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TEST REPORT

FCC/IC 3G Test for SM-R825U

Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-1907-FI026

DATE OF ISSUE
July 29, 2019

HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 F ax. +82 31 645 6401

HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
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FCC ID/ IC
A3LSMR825/649E-SMR825

Applicant	**SAMSUNG Electronics Co., Ltd.** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Eut Type	Smart Watch
Model Name	SM-R825U
Additional Model(s)	SM-R825F
Date of Receipt	June 13, 2019
FCC Rule Part(s)	§ 22, § 24, § 27, § 2
IC Rule(s)	RSS-Gen Issue5, RSS-132 Issue3, RSS-133 Issue6, RSS-139 Issue3
FCC Classification	PCS Licensed Transmitter (PCB)
Manufacturer	SAMSUNG Electronics Co., Ltd.

Tested by
Kwon Jeong (signature)

Technical Manager
Jong Seok Lee (signature)

HCT CO., LTD.
Soo Chan Lee
SooChan Lee / CEO

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	July 29, 2019	Initial Release

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)

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:	A3LSMR825
IC	649E-SMR825
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 22, § 24, § 27, § 2
IC Rule(s):	RSS-Gen Issue5, RSS-132 Issue3, RSS-133 Issue6, RSS-139 Issue3
EUT Type:	Smart Watch
Model(s):	SM-R825U
Additional Model	SM-R825F
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:	June 13, 2019~ July 26, 2019

1.1. MAXIMUM OUTPUT POWER

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	4M17F9W	0.014	11.52

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	4M14F9W	0.037	15.64
WCDMA1700	1712.4 – 1752.6	2112.4 – 2152.6	4M15F9W	0.024	13.88

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Smart Watch with UMTS and LTE.

It also supports IEEE 802.11 b/g/n (HT20), Bluetooth, BT LE.

2.2. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI C63.26-2015 – Section 5.2 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points > 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

   The power is calculated by the following formula;

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

   Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.
3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain

value.

These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

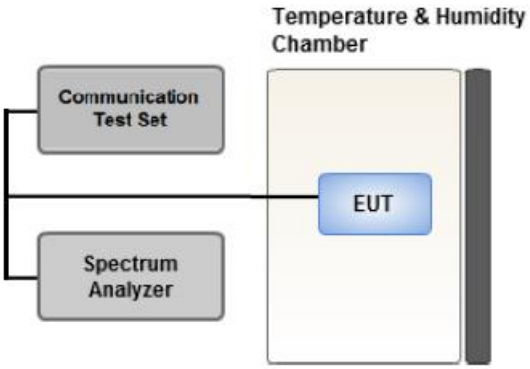
Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 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

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;

2. Set the number of counts to a value that stabilizes the measured CCDF curve;

3. Set the measurement interval as follows:

.- for continuous transmissions, set to 1 ms,

.- or burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.

4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{Pk}.

Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{Avg}. Determine the P.A.R. from:

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

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:

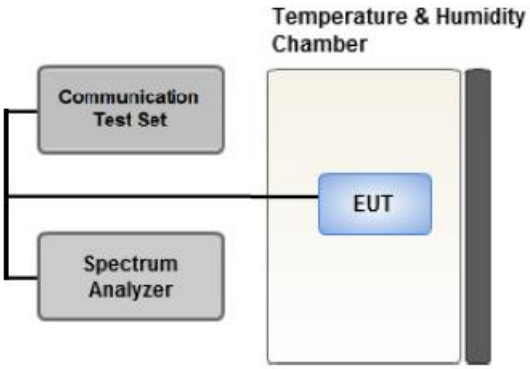
   Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep

   (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 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25%.

3.5 OCCUPIED BANDWIDTH.



Test setup

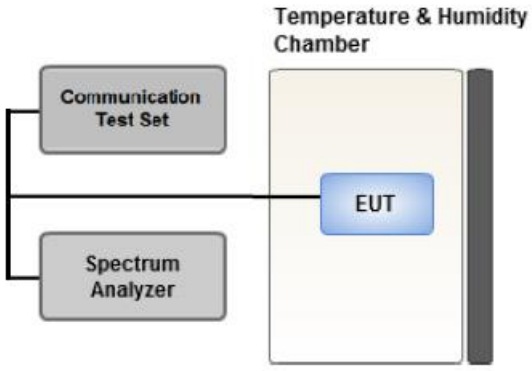
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

The EUT makes a call to the communication simulator.
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.
The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

Test Overview

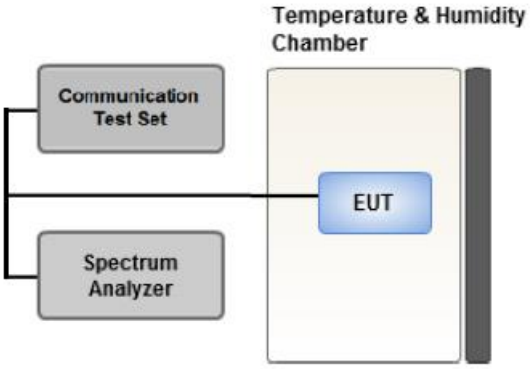
The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured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

Test Settings(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 * 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

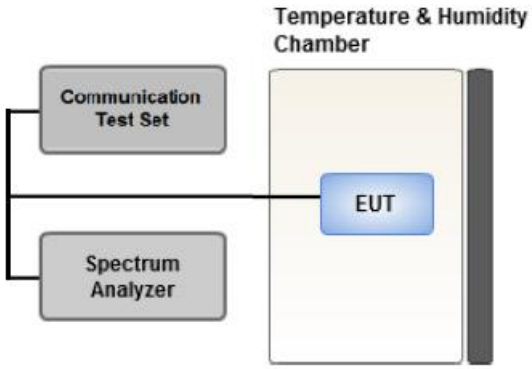
According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB. In

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)

- SM-R825U & additional model were tested and the worst case results are reported.
  (Worst case : SM-R825U)
- All modes of operation were investigated and the worst case configuration results are reported.

[Worst case]

Test Description	Modulation	Test Channel
Occupied Bandwidth	3G : QPSK	Low, Mid, High
Band Edge	3G : QPSK	Low, High
Spurious and Harmonic Emissions at Antenna Terminal	3G : QPSK	Low, Mid, High

[Test Channel]

	UplinkChannel		
	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.
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- SM-R825U & additional model were tested and the worst case results are reported.
  (Worst case : SM-R825U)
- All modes of operation were tested and the worst case results are reported.
  Mode : Stand alone, Stand alone+ wireless charging dock
  Worst case : Stand alone+ wireless charging dock
- 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 : X	Low, Mid, High
Radiated Spurious and Harmonic Emissions	QPSK (WCDMA)	12.2 kbps RMC	WCDMA B2 : X WCDMA B4 : X WCDMA B5 : X	Low, Mid, High

[Test Channel]

	UplinkChannel		
	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

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibration Interval	Calibration Due
REOHDE & SCHWARZ	SCU 18 / AMPLIFIER	10094	04/16/2019	Annual	04/16/2020
Wainwright	WHK1.2/15G-10EF/H.P.F	4	04/02/2019	Annual	04/02/2020
Wainwright	WHK3.3/18G-10EF/H.P.F	2	04/02/2019	Annual	04/02/2020
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	05/03/2019	Annual	05/03/2020
Agilent	E3632A/DC Power Supply	MY50360067	10/17/2018	Annual	10/17/2019
Schwarzbeck	UHAP/ Dipole Antenna	557	03/29/2019	Biennial	03/29/2021
Schwarzbeck	UHAP/ Dipole Antenna	558	03/29/2019	Biennial	03/29/2021
ESPEC	SU-642 / Chamber	93000718	08/07/2018	Annual	08/07/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	09/14/2018	Annual	09/14/2019
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	10/04/2018	Annual	10/04/2019
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	04/29/2019	Biennial	04/29/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	01/28/2019	Biennial	01/28/2021
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY51110063	05/08/2019	Annual	05/08/2020
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2019	Annual	06/04/2020
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/22/2018	Annual	10/22/2019
Agilent	8960 (E5515C)/ Base Station	MY48360800	09/27/2018	Annual	09/27/2019
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-175	08/23/2018	Biennial	08/23/2020
Schwarzbeck	VULB9160/ Bilog Antenna	9160-3368	08/09/2018	Biennial	08/09/2020
Schwarzbeck	VULB9160/ Hybrid Antenna	760	03/22/2019	Biennial	03/22/2021
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6201502997	08/13/2018	Annual	08/13/2019
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/30/2019	Annual	01/30/2020
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	114415	10/01/2018	Annual	10/01/2019
REOHDE & SCHWARZ	ESU40 / EMI TEST RECEIVER	100524	07/27/2018	Annual	07/27/2019
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.

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

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

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

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	IC Section(s)	Test Limit	Test Result
Occupied Bandwidth	§ 2.1049	RSS Gen(6.7)	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§ 2.1051, § 22.917(a), § 24.238(a), § 27.53(h)	RSS 132(5.5) RSS 133(6.5) RSS 139(6.6)	< 43 + 10log10 (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)	RSS 133(6.4) RSS 139(6.5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§ 2.1055, § 22.355	RSS 132(5.3)	< 2.5 ppm	PASS
	§ 24.235, § 27.54	RSS 133(6.3) RSS 139(6.4)	Emission must remain in band	PASS

Note:

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

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	IC Section(s)	Test Limit	Test Result
Effective Radiated Power	§ 22.913(a)(5)	RSS 132(5.4)	< 7 Watts max. ERP	PASS
Equivalent Isotropic Radiated Power	§ 24.232(c), § 27.50(d)(4)	RSS 133(6.4) RSS 139(6.5)	< 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)	RSS 132(5.5) RSS 133(6.5) RSS 139(6.6)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS
Receiver Spurious Emissions	N/A	RSS Gen(7)	Section 8.9	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

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

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

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

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

3) Record the field strength meter's level.

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

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

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

7.2 EIRP Sample Calculation

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

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

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

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

3) Record the field strength meter's level.

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

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

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

7.3. Emission Desi0gnator

GSM Emission Designator

Emission Designator = 249KGXW
GSM BW = 249 kHz
G = Phase Modulation
X = Cases not otherwise covered
W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W
GSM BW = 249 kHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W
WCDMA BW = 4.17 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D
LTE BW = 4.48 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission; telemetry; telecommand

16QAM Modulation

Emission Designator = 4M48W7D
LTE BW = 4.48 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EFFECTIVE RADIATED POWER

Mode	Ch./ Freq.		Measured Level (dBm)	Substitute LEVEL (dBm)	Ant. Gain (dBd)	C.L	Pol.	Limit	ERP	
	channel	Freq.(MHz)						W	W	dBm
WCDMA850	4132	826.4	-38.77	22.64	-10.26	0.86	H	< 7.00	0.014	11.52
	4183	836.6	-40.10	22.20	-10.21	0.87	H		0.013	11.12
	4233	846.6	-40.80	21.54	-10.17	0.87	H		0.011	10.50

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	-25.33	6.71	10.27	1.34	H	< 2.00	0.037	15.64
	9400	1880.0	-26.52	5.61	10.29	1.36	H		0.028	14.54
	9538	1907.6	-27.42	5.11	10.31	1.37	H		0.025	14.05

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	-27.16	4.63	9.92	1.29	H	< 1.00	0.021	13.26
	1412	1732.4	-26.66	5.16	10.00	1.28	H		0.024	13.88
	1513	1752.6	-27.02	4.80	10.10	1.29	H		0.023	13.61

8.3 RADIATED SPURIOUS EMISSIONS

▣ MEASURED OUTPUT POWER: 11.52 dBm = 0.014 W

▣ MODULATION SIGNAL: WCDMA850

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 24.52 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBd)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
4,132 (826.4)	1,652.80	-47.69	7.46	-56.58	1.27	H	-52.54	64.06
	2,479.20	-58.15	8.71	-64.52	1.60	H	-59.56	71.08
	3,305.60	-58.10	10.32	-64.13	1.87	H	-57.83	69.35
4,183 (836.6)	1,673.20	-52.00	7.53	-60.99	1.28	H	-56.89	68.41
	2,509.80	-58.05	8.83	-64.37	1.62	V	-59.31	70.83
	3,346.40	-58.69	10.51	-65.01	1.91	V	-58.56	70.08
4,233 (846.6)	1,693.20	-48.87	7.67	-57.90	1.28	H	-53.66	65.18
	2,539.80	-58.01	8.85	-63.79	1.61	H	-58.70	70.22
	3,386.40	-58.13	10.56	-64.41	1.93	V	-57.93	69.45

▣ MEASURED OUTPUT POWER: 15.64 dBm = 0.037 W

▣ MODULATION SIGNAL: WCDMA1900

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 28.64 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
9262 (1852.4)	3,704.80	-57.23	12.50	-63.86	1.99	H	-53.35	68.99
	5,557.20	-57.45	13.64	-58.69	2.71	V	-47.76	63.40
	7,409.60	-57.78	11.50	-52.49	2.93	H	-43.92	59.56
9400 (1880.0)	3,760.00	-58.03	12.40	-64.47	2.00	H	-54.07	69.71
	5,640.00	-58.03	13.78	-58.86	2.70	V	-47.78	63.42
	7,520.00	-58.24	11.57	-53.03	2.93	H	-44.39	60.03
9538 (1907.6)	3,815.20	-57.48	12.52	-63.85	2.06	H	-53.38	69.02
	5,722.80	-57.88	13.70	-57.57	2.72	V	-46.59	62.23
	7,630.40	-58.04	11.95	-53.23	2.98	H	-44.26	59.89

▣ MEASURED OUTPUT POWER: 13.88 dBm = 0.024 W

▣ MODULATION SIGNAL: WCDMA1700

▣ DISTANCE: 3 meters

▣ LIMIT: 43 + 10 log10 (W) = 26.88 dBc

Ch.	Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	dBc
1312 (1712.4)	3,424.80	-57.96	12.69	-65.96	1.90	H	-55.17	69.05
	5,137.20	-56.99	12.75	-58.70	2.52	H	-48.47	62.35
	6,849.60	-56.74	12.52	-53.98	2.81	V	-44.27	58.15
1412 (1732.4)	3,464.80	-58.65	12.60	-66.24	1.97	H	-55.61	69.49
	5,197.20	-57.31	13.17	-59.22	2.54	H	-48.59	62.47
	6,929.60	-56.88	12.46	-53.55	2.83	V	-43.92	57.80
1513 (1752.6)	3,505.20	-58.91	12.44	-66.17	1.92	V	-55.65	69.53
	5,257.80	-56.56	13.48	-59.37	2.59	V	-48.48	62.36
	7,010.40	-57.41	12.24	-54.43	2.84	H	-45.03	58.92

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)			
WCDMA1900	9400	CCDF Procedure					2.72	13	Pass
WCDMA1700	1732.4						2.73		

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 53 ~ 54.

8.5 OCCUPIED BANDWIDTH

Band	Channel	Frequency(MHz)	Data (WCDMA : MHz)
WCDMA850	4132	826.4	4.1648
	4183	836.6	4.1529
	4233	846.6	4.1500
WCDMA1900	9262	1852.4	4.1348
	9400	1880.0	4.1439
	9538	1907.6	4.1421
WCDMA1700	1312	1712.4	4.1511
	1412	1732.4	4.1444
	1513	1752.6	4.1523

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page44 ~52.

8.6 CONDUCTED SPURIOUS EMISSIONS

Band	Channel	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result	(dBm)
WCDMA850	4132	2.4029	27.976	-72.144	-44.168	-13.00
	4183	4.1880	27.976	-75.563	-47.587	
	4233	2.4263	27.976	-71.616	-43.640	
WCDMA1900	9262	2.4029	27.976	-69.715	-41.739	
	9400	18.9257	29.489	-72.514	-43.025	
	9538	3.8176	27.976	-70.892	-42.916	
WCDMA1700	1712	18.62447	29.489	-72.740	-43.251	
	1732	18.94072	29.489	-72.908	-43.419	
	1753	18.88897	29.489	-72.657	-43.168	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 67 ~ 81.
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 55 ~ 66.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ Mode: WCDMA850

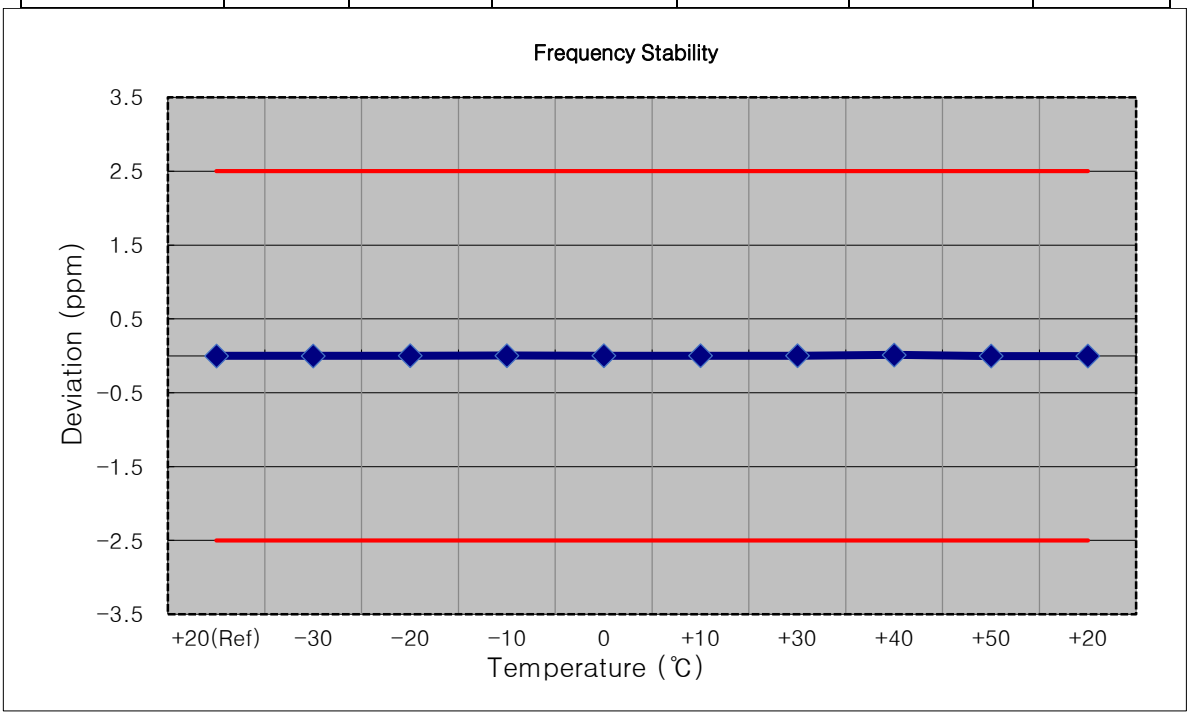
▣ OPERATING FREQUENCY: 836,600,000 Hz

▣ CHANNEL: 4183

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: ± 0.000 25 % or 2.5 ppm

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	836 600 001	0.0	0.000 000	0.0000
100%		-30	836 600 000	-1.1	0.000 000	-0.0014
100%		-20	836 600 003	1.5	0.000 000	0.0018
100%		-10	836 600 004	2.8	0.000 000	0.0033
100%		0	836 600 004	2.1	0.000 000	0.0025
100%		+10	836 600 003	1.3	0.000 000	0.0016
100%		+30	836 600 003	1.3	0.000 000	0.0016
100%		+40	836 600 013	11.2	0.000 001	0.0134
100%		+50	836 600 000	-1.6	0.000 000	-0.0019
Batt. Endpoint	3.500	+20	836 599 999	-2.0	0.000 000	-0.0024



