

# FCC 2G3G REPORT

## Certification

**Applicant Name:**  
 SAMSUNG Electronics Co., Ltd.

**Date of Issue:**  
 June 27, 2022

**Address:**  
 129, Samsung-ro, Yeongtong-gu,  
 Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

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

**Report No.:** HCT-RF-2206-FC016-R1

**FCC ID:** A3LSMG990B2

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

Model(s): SM-G990B2/DS  
 Additional Model(s): SM-G990B2  
 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	246KGXW	0.659	28.19
GSM850 EDGE			248KG7W	0.167	22.23
WCDMA850	826.4 – 846.6	871.4 – 891.6	4M16F9W	0.116	20.65

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	248KGXW	0.667	28.24
GSM1900 EDGE			244KG7W	0.272	24.34
WCDMA1900	1852.4 – 1907.6	1932.4 – 1987.6	4M17F9W	0.175	22.44
WCDMA1700	1712.4 – 1752.6	2112.4 – 2152.6	4M16F9W	0.182	22.61

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 No.: HCT-RF-2206-FC016-R1

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REVIEWED BY



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

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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)

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## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2206-FC016	June 17, 2022	- First Approval Report
HCT-RF-2206-FC016-R1	June 27, 2022	- Added the PAR Test Result (Page 30, 62~72.)

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

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# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

<b>Applicant Name:</b>	SAMSUNG Electronics Co., Ltd.
<b>Address:</b>	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
<b>FCC ID:</b>	A3LSMG990B2
<b>Application Type:</b>	Certification
<b>FCC Classification:</b>	PCS Licensed Transmitter Held to Ear (PCE)
<b>FCC Rule Part(s):</b>	§22, §24, §27, §2
<b>EUT Type:</b>	Mobile phone
<b>Model(s):</b>	SM-G990B2/DS
<b>Additional Model(s):</b>	SM-G990B2
<b>Tx Frequency:</b>	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)
<b>Rx Frequency:</b>	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)
<b>Date(s) of Tests:</b>	May 26, 2022~ June 27, 2022
<b>Serial number:</b>	Radiated: R3CT40C5N2R Conducted: R3CT40C5GEE

## **2. INTRODUCTION**

### **2.1. DESCRIPTION OF EUT**

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (20/40/80), Bluetooth, BT LE, NFC, WPT.

### **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
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 1 MHz
3. VBW  $\geq$  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 1 GHz, 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;

$$P_d \text{ (dBm)} = P_g \text{ (dBm)} - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

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 = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  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<sup>th</sup> 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 1 GHz, 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;

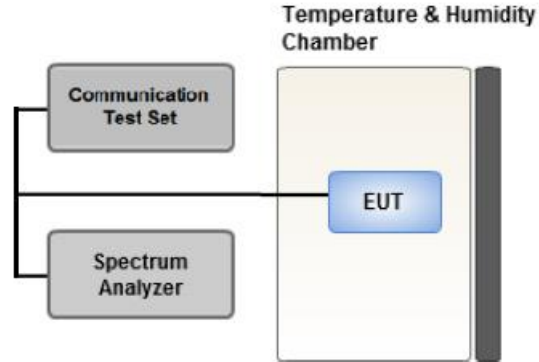
$$\text{Result (dBm)} = P_g \text{ (dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

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

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

$$\text{EIRP (dBm)} = \text{ERP (dBm)} + 2.15$$

### 3.4 PEAK- TO- AVERAGE RATIO



**Test setup**

① CCDF Procedure for PAPR

**Test Settings**

1. Set resolution/measurement bandwidth  $\geq$  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:

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

**Test Settings(Peak Power)**

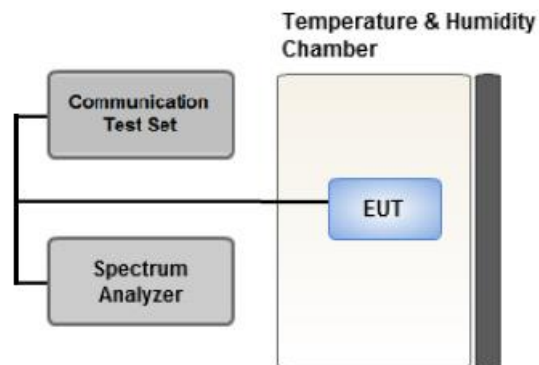
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW  $\geq 3 \times$  RBW.

1. Set the RBW  $\geq$  OBW.
2. Set VBW  $\geq 3 \times$  RBW.
3. Set span  $\geq 2 \times$  OBW.
4. Sweep time  $\geq 10 \times$  (number of points in sweep)  $\times$  (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  $2 \times$  to  $3 \times$  the OBW.
2. Set RBW  $\geq$  OBW.
3. Set VBW  $\geq 3 \times$  RBW.
4. Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
5. Sweep time:  
Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  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  $[10 \times \log (1/\text{duty cycle})]$  to the measured maximum power level to compute the average power during continuous transmission. For example, add  $[10 \times \log (1/0.25)] = 6$  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.

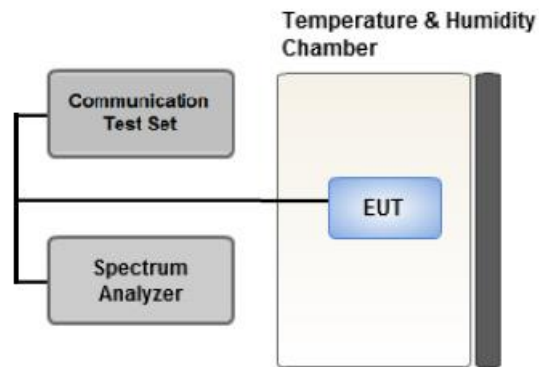
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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 26 dB 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  $\geq$  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.

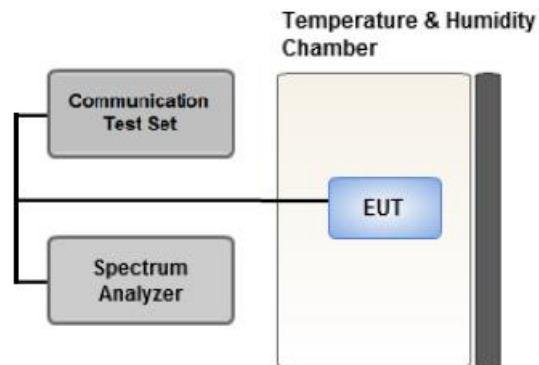
#### Test Settings(GSM)

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

#### Test Settings(WCDMA)

1. RBW = 1 MHz
2. VBW  $\geq$  3 MHz
3. Detector = RMS
4. Trace Mode = trace average
5. Sweep time = auto
6. Number of points in sweep  $\geq$  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  $\geq 2 \times \text{Span/RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

#### Test Notes

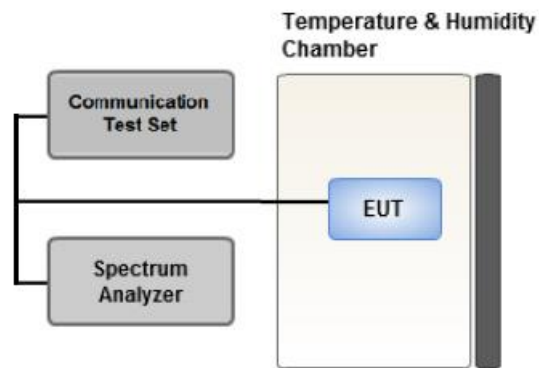
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \times \log(P)$  dB. In the 1 MHz bands immediately outside and adjacent to the frequency 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.

Where Margin < 1 dB the emission level is either corrected by  $10 \log(1 \text{ MHz/ RB})$  or the emission is integrated over a 1 MHz bandwidth to determine the final result. When using the integration method the integration window is either centered on the emission or, for emissions at the band edge, centered by an offset of 500 kHz from the block edge so that the integration window is the 1 MHz adjacent to the block edge.

### 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-G990B2/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-G990B2/DS)

[ Worst case ]

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

[ Test Channel ]

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



**3.10 WORST CASE(RADIATED TEST)**

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.  
 Mode : Stand alone, Stand alone + External accessories (Earphone, AC adapter, etc)  
 Worst case : Stand alone
- We were performed the RSE test in condition of co-location.  
 Mode : Stand alone, Simultaneous transmission scenarios  
 Worst case : Stand alone
- 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-G990B2/DS & additional models were tested and the worst case results are reported.  
 (Worst case : SM-G990B2/DS)

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

[ Worst case\_2G ]

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

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
H.P.F	FBSR-02B(WHK1.2/15 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
H.P.F	FBSR-02B(WHK3.3/18 G-10EF)	T&M SYSTEM	-	02/18/2023	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	11275	03/11/2023	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/28/2022	Annual
Dipole Antenna	UHAP	Schwarzbeck	557	04/05/2023	Biennial
Dipole Antenna	UHAP	Schwarzbeck	558	04/05/2023	Biennial
Chamber	SU-642	ESPEC	93008124	03/04/2023	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/30/2022	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/15/2023	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	10/13/2022	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	04/12/2023	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	05/02/2023	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	05/18/2023	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	09/29/2022	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/18/2022	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/03/2023	Biennial
Hybrid Antenna	VULB9168	Schwarzbeck	760	02/22/2023	Biennial
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262116770	07/12/2022	Annual
Wideband Radio Communication Tester	MT8820C	Anritsu Corp.	6200863156	12/29/2022	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/05/2022	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/30/2023	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

**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  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty ( $\pm$ dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	2.00 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (9 kHz ~ 30 MHz)	4.40 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (30 MHz ~ 1 GHz)	5.74 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (1 GHz ~ 18 GHz)	5.51 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (18 GHz ~ 40 GHz)	5.92 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (Above 40 GHz)	5.48 (Confidence level about 95 %, $k=2$ )

## 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	<u>See Note1</u>
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

### 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

$$ERP = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 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

$$EIRP = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

## 8. TEST DATA

### 8.1 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	-23.74	39.18	-10.25	1.39	V	< 7.00	0.568	27.55
	190	836.6	-23.25	39.79	-10.19	1.41	V		0.659	28.19
	251	848.8	-24.33	39.01	-10.14	1.42	V		0.556	27.45
EDGE	190	836.6	-29.55	34.02	-10.38	1.41	V		0.167	22.23

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	-30.75	32.25	-10.23	1.40	V	< 7.00	0.115	20.62
	4183	836.6	-30.79	32.25	-10.19	1.41	V		0.116	20.65
	4233	846.6	-31.41	31.77	-10.15	1.42	V		0.105	20.20

**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	-13.70	19.95	10.40	2.11	V	< 2.00	0.667	28.24
	661	1880.0	-15.04	19.04	10.40	2.15	V		0.536	27.29
	810	1909.8	-14.76	19.54	10.40	2.15	V		0.601	27.79
EDGE	512	1850.2	-17.60	16.05	10.40	2.11	V		0.272	24.34

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	-19.51	14.14	10.40	2.11	H	< 2.00	0.175	22.43
	9400	1880.0	-19.89	14.19	10.40	2.15	H		0.175	22.44
	9538	1907.6	-20.59	13.71	10.40	2.15	H		0.157	21.96

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	-18.98	14.62	10.04	2.05	H	< 1.00	0.182	22.61
	1412	1732.4	-19.72	13.76	10.12	2.05	H		0.152	21.83
	1513	1752.6	-20.74	12.77	10.20	2.06	H		0.123	20.91



**8.3 RADIATED SPURIOUS EMISSIONS**

▣ MODULATION SIGNAL: GSM850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured Level</u> [dBm]	Ant. Gain (dBi)	<u>Substitute Level</u> [dBm]	C.L	Pol.	Result (dBm)	Limit
128 (824.2)	1 648.40	-52.30	9.70	-62.62	1.99	V	-54.91	-13.00
	2 472.60	-26.30	10.46	-30.95	2.47	V	-22.96	-13.00
	3 296.80	-57.61	12.07	-59.09	2.89	V	-49.90	-13.00
190 (836.6)	1 673.20	-51.87	9.82	-62.38	2.01	H	-54.57	-13.00
	2 509.80	-26.29	10.70	-30.59	2.50	V	-22.39	-13.00
	3 346.40	-58.03	12.37	-59.69	2.92	H	-50.24	-13.00
251 (848.8)	1 697.60	-52.54	10.00	-62.63	2.04	V	-54.67	-13.00
	2 546.40	-25.92	10.70	-29.83	2.52	V	-21.65	-13.00
	3 395.20	-56.80	12.58	-58.55	2.94	H	-48.91	-13.00

▣ MODULATION SIGNAL: GSM1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured</u> <u>Level</u> <u>[dBm]</u>	Ant. Gain (dBi)	<u>Substitute</u> <u>Level</u> <u>[dBm]</u>	C.L	Pol.	Result (dBm)	Limit
512 (1850.2)	3 700.40	-54.68	12.30	-59.27	3.08	H	-50.05	-13.00
	5 550.60	-53.77	13.00	-51.78	3.81	V	-42.59	-13.00
	7 400.80	-53.05	10.80	-42.80	4.44	H	-36.44	-13.00
661 (1880.0)	3 760.00	-54.21	12.32	-58.53	3.10	V	-49.31	-13.00
	5 640.00	-50.56	13.10	-48.37	3.85	V	-39.12	-13.00
	7 520.00	-50.61	10.84	-39.76	4.46	H	-33.38	-13.00
810 (1909.8)	3 819.60	-52.70	12.40	-57.39	3.14	V	-48.13	-13.00
	5 729.40	-46.45	13.04	-45.62	3.69	V	-36.27	-13.00
	7 639.20	-50.98	11.26	-40.27	4.47	H	-33.48	-13.00

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured</u> <u>Level</u> <u>[dBm]</u>	Ant. Gain (dBi)	<u>Substitute</u> <u>Level</u> <u>[dBm]</u>	C.L	Pol.	Result (dBm)	Limit
4 132 (826.4)	1 652.80	-53.11	9.70	-63.43	1.99	V	-55.72	-13.00
	2 479.20	-44.58	10.54	-49.36	2.48	H	-41.30	-13.00
	3 305.60	-57.31	12.13	-58.73	2.90	V	-49.49	-13.00
4 183 (836.6)	1 673.20	-52.84	9.82	-63.35	2.01	H	-55.54	-13.00
	2 509.80	-44.16	10.70	-48.46	2.50	V	-40.26	-13.00
	3 346.40	-58.23	12.37	-59.89	2.92	V	-50.44	-13.00
4 233 (846.6)	1 693.20	-52.10	9.94	-62.51	2.03	V	-54.60	-13.00
	2 539.80	-45.15	10.70	-49.23	2.51	V	-41.04	-13.00
	3 386.40	-58.12	12.54	-59.79	2.94	H	-50.18	-13.00

▣ MODULATION SIGNAL: WCDMA1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured</u> <u>Level</u> <u>[dBm]</u>	Ant. Gain (dBi)	<u>Substitute</u> <u>Level</u> <u>[dBm]</u>	C.L	Pol.	Result (dBm)	Limit
9262 (1852.4)	3 704.80	-54.65	12.30	-58.52	3.80	V	-50.02	-13.00
	5 557.20	-55.10	13.20	-53.31	3.82	V	-43.93	-13.00
	7 409.60	-56.12	10.80	-45.63	4.45	V	-39.28	-13.00
9400 (1880.0)	3 760.00	-53.85	12.32	-58.17	3.10	H	-48.95	-13.00
	5 640.00	-55.33	13.10	-53.14	3.85	V	-43.89	-13.00
	7 520.00	-56.33	10.84	-45.48	4.46	V	-39.10	-13.00
9538 (1907.6)	3 815.20	-55.22	12.40	-59.99	3.14	H	-50.73	-13.00
	5 722.80	-56.13	13.06	-53.10	3.88	H	-43.92	-13.00
	7 630.40	-56.42	11.22	-45.58	4.48	H	-38.84	-13.00

▣ MODULATION SIGNAL: WCDMA1700

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured Level</u> [dBm]	Ant. Gain (dBi)	<u>Substitute Level</u> [dBm]	C.L	Pol.	Result (dBm)	Limit
1312 (1712.4)	3 424.80	-54.59	12.55	-61.27	2.95	V	-51.67	-13.00
	5 137.20	-56.03	12.28	-53.18	3.66	V	-44.56	-13.00
	6 849.60	-56.23	12.00	-49.30	4.25	V	-41.55	-13.00
1412 (1732.4)	3 464.80	-54.91	12.47	-61.25	2.97	V	-51.75	-13.00
	5 197.20	-56.92	12.50	-55.47	3.70	H	-46.67	-13.00
	6 929.60	-55.76	11.78	-47.96	4.28	V	-40.46	-13.00
1513 (1752.6)	3 505.20	-54.84	12.40	-61.00	2.98	V	-51.58	-13.00
	5 257.80	-55.20	12.84	-54.26	3.71	V	-45.13	-13.00
	7 010.40	-55.85	11.34	-47.37	4.32	H	-40.35	-13.00

**8.4 PEAK-TO-AVERAGE RATIO**

Band	Ch.	Measured P <sub>Pk</sub> (dBm)	Measured P <sub>Avg</sub> (dBm)	P <sub>Avg</sub> (Duty Cycle)			P.A.R. = P <sub>Pk</sub> - P <sub>Avg</sub> (dB)	Limit (dB)	Pass / Fail		
				Tx <sub>Total</sub> (ms)	Tx <sub>On</sub> (ms)	Factor (dB)					
GSM1900	661	29.431	19.52	4.6160	0.5475	9.26	0.65	13	Pass		
GSM1900 EDGE	661	28.969	16.23	4.6160	0.5475	9.26	3.48				
GSM850	190	CCDF Procedure					3.04			13	Pass
GSM850 EDGE	190						5.91				
WCDMA850	4408						2.73				
WCDMA1900	9400						2.91				
WCDMA1700	1412						2.88				

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 62 ~ 72.
2. Only GSM(include EDGE) Mode was tested by alternate procedure for PAPR

$P.A.R. (dB) = P_{Pk} (dBm) - P_{Avg} (dBm)$  (P<sub>Avg</sub> = Average Power + Duty cycle Factor)

Duty cycle Factor =  $10 \times \log (1/X)$ , X = Tx<sub>On</sub> / Tx<sub>Total</sub>

**8.5 OCCUPIED BANDWIDTH**

Band	Channel	Frequency(MHz)	Data (GSM: kHz / WCDMA : MHz)
GSM850	128	824.20	245.46
	190	836.60	245.59
	251	848.80	246.44
GSM850 EDGE	128	824.20	245.43
	190	836.60	247.67
	251	848.80	243.82
GSM1900	512	1,850.20	245.04
	661	1,880.00	244.55
	810	1,909.80	247.65
GSM1900 EDGE	512	1,850.20	240.37
	661	1,880.00	244.14
	810	1,909.80	236.49
WCDMA850	4132	826.40	4.1606
	4183	836.60	4.1577
	4233	846.60	4.1614
WCDMA1900	9262	1852.40	4.1645
	9400	1880.00	4.1666
	9538	1907.60	4.1412
WCDMA1700	1312	1712.40	4.1495
	1412	1732.40	4.1562
	1513	1752.60	4.1616

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 45 ~ 61.

**8.6 CONDUCTED SPURIOUS EMISSIONS**

Band	Channel	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result	(dBm)
GSM850	128	3.6820	27.976	-56.97	-28.989	-13.00
	190	2.8700	27.976	-57.73	-29.758	
	251	6.9158	28.591	-58.00	-29.411	
GSM1900	512	19.07198	29.489	-52.558	-23.069	
	661	18.85772	29.489	-52.765	-23.276	
	810	16.99867	29.489	-52.743	-23.254	
WCDMA850	4132	2.4766	27.976	-75.381	-47.405	
	4183	2.5070	27.976	-75.198	-47.222	
	4233	2.5375	27.976	-74.886	-46.910	
WCDMA1900	9262	18.8960	29.489	-72.964	-43.475	
	9400	18.9042	29.489	-72.960	-43.471	
	9538	18.9330	29.489	-72.925	-43.436	
WCDMA1700	1312	1.78821	27.976	-71.885	-43.909	
	1412	19.54799	29.489	-73.029	-43.540	
	1513	18.89622	29.489	-73.017	-43.528	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 109 ~ 132.
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(26.5)	30.131

**8.7 BAND EDGE**

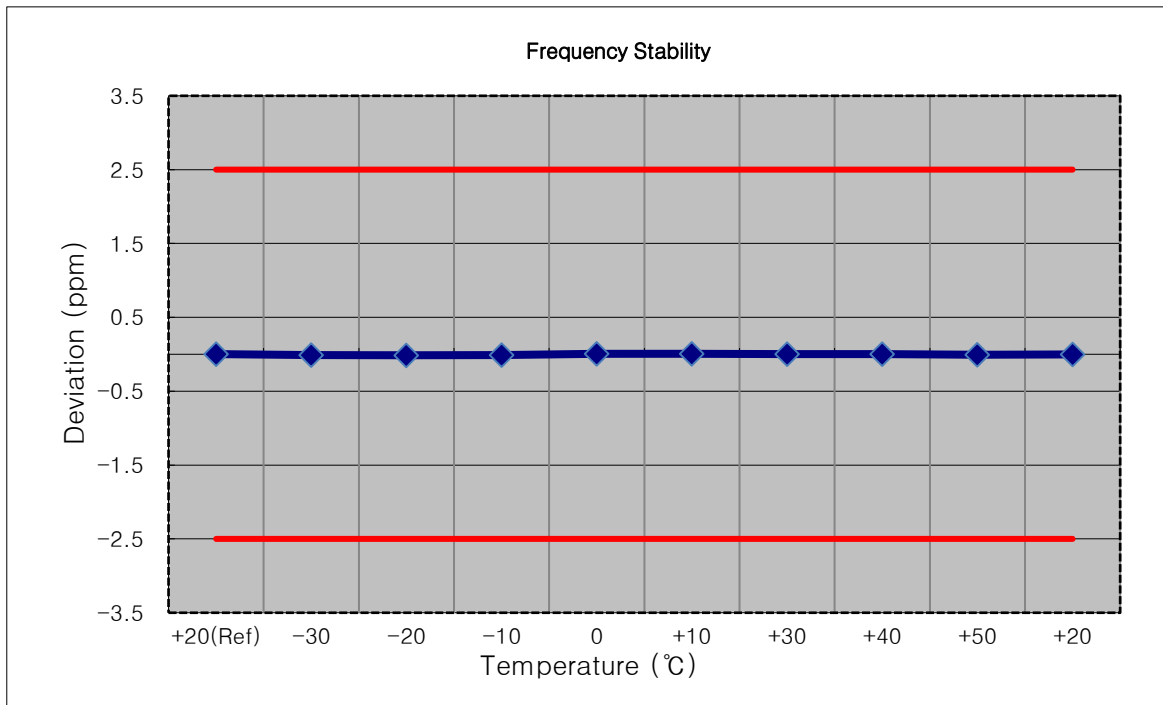
- Plots of the EUT's Band Edge are shown Page 73 ~ 108.



**8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE**

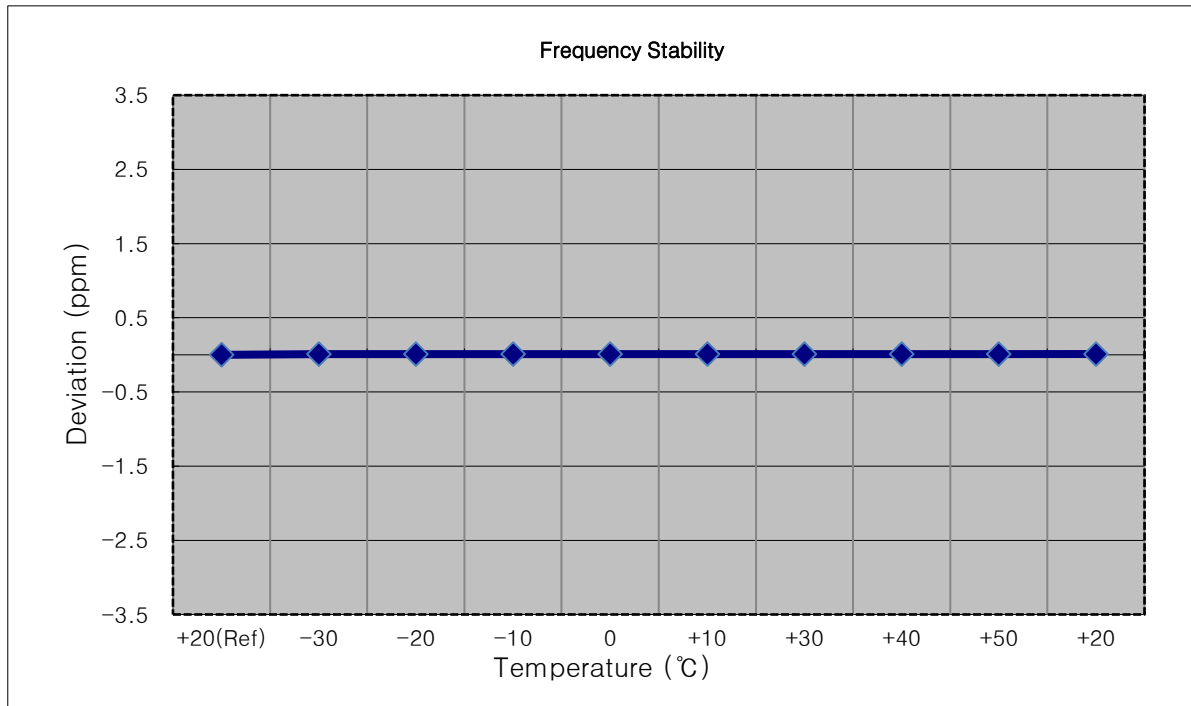
- ▣ MODE: GSM850
- ▣ OPERATING FREQUENCY: 836,600,000 Hz
- ▣ CHANNEL: 190
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	836 599 991	0.0	0.000 000	0.0000
100 %		-30	836 599 983	-8.1	-0.000 001	-0.0097
100 %		-20	836 599 980	-11.1	-0.000 001	-0.0132
100 %		-10	836 599 981	-9.9	-0.000 001	-0.0118
100 %		0	836 599 996	5.1	0.000 001	0.0061
100 %		+10	836 599 995	4.0	0.000 000	0.0048
100 %		+30	836 599 994	3.3	0.000 000	0.0040
100 %		+40	836 599 994	3.2	0.000 000	0.0038
100 %		+50	836 599 987	-3.7	0.000 000	-0.0044
Batt. Endpoint		3.650	+20	836 599 987	-3.3	0.000 000



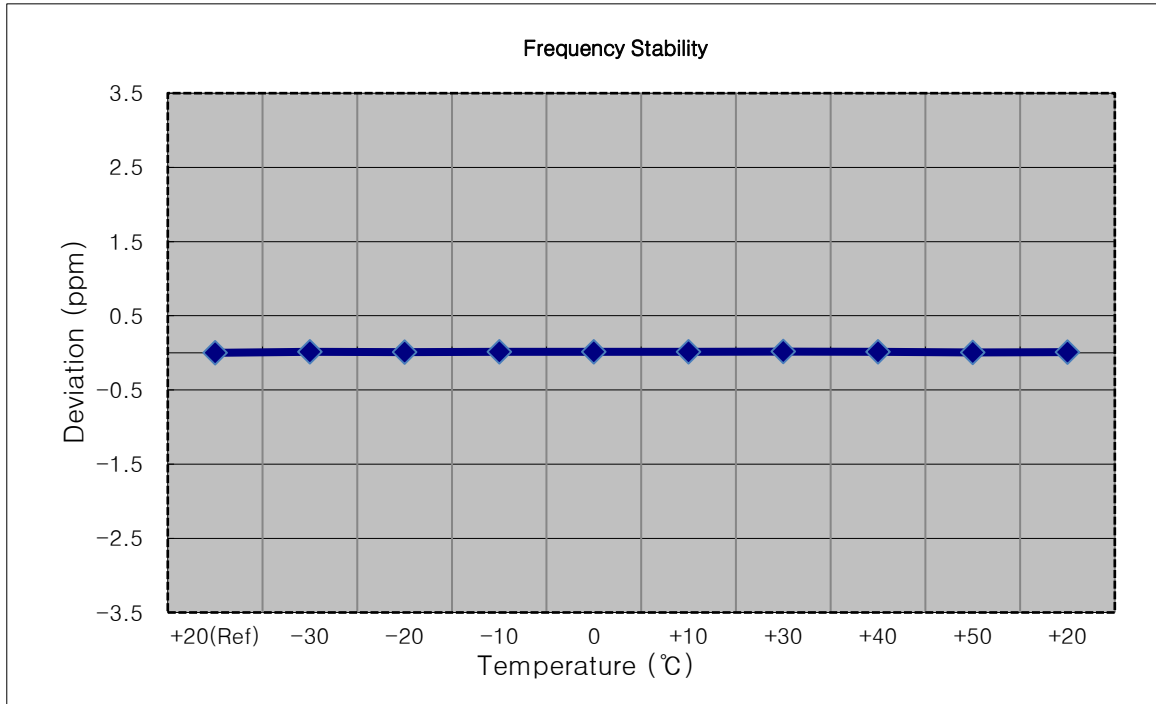
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1850,200,000 Hz
- ▣ CHANNEL: 512
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1850 200 015	0.0	0.000 000	0.0000
100 %		-30	1850 200 031	16.2	0.000 001	0.0088
100 %		-20	1850 200 031	16.6	0.000 001	0.0090
100 %		-10	1850 200 033	18.6	0.000 001	0.0101
100 %		0	1850 200 033	18.0	0.000 001	0.0097
100 %		+10	1850 200 032	17.5	0.000 001	0.0095
100 %		+30	1850 200 034	18.9	0.000 001	0.0102
100 %		+40	1850 200 032	17.7	0.000 001	0.0095
100 %		+50	1850 200 033	17.9	0.000 001	0.0097
Batt. Endpoint		3.650	+20	1850 200 035	20.2	0.000 001



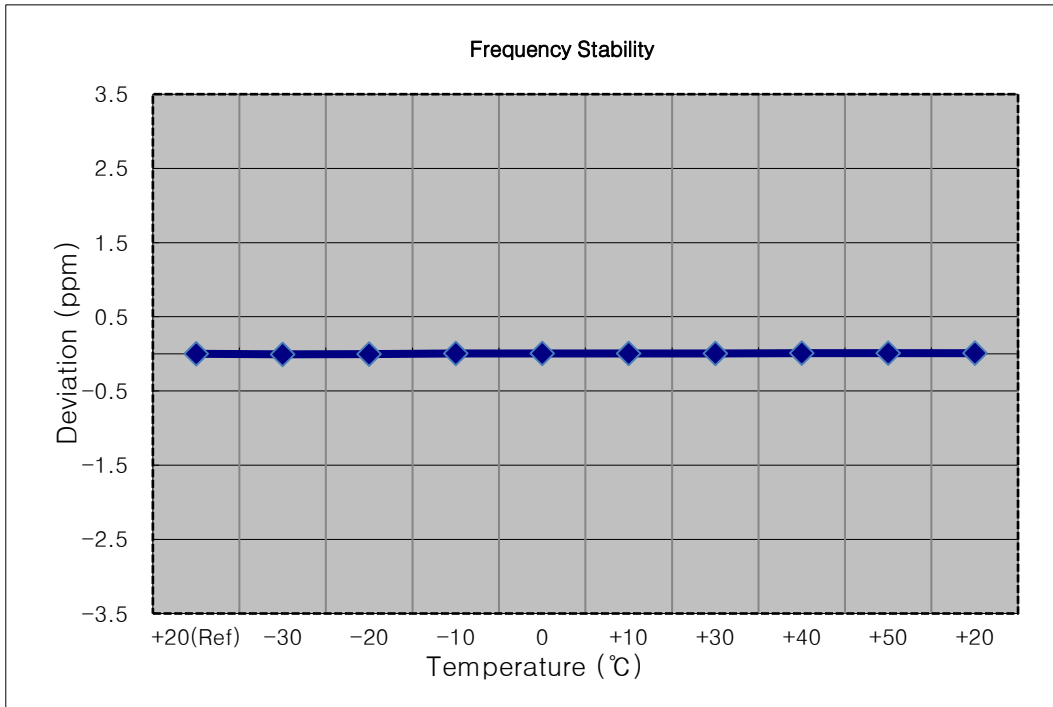
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1880,000,000 Hz
- ▣ CHANNEL: 661
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1880 000 021	0.0	0.000 000	0.000
100 %		-30	1880 000 043	21.9	0.000 001	0.012
100 %		-20	1880 000 043	21.5	0.000 001	0.011
100 %		-10	1880 000 045	23.5	0.000 001	0.012
100 %		0	1880 000 048	26.5	0.000 001	0.014
100 %		+10	1880 000 048	26.8	0.000 001	0.014
100 %		+30	1880 000 051	30.4	0.000 002	0.016
100 %		+40	1880 000 050	29.4	0.000 002	0.016
100 %		+50	1880 000 033	12.3	0.000 001	0.007
Batt. Endpoint	3.650	+20	1880 000 035	14.2	0.000 001	0.008



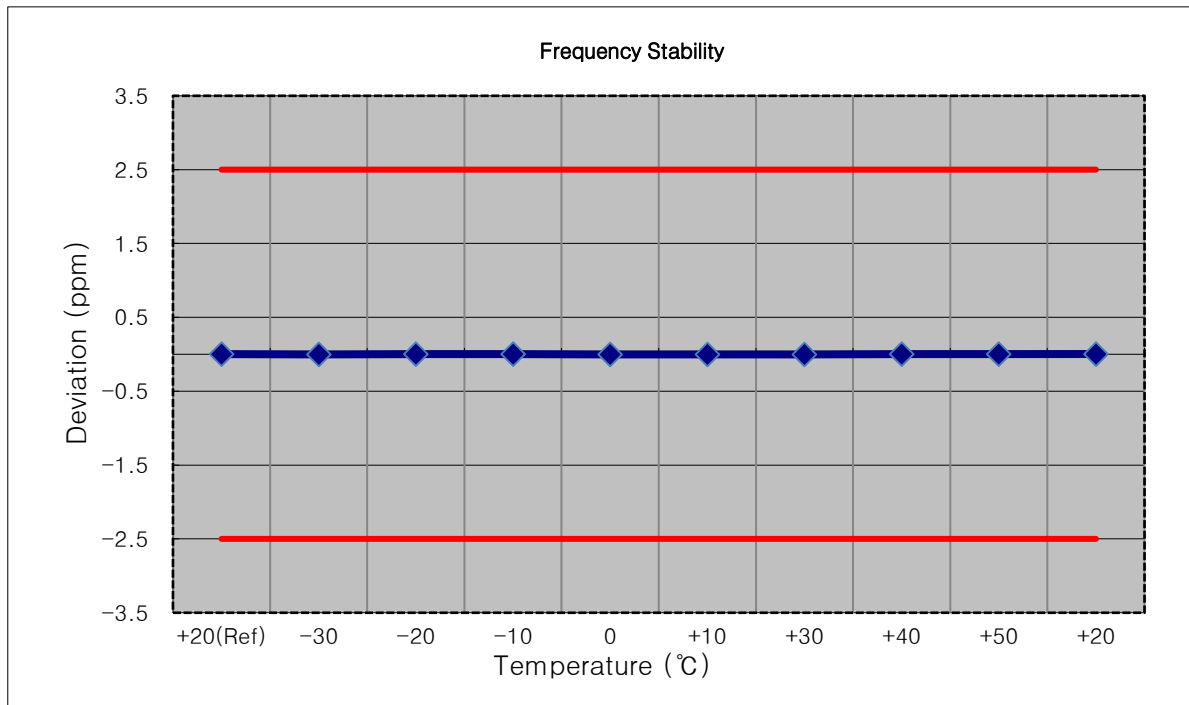
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1909,800,000 Hz
- ▣ CHANNEL: 810
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1909 800 019	0.0	0.000 000	0.000
100 %		-30	1909 800 007	-12.1	-0.000 001	-0.006
100 %		-20	1909 800 010	-8.7	0.000 000	-0.005
100 %		-10	1909 800 028	9.4	0.000 000	0.005
100 %		0	1909 800 028	9.4	0.000 000	0.005
100 %		+10	1909 800 032	13.4	0.000 001	0.007
100 %		+30	1909 800 032	13.8	0.000 001	0.007
100 %		+40	1909 800 033	14.8	0.000 001	0.008
100 %		+50	1909 800 034	15.6	0.000 001	0.008
Batt. Endpoint		3.650	+20	1909 800 035	16.6	0.000 001



