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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:
October 31, 2019

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

Report No.: HCT-RF-1910-FC010

FCC ID:	**A3LSMG770F**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-G770F/DS
Additional Model(s):	SM-G770F/DSM, SM-G770F
EUT Type:	Mobile Phone
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §27, §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	0.493	26.93
GSM850 EDGE			245 KG7W	0.129	21.10
WCDMA850	826.4 – 846.6	871.4 – 891.6	4M15F9W	0.059	17.73

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	0.650	28.13
GSM1900 EDGE			246 KG7W	0.068	18.35
WCDMA1900	1852.4 – 1907.6	1932.4 – 1987.6	4M17F9W	0.165	22.18
WCDMA1700	1712.4 – 1752.6	2112.4 – 2152.6	4M17F9W	0.066	18.18

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 Ryang 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-1910-FC010	October 31, 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:	A3LSMG770F
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §27, §2
EUT Type:	Mobile Phone
Model(s):	SM-G770F/DS
Additional Model(s):	SM-G770F/DSM, SM-G770F
Tx Frequency:	824.20 - 848.80 MHz (GSM850) 826.40 - 846.60 MHz (WCDMA850) 1 850.20 - 1 909.80 MHz (GSM1900) 1 852.4 – 1 907.6 MHz (WCDMA1900) 1 712.4 – 1 752.6 MHz (WCDMA1700)
Rx Frequency:	869.20 - 893.80 MHz (GSM850) 871.40 - 891.60 MHz (WCDMA850) 1 930.20 - 1 989.80 MHz (GSM1900) 1 932.4 – 1 987.6 MHz (WCDMA1900) 2 112.4 – 2 152.6 MHz (WCDMA1700)
Date(s) of Tests:	September 09, 2019 ~ October 14, 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, 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 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 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 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;

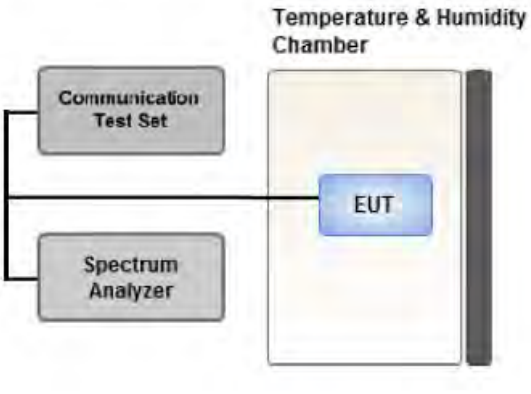
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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:

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

Test Settings(Peak Power)

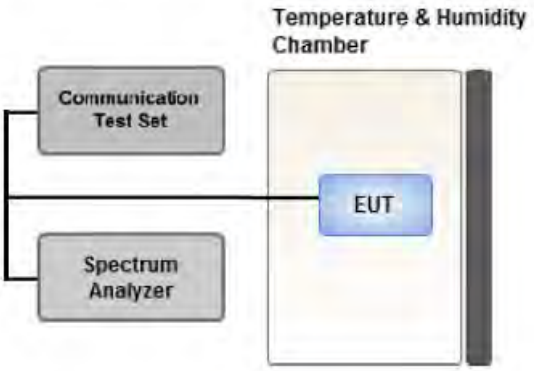
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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.

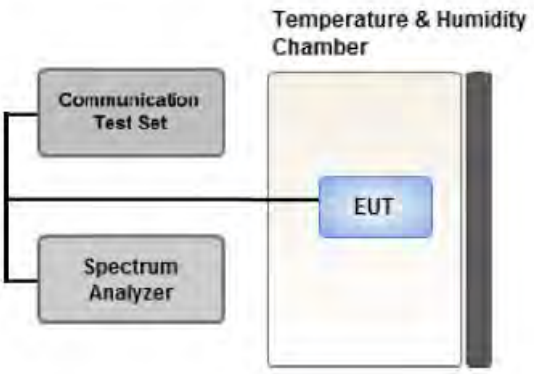
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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.

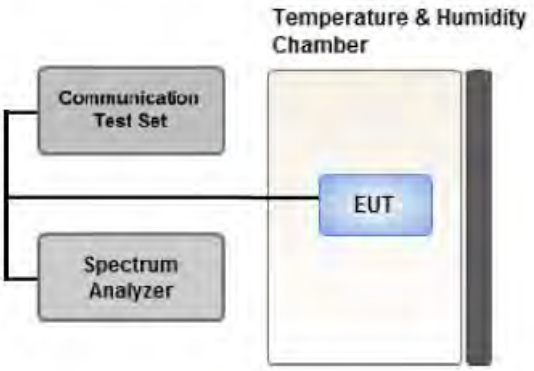
Test Settings(GSM)

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

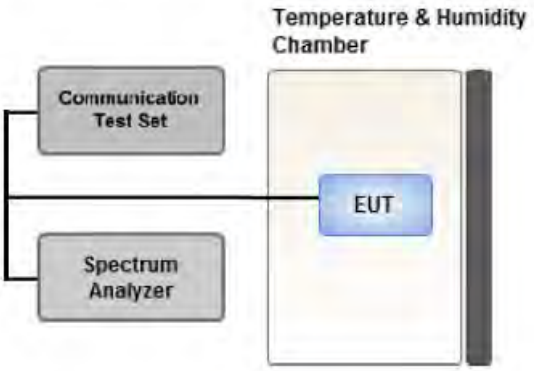
Test Notes

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.
- SM-G770FDS & additional models were tested and the worst case results are reported.

(Worst case : SM-G770FDS)

[Worst case]

Test Description	Modulation	Test Channel
Occupied Bandwidth	2G : Voice & EDGE(1 TX Slot) 3G : QPSK	Low, Mid, High
	2G : EDGE(1 TX Slot)	Low, Mid, High
Band Edge	2G : Voice & EDGE(1 TX Slot) 3G : QPSK	Low, High
Spurious and Harmonic Emissions at Antenna Terminal	2G : Voice 3G : QPSK	Low, Mid, High

[Test Channel]

	UplinkChannel				
	2G (GSM850)	2G (GSM1900)	3G (WCDMA B2)	3G (WCDMA B4)	3G (WCDMA B5)
Low	128	512	9262	1312	4132
Mid	190	661	9400	1412	4183
High	251	810	9538	1513	4233

3.10 WORST CASE(RADIATED TEST)

- This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation.
  The tuner for this device was set to simulate a **"free space"** condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.
- 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-G770FDS & additional models were tested and the worst case results are reported.

(Worst case : SM-G770FDS)

[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 B2 : Z WCDMA B4 : X WCDMA B5 : X	Low, Mid, High
Radiated Spurious and Harmonic Emissions	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B2 : Z WCDMA B4 : Z WCDMA B5 : X	Low, Mid, High

[Worst case_2G]

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

[Test Channel]

	UplinkChannel				
	2G (GSM850)	2G (GSM1900)	3G (WCDMA B2)	3G (WCDMA B4)	3G (WCDMA B5)
Low	128	512	9262	1312	4132
Mid	190	661	9400	1412	4183
High	251	810	9538	1513	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	-	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, §22.917(a), §24.238(a), §27.53(h)	< 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), §27.50(d)(5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, § 22.355	< 2.5 ppm	PASS
	§24.235, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report
2. The same samples were used for SAR and EMC

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS
Equivalent Isotropic Radiated Power	§24.232(c), §27.50(d)(4)	< 2 Watts max. EIRP < 1 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a), §24.238(a), §27.53(h)	< 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

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 EFFECTIVE RADIATED POWER

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBd)	C.L	Pol.	Limit	EIRP	
	channel	Freq.(MHz)						W	W	dBm
GSM850	128	824.2	-25.15	38.46	-10.25	1.28	H	< 7.00	0.493	26.93
	190	836.6	-25.98	38.20	-10.19	1.29	H		0.470	26.72
	251	848.8	-26.34	37.68	-10.14	1.30	H		0.420	26.24
EDGE	128	824.2	-30.98	32.63	-10.25	1.28	H		0.129	21.10

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	-34.35	29.26	-10.25	1.28	H	< 7.00	0.059	17.73
	4183	836.6	-35.30	28.88	-10.19	1.29	H		0.055	17.40
	4233	846.6	-35.91	28.14	-10.15	1.30	H		0.047	16.69

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	-14.51	19.13	10.10	1.94	H	< 2.00	0.536	27.29
	661	1880.0	-14.72	19.17	10.15	1.98	H		0.542	27.34
	810	1909.8	-14.44	19.90	10.23	2.00	H		0.650	28.13
EDGE	810	1909.8	-24.22	10.12	10.23	2.00	H		0.068	18.35

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit	EIRP	
	channel	Freq.(MHz)						W	W	dBm
WCDMA1900	9262	1852.4	-19.94	13.70	10.10	1.94	V	< 2.00	0.153	21.86
	9400	1880.0	-20.45	13.44	10.15	1.98	V		0.145	21.61
	9538	1907.6	-20.39	13.95	10.23	2.00	V		0.165	22.18

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit	EIRP	
	channel	Freq.(MHz)						W	W	dBm
WCDMA1700	1312	1712.4	-23.09	10.21	9.85	1.88	H	< 1.00	0.066	18.18
	1412	1732.4	-23.38	10.00	9.90	1.89	H		0.063	18.01
	1513	1752.6	-23.53	9.79	10.00	1.90	H		0.061	17.89

8.3 RADIATED SPURIOUS EMISSIONS

▣ MEASURED OUTPUT POWER: 29.08 dBm = 0.809 W

▣ MODULATION SIGNAL: GSM850

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 x log10 (W) = 42.08 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
128 (824.2)	1,648.40	-43.98	9.50	-54.74	1.84	H	-47.08	76.17
	2,472.60	-32.46	10.60	-37.50	2.28	H	-29.18	58.26
	3,296.80	-53.36	12.25	-55.18	2.69	H	-45.62	74.71
	4,121.00	-52.82	12.80	-51.44	3.02	V	-41.66	70.74
190 (836.6)	1,673.20	-42.50	9.65	-53.26	1.86	H	-45.47	74.55
	2,509.80	-30.06	10.75	-35.17	2.32	H	-26.74	55.82
	3,346.40	-54.90	12.48	-56.55	2.70	H	-46.78	75.86
251 (848.8)	1,697.60	-41.41	9.80	-51.88	1.87	V	-43.95	73.03
	2,546.40	-31.21	10.88	-35.32	2.32	H	-26.76	55.85
	3,395.20	-54.46	12.68	-56.44	2.72	H	-46.48	75.56

▣ MEASURED OUTPUT POWER: 28.13 dBm = 0.650 W

▣ MODULATION SIGNAL: GSM1900

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 x log10 (W) = 41.13 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
512 (1850.2)	3,700.40	-55.26	12.40	-60.23	2.86	H	-50.69	78.81
	5,550.60	-56.40	13.10	-54.85	3.58	V	-45.33	73.45
	7,400.80	-57.56	11.10	-47.77	4.26	H	-40.93	69.05
661 (1880.0)	3,760.00	-52.08	12.48	-57.06	2.88	H	-47.46	75.58
	5,640.00	-56.45	13.30	-55.07	3.62	V	-45.39	73.52
	7,520.00	-56.57	11.30	-46.40	4.30	V	-39.40	67.52
810 (1909.8)	3,819.60	-48.32	12.40	-53.29	2.90	H	-43.79	71.92
	5,729.40	-53.88	13.35	-51.78	3.63	V	-42.06	70.19
	7,639.20	-57.27	11.65	-47.14	4.34	H	-39.83	67.96

▣ MEASURED OUTPUT POWER: 19.88 dBm = 0.097 W

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 x log10 (W) = 32.88 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
4,132 (826.4)	1,652.80	-53.48	9.50	-64.24	1.84	V	-56.58	76.47
	2,479.20	-55.49	10.60	-60.30	2.30	H	-52.00	71.88
	3,305.60	-58.36	12.33	-60.35	2.69	V	-50.71	70.60
4,183 (836.6)	1,673.20	-53.23	9.65	-63.99	1.86	H	-56.20	76.08
	2,509.80	-54.65	10.75	-59.76	2.32	V	-51.33	71.21
	3,346.40	-57.65	12.48	-59.30	2.70	H	-49.53	69.41
4,233 (846.6)	1,693.20	-53.62	9.73	-64.24	1.87	V	-56.38	76.26
	2,539.80	-55.40	10.85	-59.26	2.32	V	-50.73	70.61
	3,386.40	-58.21	12.63	-60.21	2.72	V	-50.30	70.18

▣ MEASURED OUTPUT POWER: 22.18 dBm = 0.165 W

▣ MODULATION SIGNAL: WCDMA1900

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 x log10 (W) = 35.18 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
9262 (1852.4)	3,704.80	-50.65	12.42	-55.64	2.86	H	-46.08	68.25
	5,557.20	-56.41	13.15	-54.87	3.58	V	-45.30	67.48
	7,409.60	-57.60	11.13	-47.69	4.25	H	-40.81	62.98
9400 (1880.0)	3,760.00	-51.35	12.48	-56.33	2.88	H	-46.73	68.90
	5,640.00	-56.18	13.30	-54.80	3.62	V	-45.12	67.30
	7,520.00	-57.85	11.30	-47.68	4.30	H	-40.68	62.85
9538 (1907.6)	3,815.20	-47.41	12.40	-52.42	2.90	H	-42.92	65.09
	5,722.80	-57.14	13.35	-55.00	3.63	H	-45.28	67.46
	7,630.40	-57.67	11.60	-47.62	4.34	H	-40.36	62.53

▣ MEASURED OUTPUT POWER: 18.18 dBm = 0.066 W

▣ MODULATION SIGNAL: WCDMA1700

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 x log10 (W) = 31.18 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
1312 (1712.4)	3,424.80	-55.24	12.60	-62.08	2.73	H	-52.21	70.39
	5,137.20	-56.89	12.45	-54.60	3.39	H	-45.54	63.72
	6,849.60	-56.67	12.20	-50.67	4.03	V	-42.50	60.68
1412 (1732.4)	3,464.80	-54.17	12.48	-61.04	2.76	H	-51.32	69.50
	5,197.20	-56.85	12.90	-56.12	3.43	V	-46.65	64.83
	6,929.60	-56.27	12.05	-48.82	4.08	H	-40.85	59.04
1513 (1752.6)	3,505.20	-54.91	12.28	-61.41	2.76	V	-51.89	70.07
	5,257.80	-55.91	13.25	-55.63	3.47	H	-45.85	64.03
	7,010.40	-57.50	11.65	-49.24	4.10	H	-41.69	59.88

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	32.625	22.93	4.6160	0.5475	9.26	0.44	13	Pass
GSM1900 EDGE	661	31.179	18.44	4.616	0.5475	9.26	3.48		
WCDMA1900	9400	CCDF Procedure					2.97		
WCDMA1700	1732.4						3.07		

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 61 ~ 68.

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	242.23
	190	836.60	244.04
	251	848.80	244.10
GSM850 EDGE	128	824.20	243.81
	190	836.60	245.02
	251	848.80	243.07
GSM1900	512	1,850.20	247.27
	661	1,880.00	245.07
	810	1,909.80	240.60
GSM1900 EDGE	512	1,850.20	238.47
	661	1,880.00	240.55
	810	1,909.80	245.63
WCDMA850	4132	826.40	4.1509
	4183	836.60	4.1479
	4233	846.60	4.1544
WCDMA1900	9262	1852.40	4.1549
	9400	1880.00	4.1622
	9538	1907.60	4.1674
WCDMA1700	1312	1712.40	4.1662
	1412	1732.40	4.1622
	1513	1752.60	4.1608

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 44 ~ 60.

8.6 CONDUCTED SPURIOUS EMISSIONS

Band	Channel	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result	(dBm)
GSM850	128	3.6785	27.976	-57.57	-29.591	-13.00
	190	2.5105	27.976	-57.89	-29.915	
	251	6.2089	28.591	-57.40	-28.812	
GSM1900	512	18.72472	29.489	-52.872	-23.383	
	661	18.90722	29.489	-53.537	-24.048	
	810	18.93047	29.489	-52.723	-23.234	
WCDMA850	4132	2.4816	27.976	-75.830	-47.854	
	4183	2.5075	27.976	-76.039	-48.063	
	4233	2.5434	27.976	-75.691	-47.715	
WCDMA1900	9262	18.9087	29.489	-72.683	-43.194	
	9400	18.9117	29.489	-72.809	-43.320	
	9538	18.9045	29.489	-73.047	-43.558	
WCDMA1700	1712.4	18.91097	29.489	-72.674	-43.185	
	1732.4	18.92697	29.489	-72.644	-43.155	
	1752.6	18.90347	29.489	-72.883	-43.394	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 105 ~ 128.
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 69 ~ 104.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: GSM850

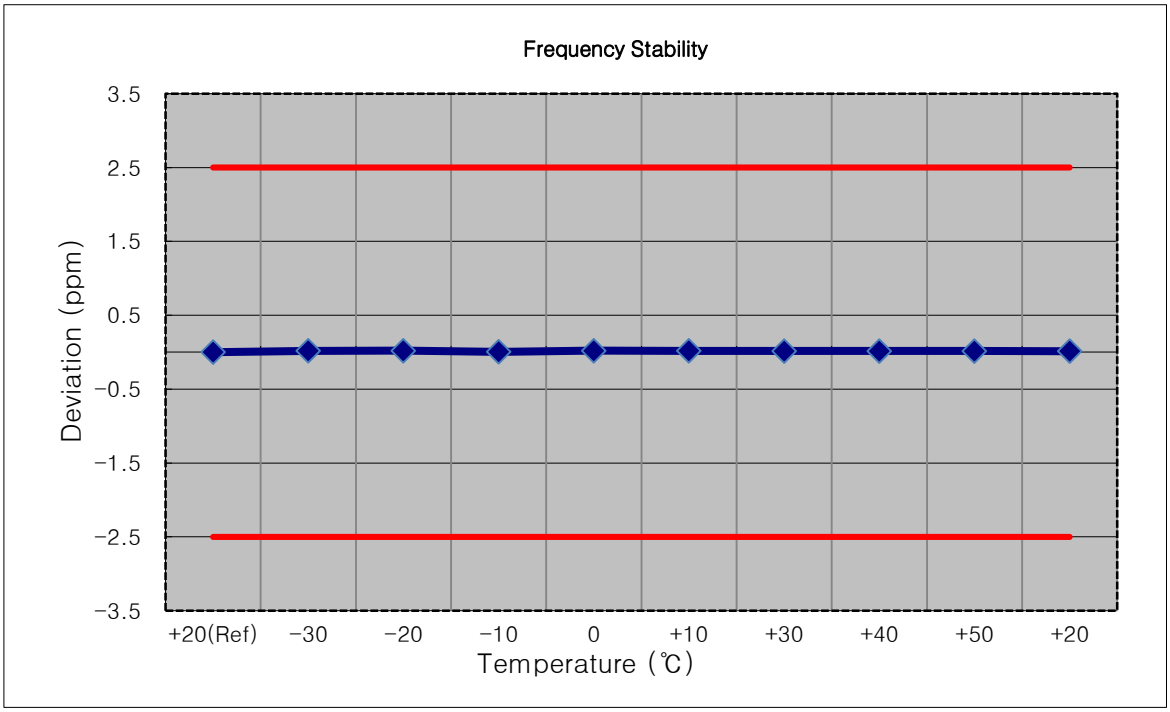
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 190

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	836 600 016	0.0	0.000 000	0.0000
100%		-30	836 600 032	16.2	0.000 002	0.0194
100%		-20	836 600 033	16.5	0.000 002	0.0197
100%		-10	836 600 021	5.2	0.000 001	0.0062
100%		0	836 600 033	17.3	0.000 002	0.0207
100%		+10	836 600 031	14.9	0.000 002	0.0178
100%		+30	836 600 029	13.1	0.000 002	0.0157
100%		+40	836 600 030	13.7	0.000 002	0.0164
100%		+50	836 600 029	13.2	0.000 002	0.0157
Batt. Endpoint	3.400	+20	836 600 028	11.9	0.000 001	0.0142



▣ Mode: GSM1900

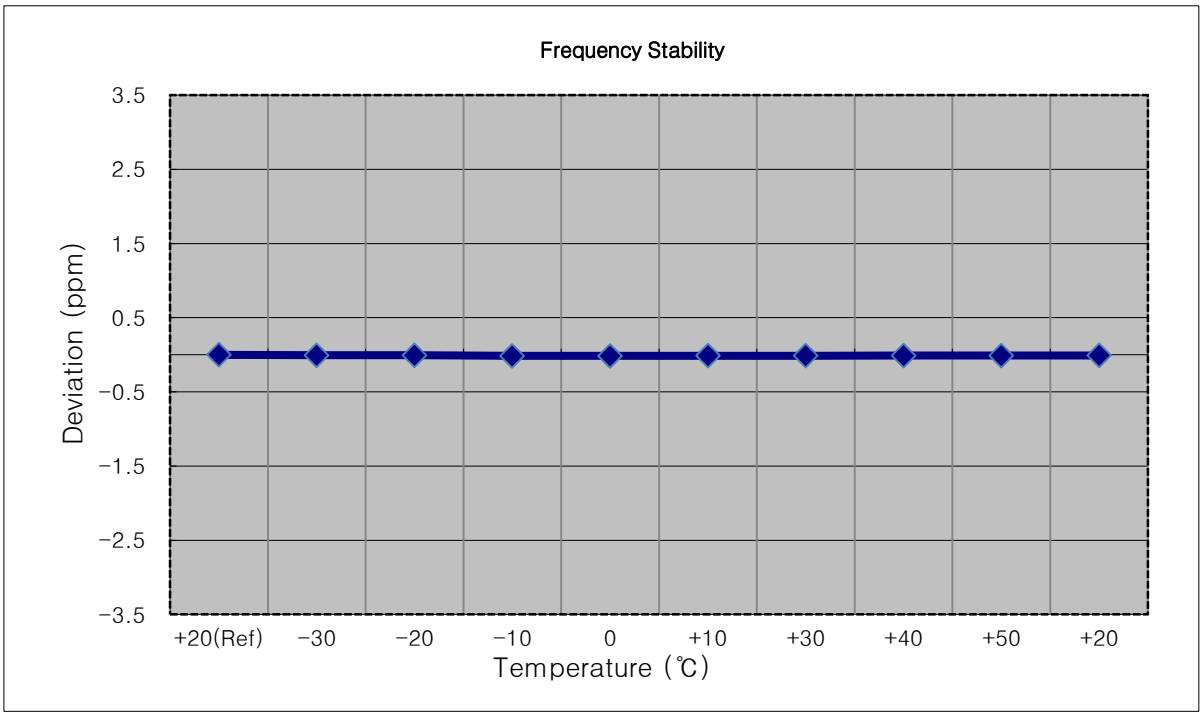
▣ OPERATING FREQUENCY: 1850,200,000 Hz

▣ CHANNEL: 512

▣ 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 199 986	0.0	0.000 000	0.0000
100%		-30	1850 199 974	-12.7	-0.000 001	-0.0069
100%		-20	1850 199 975	-11.9	-0.000 001	-0.0064
100%		-10	1850 199 959	-27.5	-0.000 001	-0.0149
100%		0	1850 199 958	-28.0	-0.000 002	-0.0151
100%		+10	1850 199 961	-25.0	-0.000 001	-0.0135
100%		+30	1850 199 962	-24.5	-0.000 001	-0.0132
100%		+40	1850 199 966	-20.9	-0.000 001	-0.0113
100%		+50	1850 199 967	-19.7	-0.000 001	-0.0106
Batt. Endpoint	3.400	+20	1850 199 970	-16.7	-0.000 001	-0.0090



▣ Mode: GSM1900

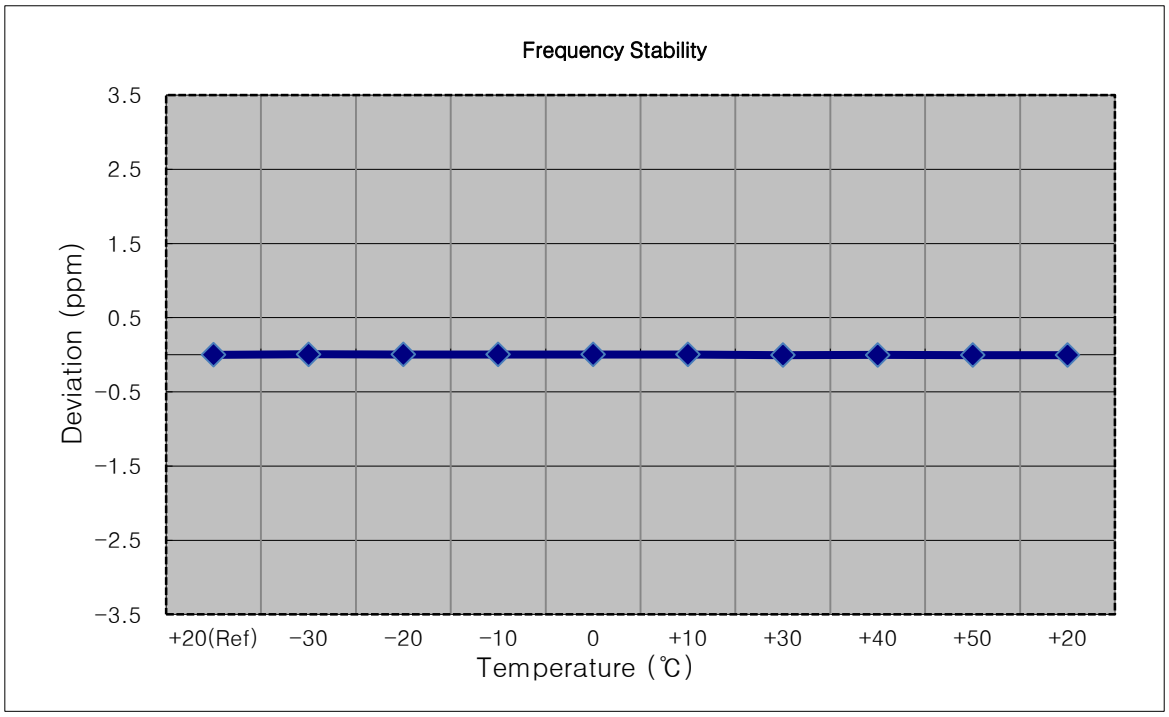
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 661

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1880 000 009	0.0	0.000 000	0.000
100%		-30	1880 000 020	10.4	0.000 001	0.006
100%		-20	1880 000 019	9.4	0.000 000	0.005
100%		-10	1880 000 018	9.0	0.000 000	0.005
100%		0	1880 000 016	6.7	0.000 000	0.004
100%		+10	1880 000 016	6.5	0.000 000	0.003
100%		+30	1880 000 002	-7.3	0.000 000	-0.004
100%		+40	1880 000 003	-6.6	0.000 000	-0.003
100%		+50	1880 000 001	-8.2	0.000 000	-0.004
Batt. Endpoint	3.400	+20	1880 000 002	-7.3	0.000 000	-0.004



▣ Mode: GSM1900

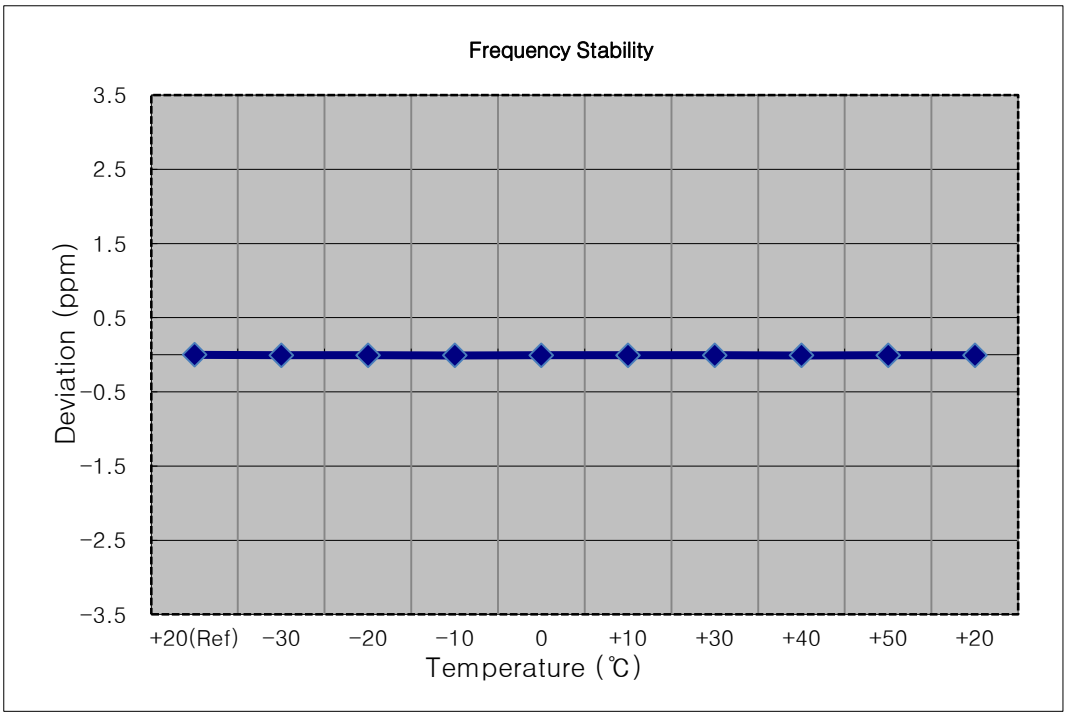
▣ OPERATING FREQUENCY: 1909,800,000 Hz

▣ CHANNEL: 810

▣ 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 799 981	0.0	0.000 000	0.000
100%		-30	1909 799 967	-14.7	-0.000 001	-0.008
100%		-20	1909 799 967	-14.7	-0.000 001	-0.008
100%		-10	1909 799 966	-15.7	-0.000 001	-0.008
100%		0	1909 799 969	-12.7	-0.000 001	-0.007
100%		+10	1909 799 967	-14.6	-0.000 001	-0.008
100%		+30	1909 799 969	-12.6	-0.000 001	-0.007
100%		+40	1909 799 965	-16.7	-0.000 001	-0.009
100%		+50	1909 799 968	-13.2	-0.000 001	-0.007
Batt. Endpoint	3.400	+20	1909 799 969	-12.3	-0.000 001	-0.006



▣ Mode: WCDMA850

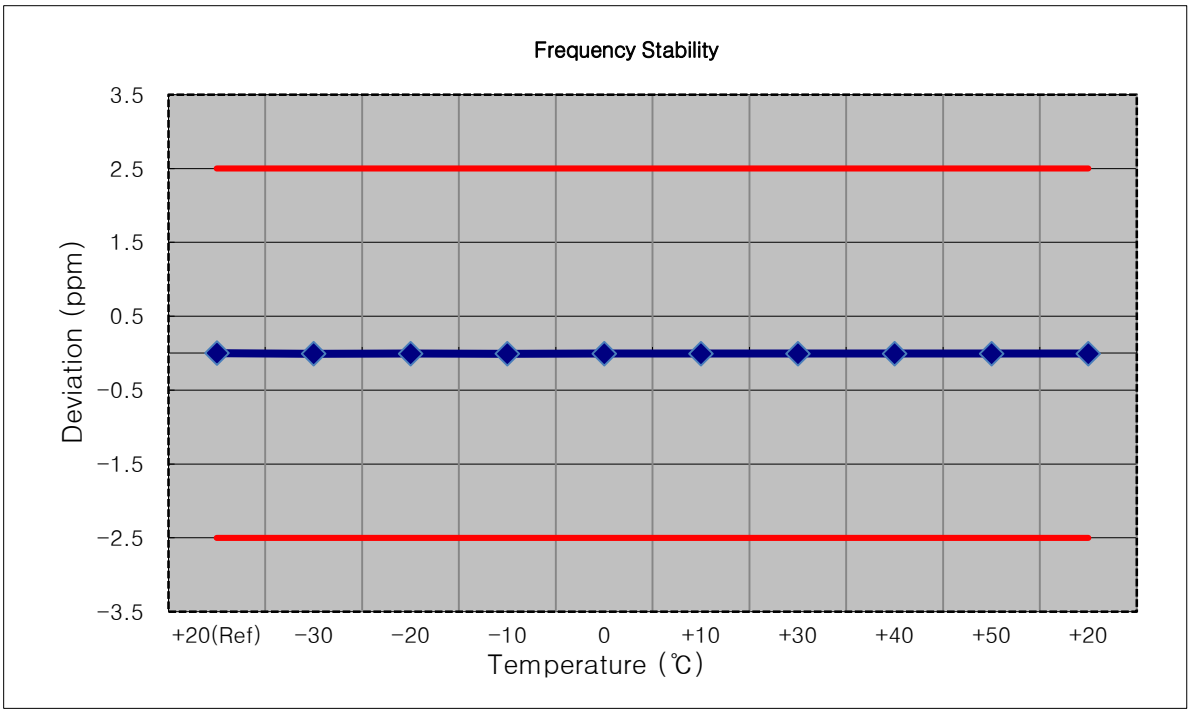
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 4183

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	836 599 995	0.0	0.000 000	0.0000
100%		-30	836 599 989	-5.9	-0.000 001	-0.0070
100%		-20	836 599 990	-5.0	-0.000 001	-0.0059
100%		-10	836 599 990	-5.6	-0.000 001	-0.0067
100%		0	836 599 991	-4.2	-0.000 001	-0.0051
100%		+10	836 599 990	-5.3	-0.000 001	-0.0064
100%		+30	836 599 991	-4.5	-0.000 001	-0.0054
100%		+40	836 599 990	-5.1	-0.000 001	-0.0061
100%		+50	836 599 991	-4.4	-0.000 001	-0.0052
Batt. Endpoint	3.400	+20	836 599 990	-4.8	-0.000 001	-0.0057



▣ Mode: WCDMA1900

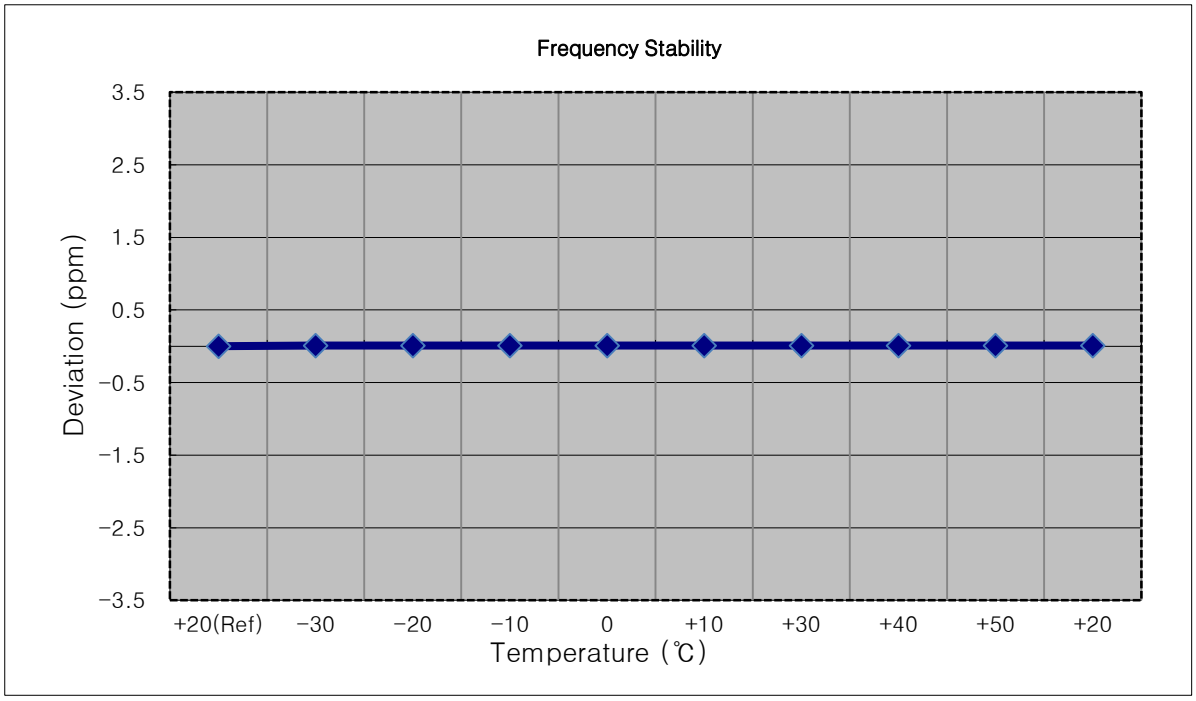
▣ OPERATING FREQUENCY: 1,852,400,000 Hz

▣ CHANNEL: 9262

▣ 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 400 016	0.0	0.000 000	0.0000
100%		-30	1852 400 032	16.1	0.000 001	0.0087
100%		-20	1852 400 032	16.7	0.000 001	0.0090
100%		-10	1852 400 032	16.2	0.000 001	0.0088
100%		0	1852 400 032	16.6	0.000 001	0.0090
100%		+10	1852 400 032	15.9	0.000 001	0.0086
100%		+30	1852 400 032	16.7	0.000 001	0.0090
100%		+40	1852 400 033	17.5	0.000 001	0.0095
100%		+50	1852 400 033	16.9	0.000 001	0.0091
Batt. Endpoint	3.400	+20	1852 400 033	17.2	0.000 001	0.0093



▣ Mode: WCDMA1900

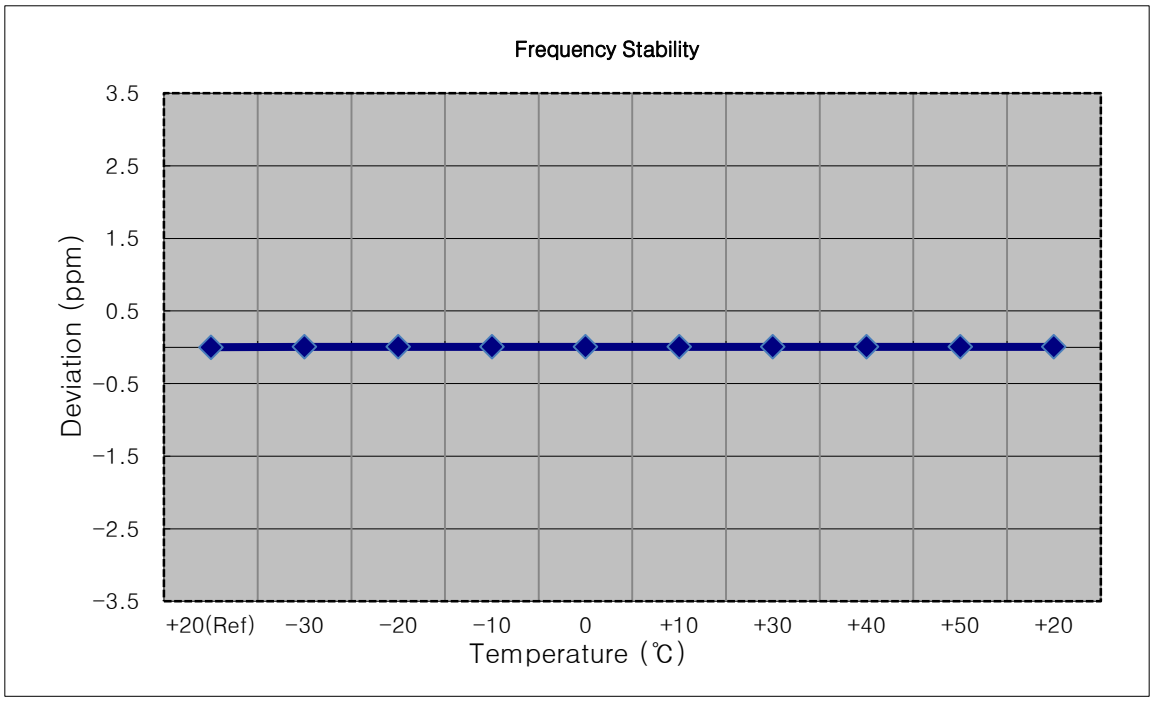
▣ OPERATING FREQUENCY: 1,880,000,000 Hz

▣ CHANNEL: 9400

▣ 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 000 013	0.0	0.000 000	0.0000
100%		-30	1880 000 024	11.4	0.000 001	0.0061
100%		-20	1880 000 025	12.4	0.000 001	0.0066
100%		-10	1880 000 023	11.0	0.000 001	0.0058
100%		0	1880 000 024	11.3	0.000 001	0.0060
100%		+10	1880 000 025	12.2	0.000 001	0.0065
100%		+30	1880 000 024	11.5	0.000 001	0.0061
100%		+40	1880 000 024	11.8	0.000 001	0.0063
100%		+50	1880 000 025	12.5	0.000 001	0.0067
Batt. Endpoint	3.400	+20	1880 000 024	11.3	0.000 001	0.0060



