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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:
January 26, 2022

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

Report No.: HCT-RF-2201-FC091

FCC ID: **A3LSMM236B**

APPLICANT: **SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-M236B/DS
EUT Type:	Mobile phone
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§24, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band2 (1.4)	1850.7 - 1909.3	1M09G7D	QPSK	0.160	22.04
		1M09W7D	16QAM	0.137	21.37
		1M09W7D	64QAM	0.108	20.34
LTE – Band2 (3)	1851.5 - 1908.5	2M71G7D	QPSK	0.166	22.20
		2M70W7D	16QAM	0.144	21.58
		2M70W7D	64QAM	0.111	20.46
LTE – Band2 (5)	1852.5 - 1907.5	4M53G7D	QPSK	0.164	22.15
		4M48W7D	16QAM	0.141	21.49
		4M52W7D	64QAM	0.110	20.43
LTE – Band2 (10)	1855.0 - 1905.0	8M97G7D	QPSK	0.166	22.19
		8M99W7D	16QAM	0.142	21.53
		8M97W7D	64QAM	0.110	20.40
LTE – Band2 (15)	1857.5 - 1902.5	13M5G7D	QPSK	0.163	22.11
		13M5W7D	16QAM	0.139	21.44
		13M4W7D	64QAM	0.107	20.28
LTE – Band2 (20)	1860.0 - 1900.0	17M9G7D	QPSK	0.161	22.06
		17M9W7D	16QAM	0.137	21.35
		17M9W7D	64QAM	0.106	20.24

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 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)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2201-FC091	January 26, 2022	- First Approval Report

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

Table of Contents

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:	A3LSMM236B
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§24, §2
EUT Type:	Mobile phone
Model(s):	SM-M236B/DS
Tx Frequency:	1850.7 MHz – 1909.3 MHz (LTE – Band2 (1.4 MHz)) 1851.5 MHz – 1908.5 MHz (LTE – Band2 (3 MHz)) 1852.5 MHz – 1907.5 MHz (LTE – Band2 (5 MHz)) 1855.0 MHz – 1905.0 MHz (LTE – Band2 (10 MHz)) 1857.5 MHz – 1902.5 MHz (LTE – Band2 (15 MHz)) 1860.0 MHz – 1900.0 MHz (LTE – Band2 (20 MHz))
Date(s) of Tests:	December 23, 2021 ~ January 25, 2022
Serial number:	Radiated: R3CRB0JMDVJ Conducted: R3CRB0HM09R

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 (20/40/80), 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
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 1 MHz
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 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;

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

   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 = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
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 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;

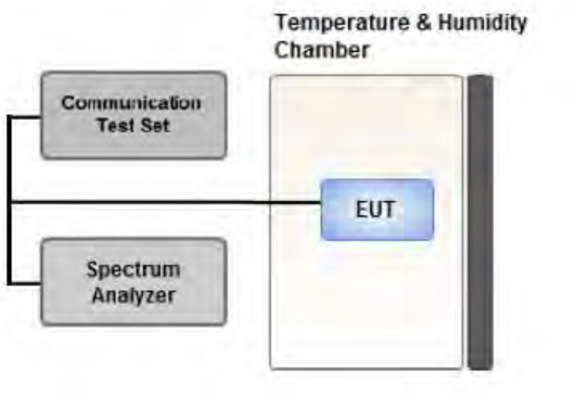
$$\text{Result}_{(dBm)} = \text{Pg}_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   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.

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

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 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)

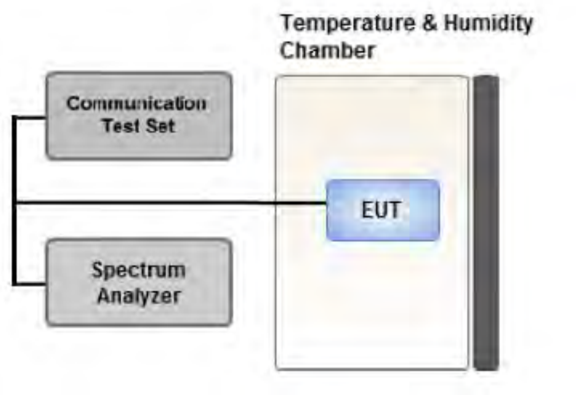
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

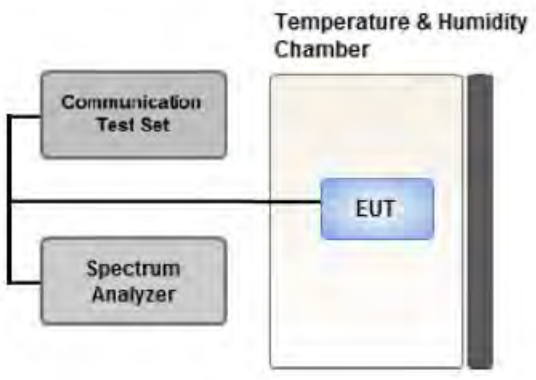
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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 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 ≥ 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

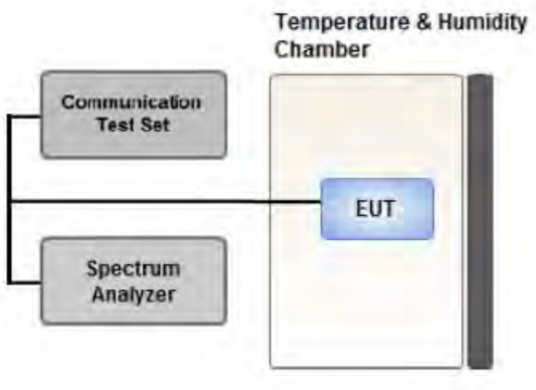
Test Overview

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

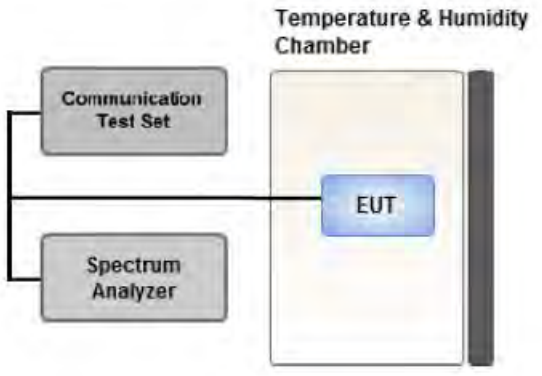
Test Notes

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.
  Mode : Stand alone, Stand alone + External accessories (Earphone, AC adapter, etc)
  Worst case : Stand alone
- We were performed the RSE test in condition of co-location. There has no significant emission raised.
- WWAN + WLAN 5 GHz + BT (Worst case : Stand alone)
- In the case of radiated spurious emissions, all bandwidth of operation were investigated and the worst case bandwidth results are reported. (Worst case : 3 MHz)
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- Please refer to the table below.

[Worst case]

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

3.10 WORST CASE(CONDUCTED TEST)

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM, 64QAM,	1.4, 3, 5, 10, 15, 20	Mid	Full RB	0
Peak-To-Average Ratio	QPSK, 16QAM, 64QAM,	1.4, 3, 5, 10, 15, 20	Mid	Full RB	0
Band Edge	QPSK	1.4	Low	1	0
			High	1	5
		3	Low	1	0
			High	1	14
		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
		1.4, 3, 5, 10, 15, 20	Low, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	QPSK	1.4, 3, 5, 10, 15, 20	Low, Mid, High	1	0

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

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	09/15/2023	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	10/13/2022	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	04/12/2023	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	05/18/2022	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	06/01/2022	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	09/29/2022	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.	6200863156	12/29/2022	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. Espectially, 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 (±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, §24.238(a)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§2.1046	N/A	**See Note1**
Peak- to- Average Ratio	§24.232(d)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§24.235	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	§24.232(c)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §24.238(a)	< 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 = 4M48 G7D

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)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1850.7	LTE B2/ 1.4 MHz	QPSK	-19.90	13.75	10.40	2.11	V	< 2.00	0.160	22.04
		16-QAM	-20.59	13.06	10.40	2.11	V		0.137	21.35
		64-QAM	-21.60	12.05	10.40	2.11	V		0.108	20.34
1880.0		QPSK	-20.47	13.61	10.40	2.15	V		0.154	21.86
		16-QAM	-21.08	13.00	10.40	2.15	V		0.133	21.25
		64-QAM	-22.15	11.93	10.40	2.15	V		0.104	20.18
1909.3		QPSK	-20.64	13.66	10.40	2.15	V		0.155	21.91
		16-QAM	-21.18	13.12	10.40	2.15	V		0.137	21.37
		64-QAM	-22.32	11.98	10.40	2.15	V		0.105	20.23

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1851.5	LTE B2/ 3 MHz	QPSK	-19.80	13.85	10.40	2.11	V	< 2.00	0.164	22.14
		16-QAM	-20.46	13.19	10.40	2.11	V		0.141	21.48
		64-QAM	-21.54	12.11	10.40	2.11	V		0.110	20.40
1880.0		QPSK	-20.40	13.68	10.40	2.15	V		0.156	21.93
		16-QAM	-21.09	12.99	10.40	2.15	V		0.133	21.24
		64-QAM	-22.15	11.93	10.40	2.15	V		0.104	20.18
1908.5		QPSK	-20.35	13.95	10.40	2.15	V		0.166	22.20
		16-QAM	-20.97	13.33	10.40	2.15	V		0.144	21.58
		64-QAM	-22.09	12.21	10.40	2.15	V		0.111	20.46

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1852.5	LTE B2/ 5 MHz	QPSK	-19.90	13.75	10.40	2.11	V	< 2.00	0.160	22.04
		16-QAM	-20.54	13.11	10.40	2.11	V		0.138	21.40
		64-QAM	-21.64	12.01	10.40	2.11	V		0.107	20.30
1880.0		QPSK	-20.42	13.66	10.40	2.15	V		0.155	21.91
		16-QAM	-21.08	13.00	10.40	2.15	V		0.133	21.25
		64-QAM	-22.19	11.89	10.40	2.15	V		0.103	20.14
1907.5		QPSK	-20.40	13.90	10.40	2.15	V		0.164	22.15
		16-QAM	-21.06	13.24	10.40	2.15	V		0.141	21.49
		64-QAM	-22.12	12.18	10.40	2.15	V		0.110	20.43

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1855.0	LTE B2/ 10 MHz	QPSK	-20.21	13.56	10.40	2.12	V	< 2.00	0.153	21.85
		16-QAM	-20.86	12.91	10.40	2.12	V		0.132	21.20
		64-QAM	-21.96	11.81	10.40	2.12	V		0.102	20.10
1880.0		QPSK	-20.50	13.58	10.40	2.15	V		0.153	21.83
		16-QAM	-21.14	12.94	10.40	2.15	V		0.132	21.19
		64-QAM	-22.26	11.82	10.40	2.15	V		0.102	20.07
1905.0		QPSK	-20.29	13.94	10.40	2.15	V		0.166	22.19
		16-QAM	-20.95	13.28	10.40	2.15	V		0.142	21.53
		64-QAM	-22.08	12.15	10.40	2.15	V		0.110	20.40

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1857.5	LTE B2/ 15 MHz	QPSK	-20.30	13.60	10.40	2.12	V	< 2.00	0.154	21.88
		16-QAM	-20.95	12.95	10.40	2.12	V		0.133	21.23
		64-QAM	-22.07	11.83	10.40	2.12	V		0.102	20.11
1880.0		QPSK	-20.50	13.58	10.40	2.15	V		0.153	21.83
		16-QAM	-21.15	12.93	10.40	2.15	V		0.131	21.18
		64-QAM	-22.30	11.78	10.40	2.15	V		0.101	20.03
1902.5		QPSK	-20.30	13.86	10.40	2.15	V		0.163	22.11
		16-QAM	-20.97	13.19	10.40	2.15	V		0.139	21.44
		64-QAM	-22.13	12.03	10.40	2.15	V		0.107	20.28

Freq (MHz)	Mod/ Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
1860.0	LTE B2/ 20 MHz	QPSK	-20.12	13.78	10.40	2.12	V	< 2.00	0.161	22.06
		16-QAM	-20.83	13.07	10.40	2.12	V		0.136	21.35
		64-QAM	-21.94	11.96	10.40	2.12	V		0.106	20.24
1880.0		QPSK	-20.55	13.53	10.40	2.15	V		0.151	21.78
		16-QAM	-21.22	12.86	10.40	2.15	V		0.129	21.11
		64-QAM	-22.35	11.73	10.40	2.15	V		0.100	19.98
1900.0		QPSK	-20.51	13.65	10.40	2.15	V		0.155	21.90
		16-QAM	-21.06	13.10	10.40	2.15	V		0.137	21.35
		64-QAM	-22.25	11.91	10.40	2.15	V		0.104	20.16

8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY: 1907.5 MHz
- ▣ MEASURED OUTPUT POWER: 22.20 dBm = 0.166 W
- ▣ MODE: LTE B2
- ▣ MODULATION SIGNAL: 3 MHz QPSK
- ▣ DISTANCE: 3 meters
- ▣ LIMIT: 43 + 10 log10 (W) = 35.20 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18615 (1851.5)	3 703.00	-54.77	12.30	-59.36	3.08	V	-50.14	72.34
	5 554.50	-56.37	13.10	-54.48	3.82	V	-45.20	67.39
	7 406.00	-44.79	10.80	-34.42	4.45	V	-28.06	50.26
18900 (1880.0)	3 760.00	-54.89	12.32	-59.21	3.10	H	-49.99	72.18
	5 640.00	-55.67	13.10	-53.48	3.85	V	-44.23	66.42
	7 520.00	-46.34	10.84	-35.49	4.46	H	-29.11	51.31
19185 (1908.5)	3 817.00	-54.52	12.40	-59.21	3.14	V	-49.95	72.15
	5 725.50	-56.17	13.05	-53.31	3.88	V	-44.13	66.33
	7 634.00	-51.93	11.24	-41.15	4.48	H	-34.39	56.59

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
2	1.4 MHz	1880.0	QPSK	6	0	4.98
			16-QAM	6	0	5.77
			64-QAM	6	0	6.42
	3 MHz		QPSK	15	0	5.01
			16-QAM	15	0	5.78
			64-QAM	15	0	6.33
	5 MHz		QPSK	25	0	5.00
			16-QAM	25	0	5.75
			64-QAM	25	0	6.33
	10 MHz		QPSK	50	0	5.10
			16-QAM	50	0	5.79
			64-QAM	50	0	6.31
	15 MHz		QPSK	75	0	5.05
			16-QAM	75	0	5.77
			64-QAM	75	0	6.35
	20 MHz		QPSK	100	0	5.05
			16-QAM	100	0	5.79
			64-QAM	100	0	6.32

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 104 ~ 121.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
2	1.4 MHz	1880.0	QPSK	6	0	1.0928
			16-QAM	6	0	1.0926
			64-QAM	6	0	1.0925
	3 MHz		QPSK	15	0	2.7093
			16-QAM	15	0	2.6965
			64-QAM	15	0	2.7024
	5 MHz		QPSK	25	0	4.5259
			16-QAM	25	0	4.4794
			64-QAM	25	0	4.5236
	10 MHz		QPSK	50	0	8.9713
			16-QAM	50	0	8.9853
			64-QAM	50	0	8.9698
	15 MHz		QPSK	75	0	13.458
			16-QAM	75	0	13.451
			64-QAM	75	0	13.439
	20 MHz		QPSK	100	0	17.916
			16-QAM	100	0	17.903
			64-QAM	100	0	17.896

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 86 ~ 103.

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)
2	1.4	1850.7	3.7020	27.976	-76.808	-48.832	-13.00
		1880.0	3.6686	27.976	-77.134	-49.158	
		1909.3	3.6780	27.976	-77.105	-49.129	
	3	1851.5	7.4018	28.591	-76.733	-48.142	
		1880.0	3.7124	27.976	-77.055	-49.079	
		1908.5	3.6591	27.976	-77.247	-49.271	
	5	1852.5	7.4023	28.591	-76.569	-47.978	
		1880.0	7.5120	28.591	-77.267	-48.676	
		1907.5	3.6980	27.976	-76.952	-48.976	
	10	1855.0	3.7084	27.976	-77.219	-49.243	
		1880.0	7.5030	28.591	-76.809	-48.218	
		1905.0	3.6935	27.976	-77.305	-49.329	
	15	1857.5	3.6840	27.976	-77.017	-49.041	
		1880.0	3.6985	27.976	-77.316	-49.340	
		1902.5	3.7114	27.976	-77.156	-49.180	
	20	1860.0	3.7029	27.976	-77.338	-49.362	
		1880.0	7.4851	28.591	-76.970	-48.379	
		1900.0	3.7015	27.976	-77.186	-49.210	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 122 ~ 157.

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(26.5)	30.131

8.6 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 50 ~ 85.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE B2

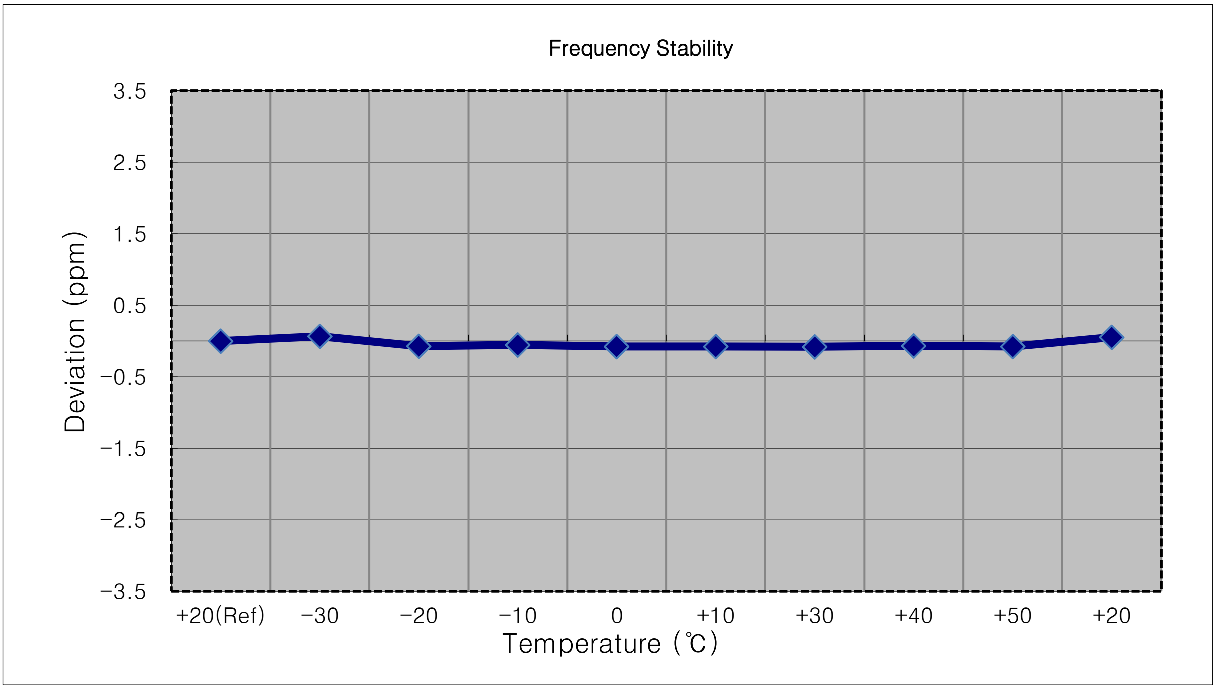
▣ OPERATING FREQUENCY: 1850,700,000 Hz

▣ CHANNEL: 18607 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1850 699 843	0.0	0.000 000	0.000
100 %		-30	1850 699 964	120.7	0.000 007	0.065
100 %		-20	1850 699 707	-136.1	-0.000 007	-0.074
100 %		-10	1850 699 746	-97.2	-0.000 005	-0.053
100 %		0	1850 699 698	-145.0	-0.000 008	-0.078
100 %		+10	1850 699 703	-139.6	-0.000 008	-0.075
100 %		+30	1850 699 695	-147.9	-0.000 008	-0.080
100 %		+40	1850 699 714	-128.7	-0.000 007	-0.070
100 %		+50	1850 699 704	-138.7	-0.000 007	-0.075
Batt. Endpoint	3.650	+20	1850 699 938	94.9	0.000 005	0.051



▣ MODE: LTE B2

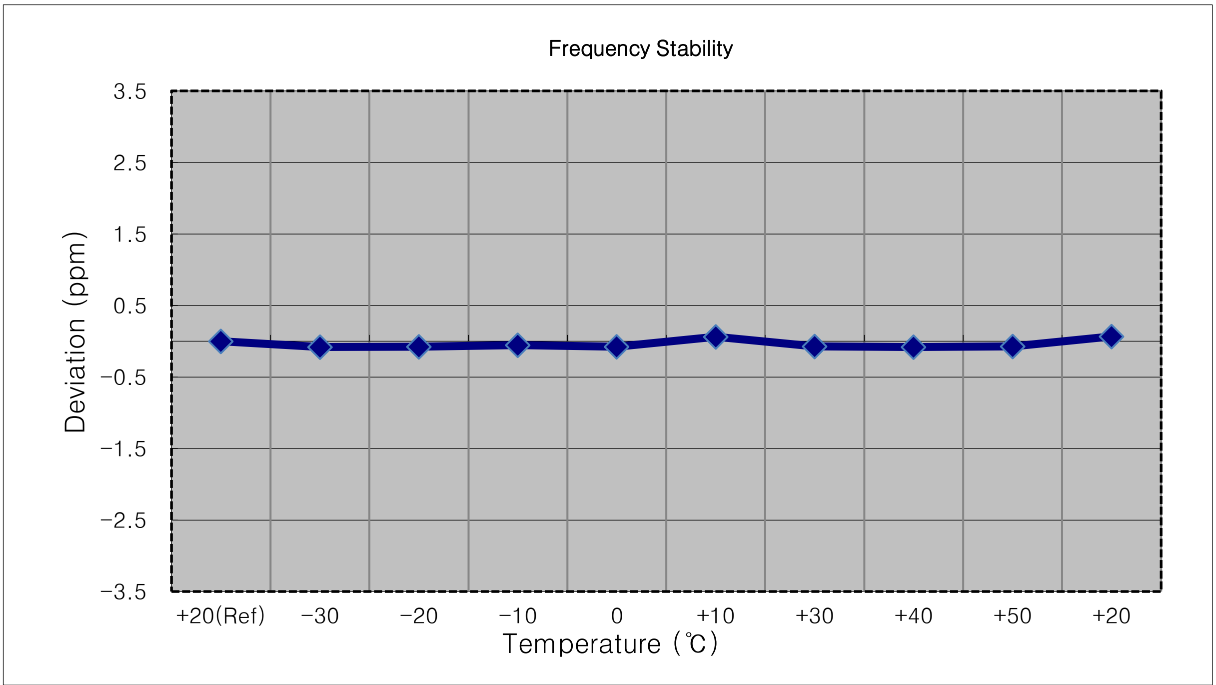
▣ OPERATING FREQUENCY: 1851,500,000 Hz

▣ CHANNEL: 18615 (3 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1851 500 084	0.0	0.000 000	0.000
100 %		-30	1851 499 934	-150.2	-0.000 008	-0.081
100 %		-20	1851 499 943	-141.0	-0.000 008	-0.076
100 %		-10	1851 499 984	-100.8	-0.000 005	-0.054
100 %		0	1851 499 942	-142.1	-0.000 008	-0.077
100 %		+10	1851 500 202	117.5	0.000 006	0.063
100 %		+30	1851 499 949	-135.5	-0.000 007	-0.073
100 %		+40	1851 499 935	-149.0	-0.000 008	-0.080
100 %		+50	1851 499 954	-130.5	-0.000 007	-0.070
Batt. Endpoint	3.650	+20	1851 500 208	123.5	0.000 007	0.067



▣ MODE: LTE B2

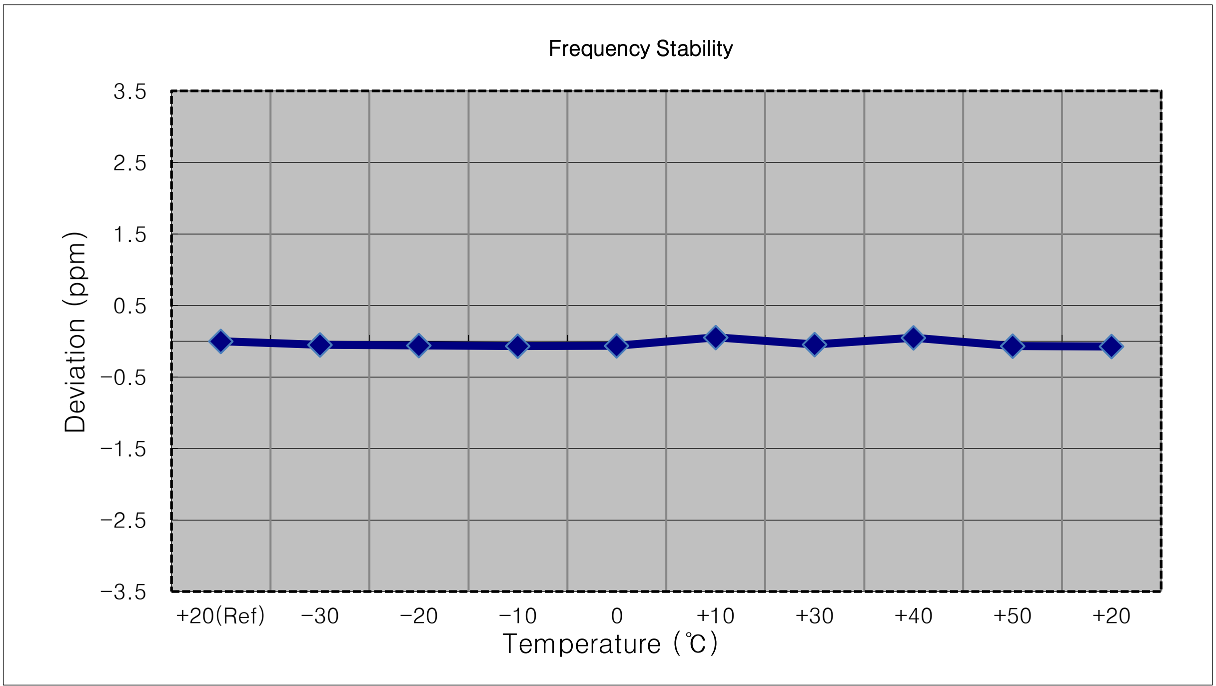
▣ OPERATING FREQUENCY: 1852,500,000 Hz

▣ CHANNEL: 18625 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1852 499 863	0.0	0.000 000	0.000
100 %		-30	1852 499 773	-89.5	-0.000 005	-0.048
100 %		-20	1852 499 754	-109.2	-0.000 006	-0.059
100 %		-10	1852 499 733	-129.6	-0.000 007	-0.070
100 %		0	1852 499 742	-120.9	-0.000 007	-0.065
100 %		+10	1852 499 963	99.9	0.000 005	0.054
100 %		+30	1852 499 779	-84.2	-0.000 005	-0.045
100 %		+40	1852 499 952	89.5	0.000 005	0.048
100 %		+50	1852 499 740	-123.2	-0.000 007	-0.067
Batt. Endpoint	3.650	+20	1852 499 725	-137.5	-0.000 007	-0.074



▣ MODE: LTE B2

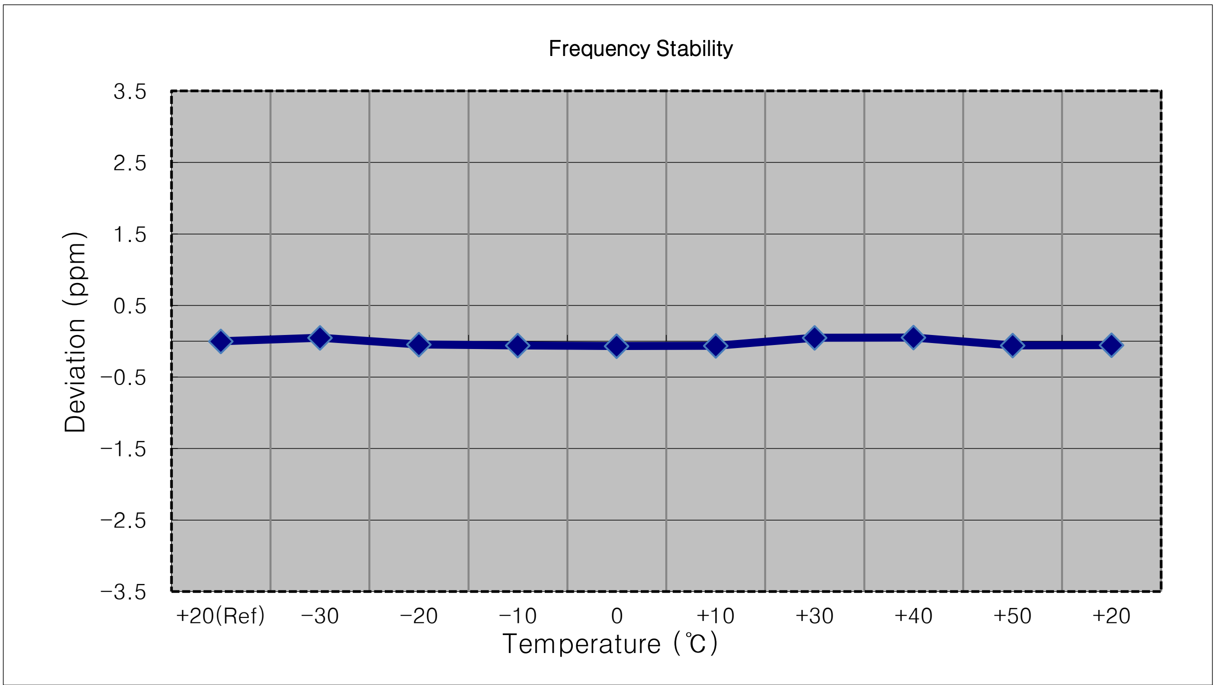
▣ OPERATING FREQUENCY: 1855,000,000 Hz

▣ CHANNEL: 18650 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1854 999 898	0.0	0.000 000	0.000
100 %		-30	1854 999 989	90.5	0.000 005	0.049
100 %		-20	1854 999 813	-85.1	-0.000 005	-0.046
100 %		-10	1854 999 785	-113.4	-0.000 006	-0.061
100 %		0	1854 999 774	-124.6	-0.000 007	-0.067
100 %		+10	1854 999 777	-121.2	-0.000 007	-0.065
100 %		+30	1854 999 984	85.9	0.000 005	0.046
100 %		+40	1854 999 994	95.2	0.000 005	0.051
100 %		+50	1854 999 785	-113.1	-0.000 006	-0.061
Batt. Endpoint	3.650	+20	1854 999 797	-101.3	-0.000 005	-0.055



▣ MODE: LTE B2

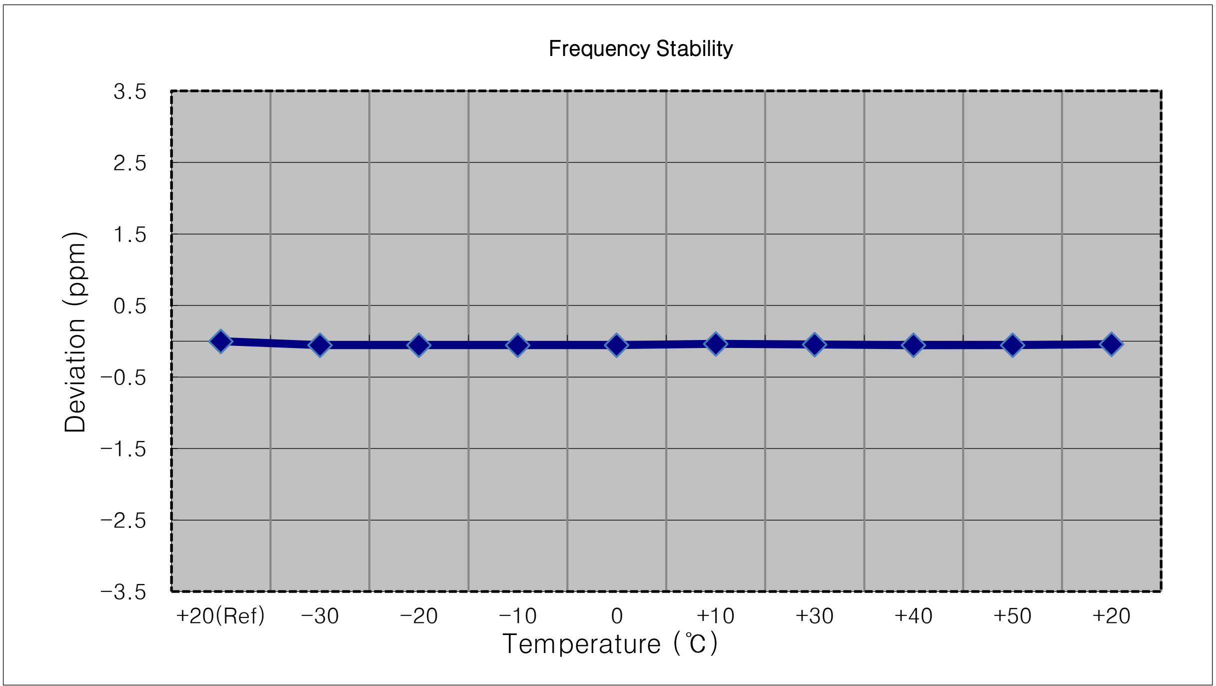
▣ OPERATING FREQUENCY: 1857,500,000 Hz

▣ CHANNEL: 18675 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1857 499 902	0.0	0.000 000	0.000
100 %		-30	1857 499 802	-99.5	-0.000 005	-0.054
100 %		-20	1857 499 802	-99.7	-0.000 005	-0.054
100 %		-10	1857 499 800	-101.4	-0.000 005	-0.055
100 %		0	1857 499 802	-99.8	-0.000 005	-0.054
100 %		+10	1857 499 831	-70.7	-0.000 004	-0.038
100 %		+30	1857 499 814	-87.3	-0.000 005	-0.047
100 %		+40	1857 499 797	-104.9	-0.000 006	-0.056
100 %		+50	1857 499 801	-100.6	-0.000 005	-0.054
Batt. Endpoint	3.650	+20	1857 499 823	-78.9	-0.000 004	-0.042



▣ MODE: LTE B2

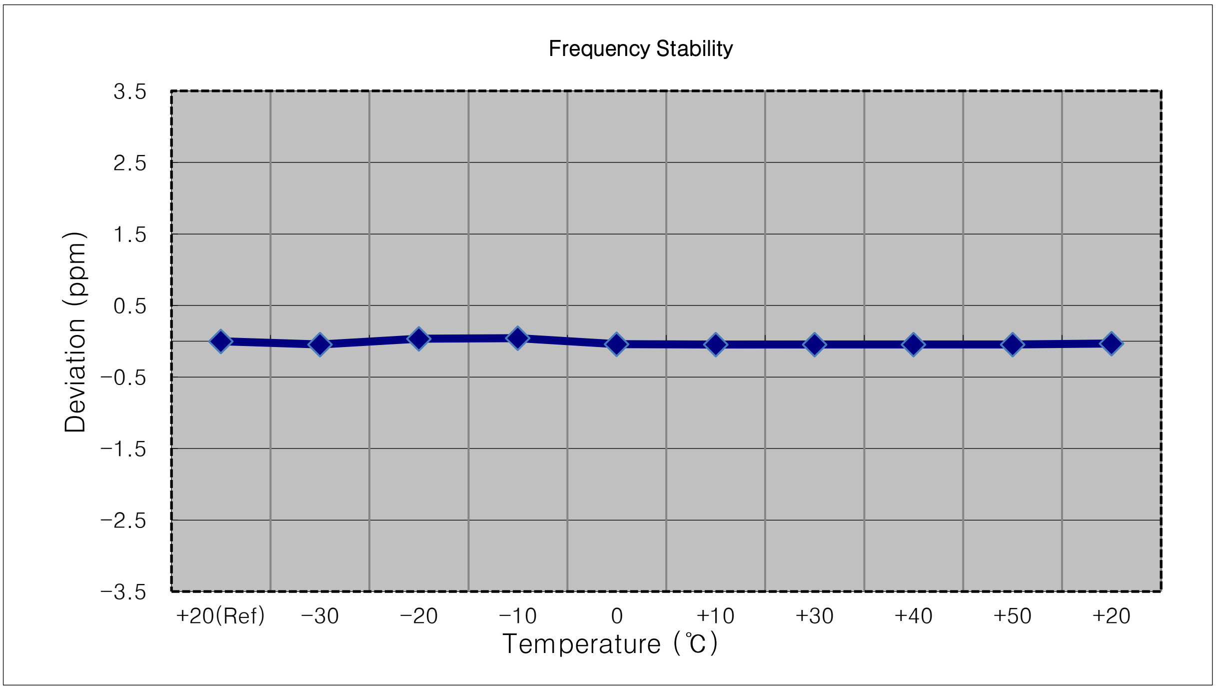
▣ OPERATING FREQUENCY: 1860,000,000 Hz

▣ CHANNEL: 18700 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1860 000 082	0.0	0.000 000	0.000
100 %		-30	1859 999 998	-84.3	-0.000 005	-0.045
100 %		-20	1860 000 145	62.8	0.000 003	0.034
100 %		-10	1860 000 161	79.2	0.000 004	0.043
100 %		0	1860 000 005	-77.5	-0.000 004	-0.042
100 %		+10	1859 999 995	-87.1	-0.000 005	-0.047
100 %		+30	1859 999 998	-84.0	-0.000 005	-0.045
100 %		+40	1859 999 999	-82.9	-0.000 004	-0.045
100 %		+50	1860 000 002	-80.6	-0.000 004	-0.043
Batt. Endpoint	3.650	+20	1860 000 022	-59.9	-0.000 003	-0.032



▣ MODE: LTE B2

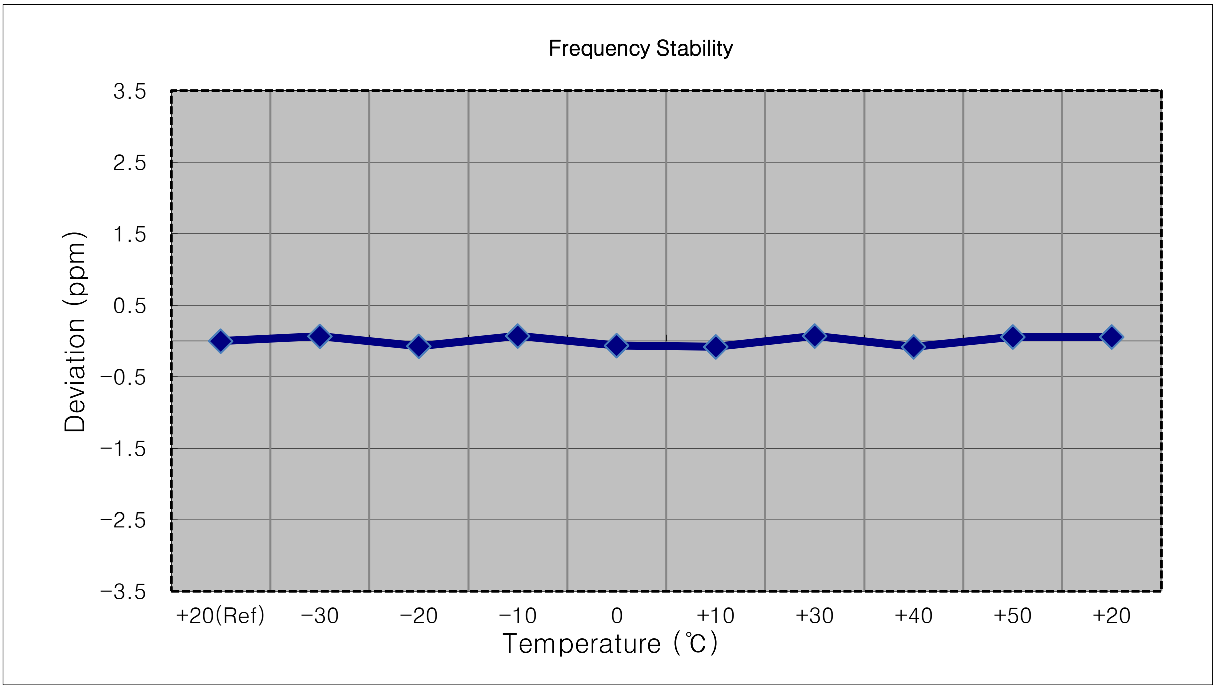
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1879 999 863	0.0	0.000 000	0.000
100 %		-30	1879 999 991	128.5	0.000 007	0.068
100 %		-20	1879 999 729	-133.6	-0.000 007	-0.071
100 %		-10	1879 999 994	131.2	0.000 007	0.070
100 %		0	1879 999 746	-117.1	-0.000 006	-0.062
100 %		+10	1879 999 711	-151.4	-0.000 008	-0.081
100 %		+30	1879 999 996	133.0	0.000 007	0.071
100 %		+40	1879 999 712	-150.6	-0.000 008	-0.080
100 %		+50	1879 999 970	107.1	0.000 006	0.057
Batt. Endpoint	3.650	+20	1879 999 974	111.6	0.000 006	0.059



▣ MODE: LTE B2

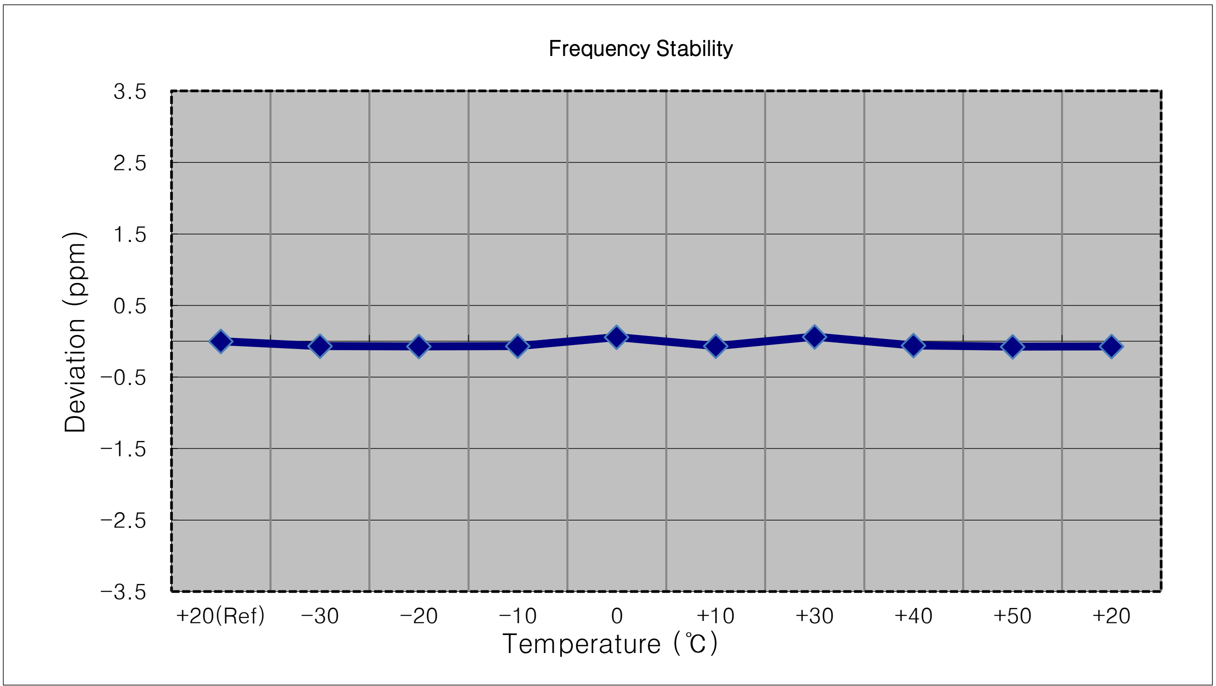
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (3 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1879 999 887	0.0	0.000 000	0.000
100 %		-30	1879 999 760	-126.3	-0.000 007	-0.067
100 %		-20	1879 999 752	-134.5	-0.000 007	-0.072
100 %		-10	1879 999 757	-129.6	-0.000 007	-0.069
100 %		0	1879 999 994	107.4	0.000 006	0.057
100 %		+10	1879 999 756	-130.8	-0.000 007	-0.070
100 %		+30	1880 000 007	120.1	0.000 006	0.064
100 %		+40	1879 999 777	-109.4	-0.000 006	-0.058
100 %		+50	1879 999 744	-142.5	-0.000 008	-0.076
Batt. Endpoint	3.650	+20	1879 999 751	-136.0	-0.000 007	-0.072



▣ MODE: LTE B2

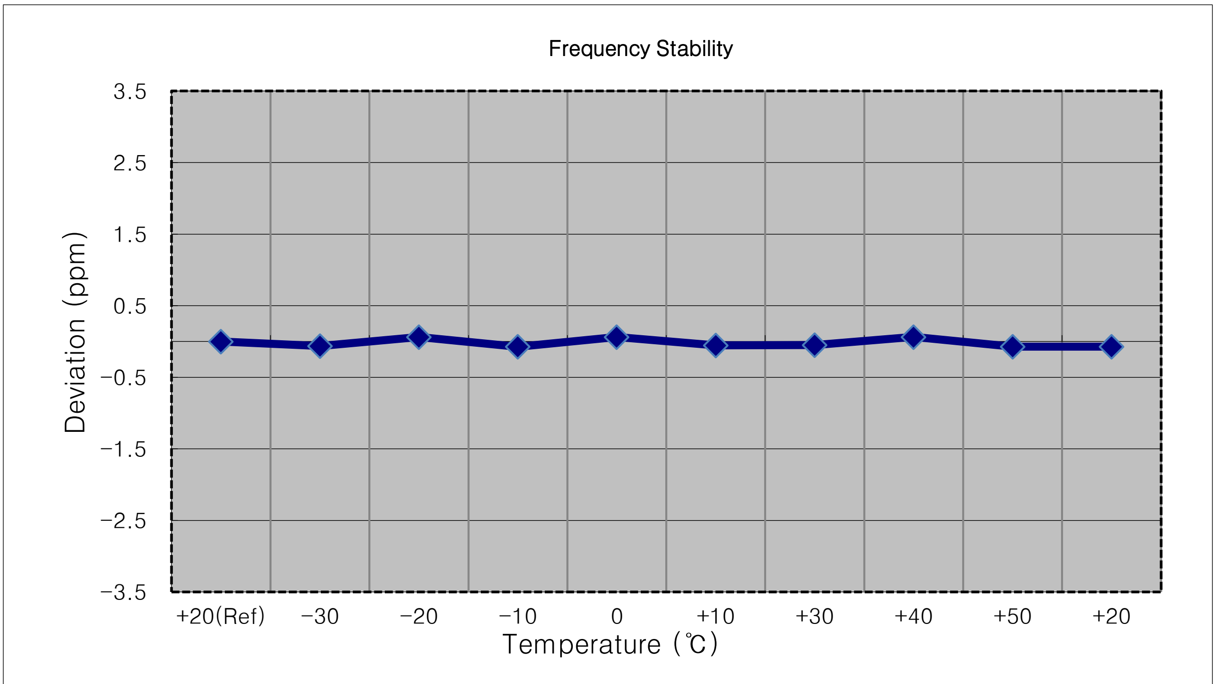
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1880 000 091	0.0	0.000 000	0.000
100 %		-30	1879 999 969	-122.4	-0.000 007	-0.065
100 %		-20	1880 000 210	119.1	0.000 006	0.063
100 %		-10	1879 999 952	-139.3	-0.000 007	-0.074
100 %		0	1880 000 208	116.8	0.000 006	0.062
100 %		+10	1879 999 991	-99.5	-0.000 005	-0.053
100 %		+30	1879 999 999	-92.3	-0.000 005	-0.049
100 %		+40	1880 000 211	120.1	0.000 006	0.064
100 %		+50	1879 999 953	-138.1	-0.000 007	-0.073
Batt. Endpoint	3.650	+20	1879 999 959	-132.3	-0.000 007	-0.070



