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FCC LTE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

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

Date of Issue:
October 29, 2020

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

Report No.: HCT-RF-2010-FC019

FCC ID:	**A3LSMG991U**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-G991U
Additional Model(s):	SM-G991U1
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 7 (5)	2502.5 – 2567.5	4M50G7D	QPSK	0.180	22.56
		4M49W7D	16QAM	0.155	21.92
		4M51W7D	64QAM	0.122	20.86
		4M50W7D	256QAM	0.060	17.75
LTE – Band 7 (10)	2505.0 – 2565.0	8M96G7D	QPSK	0.195	22.90
		8M96W7D	16QAM	0.170	22.32
		8M98W7D	64QAM	0.125	20.97
		8M96W7D	256QAM	0.061	17.84
LTE – Band 7 (15)	2507.5 – 2562.5	13M5G7D	QPSK	0.198	22.97
		13M5W7D	16QAM	0.173	22.37
		13M4W7D	64QAM	0.135	21.31
		13M5W7D	256QAM	0.065	18.15
LTE – Band 7 (20)	2510.0 – 2560.0	18M0G7D	QPSK	0.198	22.97
		17M9W7D	16QAM	0.174	22.41
		18M0W7D	64QAM	0.134	21.28
		17M9W7D	256QAM	0.064	18.09

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

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

REVIEWED BY

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

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

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

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2010-FC019	October 29, 2020	- First Approval Report

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

Table of Contents

REVIEWED BY 2
1. GENERAL INFORMATION 5
2. INTRODUCTION 6
2.1. DESCRIPTION OF EUT 6
2.2. MEASURING INSTRUMENT CALIBRATION 6
2.3. TEST FACILITY 6
3. DESCRIPTION OF TESTS 7
3.1 TEST PROCEDURE 7
3.2 RADIATED POWER 8
3.3 RADIATED SPURIOUS EMISSIONS 9
3.4 PEAK- TO- AVERAGE RATIO 10
3.5 OCCUPIED BANDWIDTH. 12
3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL 13
3.7 BAND EDGE 14
3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE 15
3.9 WORST CASE(RADIATED TEST) 16
3.10 WORST CASE(CONDUCTED TEST) 17
4. LIST OF TEST EQUIPMENT 18
5. MEASUREMENT UNCERTAINTY 19
6. SUMMARY OF TEST RESULTS 20
7. SAMPLE CALCULATION 21
8. TEST DATA 23
8.1 EQUIVALENT ISOTROPIC RADIATED POWER 23
8.2 RADIATED SPURIOUS EMISSIONS 25
8.3 PEAK-TO-AVERAGE RATIO 29
8.4 OCCUPIED BANDWIDTH 30
8.5 CONDUCTED SPURIOUS EMISSIONS 31
8.6 CHANNEL EDGE 32
8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE 33
9. TEST PLOTS 45
10. APPENDIX A_ TEST SETUP PHOTO 126

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:	A3LSMG991U
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-G991U
Additional Model(s):	SM-G991U1
Tx Frequency:	2502.5 – 2567.5 : 5 MHz 2505.0 – 2565.0 : 10 MHz 2507.5 – 2562.5 : 15 MHz 2510.0 – 2560.0 : 20 MHz
Date(s) of Tests:	September 23, 2020 ~ October 27, 2020

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS, CDMA(BC0, 1, 10) and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, NFC, WPT, mmWave(n260/261).

2.2. MEASURING INSTRUMENT CALIBRATION

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

2.3. TEST FACILITY

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

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

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

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

   The power is calculated by the following formula;

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

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

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

Test Settings

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

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.
   The spurious emissions is calculated by the following formula;

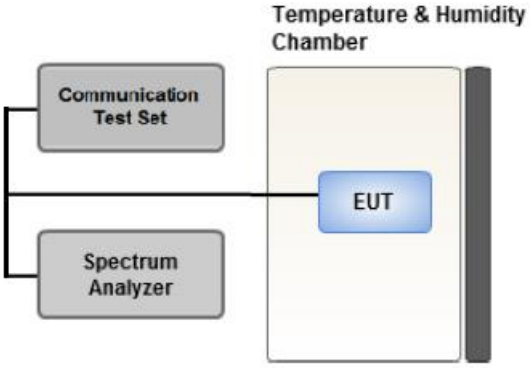
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

$$EIRP_{(dBm)} = ERP_{(dBm)} + 2.15$$

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

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

② **Alternate Procedure for PAPR**

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

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

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

Test Settings(Peak Power)

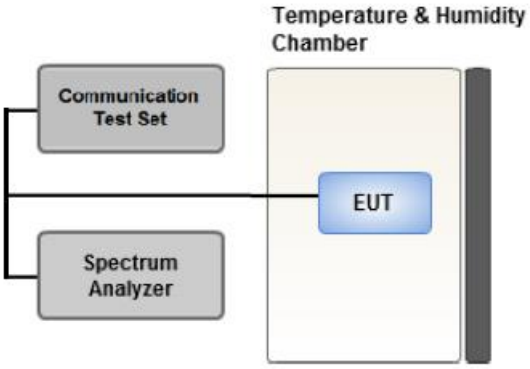
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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

Test Settings(Average Power)

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

3.5 OCCUPIED BANDWIDTH.



Test setup

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

The EUT makes a call to the communication simulator.

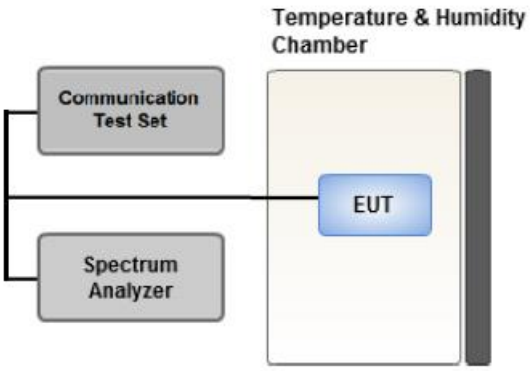
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

Test Settings

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

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

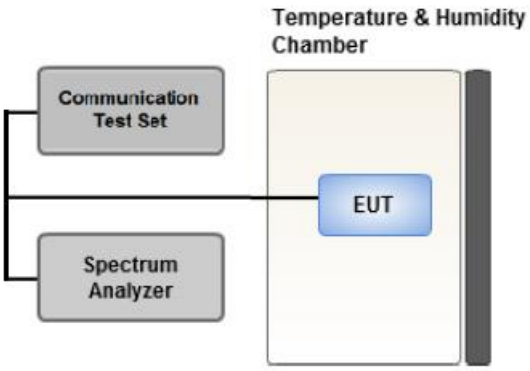
Test Overview

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

Test Settings

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

3.7 BAND 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. RBW > 1% of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

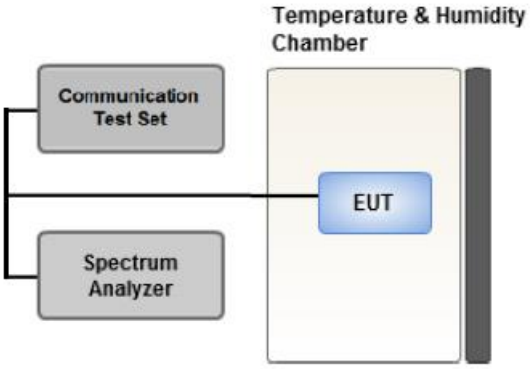
Test Notes

According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

All measurements were done at 2 channels(low and high operational frequency range.)

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.
- SM-G991U & additional models were tested and the worst case results are reported. (Worst case : SM-G991U)

[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	X

3.10 WORST CASE(CONDUCTED TEST)

[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
Band Edge	QPSK	5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	49
		15	Low	1	0
			High	1	74
		20	Low	1	0
			High	1	99
		5, 10, 15, 20	Low, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	QPSK	5, 10, 15, 20	Low, Mid, High	1	0

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

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

- SM-G991U & additional models were tested and the worst case results are reported.

(Worst case : SM-G991U)

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/09/2020	Annual	03/09/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/27/2020	Annual	04/27/2021
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93008124	03/18/2020	Annual	03/18/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	04/27/2020	Annual	04/27/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2020	Annual	06/04/2021
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2020	Annual	10/14/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	04/26/2019	Biennial	04/26/2021
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/12/2019	Biennial	03/12/2021
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/22/2020	Annual	01/22/2021
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).
3. Model : FSV40/Spectrum
   - Use date of equipment : September 23, 2020 ~ October 12, 2020, October 14, 2020 ~

5. MEASUREMENT UNCERTAINTY

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

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(m)(4)	■ < 40 + 10log10 (P[Watts]) at Channel edges ■ < 43 + 10log10 (P[Watts]) between 5 and X MHz from Channel edges ■ < 55 + 10log10 (P[Watts]) beyond X MHz beyond from Channel edges ■ < 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz	PASS
Conducted Output Power	§2.1046	N/A	See Note1
Frequency stability / variation of ambient temperature	§2.1055, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report

2. The same samples were used for SAR and EMC

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)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

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

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

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test , the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

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

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test , the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2502.5	LTE B7/ 5 MHz	QPSK	-23.80	13.38	10.70	2.49	V	< 2.00	0.144	21.59
		16-QAM	-24.43	12.75	10.70	2.49	V		0.125	20.96
		64-QAM	-25.58	11.60	10.70	2.49	V		0.096	19.81
		256-QAM	-28.67	8.51	10.70	2.49	V		0.047	16.72
2535.0		QPSK	-23.08	14.23	10.83	2.51	V		0.180	22.56
		16-QAM	-23.72	13.59	10.83	2.51	V		0.155	21.92
		64-QAM	-24.78	12.53	10.83	2.51	V		0.122	20.86
		256-QAM	-27.91	9.40	10.83	2.51	V		0.059	17.73
2567.5		QPSK	-23.29	13.91	10.95	2.52	V		0.172	22.34
		16-QAM	-23.95	13.25	10.95	2.52	V		0.147	21.68
		64-QAM	-25.83	11.37	10.95	2.52	V		0.096	19.80
		256-QAM	-27.88	9.32	10.95	2.52	V		0.060	17.75

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2505.0	LTE B7/ 10 MHz	QPSK	-23.77	13.47	10.73	2.50	V	< 2.00	0.148	21.70
		16-QAM	-24.44	12.80	10.73	2.50	V		0.127	21.03
		64-QAM	-25.59	11.65	10.73	2.50	V		0.097	19.88
		256-QAM	-28.83	8.41	10.73	2.50	V		0.046	16.64
2535.0		QPSK	-23.02	14.29	10.83	2.51	V		0.183	22.62
		16-QAM	-23.59	13.72	10.83	2.51	V		0.160	22.05
		64-QAM	-24.82	12.49	10.83	2.51	V		0.121	20.82
		256-QAM	-28.16	9.15	10.83	2.51	V		0.056	17.48
2565.0		QPSK	-22.73	14.48	10.94	2.52	V		0.195	22.90
		16-QAM	-23.31	13.90	10.94	2.52	V		0.170	22.32
		64-QAM	-24.66	12.55	10.94	2.52	V		0.125	20.97
		256-QAM	-27.79	9.42	10.94	2.52	V		0.061	17.84

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2507.5	LTE B7/ 15 MHz	QPSK	-23.78	13.53	10.75	2.50	V	< 2.00	0.151	21.78
		16-QAM	-24.49	12.82	10.75	2.50	V		0.128	21.07
		64-QAM	-25.62	11.69	10.75	2.50	V		0.099	19.94
		256-QAM	-28.86	8.45	10.75	2.50	V		0.047	16.70
2535.0		QPSK	-22.90	14.41	10.83	2.51	V		0.188	22.74
		16-QAM	-23.55	13.76	10.83	2.51	V		0.162	22.09
		64-QAM	-24.63	12.68	10.83	2.51	V		0.126	21.01
		256-QAM	-27.82	9.49	10.83	2.51	V		0.060	17.82
2562.5		QPSK	-22.65	14.56	10.93	2.52	V		0.198	22.97
		16-QAM	-23.25	13.96	10.93	2.52	V		0.173	22.37
		64-QAM	-24.31	12.90	10.93	2.52	V		0.135	21.31
		256-QAM	-27.47	9.74	10.93	2.52	V		0.065	18.15

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2510.0	LTE B7/ 20 MHz	QPSK	-23.76	13.55	10.75	2.50	V	< 2.00	0.151	21.80
		16-QAM	-24.54	12.77	10.75	2.50	V		0.126	21.02
		64-QAM	-25.55	11.76	10.75	2.50	V		0.100	20.01
		256-QAM	-28.85	8.46	10.75	2.50	V		0.047	16.71
2535.0		QPSK	-22.87	14.44	10.83	2.51	V		0.189	22.77
		16-QAM	-23.75	13.56	10.83	2.51	V		0.154	21.89
		64-QAM	-24.69	12.62	10.83	2.51	V		0.124	20.95
		256-QAM	-27.88	9.43	10.83	2.51	V		0.060	17.76
2560.0		QPSK	-22.65	14.56	10.93	2.52	V		0.198	22.97
		16-QAM	-23.21	14.00	10.93	2.52	V		0.174	22.41
		64-QAM	-24.34	12.87	10.93	2.52	V		0.134	21.28
		256-QAM	-27.53	9.68	10.93	2.52	V		0.064	18.09

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY : 2535.0 MHz

▣ MEASURED OUTPUT POWER: 22.56 dBm = 0.180 W

▣ MODE: LTE B7

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 47.56 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20775 (2502.5)	5 005.00	-55.27	12.68	-64.53	3.60	V	-55.45	78.01
	7 507.50	-56.97	11.25	-58.11	4.48	H	-51.34	73.89
	10 010.00	-55.47	10.98	-52.49	5.27	V	-46.78	69.34
21100 (2535.0)	5 070.00	-55.48	12.40	-64.08	3.65	H	-55.33	77.89
	7 605.00	-52.84	11.53	-54.37	4.49	H	-47.32	69.88
	10 140.00	-56.27	11.18	-52.64	5.29	V	-46.75	69.30
21425 (2567.5)	5 135.00	-52.10	12.43	-60.69	3.67	H	-51.93	74.48
	7 702.50	-53.43	11.70	-54.93	4.51	H	-47.74	70.30
	10 270.00	-56.09	10.90	-51.65	5.40	H	-46.15	68.70

▣ OPERATING FREQUENCY : 2565.0 MHz

▣ MEASURED OUTPUT POWER: 22.90 dBm = 0.195 W

▣ MODE: LTE B7

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 47.90 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20800 (2505.0)	5 010.00	-56.39	12.65	-65.60	3.59	V	-56.54	79.43
	7 515.00	-57.33	11.28	-58.48	4.46	V	-51.66	74.56
	10 020.00	-59.64	11.05	-56.03	5.27	V	-50.25	73.14
21100 (2535.0)	5 070.00	-55.66	12.40	-64.26	3.65	V	-55.51	78.41
	7 605.00	-51.55	11.53	-53.08	4.49	V	-46.03	68.93
	10 140.00	-59.17	11.18	-55.54	5.29	H	-49.65	72.54
21400 (2565.0)	5 130.00	-57.11	12.40	-65.47	3.67	H	-56.74	79.64
	7 695.00	-49.95	11.70	-51.34	4.51	V	-44.15	67.05
	10 260.00	-56.05	10.95	-51.31	5.40	H	-45.76	68.65

▣ OPERATING FREQUENCY : 2562.5 MHz

▣ MEASURED OUTPUT POWER: 22.97 dBm = 0.198 W

▣ MODE: LTE B7

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 47.97 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20825 (2507.5)	5 015.00	-56.13	12.63	-65.38	3.60	V	-56.35	79.32
	7 522.50	-53.63	11.30	-54.97	4.46	V	-48.13	71.10
	10 030.00	-58.89	11.05	-54.97	5.29	H	-49.21	72.17
21100 (2535.0)	5 070.00	-56.40	12.40	-65.00	3.65	V	-56.25	79.22
	7 605.00	-51.09	11.53	-52.62	4.49	V	-45.57	68.54
	10 140.00	-58.89	11.18	-55.26	5.29	H	-49.37	72.34
21375 (2562.5)	5 125.00	-56.08	12.40	-64.07	3.67	H	-55.34	78.31
	7 687.50	-50.31	11.70	-51.58	4.51	V	-44.39	67.36
	10 250.00	-57.82	11.00	-52.81	5.39	H	-47.20	70.16

▣ OPERATING FREQUENCY : 2560.0 MHz

▣ MEASURED OUTPUT POWER: 22.97 dBm = 0.198 W

▣ MODE: LTE B7

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 47.97 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20850 (2510.0)	5 020.00	-56.79	12.60	-66.07	3.60	H	-57.07	80.04
	7 530.00	-54.14	11.30	-55.15	4.45	V	-48.30	71.27
	10 040.00	-58.77	11.13	-54.81	5.32	V	-49.00	71.97
21100 (2535.0)	5 070.00	-56.50	12.40	-65.10	3.65	H	-56.35	79.32
	7 605.00	-51.54	11.53	-53.07	4.49	V	-46.02	68.99
	10 140.00	-59.51	11.18	-55.88	5.29	V	-49.99	72.96
21350 (2560.0)	5 120.00	-56.59	12.40	-64.21	3.67	H	-55.48	78.45
	7 680.00	-49.37	11.70	-50.20	4.50	V	-43.00	65.97
	10 240.00	-56.06	11.00	-51.23	5.37	V	-45.60	68.57

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
7	5 MHz	2535.0	QPSK	25	0	5.26
			16-QAM	25	0	6.02
			64-QAM	25	0	6.53
			256-QAM	25	0	6.55
	10 MHz		QPSK	50	0	5.32
			16-QAM	50	0	6.03
			64-QAM	50	0	6.51
			256-QAM	50	0	6.51
	15 MHz		QPSK	75	0	5.32
			16-QAM	75	0	6.02
			64-QAM	75	0	6.59
			256-QAM	75	0	6.56
	20 MHz		QPSK	100	0	5.30
			16-QAM	100	0	6.05
			64-QAM	100	0	6.55
			256-QAM	100	0	6.60

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 62 ~ 77.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
7	5 MHz	2535.0	QPSK	25	0	4.4986
			16-QAM	25		4.4912
			64-QAM	25		4.5090
			256-QAM	25		4.5030
	10 MHz		QPSK	50		8.9586
			16-QAM	50		8.9559
			64-QAM	50		8.9780
			256-QAM	50		8.9586
	15 MHz		QPSK	75		13.477
			16-QAM	75		13.452
			64-QAM	75		13.433
			256-QAM	75		13.479
	20 MHz		QPSK	100		17.994
			16-QAM	100		17.929
			64-QAM	100		17.958
			256-QAM	100		17.892

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 46 ~ 61.

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)
7	5	2502.5	26.1605	30.131	-76.629	-46.498	-25.00
		2535.0	26.1172	30.131	-76.642	-46.511	
		2567.5	26.1382	30.131	-76.293	-46.162	
	10	2505.0	26.1452	30.131	-76.629	-46.498	
		2535.0	26.1308	30.131	-76.023	-45.892	
		2565.0	26.1242	30.131	-76.490	-46.359	
	15	2507.5	25.8210	30.131	-76.791	-46.660	
		2535.0	25.9126	30.131	-76.799	-46.668	
		2562.5	26.1799	30.131	-76.645	-46.514	
	20	2510.0	25.7661	30.131	-76.675	-46.544	
		2535.0	25.7954	30.131	-76.753	-46.622	
		2560.0	26.0908	30.131	-76.344	-46.213	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 102 ~125.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

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

8.6 CHANNEL EDGE

Band Width (Modulation)	Frequency (MHz)	RB Size / Offset	C.E ~ (C.E ± 1MHz)		2 496 MHz ~ 2 499 MHz	(C.E + 1 MHz) ~ (C.E + 5 MHz)	2 490.5 MHz ~ 2 496 MHz	(C.E + 5 MHz) ~ (C.E + X MHz)	Below 2 490.5 MHz	Above (C.E + X MHz)
			Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
5MHz	2502.5	25 / 0	-28.80	-27.83	-25.88	-25.71	-30.44	-31.50	-45.41	-31.93
10MHz	2505.0	50 / 0	-29.72	-29.27	-26.24	-25.31	-29.46	-26.84	-39.80	-32.98
15MHz	2507.5	75 / 0	-29.13	-28.74	-25.35	-25.59	-28.78	-27.65	-34.07	-34.83
20MHz	2510.0	100 / 0	-28.45	-27.35	-25.55	-24.59	-28.44	-26.79	-34.82	-37.22
Limit			-10.0		-10.0		-13.0		-25.0	

Band Width (Modulation)	Frequency (MHz)	RB Size / Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
			Lower	Upper	Lower	Upper
5MHz (QPSK)	2535.0	25 / 0	-28.39	-28.25	-28.73	-27.29
	2567.5	25 / 0	-28.79	-28.39	-31.51	-29.22
10MHz (QPSK)	2535.0	50 / 0	-30.64	-30.48	-29.45	-28.82
	2565.0	50 / 0	-31.21	-31.17	-30.91	-29.46
15MHz (QPSK)	2535.0	75 / 0	-30.96	-30.69	-29.81	-29.43
	2562.5	75 / 0	-31.57	-29.53	-29.62	-26.02
20MHz (QPSK)	2535.0	100 / 0	-29.94	-30.09	-28.71	-28.55
	2560.0	100 / 0	-28.16	-25.97	-26.53	-23.05
Limit			-10.0		-10.0	

Band Width (Modulation)	Frequency (MHz)	Resource Block Size	(C.E ± 5 MHz) ~ (C.E ± X MHz)		Above (C.E ± X MHz)	
			Lower	Upper	Lower	Upper
5MHz (QPSK)	2535.0	25 / 0	-32.82	-32.61	-33.26	-32.81
	2567.5	25 / 0	-33.98	-33.92	-34.37	-34.61
10MHz (QPSK)	2535.0	50 / 0	-31.49	-29.99	-34.62	-33.47
	2565.0	50 / 0	-31.60	-30.59	-35.35	-37.74
15MHz (QPSK)	2535.0	75 / 0	-32.09	-30.56	-37.26	-35.33
	2562.5	75 / 0	-30.94	-29.19	-38.03	-42.08
20MHz (QPSK)	2535.0	100 / 0	-31.89	-30.17	-38.83	-36.13
	2560.0	100 / 0	-30.35	-27.47	-38.44	-46.88
Limit			-13.0		-25.0	

Note:

1. C.E = Channel Edge
2. X = X is the greater of 6MHz or the actual emission bandwidth.
3. X = 6MHz(5MHz Bandwidth), 10MHz(10MHz Bandwidth), 15MHz(15MHz Bandwidth), 20MHz(20MHz Bandwidth)
4. Plots of the EUT's Channel Edge are shown Page 78 ~ 101.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE 7

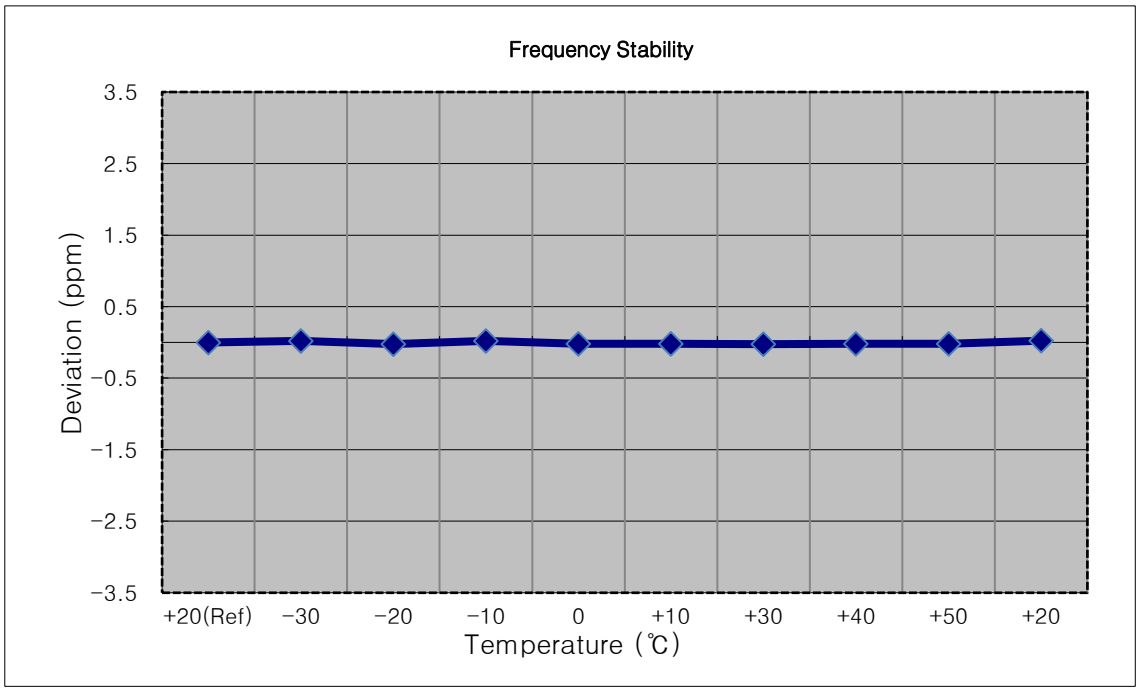
▣ OPERATING FREQUENCY: 2,502,500,000 Hz

▣ CHANNEL: 20775 (5 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2502 499 943	0.0	0.000 000	0.000
100%		-30	2502 499 995	52.1	0.000 002	0.021
100%		-20	2502 499 886	-56.8	-0.000 002	-0.023
100%		-10	2502 500 000	57.7	0.000 002	0.023
100%		0	2502 499 890	-53.0	-0.000 002	-0.021
100%		+10	2502 499 892	-50.8	-0.000 002	-0.020
100%		+30	2502 499 881	-61.7	-0.000 002	-0.025
100%		+40	2502 499 895	-47.7	-0.000 002	-0.019
100%		+50	2502 499 896	-47.0	-0.000 002	-0.019
Batt. Endpoint	3.650	+20	2502 500 002	59.3	0.000 002	0.024



▣ MODE: LTE 7

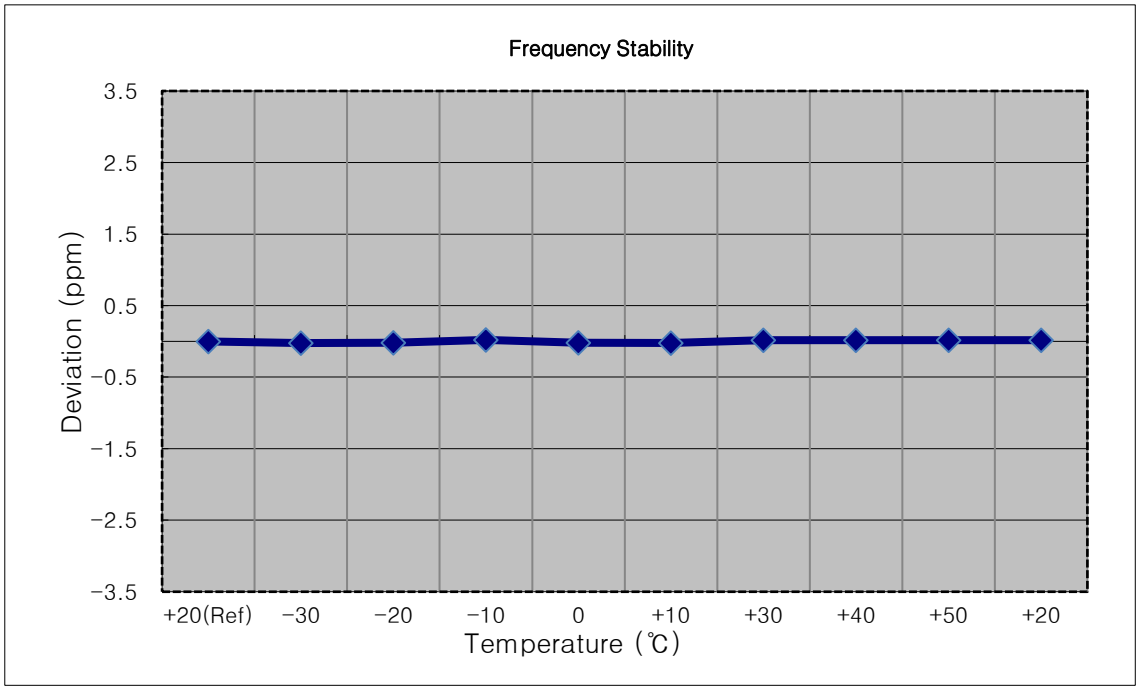
▣ OPERATING FREQUENCY: 2,505,000,000 Hz

▣ CHANNEL: 20800 (10 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2504 999 940	0.0	0.000 000	0.000
100%		-30	2504 999 886	-54.3	-0.000 002	-0.022
100%		-20	2504 999 890	-50.5	-0.000 002	-0.020
100%		-10	2504 999 991	51.1	0.000 002	0.020
100%		0	2504 999 898	-42.5	-0.000 002	-0.017
100%		+10	2504 999 884	-56.0	-0.000 002	-0.022
100%		+30	2504 999 985	44.9	0.000 002	0.018
100%		+40	2504 999 984	43.6	0.000 002	0.017
100%		+50	2504 999 983	43.2	0.000 002	0.017
Batt. Endpoint	3.650	+20	2504 999 987	46.8	0.000 002	0.019



▣ MODE: LTE 7

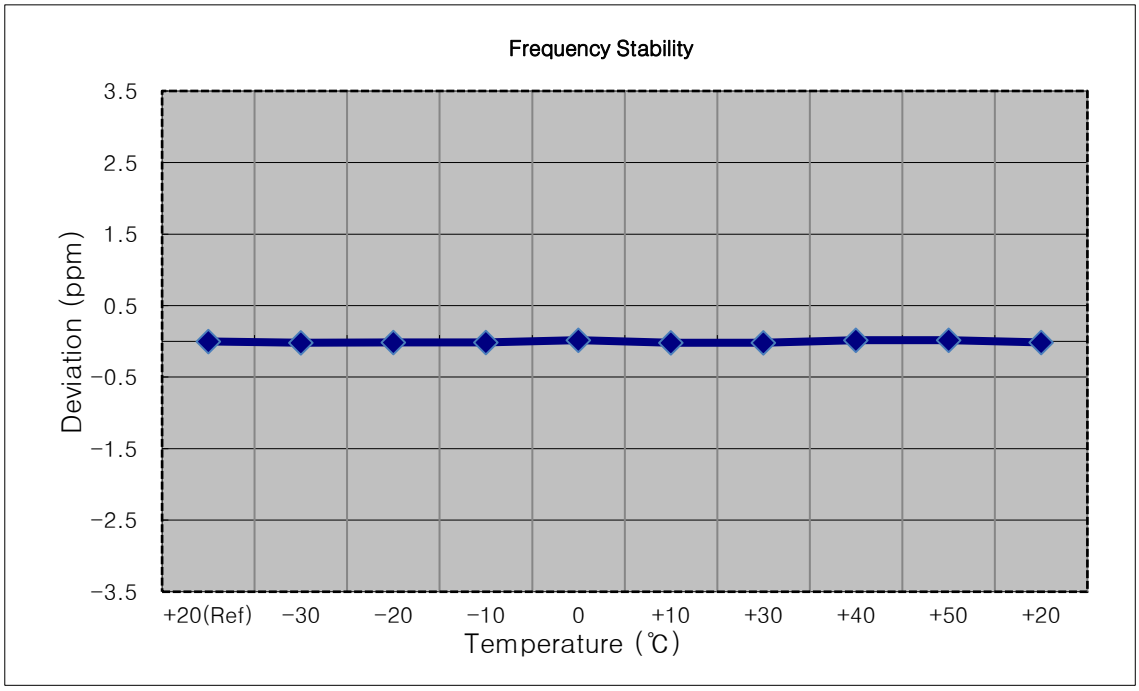
▣ OPERATING FREQUENCY: 2,507,500,000 Hz

▣ CHANNEL: 20825 (15 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2507 499 952	0.0	0.000 000	0.000
100%		-30	2507 499 904	-47.5	-0.000 002	-0.019
100%		-20	2507 499 916	-36.3	-0.000 001	-0.014
100%		-10	2507 499 917	-35.1	-0.000 001	-0.014
100%		0	2507 499 995	42.7	0.000 002	0.017
100%		+10	2507 499 903	-48.8	-0.000 002	-0.019
100%		+30	2507 499 906	-45.5	-0.000 002	-0.018
100%		+40	2507 499 990	37.9	0.000 002	0.015
100%		+50	2507 499 989	37.5	0.000 001	0.015
Batt. Endpoint	3.650	+20	2507 499 910	-41.8	-0.000 002	-0.017



▣ MODE: LTE 7

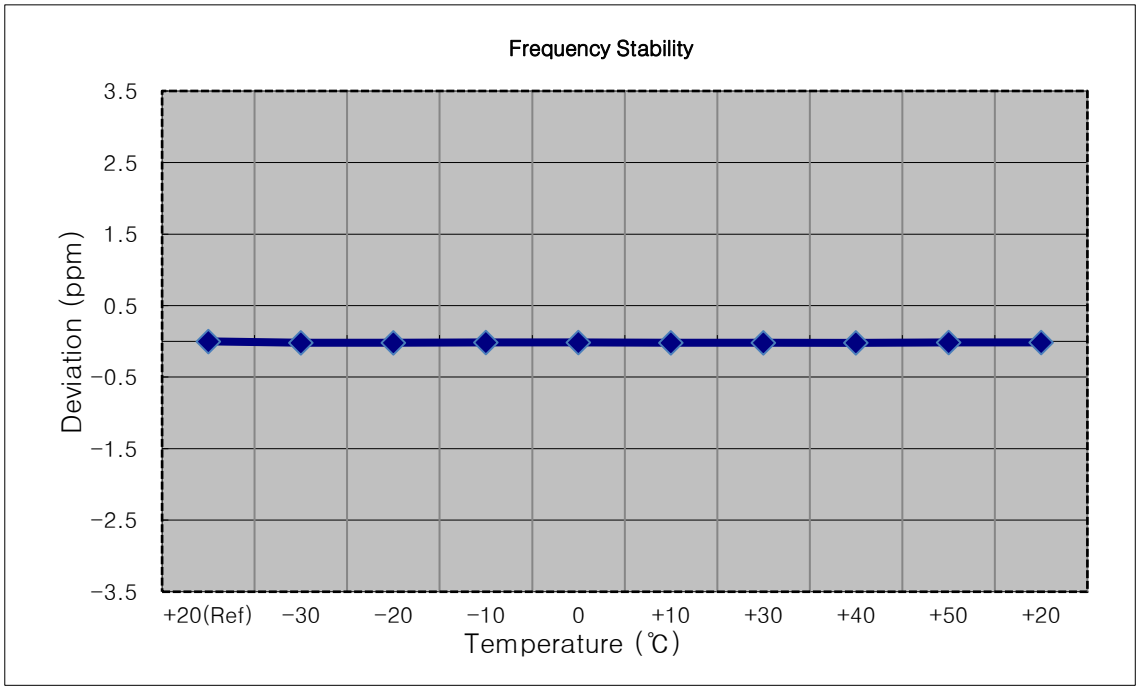
▣ OPERATING FREQUENCY: 2,510,000,000 Hz

▣ CHANNEL: 20850 (20 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2509 999 962	0.0	0.000 000	0.000
100%		-30	2509 999 916	-45.9	-0.000 002	-0.018
100%		-20	2509 999 920	-42.2	-0.000 002	-0.017
100%		-10	2509 999 926	-36.0	-0.000 001	-0.014
100%		0	2509 999 922	-39.9	-0.000 002	-0.016
100%		+10	2509 999 913	-49.0	-0.000 002	-0.020
100%		+30	2509 999 918	-43.7	-0.000 002	-0.017
100%		+40	2509 999 909	-52.8	-0.000 002	-0.021
100%		+50	2509 999 923	-38.8	-0.000 002	-0.015
Batt. Endpoint	3.650	+20	2509 999 923	-39.3	-0.000 002	-0.016



