74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
TEL: +82-31-645-6300 FAX: +82-31-645-6401

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 06, 2021

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

Report No.: HCT-RF-2101-FC002

FCC ID:	**A3LSMA022M**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-A022M/DS
Additional Model(s):	SM-A022M, SM-M022M/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	1M10G7D	QPSK	0.159	22.01
		1M09W7D	16QAM	0.134	21.27
		1M10W7D	64QAM	0.105	20.22
LTE – Band2 (3)	1851.5 - 1908.5	2M70G7D	QPSK	0.162	22.09
		2M70W7D	16QAM	0.136	21.35
		2M69W7D	64QAM	0.106	20.25
LTE – Band2 (5)	1852.5 - 1907.5	4M51G7D	QPSK	0.158	21.97
		4M50W7D	16QAM	0.133	21.23
		4M51W7D	64QAM	0.104	20.15
LTE – Band2 (10)	1855.0 - 1905.0	8M99G7D	QPSK	0.165	22.17
		8M99W7D	16QAM	0.139	21.44
		9M00W7D	64QAM	0.108	20.32
LTE – Band2 (15)	1857.5 - 1902.5	13M5G7D	QPSK	0.168	22.25
		13M5W7D	16QAM	0.142	21.51
		13M5W7D	64QAM	0.110	20.42
LTE – Band2 (20)	1860.0 - 1900.0	18M0G7D	QPSK	0.162	22.10
		17M9W7D	16QAM	0.137	21.37
		18M0W7D	64QAM	0.106	20.25

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-2101-FC002	January 06, 2021	- 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 26
8.3 PEAK-TO-AVERAGE RATIO 27
8.4 OCCUPIED BANDWIDTH 28
8.5 CONDUCTED SPURIOUS EMISSIONS 29
8.6 BAND EDGE 29
8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE 30
9. TEST PLOTS 48
10. APPENDIX A_ TEST SETUP PHOTO 157

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:	A3LSMA022M
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-A022M/DS
Additional Model(s):	SM-A022M, SM-M022M/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 08, 2020 ~ December 31, 2020
Serial number:	Radiated: R38NB03QV5M Conducted: R38NB03QV2D

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

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

It also supports IEEE 802.11 b/g/n (HT20), Bluetooth, BT LE.

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;

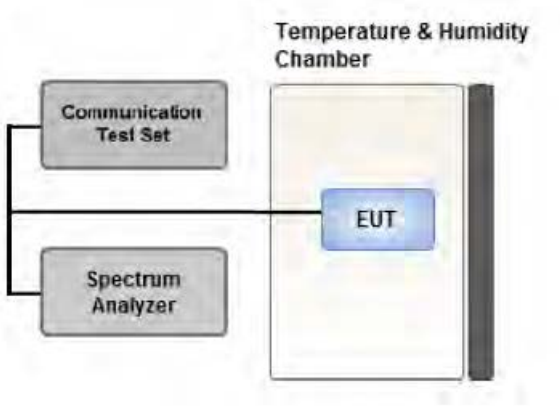
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

   If the fundamental 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)

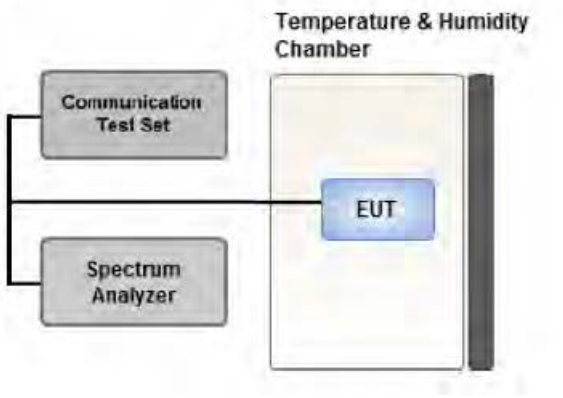
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

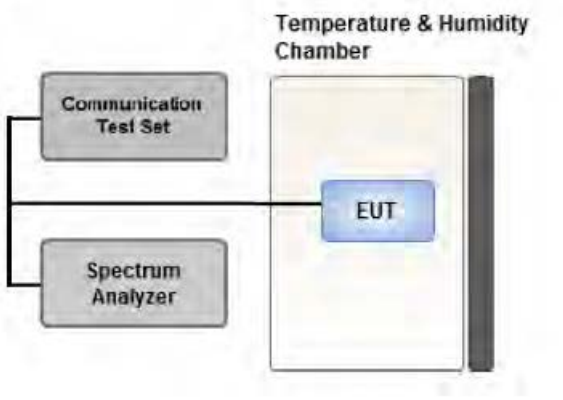
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

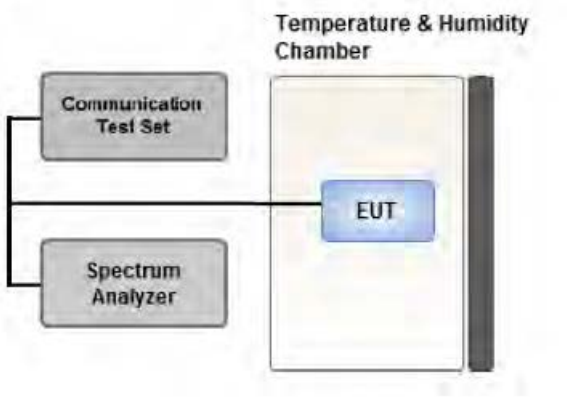
Test Overview

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

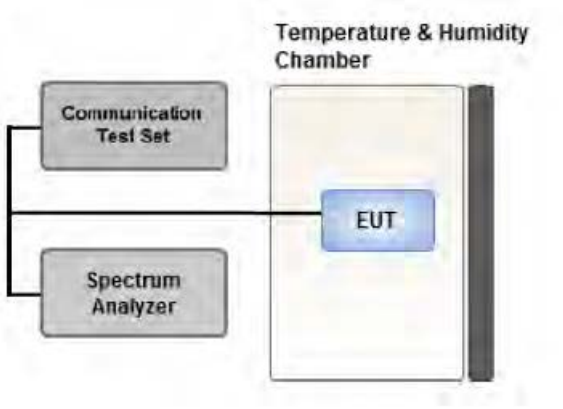
Test Notes

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.

(In the case of radiated spurious emissions, only the B.W result that confirmed the maximum radiated power was reported.)

- 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.
- SM-A022M/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-A022M/DS)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM	1	0	X
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

- 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.
- All modes of operation were investigated and the worst case configuration results are reported.
- SM-A022M/DS & additional models were tested and the worst case results are reported.
  (Worst case : SM-A022M/DS)

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
Wainwright Instruments	WHKX10-900-1000-15000-40SS/ High Pass Filter	5	07/13/2020	Annual	07/13/2021
Wainwright Instruments	WHKX10-2700-3000-18000-40SS/ High Pass Filter	145	09/03/2020	Annual	09/03/2021
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/27/2020	Annual	04/27/2021
CERNEX	LOW NOISE AMP (100MHz ~ 18GHz)	26822	06/04/2020	Annual	06/04/2021
CERNEX	CBL18265035 / Power Amplifier	22966	12/04/2020	Annual	12/04/2021
CERNEX	CBL26405040 / Power Amplifier	25956	03/23/2020	Annual	03/23/2021
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP / Precision Dipole Antenna	01273	05/30/2020	Biennial	05/30/2022
Schwarzbeck	UHAP / Precision Dipole Antenna	01274	05/30/2020	Biennial	05/30/2022
ESPEC	SU-642 / Chamber	93008124	03/18/2020	Annual	03/18/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	02289	05/08/2020	Biennial	05/08/2022
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1299	05/10/2019	Biennial	05/10/2021
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)	101436	03/16/2020	Annual	03/16/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Rohde & Schwarz	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	05/18/2020	Biennial	05/18/2022
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).

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, §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 = 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)	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	-18.03	13.84	10.10	1.93	H	< 2.00	0.159	22.01
		16-QAM	-18.77	13.10	10.10	1.93	H		0.134	21.27
		64-QAM	-19.82	12.05	10.10	1.93	H		0.105	20.22
1880.0		QPSK	-18.39	13.69	9.98	1.97	H		0.148	21.70
		16-QAM	-19.13	12.95	9.98	1.97	H		0.125	20.96
		64-QAM	-20.16	11.92	9.98	1.97	H		0.098	19.93
1909.3		QPSK	-20.30	12.27	9.88	1.98	H		0.104	20.17
		16-QAM	-21.06	11.51	9.88	1.98	H		0.087	19.41
		64-QAM	-22.11	10.46	9.88	1.98	H		0.068	18.36

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	-17.95	13.92	10.10	1.93	H	< 2.00	0.162	22.09
		16-QAM	-18.69	13.18	10.10	1.93	H		0.136	21.35
		64-QAM	-19.79	12.08	10.10	1.93	H		0.106	20.25
1880.0		QPSK	-18.21	13.87	9.98	1.97	H		0.154	21.88
		16-QAM	-19.05	13.03	9.98	1.97	H		0.127	21.04
		64-QAM	-20.04	12.04	9.98	1.97	H		0.101	20.05
1908.5		QPSK	-20.11	12.46	9.88	1.98	H		0.109	20.36
		16-QAM	-20.85	11.72	9.88	1.98	H		0.092	19.62
		64-QAM	-21.90	10.67	9.88	1.98	H		0.072	18.57

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	-18.07	13.80	10.10	1.93	H	< 2.00	0.158	21.97
		16-QAM	-18.81	13.06	10.10	1.93	H		0.133	21.23
		64-QAM	-19.89	11.98	10.10	1.93	H		0.104	20.15
1880.0		QPSK	-18.22	13.86	9.98	1.97	H		0.154	21.87
		16-QAM	-18.97	13.11	9.98	1.97	H		0.129	21.12
		64-QAM	-20.03	12.05	9.98	1.97	H		0.101	20.06
1907.5		QPSK	-20.48	12.09	9.88	1.98	H		0.100	19.99
		16-QAM	-20.95	11.62	9.88	1.98	H		0.089	19.52
		64-QAM	-21.95	10.62	9.88	1.98	H		0.071	18.52

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	-17.96	14.03	10.08	1.94	H	< 2.00	0.165	22.17
		16-QAM	-18.69	13.30	10.08	1.94	H		0.139	21.44
		64-QAM	-19.81	12.18	10.08	1.94	H		0.108	20.32
1880.0		QPSK	-18.10	13.98	9.98	1.97	H		0.158	21.99
		16-QAM	-18.83	13.25	9.98	1.97	H		0.134	21.26
		64-QAM	-19.94	12.14	9.98	1.97	H		0.104	20.15
1905.0		QPSK	-19.93	12.65	9.89	1.98	H		0.114	20.57
		16-QAM	-20.64	11.94	9.89	1.98	H		0.097	19.86
		64-QAM	-21.77	10.81	9.89	1.98	H		0.075	18.73

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	-17.97	14.13	10.06	1.94	H	< 2.00	0.168	22.25
		16-QAM	-18.71	13.39	10.06	1.94	H		0.142	21.51
		64-QAM	-19.80	12.30	10.06	1.94	H		0.110	20.42
1880.0		QPSK	-18.48	13.60	9.98	1.97	H		0.145	21.61
		16-QAM	-19.19	12.89	9.98	1.97	H		0.123	20.90
		64-QAM	-20.05	12.03	9.98	1.97	H		0.101	20.04
1902.5		QPSK	-19.81	12.79	9.90	1.97	H		0.118	20.72
		16-QAM	-20.51	12.09	9.90	1.97	H		0.101	20.02
		64-QAM	-21.64	10.96	9.90	1.97	H		0.077	18.89

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	-18.12	13.98	10.06	1.94	H	< 2.00	0.162	22.10
		16-QAM	-18.85	13.25	10.06	1.94	H		0.137	21.37
		64-QAM	-19.97	12.13	10.06	1.94	H		0.106	20.25
1880.0		QPSK	-18.65	13.43	9.98	1.97	H		0.139	21.44
		16-QAM	-19.38	12.70	9.98	1.97	H		0.118	20.71
		64-QAM	-20.50	11.58	9.98	1.97	H		0.091	19.59
1900.0		QPSK	-19.53	13.07	9.90	1.97	H		0.126	21.00
		16-QAM	-20.25	12.35	9.90	1.97	H		0.107	20.28
		64-QAM	-21.35	11.25	9.90	1.97	H		0.083	19.18

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY: 1857.5 MHz

▣ MEASURED OUTPUT POWER: 22.21 dBm = 0.166 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 35.21 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18675 (1857.5)	3 715.00	-60.91	11.70	-63.94	2.82	V	-55.06	77.27
	5 572.50	-60.16	12.06	-57.07	3.51	H	-48.52	70.72
	7 430.00	-64.28	11.32	-51.89	4.12	V	-44.69	66.89
18900 (1880.0)	3 760.00	-59.58	11.64	-62.57	2.85	V	-53.78	75.99
	5 640.00	-59.93	12.00	-56.71	3.54	H	-48.25	70.46
	7 520.00	-63.27	11.54	-50.92	4.12	H	-43.50	65.71
19125 (1902.5)	3 805.00	-60.43	11.38	-62.71	2.86	V	-54.19	76.40
	5 707.50	-60.32	11.78	-56.51	3.56	H	-48.29	70.50
	7 610.00	-63.45	11.60	-51.99	4.14	H	-44.53	66.74

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	5.74
			16-QAM	6	0	6.51
			64-QAM	6	0	6.70
	3 MHz		QPSK	15	0	5.84
			16-QAM	15	0	6.49
			64-QAM	15	0	6.69
	5 MHz		QPSK	25	0	5.78
			16-QAM	25	0	6.51
			64-QAM	25	0	6.70
	10 MHz		QPSK	50	0	5.90
			16-QAM	50	0	6.53
			64-QAM	50	0	6.69
	15 MHz		QPSK	75	0	5.84
			16-QAM	75	0	6.49
			64-QAM	75	0	6.72
	20 MHz		QPSK	100	0	5.82
			16-QAM	100	0	6.53
			64-QAM	100	0	6.75

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 67 ~ 84.

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	1.0945
			16-QAM	6	0	1.0923
			64-QAM	6	0	1.0948
	3 MHz		QPSK	15	0	2.6984
			16-QAM	15	0	2.6956
			64-QAM	15	0	2.6944
	5 MHz		QPSK	25	0	4.5124
			16-QAM	25	0	4.5010
			64-QAM	25	0	4.5088
	10 MHz		QPSK	50	0	8.9857
			16-QAM	50	0	8.9914
			64-QAM	50	0	8.9973
	15 MHz		QPSK	75	0	13.452
			16-QAM	75	0	13.471
			64-QAM	75	0	13.457
	20 MHz		QPSK	100	0	18.013
			16-QAM	100	0	17.931
			64-QAM	100	0	17.963

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 49 ~ 66.

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	5.5514	28.591	-75.542	-46.951	-13.00
		1880.0	5.6396	28.591	-75.745	-47.154	
		1909.3	5.7298	28.591	-75.753	-47.162	
	3	1851.5	5.5514	28.591	-76.689	-48.098	
		1880.0	5.6371	28.591	-75.958	-47.367	
		1908.5	5.7298	28.591	-76.967	-48.376	
	5	1852.5	5.5514	28.591	-76.749	-48.158	
		1880.0	5.6341	28.591	-76.510	-47.919	
		1907.5	3.7005	27.976	-77.168	-49.192	
	10	1855.0	3.7015	27.976	-76.902	-48.926	
		1880.0	5.6277	28.591	-76.526	-47.935	
		1905.0	5.7289	28.591	-75.230	-46.639	
	15	1857.5	5.5529	28.591	-77.116	-48.525	
		1880.0	5.6207	28.591	-76.093	-47.502	
		1902.5	5.7284	28.591	-76.007	-47.416	
	20	1860.0	5.5539	28.591	-76.642	-48.051	
		1880.0	5.6142	28.591	-75.047	-46.456	
		1900.0	5.7274	28.591	-76.538	-47.947	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 121 ~ 156.
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 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 85 ~ 120.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE B2

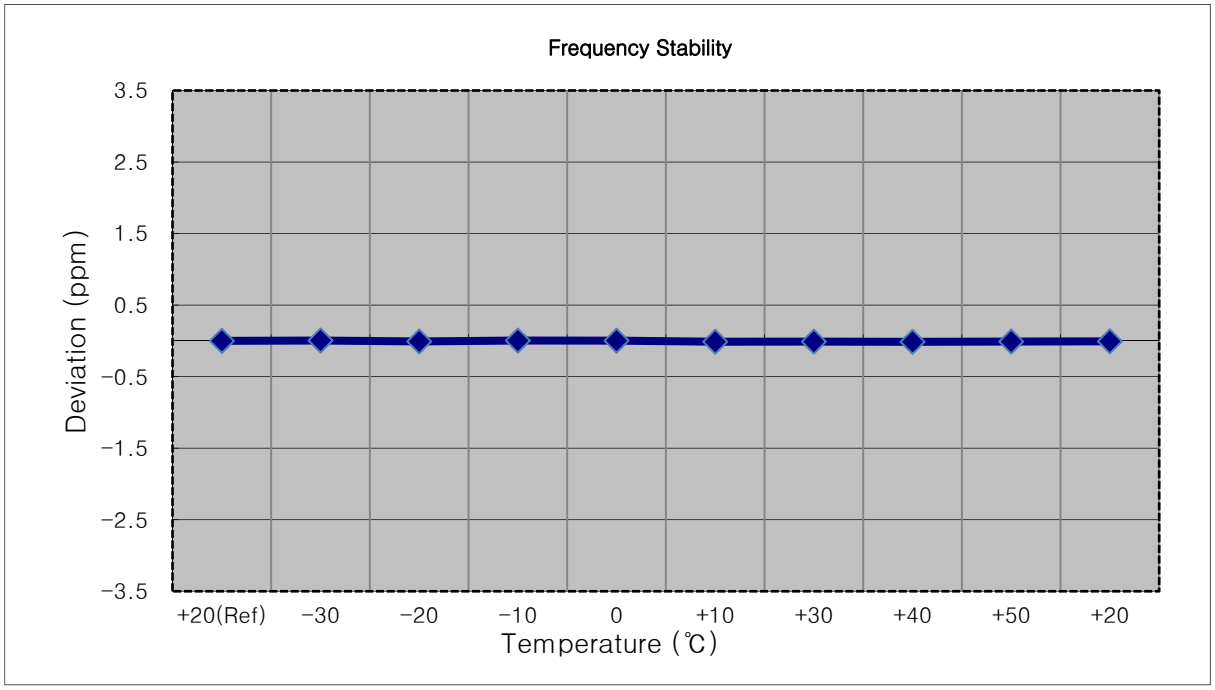
▣ OPERATING FREQUENCY: 1850,700,000 Hz

▣ CHANNEL: 18607 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1850 699 977	0.0	0.000 000	0.000
100%		-30	1850 699 987	9.2	0.000 000	0.005
100%		-20	1850 699 963	-14.6	-0.000 001	-0.008
100%		-10	1850 699 986	8.4	0.000 000	0.005
100%		0	1850 699 982	4.9	0.000 000	0.003
100%		+10	1850 699 955	-22.3	-0.000 001	-0.012
100%		+30	1850 699 958	-19.8	-0.000 001	-0.011
100%		+40	1850 699 953	-24.3	-0.000 001	-0.013
100%		+50	1850 699 959	-18.6	-0.000 001	-0.010
Batt. Endpoint	3.370	+20	1850 699 966	-11.8	-0.000 001	-0.006



▣ MODE: LTE B2

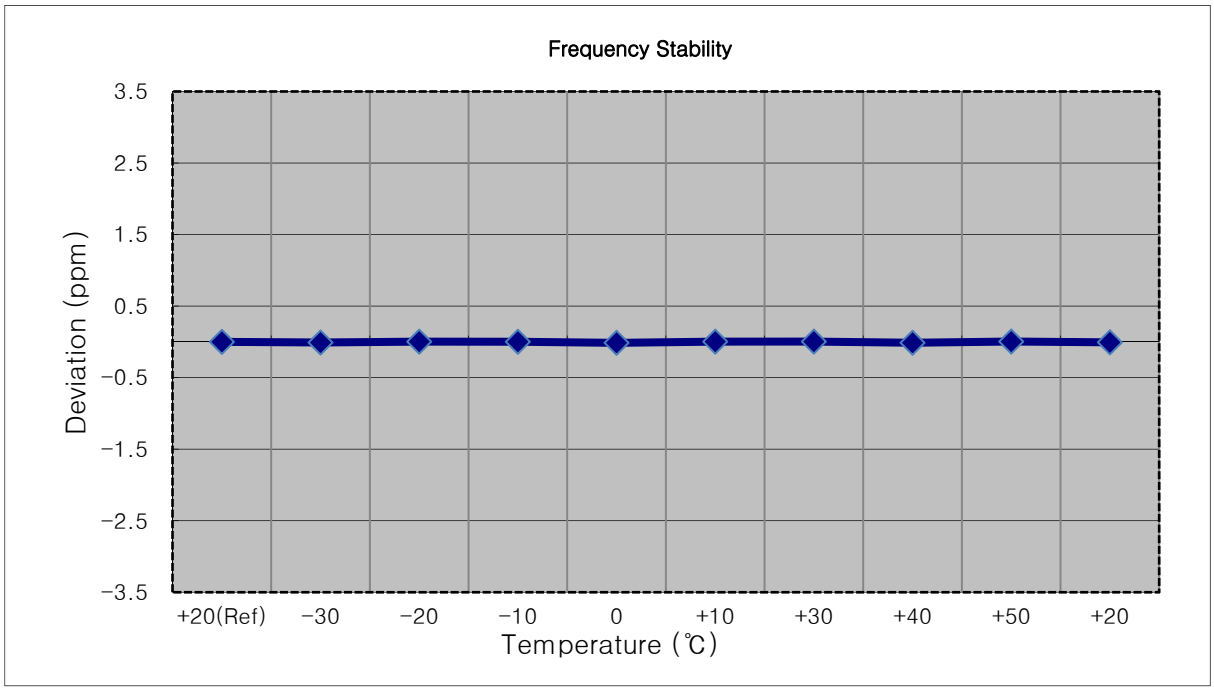
▣ OPERATING FREQUENCY: 1851,500,000 Hz

▣ CHANNEL: 18615 (3 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1851 500 006	0.0	0.000 000	0.000
100%		-30	1851 499 990	-16.6	-0.000 001	-0.009
100%		-20	1851 500 011	4.8	0.000 000	0.003
100%		-10	1851 500 010	3.2	0.000 000	0.002
100%		0	1851 499 981	-25.4	-0.000 001	-0.014
100%		+10	1851 500 012	5.6	0.000 000	0.003
100%		+30	1851 500 014	7.2	0.000 000	0.004
100%		+40	1851 499 984	-22.9	-0.000 001	-0.012
100%		+50	1851 500 015	8.8	0.000 000	0.005
Batt. Endpoint	3.370	+20	1851 499 993	-13.0	-0.000 001	-0.007



▣ MODE: LTE B2

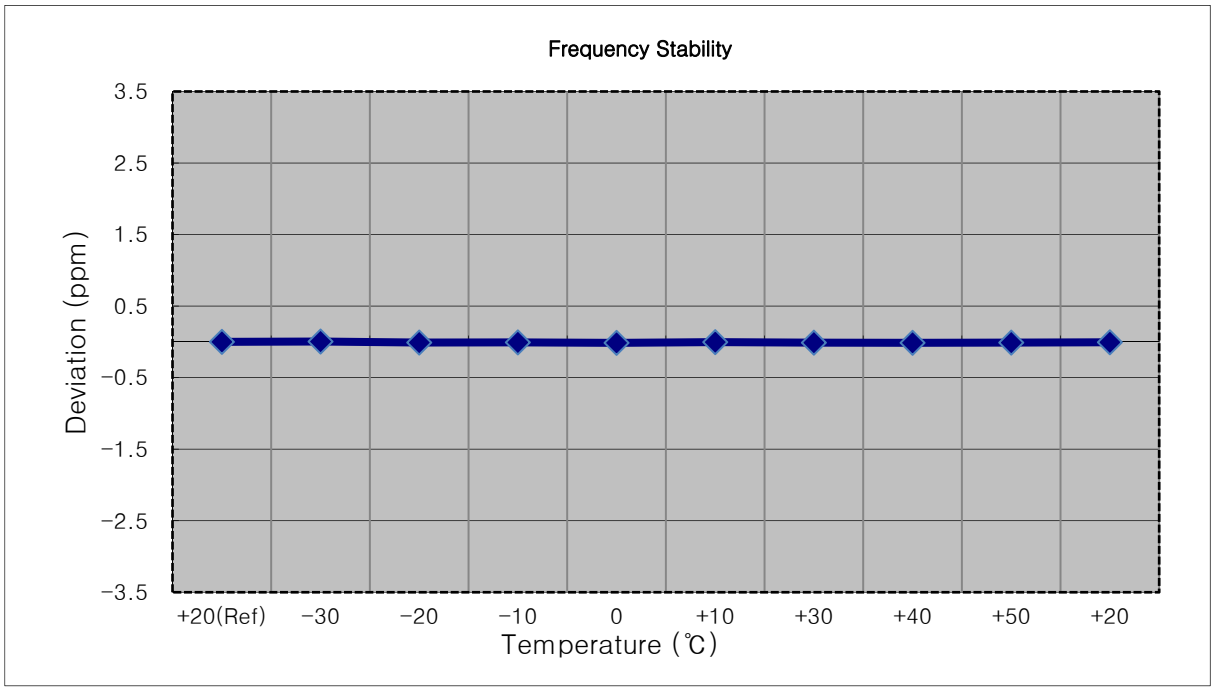
▣ OPERATING FREQUENCY: 1852,500,000 Hz

▣ CHANNEL: 18625 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1852 499 986	0.0	0.000 000	0.000
100%		-30	1852 499 994	8.2	0.000 000	0.004
100%		-20	1852 499 968	-17.5	-0.000 001	-0.009
100%		-10	1852 499 972	-14.1	-0.000 001	-0.008
100%		0	1852 499 960	-26.2	-0.000 001	-0.014
100%		+10	1852 499 978	-7.5	0.000 000	-0.004
100%		+30	1852 499 965	-20.6	-0.000 001	-0.011
100%		+40	1852 499 961	-24.4	-0.000 001	-0.013
100%		+50	1852 499 967	-19.2	-0.000 001	-0.010
Batt. Endpoint	3.370	+20	1852 499 974	-11.7	-0.000 001	-0.006



▣ MODE: LTE B2

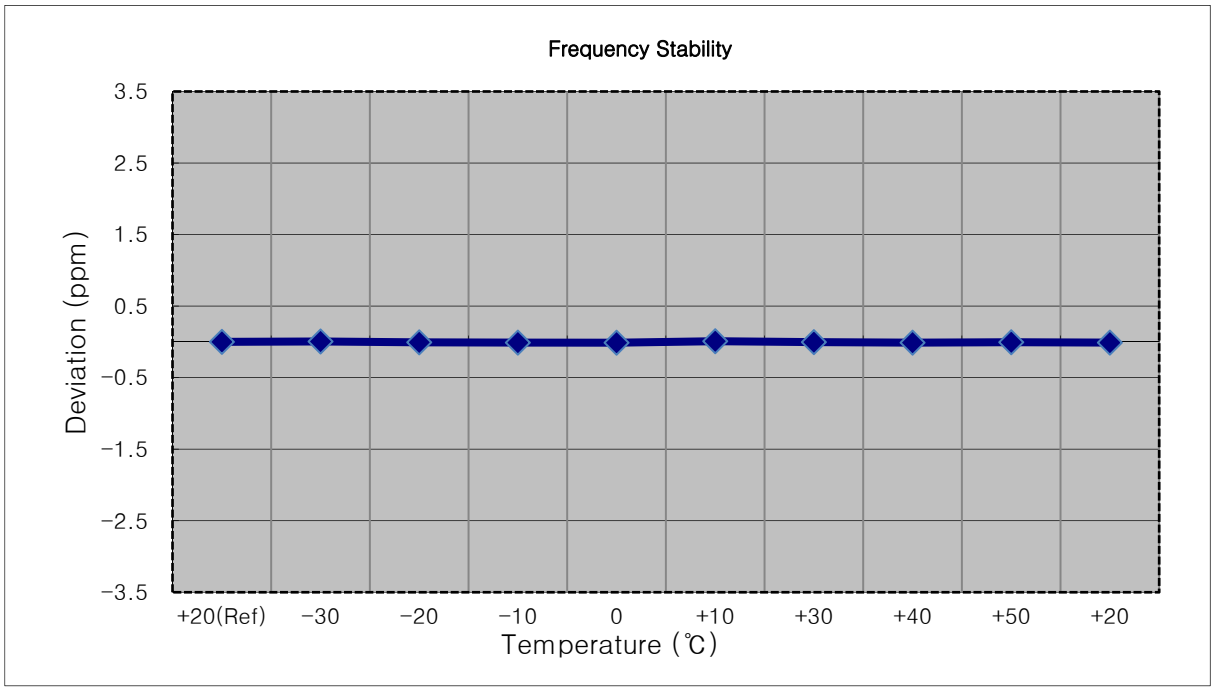
▣ OPERATING FREQUENCY: 1855,000,000 Hz

▣ CHANNEL: 18650 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1854 999 996	0.0	0.000 000	0.000
100%		-30	1855 000 006	9.7	0.000 001	0.005
100%		-20	1854 999 984	-12.3	-0.000 001	-0.007
100%		-10	1854 999 976	-19.4	-0.000 001	-0.010
100%		0	1854 999 974	-21.9	-0.000 001	-0.012
100%		+10	1855 000 013	16.9	0.000 001	0.009
100%		+30	1854 999 989	-7.0	0.000 000	-0.004
100%		+40	1854 999 975	-20.5	-0.000 001	-0.011
100%		+50	1854 999 986	-10.3	-0.000 001	-0.006
Batt. Endpoint	3.370	+20	1854 999 977	-18.8	-0.000 001	-0.010



