74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
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FCC 3G REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

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

Date of Issue:
May 09, 2023

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

Report No.: HCT-RF-2305-FC007

FCC ID:	**A3LSMX818U**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model(s):	SM-X818U
EUT Type:	Tablet
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§22, §24, §27, §2

Mode	Tx Frequency (MHz)	Rx Frequency (MHz)	Emission Designator	ERP	
				Max. Power (W)	Max. Power (dBm)
WCDMA850	826.4 – 846.6	871.4 – 891.6	4M16F9W	0.154	21.88

Mode	Tx Frequency (MHz)	Rx Frequency (MHz)	Emission Designator	EIRP	
				Max. Power (W)	Max. Power (dBm)
WCDMA1900	1852.4 – 1907.6	1932.4 – 1987.6	4M17F9W	0.188	22.75
WCDMA1700	1712.4 – 1752.6	2112.4 – 2152.6	4M16F9W	0.219	23.40

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

REVIEWED BY

Report prepared by : Jae 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)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2305-FC007	May 09, 2023	- First Approval Report

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

Table of Contents

MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMX818U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§22, §24, §27, §2
EUT Type:	Tablet
Model(s):	SM-X818U
Tx Frequency:	826.40 - 846.60 MHz (WCDMA850) 1 852.4 – 1 907.6 MHz (WCDMA1900) 1 712.4 – 1 752.6 MHz (WCDMA1700)
Rx Frequency:	871.40 - 891.60 MHz (WCDMA850) 1 932.4 – 1 987.6 MHz (WCDMA1900) 2 112.4 – 2 152.6 MHz (WCDMA1700)
Date(s) of Tests:	March 13, 2023 ~ April 17, 2023
Serial number:	Radiated: R32W2003H3M Conducted: R32W2003JJD

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Tablet with UMTS and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (20/40/80/160 MHz),WIFI 6E AIT, Keyboard, S-pen, mmWave.

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
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 ≥ 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;

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

   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 ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10^{th} harmonics from 9 kHz.

Test Note

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

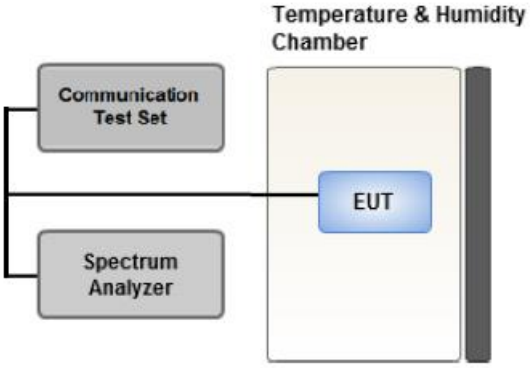
$$\text{Result}_{(dBm)} = P_g{}_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

   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 ≥ 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)

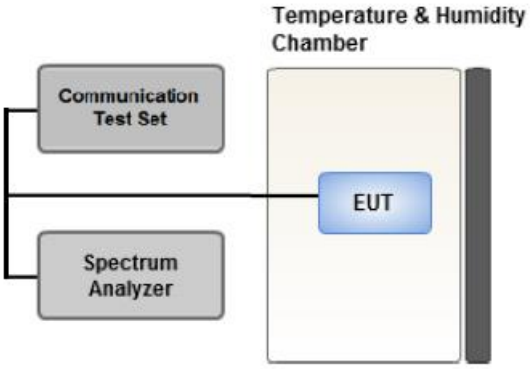
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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

Test Settings(Average Power)

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

3.5 OCCUPIED BANDWIDTH.



Test setup

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

The EUT makes a call to the communication simulator.

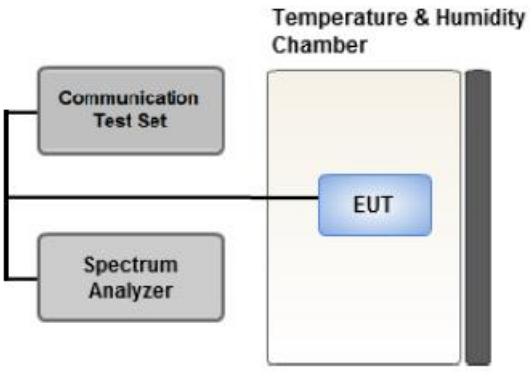
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 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 ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5 % of the 99 % occupied bandwidth observed in Step 7

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

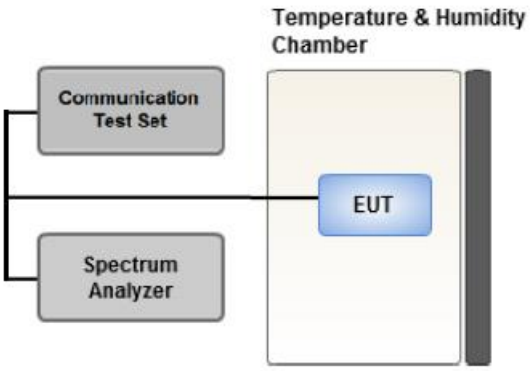
Test Settings(GSM)

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

Test Settings(WCDMA)

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

3.7 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

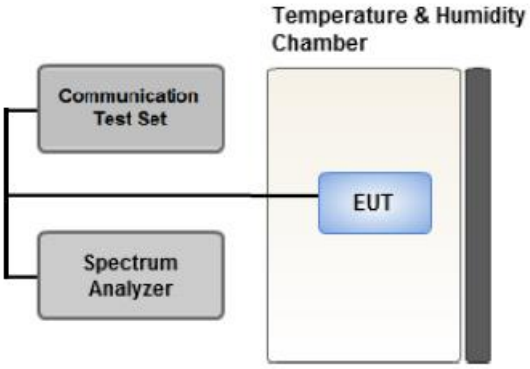
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1 % of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Notes

According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 x log(P) dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.
All measurements were done at 2 channels(low and high operational frequency range.)
The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

Where Margin < 1 dB the emission level is either corrected by 10 log(1 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.

[Worst case]

Test Description	Modulation	Test Channel
Occupied Bandwidth	WCDMA : QPSK(RMC)	Low, Mid, High
Band Edge	WCDMA : QPSK(RMC)	Low, High
Peak-To-Average Ratio	WCDMA : QPSK(RMC)	Mid
Spurious and Harmonic Emissions at Antenna Terminal	WCDMA : QPSK(RMC)	Low, Mid, High

[Test Channel]

	Uplink Channel		
	3G (WCDMA B2)	**3G (WCDMA B4)**	**3G (WCDMA B5)**
Low	9262	1312	4132
Mid	9400	1412	4183
High	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.

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

[Test Channel]

	Uplink Channel		
	3G (WCDMA B2)	**3G (WCDMA B4)**	**3G (WCDMA B5)**
Low	9262	1312	4132
Mid	9400	1412	4183
High	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	-	01/19/2024	Annual
H.P.F	FBSR-02B(WHK3.3/18 G-10EF)	T&M SYSTEM	-	01/19/2024	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	5001	04/19/2024	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/21/2023	Annual
Dipole Antenna	UHAP	Schwarzbeck	557	03/09/2025	Biennial
Dipole Antenna	UHAP	Schwarzbeck	558	03/09/2025	Biennial
Chamber	SU-642	ESPEC	93008124	02/22/2024	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/30/2023	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/15/2023	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/29/2024	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	04/20/2024	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/19/2024	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	REOHDE & SCHWARZ	100931	08/29/2023	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/18/2023	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/17/2024	Biennial
Trilog Broadband Antenna	VULB9168	Schwarzbeck	895	08/16/2024	Biennial
Trilog Broadband Antenna	VULB9168	Schwarzbeck	1135	03/21/2024	Biennial
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262094331	12/01/2023	Annual
Wideband Radio Communication Tester	MT8820C	Anritsu Corp.	6201026545	01/05/2024	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/05/2023	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_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.90 (Confidence level about 95 %, k=2)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.14 (Confidence level about 95 %, k=2)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.82 (Confidence level about 95 %, k=2)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.74 (Confidence level about 95 %, k=2)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.76 (Confidence level about 95 %, k=2)
Radiated Disturbance (Above 40 GHz)	5.52 (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	See Note1
Peak- to- Average Ratio	§24.232(d), §27.50(d)(5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, § 22.355	< 2.5 ppm	PASS
	§24.235, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS
Equivalent Isotropic Radiated Power	§24.232(c), §27.50(d)(4)	< 2 Watts max. EIRP < 1 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a), §24.238(a), §27.53(h)	< 43 + 10 x log10 (P[Watts]) for all out-of band emissions	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test , the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.

2) During the test , the turn table is rotated until the maximum signal is found.

3) Record the field strength meter's level.

4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.

5) Increase the signal generator output till the field strength meter's level is equal to the item (3).

6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission 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
WCDMA850	4132	826.4	-28.16	33.00	-9.94	1.42	V	< 7.00	0.146	21.64
	4183	836.6	-27.84	33.25	-9.94	1.43	V		0.154	21.88
	4233	846.6	-28.28	32.95	-9.93	1.43	V		0.144	21.59

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
WCDMA1900	9262	1852.4	-20.04	13.74	10.40	2.13	H	< 2.00	0.159	22.01
	9400	1880.0	-20.04	14.58	10.40	2.23	H		0.188	22.75
	9538	1907.6	-20.09	14.48	10.40	2.14	H		0.188	22.74

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	-18.05	15.06	10.04	2.06	H	< 1.00	0.201	23.04
	1412	1732.4	-18.54	14.61	10.12	2.06	H		0.185	22.67
	1513	1752.6	-17.86	15.29	10.20	2.09	H		0.219	23.40

8.3 RADIATED SPURIOUS EMISSIONS

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
4 132 (826.4)	1 652.80	-53.03	9.70	-63.62	2.04	V	-55.96	-13.00
	2 479.20	-55.31	10.54	-60.24	2.49	V	-52.19	-13.00
	3 305.60	-57.52	12.13	-58.33	2.99	V	-49.19	-13.00
4 183 (836.6)	1 673.20	-52.79	9.82	-63.52	2.06	H	-55.76	-13.00
	2 509.80	-54.16	10.70	-57.79	2.49	V	-49.58	-13.00
	3 346.40	-58.59	12.37	-59.95	3.02	H	-50.59	-13.00
4 233 (846.6)	1 693.20	-52.39	9.94	-62.74	2.05	V	-54.85	-13.00
	2 539.80	-55.67	10.70	-59.81	2.53	V	-51.64	-13.00
	3 386.40	-58.62	12.54	-59.90	2.98	H	-50.33	-13.00

▣ MODULATION SIGNAL: WCDMA1900

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
9262 (1852.4)	3 704.80	-54.11	12.30	-59.00	3.12	H	-49.81	-13.00
	5 557.20	-57.27	13.20	-55.22	3.87	H	-45.89	-13.00
	7 409.60	-56.83	10.80	-46.58	4.57	H	-40.35	-13.00
9400 (1880.0)	3 760.00	-56.09	12.32	-60.59	3.08	V	-51.35	-13.00
	5 640.00	-56.08	13.10	-54.27	3.90	V	-45.07	-13.00
	7 520.00	-57.89	10.84	-47.31	4.61	H	-41.08	-13.00
9538 (1907.6)	3 815.20	-55.67	12.40	-60.11	3.14	H	-50.84	-13.00
	5 722.80	-56.72	13.06	-54.43	3.91	V	-45.28	-13.00
	7 630.40	-57.09	11.22	-46.79	4.66	H	-40.23	-13.00

▣ MODULATION SIGNAL: WCDMA1700

▣ DISTANCE: 3 meters

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit
1312 (1712.4)	3 424.80	-55.01	12.55	-61.58	3.01	H	-52.03	-13.00
	5 137.20	-56.56	12.28	-53.92	3.71	V	-45.35	-13.00
	6 849.60	-56.85	12.00	-50.31	4.38	H	-42.69	-13.00
1412 (1732.4)	3 464.80	-55.32	12.47	-61.84	2.97	V	-52.33	-13.00
	5 197.20	-57.81	12.50	-56.86	3.78	H	-48.14	-13.00
	6 929.60	-57.03	11.78	-49.39	4.38	H	-41.99	-13.00
1513 (1752.6)	3 505.20	-55.16	12.40	-61.11	3.00	V	-51.71	-13.00
	5 257.80	-55.87	12.84	-55.27	3.74	H	-46.17	-13.00
	7 010.40	-56.81	11.34	-48.36	4.42	V	-41.44	-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)			
WCDMA850	4408	CCDF Procedure					3.11	13	Pass
WCDMA1900	9400						3.03		
WCDMA1700	1412						2.96		

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 48 ~ 50.

8.5 OCCUPIED BANDWIDTH

Band	Channel	Frequency(MHz)	Data (MHz)
WCDMA850	4132	826.40	4.1601
	4183	836.60	4.1522
	4233	846.60	4.1323
WCDMA1900	9262	1852.40	4.1572
	9400	1880.00	4.1651
	9538	1907.60	4.1689
WCDMA1700	1312	1712.40	4.1473
	1412	1732.40	4.1554
	1513	1752.60	4.1601

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 39 ~ 47.

8.6 CONDUCTED SPURIOUS EMISSIONS

Band	Channel	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result	(dBm)
WCDMA850	4132	3.7064	27.976	-76.852	-48.876	-13.00
	4183	3.6995	27.976	-77.019	-49.043	
	4233	2.5409	27.976	-76.855	-48.879	
WCDMA1900	9262	18.9250	29.489	-72.326	-42.837	
	9400	18.8647	29.489	-72.415	-42.926	
	9538	18.9080	29.489	-72.523	-43.034	
WCDMA1700	1312	18.95497	29.489	-72.496	-43.007	
	1412	18.93772	29.489	-72.559	-43.070	
	1513	18.93097	29.489	-71.921	-42.432	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 63 ~ 77.

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 51 ~ 62.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ Mode: WCDMA850

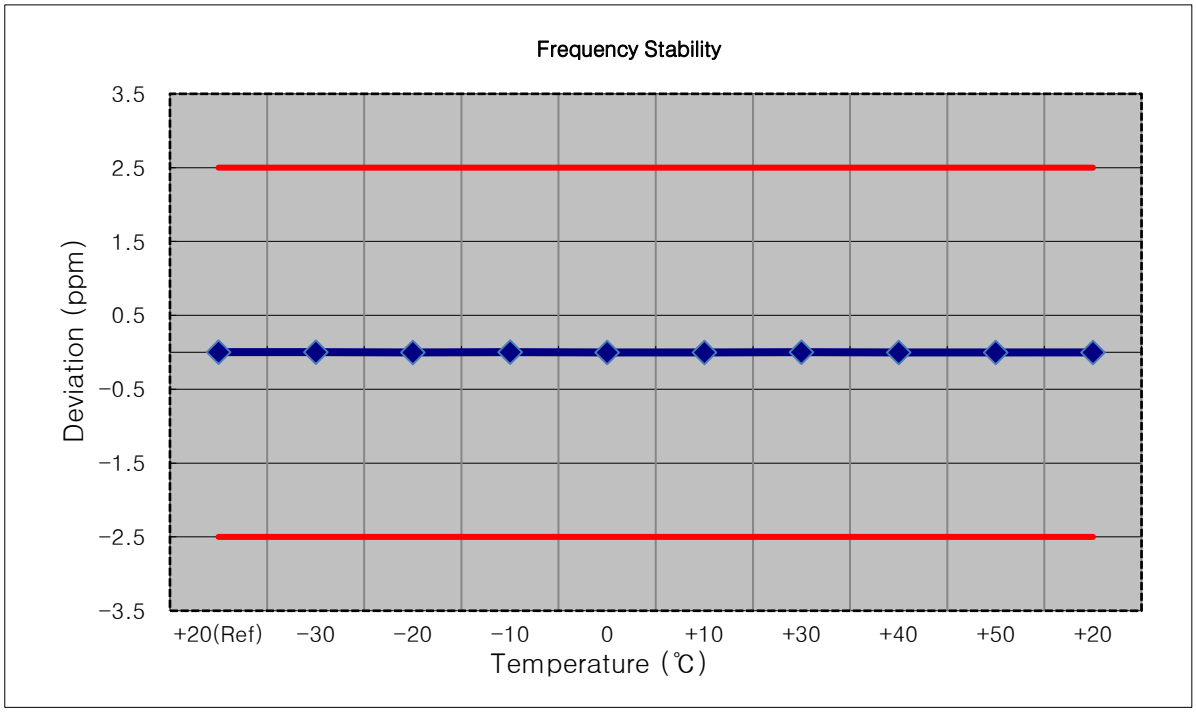
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 4183

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	836 600 001	0.0	0.000 000	0.0000
100 %		-30	836 600 002	1.1	0.000 000	0.0013
100 %		-20	836 600 000	-0.7	0.000 000	-0.0009
100 %		-10	836 600 002	0.8	0.000 000	0.0010
100 %		0	836 600 000	-1.0	0.000 000	-0.0012
100 %		+10	836 600 000	-0.9	0.000 000	-0.0011
100 %		+30	836 600 002	1.5	0.000 000	0.0018
100 %		+40	836 599 999	-1.3	0.000 000	-0.0016
100 %		+50	836 600 000	-1.1	0.000 000	-0.0013
Batt. Endpoint	3.400	+20	836 599 999	-1.4	0.000 000	-0.0017