▣ MODE: LTE 7

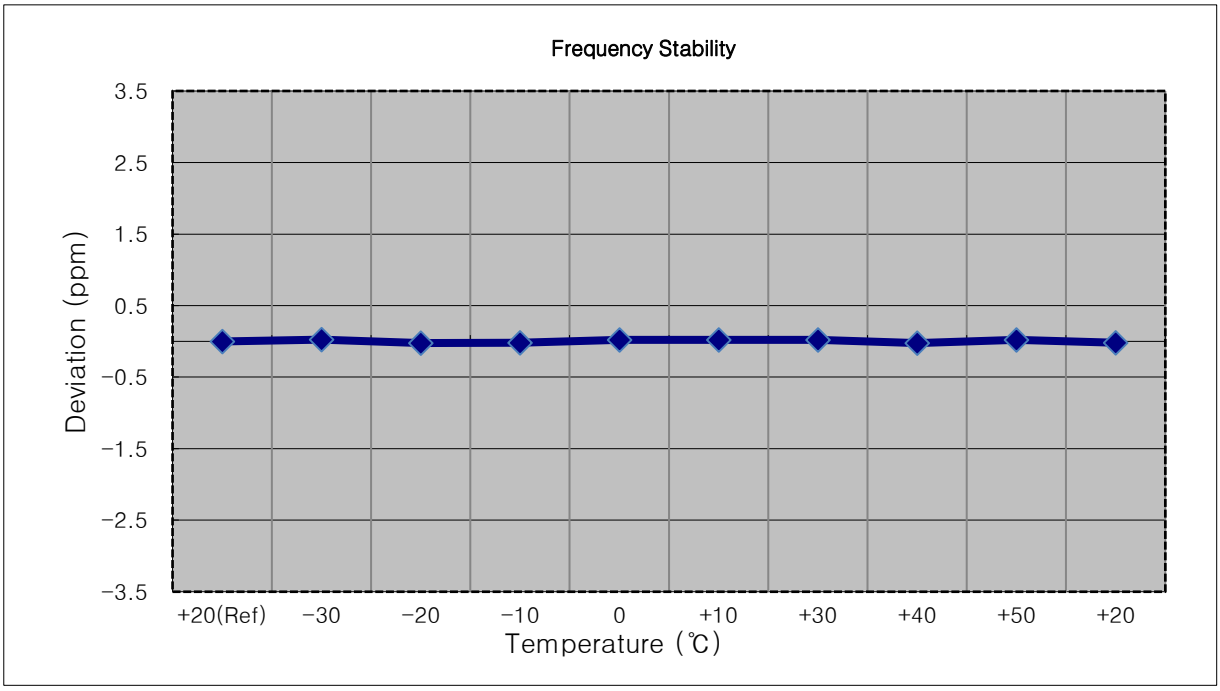
▣ OPERATING FREQUENCY: 2,535,000,000 Hz

▣ CHANNEL: 21100 (5 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2534 999 942	0.0	0.000 000	0.000
100%		-30	2535 000 004	61.6	0.000 002	0.024
100%		-20	2534 999 888	-54.1	-0.000 002	-0.021
100%		-10	2534 999 889	-53.2	-0.000 002	-0.021
100%		0	2534 999 994	51.9	0.000 002	0.020
100%		+10	2534 999 994	51.9	0.000 002	0.020
100%		+30	2534 999 993	51.3	0.000 002	0.020
100%		+40	2534 999 881	-60.9	-0.000 002	-0.024
100%		+50	2534 999 996	54.2	0.000 002	0.021
Batt. Endpoint	3.650	+20	2534 999 891	-51.6	-0.000 002	-0.020



▣ MODE: LTE 7

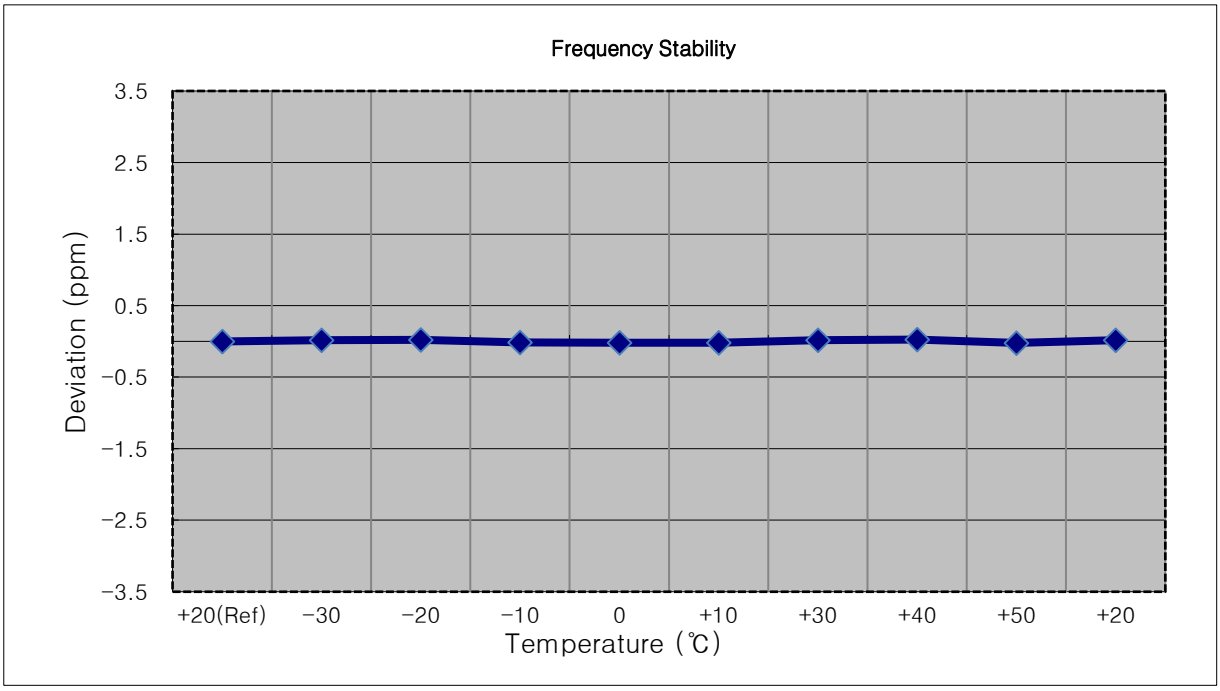
▣ OPERATING FREQUENCY: 2,535,000,000 Hz

▣ CHANNEL: 21100 (10 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2535 000 048	0.0	0.000 000	0.000
100%		-30	2535 000 096	47.7	0.000 002	0.019
100%		-20	2535 000 101	52.2	0.000 002	0.021
100%		-10	2535 000 007	-41.3	-0.000 002	-0.016
100%		0	2534 999 998	-50.2	-0.000 002	-0.020
100%		+10	2535 000 003	-45.8	-0.000 002	-0.018
100%		+30	2535 000 091	42.9	0.000 002	0.017
100%		+40	2535 000 112	63.3	0.000 002	0.025
100%		+50	2534 999 994	-54.5	-0.000 002	-0.021
Batt. Endpoint	3.650	+20	2535 000 092	43.7	0.000 002	0.017



▣ MODE: LTE 7

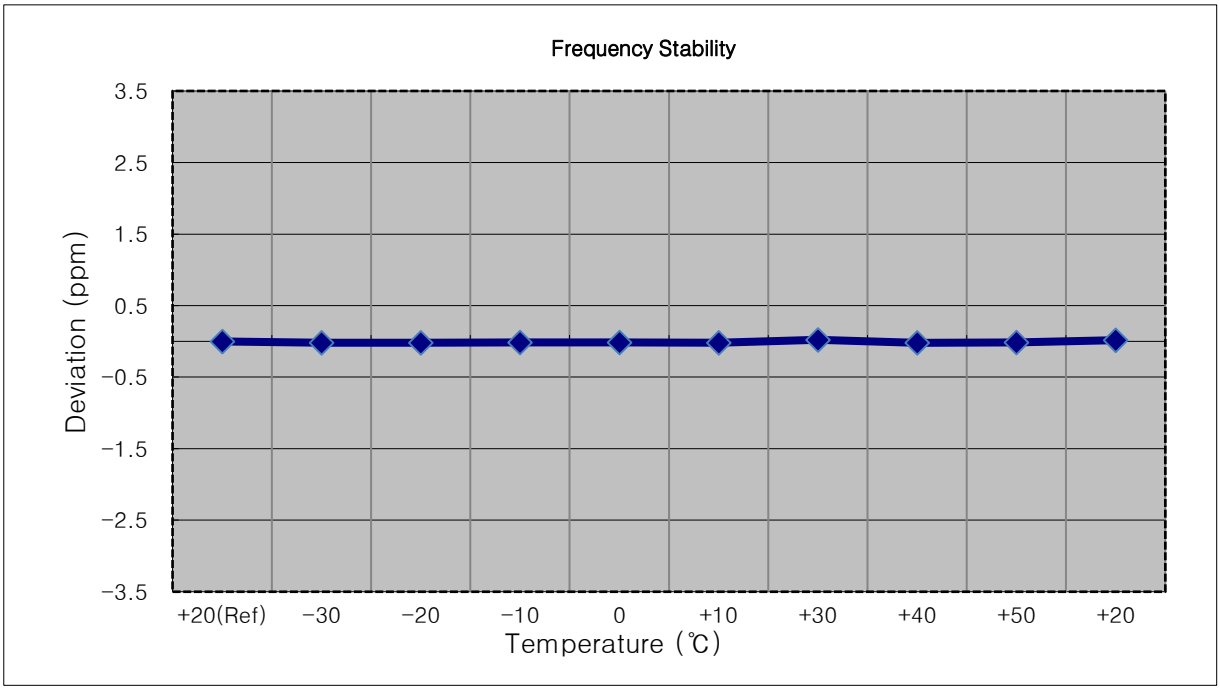
▣ OPERATING FREQUENCY: 2,535,000,000 Hz

▣ CHANNEL: 21100 (15 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2534 999 952	0.0	0.000 000	0.000
100%		-30	2534 999 906	-46.3	-0.000 002	-0.018
100%		-20	2534 999 909	-43.6	-0.000 002	-0.017
100%		-10	2534 999 914	-38.7	-0.000 002	-0.015
100%		0	2534 999 917	-35.8	-0.000 001	-0.014
100%		+10	2534 999 908	-44.0	-0.000 002	-0.017
100%		+30	2535 000 008	55.8	0.000 002	0.022
100%		+40	2534 999 900	-52.5	-0.000 002	-0.021
100%		+50	2534 999 913	-39.7	-0.000 002	-0.016
Batt. Endpoint	3.650	+20	2534 999 989	36.8	0.000 001	0.015



▣ MODE: LTE 7

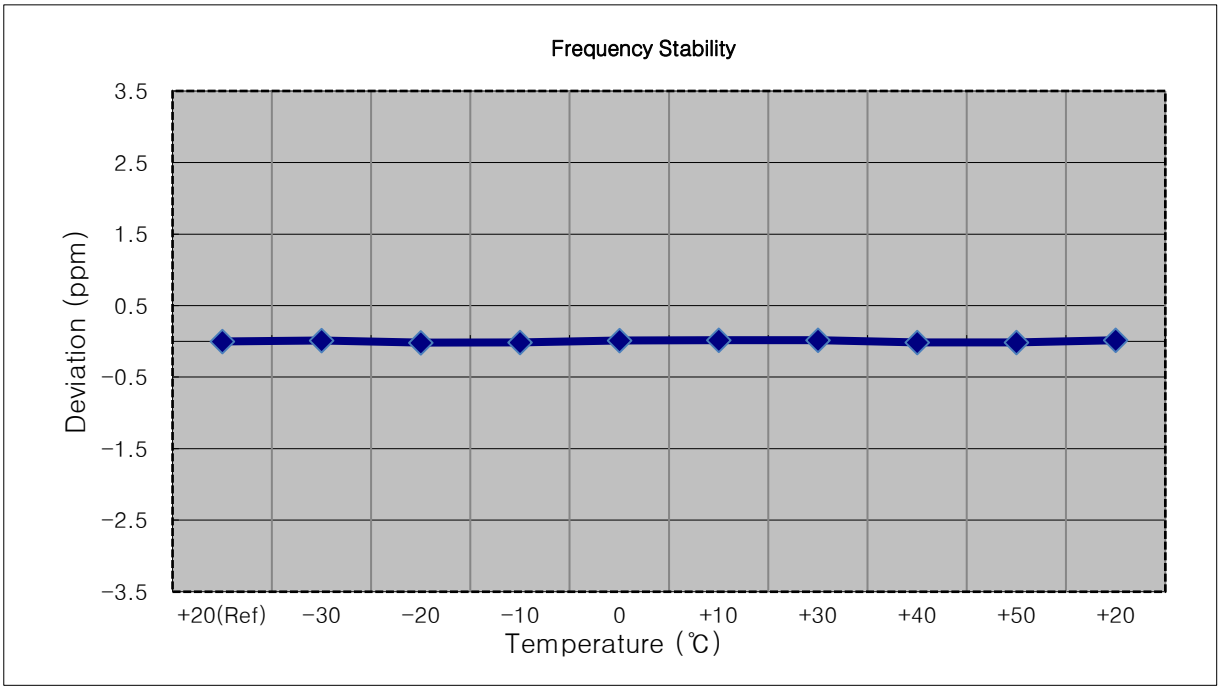
▣ OPERATING FREQUENCY: 2,535,000,000 Hz

▣ CHANNEL: 21100 (20 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2534 999 962	0.0	0.000 000	0.000
100%		-30	2534 999 995	33.0	0.000 001	0.013
100%		-20	2534 999 919	-43.1	-0.000 002	-0.017
100%		-10	2534 999 920	-42.2	-0.000 002	-0.017
100%		0	2534 999 994	32.5	0.000 001	0.013
100%		+10	2535 000 000	37.7	0.000 001	0.015
100%		+30	2535 000 002	39.7	0.000 002	0.016
100%		+40	2534 999 922	-39.6	-0.000 002	-0.016
100%		+50	2534 999 921	-40.7	-0.000 002	-0.016
Batt. Endpoint	3.650	+20	2535 000 003	40.6	0.000 002	0.016



▣ MODE: LTE 7

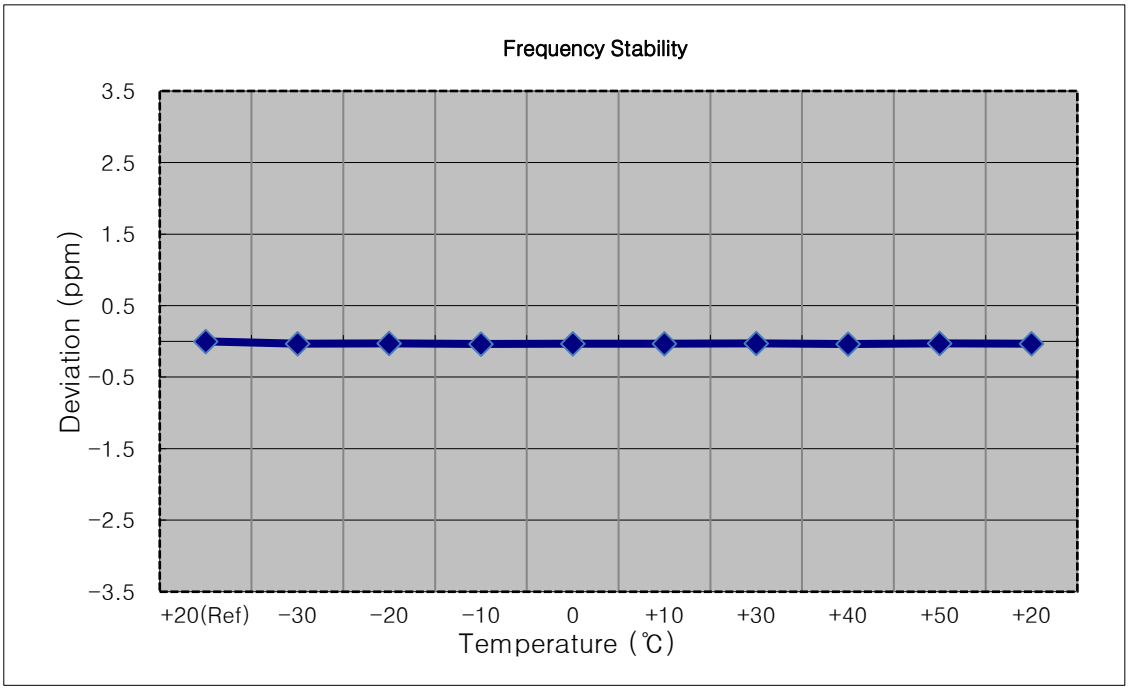
▣ OPERATING FREQUENCY: 2,567,500,000 Hz

▣ CHANNEL: 21425 (5 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2567 499 904	0.0	0.000 000	0.000
100%		-30	2567 499 822	-82.1	-0.000 003	-0.032
100%		-20	2567 499 827	-76.9	-0.000 003	-0.030
100%		-10	2567 499 811	-92.9	-0.000 004	-0.036
100%		0	2567 499 817	-86.7	-0.000 003	-0.034
100%		+10	2567 499 818	-85.3	-0.000 003	-0.033
100%		+30	2567 499 834	-70.2	-0.000 003	-0.027
100%		+40	2567 499 812	-91.7	-0.000 004	-0.036
100%		+50	2567 499 833	-70.9	-0.000 003	-0.028
Batt. Endpoint	3.650	+20	2567 499 824	-79.7	-0.000 003	-0.031



▣ MODE: LTE 7

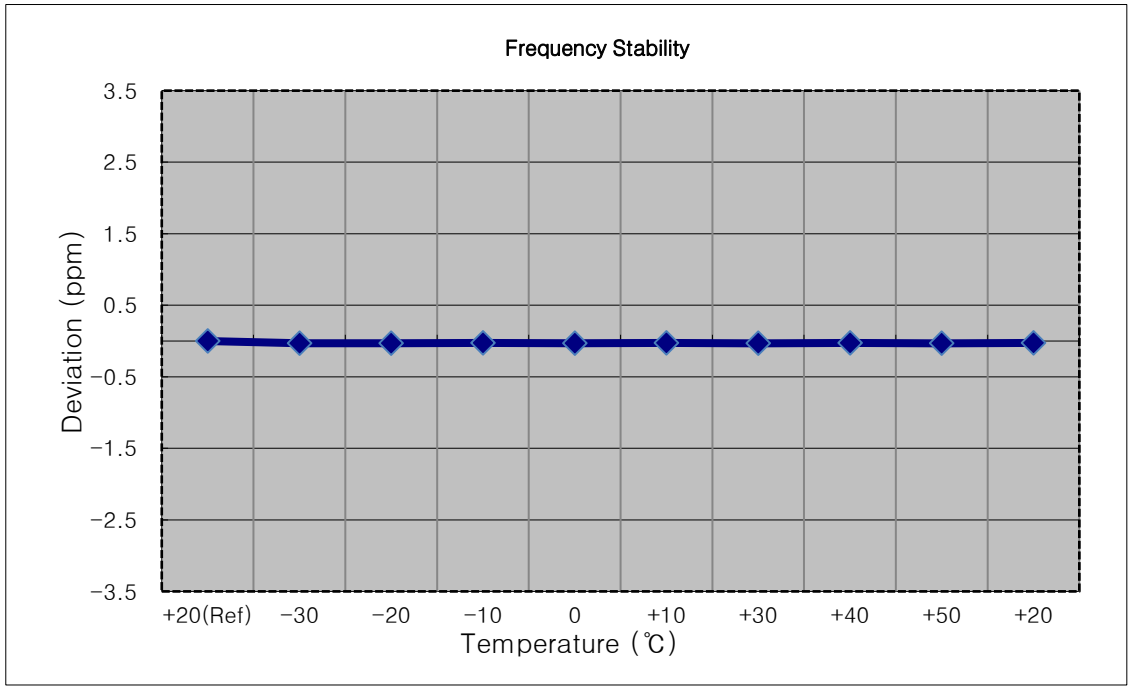
▣ OPERATING FREQUENCY: 2,565,000,000 Hz

▣ CHANNEL: 21400 (10 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2564 999 923	0.0	0.000 000	0.000
100%		-30	2564 999 845	-78.4	-0.000 003	-0.031
100%		-20	2564 999 841	-82.1	-0.000 003	-0.032
100%		-10	2564 999 850	-73.0	-0.000 003	-0.028
100%		0	2564 999 841	-82.6	-0.000 003	-0.032
100%		+10	2564 999 857	-66.0	-0.000 003	-0.026
100%		+30	2564 999 840	-83.2	-0.000 003	-0.032
100%		+40	2564 999 851	-72.4	-0.000 003	-0.028
100%		+50	2564 999 840	-83.2	-0.000 003	-0.032
Batt. Endpoint	3.650	+20	2564 999 851	-72.5	-0.000 003	-0.028



▣ MODE: LTE 7

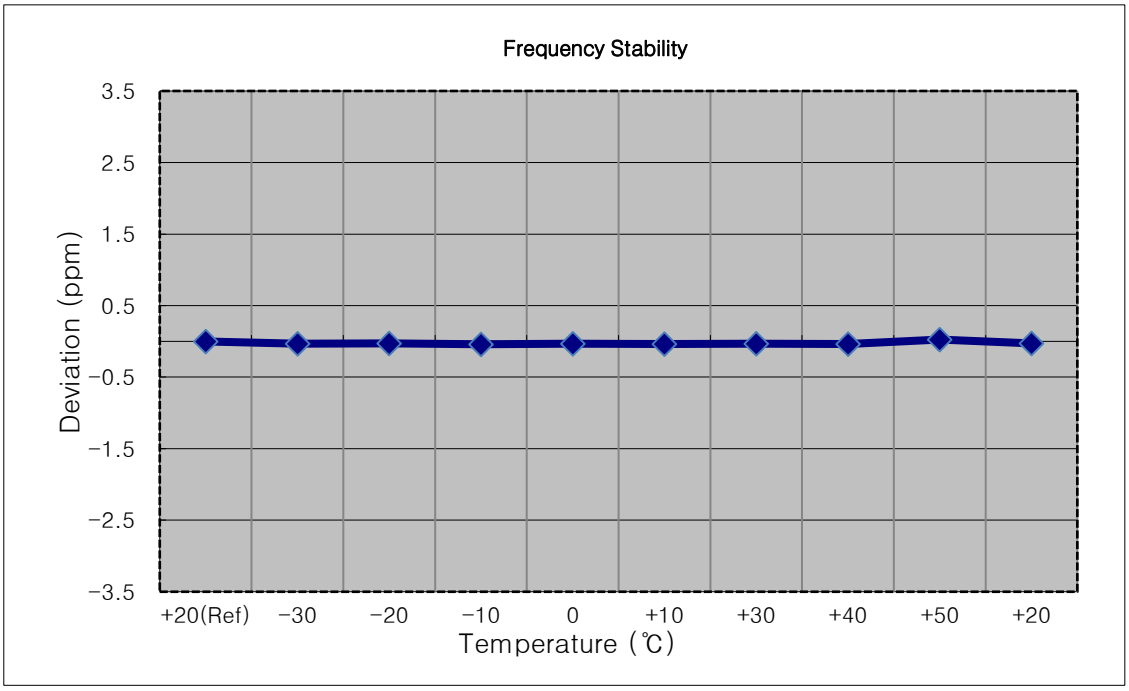
▣ OPERATING FREQUENCY: 2,562,500,000 Hz

▣ CHANNEL: 21375 (15 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2562 499 912	0.0	0.000 000	0.000
100%		-30	2562 499 832	-80.7	-0.000 003	-0.031
100%		-20	2562 499 837	-75.0	-0.000 003	-0.029
100%		-10	2562 499 809	-103.1	-0.000 004	-0.040
100%		0	2562 499 829	-83.0	-0.000 003	-0.032
100%		+10	2562 499 822	-90.1	-0.000 004	-0.035
100%		+30	2562 499 827	-85.5	-0.000 003	-0.033
100%		+40	2562 499 821	-90.9	-0.000 004	-0.035
100%		+50	2562 499 977	64.6	0.000 003	0.025
Batt. Endpoint	3.650	+20	2562 499 841	-71.1	-0.000 003	-0.028



▣ MODE: LTE 7

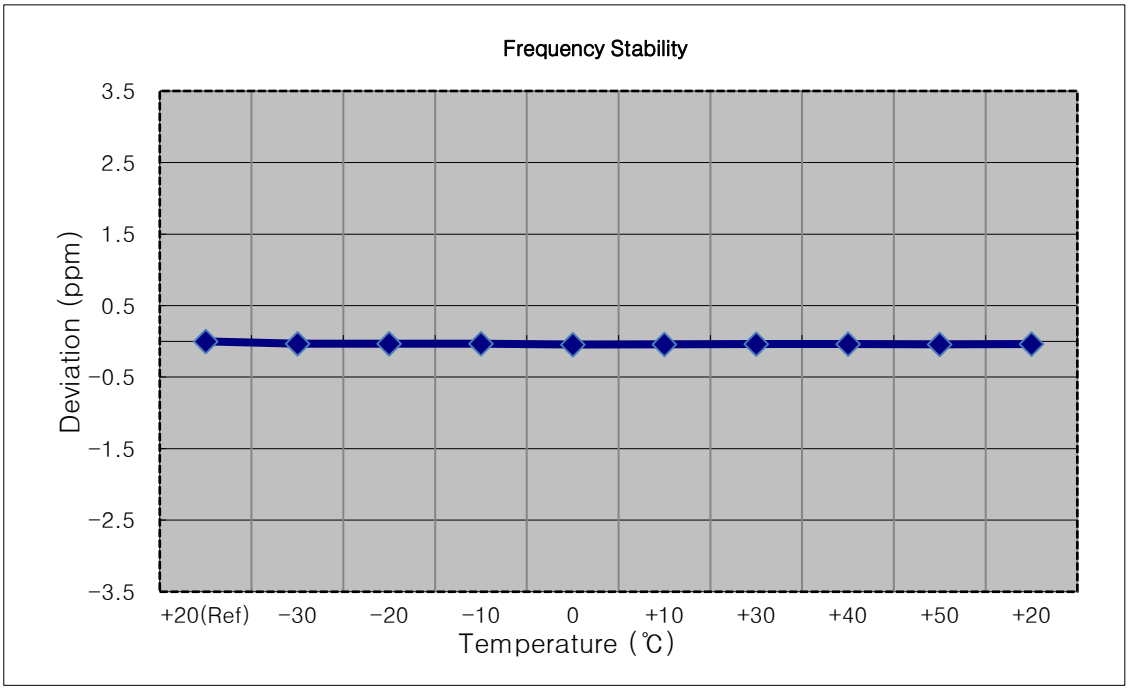
▣ OPERATING FREQUENCY: 2,560,000,000 Hz

▣ CHANNEL: 21350 (20 MHz)

▣ REFERENCE VOLTAGE: 3.88 VDC

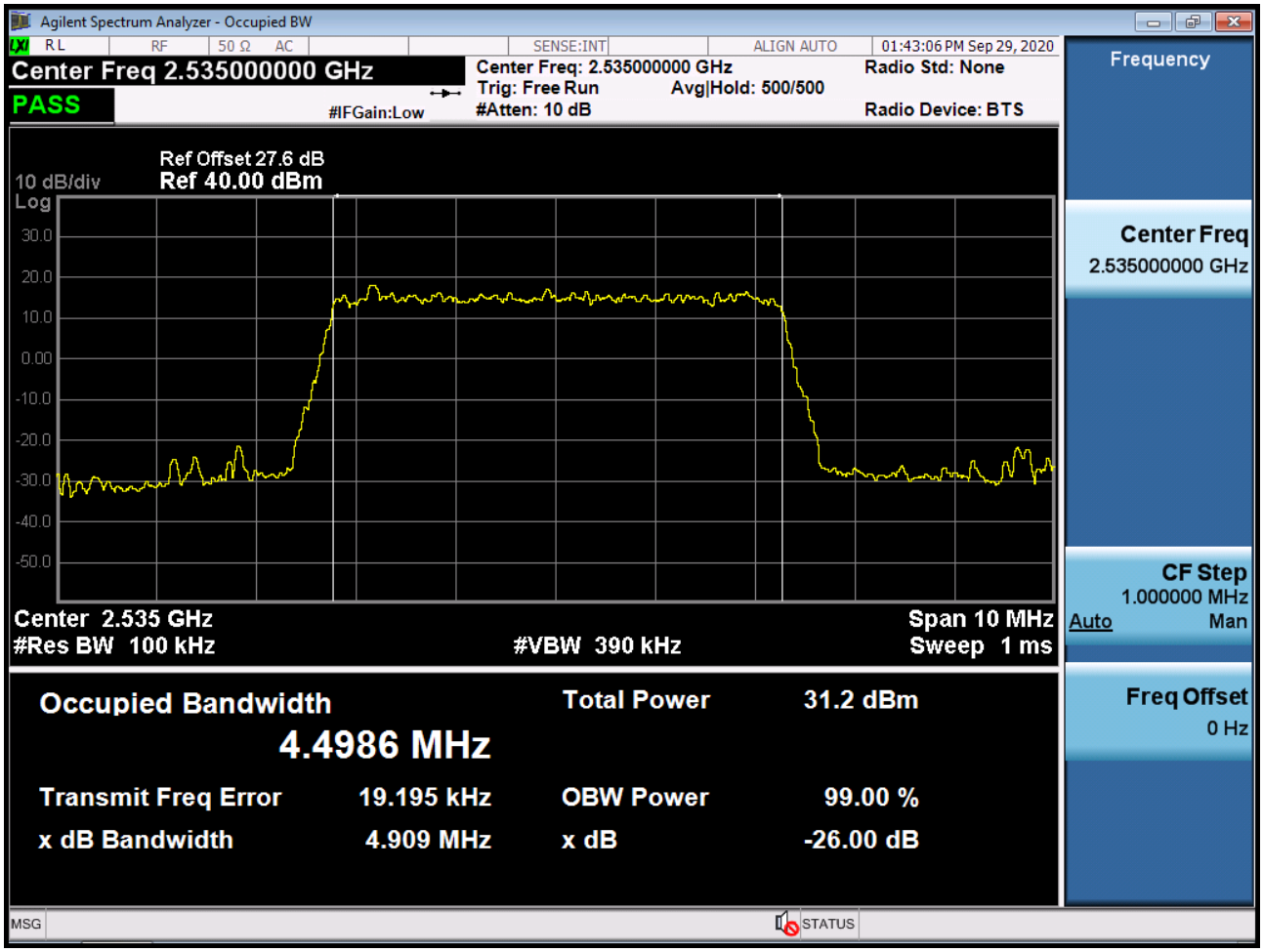
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2559 999 912	0.0	0.000 000	0.000
100%		-30	2559 999 826	-86.2	-0.000 003	-0.034
100%		-20	2559 999 828	-83.6	-0.000 003	-0.033
100%		-10	2559 999 829	-83.2	-0.000 003	-0.033
100%		0	2559 999 798	-113.5	-0.000 004	-0.044
100%		+10	2559 999 809	-102.9	-0.000 004	-0.040
100%		+30	2559 999 813	-98.6	-0.000 004	-0.039
100%		+40	2559 999 812	-100.1	-0.000 004	-0.039
100%		+50	2559 999 810	-102.0	-0.000 004	-0.040
Batt. Endpoint	3.650	+20	2559 999 821	-91.1	-0.000 004	-0.036

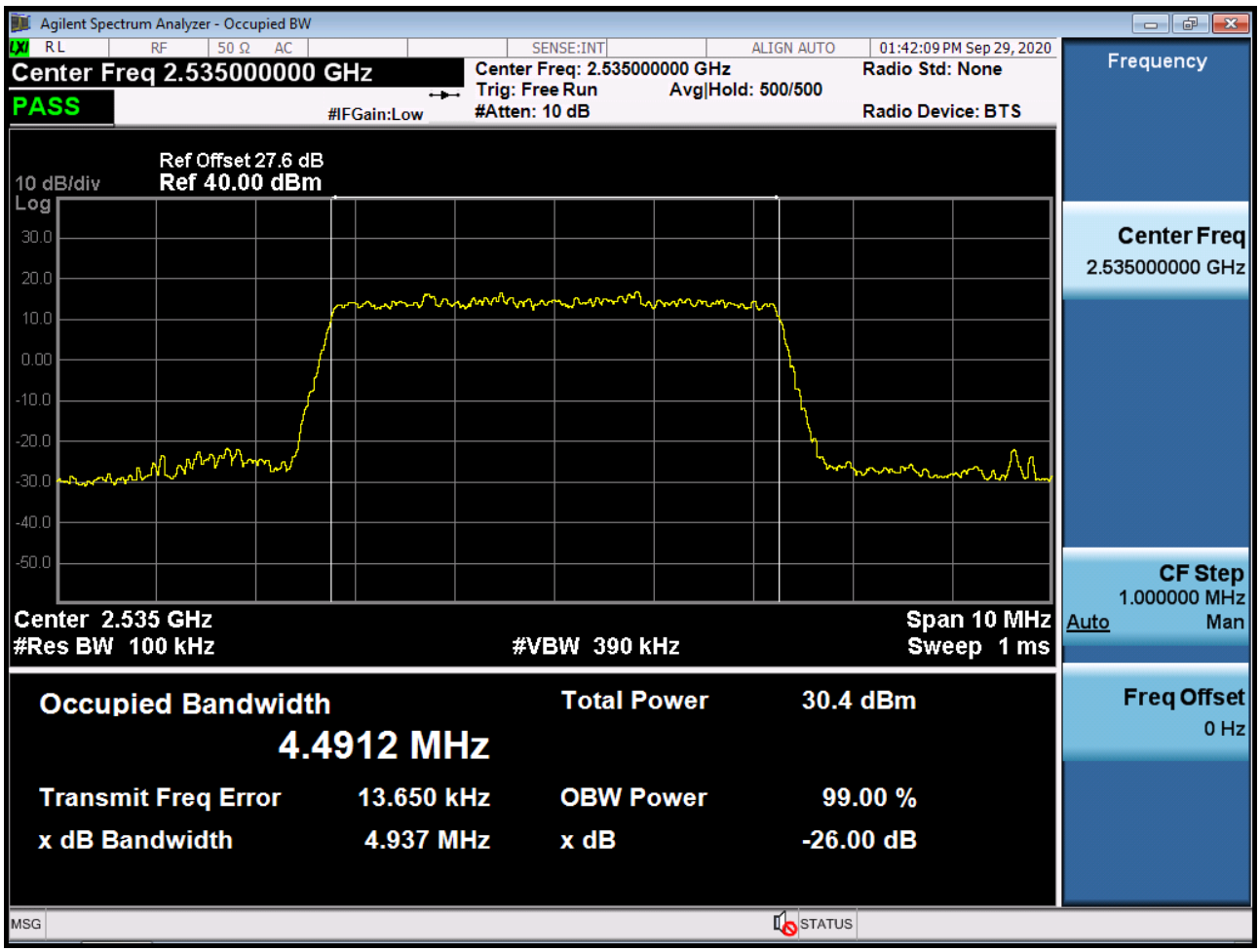


9. TEST PLOTS

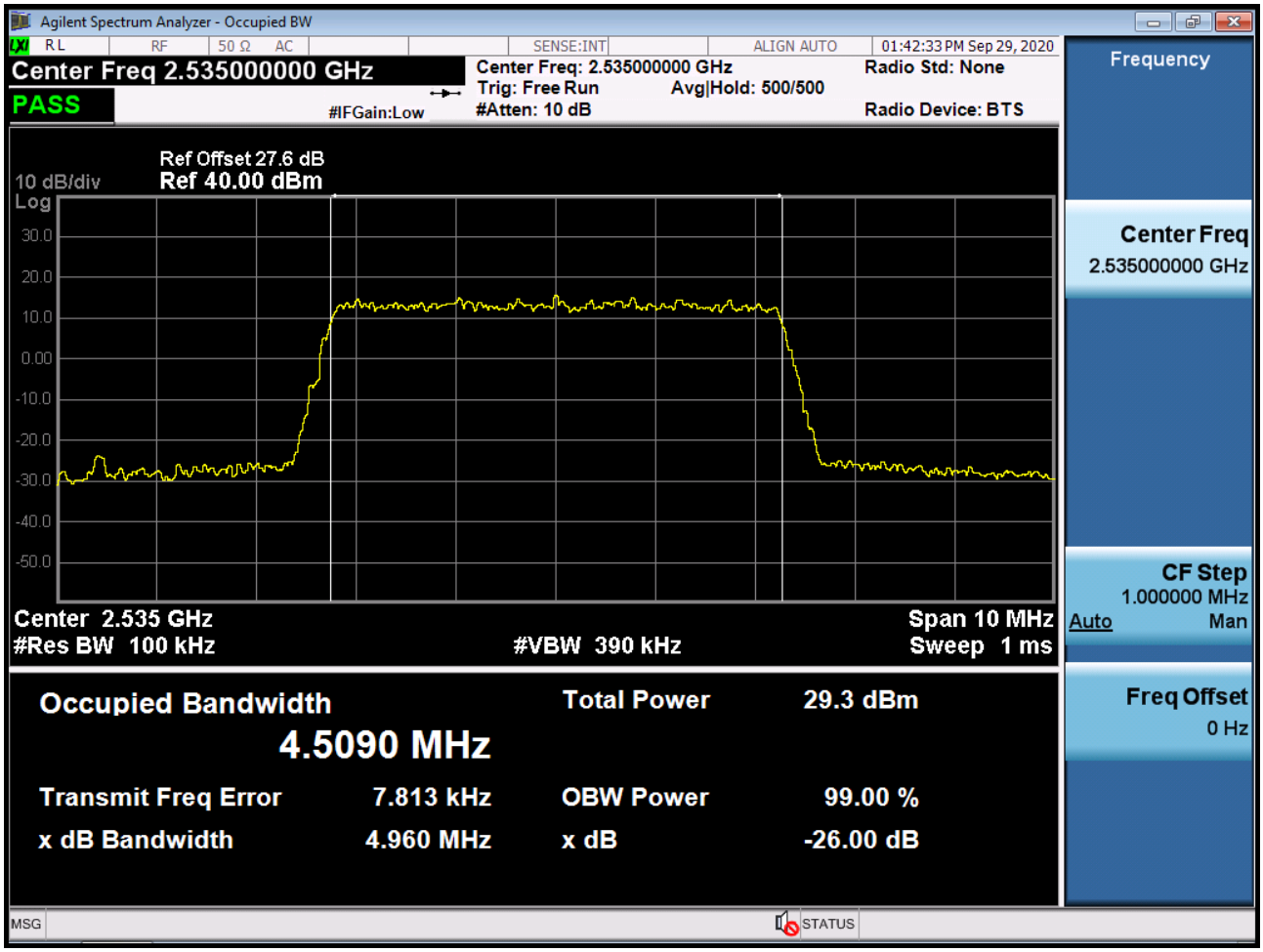
BAND 7. Occupied Bandwidth Plot (5 MHz Ch.21100 QPSK RB 25)



