

FCC 2G3G REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Date of Issue:
June 30, 2021

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

Location:
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Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-2106-FC002

FCC ID: A3LSMG990B

APPLICANT: SAMSUNG Electronics Co., Ltd.

Model(s): SM-G990B/DS
 Additional Model(s): SM-G990B
 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	246 KGXW	0.698	28.44
GSM850 EDGE			244 KG7W	0.140	21.45
WCDMA850	826.4 – 846.6	871.4 – 891.6	4M17F9W	0.085	19.27
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	244 KGXW	1.000	30.00
GSM1900 EDGE			249 KG7W	0.340	25.32
WCDMA1900	1852.4 – 1907.6	1932.4 – 1987.6	4M16F9W	0.184	22.65
WCDMA1700	1712.4 – 1752.6	2112.4 – 2152.6	4M16F9W	0.139	21.42

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-2106-FC002

REVIEWED BY



Report prepared by : Jae Mun 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)

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2106-FC002	June 30, 2021	- First Approval Report

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

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG990B
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§22, §24, §27, §2
EUT Type:	Mobile phone
Model(s):	SM-G990B/DS
Additional Model(s):	SM-G990B
Tx Frequency:	824.20 - 848.80 MHz (GSM850) 826.40 - 846.60 MHz (WCDMA850) 1 850.20 - 1 909.80 MHz (GSM1900) 1 852.4 - 1 907.6 MHz (WCDMA1900) 1 712.4 - 1 752.6 MHz (WCDMA1700)
Rx Frequency:	869.20 - 893.80 MHz (GSM850) 871.40 - 891.60 MHz (WCDMA850) 1 930.20 - 1 989.80 MHz (GSM1900) 1 932.4 - 1 987.6 MHz (WCDMA1900) 2 112.4 - 2 152.6 MHz (WCDMA1700)
Date(s) of Tests:	May 03, 2021 ~ June 07, 2021
Serial number:	Radiated: 543da2b1d81f7ece Conducted: 524d0f0dc71e7ece

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 (HT20/40/80), 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 1MHz
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 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;

$$P_{d(\text{dBm})} = P_{g(\text{dBm})} - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

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 = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
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 10th harmonics from 9 kHz.

Test Note

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

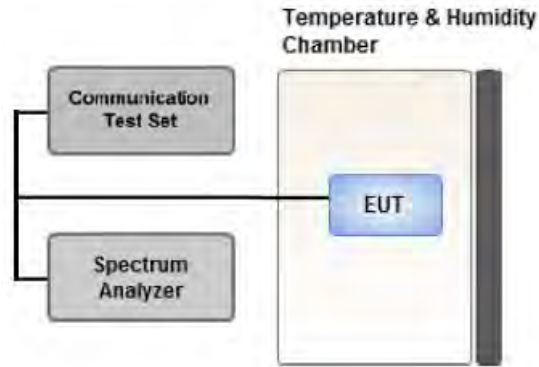
$$\text{Result}_{(\text{dBm})} = P_{g(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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.

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

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 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 \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.

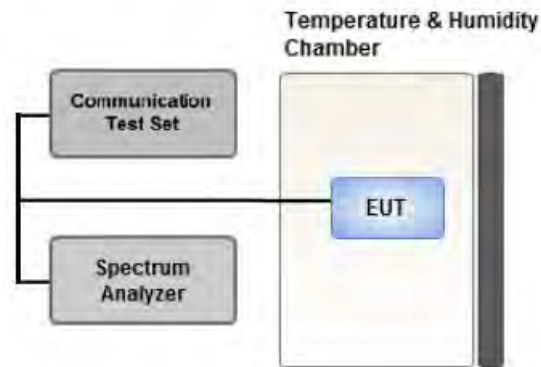
Test Settings(GSM)

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.

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-G990B/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-G990B/DS)

[Worst case]

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

[Test Channel]

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

3.10 WORST CASE(RADIATED TEST)

- 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-G990B/DS & additional models were tested and the worst case results are reported.

(Worst case : SM-G990B/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 : X	Low, Mid, High
			WCDMA B4 : X	
			WCDMA B5 : Y	

[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 : Y	Low, Mid, High

[Test Channel]

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

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibrati on Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/07/2021	Annual	04/07/2022
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP/ Dipole Antenna	557	04/05/2021	Biennial	04/05/2023
Schwarzbeck	UHAP/ Dipole Antenna	558	04/05/2021	Biennial	04/05/2023
ESPEC	SU-642 / Chamber	93008124	03/15/2021	Annual	03/15/2022
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	10/13/2020	Biennial	10/13/2022
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY50200093	11/17/2020	Annual	11/17/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/01/2021	Annual	06/01/2022
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)	1513-333	03/19/2020	Biennial	03/19/2022
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/03/2021	Biennial	03/03/2023
Schwarzbeck	VULB9168/ Hybrid Antenna	760	02/22/2021	Biennial	02/22/2023
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/07/2021	Annual	01/07/2022
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/02/2021	Annual	06/02/2022
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

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

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (\pm dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §22.917(a), §24.238(a), §27.53(h)	< 43 + 10 x log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§2.1046	N/A	<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
GSM850	128	824.2	-23.50	40.07	-10.42	1.39	V	< 7.00	0.669	28.26
	190	836.6	-23.89	40.25	-10.40	1.41	V		0.698	28.44
	251	848.8	-24.67	39.81	-10.38	1.42	V		0.633	28.01
EDGE	190	836.6	-30.88	33.24	-10.38	1.41	V		0.140	21.45

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBd)	C.L	Pol.	Limit	ERP	
	channel	Freq.(MHz)							W	W
WCDMA850	4132	826.4	-33.00	30.75	-10.42	1.40	V	< 7.00	0.078	18.93
	4183	836.6	-33.06	31.08	-10.40	1.41	V		0.085	19.27
	4233	846.6	-34.08	30.16	-10.39	1.42	V		0.068	18.35

8.2 EQUIVALENT ISOTROPIC RADIATED POWER

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit W	EIRP	
	channel	Freq.(MHz)							W	dBm
GSM1900	512	1850.2	-12.07	22.01	10.10	2.11	V	< 2.00	1.000	30.00
	661	1880.0	-13.43	21.12	10.15	2.15	V		0.817	29.12
	810	1909.8	-13.51	21.03	10.23	2.15	V		0.815	29.11
EDGE	512	1850.2	-16.75	17.33	10.10	2.11	V		0.340	25.32

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit W	EIRP	
	channel	Freq.(MHz)							W	dBm
WCDMA1900	9262	1852.4	-19.42	14.66	10.10	2.11	H	< 2.00	0.184	22.65
	9400	1880.0	-19.90	14.65	10.15	2.15	H		0.184	22.65
	9538	1907.6	-21.44	13.10	10.23	2.15	H		0.131	21.18

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBi)	C.L	Pol.	Limit W	EIRP	
	channel	Freq.(MHz)							W	dBm
WCDMA1700	1312	1712.4	-20.02	13.62	9.85	2.05	H	< 1.00	0.139	21.42
	1412	1732.4	-20.76	12.97	9.90	2.05	H		0.121	20.82
	1513	1752.6	-21.02	12.73	10.00	2.06	H		0.117	20.67

8.3 RADIATED SPURIOUS EMISSIONS

▣ MODULATION SIGNAL: GSM850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured Level [dBm]</u>	Ant. Gain (dBi)	<u>Substitute Level [dBm]</u>	C.L	Pol.	Result (dBm)	Limit
128 (824.2)	1 648.40	-51.70	9.50	-61.31	1.99	V	-53.80	-13.00
	2 472.60	-31.48	10.60	-35.61	2.47	V	-27.48	-13.00
	3 296.80	-57.36	12.25	-58.45	2.89	H	-49.08	-13.00
190 (836.6)	1 673.20	-51.39	9.65	-61.16	2.01	V	-53.52	-13.00
	2 509.80	-33.62	10.75	-37.34	2.50	V	-29.09	-13.00
	3 346.40	-57.77	12.48	-58.75	2.92	H	-49.20	-13.00
251 (848.8)	1 697.60	-51.91	9.80	-61.43	2.04	V	-53.67	-13.00
	2 546.40	-36.10	10.88	-39.38	2.52	H	-31.02	-13.00
	3 395.20	-58.04	12.68	-59.10	2.94	V	-49.36	-13.00

▣ MODULATION SIGNAL: GSM1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	<u>Measured</u> <u>Level</u> <u>[dBm]</u>	<u>Ant. Gain</u> <u>(dBi)</u>	<u>Substitute</u> <u>Level</u> <u>[dBm]</u>	C.L	Pol.	<u>Result</u> <u>(dBm)</u>	<u>Limit</u>
512 (1850.2)	3 700.40	-54.77	12.40	-58.84	3.08	H	-49.52	-13.00
	5 550.60	-55.77	13.10	-53.74	3.81	H	-44.45	-13.00
	7 400.80	-50.51	11.10	-40.55	4.44	H	-33.89	-13.00
661 (1880.0)	3 760.00	-53.54	12.48	-57.41	3.10	H	-48.03	-13.00
	5 640.00	-50.66	13.30	-48.49	3.85	H	-39.04	-13.00
	7 520.00	-48.86	11.30	-38.29	4.46	H	-31.45	-13.00
810 (1909.8)	3 819.60	-52.27	12.40	-56.70	3.14	H	-47.44	-13.00
	5 729.40	-42.21	13.35	-39.55	3.87	H	-30.07	-13.00
	7 639.20	-49.55	11.65	-39.02	4.47	H	-31.84	-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	-53.16	9.50	-62.77	1.99	V	-55.26	-13.00
	2 479.20	-51.40	10.60	-55.67	2.48	V	-47.55	-13.00
	3 305.60	-57.68	12.33	-58.76	2.90	V	-49.33	-13.00
4,183 (836.6)	1 673.20	-52.23	9.65	-62.00	2.01	V	-54.36	-13.00
	2 509.80	-48.86	10.75	-52.58	2.50	H	-44.33	-13.00
	3 346.40	-57.98	12.48	-58.96	2.92	V	-49.41	-13.00
4,233 (846.6)	1 693.20	-52.97	9.73	-62.65	2.03	V	-54.95	-13.00
	2 539.80	-47.77	10.85	-51.30	2.51	H	-42.96	-13.00
	3 386.40	-58.73	12.63	-59.81	2.94	H	-50.12	-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	-55.21	12.40	-59.28	3.08	V	-49.96	-13.00
	5 557.20	-56.45	13.15	-54.64	3.82	V	-45.31	-13.00
	7 409.60	-57.29	11.13	-47.11	4.45	H	-40.43	-13.00
9400 (1880.0)	3 760.00	-55.38	12.48	-59.25	3.10	H	-49.87	-13.00
	5 640.00	-55.37	13.30	-53.20	3.85	V	-43.75	-13.00
	7 520.00	-56.41	11.30	-45.84	4.46	V	-39.00	-13.00
9538 (1907.6)	3 815.20	-55.27	12.40	-59.66	3.14	H	-50.39	-13.00
	5 722.80	-56.72	13.35	-53.75	3.88	H	-44.28	-13.00
	7 630.40	-57.33	11.60	-47.00	4.48	V	-39.88	-13.00

▣ MODULATION SIGNAL: WCDMA1700

▣ 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
1312 (1712.4)	3 424.80	-54.95	12.60	-60.85	2.96	V	-51.20	-13.00
	5 137.20	-56.69	12.45	-53.84	3.66	H	-45.05	-13.00
	6 849.60	-56.24	12.20	-49.62	4.25	V	-41.67	-13.00
1412 (1732.4)	3 464.80	-53.84	12.48	-59.63	2.97	H	-50.12	-13.00
	5 197.20	-56.78	12.90	-55.36	3.70	H	-46.16	-13.00
	6 929.60	-56.10	12.05	-48.80	4.28	H	-41.03	-13.00
1513 (1752.6)	3 505.20	-54.78	12.28	-60.56	2.98	H	-51.26	-13.00
	5 257.80	-56.10	13.25	-55.29	3.71	H	-45.75	-13.00
	7 010.40	-56.39	11.65	-48.37	4.32	V	-41.04	-13.00

8.4 PEAK-TO-AVERAGE RATIO

Band	Ch.	Measured P _{Pk} (dBm)	Measured P _{Avg} (dBm)	P _{Avg} (Duty Cycle)			P.A.R. = P _{Pk} - P _{Avg} (dB)	Limit (dB)	Pass / Fail
				Tx _{Total} (ms)	Tx _{On} (ms)	Factor (dB)			
GSM1900	661	30.648	21.00	4.6160	0.5475	9.26	0.38	13	Pass
GSM1900 EDGE	661	29.476	16.88	4.616	0.5475	9.26	3.33		
WCDMA1900	9400	CCDF Procedure					2.87		
WCDMA1700	1412						2.92		

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 62 ~ 69.
2. Only GSM(include EDGE) Mode was tested by alternate procedure for PAPR

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

$$\text{Duty cycle Factor} = 10 \times \log (1/X), \quad X = T_{XOn} / T_{XTotal}$$

8.5 OCCUPIED BANDWIDTH

Band	Channel	Frequency(MHz)	Data (GSM: kHz / WCDMA : MHz)
GSM850	128	824.20	244.15
	190	836.60	246.27
	251	848.80	244.82
GSM850 EDGE	128	824.20	240.05
	190	836.60	244.33
	251	848.80	242.07
GSM1900	512	1,850.20	243.10
	661	1,880.00	244.17
	810	1,909.80	241.79
GSM1900 EDGE	512	1,850.20	248.75
	661	1,880.00	240.68
	810	1,909.80	242.99
WCDMA850	4132	826.40	4.1435
	4183	836.60	4.1695
	4233	846.60	4.1543
WCDMA1900	9262	1852.40	4.1352
	9400	1880.00	4.1555
	9538	1907.60	4.1587
WCDMA1700	1312	1712.40	4.1566
	1412	1732.40	4.1574
	1513	1752.60	4.1440

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	3.1815	27.976	-57.70	-29.728	-13.00
	190	5.3256	28.591	-57.36	-28.765	
	251	3.6700	27.976	-57.50	-29.523	
GSM1900	512	18.59946	29.489	-52.786	-23.297	
	661	19.51124	29.489	-53.113	-23.624	
	810	18.59346	29.489	-51.490	-22.001	
WCDMA850	4132	3.7259	27.976	-77.305	-49.329	
	4183	3.6960	27.976	-77.072	-49.096	
	4233	3.7039	27.976	-76.744	-48.768	
WCDMA1900	9262	18.9035	29.489	-72.608	-43.119	
	9400	18.8845	29.489	-72.320	-42.831	
	9538	18.8970	29.489	-72.317	-42.828	
WCDMA1700	1312	1.78821	27.976	-71.905	-43.929	
	1412	18.90647	29.489	-72.344	-42.855	
	1513	18.88122	29.489	-72.269	-42.780	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 106 ~ 129.
2. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
3. Factor(dB) = Cable Loss + Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20	30.131

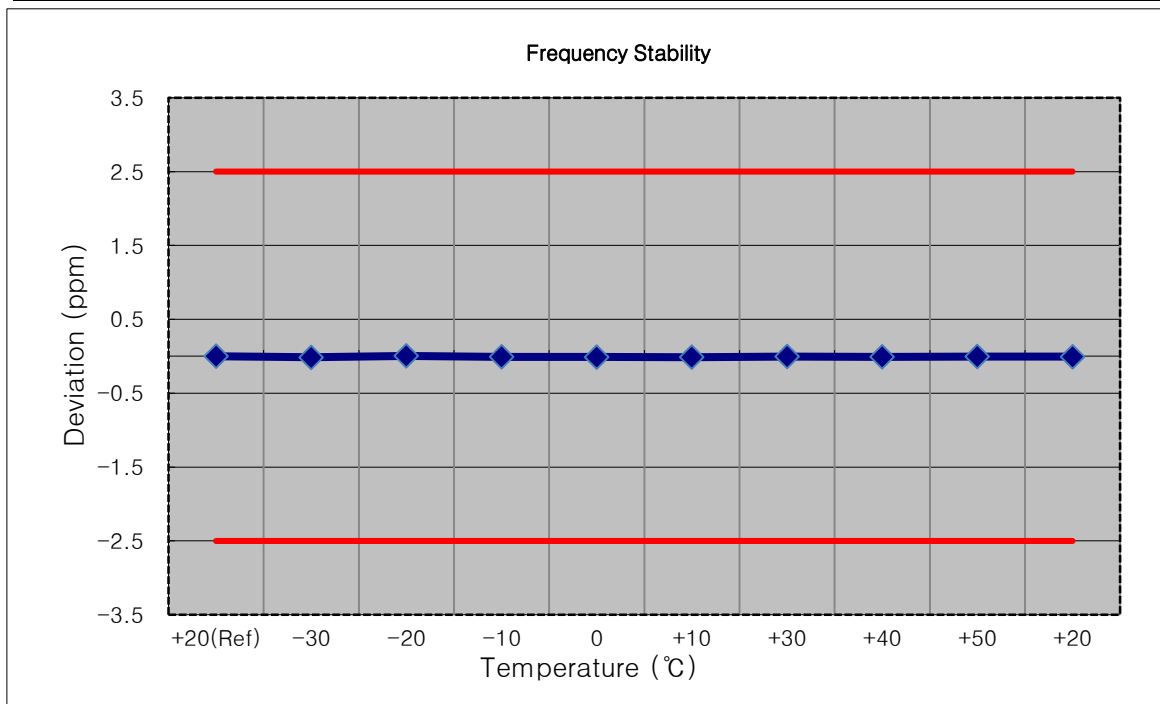
8.7 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 70 ~ 105.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

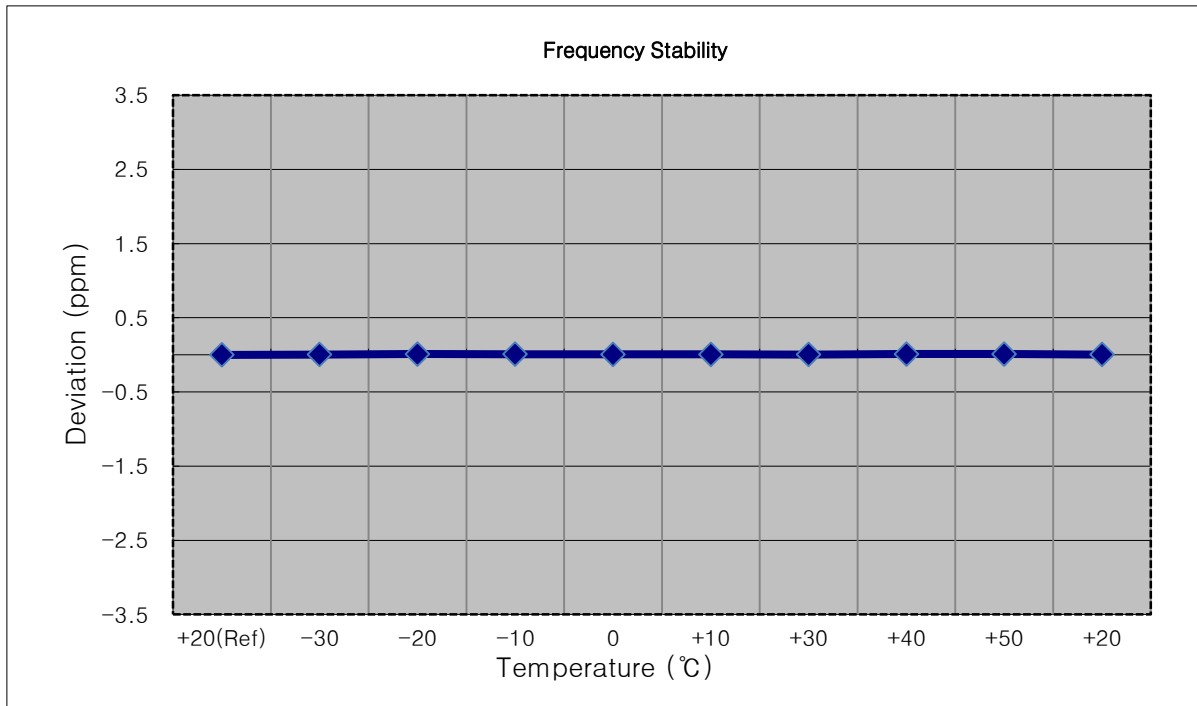
- ▣ MODE: GSM850
- ▣ OPERATING FREQUENCY: 836,600,000 Hz
- ▣ CHANNEL: 190
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	836 599 992	0.0	0.000 000	0.0000
100%		-30	836 599 981	-10.9	-0.000 001	-0.0131
100%		-20	836 599 995	3.7	0.000 000	0.0044
100%		-10	836 599 985	-6.4	-0.000 001	-0.0077
100%		0	836 599 983	-8.7	-0.000 001	-0.0104
100%		+10	836 599 981	-10.4	-0.000 001	-0.0124
100%		+30	836 599 989	-2.7	0.000 000	-0.0032
100%		+40	836 599 986	-6.2	-0.000 001	-0.0074
100%		+50	836 599 988	-3.4	0.000 000	-0.0040
Batt. Endpoint	3.650	+20	836 599 987	-4.3	-0.000 001	-0.0052



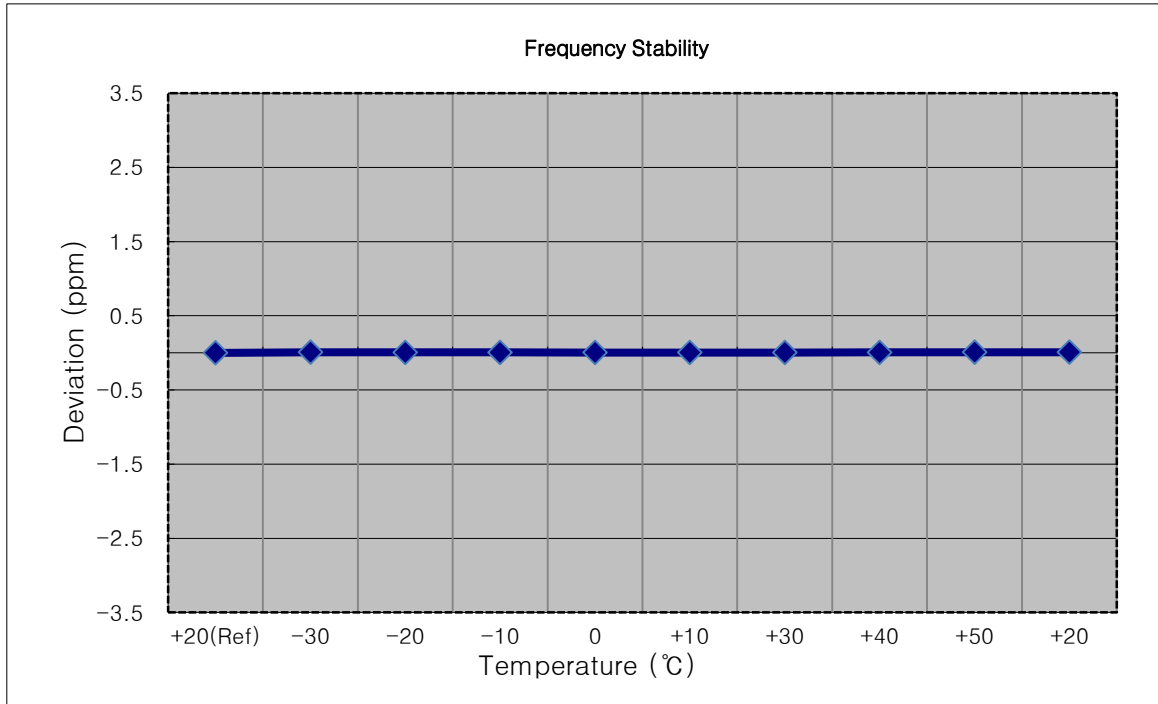
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1850,200,000 Hz
- ▣ CHANNEL: 512
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1850 200 010	0.0	0.000 000	0.0000
100%		-30	1850 200 017	6.2	0.000 000	0.0034
100%		-20	1850 200 028	17.9	0.000 001	0.0097
100%		-10	1850 200 028	17.4	0.000 001	0.0094
100%		0	1850 200 023	12.3	0.000 001	0.0066
100%		+10	1850 200 021	10.3	0.000 001	0.0056
100%		+30	1850 200 018	7.9	0.000 000	0.0043
100%		+40	1850 200 030	20.1	0.000 001	0.0108
100%		+50	1850 200 032	21.2	0.000 001	0.0115
Batt. Endpoint	3.650	+20	1850 200 018	7.6	0.000 000	0.0041



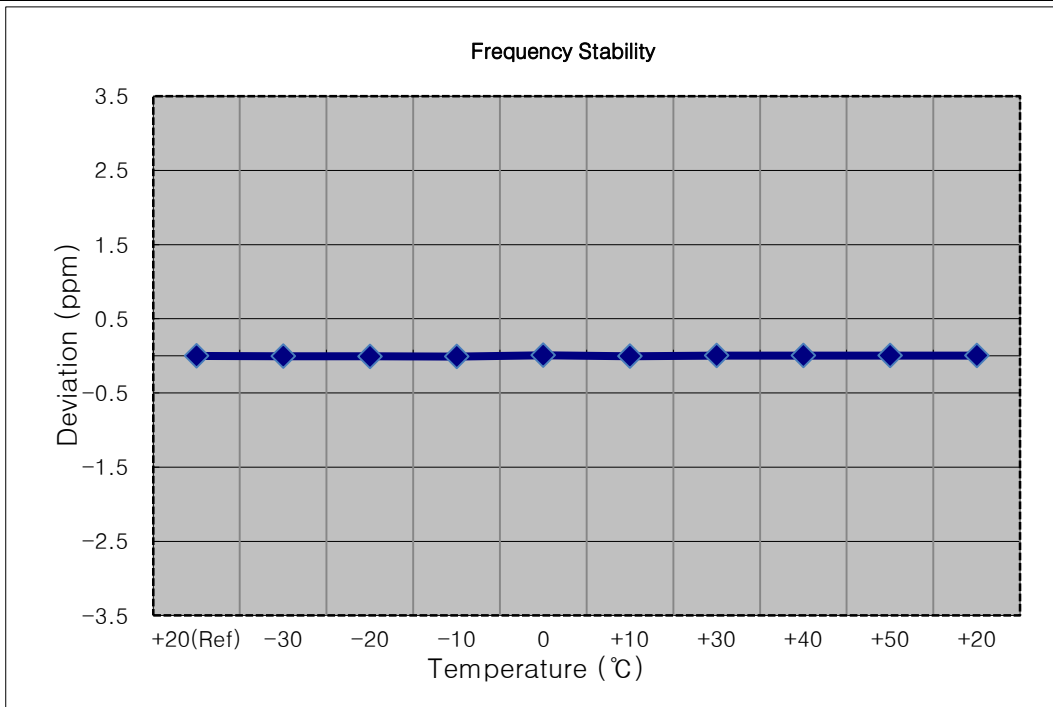
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1880,000,000 Hz
- ▣ CHANNEL: 661
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

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 000 038	17.4	0.000 001	0.009
100%		-20	1880 000 034	13.5	0.000 001	0.007
100%		-10	1880 000 032	11.1	0.000 001	0.006
100%		0	1880 000 030	9.6	0.000 001	0.005
100%		+10	1880 000 030	9.3	0.000 000	0.005
100%		+30	1880 000 029	8.2	0.000 000	0.004
100%		+40	1880 000 033	12.0	0.000 001	0.006
100%		+50	1880 000 037	16.4	0.000 001	0.009
Batt. Endpoint	3.650	+20	1880 000 036	14.8	0.000 001	0.008



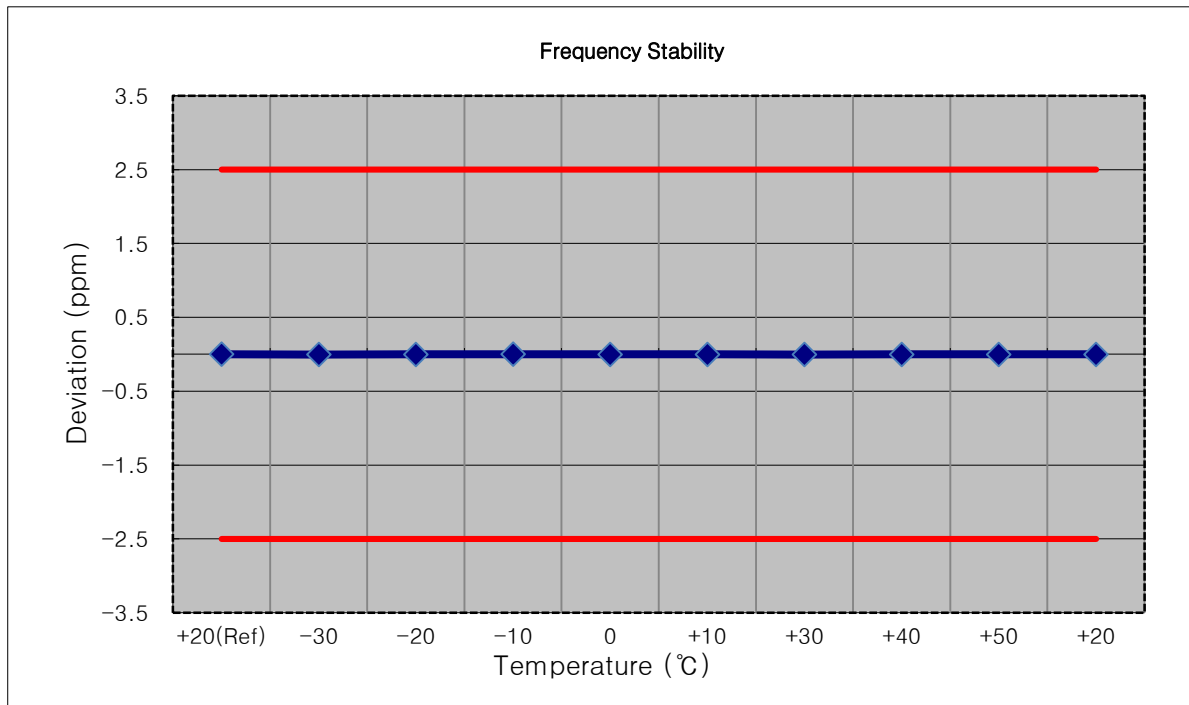
- ▣ Mode: GSM1900
- ▣ OPERATING FREQUENCY: 1909,800,000 Hz
- ▣ CHANNEL: 810
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1909 799 993	0.0	0.000 000	0.000
100%		-30	1909 799 983	-10.2	-0.000 001	-0.005
100%		-20	1909 799 979	-13.5	-0.000 001	-0.007
100%		-10	1909 799 976	-16.8	-0.000 001	-0.009
100%		0	1909 800 009	15.6	0.000 001	0.008
100%		+10	1909 799 985	-8.4	0.000 000	-0.004
100%		+30	1909 800 000	6.6	0.000 000	0.003
100%		+40	1909 800 000	6.7	0.000 000	0.004
100%		+50	1909 800 000	7.3	0.000 000	0.004
Batt. Endpoint		3.650	+20	1909 800 000	7.2	0.000 000



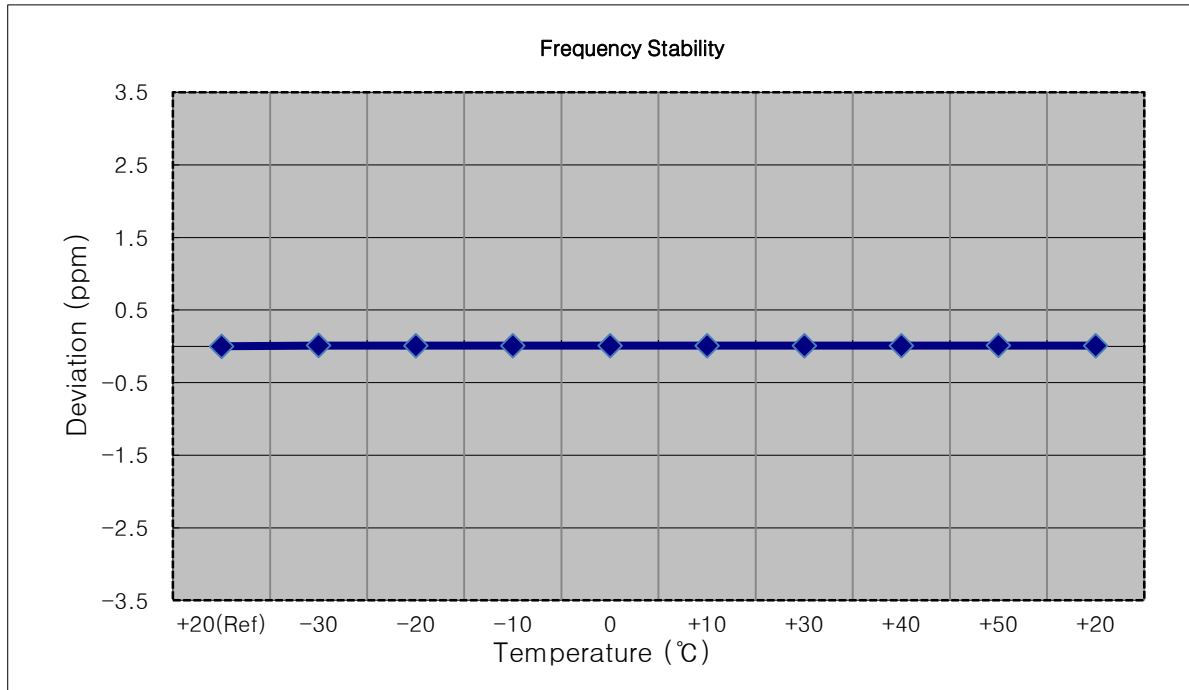
- ▣ Mode: WCDMA850
- ▣ OPERATING FREQUENCY: 836,600,000 Hz
- ▣ CHANNEL: 4183
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	836 599 999	0.0	0.000 000	0.0000
100%		-30	836 599 997	-2.0	0.000 000	-0.0023
100%		-20	836 599 997	-1.4	0.000 000	-0.0017
100%		-10	836 600 000	1.6	0.000 000	0.0019
100%		0	836 599 997	-1.4	0.000 000	-0.0017
100%		+10	836 599 997	-1.7	0.000 000	-0.0020
100%		+30	836 599 997	-2.0	0.000 000	-0.0025
100%		+40	836 599 997	-1.4	0.000 000	-0.0016
100%		+50	836 599 997	-1.4	0.000 000	-0.0017
Batt. Endpoint		3.650	+20	836 599 997	-1.5	0.000 000



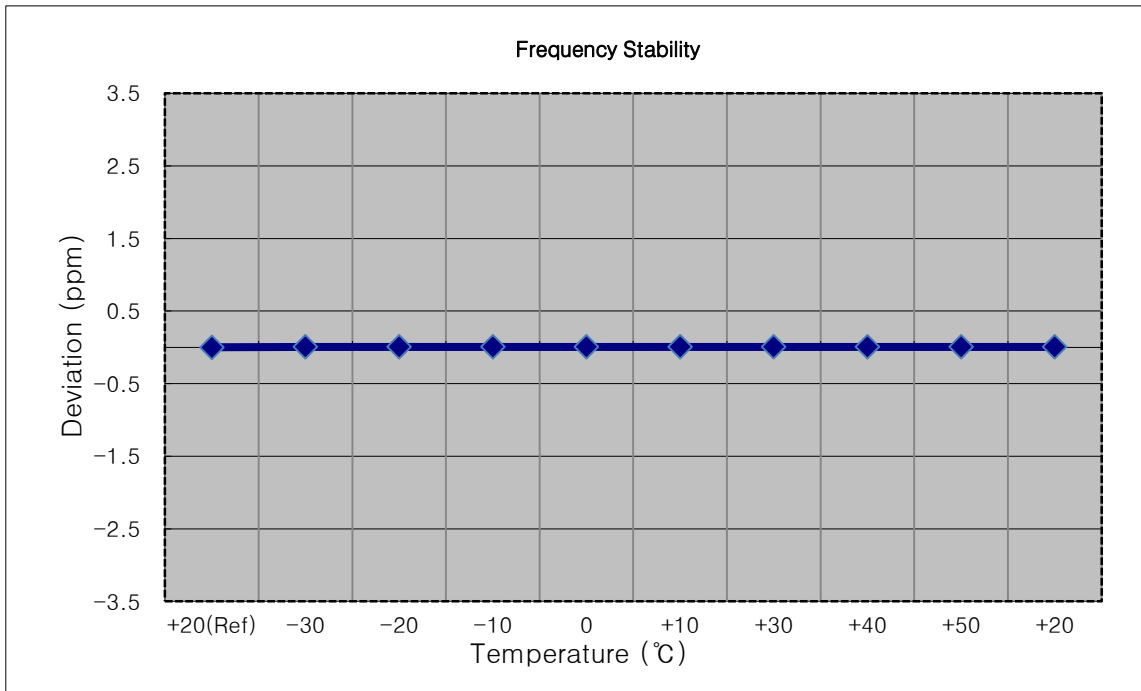
- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,852,400,000 Hz
- ▣ CHANNEL: 9262
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1852 400 019	0.0	0.000 000	0.0000
100%		-30	1852 400 037	18.0	0.000 001	0.0097
100%		-20	1852 400 036	17.0	0.000 001	0.0092
100%		-10	1852 400 036	16.8	0.000 001	0.0091
100%		0	1852 400 037	17.9	0.000 001	0.0097
100%		+10	1852 400 037	17.6	0.000 001	0.0095
100%		+30	1852 400 037	17.6	0.000 001	0.0095
100%		+40	1852 400 036	16.9	0.000 001	0.0091
100%		+50	1852 400 038	18.5	0.000 001	0.0100
Batt. Endpoint	3.650	+20	1852 400 037	17.7	0.000 001	0.0095



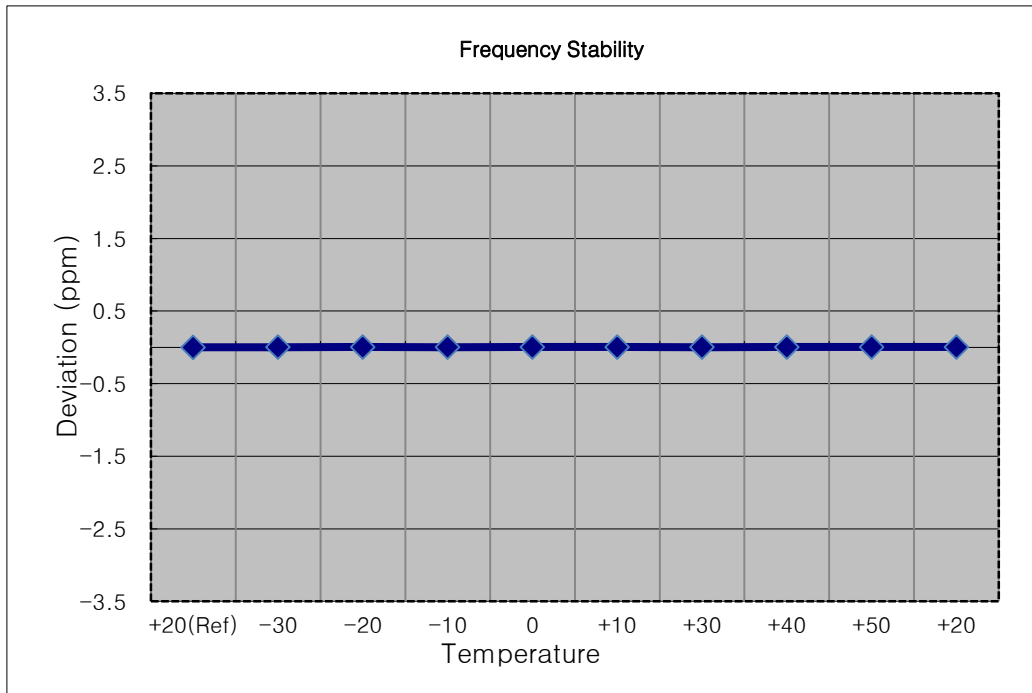
- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,880,000,000 Hz
- ▣ CHANNEL: 9400
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