▣ MODE: LTE B2

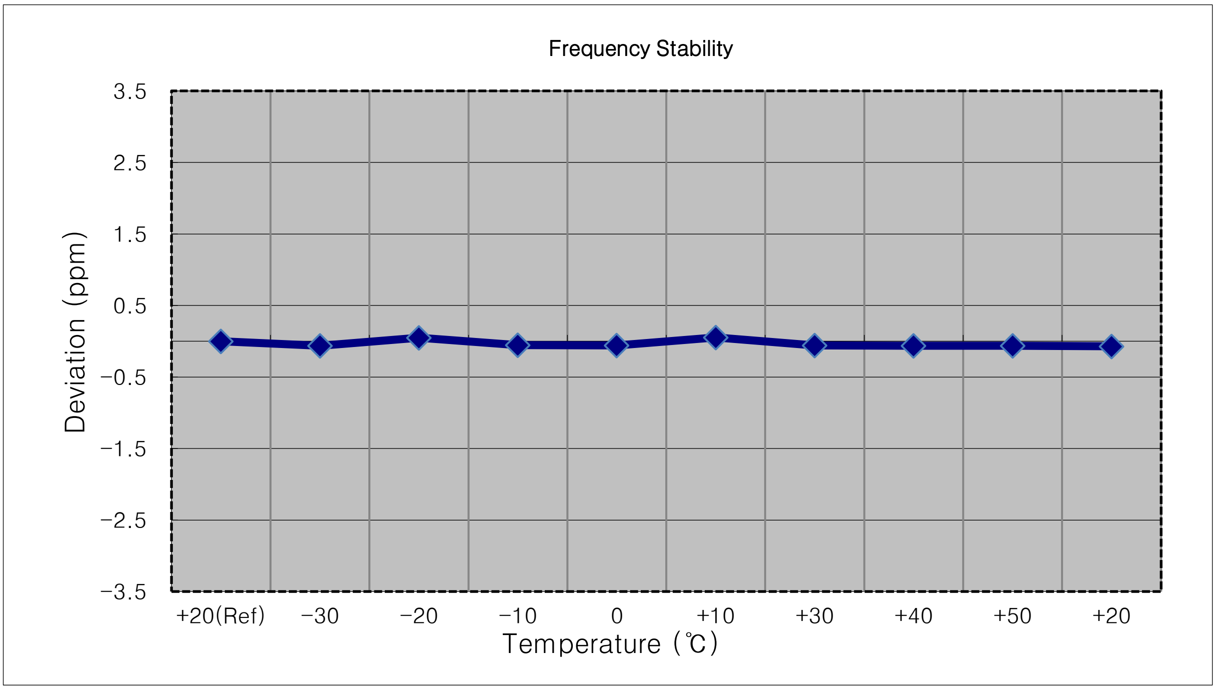
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1880 000 101	0.0	0.000 000	0.000
100 %		-30	1879 999 978	-122.6	-0.000 007	-0.065
100 %		-20	1880 000 189	88.0	0.000 005	0.047
100 %		-10	1880 000 000	-100.7	-0.000 005	-0.054
100 %		0	1879 999 986	-114.2	-0.000 006	-0.061
100 %		+10	1880 000 200	99.0	0.000 005	0.053
100 %		+30	1879 999 990	-111.1	-0.000 006	-0.059
100 %		+40	1879 999 984	-116.9	-0.000 006	-0.062
100 %		+50	1879 999 981	-119.4	-0.000 006	-0.064
Batt. Endpoint	3.650	+20	1879 999 968	-133.0	-0.000 007	-0.071



▣ MODE: LTE B2

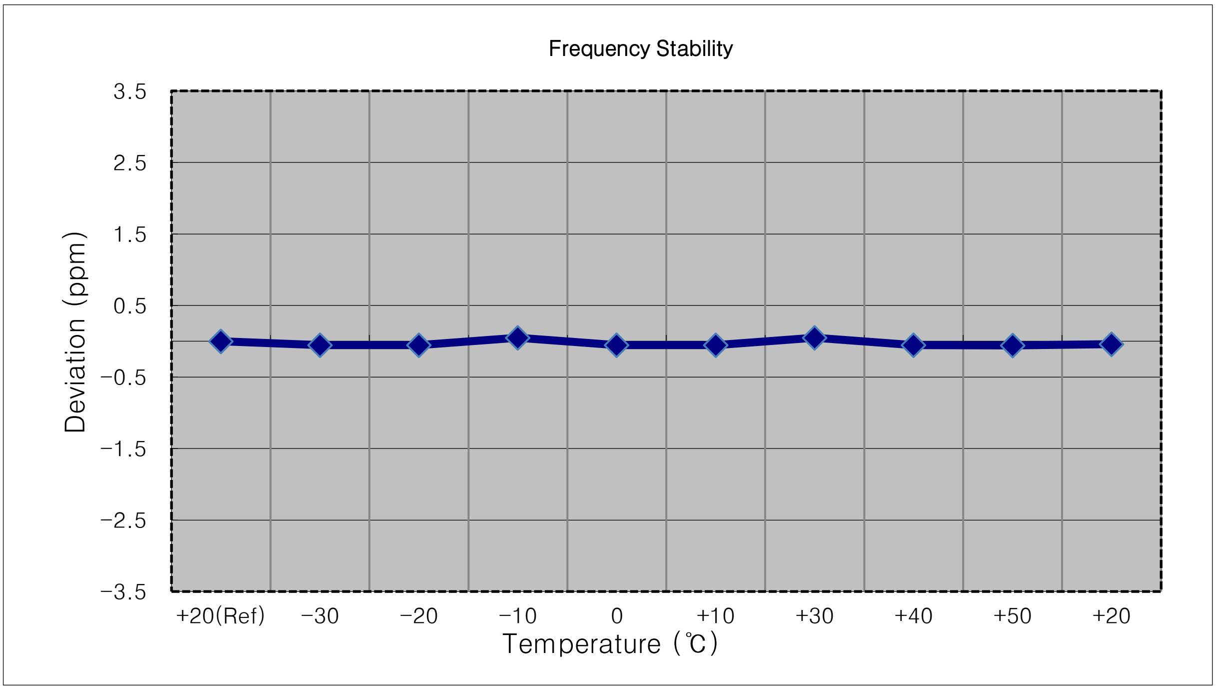
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1880 000 098	0.0	0.000 000	0.000
100 %		-30	1879 999 997	-101.3	-0.000 005	-0.054
100 %		-20	1879 999 994	-104.1	-0.000 006	-0.055
100 %		-10	1880 000 189	90.7	0.000 005	0.048
100 %		0	1879 999 995	-102.9	-0.000 005	-0.055
100 %		+10	1879 999 997	-101.1	-0.000 005	-0.054
100 %		+30	1880 000 185	87.1	0.000 005	0.046
100 %		+40	1879 999 992	-106.2	-0.000 006	-0.056
100 %		+50	1879 999 988	-110.6	-0.000 006	-0.059
Batt. Endpoint	3.650	+20	1880 000 024	-73.9	-0.000 004	-0.039



▣ MODE: LTE B2

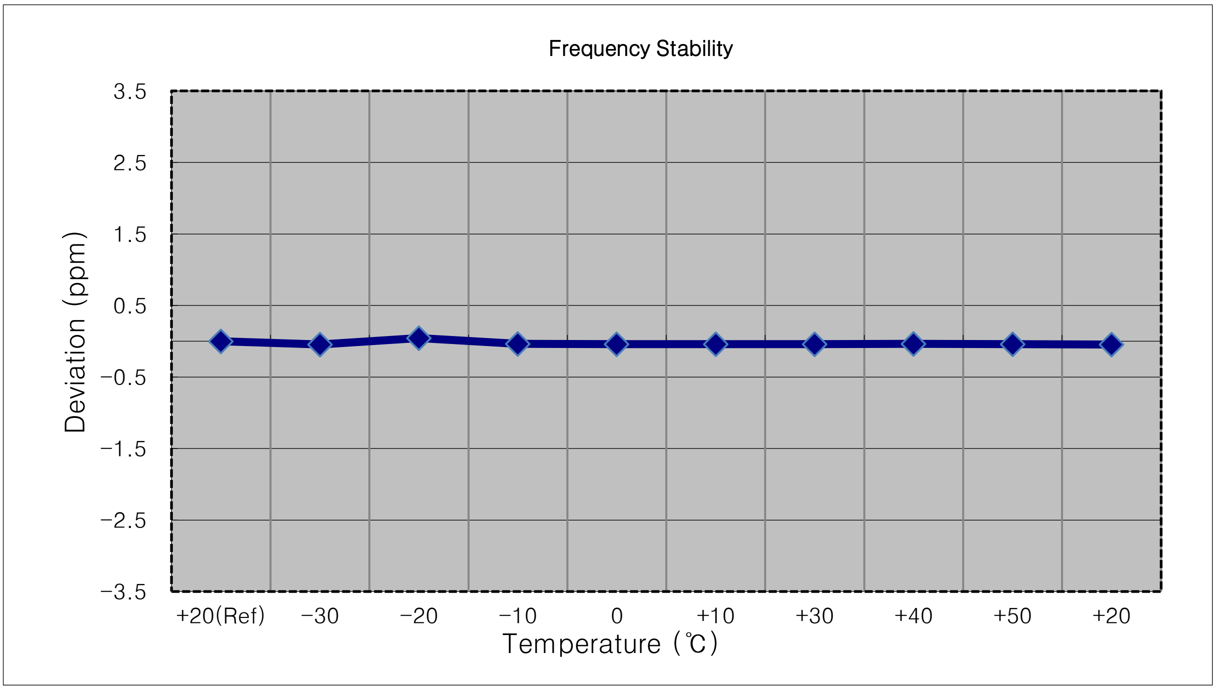
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1880 000 072	0.0	0.000 000	0.000
100 %		-30	1879 999 988	-83.8	-0.000 004	-0.045
100 %		-20	1880 000 154	82.0	0.000 004	0.044
100 %		-10	1880 000 003	-68.9	-0.000 004	-0.037
100 %		0	1879 999 993	-79.5	-0.000 004	-0.042
100 %		+10	1879 999 999	-73.5	-0.000 004	-0.039
100 %		+30	1879 999 993	-79.2	-0.000 004	-0.042
100 %		+40	1880 000 002	-70.3	-0.000 004	-0.037
100 %		+50	1879 999 999	-73.5	-0.000 004	-0.039
Batt. Endpoint	3.650	+20	1879 999 984	-87.9	-0.000 005	-0.047



▣ MODE: LTE B2

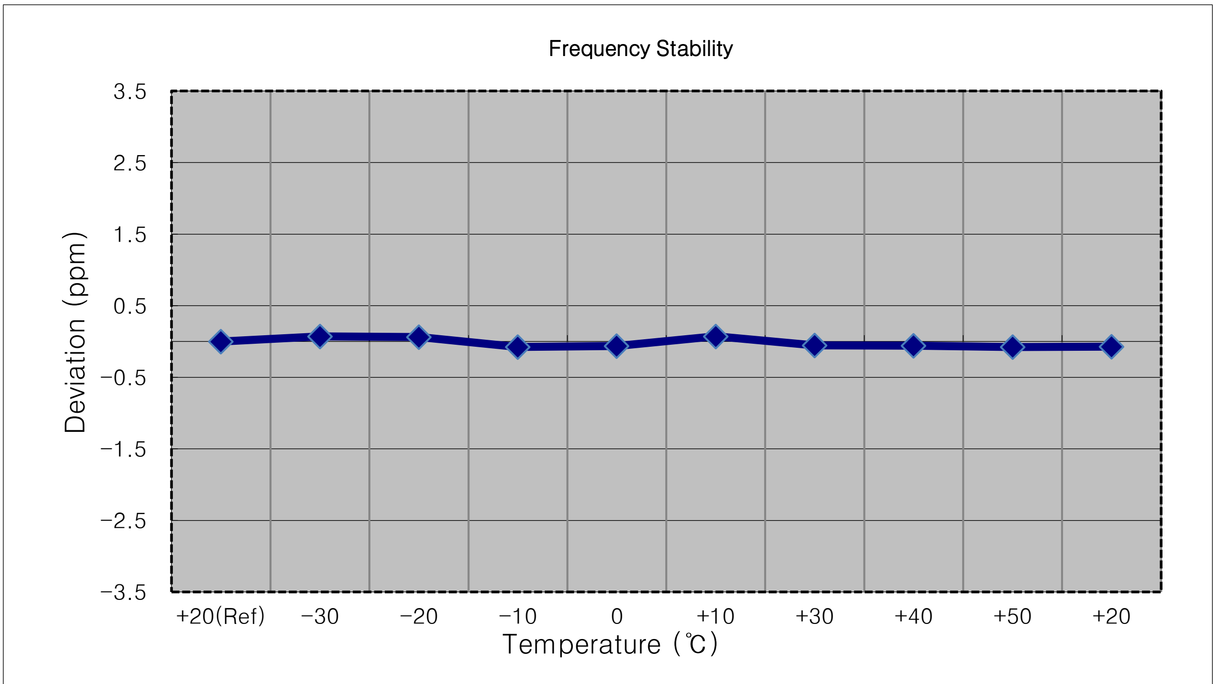
▣ OPERATING FREQUENCY: 1909,300,000 Hz

▣ CHANNEL: 19193 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1909 299 852	0.0	0.000 000	0.000
100 %		-30	1909 299 986	133.5	0.000 007	0.070
100 %		-20	1909 299 974	122.1	0.000 006	0.064
100 %		-10	1909 299 704	-148.3	-0.000 008	-0.078
100 %		0	1909 299 728	-124.6	-0.000 007	-0.065
100 %		+10	1909 299 990	137.7	0.000 007	0.072
100 %		+30	1909 299 752	-100.3	-0.000 005	-0.053
100 %		+40	1909 299 740	-112.5	-0.000 006	-0.059
100 %		+50	1909 299 704	-148.7	-0.000 008	-0.078
Batt. Endpoint	3.650	+20	1909 299 718	-134.1	-0.000 007	-0.070



▣ MODE: LTE B2

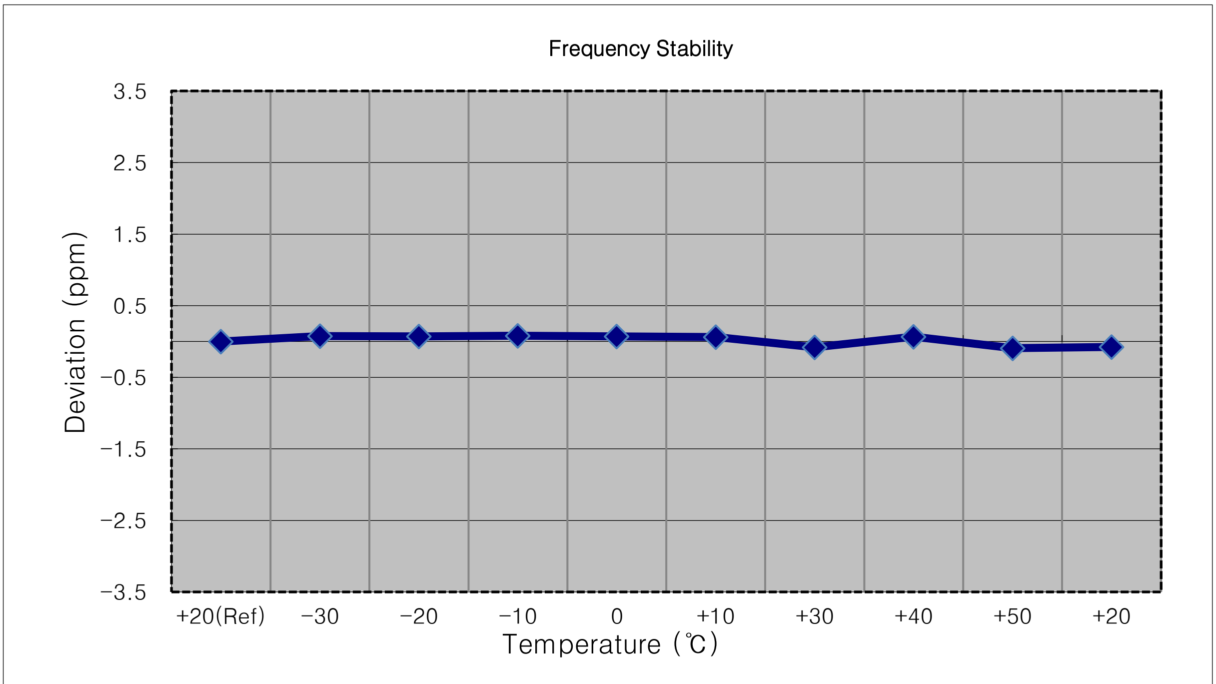
▣ OPERATING FREQUENCY: 1908,500,000 Hz

▣ CHANNEL: 19185 (3 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1908 500 095	0.0	0.000 000	0.000
100 %		-30	1908 500 237	142.7	0.000 007	0.075
100 %		-20	1908 500 232	137.3	0.000 007	0.072
100 %		-10	1908 500 247	152.7	0.000 008	0.080
100 %		0	1908 500 230	135.1	0.000 007	0.071
100 %		+10	1908 500 209	114.6	0.000 006	0.060
100 %		+30	1908 499 939	-155.9	-0.000 008	-0.082
100 %		+40	1908 500 217	122.7	0.000 006	0.064
100 %		+50	1908 499 917	-177.8	-0.000 009	-0.093
Batt. Endpoint	3.650	+20	1908 499 944	-150.4	-0.000 008	-0.079



▣ MODE: LTE B2

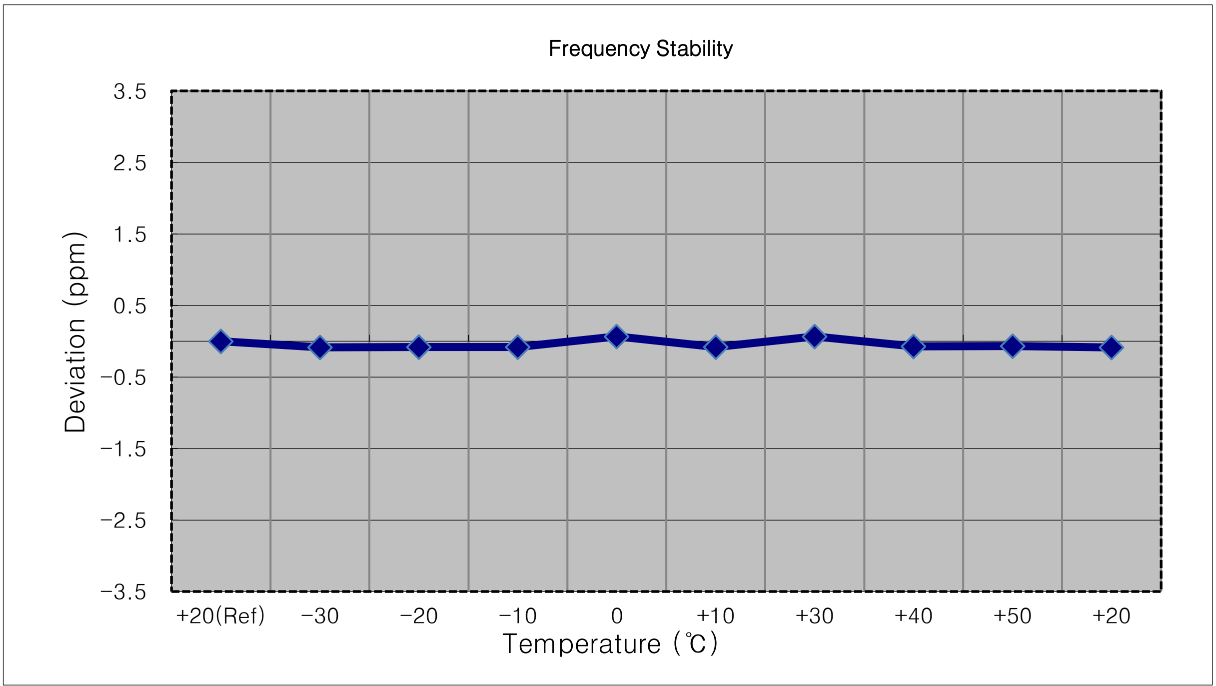
▣ OPERATING FREQUENCY: 1907,500,000 Hz

▣ CHANNEL: 19175 (5 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1907 499 833	0.0	0.000 000	0.000
100 %		-30	1907 499 671	-162.0	-0.000 008	-0.085
100 %		-20	1907 499 676	-157.8	-0.000 008	-0.083
100 %		-10	1907 499 676	-156.9	-0.000 008	-0.082
100 %		0	1907 499 961	127.6	0.000 007	0.067
100 %		+10	1907 499 681	-151.9	-0.000 008	-0.080
100 %		+30	1907 499 956	123.0	0.000 006	0.064
100 %		+40	1907 499 694	-138.9	-0.000 007	-0.073
100 %		+50	1907 499 705	-128.7	-0.000 007	-0.067
Batt. Endpoint	3.650	+20	1907 499 667	-166.3	-0.000 009	-0.087



▣ MODE: LTE B2

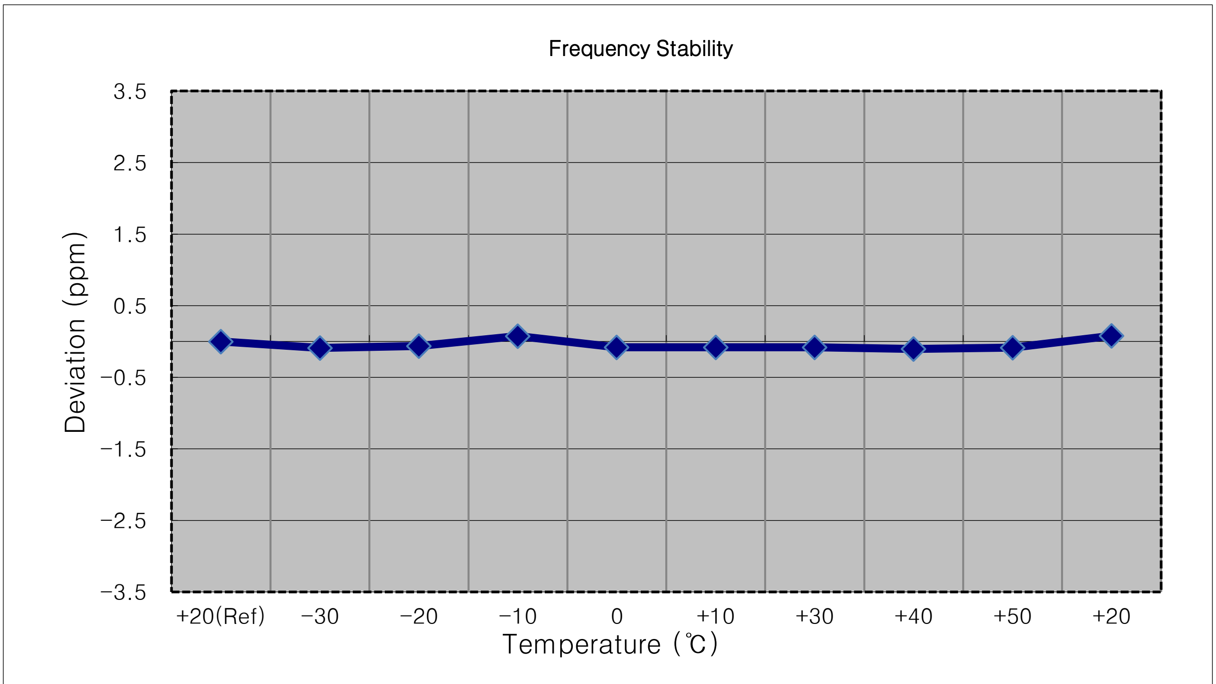
▣ OPERATING FREQUENCY: 1905,000,000 Hz

▣ CHANNEL: 19150 (10 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1904 999 832	0.0	0.000 000	0.000
100 %		-30	1904 999 661	-171.3	-0.000 009	-0.090
100 %		-20	1904 999 715	-116.7	-0.000 006	-0.061
100 %		-10	1904 999 977	145.3	0.000 008	0.076
100 %		0	1904 999 678	-154.3	-0.000 008	-0.081
100 %		+10	1904 999 677	-155.1	-0.000 008	-0.081
100 %		+30	1904 999 673	-159.0	-0.000 008	-0.083
100 %		+40	1904 999 633	-199.1	-0.000 010	-0.105
100 %		+50	1904 999 672	-160.3	-0.000 008	-0.084
Batt. Endpoint	3.650	+20	1904 999 982	149.8	0.000 008	0.079



▣ MODE: LTE B2

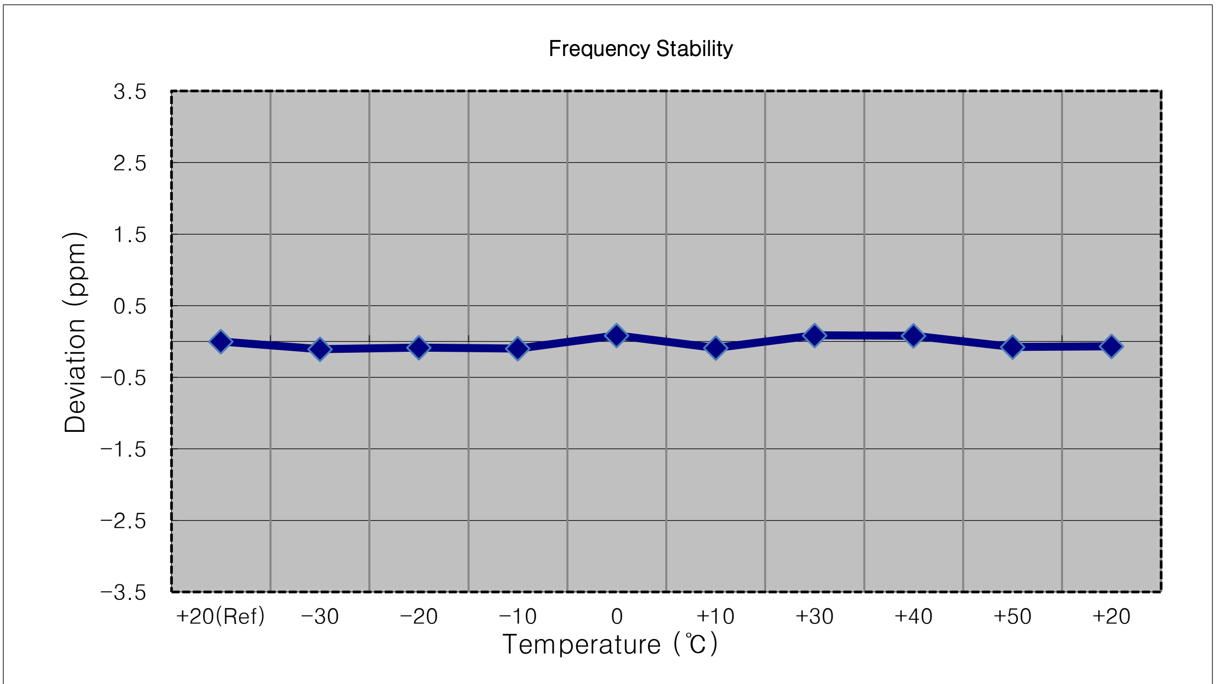
▣ OPERATING FREQUENCY: 1902,500,000 Hz

▣ CHANNEL: 19125 (15 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1902 499 836	0.0	0.000 000	0.000
100 %		-30	1902 499 632	-204.1	-0.000 011	-0.107
100 %		-20	1902 499 676	-159.8	-0.000 008	-0.084
100 %		-10	1902 499 648	-188.5	-0.000 010	-0.099
100 %		0	1902 499 994	157.8	0.000 008	0.083
100 %		+10	1902 499 665	-171.2	-0.000 009	-0.090
100 %		+30	1902 500 000	163.9	0.000 009	0.086
100 %		+40	1902 499 988	151.7	0.000 008	0.080
100 %		+50	1902 499 690	-146.2	-0.000 008	-0.077
Batt. Endpoint	3.650	+20	1902 499 710	-125.9	-0.000 007	-0.066



▣ MODE: LTE B2

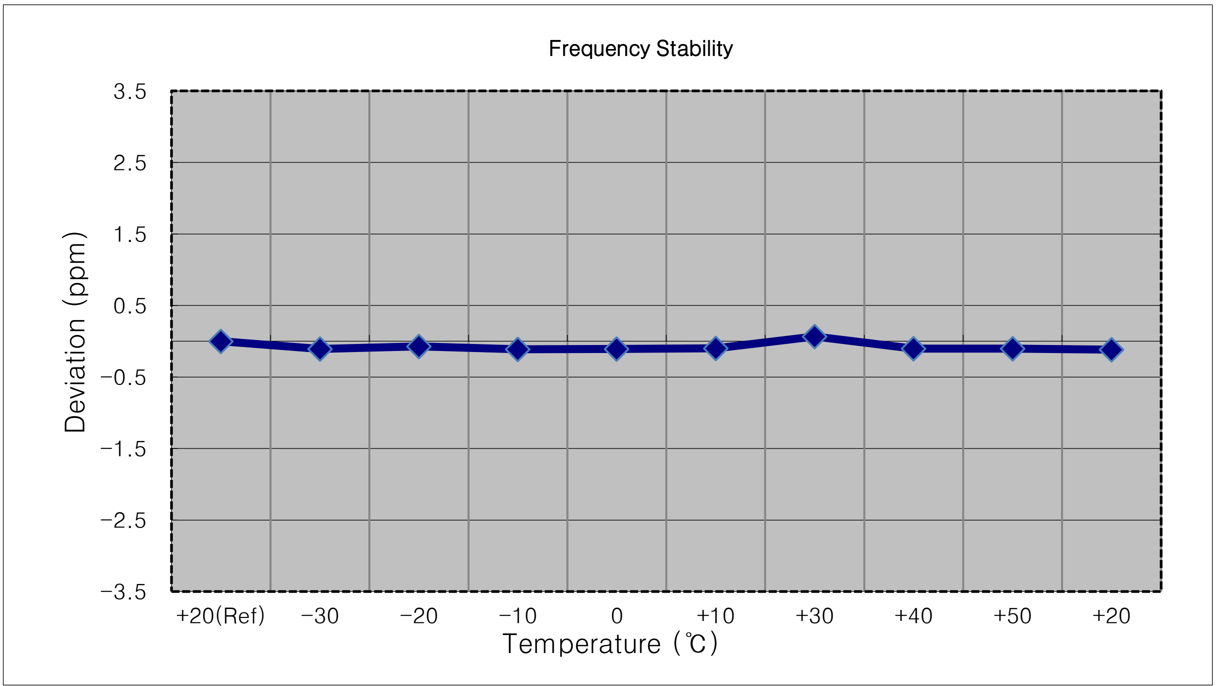
▣ OPERATING FREQUENCY: 1900,000,000 Hz

▣ CHANNEL: 19100 (20 MHz)

▣ REFERENCE VOLTAGE: 3.860 VDC

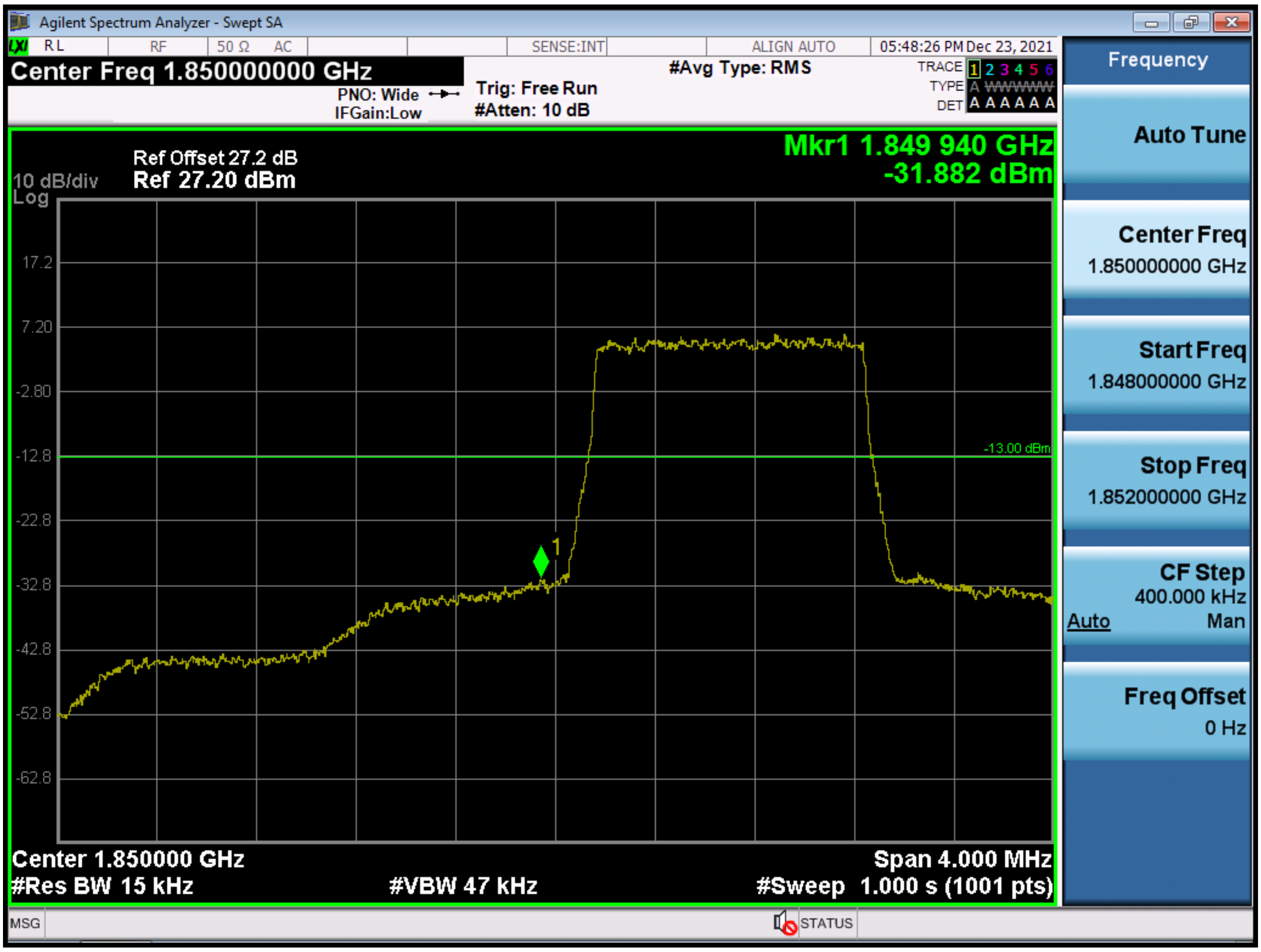
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.860	+20(Ref)	1899 999 788	0.0	0.000 000	0.000
100 %		-30	1899 999 580	-208.2	-0.000 011	-0.110
100 %		-20	1899 999 653	-134.9	-0.000 007	-0.071
100 %		-10	1899 999 575	-213.3	-0.000 011	-0.112
100 %		0	1899 999 585	-203.1	-0.000 011	-0.107
100 %		+10	1899 999 601	-187.7	-0.000 010	-0.099
100 %		+30	1899 999 913	124.4	0.000 007	0.065
100 %		+40	1899 999 588	-200.2	-0.000 011	-0.105
100 %		+50	1899 999 593	-195.3	-0.000 010	-0.103
Batt. Endpoint	3.650	+20	1899 999 564	-223.9	-0.000 012	-0.118

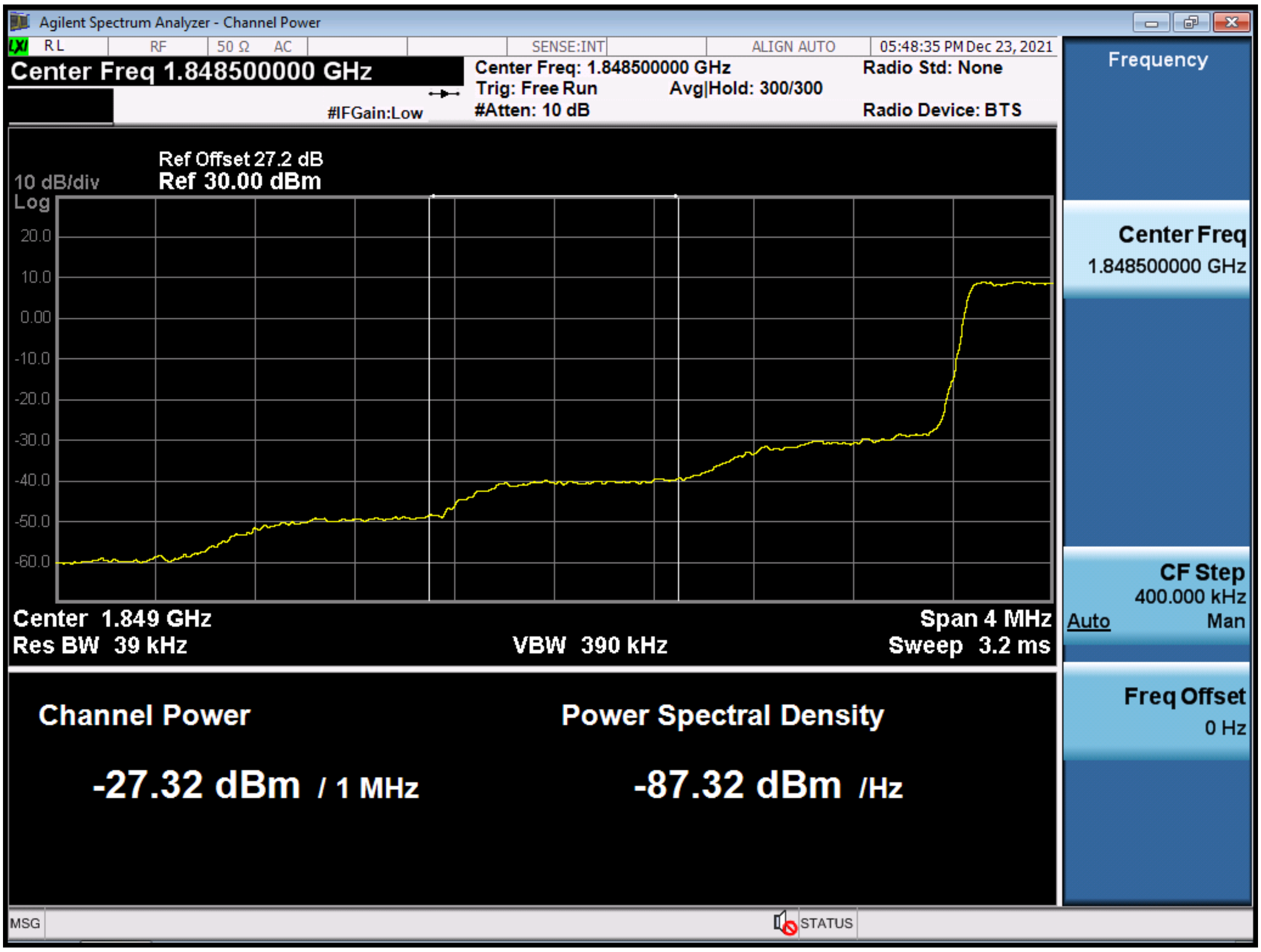


9. TEST PLOTS

BW1.4 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

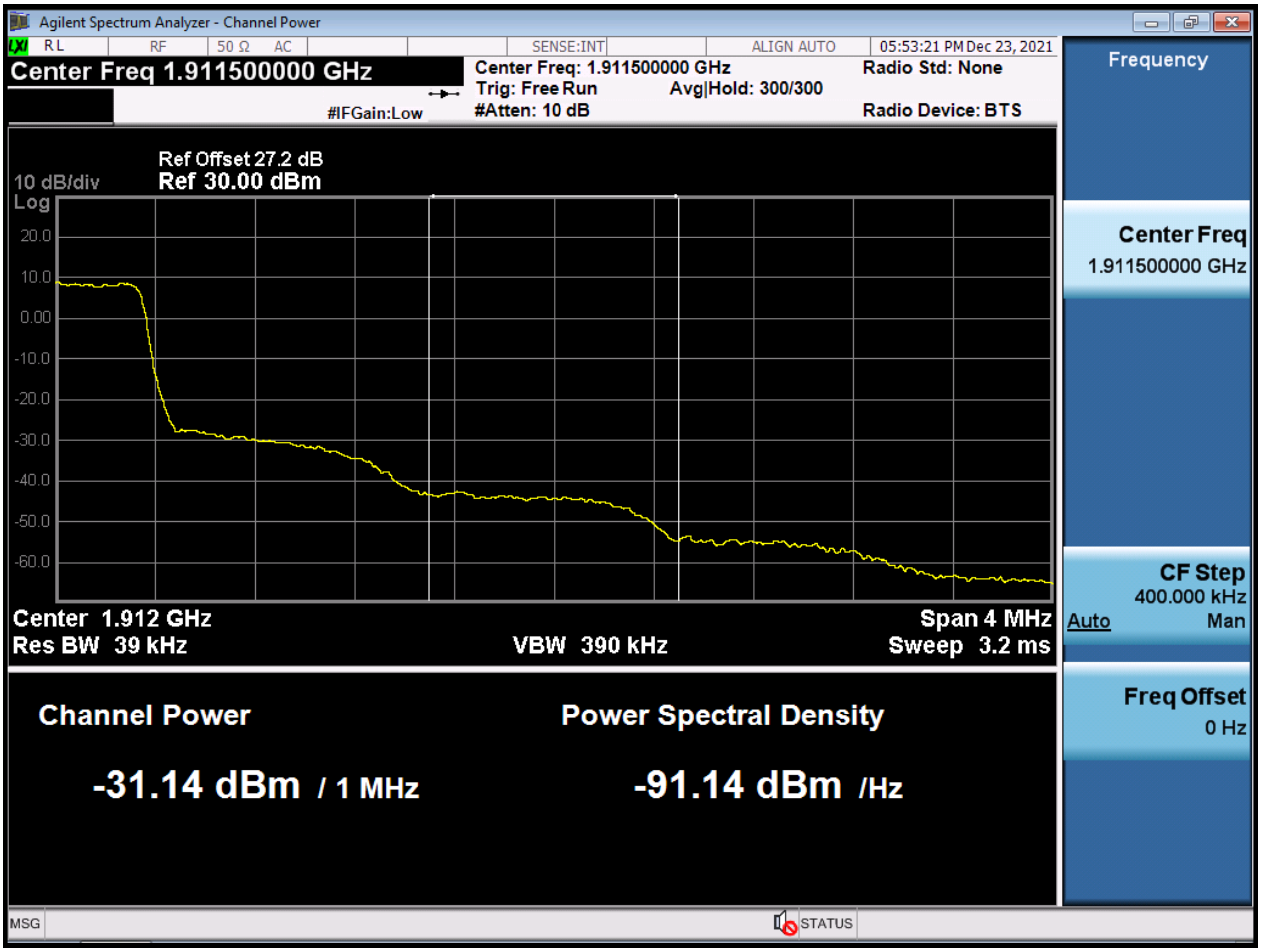


BW1.4 M_BandEdge_Lowest Channel_QPSK_FullRB(2)

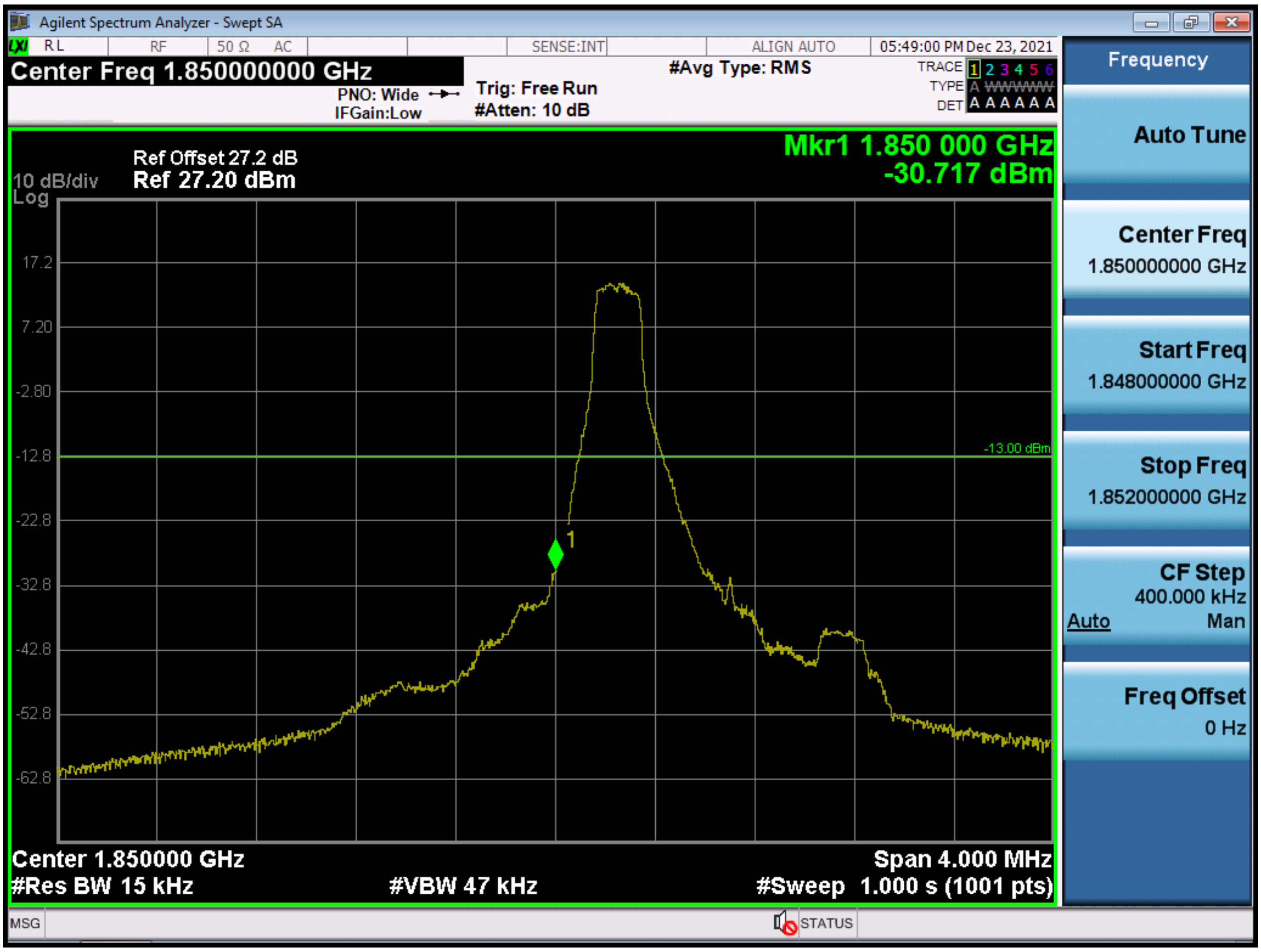


BW1.4 M_BandEdge_Highest Channel_QPSK_FullRB(1)