▣ MODE: LTE B2

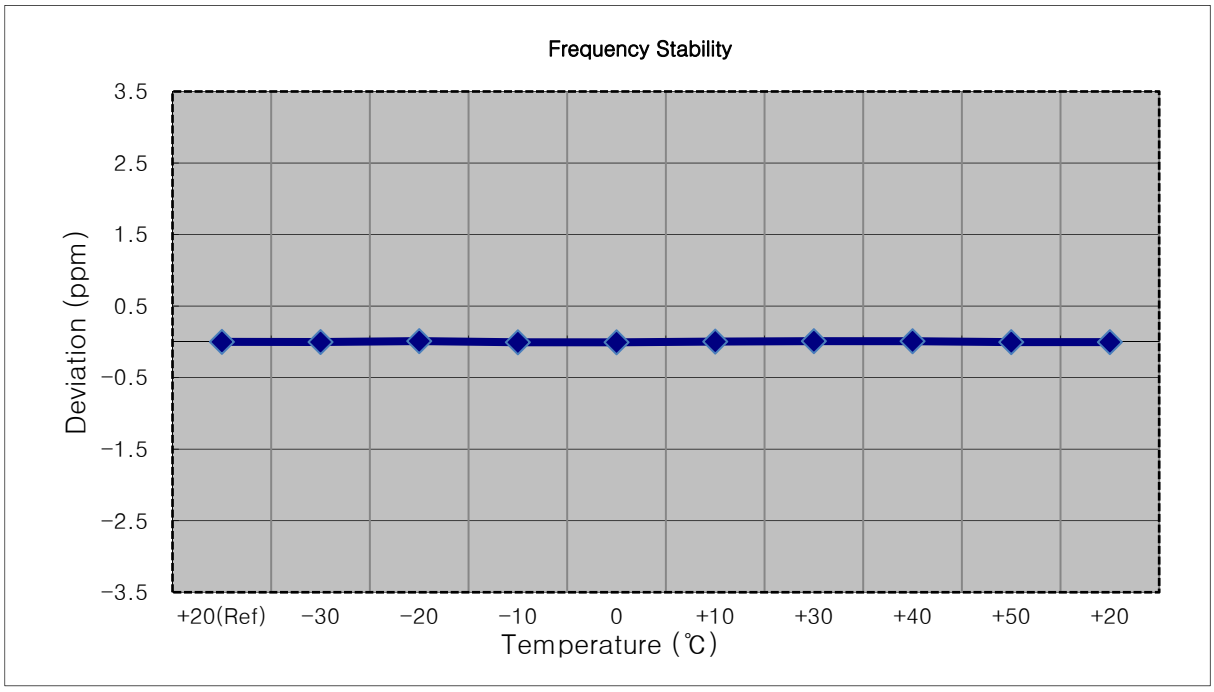
▣ OPERATING FREQUENCY: 1857,500,000 Hz

▣ CHANNEL: 18675 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1857 499 985	0.0	0.000 000	0.000
100%		-30	1857 499 980	-4.9	0.000 000	-0.003
100%		-20	1857 500 005	19.4	0.000 001	0.010
100%		-10	1857 499 975	-10.6	-0.000 001	-0.006
100%		0	1857 499 973	-11.8	-0.000 001	-0.006
100%		+10	1857 499 992	6.6	0.000 000	0.004
100%		+30	1857 500 003	17.6	0.000 001	0.009
100%		+40	1857 500 001	16.0	0.000 001	0.009
100%		+50	1857 499 978	-7.6	0.000 000	-0.004
Batt. Endpoint	3.370	+20	1857 499 978	-7.2	0.000 000	-0.004



▣ MODE: LTE B2

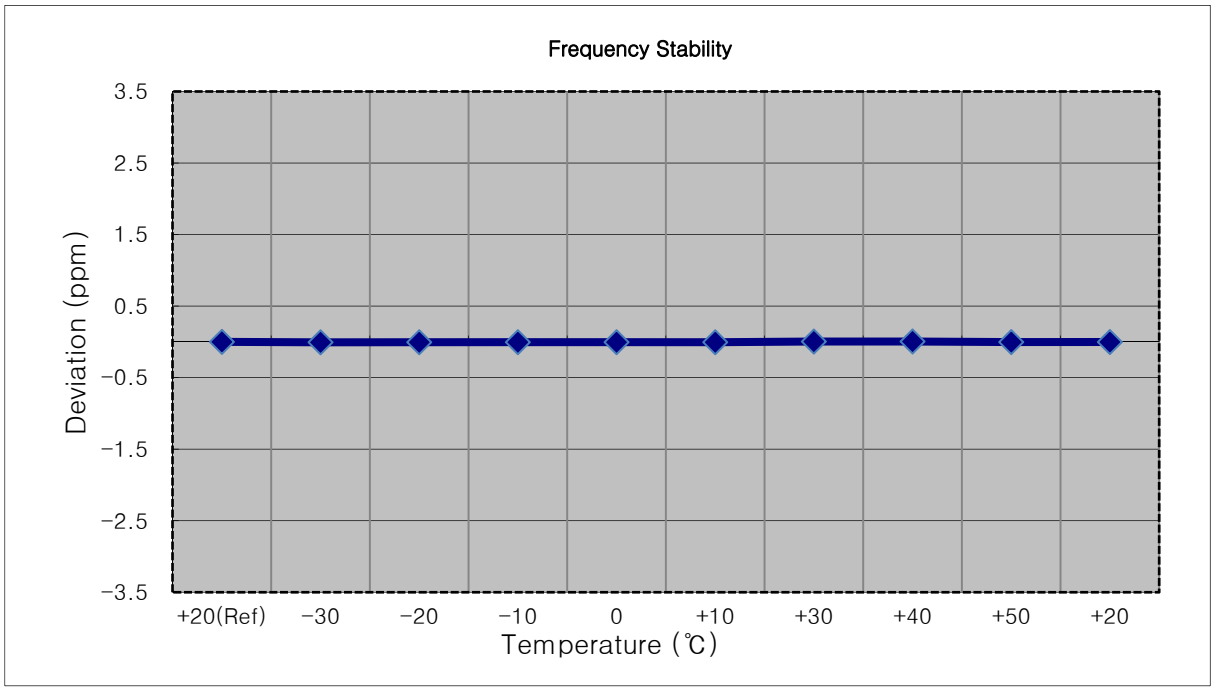
▣ OPERATING FREQUENCY: 1860,000,000 Hz

▣ CHANNEL: 18700 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1859 999 994	0.0	0.000 000	0.000
100%		-30	1859 999 983	-11.3	-0.000 001	-0.006
100%		-20	1859 999 984	-10.1	-0.000 001	-0.005
100%		-10	1859 999 986	-8.0	0.000 000	-0.004
100%		0	1859 999 986	-8.2	0.000 000	-0.004
100%		+10	1859 999 984	-10.4	-0.000 001	-0.006
100%		+30	1860 000 003	8.5	0.000 000	0.005
100%		+40	1860 000 004	9.1	0.000 000	0.005
100%		+50	1859 999 988	-6.0	0.000 000	-0.003
Batt. Endpoint	3.370	+20	1859 999 991	-3.6	0.000 000	-0.002



▣ MODE: LTE B2

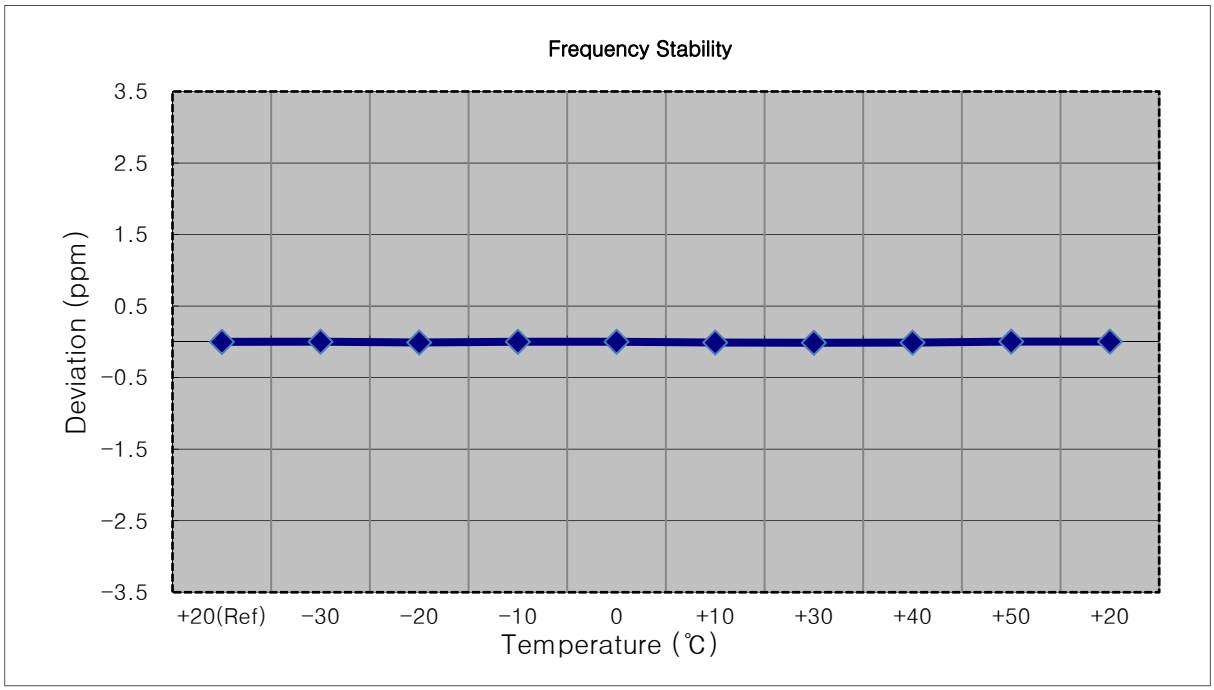
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1880 000 010	0.0	0.000 000	0.000
100%		-30	1880 000 014	3.7	0.000 000	0.002
100%		-20	1879 999 993	-16.6	-0.000 001	-0.009
100%		-10	1880 000 013	2.8	0.000 000	0.001
100%		0	1880 000 013	2.7	0.000 000	0.001
100%		+10	1879 999 992	-18.0	-0.000 001	-0.010
100%		+30	1879 999 987	-23.4	-0.000 001	-0.012
100%		+40	1879 999 990	-20.3	-0.000 001	-0.011
100%		+50	1880 000 016	6.3	0.000 000	0.003
Batt. Endpoint	3.370	+20	1880 000 017	7.0	0.000 000	0.004



▣ MODE: LTE B2

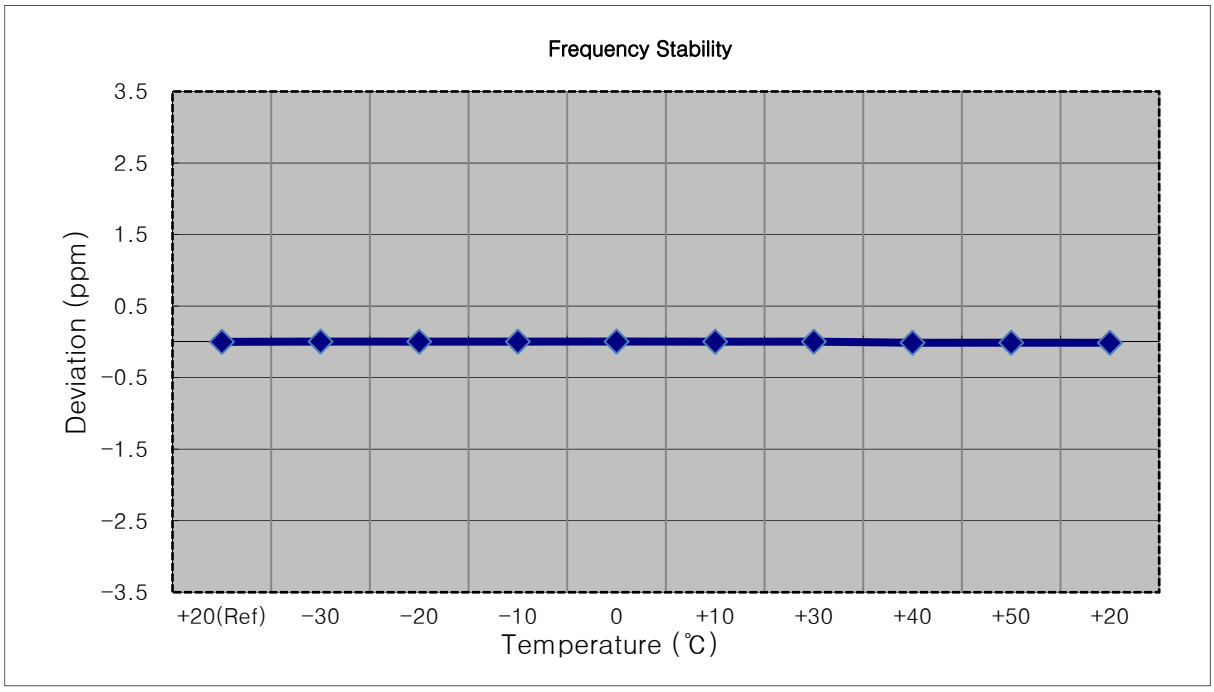
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (3 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1879 999 979	0.0	0.000 000	0.000
100%		-30	1879 999 987	8.0	0.000 000	0.004
100%		-20	1879 999 985	6.0	0.000 000	0.003
100%		-10	1879 999 985	6.1	0.000 000	0.003
100%		0	1879 999 986	7.8	0.000 000	0.004
100%		+10	1879 999 982	3.6	0.000 000	0.002
100%		+30	1879 999 984	5.1	0.000 000	0.003
100%		+40	1879 999 955	-23.4	-0.000 001	-0.012
100%		+50	1879 999 956	-22.7	-0.000 001	-0.012
Batt. Endpoint	3.370	+20	1879 999 955	-23.4	-0.000 001	-0.012



▣ MODE: LTE B2

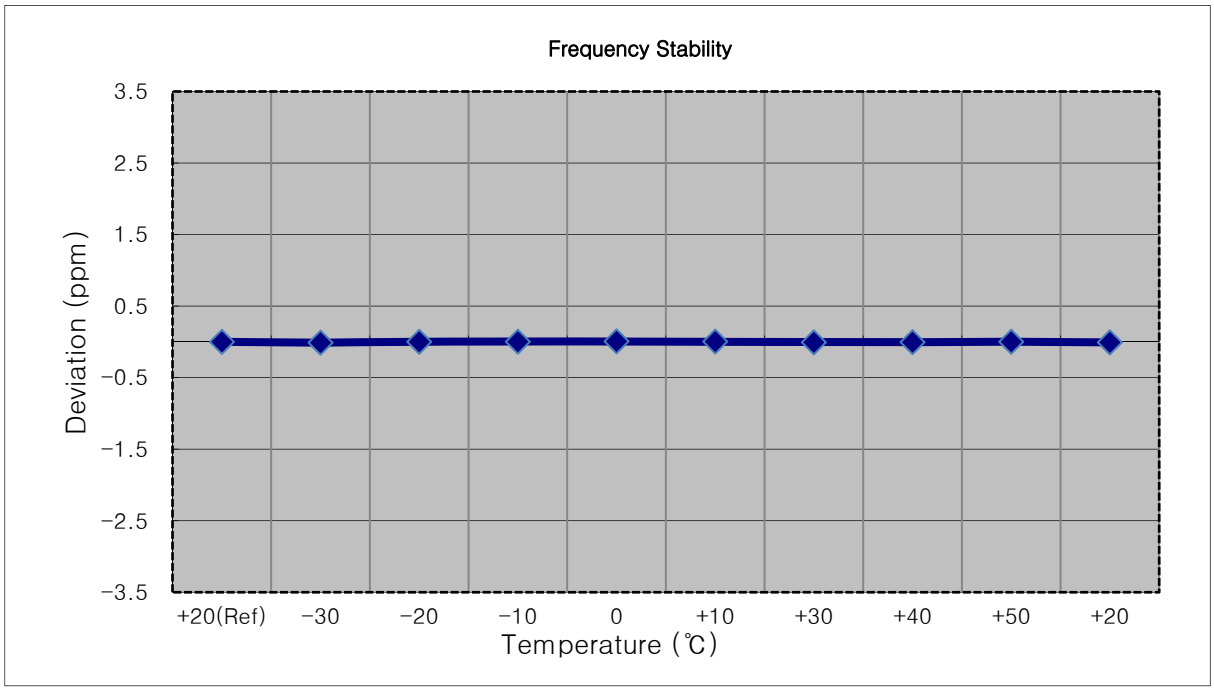
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1879 999 993	0.0	0.000 000	0.000
100%		-30	1879 999 972	-21.3	-0.000 001	-0.011
100%		-20	1879 999 995	1.9	0.000 000	0.001
100%		-10	1879 999 997	3.9	0.000 000	0.002
100%		0	1880 000 007	13.6	0.000 001	0.007
100%		+10	1880 000 002	8.6	0.000 000	0.005
100%		+30	1879 999 981	-12.1	-0.000 001	-0.006
100%		+40	1879 999 984	-9.1	0.000 000	-0.005
100%		+50	1879 999 997	3.1	0.000 000	0.002
Batt. Endpoint	3.370	+20	1879 999 980	-13.4	-0.000 001	-0.007



▣ MODE: LTE B2

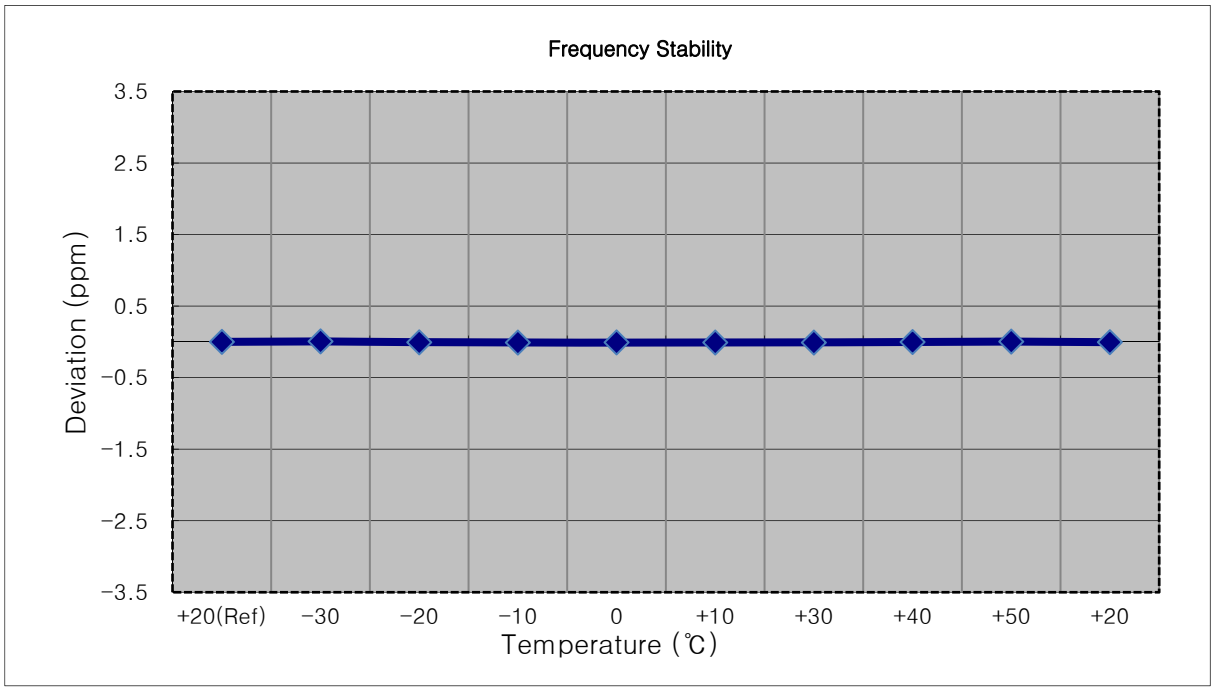
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1880 000 015	0.0	0.000 000	0.000
100%		-30	1880 000 027	12.4	0.000 001	0.007
100%		-20	1880 000 002	-13.1	-0.000 001	-0.007
100%		-10	1879 999 996	-18.5	-0.000 001	-0.010
100%		0	1880 000 000	-14.7	-0.000 001	-0.008
100%		+10	1879 999 998	-16.9	-0.000 001	-0.009
100%		+30	1879 999 996	-18.4	-0.000 001	-0.010
100%		+40	1880 000 011	-4.1	0.000 000	-0.002
100%		+50	1880 000 022	7.0	0.000 000	0.004
Batt. Endpoint	3.370	+20	1880 000 006	-8.6	0.000 000	-0.005



▣ MODE: LTE B2

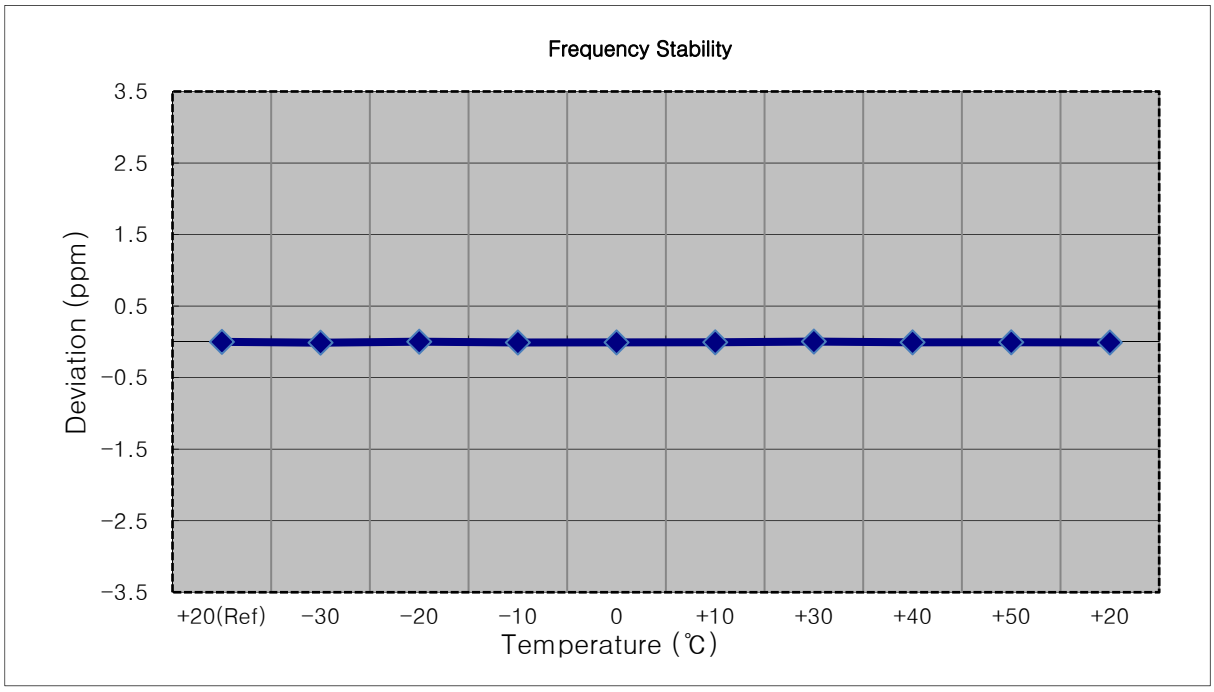
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1880 000 002	0.0	0.000 000	0.000
100%		-30	1879 999 981	-21.3	-0.000 001	-0.011
100%		-20	1880 000 006	3.6	0.000 000	0.002
100%		-10	1879 999 986	-16.2	-0.000 001	-0.009
100%		0	1879 999 988	-14.3	-0.000 001	-0.008
100%		+10	1879 999 991	-11.3	-0.000 001	-0.006
100%		+30	1880 000 010	8.1	0.000 000	0.004
100%		+40	1879 999 990	-12.1	-0.000 001	-0.006
100%		+50	1879 999 991	-11.0	-0.000 001	-0.006
Batt. Endpoint	3.370	+20	1879 999 985	-17.0	-0.000 001	-0.009



▣ MODE: LTE B2

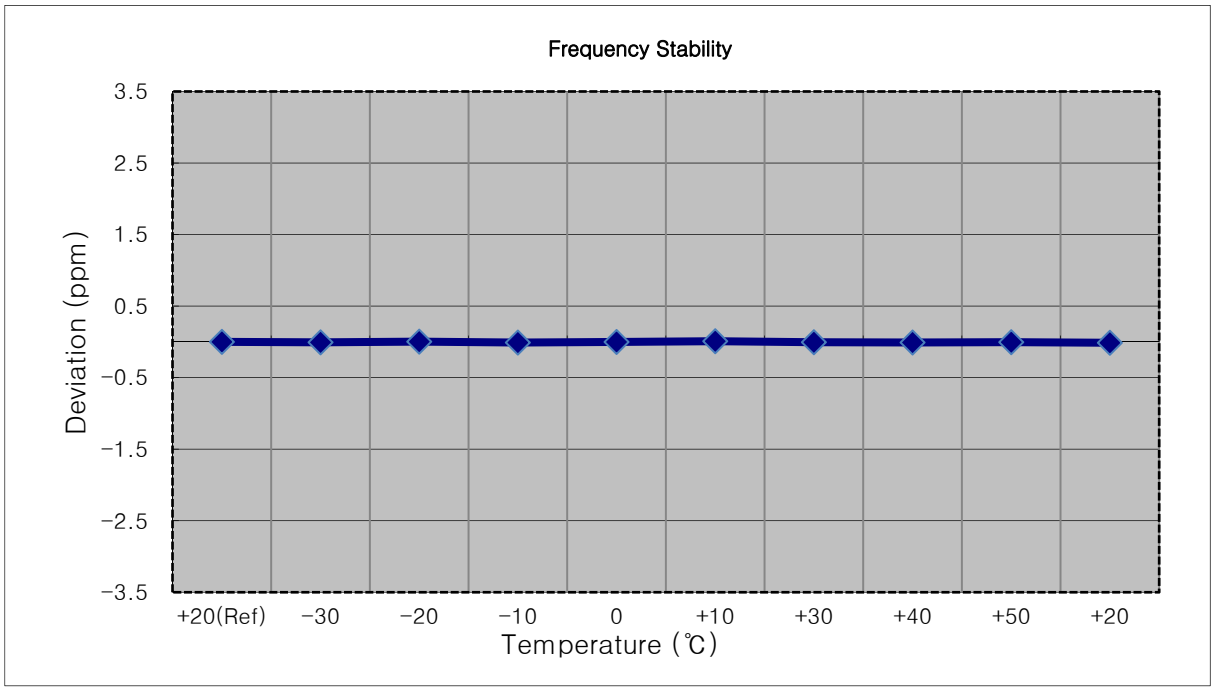
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 18900 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1880 000 009	0.0	0.000 000	0.000
100%		-30	1879 999 997	-12.1	-0.000 001	-0.006
100%		-20	1880 000 015	5.9	0.000 000	0.003
100%		-10	1879 999 991	-18.1	-0.000 001	-0.010
100%		0	1880 000 007	-2.8	0.000 000	-0.001
100%		+10	1880 000 027	17.2	0.000 001	0.009
100%		+30	1880 000 000	-9.8	-0.000 001	-0.005
100%		+40	1879 999 992	-17.1	-0.000 001	-0.009
100%		+50	1880 000 000	-8.9	0.000 000	-0.005
Batt. Endpoint	3.370	+20	1879 999 986	-23.5	-0.000 001	-0.012