▣ Mode: WCDMA1900

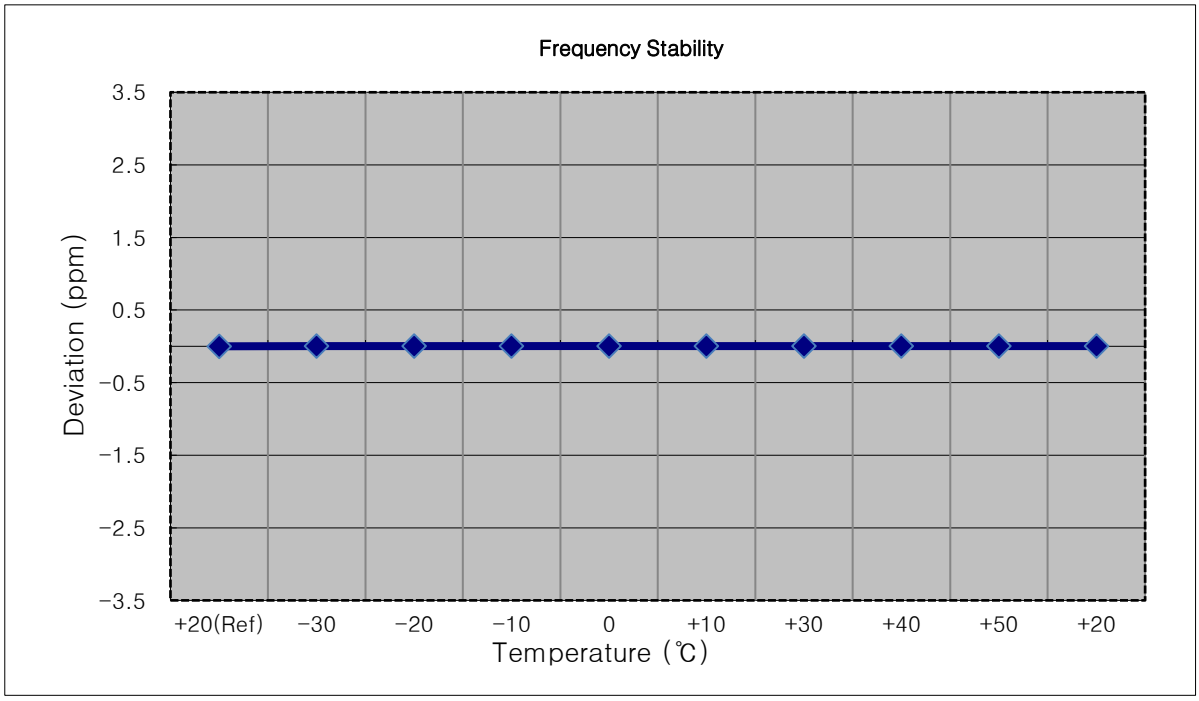
▣ OPERATING FREQUENCY: 1,852,400,000 Hz

▣ CHANNEL: 9262

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1852 400 007	0.0	0.000 000	0.0000
100 %		-30	1852 400 013	6.4	0.000 000	0.0034
100 %		-20	1852 400 013	6.7	0.000 000	0.0036
100 %		-10	1852 400 013	6.8	0.000 000	0.0037
100 %		0	1852 400 014	7.9	0.000 000	0.0043
100 %		+10	1852 400 012	5.8	0.000 000	0.0031
100 %		+30	1852 400 014	7.0	0.000 000	0.0038
100 %		+40	1852 400 013	6.3	0.000 000	0.0034
100 %		+50	1852 400 013	6.0	0.000 000	0.0033
Batt. Endpoint	3.400	+20	1852 400 013	6.4	0.000 000	0.0034



▣ Mode: WCDMA1900

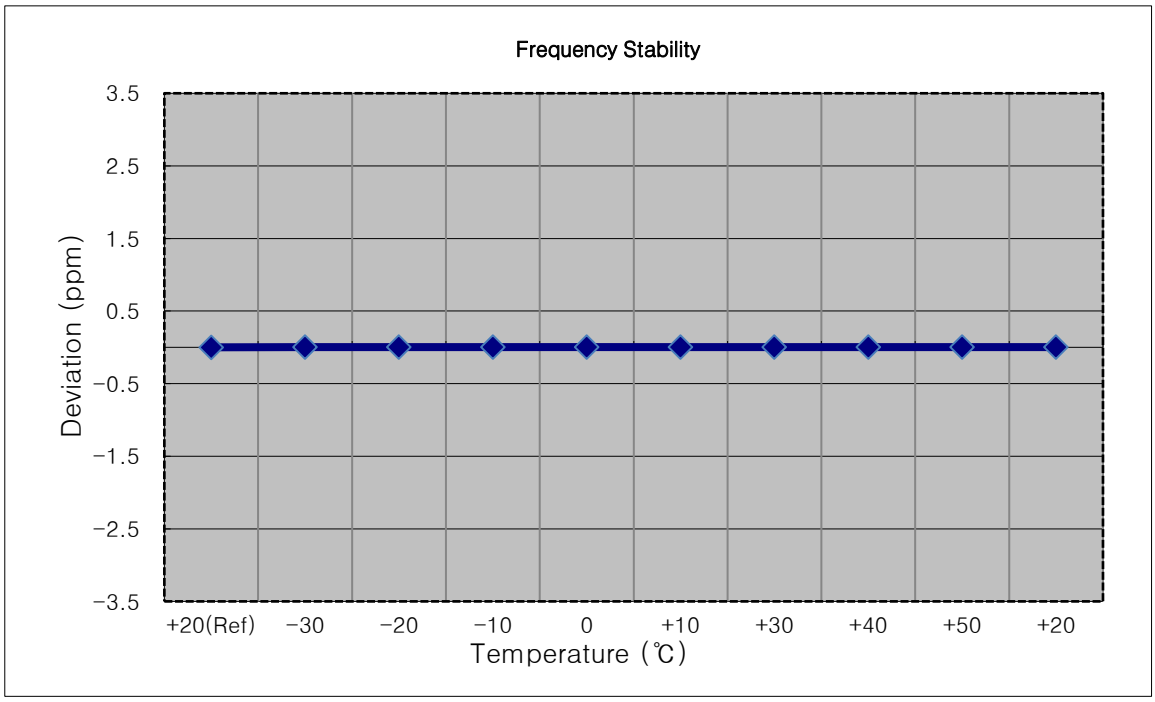
▣ OPERATING FREQUENCY: 1,880,000,000 Hz

▣ CHANNEL: 9400

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1880 000 003	0.0	0.000 000	0.0000
100 %		-30	1880 000 006	3.3	0.000 000	0.0018
100 %		-20	1880 000 009	5.6	0.000 000	0.0030
100 %		-10	1880 000 007	3.8	0.000 000	0.0020
100 %		0	1880 000 009	6.3	0.000 000	0.0033
100 %		+10	1880 000 007	4.0	0.000 000	0.0021
100 %		+30	1880 000 006	2.9	0.000 000	0.0016
100 %		+40	1880 000 006	2.8	0.000 000	0.0015
100 %		+50	1880 000 007	4.0	0.000 000	0.0021
Batt. Endpoint	3.400	+20	1880 000 006	3.2	0.000 000	0.0017



▣ Mode: WCDMA1900

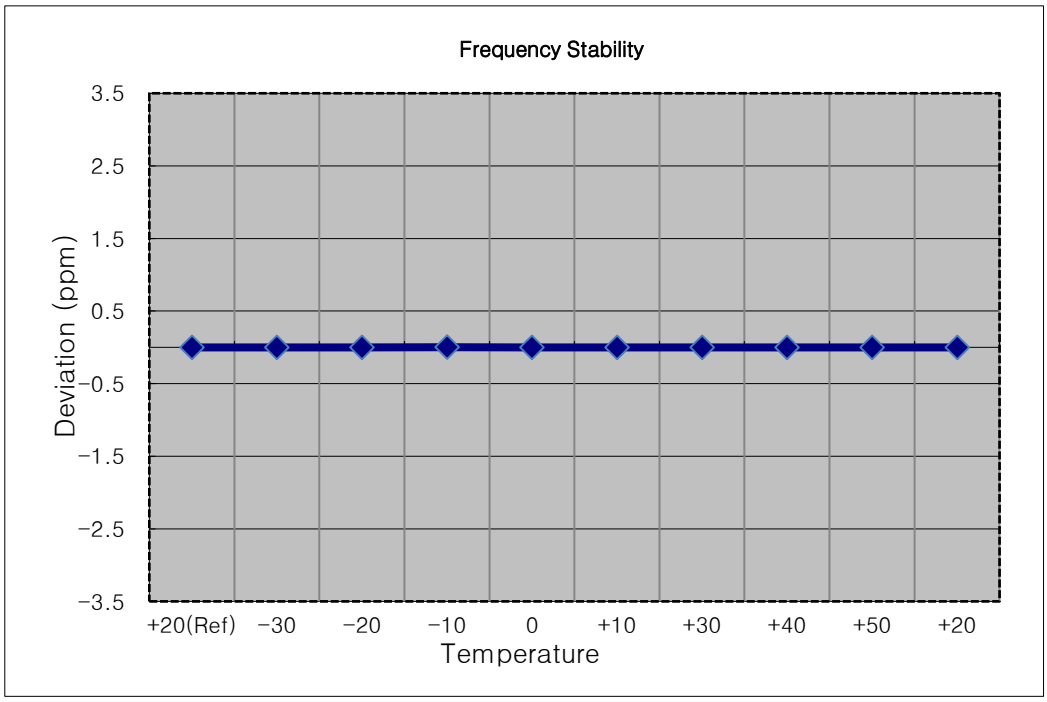
▣ OPERATING FREQUENCY: 1,907,600,000 Hz

▣ CHANNEL: 9538

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1907 599 997	0.0	0.000 000	0.0000
100 %		-30	1907 599 996	-1.8	0.000 000	-0.0009
100 %		-20	1907 599 995	-2.4	0.000 000	-0.0013
100 %		-10	1907 600 001	3.3	0.000 000	0.0017
100 %		0	1907 599 995	-2.4	0.000 000	-0.0012
100 %		+10	1907 599 999	1.5	0.000 000	0.0008
100 %		+30	1907 599 995	-2.2	0.000 000	-0.0012
100 %		+40	1907 599 996	-1.5	0.000 000	-0.0008
100 %		+50	1907 599 995	-2.4	0.000 000	-0.0013
Batt. Endpoint	3.400	+20	1907 599 995	-2.1	0.000 000	-0.0011



▣ Mode: WCDMA1700

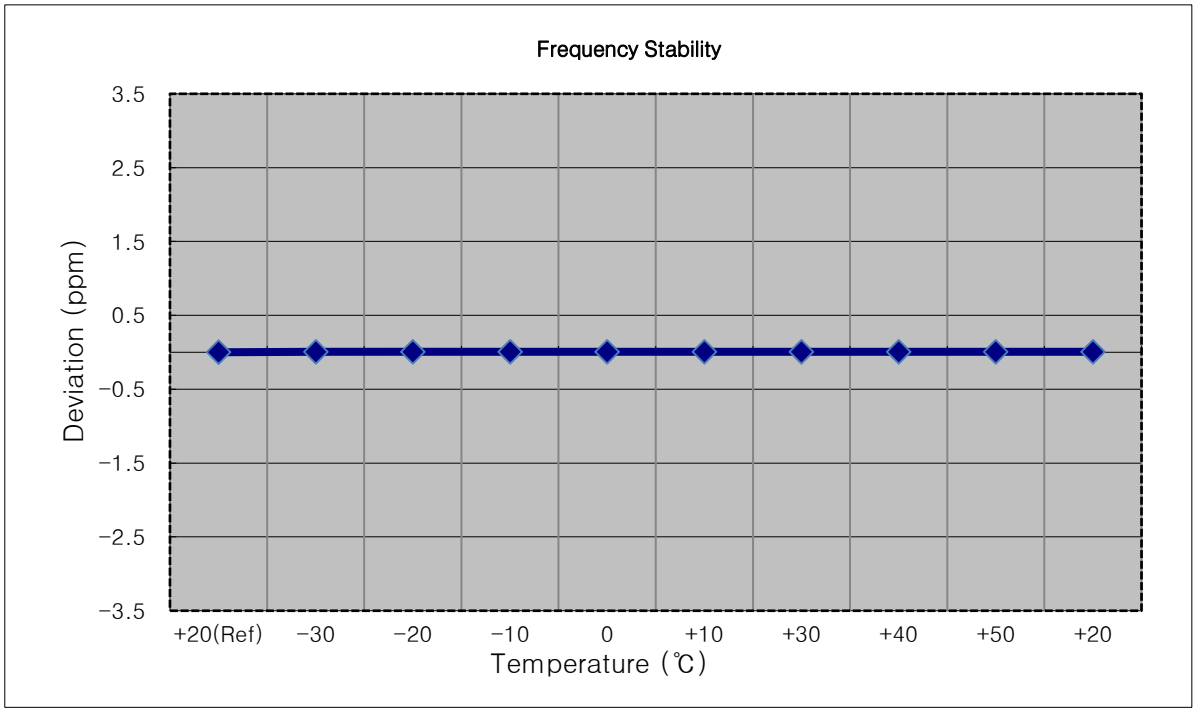
▣ OPERATING FREQUENCY: 1,712,400,000 Hz

▣ CHANNEL: 1312

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1712 400 011	0.0	0.000 000	0.0000
100 %		-30	1712 400 021	10.2	0.000 001	0.0059
100 %		-20	1712 400 022	11.7	0.000 001	0.0068
100 %		-10	1712 400 022	11.2	0.000 001	0.0065
100 %		0	1712 400 021	10.5	0.000 001	0.0061
100 %		+10	1712 400 021	10.6	0.000 001	0.0062
100 %		+30	1712 400 021	10.6	0.000 001	0.0062
100 %		+40	1712 400 022	11.3	0.000 001	0.0066
100 %		+50	1712 400 022	11.4	0.000 001	0.0067
Batt. Endpoint	3.400	+20	1712 400 022	11.3	0.000 001	0.0066



▣ Mode: WCDMA1700

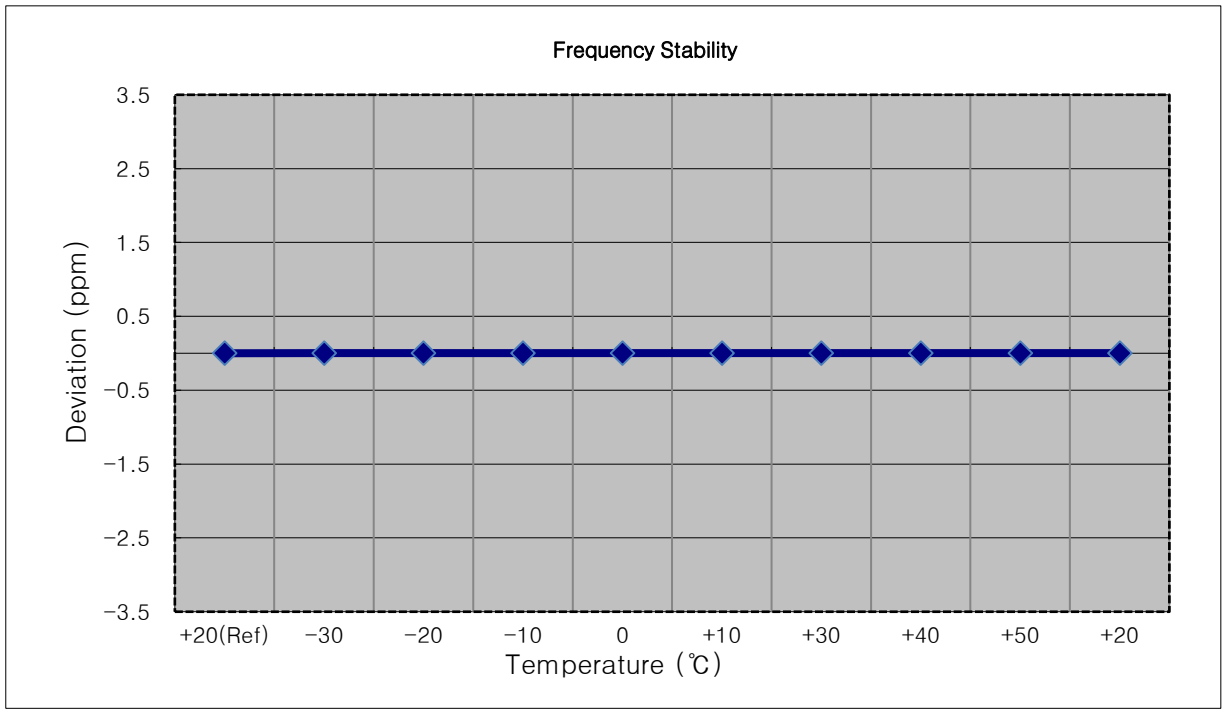
▣ OPERATING FREQUENCY: 1,732,400,000 Hz

▣ CHANNEL: 1412

▣ REFERENCE VOLTAGE: 3.880 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1732 400 003	0.0	0.000 000	0.0000
100 %		-30	1732 400 006	2.7	0.000 000	0.0015
100 %		-20	1732 400 005	2.3	0.000 000	0.0014
100 %		-10	1732 400 006	3.0	0.000 000	0.0017
100 %		0	1732 400 006	2.8	0.000 000	0.0016
100 %		+10	1732 400 004	1.5	0.000 000	0.0009
100 %		+30	1732 400 005	2.4	0.000 000	0.0014
100 %		+40	1732 400 005	2.2	0.000 000	0.0013
100 %		+50	1732 400 005	2.4	0.000 000	0.0014
Batt. Endpoint	3.400	+20	1732 400 006	2.7	0.000 000	0.0016



