HCT CO.,LTD.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
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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:**
November 12, 2020

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

**Report No.:** HCT-RF-2010-FC015-R1

| | |
|---|---|
| **FCC ID:** | **A3LSMG991U** |
| **APPLICANT:** | **SAMSUNG Electronics Co., Ltd.** |

| | |
|---|---|
| Model(s): | SM-G991U |
| Additional Model(s): | SM-G991U1 |
| EUT Type: | Mobile Phone |
| FCC Classification: | PCS Licensed Transmitter Held to Ear (PCE) |
| FCC Rule Part(s): | §22, §24, §27, §2, §90 |

| 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 | 248 KGXW | 0.541 | 27.33 |
| GSM850 EDGE | | | 247 KG7W | 0.108 | 20.34 |
| WCDMA850 | 826.4 – 846.6 | 871.4 – 891.6 | 4M16F9W | 0.094 | 19.75 |
| CDMA Secondary800 | 817.9 – 823.1 | 862.9 – 868.1 | 1M28F9W | 0.087 | 19.40 |
| CDMA 850 | 824.70– 848.31 | 869.70– 893.31 | 1M28F9W | 0.084 | 19.26 |

| 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 | 245 KGXW | 0.690 | 28.39 |
| GSM1900 EDGE | | | 250 KG7W | 0.273 | 24.36 |
| WCDMA1900 | 1852.4 – 1907.6 | 1932.4 – 1987.6 | 4M15F9W | 0.216 | 23.34 |
| WCDMA1700 | 1712.4 – 1752.6 | 2112.4 – 2152.6 | 4M16F9W | 0.237 | 23.75 |
| CDMA PCS | 1851.25– 1 908.75 | 1 931.25– 1 988.75 | 1M28F9W | 0.185 | 22.67 |

| Mode | Tx Frequency (MHz) | Rx Frequency (MHz) | Emission Designator | Conducted Output Power | |
|---|---|---|---|---|---|
| | | | | Max. Power (W) | Max. Power (dBm) |
| CDMA Secondary800 | 817.9 – 823.1 | 862.9 – 868.1 | 1M28F9W | 0.303 | 24.81 |

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

REVIEWED BY

**Report prepared by : Jae Ryang Do**
**Engineer of Telecommunication Testing Center**

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

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

# Version

| TEST REPORT NO. | DATE | DESCRIPTION |
|---|---|---|
| HCT-RF-2010-FC015 | October 29, 2020 | - First Approval Report |
| HCT-RF-2010-FC015-R1 | November 12, 2020 | - Revised the Max power table on 1 page.<br>(CDMA Secondary800) |

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

# Table of Contents

# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

| | |
|---|---|
| **Applicant Name:** | SAMSUNG Electronics Co., Ltd. |
| **Address:** | 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea |
| **FCC ID:** | A3LSMG991U |
| **Application Type:** | Certification |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part(s):** | §22, §24, §27, §2, §90 |
| **EUT Type:** | Mobile Phone |
| **Model(s):** | SM-G991U |
| **Additional Model(s):** | SM-G991U1 |
| **Tx Frequency:** | 824.20 - 848.80 MHz (GSM850)<br>826.40 - 846.60 MHz (WCDMA850)<br>1 850.20 - 1 909.80 MHz (GSM1900)<br>1 852.4 – 1 907.6 MHz (WCDMA1900)<br>1 712.4 – 1 752.6 MHz (WCDMA1700)<br>824.70 — 848.31 MHz (CDMA BC0)<br>1 851.25 – 1 908.75 MHz (PCS CDMA BC1)<br>817.90 — 823.10 MHz (Secondary CDMA BC10) |
| **Rx Frequency:** | 869.20 - 893.80 MHz (GSM850)<br>871.40 - 891.60 MHz (WCDMA850)<br>1 930.20 - 1 989.80 MHz (GSM1900)<br>1 932.4 – 1 987.6 MHz (WCDMA1900)<br>2 112.4 – 2 152.6 MHz (WCDMA1700)<br>869.70 — 893.31 MHz (CDMA BC0)<br>1 931.25 – 1 988.75 MHz (PCS CDMA BC1)<br>862.90 — 868.10 MHz (Secondary CDMA BC10) |
| **Date(s) of Tests:** | September 23, 2020 ~ October 28, 2020 |

# 2. INTRODUCTION

## 2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS, CDMA(BC0, 1, 10) and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, NFC, WPT, mmWave(n260/261).

## 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<br>- ANSI C63.26-2015 – Section 5.4.4 |
| Band Edge | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7 |
| Spurious and Harmonic Emissions at Antenna Terminal | - KDB 971168 D01 v03r01 – Section 6.0<br>- ANSI C63.26-2015 – Section 5.7 |
| Conducted Output Power | - KDB 971168 D01 v03r01 – Section 5.2.4<br>- ANSI C63.26-2015 – Section 5.2.1 & 5.2.4.2<br>* See SAR Report except Secondary 800 |
| Peak- to- Average Ratio | - KDB 971168 D01 v03r01 – Section 5.7<br>- ANSI C63.26-2015 – Section 5.2.3.4<br>- ANSI C63.26-2015 – Section 5.2.6(only GSM) |
| Frequency stability | - ANSI C63.26-2015 – Section 5.6 |
| Effective Radiated Power/<br>Effective Isotropic Radiated Power | - KDB 971168 D01 v03r01 – Section 5.2 & 5.8<br>- ANSI C63.26-2015 – Section 5.2<br>- ANSI/TIA-603-E-2016 – Section 2.2.17 |
| Radiated Spurious and Harmonic Emissions | - KDB 971168 D01 v03r01 – Section 6.2<br>- ANSI/TIA-603-E-2016 – Section 2.2.12 |

## 3.2 CONDUCTED OUTPUT POWER

**Test Overview**

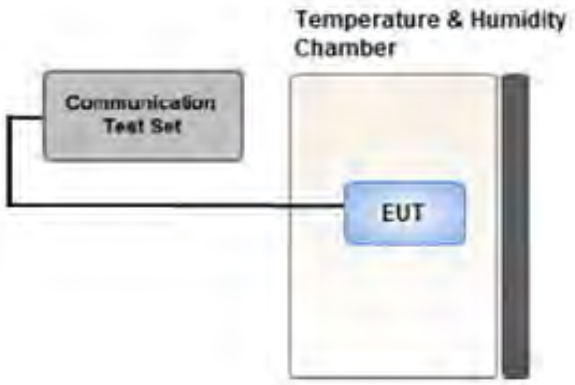
According to ANSI C63.26-2015 Section 5.2.1 when measuring the maximum RF output power from such devices, control over the EUT must be provided either through special test software (provided by manufacturer specifically for compliance testing, but not accessible by an end user) or through use of a base station emulator, communications test set, call box, or similar instrumentation that is capable of establishing a communications link with the EUT to enable control over variable parameters (e.g., output power, OBW, etc.).

In some cases, these instruments also include basic digital spectrum analyzer and/or power meter capabilities that can be utilized to measure the RF output power if the specified detectors and requirements can be realized and the measurement functions have been calibrated.

**Test Procedure**

1. The RF port of the EUT was connected to the Communication Tester via an RF cable.
2. Conducted average power was measured using a calibrated Radio Communication Tester.

**Test setup**



## 3.3 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.

## 3.4 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;

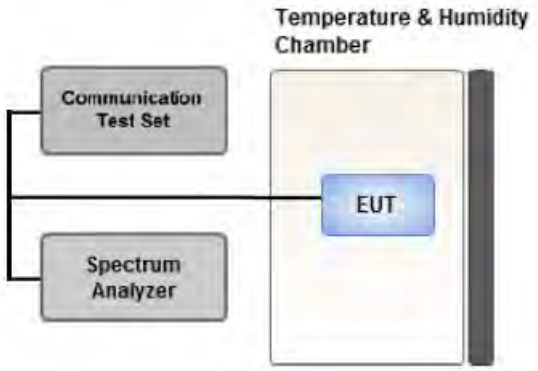
$$Result_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   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.

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

### 3.5 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)**

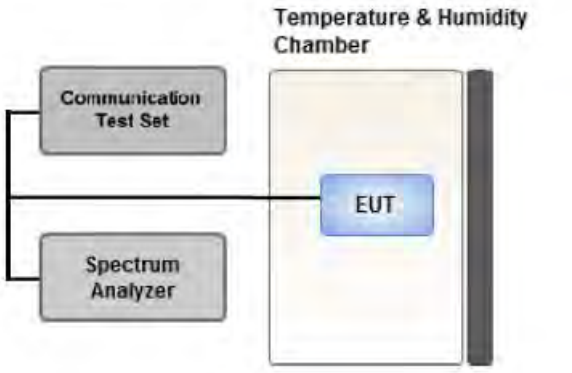
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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%.

### 3.6 OCCUPIED BANDWIDTH.




**Test setup**

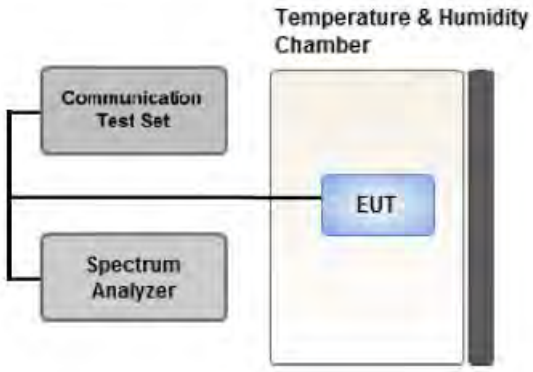
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

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

## 3.7 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.

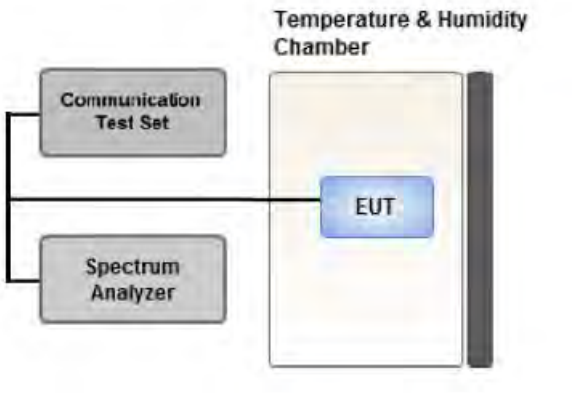
**Test Settings(GSM)**

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

### 3.8 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

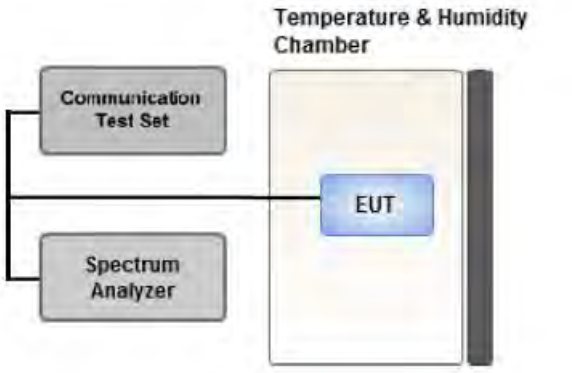
**Test Notes**

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.

### 3.9 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.

### 3.10 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.
- SM-G991U & additional models were tested and the worst case results are reported.

(Worst case : SM-G991U)

[ Worst case ]

| Test Description | Modulation | Test Channel |
|---|---|---|
| **Occupied Bandwidth** | GSM : Voice & EDGE(1 TX Slot)<br>WCDMA : QPSK(RMC)<br>CDMA : RC3/SO55 | Low, Mid, High |
| **Band Edge** | GSM : Voice & EDGE(1 TX Slot)<br>WCDMA : QPSK(RMC)<br>CDMA : RC3/SO55 | Low, High |
| **Spurious and Harmonic Emissions at Antenna Terminal** | GSM : Voice<br>WCDMA : QPSK(RMC)<br>CDMA : RC3/SO55 | Low, Mid, High |

[ Test Channel ]

| | UplinkChannel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2G (GSM850) | 2G (GSM1900) | 3G (WCDMA B2) | 3G (WCDMA B4) | 3G (WCDMA B5) | CDMA (BC 0) | CDMA (BC 1) | CDMA (BC 10) |
| **Low** | 128 | 512 | 9262 | 1312 | 4132 | 1013 | 25 | 476 |
| **Mid** | 190 | 661 | 9400 | 1412 | 4183 | 384 | 600 | 580 |
| **High** | 251 | 810 | 9538 | 1513 | 4233 | 777 | 1175 | 684 |

### 3.11 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- Please refer to the table below.
- SM-G991U & additional models were tested and the worst case results are reported.

(Worst case : SM-G991U)

[ 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 : X<br>WCDMA B4 : X<br>WCDMA B5 : Y | Low, Mid, High |
| **Radiated Spurious and Harmonic Emissions** | QPSK (WCDMA) | 12.2 kbps RMC | WCDMA B2 : Y<br>WCDMA B4 : Y<br>WCDMA B5 : Z | Low, Mid, High |

[ Worst case_2G ]

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

[ Worst case_CDMA ]

| Test Description | Modulation | Axis | Test Channel |
|---|---|---|---|
| **Effective Radiated Power, Effective Isotropic Radiated Power** | RC3/SO55 | CDMA BC0 : Y<br>CDMA BC1 : X<br>CDMA BC10 : Y | Low, Mid, High |
| **Radiated Spurious and Harmonic Emissions** | RC3/SO55 | CDMA BC0 : X<br>CDMA BC1 : Z<br>CDMA BC10 : X | Low, Mid, High |

[ Test Channel ]

| | UplinkChannel | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2G (GSM850) | 2G (GSM1900) | 3G (WCDMA B2) | 3G (WCDMA B4) | 3G (WCDMA B5) | CDMA (BC 0) | CDMA (BC 1) | CDMA (BC 10) |
| **Low** | 128 | 512 | 9262 | 1312 | 4132 | 1013 | 25 | 476 |
| **Mid** | 190 | 661 | 9400 | 1412 | 4183 | 384 | 600 | 580 |
| **High** | 251 | 810 | 9538 | 1513 | 4233 | 777 | 1175 | 684 |

## 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).
3. Model : FSV40/Spectrum
   - Use date of equipment : September 23, 2020 ~ October 12, 2020, October 14, 2020 ~

## 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), §90.691 | < 43 + 10 x log10 (P[Watts]) at Band Edge and for all out-of-band emissions | PASS |
| Conducted Output Power | §2.1046, §90.635 | 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, §90.213, § 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<br>< 1 Watts max. EIRP | PASS |
| Radiated Spurious and Harmonic Emissions | §2.1053, §22.917(a), §24.238(a), §27.53(h), §90.691 | < 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 CONDUCTED OUTPUT POWER

| Channel | SO2 | SO2 | SO55 | SO55 | TDSO SO32 | 1xEvDO REV.0 | 1xEvDO REV.0 | 1xEvDO REV.A | 1xEvDO REV.A |
|---|---|---|---|---|---|---|---|---|---|
| | RC1/1 | RC3/3 | RC1/1 | RC3/3 | RC3/3 | FTAP | RTAP | FETAP | FETAP |
| | (dBm) | (dBm) | (dBm) | (dBm) | (dBm) | (dBm) | (dBm) | (dBm) | (dBm) |
| 476 | 24.81 | 24.79 | 24.78 | 24.77 | 24.77 | 24.52 | 24.54 | 24.52 | 24.55 |
| 580 | 24.79 | 24.77 | 24.77 | 24.76 | 24.77 | 24.53 | 24.54 | 24.51 | 24.53 |
| 684 | 24.76 | 24.75 | 24.74 | 24.75 | 24.76 | 24.54 | 24.53 | 24.53 | 24.54 |

### 8.2 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 | -25.42 | 37.98 | -10.25 | 1.39 | V | < 7.00 | 0.430 | 26.34 |
| | 190 | 836.6 | -25.00 | 38.93 | -10.19 | 1.41 | V | | 0.541 | 27.33 |
| | 251 | 848.8 | -26.09 | 38.15 | -10.14 | 1.42 | V | | 0.456 | 26.59 |
| EDGE | 190 | 836.6 | -31.99 | 31.94 | -10.19 | 1.41 | V | | 0.108 | 20.34 |

| 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 | -32.48 | 31.09 | -10.24 | 1.40 | V | < 7.00 | 0.088 | 19.45 |
| | 4183 | 836.6 | -32.74 | 31.19 | -10.19 | 1.41 | V | | 0.091 | 19.59 |
| | 4233 | 846.6 | -32.68 | 31.32 | -10.15 | 1.42 | V | | 0.094 | 19.75 |

| Mode | Ch./ Freq. | | Measured Level (dBm) | Substitute LEVEL (dBm) | Ant. Gain (dBd) | C.L | Pol. | Limit | ERP | |
|---|---|---|---|---|---|---|---|---|---|---|
| | channel | Freq.(MHz) | | | | | | W | W | dBm |
| CDMA Secondary 800 | 476 | 817.9 | -32.33 | 30.84 | -10.27 | 1.39 | V | < 100 | 0.083 | 19.18 |
| | 580 | 820.5 | -32.33 | 30.96 | -10.26 | 1.39 | V | | 0.085 | 19.31 |
| | 684 | 823.1 | -32.37 | 31.04 | -10.25 | 1.39 | V | | 0.087 | 19.40 |

| Mode | Ch./ Freq. | | Measured Level (dBm) | Substitute LEVEL (dBm) | Ant. Gain (dBd) | C.L | Pol. | Limit | ERP | |
|---|---|---|---|---|---|---|---|---|---|---|
| | channel | Freq.(MHz) | | | | | | W | W | dBm |
| CDMA850 | 1013 | 824.7 | -32.60 | 30.90 | -10.24 | 1.40 | V | < 7.00 | 0.084 | 19.26 |
| | 384 | 836.5 | -33.26 | 30.67 | -10.19 | 1.41 | V | | 0.081 | 19.07 |
| | 777 | 848.3 | -35.04 | 29.10 | -10.14 | 1.42 | V | | 0.057 | 17.54 |

### 8.3 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 | -13.72 | 20.36 | 10.10 | 2.11 | H | < 2.00 | 0.684 | 28.35 |
| | 661 | 1880.0 | -14.16 | 20.39 | 10.15 | 2.15 | H | | 0.690 | 28.39 |
| | 810 | 1909.8 | -14.72 | 19.82 | 10.23 | 2.15 | H | | 0.617 | 27.90 |
| EDGE | 661 | 1880.0 | -18.19 | 16.36 | 10.15 | 2.15 | H | | 0.273 | 24.36 |

| 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 | -18.73 | 15.35 | 10.10 | 2.11 | H | < 2.00 | 0.216 | 23.34 |
| | 9400 | 1880.0 | -19.35 | 15.20 | 10.15 | 2.15 | H | | 0.209 | 23.20 |
| | 9538 | 1907.6 | -20.16 | 14.38 | 10.23 | 2.15 | H | | 0.176 | 22.46 |

| 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 | -17.69 | 15.95 | 9.85 | 2.05 | H | < 1.00 | 0.237 | 23.75 |
| | 1412 | 1732.4 | -17.91 | 15.82 | 9.90 | 2.05 | H | | 0.233 | 23.67 |
| | 1513 | 1752.6 | -18.26 | 15.49 | 10.00 | 2.06 | H | | 0.220 | 23.43 |

| Mode | Ch./ Freq. | | Measured Level (dBm) | Substitute LEVEL (dBm) | Ant. Gain (dBi) | C.L | Pol. | Limit | EIRP | |
|---|---|---|---|---|---|---|---|---|---|---|
| | channel | Freq.(MHz) | | | | | | W | W | dBm |
| CDMA PCS | 25 | 1851.3 | -19.40 | 14.68 | 10.10 | 2.11 | H | < 2.00 | 0.185 | 22.67 |
| | 600 | 1880.0 | -20.18 | 14.37 | 10.15 | 2.15 | H | | 0.173 | 22.37 |
| | 1175 | 1908.8 | -21.17 | 13.37 | 10.23 | 2.15 | H | | 0.140 | 21.45 |

### 8.4 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 | -52.21 | 9.50 | -61.82 | 1.99 | V | -54.31 | -13.00 |
| | 2 472.60 | -37.00 | 10.60 | -41.13 | 2.47 | H | -33.00 | -13.00 |
| | 3 296.80 | -57.98 | 12.25 | -59.07 | 2.89 | H | -49.70 | -13.00 |
| 190 (836.6) | 1 673.20 | -52.34 | 9.65 | -62.11 | 2.01 | H | -54.47 | -13.00 |
| | 2 509.80 | -37.28 | 10.75 | -41.00 | 2.50 | H | -32.75 | -13.00 |
| | 3 346.40 | -57.28 | 12.48 | -58.26 | 2.92 | V | -48.71 | -13.00 |
| 251 (848.8) | 1 697.60 | -52.69 | 9.80 | -62.21 | 2.04 | V | -54.45 | -13.00 |
| | 2 546.40 | -37.12 | 10.88 | -40.40 | 2.52 | H | -32.04 | -13.00 |
| | 3 395.20 | -57.38 | 12.68 | -58.44 | 2.94 | V | -48.70 | -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 | -54.95 | 12.40 | -59.02 | 3.08 | V | -49.70 | -13.00 |
| | 5 550.60 | -47.20 | 13.10 | -45.17 | 3.81 | H | -35.88 | -13.00 |
| | 7 400.80 | -57.42 | 11.10 | -47.46 | 4.44 | H | -40.80 | -13.00 |
| 661 (1880.0) | 3 760.00 | -54.42 | 12.48 | -58.29 | 3.10 | H | -48.91 | -13.00 |
| | 5 640.00 | -45.44 | 13.30 | -43.27 | 3.85 | H | -33.82 | -13.00 |
| | 7 520.00 | -56.90 | 11.30 | -46.33 | 4.46 | H | -39.49 | -13.00 |
| 810 (1909.8) | 3 819.60 | -54.83 | 12.40 | -59.26 | 3.14 | H | -50.00 | -13.00 |
| | 5 729.40 | -46.46 | 13.35 | -43.80 | 3.87 | H | -34.32 | -13.00 |
| | 7 639.20 | -56.68 | 11.65 | -46.15 | 4.47 | H | -38.97 | -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 | -53.95 | 9.50 | -63.56 | 1.99 | H | -56.05 | -13.00 |
| | 2 479.20 | -48.35 | 10.60 | -52.62 | 2.48 | H | -44.50 | -13.00 |
| | 3 305.60 | -56.94 | 12.33 | -58.02 | 2.90 | V | -48.59 | -13.00 |
| 4,183 (836.6) | 1 673.20 | -53.44 | 9.65 | -63.21 | 2.01 | H | -55.57 | -13.00 |
| | 2 509.80 | -50.87 | 10.75 | -54.59 | 2.50 | H | -46.34 | -13.00 |
| | 3 346.40 | -58.22 | 12.48 | -59.20 | 2.92 | V | -49.65 | -13.00 |
| 4,233 (846.6) | 1 693.20 | -52.91 | 9.73 | -62.59 | 2.03 | V | -54.89 | -13.00 |
| | 2 539.80 | -52.02 | 10.85 | -55.55 | 2.51 | V | -47.21 | -13.00 |
| | 3 386.40 | -58.01 | 12.63 | -59.09 | 2.94 | H | -49.40 | -13.00 |

▣ MODULATION SIGNAL: WCDMA1900

▣ DISTANCE: 3 meters

| Ch. | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBi) | Substitute Level [dBm] | C.L | Pol. | Result (dBm) | Limit |
|---|---|---|---|---|---|---|---|---|
| 9262 (1852.4) | 3 704.80 | -54.82 | 12.40 | -58.89 | 3.08 | H | -49.57 | -13.00 |
| | 5 557.20 | -53.61 | 13.15 | -51.80 | 3.82 | H | -42.47 | -13.00 |
| | 7 409.60 | -56.13 | 11.13 | -45.95 | 4.45 | V | -39.27 | -13.00 |
| 9400 (1880.0) | 3 760.00 | -54.65 | 12.48 | -58.52 | 3.10 | V | -49.14 | -13.00 |
| | 5 640.00 | -54.99 | 13.30 | -52.82 | 3.85 | H | -43.37 | -13.00 |
| | 7 520.00 | -57.38 | 11.30 | -46.81 | 4.46 | V | -39.97 | -13.00 |
| 9538 (1907.6) | 3 815.20 | -54.79 | 12.40 | -59.18 | 3.14 | V | -49.91 | -13.00 |
| | 5 722.80 | -54.25 | 13.35 | -51.28 | 3.88 | H | -41.81 | -13.00 |
| | 7 630.40 | -57.16 | 11.60 | -46.83 | 4.48 | H | -39.71 | -13.00 |

▣ MODULATION SIGNAL: WCDMA1700

▣ DISTANCE: 3 meters

| Ch. | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBi) | Substitute Level [dBm] | C.L | Pol. | Result (dBm) | Limit |
|---|---|---|---|---|---|---|---|---|
| 1312 (1712.4) | 3 424.80 | -54.47 | 12.60 | -60.37 | 2.96 | H | -50.72 | -13.00 |
| | 5 137.20 | -56.79 | 12.45 | -53.94 | 3.66 | H | -45.15 | -13.00 |
| | 6 849.60 | -55.79 | 12.20 | -49.17 | 4.25 | V | -41.22 | -13.00 |
| 1412 (1732.4) | 3 464.80 | -55.07 | 12.48 | -60.86 | 2.97 | H | -51.35 | -13.00 |
| | 5 197.20 | -57.20 | 12.90 | -55.78 | 3.70 | H | -46.58 | -13.00 |
| | 6 929.60 | -57.20 | 12.05 | -49.90 | 4.28 | H | -42.13 | -13.00 |
| 1513 (1752.6) | 3 505.20 | -55.23 | 12.28 | -61.01 | 2.98 | H | -51.71 | -13.00 |
| | 5 257.80 | -55.85 | 13.25 | -55.04 | 3.71 | V | -45.50 | -13.00 |
| | 7 010.40 | -56.36 | 11.65 | -48.34 | 4.32 | V | -41.01 | -13.00 |

▣ MODULATION SIGNAL: CDMA Secondary800

▣ DISTANCE: 3 meters

| Ch. | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBi) | Substitute Level [dBm] | C.L | Pol. | Result (dBm) | Limit |
|---|---|---|---|---|---|---|---|---|
| 476 (817.9) | 1 635.80 | -52.42 | 9.43 | -62.02 | 1.98 | H | -54.57 | -13.00 |
| | 2 453.70 | -47.65 | 10.52 | -51.57 | 2.46 | H | -43.51 | -13.00 |
| | 3 271.60 | -57.44 | 12.10 | -58.50 | 2.88 | V | -49.28 | -13.00 |
| 580 (820.5) | 1 641.00 | -53.31 | 9.45 | -63.06 | 1.98 | V | -55.59 | -13.00 |
| | 2 461.50 | -48.21 | 10.55 | -52.34 | 2.46 | H | -44.25 | -13.00 |
| | 3 282.00 | -56.71 | 12.12 | -57.87 | 2.88 | H | -48.63 | -13.00 |
| 684 (823.1) | 1 646.20 | -51.90 | 9.48 | -61.58 | 1.99 | V | -54.09 | -13.00 |
| | 2 469.30 | -47.91 | 10.59 | -52.04 | 2.47 | H | -43.92 | -13.00 |
| | 3 292.40 | -57.95 | 12.22 | -59.06 | 2.88 | V | -49.72 | -13.00 |

▣ MODULATION SIGNAL: CDMA850

▣ DISTANCE: 3 meters

| Ch. | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBi) | Substitute Level [dBm] | C.L | Pol. | Result (dBm) | Limit |
|---|---|---|---|---|---|---|---|---|
| 1013 (824.7) | 1 649.40 | -52.41 | 9.50 | -62.02 | 1.99 | V | -54.51 | -13.00 |
| | 2 474.10 | -48.15 | 10.60 | -52.36 | 2.47 | H | -44.23 | -13.00 |
| | 3 298.80 | -58.05 | 12.30 | -59.11 | 2.89 | V | -49.70 | -13.00 |
| 384 (836.5) | 1 673.00 | -52.68 | 9.65 | -62.45 | 2.01 | V | -54.81 | -13.00 |
| | 2 509.50 | -50.84 | 10.75 | -54.56 | 2.50 | H | -46.31 | -13.00 |
| | 3 346.00 | -56.34 | 12.48 | -57.33 | 2.92 | H | -47.77 | -13.00 |
| 777 (848.3) | 1 696.60 | -53.01 | 9.76 | -62.60 | 2.04 | H | -54.88 | -13.00 |
| | 2 544.90 | -51.35 | 10.88 | -54.64 | 2.52 | H | -46.28 | -13.00 |
| | 3 393.20 | -58.37 | 12.65 | -59.18 | 2.94 | V | -49.47 | -13.00 |

▣ MODULATION SIGNAL: CDMA PCS

▣ DISTANCE: 3 meters

| Ch. | Freq.(MHz) | Measured Level [dBm] | Ant. Gain (dBi) | Substitute Level [dBm] | C.L | Pol. | Result (dBm) | Limit |
|---|---|---|---|---|---|---|---|---|
| 25 (1851.3) | 3 702.60 | -55.45 | 12.40 | -59.52 | 3.08 | H | -50.20 | -13.00 |
| | 5 553.90 | -52.54 | 13.13 | -50.70 | 3.81 | V | -41.38 | -13.00 |
| | 7 405.20 | -56.05 | 11.12 | -45.98 | 4.45 | V | -39.31 | -13.00 |
| 600 (1880.0) | 3 760.00 | -54.39 | 12.48 | -58.26 | 3.10 | H | -48.88 | -13.00 |
| | 5 640.00 | -52.89 | 13.30 | -50.72 | 3.85 | H | -41.27 | -13.00 |
| | 7 520.00 | -56.10 | 11.30 | -45.53 | 4.46 | V | -38.69 | -13.00 |
| 1175 (1908.8) | 3 817.60 | -53.41 | 12.40 | -57.84 | 3.14 | H | -48.58 | -13.00 |
| | 5 726.40 | -55.45 | 13.35 | -52.63 | 3.88 | H | -43.16 | -13.00 |
| | 7 635.20 | -57.37 | 11.63 | -46.94 | 4.48 | V | -39.79 | -13.00 |

## 8.5 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 | 30.628 | 20.99 | 4.6160 | 0.5475 | 9.26 | 0.38 | 13 | Pass |
| GSM1900 EDGE | 661 | 29.877 | 17.50 | 4.616 | 0.5475 | 9.26 | 3.12 | | |
| WCDMA1900 | 9400 | CCDF Procedure | | | | | 3.03 | | |
| WCDMA1700 | 1732.4 | | | | | | 2.99 | | |
| CDMA PCS | 600 | | | | | | 4.17 | | |

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 78 ~ 86.

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 = $Tx_{On}$ / $Tx_{Total}$

### 8.6 OCCUPIED BANDWIDTH

| Band | Channel | Frequency(MHz) | Data (GSM: kHz / WCDMA : MHz) |
|---|---|---|---|
| GSM850 | 128 | 824.20 | 242.79 |
| | 190 | 836.60 | 244.32 |
| | 251 | 848.80 | 247.96 |
| GSM850 EDGE | 128 | 824.20 | 246.48 |
| | 190 | 836.60 | 243.88 |
| | 251 | 848.80 | 246.57 |
| GSM1900 | 512 | 1,850.20 | 244.61 |
| | 661 | 1,880.00 | 241.82 |
| | 810 | 1,909.80 | 242.83 |
| GSM1900 EDGE | 512 | 1,850.20 | 249.48 |
| | 661 | 1,880.00 | 242.00 |
| | 810 | 1,909.80 | 244.04 |
| WCDMA850 | 4132 | 826.40 | 4.1441 |
| | 4183 | 836.60 | 4.1540 |
| | 4233 | 846.60 | 4.1604 |
| WCDMA1900 | 9262 | 1852.40 | 4.1416 |
| | 9400 | 1880.00 | 4.1423 |
| | 9538 | 1907.60 | 4.1446 |
| WCDMA1700 | 1312 | 1712.40 | 4.1425 |
| | 1412 | 1732.40 | 4.1579 |
| | 1513 | 1752.60 | 4.1541 |

| Band | Channel | Frequency(MHz) | Data (CDMA : MHz) |
|---|---|---|---|
| CDMA Secondary800 | 476 | 817.9 | 1.2707 |
| | 580 | 820.5 | 1.2711 |
| | 684 | 823.1 | 1.2807 |
| CDMA850 | 1013 | 824.7 | 1.2753 |
| | 384 | 836.5 | 1.2713 |
| | 777 | 848.3 | 1.2686 |
| CDMA PCS | 25 | 1851.3 | 1.2695 |
| | 600 | 1880.0 | 1.2742 |
| | 1175 | 1908.8 | 1.2769 |

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 58 ~ 77.

### 8.7 CONDUCTED SPURIOUS EMISSIONS

| Band | Channel | Frequency of Maximum Harmonic (GHz) | Factor (dB) | Measurement Maximum Data (dBm) | Result | (dBm) |
|---|---|---|---|---|---|---|
| GSM850 | 128 | 5.9841 | 28.591 | -57.43 | -28.836 | -13.00 |
| | 190 | 5.4392 | 28.591 | -57.70 | -29.106 | |
| | 251 | 3.1725 | 27.976 | -56.82 | -28.840 | |
| GSM1900 | 512 | 18.61572 | 29.489 | -52.489 | -23.000 | |
| | 661 | 19.89550 | 29.489 | -52.327 | -22.838 | |
| | 810 | 18.90122 | 29.489 | -52.413 | -22.924 | |
| WCDMA850 | 4132 | 2.4771 | 27.976 | -74.982 | -47.006 | |
| | 4183 | 2.5135 | 27.976 | -75.444 | -47.468 | |
| | 4233 | 2.5380 | 27.976 | -74.560 | -46.584 | |
| WCDMA1900 | 9262 | 18.9087 | 29.489 | -72.597 | -43.108 | |
| | 9400 | 19.0180 | 29.489 | -72.745 | -43.256 | |
| | 9538 | 18.9480 | 29.489 | -72.487 | -42.998 | |
| WCDMA1700 | 1712.4 | 18.97072 | 29.489 | -72.631 | -43.142 | |
| | 1732.4 | 18.93072 | 29.489 | -72.430 | -42.941 | |
| | 1752.6 | 18.89847 | 29.489 | -72.557 | -43.068 | |
| CDMA Secondary800 | 476 | 2.4552 | 27.976 | -71.352 | -43.376 | |
| | 580 | 2.4622 | 27.976 | -72.081 | -44.105 | |
| | 684 | 2.4697 | 27.976 | -73.093 | -45.117 | |
| CDMA850 | 1013 | 2.4751 | 27.976 | -72.694 | -44.718 | |
| | 384 | 2.5095 | 27.976 | -72.071 | -44.095 | |
| | 777 | 2.5464 | 27.976 | -75.815 | -47.839 | |
| CDMA PCS | 25 | 18.8777 | 29.489 | -72.538 | -43.049 | |
| | 600 | 18.8882 | 29.489 | -72.325 | -42.836 | |
| | 1175 | 18.8912 | 29.489 | -72.201 | -42.712 | |

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 133 ~ 160.

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 |

## 8.8 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 87 ~ 132.

## 8.9 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: GSM850

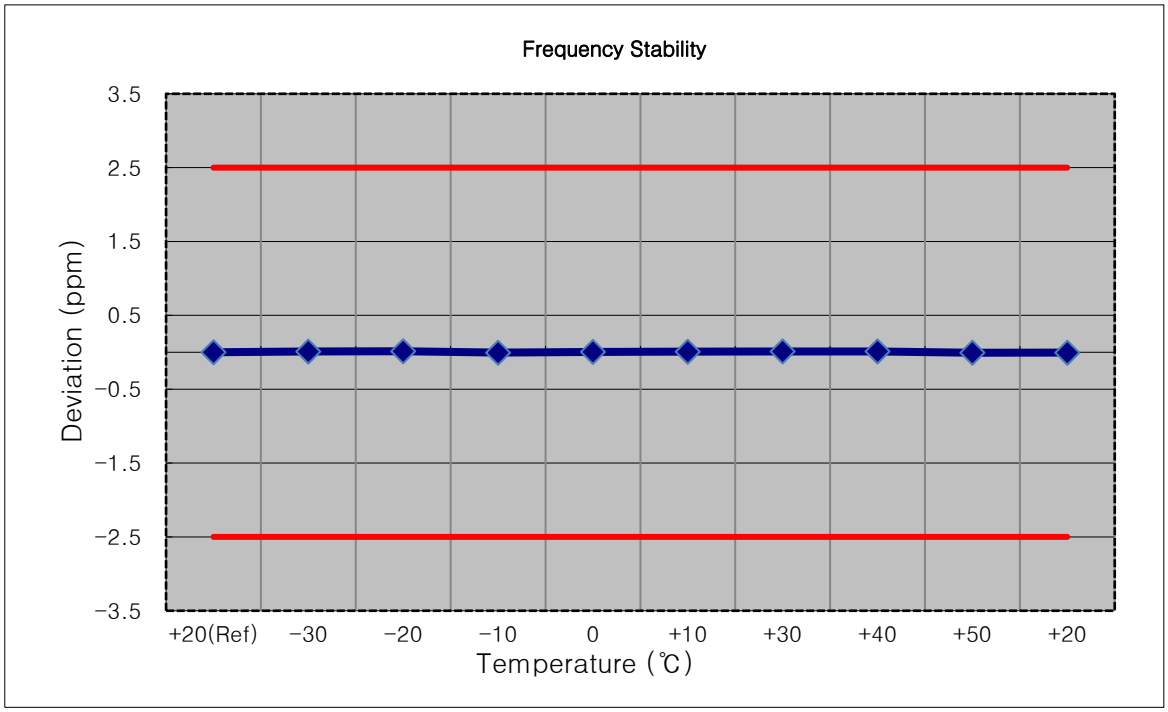
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 190

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 836 599 992 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 836 600 000 | 8.9 | 0.000 001 | 0.0106 |
| 100% | | -20 | 836 600 003 | 11.5 | 0.000 001 | 0.0138 |
| 100% | | -10 | 836 599 987 | -4.3 | -0.000 001 | -0.0052 |
| 100% | | 0 | 836 599 996 | 4.5 | 0.000 001 | 0.0053 |
| 100% | | +10 | 836 599 999 | 7.0 | 0.000 001 | 0.0084 |
| 100% | | +30 | 836 600 001 | 9.3 | 0.000 001 | 0.0112 |
| 100% | | +40 | 836 600 001 | 9.8 | 0.000 001 | 0.0117 |
| 100% | | +50 | 836 599 986 | -5.3 | -0.000 001 | -0.0064 |
| Batt. Endpoint | 3.650 | +20 | 836 599 987 | -4.1 | 0.000 000 | -0.0048 |



▣ Mode: GSM1900

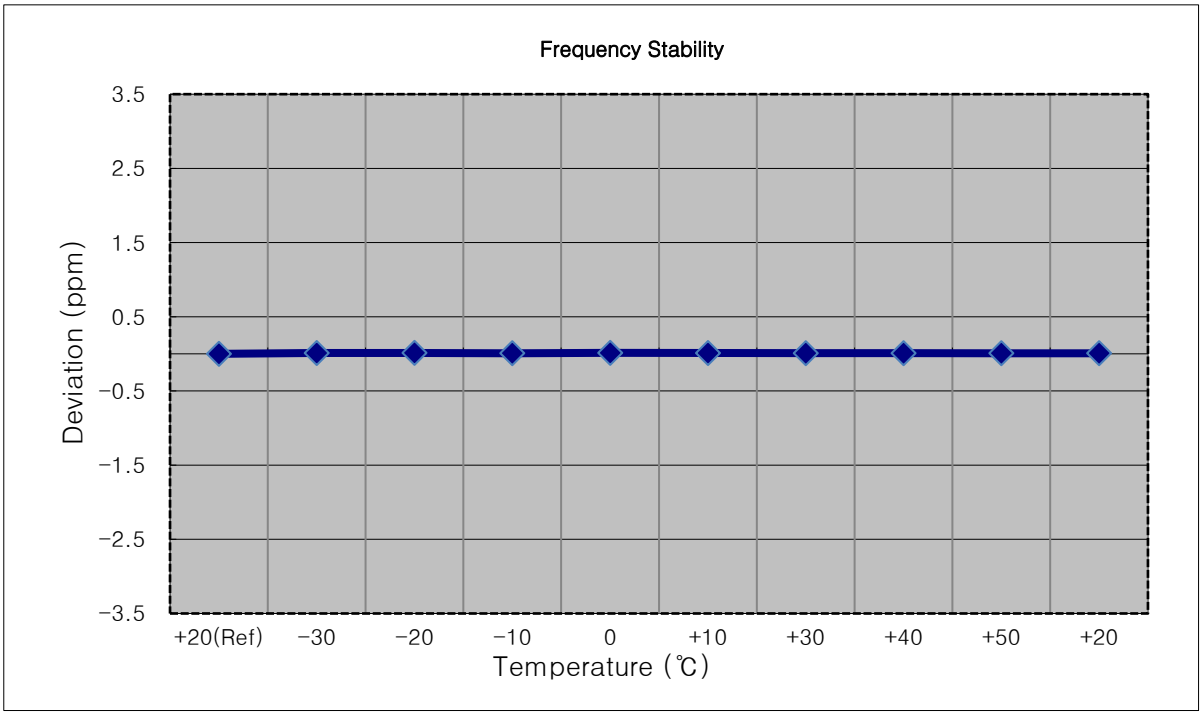
▣ OPERATING FREQUENCY: 1850,200,000 Hz

▣ CHANNEL: 512

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1850 200 024 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1850 200 045 | 20.7 | 0.000 001 | 0.0112 |
| 100% | | -20 | 1850 200 046 | 21.5 | 0.000 001 | 0.0116 |
| 100% | | -10 | 1850 200 038 | 13.8 | 0.000 001 | 0.0075 |
| 100% | | 0 | 1850 200 049 | 24.8 | 0.000 001 | 0.0134 |
| 100% | | +10 | 1850 200 046 | 21.4 | 0.000 001 | 0.0116 |
| 100% | | +30 | 1850 200 040 | 16.0 | 0.000 001 | 0.0087 |
| 100% | | +40 | 1850 200 040 | 16.2 | 0.000 001 | 0.0088 |
| 100% | | +50 | 1850 200 039 | 15.2 | 0.000 001 | 0.0082 |
| Batt. Endpoint | 3.650 | +20 | 1850 200 039 | 14.4 | 0.000 001 | 0.0078 |



▣ Mode: GSM1900

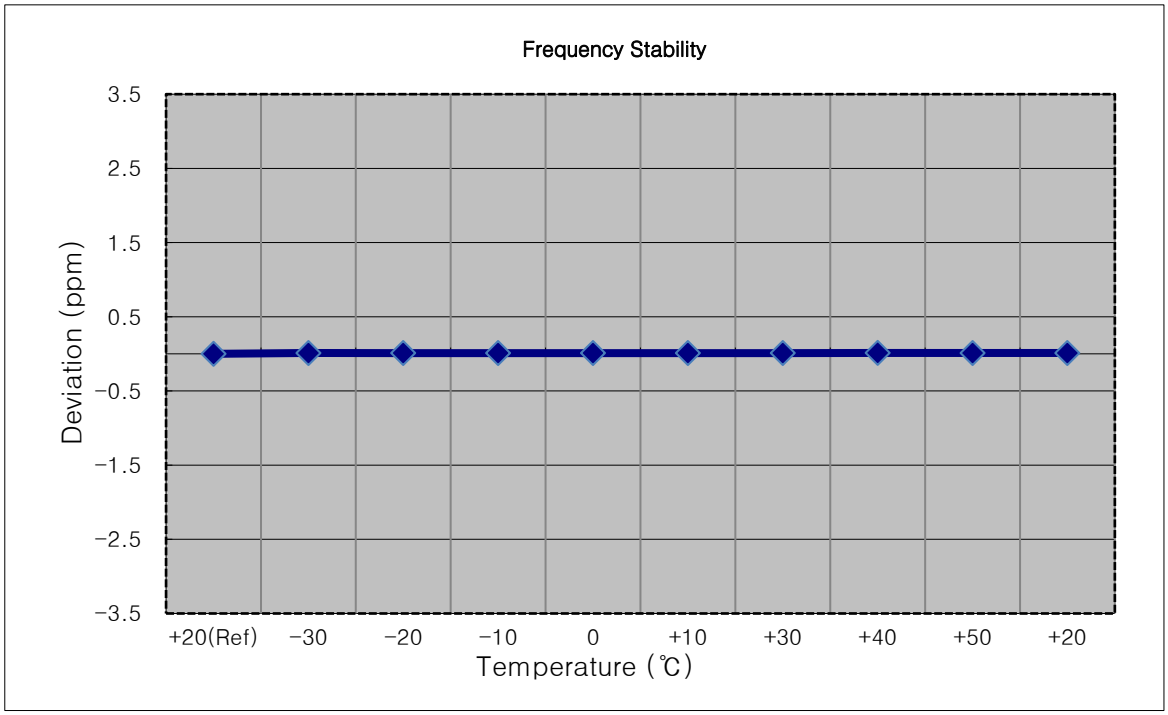
▣ OPERATING FREQUENCY: 1880,000,000 Hz

▣ CHANNEL: 661

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1880 000 018 | 0.0 | 0.000 000 | 0.000 |
| 100% | | -30 | 1880 000 038 | 20.3 | 0.000 001 | 0.011 |
| 100% | | -20 | 1880 000 037 | 19.1 | 0.000 001 | 0.010 |
| 100% | | -10 | 1880 000 037 | 19.2 | 0.000 001 | 0.010 |
| 100% | | 0 | 1880 000 036 | 18.0 | 0.000 001 | 0.010 |
| 100% | | +10 | 1880 000 038 | 19.6 | 0.000 001 | 0.010 |
| 100% | | +30 | 1880 000 037 | 19.2 | 0.000 001 | 0.010 |
| 100% | | +40 | 1880 000 041 | 22.5 | 0.000 001 | 0.012 |
| 100% | | +50 | 1880 000 039 | 20.9 | 0.000 001 | 0.011 |
| Batt. Endpoint | 3.650 | +20 | 1880 000 038 | 20.3 | 0.000 001 | 0.011 |



▣ Mode: GSM1900

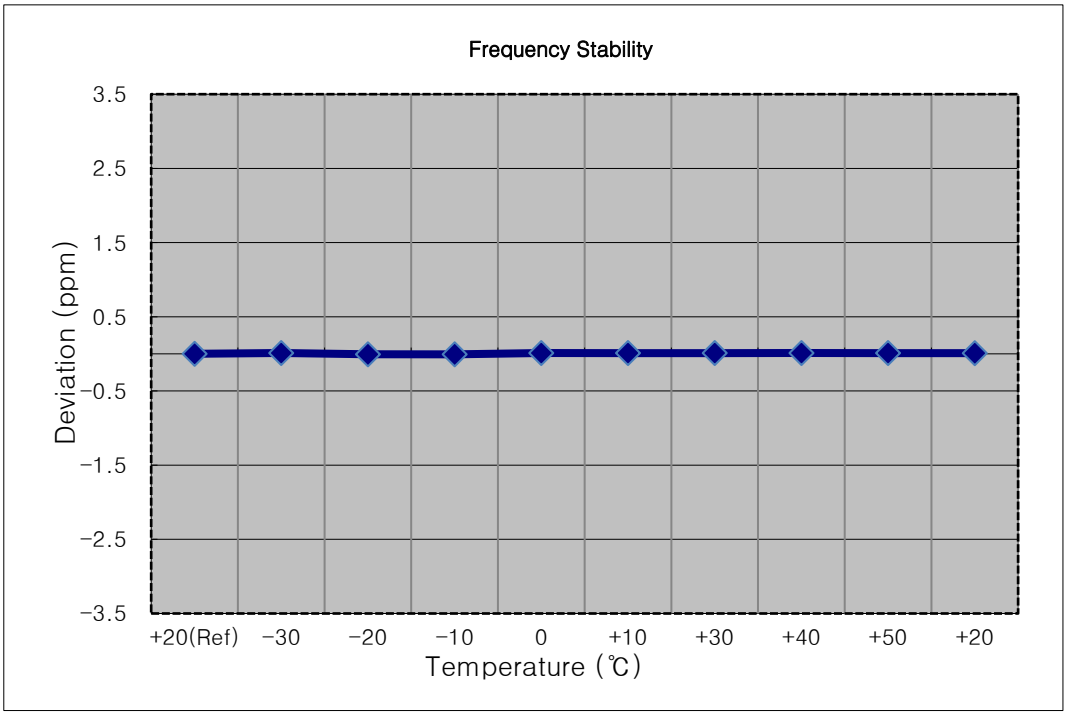
▣ OPERATING FREQUENCY: 1909,800,000 Hz

▣ CHANNEL: 810

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1909 799 991 | 0.0 | 0.000 000 | 0.000 |
| 100% | | -30 | 1909 800 011 | 20.4 | 0.000 001 | 0.011 |
| 100% | | -20 | 1909 799 979 | -11.7 | -0.000 001 | -0.006 |
| 100% | | -10 | 1909 799 978 | -12.9 | -0.000 001 | -0.007 |
| 100% | | 0 | 1909 800 012 | 21.4 | 0.000 001 | 0.011 |
| 100% | | +10 | 1909 800 010 | 19.3 | 0.000 001 | 0.010 |
| 100% | | +30 | 1909 800 009 | 18.4 | 0.000 001 | 0.010 |
| 100% | | +40 | 1909 800 011 | 20.2 | 0.000 001 | 0.011 |
| 100% | | +50 | 1909 800 010 | 19.7 | 0.000 001 | 0.010 |
| Batt. Endpoint | 3.650 | +20 | 1909 800 008 | 17.2 | 0.000 001 | 0.009 |



