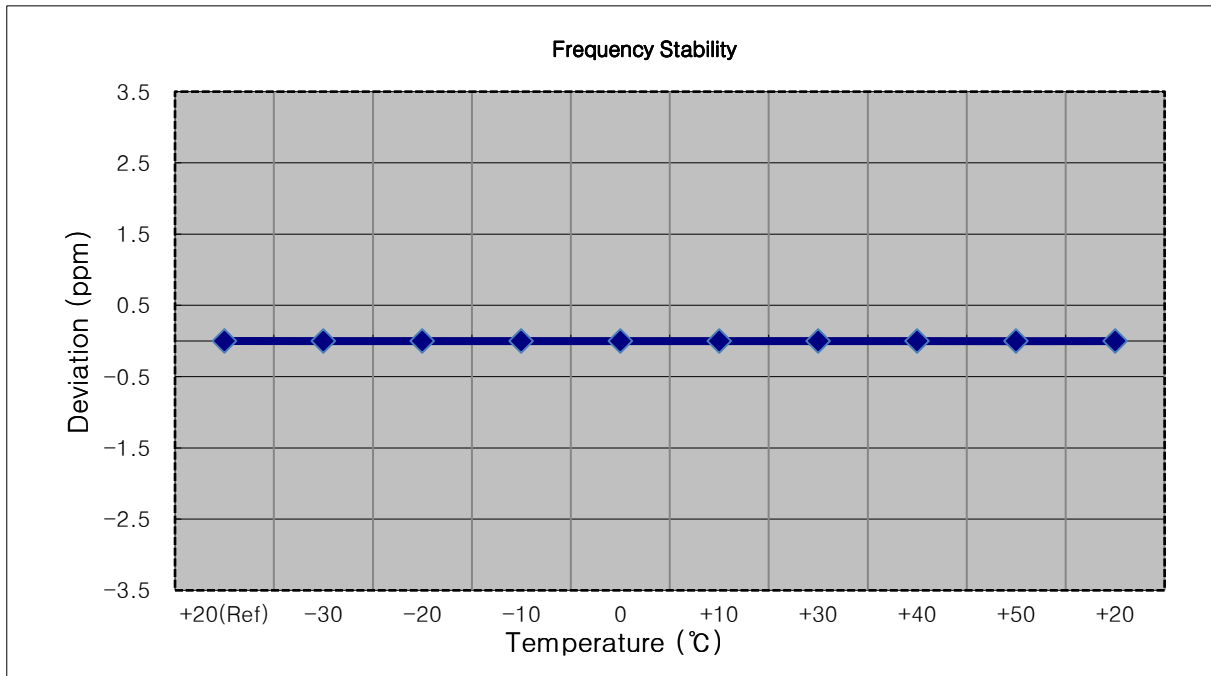
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (10 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2592 999 995	0.0	0.000 000	0.000
100%		-30	2592 999 990	-5.1	0.000 000	-0.002
100%		-20	2592 999 989	-6.2	0.000 000	-0.002
100%		-10	2592 999 990	-5.4	0.000 000	-0.002
100%		0	2592 999 988	-7.8	0.000 000	-0.003
100%		+10	2592 999 999	3.1	0.000 000	0.001
100%		+30	2592 999 990	-5.9	0.000 000	-0.002
100%		+40	2592 999 992	-3.9	0.000 000	-0.002
100%		+50	2592 999 991	-4.2	0.000 000	-0.002
Batt. Endpoint	3.400	+20	2592 999 990	-5.4	0.000 000	-0.002



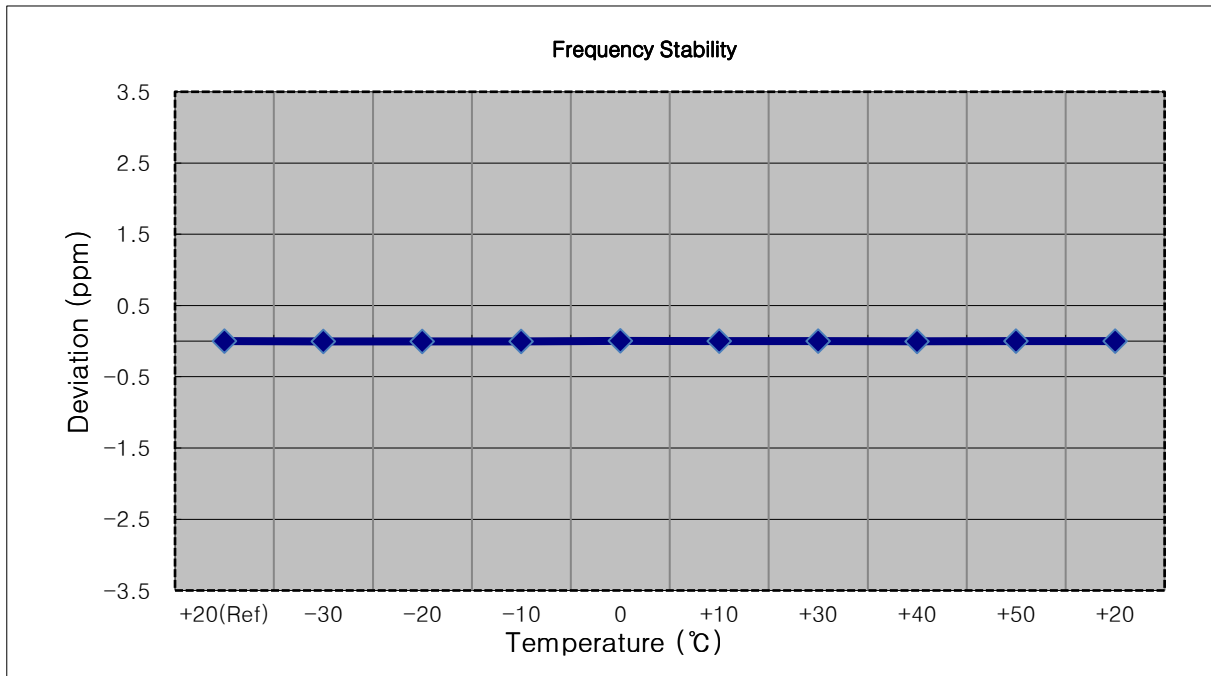
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (15 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2592 999 996	0.0	0.000 000	0.000
100%		-30	2592 999 992	-4.1	0.000 000	-0.002
100%		-20	2592 999 993	-3.5	0.000 000	-0.001
100%		-10	2592 999 992	-3.7	0.000 000	-0.001
100%		0	2592 999 991	-4.6	0.000 000	-0.002
100%		+10	2592 999 992	-4.0	0.000 000	-0.002
100%		+30	2592 999 989	-6.8	0.000 000	-0.003
100%		+40	2592 999 990	-6.5	0.000 000	-0.003
100%		+50	2592 999 989	-7.0	0.000 000	-0.003
Batt. Endpoint	3.400	+20	2592 999 992	-4.1	0.000 000	-0.002



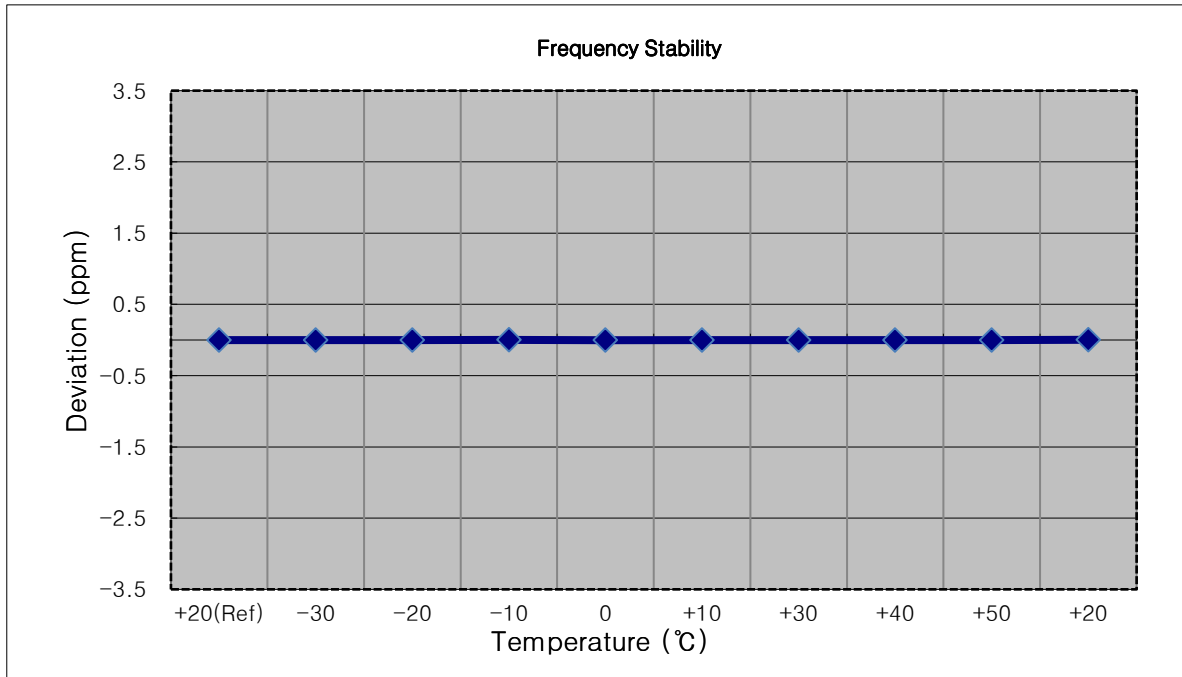
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2593,000,000 Hz
- ▣ BANDWIDTH: 40620 (20 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2592 999 995	0.0	0.000 000	0.000
100%		-30	2592 999 990	-5.4	0.000 000	-0.002
100%		-20	2592 999 989	-5.6	0.000 000	-0.002
100%		-10	2592 999 990	-5.1	0.000 000	-0.002
100%		0	2593 000 003	8.0	0.000 000	0.003
100%		+10	2592 999 990	-4.7	0.000 000	-0.002
100%		+30	2592 999 991	-4.3	0.000 000	-0.002
100%		+40	2592 999 989	-5.9	0.000 000	-0.002
100%		+50	2593 000 001	6.4	0.000 000	0.002
Batt. Endpoint	3.400	+20	2592 999 991	-4.1	0.000 000	-0.002



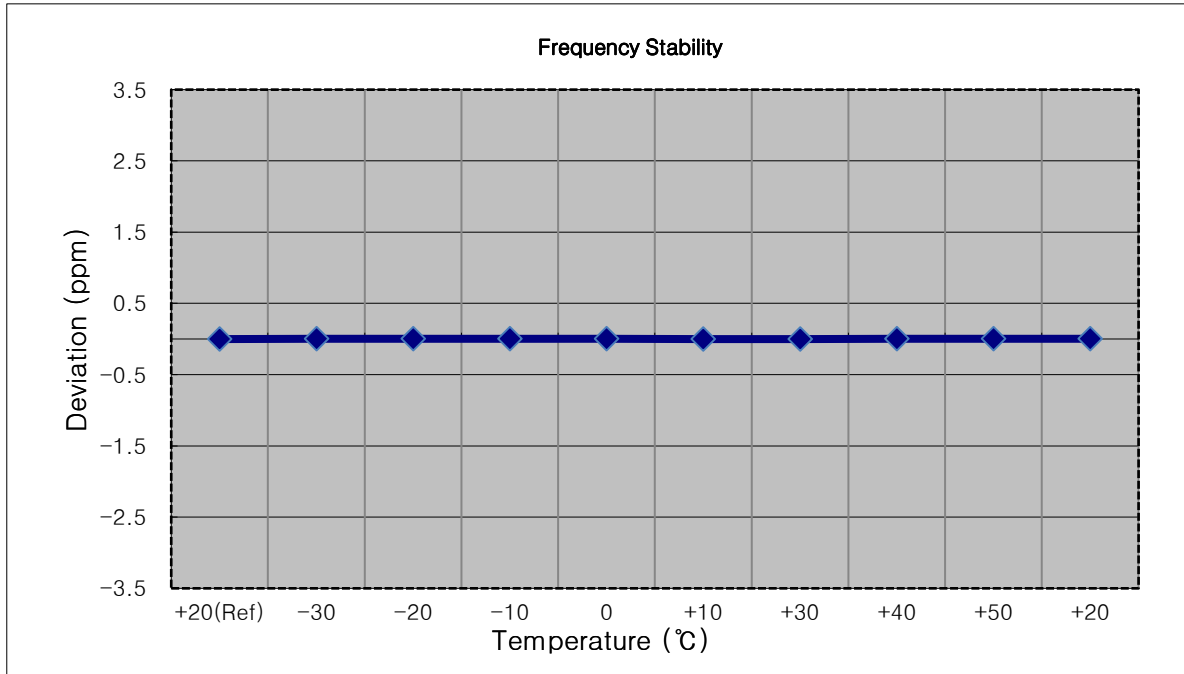
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2687,500,000 Hz
- ▣ BANDWIDTH: 41565 (5 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2687 500 005	0.0	0.000 000	0.000
100%		-30	2687 500 001	-4.3	0.000 000	-0.002
100%		-20	2687 500 002	-3.0	0.000 000	-0.001
100%		-10	2687 500 009	4.5	0.000 000	0.002
100%		0	2687 499 997	-7.6	0.000 000	-0.003
100%		+10	2687 499 999	-5.9	0.000 000	-0.002
100%		+30	2687 500 000	-5.2	0.000 000	-0.002
100%		+40	2687 499 999	-5.6	0.000 000	-0.002
100%		+50	2687 500 000	-4.7	0.000 000	-0.002
Batt. Endpoint		3.400	+20	2687 500 009	3.6	0.000 000



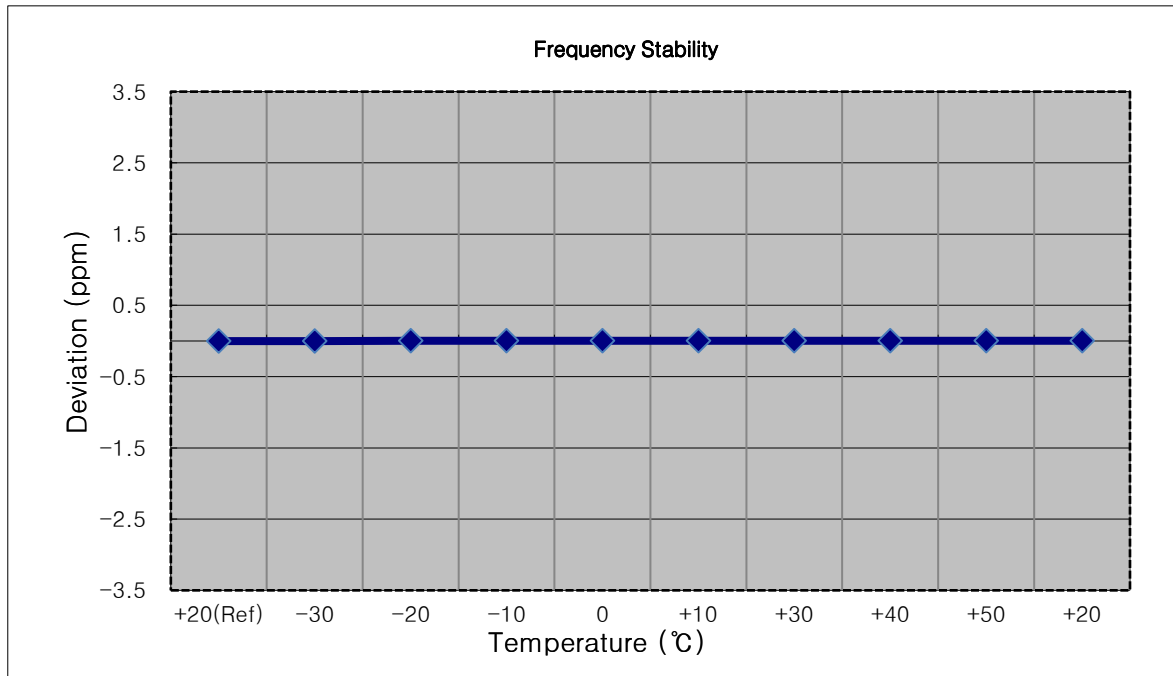
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2685,000,000 Hz
- ▣ BANDWIDTH: 41540 (10 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2685 000 004	0.0	0.000 000	0.000
100%		-30	2685 000 010	6.4	0.000 000	0.002
100%		-20	2685 000 009	4.9	0.000 000	0.002
100%		-10	2685 000 011	7.2	0.000 000	0.003
100%		0	2685 000 008	3.8	0.000 000	0.001
100%		+10	2685 000 000	-3.8	0.000 000	-0.001
100%		+30	2685 000 001	-2.6	0.000 000	-0.001
100%		+40	2685 000 007	3.3	0.000 000	0.001
100%		+50	2685 000 009	5.0	0.000 000	0.002
Batt. Endpoint	3.400	+20	2685 000 008	4.5	0.000 000	0.002



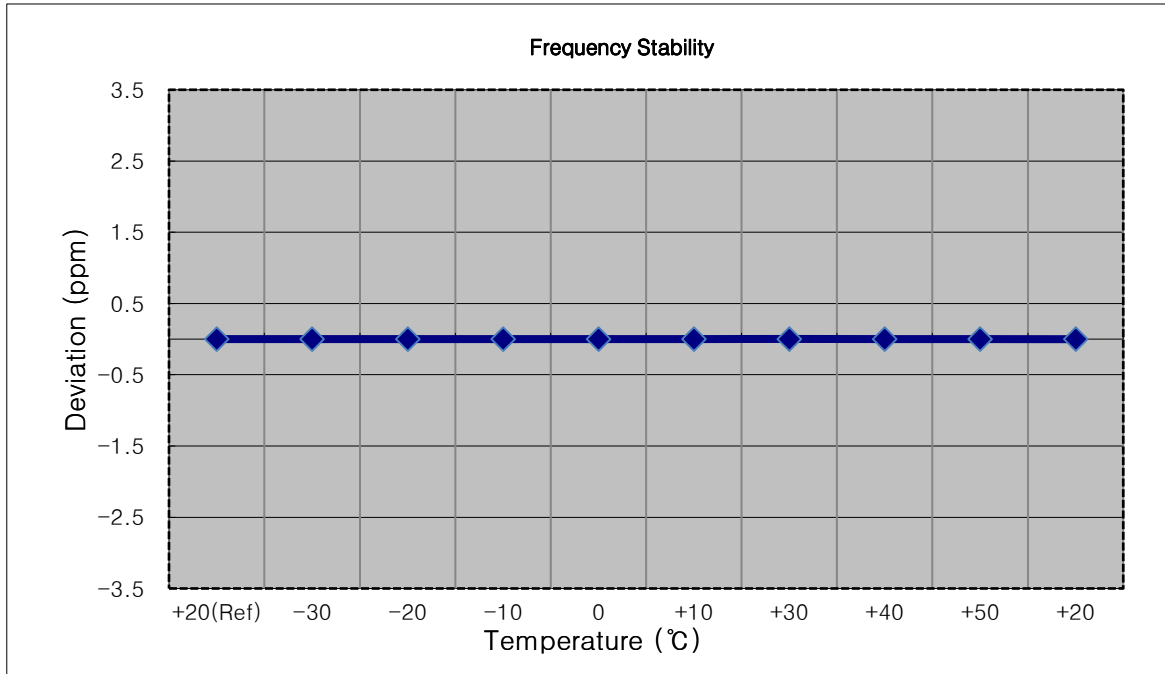
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2682,500,000 Hz
- ▣ BANDWIDTH: 41515 (15 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2682 500 005	0.0	0.000 000	0.000
100%		-30	2682 500 000	-5.1	0.000 000	-0.002
100%		-20	2682 500 010	4.7	0.000 000	0.002
100%		-10	2682 500 010	5.4	0.000 000	0.002
100%		0	2682 500 013	8.5	0.000 000	0.003
100%		+10	2682 500 010	5.4	0.000 000	0.002
100%		+30	2682 500 011	5.9	0.000 000	0.002
100%		+40	2682 500 010	4.8	0.000 000	0.002
100%		+50	2682 500 010	4.6	0.000 000	0.002
Batt. Endpoint	3.400	+20	2682 500 009	3.9	0.000 000	0.001



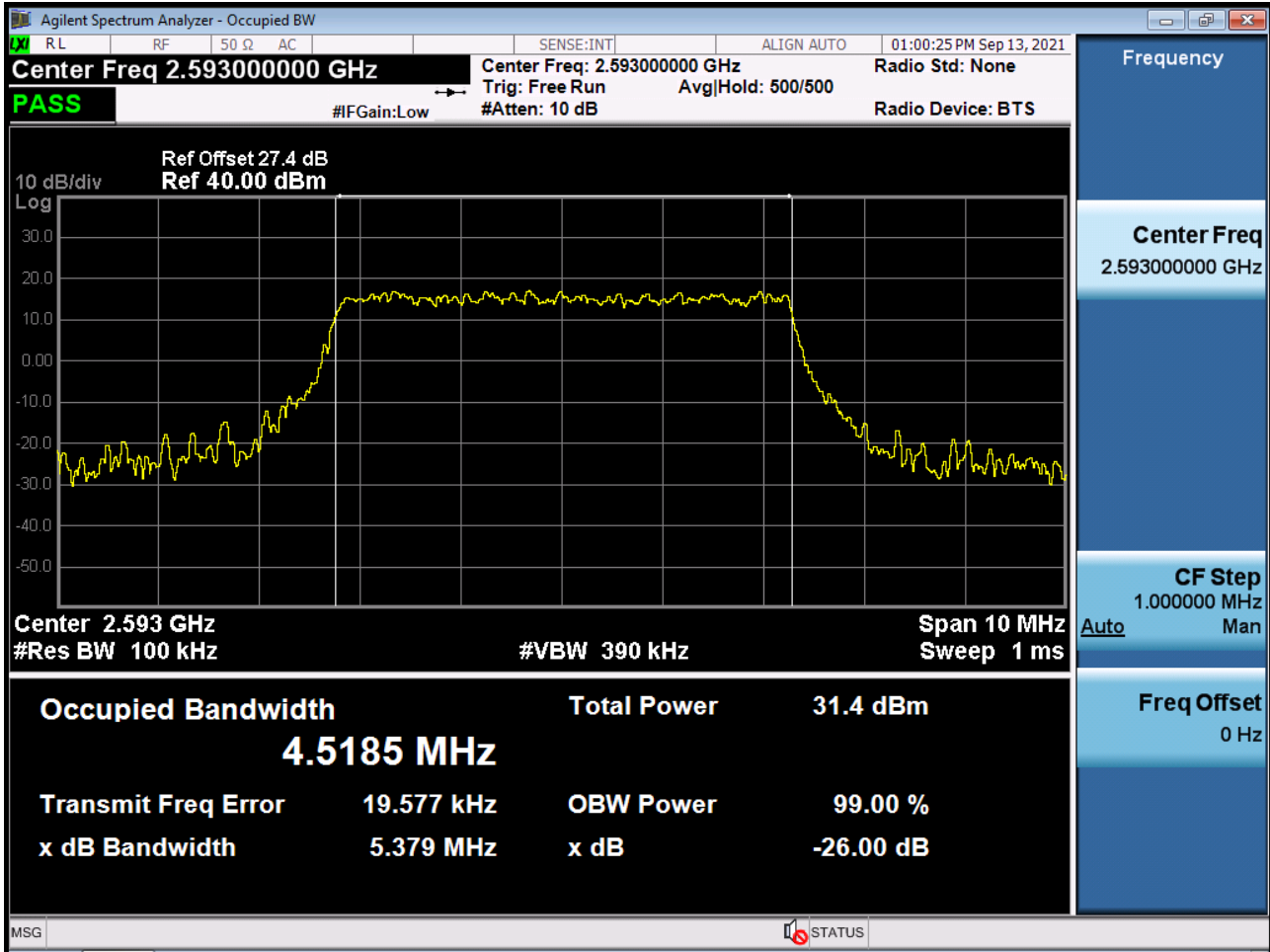
- ▣ MODE: LTE 41
- ▣ OPERATING FREQUENCY: 2680,000,000 Hz
- ▣ BANDWIDTH: 41490 (20 MHz)
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	2679 999 997	0.0	0.000 000	0.000
100%		-30	2680 000 001	3.9	0.000 000	0.001
100%		-20	2679 999 999	2.2	0.000 000	0.001
100%		-10	2679 999 994	-2.9	0.000 000	-0.001
100%		0	2680 000 002	5.1	0.000 000	0.002
100%		+10	2680 000 002	4.9	0.000 000	0.002
100%		+30	2680 000 004	6.8	0.000 000	0.003
100%		+40	2680 000 000	3.3	0.000 000	0.001
100%		+50	2680 000 002	5.2	0.000 000	0.002
Batt. Endpoint	3.400	+20	2679 999 994	-3.3	0.000 000	-0.001

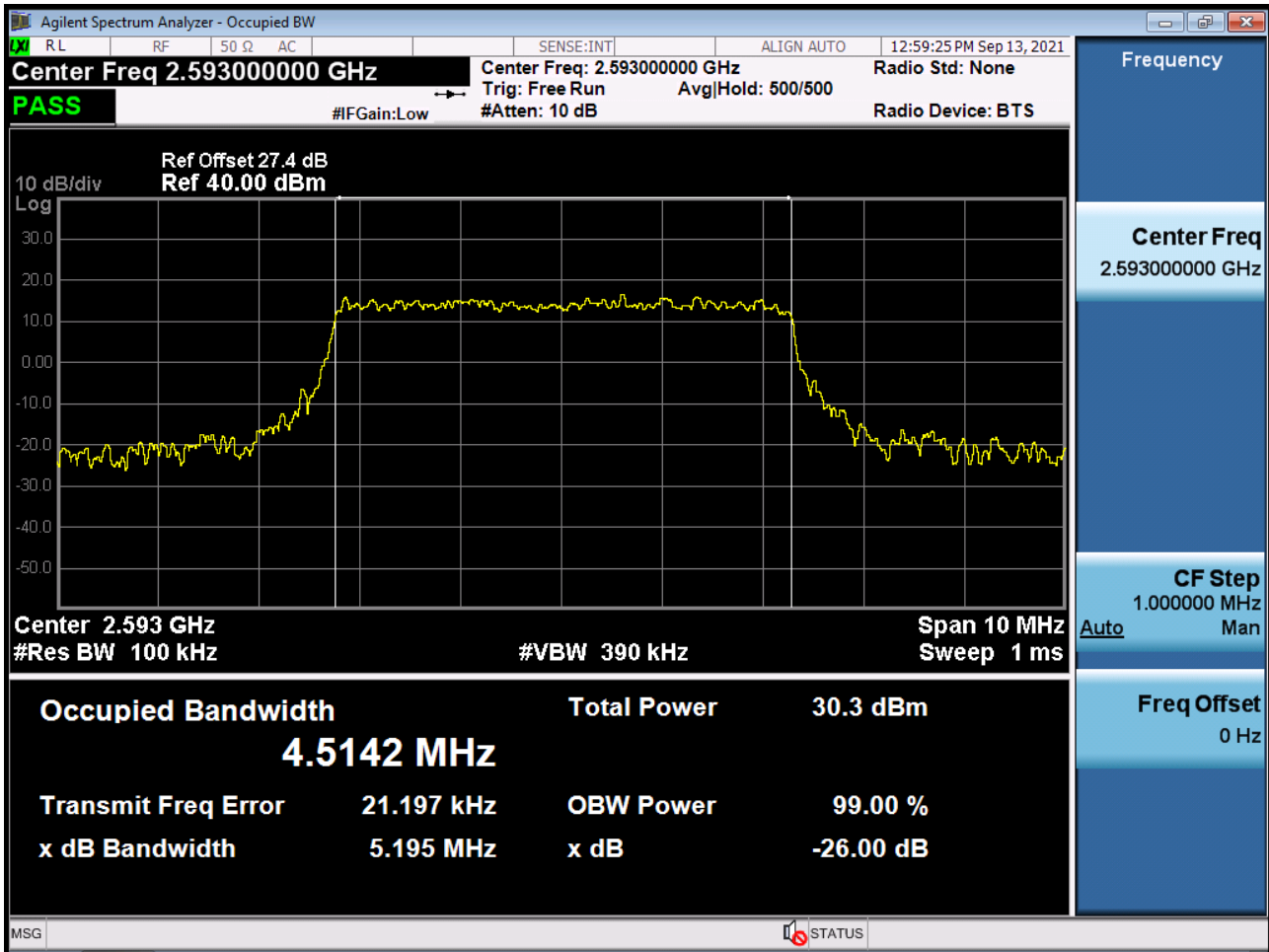


9. TEST PLOTS

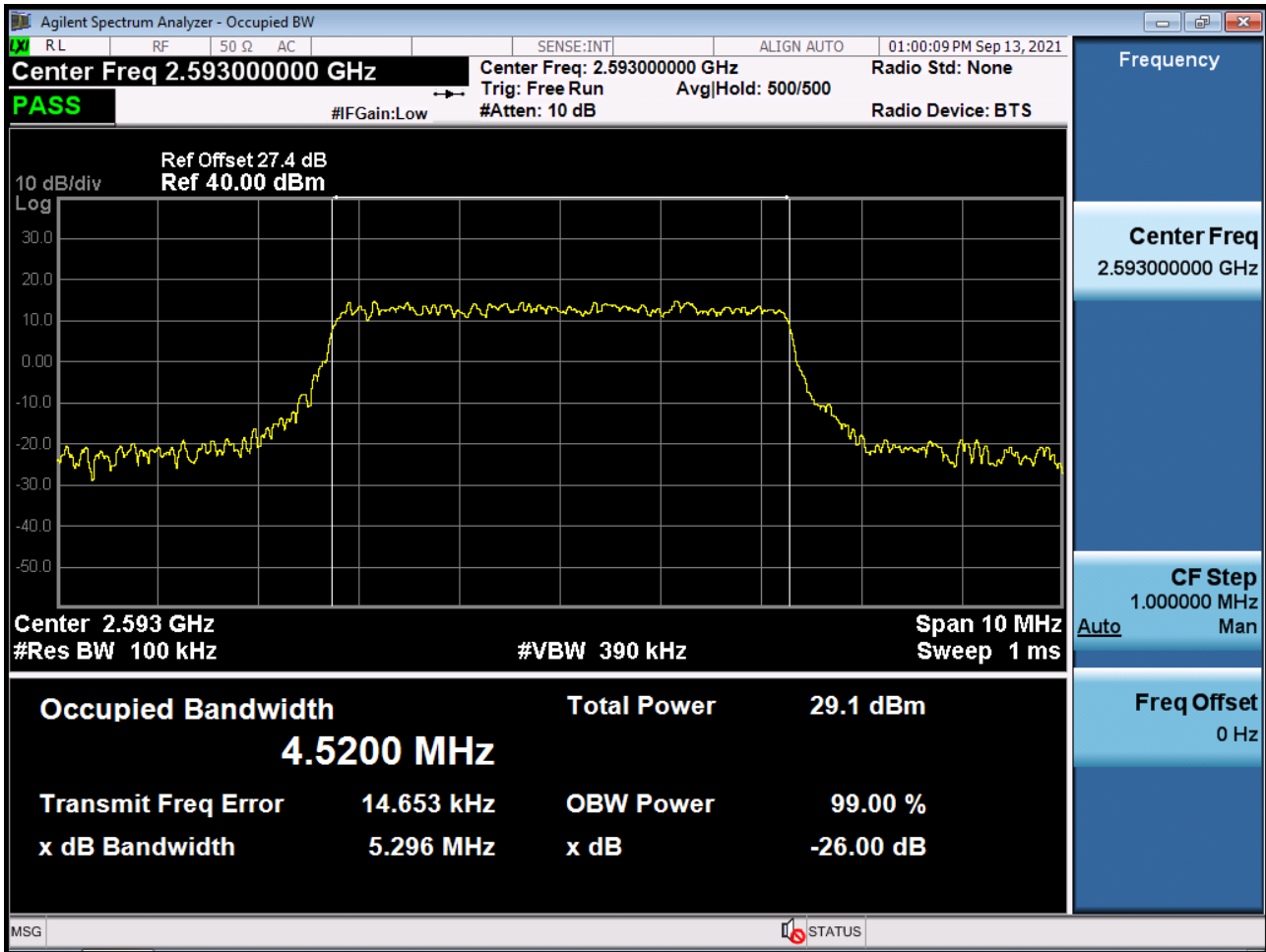
Occupied Bandwidth Plot (5 MHz Ch.40620 QPSK RB 25) (POWER CLASS 2)



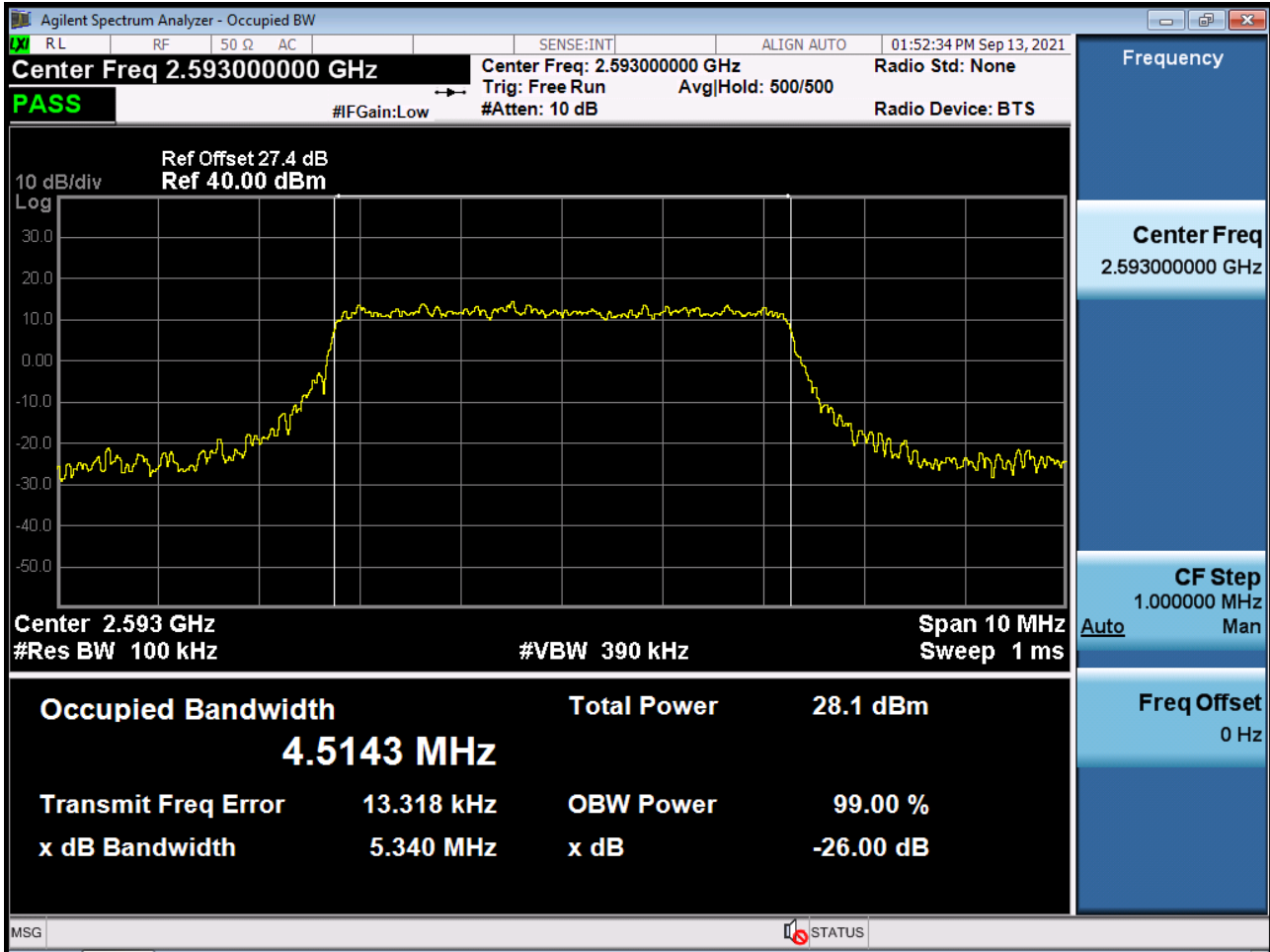
Occupied Bandwidth Plot (5 MHz Ch.40620 16-QAM RB 25) (POWER CLASS 2)



