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TEST REPORT

FCC LTE Test for SM-T727U

Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-1906-FC059-R1

DATE OF ISSUE
27 June 2019

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ID
FCC: A3LSMT727U

Applicant	**SAMSUNG Electronics Co., Ltd.** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Eut Type	Tablet
Model Name	SM-T727U
Additional Model(s)	SM-T727P
Date of Receipt	May 22, 2019
FCC Rule Part(s)	§ 27, § 2
FCC Classification	PCS Licensed Transmitter (PCB)
Manufacturer	SAMSUNG Electronics Co., Ltd.

Tested by
Kwon Jeong

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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	June 25, 2019	Initial Release
1	June 27, 2019	Revised the pages of test plots

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)

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMT727U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 27, § 2
EUT Type:	Tablet
Model(s):	SM-T727U
Additional Model(s)	SM-T727P
Tx Frequency:	2307.5 MHz – 2312.5 MHz (LTE – Band30 (5 MHz)) 2310.0 MHz (LTE – Band30 (10 MHz))
Date(s) of Tests:	June 04, 2019~ June 24, 2019

1.1. MAXIMUM OUTPUT POWER

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 30 (5)	2307.5 – 2312.5	4M52G7D	QPSK	0.070	18.45
		4M50W7D	16QAM	0.059	17.73
		4M52W7D	64QAM	0.046	16.66
LTE – Band 30 (10)	2310.0	8M99G7D	QPSK	0.069	18.41
		8M98W7D	16QAM	0.059	17.69
		8M98W7D	64QAM	0.046	16.61

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Tablet with UMTS and LTE.

It also supports IEEE 802.11 a/b/g/n/ac (HT20/40/80), ANT+, 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
Channel 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/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

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.

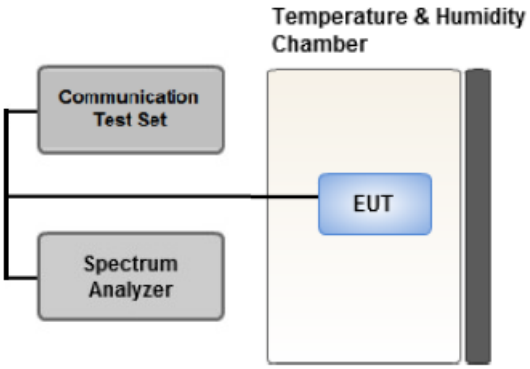
Test Settings

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 10th harmonics from 9 kHz.

Test Note

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

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)

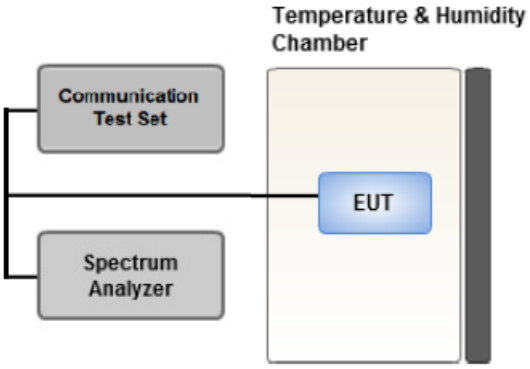
1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time:

   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

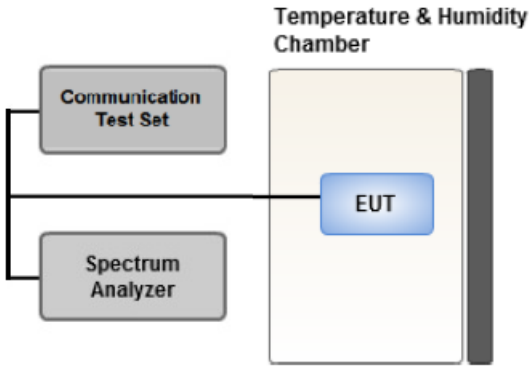
The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

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

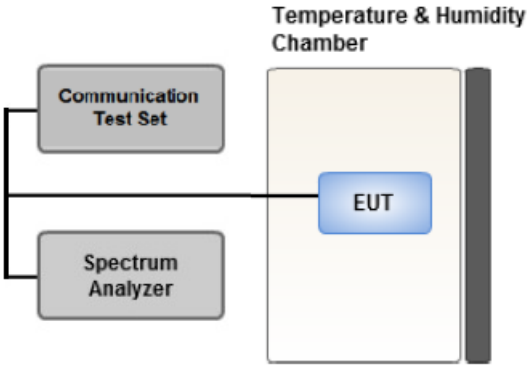
Test Overview

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

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = RMS
4. Trace Mode = 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 Limit