▣ Mode: WCDMA1900

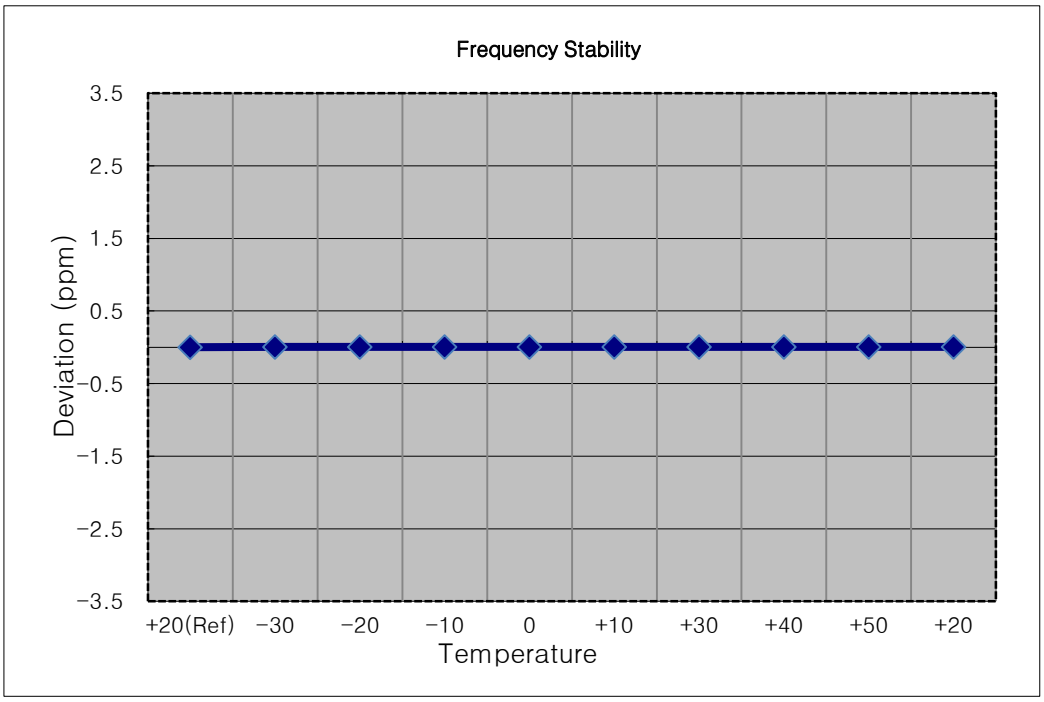
▣ OPERATING FREQUENCY: 1,907,600,000 Hz

▣ CHANNEL: 9538

▣ 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 600 007	0.0	0.000 000	0.0000
100%		-30	1907 600 015	7.2	0.000 000	0.0038
100%		-20	1907 600 015	7.6	0.000 000	0.0040
100%		-10	1907 600 015	7.4	0.000 000	0.0039
100%		0	1907 600 014	6.9	0.000 000	0.0036
100%		+10	1907 600 013	6.1	0.000 000	0.0032
100%		+30	1907 600 015	7.5	0.000 000	0.0039
100%		+40	1907 600 014	6.8	0.000 000	0.0036
100%		+50	1907 600 014	6.9	0.000 000	0.0036
Batt. Endpoint	3.400	+20	1907 600 014	7.1	0.000 000	0.0037



▣ Mode: WCDMA1700

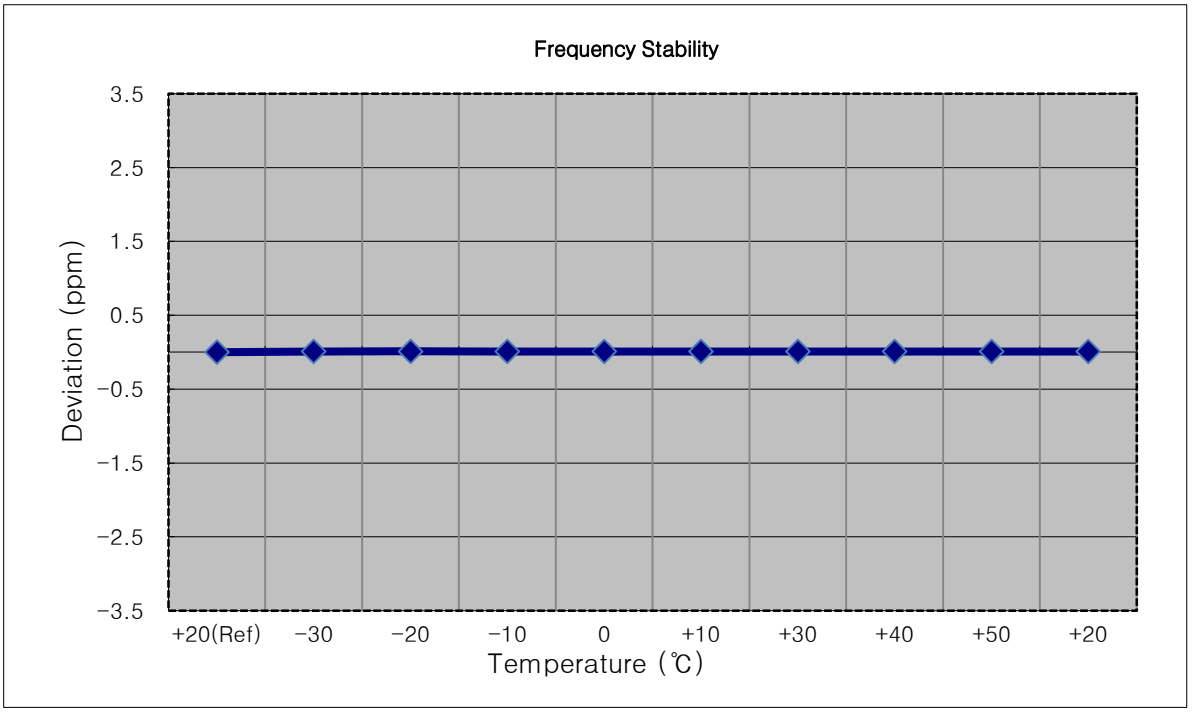
▣ OPERATING FREQUENCY: 1,712,400,000 Hz

▣ CHANNEL: 1312

▣ 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)	1712 400 018	0.0	0.000 000	0.0000
100%		-30	1712 400 036	18.0	0.000 001	0.0105
100%		-20	1712 400 036	18.6	0.000 001	0.0109
100%		-10	1712 400 036	17.8	0.000 001	0.0104
100%		0	1712 400 035	17.8	0.000 001	0.0104
100%		+10	1712 400 035	17.3	0.000 001	0.0101
100%		+30	1712 400 036	17.9	0.000 001	0.0104
100%		+40	1712 400 036	18.0	0.000 001	0.0105
100%		+50	1712 400 036	18.3	0.000 001	0.0107
Batt. Endpoint	3.400	+20	1712 400 036	18.3	0.000 001	0.0107



▣ Mode: WCDMA1700

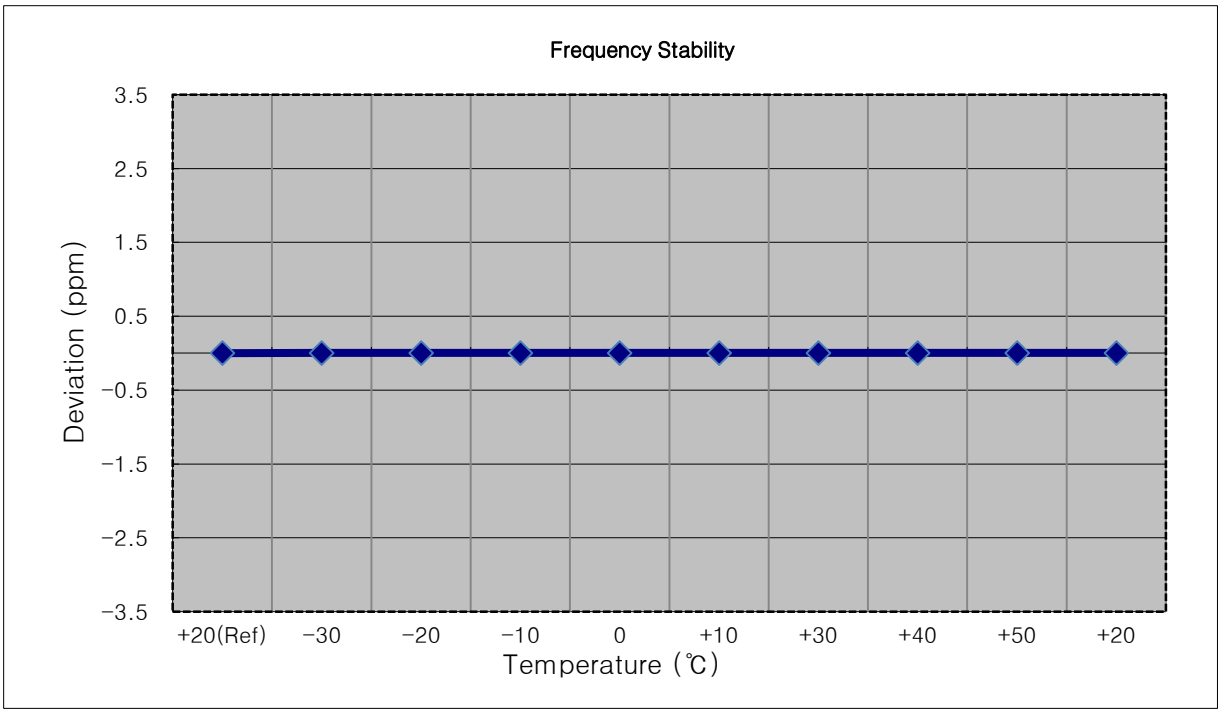
▣ OPERATING FREQUENCY: 1,732,400,000 Hz

▣ CHANNEL: 1412

▣ 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)	1732 400 006	0.0	0.000 000	0.0000
100%		-30	1732 400 011	5.6	0.000 000	0.0032
100%		-20	1732 400 012	6.3	0.000 000	0.0036
100%		-10	1732 400 012	6.0	0.000 000	0.0035
100%		0	1732 400 012	6.9	0.000 000	0.0040
100%		+10	1732 400 012	6.4	0.000 000	0.0037
100%		+30	1732 400 011	5.7	0.000 000	0.0033
100%		+40	1732 400 012	6.7	0.000 000	0.0039
100%		+50	1732 400 012	6.4	0.000 000	0.0037
Batt. Endpoint	3.400	+20	1732 400 011	5.7	0.000 000	0.0033



▣ Mode: WCDMA1700

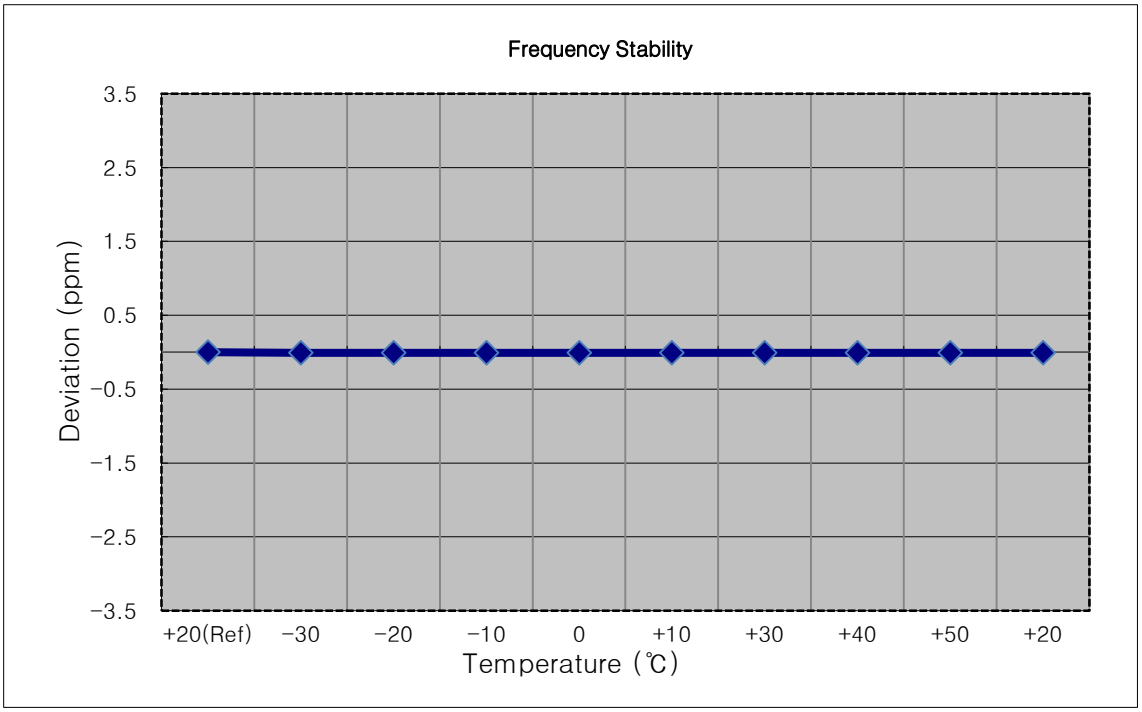
▣ OPERATING FREQUENCY: 1,752,600,000 Hz

▣ CHANNEL: 1513

▣ REFERENCE VOLTAGE: 3.85 VDC

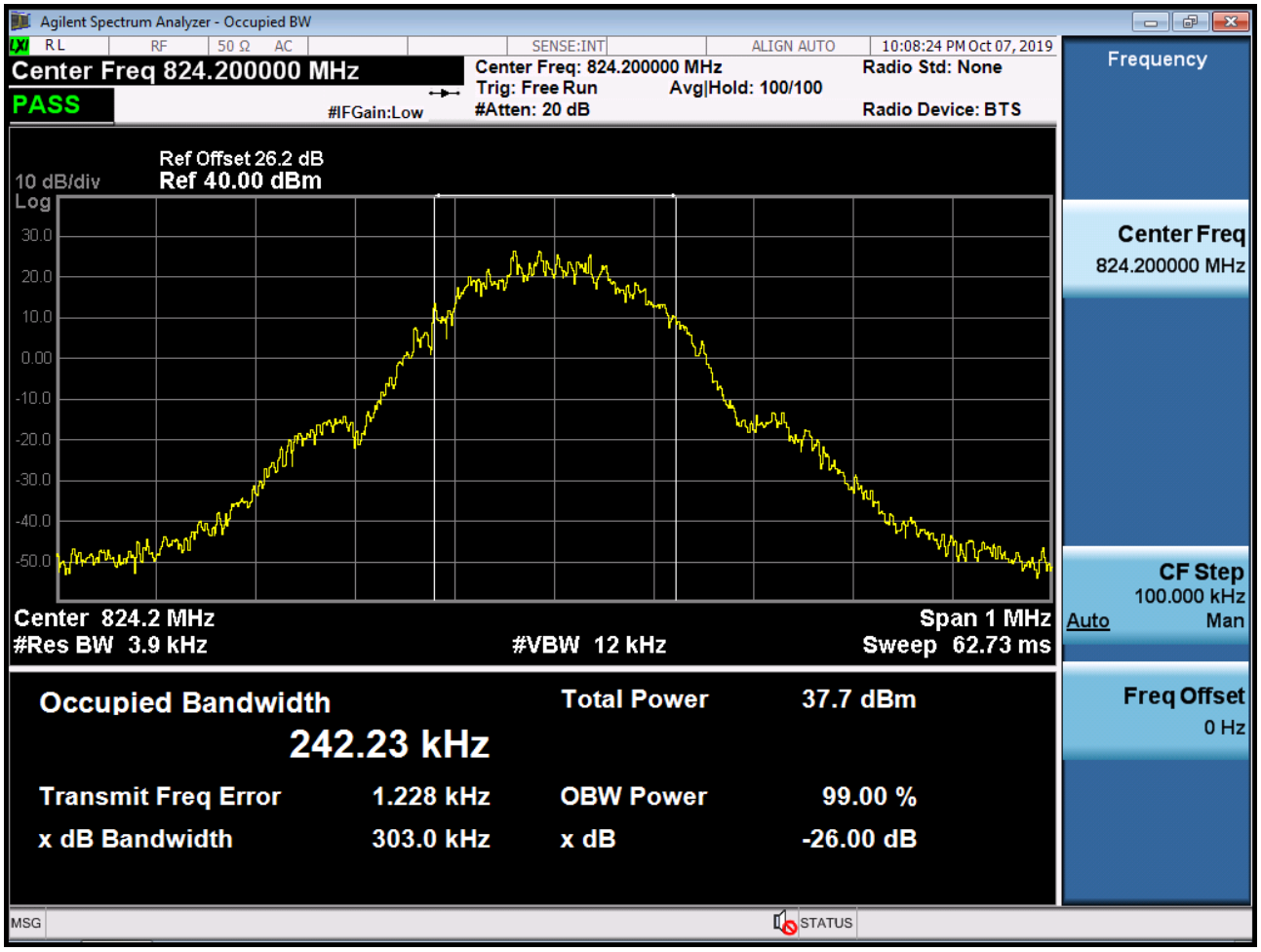
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1752 599 988	0.0	0.000 000	0.0000
100%		-30	1752 599 976	-12.0	-0.000 001	-0.0068
100%		-20	1752 599 976	-12.2	-0.000 001	-0.0070
100%		-10	1752 599 976	-12.2	-0.000 001	-0.0070
100%		0	1752 599 975	-12.9	-0.000 001	-0.0073
100%		+10	1752 599 975	-12.6	-0.000 001	-0.0072
100%		+30	1752 599 975	-12.8	-0.000 001	-0.0073
100%		+40	1752 599 976	-11.7	-0.000 001	-0.0067
100%		+50	1752 599 976	-12.0	-0.000 001	-0.0069
Batt. Endpoint	3.400	+20	1752 599 976	-11.9	-0.000 001	-0.0068

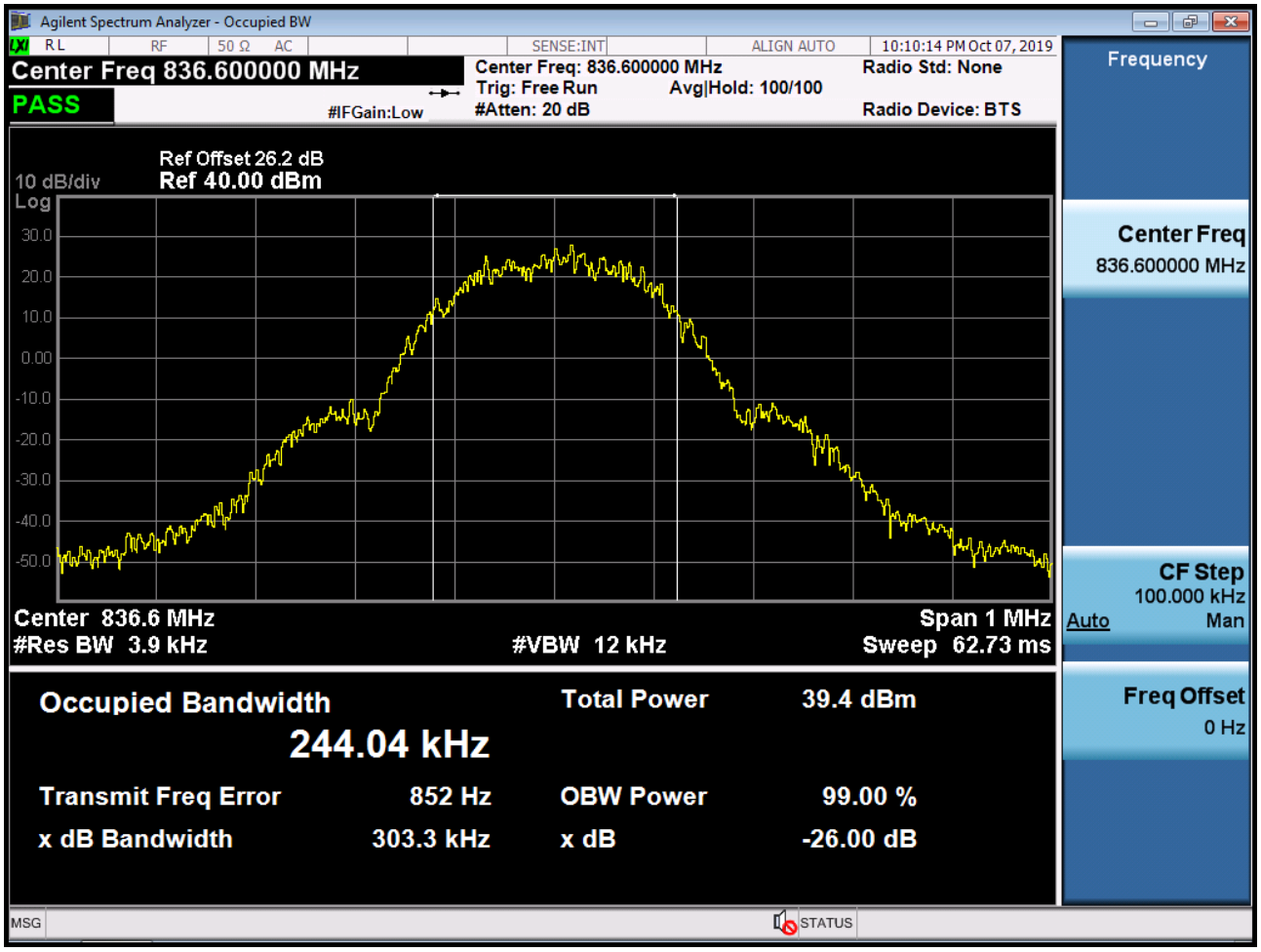


9. TEST PLOTS

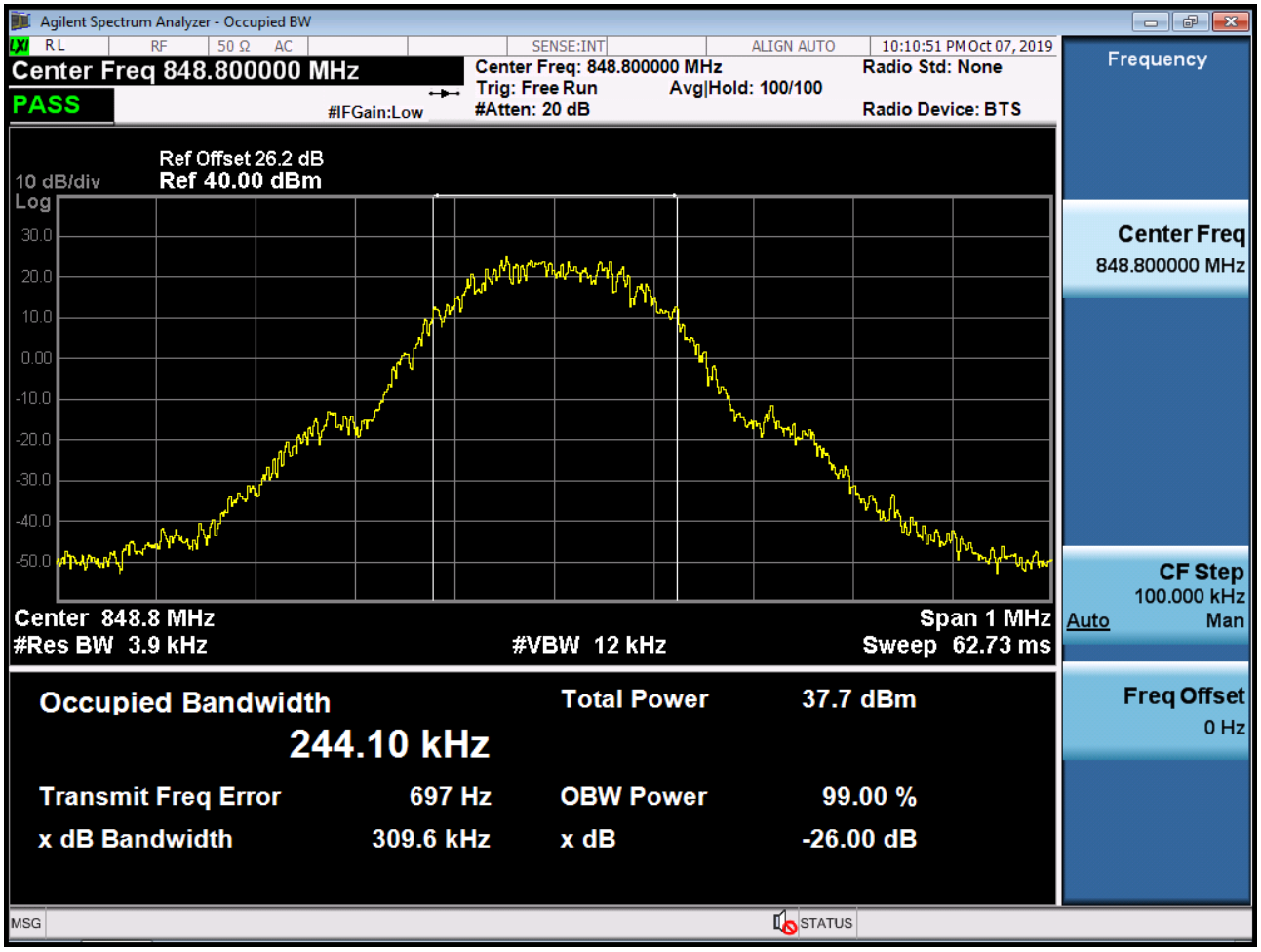
■ GSM850 MODE (128 CH.) Occupied Bandwidth



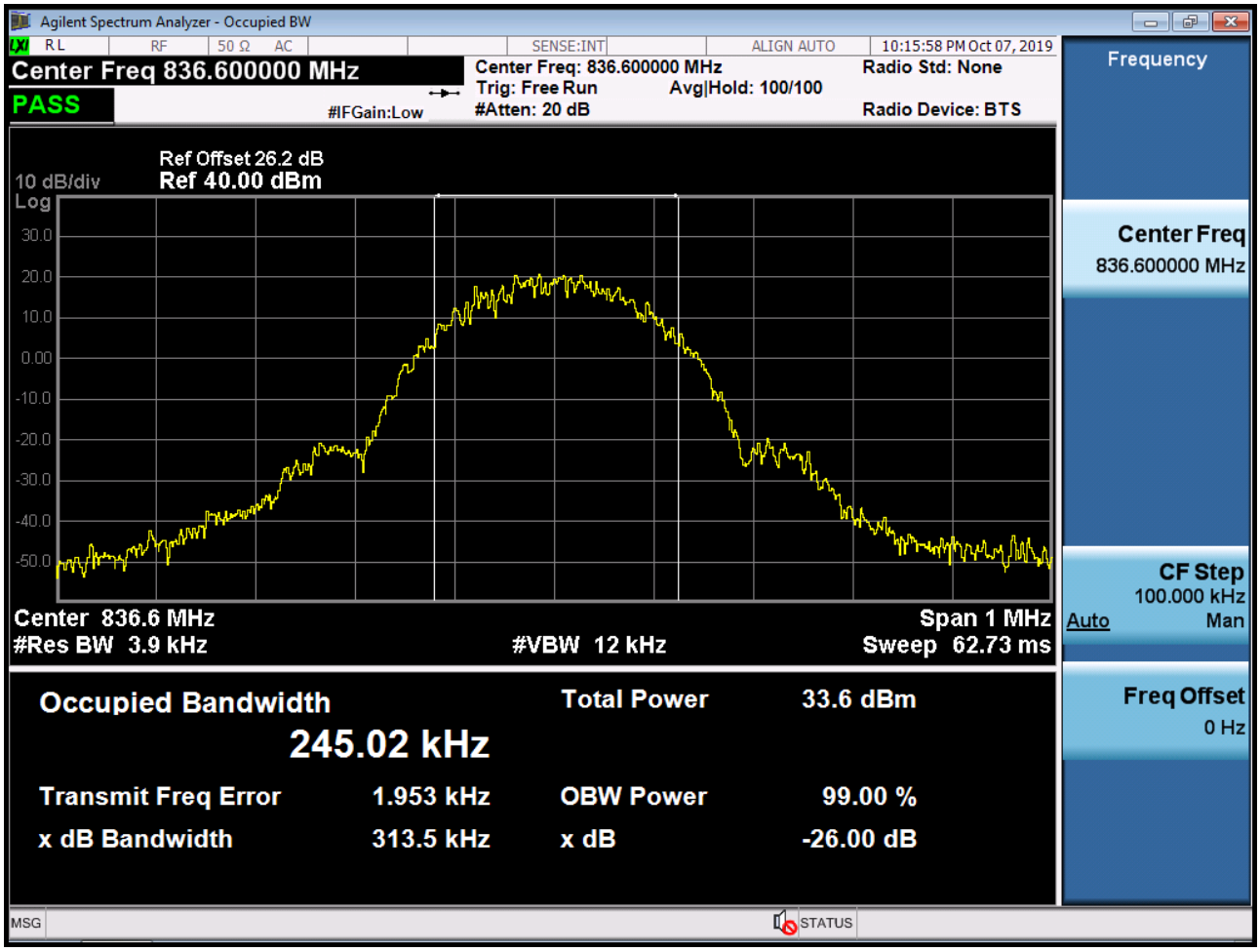
■ GSM850 MODE (190 CH.) Occupied Bandwidth



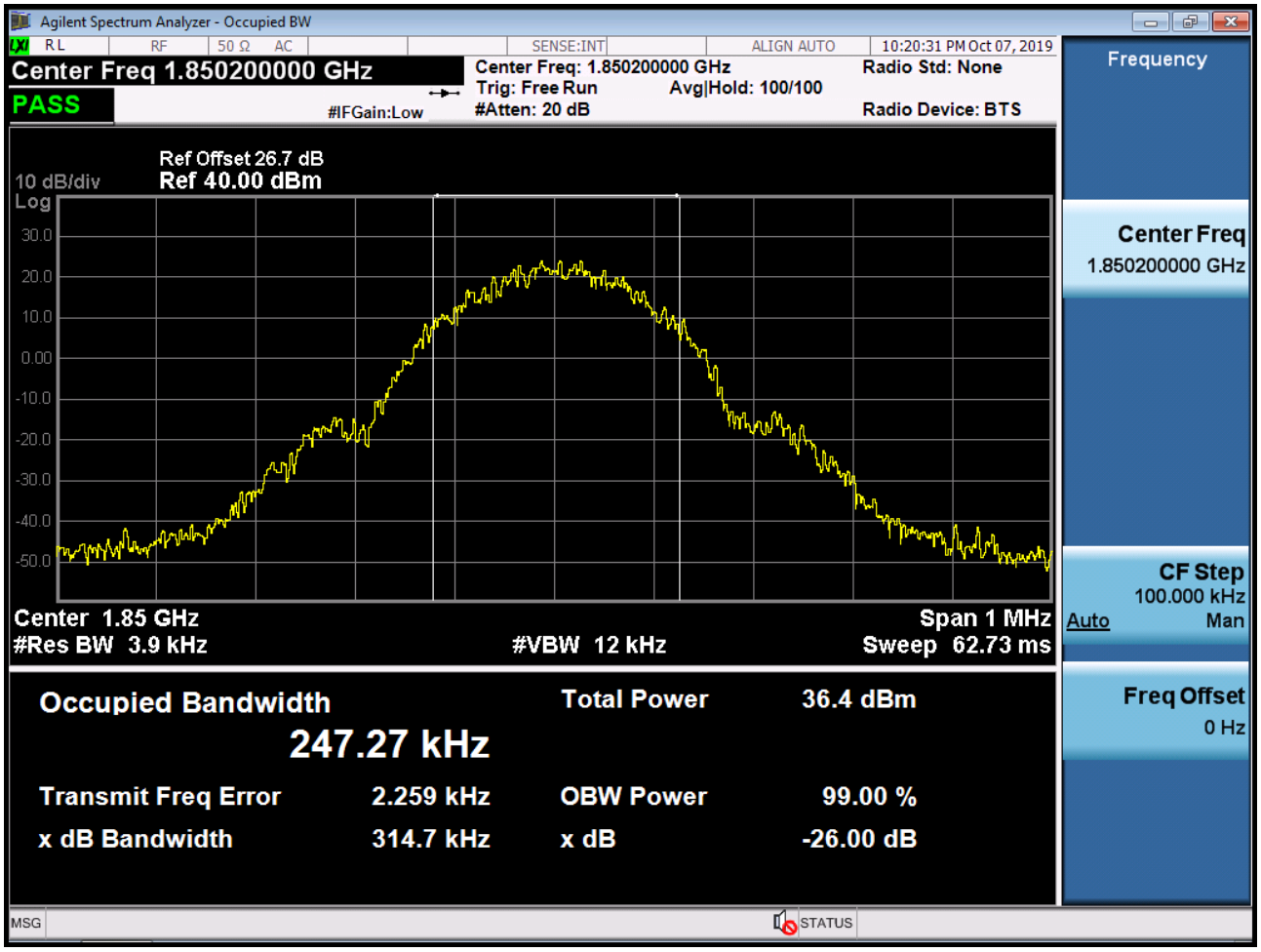
■ GSM850 MODE (251 CH.) Occupied Bandwidth



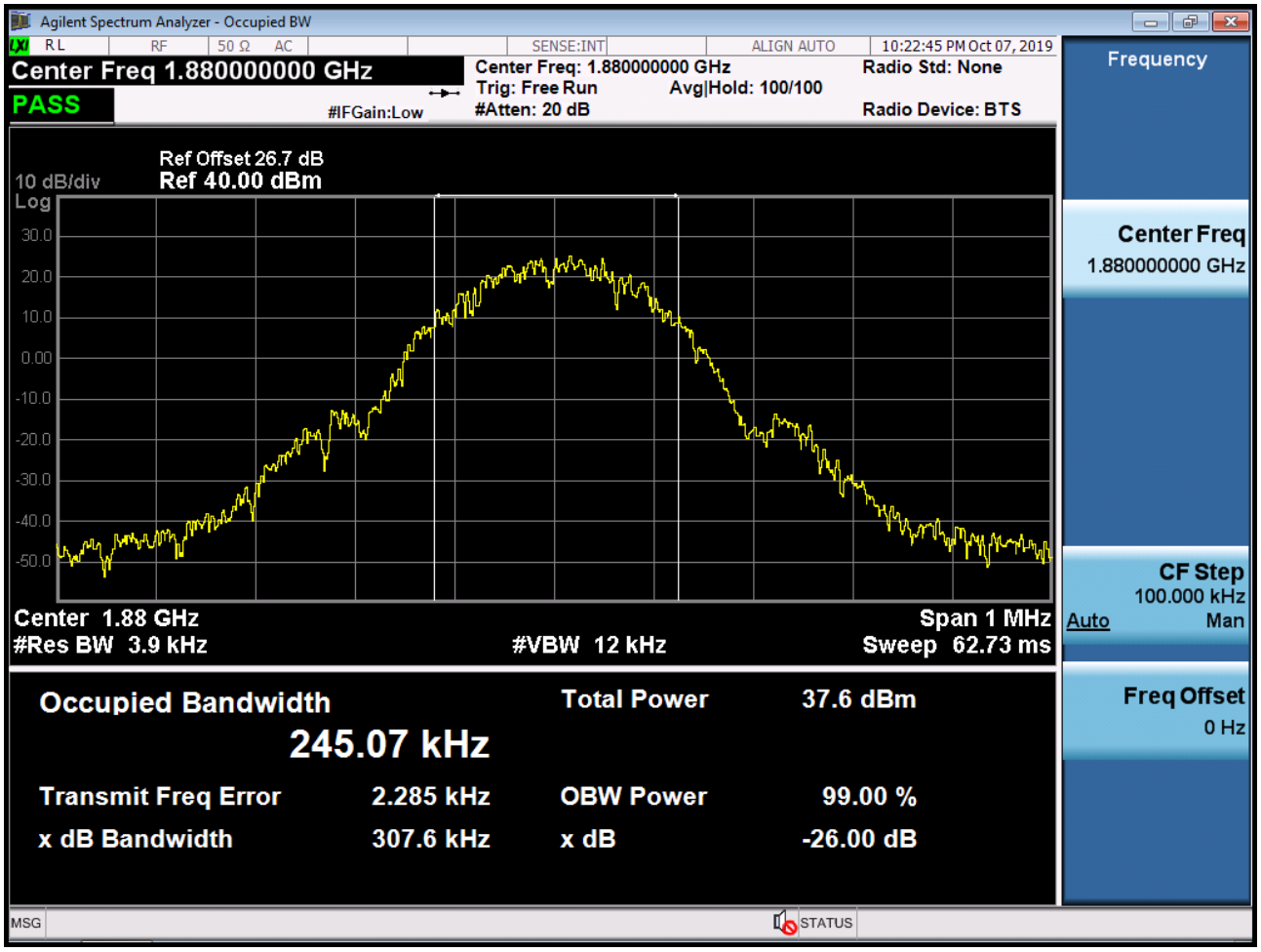
■ GSM850 EDGE (190 CH.) Occupied Bandwidth