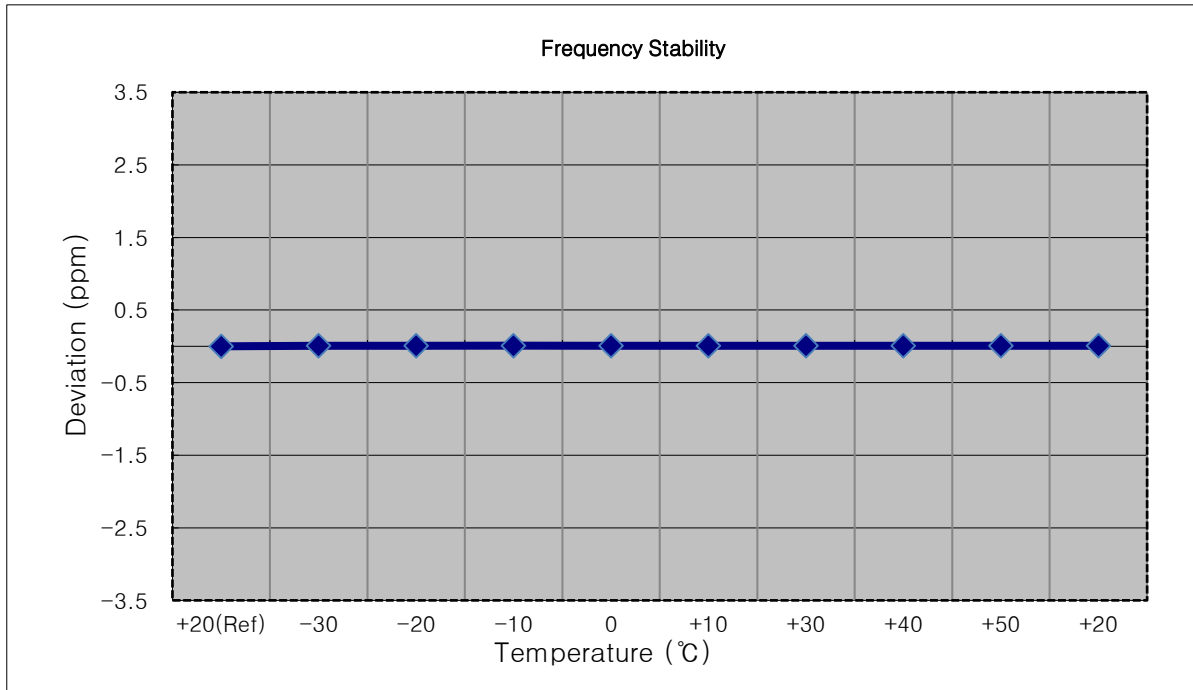
- ▣ Mode: WCDMA850
- ▣ OPERATING FREQUENCY: 836,600,000 Hz
- ▣ CHANNEL: 4183
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	836 600 001	0.0	0.000 000	0.0000
100 %		-30	836 600 000	-1.2	0.000 000	-0.0015
100 %		-20	836 600 003	1.5	0.000 000	0.0017
100 %		-10	836 600 002	0.6	0.000 000	0.0007
100 %		0	836 600 000	-1.3	0.000 000	-0.0015
100 %		+10	836 599 999	-1.5	0.000 000	-0.0019
100 %		+30	836 600 000	-1.1	0.000 000	-0.0013
100 %		+40	836 600 002	1.2	0.000 000	0.0014
100 %		+50	836 600 003	2.4	0.000 000	0.0028
Batt. Endpoint		3.650	+20	836 600 004	2.6	0.000 000



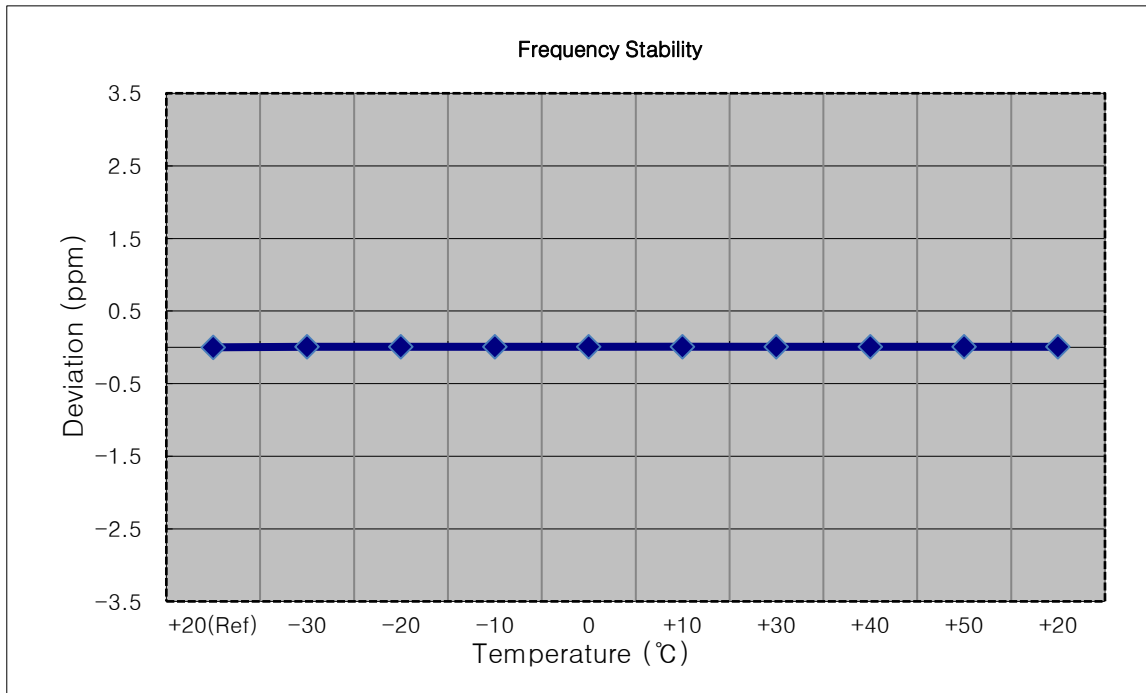
- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,852,400,000 Hz
- ▣ CHANNEL: 9262
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1852 400 017	0.0	0.000 000	0.0000
100 %		-30	1852 400 033	16.2	0.000 001	0.0087
100 %		-20	1852 400 033	16.4	0.000 001	0.0088
100 %		-10	1852 400 034	17.3	0.000 001	0.0094
100 %		0	1852 400 034	16.8	0.000 001	0.0091
100 %		+10	1852 400 034	16.9	0.000 001	0.0091
100 %		+30	1852 400 033	16.4	0.000 001	0.0088
100 %		+40	1852 400 033	15.9	0.000 001	0.0086
100 %		+50	1852 400 032	15.2	0.000 001	0.0082
Batt. Endpoint	3.650	+20	1852 400 034	17.0	0.000 001	0.0092



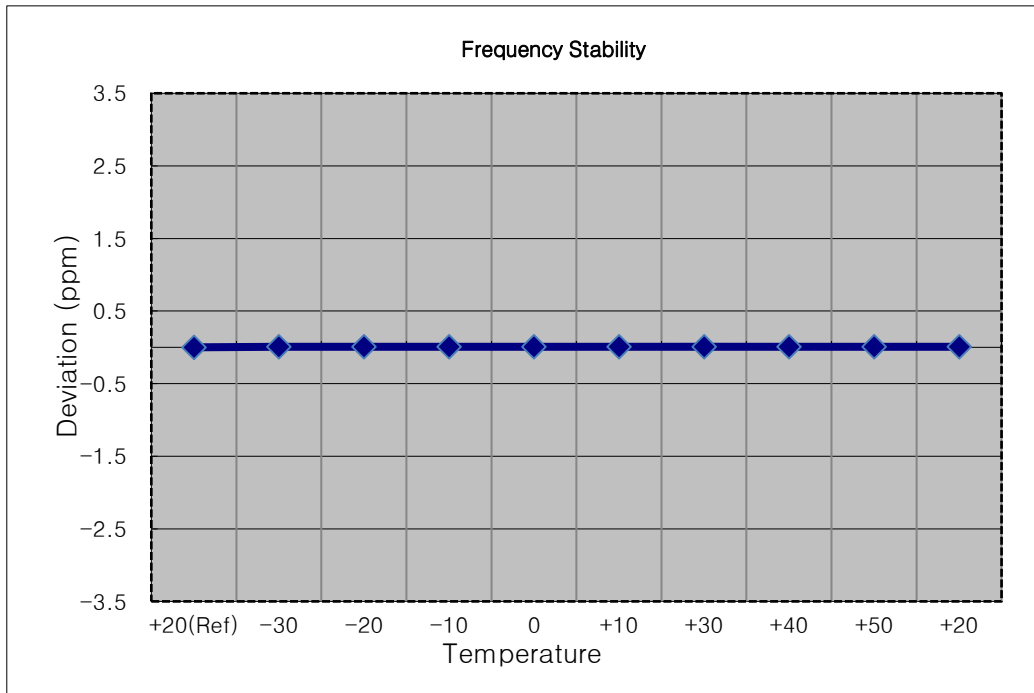
- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,880,000,000 Hz
- ▣ CHANNEL: 9400
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1880 000 013	0.0	0.000 000	0.0000
100 %		-30	1880 000 027	14.1	0.000 001	0.0075
100 %		-20	1880 000 026	13.1	0.000 001	0.0070
100 %		-10	1880 000 025	12.6	0.000 001	0.0067
100 %		0	1880 000 025	12.2	0.000 001	0.0065
100 %		+10	1880 000 029	16.0	0.000 001	0.0085
100 %		+30	1880 000 026	13.7	0.000 001	0.0073
100 %		+40	1880 000 028	14.9	0.000 001	0.0079
100 %		+50	1880 000 027	14.7	0.000 001	0.0078
Batt. Endpoint		3.650	+20	1880 000 026	13.6	0.000 001



- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,907,600,000 Hz
- ▣ CHANNEL: 9538
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

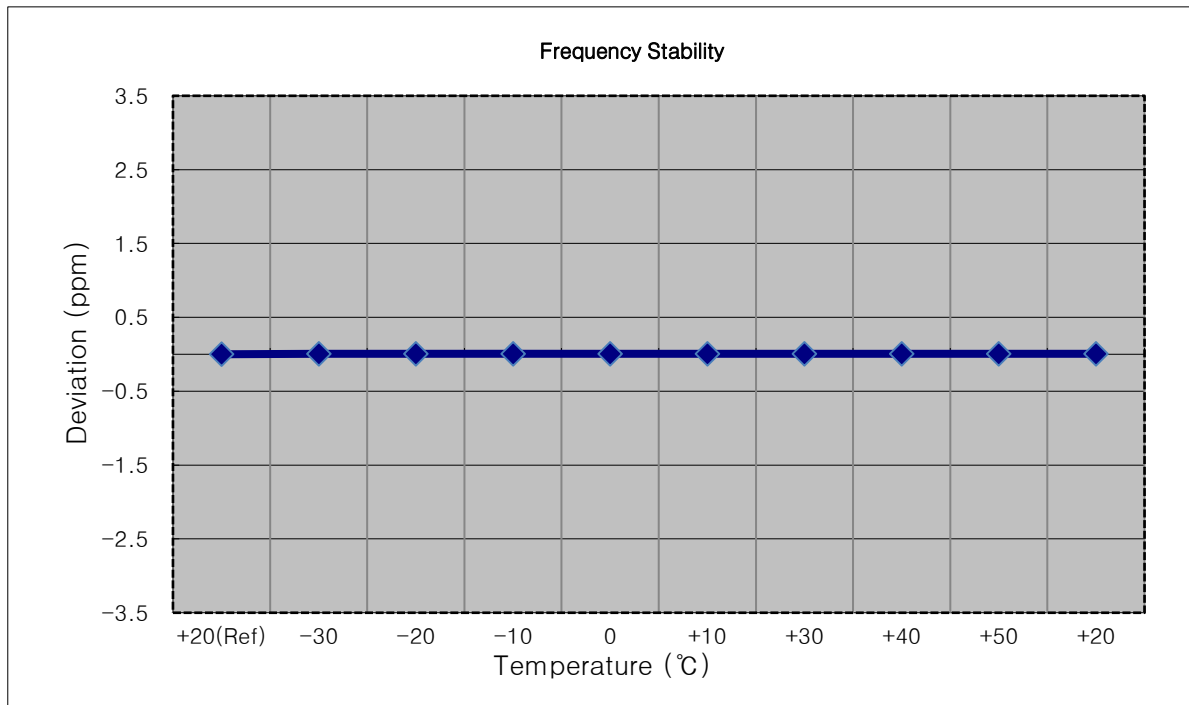
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1907 600 013	0.0	0.000 000	0.0000
100 %		-30	1907 600 027	13.9	0.000 001	0.0073
100 %		-20	1907 600 026	12.1	0.000 001	0.0064
100 %		-10	1907 600 028	14.3	0.000 001	0.0075
100 %		0	1907 600 027	14.0	0.000 001	0.0073
100 %		+10	1907 600 026	13.0	0.000 001	0.0068
100 %		+30	1907 600 028	14.8	0.000 001	0.0078
100 %		+40	1907 600 027	13.8	0.000 001	0.0073
100 %		+50	1907 600 028	14.5	0.000 001	0.0076
Batt. Endpoint		3.650	+20	1907 600 027	13.4	0.000 001





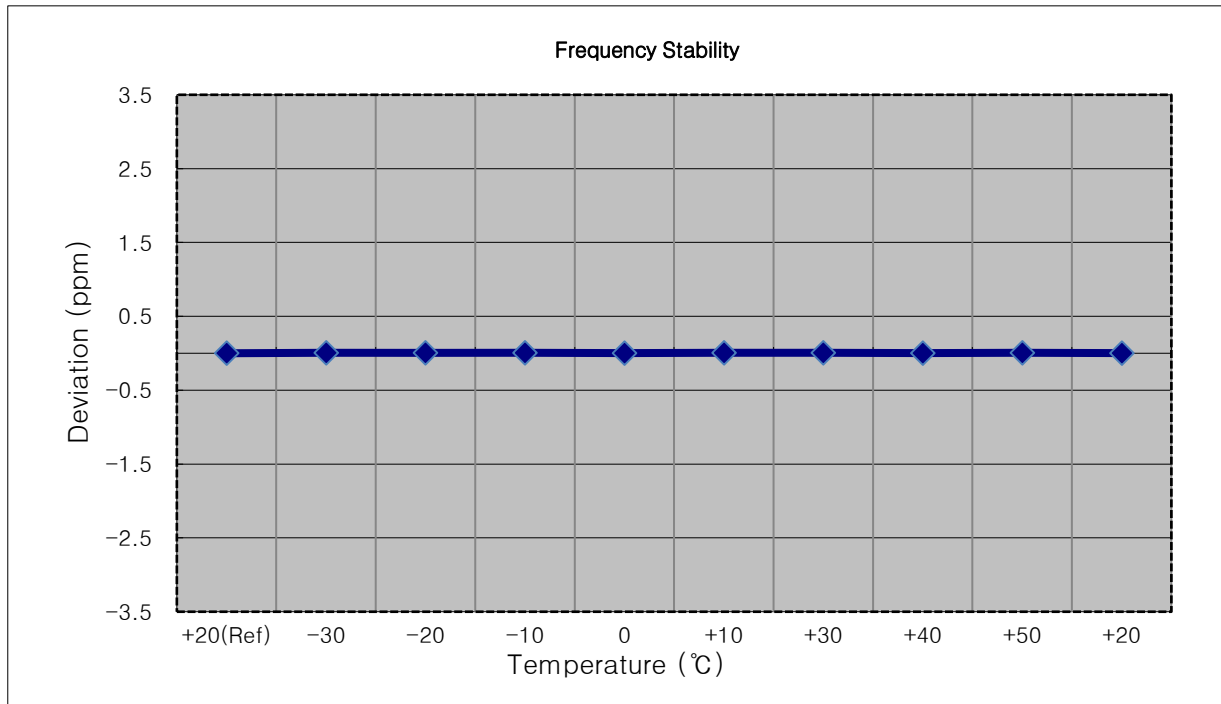
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,712,400,000 Hz
- ▣ CHANNEL: 1312
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1712 400 010	0.0	0.000 000	0.0000
100 %		-30	1712 400 020	10.5	0.000 001	0.0061
100 %		-20	1712 400 020	10.4	0.000 001	0.0061
100 %		-10	1712 400 022	11.9	0.000 001	0.0069
100 %		0	1712 400 020	10.1	0.000 001	0.0059
100 %		+10	1712 400 021	11.0	0.000 001	0.0064
100 %		+30	1712 400 021	11.2	0.000 001	0.0065
100 %		+40	1712 400 021	10.9	0.000 001	0.0064
100 %		+50	1712 400 021	11.0	0.000 001	0.0064
Batt. Endpoint		3.650	+20	1712 400 021	10.9	0.000 001



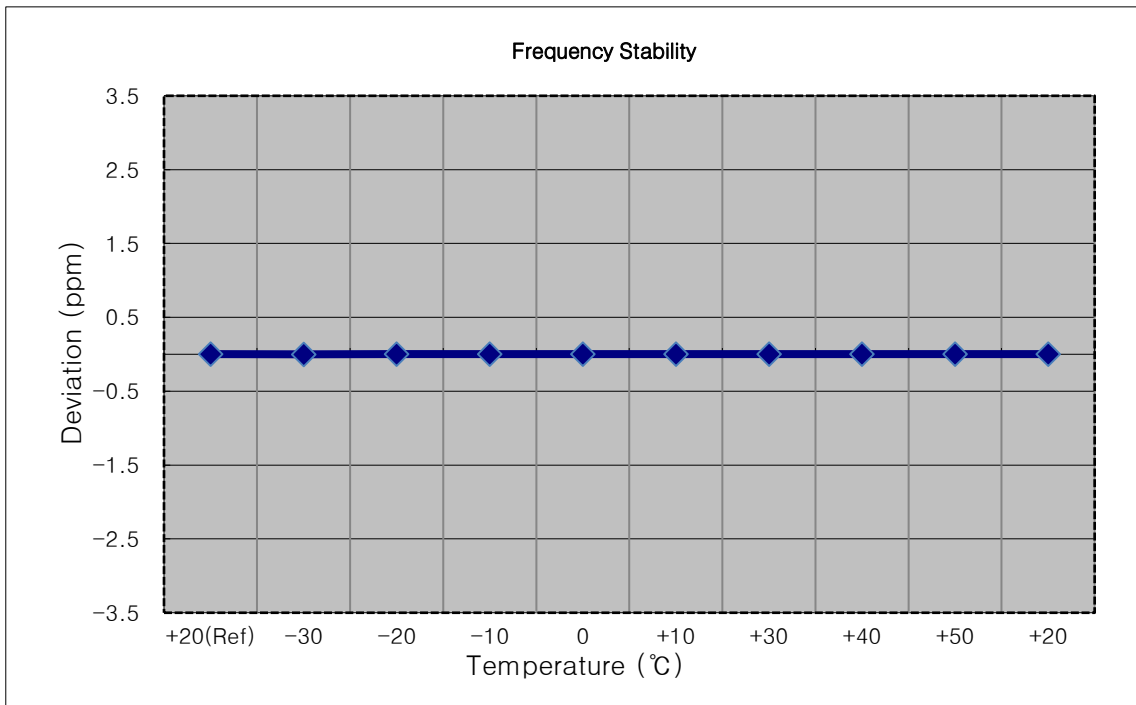
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,732,400,000 Hz
- ▣ CHANNEL: 1412
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1732 400 009	0.0	0.000 000	0.0000
100 %		-30	1732 400 017	8.6	0.000 000	0.0049
100 %		-20	1732 400 018	9.1	0.000 001	0.0052
100 %		-10	1732 400 016	7.6	0.000 000	0.0044
100 %		0	1732 400 016	7.2	0.000 000	0.0042
100 %		+10	1732 400 016	7.7	0.000 000	0.0044
100 %		+30	1732 400 016	7.9	0.000 000	0.0046
100 %		+40	1732 400 015	6.8	0.000 000	0.0039
100 %		+50	1732 400 017	8.1	0.000 000	0.0046
Batt. Endpoint		3.650	+20	1732 400 016	7.3	0.000 000



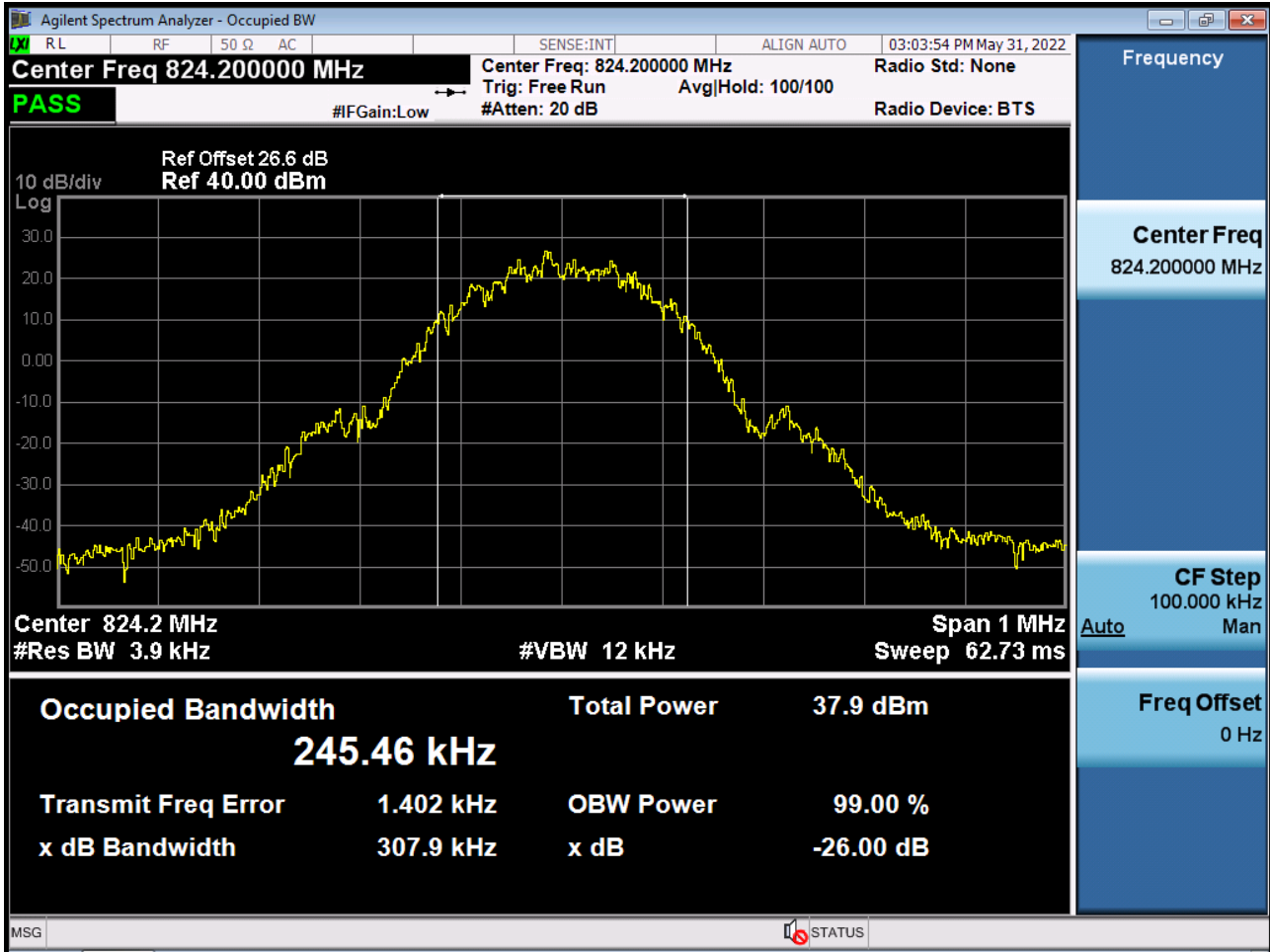
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,752,600,000 Hz
- ▣ CHANNEL: 1513
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	4.200	+20(Ref)	1752 599 998	0.0	0.000 000	0.0000
100 %		-30	1752 599 997	-1.4	0.000 000	-0.0008
100 %		-20	1752 600 002	4.4	0.000 000	0.0025
100 %		-10	1752 600 001	2.9	0.000 000	0.0016
100 %		0	1752 600 001	2.5	0.000 000	0.0014
100 %		+10	1752 600 001	2.9	0.000 000	0.0016
100 %		+30	1752 600 001	2.9	0.000 000	0.0017
100 %		+40	1752 600 002	3.5	0.000 000	0.0020
100 %		+50	1752 600 001	3.2	0.000 000	0.0018
Batt. Endpoint		3.650	+20	1752 600 000	2.0	0.000 000

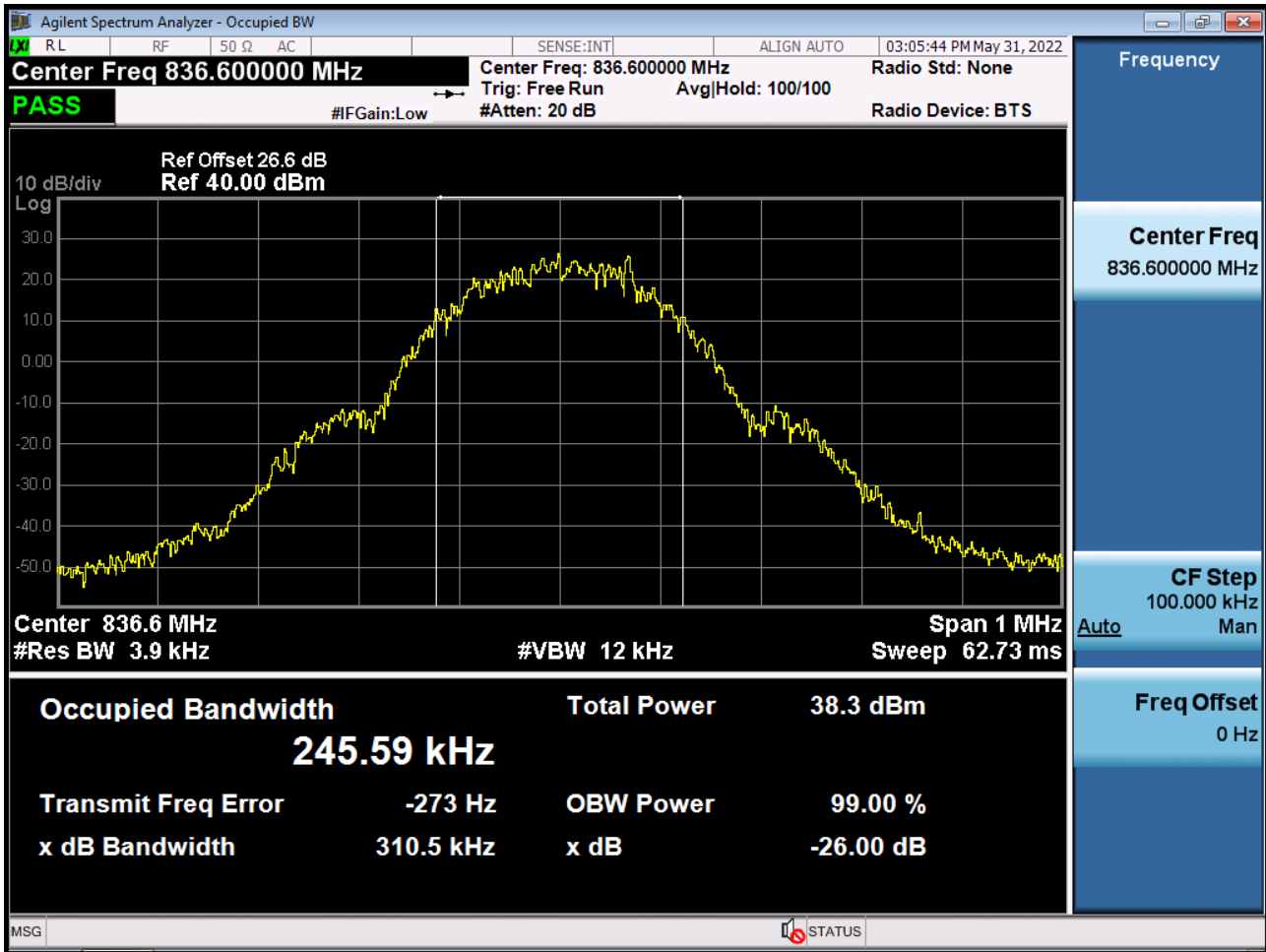


## 9. TEST PLOTS

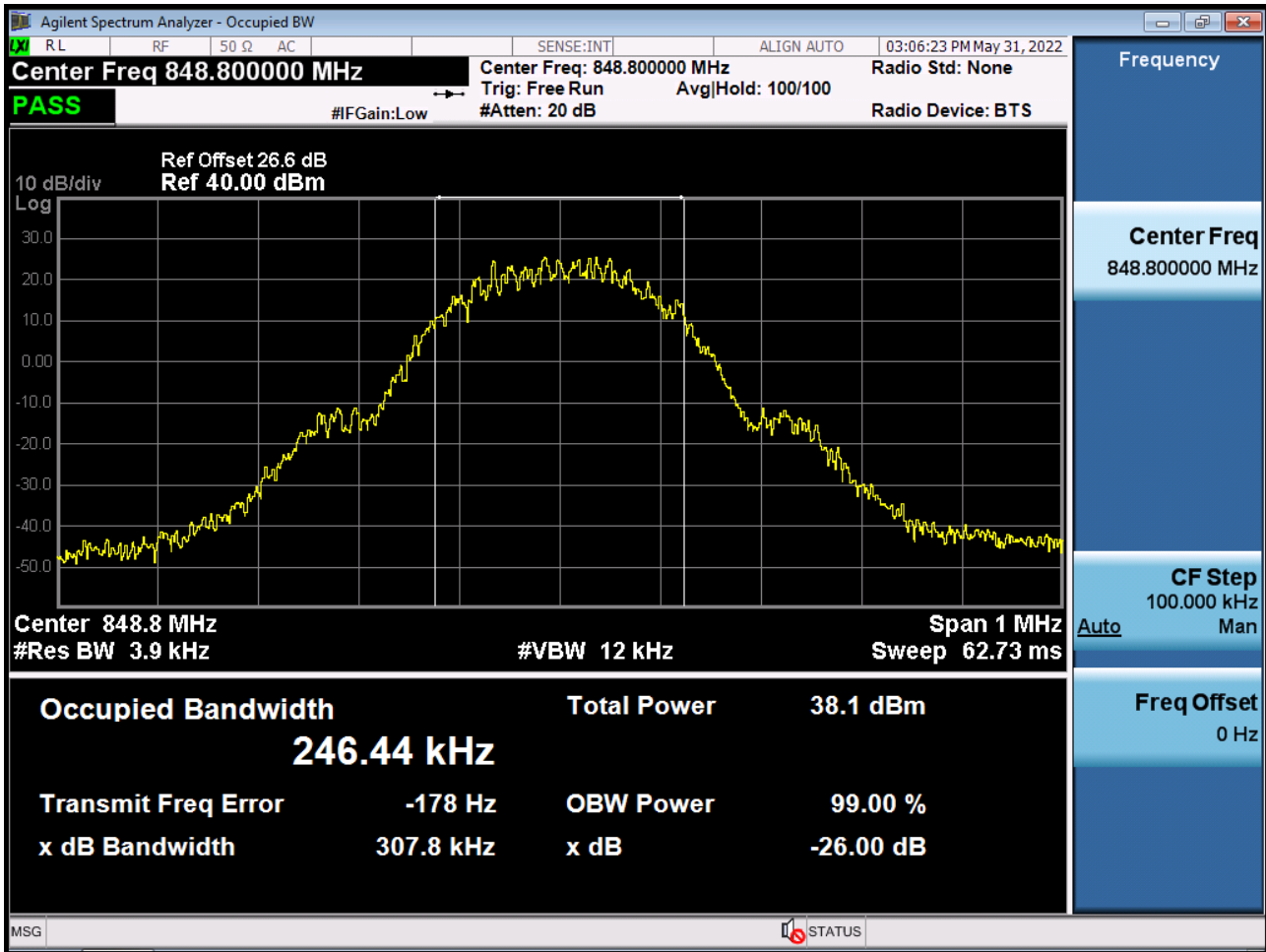
■ GSM850 MODE (128 CH.) Occupied Bandwidth



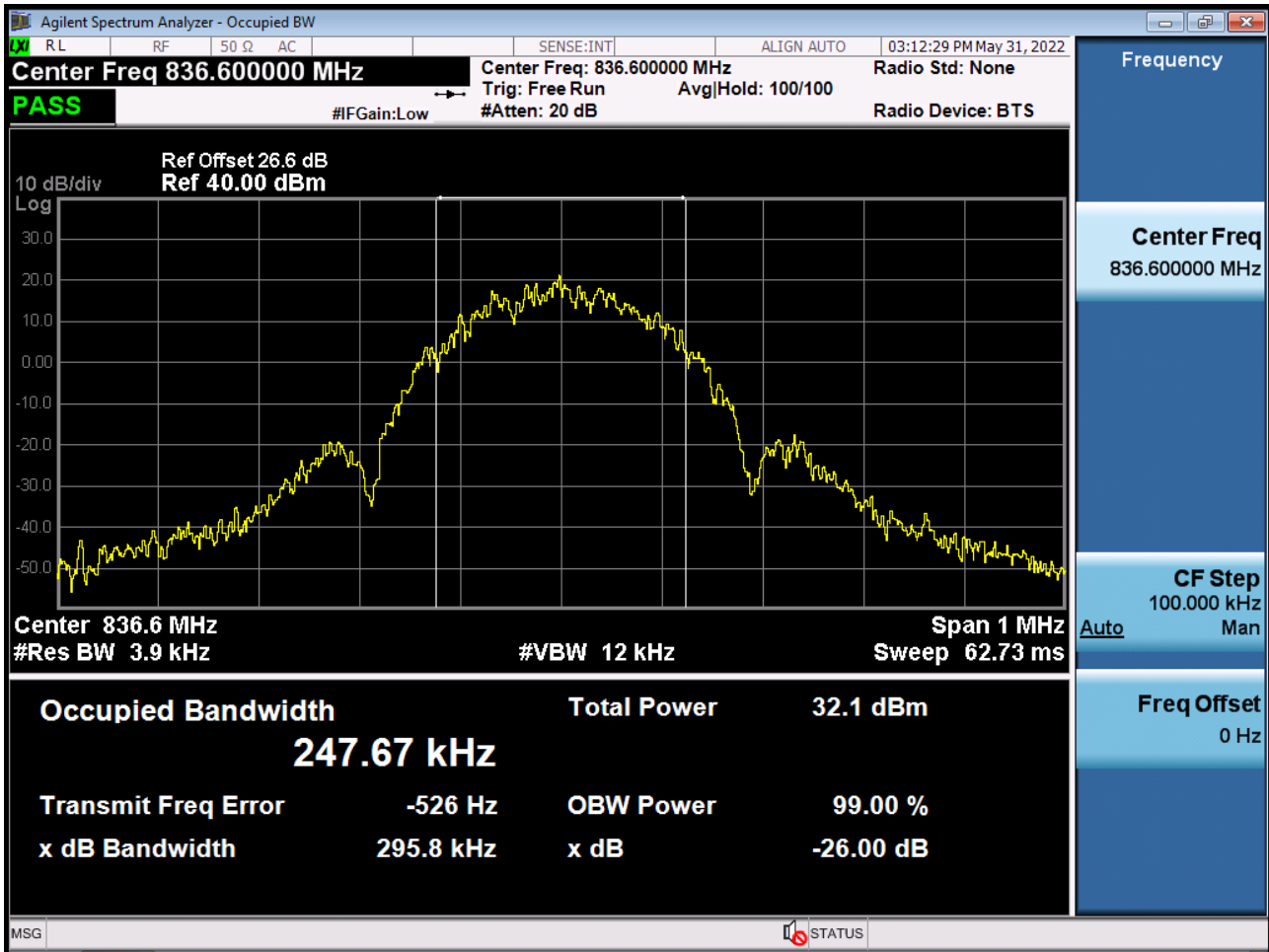
■ GSM850 MODE (190 CH.) Occupied Bandwidth