▣ Mode: WCDMA1700

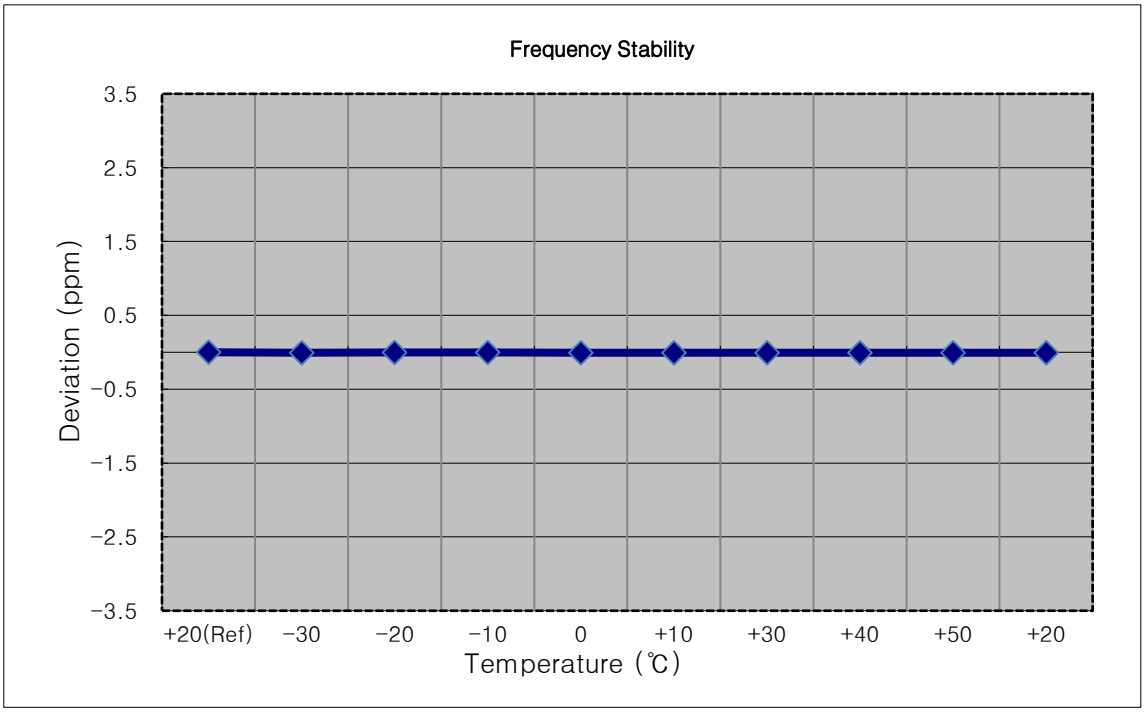
▣ OPERATING FREQUENCY: 1,752,600,000 Hz

▣ CHANNEL: 1513

▣ REFERENCE VOLTAGE: 3.880 VDC

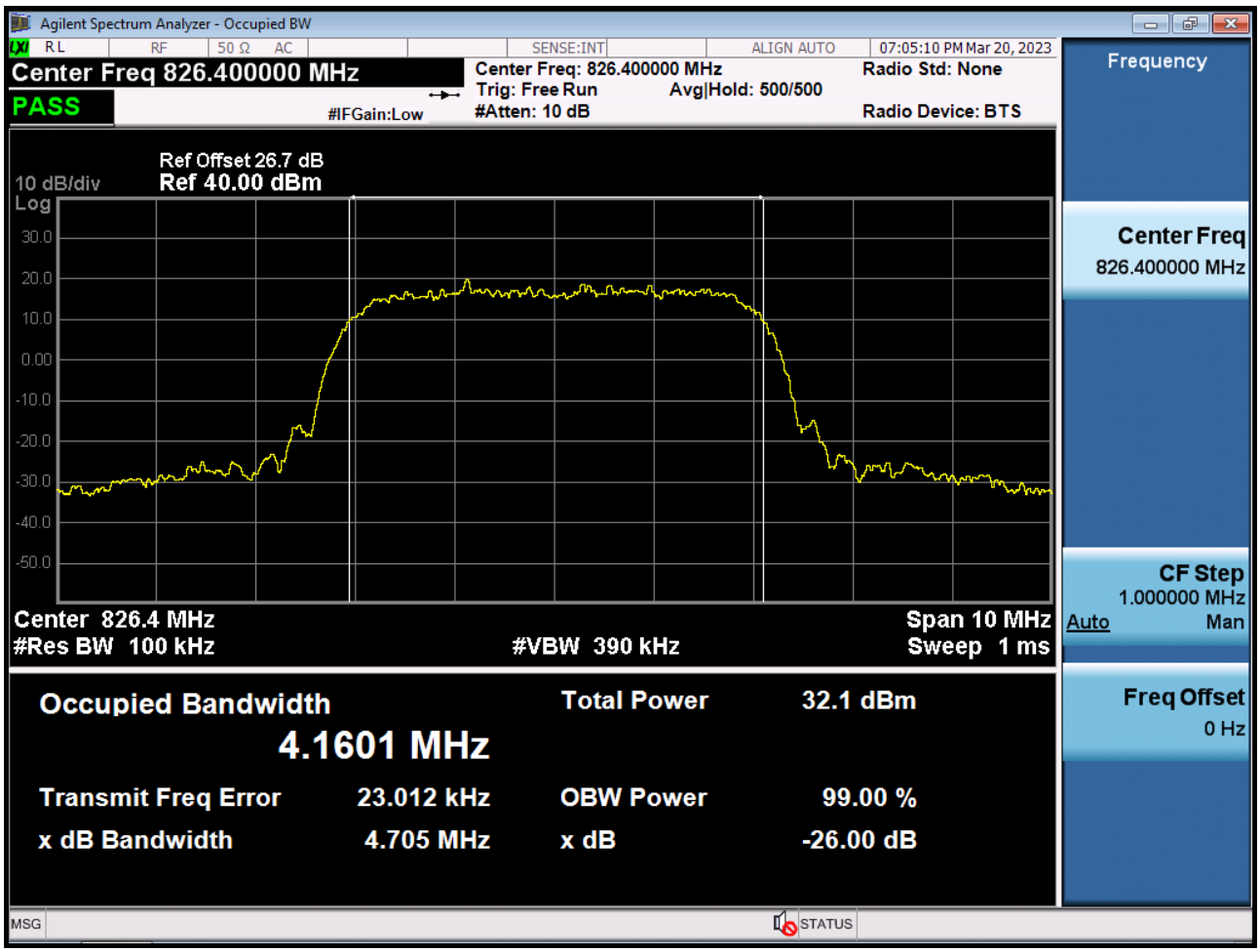
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	1752 599 992	0.0	0.000 000	0.0000
100 %		-30	1752 599 984	-8.1	0.000 000	-0.0046
100 %		-20	1752 599 984	-7.6	0.000 000	-0.0043
100 %		-10	1752 599 984	-7.5	0.000 000	-0.0043
100 %		0	1752 599 984	-8.4	0.000 000	-0.0048
100 %		+10	1752 599 984	-8.5	0.000 000	-0.0048
100 %		+30	1752 599 982	-10.1	-0.000 001	-0.0057
100 %		+40	1752 599 984	-7.7	0.000 000	-0.0044
100 %		+50	1752 599 984	-8.1	0.000 000	-0.0046
Batt. Endpoint	3.400	+20	1752 599 984	-8.1	0.000 000	-0.0046

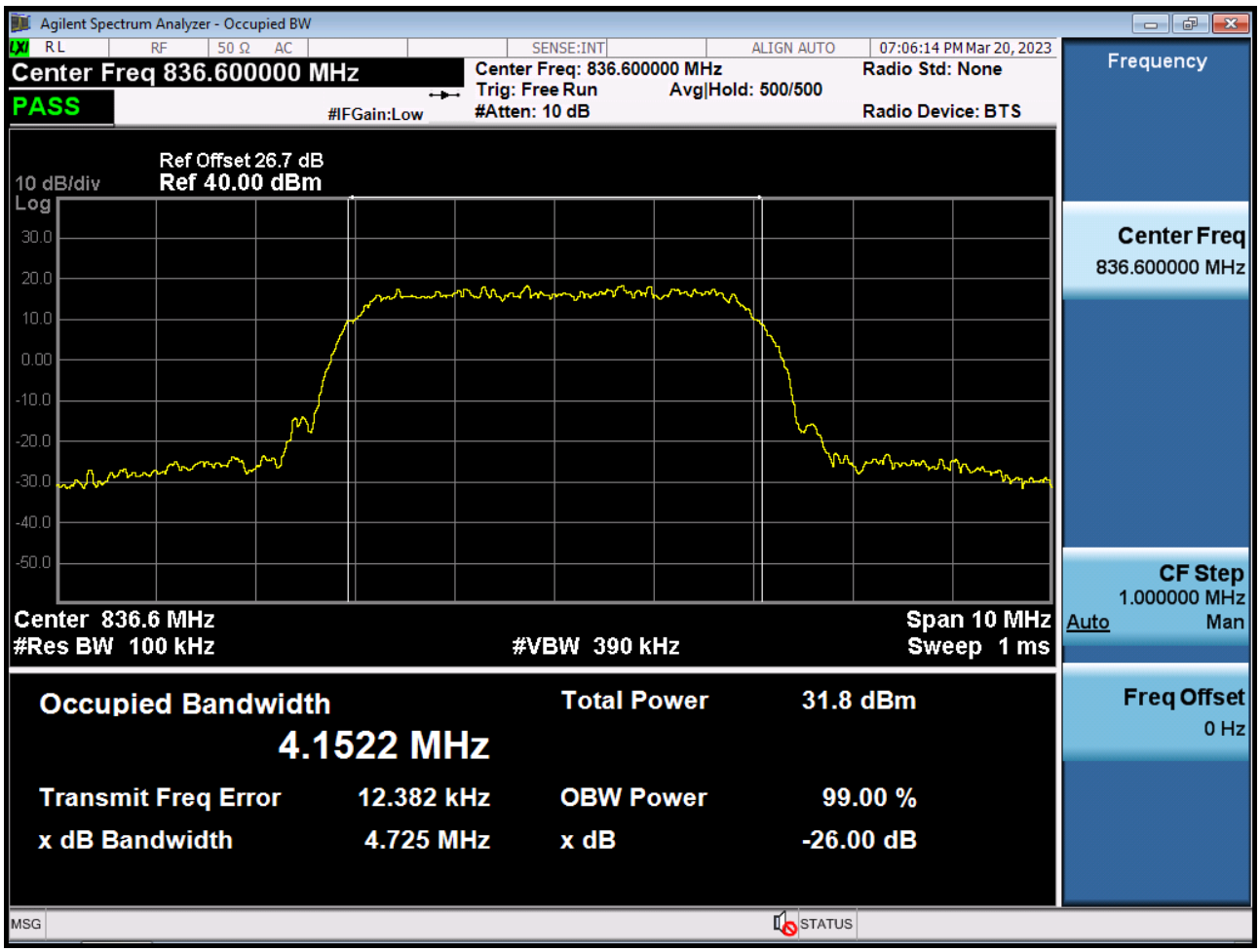


9. TEST PLOTS

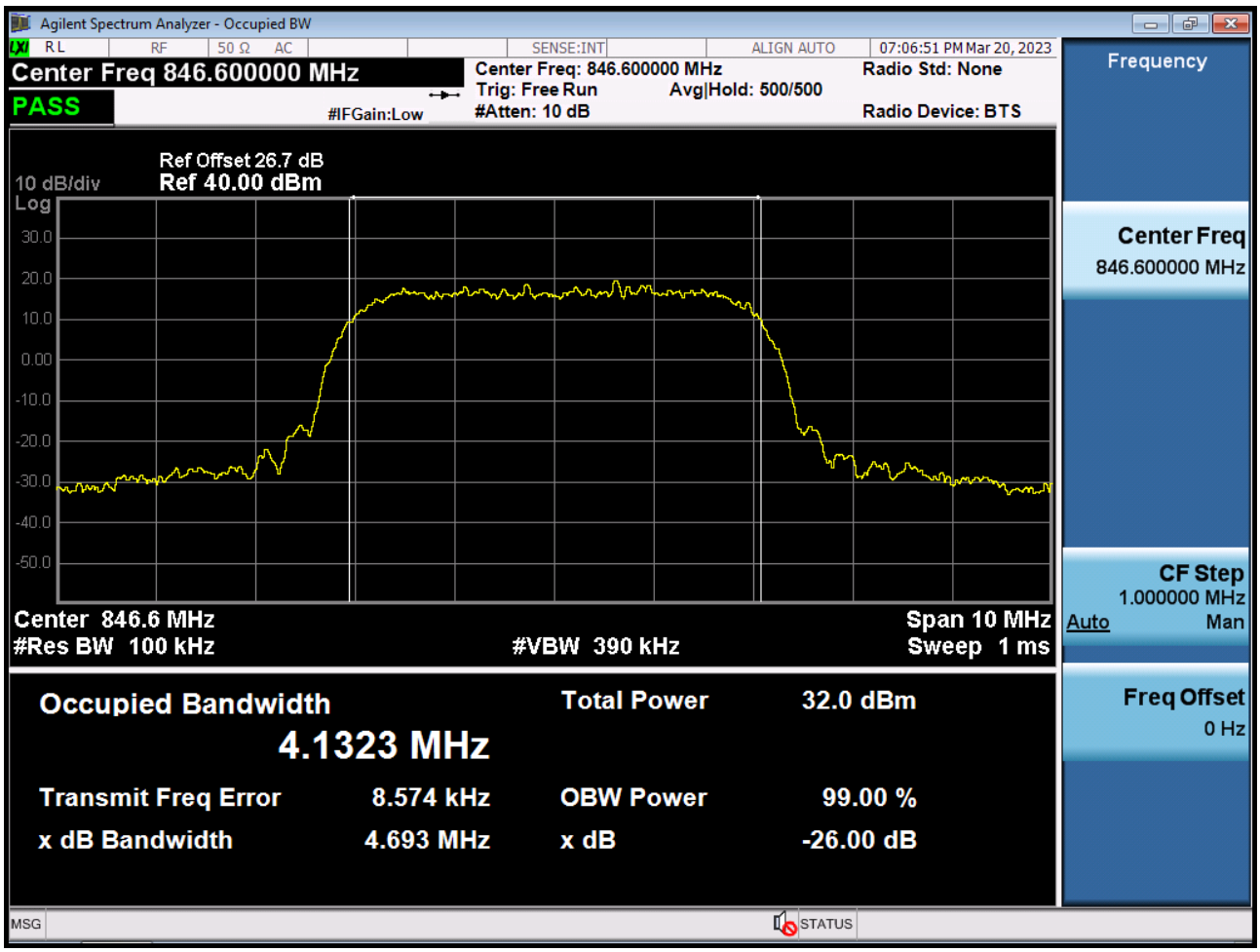
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



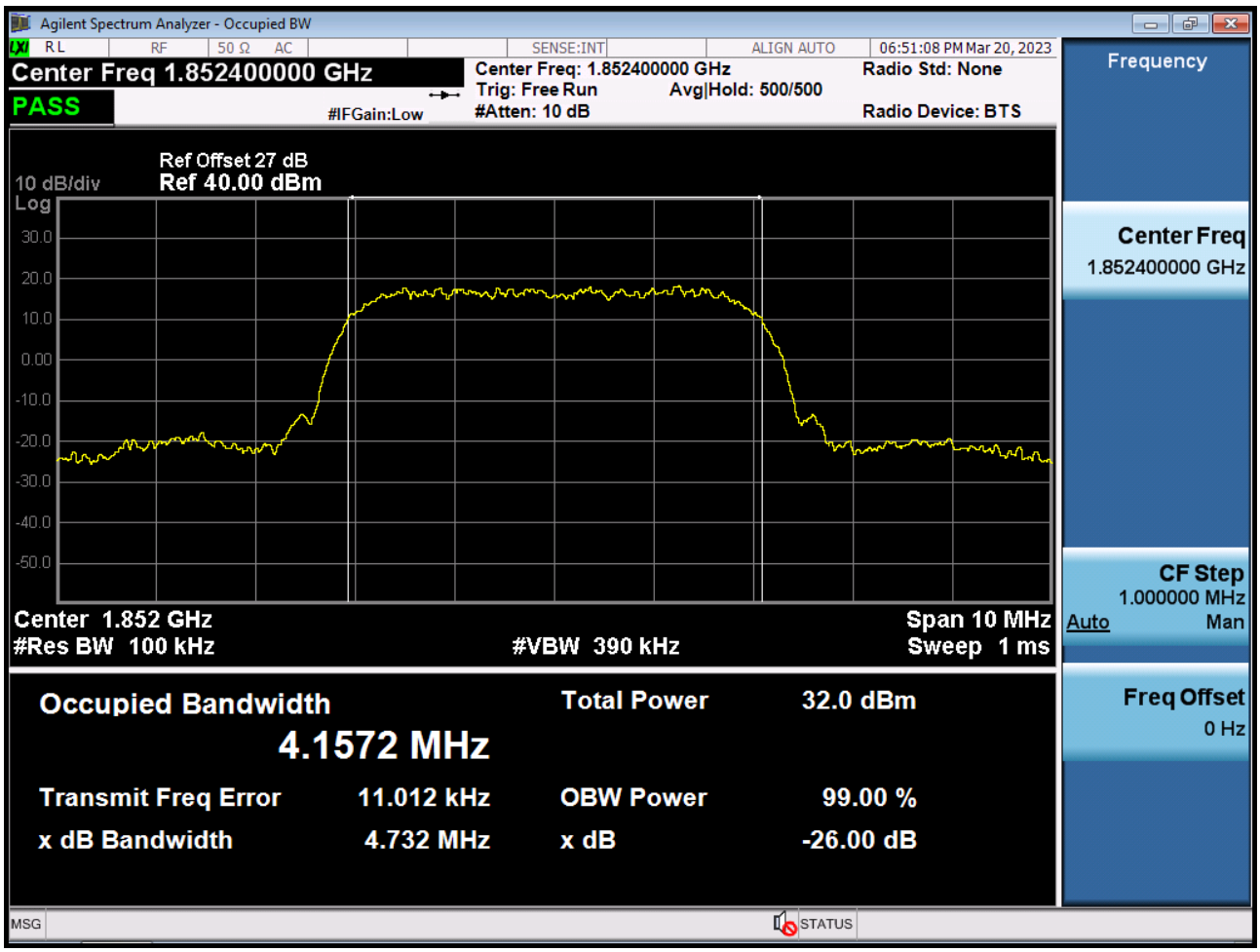
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



