HCT CO.,LTD.
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 2G3G 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, 2020

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

Report No.: HCT-RF-2012-FC011

FCC ID:	**A3LSMA326J**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SCG08
EUT Type:	Mobile Phone
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §2

Mode	Tx Frequency (MHz)	Rx Frequency (MHz)	Emission Designator	ERP	
				Max. Power (W)	Max. Power (dBm)
GSM850	824.2 – 848.8	869.2 – 893.8	244 KGXW	0.601	27.79
GSM850 EDGE			245 KG7W	0.174	22.40
WCDMA850	826.4 – 846.6	871.4 – 891.6	4M17F9W	0.071	18.49

Mode	Tx Frequency (MHz)	Rx Frequency (MHz)	Emission Designator	EIRP	
				Max. Power (W)	Max. Power (dBm)
GSM1900	1850.2 – 1909.8	1930.2 – 1989.8	247 KGXW	0.490	26.90
GSM1900 EDGE			262 KG7W	0.203	23.07

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 : Kwon Jeong
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-2012-FC011	December 11, 2020	- First Approval Report

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

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMA326J
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §2
EUT Type:	Mobile Phone
Model(s):	SCG08
Tx Frequency:	824.20 - 848.80 MHz (GSM850) 826.40 - 846.60 MHz (WCDMA850) 1 850.20 - 1 909.80 MHz (GSM1900)
Rx Frequency:	869.20 - 893.80 MHz (GSM850) 871.40 - 891.60 MHz (WCDMA850) 1 930.20 - 1 989.80 MHz (GSM1900)
Date(s) of Tests:	November 16, 2020 ~ December 04, 2020

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.

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 C63.26-2015 – Section 5.2 - 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 dat
3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.
   The spurious emissions is calculated by the following formula;

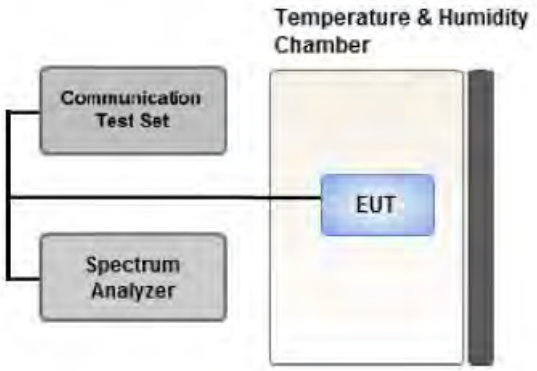
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

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

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

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

② Alternate Procedure for PAPR

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

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

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

Test Settings(Peak Power)

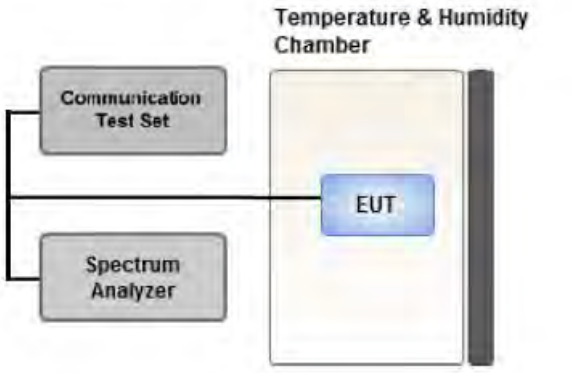
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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

Test Settings(Average Power)

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

3.5 OCCUPIED BANDWIDTH.



Test setup

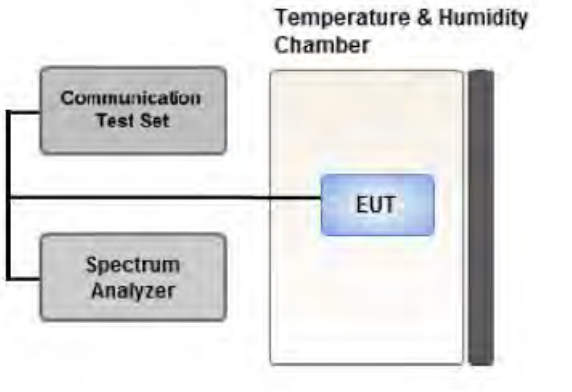
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

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.

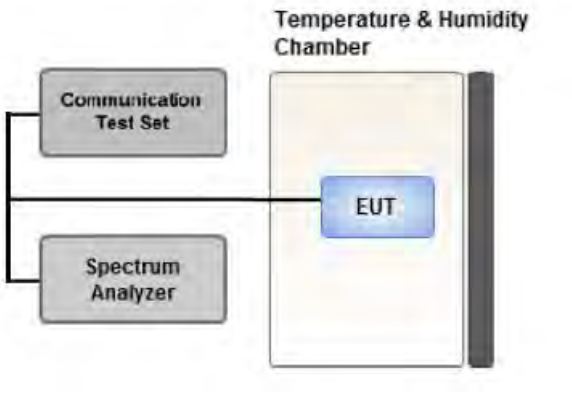
Test Settings(GSM)

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = Peak
4. Trace Mode = max hold
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

Test Settings(WCDMA)

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x 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

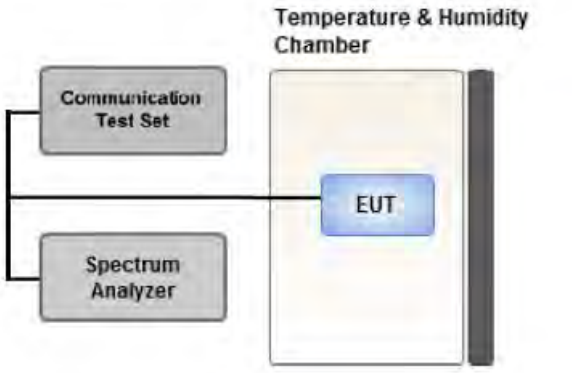
Test Notes

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 x 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(CONDUCTED TEST)

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

[Worst case]

Test Description	Modulation	Test Channel
Occupied Bandwidth	GSM : Voice & EDGE(1 TX Slot) WCDMA : QPSK(RMC)	Low, Mid, High
Band Edge	GSM : Voice & EDGE(1 TX Slot) WCDMA : QPSK(RMC)	Low, High
Spurious and Harmonic Emissions at Antenna Terminal	GSM : Voice WCDMA : QPSK(RMC)	Low, Mid, High

[Test Channel]

	UplinkChannel		
	2G (GSM850)	**2G (GSM1900)**	**3G (WCDMA B5)**
Low	128	512	4132
Mid	190	661	4183
High	251	810	4233

3.10 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.

[Worst case_3G]

Test Description	Modulation	Paging Service	Axis	Test Channel
Effective Radiated Power, Effective Isotropic Radiated Power	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B5 : Y	Low, Mid, High
Radiated Spurious and Harmonic Emissions	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B5 : X	Low, Mid, High

[Worst case_2G]

Test Description	Mod	Axis	Test Channel
Effective Radiated Power, Effective Isotropic Radiated Power	Voice	GSM850 : Y GSM1900 : Z	Low, Mid, High
	EDGE(1 TX Slot)	GSM850 : Y GSM1900 :Z	GSM 850 : Low GSM1900 : Low
Radiated Spurious and Harmonic Emissions	Voice	GSM850 : Y GSM1900 : Y	Low, Mid, High

[Test Channel]

	UplinkChannel		
	2G (GSM850)	**2G (GSM1900)**	**3G (WCDMA B5)**
Low	128	512	4132
Mid	190	661	4183
High	251	810	4233

4. LIST OF TEST EQUIPMENT

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

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

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, §22.917(a), §24.238(a),	< 43 + 10 x log10 (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	§2.1055, §22.355	< 2.5 ppm	PASS
	§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
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS
Equivalent Isotropic Radiated Power	§24.232(c)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a), §24.238(a)	< 43 + 10 x log10 (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 Desi0gnator

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 EFFECTIVE RADIATED POWER

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBd)	C.L	Pol.	Limit	ERP	
	channel	Freq.(MHz)						W	W	dBm
GSM850	128	824.2	-24.21	39.19	-10.25	1.39	V	< 7.00	0.568	27.55
	190	836.6	-24.54	39.39	-10.19	1.41	V		0.601	27.79
	251	848.8	-25.79	38.45	-10.14	1.42	V		0.489	26.89
EDGE	190	836.6	-29.93	34.00	-10.19	1.41	V		0.174	22.40

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBd)	C.L	Pol.	Limit	ERP	
	channel	Freq.(MHz)						W	W	dBm
WCDMA850	4132	826.4	-33.44	30.13	-10.24	1.40	V	< 7.00	0.071	18.49
	4183	836.6	-33.91	30.02	-10.19	1.41	V		0.070	18.42
	4233	846.6	-35.04	28.96	-10.15	1.42	V		0.055	17.39

8.2 EQUIVALENT ISOTROPIC RADIATED POWER

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit	EIRP	
	channel	Freq.(MHz)						W	W	dBm
GSM1900	512	1850.2	-16.62	17.46	10.10	2.11	V	< 2.00	0.351	25.45
	661	1880.0	-16.19	18.36	10.15	2.15	V		0.433	26.36
	810	1909.8	-15.72	18.82	10.23	2.15	V		0.490	26.90
EDGE	810	1909.8	-19.55	14.99	10.23	2.15	V		0.203	23.07

8.3 RADIATED SPURIOUS EMISSIONS

▣ MODULATION SIGNAL: GSM850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
128 (824.2)	1 648.40	-40.67	9.50	-50.28	1.99	H	-42.77	-13.00
	2 472.60	-41.46	10.60	-45.59	2.47	H	-37.46	-13.00
	3 296.80	-55.27	12.25	-56.36	2.89	H	-46.99	-13.00
190 (836.6)	1 673.20	-42.43	9.65	-52.20	2.01	H	-44.56	-13.00
	2 509.80	-41.77	10.75	-45.49	2.50	H	-37.24	-13.00
	3 346.40	-57.41	12.48	-58.39	2.92	H	-48.84	-13.00
	4 183.00	-53.76	12.80	-51.94	3.29	H	-42.43	-13.00
251 (848.8)	1 697.60	-42.29	9.80	-51.81	2.04	H	-44.05	-13.00
	2 546.40	-42.42	10.88	-45.70	2.52	V	-37.34	-13.00
	3 395.20	-57.23	12.68	-58.29	2.94	V	-48.55	-13.00

▣ MODULATION SIGNAL: GSM1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
512 (1850.2)	3 700.40	-48.59	12.40	-52.66	3.08	V	-43.34	-13.00
	5 550.60	-56.87	13.10	-54.84	3.81	V	-45.55	-13.00
	7 400.80	-57.32	11.10	-47.36	4.44	V	-40.70	-13.00
661 (1880.0)	3 760.00	-45.69	12.48	-49.56	3.10	H	-40.18	-13.00
	5 640.00	-56.57	13.30	-54.40	3.85	V	-44.95	-13.00
	7 520.00	-55.94	11.30	-45.37	4.46	H	-38.53	-13.00
810 (1909.8)	3 819.60	-47.63	12.40	-52.06	3.14	H	-42.80	-13.00
	5 729.40	-56.42	13.35	-53.76	3.87	H	-44.28	-13.00
	7 639.20	-56.49	11.65	-45.96	4.47	H	-38.78	-13.00

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
4,132 (826.4)	1 652.80	-49.21	9.50	-58.82	1.99	H	-51.31	-13.00
	2 479.20	-50.98	10.60	-55.25	2.48	V	-47.13	-13.00
	3 305.60	-52.78	12.33	-53.86	2.90	V	-44.43	-13.00
4,183 (836.6)	1 673.20	-48.82	9.65	-58.59	2.01	V	-50.95	-13.00
	2 509.80	-51.04	10.75	-54.76	2.50	H	-46.51	-13.00
	3 346.40	-53.70	12.48	-54.68	2.92	V	-45.13	-13.00
4,233 (846.6)	1 693.20	-48.47	9.73	-58.15	2.03	V	-50.45	-13.00
	2 539.80	-51.20	10.85	-54.73	2.51	V	-46.39	-13.00
	3 386.40	-53.45	12.63	-54.53	2.94	H	-44.84	-13.00

8.4 PEAK-TO-AVERAGE RATIO

Band	Ch.	Measured P_{Pk} (dBm)	Measured P_{Avg} (dBm)	P_{Avg} (Duty Cycle)			P.A.R. = P_{Pk} - P_{Avg} (dB)	Limit (dB)	Pass / Fail
				Tx_{Total} (ms)	Tx_{On} (ms)	Factor (dB)			
GSM1900	661	30.128	21.05	4.6160	0.5475	9.26	-0.18	13	Pass
GSM1900 EDGE	661	29.449	17.21	4.616	0.5475	9.26	2.98		

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 48 ~ 53.

2. Only GSM(include EDGE) Mode was tested by alternate procedure for PAPR

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

Duty cycle Factor = 10 x log (1/X), X = Tx_{On} / Tx_{Total}

8.5 OCCUPIED BANDWIDTH

Band	Channel	Frequency(MHz)	Data (GSM: kHz / WCDMA : MHz)
GSM850	128	824.20	241.97
	190	836.60	243.28
	251	848.80	244.09
GSM850 EDGE	128	824.20	243.46
	190	836.60	245.38
	251	848.80	241.30
GSM1900	512	1,850.20	245.56
	661	1,880.00	244.62
	810	1,909.80	247.13
GSM1900 EDGE	512	1,850.20	261.72
	661	1,880.00	251.95
	810	1,909.80	255.26
WCDMA850	4132	826.40	4.1387
	4183	836.60	4.1717
	4233	846.60	4.1622

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 37 ~ 47.

8.6 CONDUCTED SPURIOUS EMISSIONS

Band	Channel	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result	(dBm)
GSM850	128	1.6491	27.976	-46.71	-18.735	-13.00
	190	1.6741	27.976	-49.89	-21.917	
	251	1.6980	27.976	-51.12	-23.145	
GSM1900	512	19.22373	29.489	-52.596	-23.107	
	661	18.58271	29.489	-51.989	-22.500	
	810	18.90197	29.489	-52.217	-22.728	
WCDMA850	4132	3.6910	27.976	-77.253	-49.277	
	4183	3.6770	27.976	-76.989	-49.013	
	4233	2.5375	27.976	-77.230	-49.254	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 82 ~ 93.
2. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
3. 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

8.7 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 54 ~ 81.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: GSM850

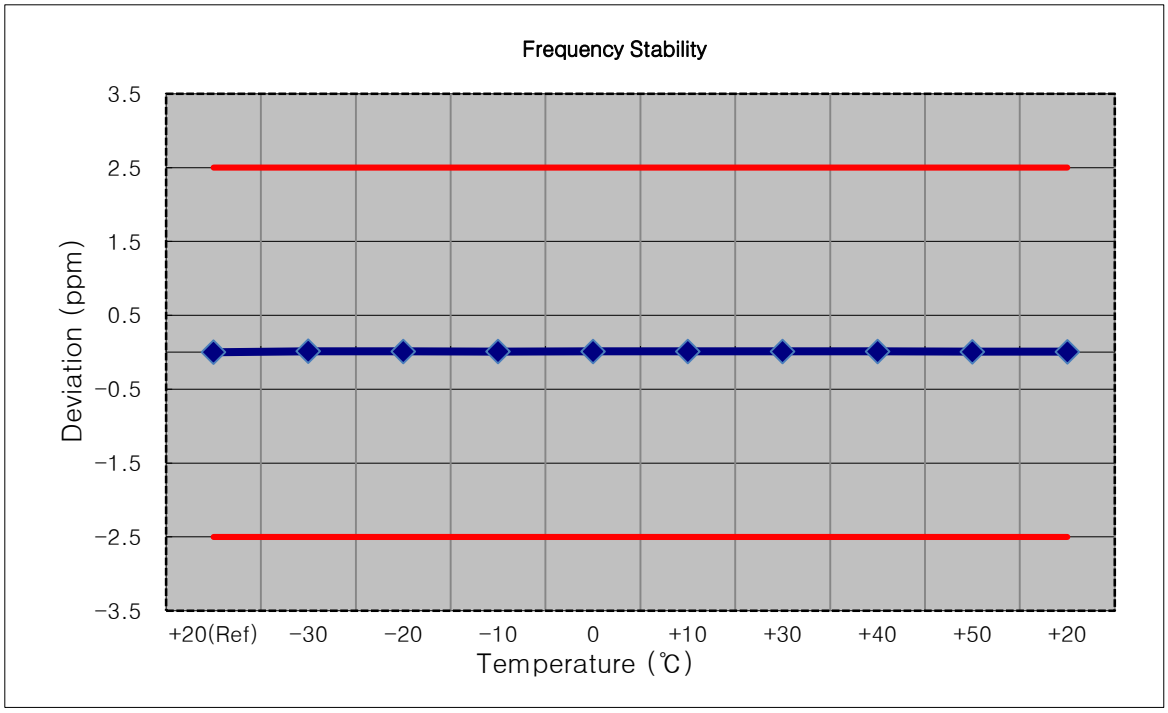
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 190

▣ REFERENCE VOLTAGE: 3.86 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	836 600 011	0.0	0.000 000	0.0000
100%		-30	836 600 023	11.2	0.000 001	0.0134
100%		-20	836 600 022	10.4	0.000 001	0.0124
100%		-10	836 600 020	9.0	0.000 001	0.0107
100%		0	836 600 022	10.6	0.000 001	0.0126
100%		+10	836 600 022	10.3	0.000 001	0.0123
100%		+30	836 600 022	10.3	0.000 001	0.0123
100%		+40	836 600 022	10.6	0.000 001	0.0126
100%		+50	836 600 018	6.8	0.000 001	0.0082
Batt. Endpoint	3.400	+20	836 600 018	6.6	0.000 001	0.0079



▣ Mode: GSM1900

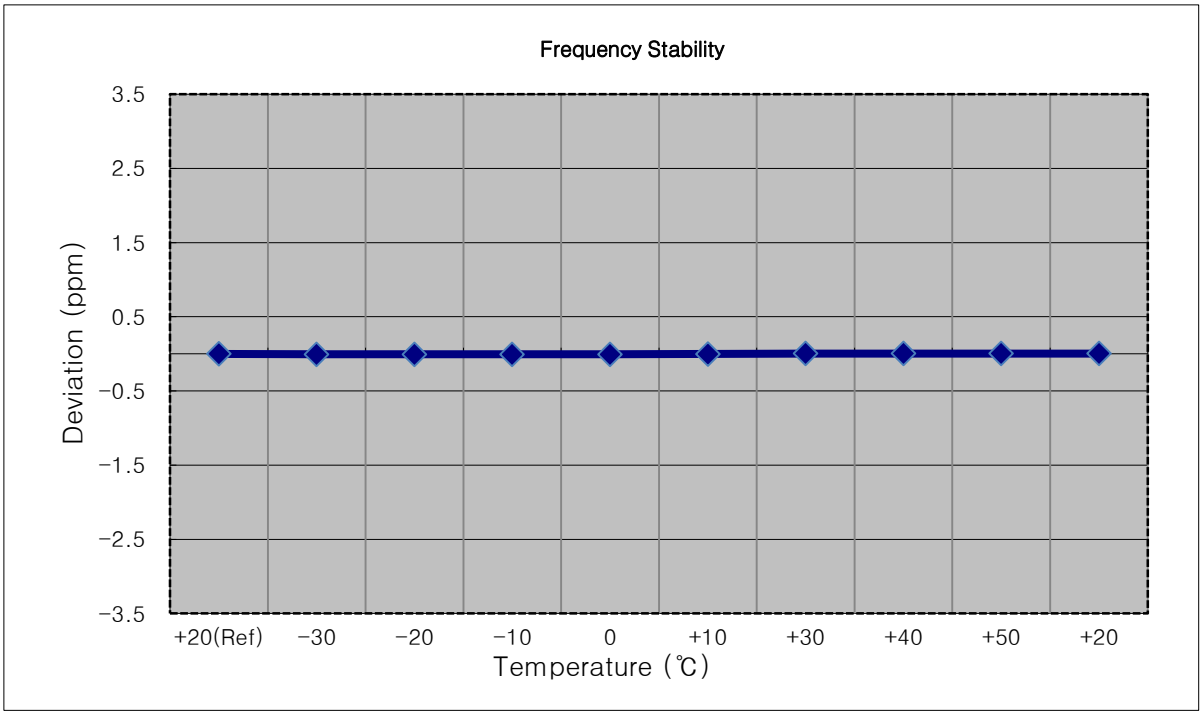
▣ OPERATING FREQUENCY: 1850,200,000 Hz

▣ CHANNEL: 512

▣ REFERENCE VOLTAGE: 3.86 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	1850 199 988	0.0	0.000 000	0.0000
100%		-30	1850 199 976	-12.1	-0.000 001	-0.0065
100%		-20	1850 199 975	-12.2	-0.000 001	-0.0066
100%		-10	1850 199 974	-13.5	-0.000 001	-0.0073
100%		0	1850 199 974	-13.5	-0.000 001	-0.0073
100%		+10	1850 199 981	-6.2	0.000 000	-0.0033
100%		+30	1850 199 994	6.1	0.000 000	0.0033
100%		+40	1850 199 994	6.8	0.000 000	0.0037
100%		+50	1850 199 995	7.5	0.000 000	0.0041
Batt. Endpoint	3.400	+20	1850 199 996	8.2	0.000 000	0.0044



▣ Mode: GSM1900

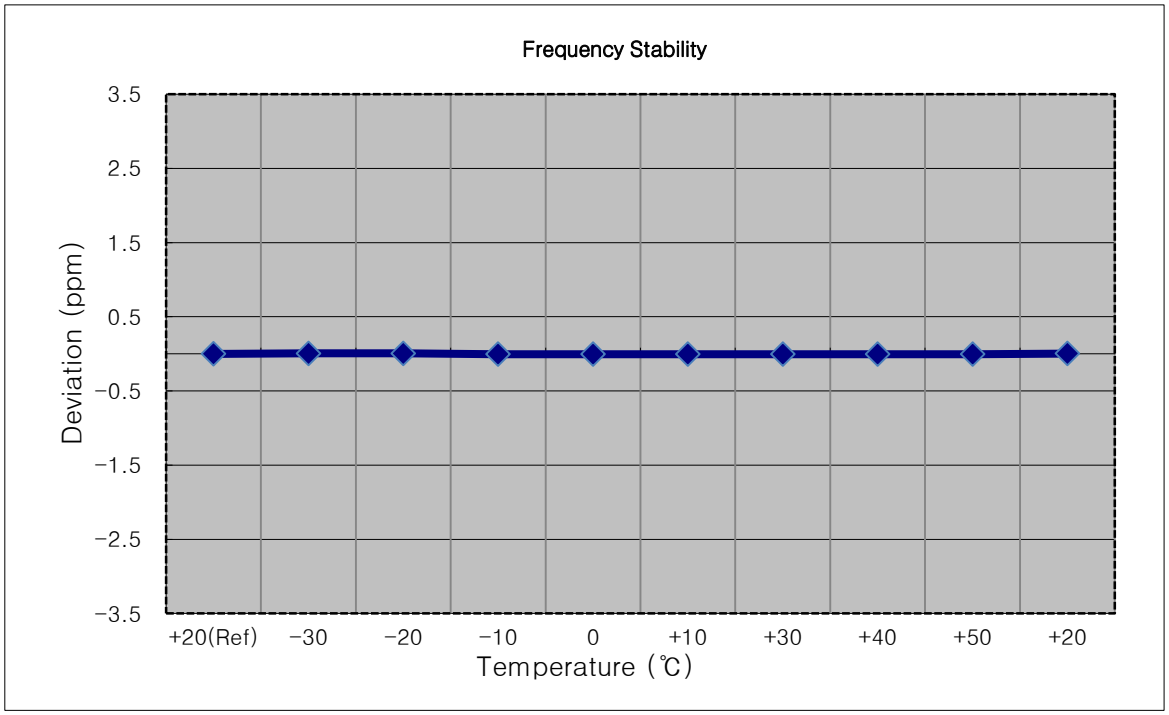
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 661

▣ REFERENCE VOLTAGE: 3.86 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	1880 000 012	0.0	0.000 000	0.000
100%		-30	1880 000 024	12.0	0.000 001	0.006
100%		-20	1880 000 023	10.8	0.000 001	0.006
100%		-10	1880 000 005	-6.8	0.000 000	-0.004
100%		0	1880 000 004	-8.1	0.000 000	-0.004
100%		+10	1880 000 004	-8.0	0.000 000	-0.004
100%		+30	1880 000 002	-9.9	-0.000 001	-0.005
100%		+40	1880 000 004	-7.4	0.000 000	-0.004
100%		+50	1880 000 004	-8.0	0.000 000	-0.004
Batt. Endpoint	3.400	+20	1880 000 021	8.8	0.000 000	0.005



▣ Mode: GSM1900

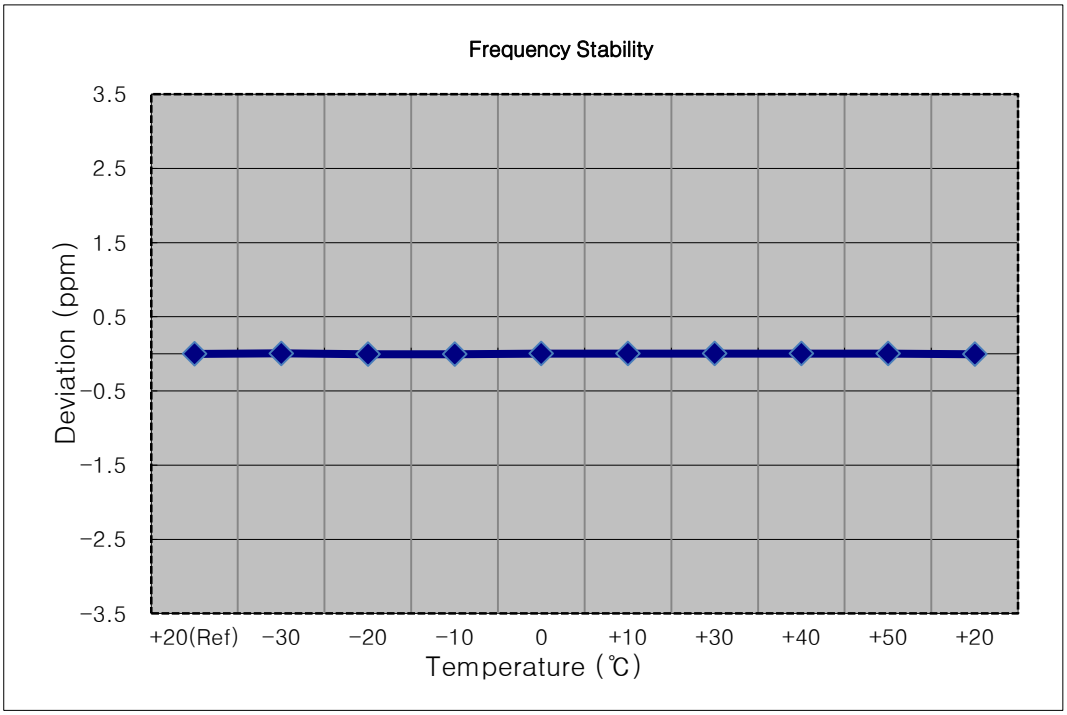
▣ OPERATING FREQUENCY: 1909,800,000 Hz

▣ CHANNEL: 810

▣ REFERENCE VOLTAGE: 3.86 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	1909 800 010	0.0	0.000 000	0.000
100%		-30	1909 800 021	10.9	0.000 001	0.006
100%		-20	1909 800 002	-7.9	0.000 000	-0.004
100%		-10	1909 800 003	-7.2	0.000 000	-0.004
100%		0	1909 800 016	6.5	0.000 000	0.003
100%		+10	1909 800 017	7.3	0.000 000	0.004
100%		+30	1909 800 019	8.8	0.000 000	0.005
100%		+40	1909 800 019	9.1	0.000 000	0.005
100%		+50	1909 800 018	8.1	0.000 000	0.004
Batt. Endpoint	3.400	+20	1909 799 999	-10.7	-0.000 001	-0.006