▣ Mode: WCDMA850

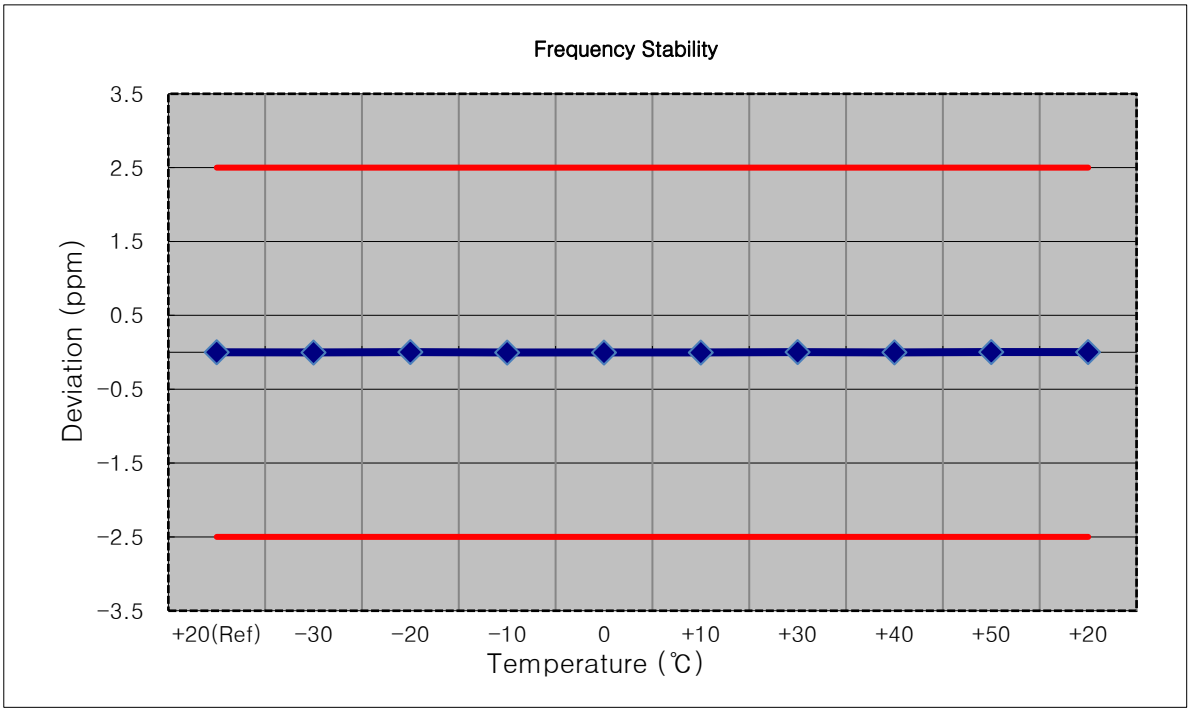
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 4183

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 836 599 998 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 836 599 995 | -2.1 | 0.000 000 | -0.0026 |
| 100% | | -20 | 836 600 000 | 2.2 | 0.000 000 | 0.0026 |
| 100% | | -10 | 836 599 995 | -2.5 | 0.000 000 | -0.0029 |
| 100% | | 0 | 836 599 996 | -2.0 | 0.000 000 | -0.0024 |
| 100% | | +10 | 836 599 996 | -2.1 | 0.000 000 | -0.0026 |
| 100% | | +30 | 836 600 000 | 1.9 | 0.000 000 | 0.0023 |
| 100% | | +40 | 836 599 996 | -1.4 | 0.000 000 | -0.0017 |
| 100% | | +50 | 836 600 000 | 2.8 | 0.000 000 | 0.0034 |
| Batt. Endpoint | 3.650 | +20 | 836 600 000 | 2.2 | 0.000 000 | 0.0027 |



▣ Mode: WCDMA1900

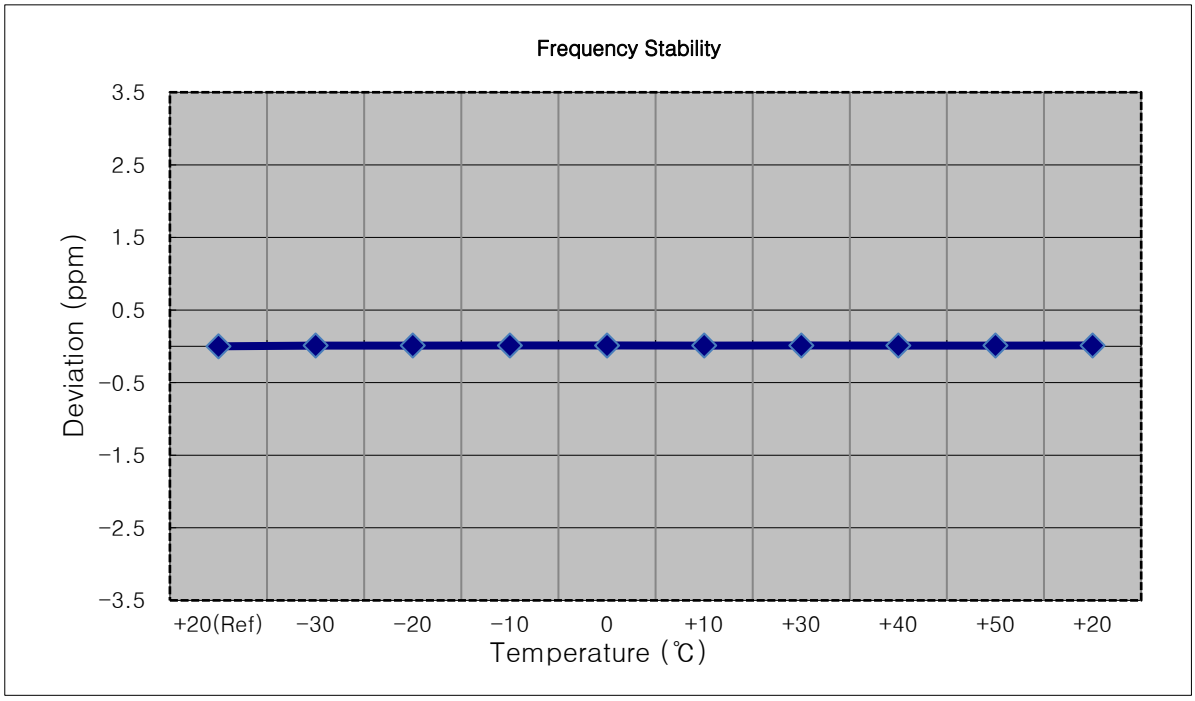
▣ OPERATING FREQUENCY: 1,852,400,000 Hz

▣ CHANNEL: 9262

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1852 400 020 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1852 400 040 | 19.9 | 0.000 001 | 0.0107 |
| 100% | | -20 | 1852 400 039 | 19.0 | 0.000 001 | 0.0103 |
| 100% | | -10 | 1852 400 040 | 20.2 | 0.000 001 | 0.0109 |
| 100% | | 0 | 1852 400 040 | 20.3 | 0.000 001 | 0.0109 |
| 100% | | +10 | 1852 400 039 | 19.2 | 0.000 001 | 0.0104 |
| 100% | | +30 | 1852 400 041 | 20.9 | 0.000 001 | 0.0113 |
| 100% | | +40 | 1852 400 040 | 19.9 | 0.000 001 | 0.0107 |
| 100% | | +50 | 1852 400 039 | 19.1 | 0.000 001 | 0.0103 |
| Batt. Endpoint | 3.650 | +20 | 1852 400 041 | 21.5 | 0.000 001 | 0.0116 |



▣ Mode: WCDMA1900

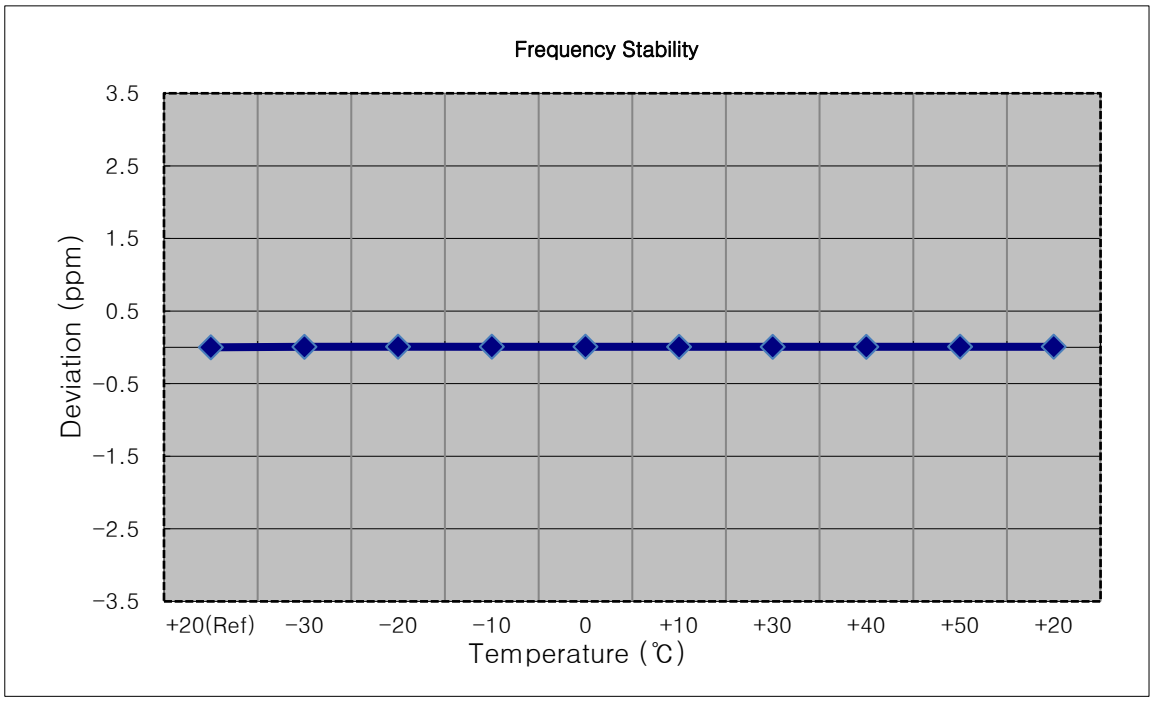
▣ OPERATING FREQUENCY: 1,880,000,000 Hz

▣ CHANNEL: 9400

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1880 000 014 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1880 000 028 | 13.9 | 0.000 001 | 0.0074 |
| 100% | | -20 | 1880 000 029 | 15.5 | 0.000 001 | 0.0083 |
| 100% | | -10 | 1880 000 028 | 14.5 | 0.000 001 | 0.0077 |
| 100% | | 0 | 1880 000 029 | 14.7 | 0.000 001 | 0.0078 |
| 100% | | +10 | 1880 000 028 | 13.8 | 0.000 001 | 0.0074 |
| 100% | | +30 | 1880 000 028 | 14.0 | 0.000 001 | 0.0075 |
| 100% | | +40 | 1880 000 027 | 13.4 | 0.000 001 | 0.0071 |
| 100% | | +50 | 1880 000 028 | 14.6 | 0.000 001 | 0.0078 |
| Batt. Endpoint | 3.650 | +20 | 1880 000 028 | 14.1 | 0.000 001 | 0.0075 |



▣ Mode: WCDMA1900

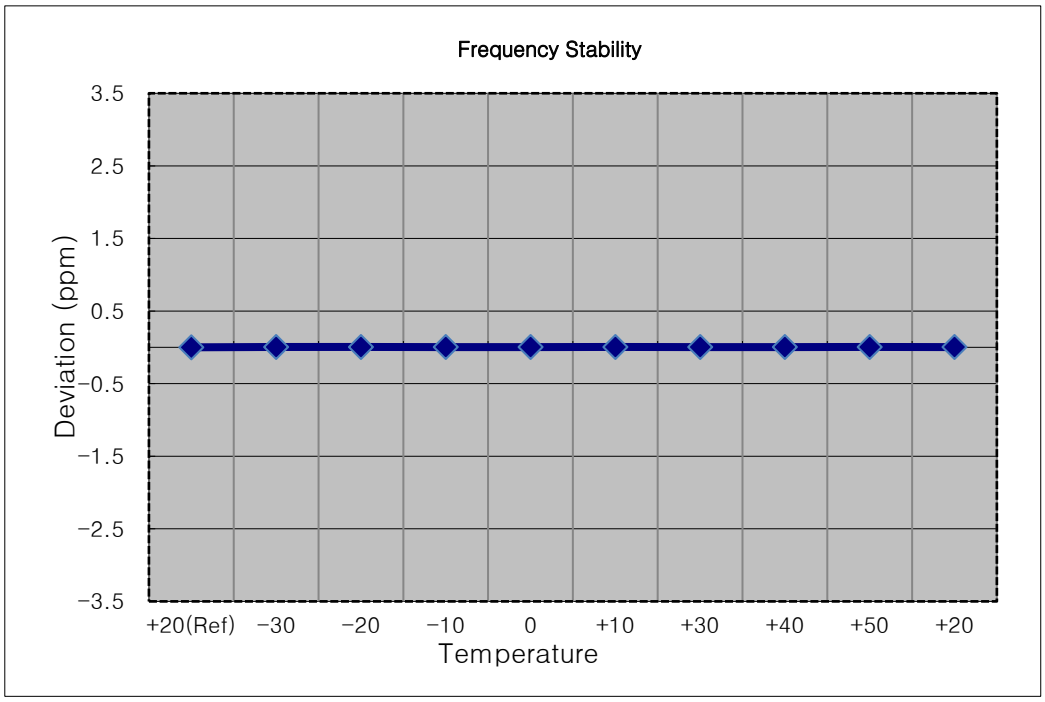
▣ OPERATING FREQUENCY: 1,907,600,000 Hz

▣ CHANNEL: 9538

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1907 600 008 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1907 600 018 | 9.3 | 0.000 000 | 0.0049 |
| 100% | | -20 | 1907 600 017 | 8.7 | 0.000 000 | 0.0045 |
| 100% | | -10 | 1907 600 015 | 7.2 | 0.000 000 | 0.0038 |
| 100% | | 0 | 1907 600 015 | 7.2 | 0.000 000 | 0.0038 |
| 100% | | +10 | 1907 600 016 | 8.2 | 0.000 000 | 0.0043 |
| 100% | | +30 | 1907 600 014 | 6.1 | 0.000 000 | 0.0032 |
| 100% | | +40 | 1907 600 016 | 7.7 | 0.000 000 | 0.0041 |
| 100% | | +50 | 1907 600 017 | 8.6 | 0.000 000 | 0.0045 |
| Batt. Endpoint | 3.650 | +20 | 1907 600 016 | 7.6 | 0.000 000 | 0.0040 |



▣ Mode: WCDMA1700

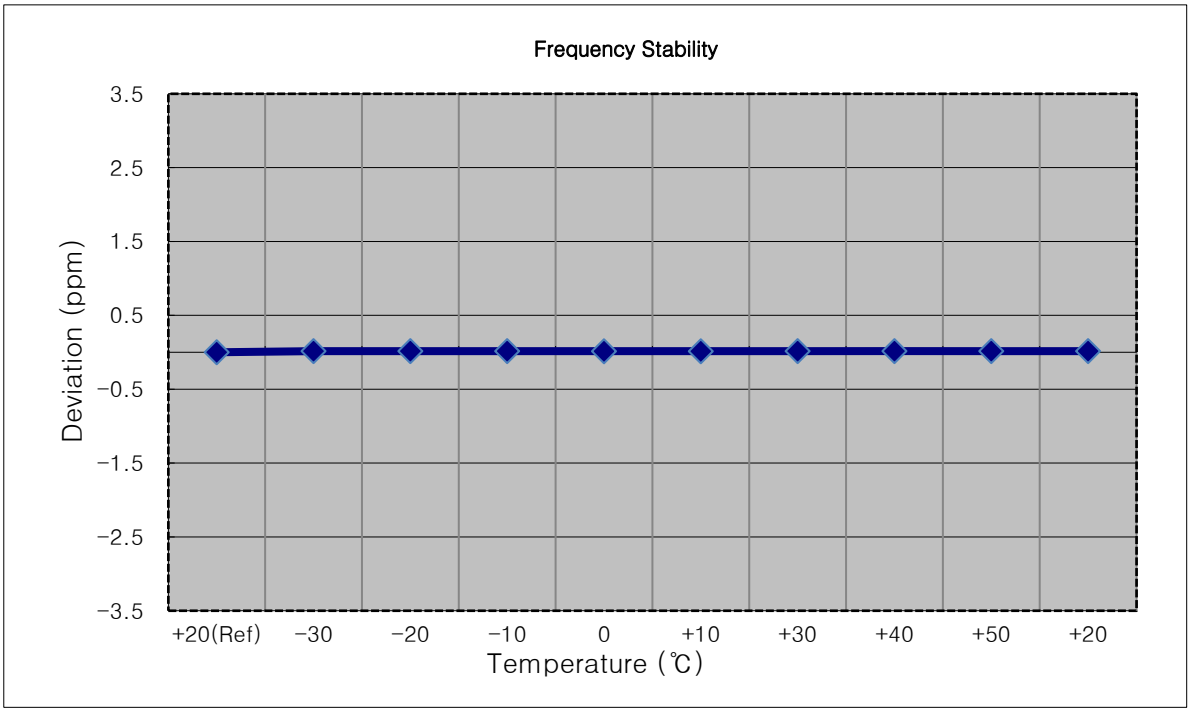
▣ OPERATING FREQUENCY: 1,712,400,000 Hz

▣ CHANNEL: 1312

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1712 400 027 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1712 400 054 | 26.9 | 0.000 002 | 0.0157 |
| 100% | | -20 | 1712 400 054 | 27.0 | 0.000 002 | 0.0158 |
| 100% | | -10 | 1712 400 054 | 26.7 | 0.000 002 | 0.0156 |
| 100% | | 0 | 1712 400 052 | 25.3 | 0.000 001 | 0.0148 |
| 100% | | +10 | 1712 400 052 | 24.8 | 0.000 001 | 0.0145 |
| 100% | | +30 | 1712 400 053 | 26.5 | 0.000 002 | 0.0155 |
| 100% | | +40 | 1712 400 054 | 27.0 | 0.000 002 | 0.0158 |
| 100% | | +50 | 1712 400 054 | 26.6 | 0.000 002 | 0.0155 |
| Batt. Endpoint | 3.650 | +20 | 1712 400 053 | 26.3 | 0.000 002 | 0.0154 |



▣ Mode: WCDMA1700

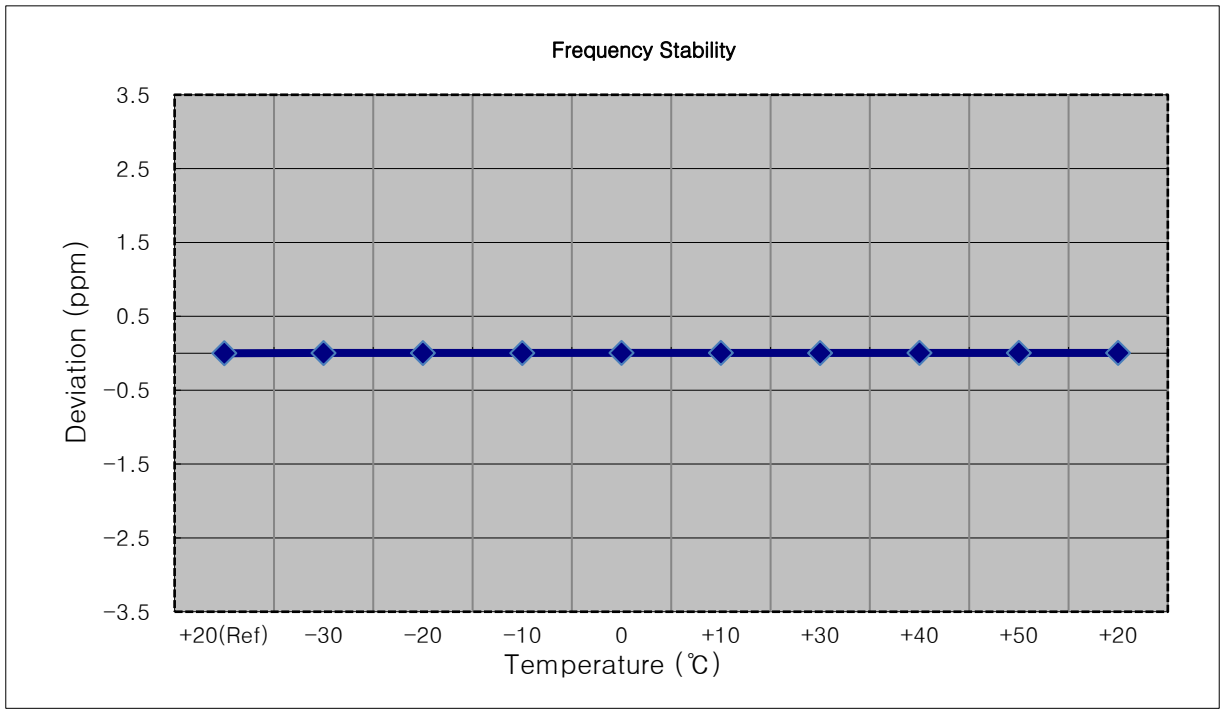
▣ OPERATING FREQUENCY: 1,732,400,000 Hz

▣ CHANNEL: 1412

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1732 400 008 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1732 400 015 | 6.8 | 0.000 000 | 0.0039 |
| 100% | | -20 | 1732 400 014 | 6.4 | 0.000 000 | 0.0037 |
| 100% | | -10 | 1732 400 015 | 7.1 | 0.000 000 | 0.0041 |
| 100% | | 0 | 1732 400 017 | 8.8 | 0.000 001 | 0.0051 |
| 100% | | +10 | 1732 400 016 | 8.3 | 0.000 000 | 0.0048 |
| 100% | | +30 | 1732 400 015 | 6.8 | 0.000 000 | 0.0039 |
| 100% | | +40 | 1732 400 016 | 8.0 | 0.000 000 | 0.0046 |
| 100% | | +50 | 1732 400 016 | 7.9 | 0.000 000 | 0.0046 |
| Batt. Endpoint | 3.650 | +20 | 1732 400 016 | 7.5 | 0.000 000 | 0.0043 |



▣ Mode: WCDMA1700

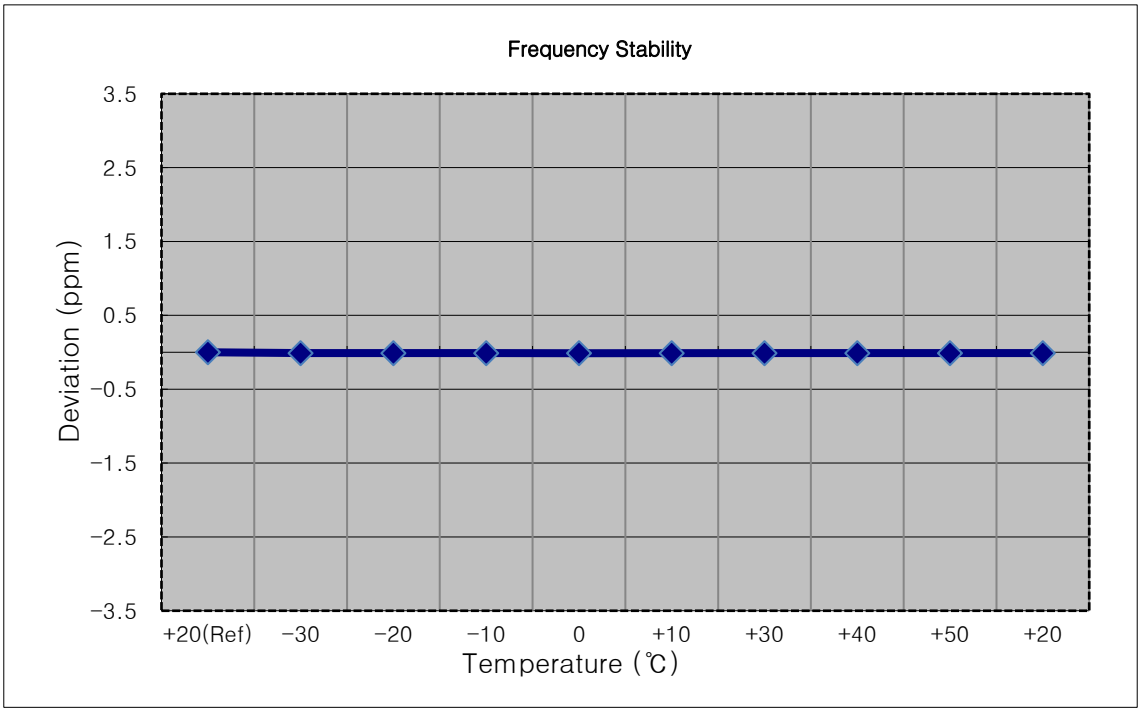
▣ OPERATING FREQUENCY: 1,752,600,000 Hz

▣ CHANNEL: 1513

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1752 599 980 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1752 599 960 | -20.0 | -0.000 001 | -0.0114 |
| 100% | | -20 | 1752 599 960 | -20.0 | -0.000 001 | -0.0114 |
| 100% | | -10 | 1752 599 959 | -20.4 | -0.000 001 | -0.0116 |
| 100% | | 0 | 1752 599 959 | -21.0 | -0.000 001 | -0.0120 |
| 100% | | +10 | 1752 599 959 | -21.0 | -0.000 001 | -0.0120 |
| 100% | | +30 | 1752 599 959 | -20.7 | -0.000 001 | -0.0118 |
| 100% | | +40 | 1752 599 960 | -20.1 | -0.000 001 | -0.0115 |
| 100% | | +50 | 1752 599 960 | -19.4 | -0.000 001 | -0.0110 |
| Batt. Endpoint | 3.650 | +20 | 1752 599 959 | -20.9 | -0.000 001 | -0.0119 |



▣ Mode: CDMA850

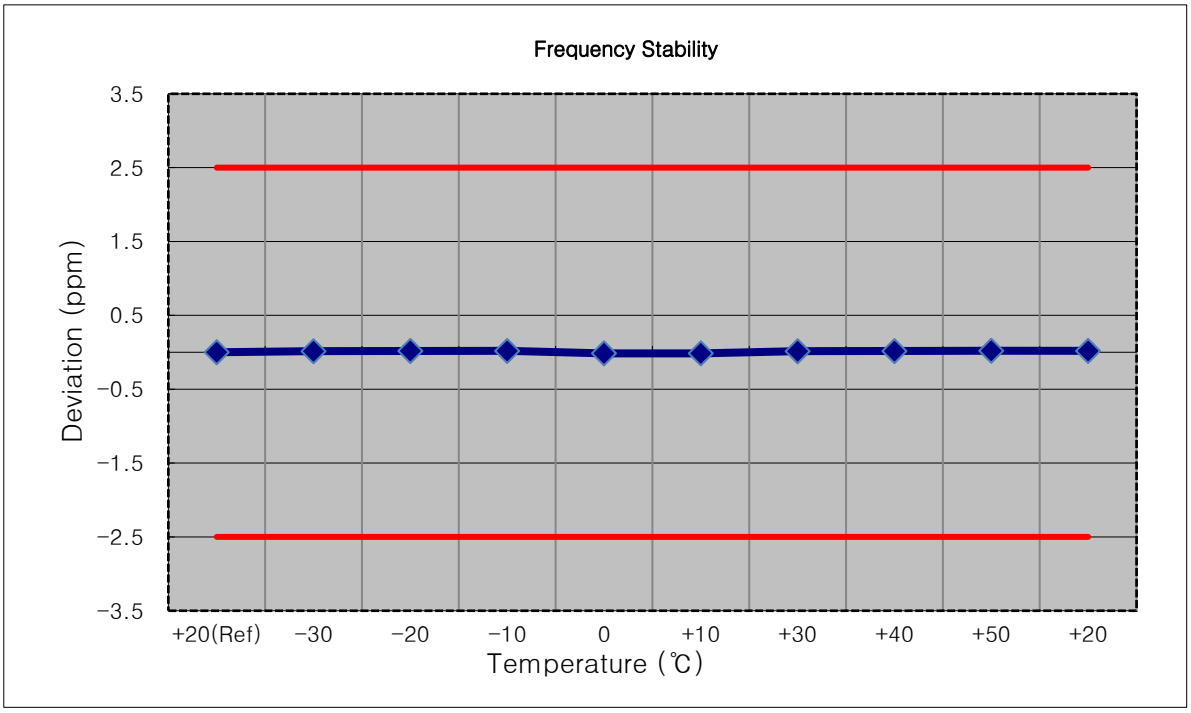
▣ OPERATING FREQUENCY: 836,500,000 Hz

▣ CHANNEL: 384

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 836 499 990 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 836 500 002 | 12.0 | 0.000 001 | 0.0144 |
| 100% | | -20 | 836 500 005 | 15.0 | 0.000 002 | 0.0180 |
| 100% | | -10 | 836 500 005 | 15.4 | 0.000 002 | 0.0184 |
| 100% | | 0 | 836 499 977 | -12.4 | -0.000 001 | -0.0148 |
| 100% | | +10 | 836 499 977 | -12.6 | -0.000 002 | -0.0150 |
| 100% | | +30 | 836 500 002 | 12.7 | 0.000 002 | 0.0151 |
| 100% | | +40 | 836 500 004 | 13.8 | 0.000 002 | 0.0165 |
| 100% | | +50 | 836 500 007 | 17.3 | 0.000 002 | 0.0207 |
| Batt. Endpoint | 3.650 | +20 | 836 500 005 | 15.5 | 0.000 002 | 0.0185 |



▣ Mode: CDMA Secondary800

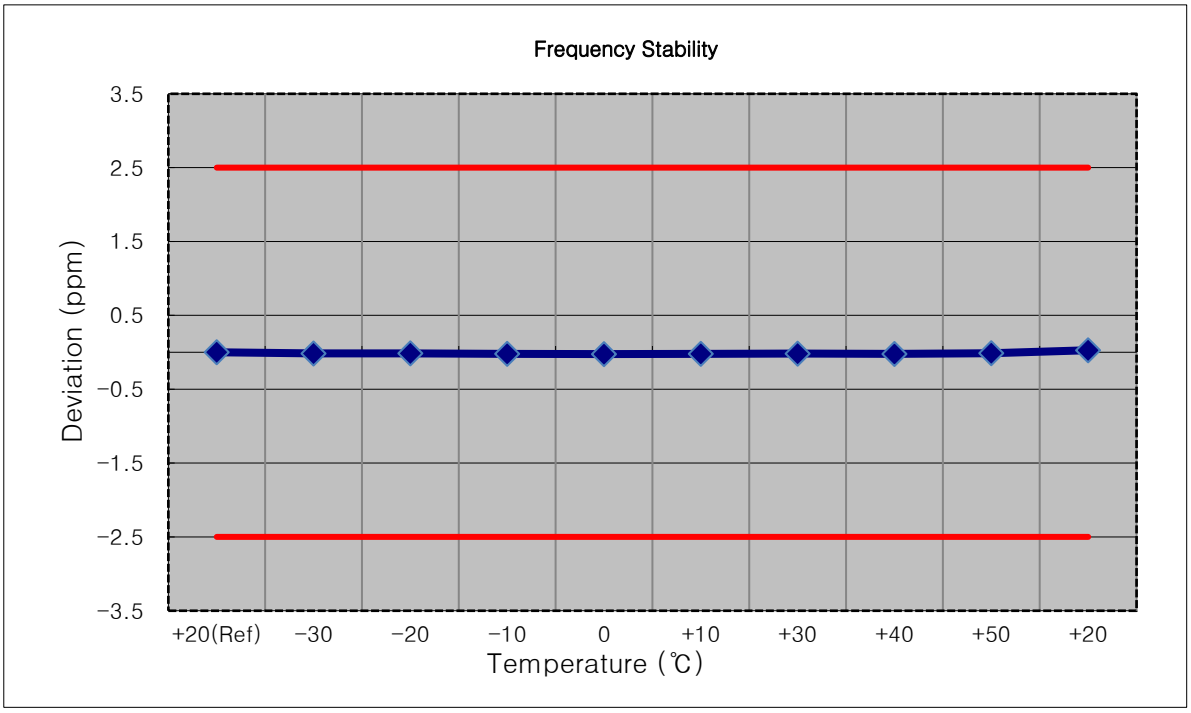
▣ OPERATING FREQUENCY: 820,500,000 Hz

▣ CHANNEL: 580

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 820 499 984 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 820 499 971 | -13.1 | -0.000 002 | -0.0160 |
| 100% | | -20 | 820 499 972 | -11.9 | -0.000 001 | -0.0144 |
| 100% | | -10 | 820 499 967 | -17.8 | -0.000 002 | -0.0217 |
| 100% | | 0 | 820 499 964 | -20.2 | -0.000 002 | -0.0246 |
| 100% | | +10 | 820 499 967 | -17.0 | -0.000 002 | -0.0207 |
| 100% | | +30 | 820 499 969 | -15.1 | -0.000 002 | -0.0184 |
| 100% | | +40 | 820 499 967 | -17.8 | -0.000 002 | -0.0217 |
| 100% | | +50 | 820 499 974 | -10.1 | -0.000 001 | -0.0123 |
| Batt. Endpoint | 3.650 | +20 | 820 500 007 | 22.5 | 0.000 003 | 0.0274 |



▣ Mode: CDMA PCS

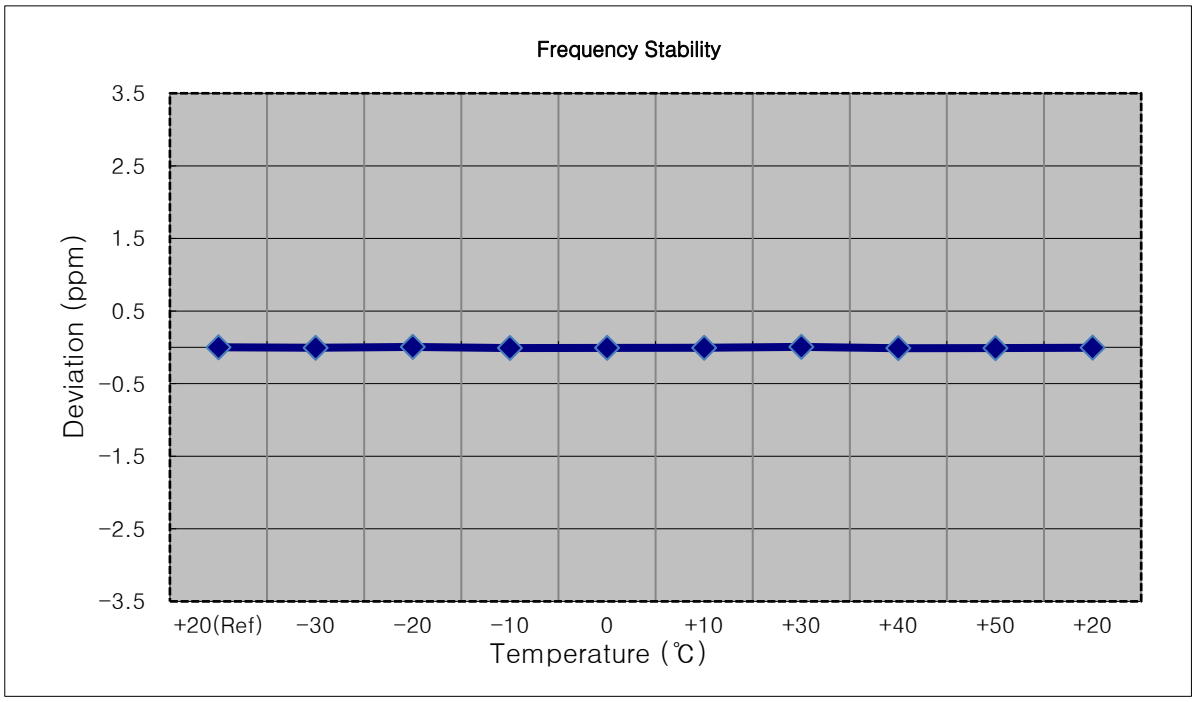
▣ OPERATING FREQUENCY: 1,851,250,000 Hz

▣ CHANNEL: 25

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1851 249 981 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1851 249 971 | -10.8 | -0.000 001 | -0.0058 |
| 100% | | -20 | 1851 249 991 | 9.9 | 0.000 001 | 0.0053 |
| 100% | | -10 | 1851 249 964 | -17.1 | -0.000 001 | -0.0093 |
| 100% | | 0 | 1851 249 967 | -14.0 | -0.000 001 | -0.0076 |
| 100% | | +10 | 1851 249 970 | -11.6 | -0.000 001 | -0.0062 |
| 100% | | +30 | 1851 249 993 | 11.4 | 0.000 001 | 0.0061 |
| 100% | | +40 | 1851 249 959 | -22.7 | -0.000 001 | -0.0122 |
| 100% | | +50 | 1851 249 962 | -19.0 | -0.000 001 | -0.0103 |
| Batt. Endpoint | 3.650 | +20 | 1851 249 972 | -9.4 | -0.000 001 | -0.0051 |



▣ Mode: CDMA PCS

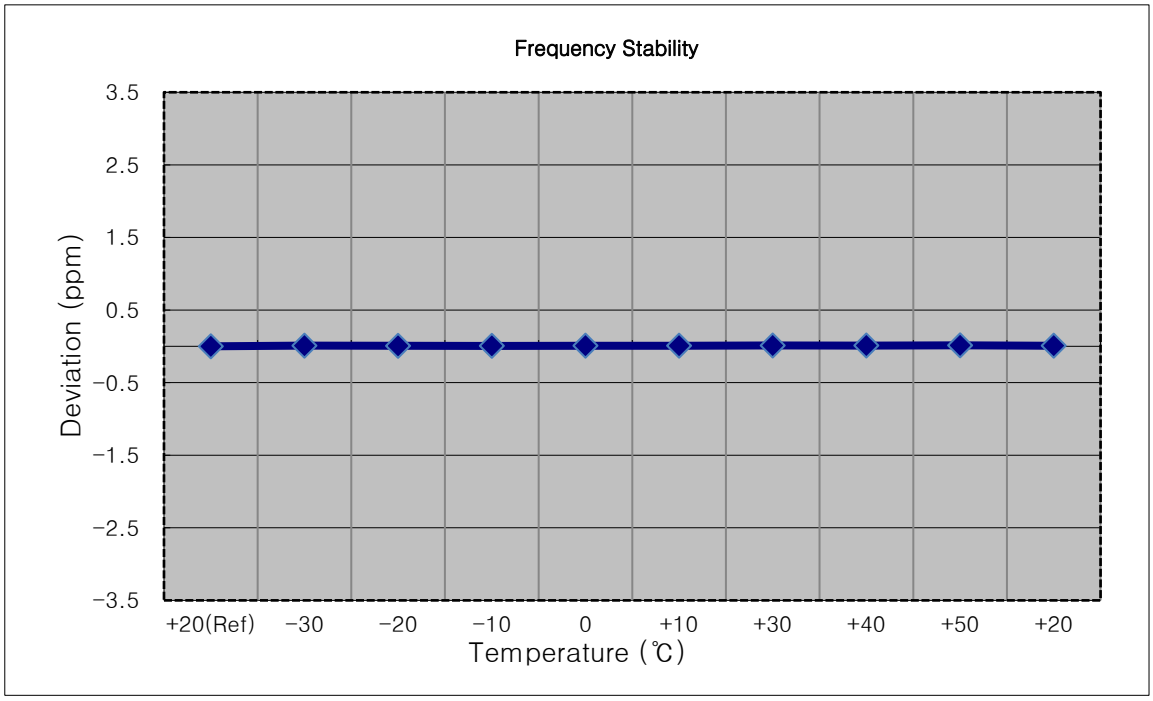
▣ OPERATING FREQUENCY: 1,880,000,000 Hz

▣ CHANNEL: 600

▣ REFERENCE VOLTAGE: 3.88 VDC

▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1880 000 019 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1880 000 037 | 17.9 | 0.000 001 | 0.0095 |
| 100% | | -20 | 1880 000 032 | 12.7 | 0.000 001 | 0.0068 |
| 100% | | -10 | 1880 000 030 | 11.4 | 0.000 001 | 0.0061 |
| 100% | | 0 | 1880 000 033 | 14.2 | 0.000 001 | 0.0075 |
| 100% | | +10 | 1880 000 034 | 14.9 | 0.000 001 | 0.0079 |
| 100% | | +30 | 1880 000 040 | 21.0 | 0.000 001 | 0.0112 |
| 100% | | +40 | 1880 000 039 | 19.8 | 0.000 001 | 0.0105 |
| 100% | | +50 | 1880 000 045 | 25.5 | 0.000 001 | 0.0136 |
| Batt. Endpoint | 3.650 | +20 | 1880 000 033 | 14.1 | 0.000 001 | 0.0075 |



▣ Mode: CDMA PCS

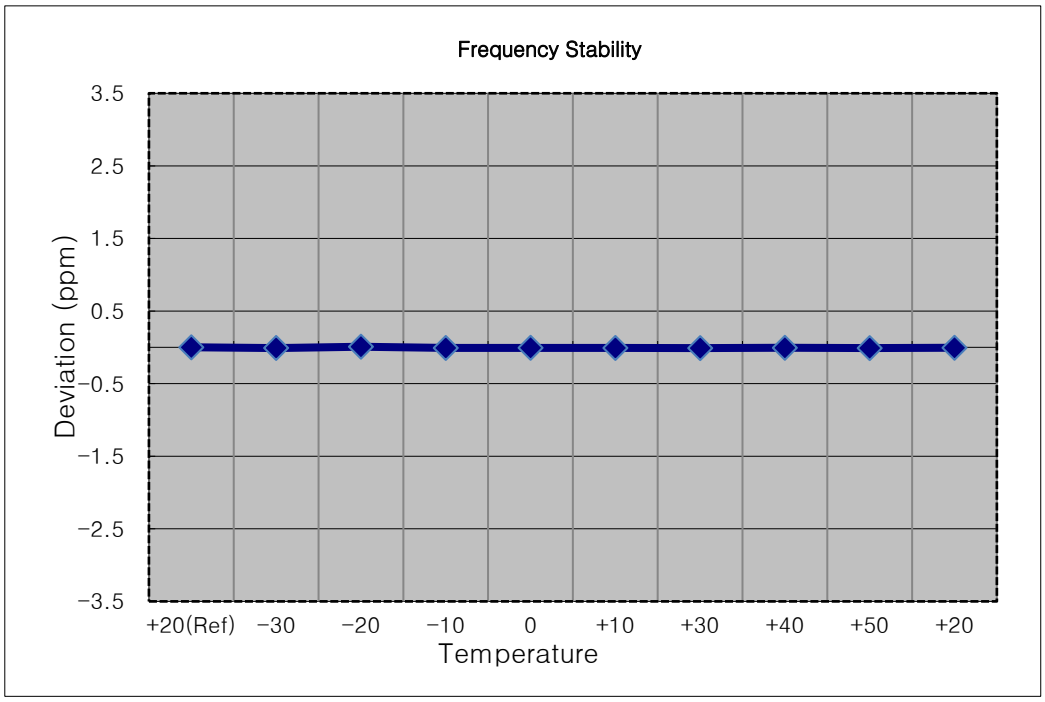
▣ OPERATING FREQUENCY: 1,908,750,000 Hz

▣ CHANNEL: 1175

▣ REFERENCE VOLTAGE: 3.88 VDC

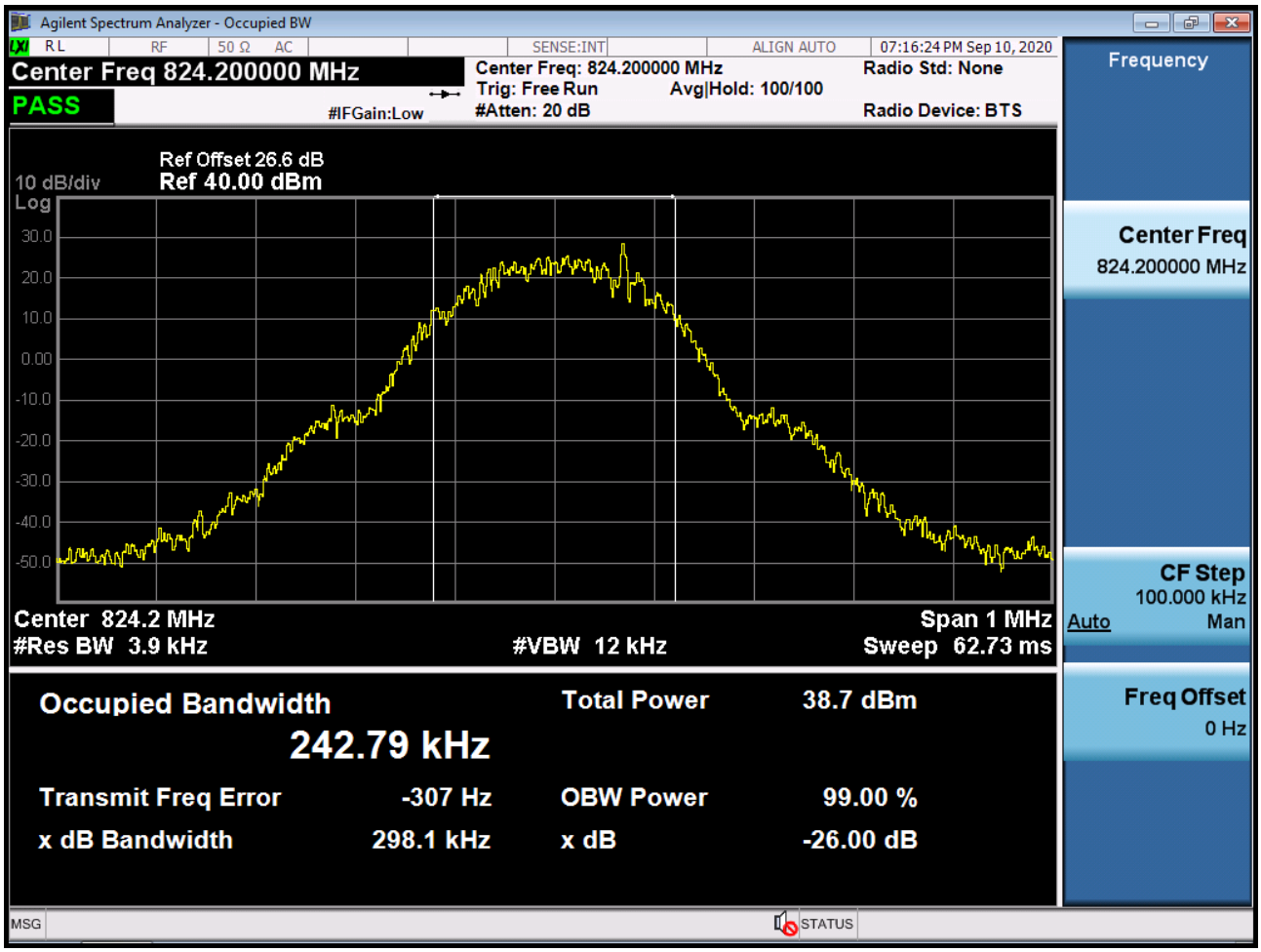
▣ DEVIATION LIMIT: Emission must remain in band

| Voltage (%) | Power (VDC) | Temp. (℃) | Frequency (Hz) | Frequency Error (Hz) | Deviation (%) | ppm |
|---|---|---|---|---|---|---|
| 100% | 3.880 | +20(Ref) | 1908 749 984 | 0.0 | 0.000 000 | 0.0000 |
| 100% | | -30 | 1908 749 966 | -17.7 | -0.000 001 | -0.0093 |
| 100% | | -20 | 1908 749 999 | 15.4 | 0.000 001 | 0.0081 |
| 100% | | -10 | 1908 749 966 | -17.1 | -0.000 001 | -0.0090 |
| 100% | | 0 | 1908 749 969 | -14.5 | -0.000 001 | -0.0076 |
| 100% | | +10 | 1908 749 968 | -15.3 | -0.000 001 | -0.0080 |
| 100% | | +30 | 1908 749 963 | -20.4 | -0.000 001 | -0.0107 |
| 100% | | +40 | 1908 749 972 | -11.6 | -0.000 001 | -0.0061 |
| 100% | | +50 | 1908 749 964 | -19.9 | -0.000 001 | -0.0104 |
| Batt. Endpoint | 3.650 | +20 | 1908 749 971 | -12.8 | -0.000 001 | -0.0067 |

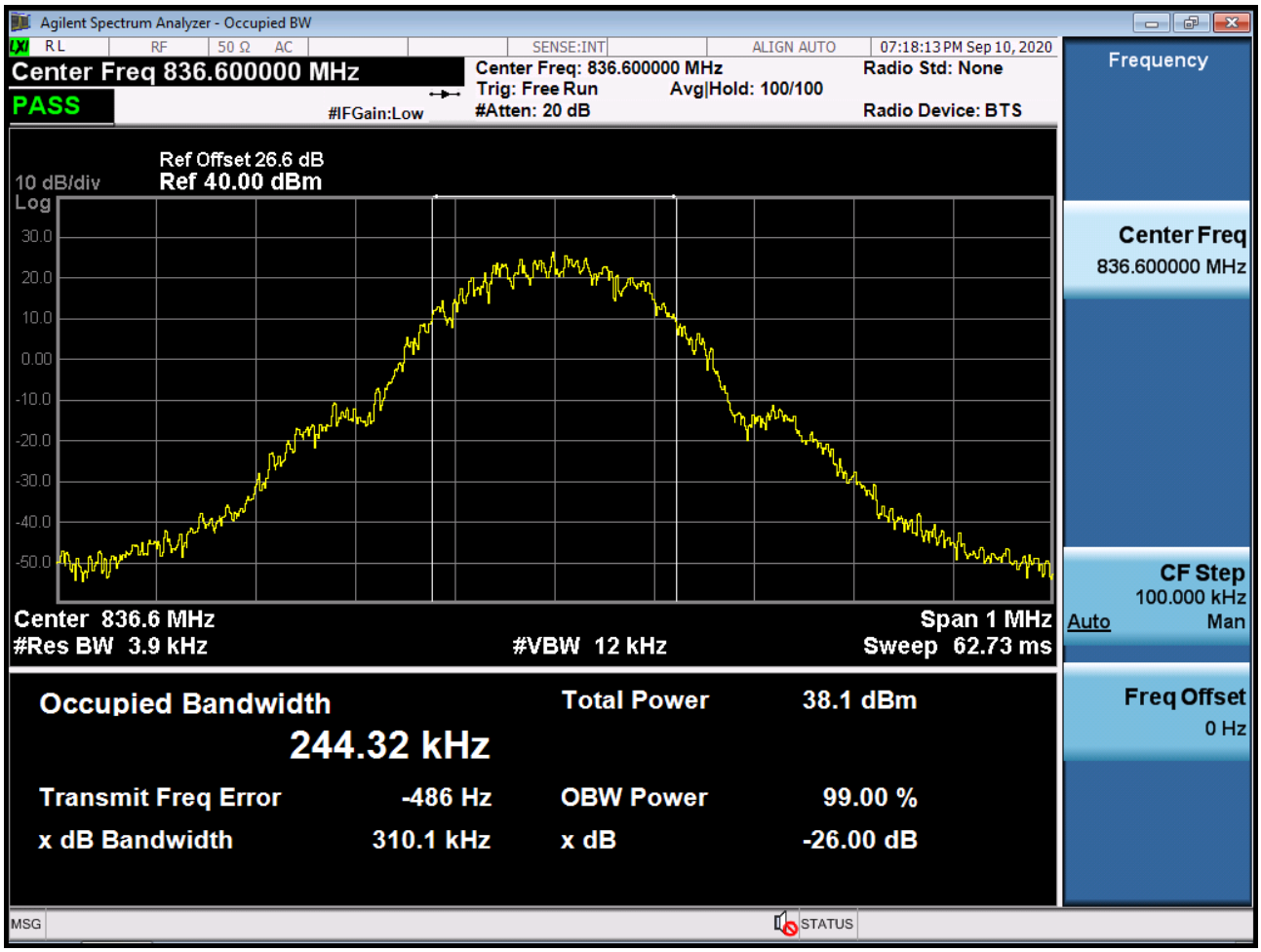


## 9. TEST PLOTS

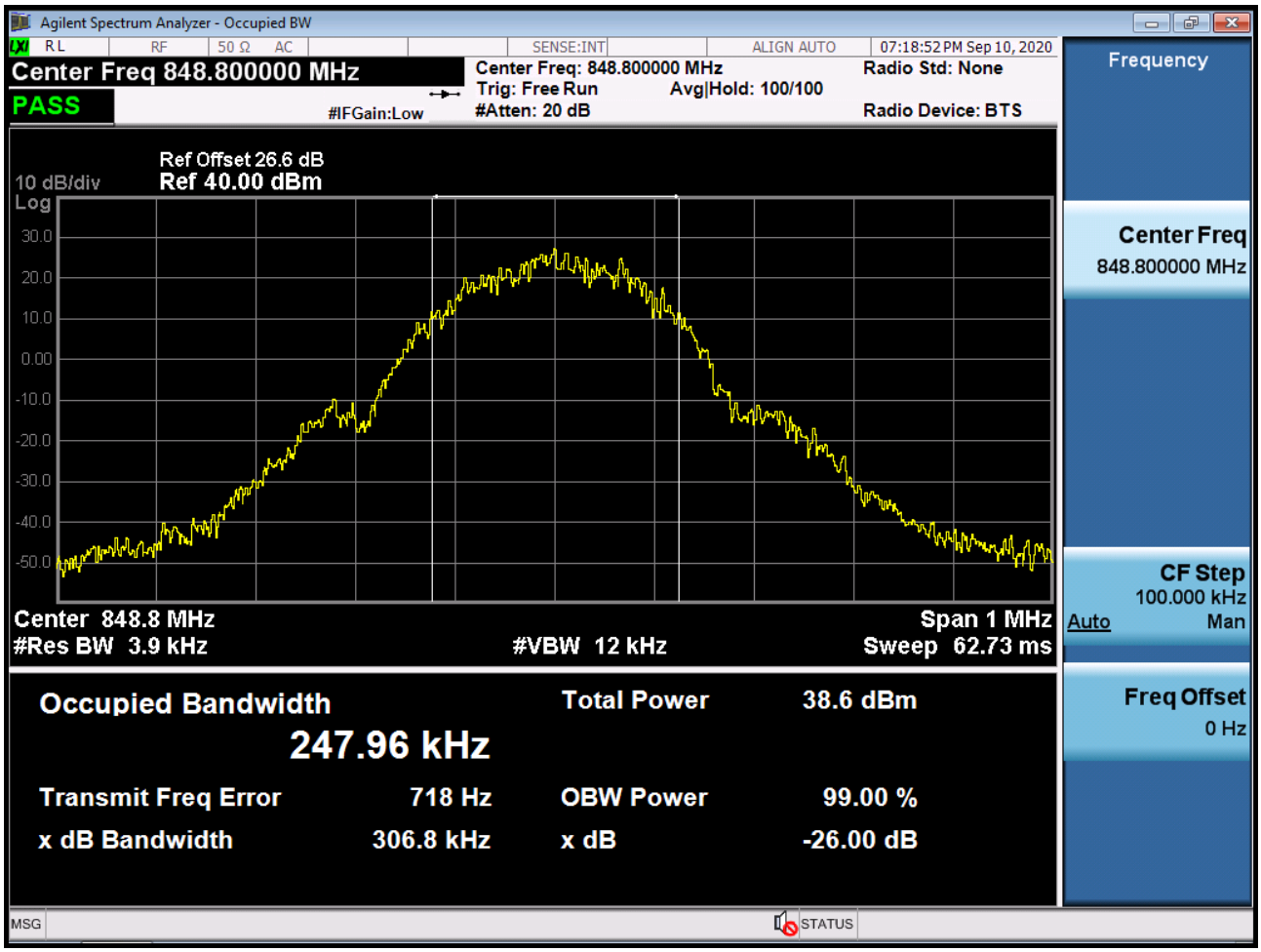
■ GSM850 MODE (128 CH.) Occupied Bandwidth