■ GSM850 MODE (251 CH.) Occupied Bandwidth

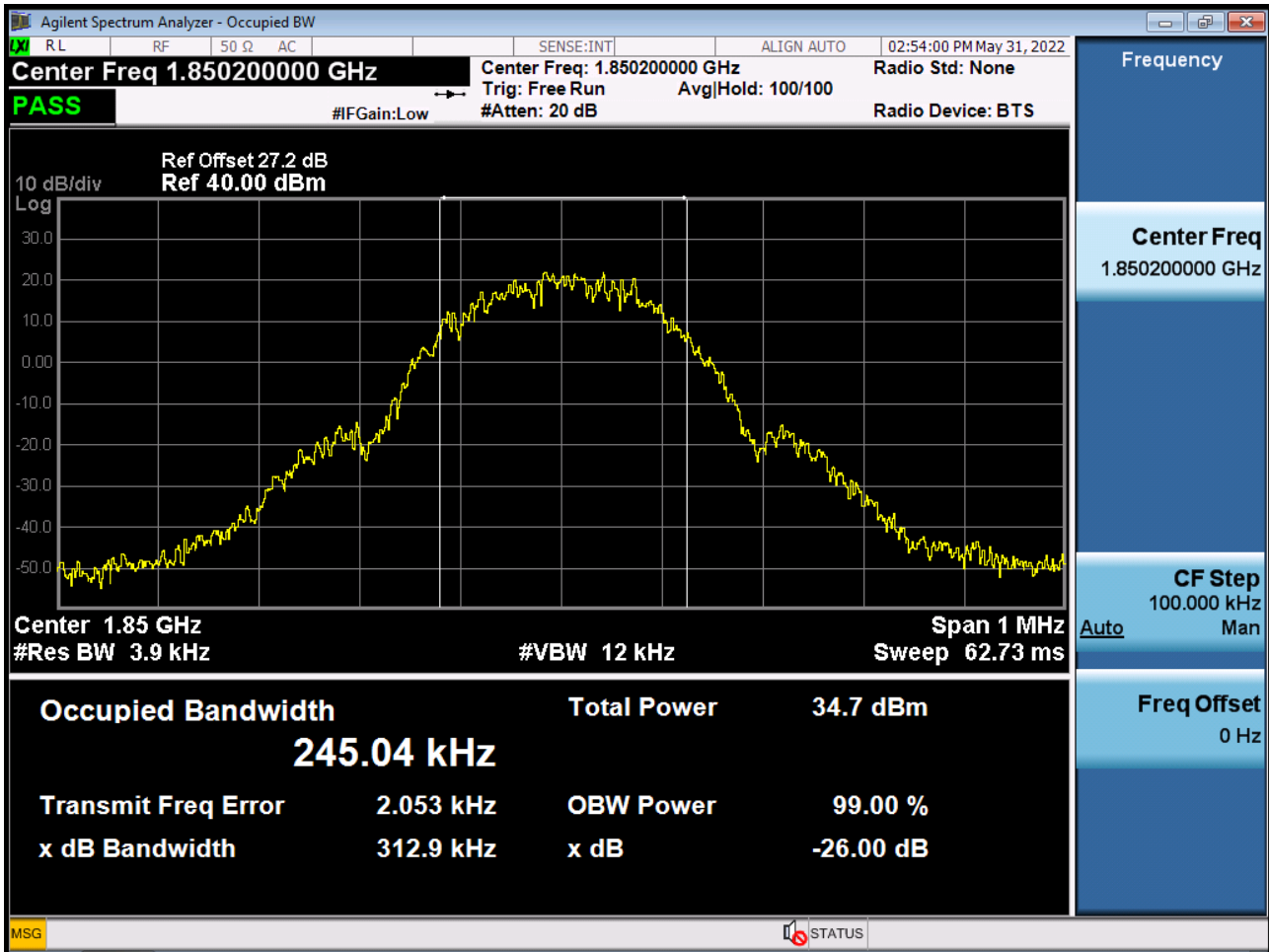


■ GSM850 EDGE (190 CH.) Occupied Bandwidth

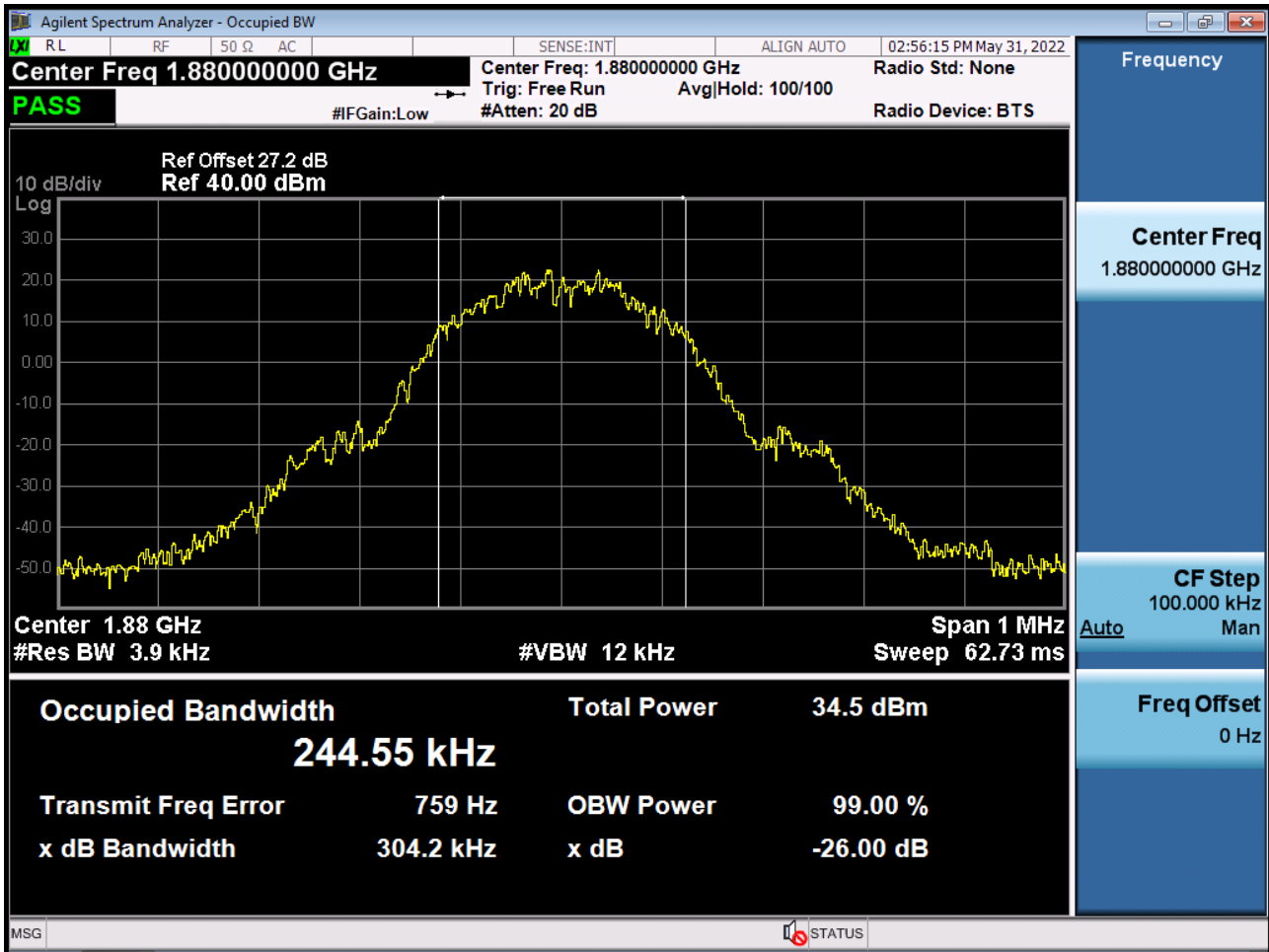




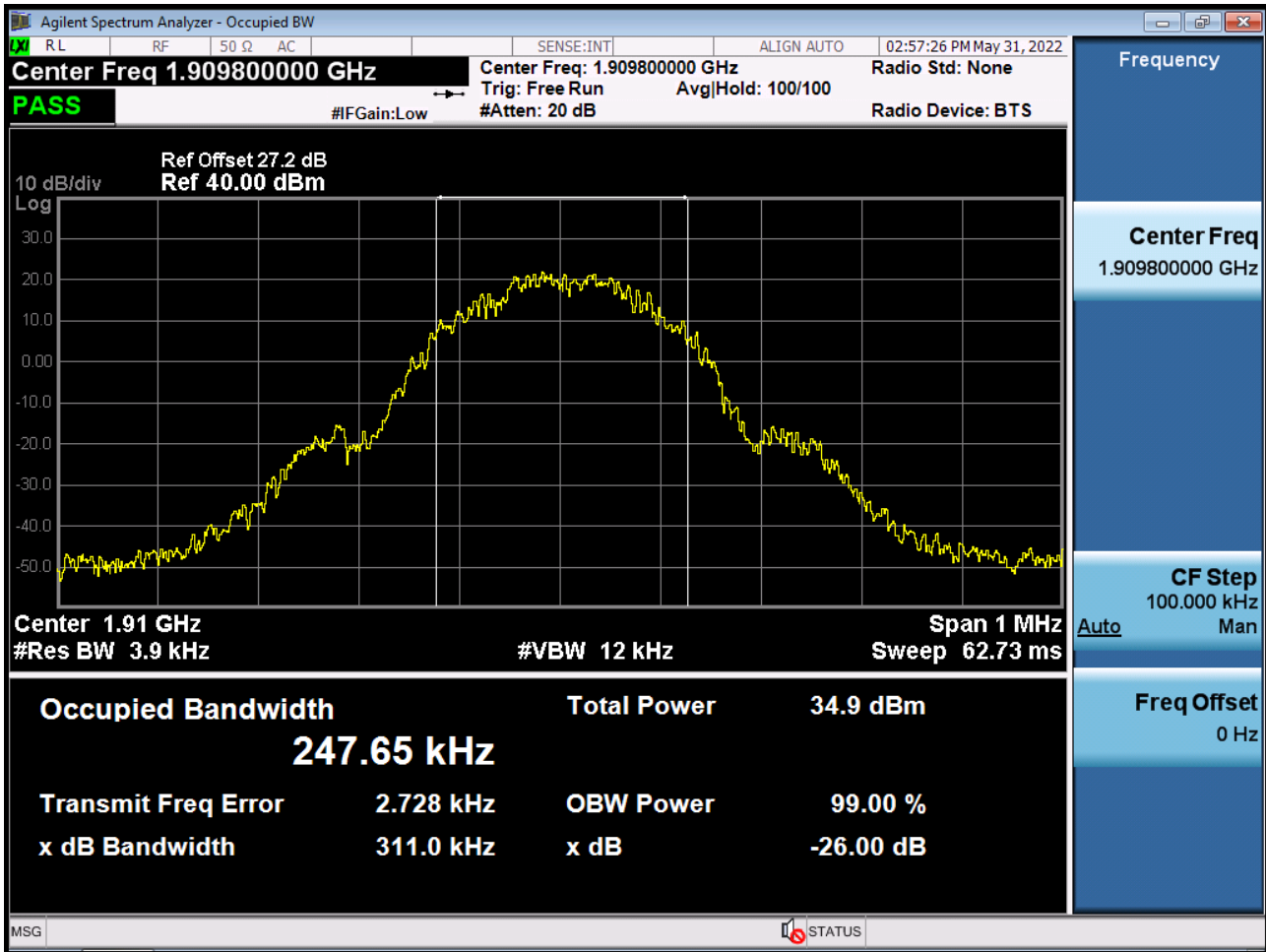
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



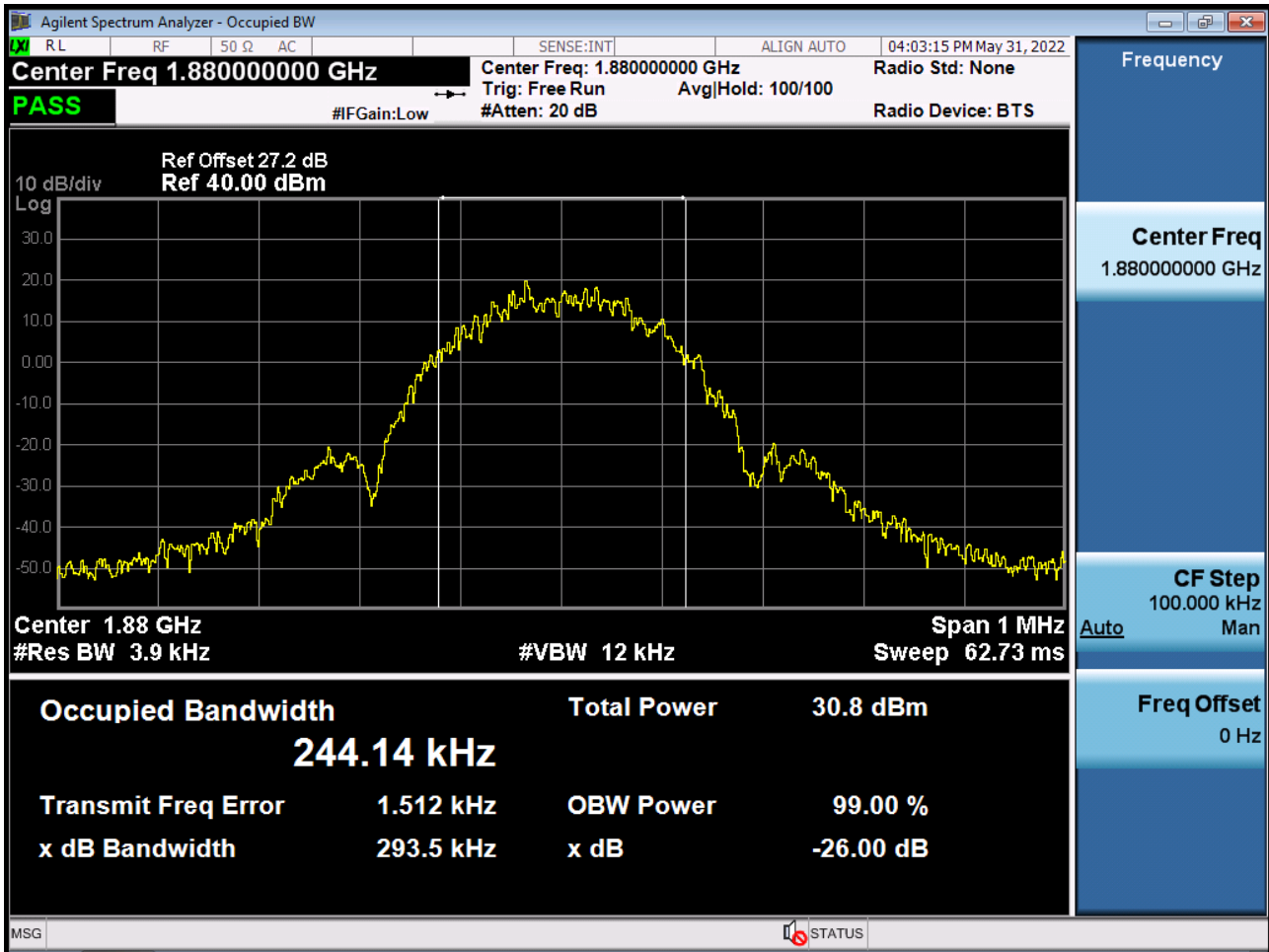
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



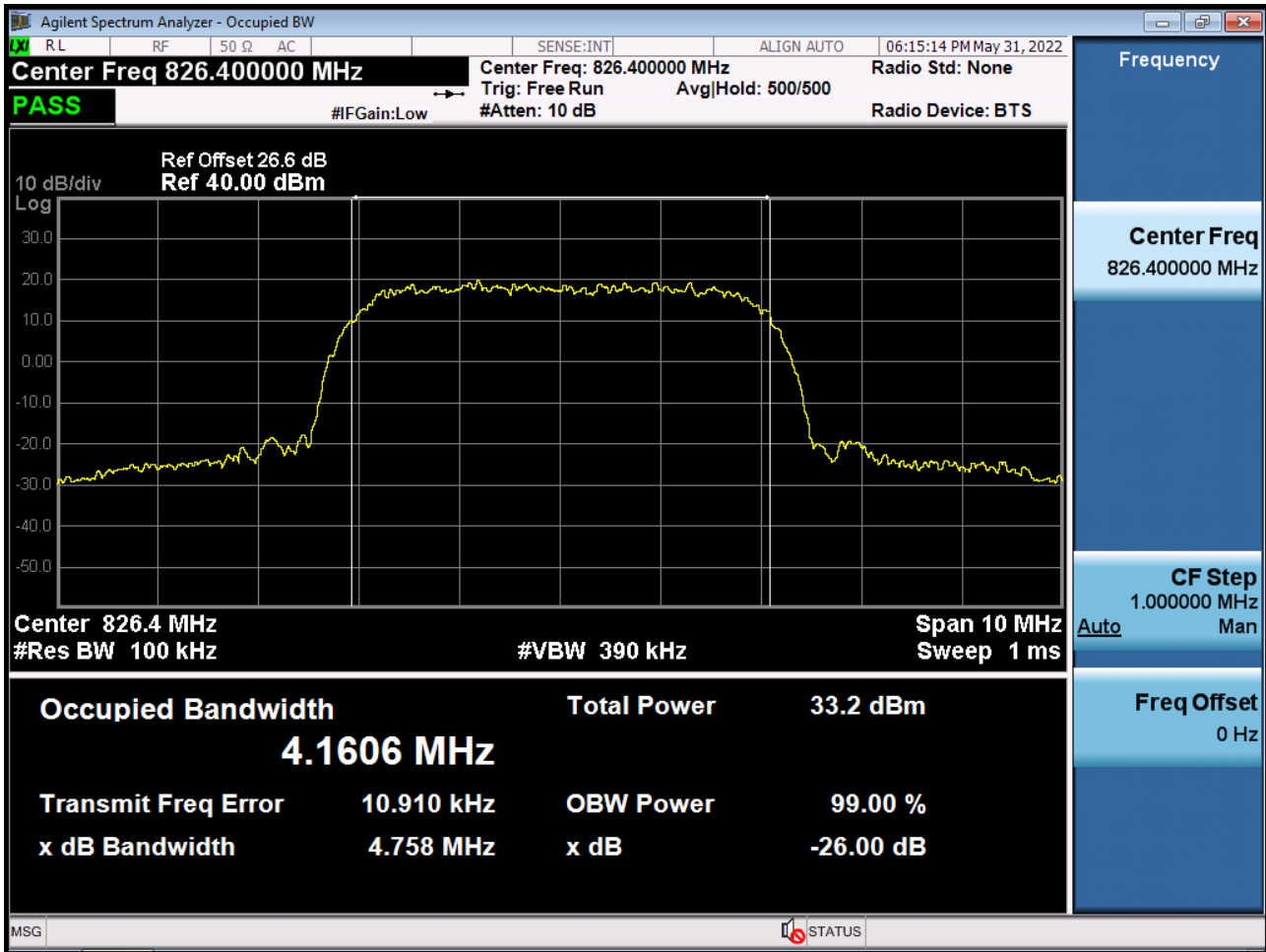
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



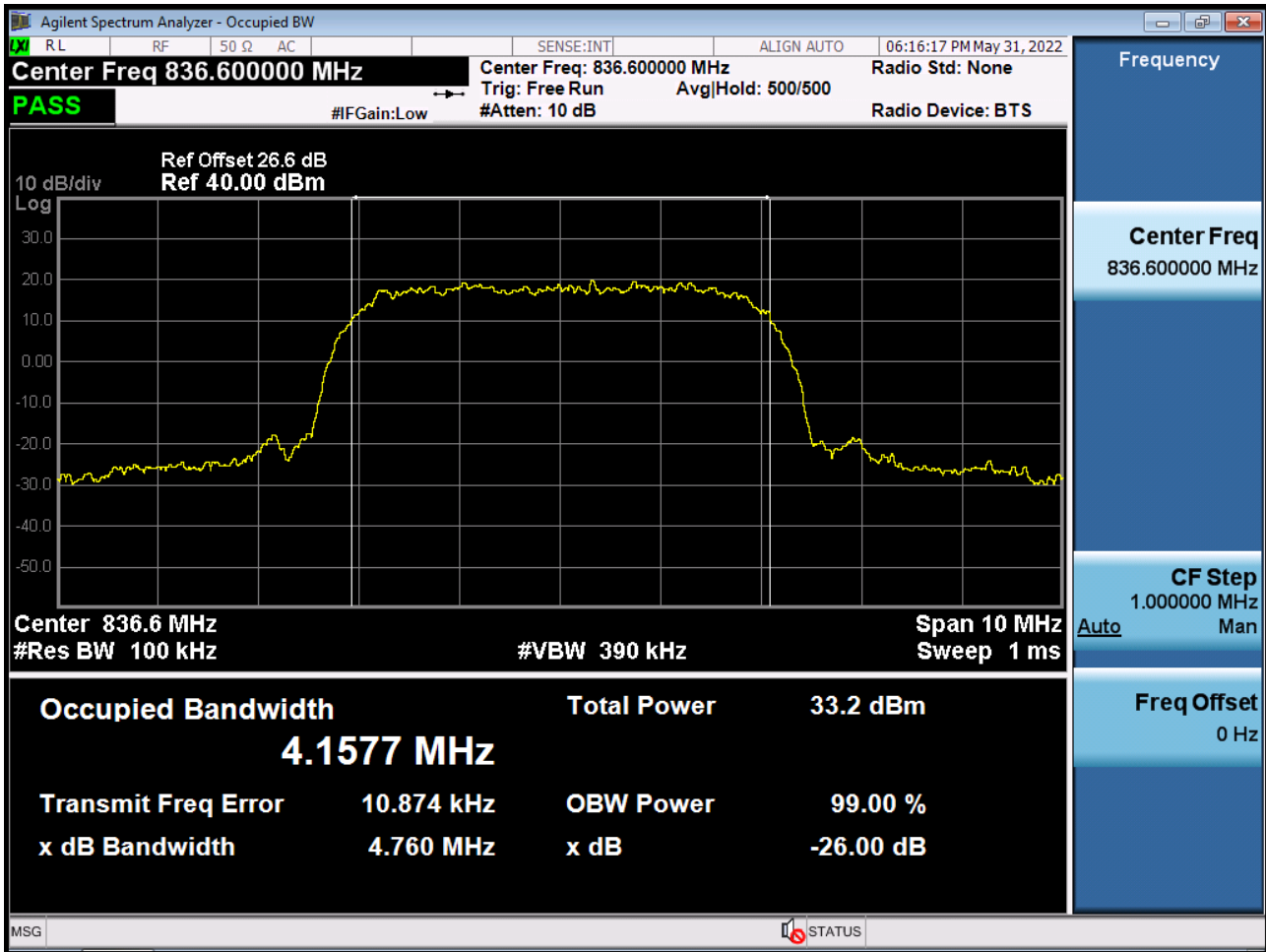
■ GSM1900 EDGE (661 CH.) Occupied Bandwidth



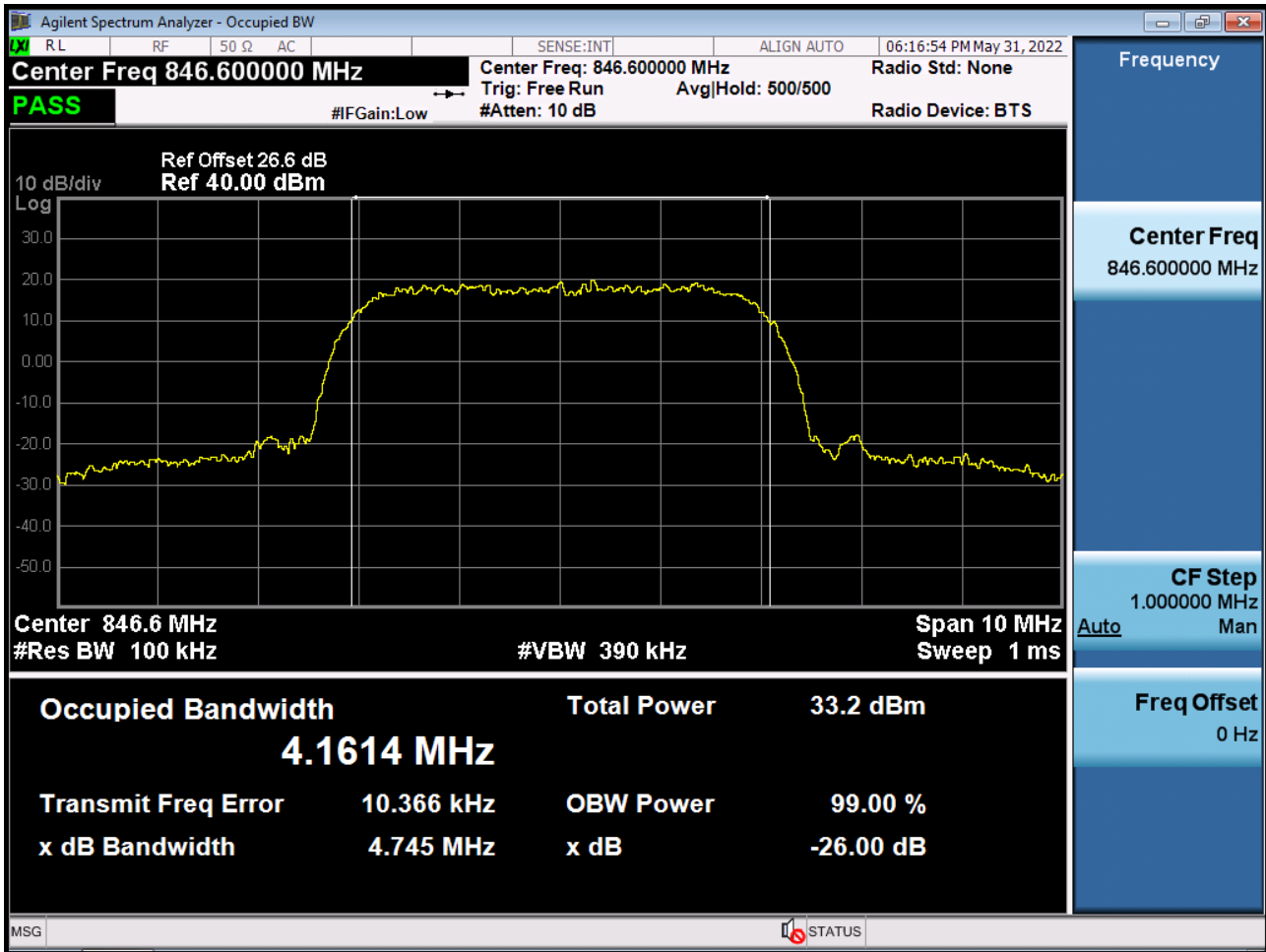
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



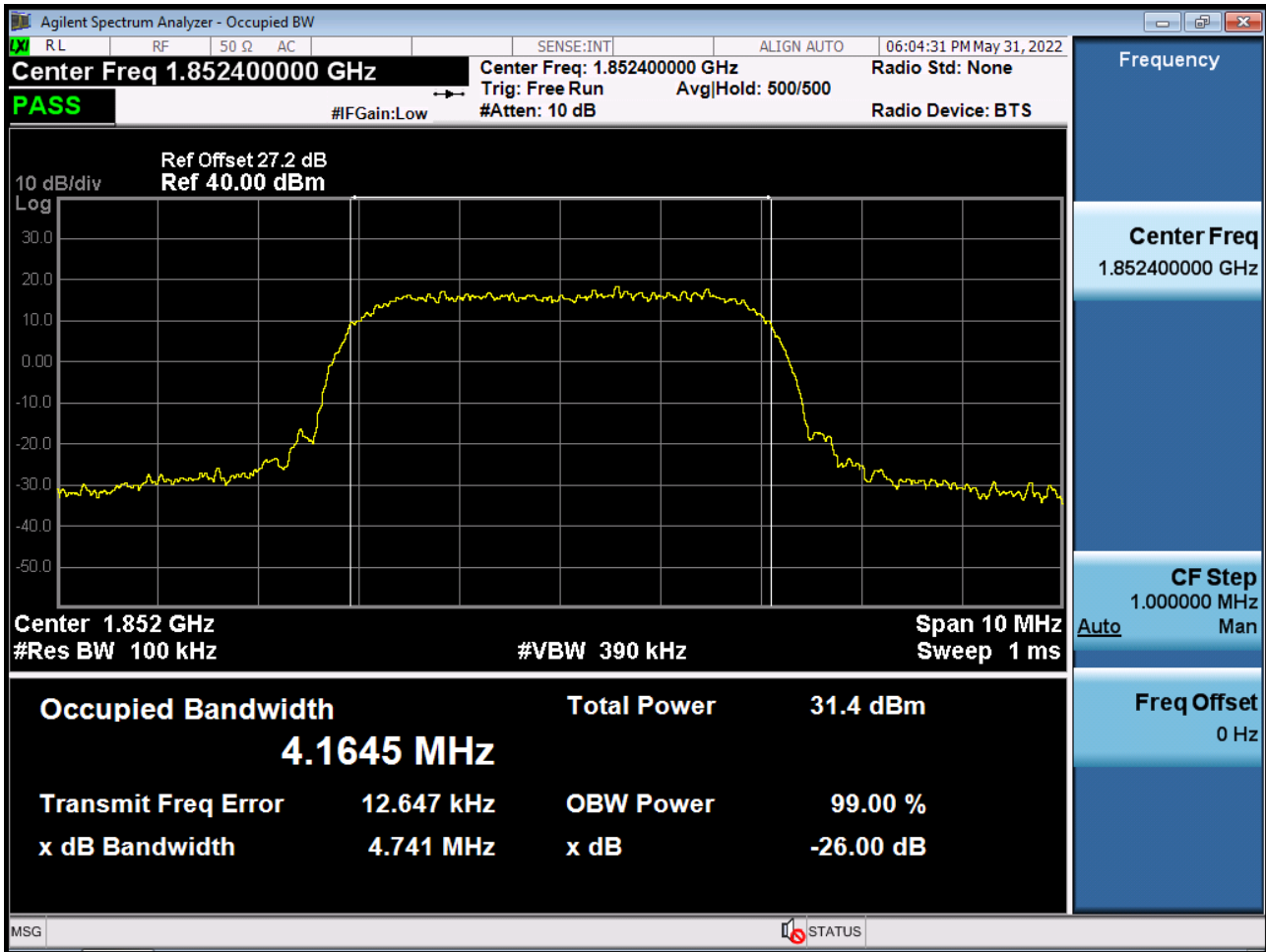
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



■ WCDMA850MODE (4233 CH.) Occupied Bandwidth

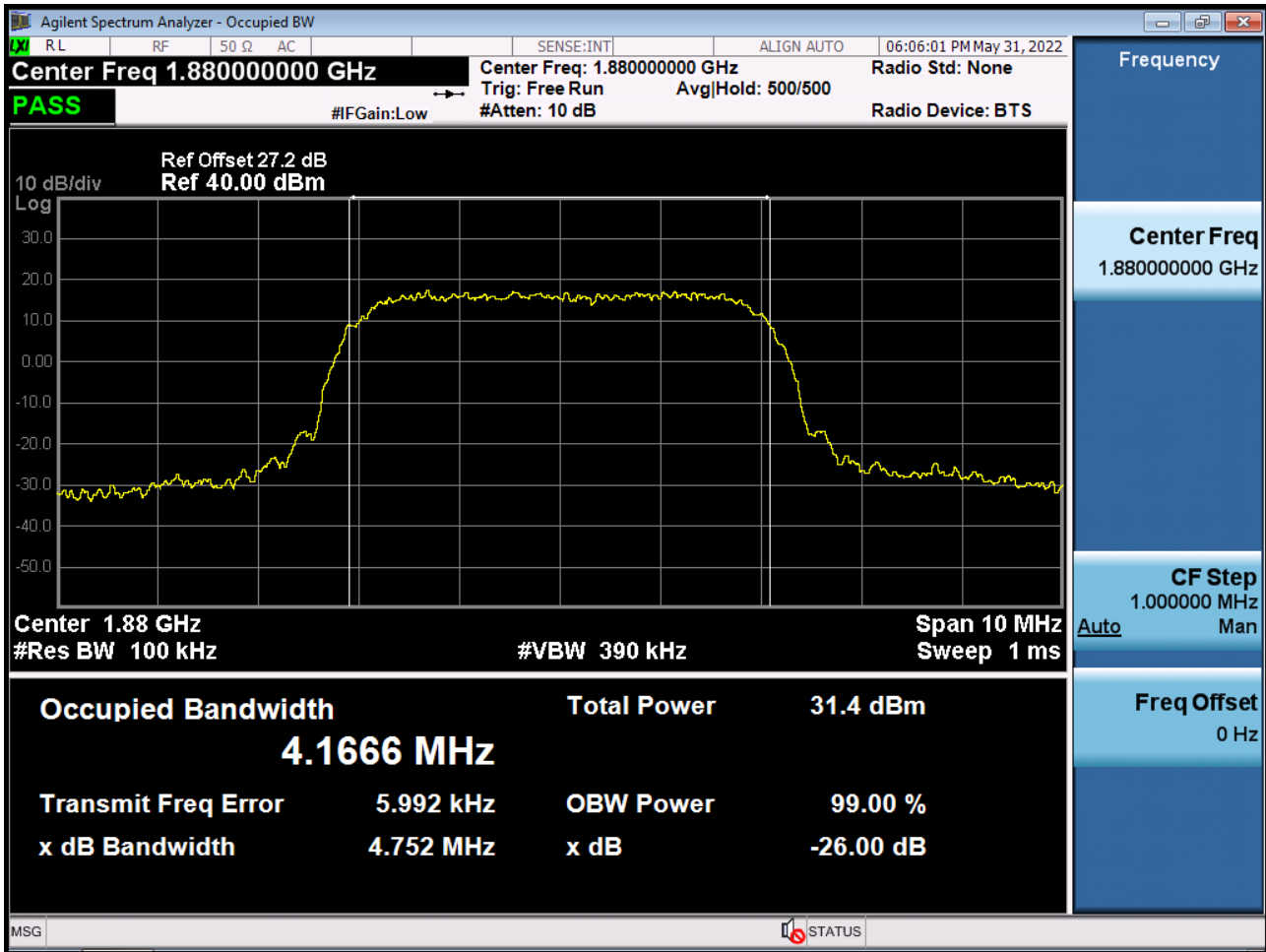


■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth

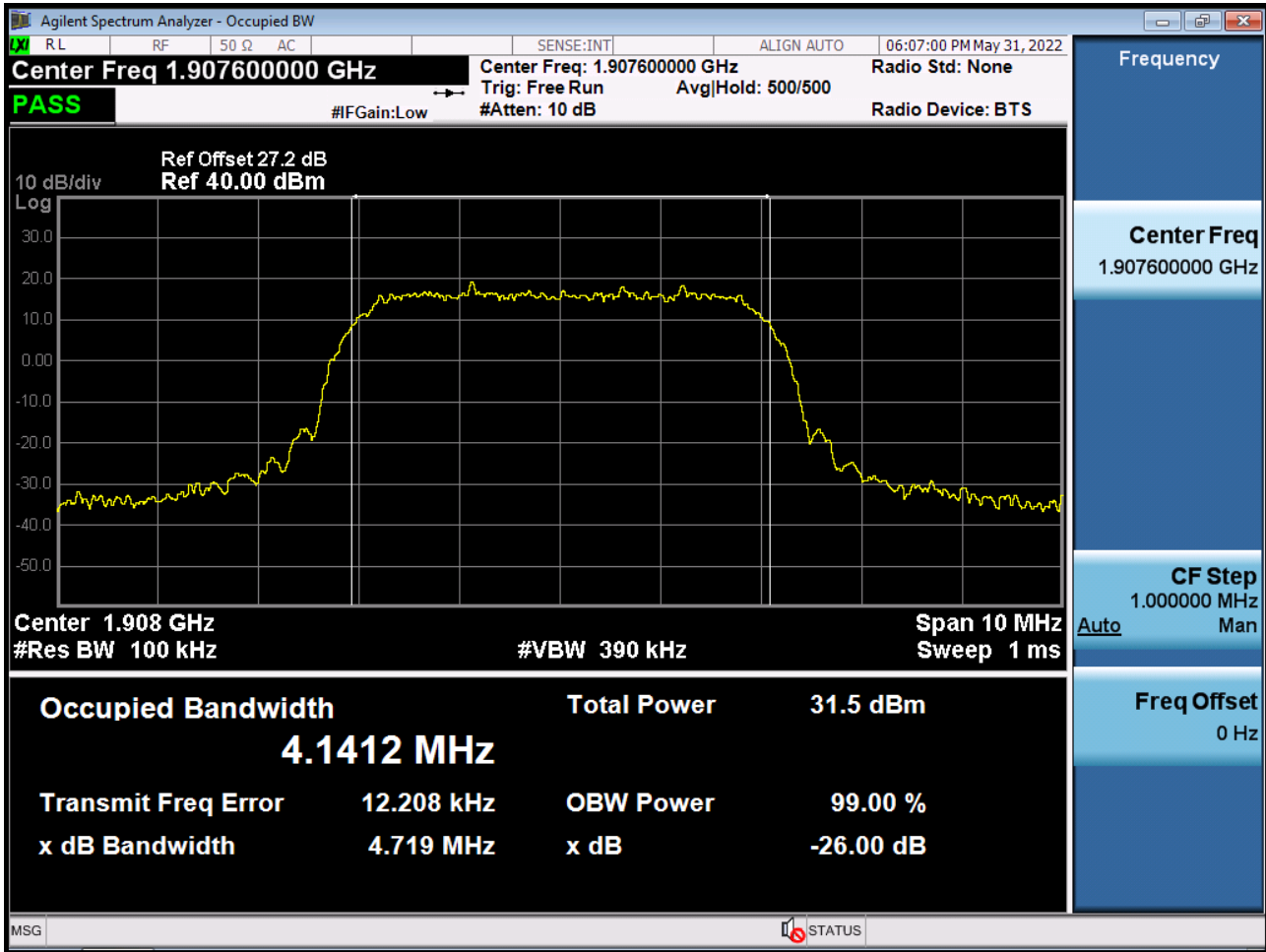




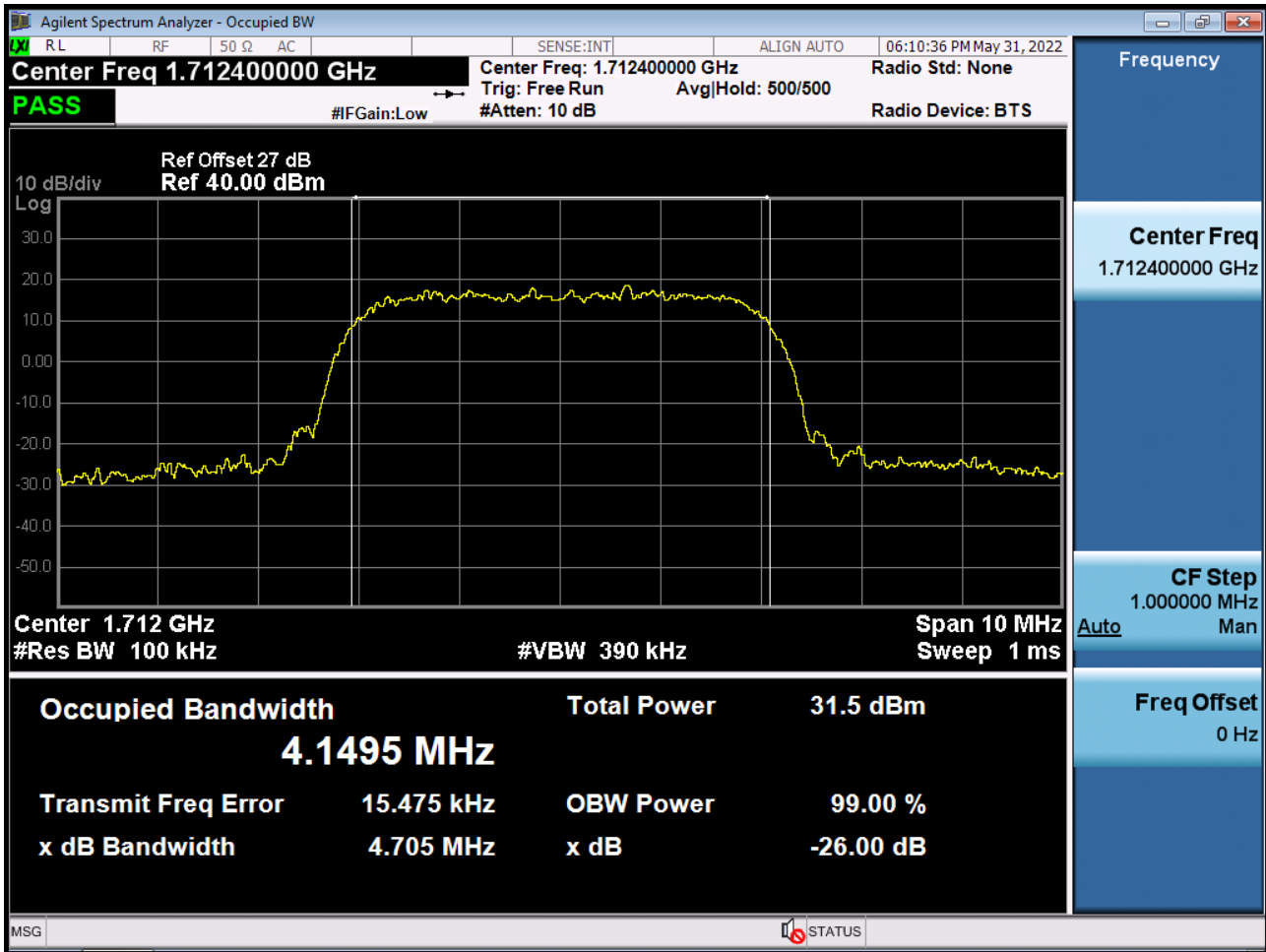
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