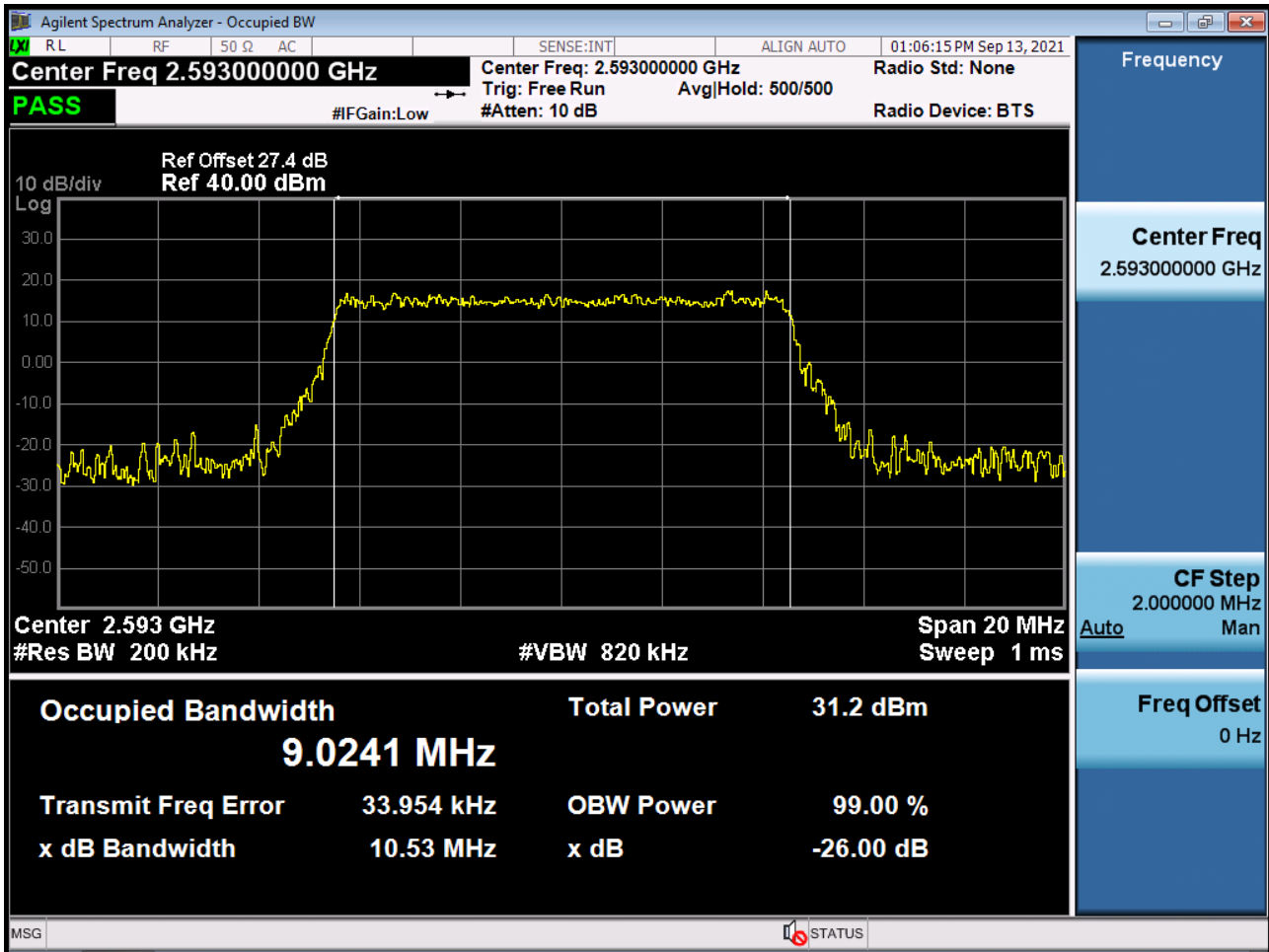
Occupied Bandwidth Plot (5 MHz Ch.40620 64-QAM RB 25) (POWER CLASS 2)



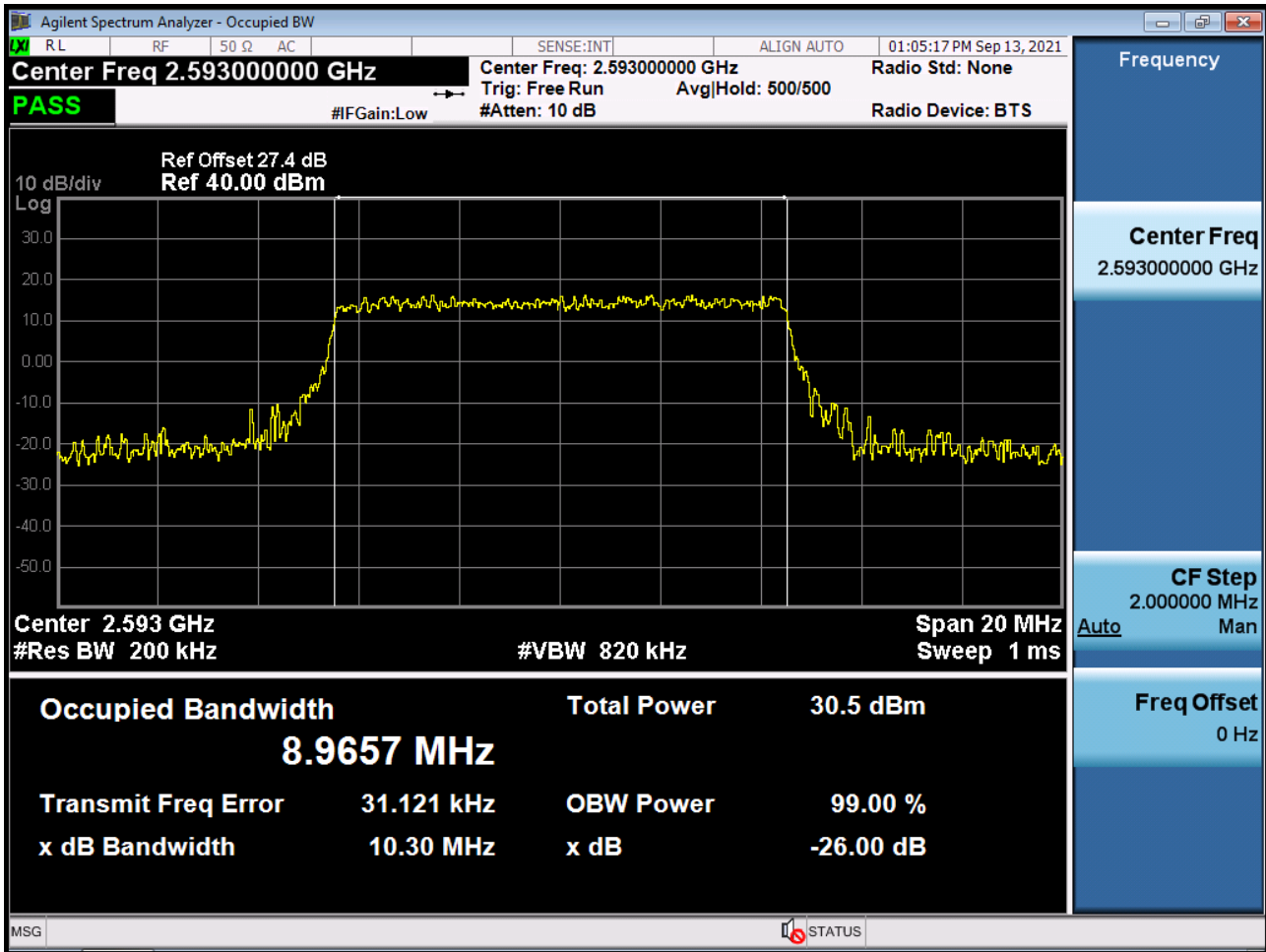
Occupied Bandwidth Plot (5 MHz Ch.40620 256-QAM RB 25) (POWER CLASS 2)



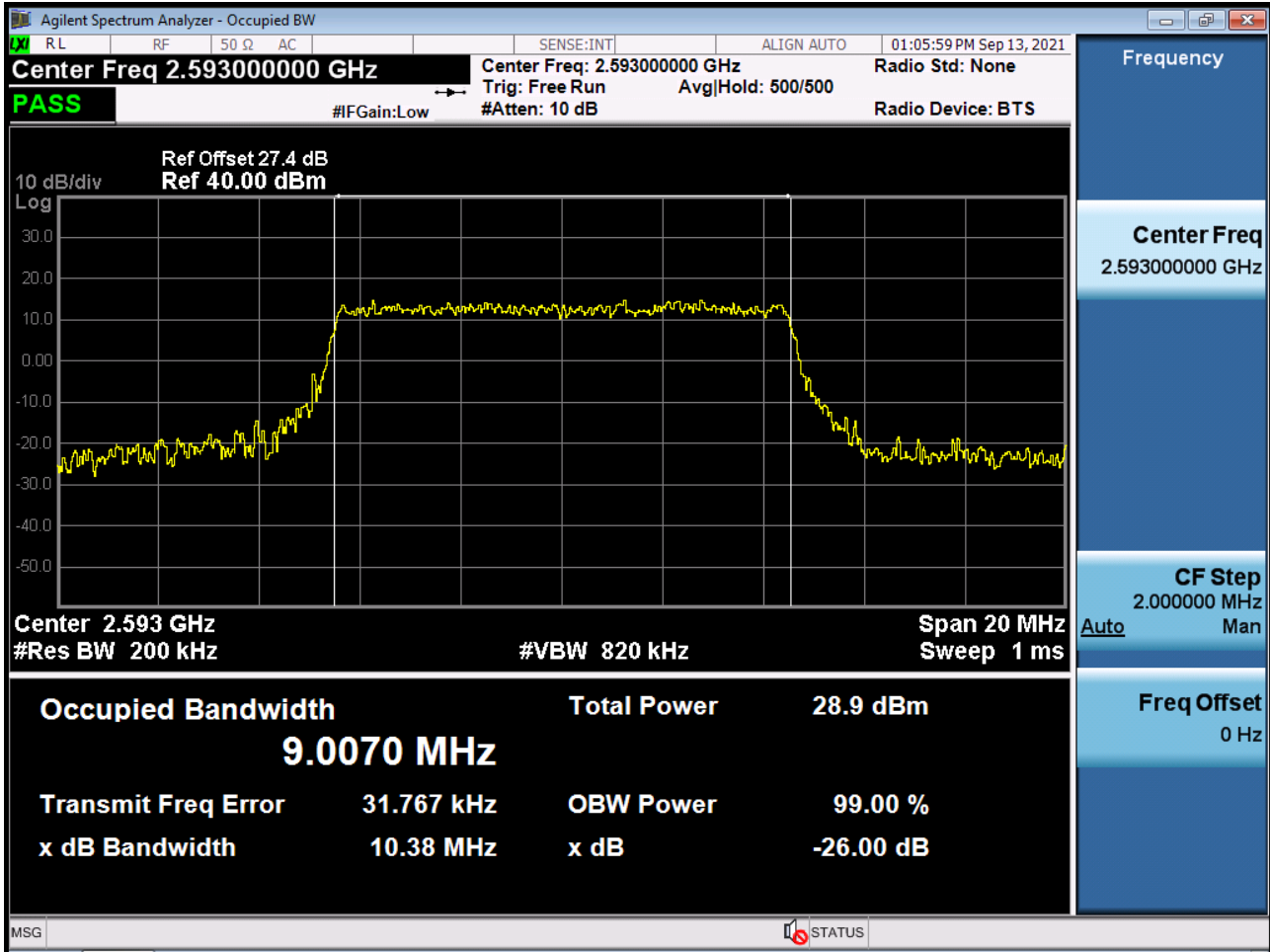
Occupied Bandwidth Plot (10 MHz Ch.40620 QPSK RB 50) (POWER CLASS 2)



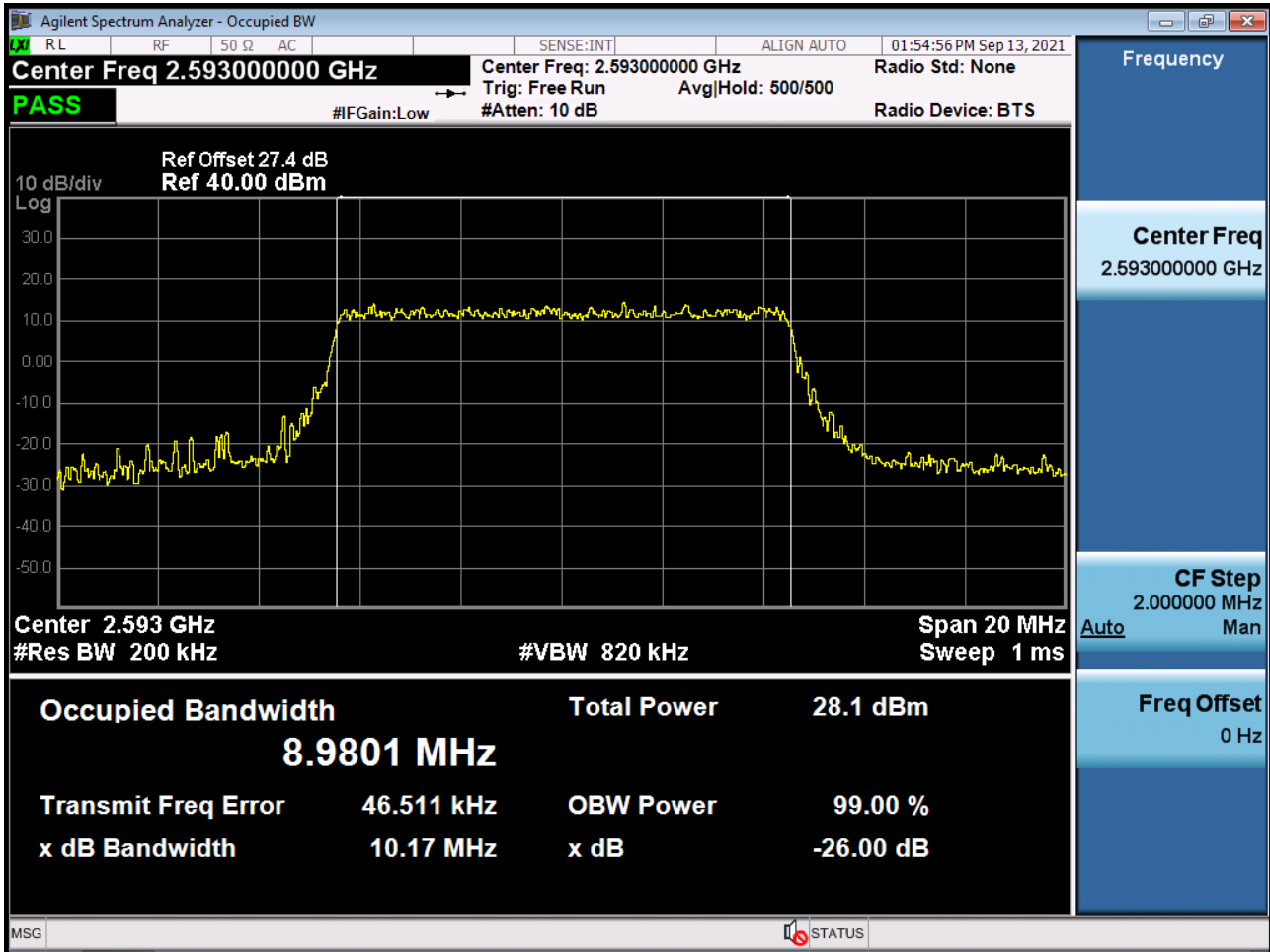
Occupied Bandwidth Plot (10 MHz Ch.40620 16-QAM RB 50) (POWER CLASS 2)



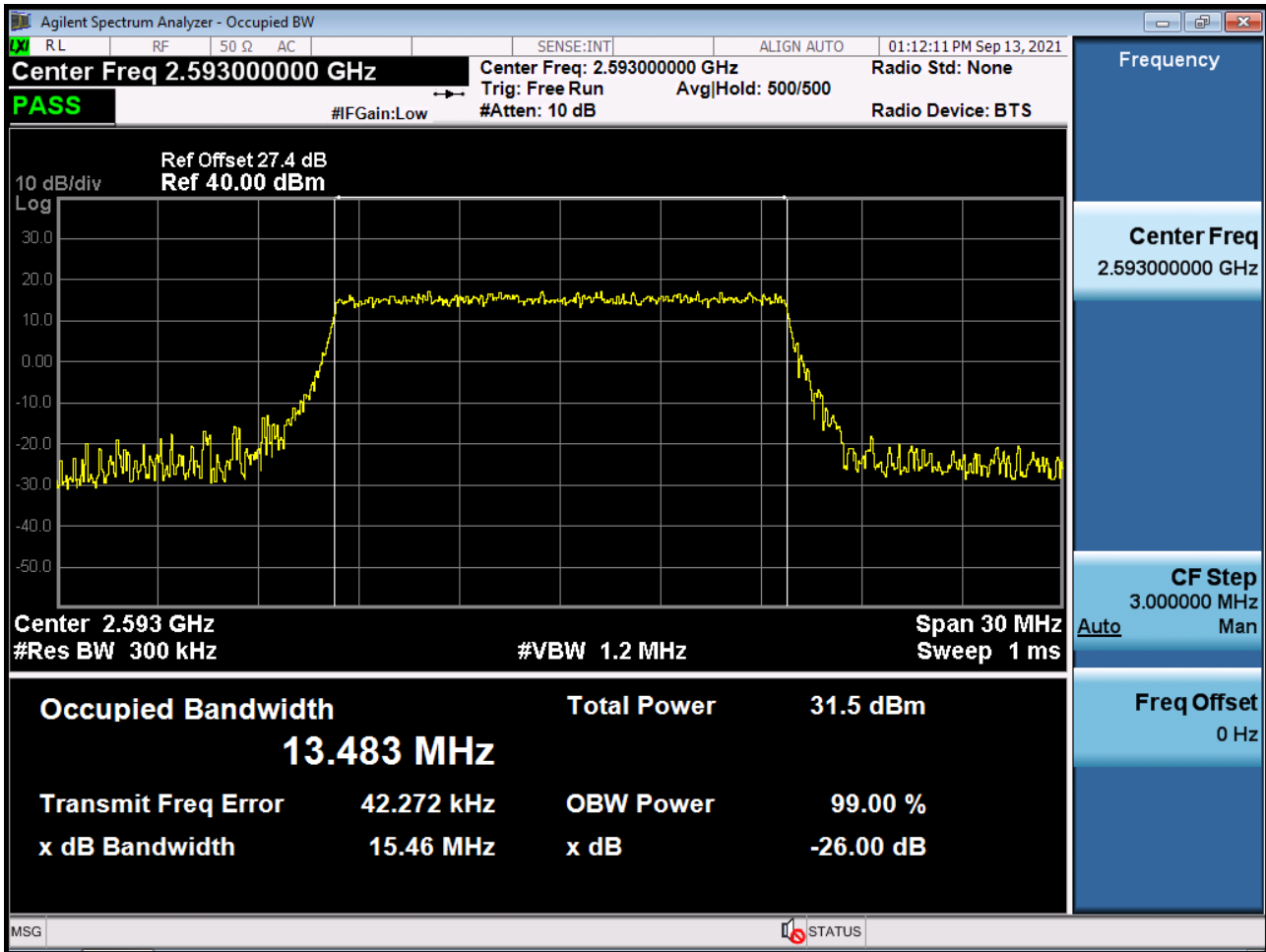
Occupied Bandwidth Plot (10 MHz Ch.40620 64-QAM RB 50) (POWER CLASS 2)



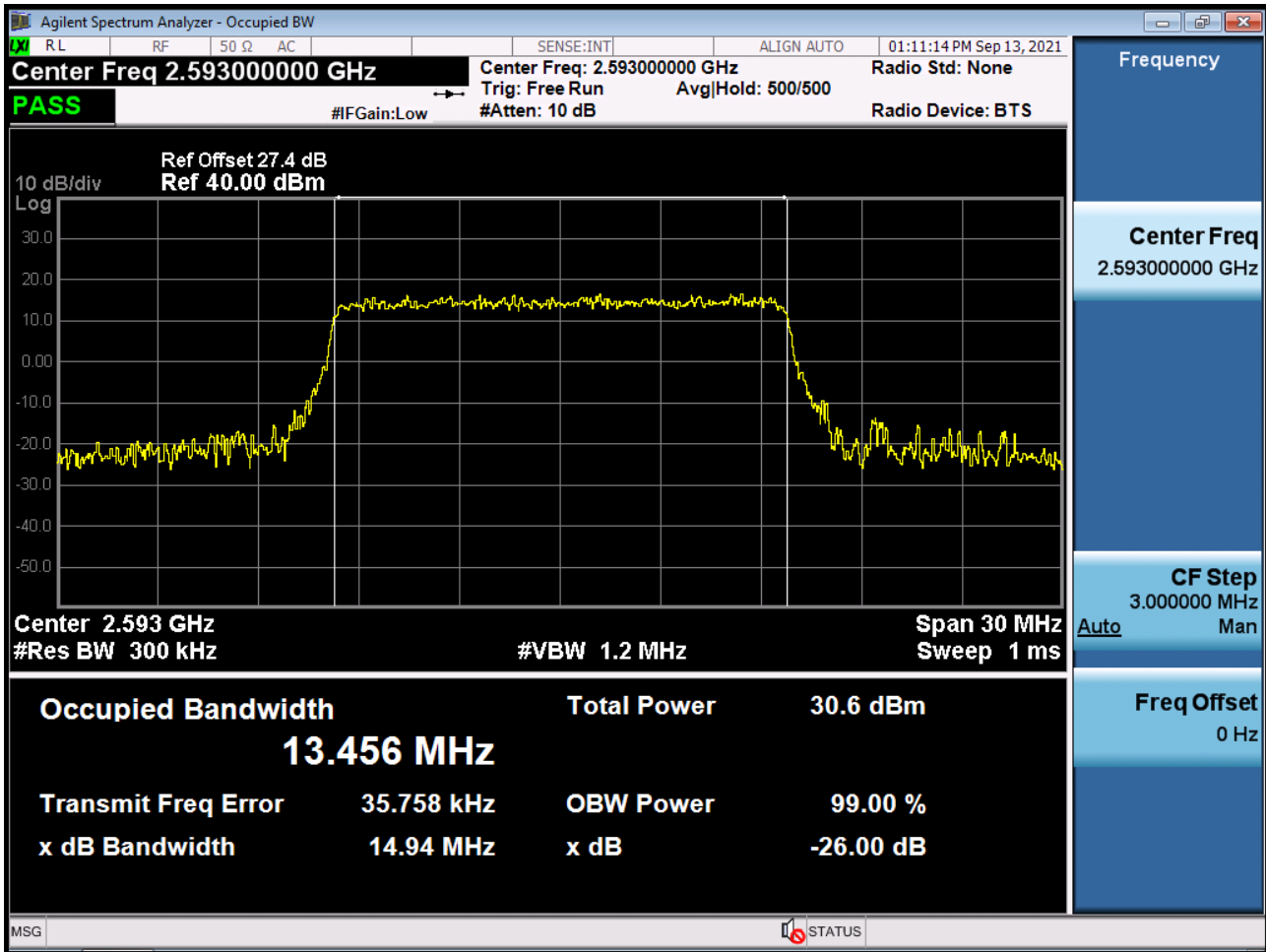
Occupied Bandwidth Plot (10 MHz Ch.40620 256-QAM RB 50) (POWER CLASS 2)



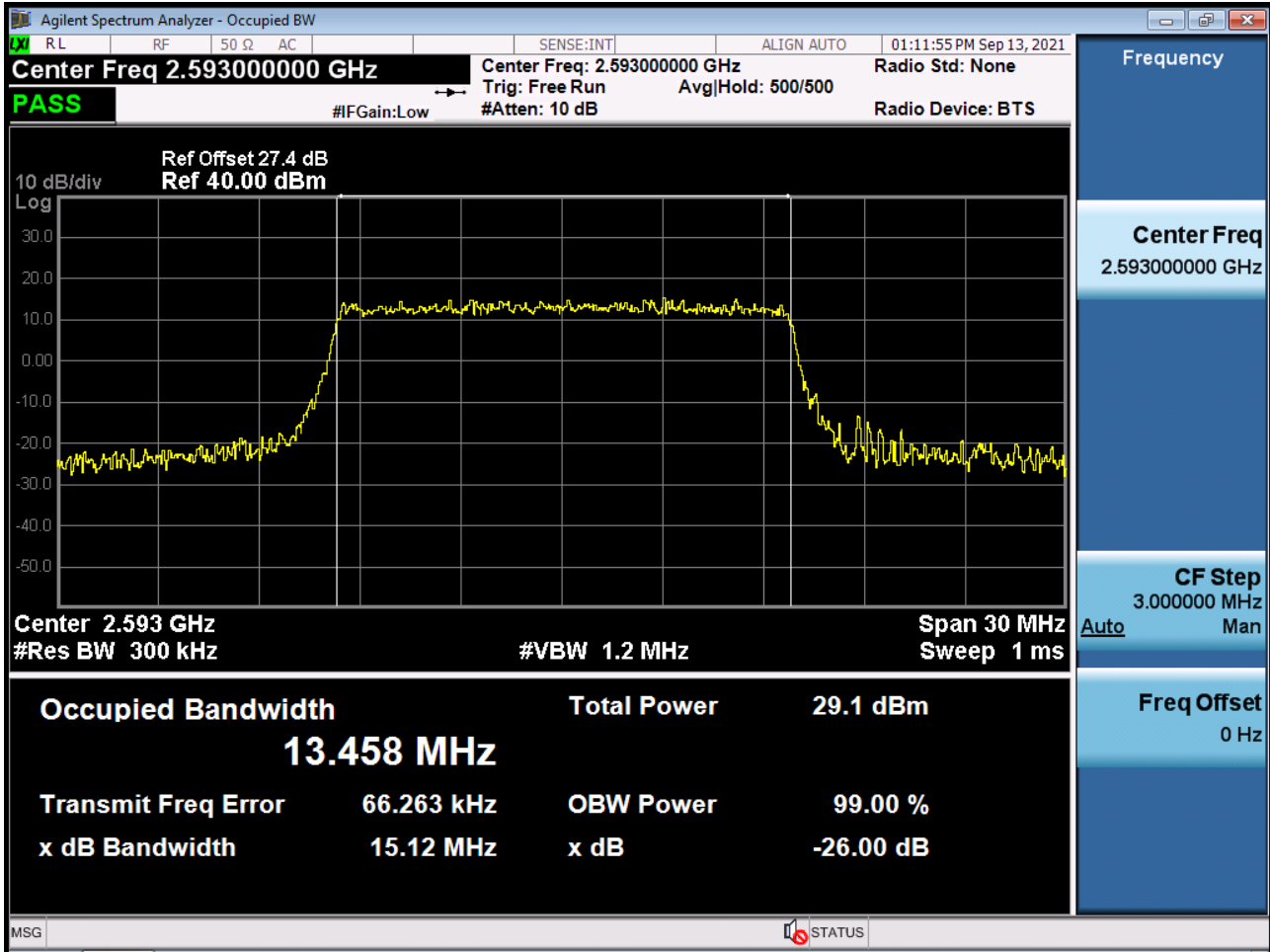
Occupied Bandwidth Plot (15 MHz Ch.40620 QPSK RB 75) (POWER CLASS 2)



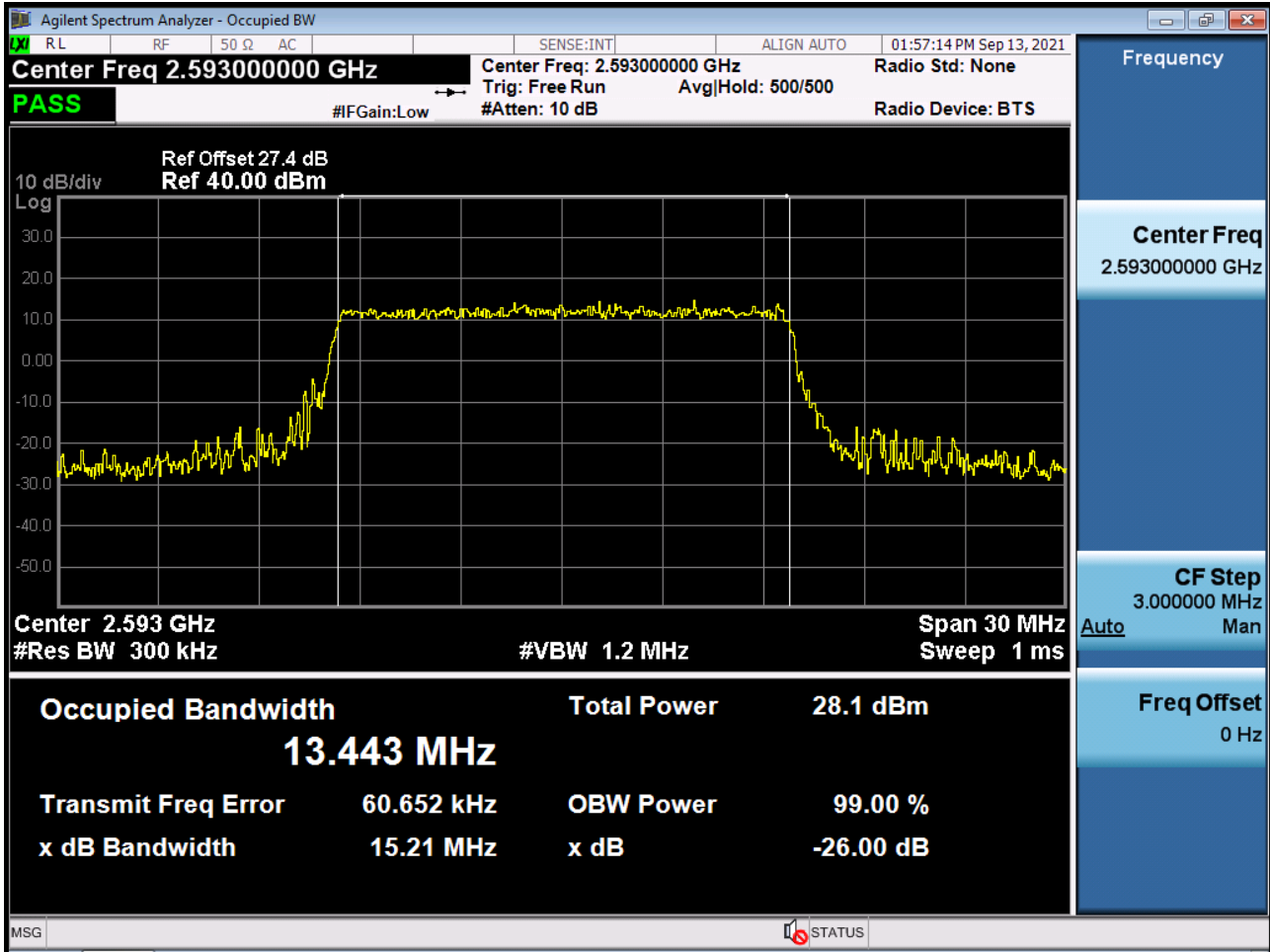
Occupied Bandwidth Plot (15 MHz Ch.40620 16-QAM RB 75) (POWER CLASS 2)



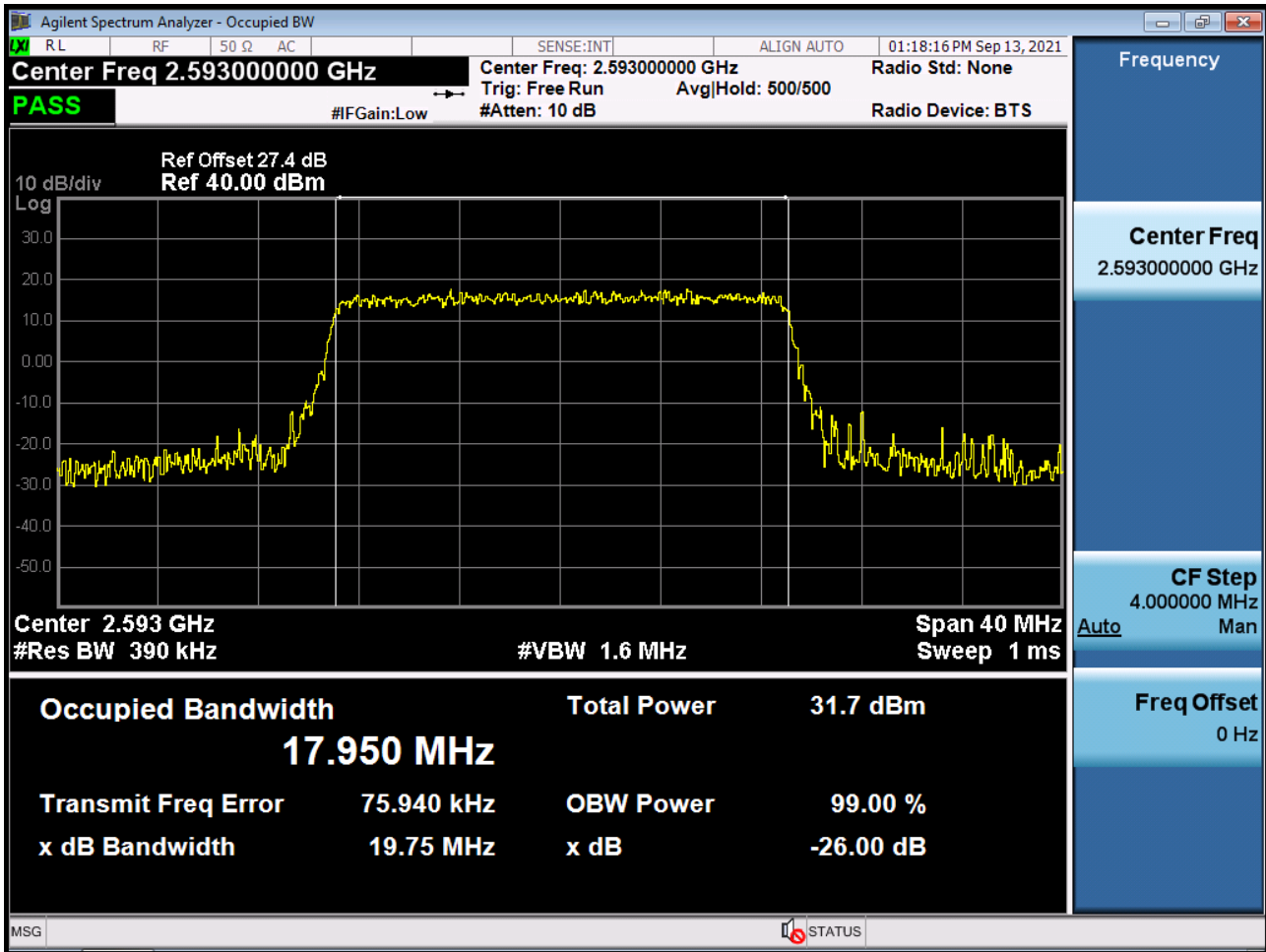
Occupied Bandwidth Plot (15 MHz Ch.40620 64-QAM RB 75) (POWER CLASS 2)



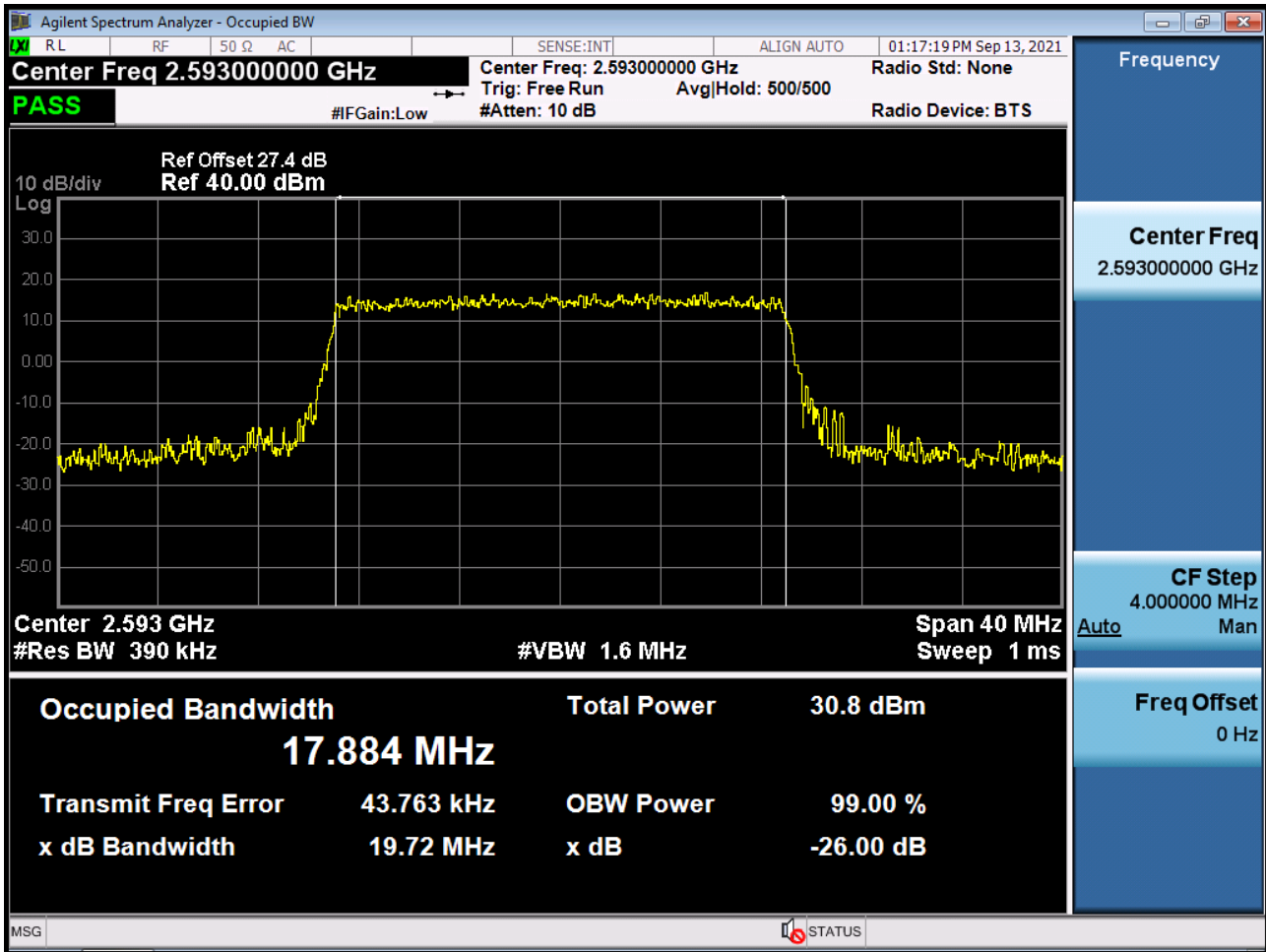
Occupied Bandwidth Plot (15 MHz Ch.40620 256-QAM RB 75) (POWER CLASS 2)