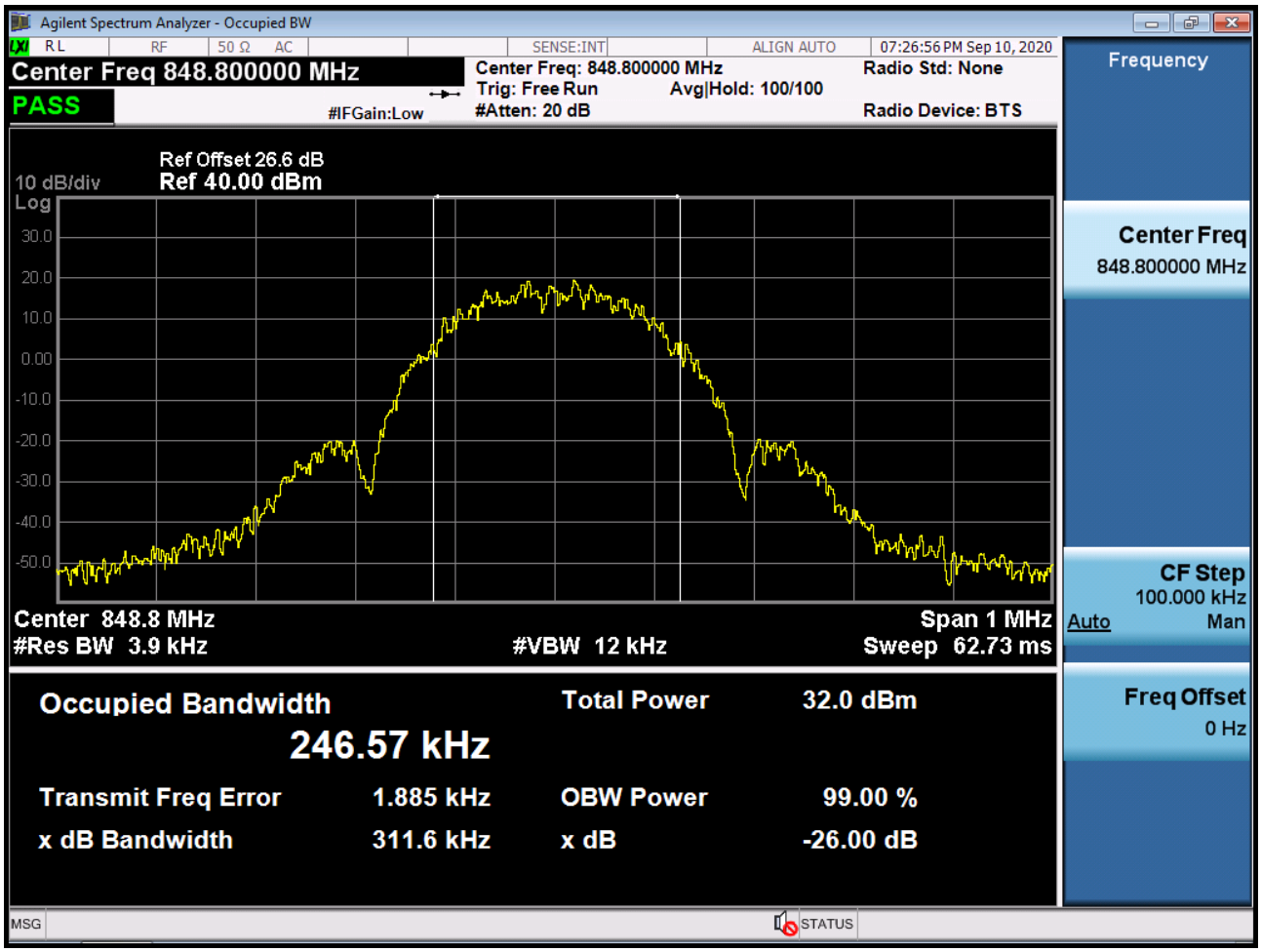
■ GSM850 MODE (190 CH.) Occupied Bandwidth



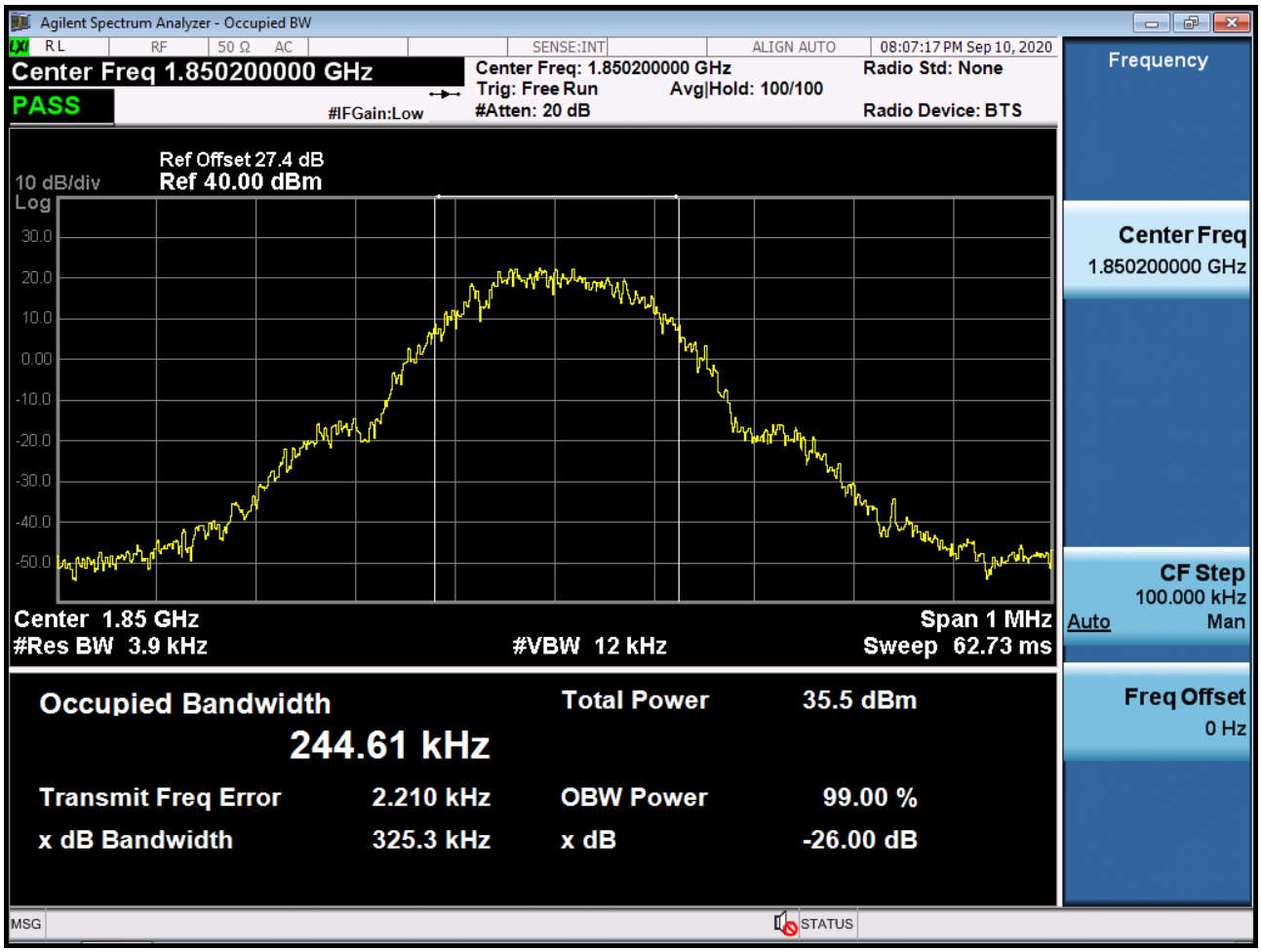
■ GSM850 MODE (251 CH.) Occupied Bandwidth



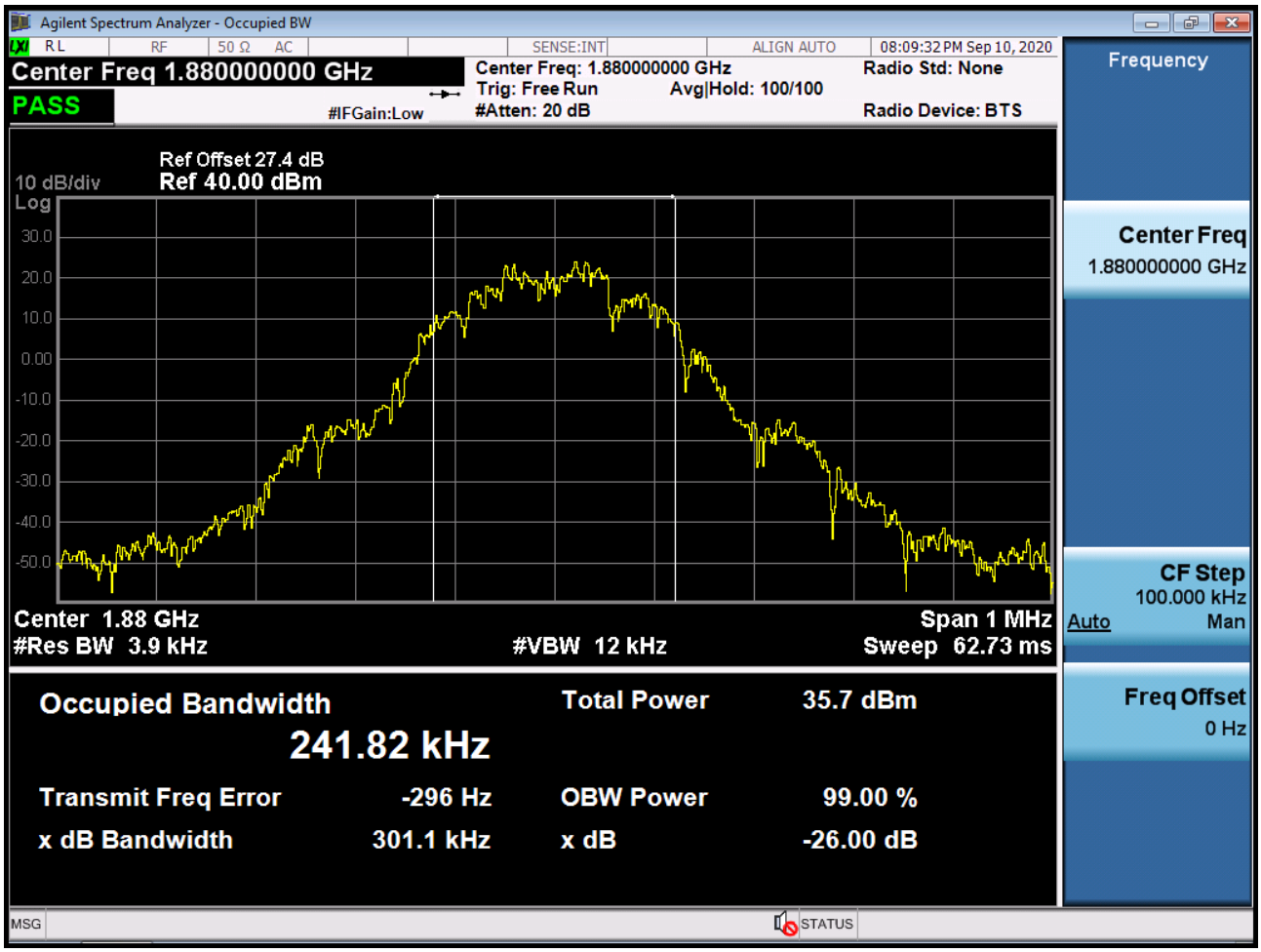
■ GSM850 EDGE (251 CH.) Occupied Bandwidth



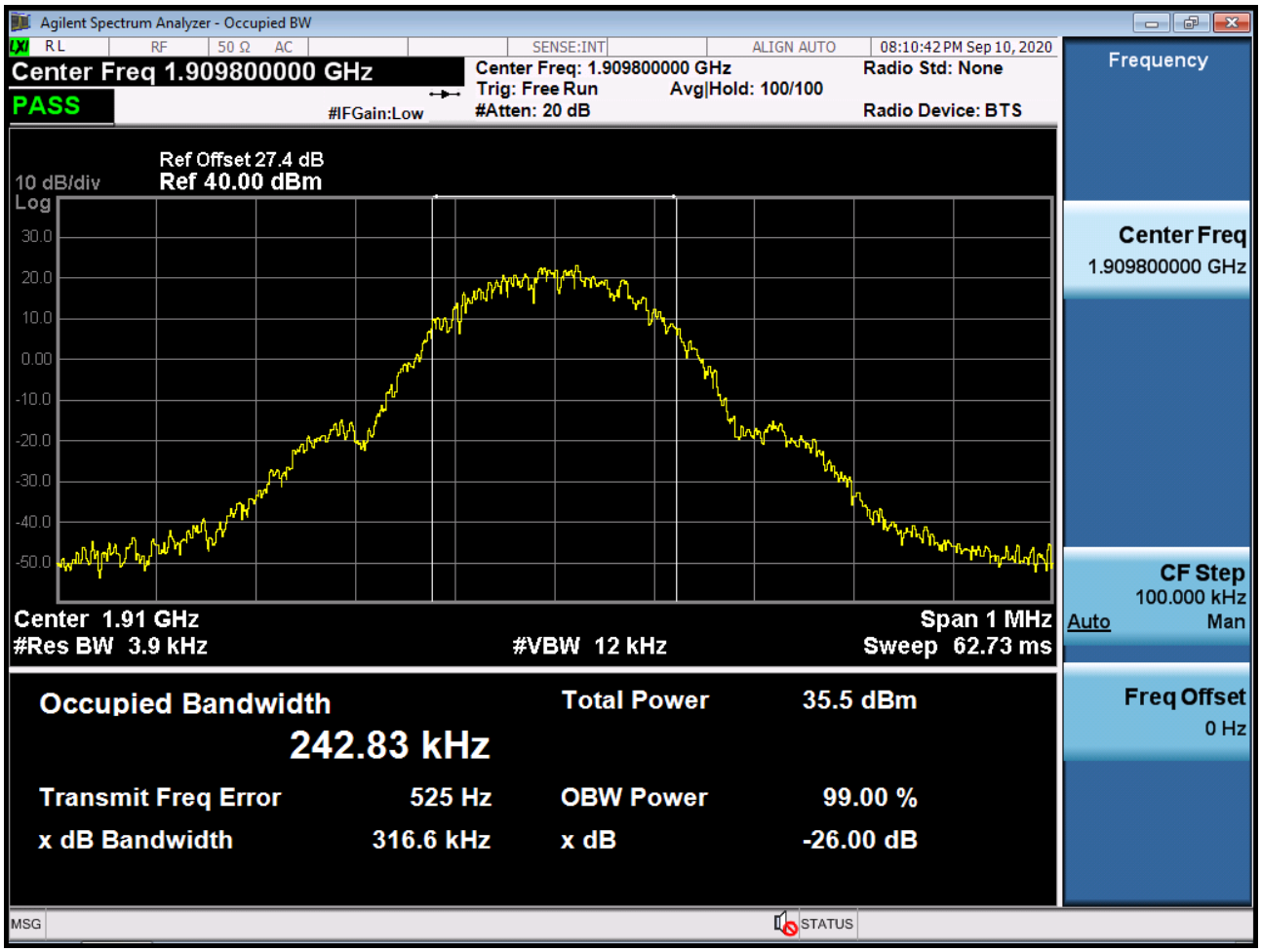
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



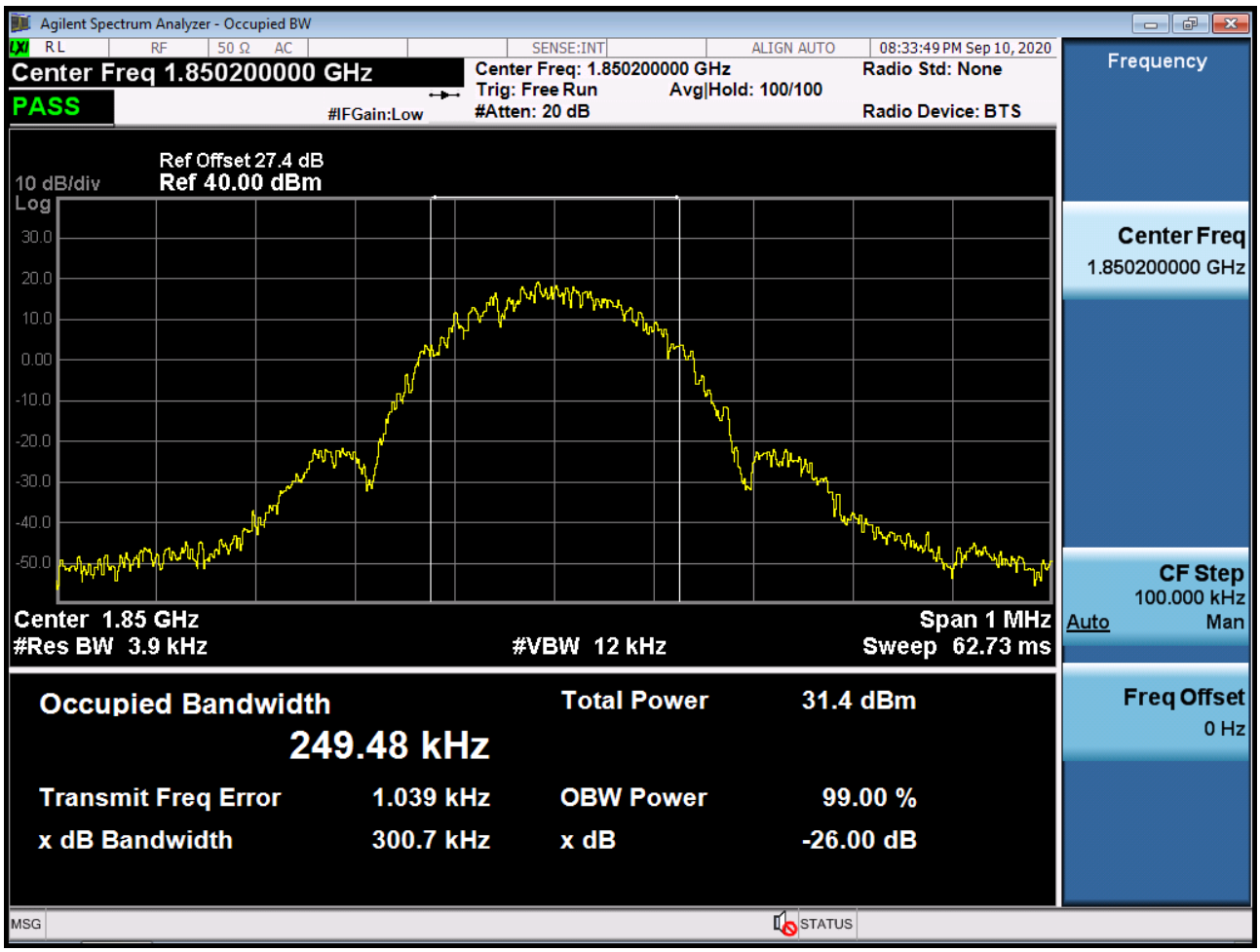
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



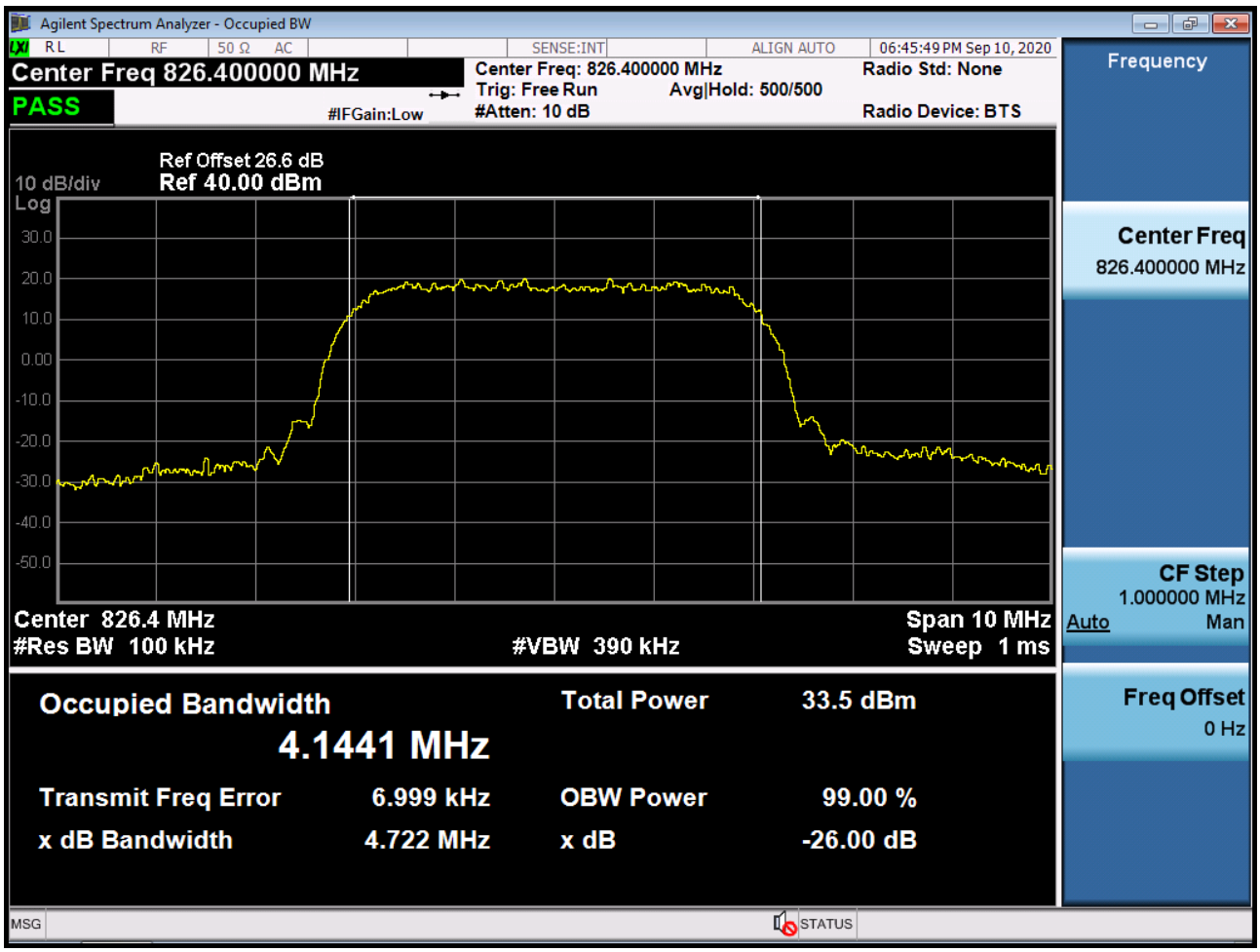
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



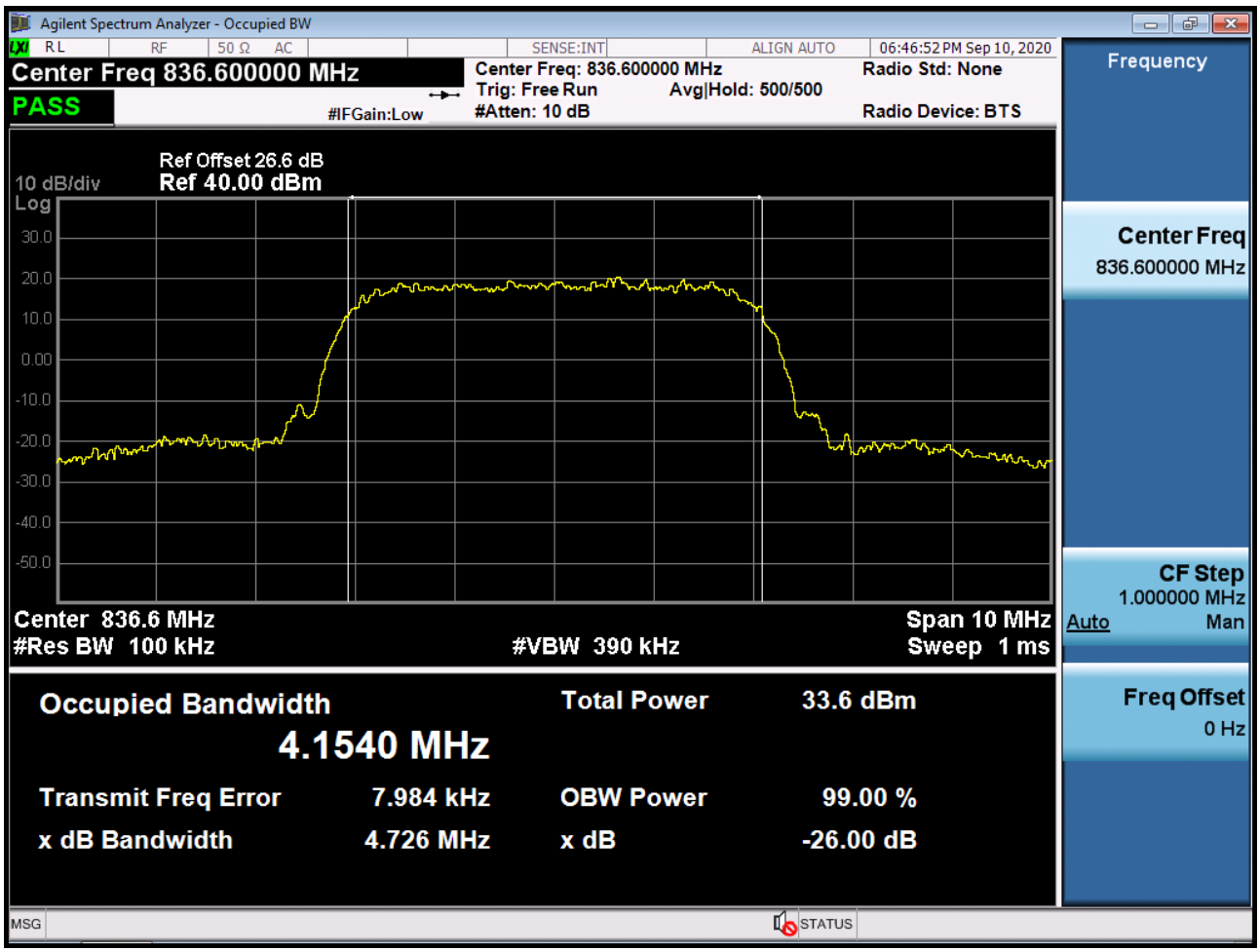
■ GSM1900 EDGE (512 CH.) Occupied Bandwidth



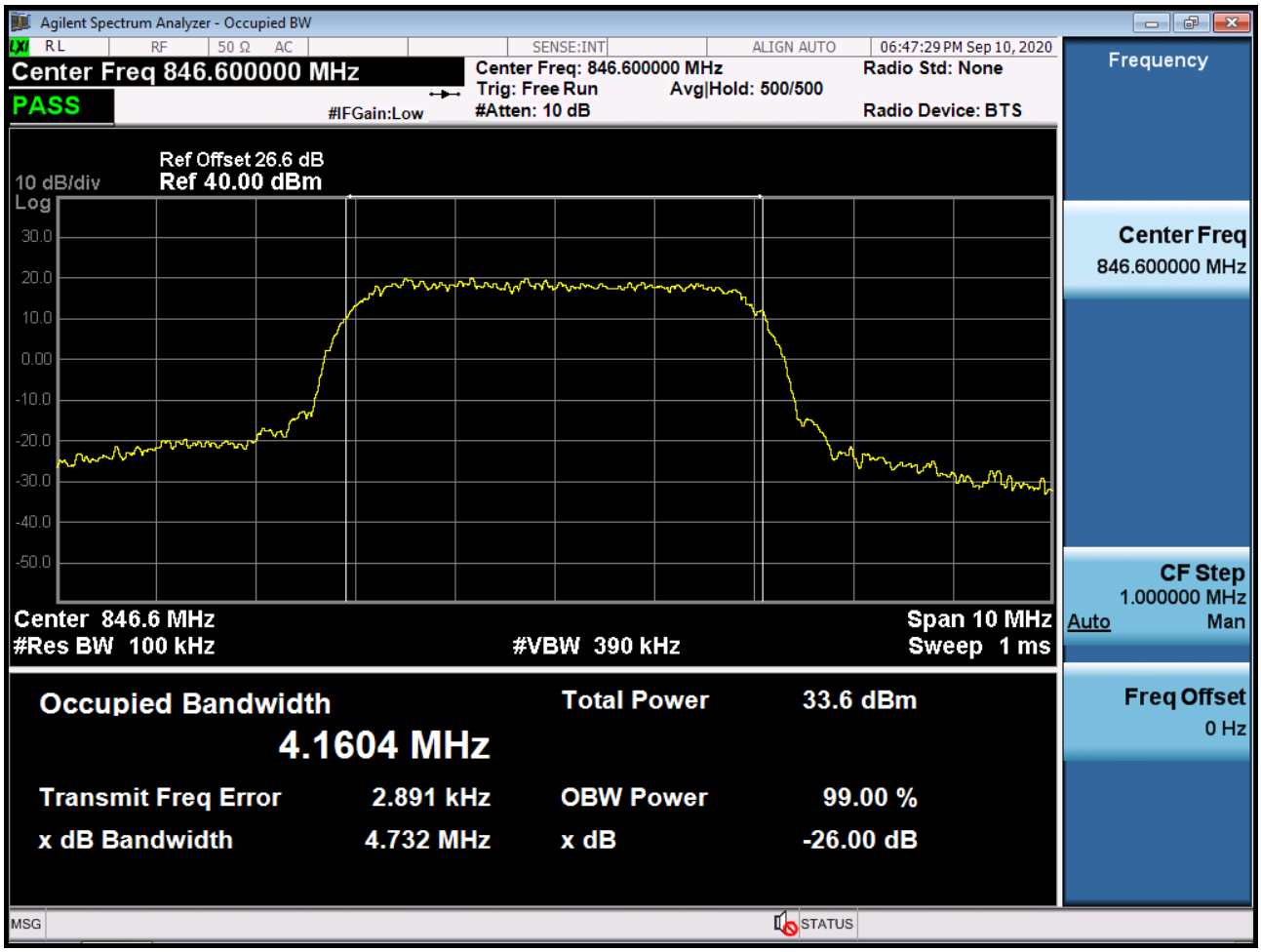
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



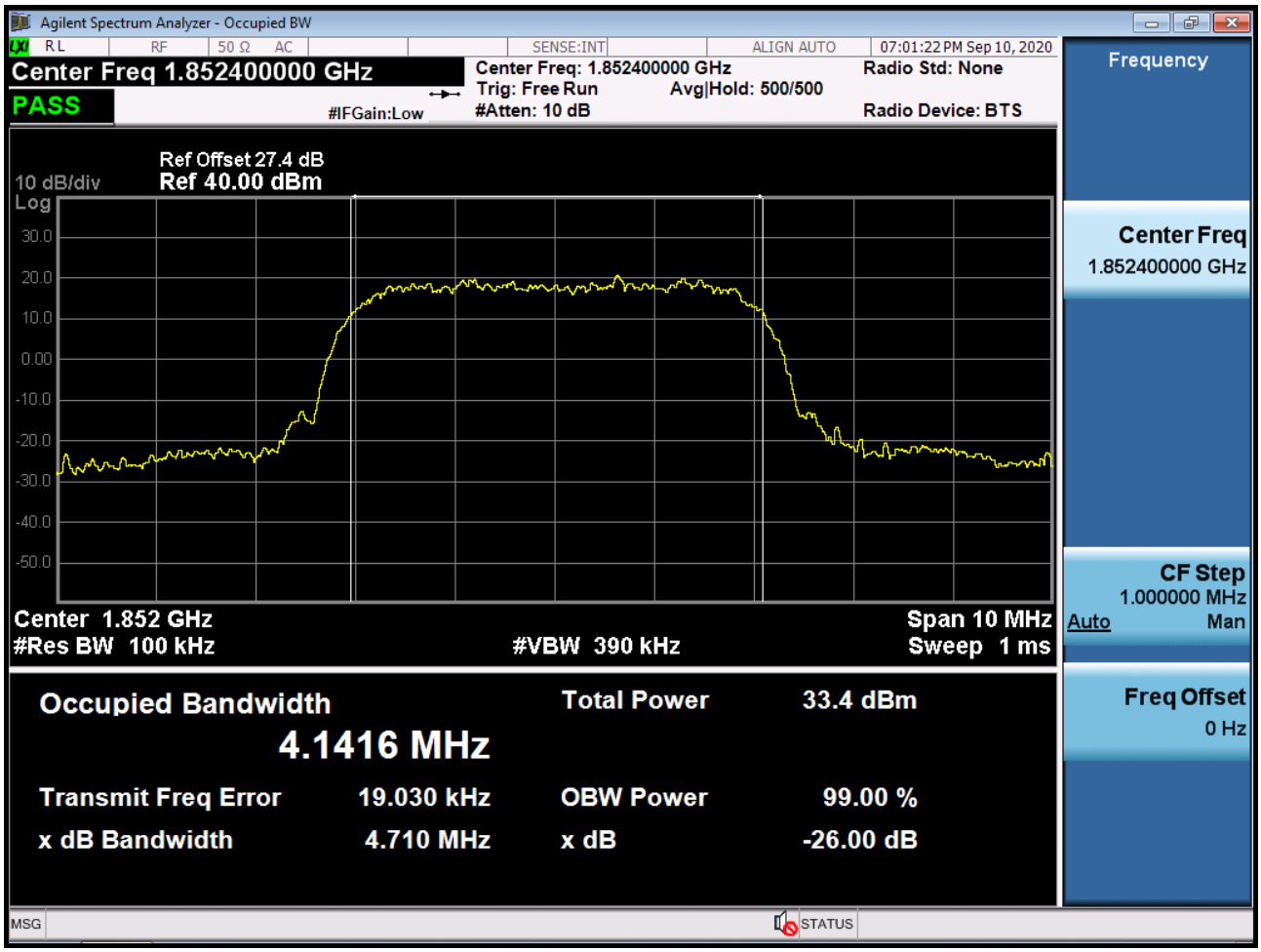
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



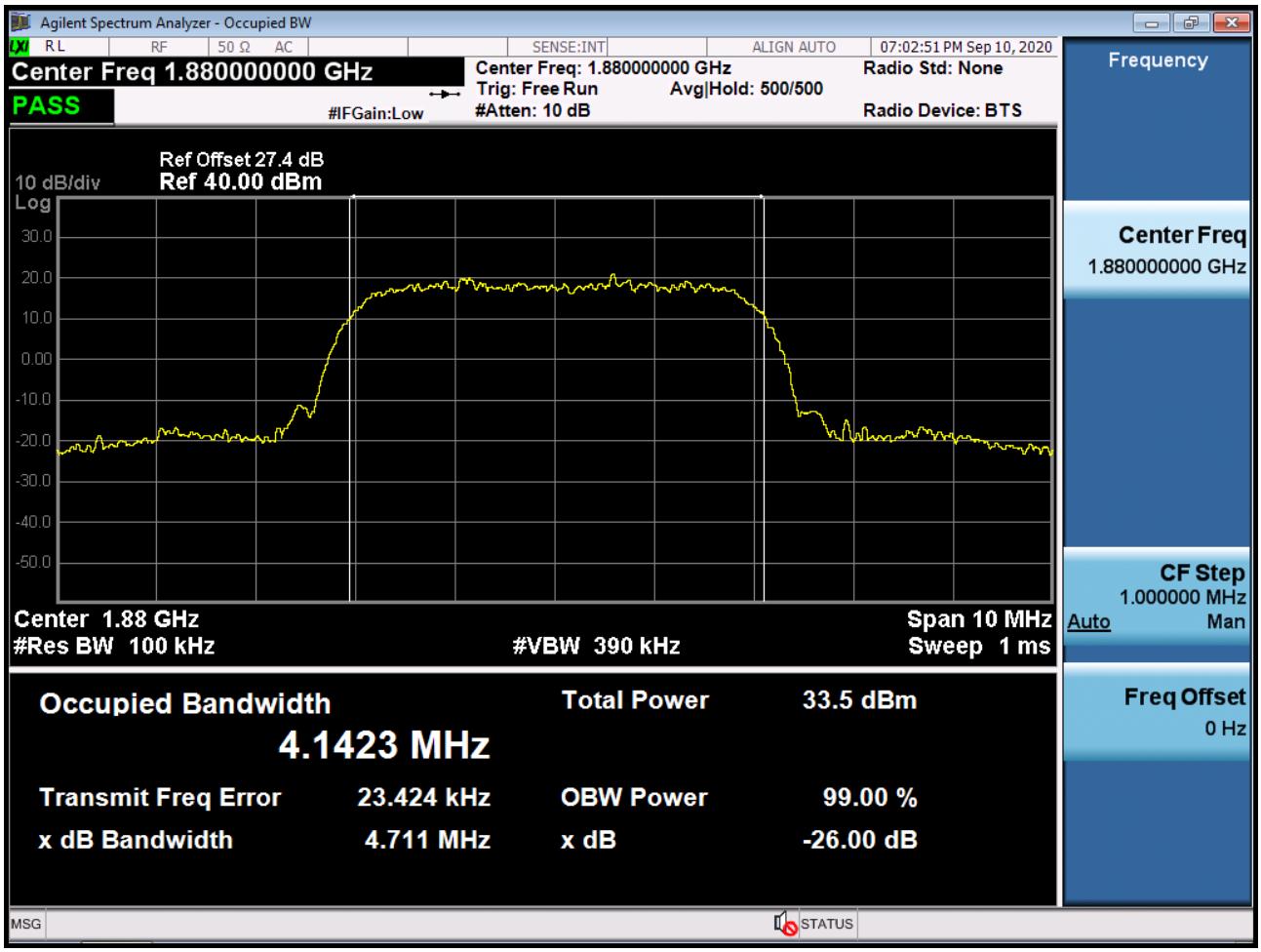
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



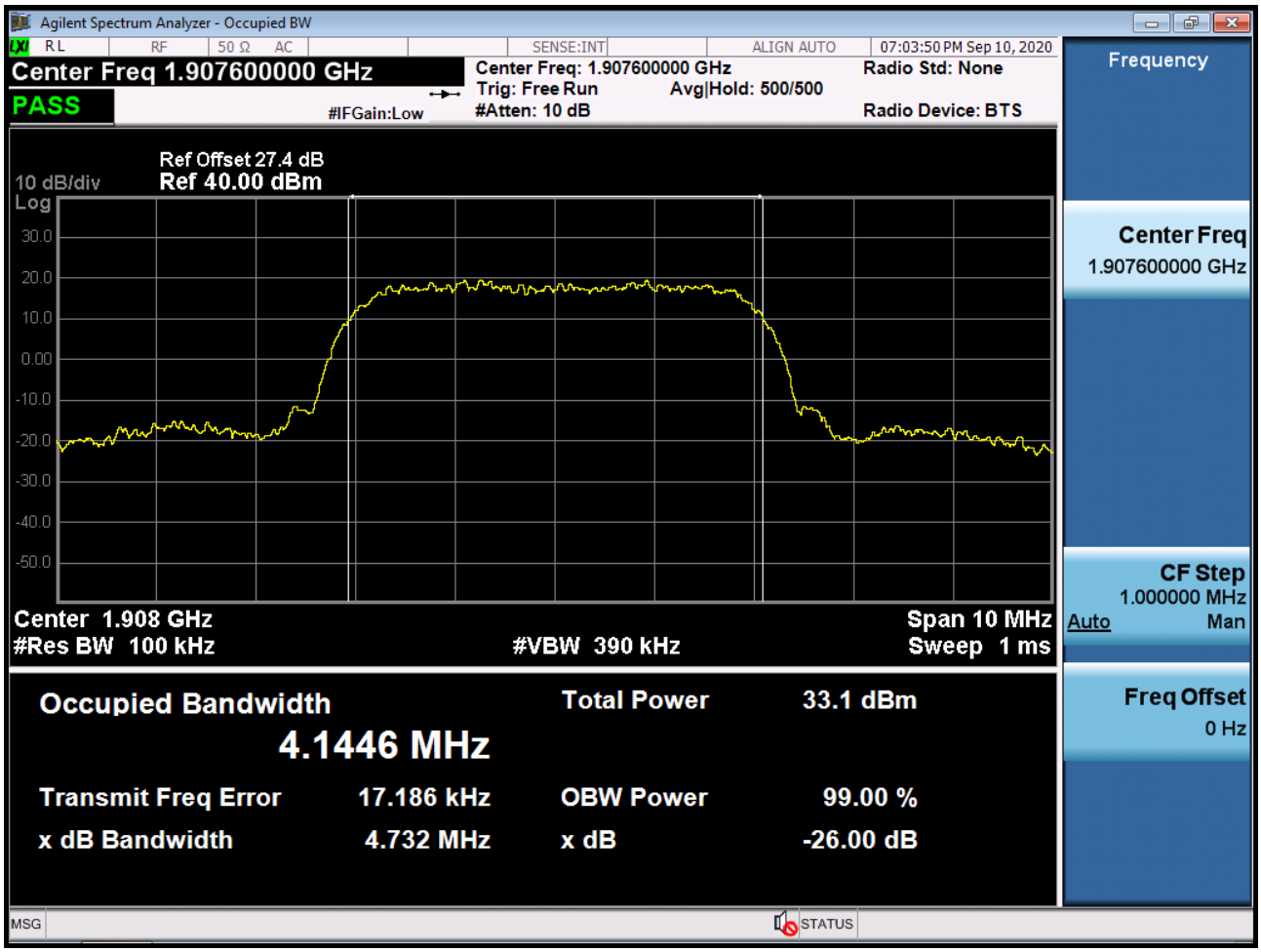
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



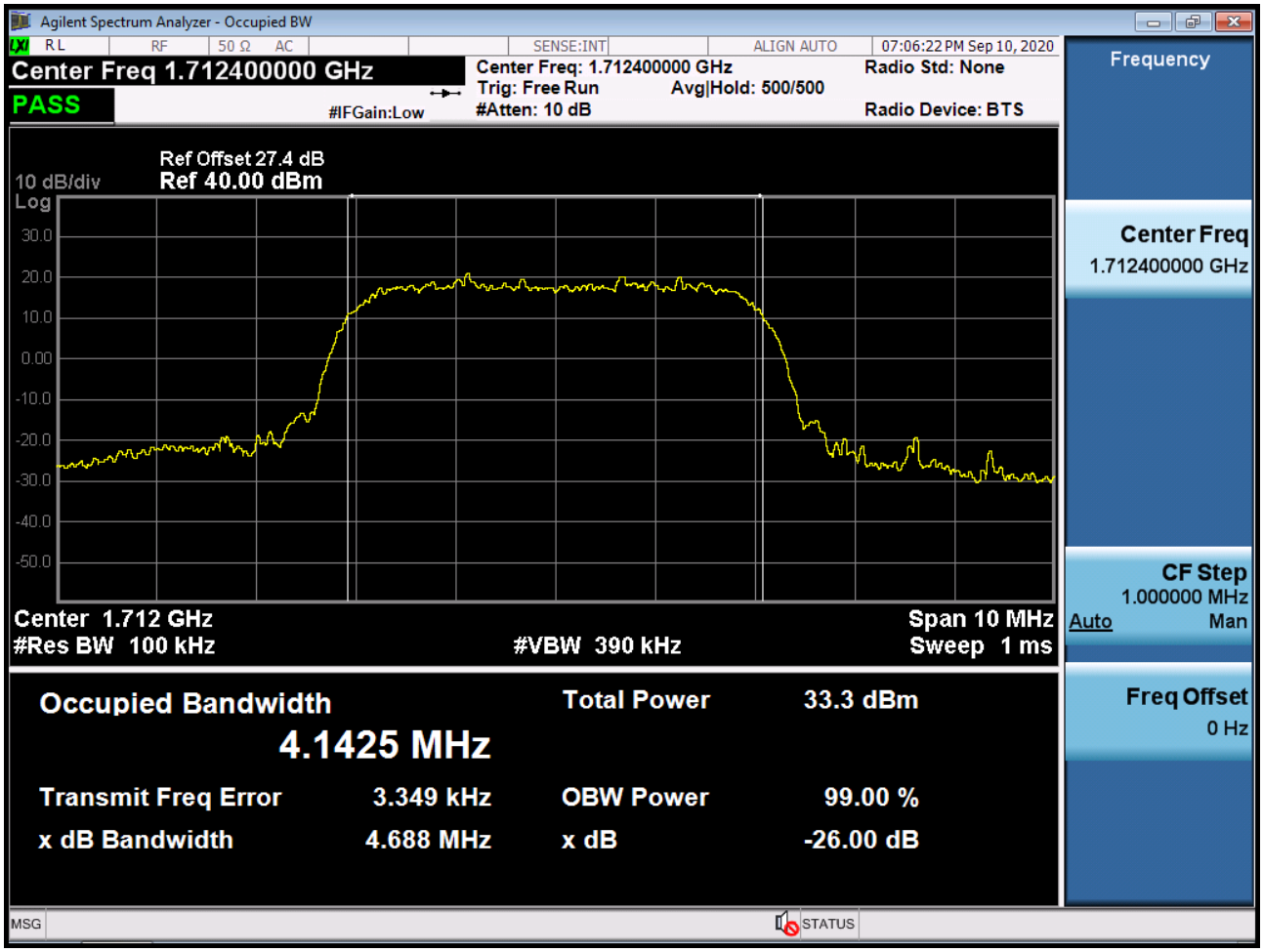
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