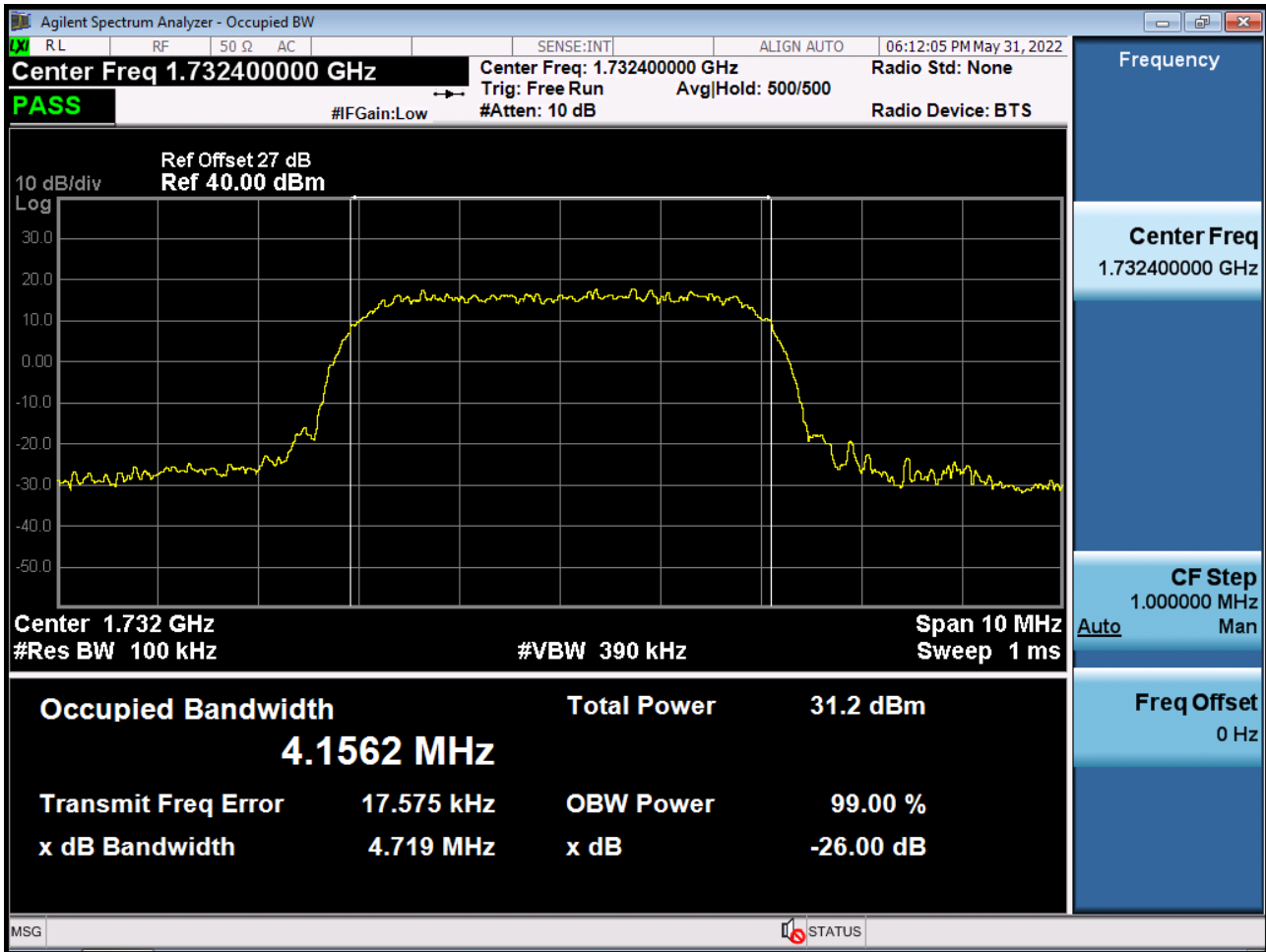
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



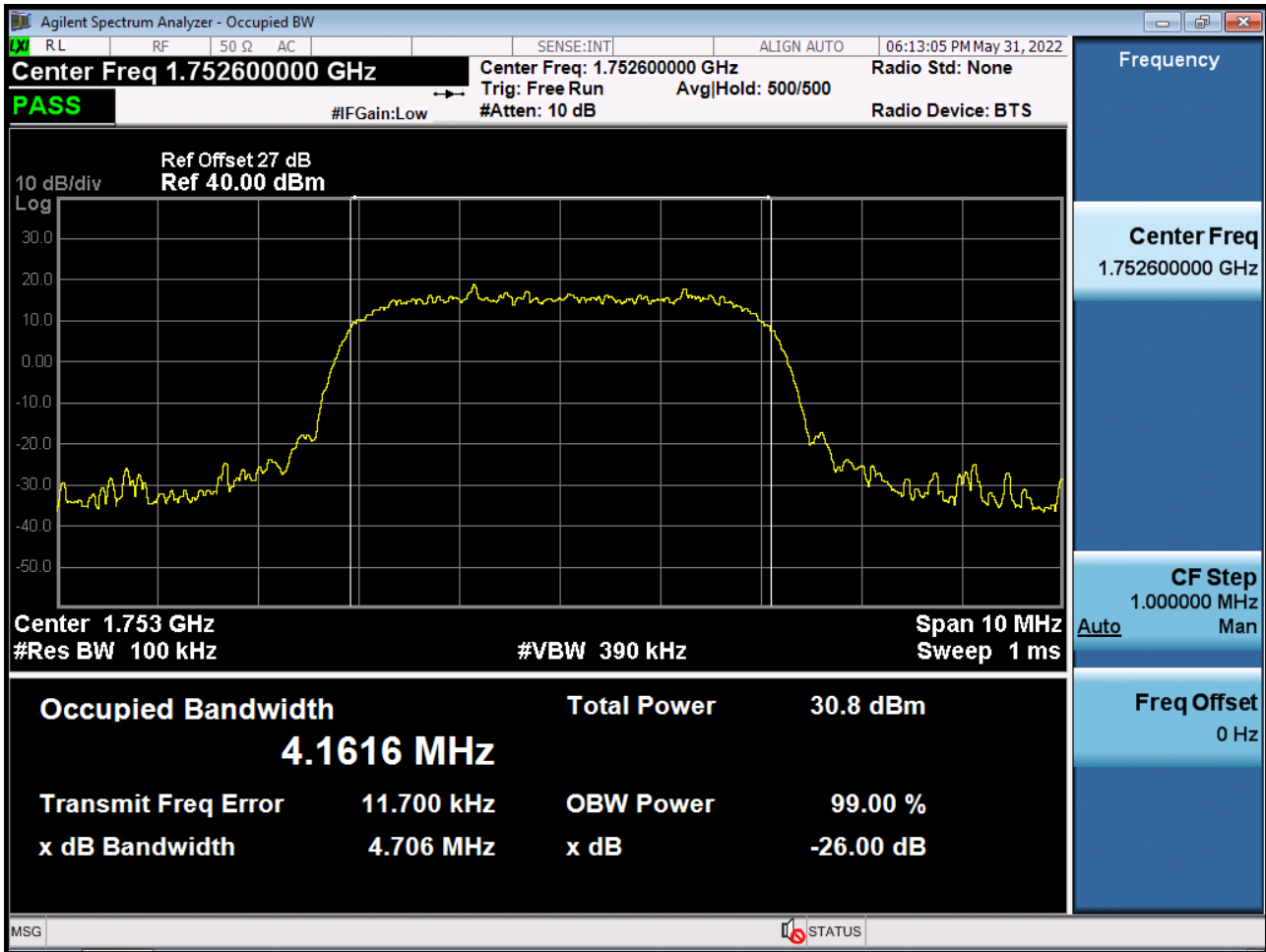
■ WCDMA1700 MODE (1312 CH.) Occupied Bandwidth



■ WCDMA1700 MODE (1412 CH.) Occupied Bandwidth



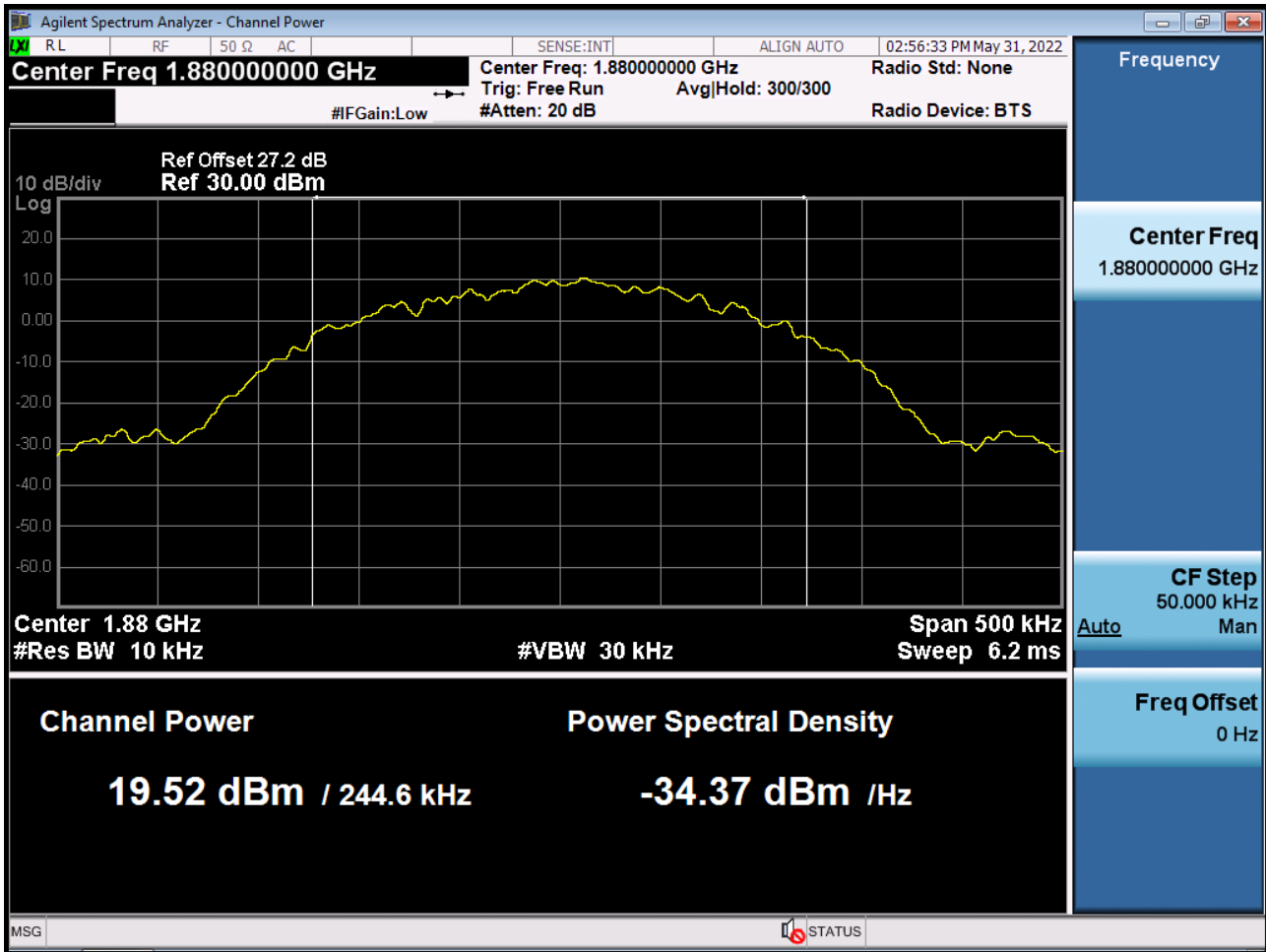
■ WCDMA1700 MODE (1513 CH.) Occupied Bandwidth



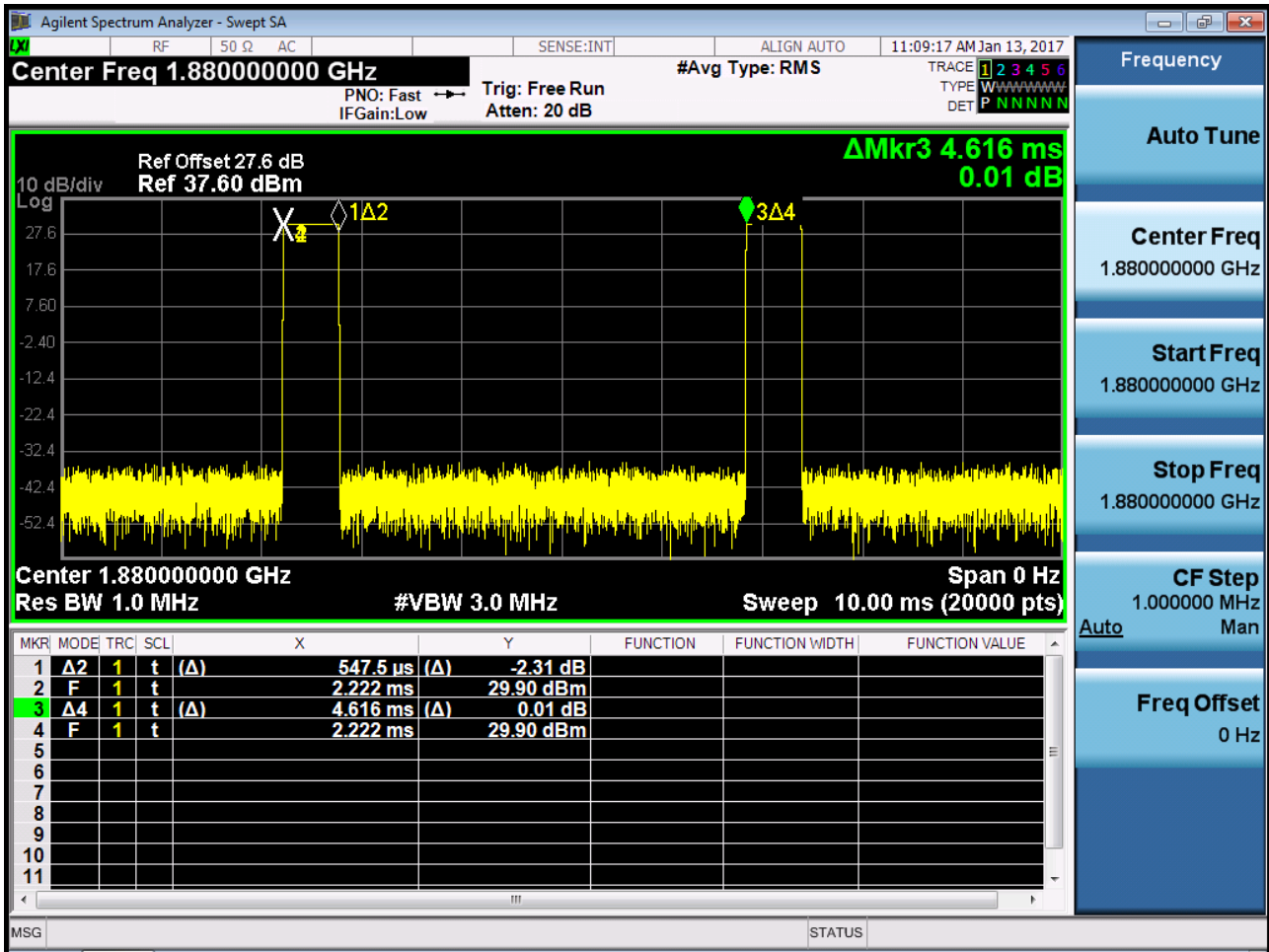
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P<sub>PK</sub>



■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P<sub>Avg</sub>

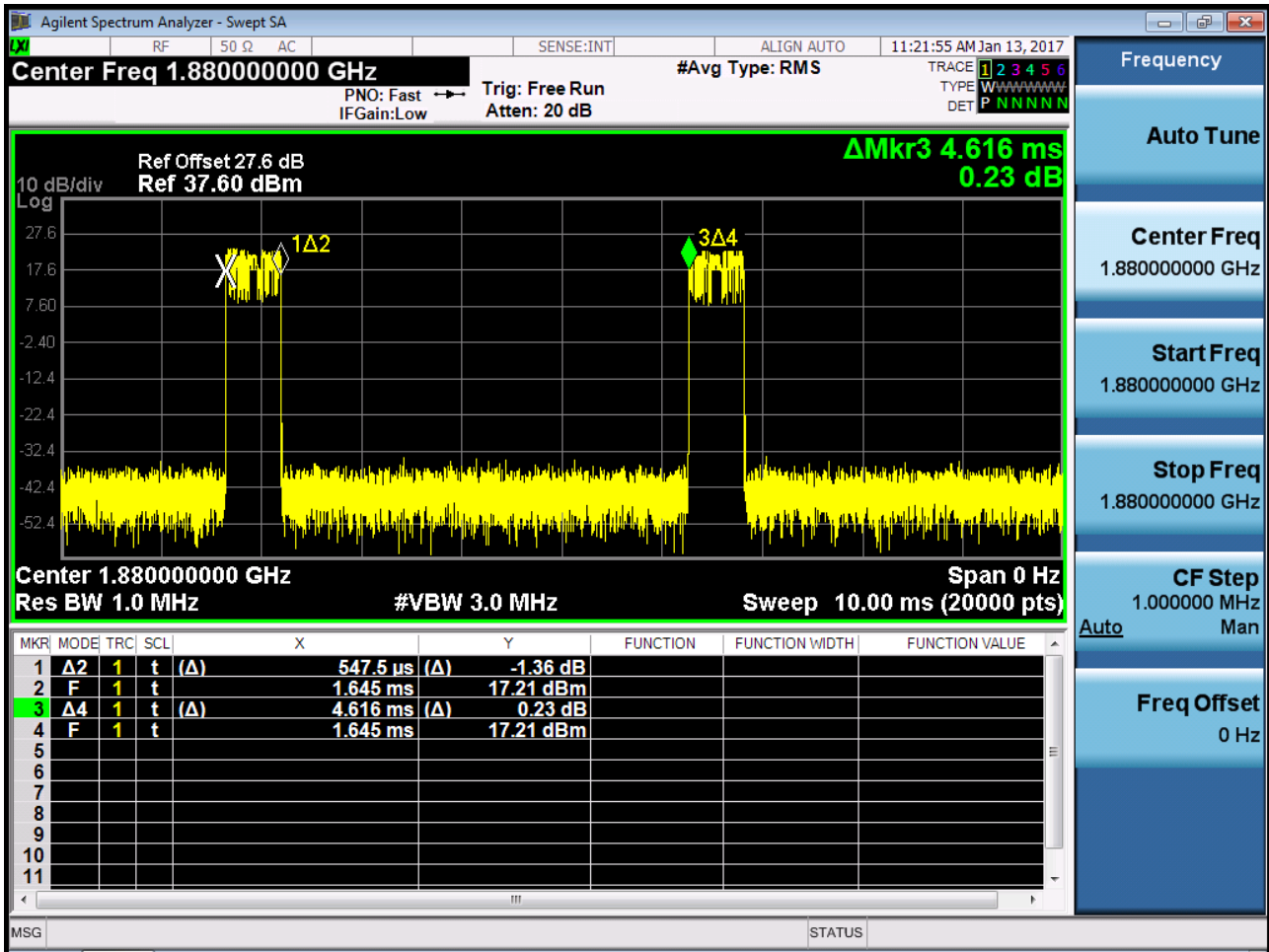


■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio Duty

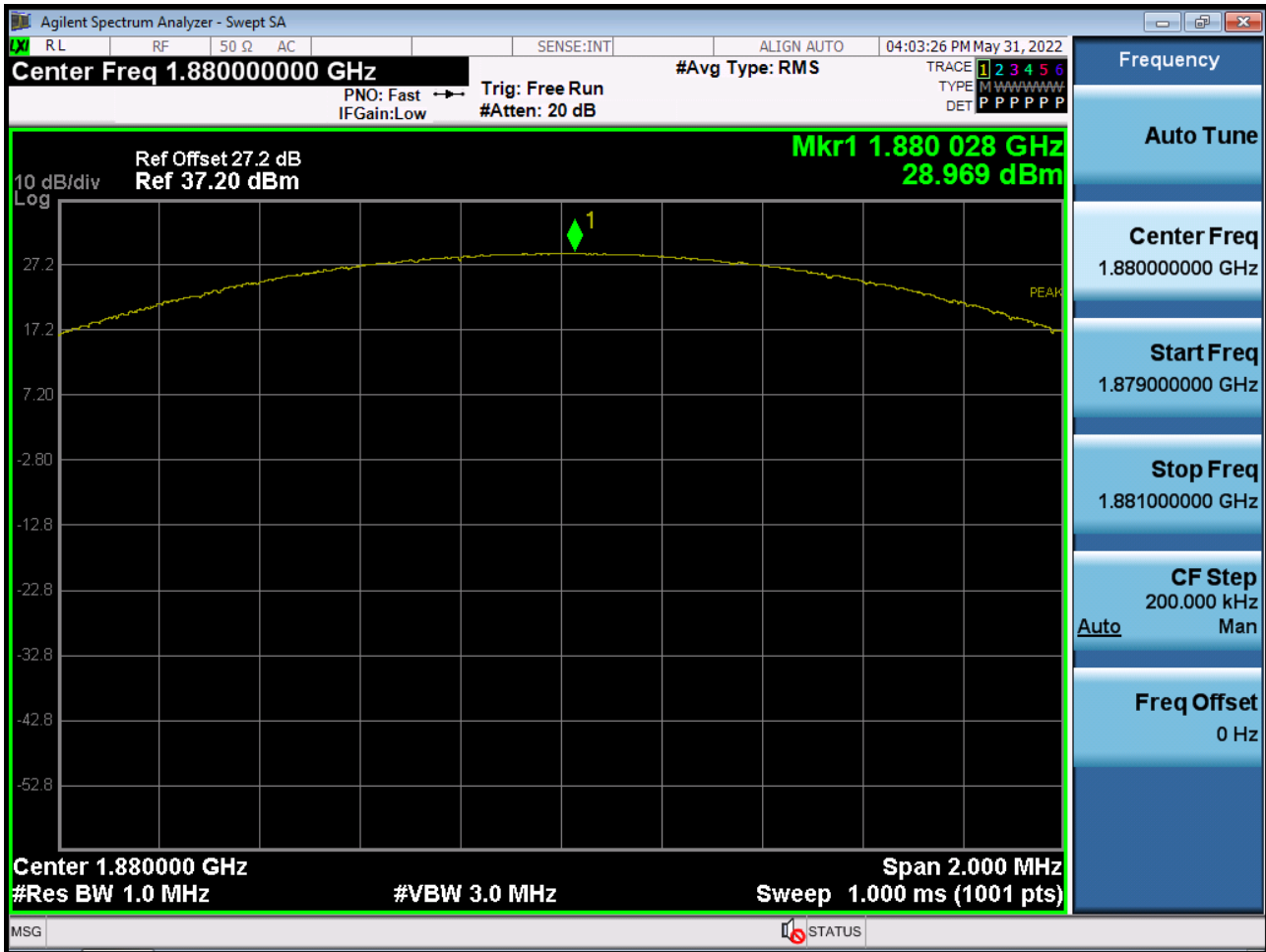




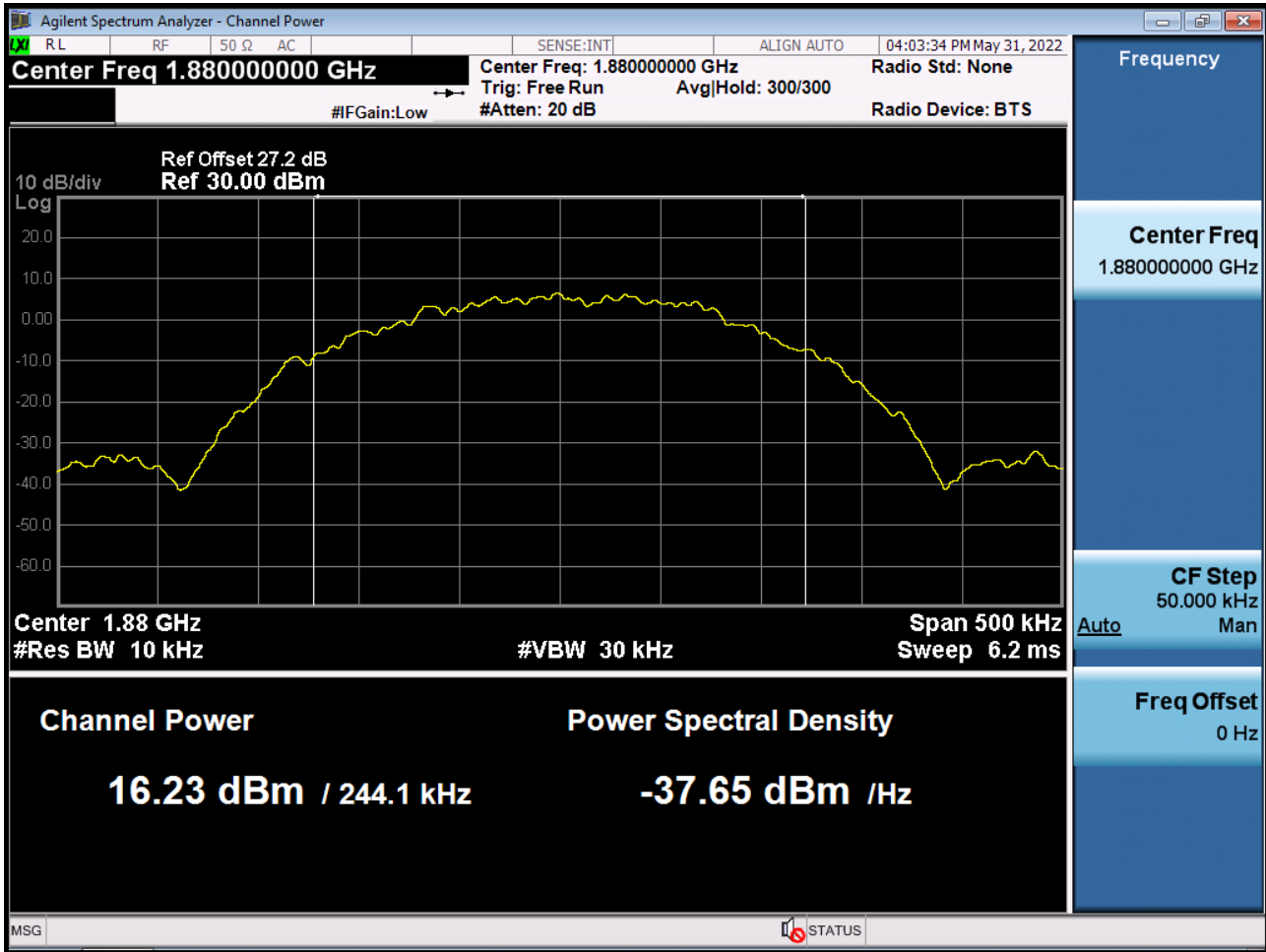
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio Duty



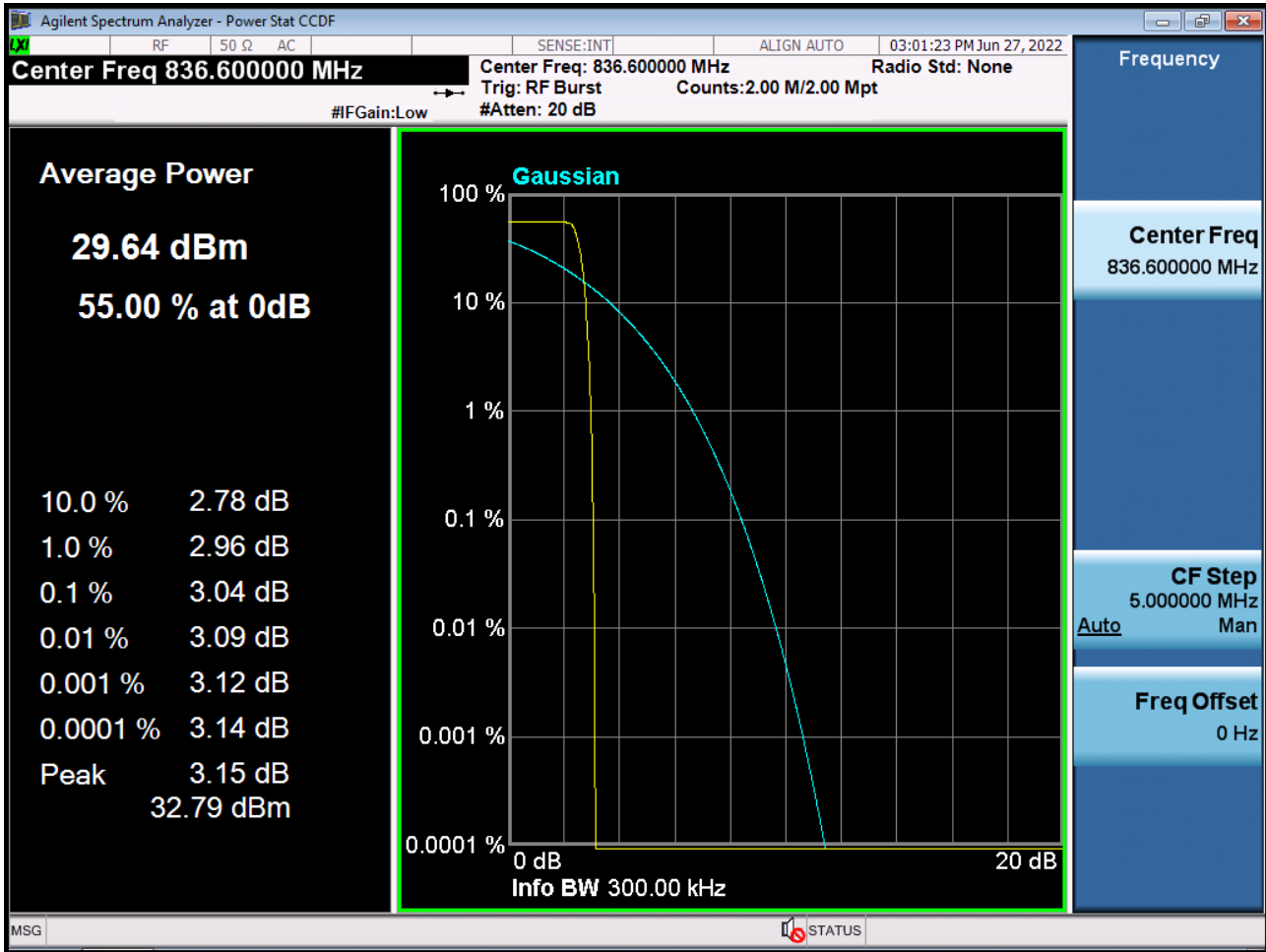
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P<sub>PK</sub>