▣ Mode: WCDMA850

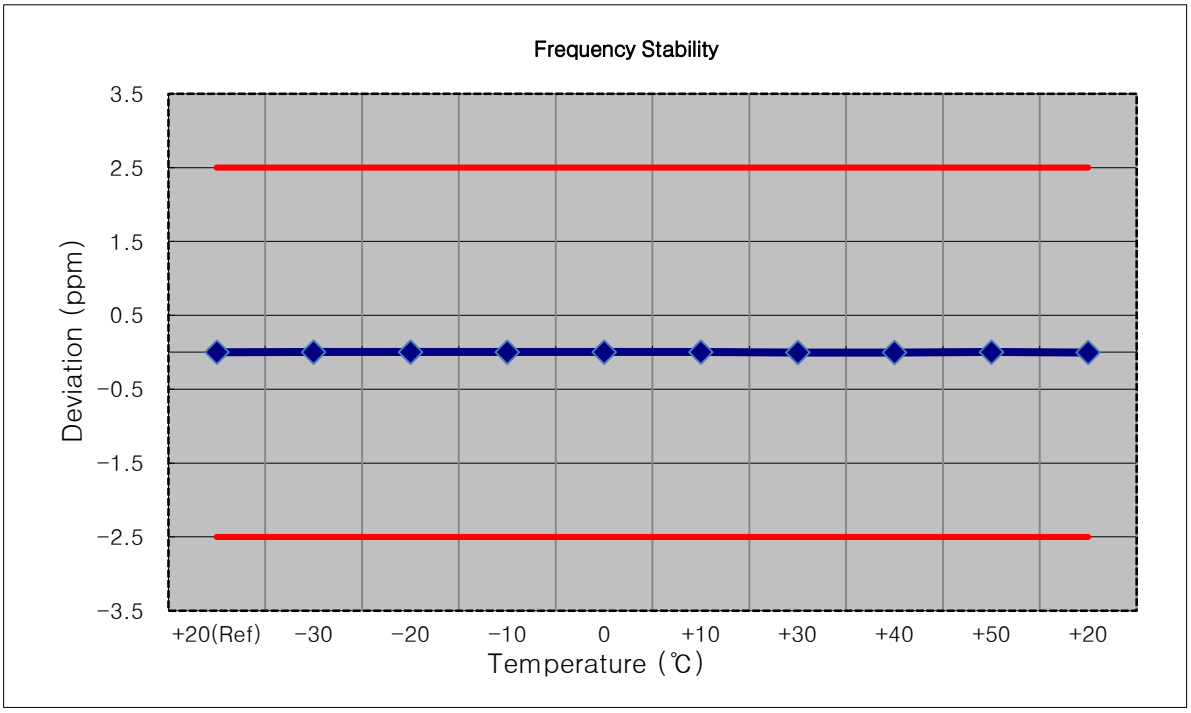
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 4183

▣ REFERENCE VOLTAGE: 3.86 VDC

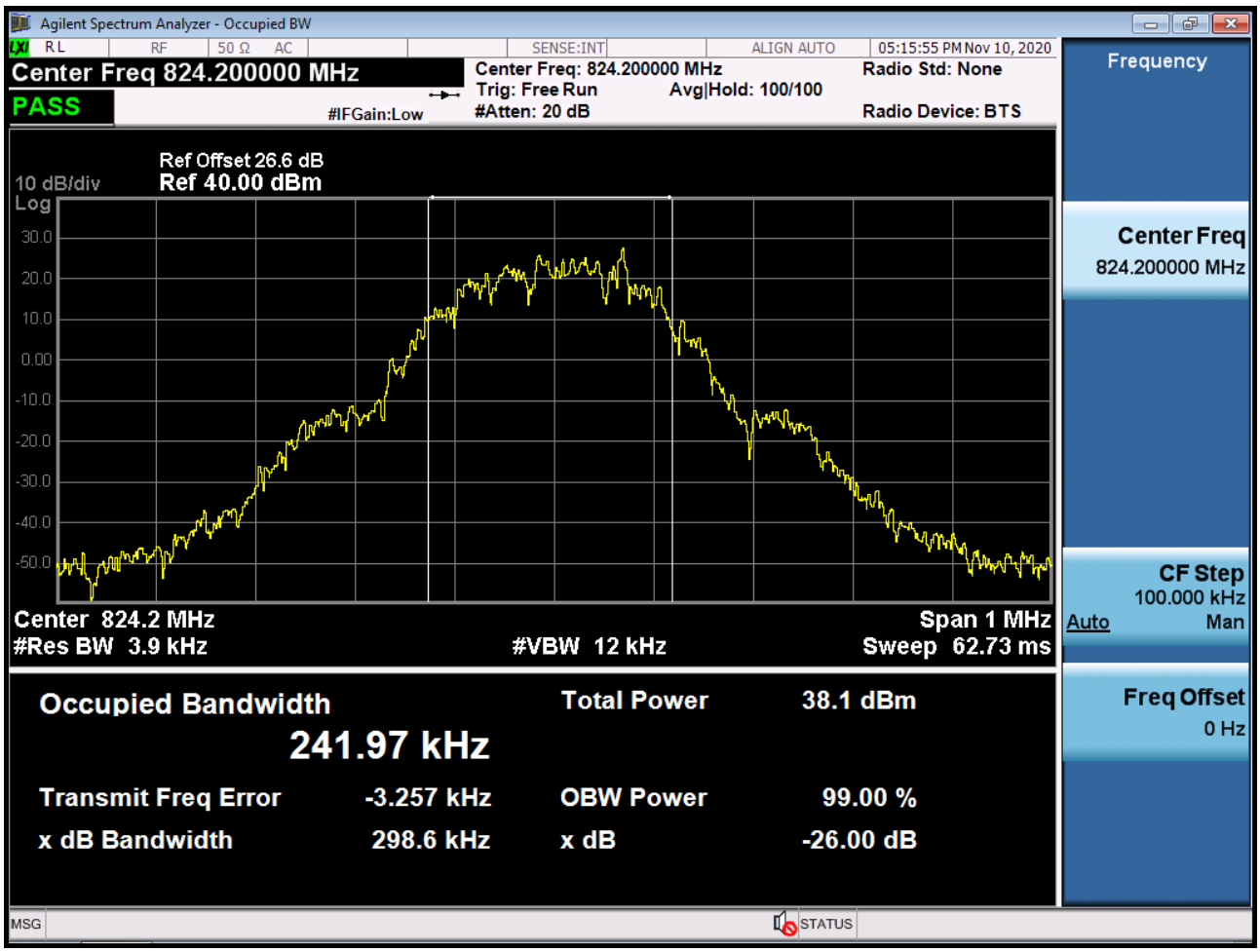
▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.860	+20(Ref)	836 599 998	0.0	0.000 000	0.0000
100%		-30	836 600 001	3.0	0.000 000	0.0036
100%		-20	836 600 001	2.6	0.000 000	0.0032
100%		-10	836 600 001	3.2	0.000 000	0.0039
100%		0	836 600 002	3.5	0.000 000	0.0042
100%		+10	836 600 000	2.2	0.000 000	0.0027
100%		+30	836 599 996	-2.1	0.000 000	-0.0025
100%		+40	836 599 996	-1.9	0.000 000	-0.0022
100%		+50	836 600 001	2.7	0.000 000	0.0032
Batt. Endpoint	3.400	+20	836 599 996	-1.9	0.000 000	-0.0023

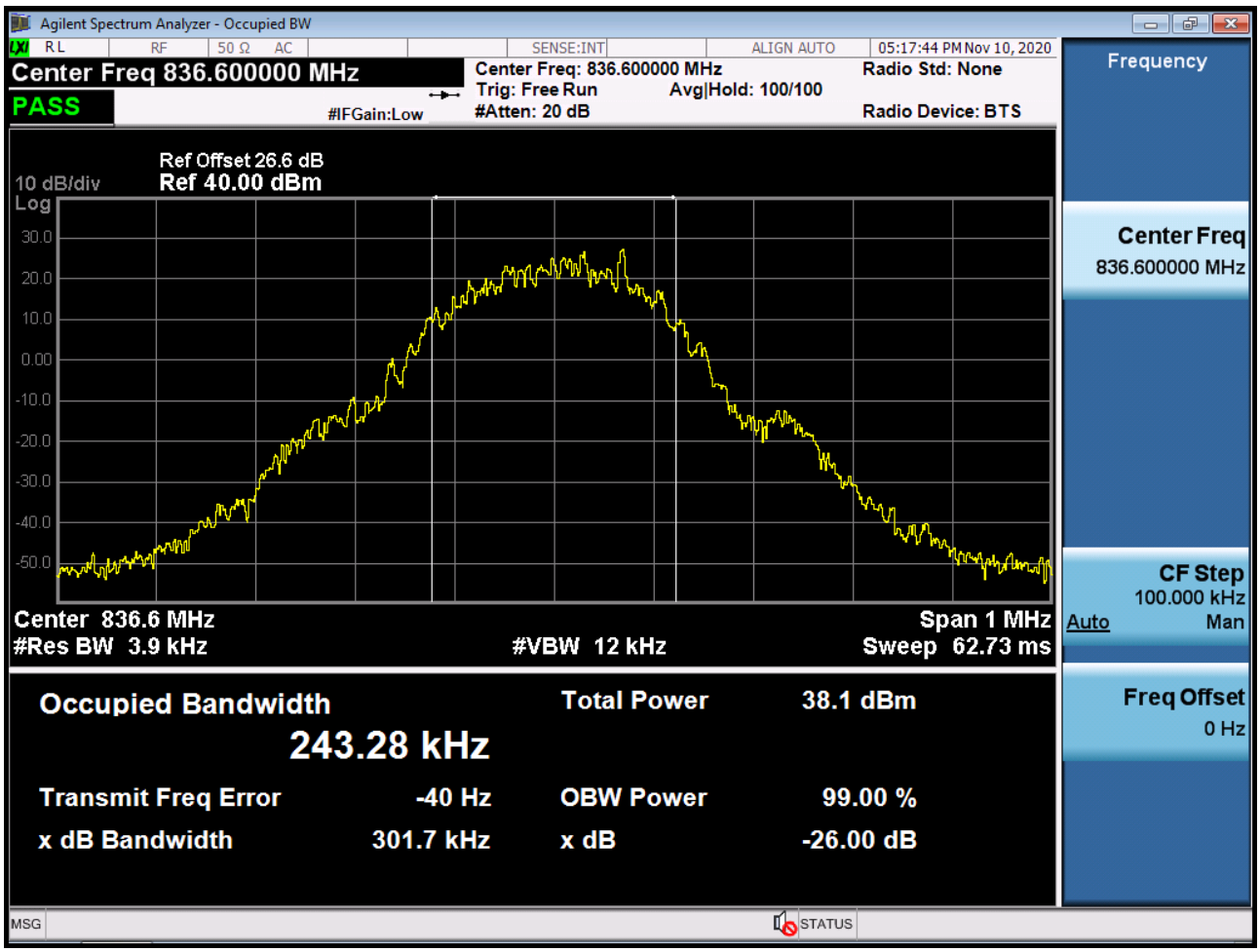


9. TEST PLOTS

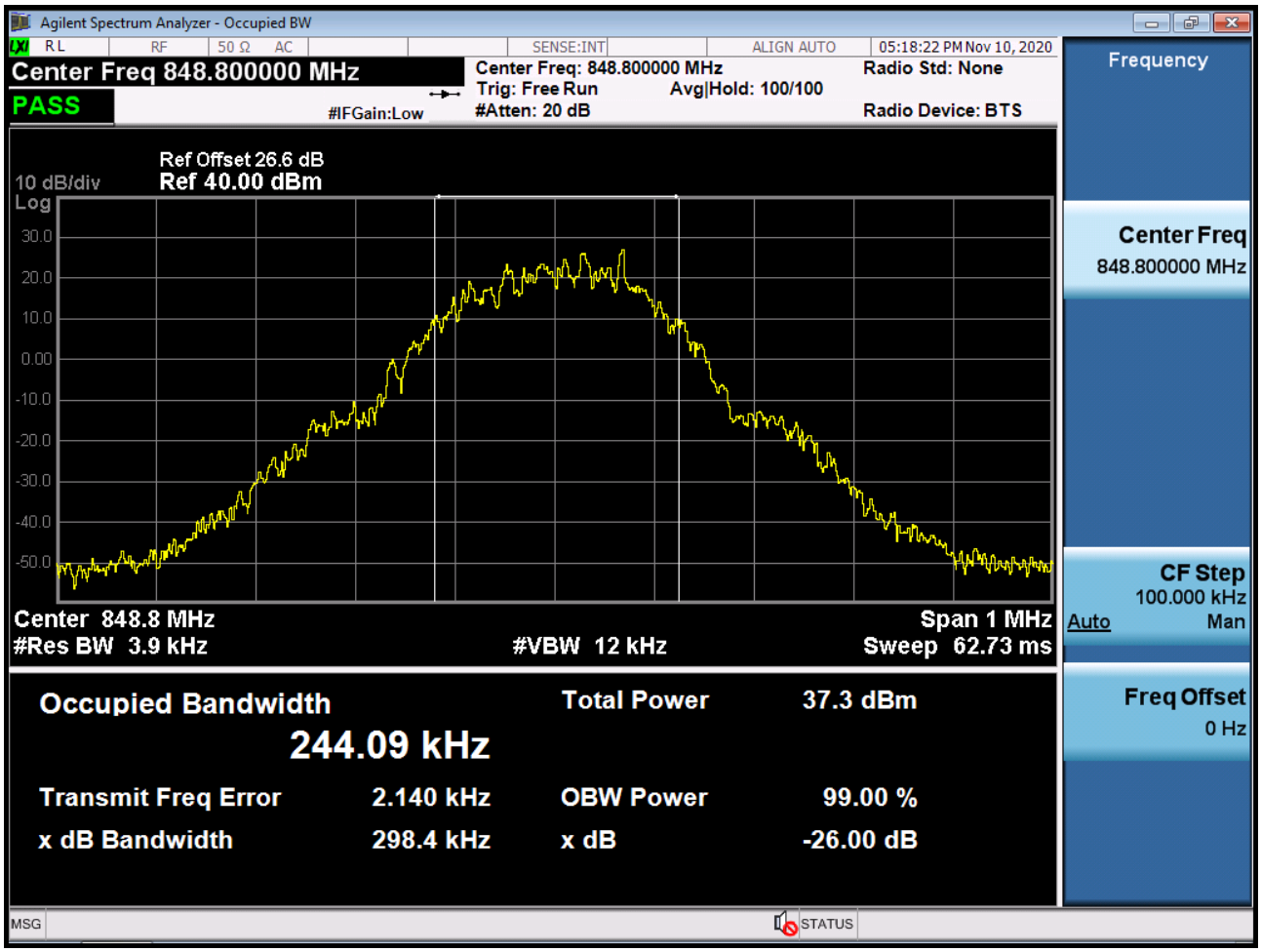
■ GSM850 MODE (128 CH.) Occupied Bandwidth



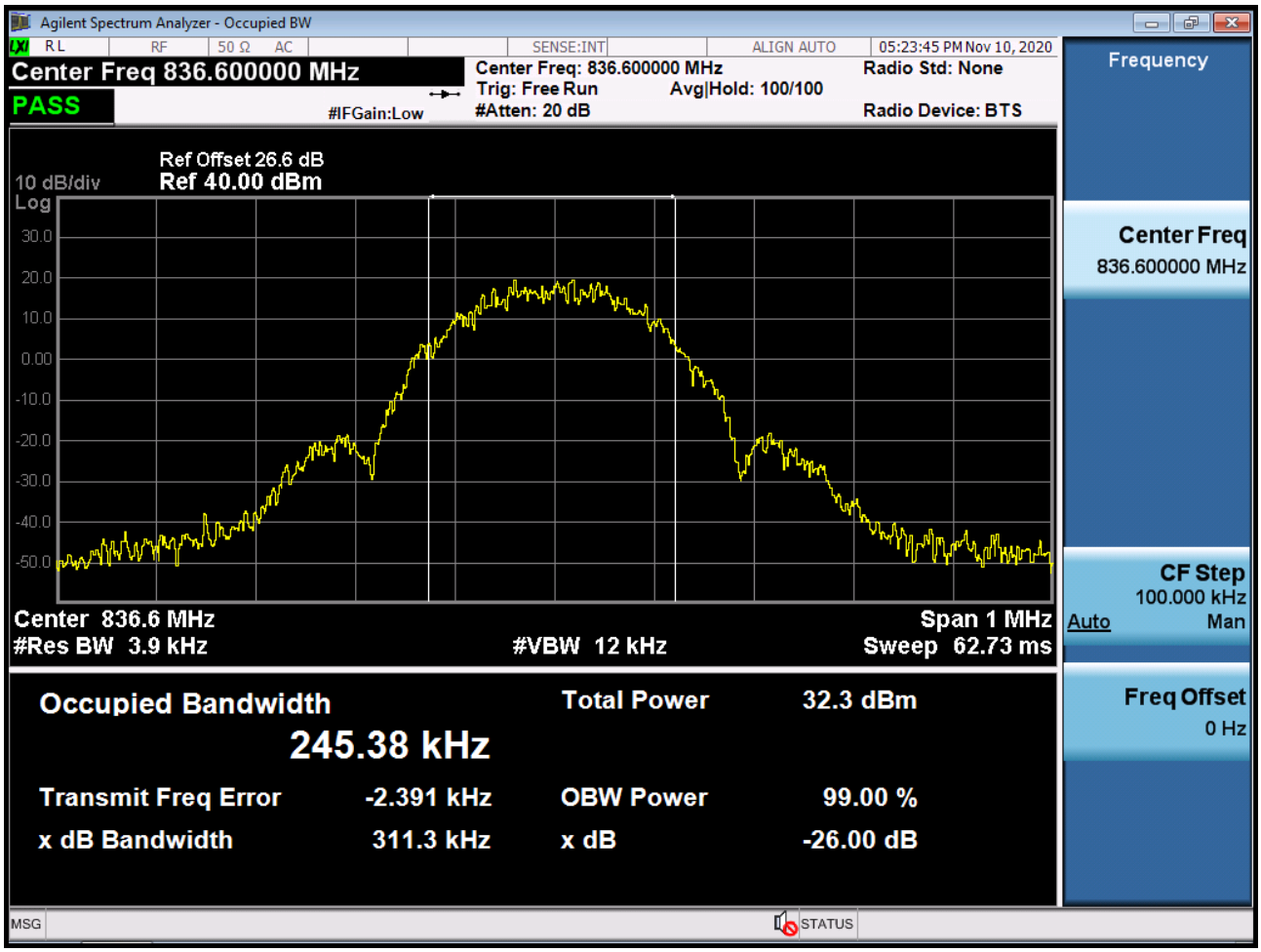
■ GSM850 MODE (190 CH.) Occupied Bandwidth



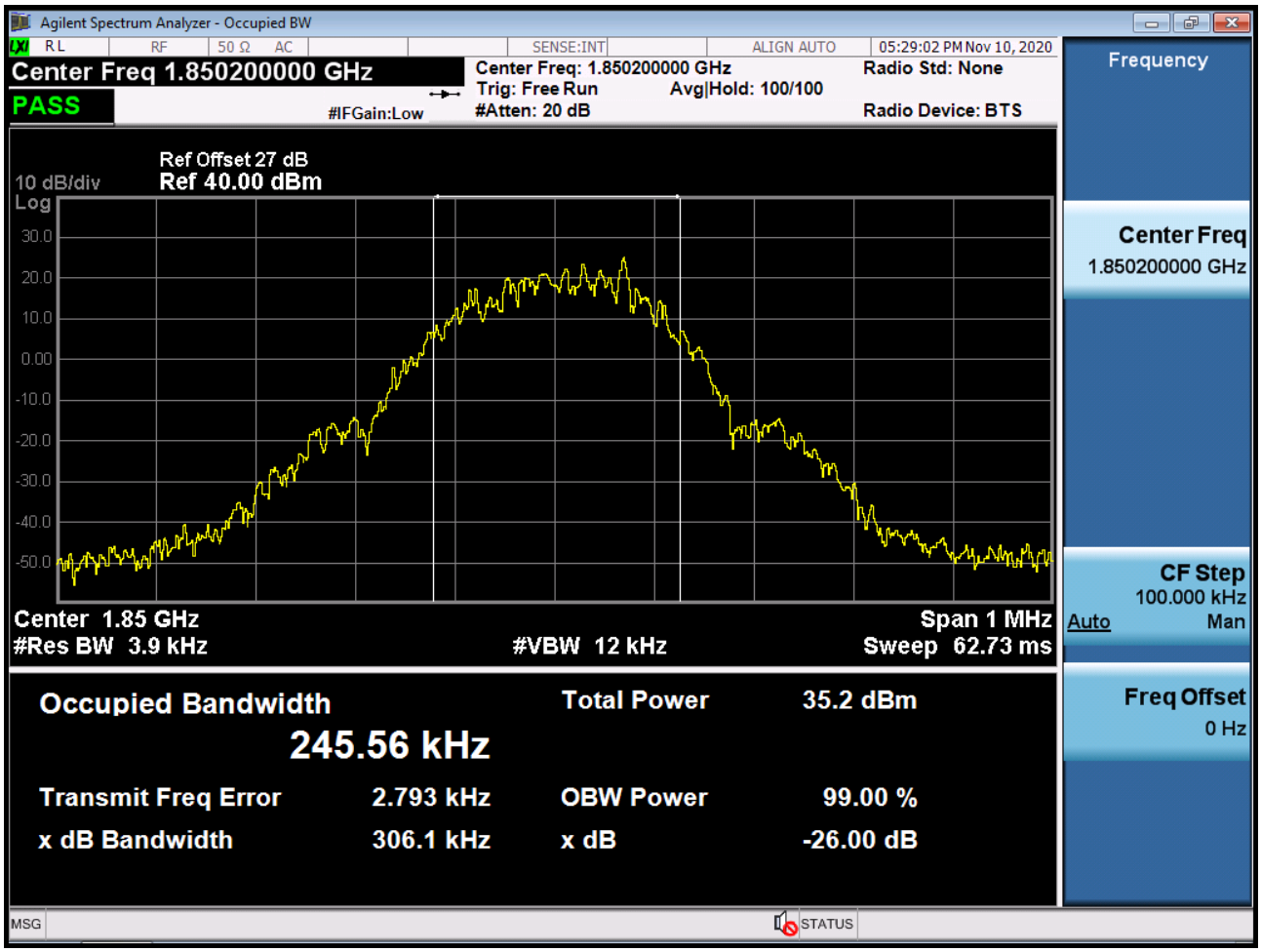
■ GSM850 MODE (251 CH.) Occupied Bandwidth



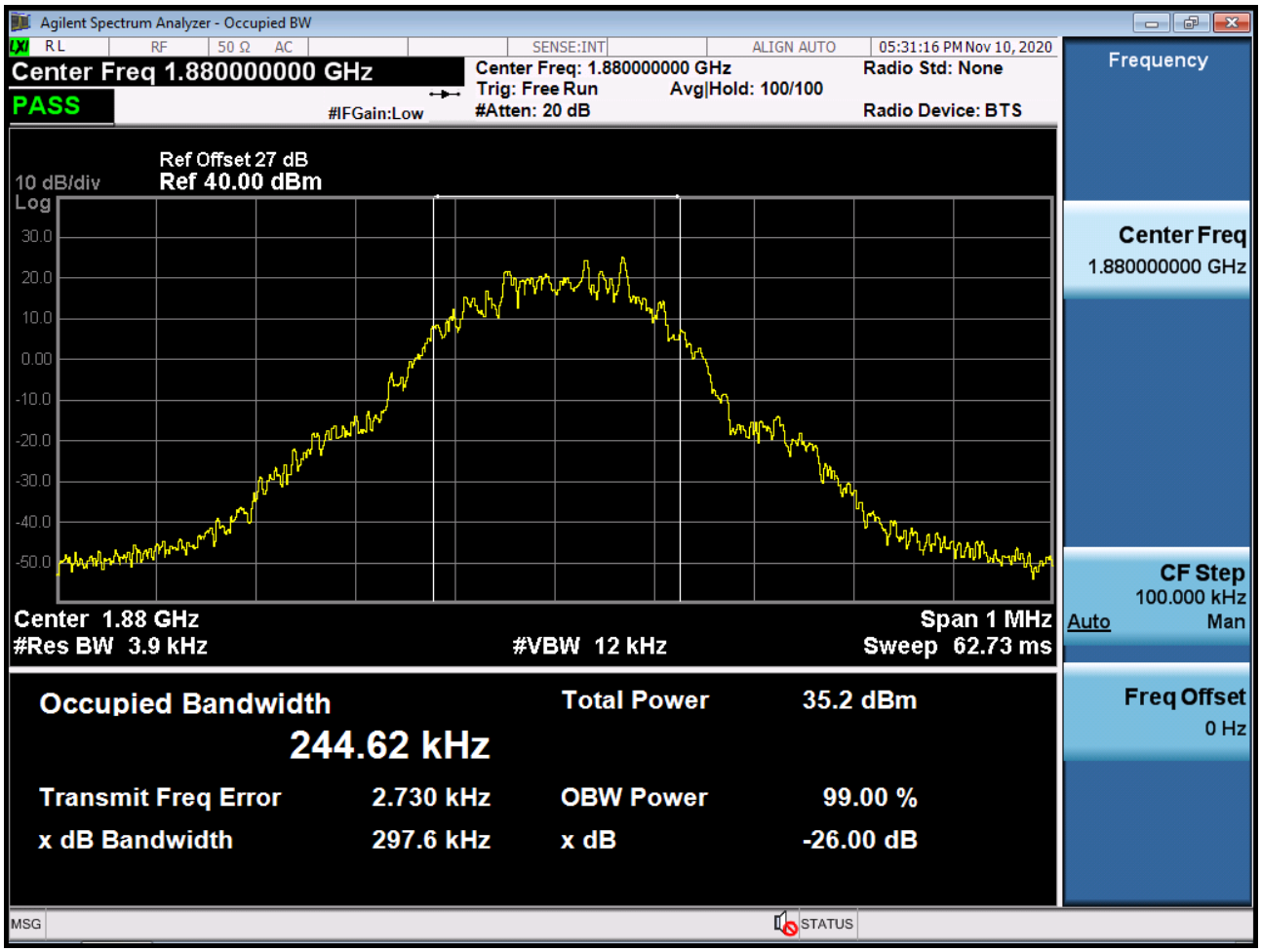
■ GSM850 EDGE (190 CH.) Occupied Bandwidth