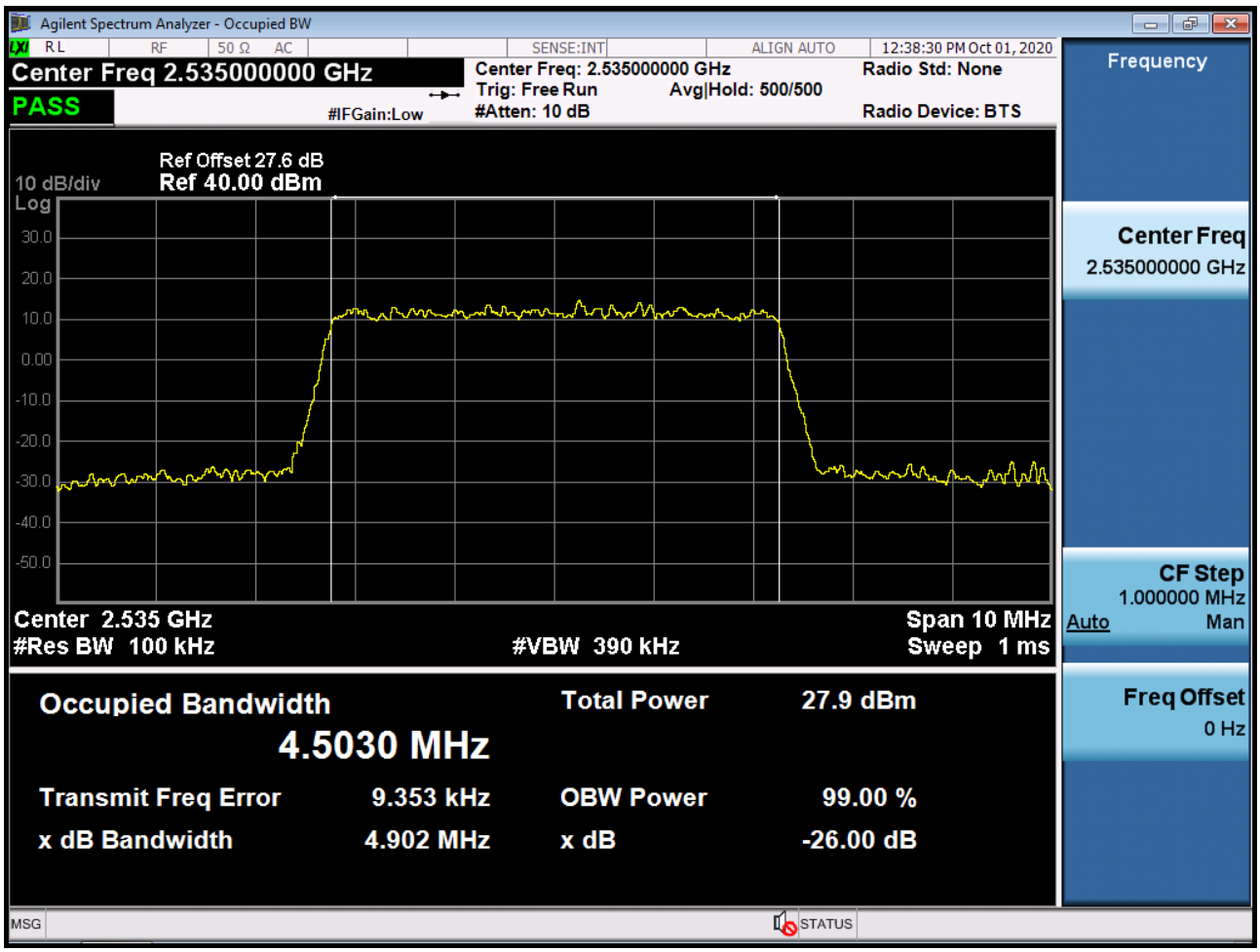
BAND 7. Occupied Bandwidth Plot (5 MHz Ch.21100 16-QAM RB 25)



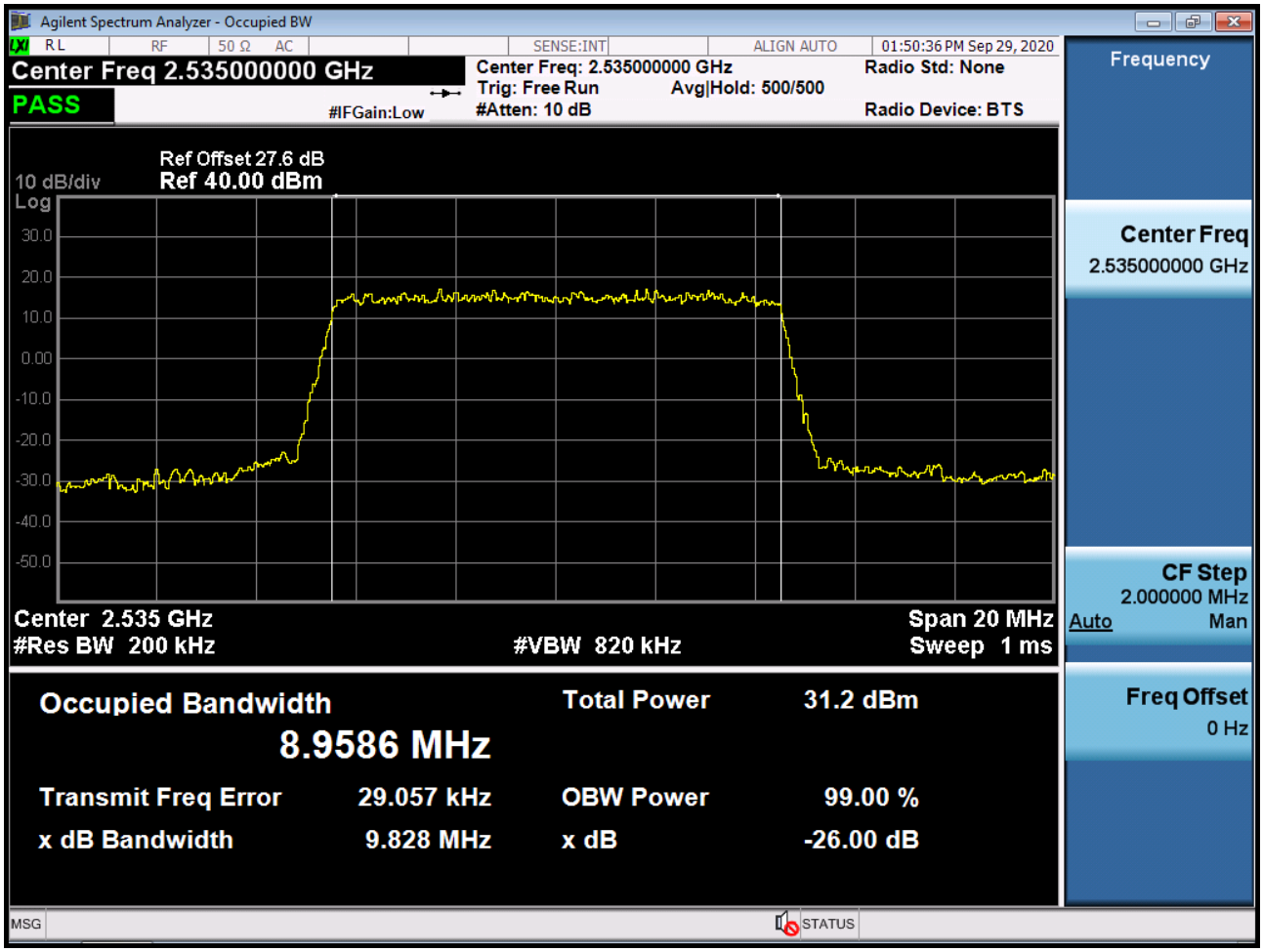
BAND 7. Occupied Bandwidth Plot (5 MHz Ch.21100 64-QAM RB 25)



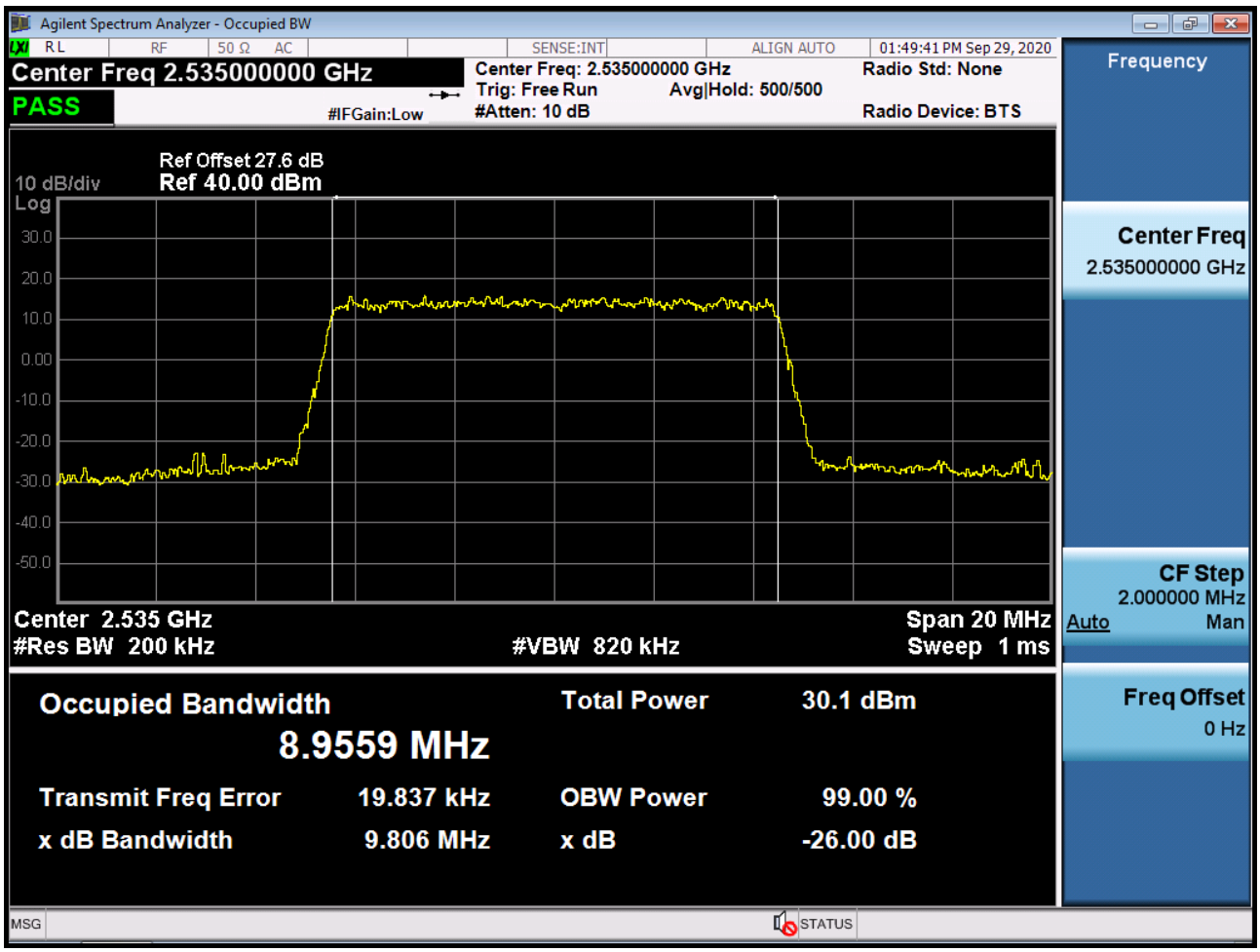
BAND 7. Occupied Bandwidth Plot (5 MHz Ch.21100 256-QAM RB 25)



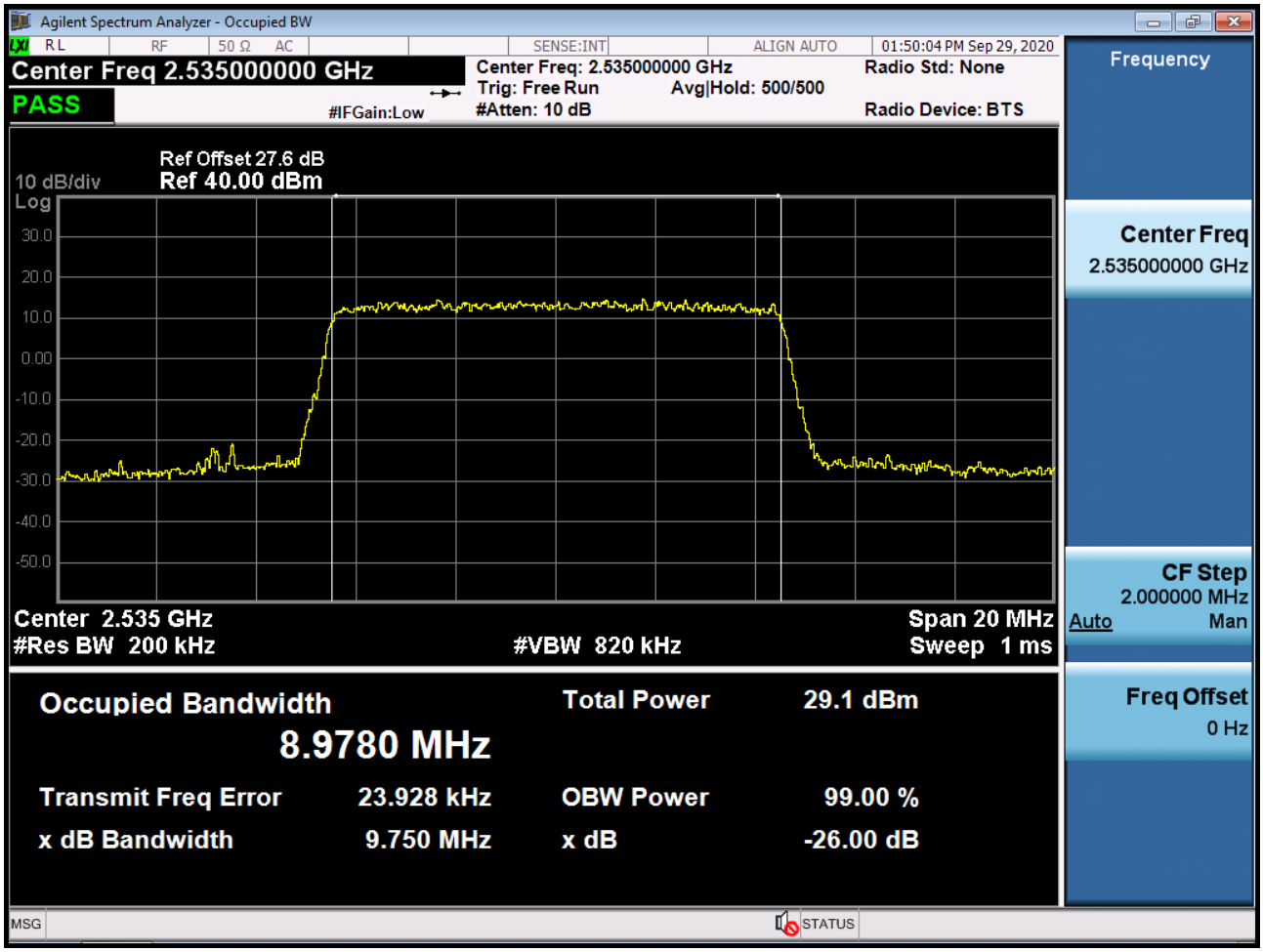
BAND 7. Occupied Bandwidth Plot (10 MHz Ch.21100 QPSK RB 50)



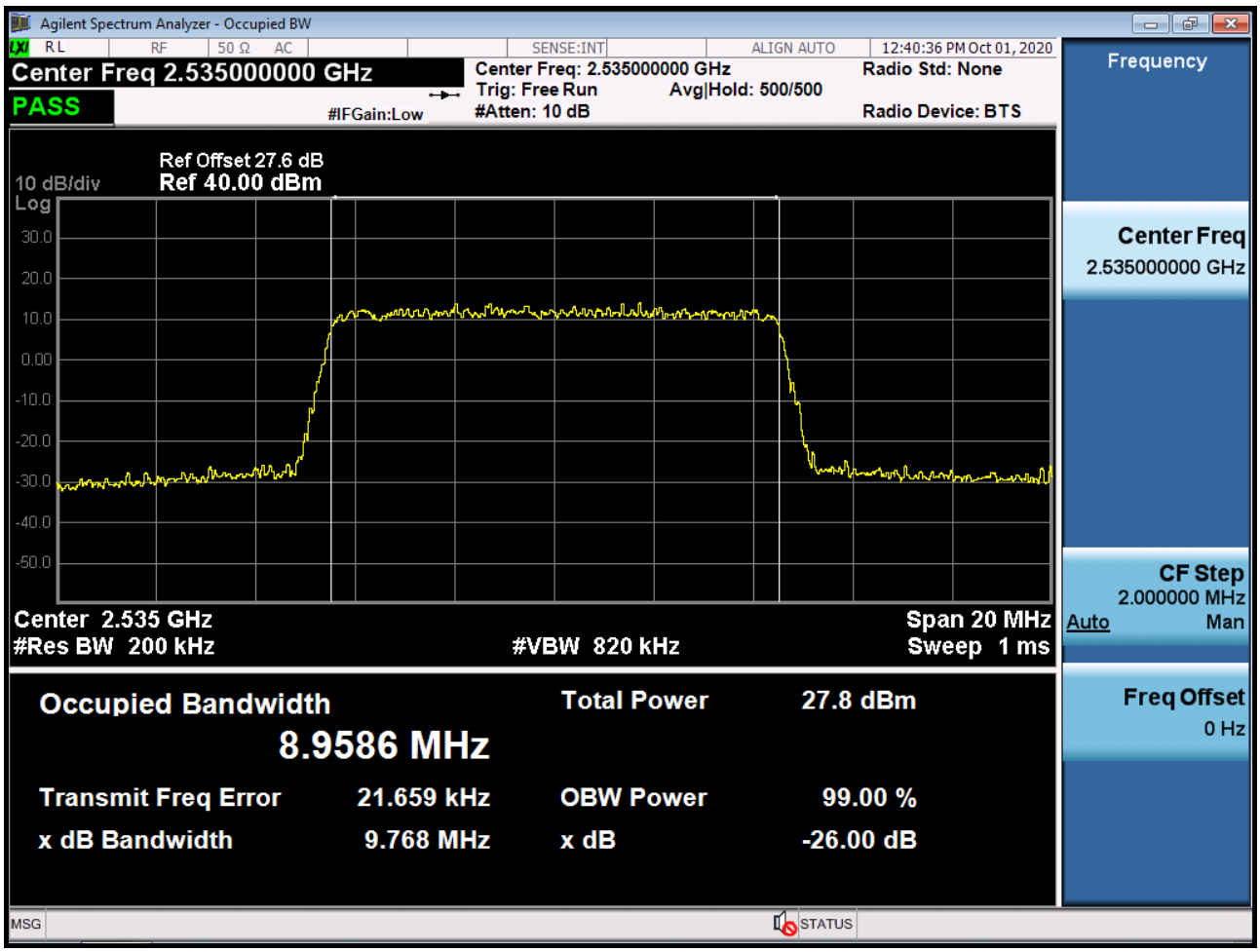
BAND 7. Occupied Bandwidth Plot (10 MHz Ch.21100 16-QAM RB 50)



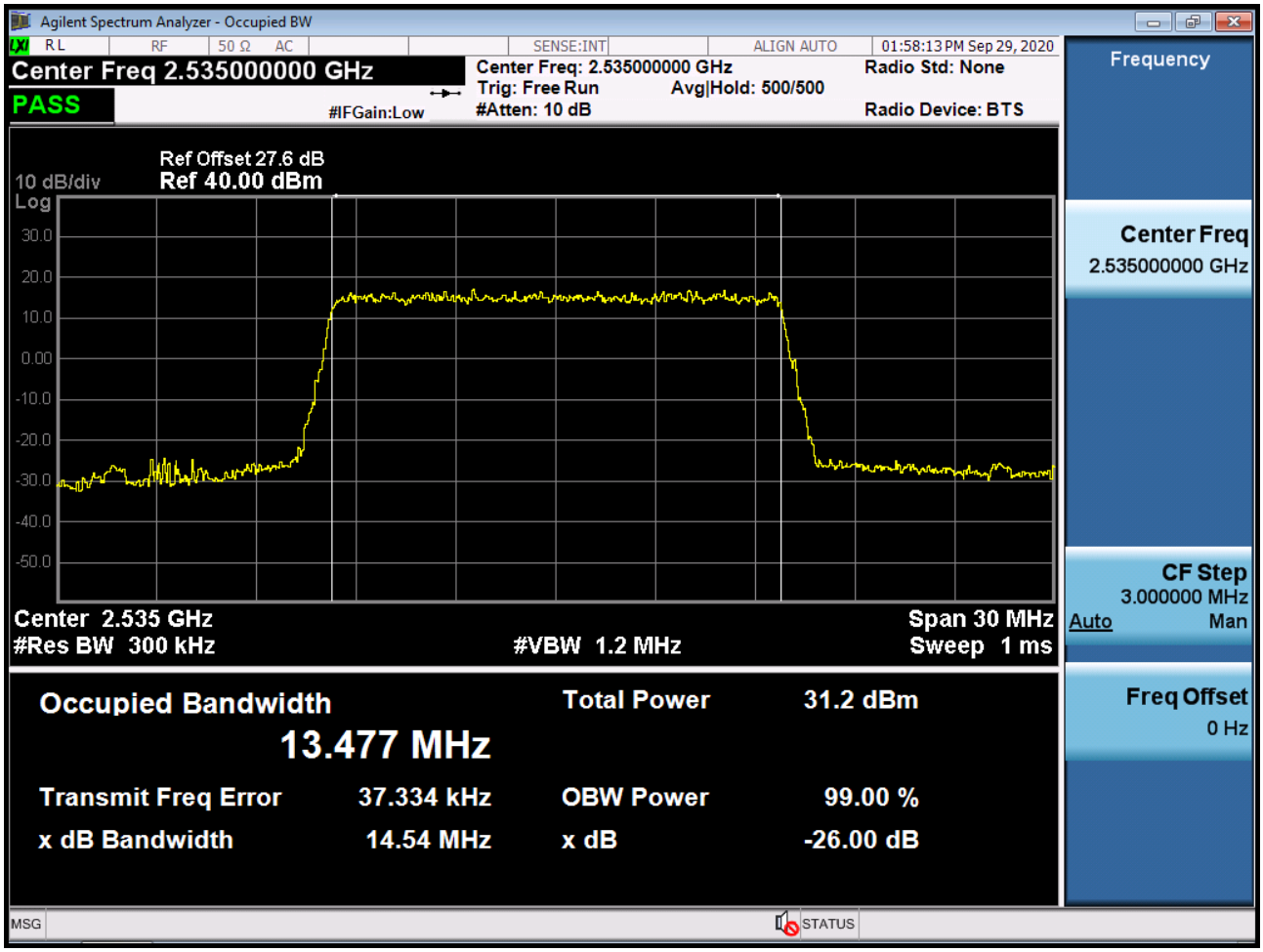
BAND 7. Occupied Bandwidth Plot (10 MHz Ch.21100 64-QAM RB 50)



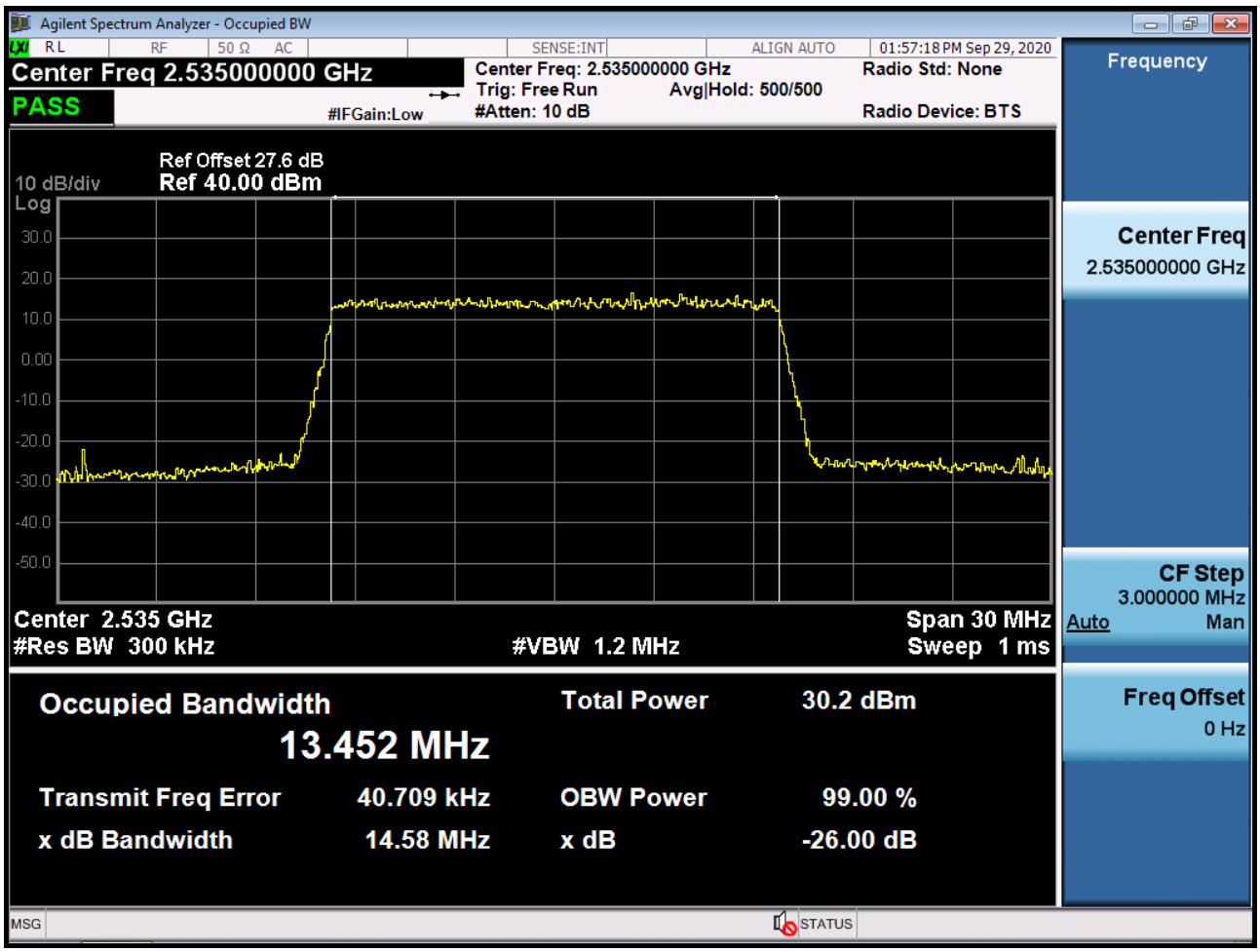
BAND 7. Occupied Bandwidth Plot (10 MHz Ch.21100 256-QAM RB 50)



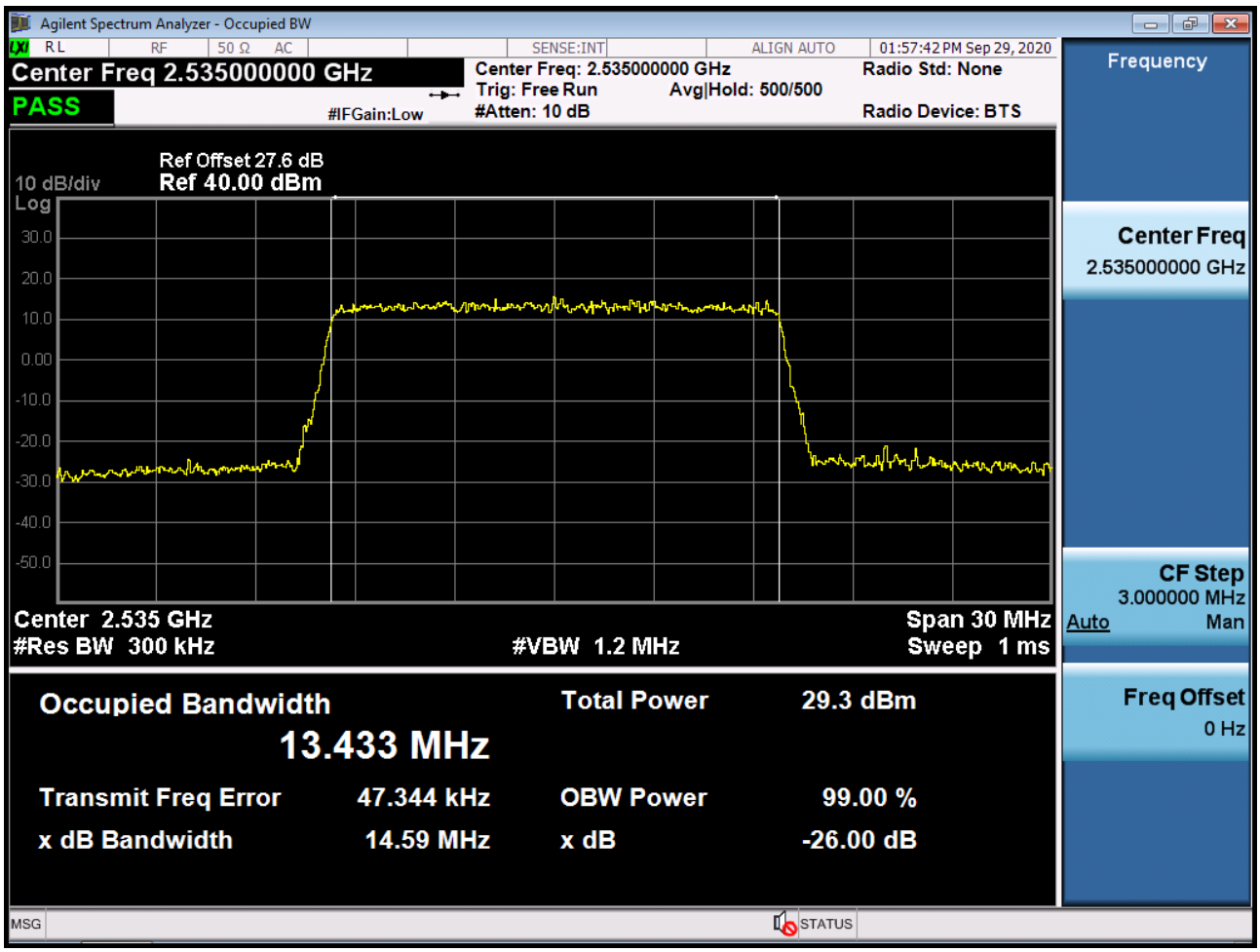
BAND 7. Occupied Bandwidth Plot (15 MHz Ch.21100 QPSK RB 75)



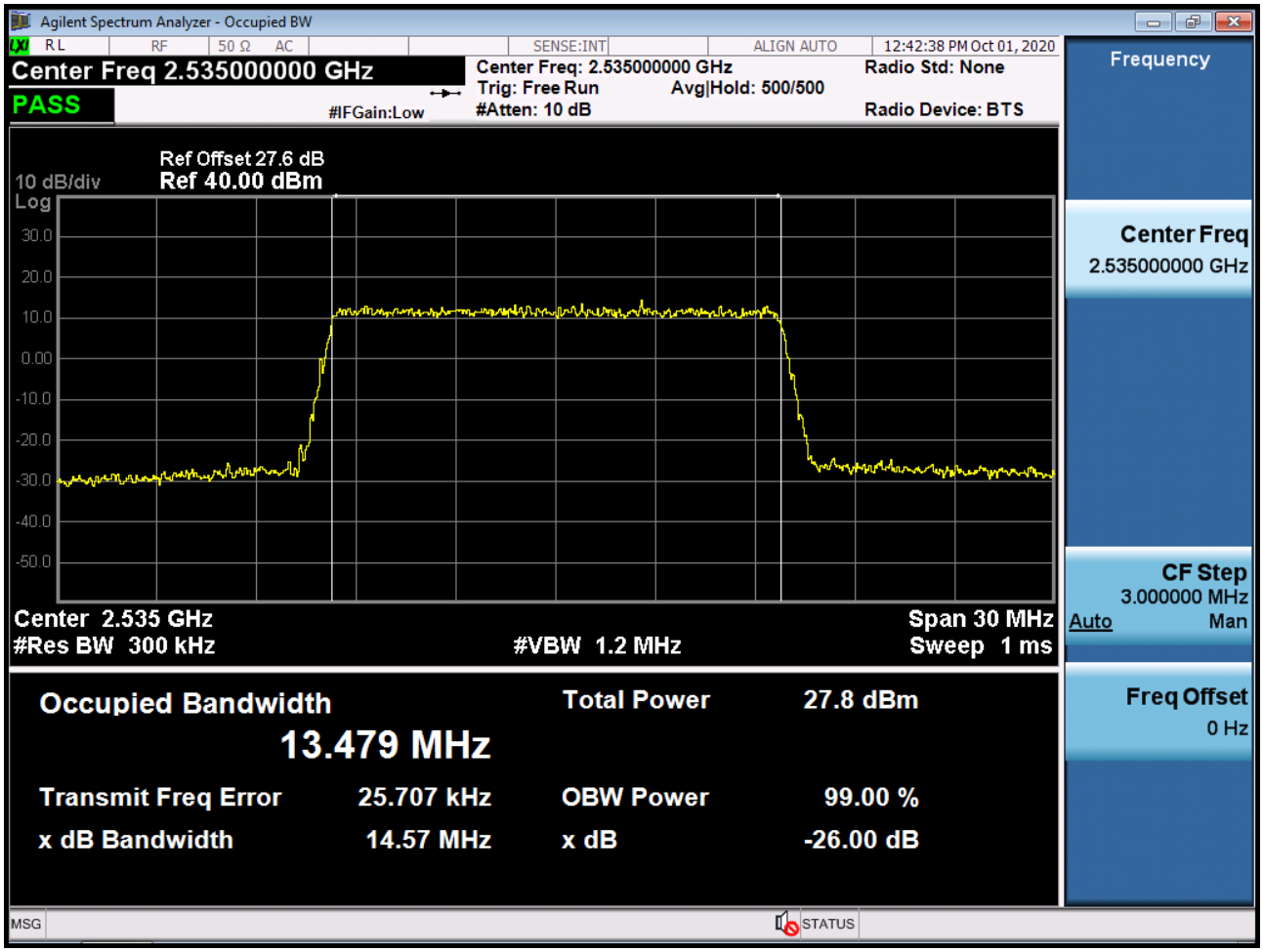
BAND 7. Occupied Bandwidth Plot (15 MHz Ch.21100 16-QAM RB 75)