▣ Mode: WCDMA1900

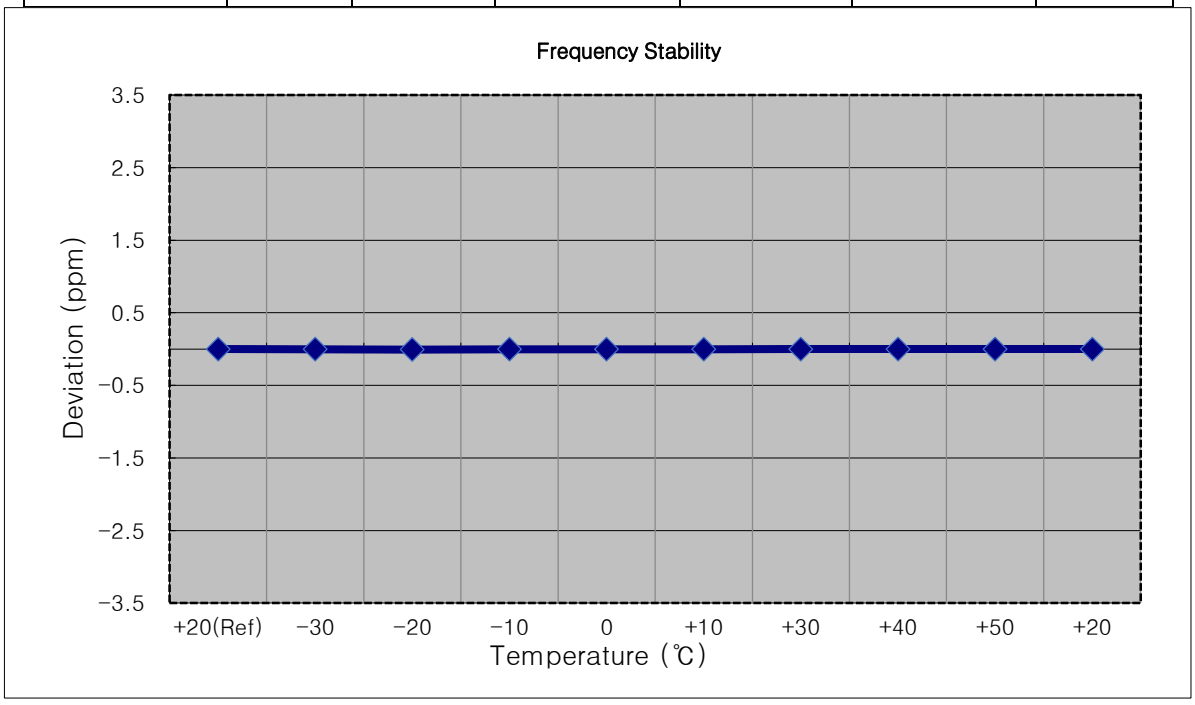
▣ OPERATING FREQUENCY: 1,852,400,000 Hz

▣ CHANNEL: 9262

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1852 399 993	0.0	0.000 000	0.0000
100%		-30	1852 399 990	-3.2	0.000 000	-0.0017
100%		-20	1852 399 982	-10.7	-0.000 001	-0.0058
100%		-10	1852 399 989	-3.9	0.000 000	-0.0021
100%		0	1852 399 987	-5.6	0.000 000	-0.0030
100%		+10	1852 399 989	-3.7	0.000 000	-0.0020
100%		+30	1852 399 992	-1.2	0.000 000	-0.0007
100%		+40	1852 399 991	-1.6	0.000 000	-0.0009
100%		+50	1852 399 995	1.9	0.000 000	0.0010
Batt. Endpoint	3.500	+20	1852 399 994	0.9	0.000 000	0.0005



▣ Mode: WCDMA1900

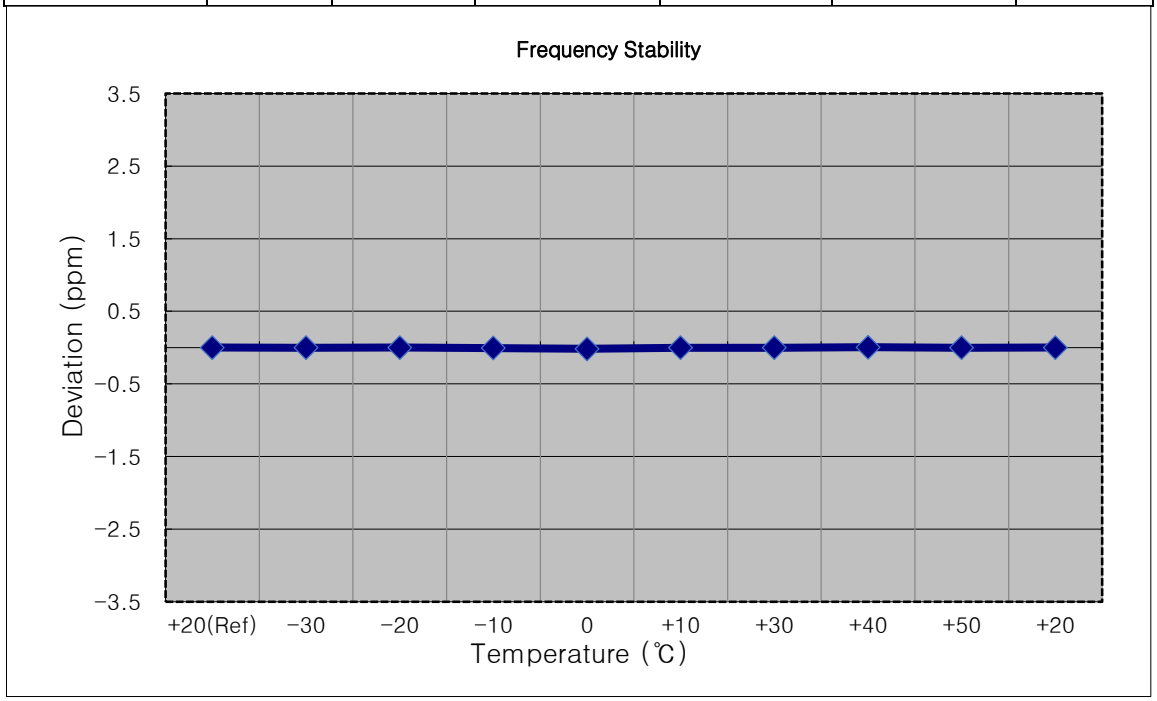
▣ OPERATING FREQUENCY: 1,880,000,000 Hz

▣ CHANNEL: 9400

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1879 999 999	0.0	0.000 000	0.0000
100%		-30	1879 999 996	-2.1	0.000 000	-0.0011
100%		-20	1879 999 997	-1.2	0.000 000	-0.0007
100%		-10	1879 999 985	-13.5	-0.000 001	-0.0072
100%		0	1879 999 966	-32.6	-0.000 002	-0.0173
100%		+10	1879 999 997	-1.8	0.000 000	-0.0010
100%		+30	1879 999 996	-2.2	0.000 000	-0.0011
100%		+40	1880 000 005	6.9	0.000 000	0.0037
100%		+50	1879 999 995	-3.4	0.000 000	-0.0018
Batt. Endpoint	3.500	+20	1879 999 997	-1.6	0.000 000	-0.0008



▣ Mode: WCDMA1900

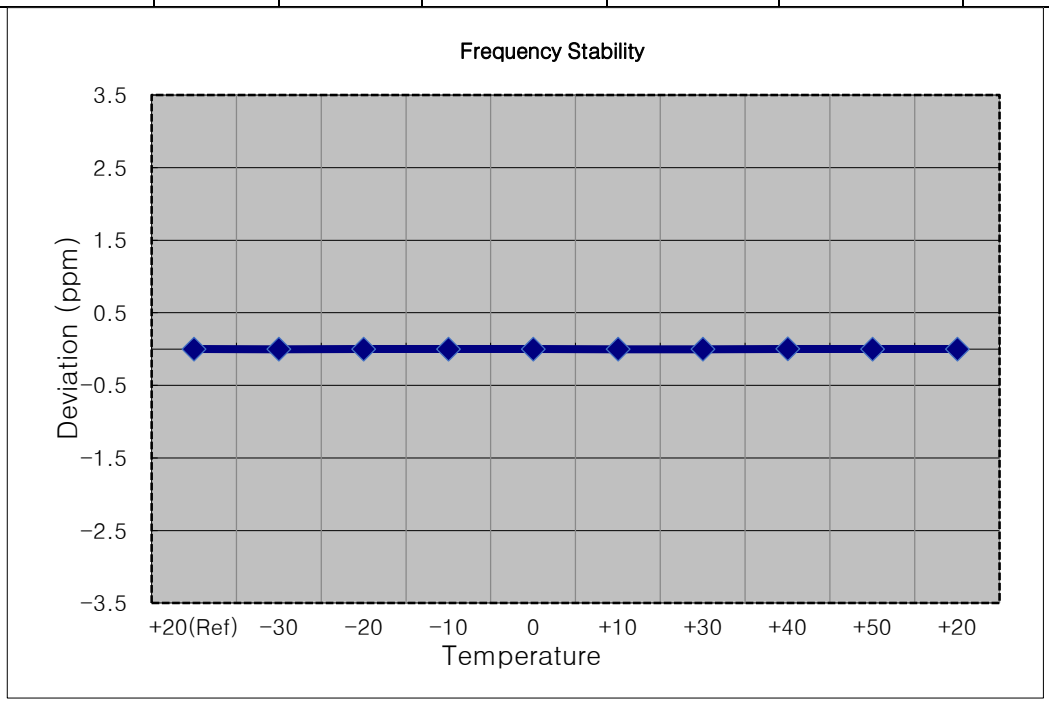
▣ OPERATING FREQUENCY: 1,907,600,000 Hz

▣ CHANNEL: 9538

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1907 600 004	0.0	0.000 000	0.0000
100%		-30	1907 600 001	-2.5	0.000 000	-0.0013
100%		-20	1907 600 006	1.7	0.000 000	0.0009
100%		-10	1907 600 002	-1.7	0.000 000	-0.0009
100%		0	1907 600 002	-1.7	0.000 000	-0.0009
100%		+10	1907 600 001	-3.1	0.000 000	-0.0016
100%		+30	1907 600 001	-3.2	0.000 000	-0.0017
100%		+40	1907 600 008	4.4	0.000 000	0.0023
100%		+50	1907 600 006	2.2	0.000 000	0.0012
Batt. Endpoint	3.500	+20	1907 600 006	2.3	0.000 000	0.0012



▣ Mode: WCDMA1700

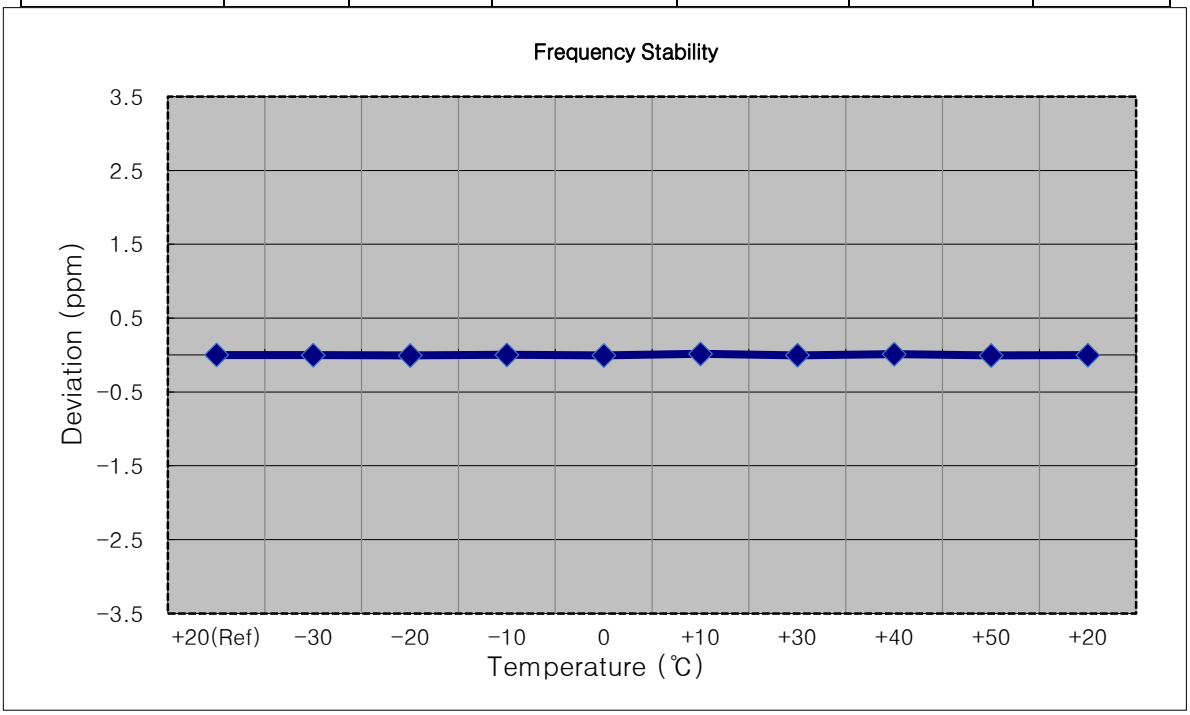
▣ OPERATING FREQUENCY: 1,712,400,000 Hz

▣ CHANNEL: 1312

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1712 399 995	0.0	0.000 000	0.0000
100%		-30	1712 399 993	-2.1	0.000 000	-0.0012
100%		-20	1712 399 986	-8.7	-0.000 001	-0.0051
100%		-10	1712 399 999	3.9	0.000 000	0.0022
100%		0	1712 399 985	-9.7	-0.000 001	-0.0057
100%		+10	1712 400 021	25.7	0.000 002	0.0150
100%		+30	1712 399 988	-7.3	0.000 000	-0.0043
100%		+40	1712 400 014	18.5	0.000 001	0.0108
100%		+50	1712 399 985	-9.7	-0.000 001	-0.0056
Batt. Endpoint	3.500	+20	1712 399 991	-3.7	0.000 000	-0.0022



▣ Mode: WCDMA1700

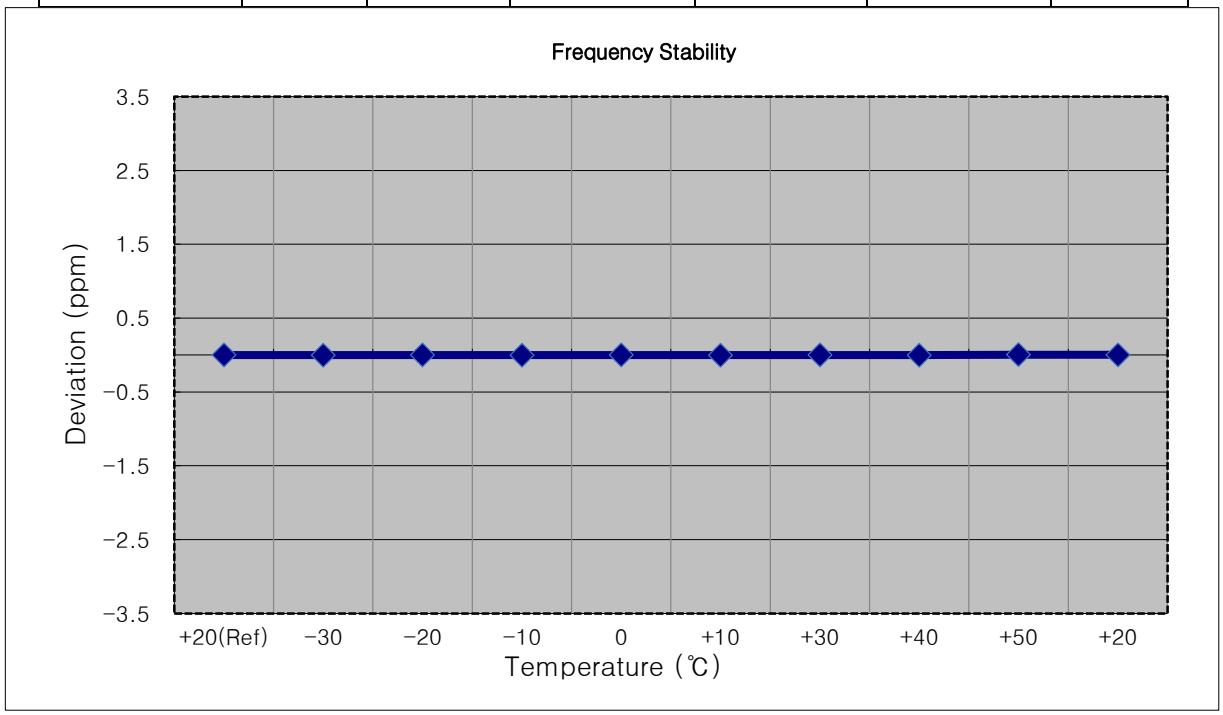
▣ OPERATING FREQUENCY: 1,732,400,000 Hz

▣ CHANNEL: 1412

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1732 400 003	0.0	0.000 000	0.0000
100%		-30	1732 400 001	-1.6	0.000 000	-0.0009
100%		-20	1732 400 005	1.8	0.000 000	0.0010
100%		-10	1732 400 001	-1.3	0.000 000	-0.0007
100%		0	1732 400 004	1.3	0.000 000	0.0008
100%		+10	1732 400 001	-1.8	0.000 000	-0.0011
100%		+30	1732 400 002	-1.2	0.000 000	-0.0007
100%		+40	1732 400 000	-2.5	0.000 000	-0.0014
100%		+50	1732 400 009	6.6	0.000 000	0.0038
Batt. Endpoint	3.500	+20	1732 400 008	4.9	0.000 000	0.0028