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	13.2	0.000 001	0.0070
100%		-20	1880 000 025	11.5	0.000 001	0.0061
100%		-10	1880 000 025	11.7	0.000 001	0.0062
100%		0	1880 000 026	12.6	0.000 001	0.0067
100%		+10	1880 000 025	11.8	0.000 001	0.0063
100%		+30	1880 000 025	11.5	0.000 001	0.0061
100%		+40	1880 000 025	11.9	0.000 001	0.0063
100%		+50	1880 000 024	10.9	0.000 001	0.0058
Batt. Endpoint		3.650	+20	1880 000 026	12.9	0.000 001



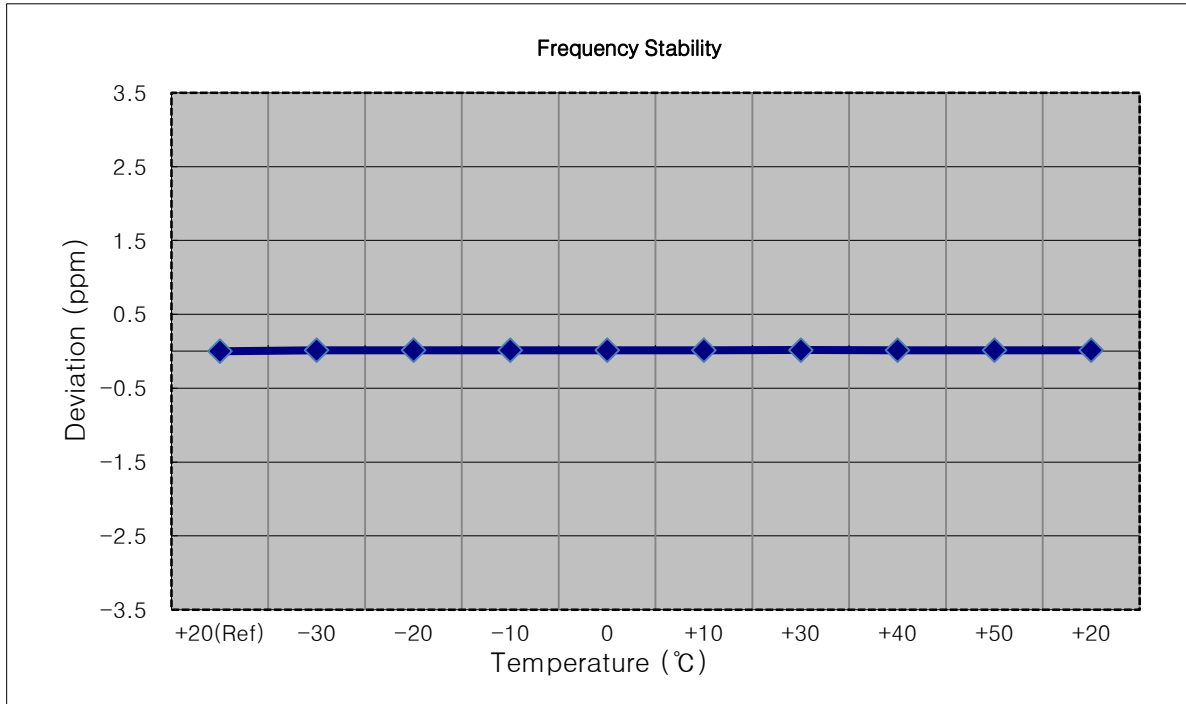
- ▣ Mode: WCDMA1900
- ▣ OPERATING FREQUENCY: 1,907,600,000 Hz
- ▣ CHANNEL: 9538
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1907 600 007	0.0	0.000 000	0.0000
100%		-30	1907 600 013	5.8	0.000 000	0.0030
100%		-20	1907 600 015	7.7	0.000 000	0.0040
100%		-10	1907 600 012	5.1	0.000 000	0.0027
100%		0	1907 600 014	7.0	0.000 000	0.0037
100%		+10	1907 600 014	6.5	0.000 000	0.0034
100%		+30	1907 600 013	5.3	0.000 000	0.0028
100%		+40	1907 600 013	6.0	0.000 000	0.0032
100%		+50	1907 600 014	6.8	0.000 000	0.0035
Batt. Endpoint		3.650	+20	1907 600 015	7.8	0.000 000



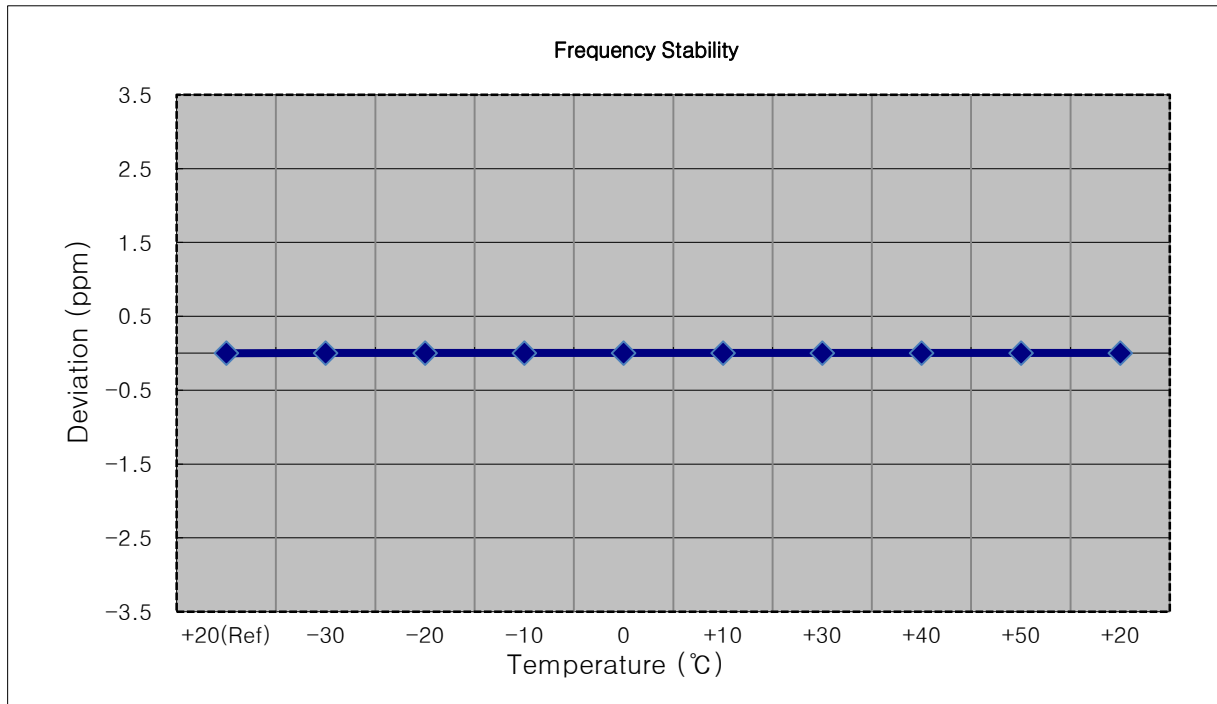
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,712,400,000 Hz
- ▣ CHANNEL: 1312
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1712 400 025	0.0	0.000 000	0.0000
100%		-30	1712 400 050	25.2	0.000 001	0.0147
100%		-20	1712 400 051	25.9	0.000 002	0.0151
100%		-10	1712 400 050	24.7	0.000 001	0.0144
100%		0	1712 400 051	25.8	0.000 002	0.0151
100%		+10	1712 400 050	24.9	0.000 001	0.0145
100%		+30	1712 400 052	26.6	0.000 002	0.0156
100%		+40	1712 400 050	24.8	0.000 001	0.0145
100%		+50	1712 400 049	24.2	0.000 001	0.0142
Batt. Endpoint		3.650	+20	1712 400 051	25.4	0.000 001



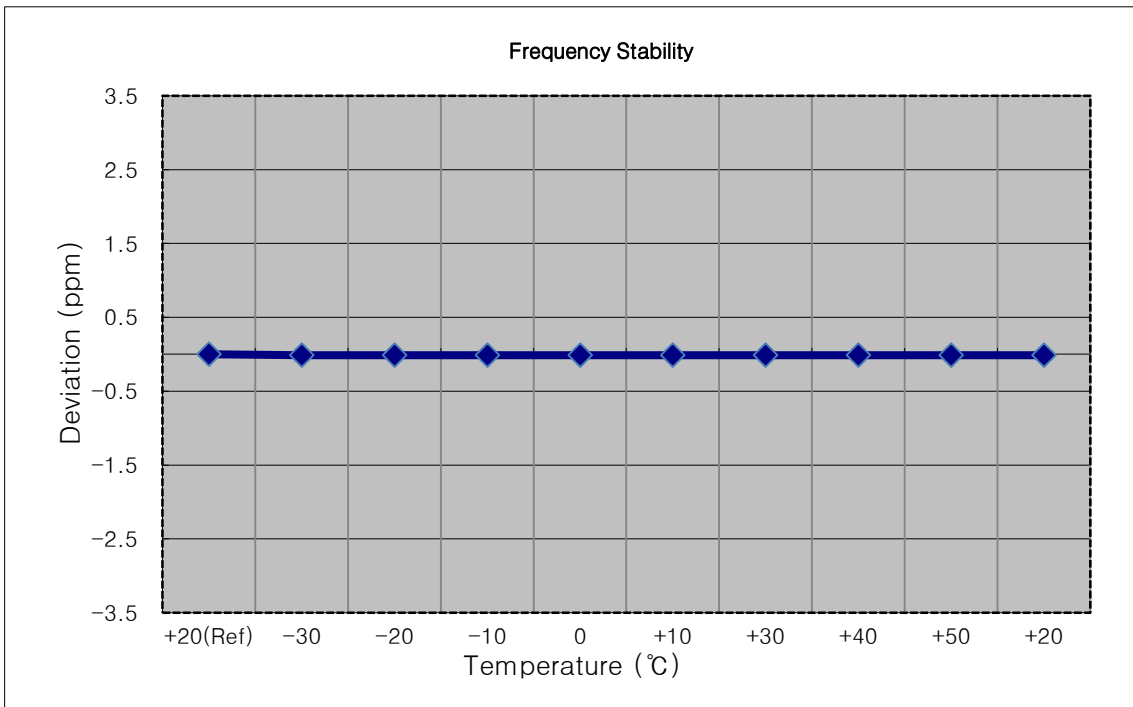
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,732,400,000 Hz
- ▣ CHANNEL: 1412
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1732 400 006	0.0	0.000 000	0.0000
100%		-30	1732 400 013	6.8	0.000 000	0.0039
100%		-20	1732 400 012	6.0	0.000 000	0.0034
100%		-10	1732 400 012	5.7	0.000 000	0.0033
100%		0	1732 400 012	6.0	0.000 000	0.0035
100%		+10	1732 400 012	5.5	0.000 000	0.0032
100%		+30	1732 400 012	5.9	0.000 000	0.0034
100%		+40	1732 400 011	4.9	0.000 000	0.0028
100%		+50	1732 400 012	5.8	0.000 000	0.0034
Batt. Endpoint	3.650	+20	1732 400 012	5.6	0.000 000	0.0033



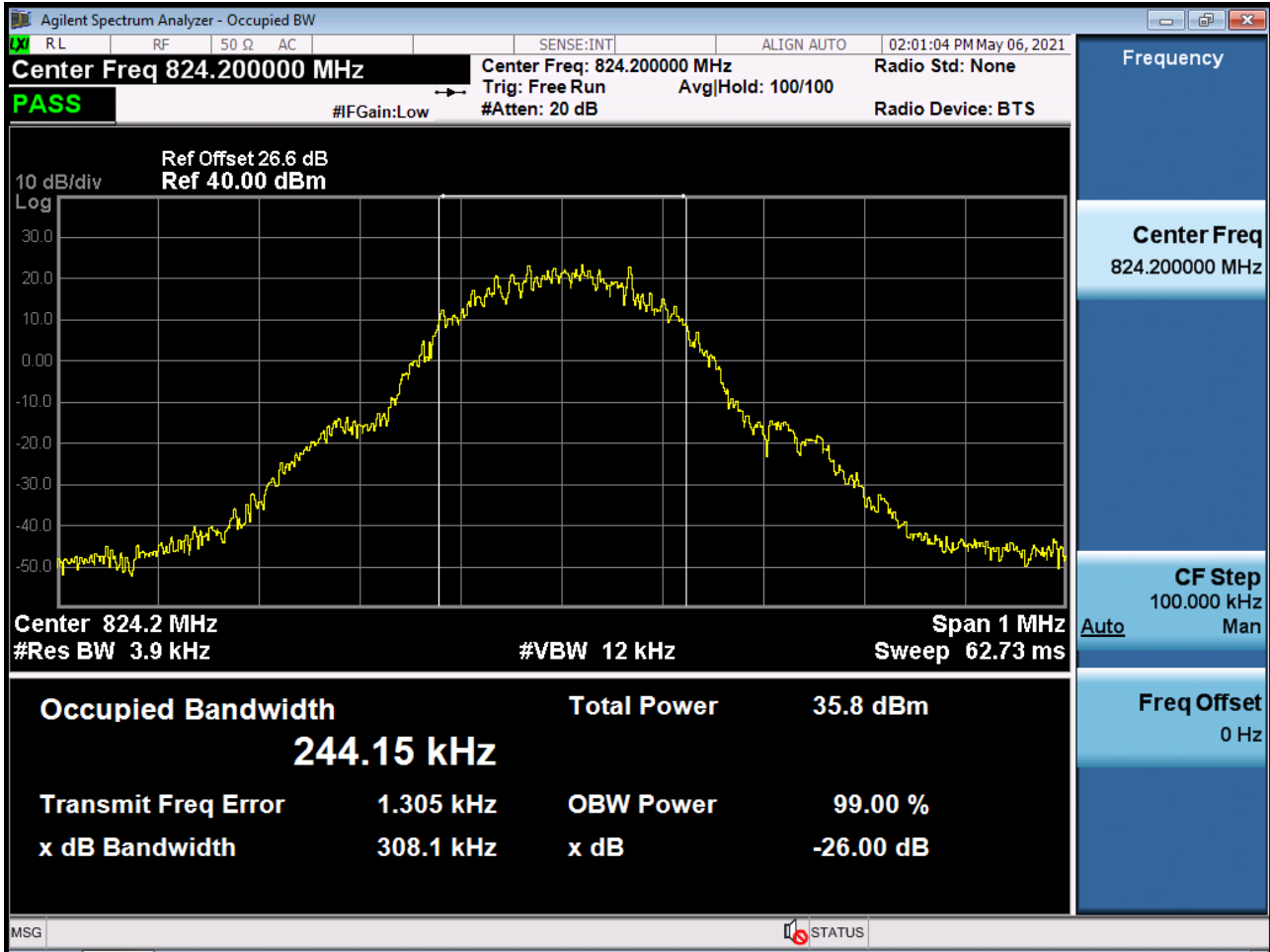
- ▣ Mode: WCDMA1700
- ▣ OPERATING FREQUENCY: 1,752,600,000 Hz
- ▣ CHANNEL: 1513
- ▣ REFERENCE VOLTAGE: 4.200 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	4.200	+20(Ref)	1752 599 980	0.0	0.000 000	0.0000
100%		-30	1752 599 960	-19.9	-0.000 001	-0.0114
100%		-20	1752 599 960	-19.4	-0.000 001	-0.0111
100%		-10	1752 599 960	-19.4	-0.000 001	-0.0111
100%		0	1752 599 959	-20.7	-0.000 001	-0.0118
100%		+10	1752 599 959	-20.3	-0.000 001	-0.0116
100%		+30	1752 599 960	-19.7	-0.000 001	-0.0112
100%		+40	1752 599 960	-20.0	-0.000 001	-0.0114
100%		+50	1752 599 958	-21.2	-0.000 001	-0.0121
Batt. Endpoint		3.650	+20	1752 599 960	-19.6	-0.000 001

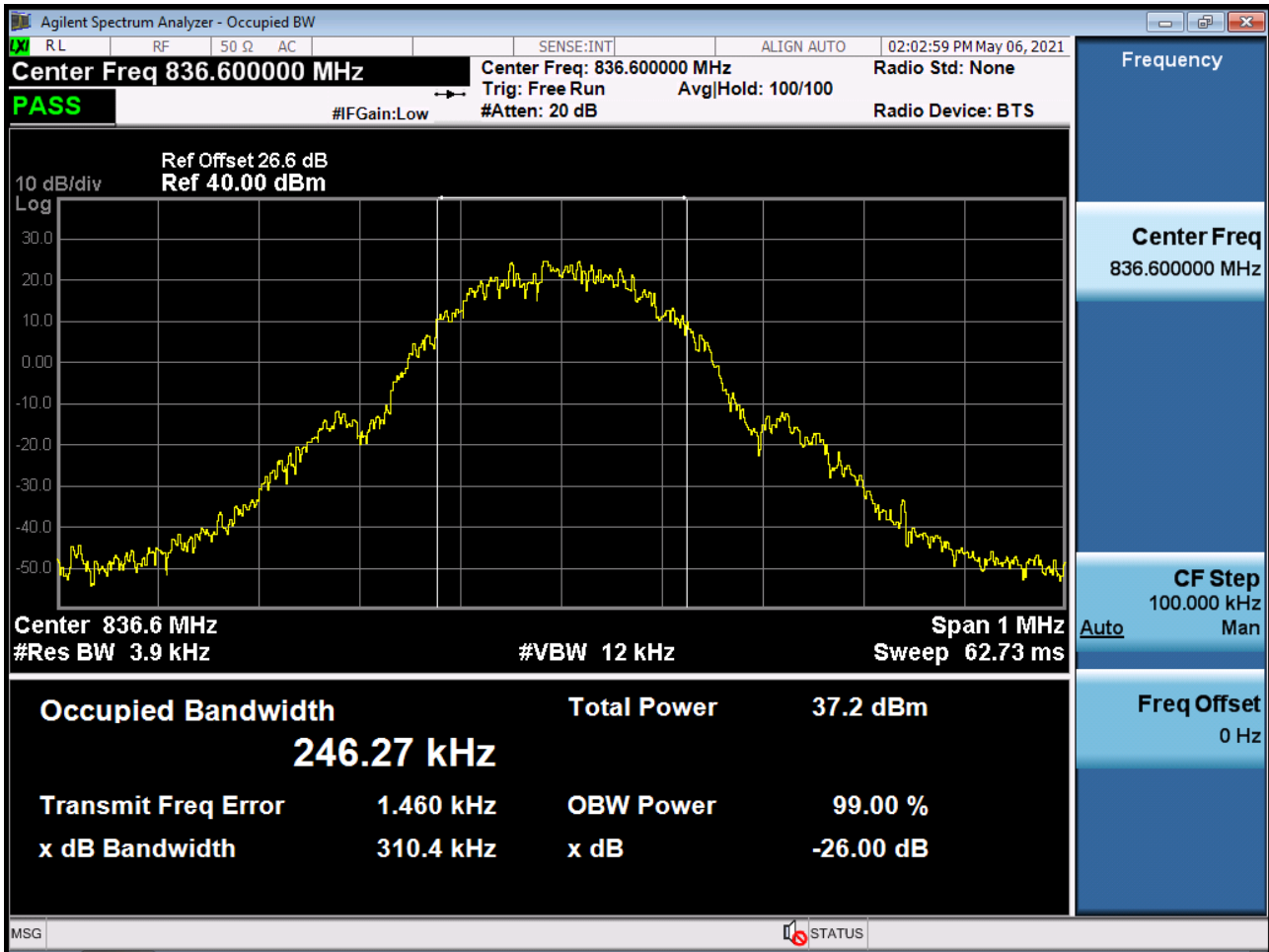


9. TEST PLOTS

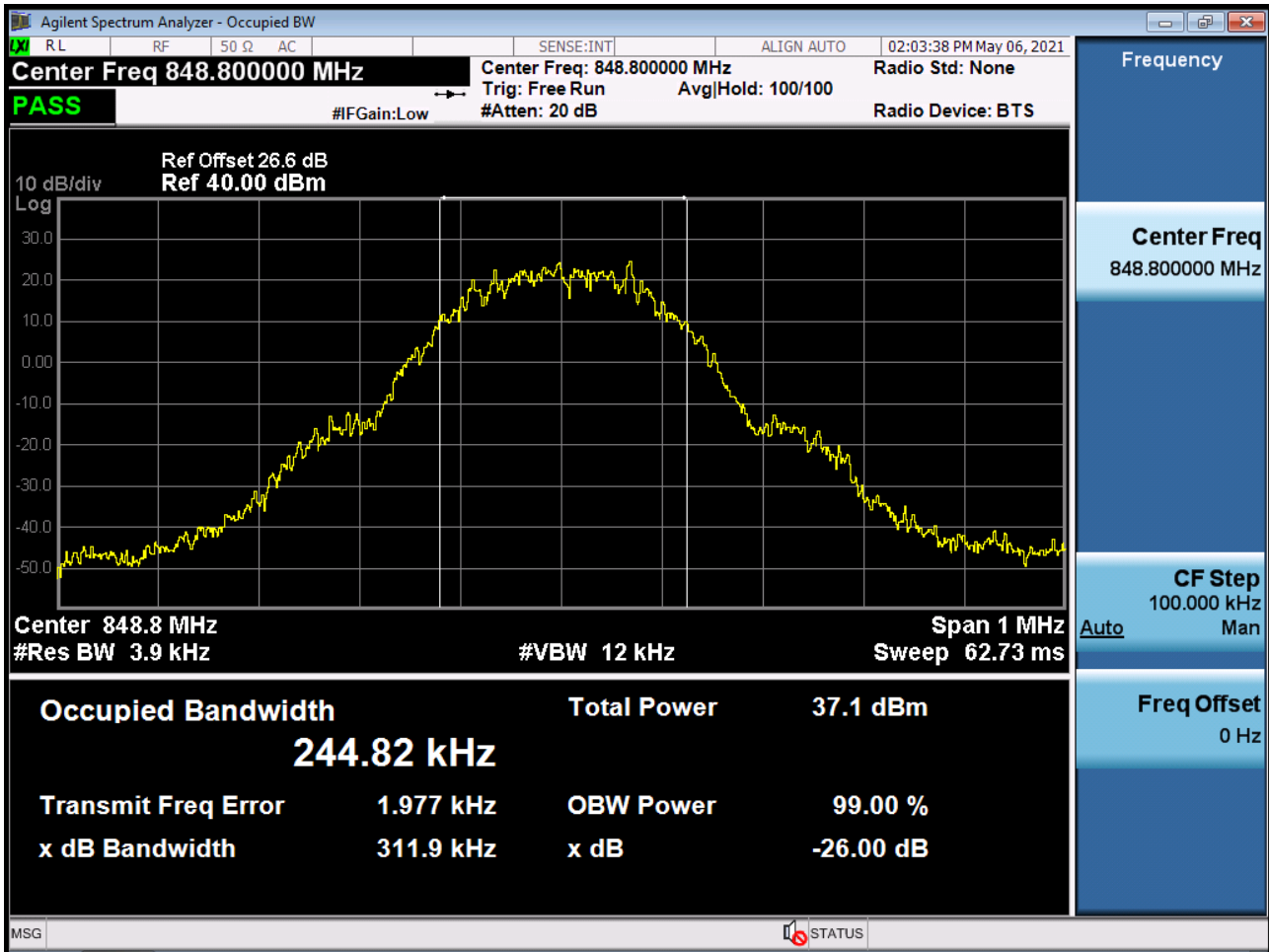
■ GSM850 MODE (128 CH.) Occupied Bandwidth



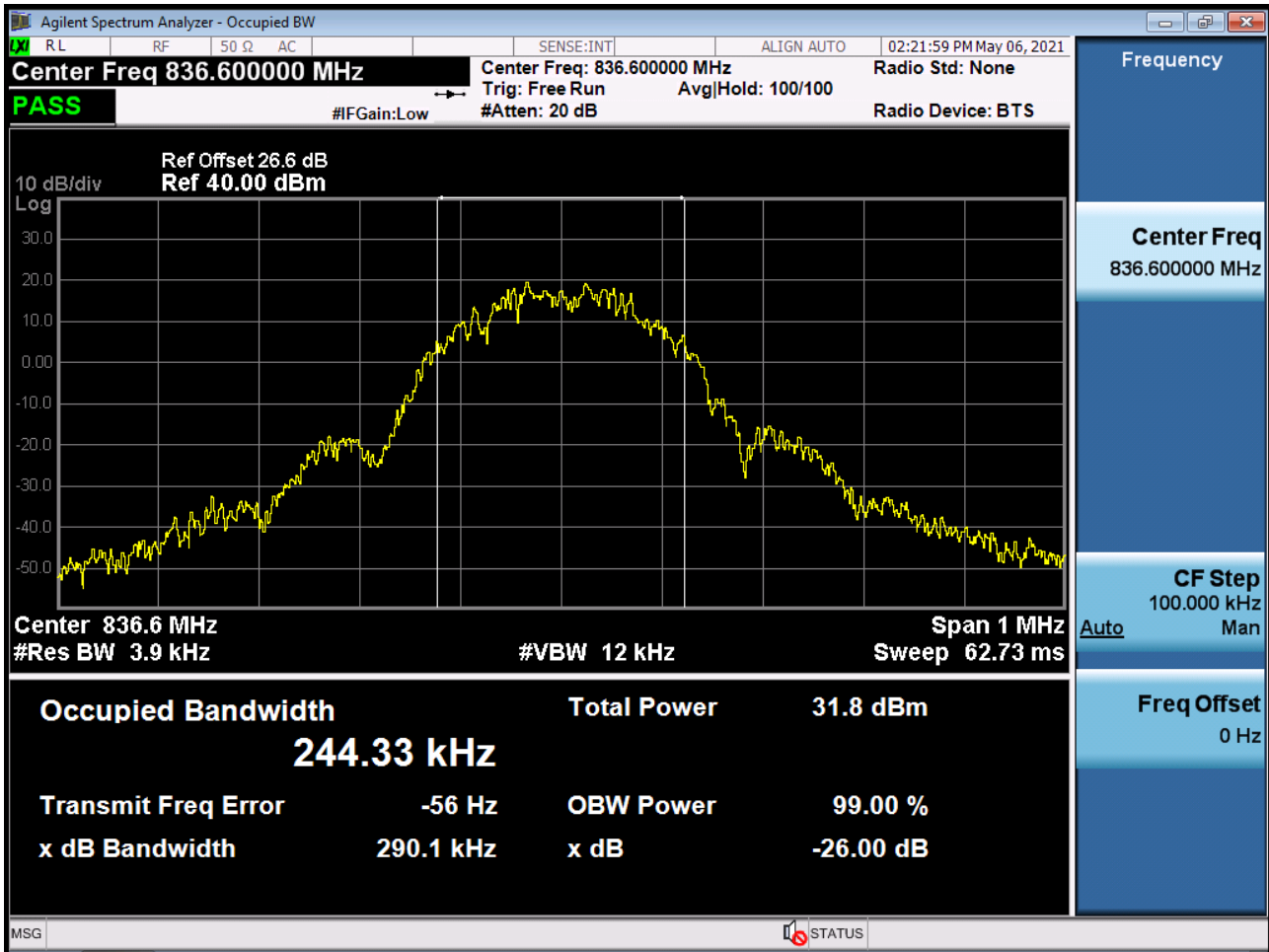
■ GSM850 MODE (190 CH.) Occupied Bandwidth



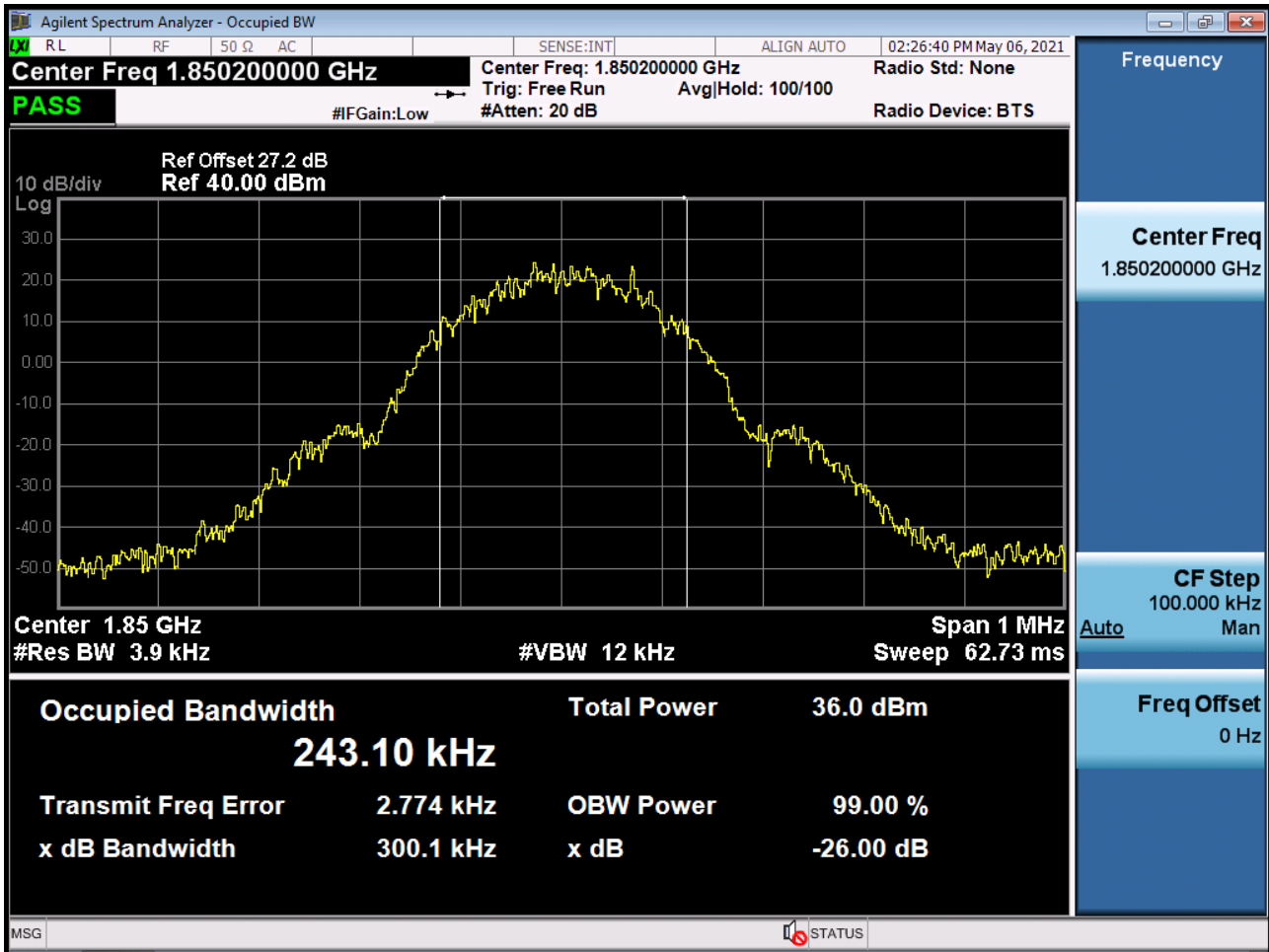
■ GSM850 MODE (251 CH.) Occupied Bandwidth



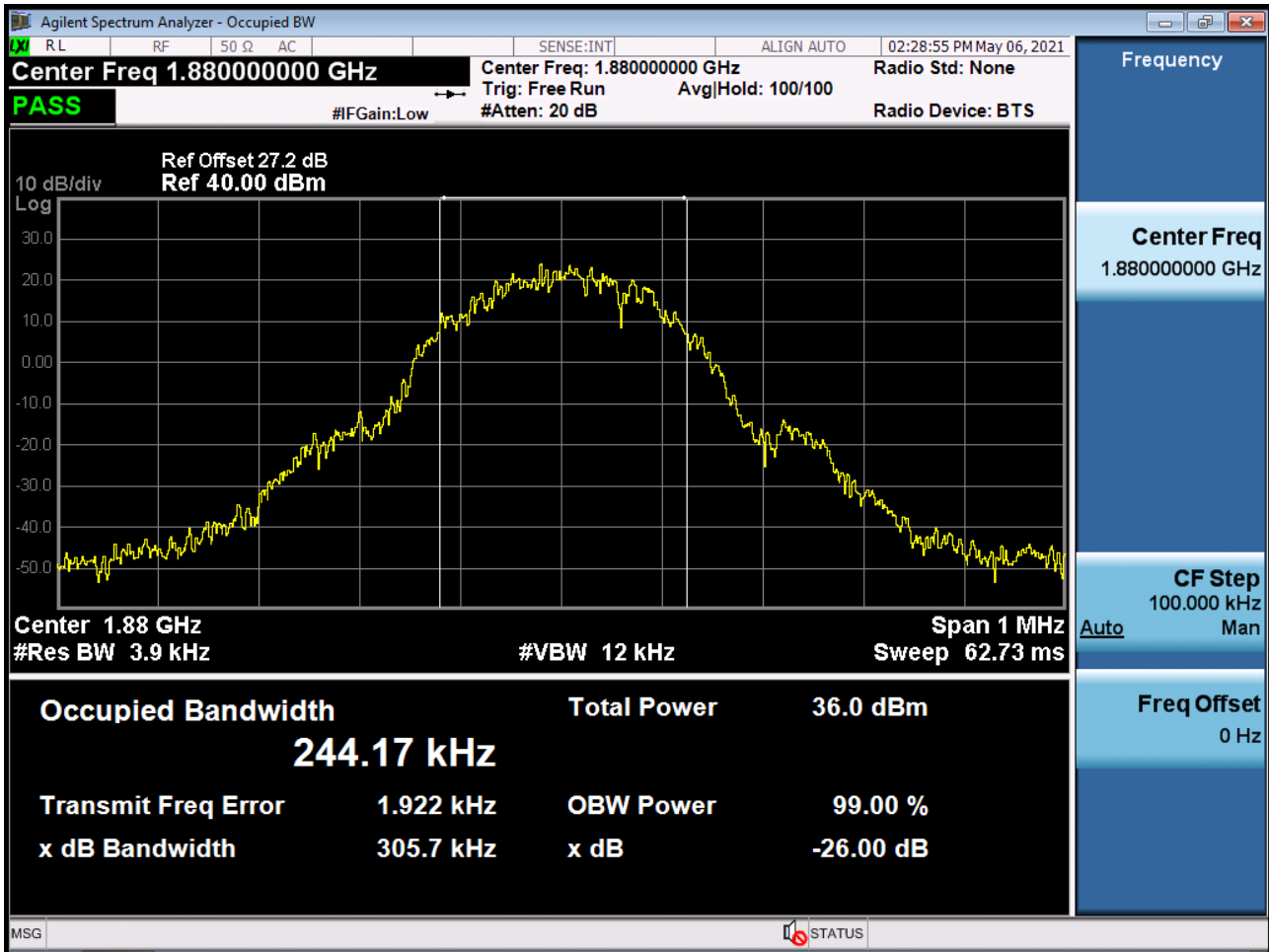
■ GSM850 EDGE (190 CH.) Occupied Bandwidth



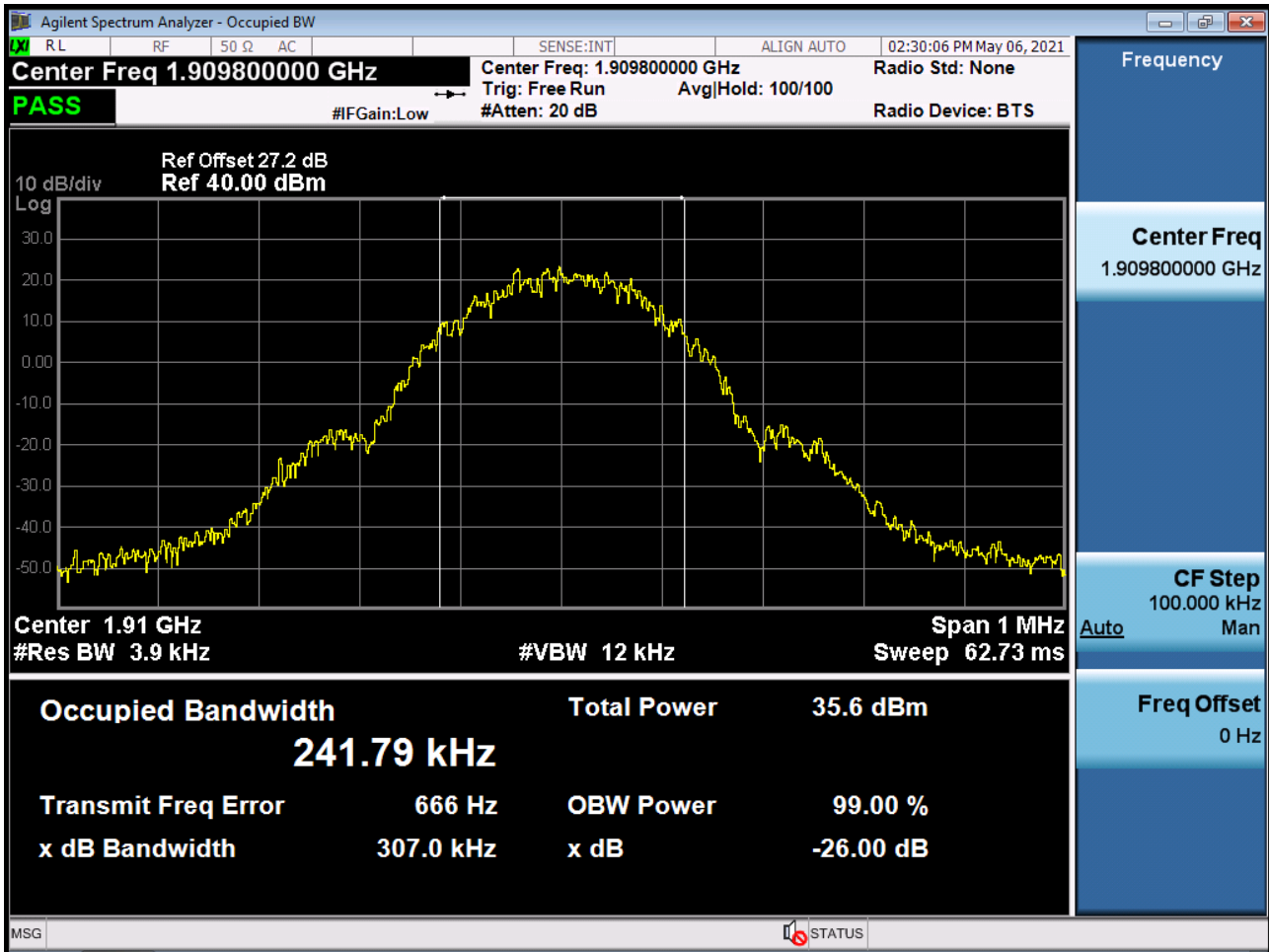
■ GSM1900 MODE (512 CH.) Occupied Bandwidth