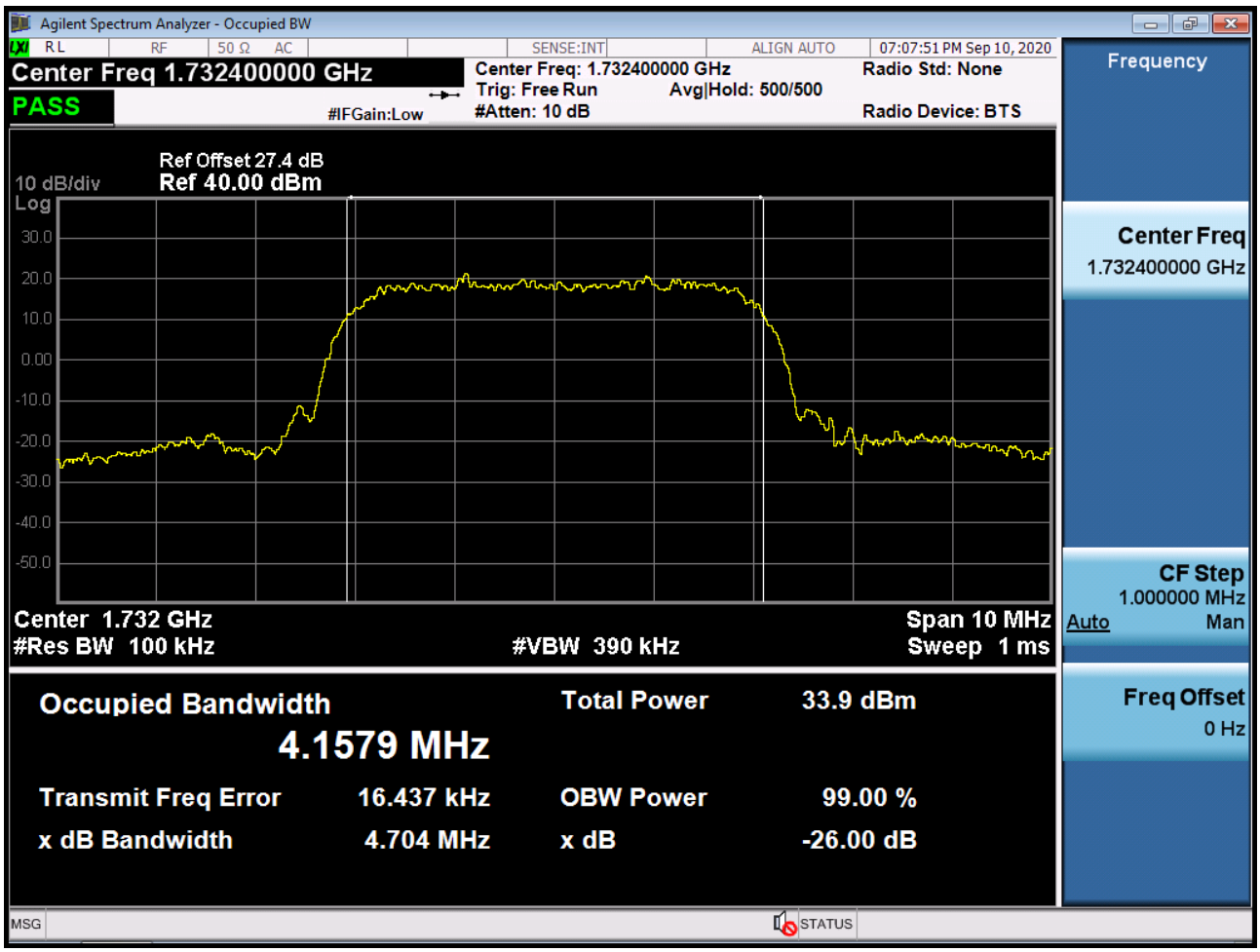
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



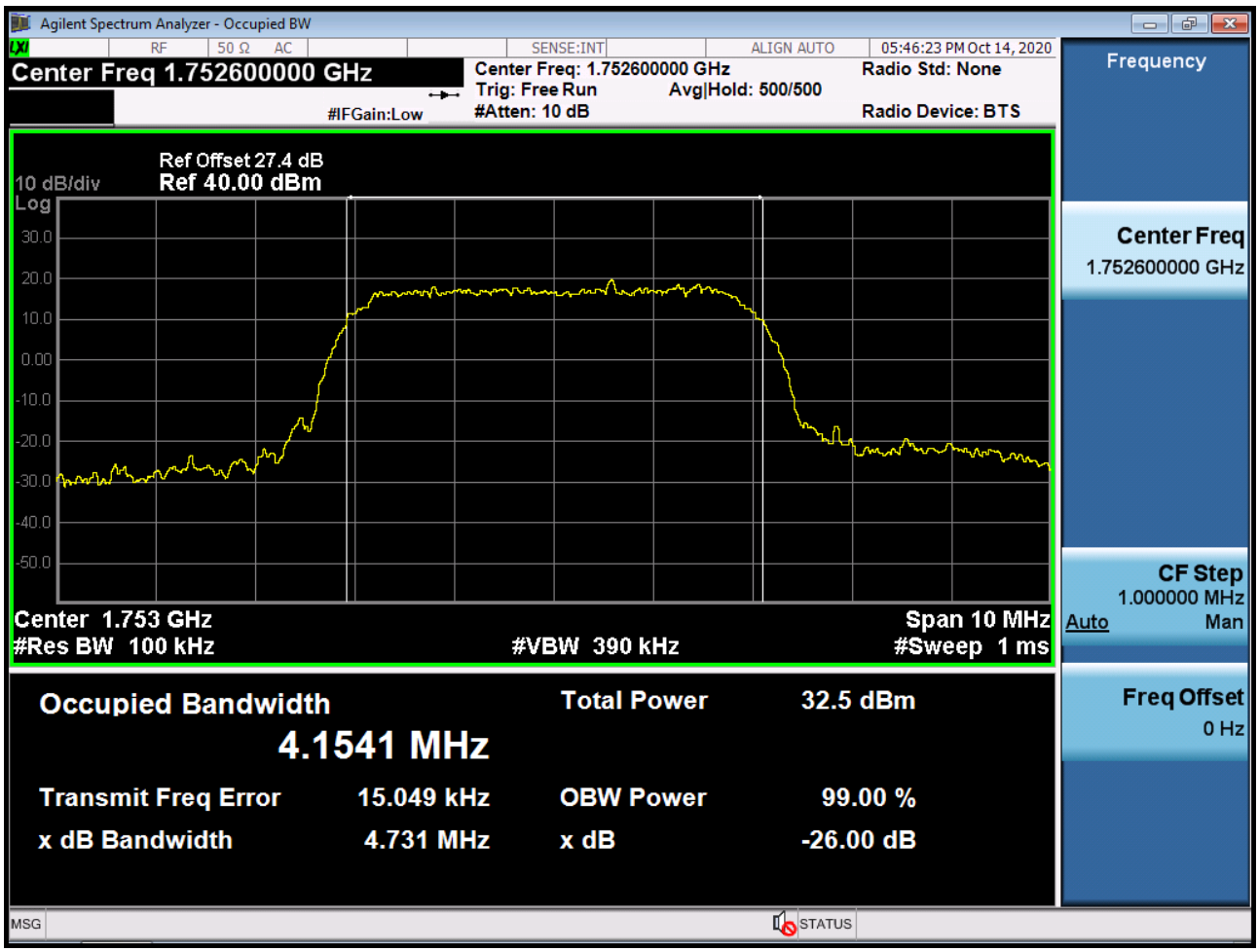
■ WCDMA1700 MODE (1712.4 CH.) Occupied Bandwidth



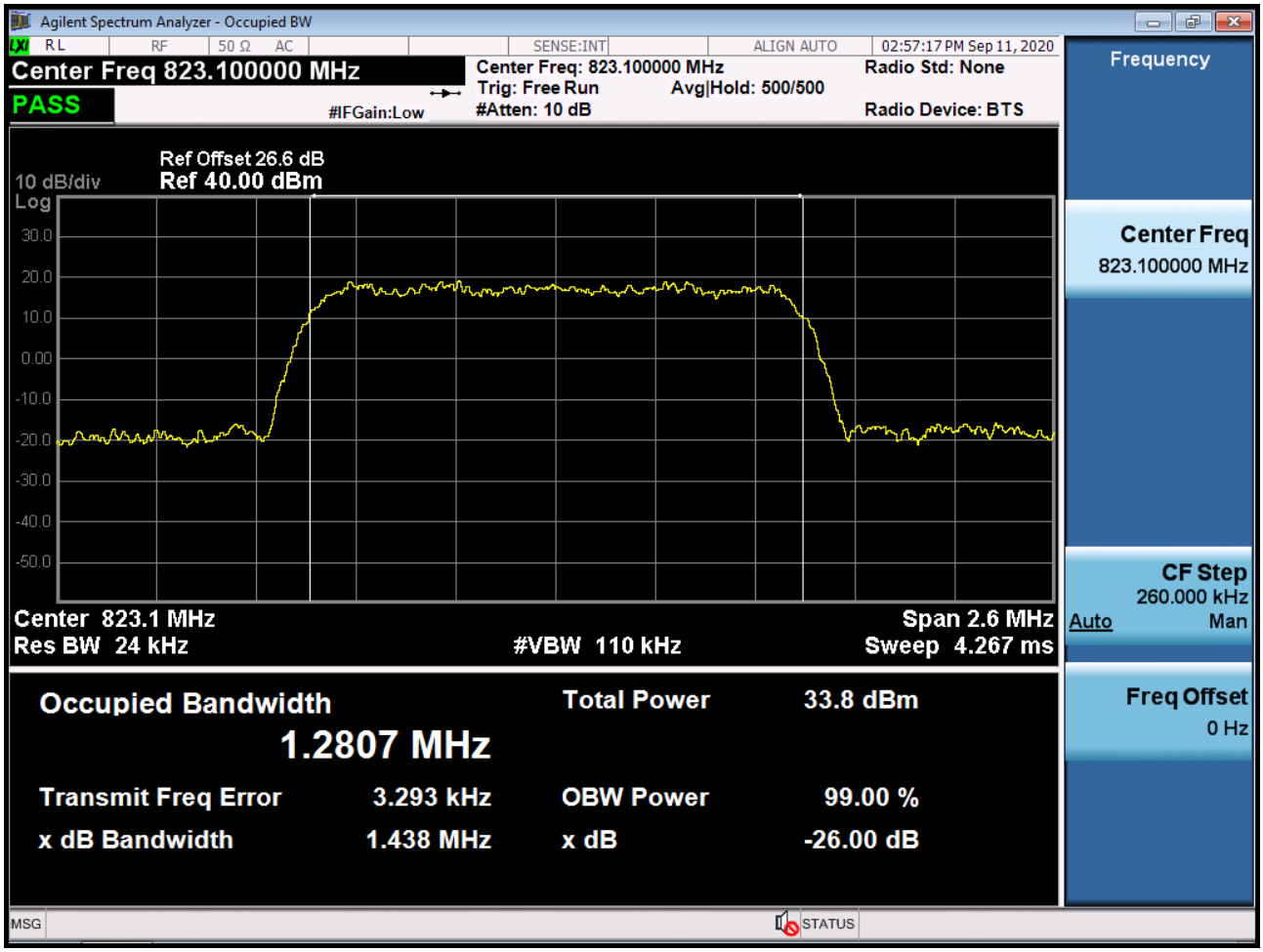
■ WCDMA1700 MODE (1732.4 CH.) Occupied Bandwidth



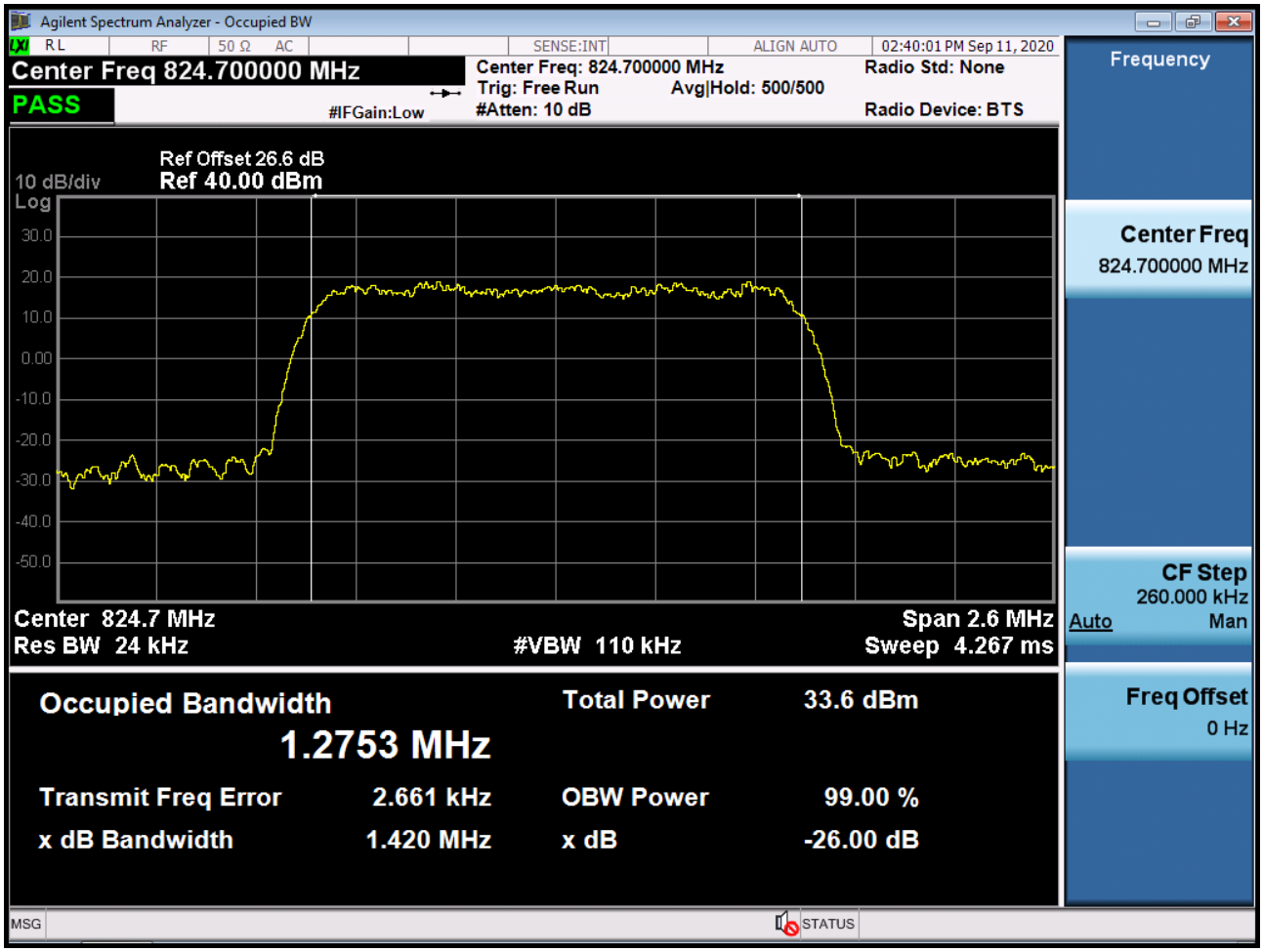
■ WCDMA1700 MODE (1752.6 CH.) Occupied Bandwidth



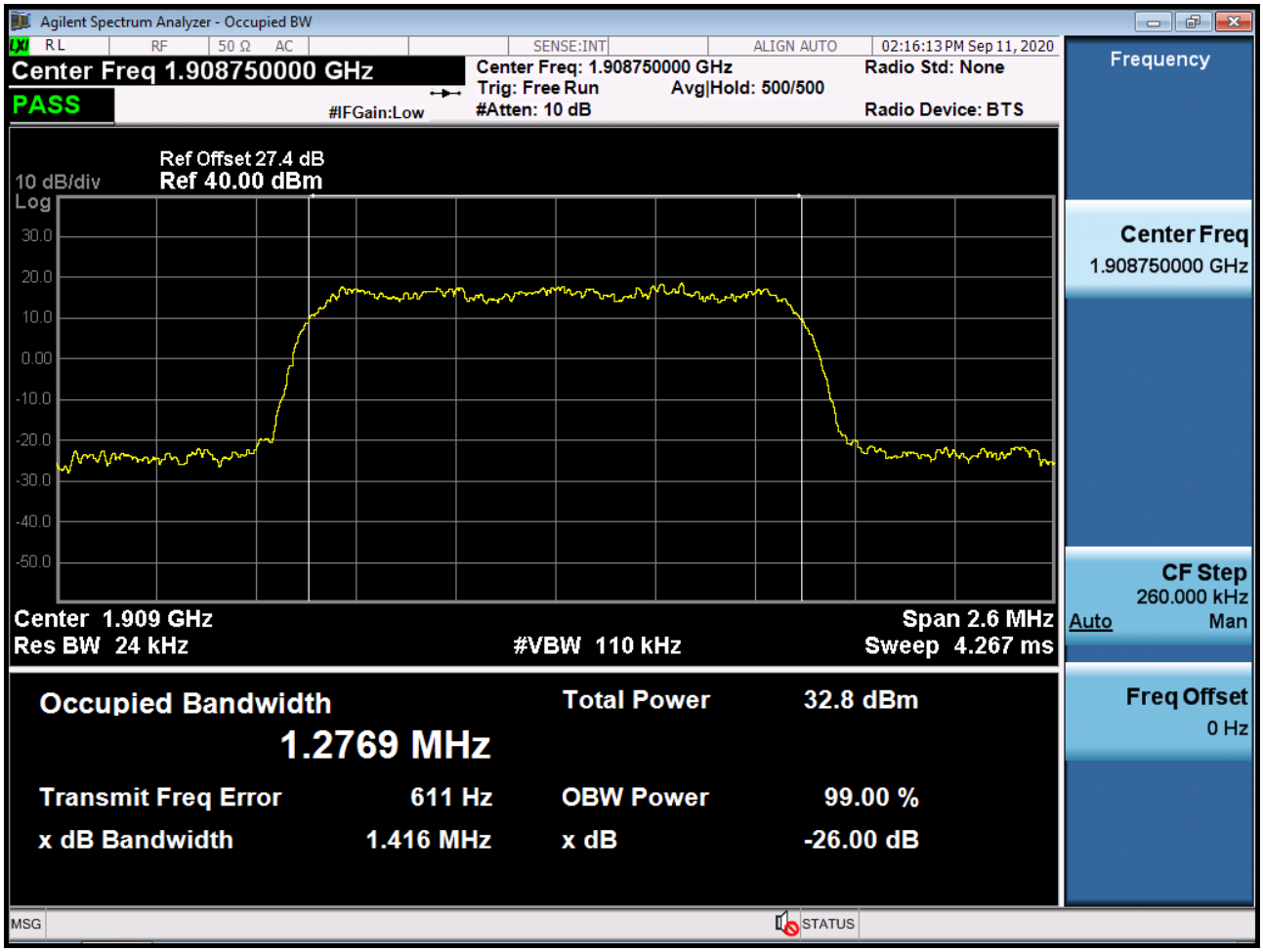
■ Secondary800_BC10 MODE (684 CH.) Occupied Bandwidth



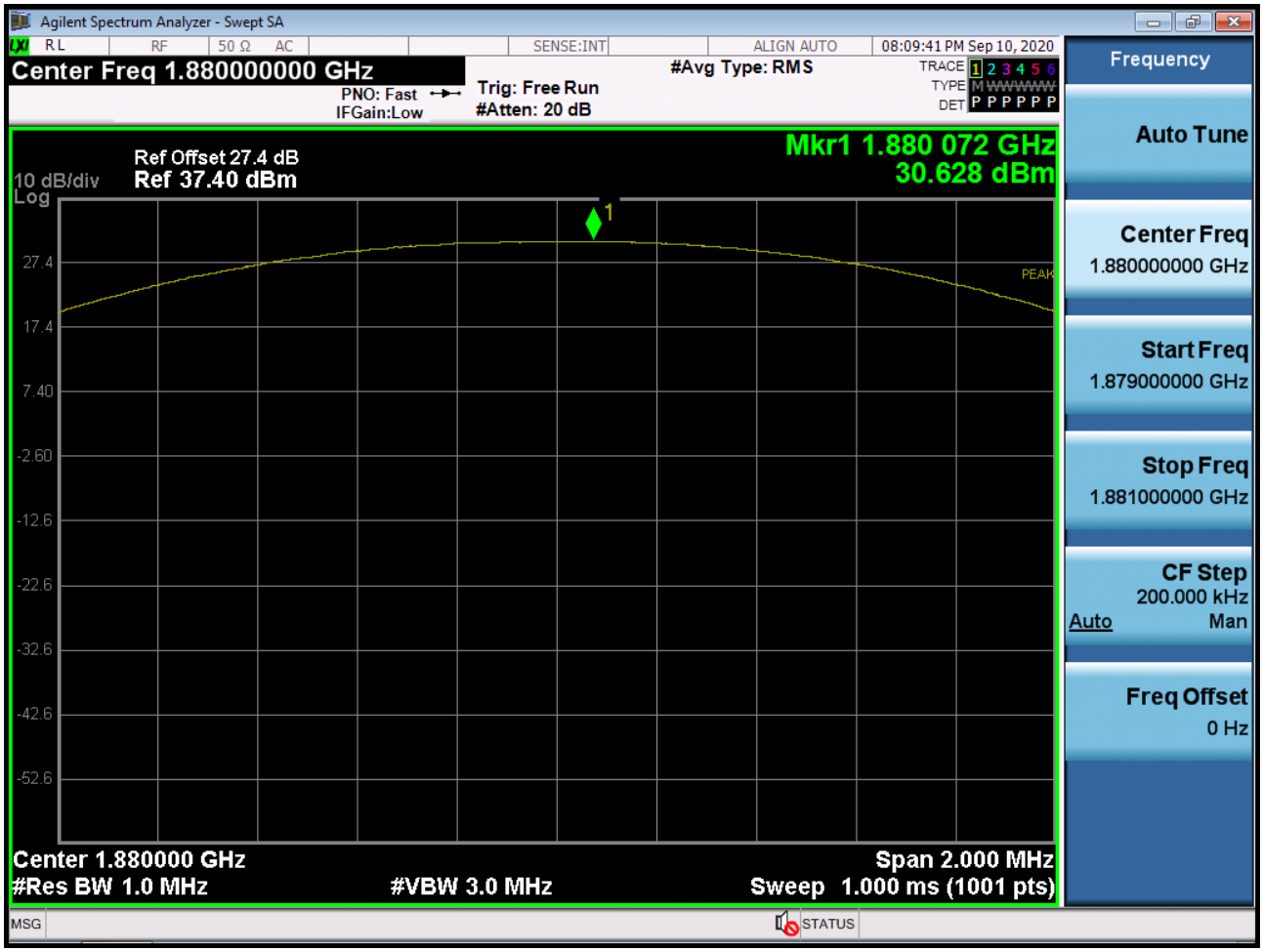
■ CDMA850_BC0 MODE (1013 CH.) Occupied Bandwidth



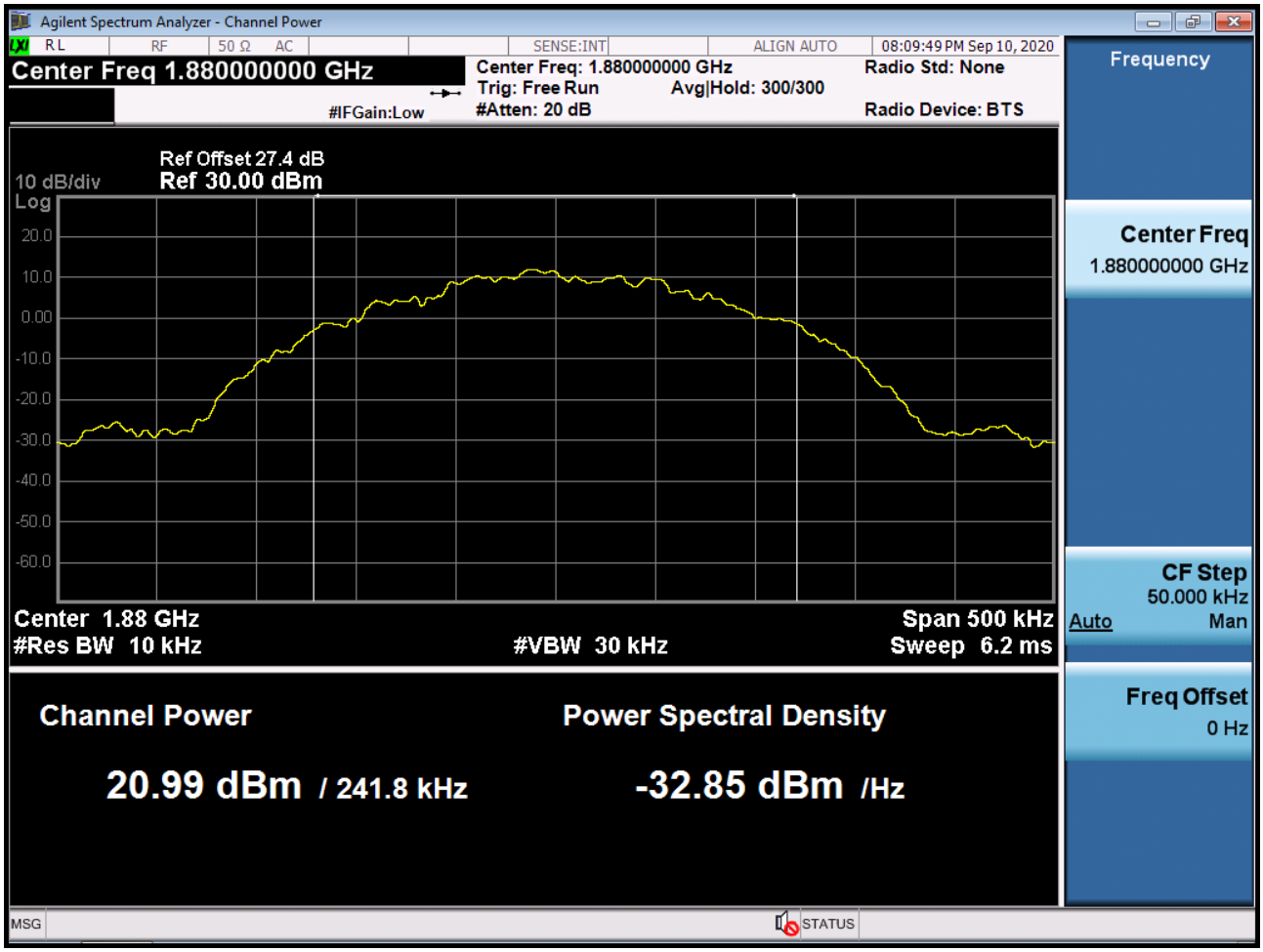
■ PCS CDMA MODE (1175 CH.) Occupied Bandwidth



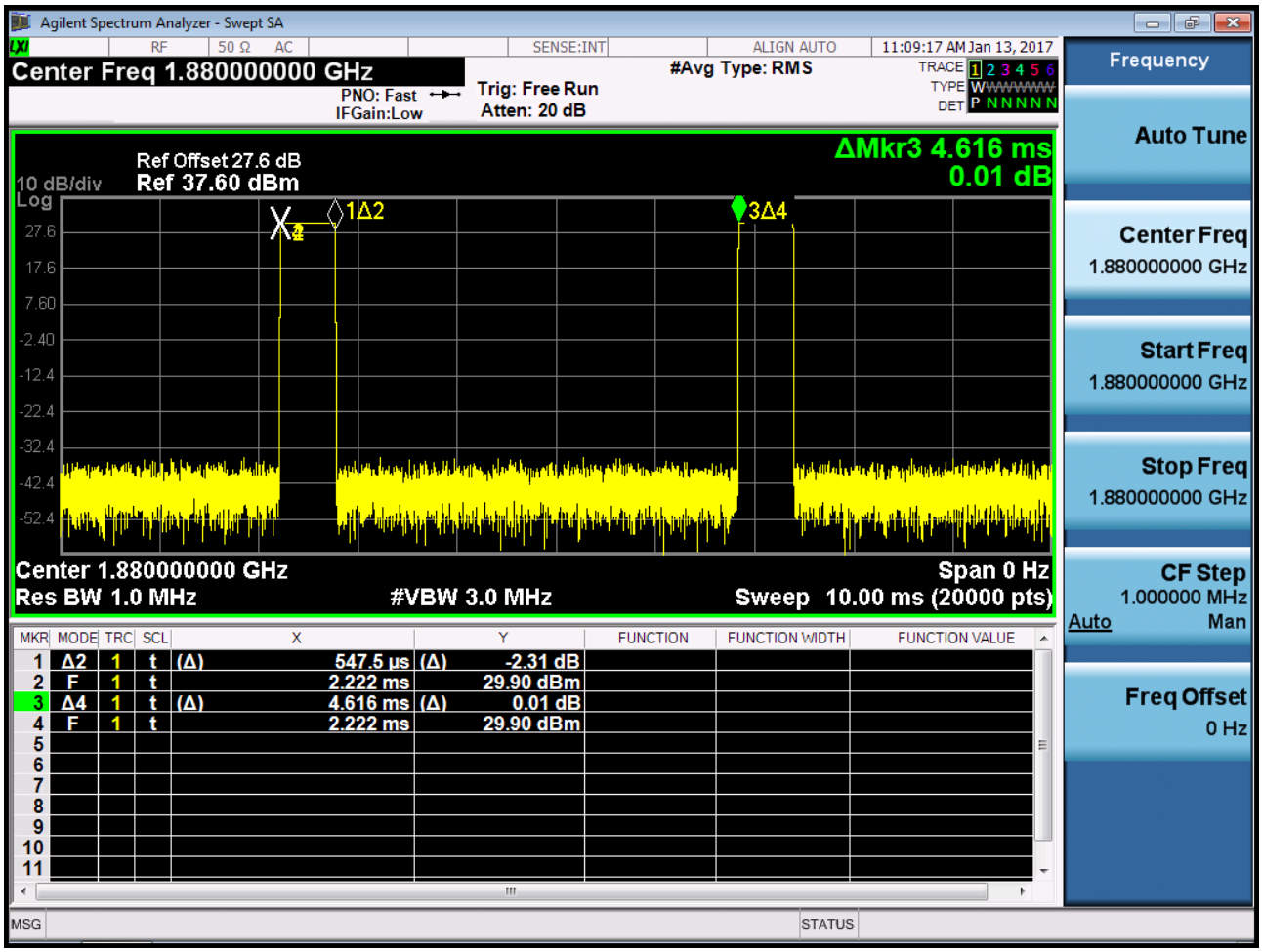
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio $P_{Pk}$



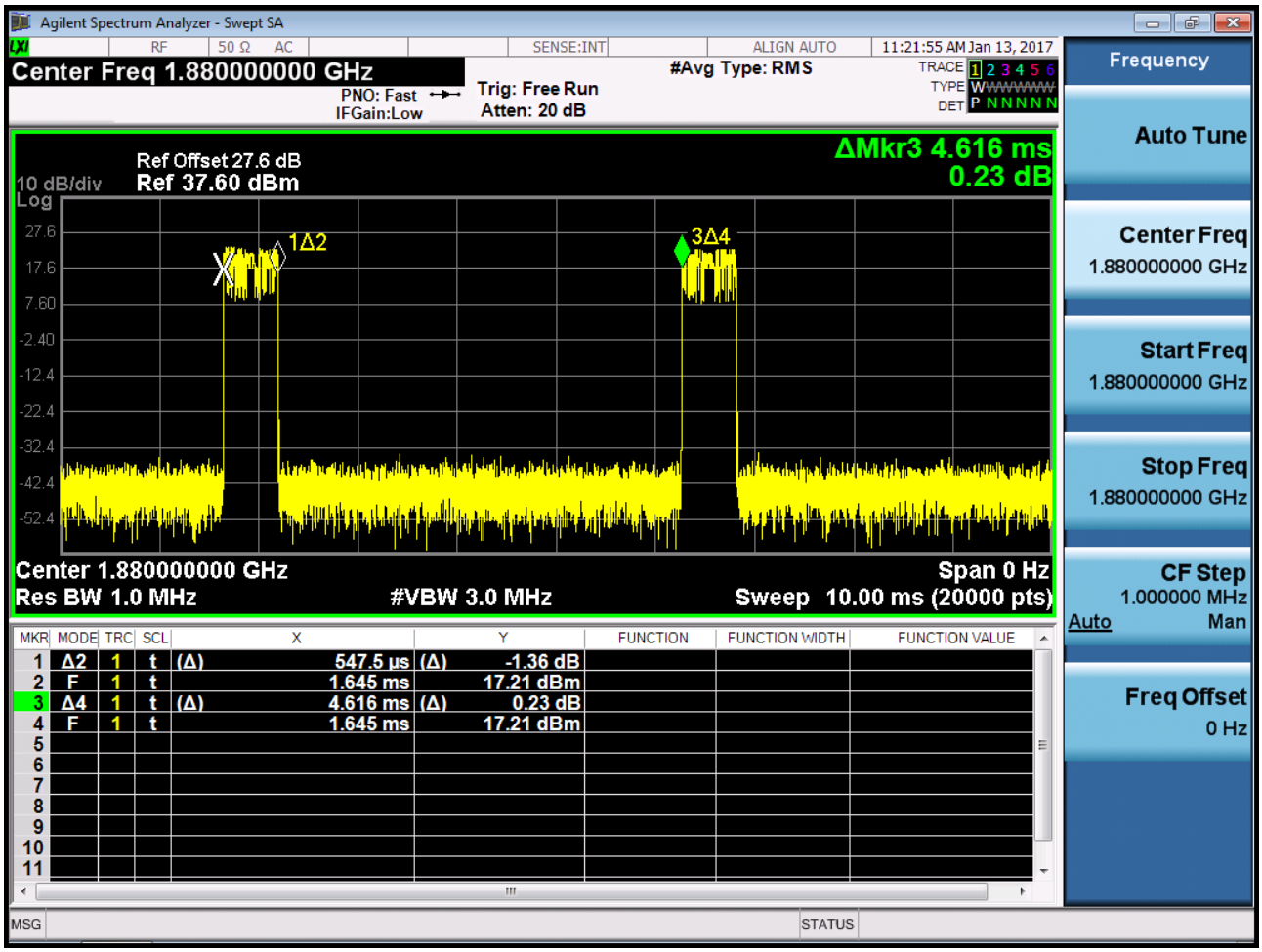
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio $P_{Avg}$



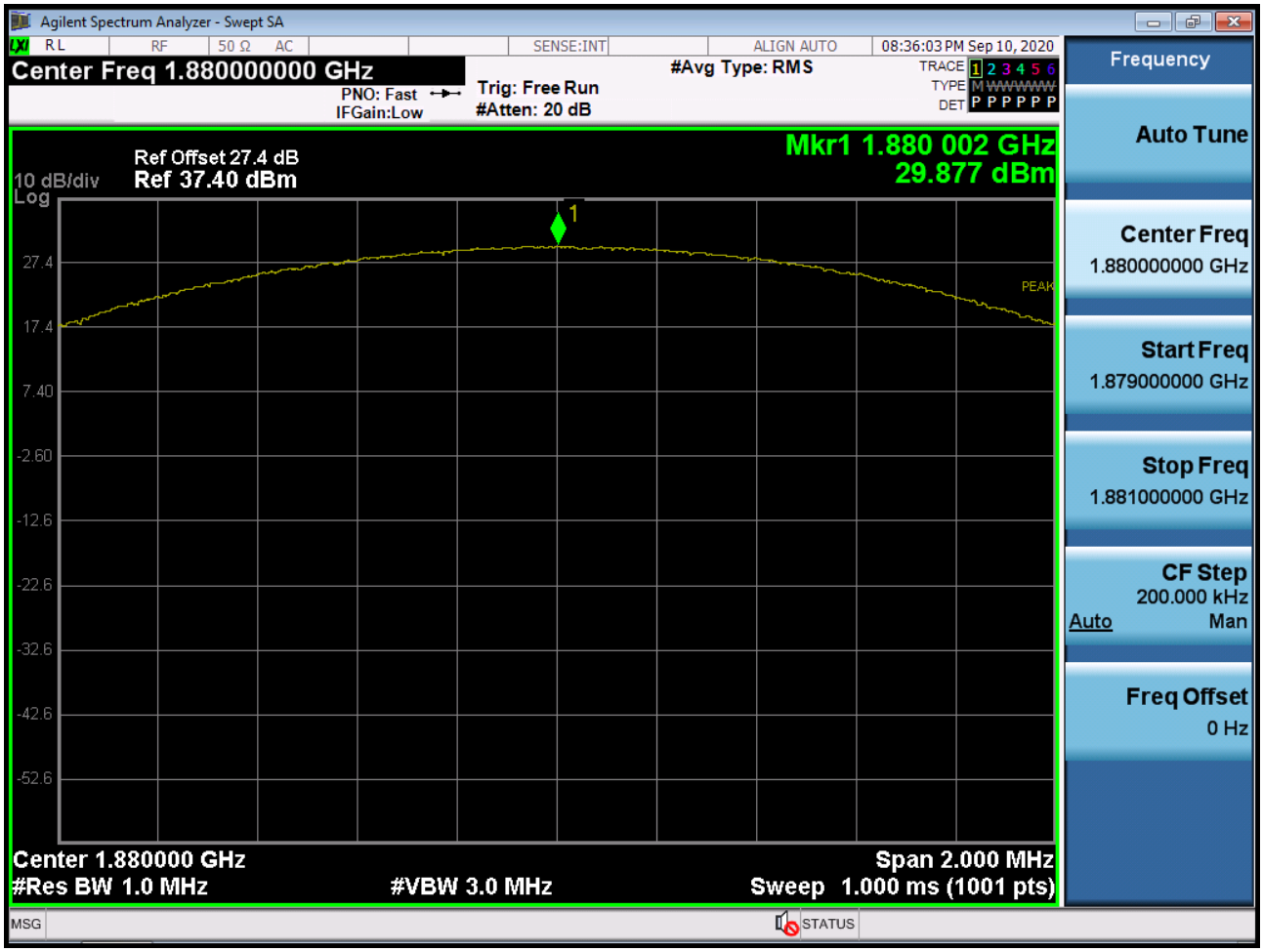
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio Duty



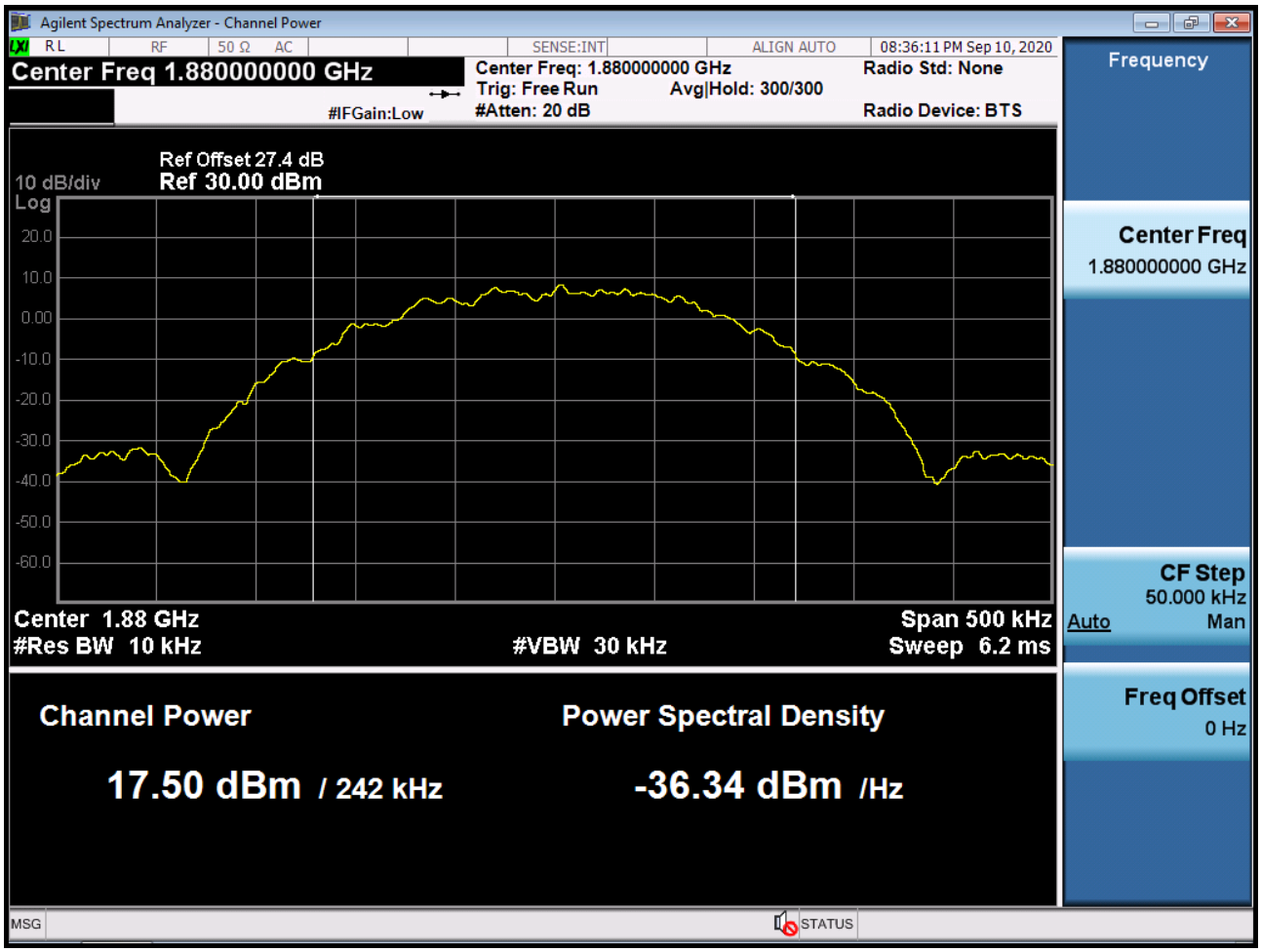
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio Duty



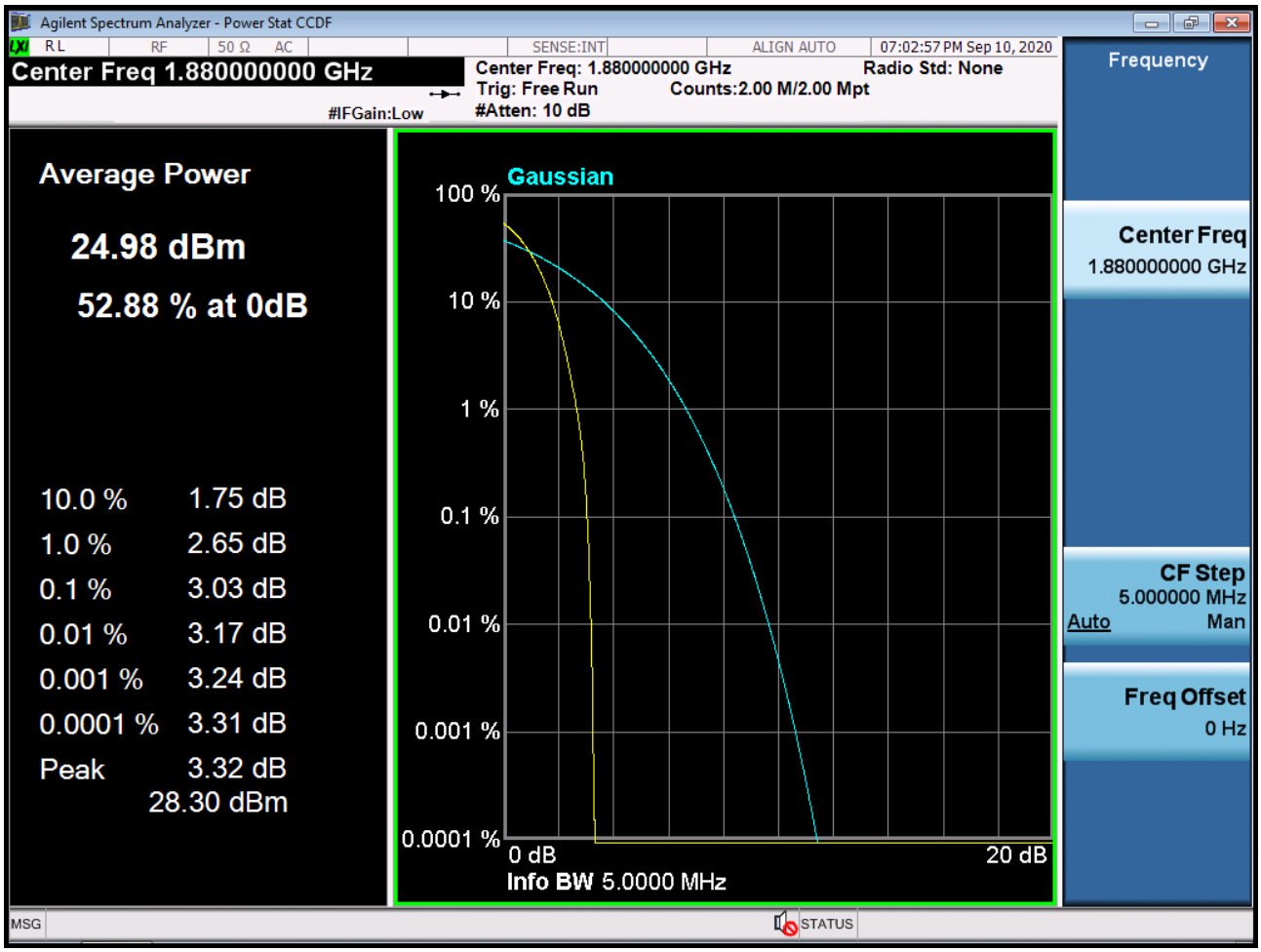
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio $P_{Pk}$



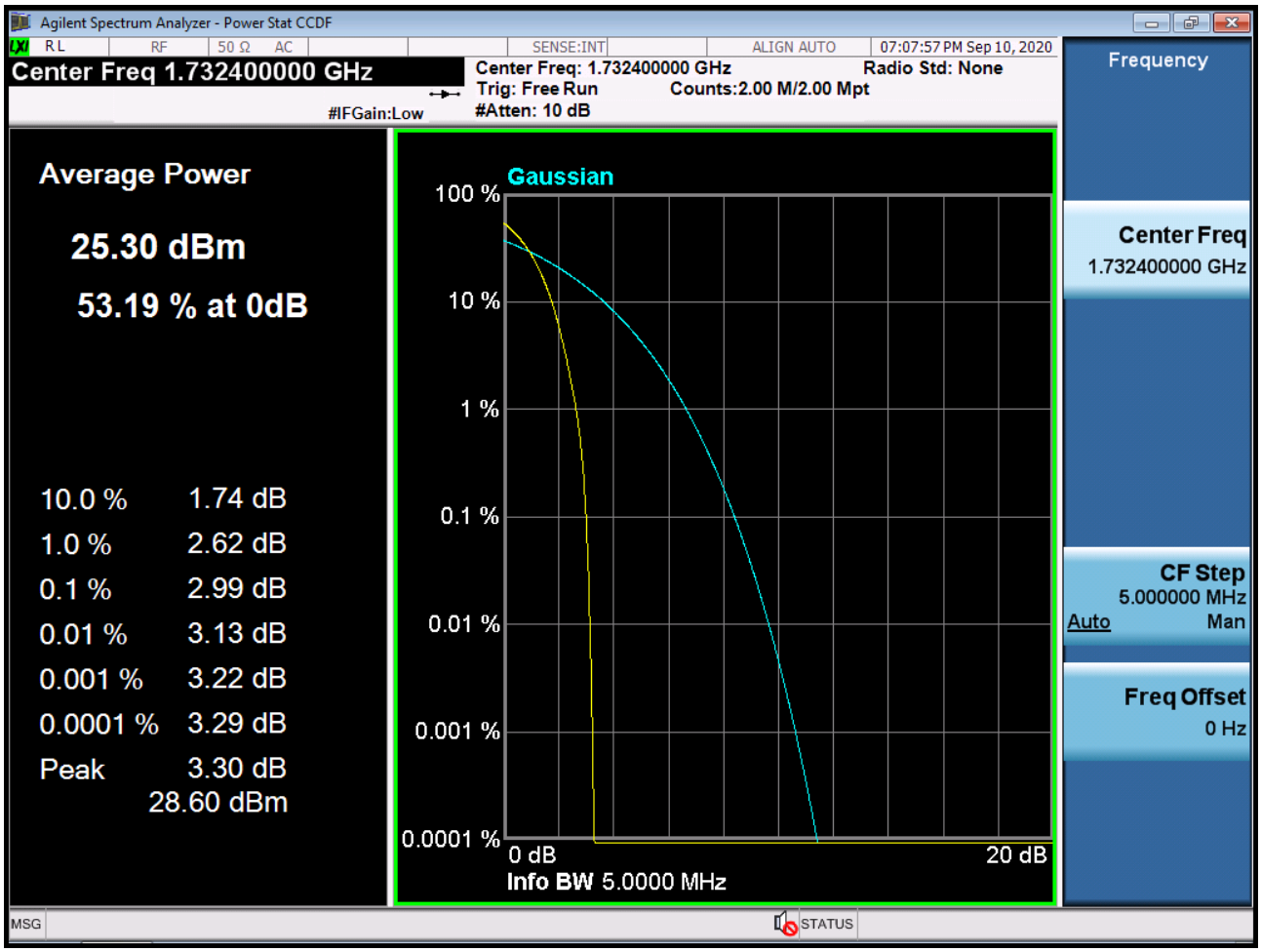
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio $P_{Avg}$



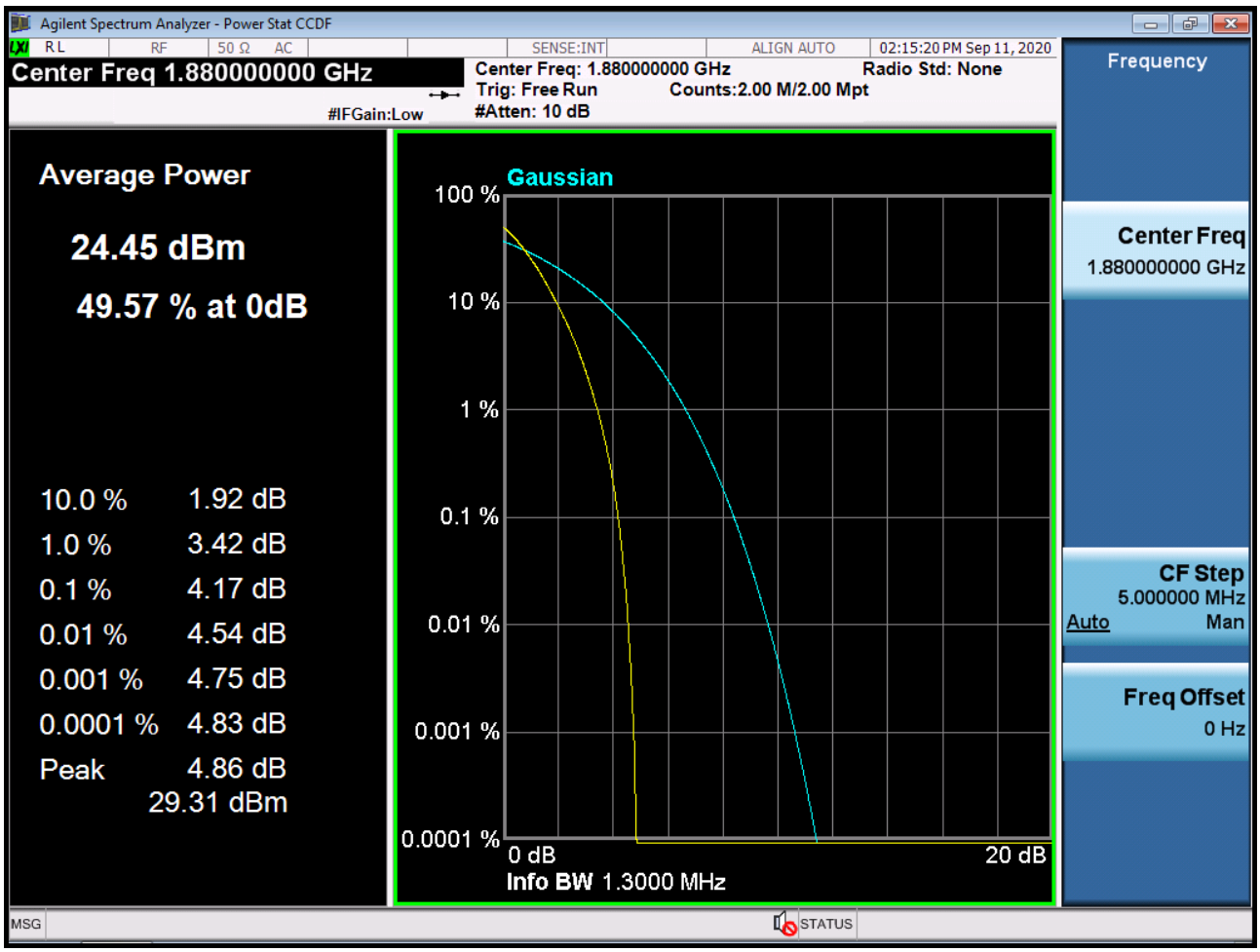
■ WCDMA1900 MODE (9400 CH.) Peak-to-Average Ratio