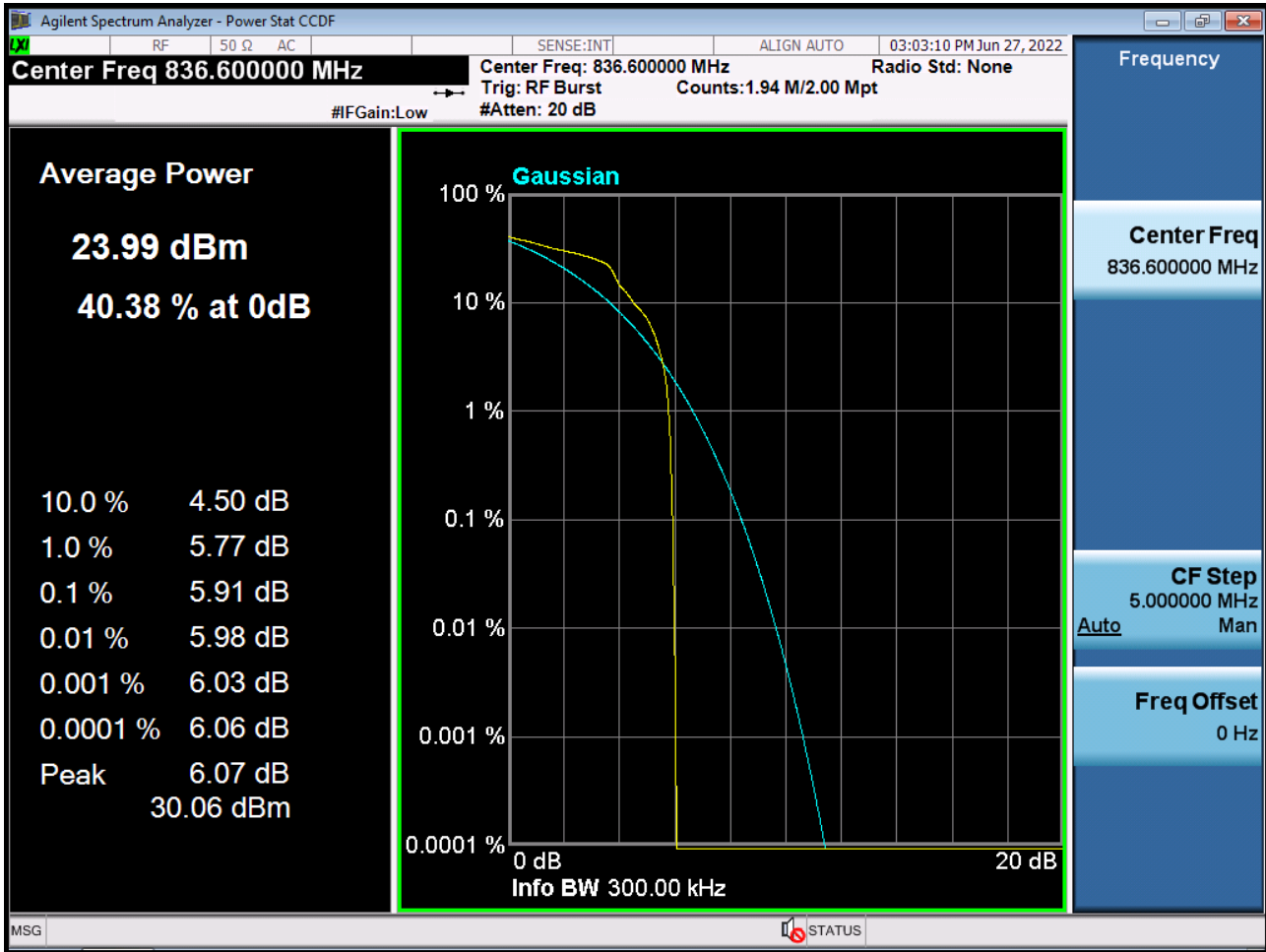
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P<sub>Avg</sub>



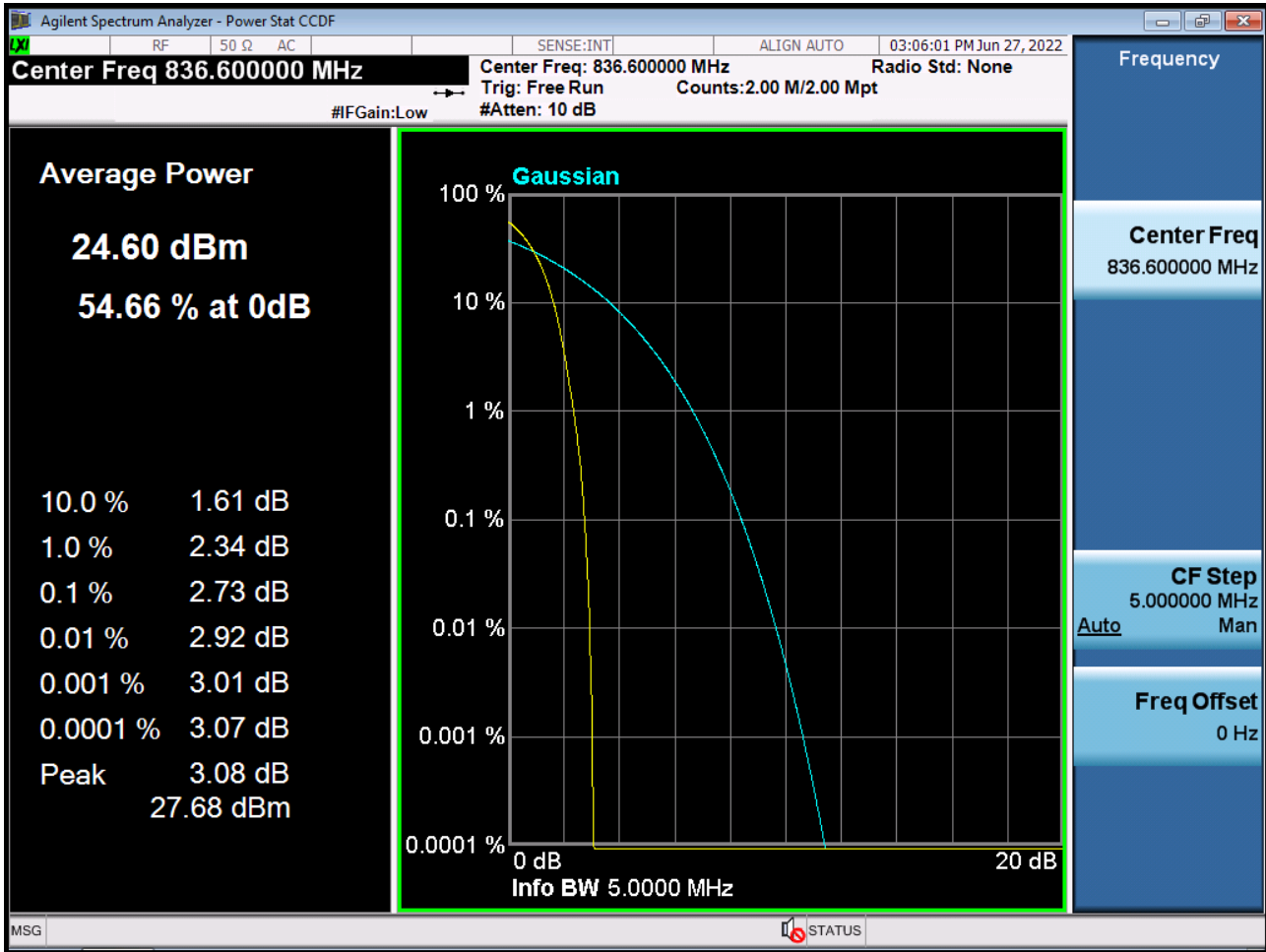
■ GSM850 MODE (190 CH.) Peak-to-Average Ratio



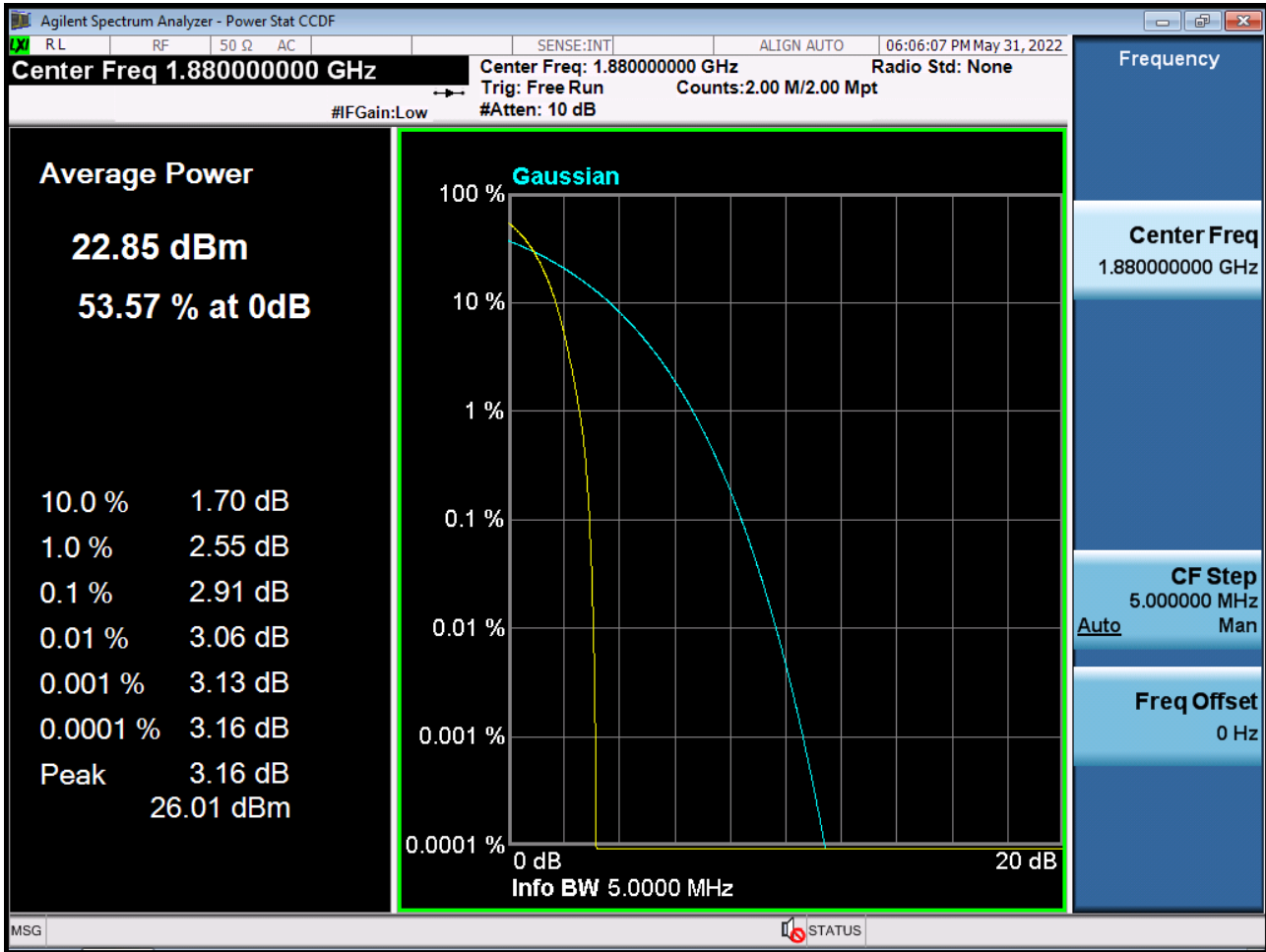
■ GSM850 EDGE (190 CH.) Peak-to-Average Ratio



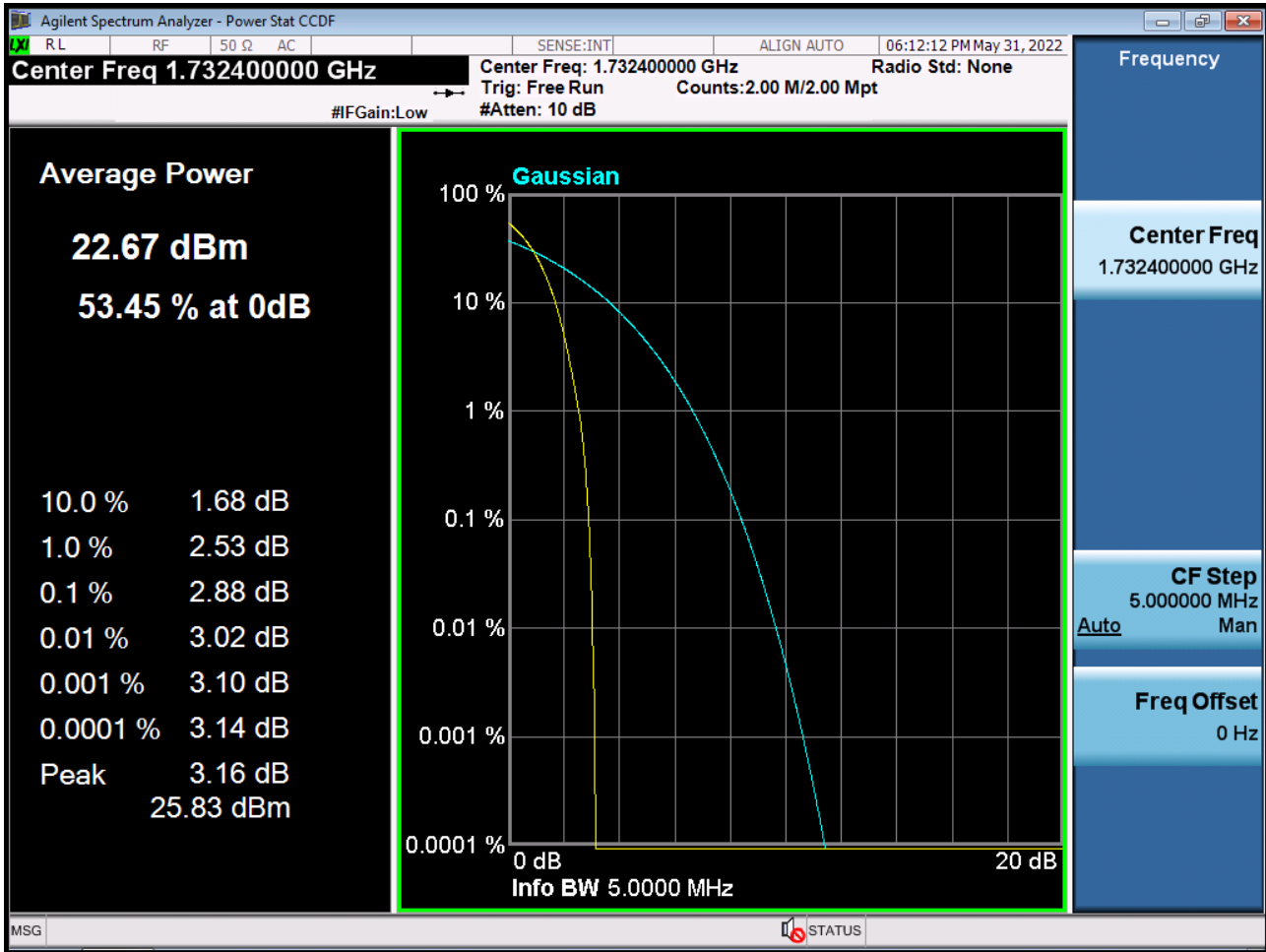
■ WCDMA850 MODE (4408 CH.) Peak-to-Average Ratio