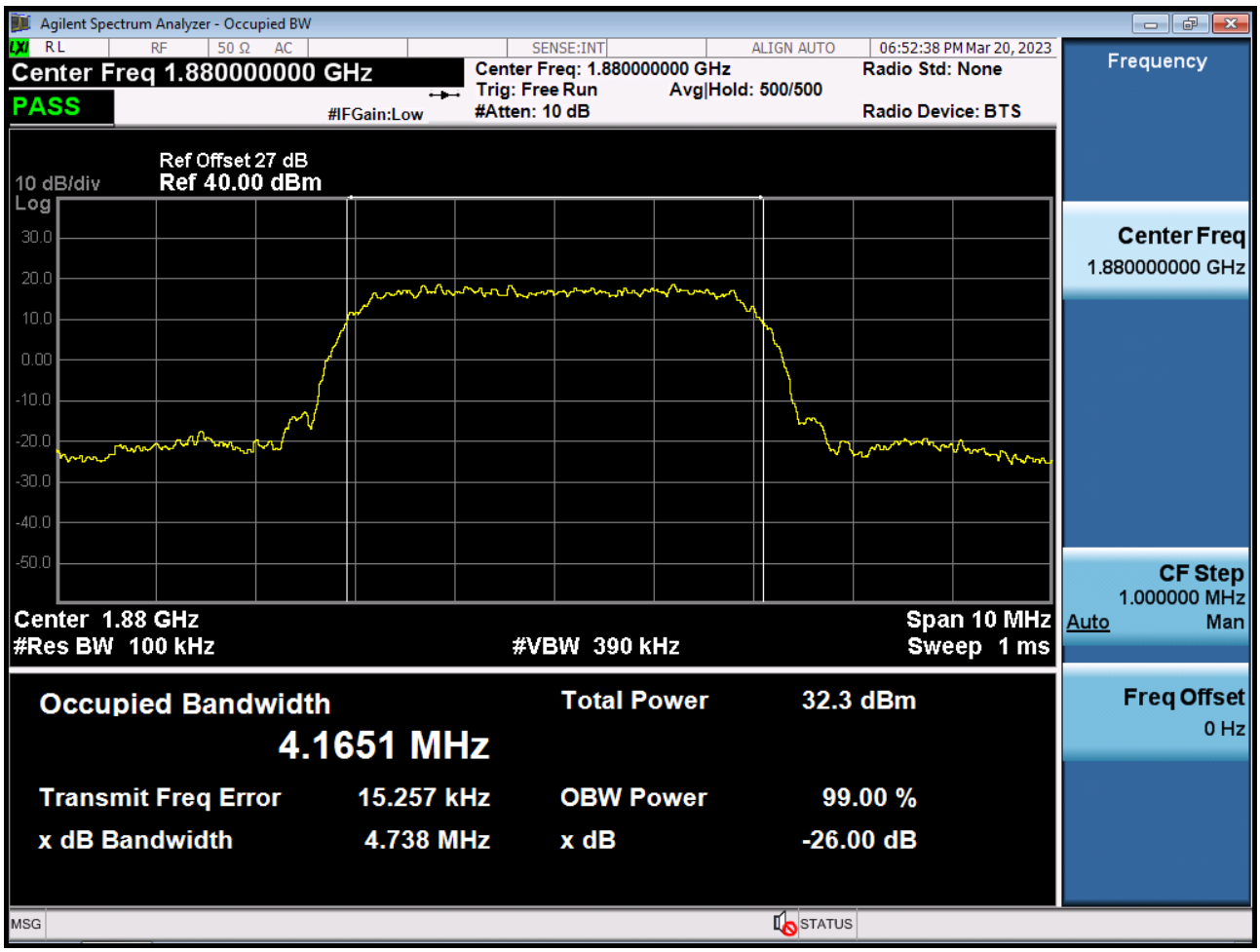
■ WCDMA850 MODE (4233 CH.) Occupied Bandwidth



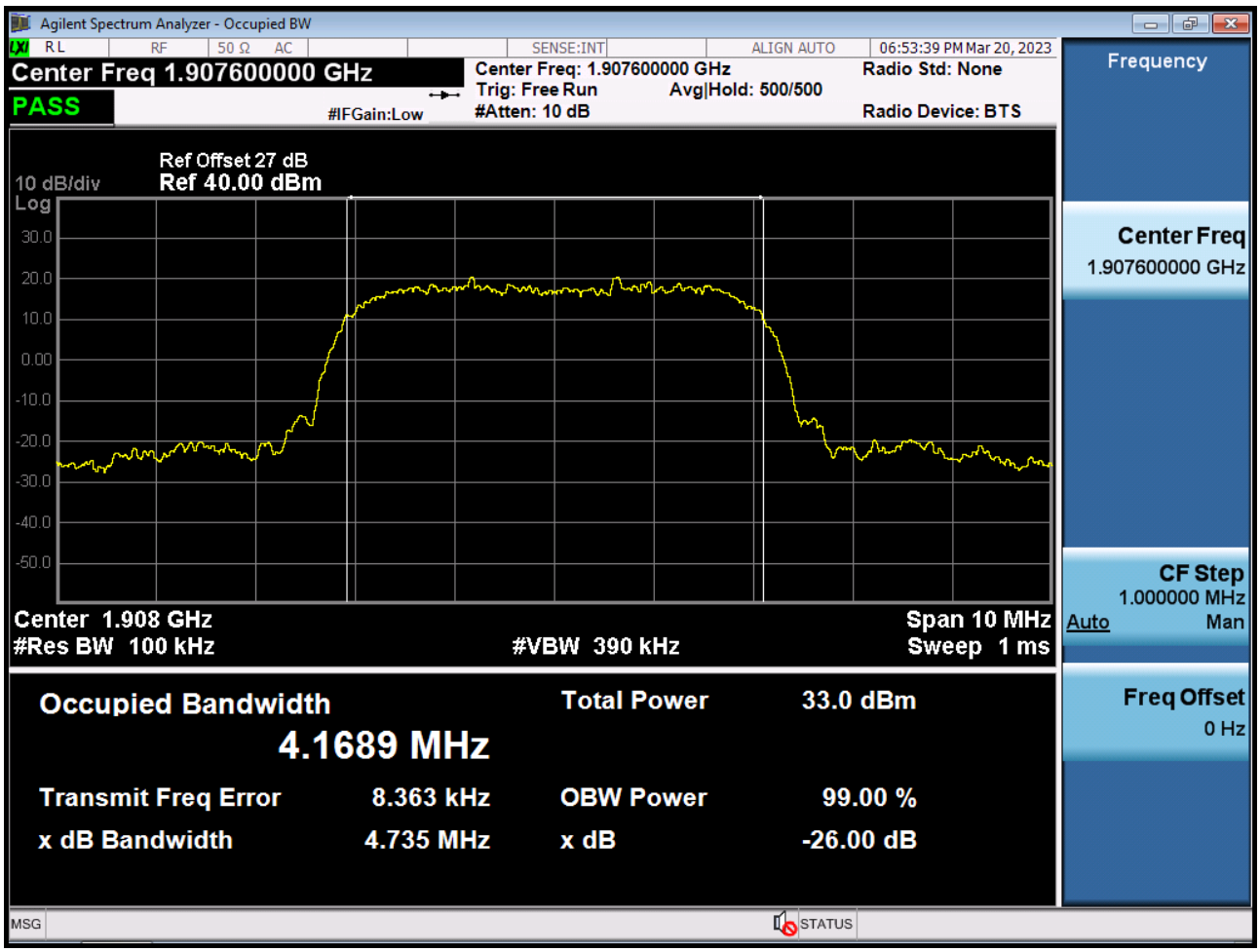
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



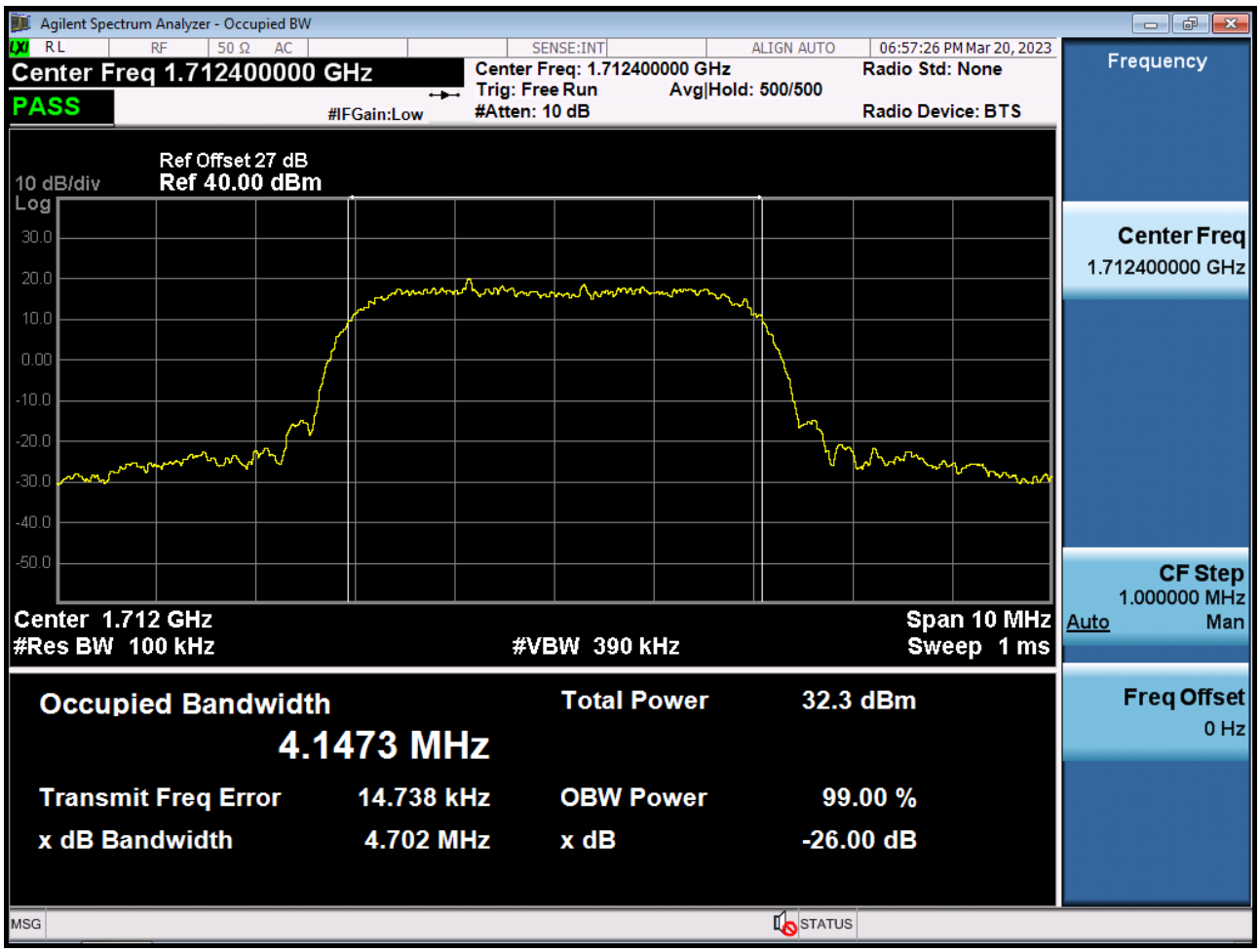
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



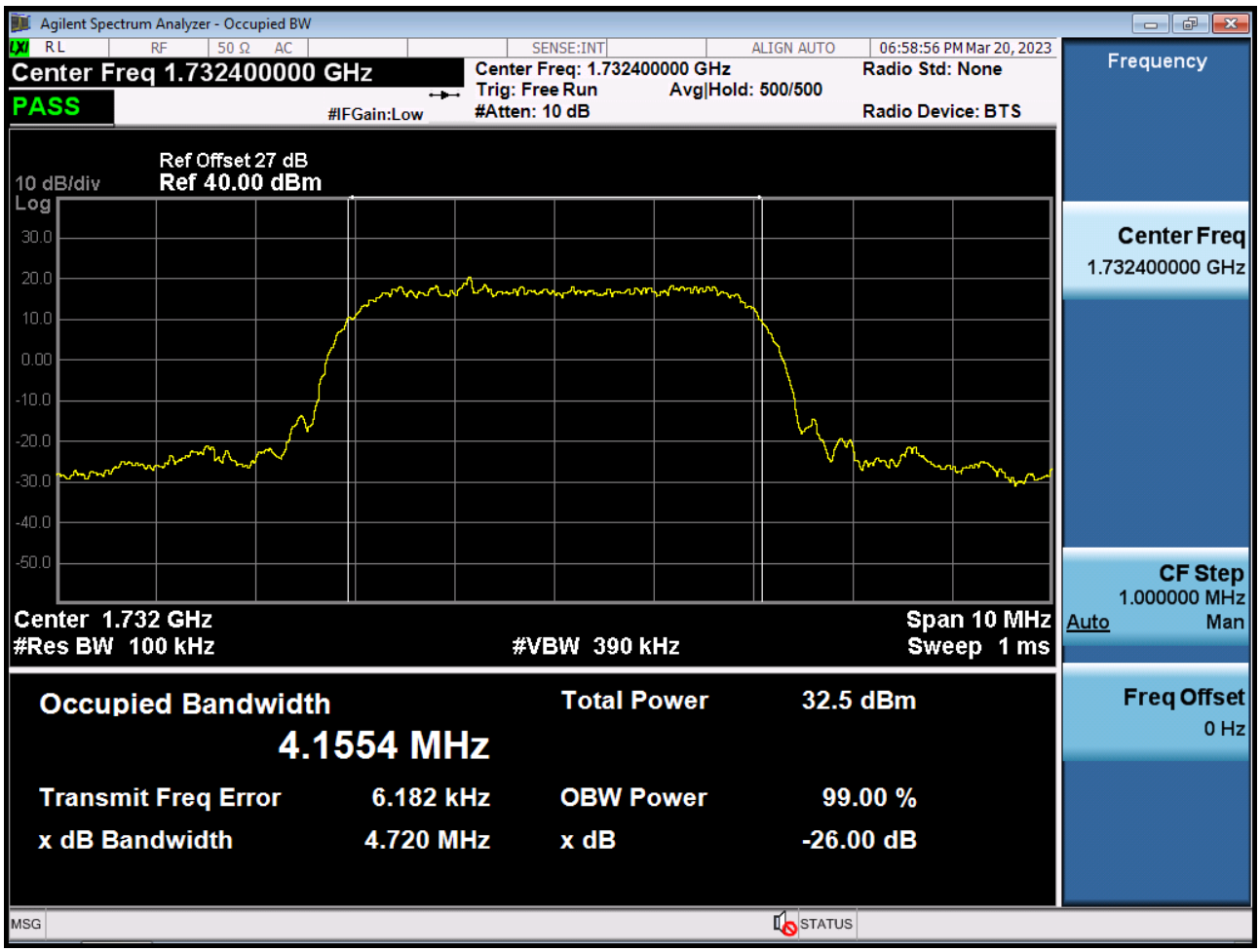
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



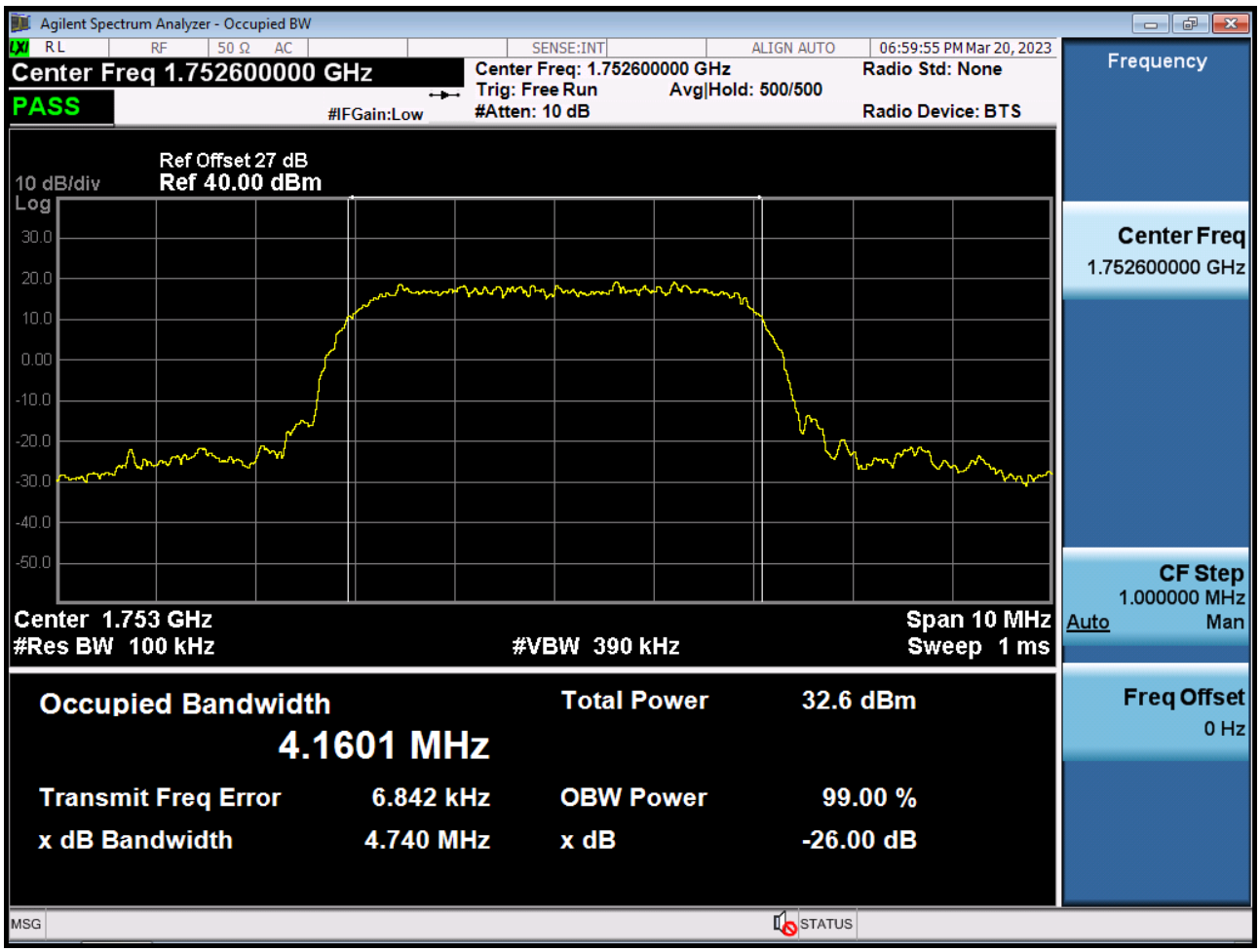
■ WCDMA1700 MODE (1312 CH.) Occupied Bandwidth