▣ MODE: LTE B2

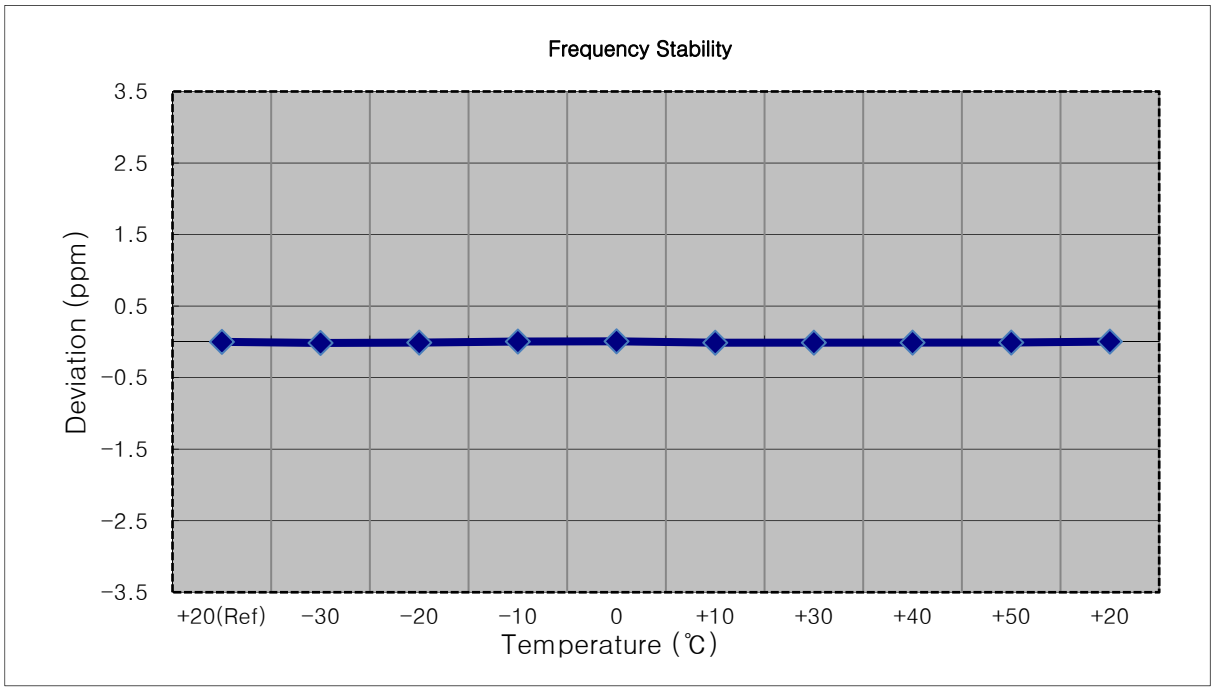
▣ OPERATING FREQUENCY: 1909,300,000 Hz

▣ CHANNEL: 19193 (1.4 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1909 300 013	0.0	0.000 000	0.000
100%		-30	1909 299 983	-29.4	-0.000 002	-0.015
100%		-20	1909 299 993	-19.6	-0.000 001	-0.010
100%		-10	1909 300 021	8.6	0.000 000	0.005
100%		0	1909 300 027	14.7	0.000 001	0.008
100%		+10	1909 299 989	-23.3	-0.000 001	-0.012
100%		+30	1909 299 991	-22.1	-0.000 001	-0.012
100%		+40	1909 299 993	-19.8	-0.000 001	-0.010
100%		+50	1909 299 995	-18.0	-0.000 001	-0.009
Batt. Endpoint	3.370	+20	1909 300 019	6.7	0.000 000	0.004



▣ MODE: LTE B2

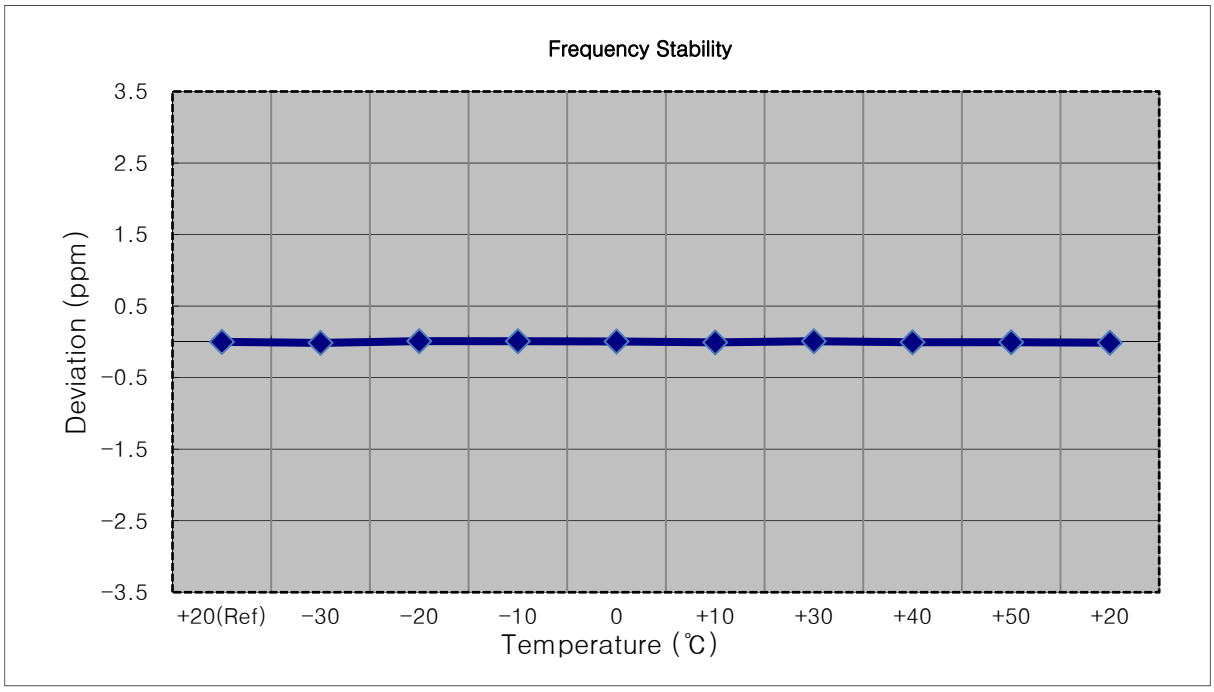
▣ OPERATING FREQUENCY: 1908,500,000 Hz

▣ CHANNEL: 19185 (3 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1908 499 978	0.0	0.000 000	0.000
100%		-30	1908 499 951	-27.4	-0.000 001	-0.014
100%		-20	1908 499 997	18.5	0.000 001	0.010
100%		-10	1908 499 995	16.8	0.000 001	0.009
100%		0	1908 499 988	9.4	0.000 000	0.005
100%		+10	1908 499 963	-14.8	-0.000 001	-0.008
100%		+30	1908 499 995	17.1	0.000 001	0.009
100%		+40	1908 499 967	-10.8	-0.000 001	-0.006
100%		+50	1908 499 968	-10.6	-0.000 001	-0.006
Batt. Endpoint	3.370	+20	1908 499 956	-22.2	-0.000 001	-0.012



▣ MODE: LTE B2

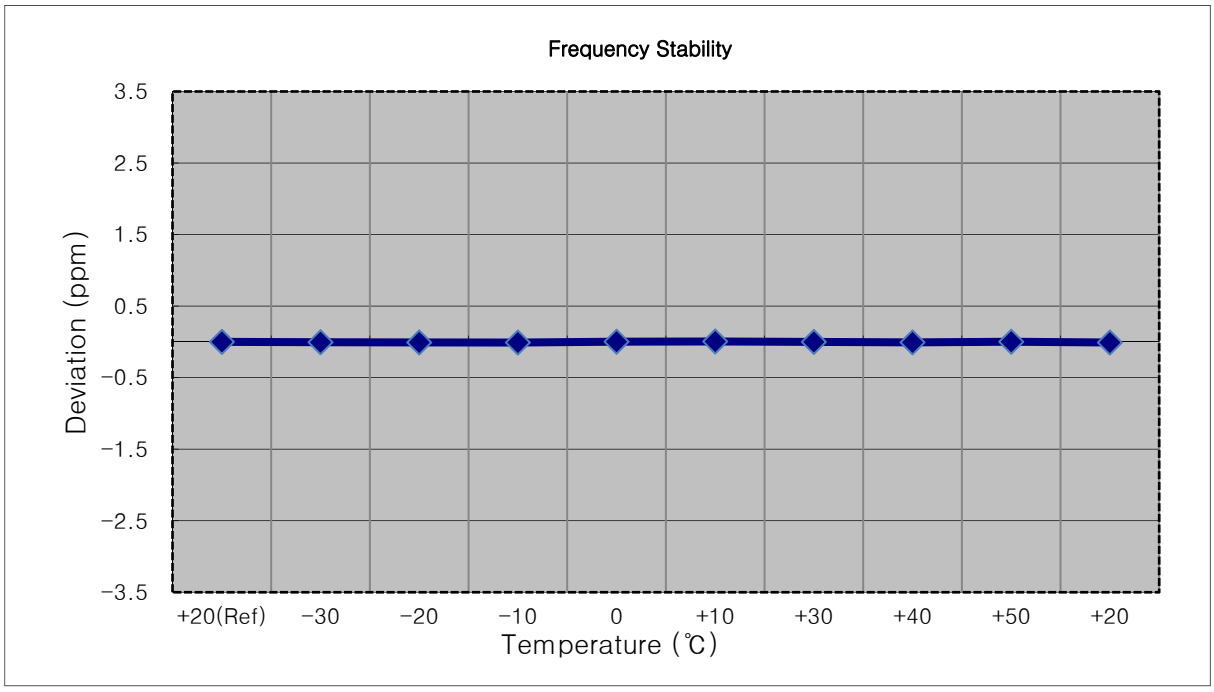
▣ OPERATING FREQUENCY: 1907,500,000 Hz

▣ CHANNEL: 19175 (5 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1907 499 992	0.0	0.000 000	0.000
100%		-30	1907 499 982	-10.2	-0.000 001	-0.005
100%		-20	1907 499 976	-15.7	-0.000 001	-0.008
100%		-10	1907 499 974	-17.8	-0.000 001	-0.009
100%		0	1907 499 996	4.1	0.000 000	0.002
100%		+10	1907 500 002	10.1	0.000 001	0.005
100%		+30	1907 499 990	-2.1	0.000 000	-0.001
100%		+40	1907 499 978	-13.9	-0.000 001	-0.007
100%		+50	1907 499 995	2.8	0.000 000	0.001
Batt. Endpoint	3.370	+20	1907 499 974	-17.7	-0.000 001	-0.009



▣ MODE: LTE B2

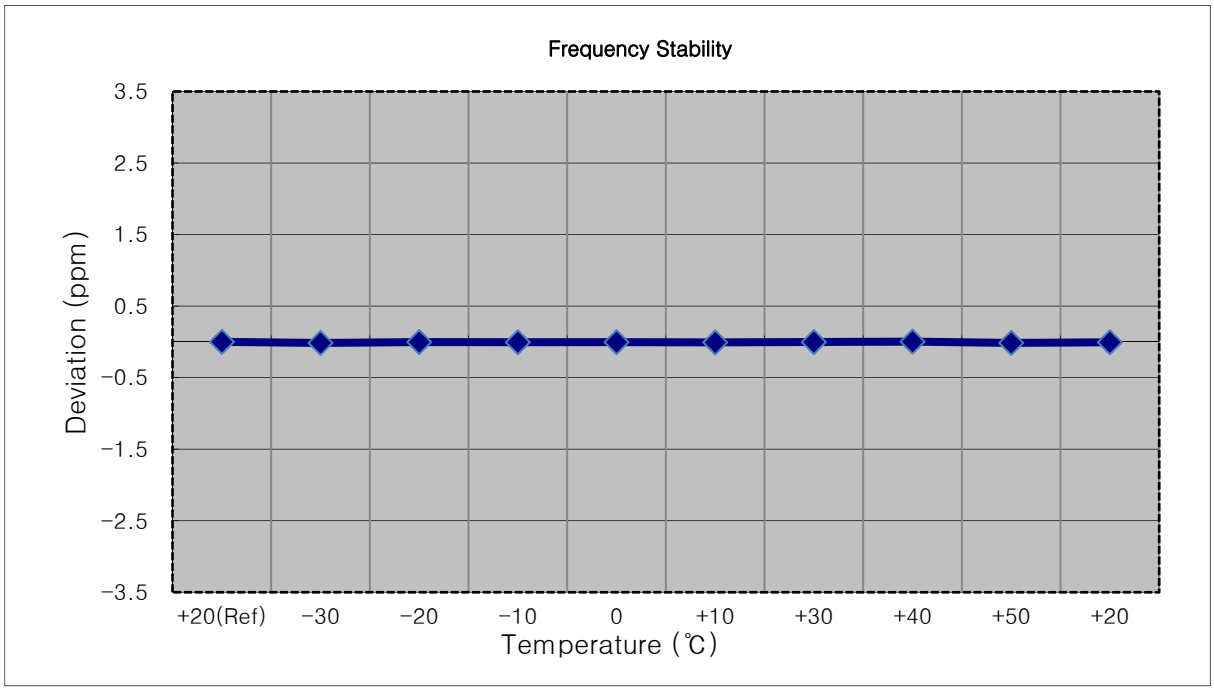
▣ OPERATING FREQUENCY: 1905,000,000 Hz

▣ CHANNEL: 19150 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1905 000 004	0.0	0.000 000	0.000
100%		-30	1904 999 974	-29.9	-0.000 002	-0.016
100%		-20	1904 999 998	-6.3	0.000 000	-0.003
100%		-10	1904 999 995	-9.3	0.000 000	-0.005
100%		0	1904 999 996	-8.2	0.000 000	-0.004
100%		+10	1904 999 990	-13.8	-0.000 001	-0.007
100%		+30	1904 999 999	-4.9	0.000 000	-0.003
100%		+40	1905 000 010	5.6	0.000 000	0.003
100%		+50	1904 999 976	-27.8	-0.000 001	-0.015
Batt. Endpoint	3.370	+20	1904 999 992	-11.8	-0.000 001	-0.006



▣ MODE: LTE B2

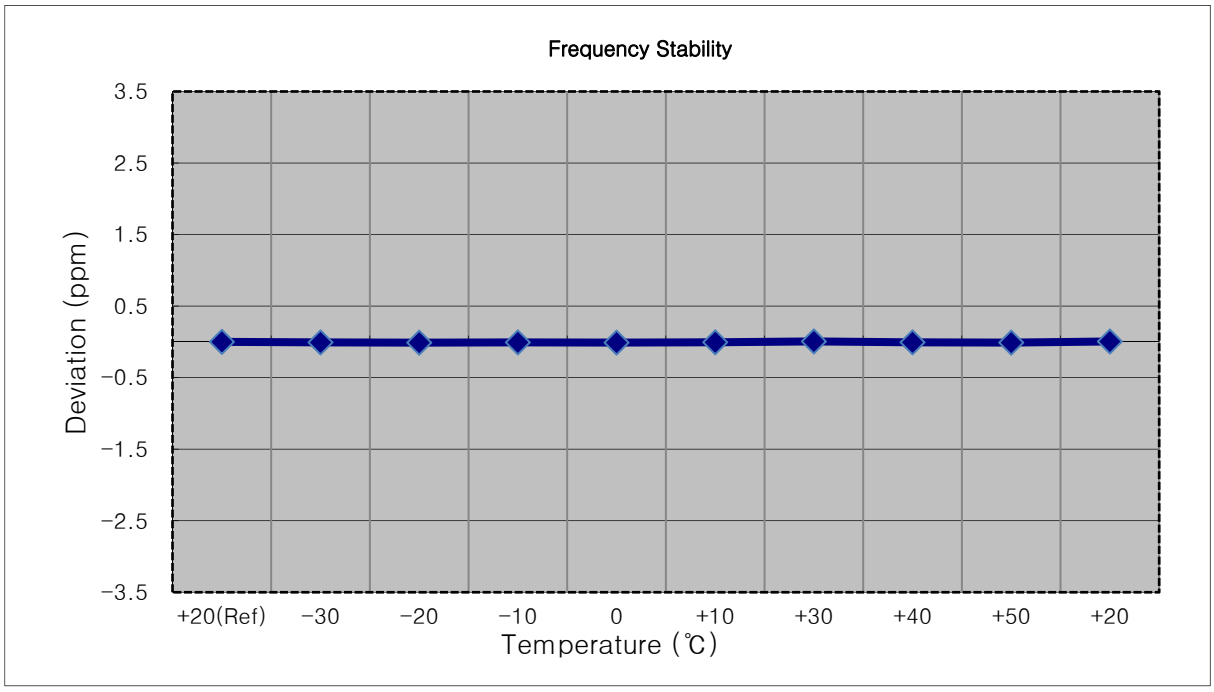
▣ OPERATING FREQUENCY: 1902,500,000 Hz

▣ CHANNEL: 19125 (15 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1902 499 980	0.0	0.000 000	0.000
100%		-30	1902 499 965	-14.8	-0.000 001	-0.008
100%		-20	1902 499 959	-20.8	-0.000 001	-0.011
100%		-10	1902 499 966	-13.7	-0.000 001	-0.007
100%		0	1902 499 959	-20.6	-0.000 001	-0.011
100%		+10	1902 499 969	-11.4	-0.000 001	-0.006
100%		+30	1902 499 992	11.7	0.000 001	0.006
100%		+40	1902 499 968	-12.2	-0.000 001	-0.006
100%		+50	1902 499 961	-19.3	-0.000 001	-0.010
Batt. Endpoint	3.370	+20	1902 499 990	9.8	0.000 001	0.005



▣ MODE: LTE B2

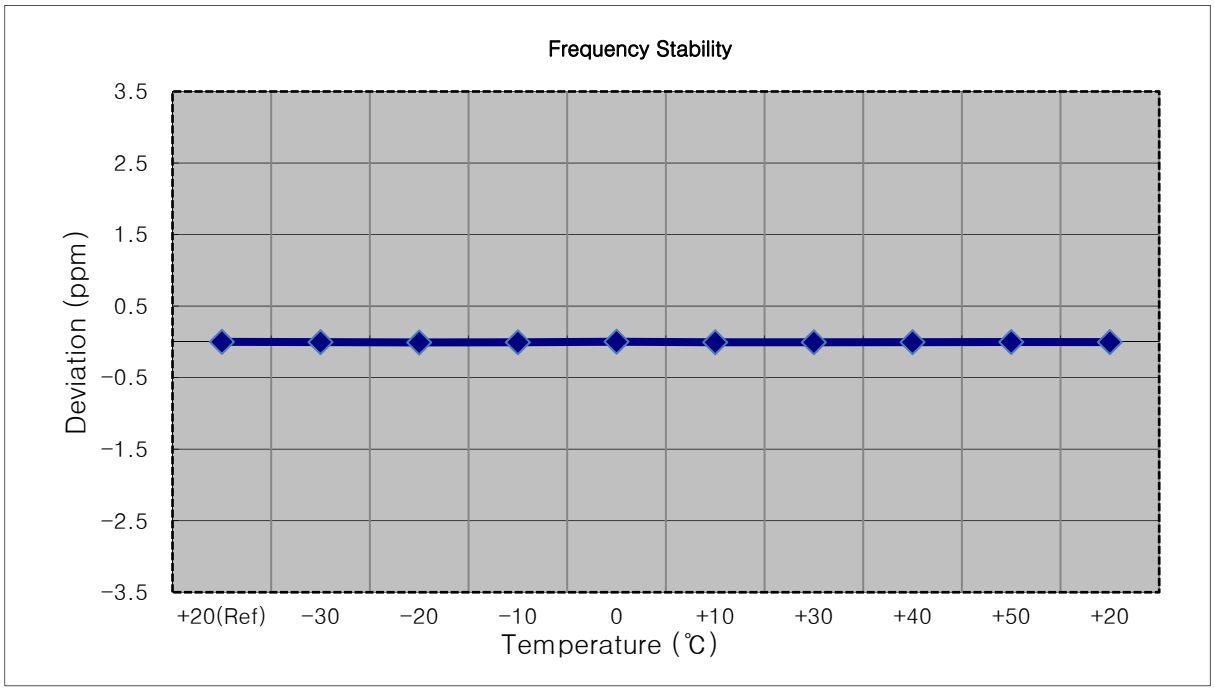
▣ OPERATING FREQUENCY: 1900,000,000 Hz

▣ CHANNEL: 19100 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

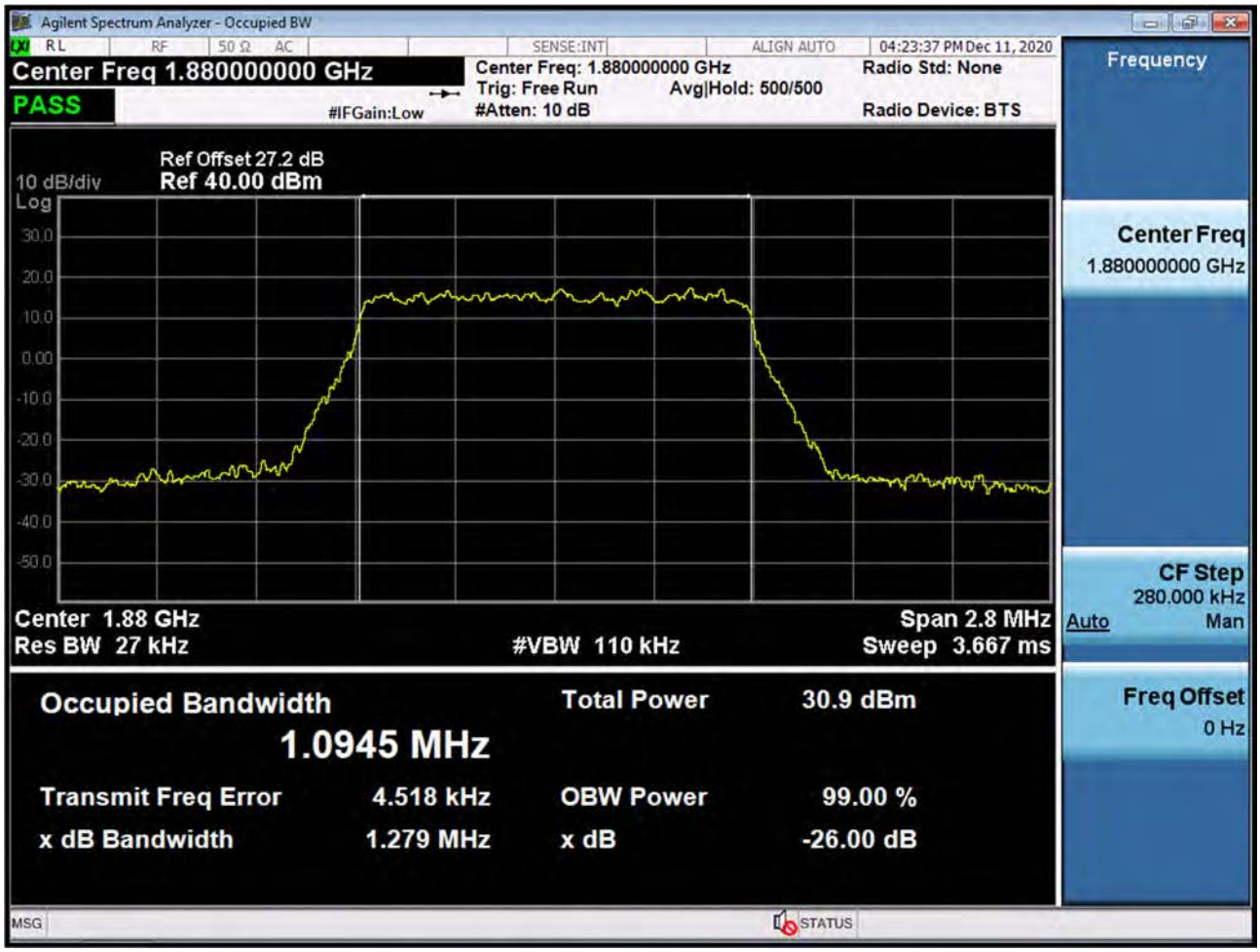
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1899 999 994	0.0	0.000 000	0.000
100%		-30	1899 999 987	-7.3	0.000 000	-0.004
100%		-20	1899 999 978	-15.6	-0.000 001	-0.008
100%		-10	1899 999 983	-10.9	-0.000 001	-0.006
100%		0	1899 999 998	4.0	0.000 000	0.002
100%		+10	1899 999 983	-10.7	-0.000 001	-0.006
100%		+30	1899 999 983	-10.7	-0.000 001	-0.006
100%		+40	1899 999 986	-8.1	0.000 000	-0.004
100%		+50	1899 999 990	-3.6	0.000 000	-0.002
Batt. Endpoint	3.370	+20	1899 999 987	-7.2	0.000 000	-0.004

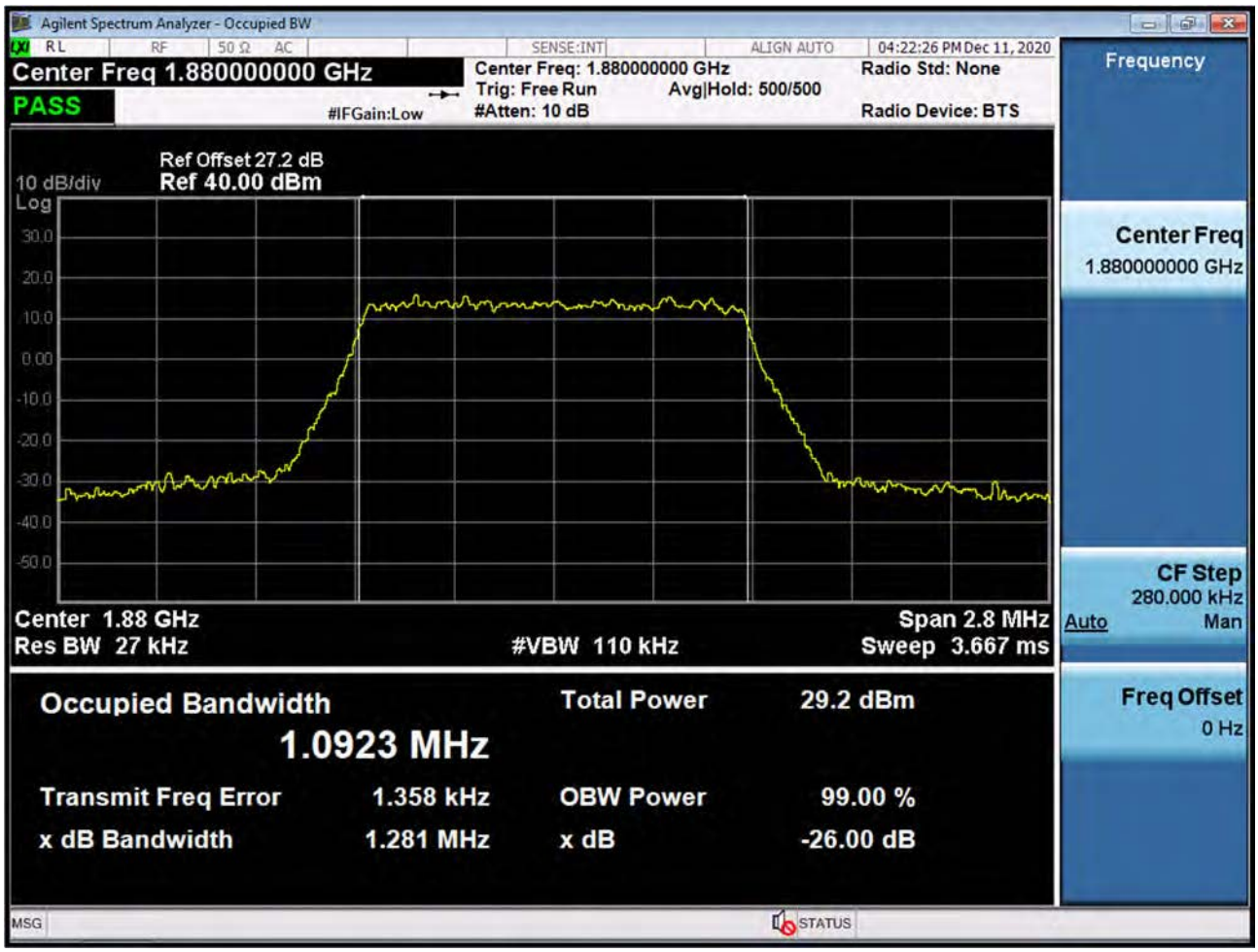


9. TEST PLOTS

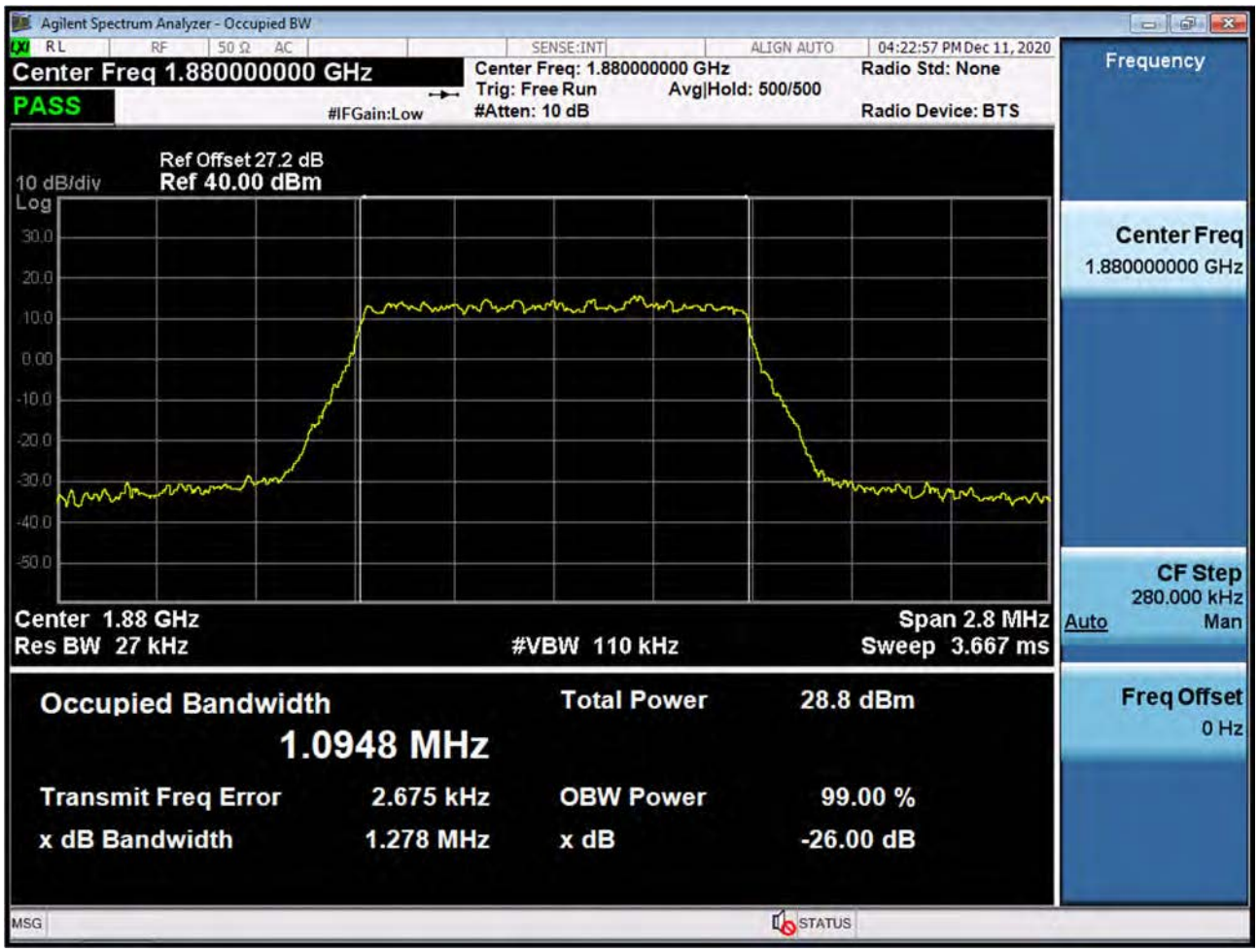
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 QPSK RB 6_0)