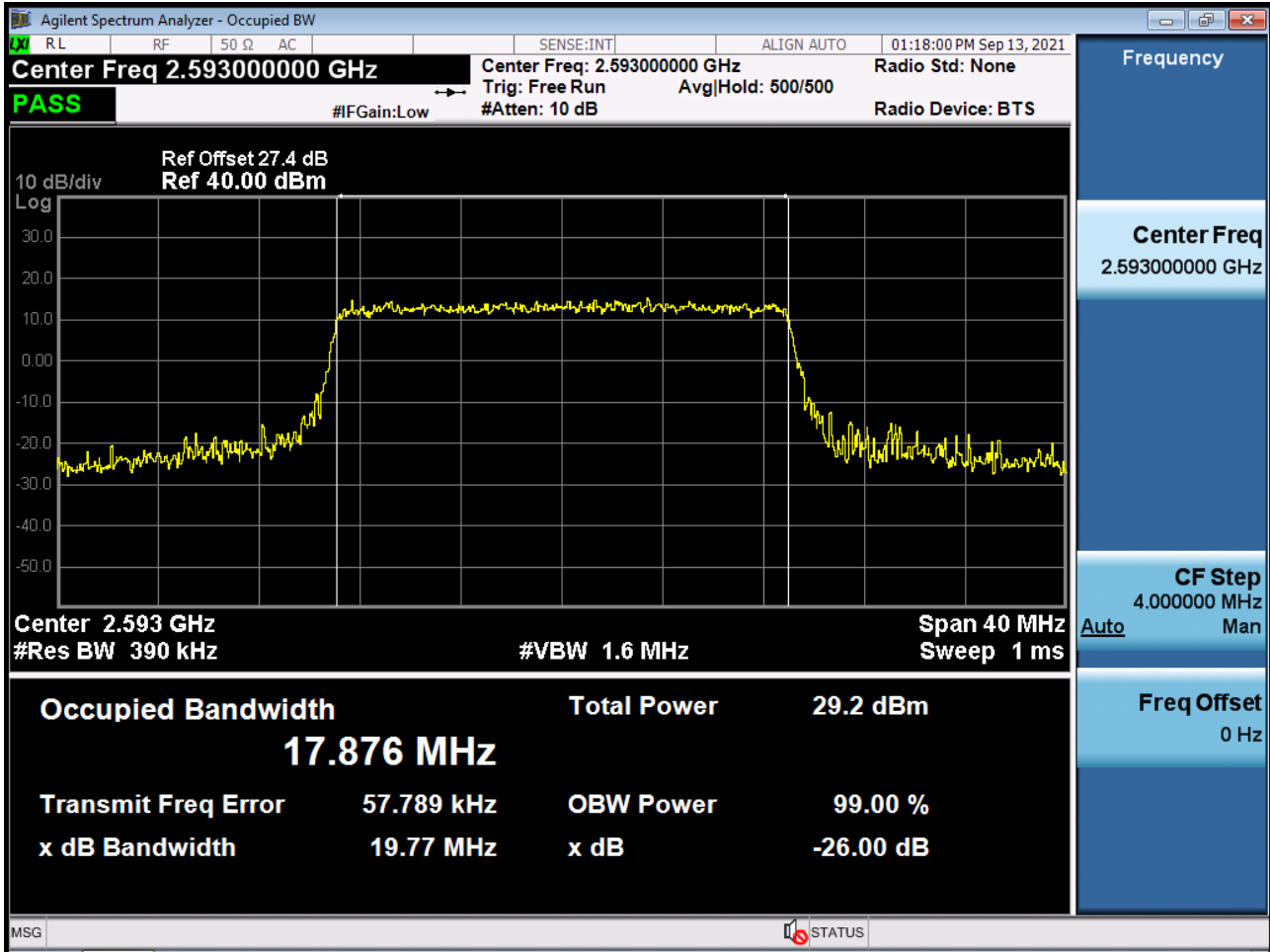
Occupied Bandwidth Plot (20 MHz Ch.40620 QPSK RB 100) (POWER CLASS 2)



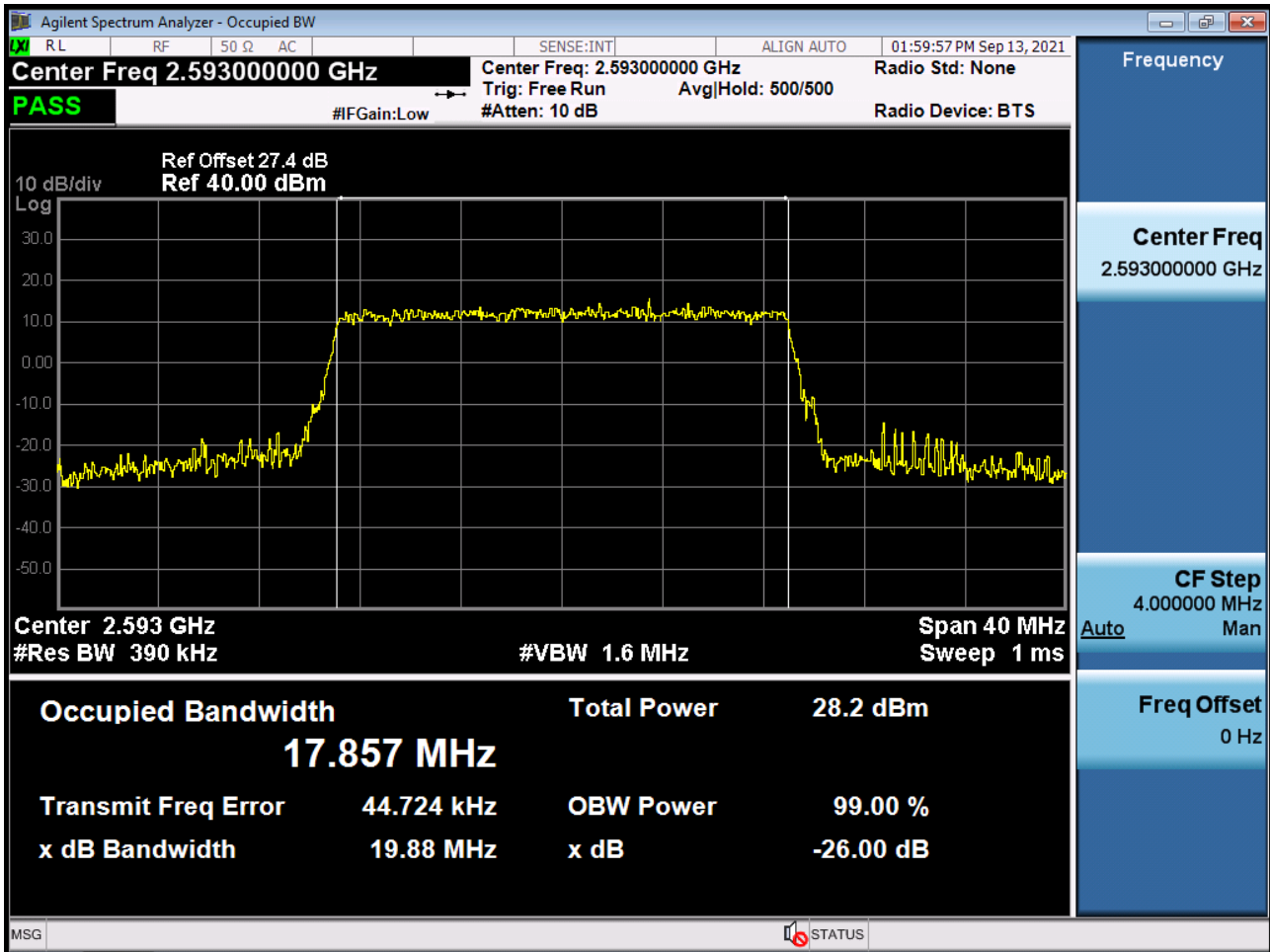
Occupied Bandwidth Plot (20 MHz Ch.40620 16-QAM RB 100) (POWER CLASS 2)



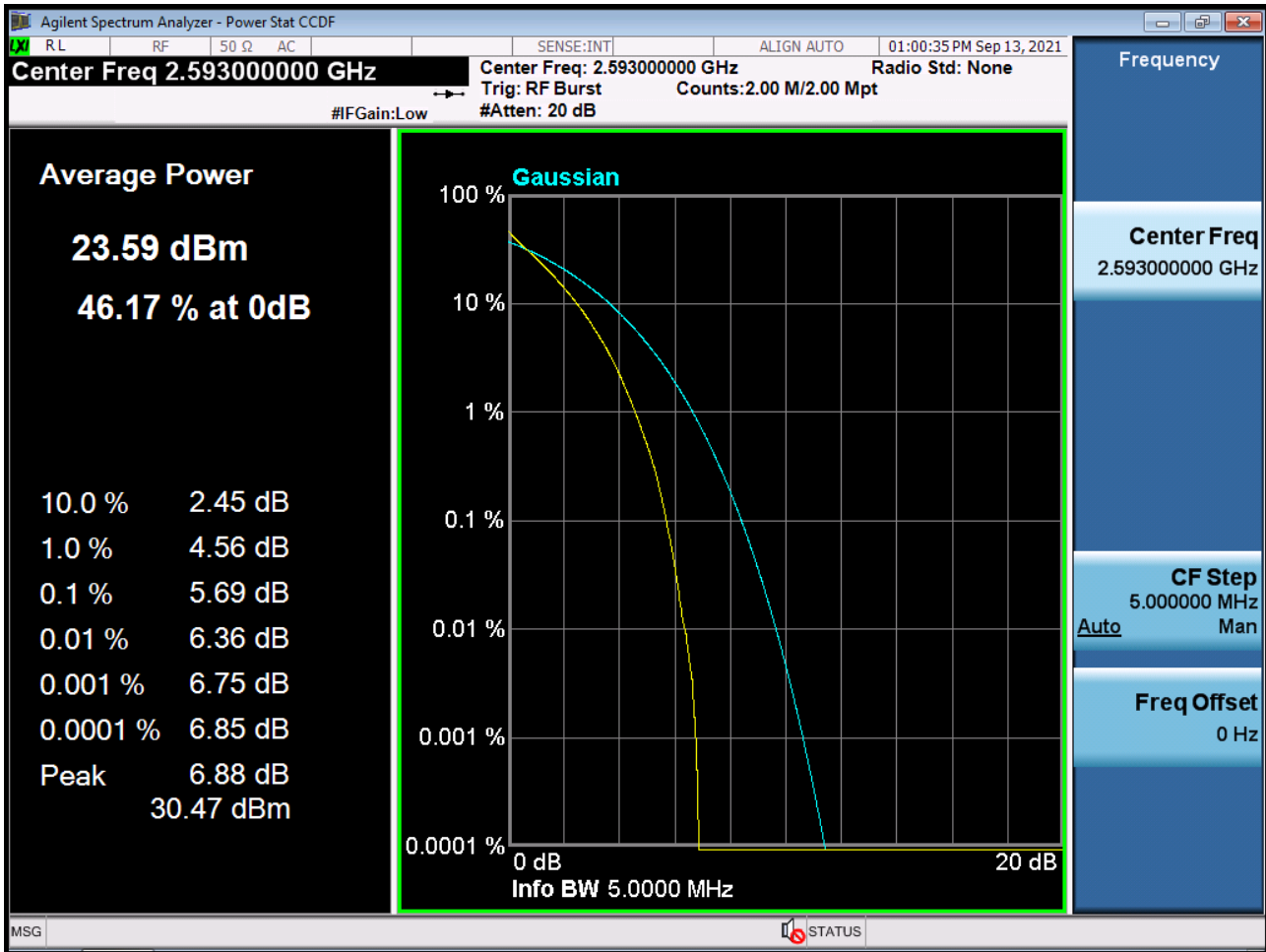
Occupied Bandwidth Plot (20 MHz Ch.40620 64-QAM RB 100) (POWER CLASS 2)



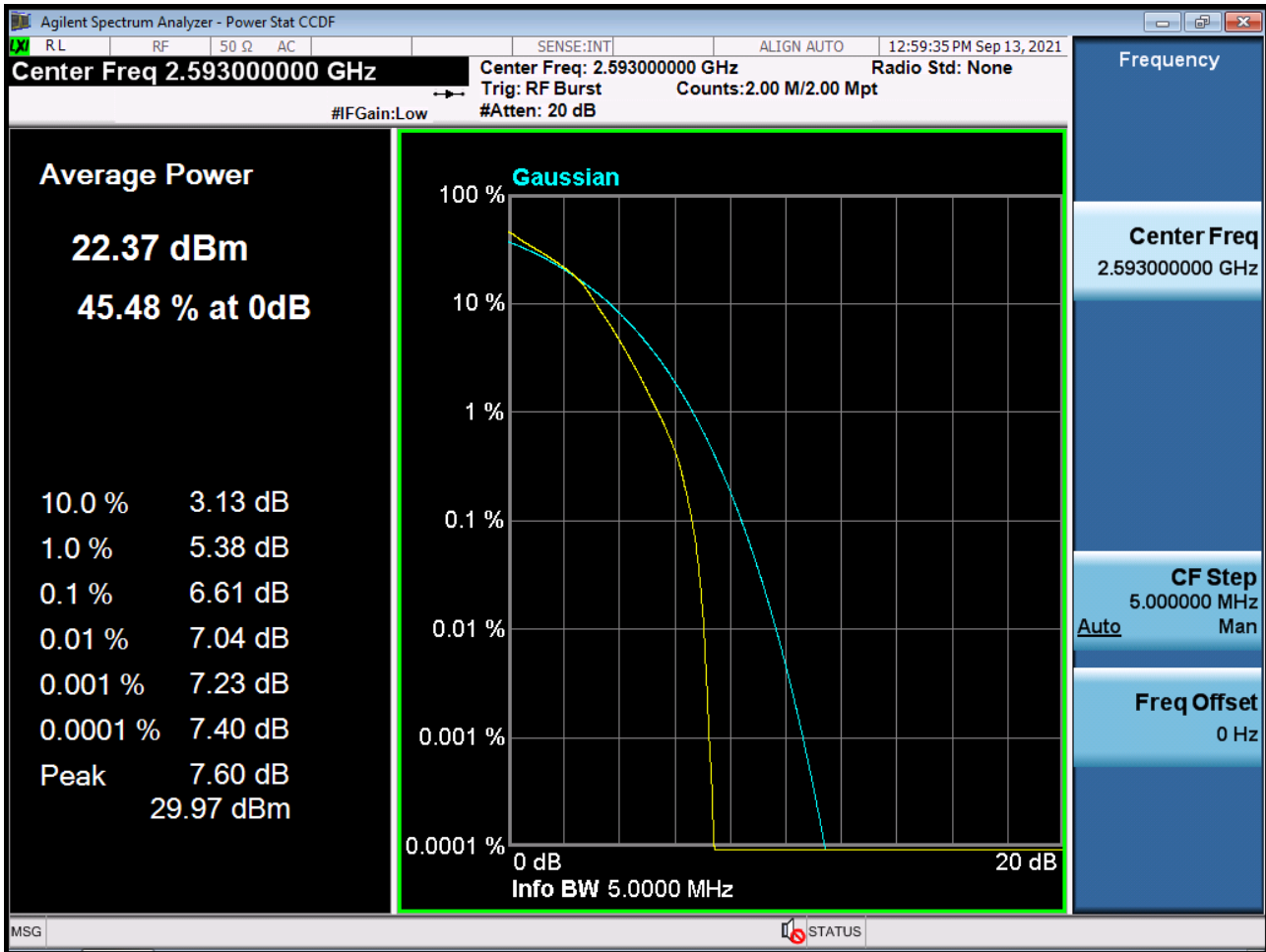
Occupied Bandwidth Plot (20 MHz Ch.40620 256-QAM RB 100) (POWER CLASS 2)



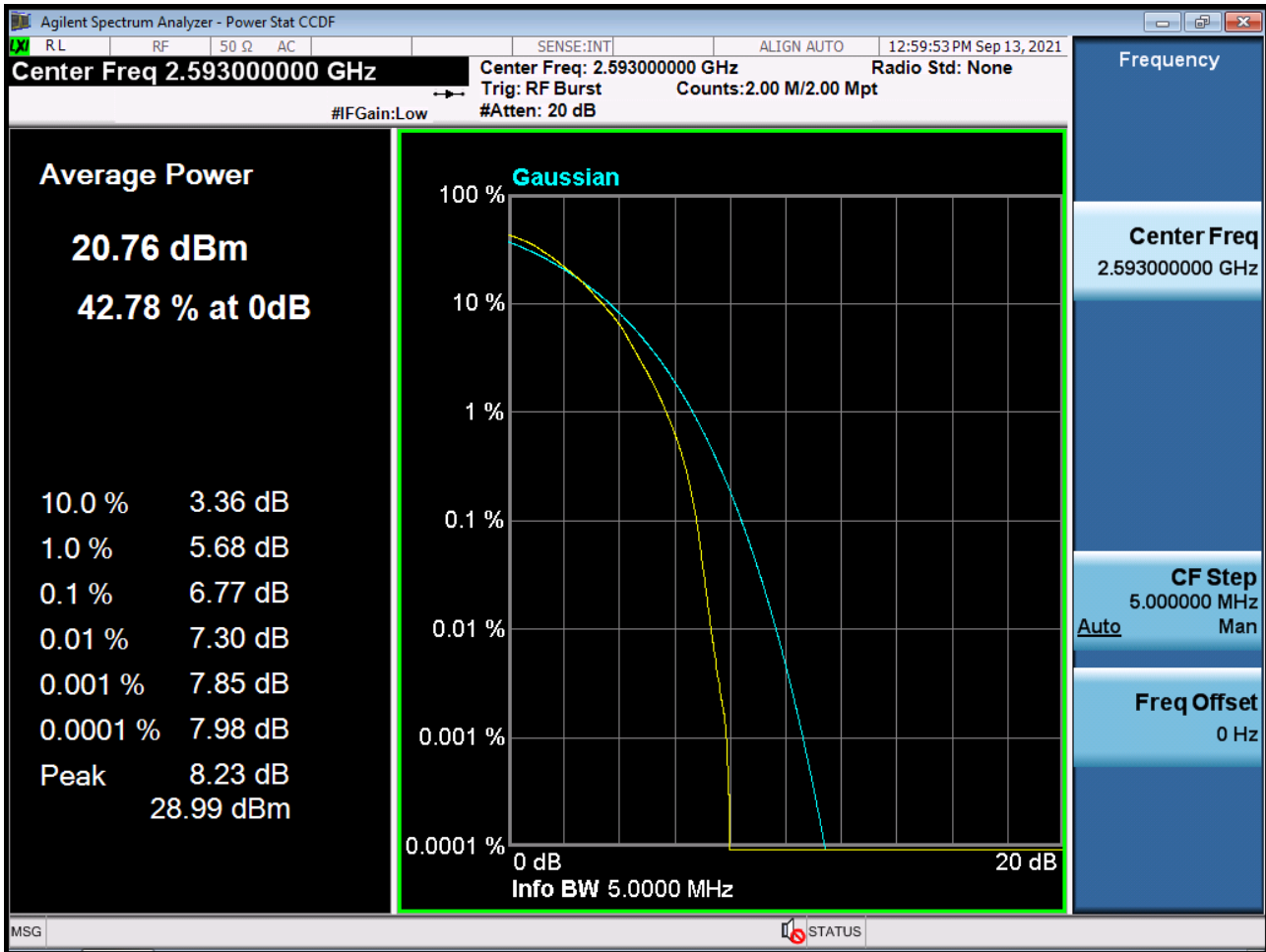
PAR Plot (5 M BW_Ch.40620_QPSK_RB25_0) (POWER CLASS 2)



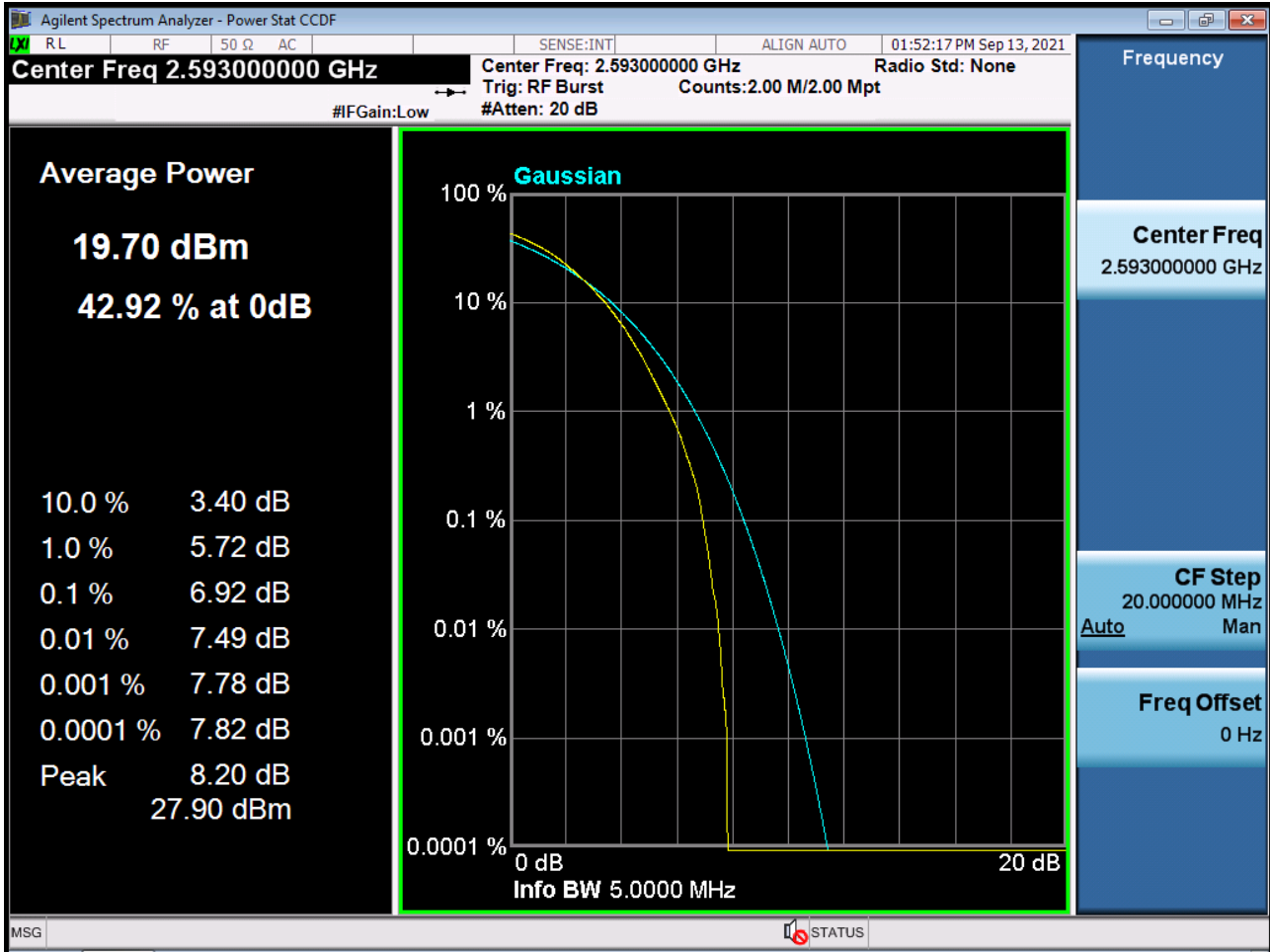
PAR Plot (5 M BW_Ch.40620_16QAM_RB25_0) (POWER CLASS 2)



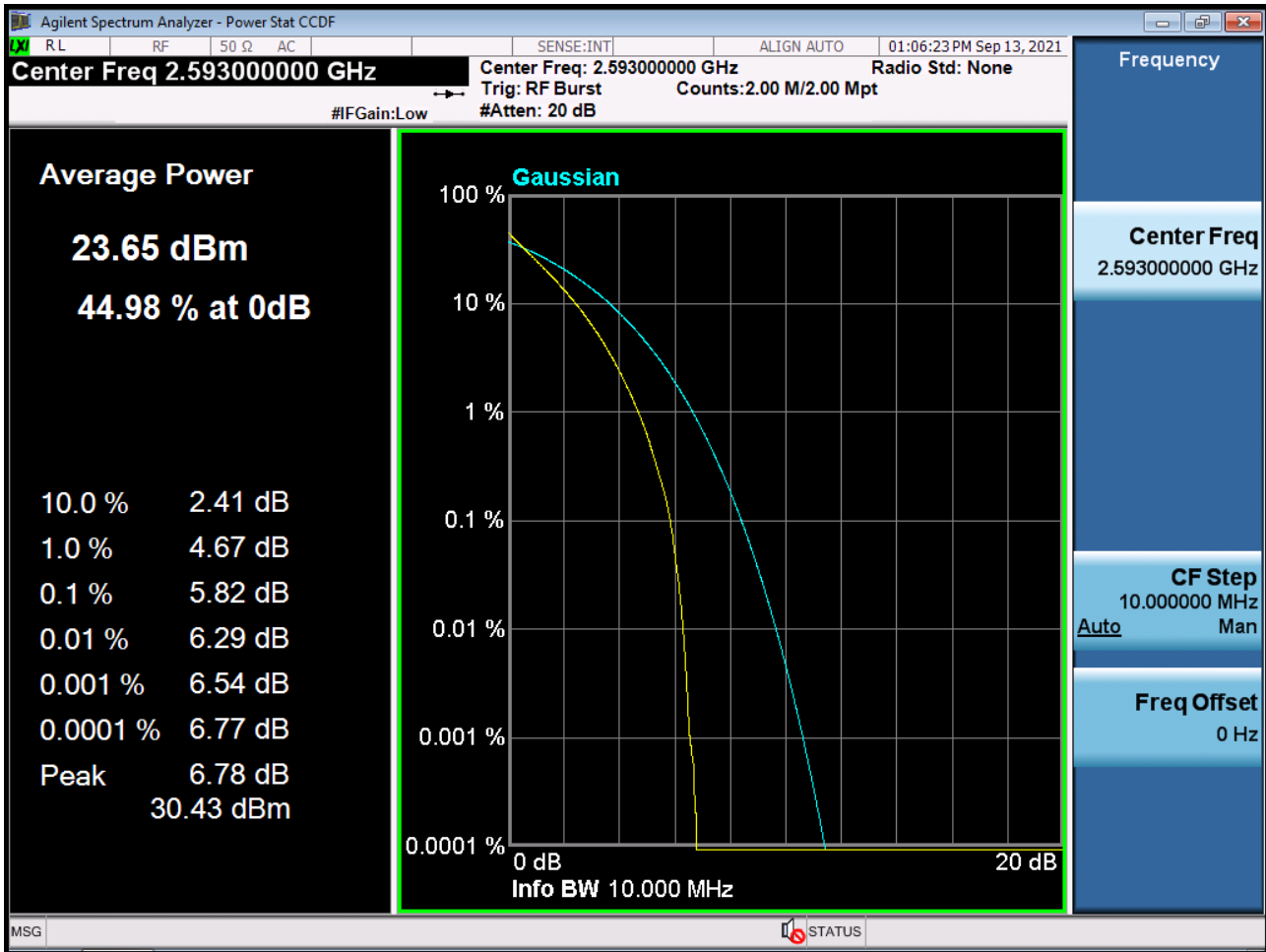
PAR Plot (5 M BW_Ch.40620_64QAM_RB25_0) (POWER CLASS 2)



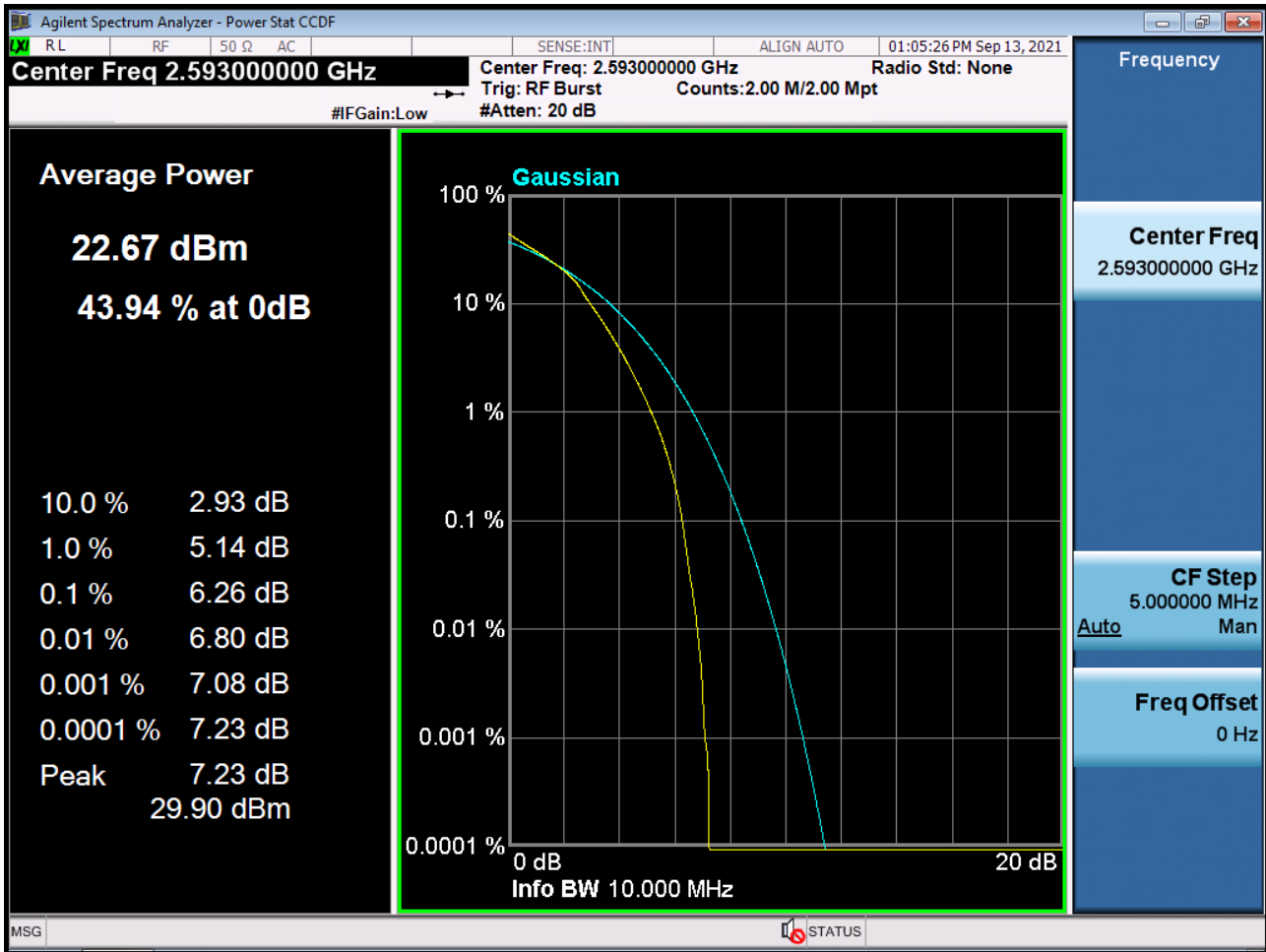
PAR Plot (5 M BW_Ch.40620_256QAM_RB25_0) (POWER CLASS 2)



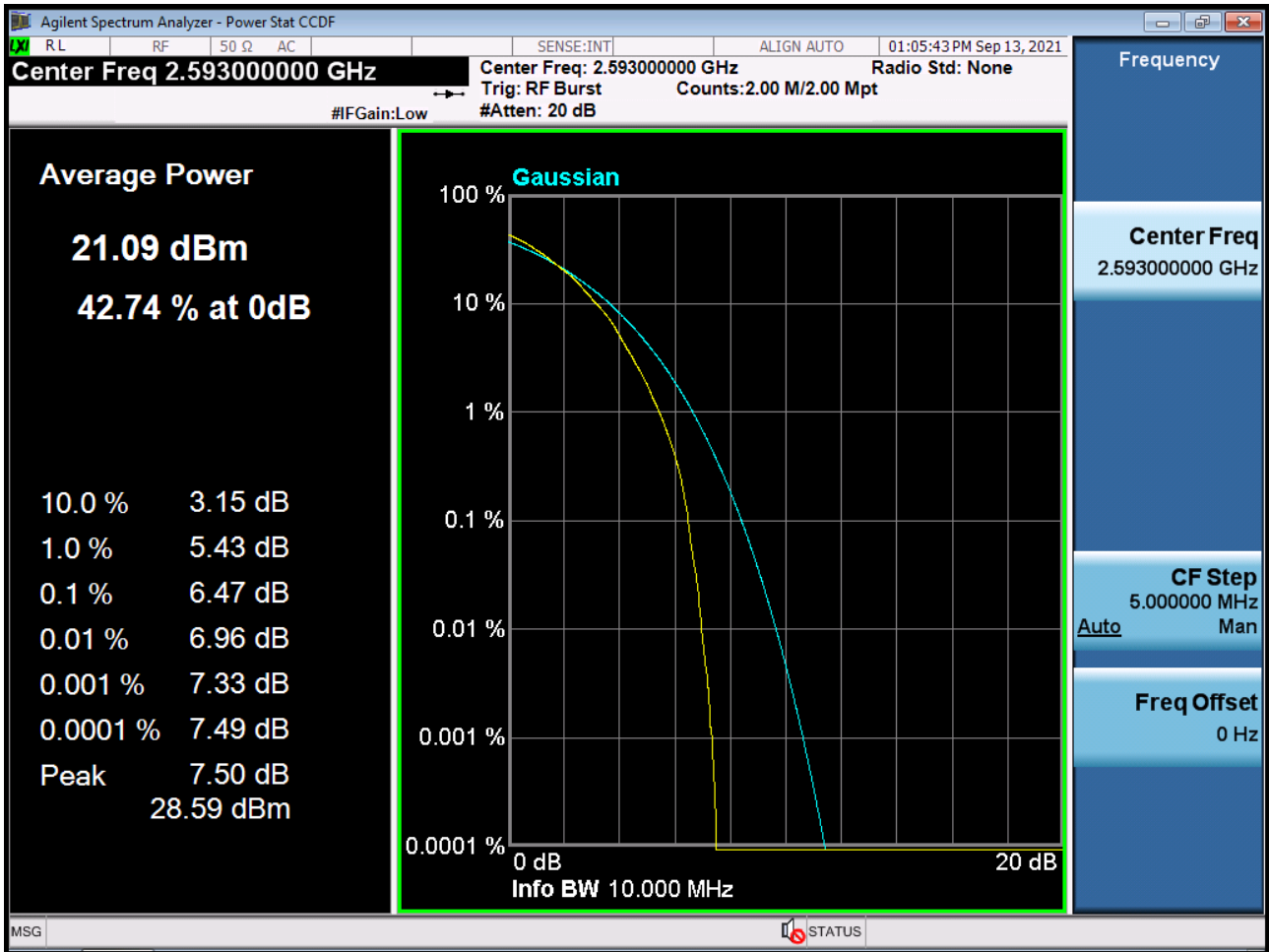
PAR Plot (10 M BW_Ch.40620_QPSK_RB50_0) (POWER CLASS 2)