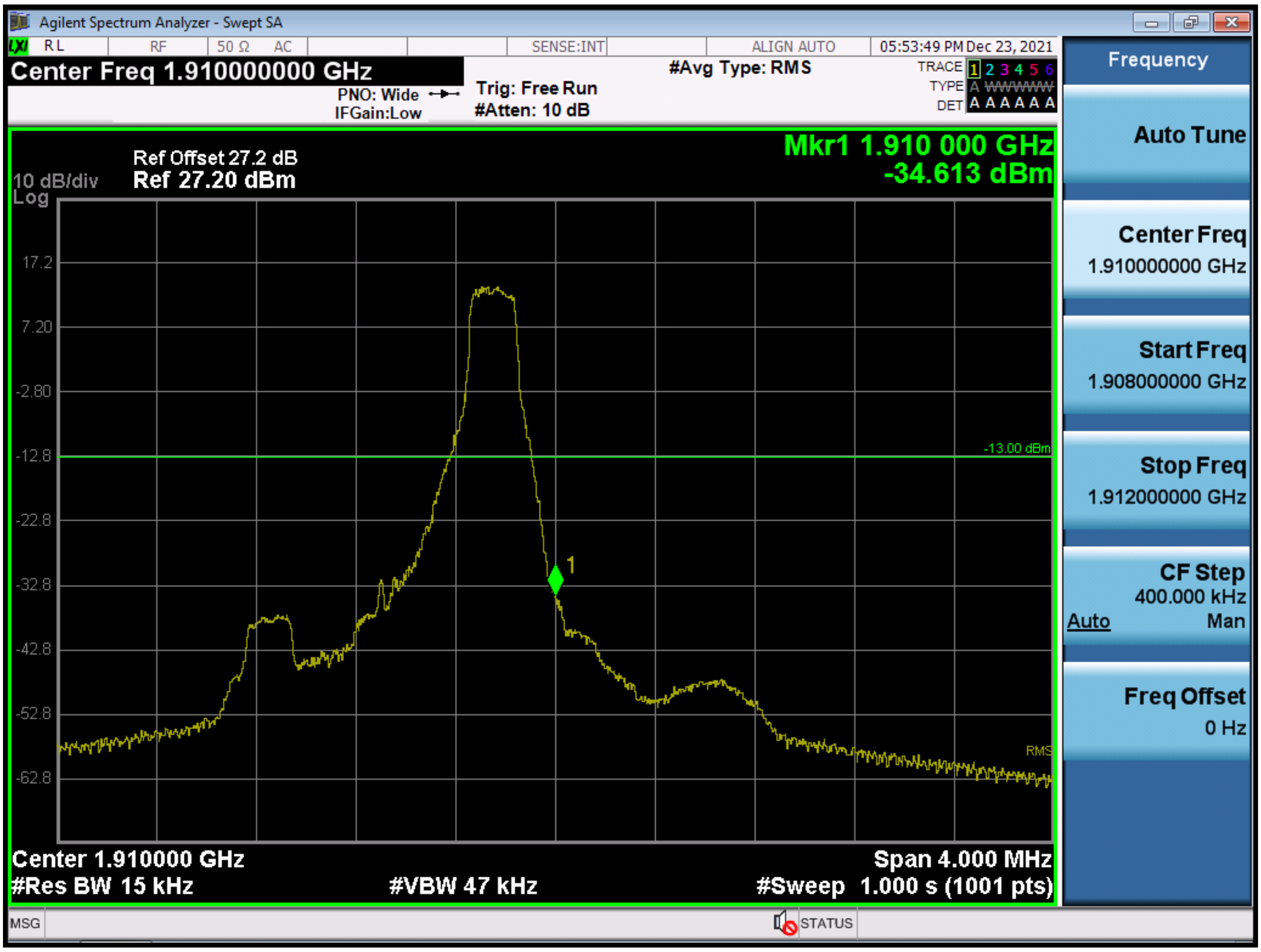
BW1.4 M_BandEdge_Highest Channel_QPSK_FullRB(2)



BW1.4 M_BandEdge_Lowest Channel_QPSK_1RB

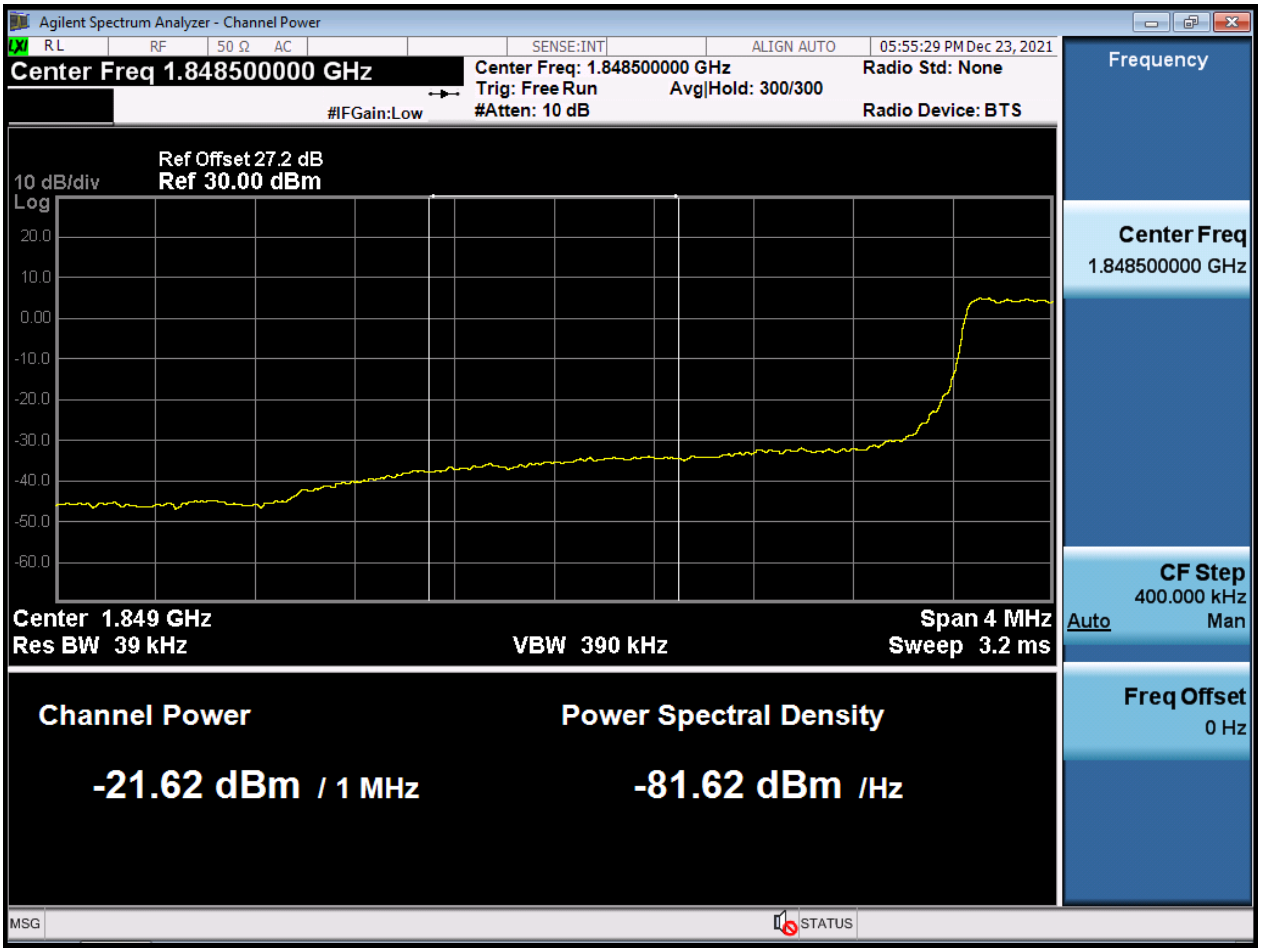


BW1.4 M_BandEdge_Highest Channel_QPSK_1RB



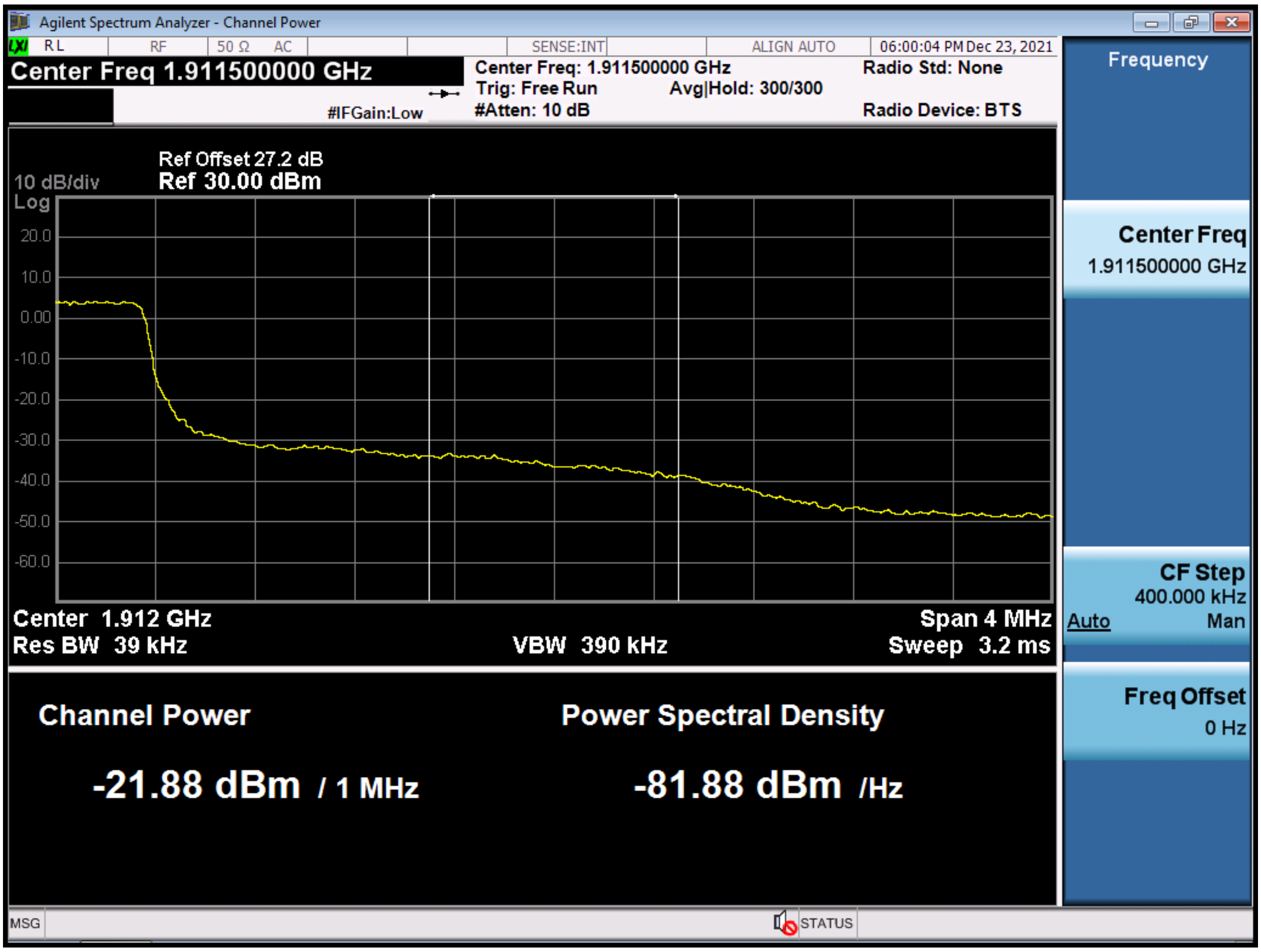
BW3 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

BW3 M_BandEdge_Lowest Channel_QPSK_FullRB(2)

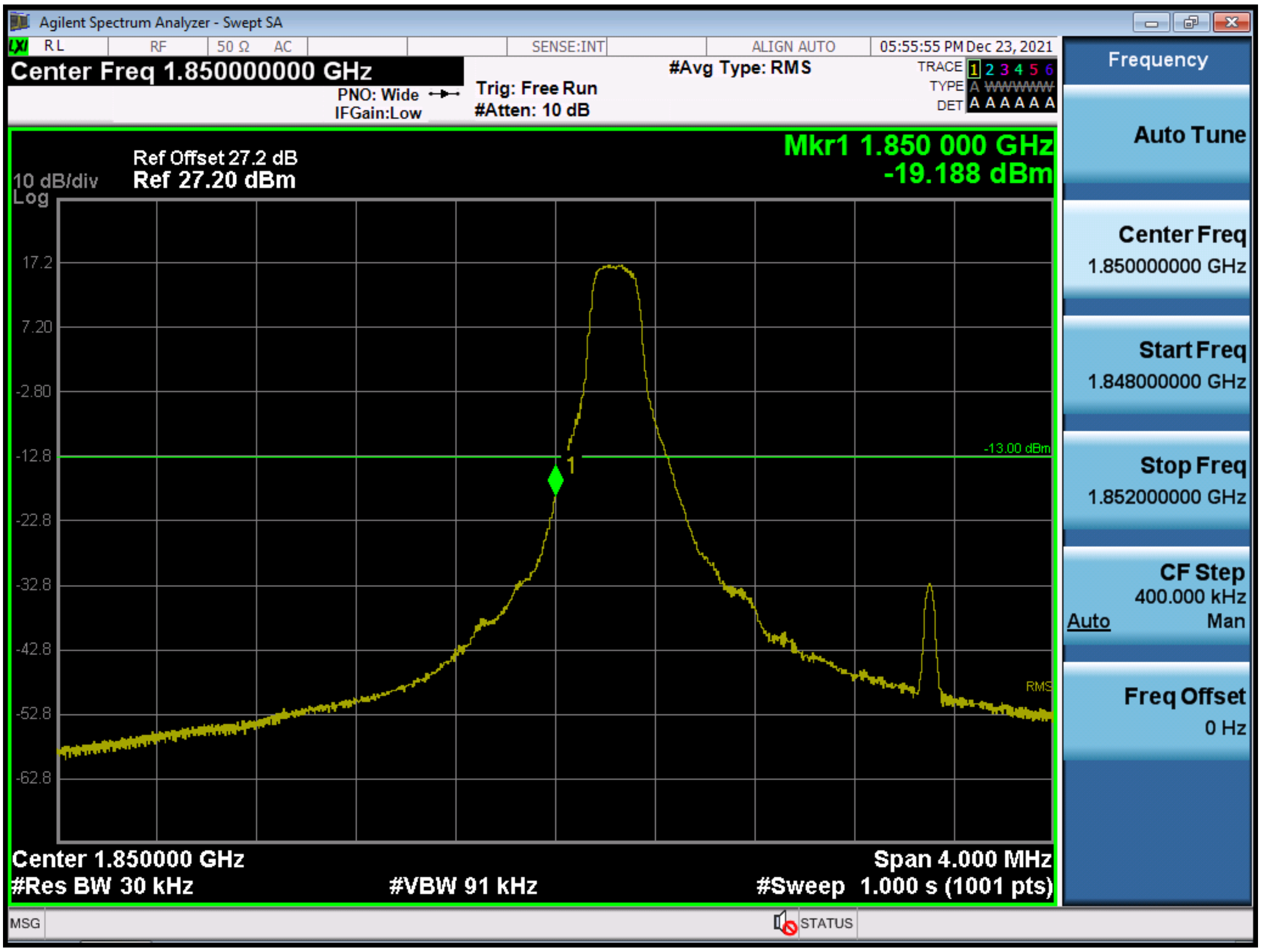


BW3 M_BandEdge_Highest Channel_QPSK_FullRB(1)

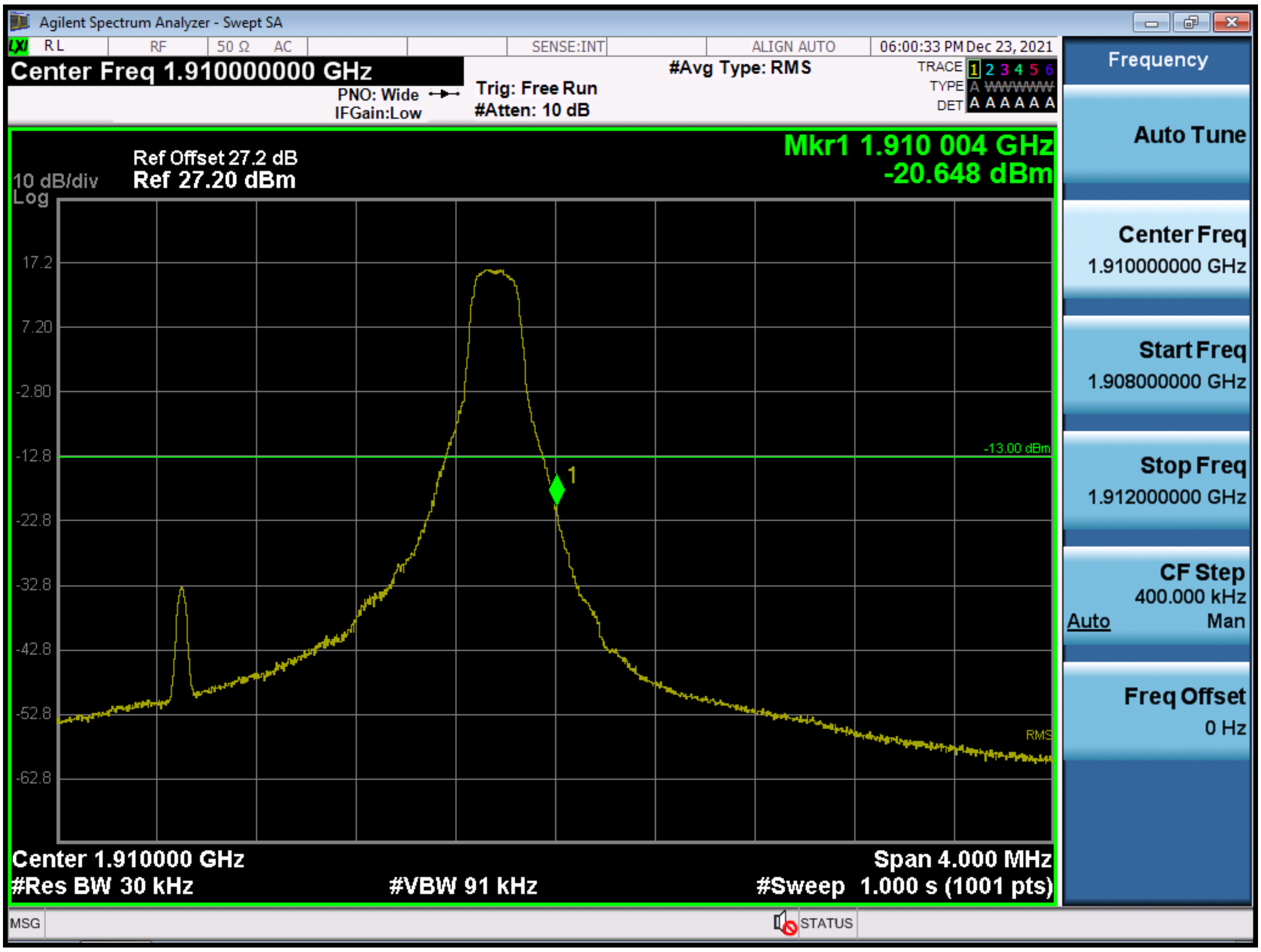
BW3 M_BandEdge_Highest Channel_QPSK_FullRB(2)



BW3 M_BandEdge_Lowest Channel_QPSK_1RB

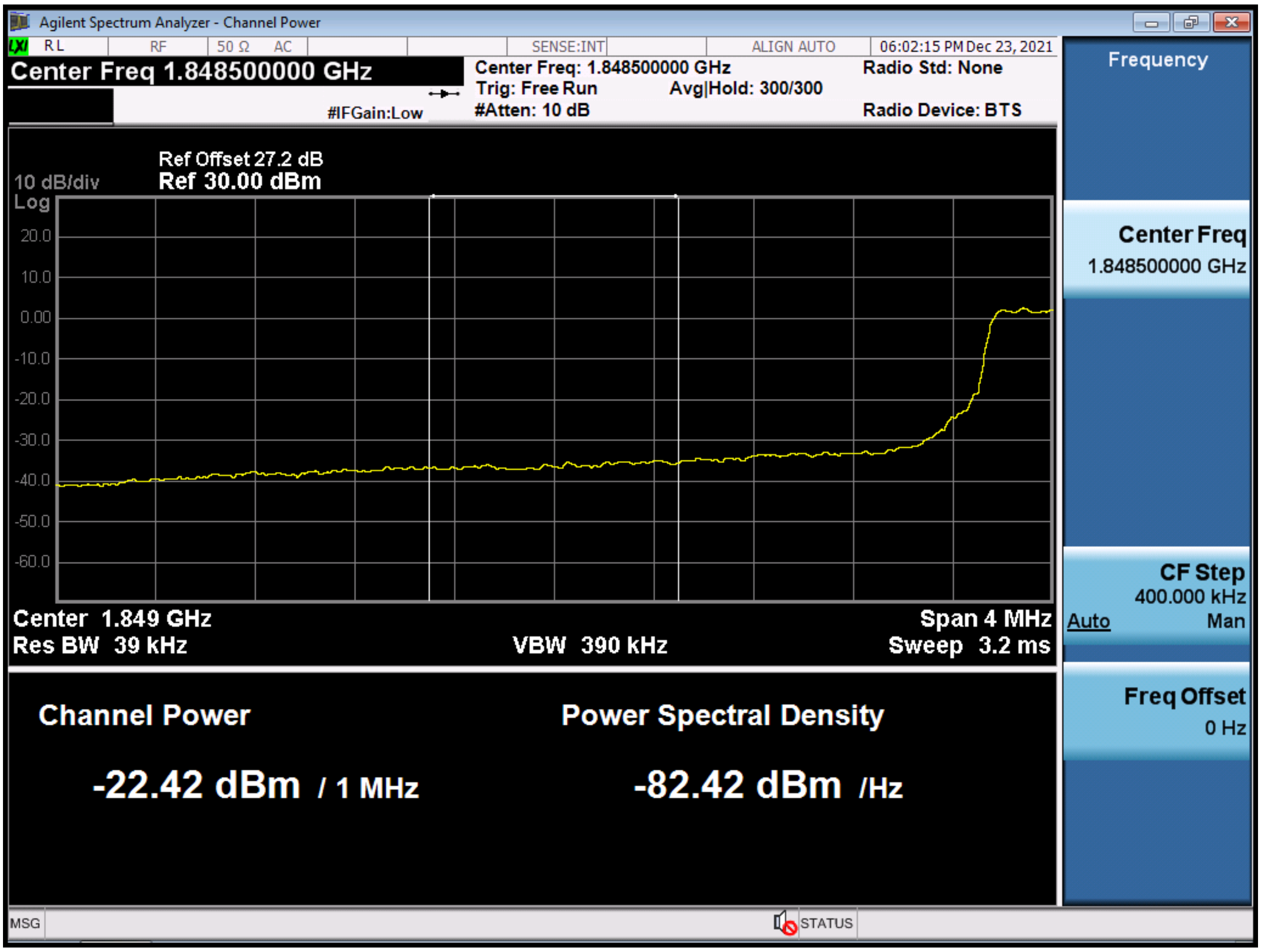


BW3 M_BandEdge_Highest Channel_QPSK_1RB



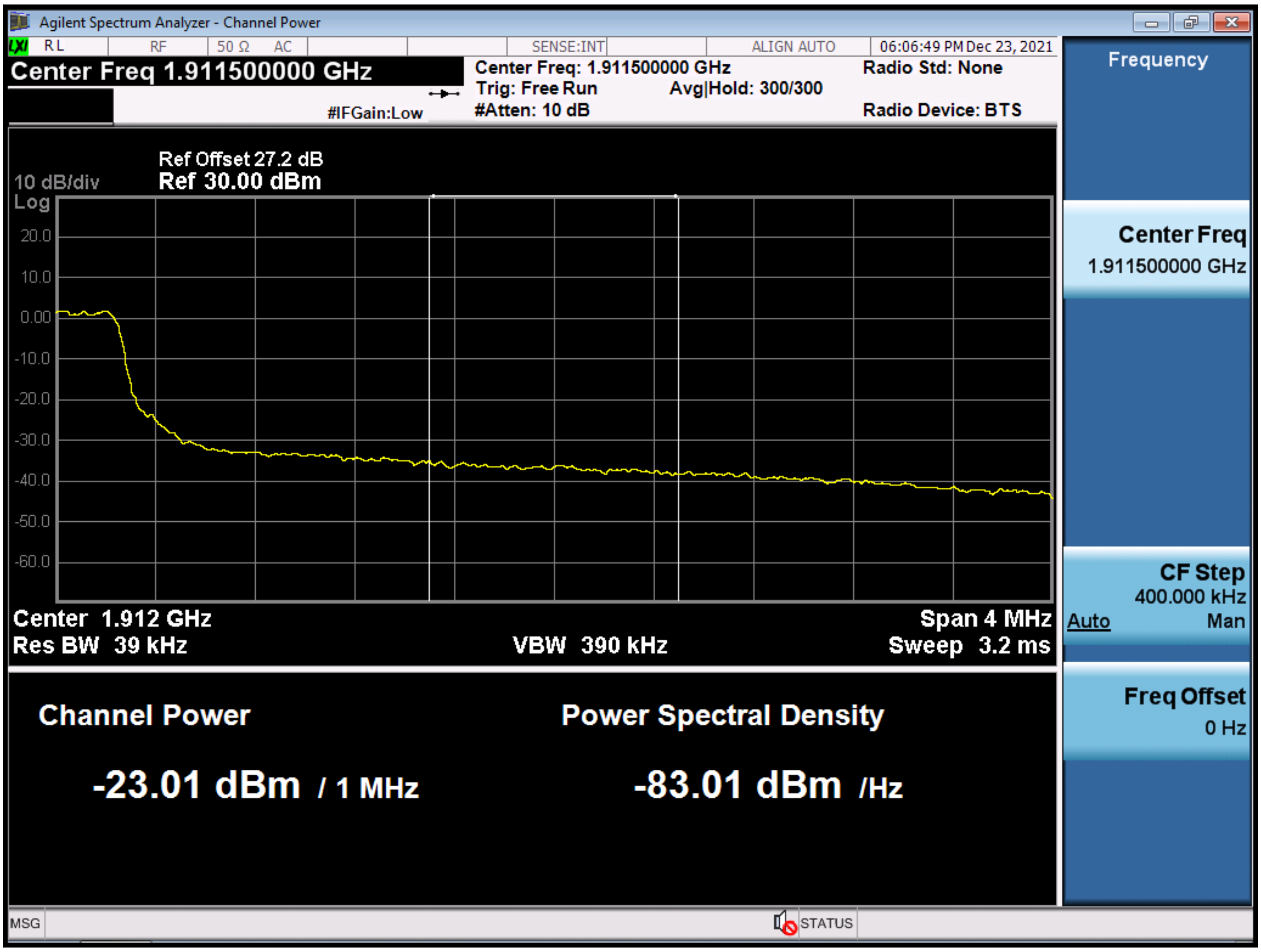
BW5 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

BW5 M_BandEdge_Lowest Channel_QPSK_FullRB(2)

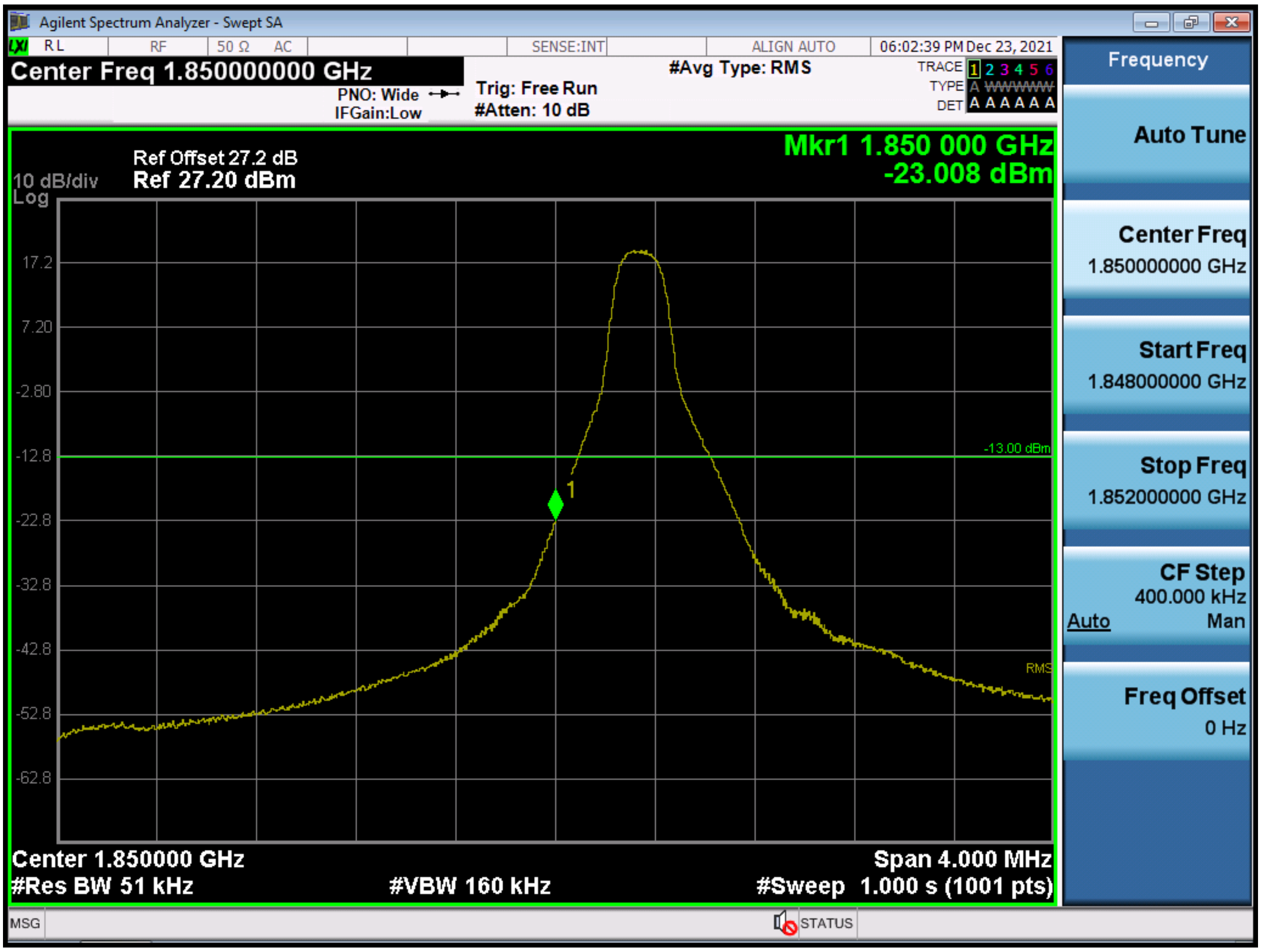


BW5 M_BandEdge_Highest Channel_QPSK_FullRB(1)

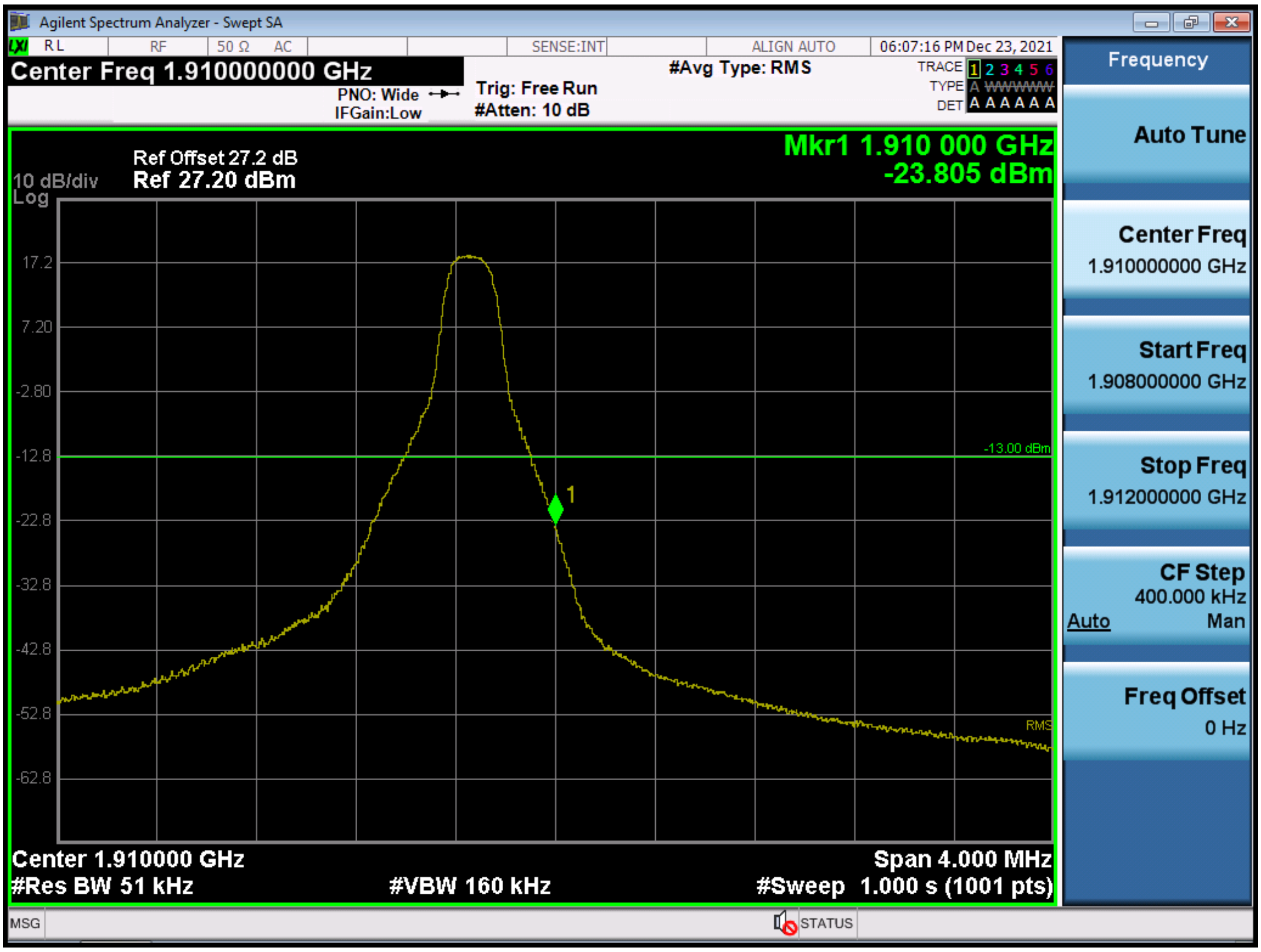
BW5 M_BandEdge_Highest Channel_QPSK_FullRB(2)



BW5 M_BandEdge_Lowest Channel_QPSK_1RB

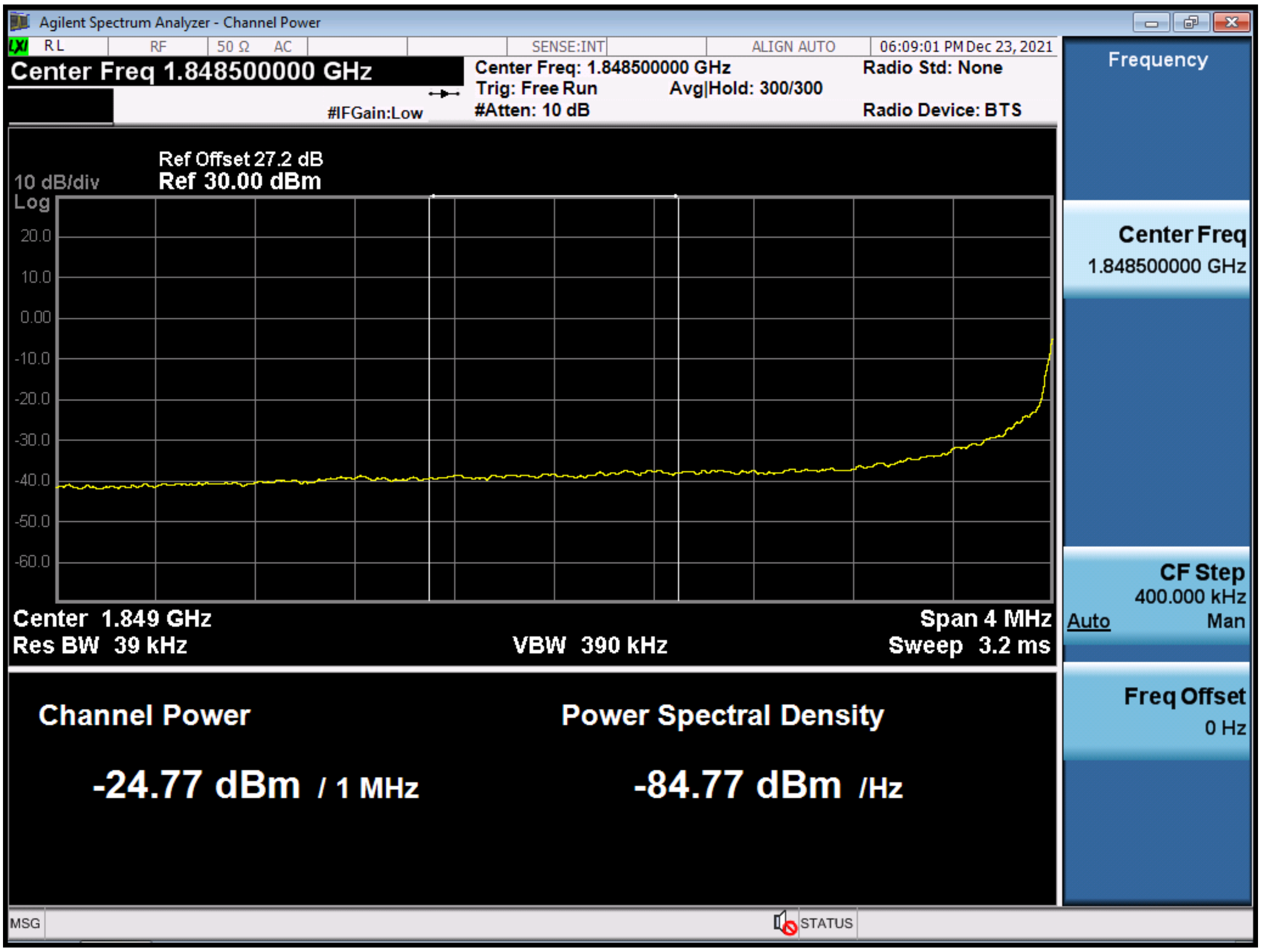


BW5 M_BandEdge_Highest Channel_QPSK_1RB



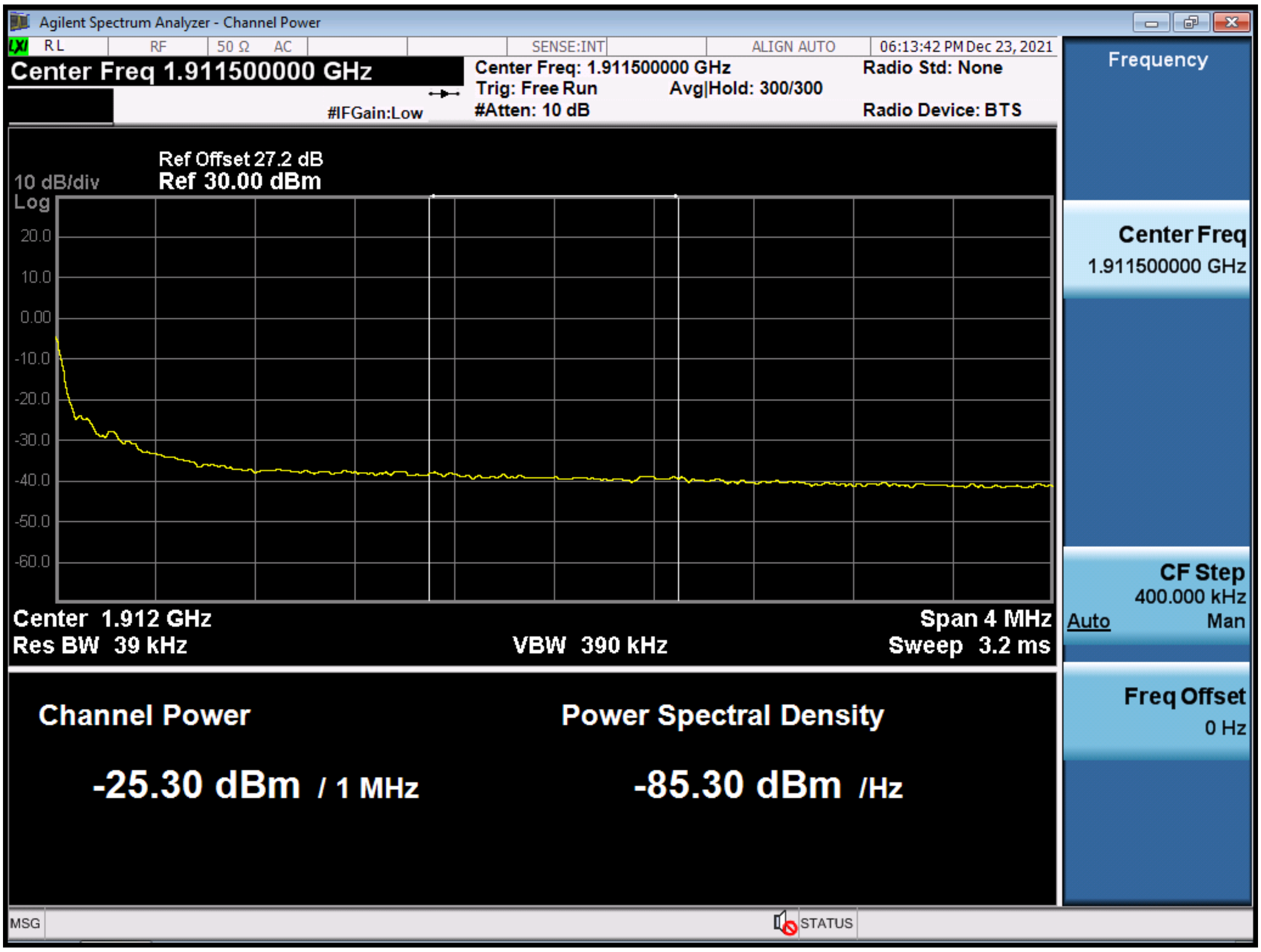
BW10 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

BW10 M_BandEdge_Lowest Channel_QPSK_FullRB(2)

