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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:
December 11, 2019

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

Report No.: HCT-RF-1912-FC011

FCC ID: **A3LSMG715FN**

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

Model(s): SM-G715FN/DS
Additional Model(s): SM-G715FN
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	0.239	23.79
		1M10W7D	16QAM	0.181	22.58
LTE – Band2 (3)	1851.5 - 1908.5	2M72G7D	QPSK	0.244	23.87
		2M73W7D	16QAM	0.186	22.70
LTE – Band2 (5)	1852.5 - 1907.5	4M52G7D	QPSK	0.242	23.84
		4M52W7D	16QAM	0.181	22.58
LTE – Band2 (10)	1855.0 - 1905.0	9M00G7D	QPSK	0.274	24.38
		8M98W7D	16QAM	0.203	23.08
LTE – Band2 (15)	1857.5 - 1902.5	13M5G7D	QPSK	0.277	24.42
		13M5W7D	16QAM	0.231	23.63
LTE – Band2 (20)	1860.0 - 1900.0	17M9G7D	QPSK	0.276	24.41
		18M0W7D	16QAM	0.204	23.09

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.
HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

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

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

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1912-FC011	December 11, 2019	- First Approval Report

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

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

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG715FN
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-G715FN/DS
Additional Model(s):	SM-G715FN
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:	November 25, 2019 ~ December 09, 2019

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 a/b/g/n/ac (HT20/40/80), Bluetooth, BT LE, NFC, ANT+.

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 10th harmonics from 9 kHz.

Test Note

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

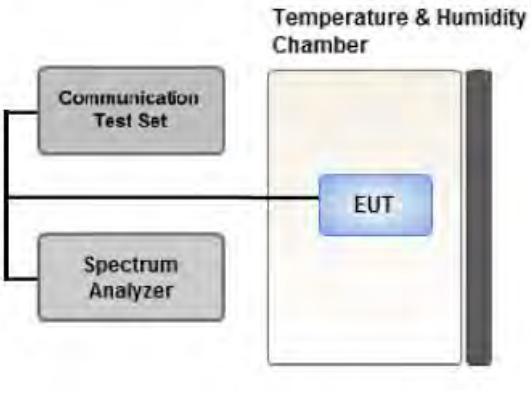
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

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

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

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

② **Alternate Procedure for PAPR**

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

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

Test Settings(Peak Power)

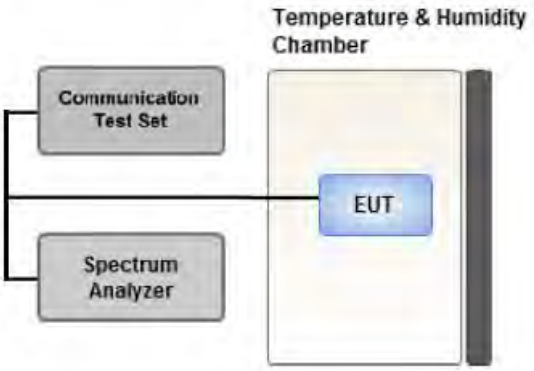
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

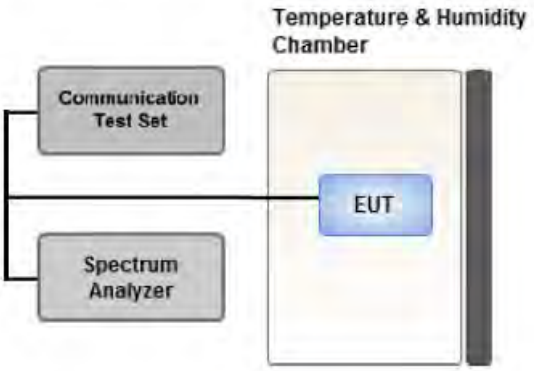
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

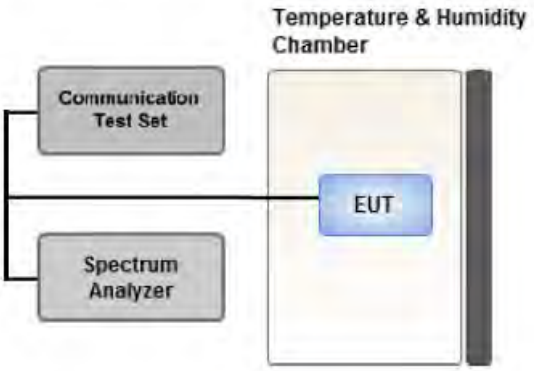
Test Overview

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

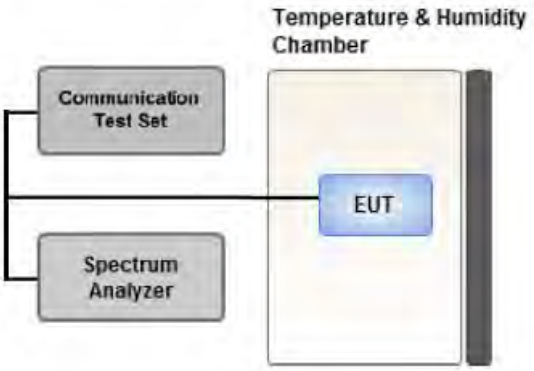
Test Notes

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.

3.8 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- Please refer to the table below.
- SM-G715FN/DS & SM-G715FN were tested and the worst case results are reported.

(Worst case : SM-G715FN/DS)

[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

3.9 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-G715FN/DS & SM-G715FN were tested and the worst case results are reported.

(Worst case : SM-G715FN/DS)

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	06/10/2019	Annual	06/10/2020
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	05/03/2019	Annual	05/03/2020
Agilent	E3632A/DC Power Supply	MY40004326	07/01/2019	Annual	07/01/2020
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93000717	08/14/2019	Annual	08/14/2020
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	01/28/2019	Biennial	01/28/2021
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	05/08/2019	Annual	05/08/2020
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2019	Annual	06/04/2020
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2019	Annual	10/14/2020
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/27/2019	Annual	08/27/2020
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/09/2019	Annual	08/09/2020
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/30/2019	Annual	01/30/2020
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/15/2019	Annual	07/15/2020
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	05/17/2019	Annual	05/17/2020
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
2. The same samples were used for SAR and EMC

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§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

16QAM 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	-18.31	15.50	10.13	1.95	V	< 2.00	0.233	23.68
		16-QAM	-19.41	14.40	10.13	1.95	V		0.181	22.58
1880.0		QPSK	-18.27	15.62	10.15	1.98	V		0.239	23.79
		16-QAM	-19.50	14.39	10.15	1.98	V		0.180	22.56
1909.3		QPSK	-19.72	14.62	10.23	2.00	V		0.193	22.85
		16-QAM	-20.61	13.73	10.23	2.00	V		0.157	21.96

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	-18.27	15.37	10.10	1.94	V	< 2.00	0.225	23.53
		16-QAM	-19.45	14.19	10.10	1.94	V		0.172	22.35
1880.0		QPSK	-18.19	15.70	10.15	1.98	V		0.244	23.87
		16-QAM	-19.36	14.53	10.15	1.98	V		0.186	22.70
1908.5		QPSK	-19.49	14.85	10.23	2.00	V		0.203	23.08
		16-QAM	-20.53	13.81	10.23	2.00	V		0.160	22.04

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	-18.10	15.54	10.10	1.94	V	< 2.00	0.234	23.70
		16-QAM	-19.36	14.28	10.10	1.94	V		0.175	22.44
1880.0		QPSK	-18.22	15.67	10.15	1.98	V		0.242	23.84
		16-QAM	-19.48	14.41	10.15	1.98	V		0.181	22.58
1907.5		QPSK	-19.41	14.93	10.23	2.00	V		0.207	23.16
		16-QAM	-20.55	13.79	10.23	2.00	V		0.159	22.02

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	-17.61	16.20	10.12	1.94	V	< 2.00	0.274	24.38
		16-QAM	-18.91	14.90	10.12	1.94	V		0.203	23.08
1880.0		QPSK	-18.53	15.36	10.15	1.98	V		0.225	23.53
		16-QAM	-19.83	14.06	10.15	1.98	V		0.167	22.23
1905.0		QPSK	-18.50	15.59	10.22	2.00	V		0.240	23.80
		16-QAM	-19.76	14.32	10.22	2.00	V		0.179	22.54

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	-17.57	16.24	10.13	1.95	V	< 2.00	0.277	24.42
		16-QAM	-18.80	15.01	10.13	1.95	V		0.208	23.19
1880.0		QPSK	-18.39	15.50	10.15	1.98	V		0.233	23.67
		16-QAM	-19.70	14.19	10.15	1.98	V		0.172	22.36
1902.5		QPSK	-18.52	15.43	10.20	2.00	V		0.231	23.63
		16-QAM	-19.80	14.15	10.20	2.00	V		0.172	22.35

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	-17.58	16.23	10.13	1.95	V	< 2.00	0.276	24.41
		16-QAM	-18.90	14.91	10.13	1.95	V		0.204	23.09
1880.0		QPSK	-18.07	15.82	10.15	1.98	V		0.250	23.99
		16-QAM	-19.34	14.55	10.15	1.98	V		0.187	22.72
1900.0		QPSK	-18.29	15.66	10.20	2.00	V		0.243	23.86
		16-QAM	-19.51	14.44	10.20	2.00	V		0.184	22.64

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY: 1880.3 MHz

▣ MEASURED OUTPUT POWER: 23.79 dBm = 0.239 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 1.4 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 36.79 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18607 (1850.7)	3,701.40	-53.74	12.40	-58.71	2.86	H	-49.17	72.95
	5,552.10	-49.78	13.10	-48.23	3.58	H	-38.71	62.49
	7,402.80	-56.61	11.10	-46.82	4.26	H	-39.98	63.76
18900 (1880.0)	3,760.00	-53.69	12.48	-58.66	2.88	H	-49.07	72.85
	5,640.00	-46.54	13.30	-45.16	3.62	H	-35.48	59.27
	7,520.00	-57.92	11.30	-47.75	4.30	H	-40.75	64.53
19193 (1909.3)	3,818.60	-54.80	12.40	-59.77	2.90	H	-50.27	74.06
	5,727.90	-47.59	13.35	-45.49	3.63	H	-35.77	59.56
	7,637.20	-57.70	11.63	-50.63	4.34	H	-43.34	67.12

▣ OPERATING FREQUENCY: 1880.0 MHz

▣ MEASURED OUTPUT POWER: 23.87 dBm = 0.244 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 3 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 36.87 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	-56.16	12.40	-61.13	2.86	H	-51.59	75.45
	5,554.50	-47.02	13.14	-45.48	3.58	H	-35.92	59.79
	7,406.00	-57.74	11.12	-47.89	4.25	H	-41.03	64.89
18900 (1880.0)	3,760.00	-55.27	12.48	-60.24	2.88	H	-50.65	74.51
	5,640.00	-47.18	13.30	-45.80	3.62	H	-36.12	59.99
	7,520.00	-58.06	11.30	-47.89	4.30	H	-40.89	64.75
19185 (1908.5)	3,817.00	-51.13	12.40	-56.10	2.90	H	-46.60	70.47
	5,725.50	-48.59	13.35	-46.47	3.63	H	-36.75	60.62
	7,634.00	-57.67	11.62	-50.58	4.34	H	-43.30	67.17

▣ OPERATING FREQUENCY: 1880.0 MHz

▣ MEASURED OUTPUT POWER: 23.84 dBm = 0.242 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 36.84 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18625 (1852.5)	3,705.00	-56.17	12.42	-61.15	2.86	H	-51.60	75.43
	5,557.50	-44.68	13.15	-43.14	3.58	H	-33.57	57.41
	7,410.00	-57.90	11.13	-47.99	4.25	H	-41.11	64.94
18900 (1880.0)	3,760.00	-55.48	12.48	-60.45	2.88	H	-50.86	74.69
	5,640.00	-45.74	13.30	-44.36	3.62	H	-34.68	58.52
	7,520.00	-57.10	11.30	-46.93	4.30	H	-39.93	63.76
19175 (1907.5)	3,815.00	-55.88	12.40	-60.85	2.90	H	-51.35	75.19
	5,722.50	-47.22	13.35	-45.08	3.63	H	-35.36	59.20
	7,630.00	-58.41	11.60	-48.36	4.34	H	-41.10	64.93

▣ OPERATING FREQUENCY: 1855.0 MHz

▣ MEASURED OUTPUT POWER: 24.38 dBm = 0.274 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 37.38 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18650 (1855.0)	3,710.00	-56.31	12.43	-61.30	2.86	H	-51.73	76.15
	5,565.00	-47.42	13.18	-45.75	3.59	H	-36.16	60.58
	7,420.00	-56.91	11.15	-47.15	4.24	H	-40.24	64.66
18900 (1880.0)	3,760.00	-55.95	12.48	-60.92	2.88	H	-51.33	75.74
	5,640.00	-46.50	13.30	-45.12	3.62	H	-35.44	59.86
	7,520.00	-58.73	11.30	-48.56	4.30	H	-41.56	65.97
19150 (1905.0)	3,810.00	-56.21	12.40	-61.25	2.90	H	-51.75	76.17
	5,715.00	-45.66	13.37	-43.53	3.63	H	-33.79	58.21
	7,620.00	-58.92	11.60	-48.96	4.34	H	-41.70	66.11

▣ OPERATING FREQUENCY: 1857.5 MHz

▣ MEASURED OUTPUT POWER: 24.42 dBm = 0.277 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 15 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 37.42 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	-52.91	12.44	-57.97	2.87	H	-48.39	72.81
	5,572.50	-46.12	13.20	-44.33	3.59	H	-34.72	59.13
	7,430.00	-58.72	11.15	-48.78	4.25	H	-41.88	66.30
18900 (1880.0)	3,760.00	-55.29	12.48	-60.26	2.88	H	-50.67	75.08
	5,640.00	-48.71	13.30	-47.33	3.62	H	-37.65	62.07
	7,520.00	-57.60	11.30	-47.43	4.30	H	-40.43	64.84
19125 (1902.5)	3,805.00	-53.17	12.40	-58.13	2.90	H	-48.63	73.05
	5,707.50	-47.47	13.39	-45.30	3.63	H	-35.54	59.96
	7,610.00	-58.92	11.55	-48.96	4.32	H	-41.73	66.15

▣ OPERATING FREQUENCY: 1860.00 MHz

▣ MEASURED OUTPUT POWER: 24.41 dBm = 0.276 W

▣ MODE: LTE B2

▣ MODULATION SIGNAL: 20 MHz QPSK

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 37.41 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
18700 (1860.0)	3,720.00	-53.03	12.45	-58.15	2.87	H	-48.57	72.98
	5,580.00	-46.57	13.20	-43.96	3.58	H	-34.34	58.75
	7,440.00	-56.92	11.18	-46.72	4.25	H	-39.79	64.20
18900 (1880.0)	3,760.00	-51.63	12.48	-56.60	2.88	H	-47.01	71.41
	5,640.00	-47.18	13.30	-45.80	3.62	H	-36.12	60.53
	7,520.00	-58.47	11.30	-48.30	4.30	H	-41.30	65.70
19100 (1900.0)	3,800.00	-48.61	12.40	-53.49	2.90	H	-43.99	68.40
	5,700.00	-47.21	13.40	-45.02	3.63	H	-35.25	59.65
	7,600.00	-57.91	11.50	-48.05	4.32	H	-40.87	65.28

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	5.83
			16-QAM	6	0	6.48
	3 MHz		QPSK	15	0	5.87
			16-QAM	15	0	6.53
	5 MHz		QPSK	25	0	5.78
			16-QAM	25	0	6.55
	10 MHz		QPSK	50	0	5.84
			16-QAM	50	0	6.44
	15 MHz		QPSK	75	0	5.72
			16-QAM	75	0	6.40
	20 MHz		QPSK	100	0	5.69
			16-QAM	100	0	6.40

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 65 ~ 76.

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	1.0955
			16-QAM	6	0	1.0998
	3 MHz		QPSK	15	0	2.7228
			16-QAM	15	0	2.7332
	5 MHz		QPSK	25	0	4.5218
			16-QAM	25	0	4.5218
	10 MHz		QPSK	50	0	9.0002
			16-QAM	50	0	8.9803
	15 MHz		QPSK	75	0	13.499
			16-QAM	75	0	13.508
	20 MHz		QPSK	100	0	17.935
			16-QAM	100	0	17.947

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 53 ~ 64.

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	3.6830	27.976	-77.308	-49.332	-13.00
		1880.0	3.7039	27.976	-77.395	-49.419	
		1909.3	3.6725	27.976	-77.189	-49.213	
	3	1851.5	3.6955	27.976	-77.039	-49.063	
		1880.0	3.6925	27.976	-77.000	-49.024	
		1908.5	3.7059	27.976	-77.340	-49.364	
	5	1852.5	3.7010	27.976	-76.863	-48.887	
		1880.0	3.7024	27.976	-77.250	-49.274	
		1907.5	3.6970	27.976	-77.222	-49.246	
	10	1855.0	3.6750	27.976	-77.379	-49.403	
		1880.0	3.7015	27.976	-77.190	-49.214	
		1905.0	3.7124	27.976	-77.332	-49.356	
	15	1857.5	1.8246	27.976	-76.803	-48.827	
		1880.0	3.7109	27.976	-77.242	-49.266	
		1902.5	5.7284	28.591	-77.046	-48.455	
	20	1860.0	3.7010	27.976	-77.175	-49.199	
		1880.0	3.7054	27.976	-77.041	-49.065	
		1900.0	3.7269	27.976	-77.421	-49.445	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 113 ~ 148.
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 77 ~ 112.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE B2

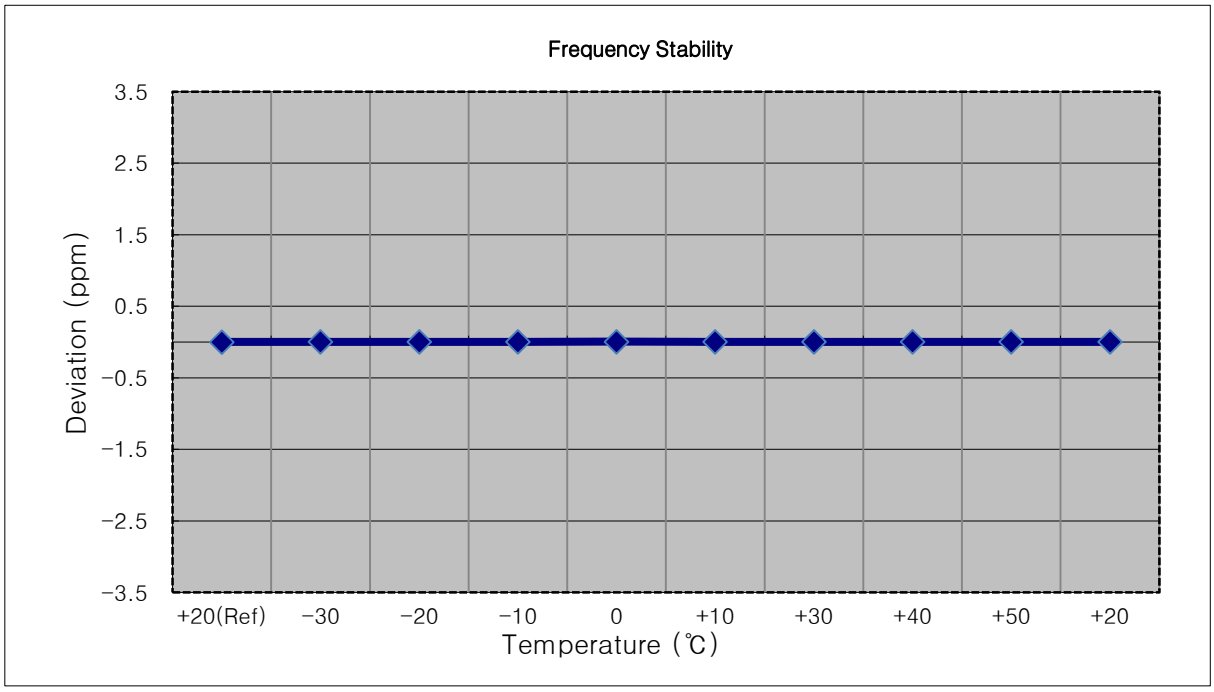
▣ OPERATING FREQUENCY: 1850,700,000 Hz

▣ 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 700 007	0.0	0.000 000	0.000
100%		-30	1850 700 013	6.6	0.000 000	0.004
100%		-20	1850 700 011	4.7	0.000 000	0.003
100%		-10	1850 700 009	2.9	0.000 000	0.002
100%		0	1850 700 013	6.9	0.000 000	0.004
100%		+10	1850 700 010	3.6	0.000 000	0.002
100%		+30	1850 700 012	5.9	0.000 000	0.003
100%		+40	1850 700 009	2.9	0.000 000	0.002
100%		+50	1850 700 011	4.5	0.000 000	0.002
Batt. Endpoint	3.400	+20	1850 700 010	3.1	0.000 000	0.002



▣ MODE: LTE B2

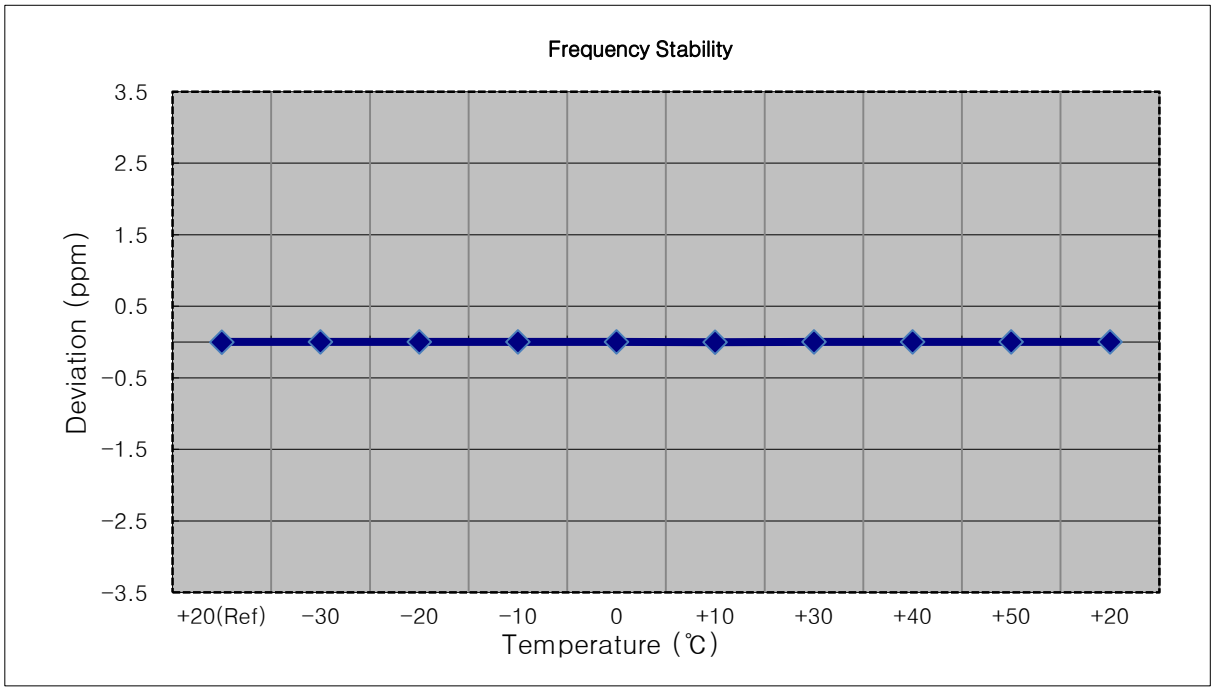
▣ OPERATING FREQUENCY: 1851,500,000 Hz

▣ 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 500 007	0.0	0.000 000	0.000
100%		-30	1851 500 014	6.1	0.000 000	0.003
100%		-20	1851 500 012	4.4	0.000 000	0.002
100%		-10	1851 500 014	6.5	0.000 000	0.004
100%		0	1851 500 012	4.7	0.000 000	0.003
100%		+10	1851 500 002	-5.2	0.000 000	-0.003
100%		+30	1851 500 012	4.6	0.000 000	0.002
100%		+40	1851 500 012	4.3	0.000 000	0.002
100%		+50	1851 500 013	5.7	0.000 000	0.003
Batt. Endpoint	3.400	+20	1851 500 014	6.5	0.000 000	0.004



▣ MODE: LTE B2

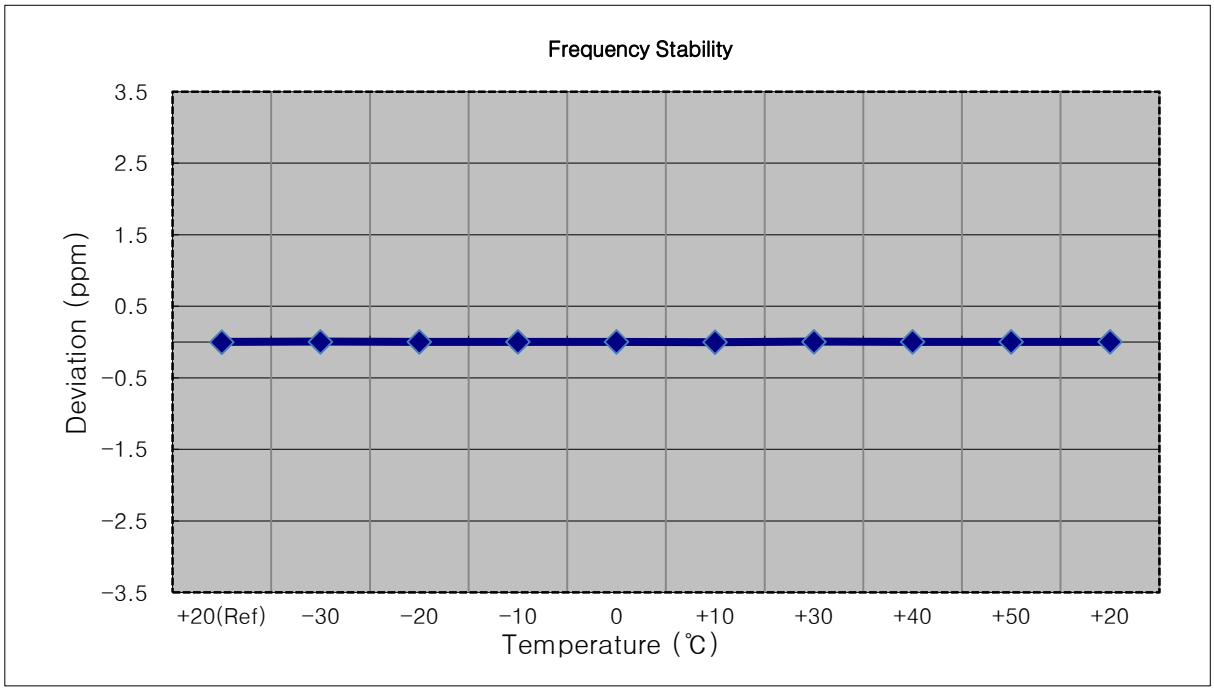
▣ OPERATING FREQUENCY: 1852,500,000 Hz

▣ 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 500 007	0.0	0.000 000	0.000
100%		-30	1852 500 014	6.9	0.000 000	0.004
100%		-20	1852 500 011	4.6	0.000 000	0.002
100%		-10	1852 500 012	5.6	0.000 000	0.003
100%		0	1852 500 012	5.5	0.000 000	0.003
100%		+10	1852 500 002	-4.8	0.000 000	-0.003
100%		+30	1852 500 014	7.7	0.000 000	0.004
100%		+40	1852 500 011	4.5	0.000 000	0.002
100%		+50	1852 500 013	6.1	0.000 000	0.003
Batt. Endpoint	3.400	+20	1852 500 012	5.3	0.000 000	0.003



▣ MODE: LTE B2

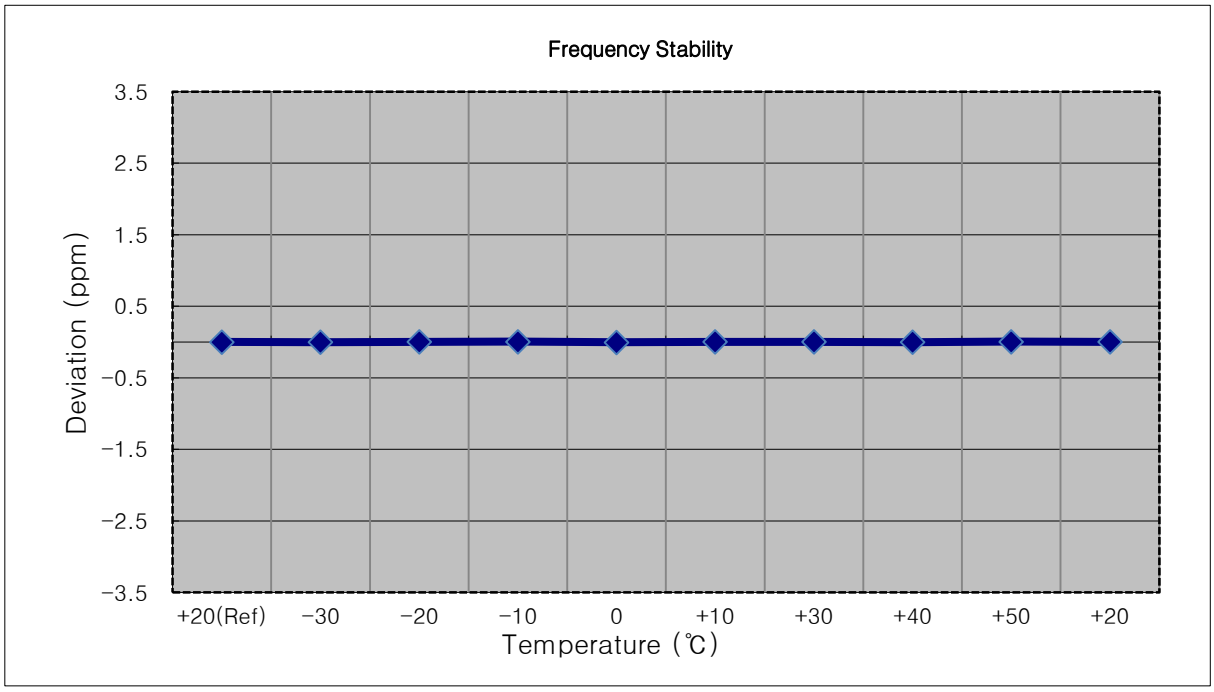
▣ OPERATING FREQUENCY: 1855,000,000 Hz

▣ 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)	1855 000 005	0.0	0.000 000	0.000
100%		-30	1855 000 002	-3.1	0.000 000	-0.002
100%		-20	1855 000 011	6.1	0.000 000	0.003
100%		-10	1855 000 013	7.9	0.000 000	0.004
100%		0	1854 999 999	-5.7	0.000 000	-0.003
100%		+10	1855 000 012	6.8	0.000 000	0.004
100%		+30	1855 000 010	5.4	0.000 000	0.003
100%		+40	1855 000 003	-2.4	0.000 000	-0.001
100%		+50	1855 000 014	8.9	0.000 000	0.005
Batt. Endpoint	3.400	+20	1855 000 009	4.3	0.000 000	0.002



▣ MODE: LTE B2

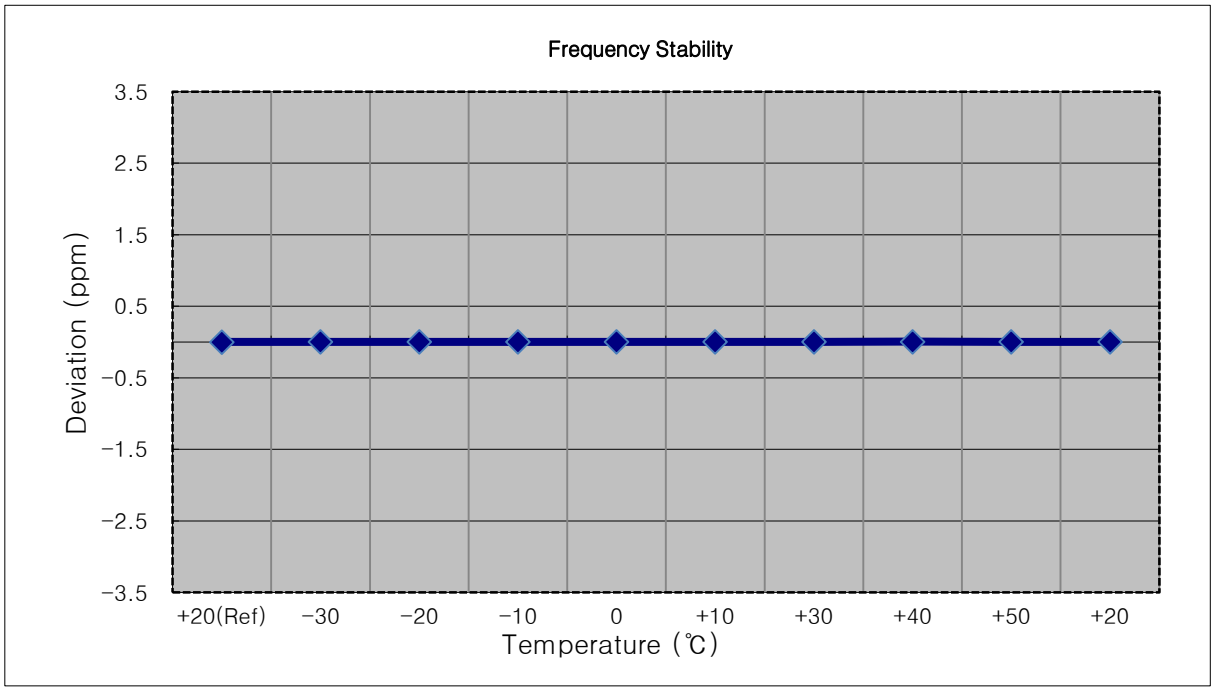
▣ OPERATING FREQUENCY: 1857,500,000 Hz

▣ 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 500 005	0.0	0.000 000	0.000
100%		-30	1857 500 009	4.1	0.000 000	0.002
100%		-20	1857 500 010	5.2	0.000 000	0.003
100%		-10	1857 500 011	5.6	0.000 000	0.003
100%		0	1857 500 010	4.4	0.000 000	0.002
100%		+10	1857 500 011	5.4	0.000 000	0.003
100%		+30	1857 500 009	4.2	0.000 000	0.002
100%		+40	1857 500 013	7.5	0.000 000	0.004
100%		+50	1857 500 010	4.6	0.000 000	0.002
Batt. Endpoint	3.400	+20	1857 500 011	6.0	0.000 000	0.003



▣ MODE: LTE B2

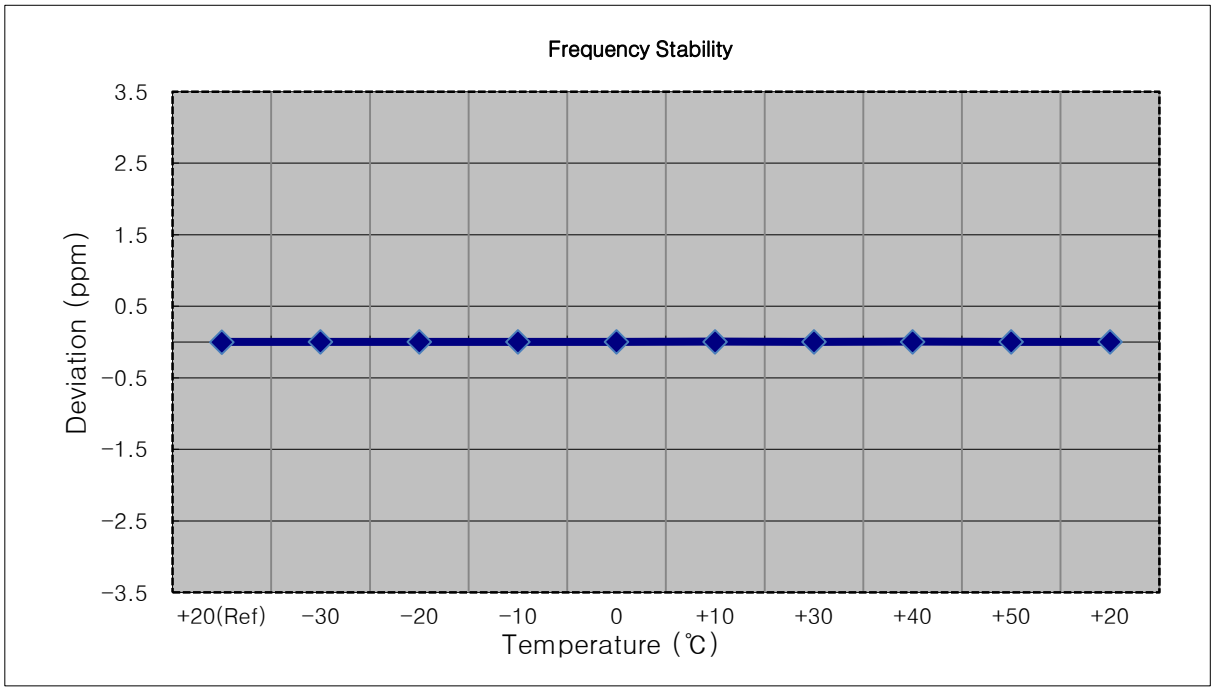
▣ OPERATING FREQUENCY: 1860,000,000 Hz

▣ 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 999 997	0.0	0.000 000	0.000
100%		-30	1860 000 002	5.0	0.000 000	0.003
100%		-20	1860 000 002	4.9	0.000 000	0.003
100%		-10	1860 000 001	3.9	0.000 000	0.002
100%		0	1860 000 003	5.8	0.000 000	0.003
100%		+10	1860 000 006	8.6	0.000 000	0.005
100%		+30	1860 000 002	4.8	0.000 000	0.003
100%		+40	1860 000 004	7.2	0.000 000	0.004
100%		+50	1860 000 002	5.4	0.000 000	0.003
Batt. Endpoint	3.400	+20	1860 000 002	5.0	0.000 000	0.003