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

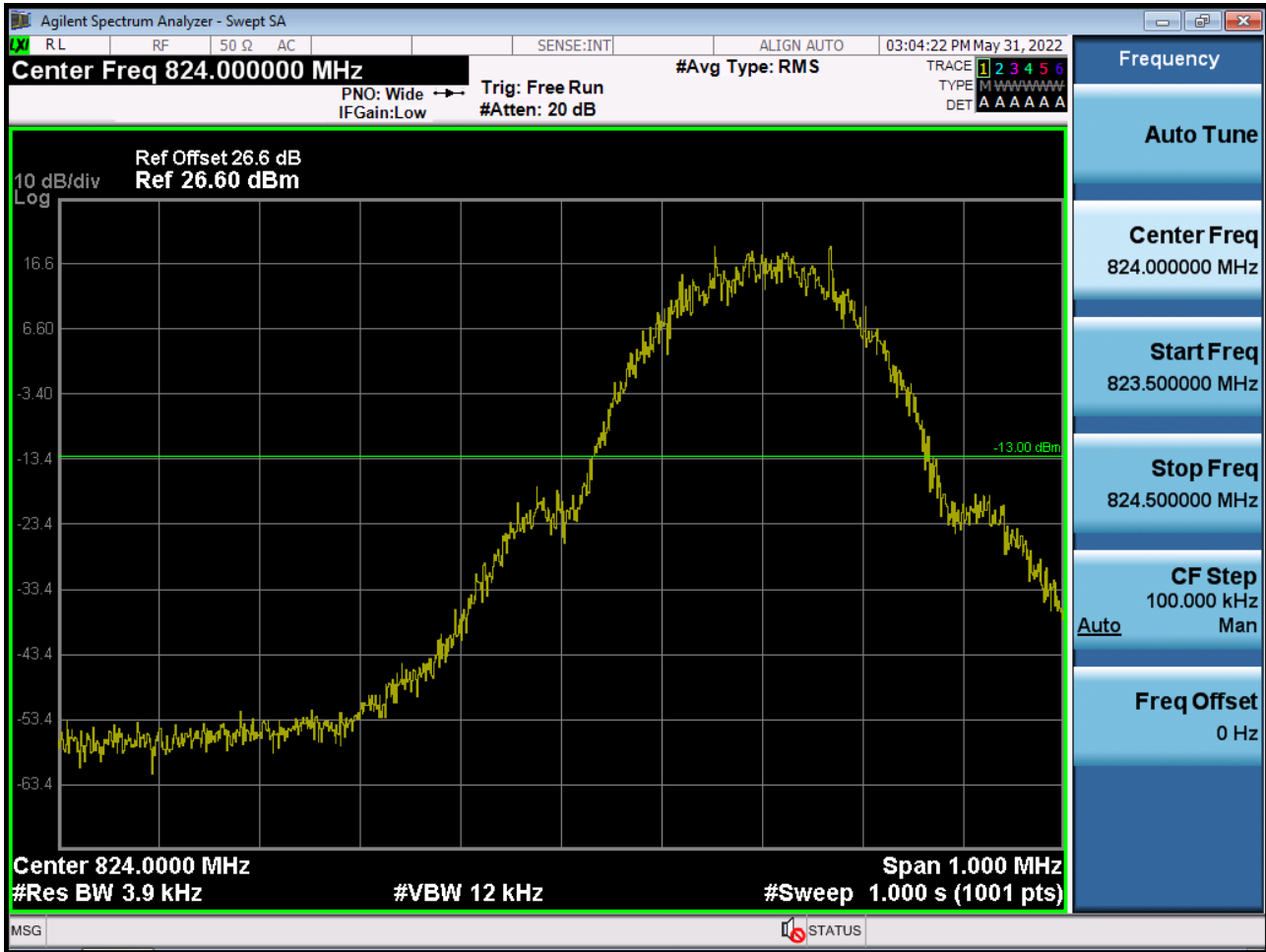


■ WCDMA1700 MODE (1412 CH.) Peak-to-Average Ratio

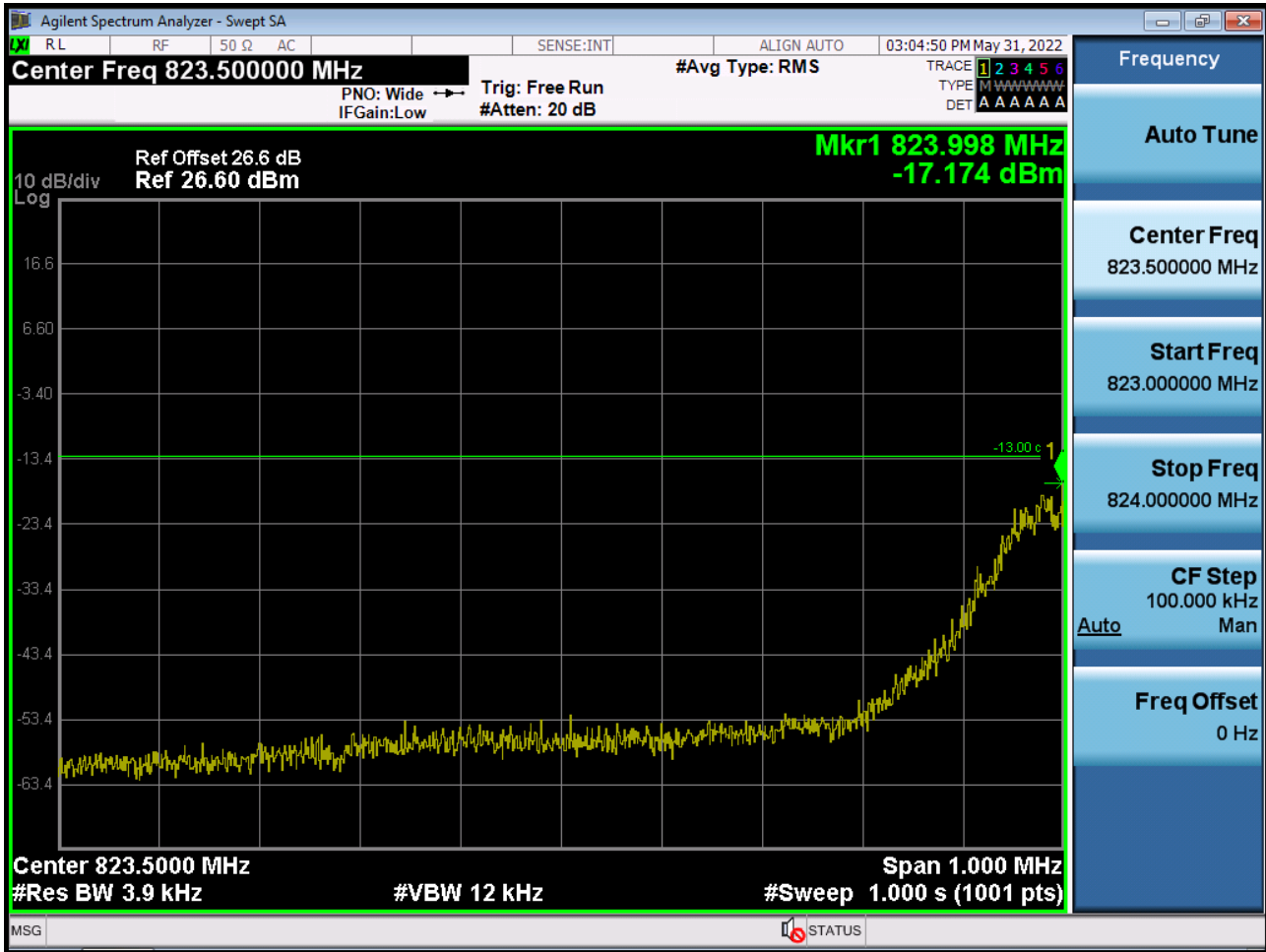




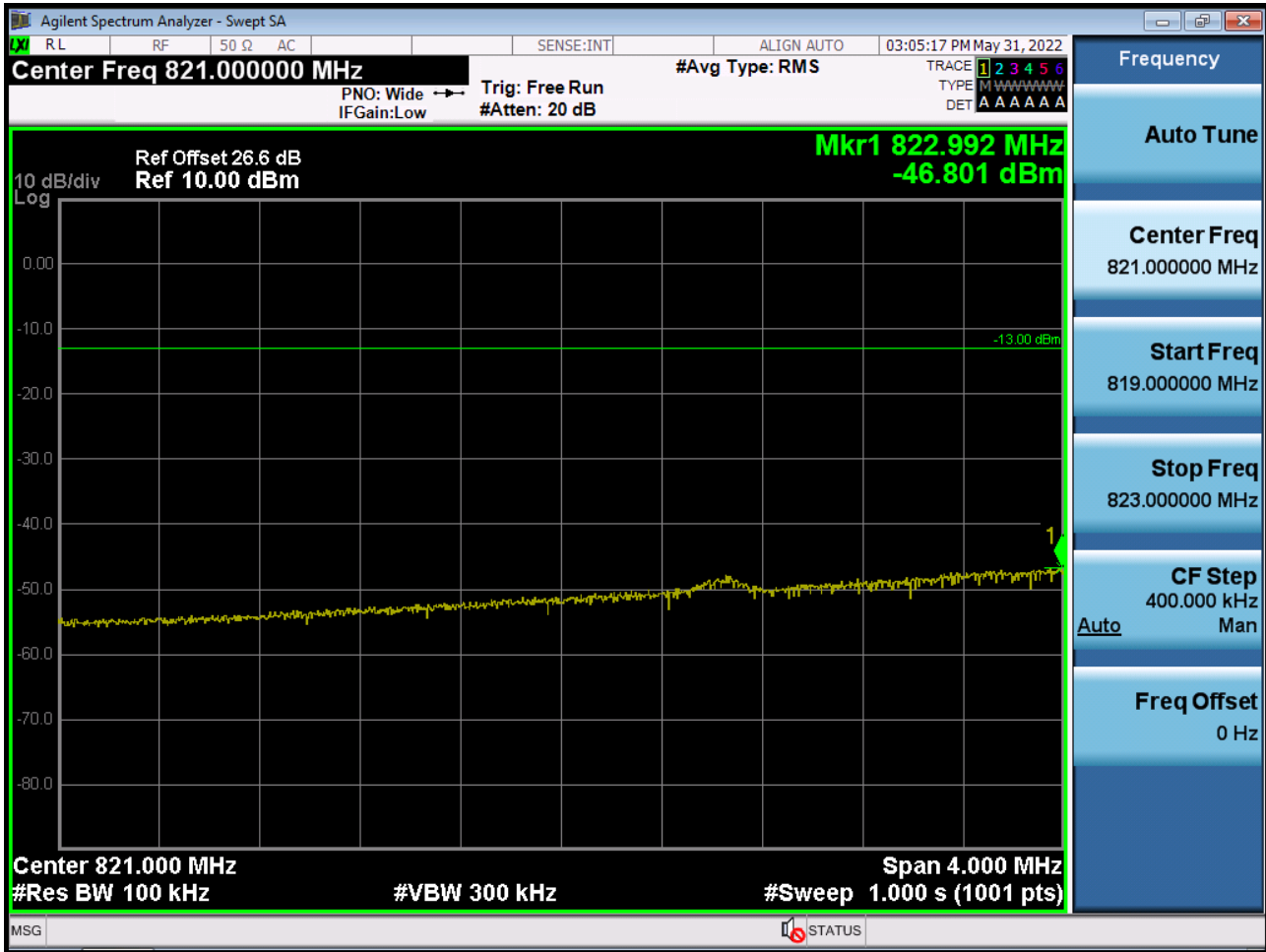
■ GSM850 MODE (128 CH.) Block Edge 1



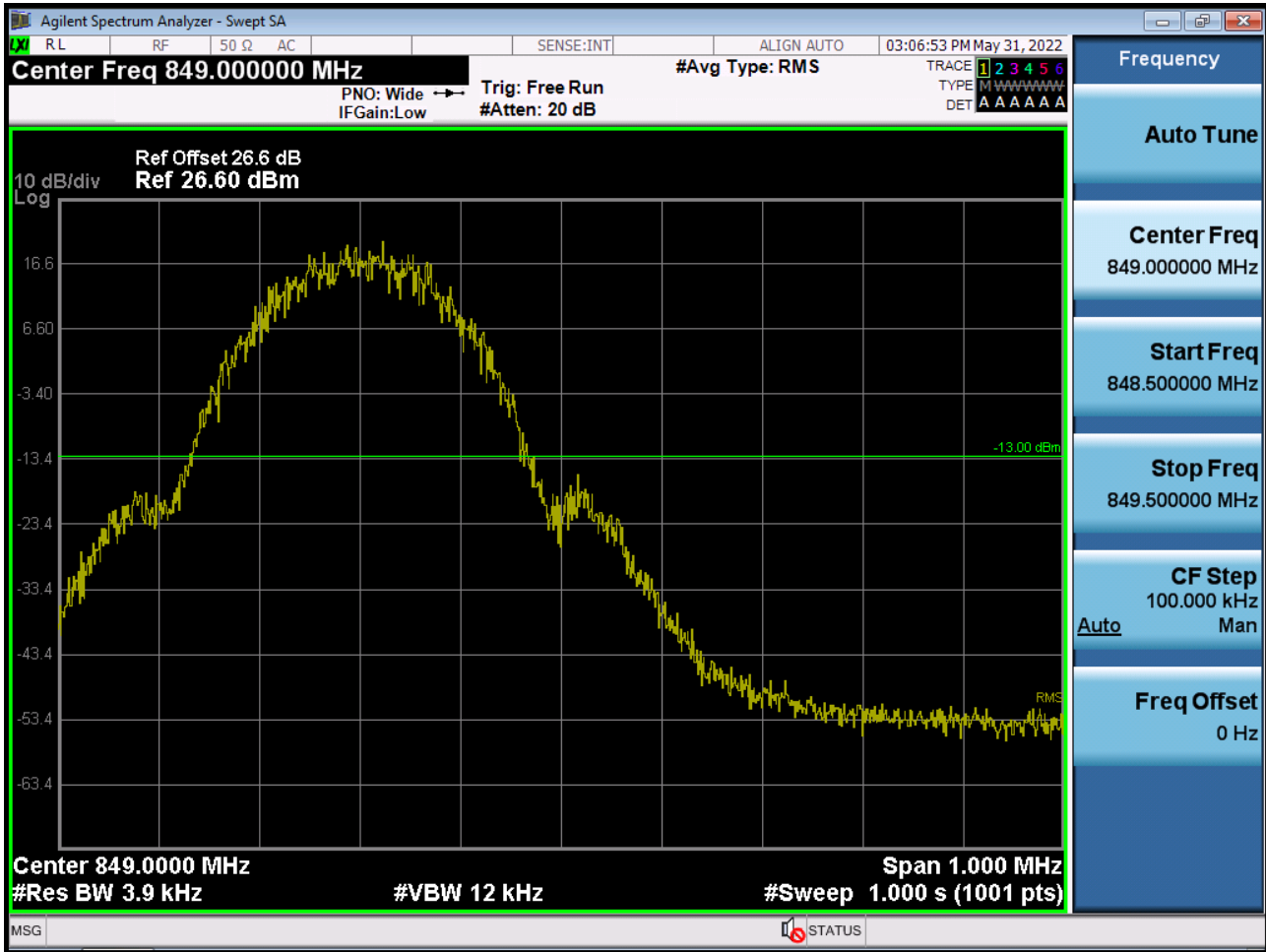
■ GSM850 MODE (128 CH.) Block Edge 2



■ GSM850 MODE (128 CH.) Block Edge 3



■ GSM850 MODE (251 CH.) Block Edge 1

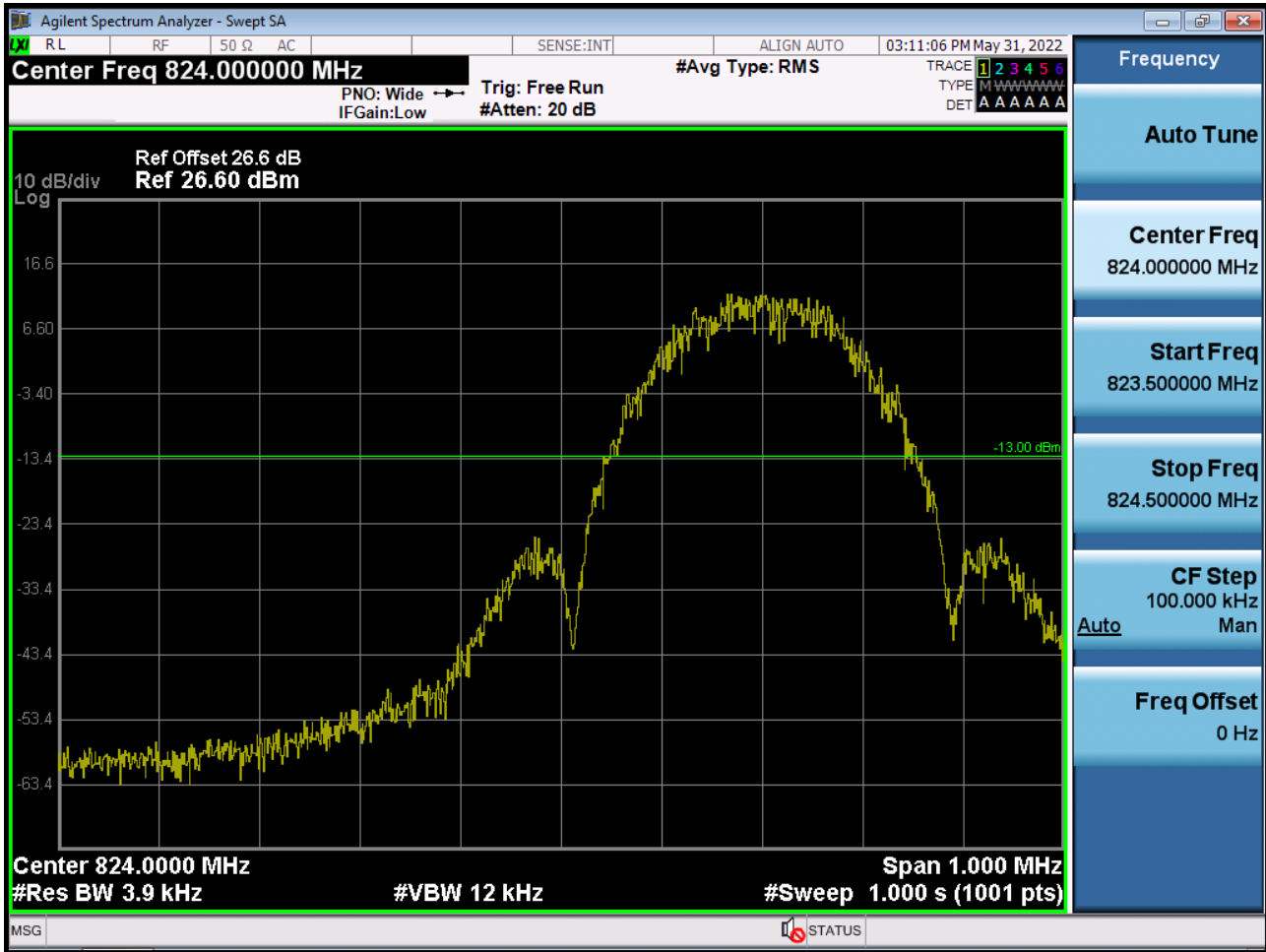




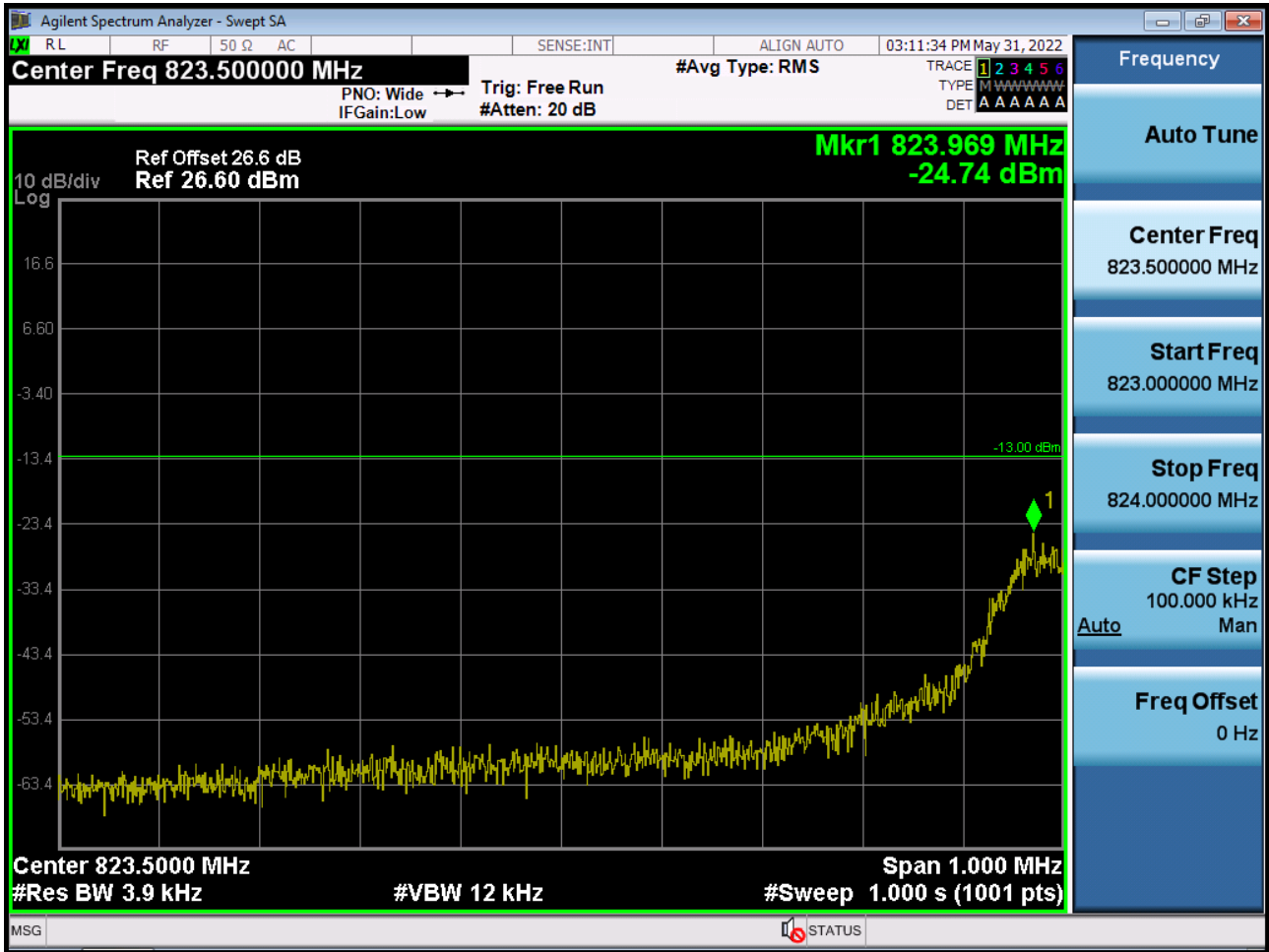
■ GSM850 MODE (251 CH.) Block Edge 3



■ EDGE MODE (128 CH.) Block Edge 1



■ EDGE MODE (128 CH.) Block Edge 2



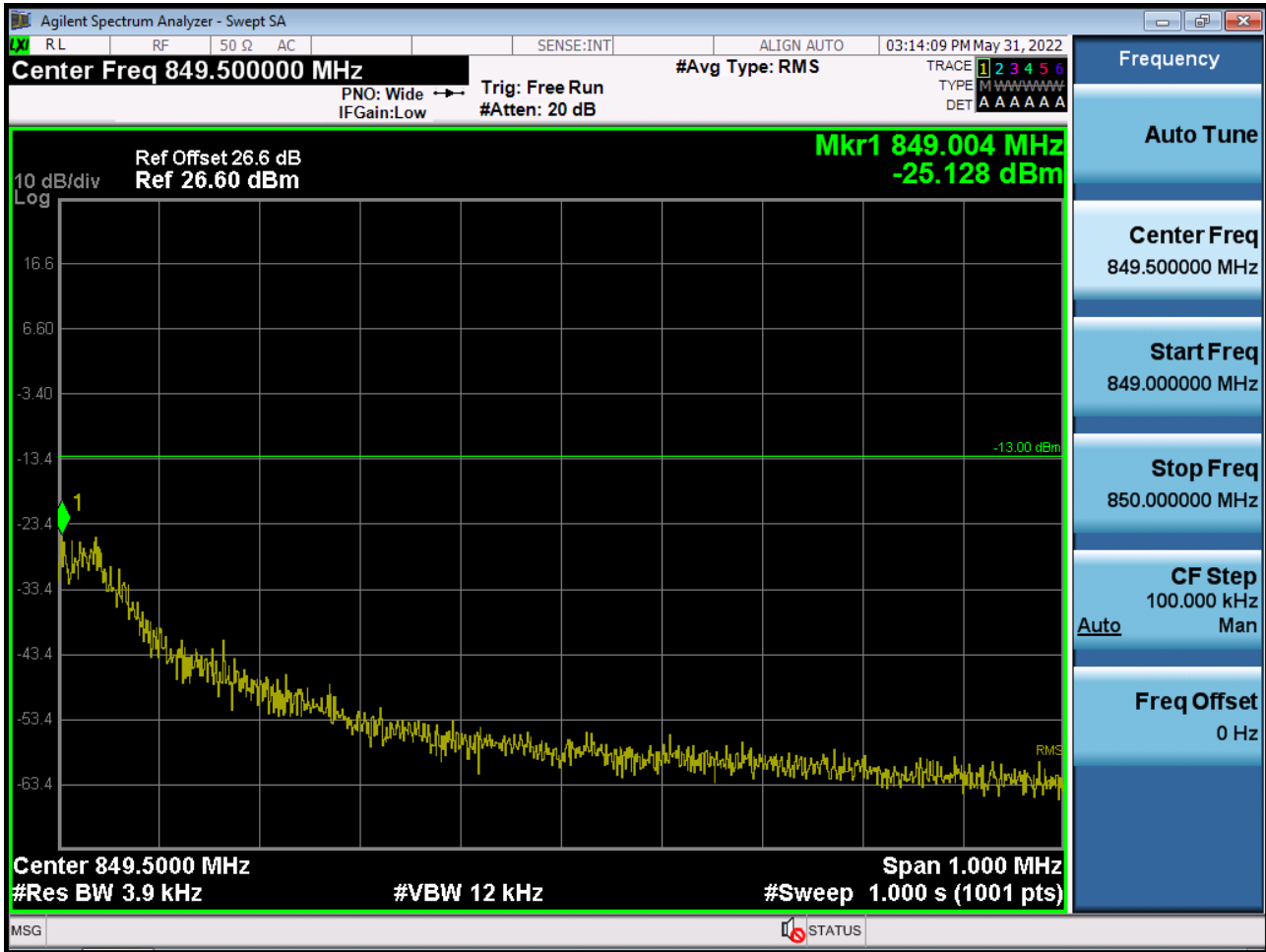


■ EDGE MODE (128 CH.) Block Edge 3

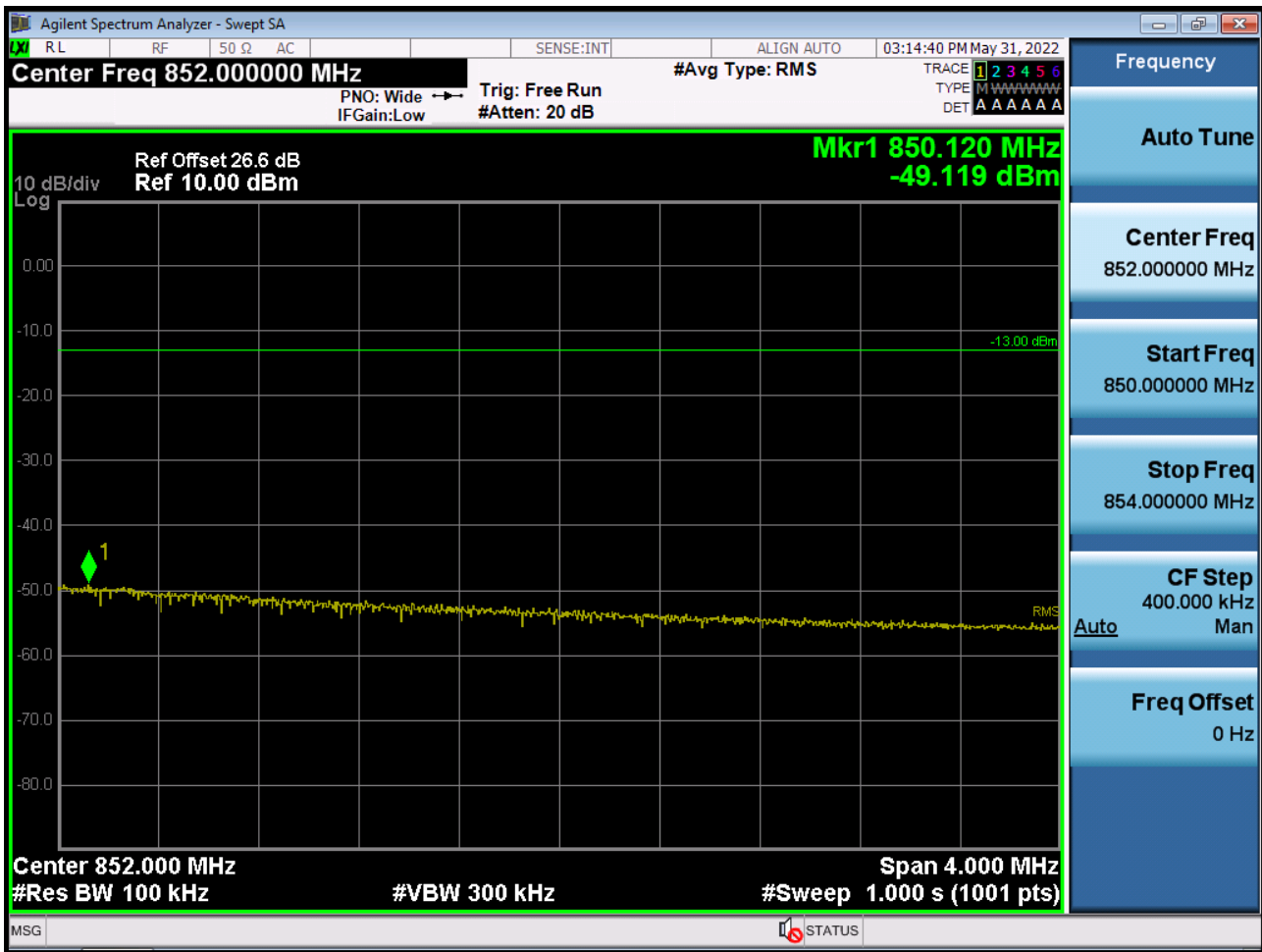




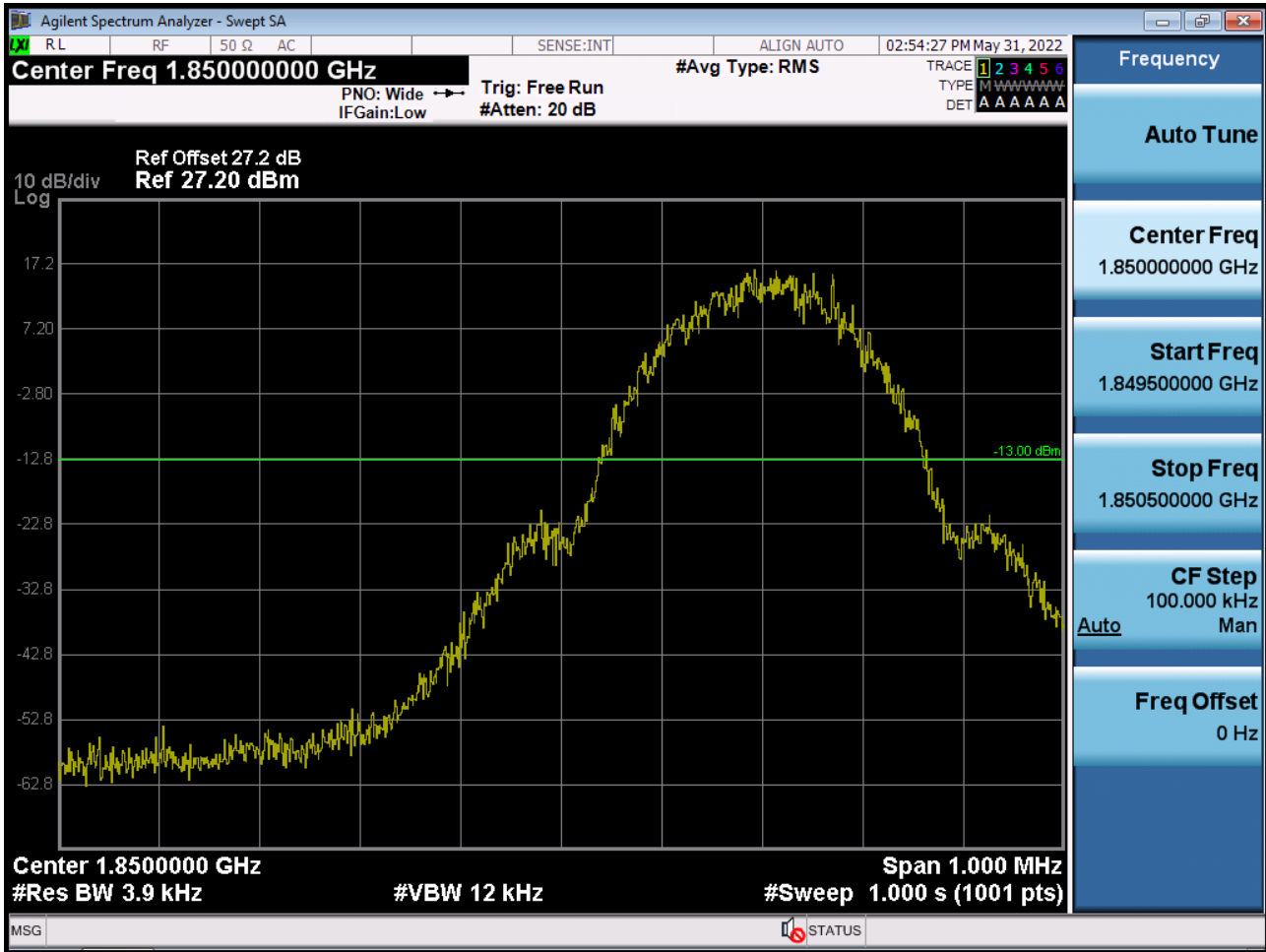
■ EDGE MODE (251 CH.) Block Edge 2



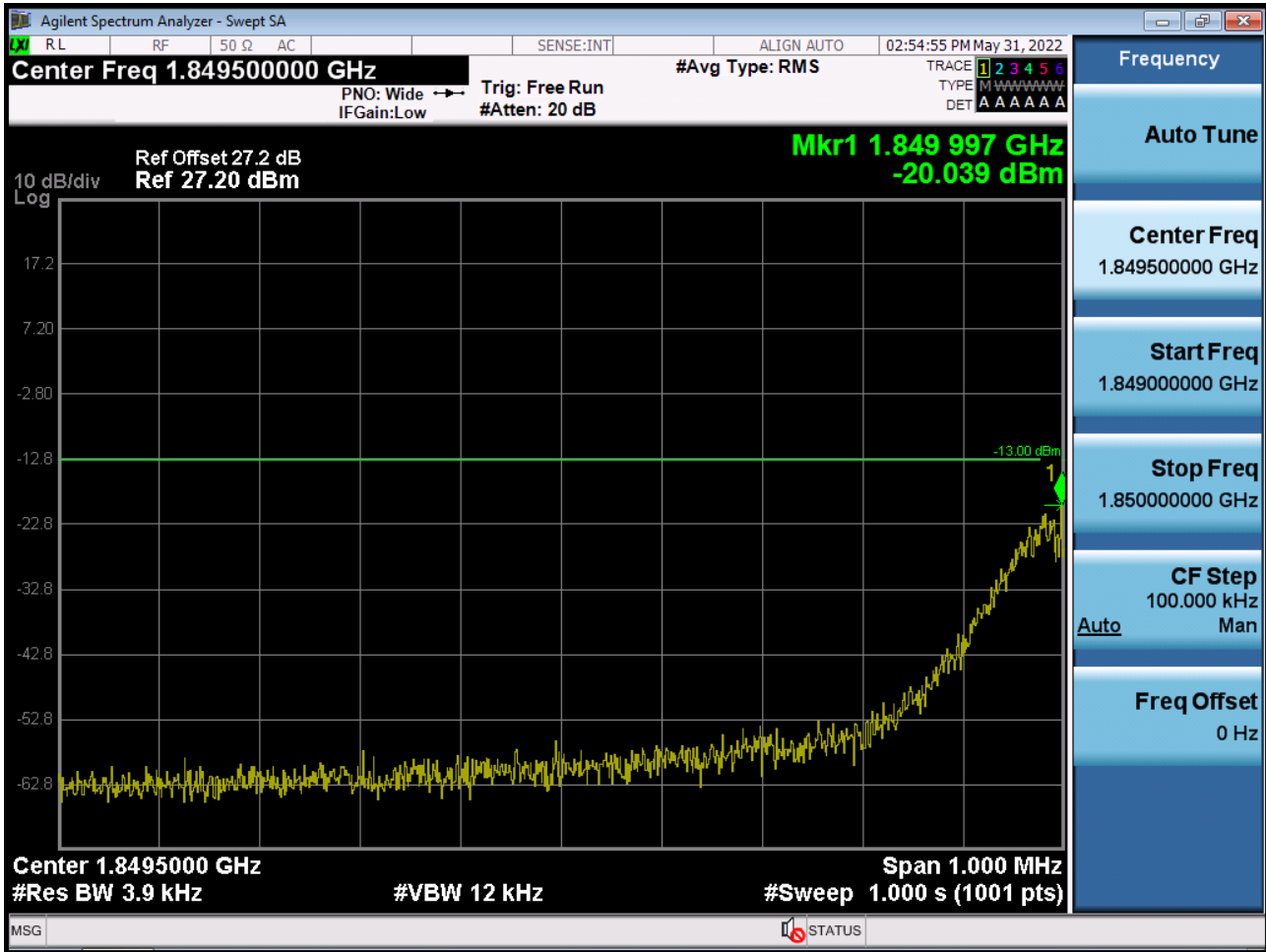
■ EDGE MODE (251 CH.) Block Edge 3



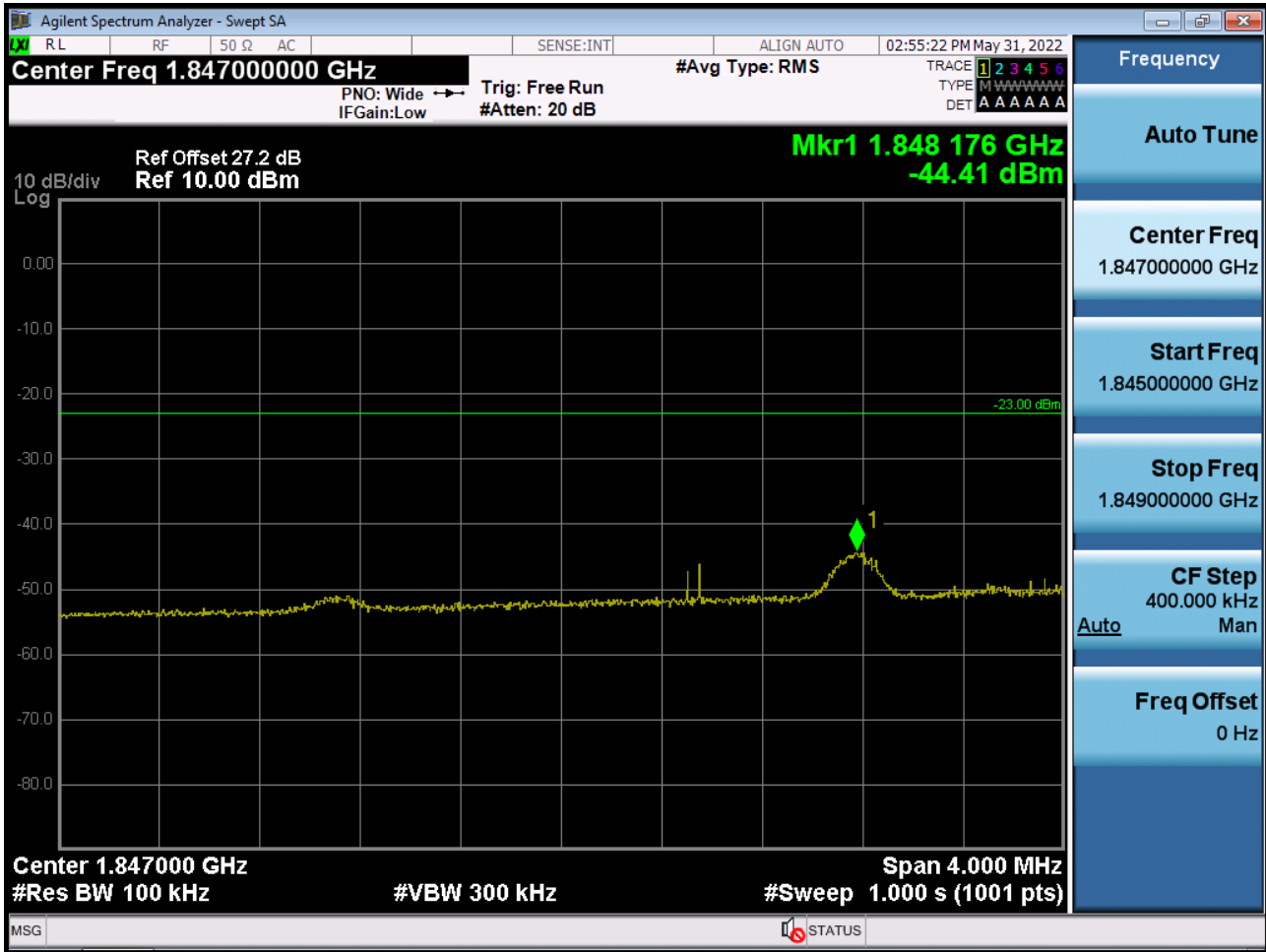
■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2



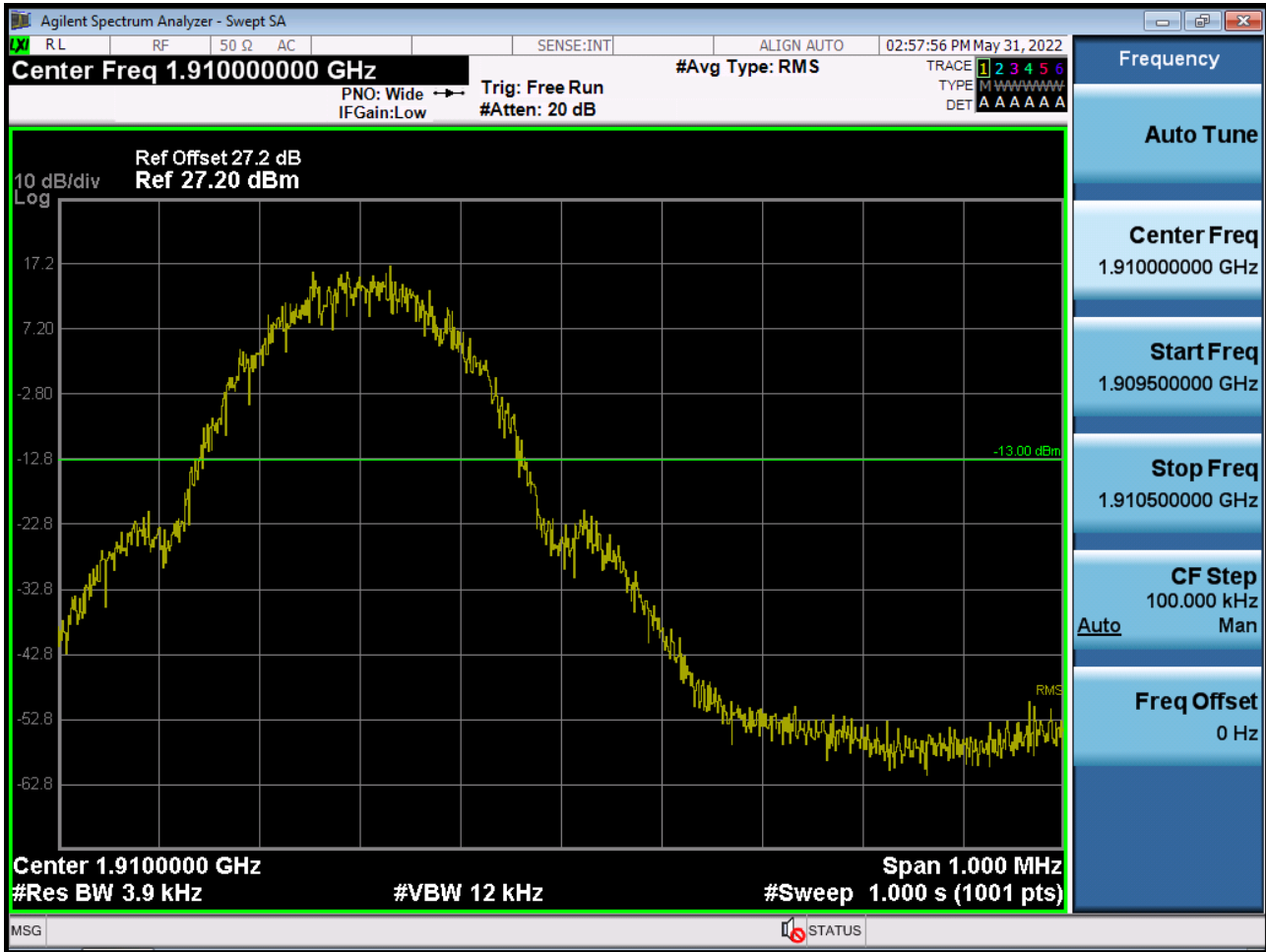
■ GSM1900 MODE (512 CH.) Block Edge 3



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

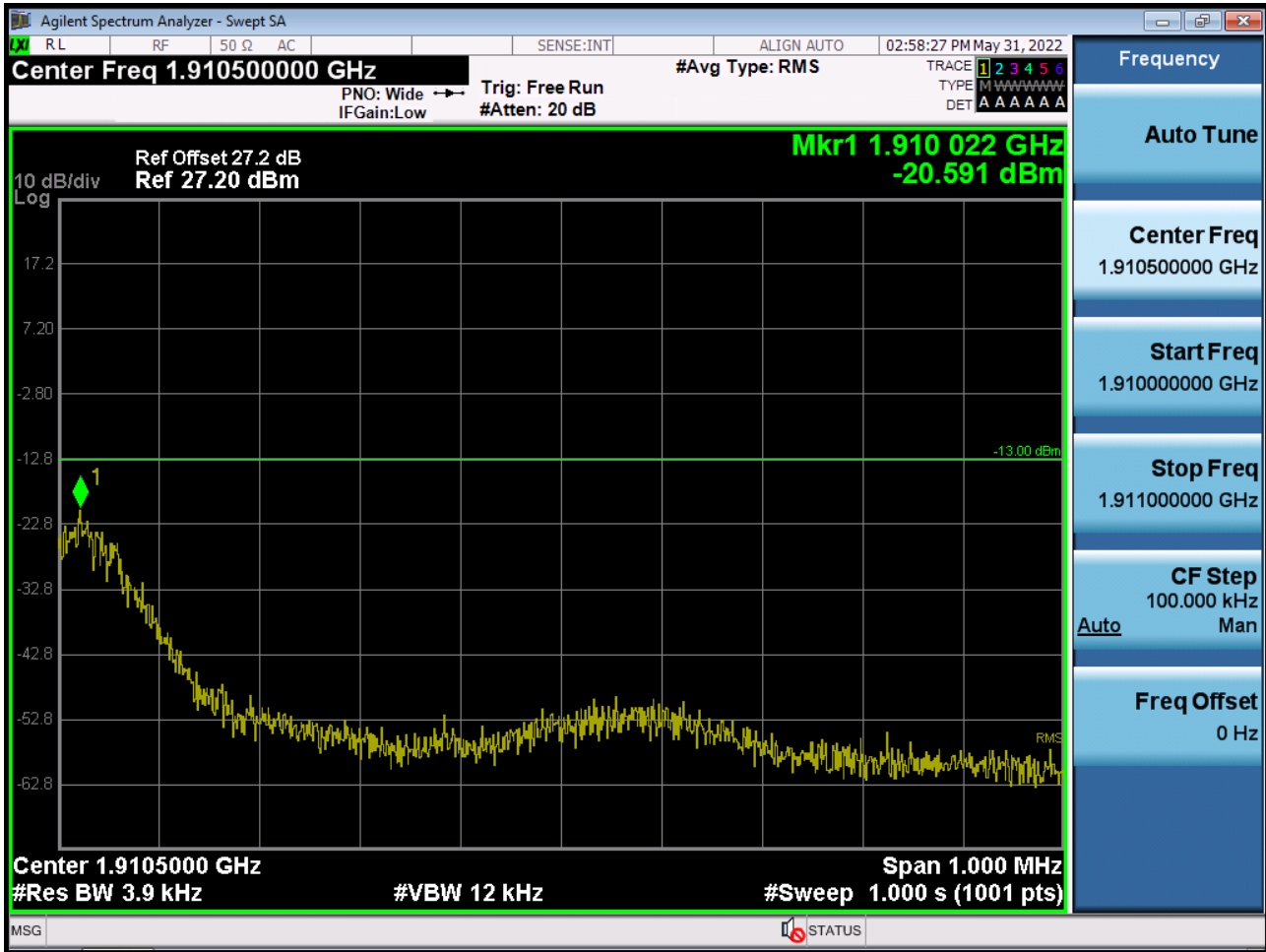
Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -44.41 dBm + 10 dB = -34.41 dBm

■ GSM1900 MODE (810 CH.) Block Edge 1





■ GSM1900 MODE (810 CH.) Block Edge 2



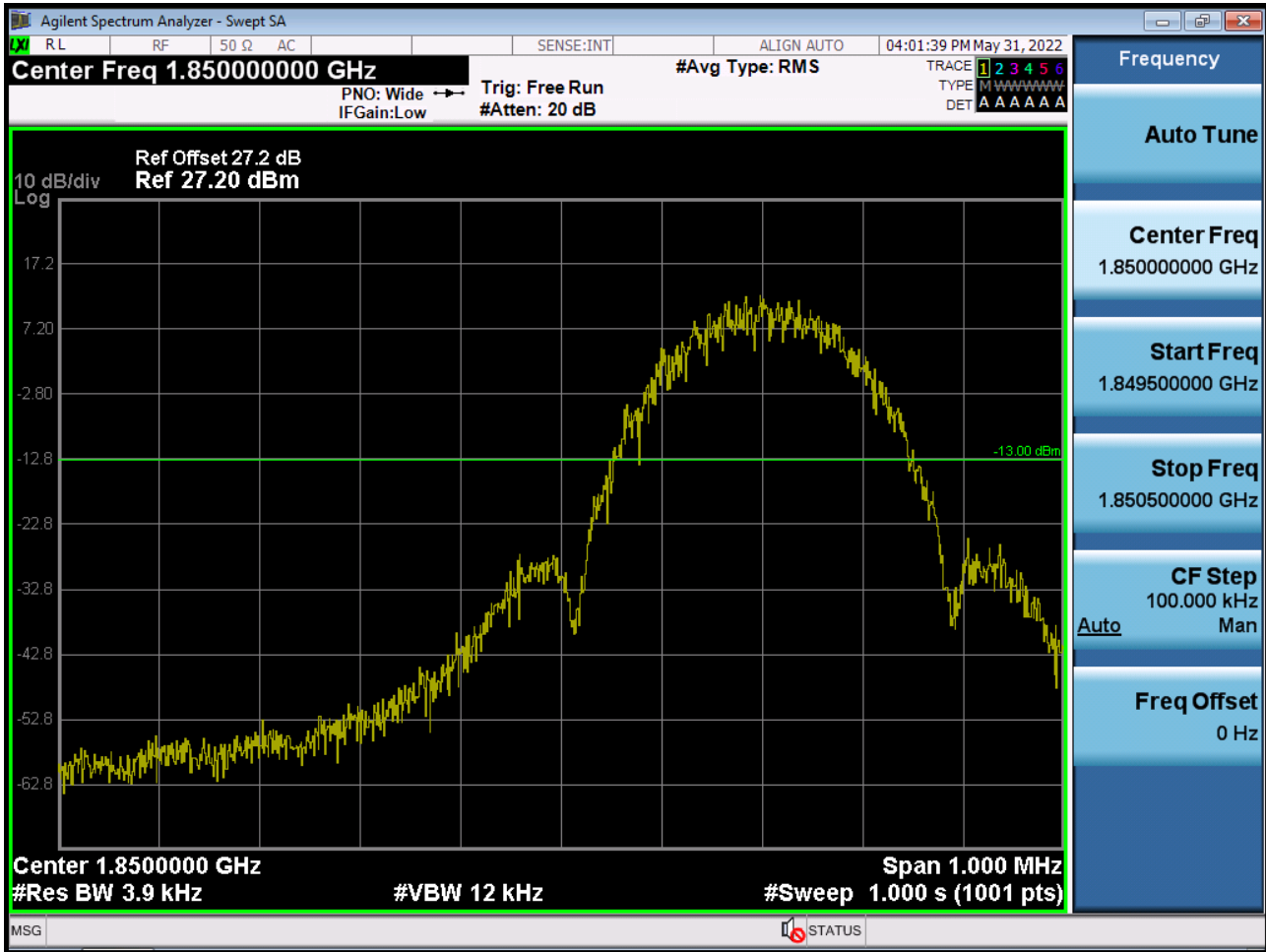
■ GSM1900 MODE (810 CH.) Block Edge 3



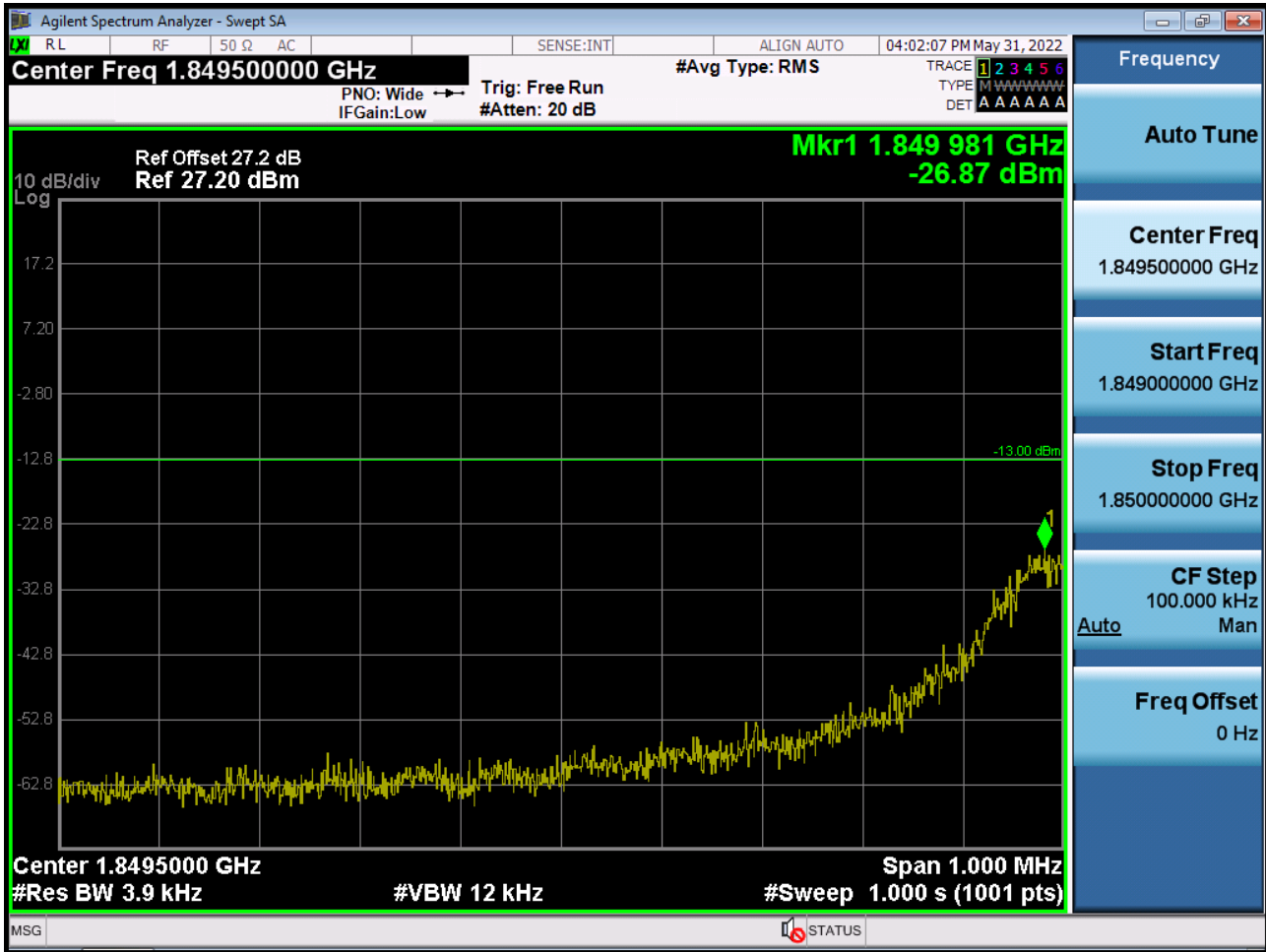
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -42.248 dBm + 10 dB = -32.248 dBm