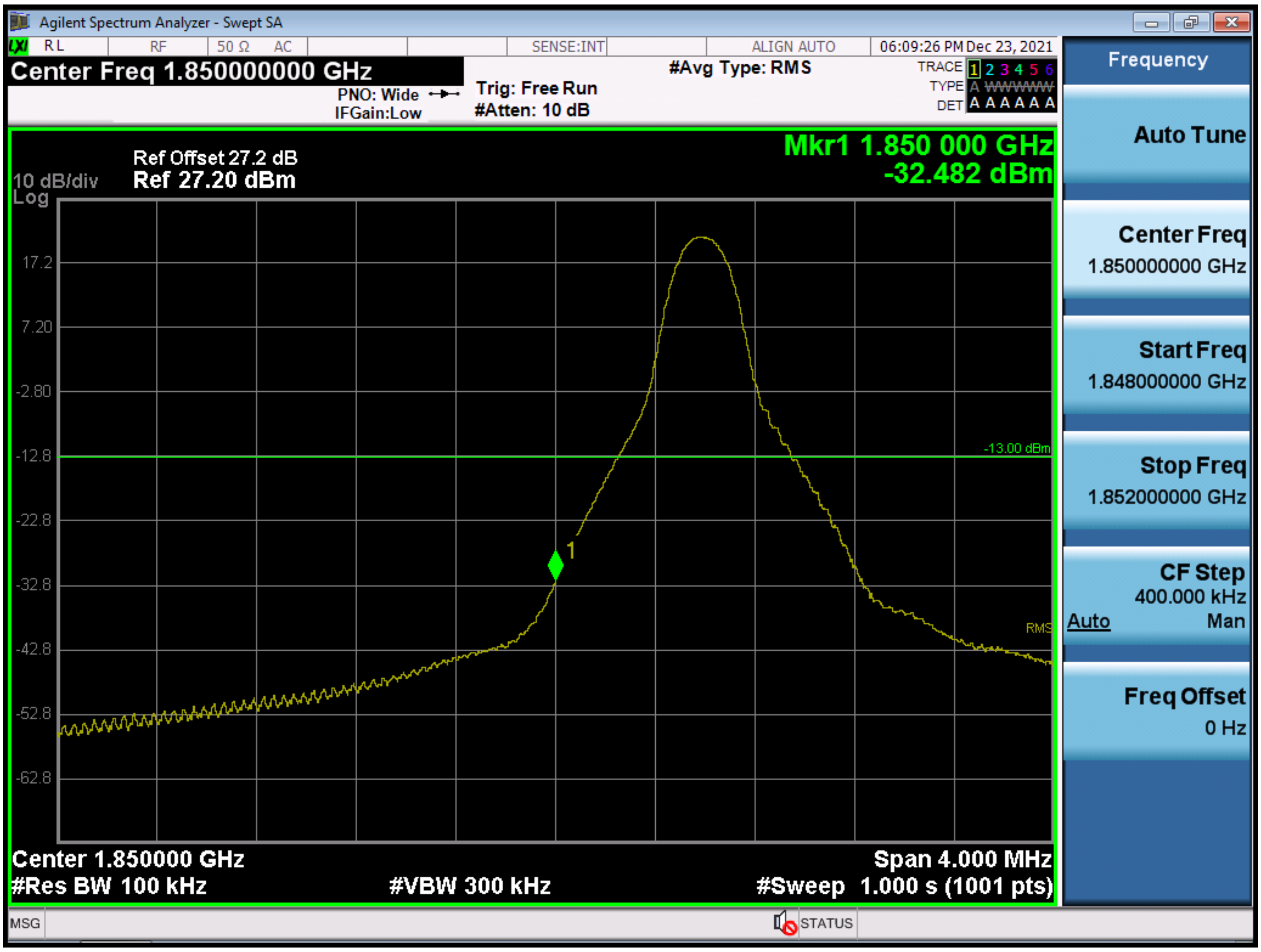


BW10 M_BandEdge_Highest Channel_QPSK_FullRB(1)

BW10 M_BandEdge_Highest Channel_QPSK_FullRB(2)



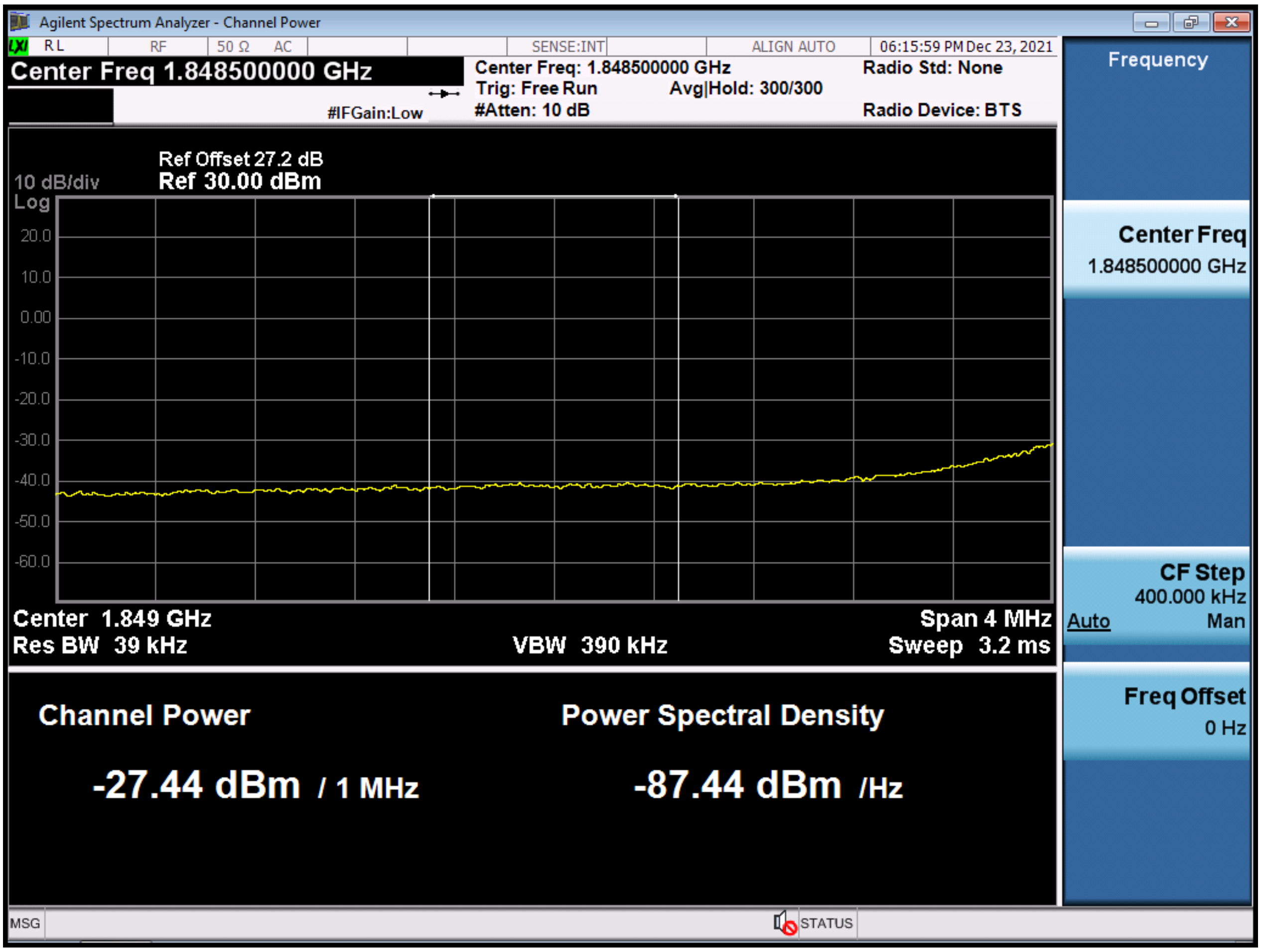
BW10 M_BandEdge_Lowest Channel_QPSK_1RB



BW10 M_BandEdge_Highest Channel_QPSK_1RB

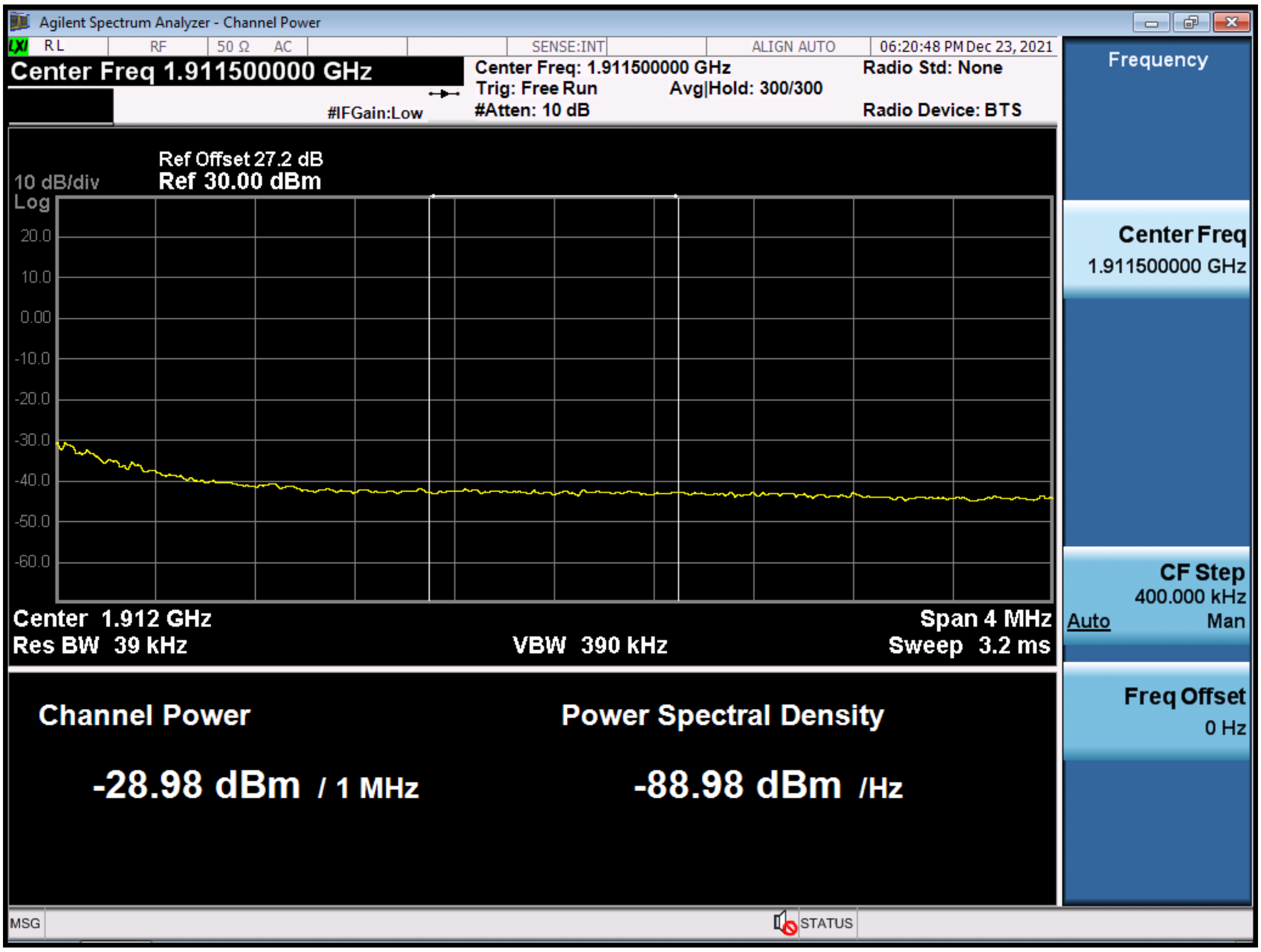
BW15 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

BW15 M_BandEdge_Lowest Channel_QPSK_FullRB(2)

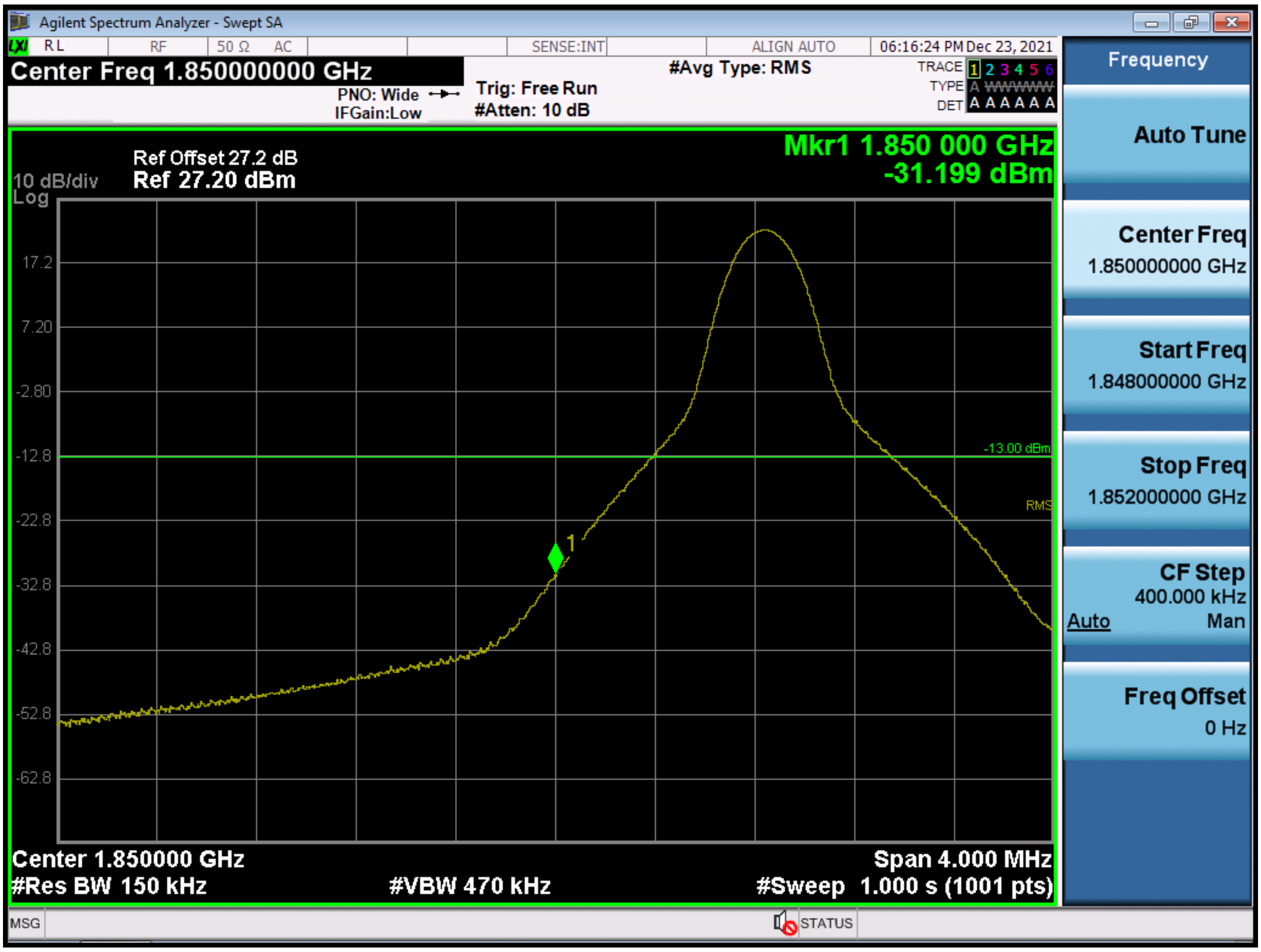


BW15 M_BandEdge_Highest Channel_QPSK_FullRB(1)

BW15 M_BandEdge_Highest Channel_QPSK_FullRB(2)



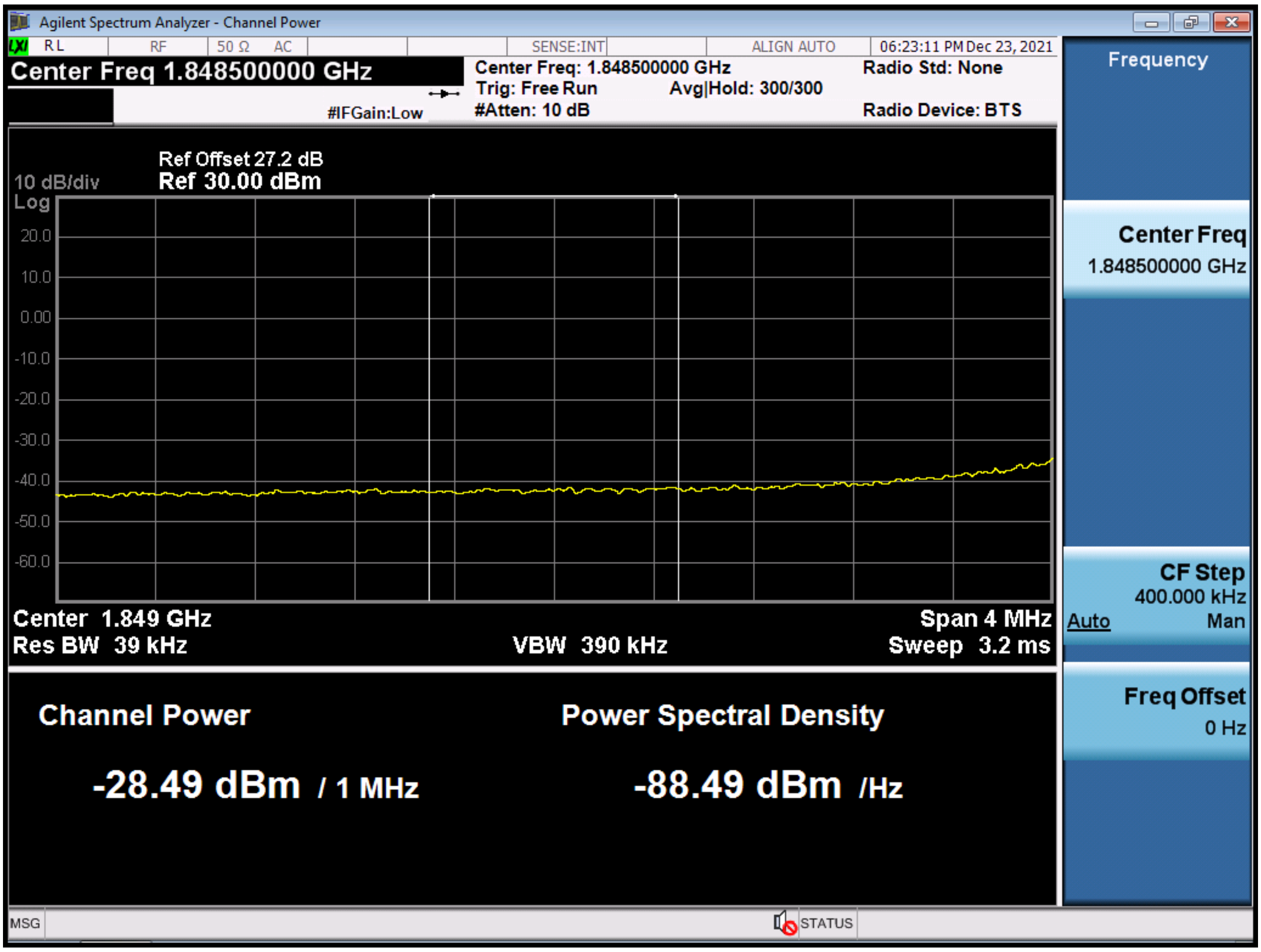
BW15 M_BandEdge_Lowest Channel_QPSK_1RB



BW15 M_BandEdge_Highest Channel_QPSK_1RB

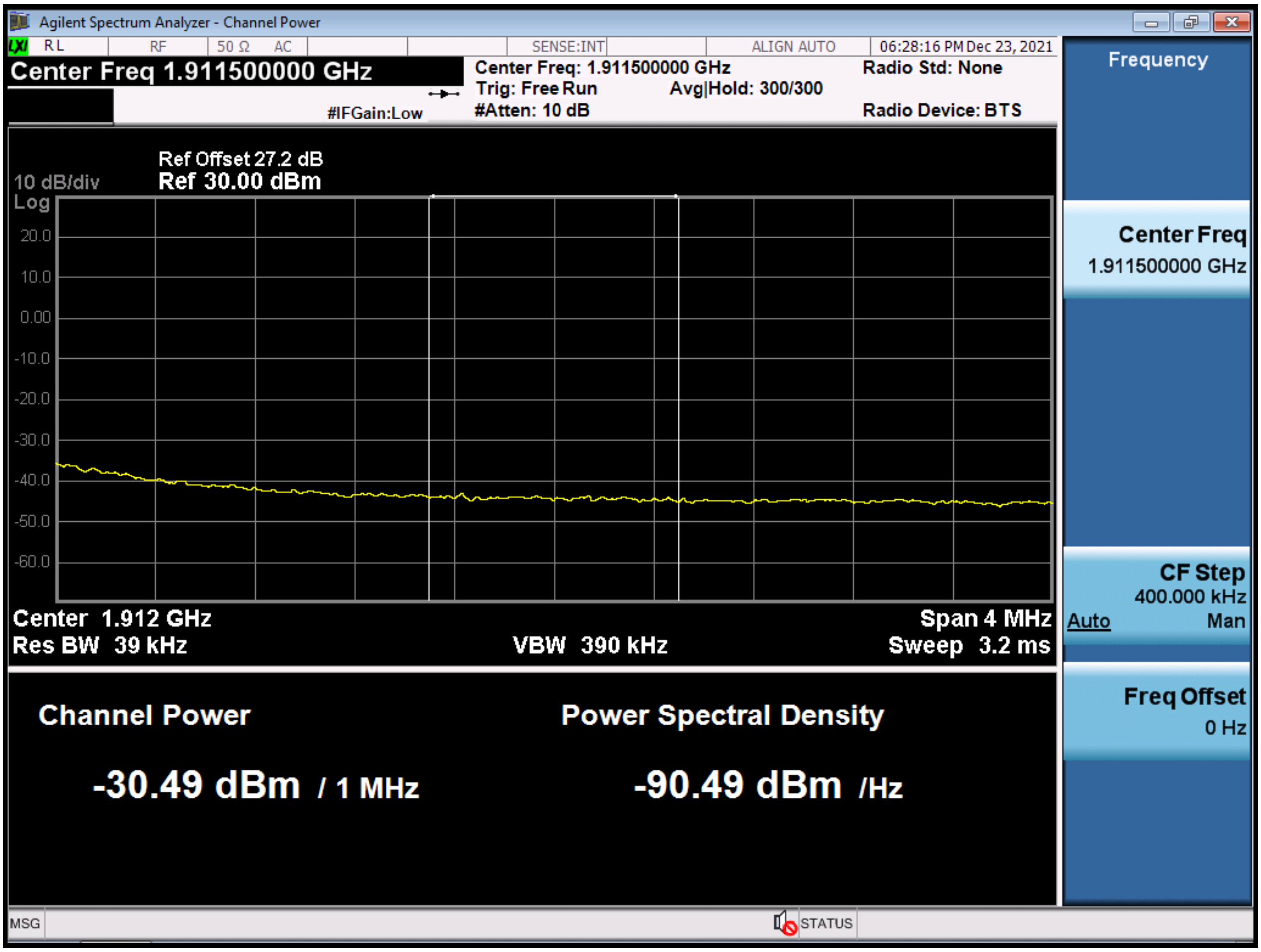
BW20 M_BandEdge_Lowest Channel_QPSK_FullRB(1)

BW20 M_BandEdge_Lowest Channel_QPSK_FullRB(2)



BW20 M_BandEdge_Highest Channel_QPSK_FullRB(1)

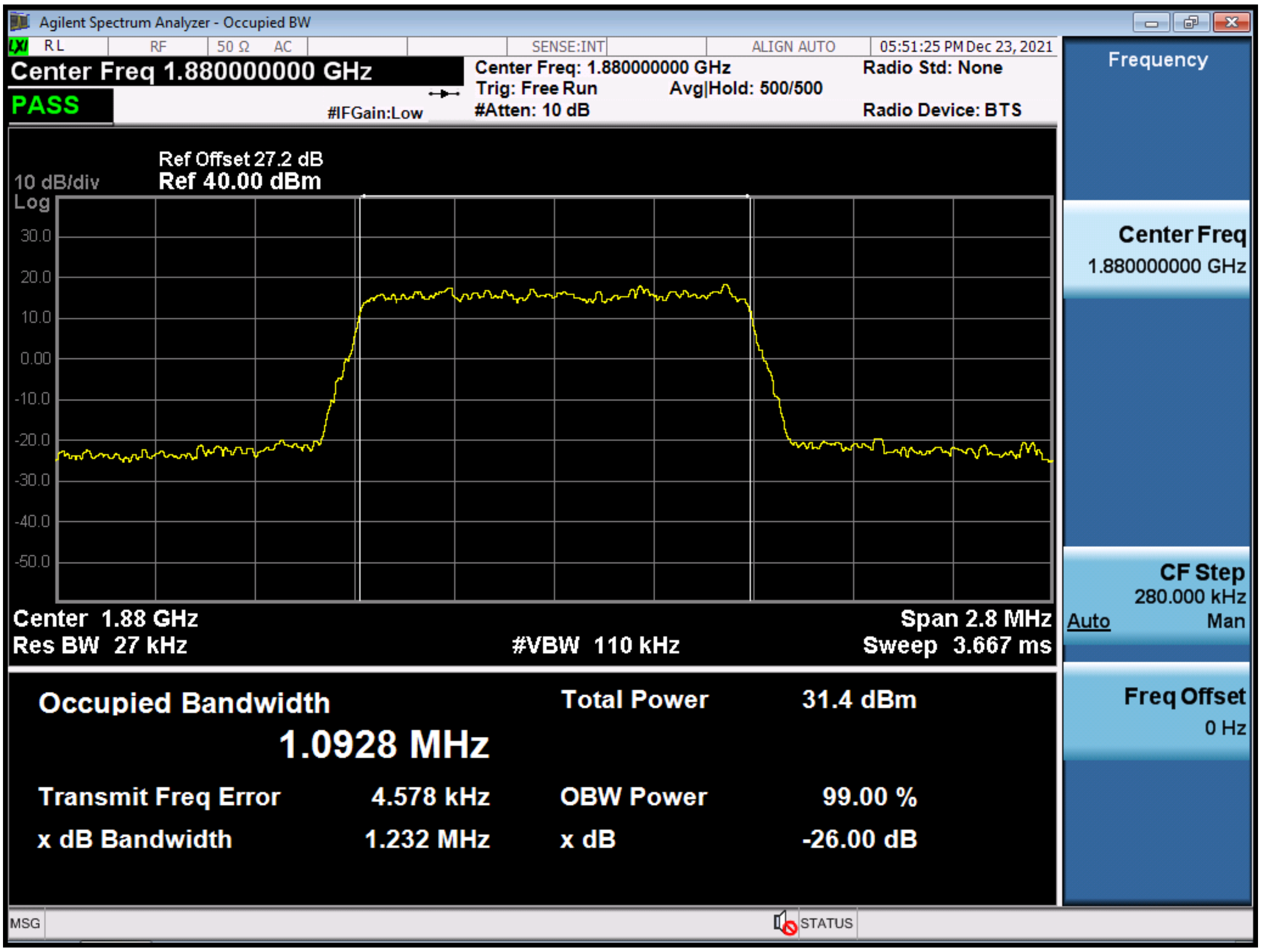
BW20 M_BandEdge_Highest Channel_QPSK_FullRB(2)



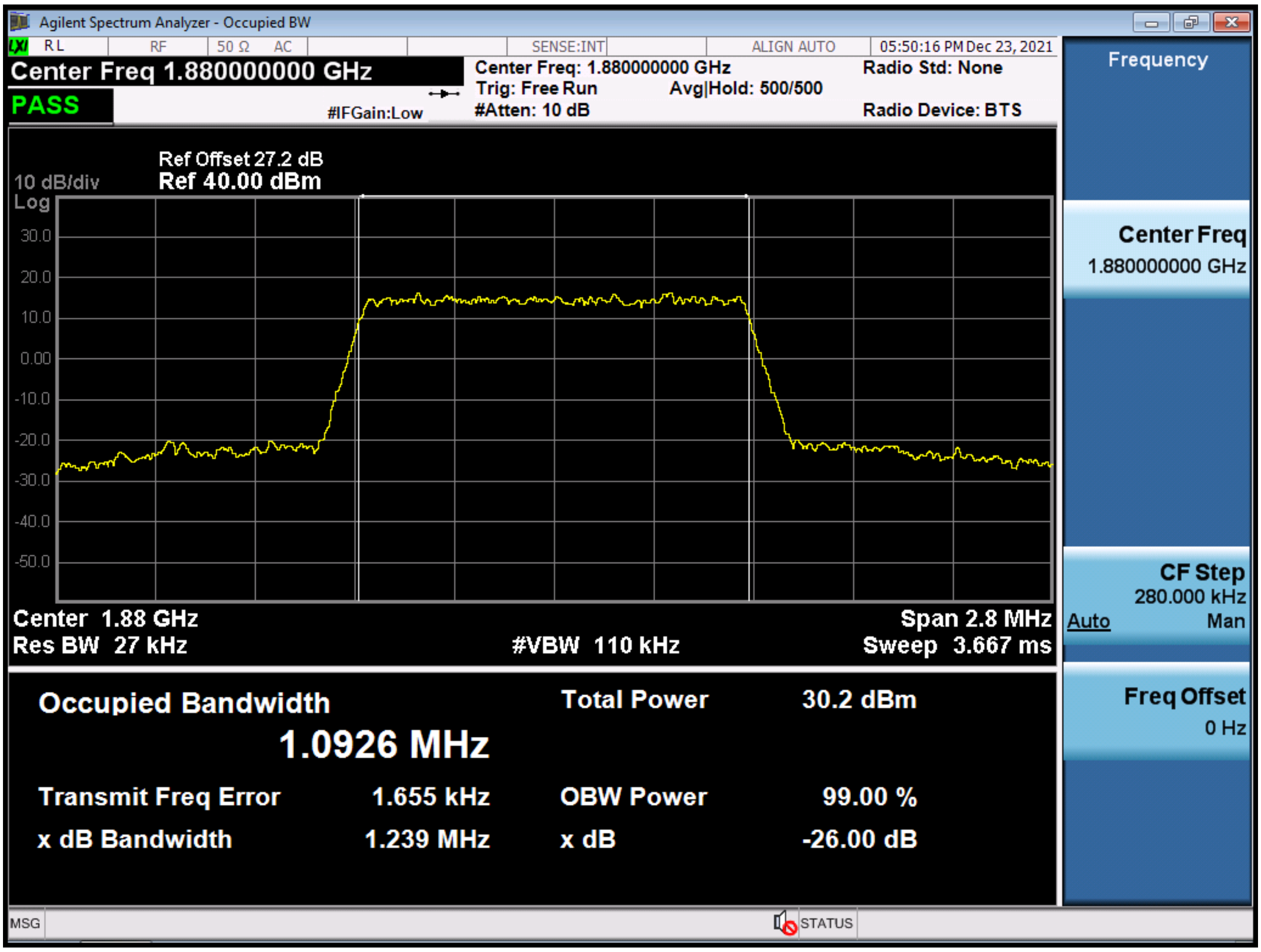
BW20 M_BandEdge_Lowest Channel_QPSK_1RB

BW20 M_BandEdge_Highest Channel_QPSK_1RB

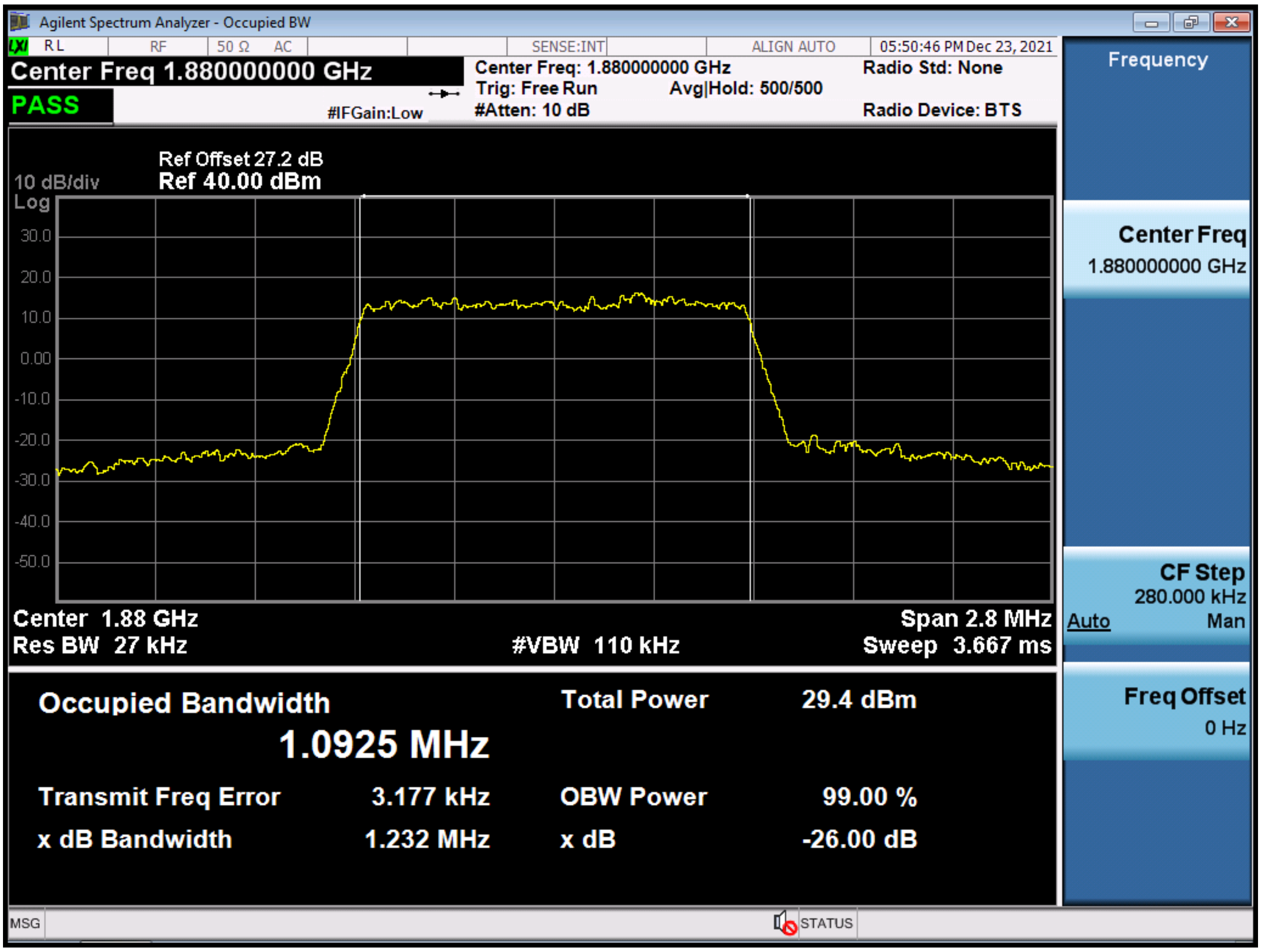
BW1.4 M_OBW_Middle Channel_QPSK_FullRB



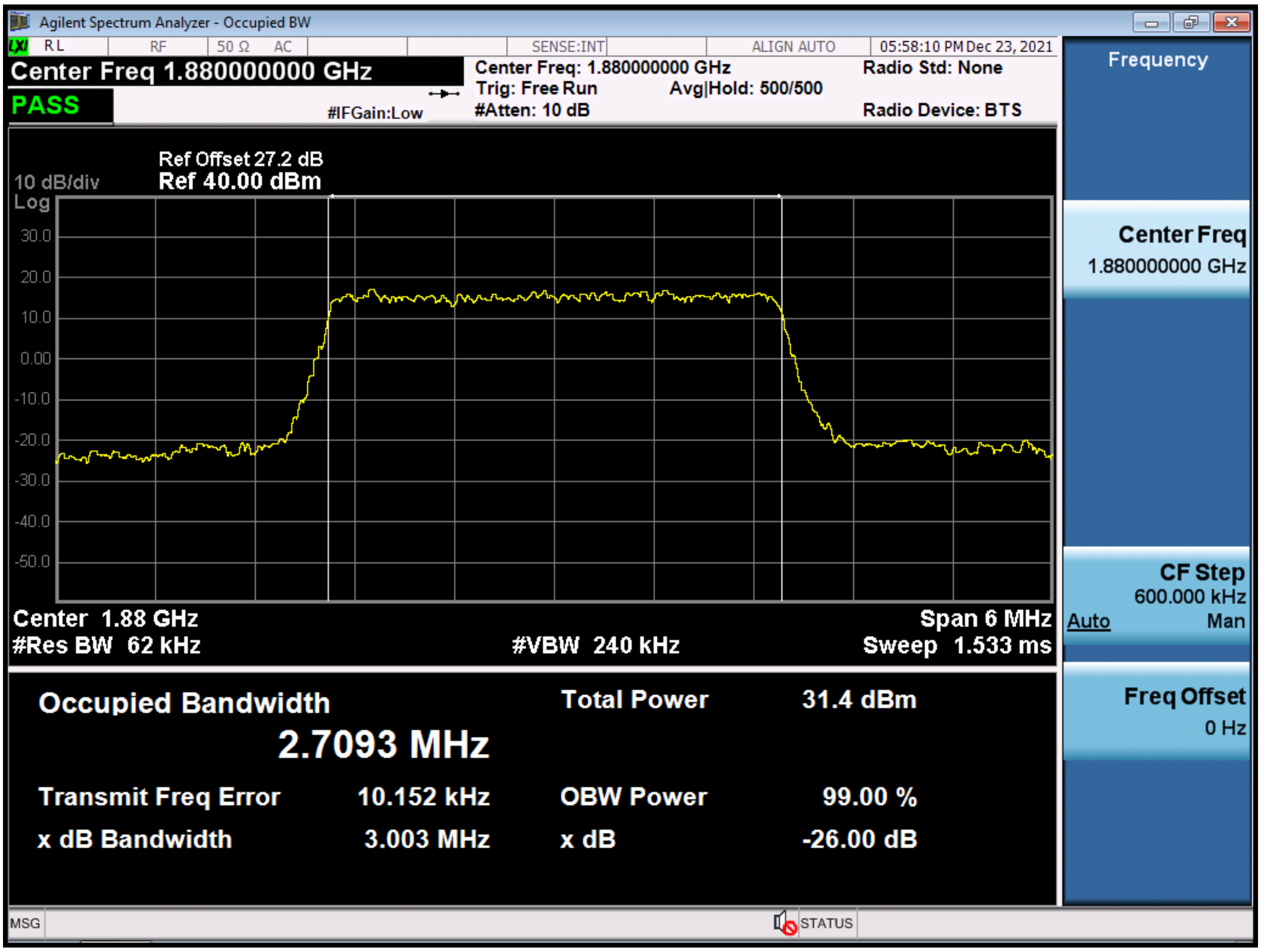
BW1.4 M_OBW_Middle Channel_16QAM_FullRB



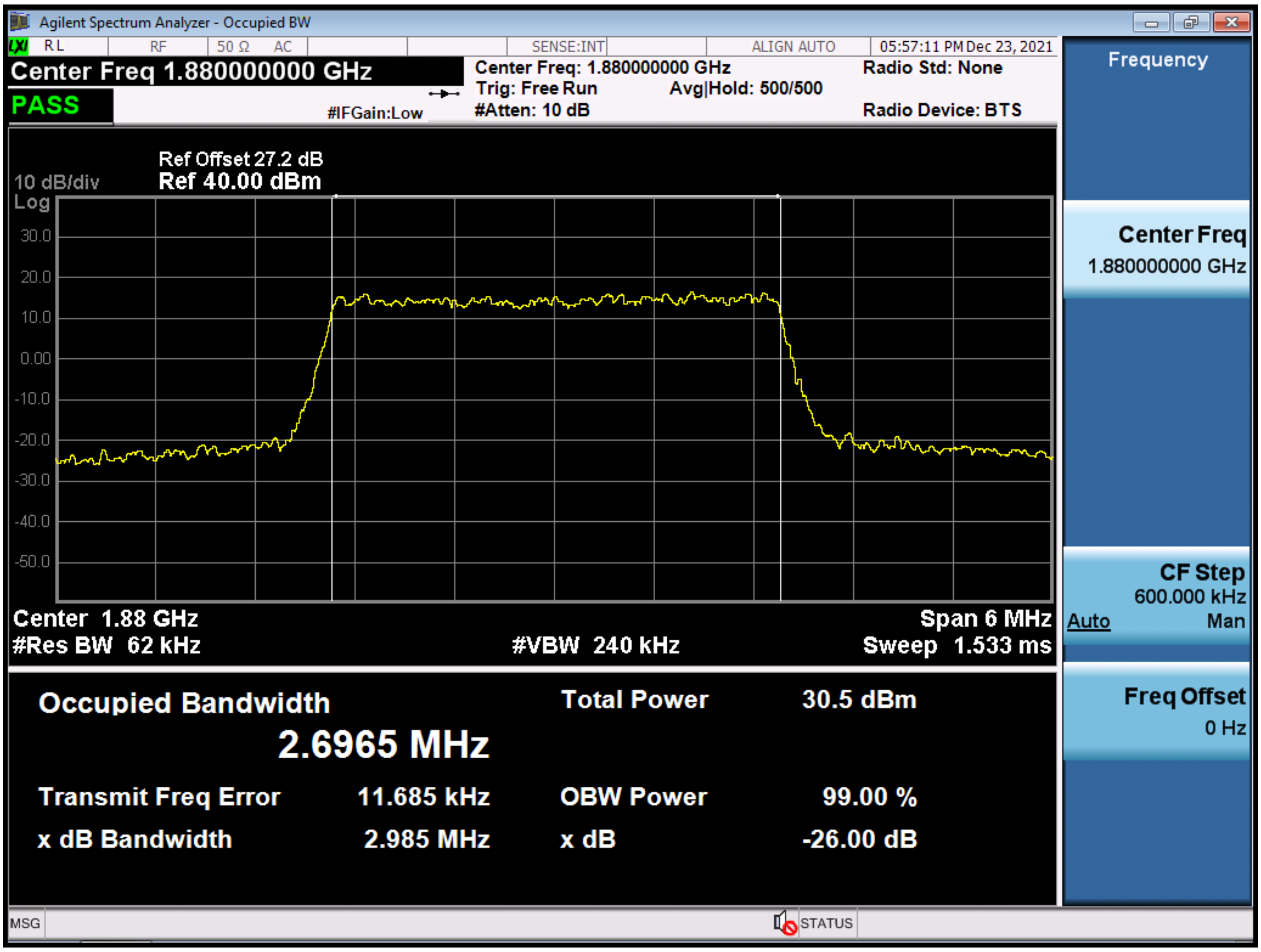
BW1.4 M_OBW_Middle Channel_64QAM_FullRB



BW3 M_OBW_Middle Channel_QPSK_FullRB



BW3 M_OBW_Middle Channel_16QAM_FullRB



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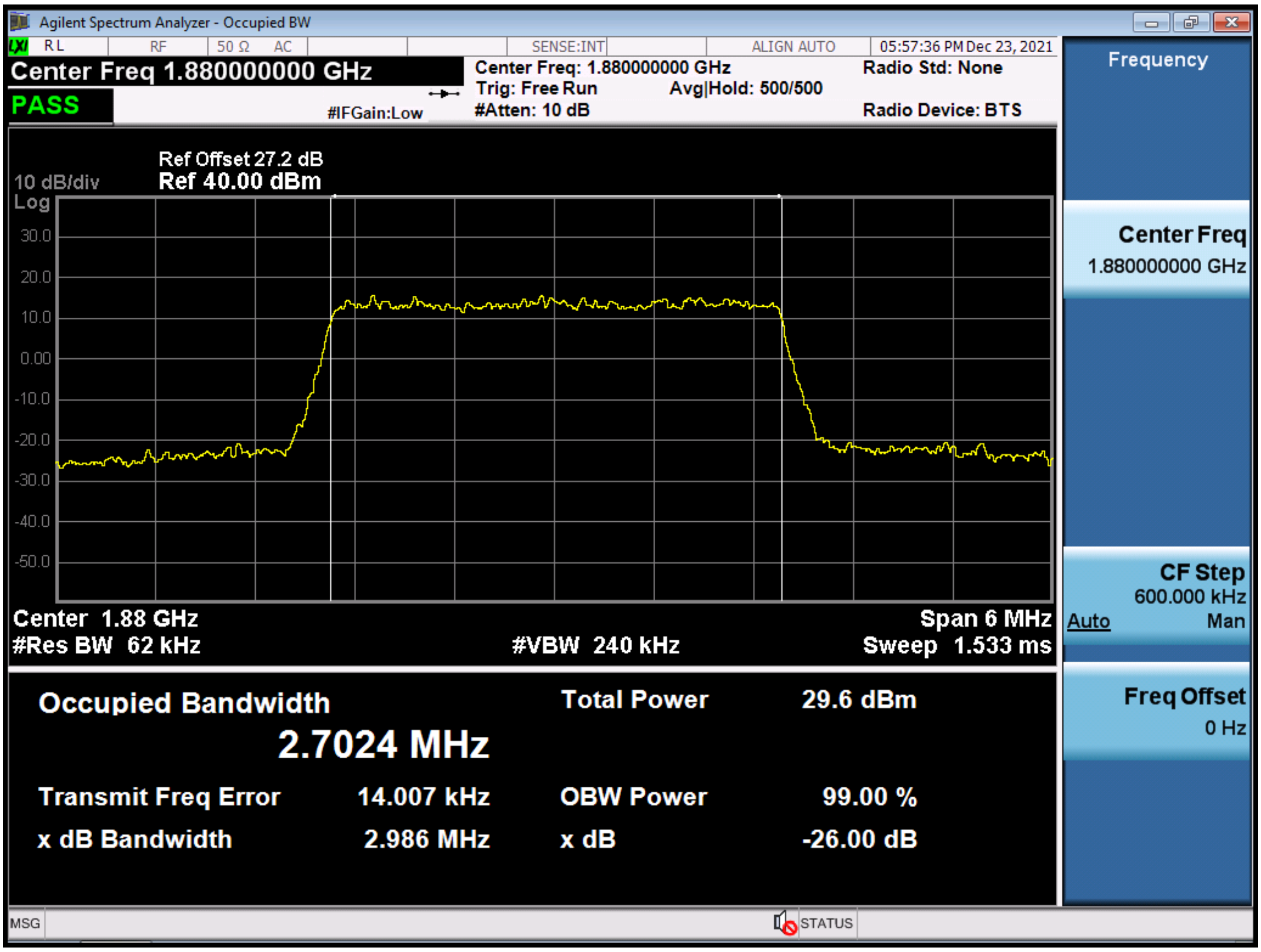
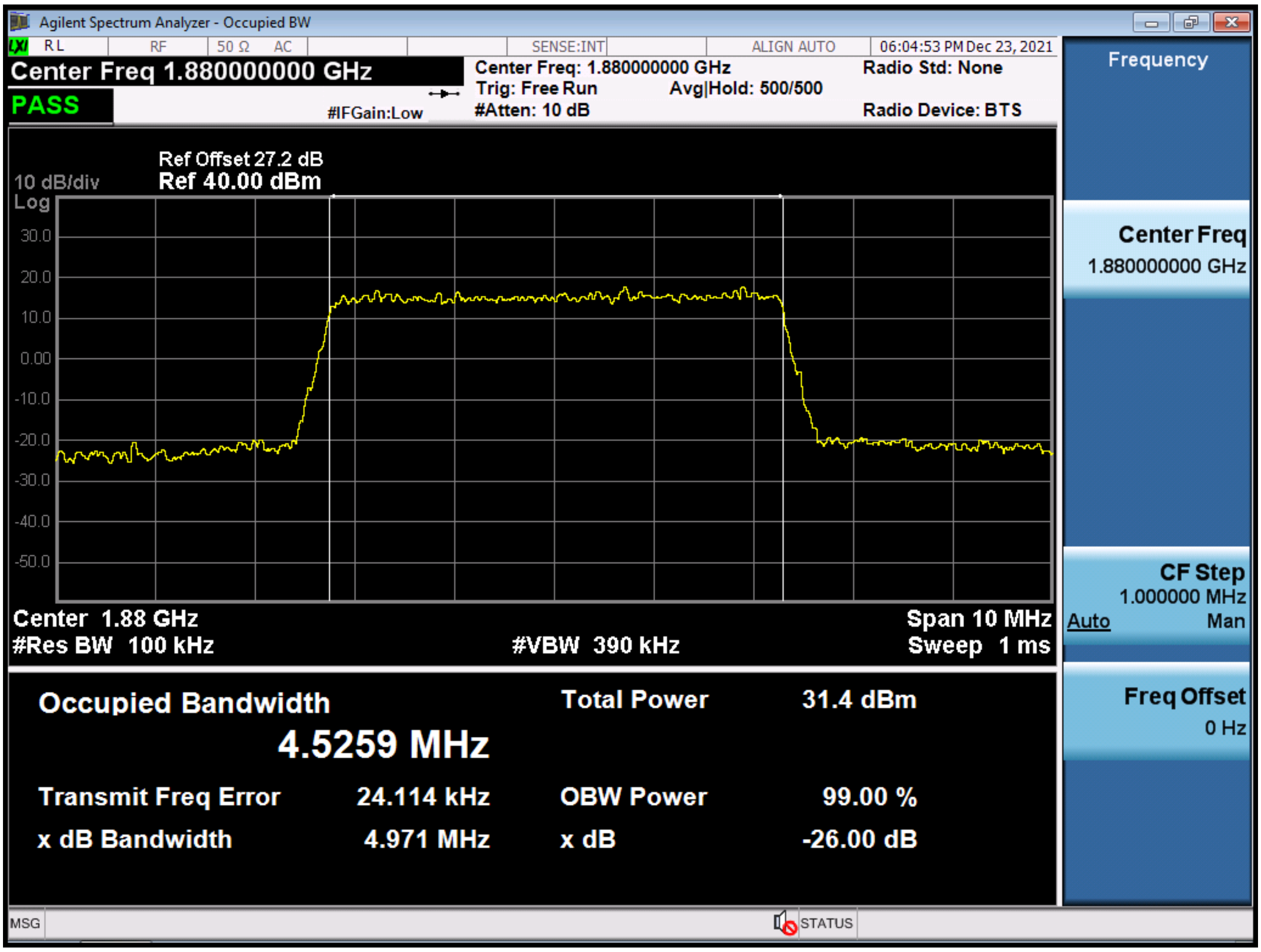
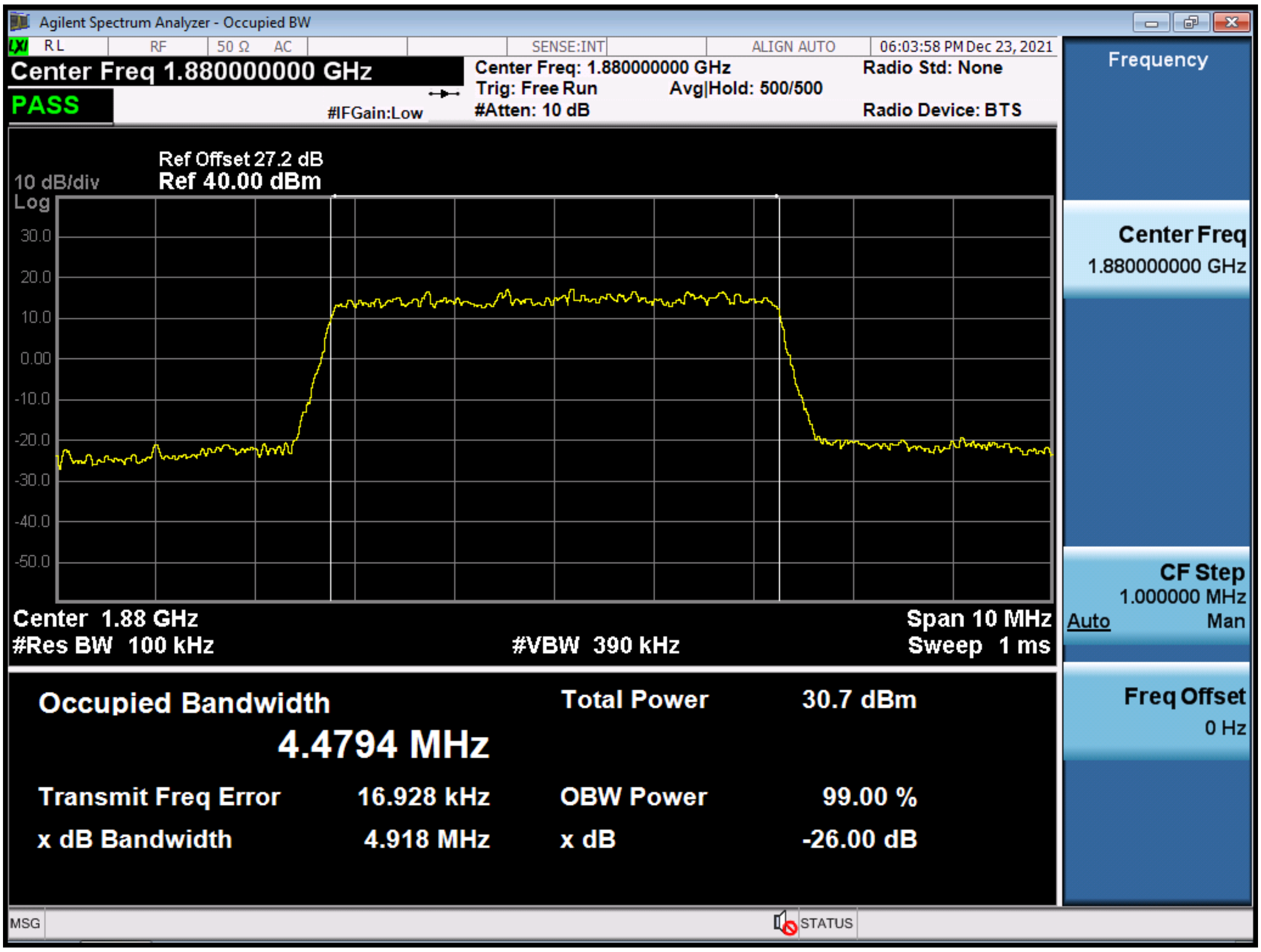