▣ MODE: LTE B2

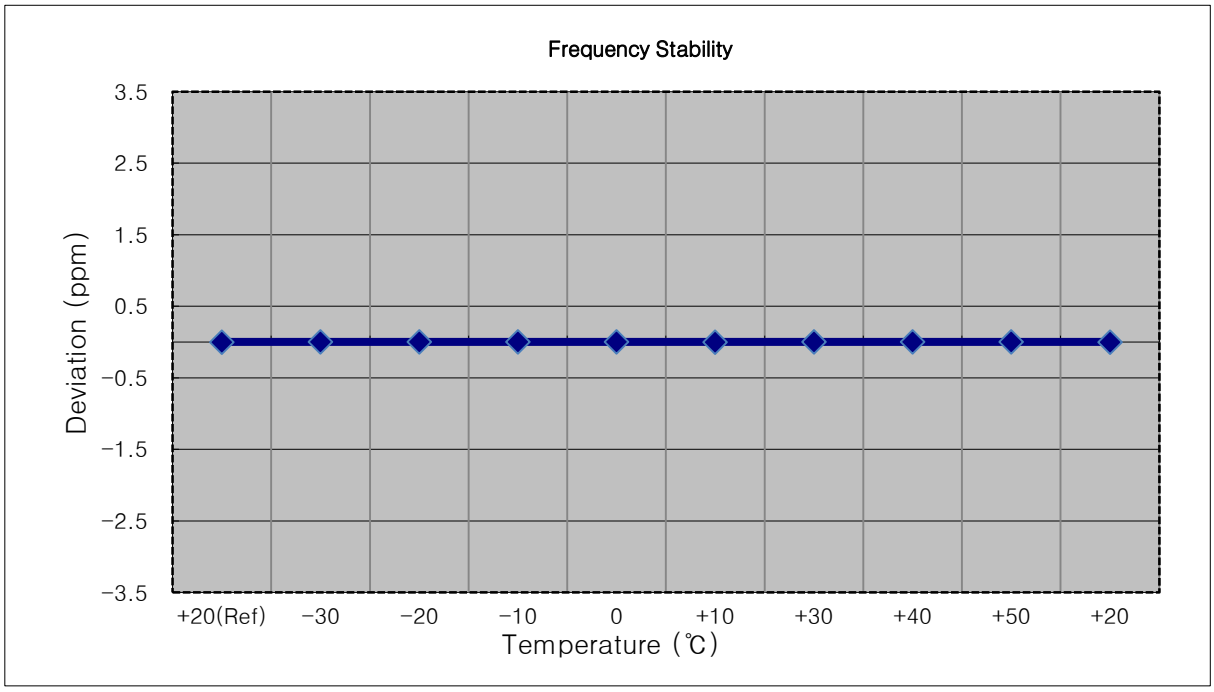
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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 000 004	0.0	0.000 000	0.000
100%		-30	1880 000 010	5.9	0.000 000	0.003
100%		-20	1880 000 007	3.0	0.000 000	0.002
100%		-10	1880 000 008	3.8	0.000 000	0.002
100%		0	1880 000 008	3.5	0.000 000	0.002
100%		+10	1880 000 007	2.7	0.000 000	0.001
100%		+30	1880 000 007	3.4	0.000 000	0.002
100%		+40	1880 000 008	3.7	0.000 000	0.002
100%		+50	1880 000 008	4.3	0.000 000	0.002
Batt. Endpoint	3.400	+20	1880 000 006	1.7	0.000 000	0.001



▣ MODE: LTE B2

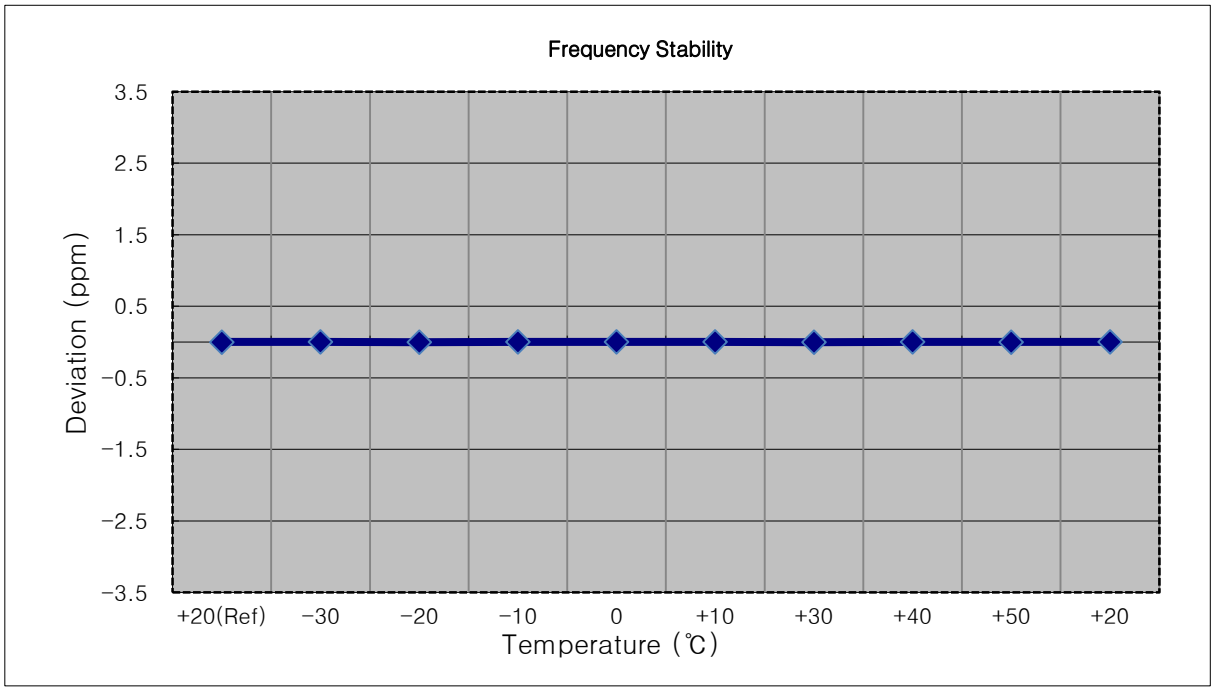
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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 999 998	0.0	0.000 000	0.000
100%		-30	1880 000 001	3.4	0.000 000	0.002
100%		-20	1879 999 994	-3.5	0.000 000	-0.002
100%		-10	1880 000 001	3.0	0.000 000	0.002
100%		0	1880 000 001	3.3	0.000 000	0.002
100%		+10	1880 000 001	3.4	0.000 000	0.002
100%		+30	1879 999 994	-3.9	0.000 000	-0.002
100%		+40	1880 000 003	5.2	0.000 000	0.003
100%		+50	1880 000 000	2.4	0.000 000	0.001
Batt. Endpoint	3.400	+20	1880 000 003	5.2	0.000 000	0.003



▣ MODE: LTE B2

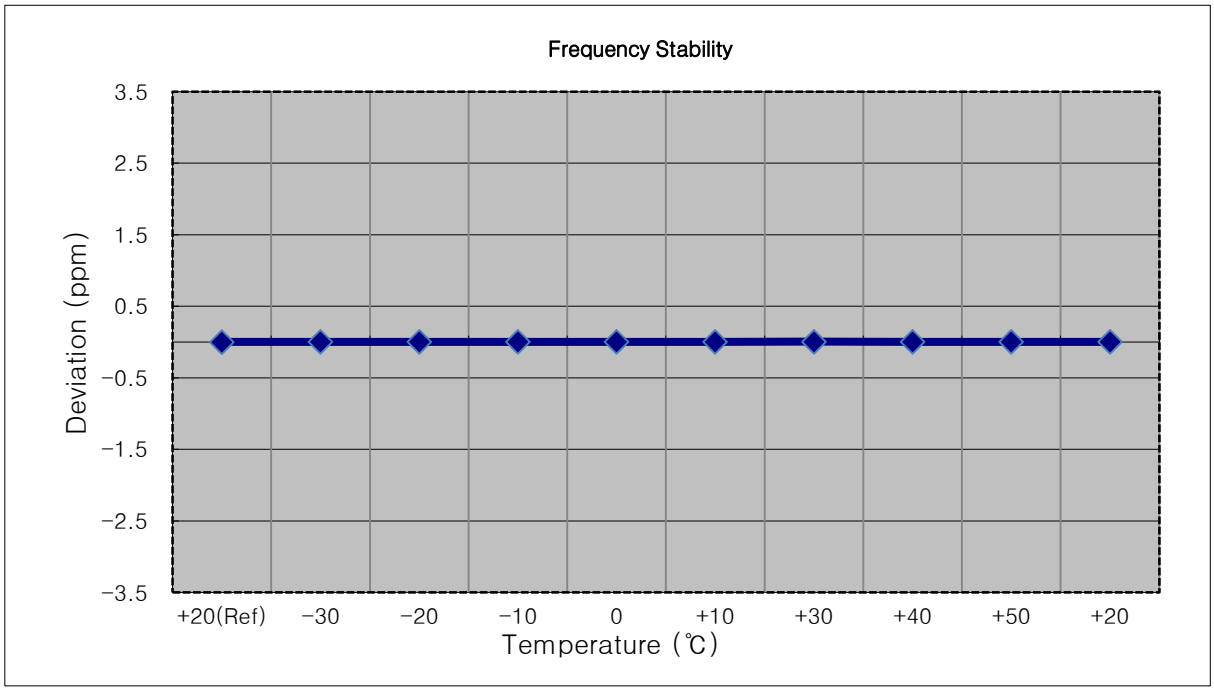
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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)	1880 000 005	0.0	0.000 000	0.000
100%		-30	1880 000 010	4.7	0.000 000	0.002
100%		-20	1880 000 011	5.8	0.000 000	0.003
100%		-10	1880 000 008	3.5	0.000 000	0.002
100%		0	1880 000 009	4.1	0.000 000	0.002
100%		+10	1880 000 010	4.9	0.000 000	0.003
100%		+30	1880 000 013	8.2	0.000 000	0.004
100%		+40	1880 000 009	4.1	0.000 000	0.002
100%		+50	1880 000 008	3.3	0.000 000	0.002
Batt. Endpoint	3.400	+20	1880 000 010	4.9	0.000 000	0.003



▣ MODE: LTE B2

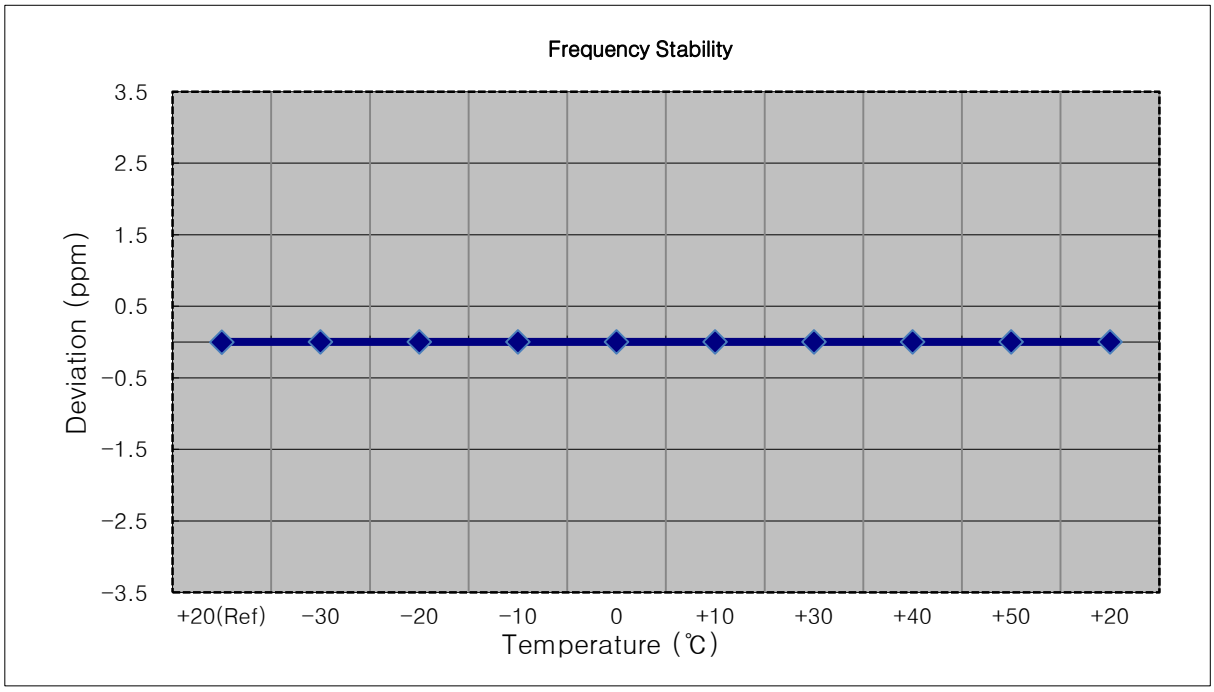
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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)	1879 999 996	0.0	0.000 000	0.000
100%		-30	1879 999 999	3.6	0.000 000	0.002
100%		-20	1879 999 999	3.4	0.000 000	0.002
100%		-10	1880 000 000	4.6	0.000 000	0.002
100%		0	1879 999 999	3.7	0.000 000	0.002
100%		+10	1880 000 000	4.2	0.000 000	0.002
100%		+30	1880 000 002	6.4	0.000 000	0.003
100%		+40	1880 000 001	5.5	0.000 000	0.003
100%		+50	1880 000 001	5.1	0.000 000	0.003
Batt. Endpoint	3.400	+20	1880 000 000	4.3	0.000 000	0.002



▣ MODE: LTE B2

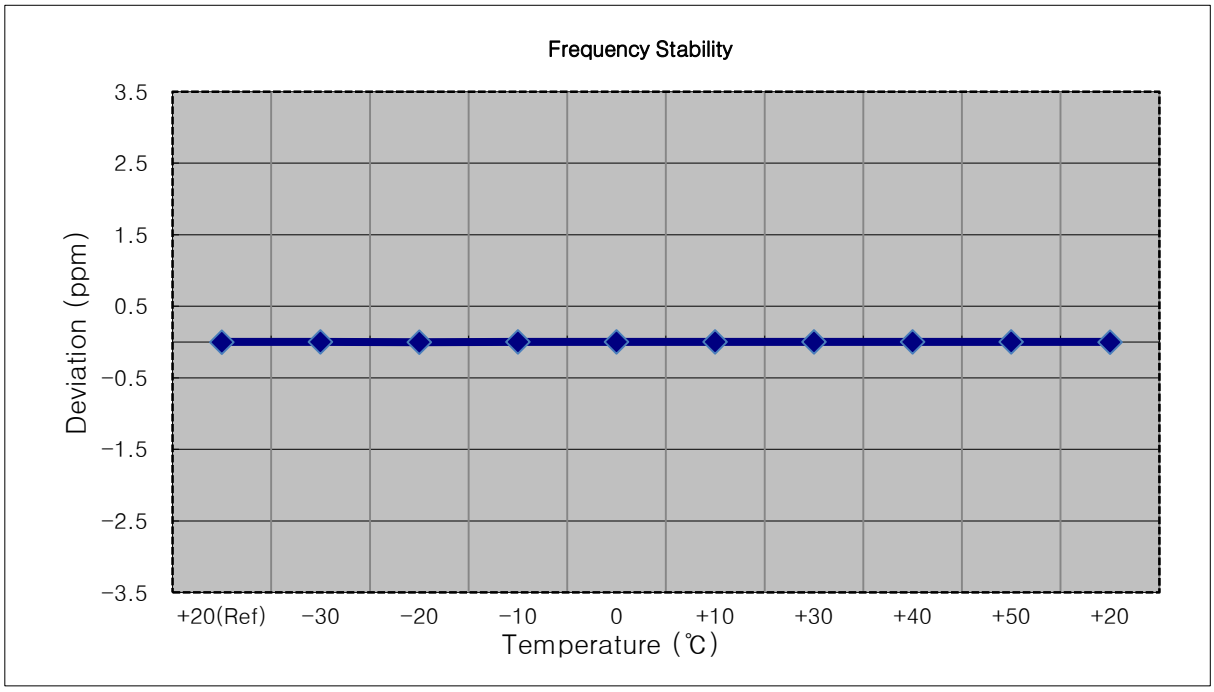
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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 000 005	0.0	0.000 000	0.000
100%		-30	1880 000 009	3.7	0.000 000	0.002
100%		-20	1880 000 000	-5.4	0.000 000	-0.003
100%		-10	1880 000 009	3.9	0.000 000	0.002
100%		0	1880 000 010	4.5	0.000 000	0.002
100%		+10	1880 000 009	3.7	0.000 000	0.002
100%		+30	1880 000 009	4.0	0.000 000	0.002
100%		+40	1880 000 009	4.1	0.000 000	0.002
100%		+50	1880 000 010	4.7	0.000 000	0.002
Batt. Endpoint	3.400	+20	1880 000 008	2.4	0.000 000	0.001



▣ MODE: LTE B2

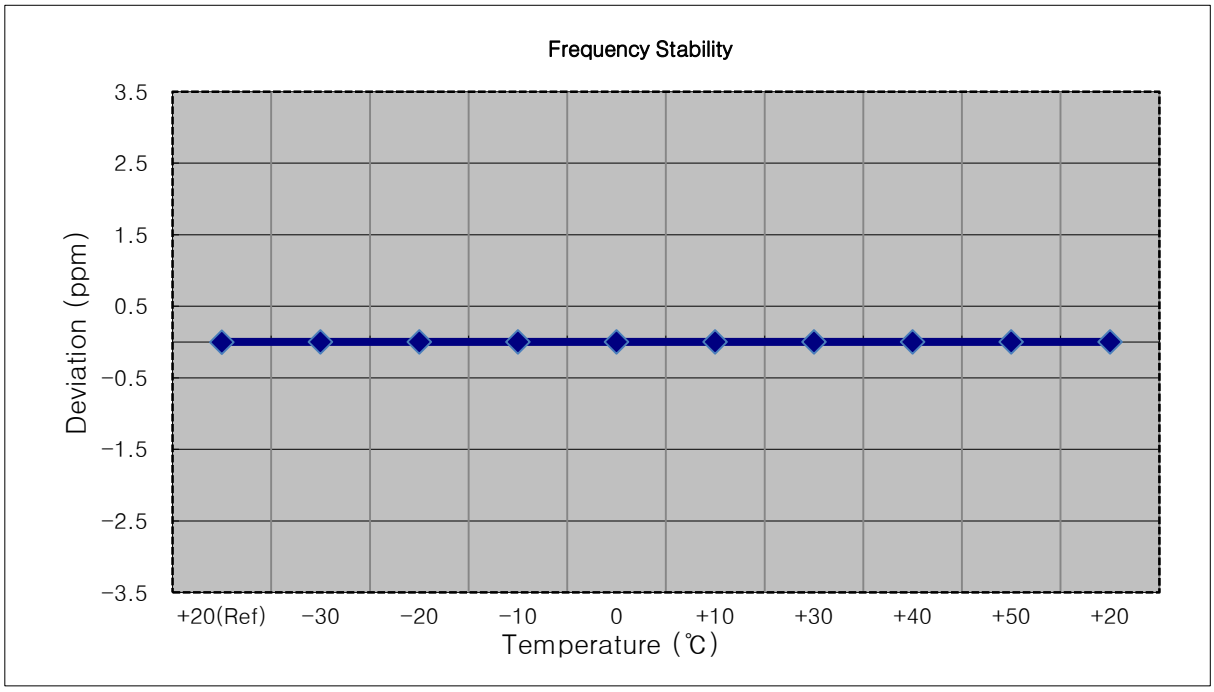
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ 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 000 004	0.0	0.000 000	0.000
100%		-30	1880 000 008	3.9	0.000 000	0.002
100%		-20	1880 000 009	4.8	0.000 000	0.003
100%		-10	1880 000 010	5.7	0.000 000	0.003
100%		0	1880 000 010	5.9	0.000 000	0.003
100%		+10	1880 000 008	3.5	0.000 000	0.002
100%		+30	1880 000 010	5.4	0.000 000	0.003
100%		+40	1880 000 008	3.8	0.000 000	0.002
100%		+50	1880 000 009	5.0	0.000 000	0.003
Batt. Endpoint	3.400	+20	1880 000 009	4.2	0.000 000	0.002



▣ MODE: LTE B2

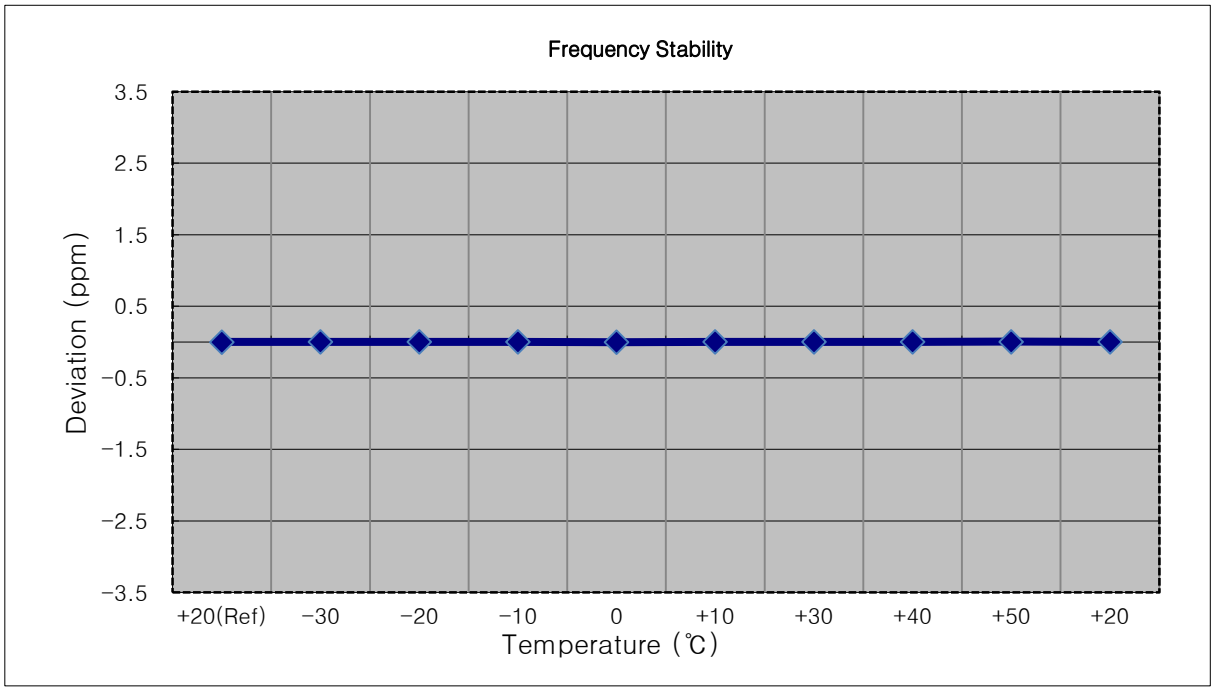
▣ OPERATING FREQUENCY: 1909,300,000 Hz

▣ 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 300 004	0.0	0.000 000	0.000
100%		-30	1909 300 010	5.9	0.000 000	0.003
100%		-20	1909 300 010	6.0	0.000 000	0.003
100%		-10	1909 300 010	6.4	0.000 000	0.003
100%		0	1909 299 999	-4.8	0.000 000	-0.003
100%		+10	1909 300 010	6.1	0.000 000	0.003
100%		+30	1909 300 008	3.9	0.000 000	0.002
100%		+40	1909 300 008	4.3	0.000 000	0.002
100%		+50	1909 300 011	7.2	0.000 000	0.004
Batt. Endpoint	3.400	+20	1909 300 010	6.1	0.000 000	0.003



▣ MODE: LTE B2

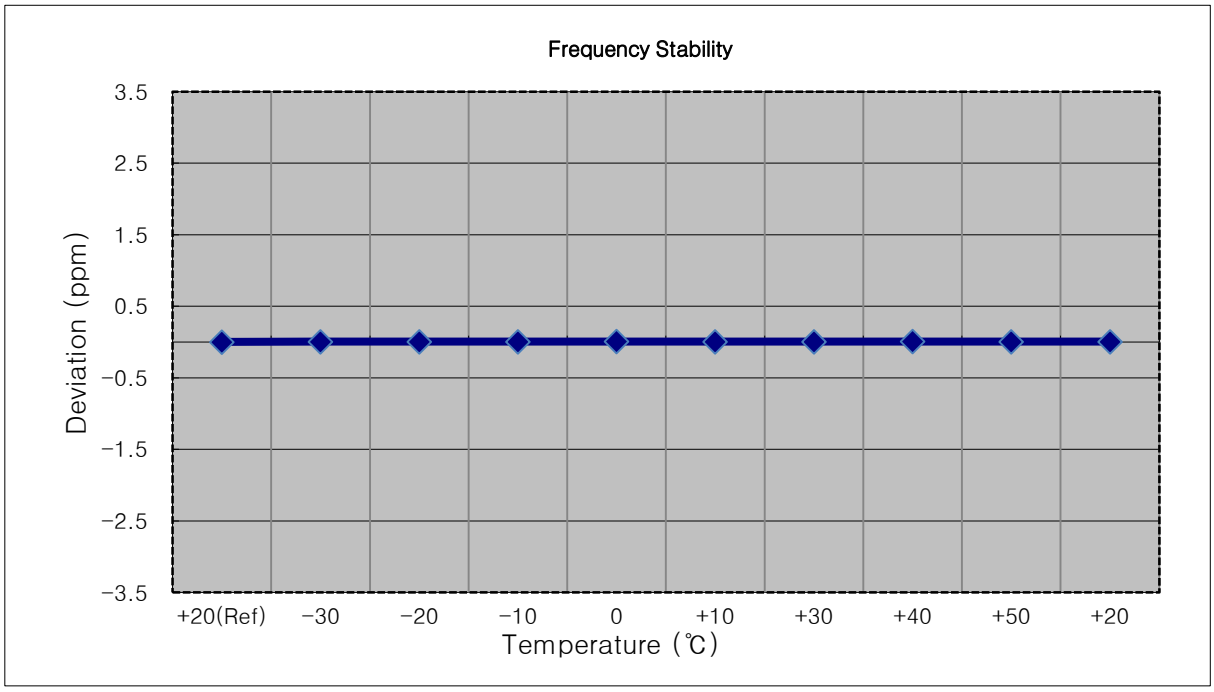
▣ OPERATING FREQUENCY: 1908,500,000 Hz

▣ 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 500 010	0.0	0.000 000	0.000
100%		-30	1908 500 021	10.7	0.000 001	0.006
100%		-20	1908 500 018	7.1	0.000 000	0.004
100%		-10	1908 500 019	8.6	0.000 000	0.005
100%		0	1908 500 026	15.4	0.000 001	0.008
100%		+10	1908 500 020	9.4	0.000 000	0.005
100%		+30	1908 500 019	8.5	0.000 000	0.004
100%		+40	1908 500 023	12.2	0.000 001	0.006
100%		+50	1908 500 018	7.4	0.000 000	0.004
Batt. Endpoint	3.400	+20	1908 500 018	7.4	0.000 000	0.004



▣ MODE: LTE B2

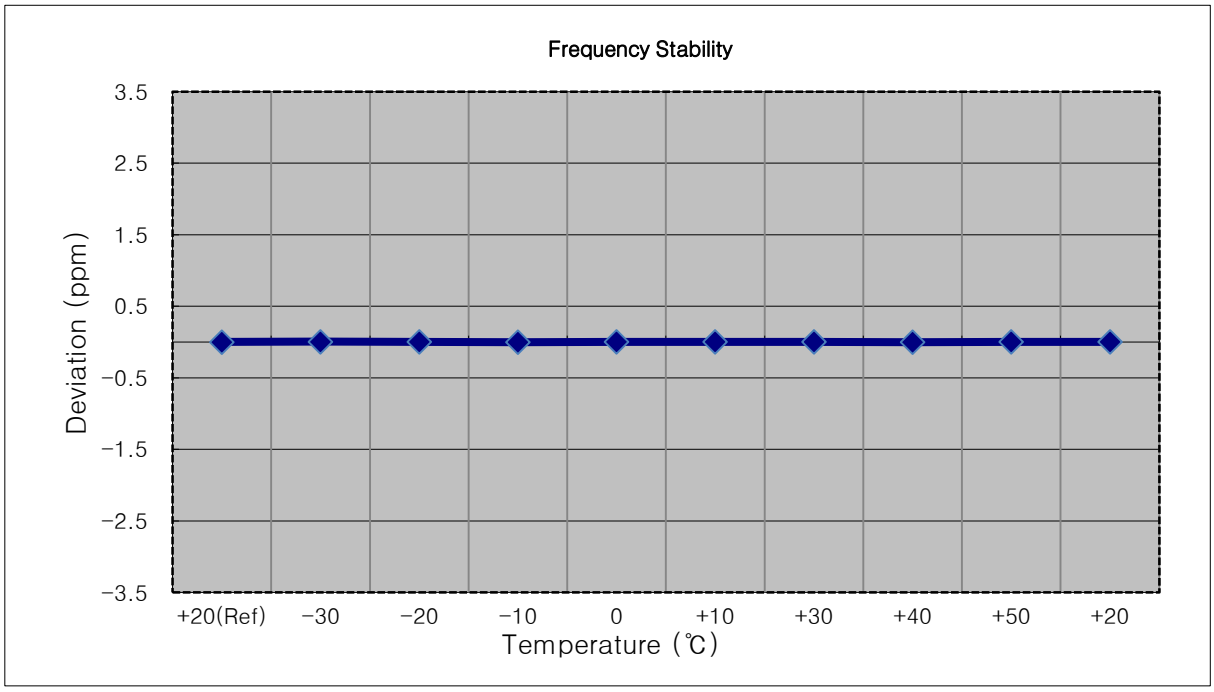
▣ OPERATING FREQUENCY: 1907,500,000 Hz

▣ 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 500 007	0.0	0.000 000	0.000
100%		-30	1907 500 014	7.4	0.000 000	0.004
100%		-20	1907 500 011	4.8	0.000 000	0.003
100%		-10	1907 500 001	-5.6	0.000 000	-0.003
100%		0	1907 500 012	5.3	0.000 000	0.003
100%		+10	1907 500 010	3.4	0.000 000	0.002
100%		+30	1907 500 012	5.2	0.000 000	0.003
100%		+40	1907 500 002	-4.3	0.000 000	-0.002
100%		+50	1907 500 011	4.9	0.000 000	0.003
Batt. Endpoint	3.400	+20	1907 500 010	3.7	0.000 000	0.002



▣ MODE: LTE B2

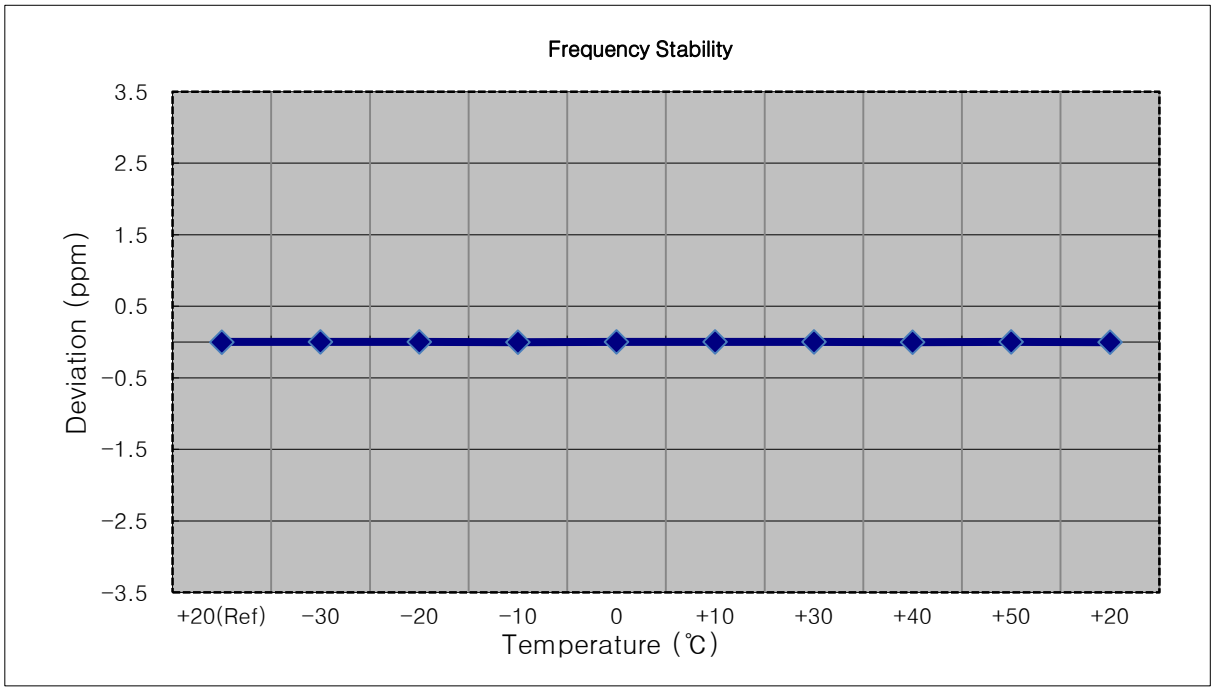
▣ OPERATING FREQUENCY: 1905,000,000 Hz

▣ 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	1905 000 009	5.0	0.000 000	0.003
100%		-20	1905 000 008	4.0	0.000 000	0.002
100%		-10	1904 999 999	-5.2	0.000 000	-0.003
100%		0	1905 000 011	6.7	0.000 000	0.004
100%		+10	1905 000 008	3.3	0.000 000	0.002
100%		+30	1905 000 010	5.1	0.000 000	0.003
100%		+40	1905 000 000	-4.4	0.000 000	-0.002
100%		+50	1905 000 009	4.3	0.000 000	0.002
Batt. Endpoint	3.400	+20	1905 000 000	-4.5	0.000 000	-0.002