▣ Mode: WCDMA1700

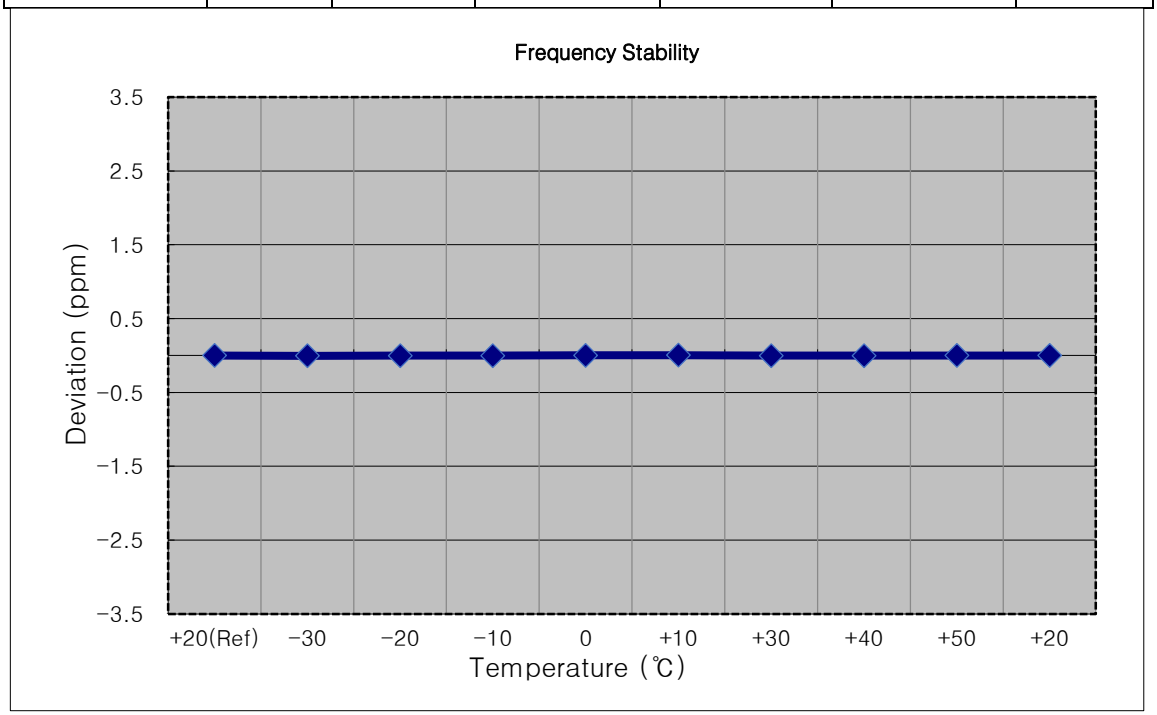
▣ OPERATING FREQUENCY: 1,752,600,000 Hz

▣ CHANNEL: 1513

▣ REFERENCE VOLTAGE: 3.85 VDC

▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	1752 600 005	0.0	0.000 000	0.0000
100%		-30	1752 599 999	-5.7	0.000 000	-0.0033
100%		-20	1752 600 001	-4.1	0.000 000	-0.0023
100%		-10	1752 600 002	-2.3	0.000 000	-0.0013
100%		0	1752 600 011	6.2	0.000 000	0.0036
100%		+10	1752 600 015	10.1	0.000 001	0.0057
100%		+30	1752 600 003	-1.5	0.000 000	-0.0008
100%		+40	1752 600 002	-2.8	0.000 000	-0.0016
100%		+50	1752 600 007	2.1	0.000 000	0.0012
Batt. Endpoint	3.500	+20	1752 600 007	1.8	0.000 000	0.0010



8.9 RECEIVER SPURIOUS EMISSIONS

Frequency Range : 30 MHz ~ 1 GHz

Frequency	Reading	Ant. factor+Cable loss- Amp Gain	Ant. POL	Total	Limit	Margin
MHz	dB μV	dB /m	(H/V)	dB μV/m	dB μV/m	dB
No Peak Found						

Frequency Range : Above 1 GHz

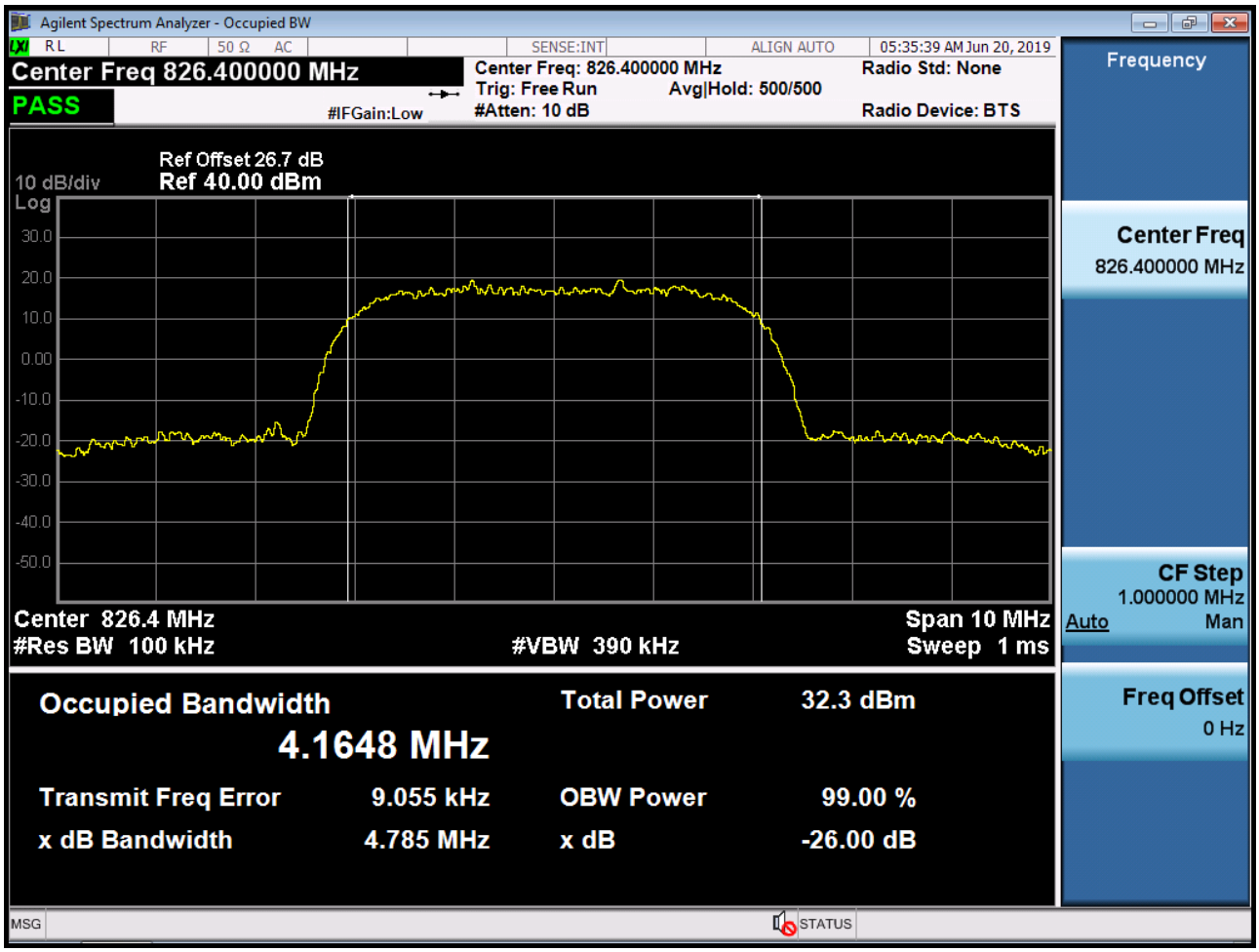
Frequency	Reading	Ant. factor+Cable loss- Amp Gain	Ant. POL	Total	Limit	Margin
MHz	dB μV	dB /m	(H/V)	dB μV/m	dB μV/m	dB
No Peak Found						

Limit

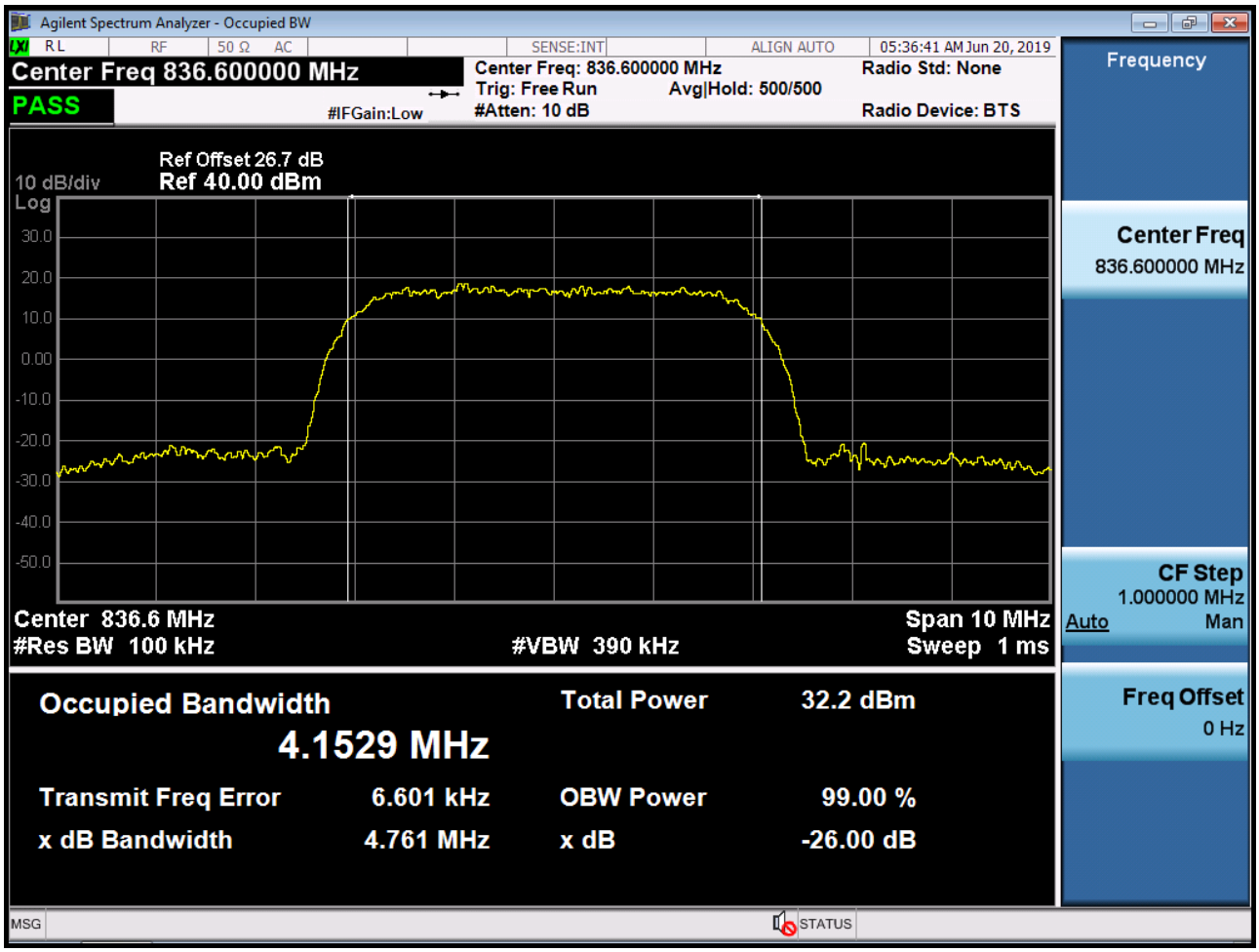
Frequency (MHz)	Field Strength (μv/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

9. TEST PLOTS

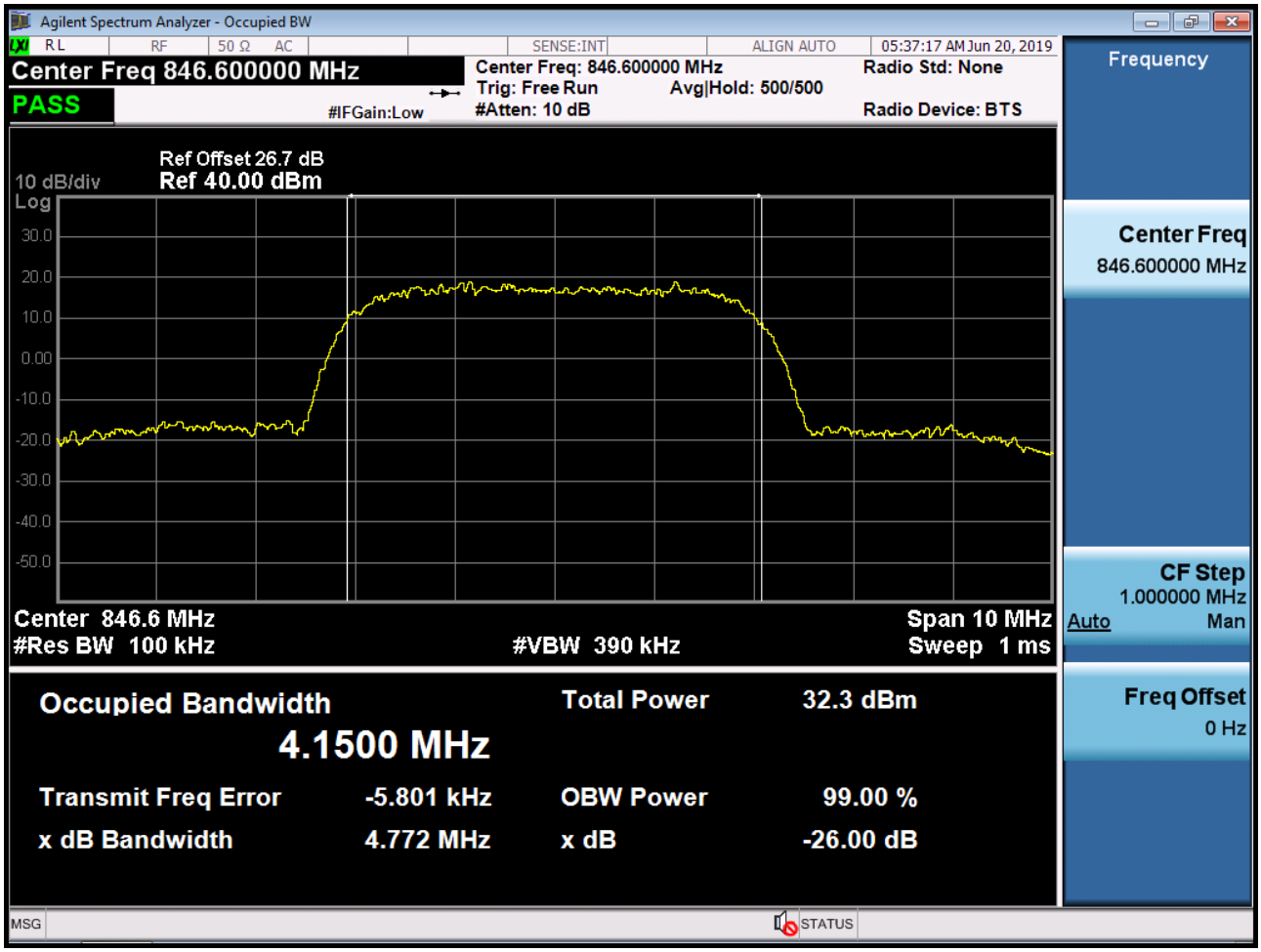
■ WCDMA850 MODE (4132 CH.) Occupied Bandwidth