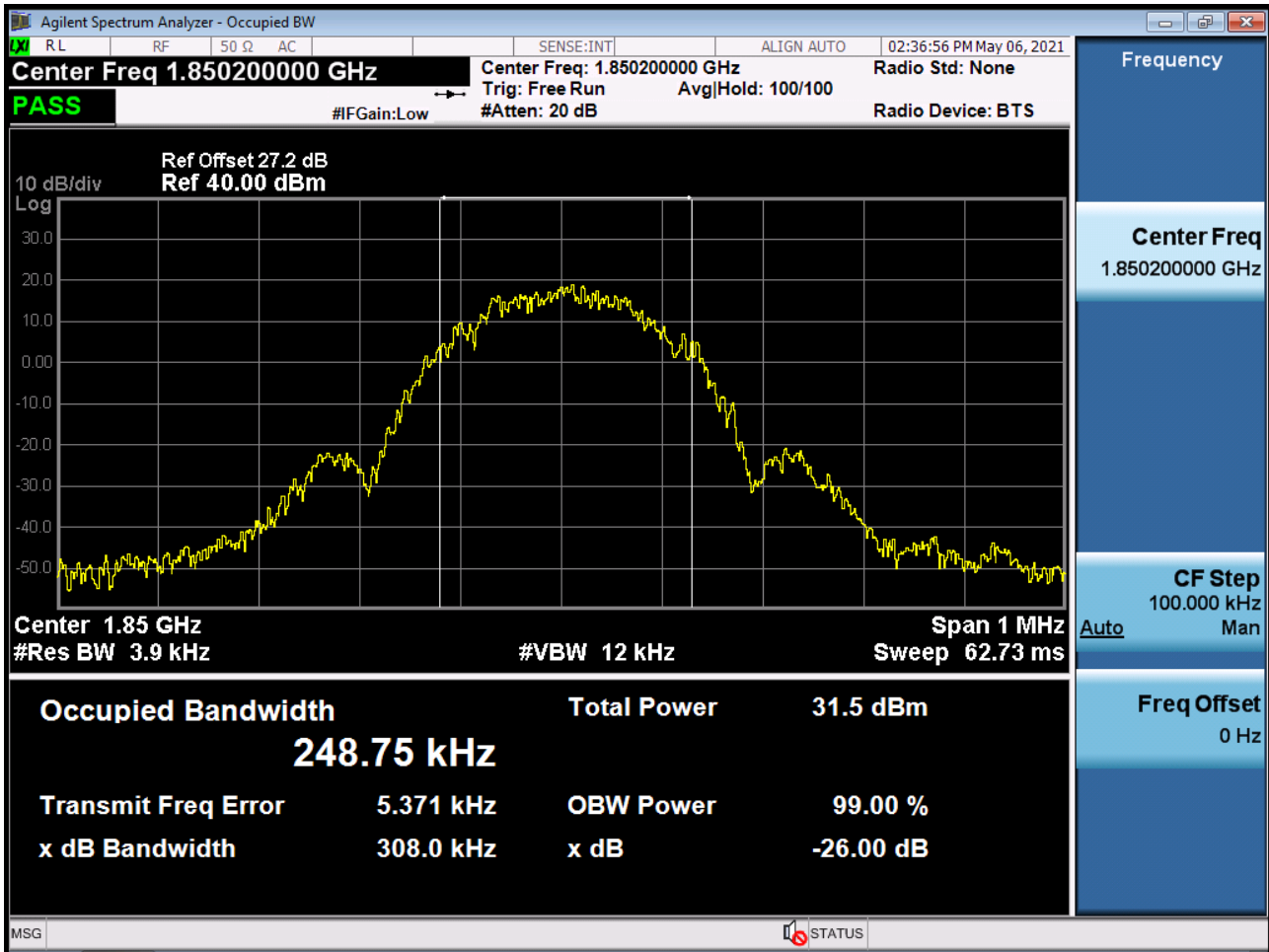
■ GSM1900 MODE (661 CH.) Occupied Bandwidth



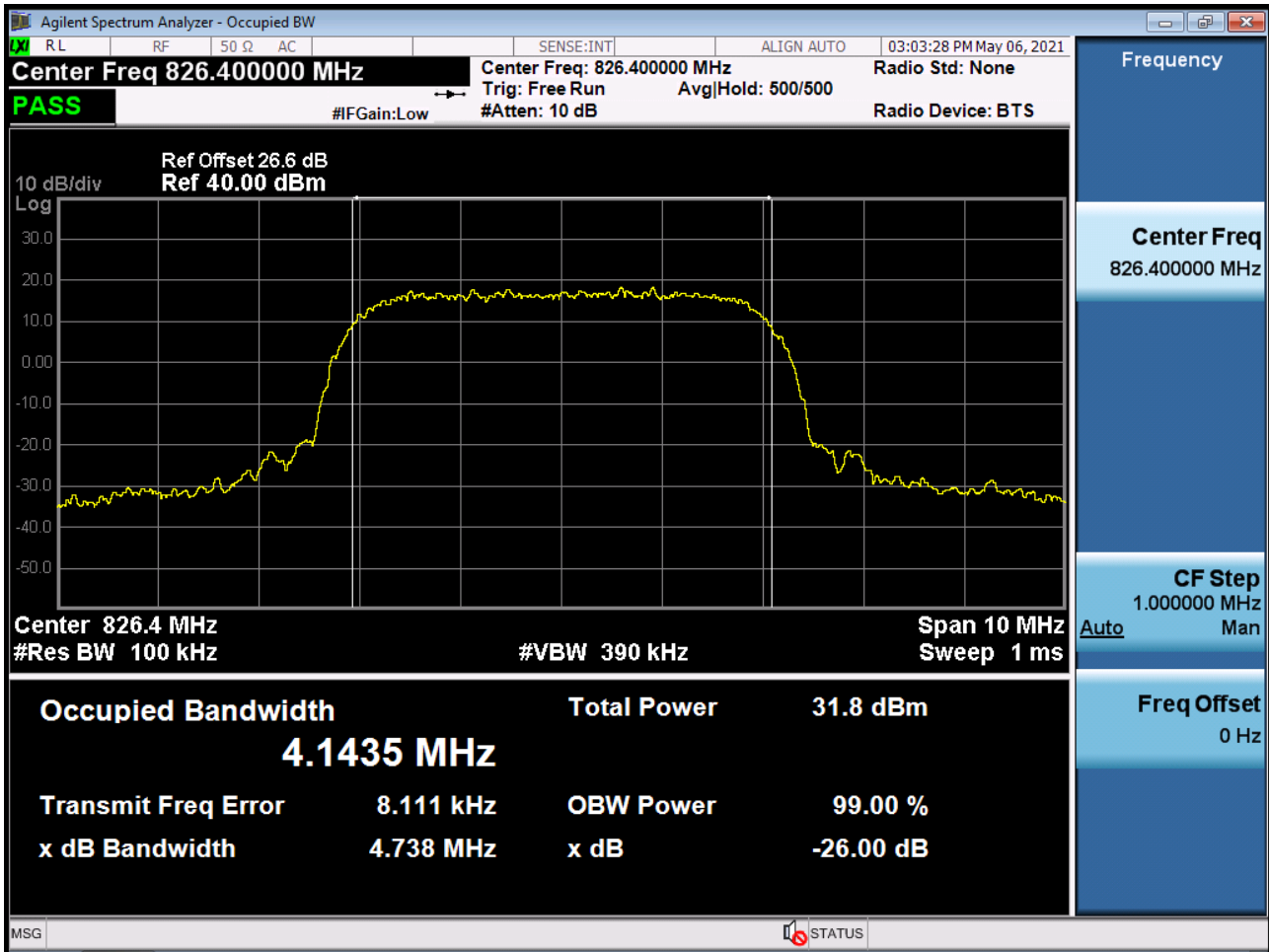
■ GSM1900 MODE (810 CH.) Occupied Bandwidth



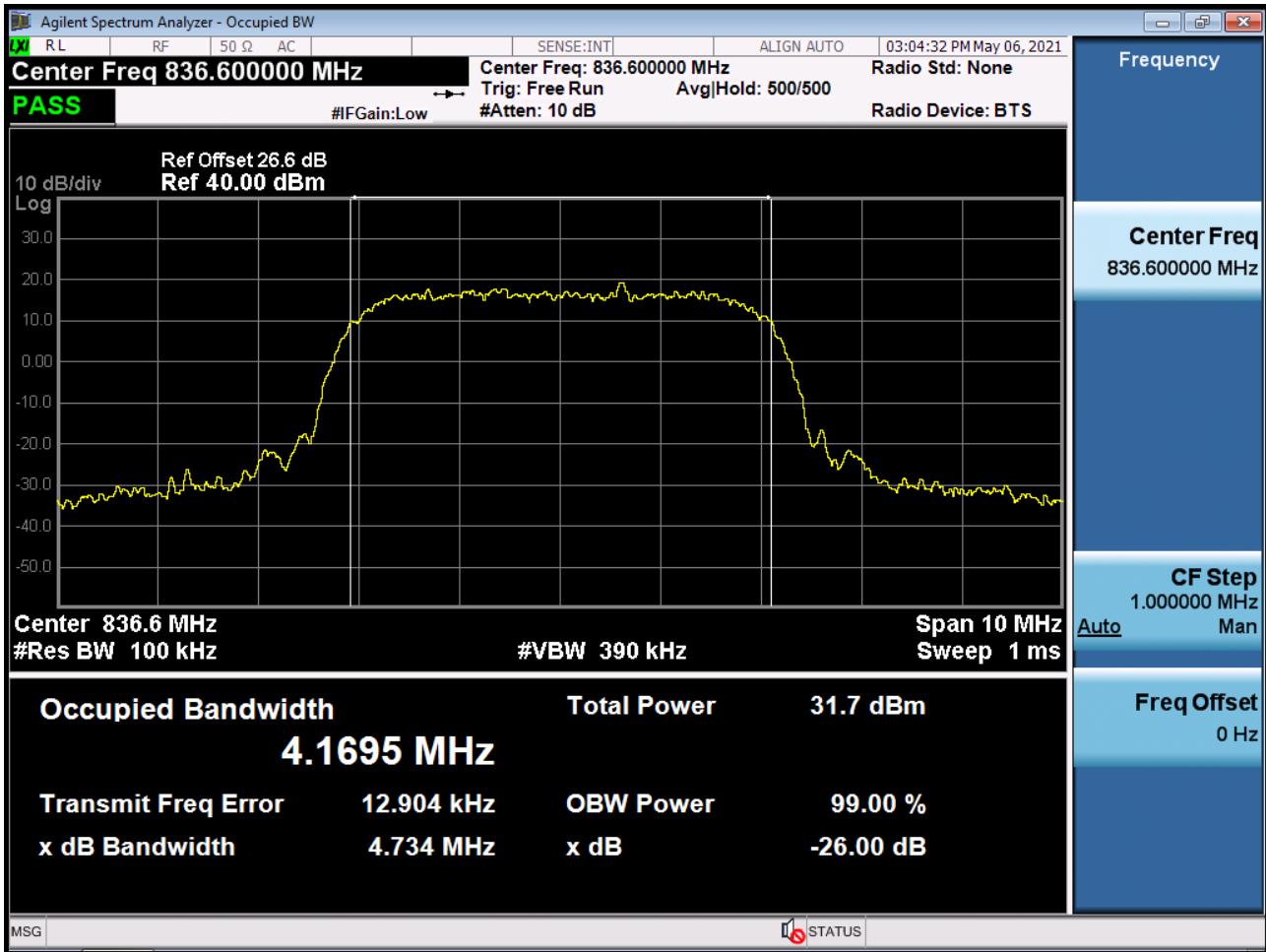
■ GSM1900 EDGE (512 CH.) Occupied Bandwidth



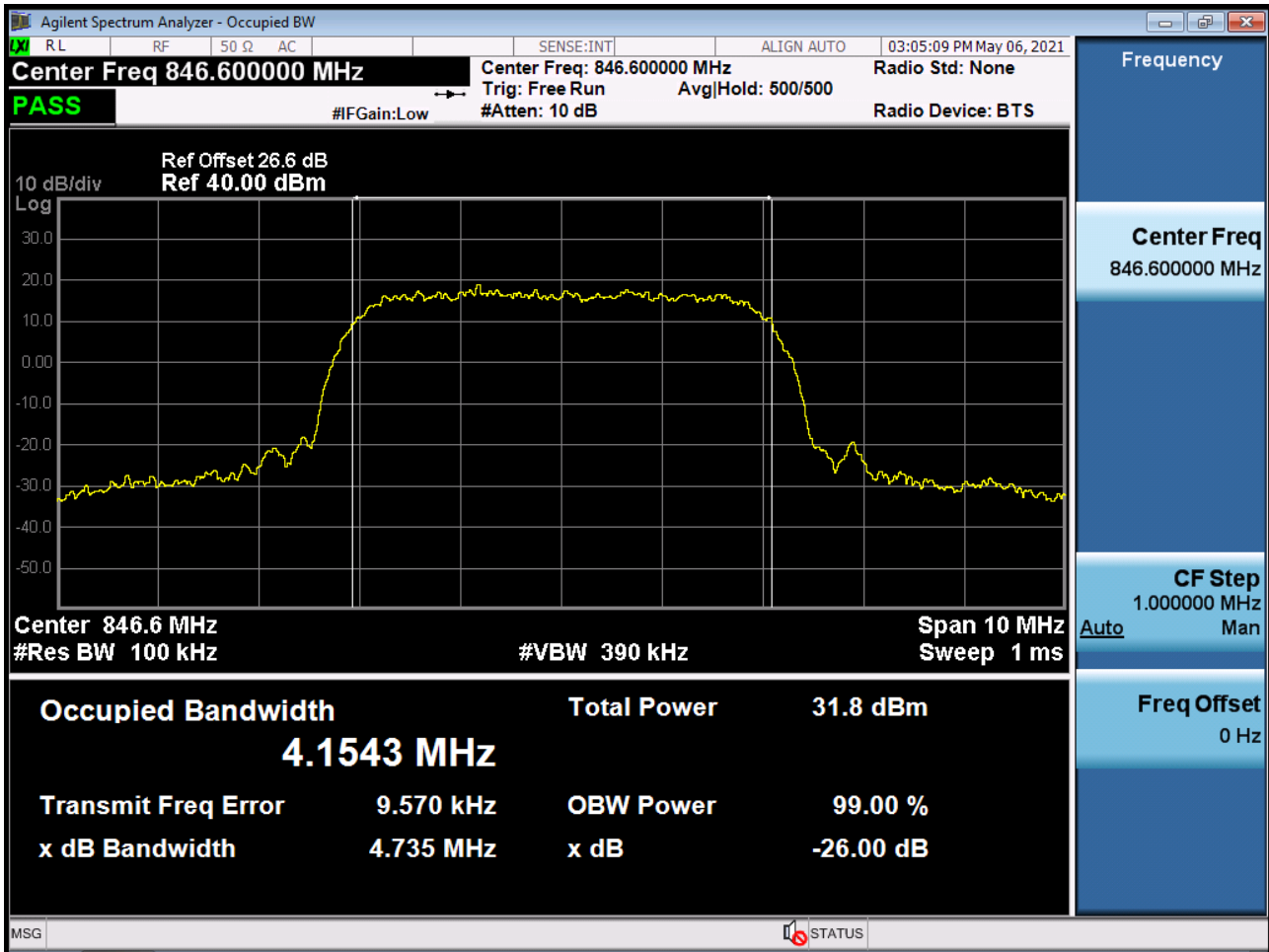
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



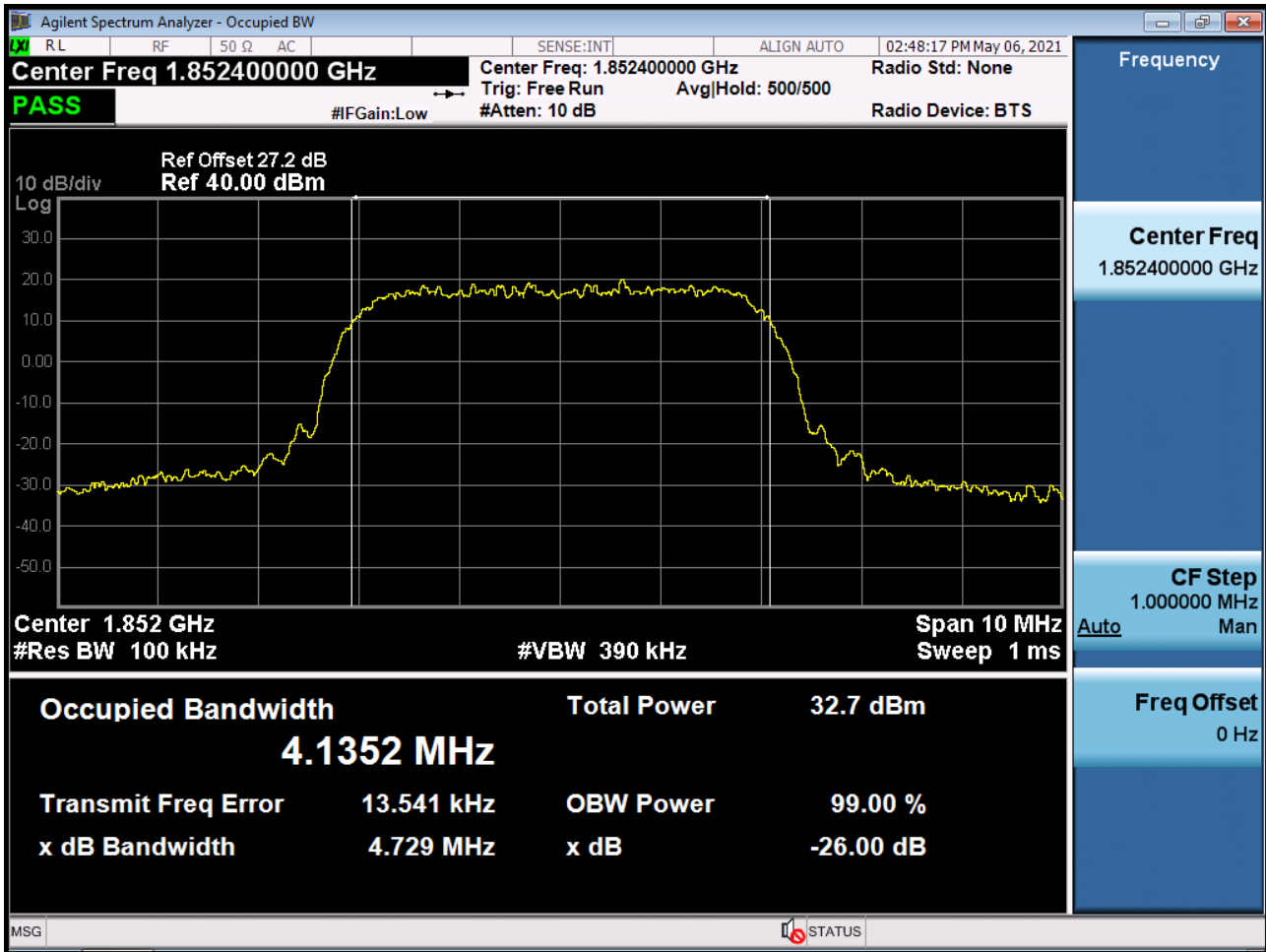
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



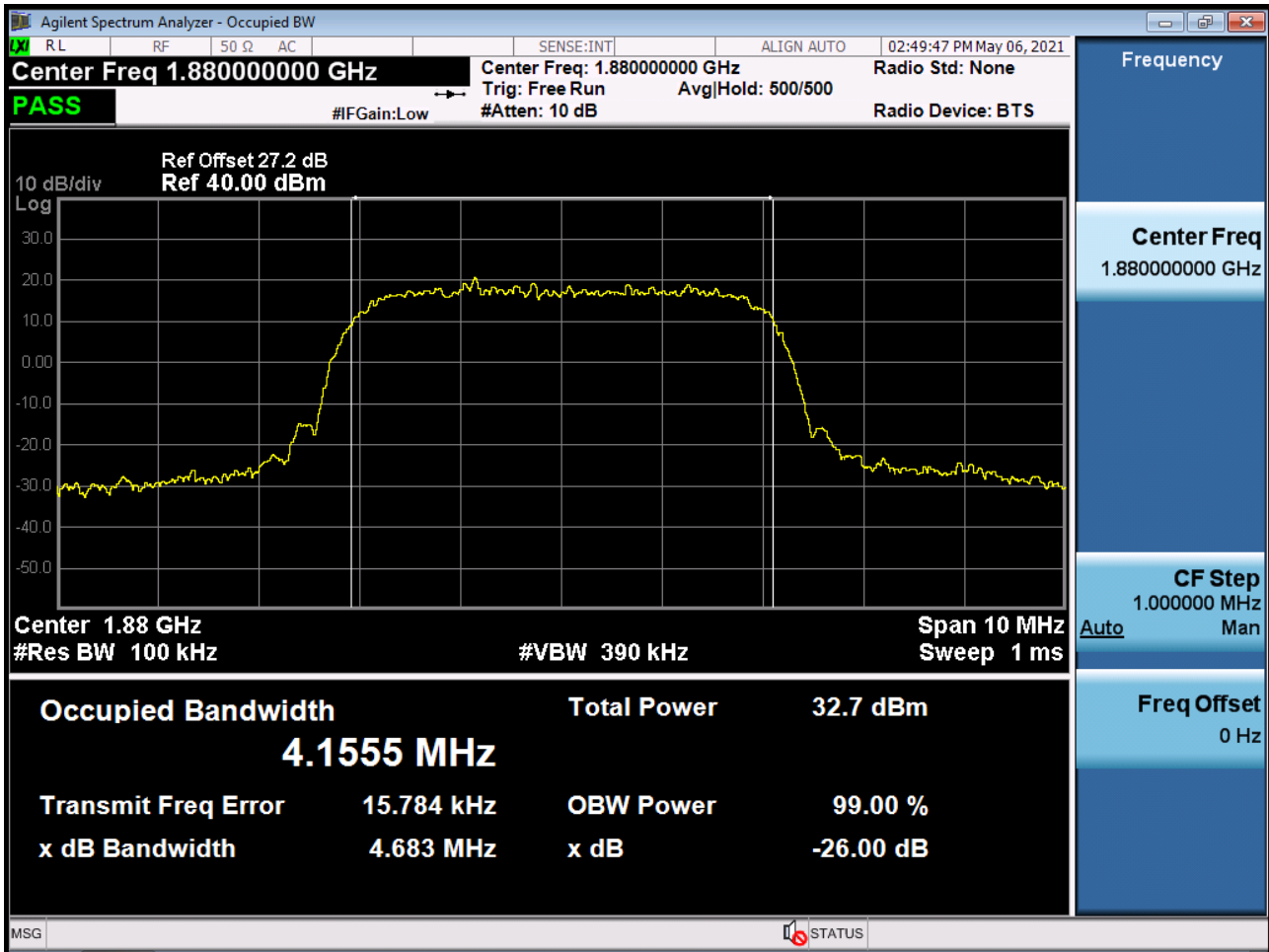
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



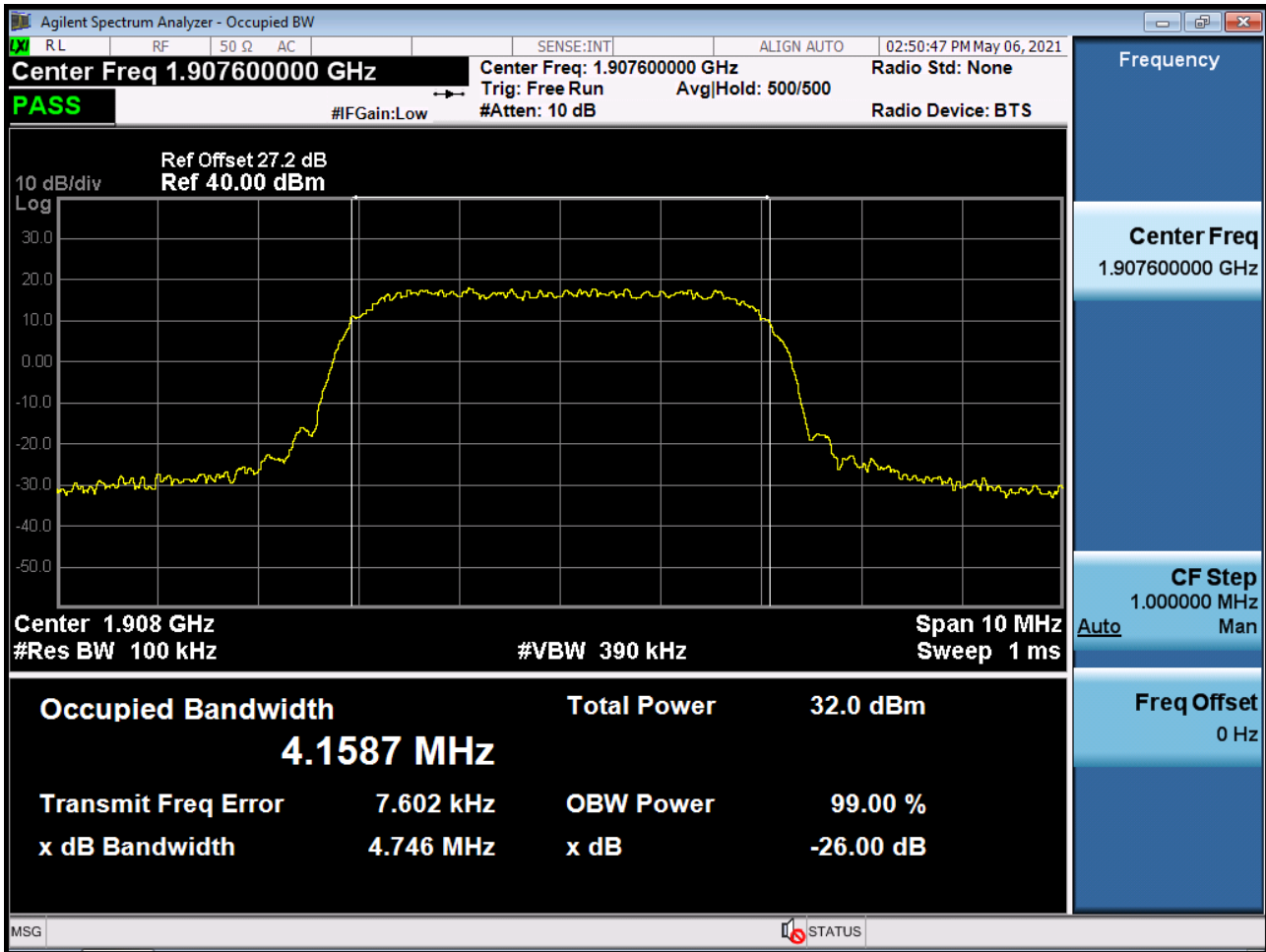
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



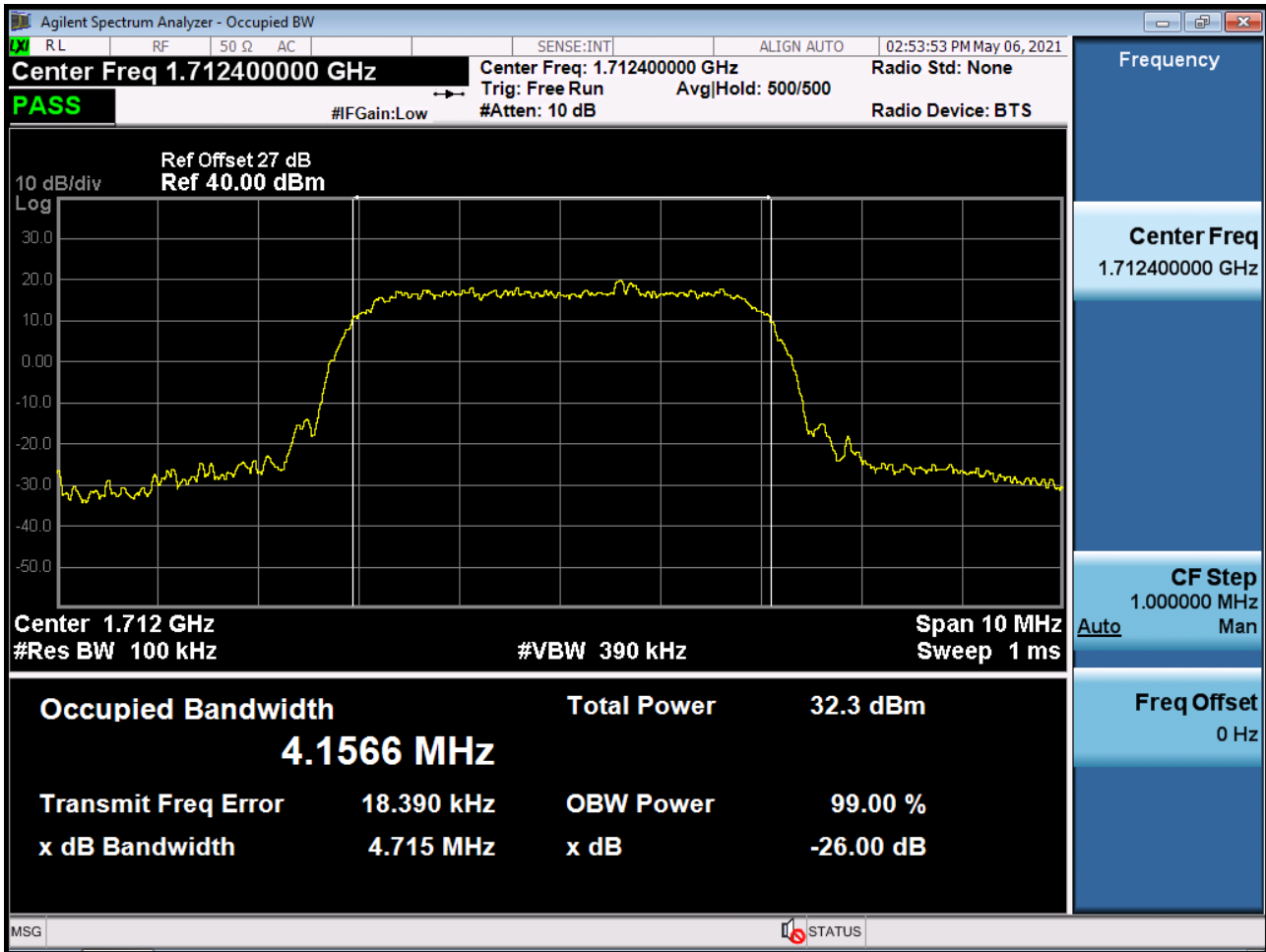
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



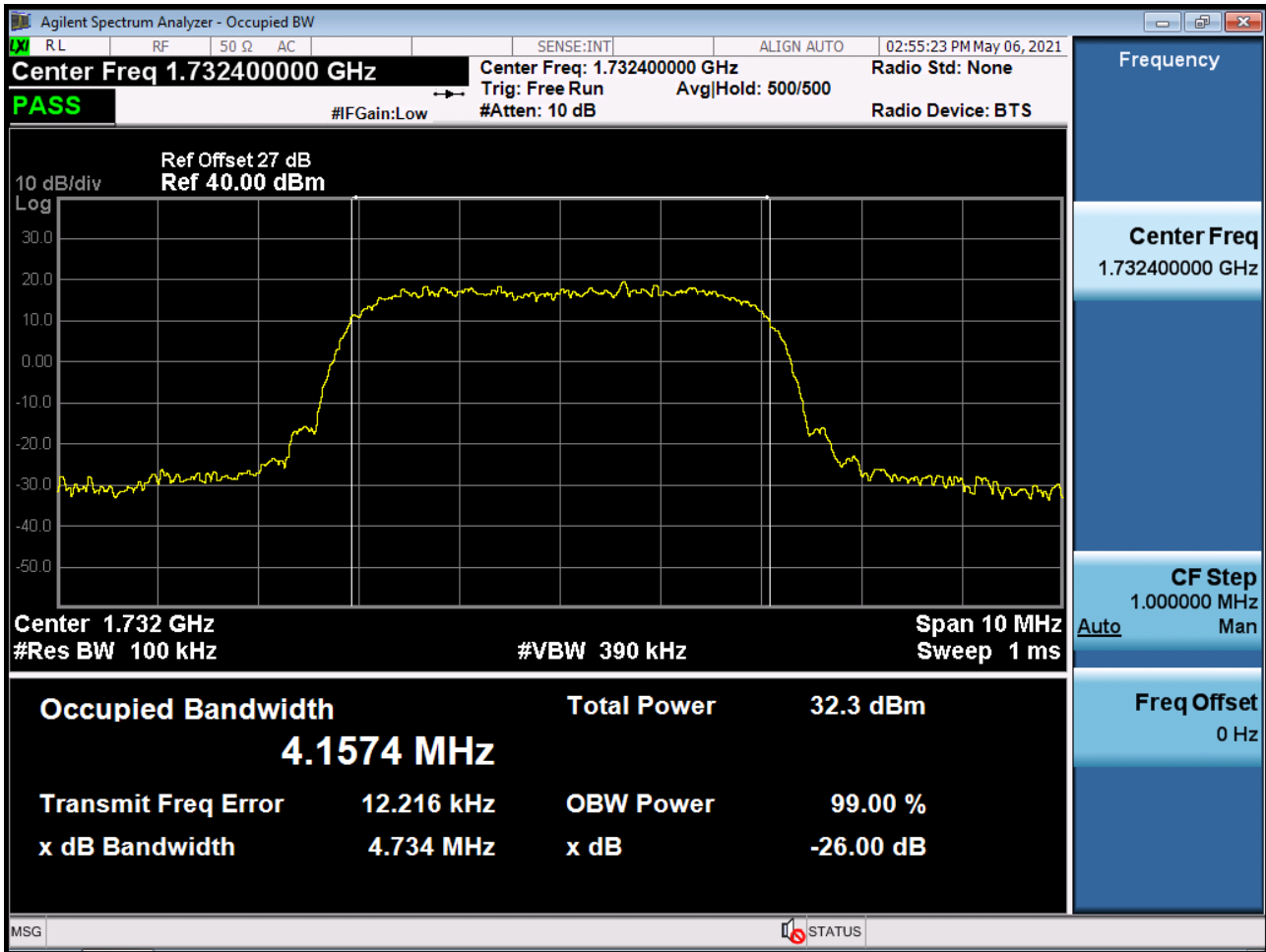
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



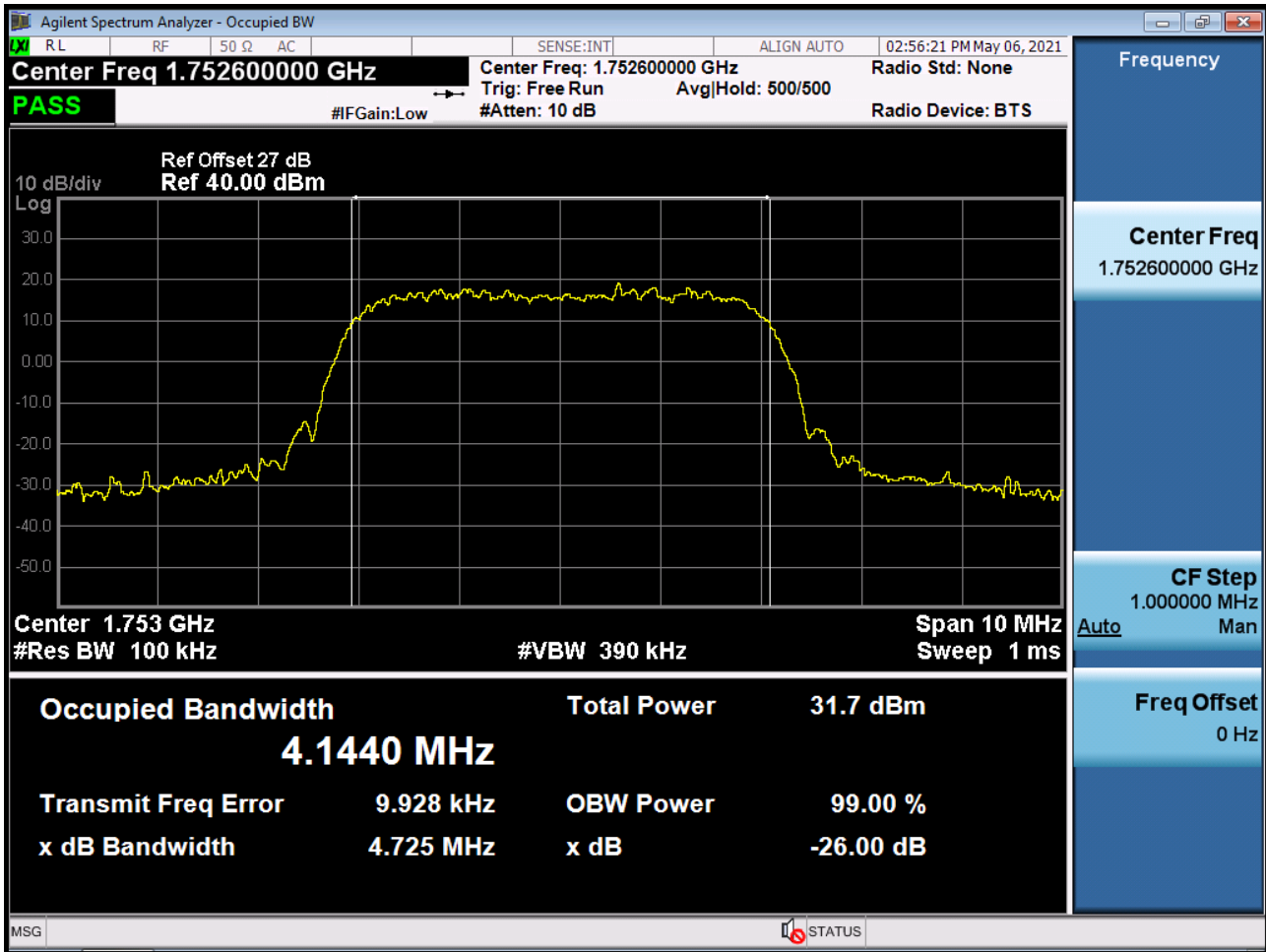
■ WCDMA1700 MODE (1312 CH.) Occupied Bandwidth



■ WCDMA1700 MODE (1412 CH.) Occupied Bandwidth



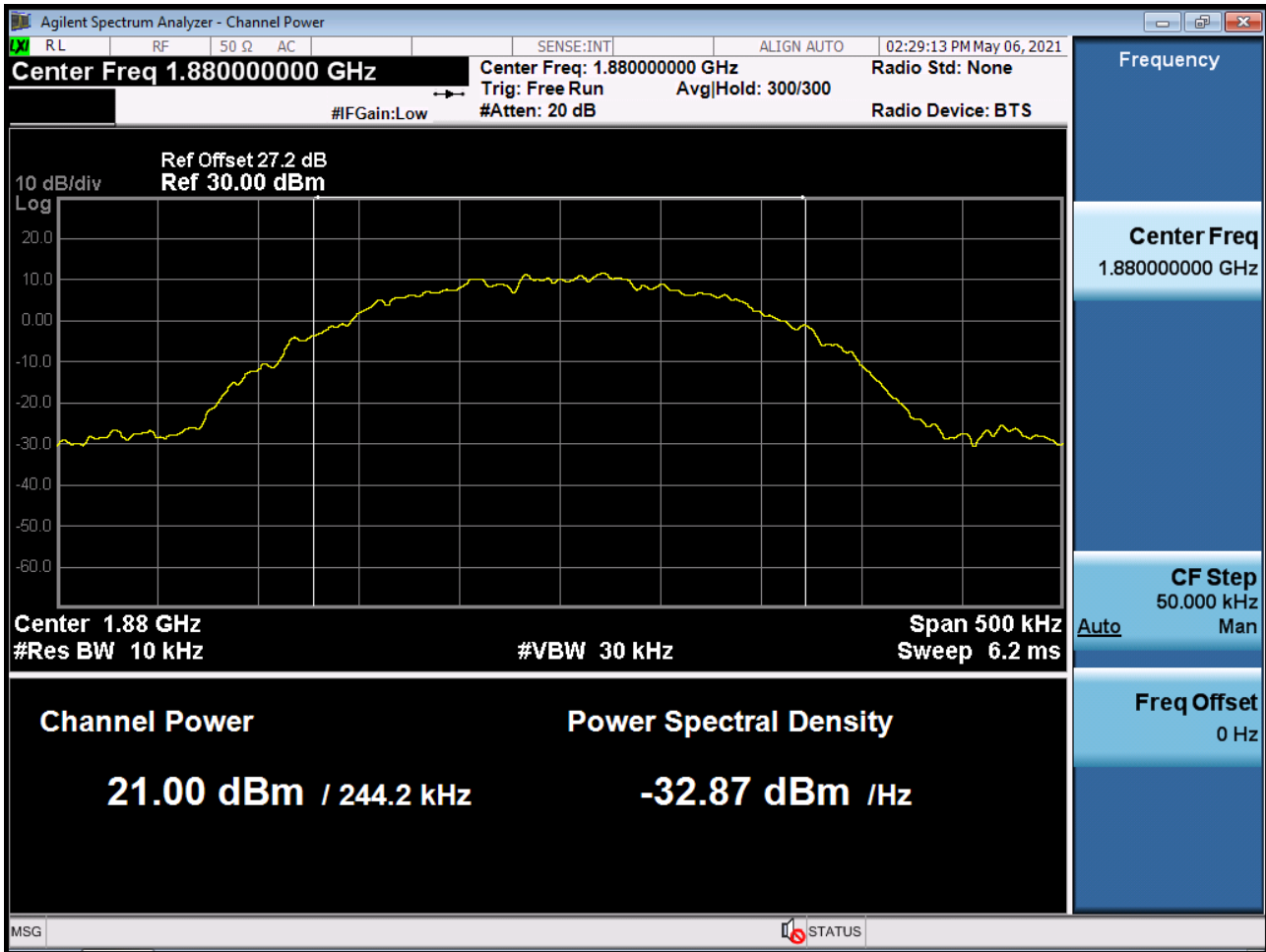
■ WCDMA1700 MODE (1513 CH.) Occupied Bandwidth