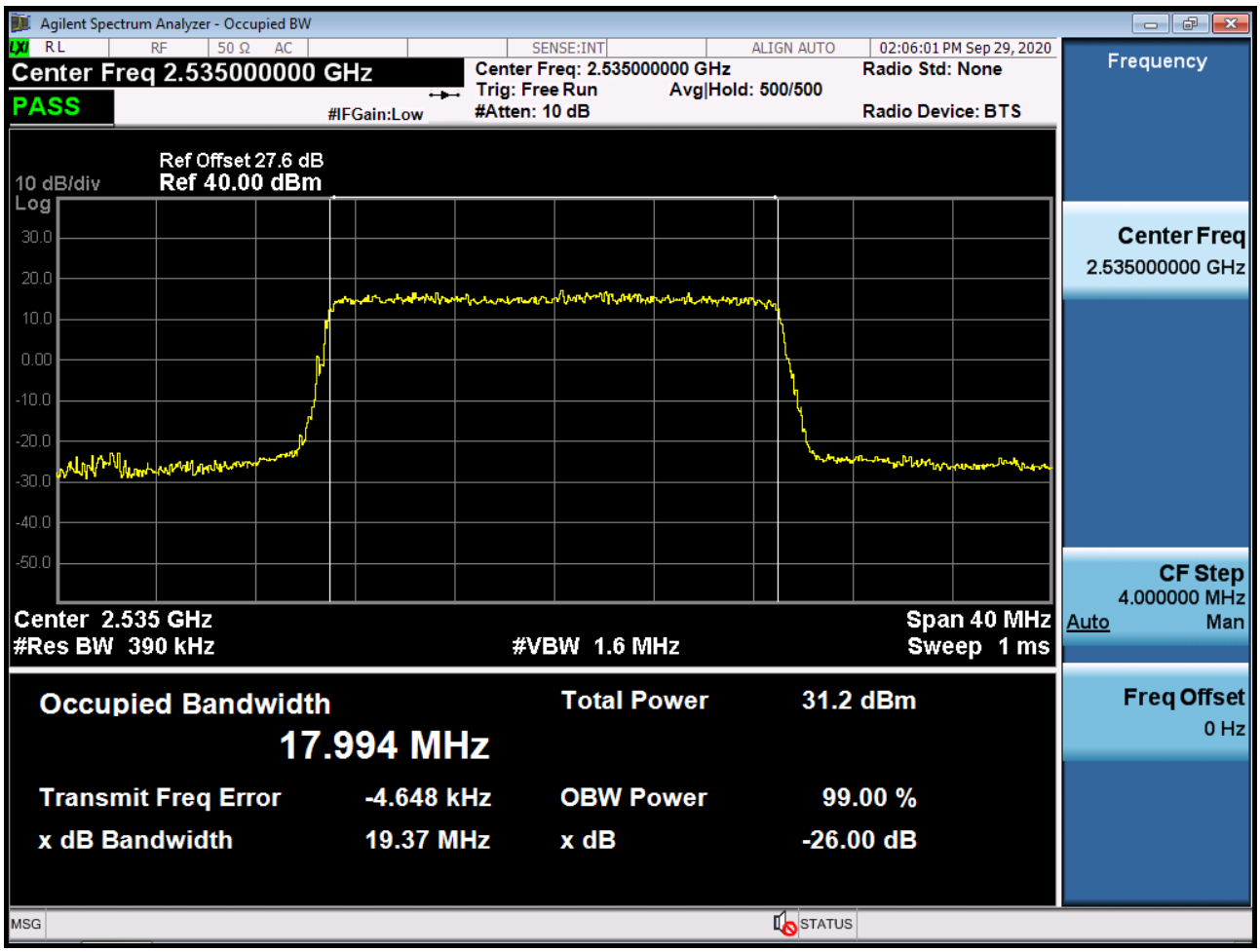
BAND 7. Occupied Bandwidth Plot (15 MHz Ch.21100 64-QAM RB 75)



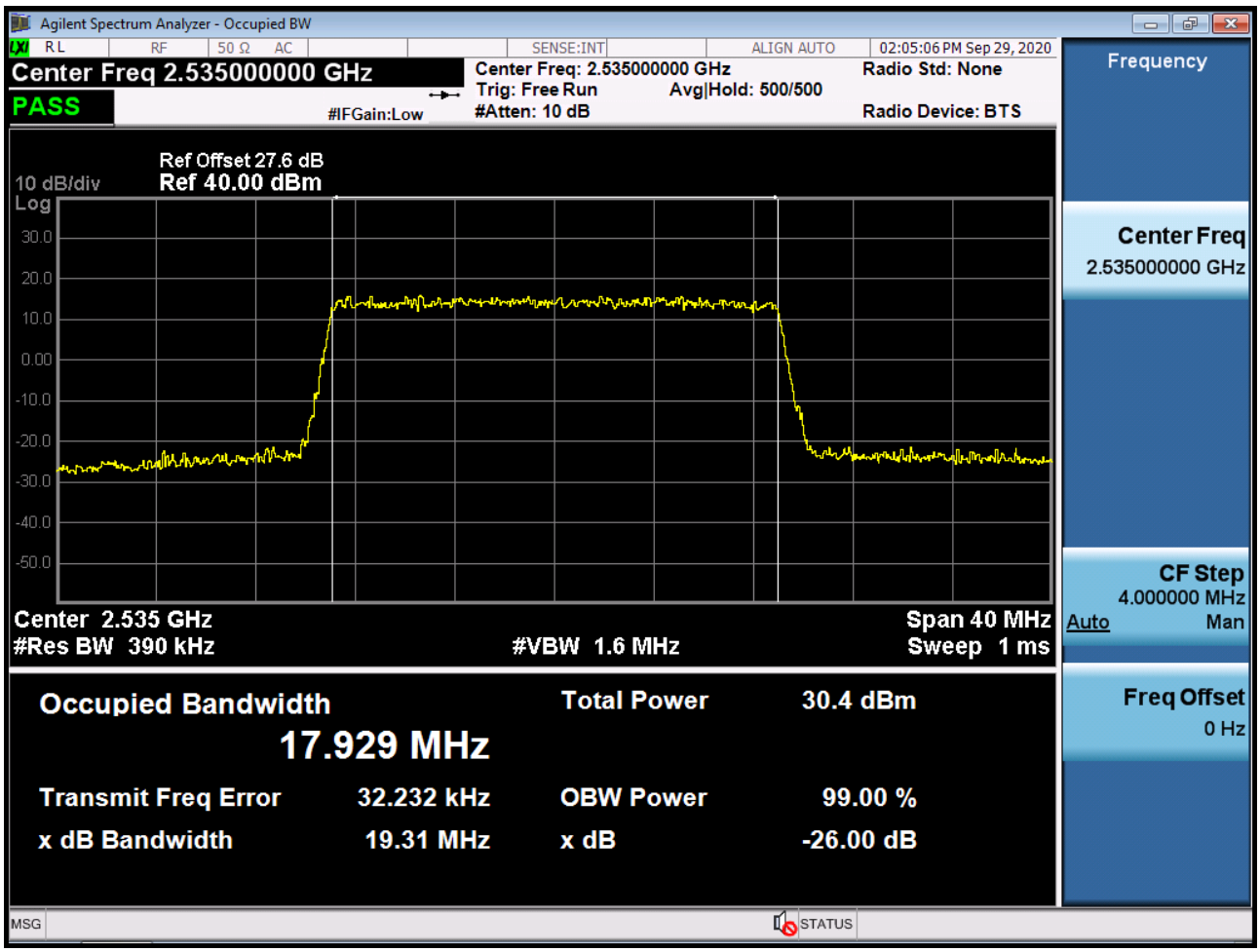
BAND 7. Occupied Bandwidth Plot (15 MHz Ch.21100 256-QAM RB 75)



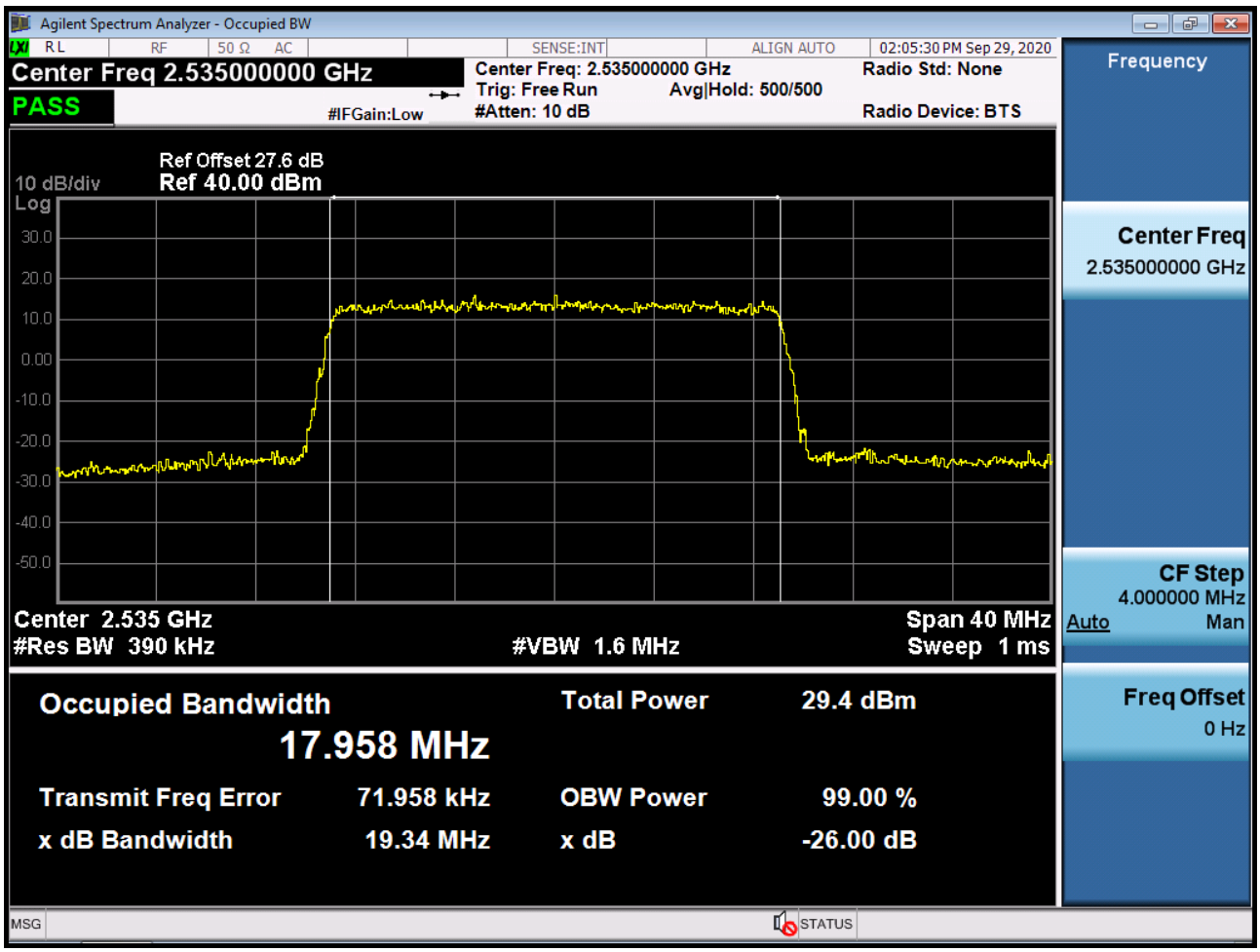
BAND 7. Occupied Bandwidth Plot (20 MHz Ch.21100 QPSK RB 100)



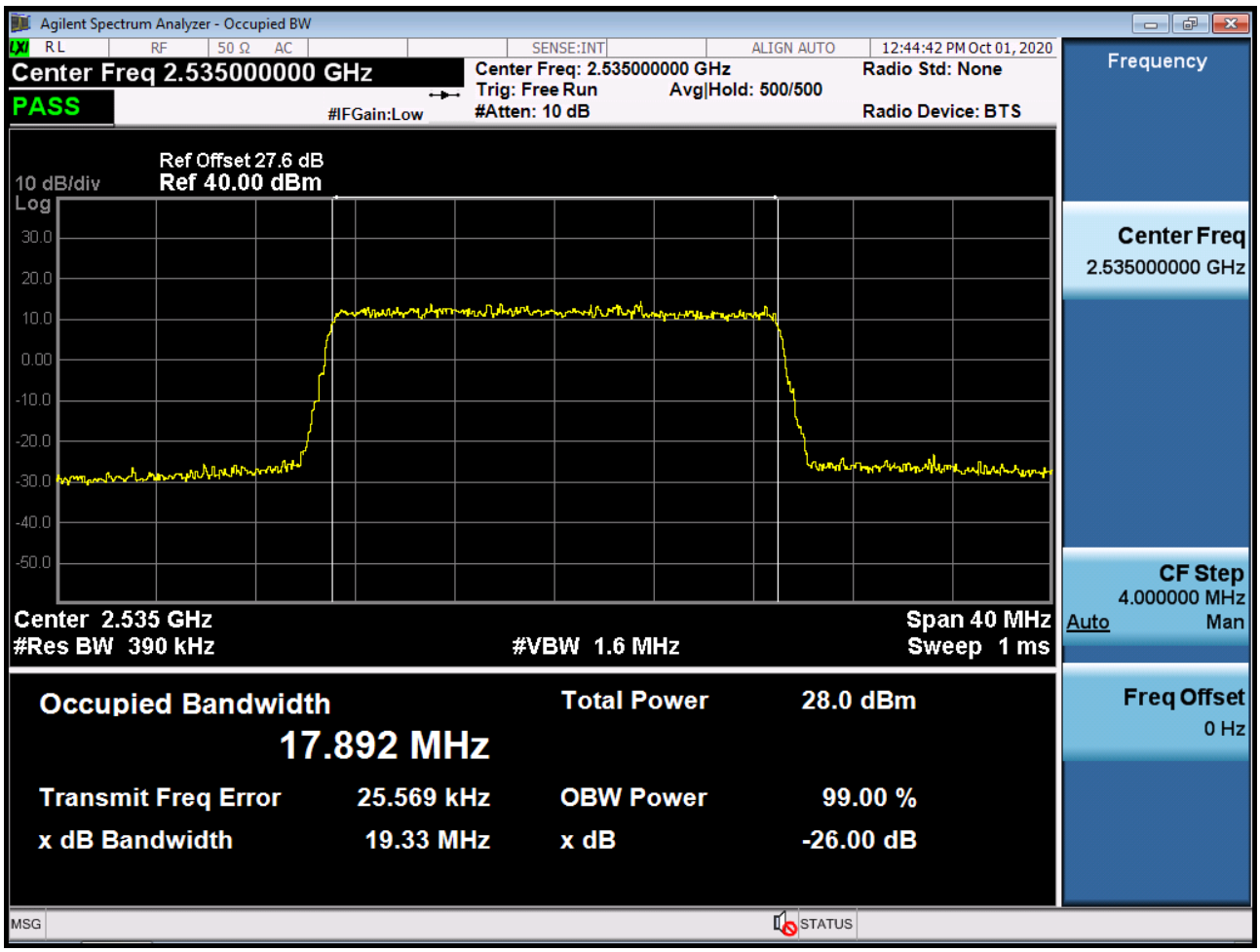
BAND 7. Occupied Bandwidth Plot (20 MHz Ch.21100 16-QAM RB 100)



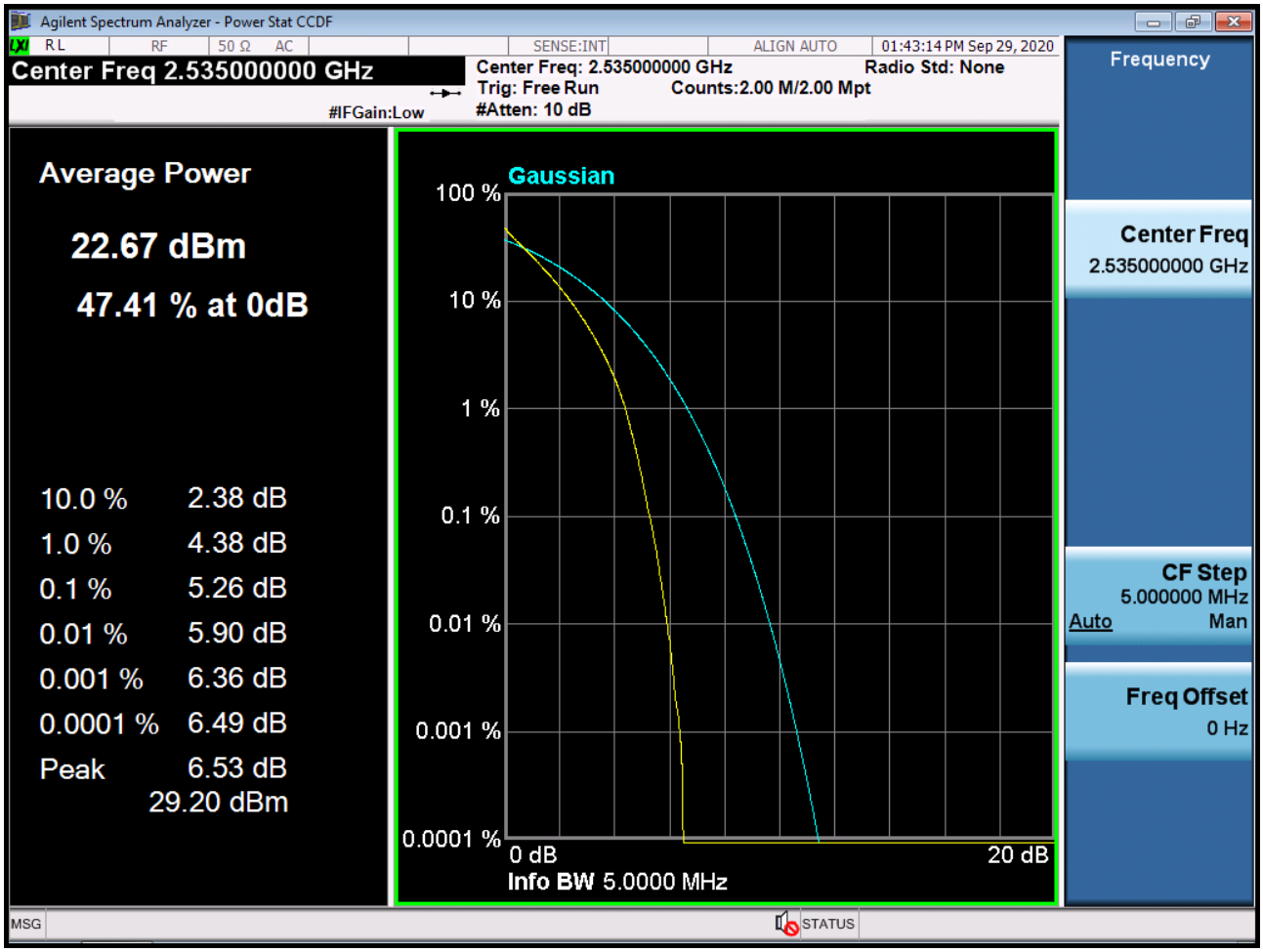
BAND 7. Occupied Bandwidth Plot (20 MHz Ch.21100 64-QAM RB 100)



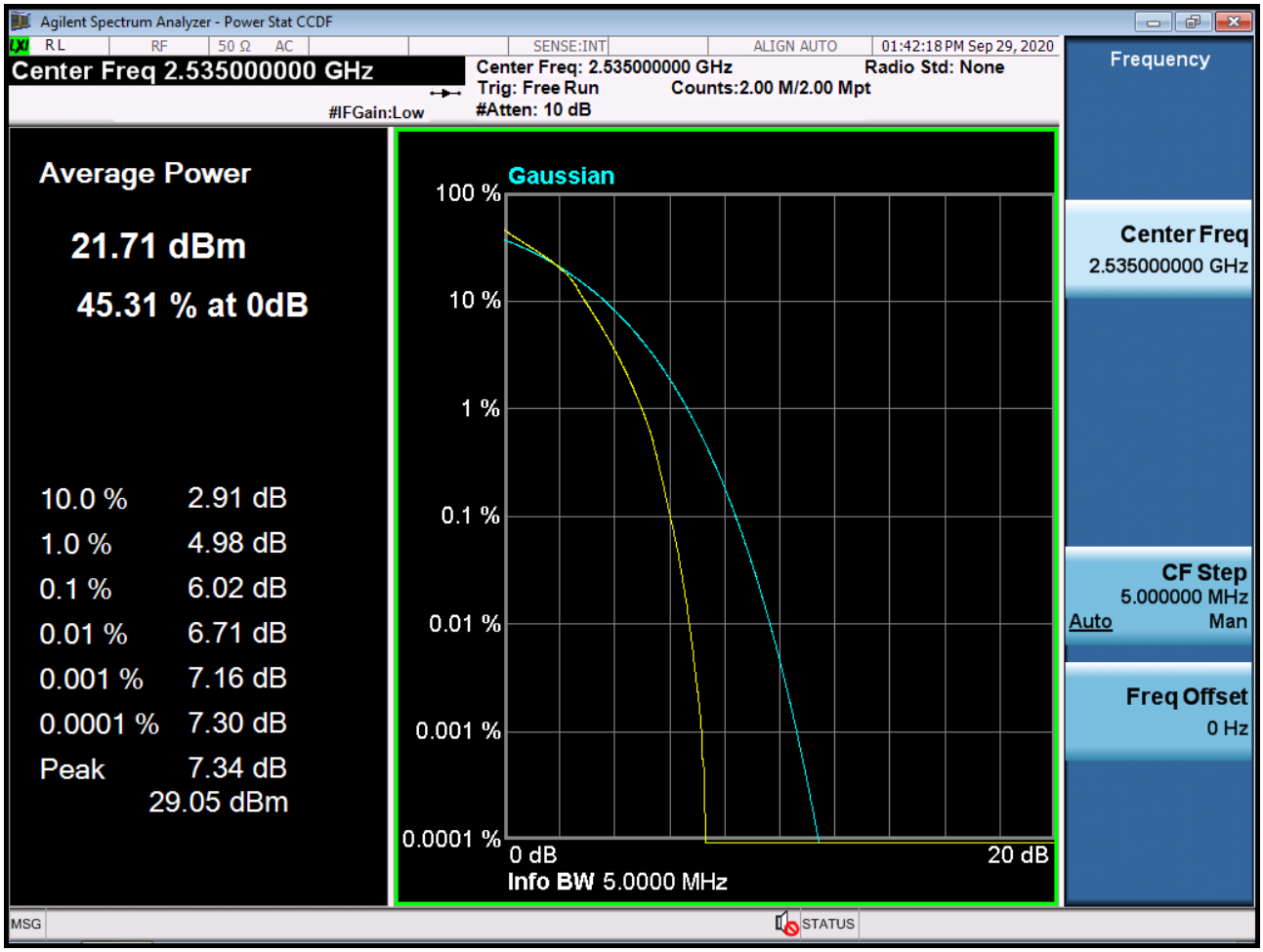
BAND 7. Occupied Bandwidth Plot (20 MHz Ch.21100 256-QAM RB 100)



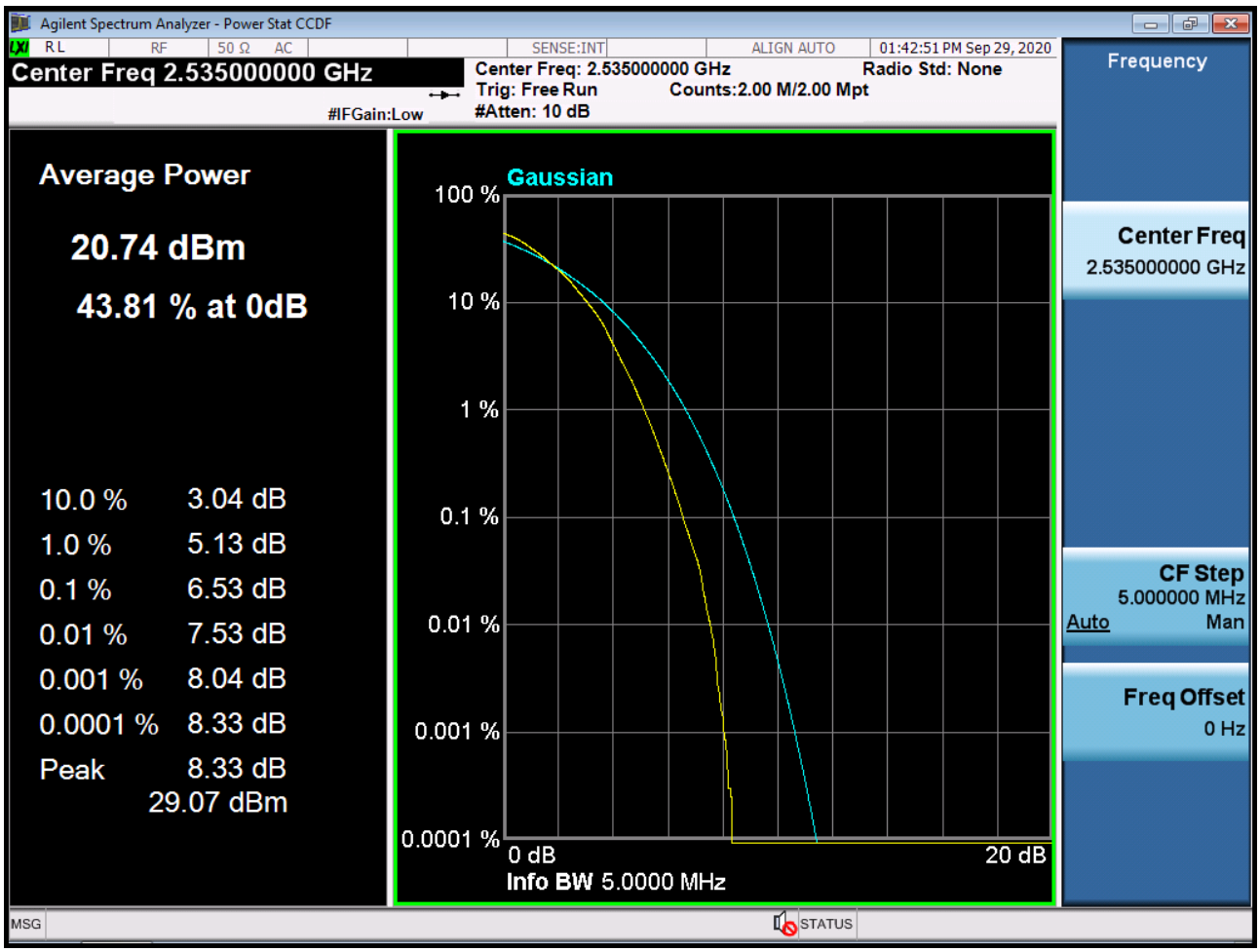
BAND 7. PAR Plot (5M BW Ch.21100 QPSK RB 25_0)



BAND 7. PAR Plot (5M BW Ch.21100 16QAM RB 25_0)

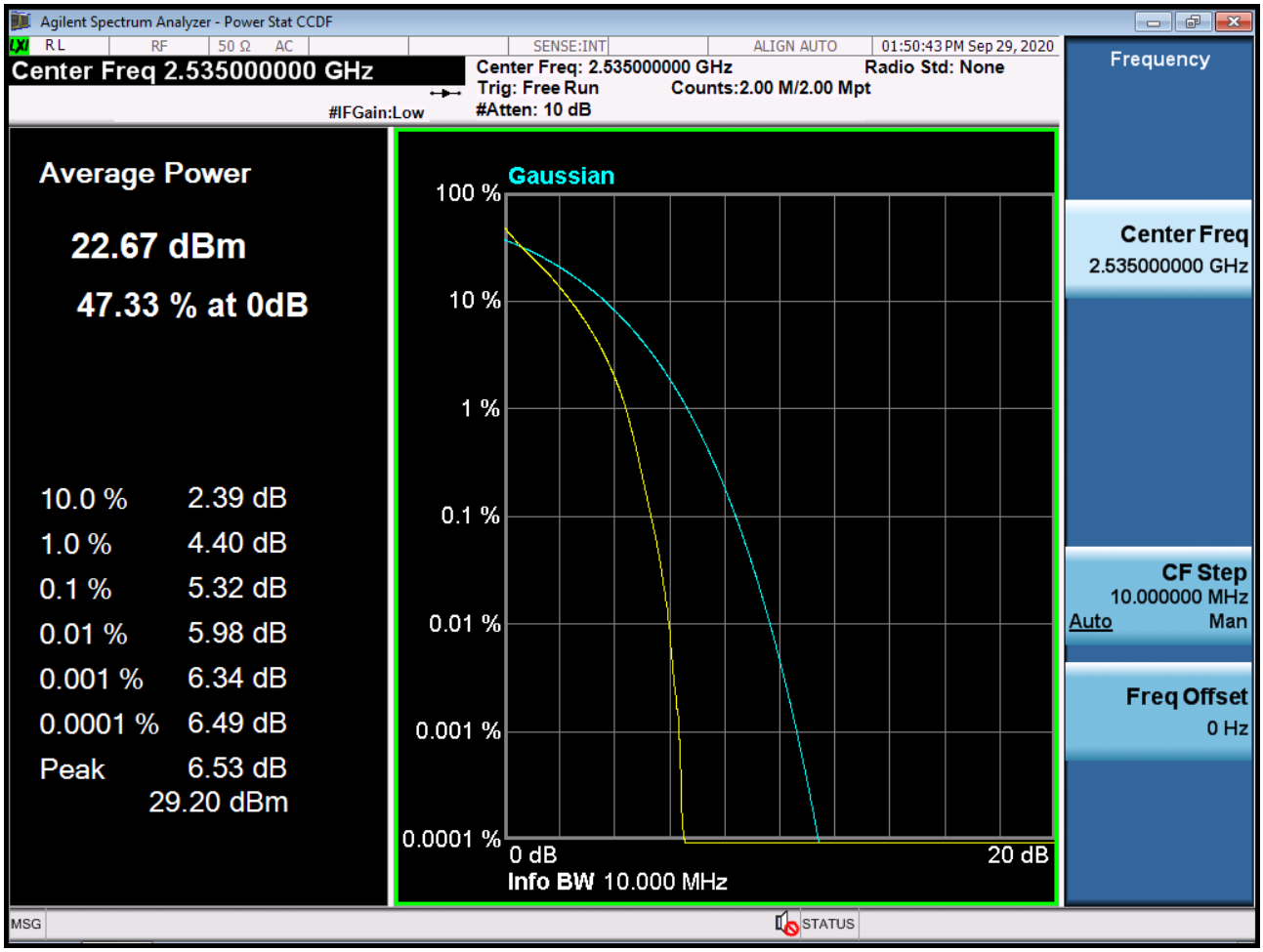


BAND 7. PAR Plot (5M BW Ch.21100 64QAM RB 25_0)

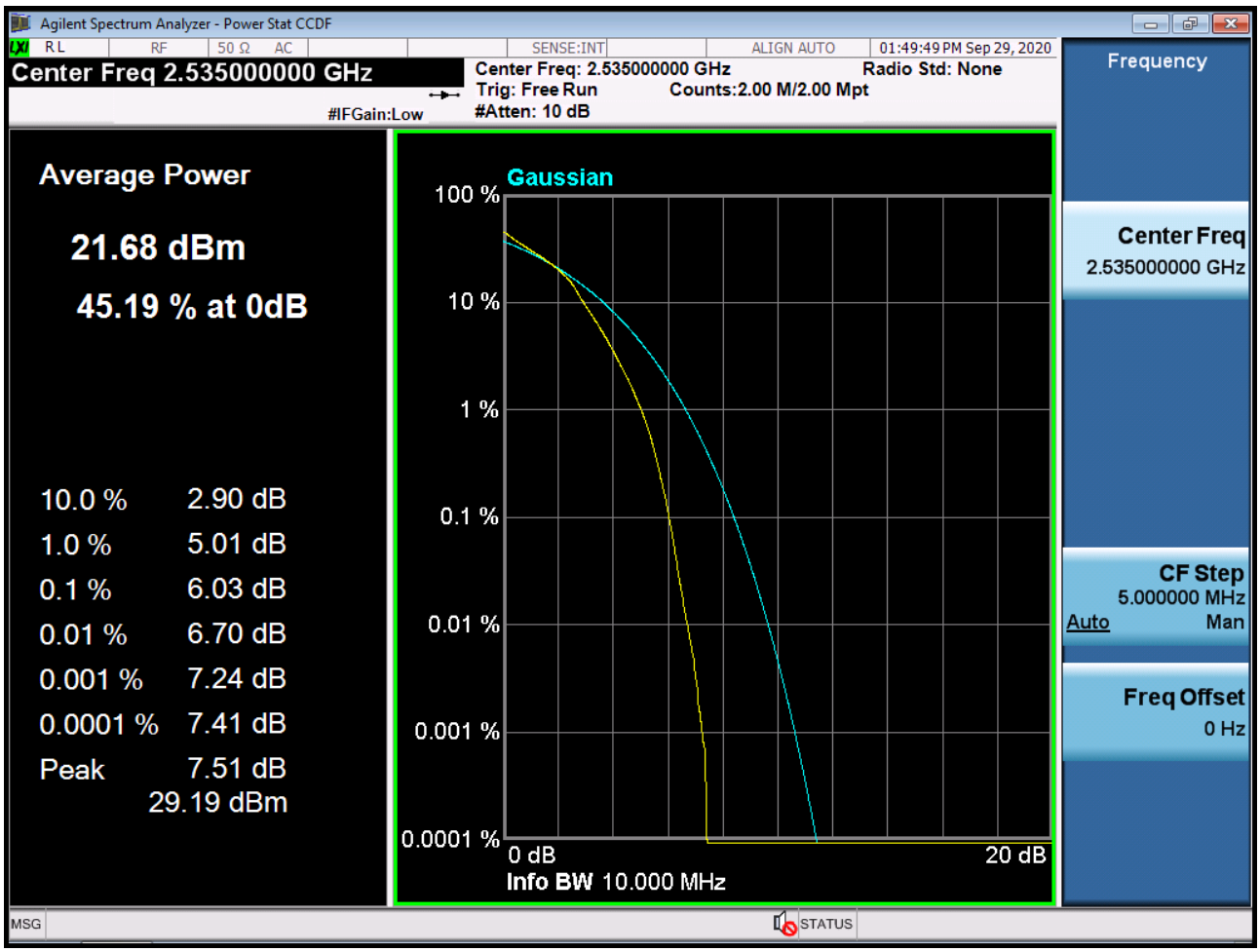


BAND 7. PAR Plot (5M BW Ch.21100 256QAM RB 25_0)

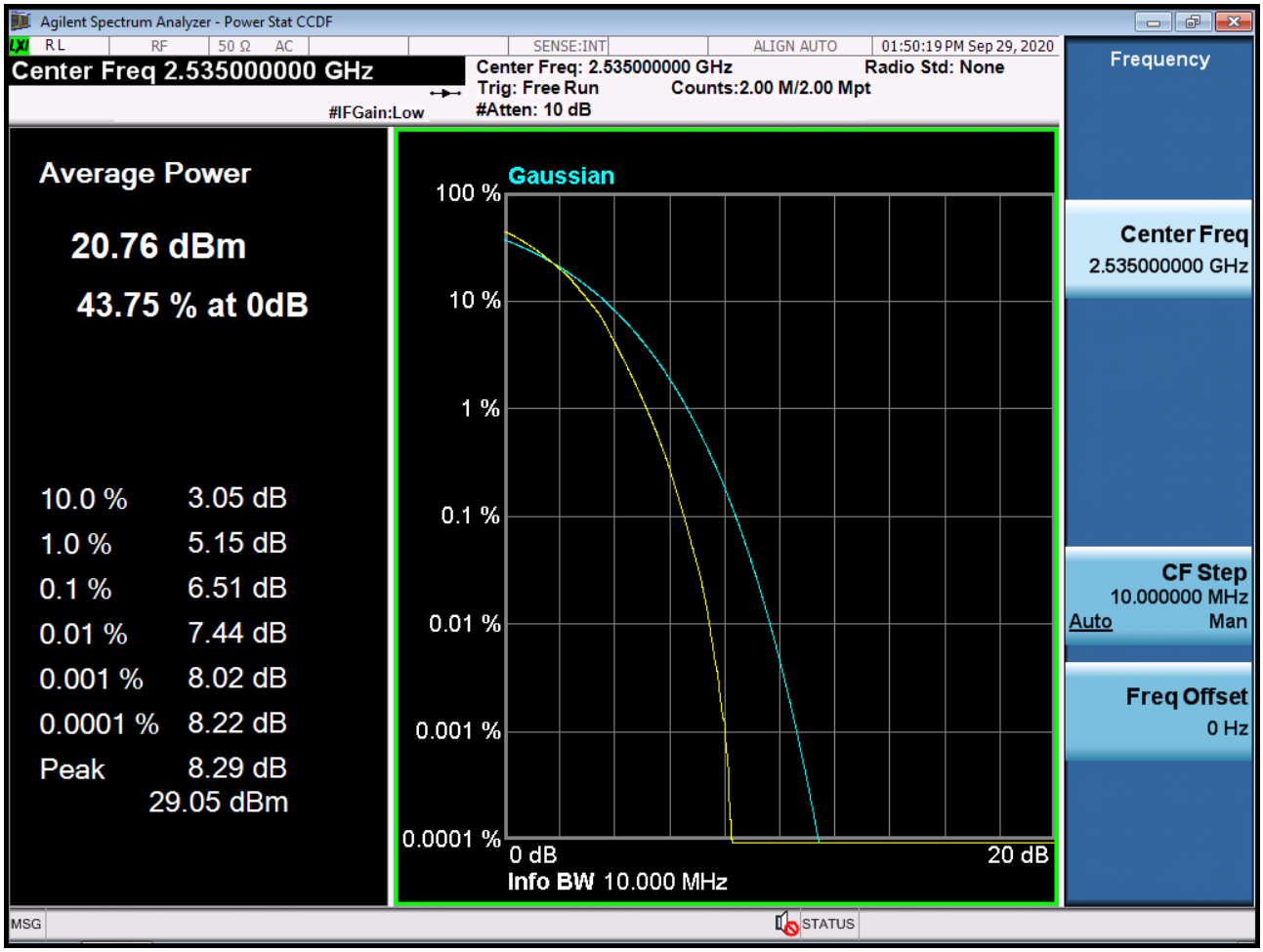
BAND 7. PAR Plot (10M BW Ch.21100 QPSK RB 50_0)