■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



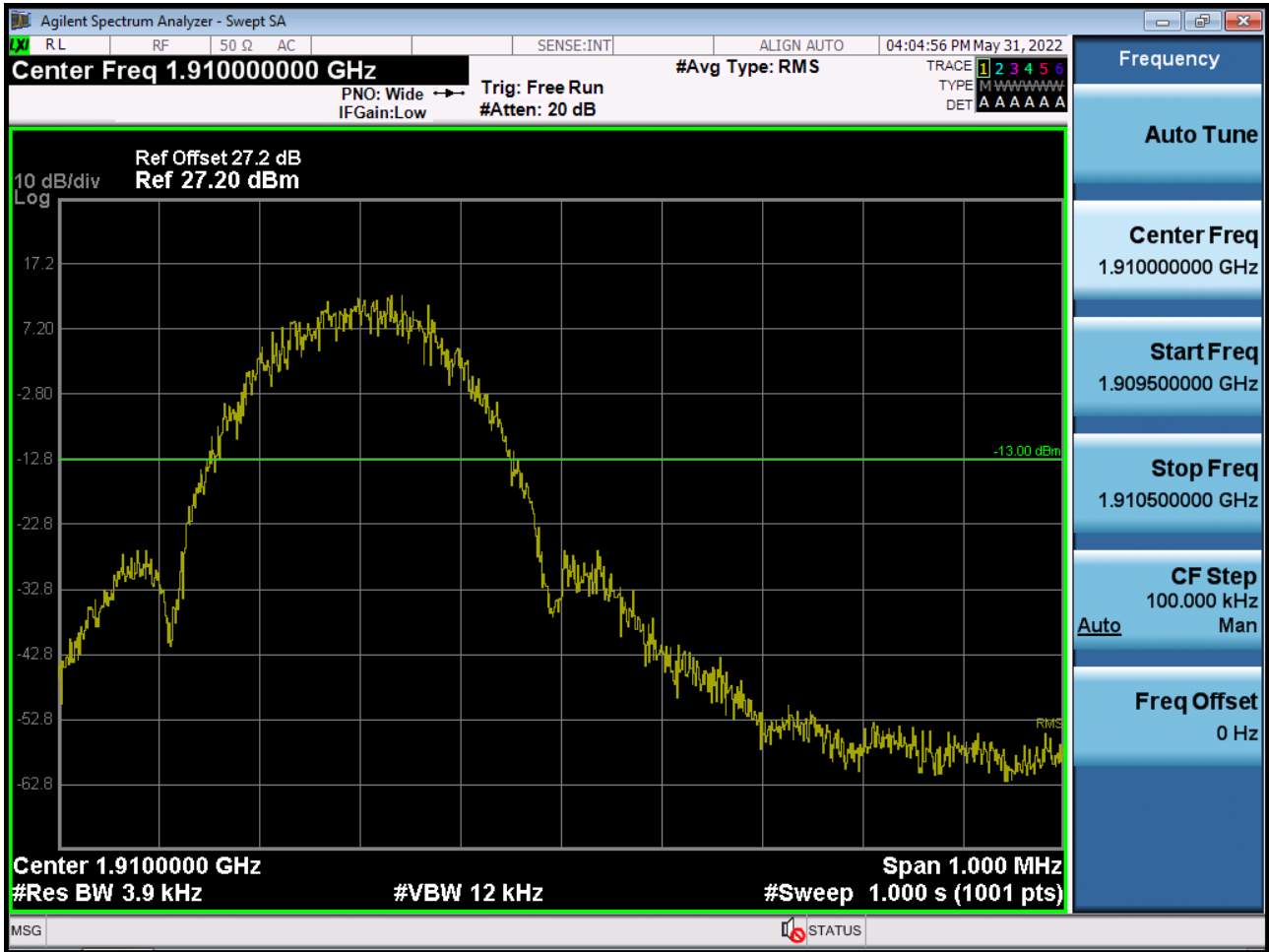
■ EDGE MODE (512 CH.) Block Edge 3



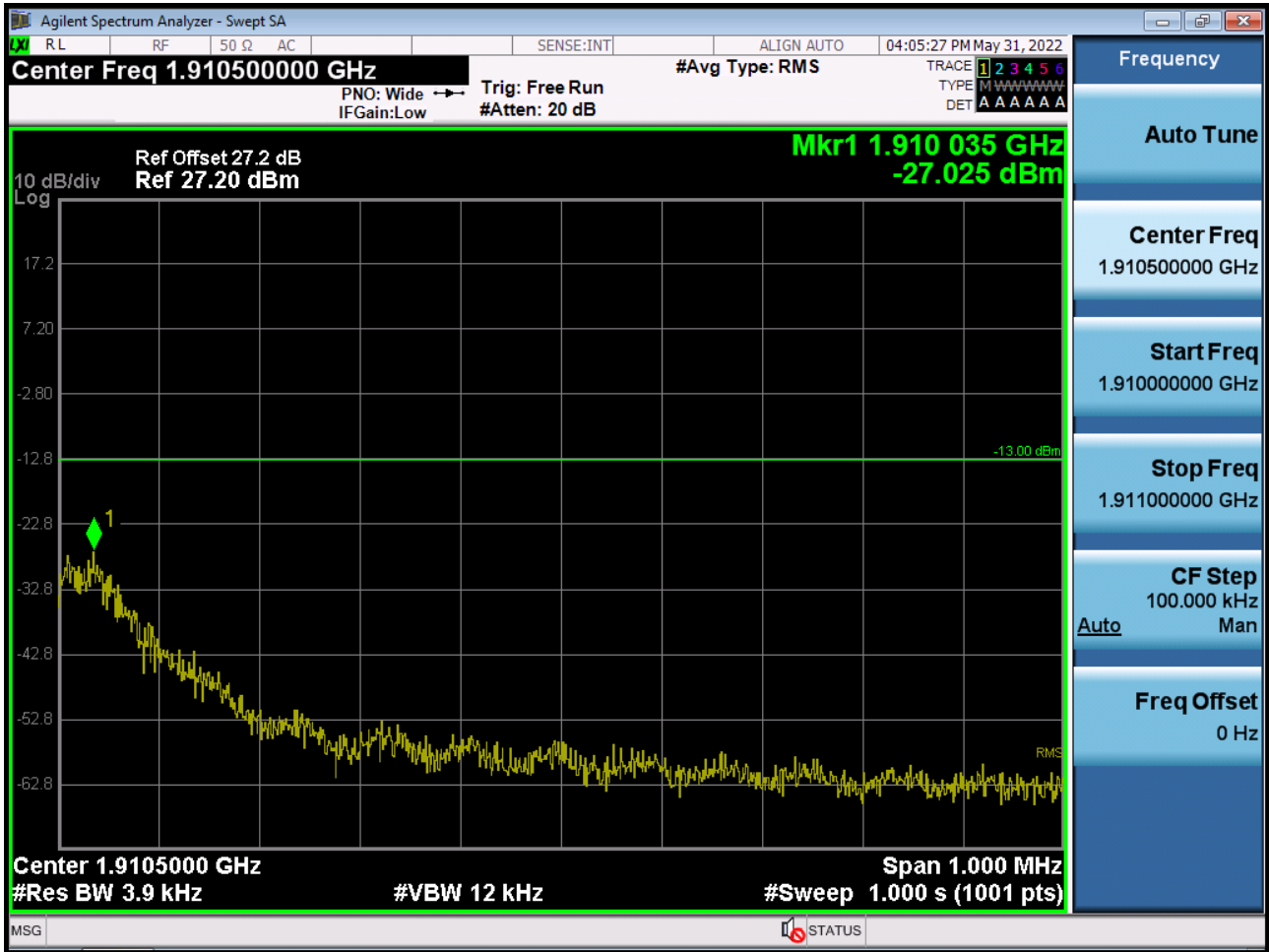
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -41.39 dBm + 10 dB = -31.39 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 = -40.036 dBm + 10 dB = -30.036 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



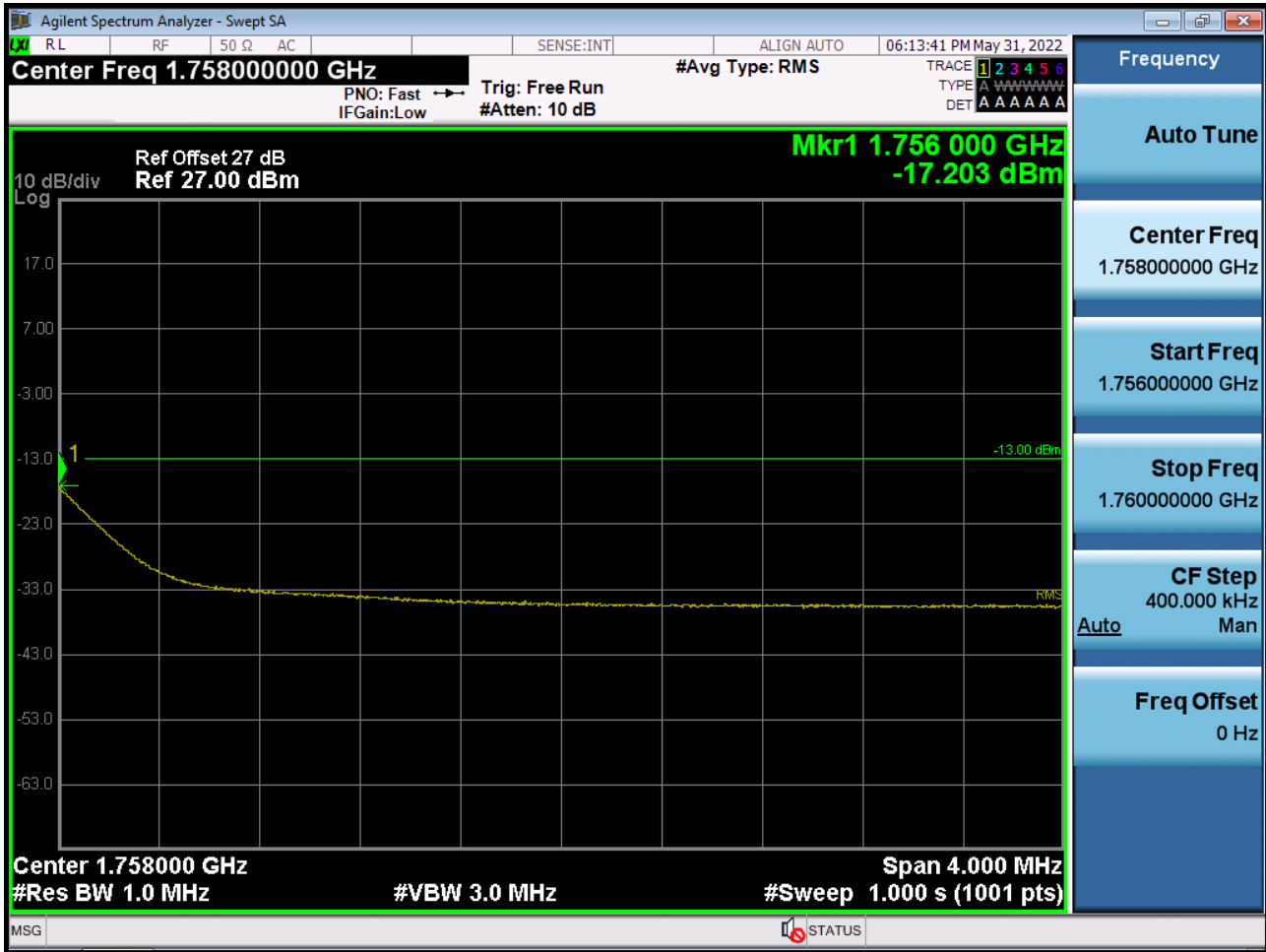
■ WCDMA1700 MODE (1312 CH.) – 4 MHz Span



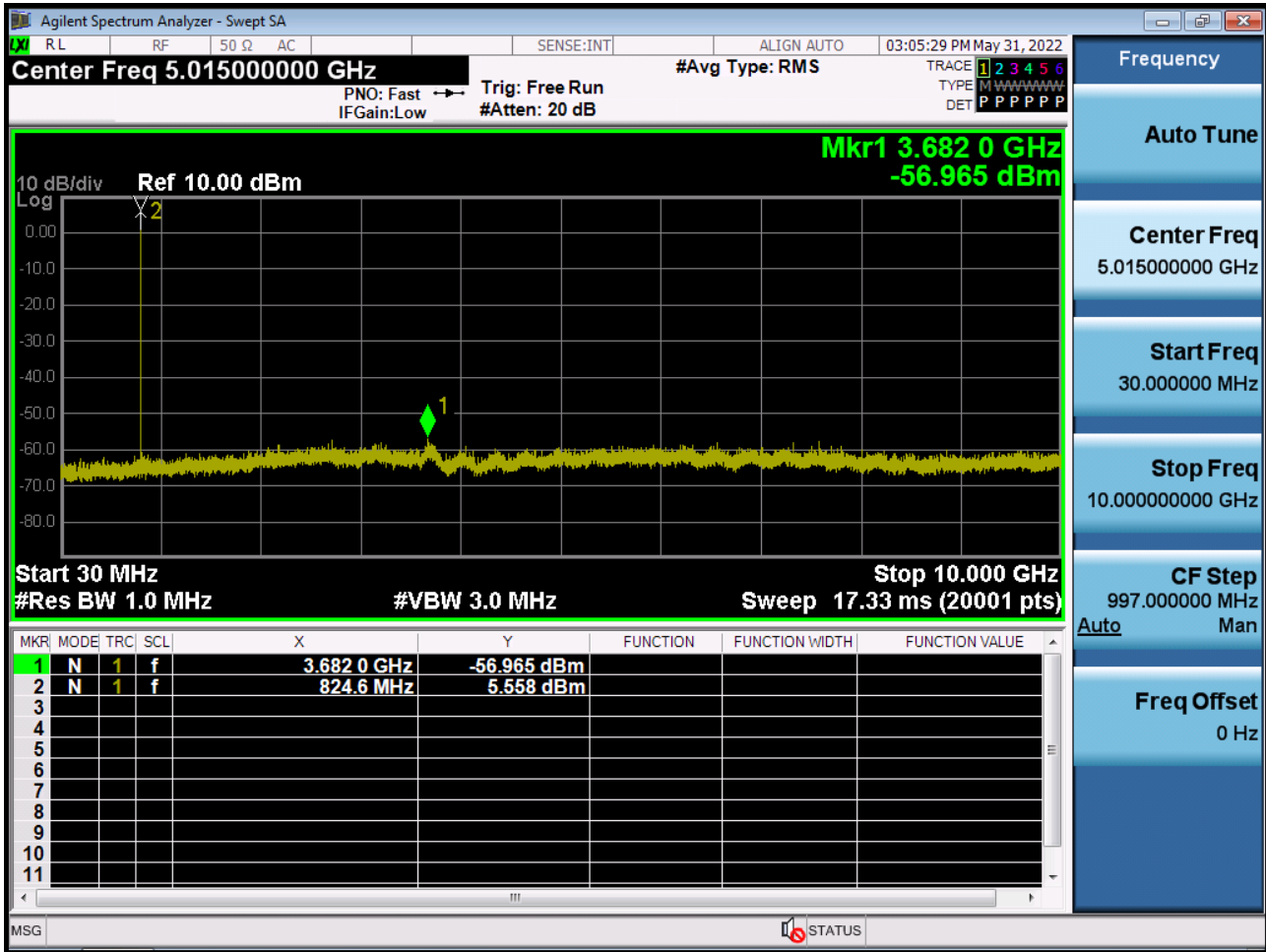
■ WCDMA1700 MODE (1513 CH.) Block Edge



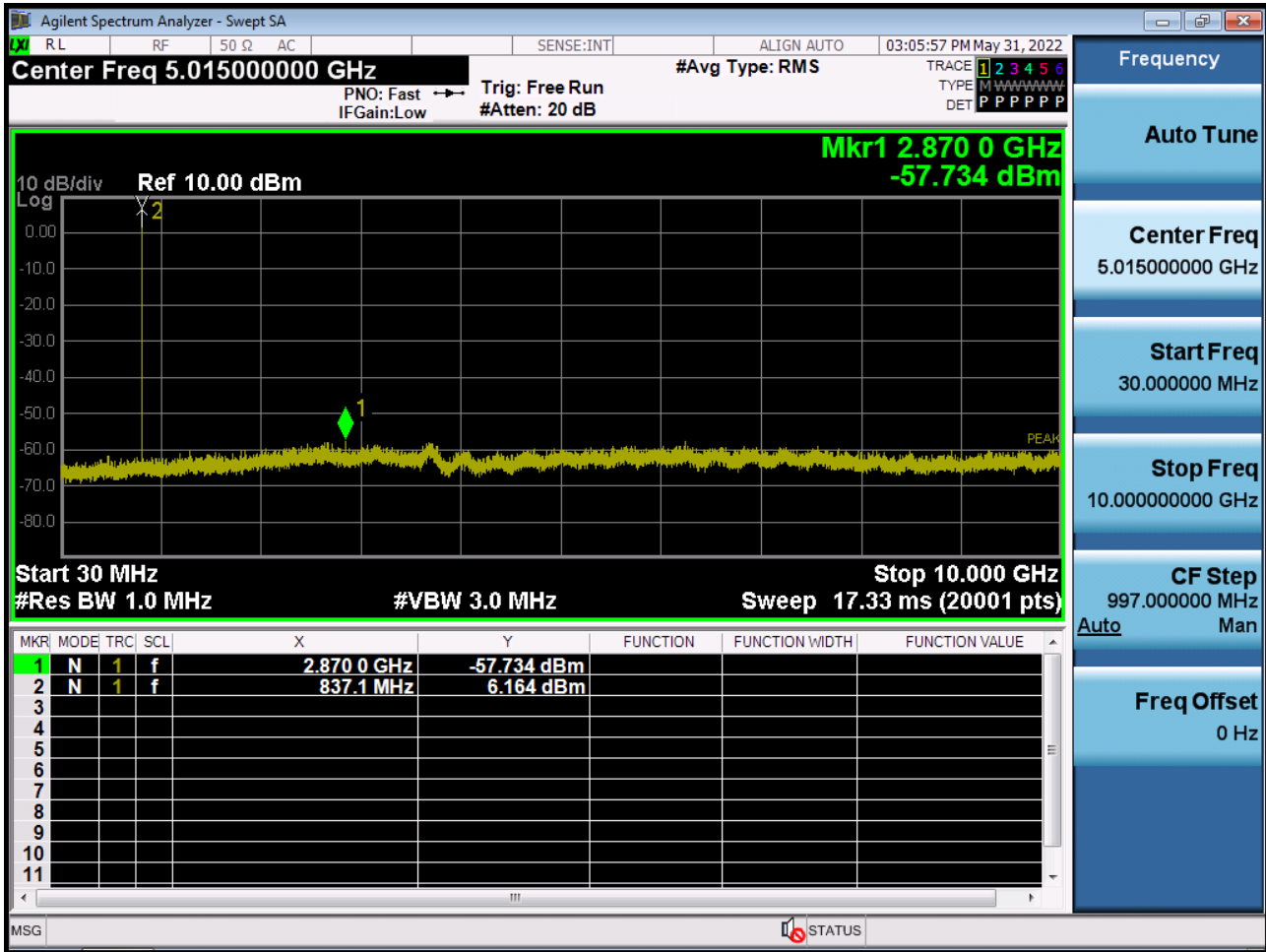
■ WCDMA1700 MODE (1513 CH.) – 4 MHz Span



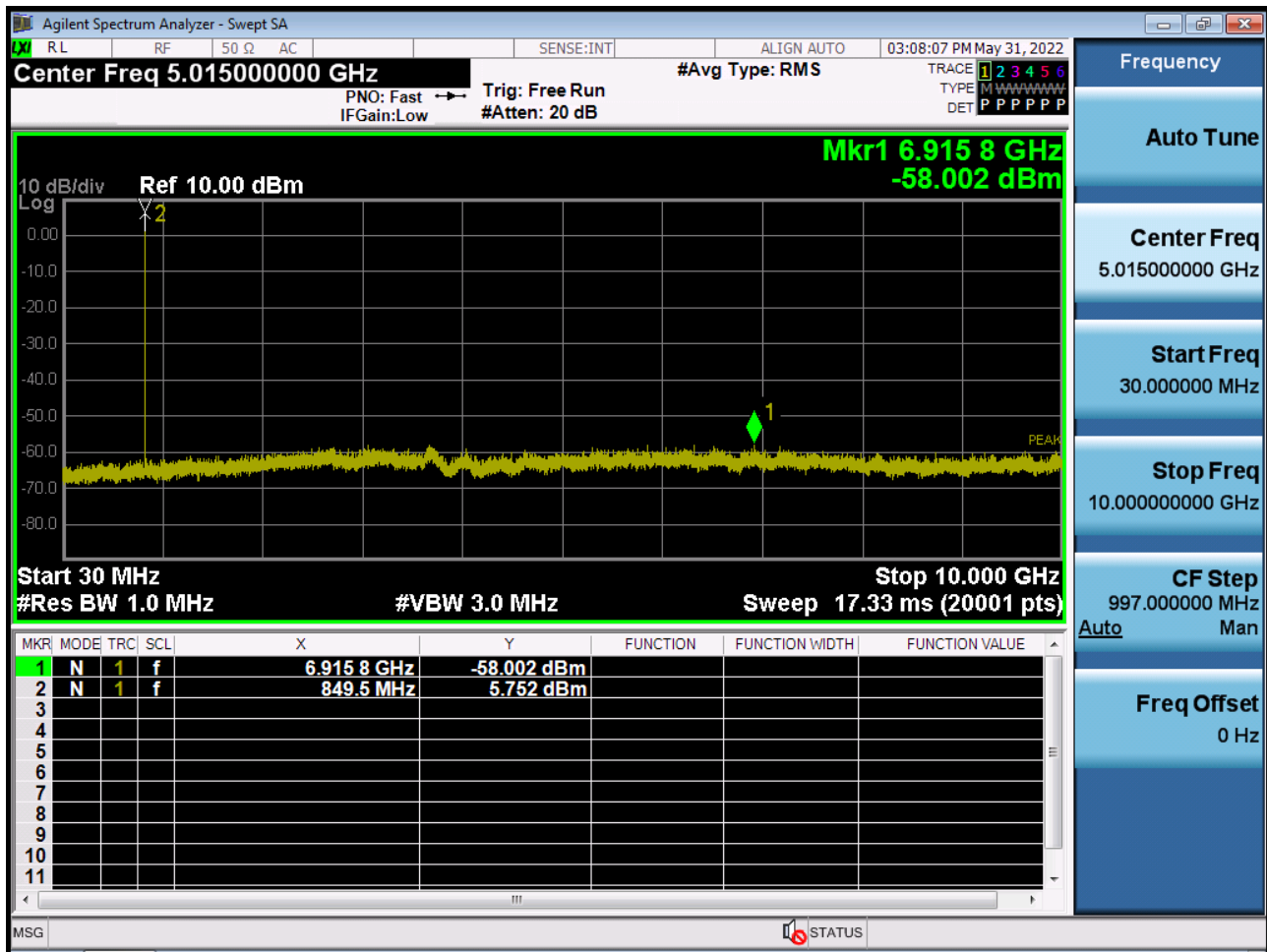
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions



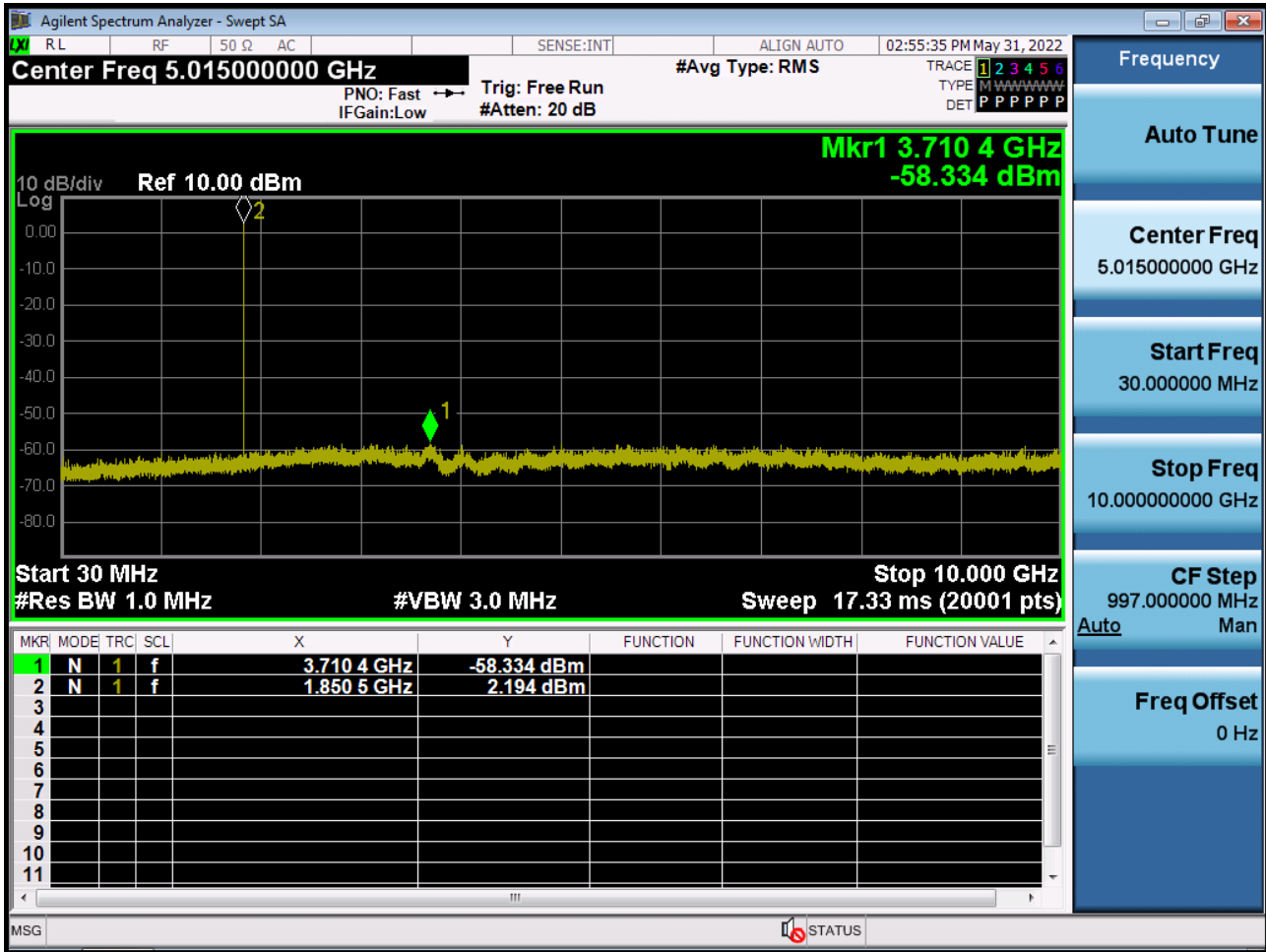
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions