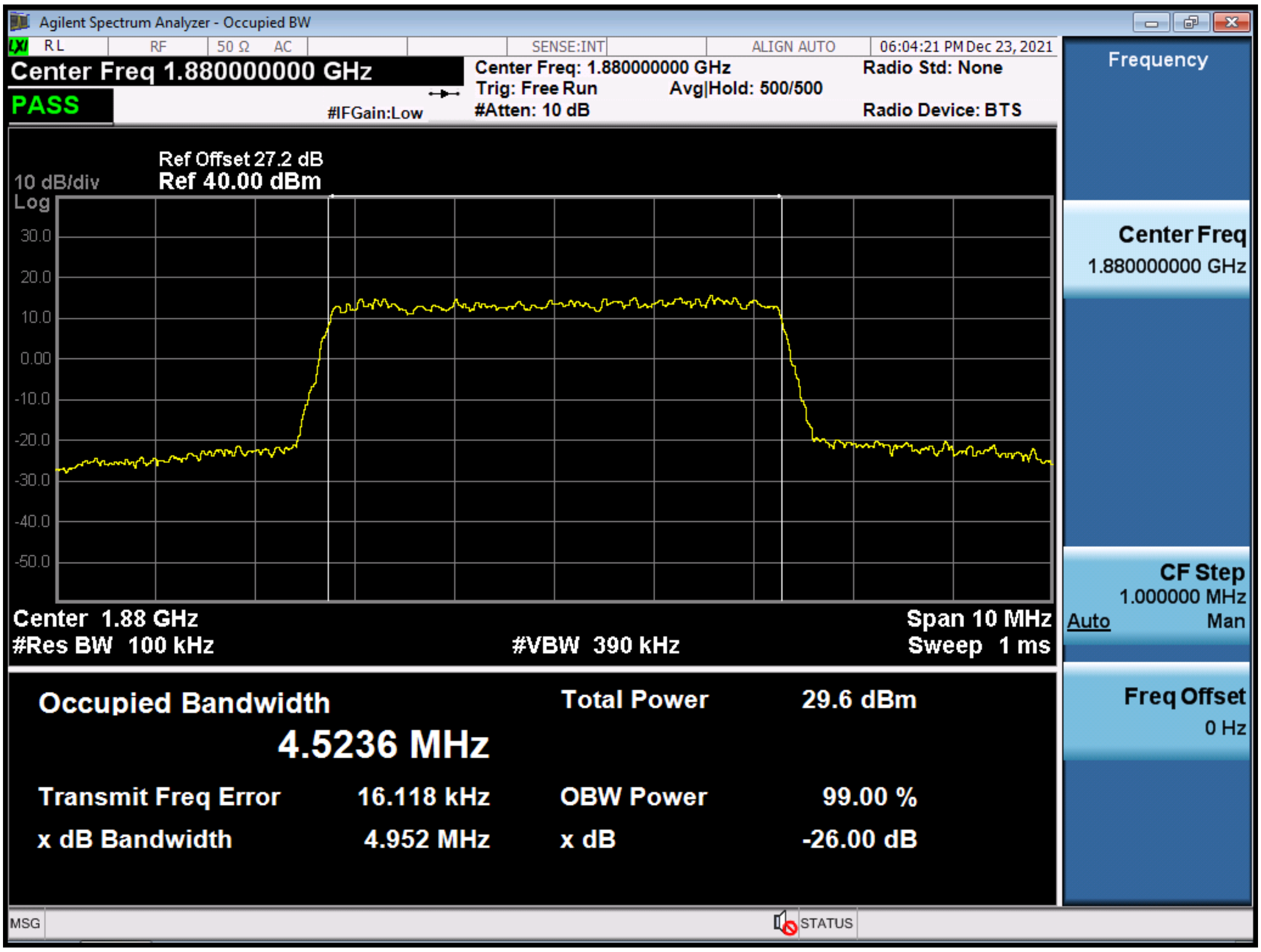
BW5 M_OBW_Middle Channel_QPSK_FullRB



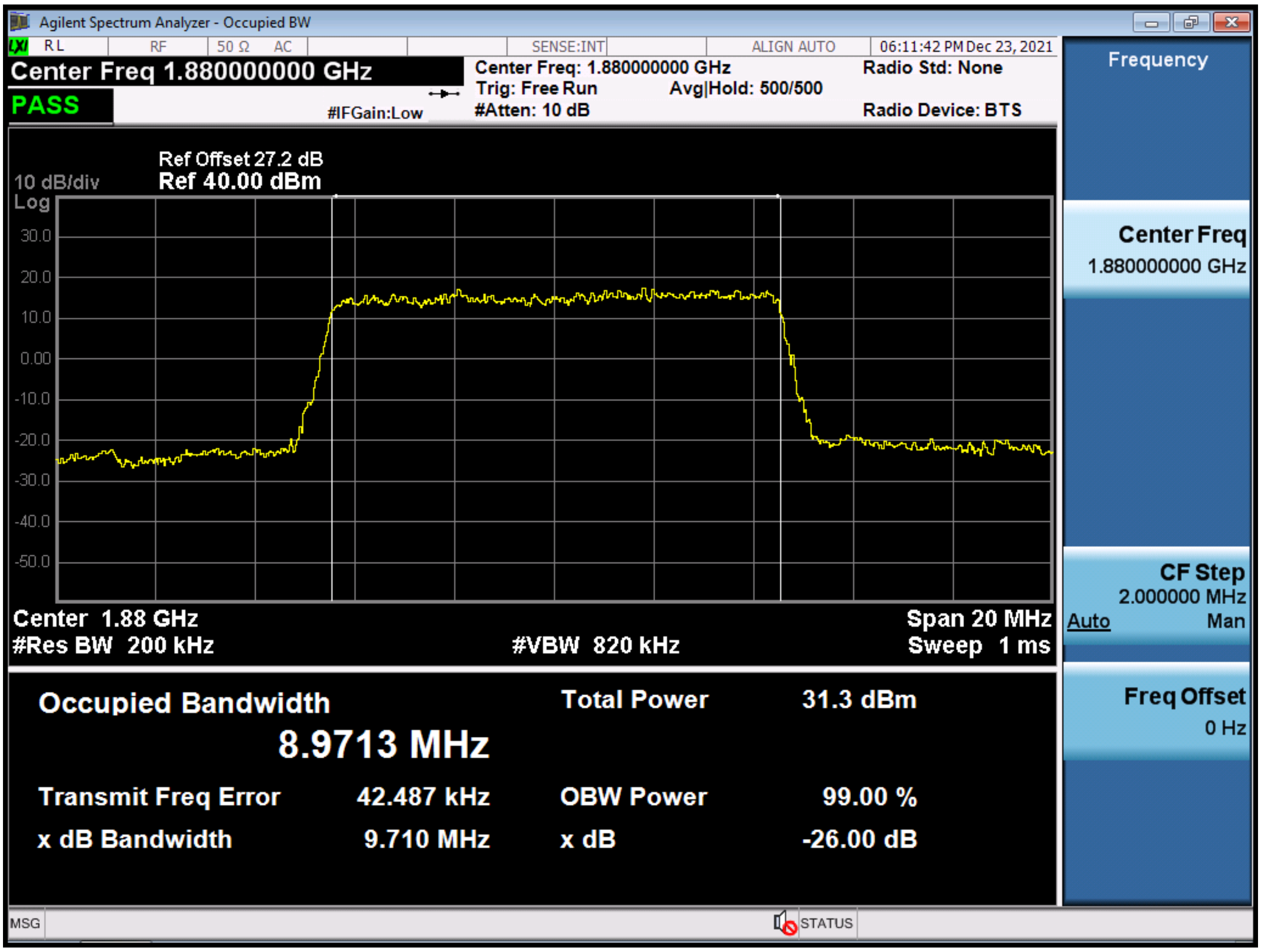
BW5 M_OBW_Middle Channel_16QAM_FullRB



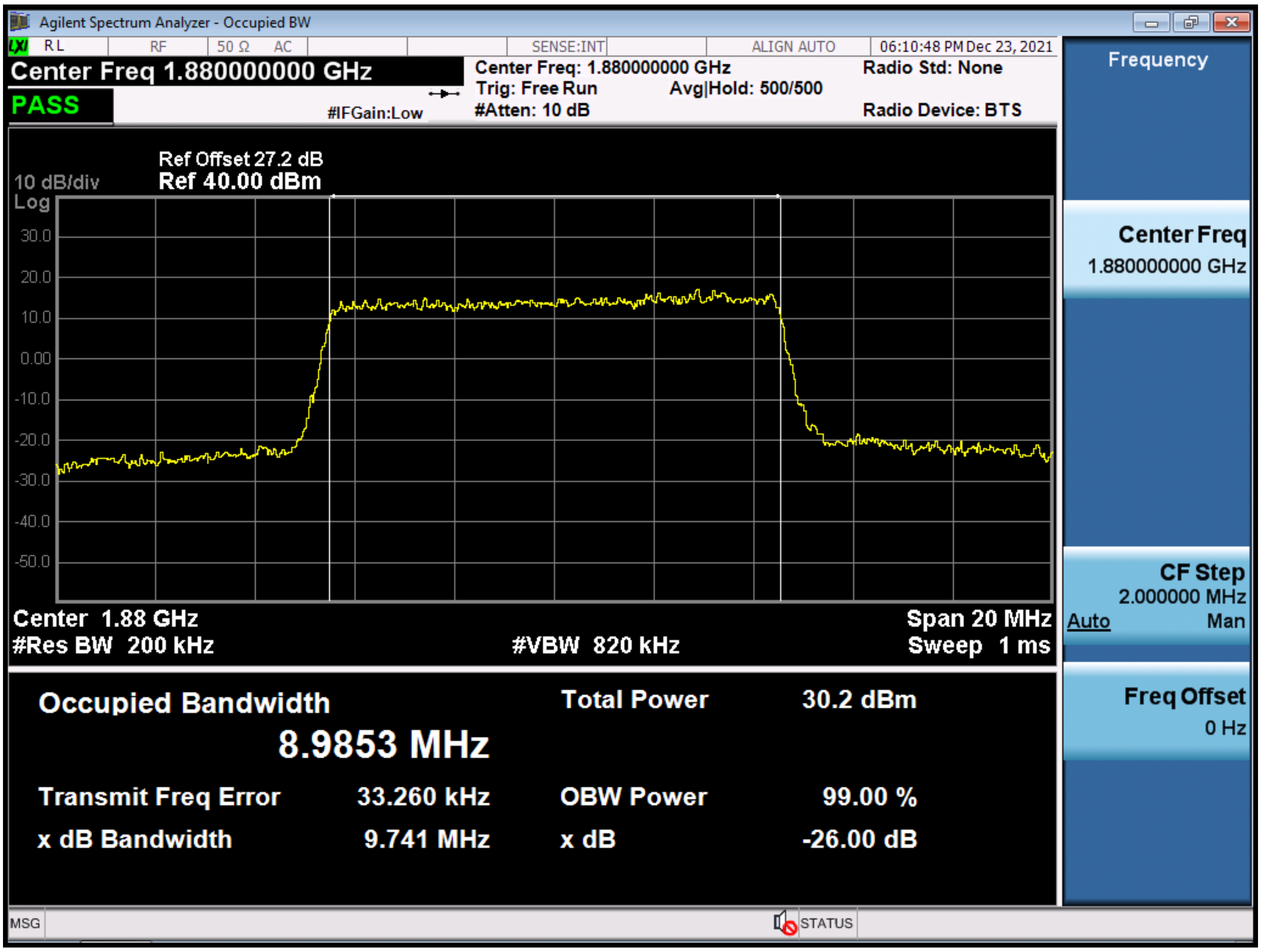
BW5 M_OBW_Middle Channel_64QAM_FullRB



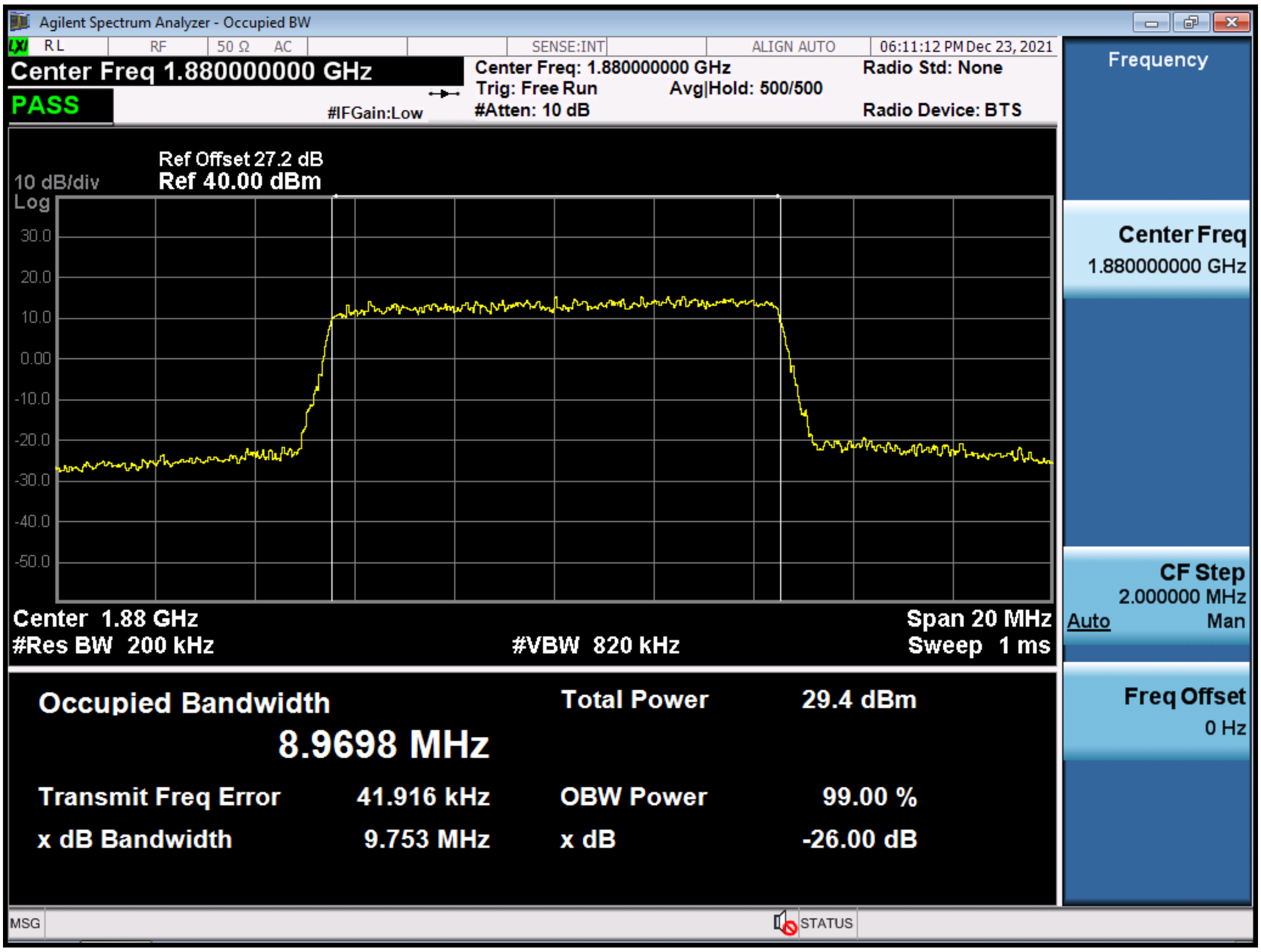
BW10 M_OBW_Middle Channel_QPSK_FullRB



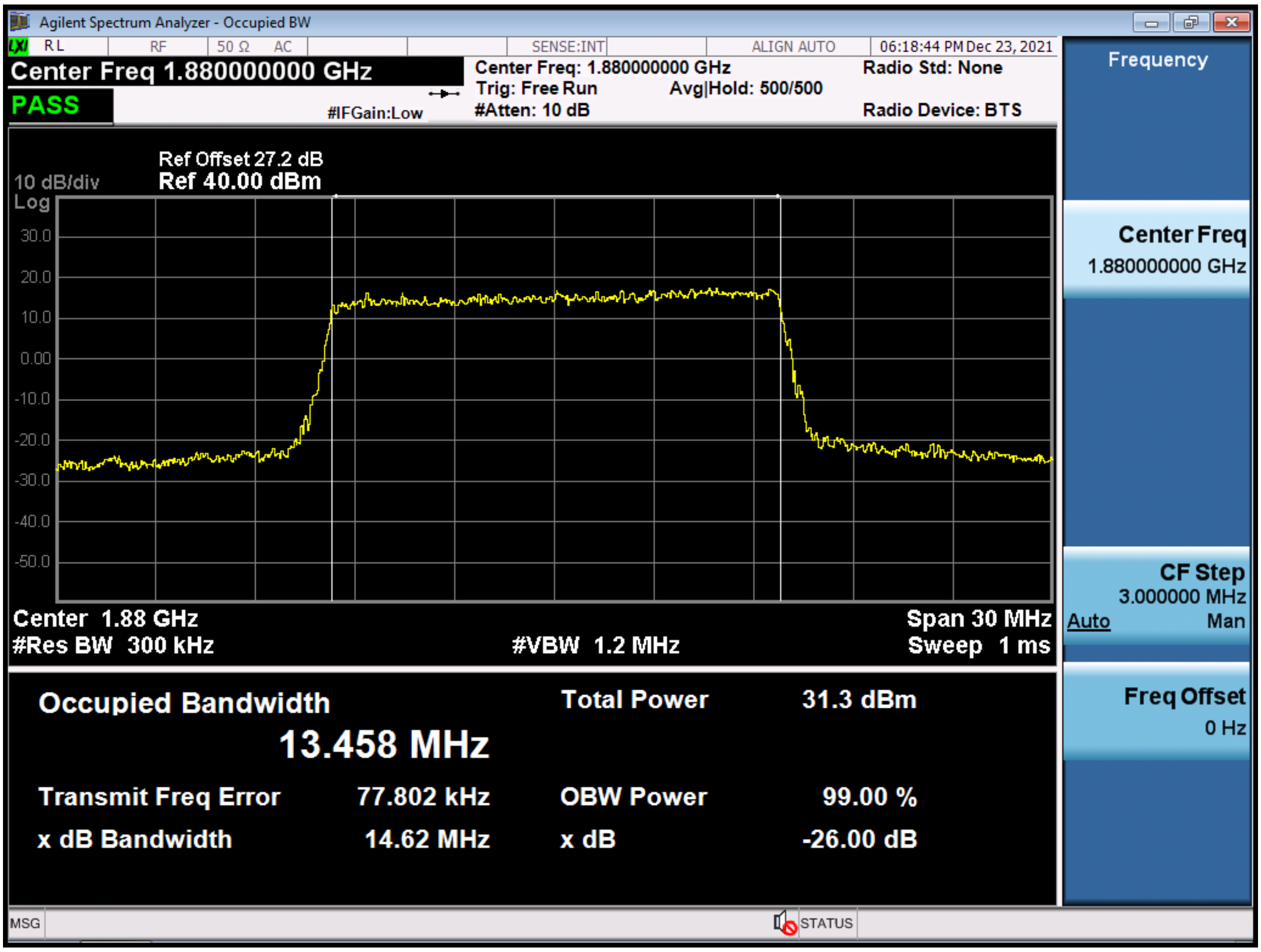
BW10 M_OBW_Middle Channel_16QAM_FullRB



BW10 M_OBW_Middle Channel_64QAM_FullRB



BW15 M_OBW_Middle Channel_QPSK_FullRB



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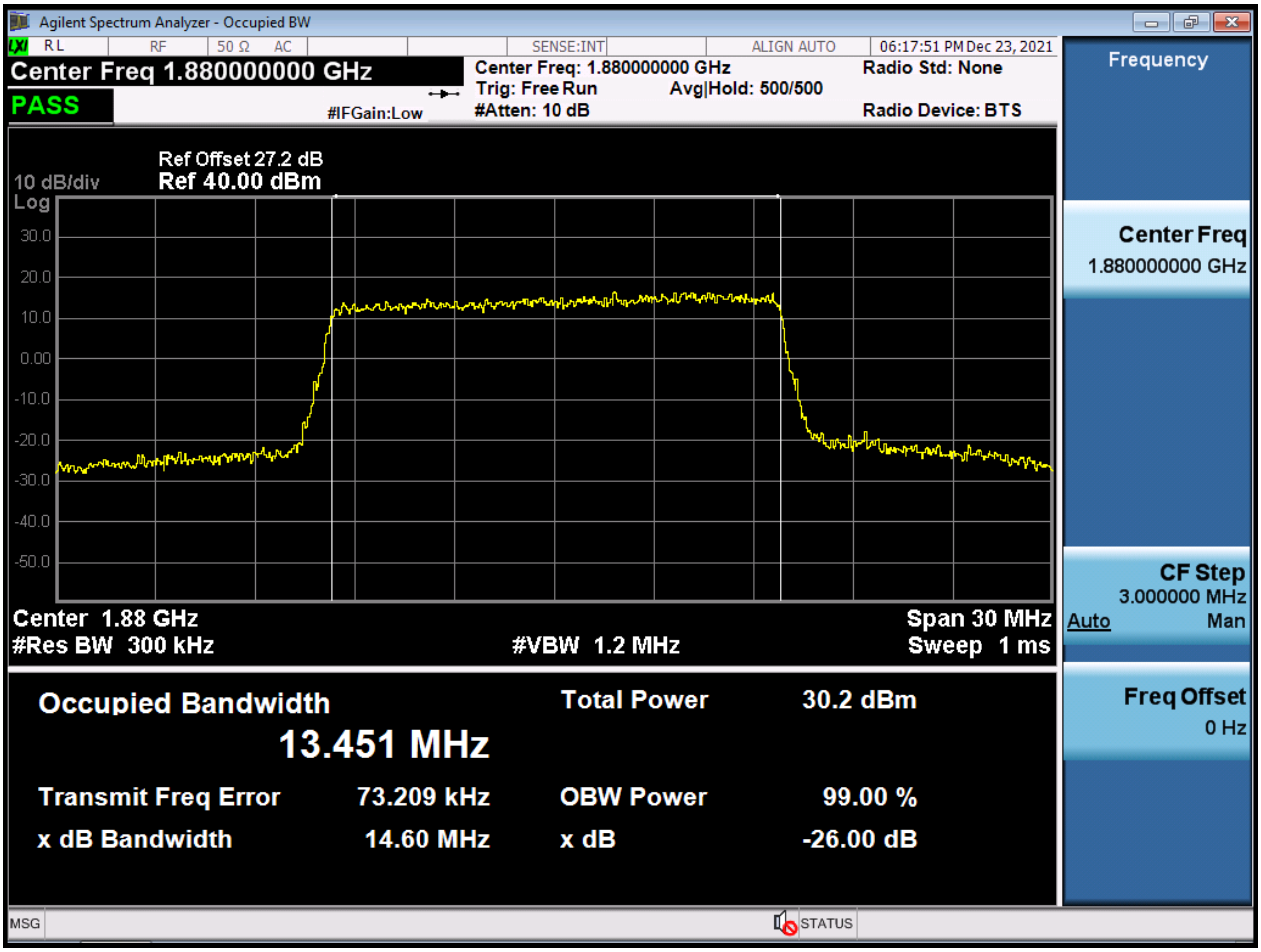

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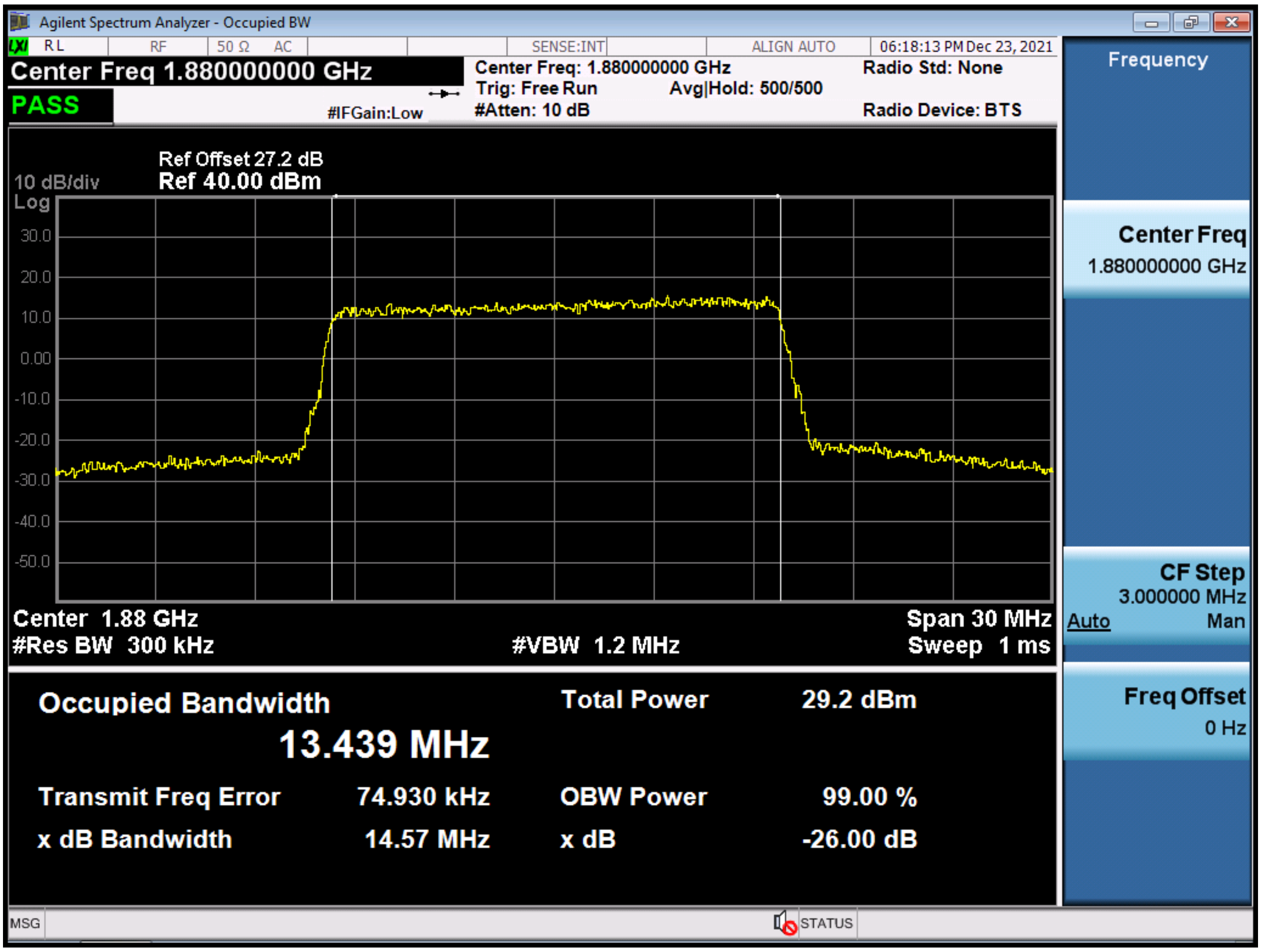
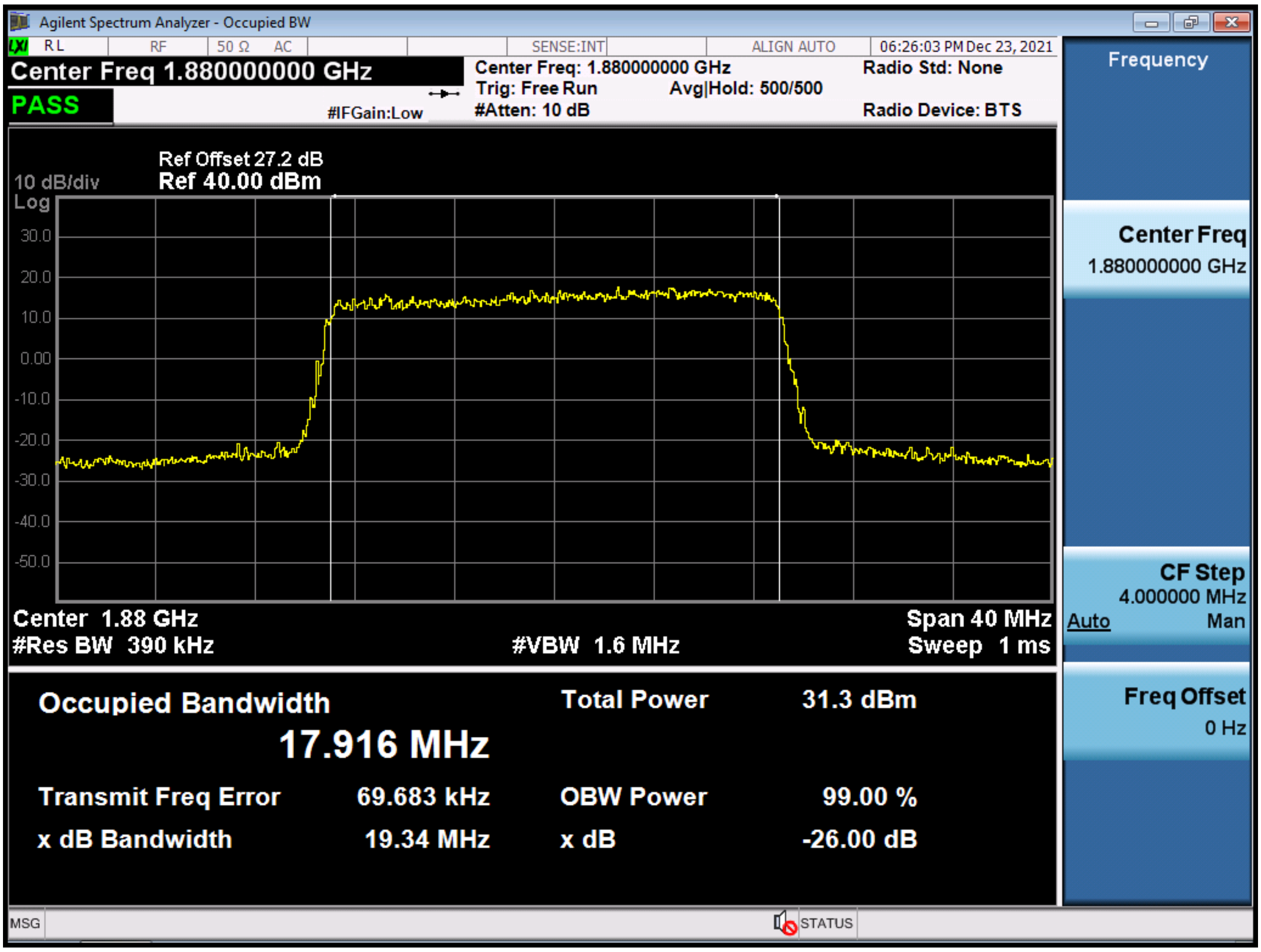


BW20 M_OBW_Middle Channel_QPSK_FullRB



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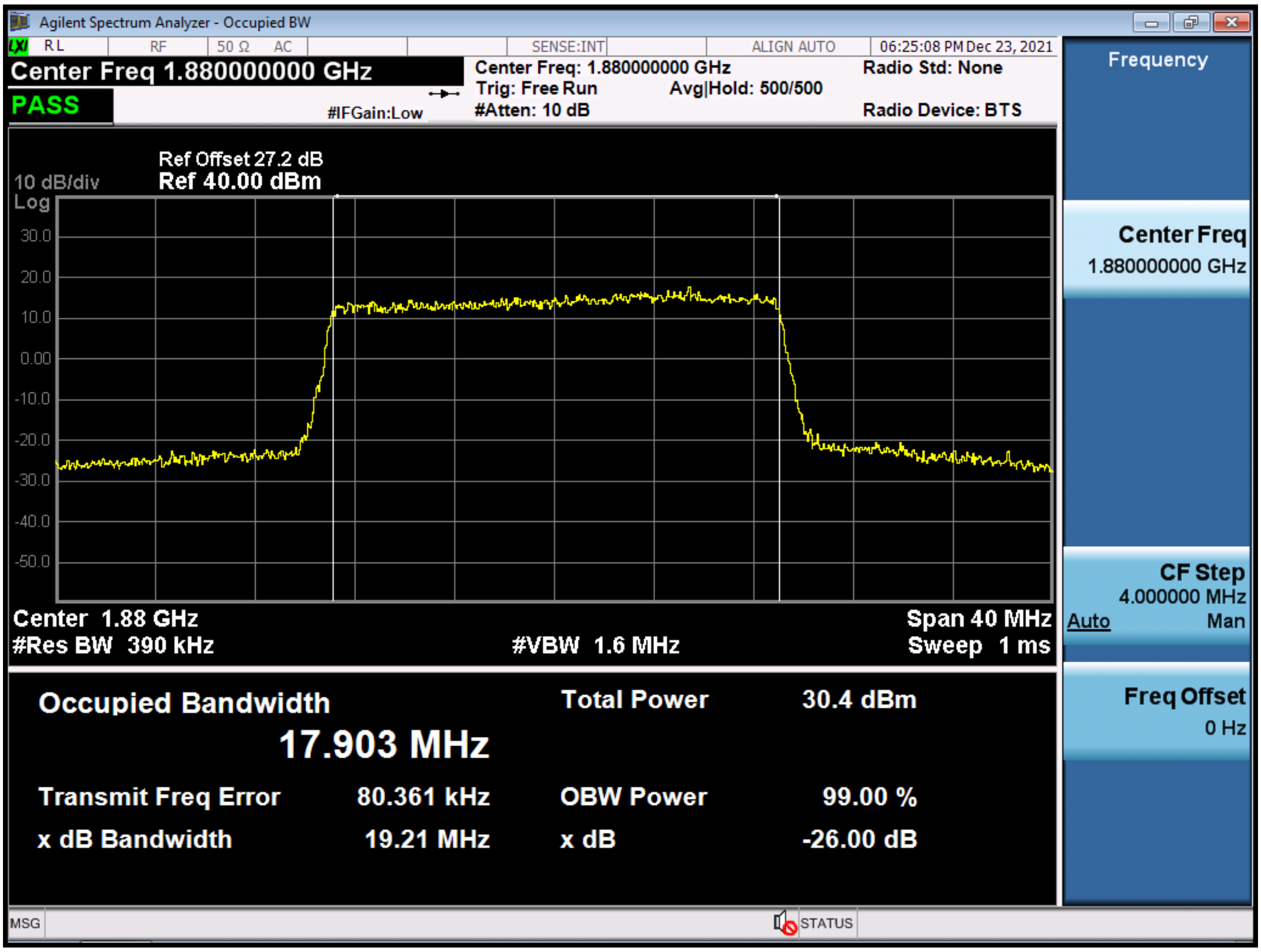
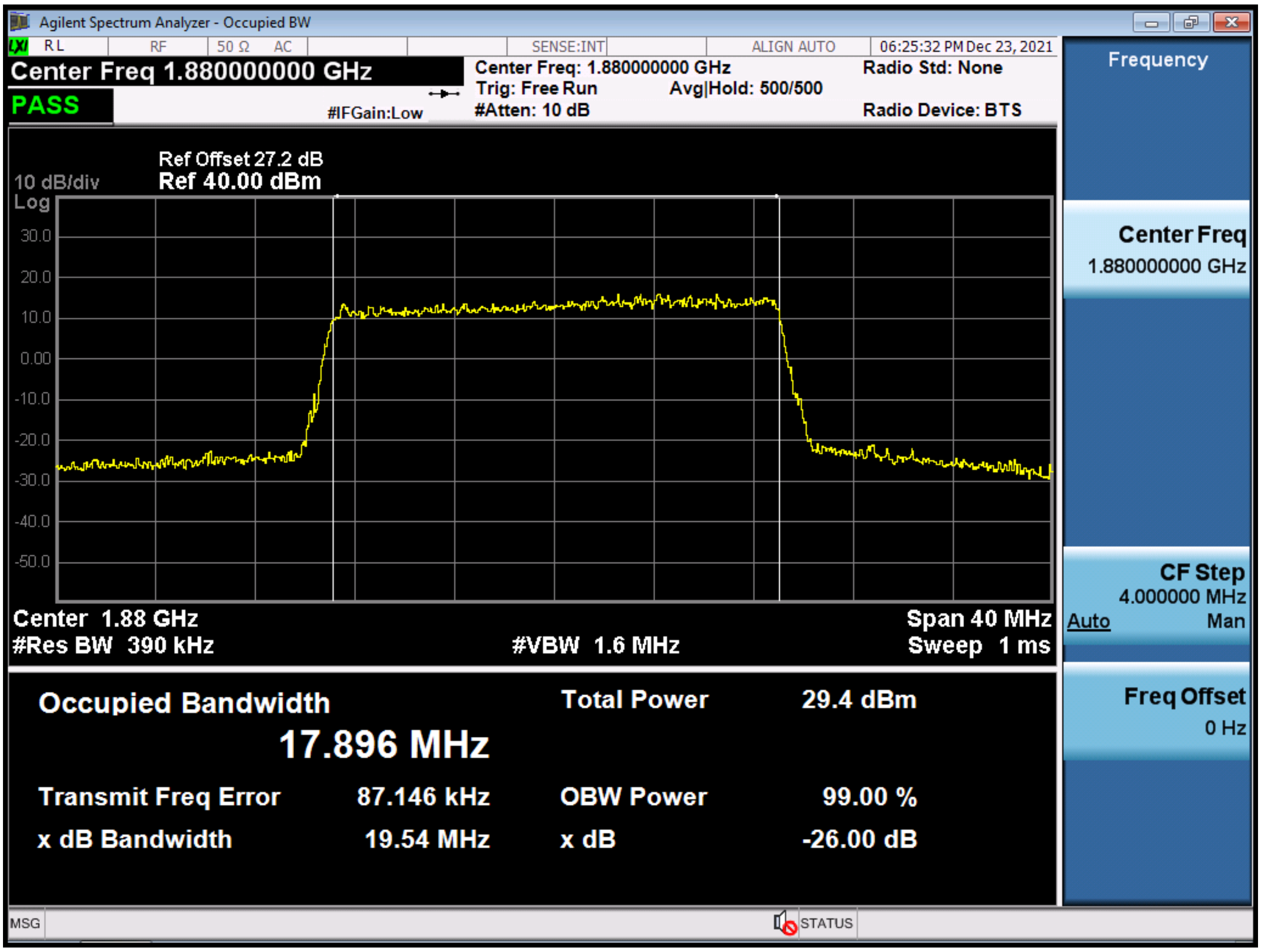
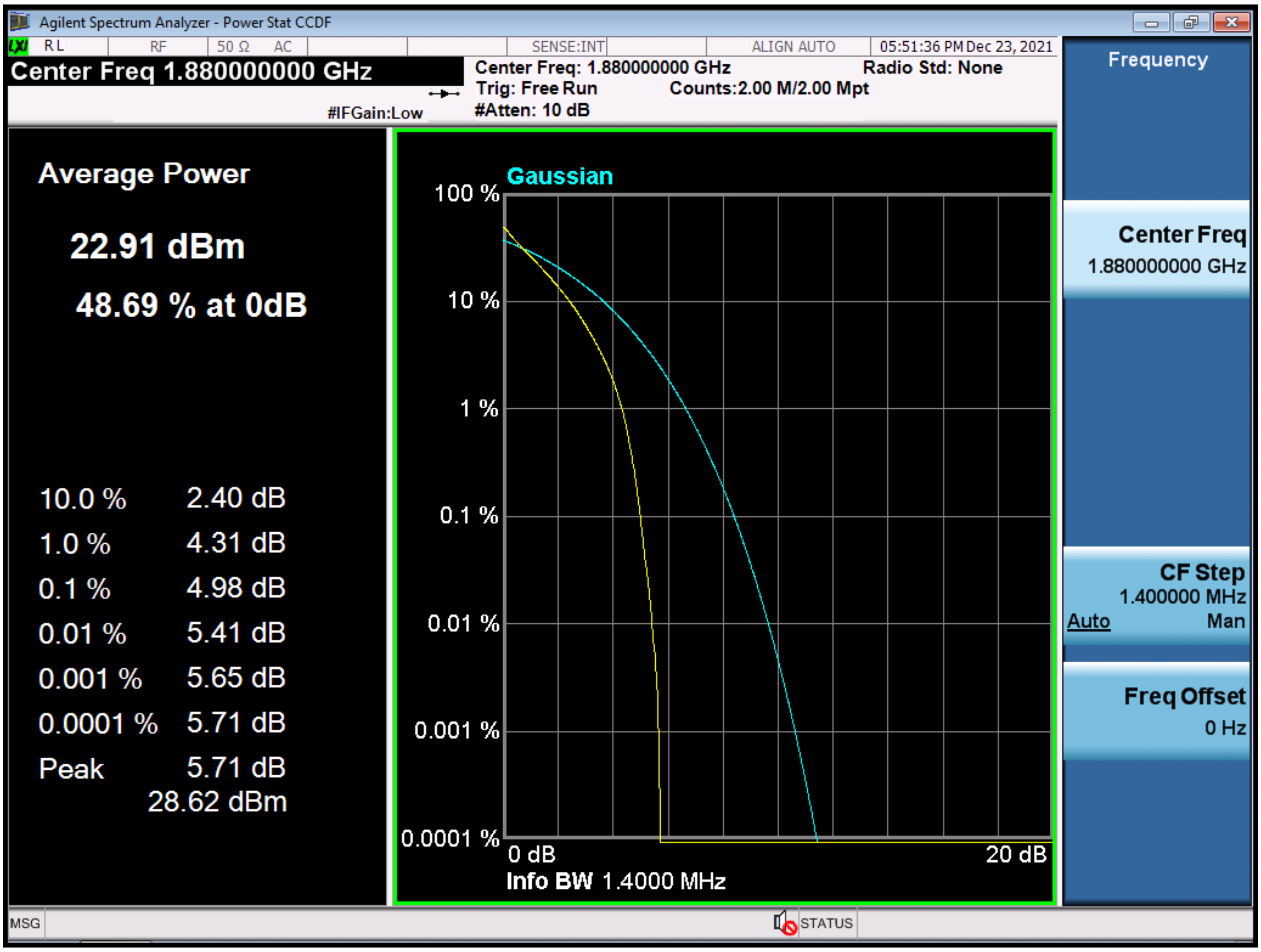