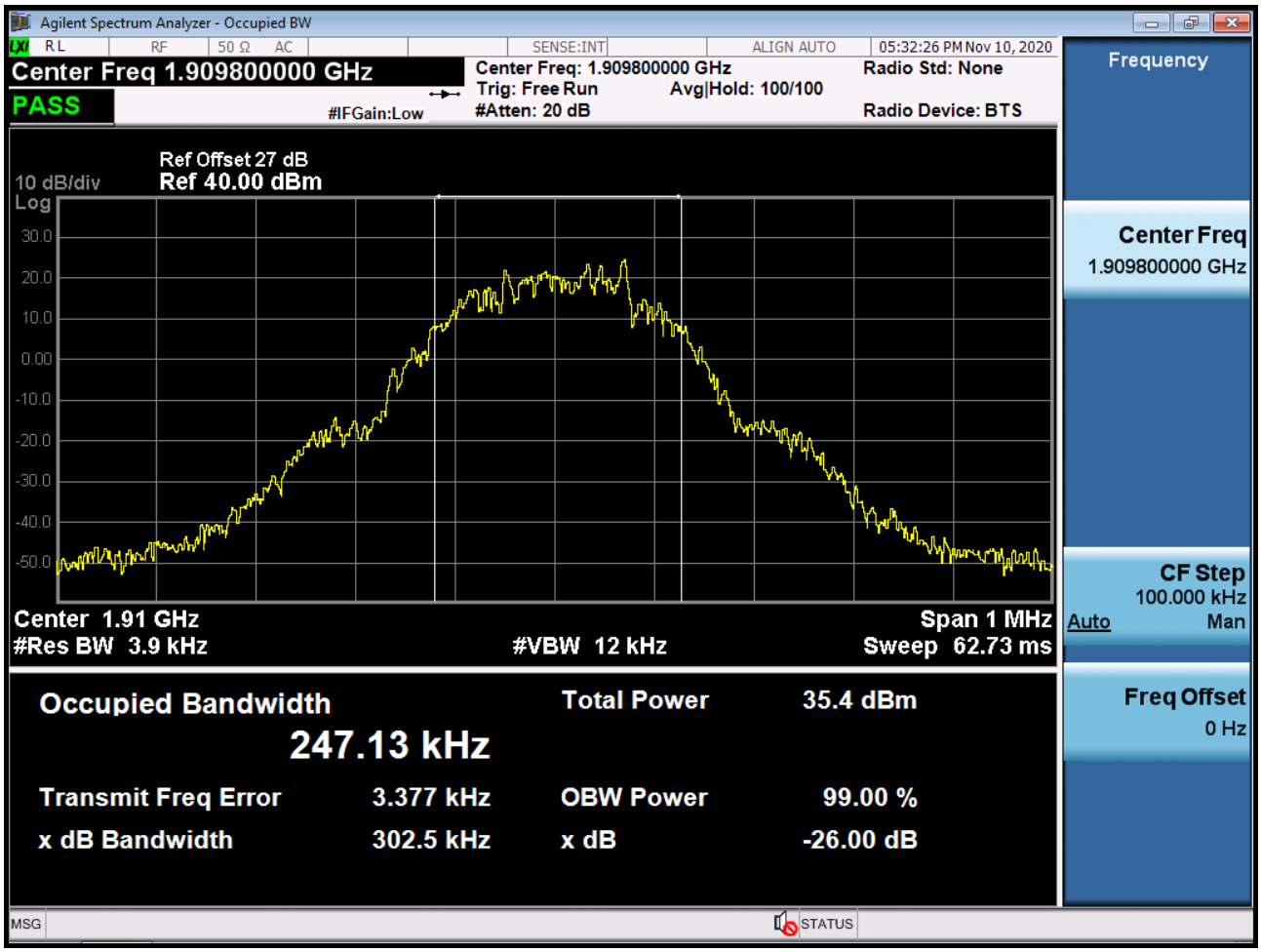
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



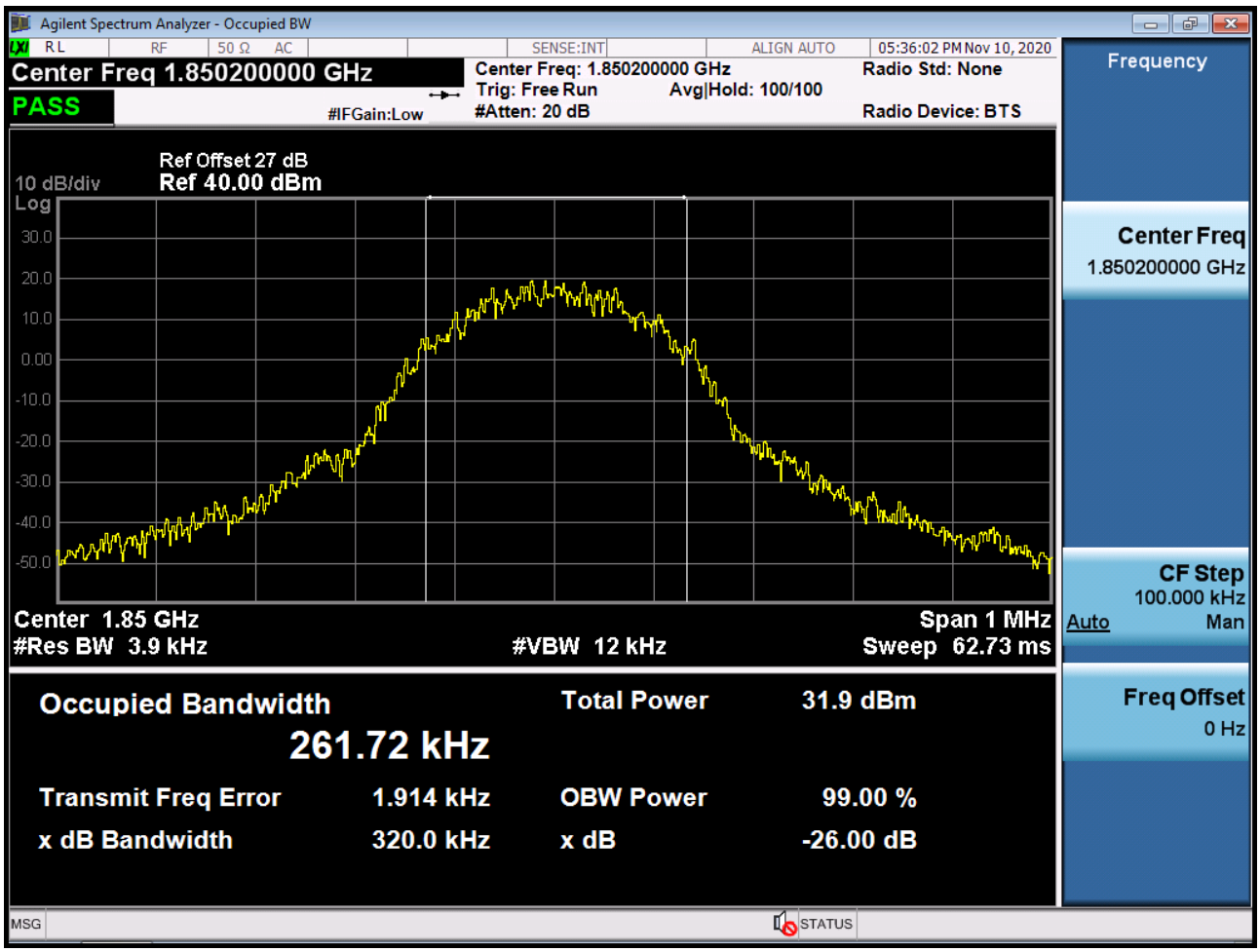
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



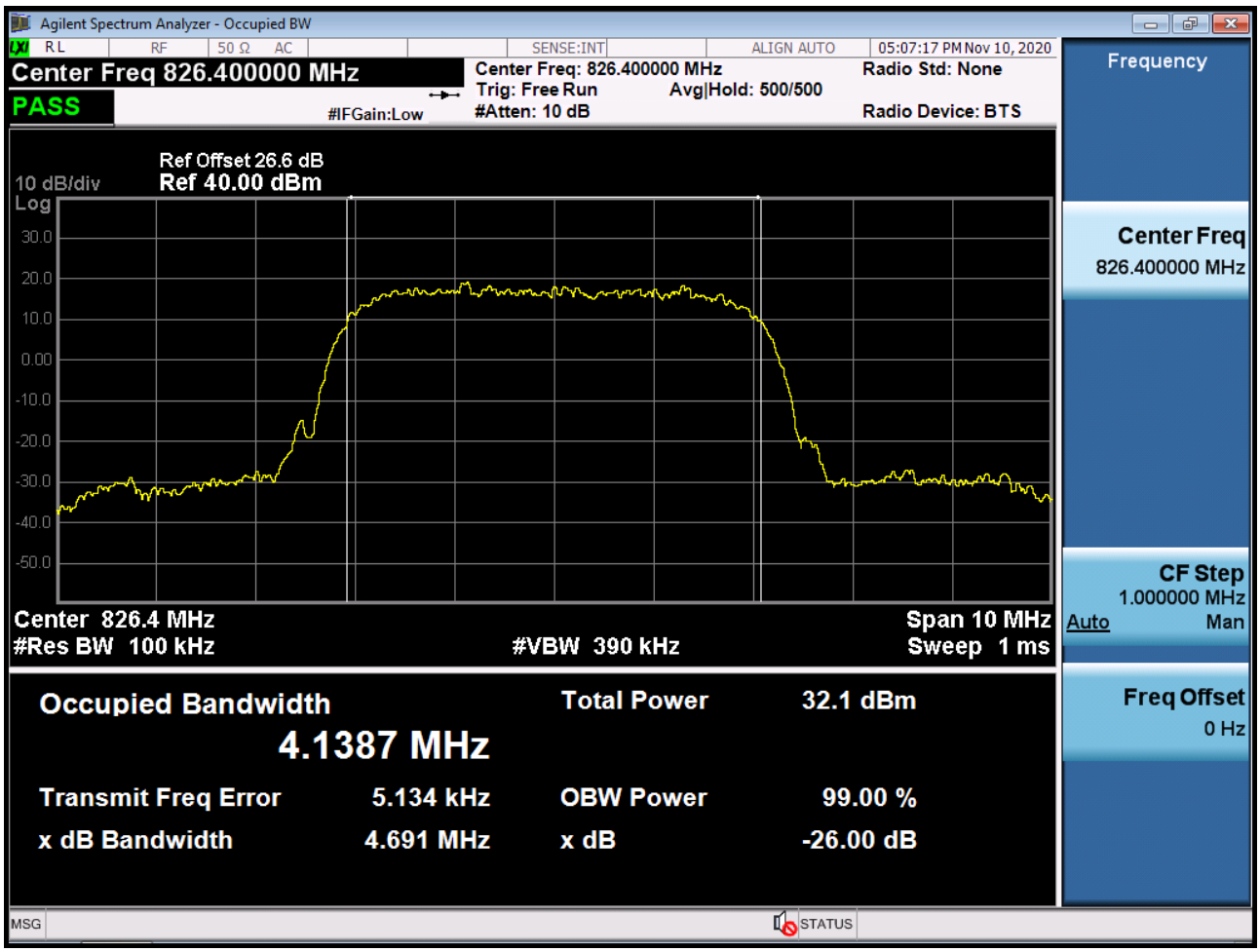
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



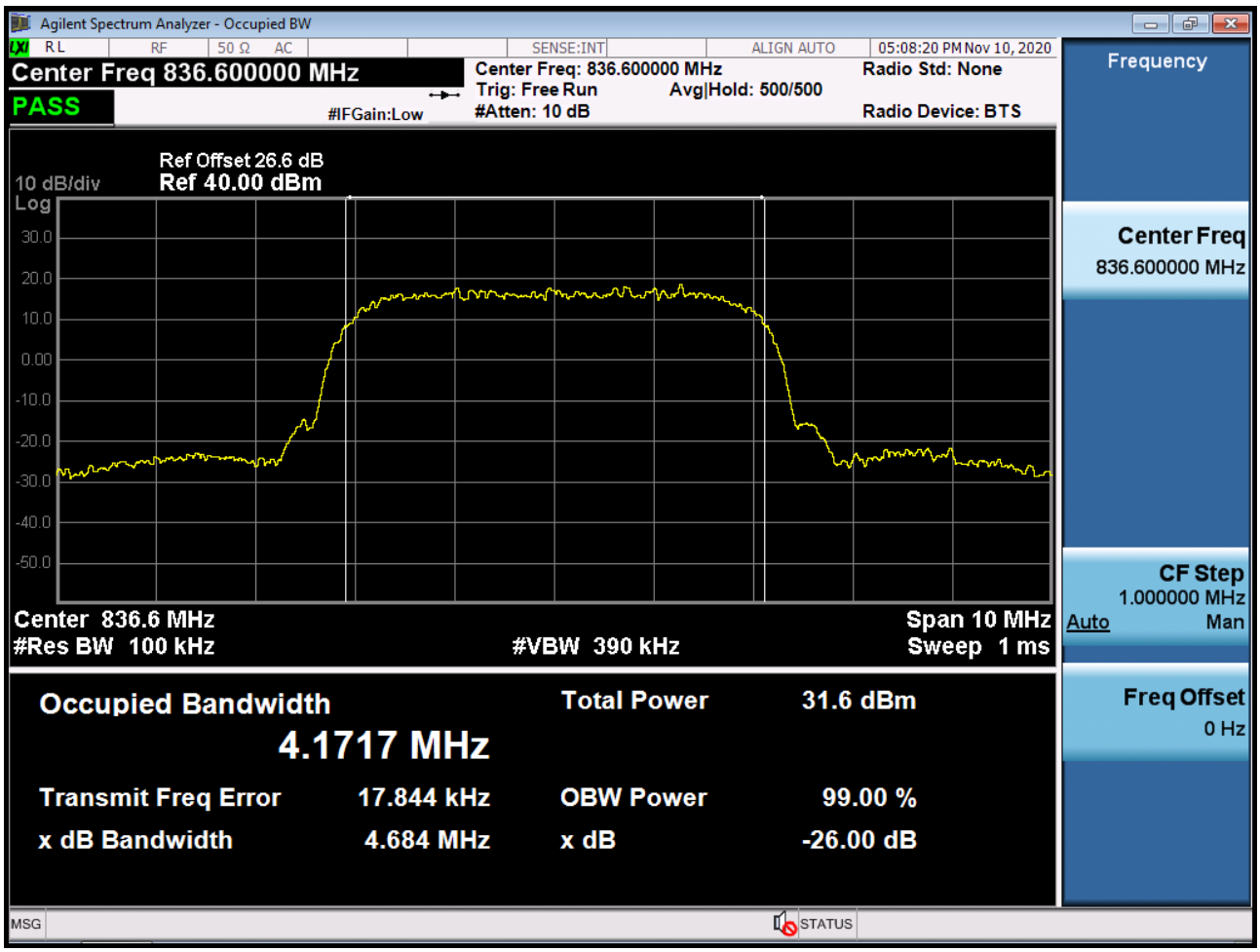
■ GSM1900 EDGE (512 CH.) Occupied Bandwidth



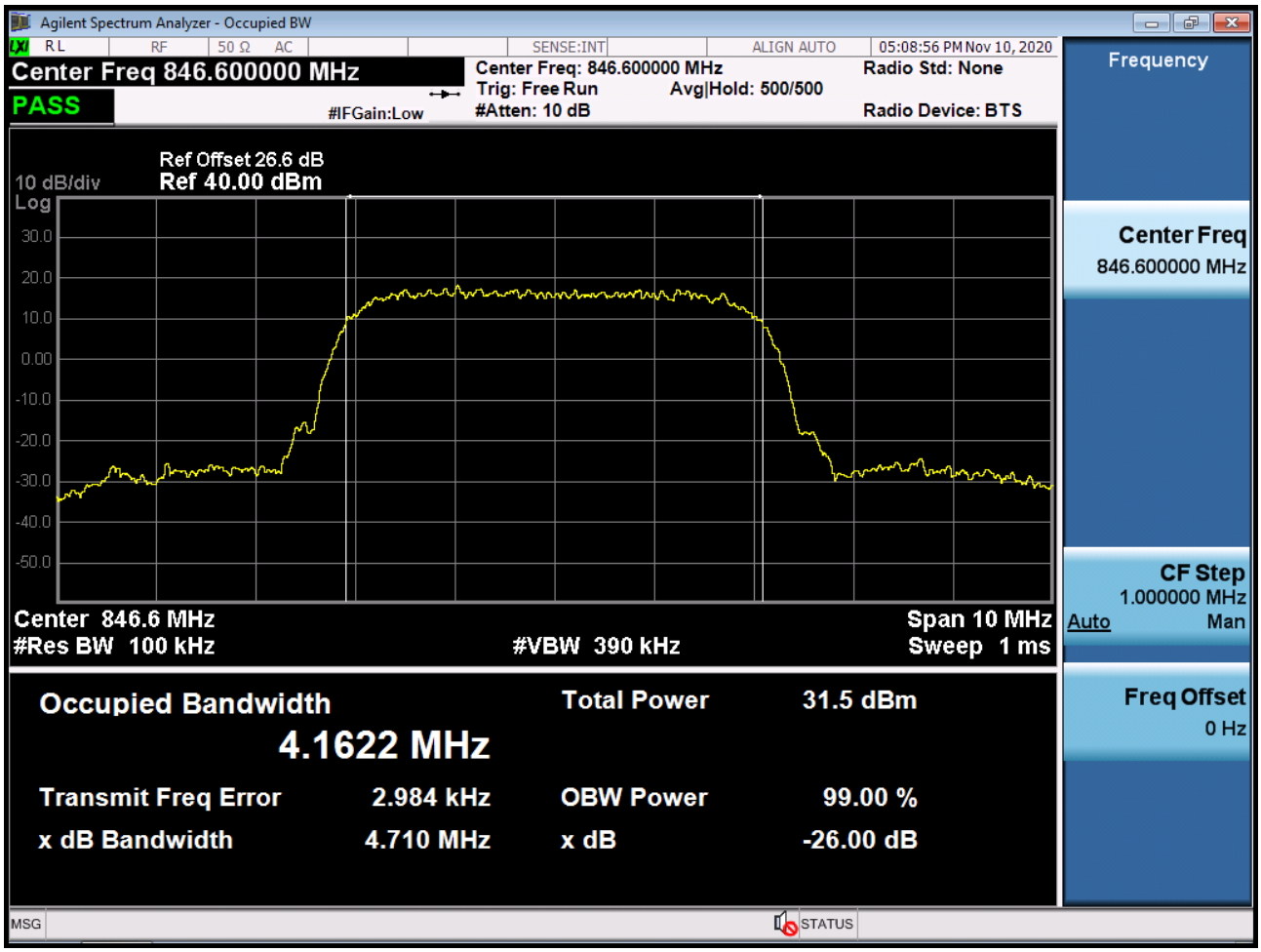
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



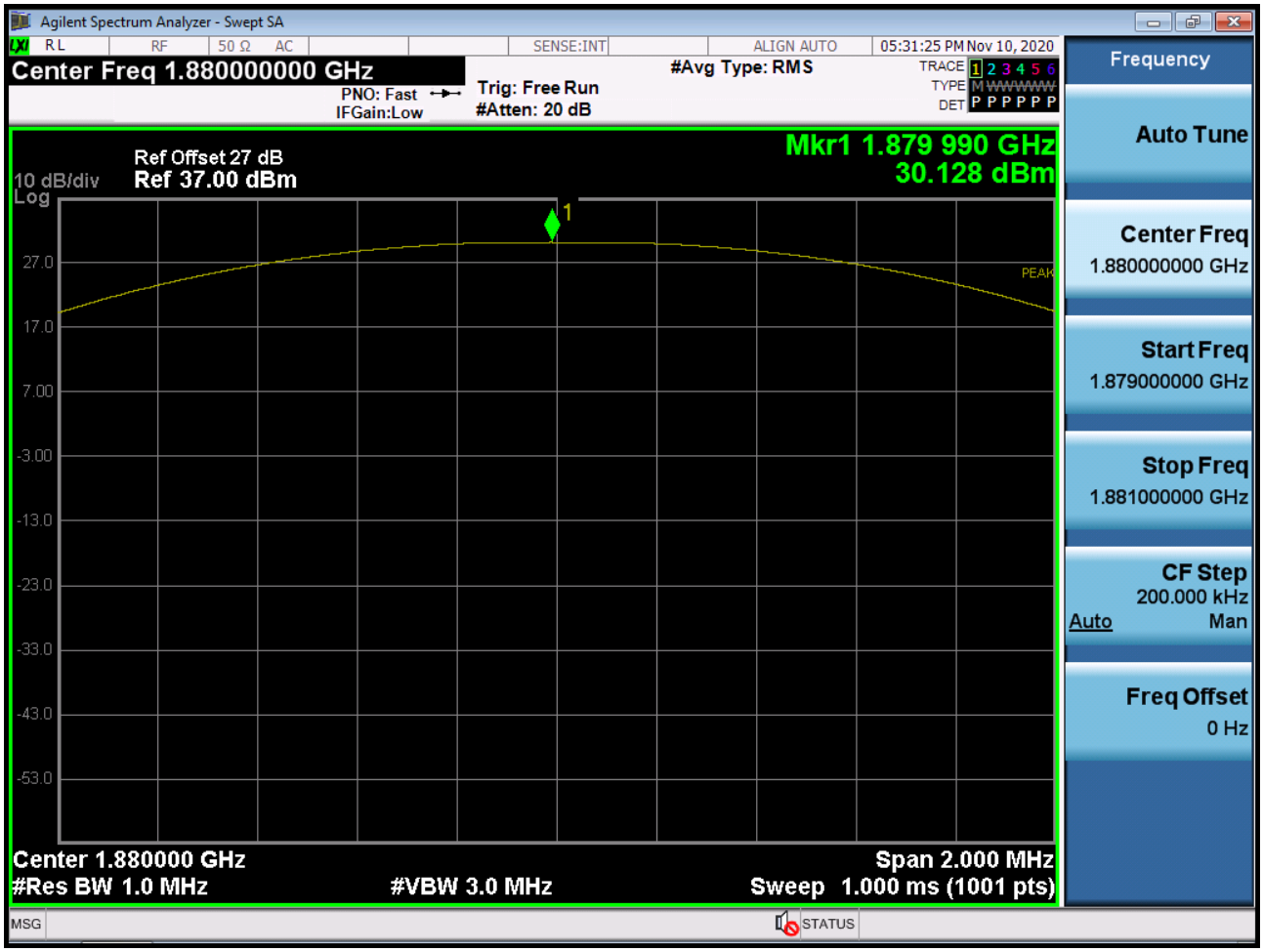
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



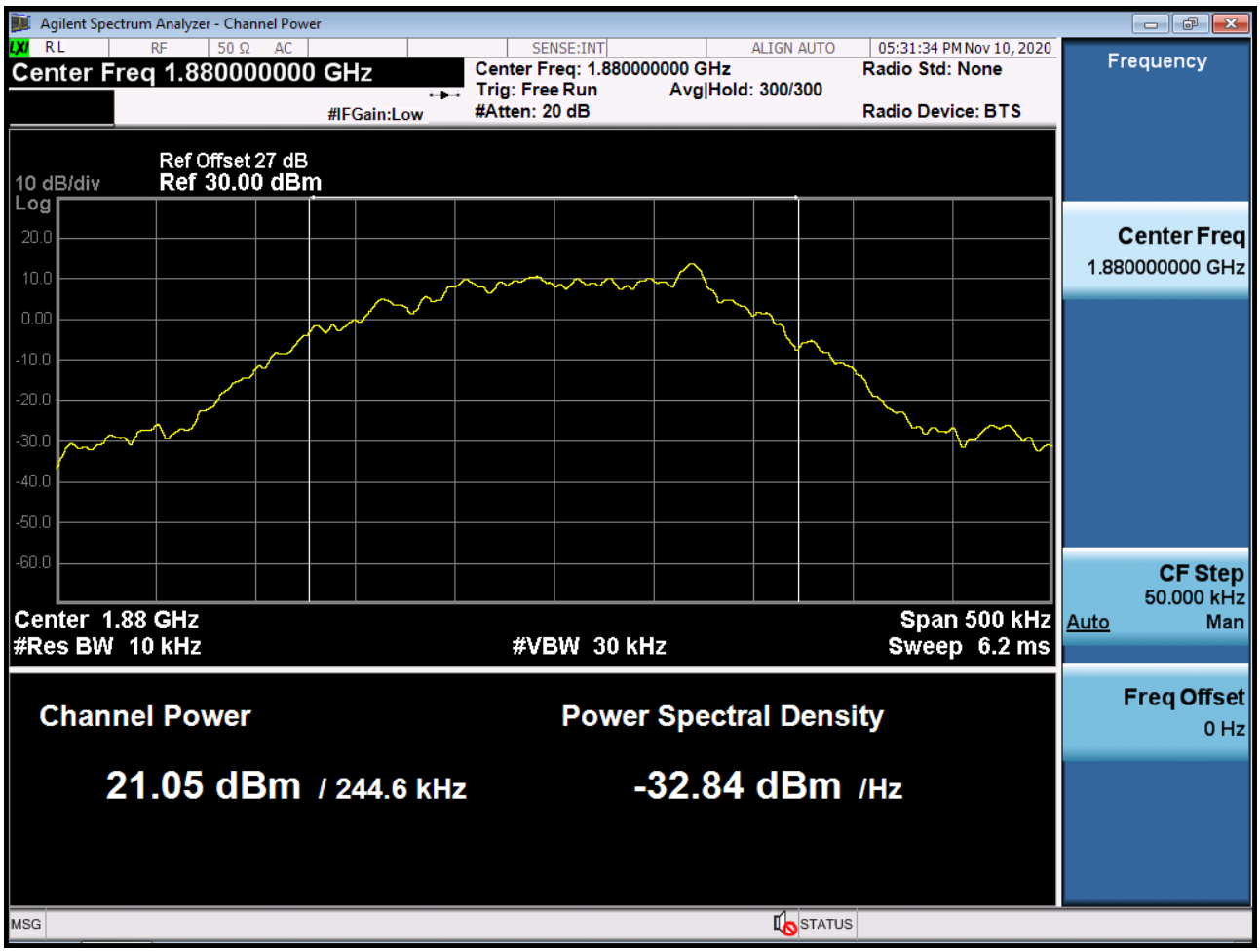
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