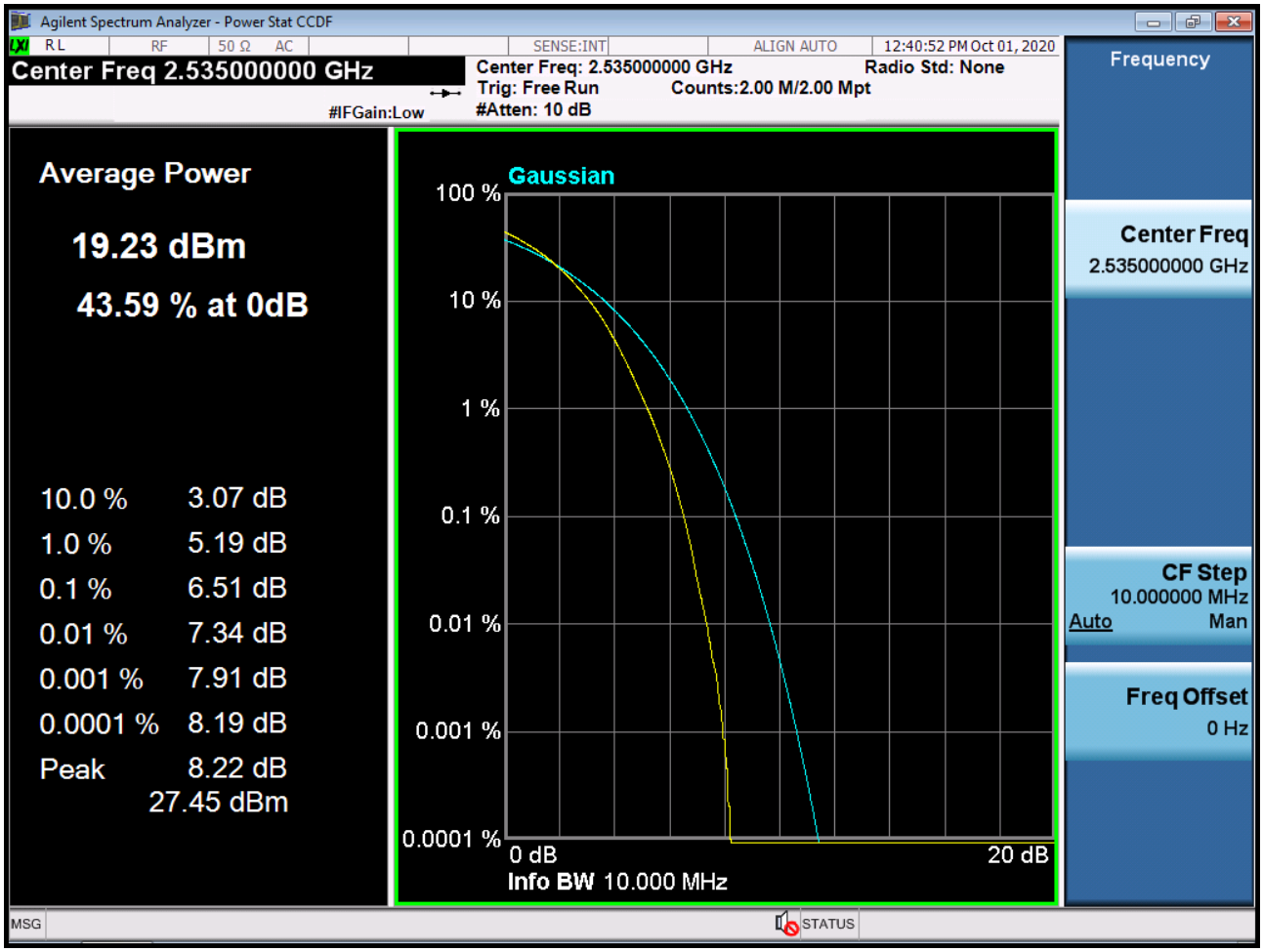
BAND 7. PAR Plot (10M BW Ch.21100 16QAM RB 50_0)



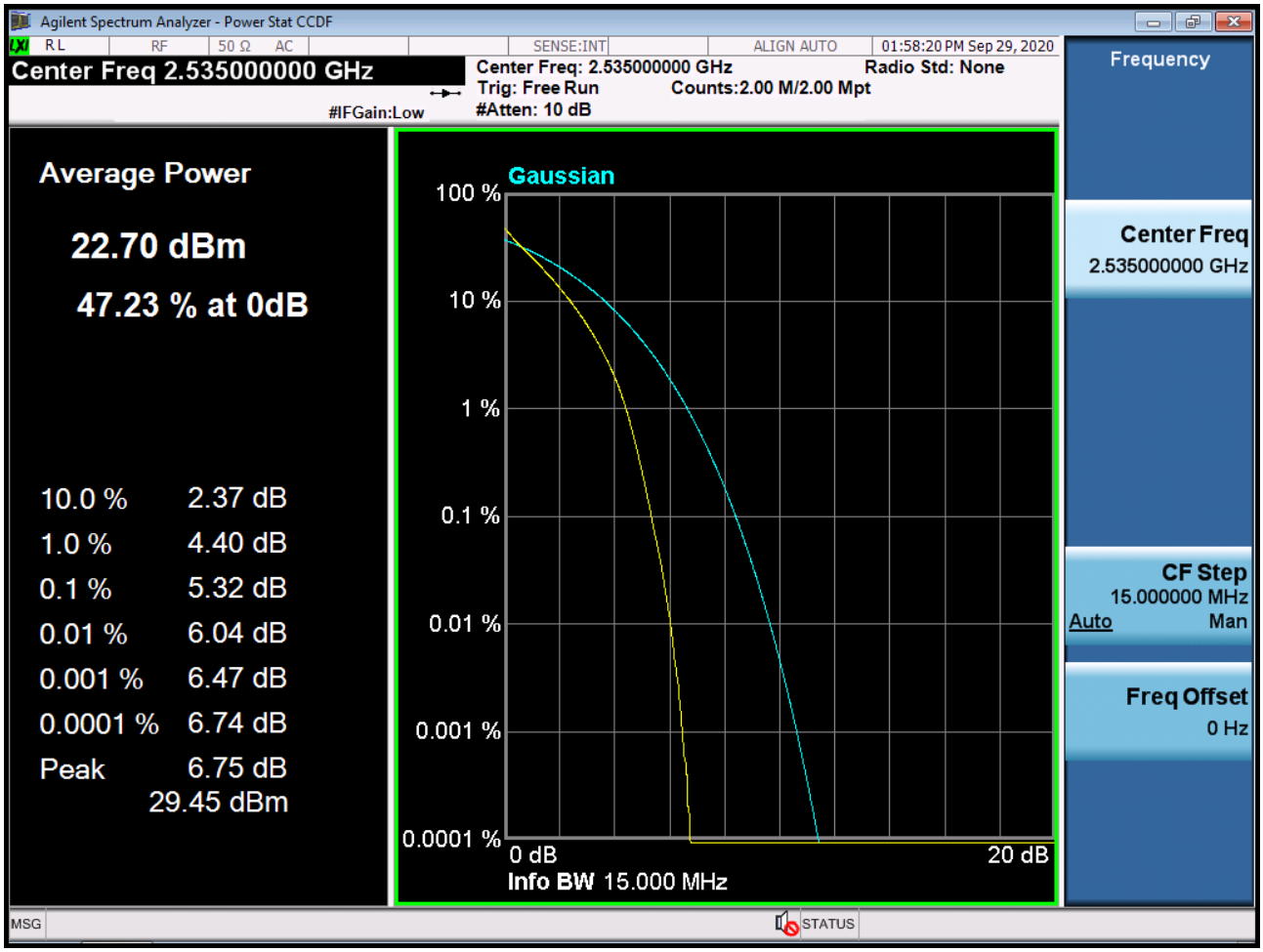
BAND 7. PAR Plot (10M BW Ch.21100 64QAM RB 50_0)



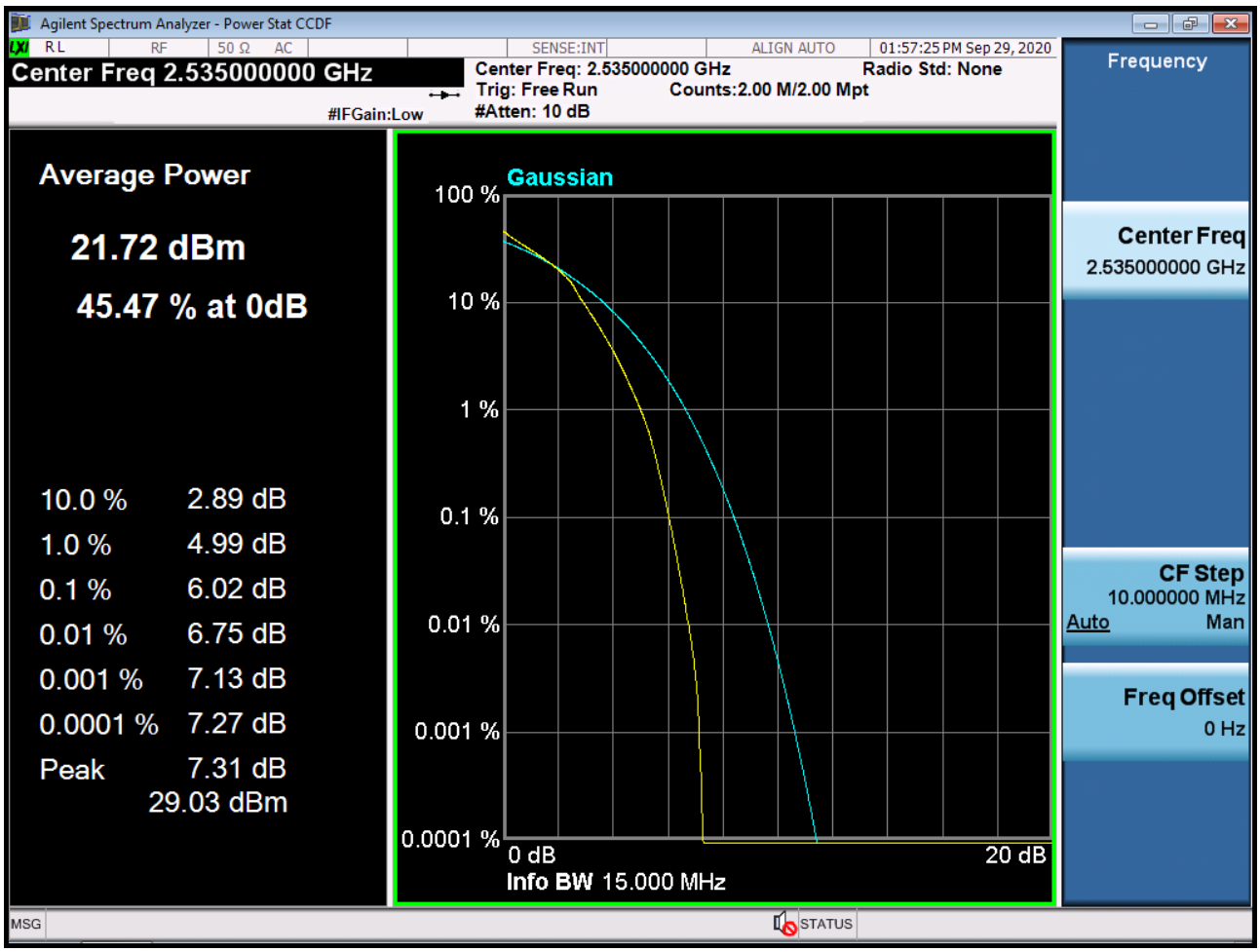
BAND 7. PAR Plot (10M BW Ch.21100 256QAM RB 50_0)



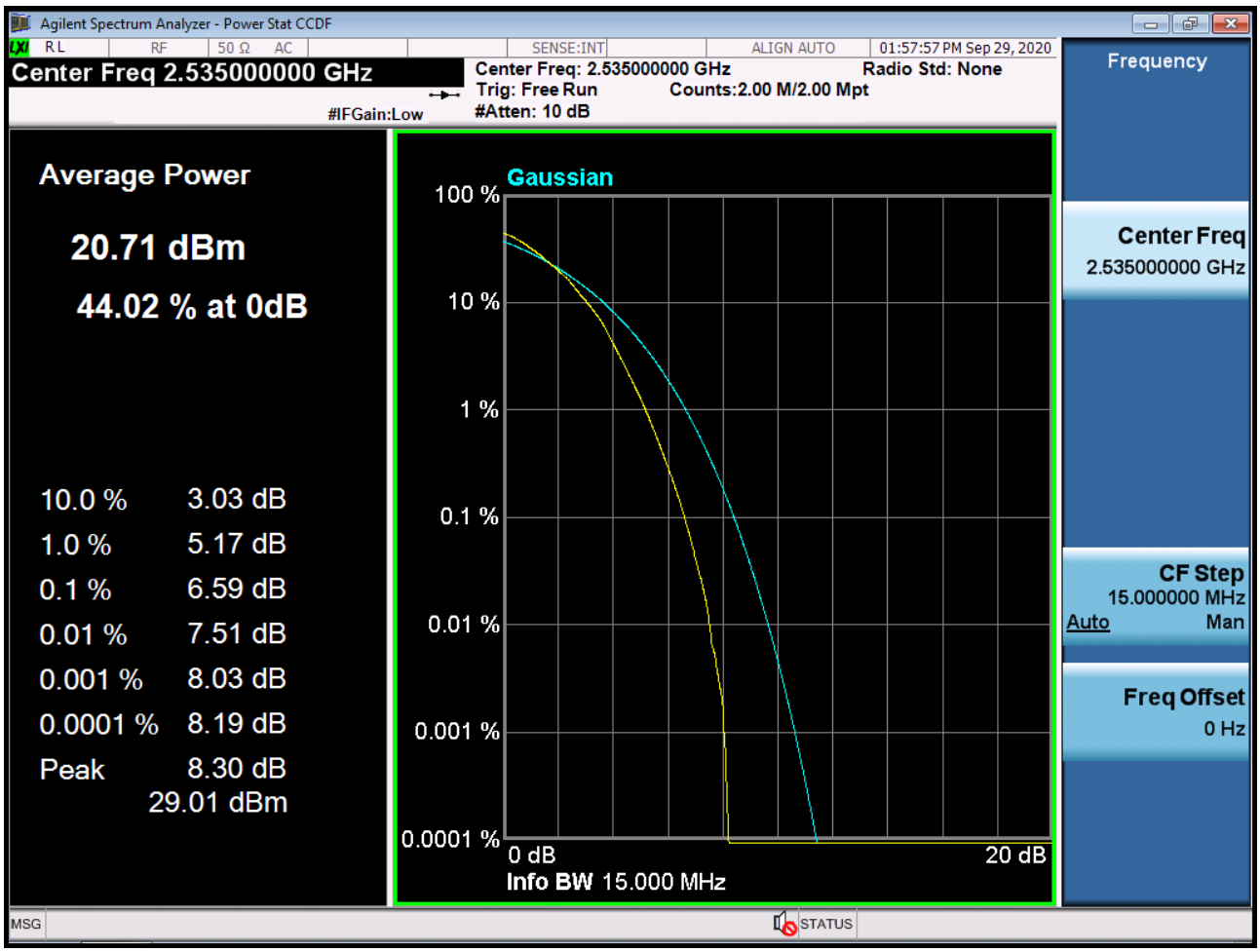
BAND 7. PAR Plot (15M BW Ch.21100 QPSK RB 75_0)



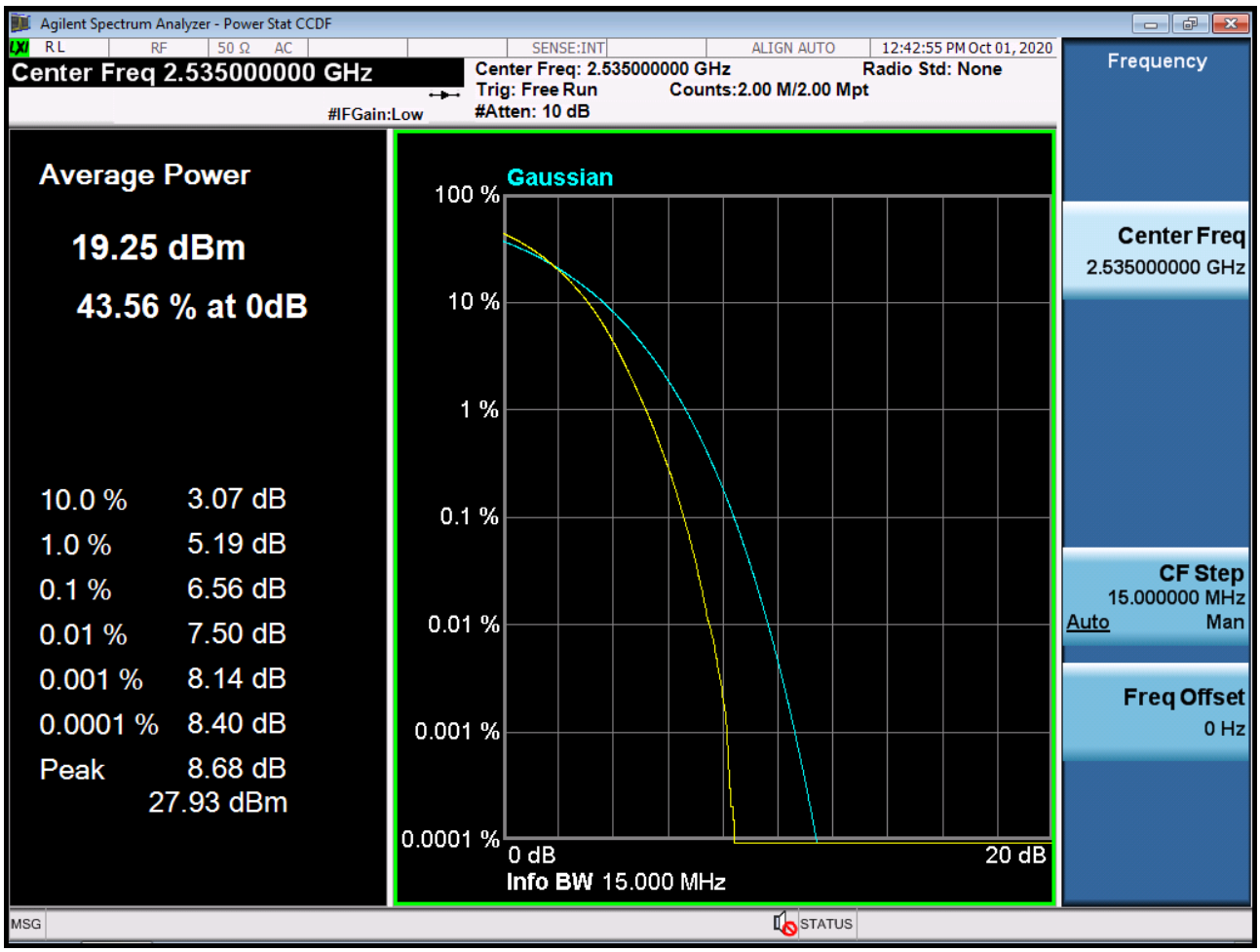
BAND 7. PAR Plot (15M BW Ch.21100 16QAM RB 75_0)



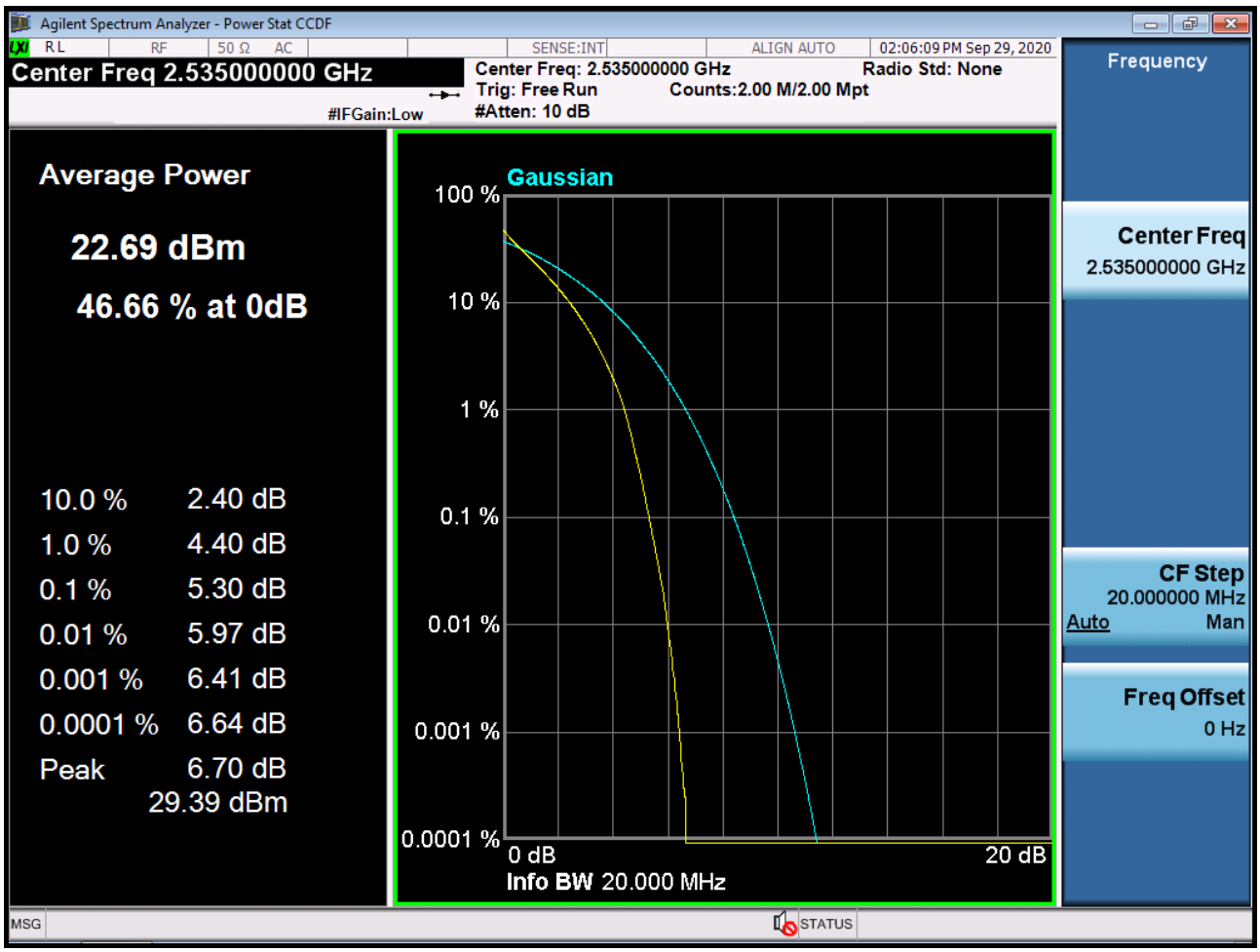
BAND 7. PAR Plot (15M BW Ch.21100 64QAM RB 75_0)



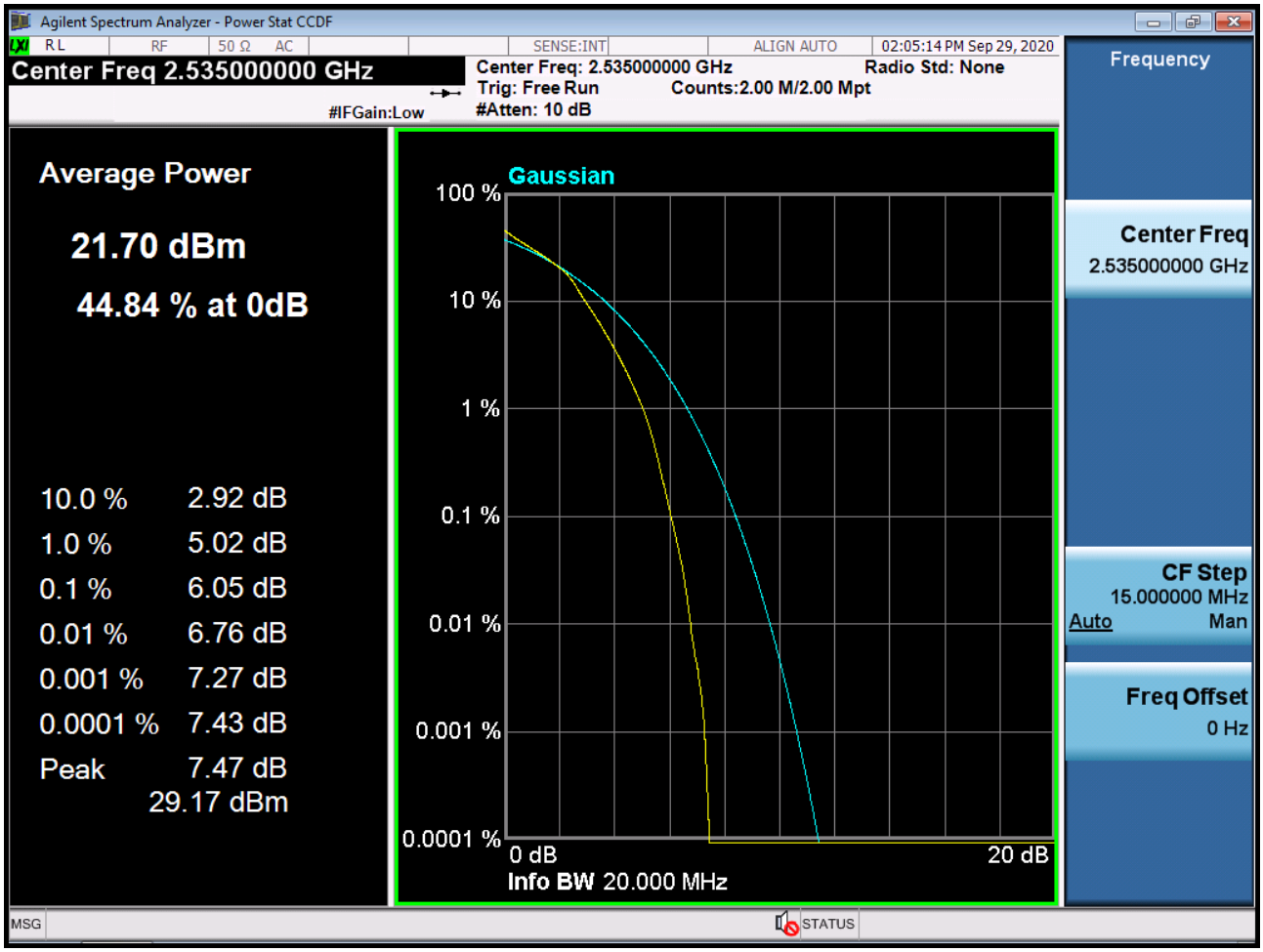
BAND 7. PAR Plot (15M BW Ch.21100 256QAM RB 75_0)



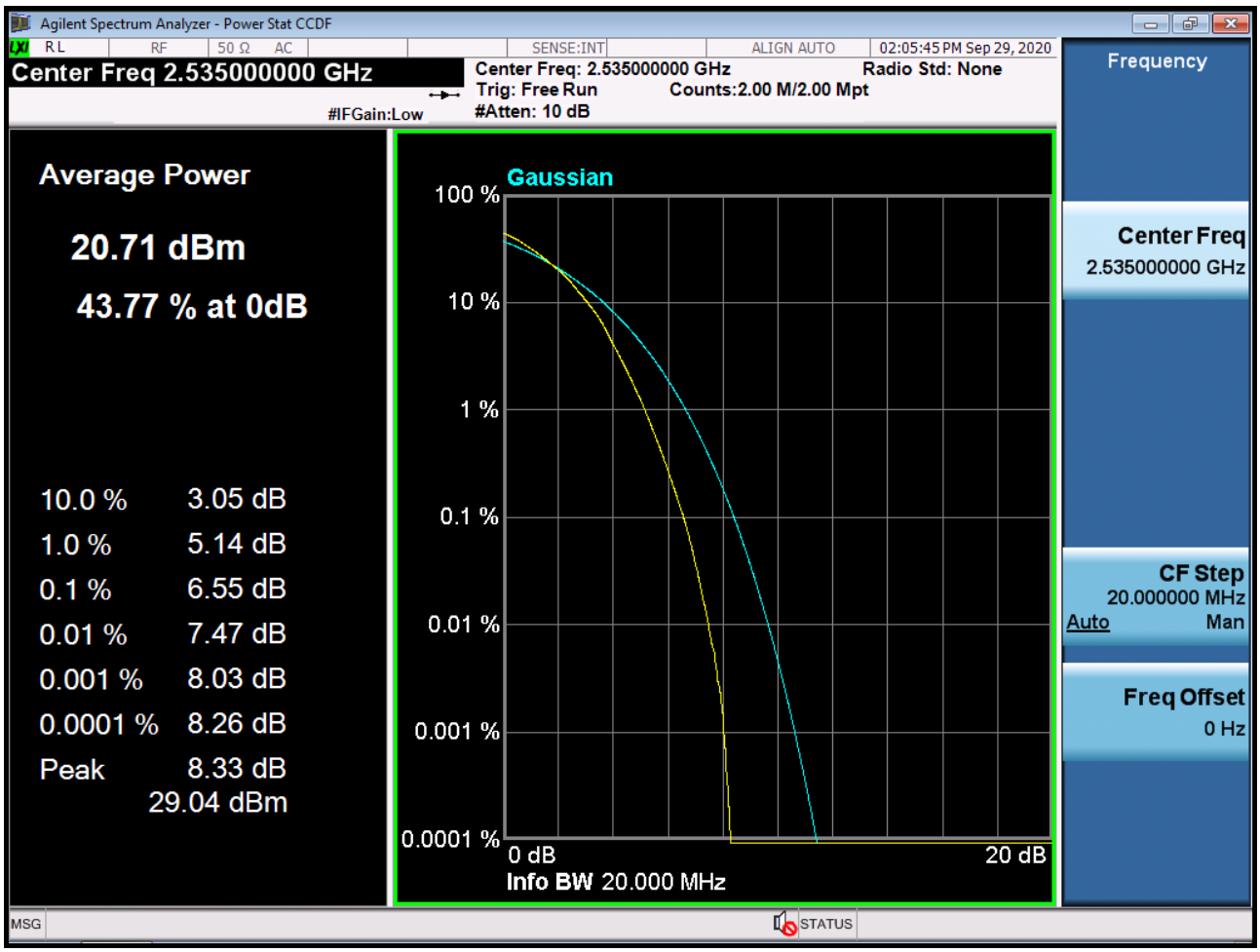
BAND 7. PAR Plot (20M BW Ch.21100 QPSK RB 100_0)



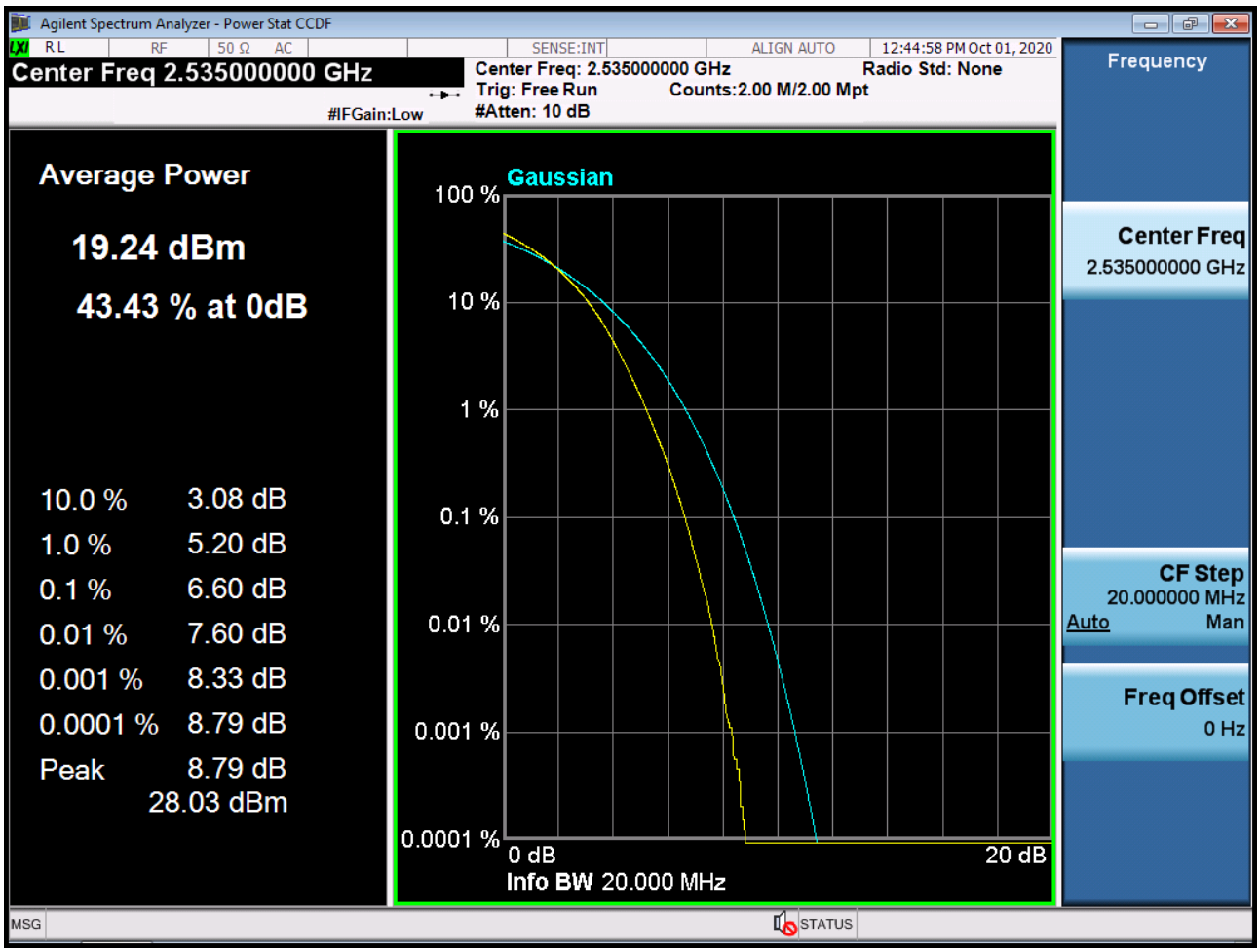
BAND 7. PAR Plot (20M BW Ch.21100 16QAM RB 100_0)