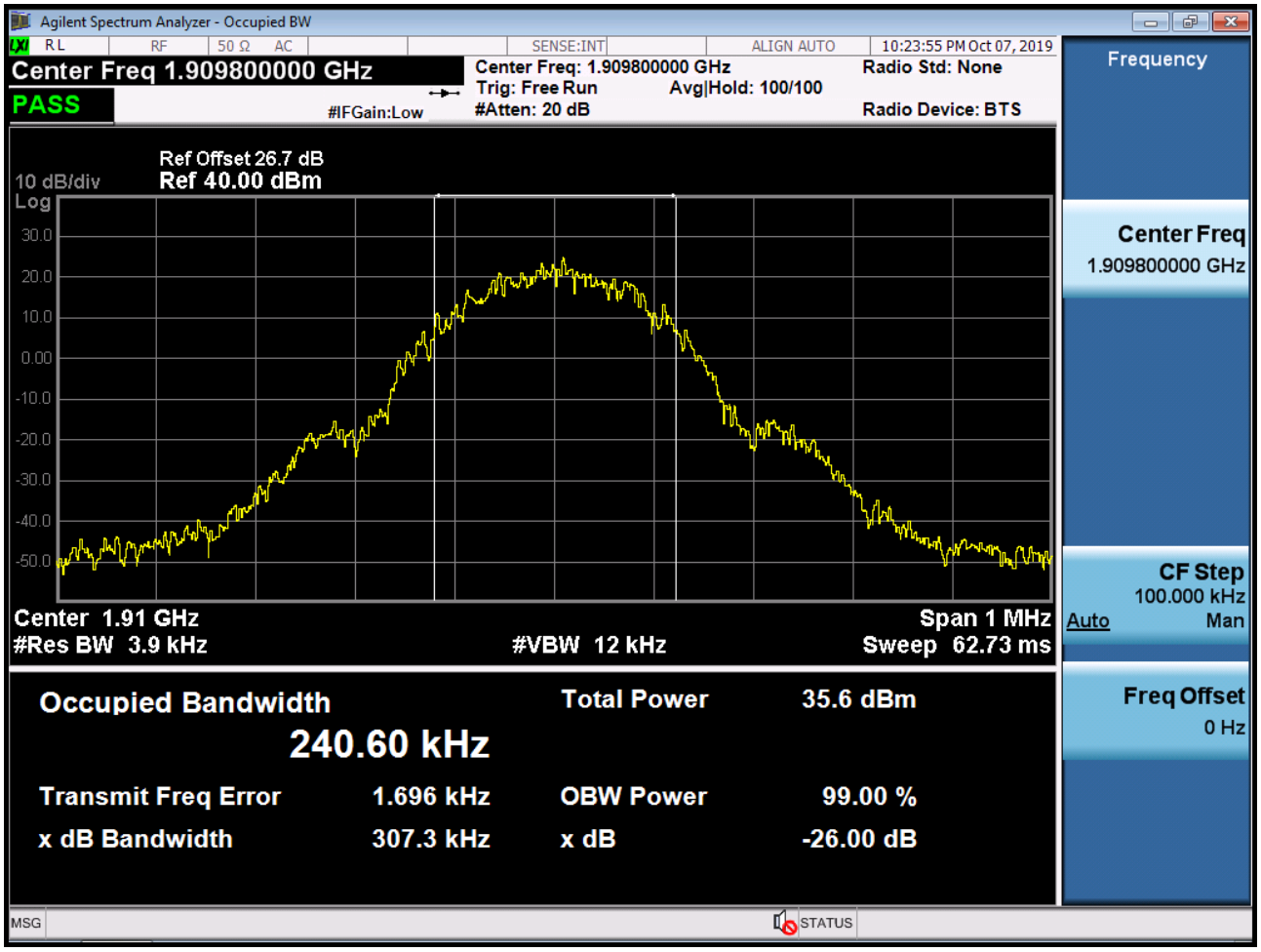
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



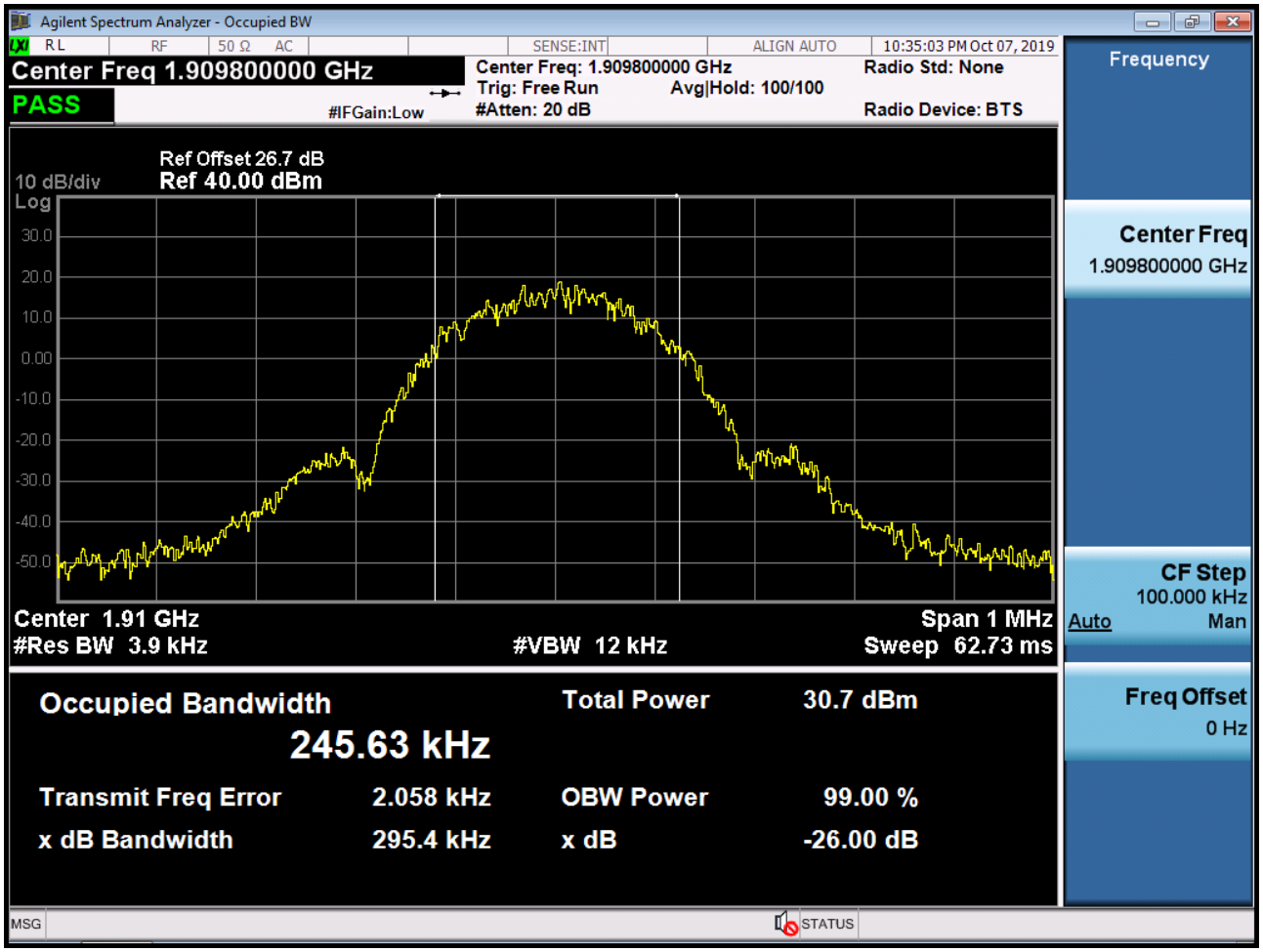
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



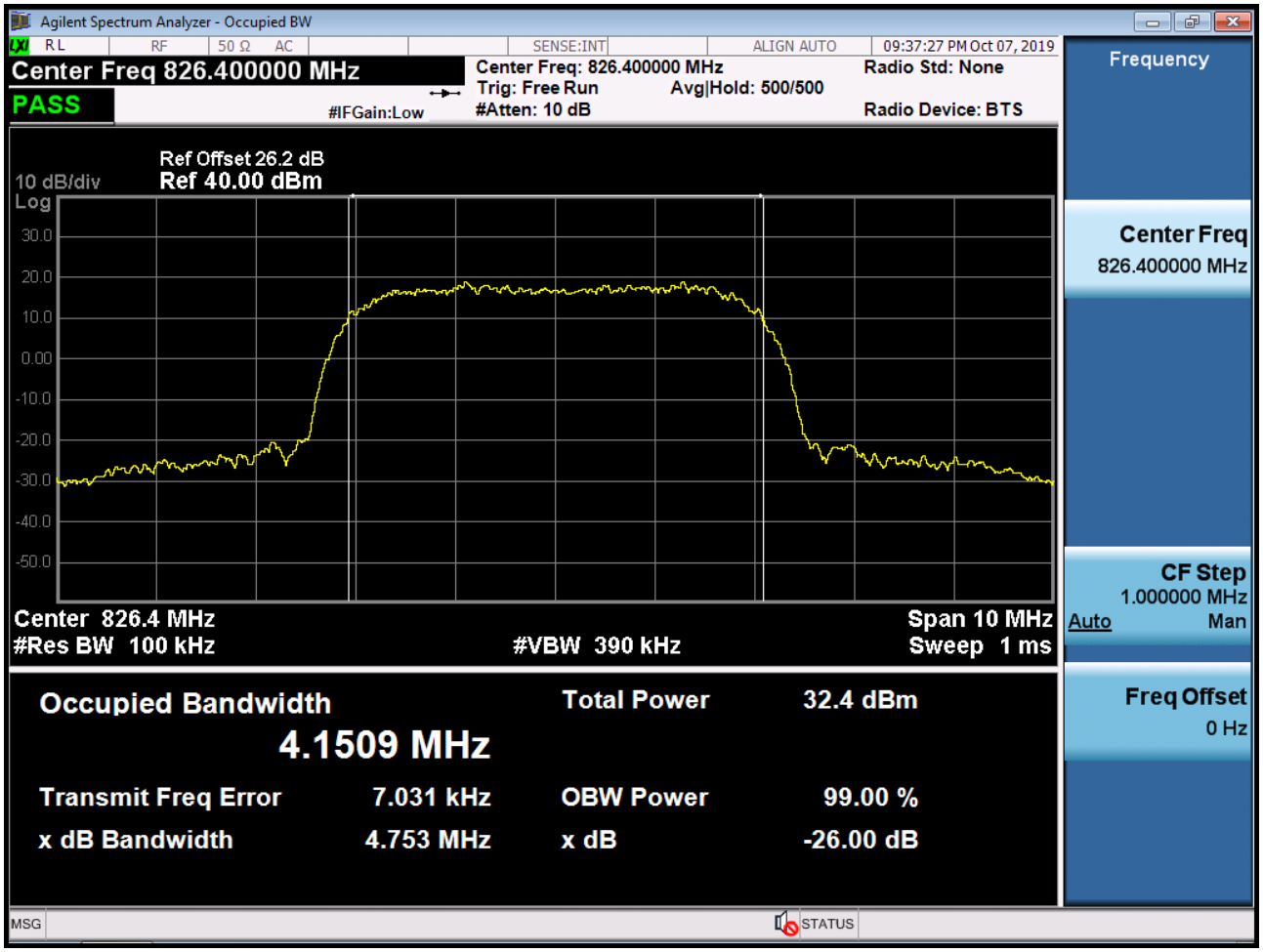
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



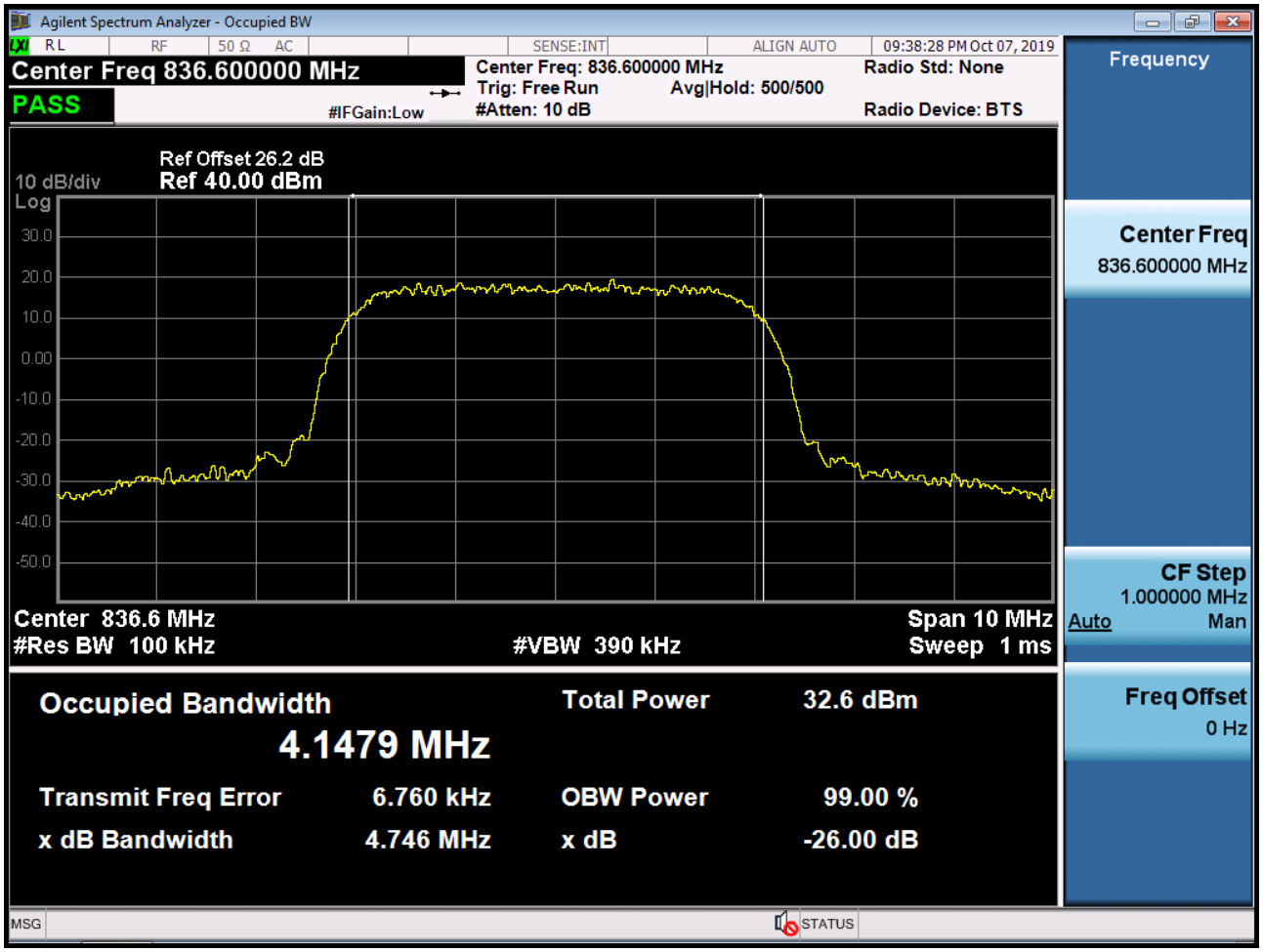
■ GSM1900 EDGE (810 CH.) Occupied Bandwidth



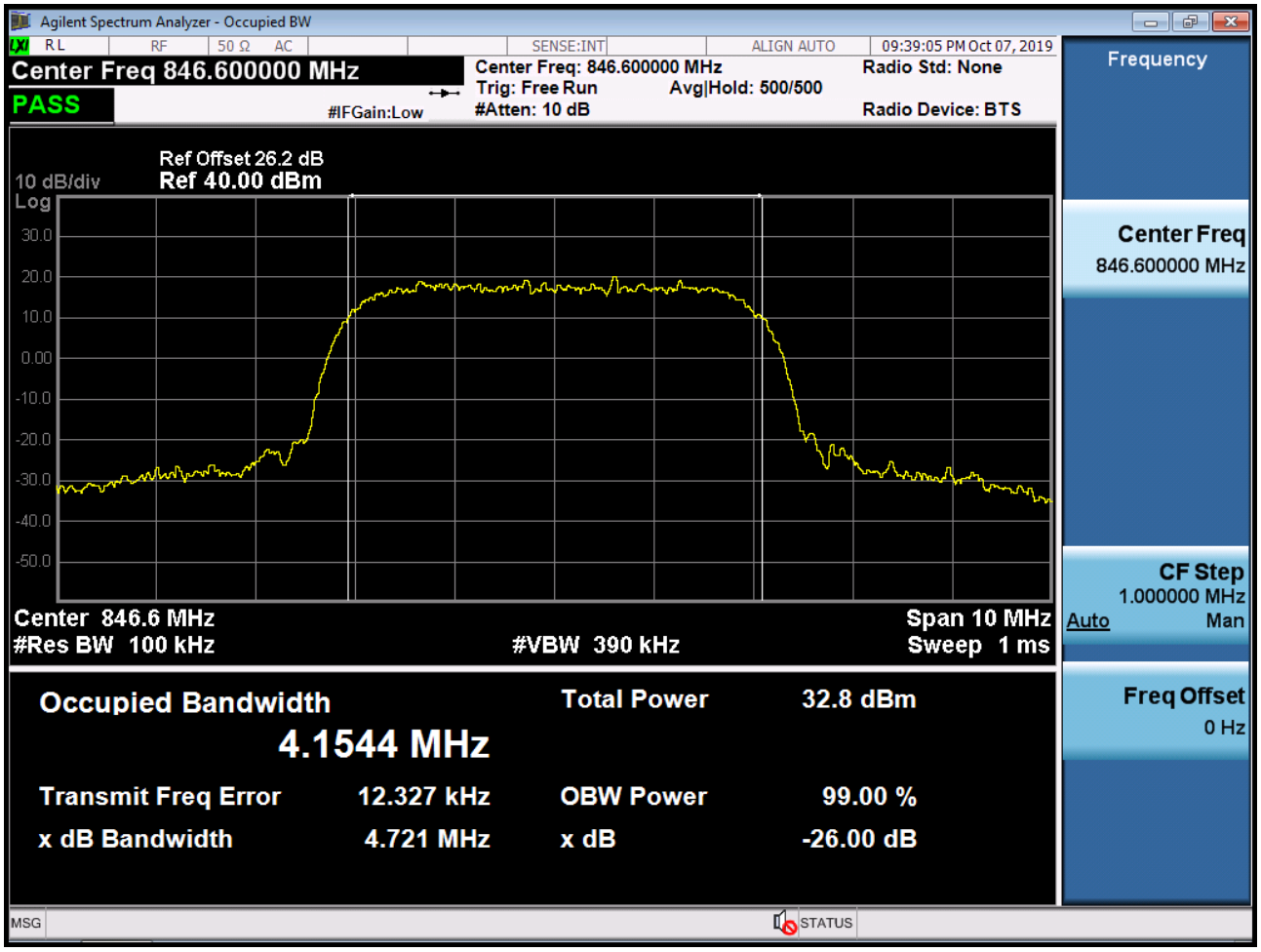
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



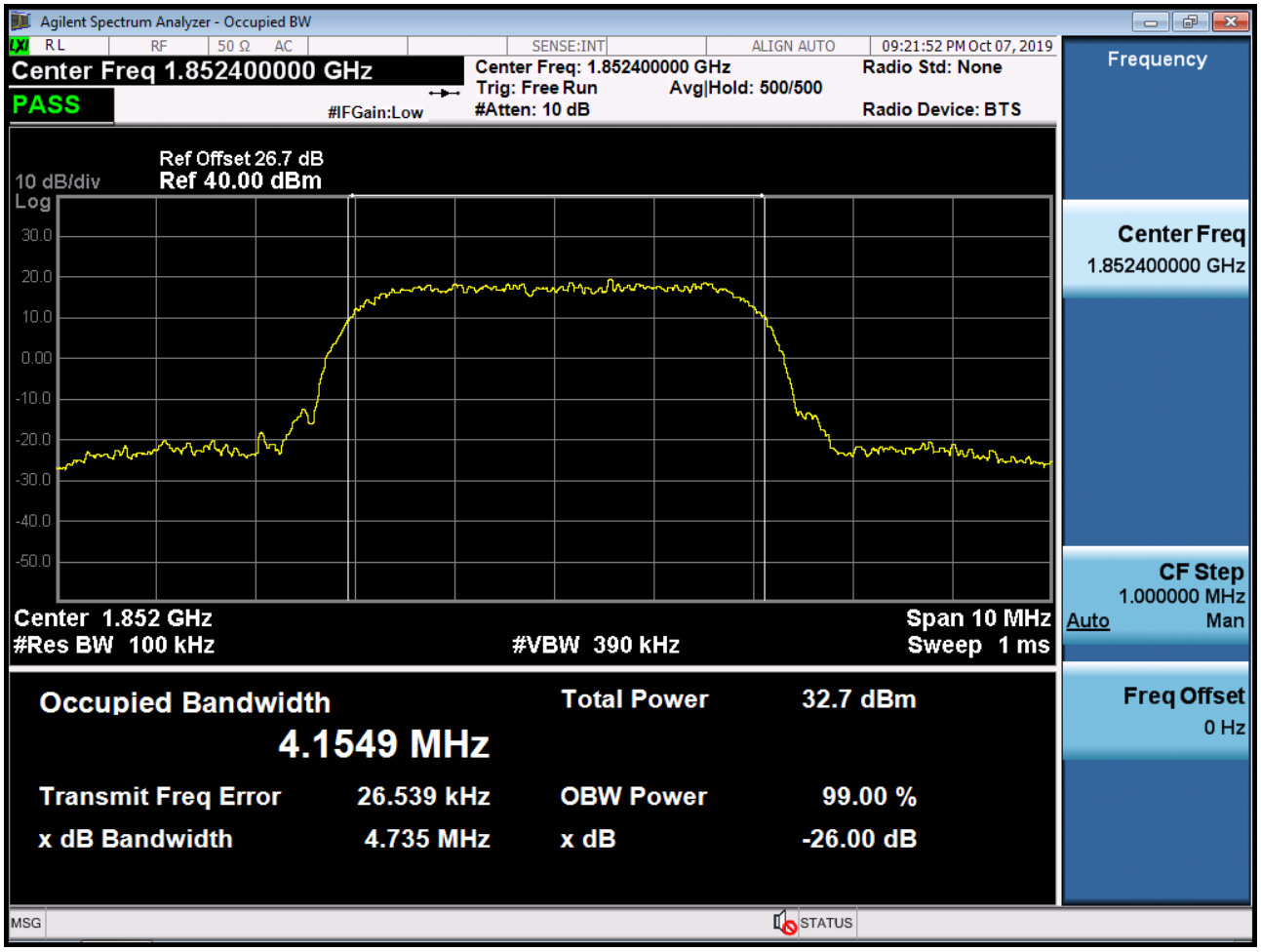
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



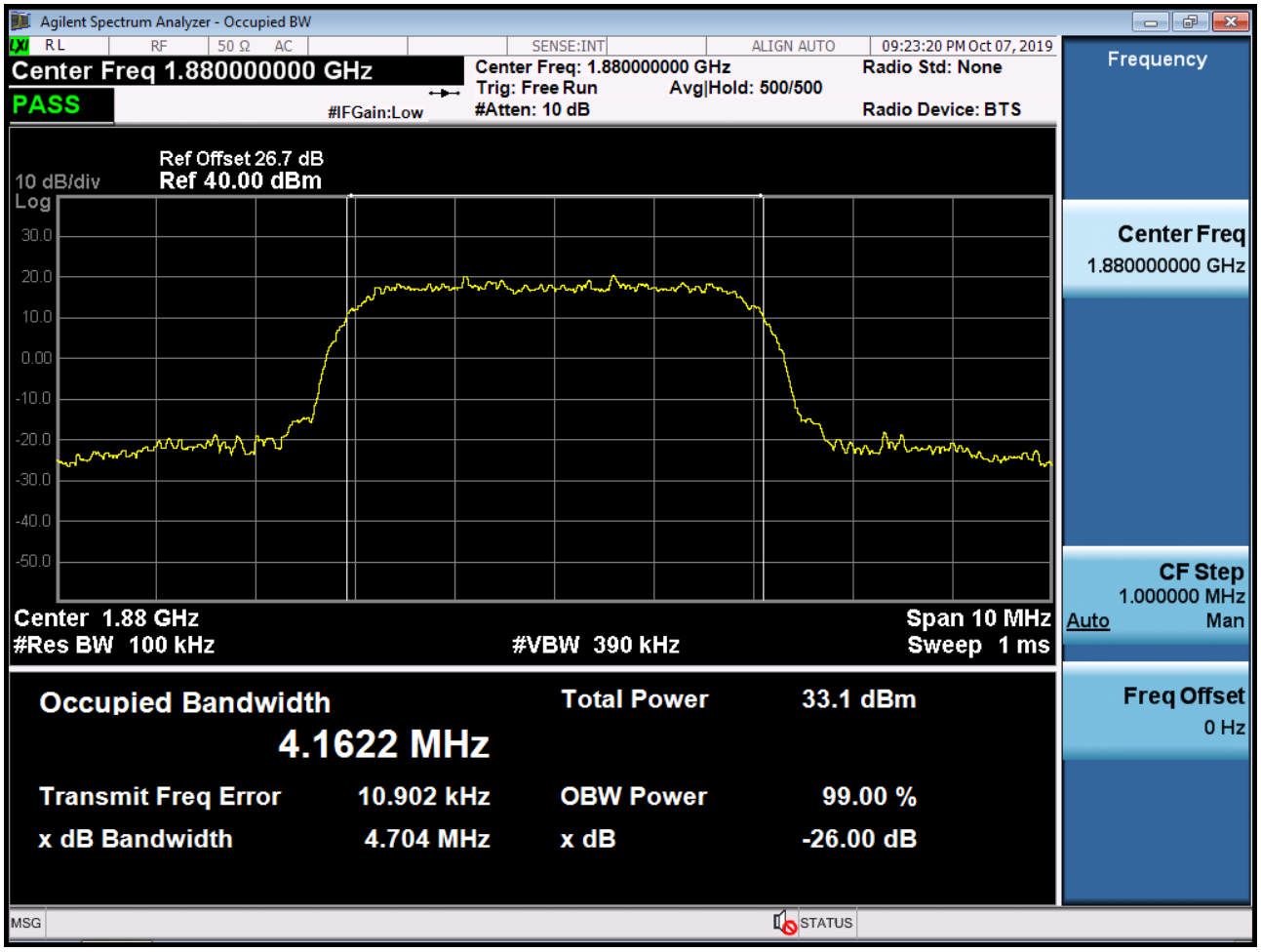
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



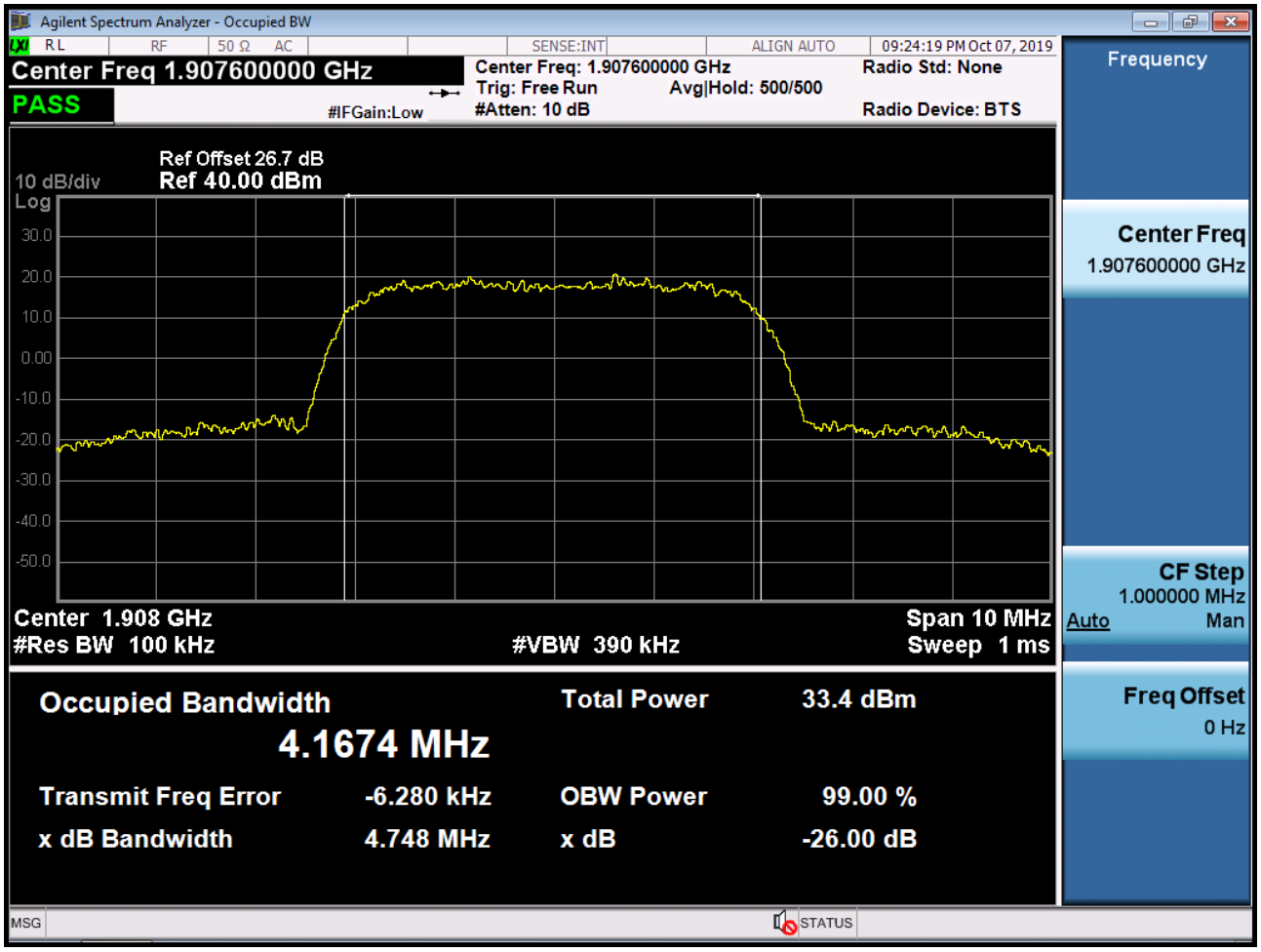
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



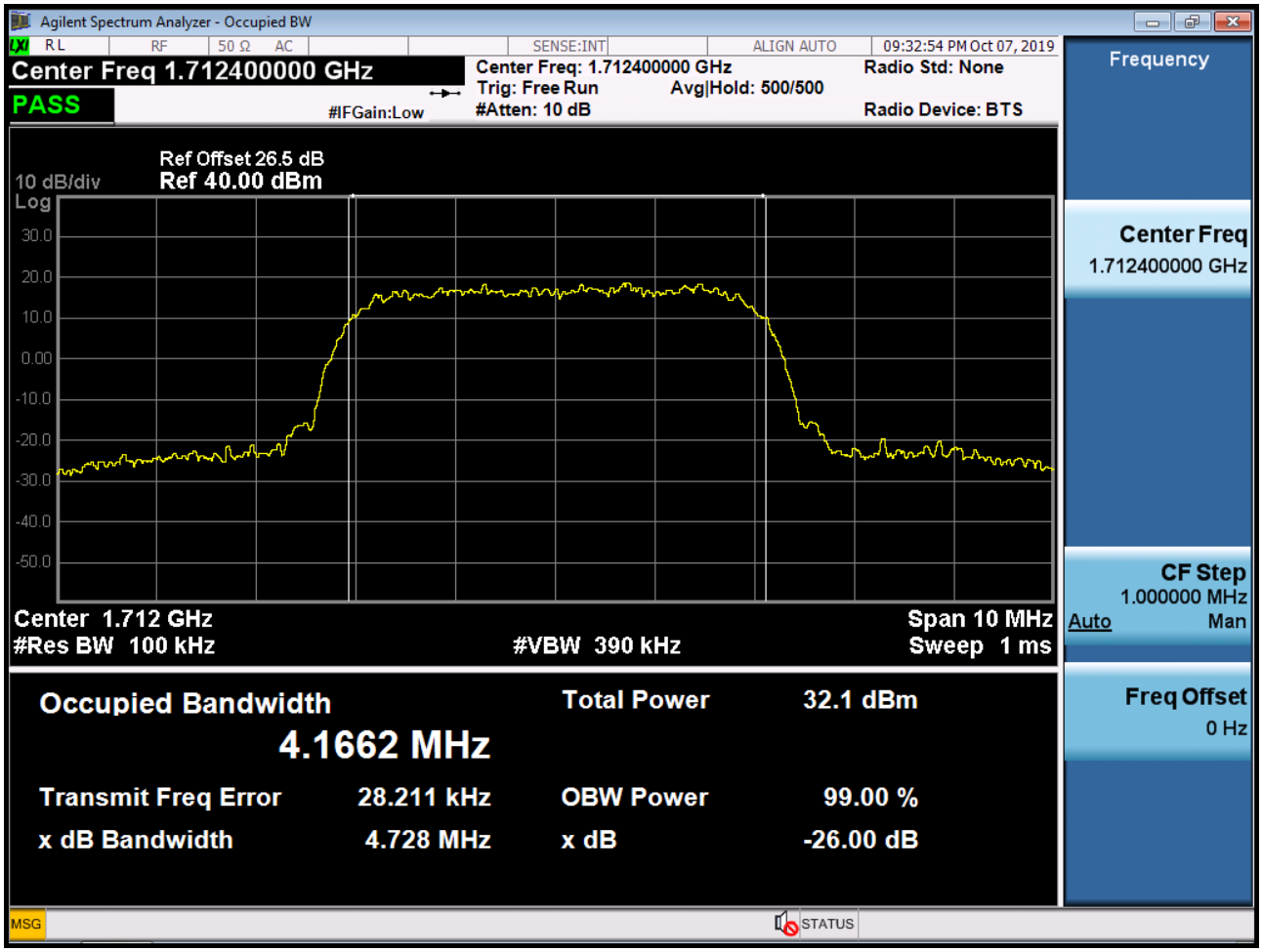
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



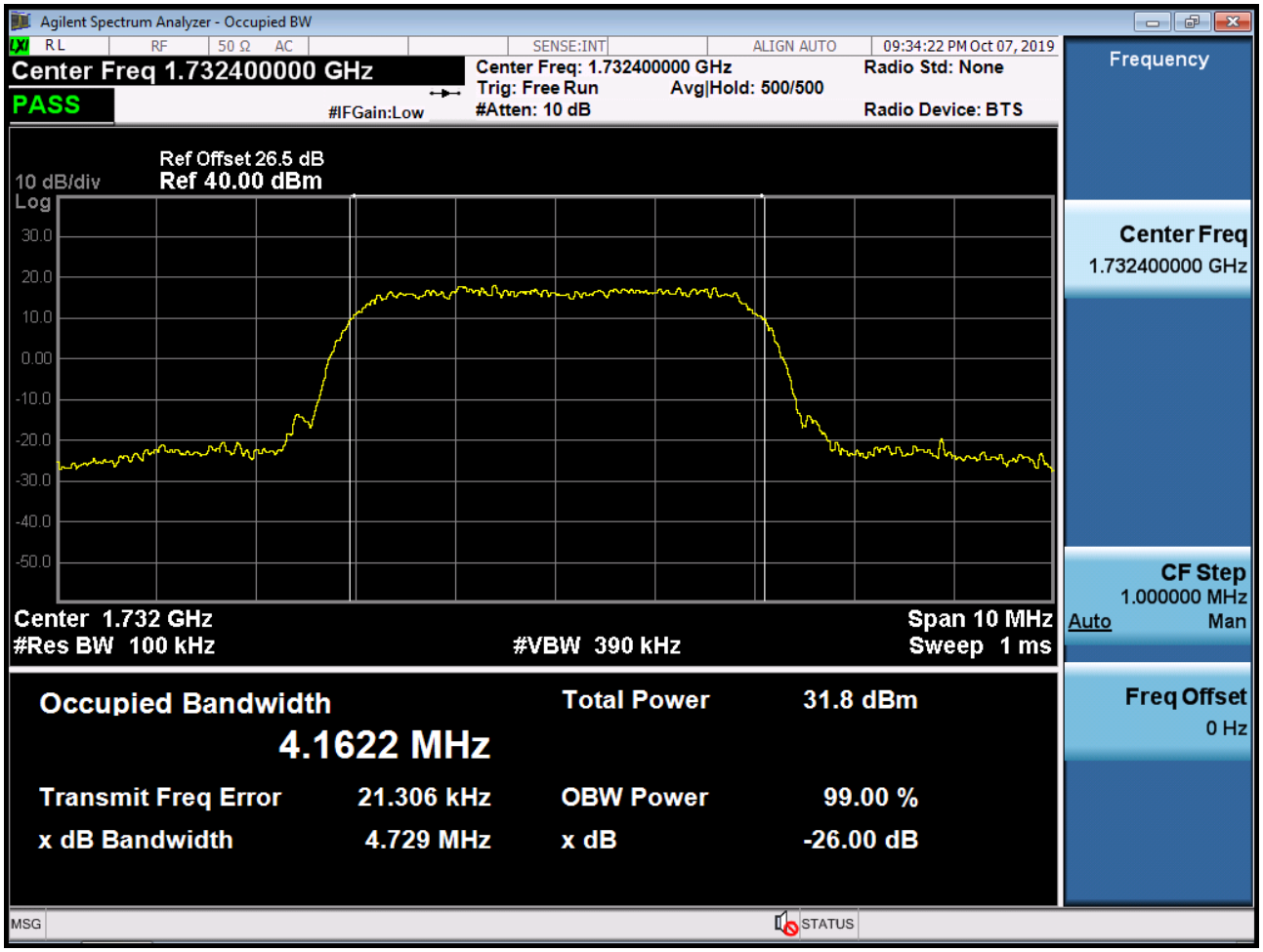
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



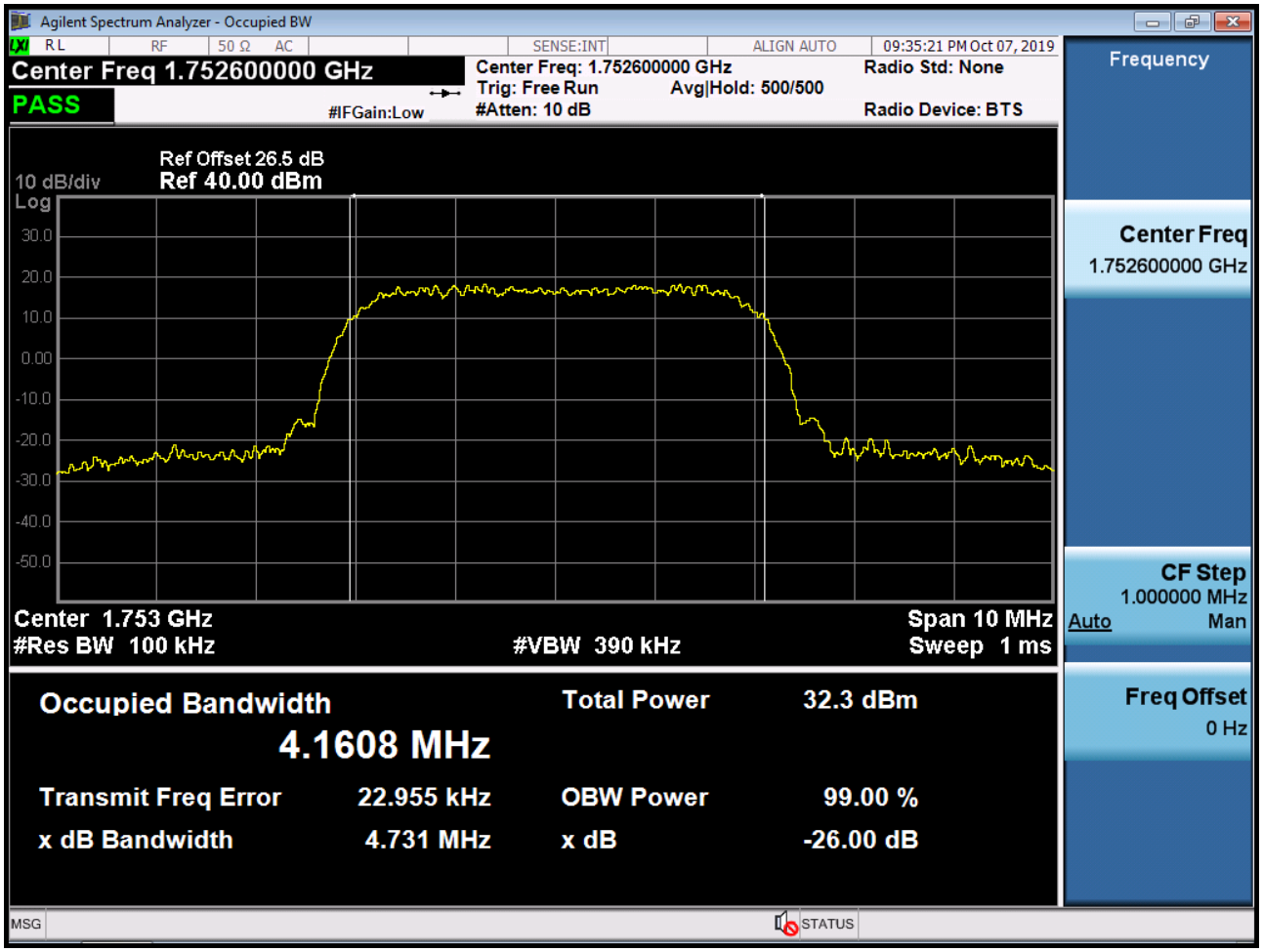
■ WCDMA1700 MODE (1712.4 CH.) Occupied Bandwidth