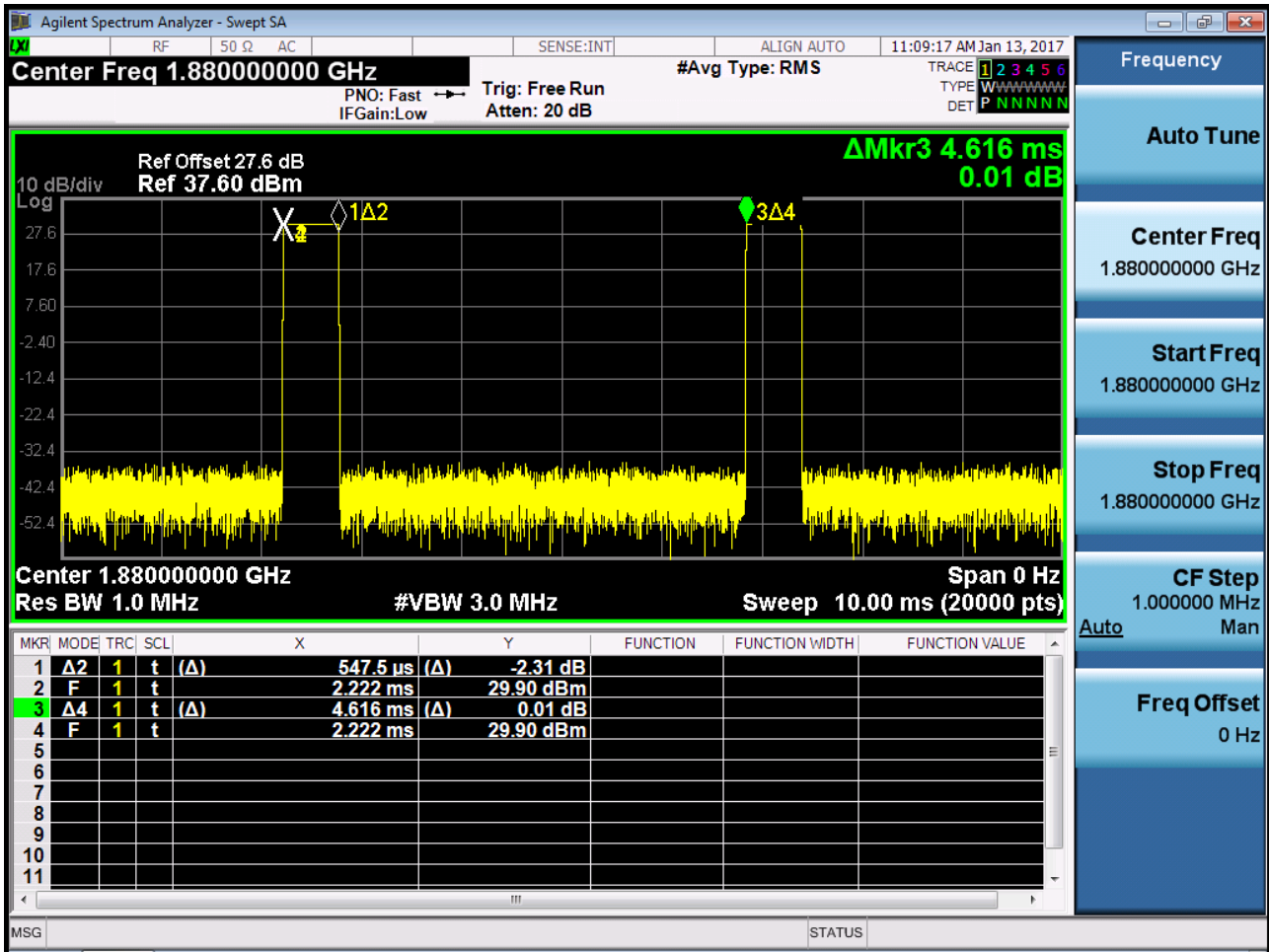
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{PK}



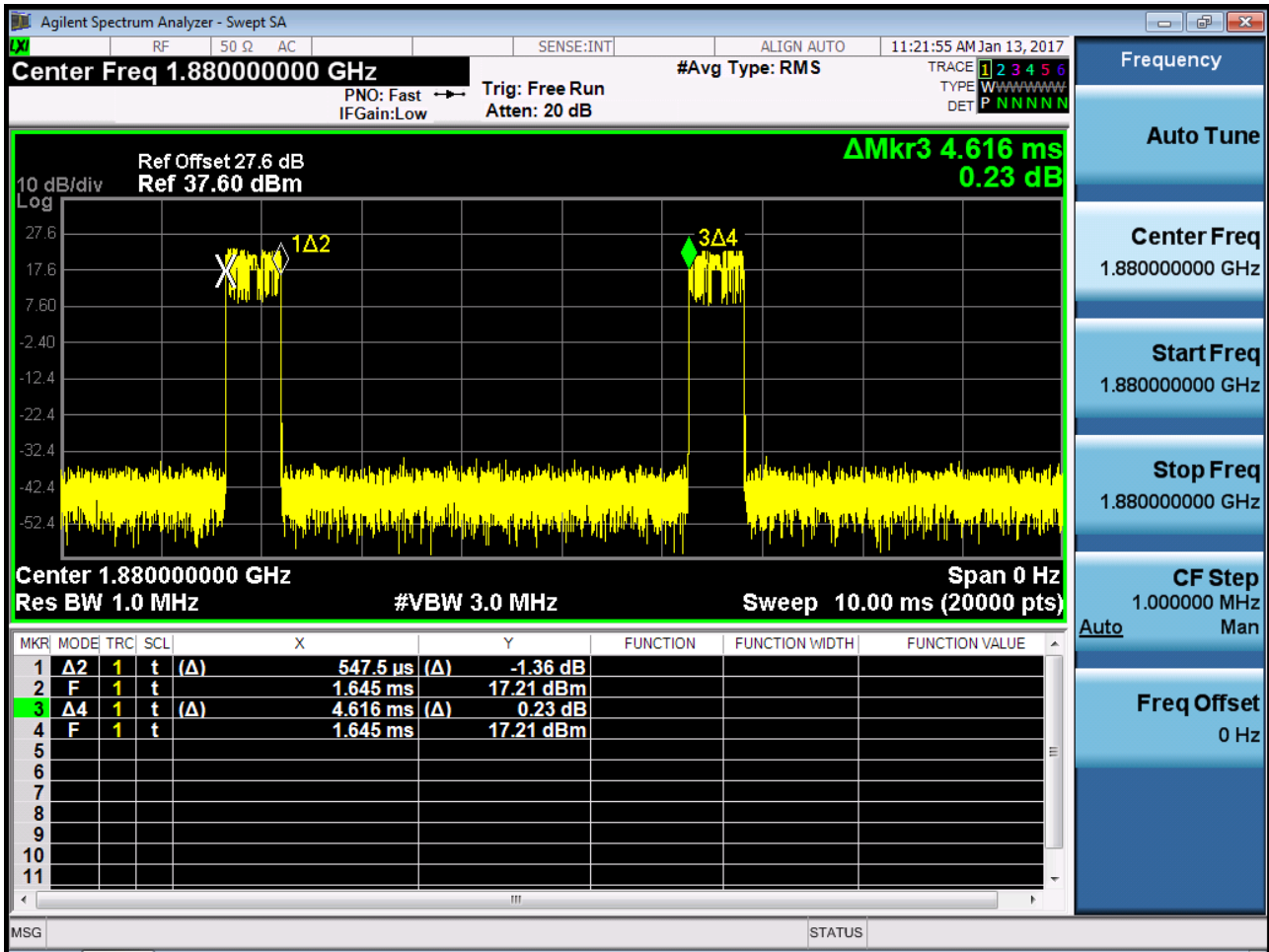
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio P_{Avg}



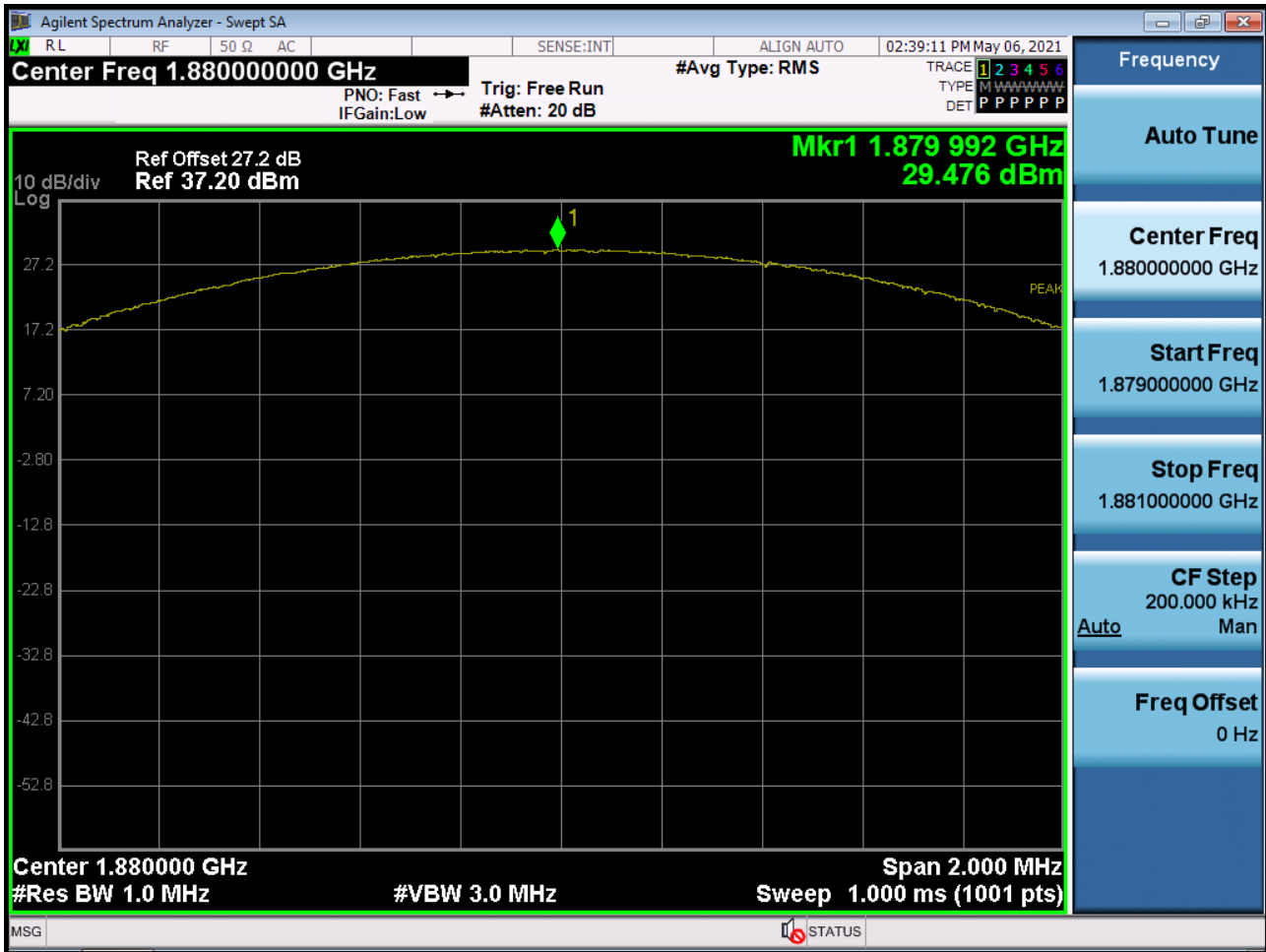
■ GSM1900 MODE (661 CH.) Peak-to-Average Ratio Duty



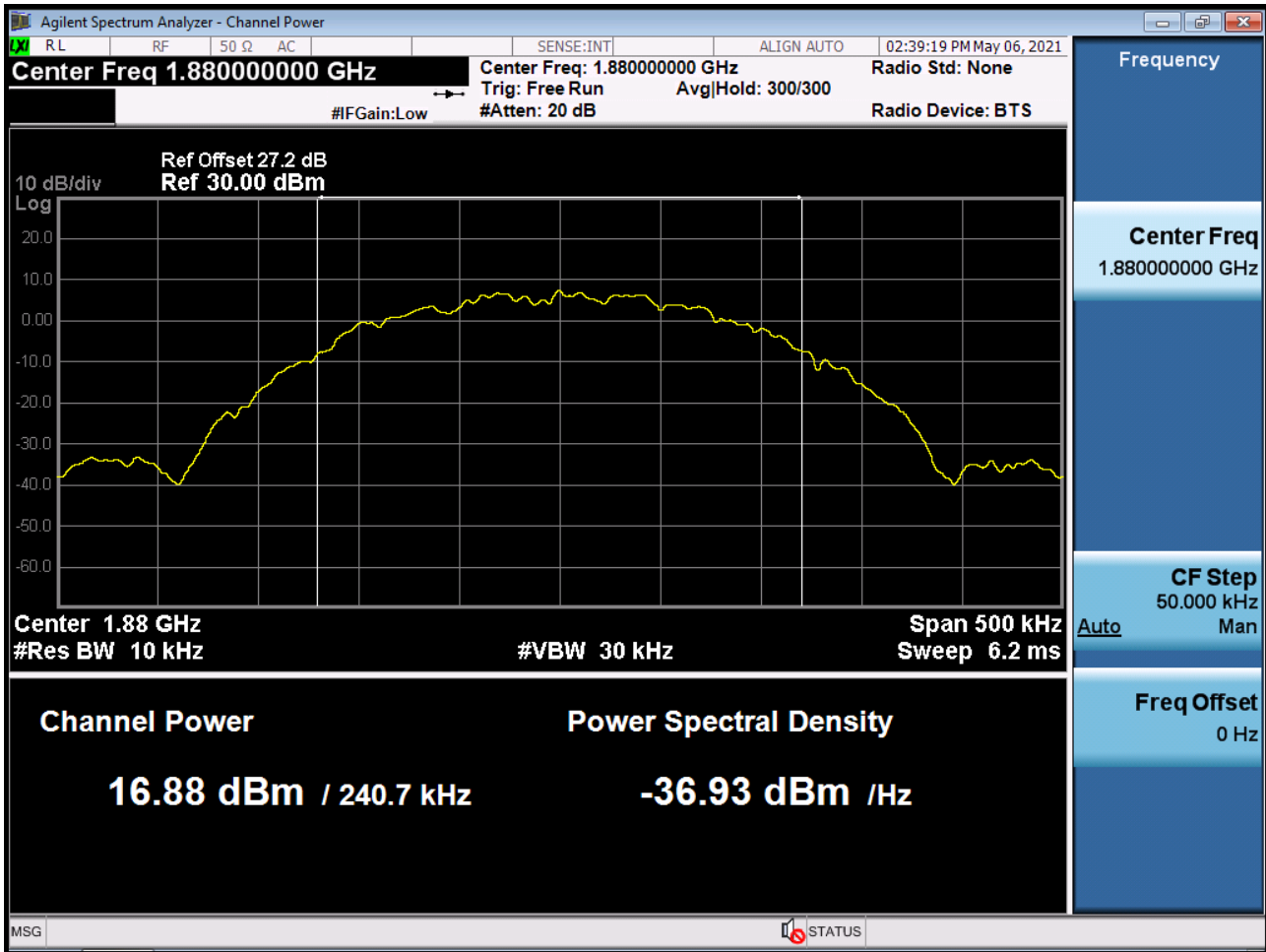
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio Duty



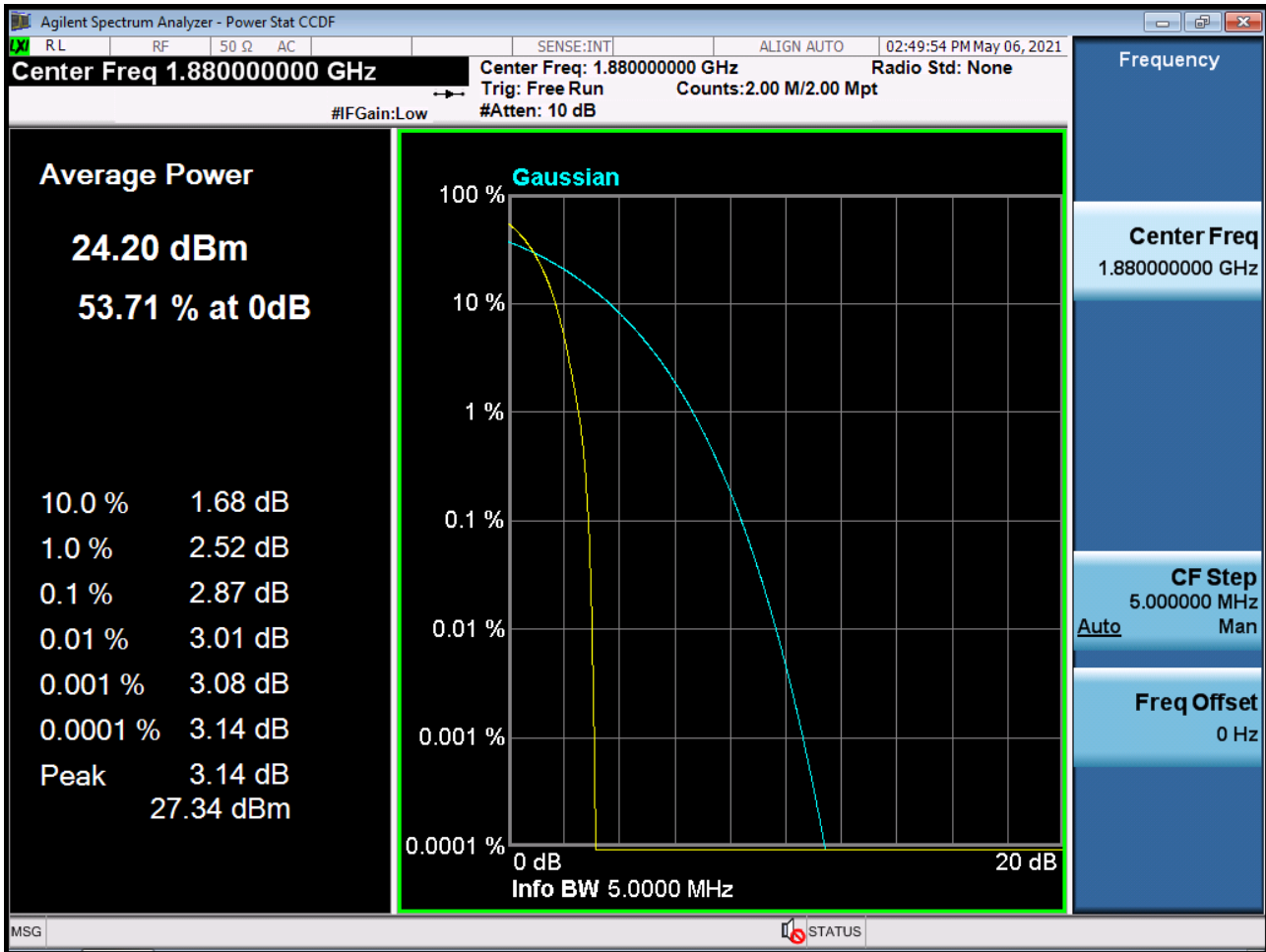
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{PK}



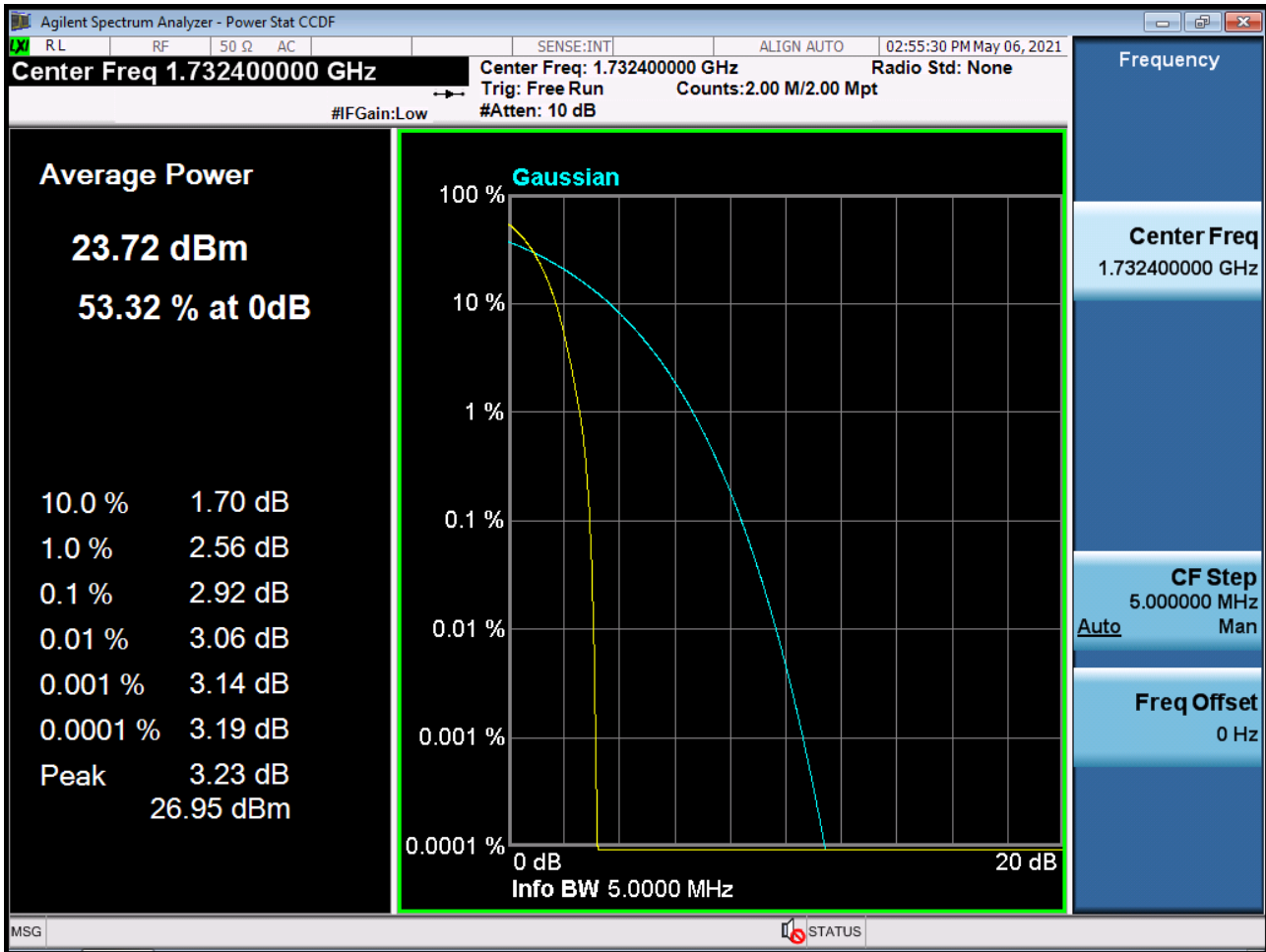
■ GSM1900 EDGE (661 CH.) Peak-to-Average Ratio P_{Avg}



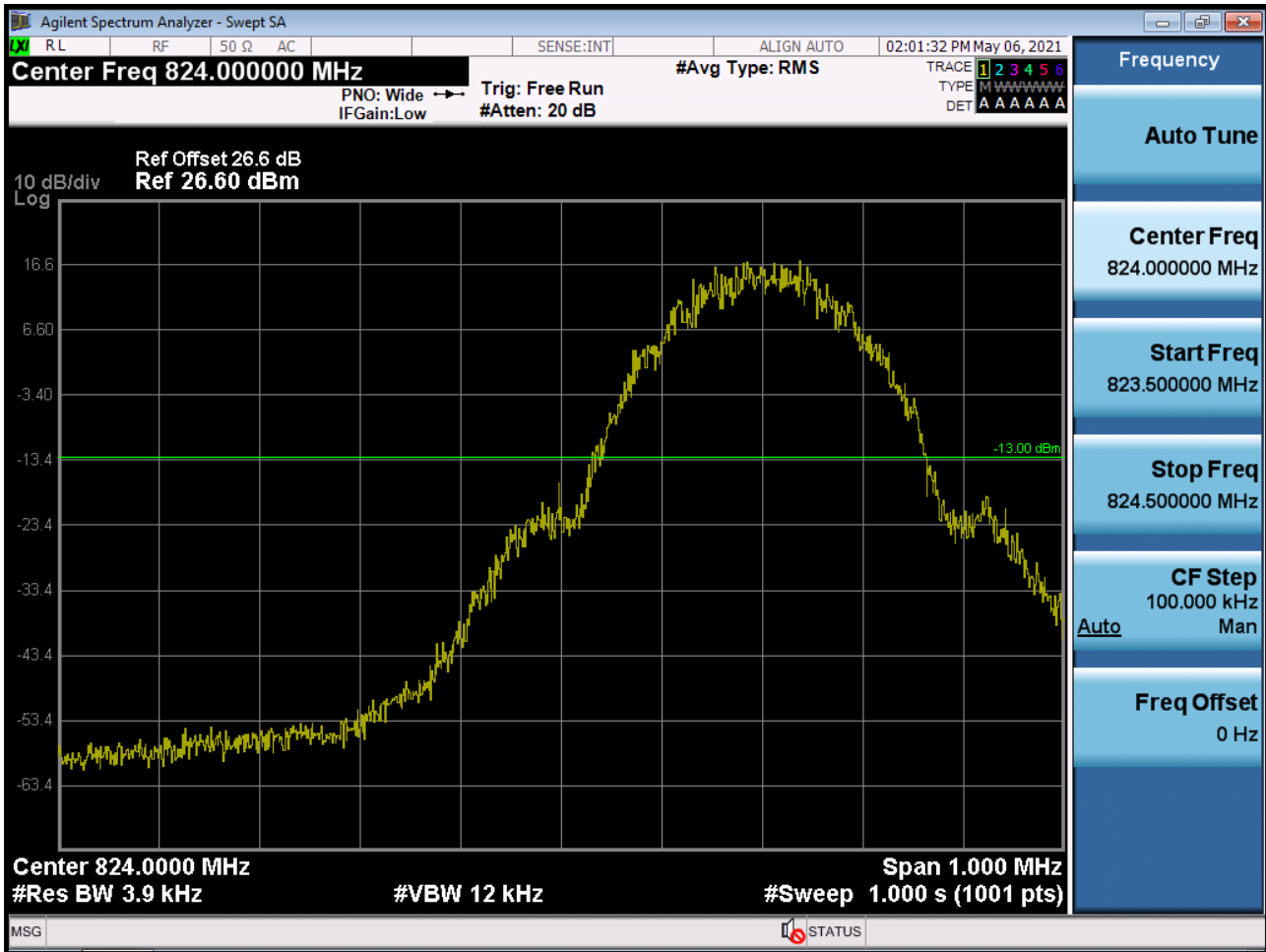
■ WCDMA1900 MODE (9400 CH.) Peak-to-Average Ratio



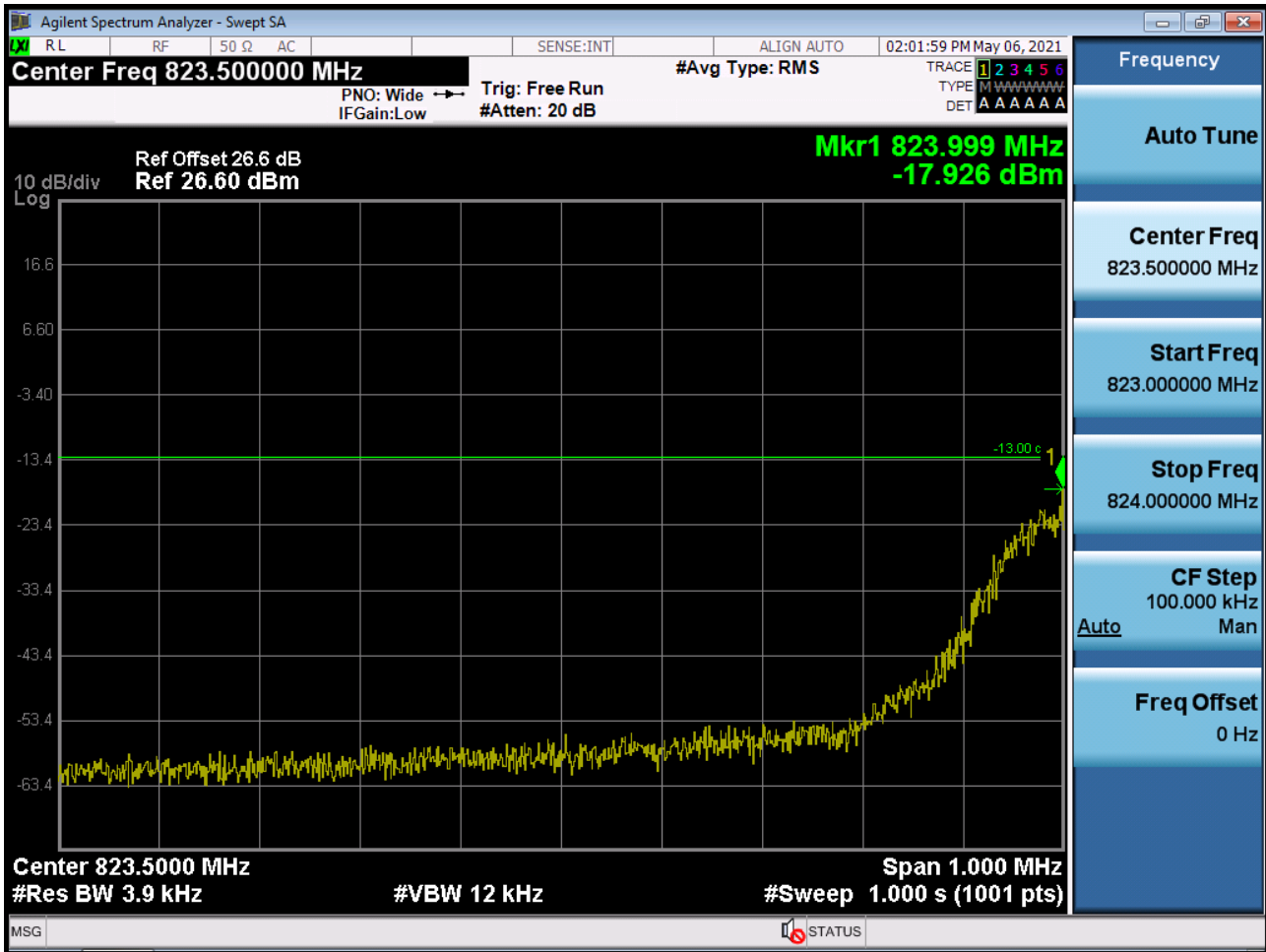
■ WCDMA1700 MODE (1412 CH.) Peak-to-Average Ratio