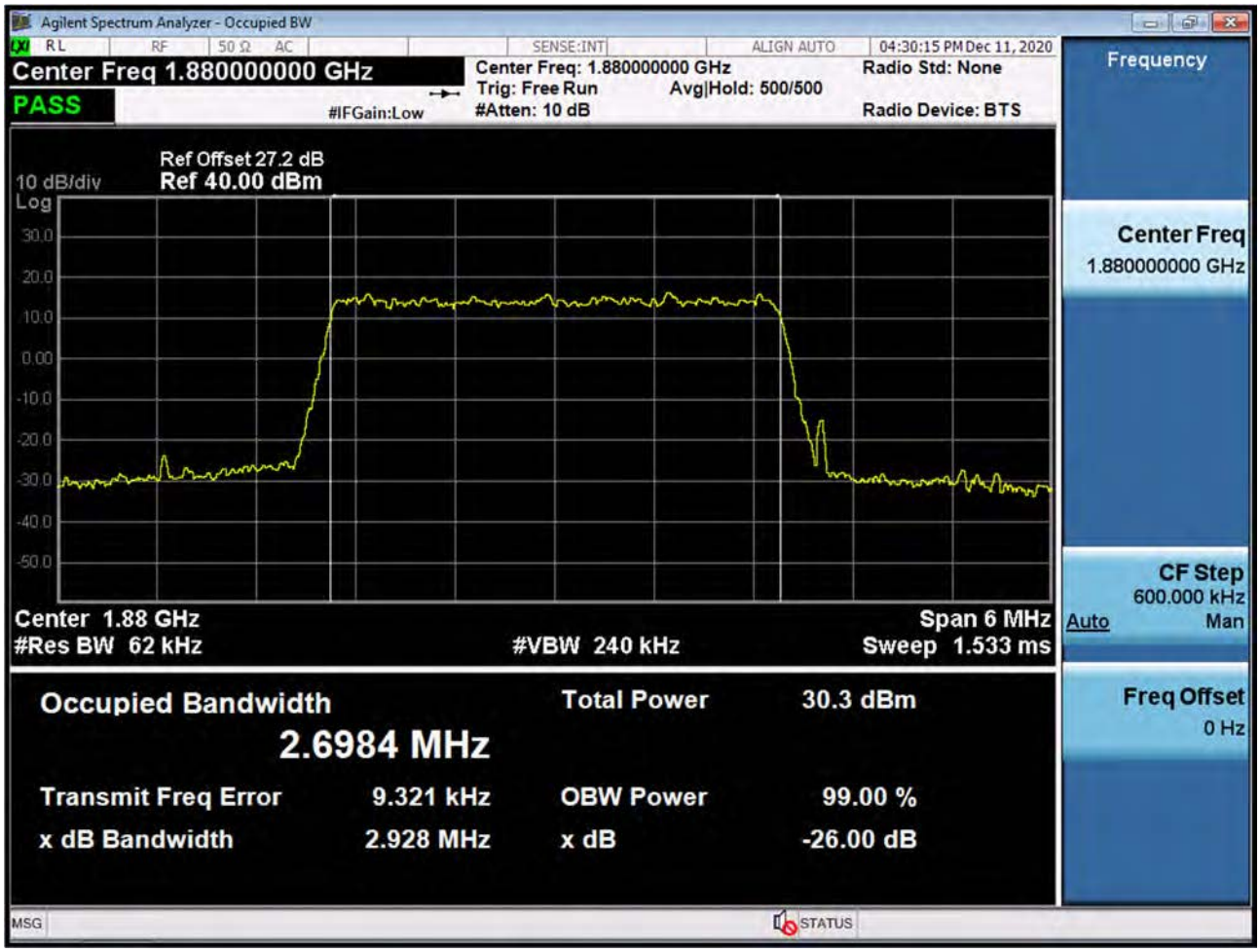
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 16QAM RB 6_0)



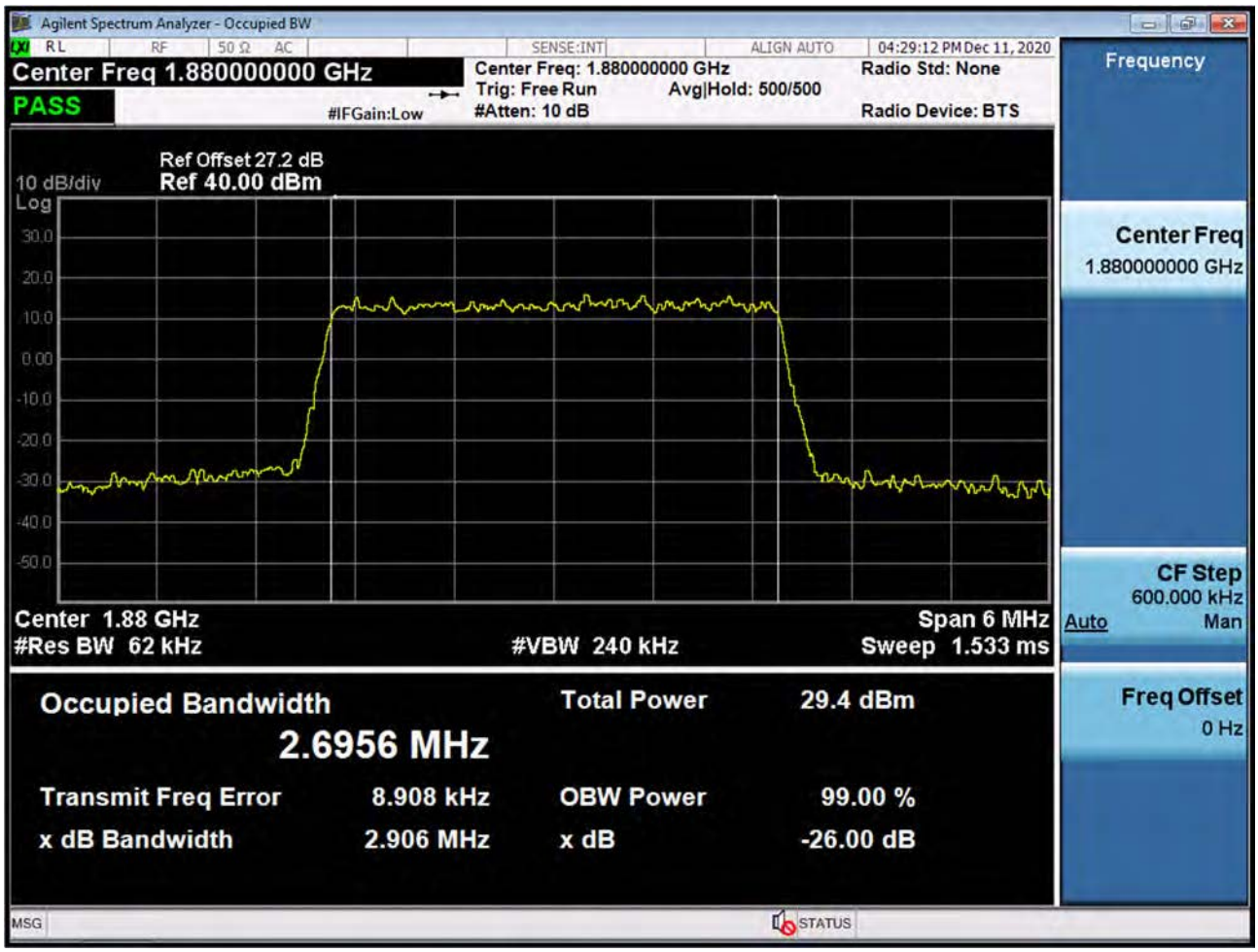
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 64QAM RB 6_0)



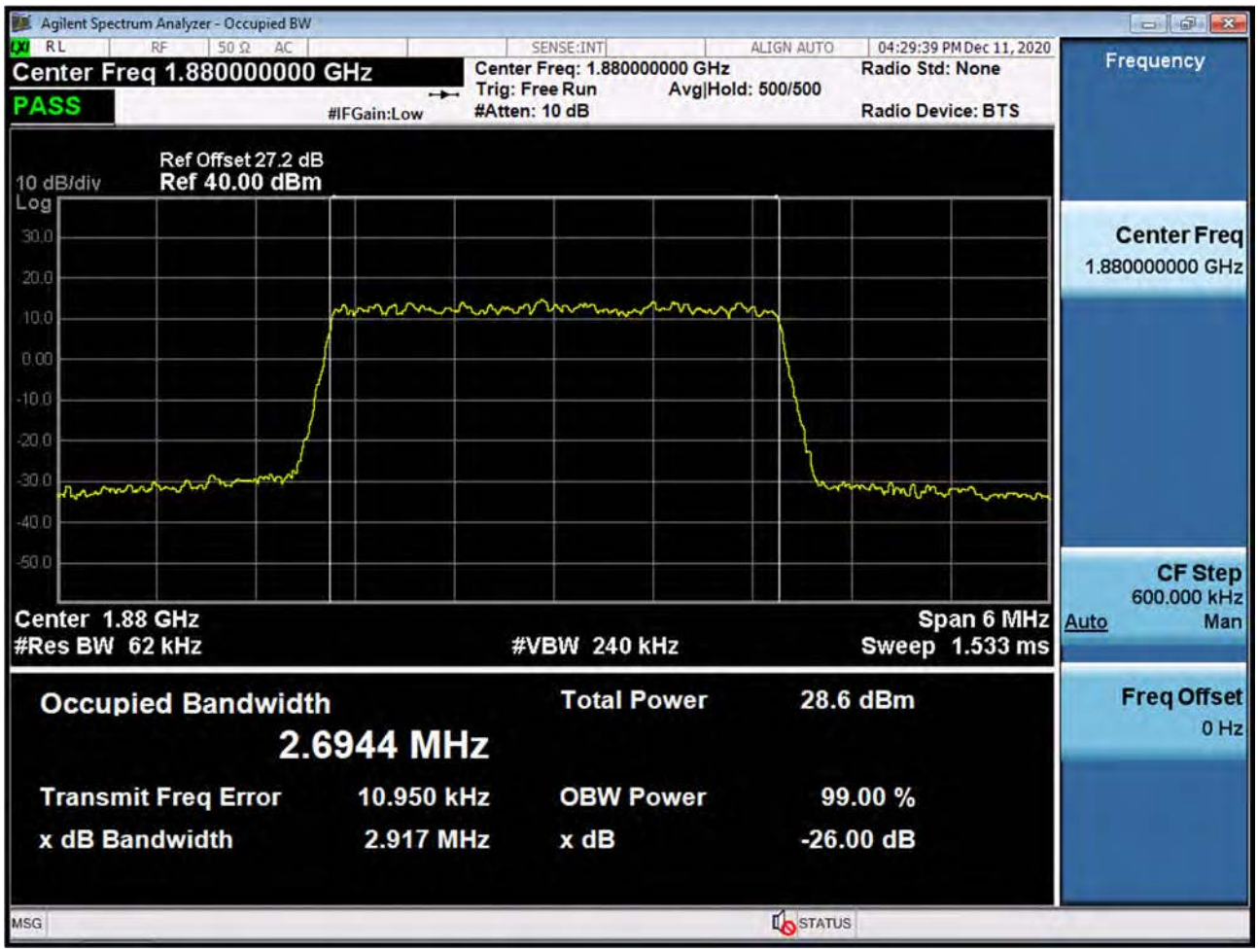
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 QPSK RB 15_0)



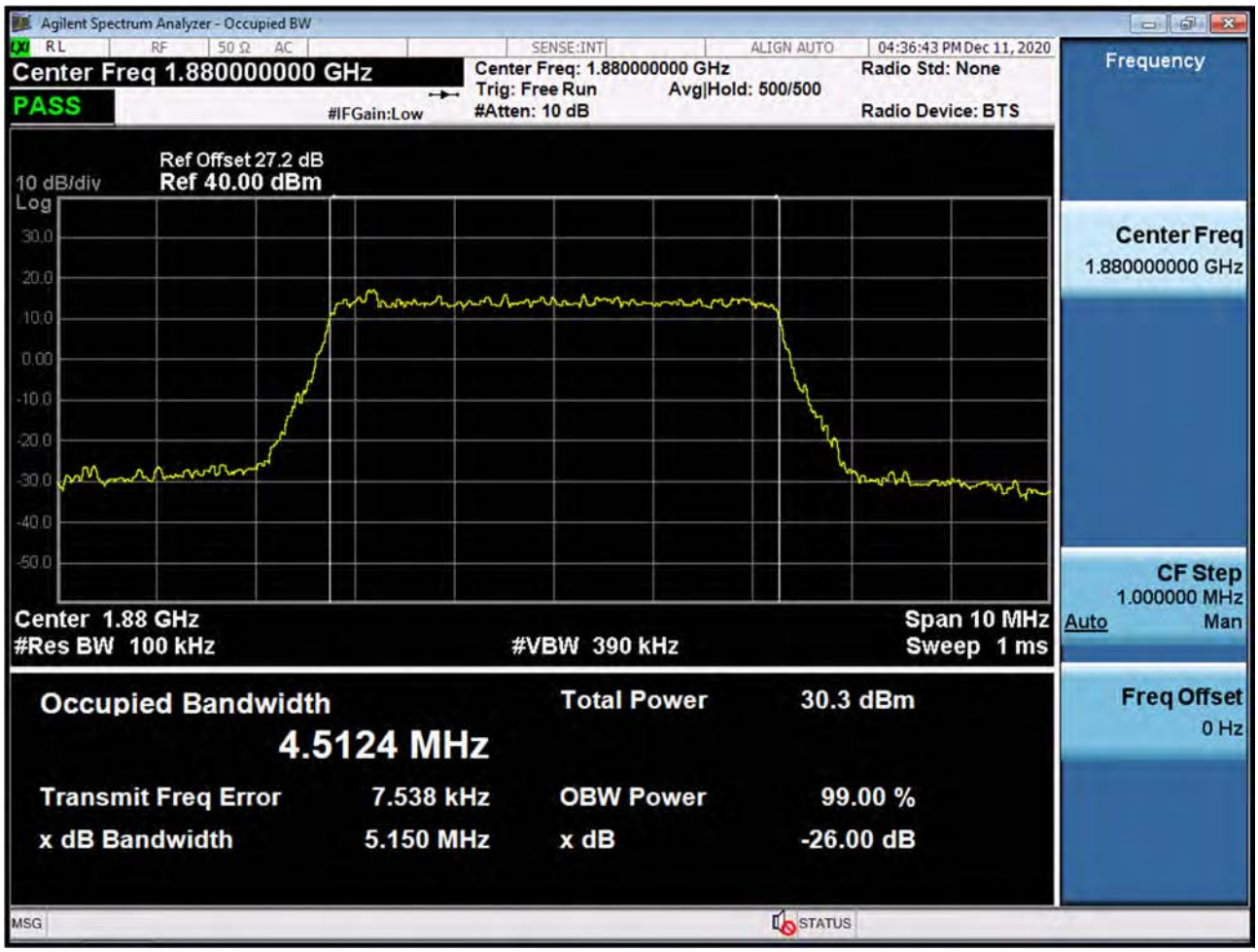
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 16QAM RB 15_0)



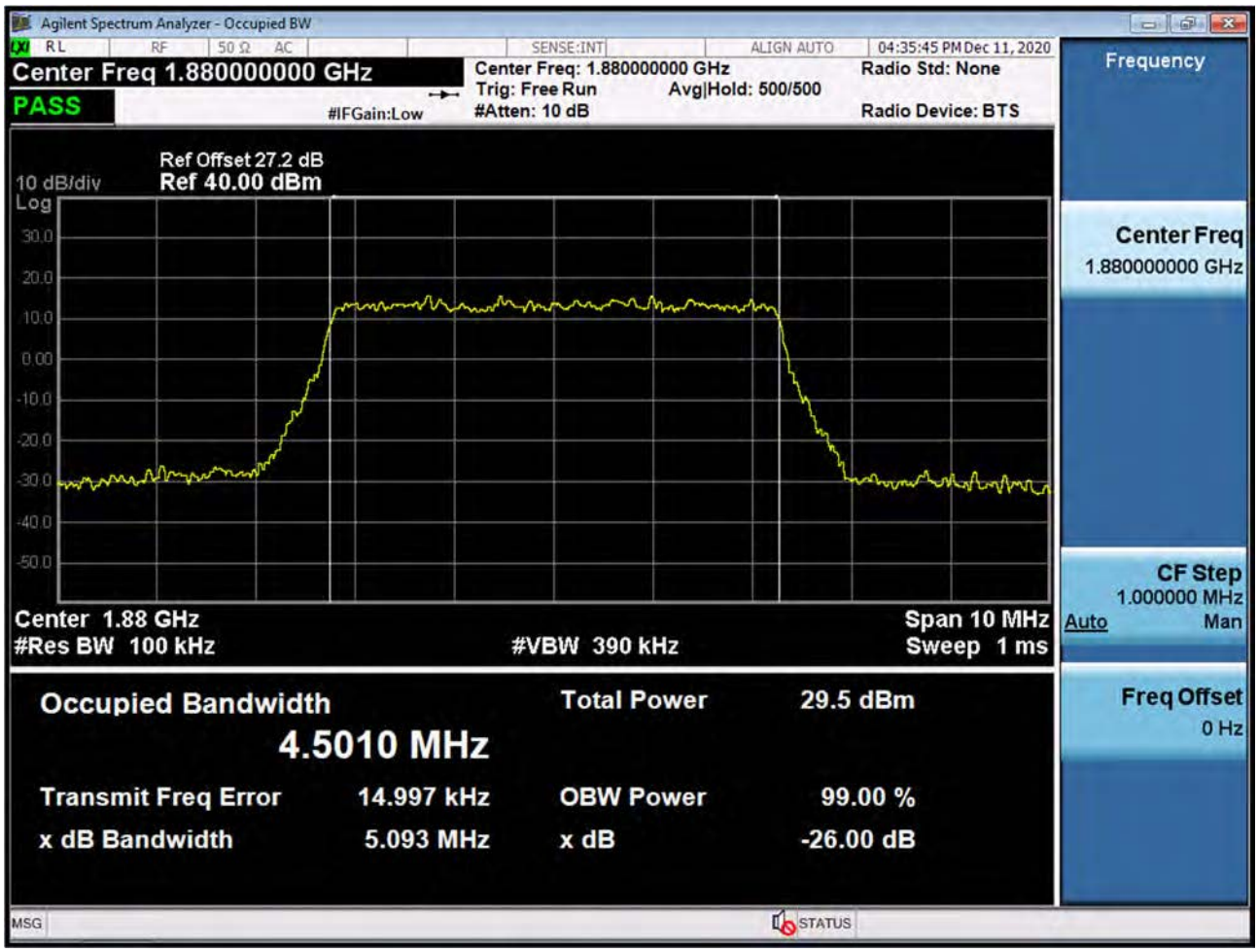
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 64QAM RB 15_0)



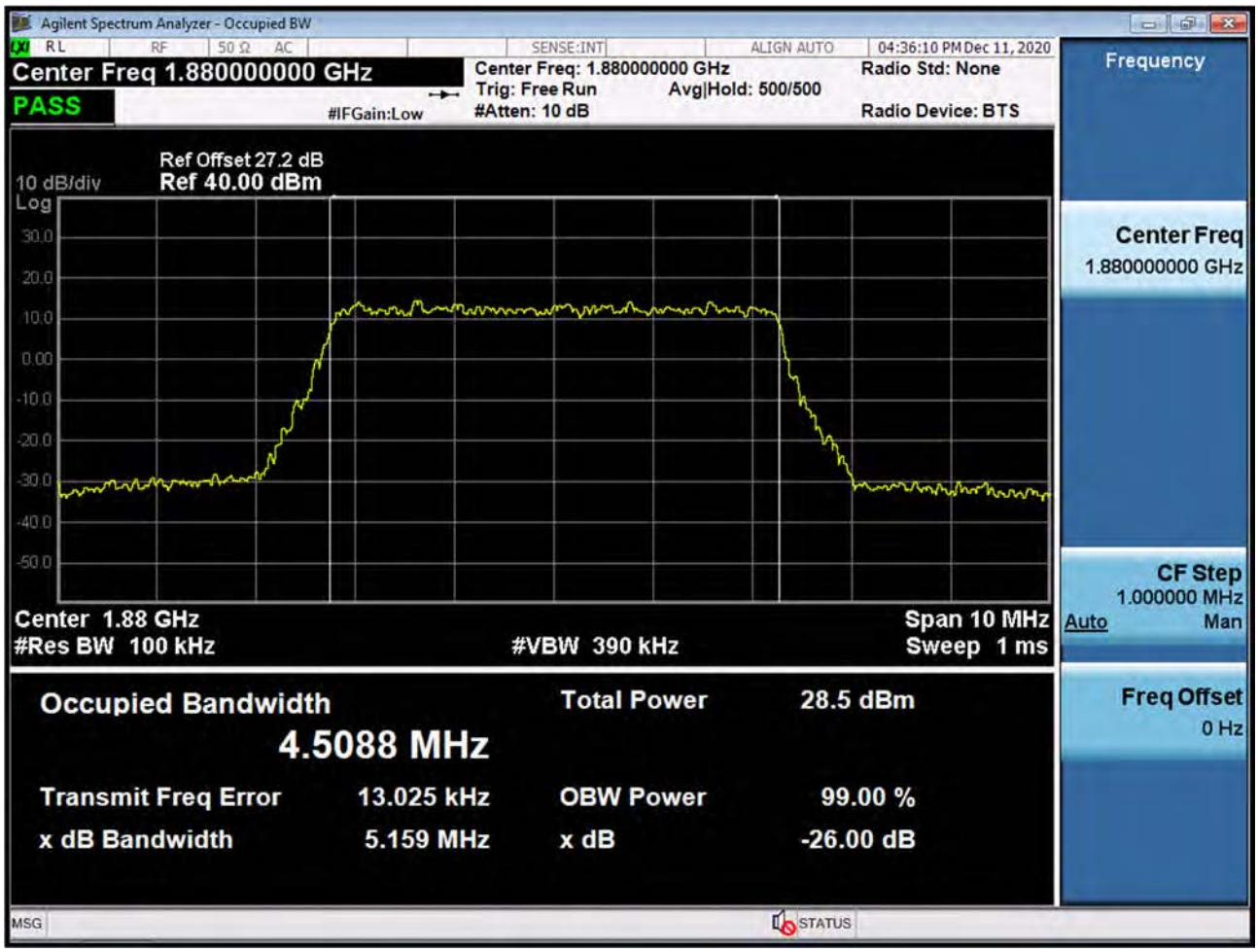
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 QPSK RB 25_0)



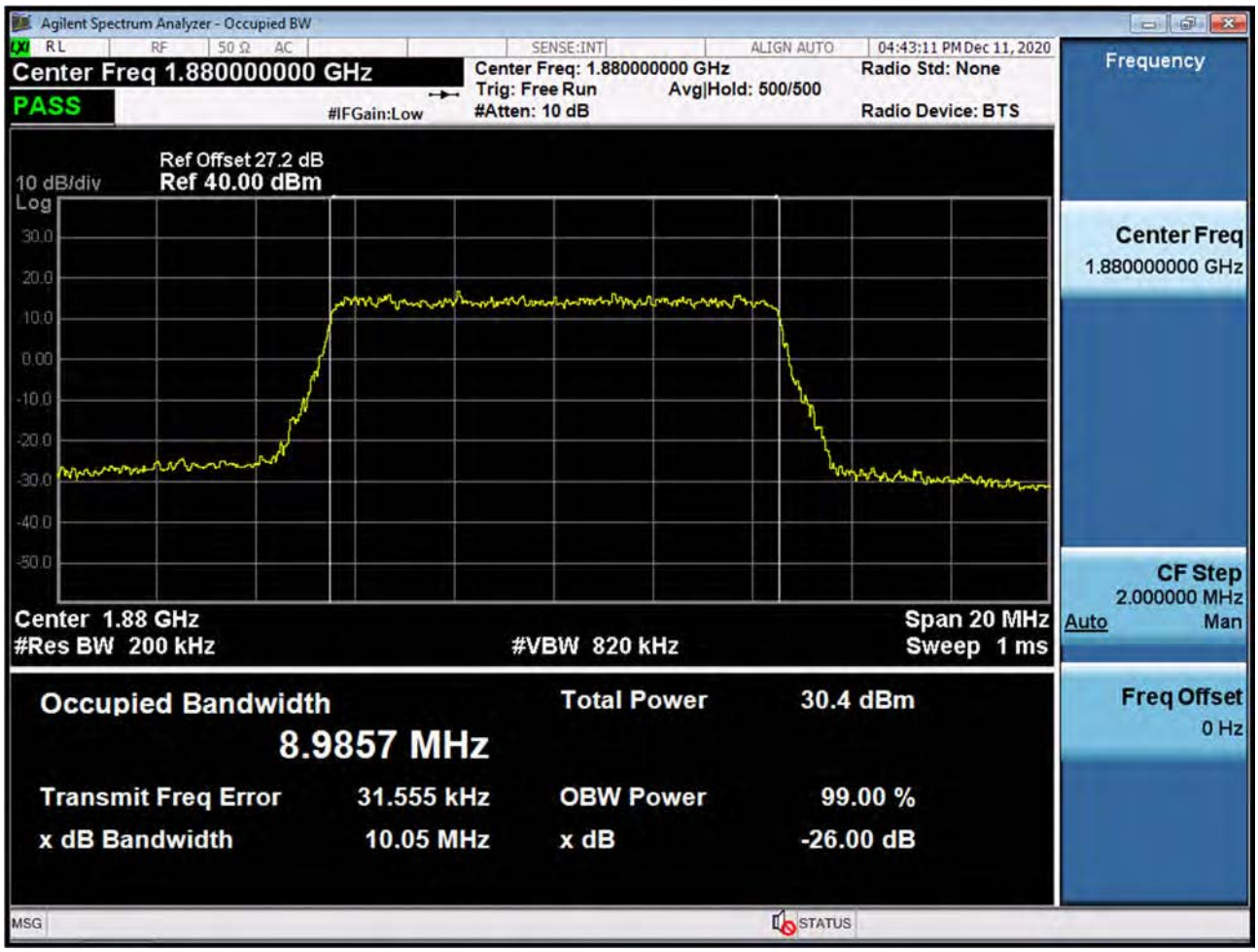
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 16QAM RB 25_0)