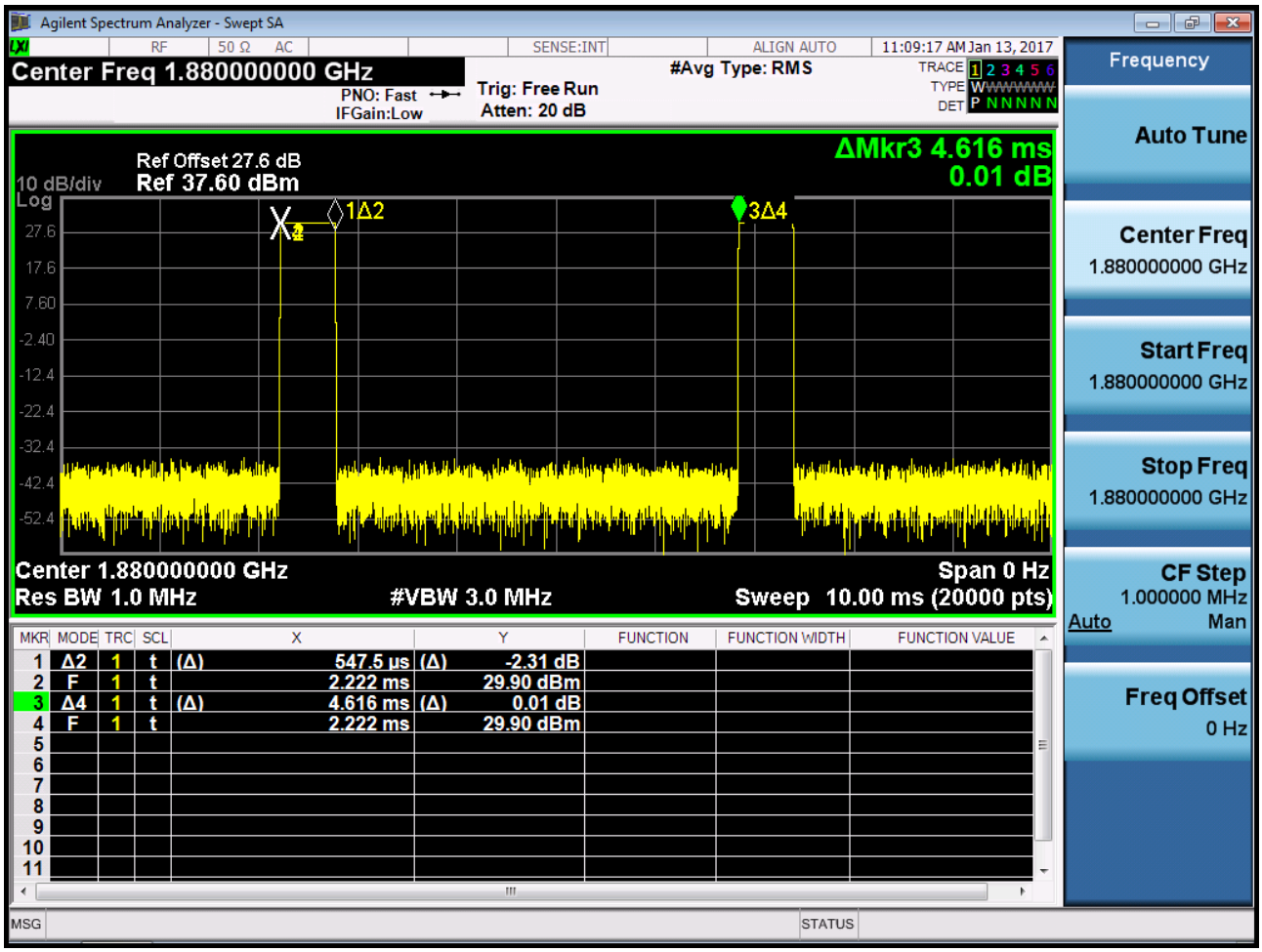
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{Pk}



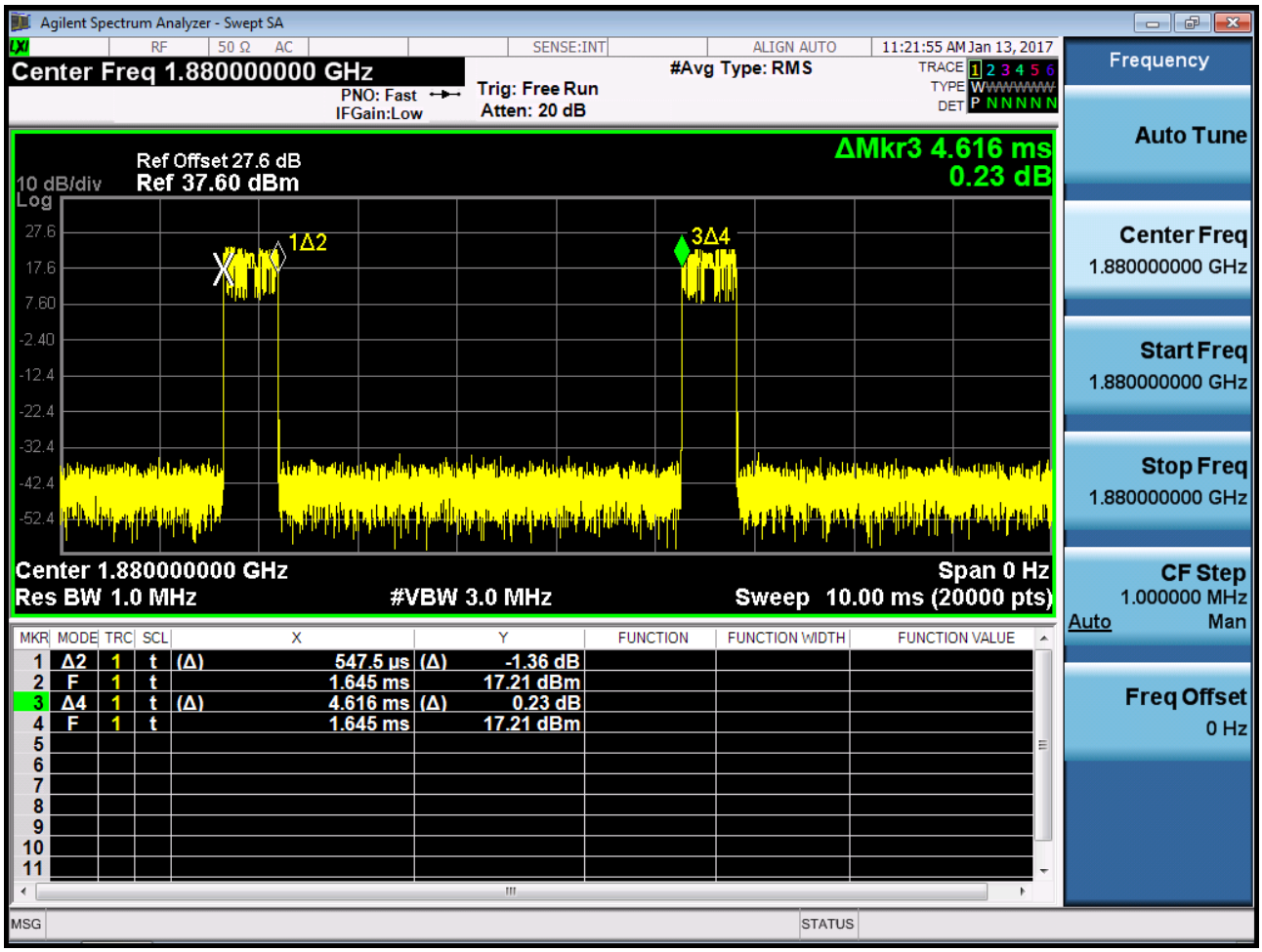
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{Avg}



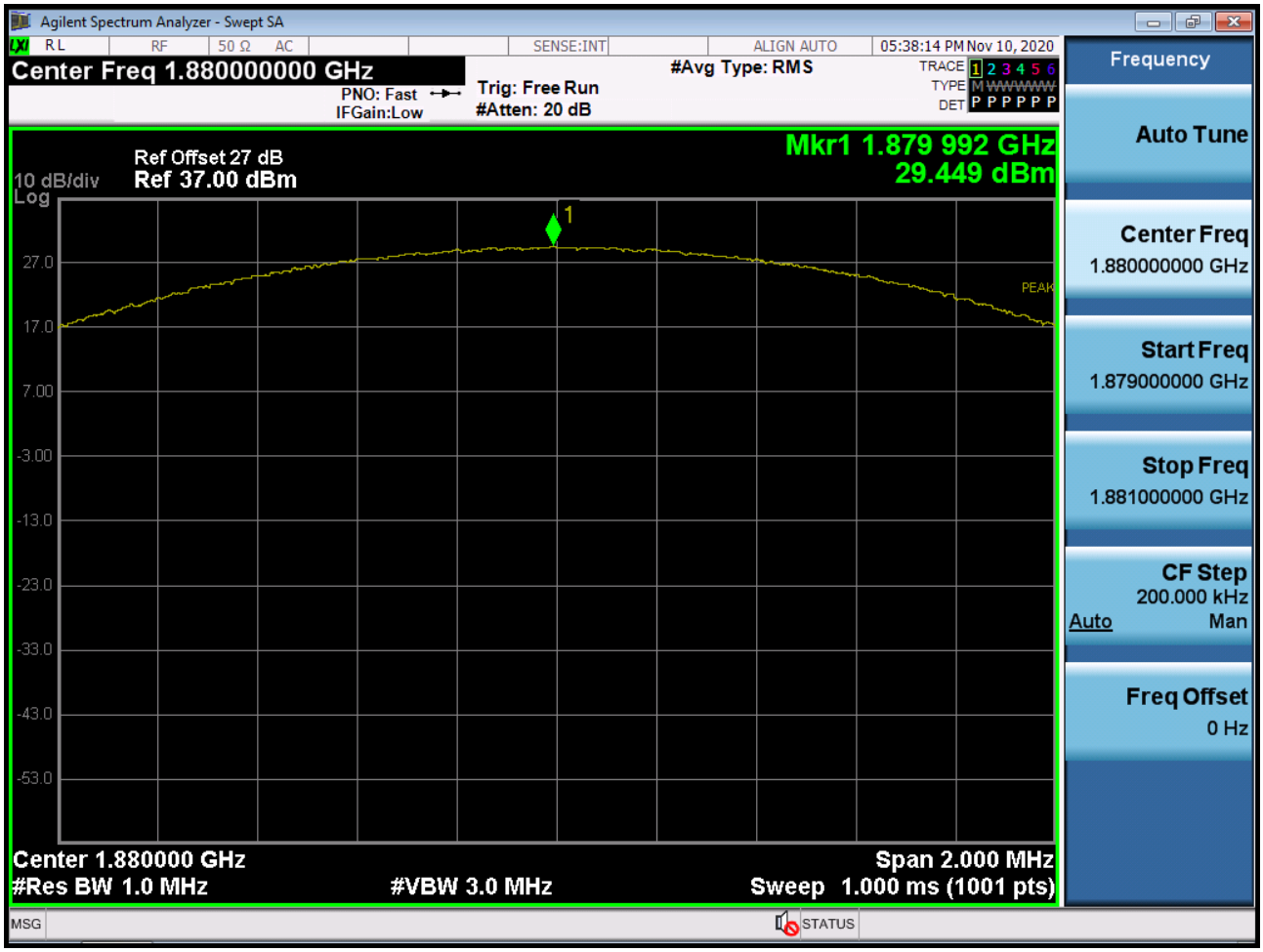
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio Duty



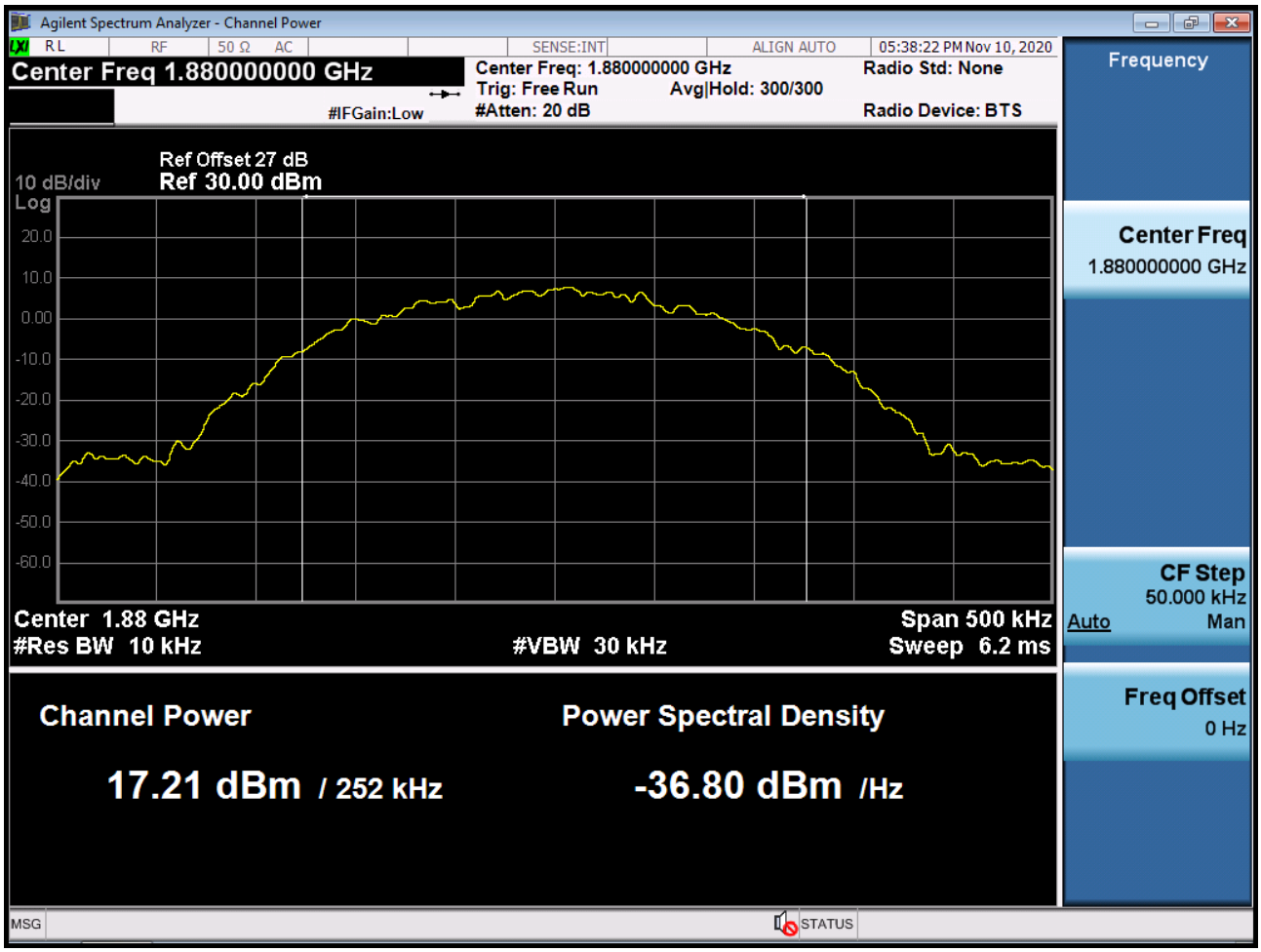
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio Duty



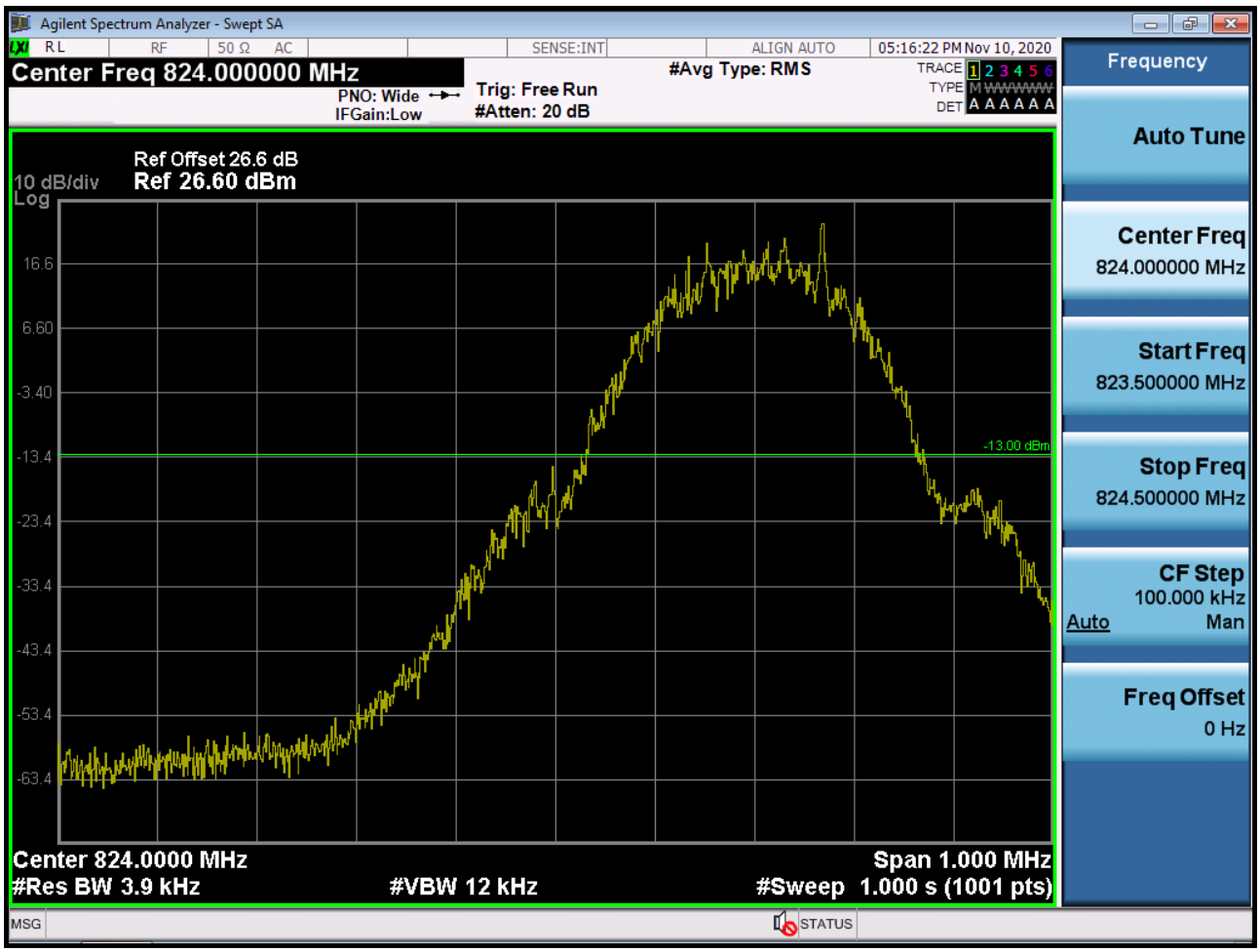
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{Pk}



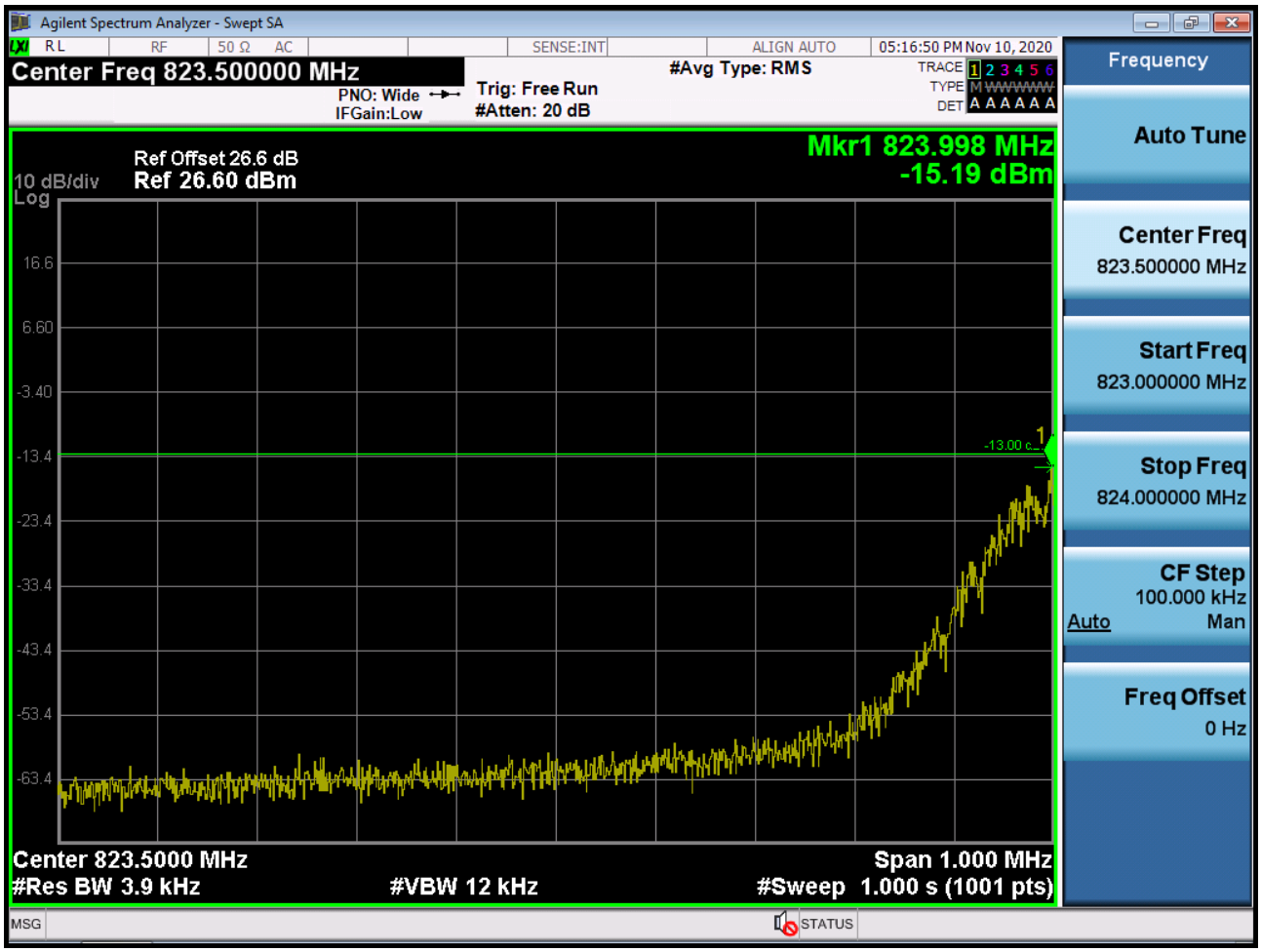
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{Avg}