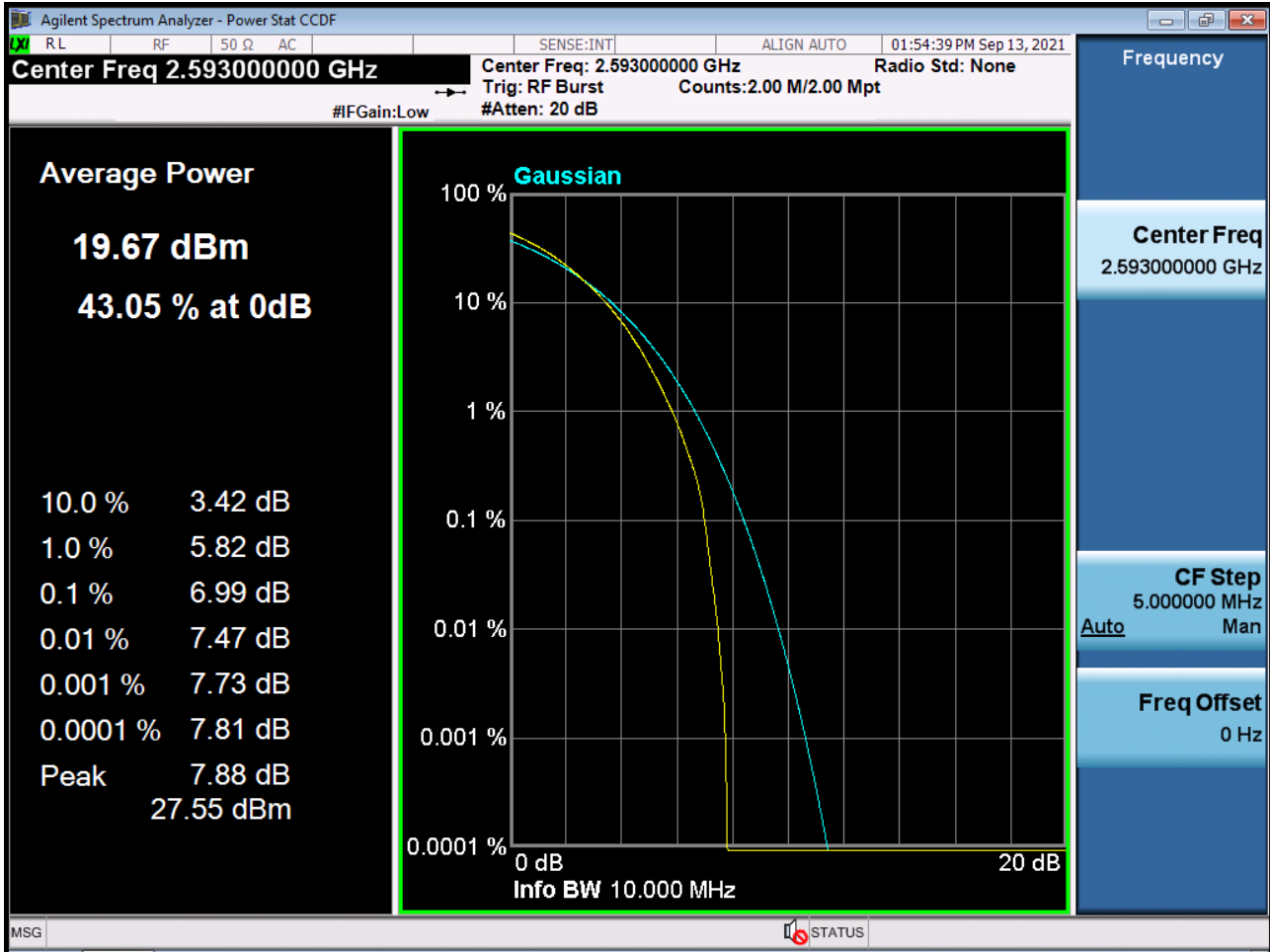
PAR Plot (10 M BW_Ch.40620_16QAM_RB50_0) (POWER CLASS 2)



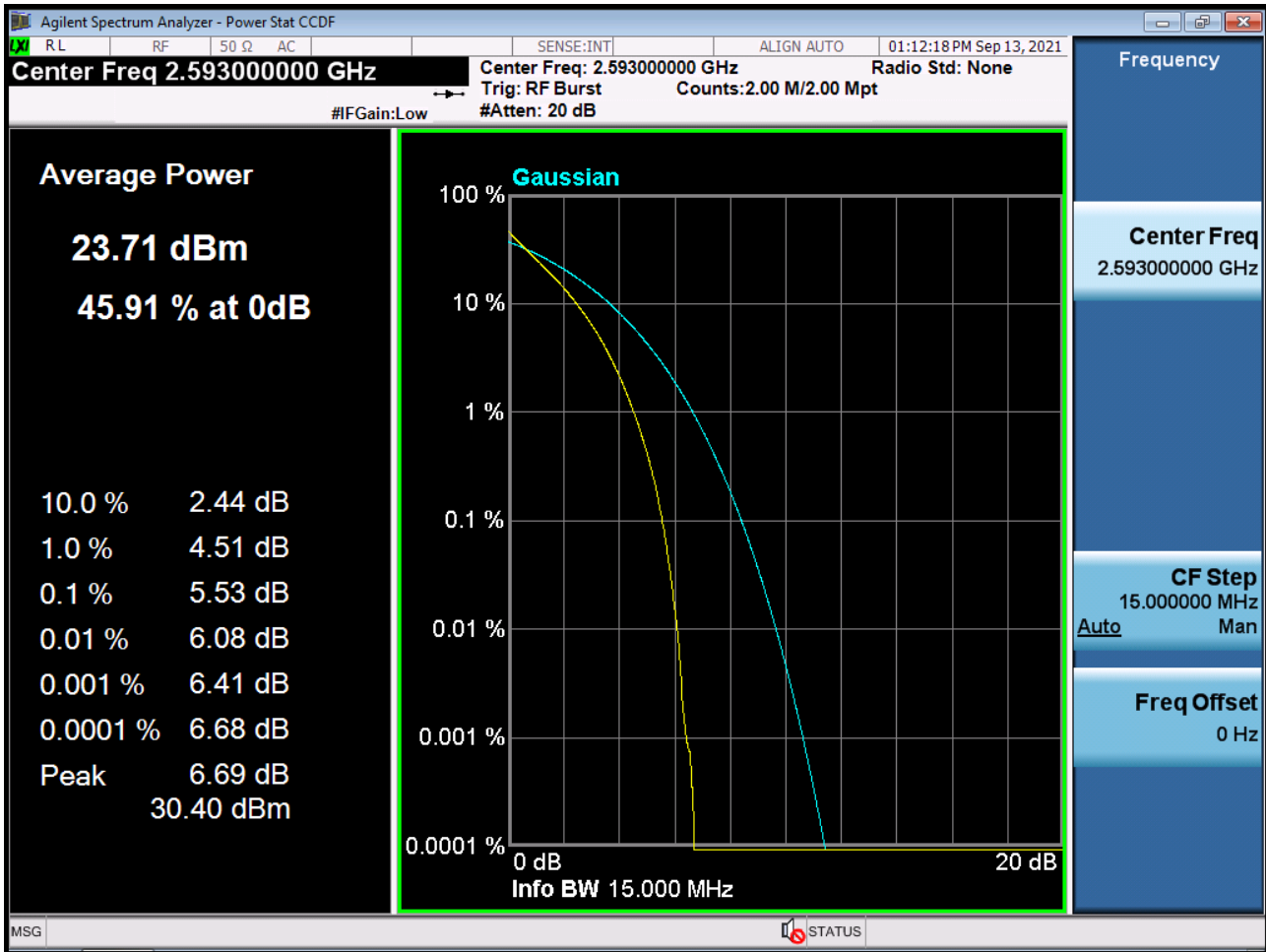
PAR Plot (10 M BW_Ch.40620_64QAM_RB50_0) (POWER CLASS 2)



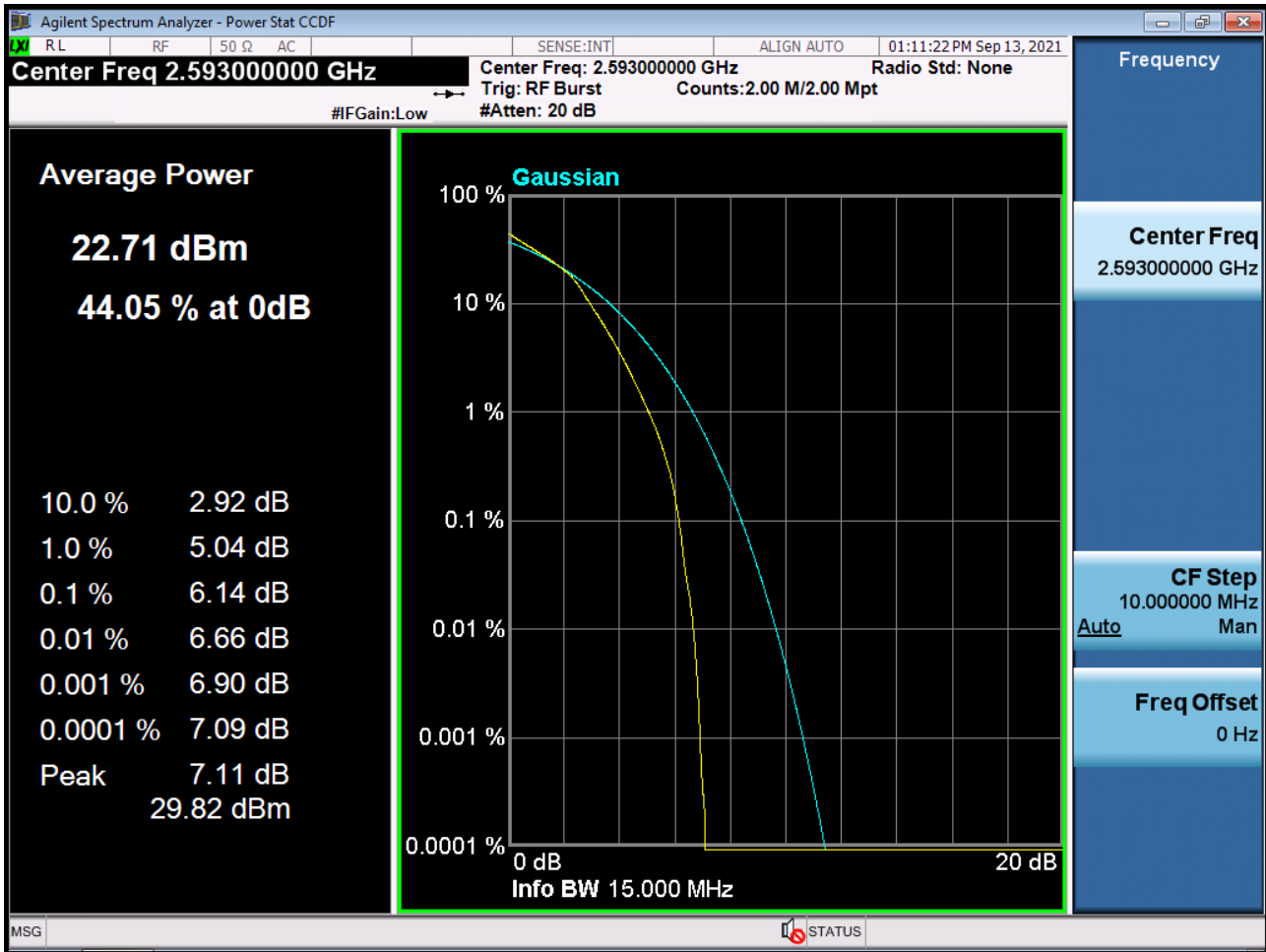
PAR Plot (10 M BW_Ch.40620_256QAM_RB50_0) (POWER CLASS 2)



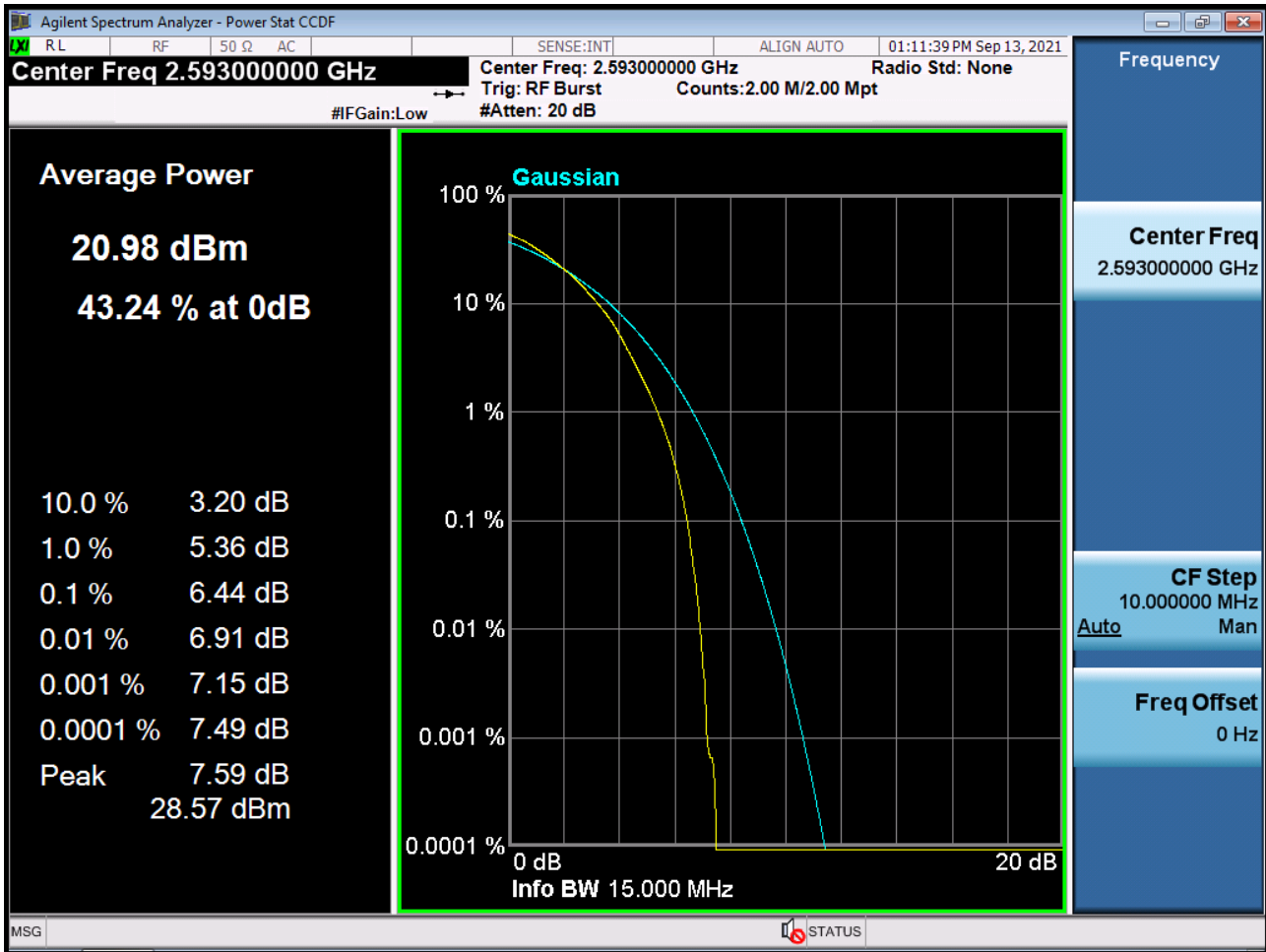
PAR Plot (15 M BW_Ch.40620_QPSK_RB75_0) (POWER CLASS 2)



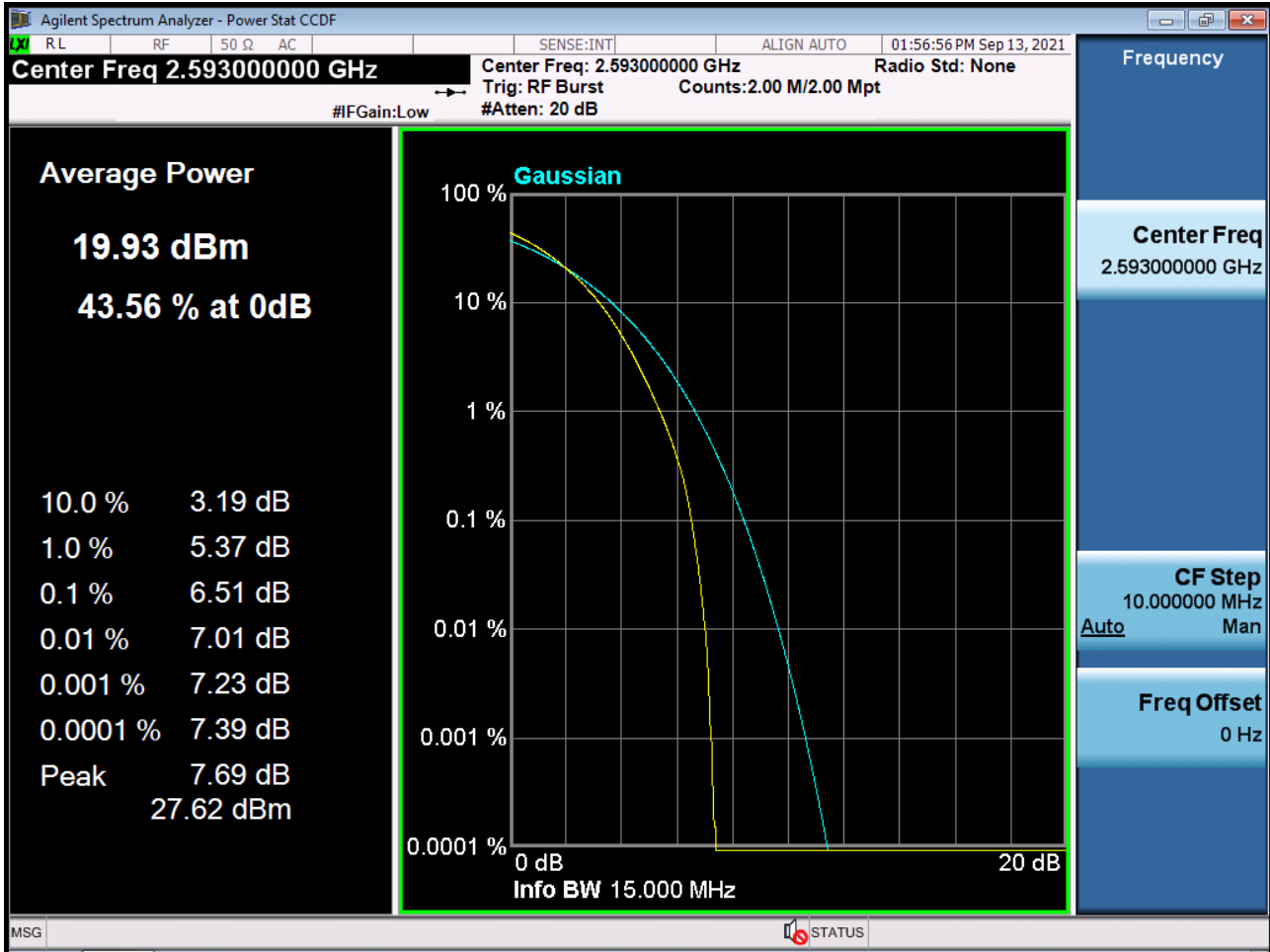
PAR Plot (15 M BW_Ch.40620_16QAM_RB75_0) (POWER CLASS 2)



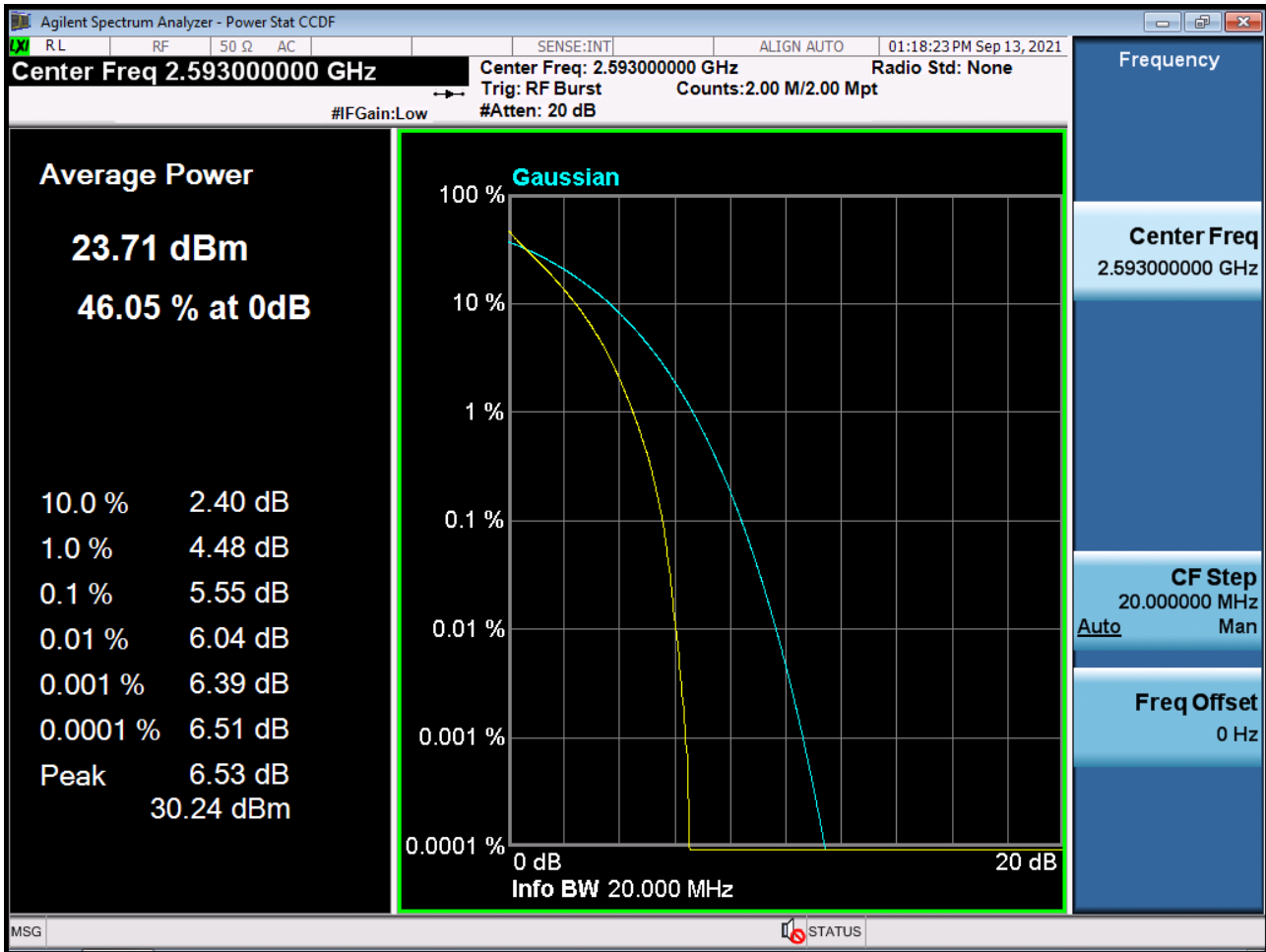
PAR Plot (15 M BW_Ch.40620_64QAM_RB75_0) (POWER CLASS 2)



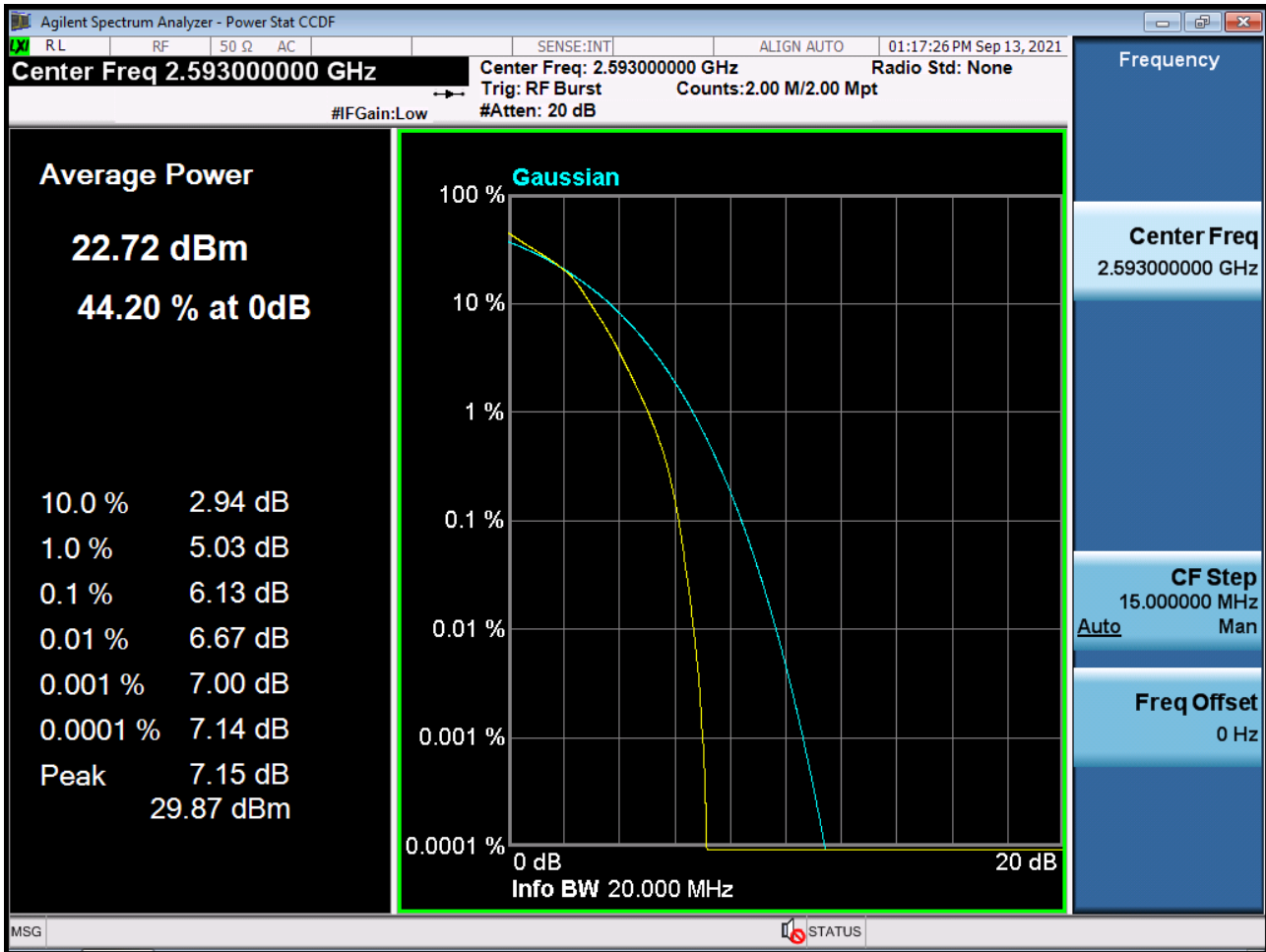
PAR Plot (15 M BW_Ch.40620_256QAM_RB75_0) (POWER CLASS 2)



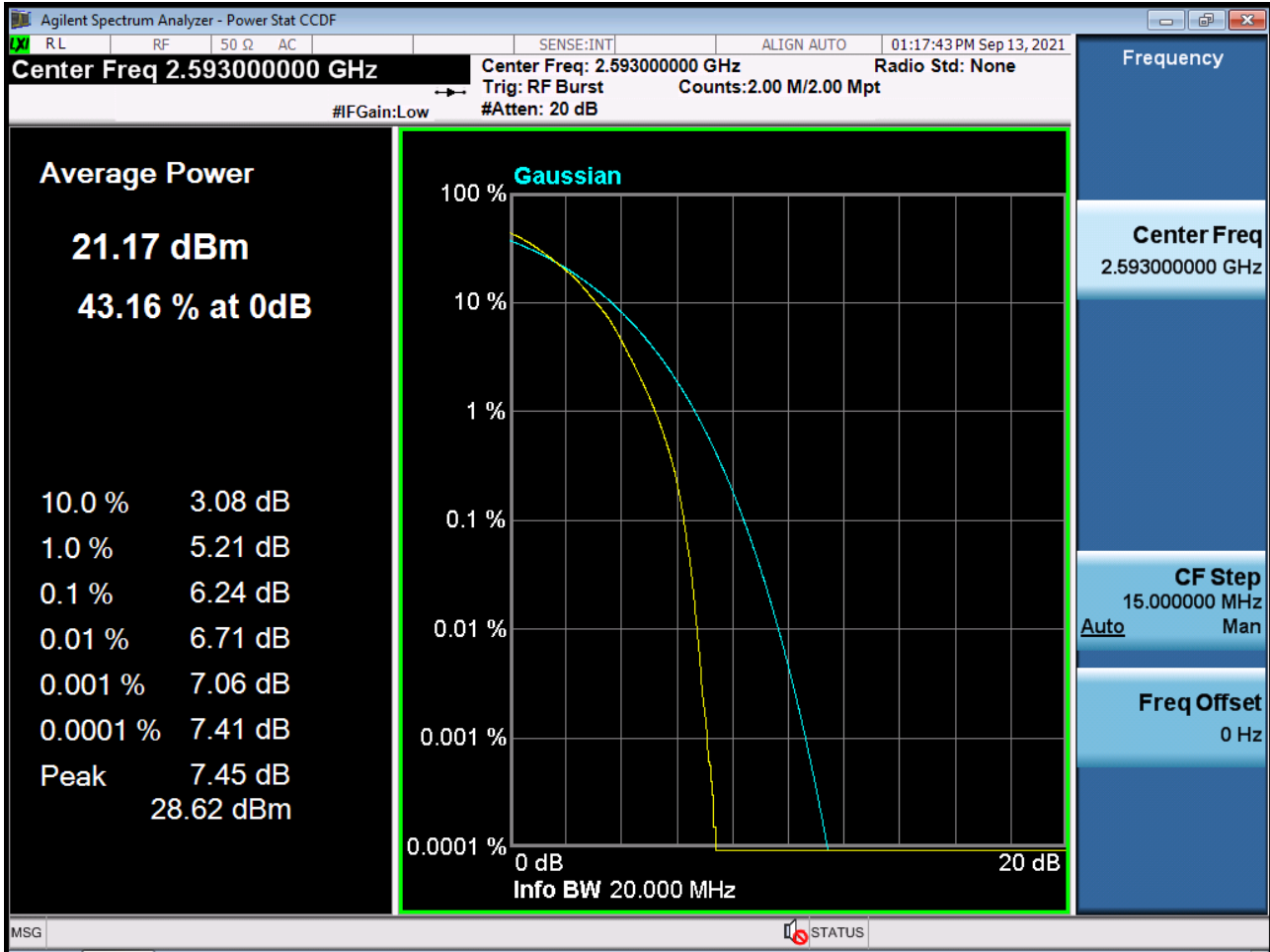
PAR Plot (20 M BW_Ch.40620_QPSK_RB100_0) (POWER CLASS 2)



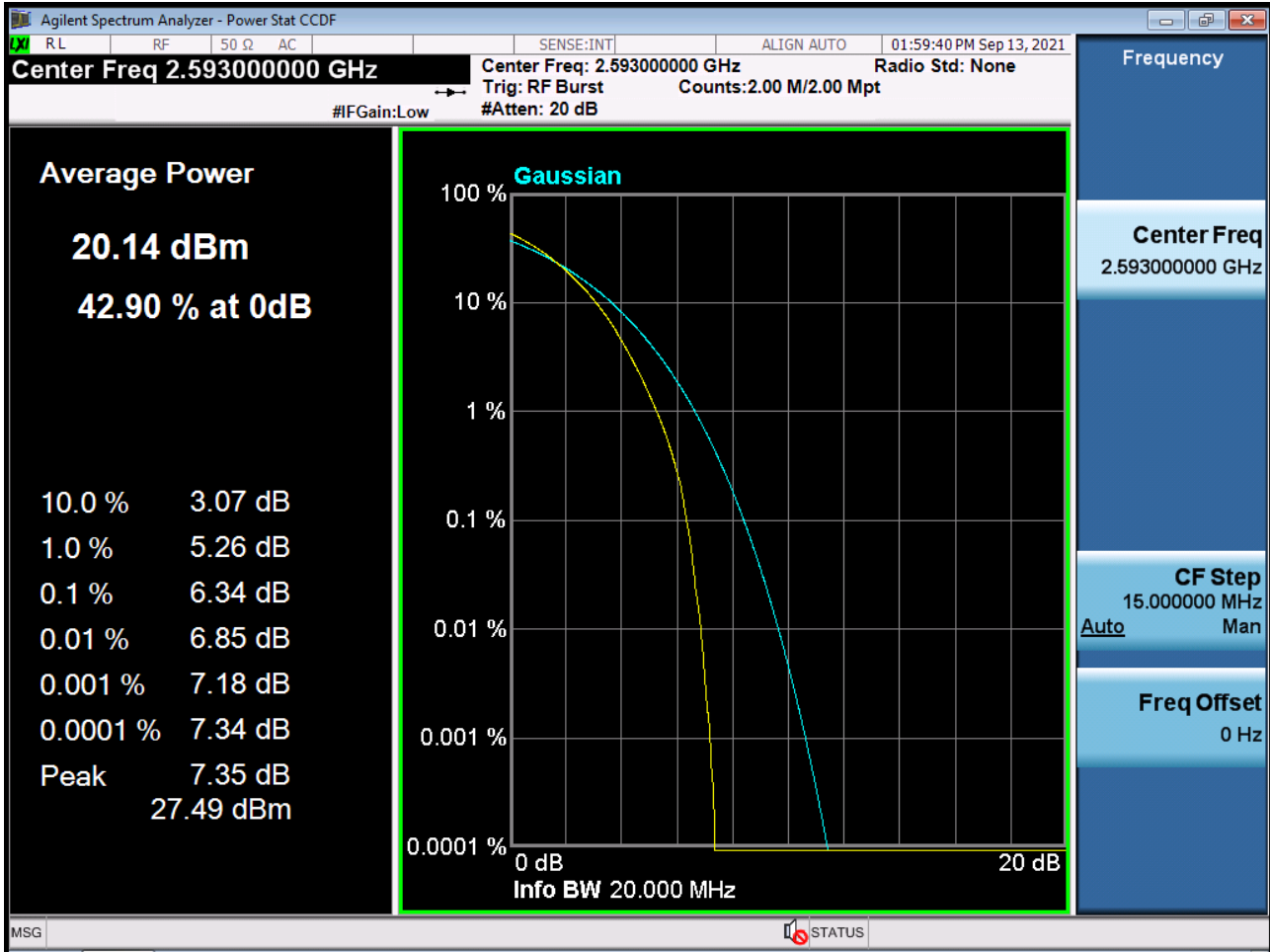
PAR Plot (20 M BW_Ch.40620_16QAM_RB100_0) (POWER CLASS 2)



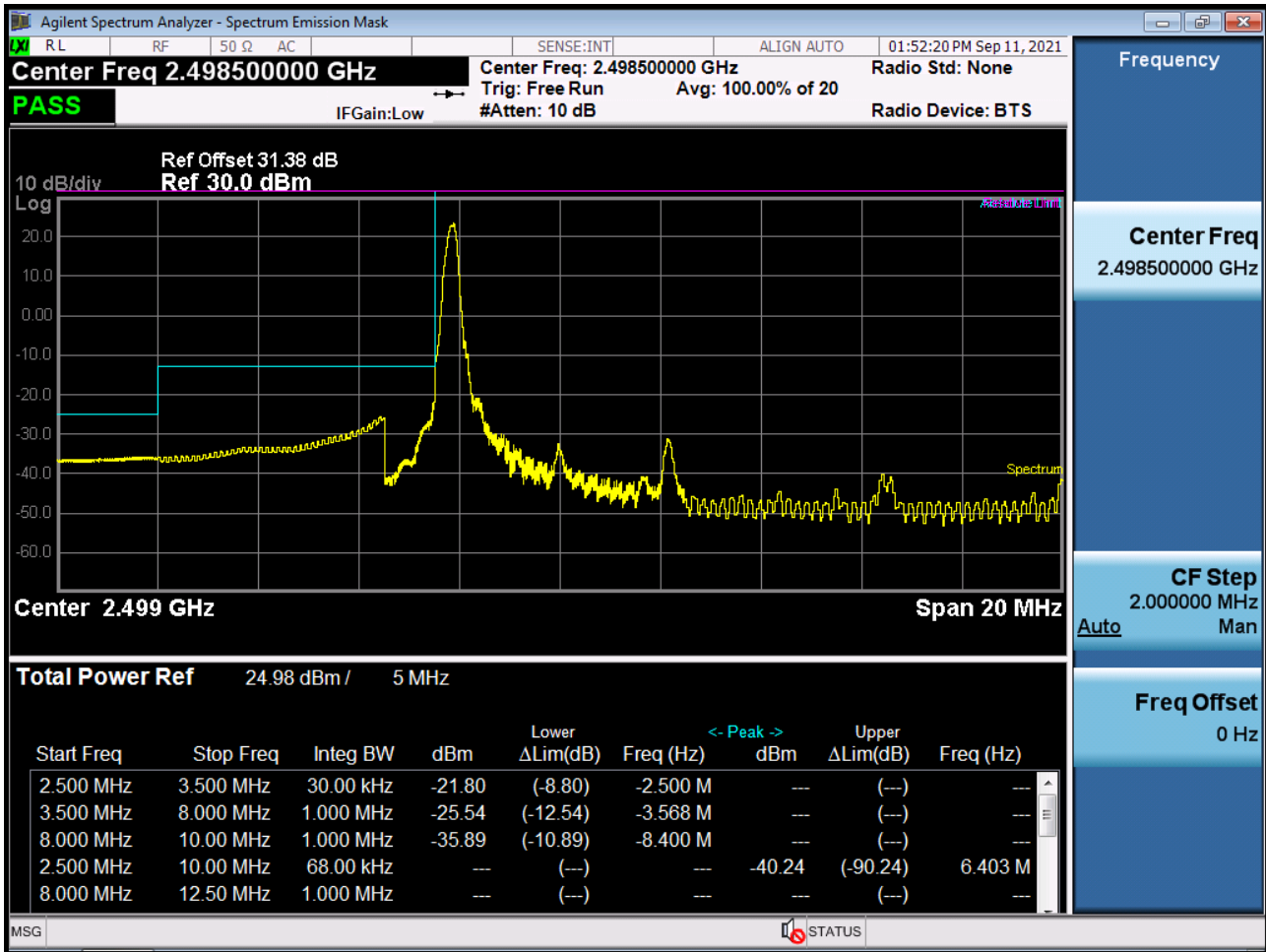
PAR Plot (20 M BW_Ch.40620_64QAM_RB100_0) (POWER CLASS 2)