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

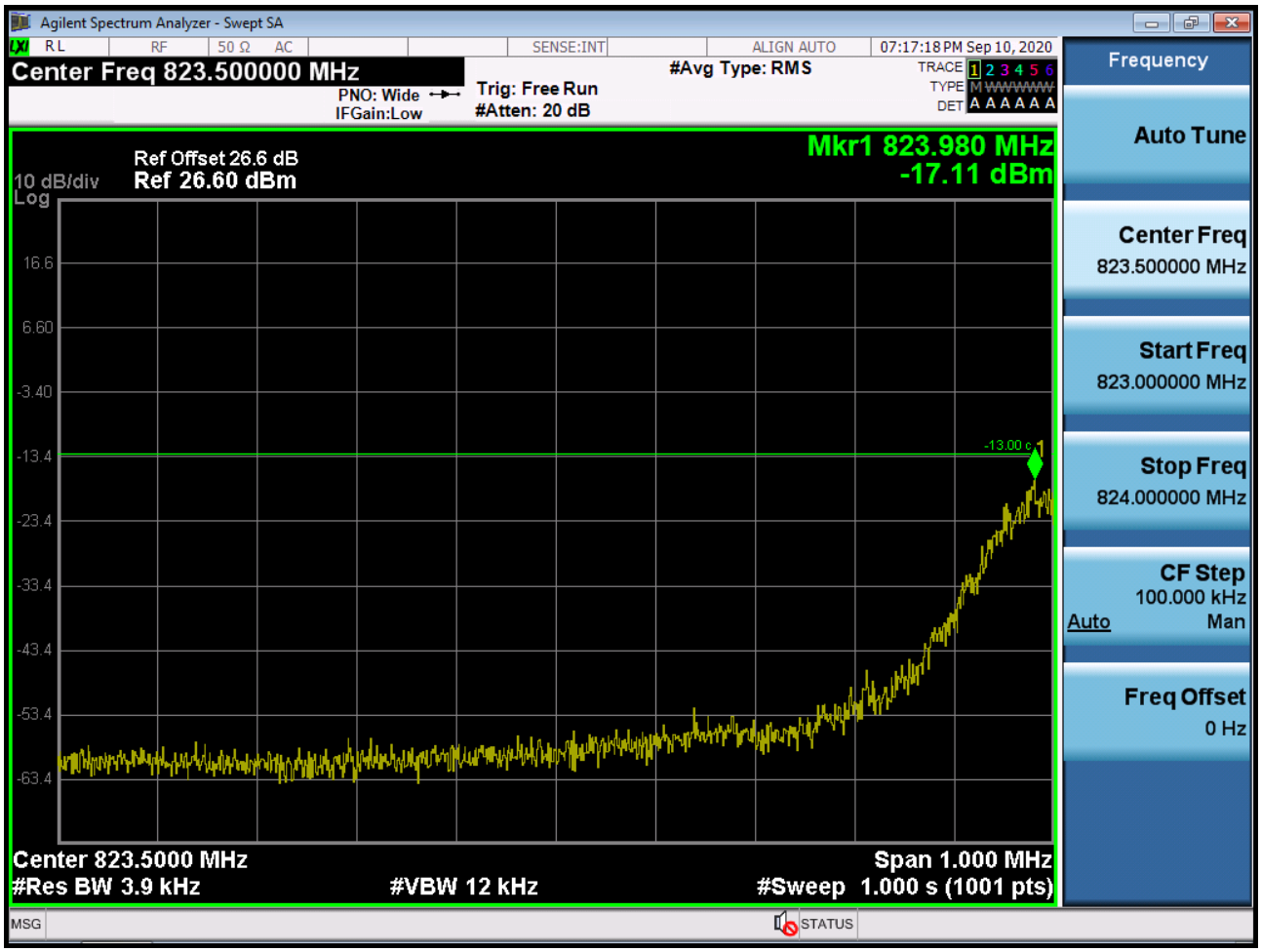


■ PCS CDMA MODE (600 CH.) Peak-to-Average Ratio



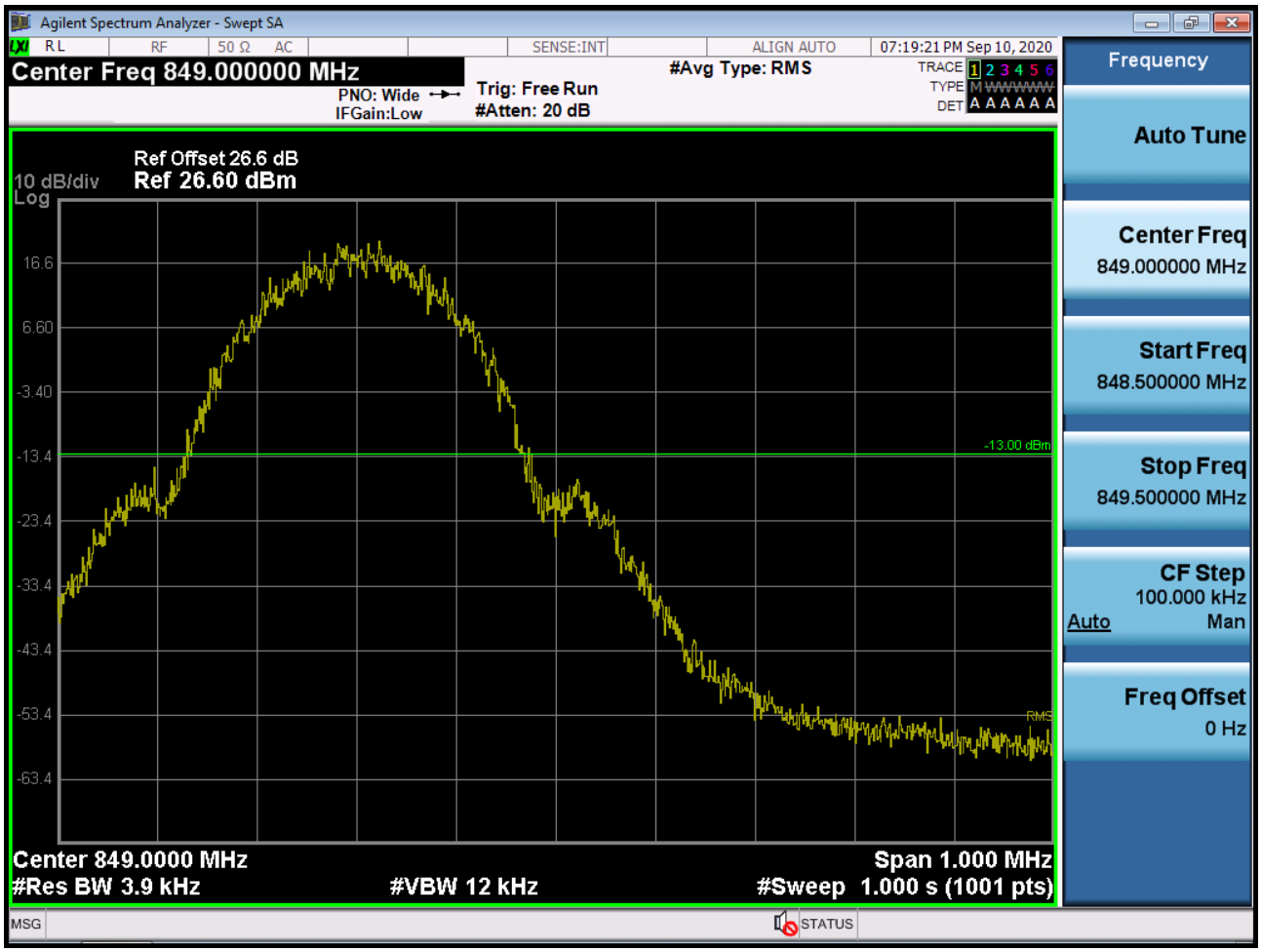
■ GSM850 MODE (128 CH.) Block Edge 1

■ GSM850 MODE (128 CH.) Block Edge 2

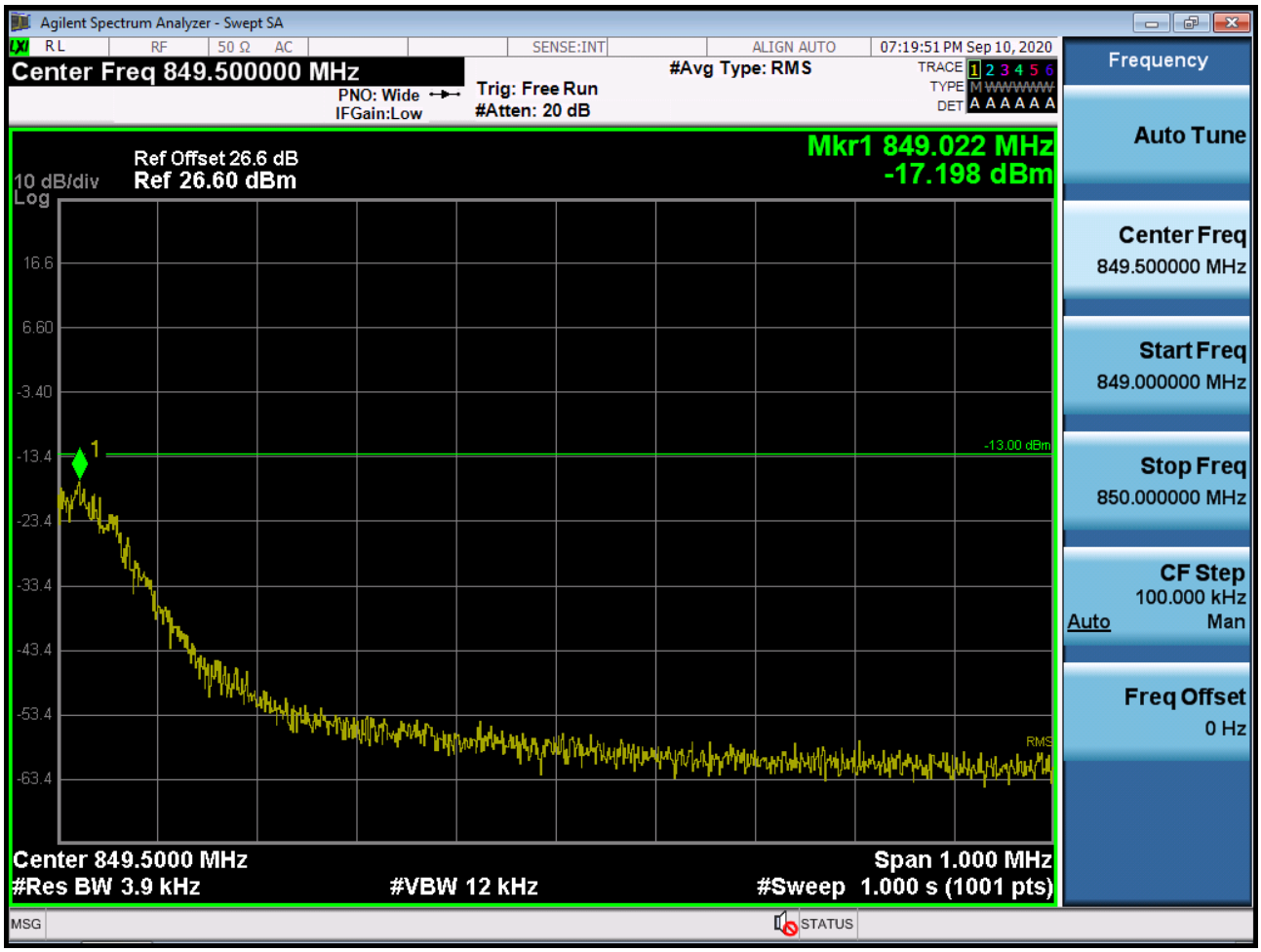


■ GSM850 MODE (128 CH.) Block Edge 3

■ GSM850 MODE (251 CH.) Block Edge 1

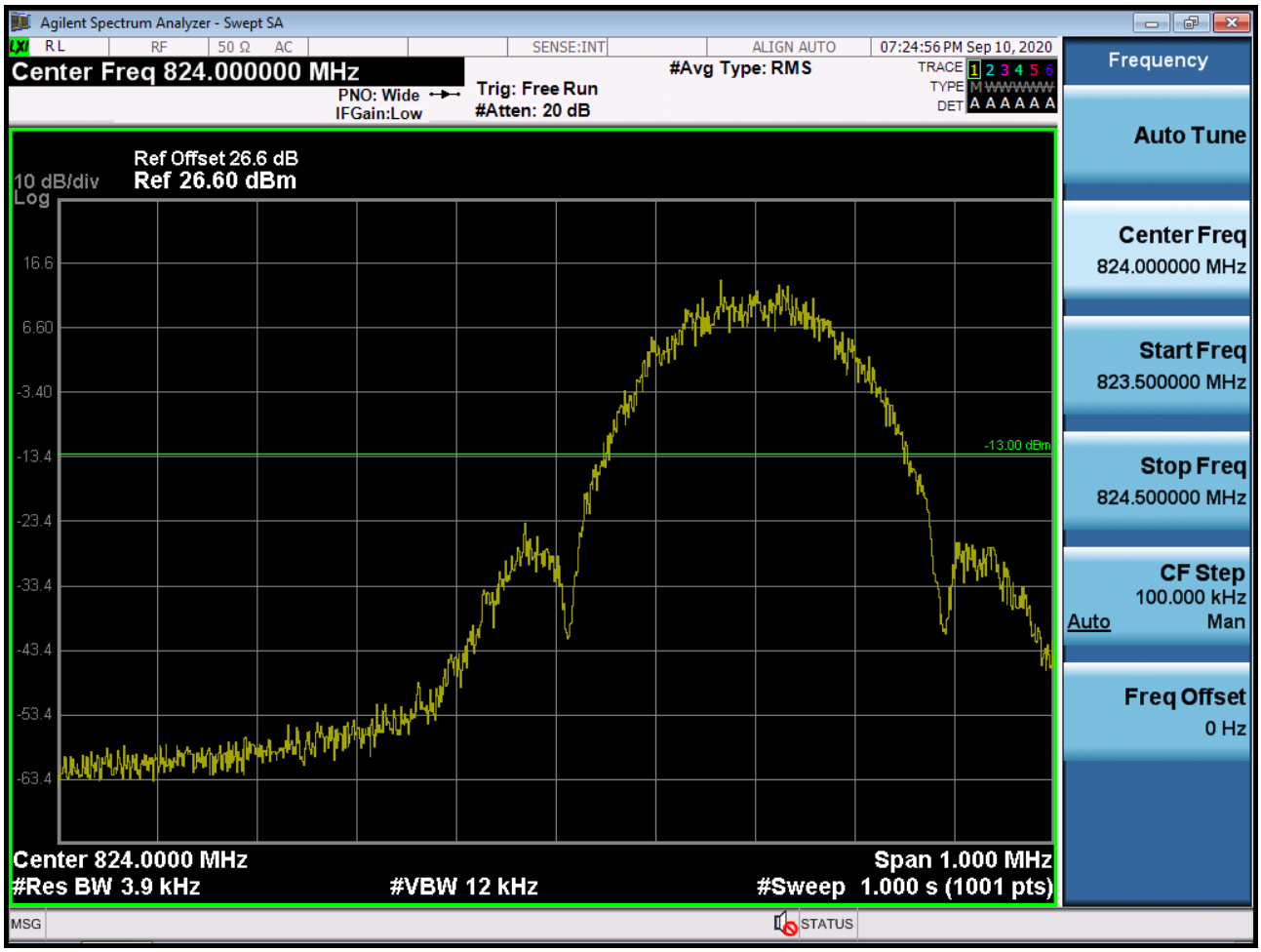


■ GSM850 MODE (251 CH.) Block Edge 2

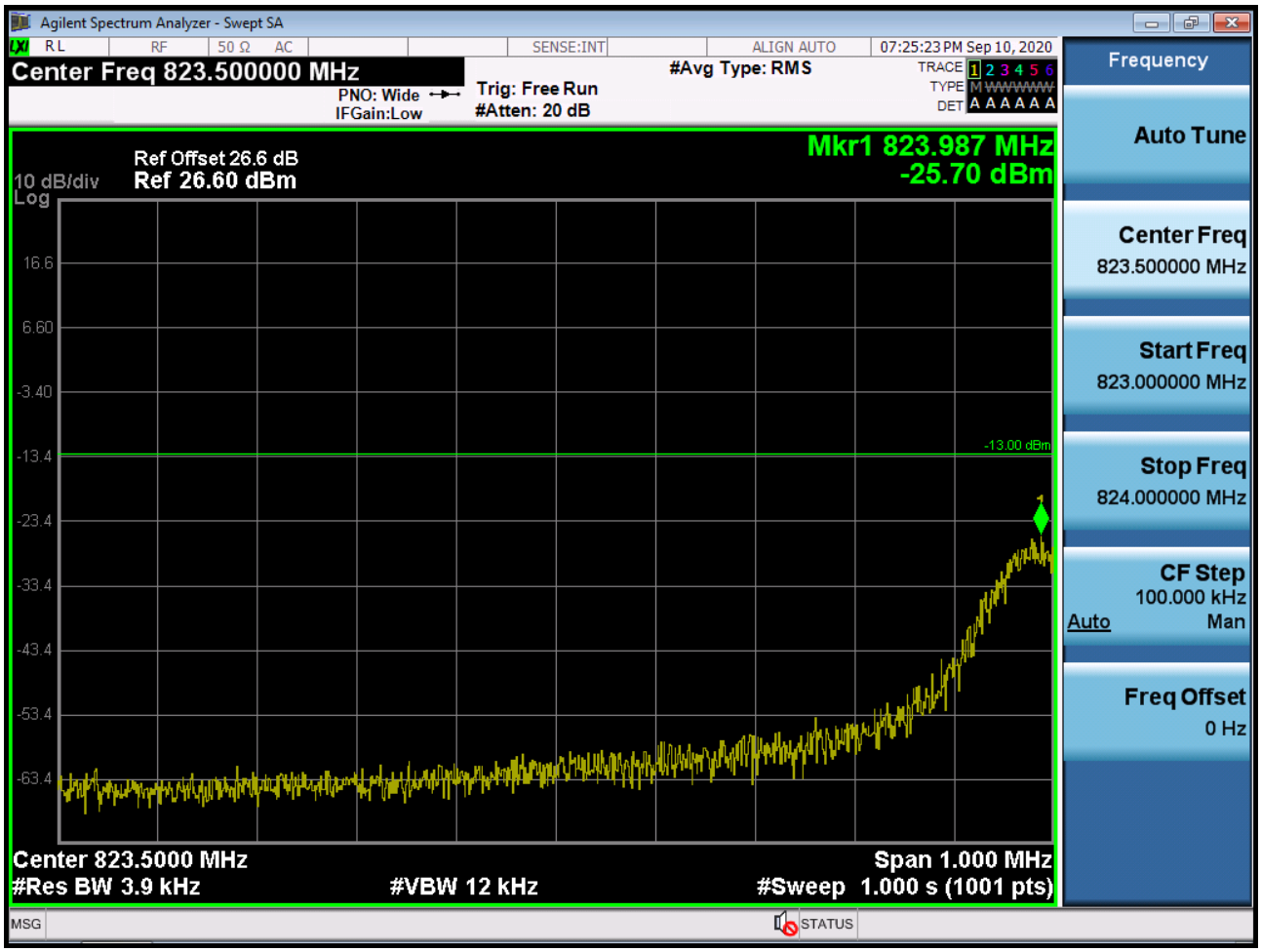


■ GSM850 MODE (251 CH.) Block Edge 3

■ EDGE MODE (128 CH.) Block Edge 1

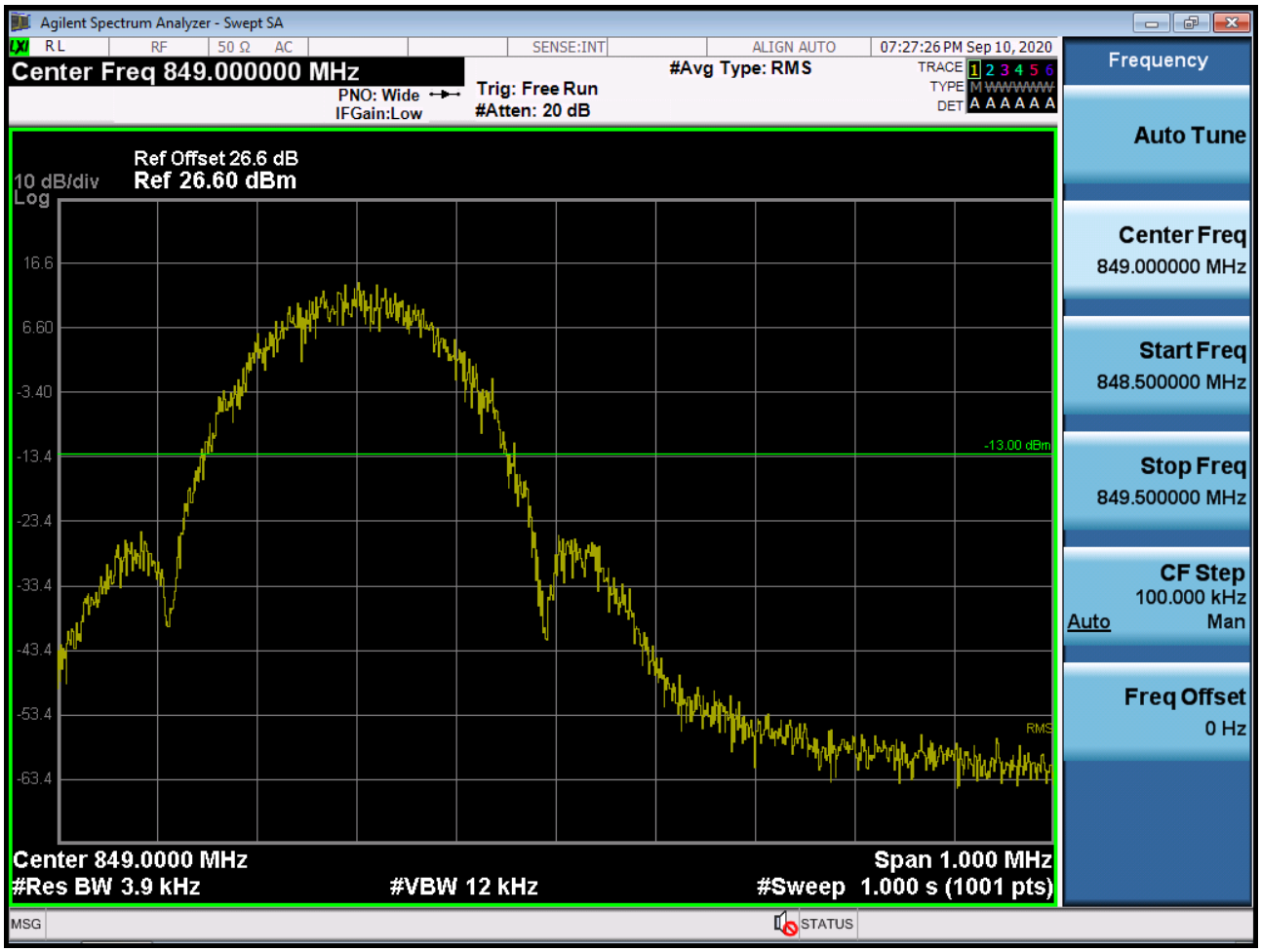


■ EDGE MODE (128 CH.) Block Edge 2

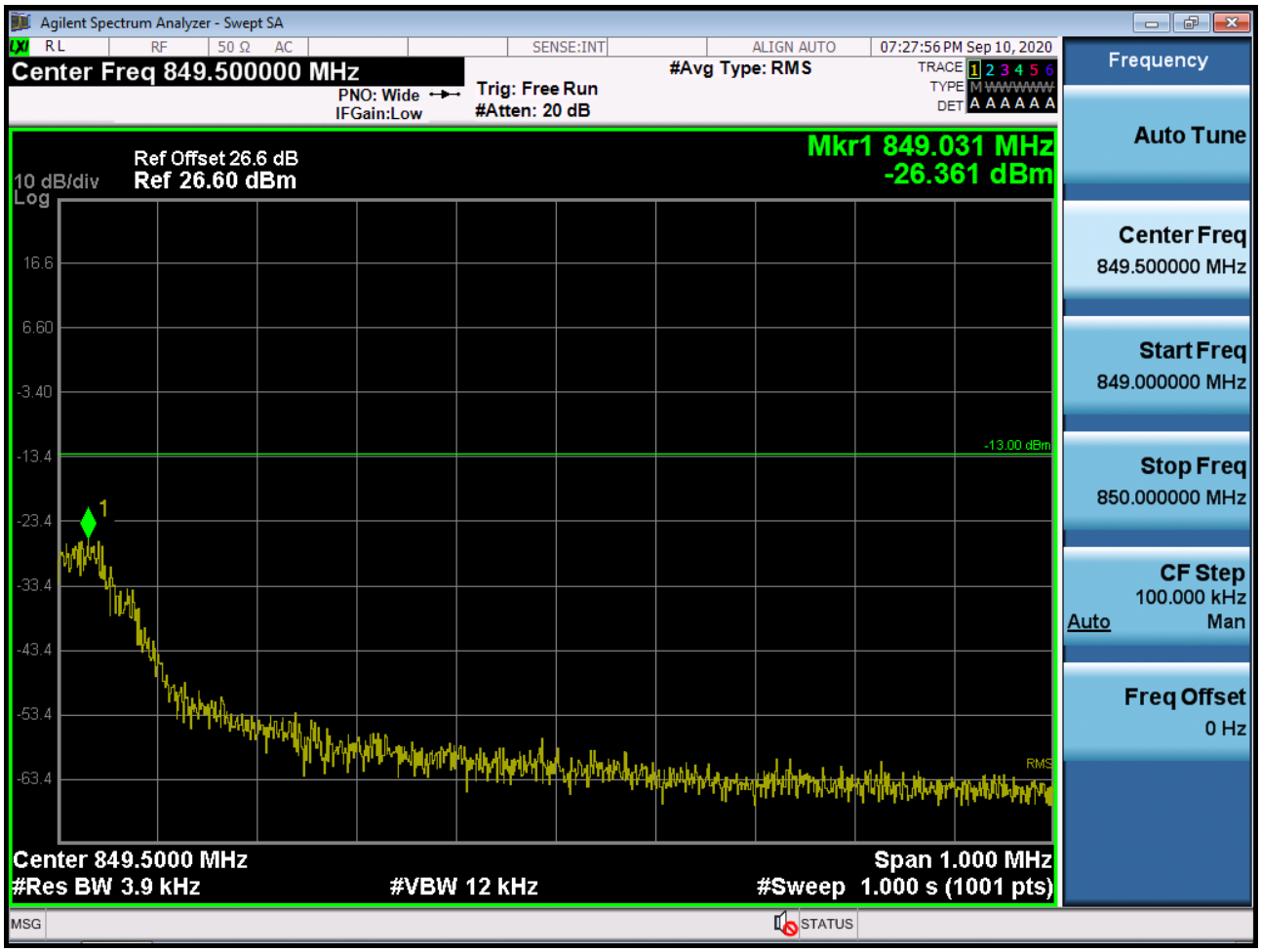


■ EDGE MODE (128 CH.) Block Edge 3

■ EDGE MODE (251 CH.) Block Edge 1

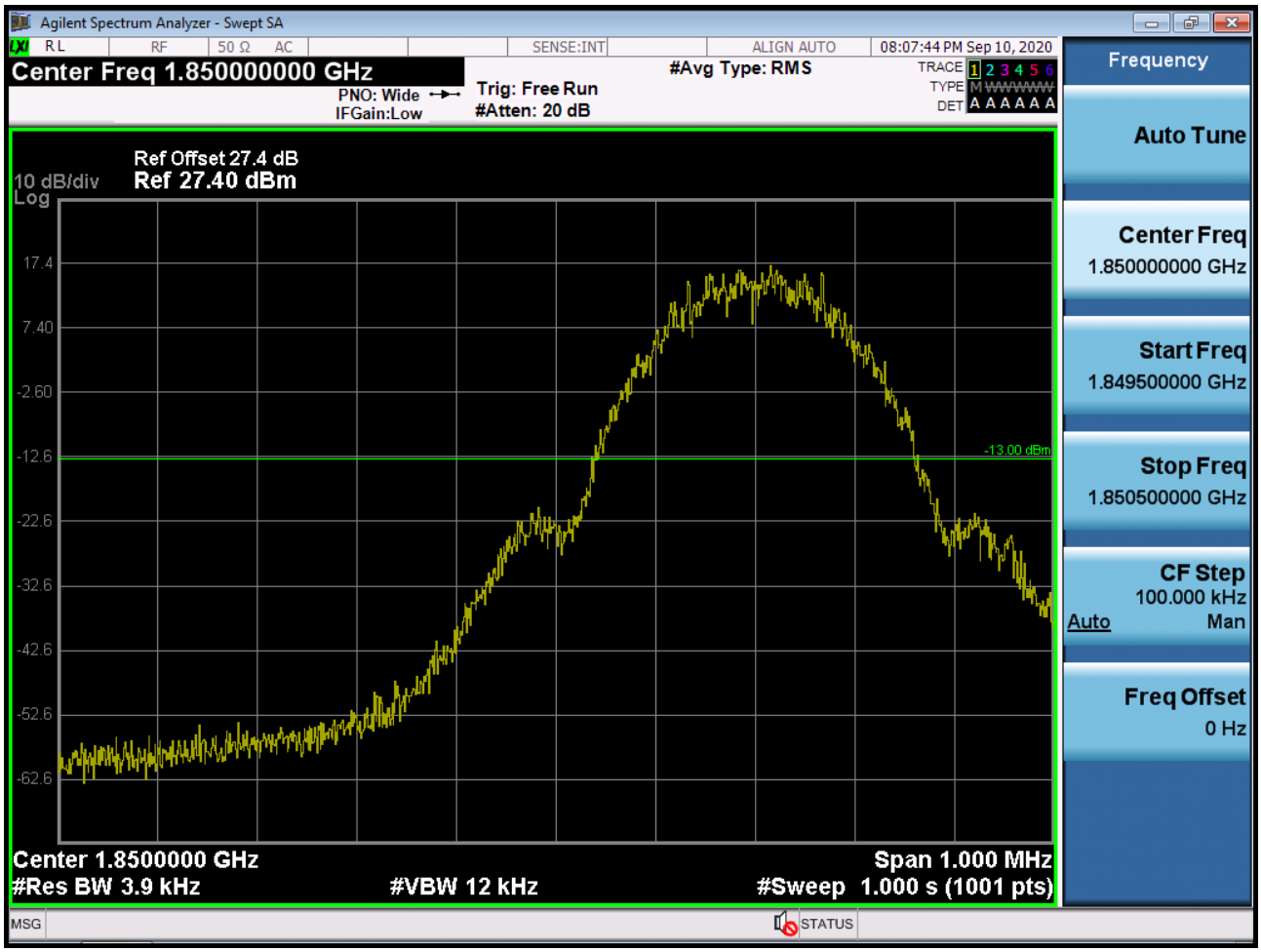


■ EDGE MODE (251 CH.) Block Edge 2

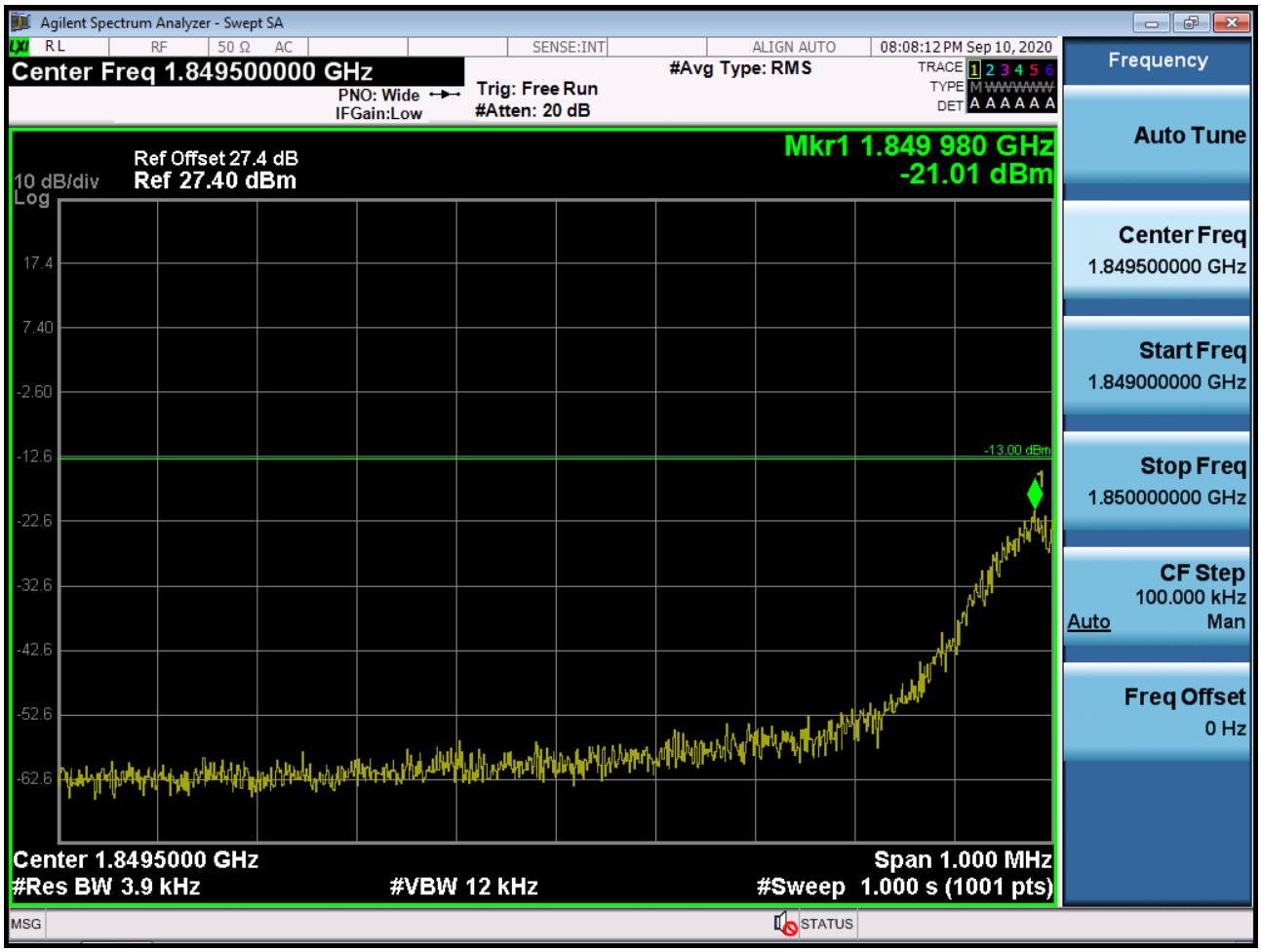


■ EDGE MODE (251 CH.) Block Edge 3

■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2

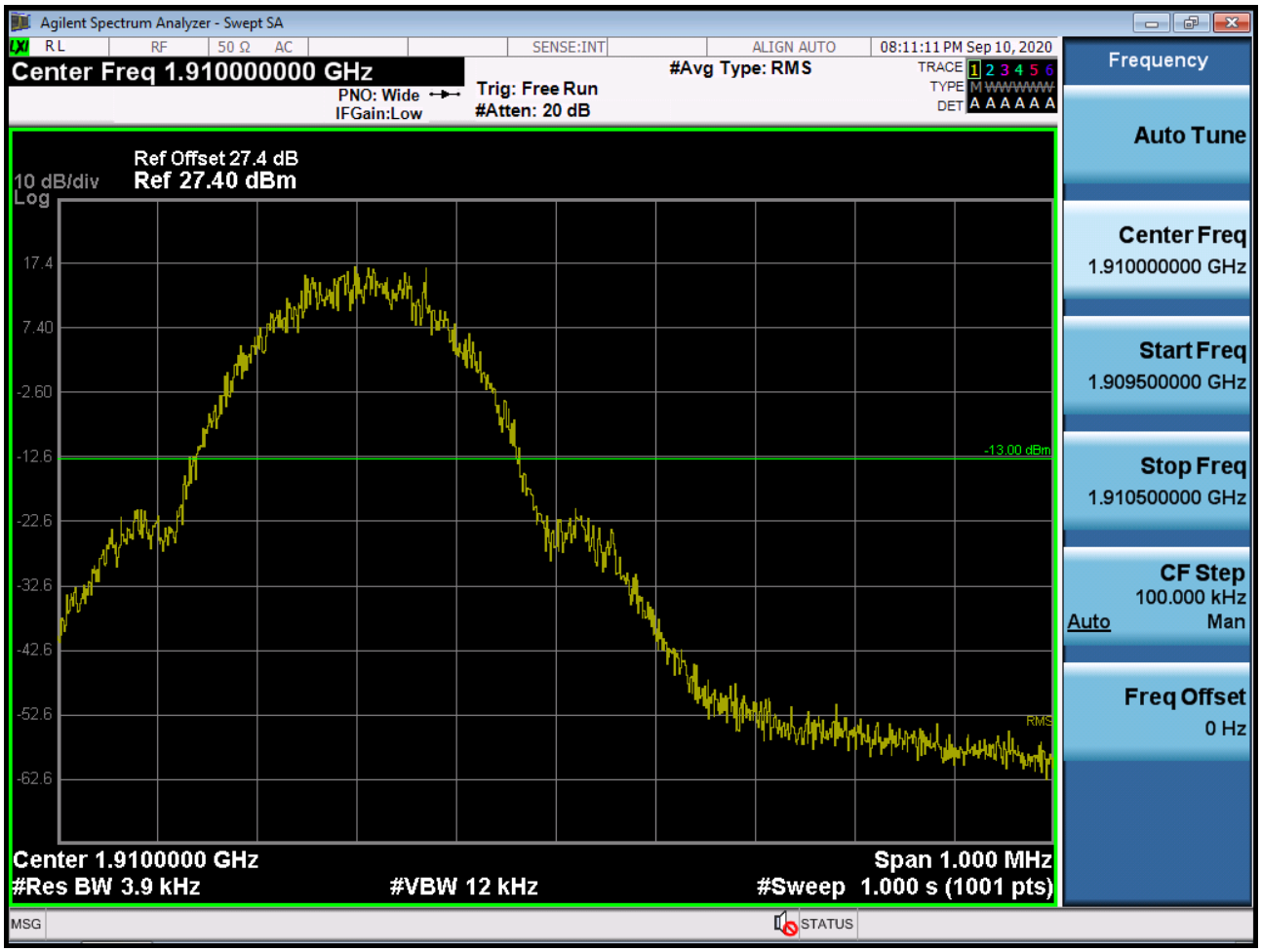


■ GSM1900 MODE (512 CH.) Block Edge 3

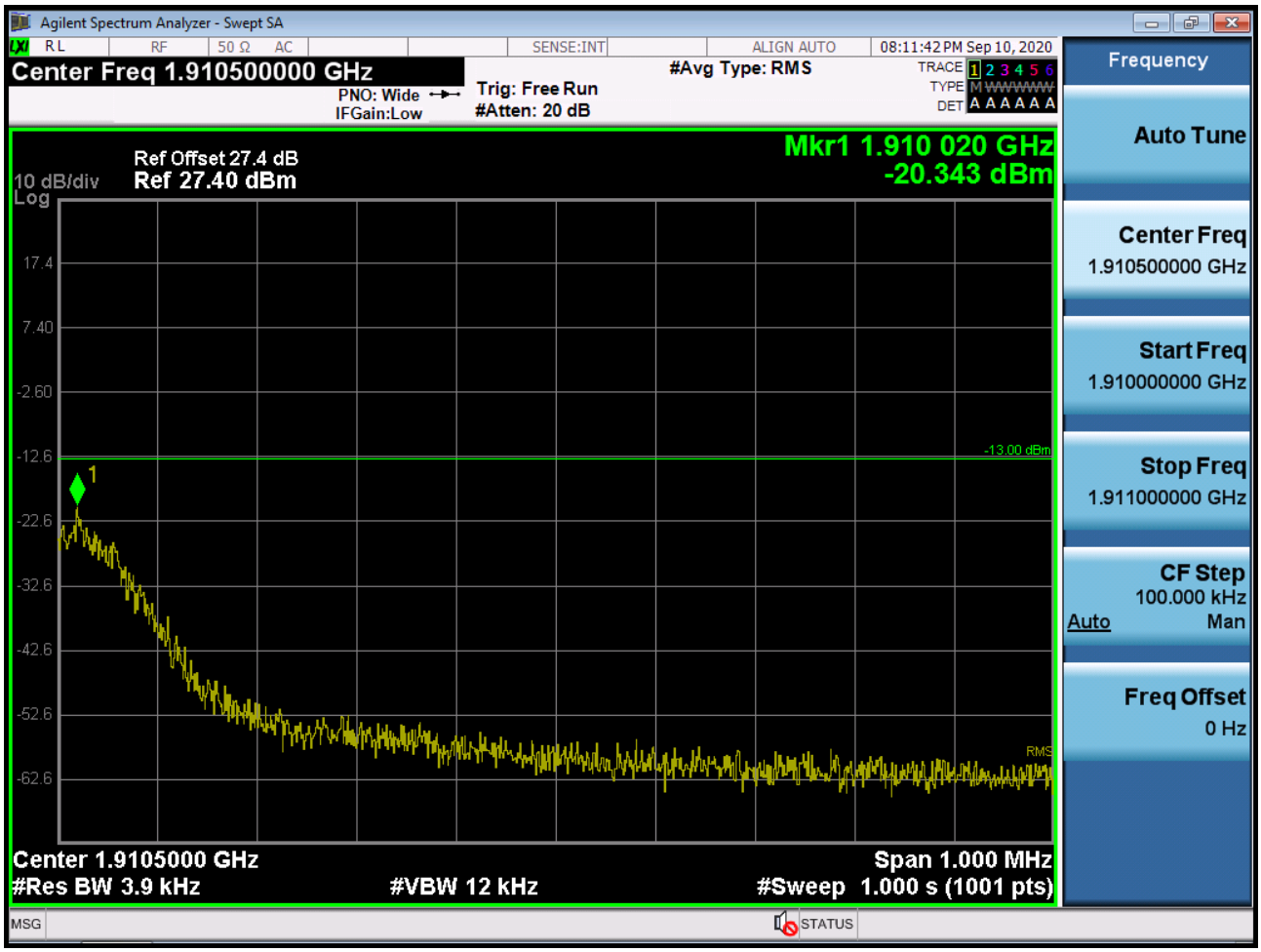

Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -48.96 dBm + 10 dB = -38.96 dBm

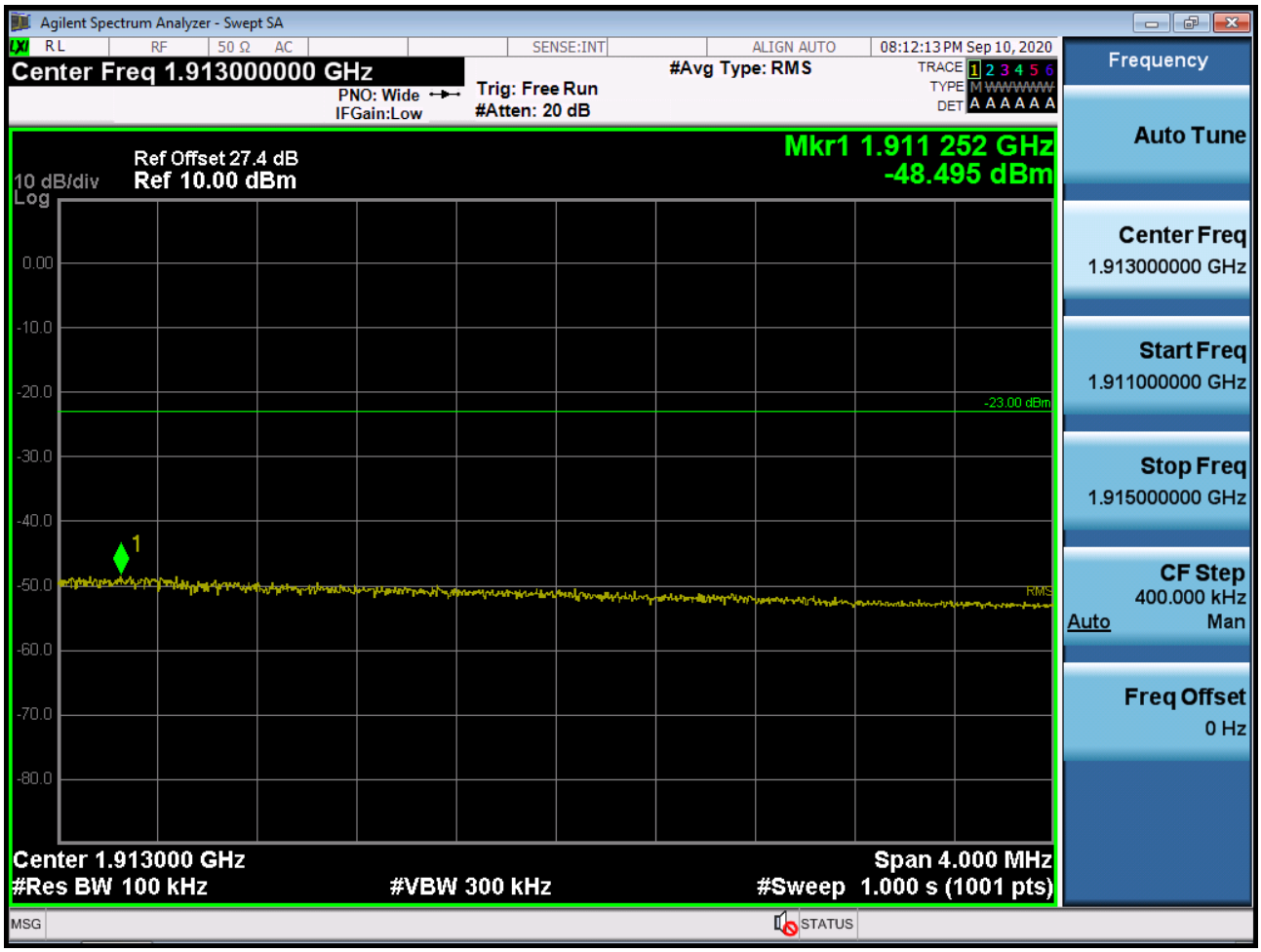
■ GSM1900 MODE (810 CH.) Block Edge 1



■ GSM1900 MODE (810 CH.) Block Edge 2



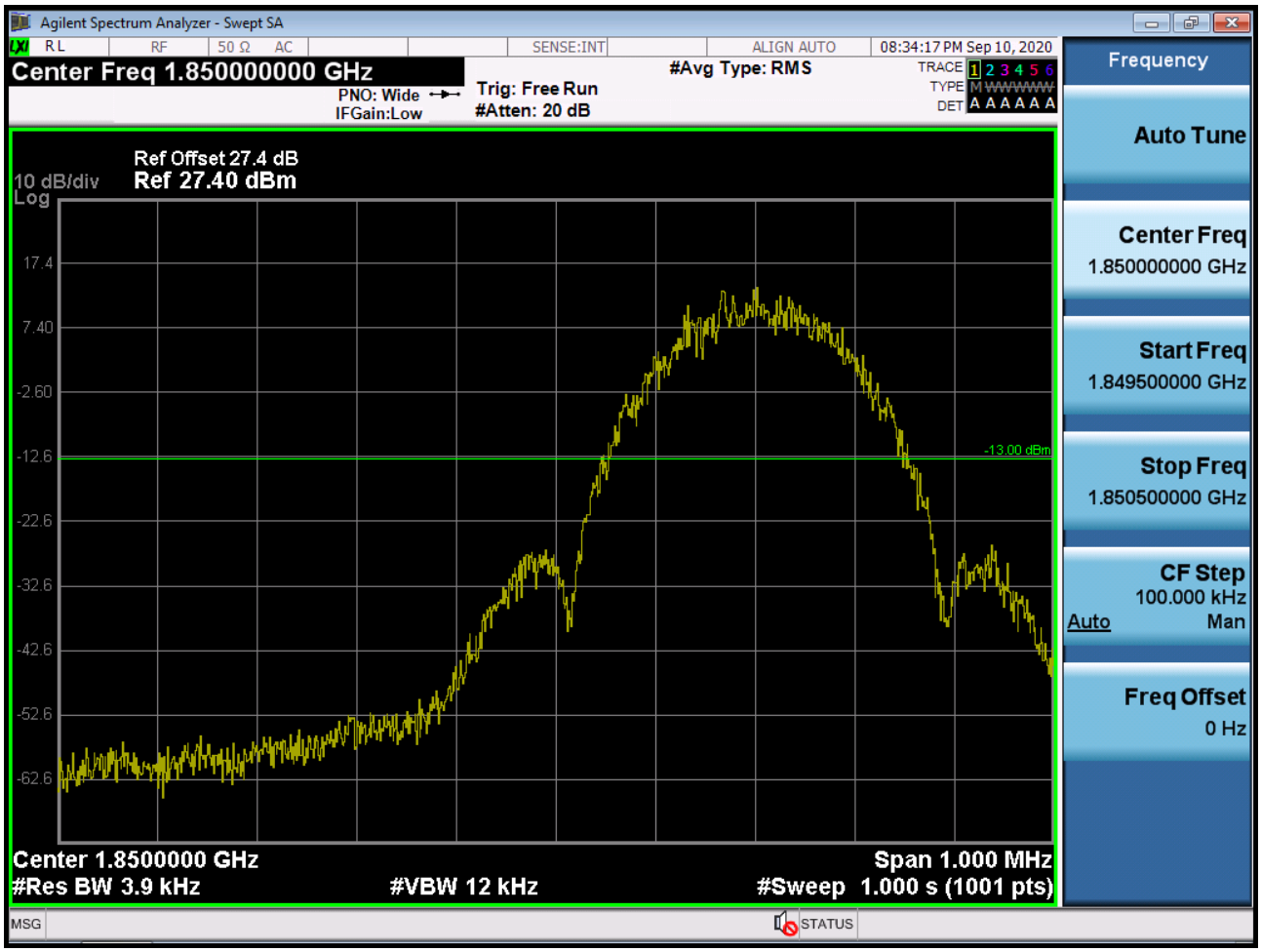
■ GSM1900 MODE (810 CH.) Block Edge 3



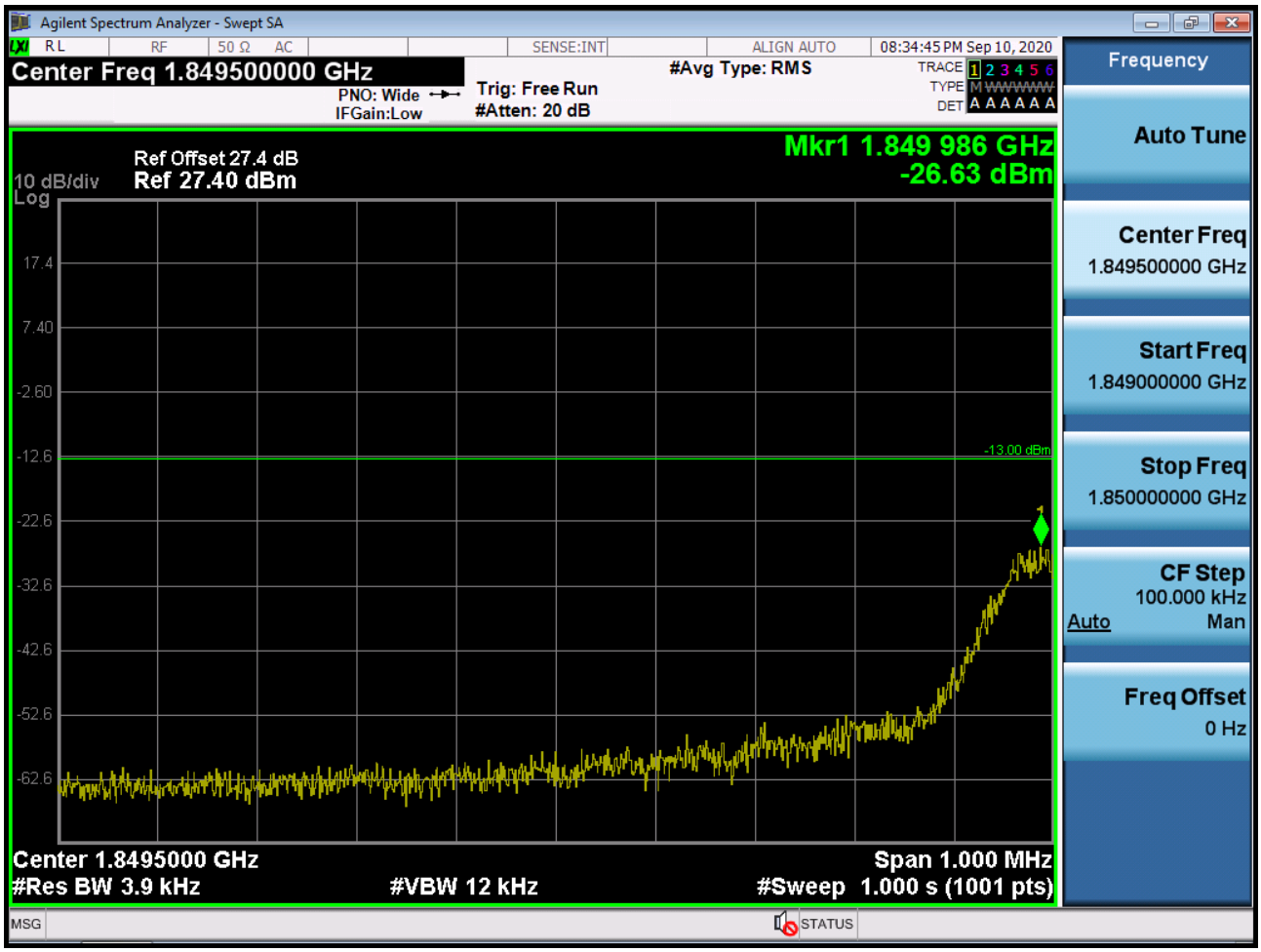

Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -48.495 dBm + 10 dB = -38.495 dBm