■ GSM850 MODE (128 CH.) Block Edge 1

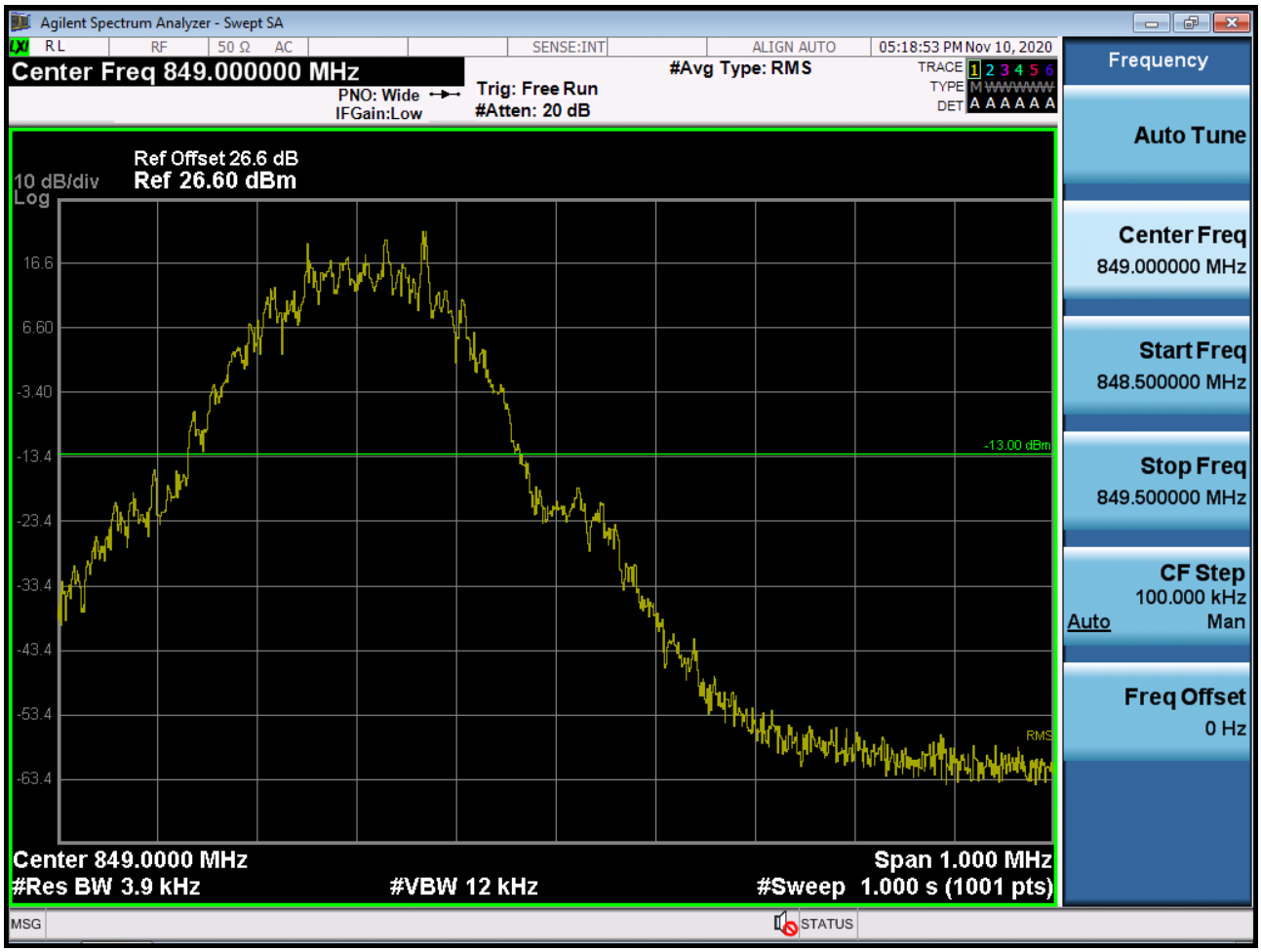


■ GSM850 MODE (128 CH.) Block Edge 2

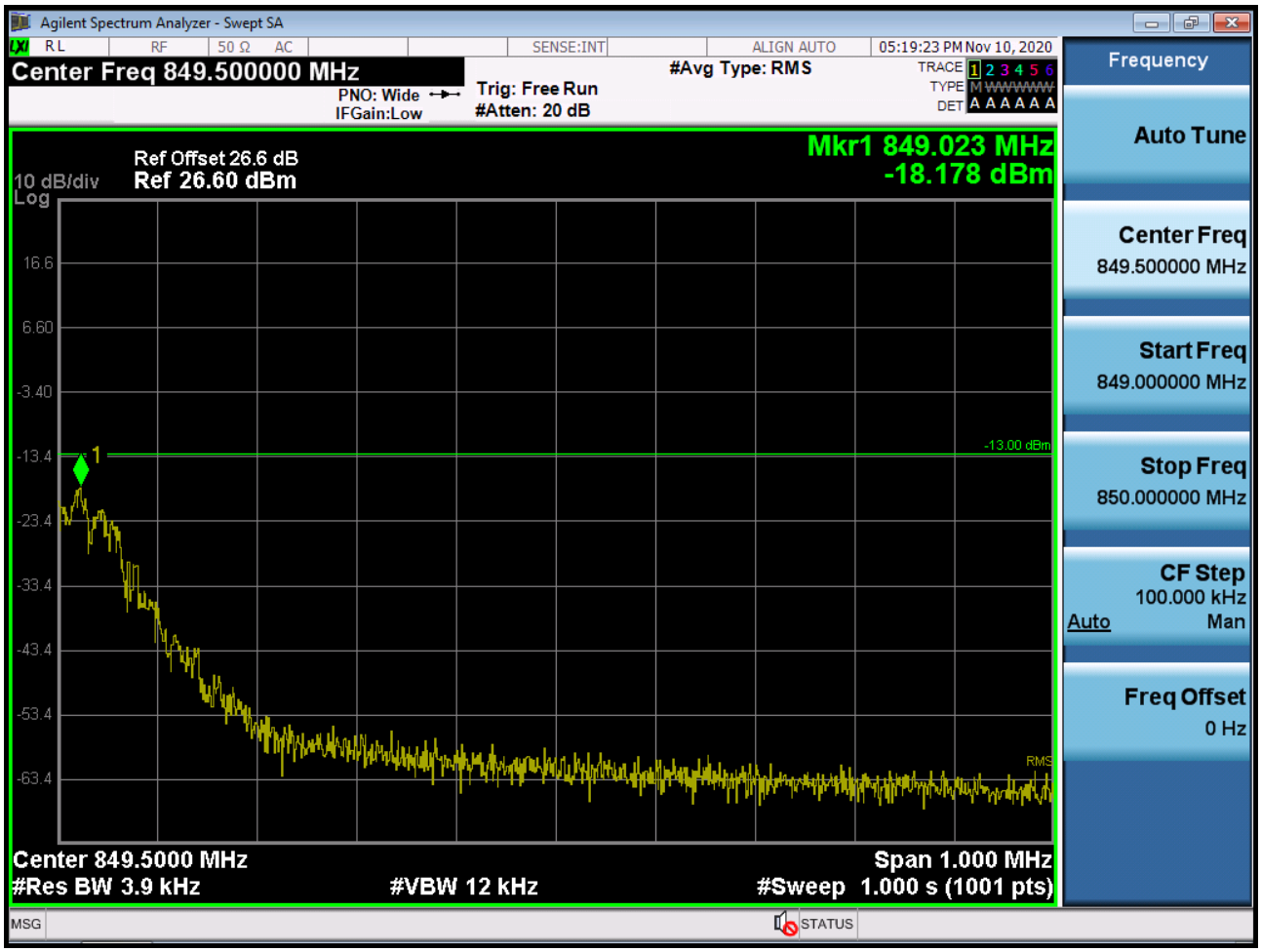


■ GSM850 MODE (128 CH.) Block Edge 3

■ GSM850 MODE (251 CH.) Block Edge 1

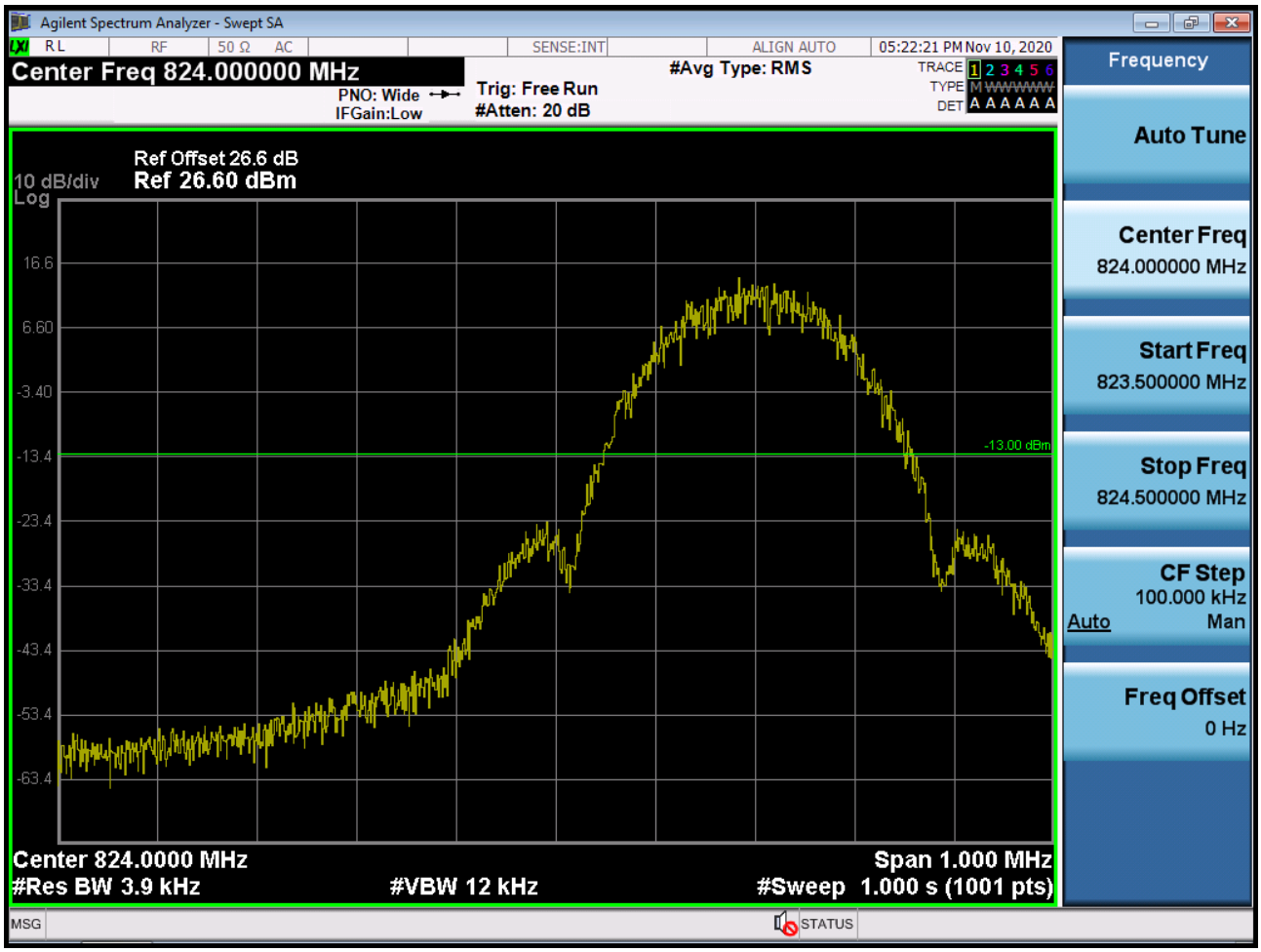


■ GSM850 MODE (251 CH.) Block Edge 2

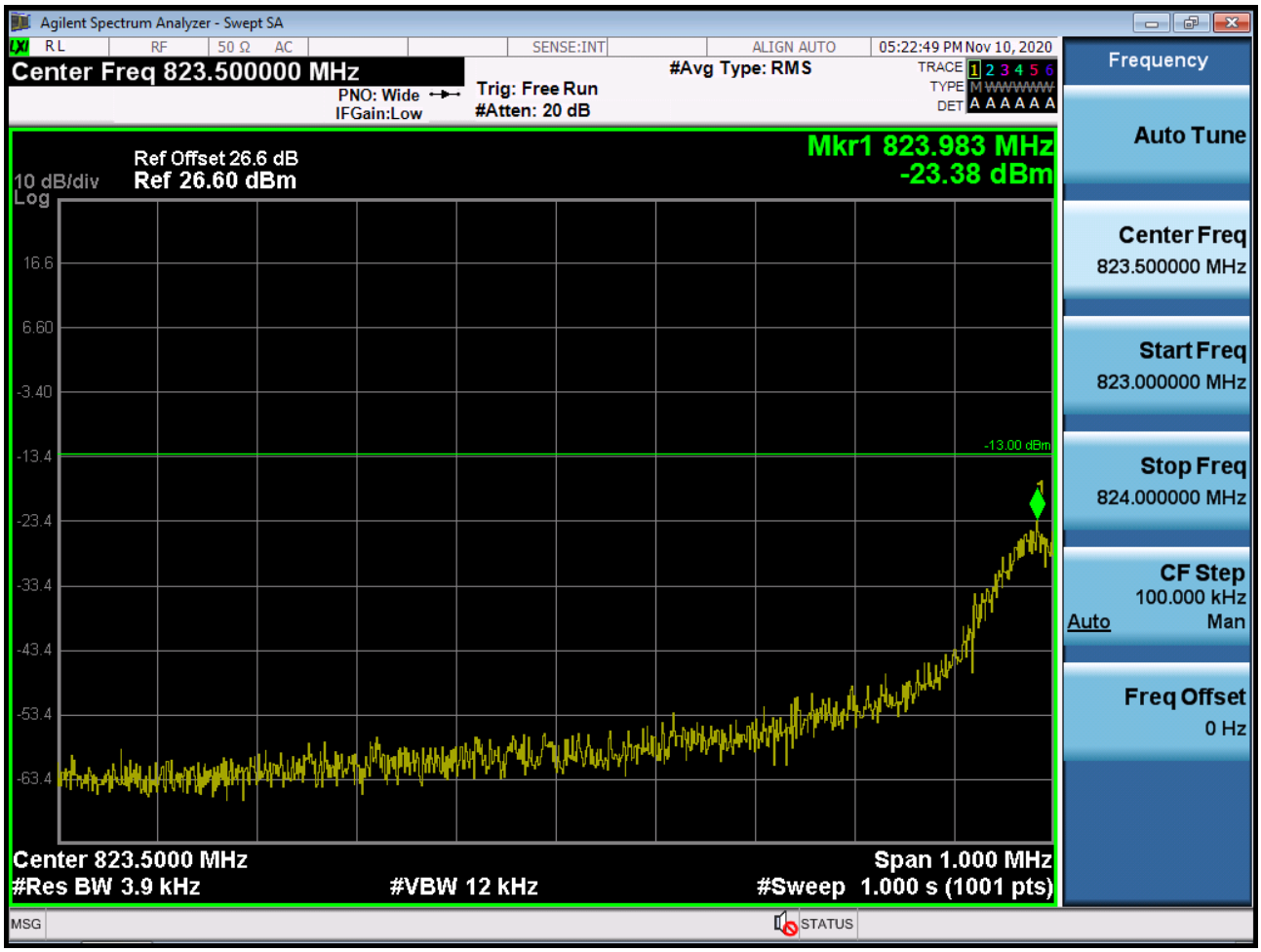


■ GSM850 MODE (251 CH.) Block Edge 3

■ EDGE MODE (128 CH.) Block Edge 1

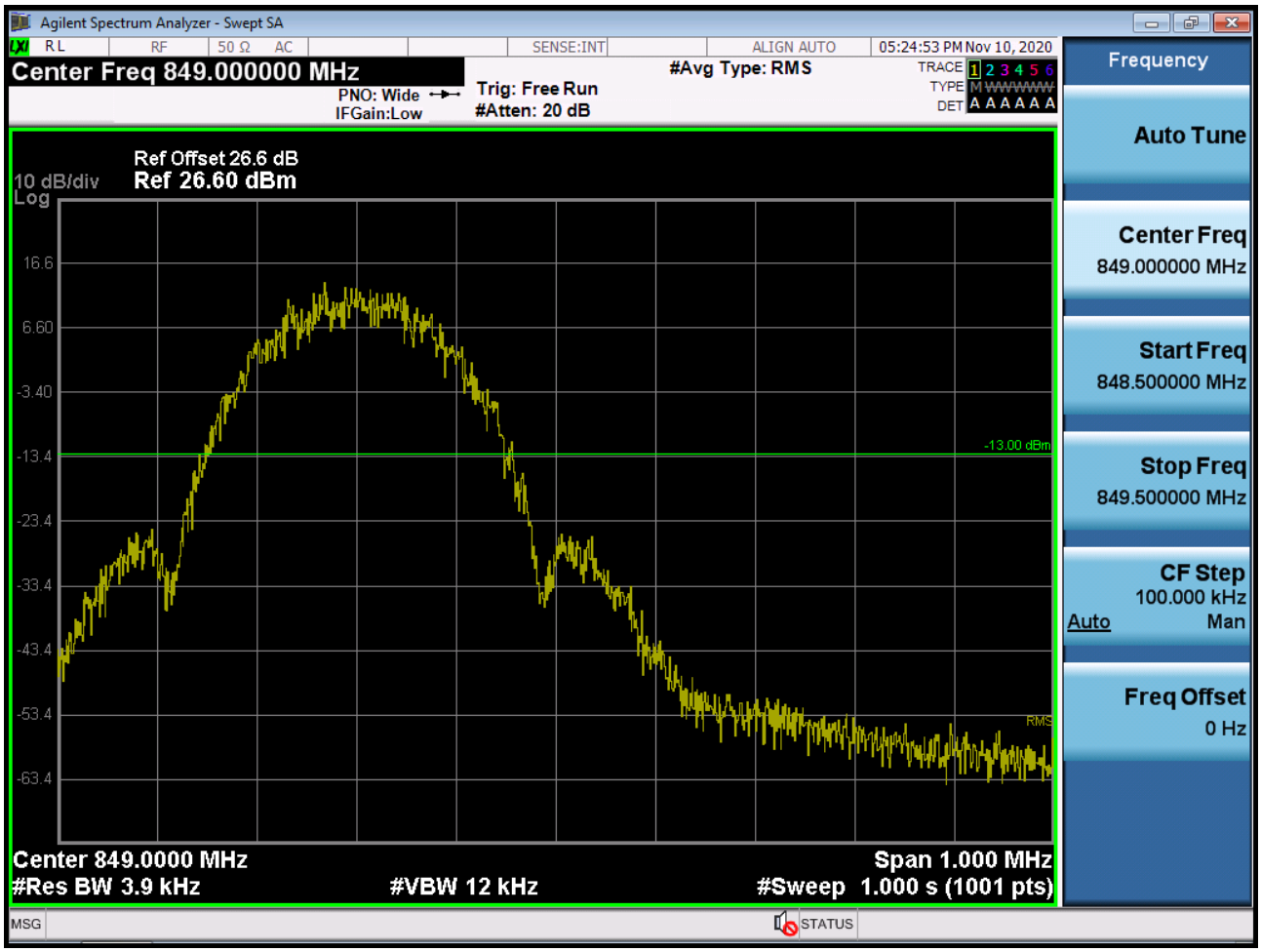


■ EDGE MODE (128 CH.) Block Edge 2

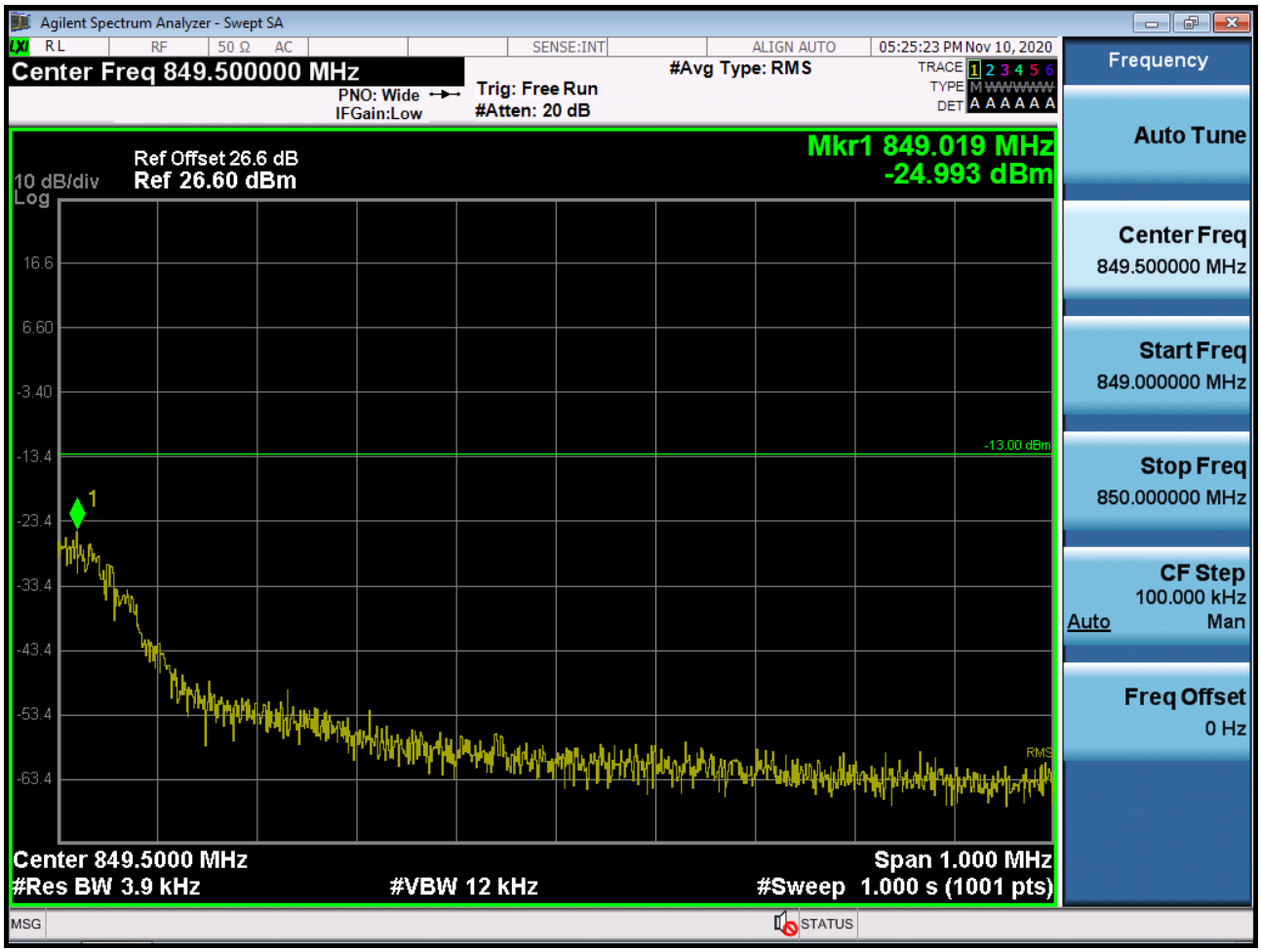


■ EDGE MODE (128 CH.) Block Edge 3

■ EDGE MODE (251 CH.) Block Edge 1

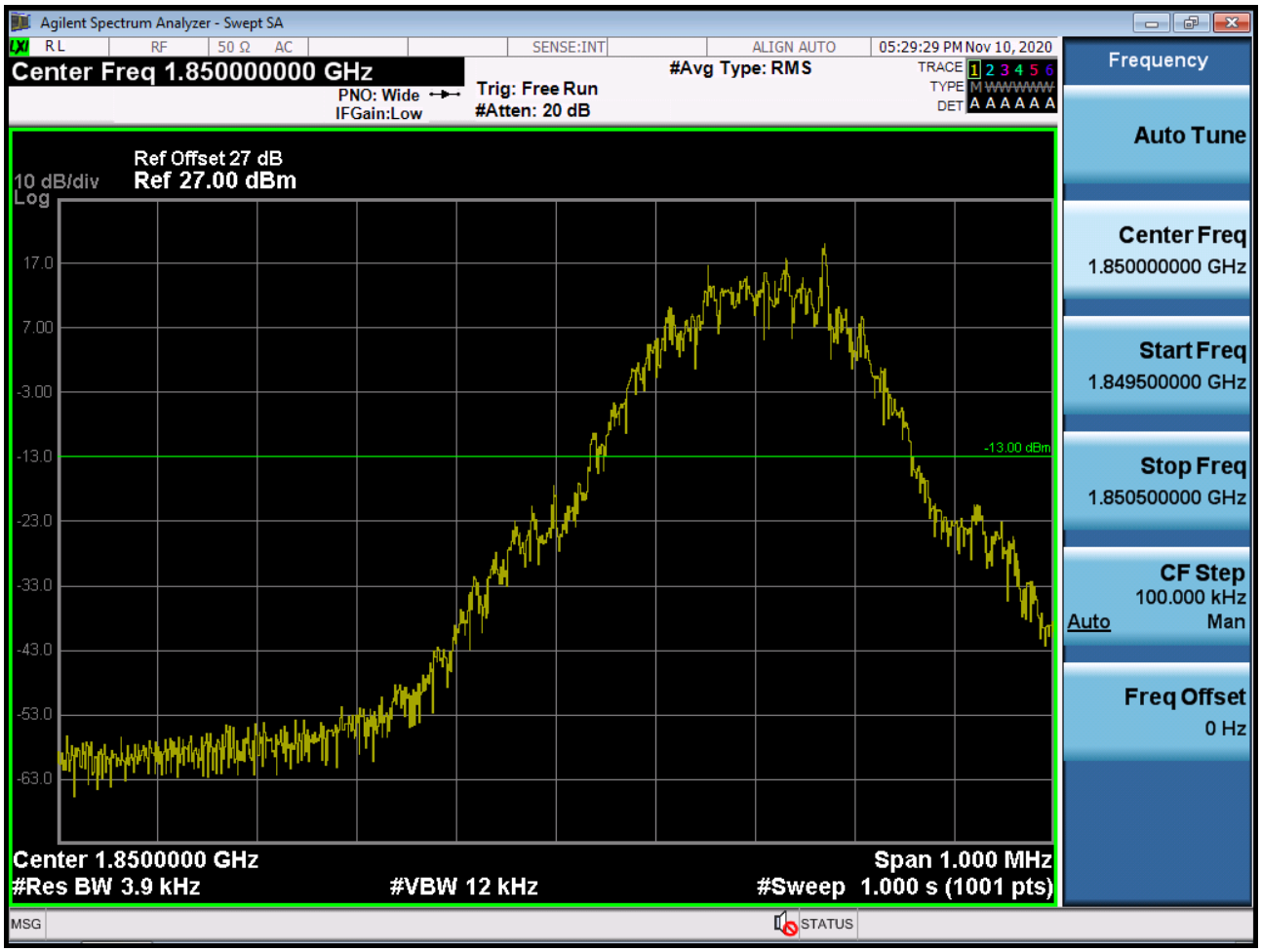


■ EDGE MODE (251 CH.) Block Edge 2

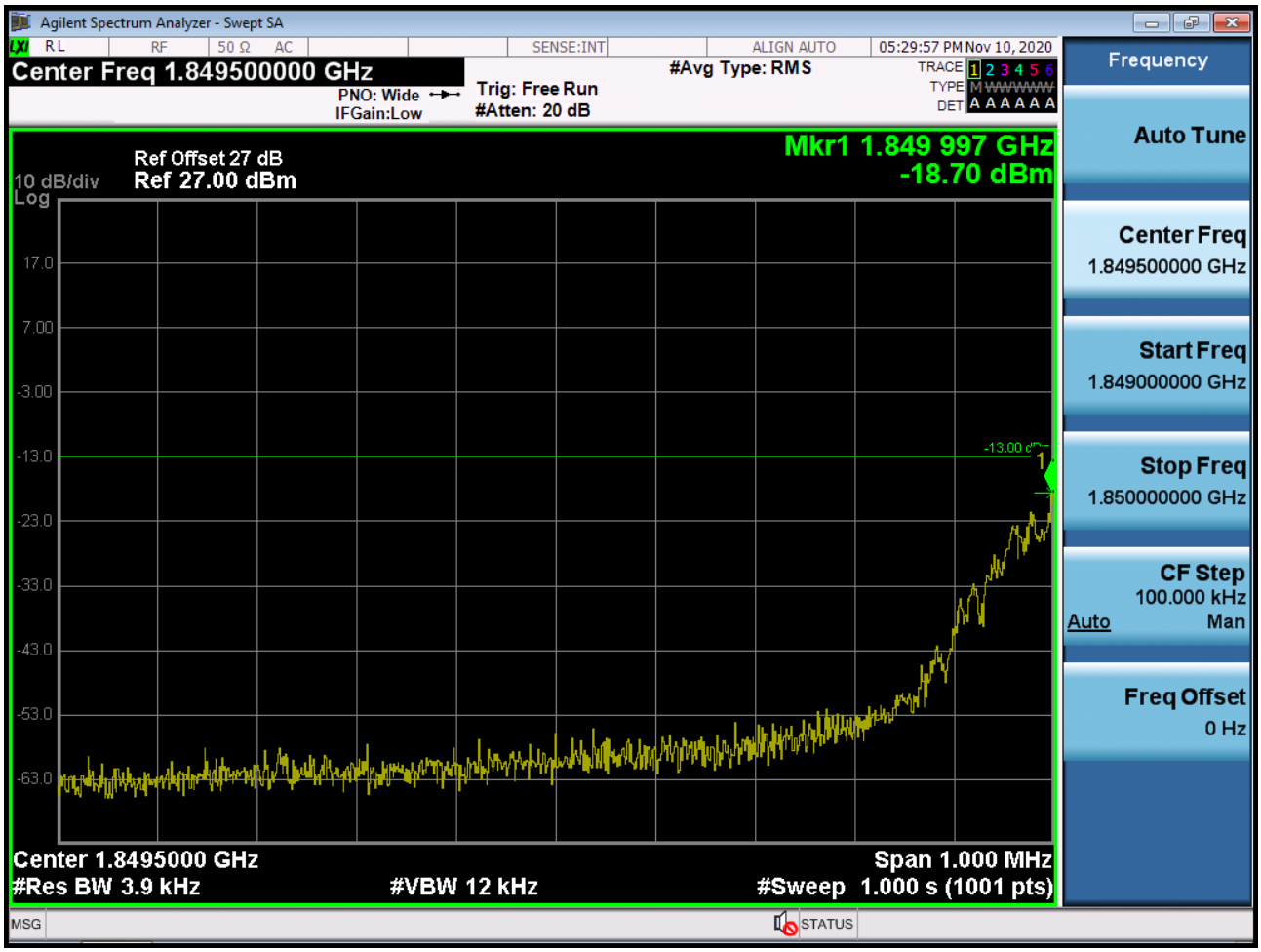