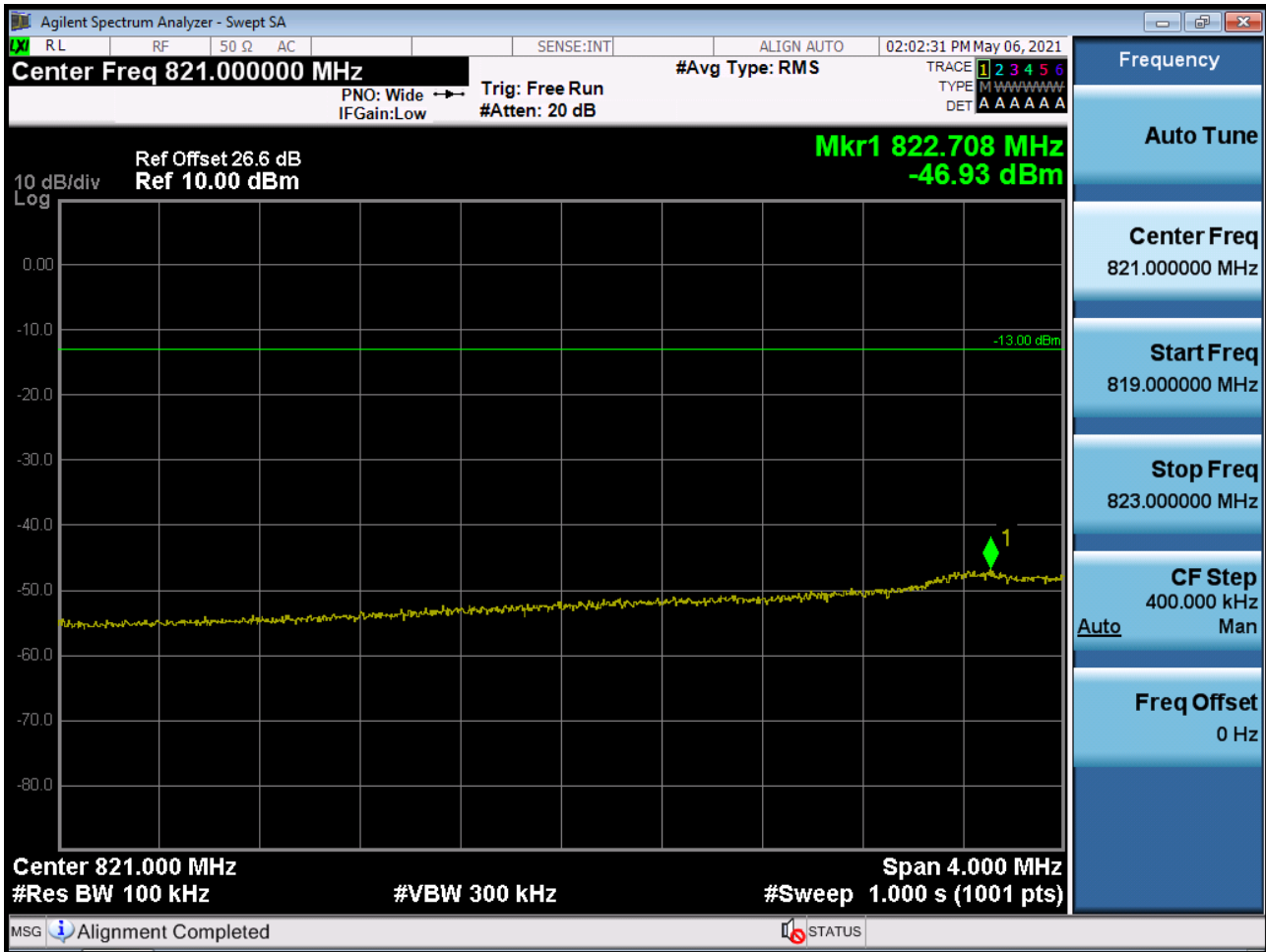
■ GSM850 MODE (128 CH.) Block Edge 1



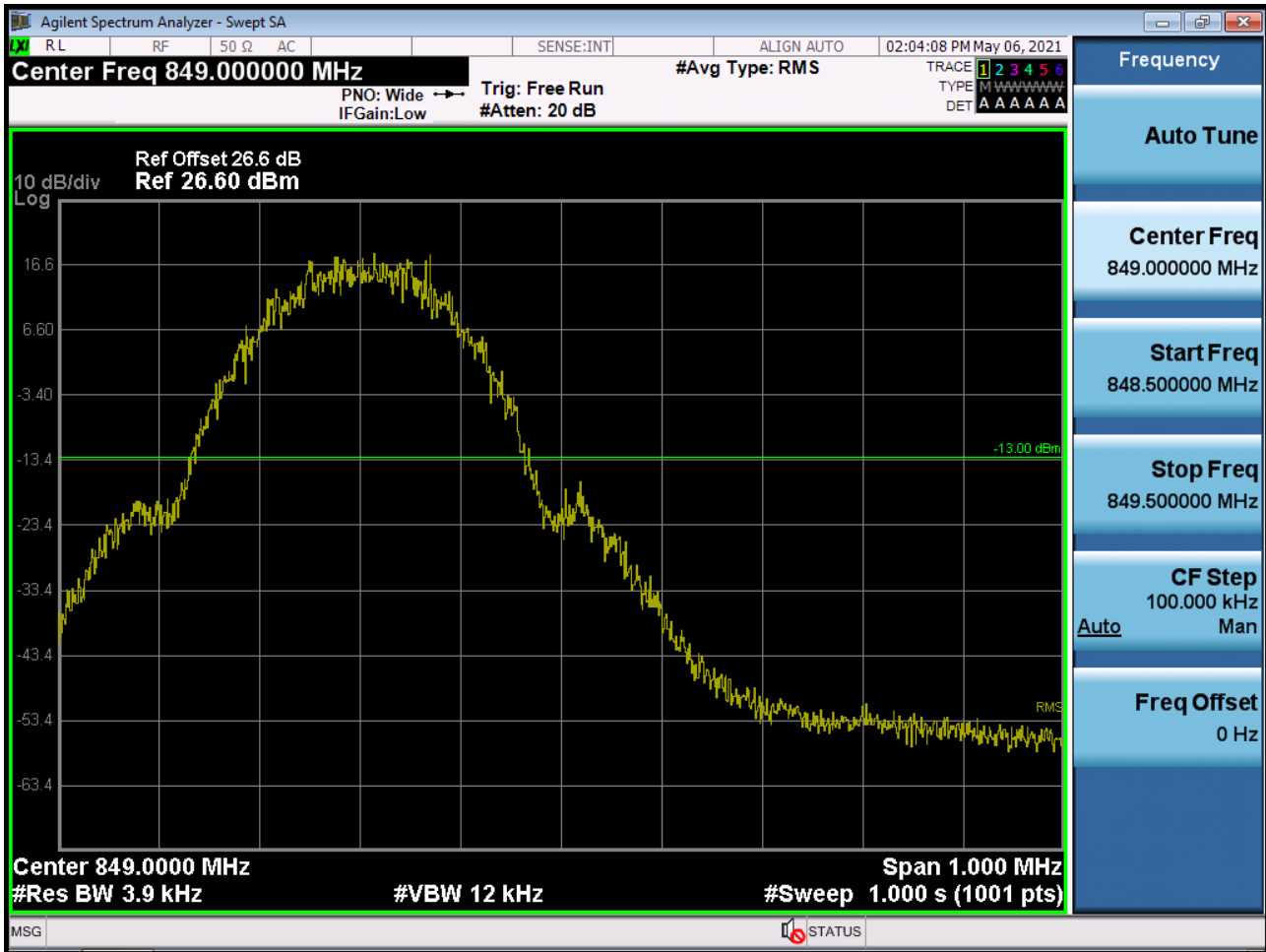
■ GSM850 MODE (128 CH.) Block Edge 2



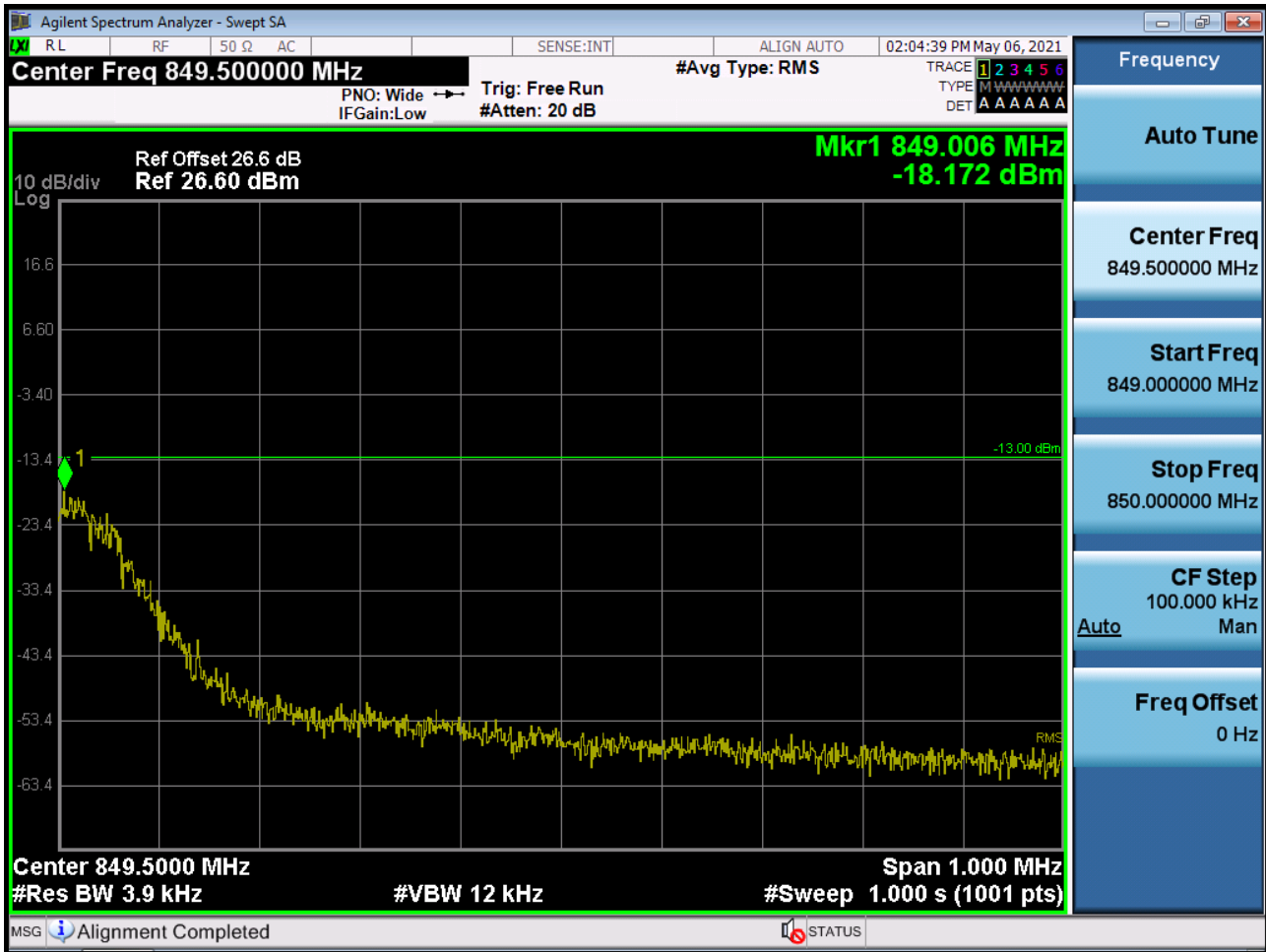
■ GSM850 MODE (128 CH.) Block Edge 3



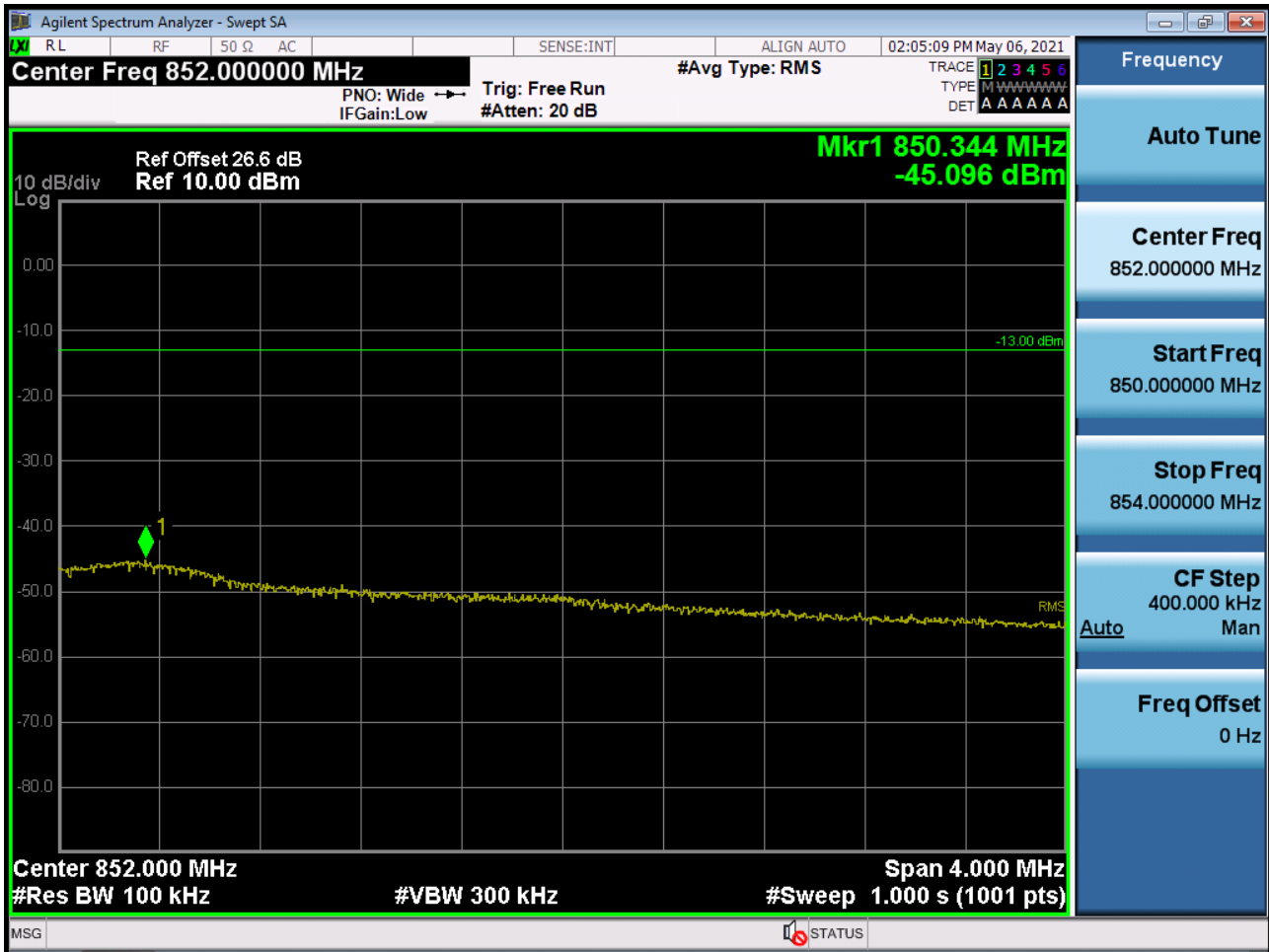
■ GSM850 MODE (251 CH.) Block Edge 1



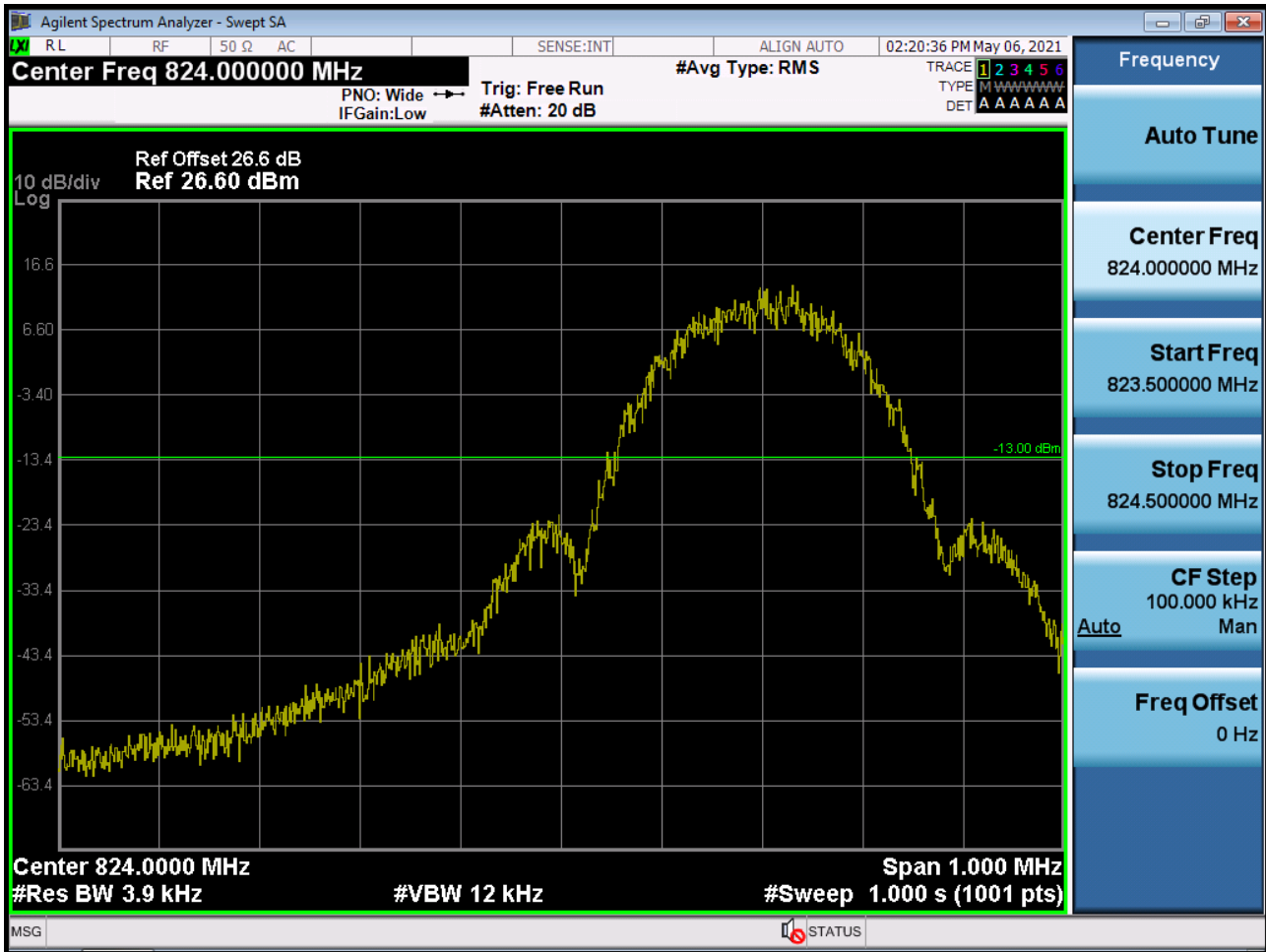
■ GSM850 MODE (251 CH.) Block Edge 2



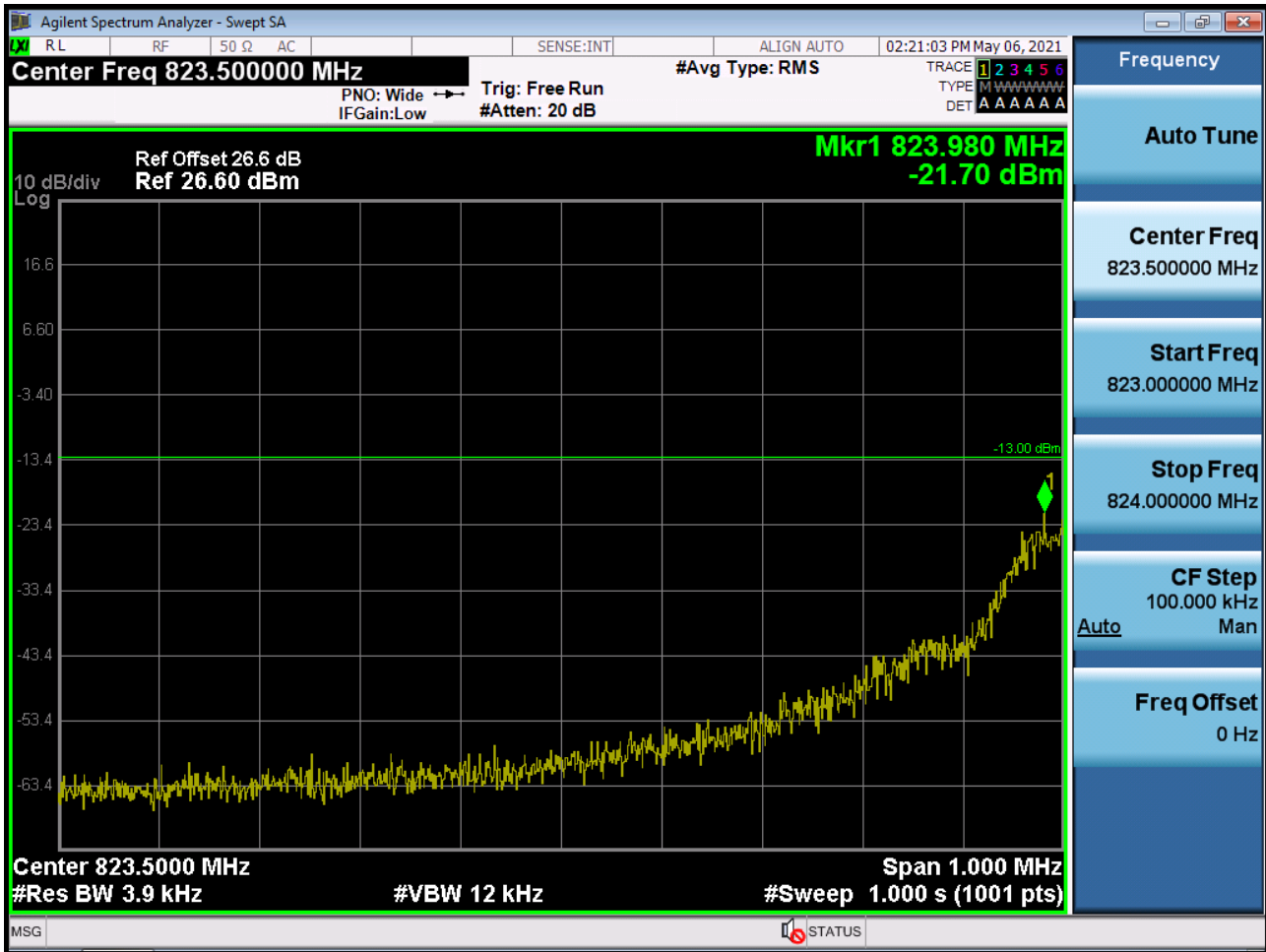
■ GSM850 MODE (251 CH.) Block Edge 3



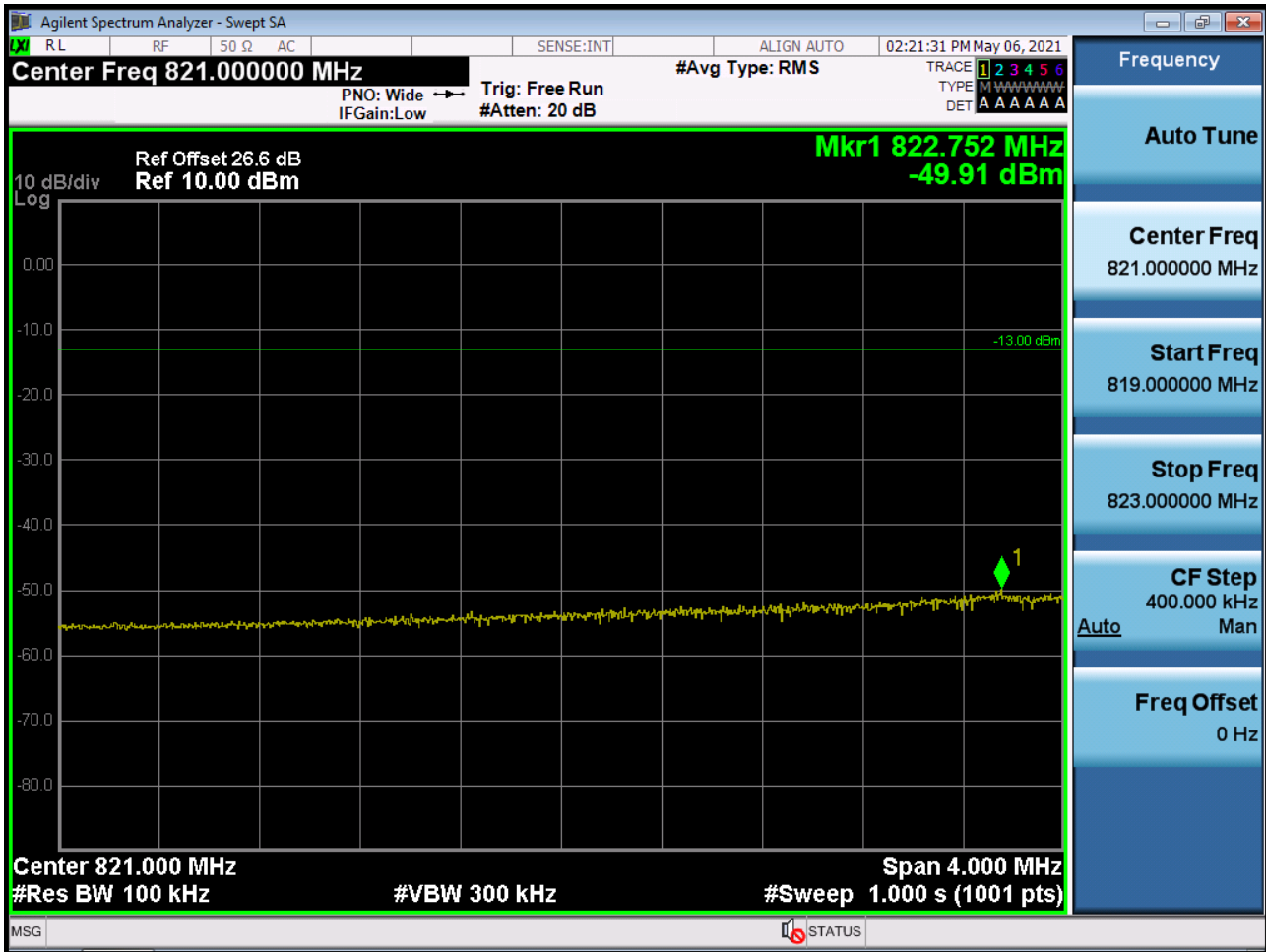
■ EDGE MODE (128 CH.) Block Edge 1



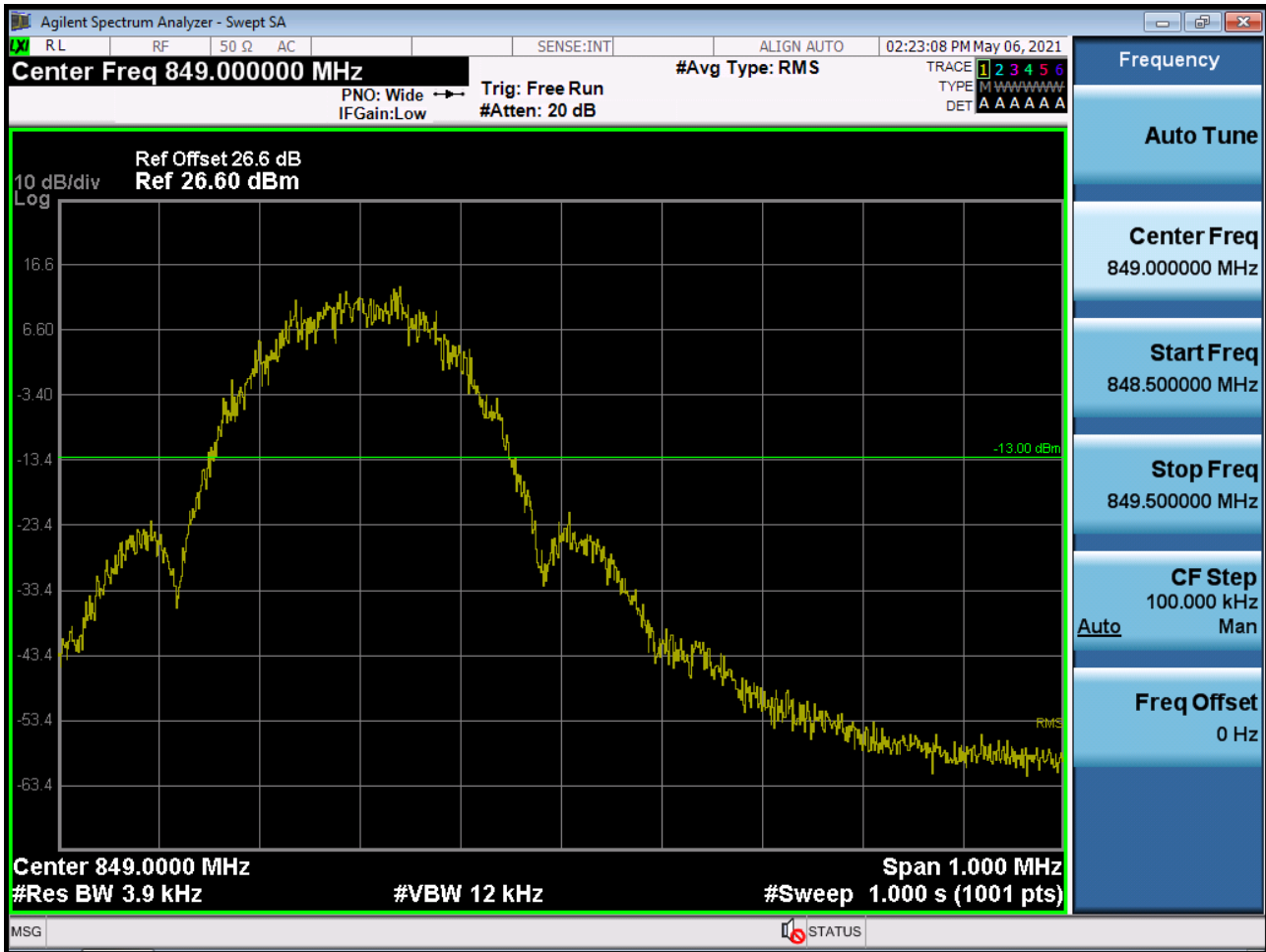
■ EDGE MODE (128 CH.) Block Edge 2



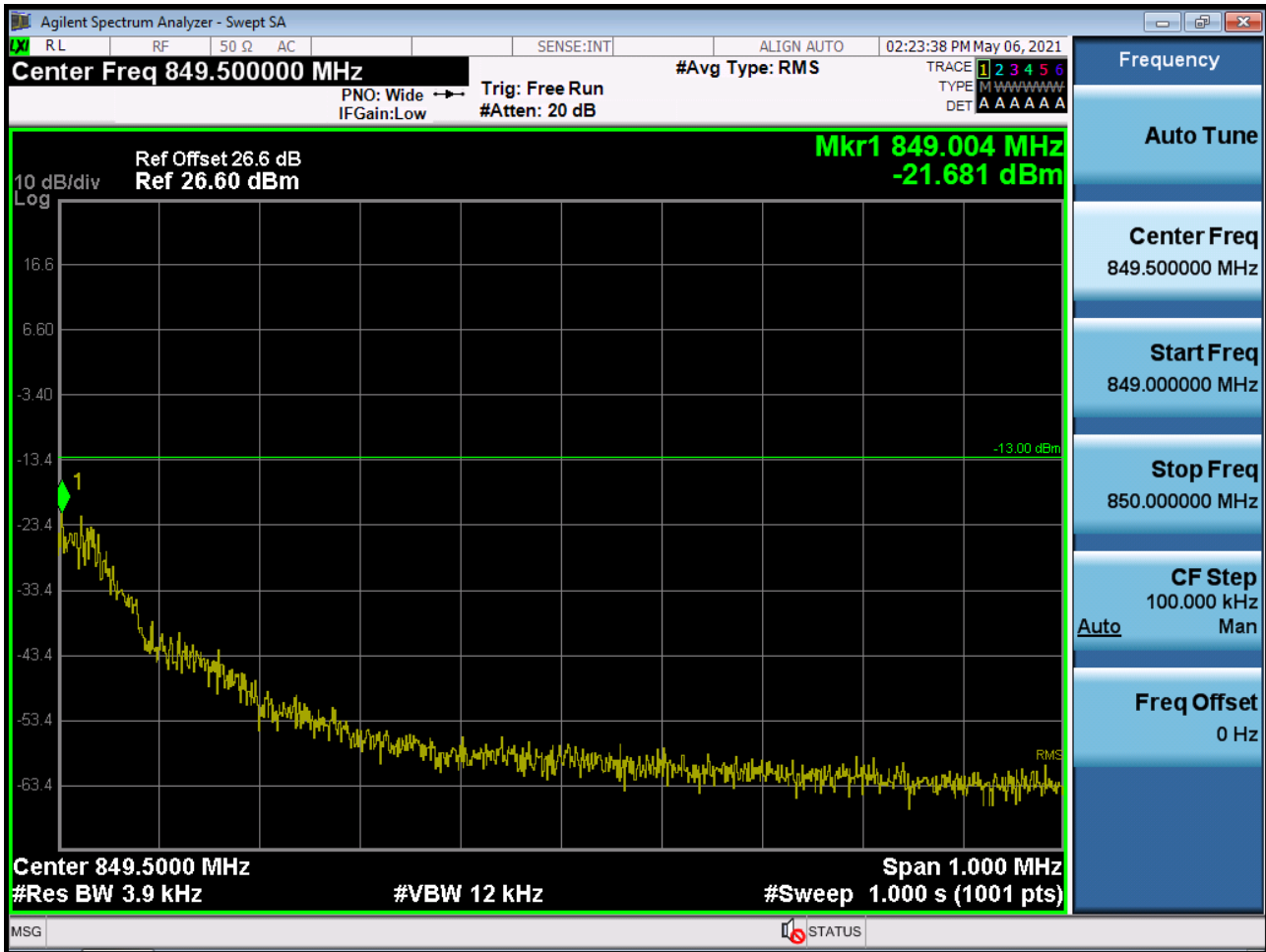
■ EDGE MODE (128 CH.) Block Edge 3



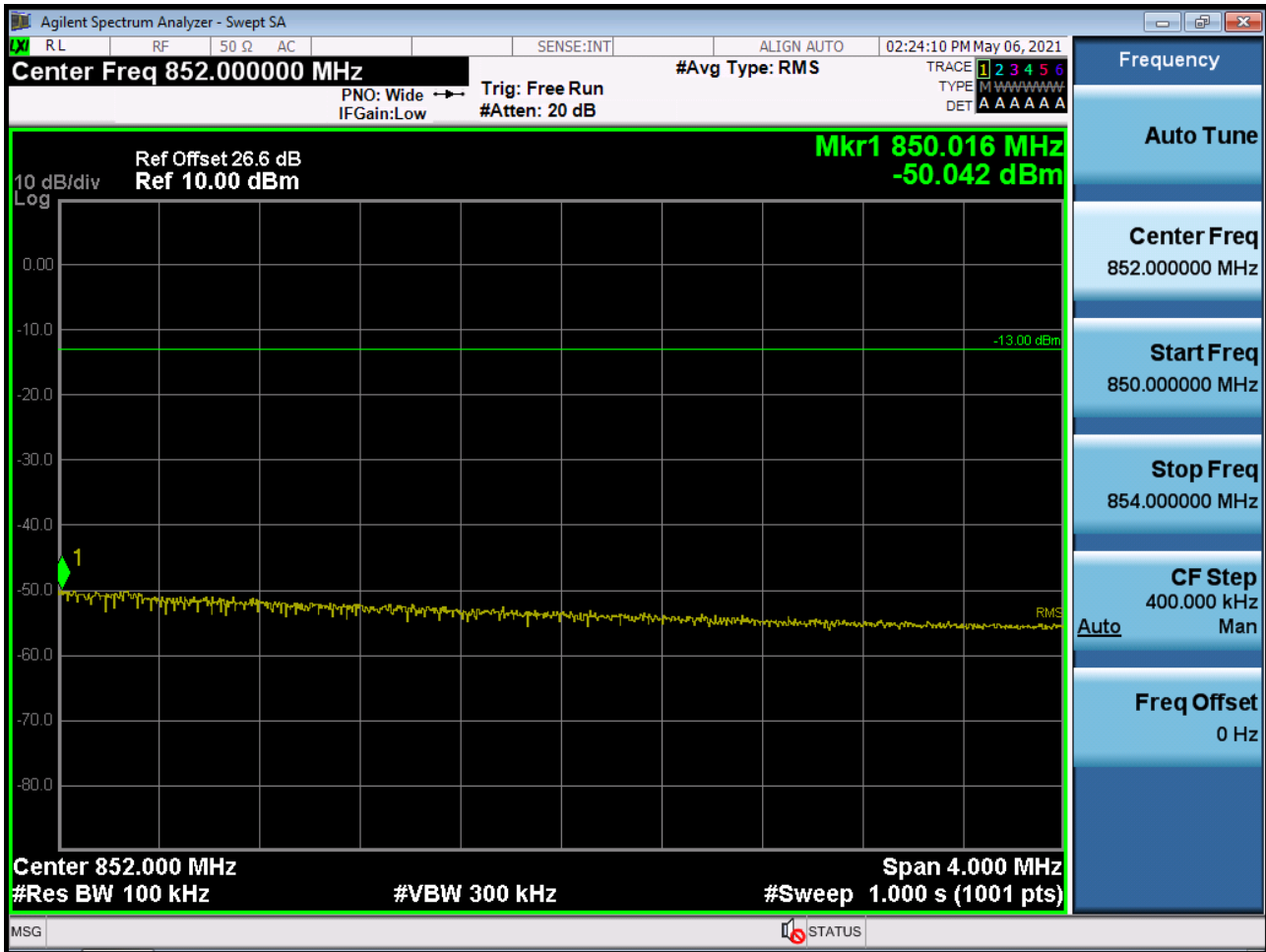
■ EDGE MODE (251 CH.) Block Edge 1



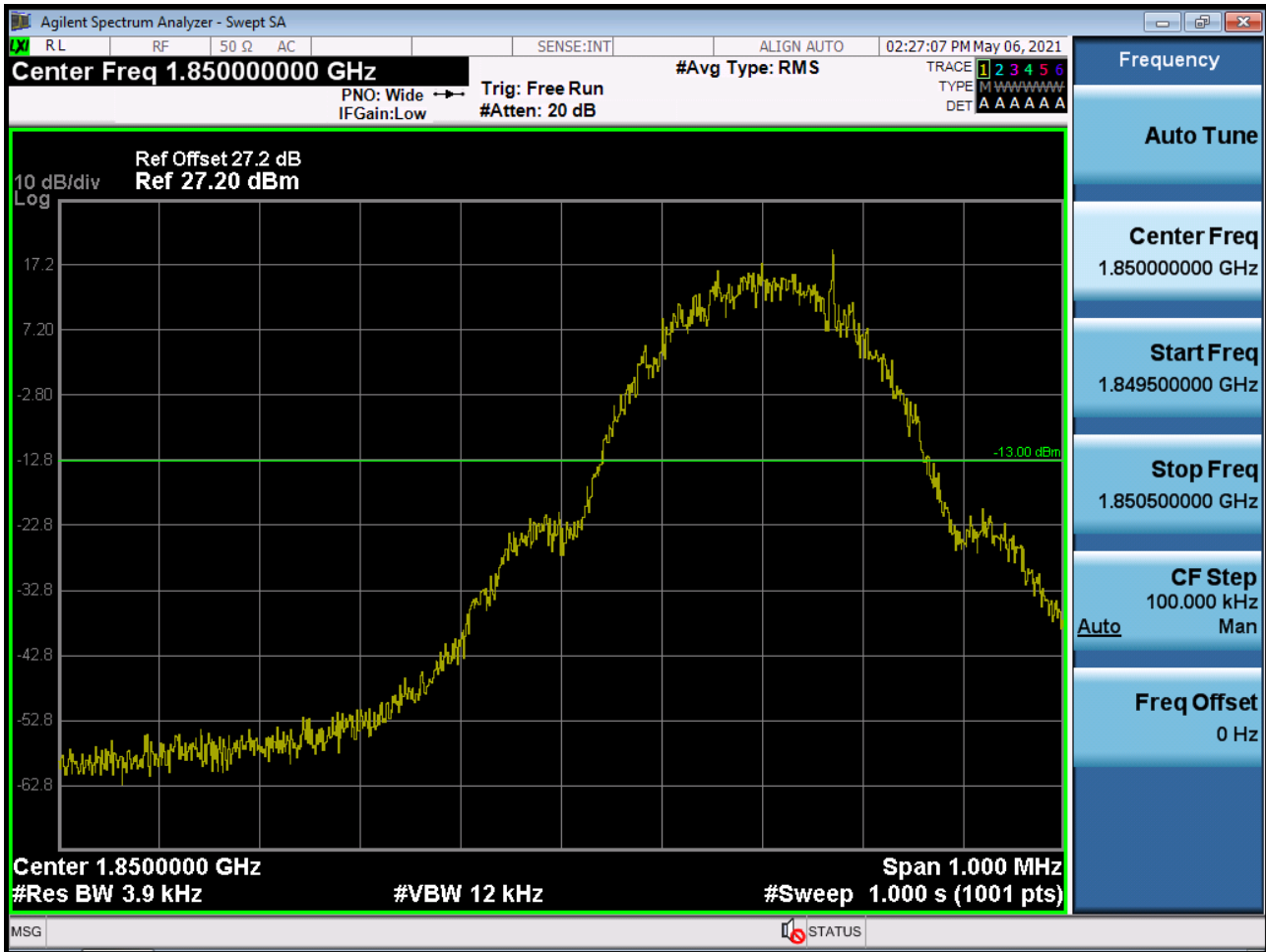
■ EDGE MODE (251 CH.) Block Edge 2



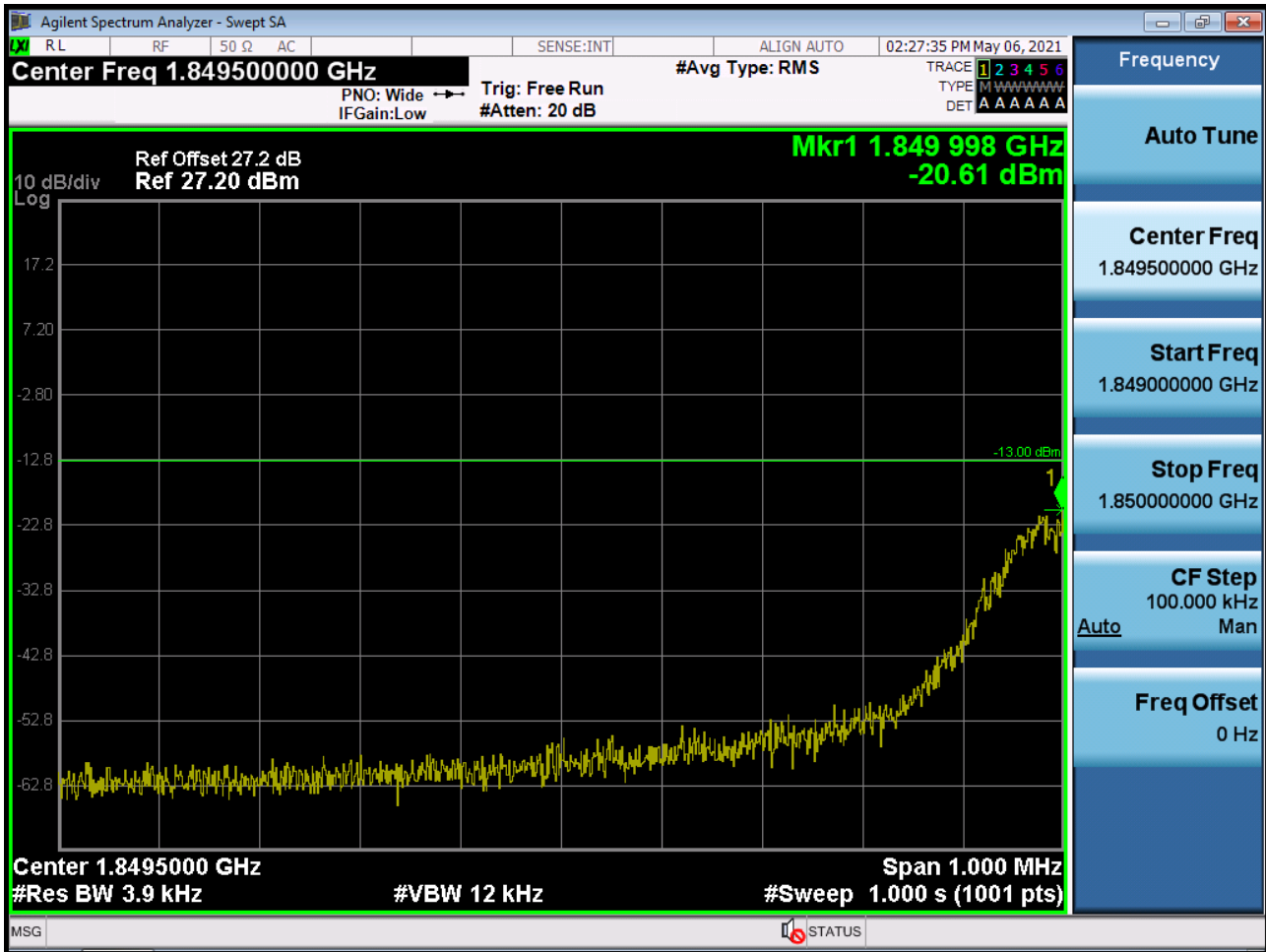
■ EDGE MODE (251 CH.) Block Edge 3



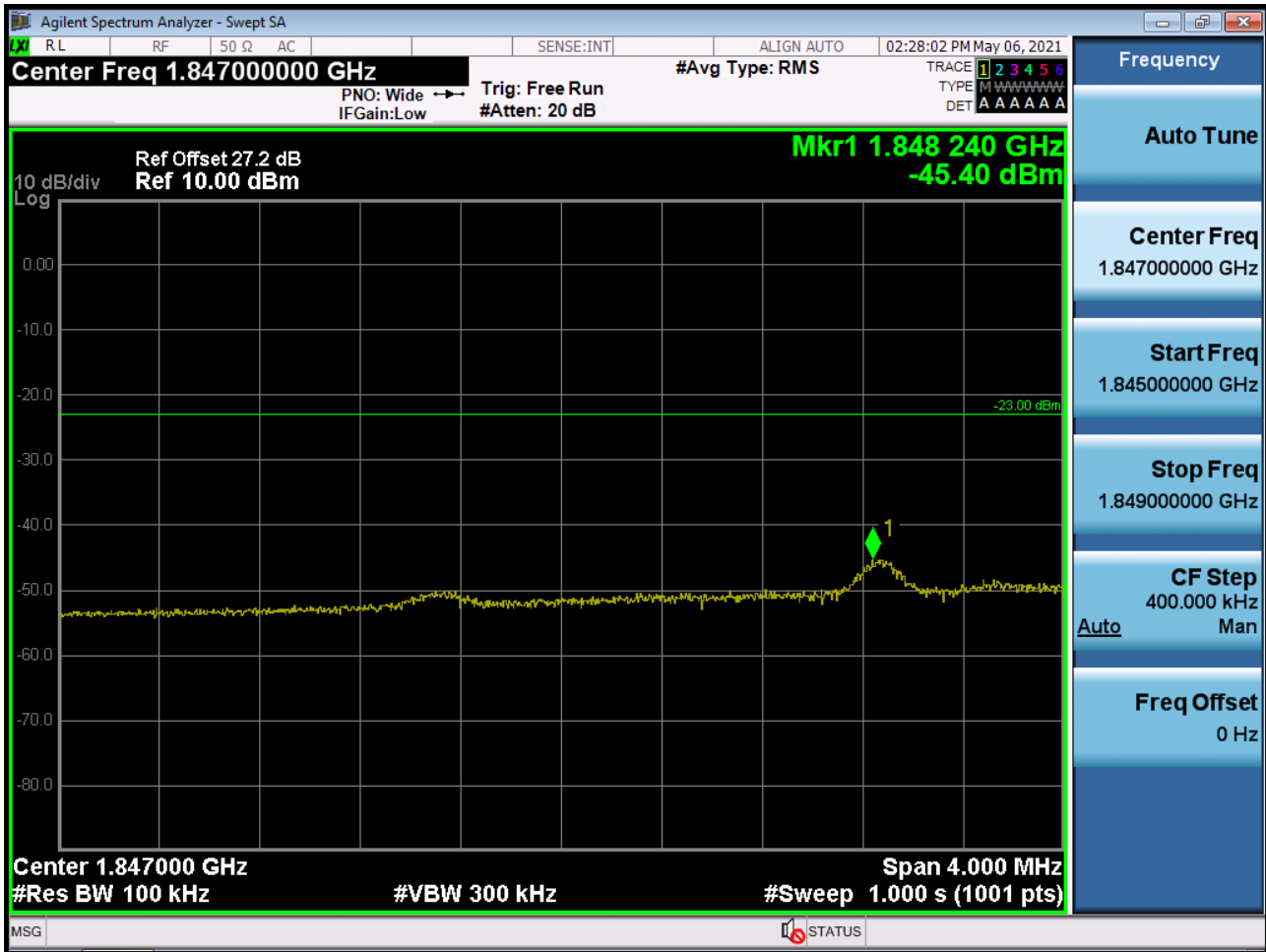
■ GSM1900 MODE (512 CH.) Block Edge 1



■ GSM1900 MODE (512 CH.) Block Edge 2