■ GSM850 MODE (251 CH.) Conducted Spurious Emissions

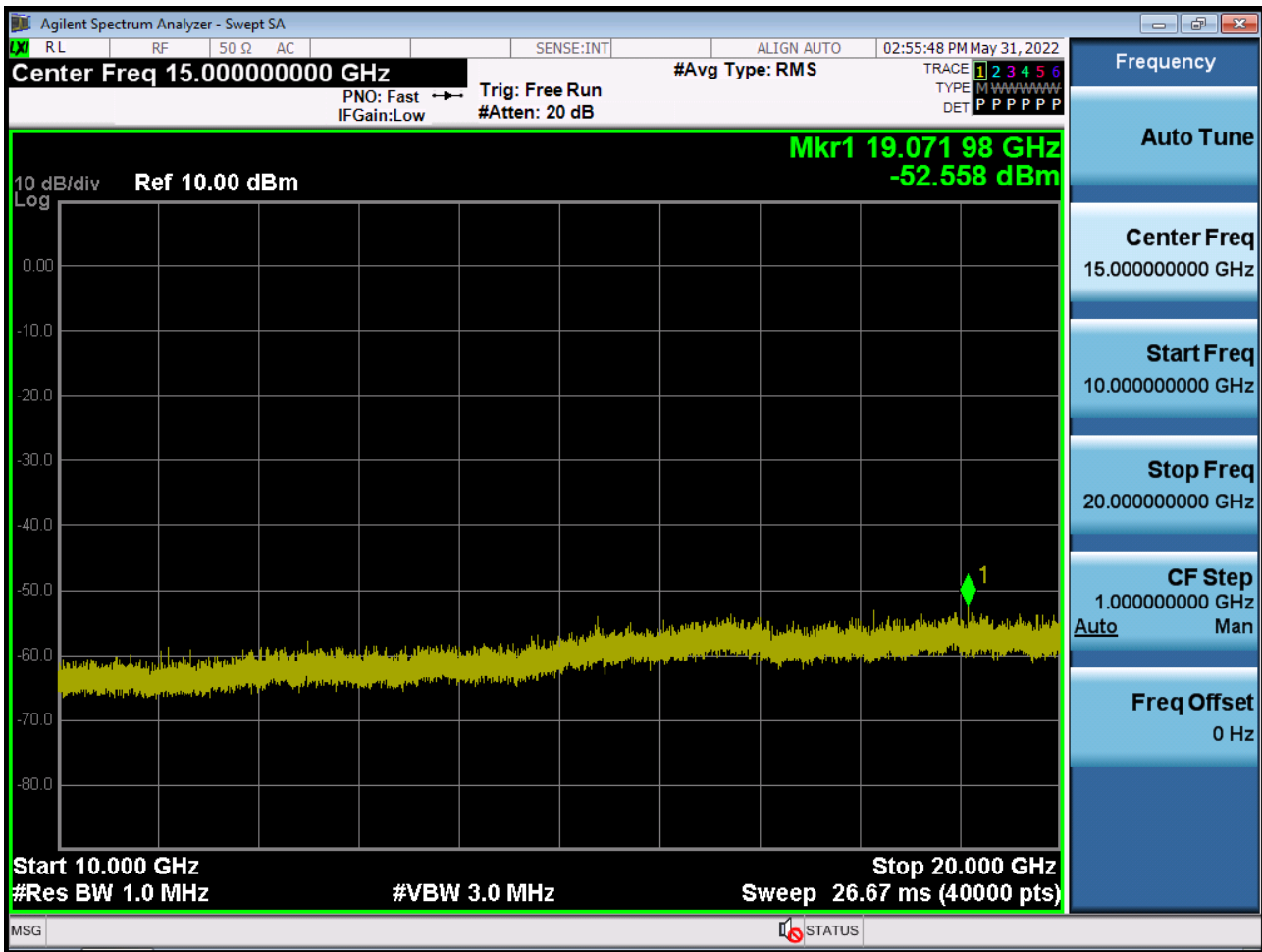


■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



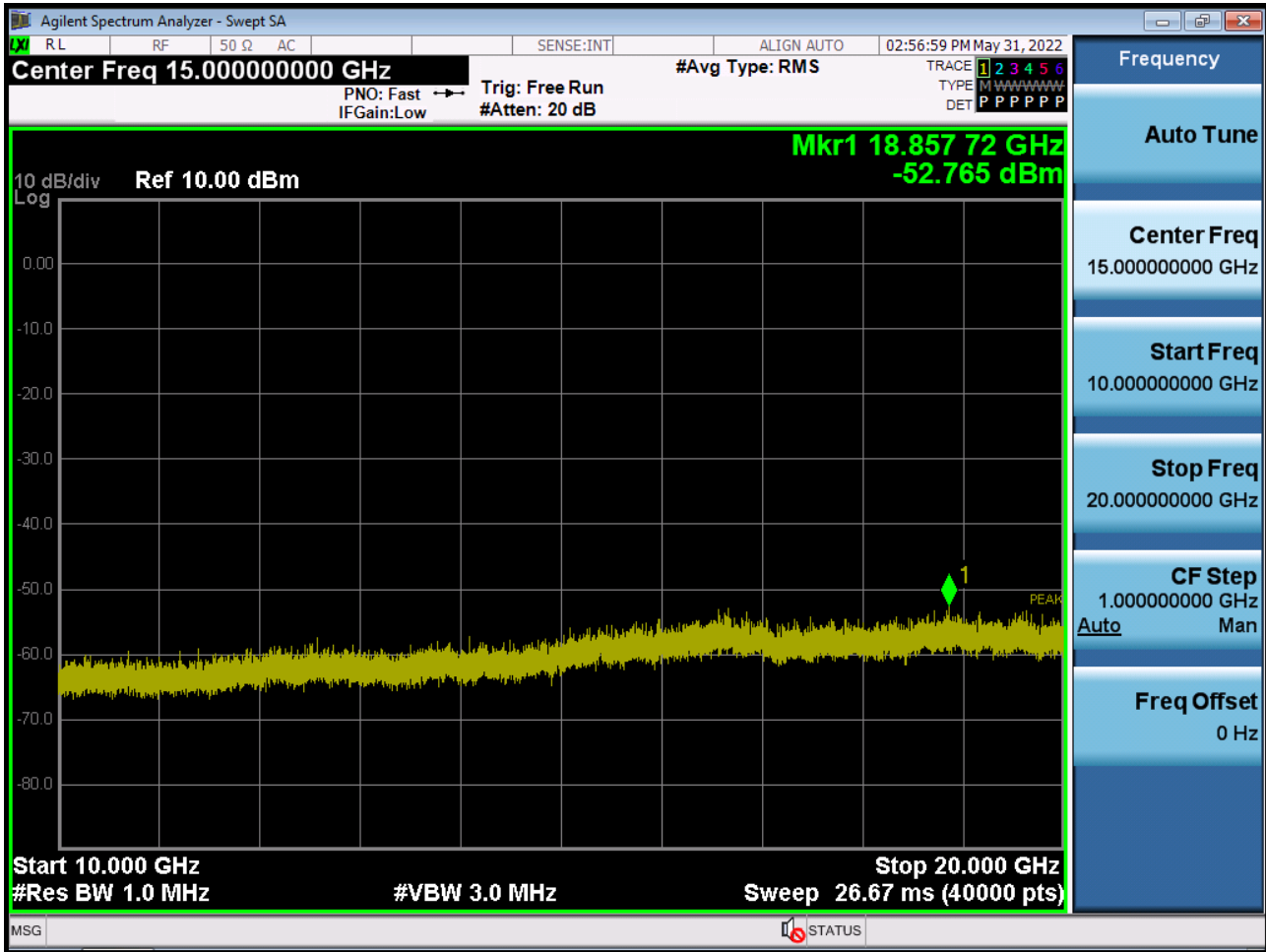


■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



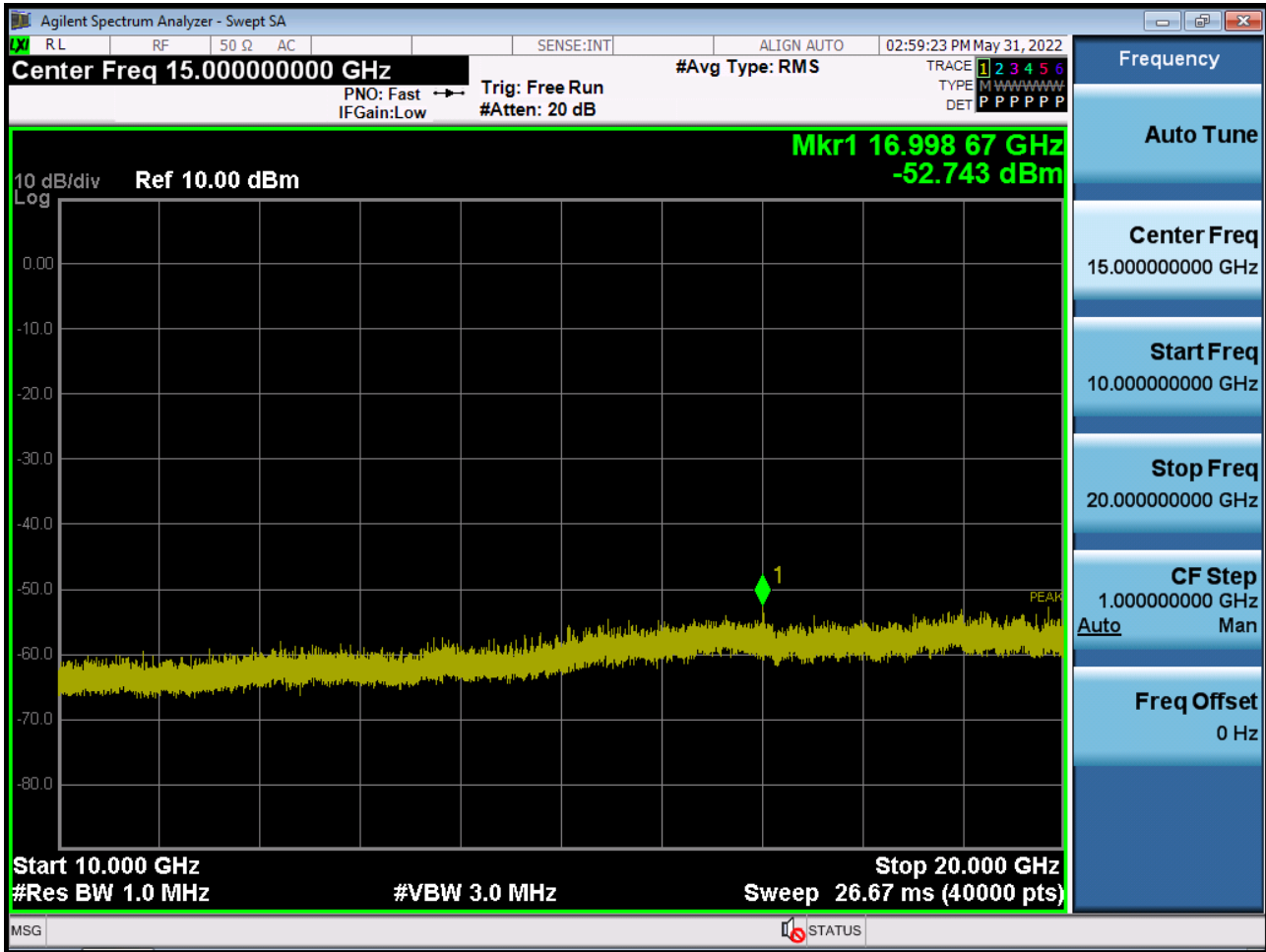


■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



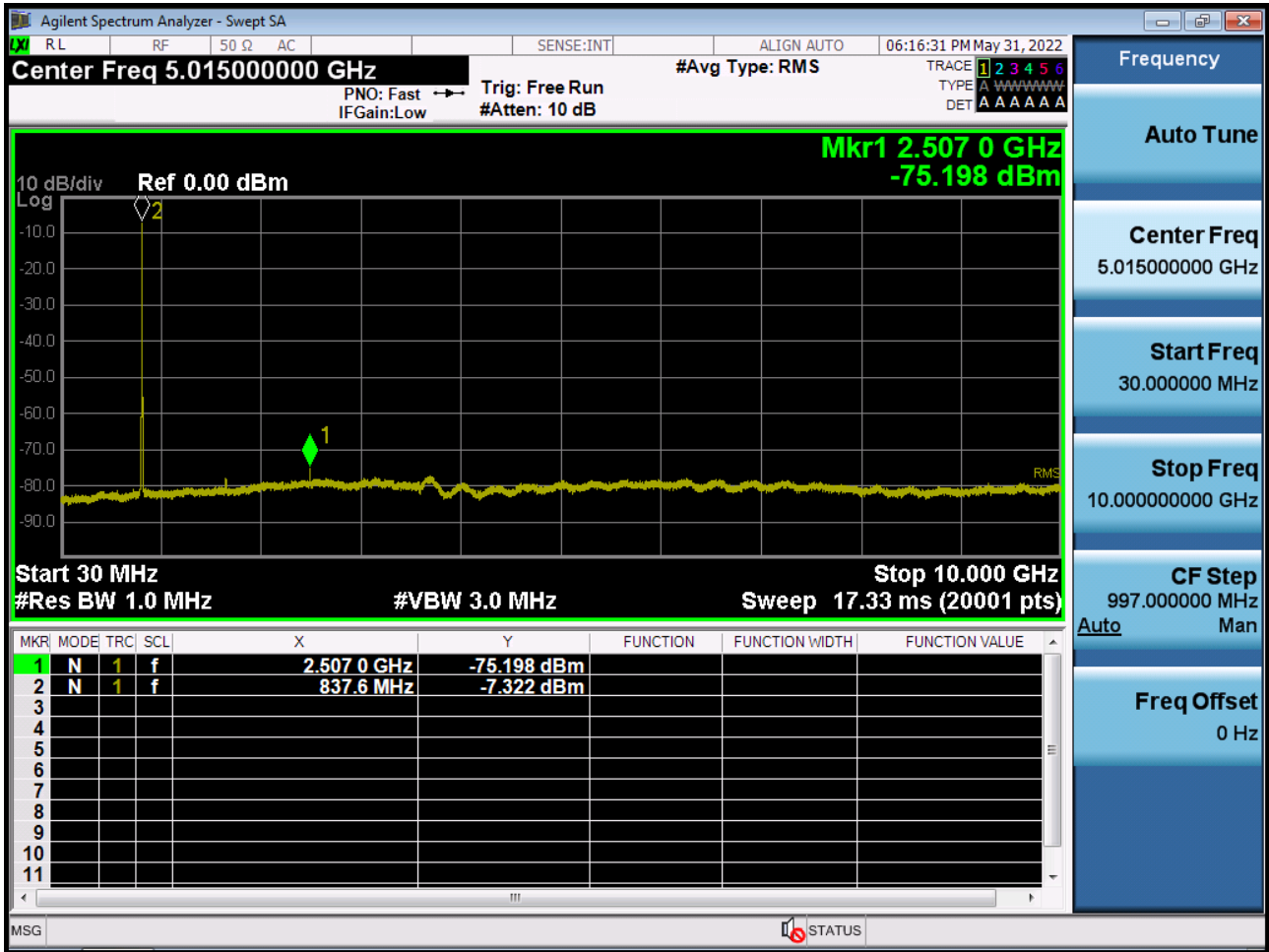


■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2

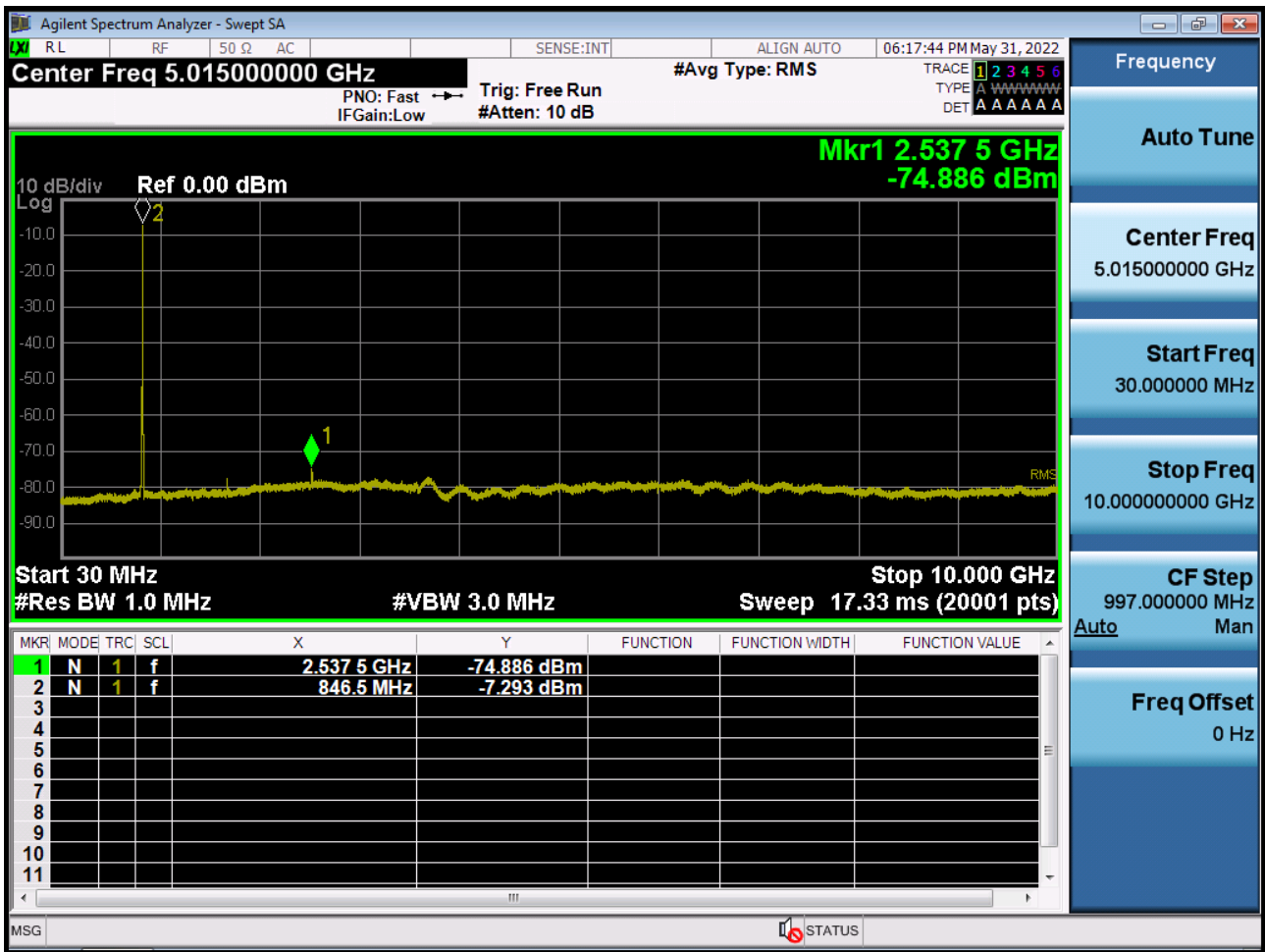




■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



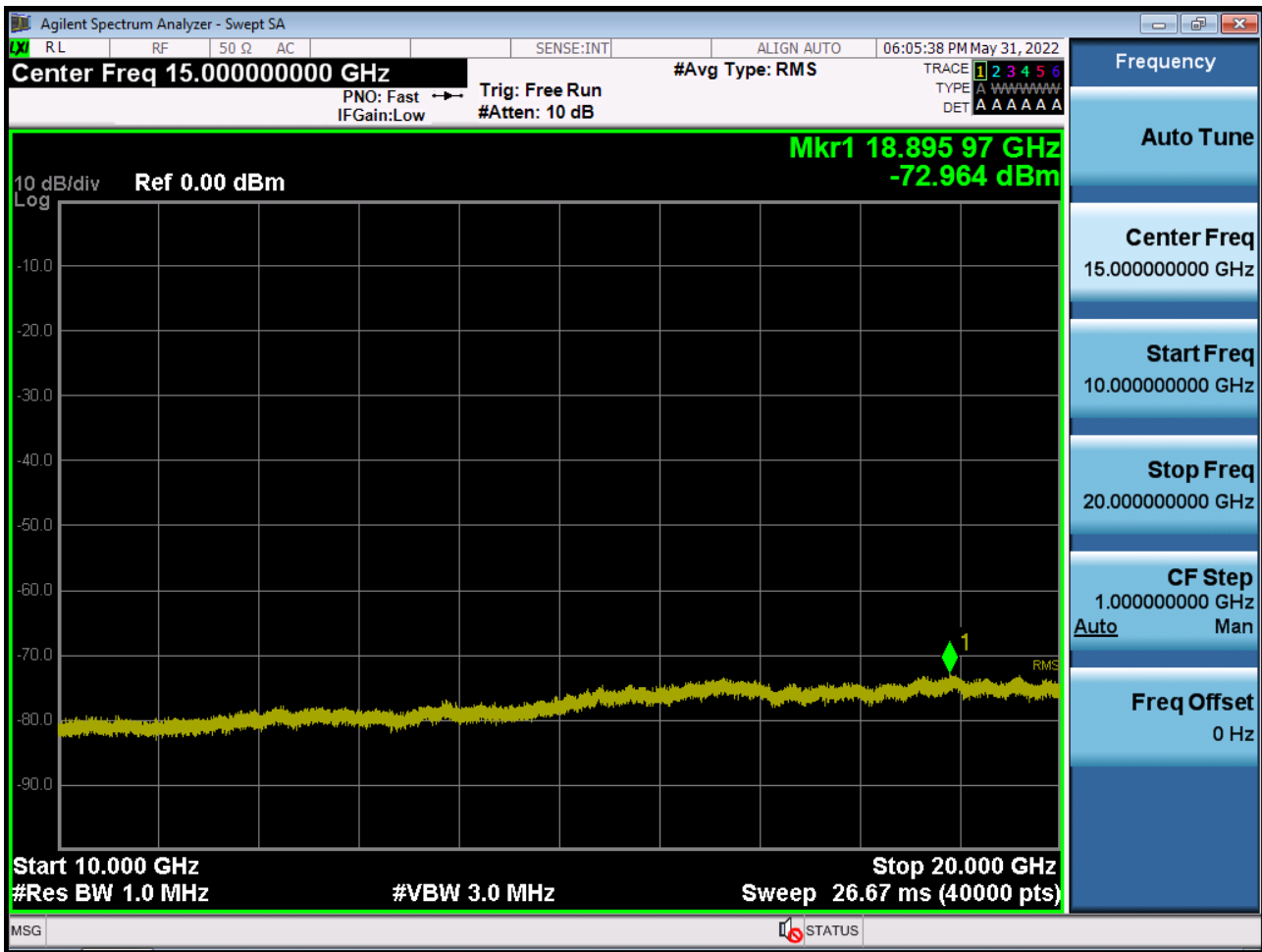
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions





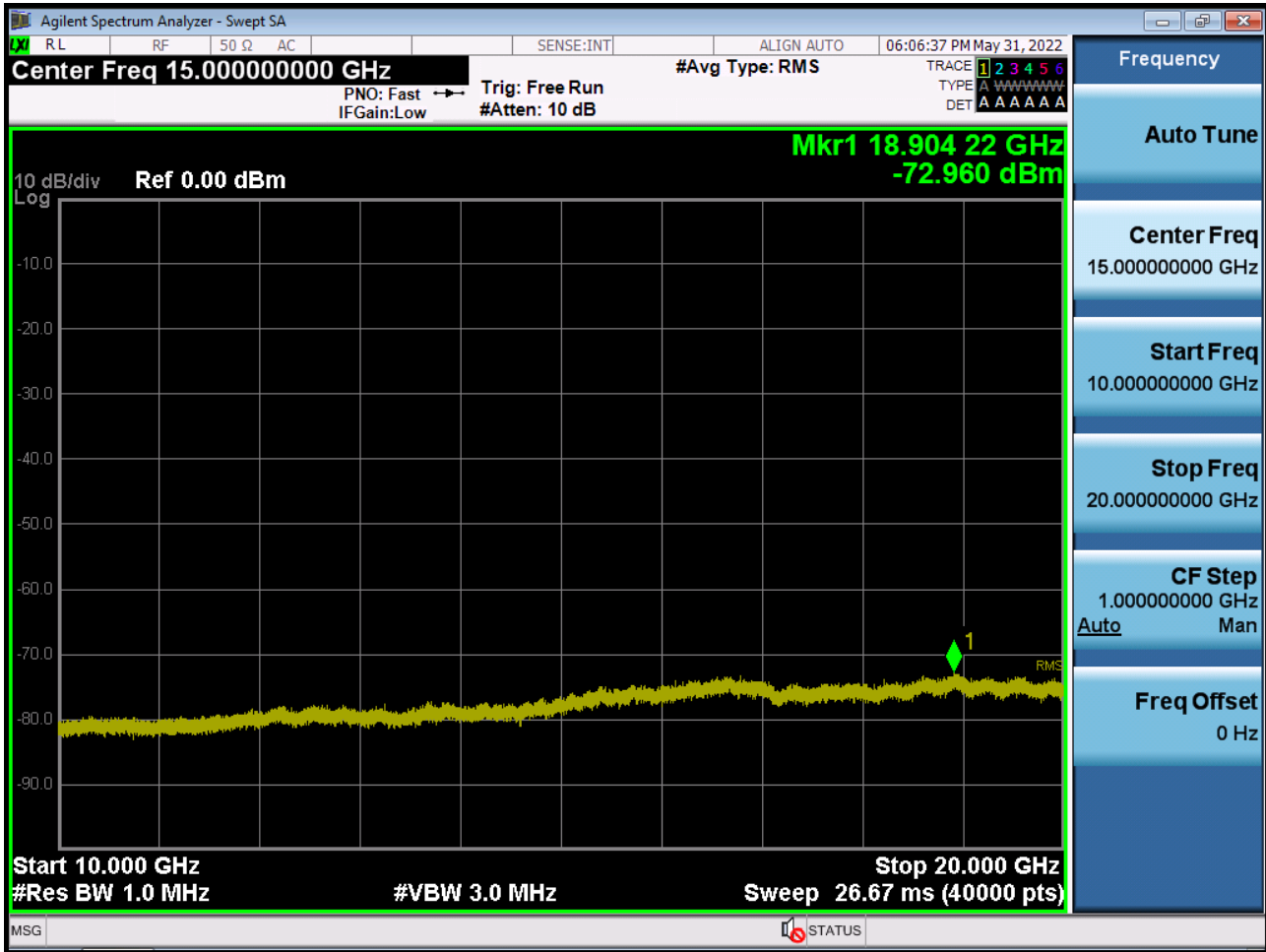


■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2





■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2

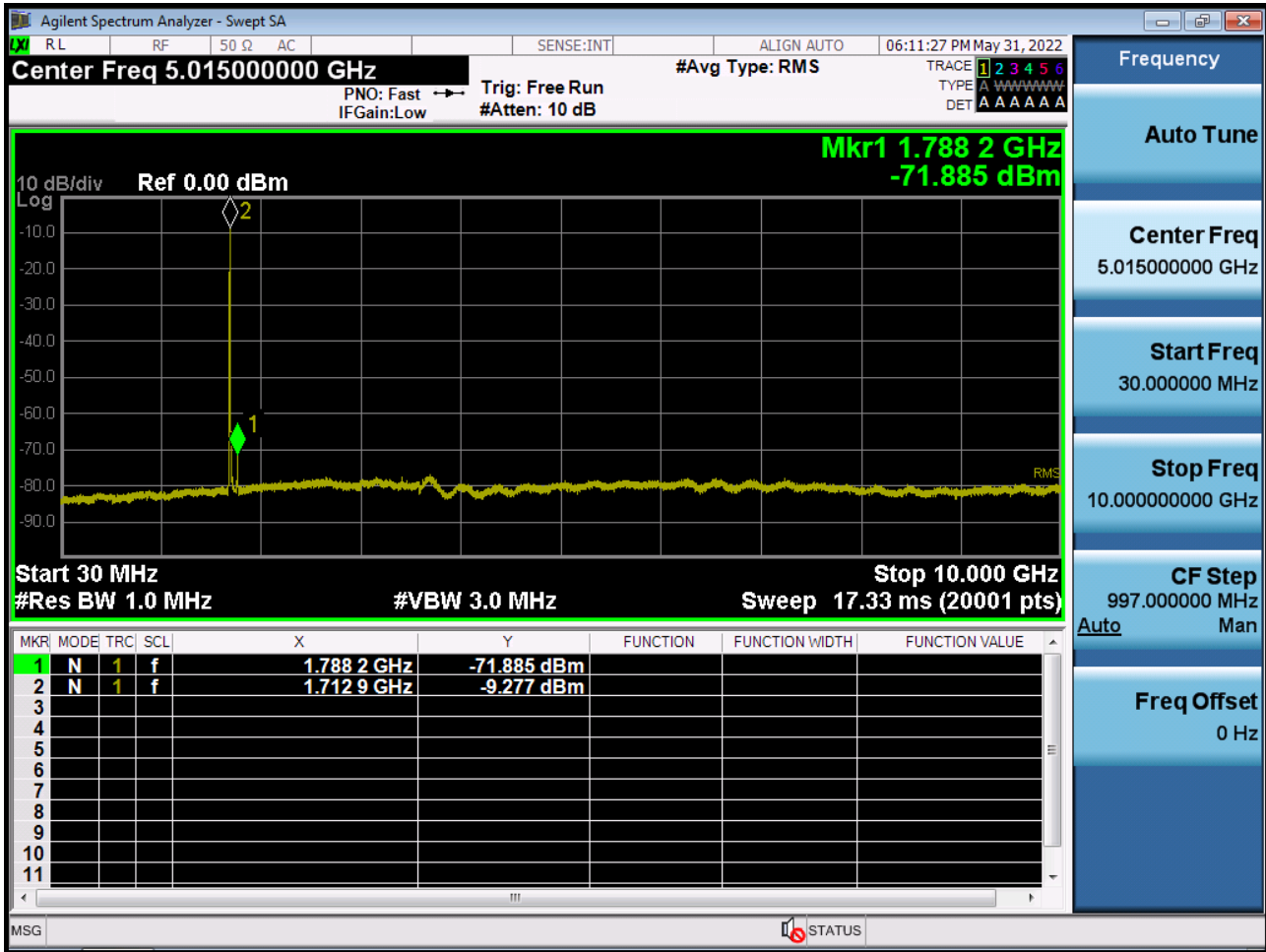




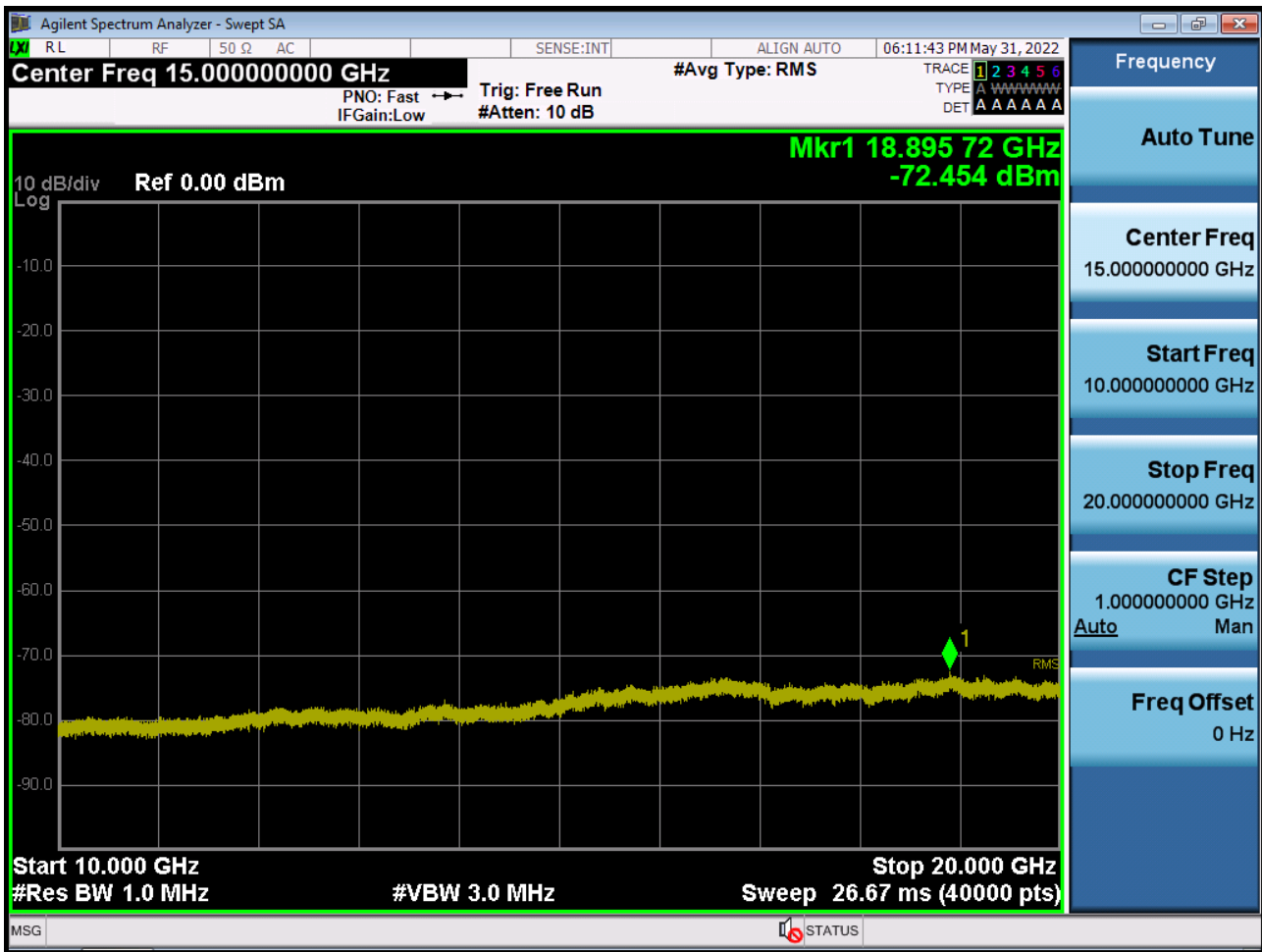
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1

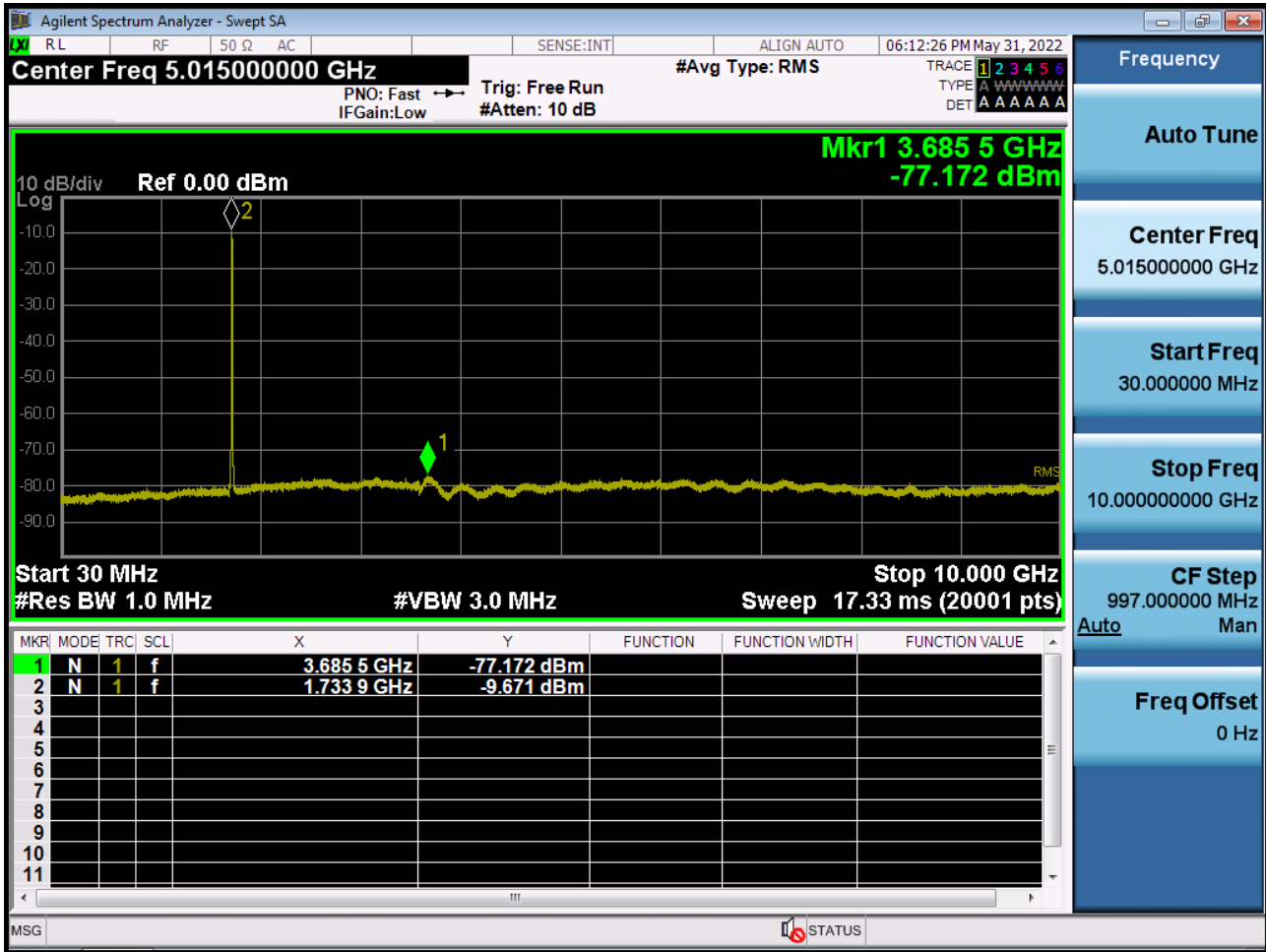


■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2

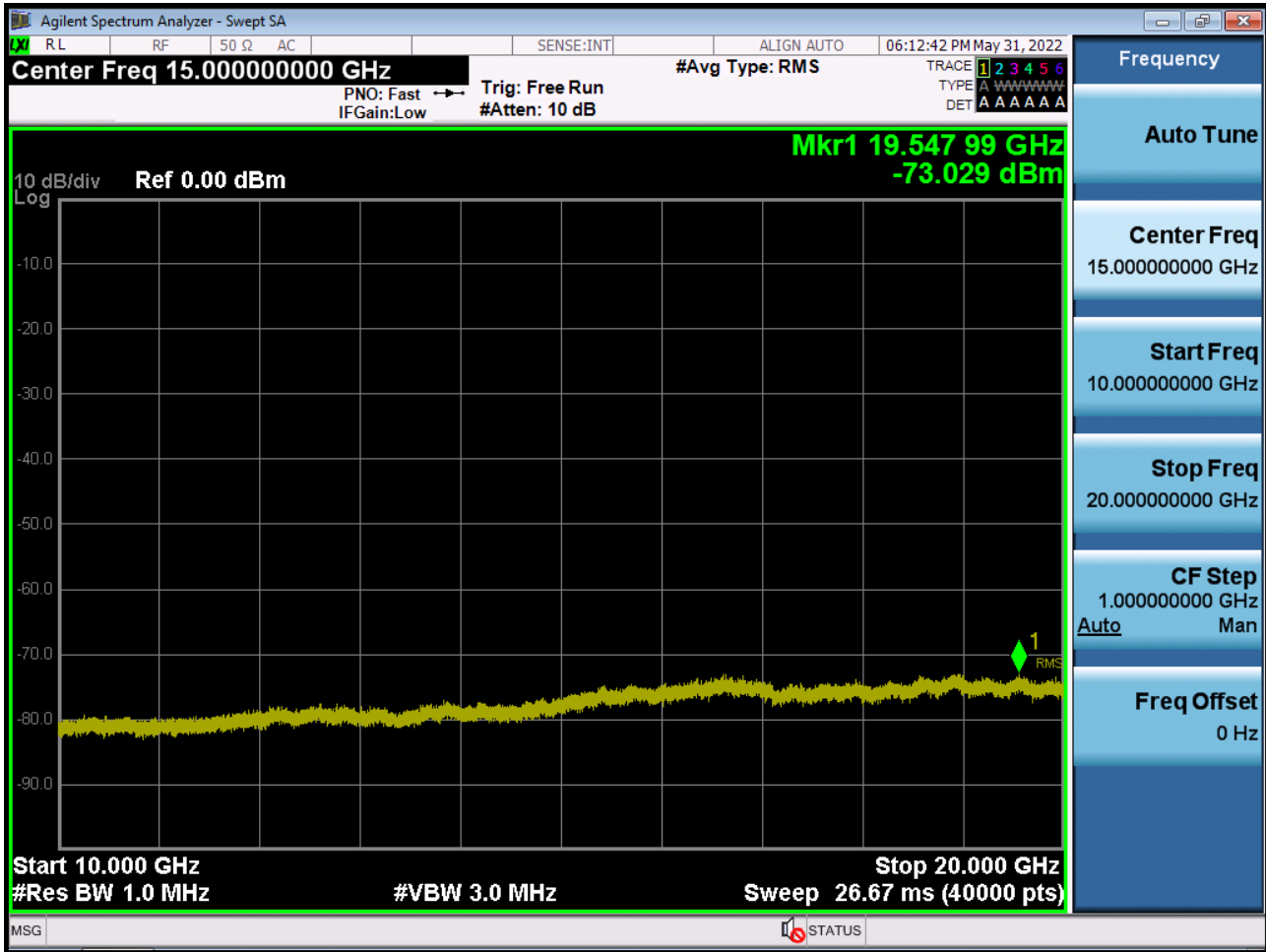




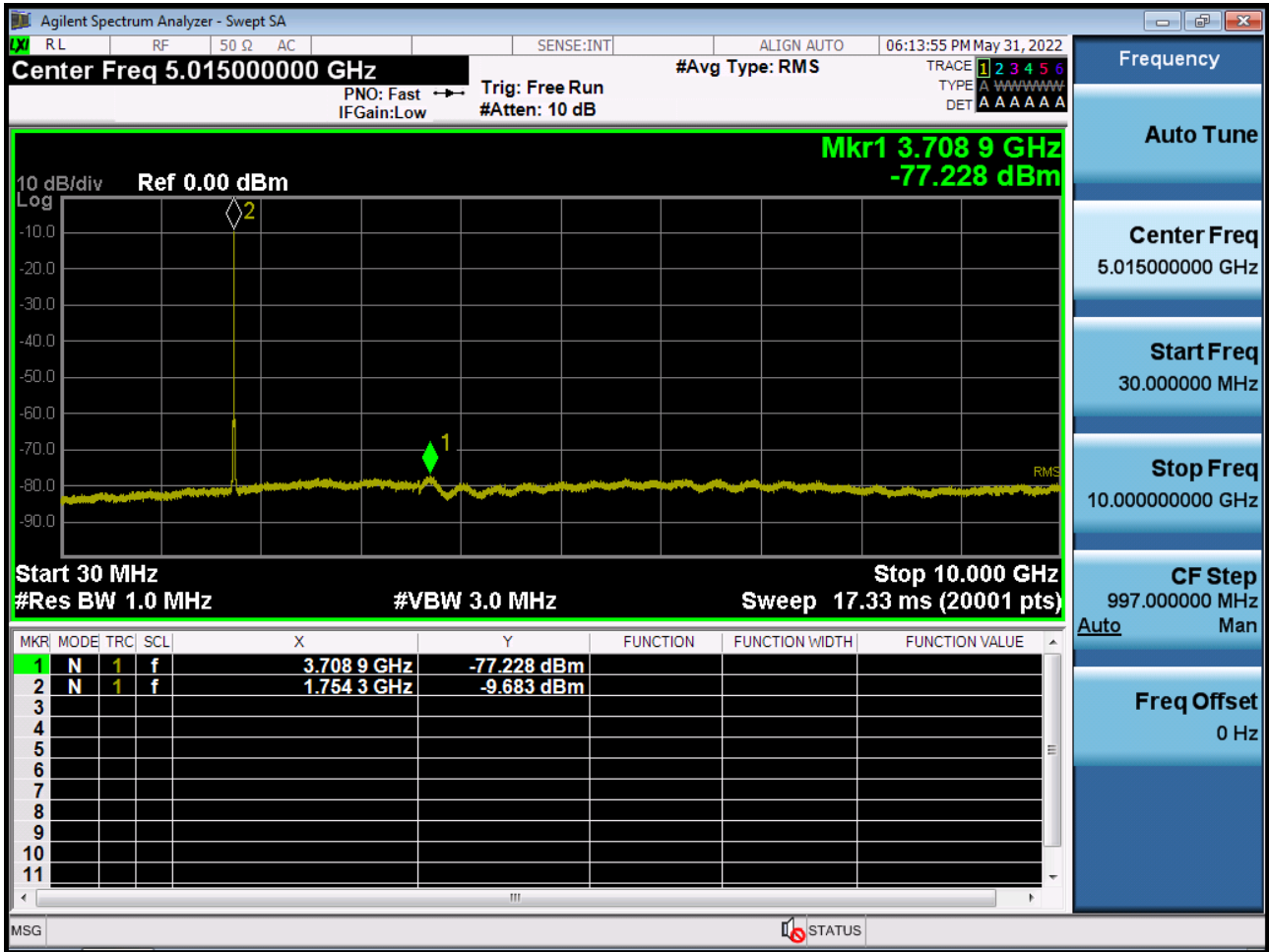
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



■ 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-2206-FC016-P