▣ MODE: LTE B2

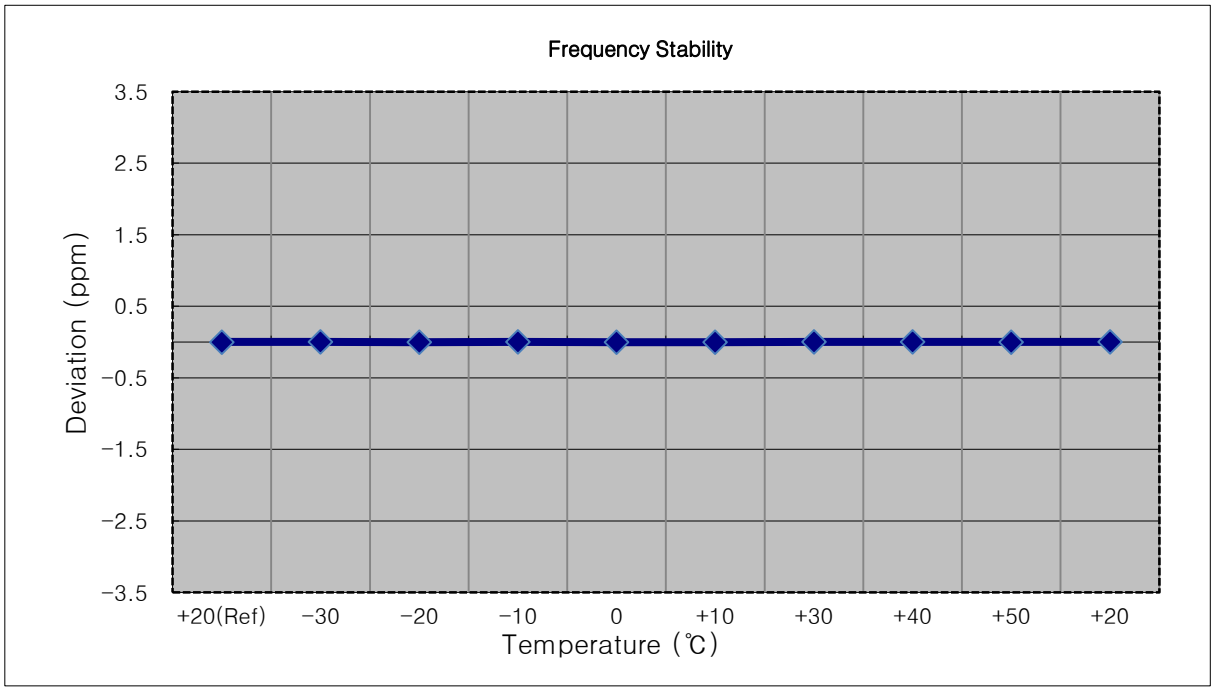
▣ OPERATING FREQUENCY: 1902,500,000 Hz

▣ 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 500 003	0.0	0.000 000	0.000
100%		-30	1902 500 009	5.6	0.000 000	0.003
100%		-20	1902 499 999	-4.5	0.000 000	-0.002
100%		-10	1902 500 007	4.1	0.000 000	0.002
100%		0	1902 499 999	-4.0	0.000 000	-0.002
100%		+10	1902 500 000	-3.2	0.000 000	-0.002
100%		+30	1902 500 007	3.9	0.000 000	0.002
100%		+40	1902 500 007	3.4	0.000 000	0.002
100%		+50	1902 500 006	2.4	0.000 000	0.001
Batt. Endpoint	3.400	+20	1902 500 007	3.3	0.000 000	0.002



▣ MODE: LTE B2

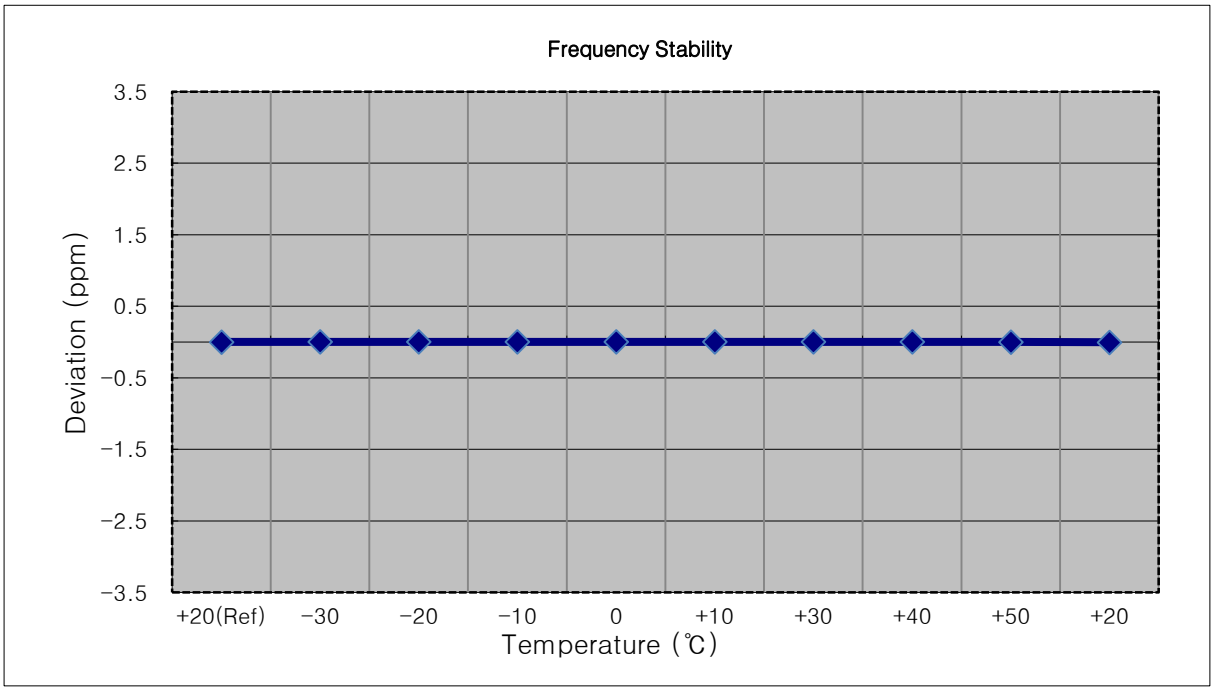
▣ OPERATING FREQUENCY: 1900,000,000 Hz

▣ CHANNEL: 19100 (20 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

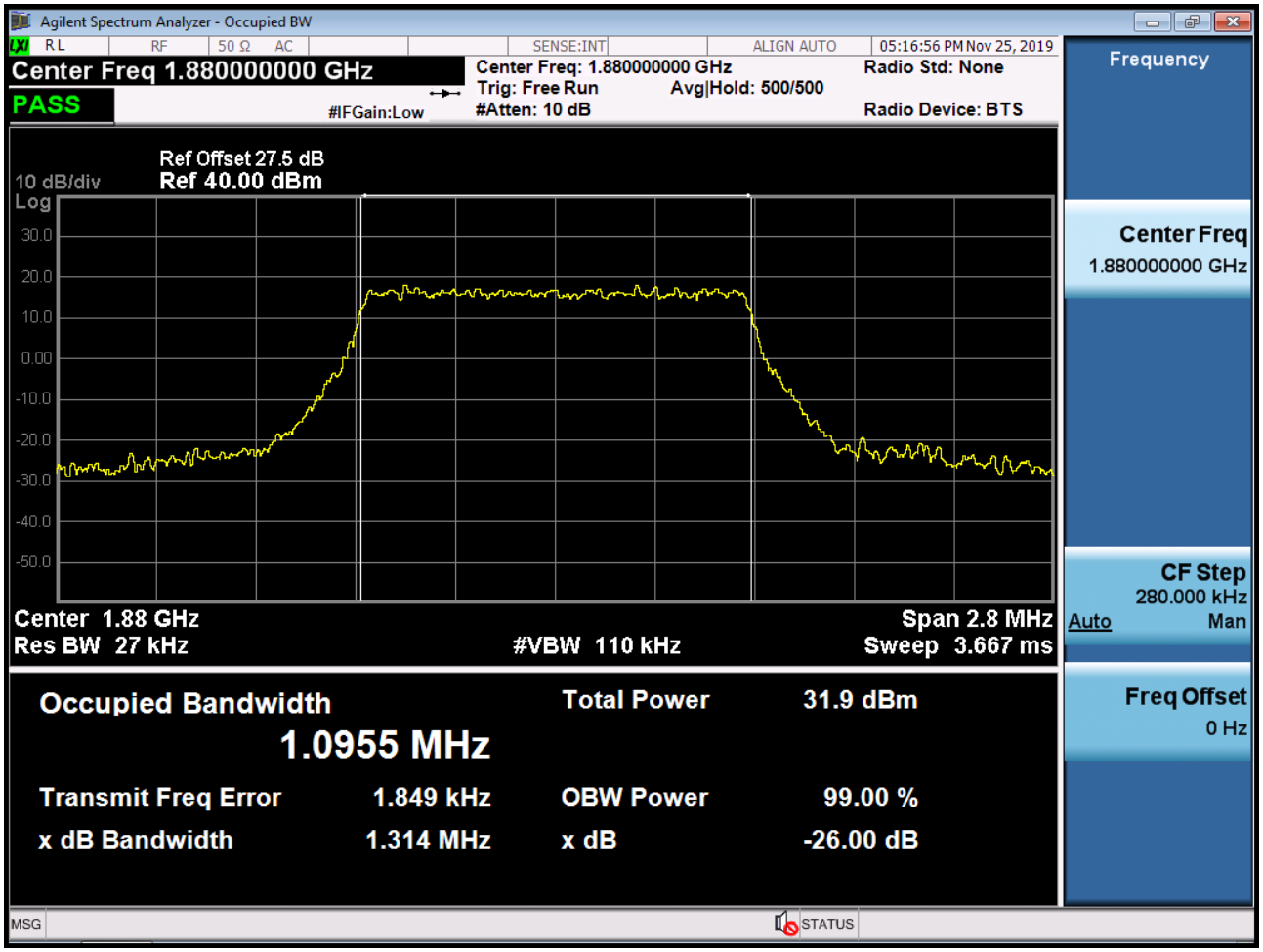
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1900 000 005	0.0	0.000 000	0.000
100%		-30	1900 000 010	4.3	0.000 000	0.002
100%		-20	1900 000 012	6.3	0.000 000	0.003
100%		-10	1900 000 010	4.7	0.000 000	0.002
100%		0	1900 000 009	3.9	0.000 000	0.002
100%		+10	1900 000 009	4.0	0.000 000	0.002
100%		+30	1900 000 010	4.9	0.000 000	0.003
100%		+40	1900 000 011	5.3	0.000 000	0.003
100%		+50	1900 000 007	2.1	0.000 000	0.001
Batt. Endpoint	3.400	+20	1899 999 998	-7.5	0.000 000	-0.004

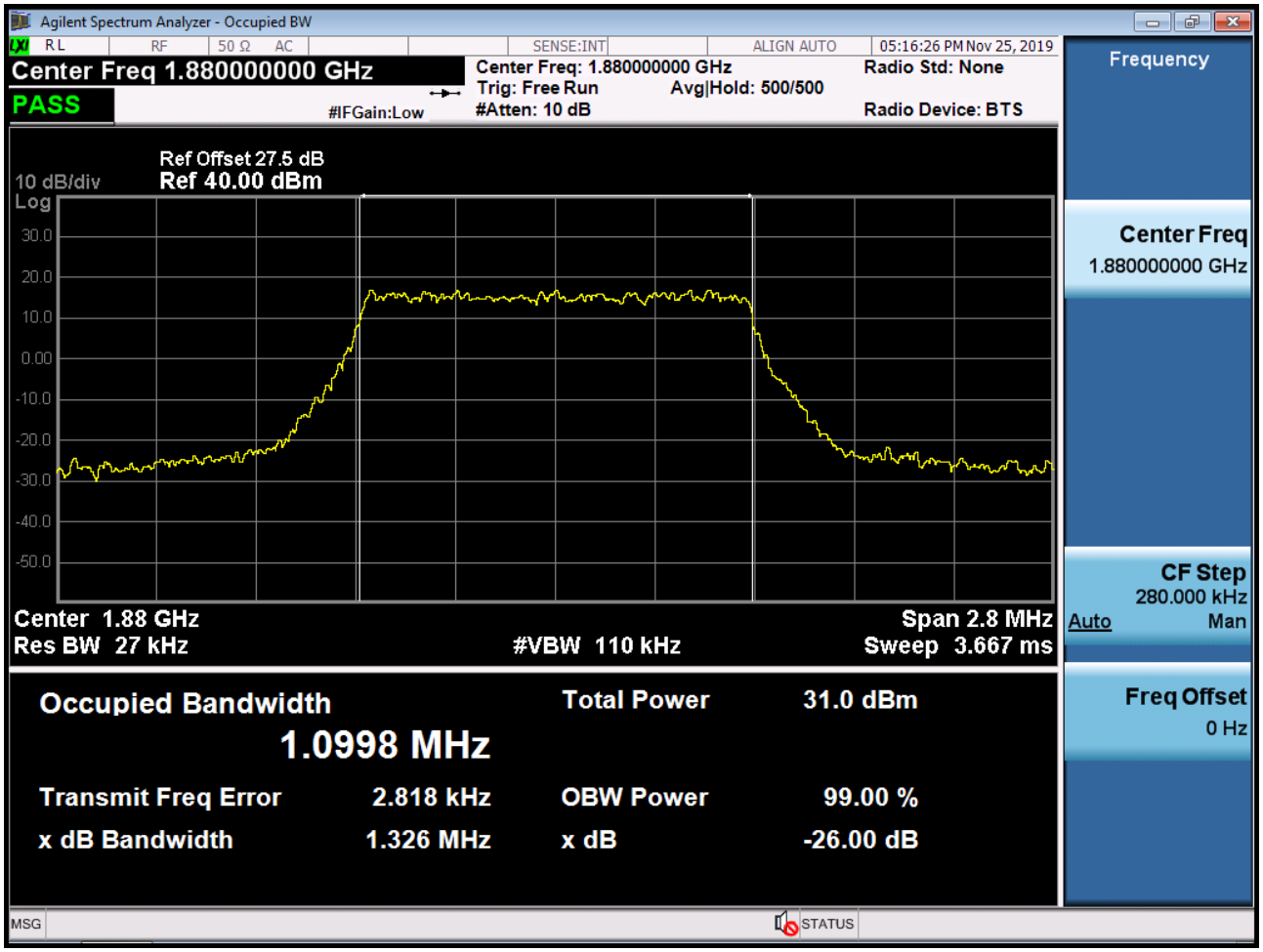


9. TEST PLOTS

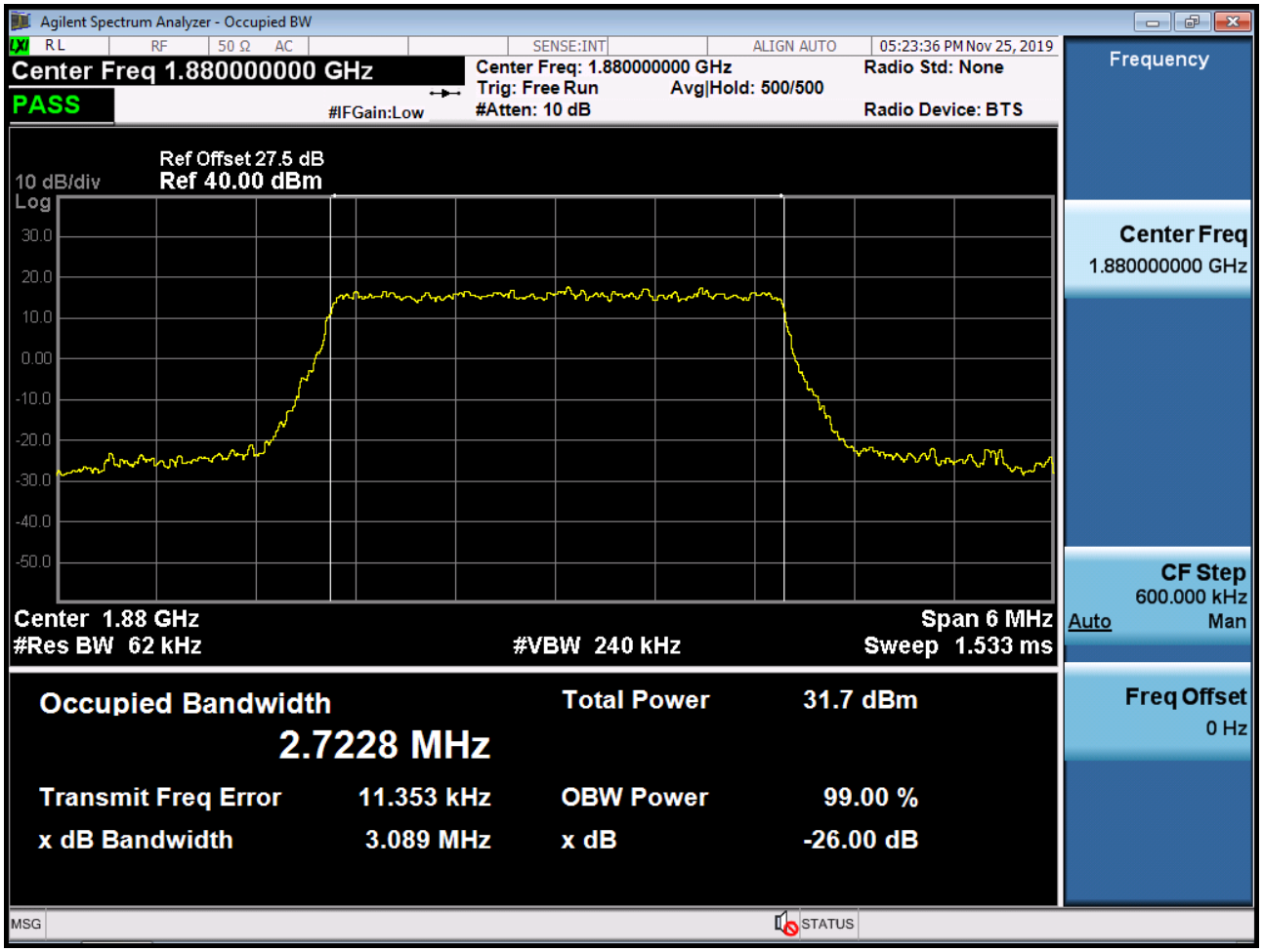
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 QPSK RB 6_0)



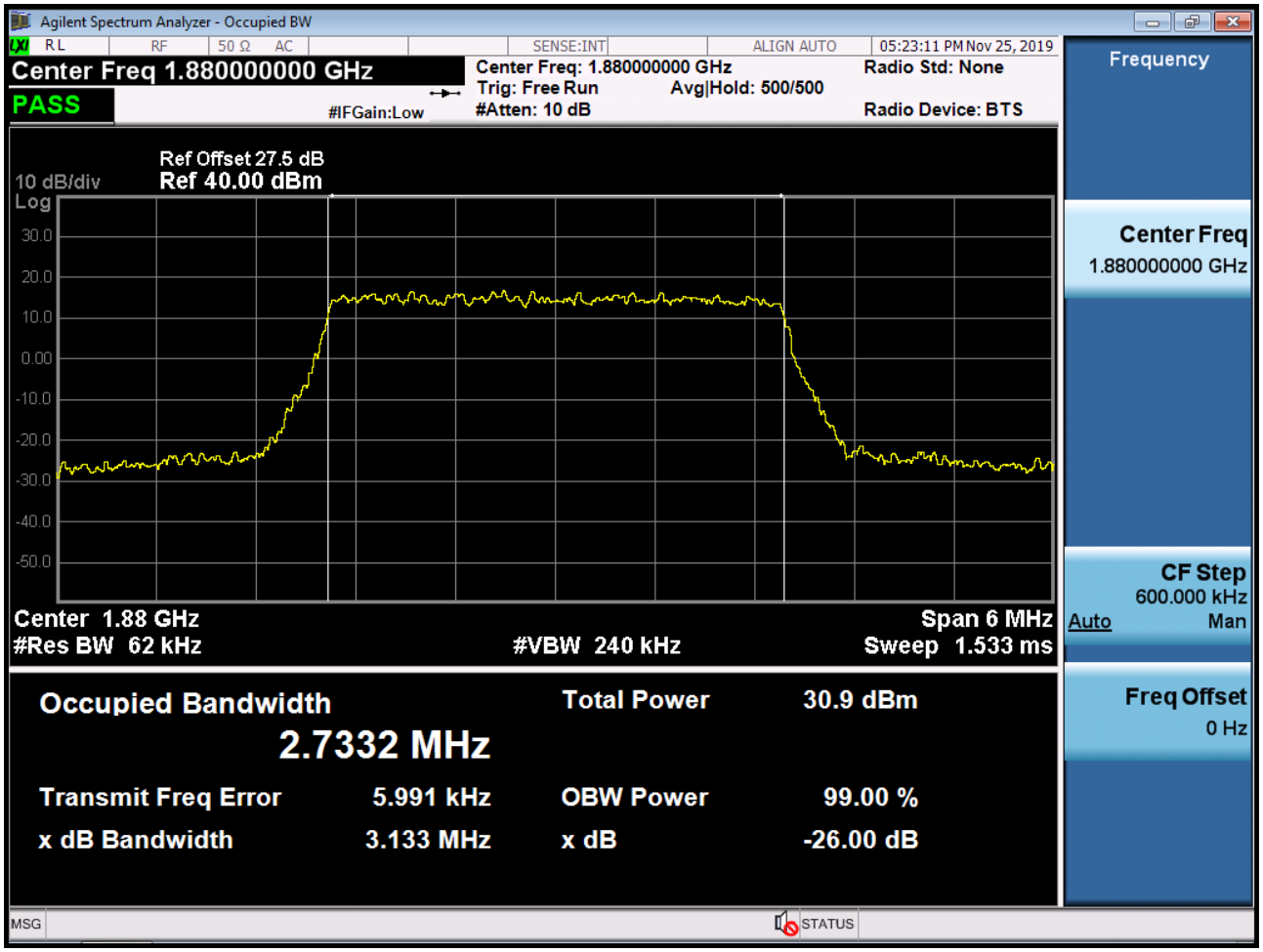
BAND 2. Occupied Bandwidth Plot (1.4M BW Ch.18900 16QAM RB 6_0)



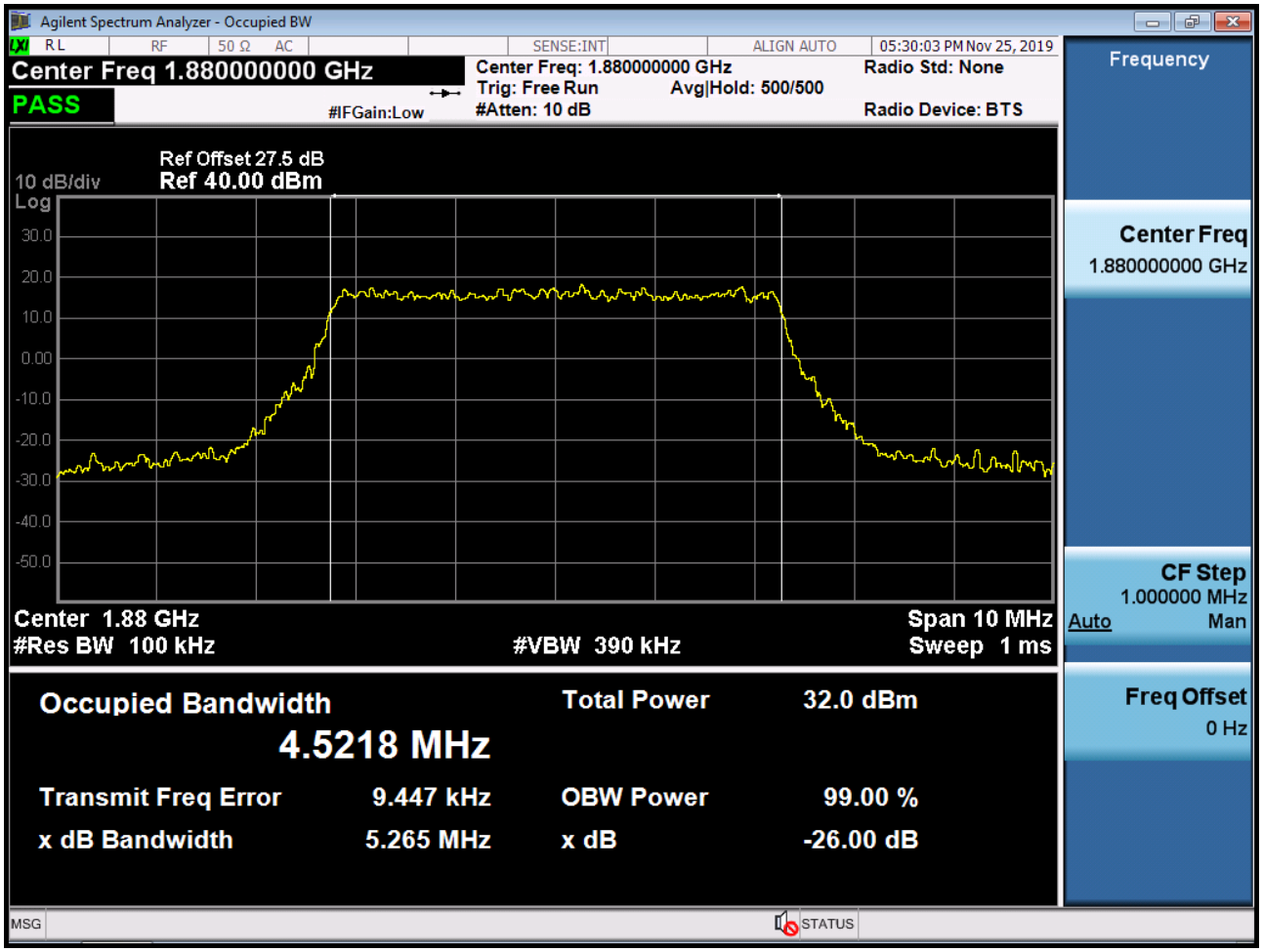
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 QPSK RB 15_0)



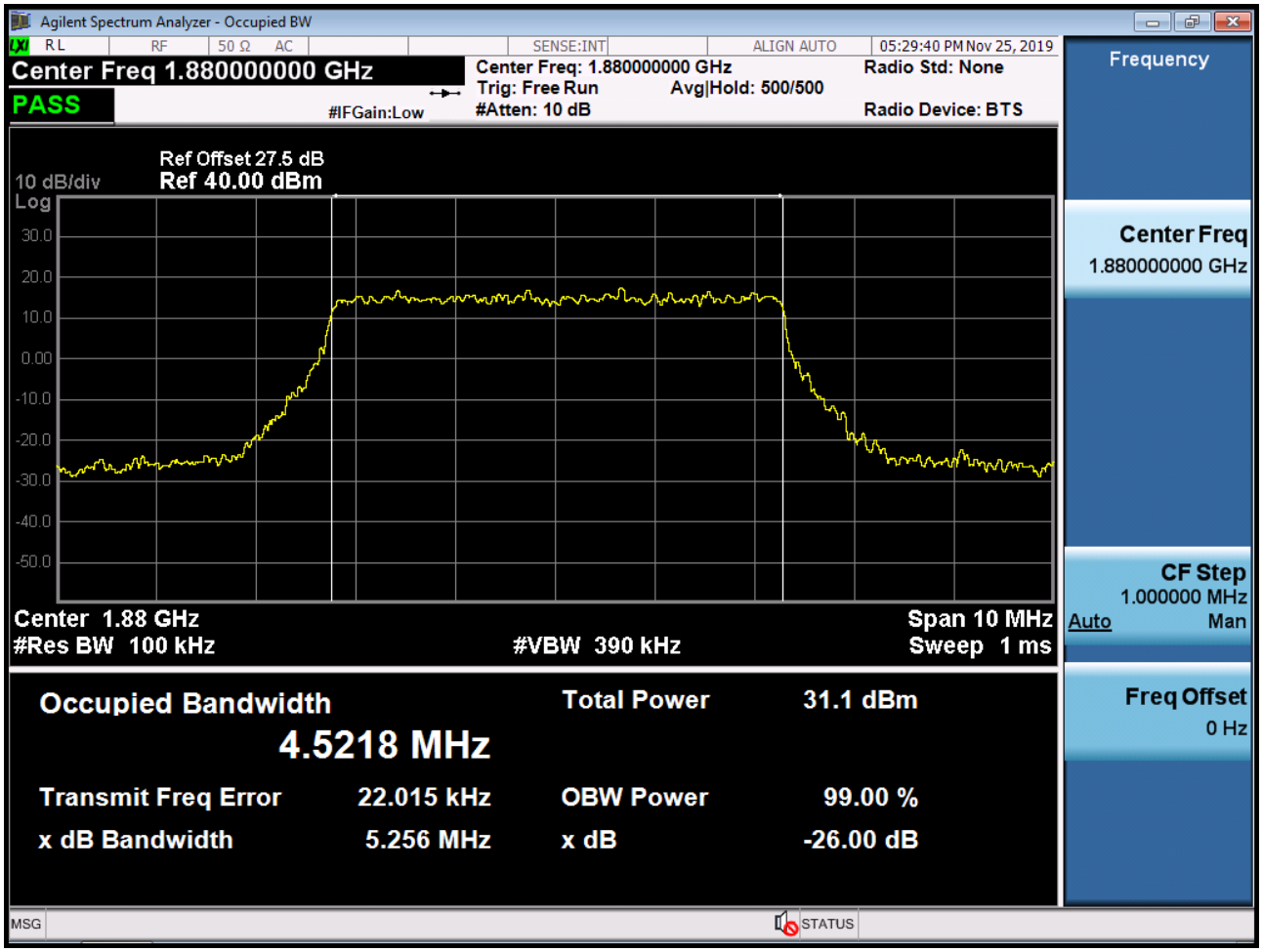
BAND 2. Occupied Bandwidth Plot (3M BW Ch.18900 16QAM RB 15_0)



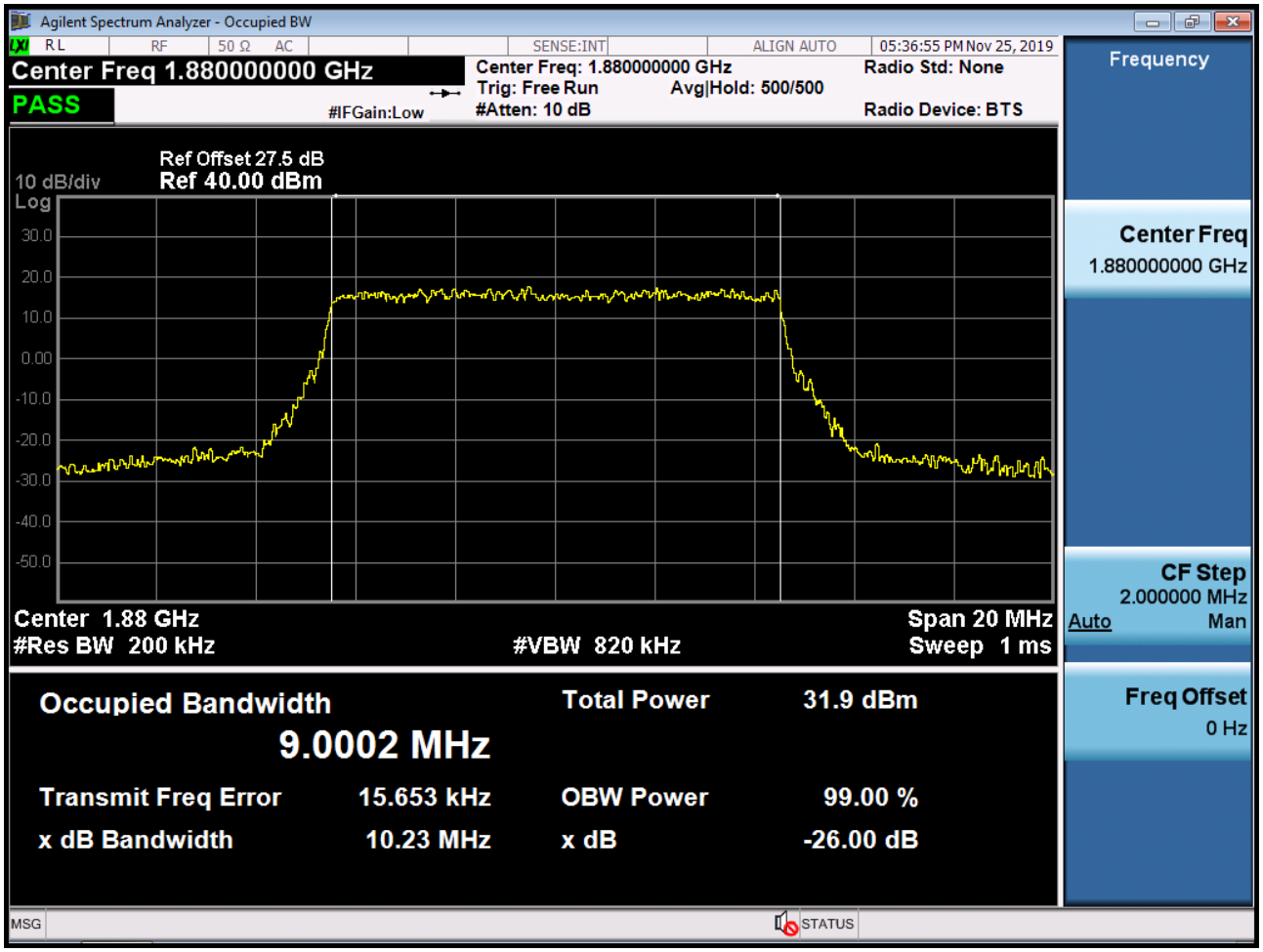
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 QPSK RB 25_0)



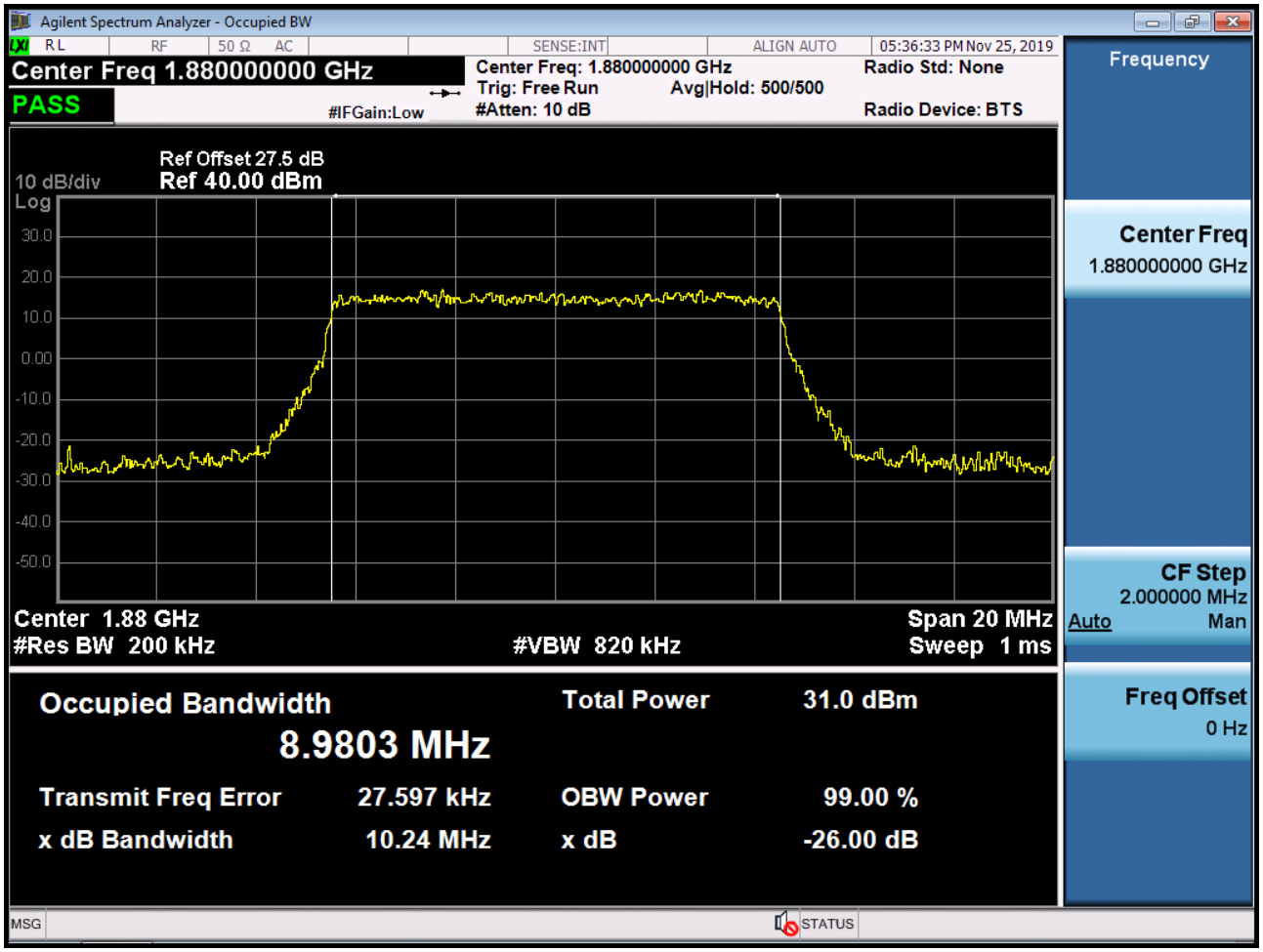
BAND 2. Occupied Bandwidth Plot (5M BW Ch.18900 16QAM RB 25_0)