■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



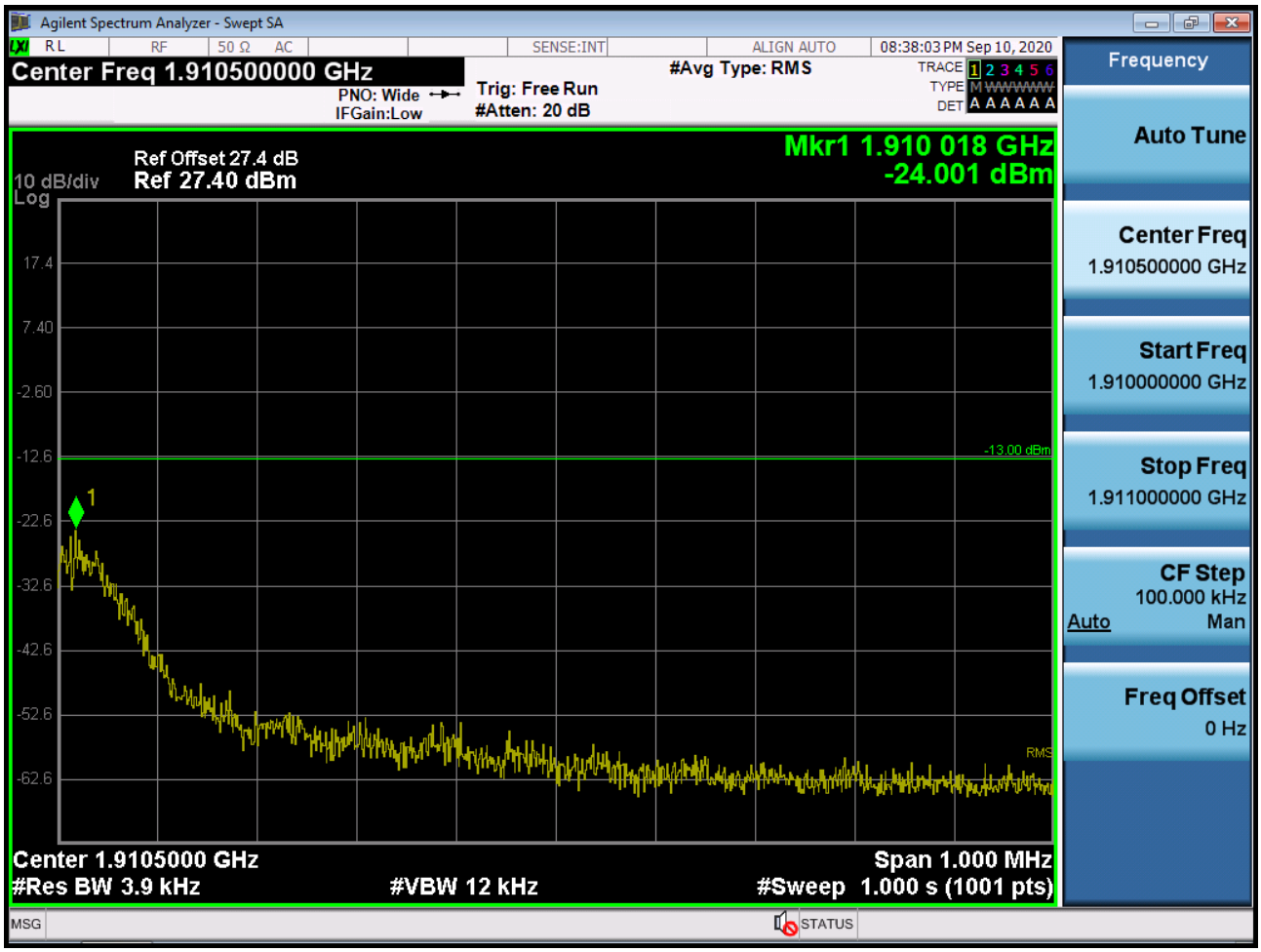
■ EDGE MODE (512 CH.) Block Edge 3


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

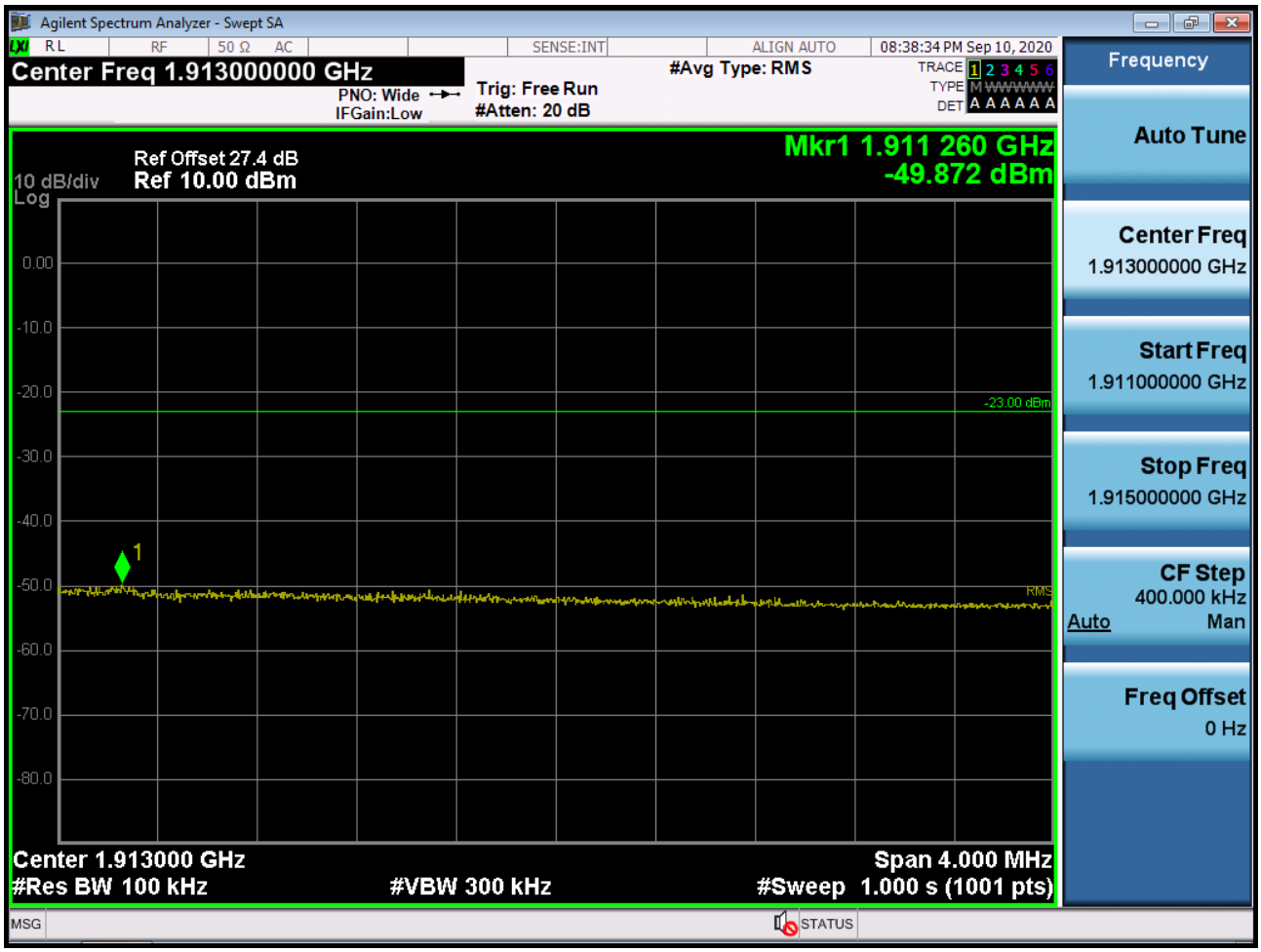
Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -50.11 dBm + 10 dB = -40.11 dBm

■ EDGE MODE (810 CH.) Block Edge 1

■ EDGE MODE (810 CH.) Block Edge 2



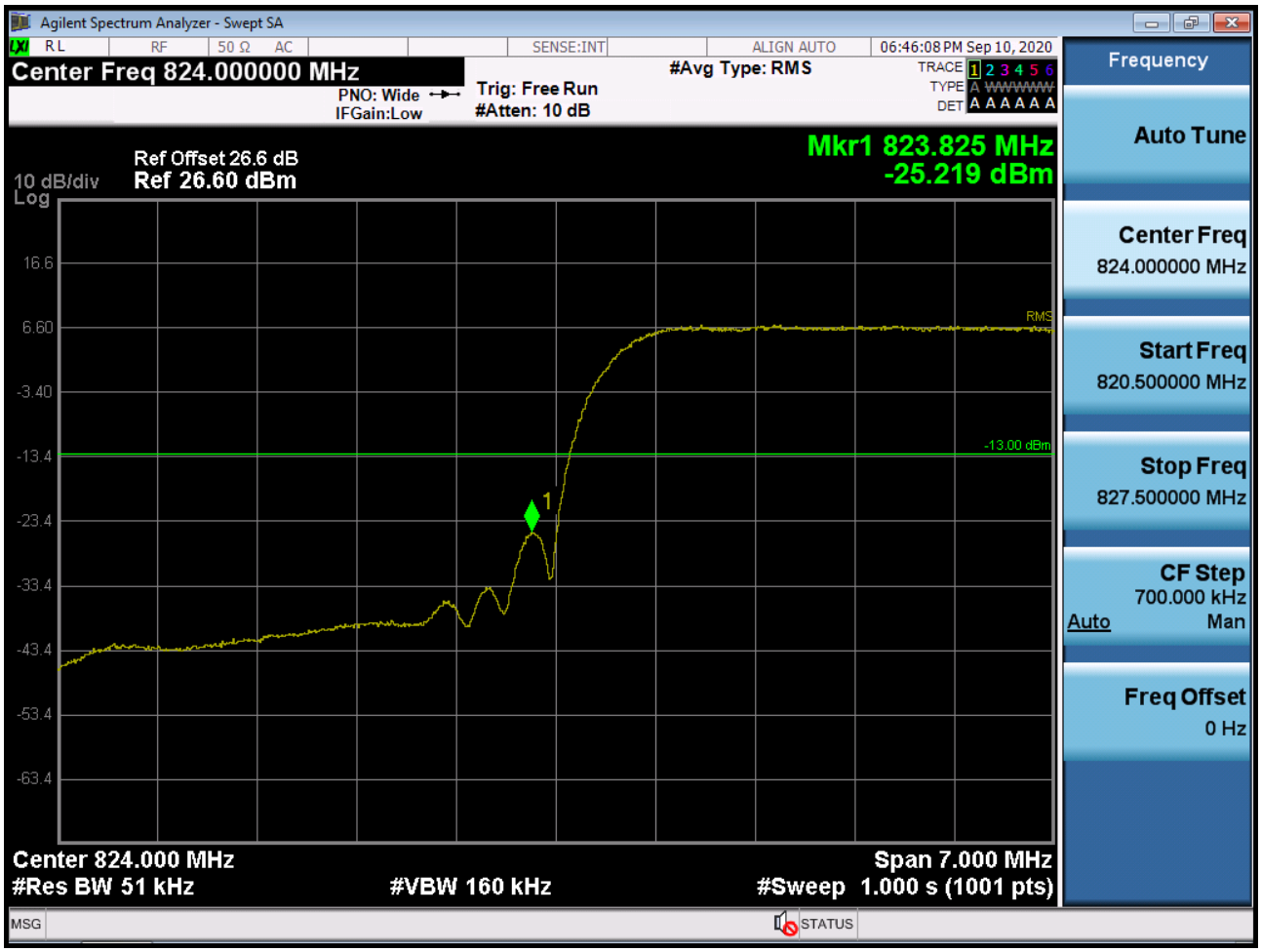
■ EDGE MODE (810 CH.) Block Edge 3




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

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -49.872 dBm + 10 dB = -39.872 dBm

■ WCDMA850 MODE (4132 CH.) Block Edge



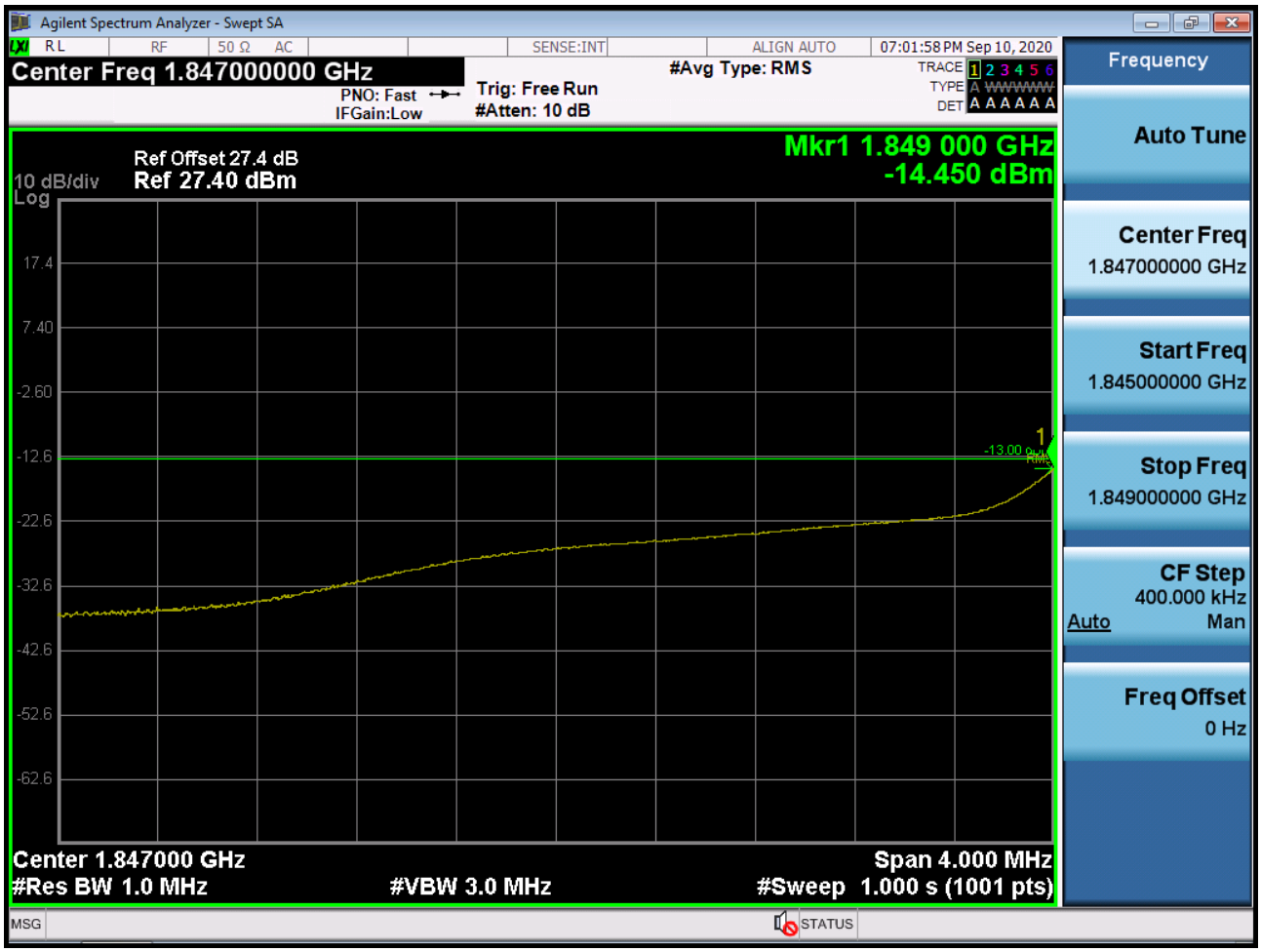
■ WCDMA850 MODE (4132 CH.) – 4 MHz Span

■ 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

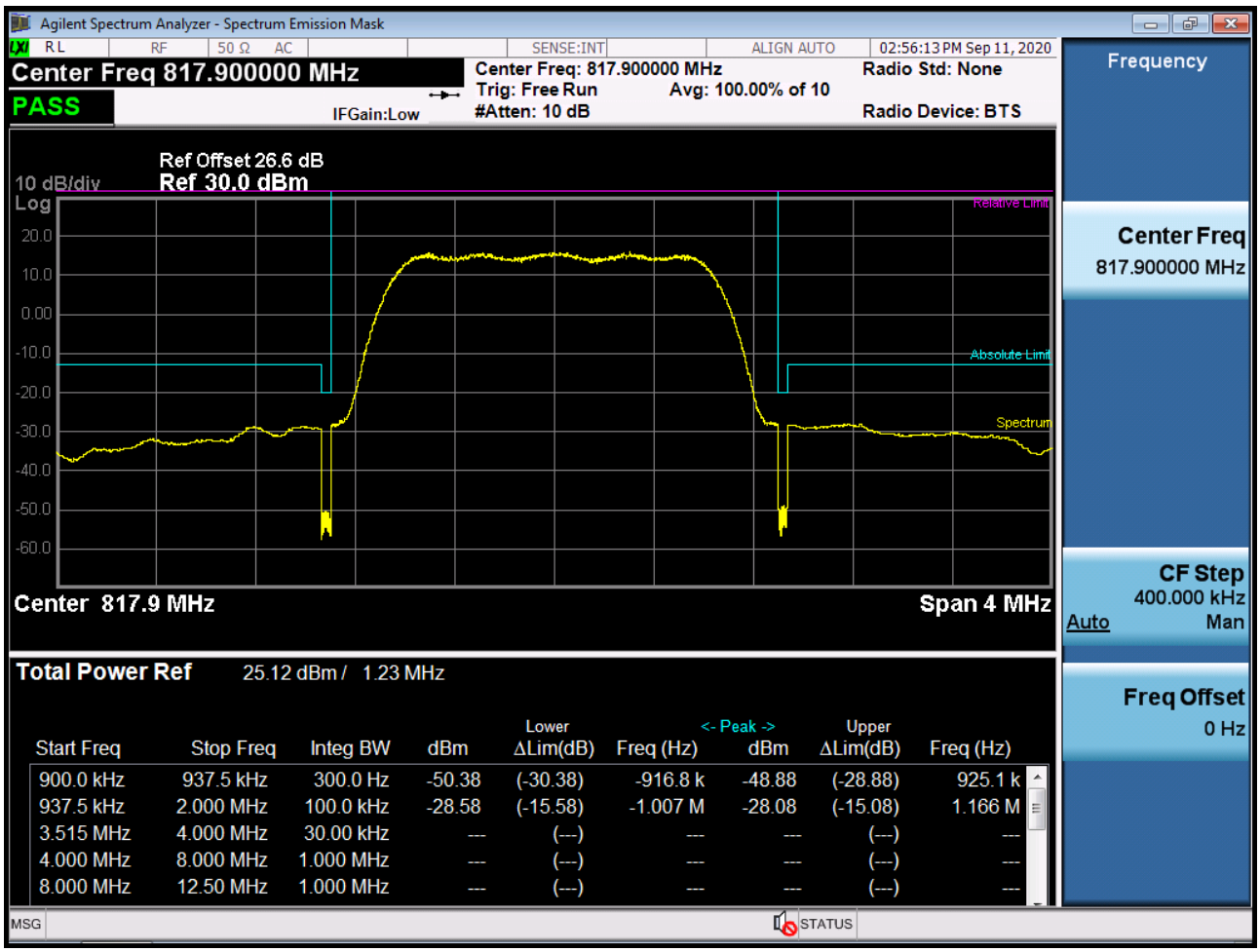
■ WCDMA1700 MODE (1312 CH.) Block Edge

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

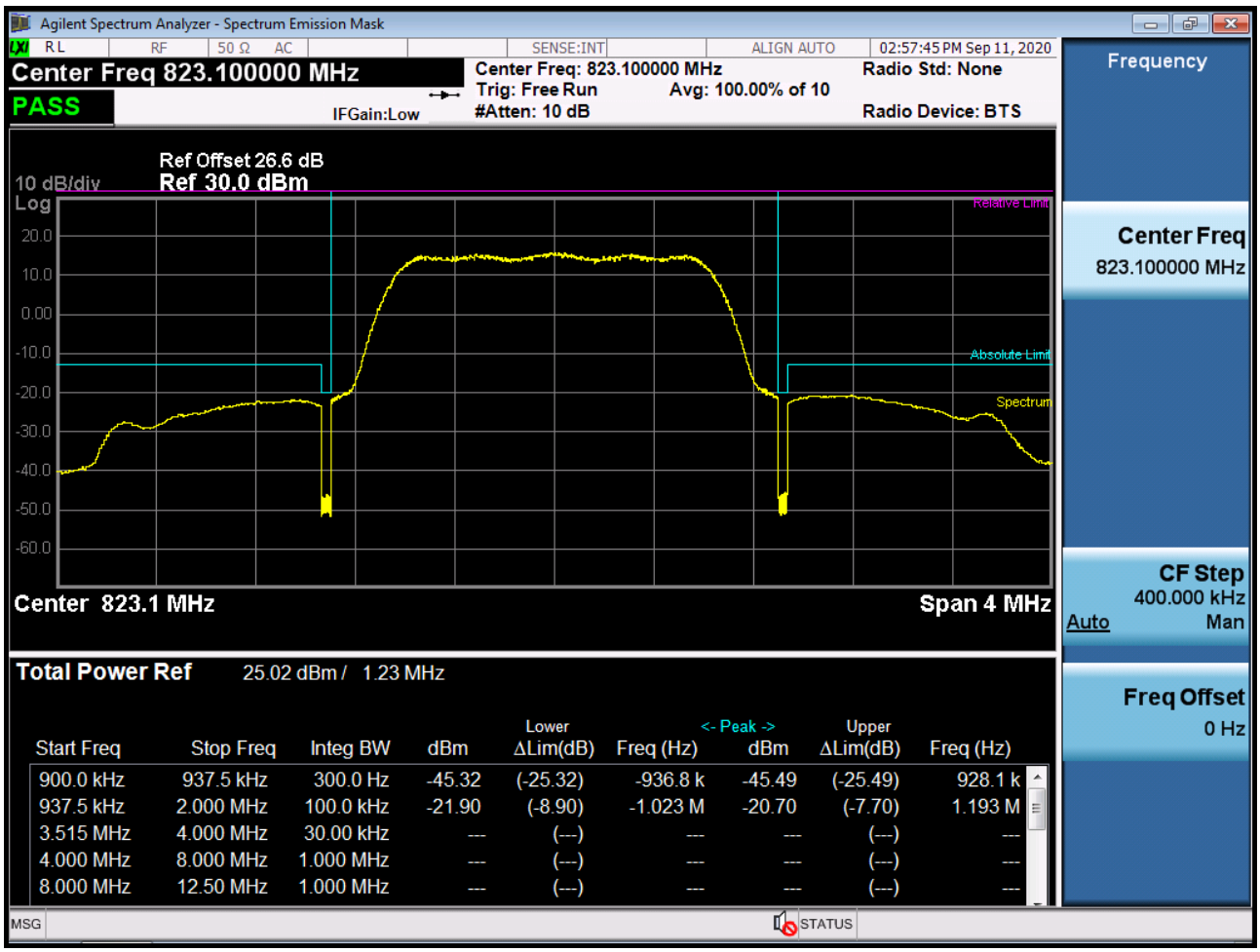
■ WCDMA1700 MODE (1513 CH.) Block Edge

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

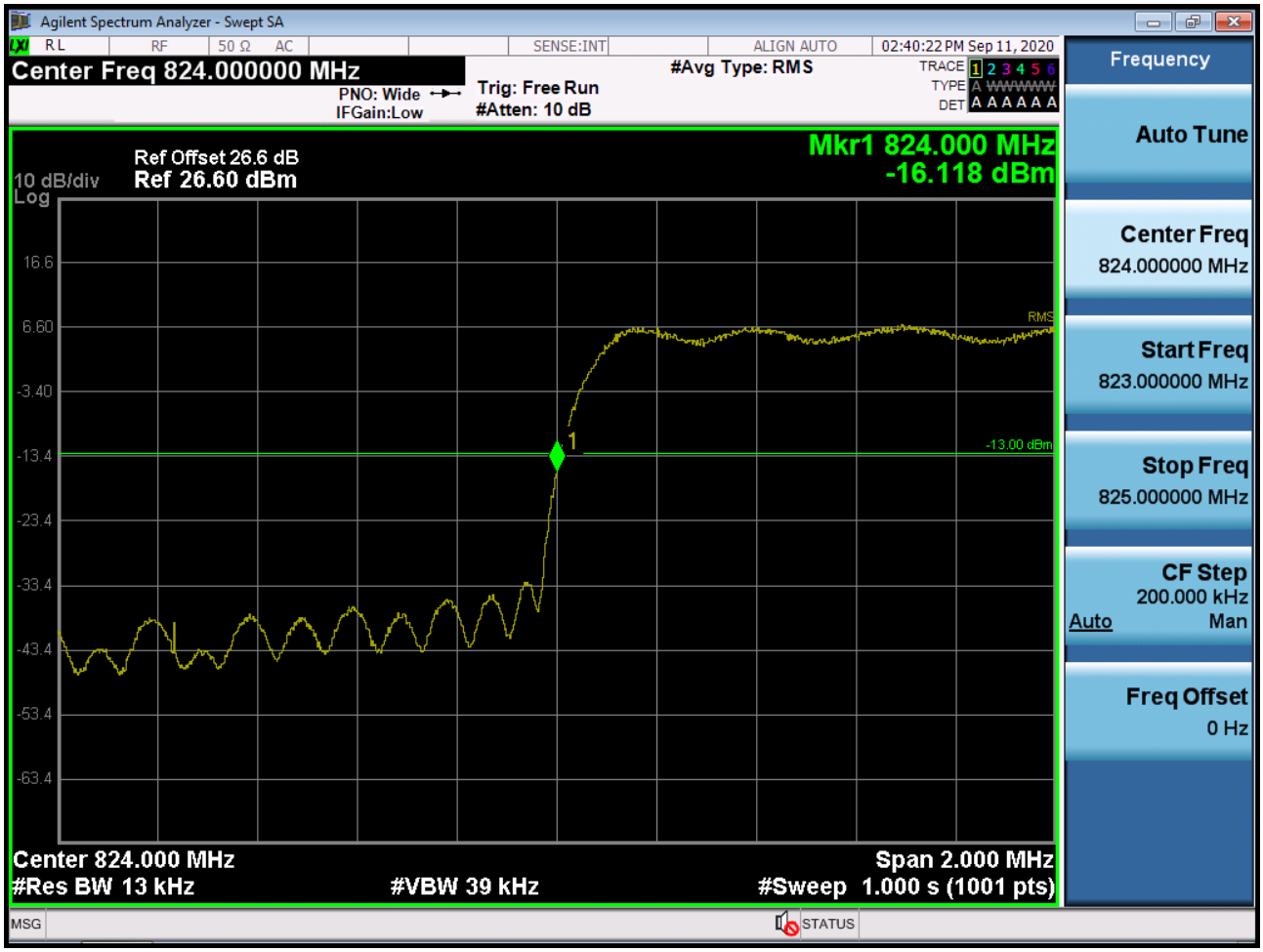
■ CDMA Secondary800 MODE (476 CH.) Block Edge



■ CDMA Secondary800 MODE (684 CH.) Block Edge



■ CDMA850 MODE (1013 CH.) Block Edge

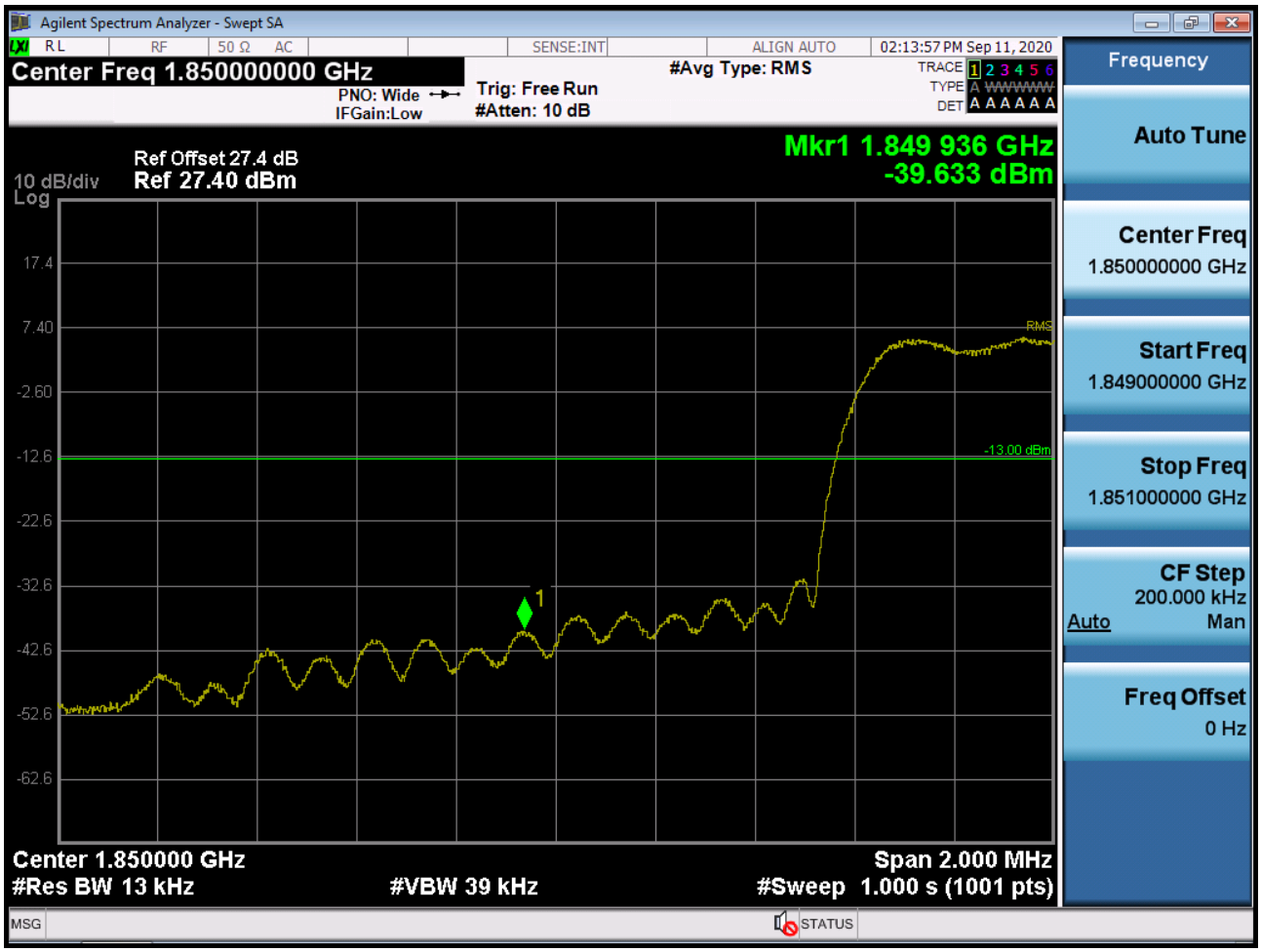


■ CDMA850 MODE (1013 CH.) 4 MHz Span

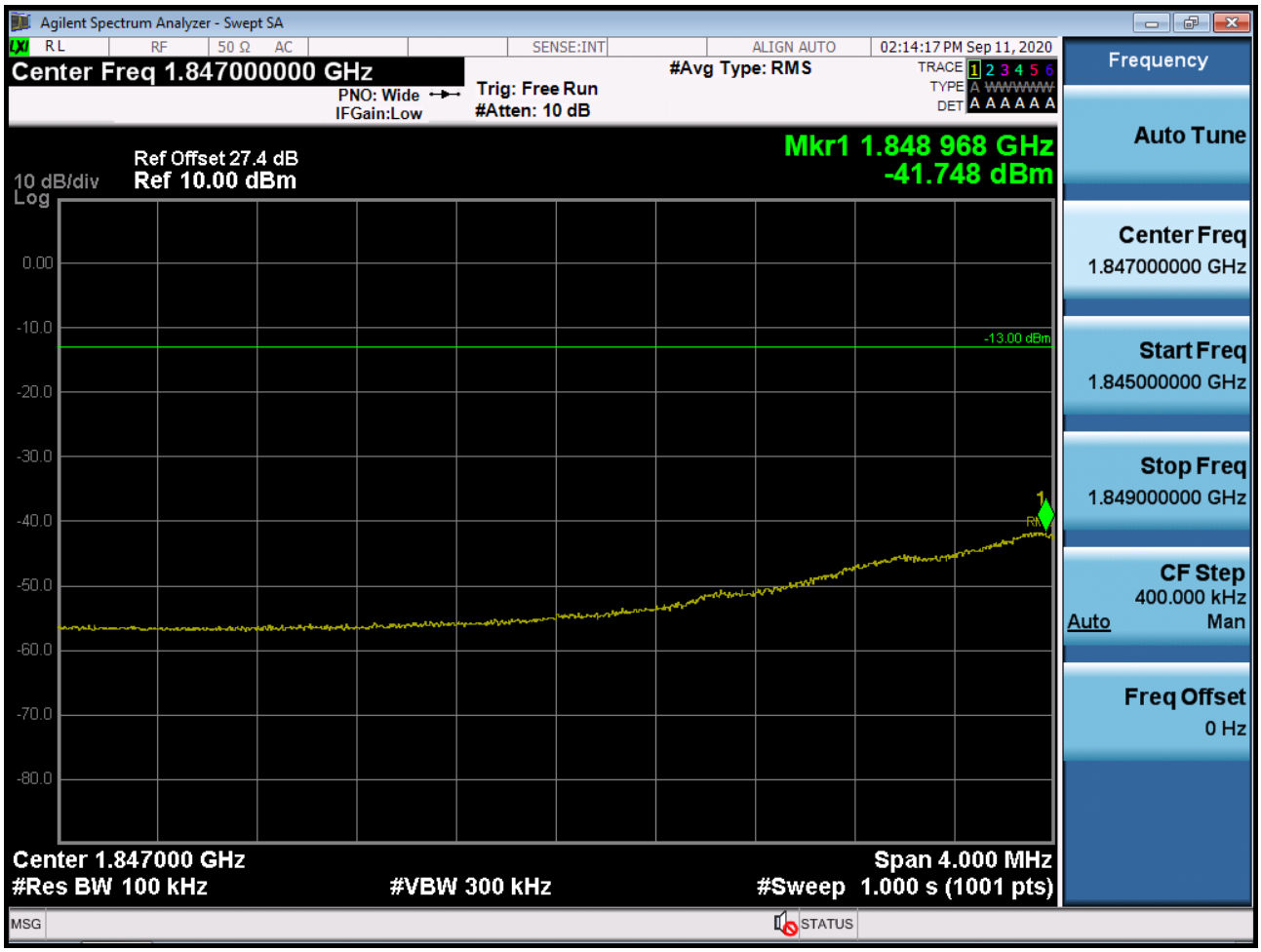
■ CDMA850 MODE (777 CH.) Block Edge_1

■ CDMA850 MODE (777 CH.) 4 MHz Span

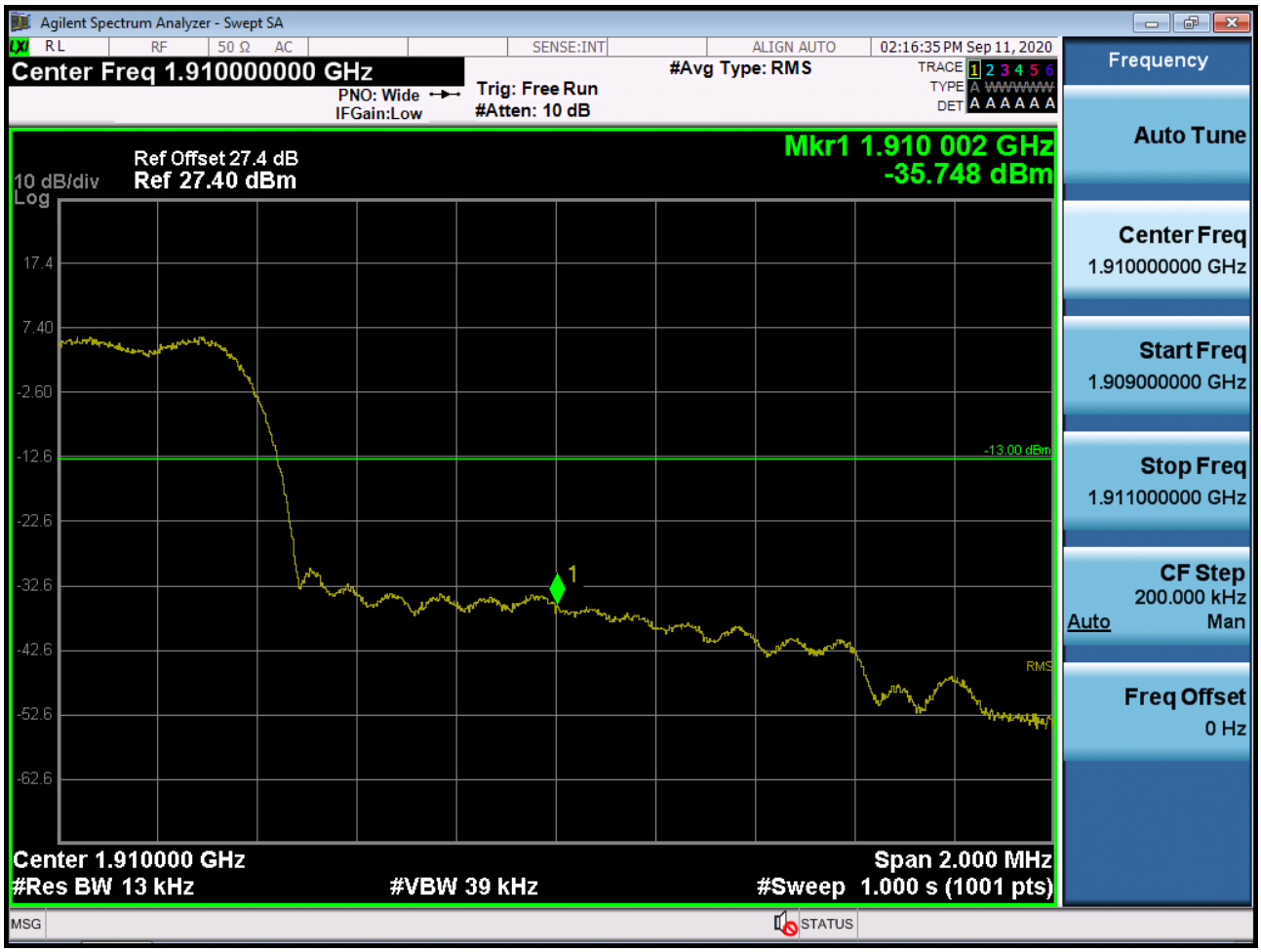
■ CDMA PCS MODE (25 CH.) Block Edge pan



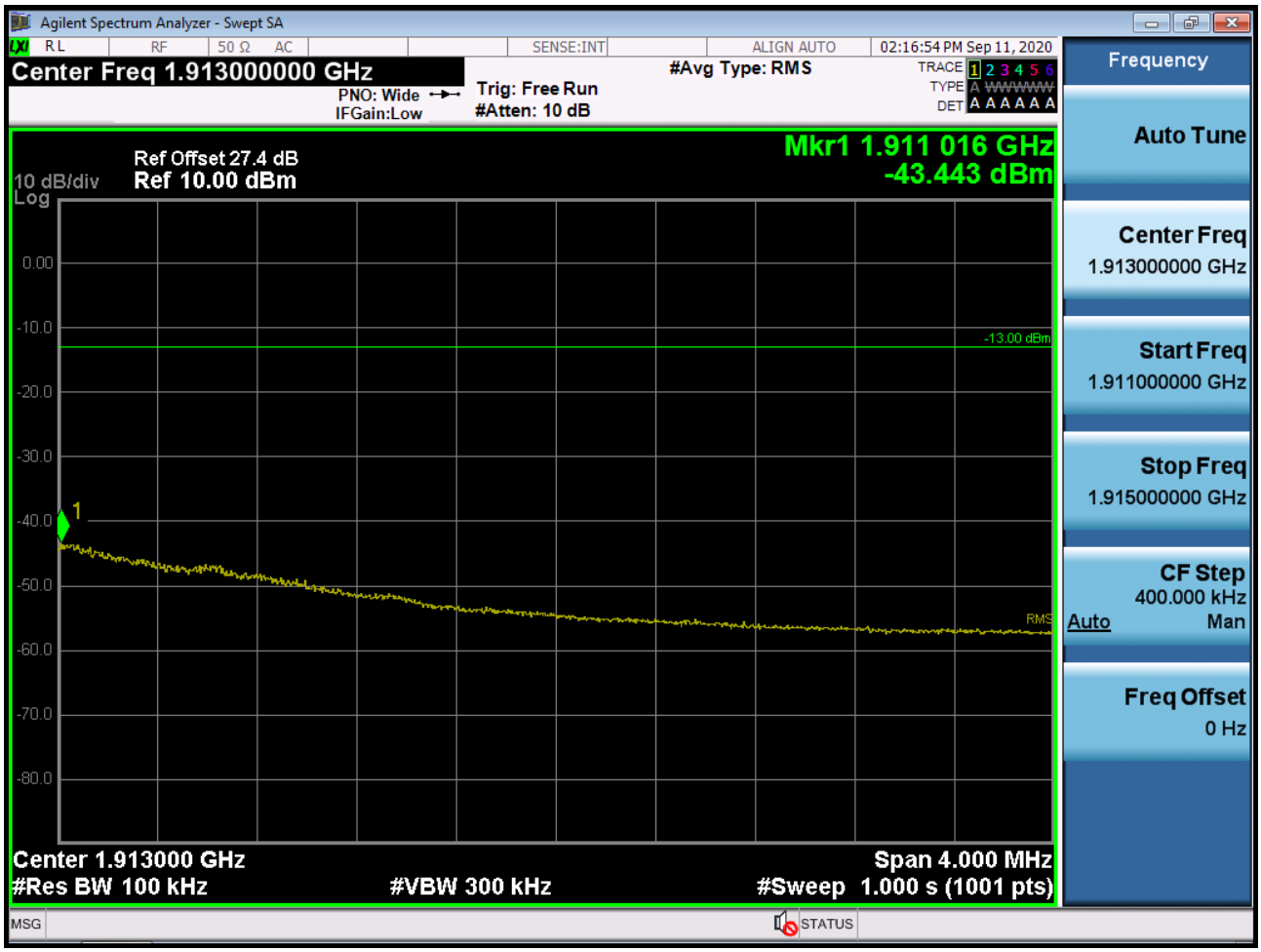
■ CDMA PCS MODE (25 CH.) 4 MHz Span



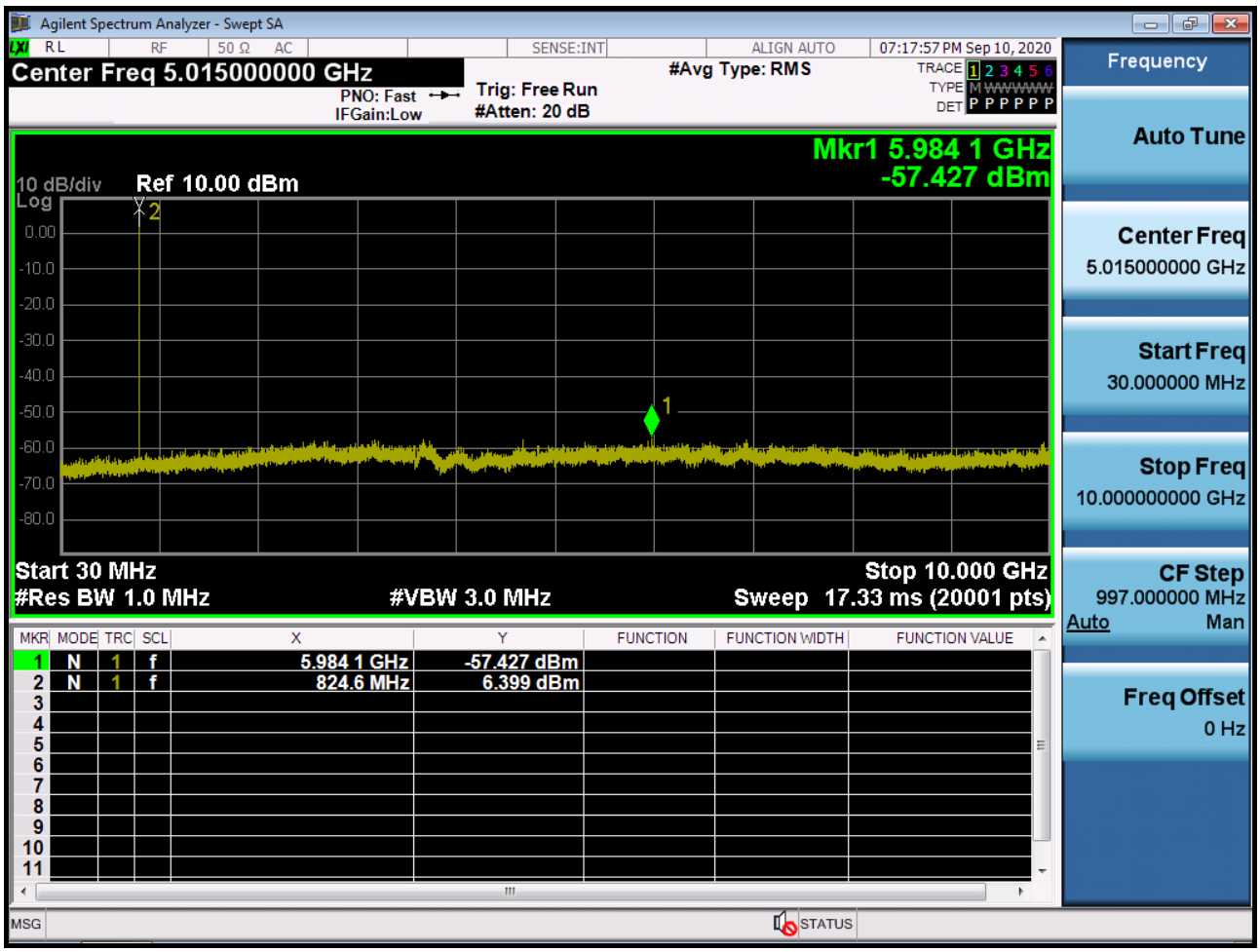
■ CDMA PCS MODE (1175 CH.) Block Edge



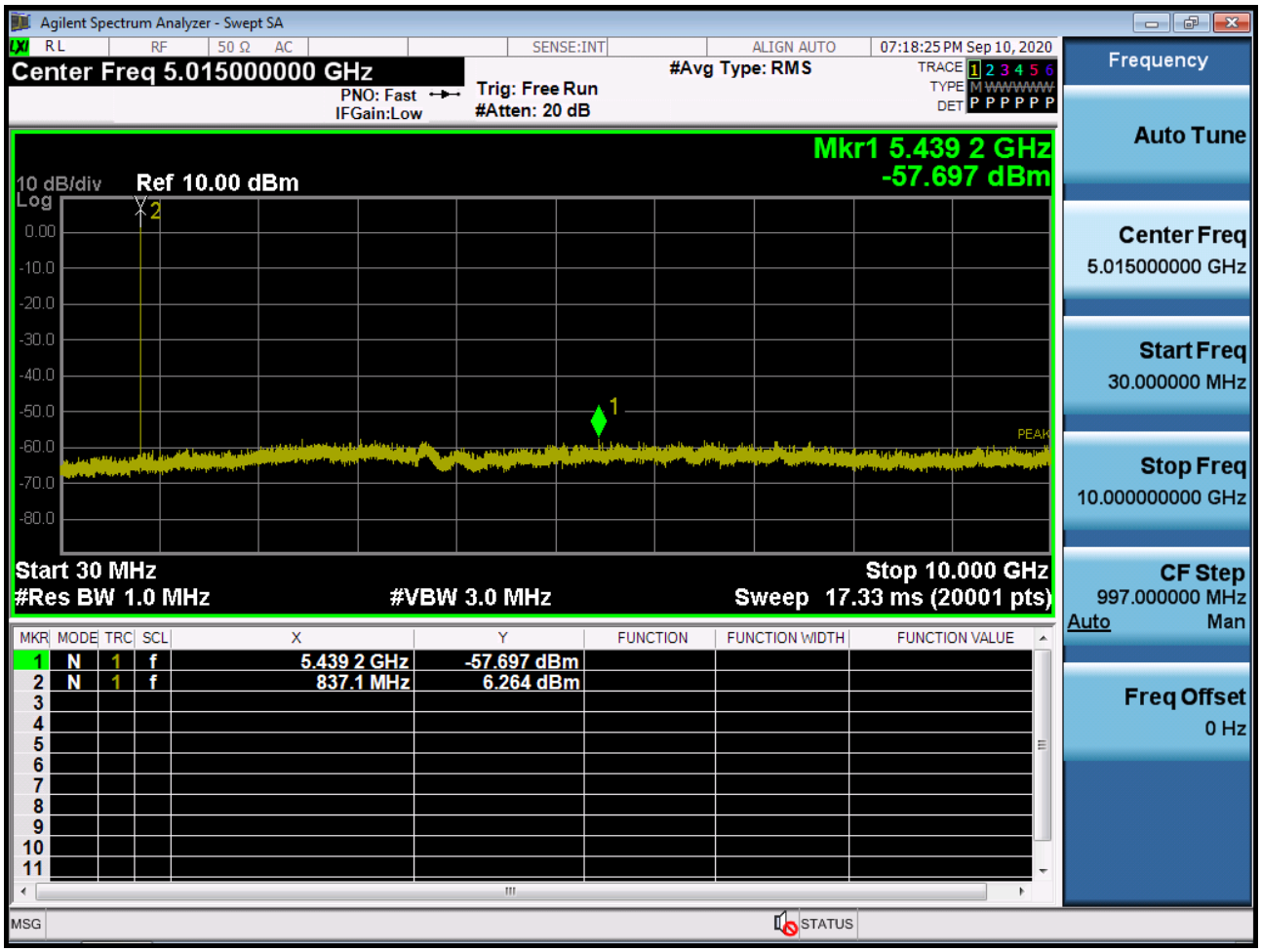
■ CDMA PCS MODE (1175 CH.) 4 MHz Span



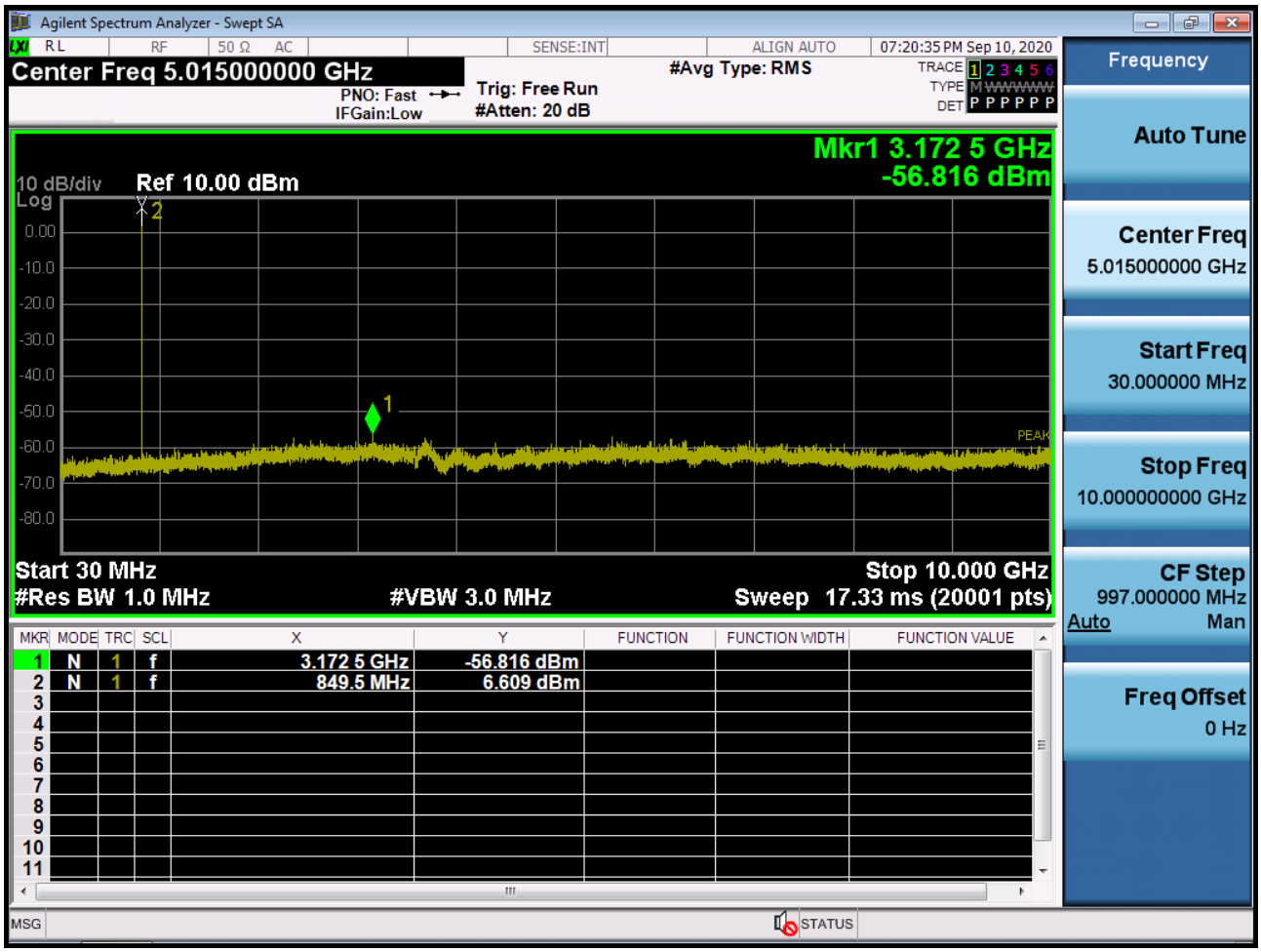
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions