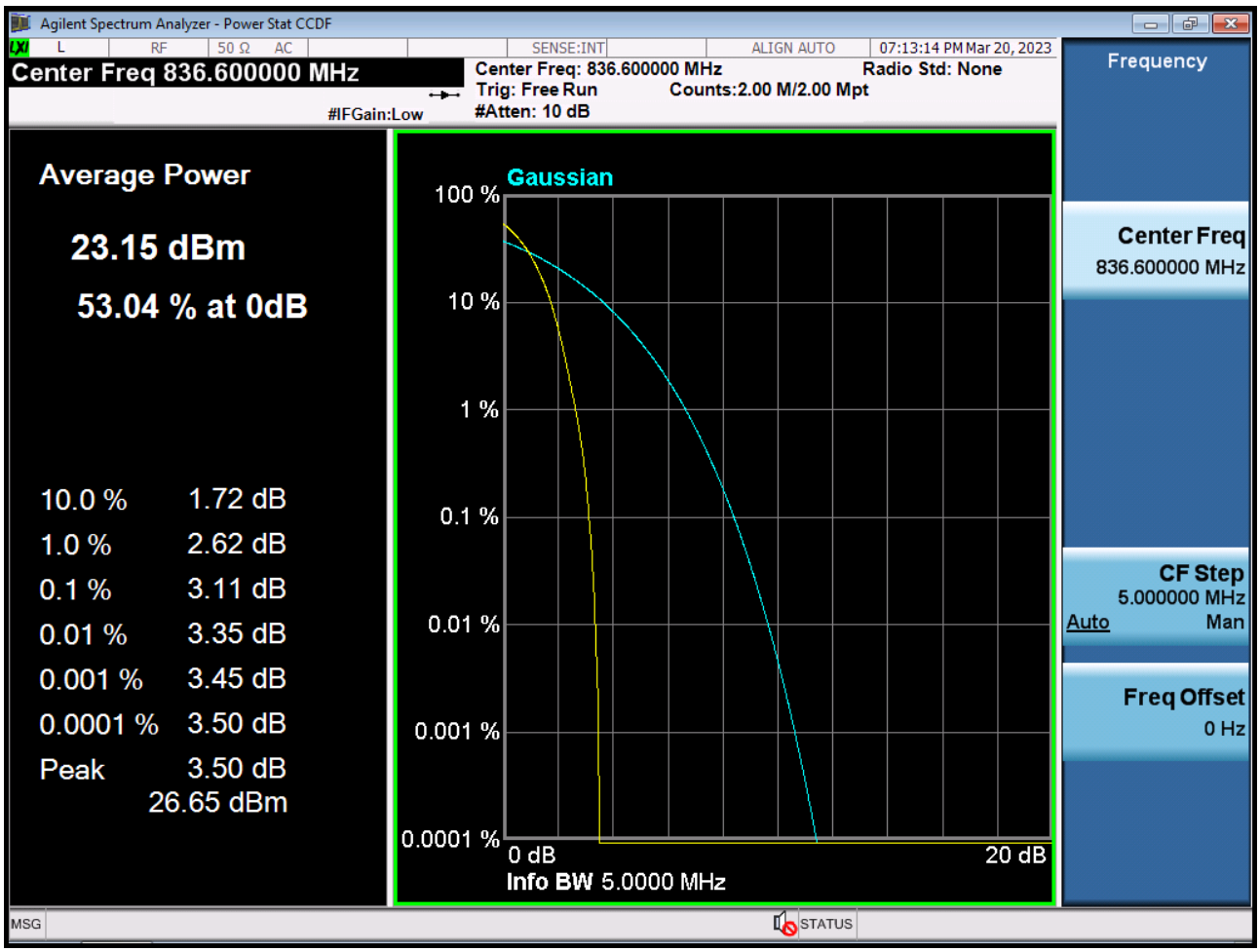
■ WCDMA1700 MODE (1412 CH.) Occupied Bandwidth



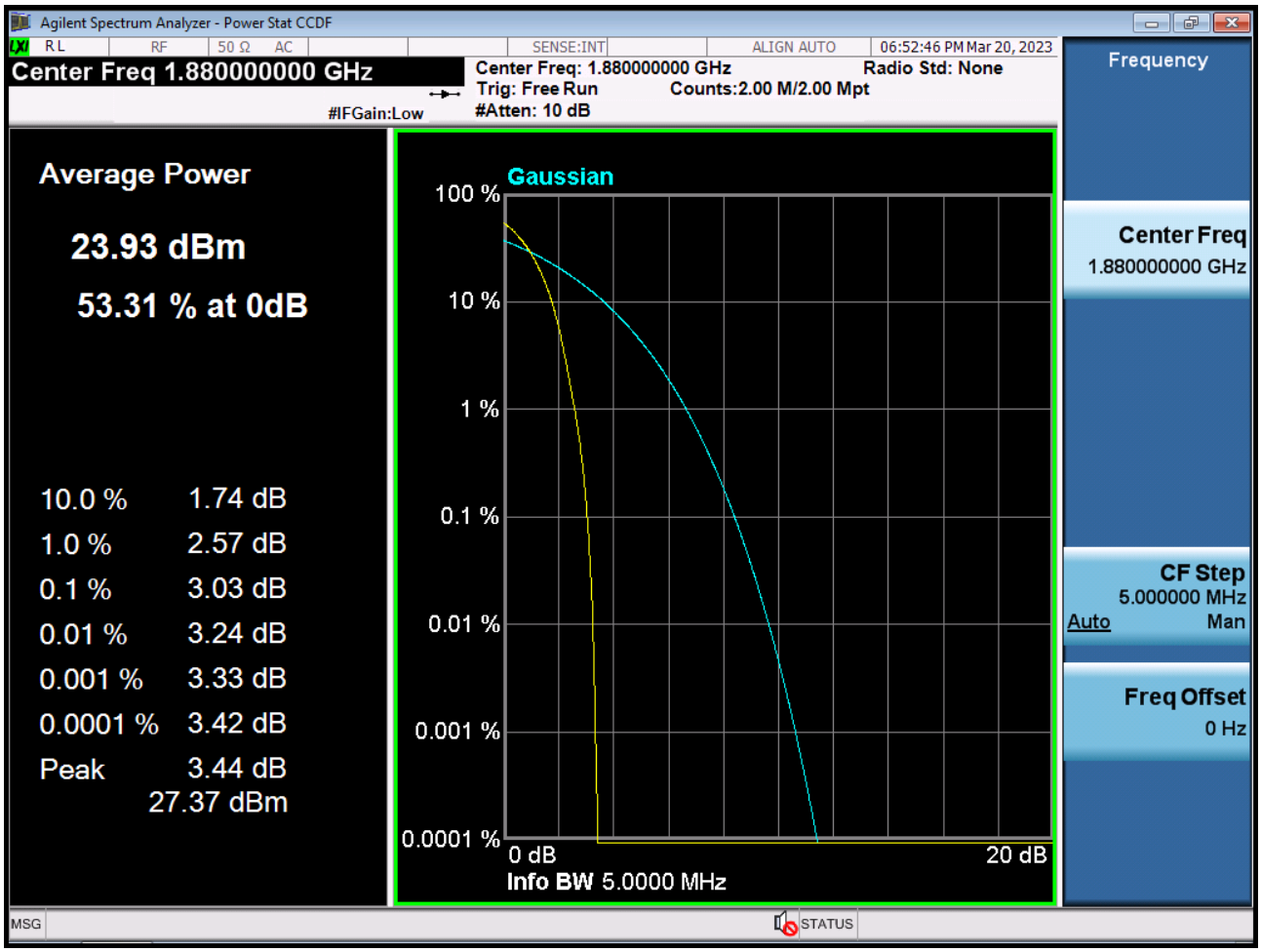
■ WCDMA1700 MODE (1513 CH.) Occupied Bandwidth