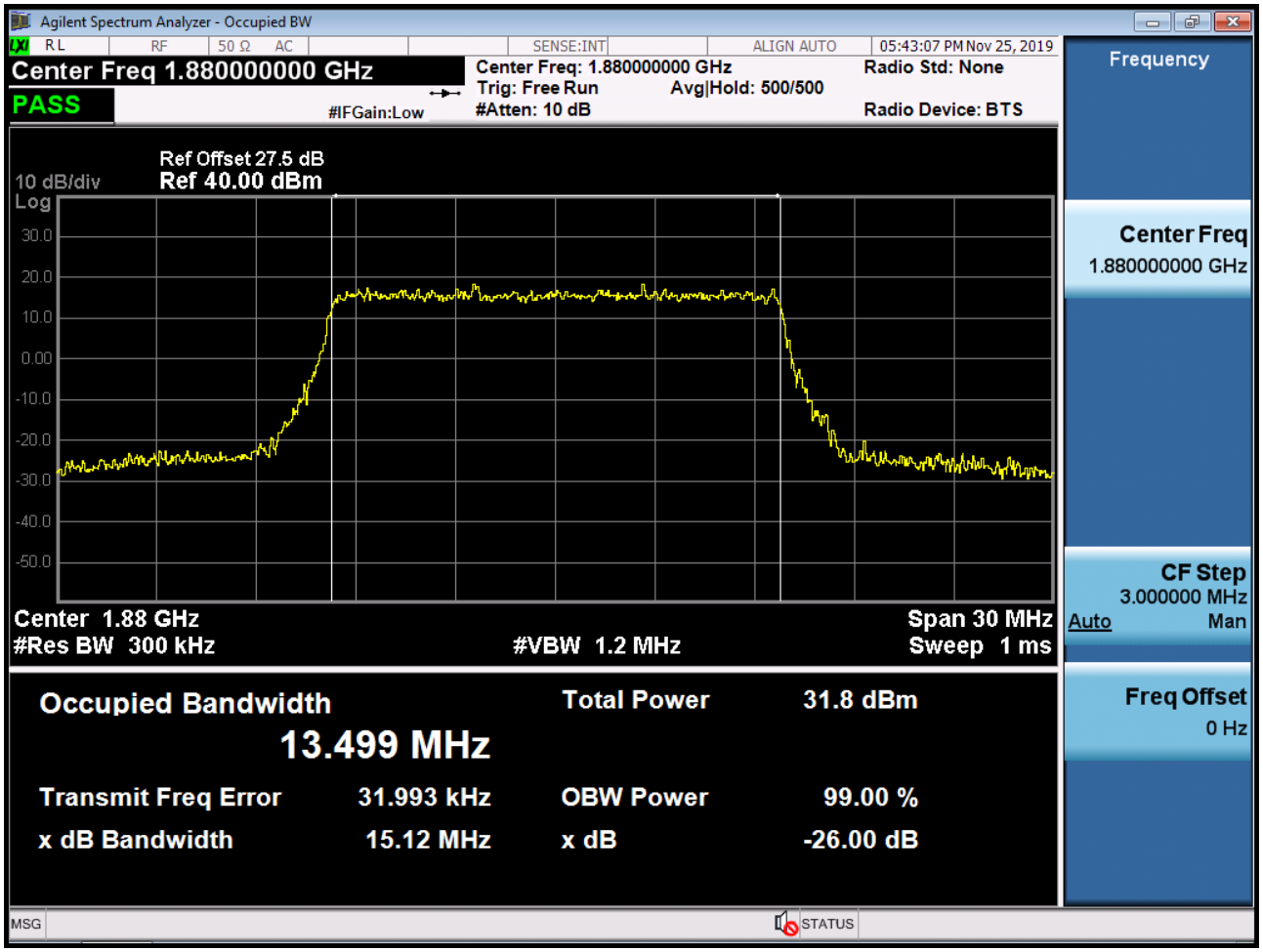
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 QPSK RB 50_0)



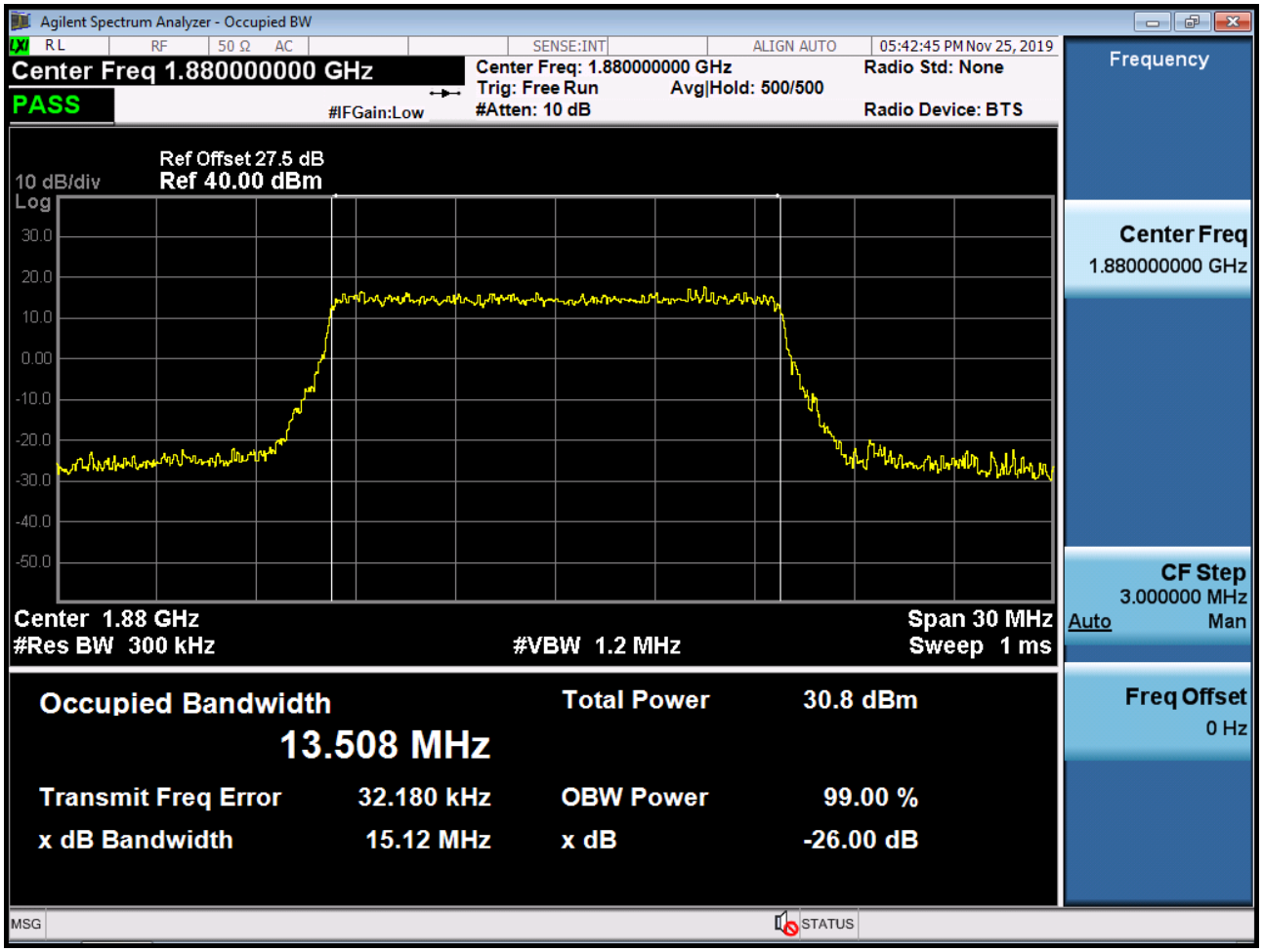
BAND 2. Occupied Bandwidth Plot (10M BW Ch.18900 16QAM RB 50_0)



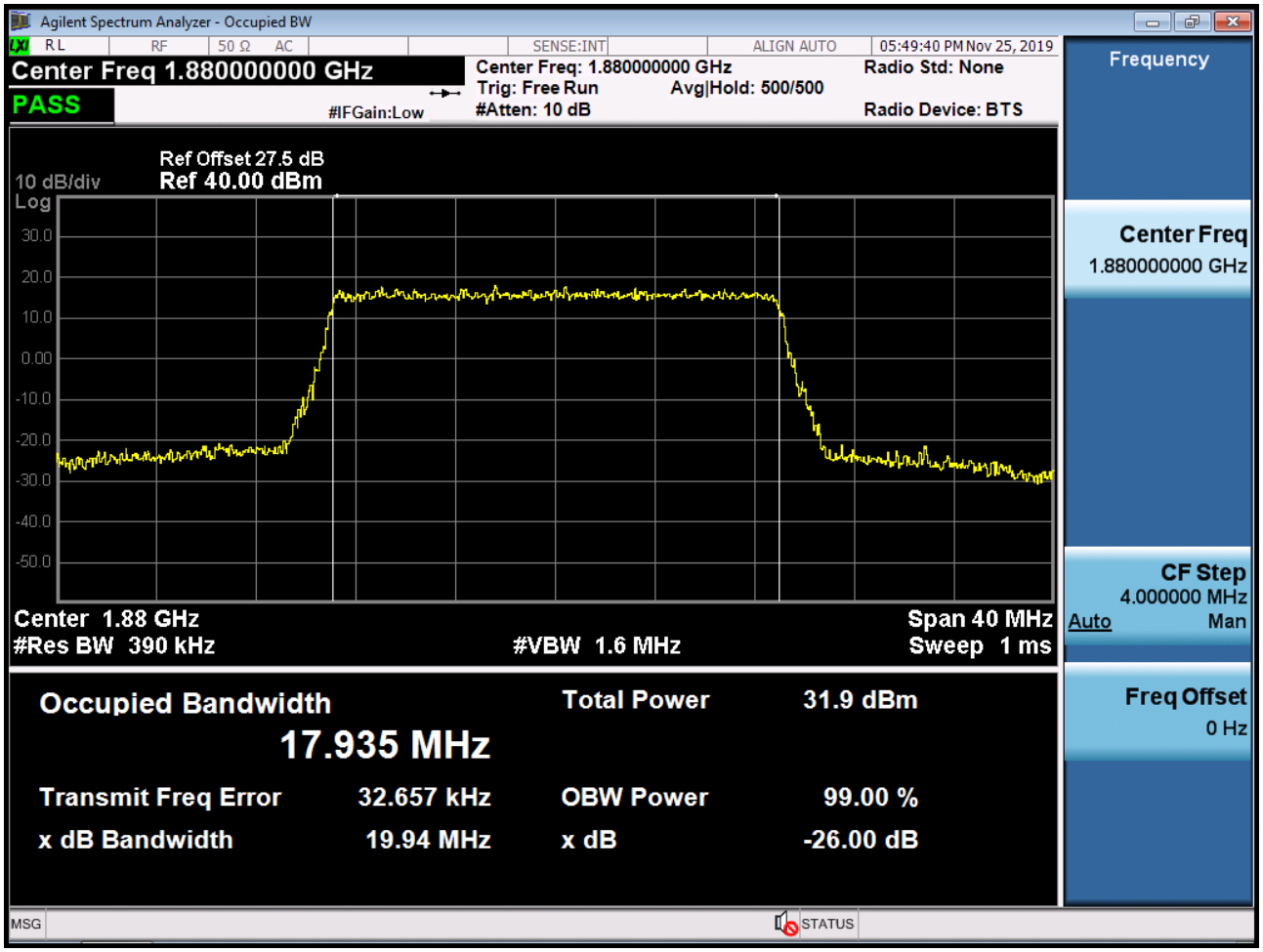
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 QPSK RB 75_0)



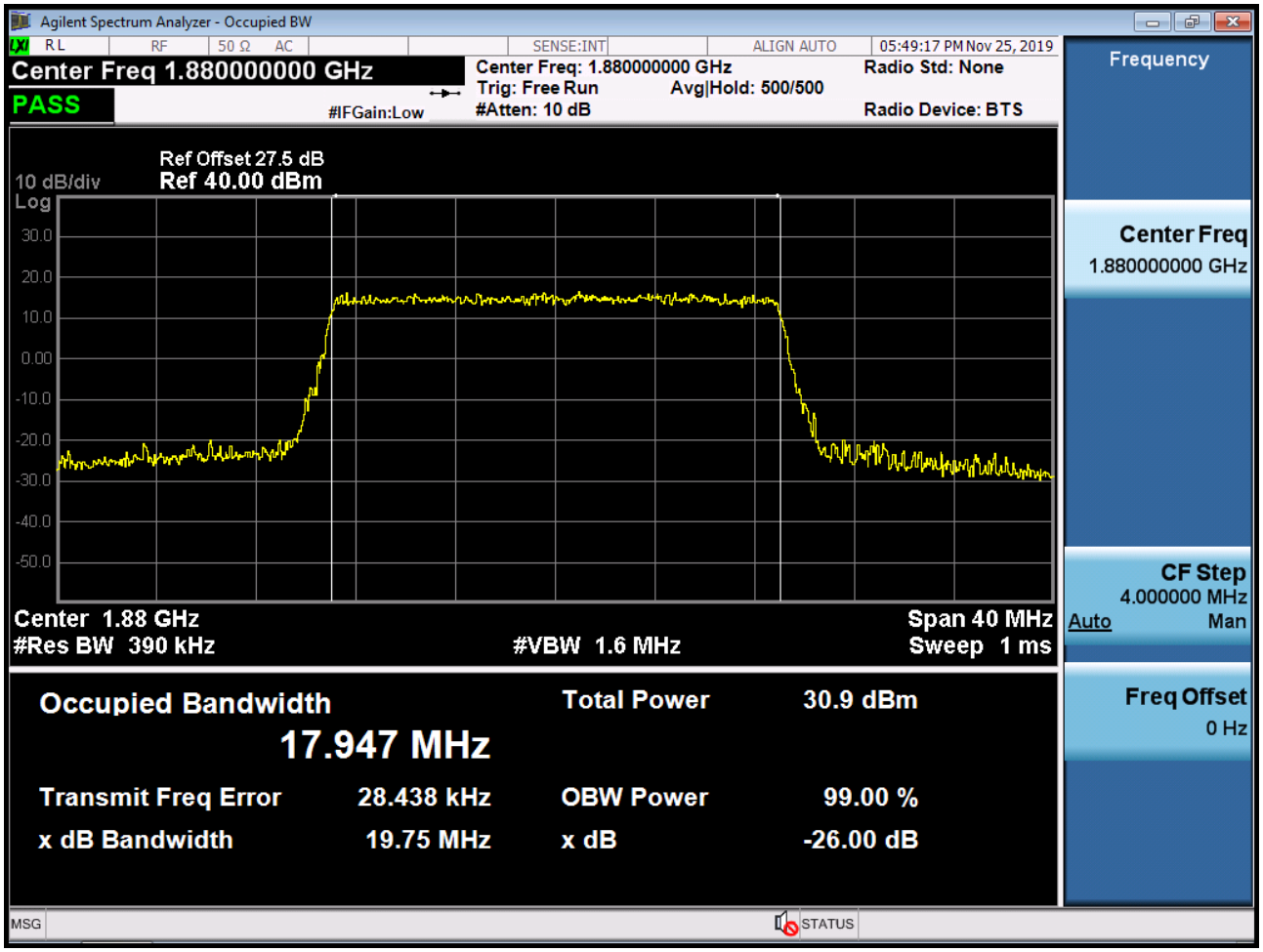
BAND 2. Occupied Bandwidth Plot (15M BW Ch.18900 16QAM RB 75_0)



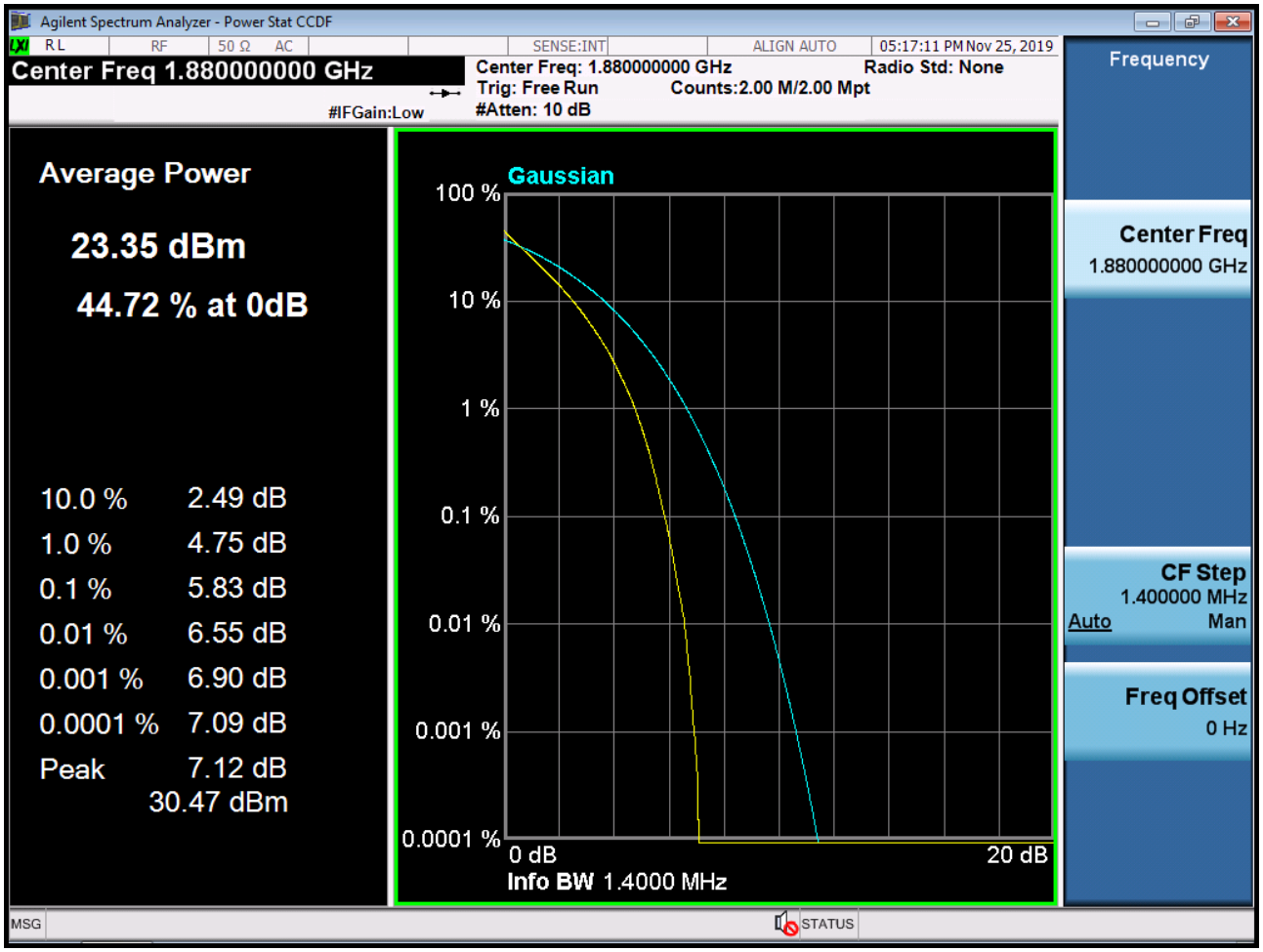
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 QPSK RB 100_0)



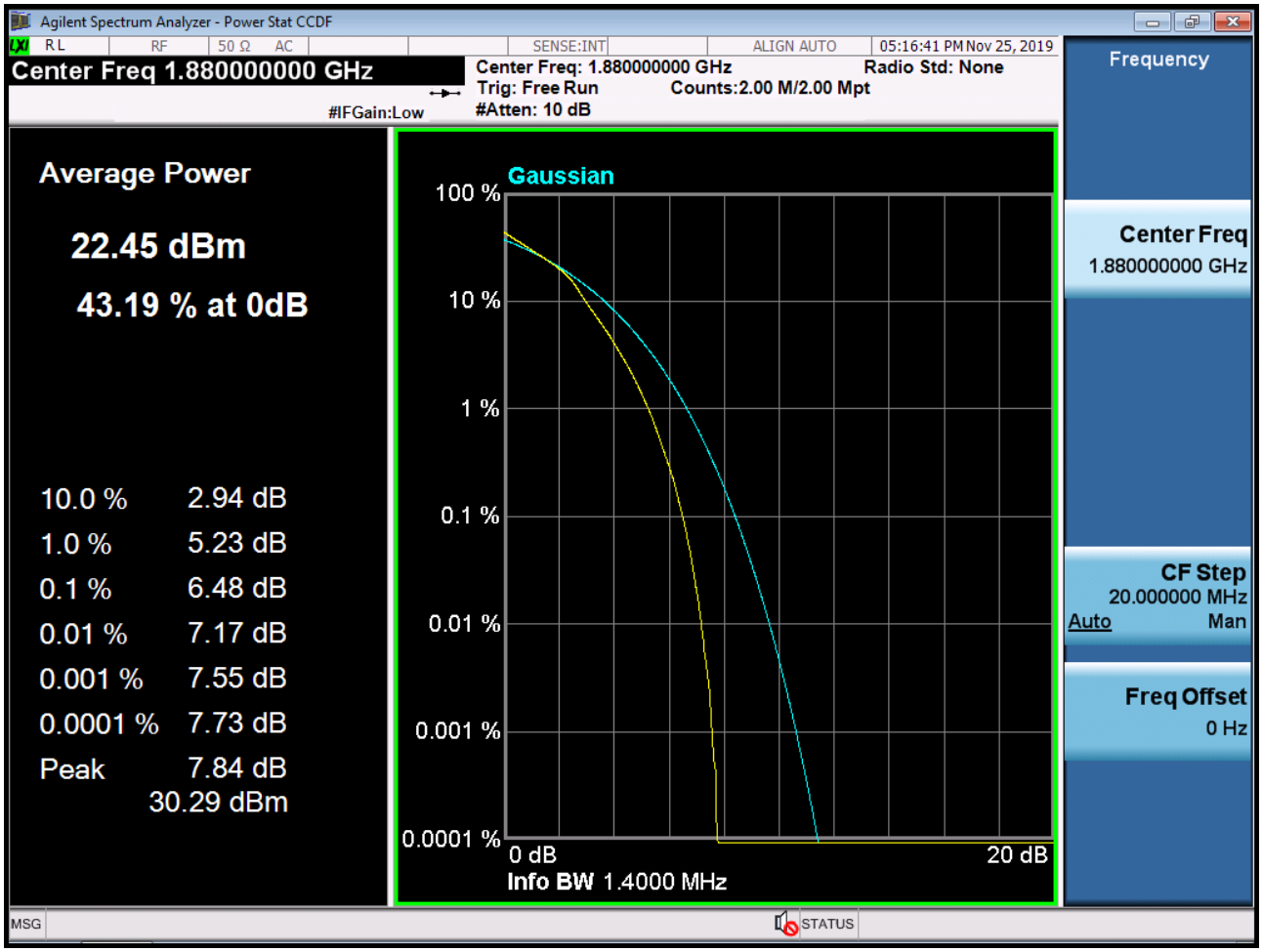
BAND 2. Occupied Bandwidth Plot (20M BW Ch.18900 16QAM RB 100_0)



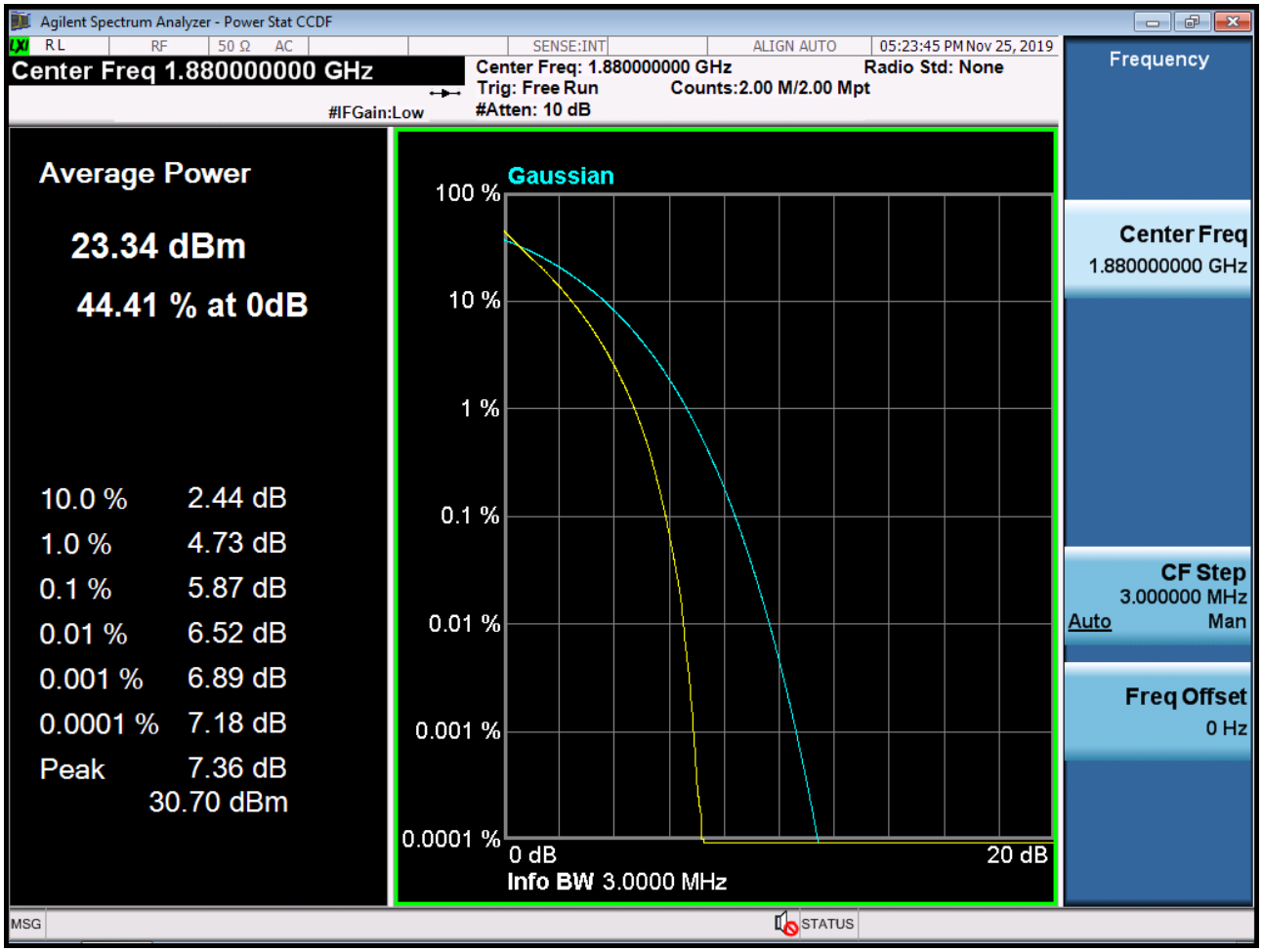
BAND 2. PAR Plot (1.4M BW Ch.18900 QPSK RB 6_0)



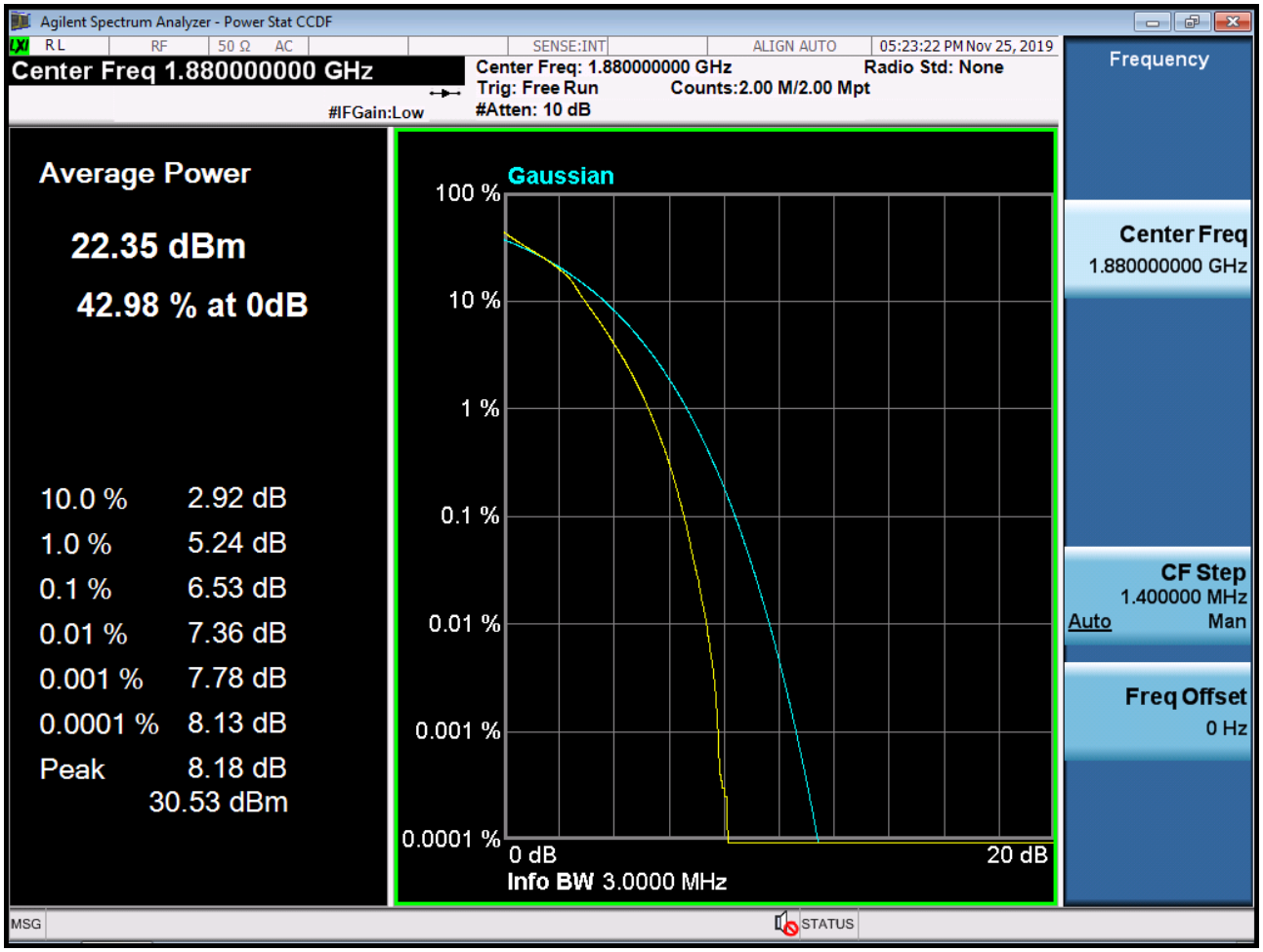
BAND 2. PAR Plot (1.4M BW Ch.18900 16QAM RB 6_0)



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

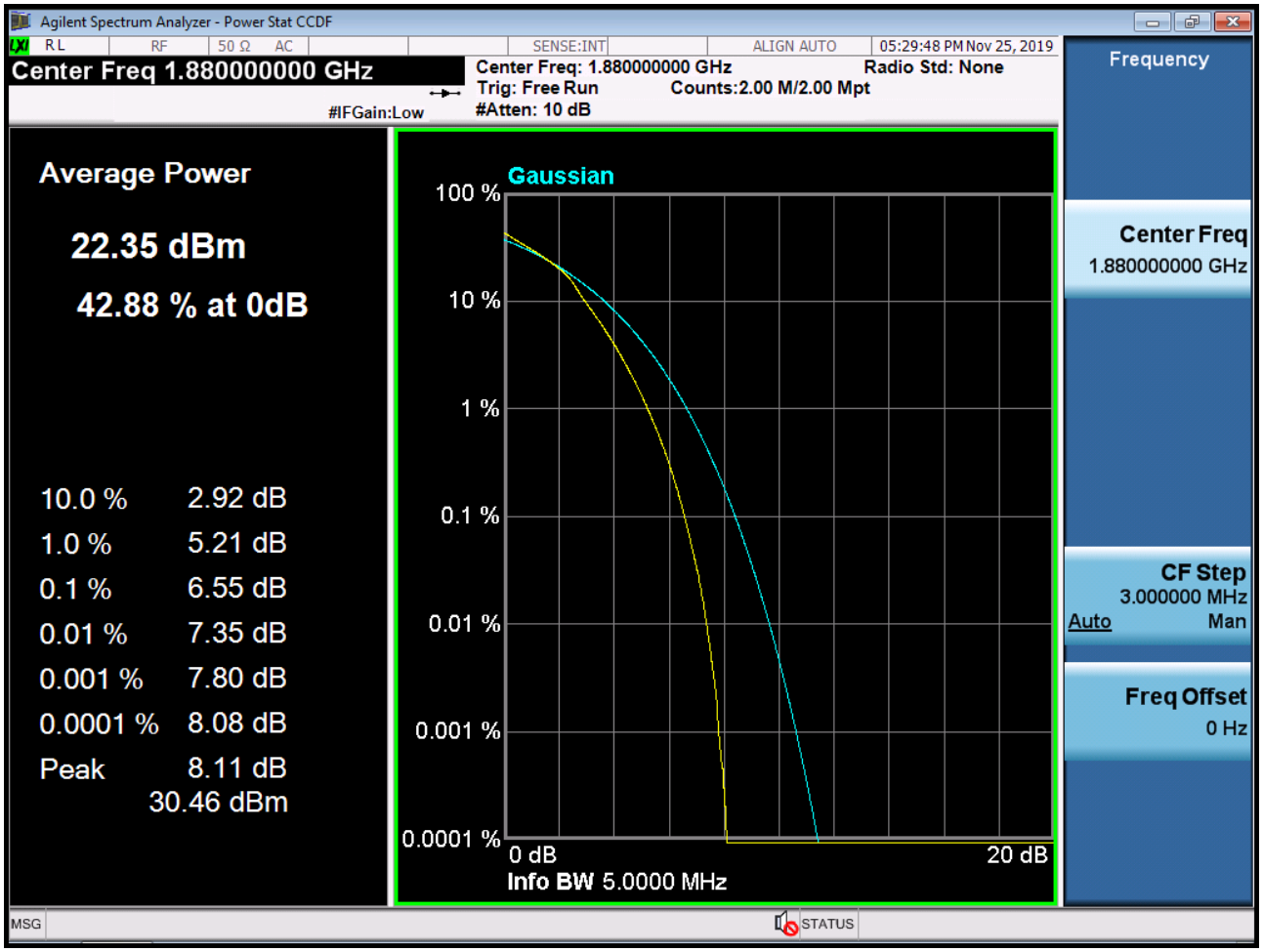


BAND 2. PAR Plot (3M BW Ch.18900 16QAM RB 15_0)

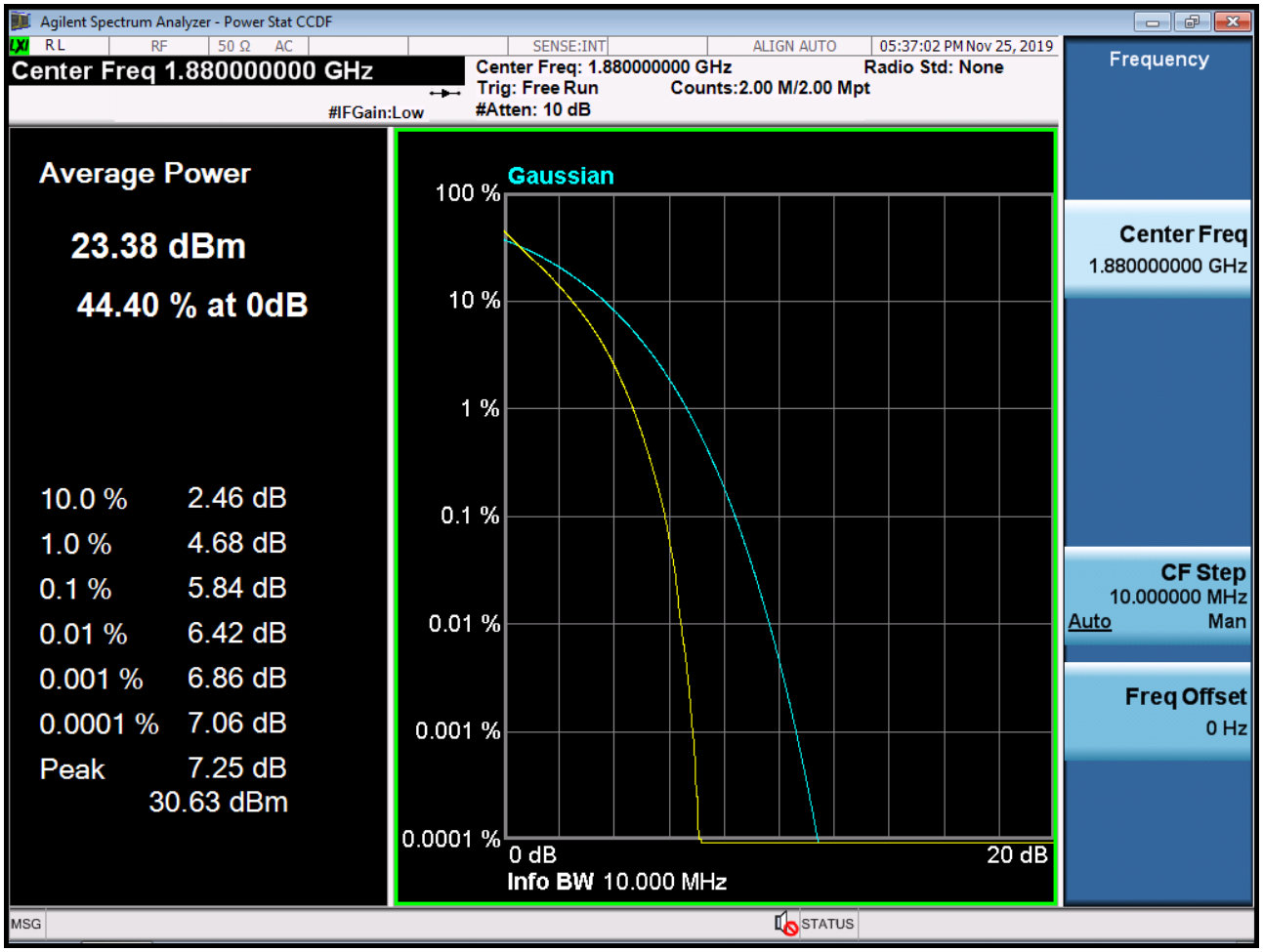


BAND 2. PAR Plot (5M BW Ch.18900 QPSK RB 25_0)