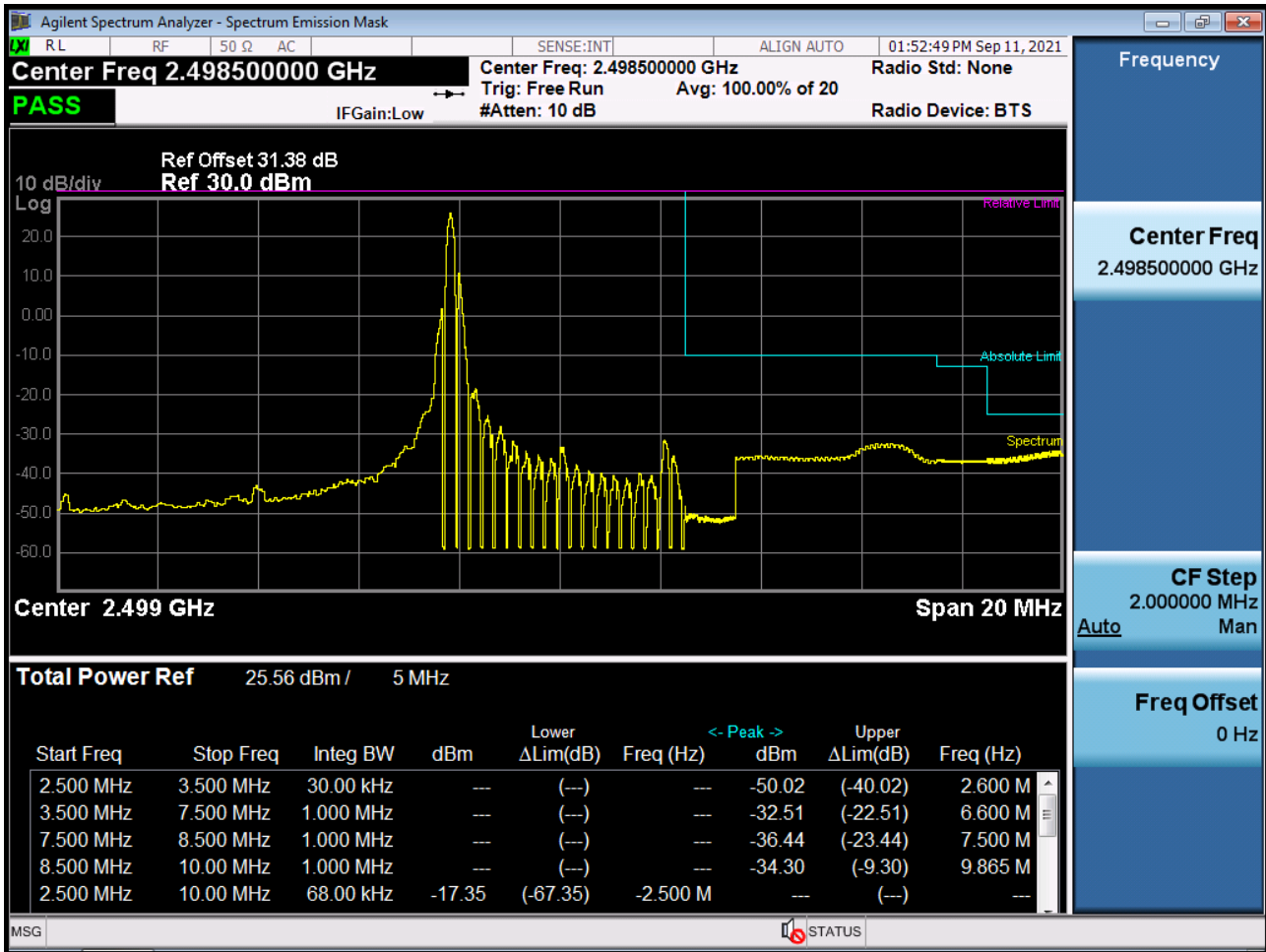
PAR Plot (20 M BW_Ch.40620_256QAM_RB100_0) (POWER CLASS 2)



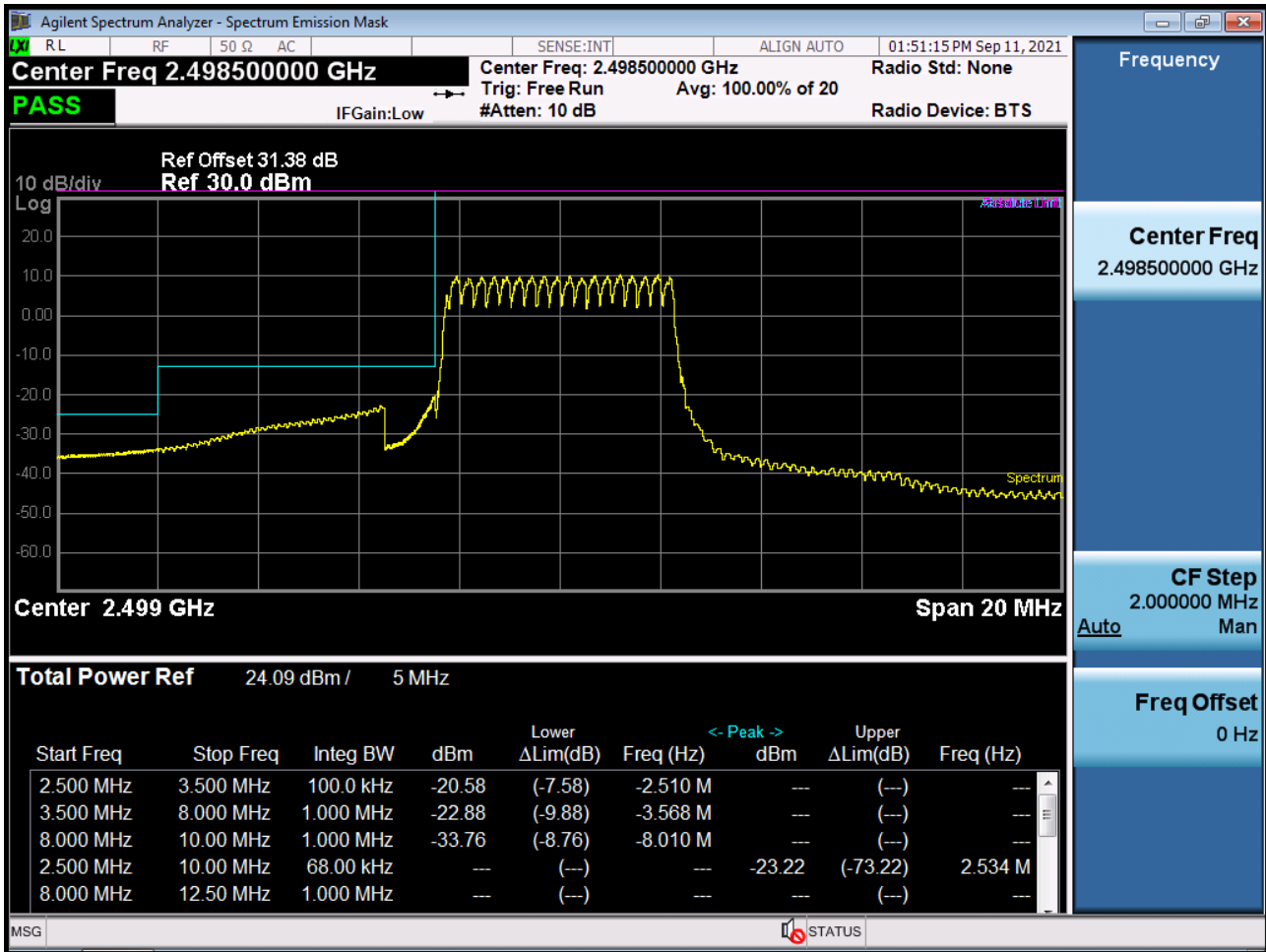
Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-1 (POWER CLASS 2)



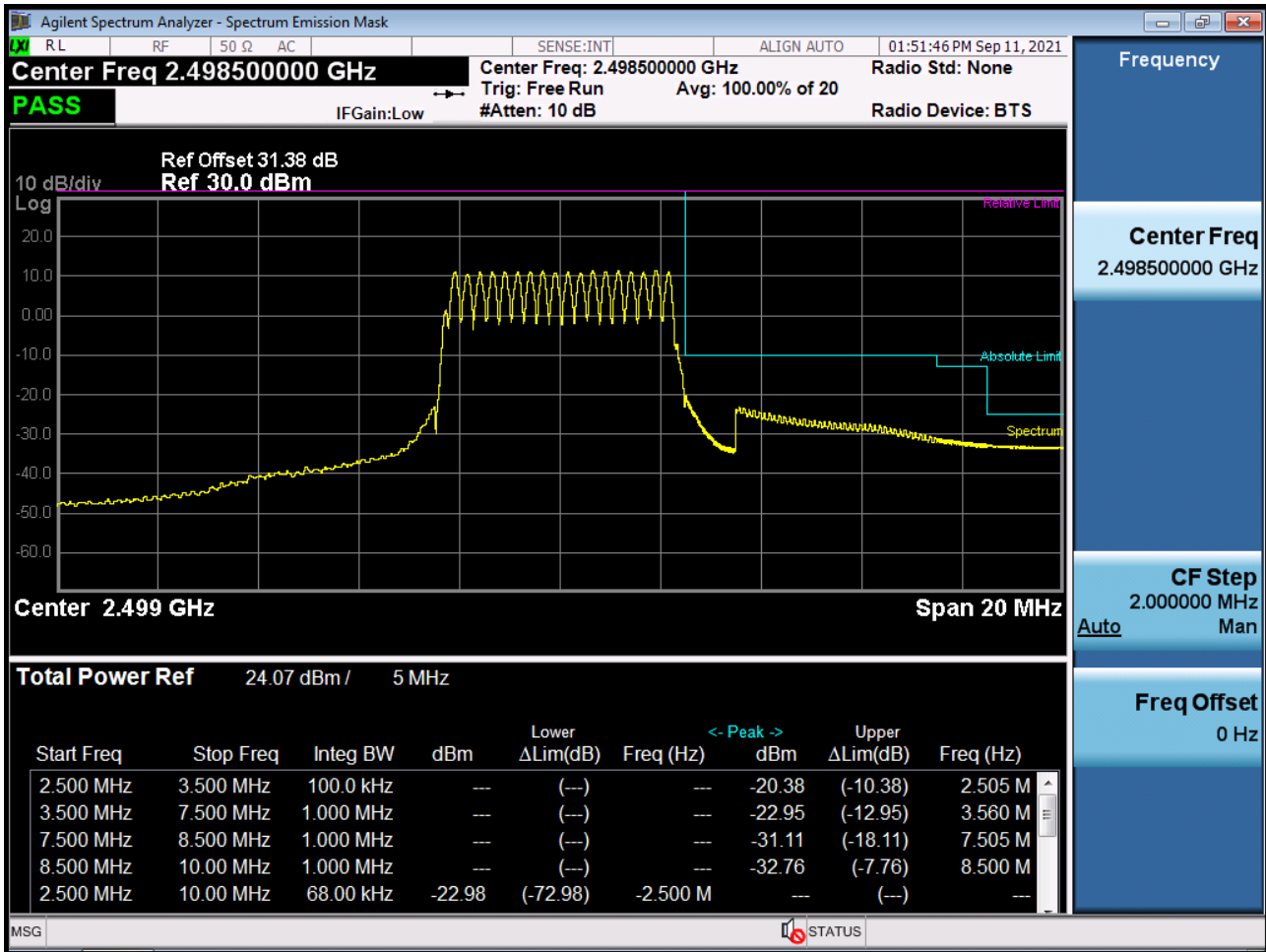
Low Channel Edge Plot (5 MHz Ch.39675 QPSK RB 1, Offset 0)-2 (POWER CLASS 2)



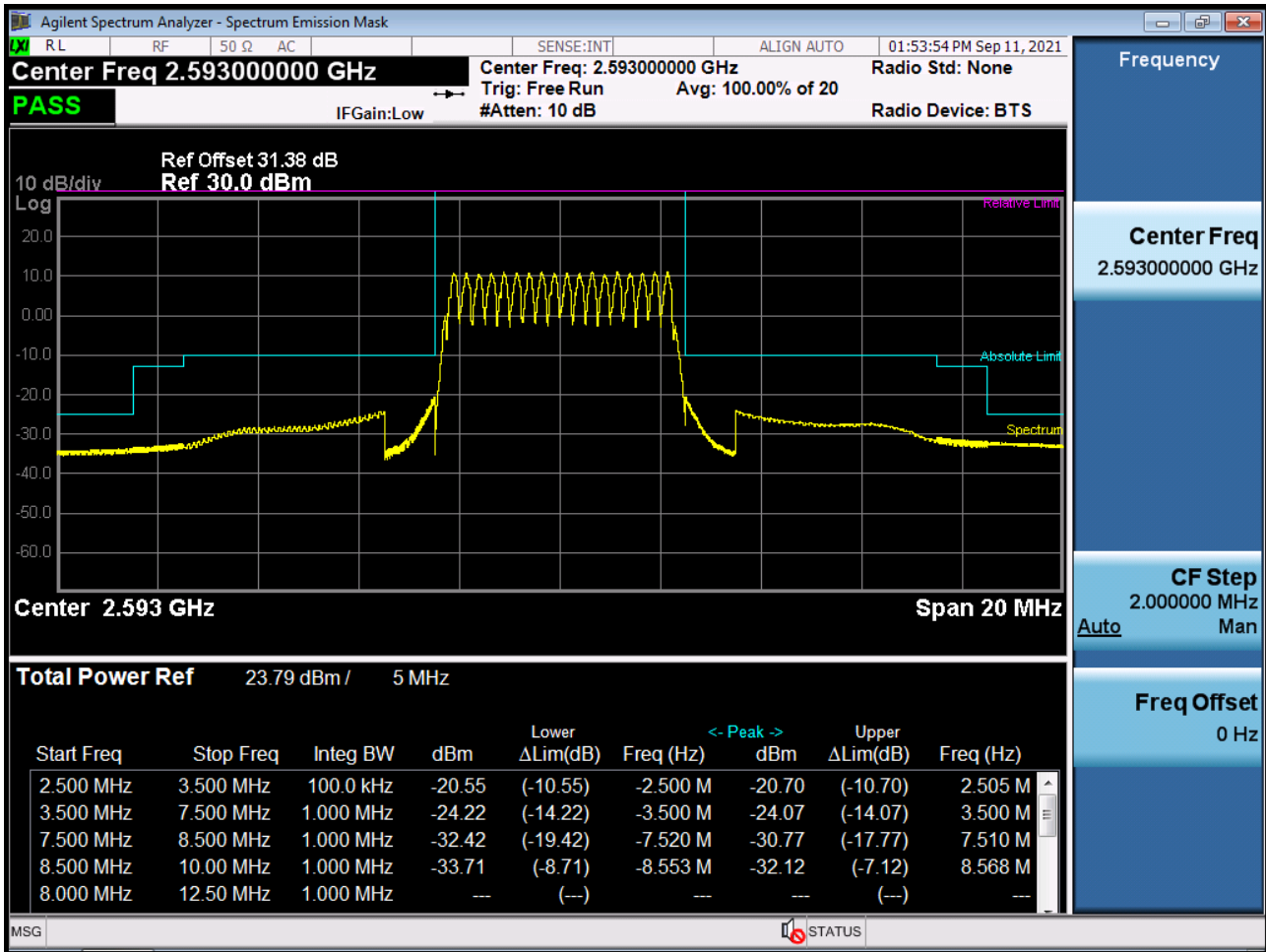
Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-1 (POWER CLASS 2)



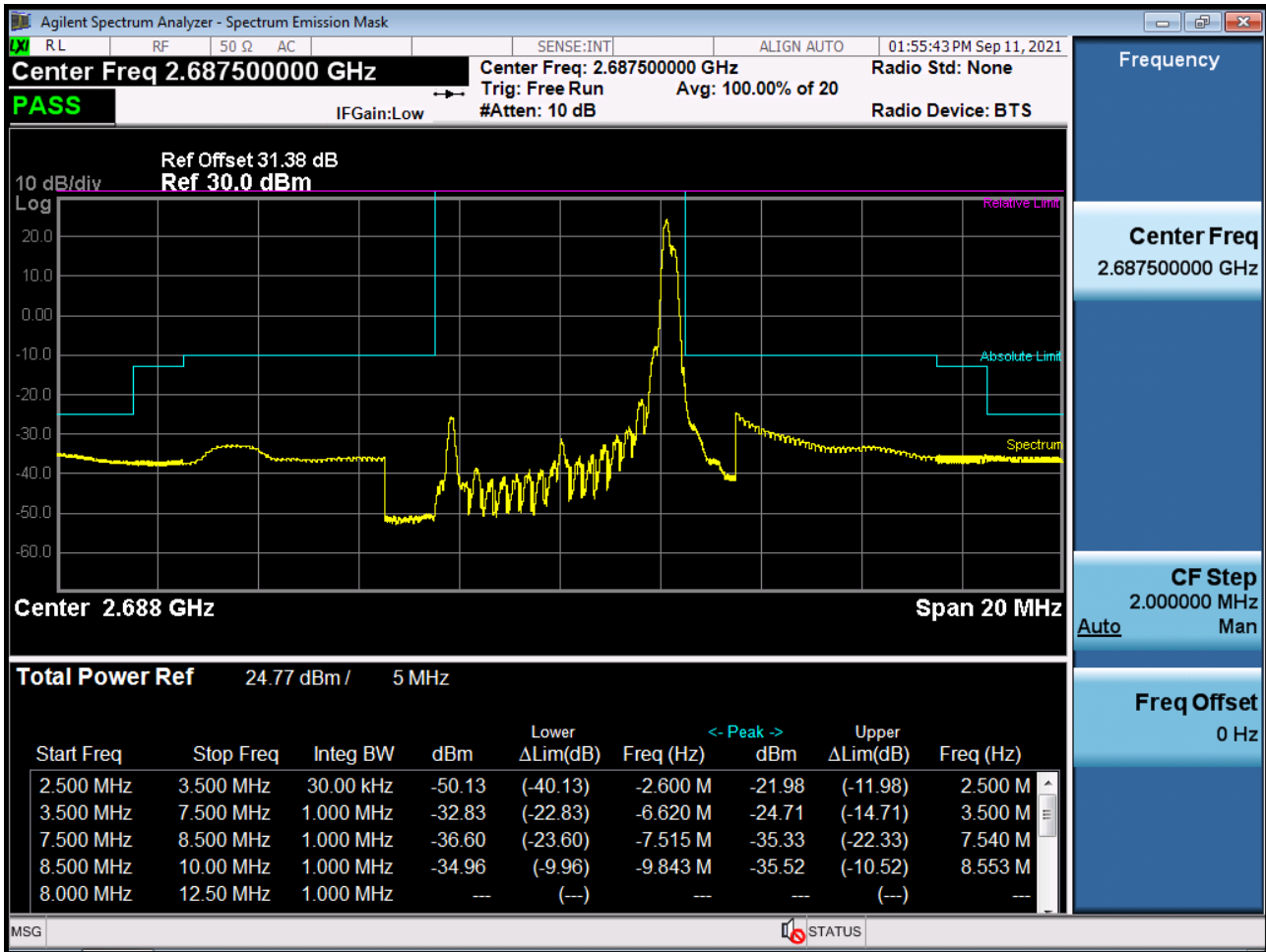
Low Channel Edge Plot (5 MHz Ch.39675 QPSK_RB25_Offset 0)-2 (POWER CLASS 2)



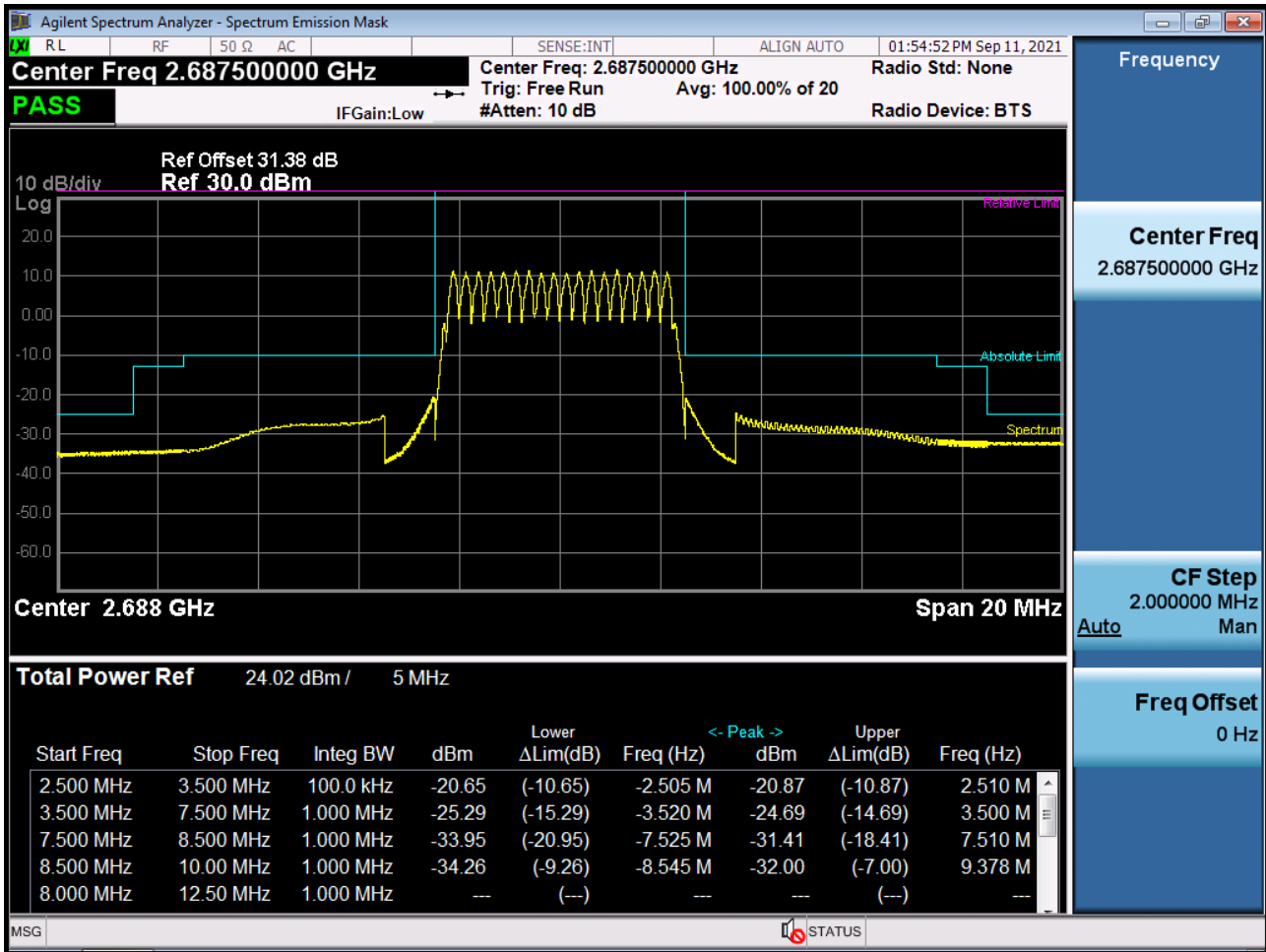
Mid Channel Edge Plot (5 MHz Ch.40620 QPSK RB 25) (POWER CLASS 2)



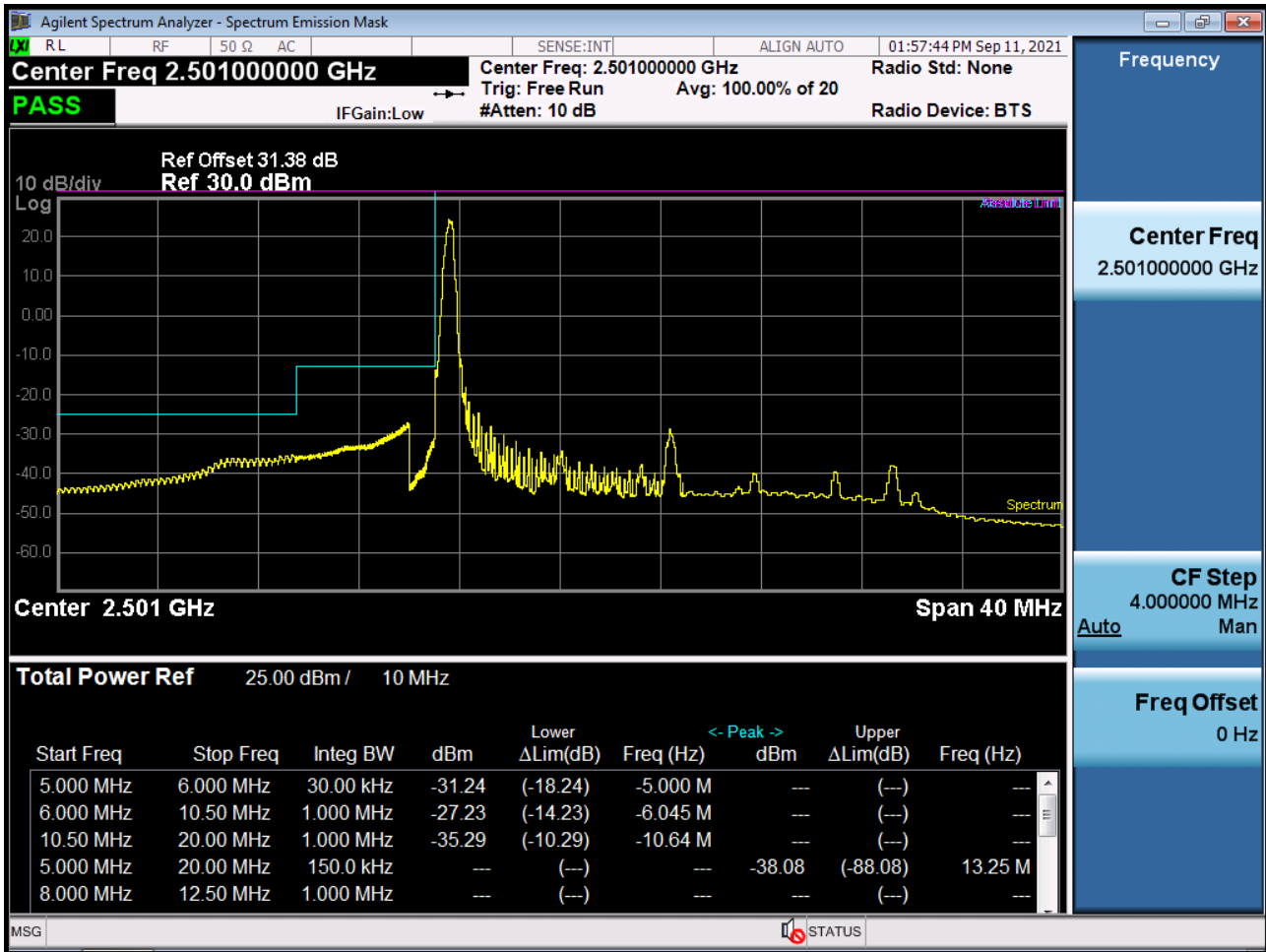
High Channel Edge Plot (5 MHz Ch.41565 QPSK RB 1, Offset 24) (POWER CLASS 2)



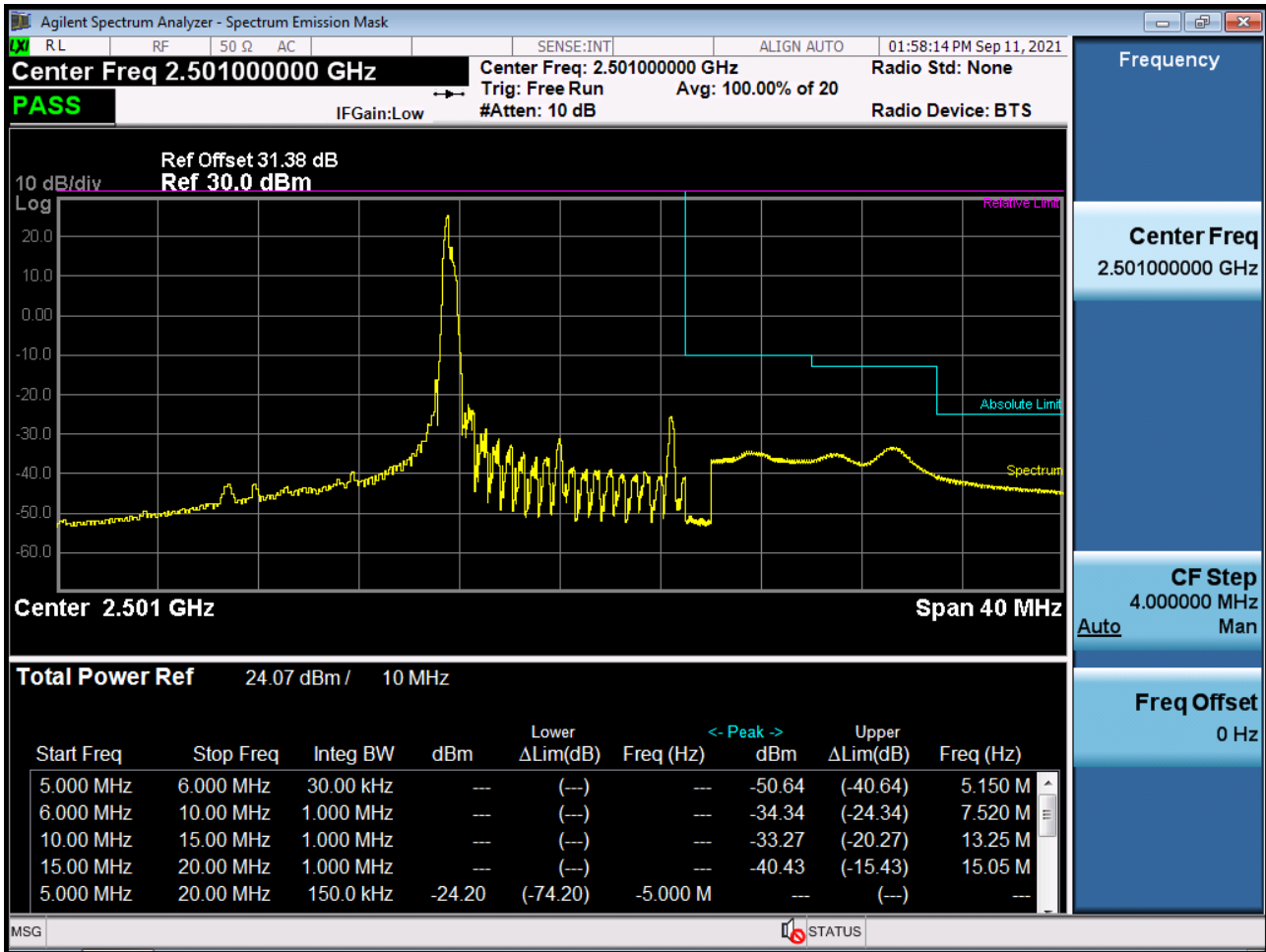
High Channel Edge Plot (5 MHz Ch.41565 QPSK_RB25_Offset 0) (POWER CLASS 2)



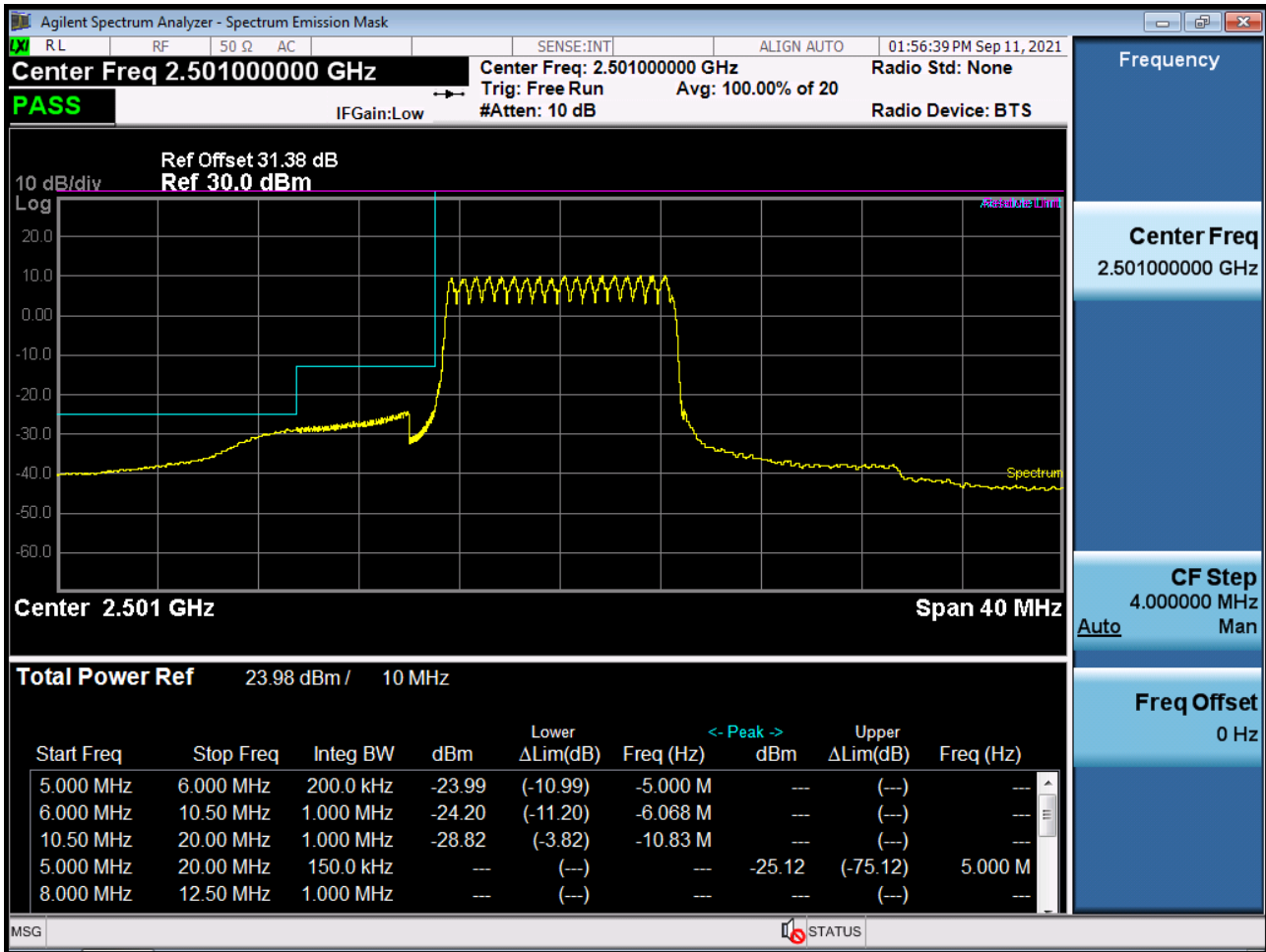
Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-1 (POWER CLASS 2)