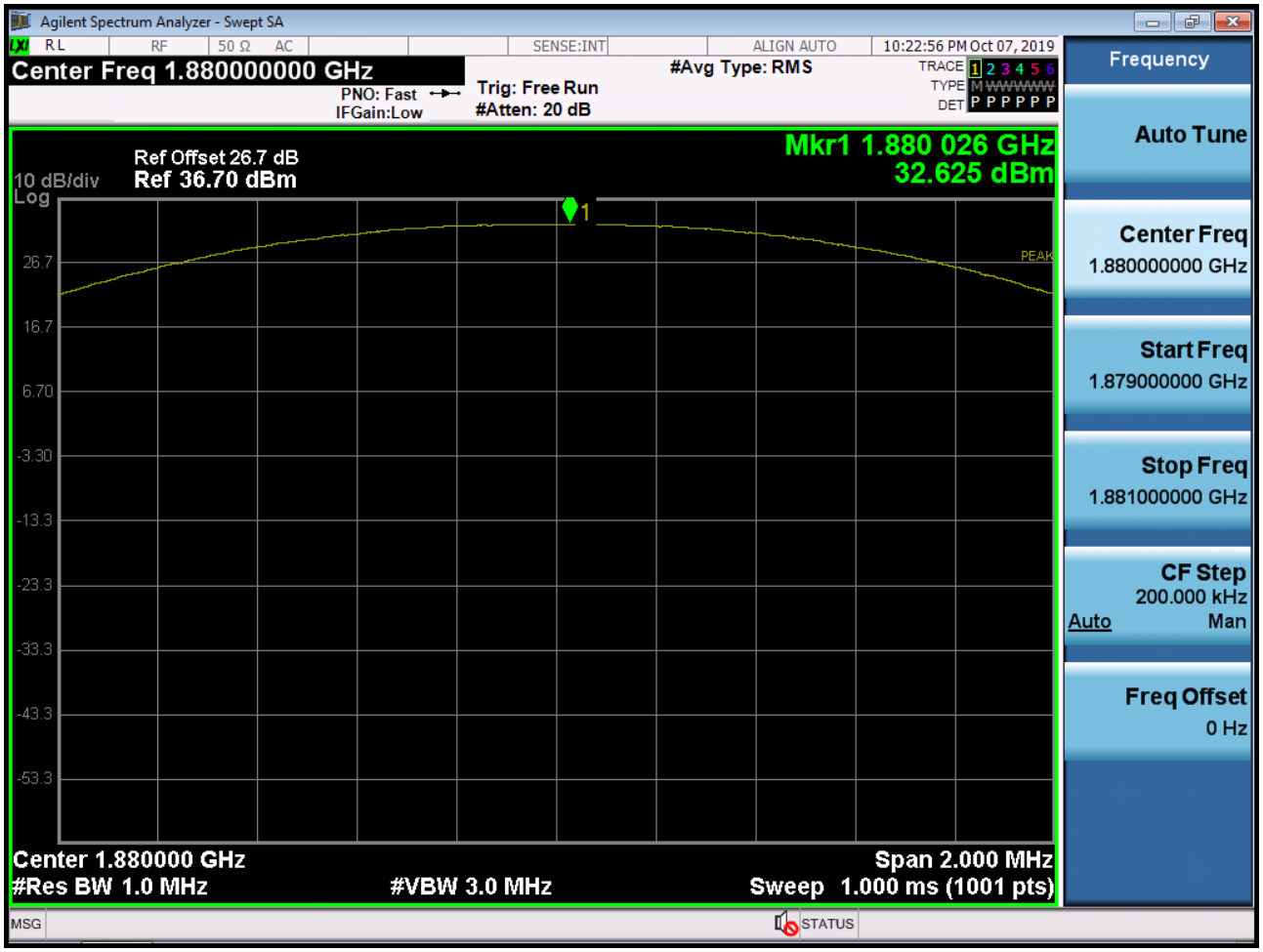
■ WCDMA1700 MODE (1732.4 CH.) Occupied Bandwidth



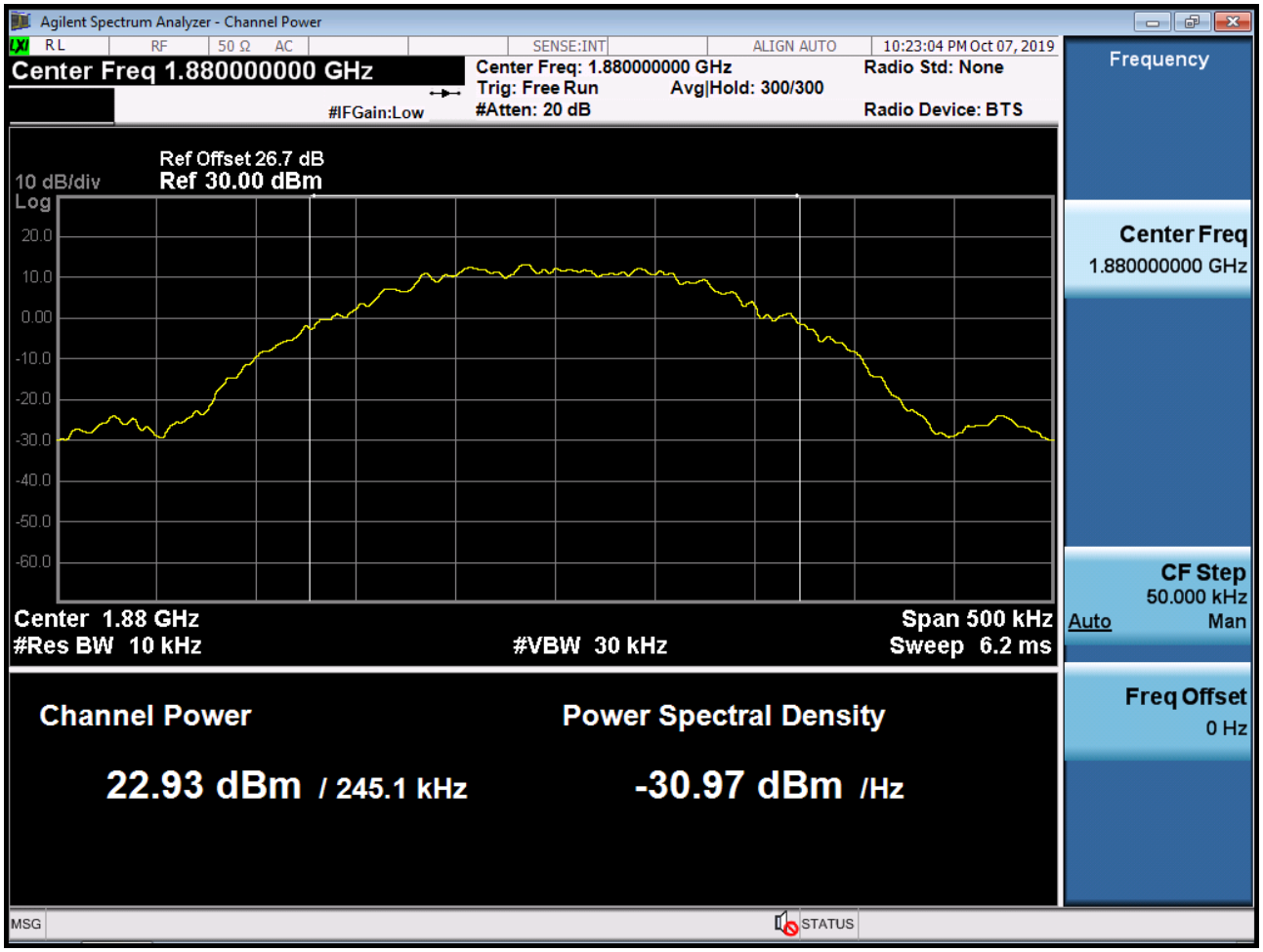
■ WCDMA1700 MODE (1752.6 CH.) Occupied Bandwidth



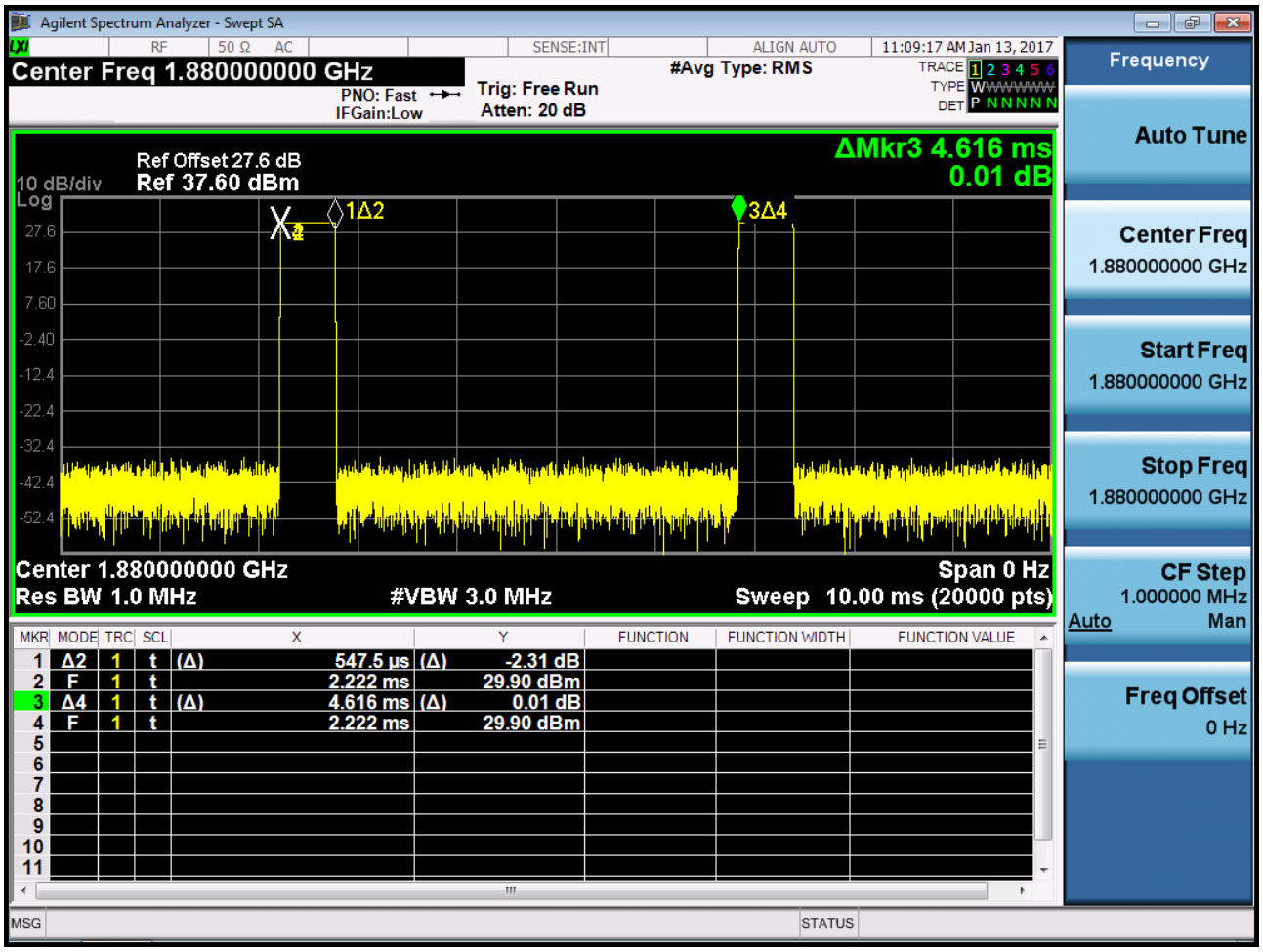
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{Pk}



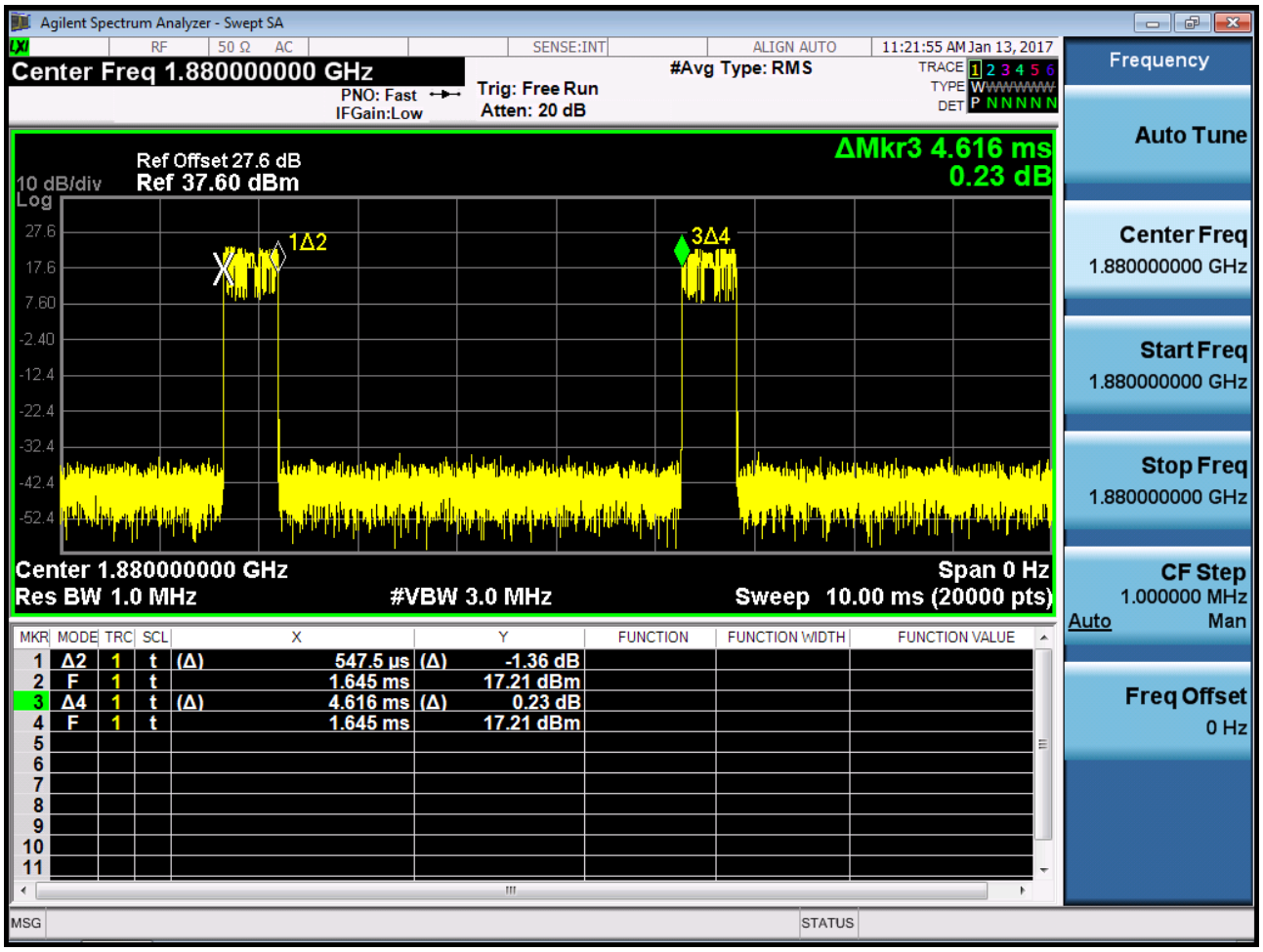
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{Avg}



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

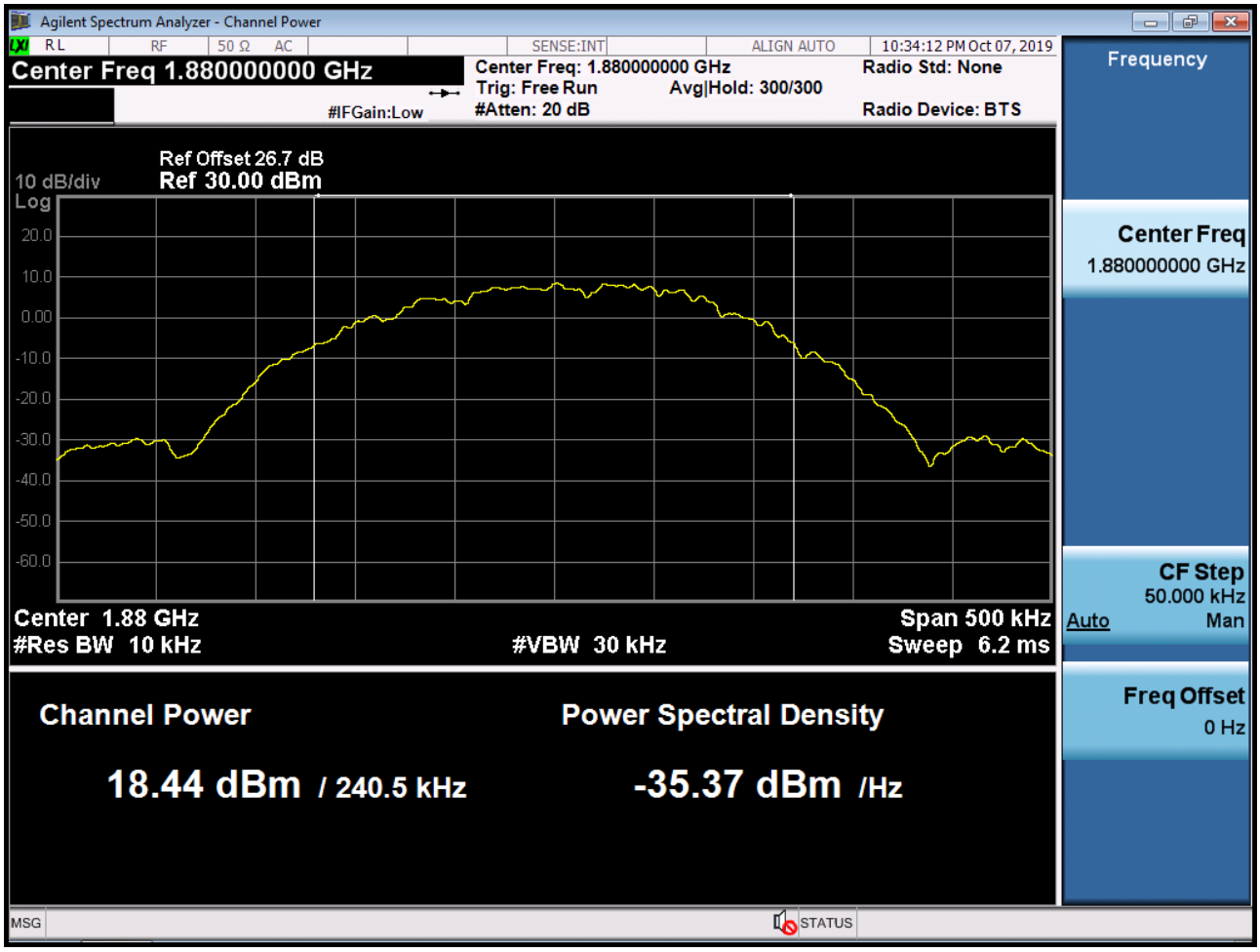


■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio Duty

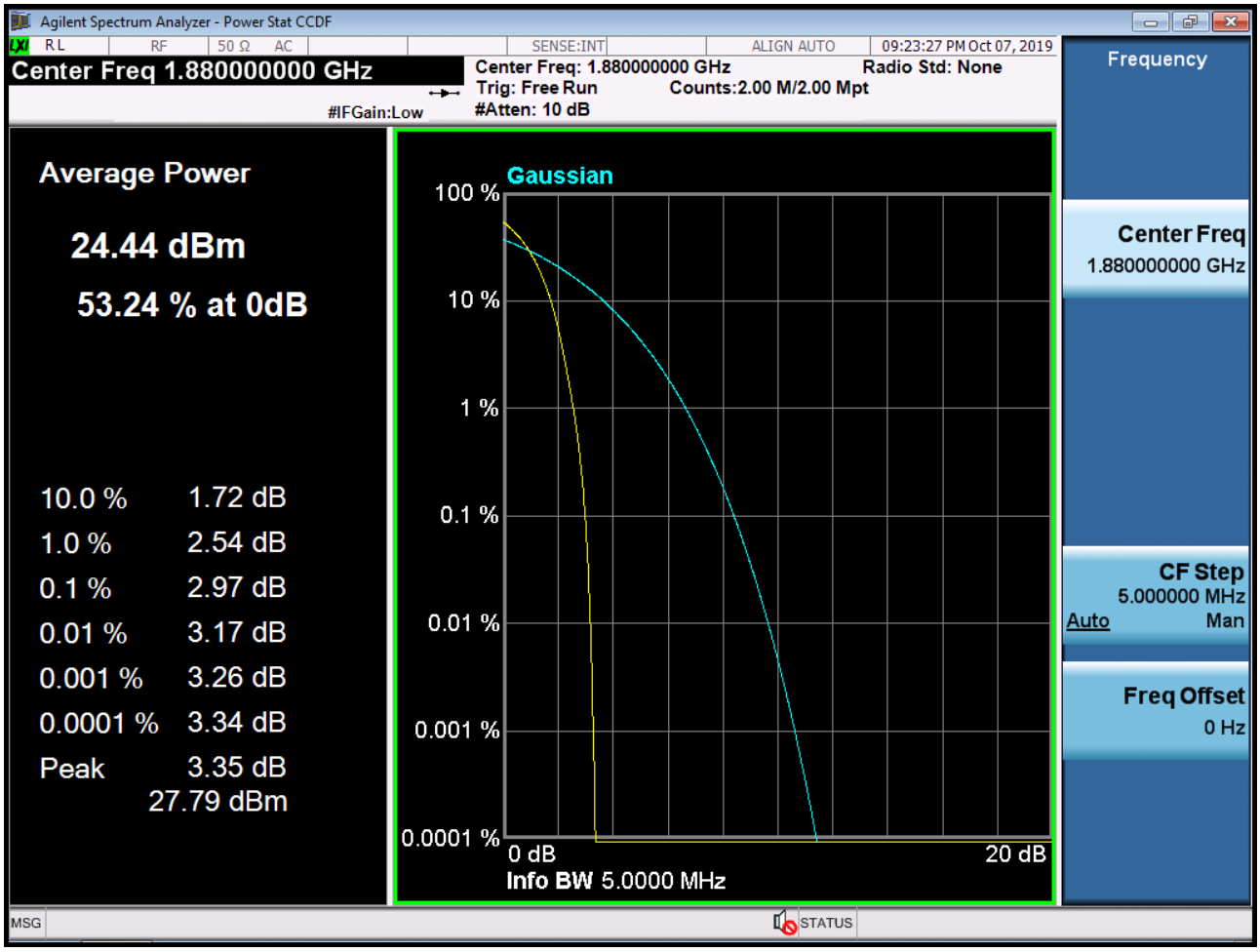


■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{Pk}

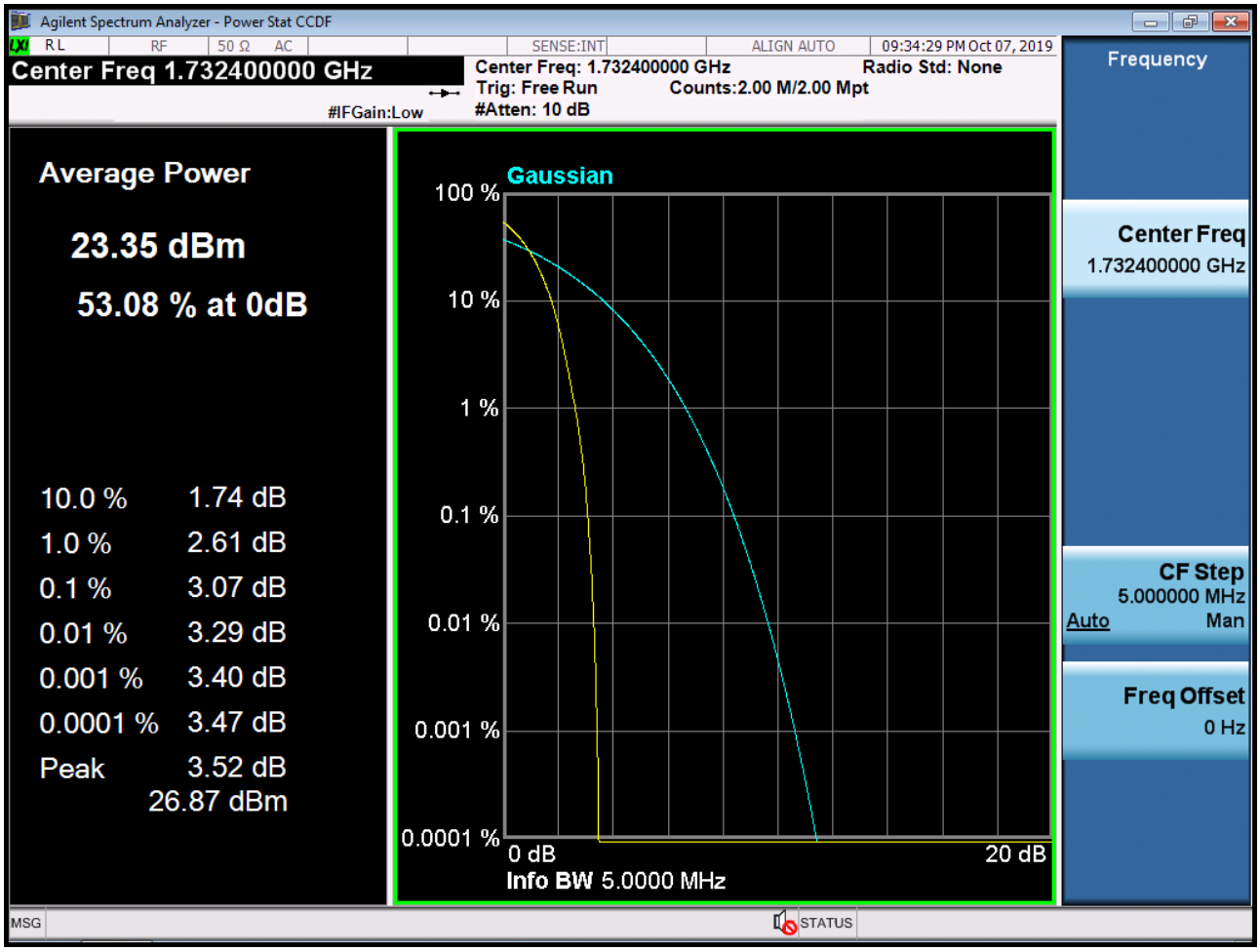
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{Avg}



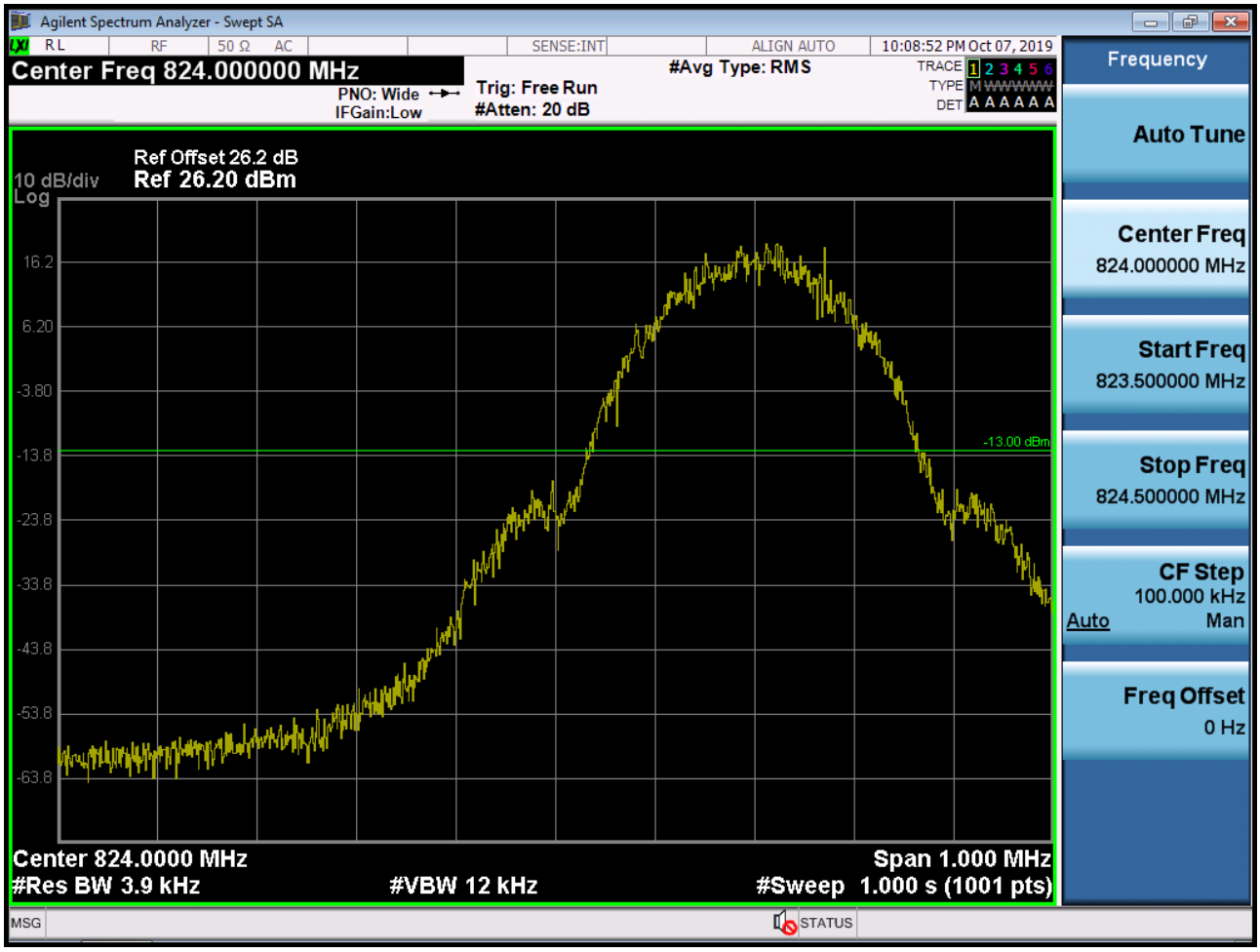
■ WCDMA1900 MODE (9400 CH.) Peak-to-Average Ratio



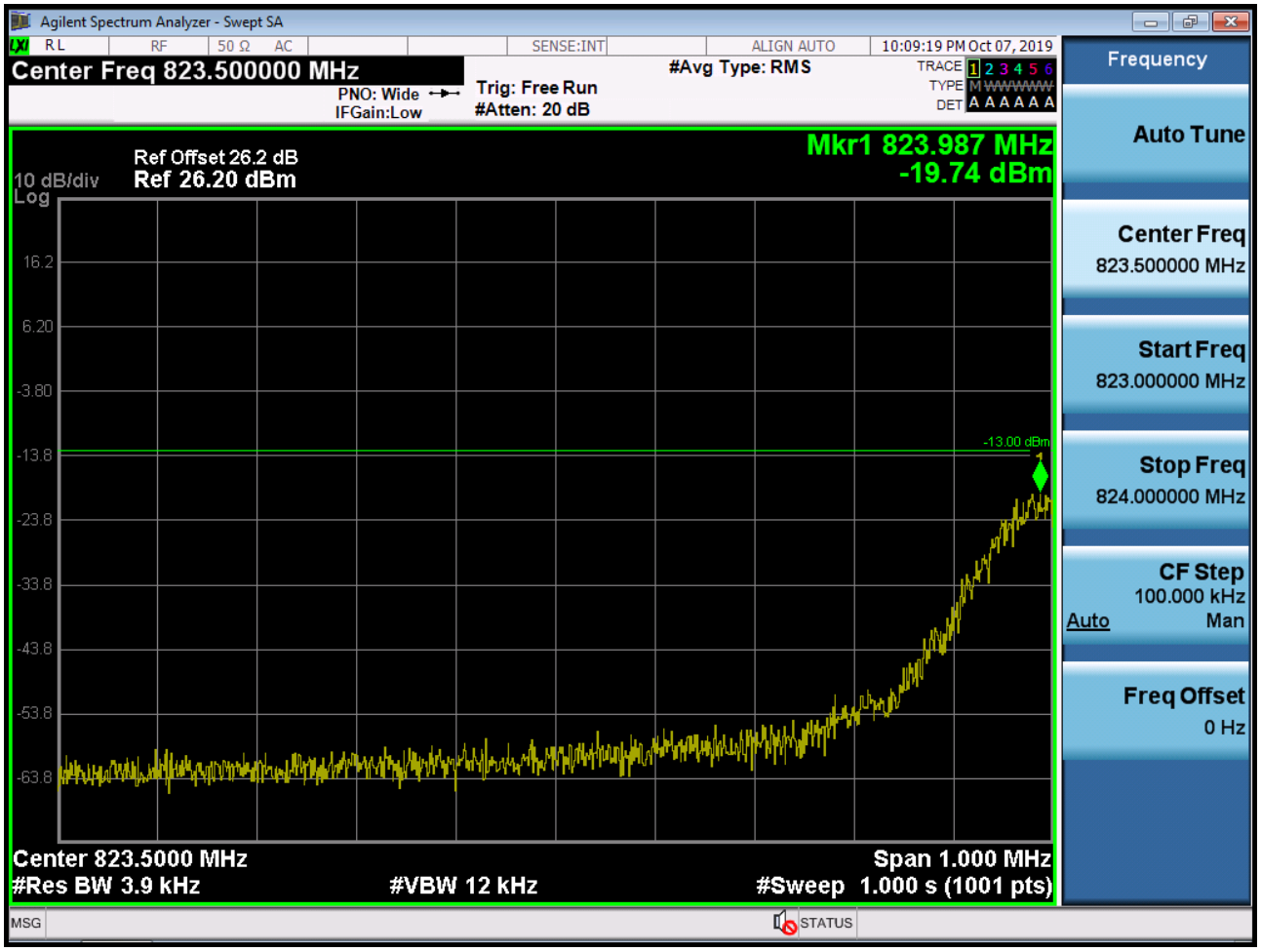
■ WCDMA1700 MODE (1412 CH.) Peak-to-Average Ratio