■ EDGE MODE (251 CH.) Block Edge 3

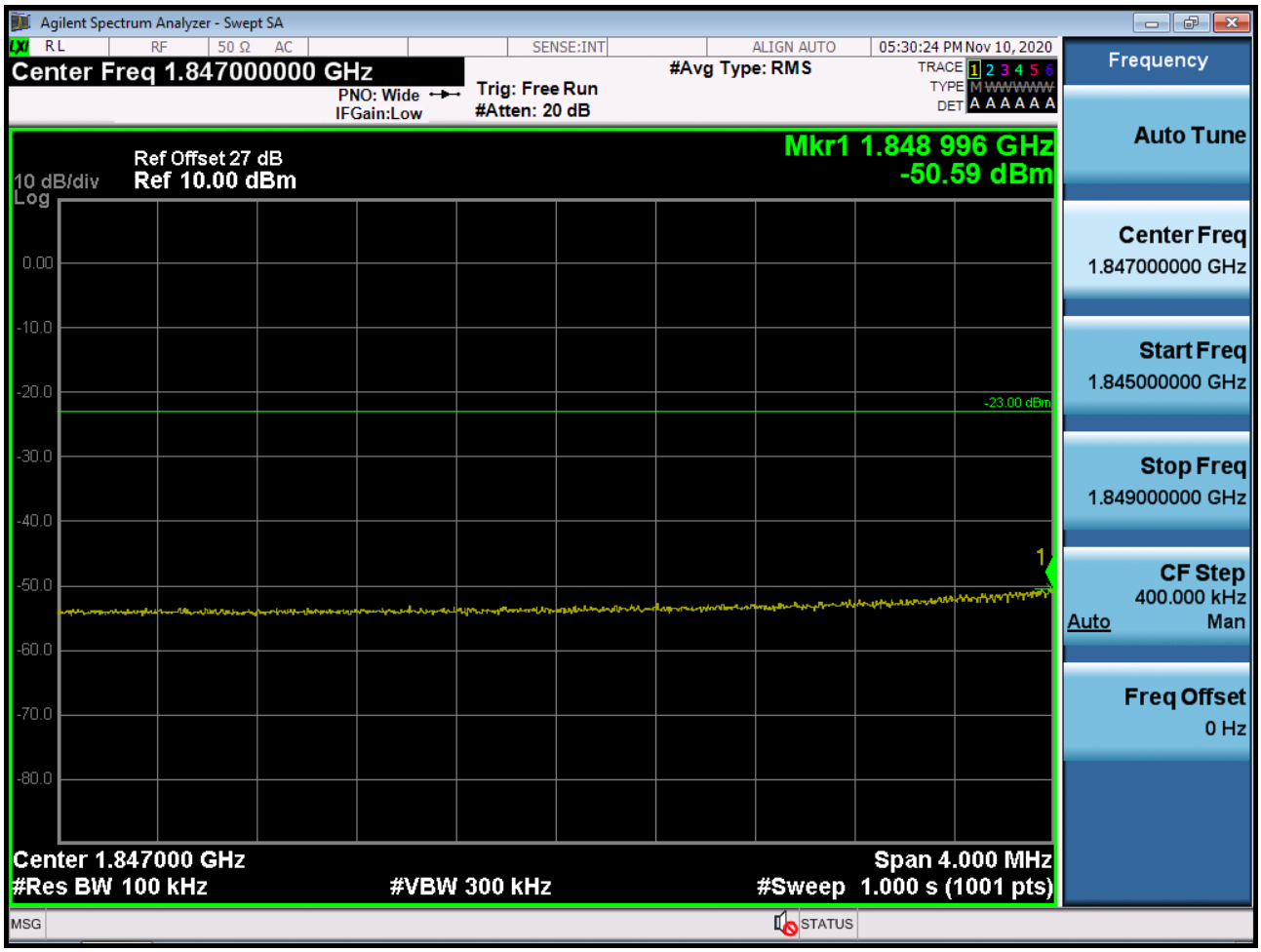
■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2



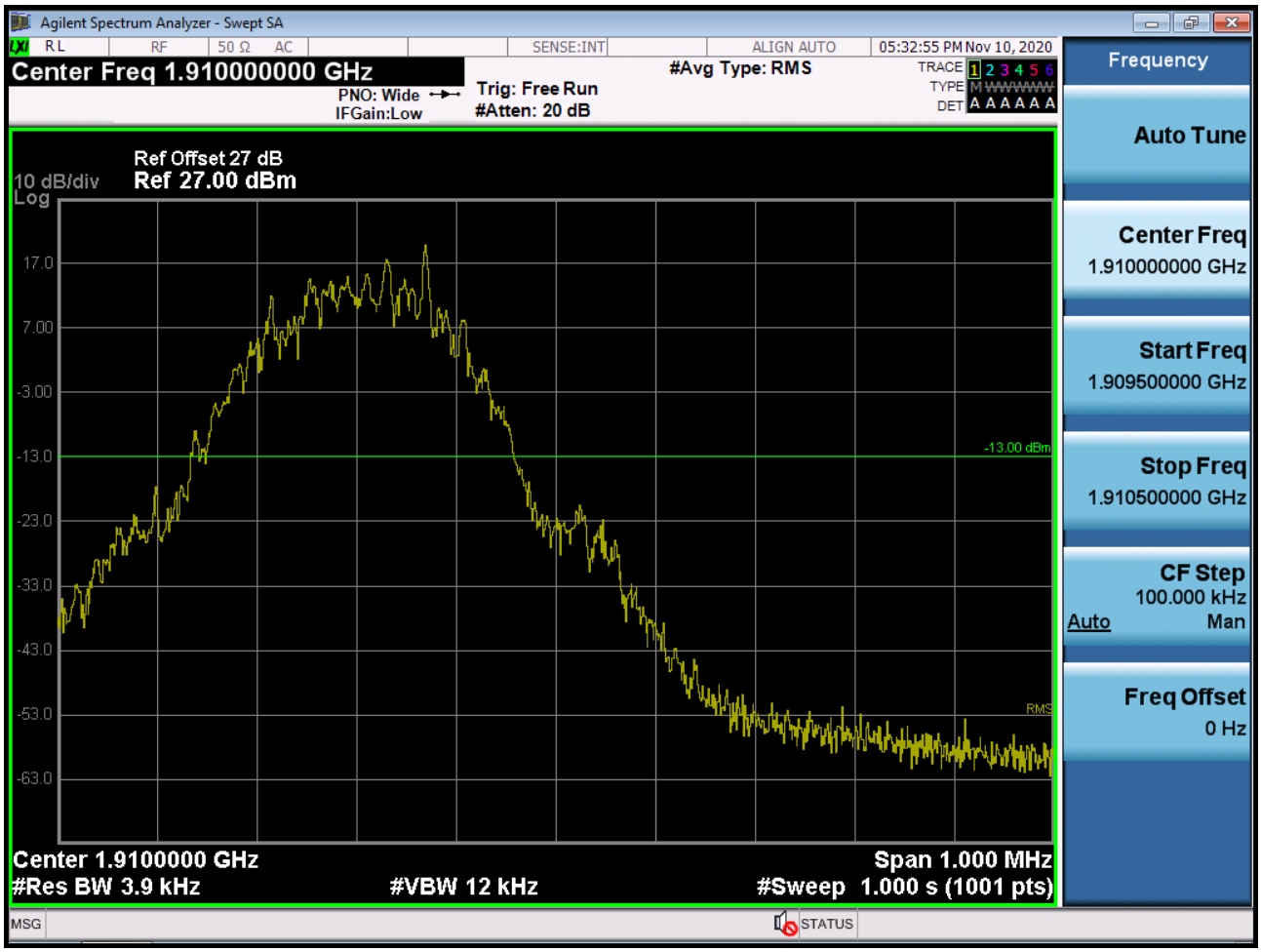
■ GSM1900 MODE (512 CH.) Block Edge 3



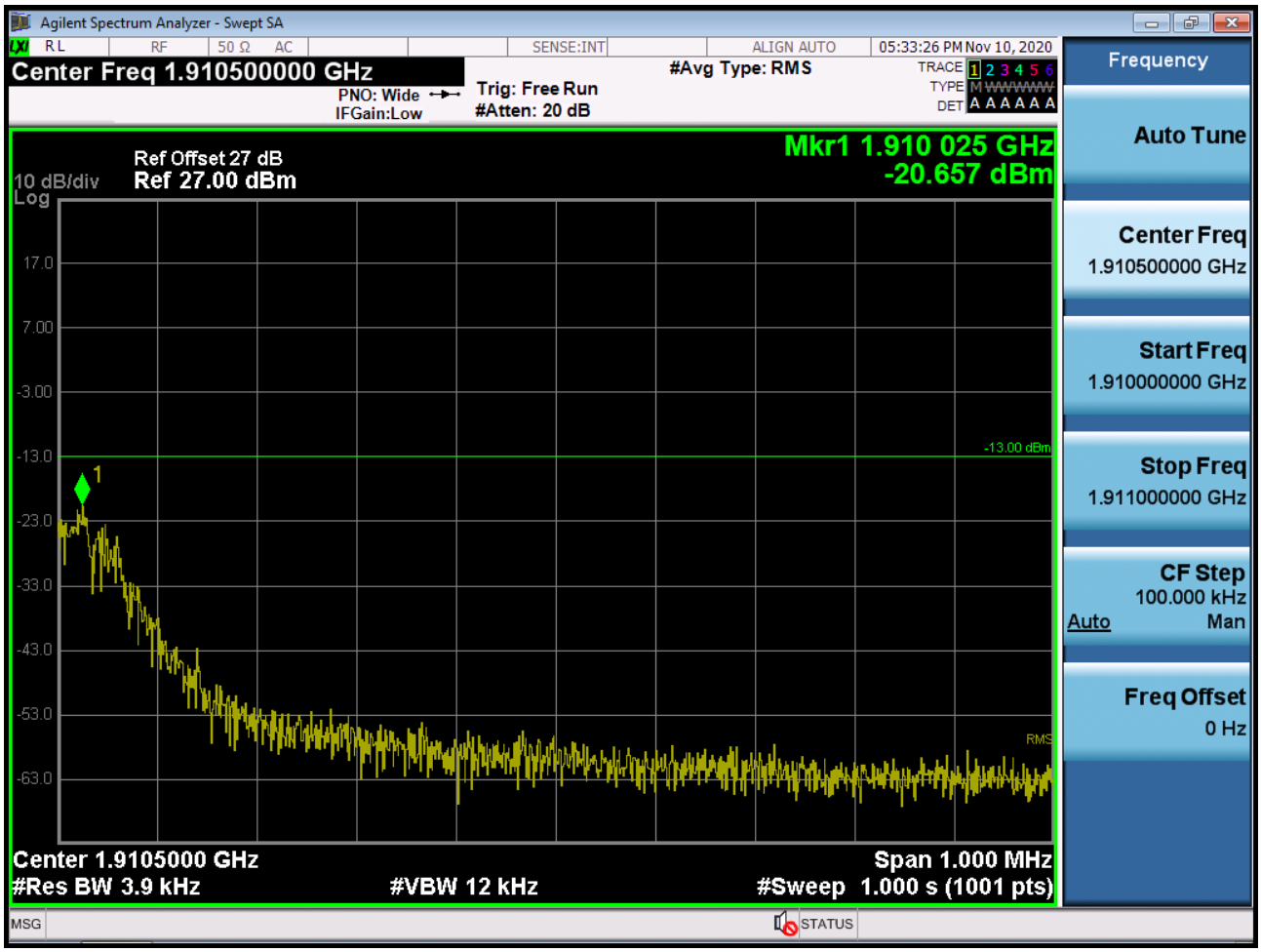
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -50.59 dBm + 10 dB = -40.59 dBm

■ GSM1900 MODE (810 CH.) Block Edge 1



■ GSM1900 MODE (810 CH.) Block Edge 2

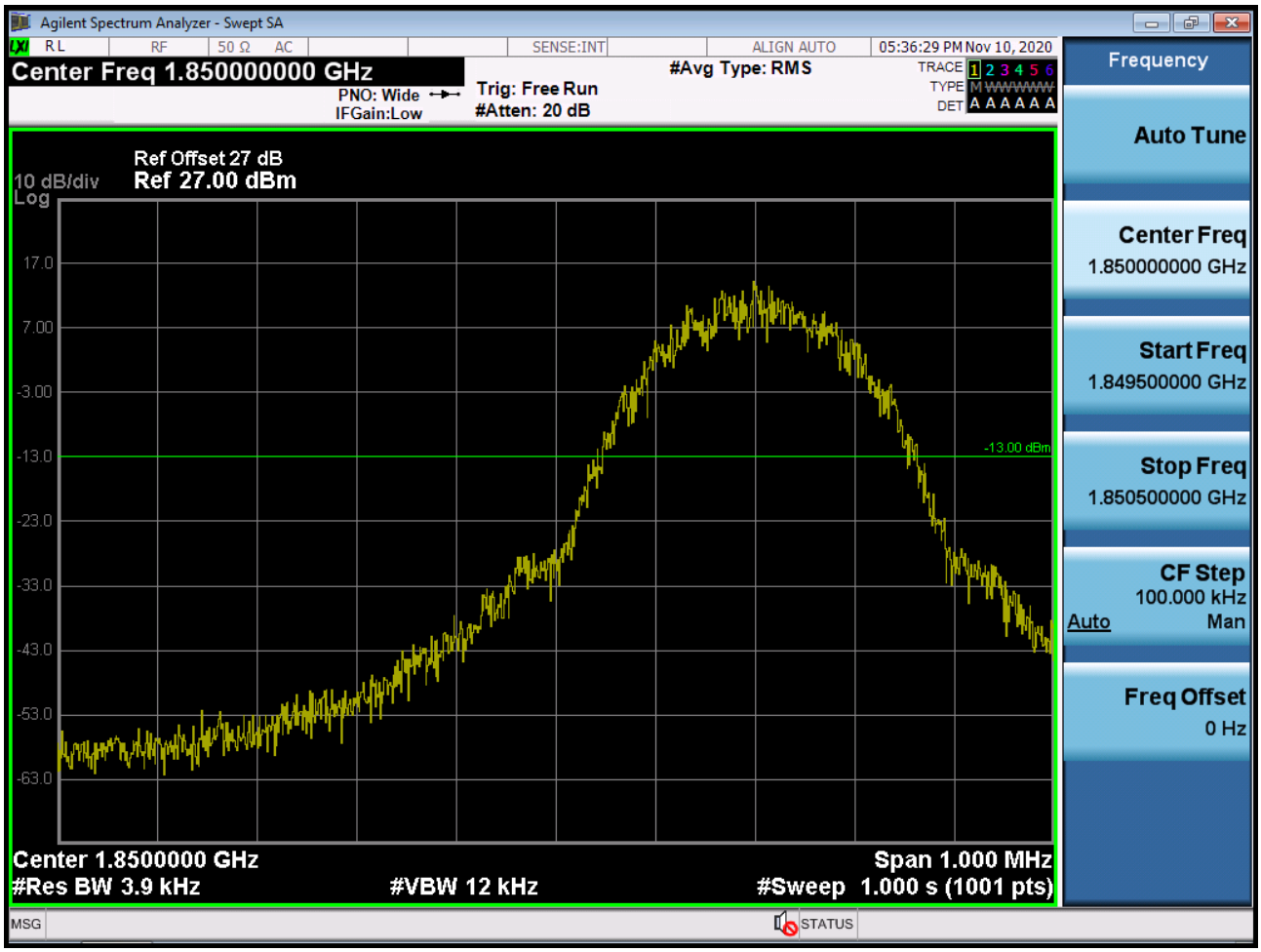


■ GSM1900 MODE (810 CH.) Block Edge 3

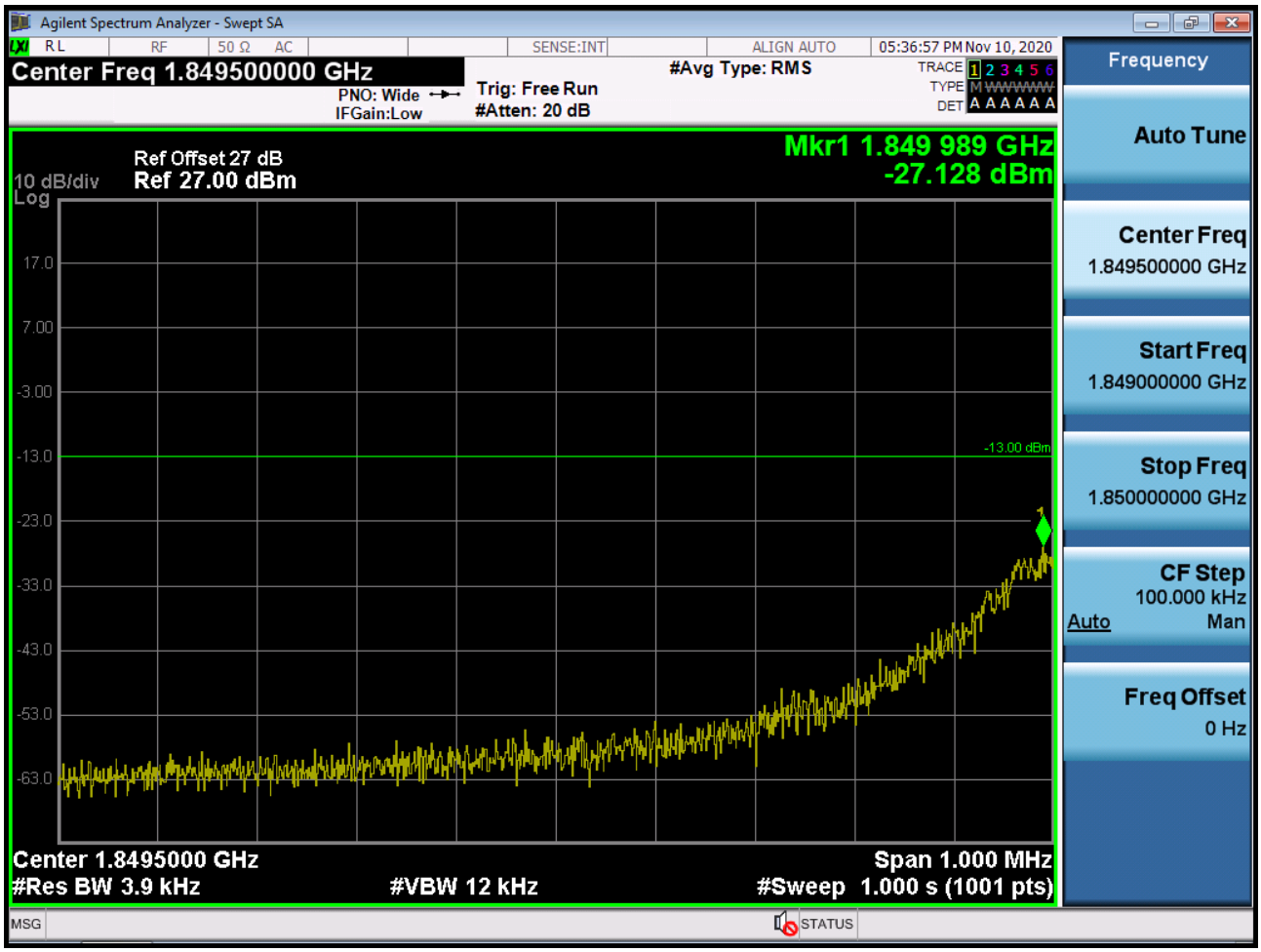
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -49.860 dBm + 10 dB = -39.860 dBm

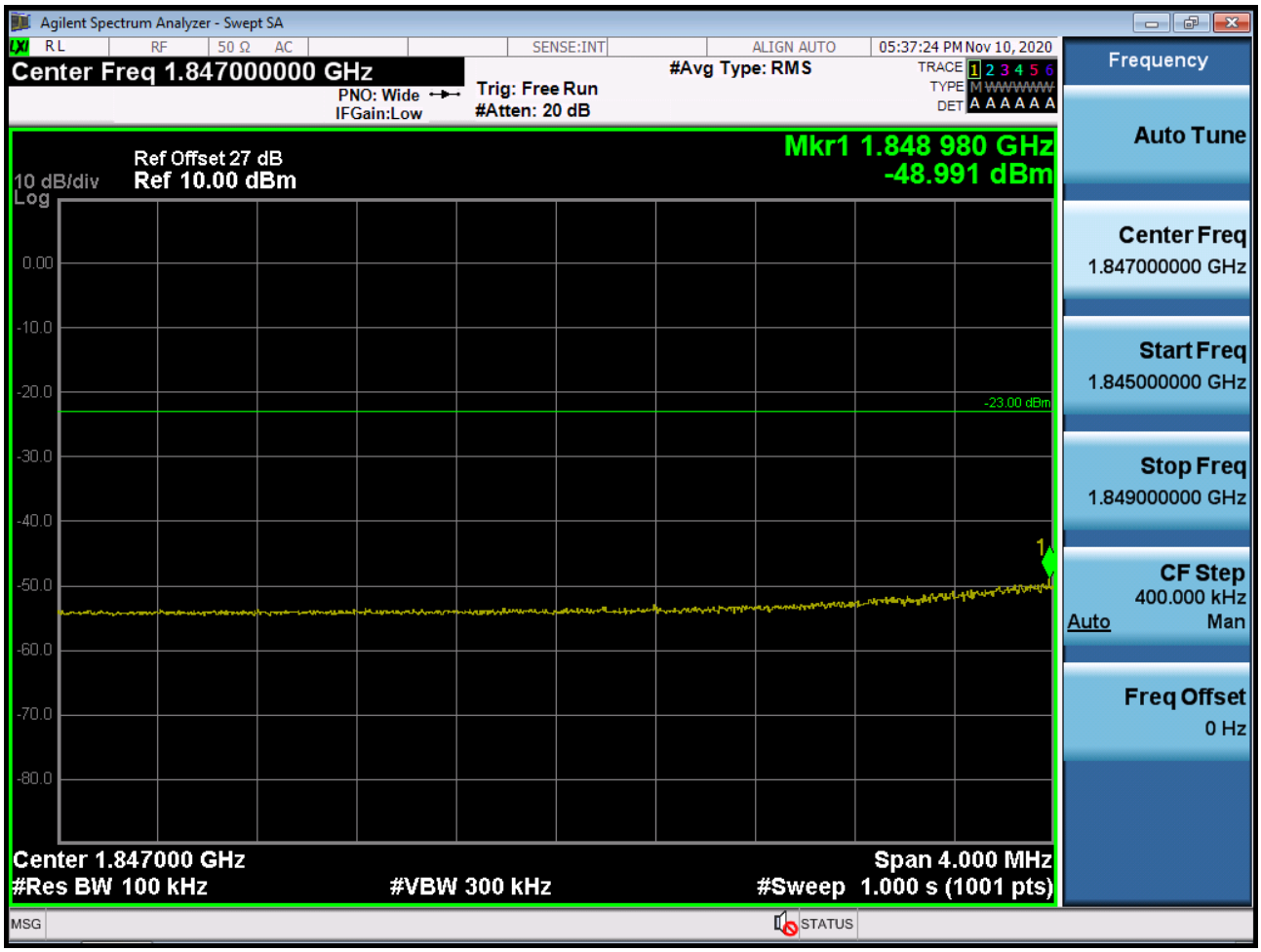
■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