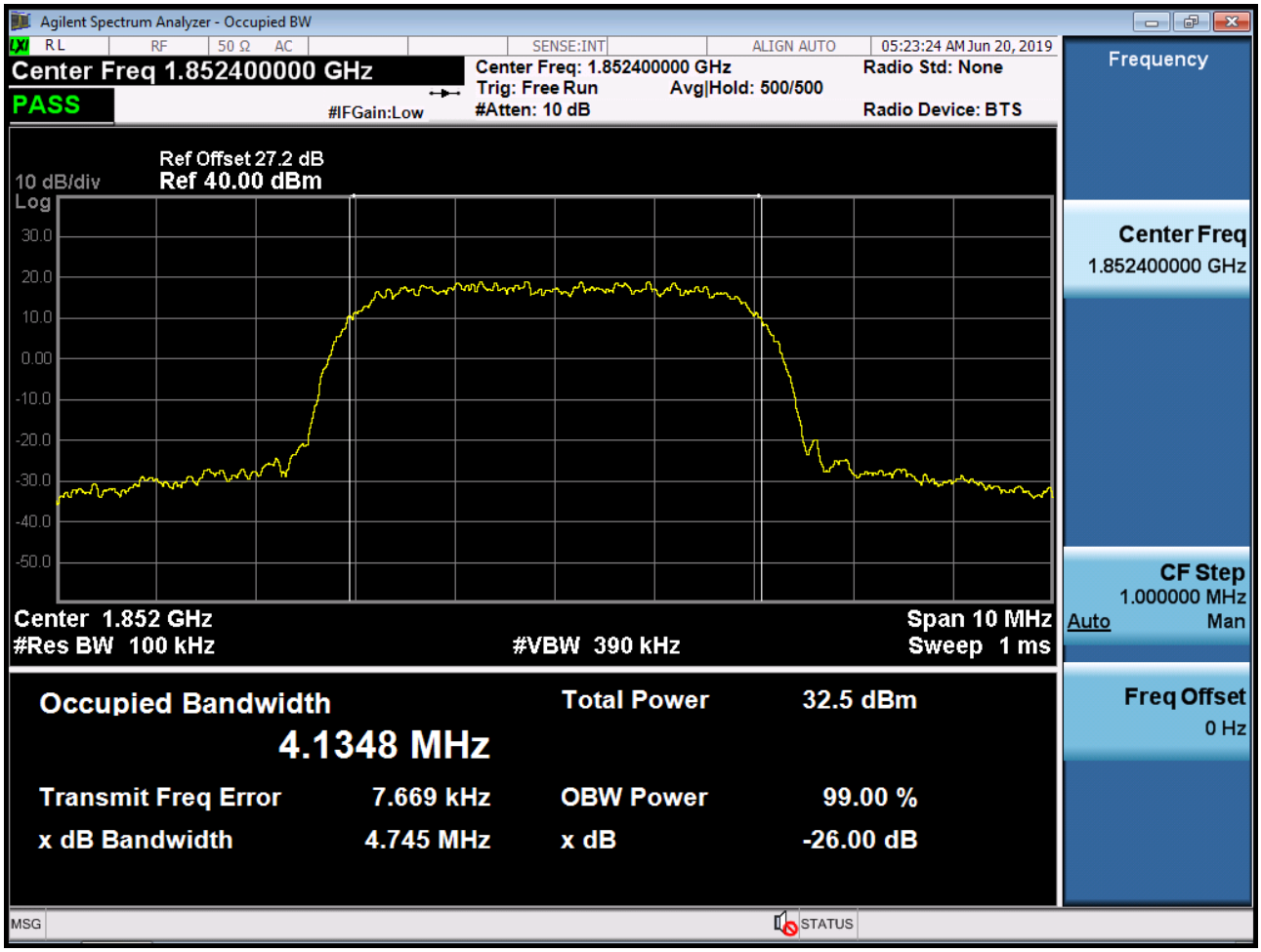
■ WCDMA850 MODE (4183 CH.) Occupied Bandwidth



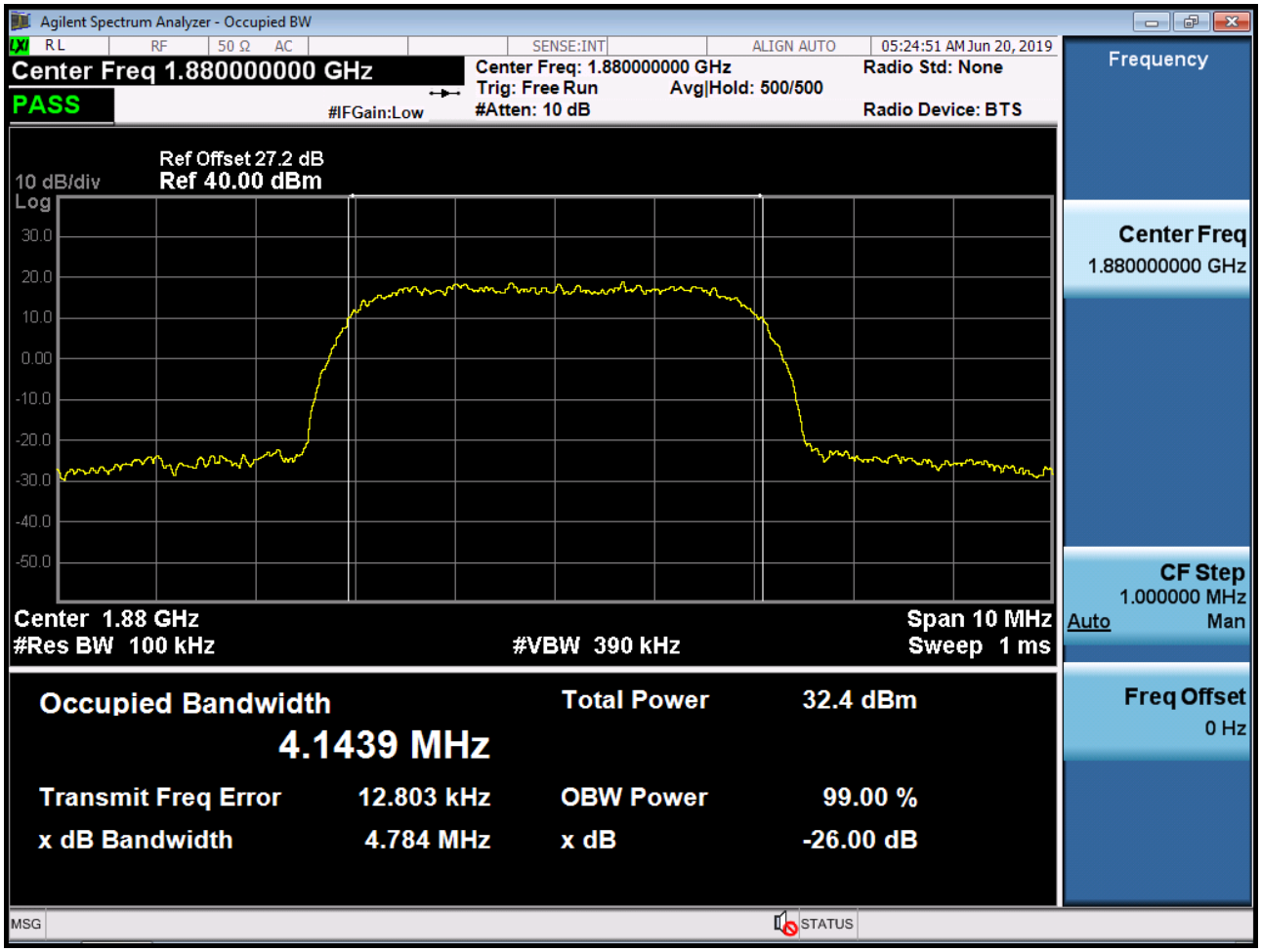
■ WCDMA850MODE (4233 CH.) Occupied Bandwidth



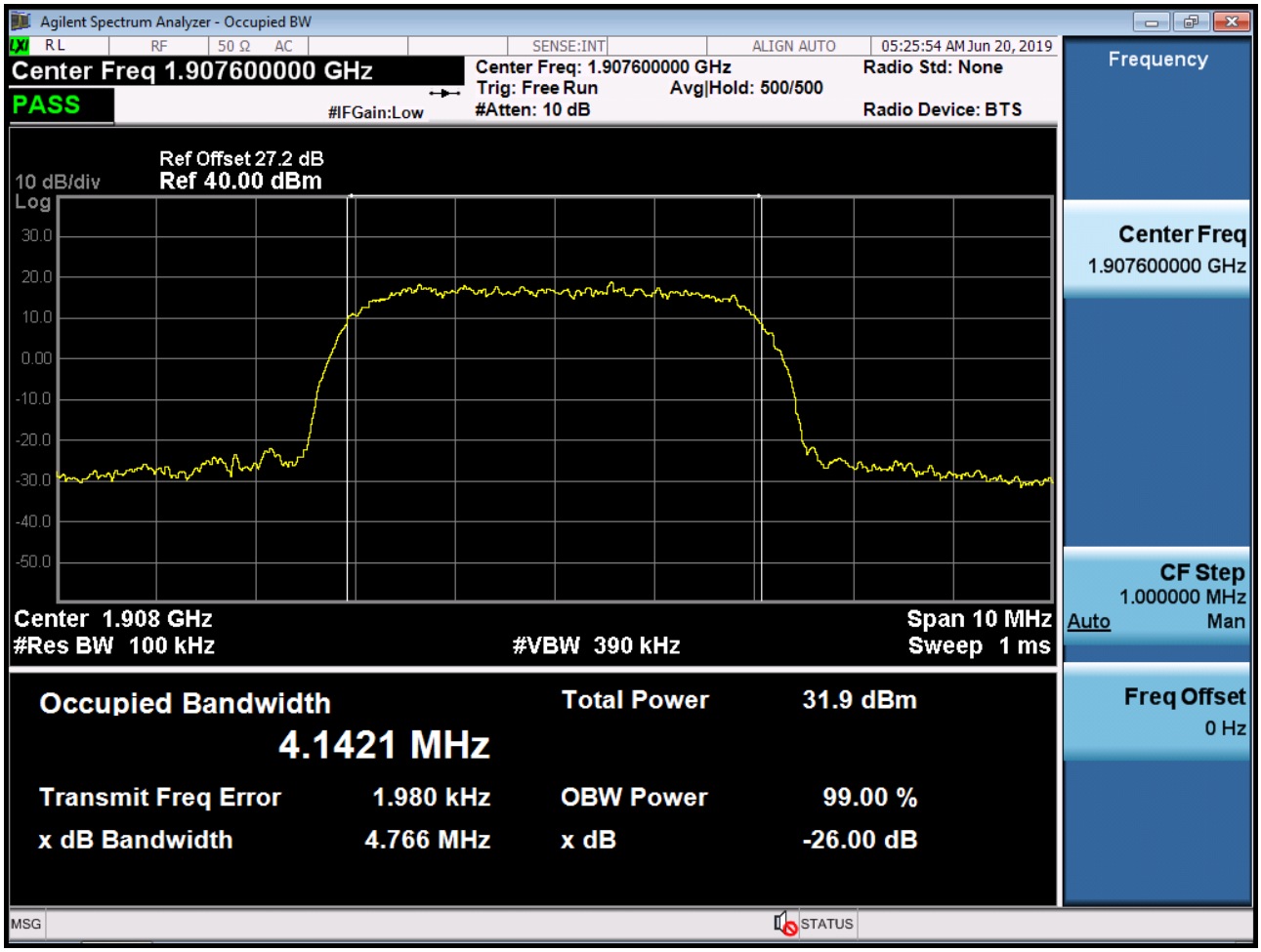
■ WCDMA1900 MODE (9262 CH.) Occupied Bandwidth



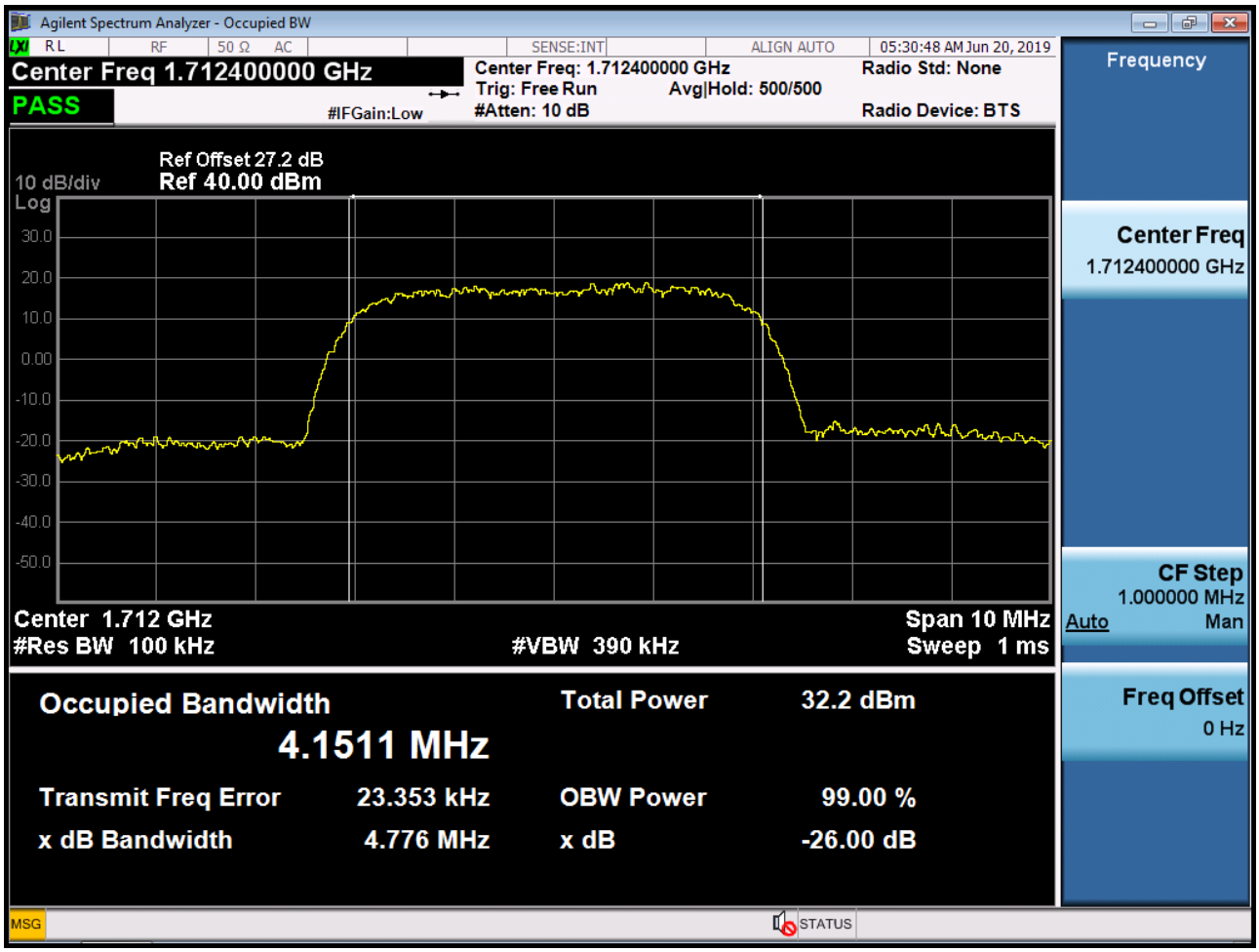
■ WCDMA1900 MODE (9400 CH.) Occupied Bandwidth



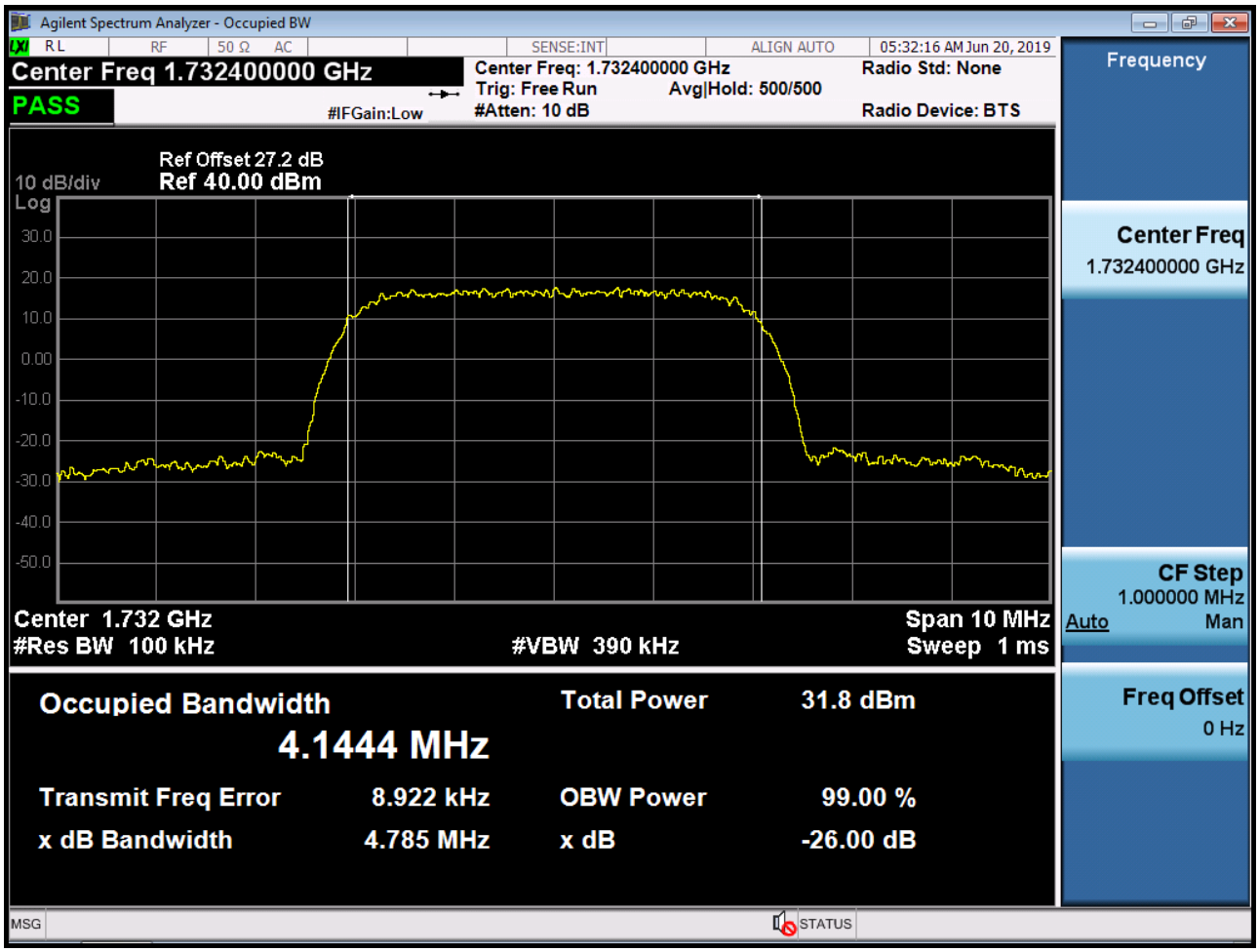
■ WCDMA1900 MODE (9538 CH.) Occupied Bandwidth