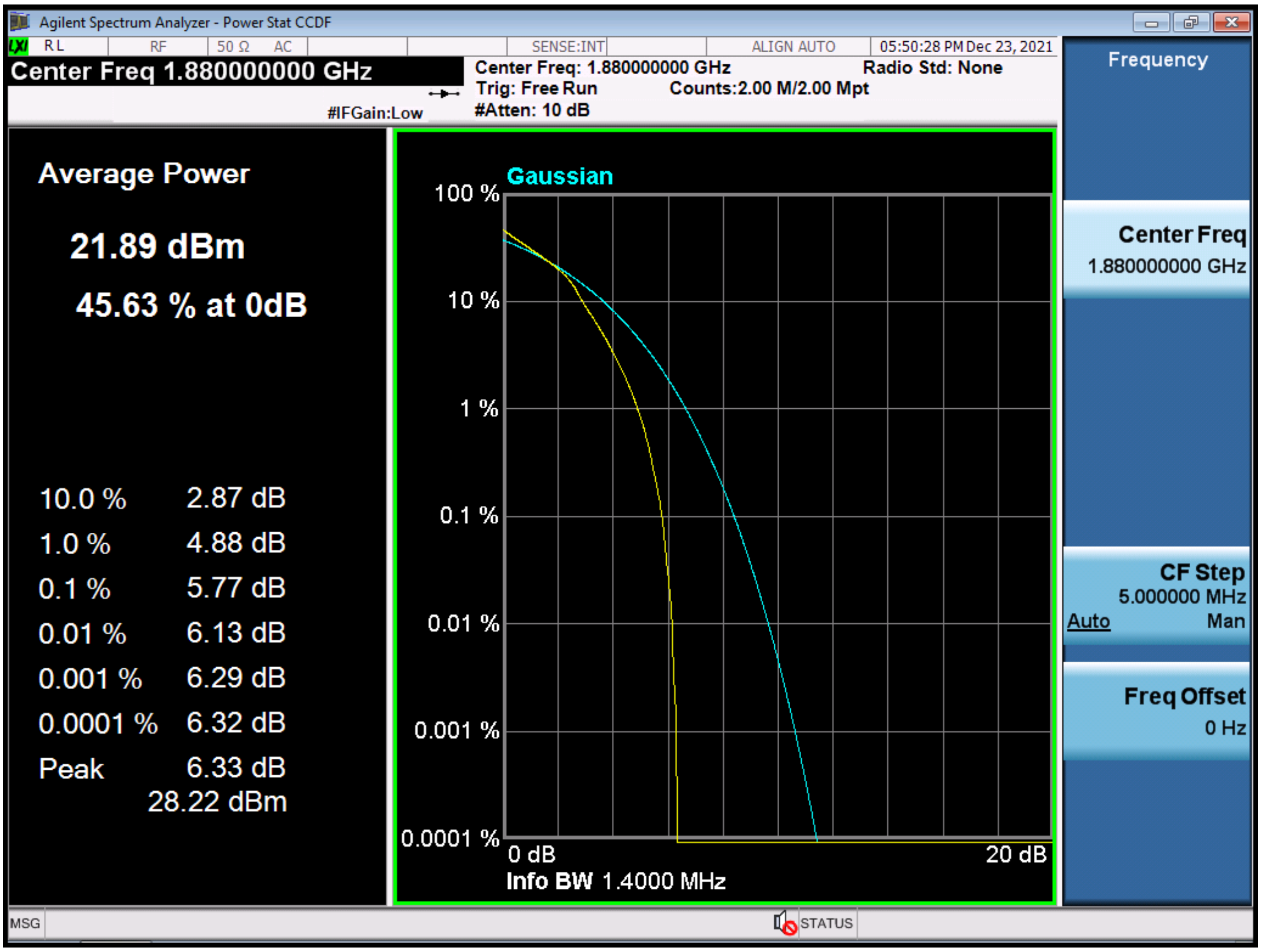
BW20 M_OBW_Middle Channel_64QAM_FullRB



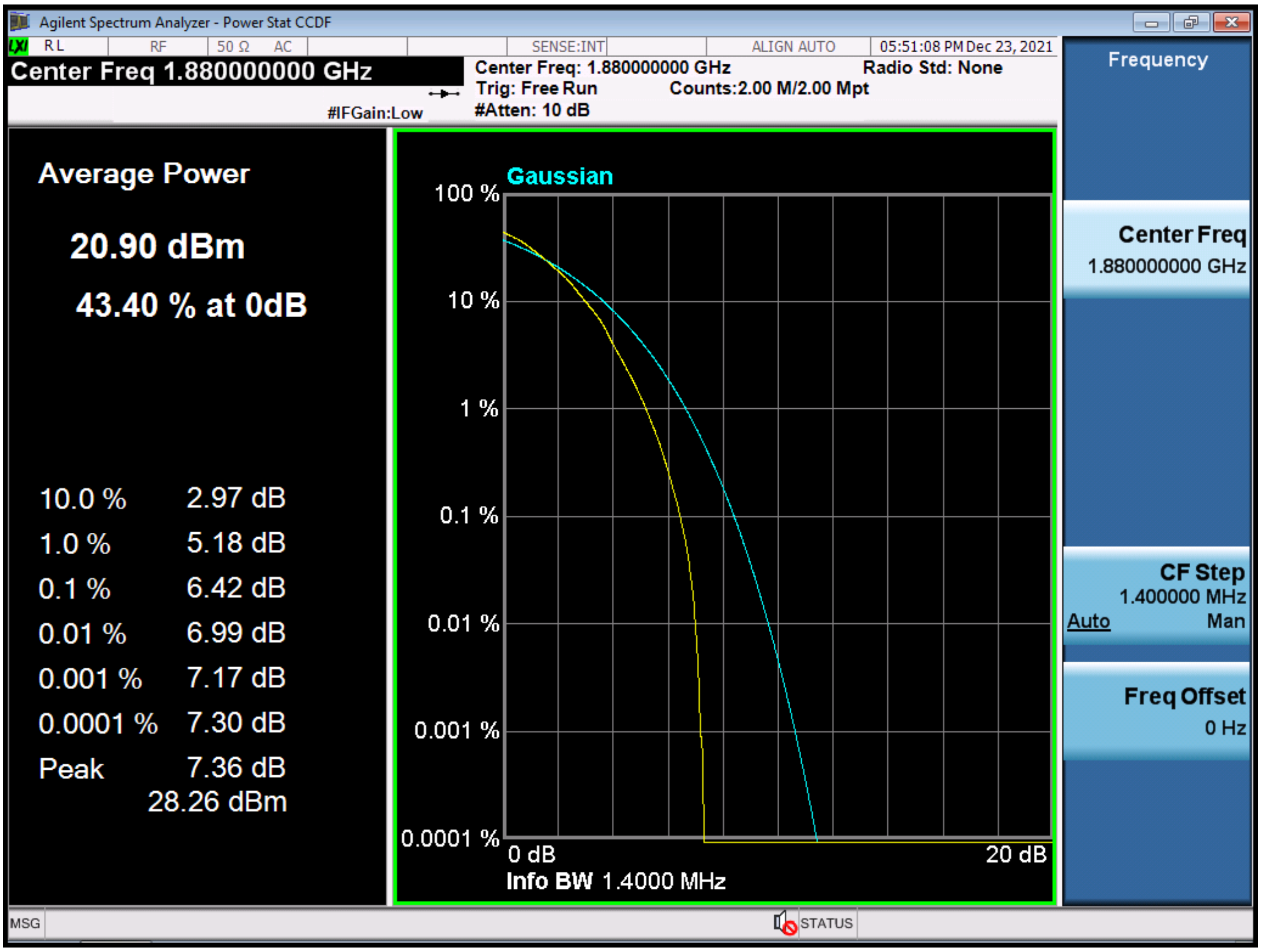
BW1.4 M_PAR_Middle Channel_QPSK_FullRB



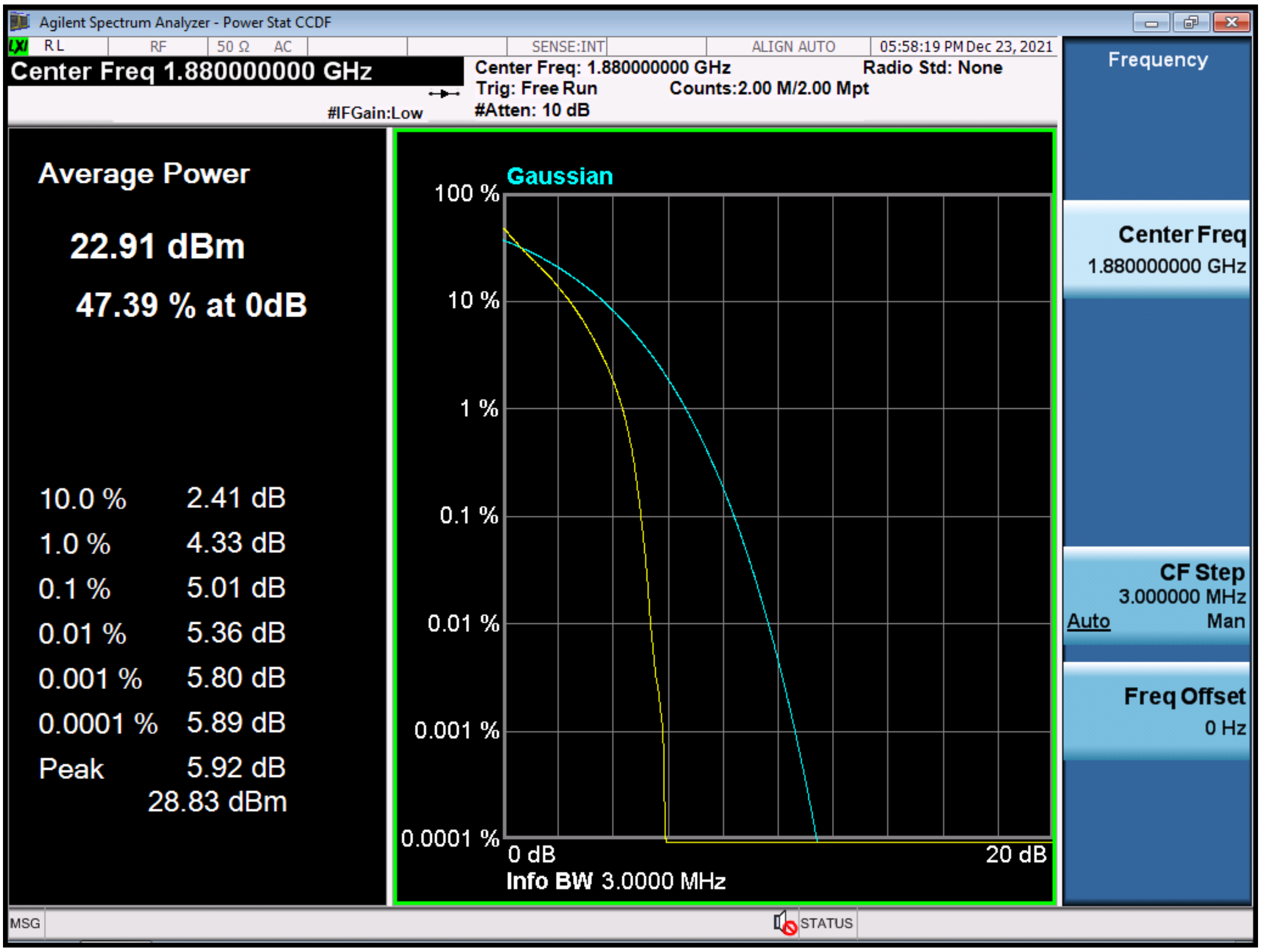
BW1.4 M_PAR_Middle Channel_16QAM_FullRB



BW1.4 M_PAR_Middle Channel_64QAM_FullRB



BW3 M_PAR_Middle Channel_QPSK_FullRB



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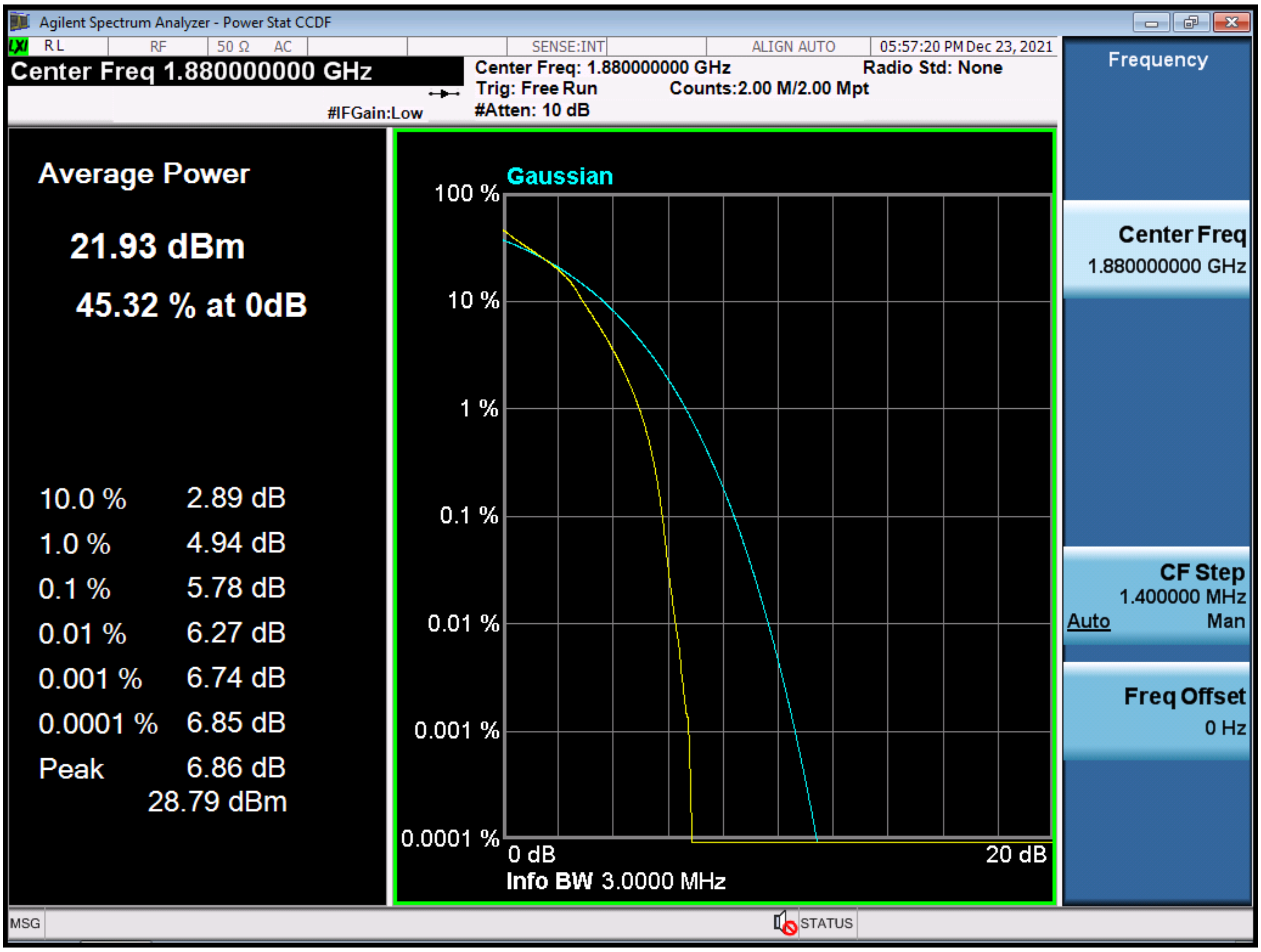

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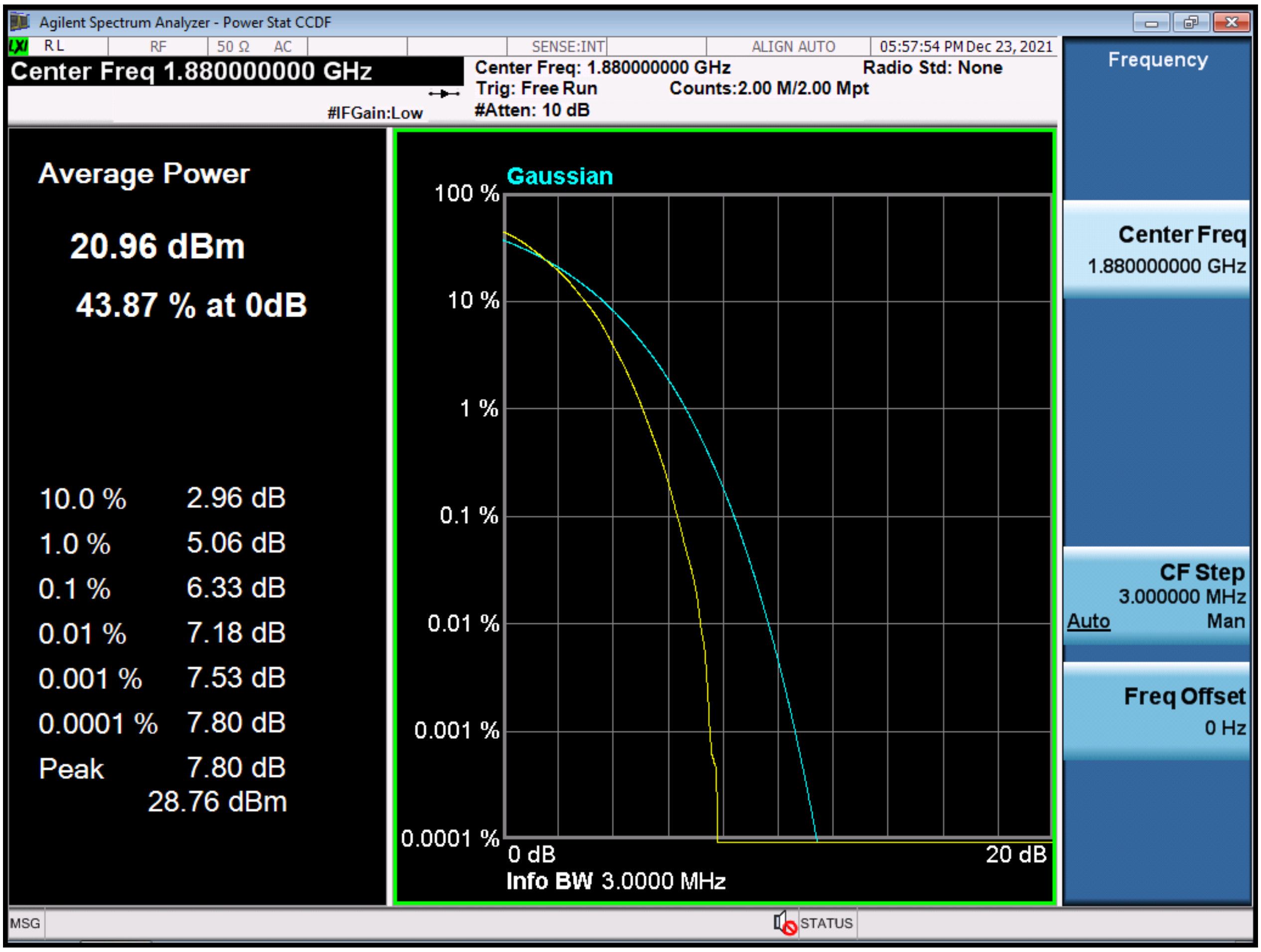
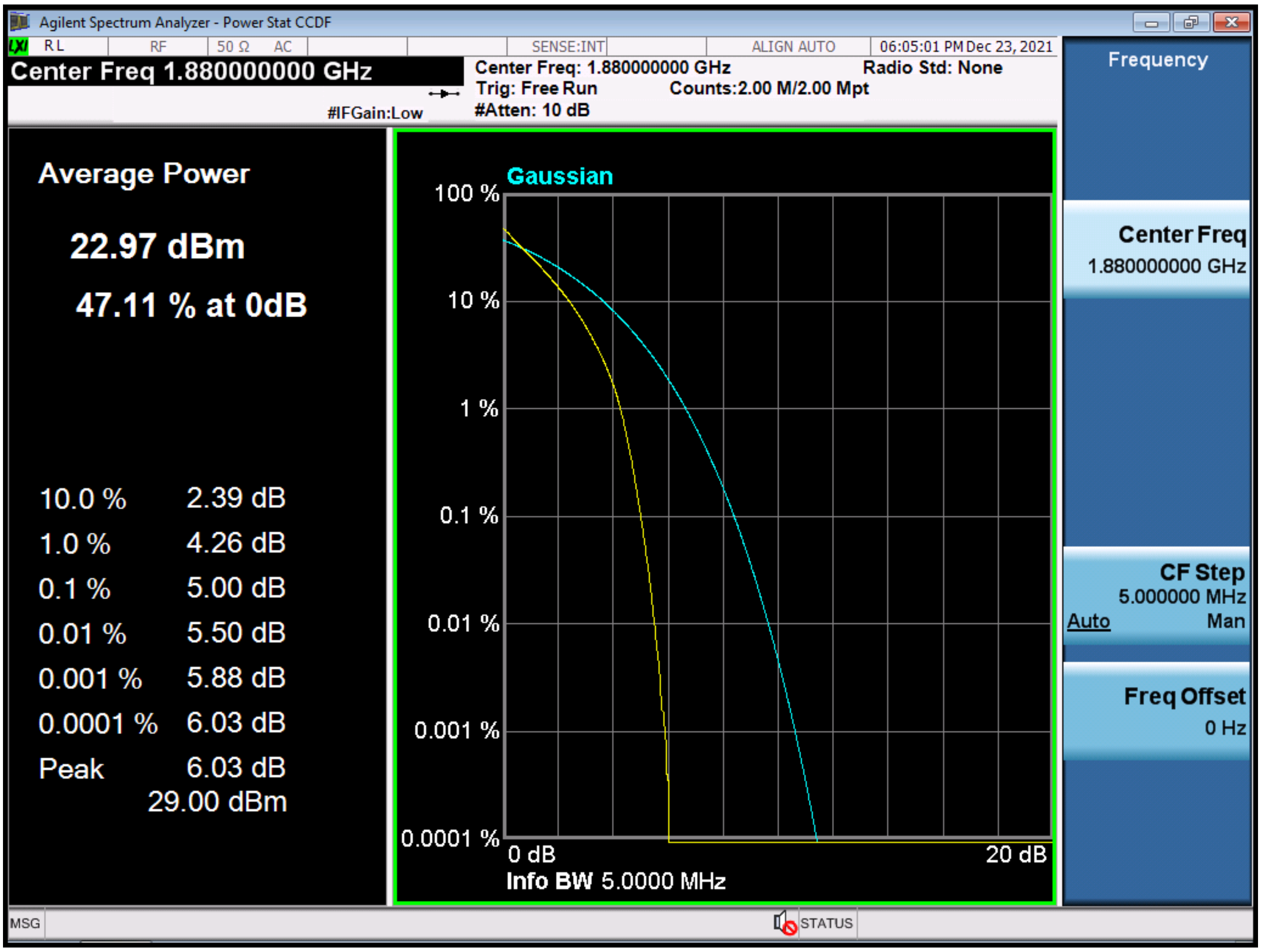


BW5 M_PAR_Middle Channel_QPSK_FullRB



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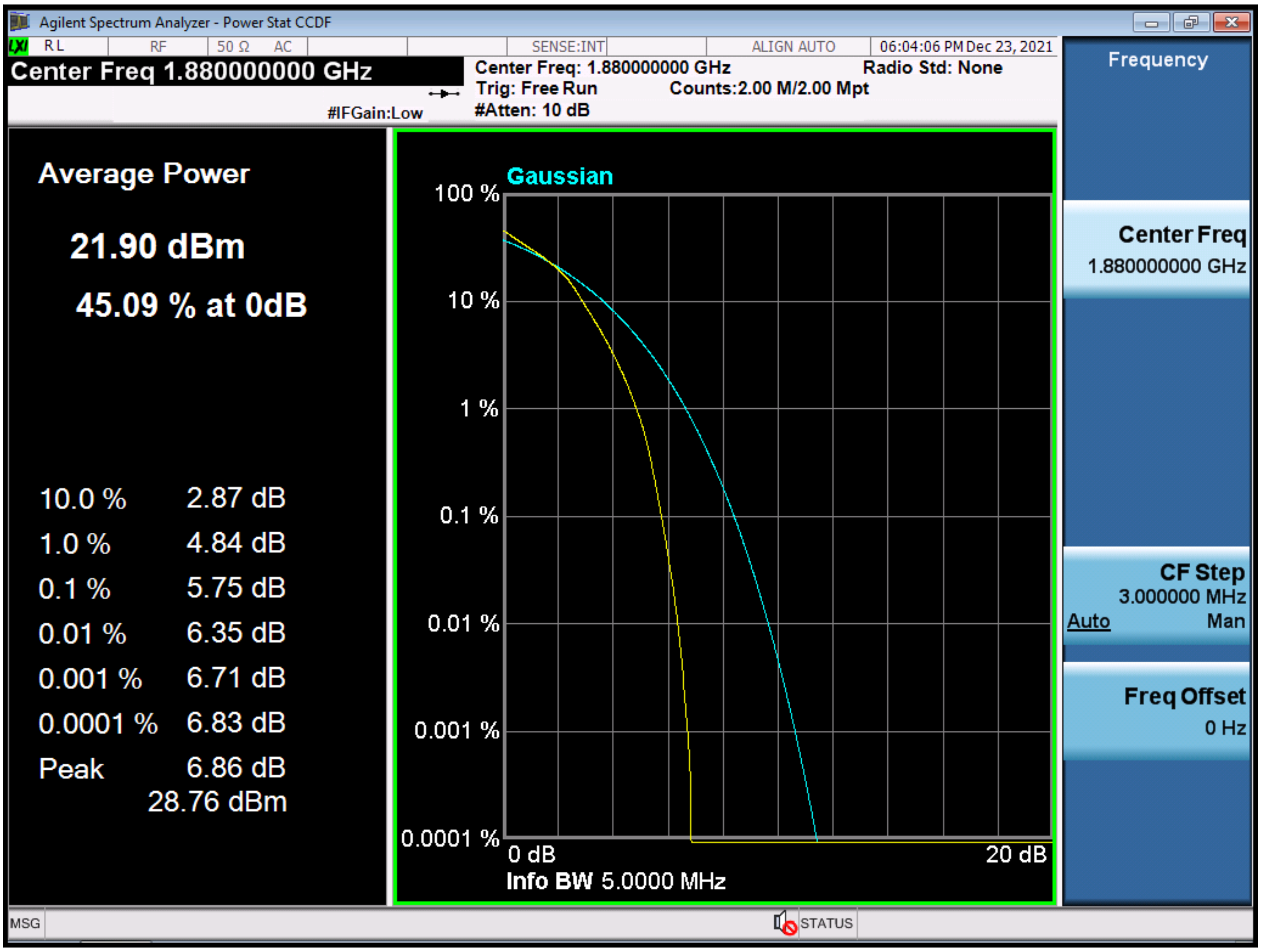
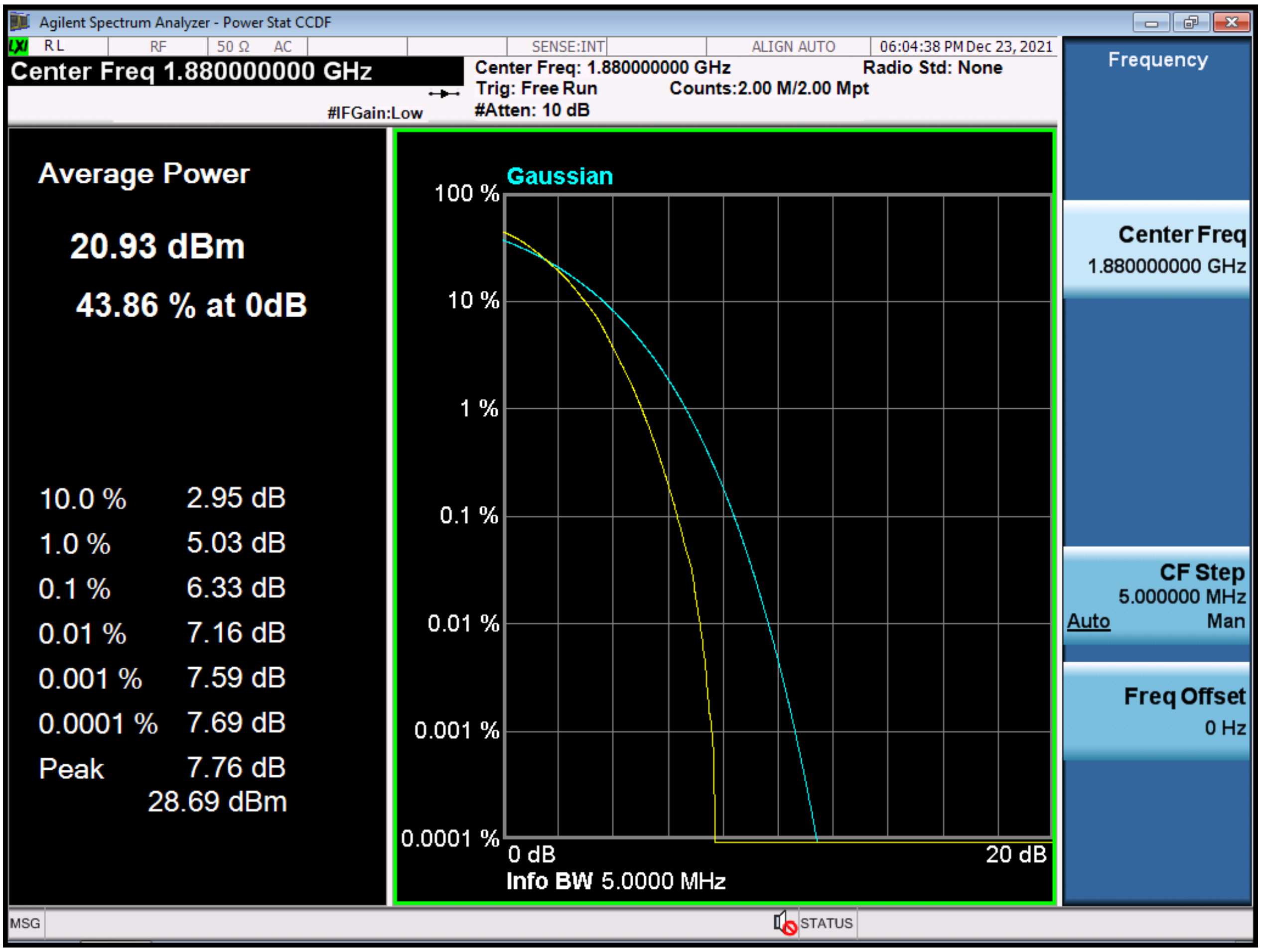
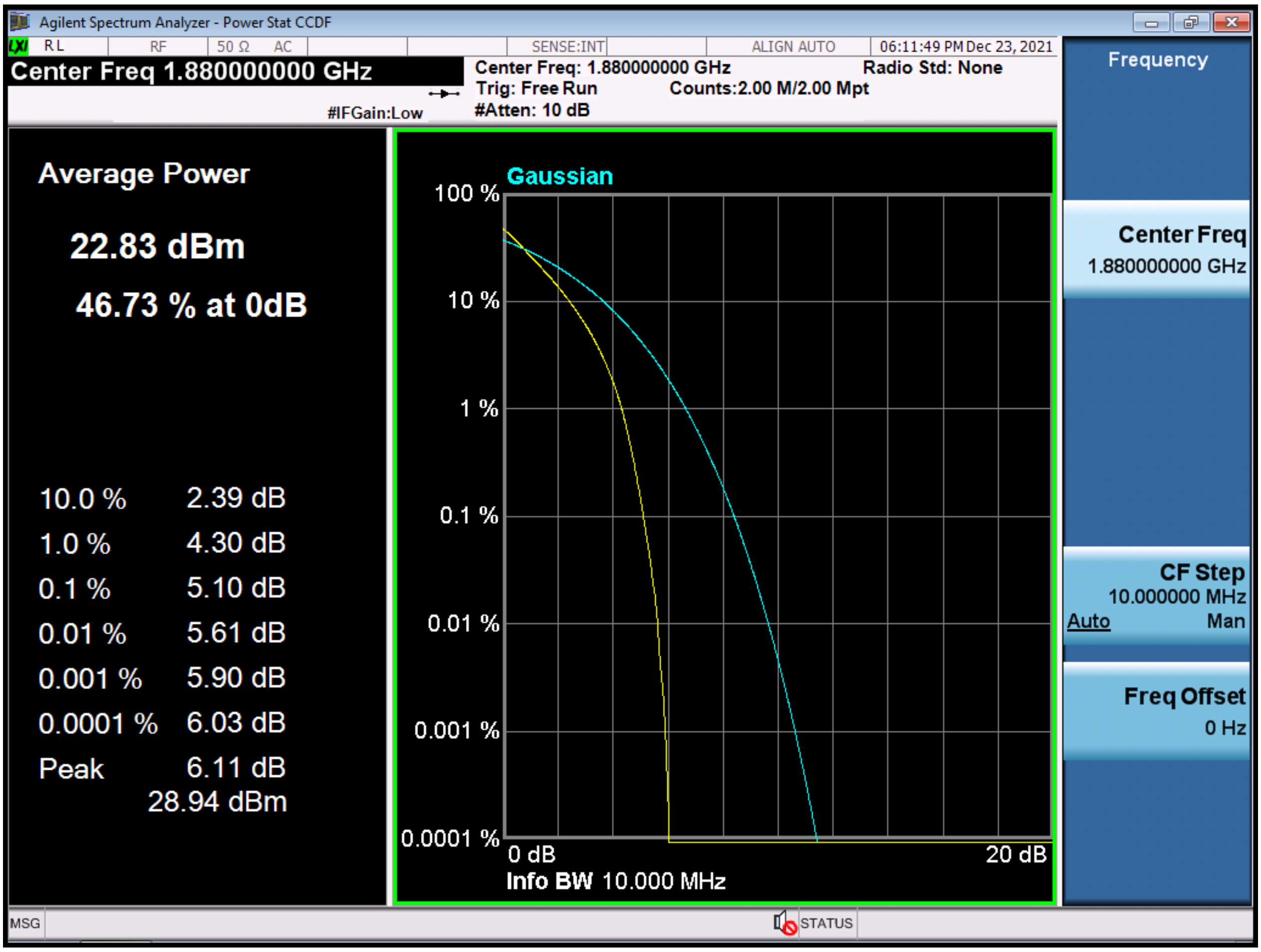


BW5 M_PAR_Middle Channel_64QAM_FullRB



BW10 M_PAR_Middle Channelz_QPSK_FullRB



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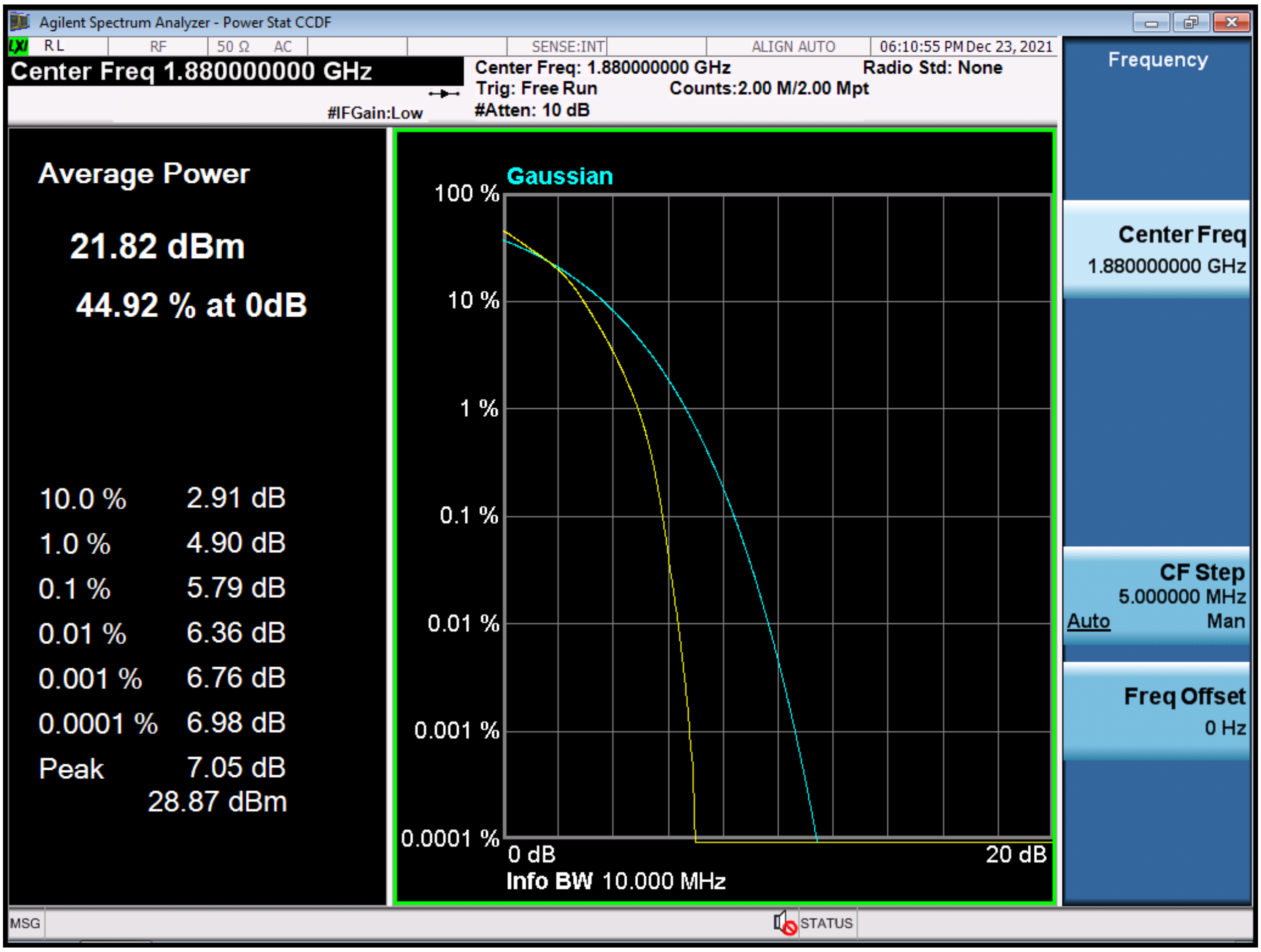

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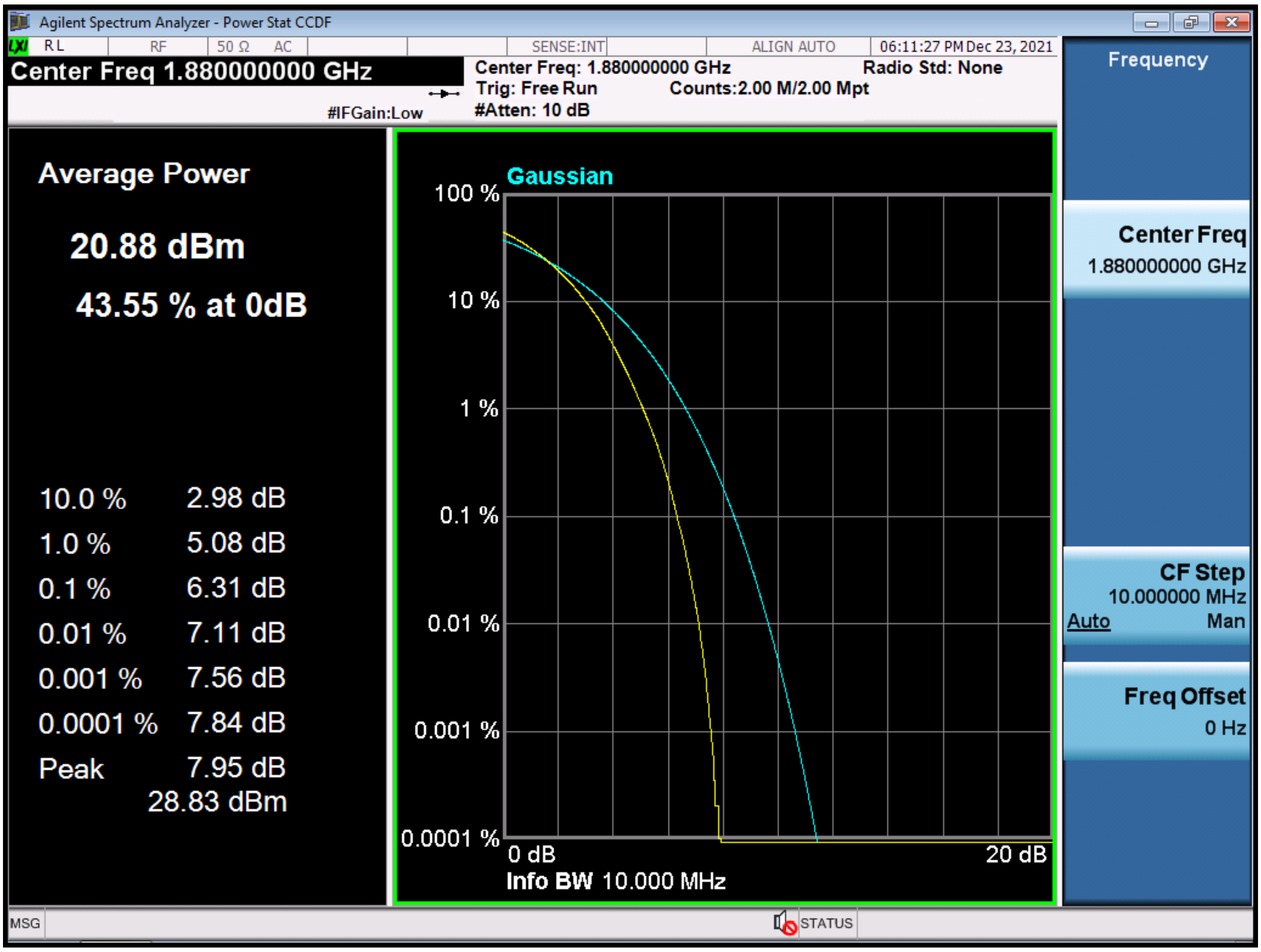
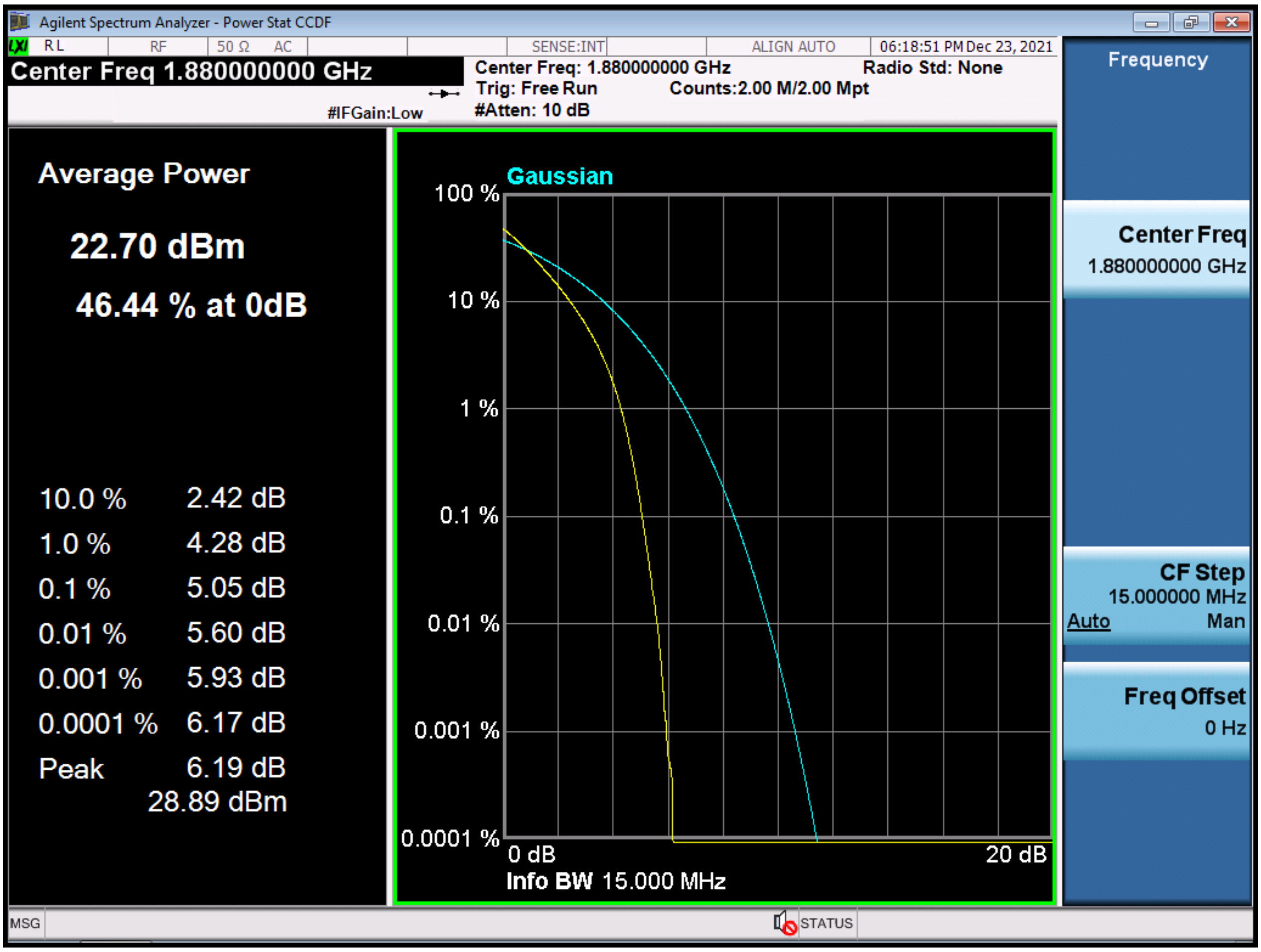