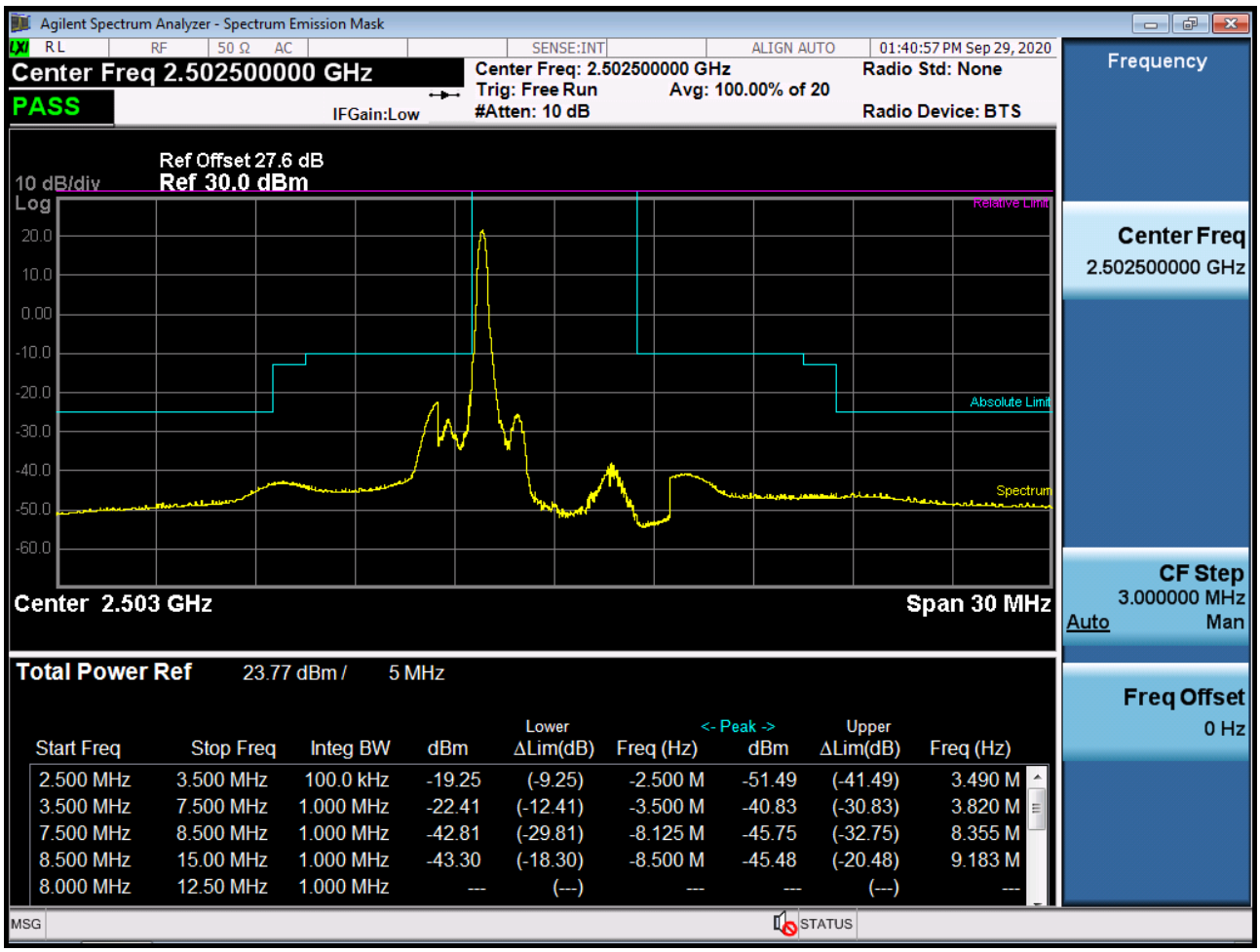
BAND 7. PAR Plot (20M BW Ch.21100 64QAM RB 100_0)



BAND 7. PAR Plot (20M BW Ch.21100 256QAM RB 100_0)



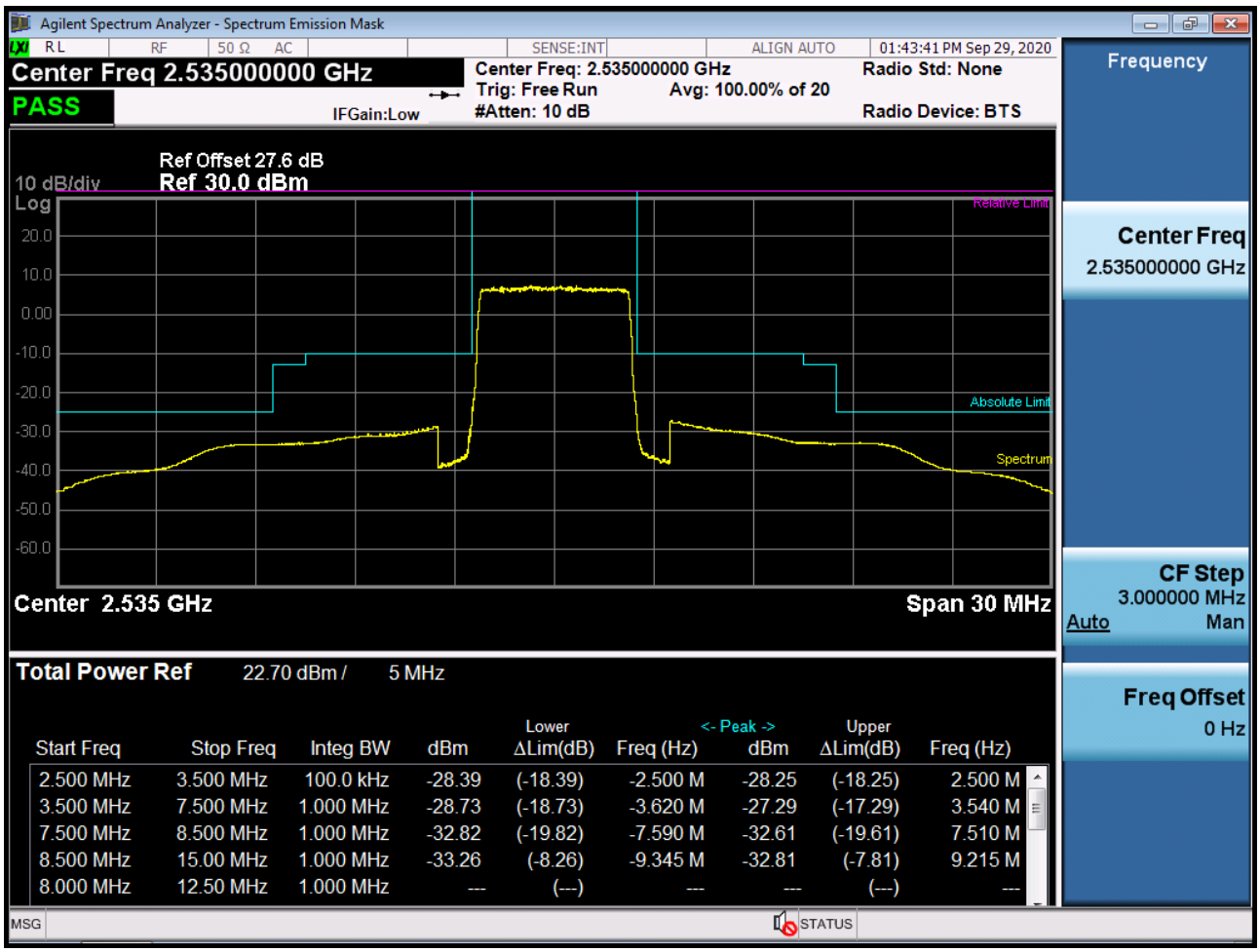
BAND 7. Low Channel Edge Plot (5 MHz Ch.20775 QPSK RB 1, Offset 0)



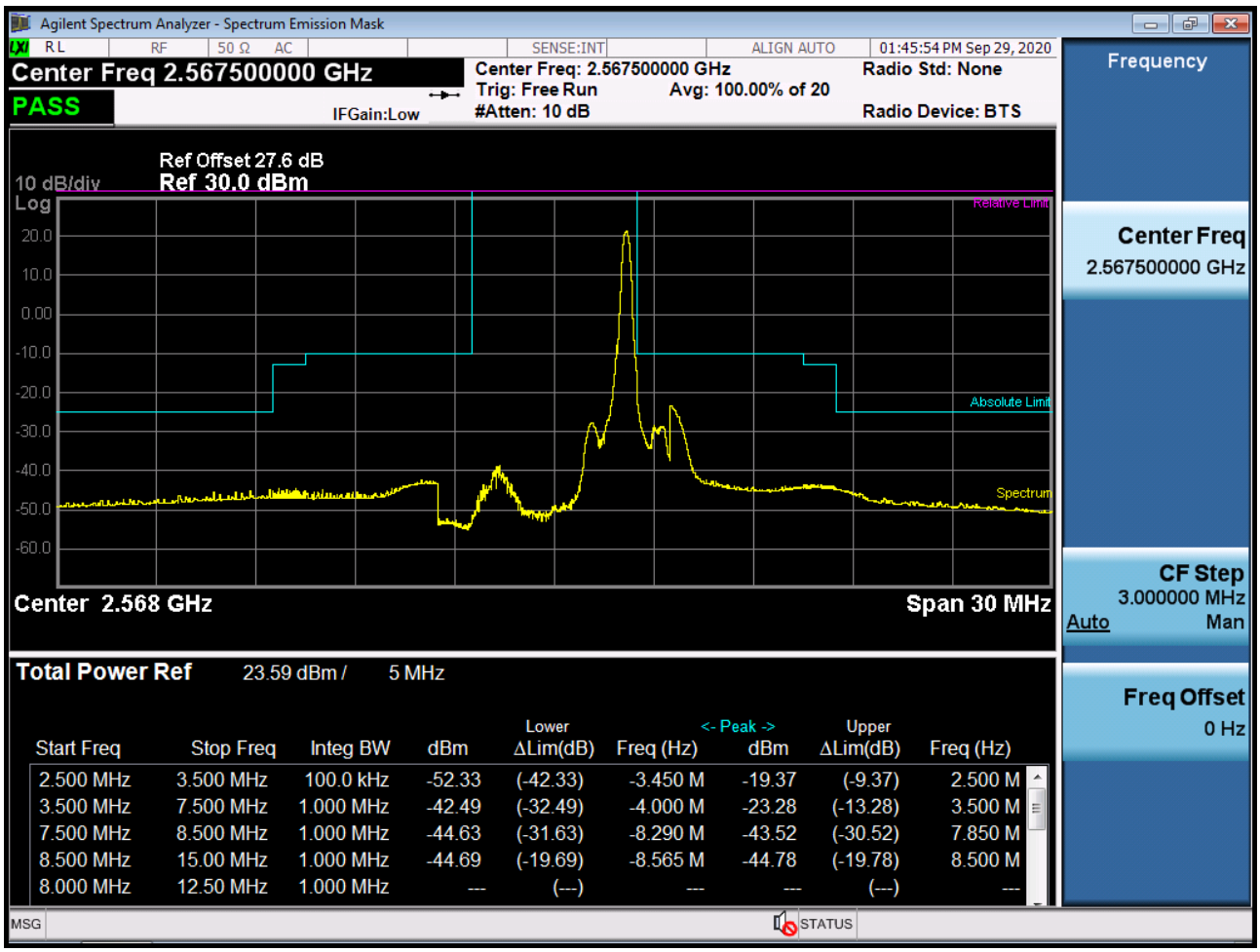
BAND 7. Low Channel Edge Plot (5 MHz Ch.20775 QPSK RB 25, Offset 0)

BAND 7. Low Channel Edge Plot (5 MHz Ch.20775 QPSK_RB 1_Offset 24)

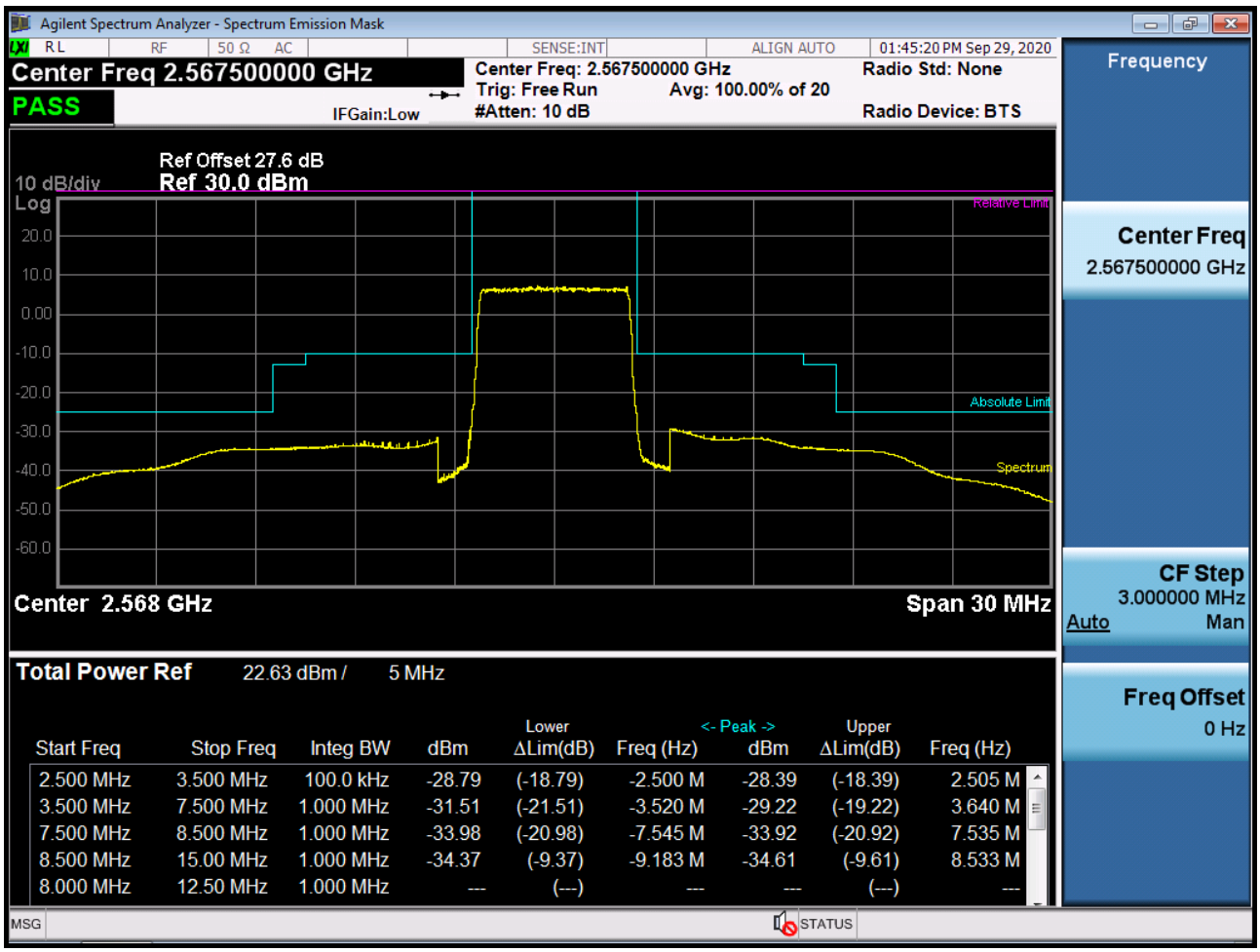
BAND 7. Mid Channel Edge Plot (5 MHz Ch.21100 QPSK RB 25)



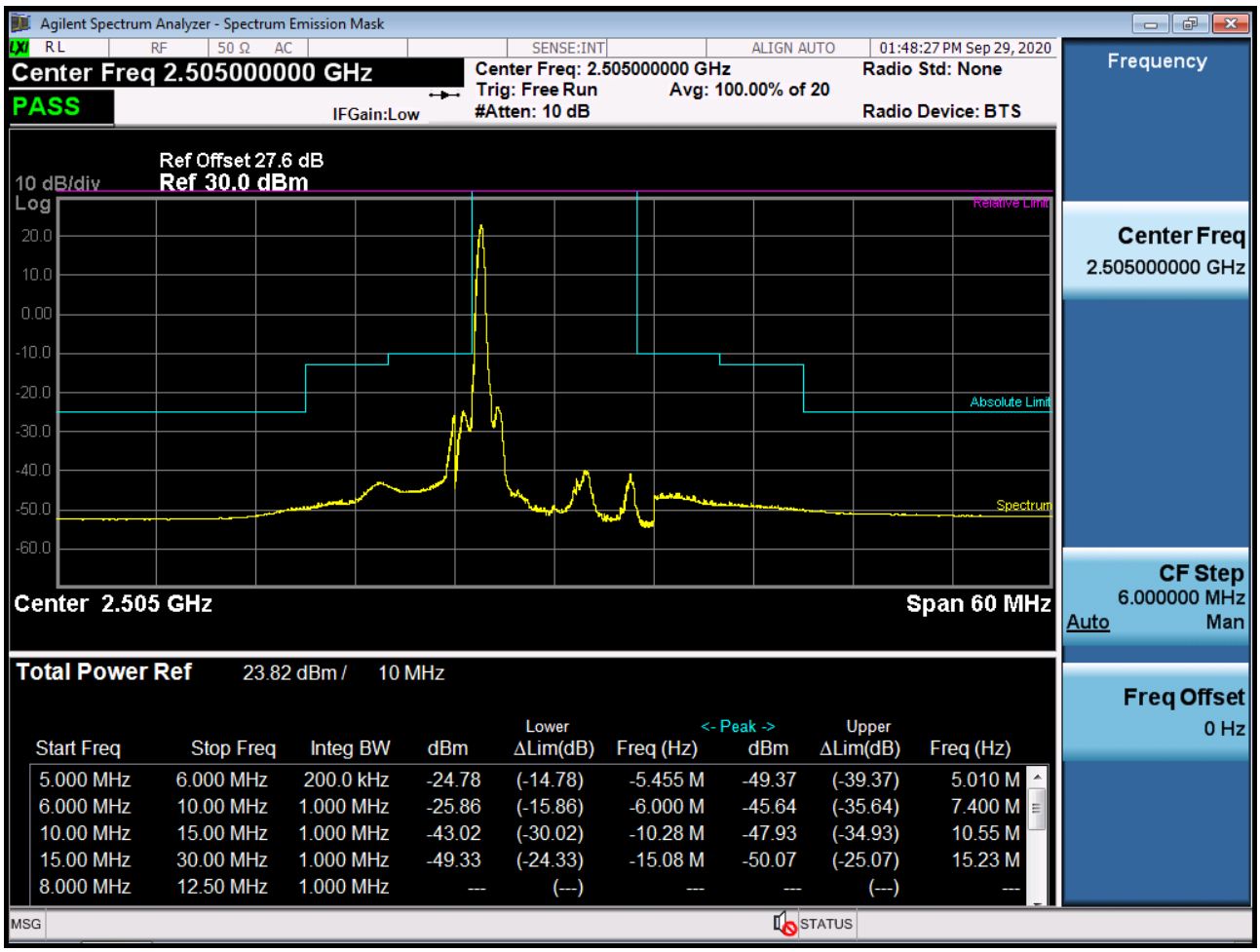
BAND 7. High Channel Edge Plot (5 MHz Ch.21425 QPSK RB 1, Offset 24)



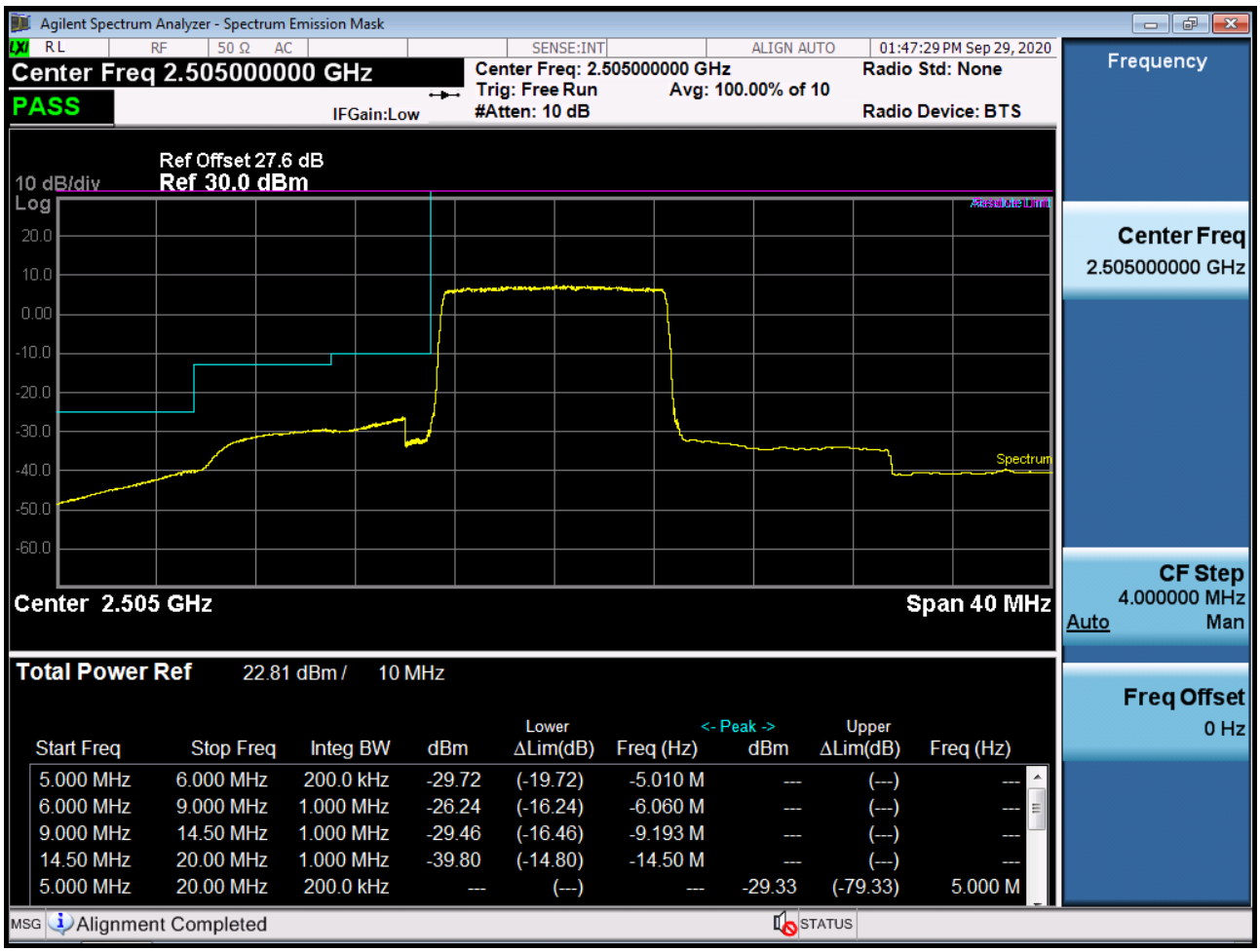
BAND 7. High Channel Edge Plot (5 MHz Ch.21425 QPSK_RB25_Offset 0)



BAND 7. Low Channel Edge Plot (10 MHz Ch.20800 QPSK RB 1, Offset 0)

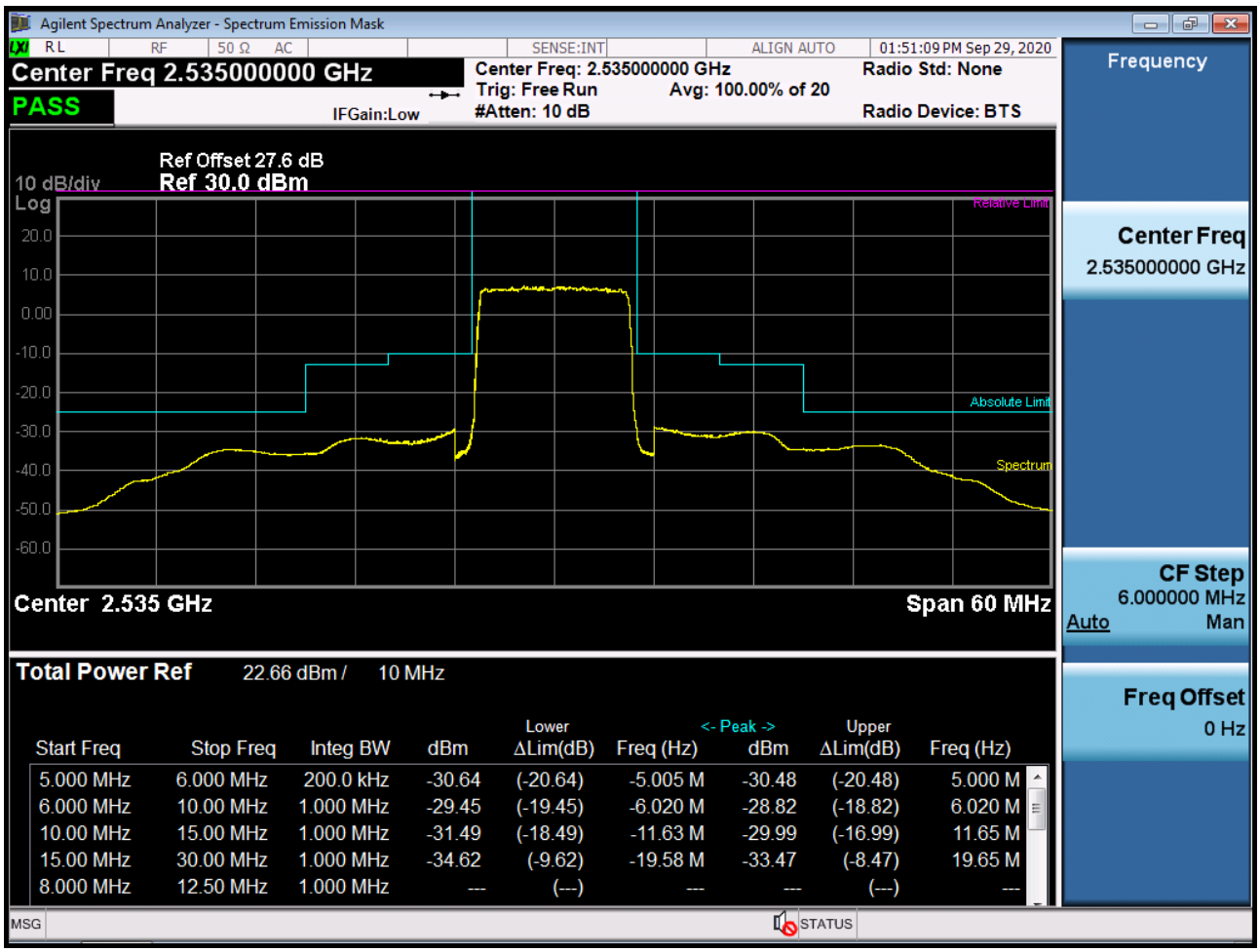


BAND 7. Low Channel Edge Plot (10 MHz Ch.20800 QPSK RB 50, Offset 0)-1

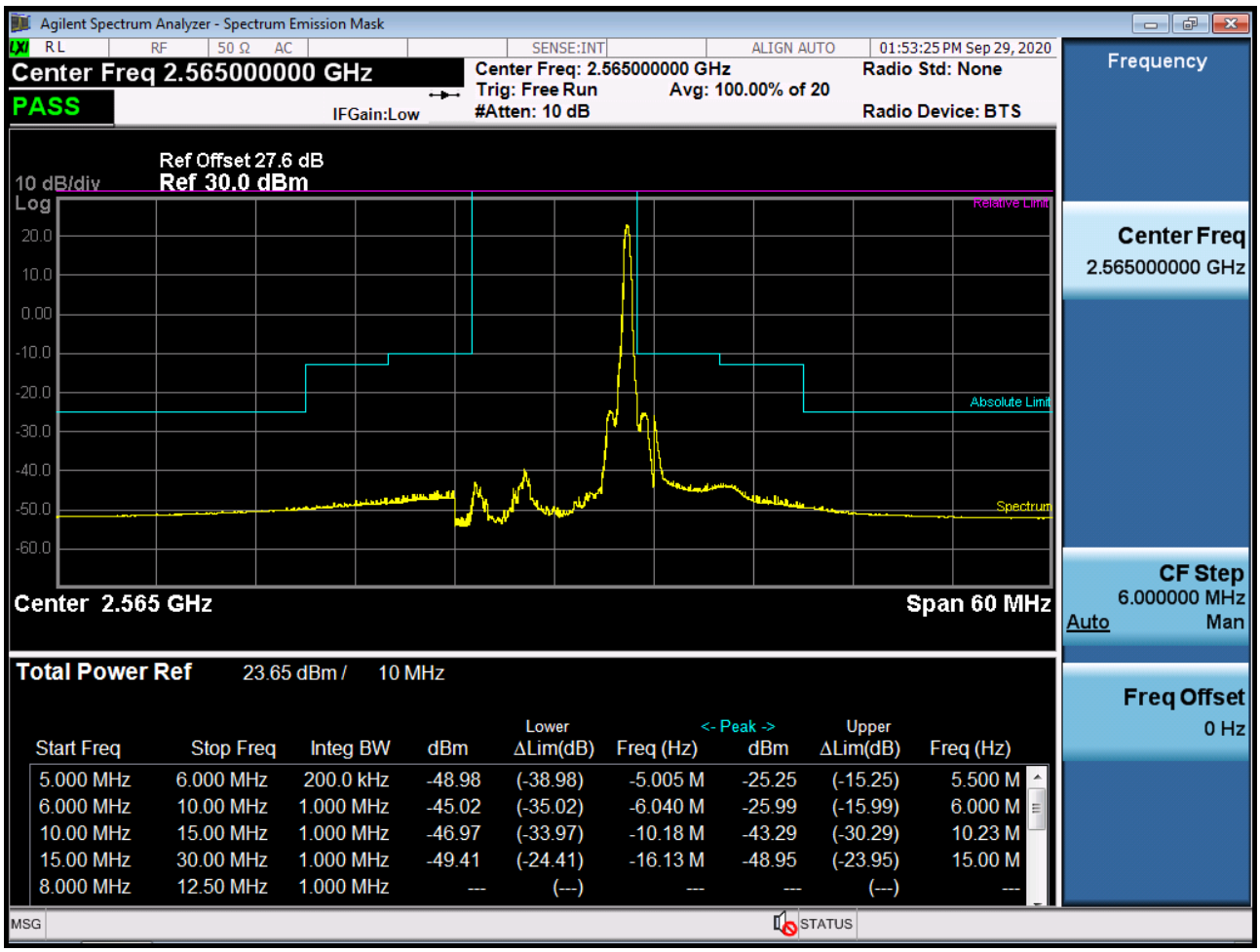


BAND 7. Low Channel Edge Plot (10 MHz Ch.20800 QPSK_RB50_Offset 0)-2

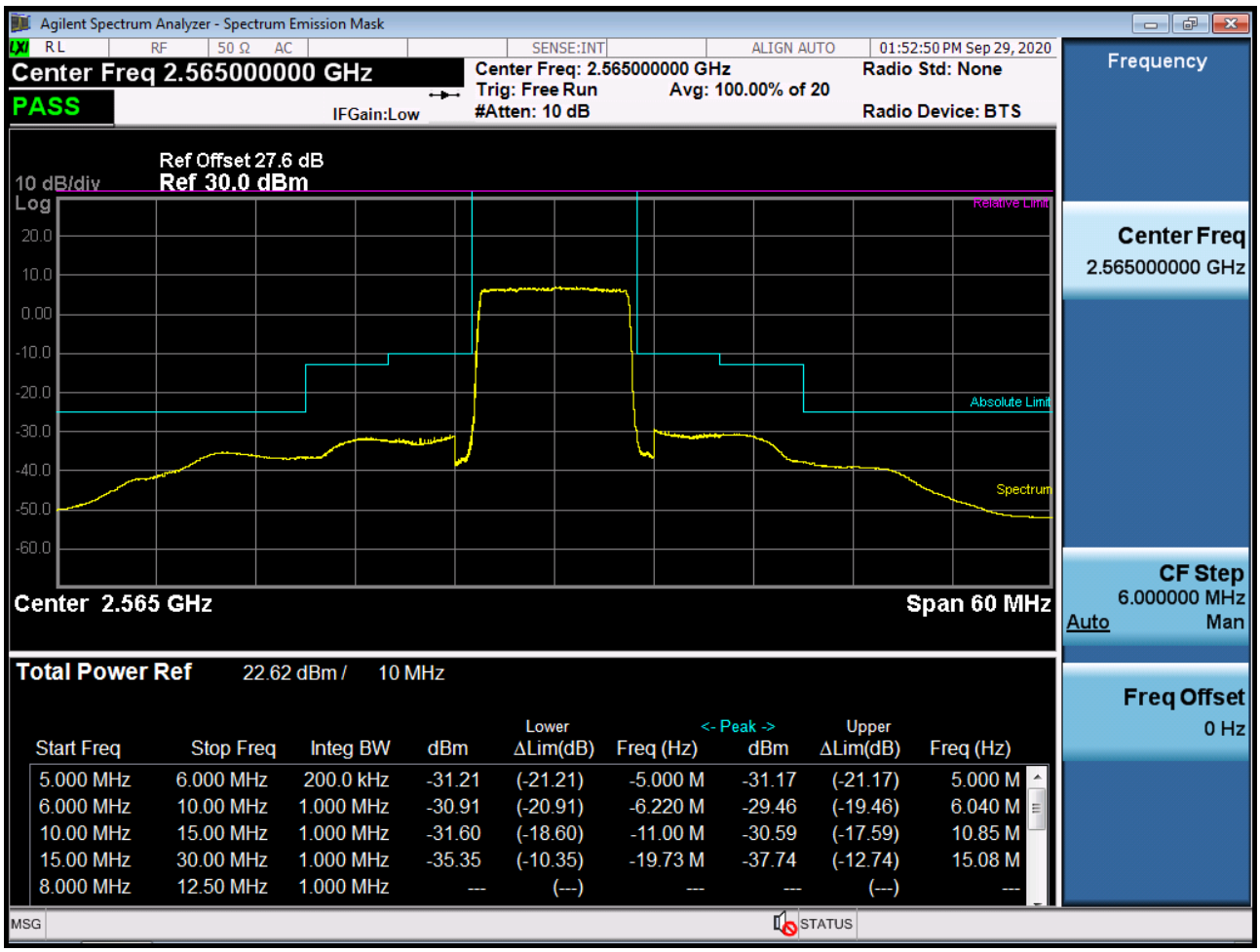
BAND 7. Mid Channel Edge Plot (10 MHz Ch.21100 QPSK RB 50)



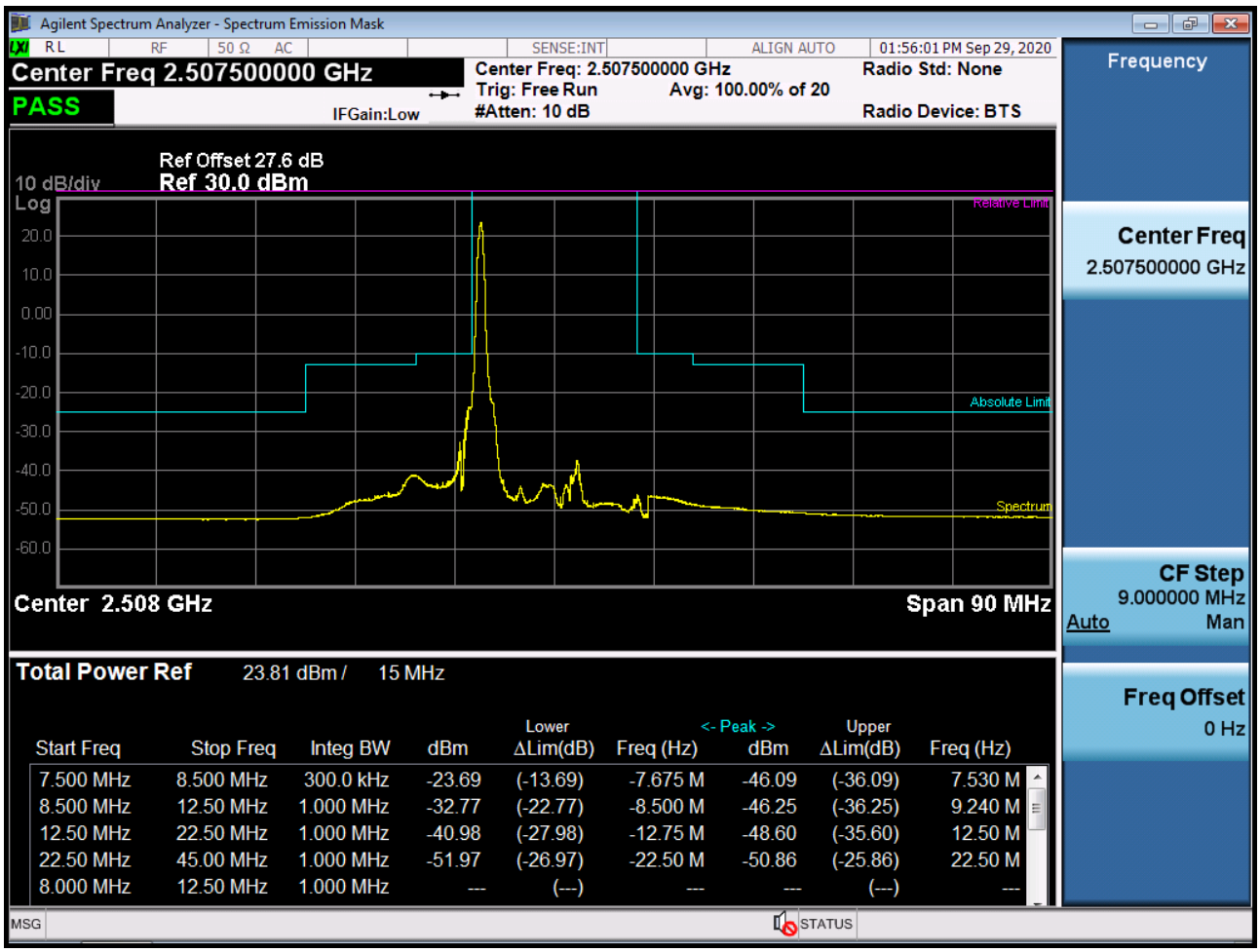
BAND 7. High Channel Edge Plot (10 MHz Ch.21400 QPSK RB 1, Offset 49)



BAND 7. High Channel Edge Plot (10 MHz Ch.21400 QPSK_RB50_Offset 0)