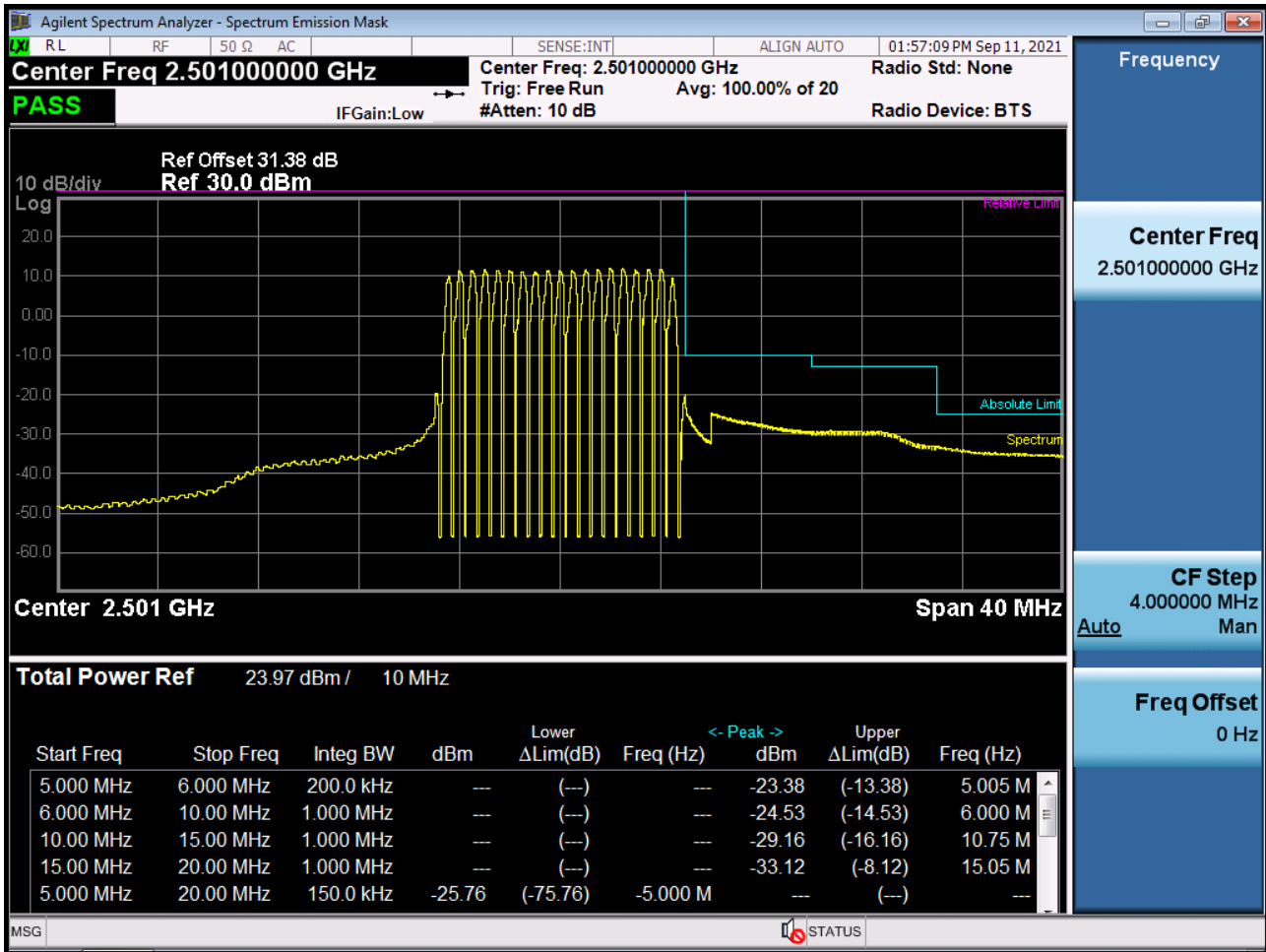
Low Channel Edge Plot (10 MHz Ch.39700 QPSK RB 1, Offset 0)-2 (POWER CLASS 2)



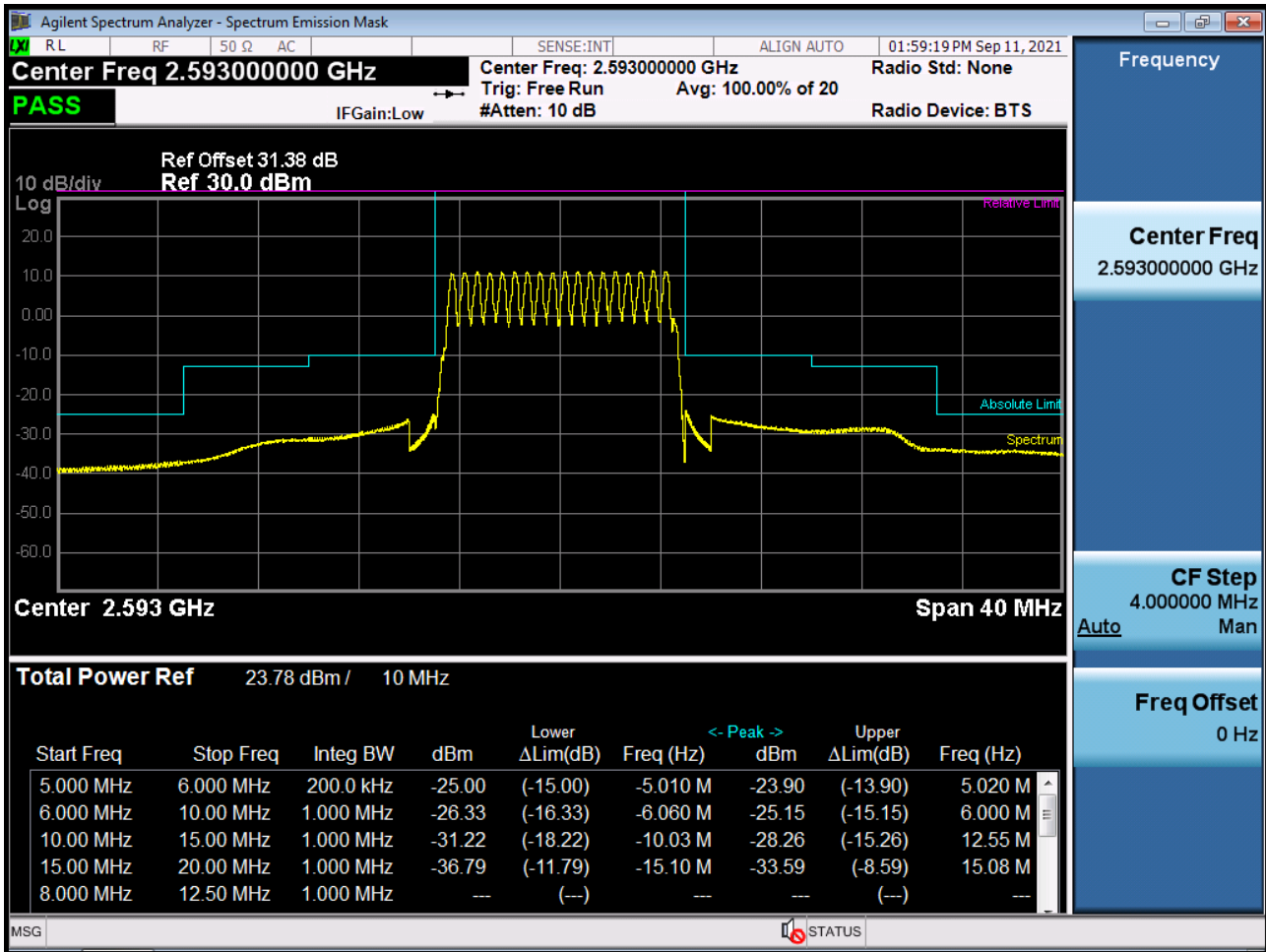
Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-1 (POWER CLASS 2)



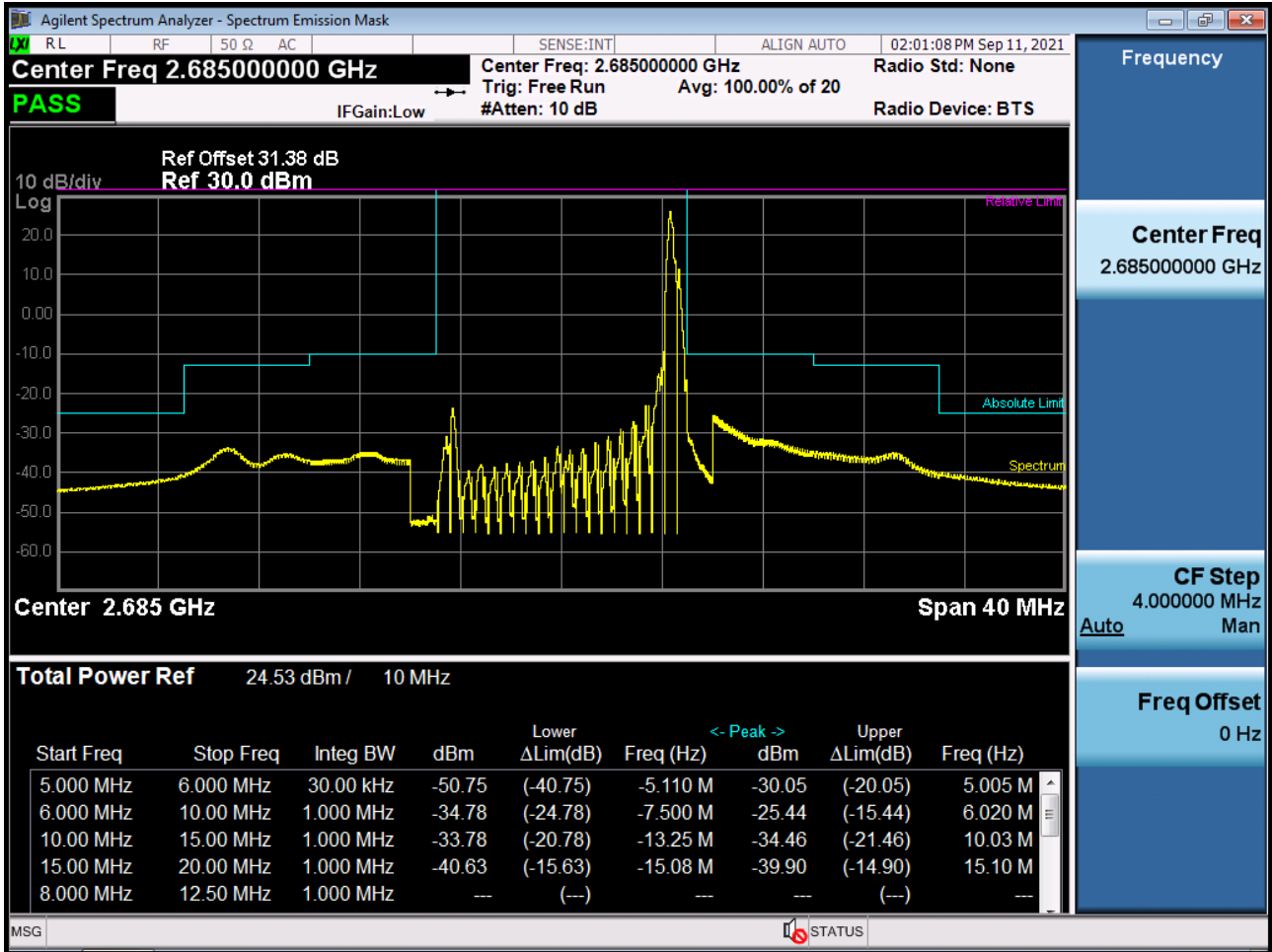
Low Channel Edge Plot (10 MHz Ch.39700 QPSK_RB50_Offset 0)-2 (POWER CLASS 2)



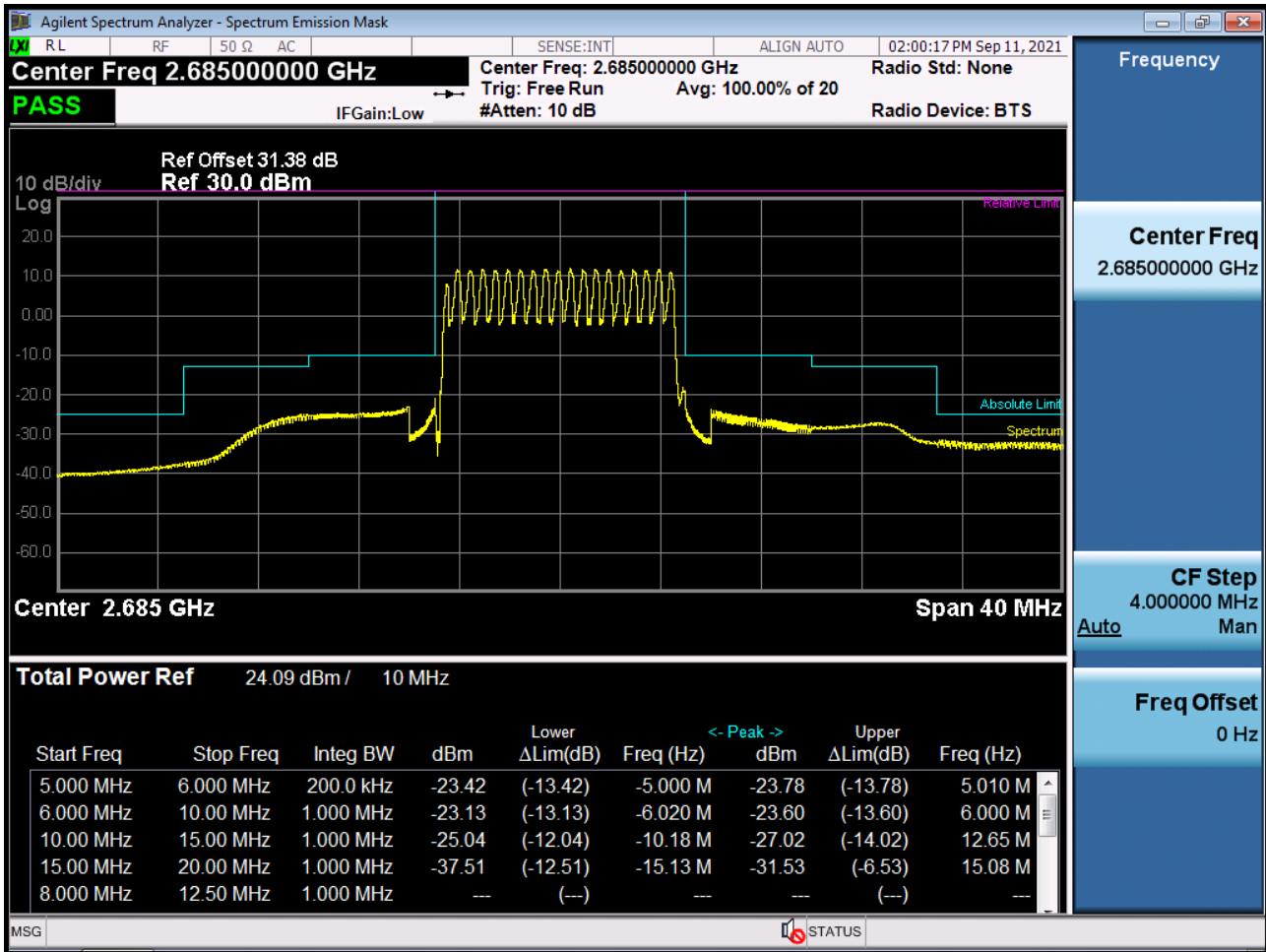
Mid Channel Edge Plot (10 MHz Ch.40620 QPSK RB 50) (POWER CLASS 2)



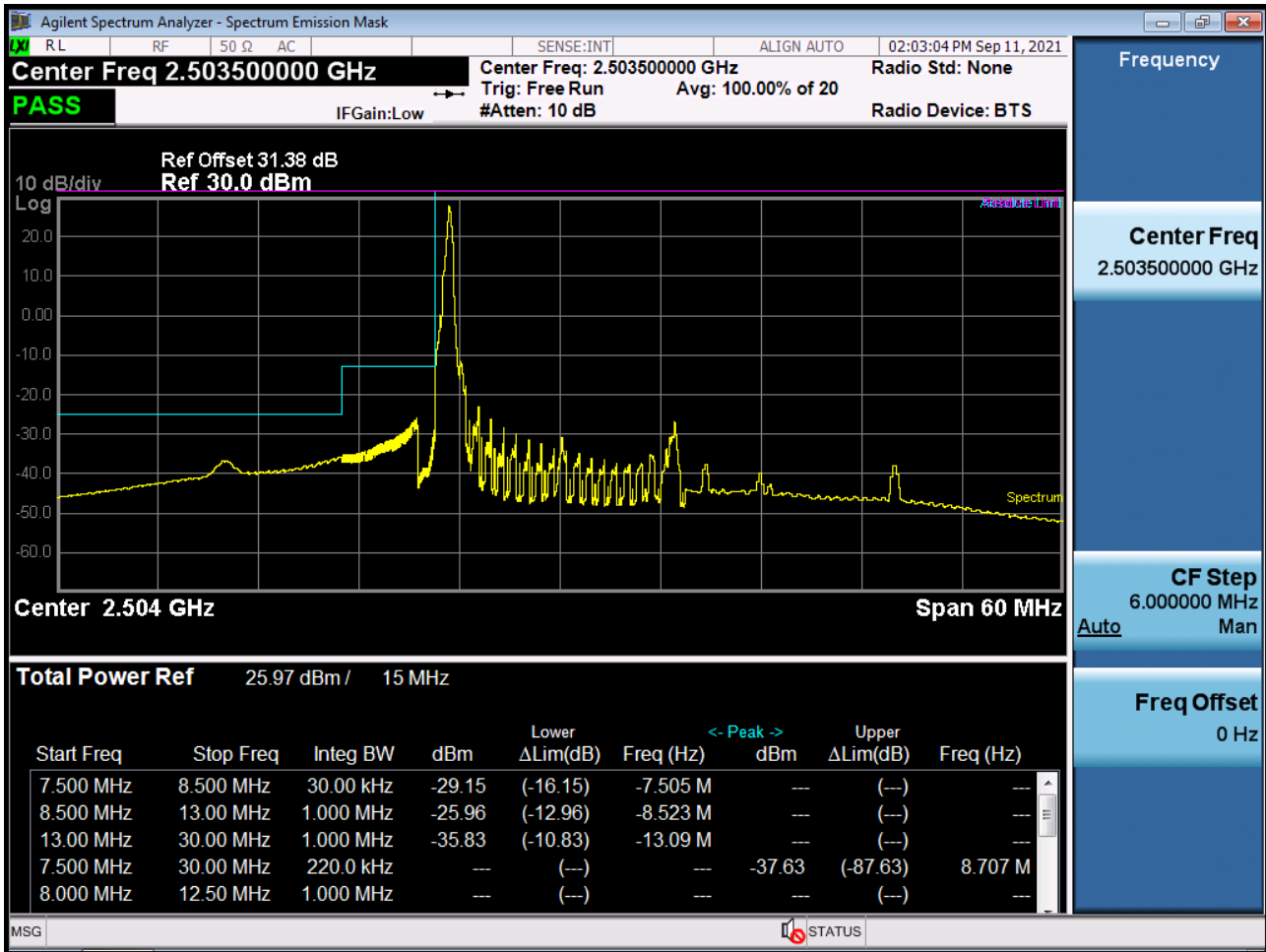
High Channel Edge Plot (10 MHz Ch.41540 QPSK RB 1, Offset 24) (POWER CLASS 2)



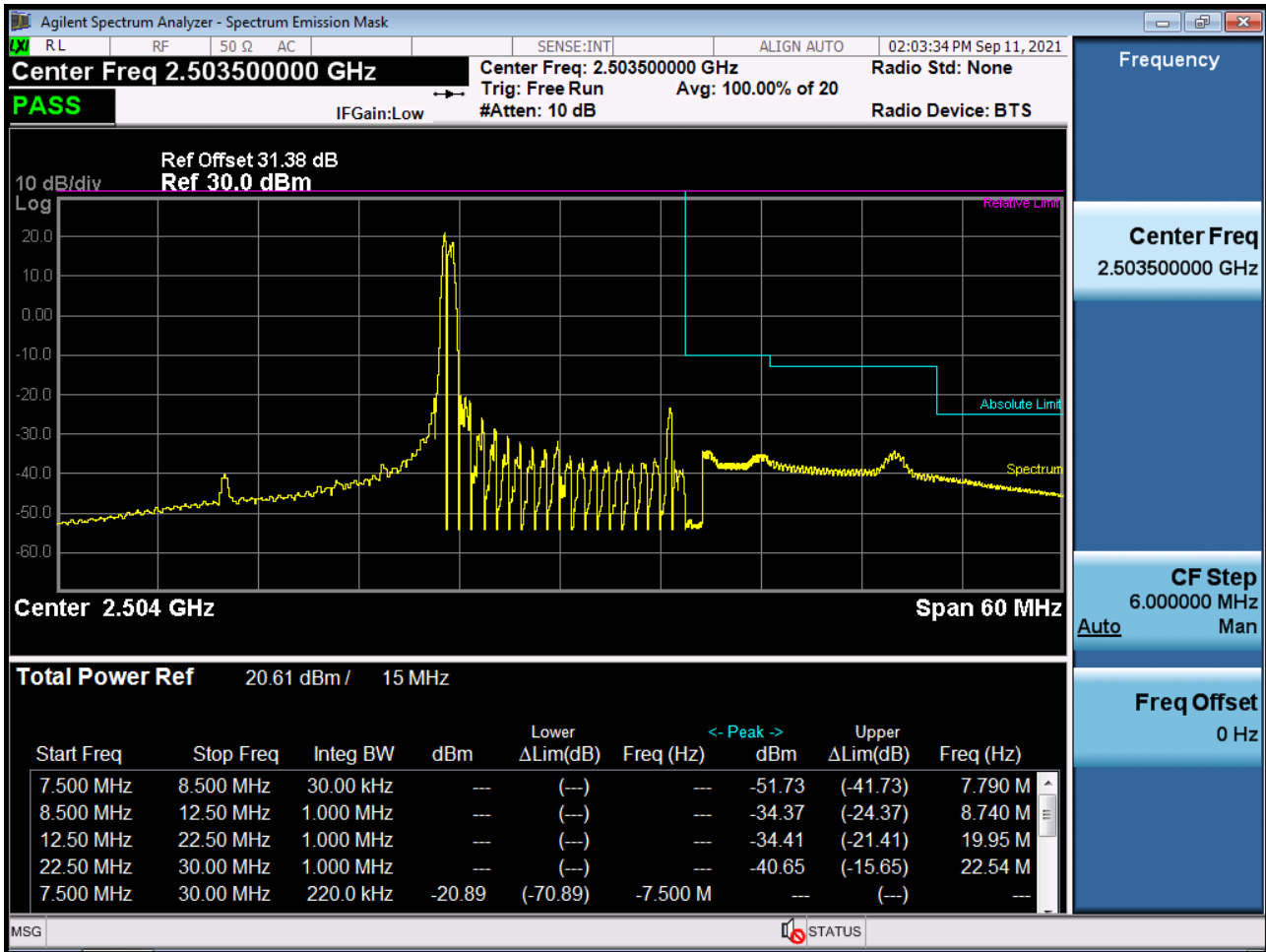
High Channel Edge Plot (10 MHz Ch.41540 QPSK_RB50_Offset 0) (POWER CLASS 2)



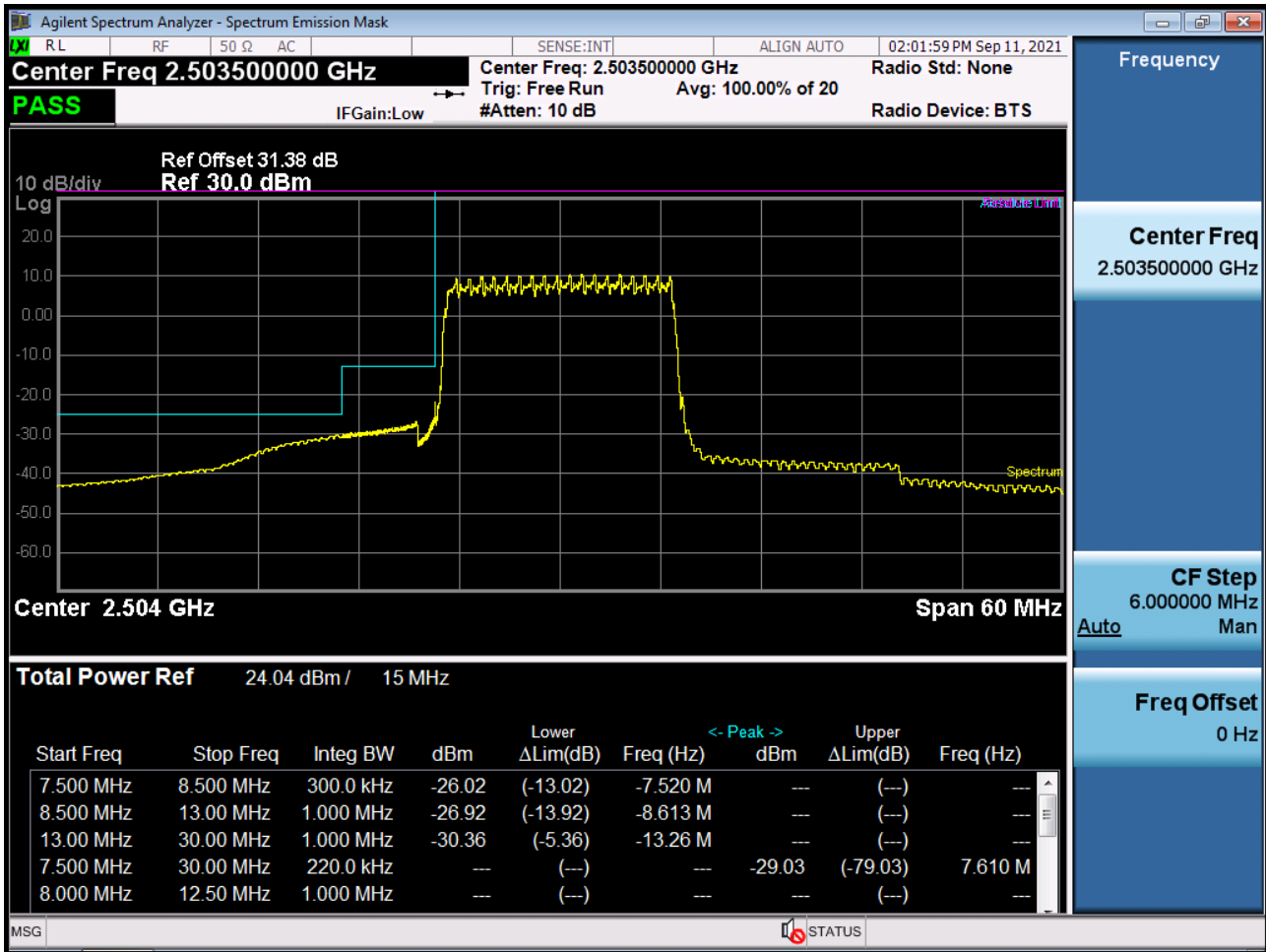
Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-1 (POWER CLASS 2)



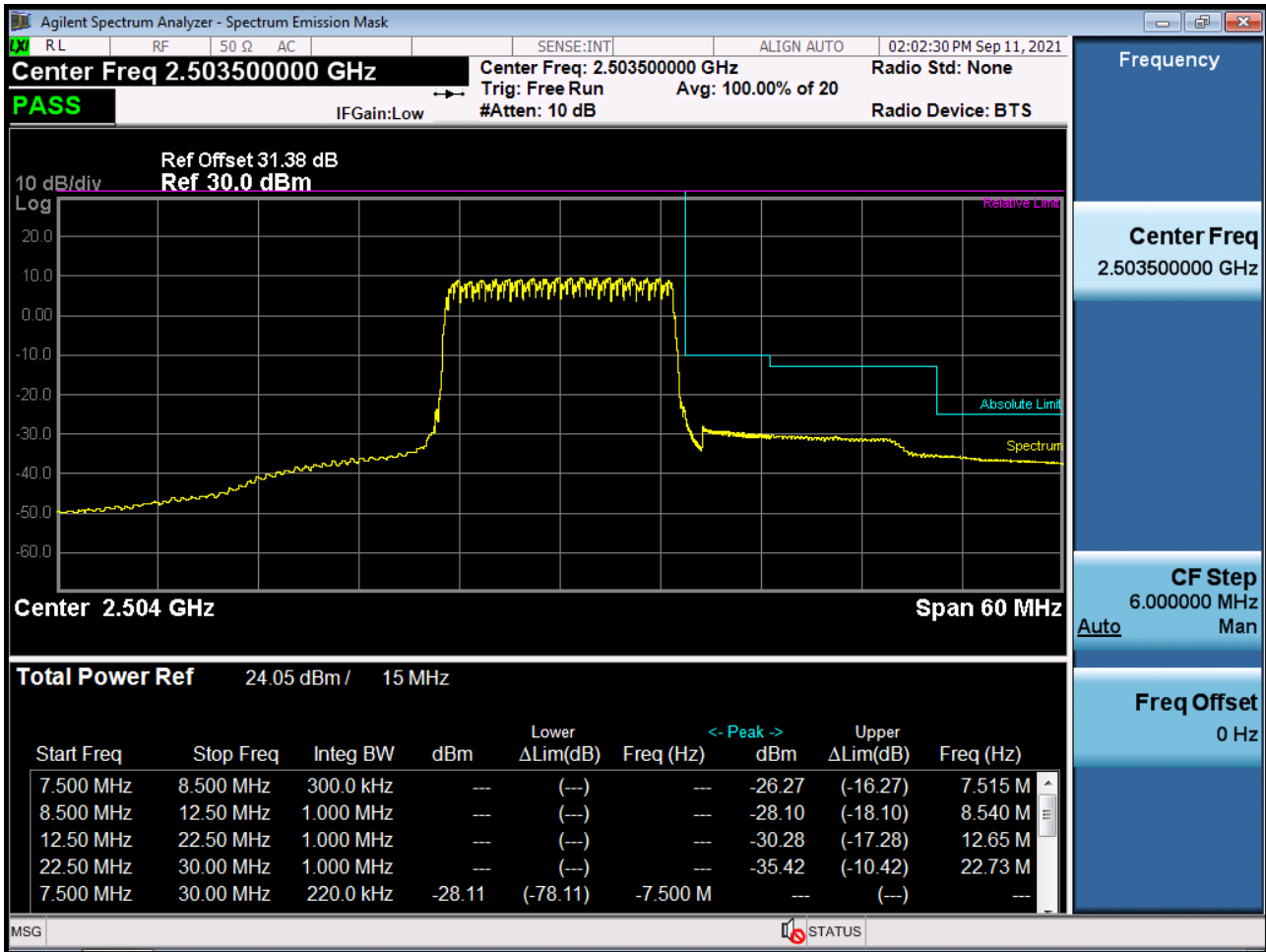
Low Channel Edge Plot (15 MHz Ch.39725 QPSK RB 1, Offset 0)-2 (POWER CLASS 2)



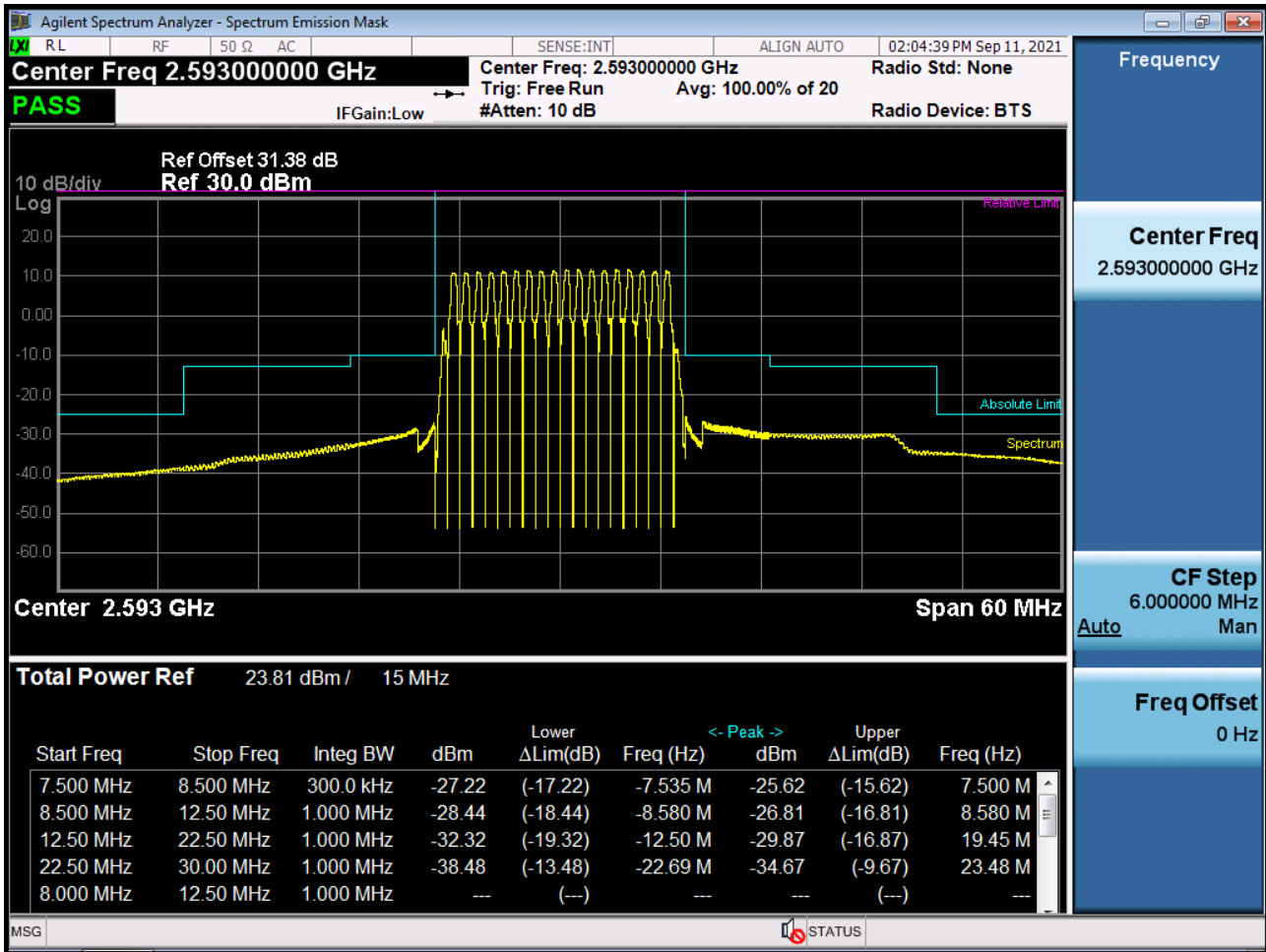
Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-1 (POWER CLASS 2)



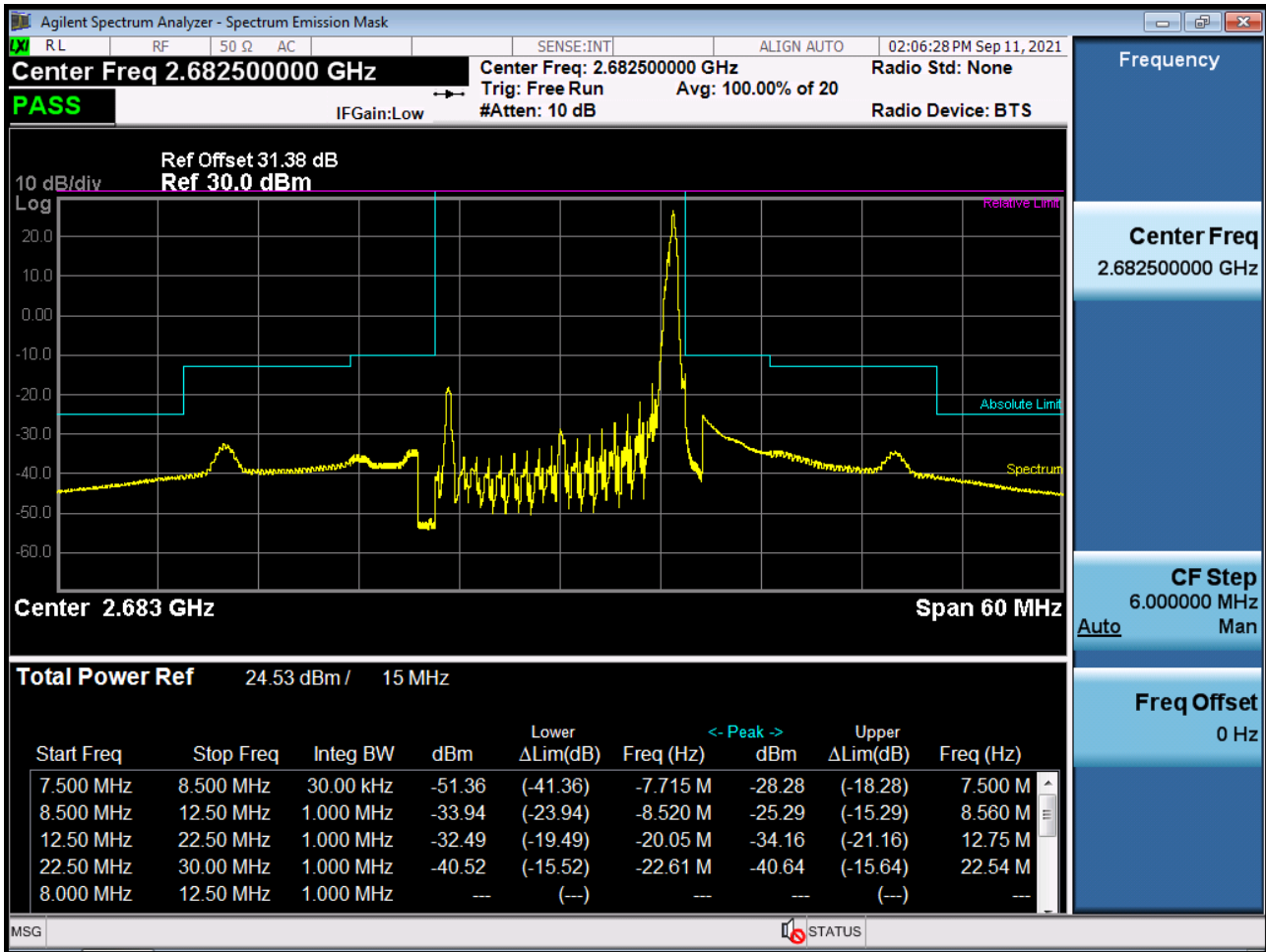
Low Channel Edge Plot (15 MHz Ch.39725 QPSK_RB75_Offset 0)-2 (POWER CLASS 2)