BW15 M_PAR_Middle Channel_QPSK_FullRB



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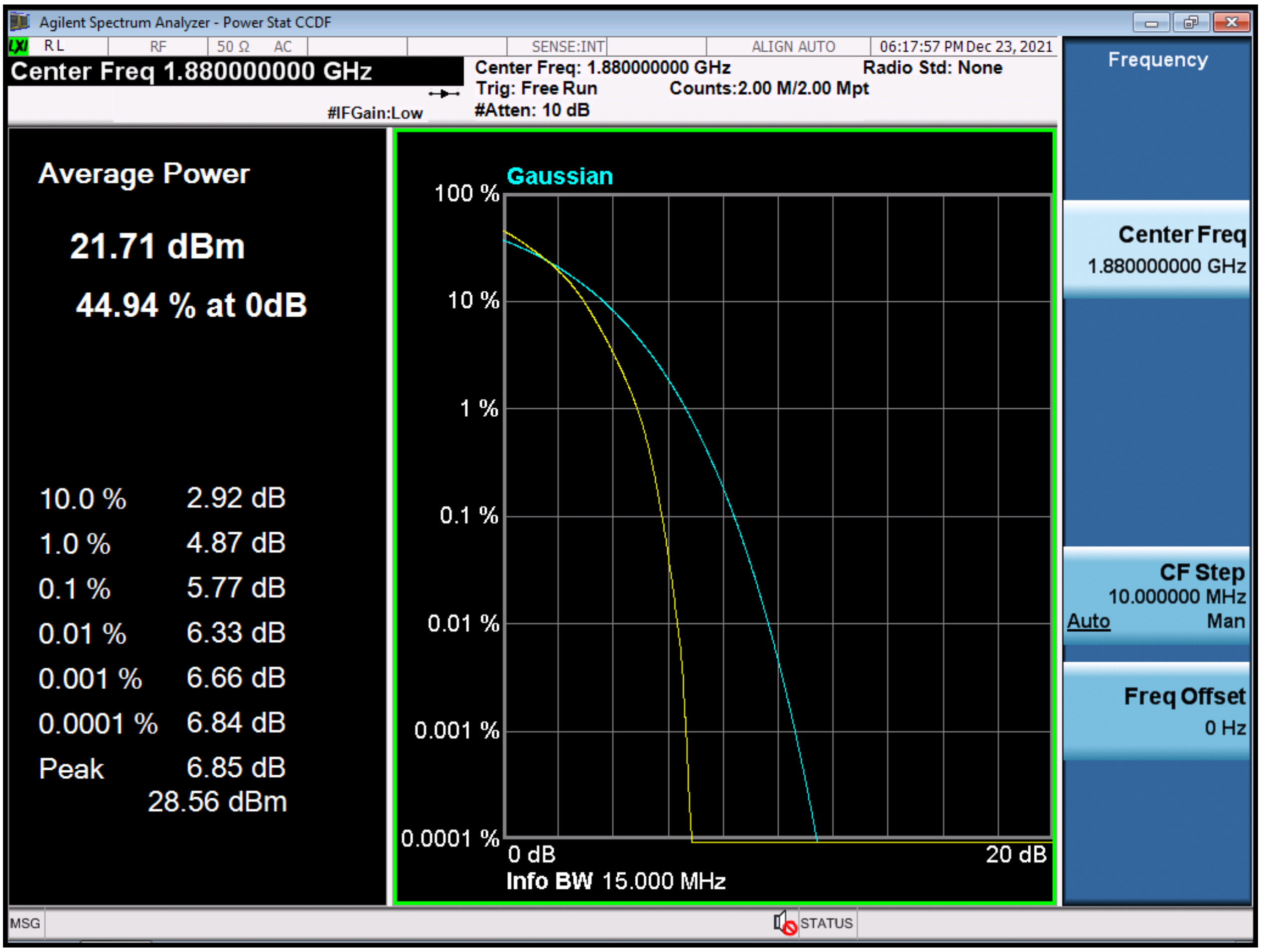
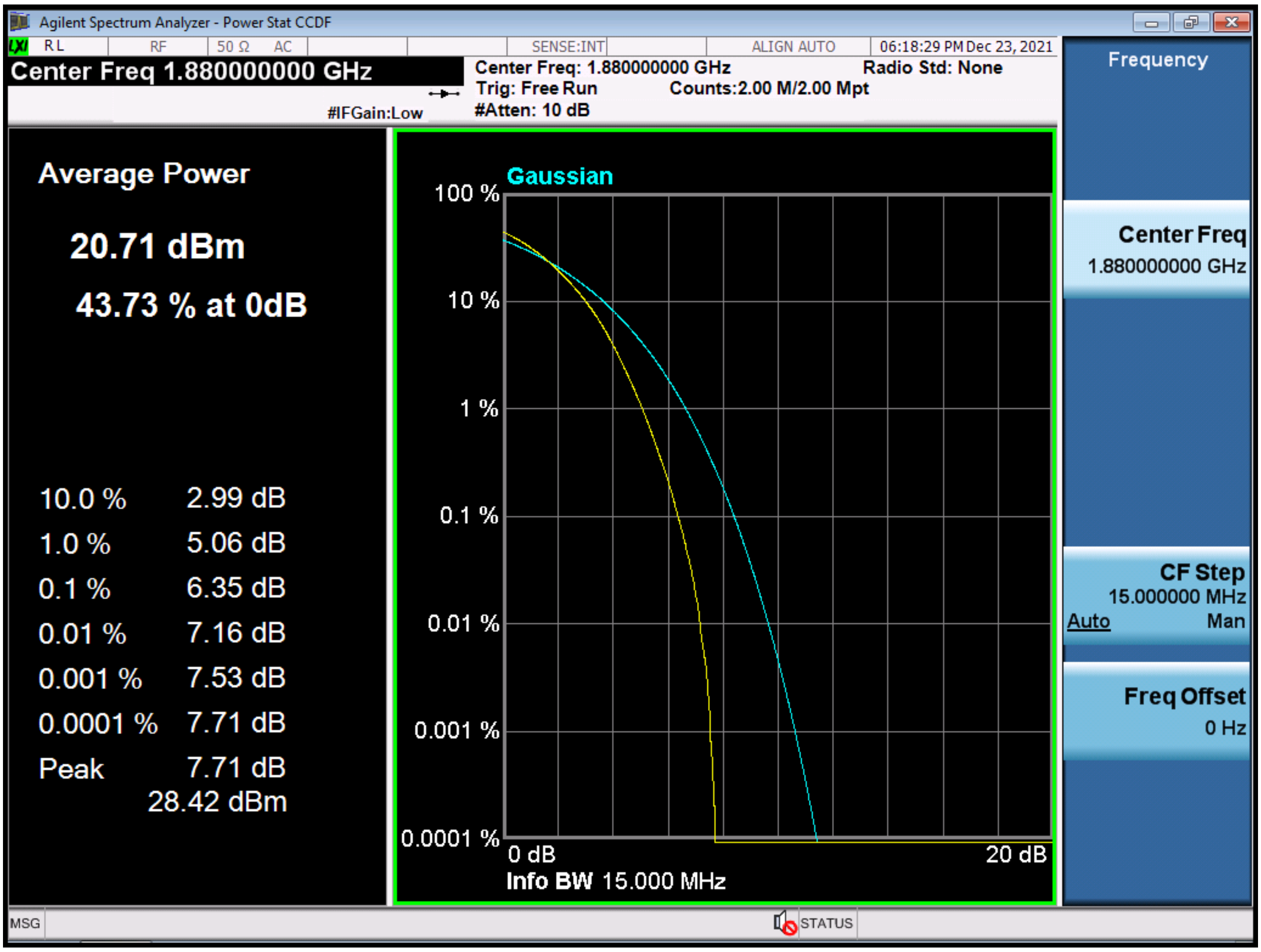
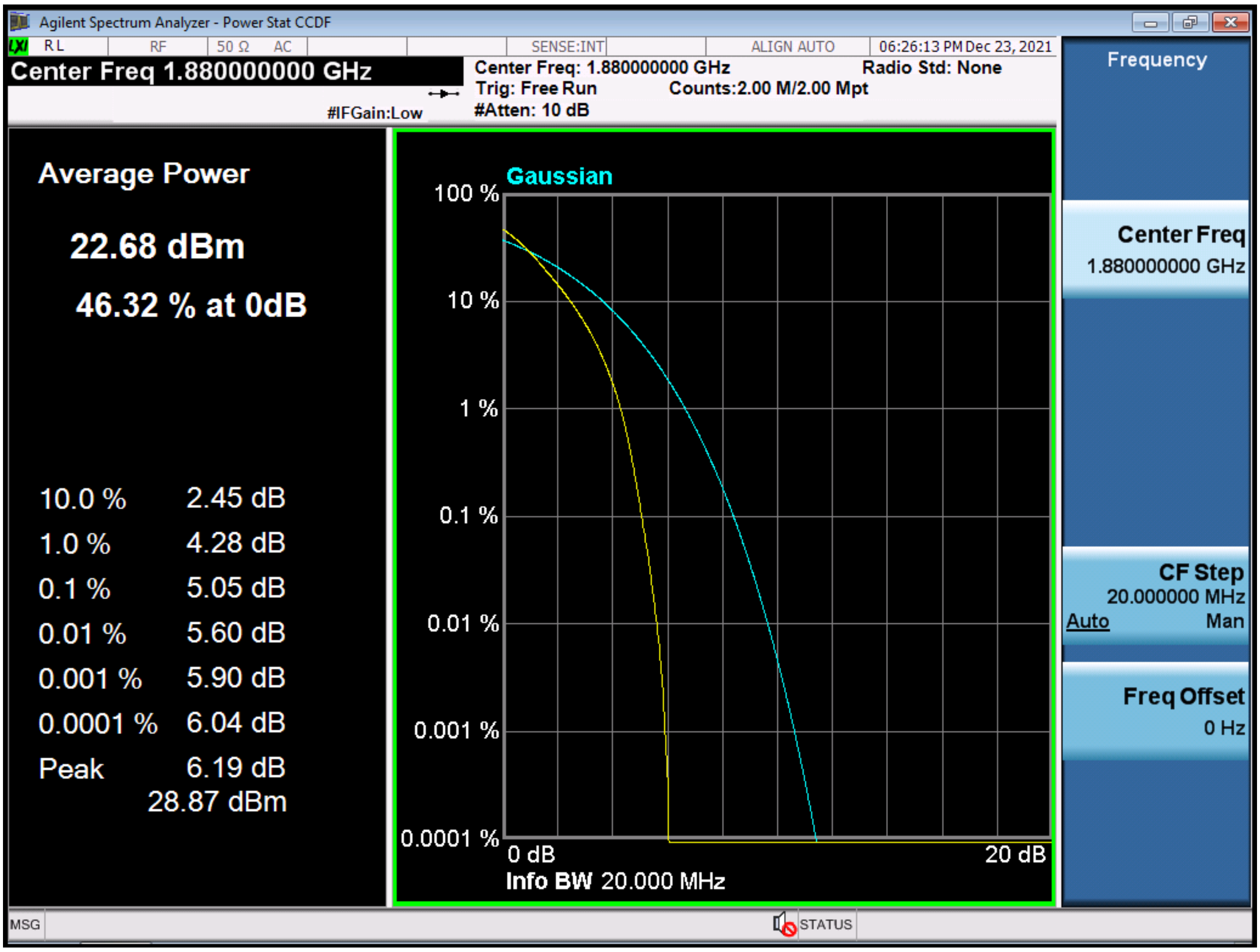


BW15 M_PAR_Middle Channel_64QAM_FullRB



BW20 M_PAR_Middle Channel_QPSK_FullRB



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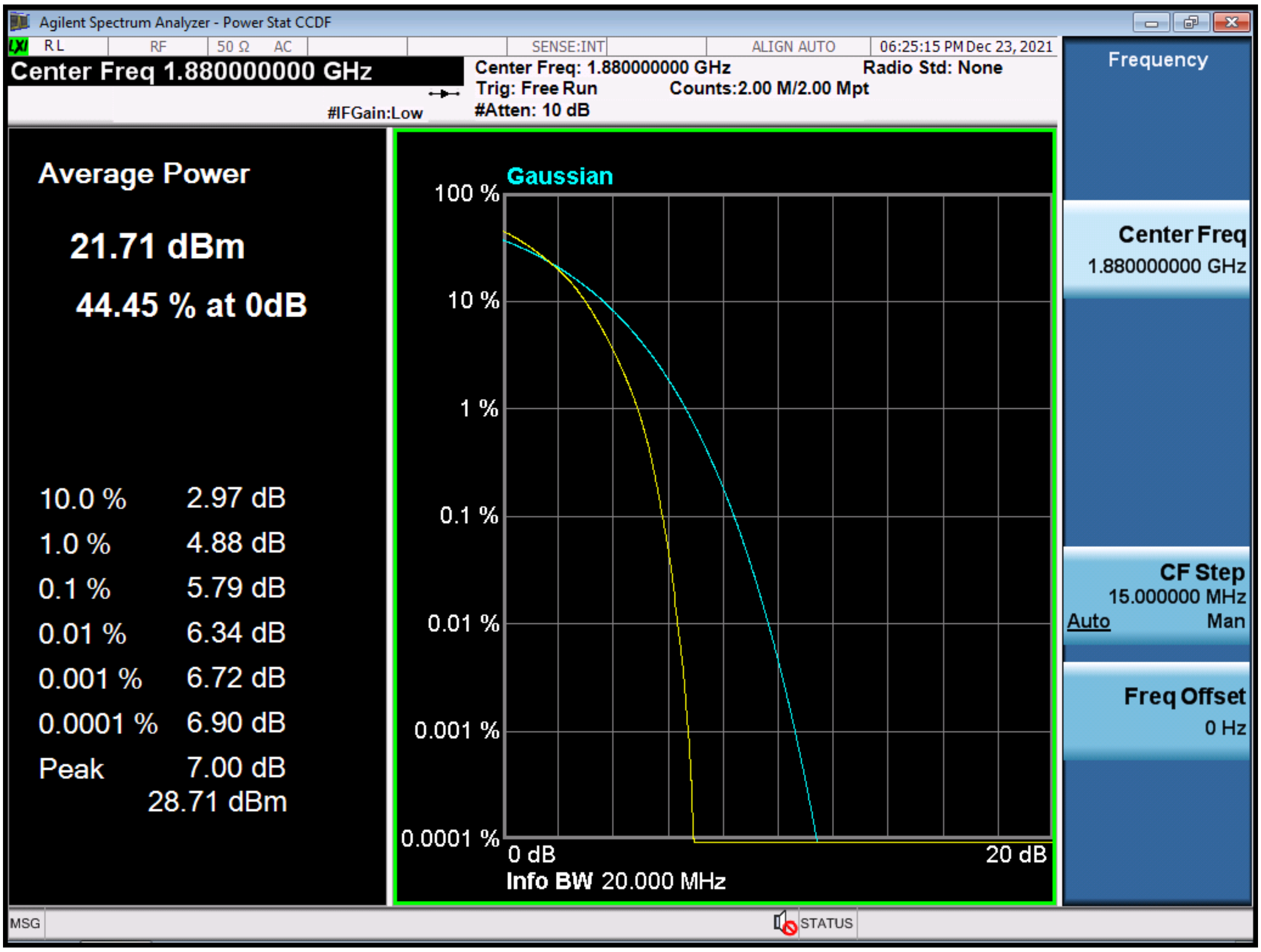

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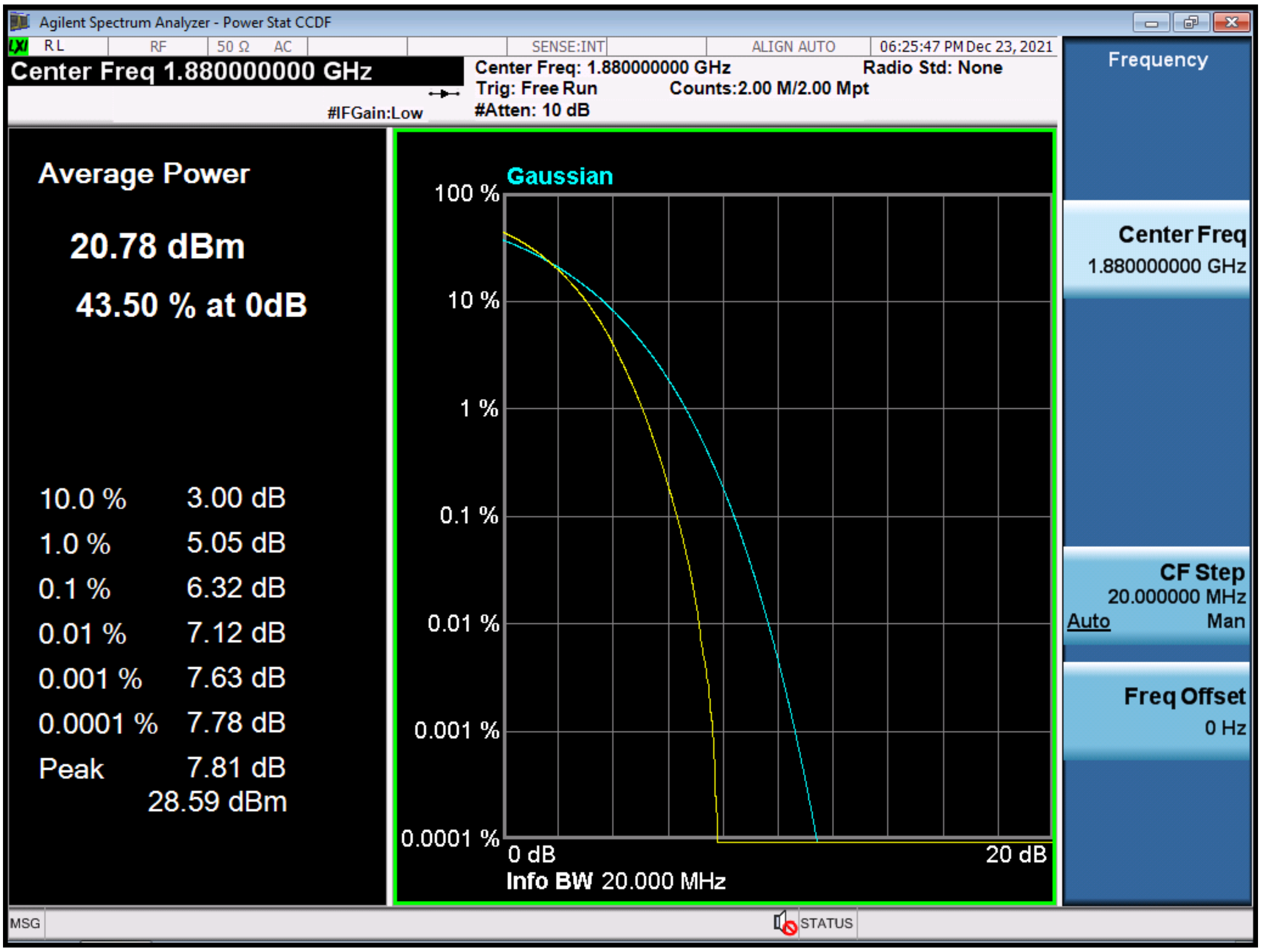
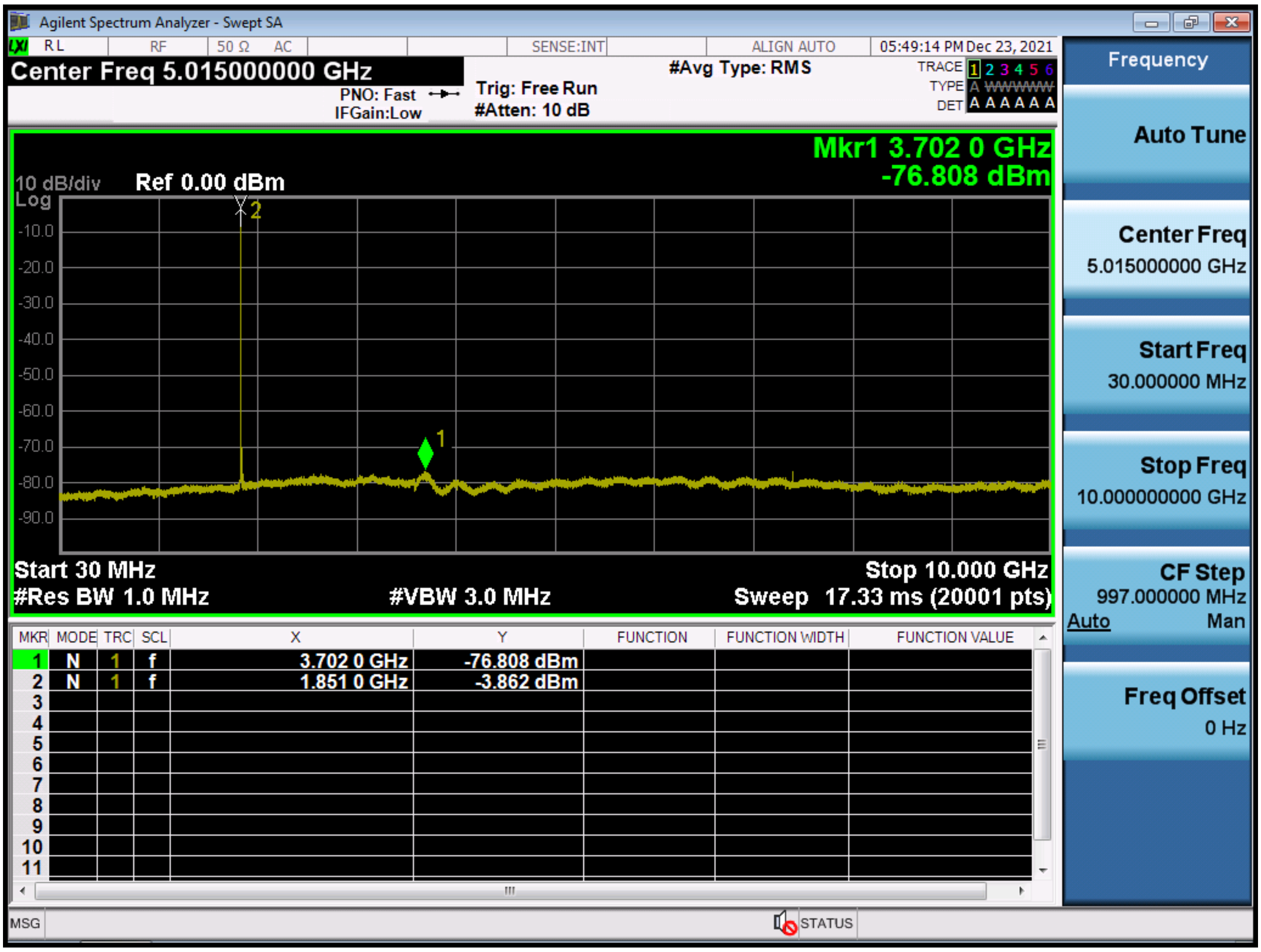
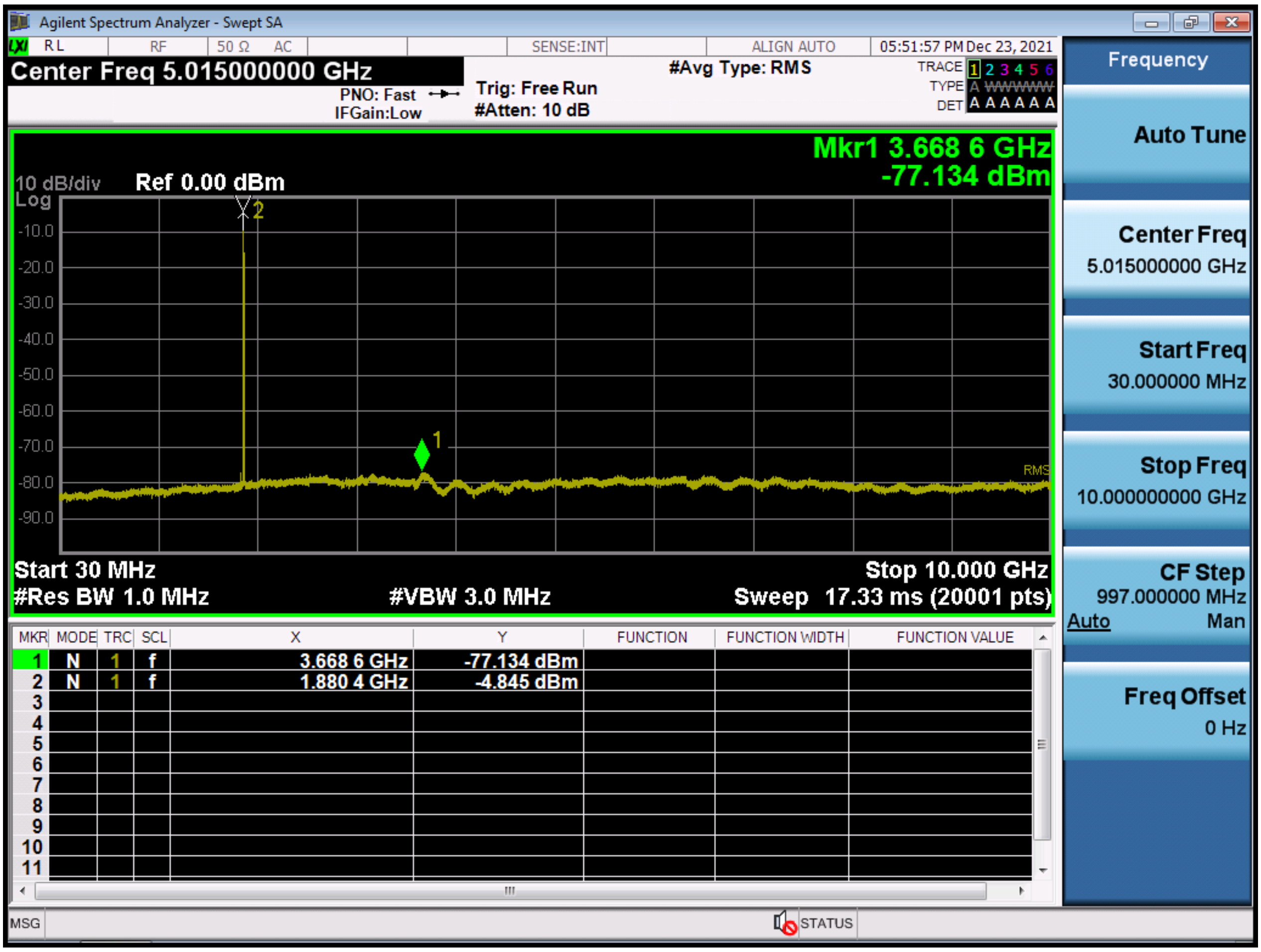


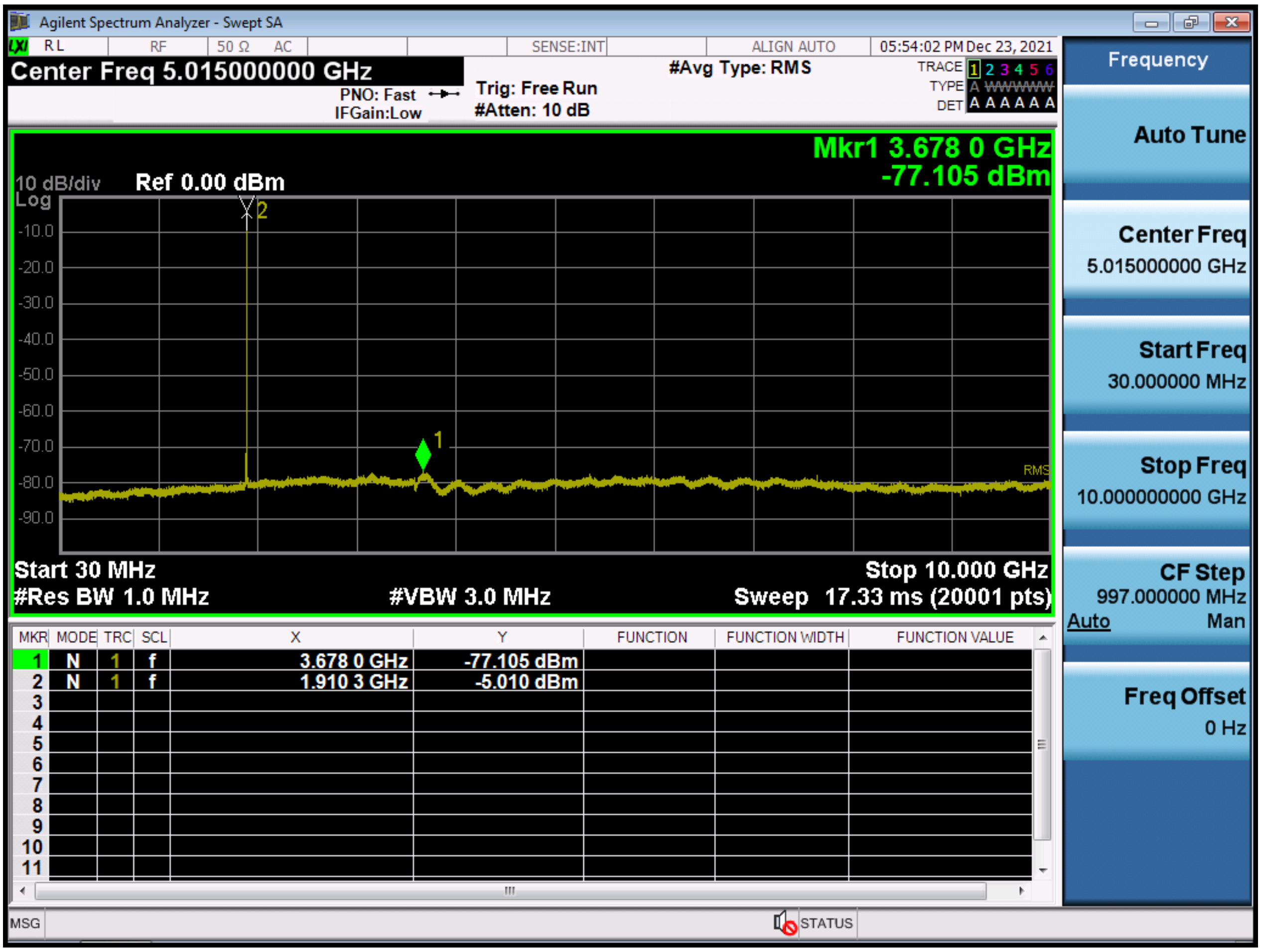
BW1.4 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



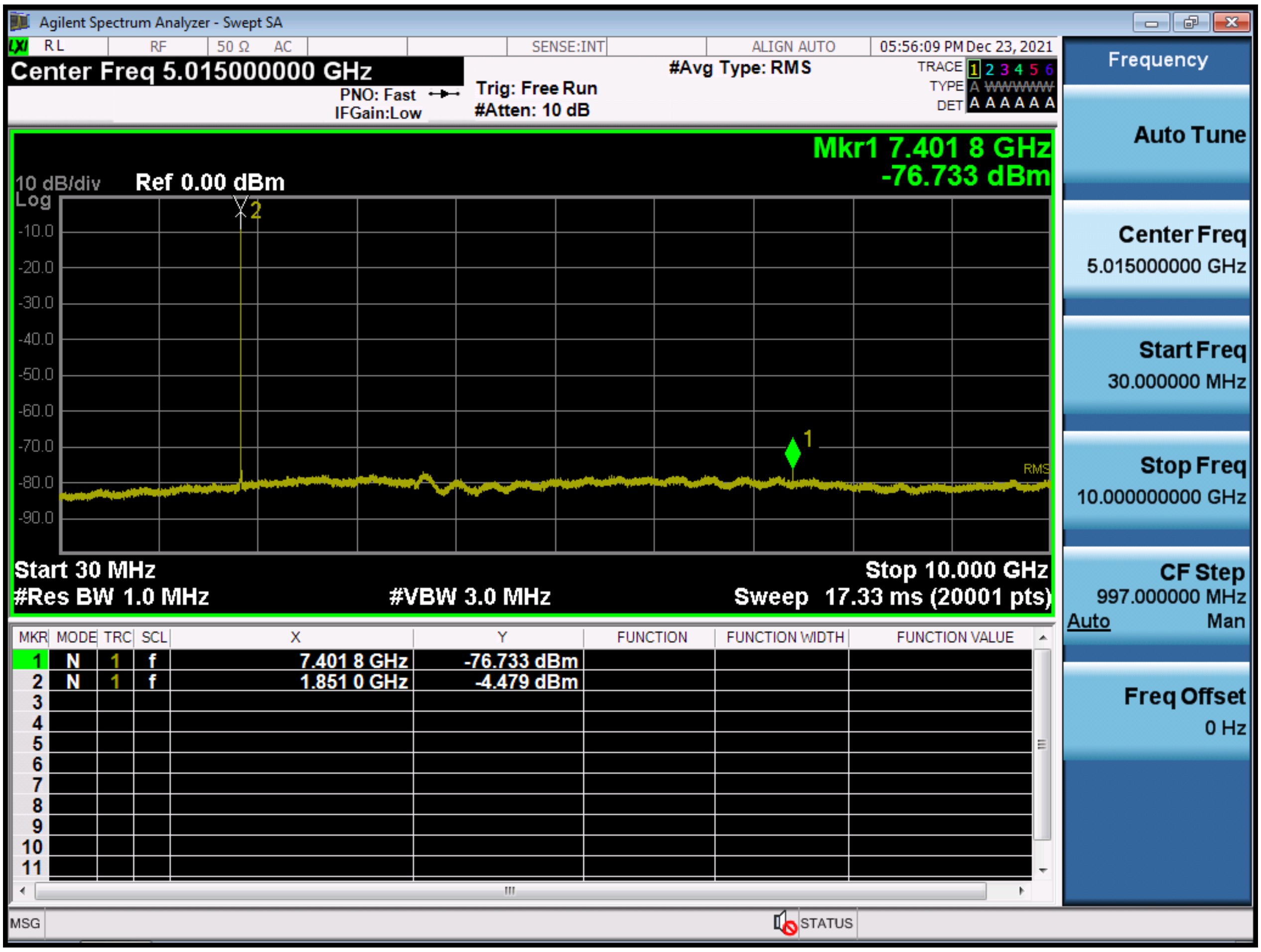
BW1.4 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



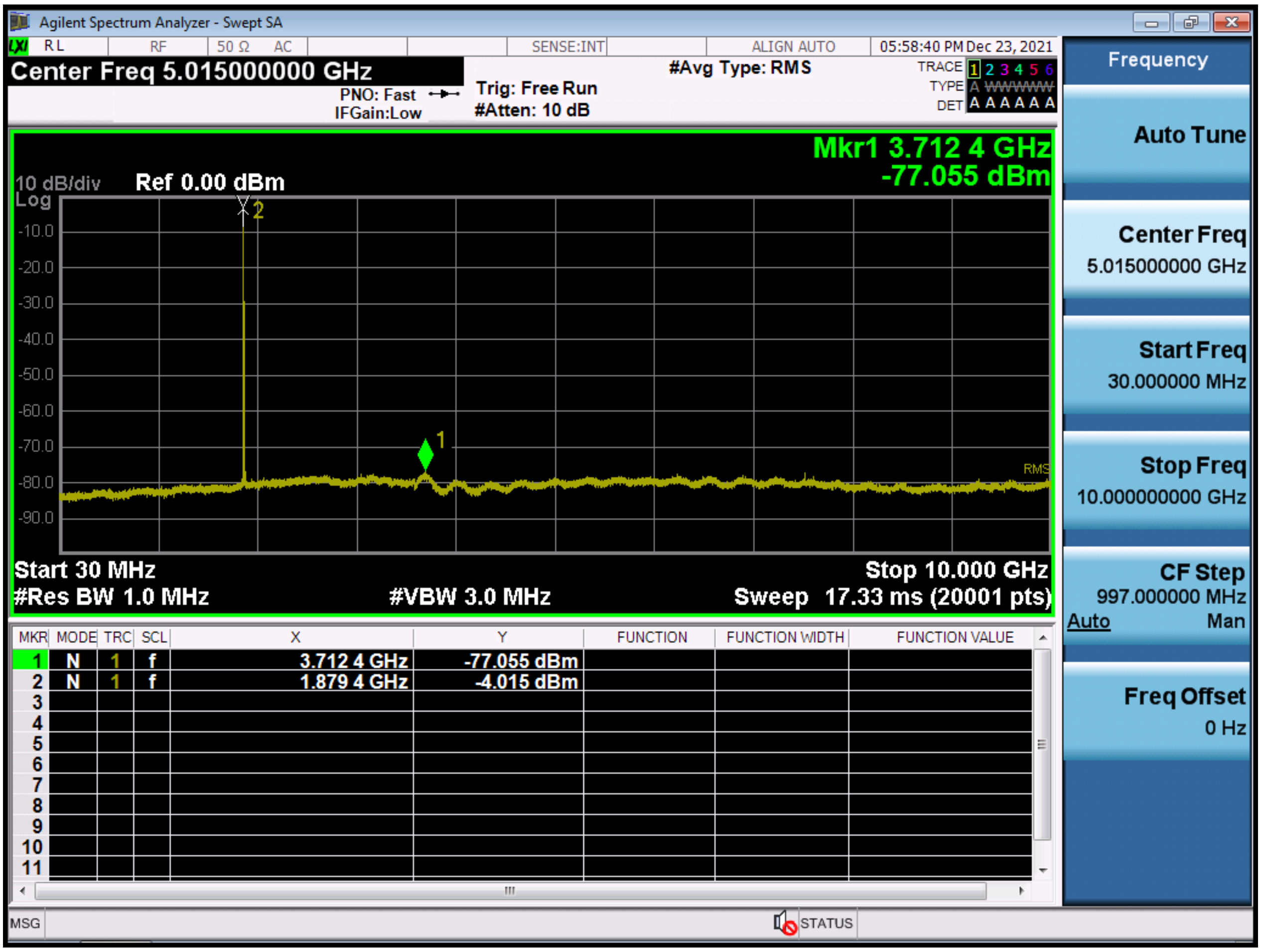
BW1.4 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB



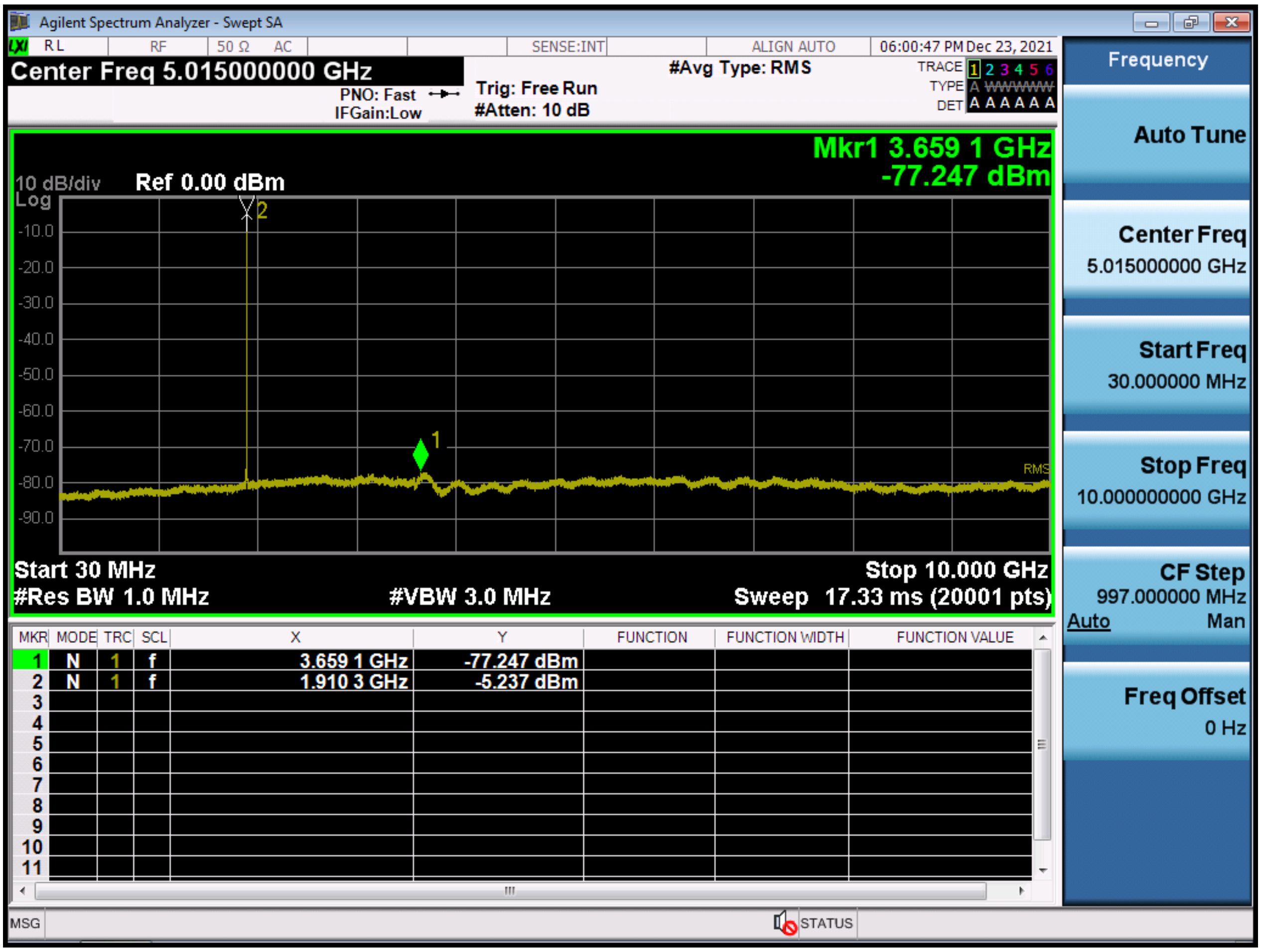
BW3 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



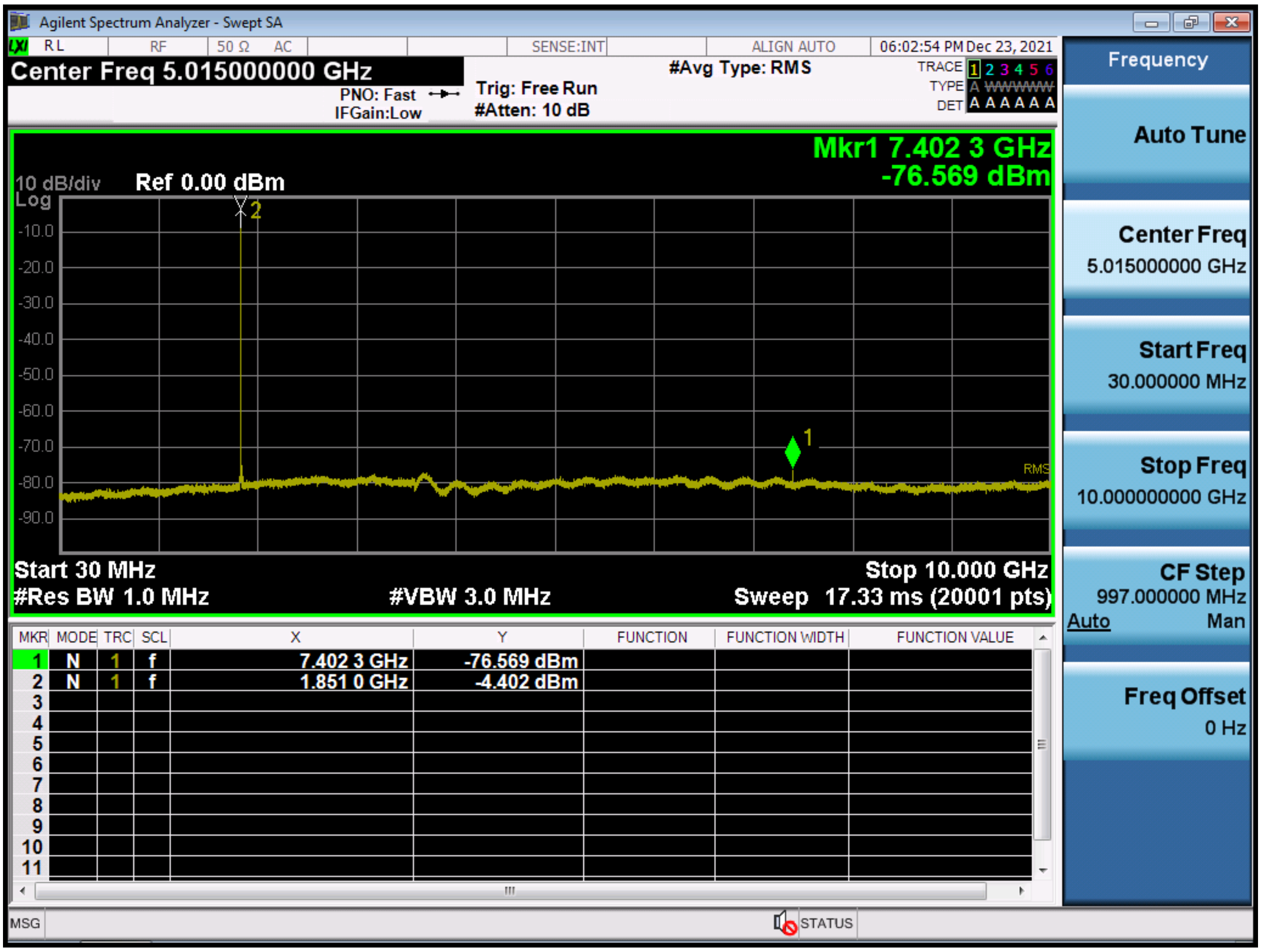
BW3 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