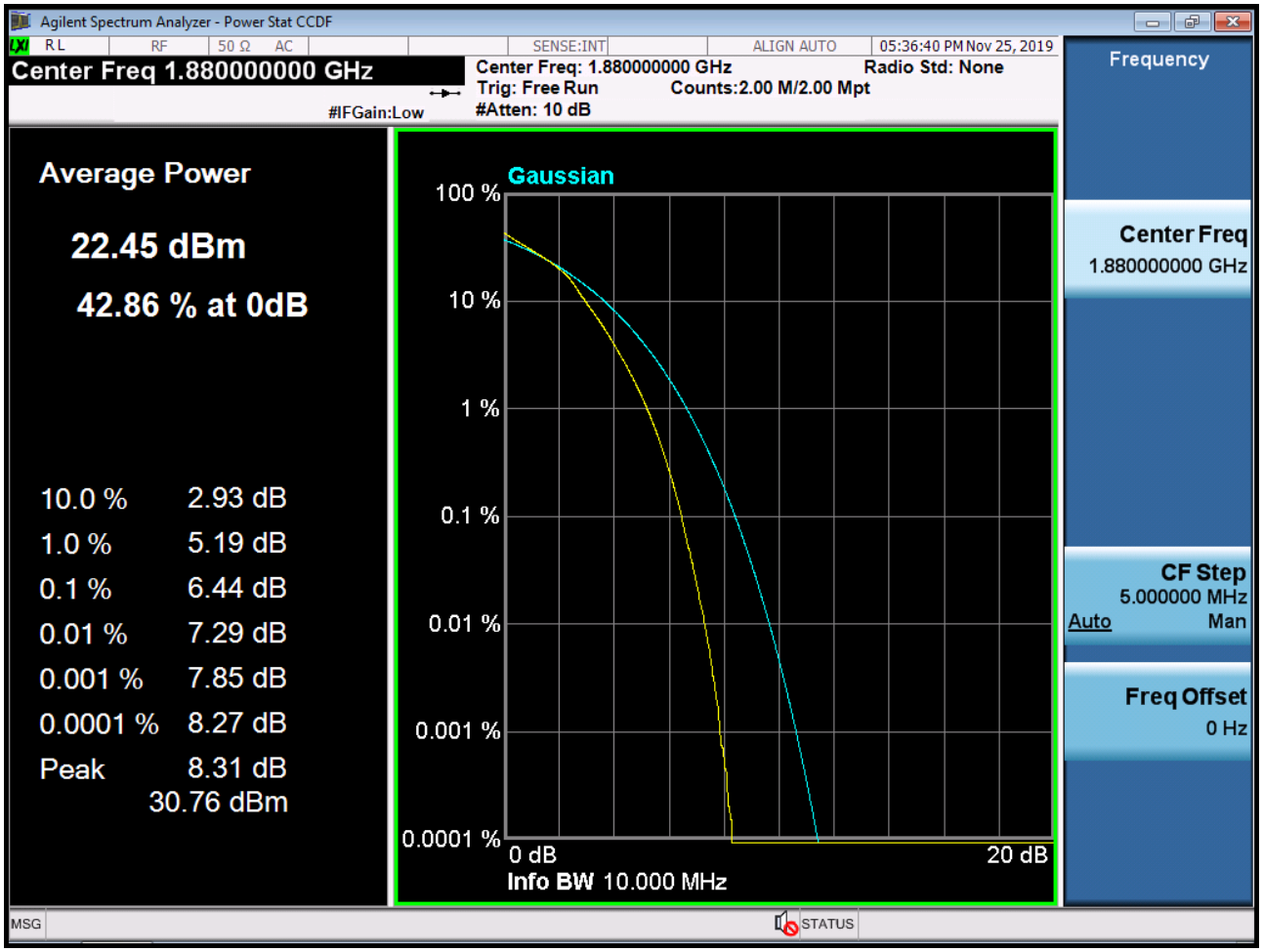
BAND 2. PAR Plot (5M BW Ch.18900 16QAM RB 25_0)



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

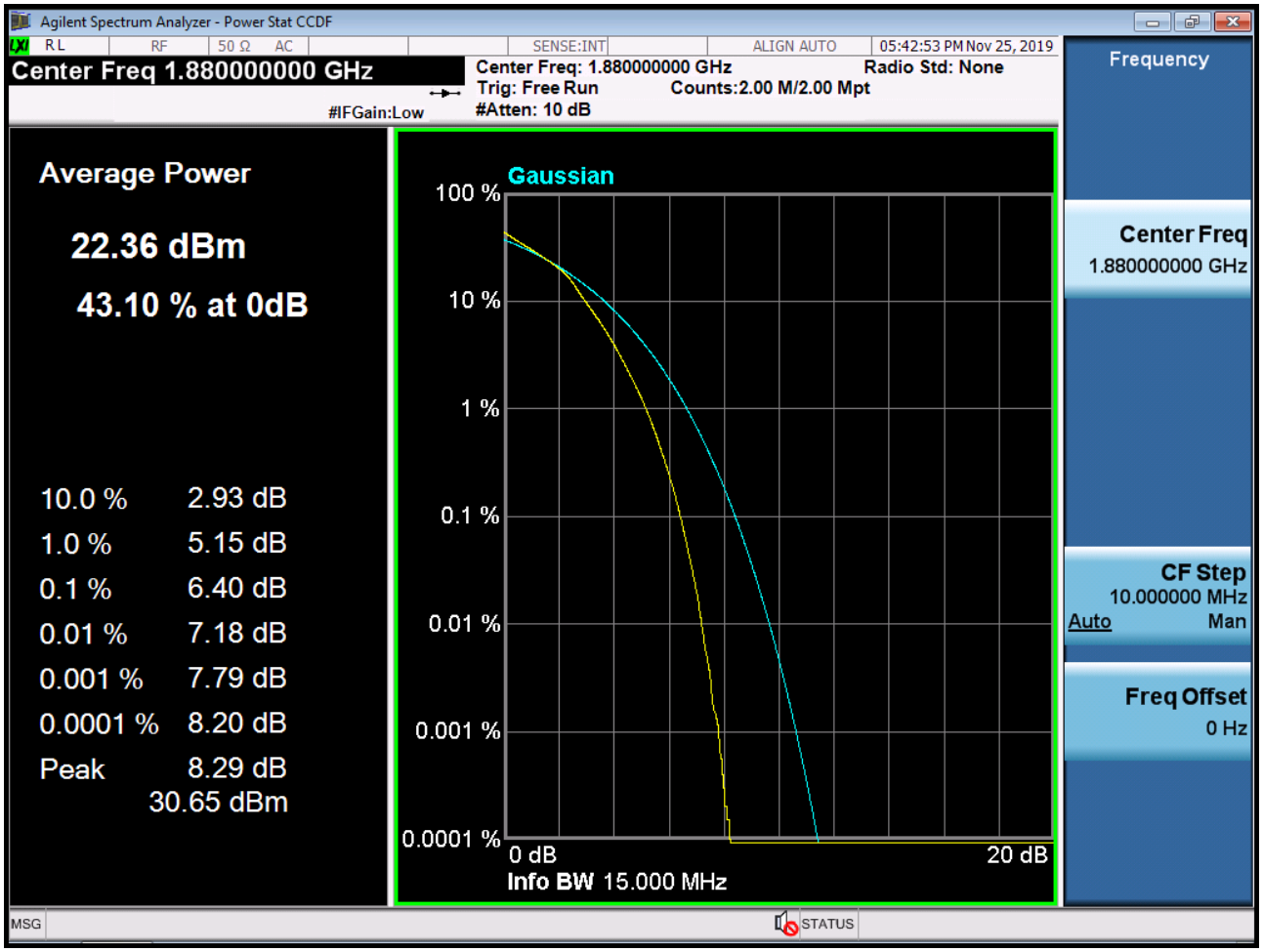


BAND 2. PAR Plot (10M BW Ch.18900 16QAM RB 50_0)

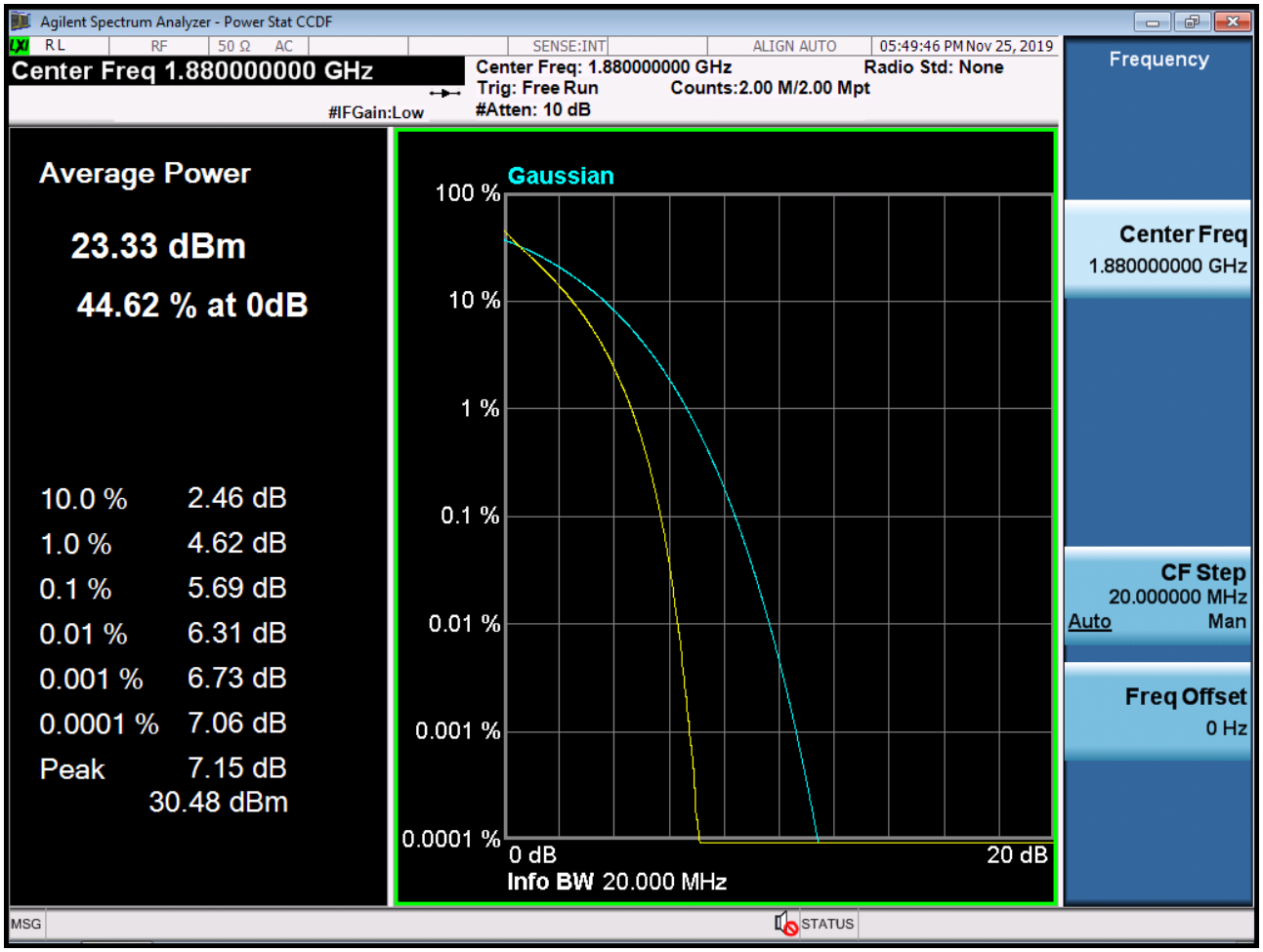


BAND 2. PAR Plot (15M BW Ch.18900 QPSK RB 75_0)

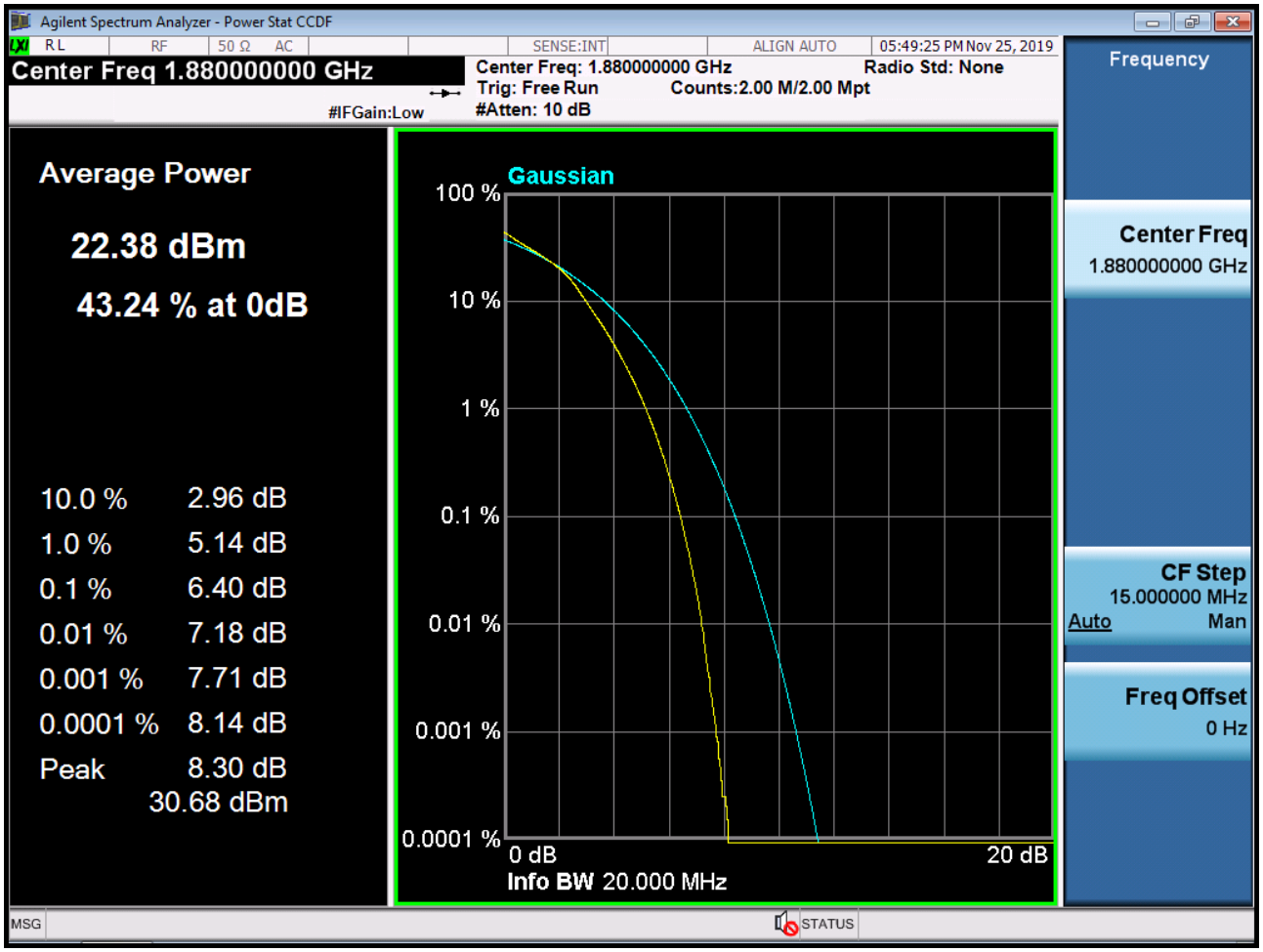
BAND 2. PAR Plot (15M BW Ch.18900 16QAM RB 75_0)



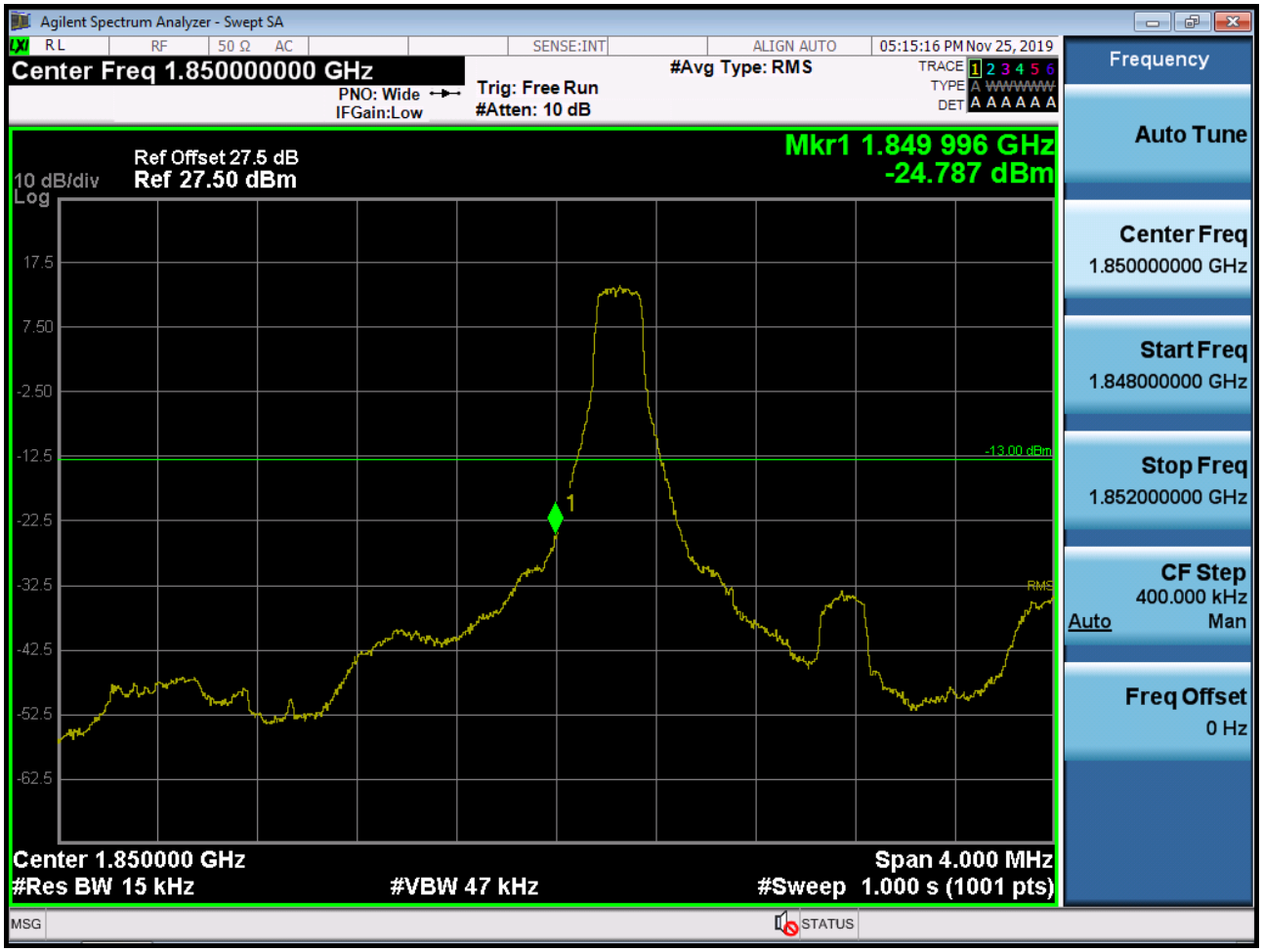
BAND 2. PAR Plot (20M BW Ch.18900 QPSK RB 100_0)



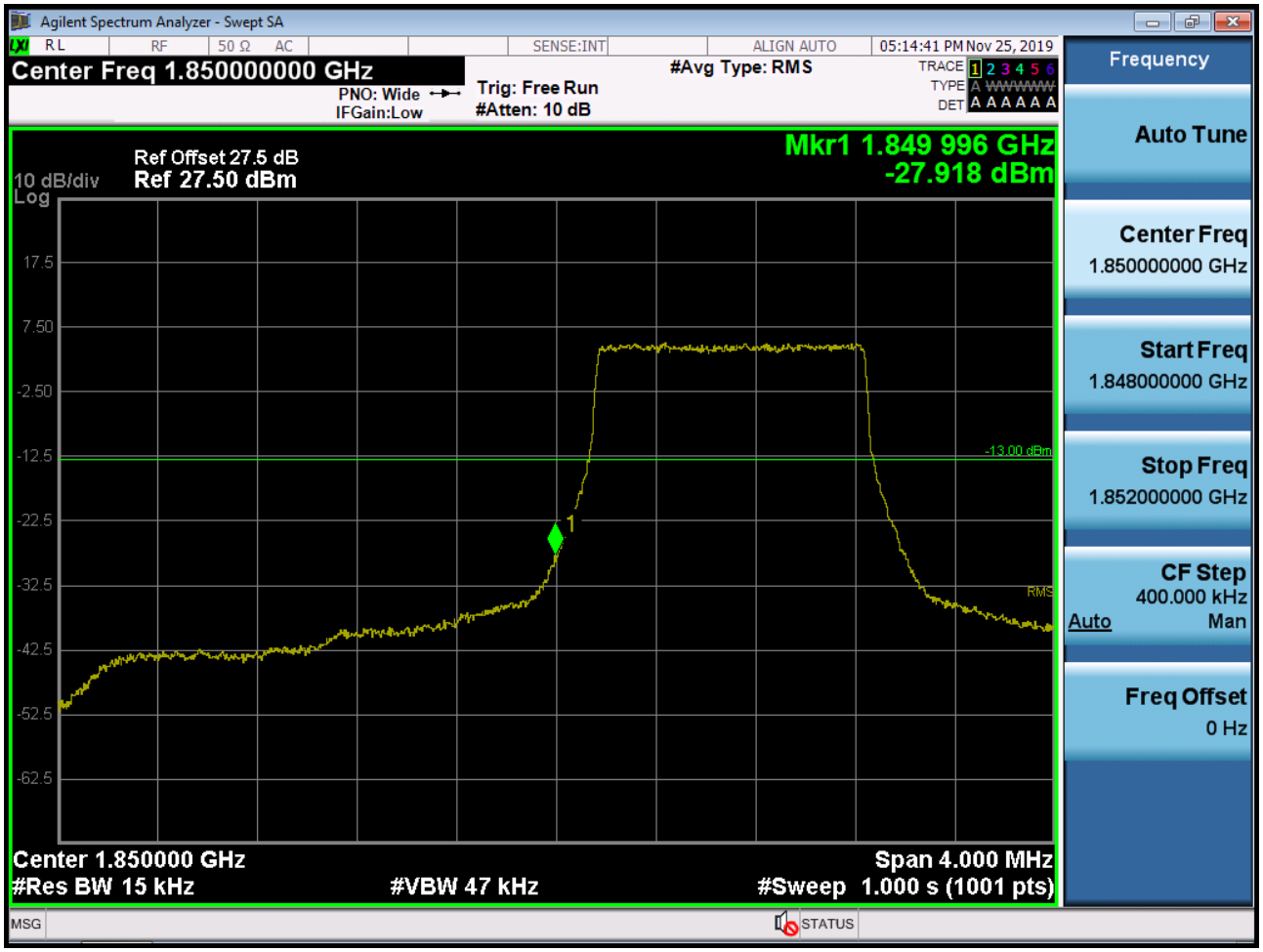
BAND 2. PAR Plot (20M BW Ch.18900 16QAM RB 100_0)



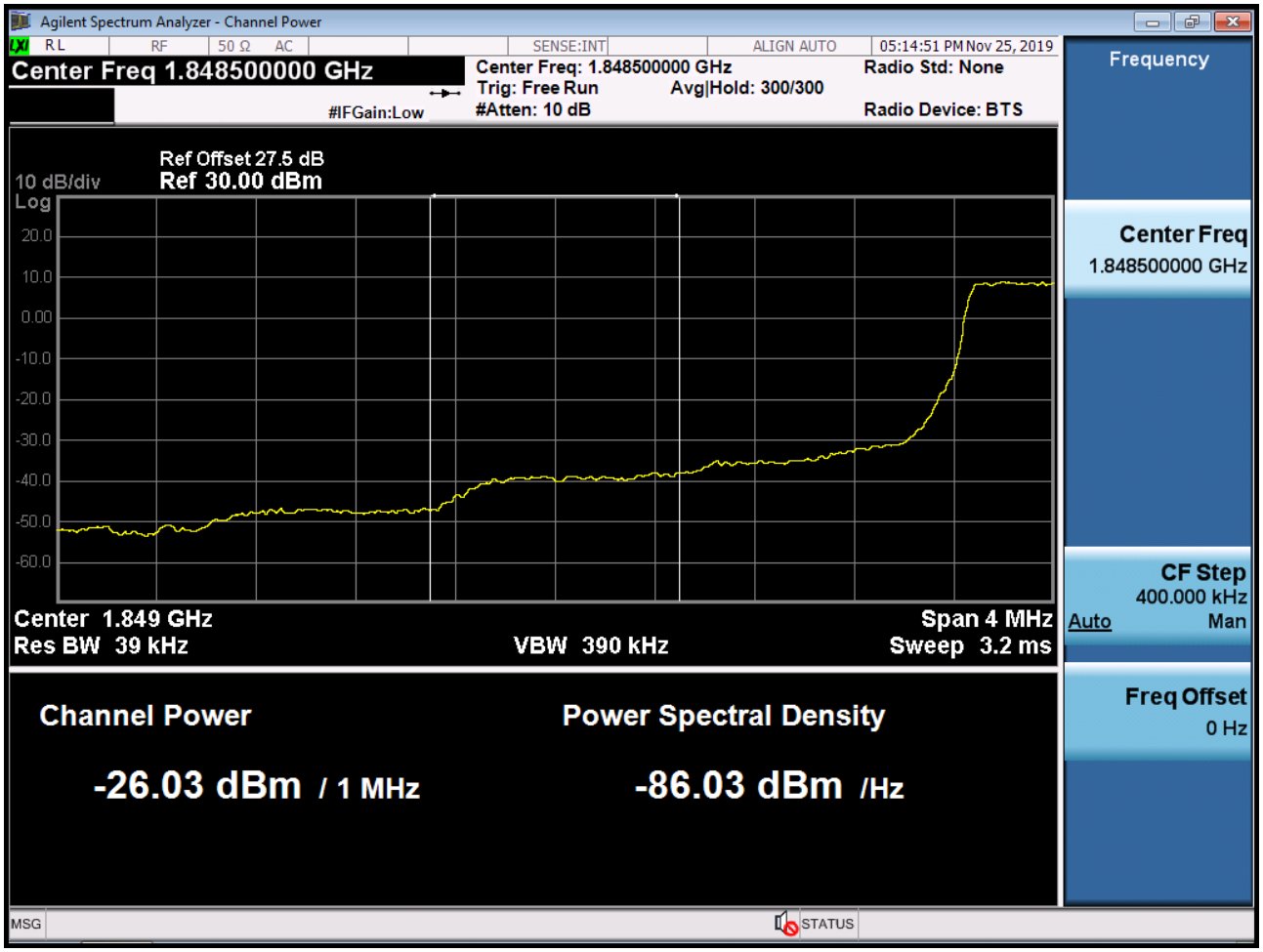
BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB1_Offset 0) -1



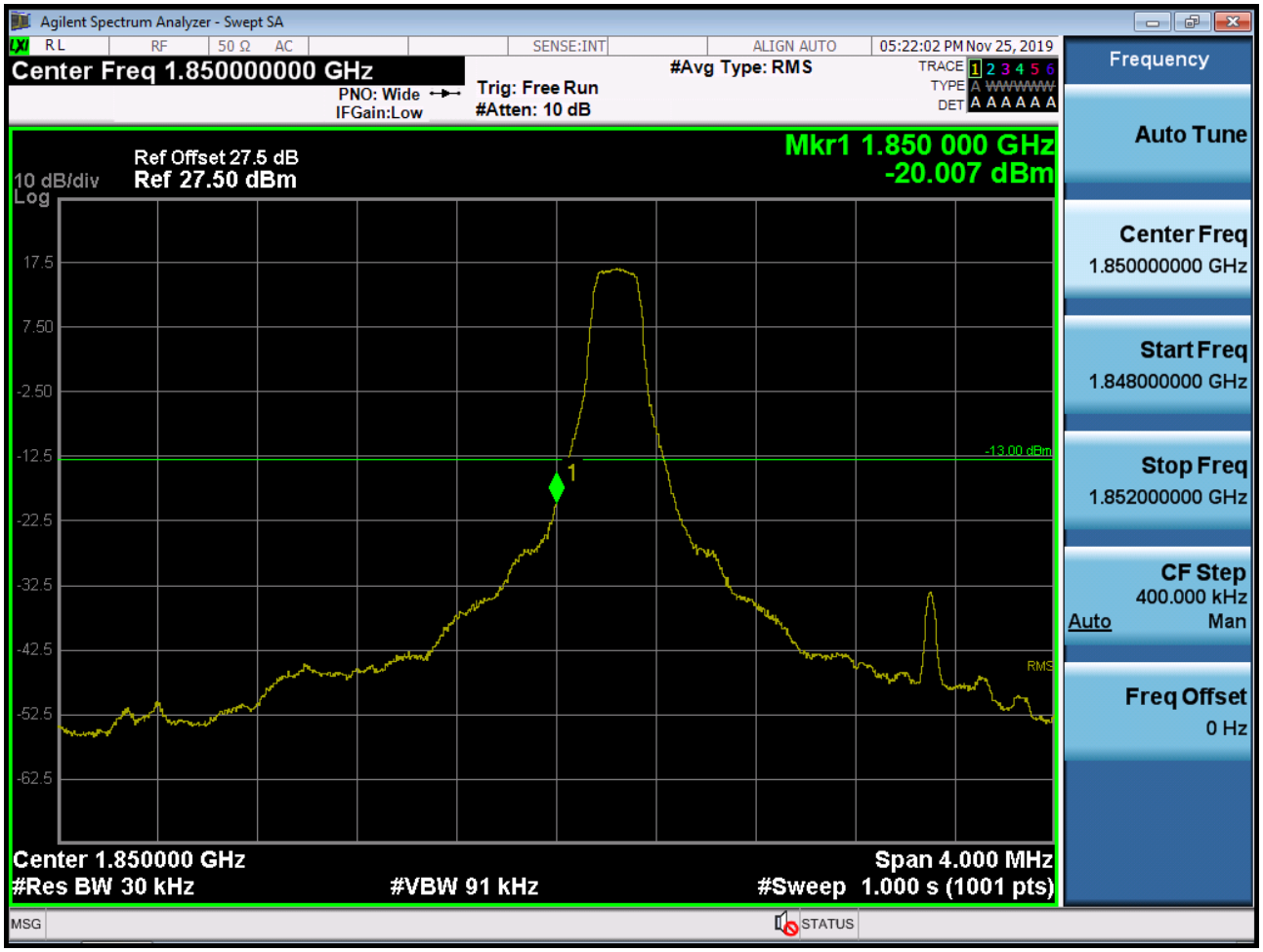
BAND 2. Lower Band Edge Plot (1.4M BW Ch.18607 QPSK_RB6_Offset 0) -2



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

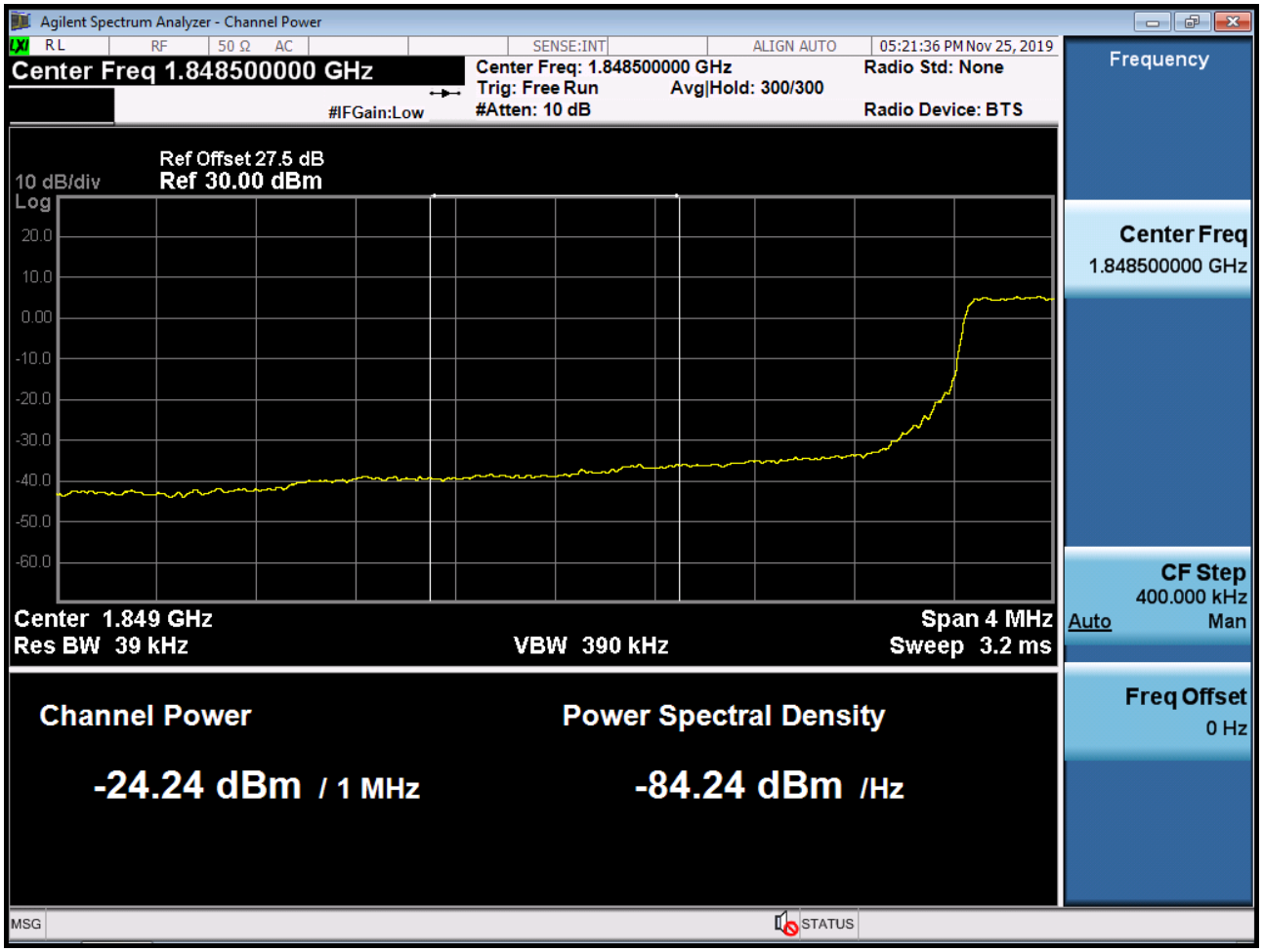


BAND 2. Lower Band Edge Plot (3M BW Ch.18615 QPSK_RB1_Offset 0) -1



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

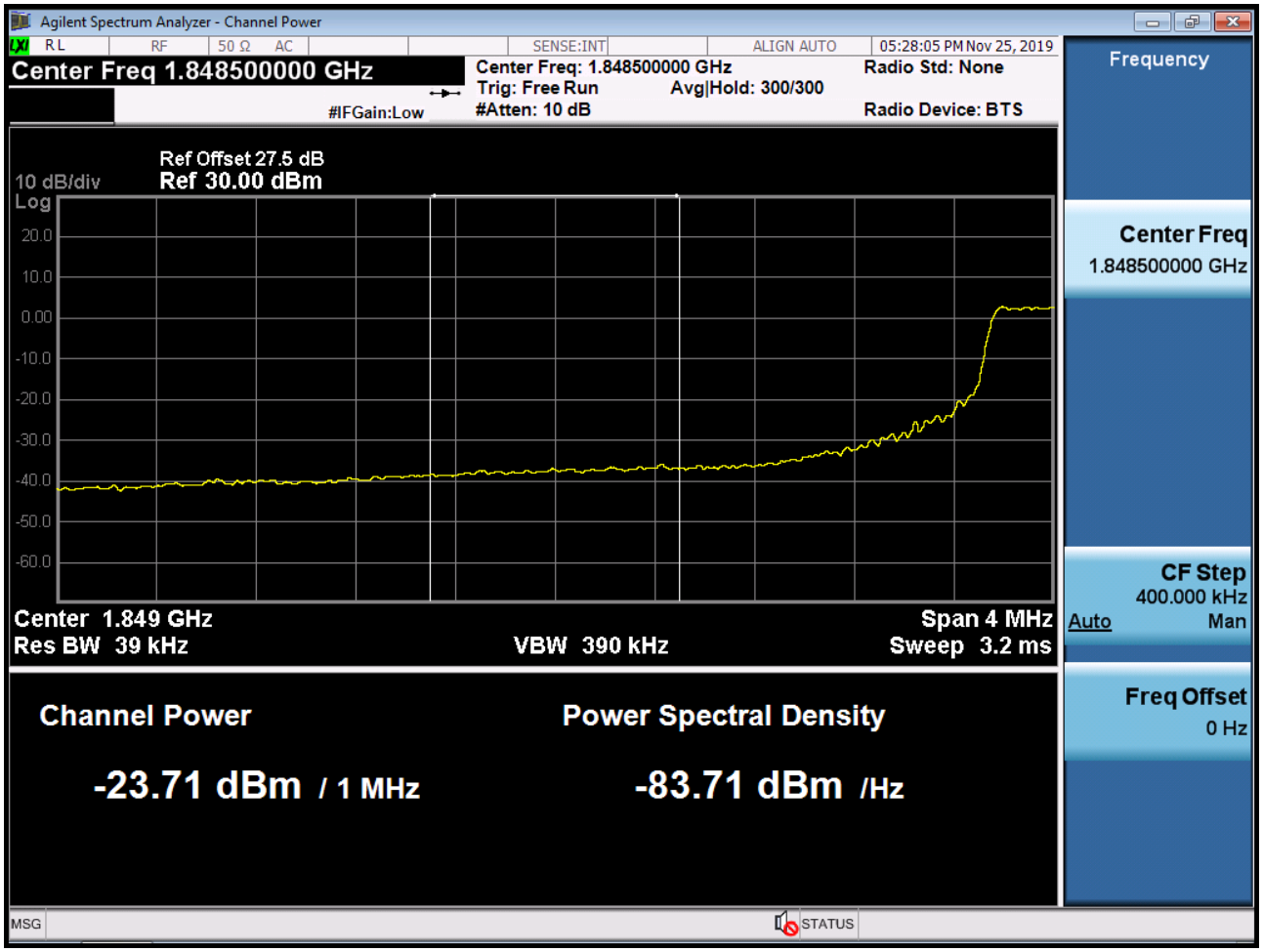
BAND 2. Lower Extended Band Edge Plot (3M BW Ch.18615 QPSK_RB15_0) -3