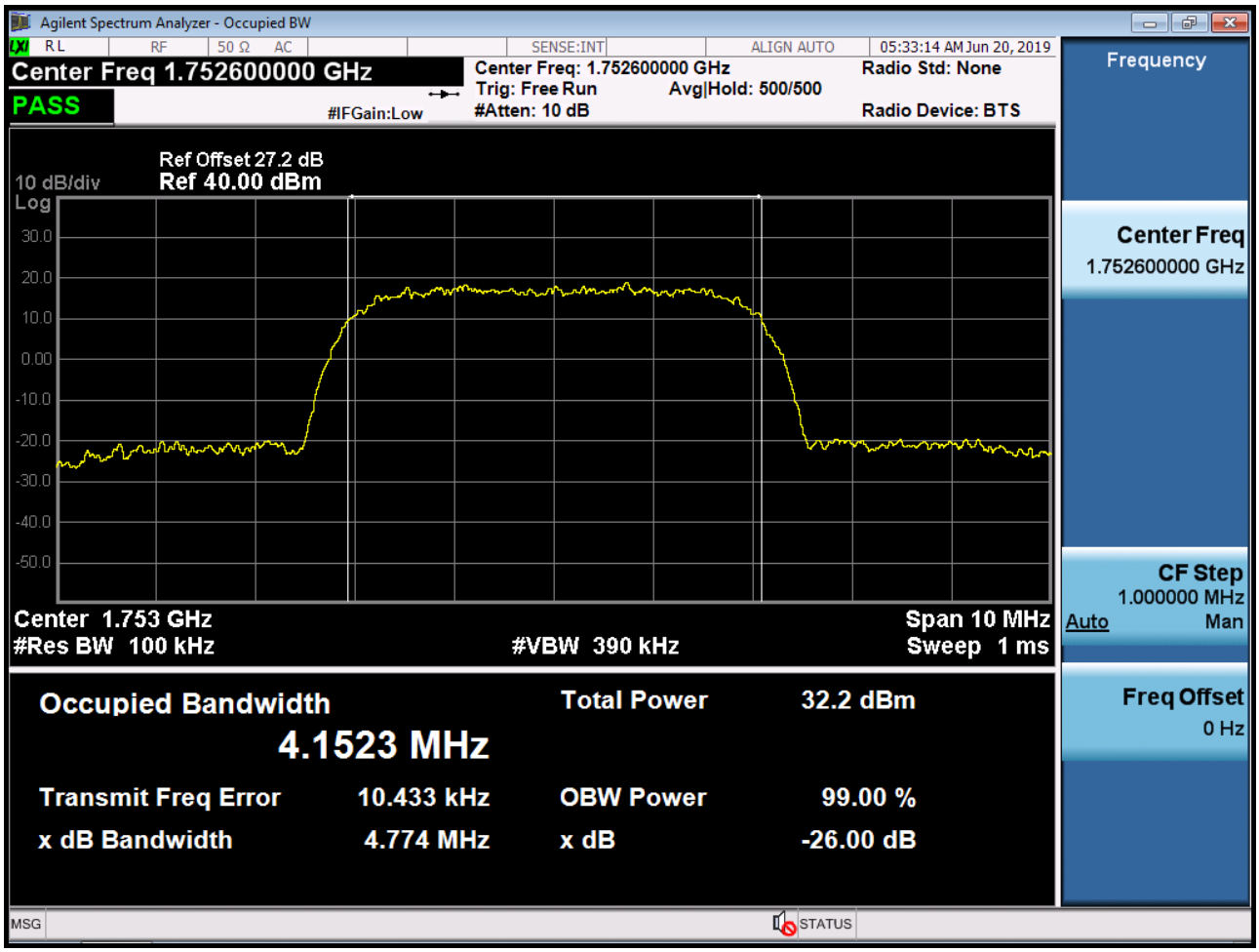
■ WCDMA1700 MODE (1712.4 CH.) Occupied Bandwidth



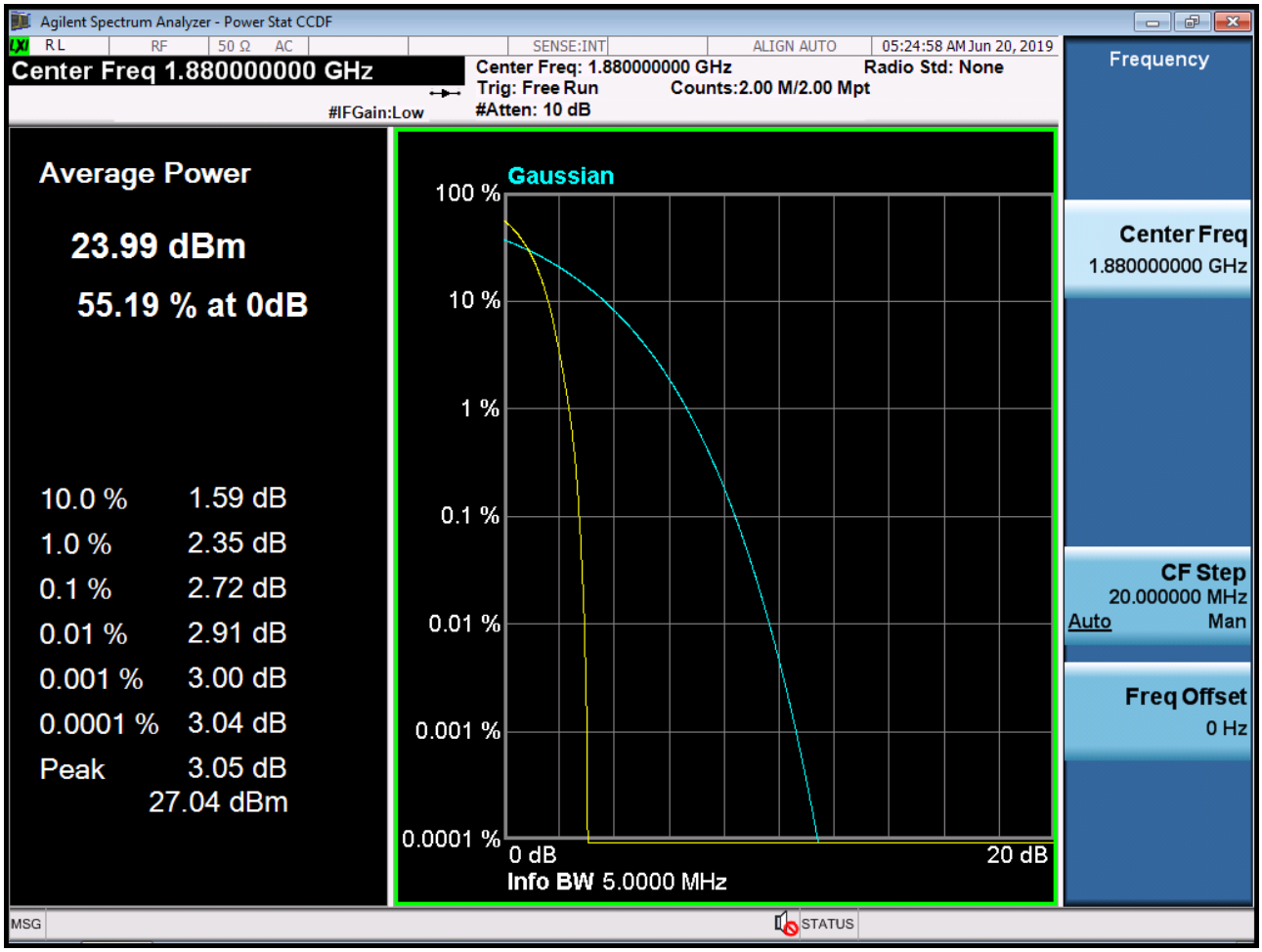
■ WCDMA1700 MODE (1732.4 CH.) Occupied Bandwidth



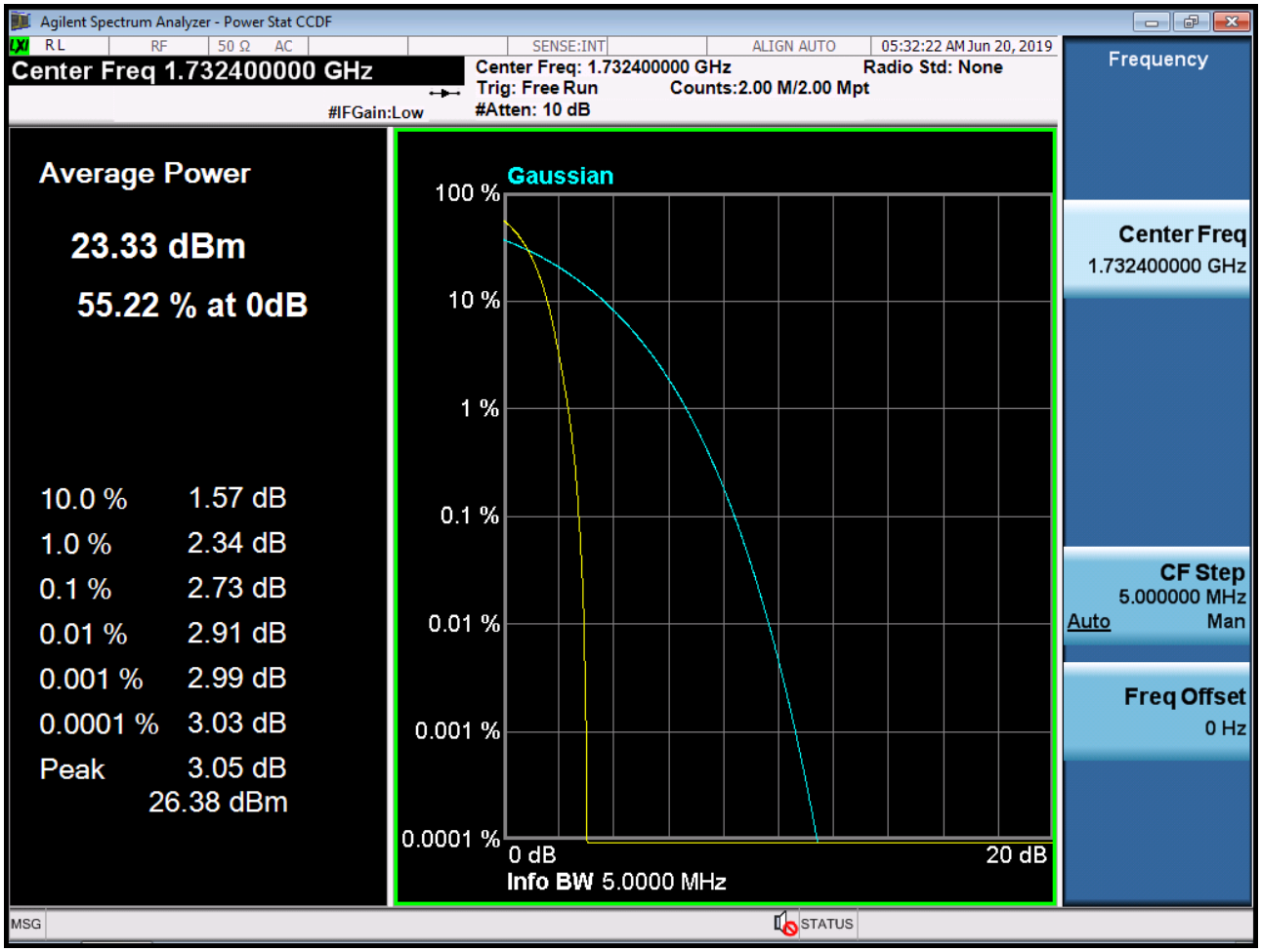
■ WCDMA1700 MODE (1752.6 CH.) Occupied Bandwidth