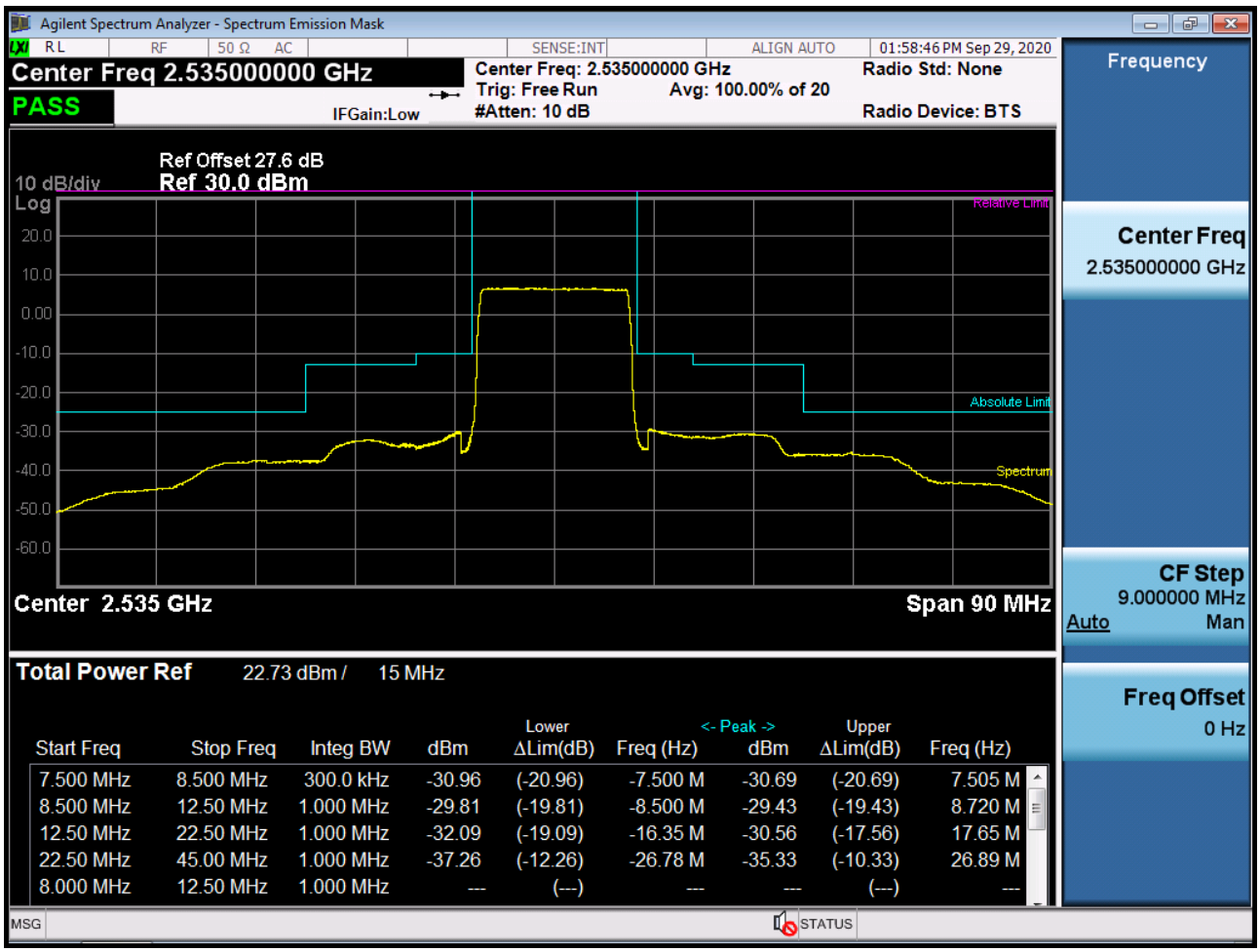
BAND 7. Low Channel Edge Plot (15 MHz Ch.20825 QPSK RB 1, Offset 0)



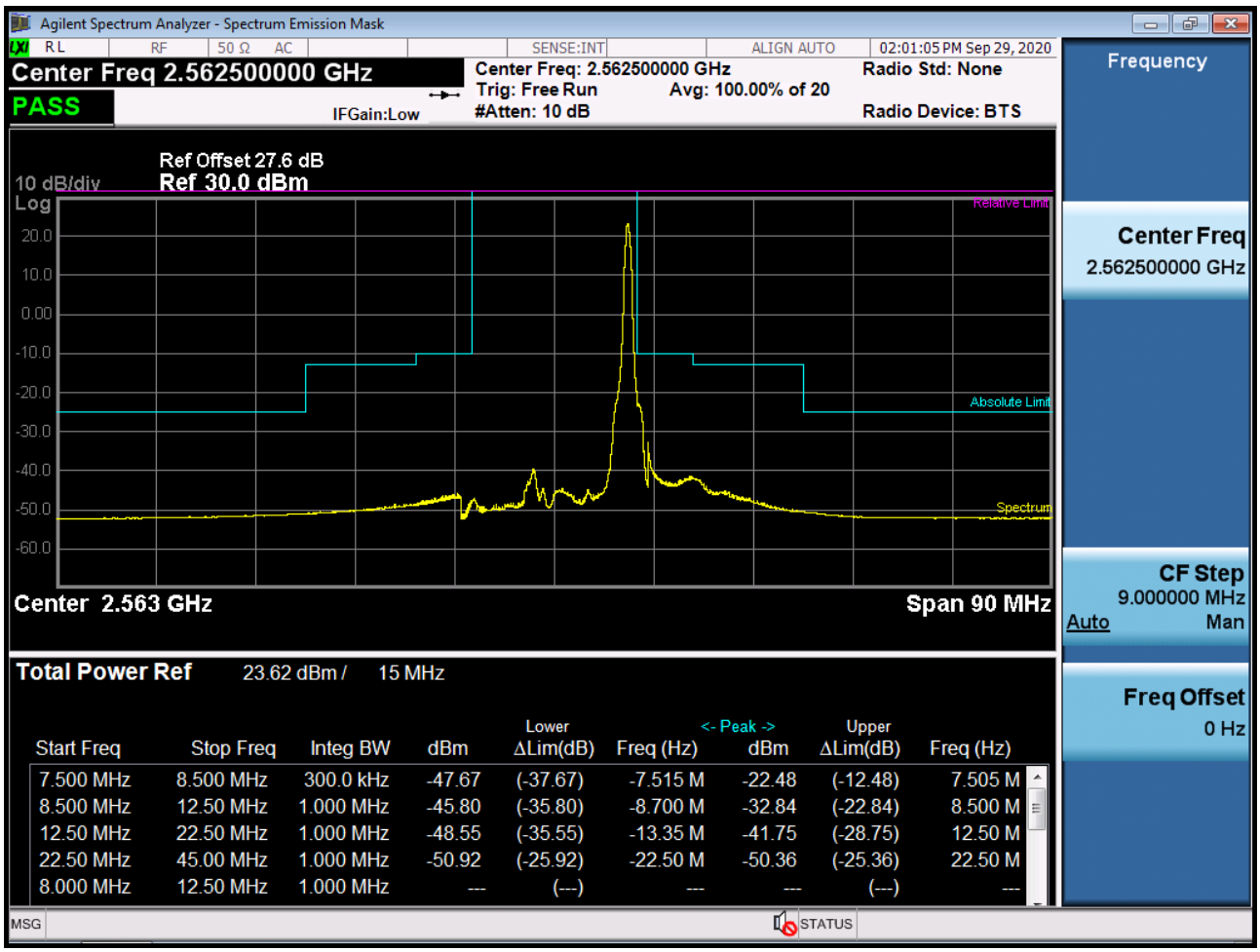
BAND 7. Low Channel Edge Plot (15 MHz Ch.20825 QPSK RB75, Offset 0)-1

BAND 7. Low Channel Edge Plot (15 MHz Ch.20825 QPSK_RB75_Offset 0)-2

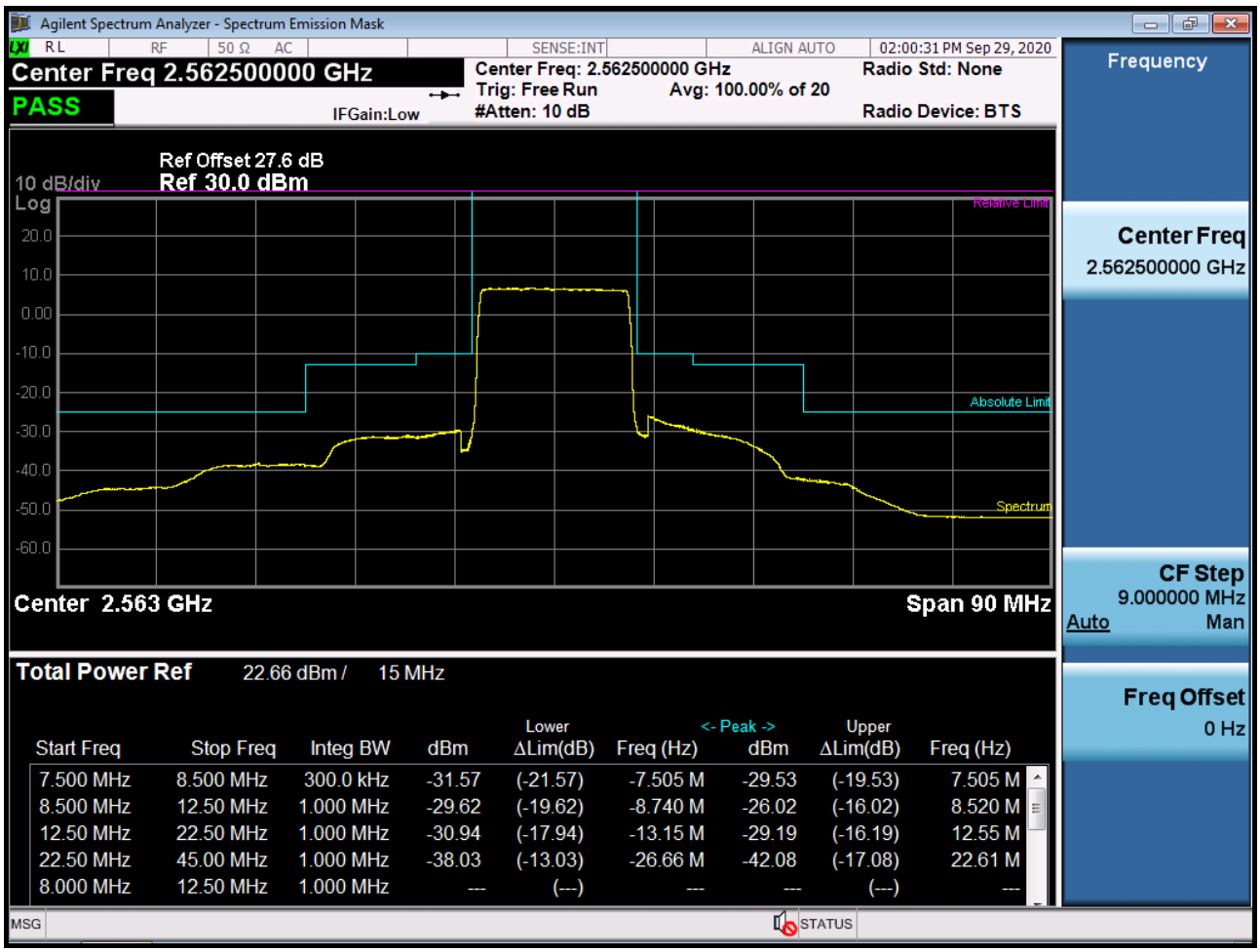
BAND 7. Mid Channel Edge Plot (15 MHz Ch.21100 QPSK RB 75, Offset 0)



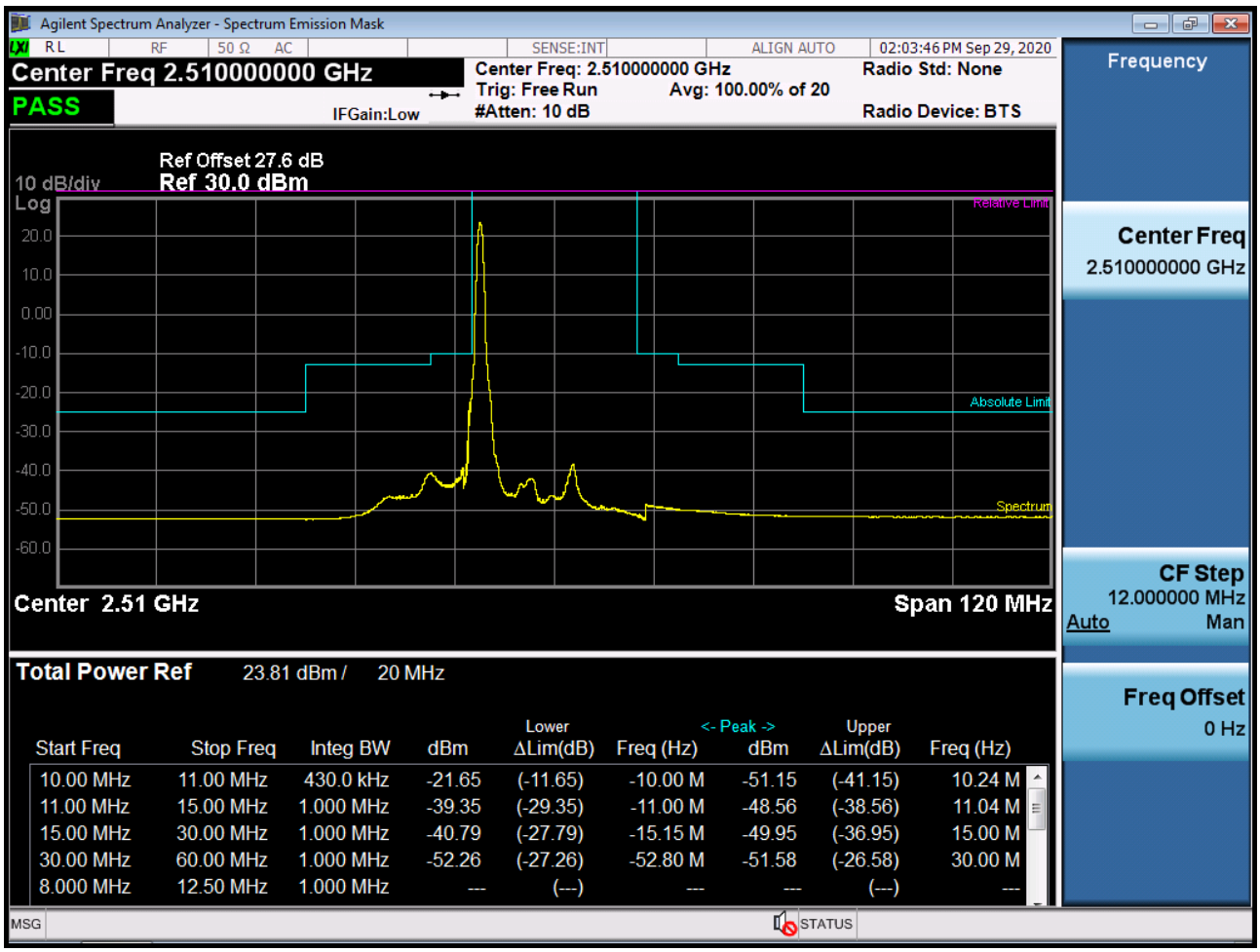
BAND 7. High Channel Edge Plot (15 MHz Ch.21375 QPSK RB 1, Offset 74)



BAND 7. High Channel Edge Plot (15 MHz Ch.21375 QPSK_RB75_Offset 0)



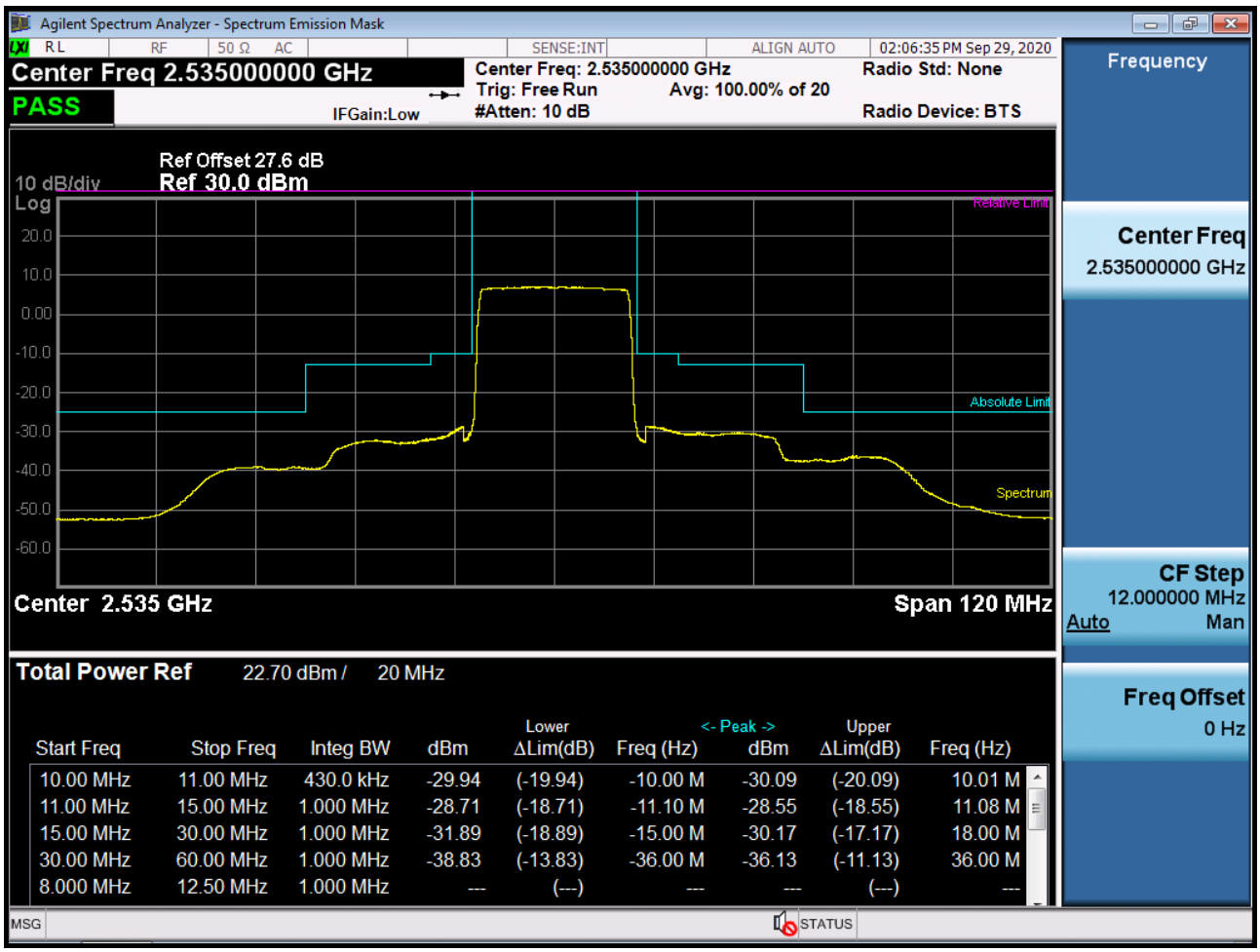
BAND 7. Low Channel Edge Plot (20 MHz Ch.20850 QPSK RB 1, Offset 0)



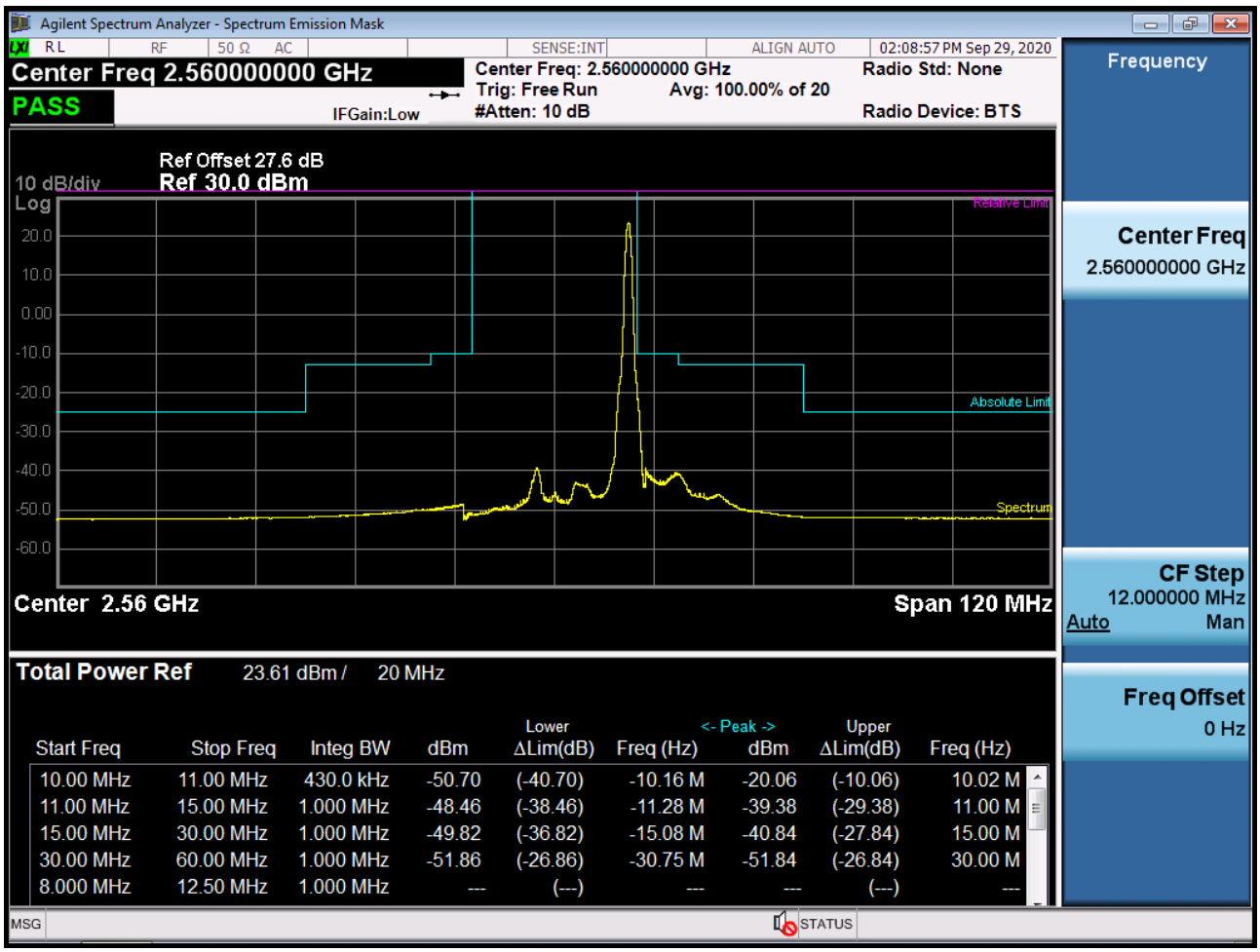
BAND 7. Low Channel Edge Plot (20 MHz Ch.20850 QPSK RB100, Offset 0)-1

BAND 7. Low Channel Edge Plot (20 MHz Ch.20850 QPSK_RB100_Offset 0)-2

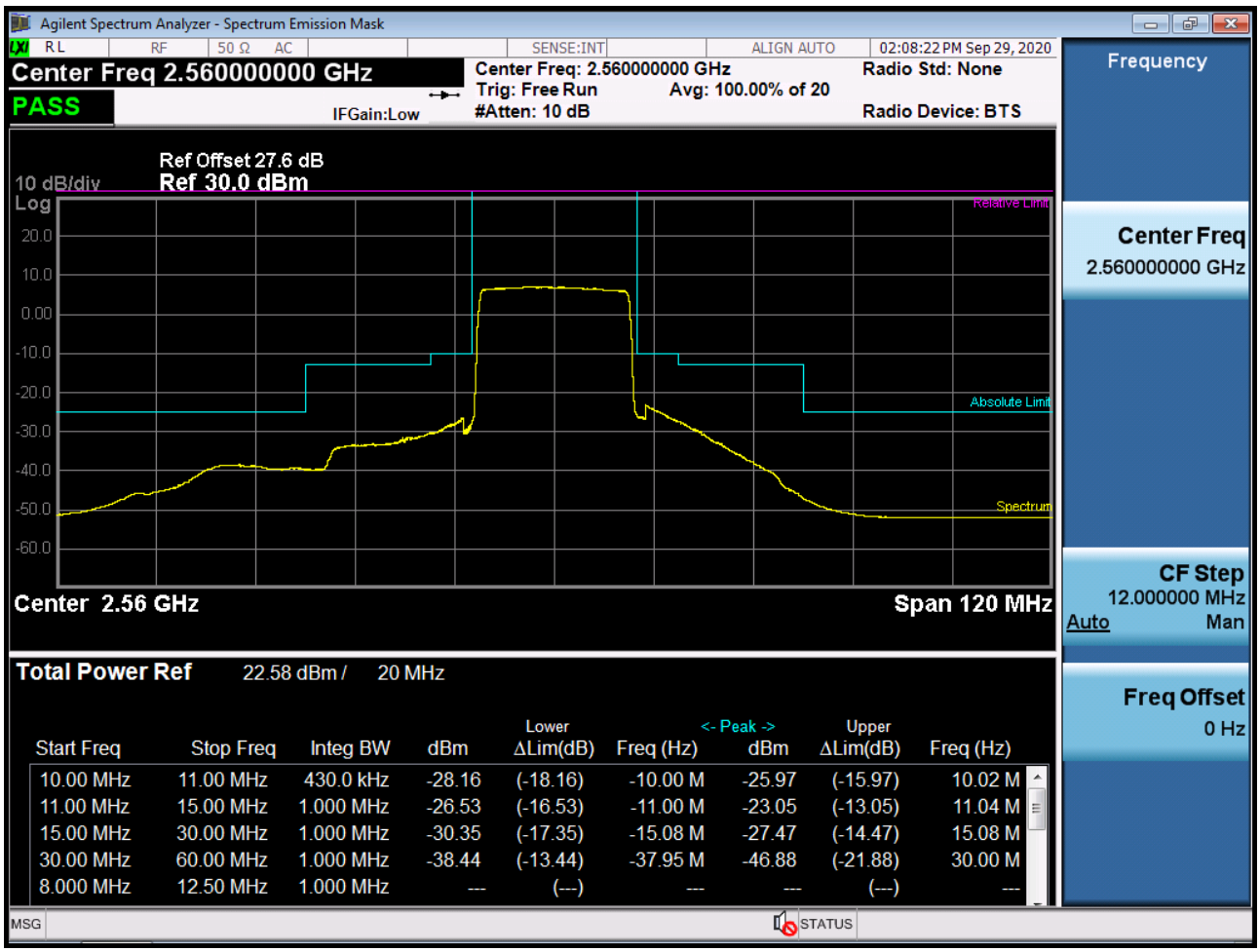
BAND 7. Mid Channel Edge Plot (20 MHz Ch.21100 QPSK RB 100, offset 0)



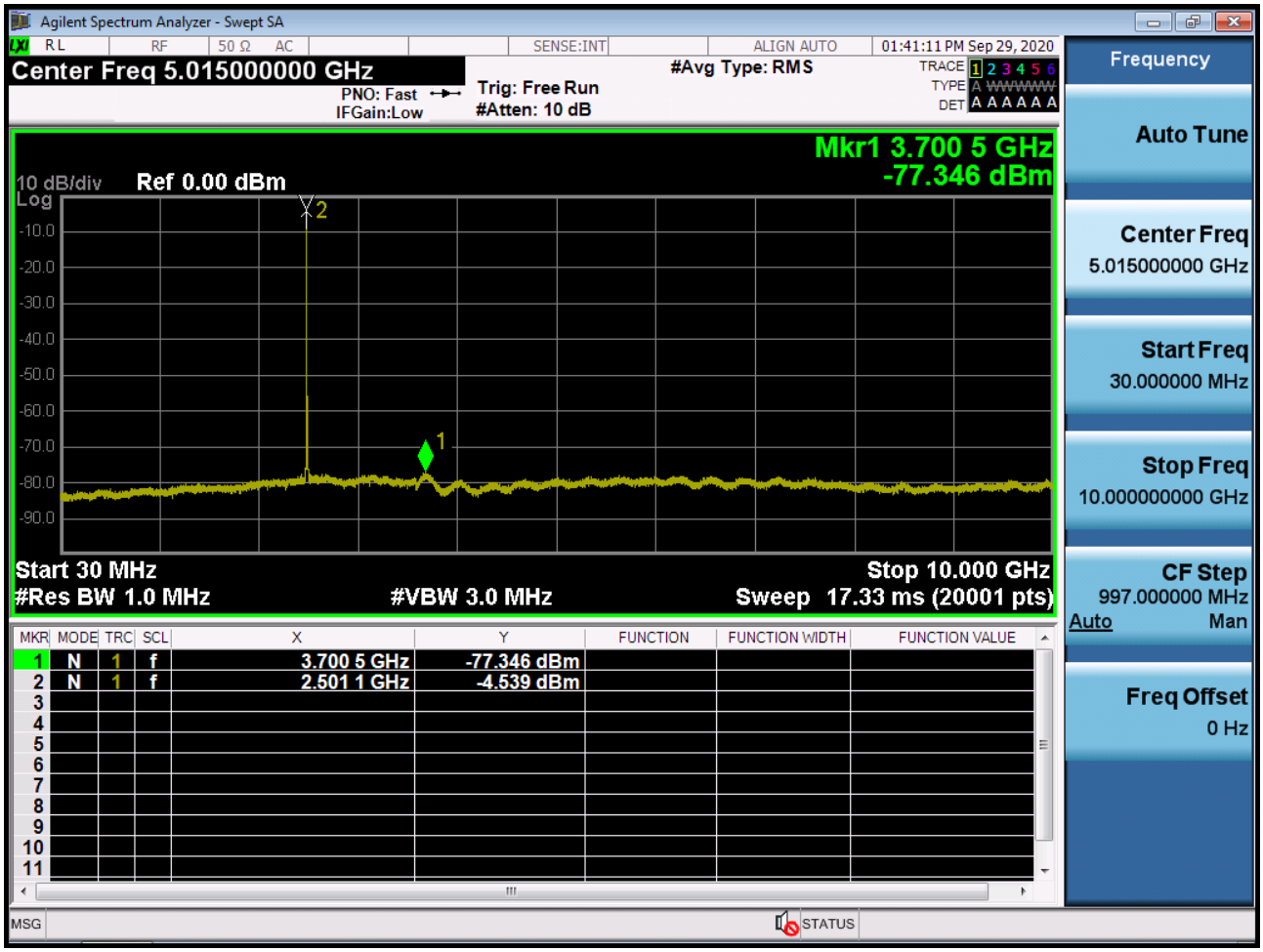
BAND 7. High Channel Edge Plot (20 MHz Ch.21350 QPSK RB 1, Offset 99)



BAND 7. High Channel Edge Plot (20 MHz Ch.21350 QPSK_RB100_Offset 0)

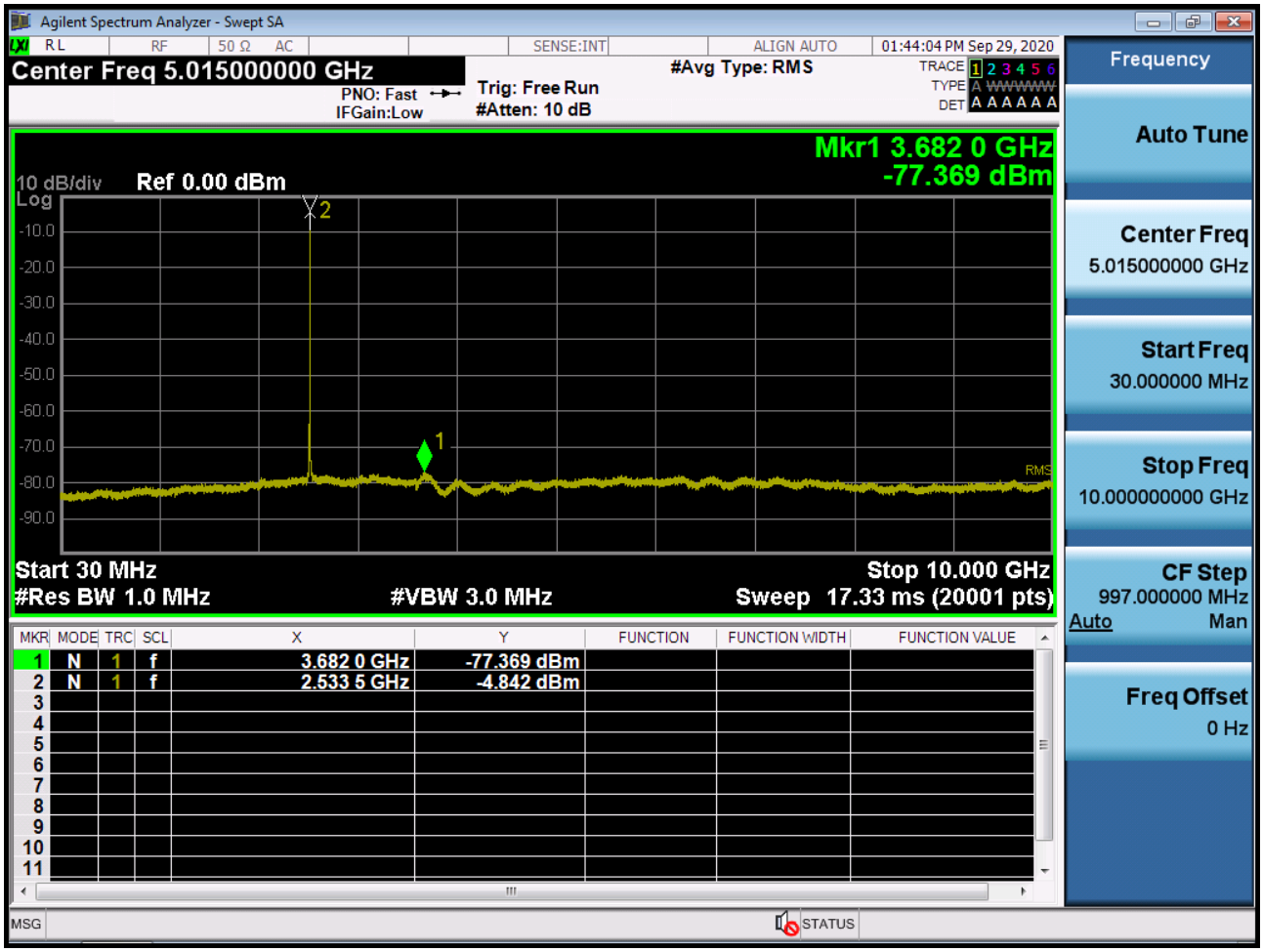


BAND 7. Conducted Spurious_1 (20775ch_5MHz_QPSK_RB 1_0)