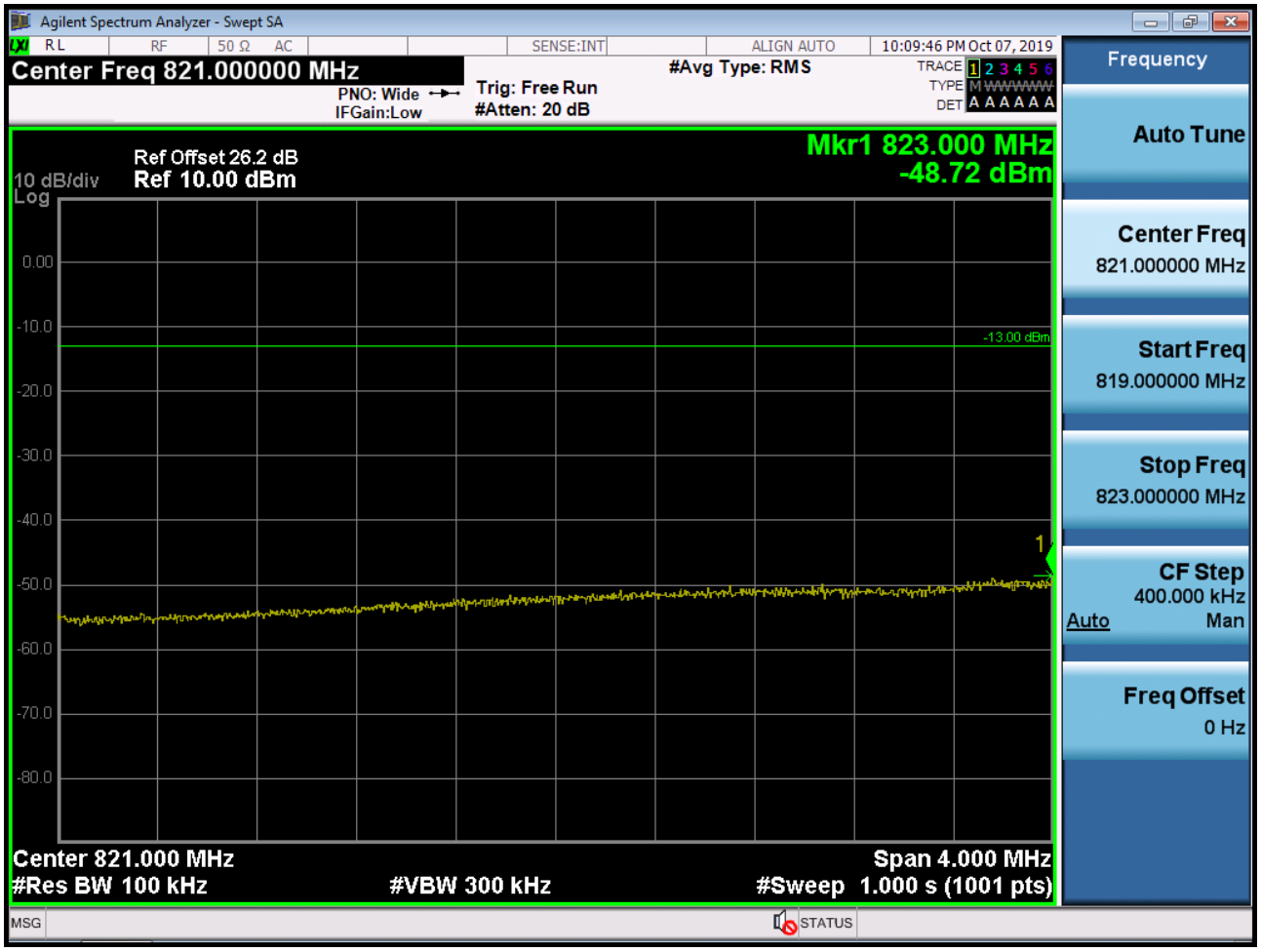
■ GSM850 MODE (128 CH.) Block Edge 1



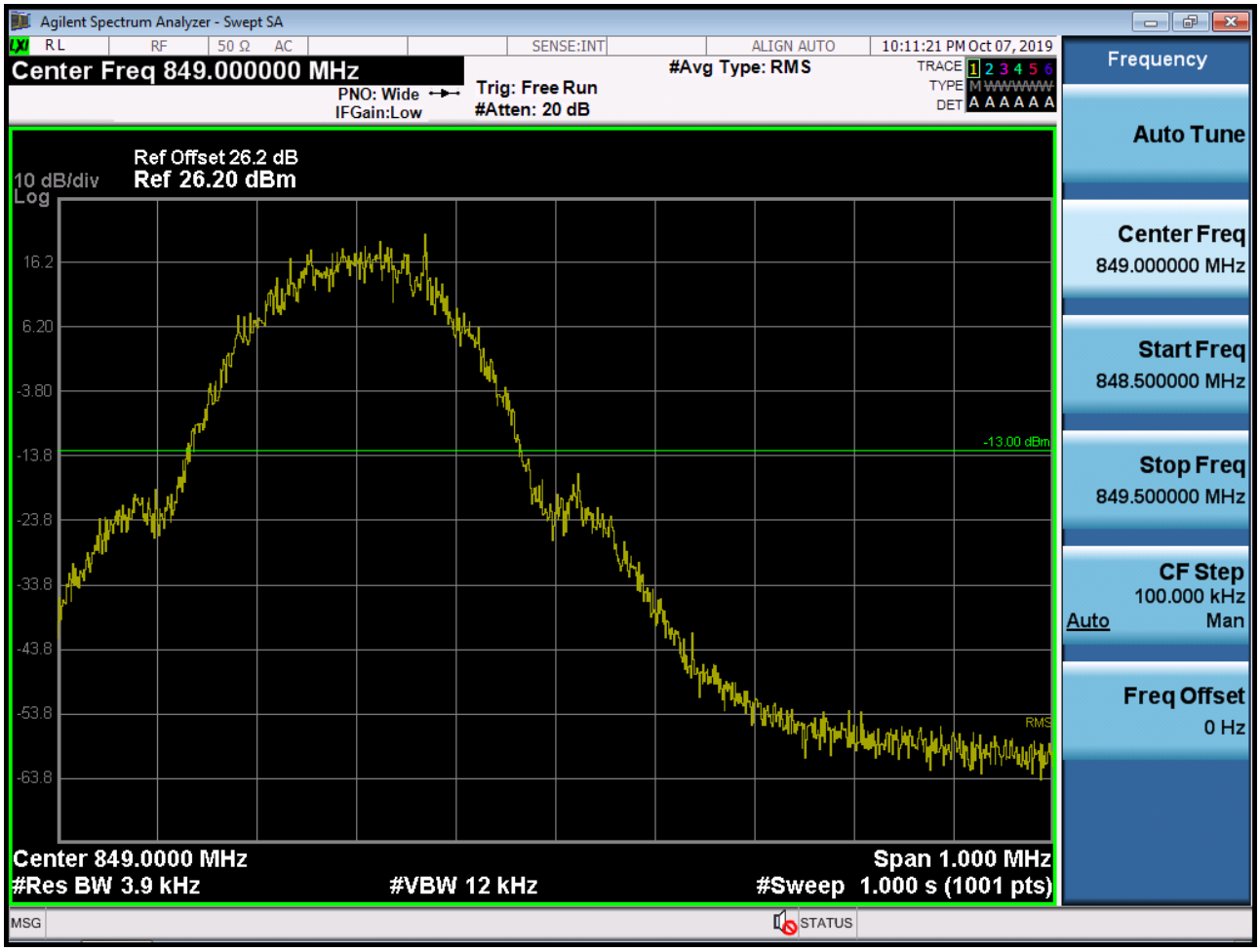
■ GSM850 MODE (128 CH.) Block Edge 2



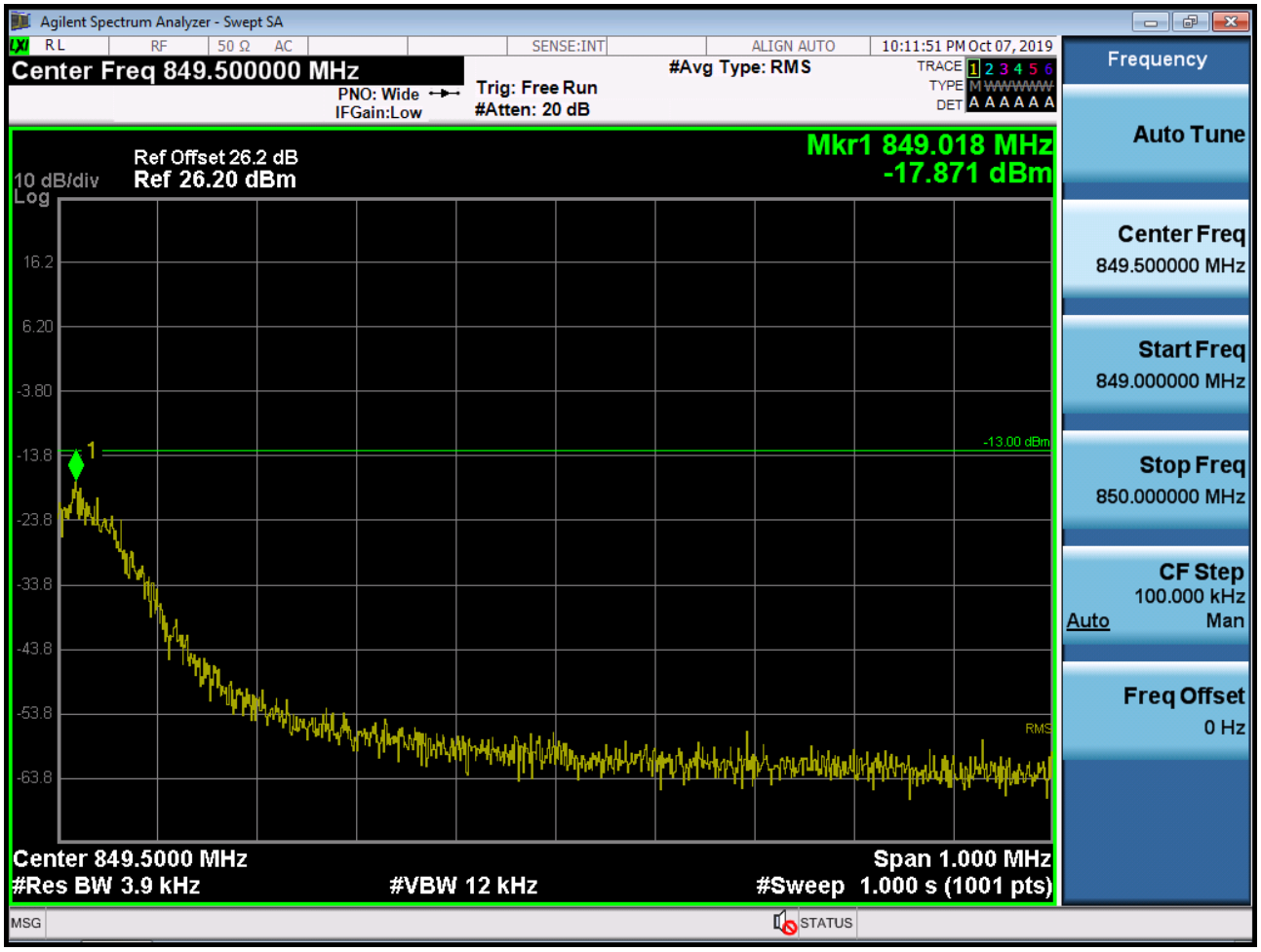
■ GSM850 MODE (128 CH.) Block Edge 3



■ GSM850 MODE (251 CH.) Block Edge 1

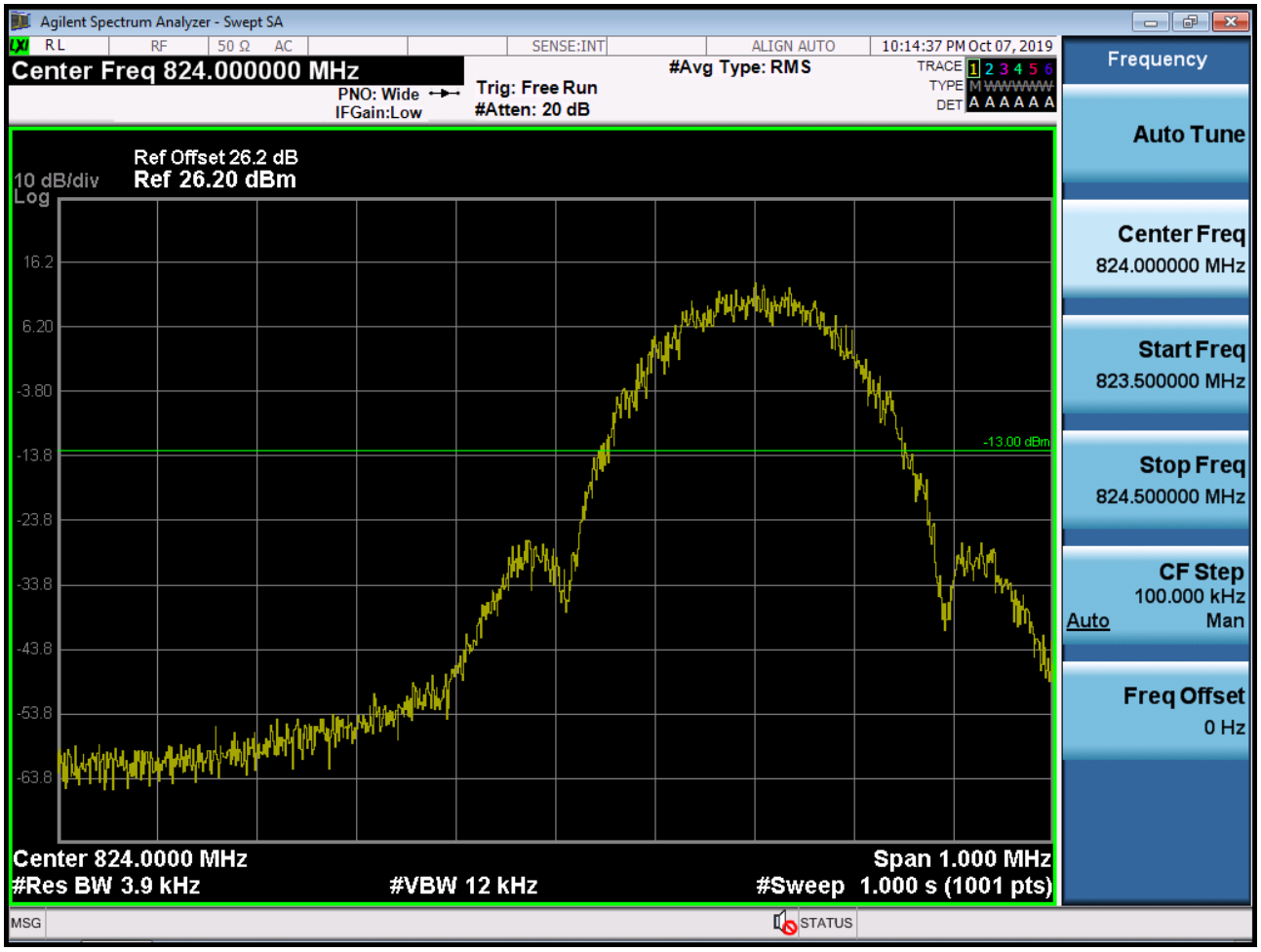


■ GSM850 MODE (251 CH.) Block Edge 2

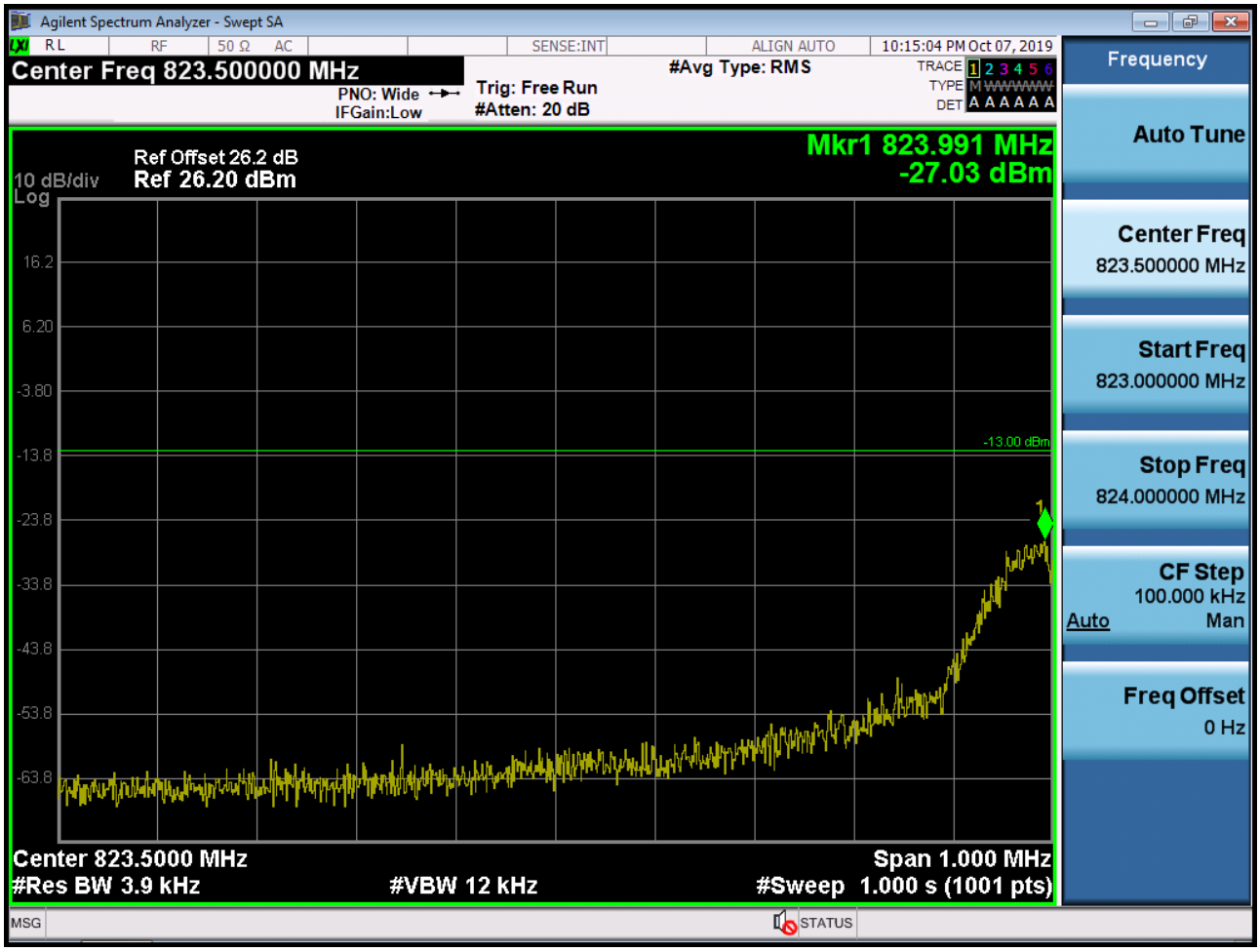


■ GSM850 MODE (251 CH.) Block Edge 3

■ EDGE MODE (128 CH.) Block Edge 1

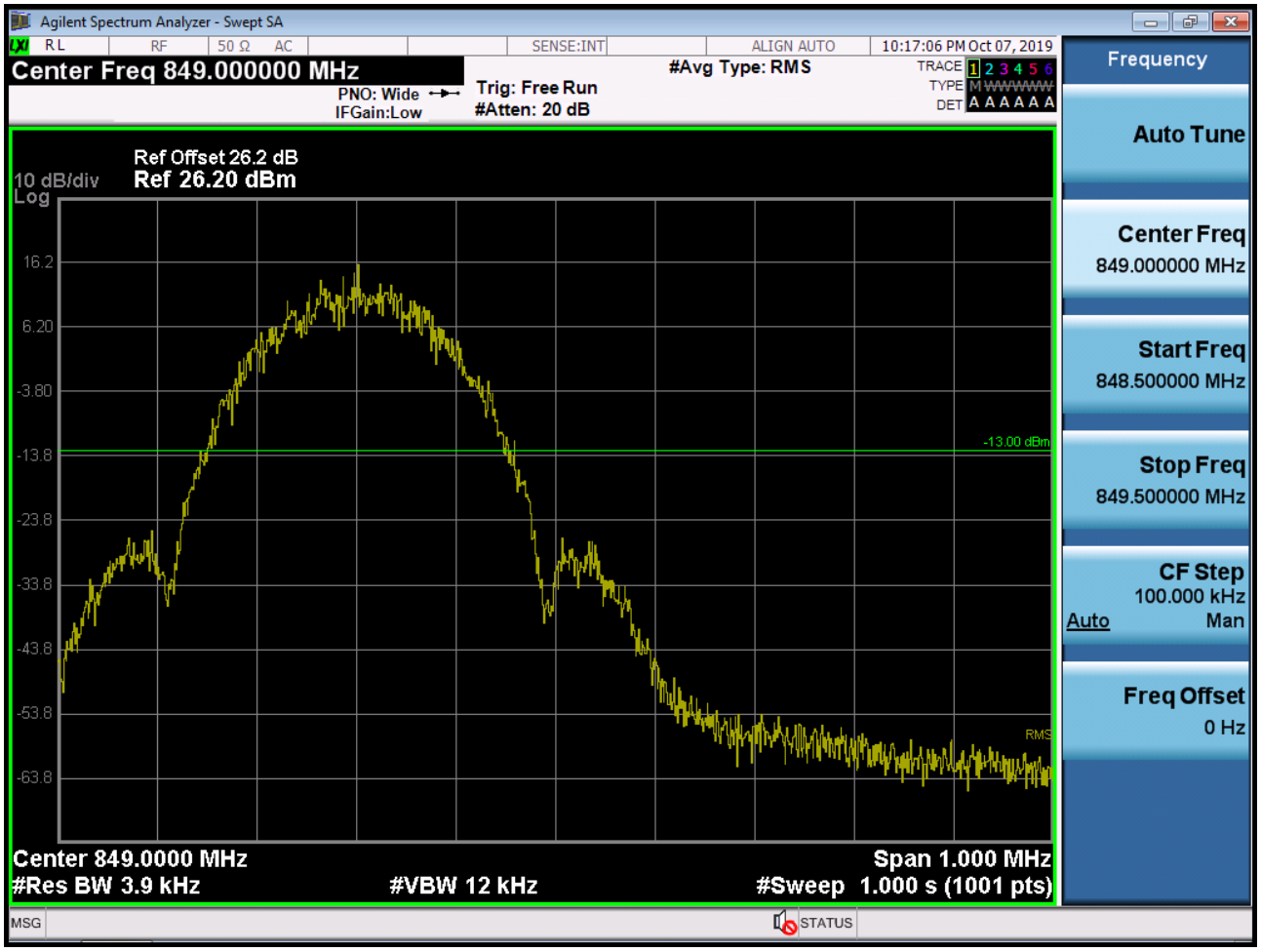


■ EDGE MODE (128 CH.) Block Edge 2

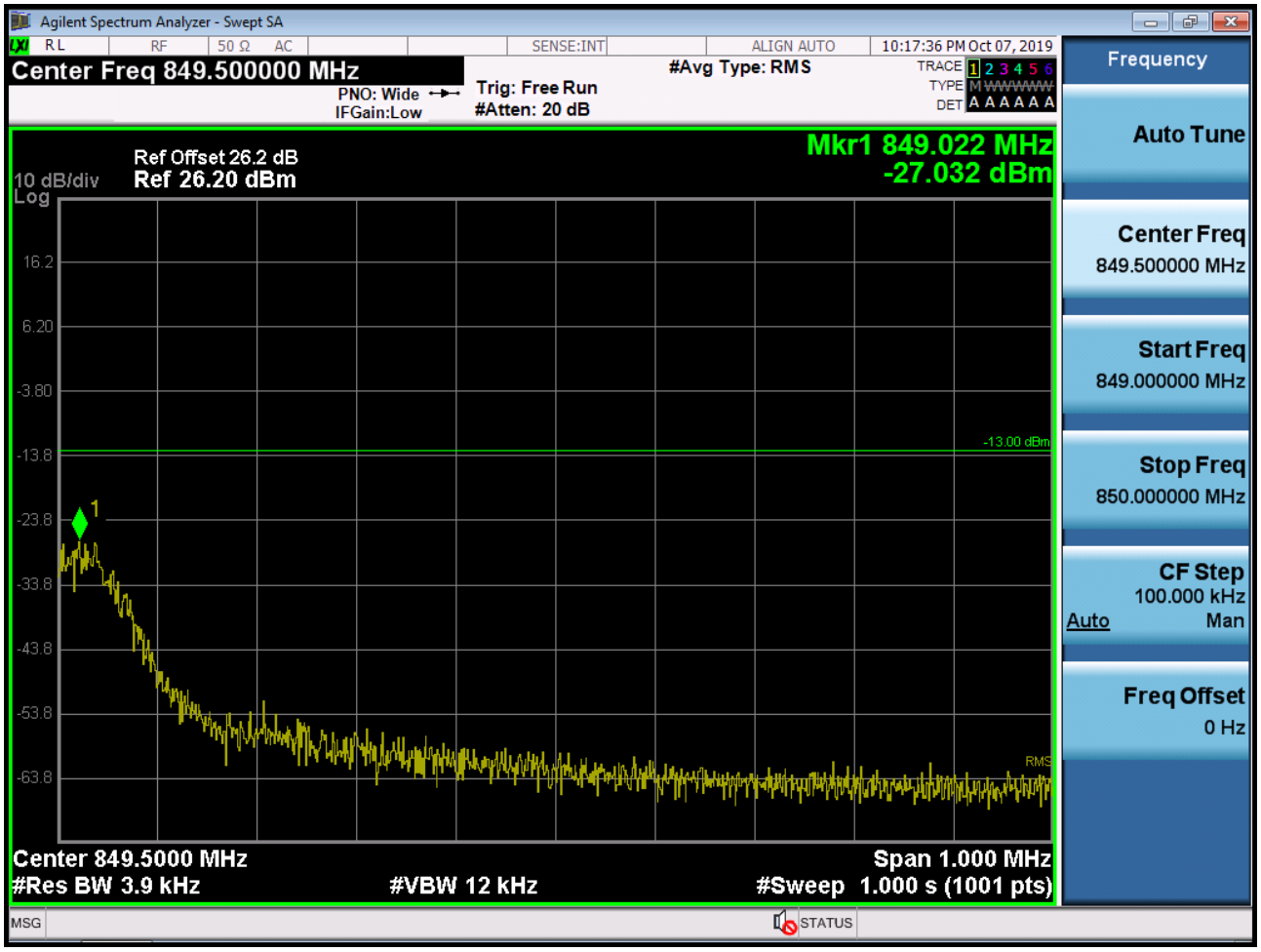


■ EDGE MODE (128 CH.) Block Edge 3

■ EDGE MODE (251 CH.) Block Edge 1

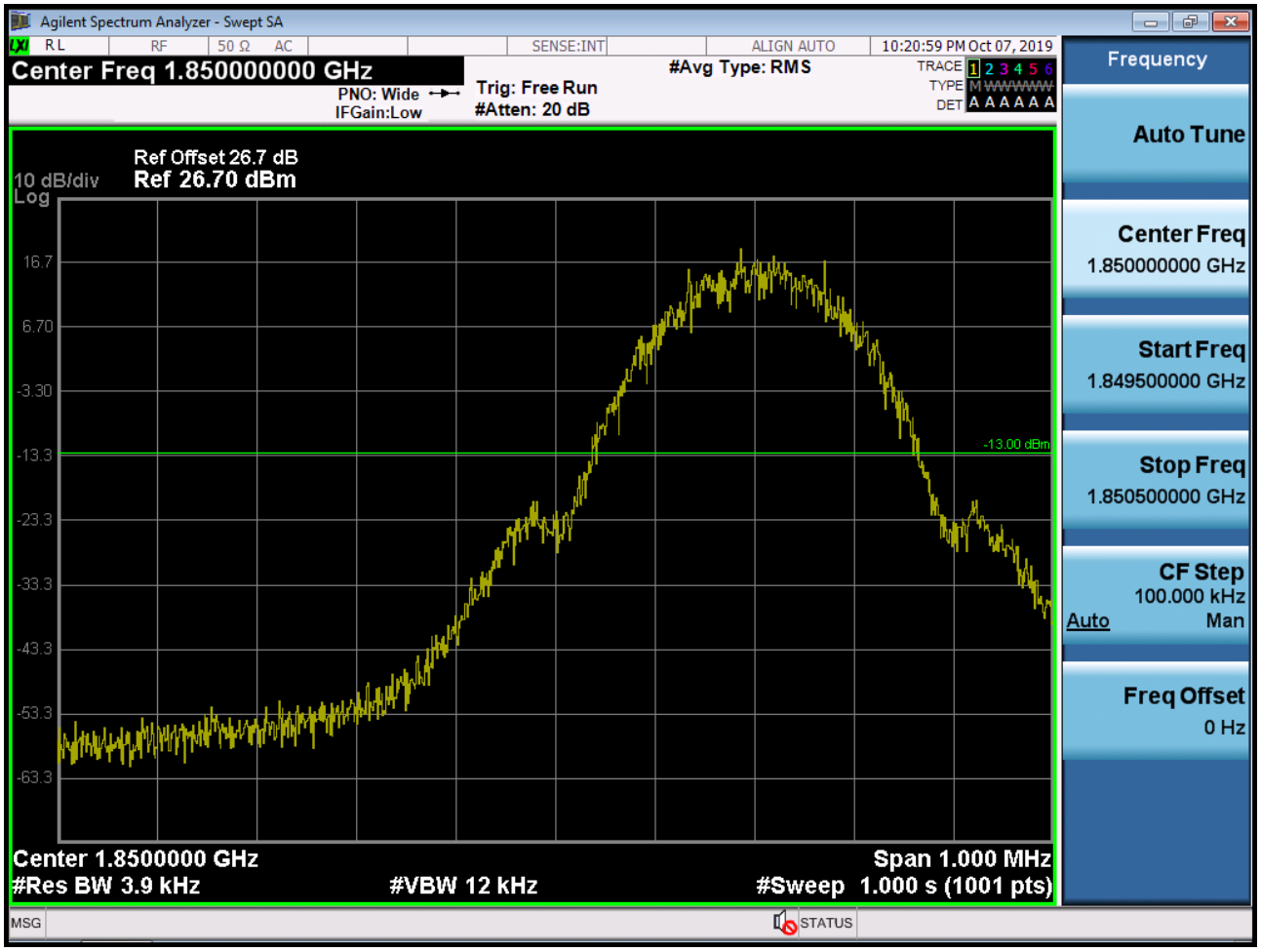


■ EDGE MODE (251 CH.) Block Edge 2

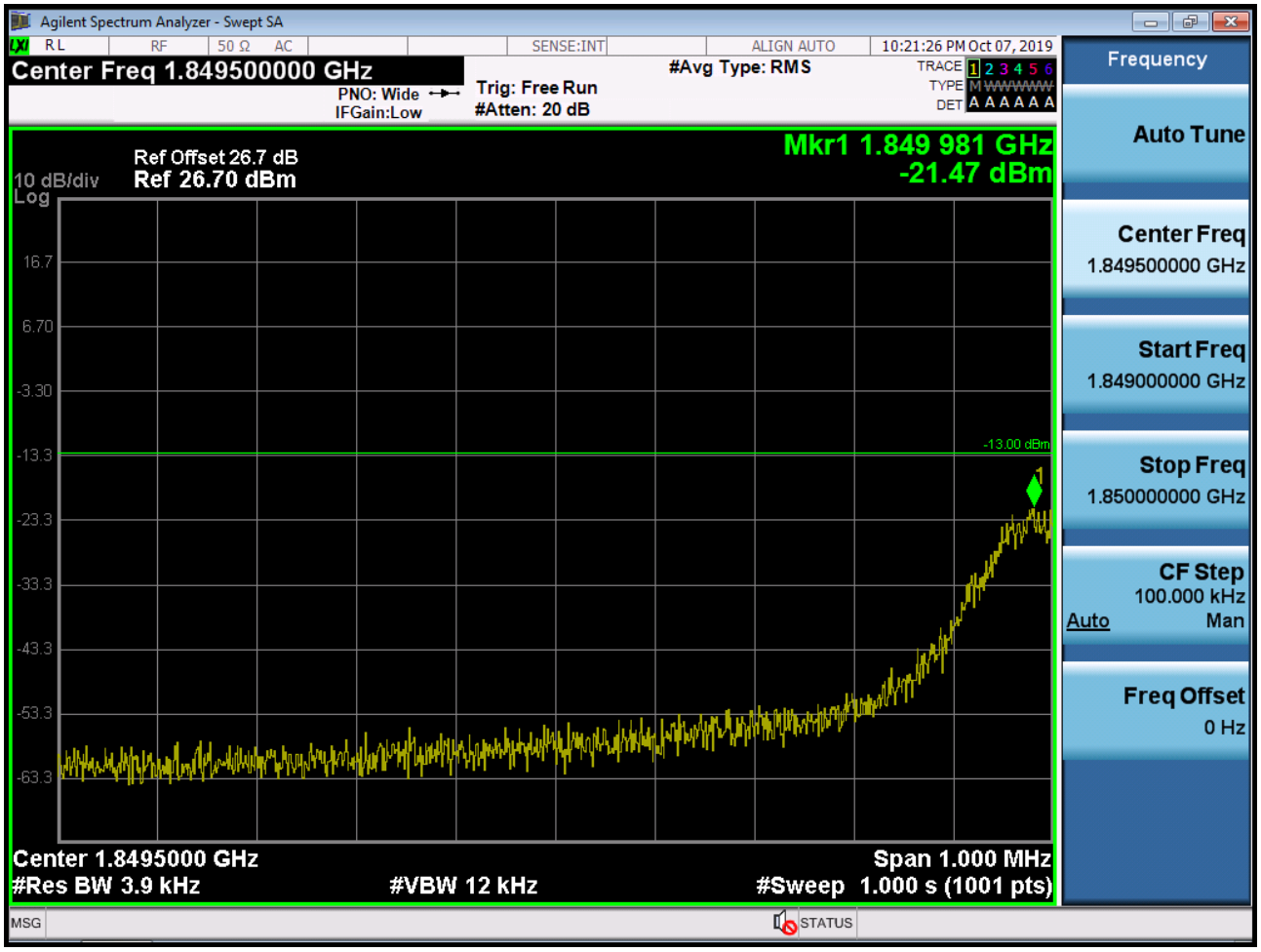


■ EDGE MODE (251 CH.) Block Edge 3

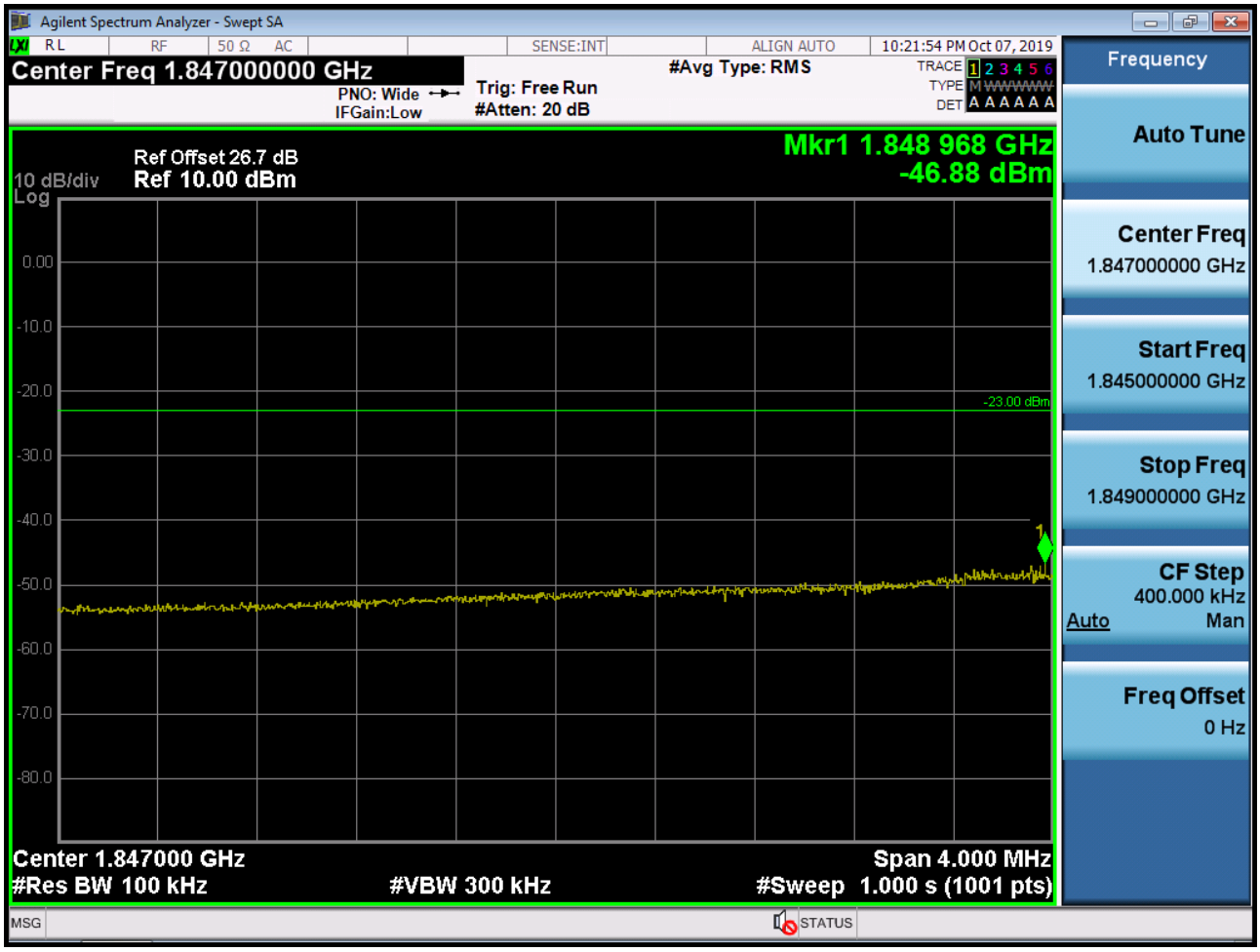
■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2



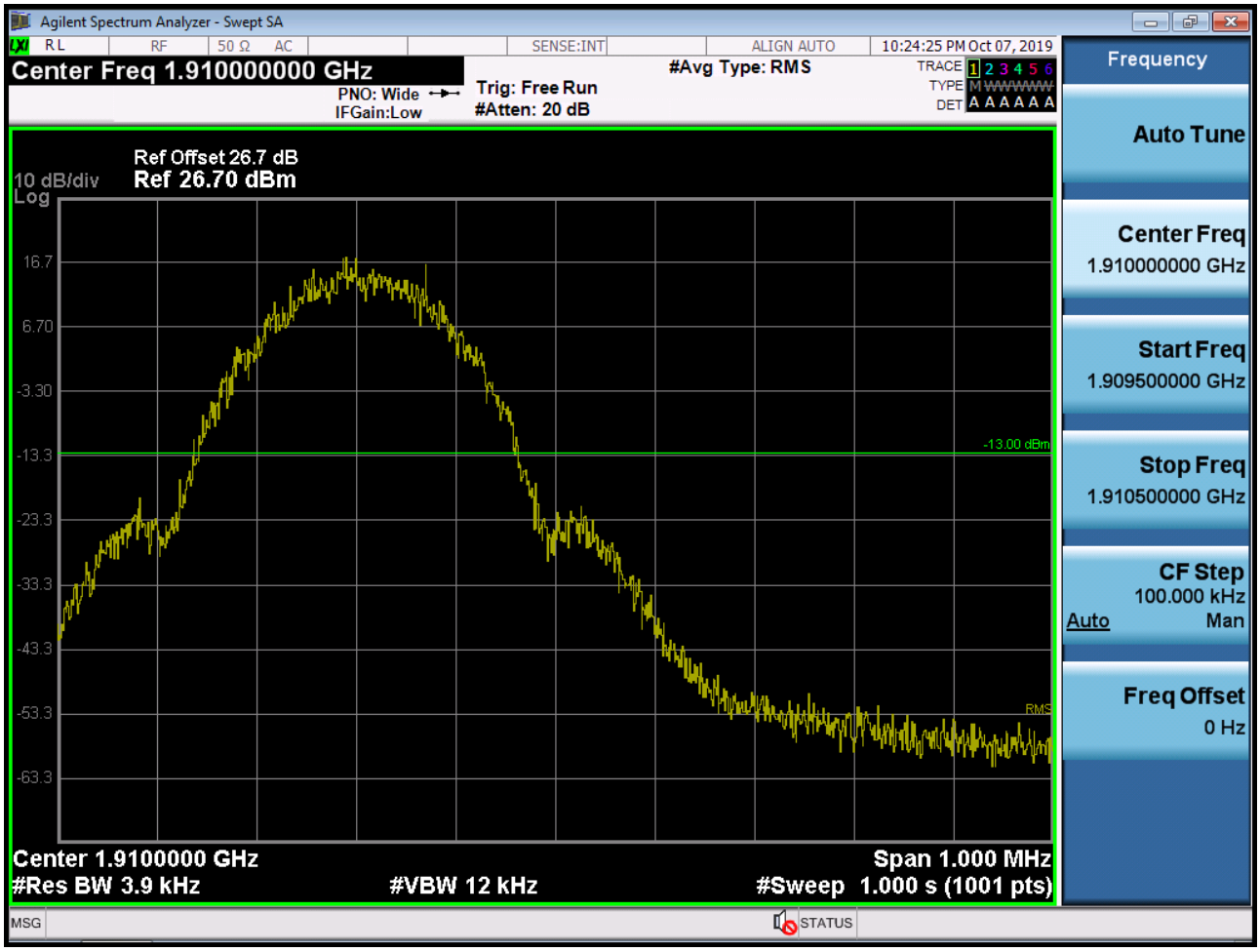
■ GSM1900 MODE (512 CH.) Block Edge 3



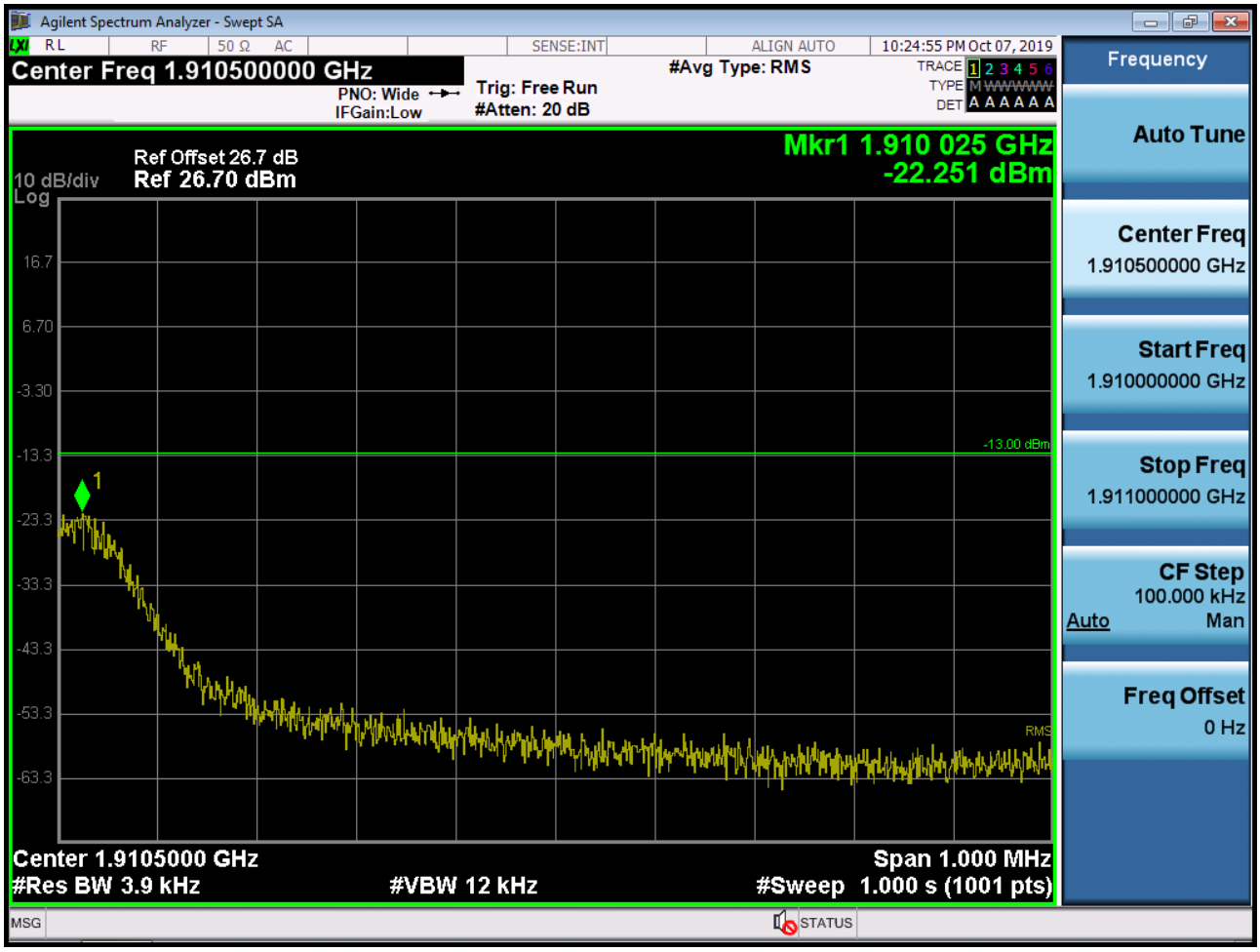
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -46.88 dBm + 10 dB = -36.88 dBm