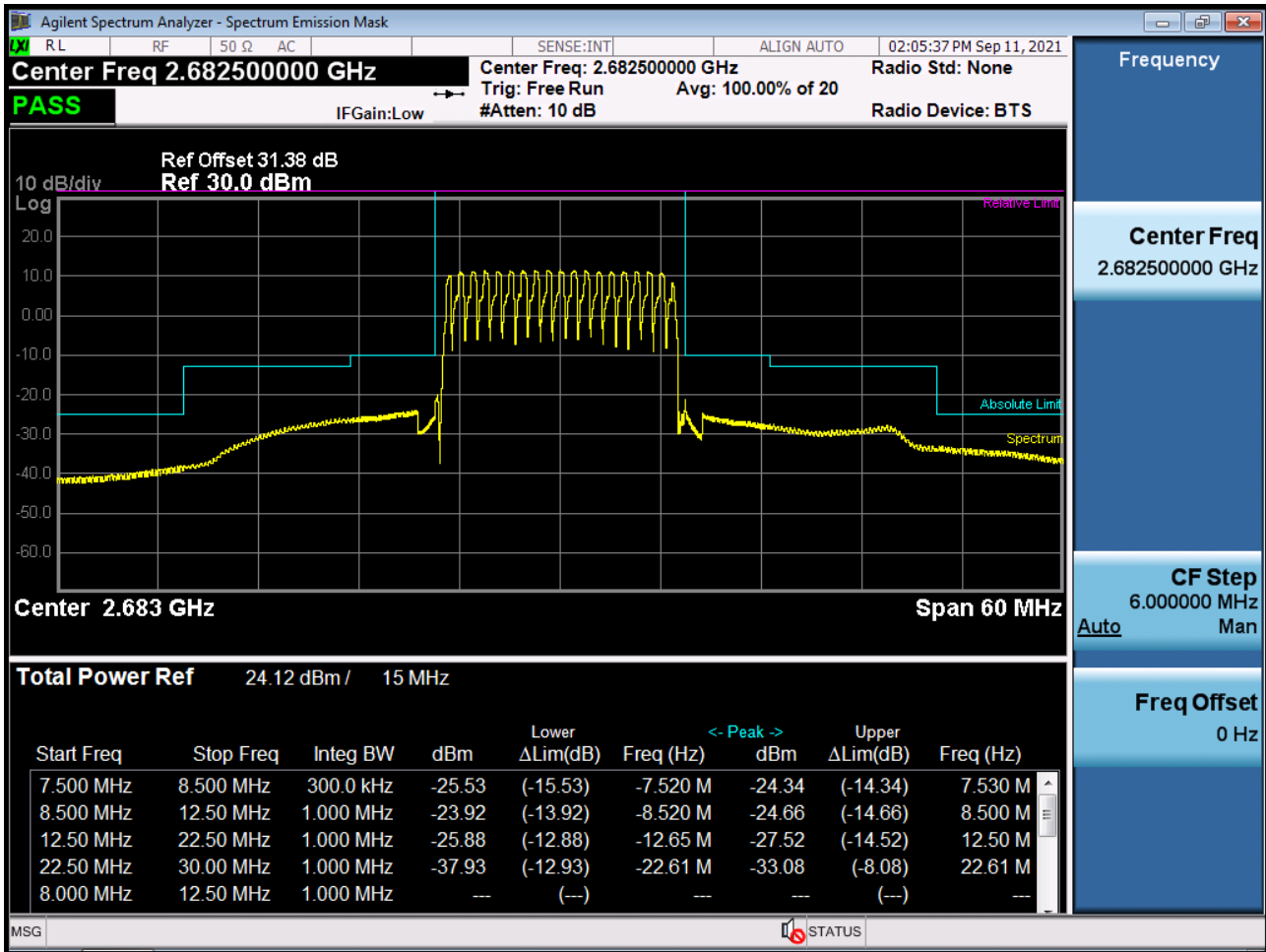
Mid Channel Edge Plot (15 MHz Ch.40620 QPSK RB 75) (POWER CLASS 2)



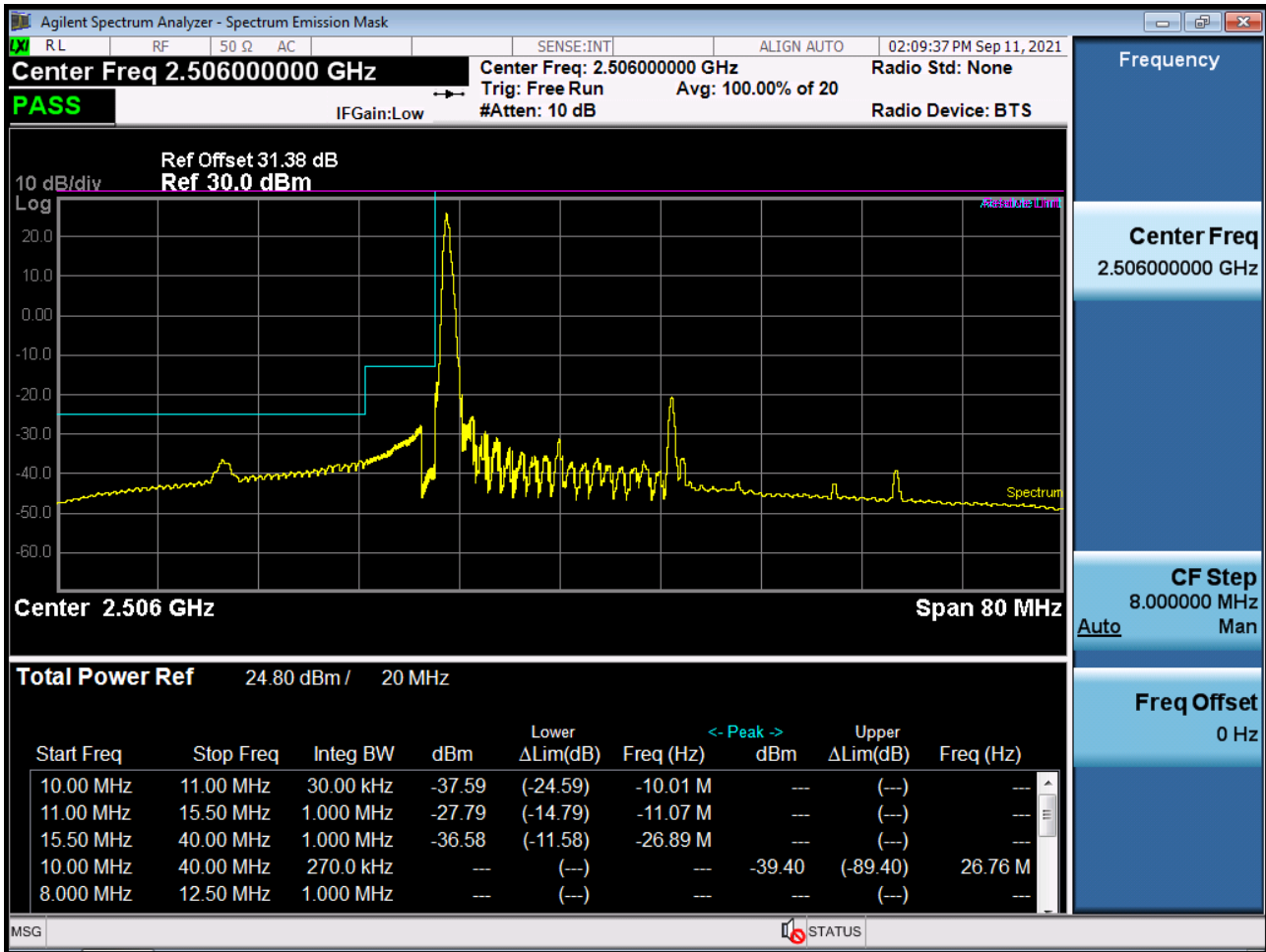
High Channel Edge Plot (15 MHz Ch.41515 QPSK RB 1, Offset 74) (POWER CLASS 2)



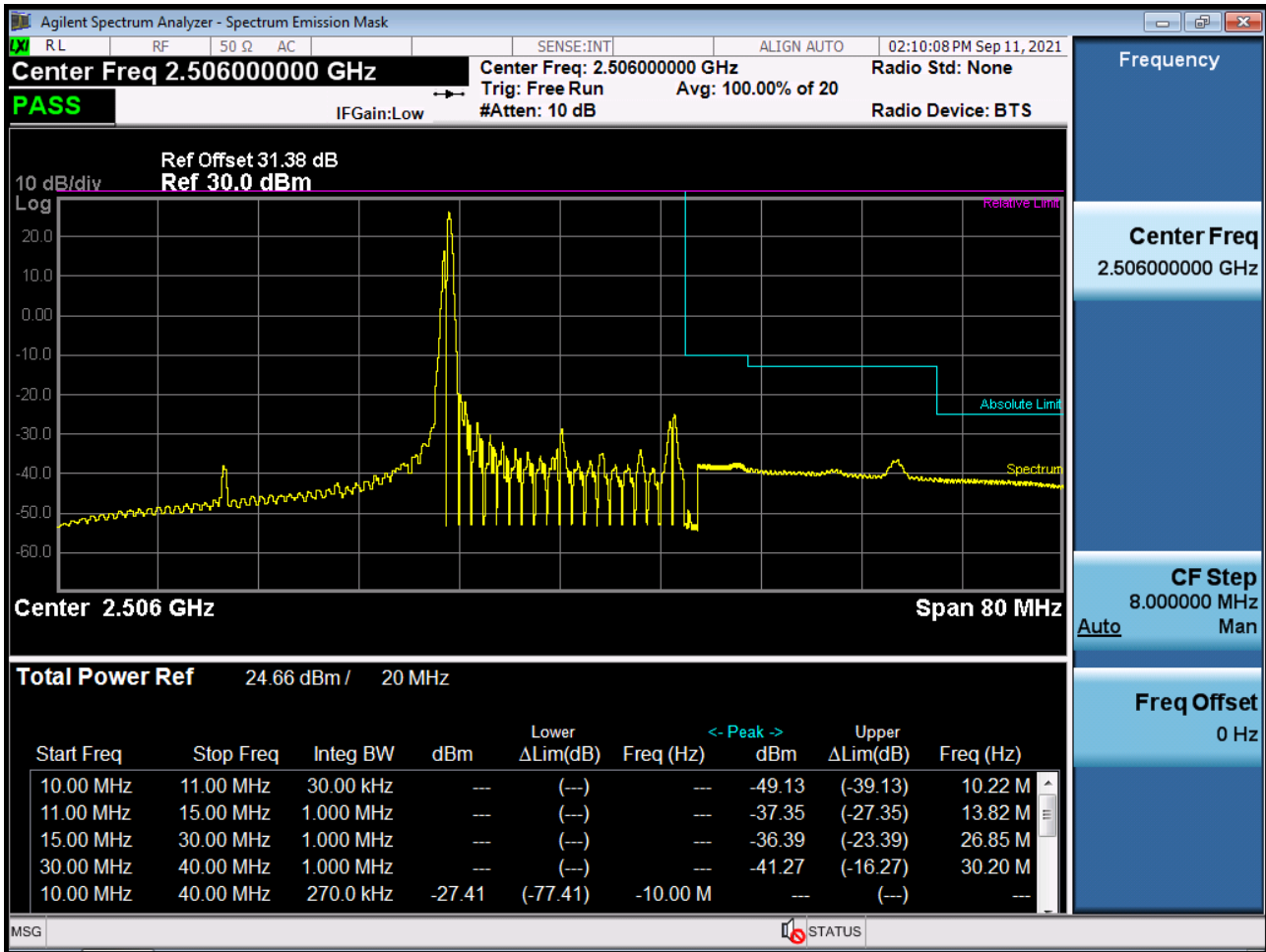
High Channel Edge Plot (15 MHz Ch.41515 QPSK_RB75_Offset 0) (POWER CLASS 2)



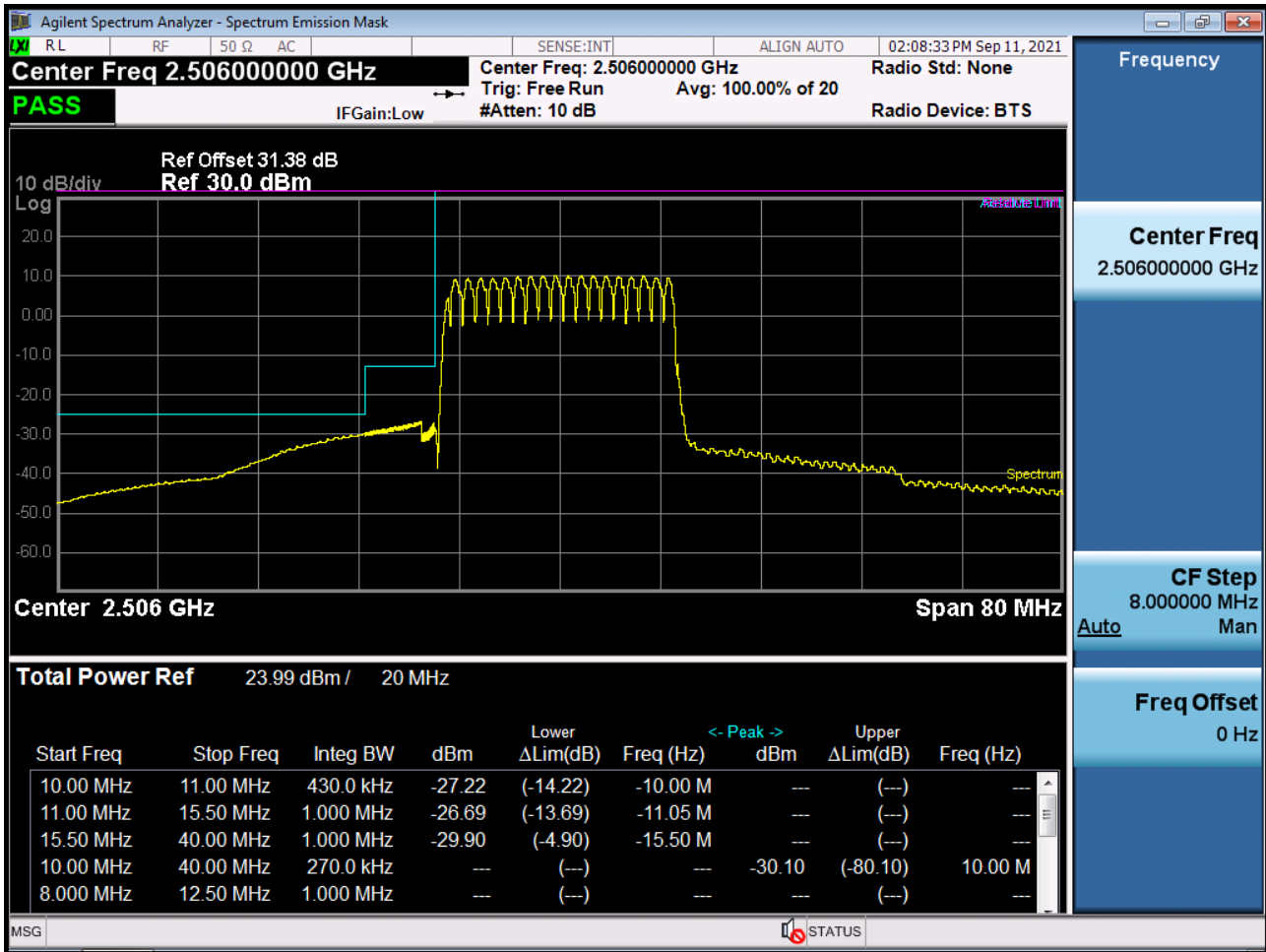
Low Channel Edge Plot (20 MHz Ch.39750 QPSK RB 1, Offset 0)-1 (POWER CLASS 2)



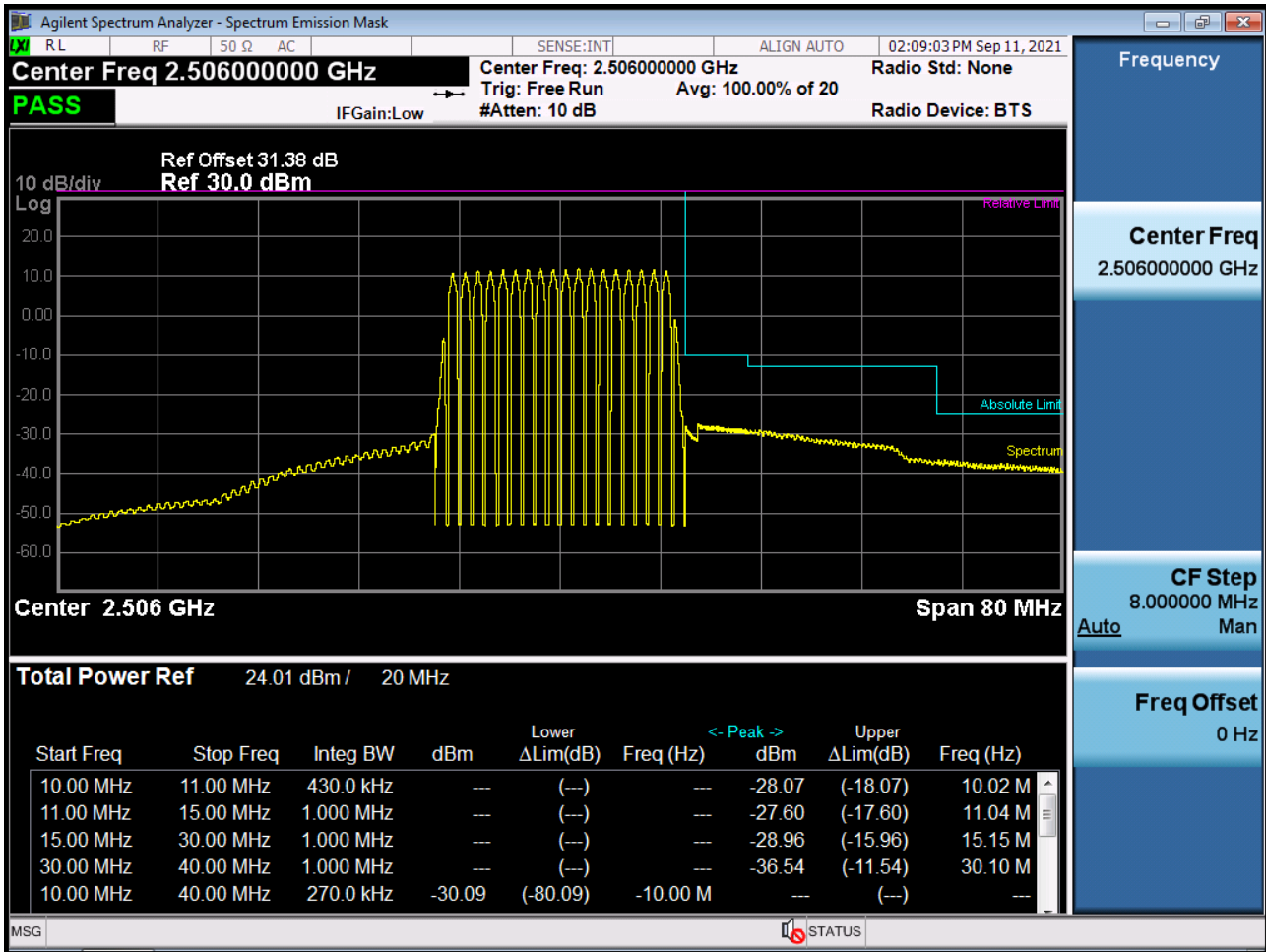
Low Channel Edge Plot (20 MHz Ch.39750 QPSK RB 1, Offset 0)-2 (POWER CLASS 2)



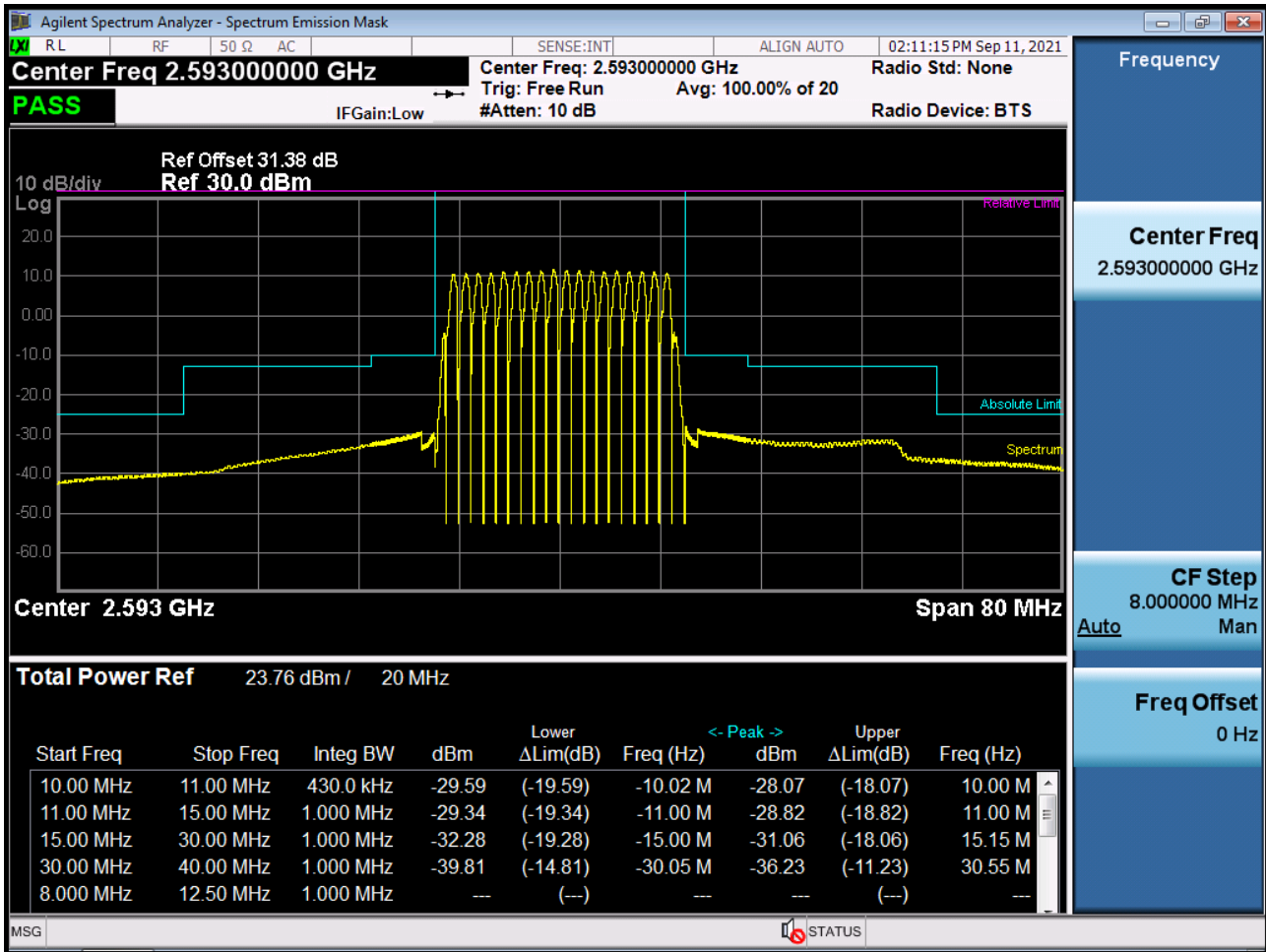
Low Channel Edge Plot (20 MHz Ch.39750 QPSK_RB100_Offset 0)-1 (POWER CLASS 2)



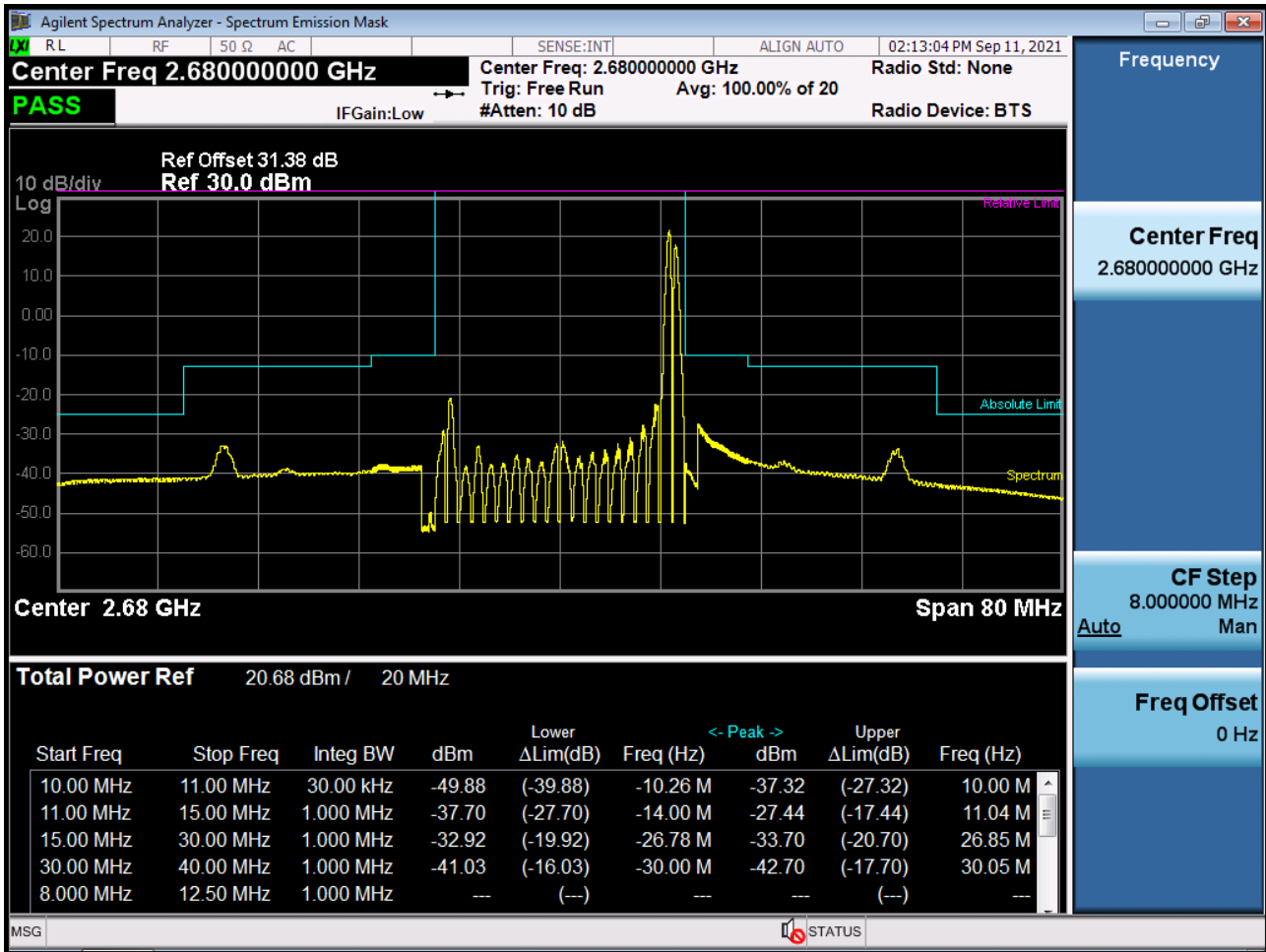
Low Channel Edge Plot (20 MHz Ch.39750 QPSK_RB100_Offset 0)-2 (POWER CLASS 2)



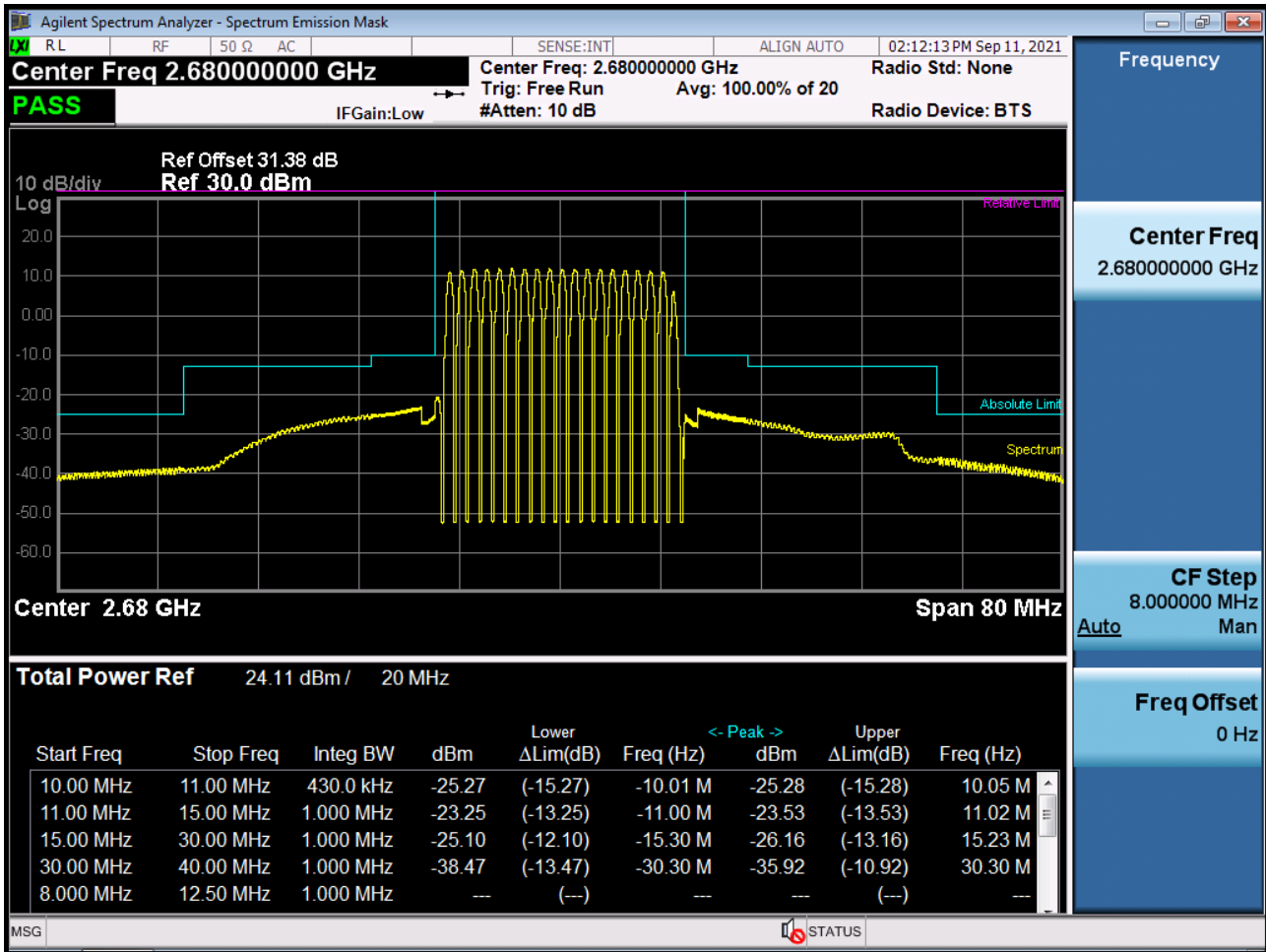
Mid Channel Edge Plot (20 MHz Ch.40620 QPSK RB 100) (POWER CLASS 2)



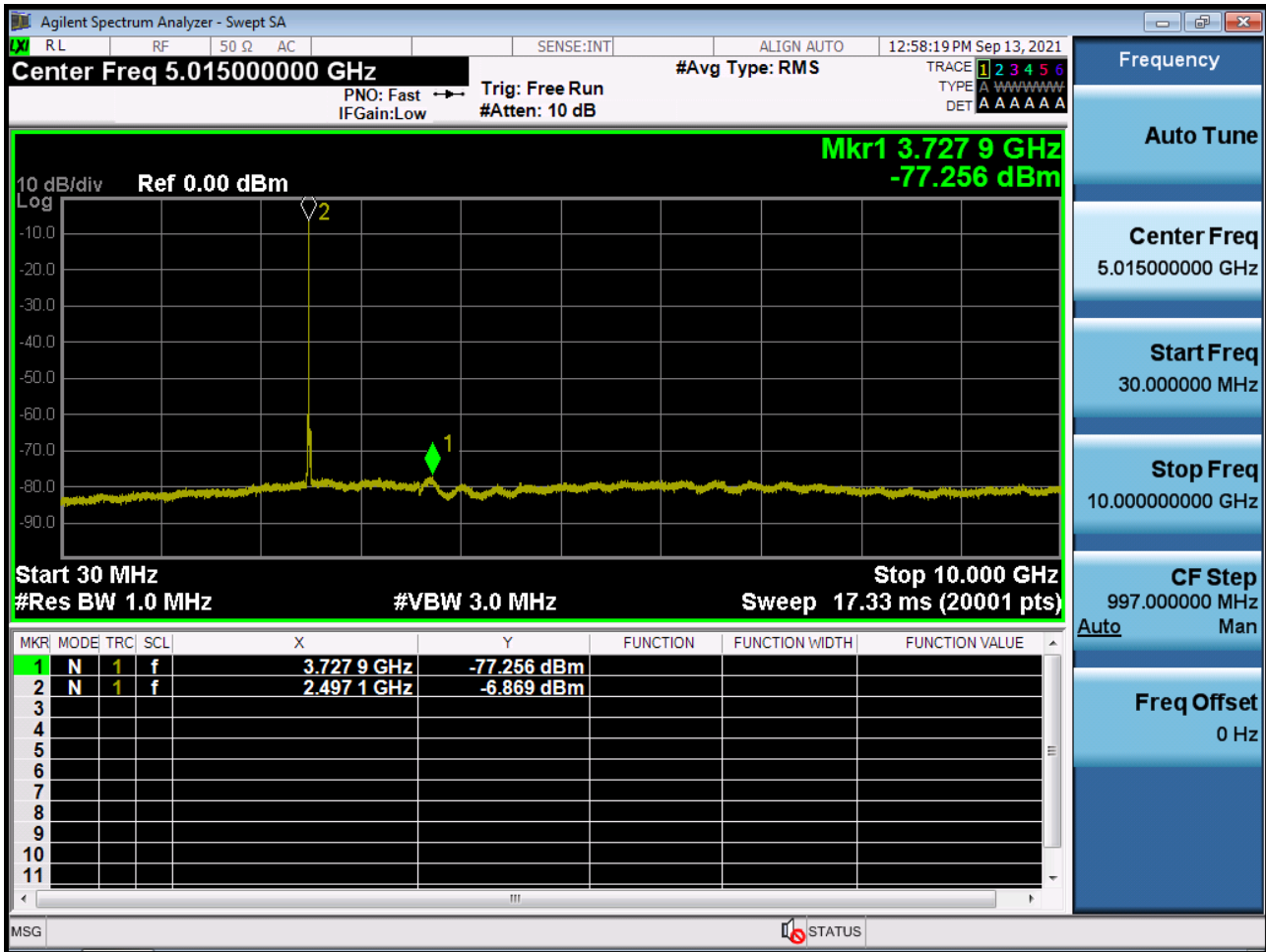
High Channel Edge Plot (20 MHz Ch.41490 QPSK RB 1, Offset 99) (POWER CLASS 2)



High Channel Edge Plot (20 MHz Ch.41490 QPSK_RB100_Offset 0) (POWER CLASS 2)