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



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



■ WCDMA850 MODE (4132 CH.) Block Edge

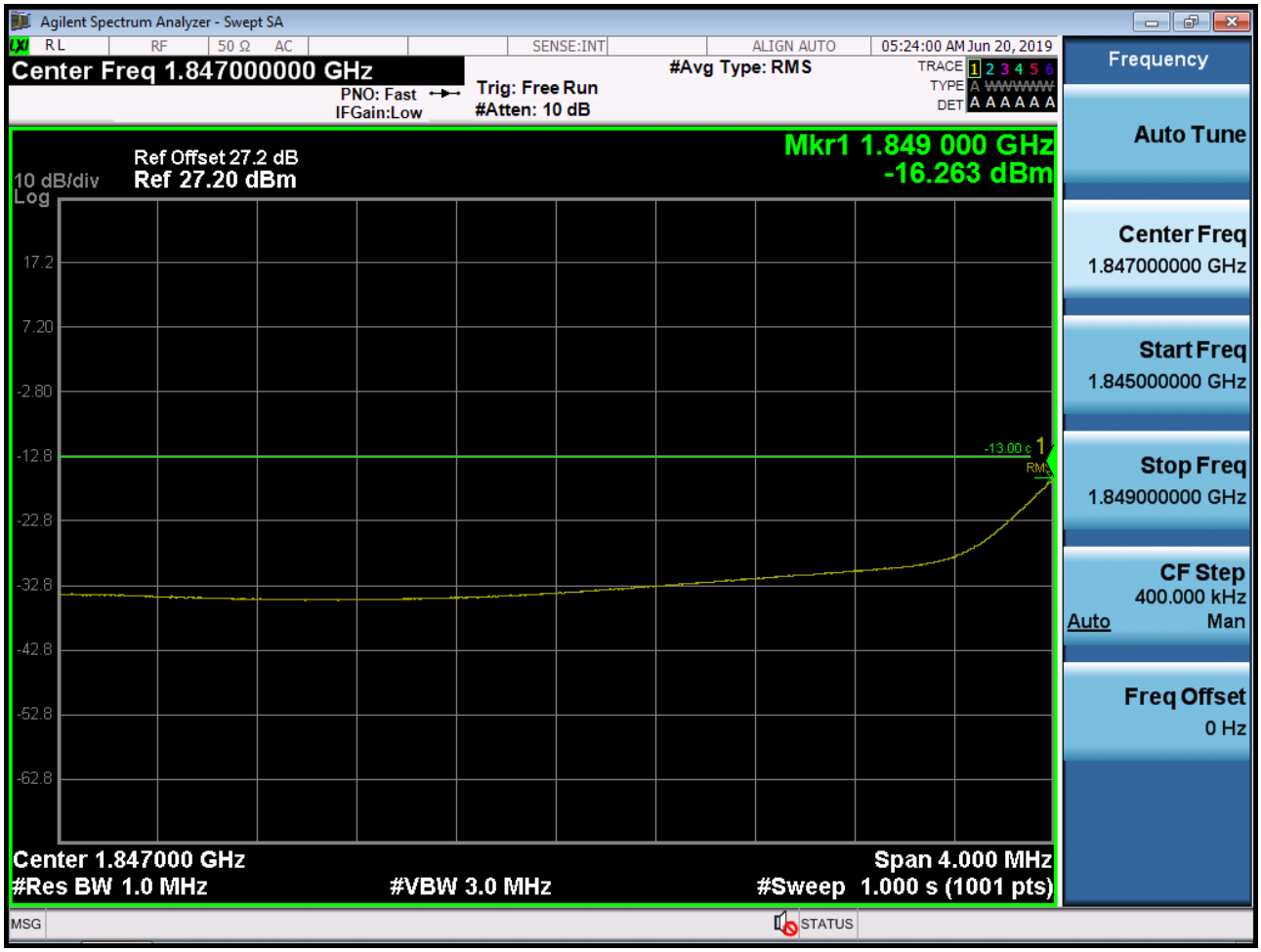
■ WCDMA850 MODE (4132 CH.) – 4 MHz Span

■ 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

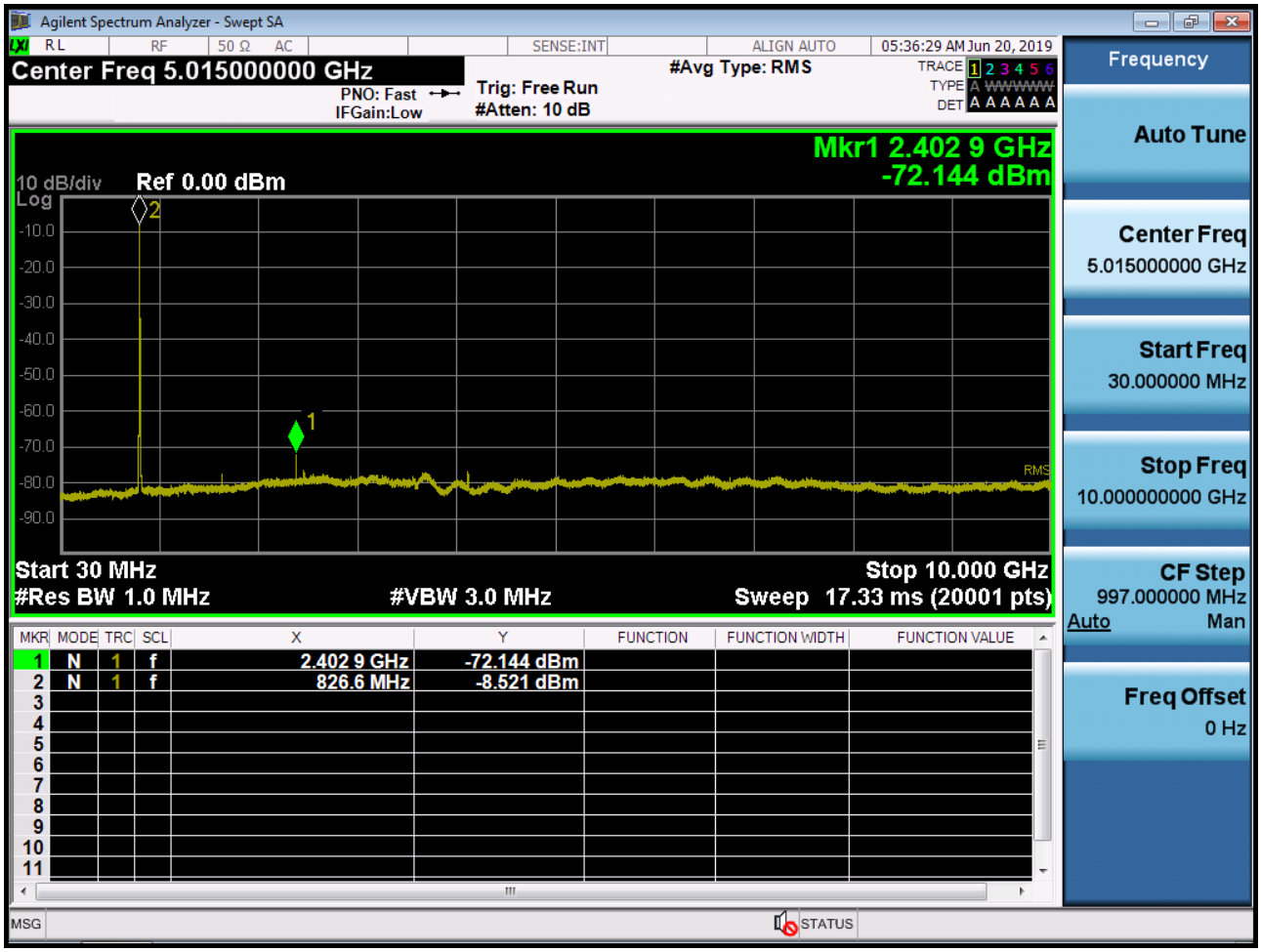
■ WCDMA1700 MODE (1312 CH.) Block Edge

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

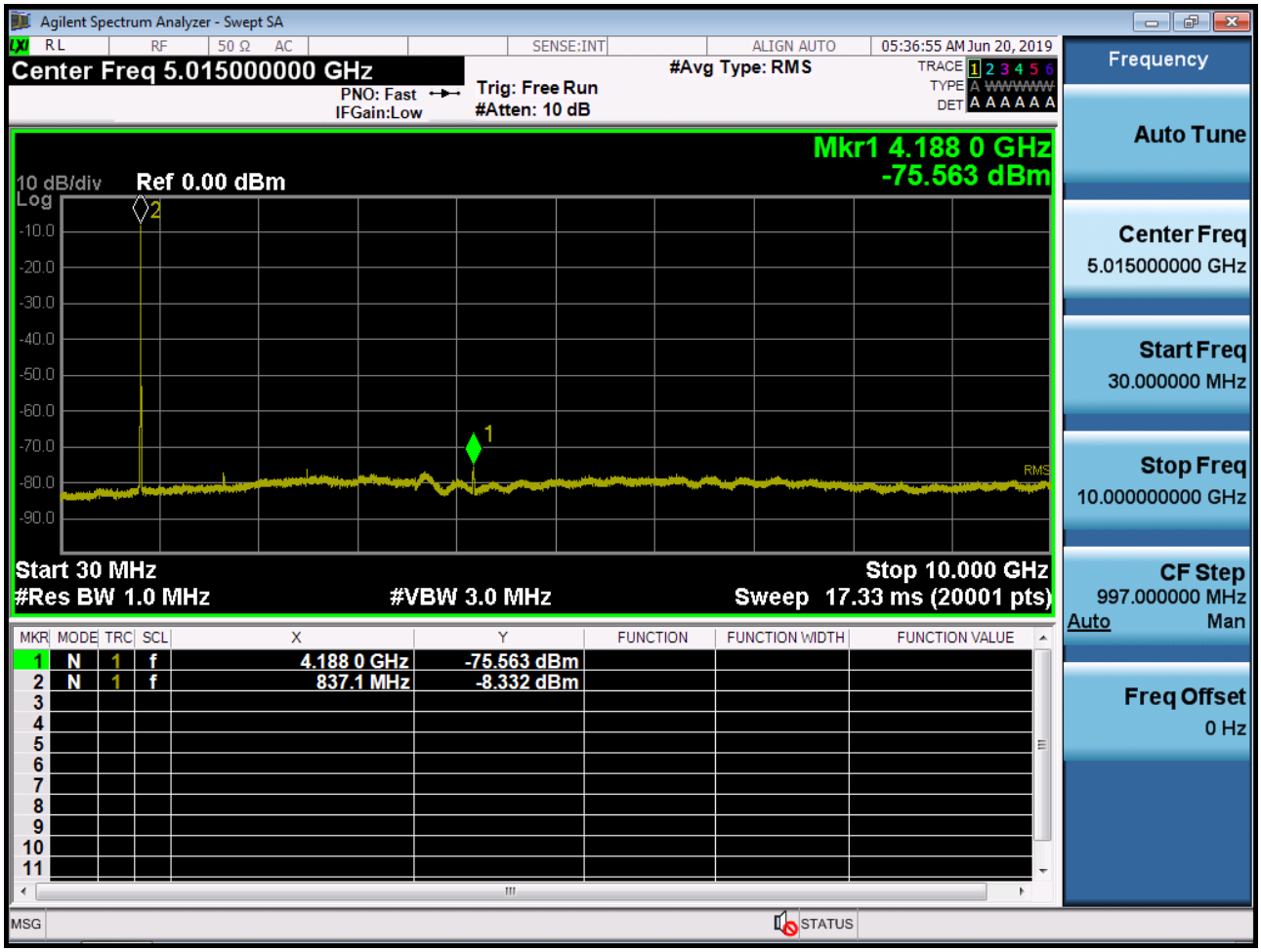
■ WCDMA1700 MODE (1513 CH.) Block Edge

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

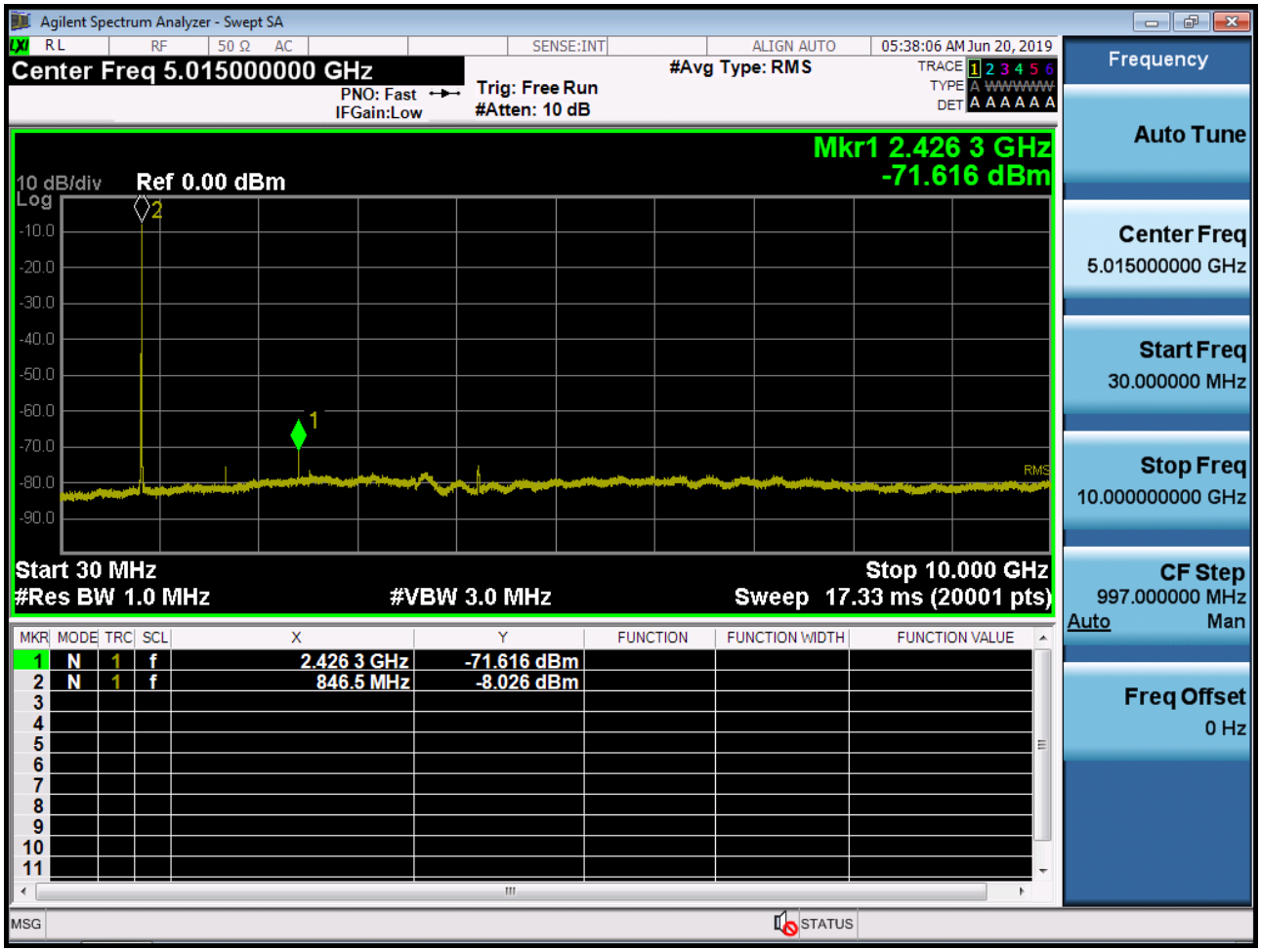
■ WCDMA850 MODE (4132 CH.) Conducted Spurious Emissions



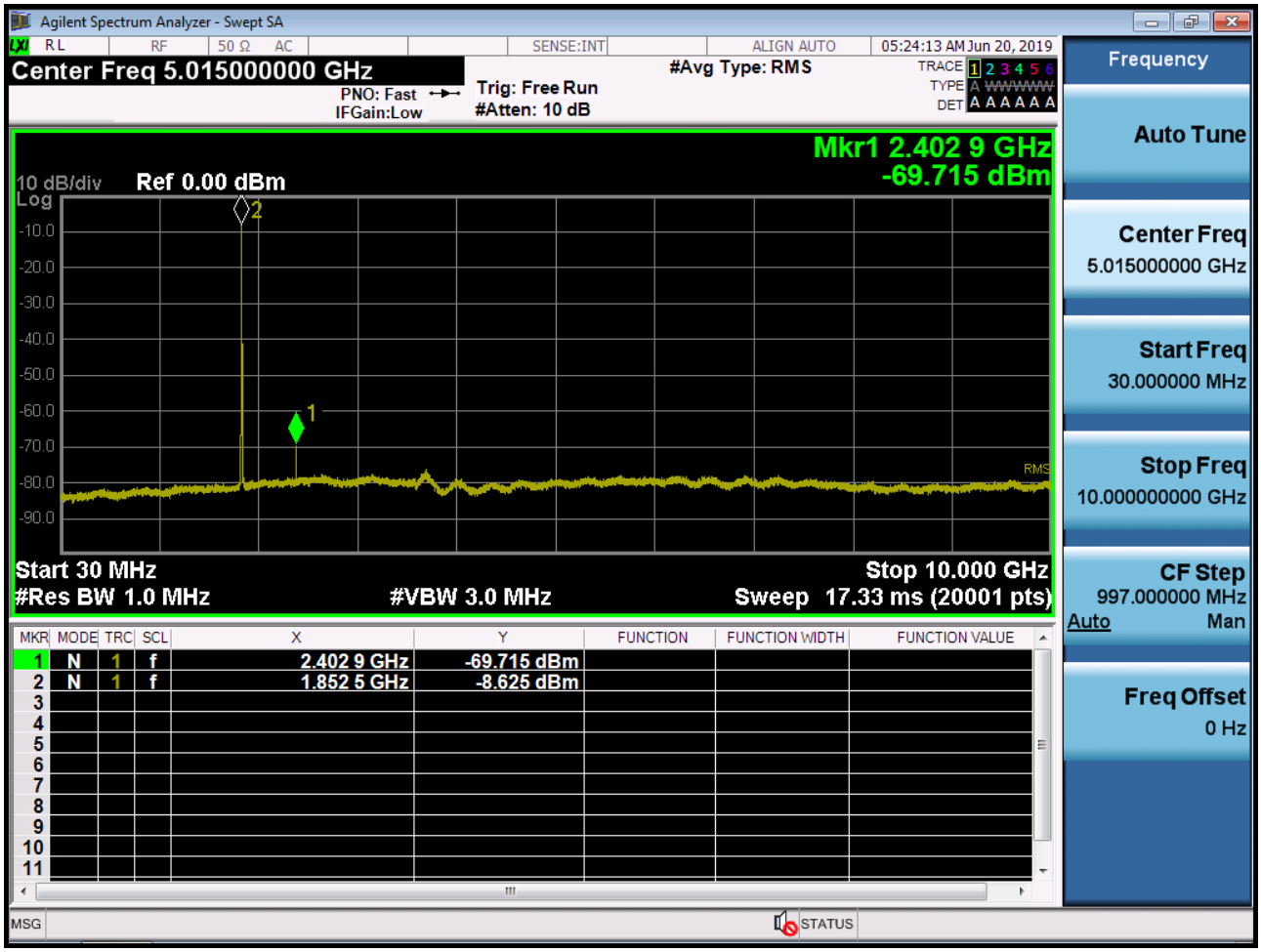
■ WCDMA850 MODE (4183 CH.) Conducted Spurious Emissions



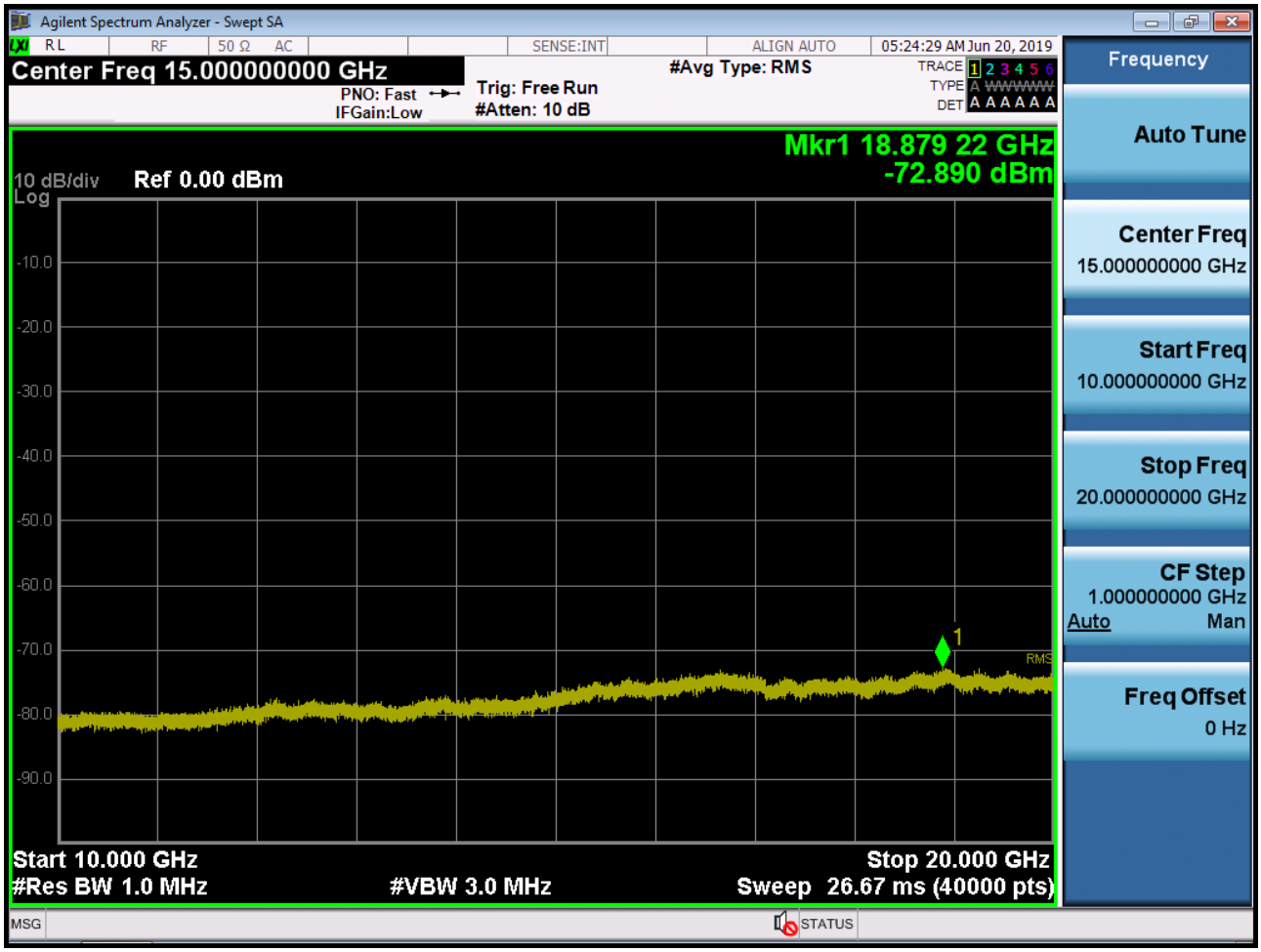
■ WCDMA850MODE (4233 CH.) Conducted Spurious Emissions



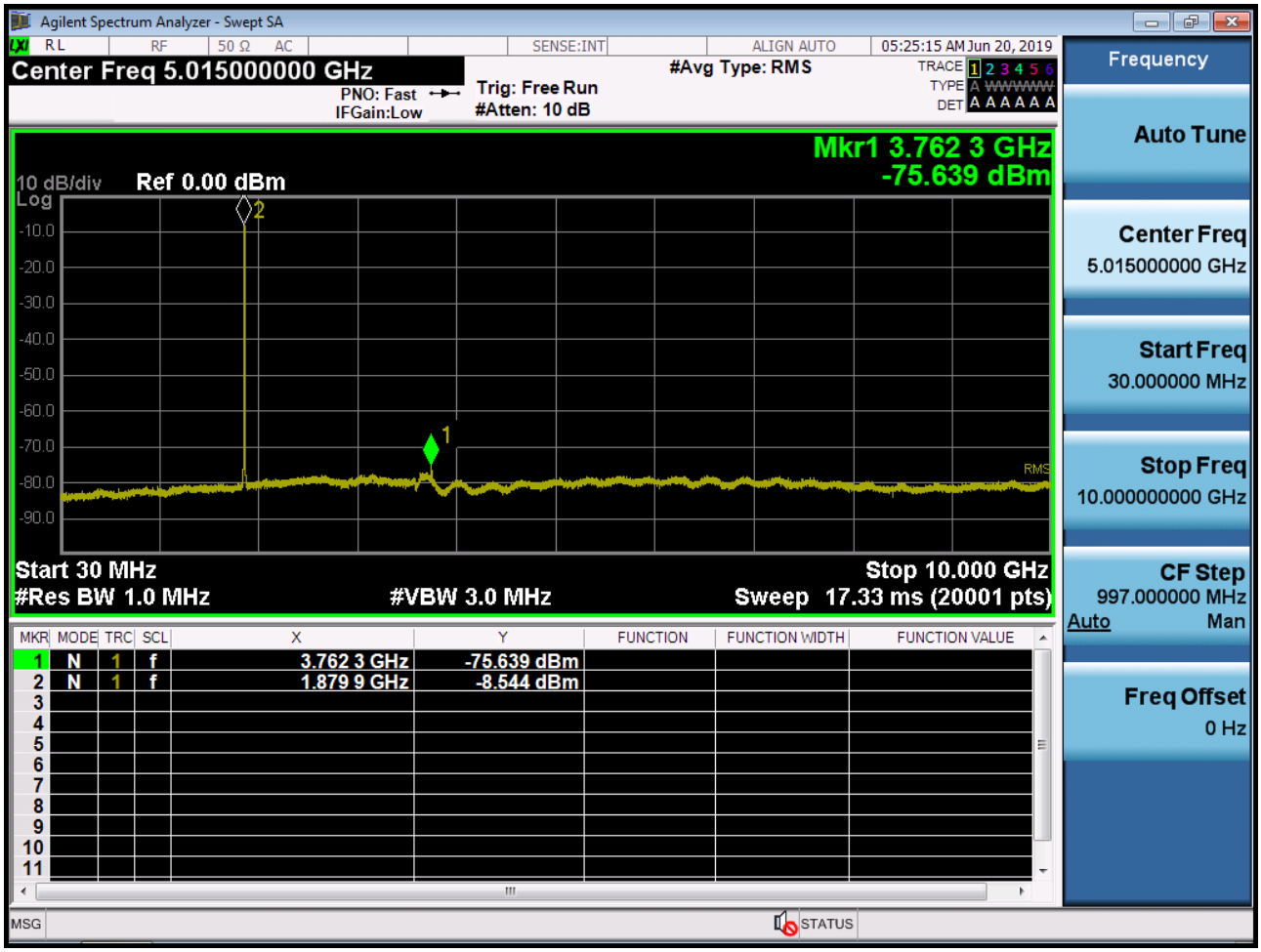
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions1