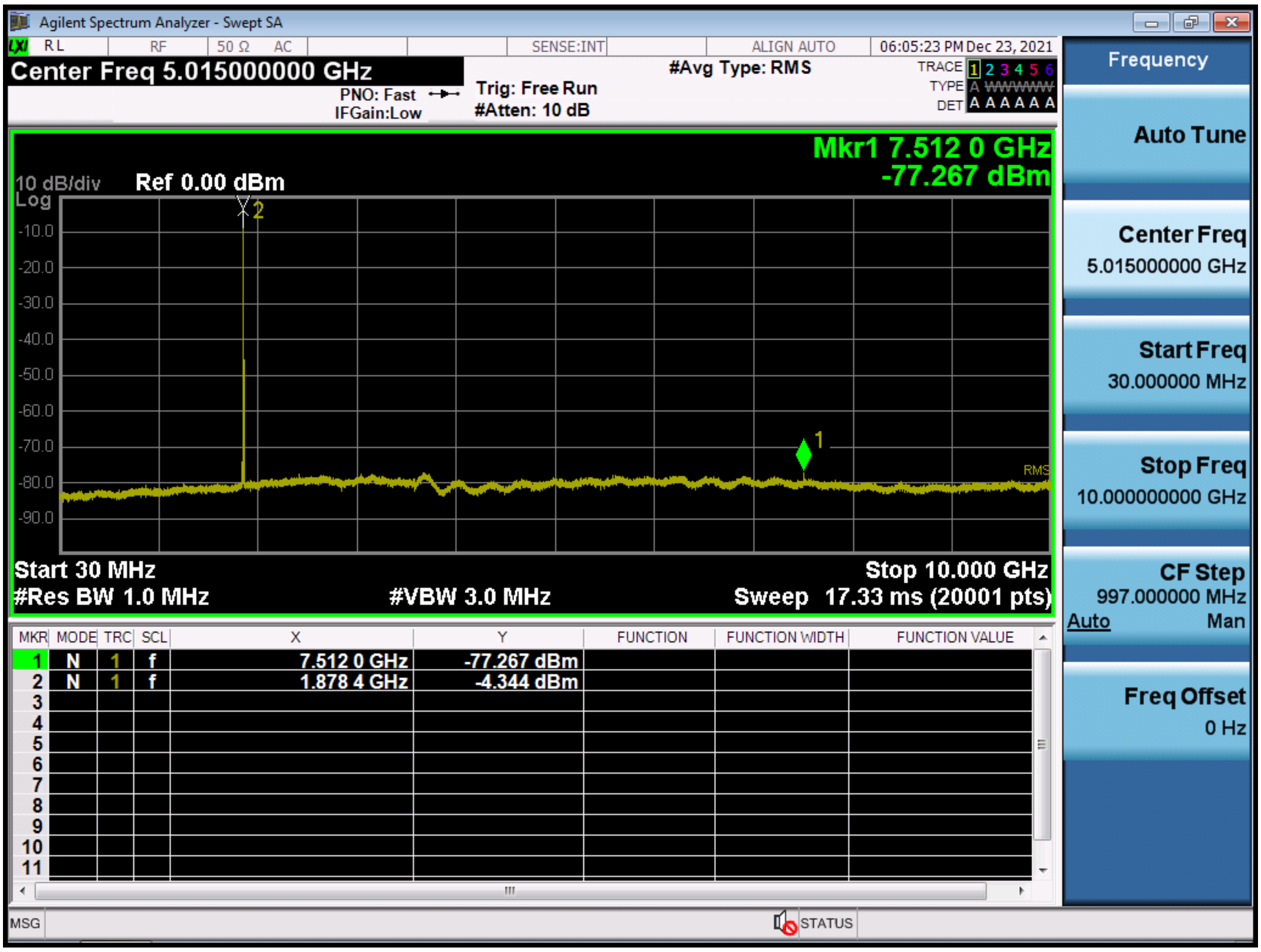
BW3 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB



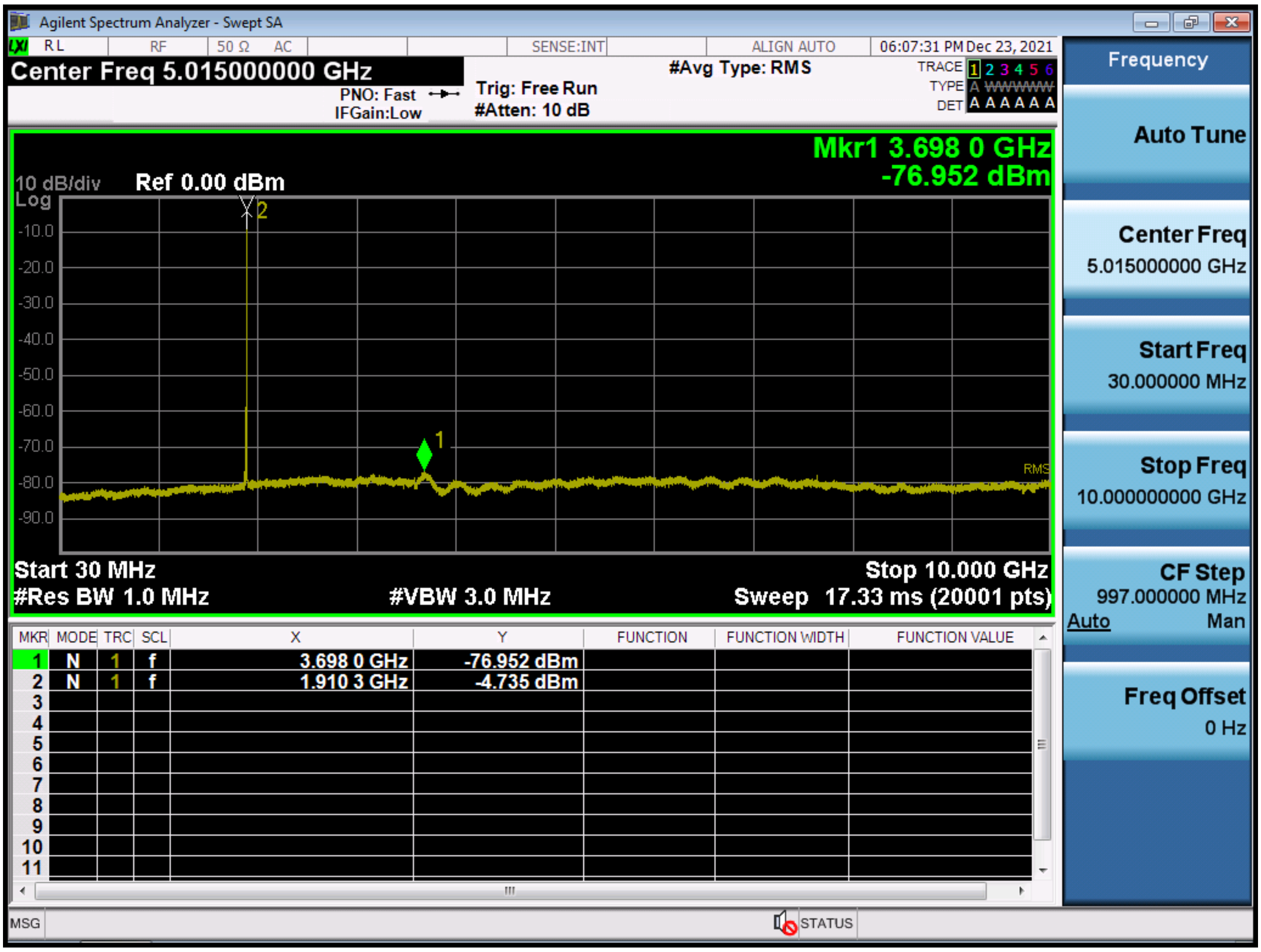
BW5 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



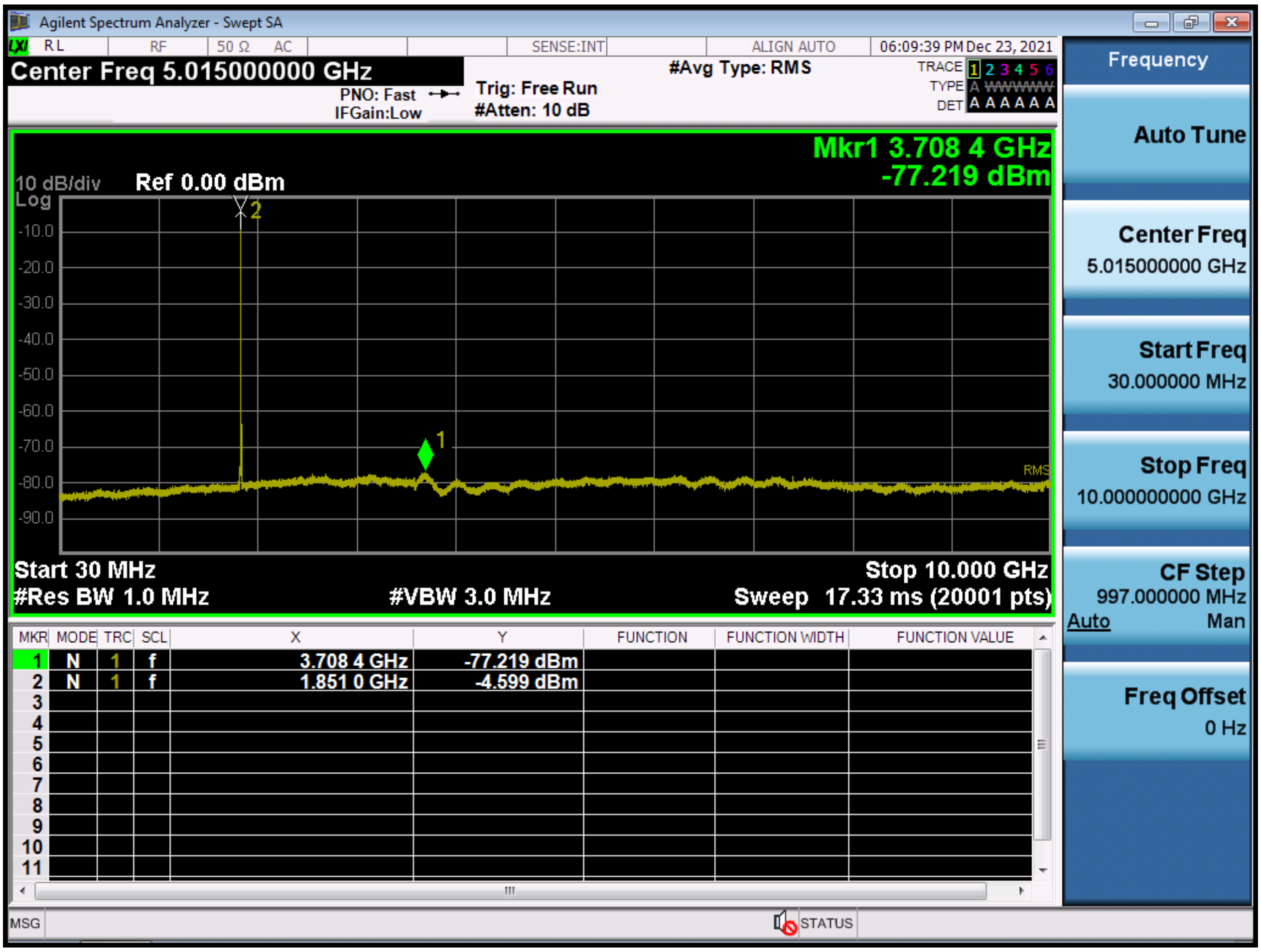
BW5 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



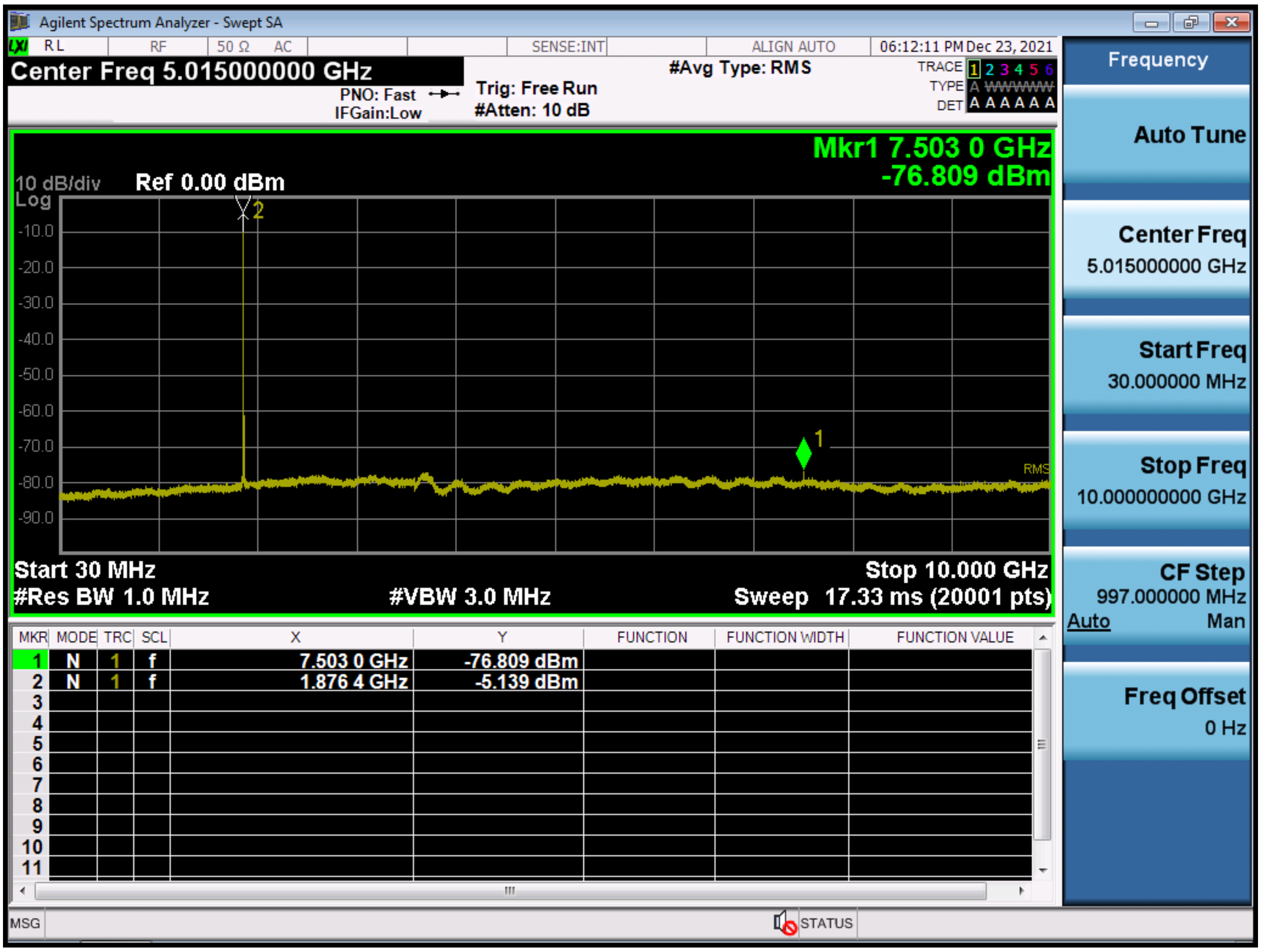
BW5 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB



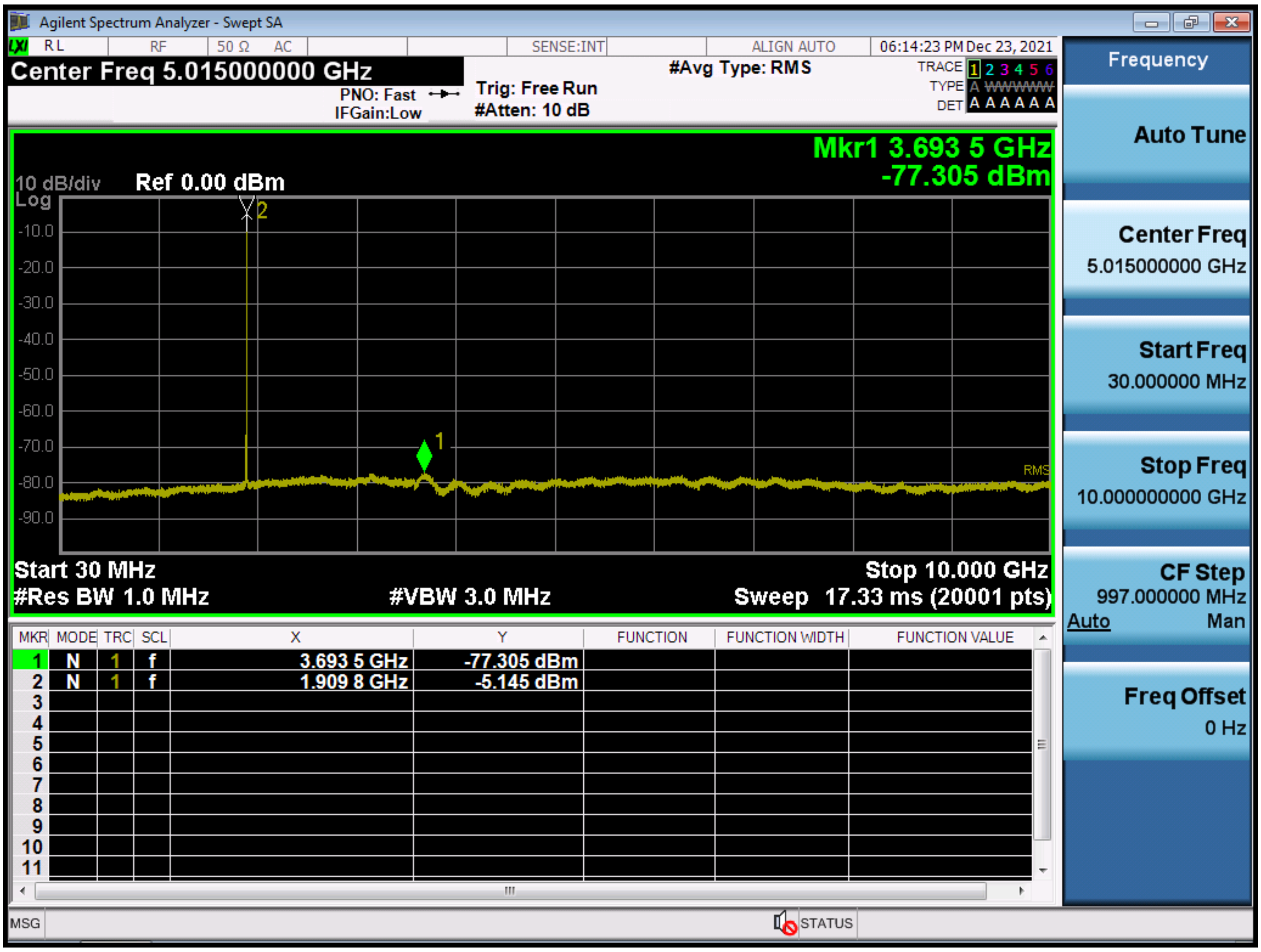
BW10 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



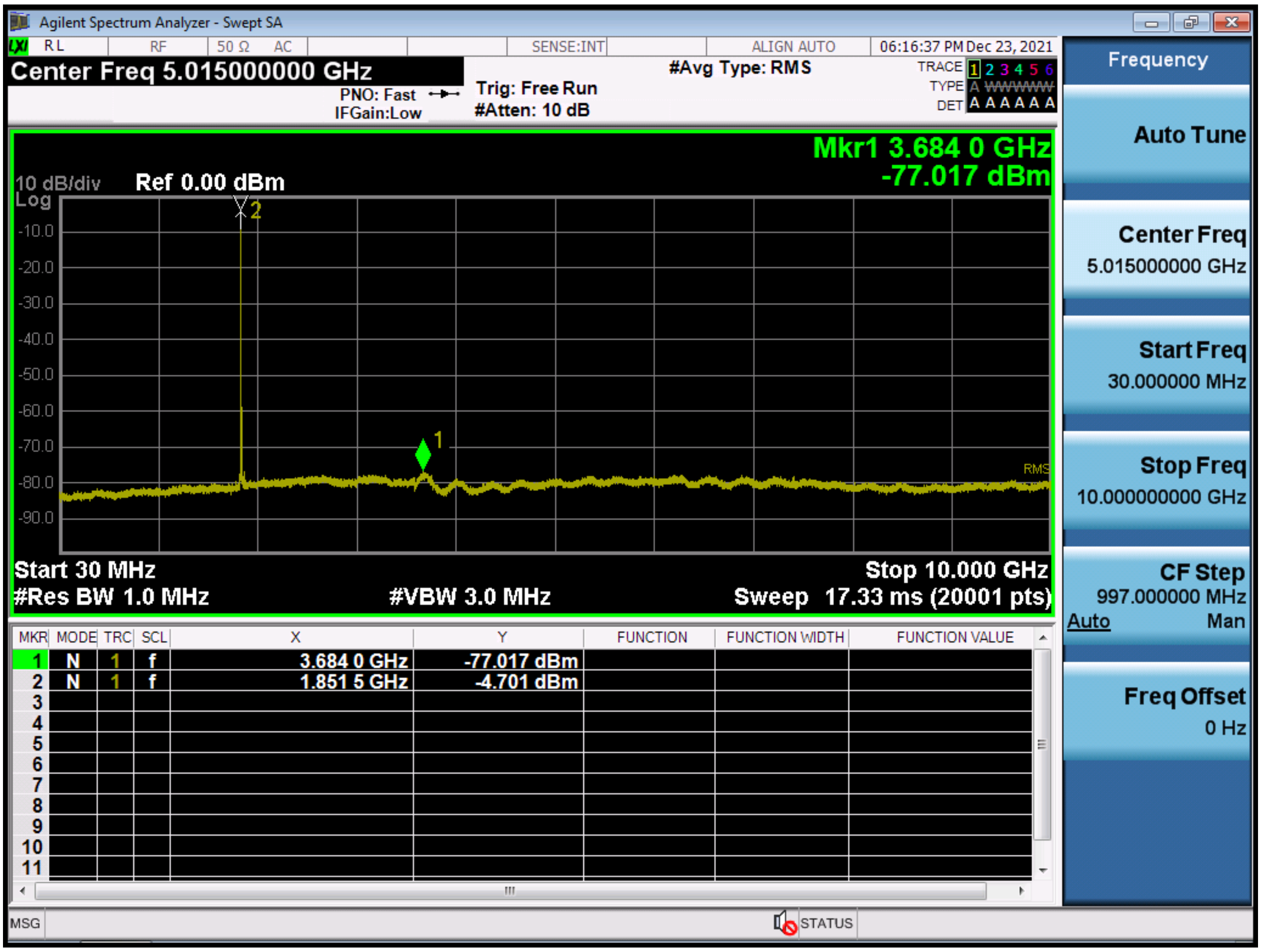
BW10 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



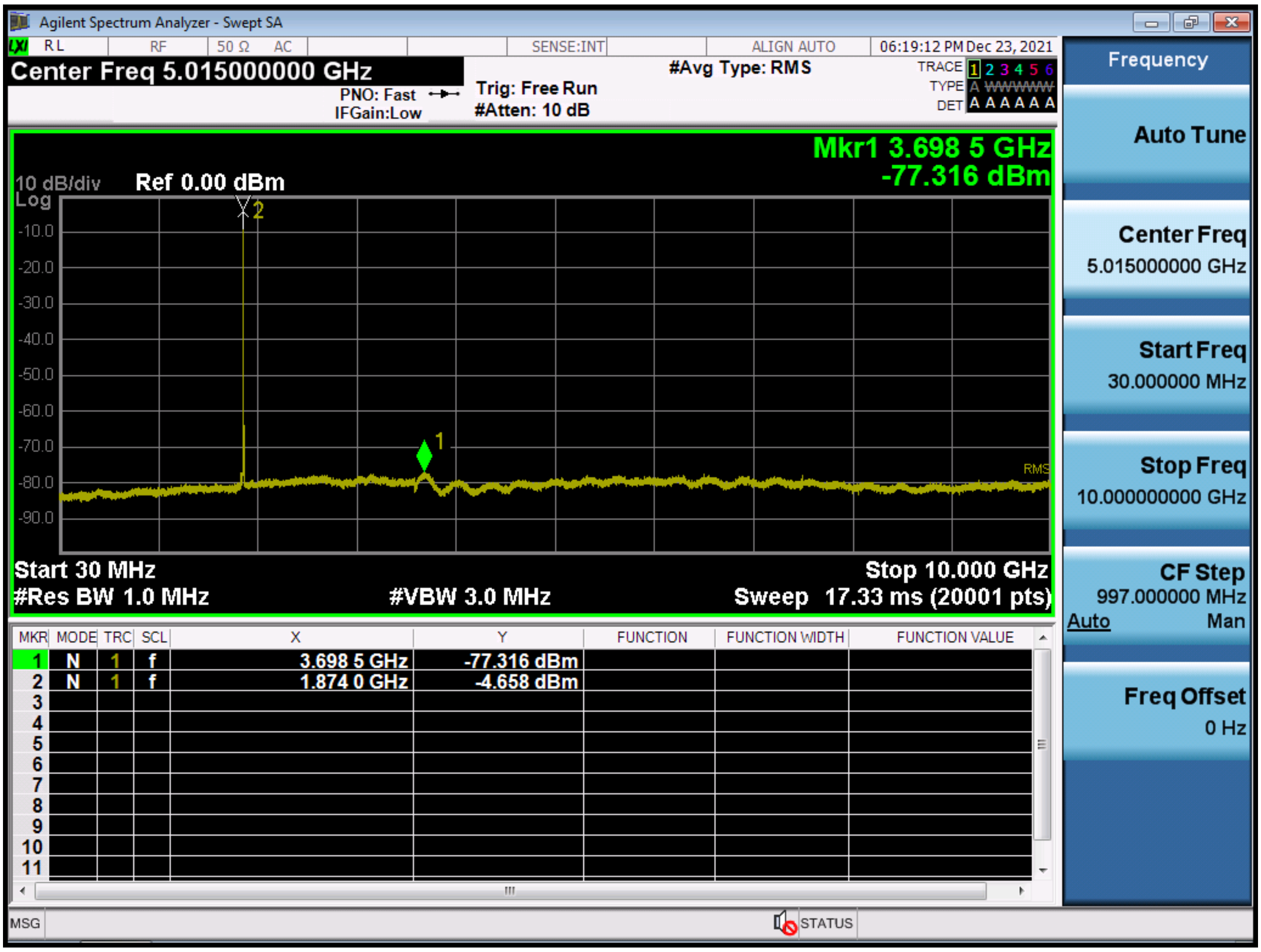
BW10 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB



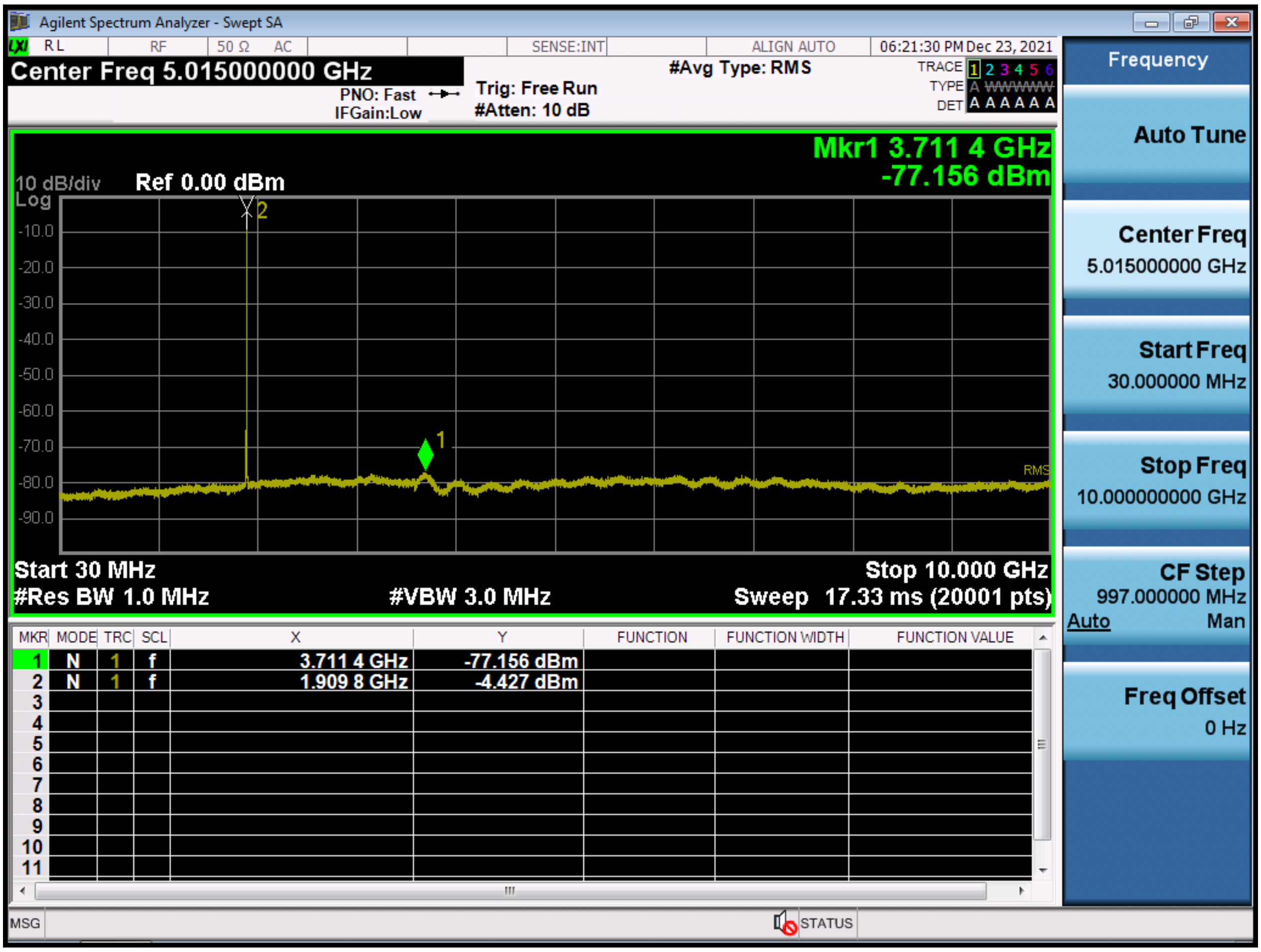
BW15 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



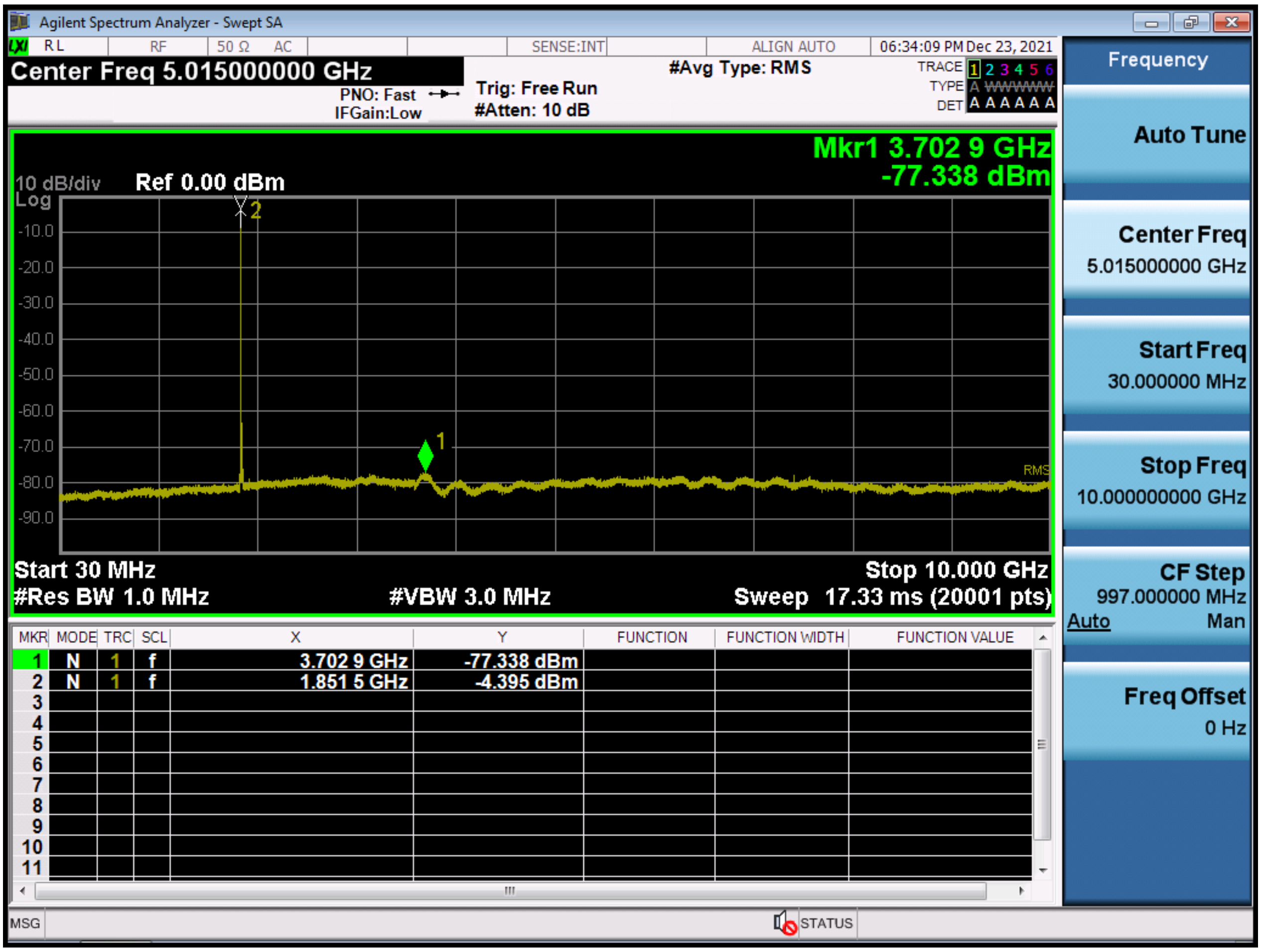
BW15 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



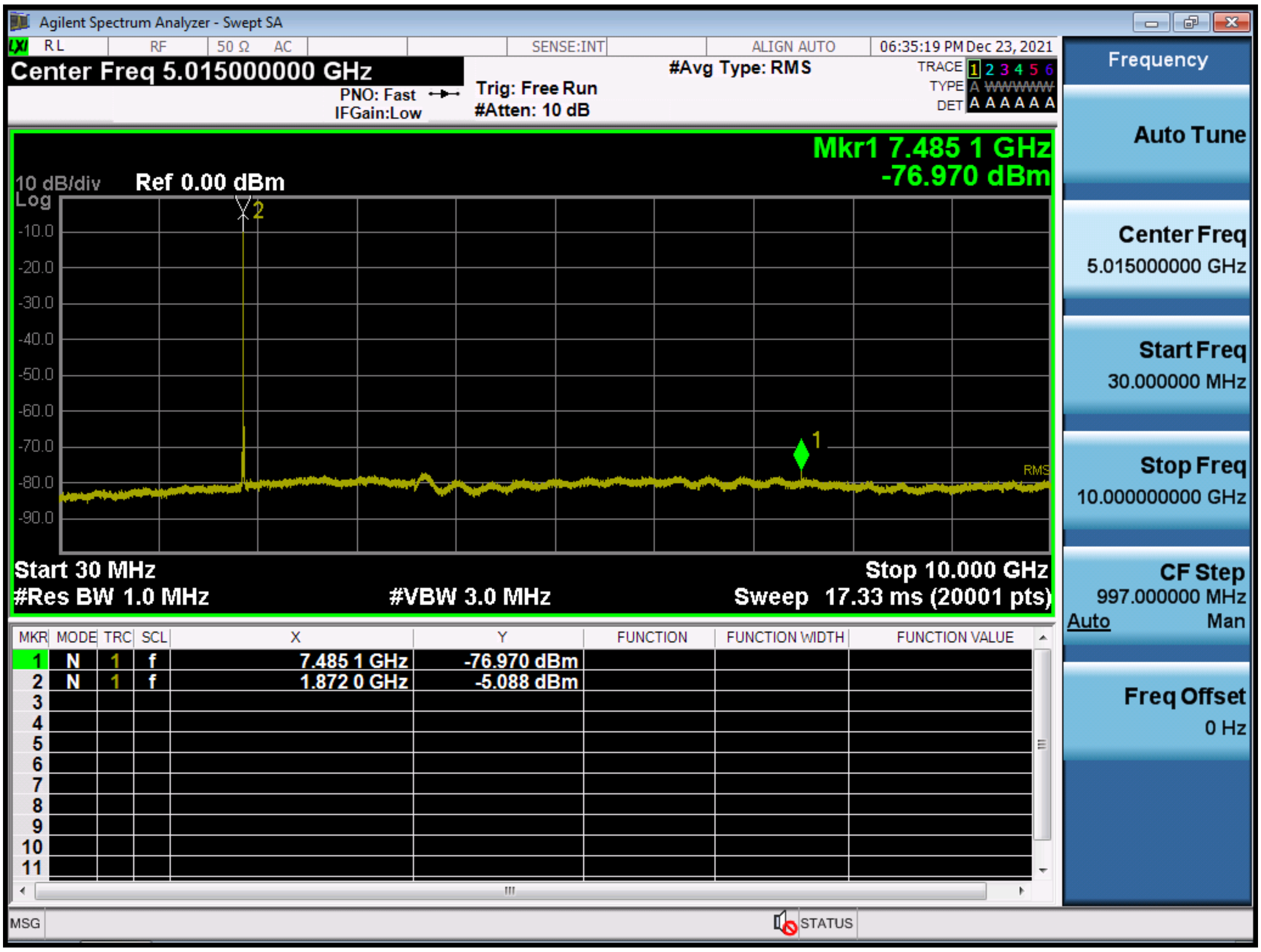
BW15 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB



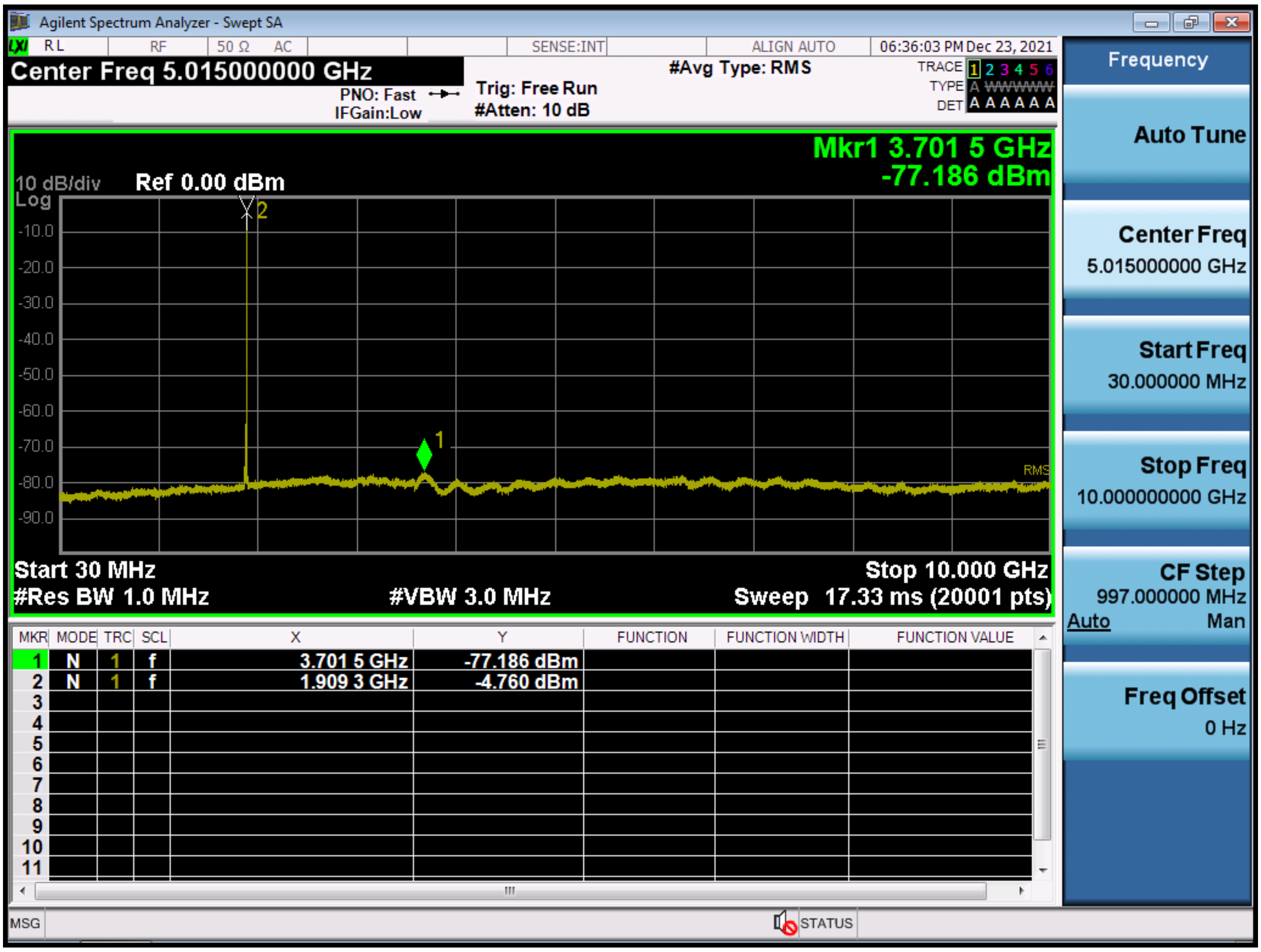
BW20 M_CSE(30 M-10 G)_Lowest Channel_QPSK_1RB



BW20 M_CSE(30 M-10 G)_Middle Channel_QPSK_1RB



BW20 M_CSE(30 M-10 G)_Highest Channel_QPSK_1RB

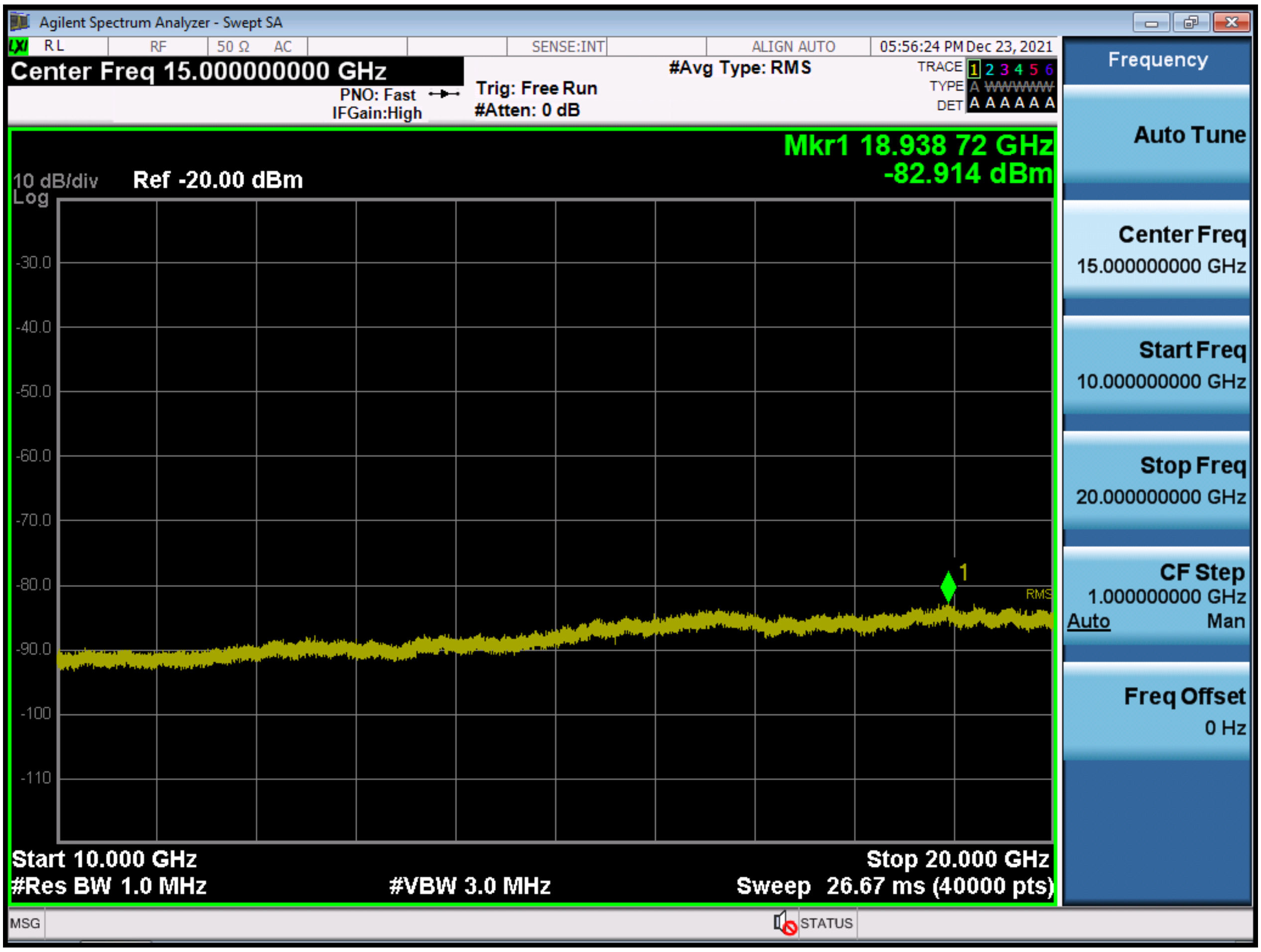


BW1.4 M_CSE(10 G-26.5 G)_Lowest Channel_QPSK_1RB

BW1.4 M_CSE(10 G-26.5 G)_Middle Channel_QPSK_1RB

BW1.4 M_CSE(10 G-26.5 G)_Highest Channel_QPSK_1RB

BW3 M_CSE(10 G-26.5 G)_Lowest Channel_QPSK_1RB



BW3 M_CSE(10 G-26.5 G)_Middle Channel_QPSK_1RB