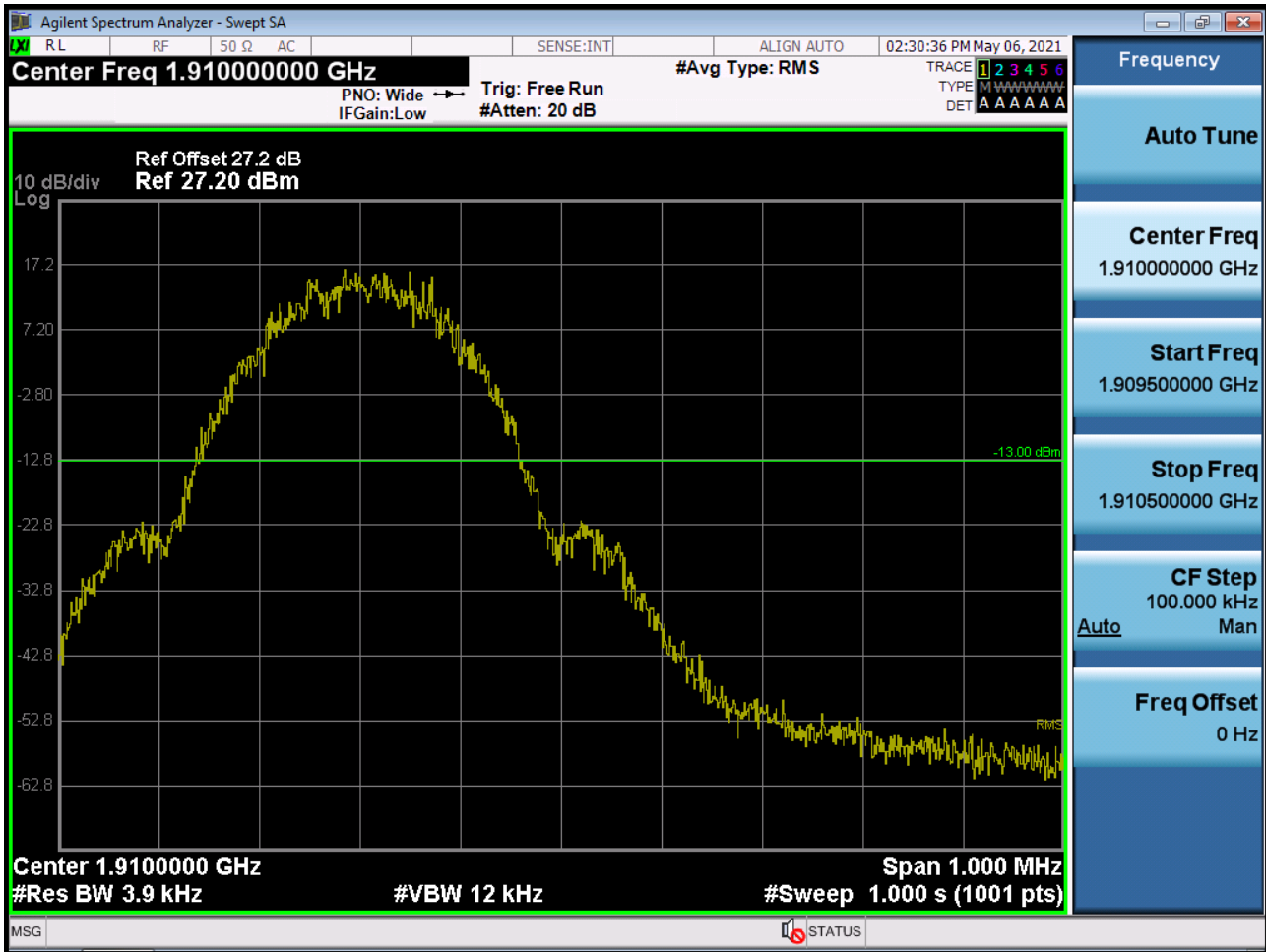
■ GSM1900 MODE (512 CH.) Block Edge 3



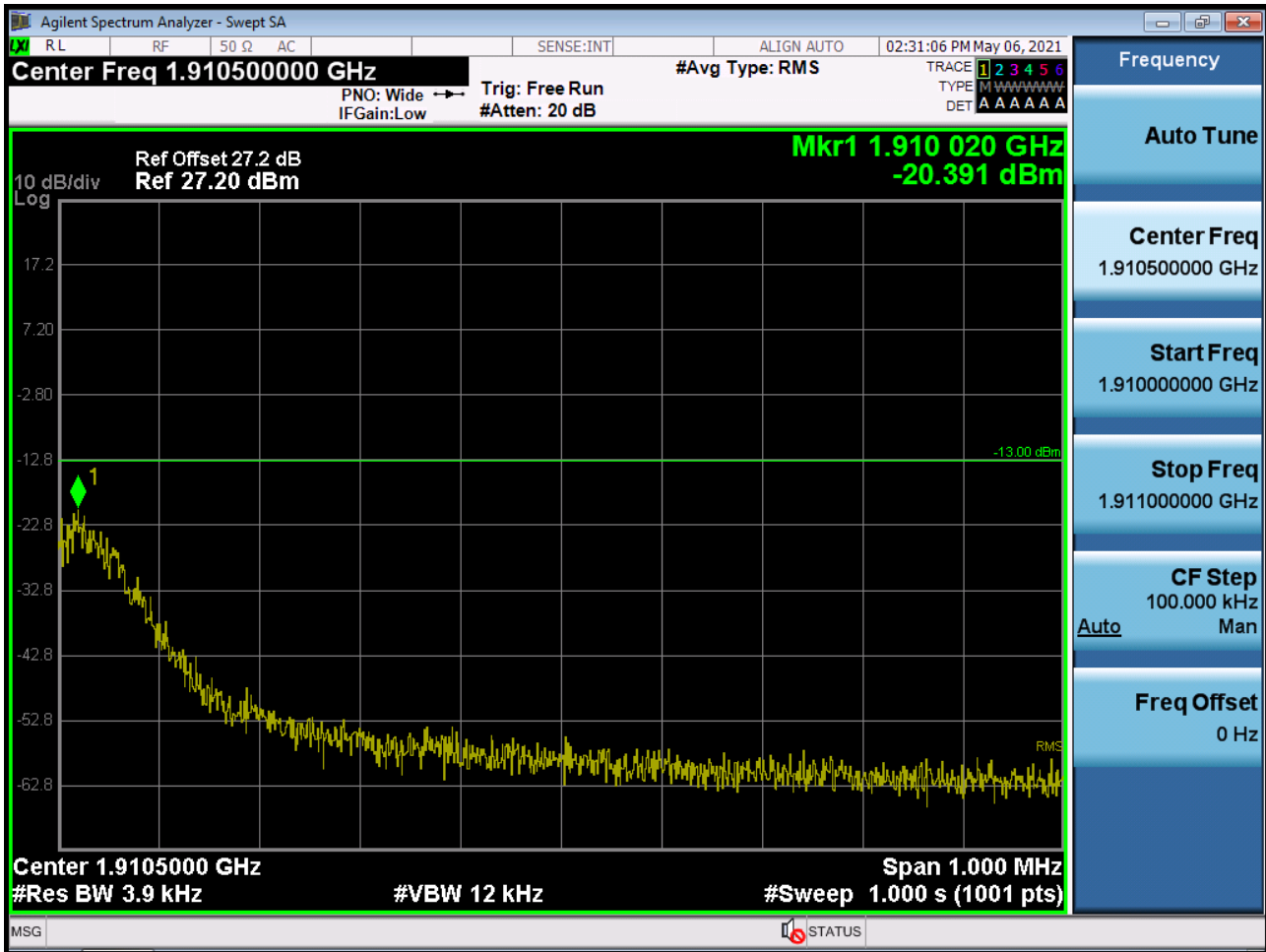
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -45.40 dBm + 10 dB = -35.40 dBm

■ GSM1900 MODE (810 CH.) Block Edge 1



■ GSM1900 MODE (810 CH.) Block Edge 2



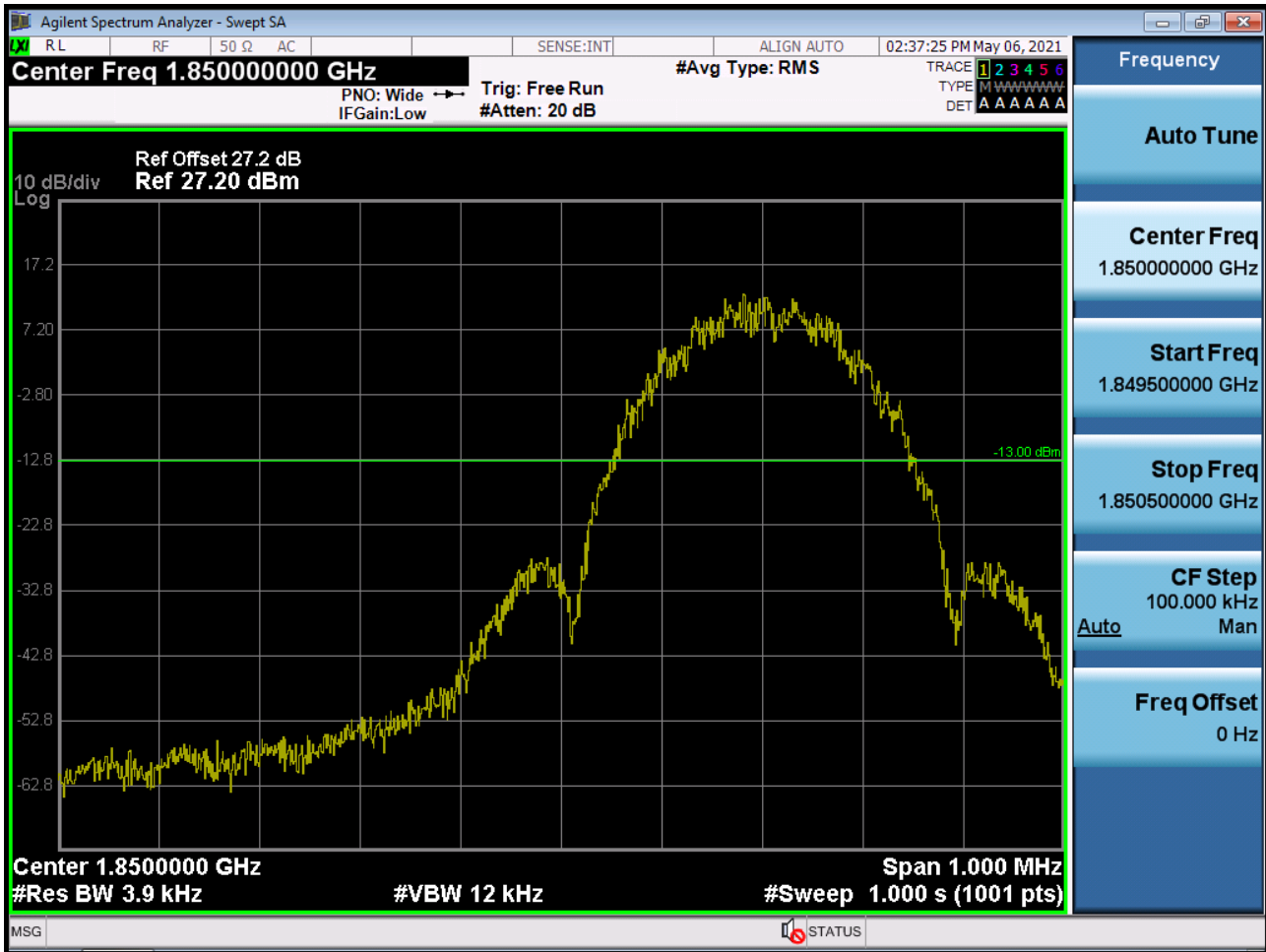
■ GSM1900 MODE (810 CH.) Block Edge 3



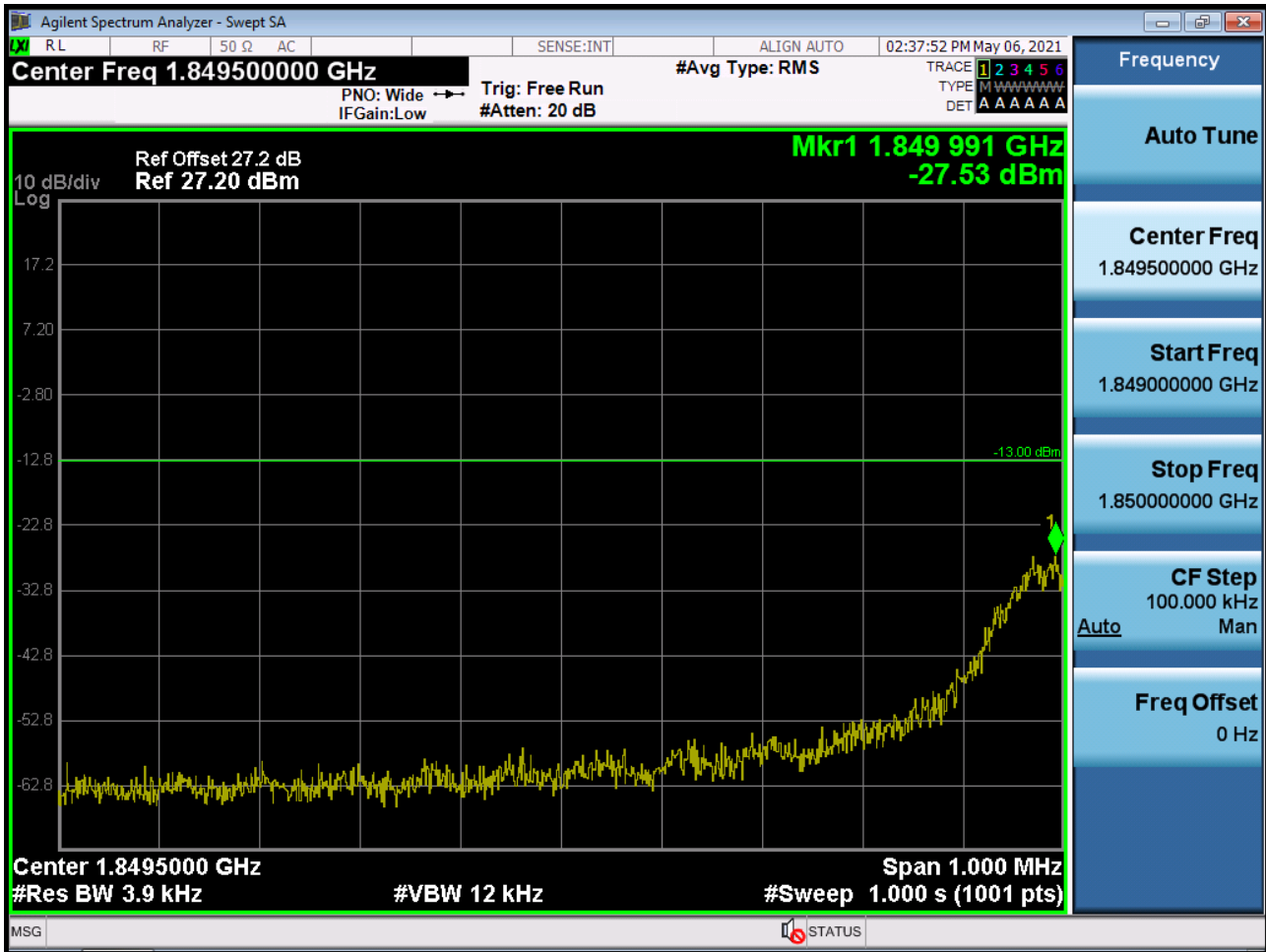
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -45.123 dBm + 10 dB = -35.123 dBm

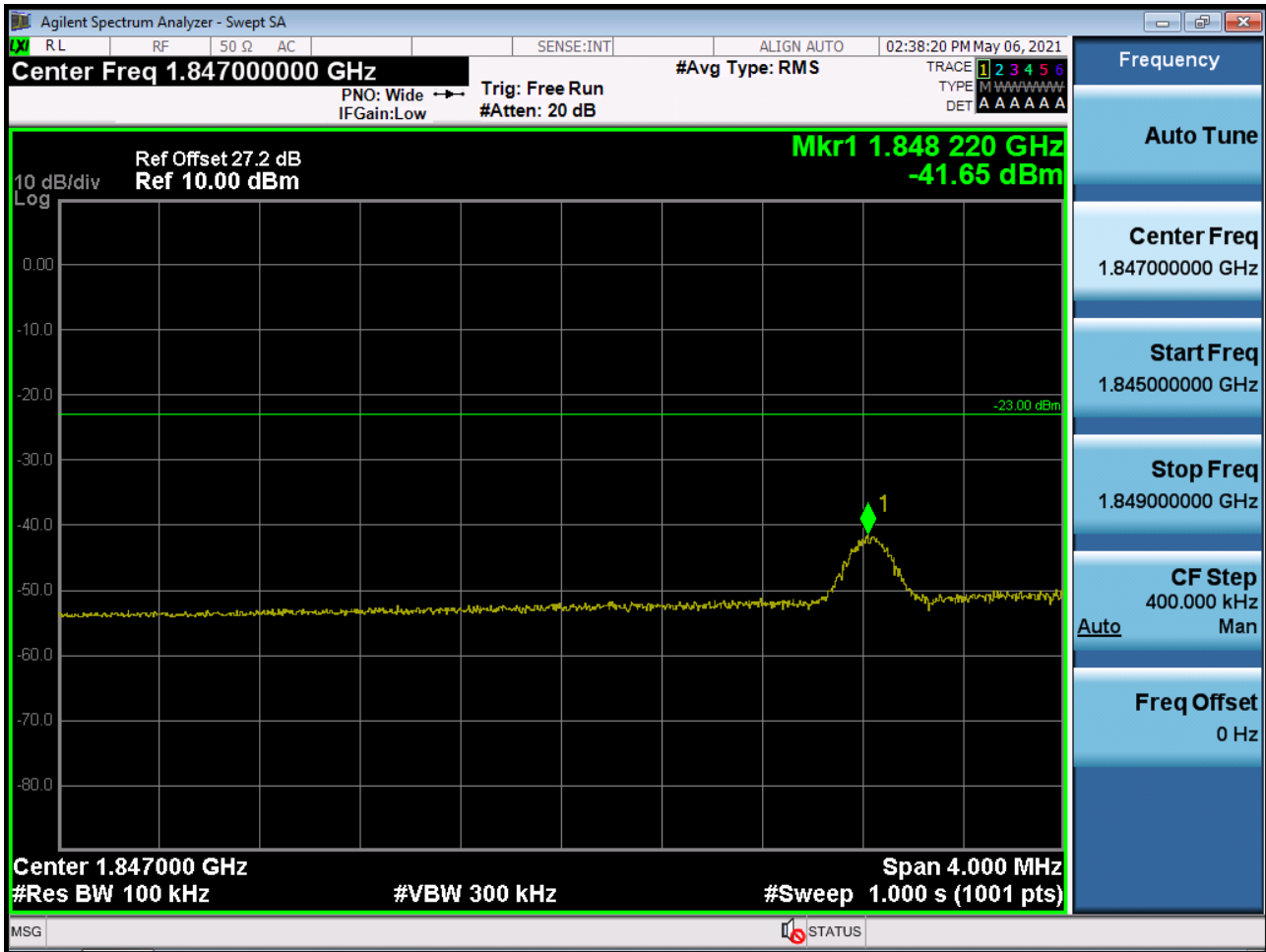
■ EDGE MODE (512 CH.) Block Edge 1



■ EDGE MODE (512 CH.) Block Edge 2



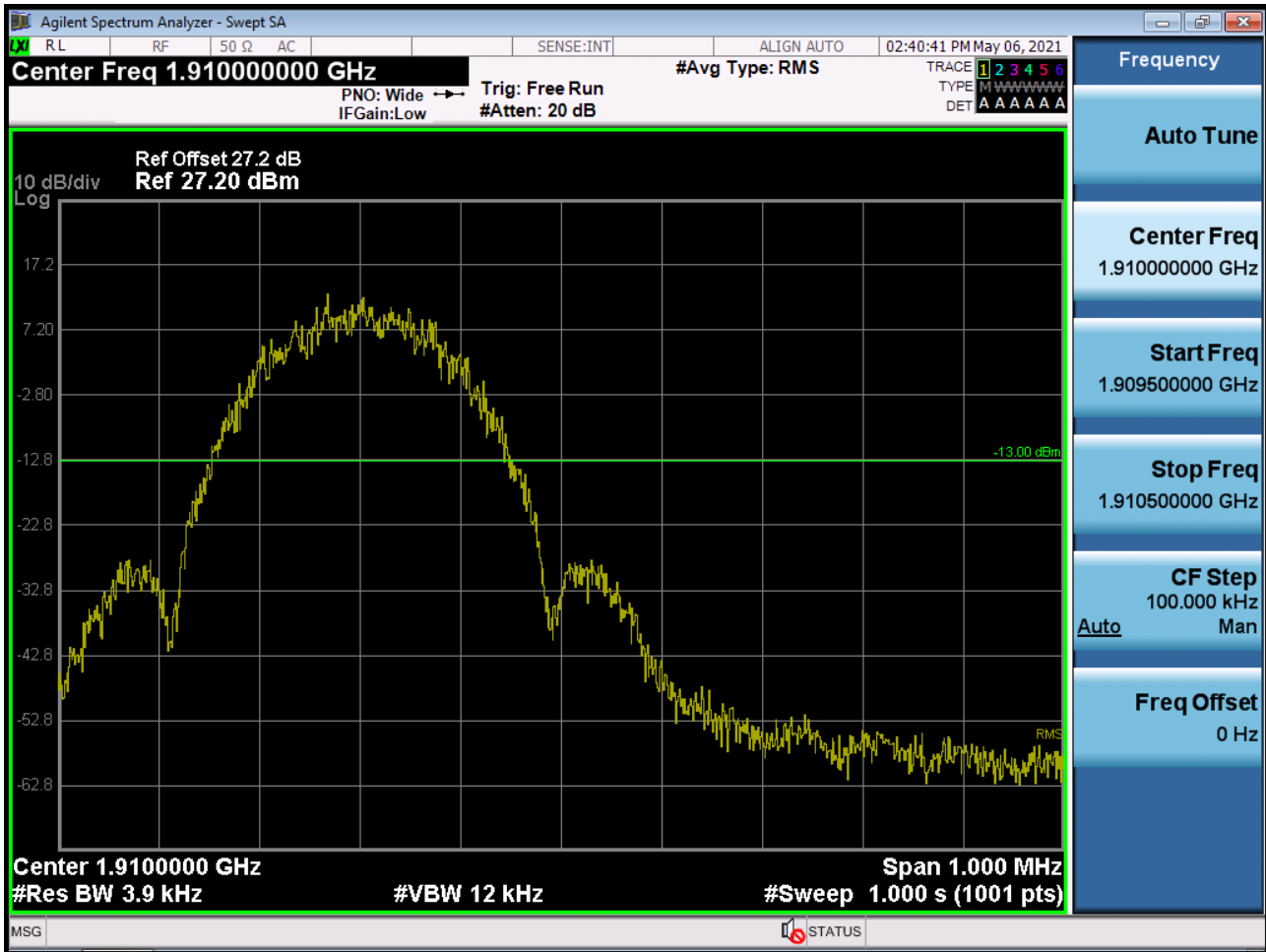
■ EDGE MODE (512 CH.) Block Edge 3



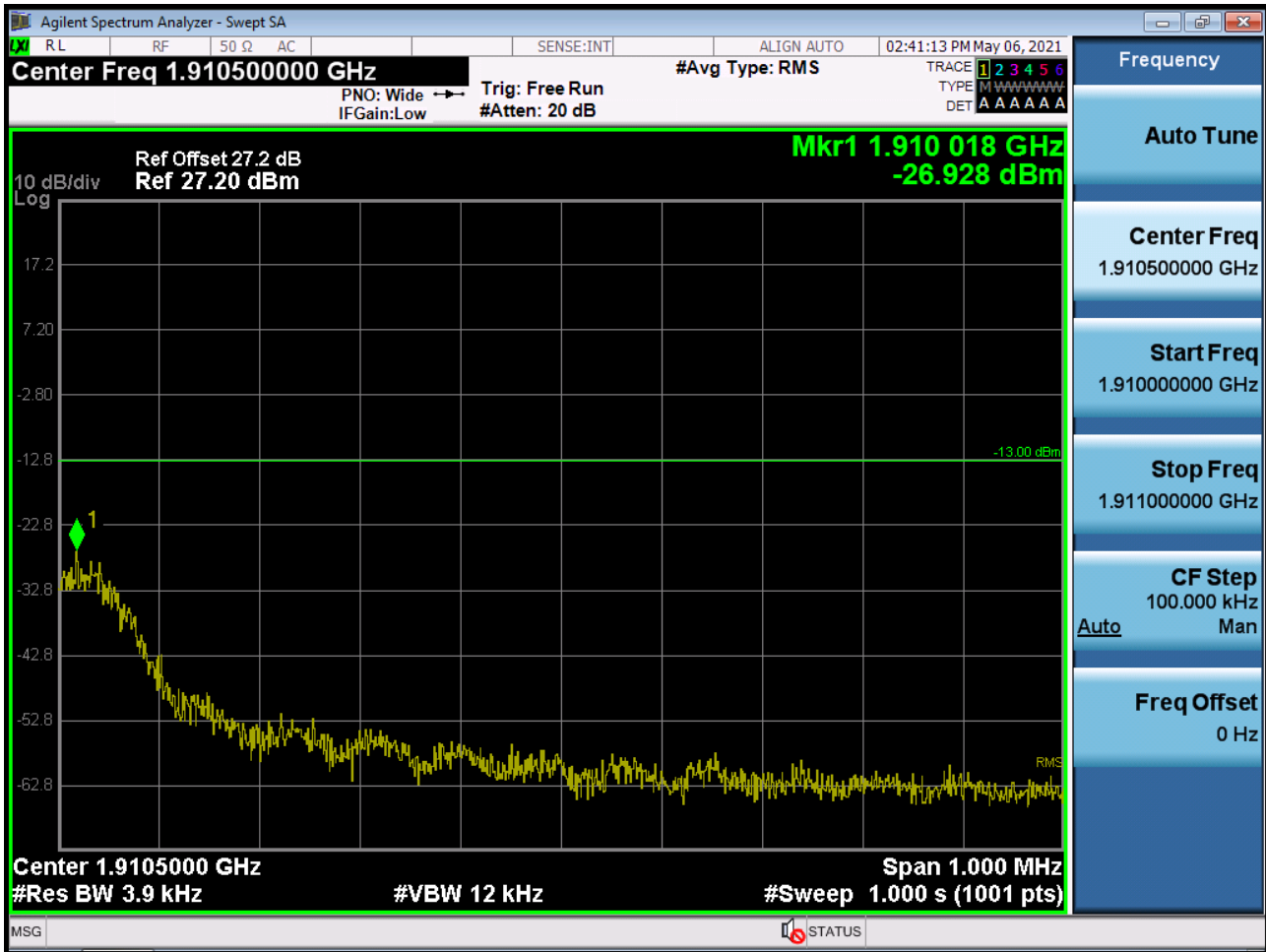
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -41.65 dBm + 10 dB = -31.65 dBm

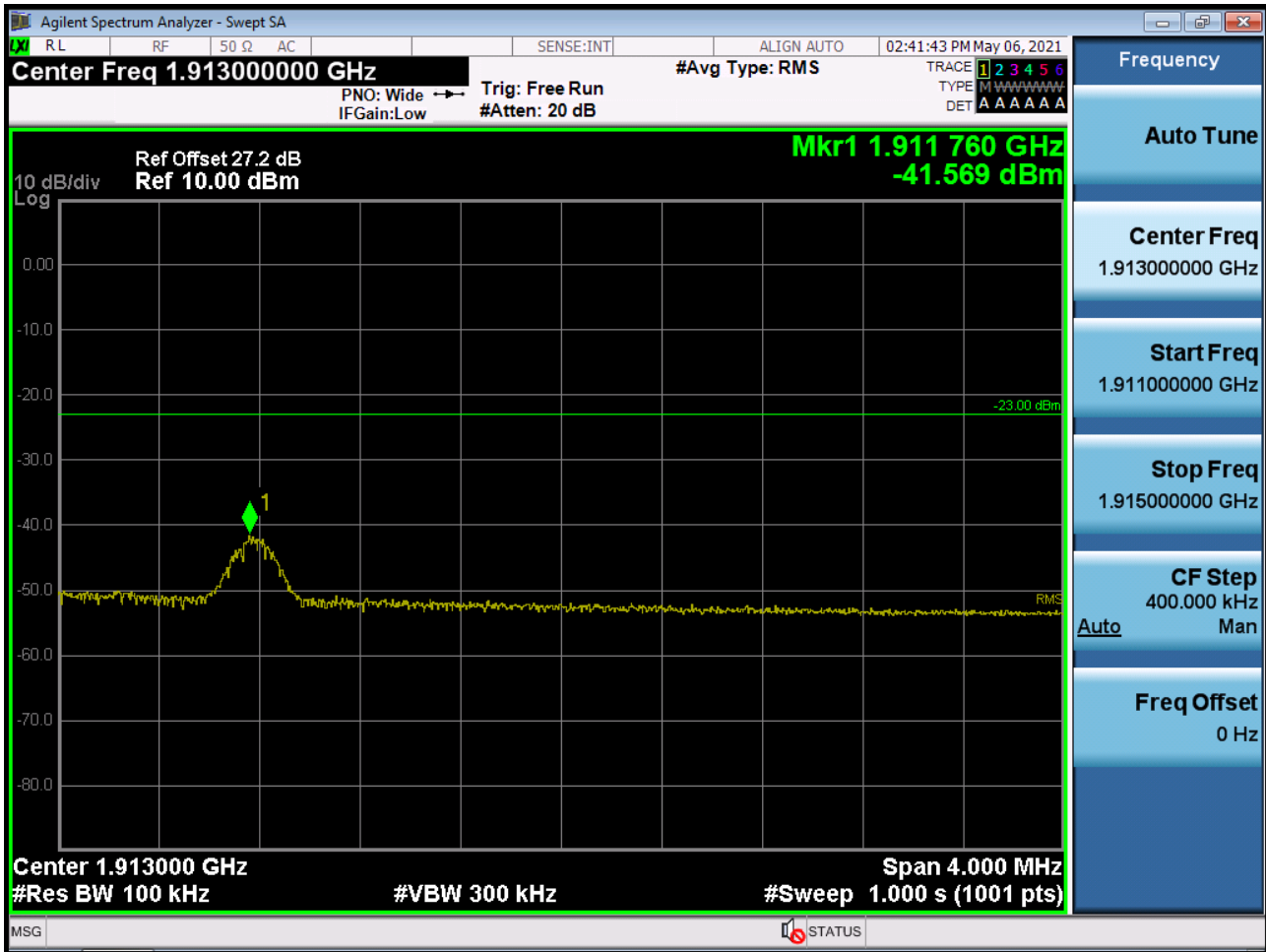
■ EDGE MODE (810 CH.) Block Edge 1



■ EDGE MODE (810 CH.) Block Edge 2



■ EDGE MODE (810 CH.) Block Edge 3



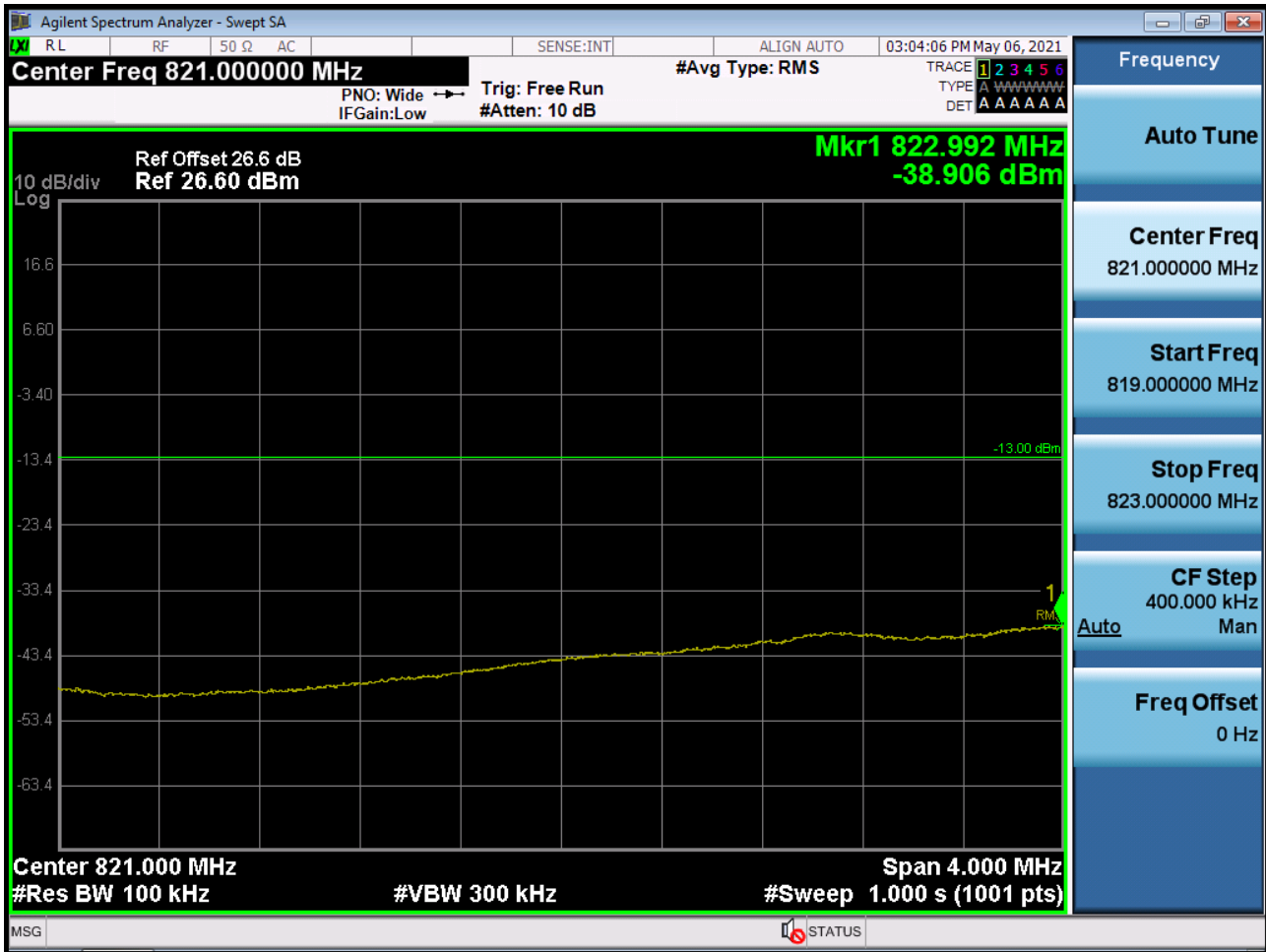
Note : We used a narrower RBW in order to increase accuracy.