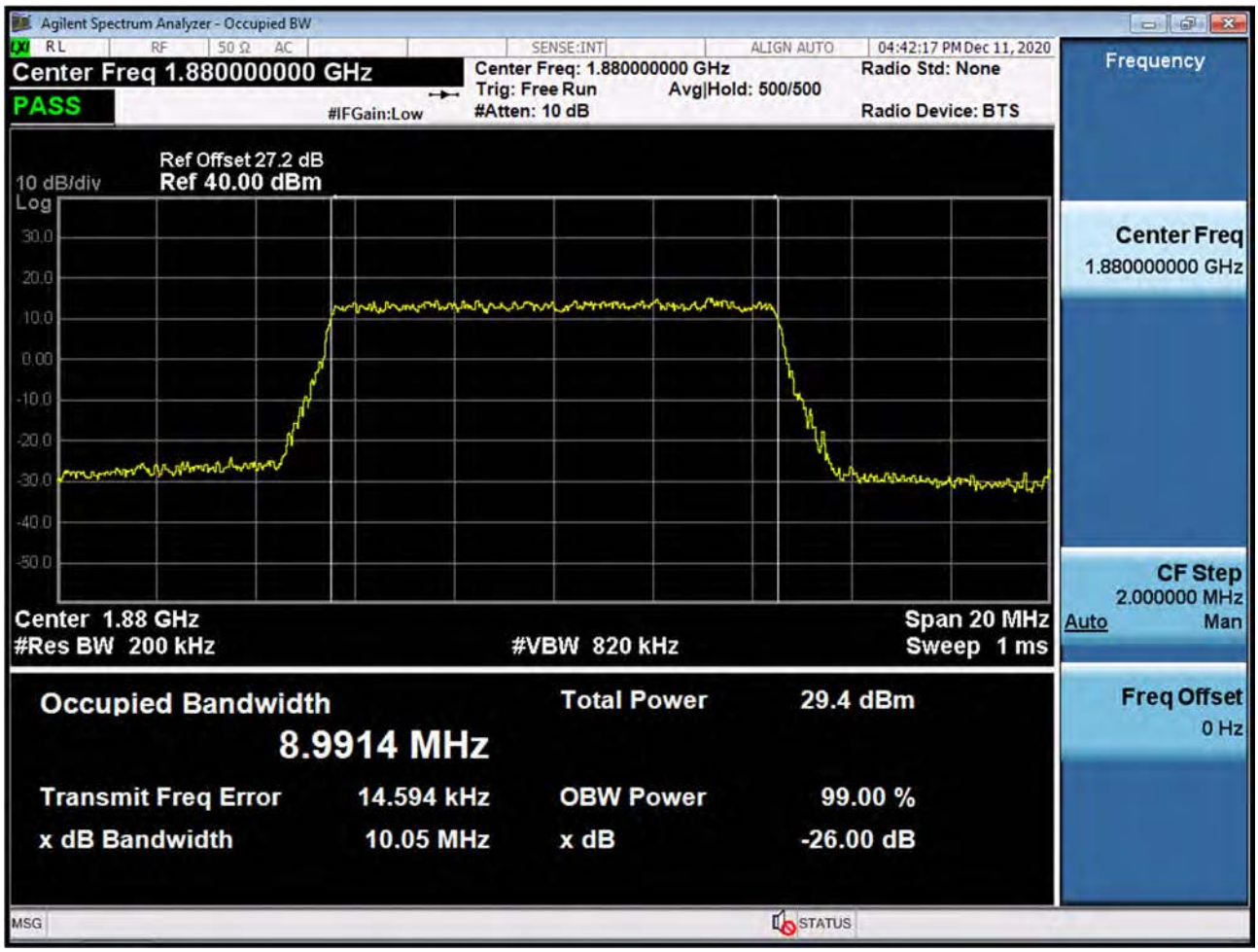
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 64QAM RB 25_0)



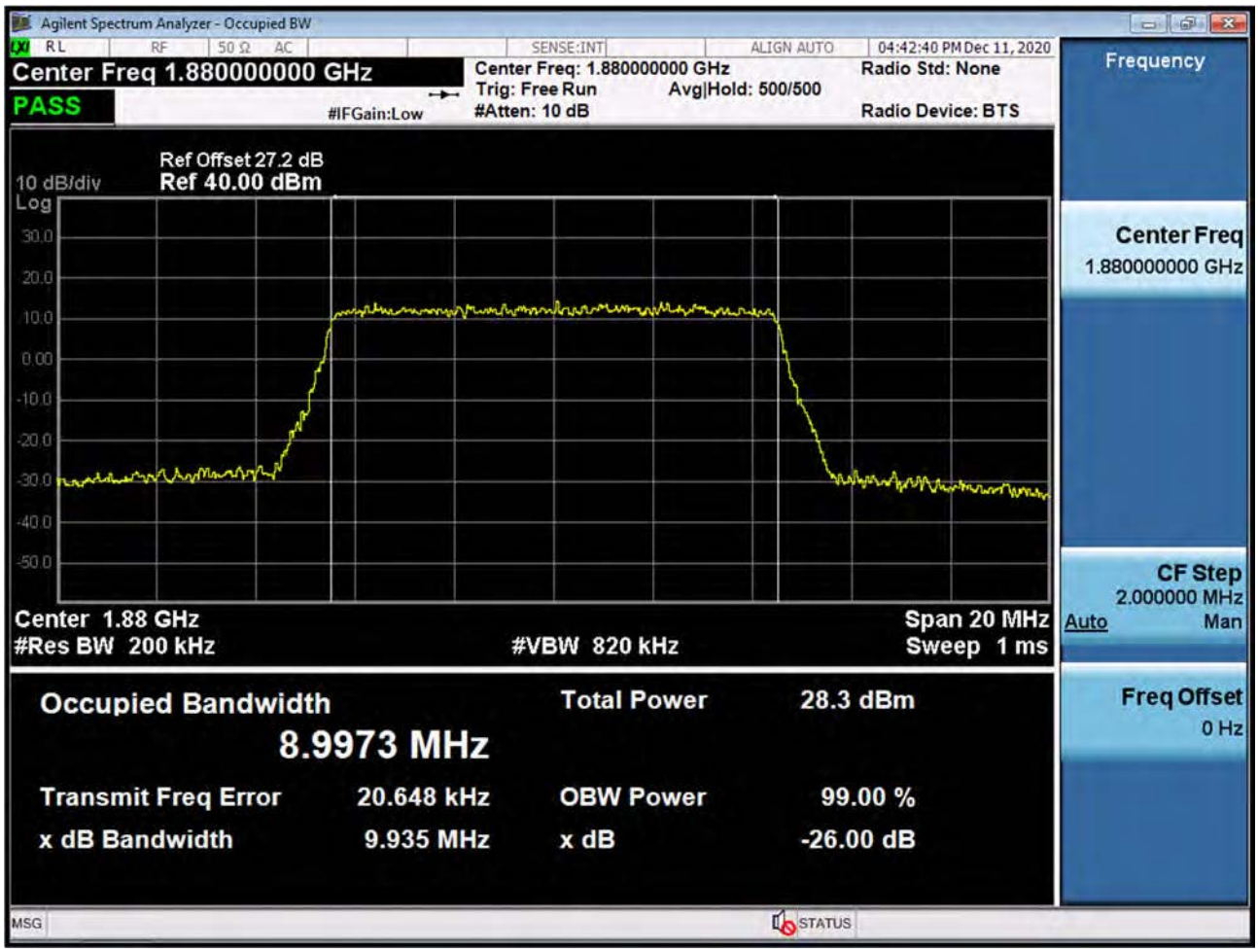
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 QPSK RB 50_0)



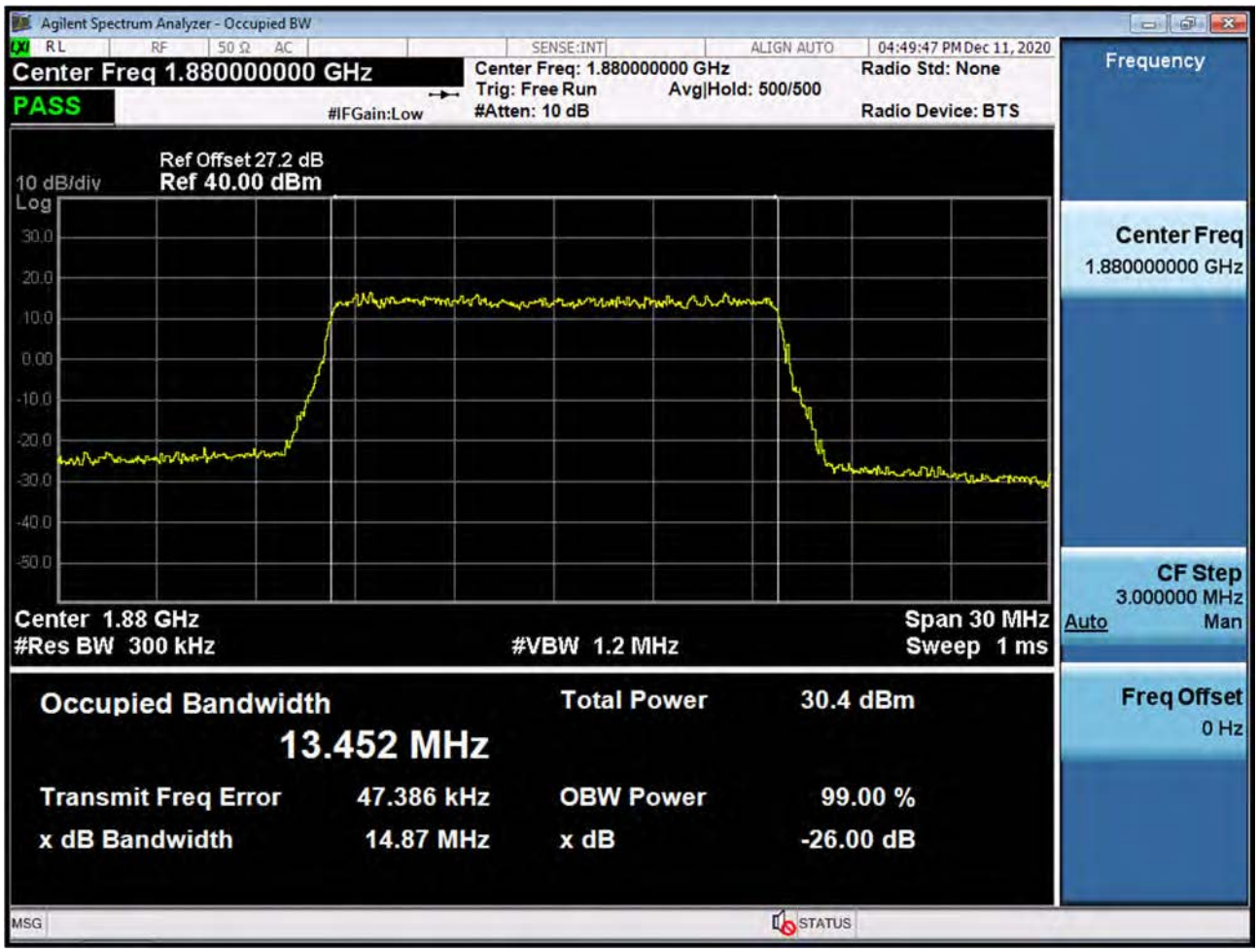
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 16QAM RB 50_0)



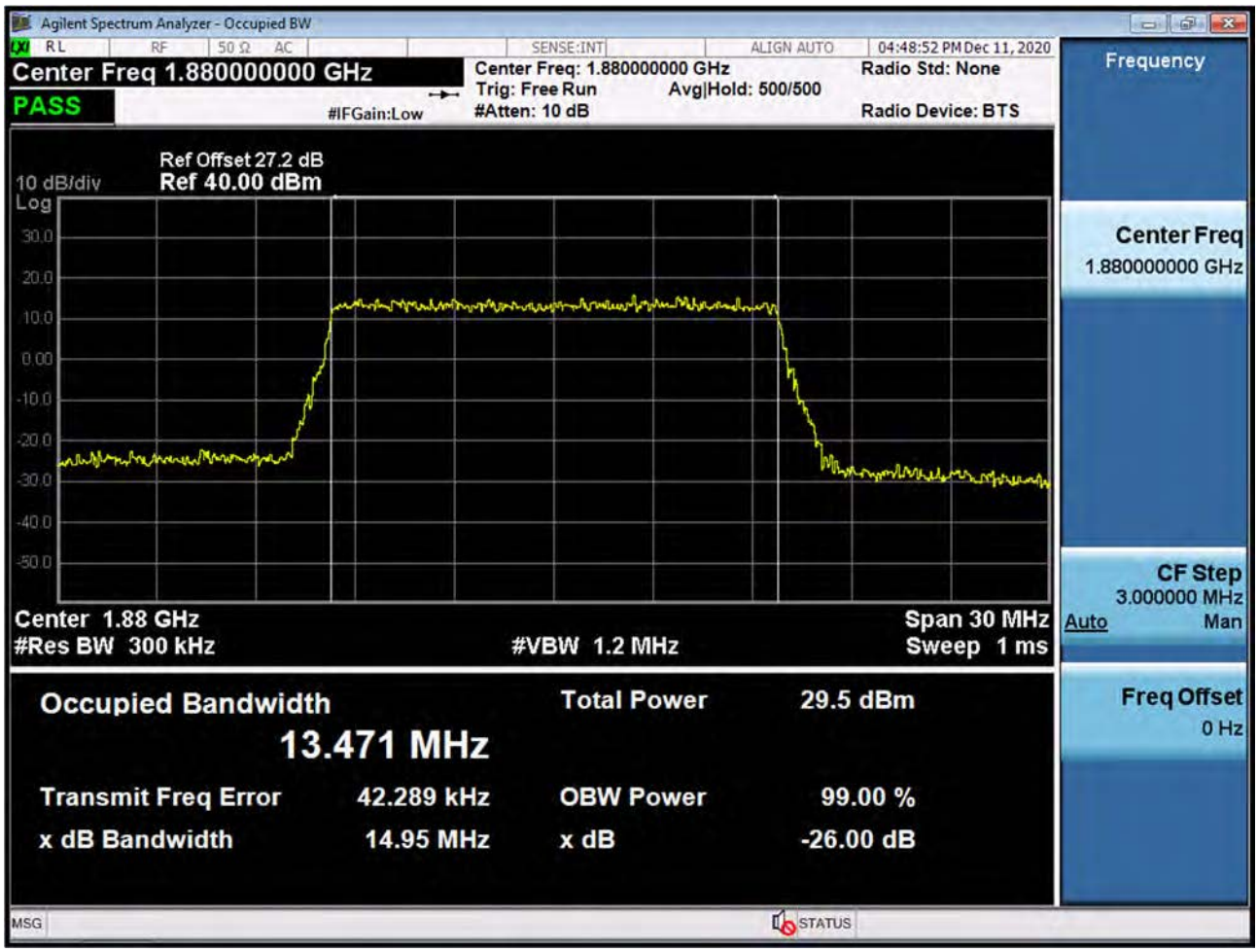
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 64QAM RB 50_0)



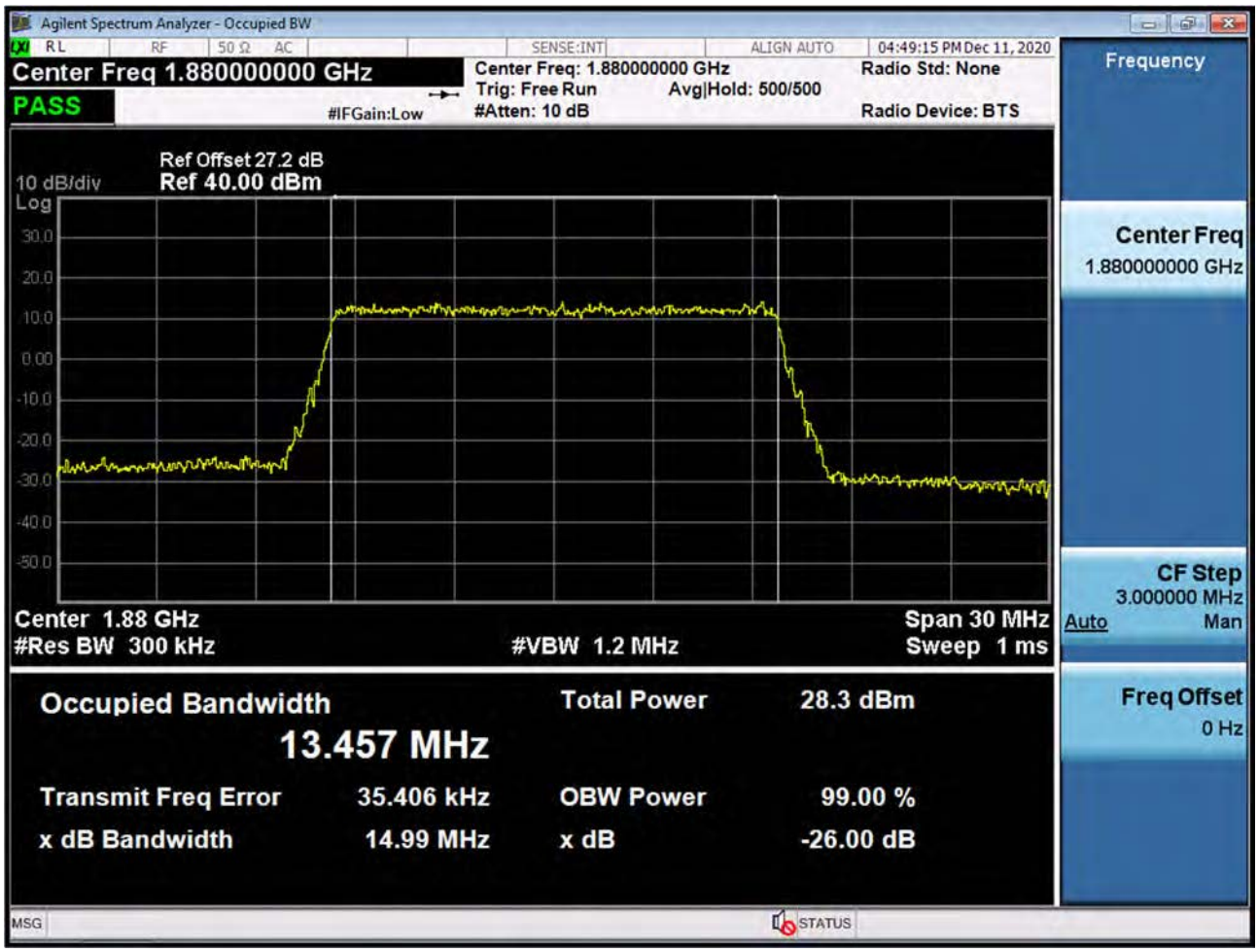
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 QPSK RB 75_0)



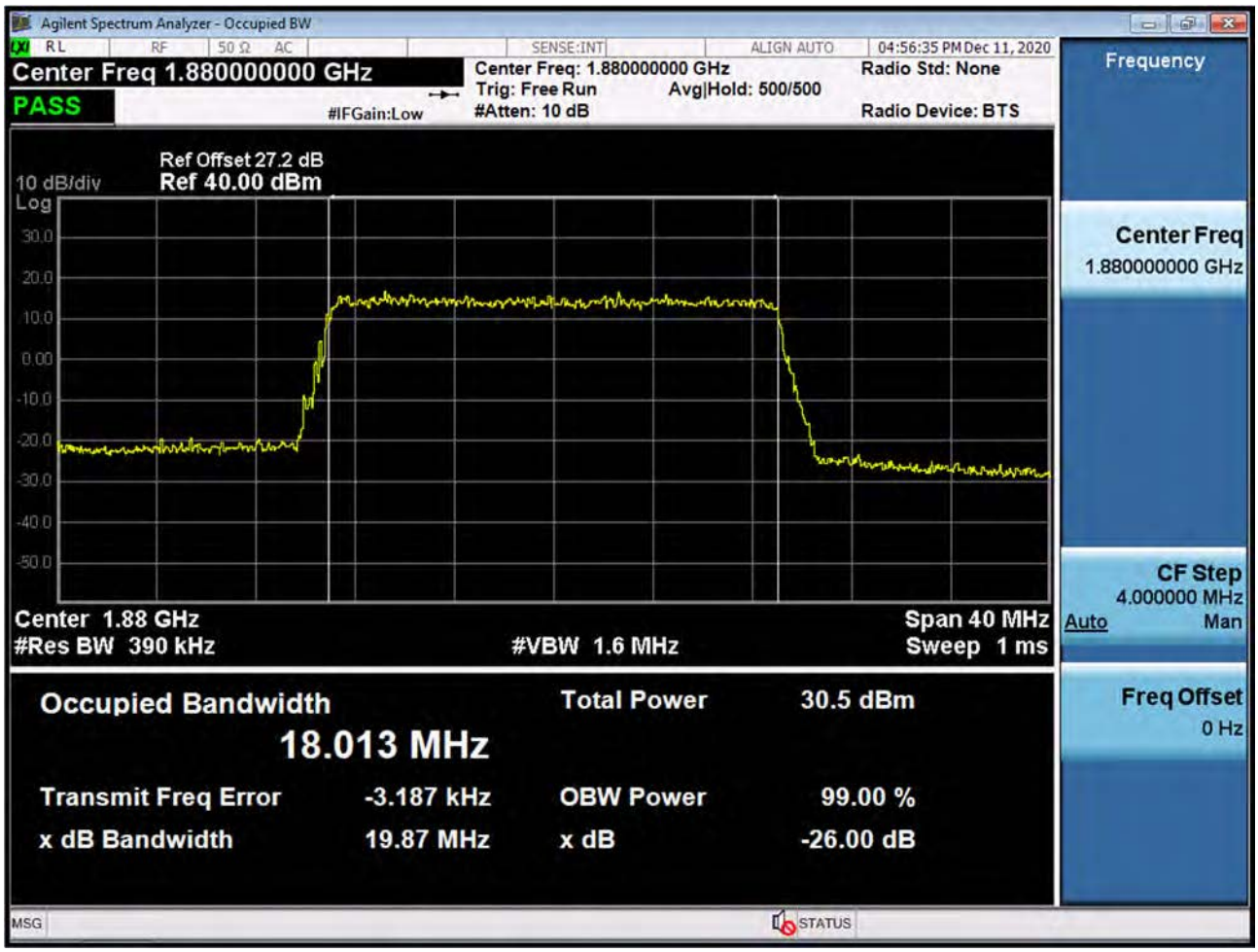
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 16QAM RB 75_0)



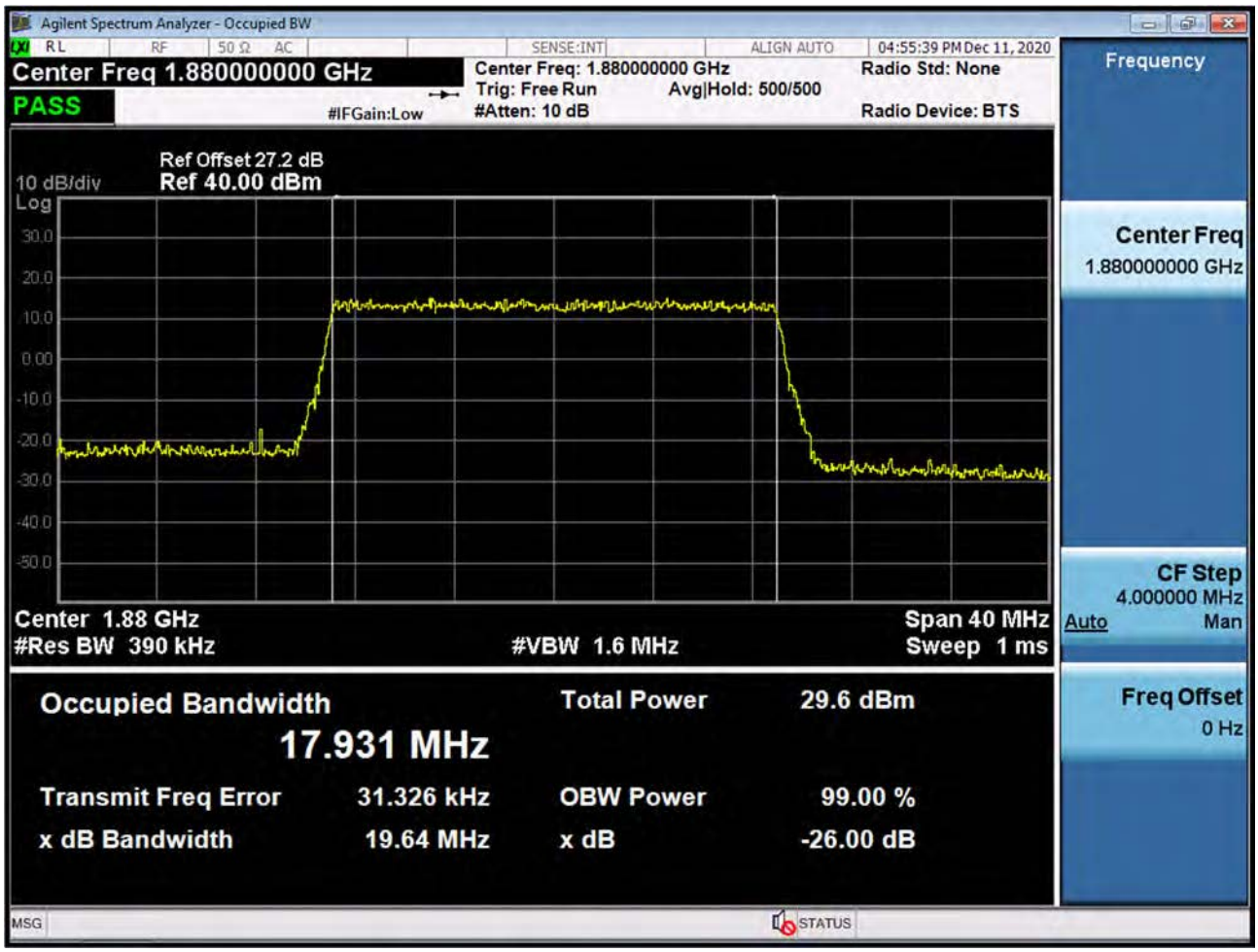
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 64QAM RB 75_0)



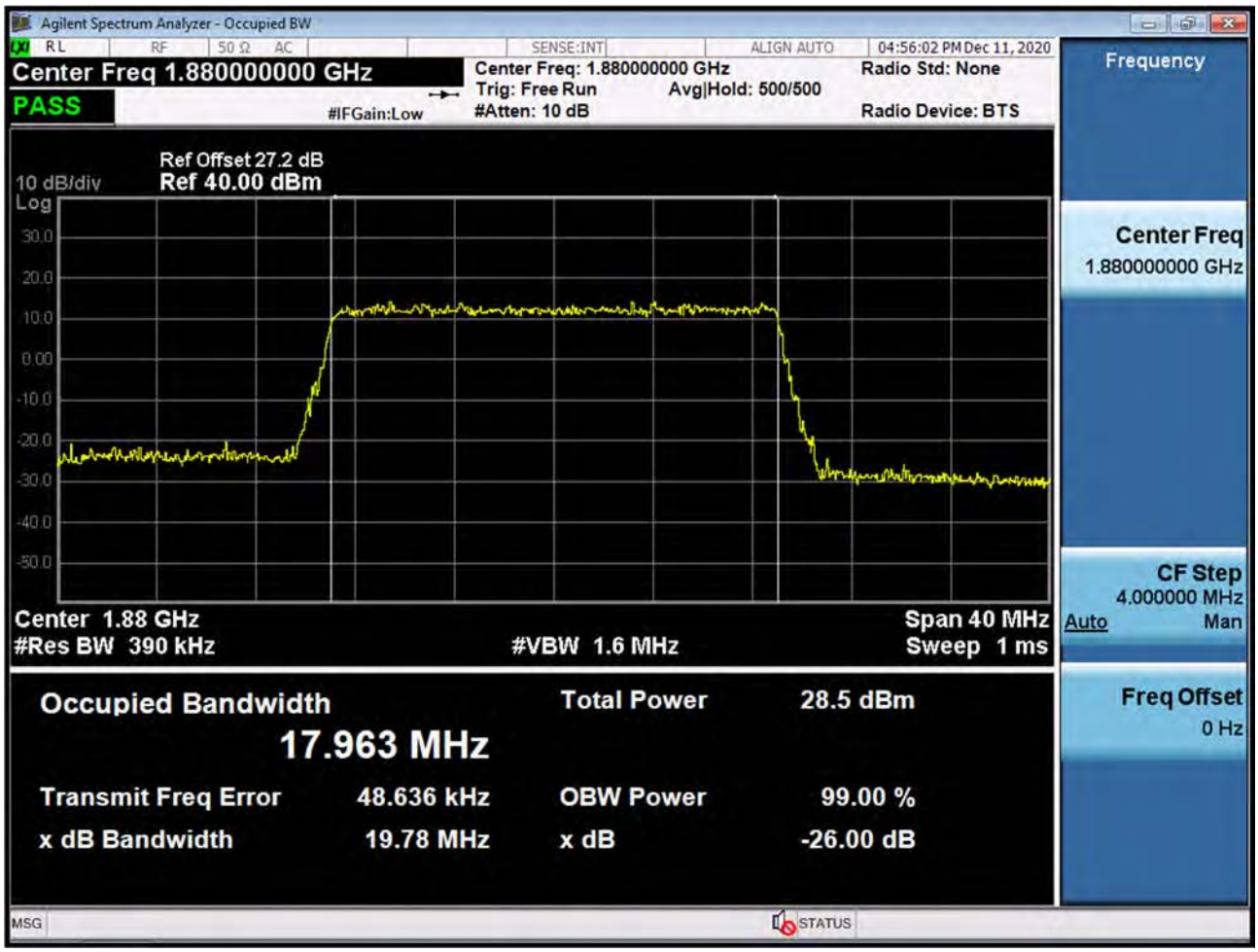
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 QPSK RB 100_0)