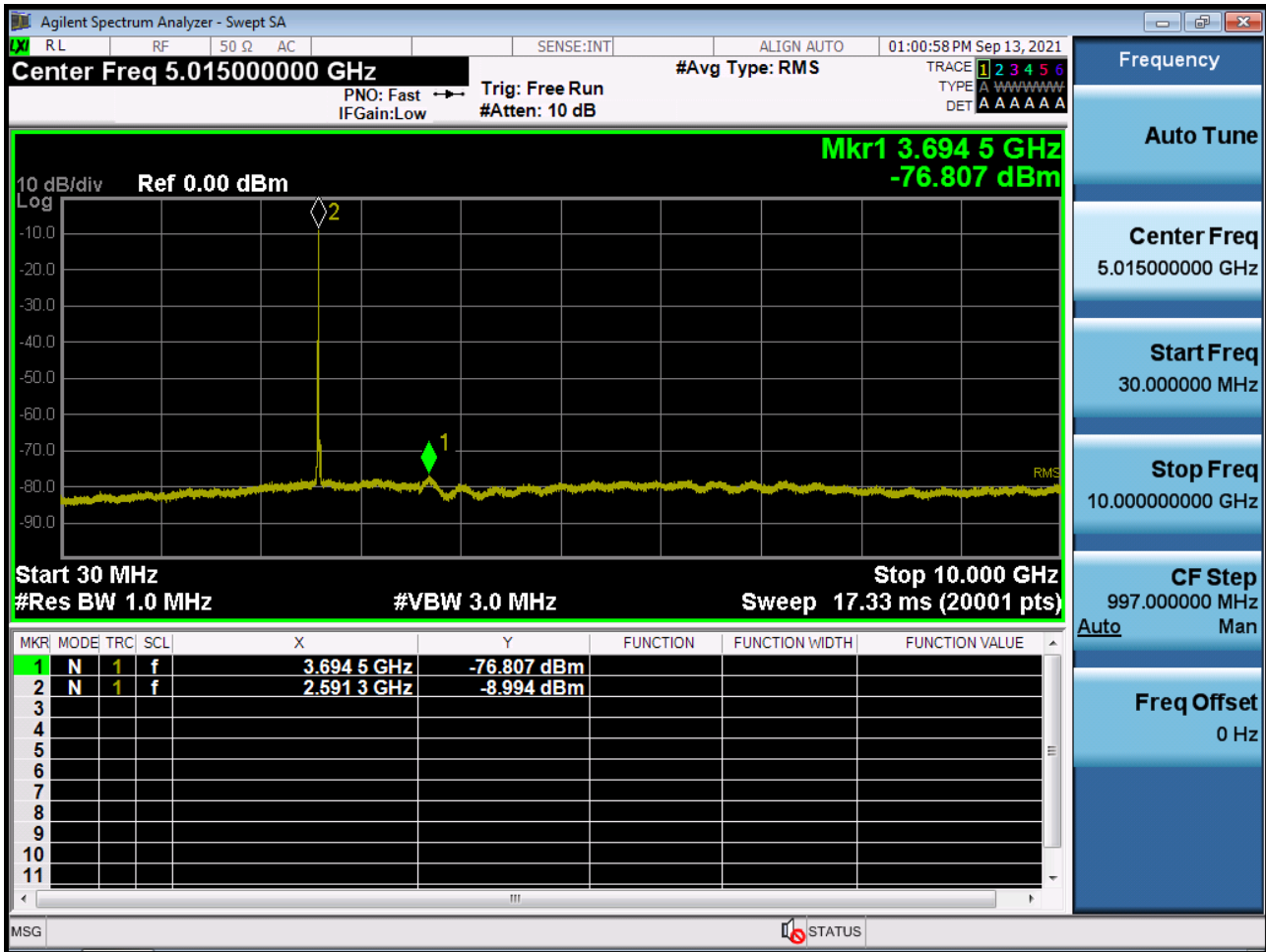
Conducted Spurious Plot 1 (5 MHz Ch.39675 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



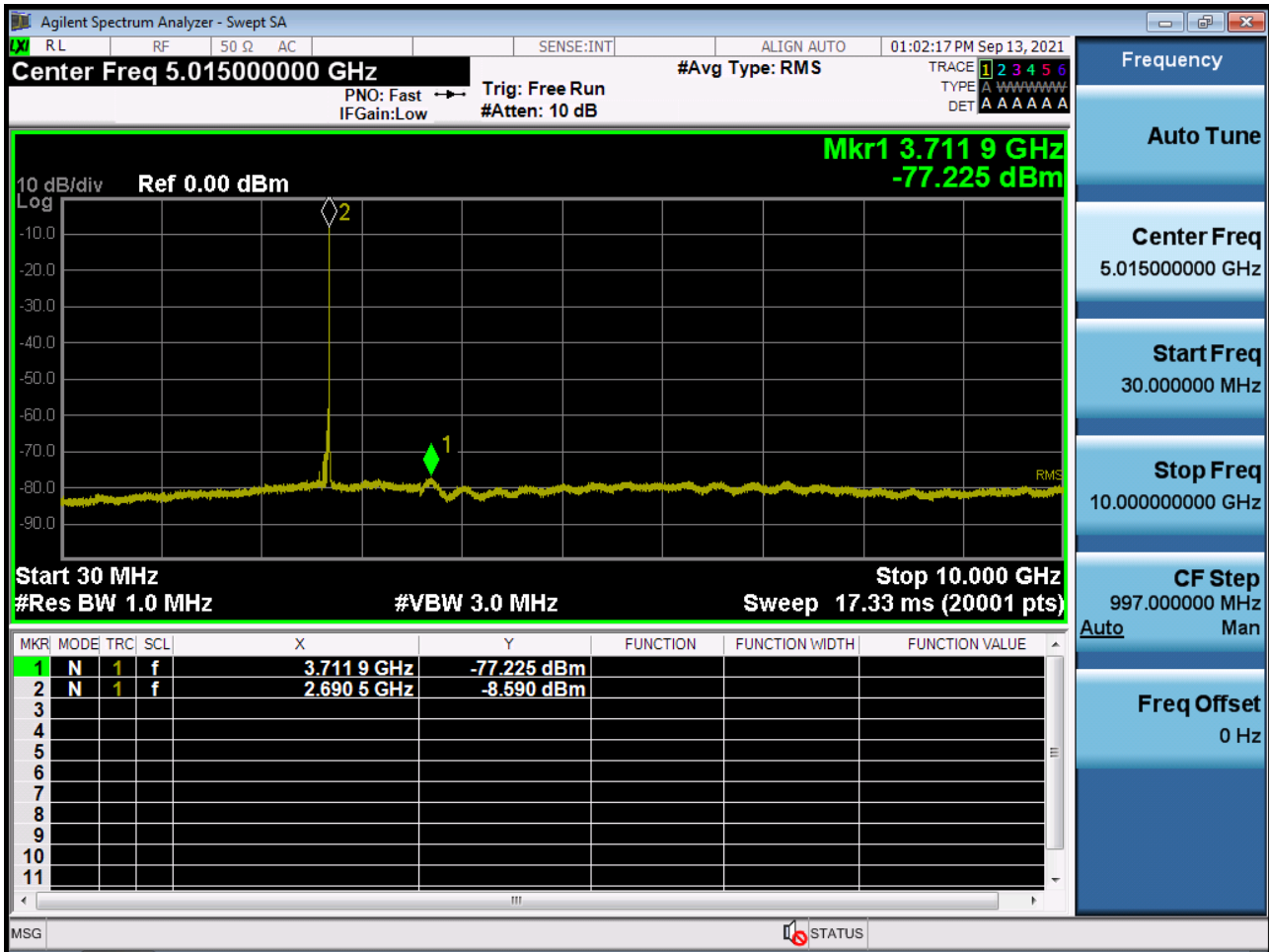
Conducted Spurious Plot 1 (5 MHz Ch.40620 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



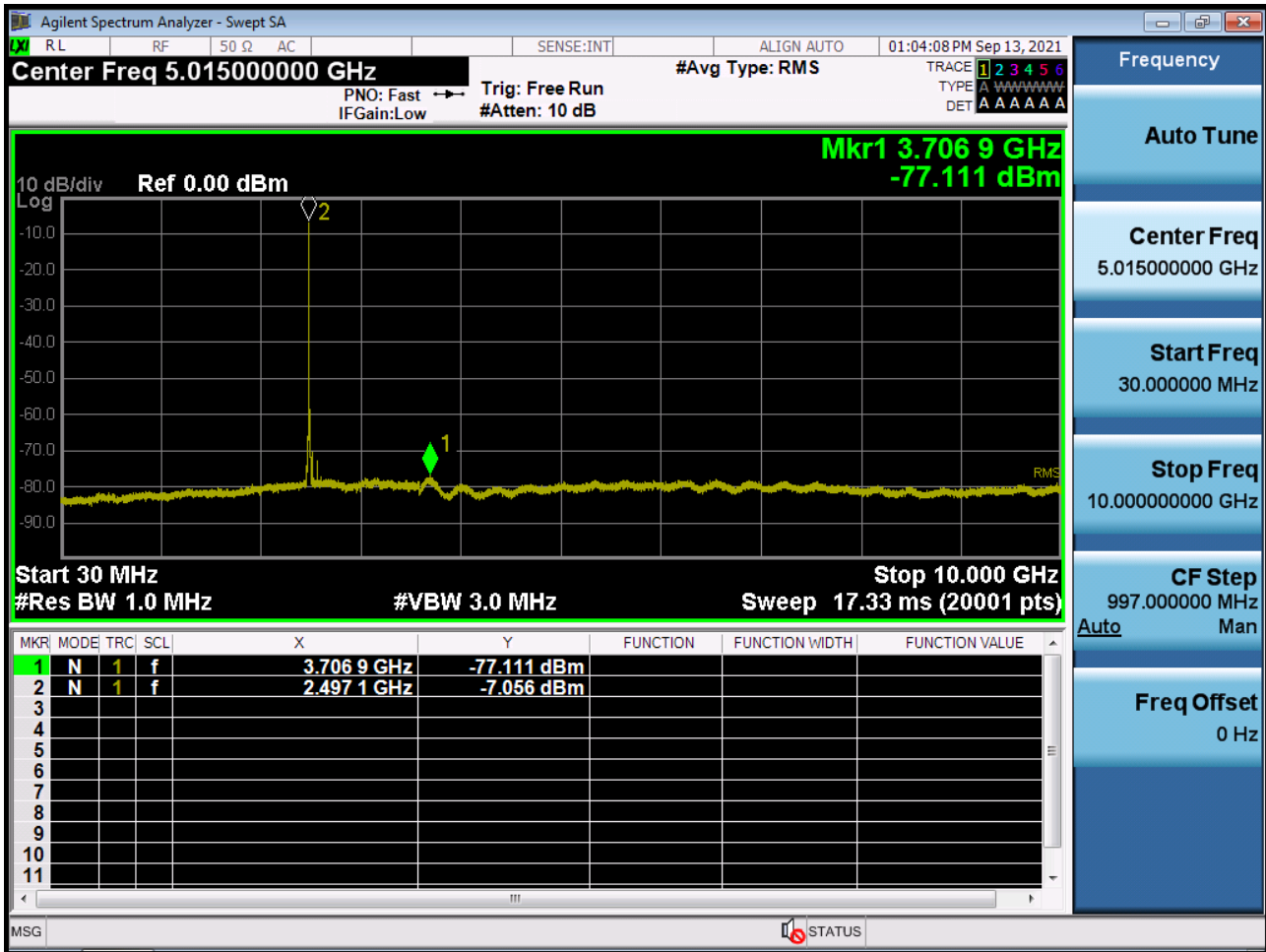
Conducted Spurious Plot 1 (5 MHz Ch.41565 QPSK RB 1, Offset 0) (POWER CLASS 2)



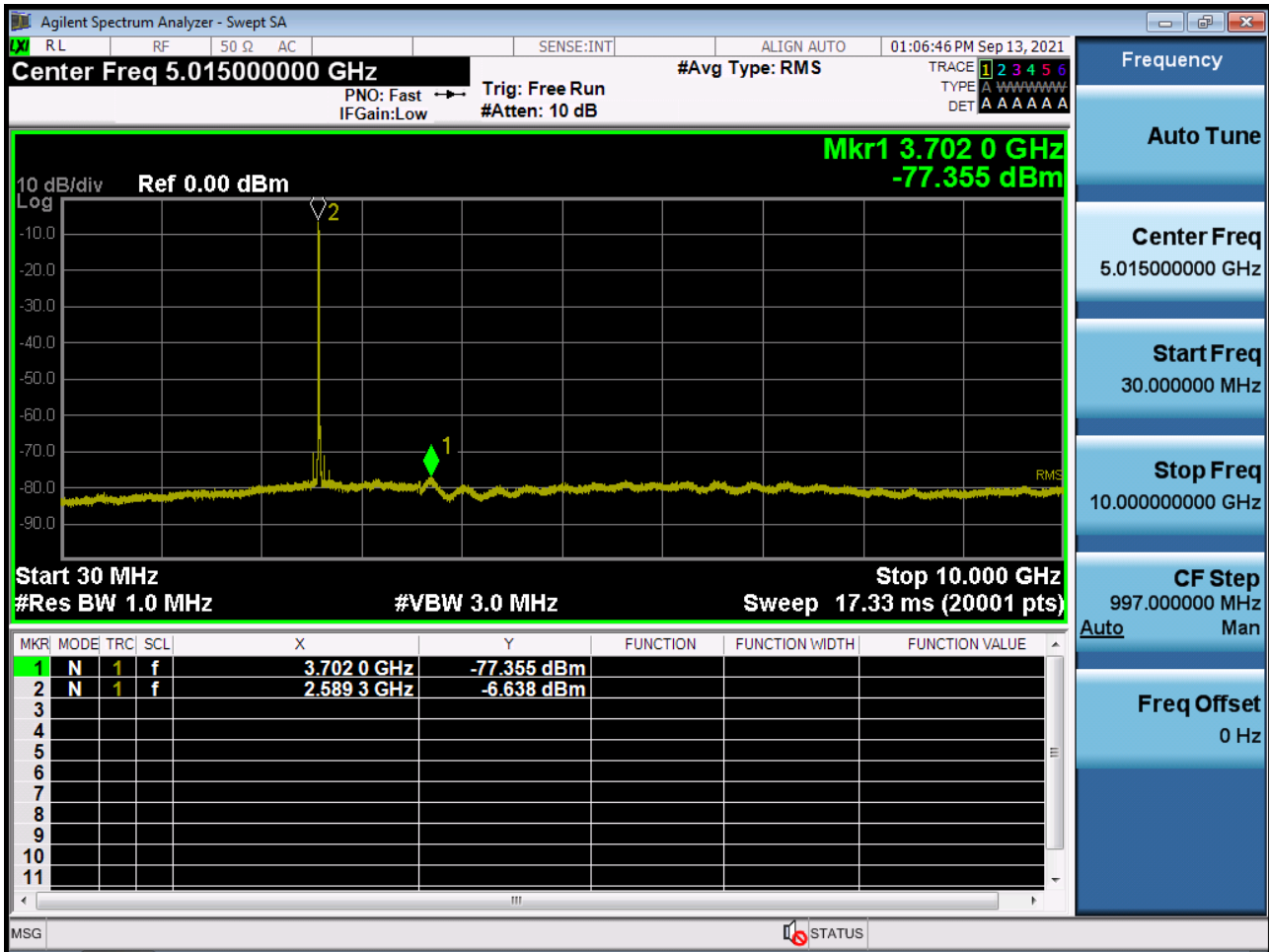
Conducted Spurious Plot 2 (5 MHz Ch. 41565 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



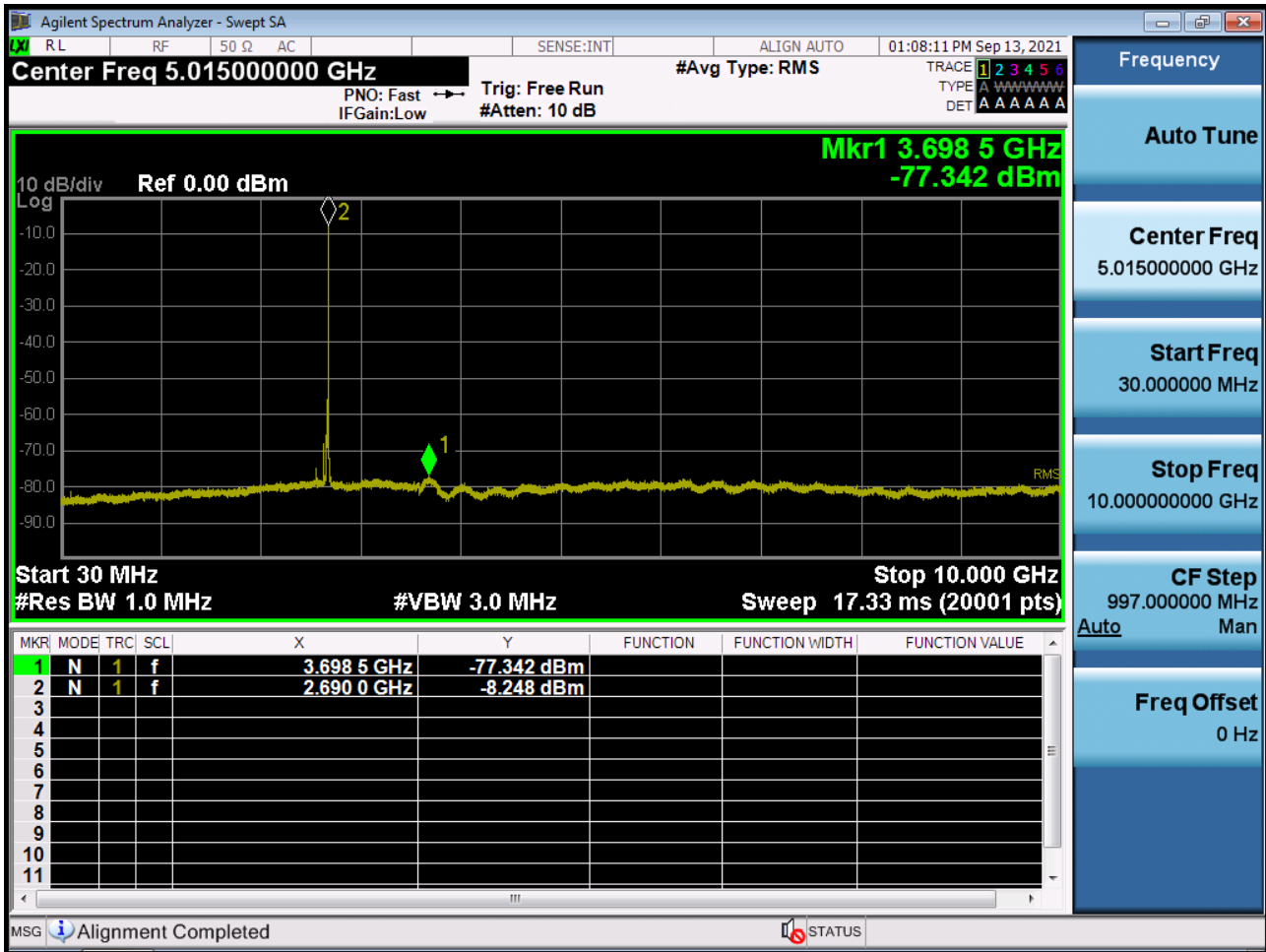
Conducted Spurious Plot 1 (10 MHz Ch.40620 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



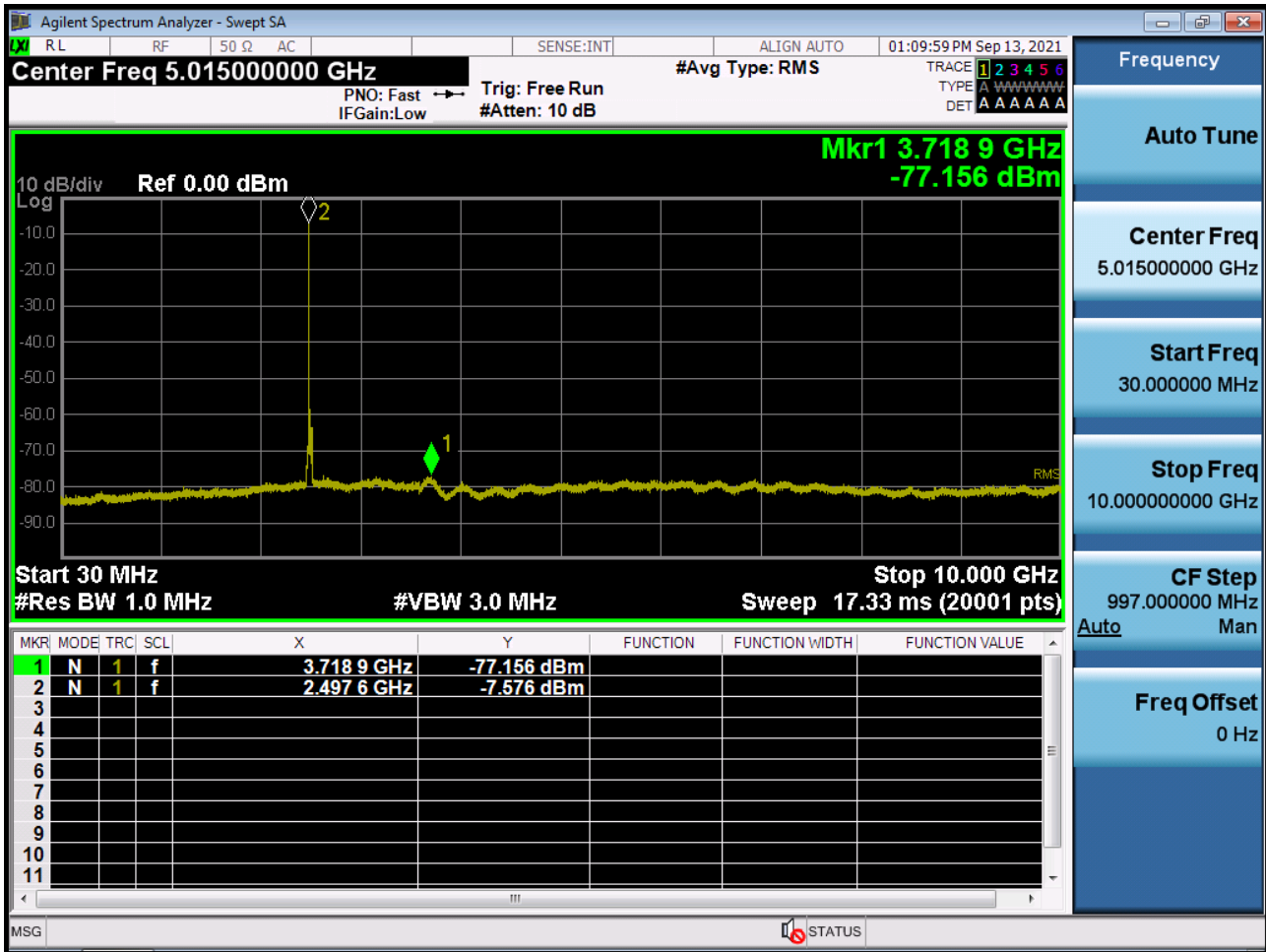
Conducted Spurious Plot 1 (10 MHz Ch. 41540 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



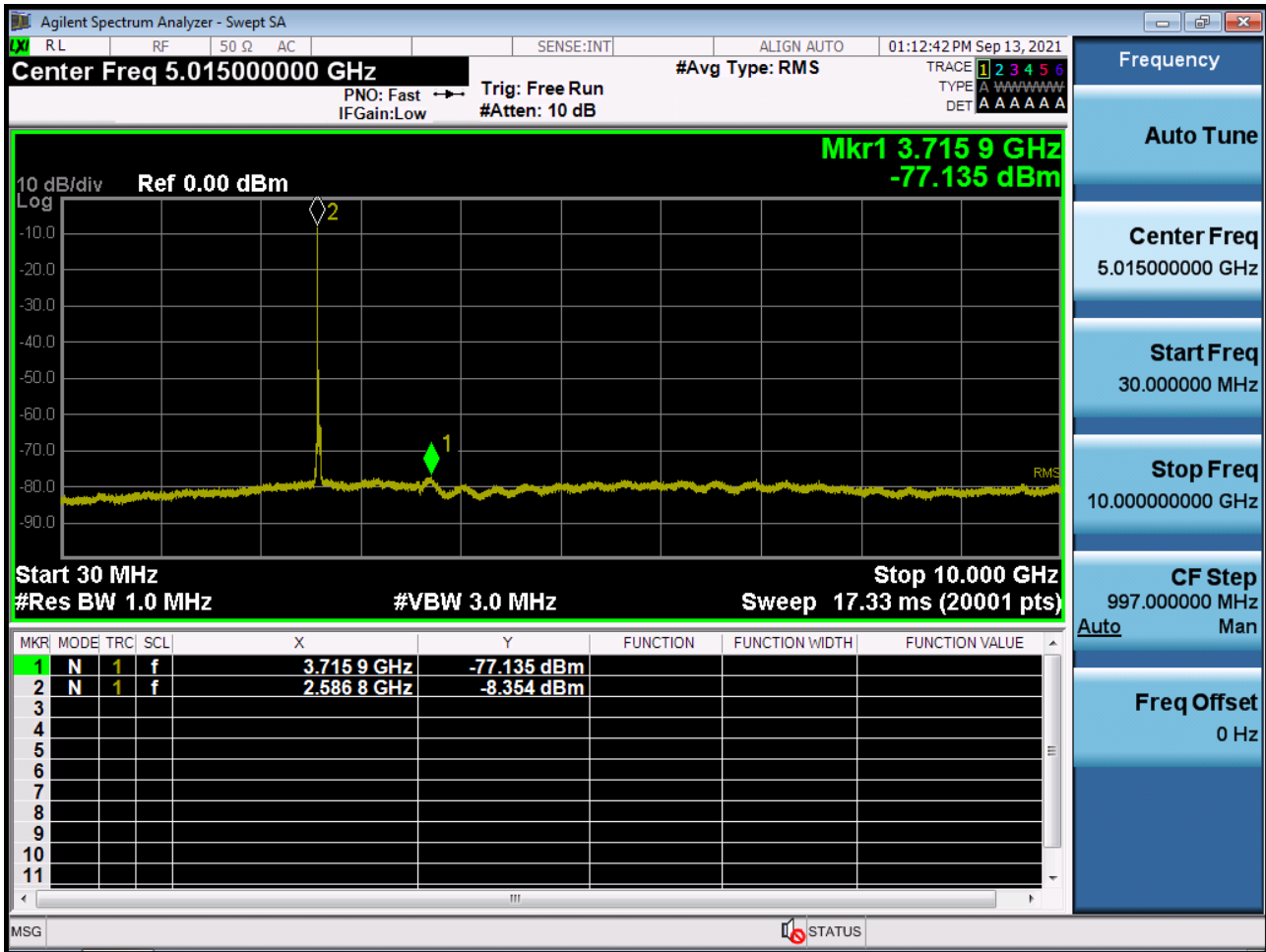
Conducted Spurious Plot 1 (15 MHz Ch.39725 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



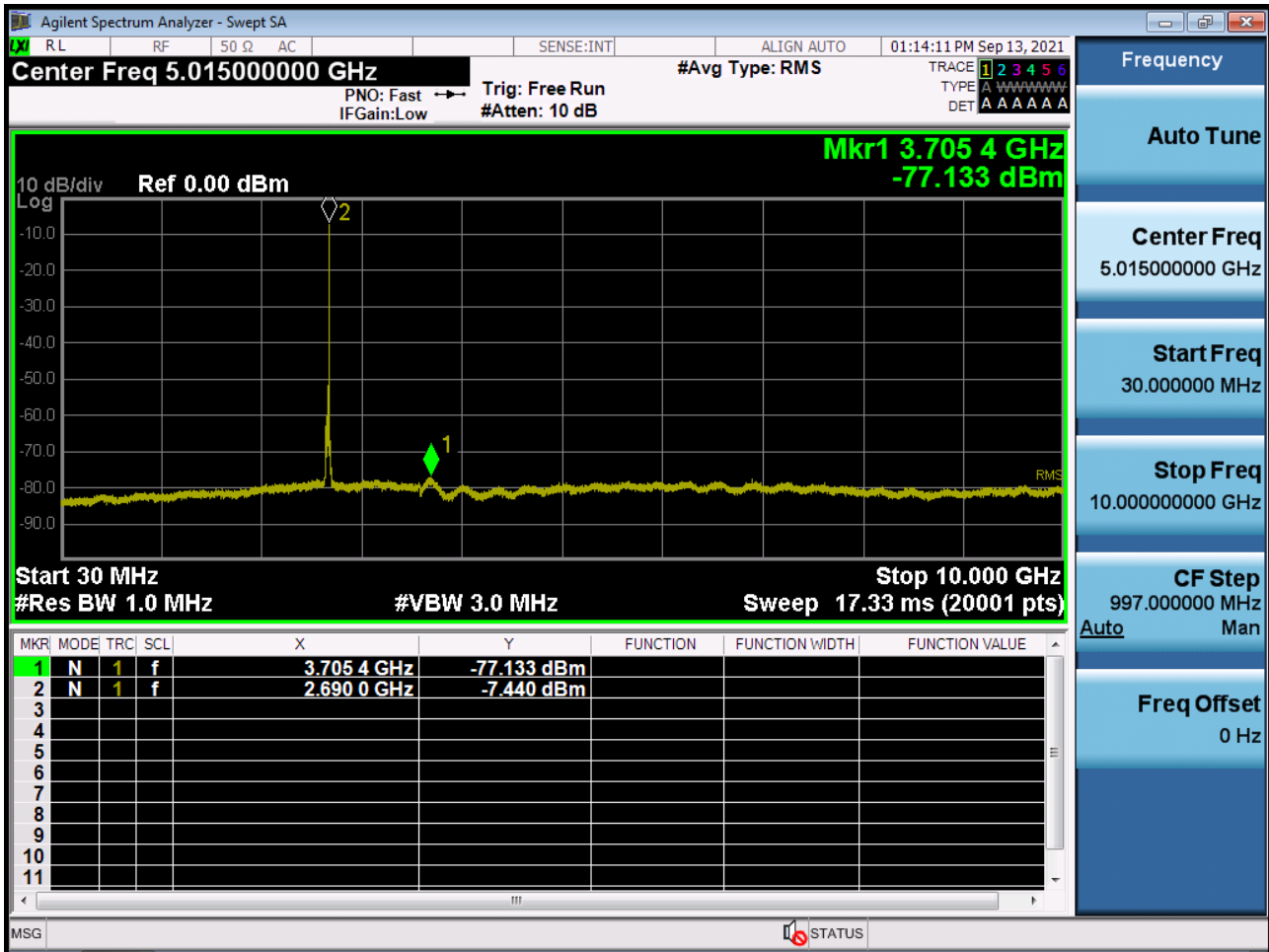
Conducted Spurious Plot 1 (15 MHz Ch.40620 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



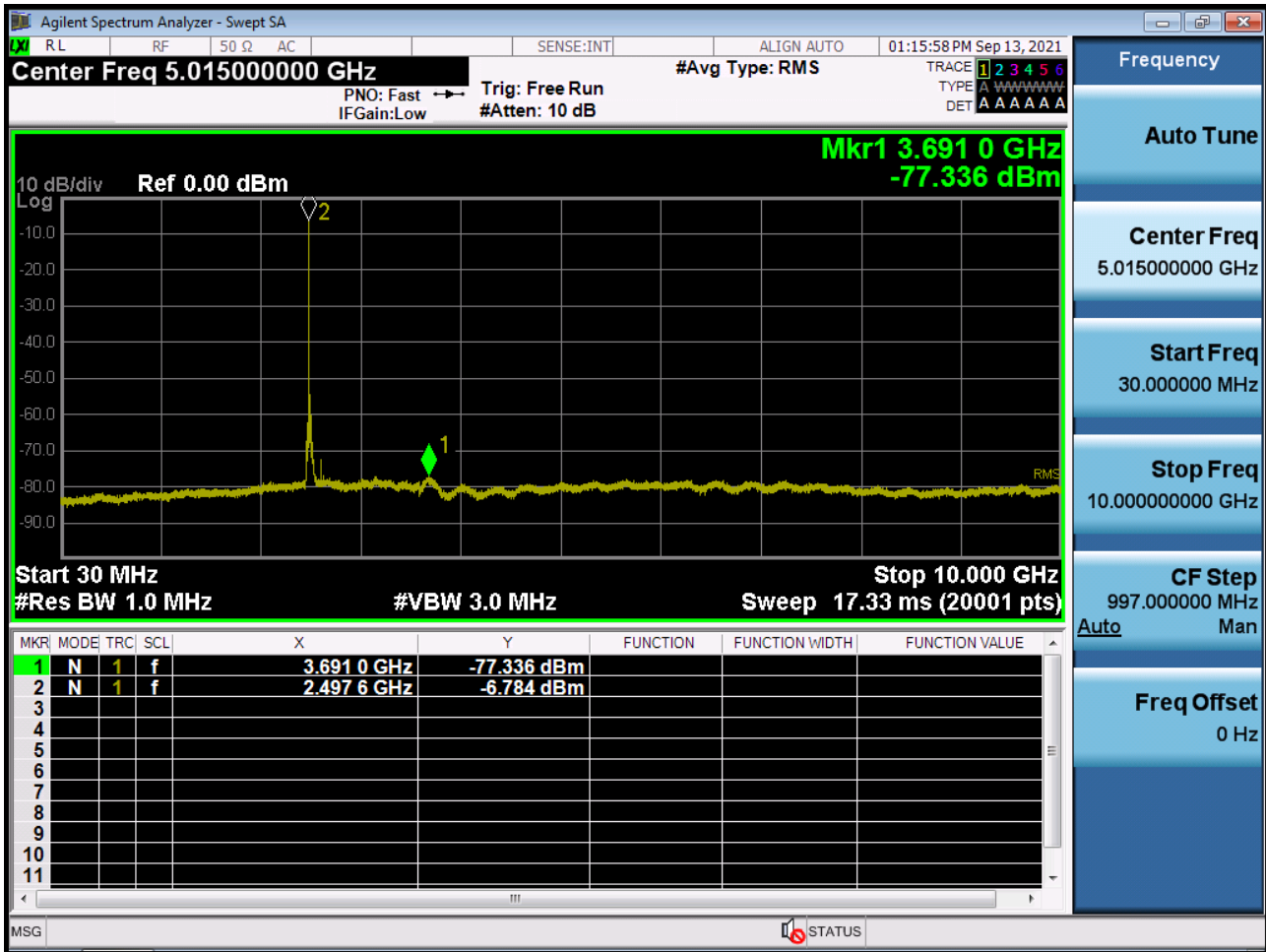
Conducted Spurious Plot 1 (15 MHz Ch.41515 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



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



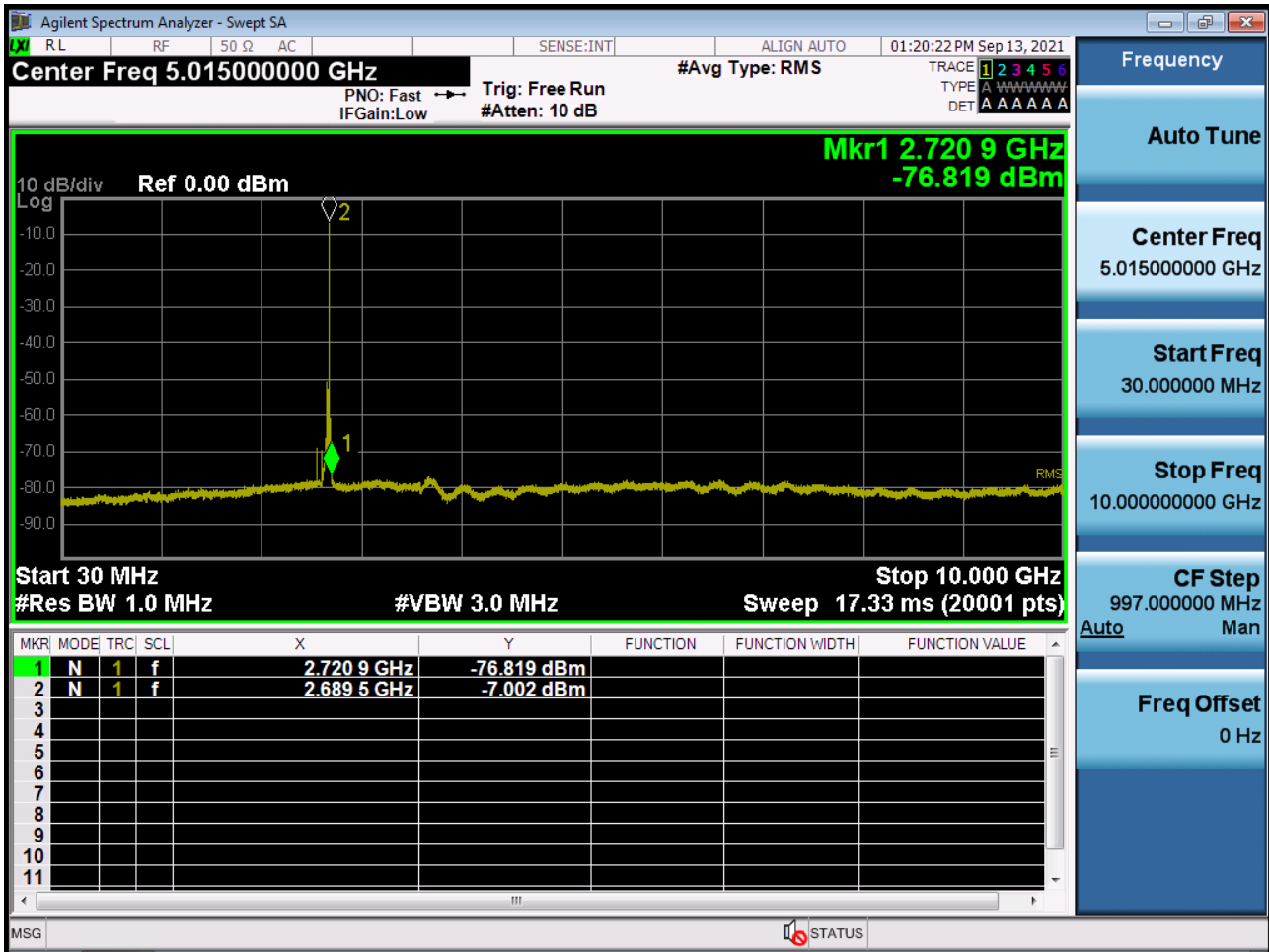
Conducted Spurious Plot 2 (20 MHz Ch. 39750 QPSK RB 1, Offset 0) (POWER CLASS 2)



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



Conducted Spurious Plot 1 (20 MHz Ch.41490 QPSK RB 1, Offset 0) (POWER CLASS 2)



Conducted Spurious Plot 2 (20 MHz Ch. 41490 QPSK RB 1, Offset 0) (POWER CLASS 2)



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2109-FC029-P