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -41.569 dBm + 10 dB = -31.569 dBm

■ WCDMA850 MODE (4132 CH.) Block Edge



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



■ WCDMA850MODE (4233 CH.) Block Edge



■ WCDMA850MODE (4233 CH.) – 4 MHz Span



■ WCDMA1900 MODE (9262 CH.) Block Edge



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



■ WCDMA1900 MODE (9538 CH.) Block Edge



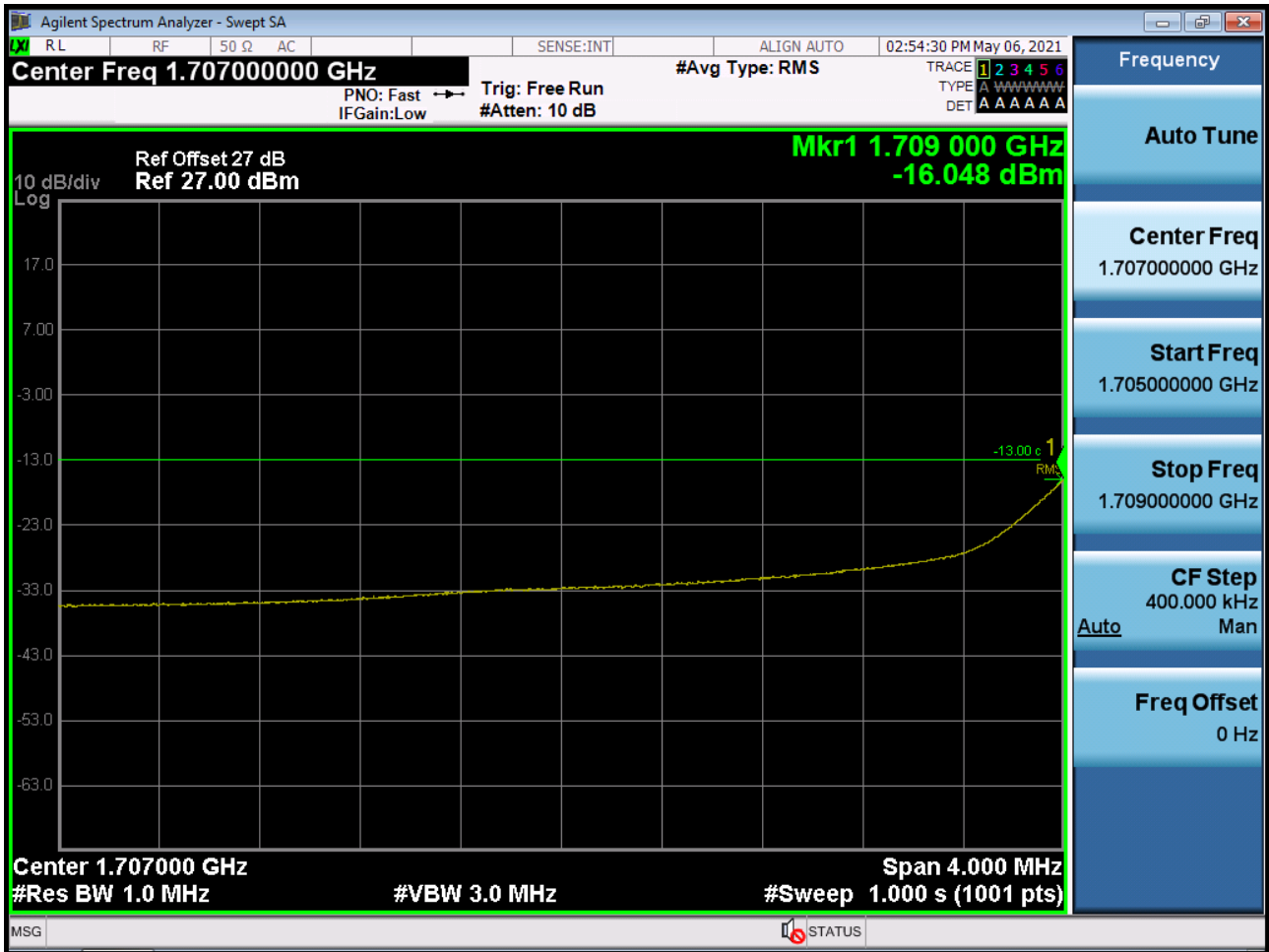
■ WCDMA1900 MODE (9538 CH.) – 4 MHz Span



■ WCDMA1700 MODE (1312 CH.) Block Edge



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



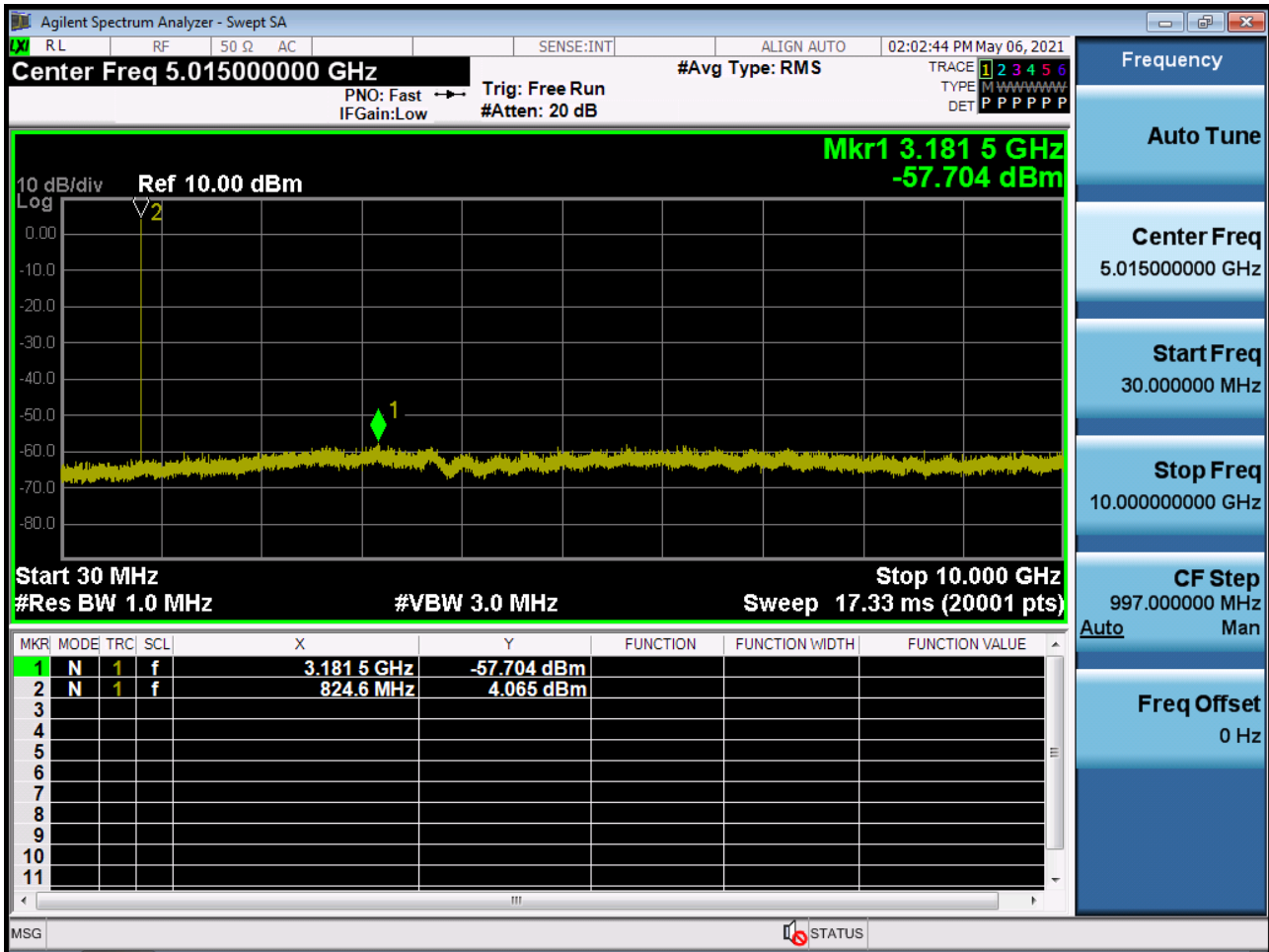
■ WCDMA1700 MODE (1513 CH.) Block Edge



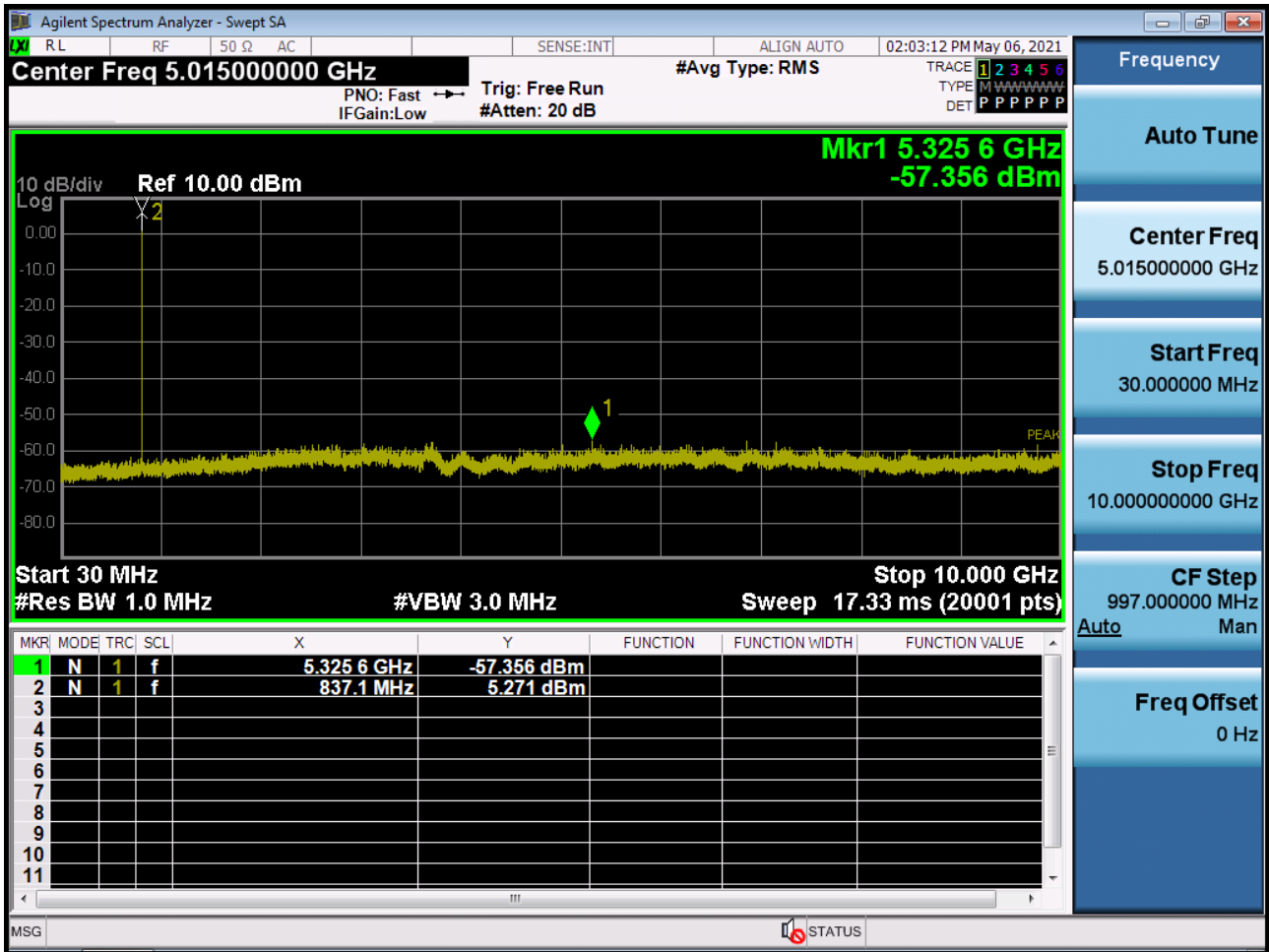
■ WCDMA1700 MODE (1513 CH.) – 4 MHz Span



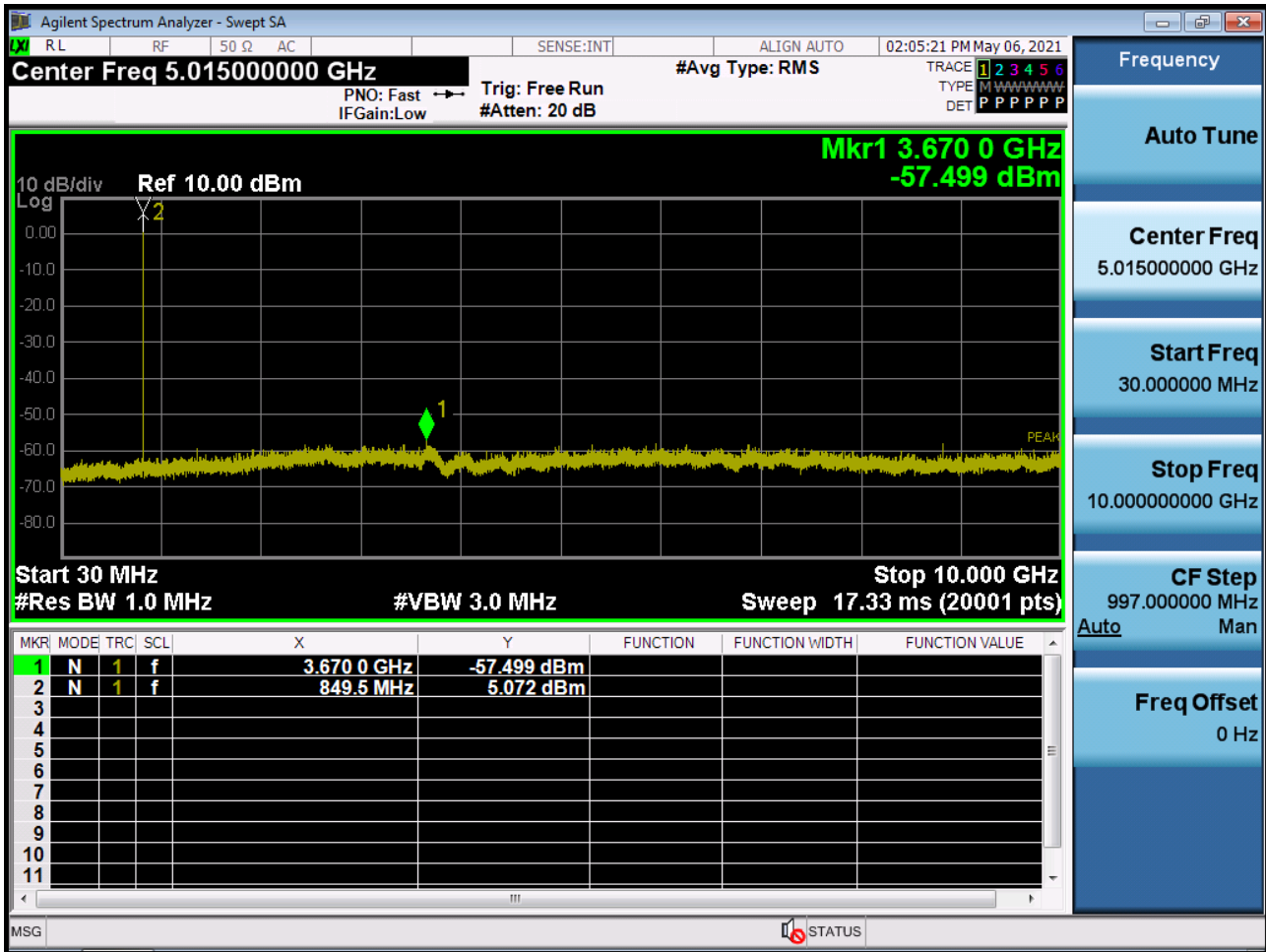
■ GSM850 MODE (128 CH.) Conducted Spurious Emissions



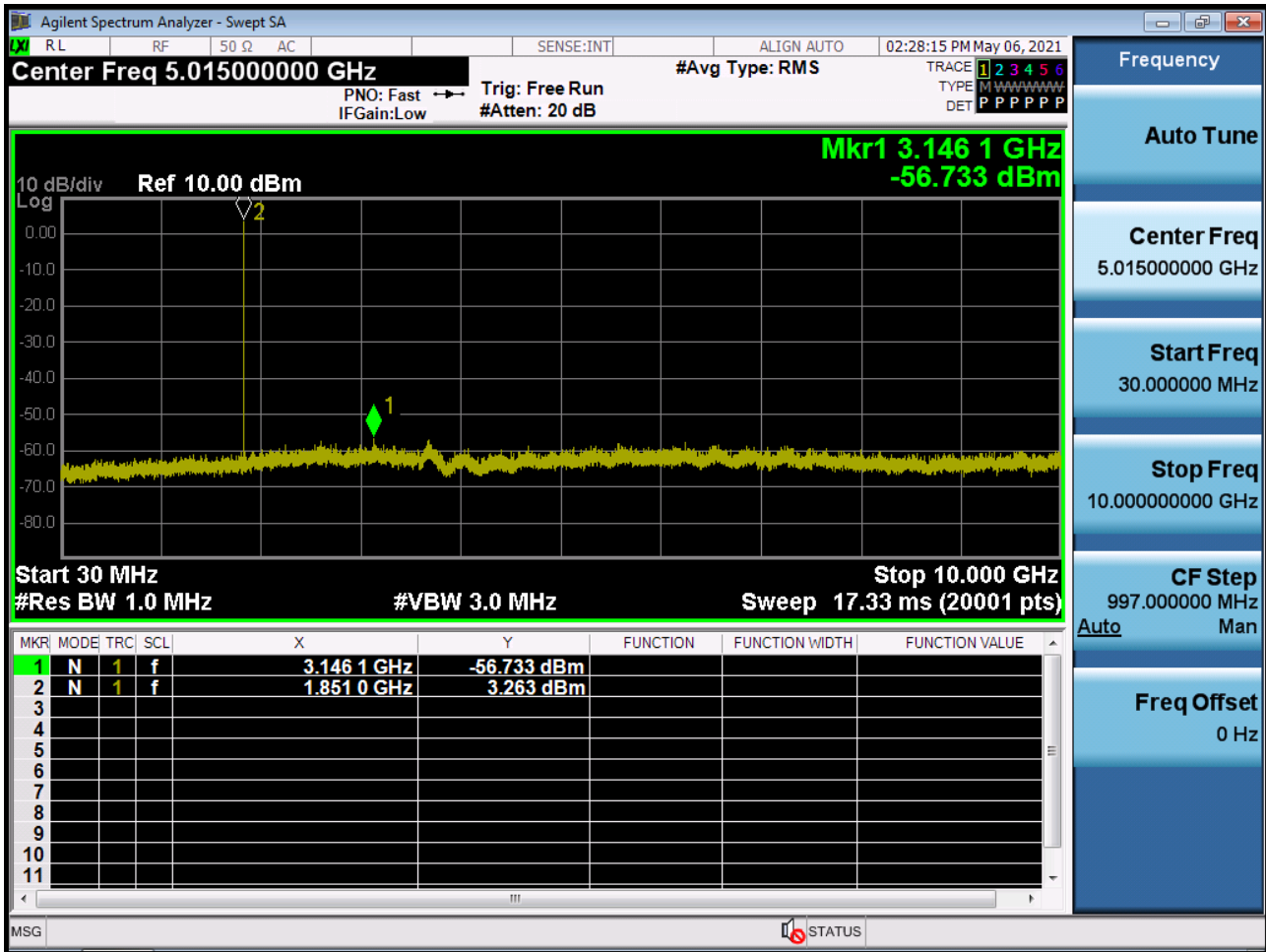
■ GSM850 MODE (190 CH.) Conducted Spurious Emissions



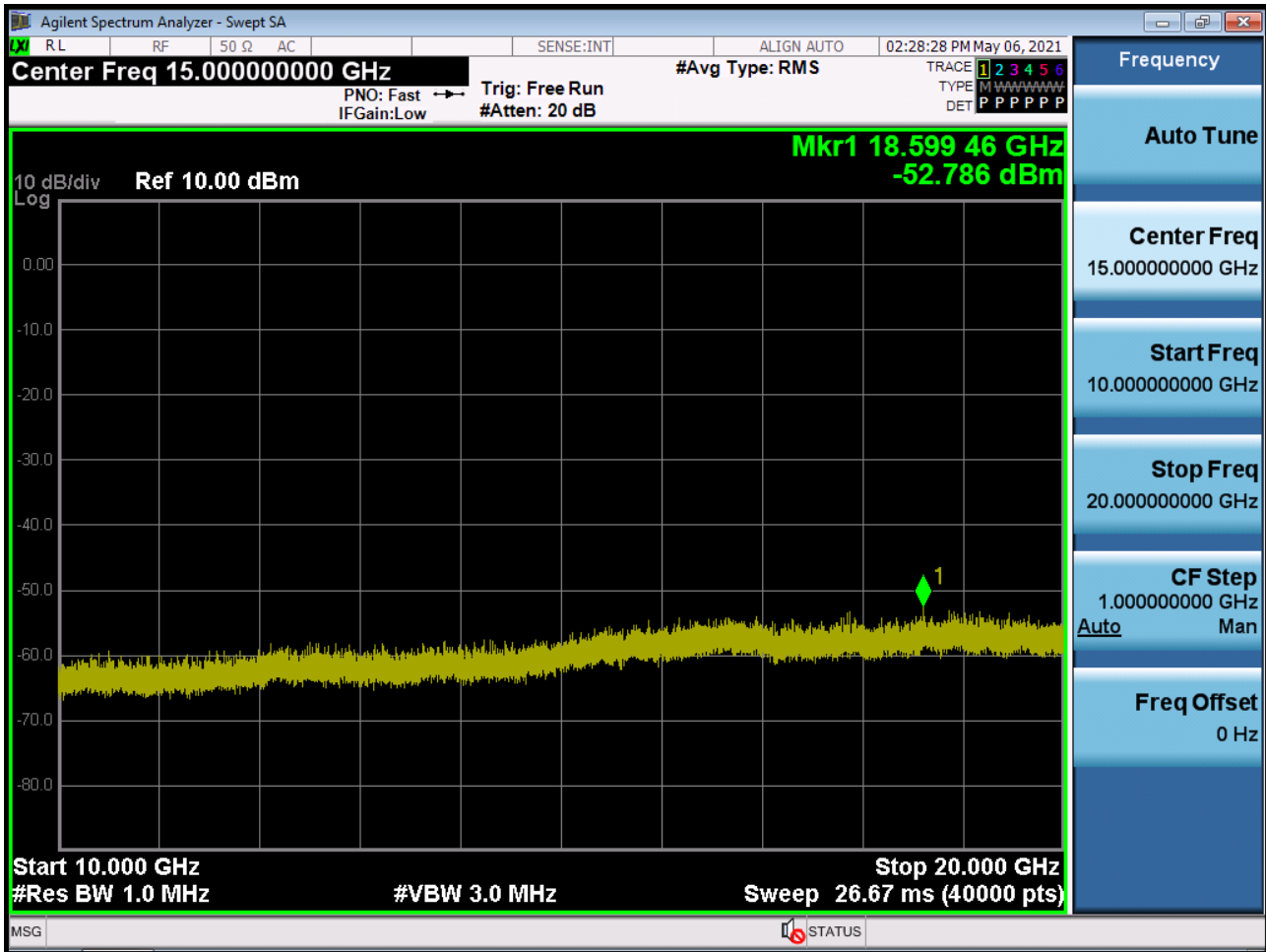
■ GSM850 MODE (251 CH.) Conducted Spurious Emissions



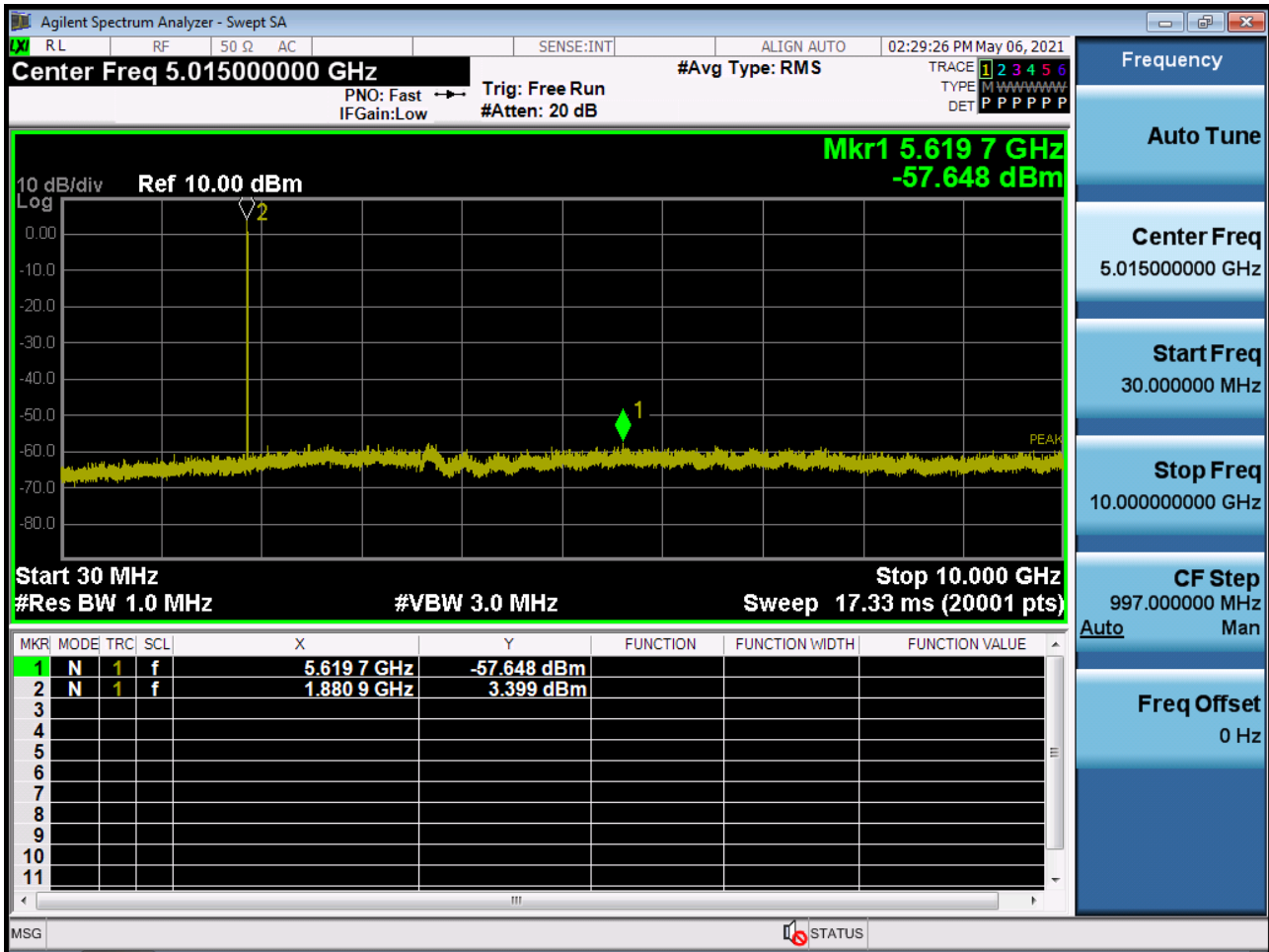
■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions1



■ GSM1900 MODE (512 CH.) Conducted Spurious Emissions2



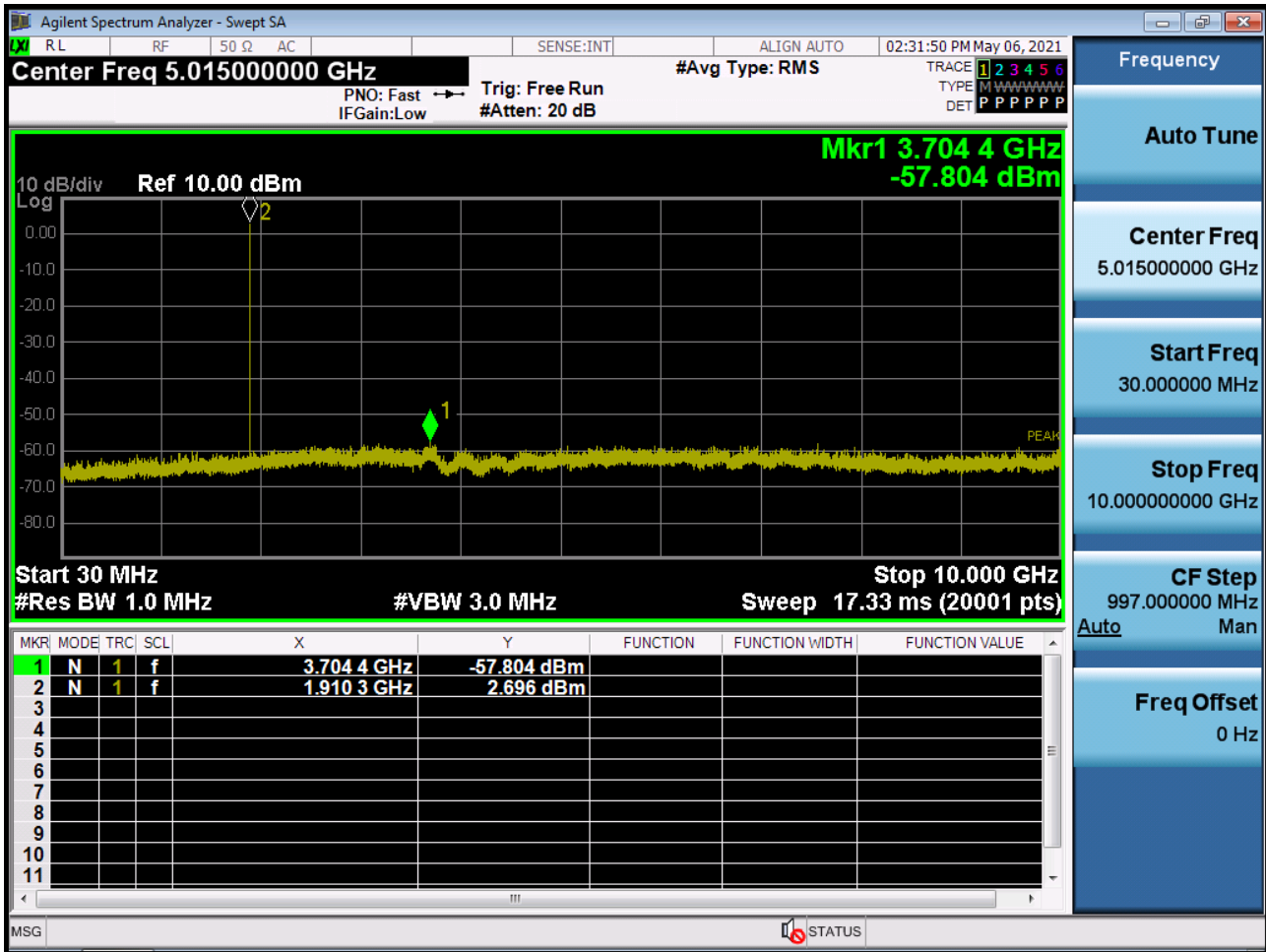
■ GSM1900 MODE (661 CH) Conducted Spurious Emissions1



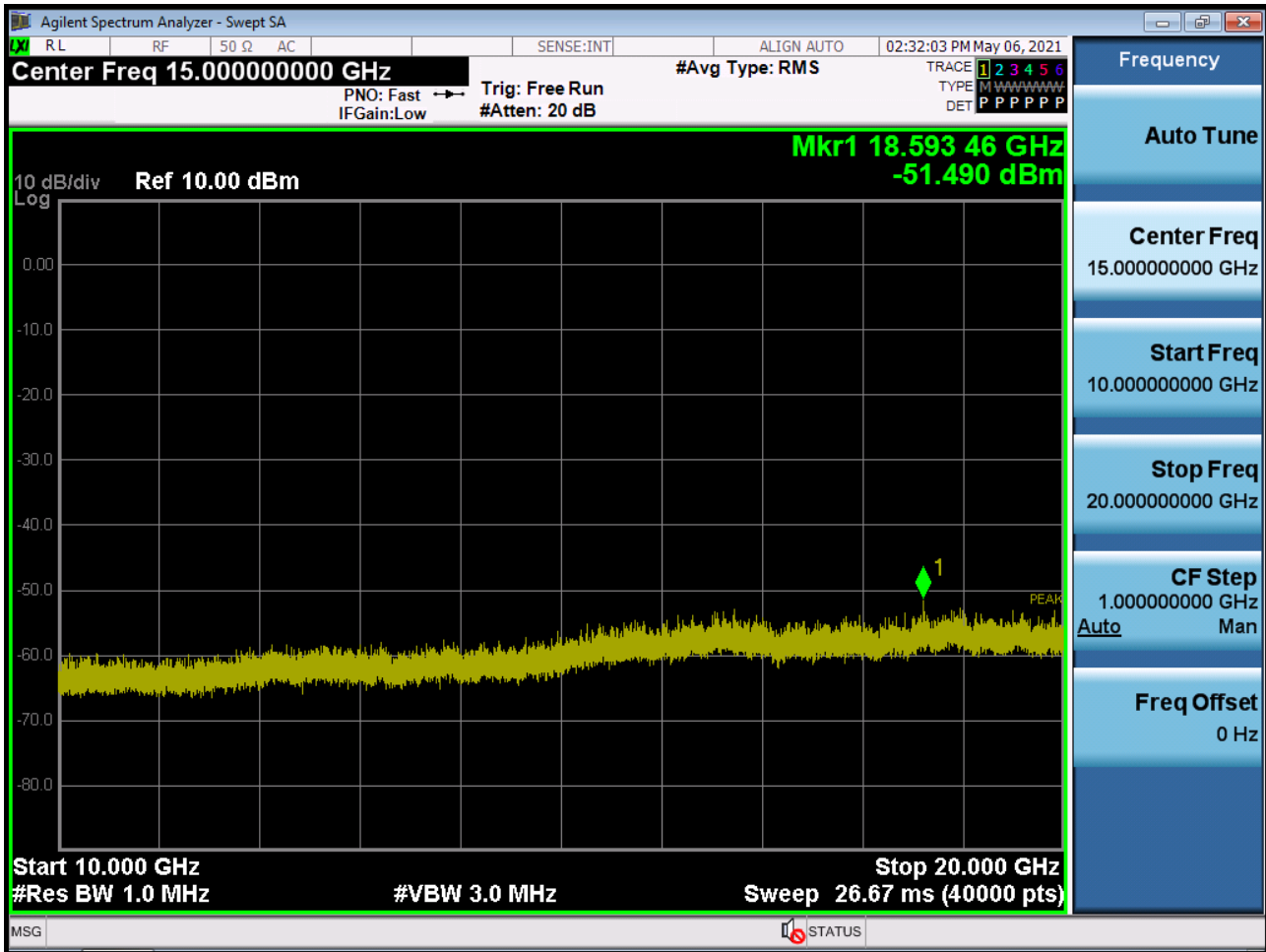
■ GSM1900 MODE (661 CH.) Conducted Spurious Emissions2



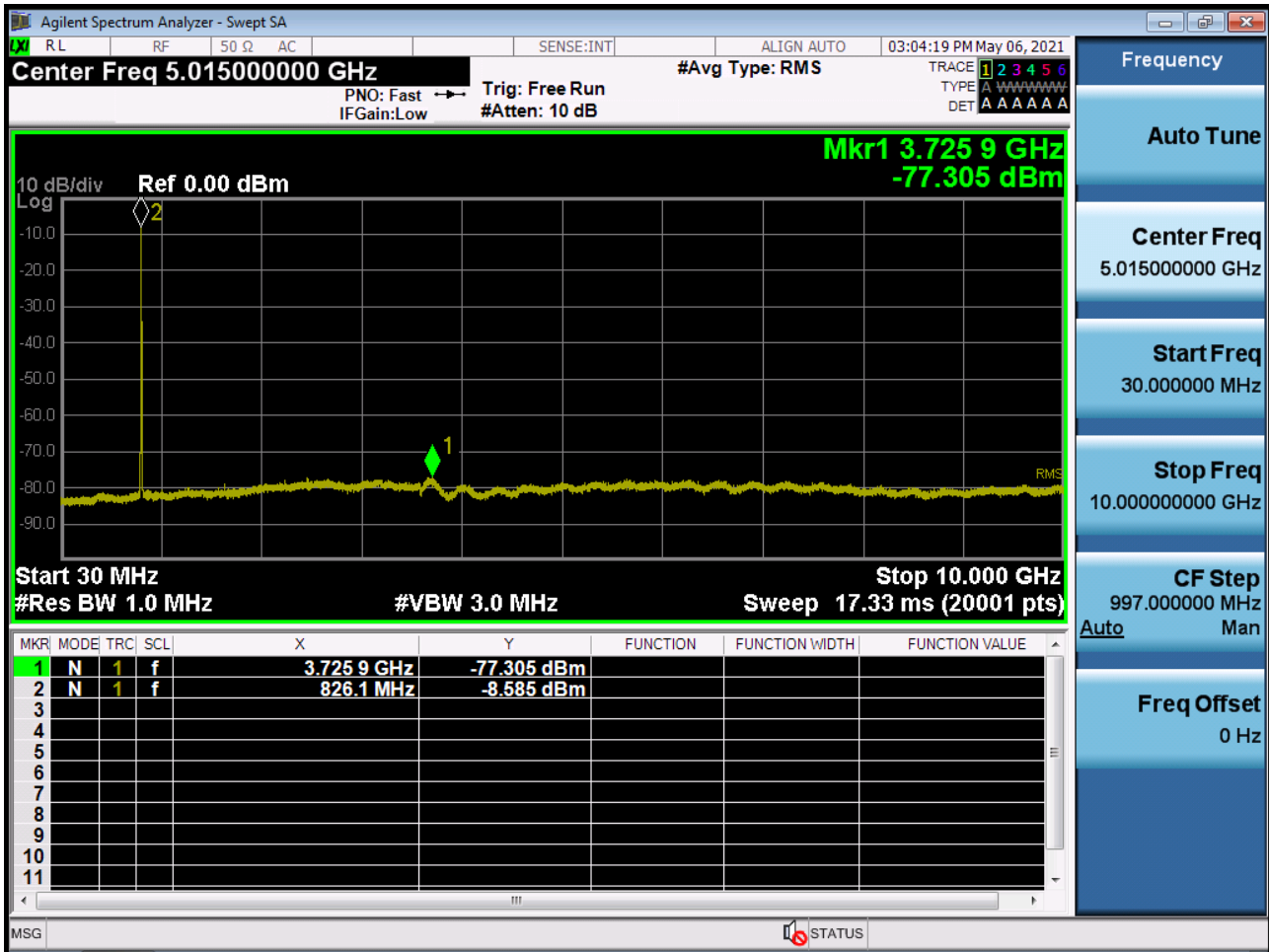
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions1



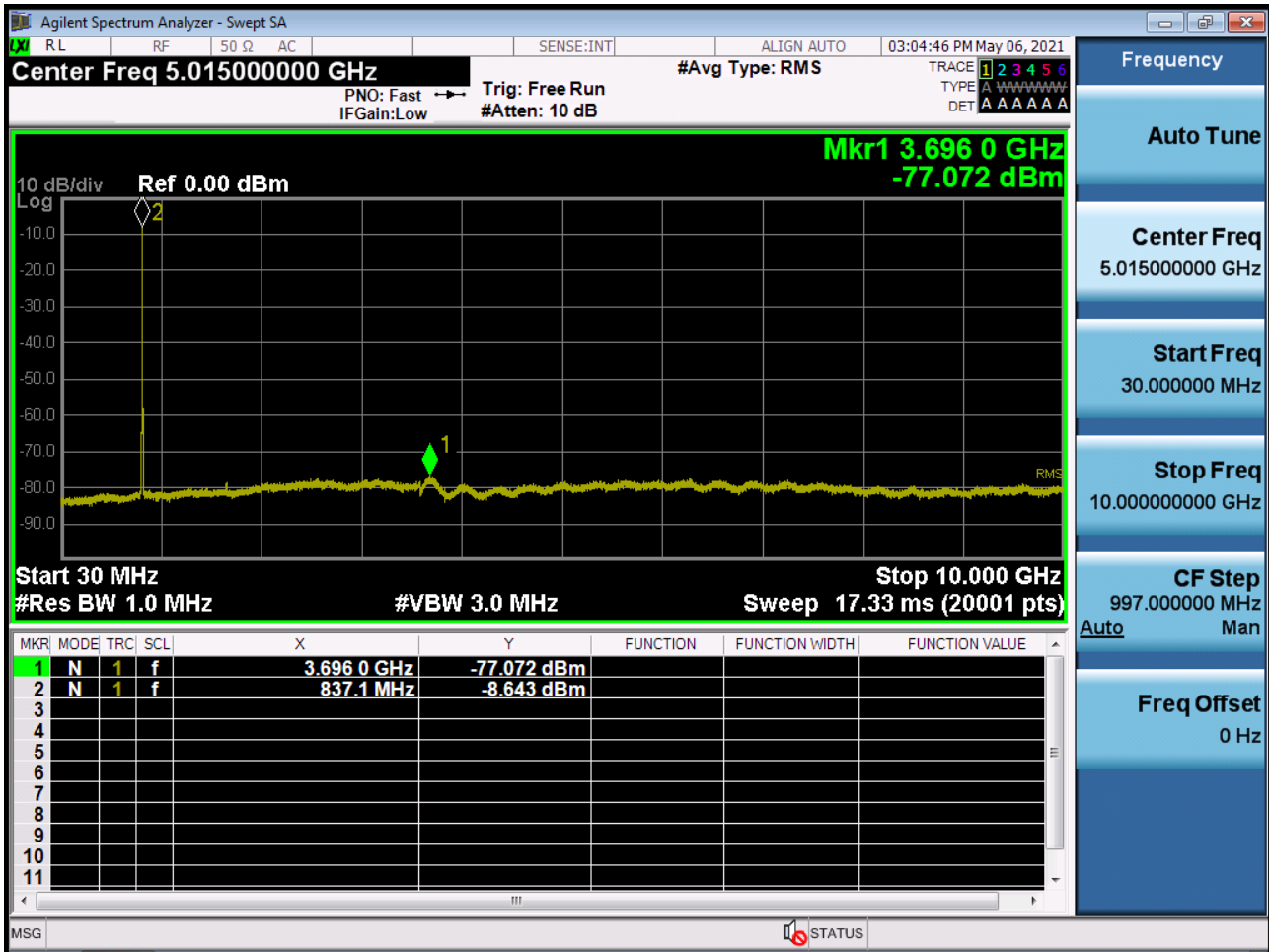
■ GSM1900 MODE (810 CH.) Conducted Spurious Emissions2