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



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



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

■ WCDMA850 MODE (4132 CH.) Block Edge

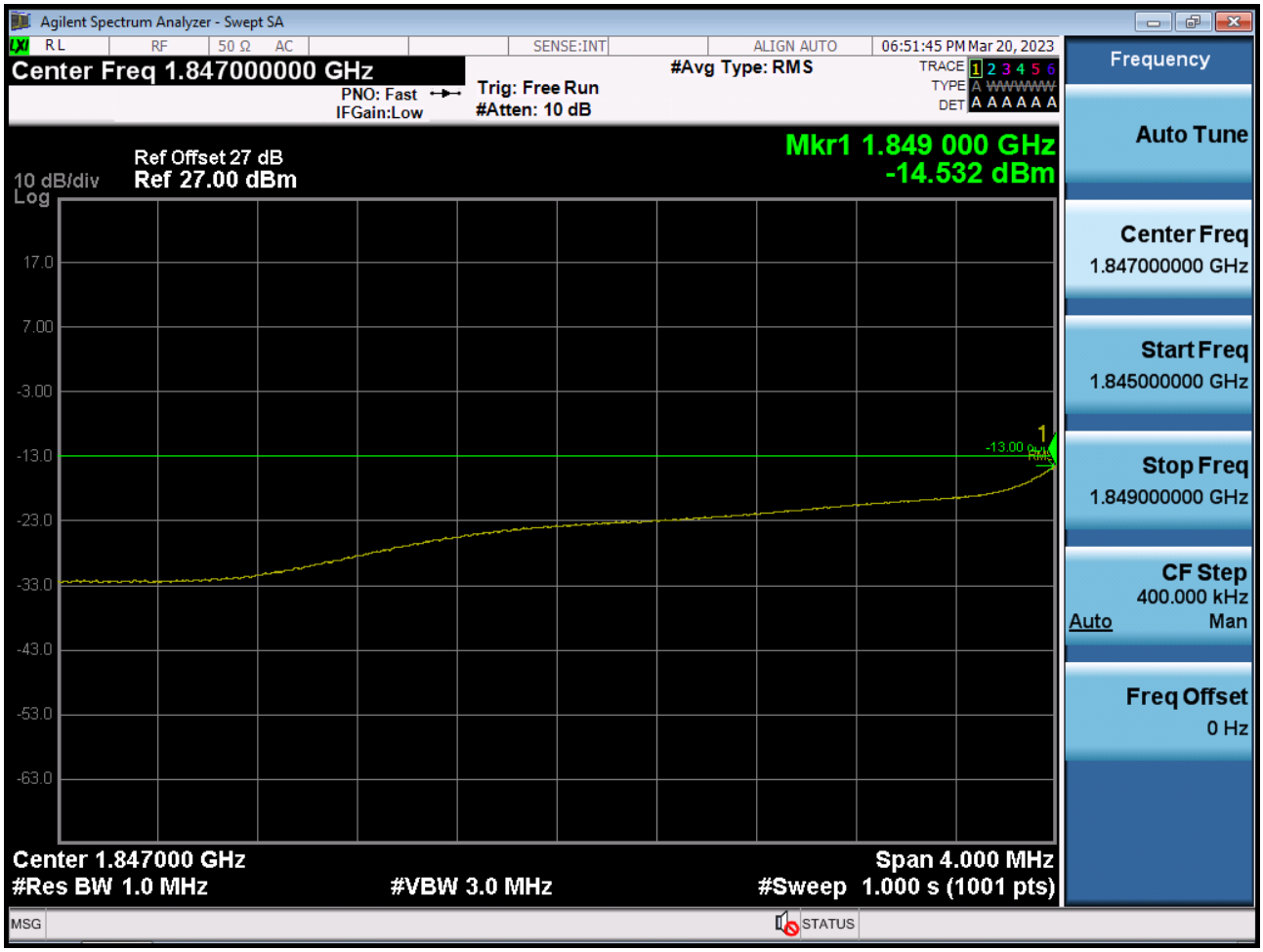
■ WCDMA850 MODE (4132 CH.) – 4 MHz Span

■ 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

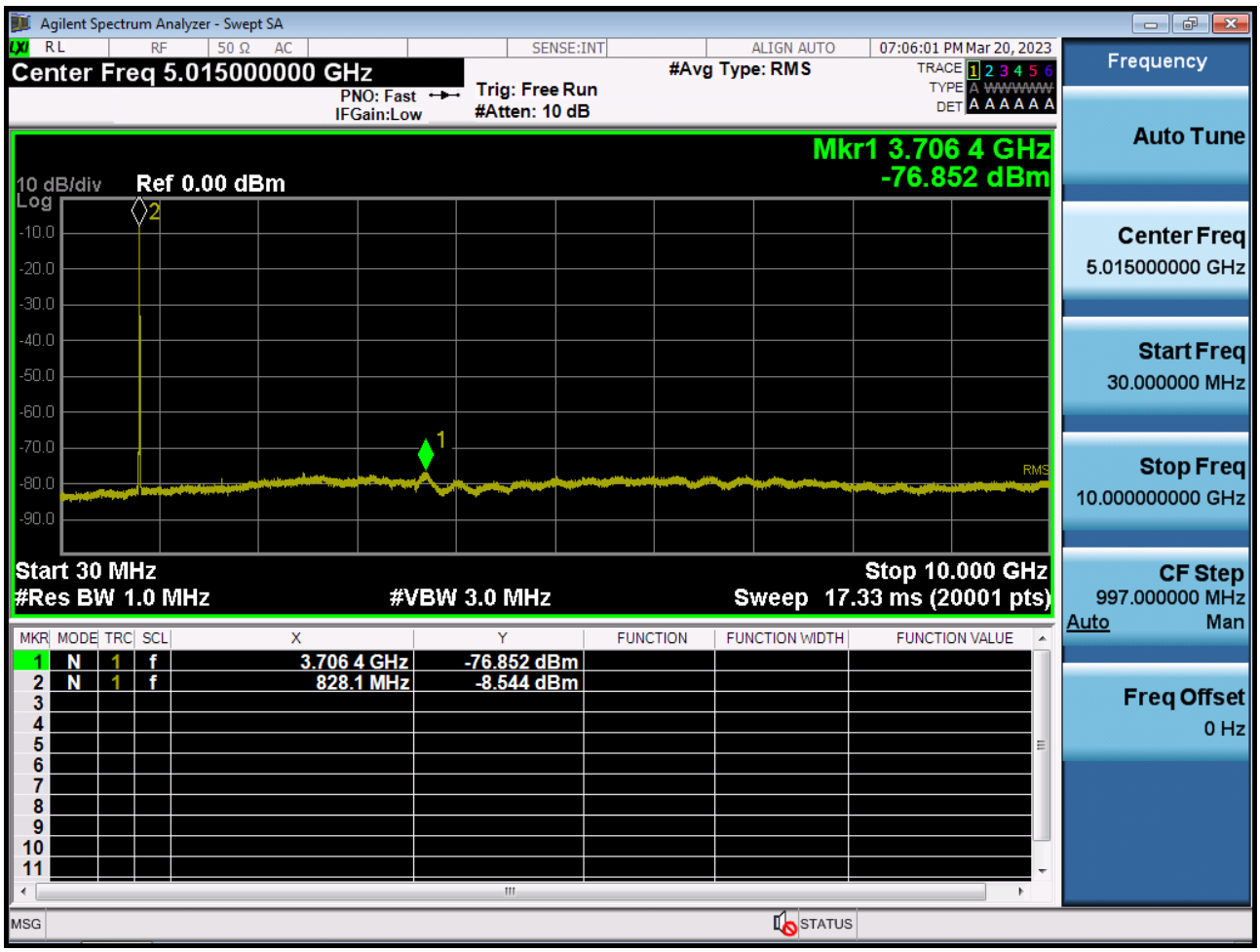
■ WCDMA1700 MODE (1312 CH.) Block Edge

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

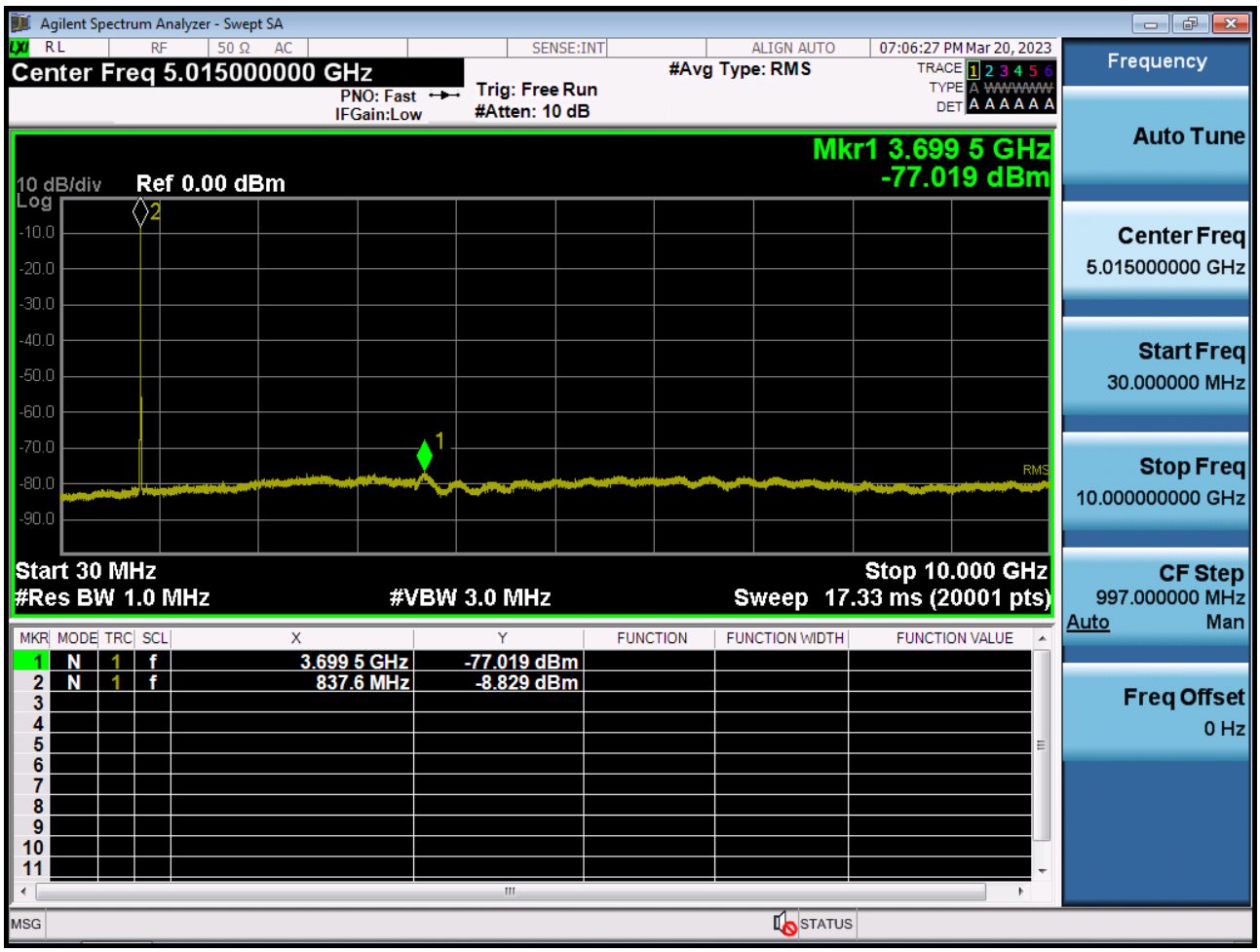
■ WCDMA1700 MODE (1513 CH.) Block Edge

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

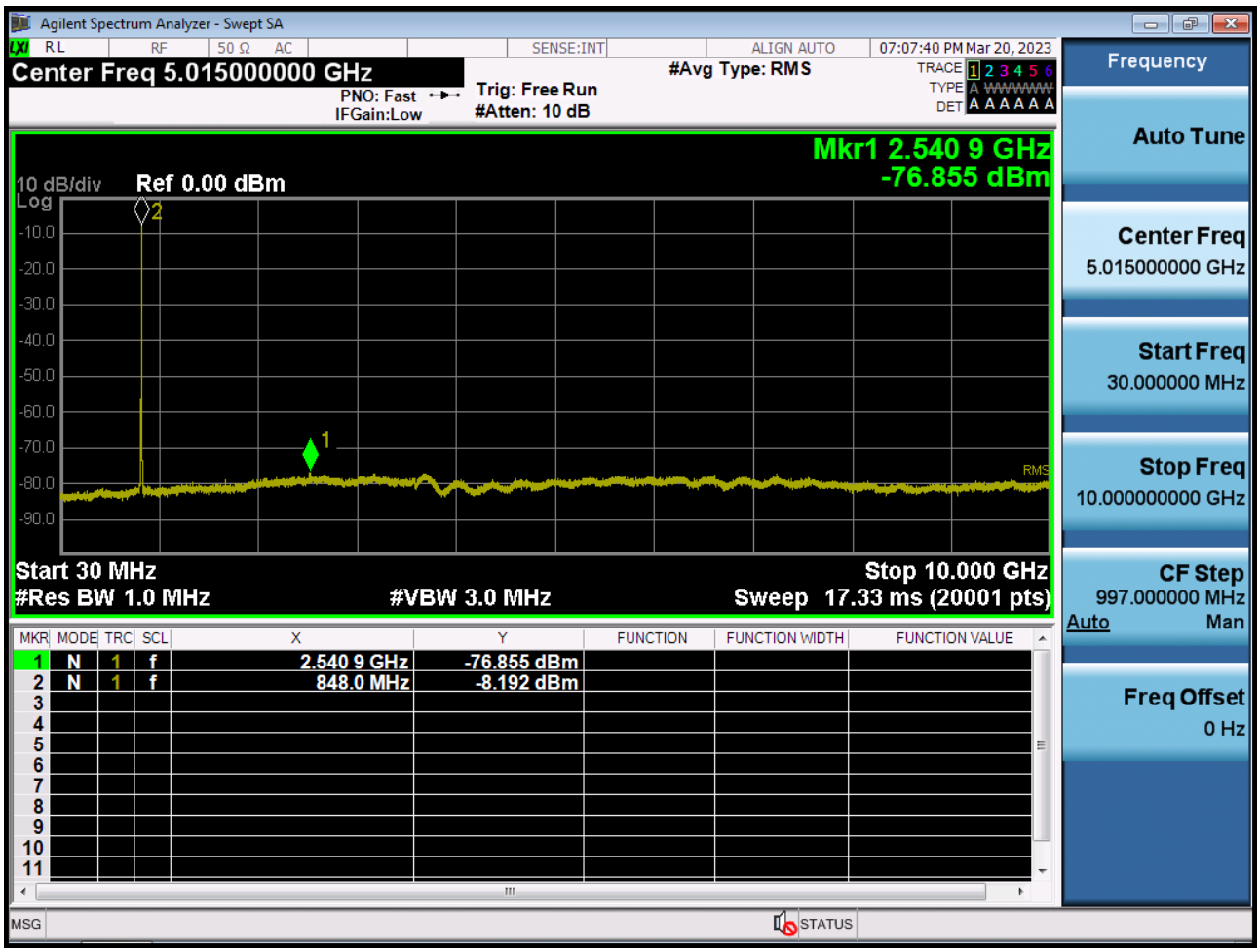
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



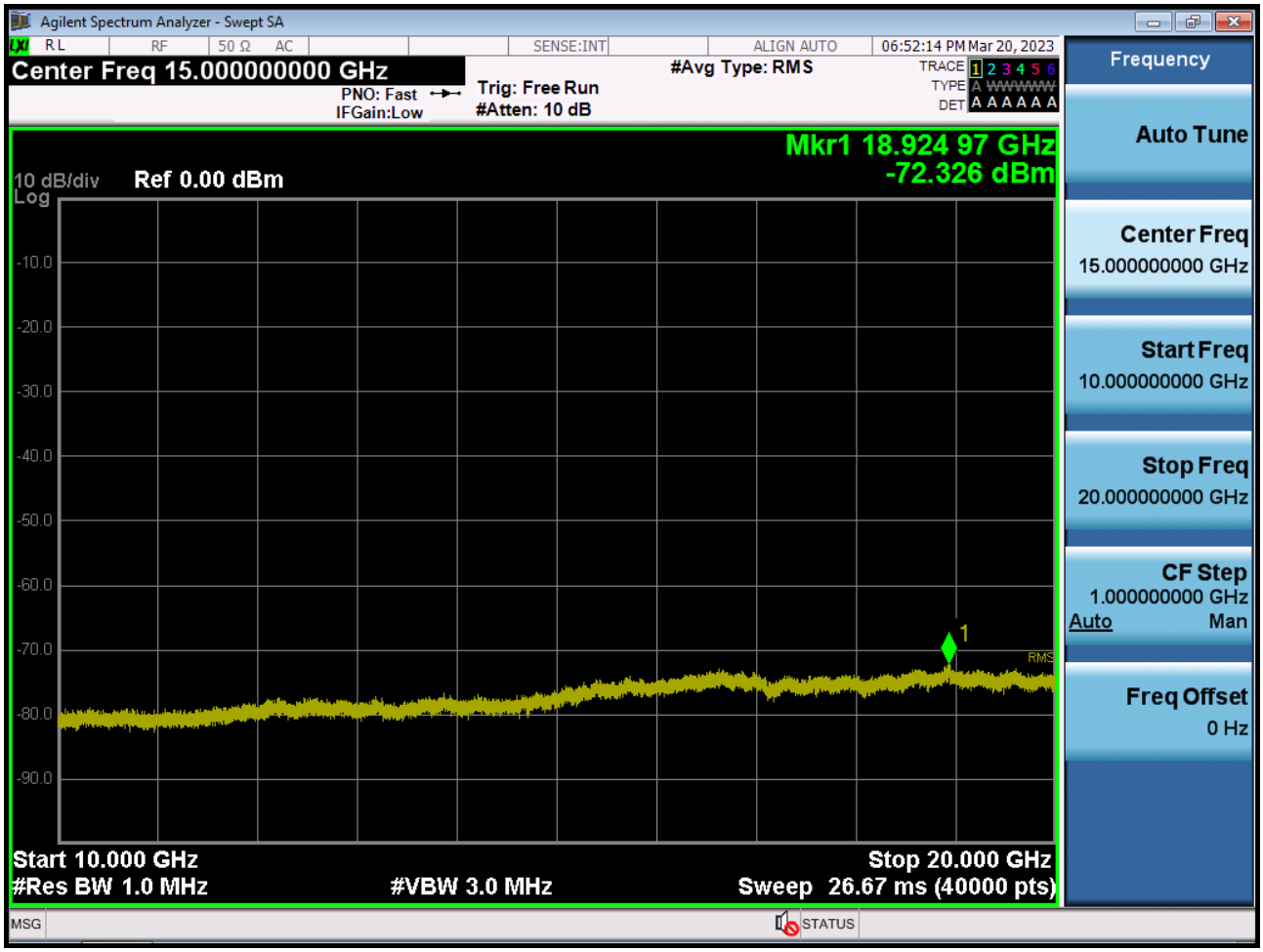
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



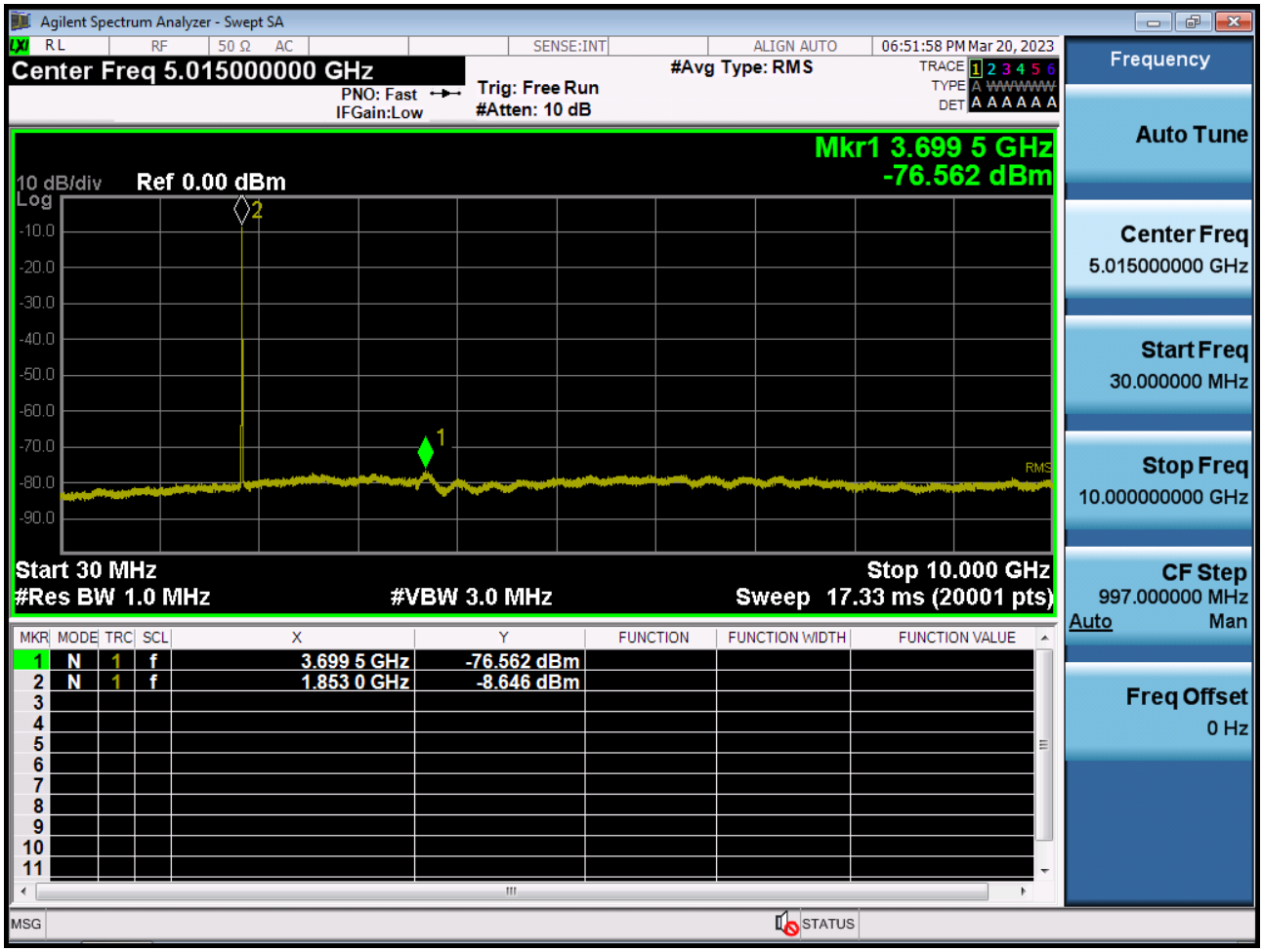
■ WCDMA850 MODE (4233 CH.) Conducted Spurious Emissions



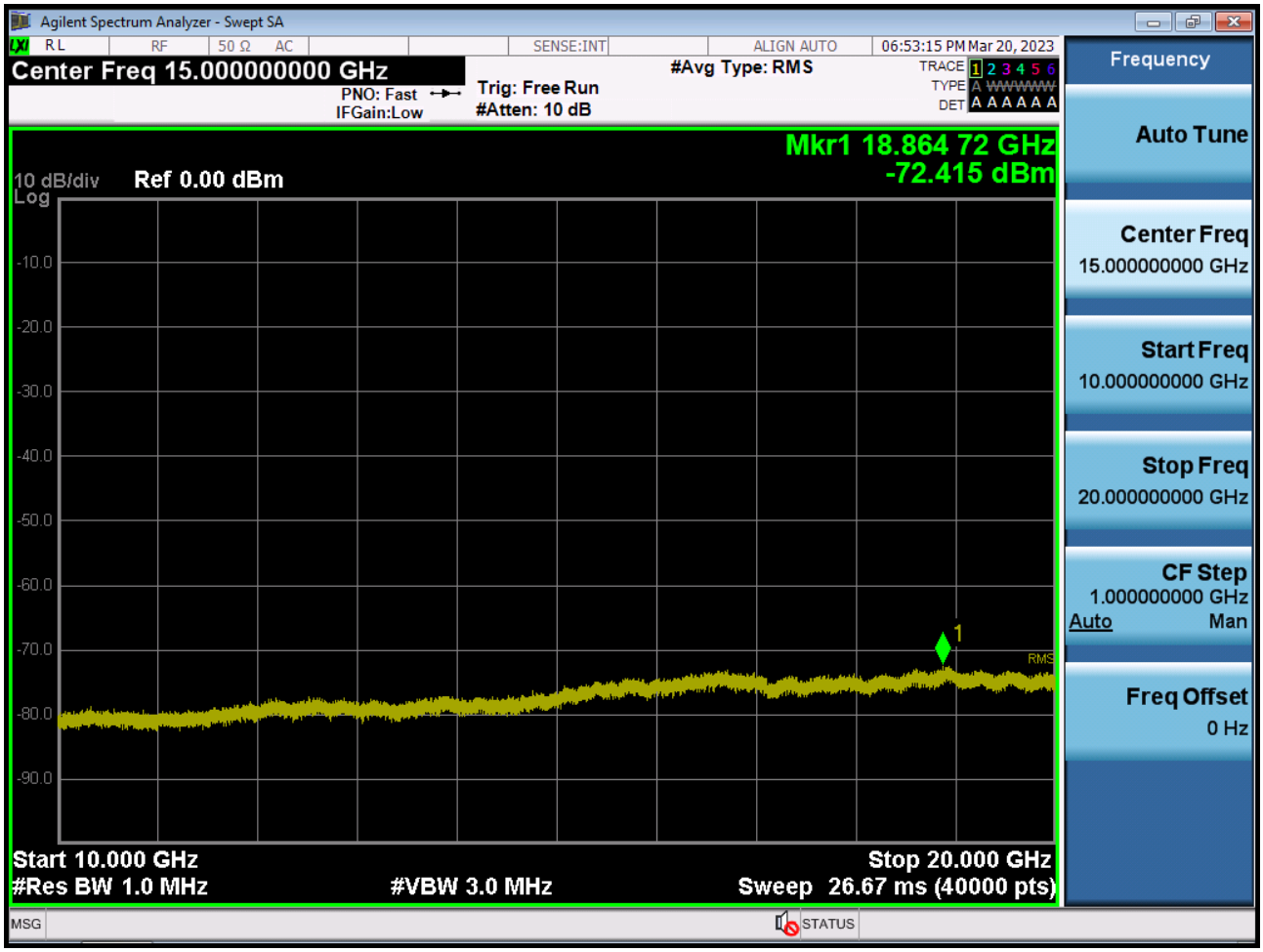
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions1