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

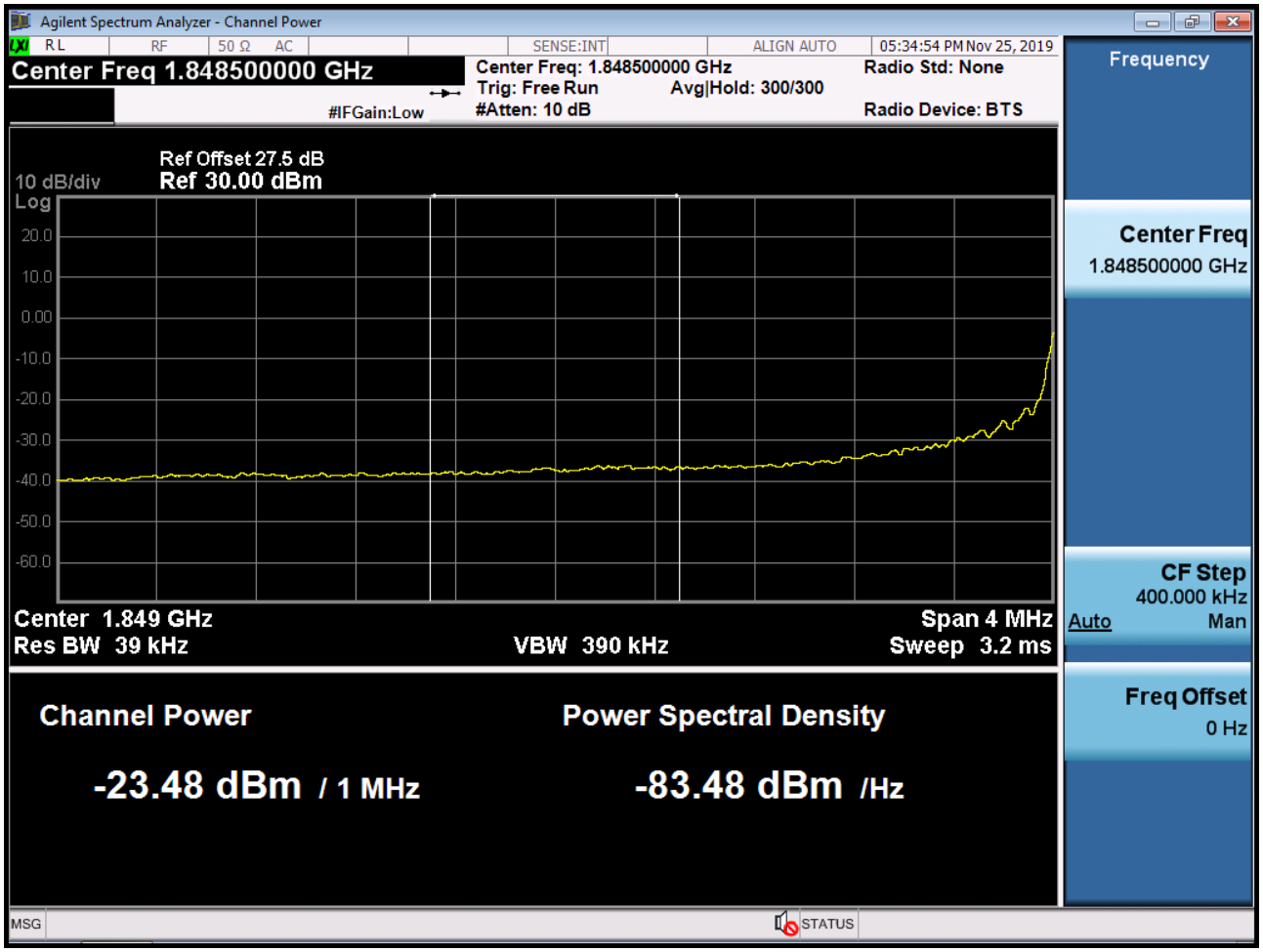
BAND 2. Lower Extended Band Edge Plot (5M BW Ch.18625 QPSK_RB25_0) -3



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

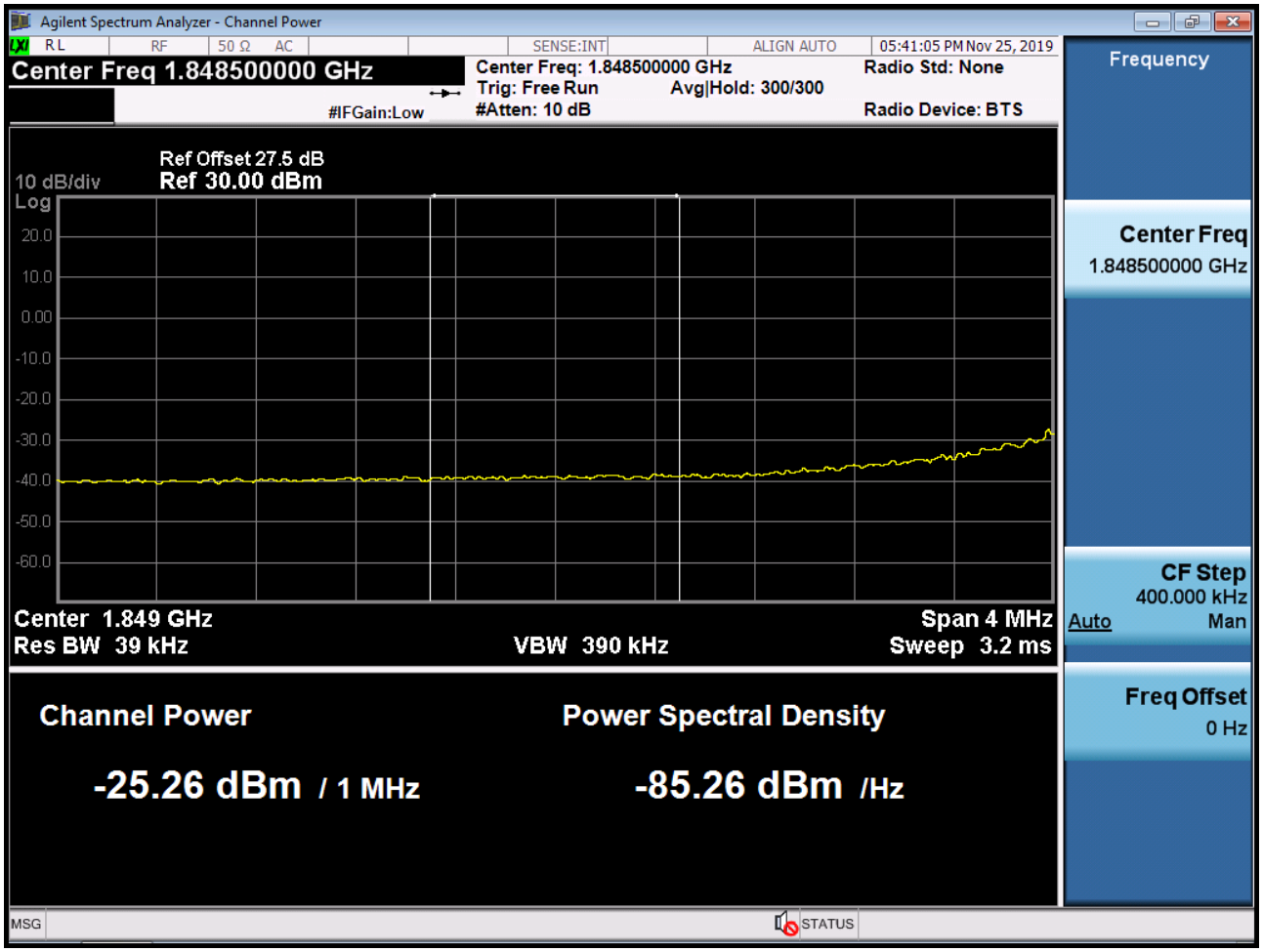
BAND 2. Lower Extended Band Edge Plot (10M BW Ch.18650 QPSK_RB50_0) -3



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

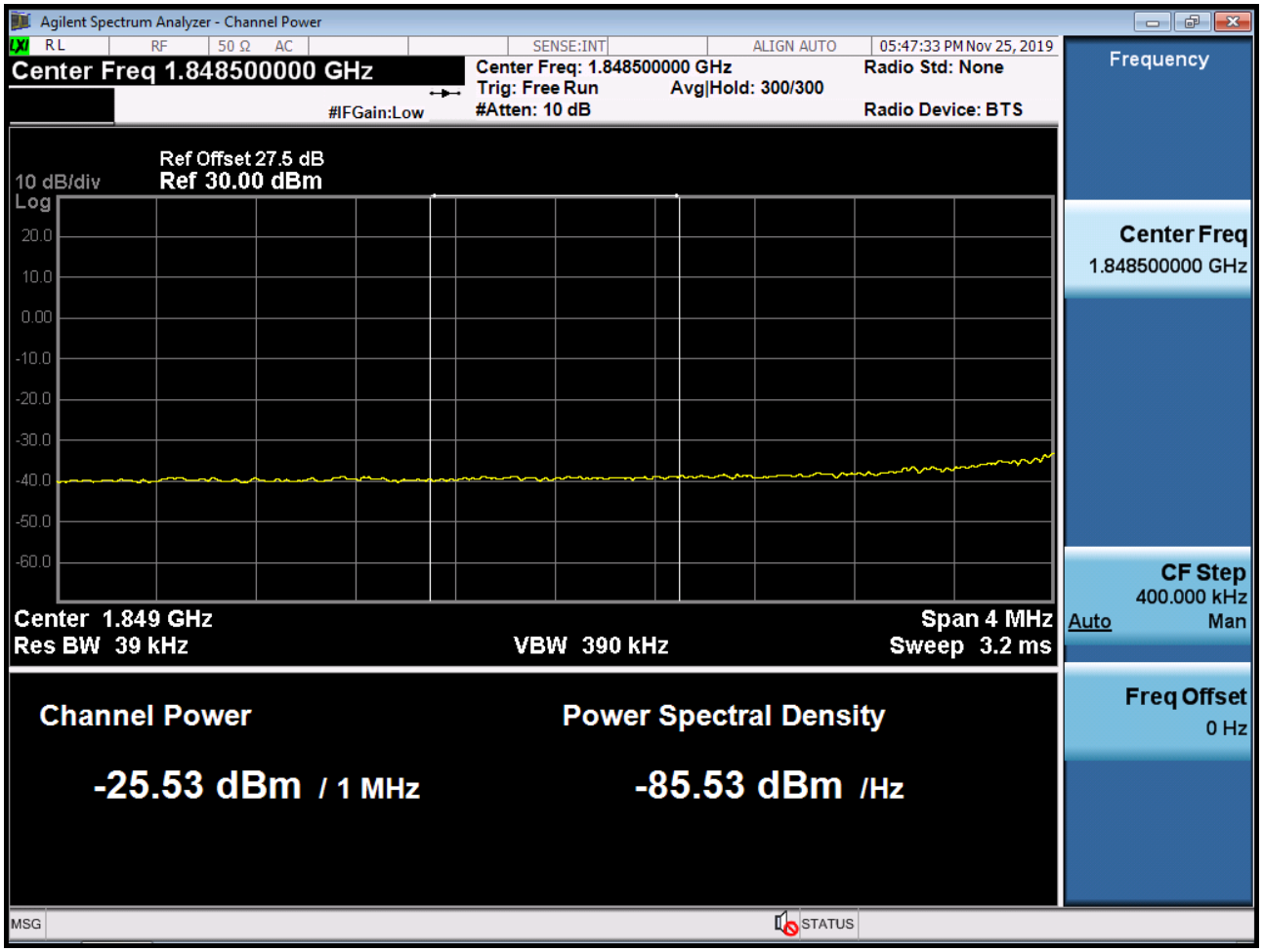
BAND 2. Lower Extended Band Edge Plot (15M BW Ch.18675 QPSK_RB75_0) -3



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

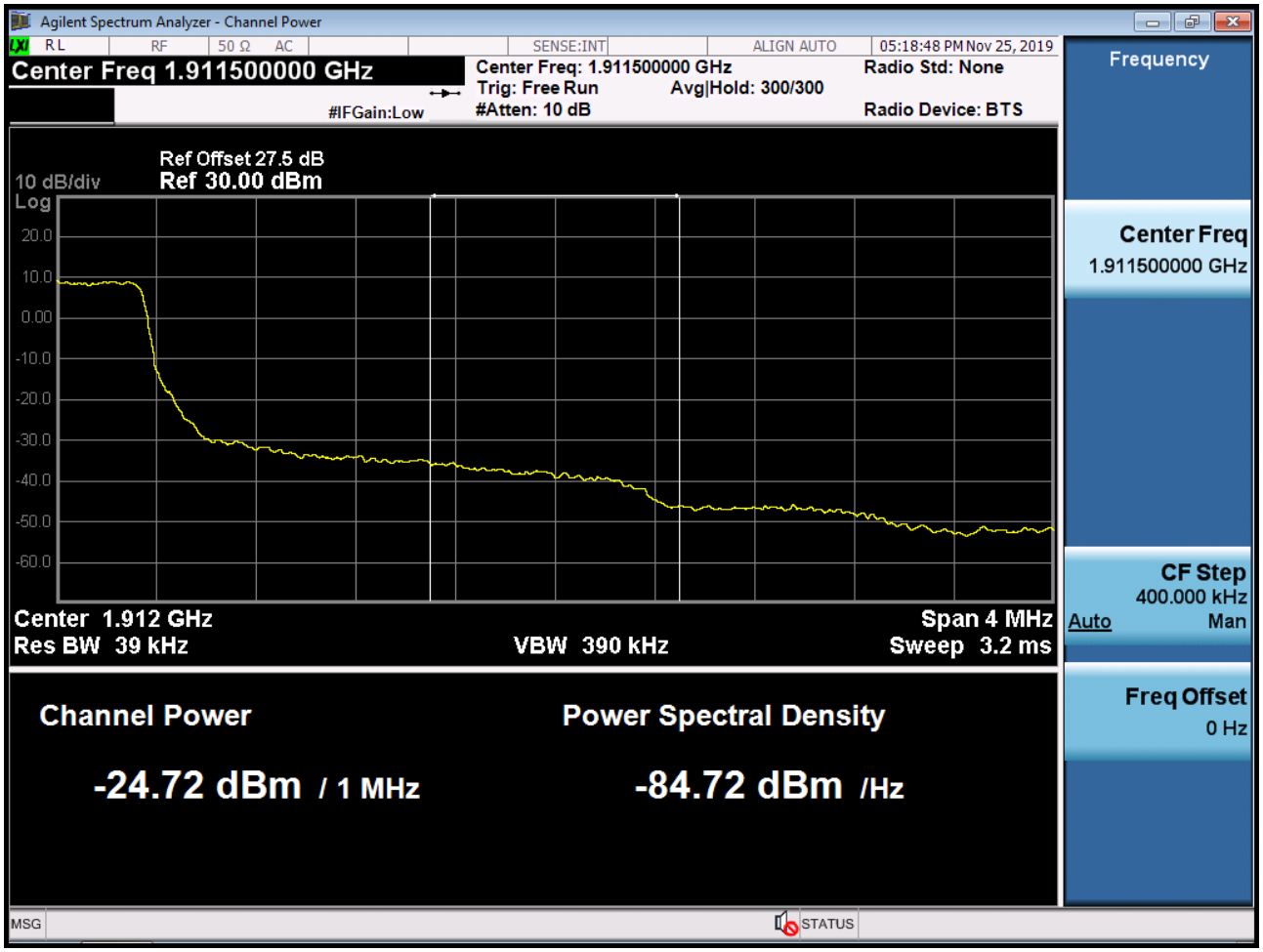
BAND 2. Lower Extended Band Edge Plot (20M BW Ch.18700 QPSK_RB100_0) -3



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

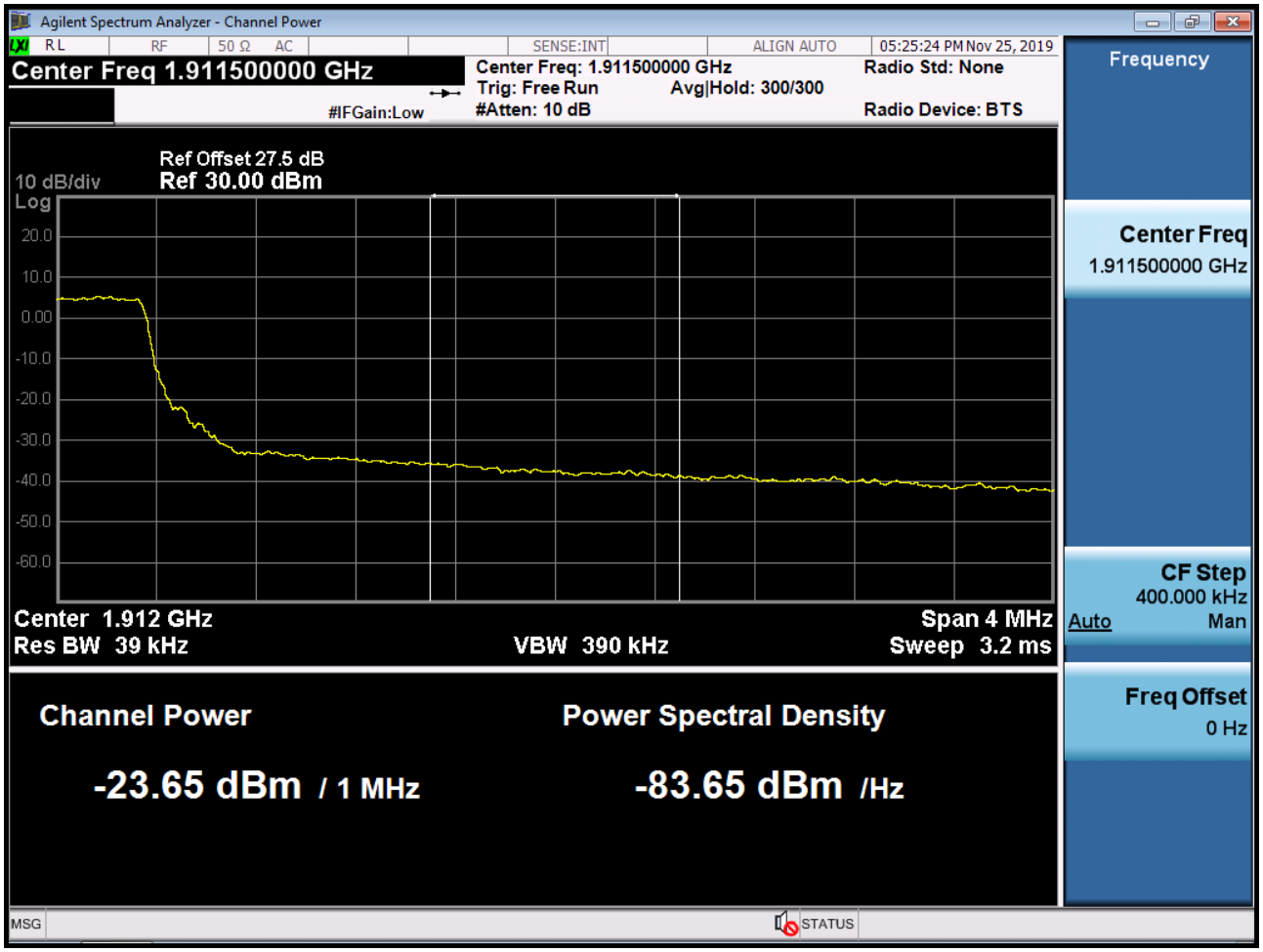
BAND 2. Upper Extended Band Edge Plot (1.4M BW Ch.19193 QPSK_RB6_0) -3



BAND 2. Upper Band Edge Plot (3M BW Ch.19185 QPSK_RB1_Offset 14) -1

BAND 2. Upper Band Edge Plot (3M BW Ch.19185 QPSK_RB15_Offset 0) -2

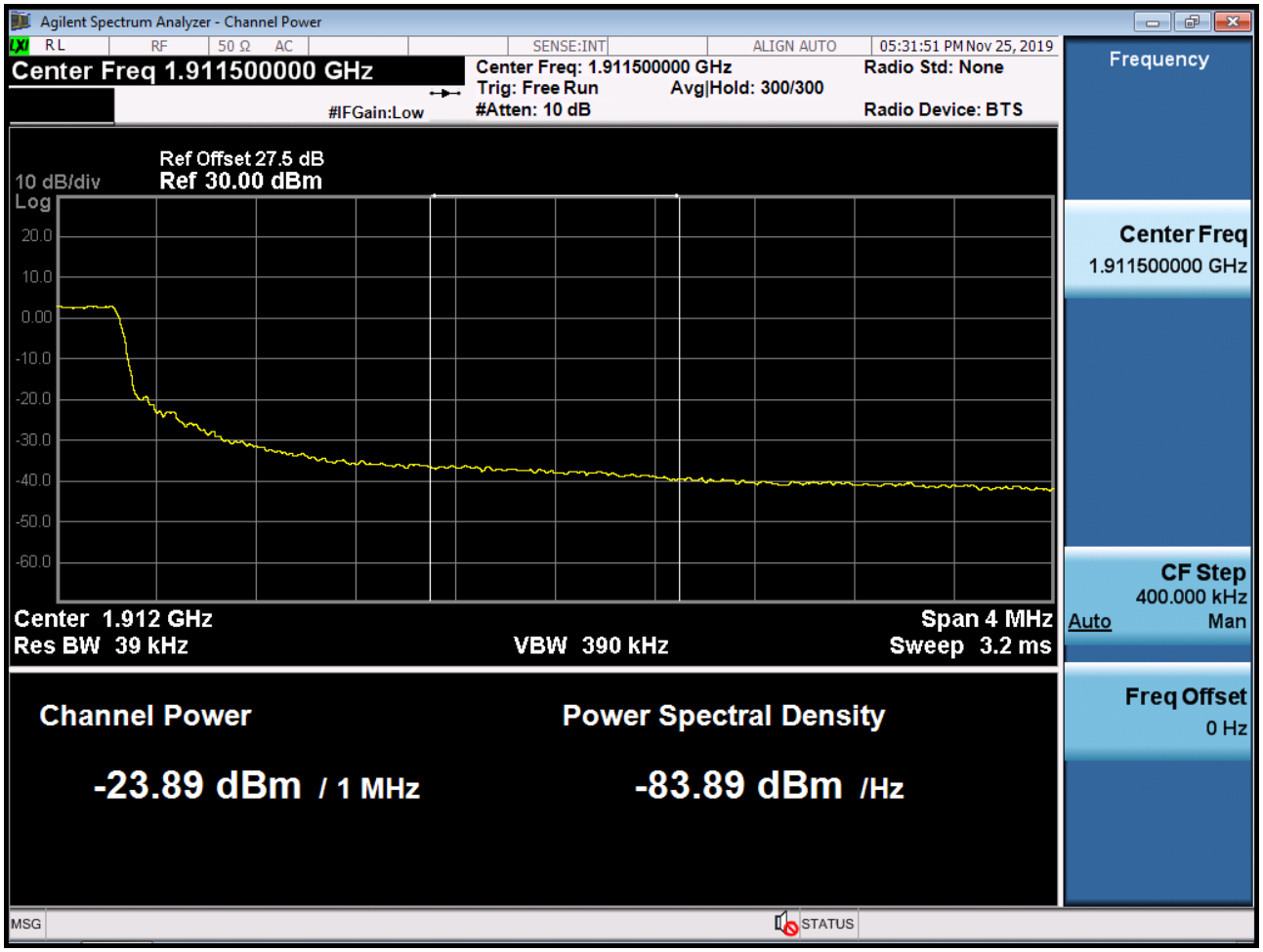
BAND 2. Upper Extended Band Edge Plot (3M BW Ch.19185 QPSK_RB15 0) -3



BAND 2. Upper Band Edge Plot (5M BW Ch.19175 QPSK_RB1_Offset 24) -1

BAND 2. Upper Band Edge Plot (5M BW Ch.19175 QPSK_RB25_Offset 0) -2

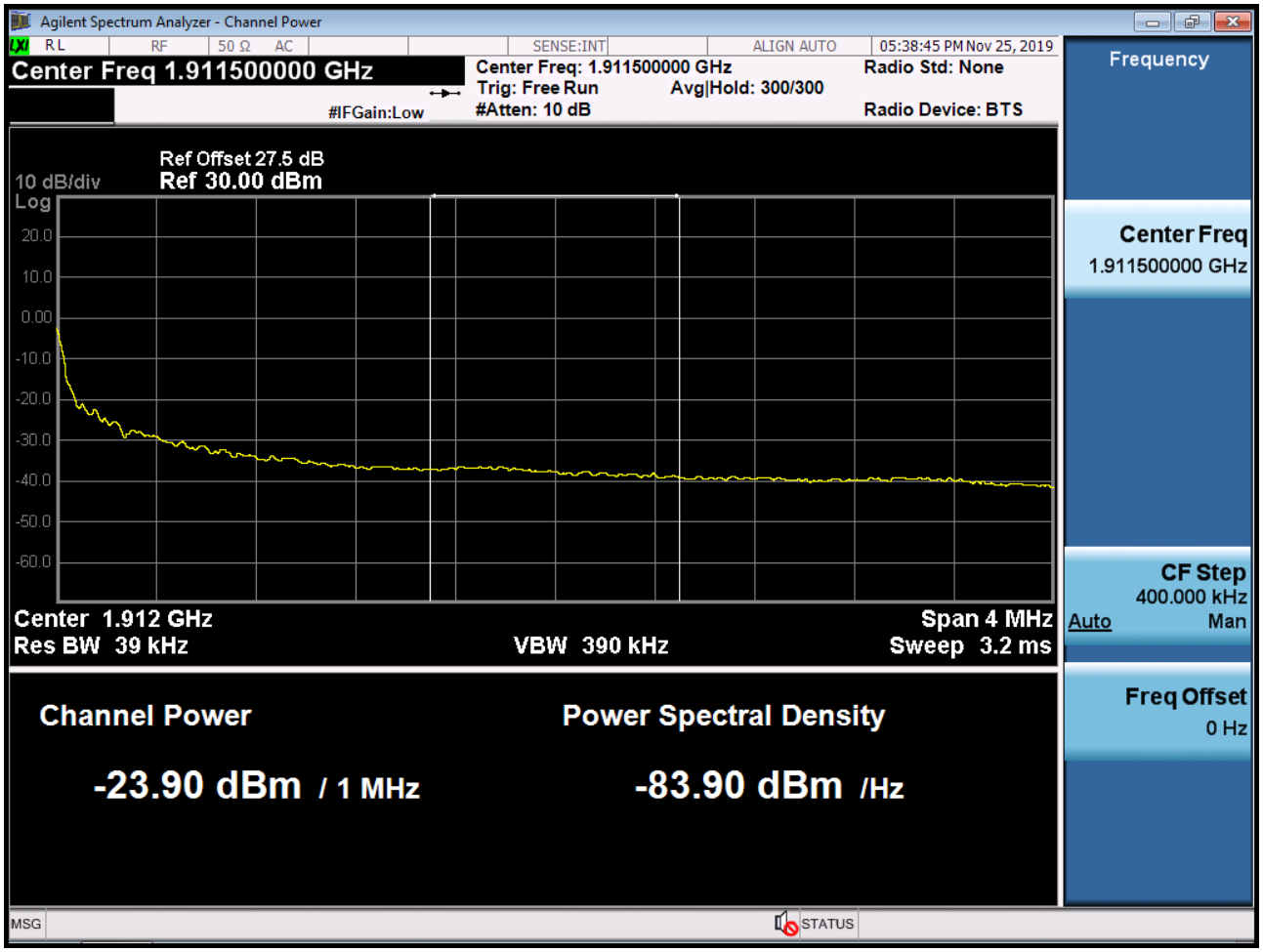
BAND 2. Upper Extended Band Edge Plot (5M BW Ch.19175 QPSK_RB25_0) -3



BAND 2. Upper Band Edge Plot (10M BW Ch.19150 QPSK_RB1_Offset 49) -1

BAND 2. Upper Band Edge Plot (10M BW Ch.19150 QPSK_RB50_Offset 0) -2

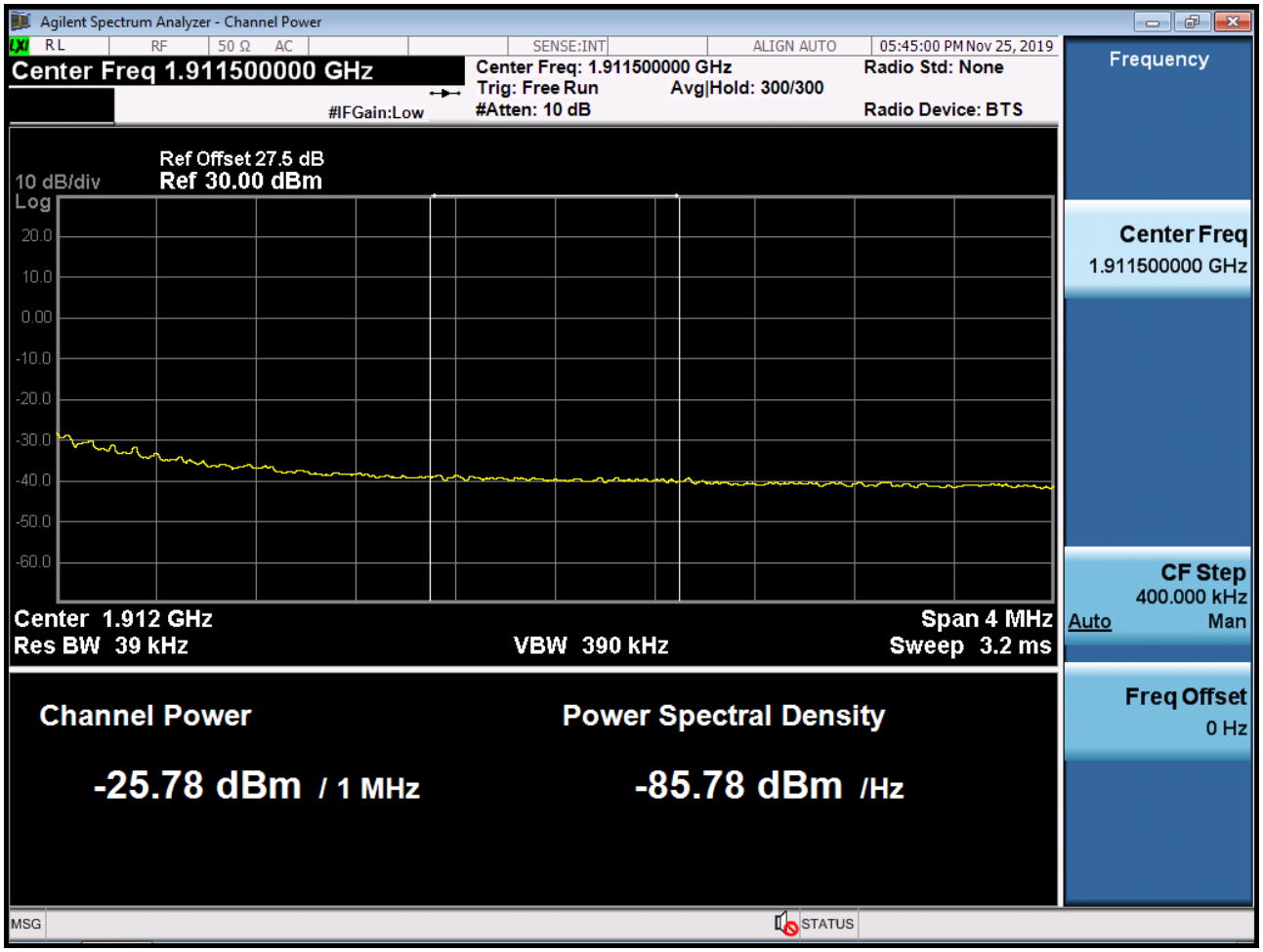
BAND 2. Upper Extended Band Edge Plot (10M BW Ch.19150 QPSK_RB50_0) -3