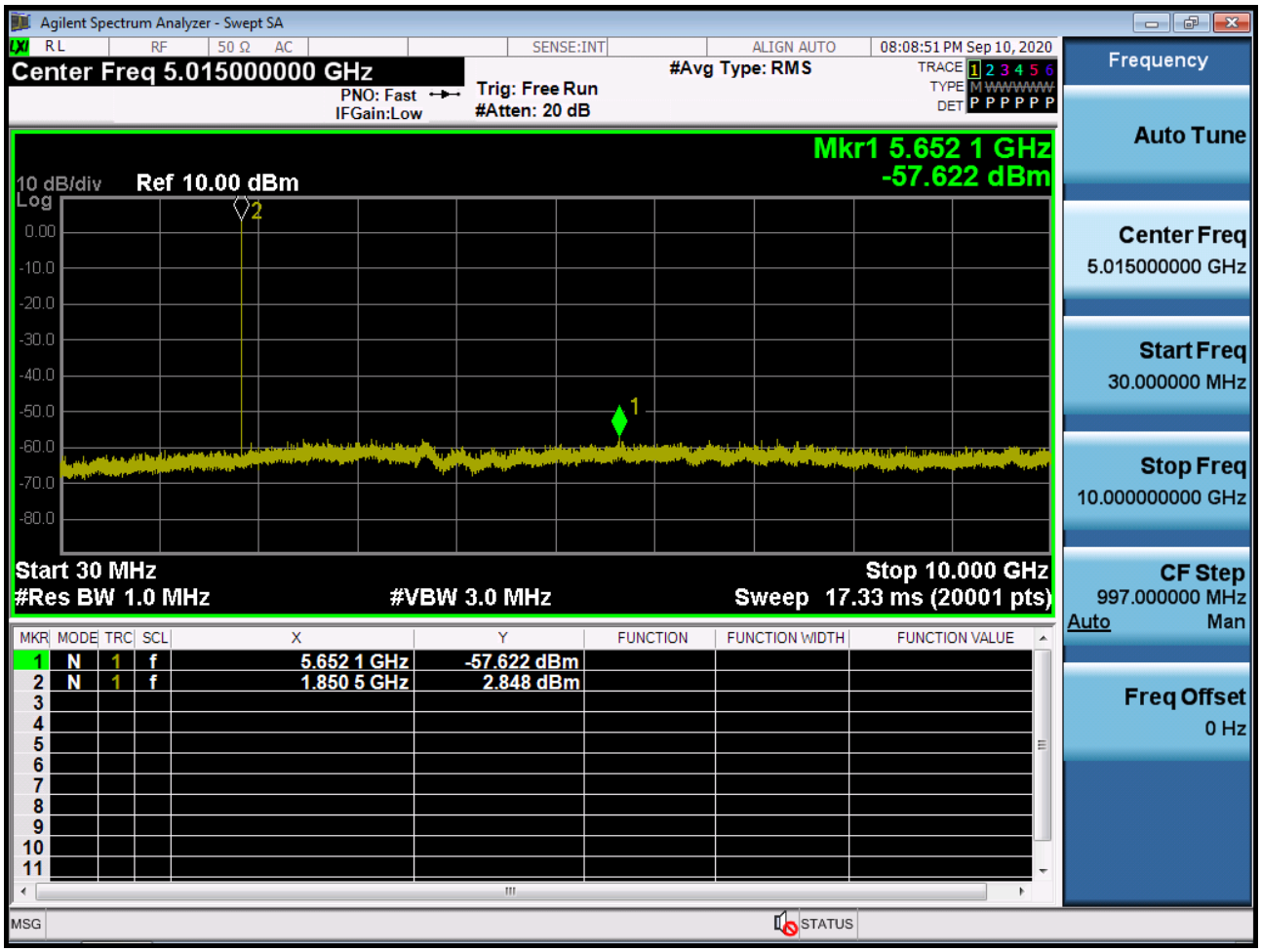
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions



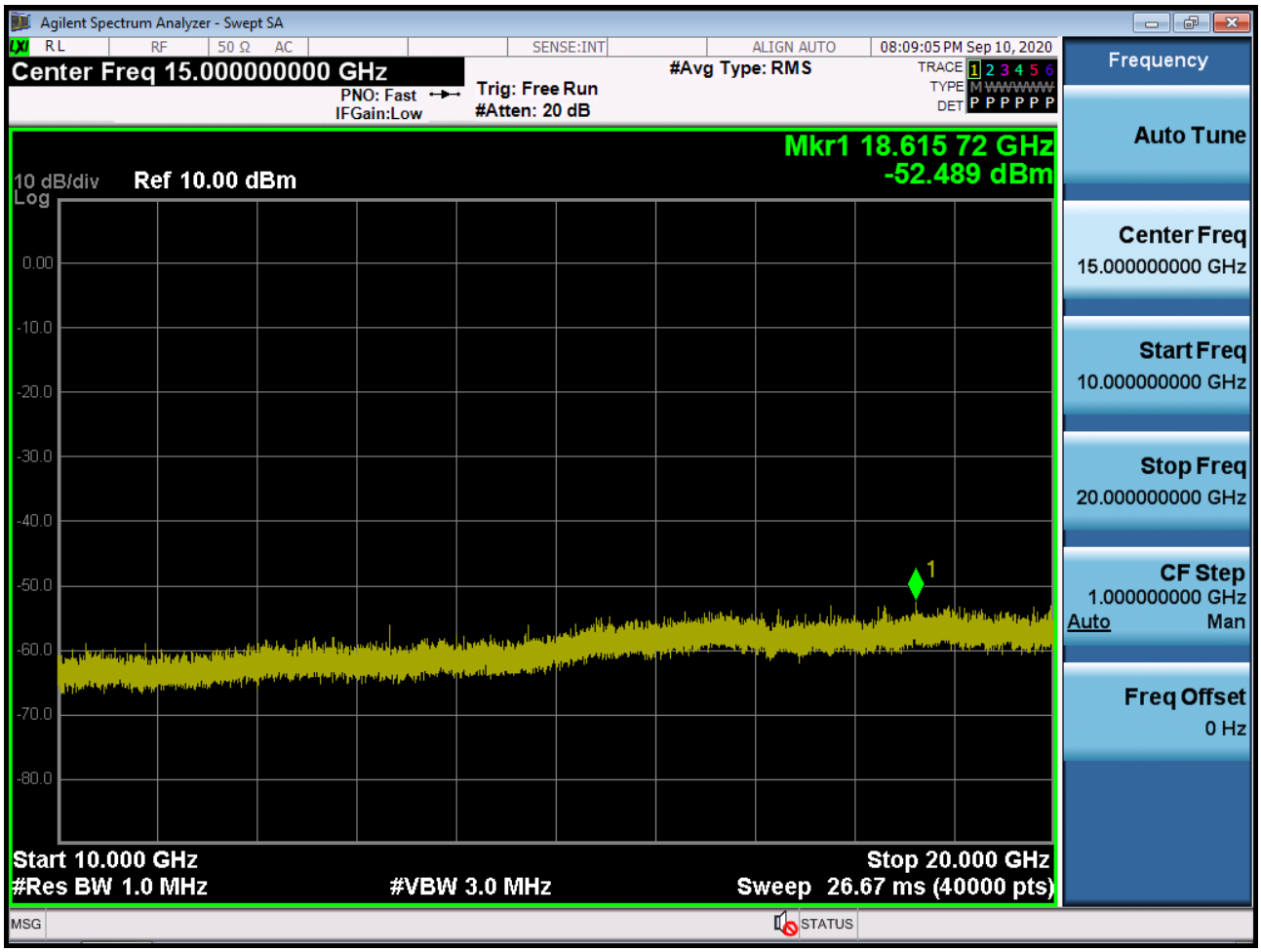
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions



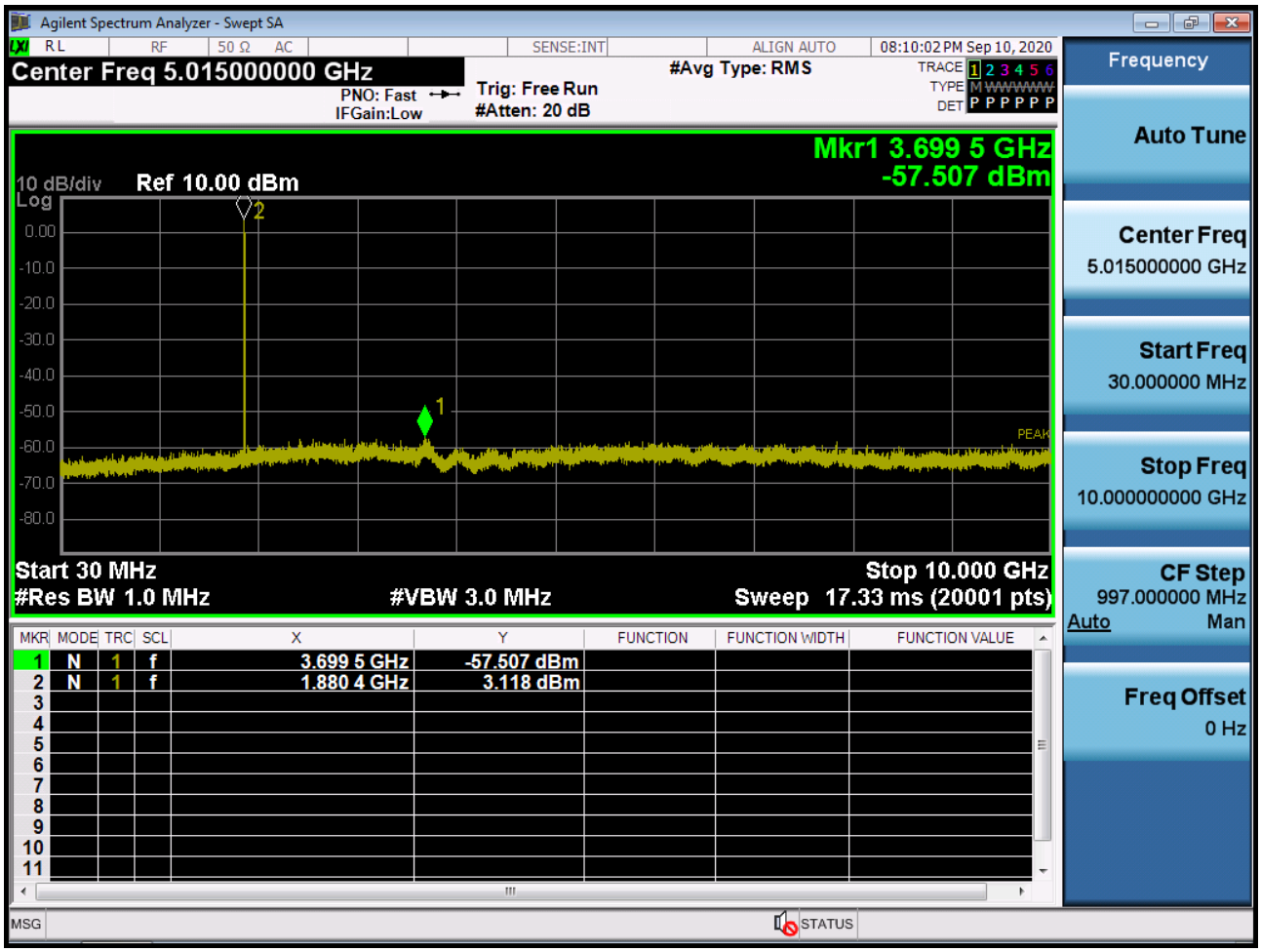
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



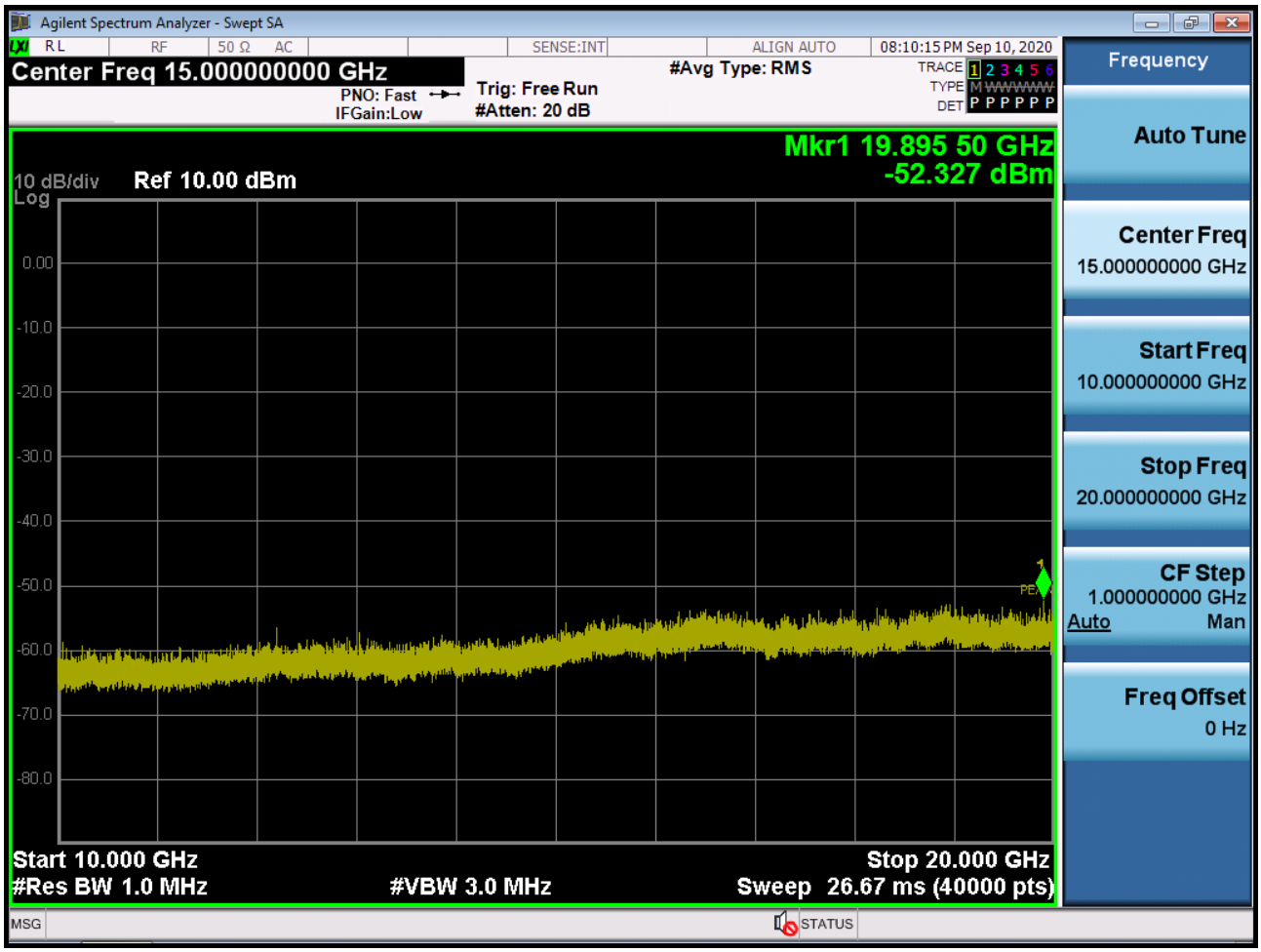
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



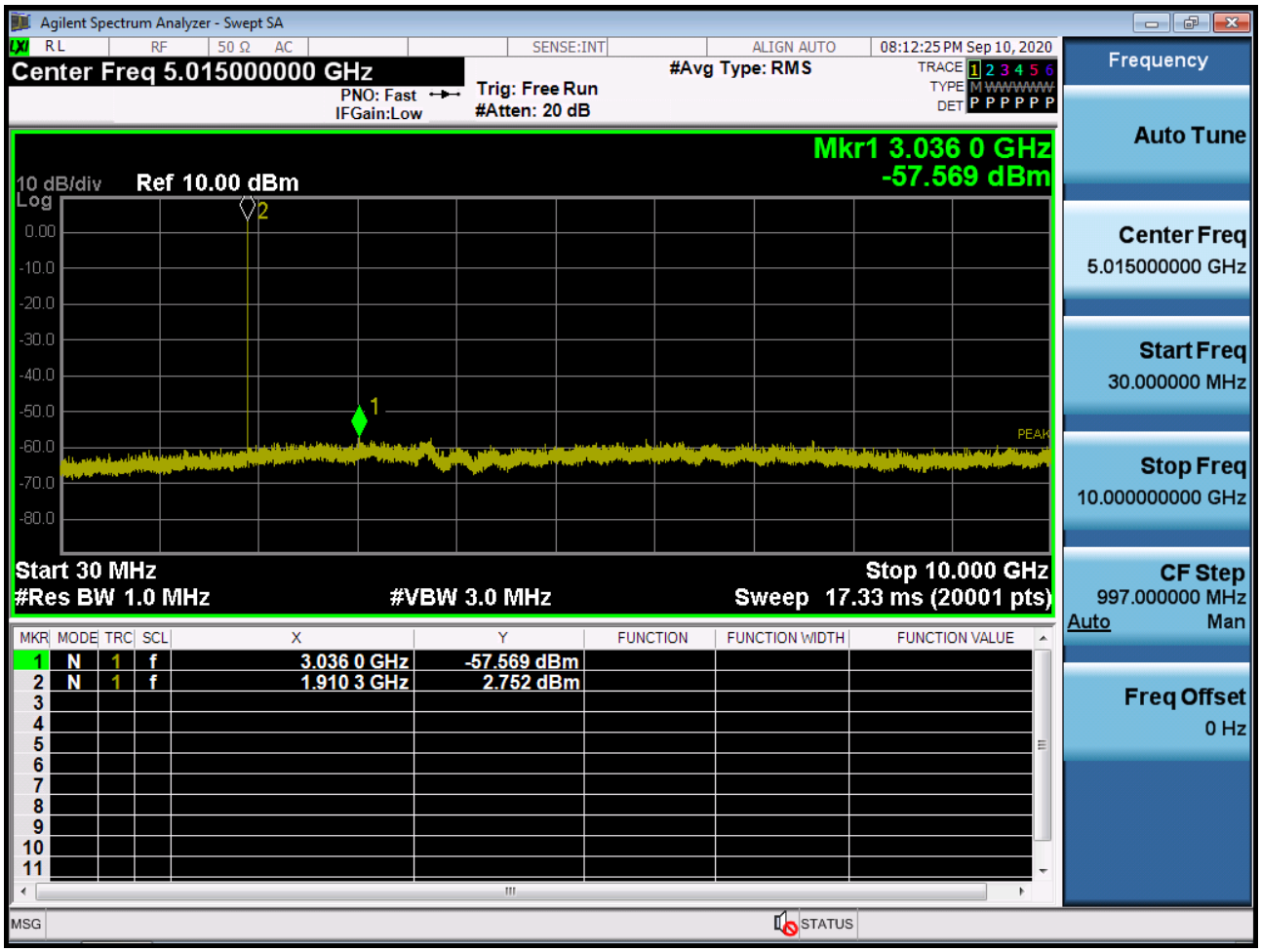
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



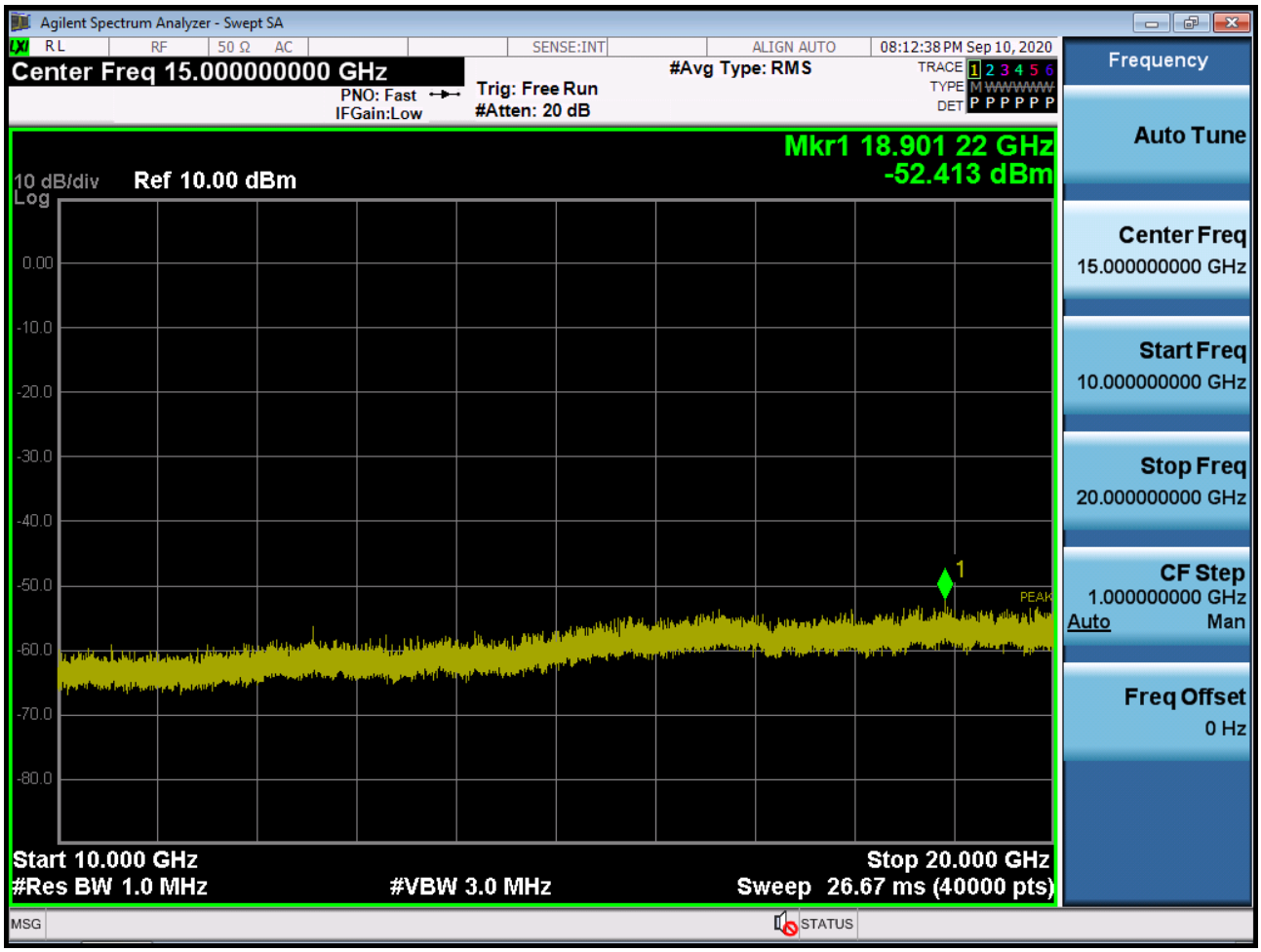
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



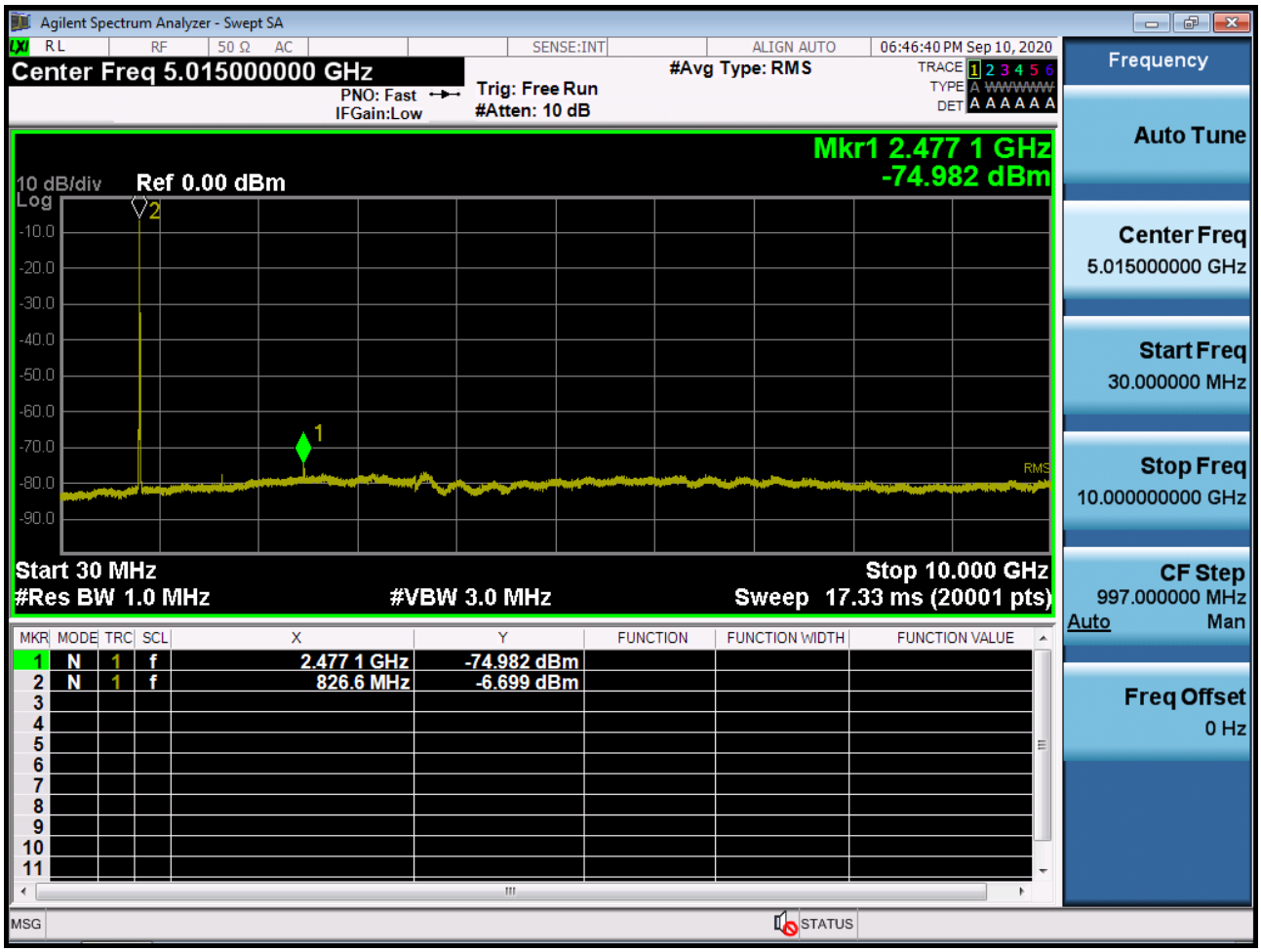
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



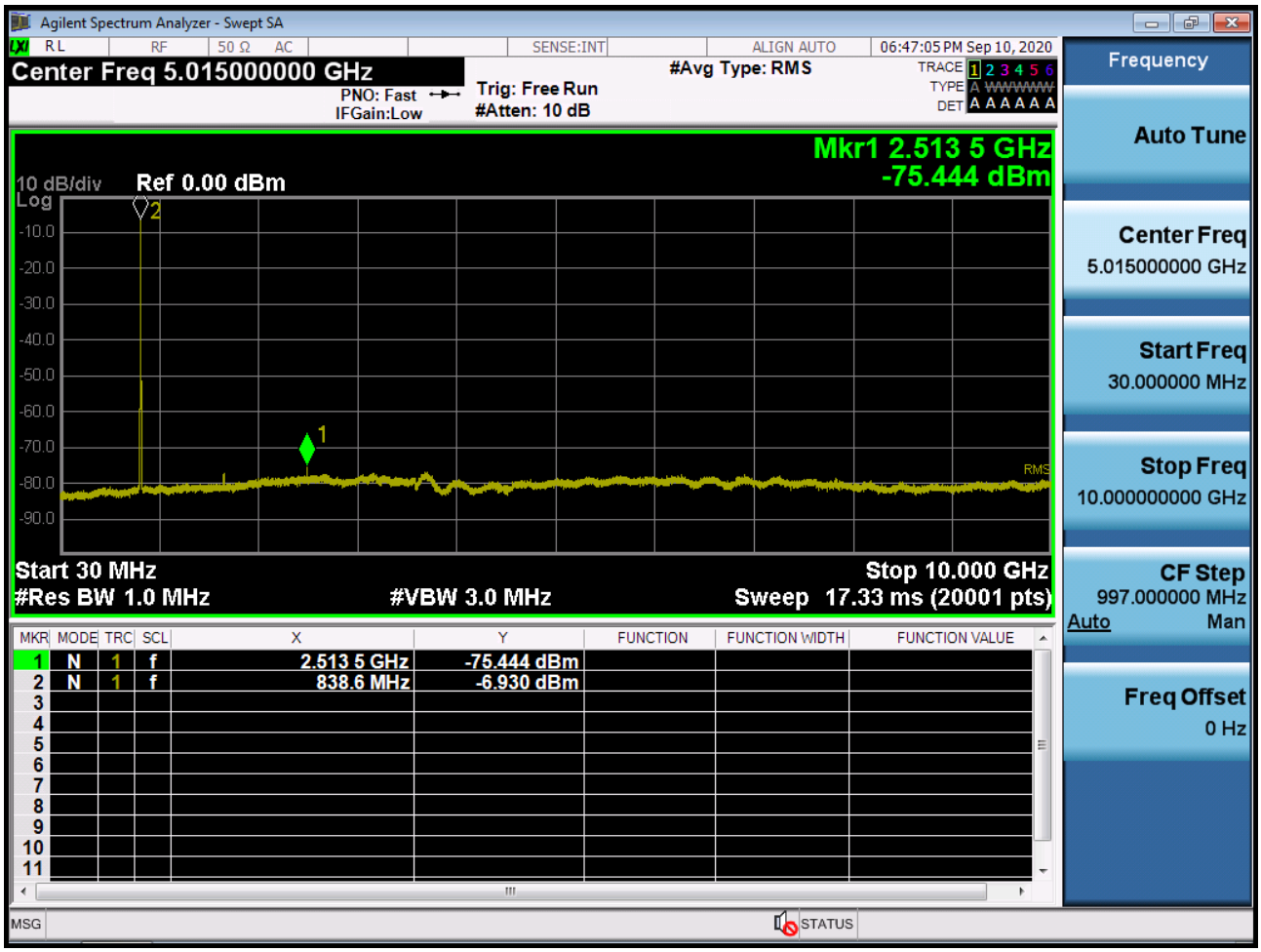
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



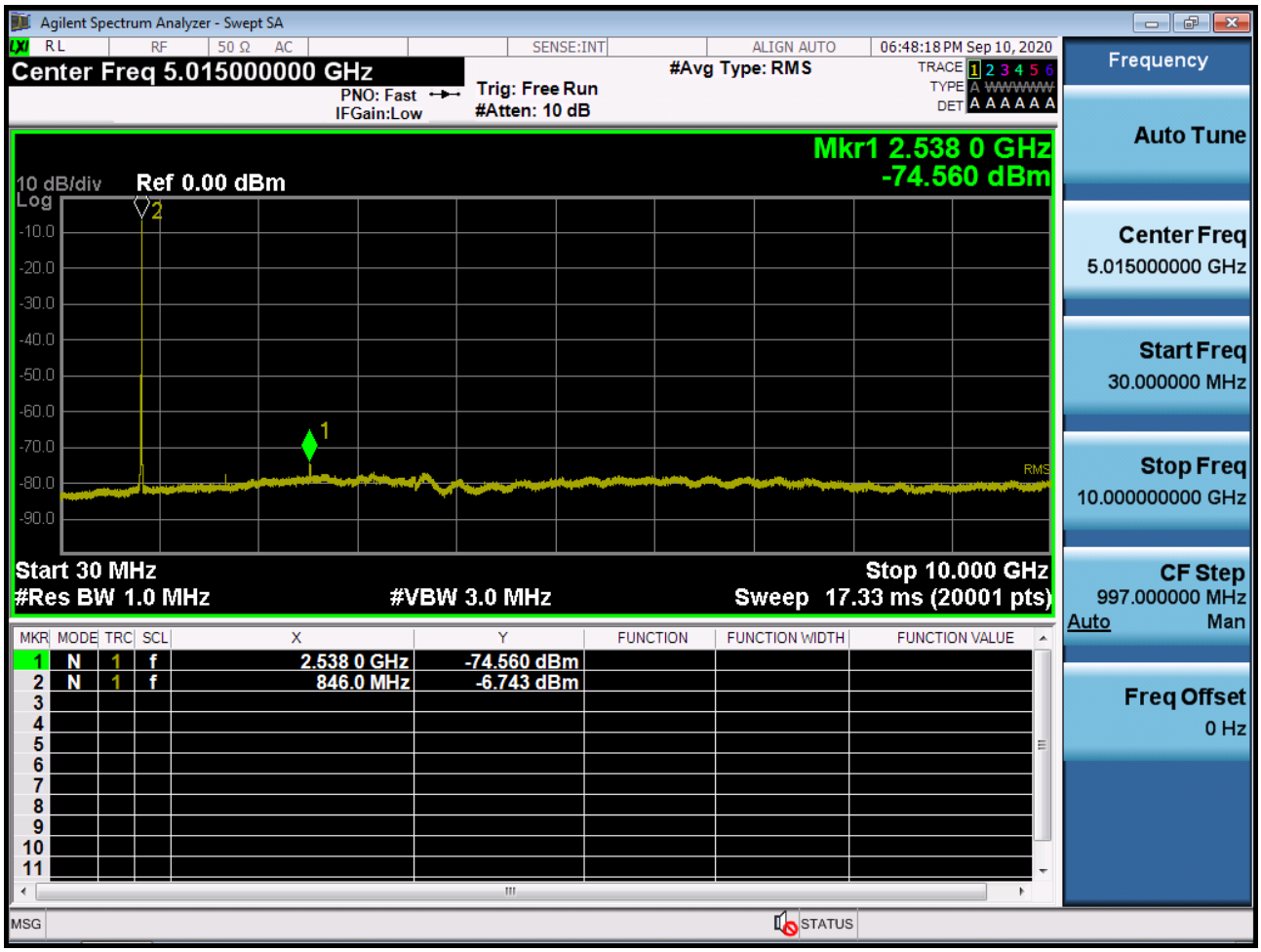
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



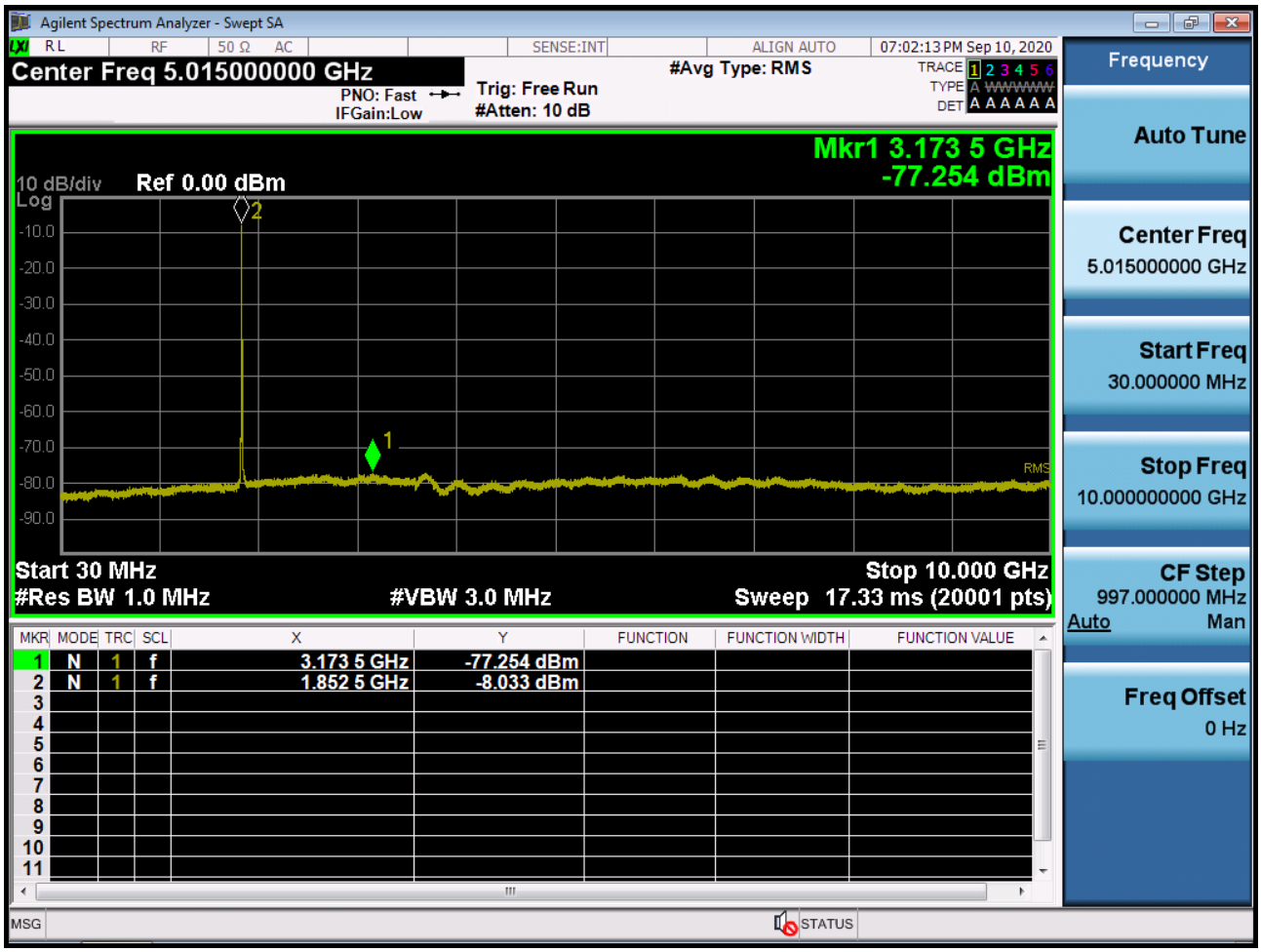
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



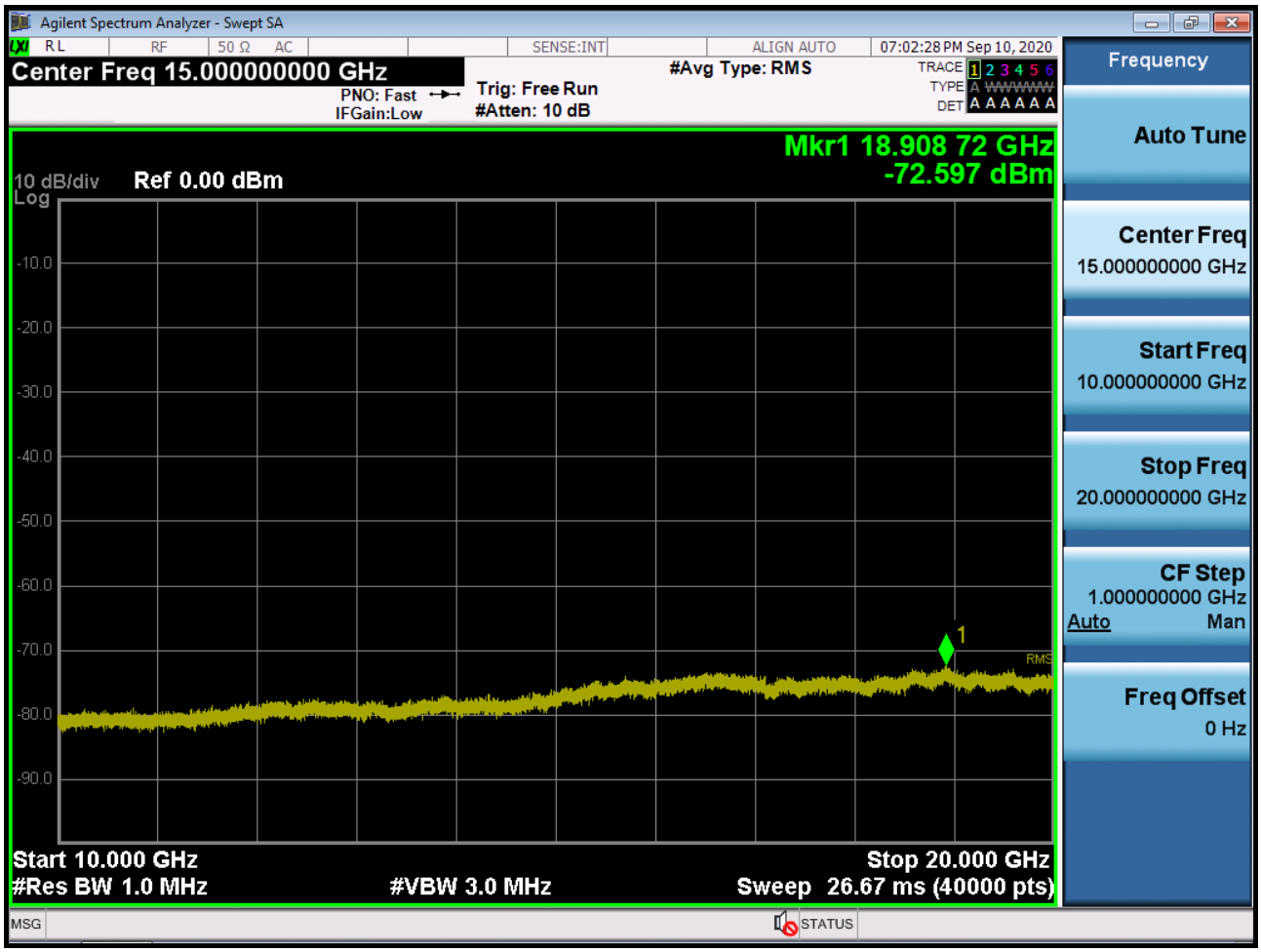
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions



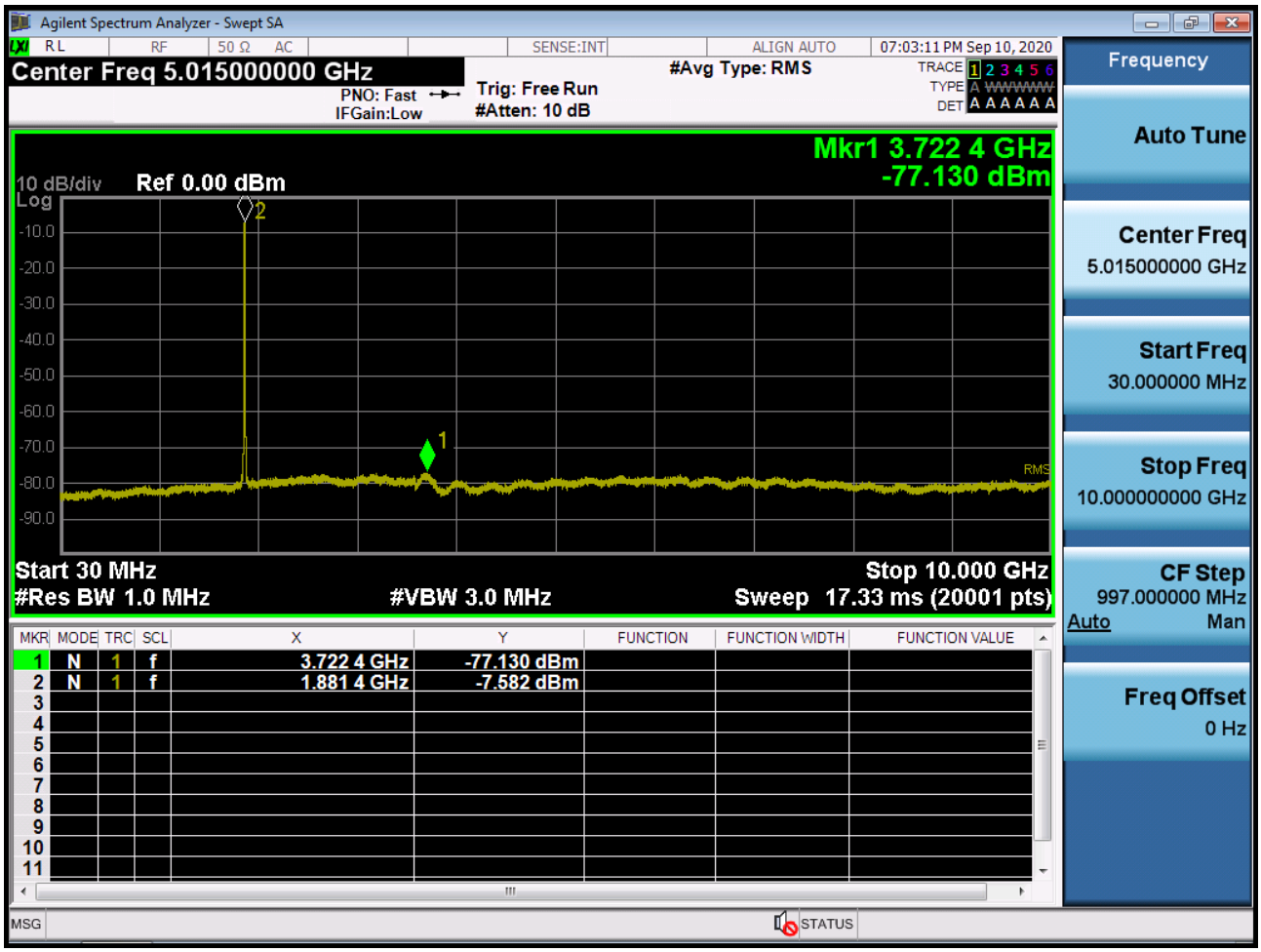
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions1