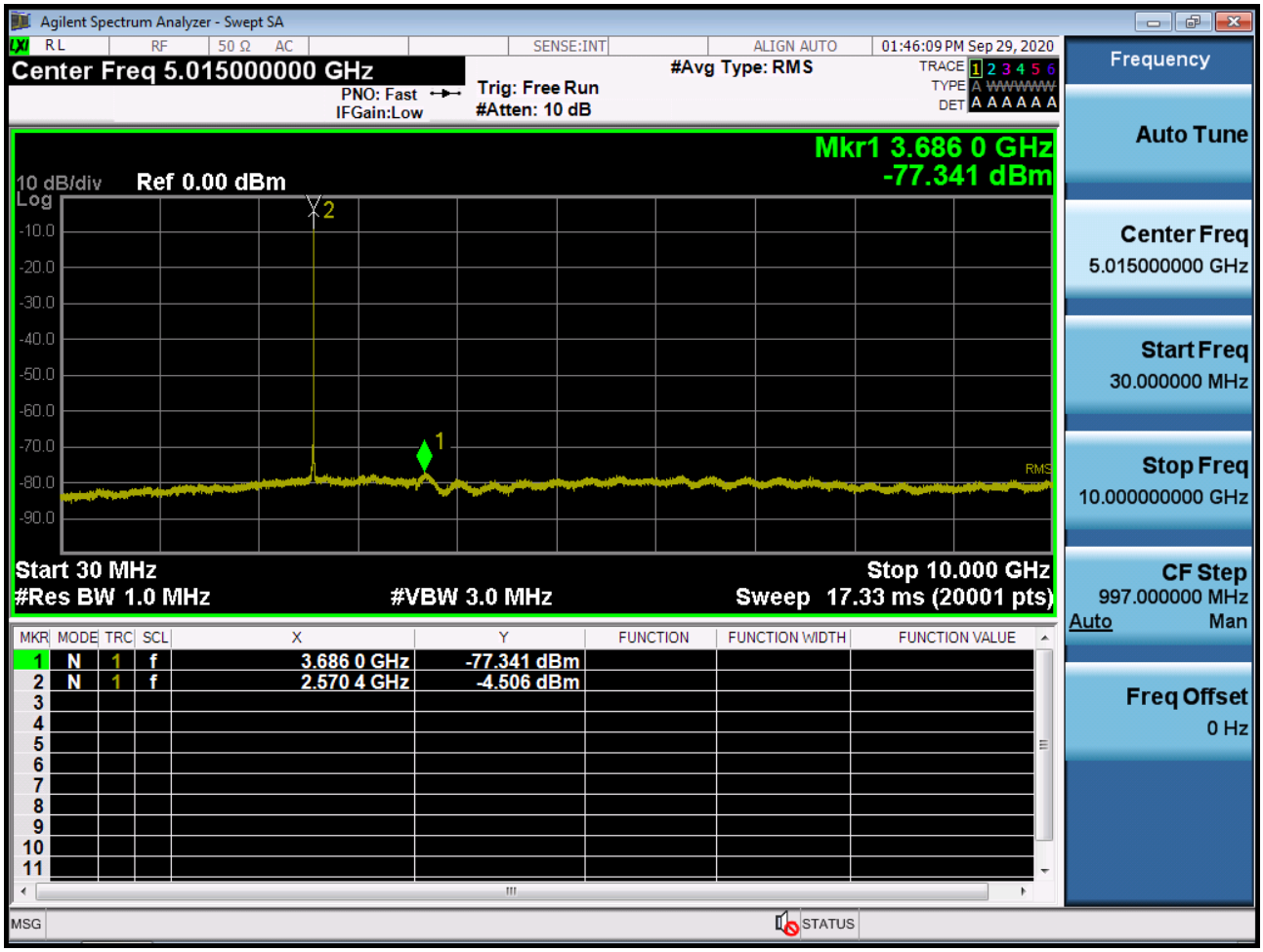
BAND 7. Conducted Spurious_2 (20775ch_5MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21100ch_5MHz_QPSK_RB 1_0)



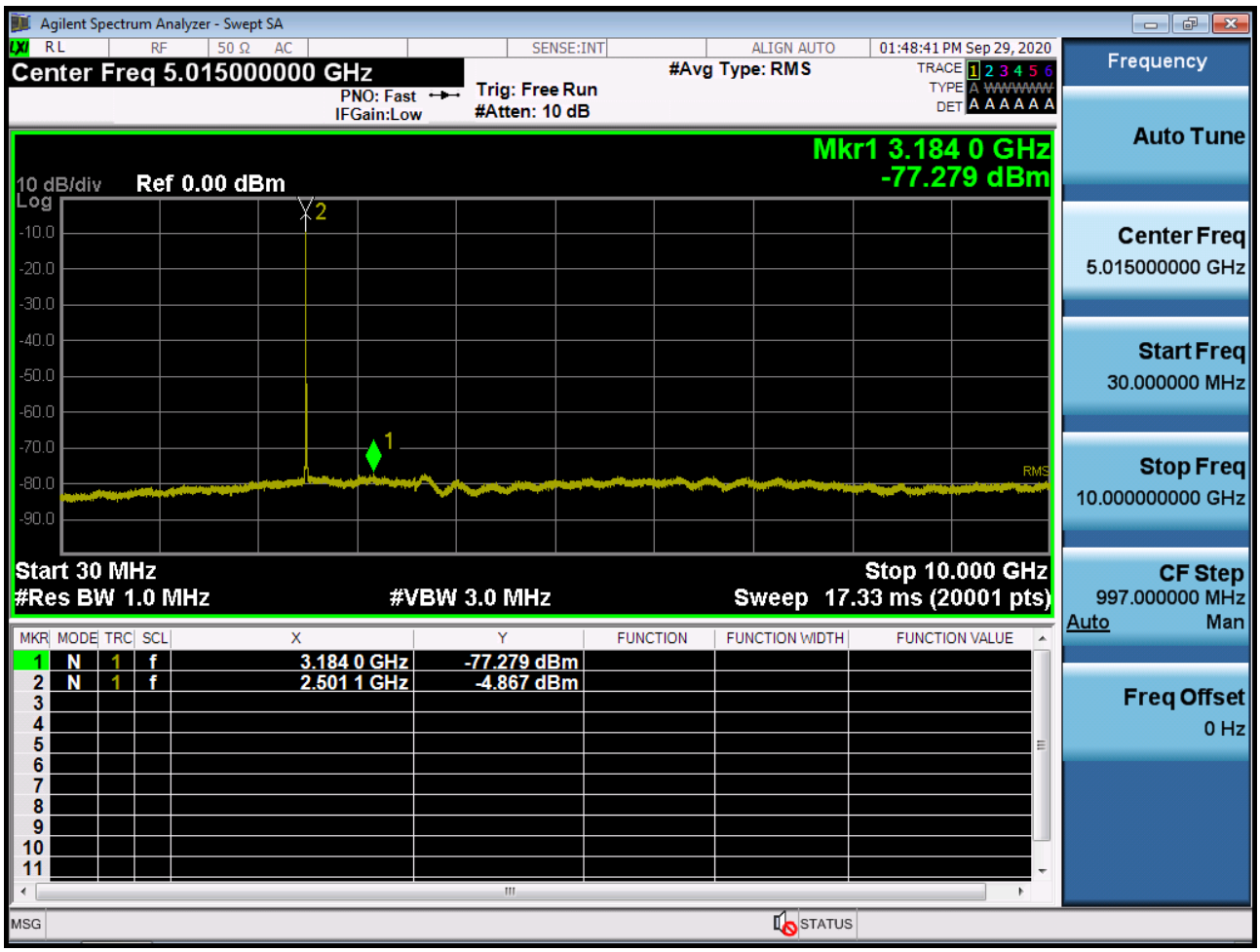
BAND 7. Conducted Spurious_2 (21100ch_5MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21425ch_5MHz_QPSK_RB 1_0)



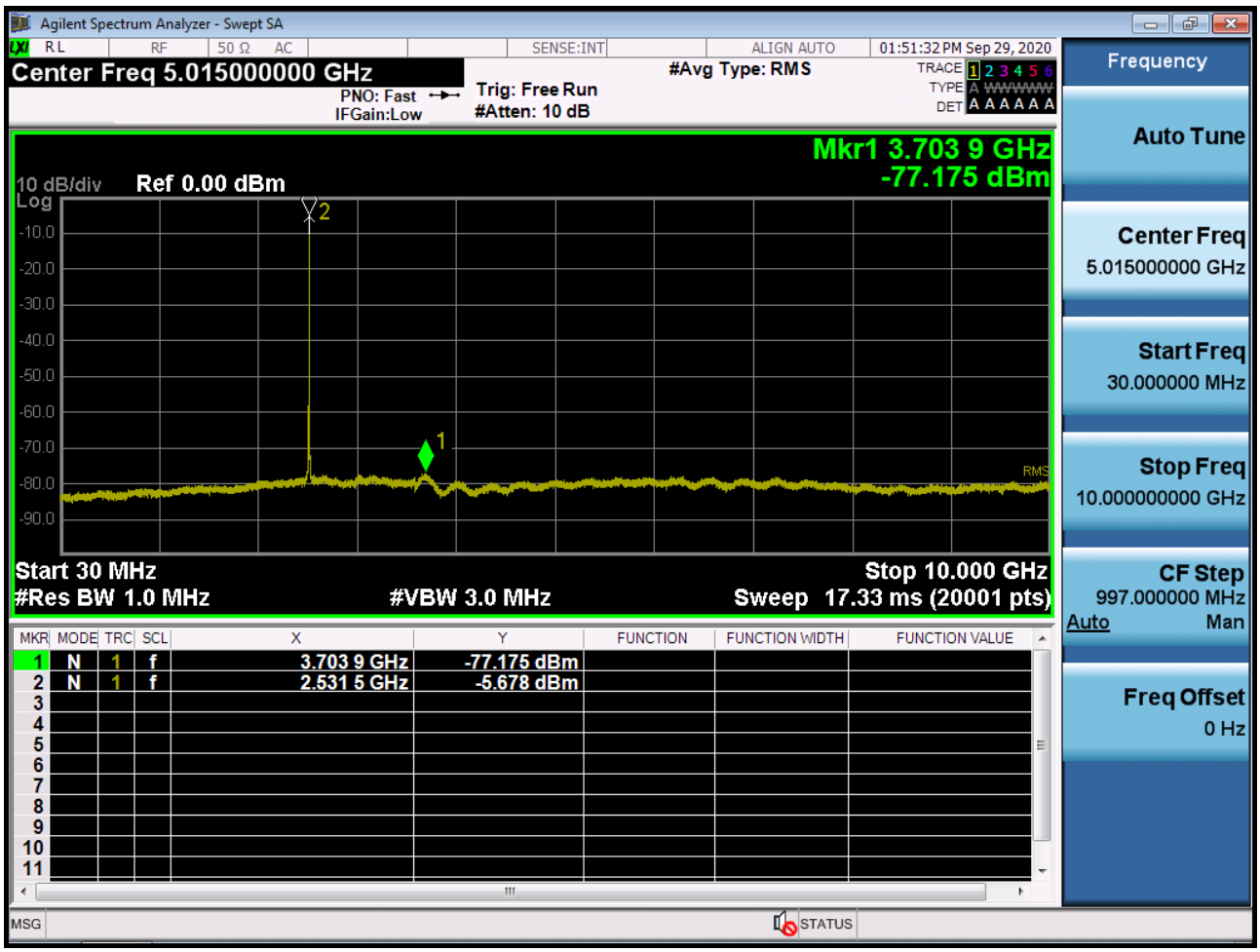
BAND 7. Conducted Spurious_2 (21425ch_5MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (20800ch_10MHz_QPSK_RB 1_0)



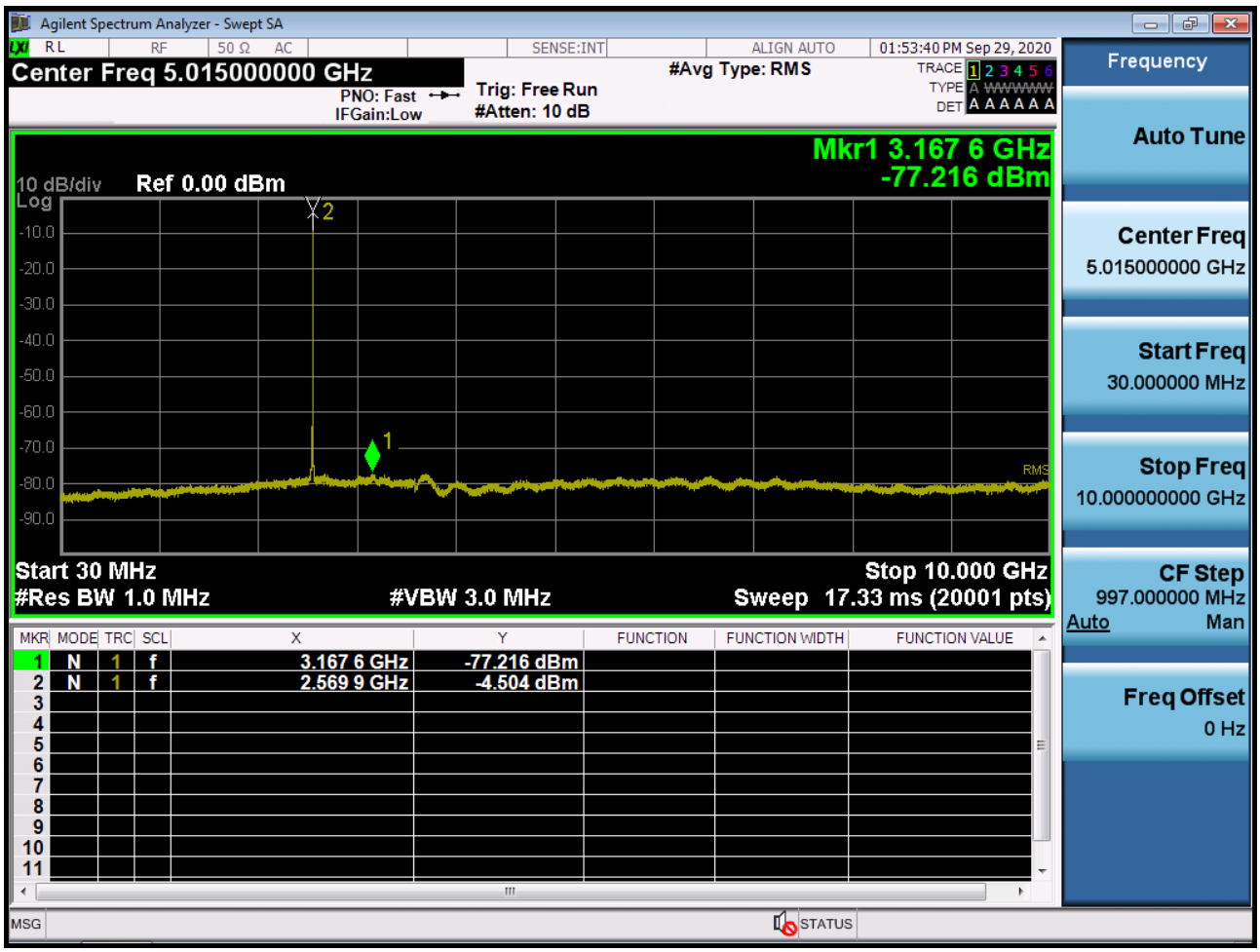
BAND 7. Conducted Spurious_2 (20800ch_10MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21100ch_10MHz_QPSK_RB 1_0)



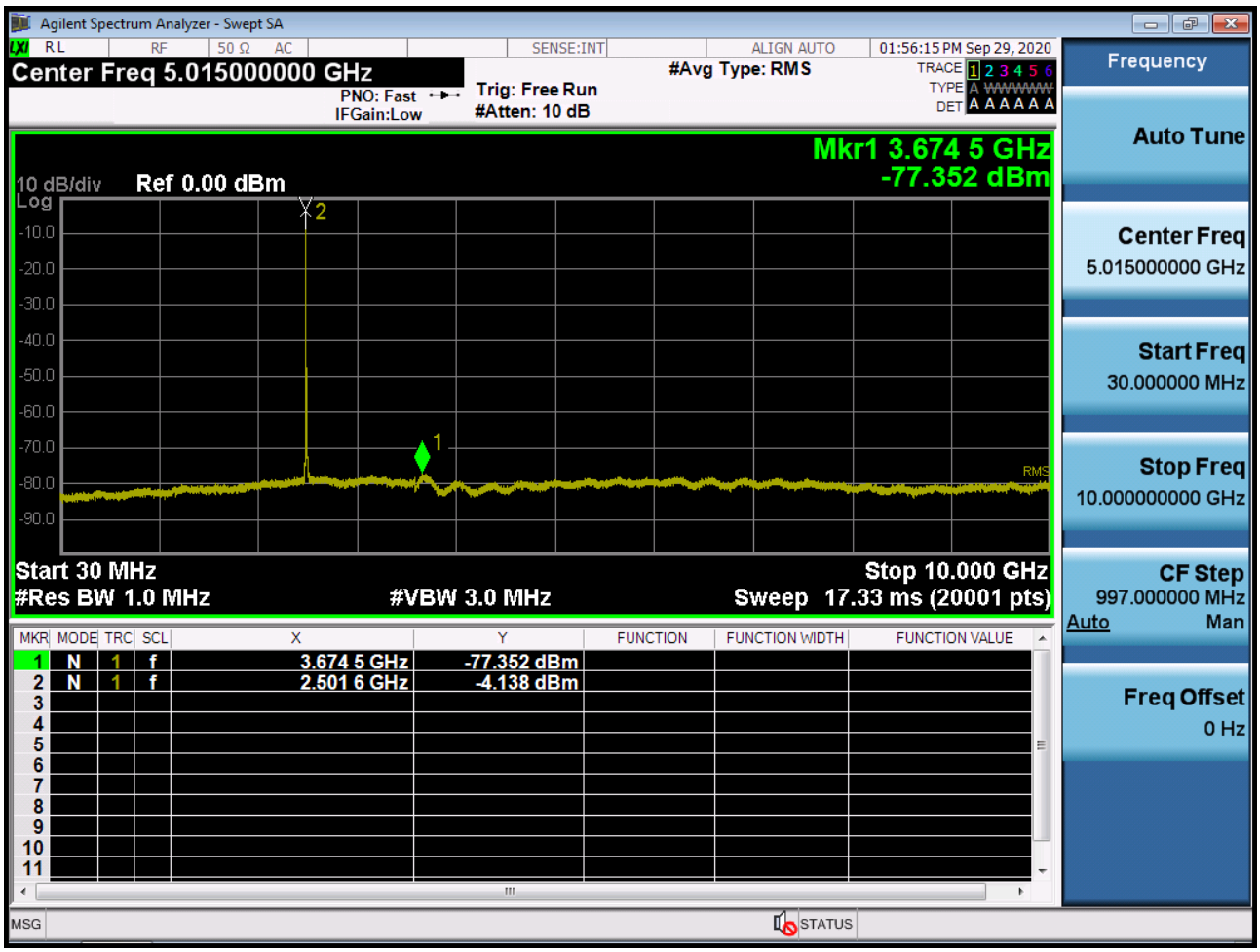
BAND 7. Conducted Spurious_2 (21100ch_10MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21400ch_10MHz_QPSK_RB 1_0)



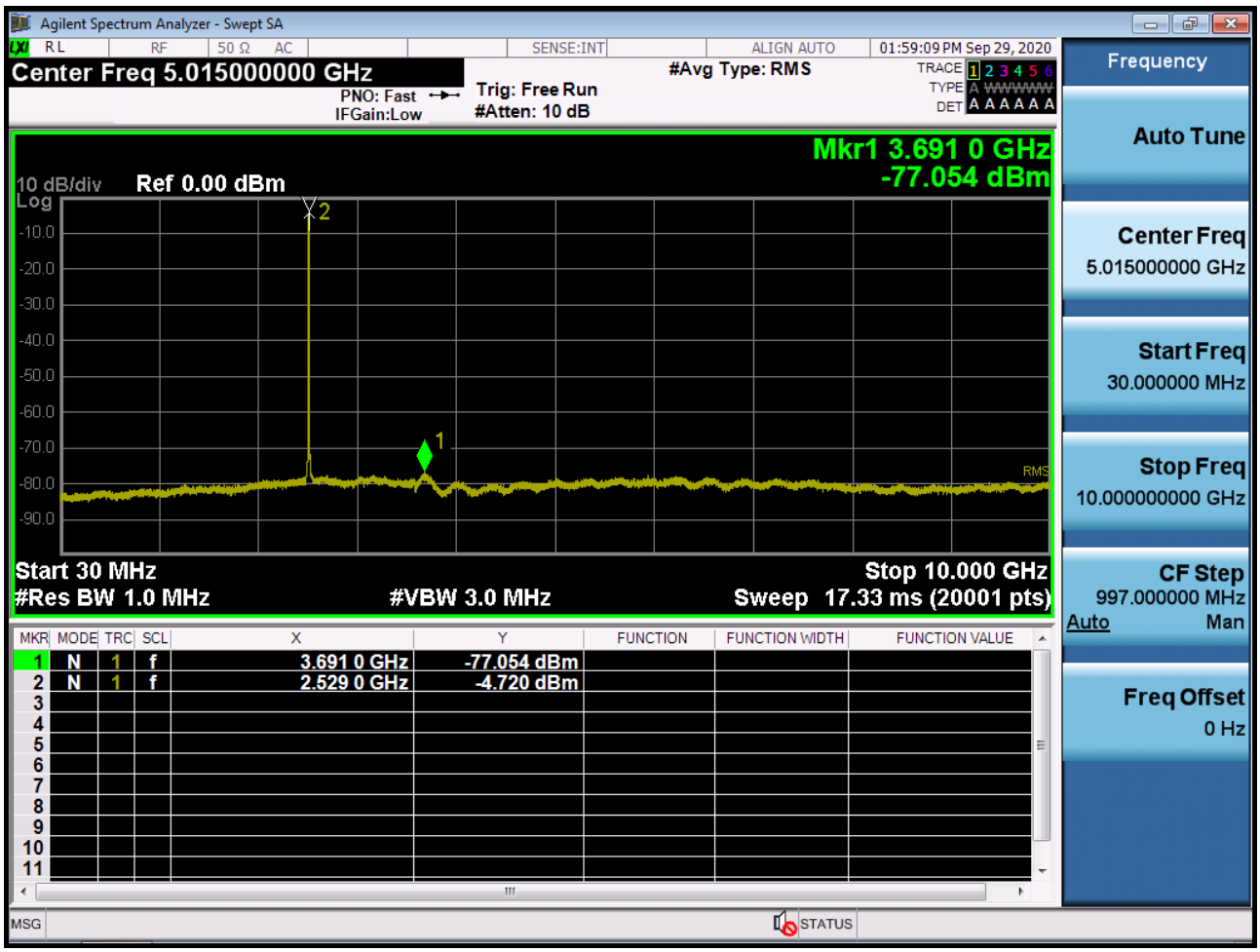
BAND 7. Conducted Spurious_2 (21400ch_10MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (20825ch_15MHz_QPSK_RB 1_0)



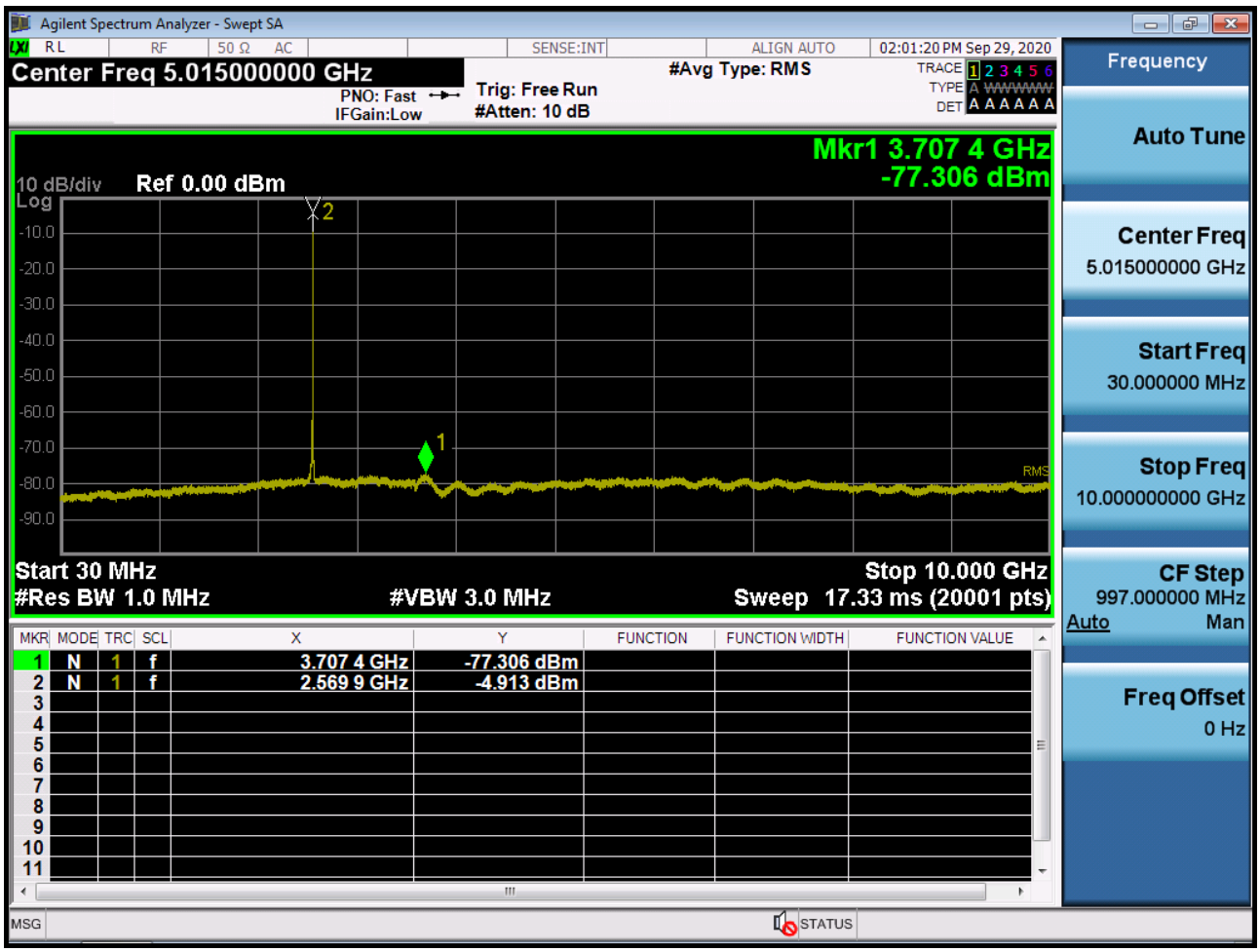
BAND 7. Conducted Spurious_2 (20825ch_15MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21100ch_15MHz_QPSK_RB 1_0)



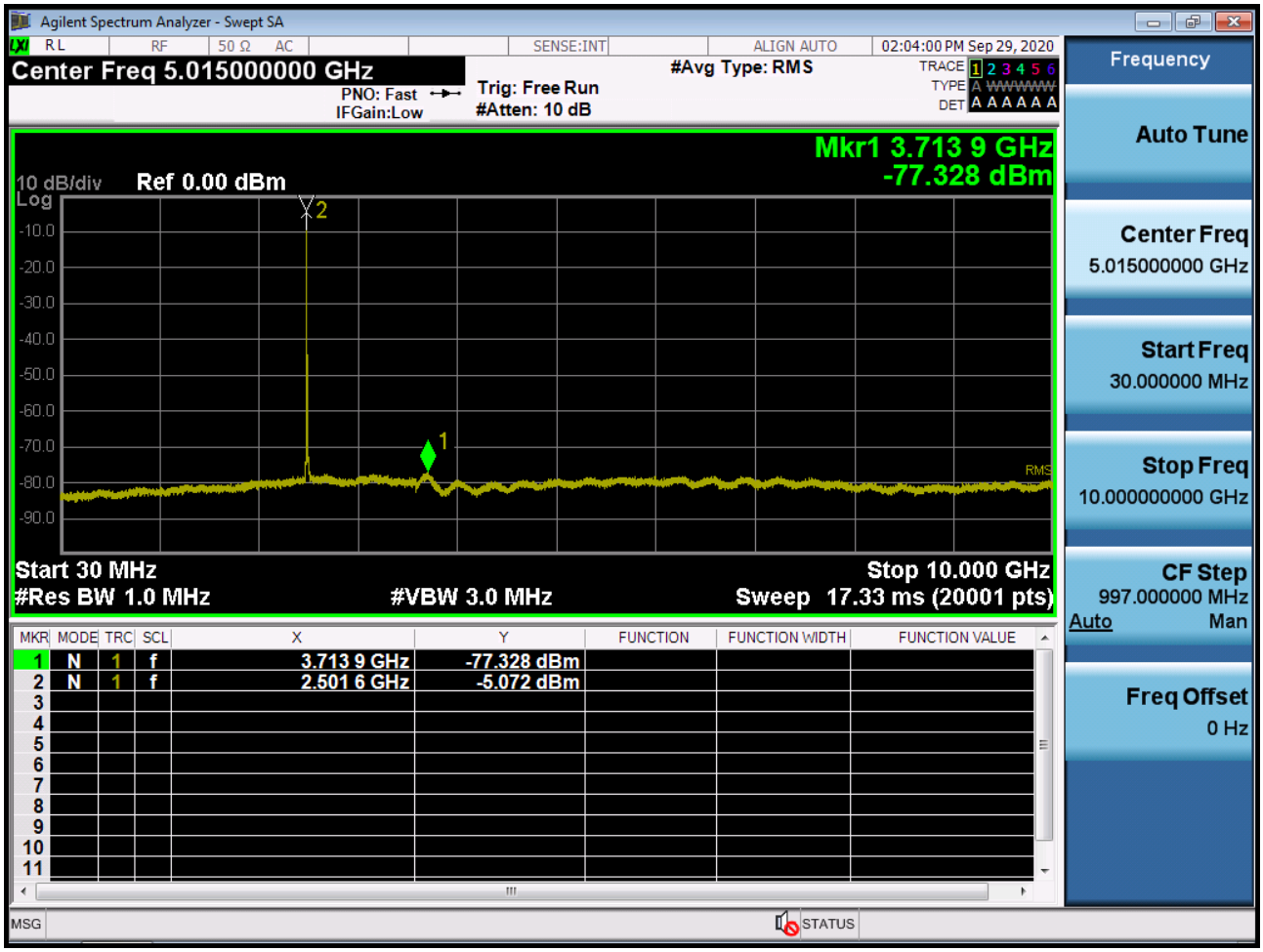
BAND 7. Conducted Spurious_2 (21100ch_15MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21375ch_15MHz_QPSK_RB 1_0)



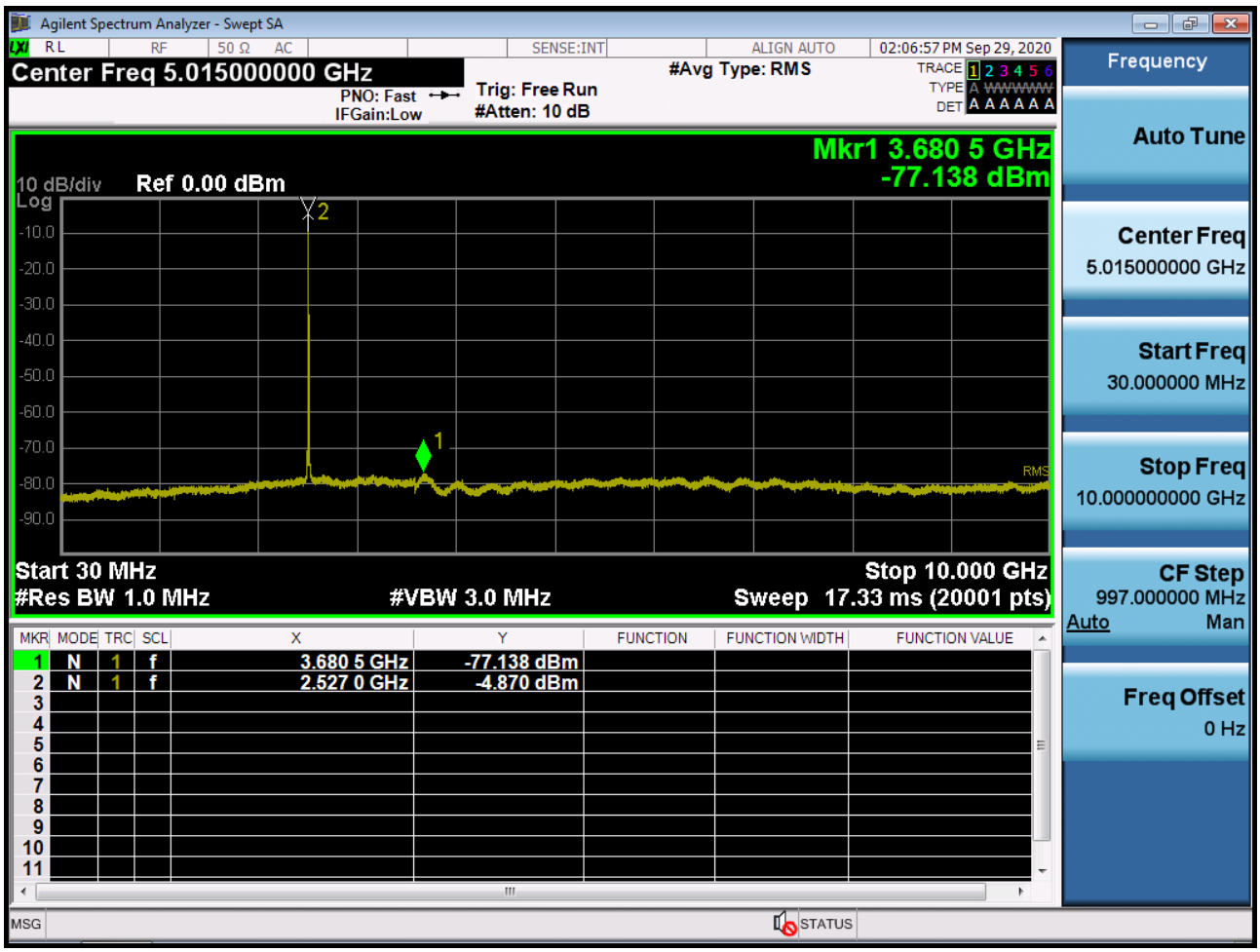
BAND 7. Conducted Spurious_2 (21375ch_15MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (20850ch_20MHz_QPSK_RB 1_0)



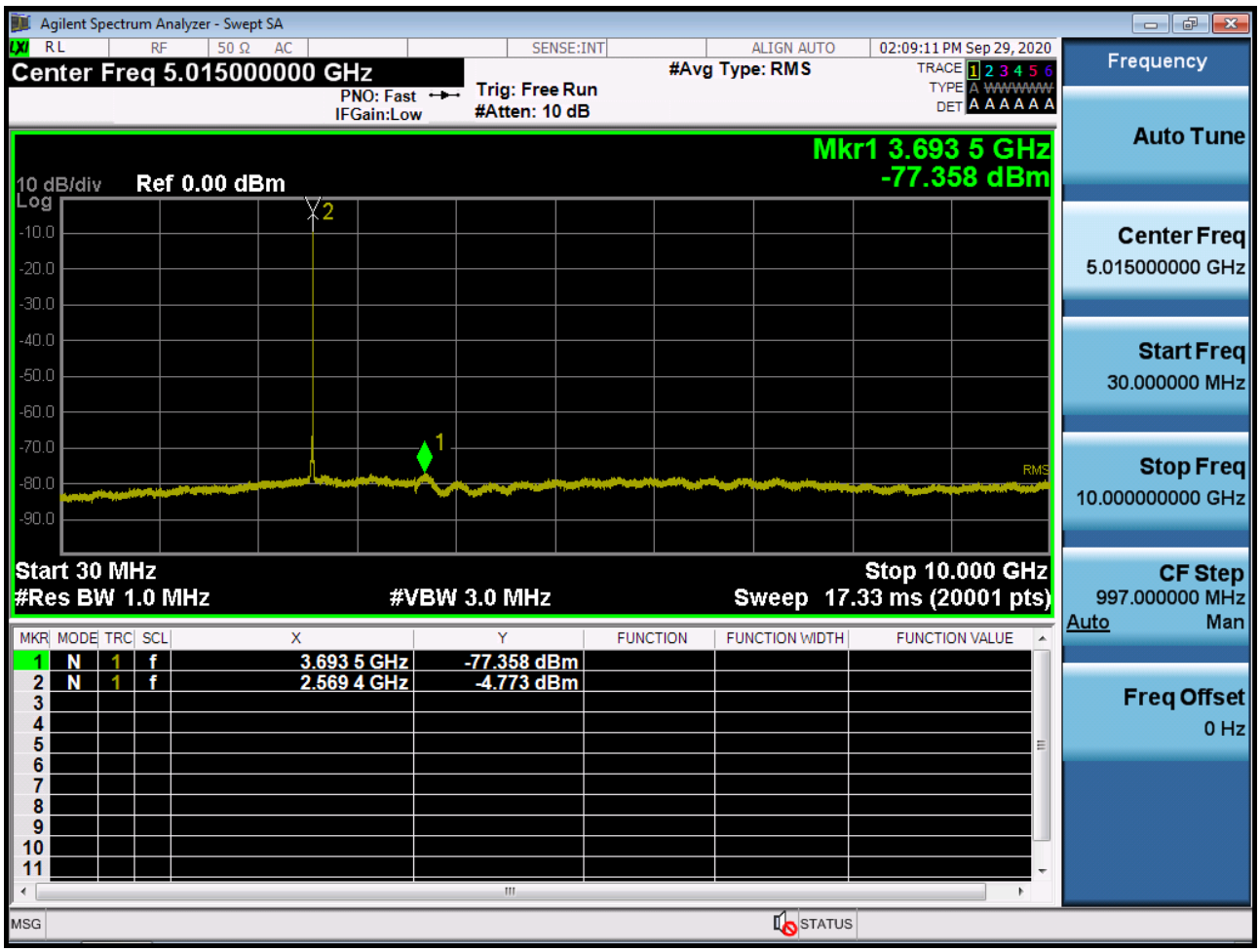
BAND 7. Conducted Spurious_2 (20850ch_20MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21100ch_20MHz_QPSK_RB 1_0)



BAND 7. Conducted Spurious_2 (21100ch_20MHz_QPSK_RB 1_0)

BAND 7. Conducted Spurious_1 (21350ch_20MHz_QPSK_RB 1_0)



BAND 7. Conducted Spurious_2 (21350ch_20MHz_QPSK_RB 1_0)

10. APPENDIX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2010-FC019-P