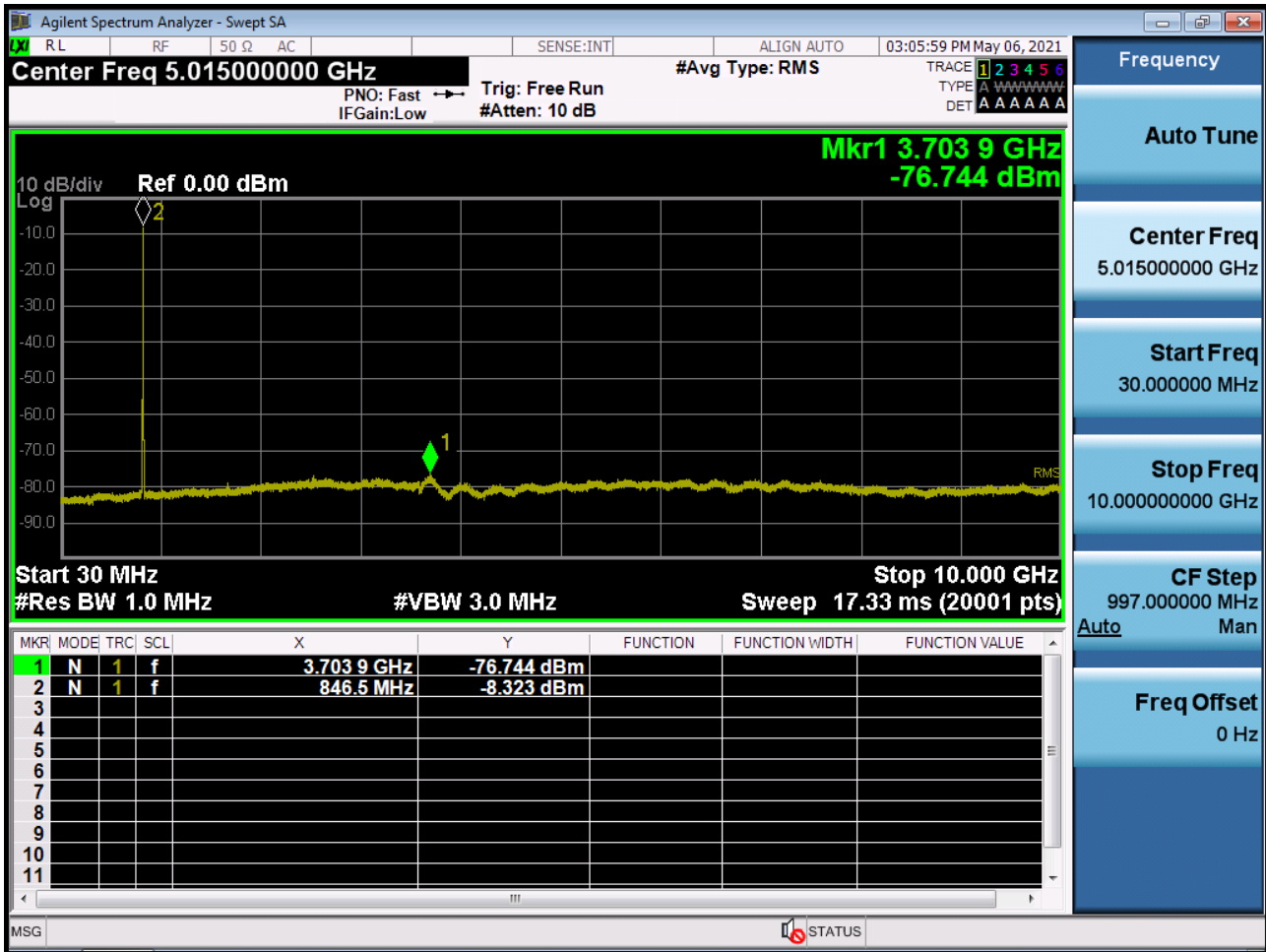
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



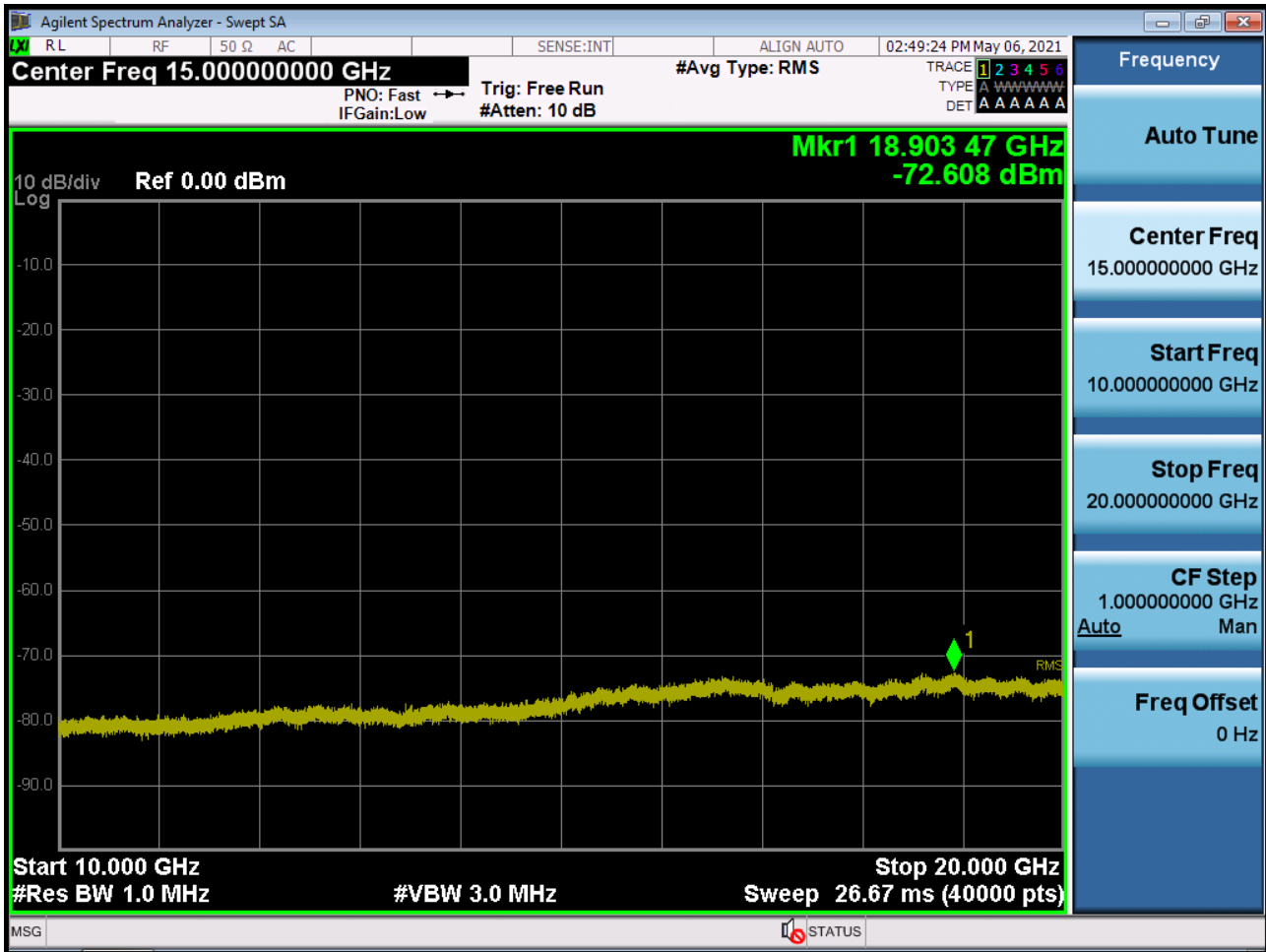
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



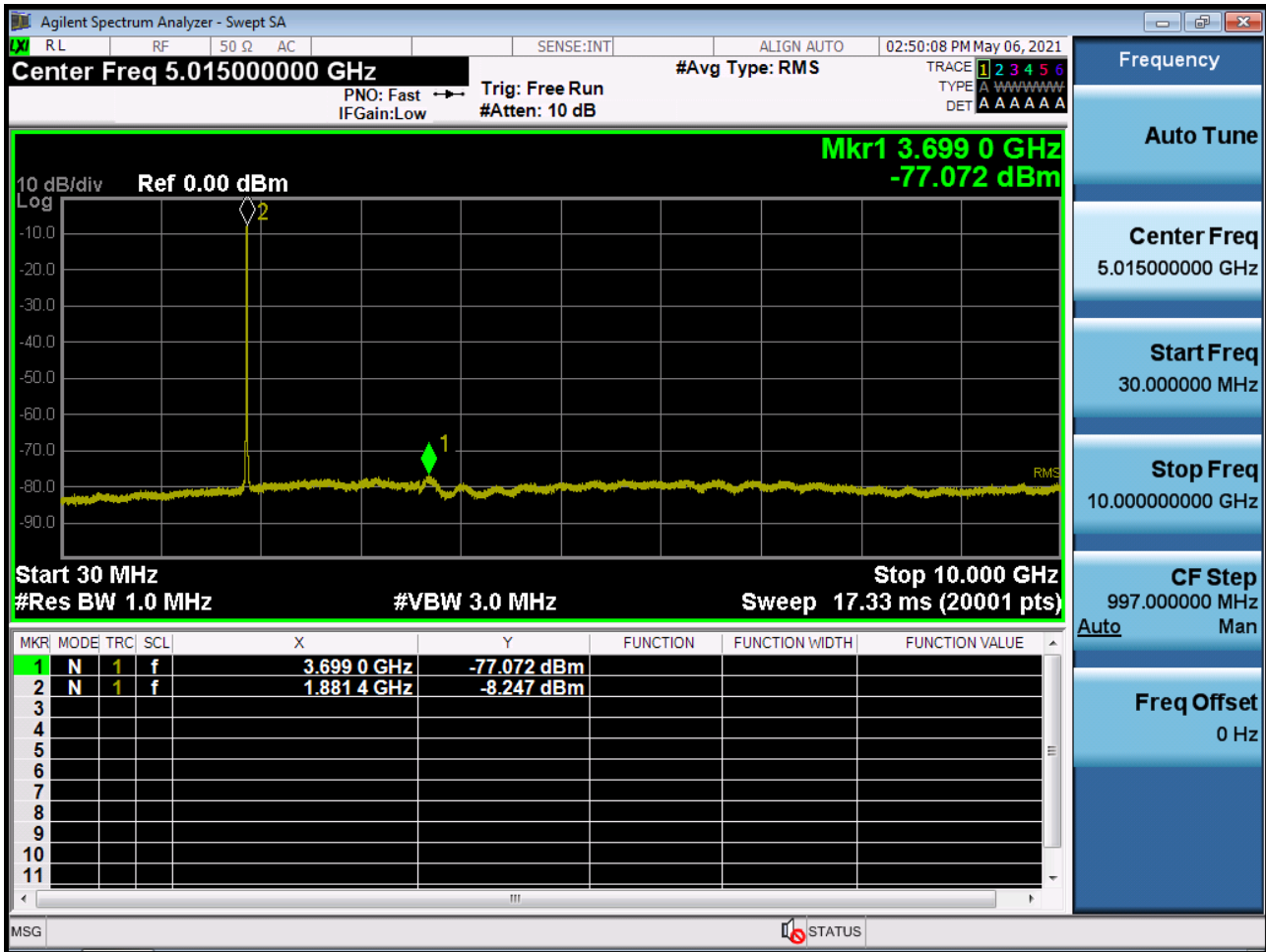
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions



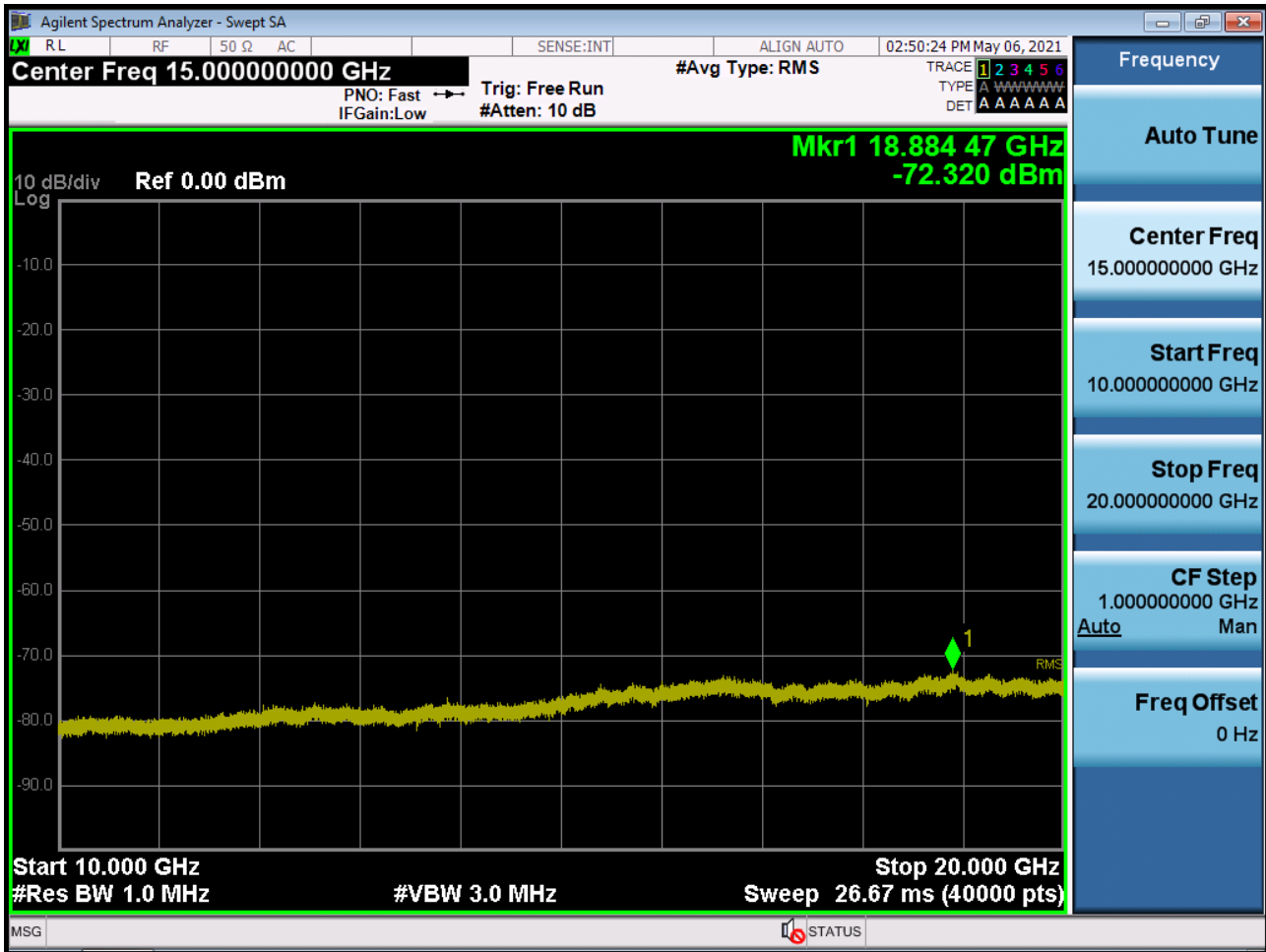
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



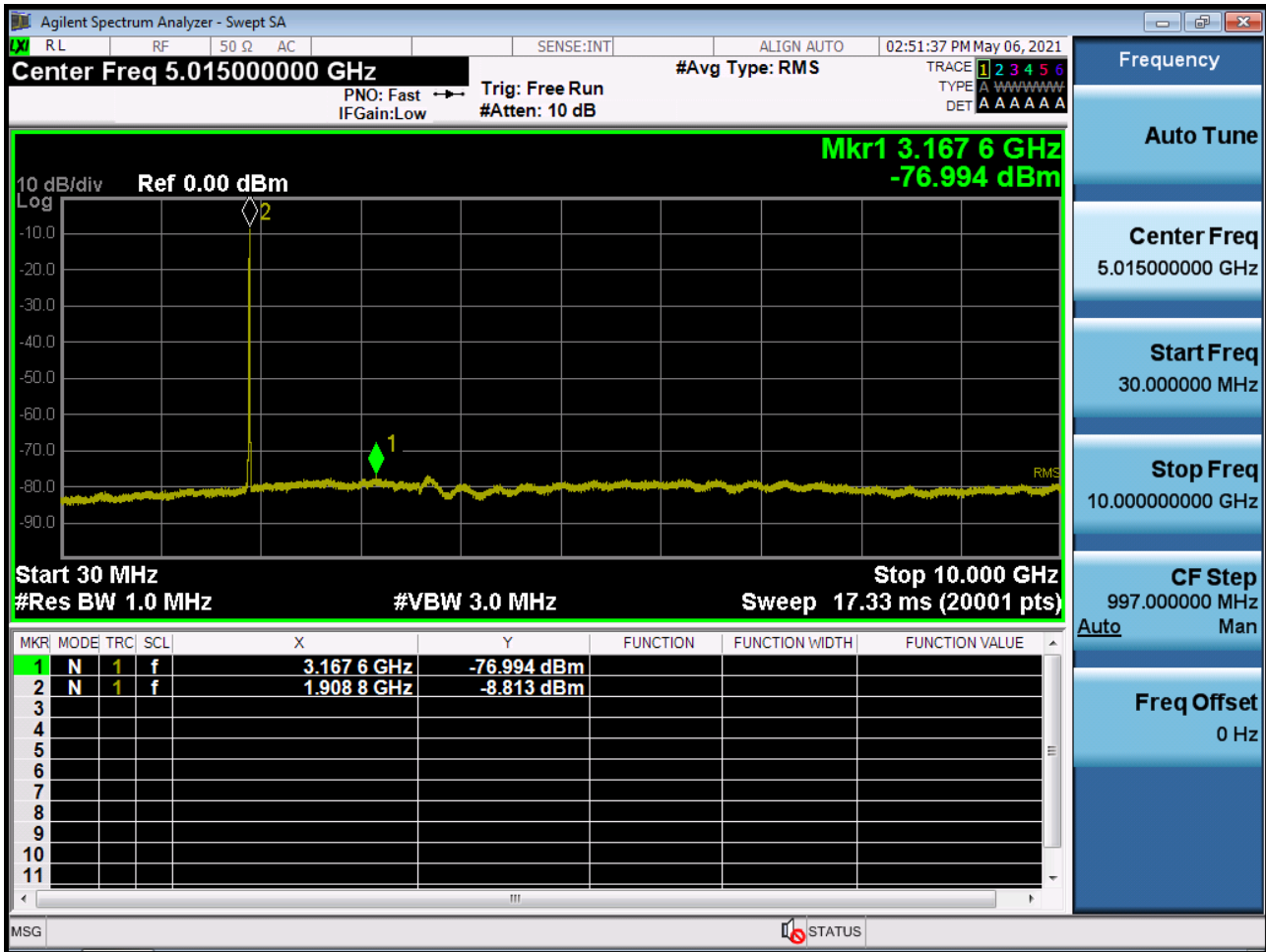
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



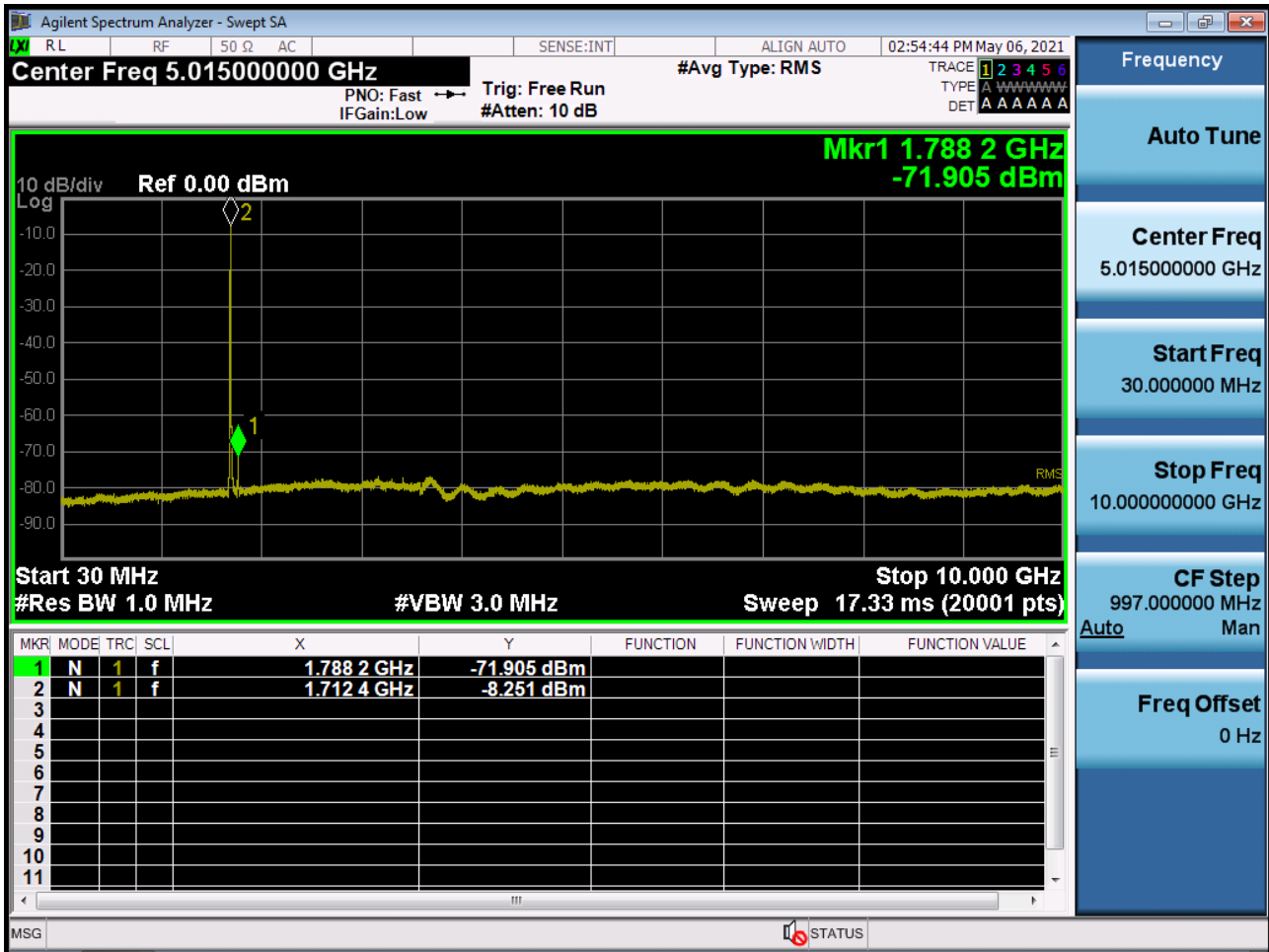
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



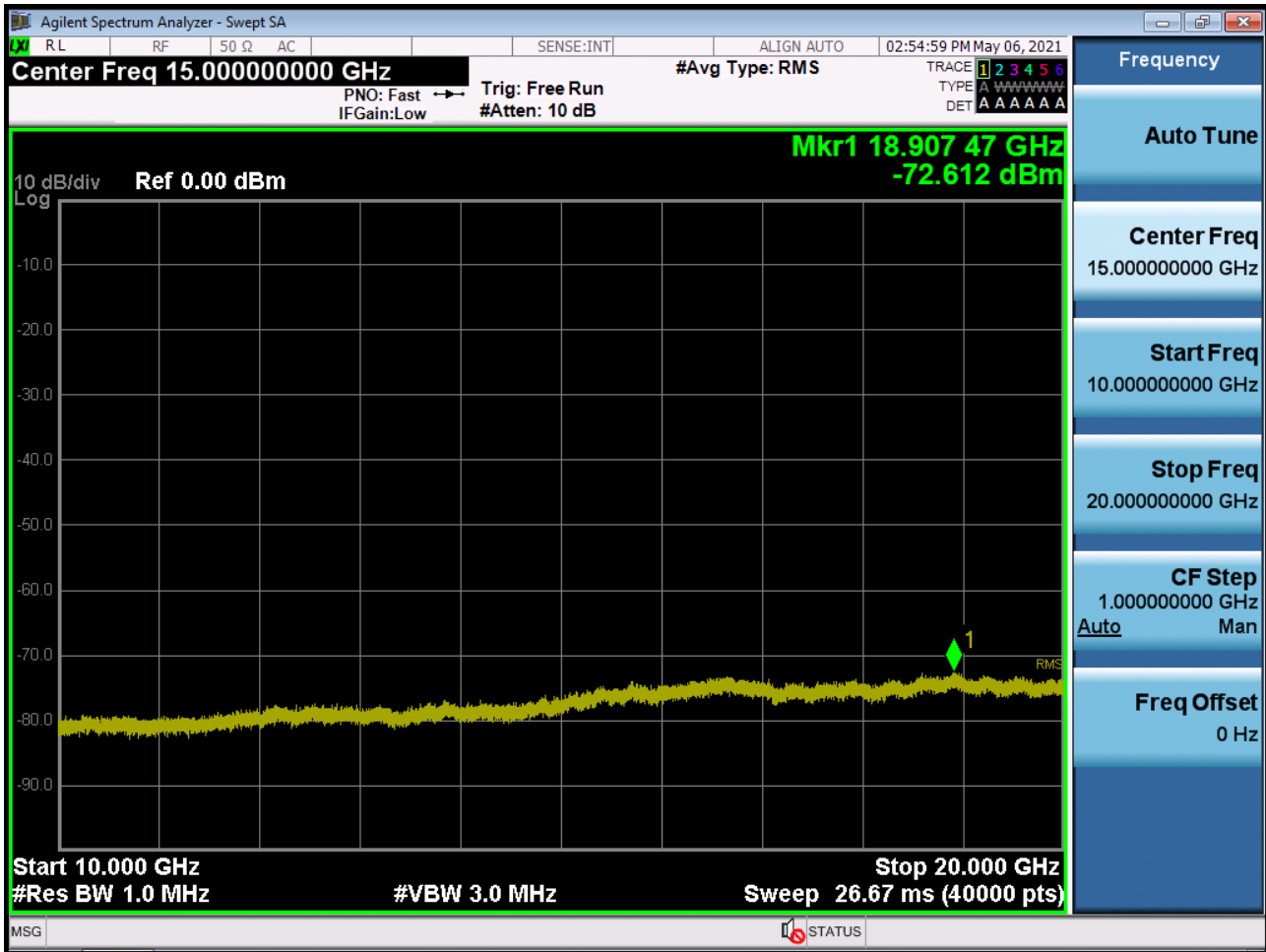
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



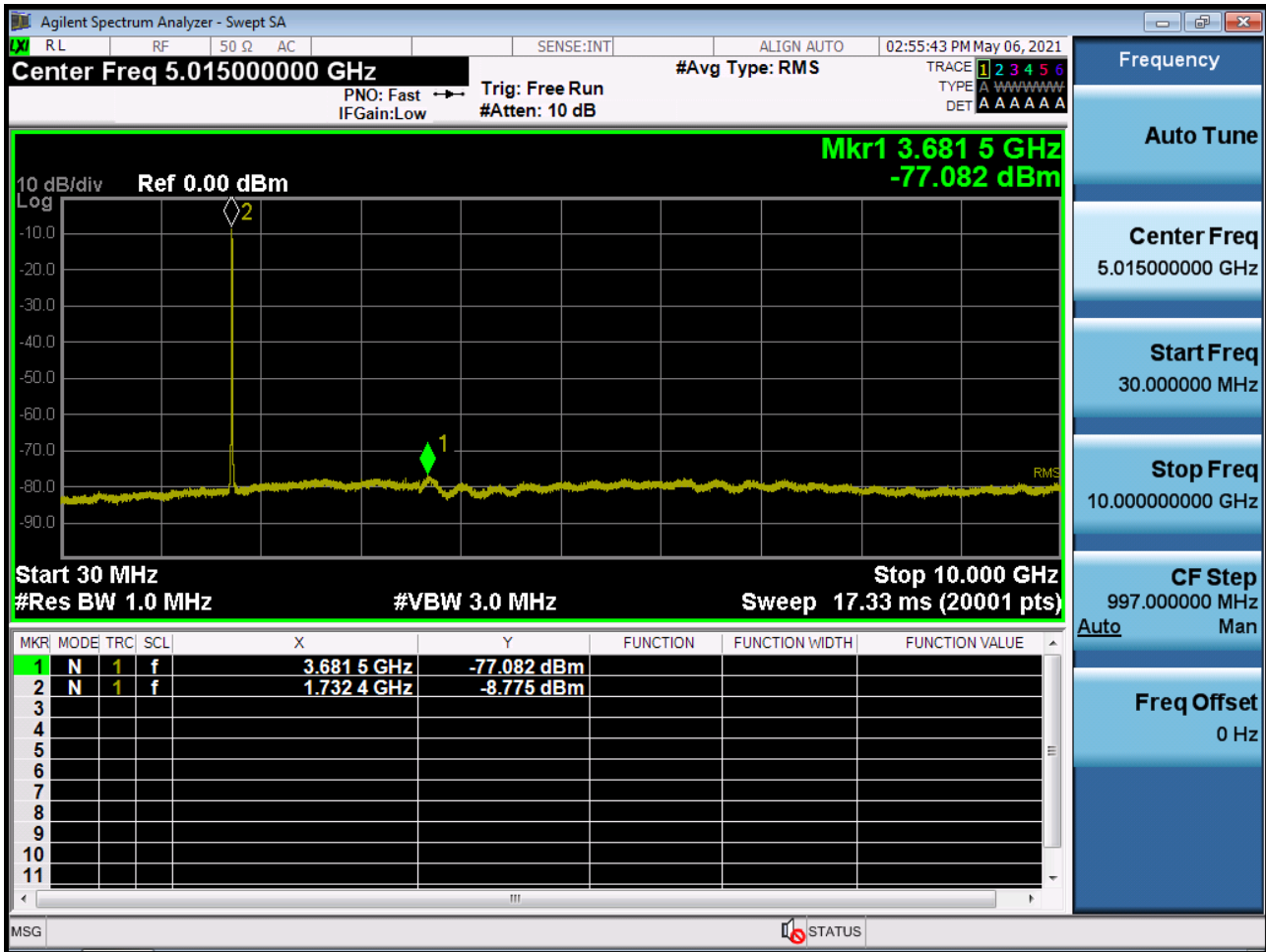
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



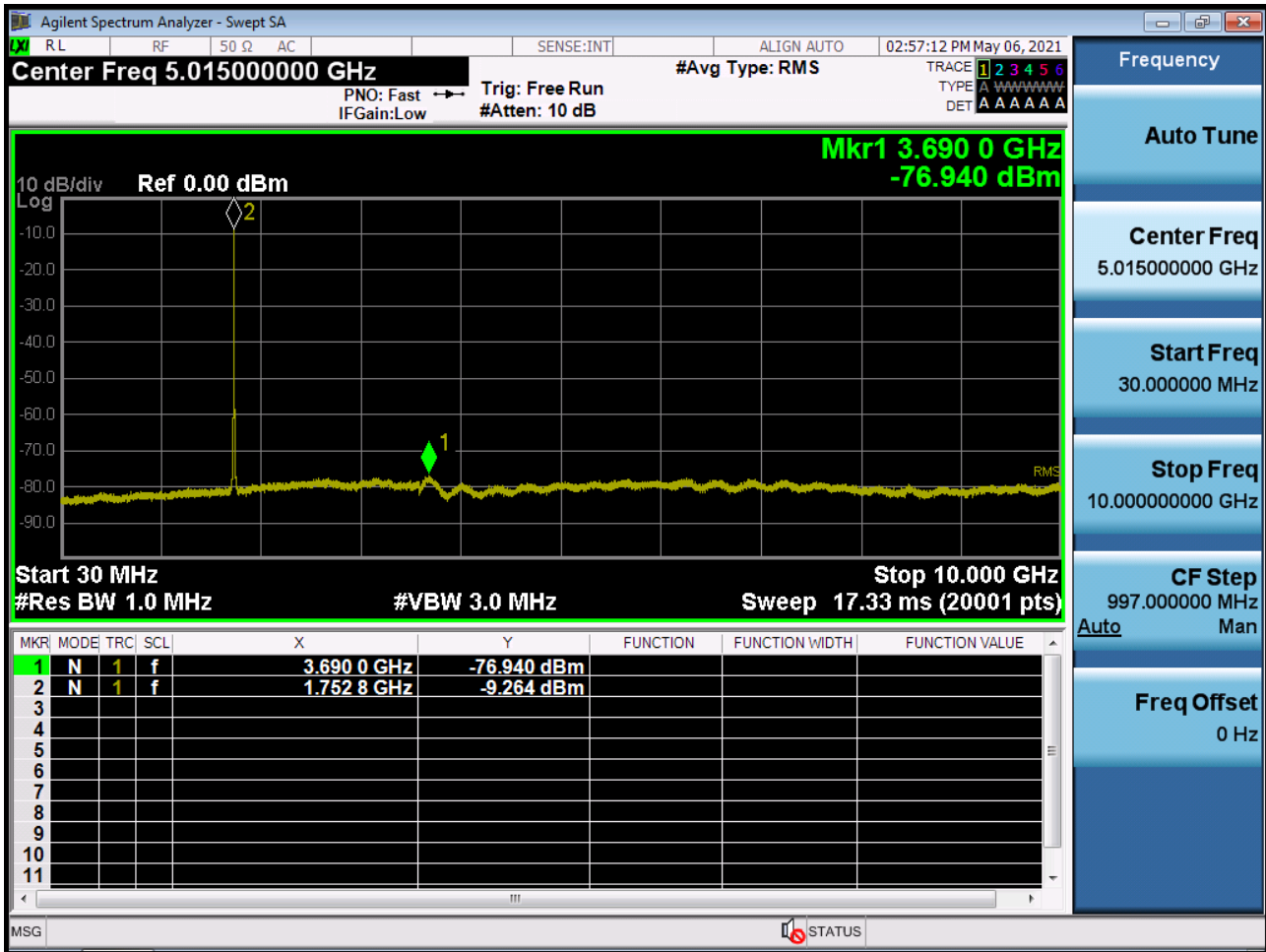
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



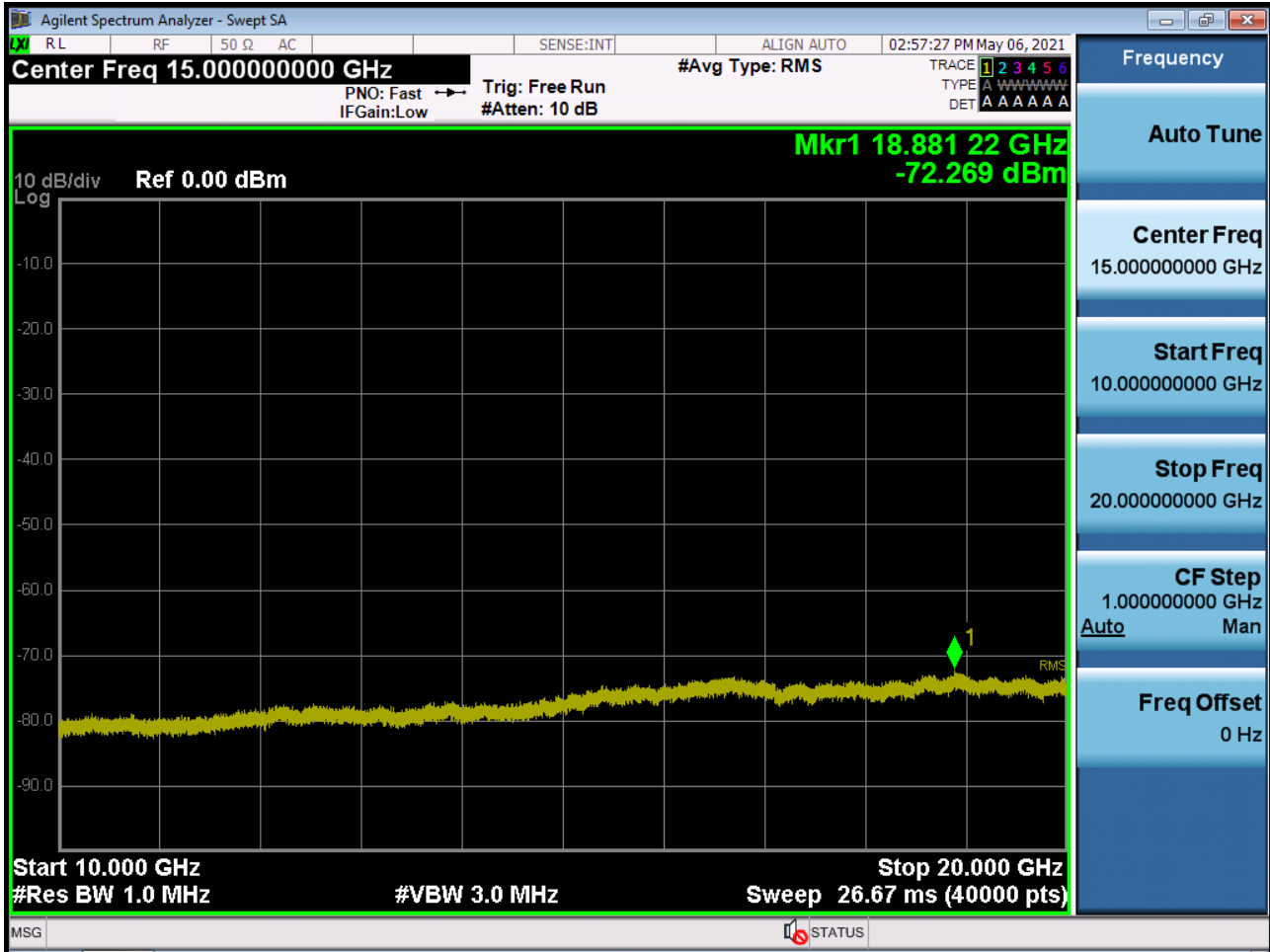
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2106-FC002-P