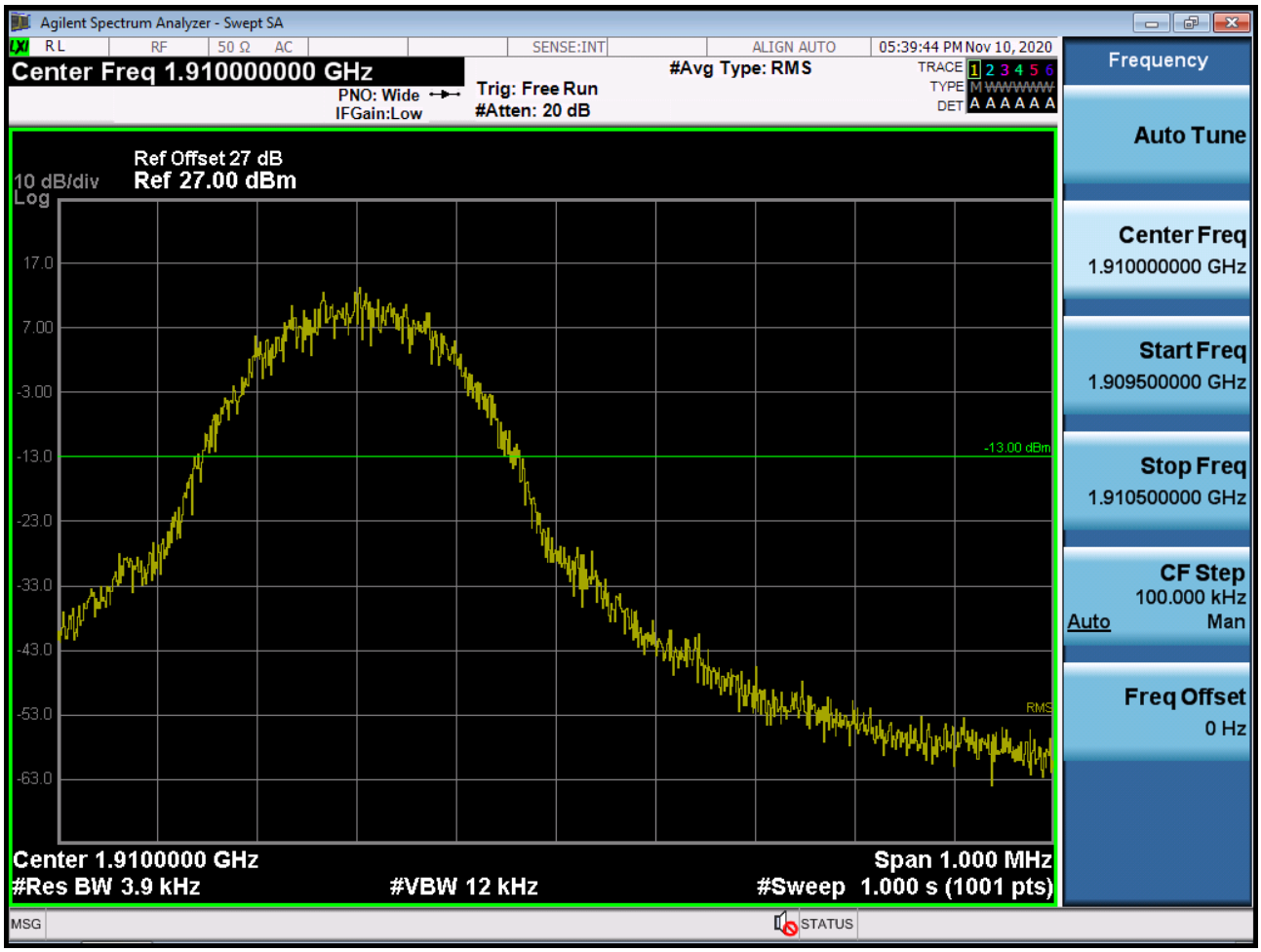
■ EDGE MODE (512 CH.) Block Edge 3



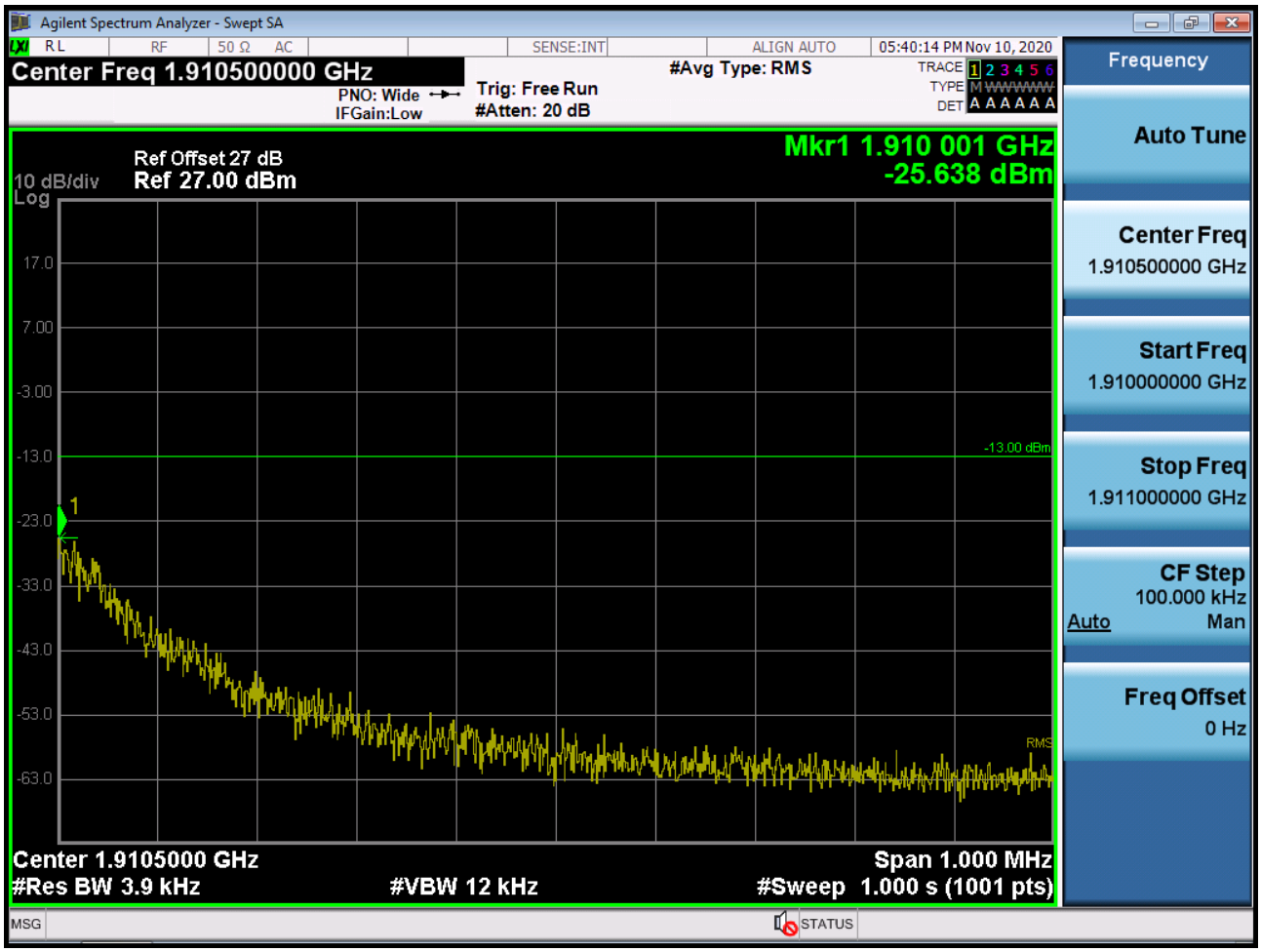
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -48.991 dBm + 10 dB = -38.991 dBm

■ EDGE MODE (810 CH.) Block Edge 1



■ EDGE MODE (810 CH.) Block Edge 2



■ EDGE MODE (810 CH.) Block Edge 3

Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -49.806 dBm + 10 dB = -39.806 dBm

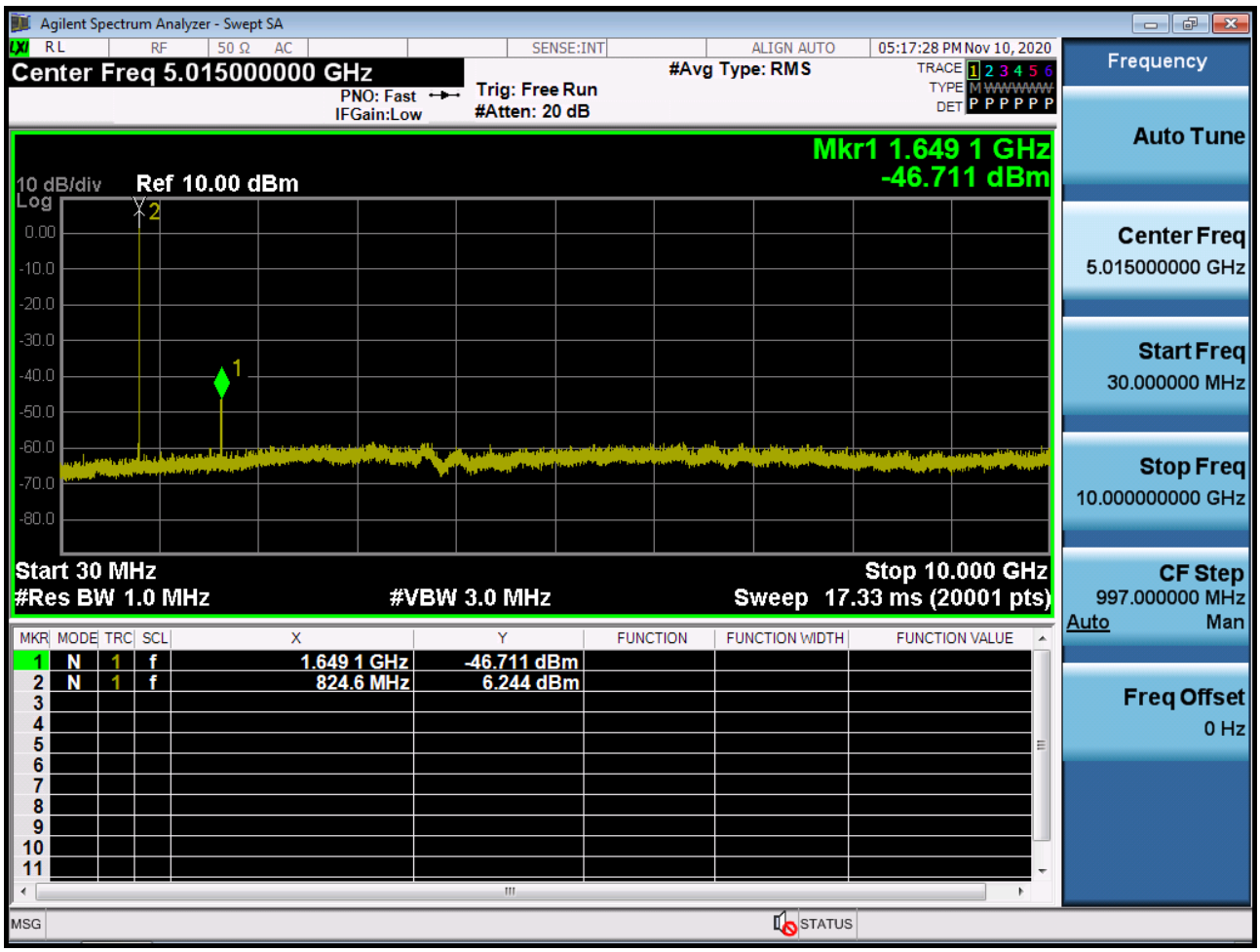
■ WCDMA850 MODE (4132 CH.) Block Edge

■ WCDMA850 MODE (4132 CH.) – 4 MHz Span

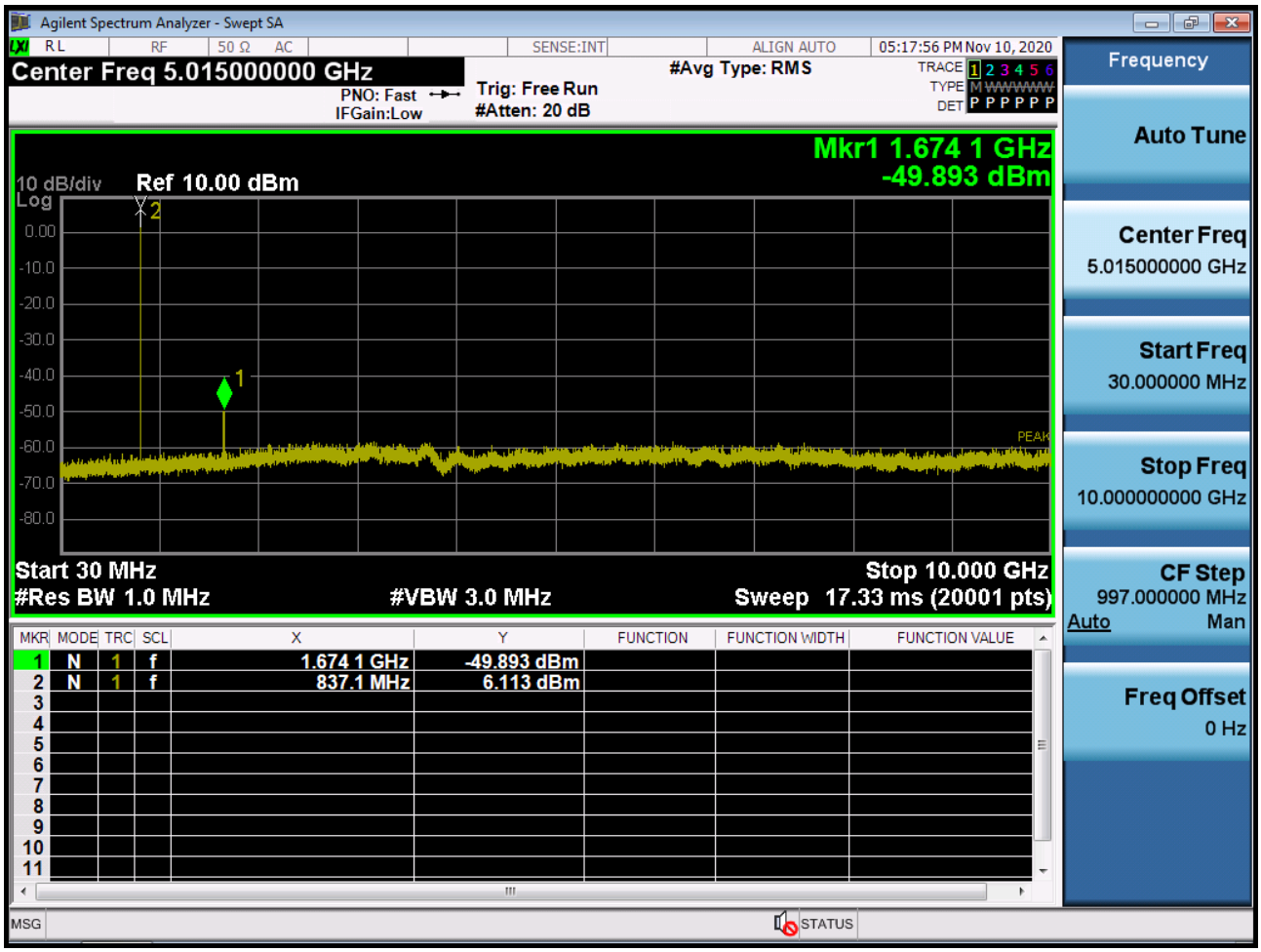
■ WCDMA850MODE (4233 CH.) Block Edge

■ WCDMA850MODE (4233 CH.) – 4 MHz Span

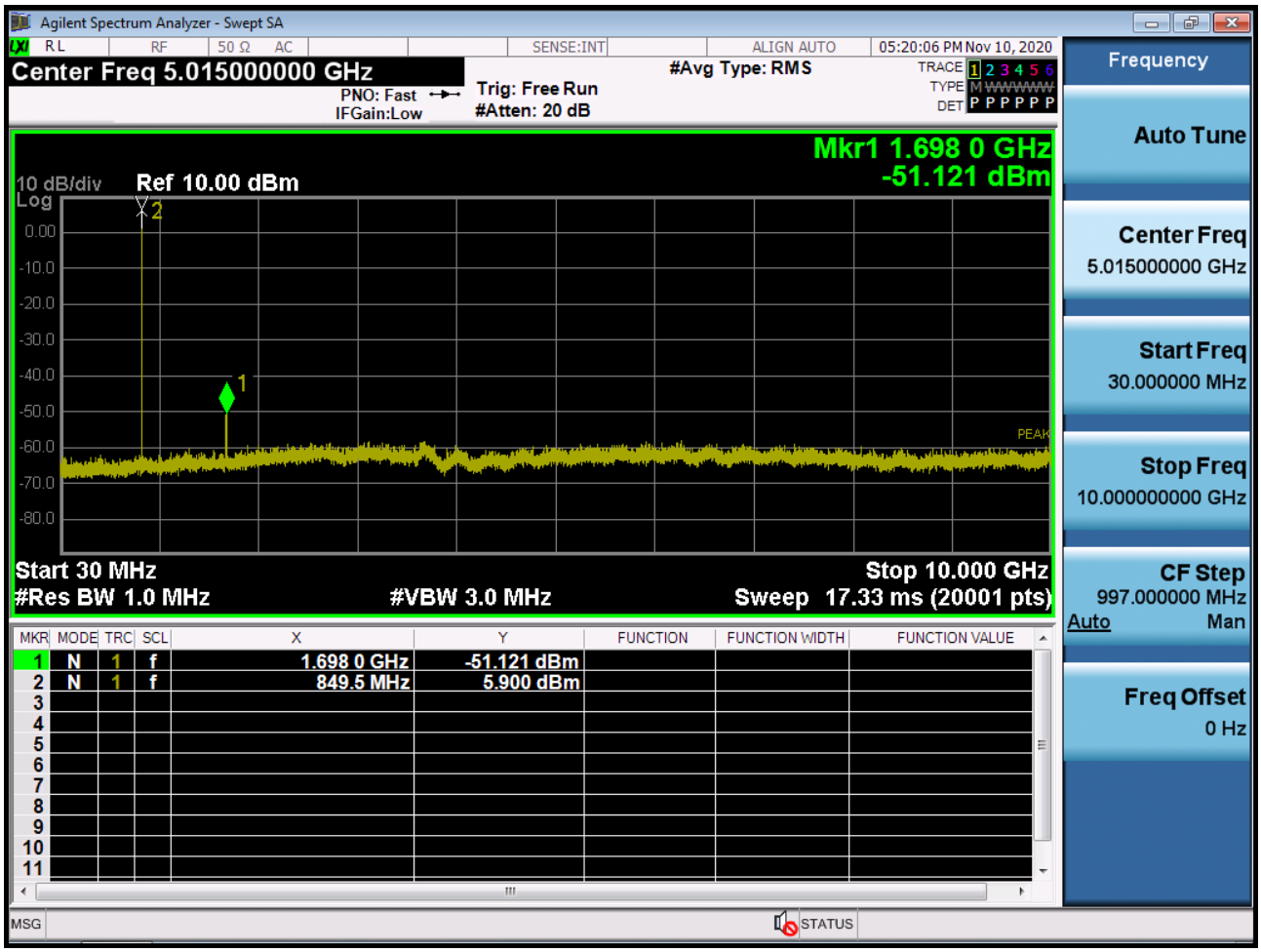
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions



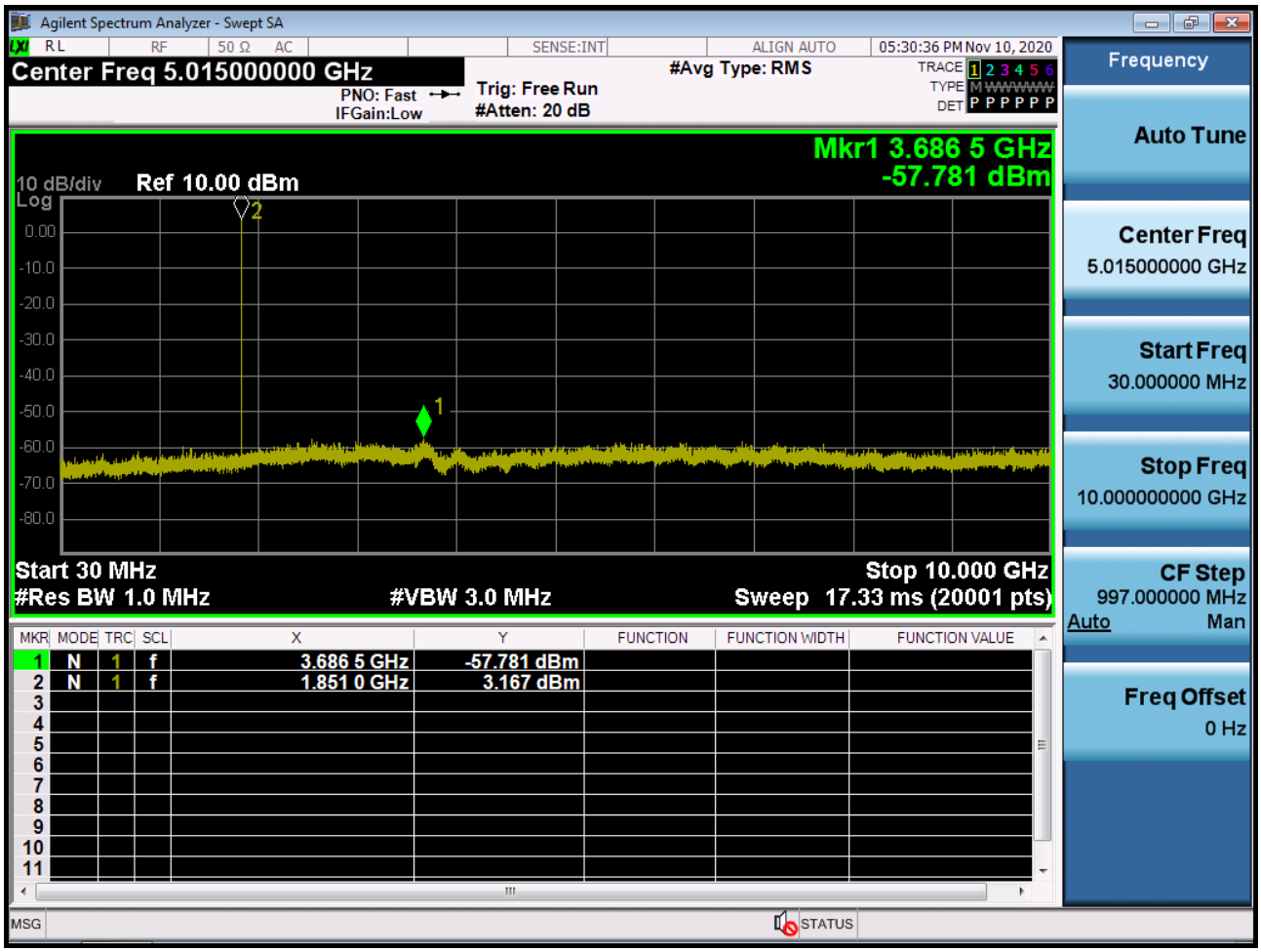
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions



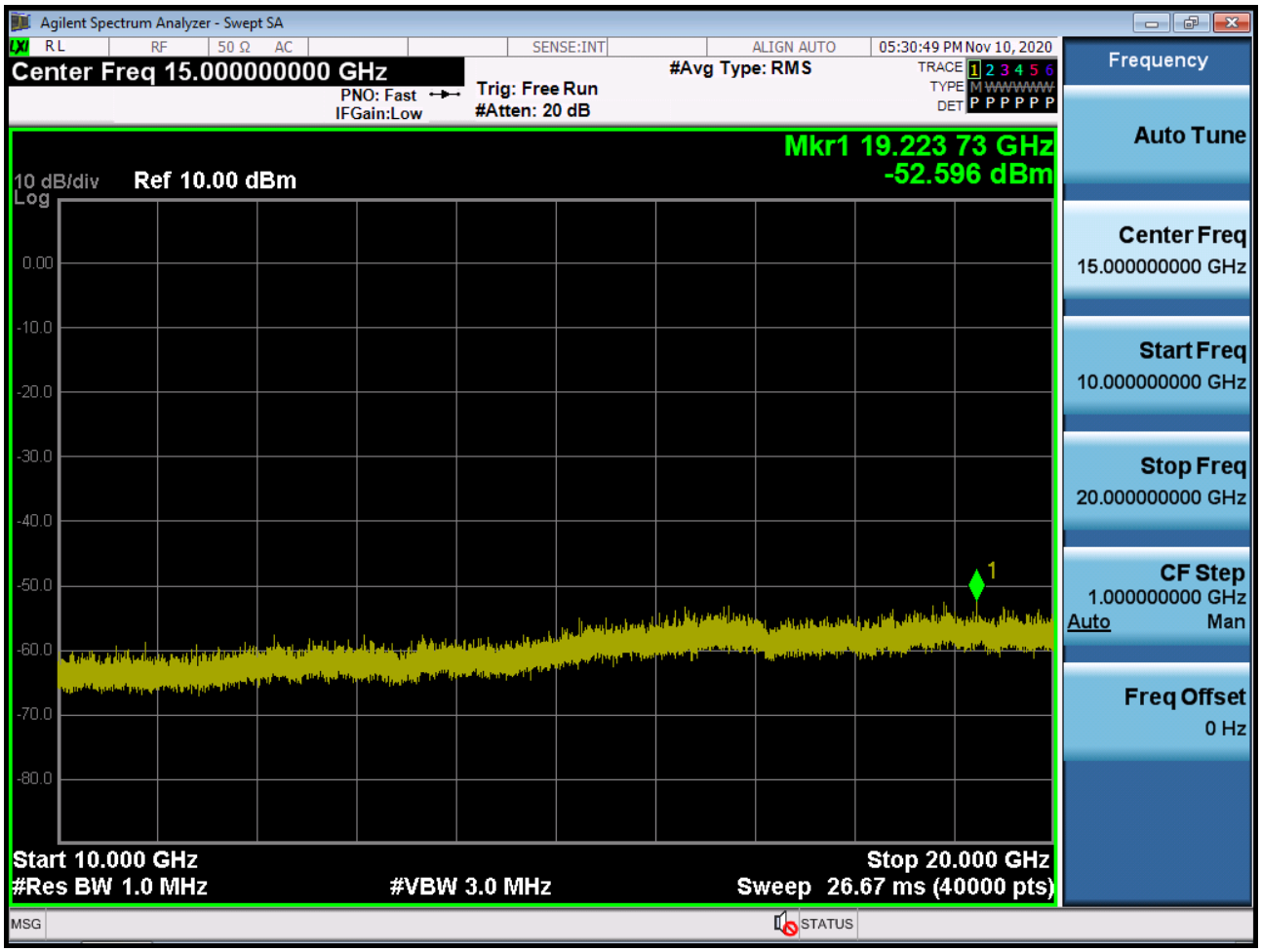
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions