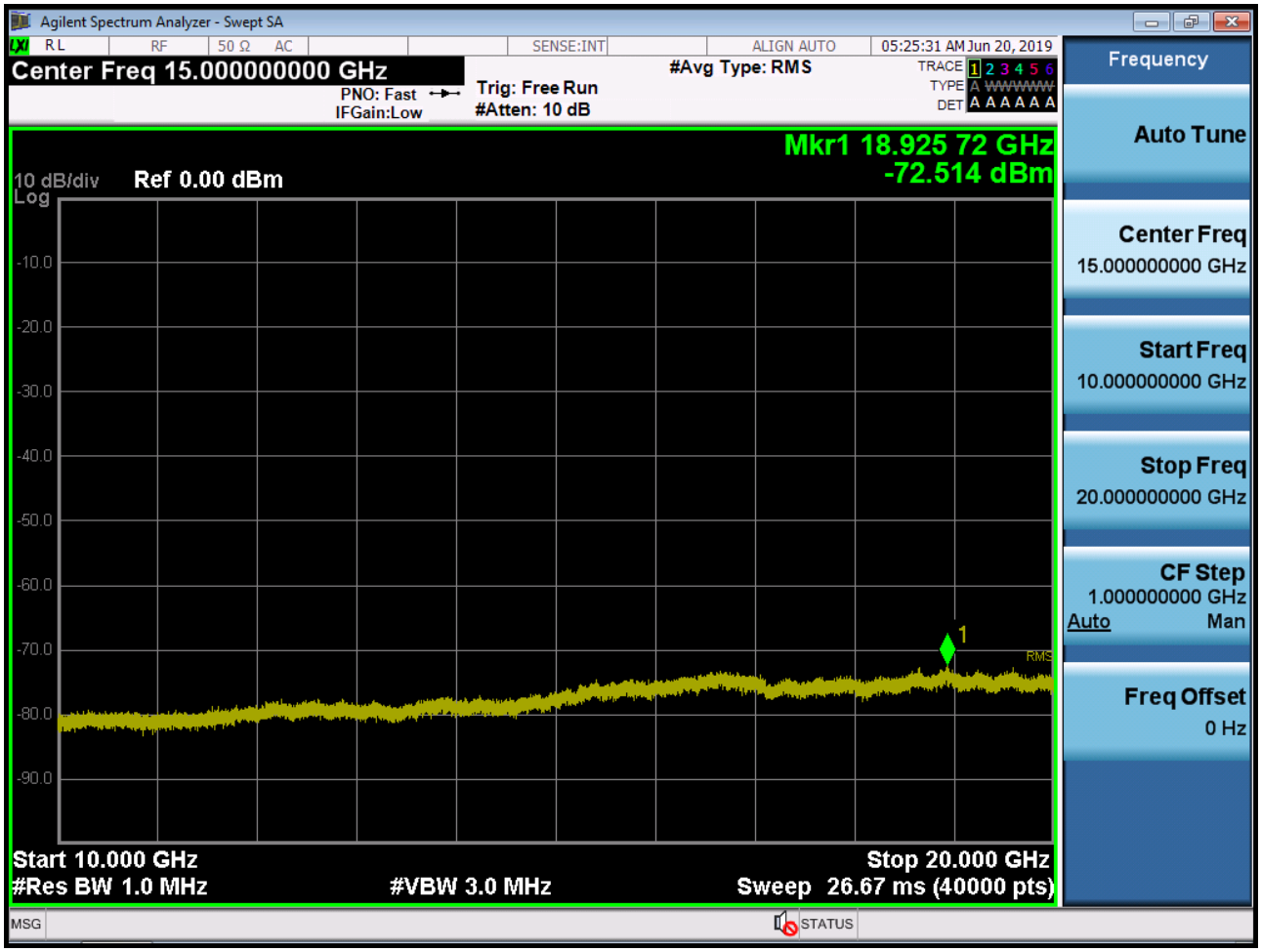
■ WCDMA1900 MODE (9262 CH.) Conducted Spurious Emissions2



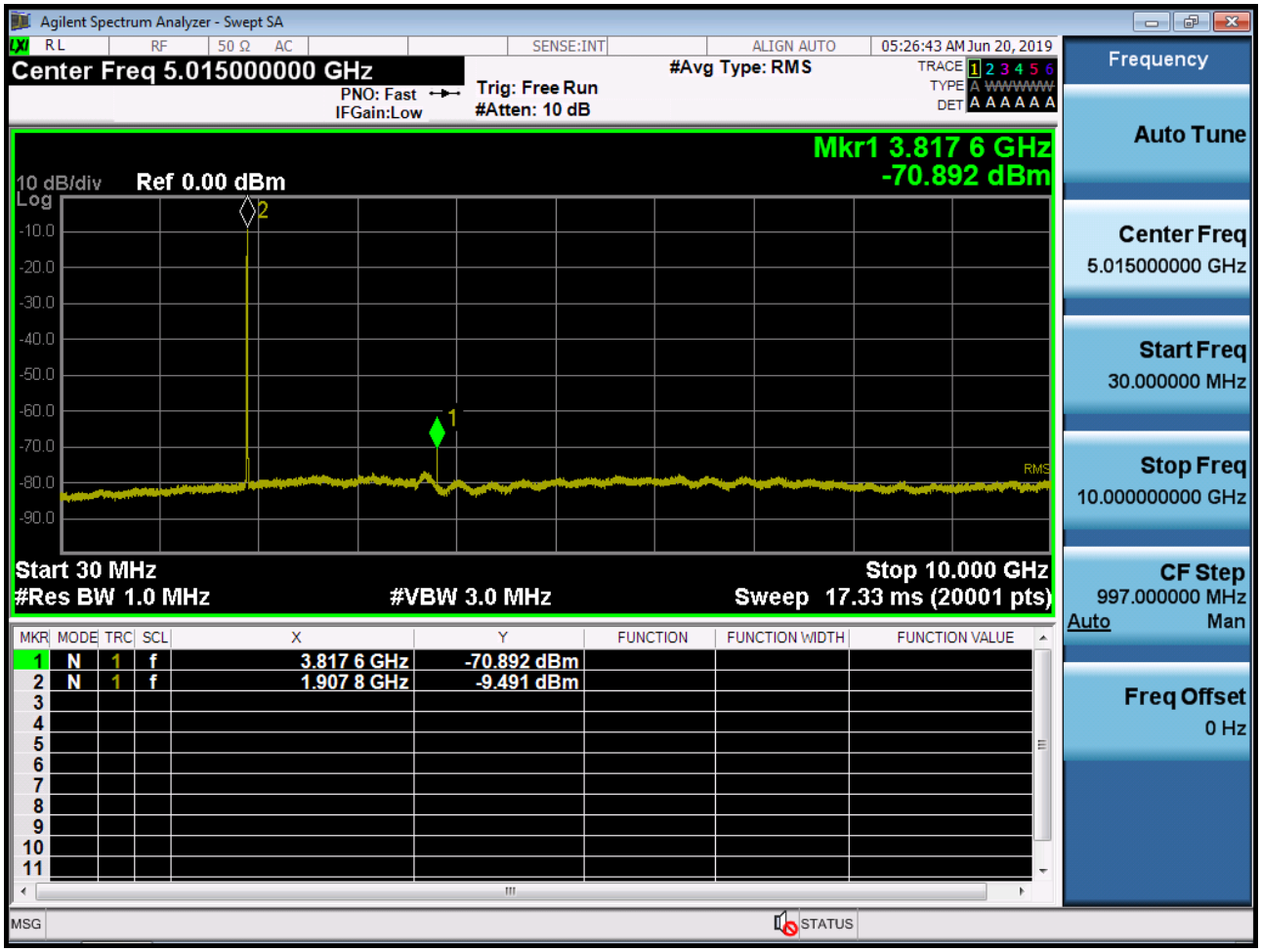
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions1



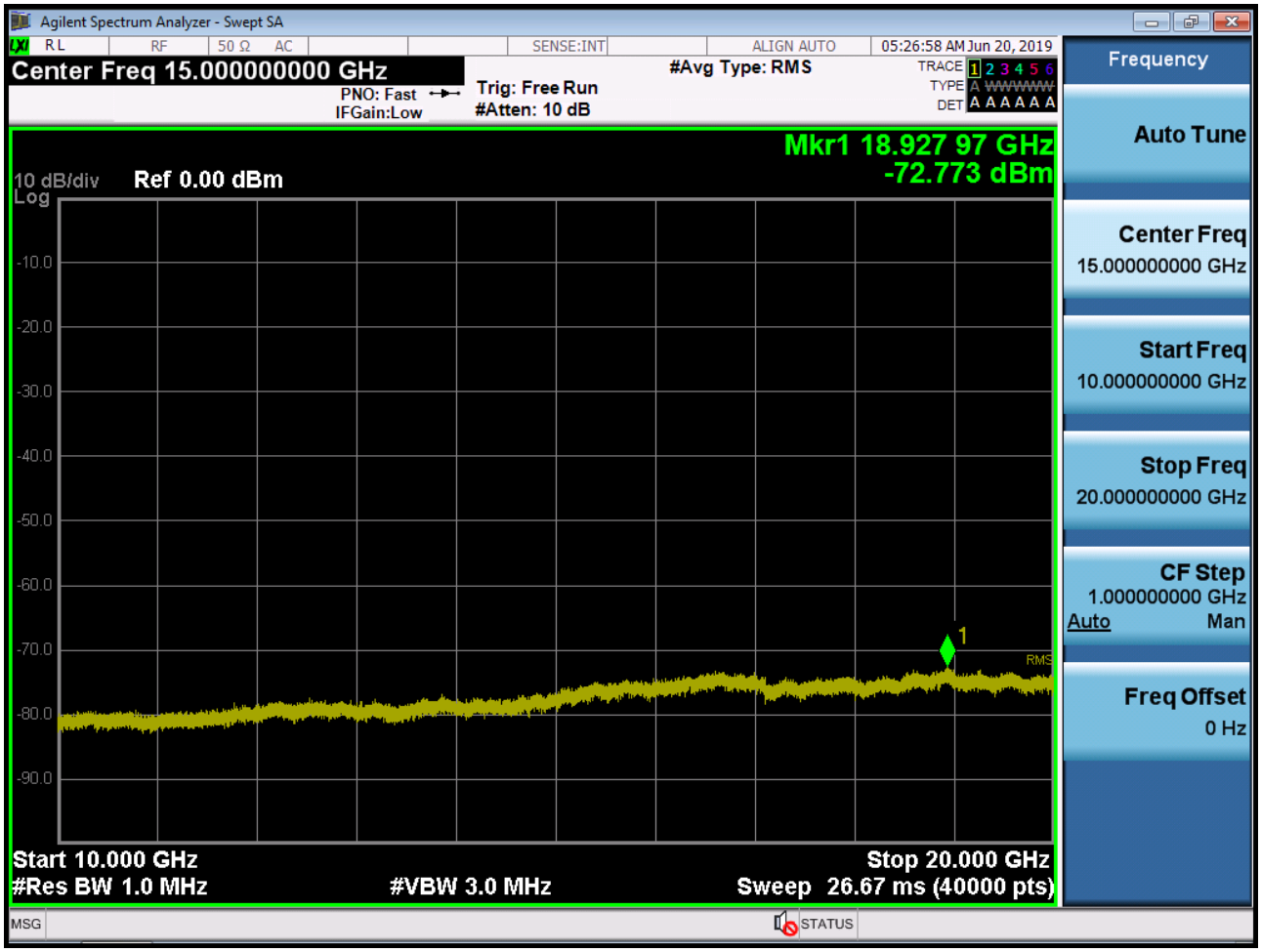
■ WCDMA1900 MODE (9400 CH.) Conducted Spurious Emissions2



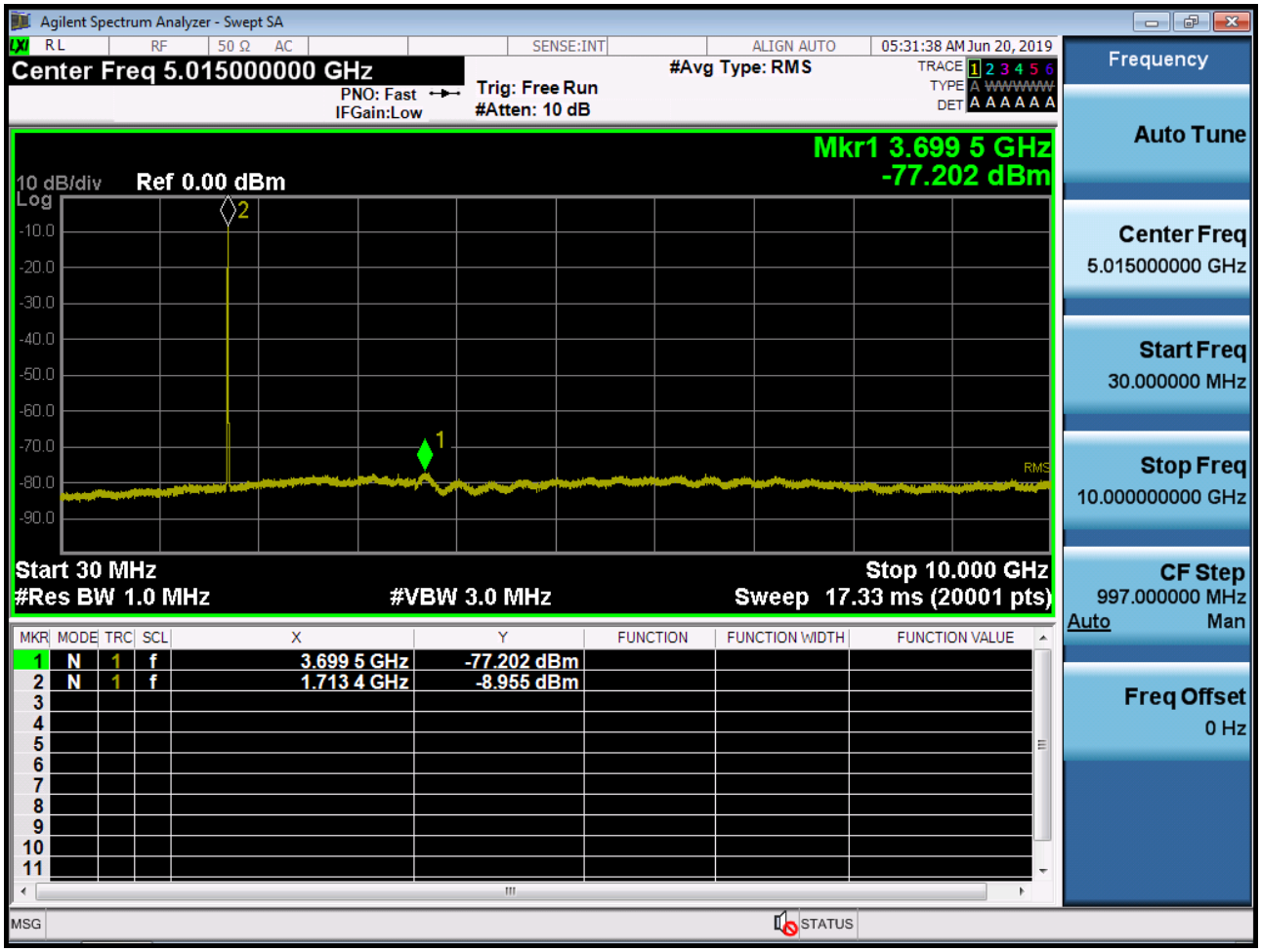
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions1