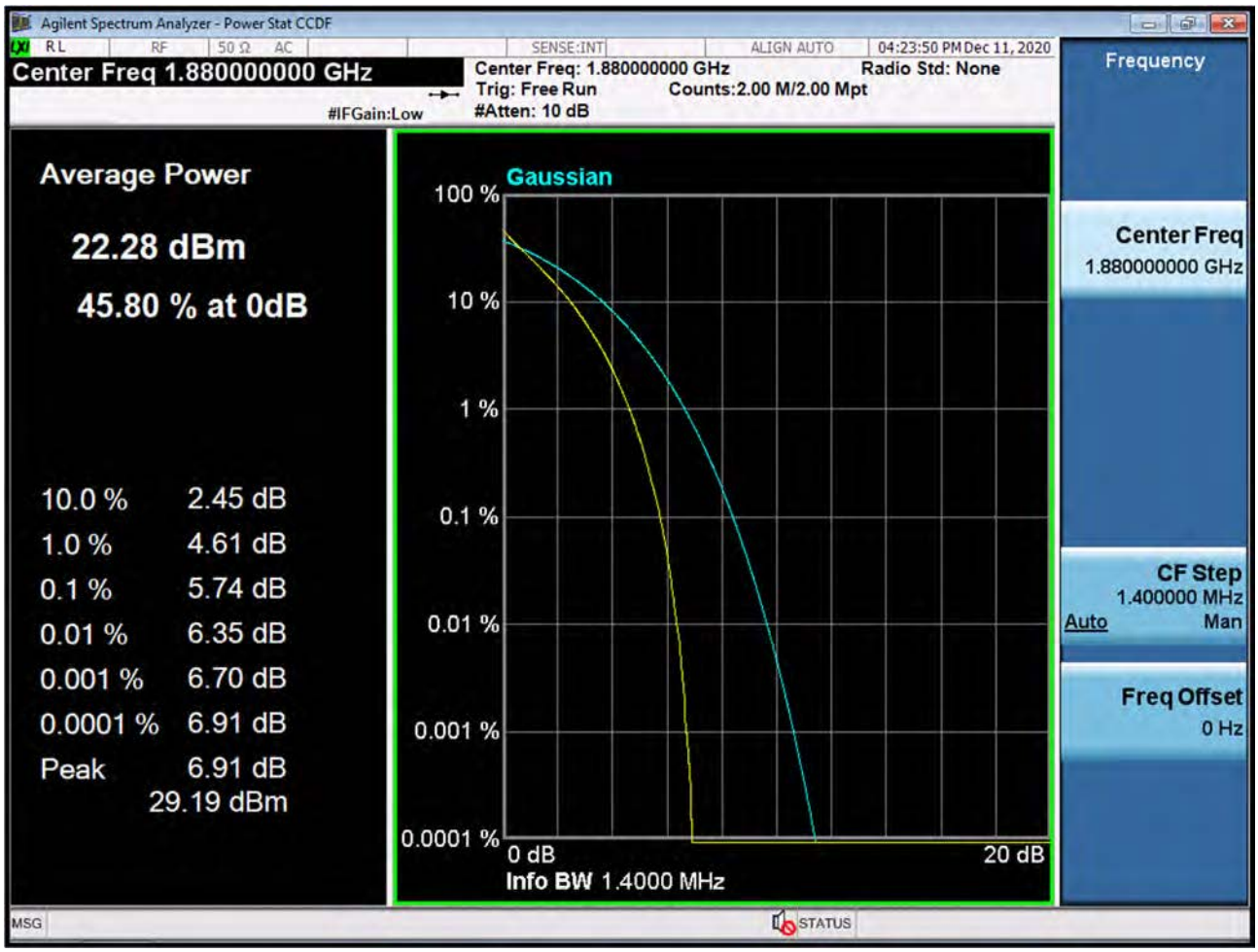
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 16QAM RB 100_0)



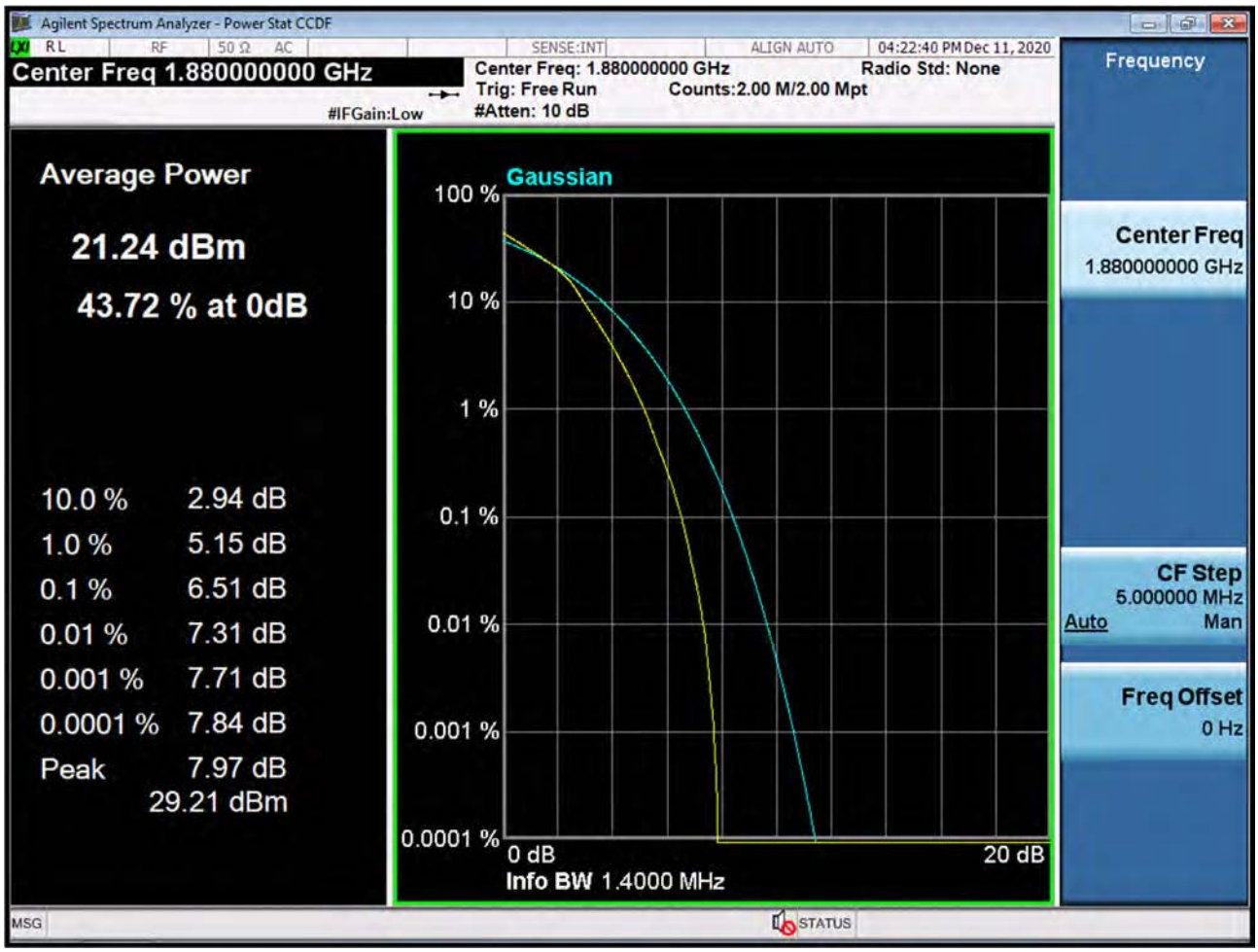
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 64QAM RB 100_0)



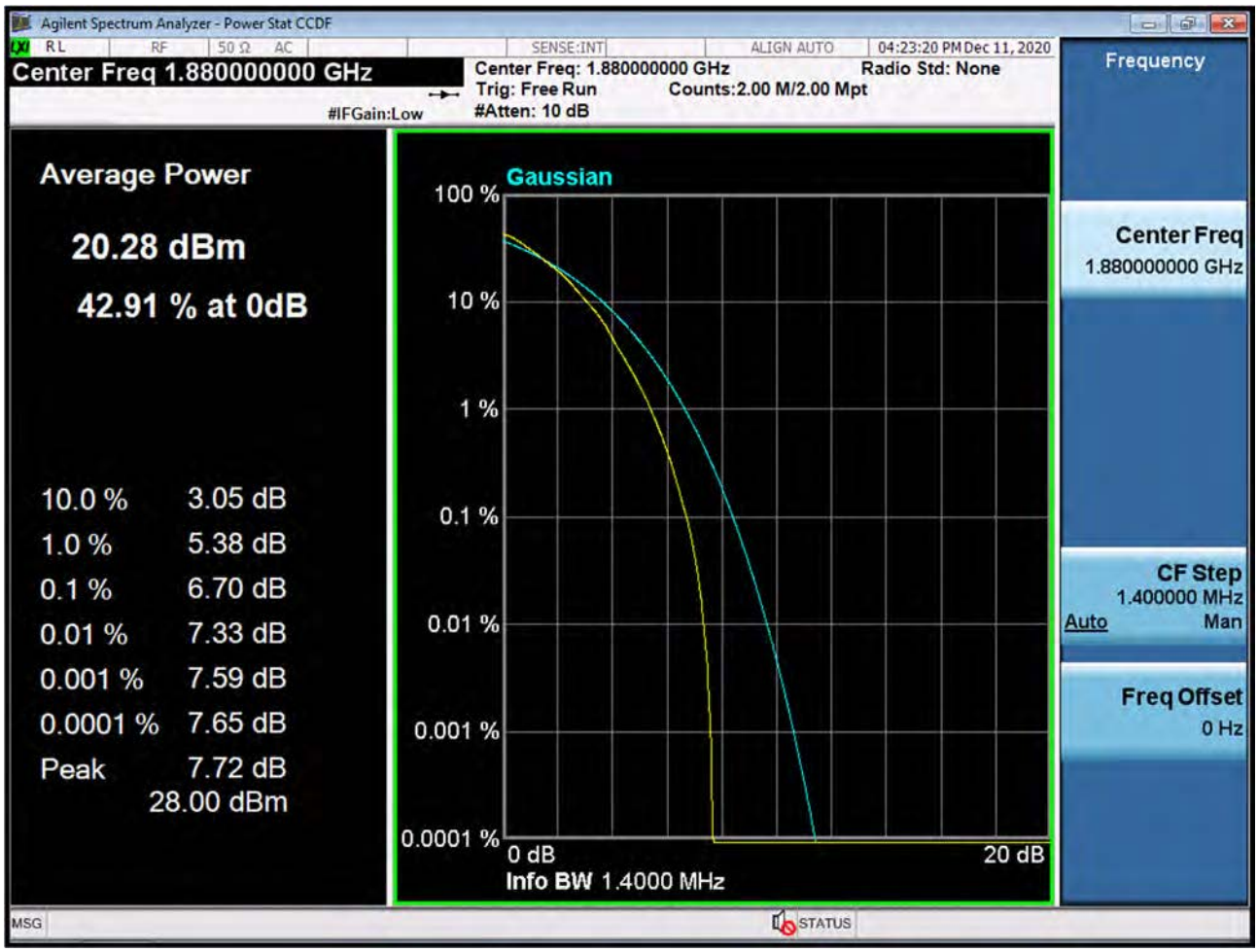
BAND 2. PAR Plot (1.4M BW Ch.18900 QPSK RB 6_0)



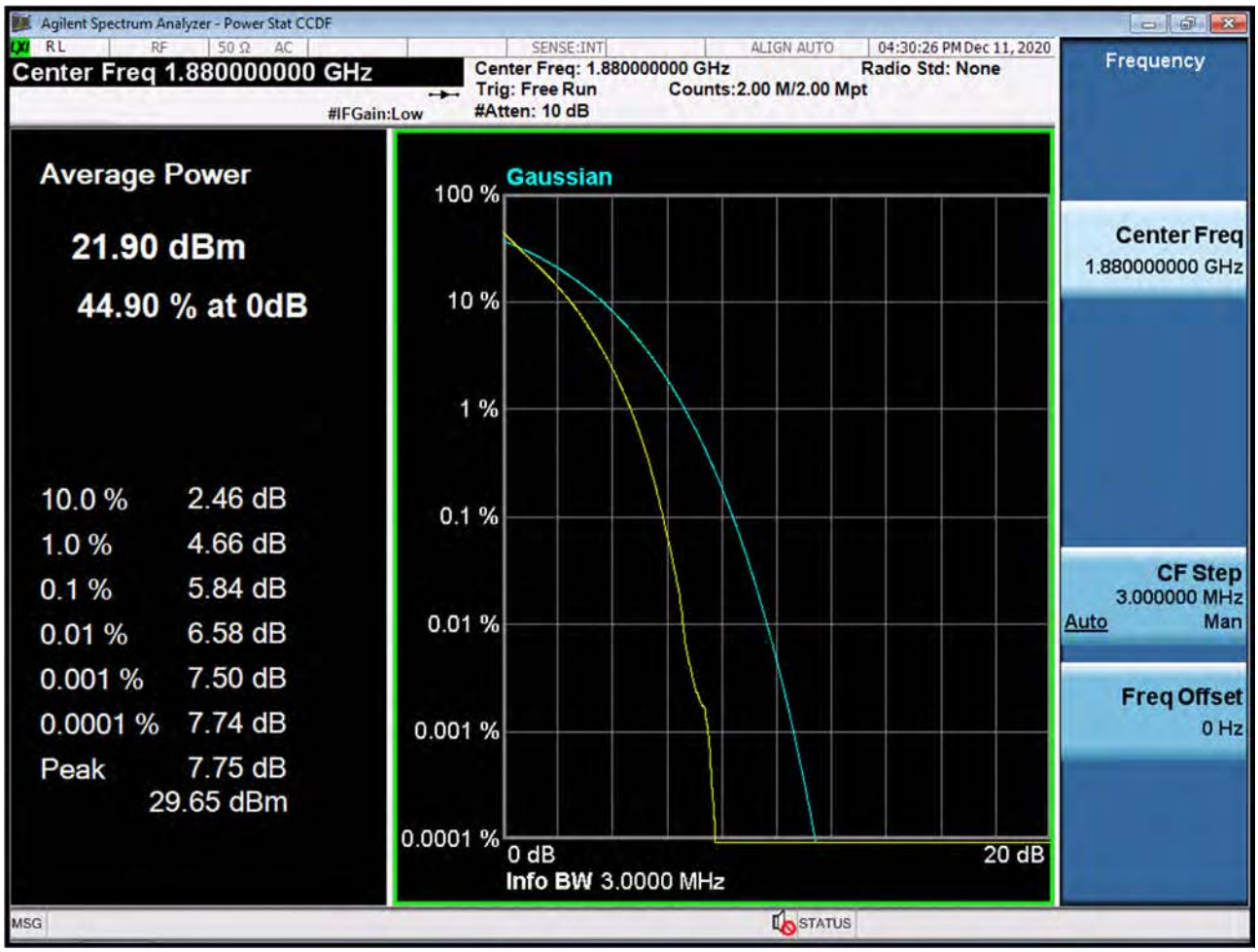
BAND 2. PAR Plot (1.4M BW Ch.18900 16QAM RB 6_0)



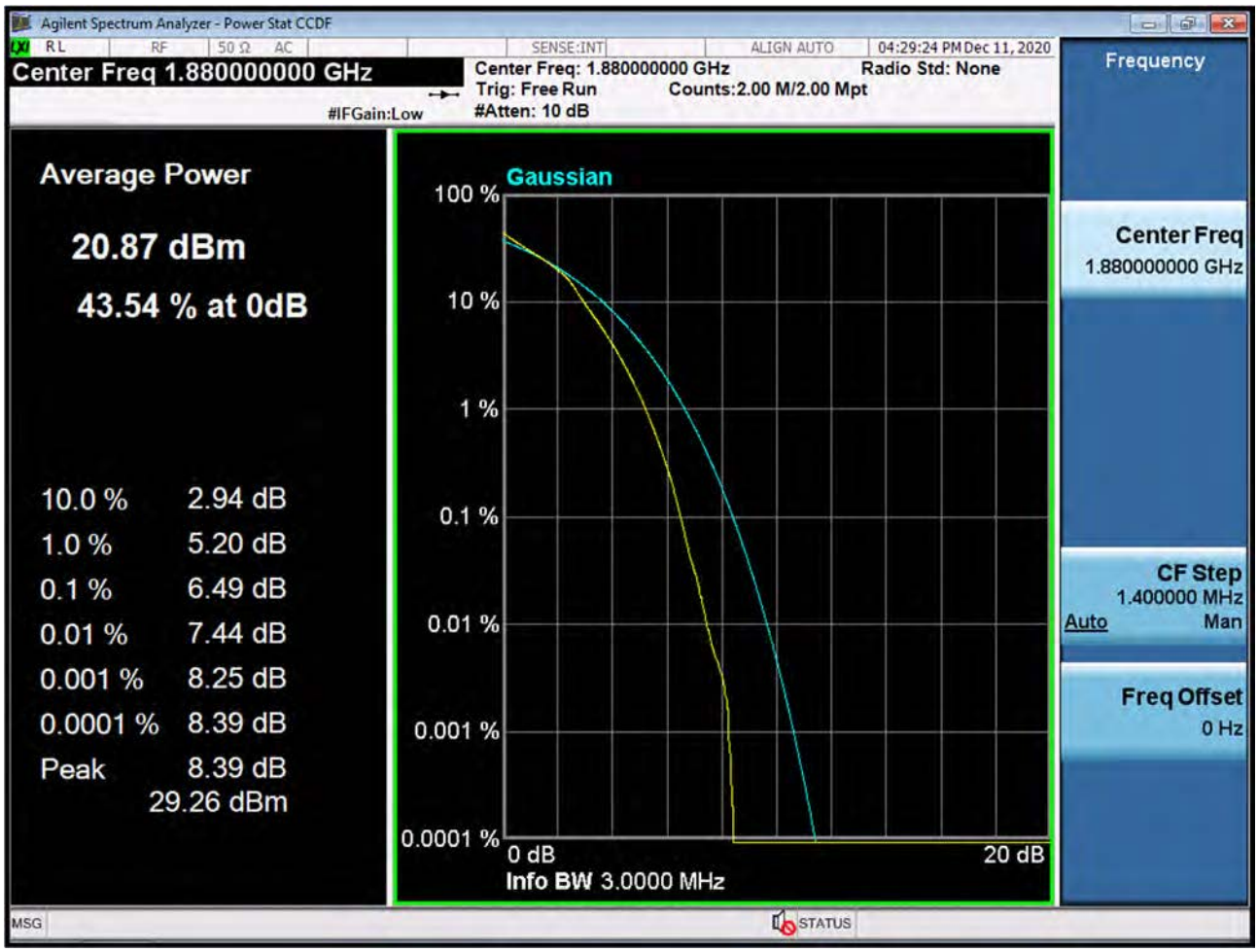
BAND 2. PAR Plot (1.4M BW Ch.18900 64QAM RB 6_0)



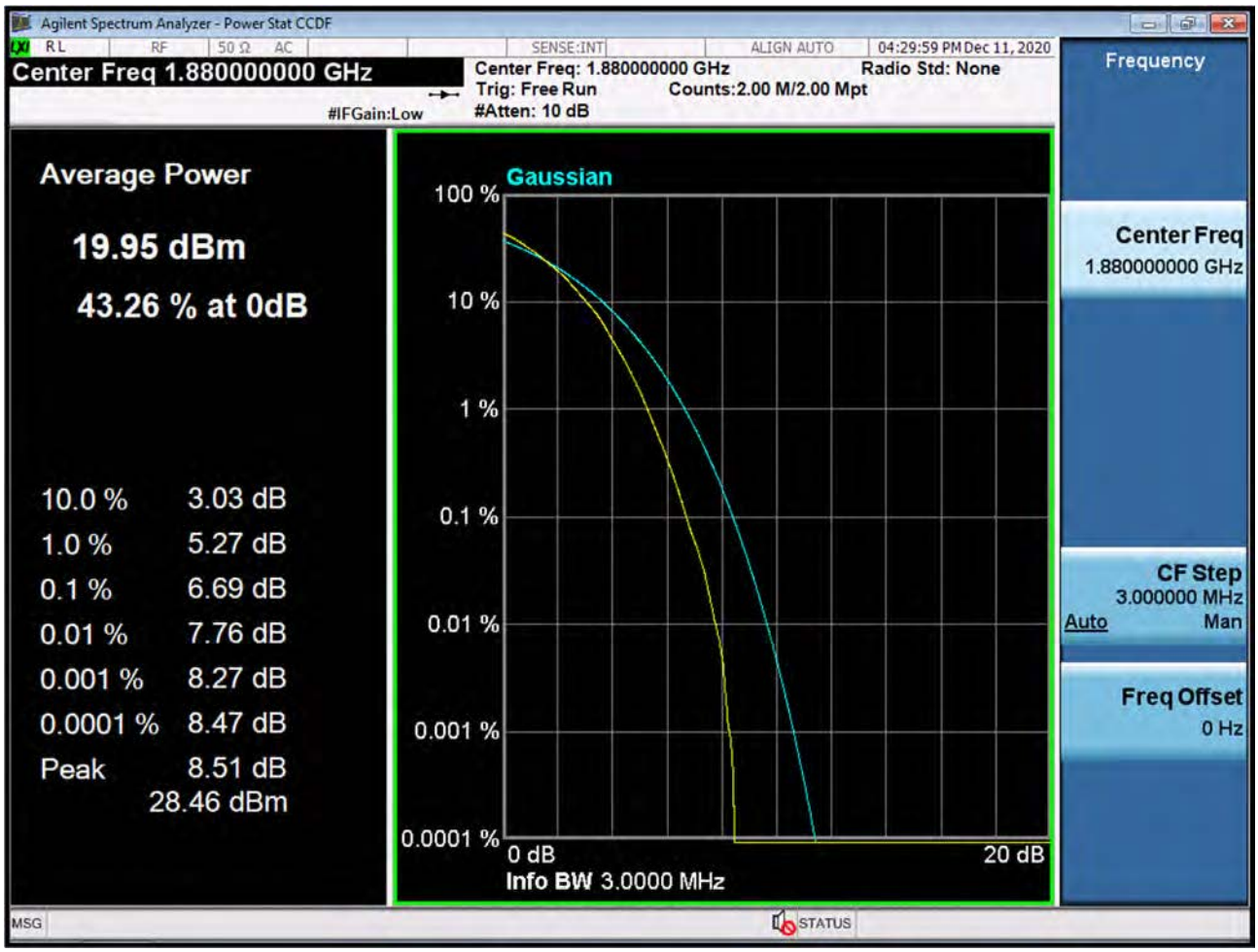
BAND 2. PAR Plot (3M BW Ch.18900 QPSK RB 15_0)



BAND 2. PAR Plot (3M BW Ch.18900 16QAM RB 15_0)

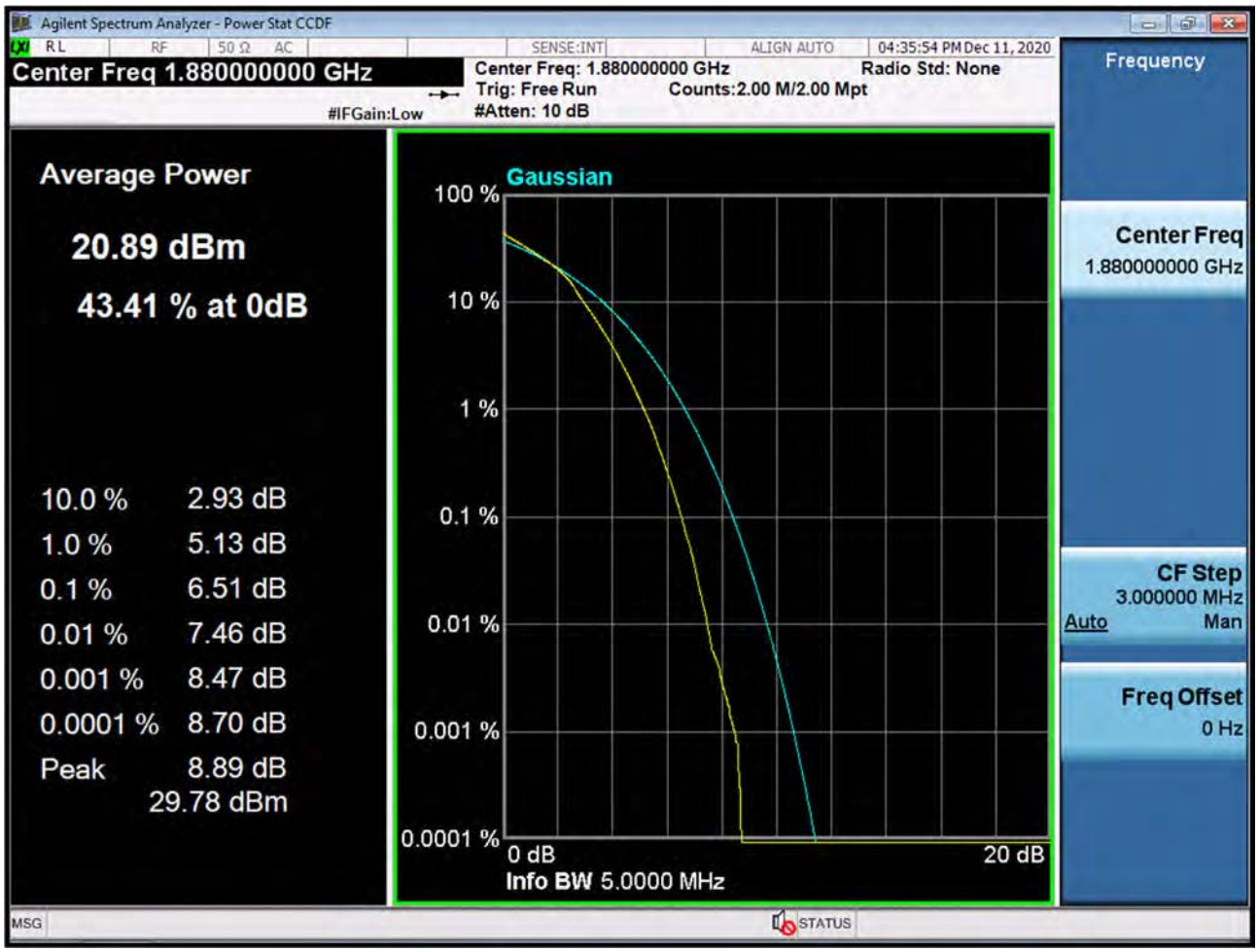


BAND 2. PAR Plot (3M BW Ch.18900 64QAM RB 15_0)

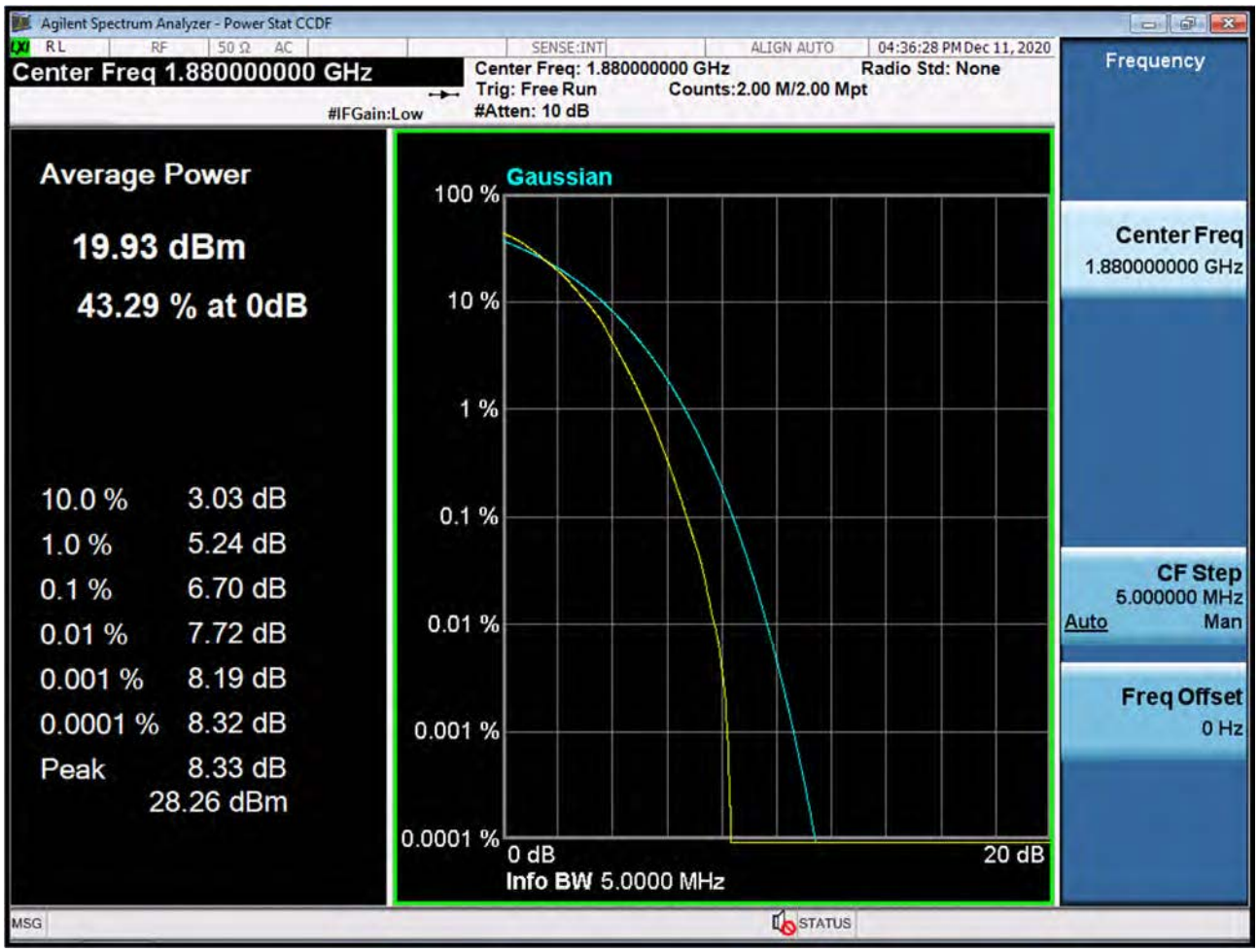


BAND 2. PAR Plot (5M BW Ch.18900 QPSK RB 25_0)