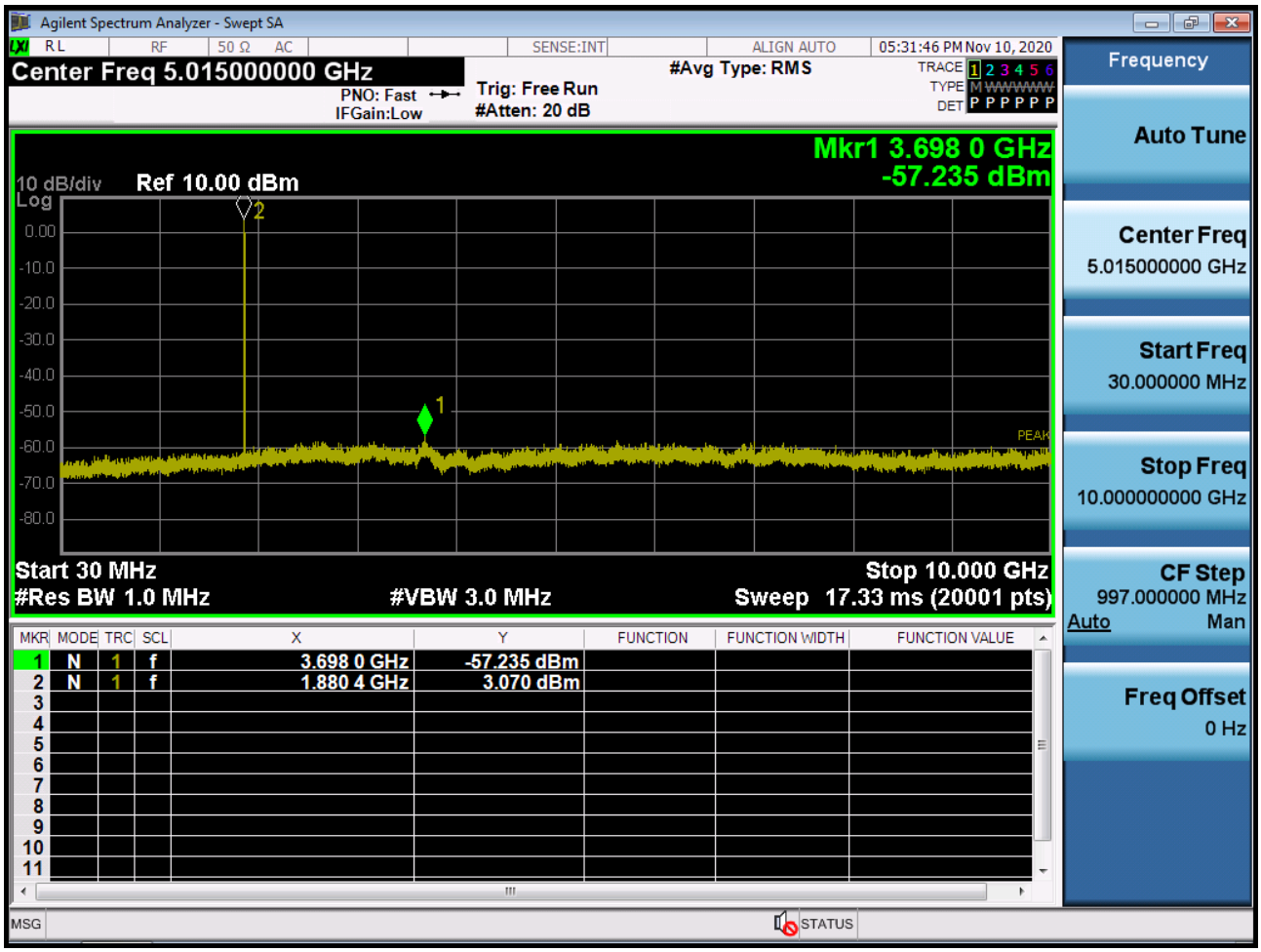
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



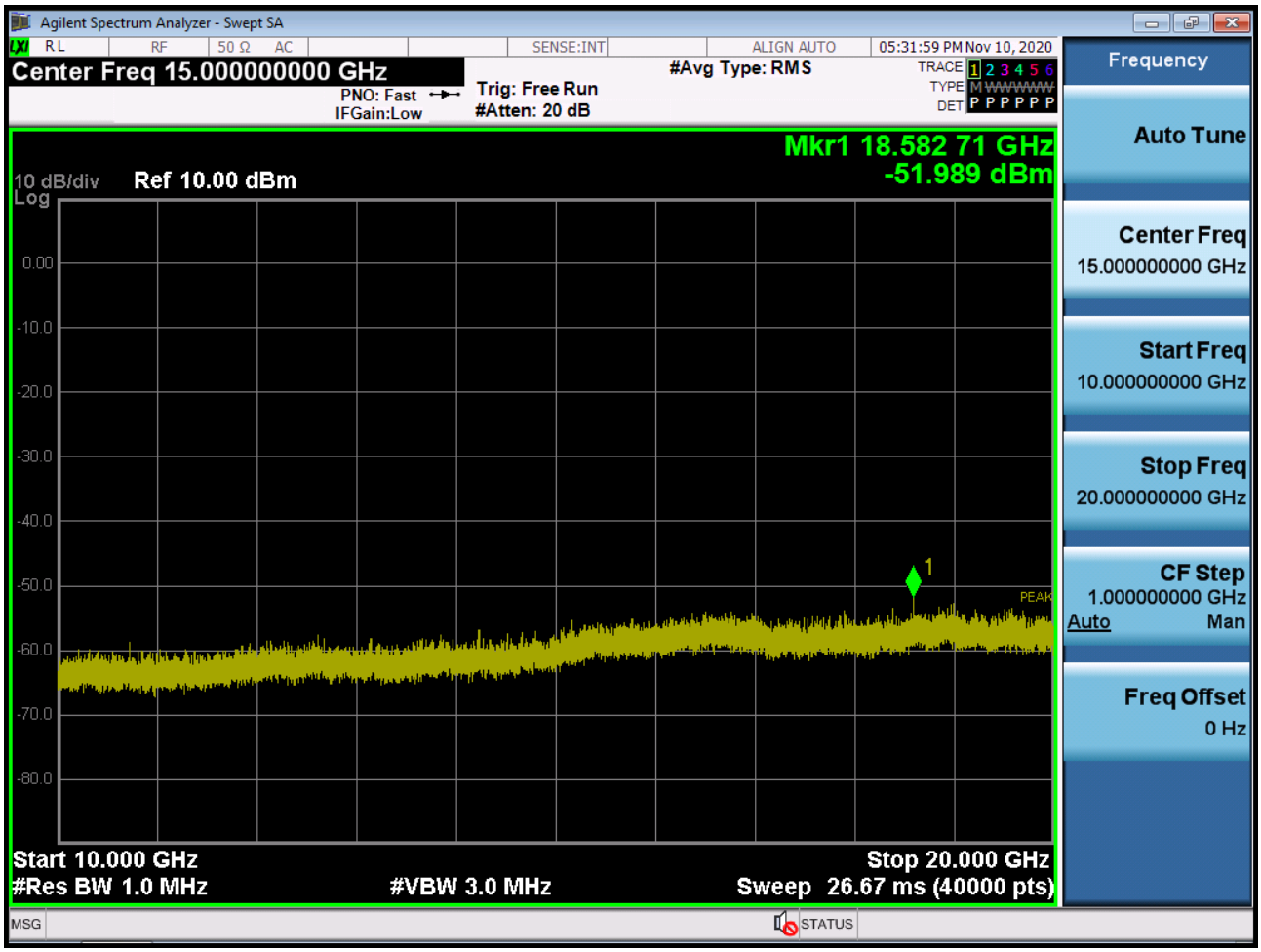
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



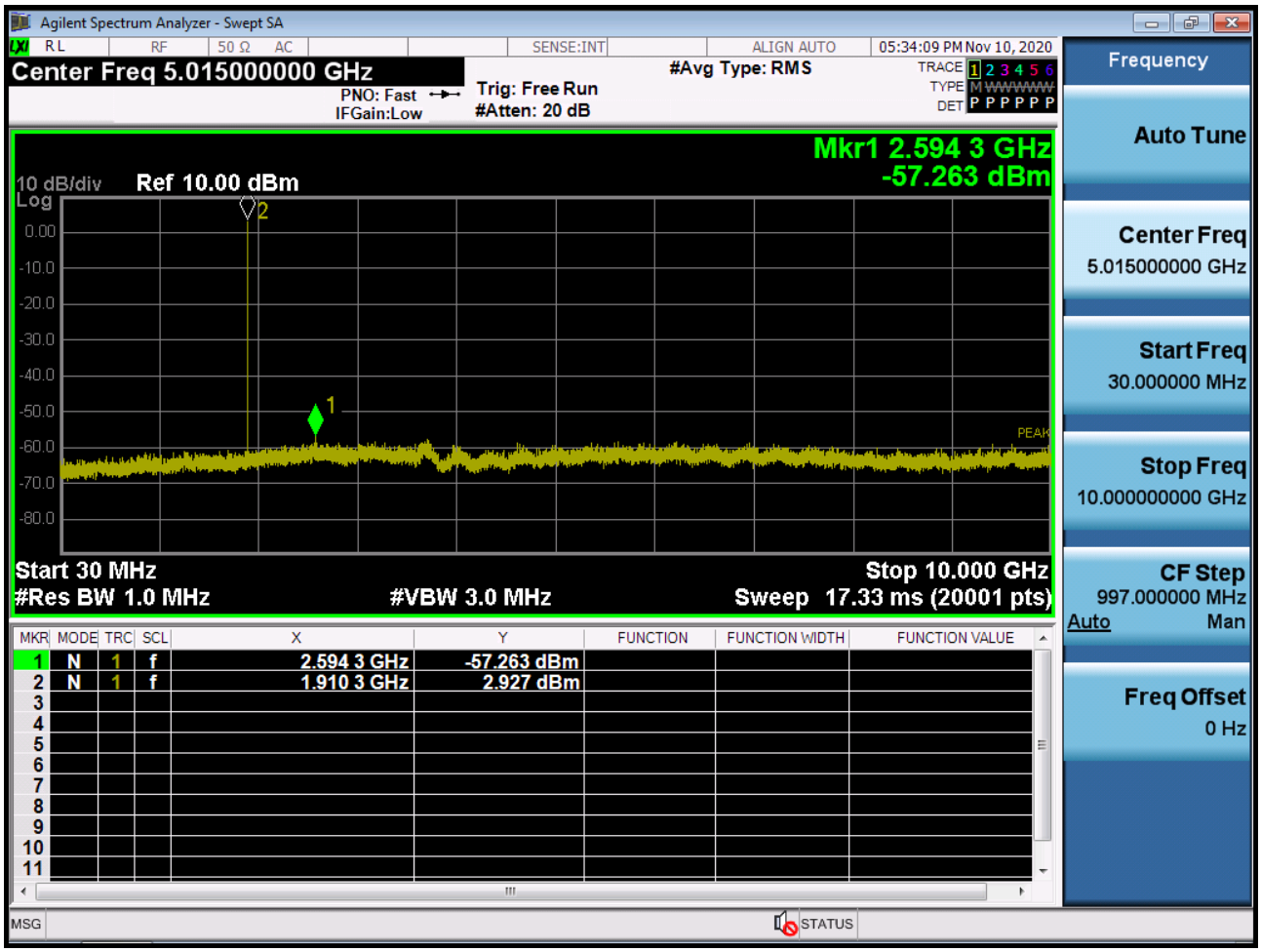
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



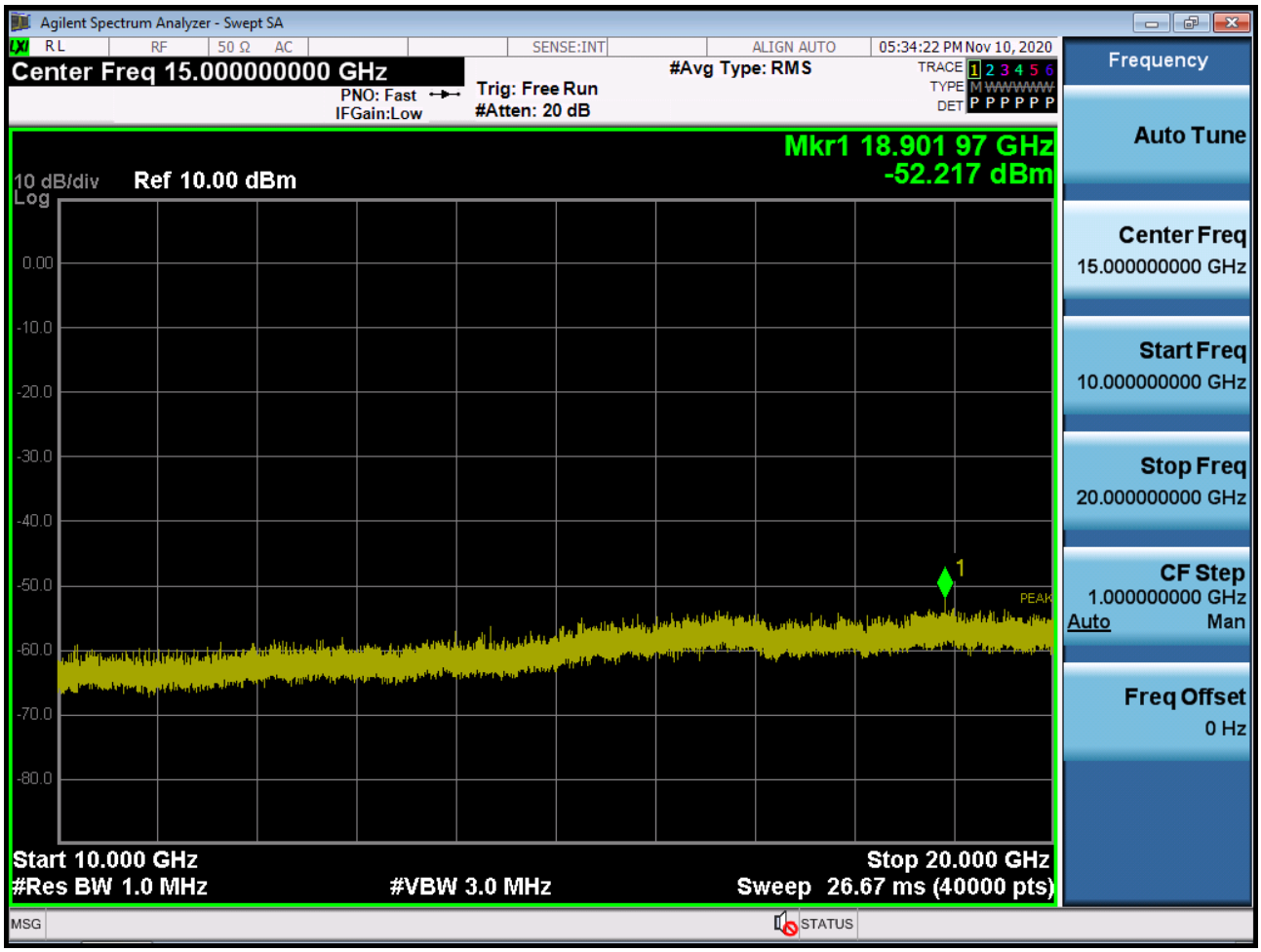
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



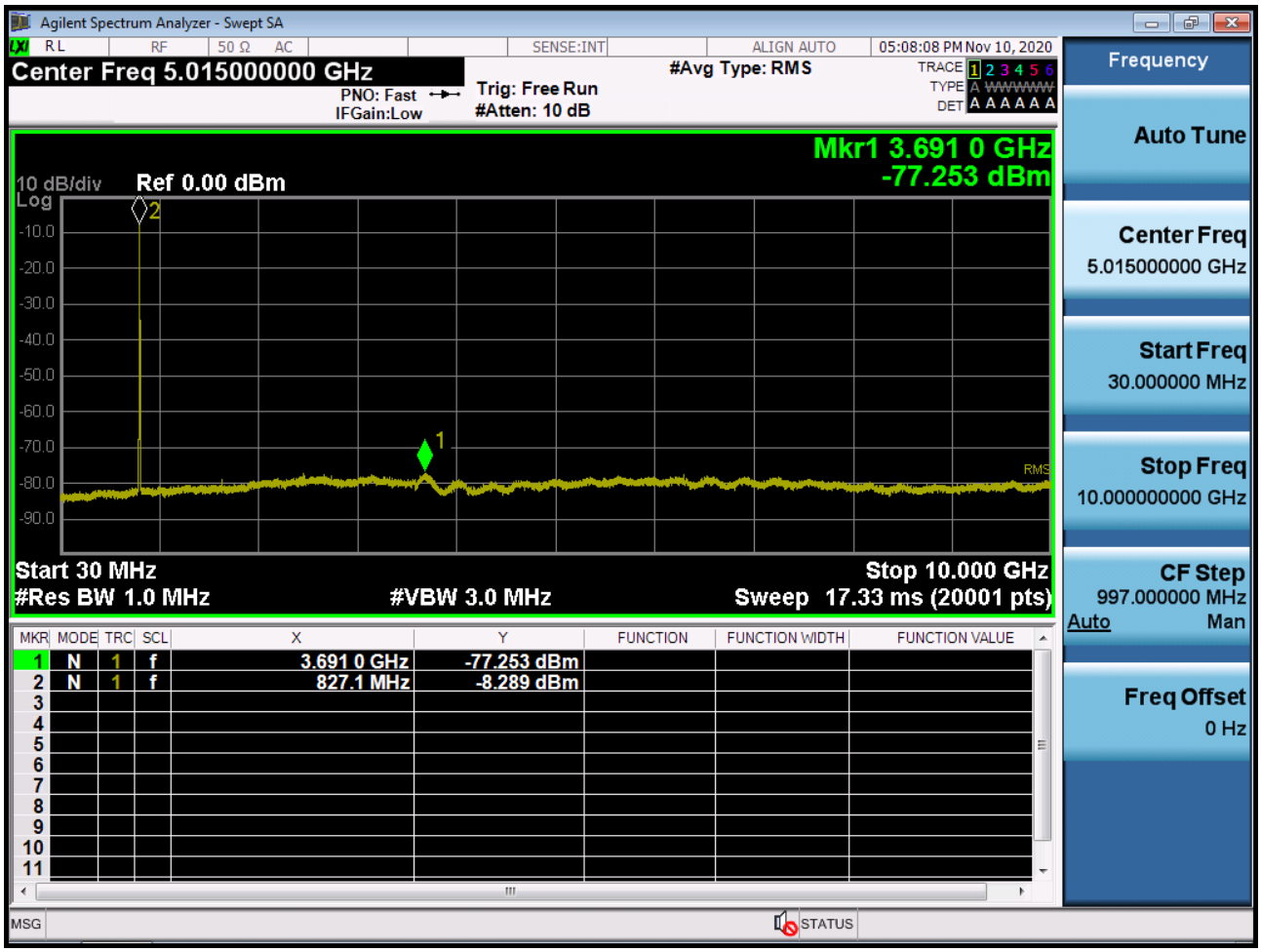
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



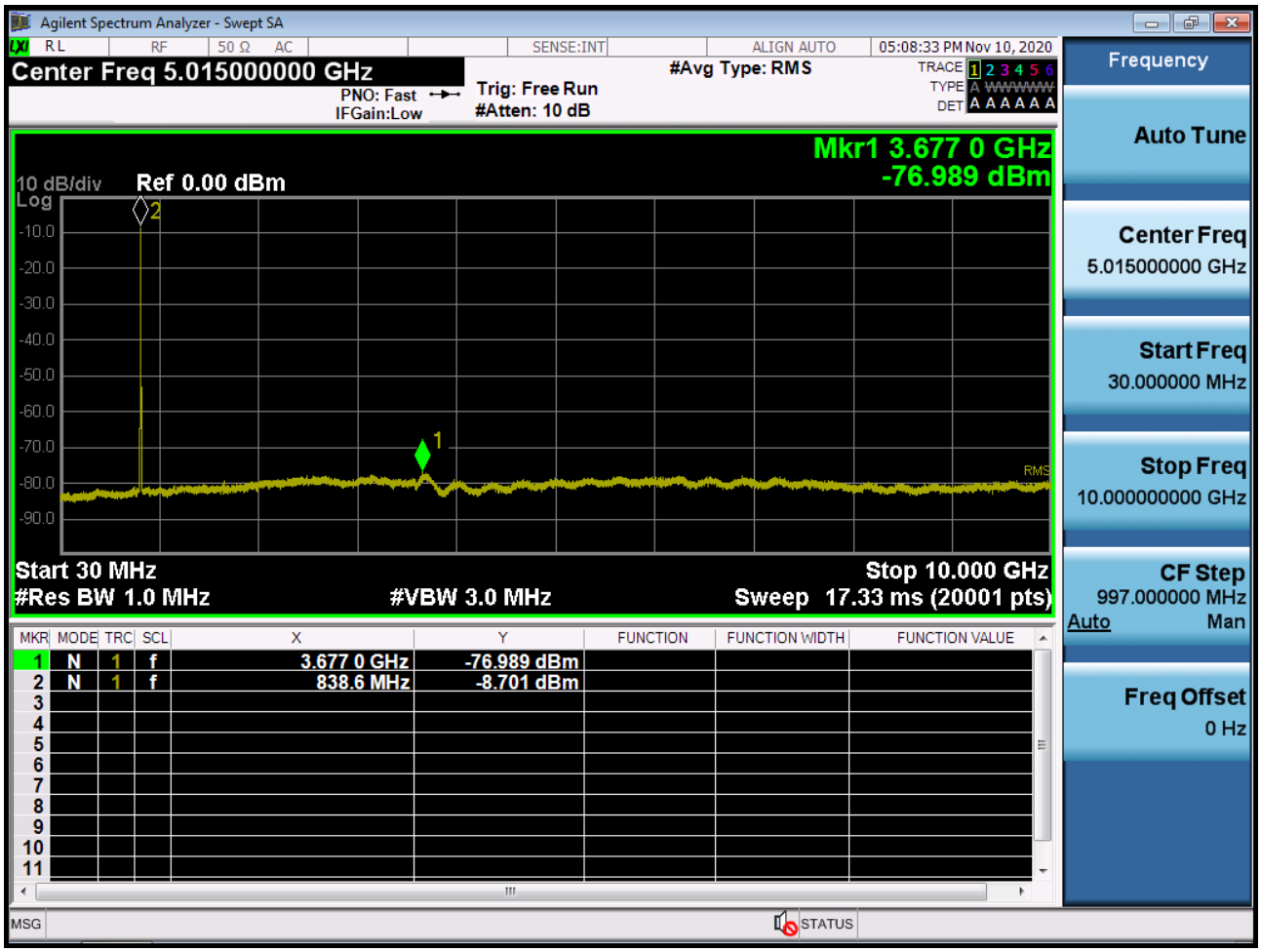
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



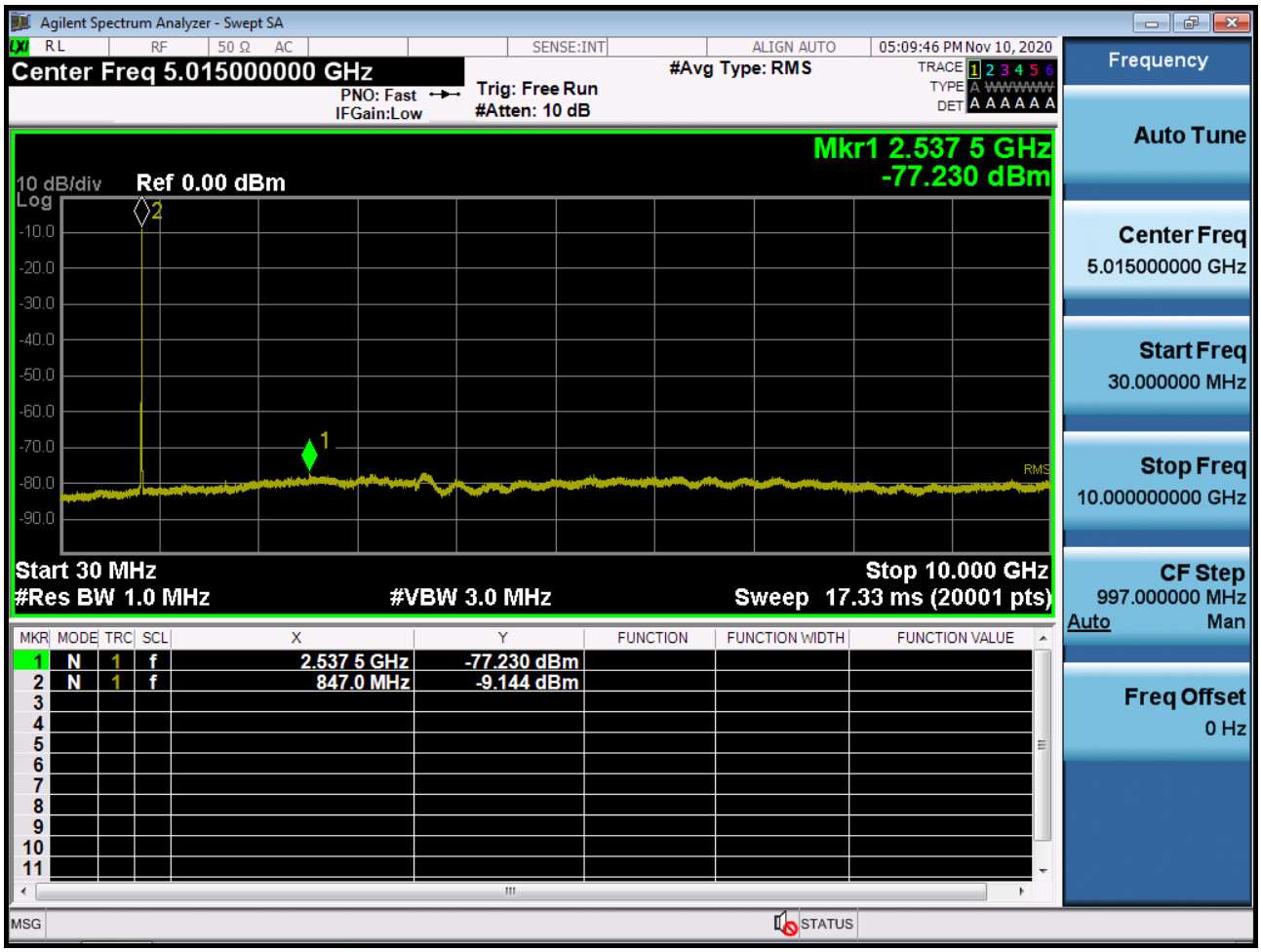
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2012-FC011-P