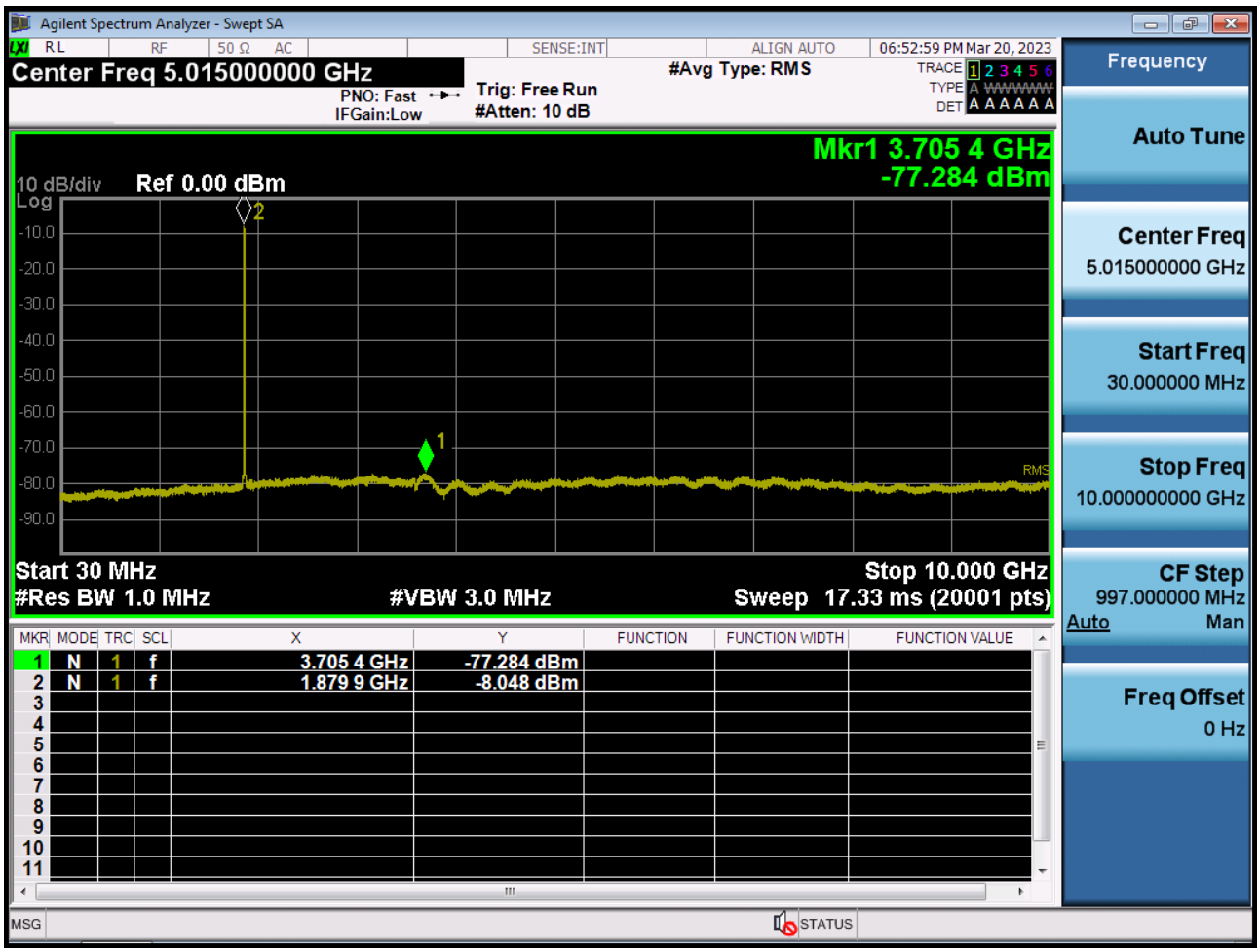
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



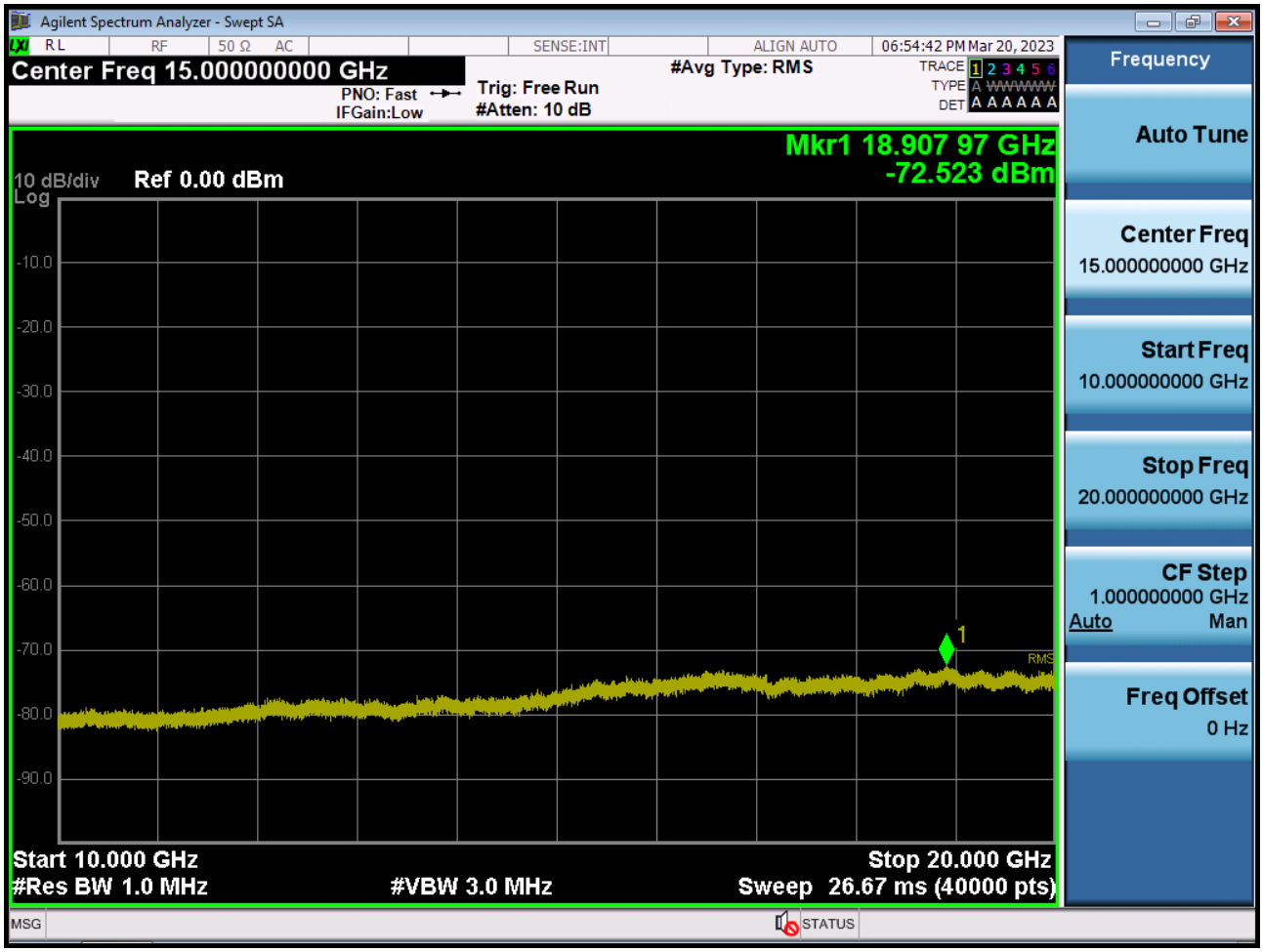
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



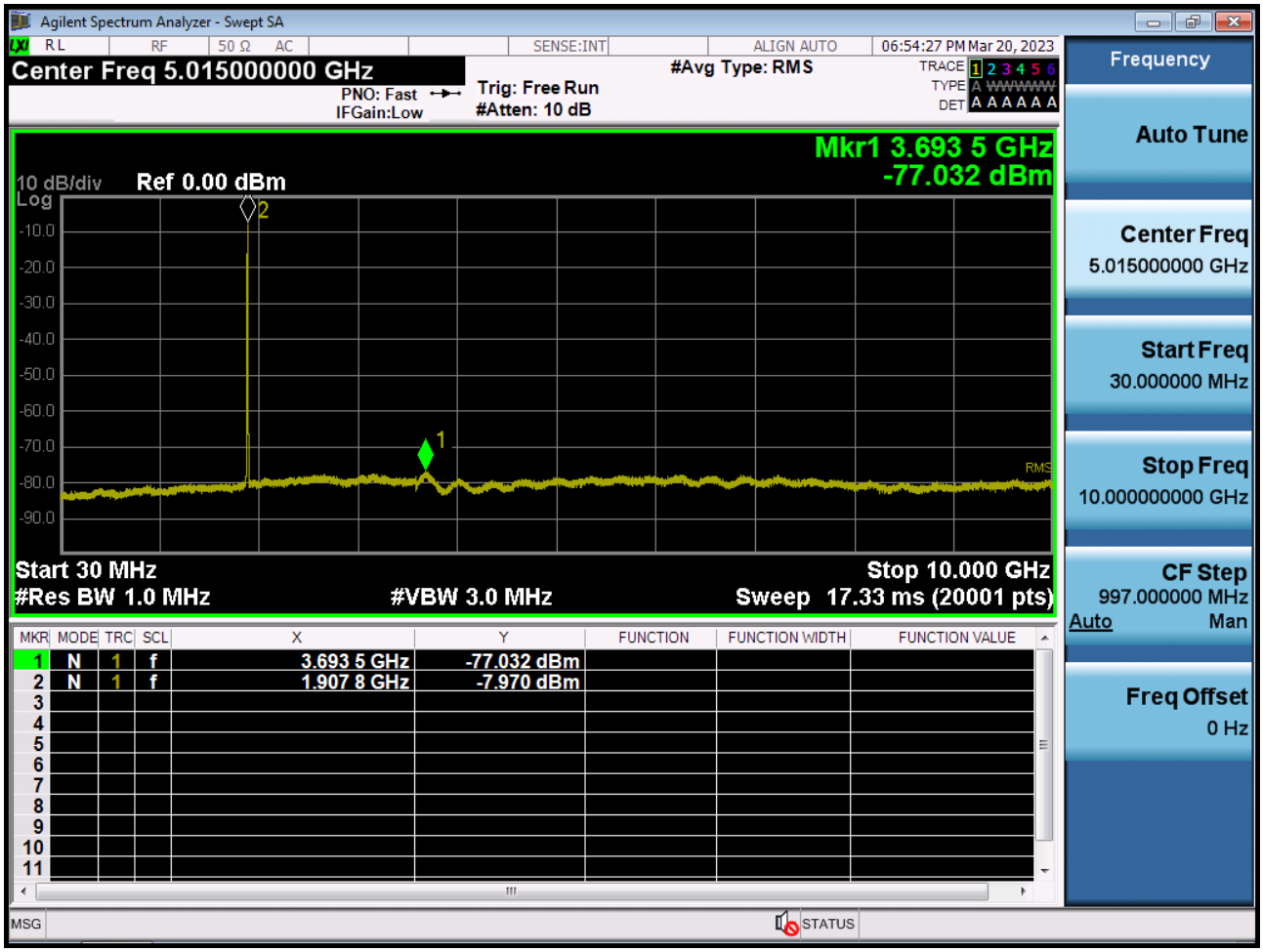
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



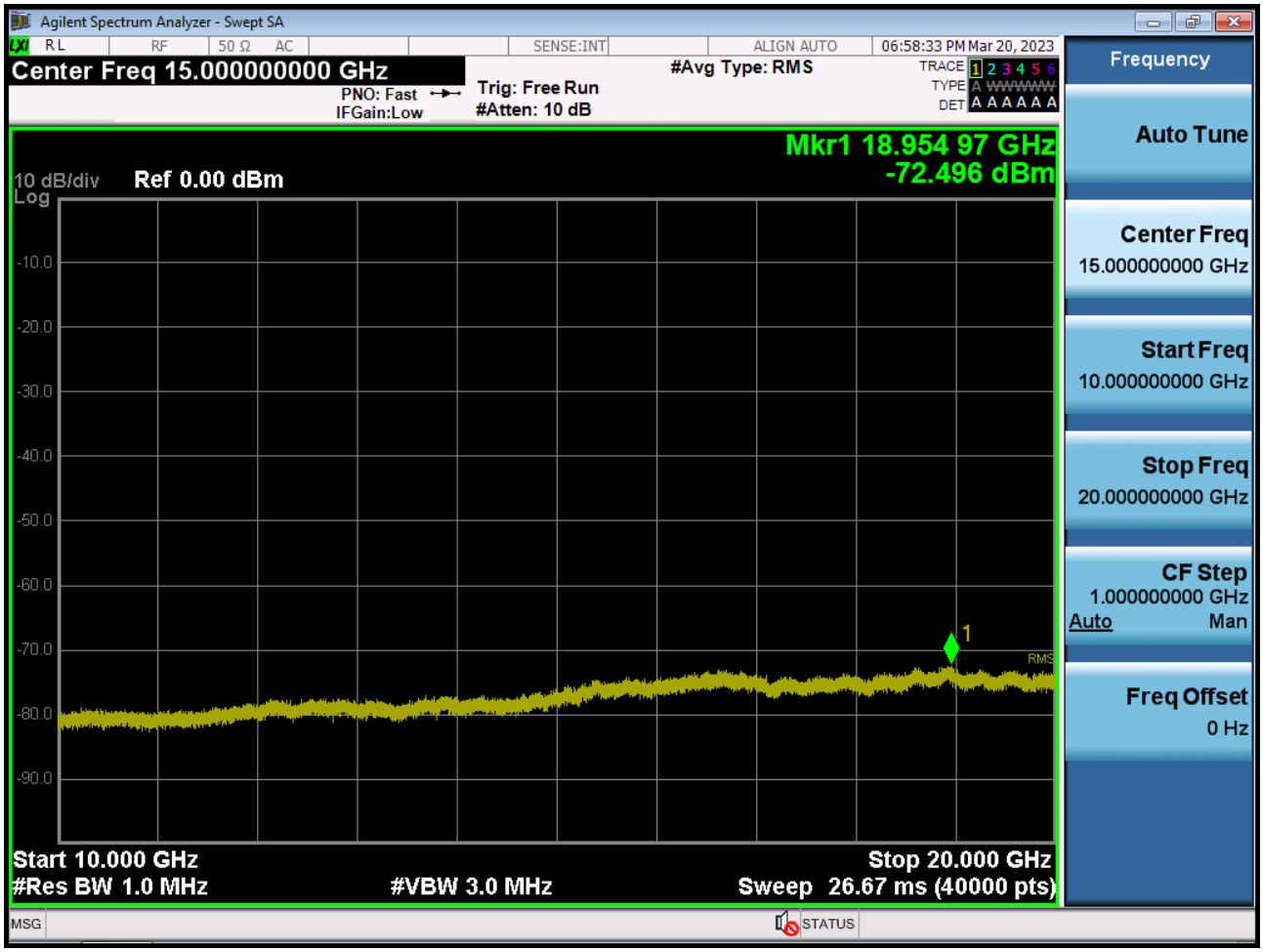
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