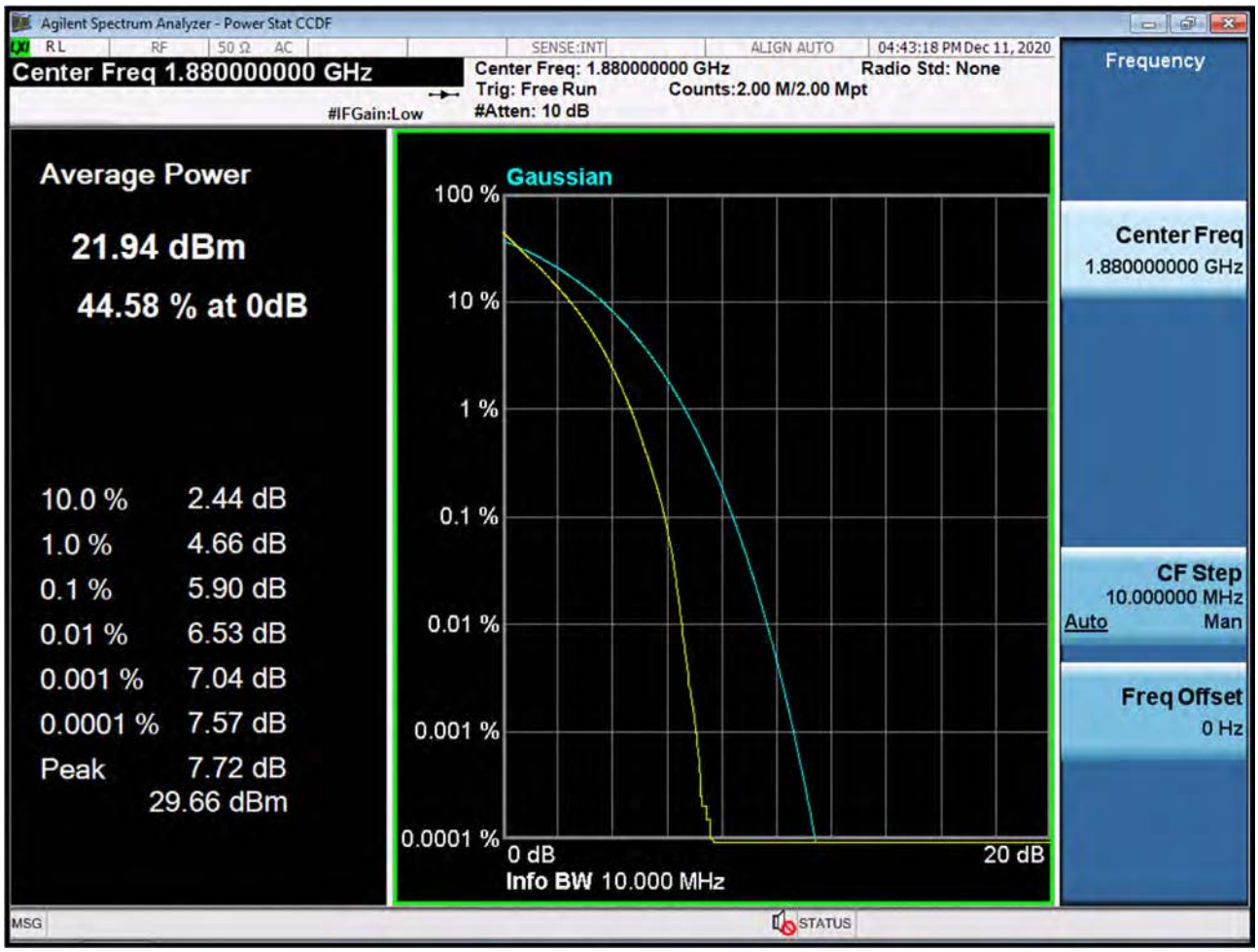
BAND 2. PAR Plot (5M BW Ch.18900 16QAM RB 25_0)



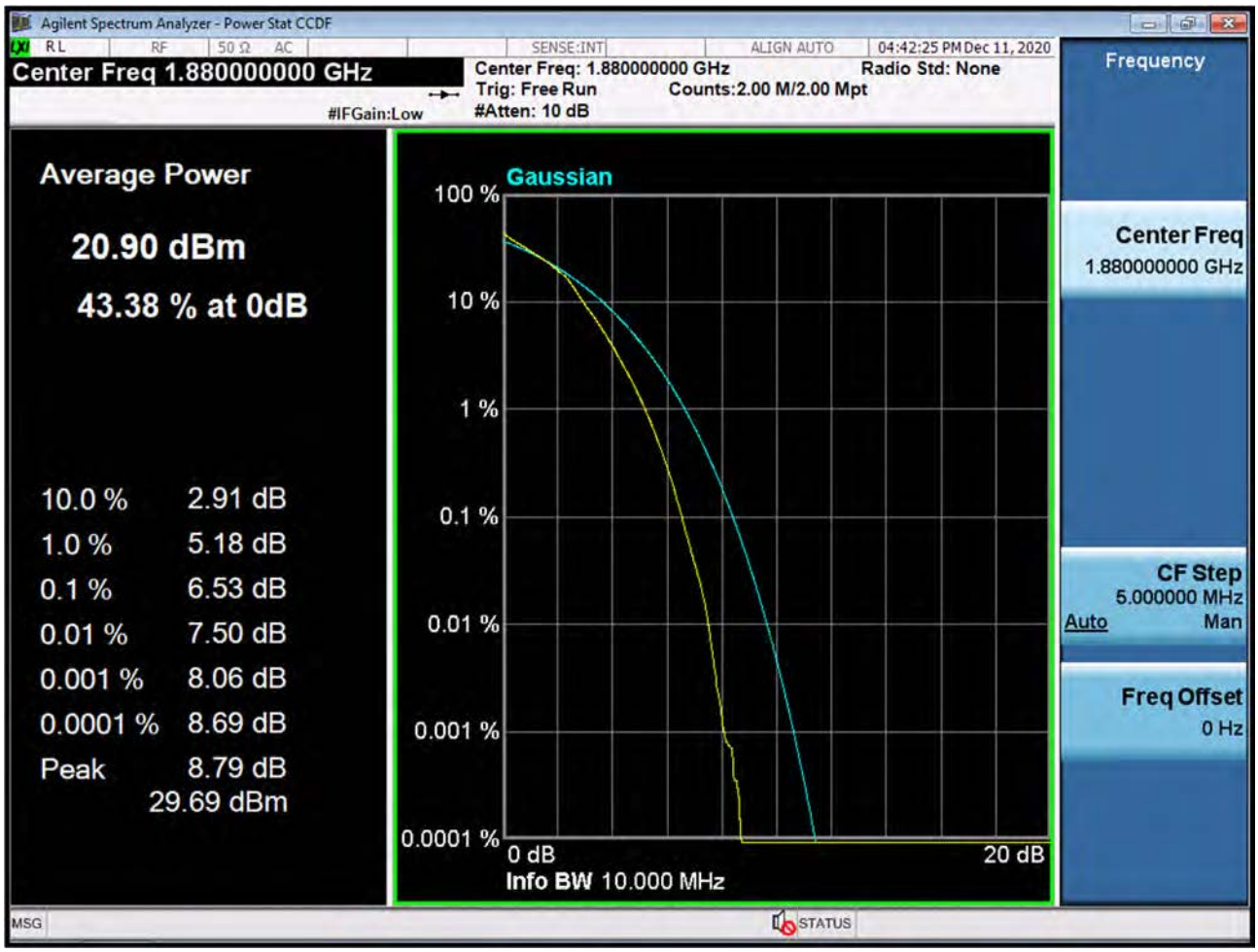
BAND 2. PAR Plot (5M BW Ch.18900 64QAM RB 25_0)



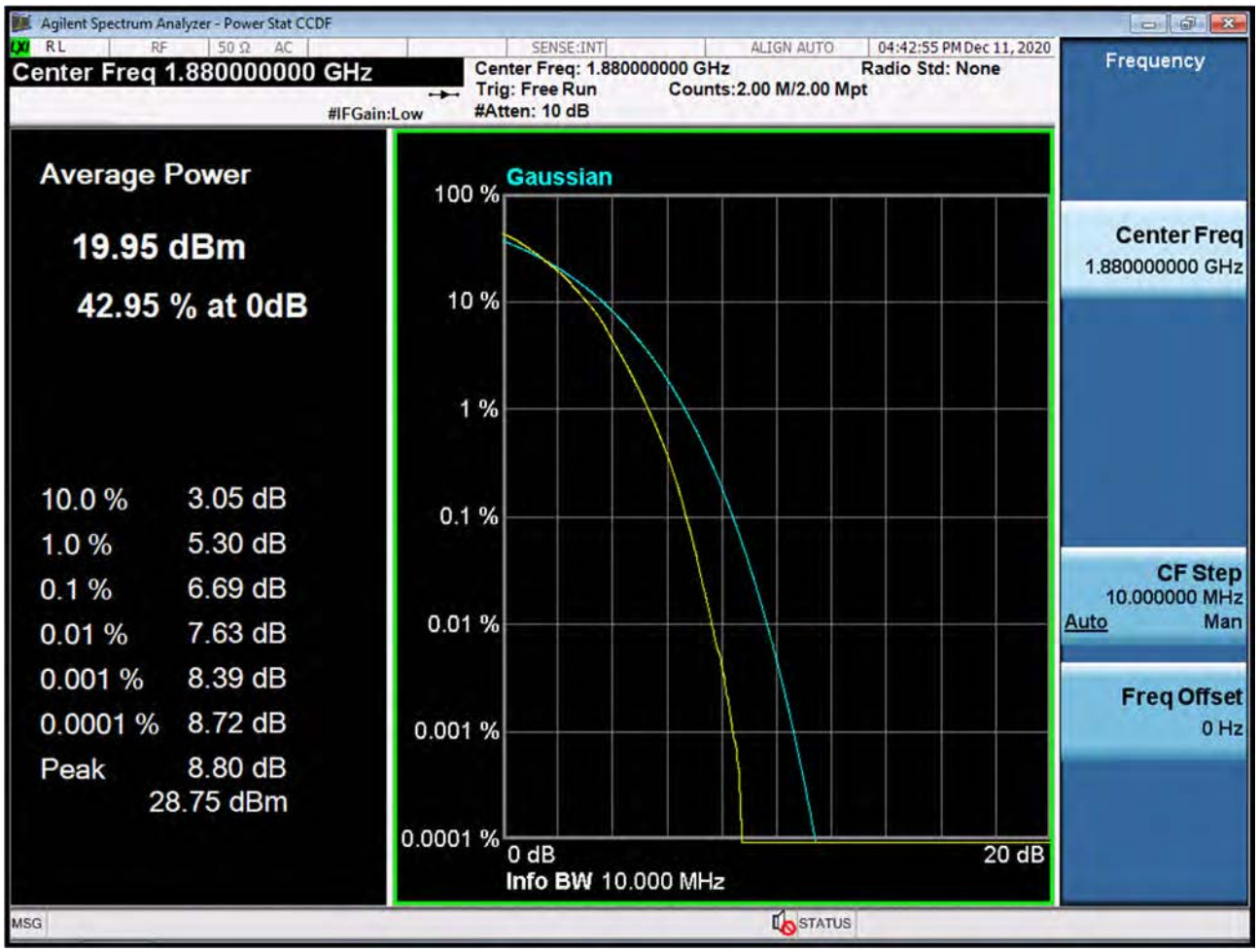
BAND 2. PAR Plot (10M BW Ch.18900 QPSK RB 50_0)



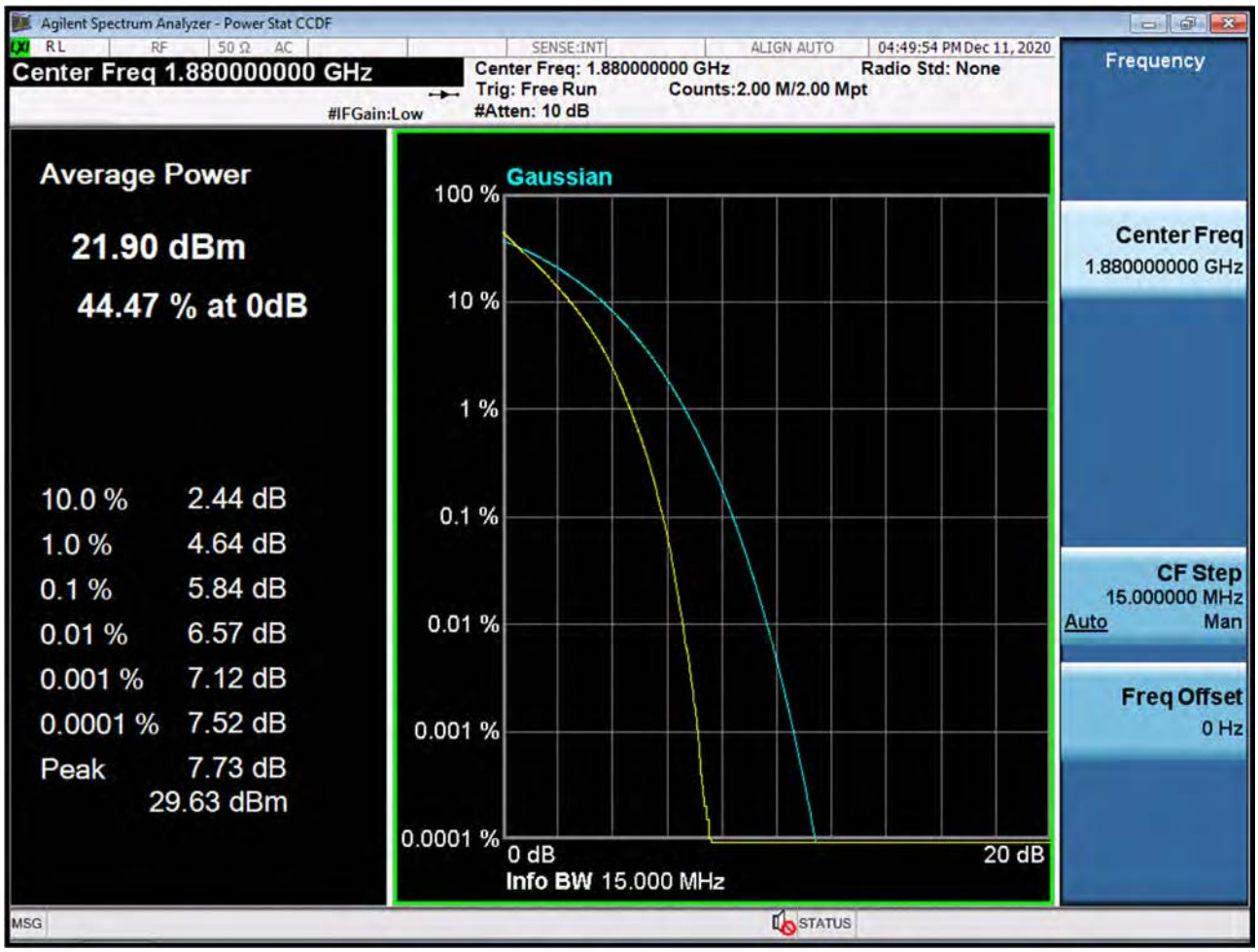
BAND 2. PAR Plot (10M BW Ch.18900 16QAM RB 50_0)



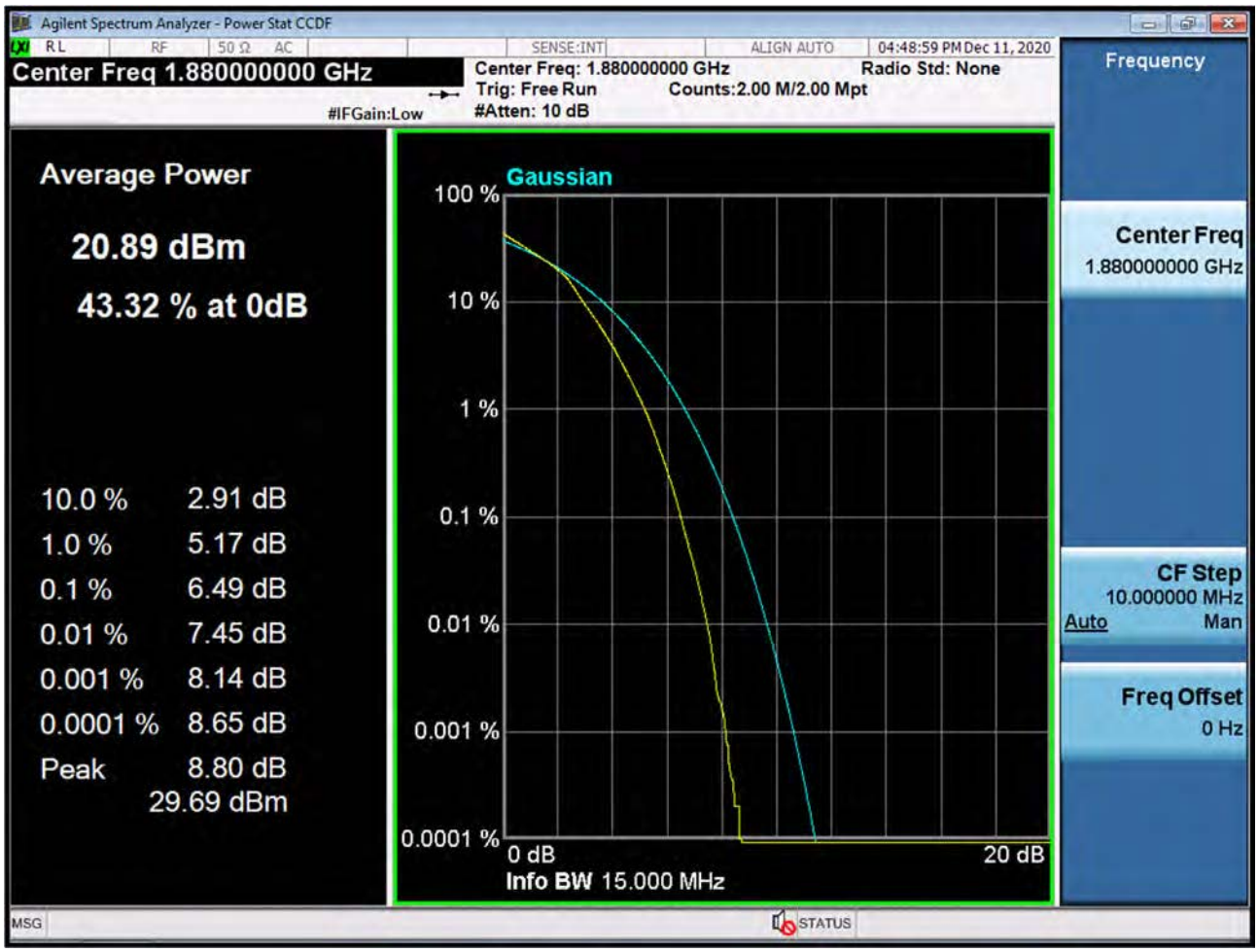
BAND 2. PAR Plot (10M BW Ch.18900 64QAM RB 50_0)



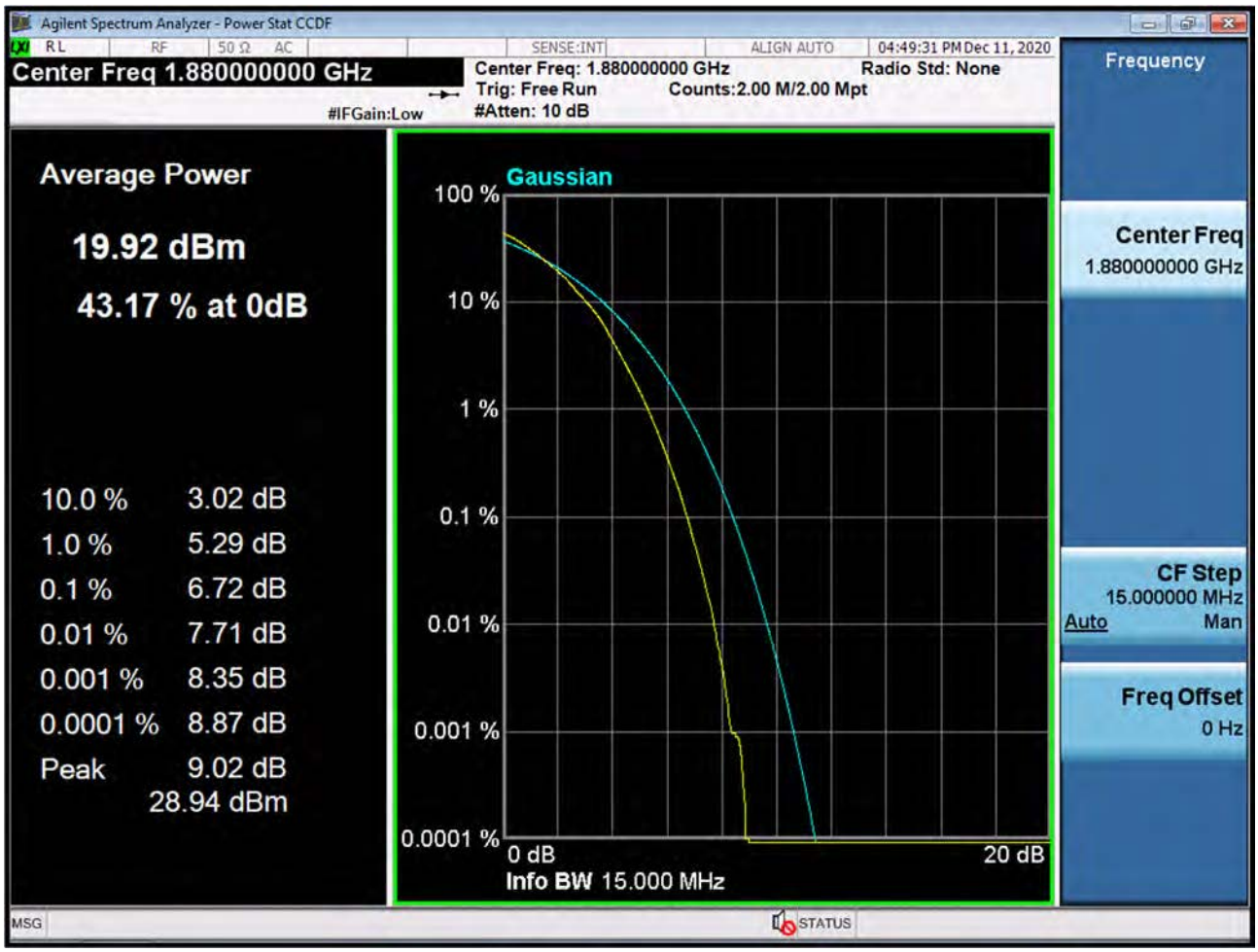
BAND 2. PAR Plot (15M BW Ch.18900 QPSK RB 75_0)



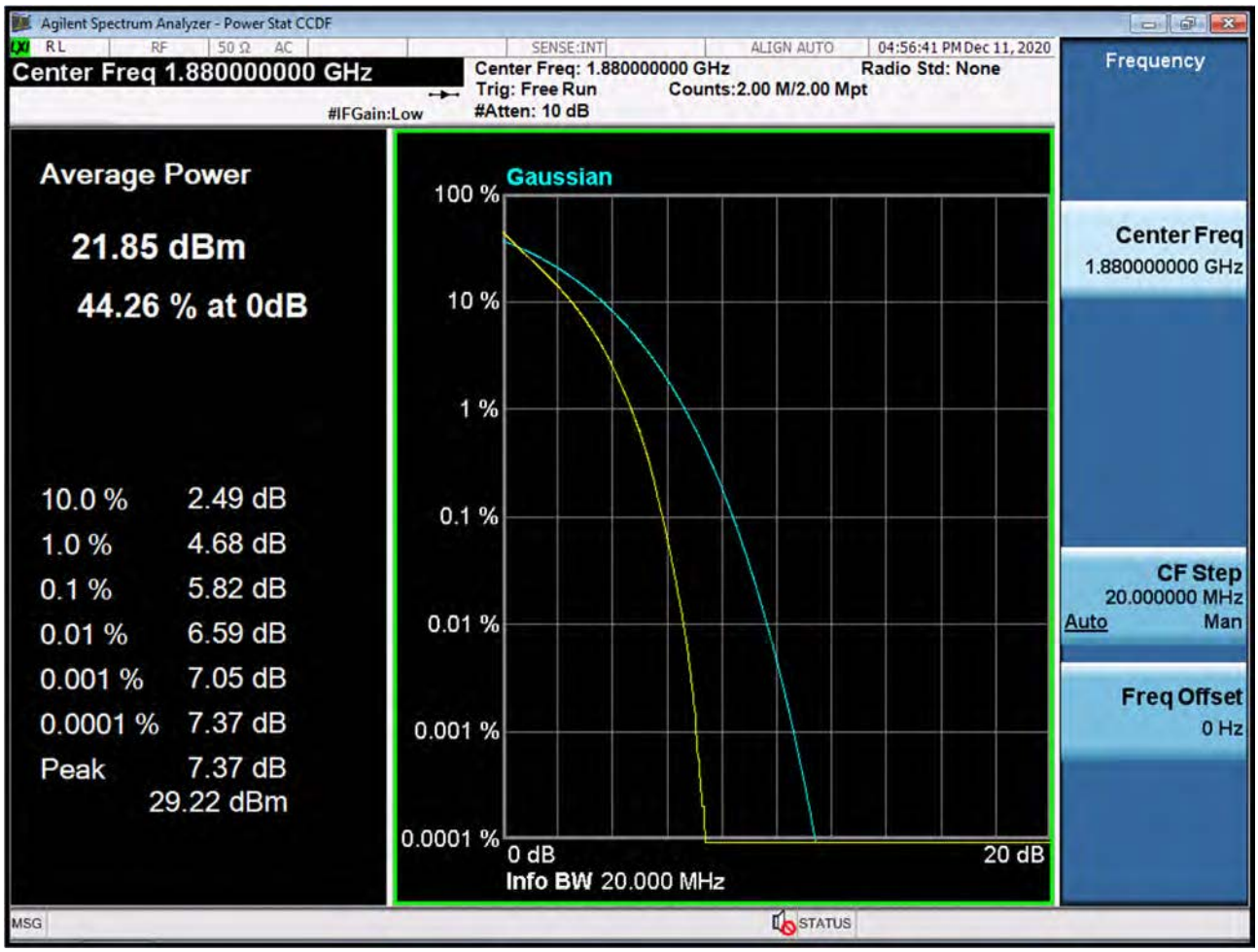
BAND 2. PAR Plot (15M BW Ch.18900 16QAM RB 75_0)



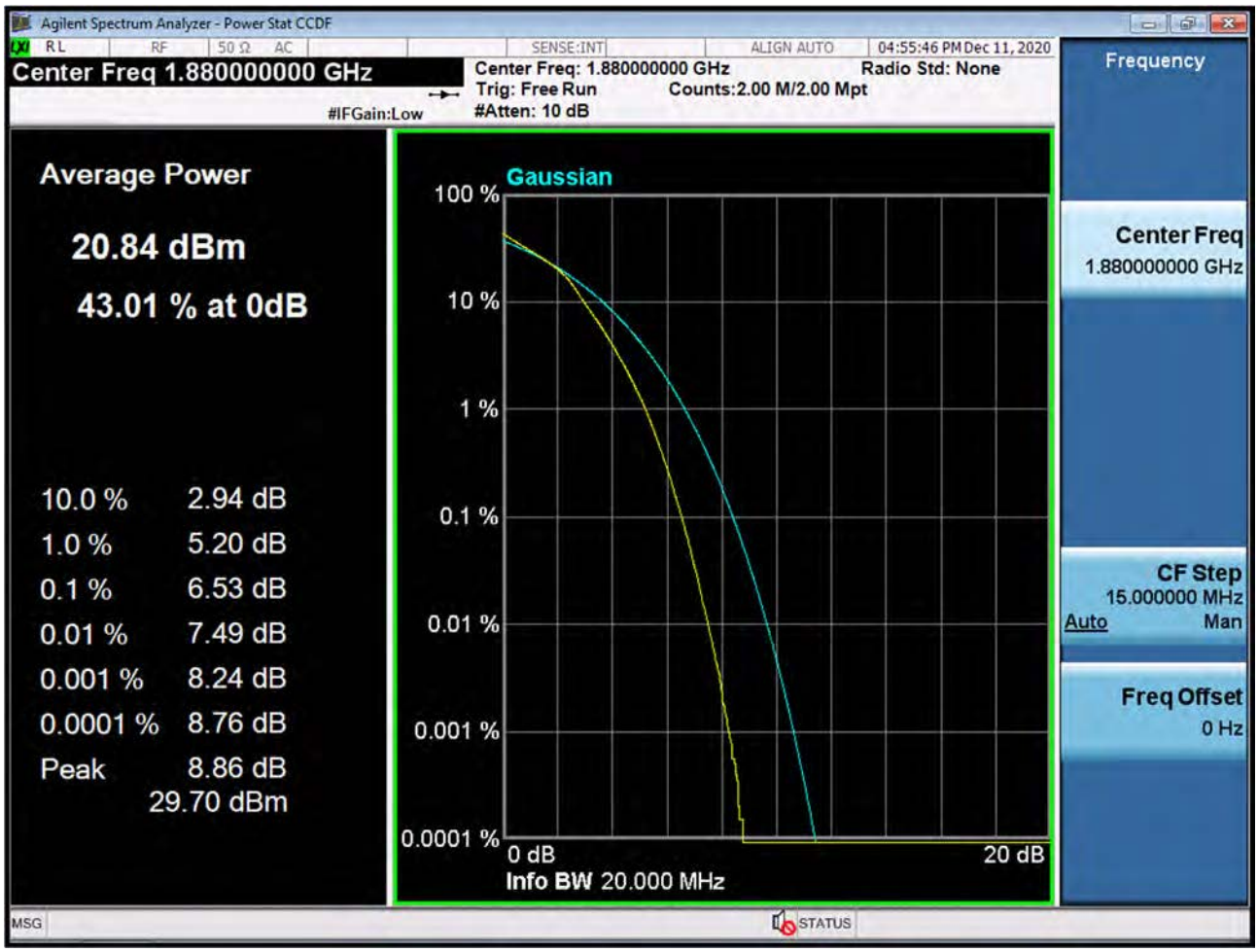
BAND 2. PAR Plot (15M BW Ch.18900 64QAM RB 75_0)