BAND 2. Upper Band Edge Plot (15M BW Ch.19125 QPSK_RB1_Offset 74) -1

BAND 2. Upper Band Edge Plot (15M BW Ch.19125 QPSK_RB75_Offset 0) -2

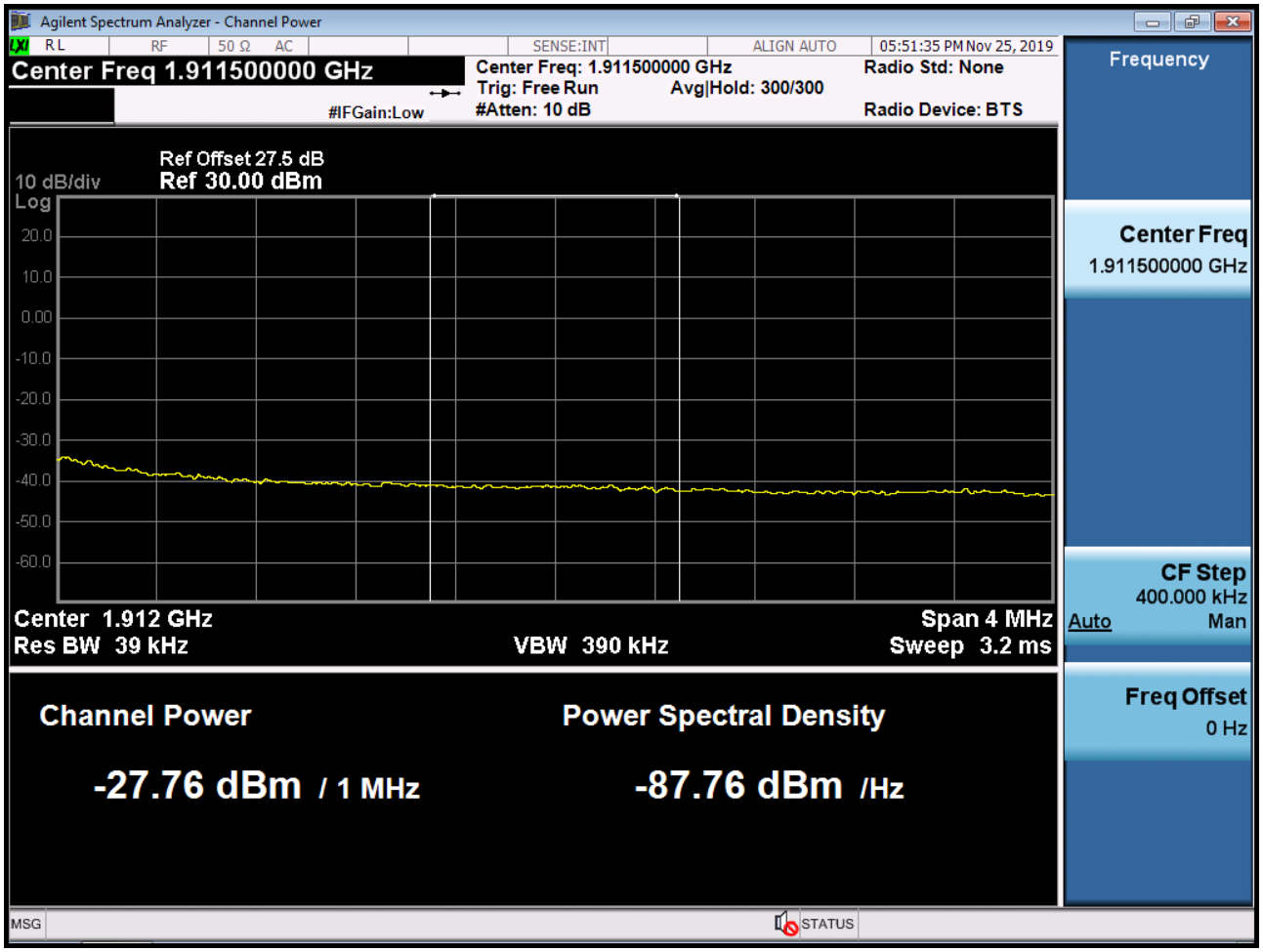
BAND 2. Upper Extended Band Edge Plot (15M BW Ch.19125 QPSK_RB75_0) -3



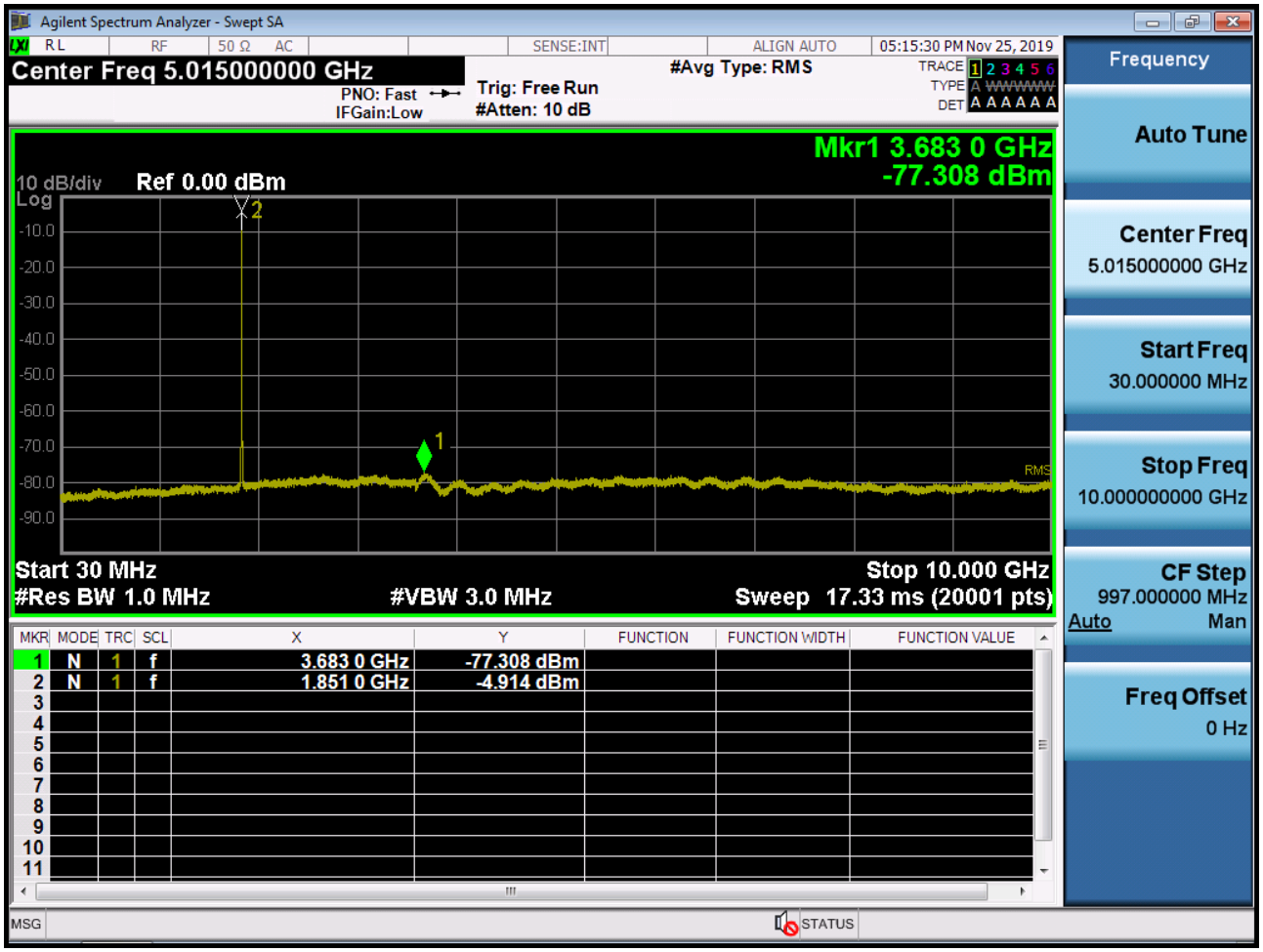
BAND 2. Upper Band Edge Plot (20M BW Ch.19100 QPSK_RB1_Offset 99) -1

BAND 2. Upper Band Edge Plot (20M BW Ch.19100 QPSK_RB100_Offset 0) -2

BAND 2. Upper Extended Band Edge Plot (20M BW Ch.19100 QPSK_RB100_0) -3

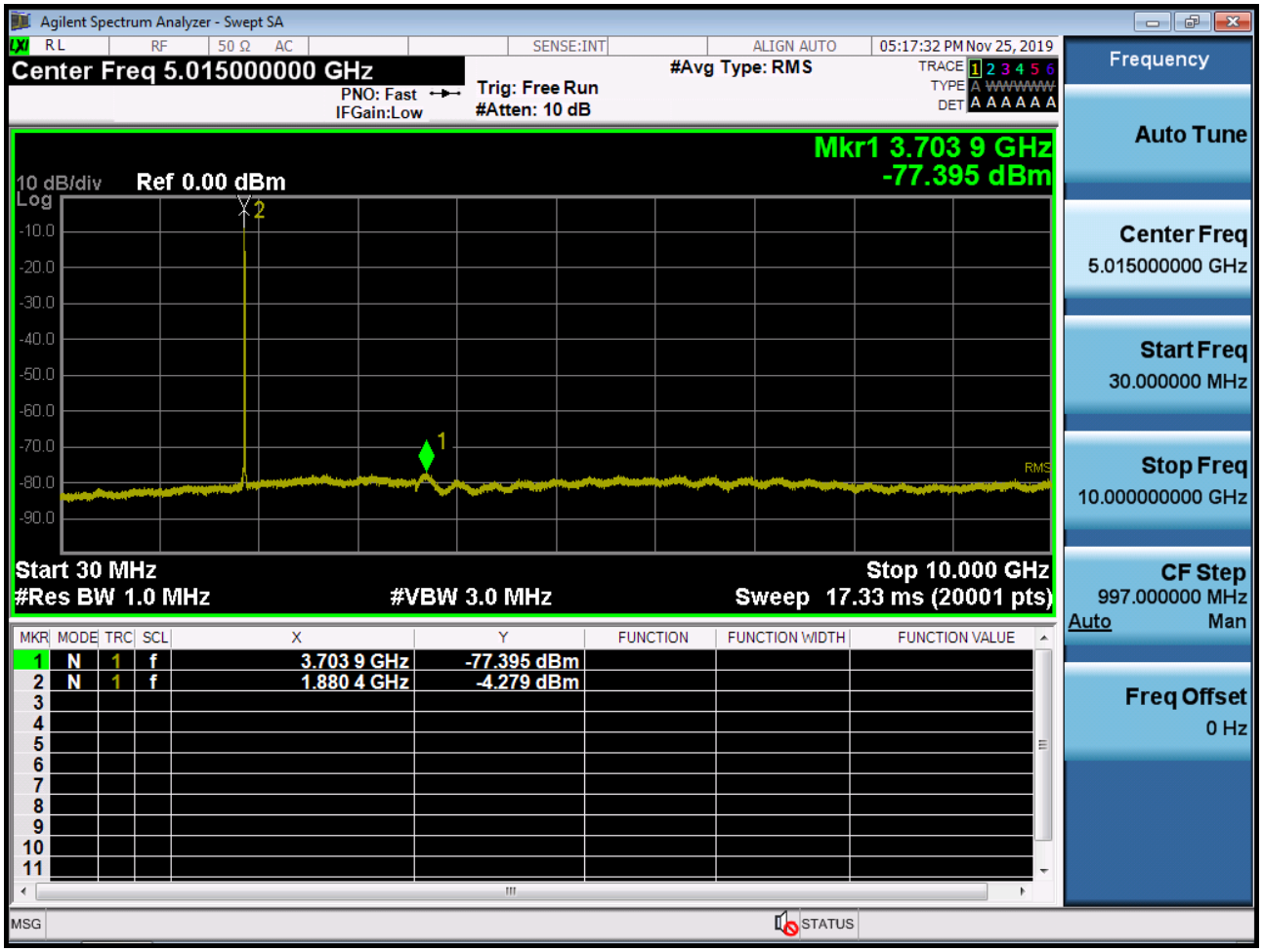


BAND 2. Conducted Spurious_1 (18607ch_1.4MHz_QPSK_RB 1_0)



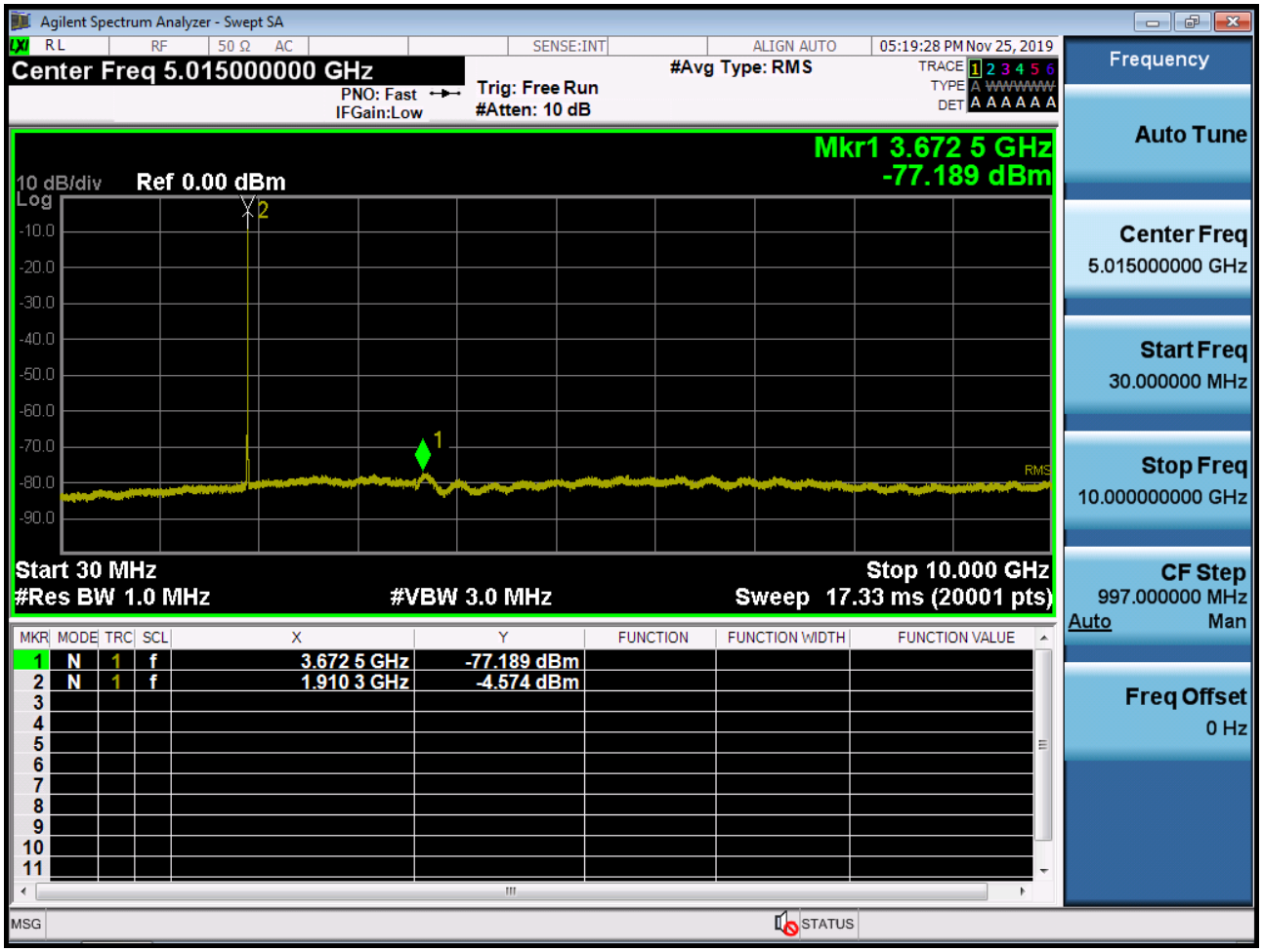
BAND 2. Conducted Spurious_2 (18607ch_1.4MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_1.4MHz_QPSK_RB 1_0)



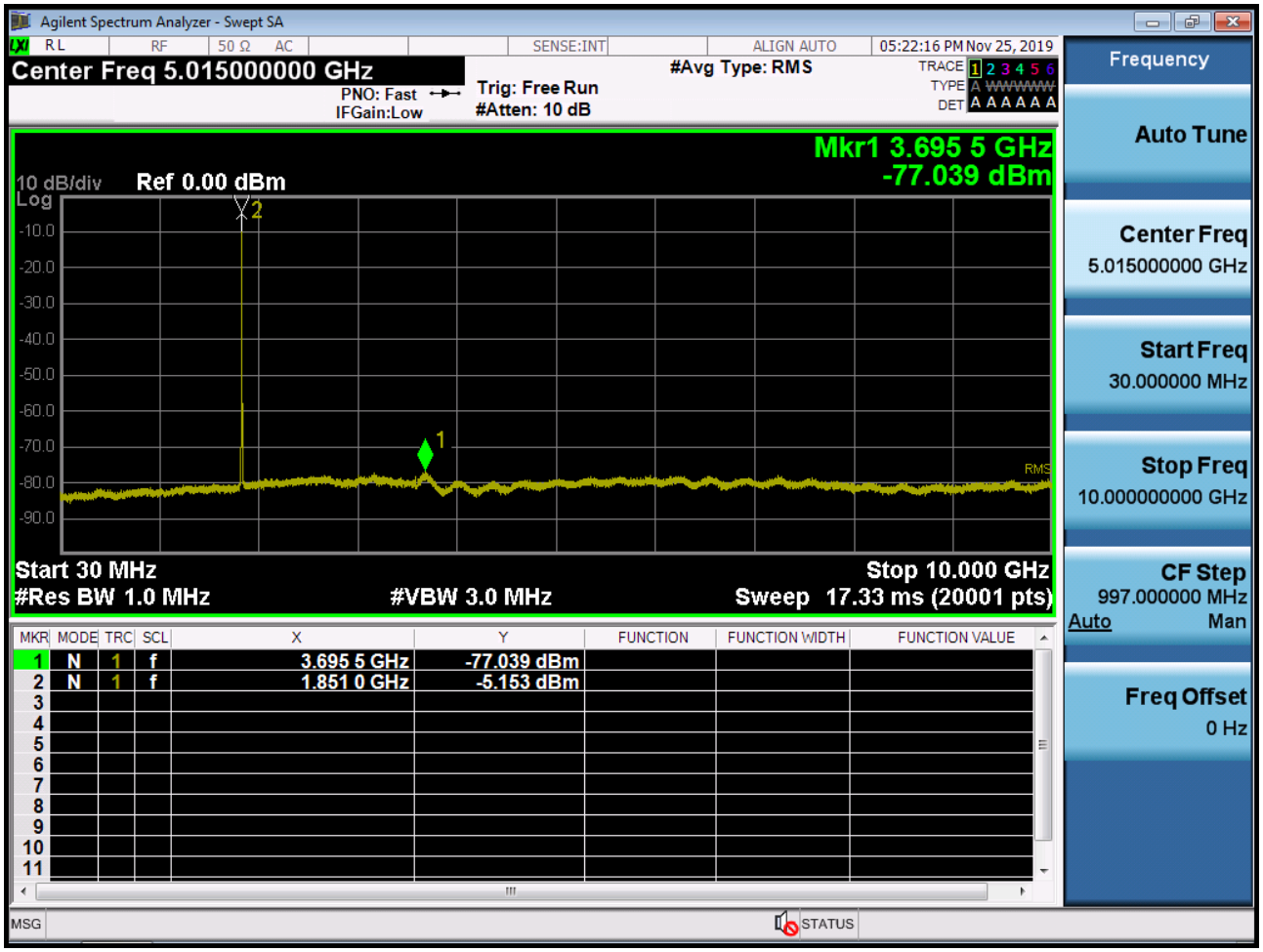
BAND 2. Conducted Spurious_2 (18900ch_1.4MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19193ch_1.4MHz_QPSK_RB 1_0)



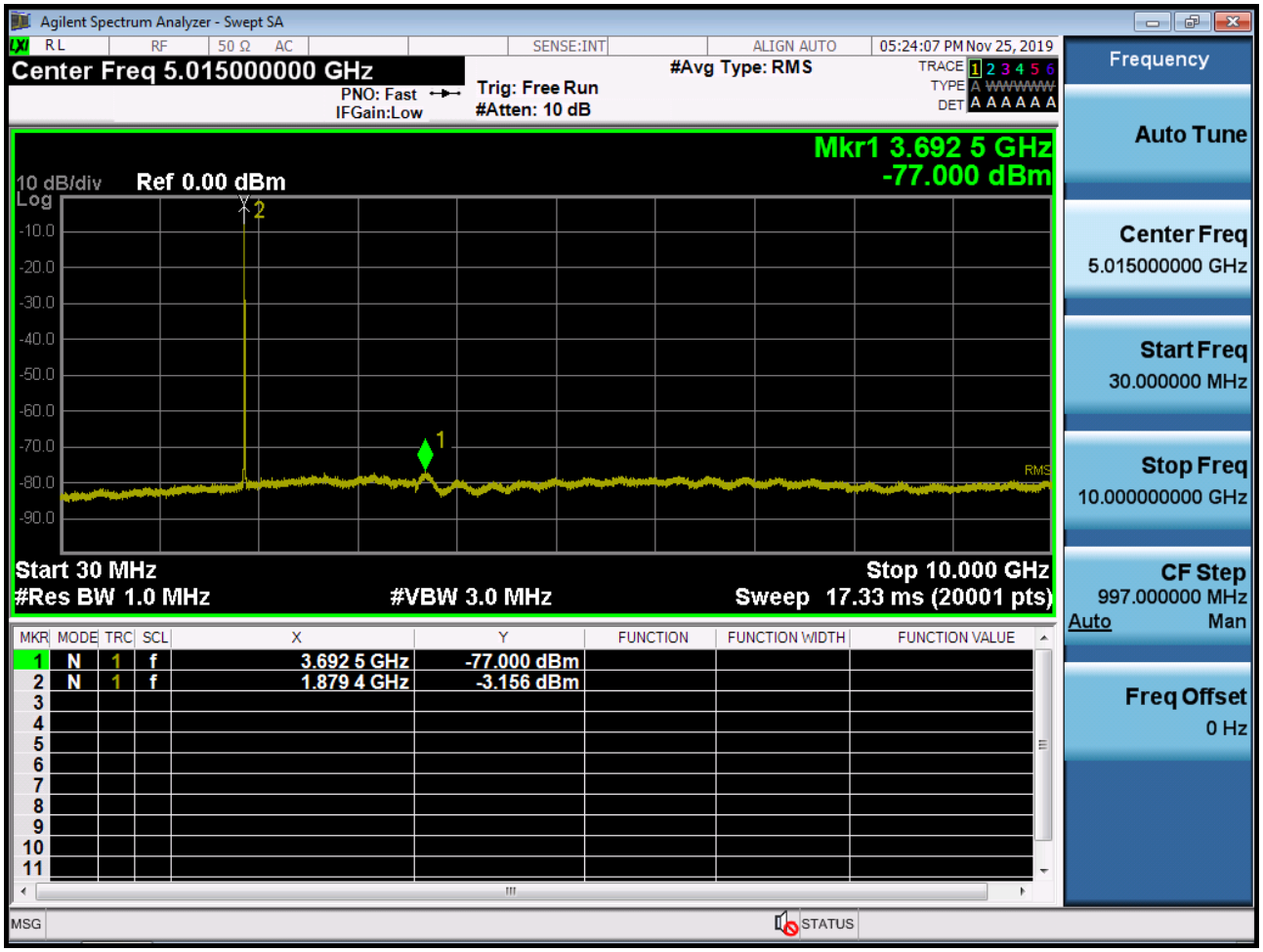
BAND 2. Conducted Spurious_2 (19193ch_1.4MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18615ch_3MHz_QPSK_RB 1_0)



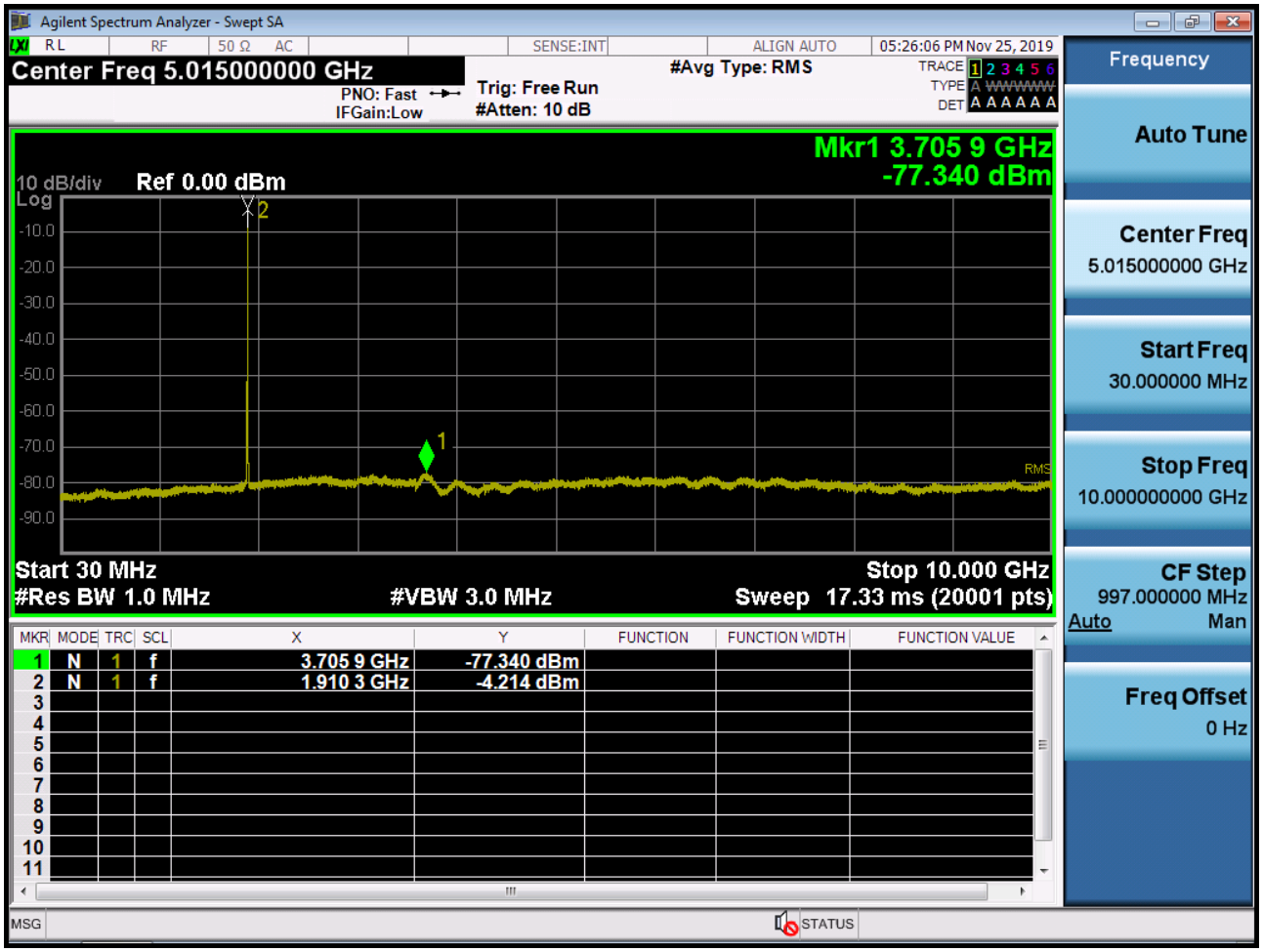
BAND 2. Conducted Spurious_2 (18615ch_3MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_3MHz_QPSK_RB 1_0)



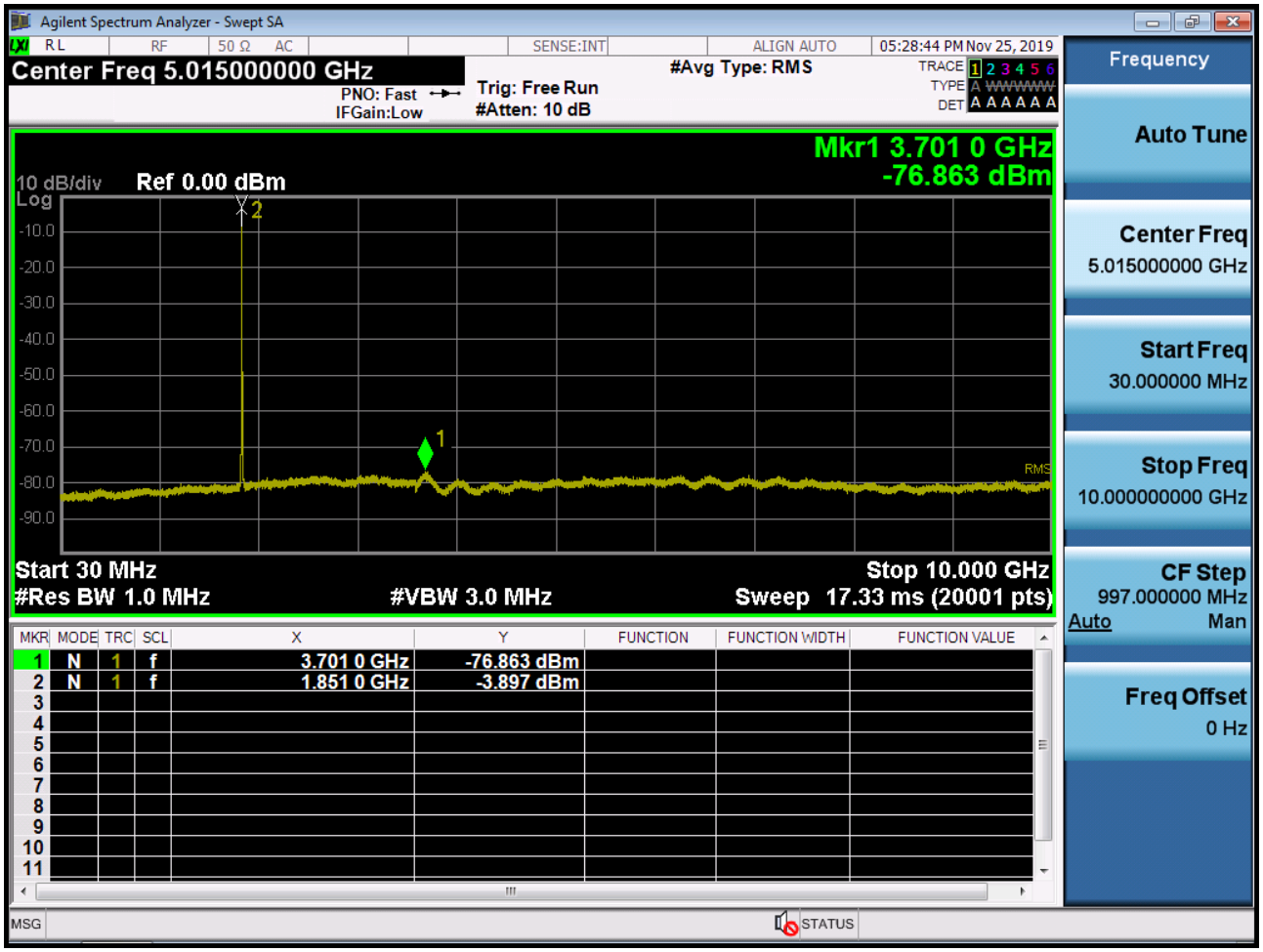
BAND 2. Conducted Spurious_2 (18900ch_3MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19185ch_3MHz_QPSK_RB 1_0)



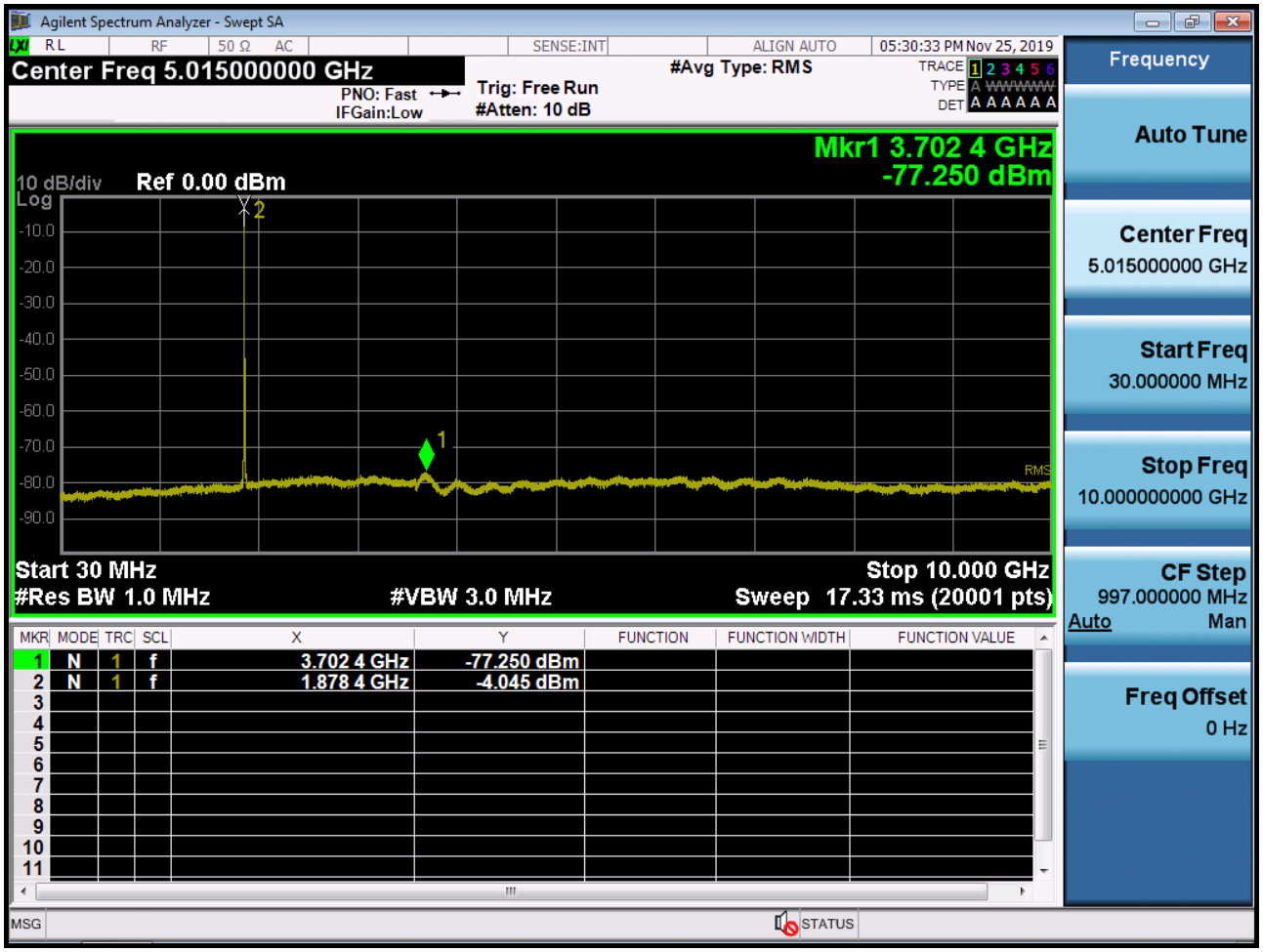
BAND 2. Conducted Spurious_2 (19185ch_3MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18625ch_5MHz_QPSK_RB 1_0)



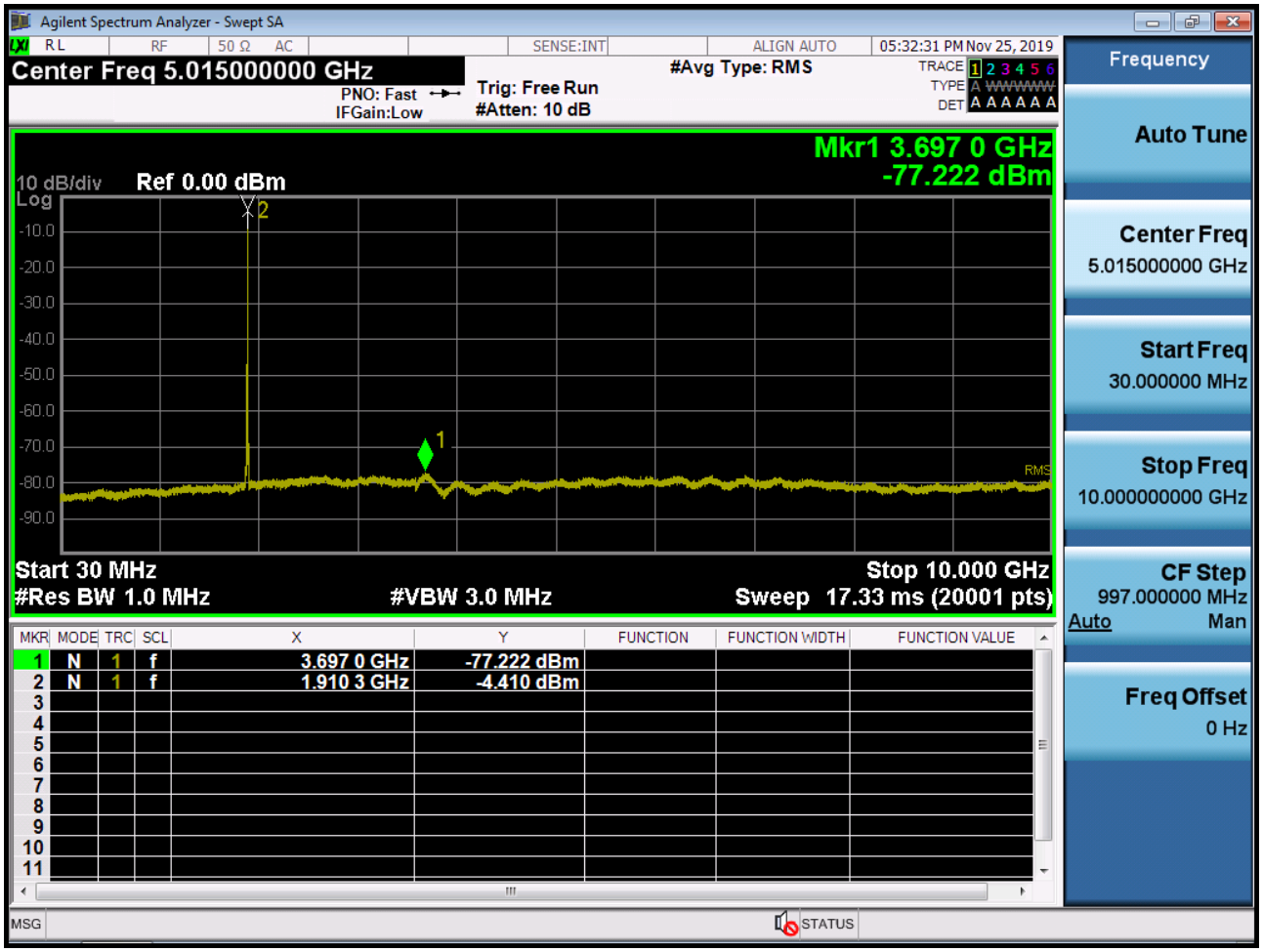
BAND 2. Conducted Spurious_2 (18625ch_5MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_5MHz_QPSK_RB 1_0)