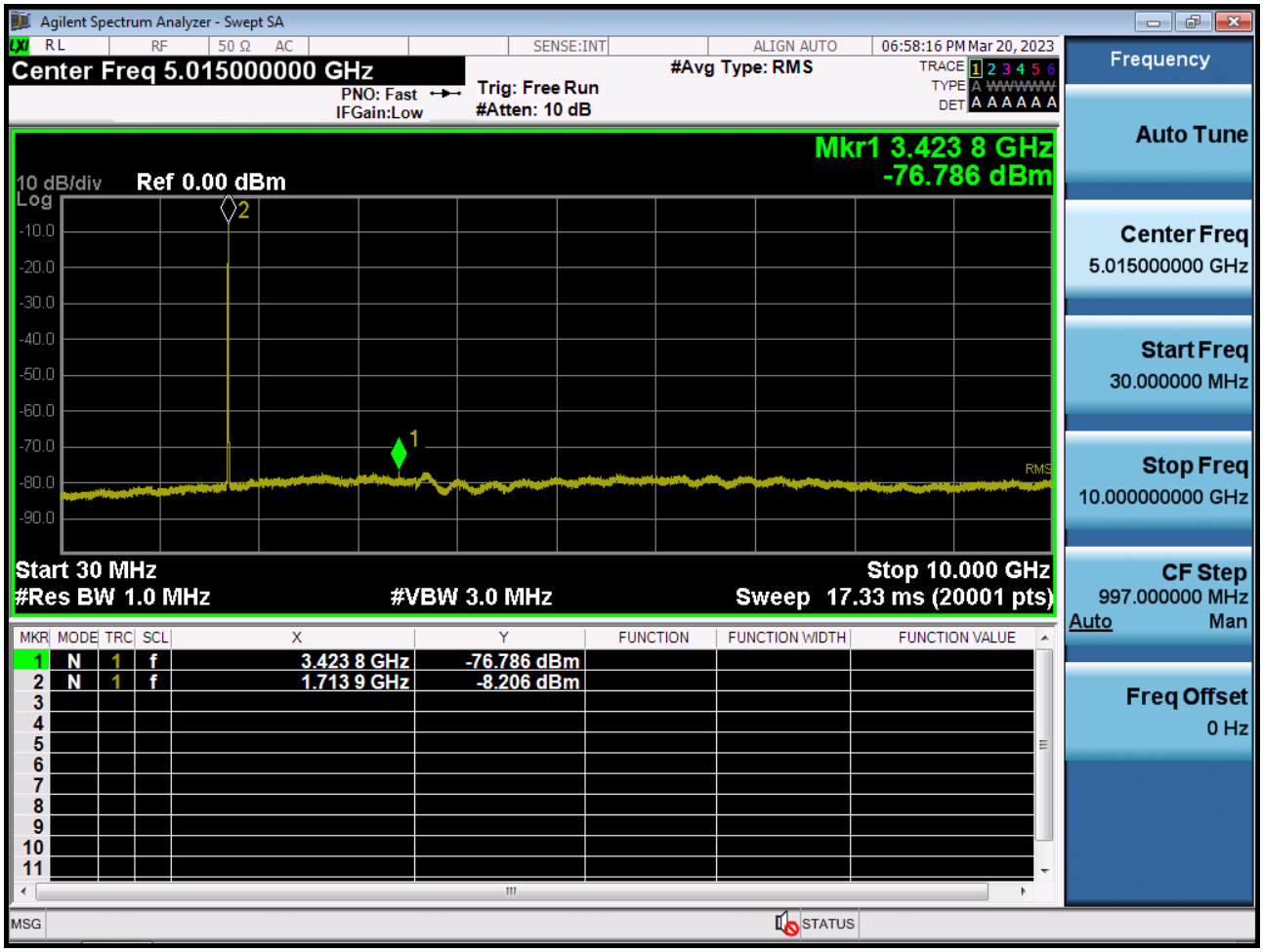
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



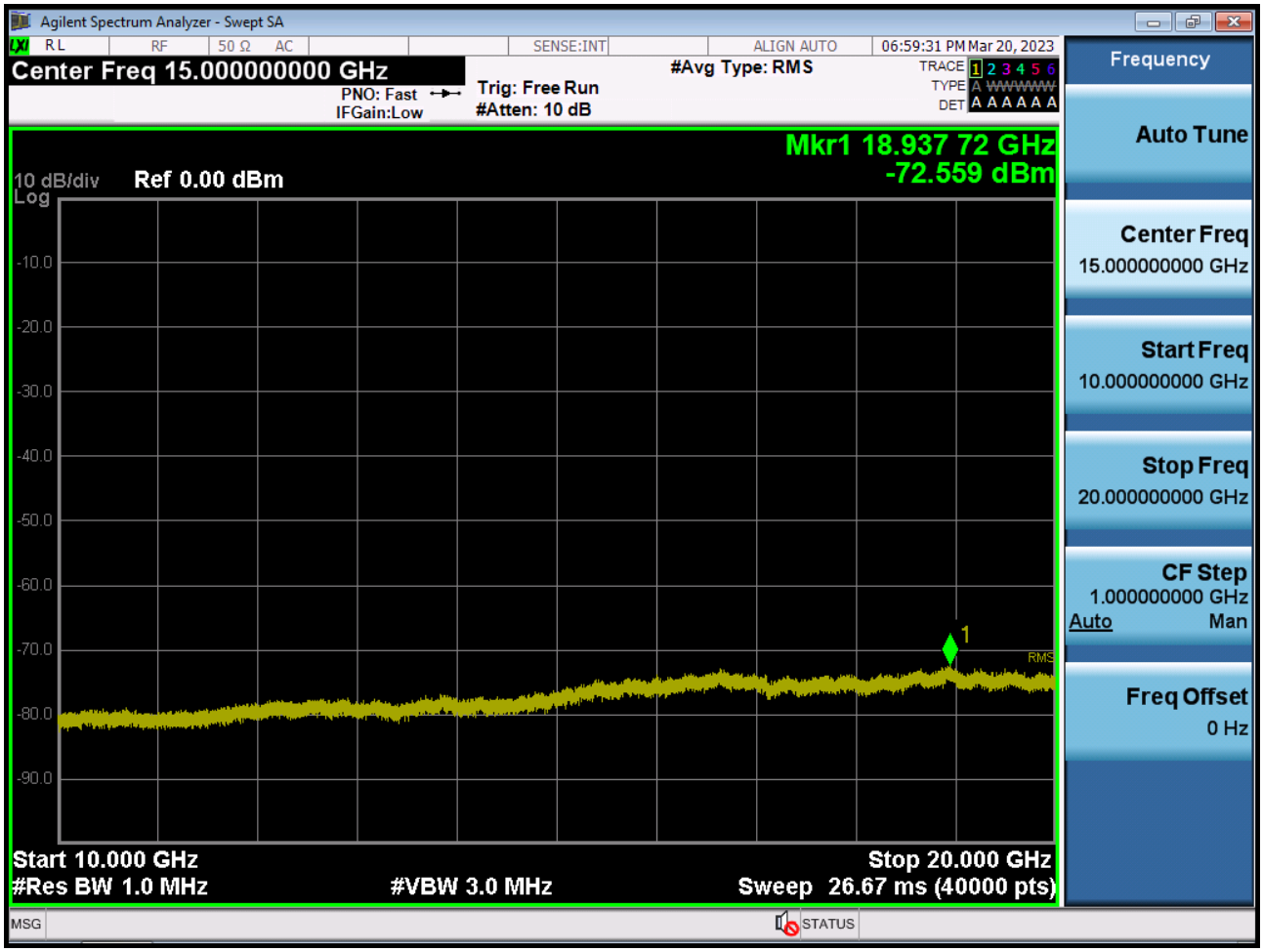
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



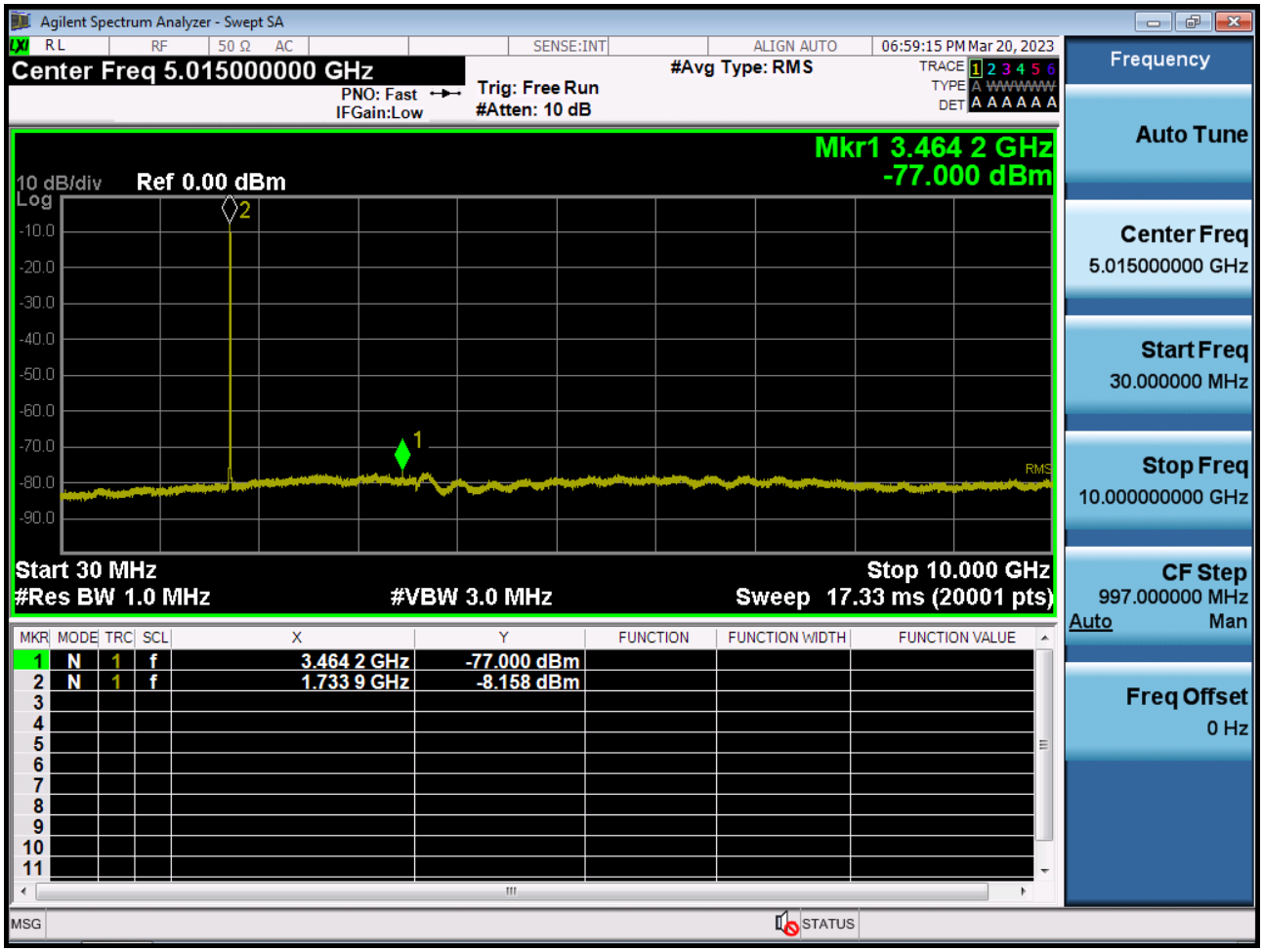
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



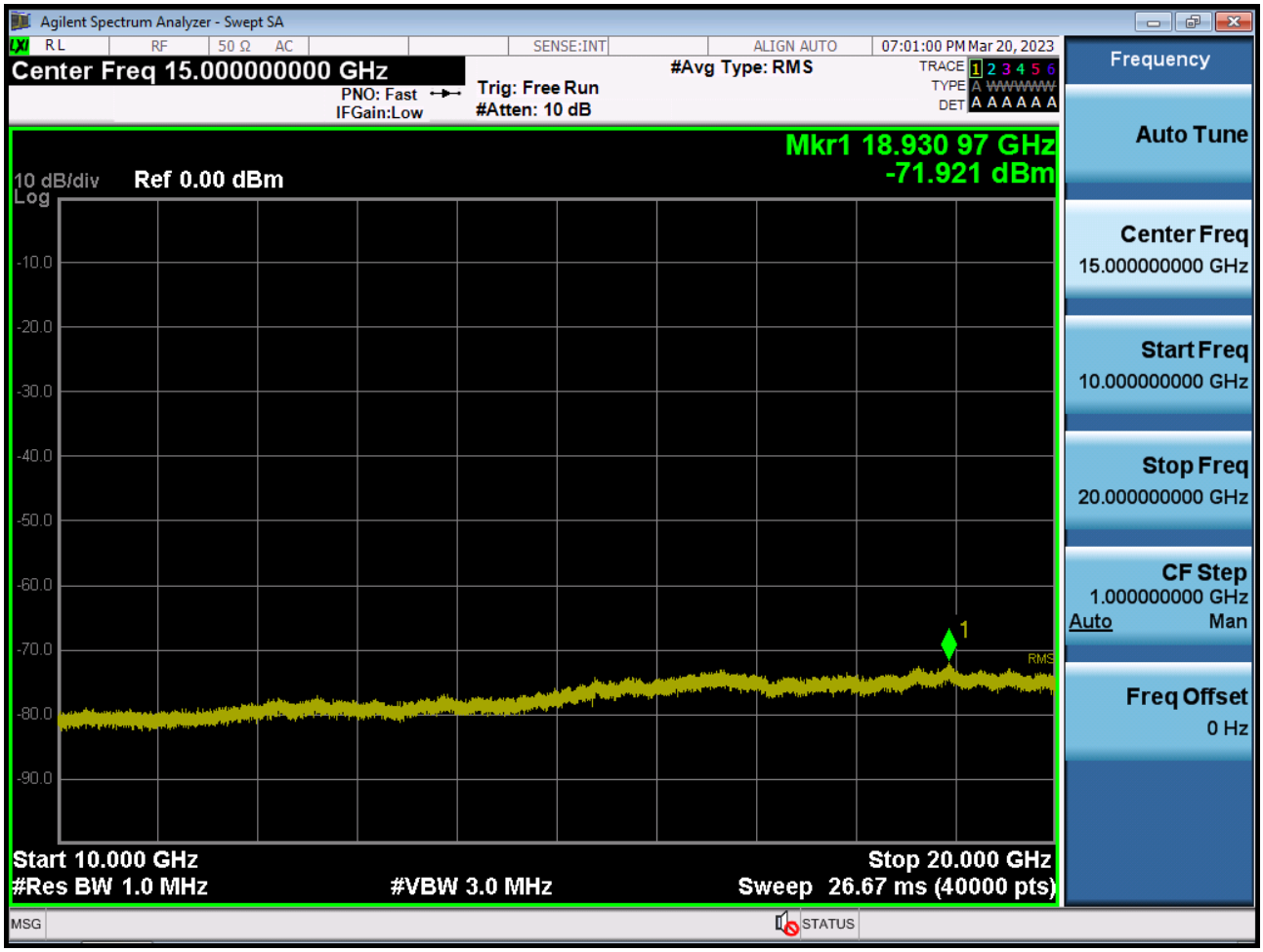
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



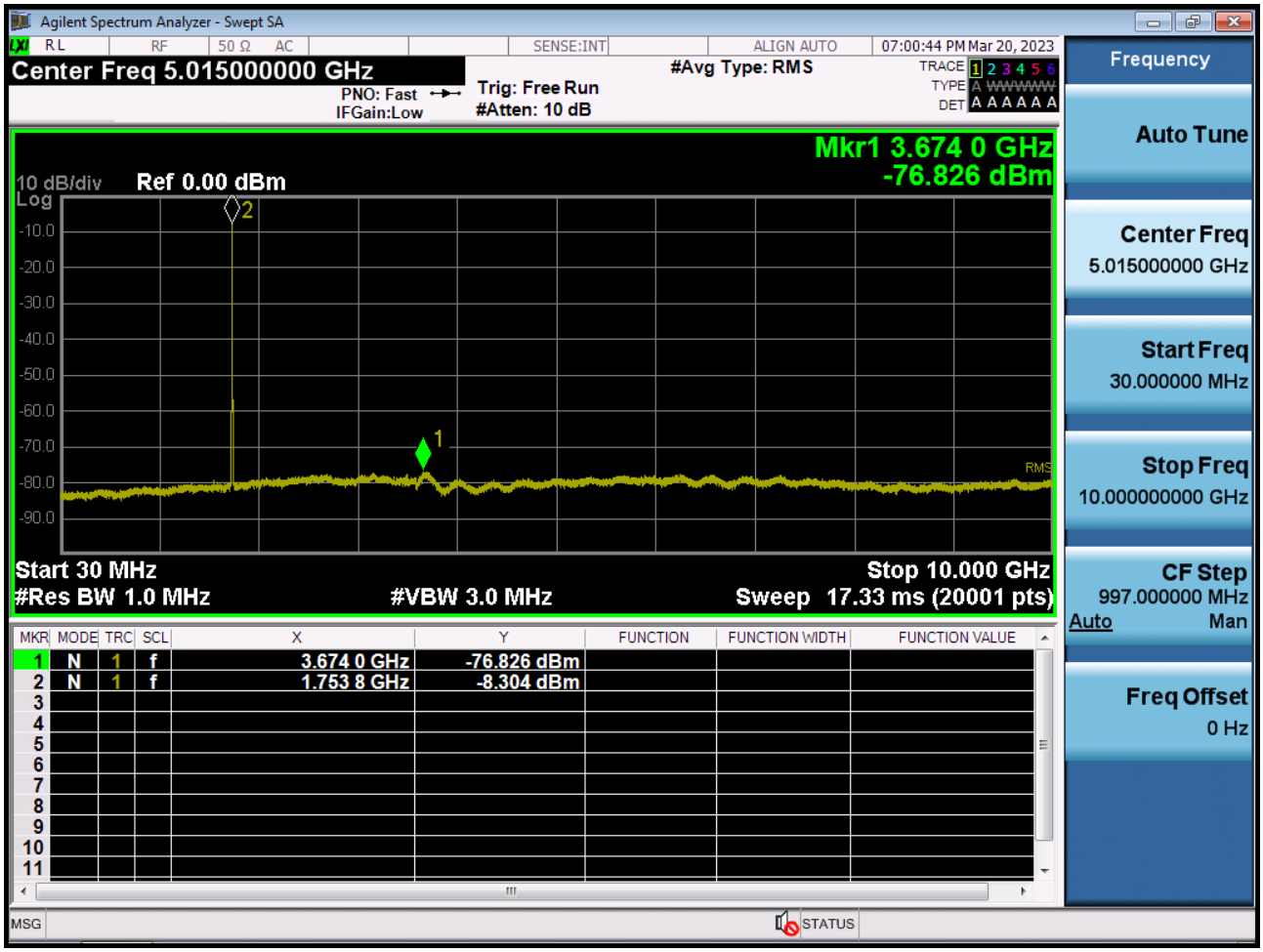
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2305-FC007-P