■ GSM1900 MODE (810 CH.) Block Edge 1



■ GSM1900 MODE (810 CH.) Block Edge 2

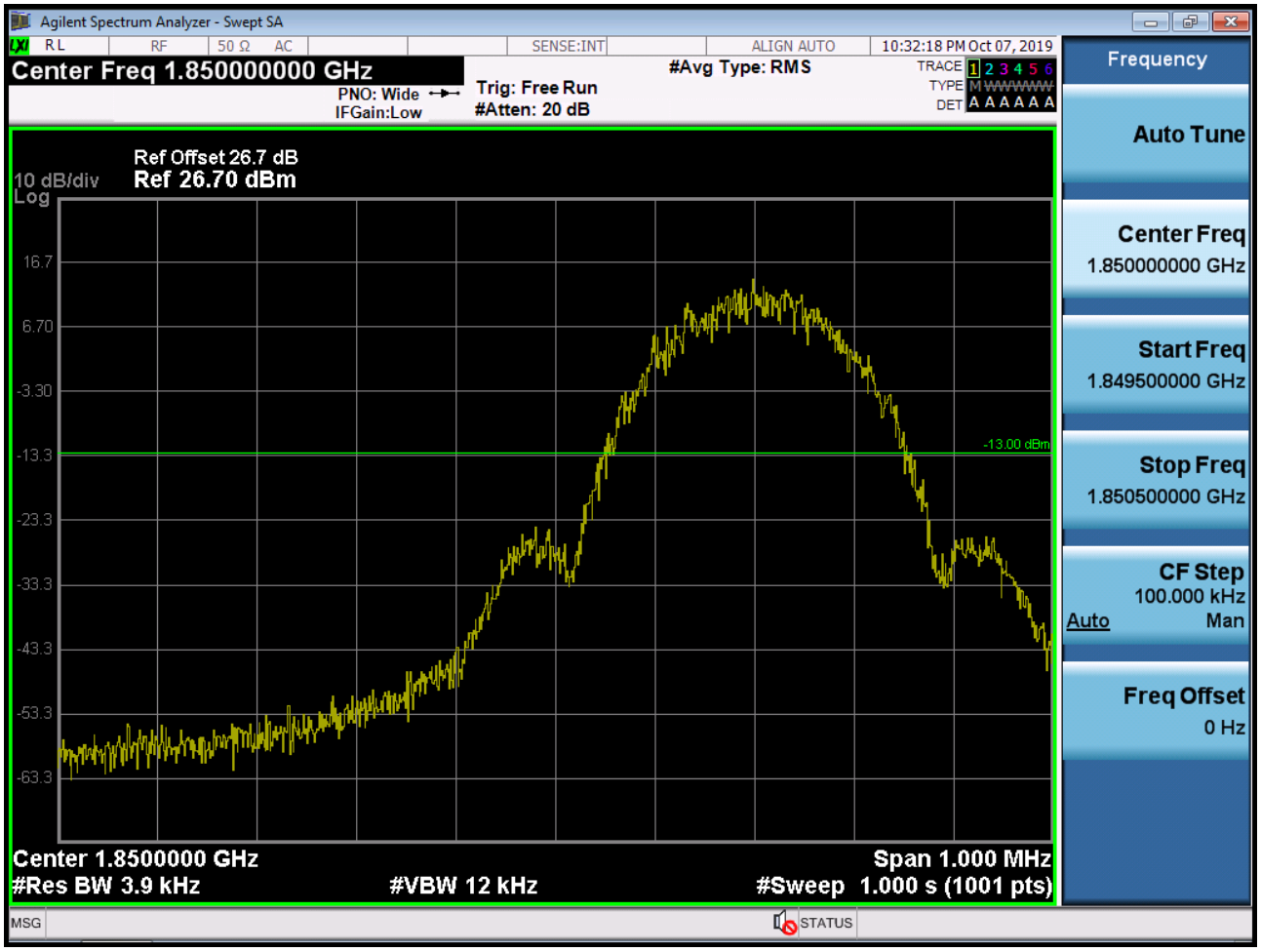


■ GSM1900 MODE (810 CH.) Block Edge 3

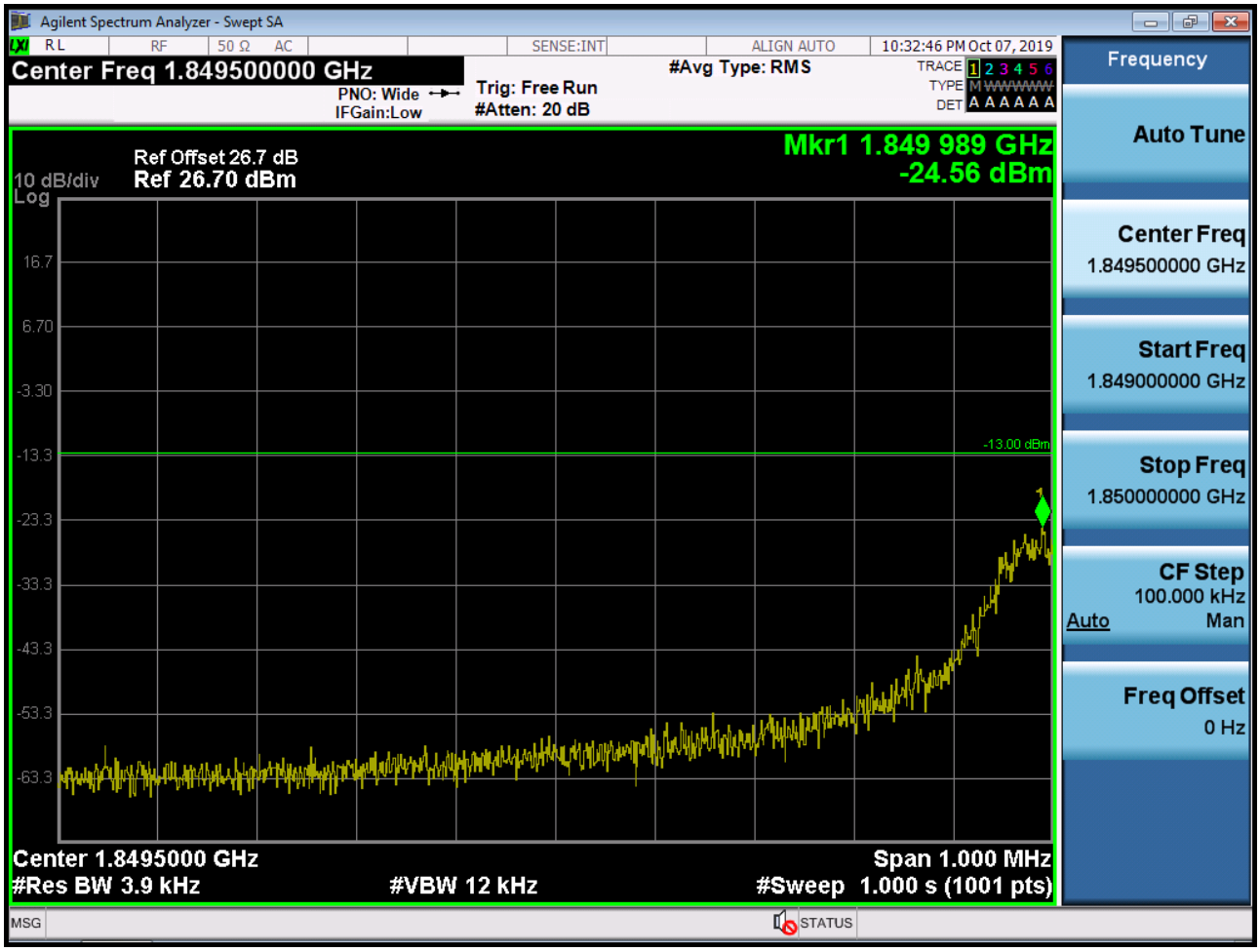
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -47.752 dBm + 10 dB = -37.752 dBm

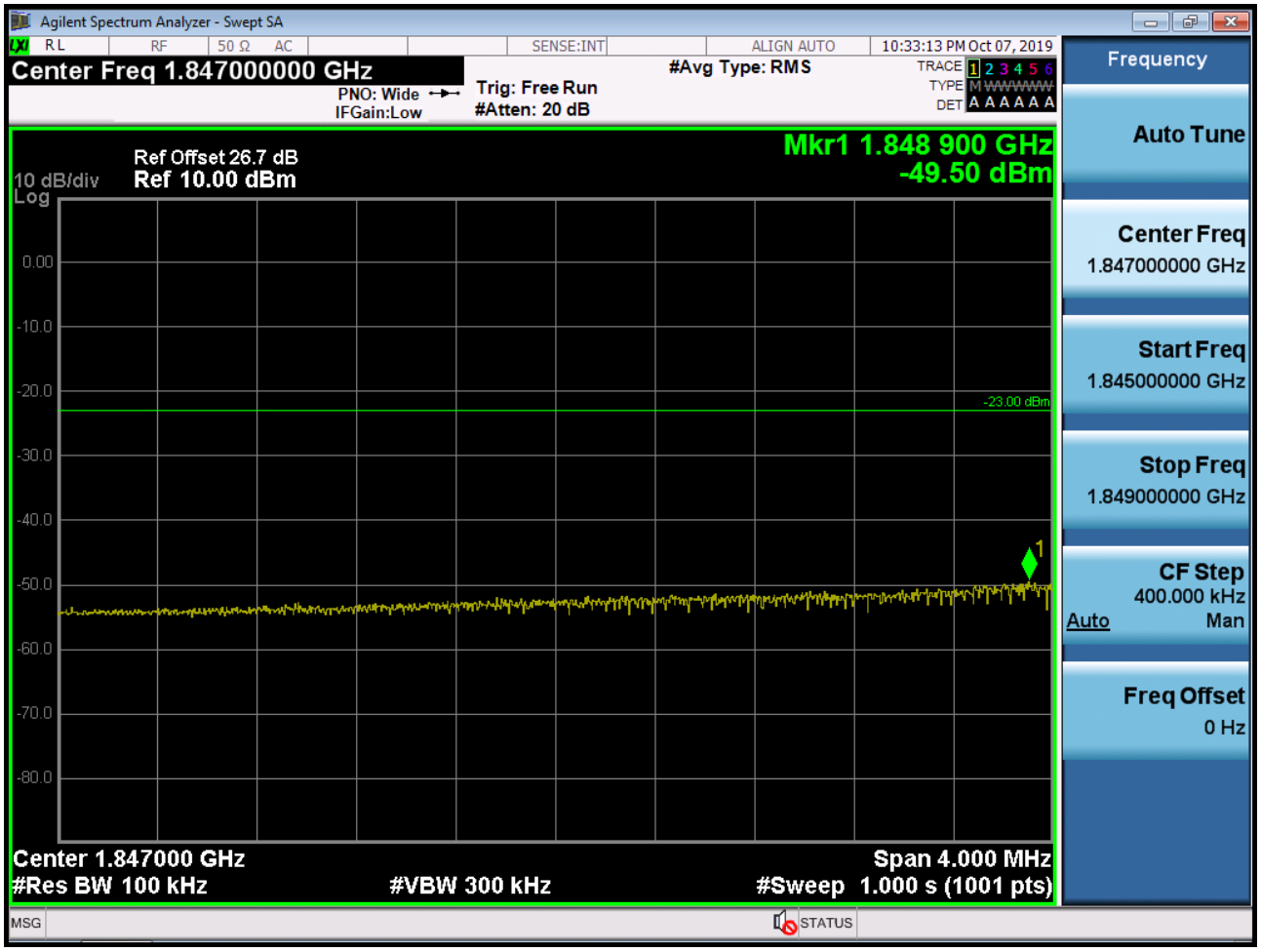
■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



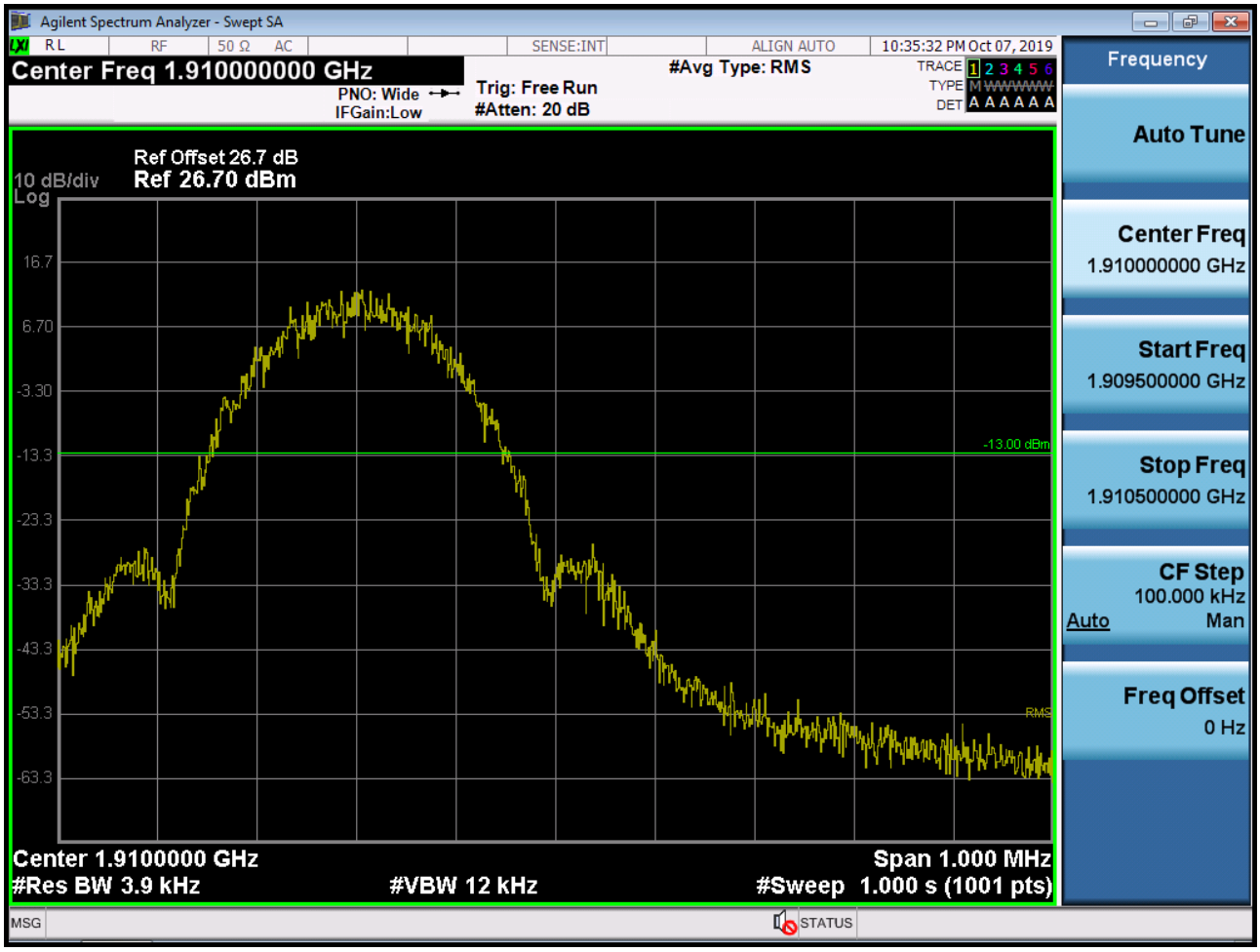
■ EDGE MODE (512 CH.) Block Edge 3



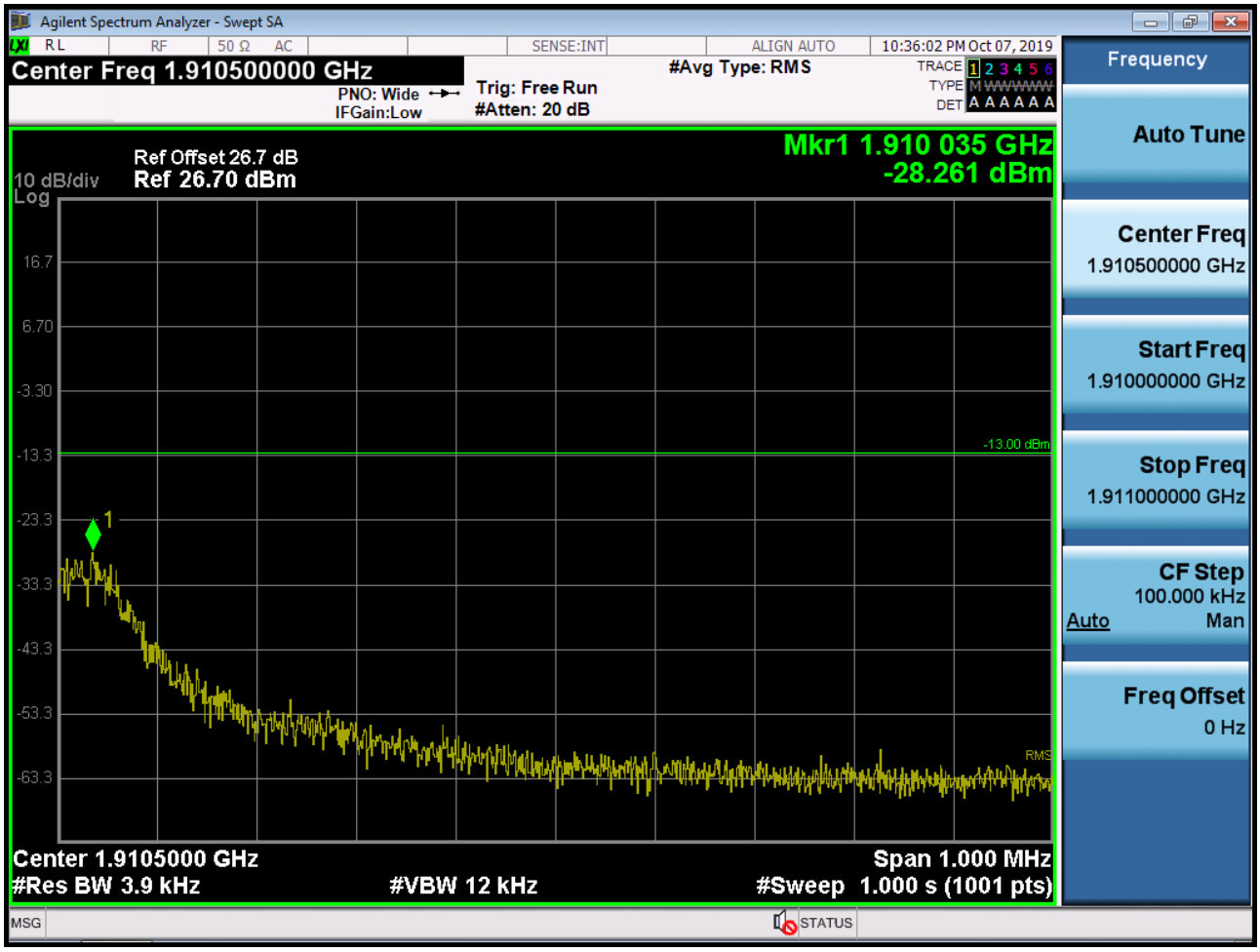
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -49.50 dBm + 10 dB = -39.50 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 = -50.096 dBm + 10 dB = -40.096 dBm

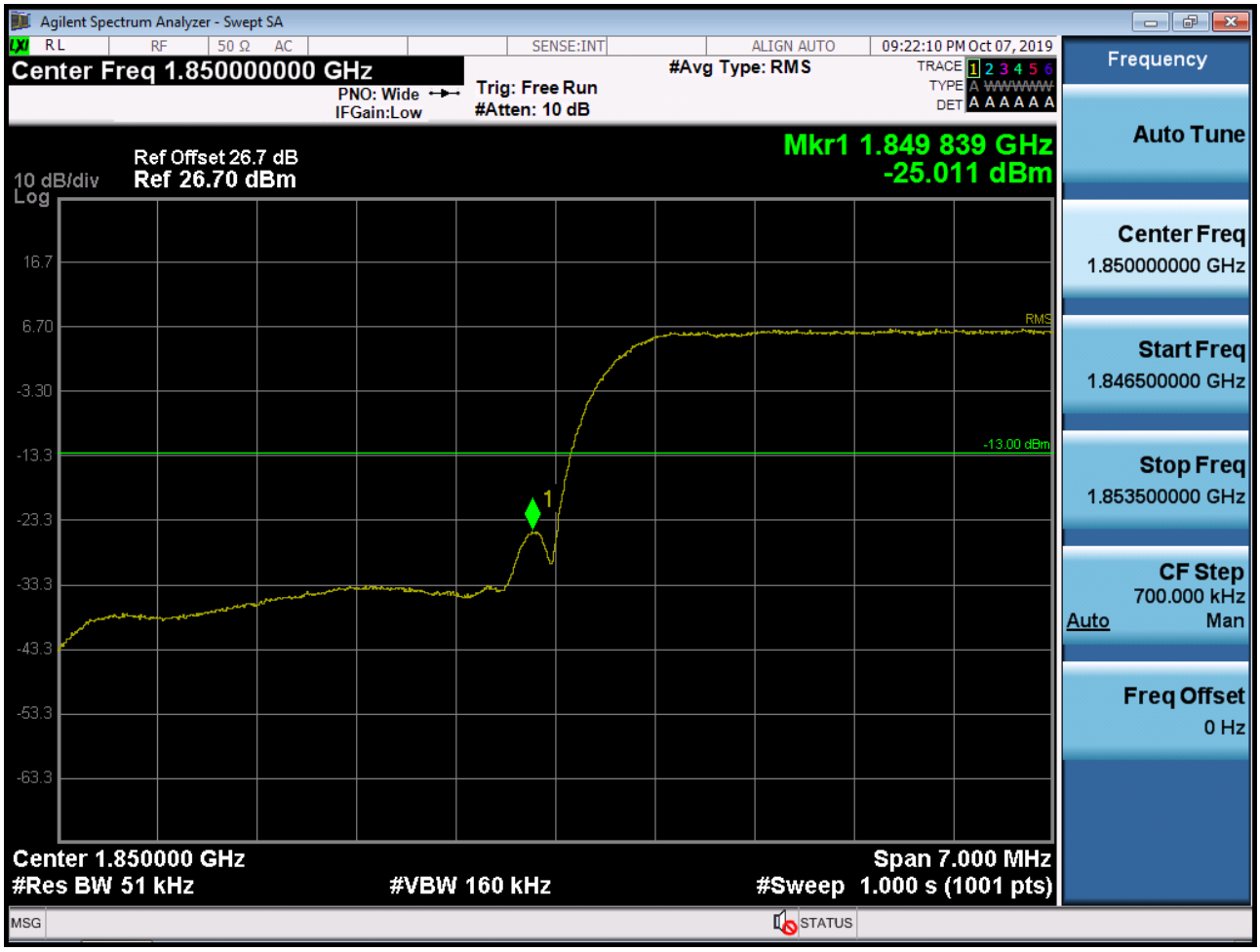
■ WCDMA850 MODE (4132 CH.) Block Edge

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

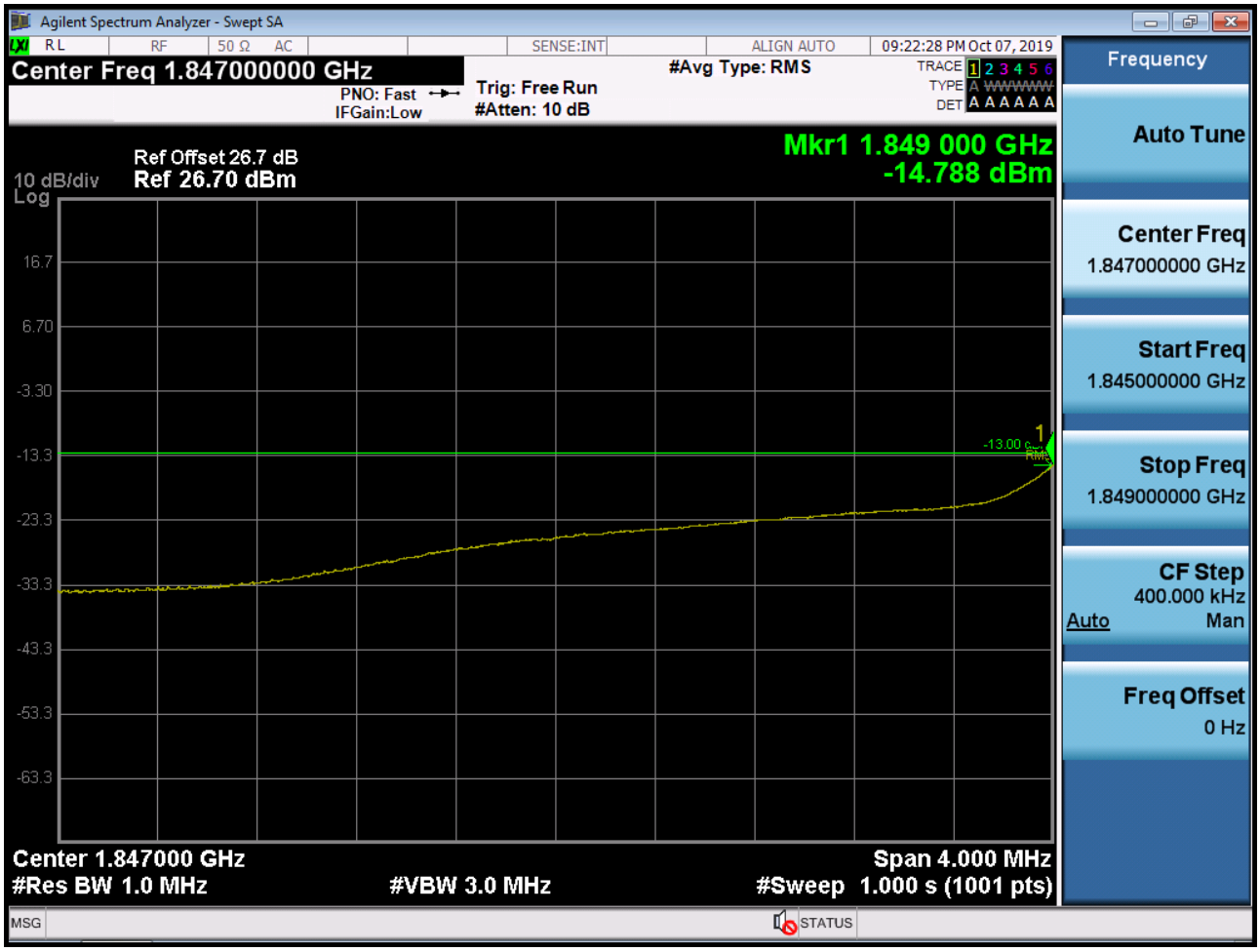
■ WCDMA850MODE (4233 CH.) Block Edge

■ WCDMA850MODE (4233 CH.) – 4 MHz Span

■ WCDMA1900 MODE (9262 CH.) Block Edge



■ WCDMA1900 MODE (9262 CH.) – 4 MHz Span



■ WCDMA1900 MODE (9538 CH.) Block Edge

■ WCDMA1900 MODE (9538 CH.) – 4 MHz Span

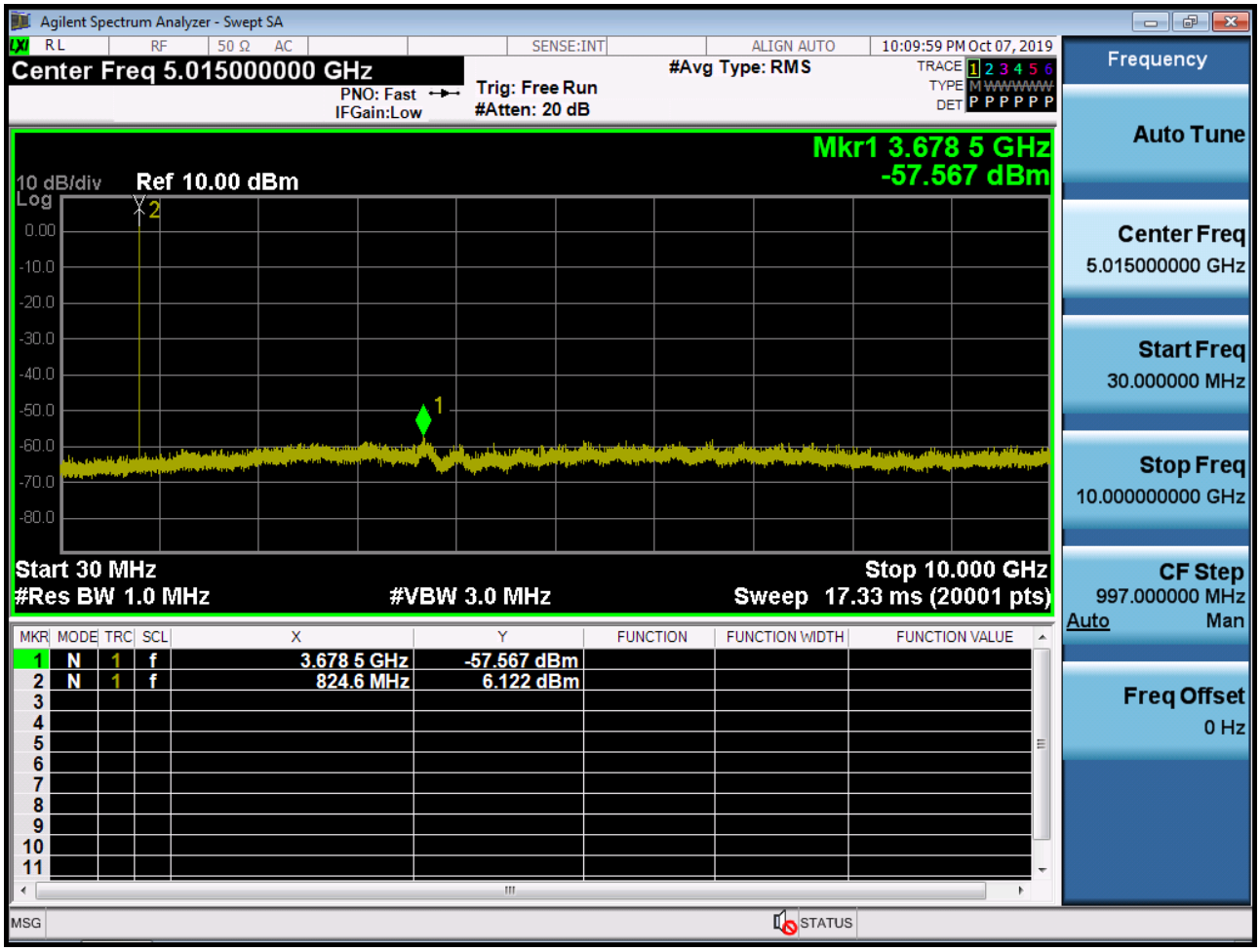
■ WCDMA1700 MODE (1312 CH.) Block Edge

■ WCDMA1700 MODE (1312 CH.) – 4 MHz Span

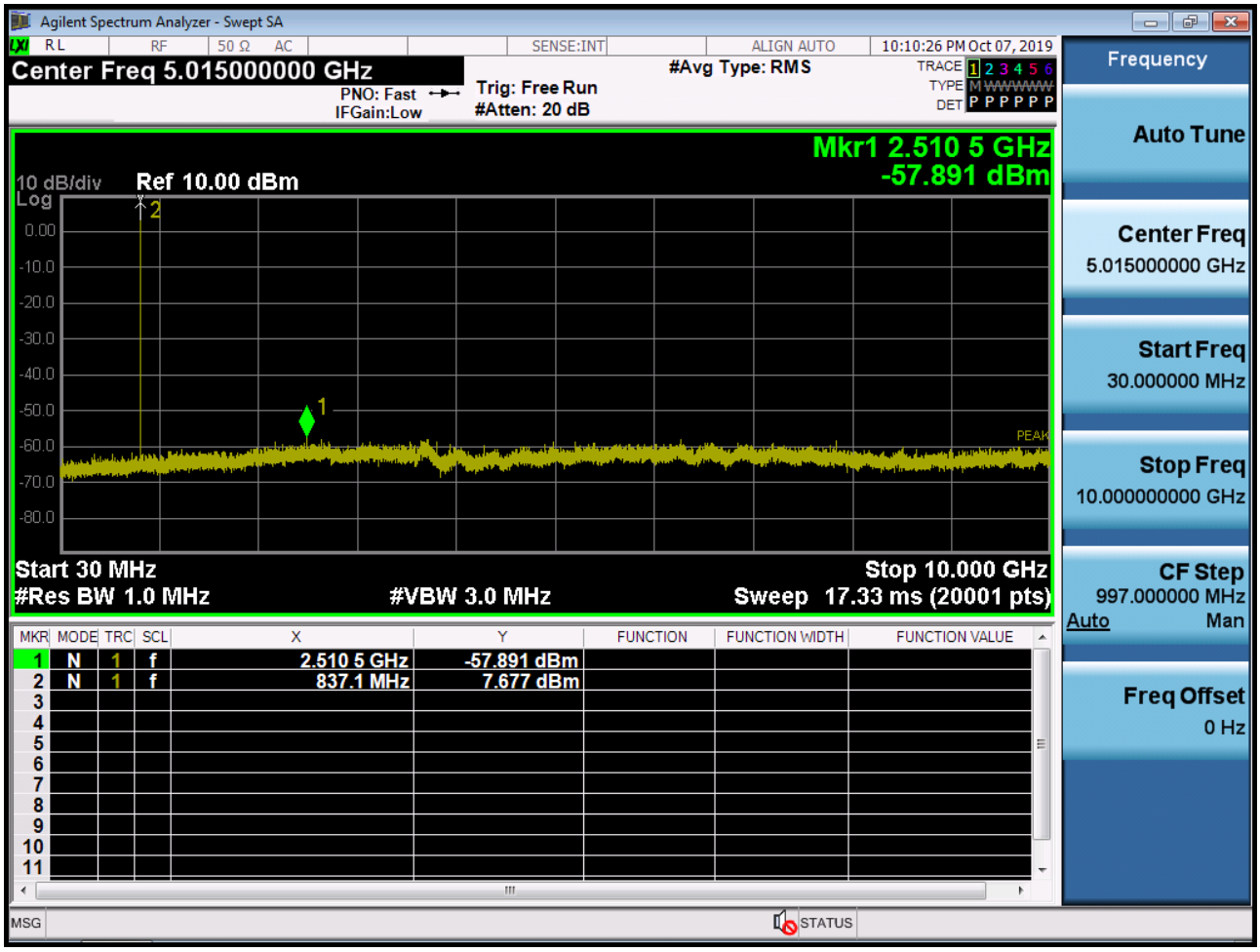
■ WCDMA1700 MODE (1513 CH.) Block Edge

■ WCDMA1700 MODE (1513 CH.) – 4 MHz Span

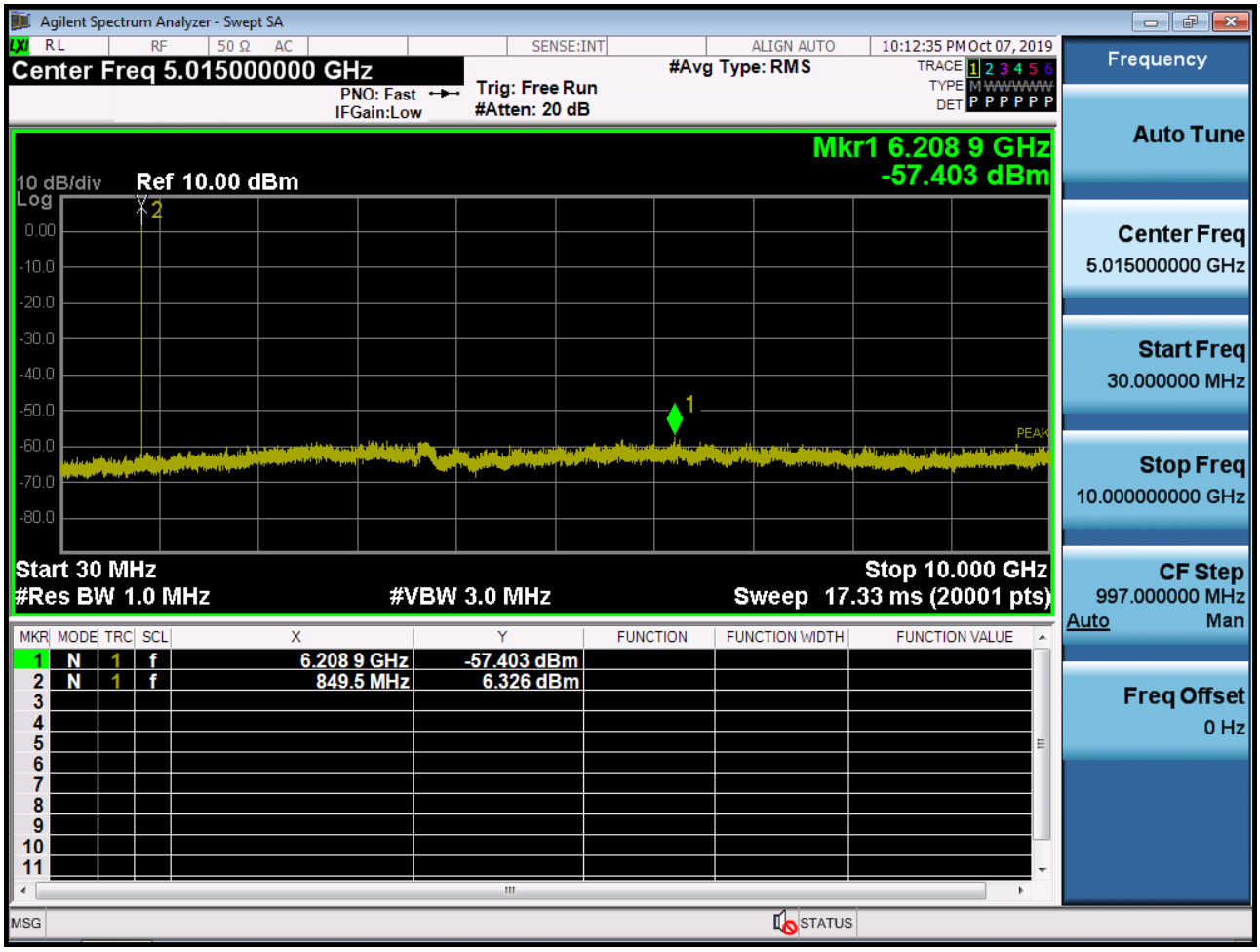
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions