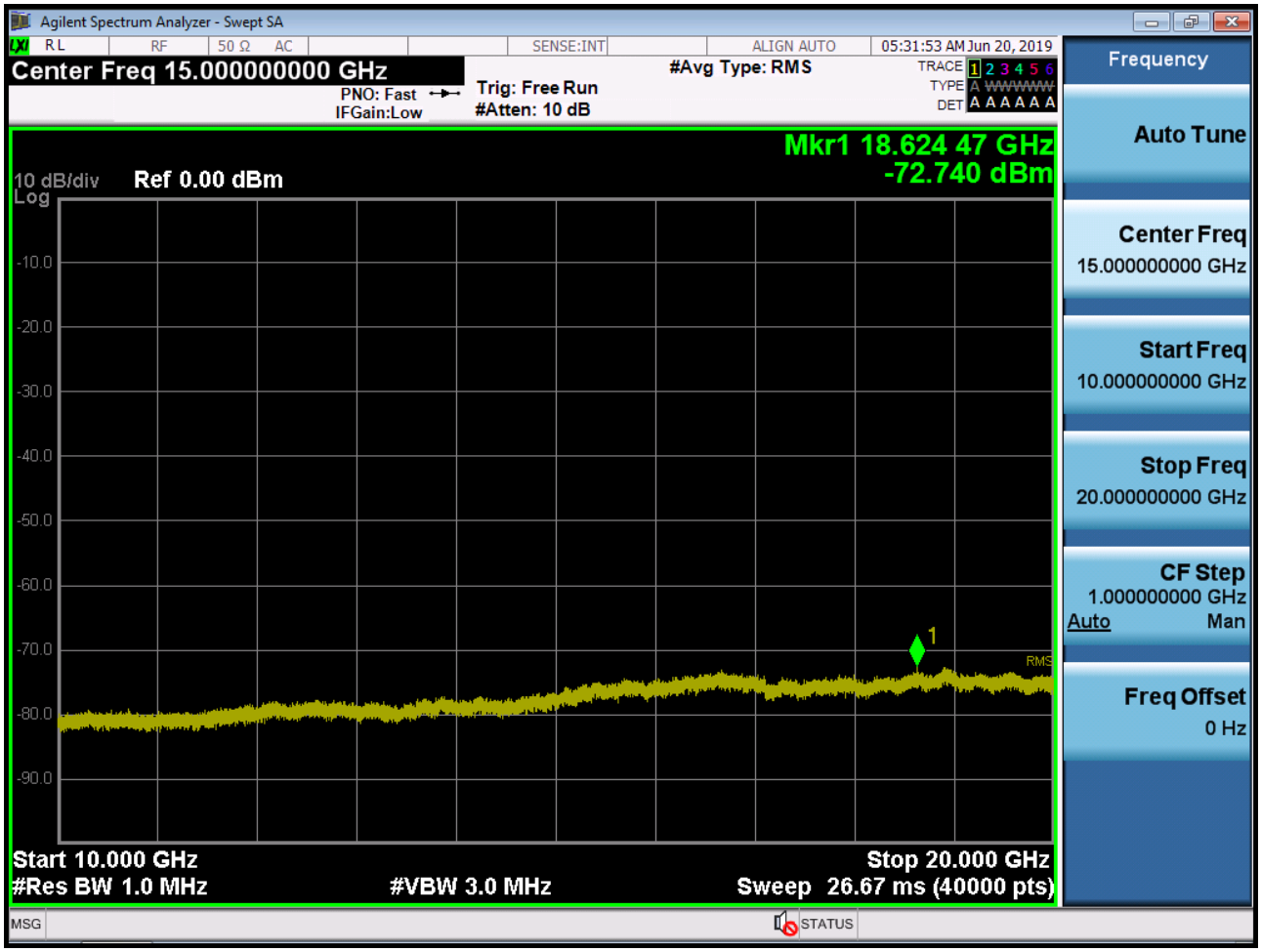
■ WCDMA1900 MODE (9538 CH.) Conducted Spurious Emissions2



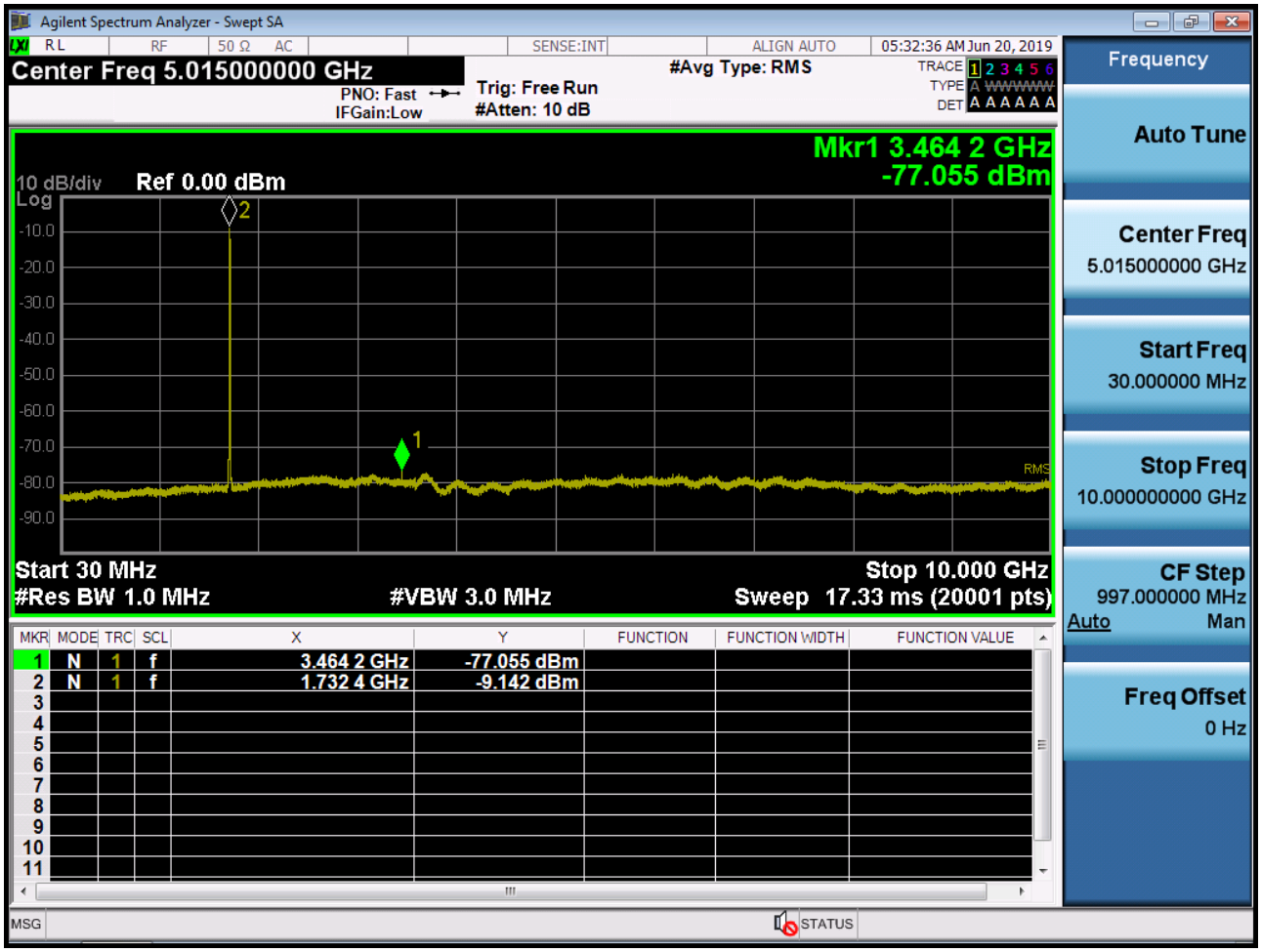
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions1



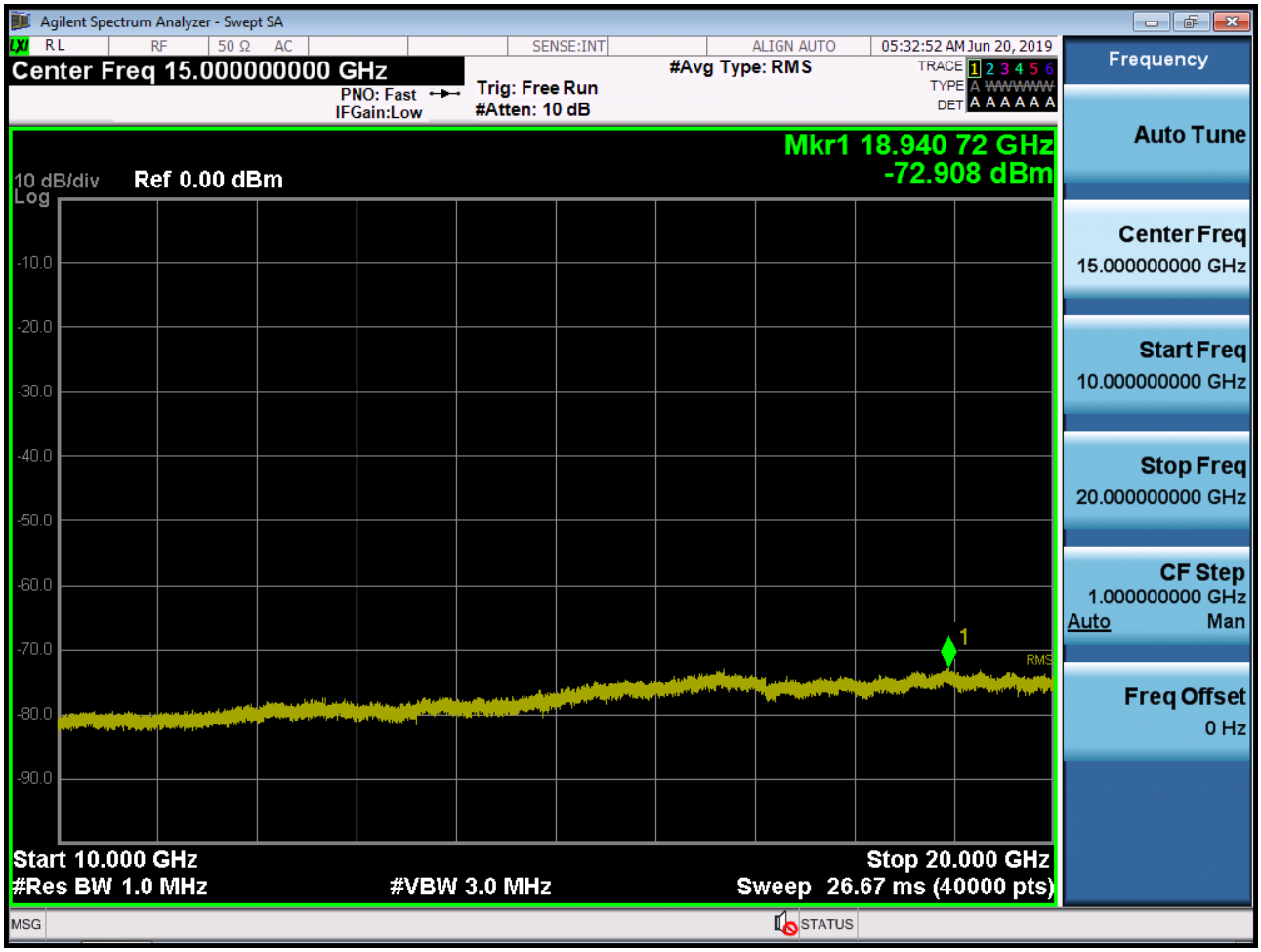
■ WCDMA1700 MODE (1312 CH.) Conducted Spurious Emissions2



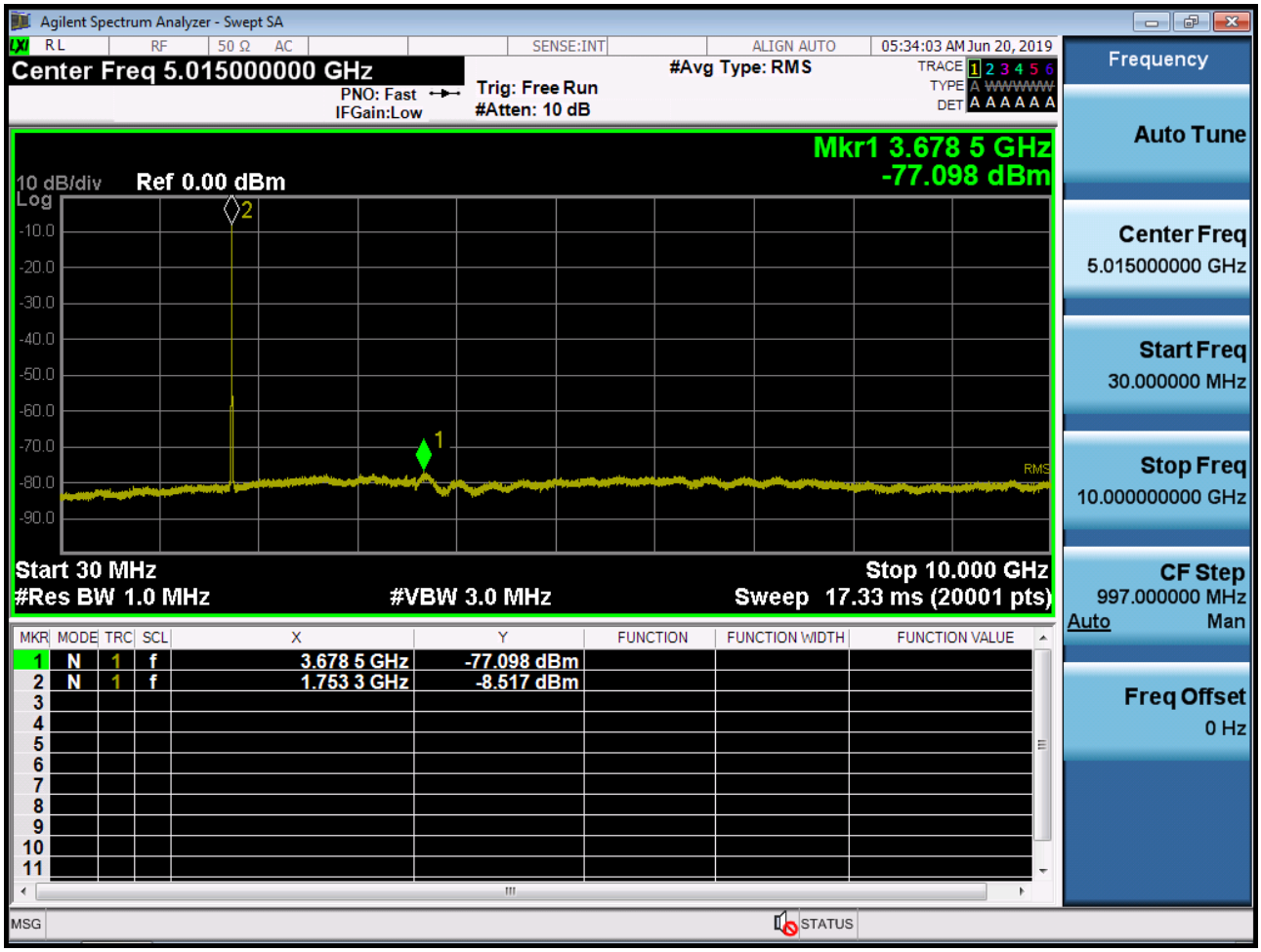
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions1



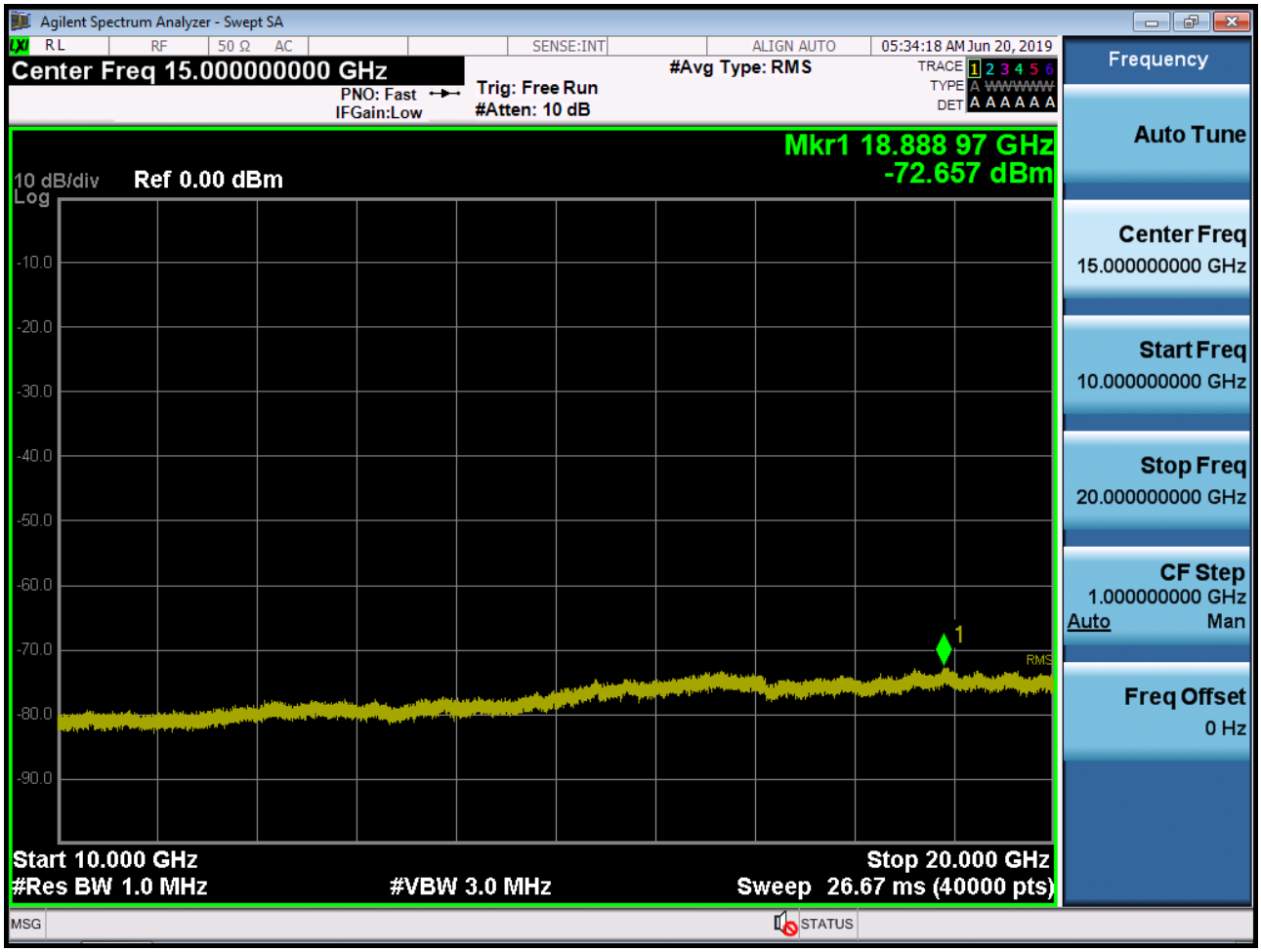
■ WCDMA1700 MODE (1412 CH.) Conducted Spurious Emissions2



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions1



■ WCDMA1700 MODE (1513 CH.) Conducted Spurious Emissions2



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-1907-FI026-P