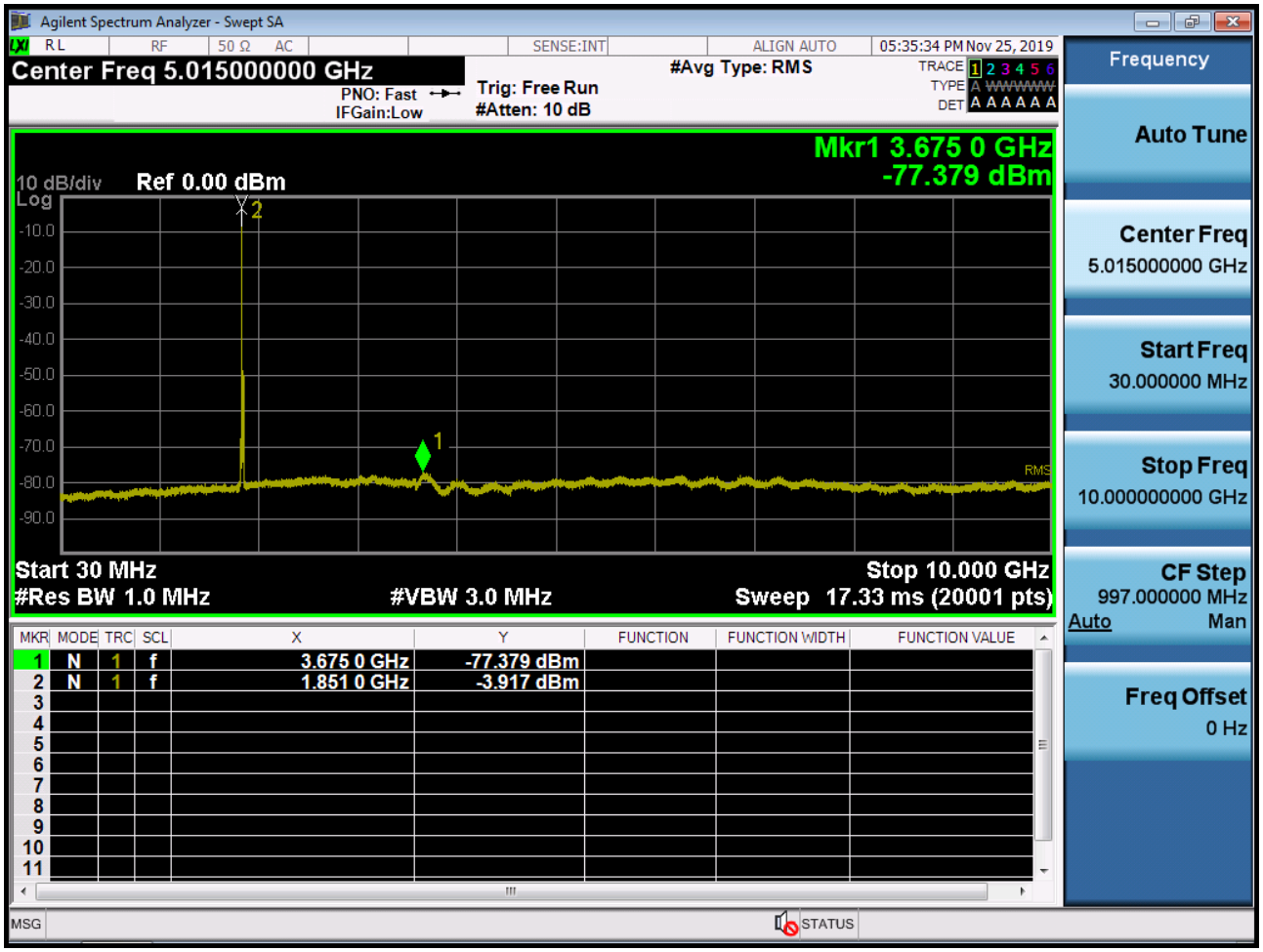
BAND 2. Conducted Spurious_2 (18900ch_5MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19175ch_5MHz_QPSK_RB 1_0)



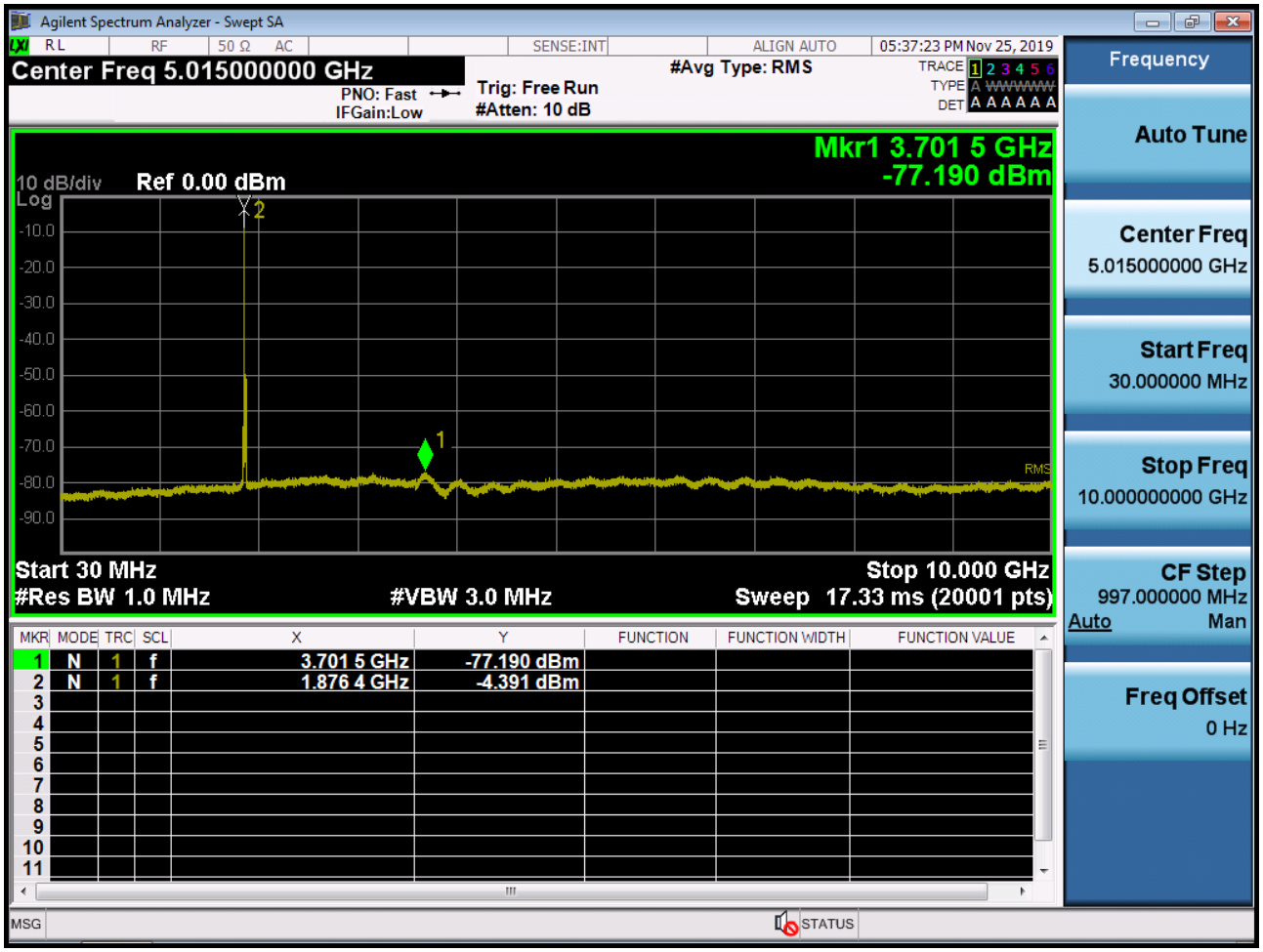
BAND 2. Conducted Spurious_2 (19175ch_5MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18650ch_10MHz_QPSK_RB 1_0)



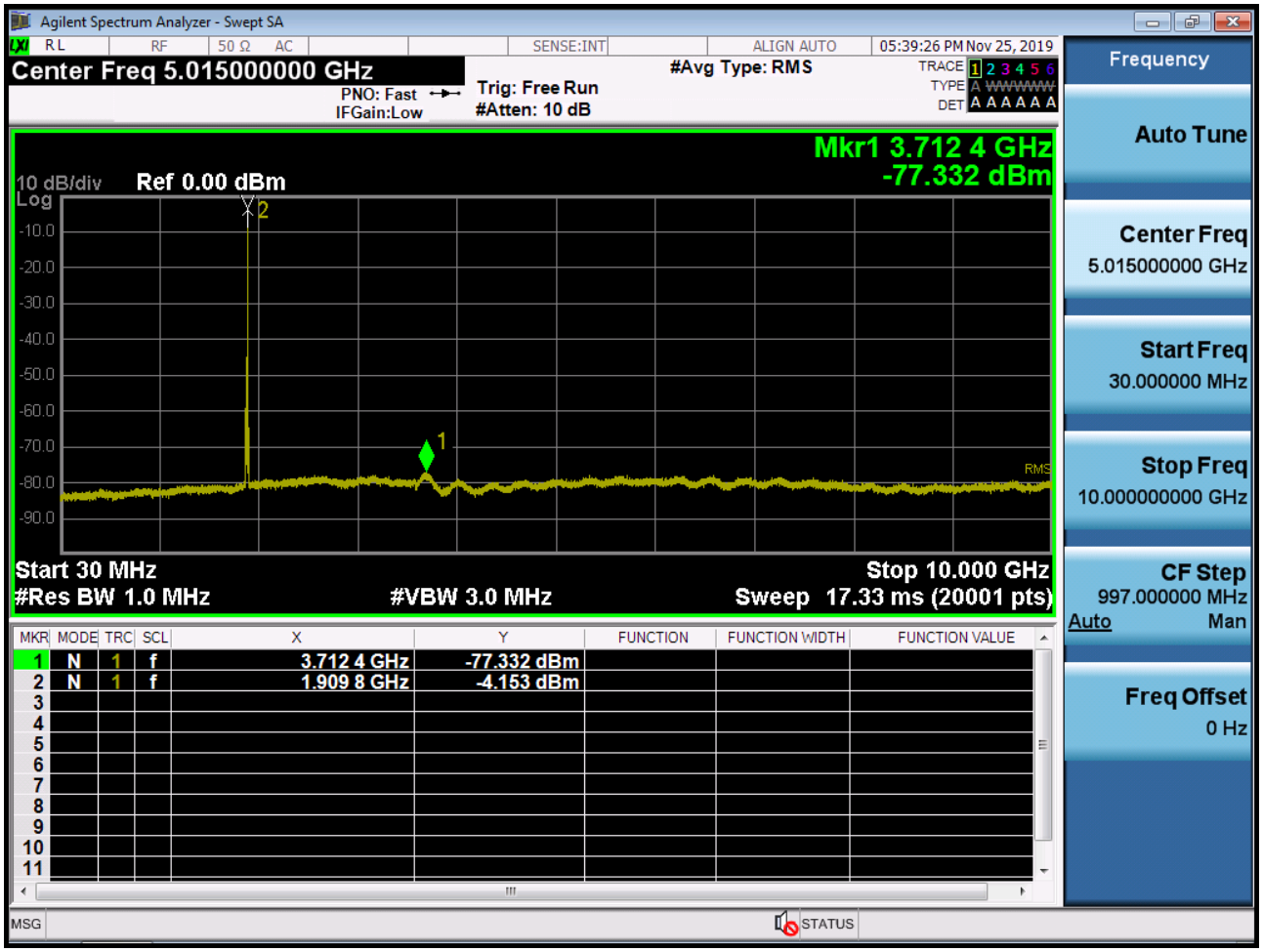
BAND 2. Conducted Spurious_2 (18650ch_10MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_10MHz_QPSK_RB 1_0)



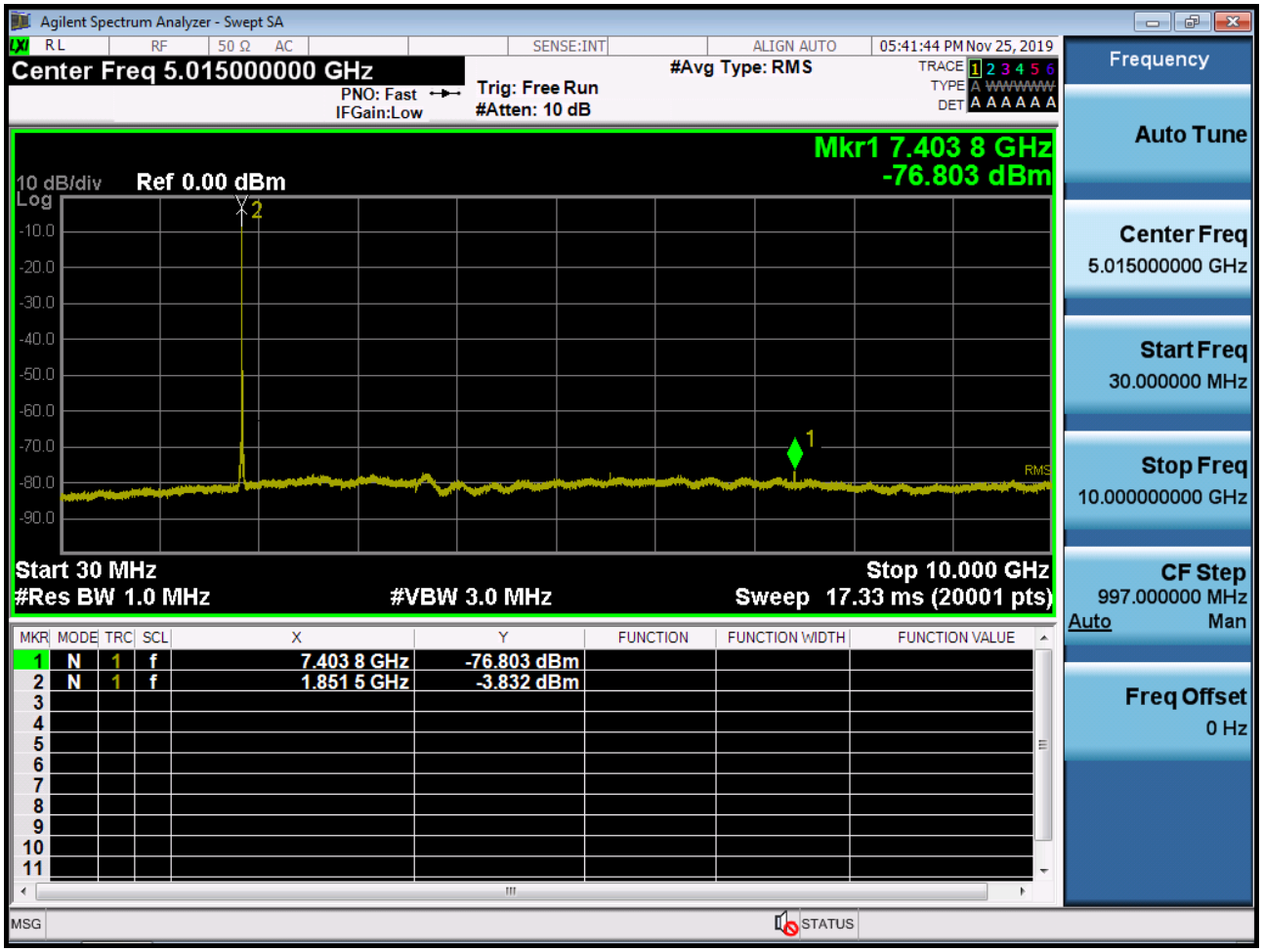
BAND 2. Conducted Spurious_2 (18900ch_10MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19150ch_10MHz_QPSK_RB 1_0)



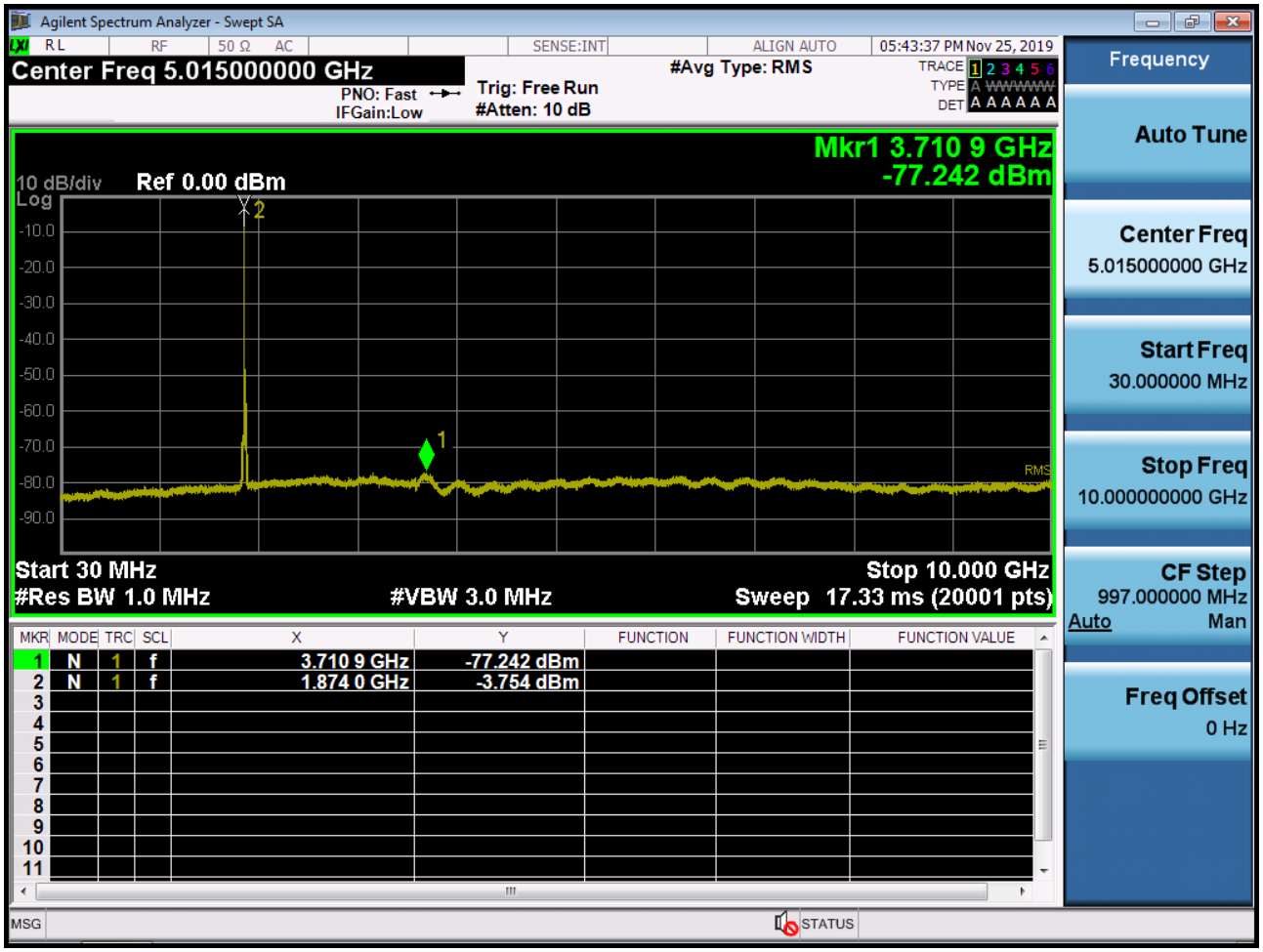
BAND 2. Conducted Spurious_2 (19150ch_10MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18675ch_15MHz_QPSK_RB 1_0)



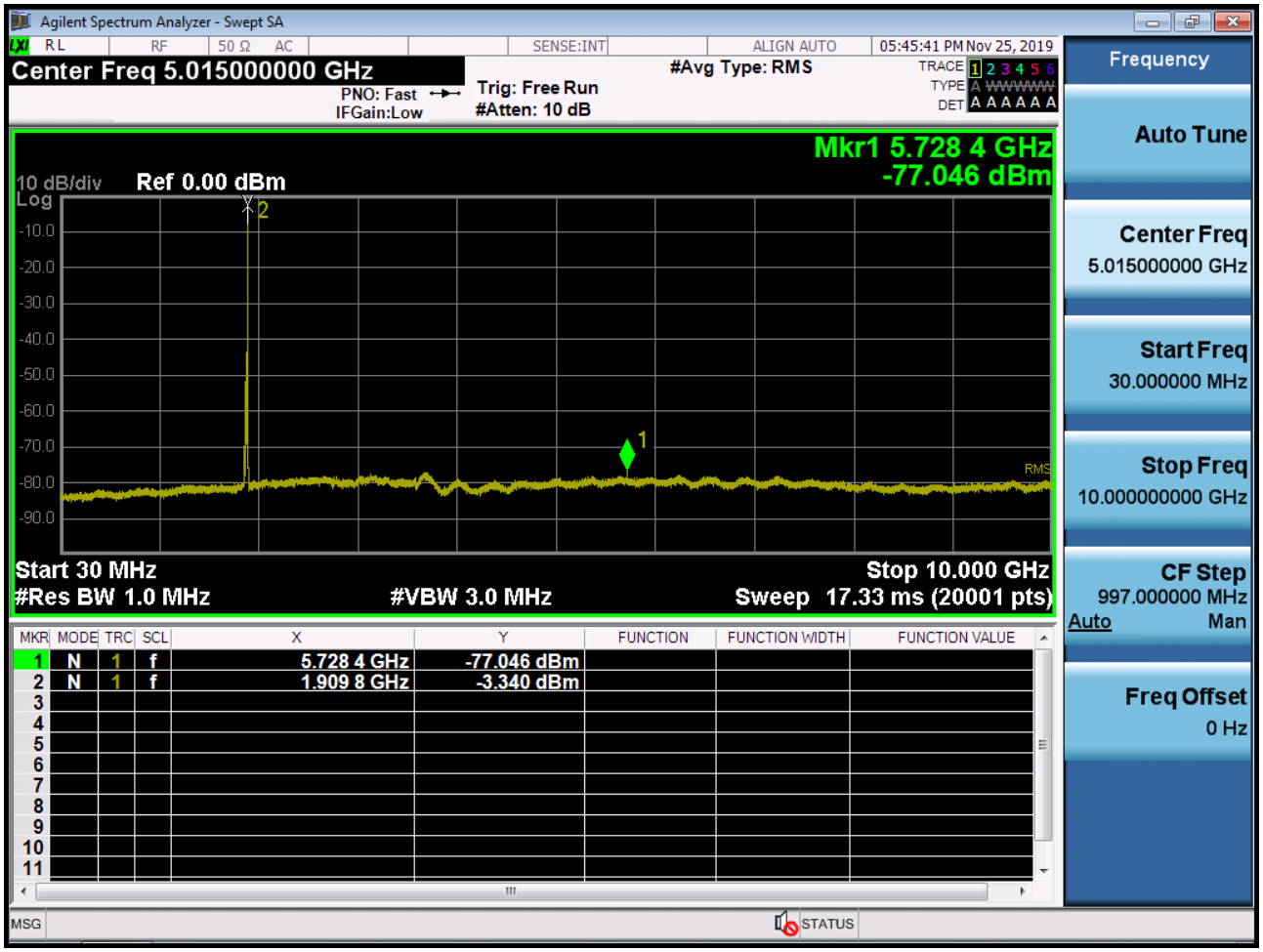
BAND 2. Conducted Spurious_2 (18675ch_15MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_15MHz_QPSK_RB 1_0)



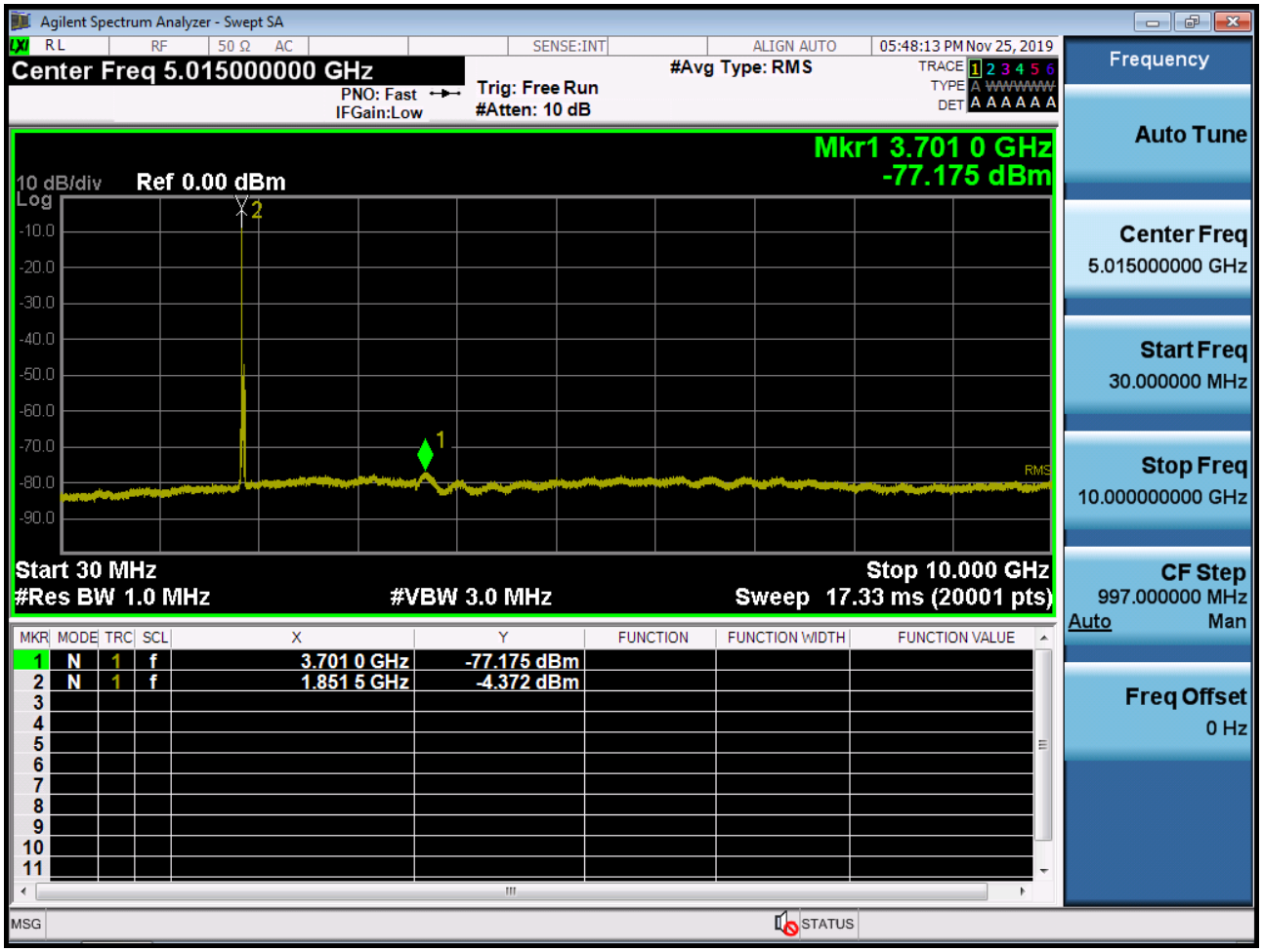
BAND 2. Conducted Spurious_2 (18900ch_15MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19125ch_15MHz_QPSK_RB 1_0)



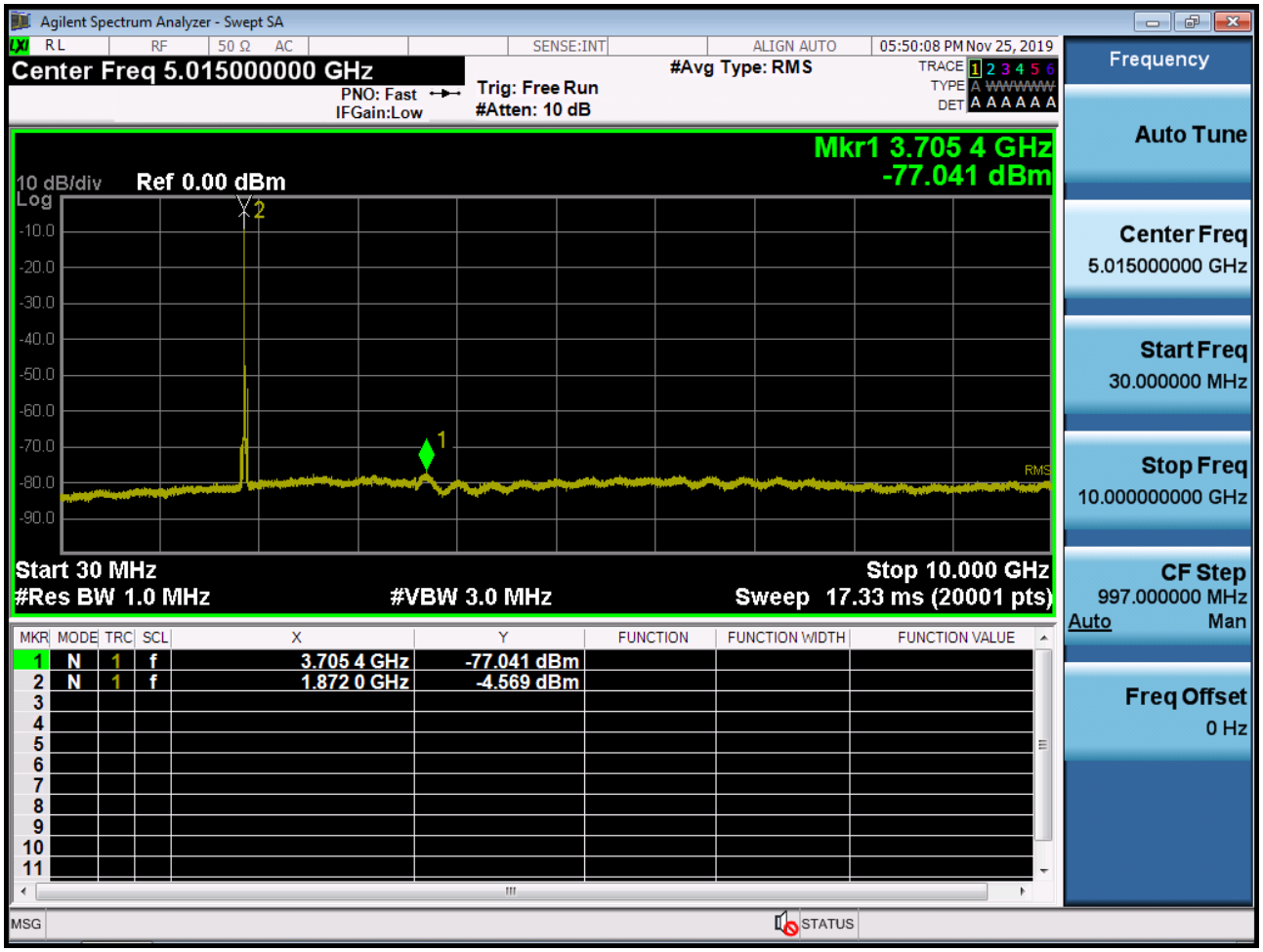
BAND 2. Conducted Spurious_2 (19125ch_15MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18700ch_20MHz_QPSK_RB 1_0)



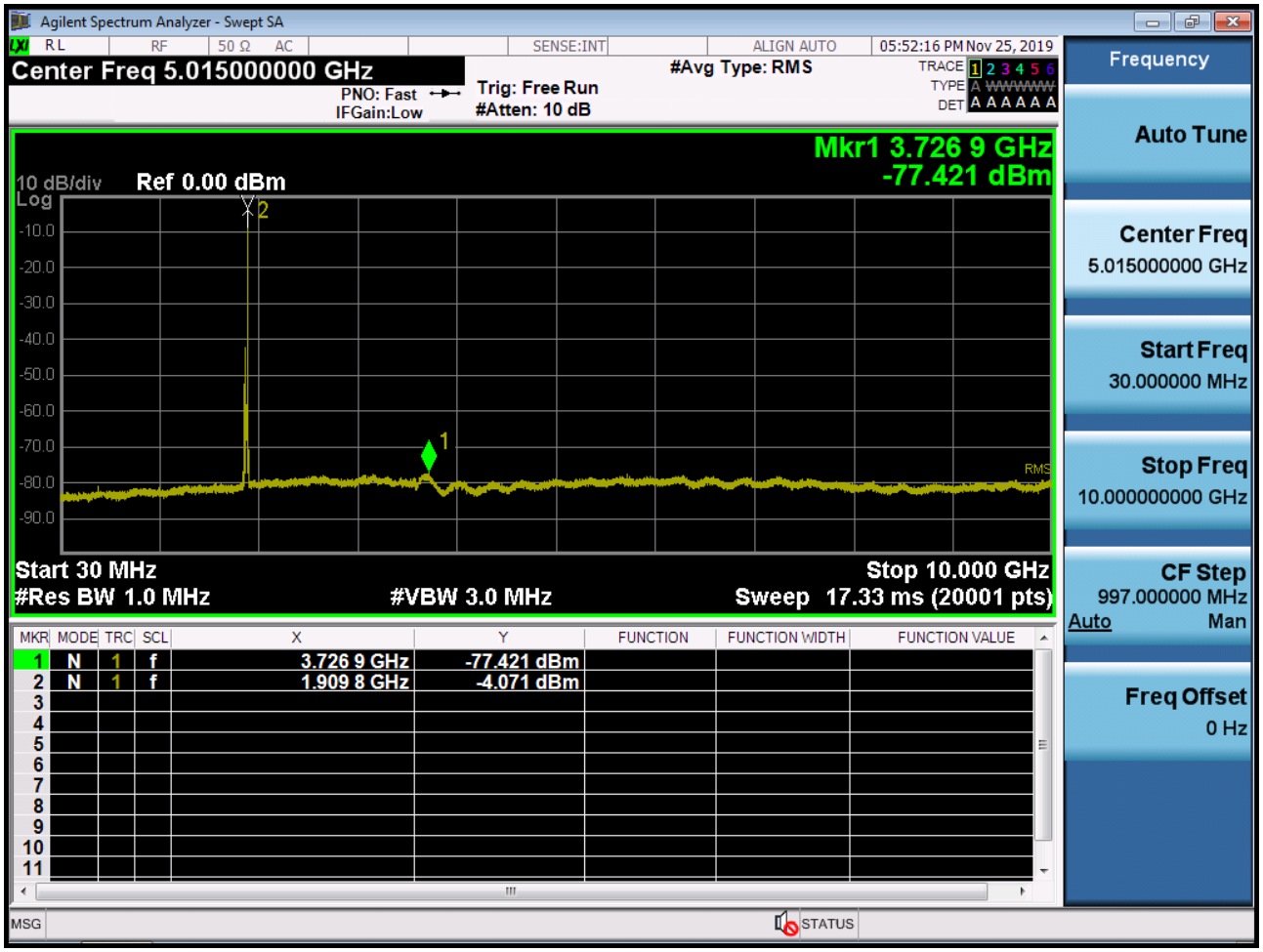
BAND 2. Conducted Spurious_2 (18700ch_20MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (18900ch_20MHz_QPSK_RB 1_0)



BAND 2. Conducted Spurious_2 (18900ch_20MHz_QPSK_RB 1_0)

BAND 2. Conducted Spurious_1 (19100ch_20MHz_QPSK_RB 1_0)



BAND 2. Conducted Spurious_2 (19100ch_20MHz_QPSK_RB 1_0)

10. APPENDIX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-1912-FC011-P