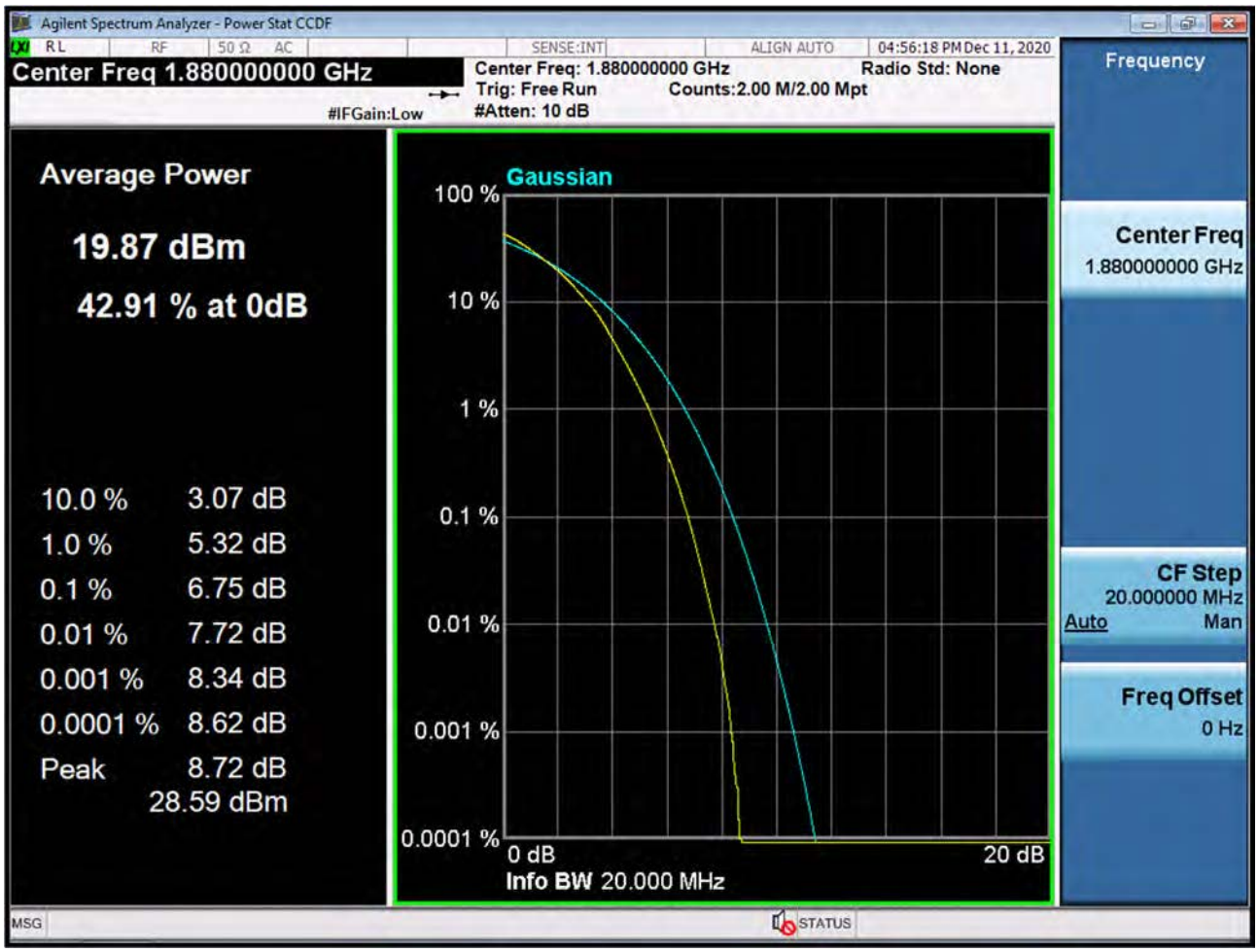
BAND 2. PAR Plot (20M BW Ch.18900 QPSK RB 100_0)



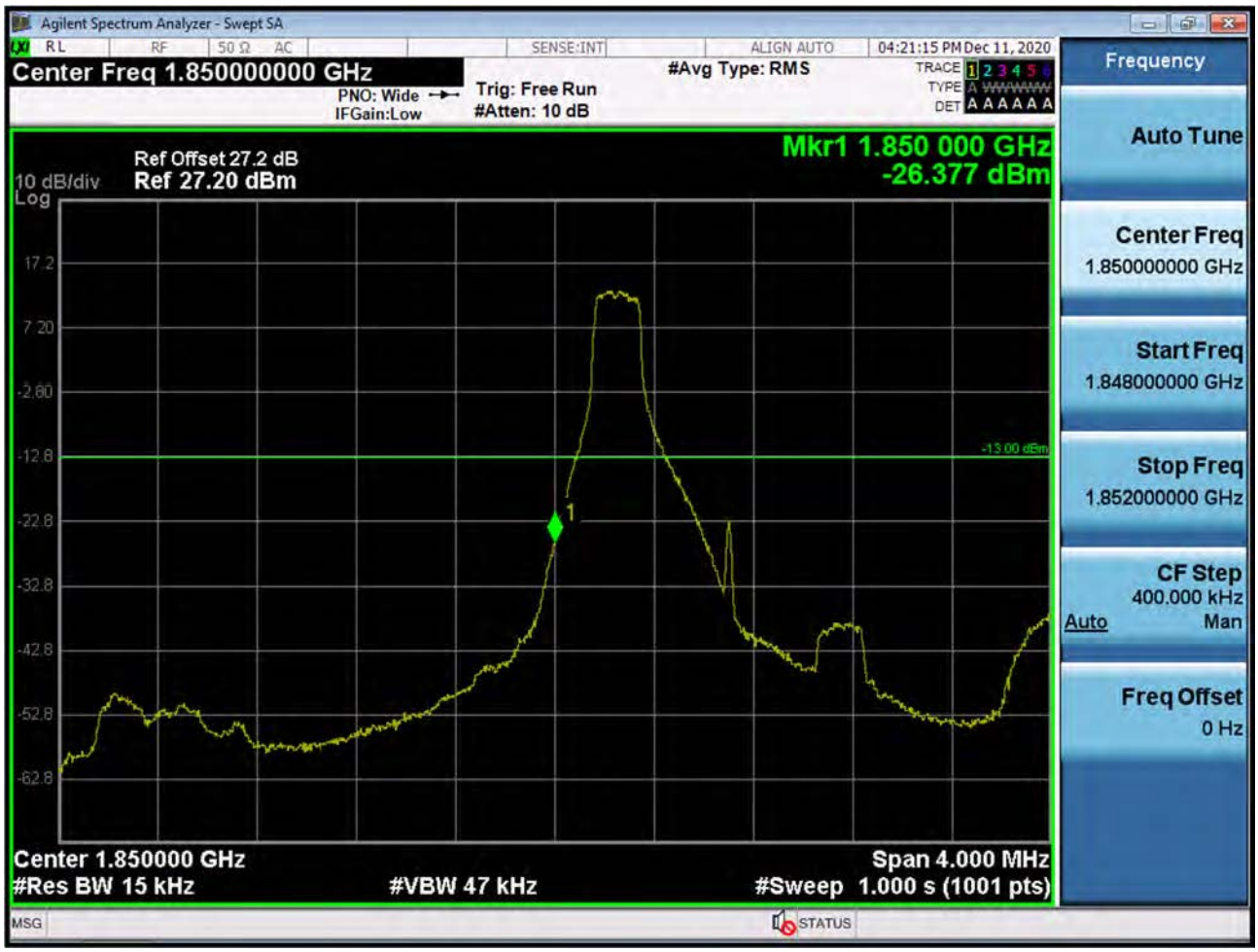
BAND 2. PAR Plot (20M BW Ch.18900 16QAM RB 100_0)



BAND 2. PAR Plot (20M BW Ch.18900 64QAM RB 100_0)

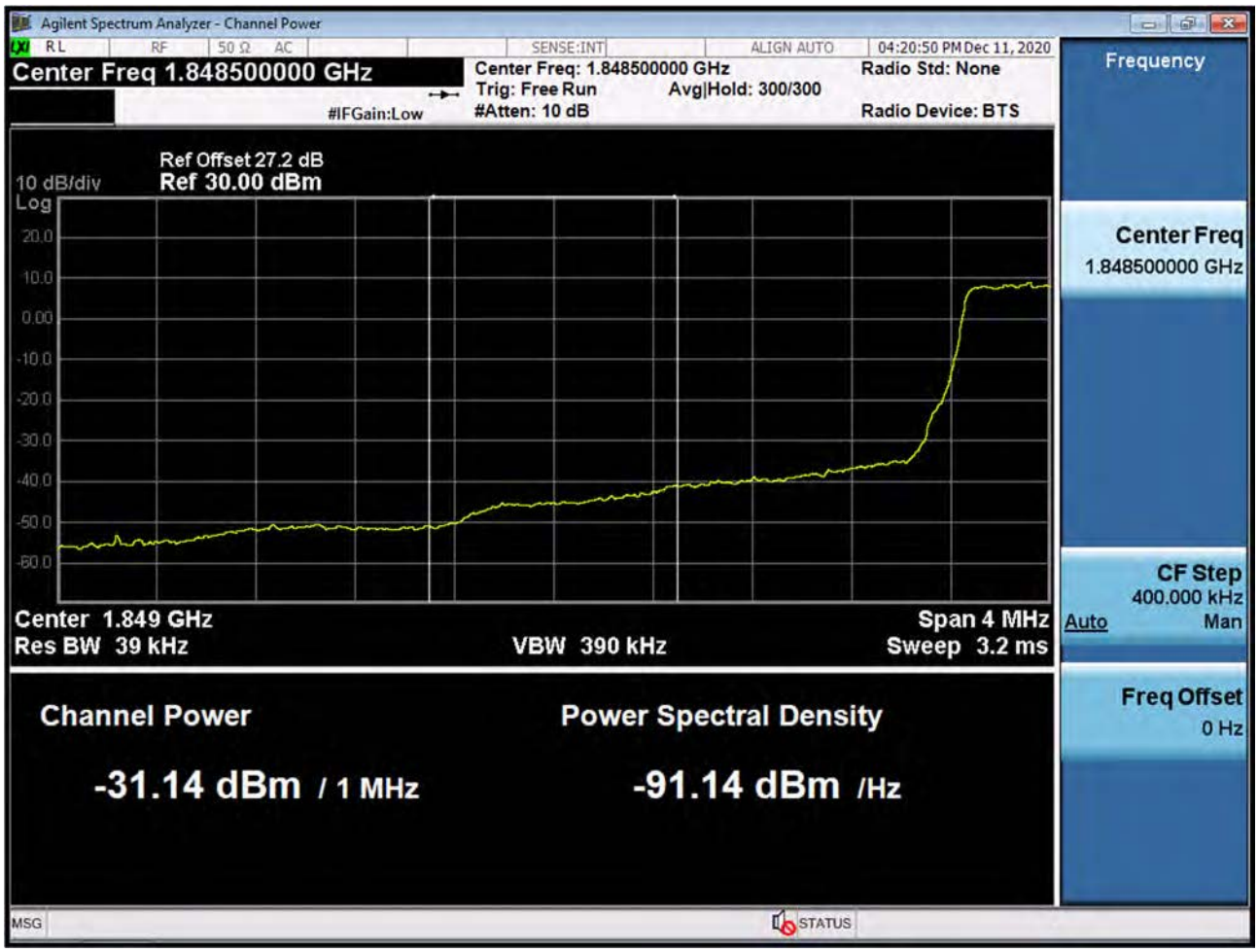


BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB1_Offset 0) -1



BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB6_Offset 0) -2

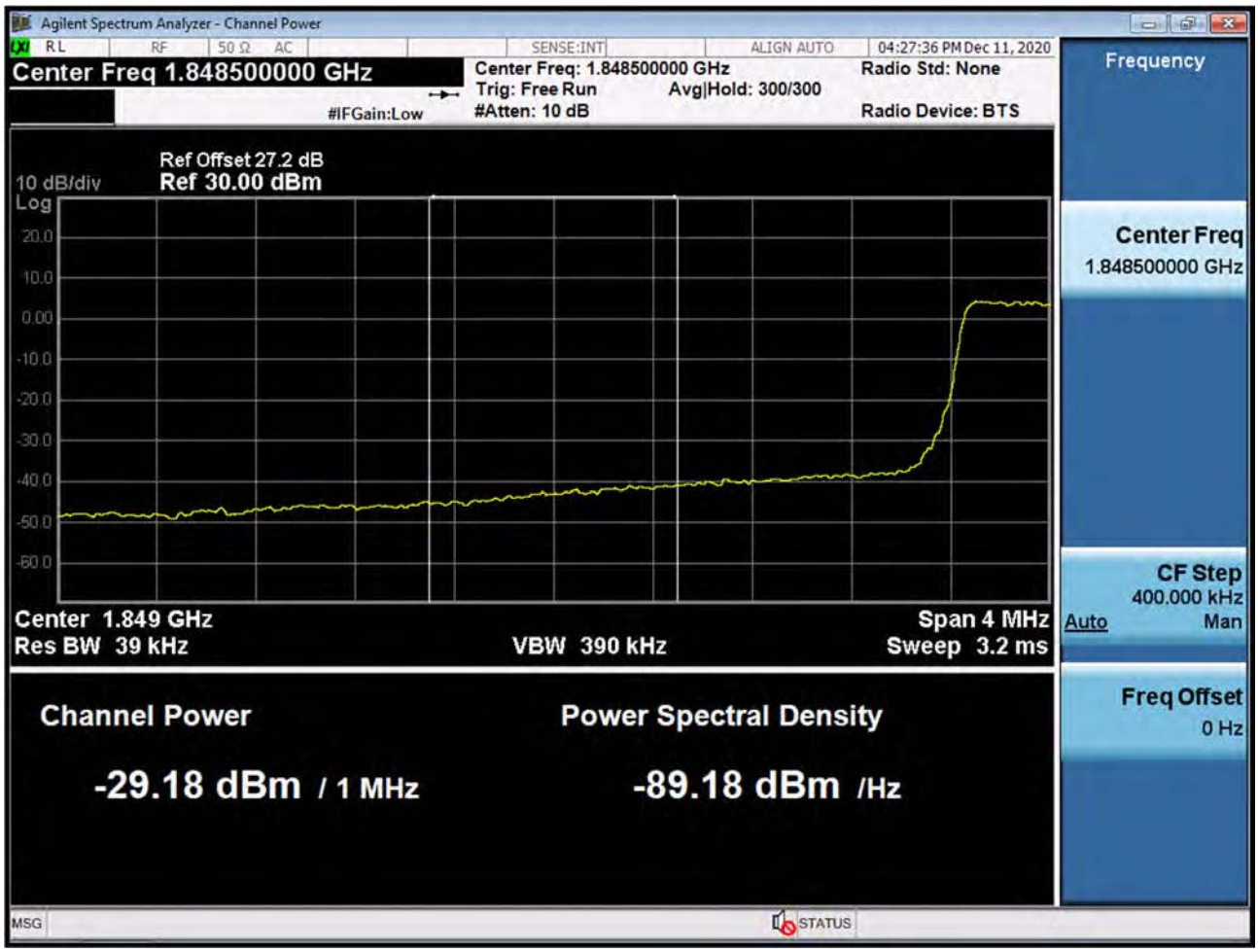
BAND 2. Lower Extended Band Edge Plot (1.4M BW Ch.18607 QPSK_RB6_0) -3



BAND 2. Lower Band Edge Plot (3M BW Ch.18615 QPSK_RB1_Offset 0) -1

BAND 2. Lower Band Edge Plot (3M BW Ch.18615 QPSK_RB15_Offset 0) -2

BAND 2. Lower Extended Band Edge Plot (3M BW Ch.18615 QPSK_RB15_0) -3



BAND 2. Lower Band Edge Plot (5M BW Ch.18625 QPSK_RB1_Offset 0) -1

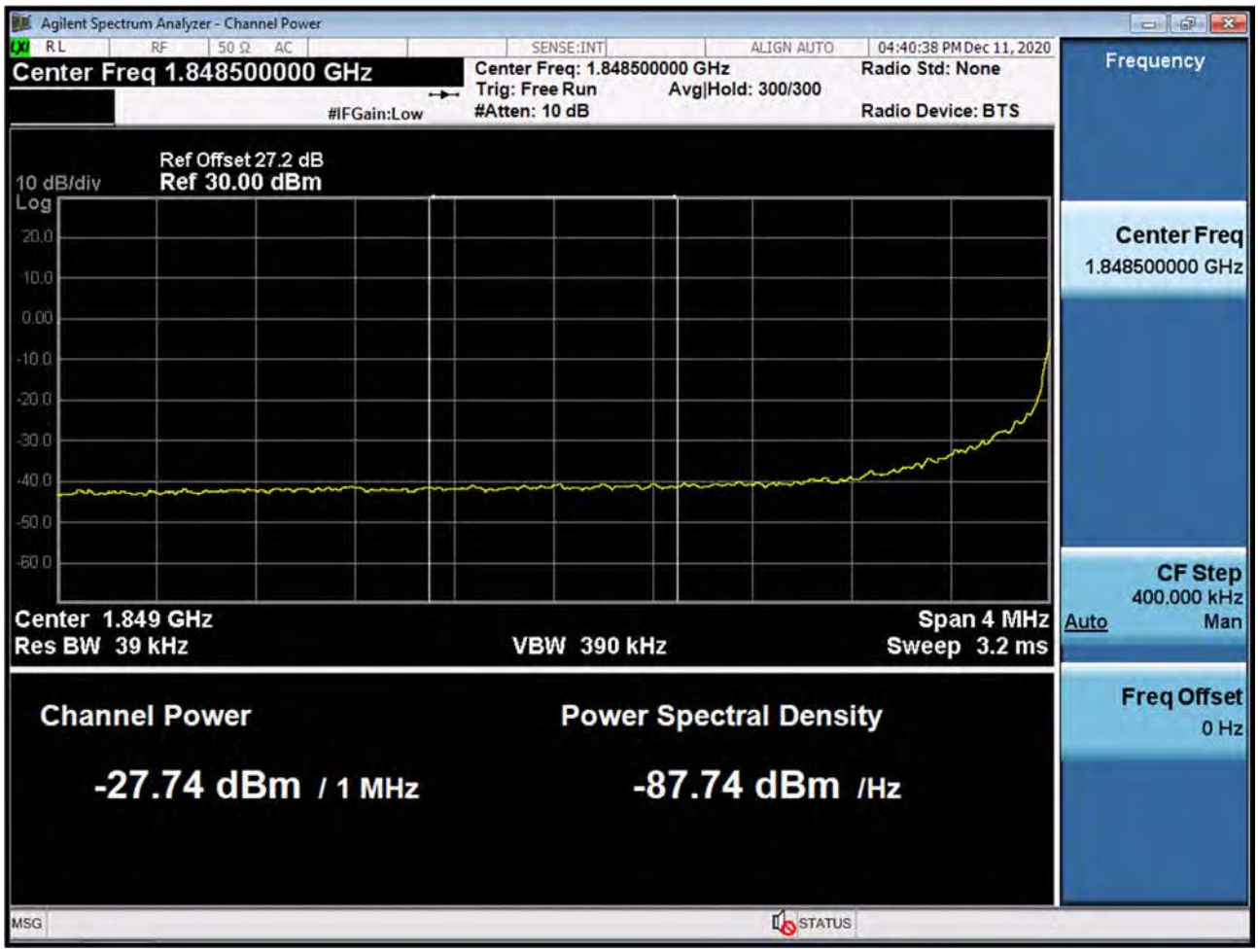
BAND 2. Lower Band Edge Plot (5M BW Ch.18625 QPSK_RB25_Offset 0) -2

BAND 2. Lower Extended Band Edge Plot (5M BW Ch.18625 QPSK_RB25_0) -3

BAND 2. Lower Band Edge Plot (10M BW Ch.18650 QPSK_RB1_Offset 0) -1

BAND 2. Lower Band Edge Plot (10M BW Ch.18650 QPSK_RB50_Offset 0) -2

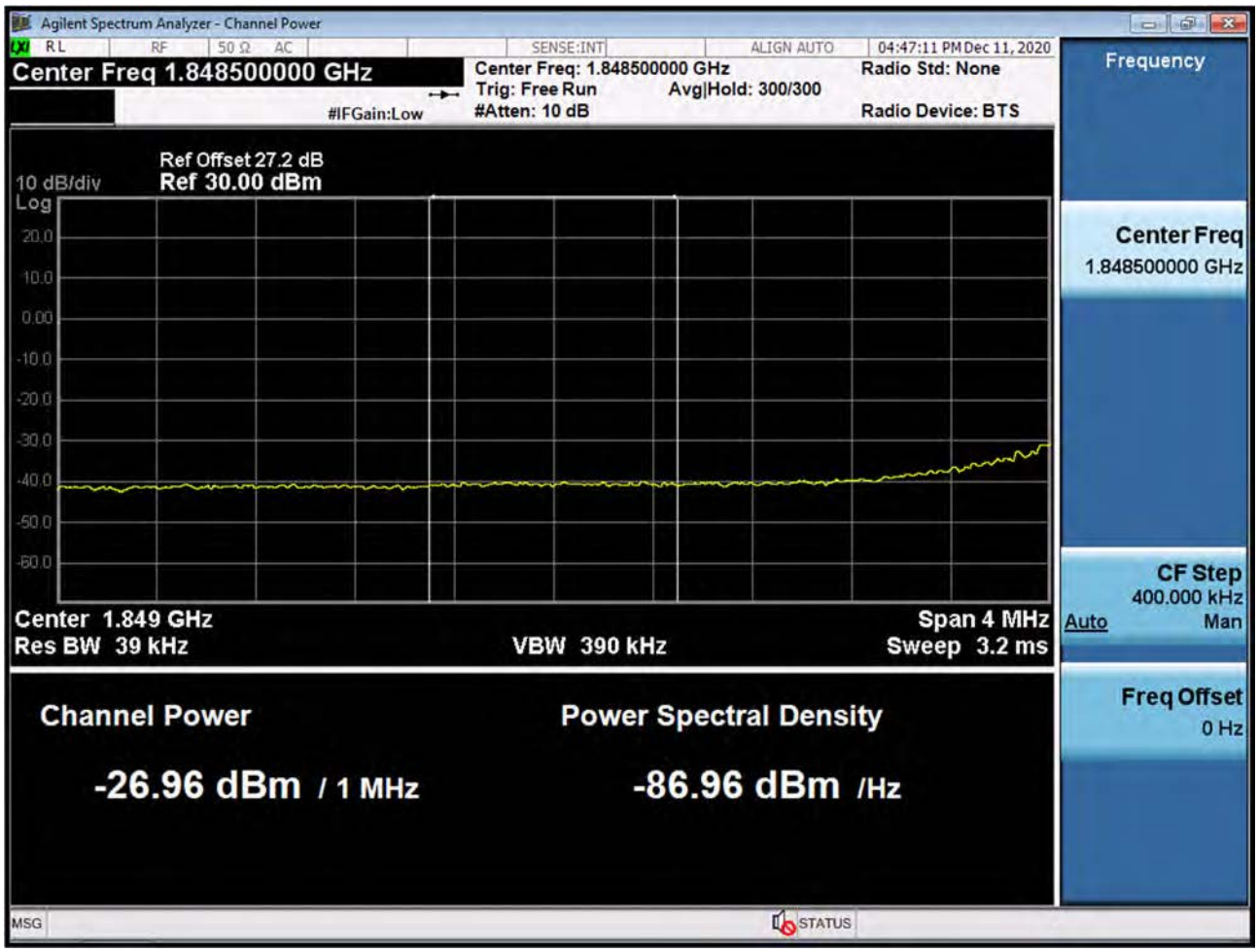
BAND 2. Lower Extended Band Edge Plot (10M BW Ch.18650 QPSK_RB50_0) -3



BAND 2. Lower Band Edge Plot (15M BW Ch.18675 QPSK_RB75_Offset 0) -1

BAND 2. Lower Band Edge Plot (15M BW Ch.18675 QPSK_RB75_Offset 0) -2

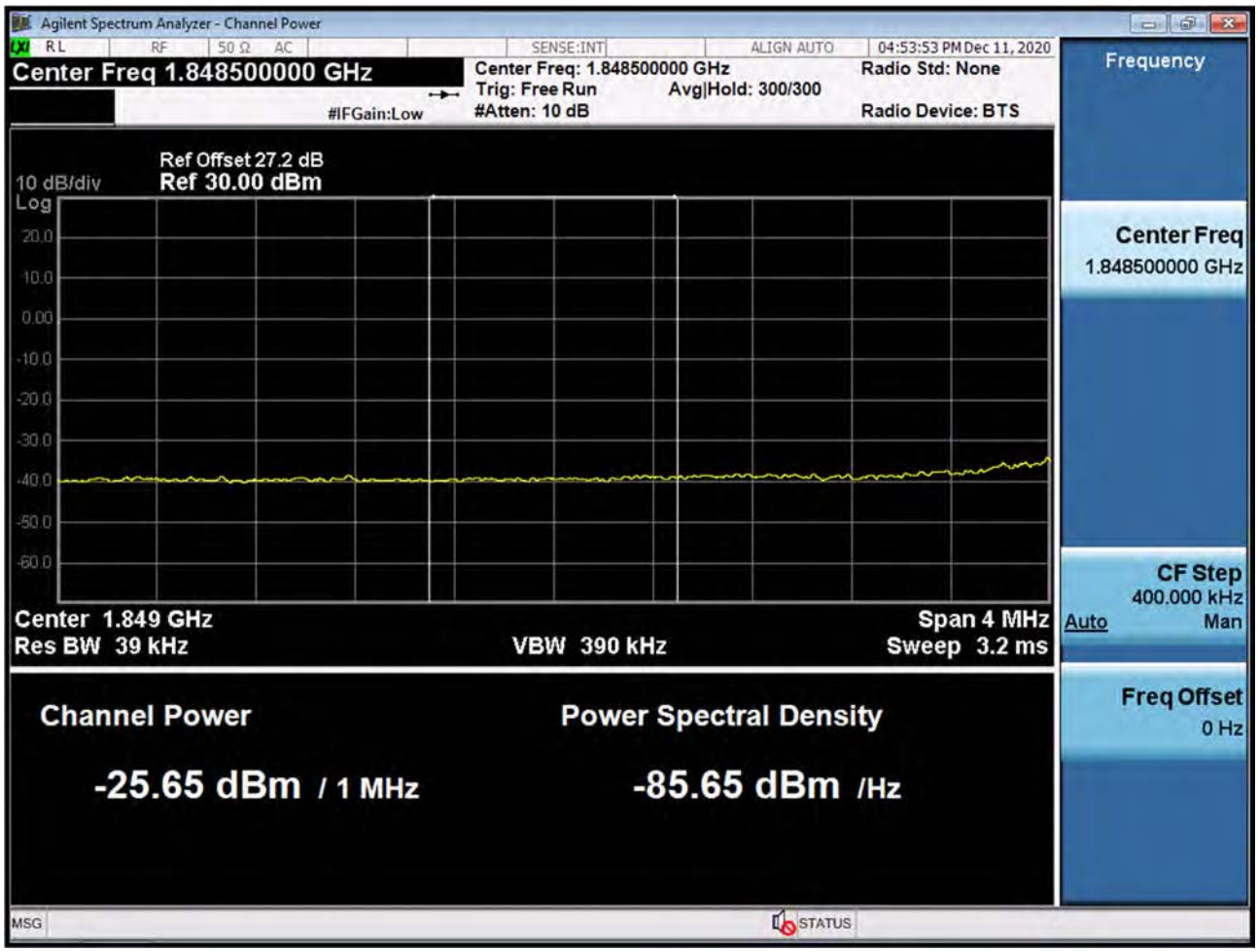
BAND 2. Lower Extended Band Edge Plot (15M BW Ch.18675 QPSK_RB75_0) -3



BAND 2. Lower Band Edge Plot (20M BW Ch.18700 QPSK_RB1_Offset 0) -1

BAND 2. Lower Band Edge Plot (20M BW Ch.18700 QPSK_RB100_Offset 0) -2

BAND 2. Lower Extended Band Edge Plot (20M BW Ch.18700 QPSK_RB100_0) -3



BAND 2. Upper Band Edge Plot (1.4M BW Ch.19193 QPSK_RB1_Offset 5) -1

BAND 2. Upper Band Edge Plot (1.4M BW Ch.19193 QPSK_RB6_Offset 0) -2

BAND 2. Upper Extended Band Edge Plot (1.4M BW Ch.19193 QPSK_RB6_0) -3