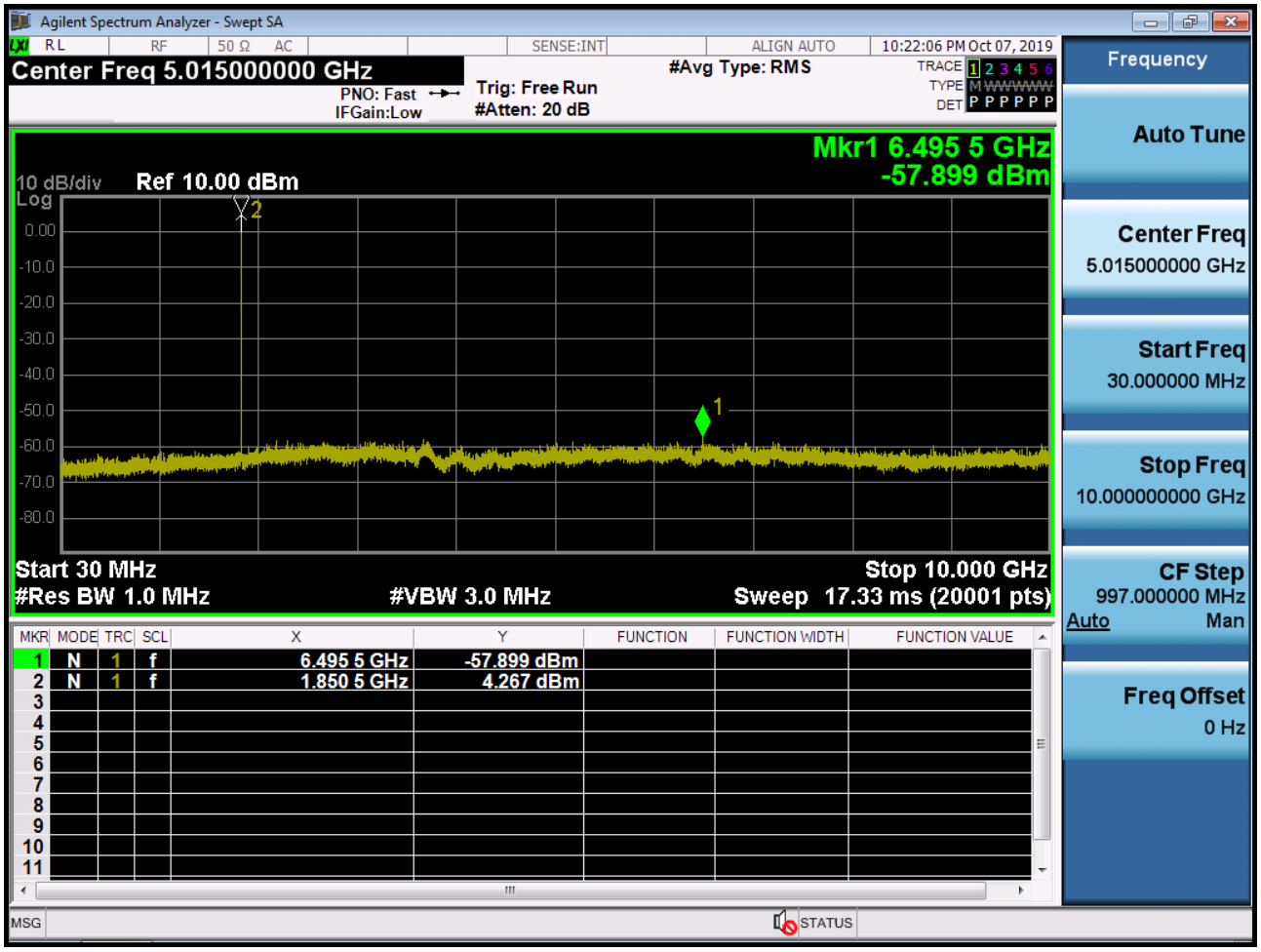
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions



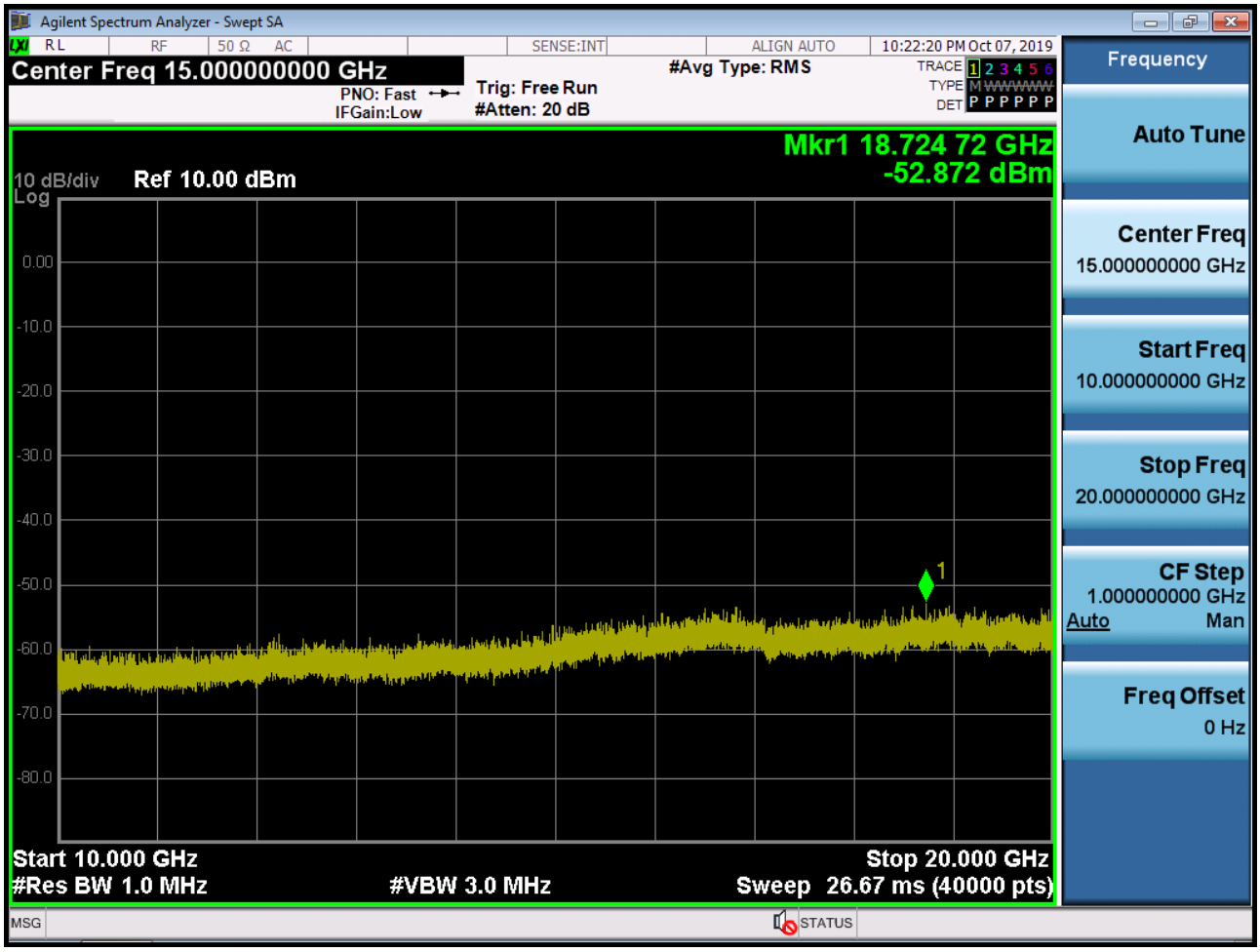
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions



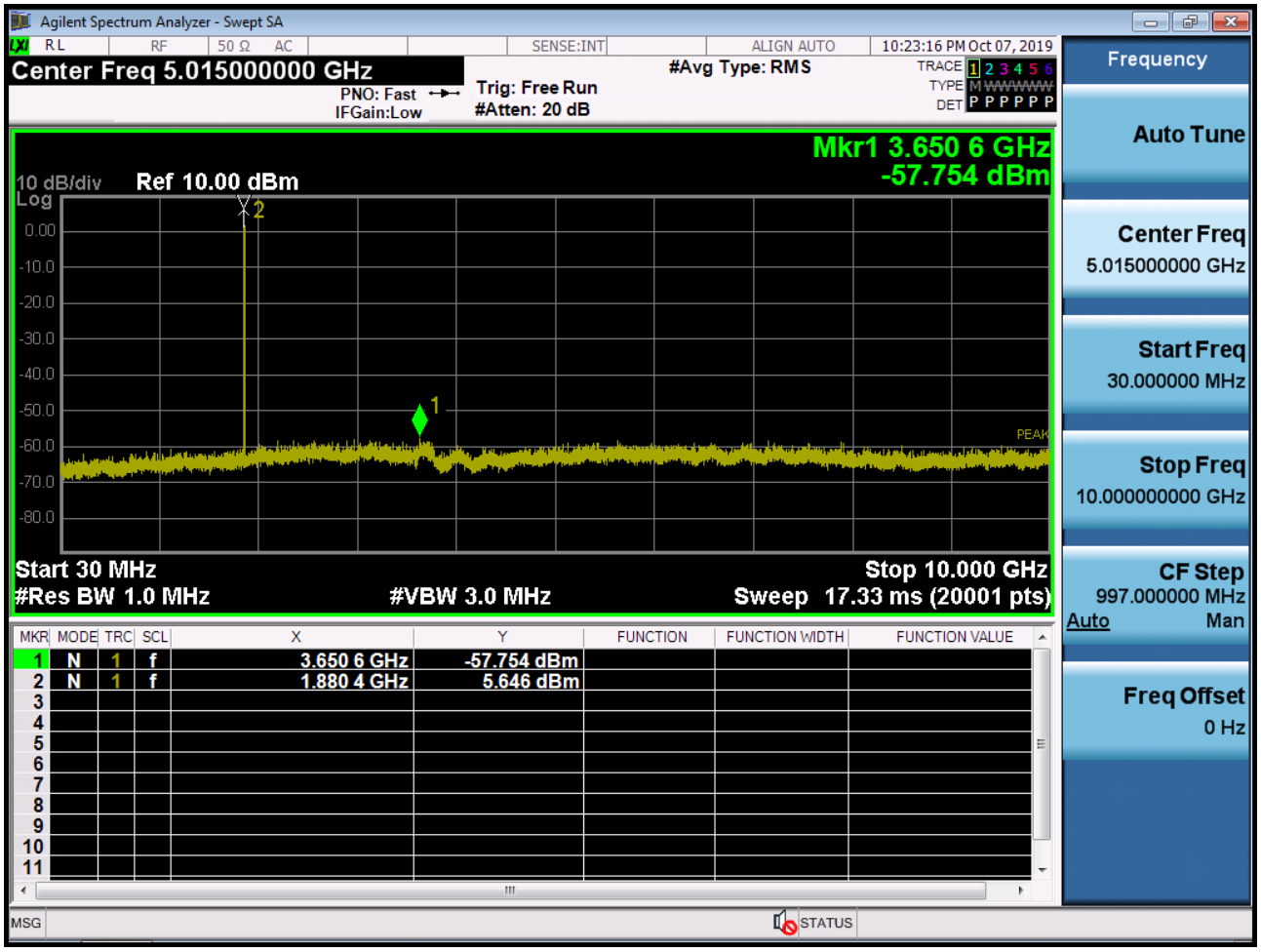
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



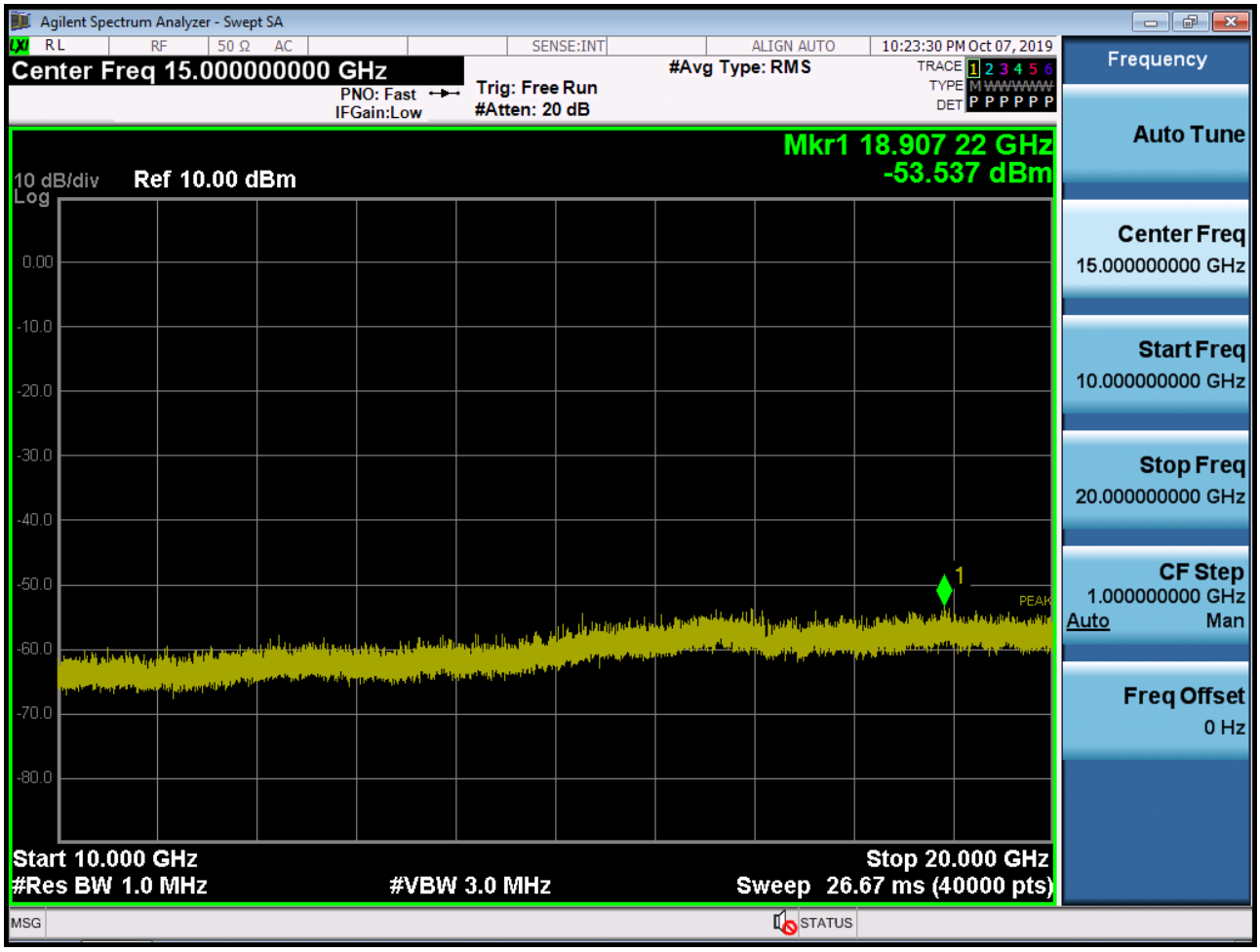
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



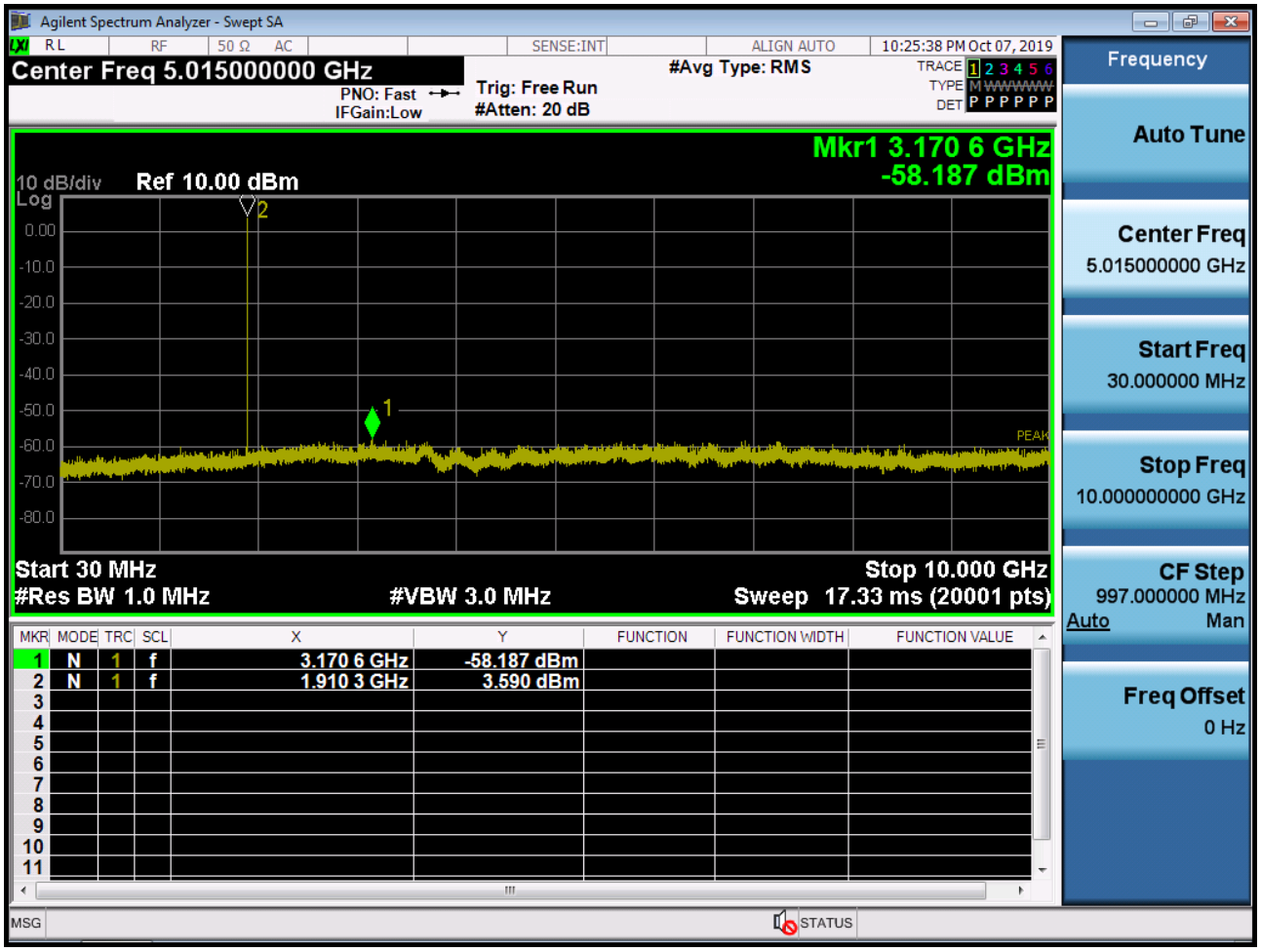
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



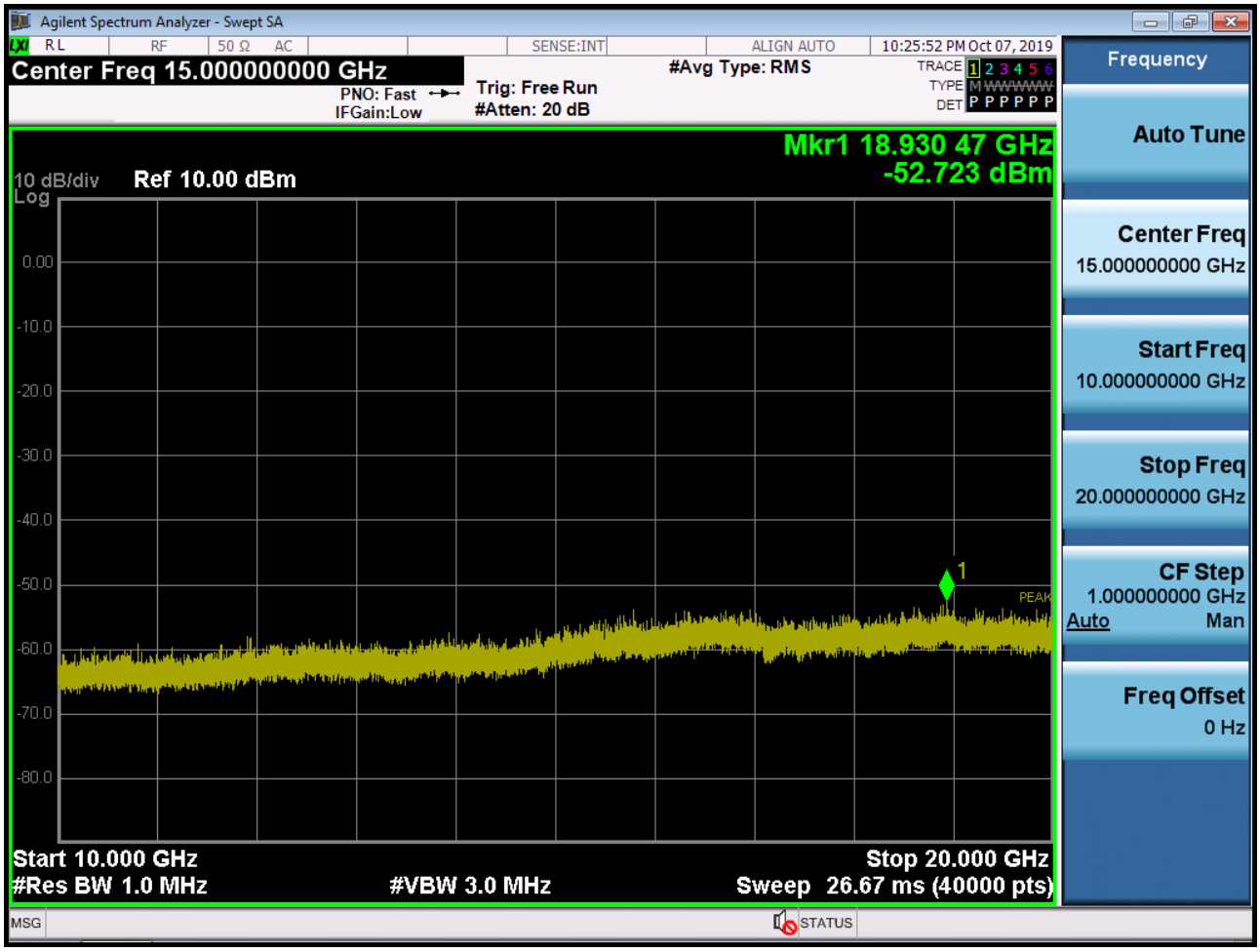
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



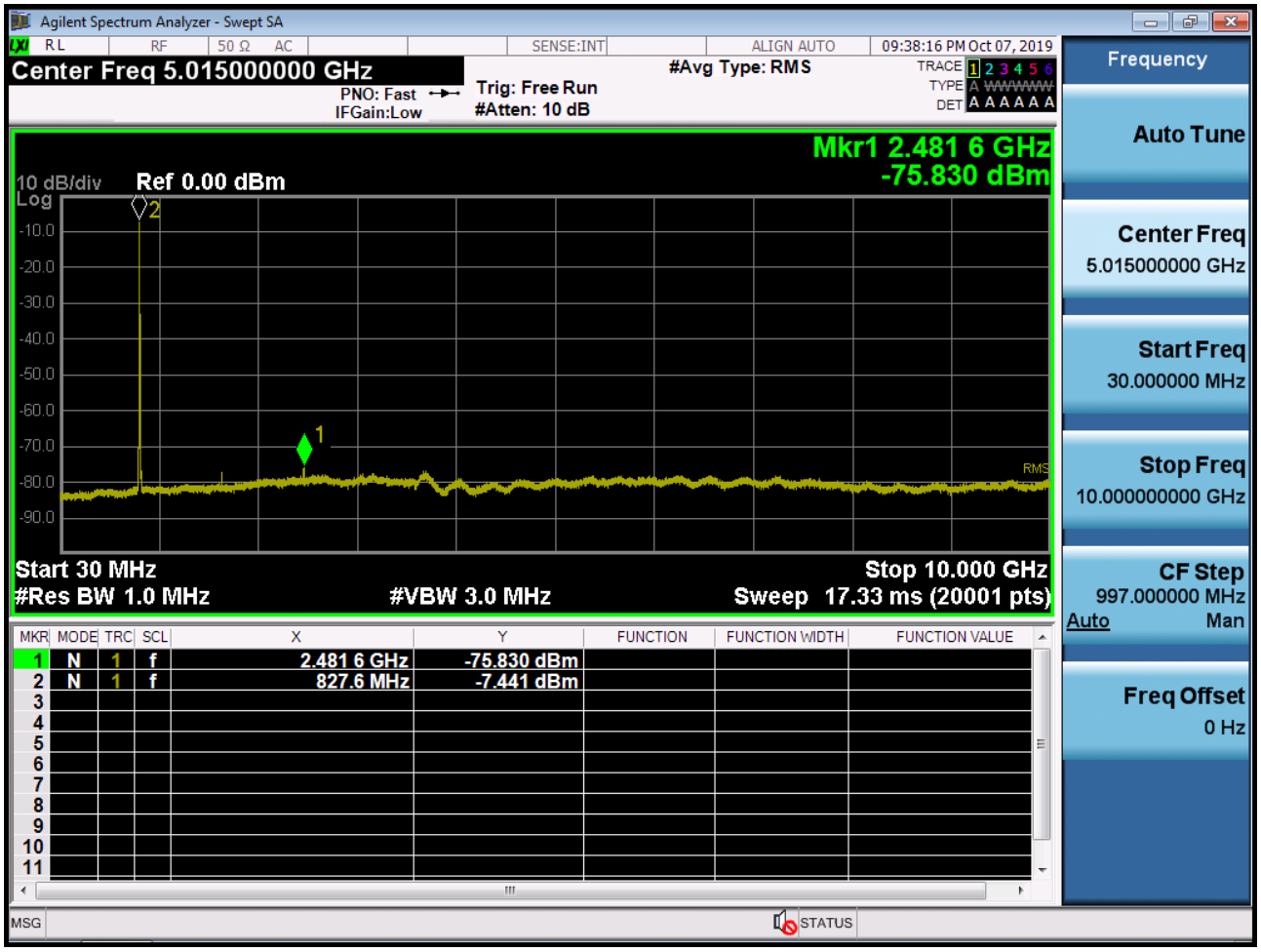
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



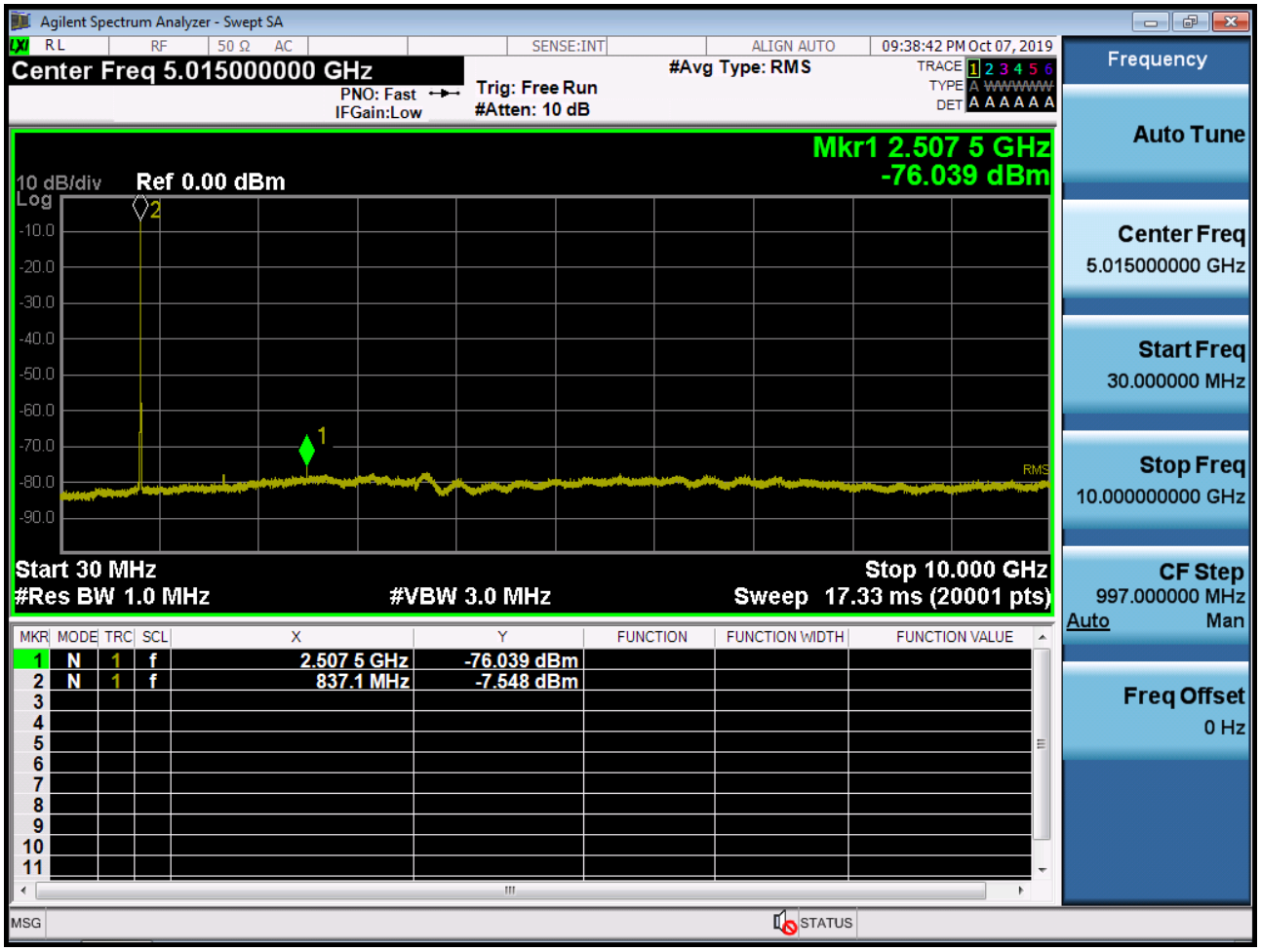
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



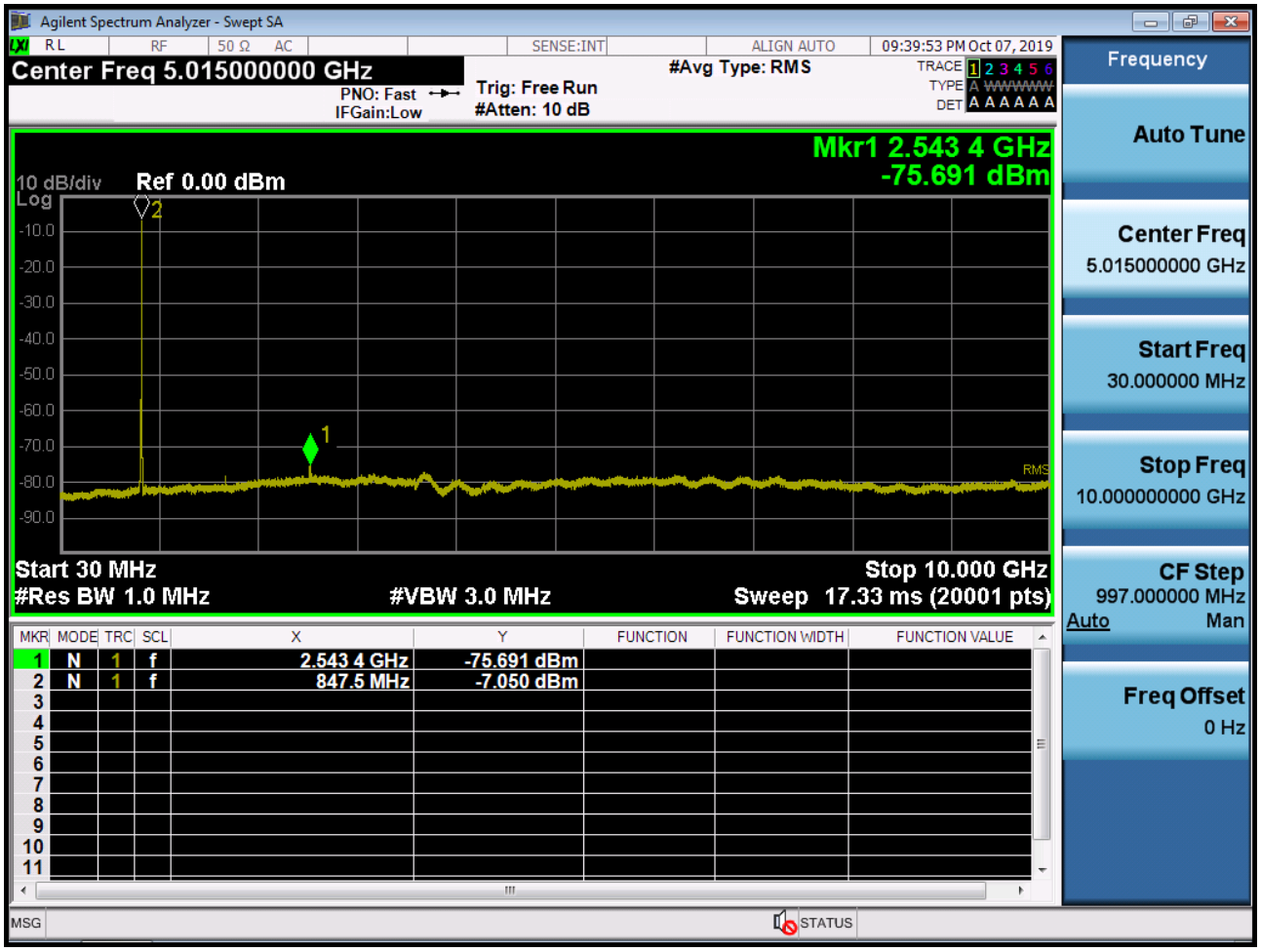
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



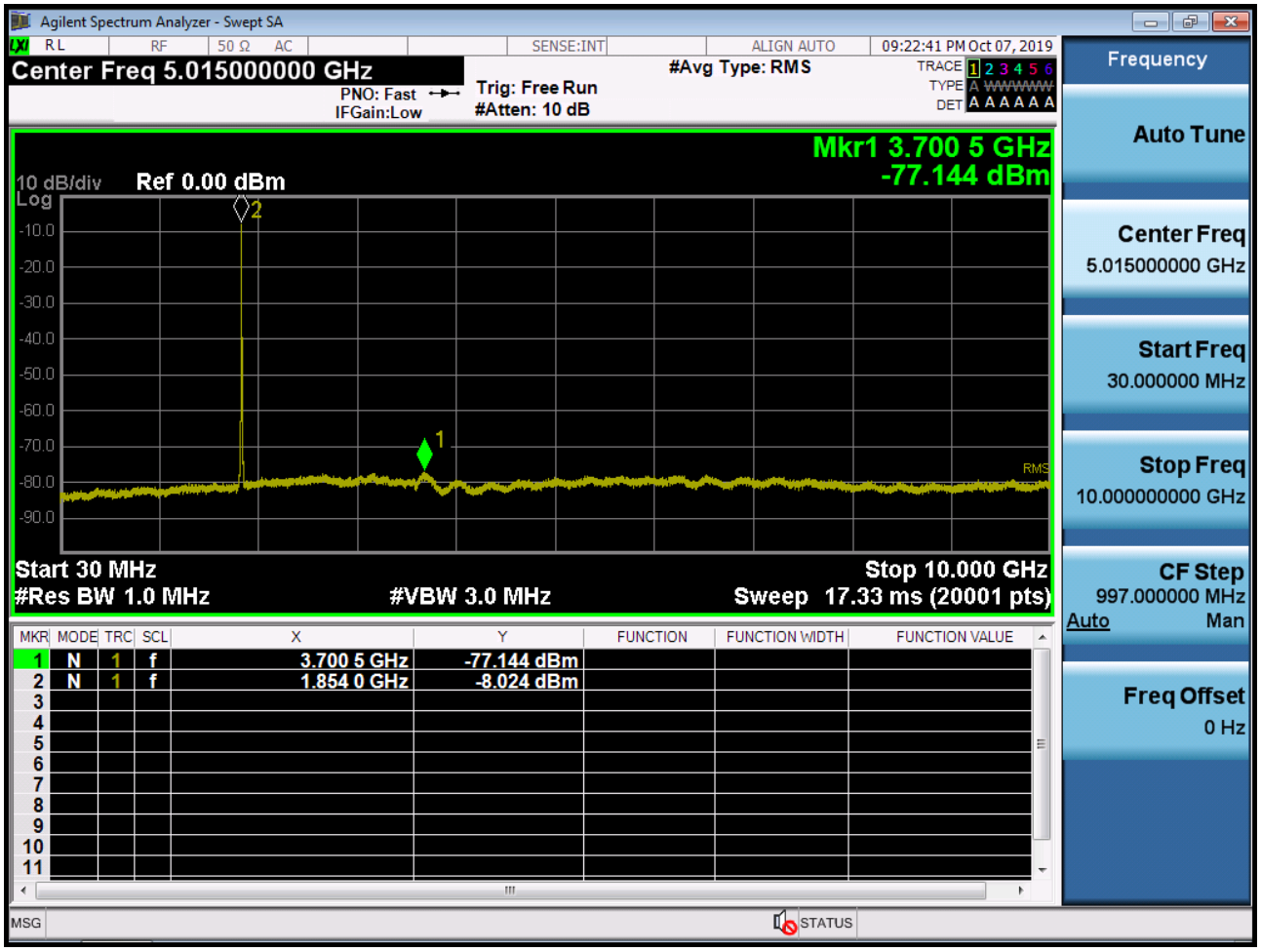
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