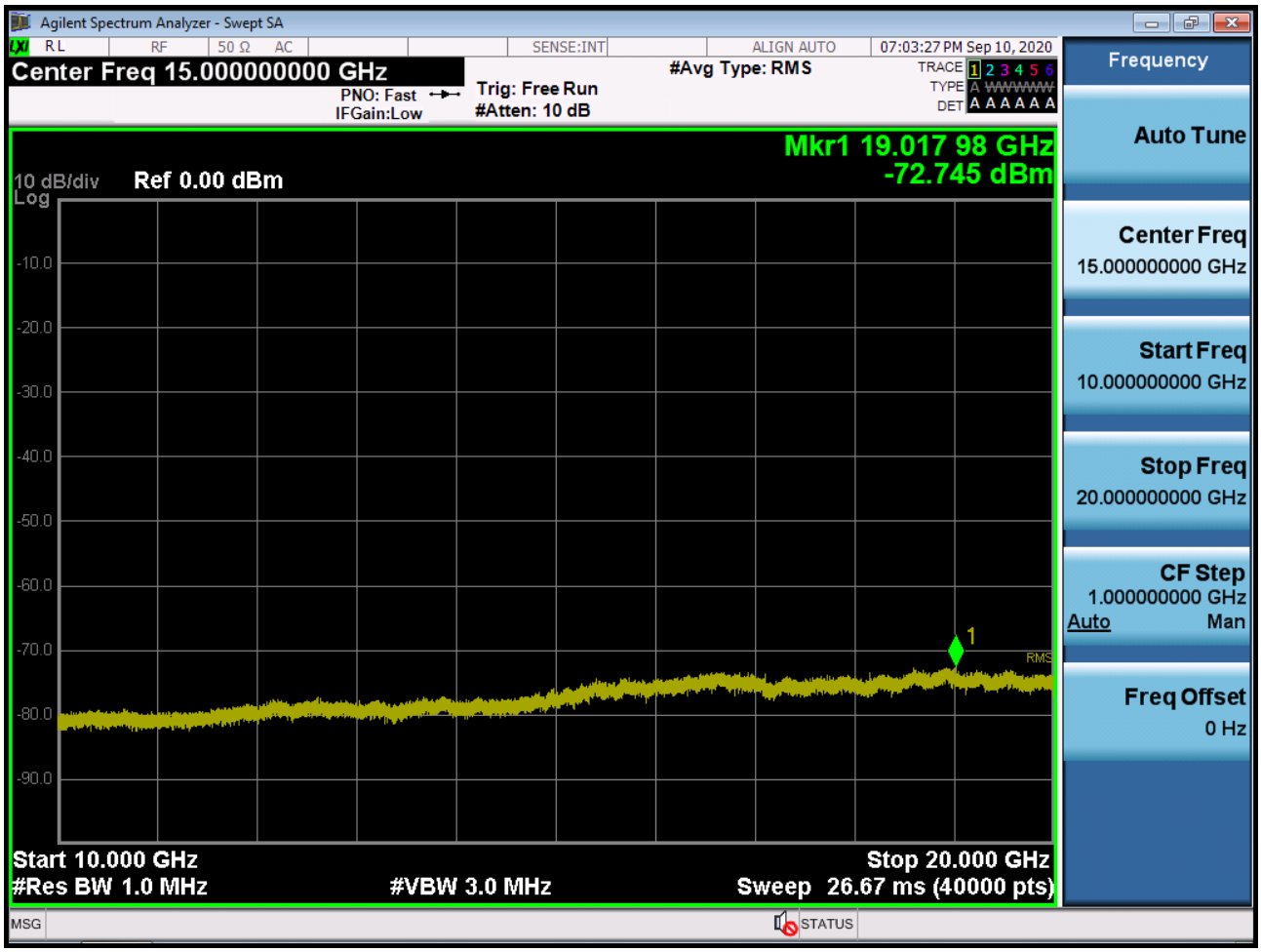
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



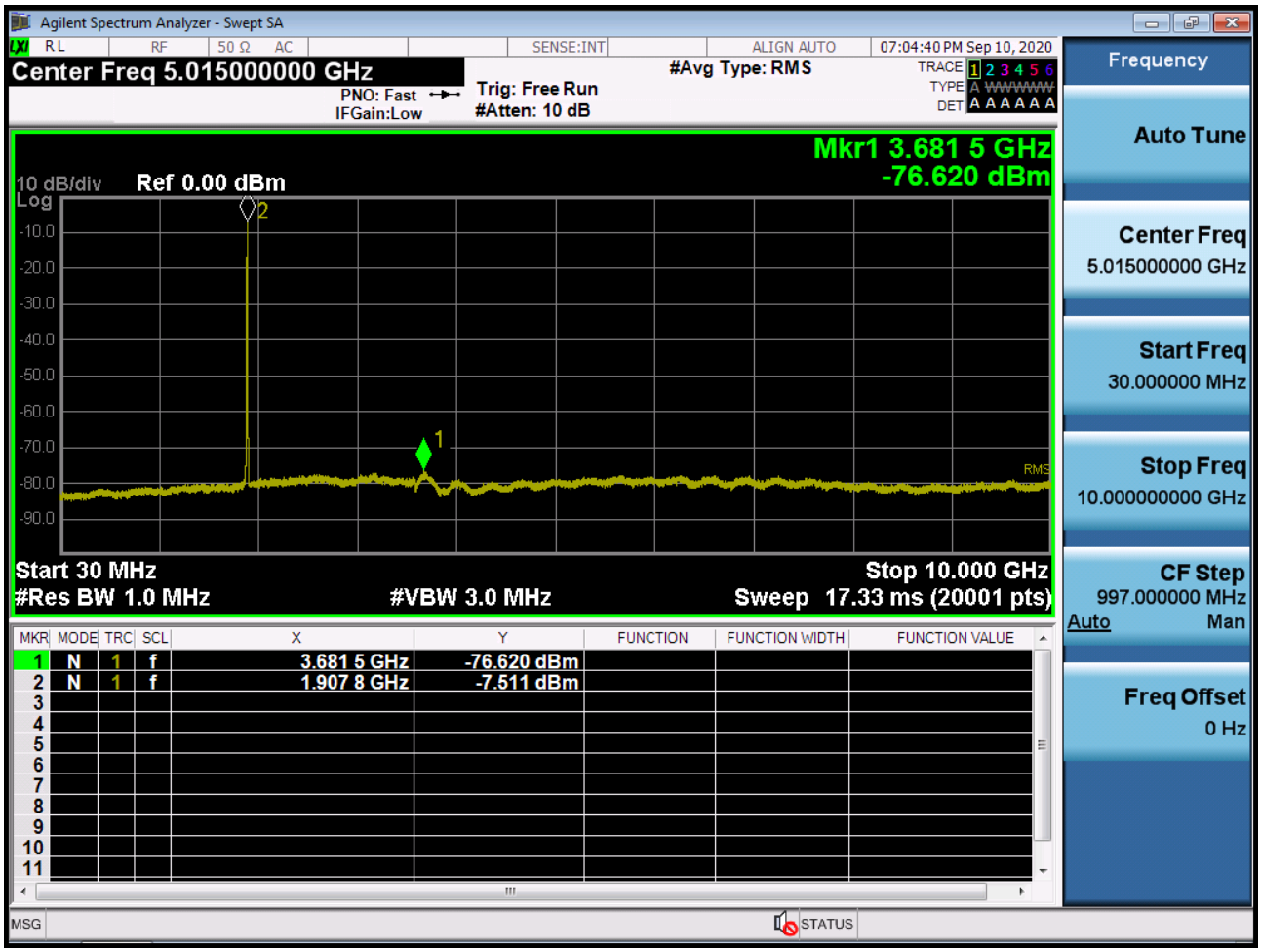
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



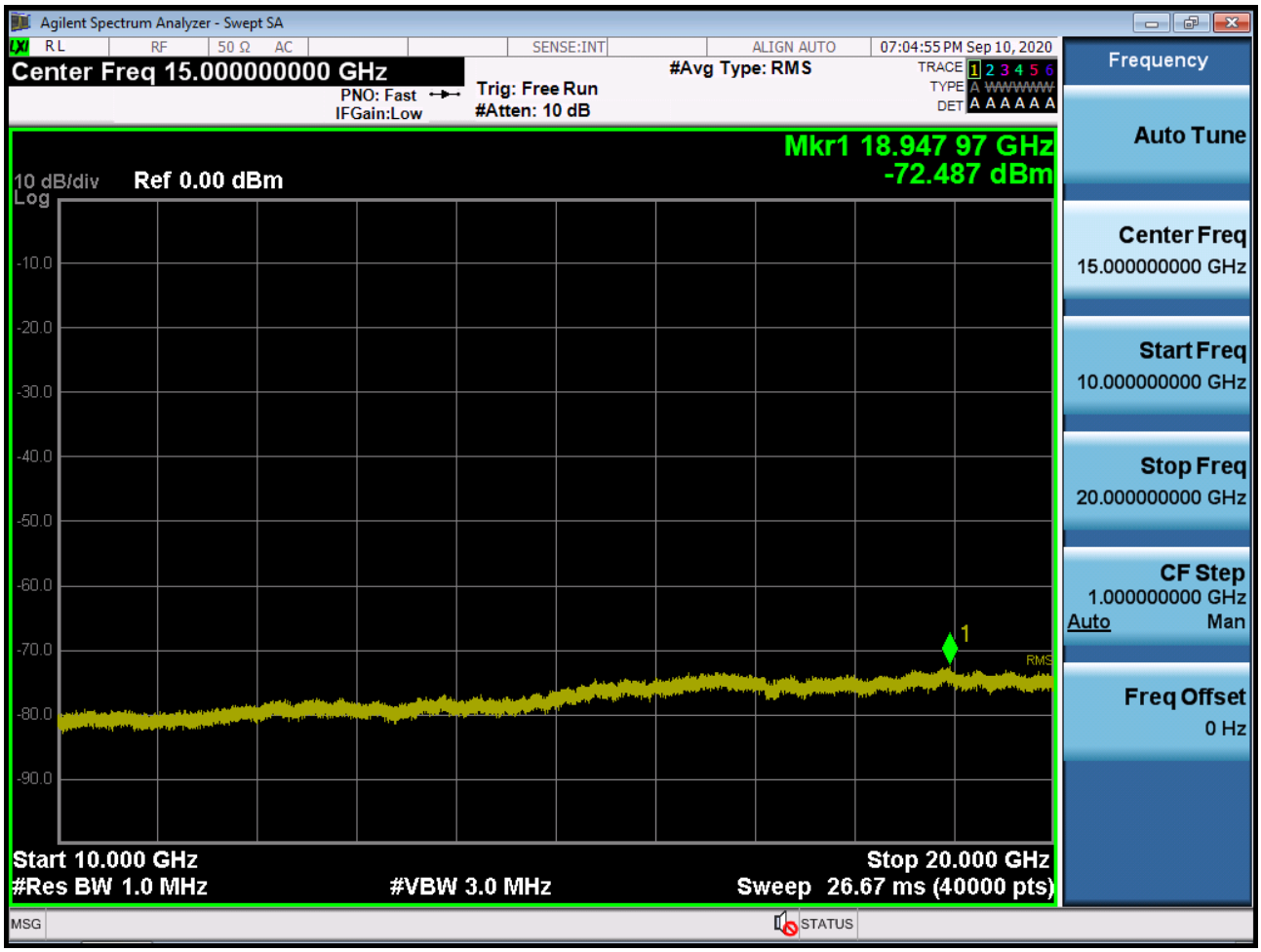
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



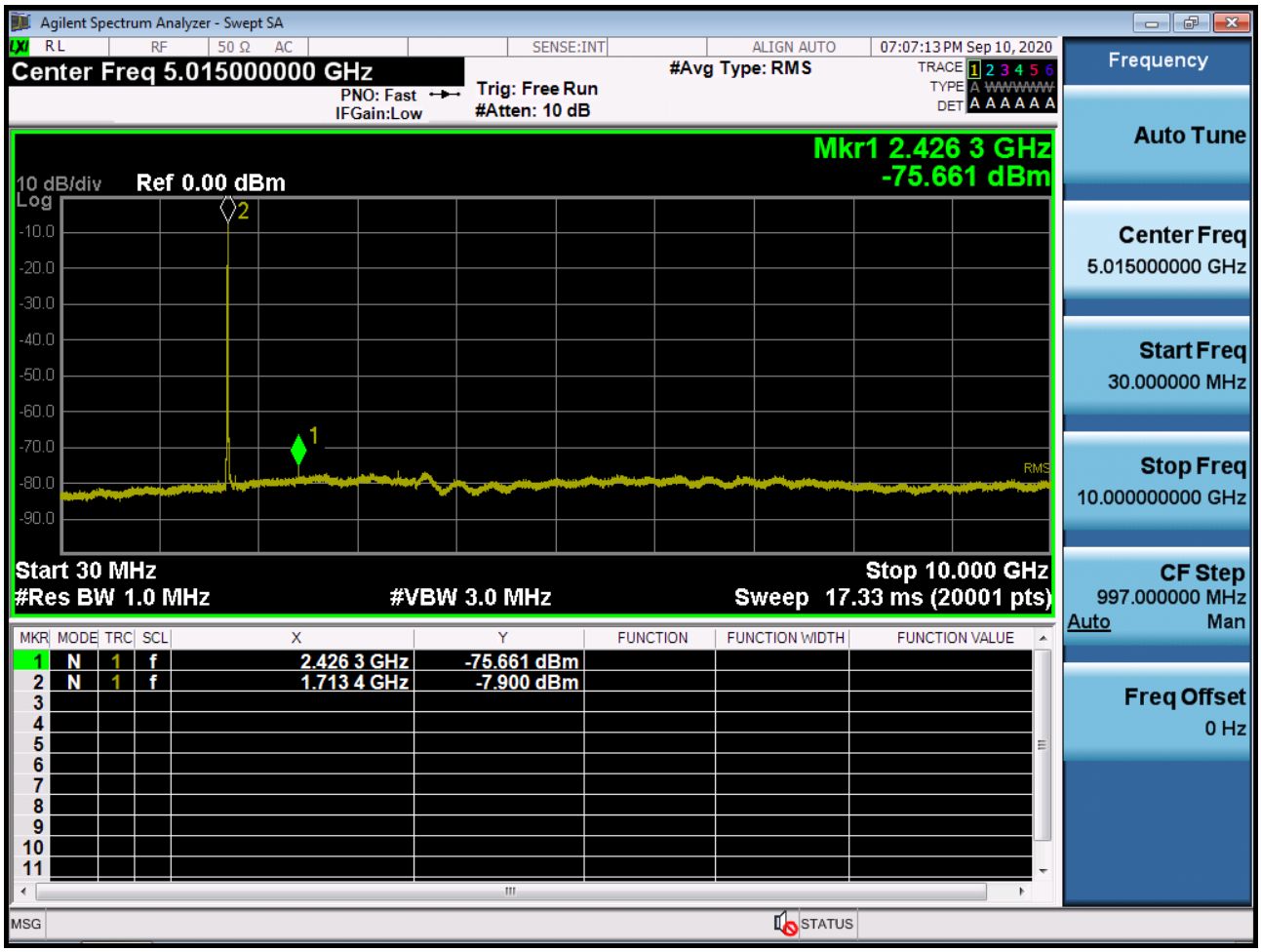
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



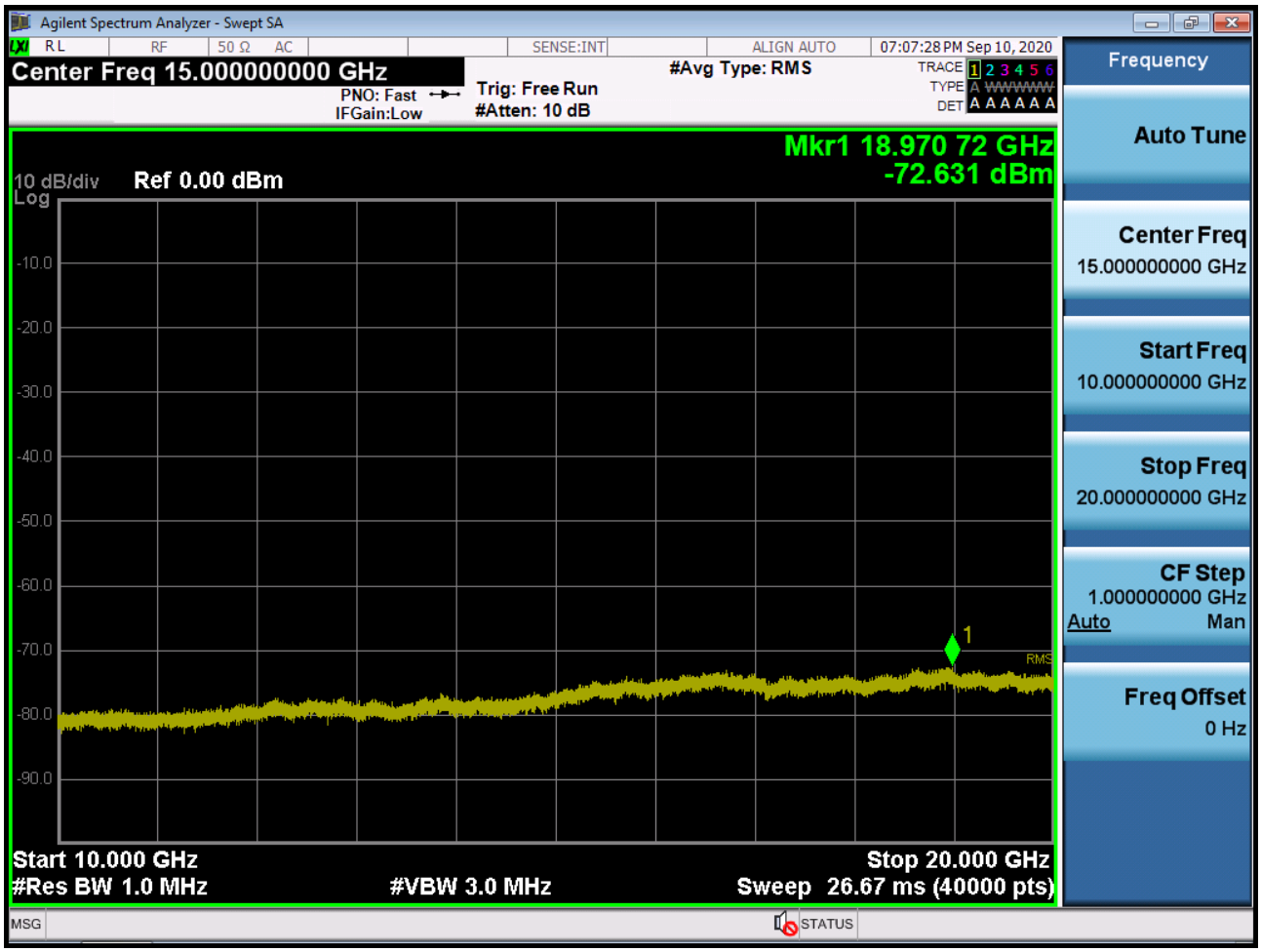
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



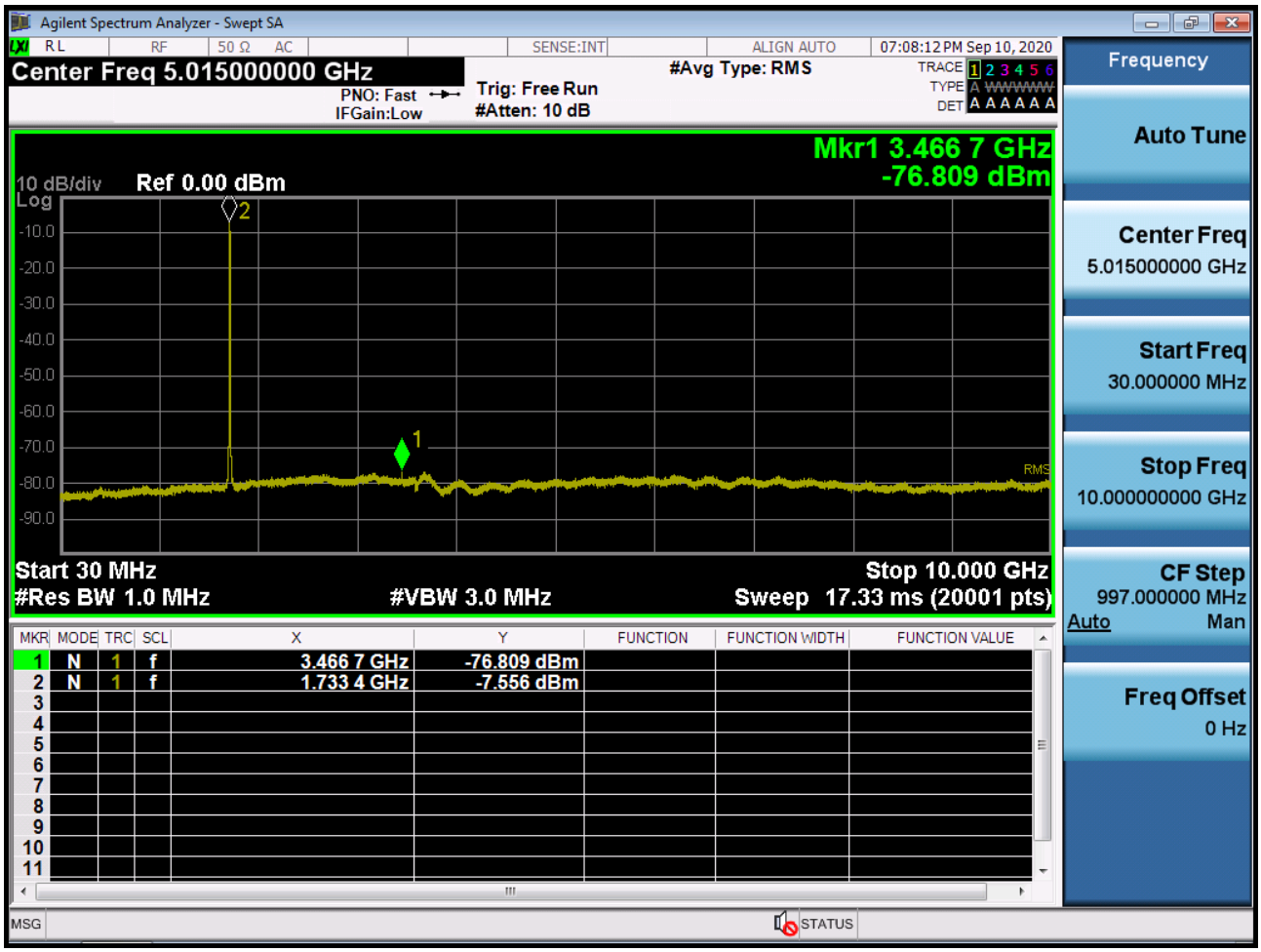
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



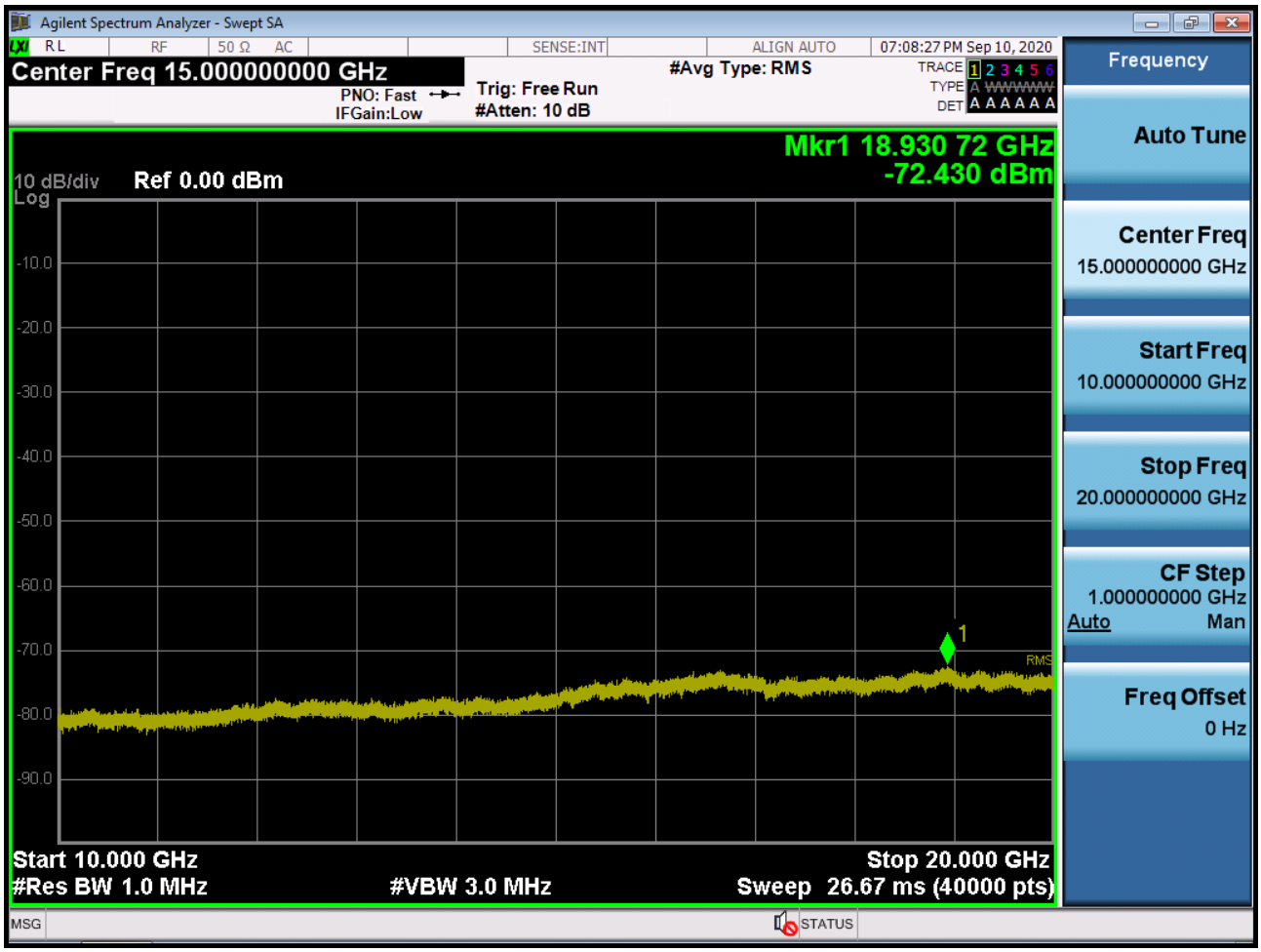
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



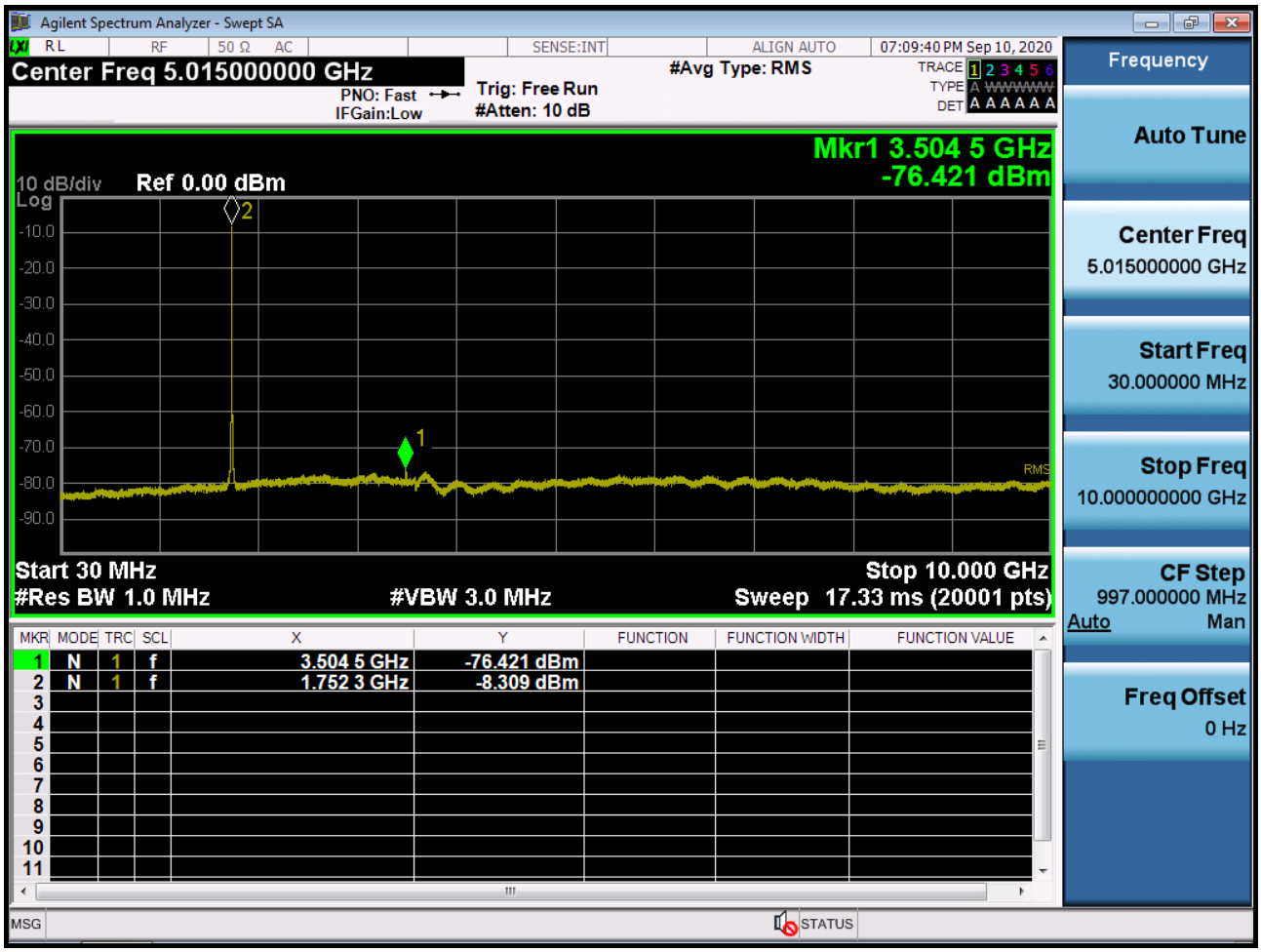
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



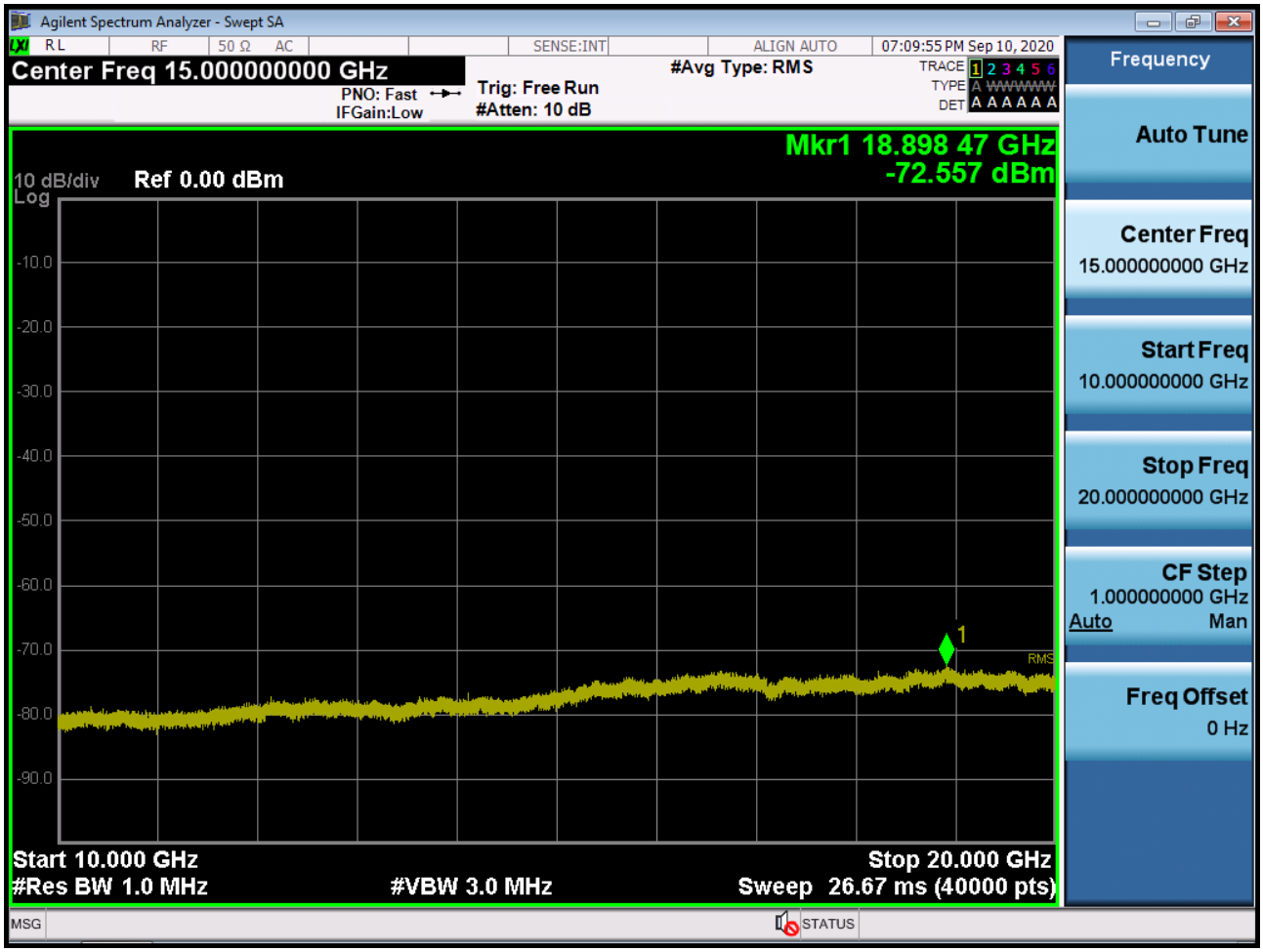
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



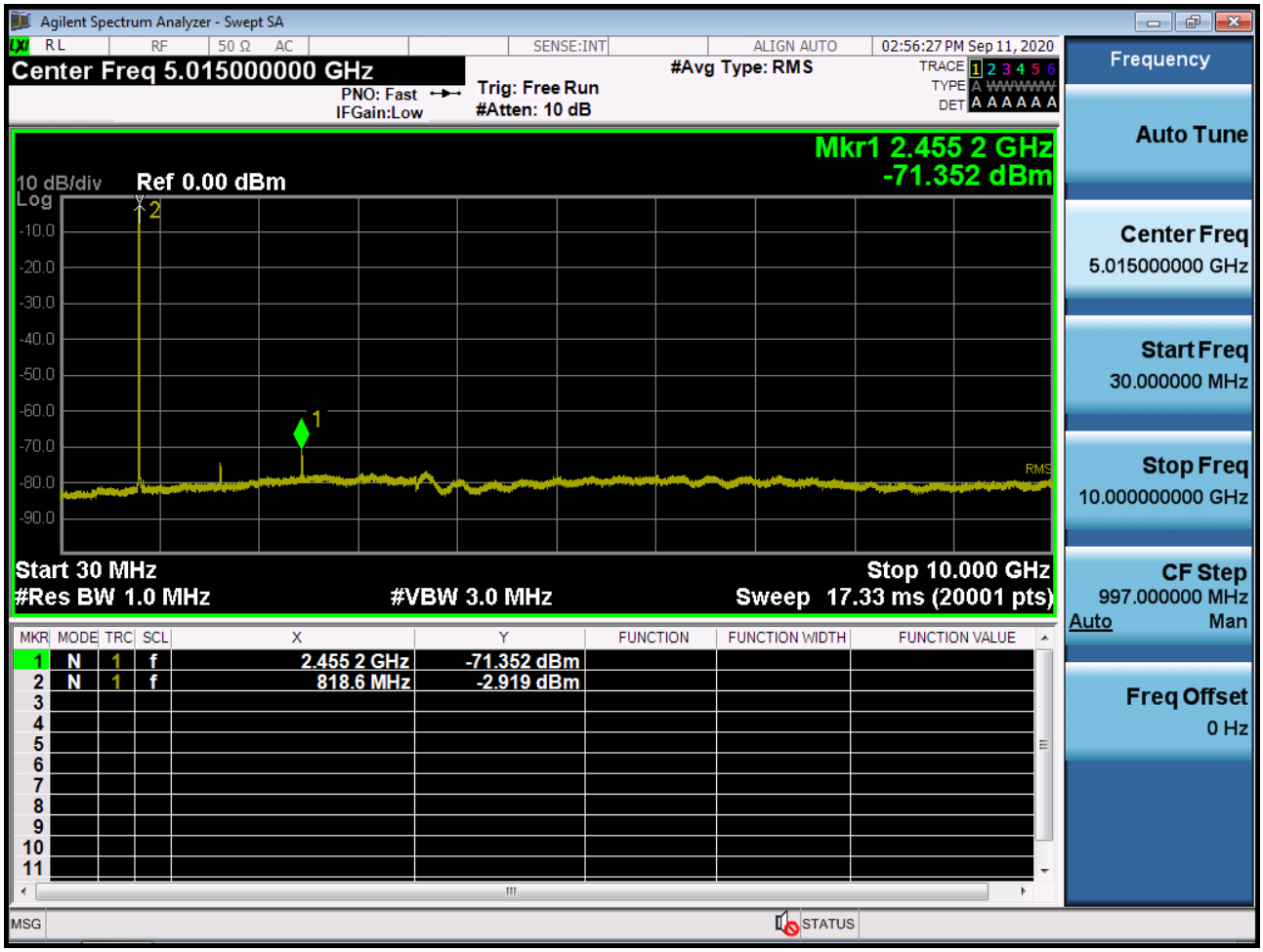
■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



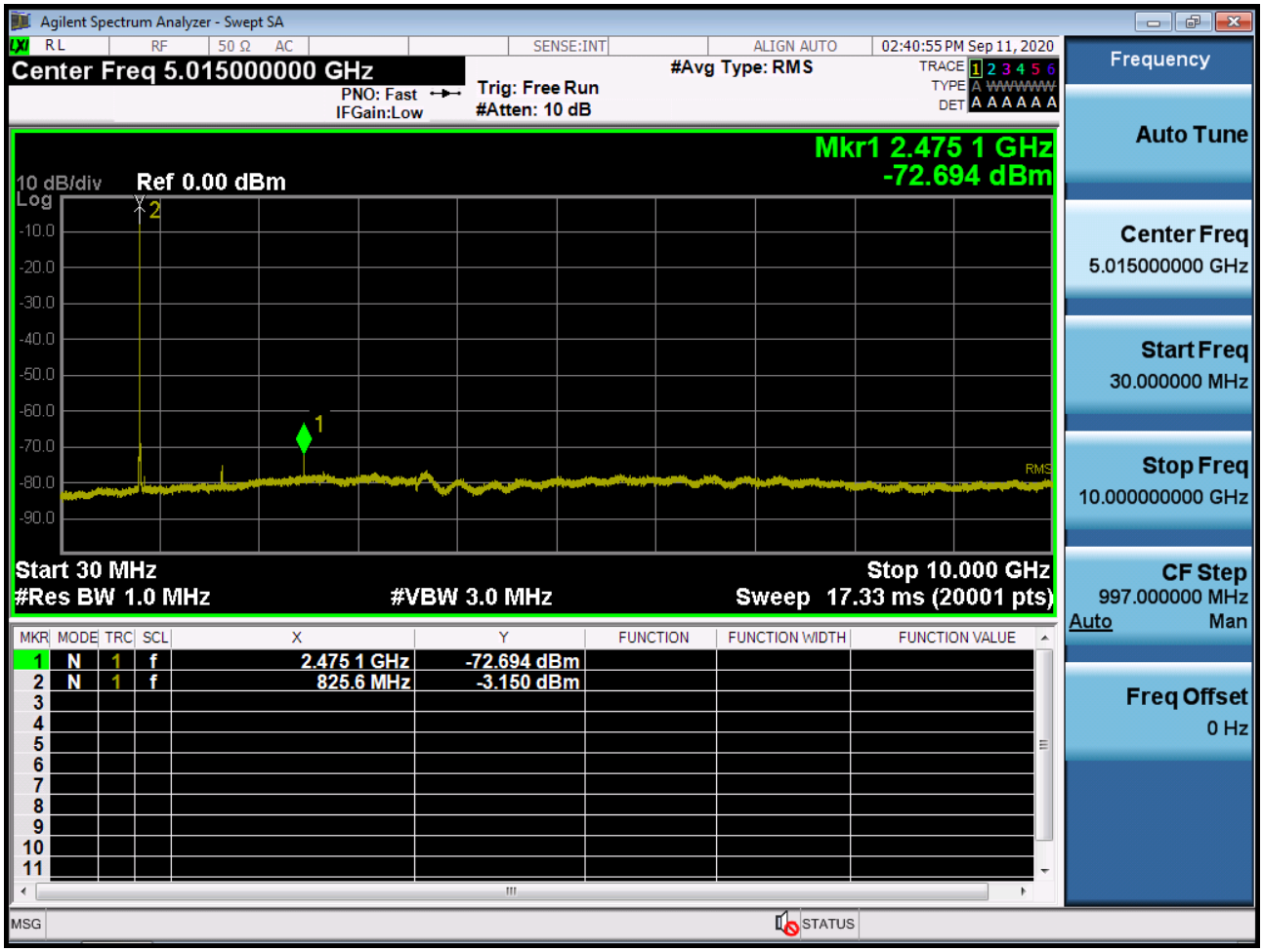
■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2



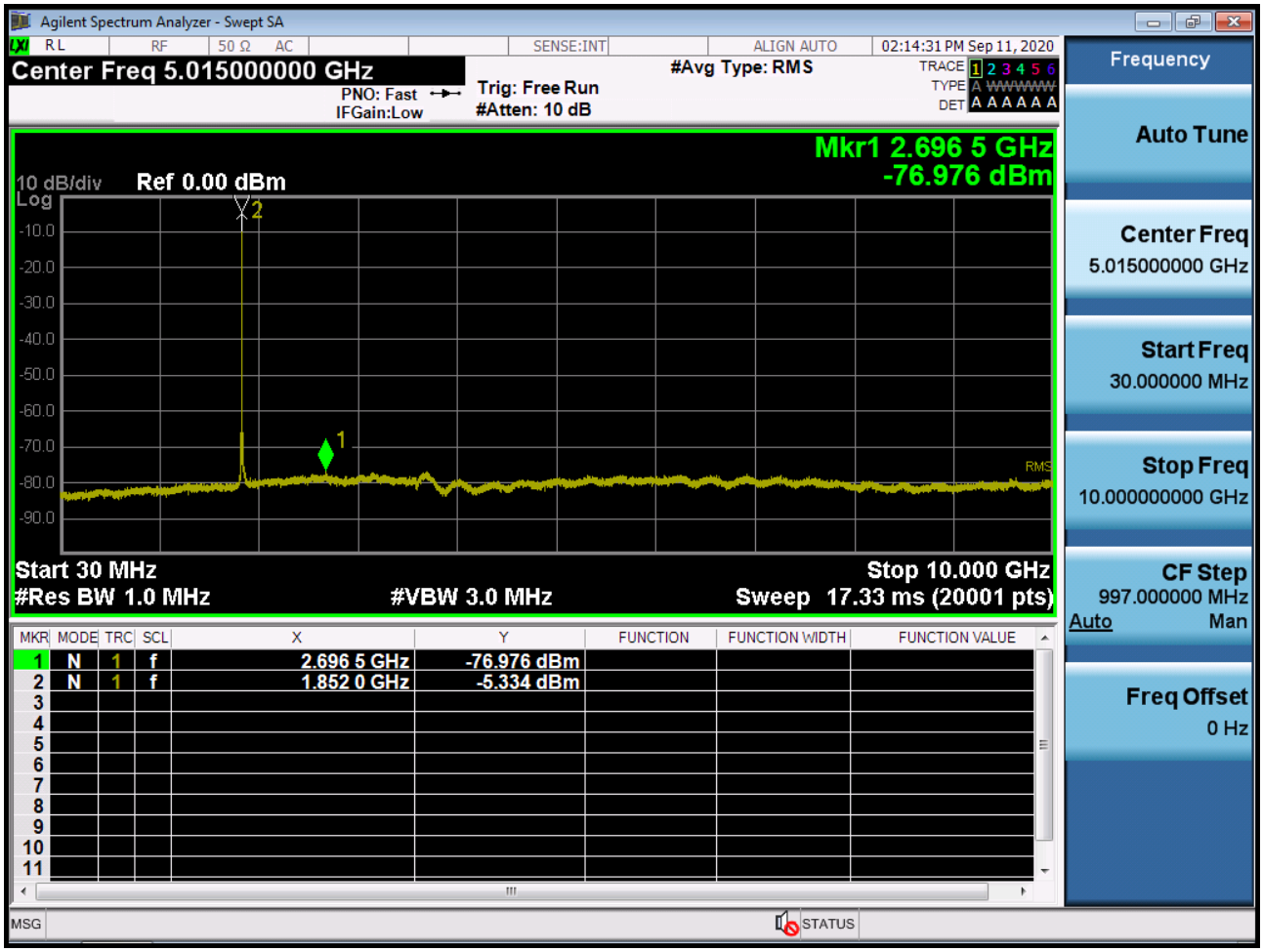
■ CDMA Secondary800 MODE (476 CH.) Conducted Spurious Emissions1



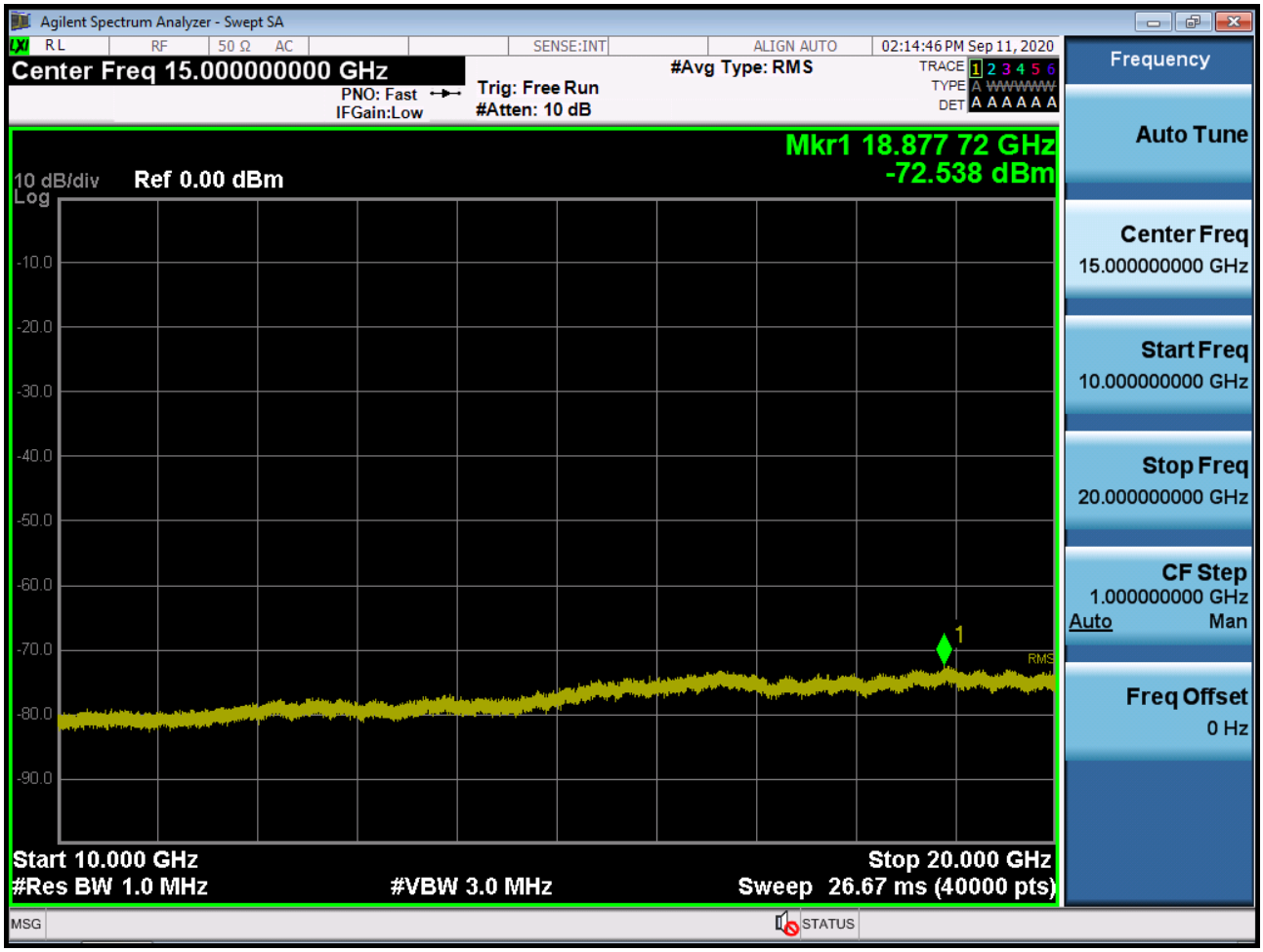
■ CDMA850 MODE (1013 CH.) Conducted Spurious Emissions1



■ CDMA PCS MODE (25 CH.) Conducted Spurious Emissions1



■ CDMA PCS MODE (25 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-2010-FC015-P |