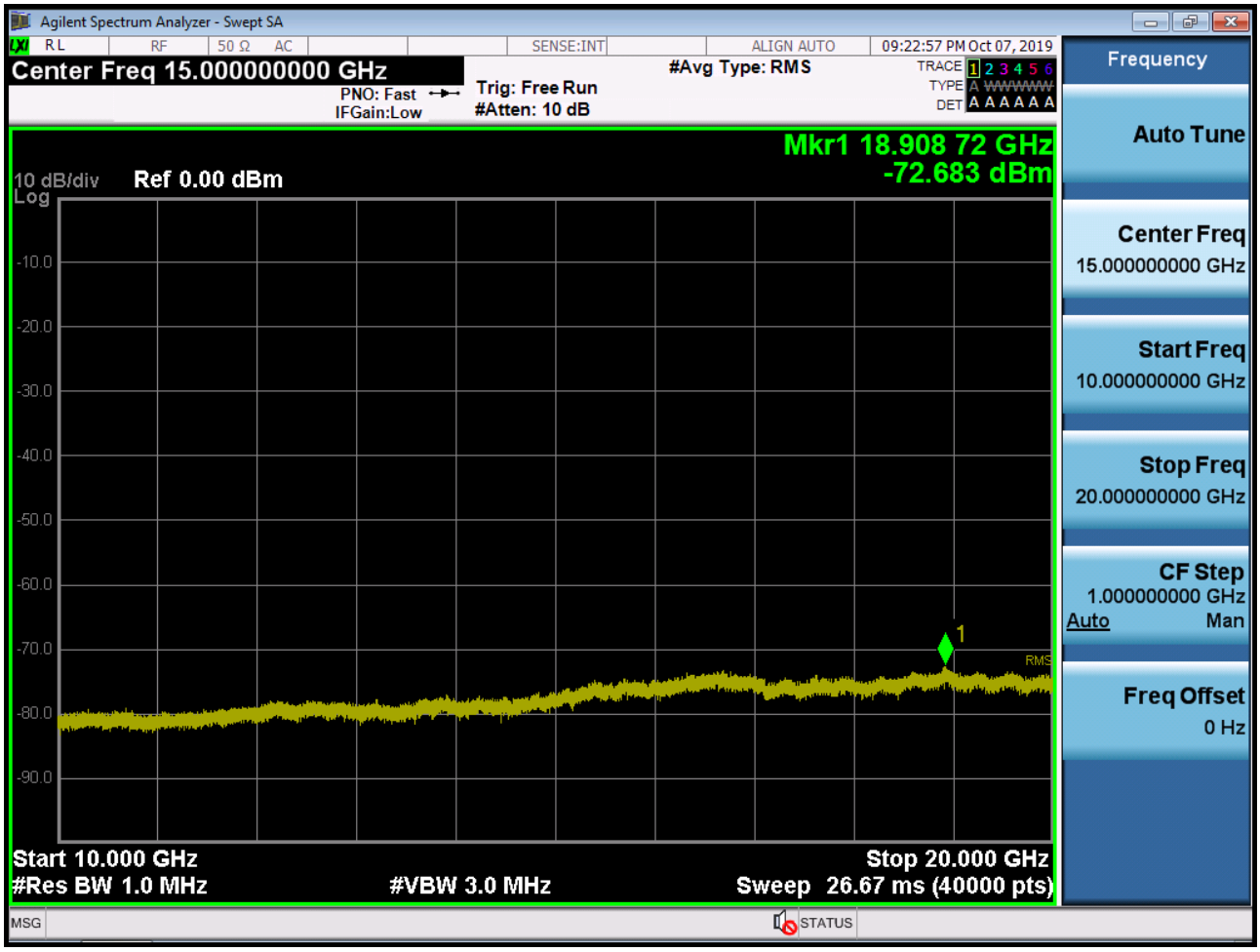
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions



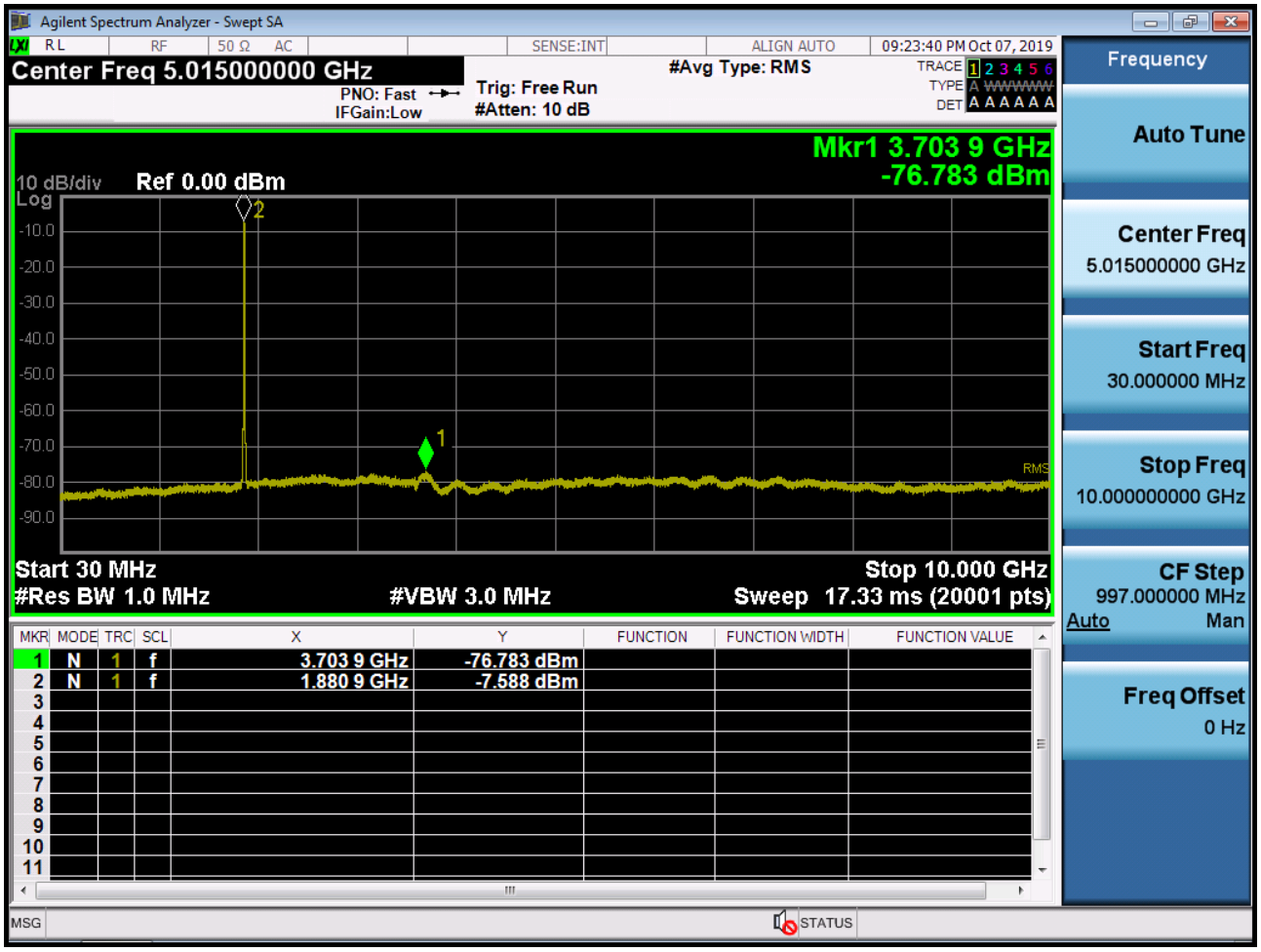
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions1



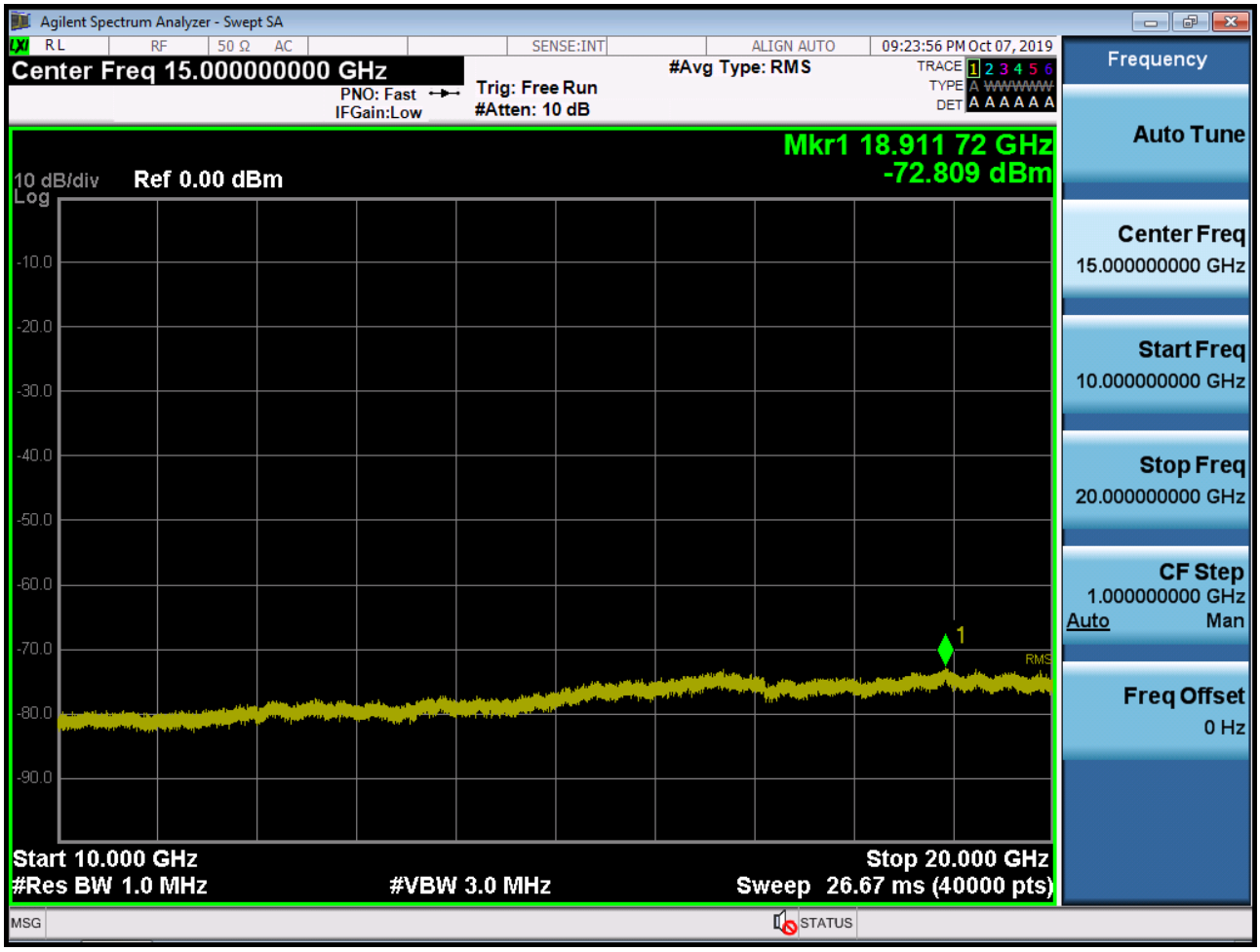
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



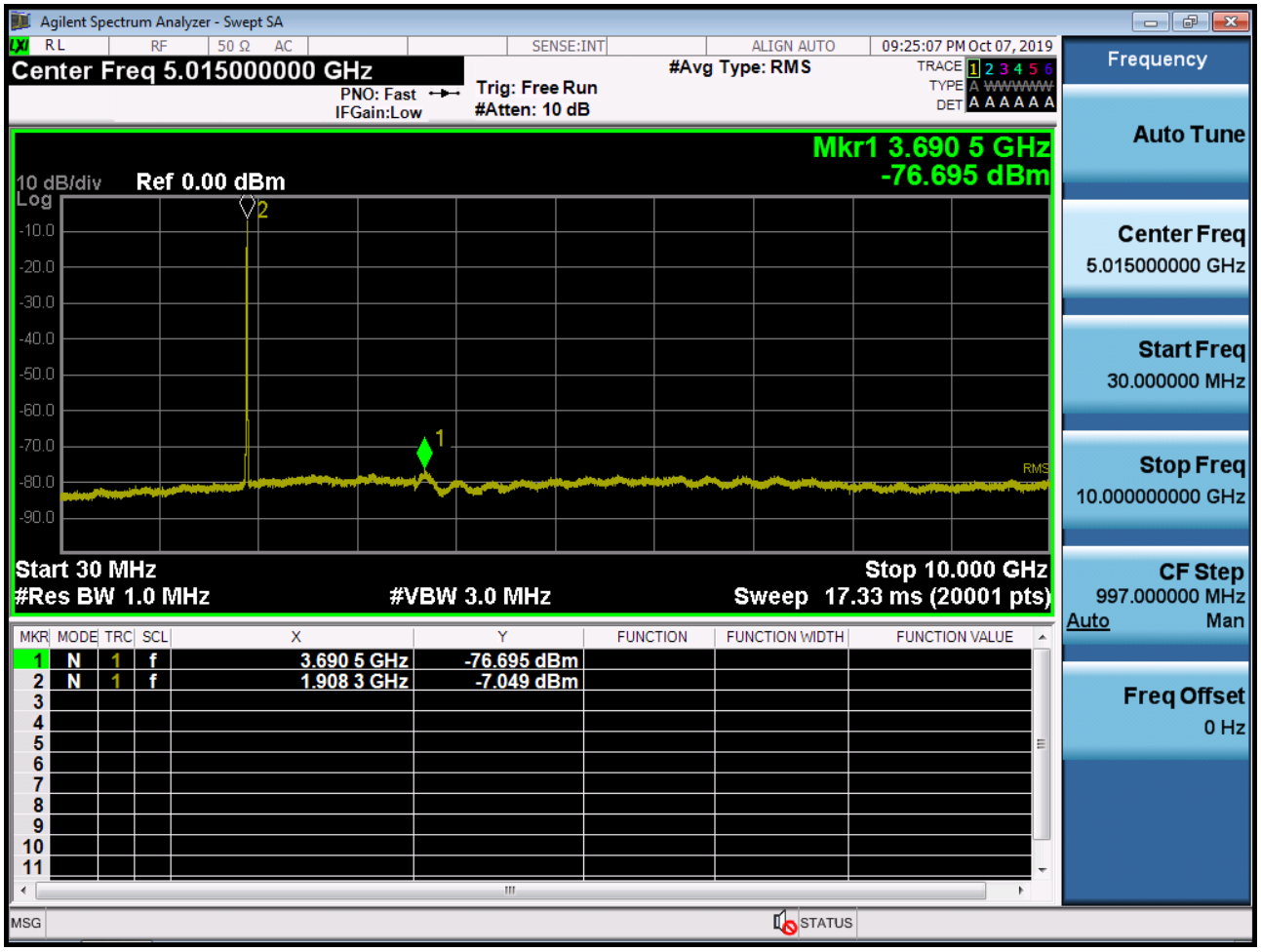
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



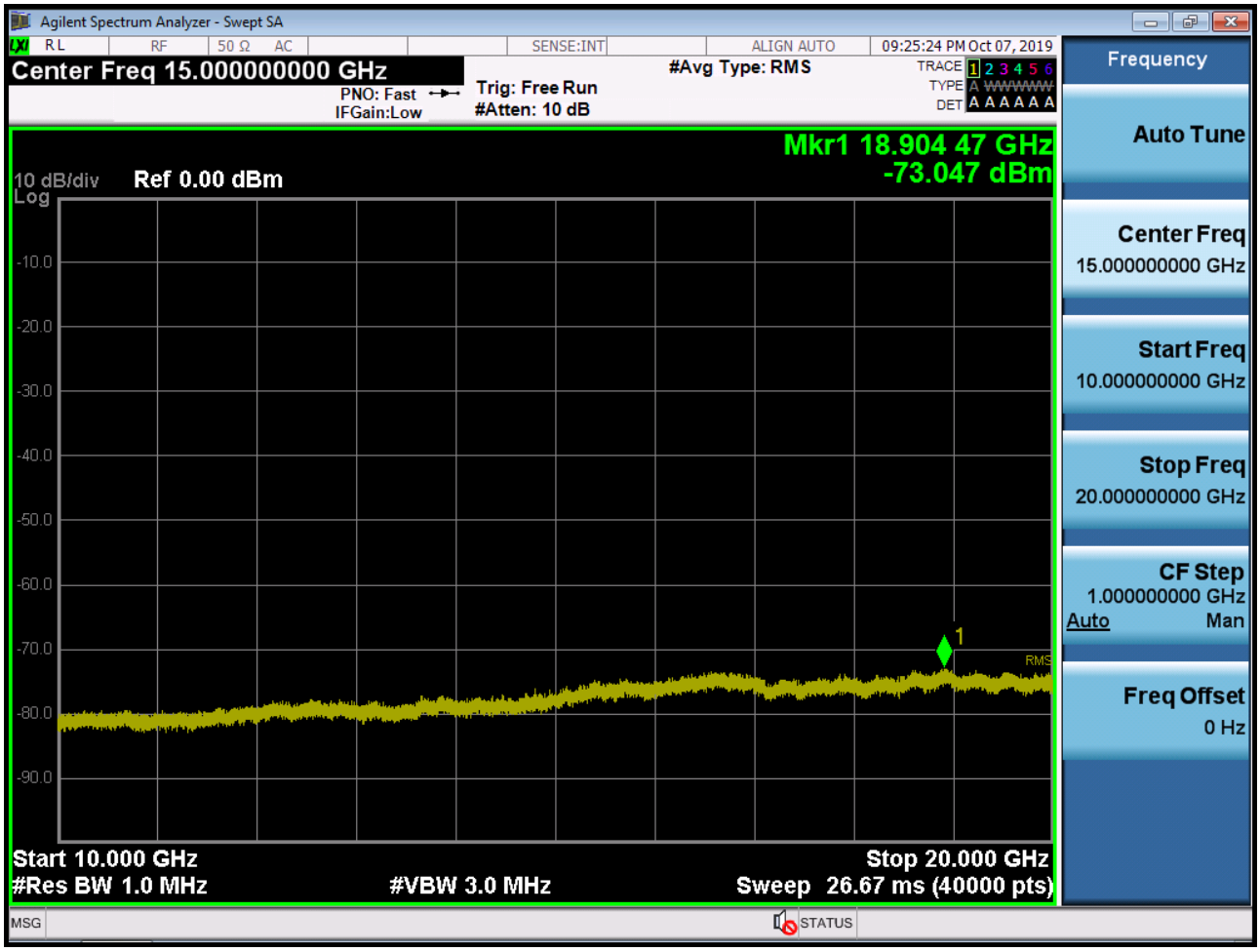
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



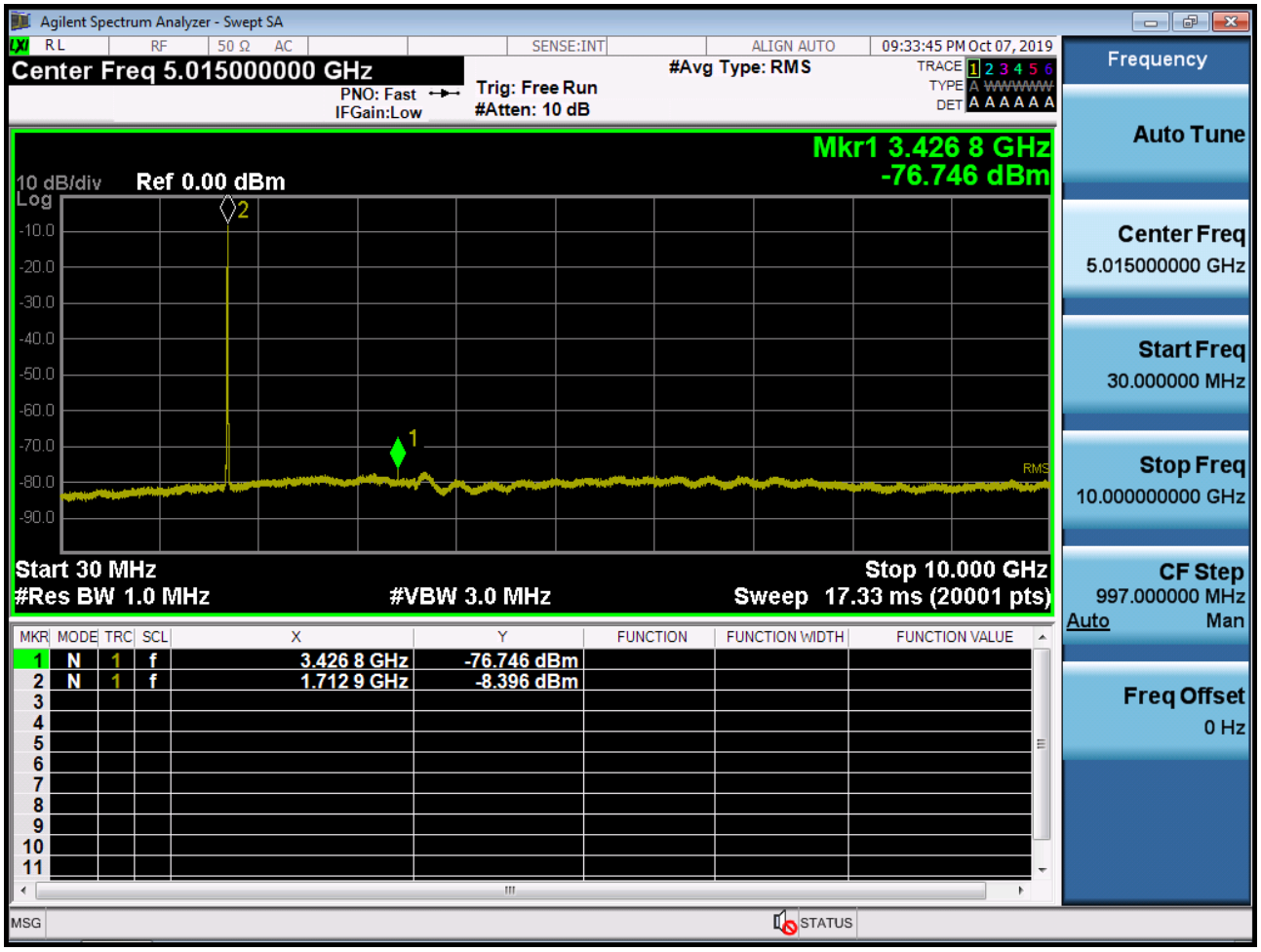
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



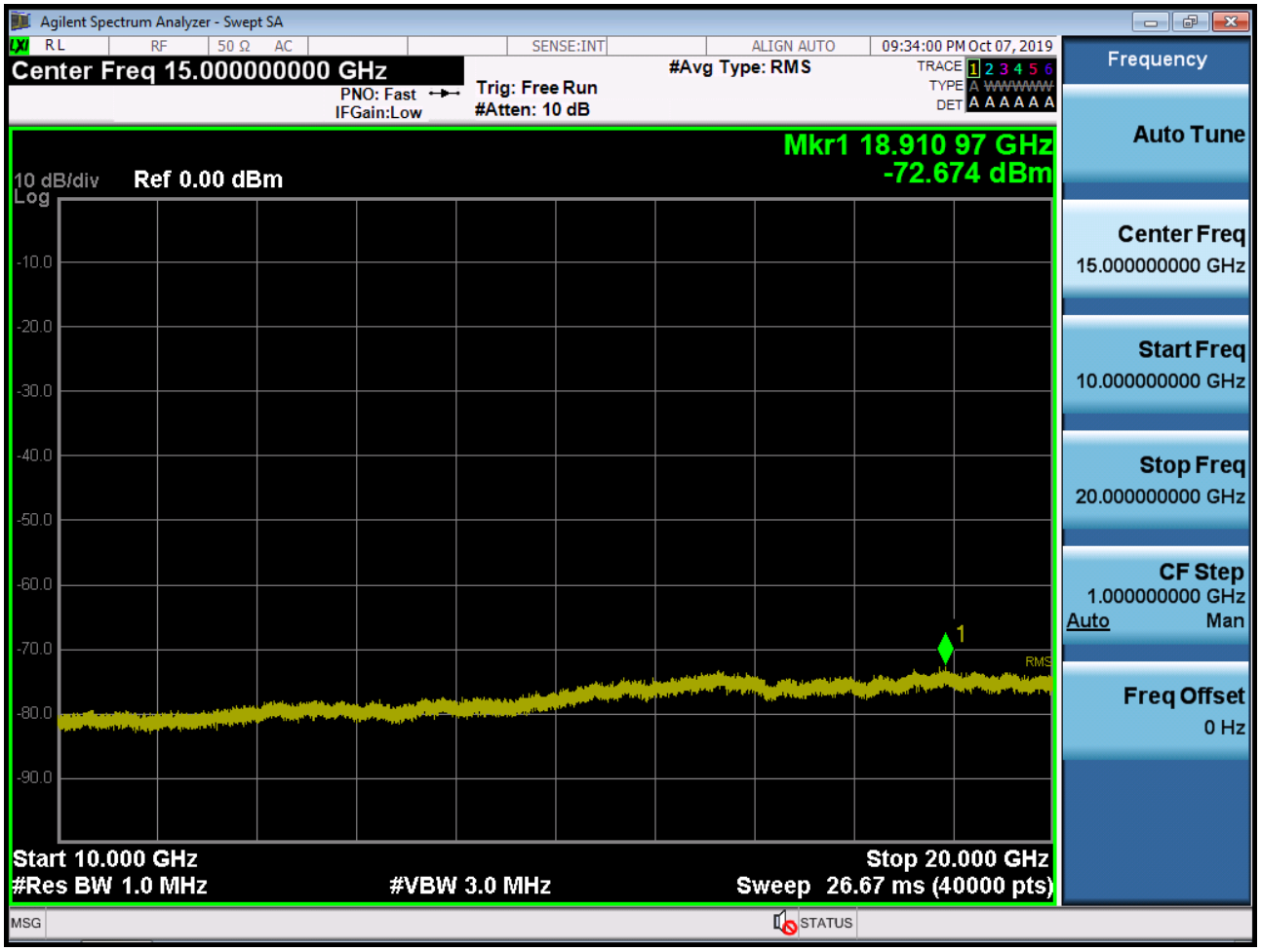
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



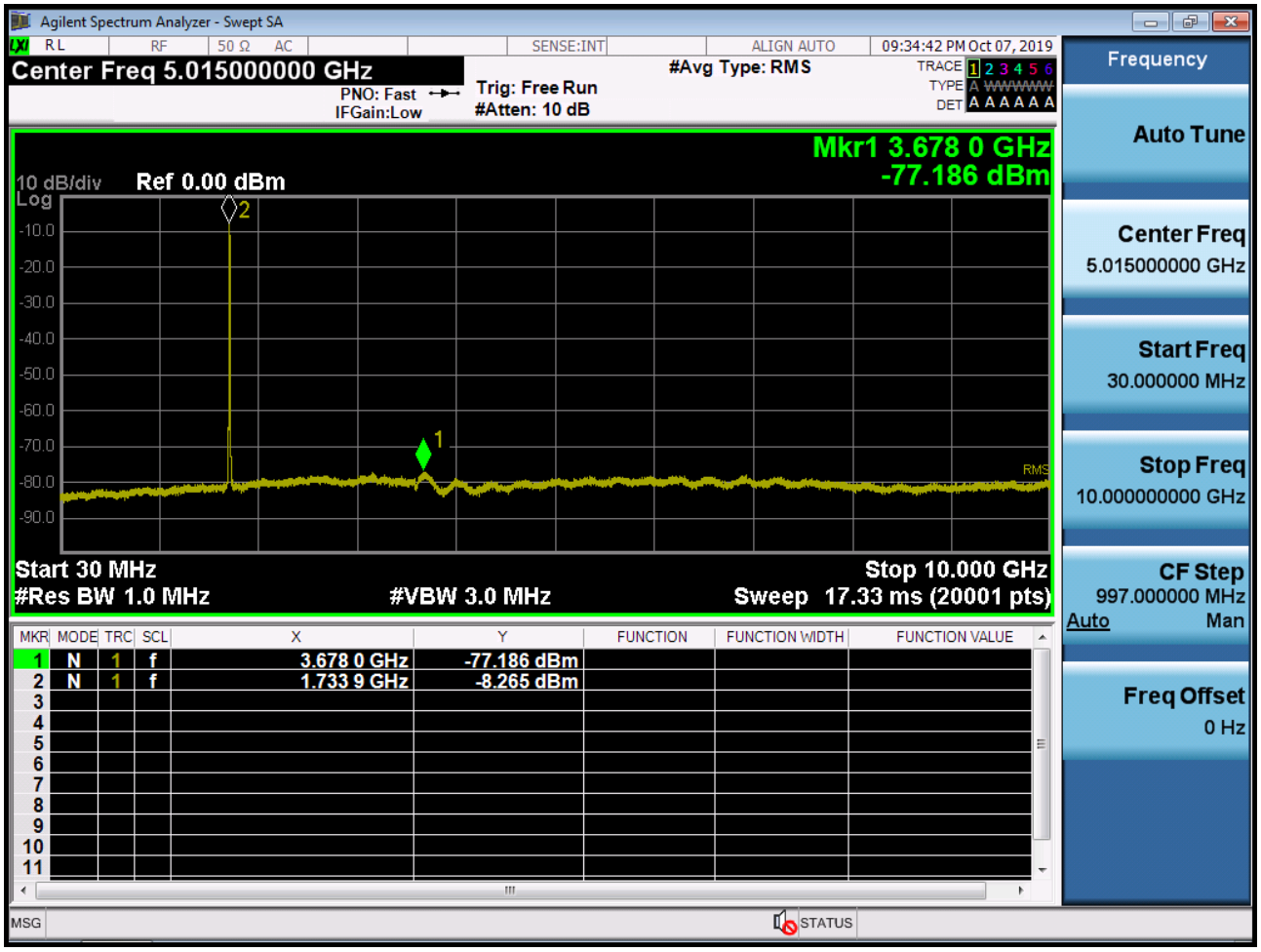
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



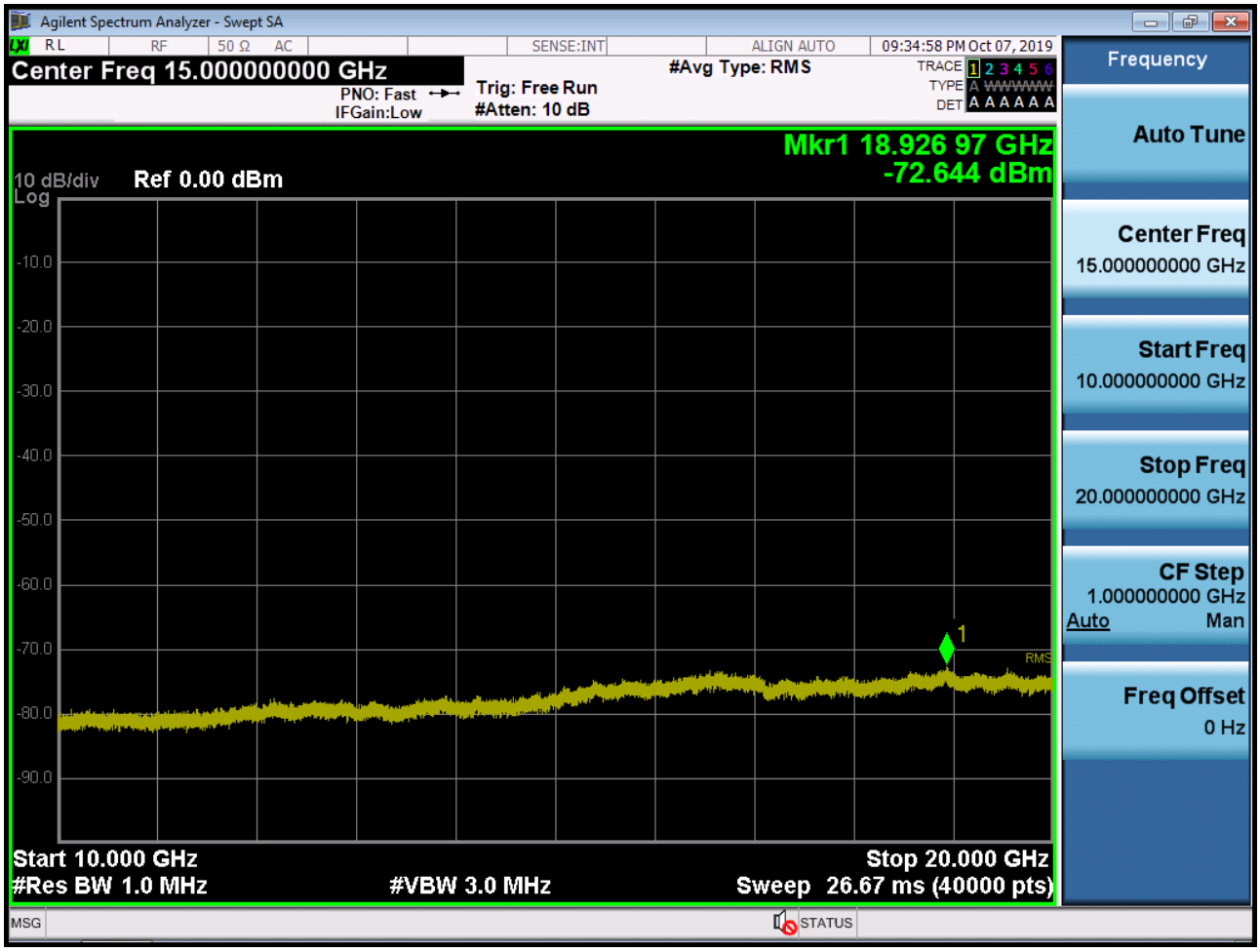
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



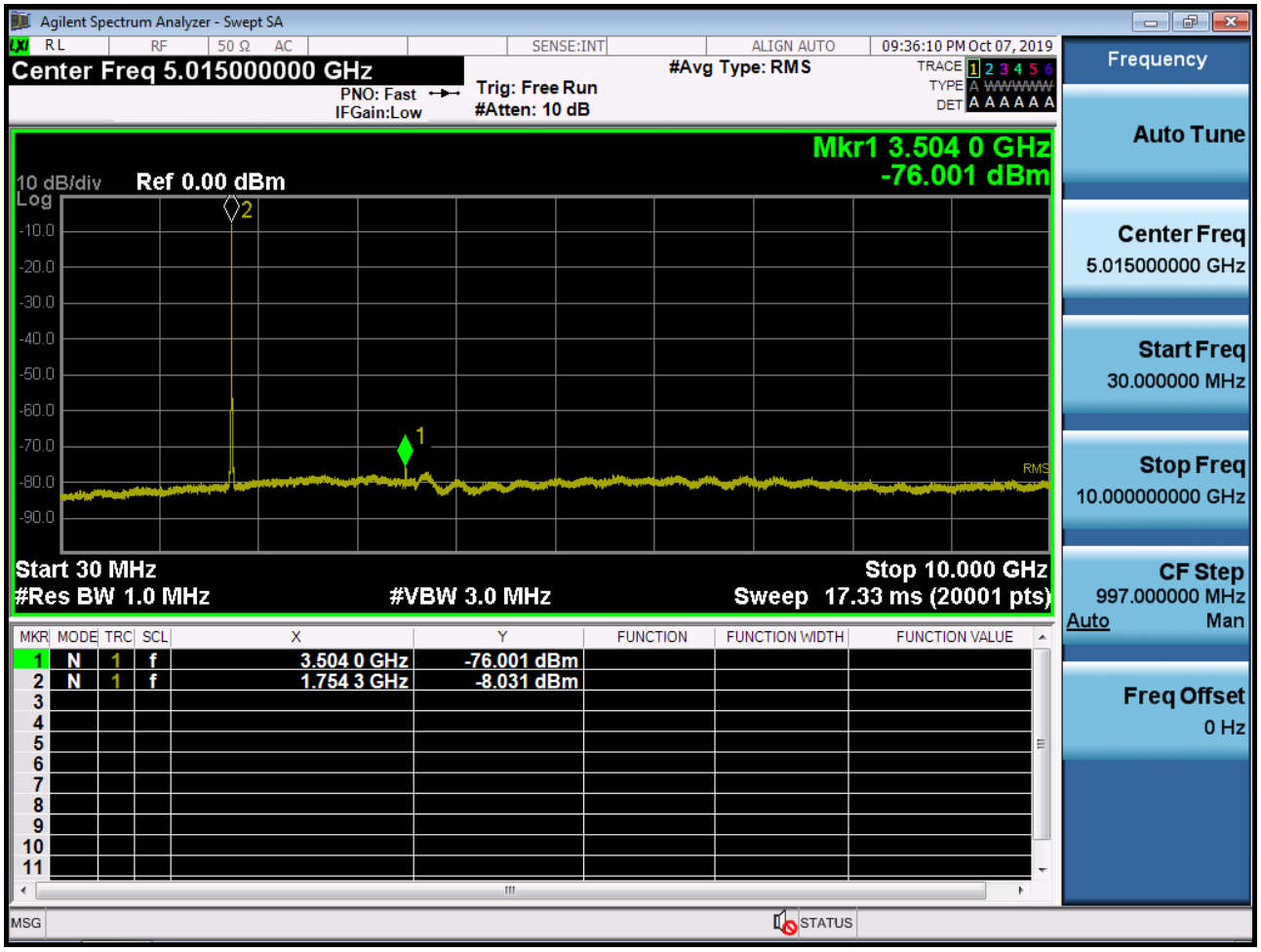
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



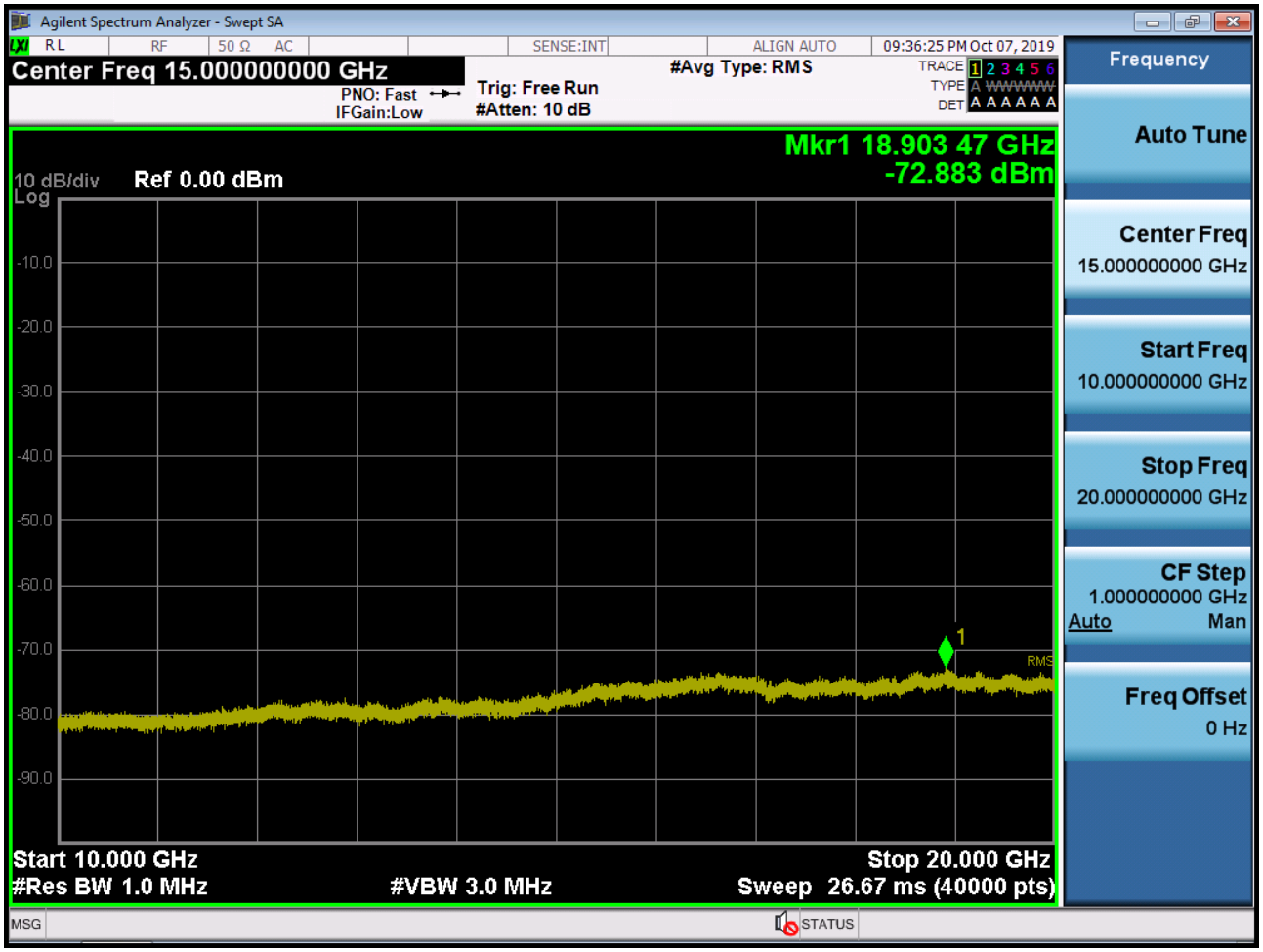
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-1910-FC010-P