§ 27.53(a)

(4) For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands:

(i) By a factor of not less than: 43 + 10 log (P) dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than 55 + 10 log (P) dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than 61 + 10 log (P) dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than 67 + 10 log (P) dB on all frequencies between 2328 and 2337 MHz;

(ii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2300 and 2305 MHz, 55 + 10 log (P) dB on all frequencies between 2296 and 2300 MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz;

(iii) By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz

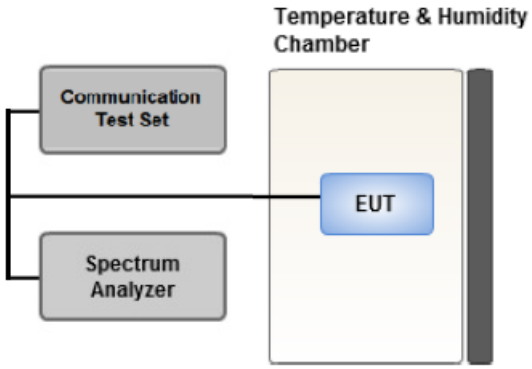
Test Notes

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.

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(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, RB sizes and offsets, and channel bandwidth configurations shown in the test data.
- Please refer to the table below.
- All modes of operation were investigated and the worst case configuration results are reported.
- Of models SM-T727U and SM-T727P, we tested on SM-T727U model. And SM-T727U result is reported.
- This report covers the models SM-T727U and SM-T727P.
  These models are identical in hardware and the only difference is that the model SM-T727P does not support operations in all frequency bands and the some bands are disabled by software.
- SM-T727U with Stand alone, Keyboard, Ear-jack and Charging pad were tested and the worst case results are reported.
  (Worst case : Stand alone)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM	1	0	X
Radiated Spurious and Harmonic Emissions	QPSK	1	0	X

3.10 WORST CASE(CONDUCTED TEST)

- Worst case : Of all modulation, We have tested modulation of the high Conducted Output Power.
  Conducted Output Power value can be confirmed on the SAR report.
- Of models SM-T727U and SM-T727P, we tested on SM-T727U model. And SM-T727U result is reported.
- This report covers the models SM-T727U and SM-T727P.
  These models are identical in hardware and the only difference is that the model SM-T727P does not support operations in all frequency bands and the some bands are disabled by software.

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM, 64QAM	5, 10	Mid	Full RB	0
Peak-To-Average Radio	QPSK, 16QAM, 64QAM	5, 10	Mid	Full RB	0
Band Edge	QPSK	5	Low, Mid, High	1	0, 24
		10	Mid	1	0, 49
		5	Low, Mid, High	Full RB	0
		10	Mid	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	QPSK	5	Low, Mid, High	1	0
		10	Mid	1	0

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	MY40004326	07/05/2018	Annual	07/05/2019
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)	177633	07/19/2018	Annual	07/19/2019
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)	Test Limit	Test Result
Occupied Bandwidth	§ 2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§ 2.1051, § 27.53(a)	Section 3.7	PASS
Conducted Output Power	§ 2.1046	N/A	See Note1
Frequency stability / variation of ambient temperature	§ 2.1055, § 27.54	Emission must remain in band	PASS

Note:

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

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§ 27.50(a)(3)	< 0.25 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 27.53(a)	< 70 + 10log10 (P[Watts])	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
27710	2310.0	-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

16QAM Modulation

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

64QAM 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 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2307.5	LTE B30/ 5 MHz	QPSK	-25.95	10.24	9.74	1.53	H	< 0.25	0.070	18.45
		16-QAM	-26.67	9.52	9.74	1.53	H		0.059	17.73
		64-QAM	-27.74	8.45	9.74	1.53	H		0.046	16.66
2310.0		QPSK	-26.09	10.07	9.76	1.53	H		0.068	18.30
		16-QAM	-26.85	9.31	9.76	1.53	H		0.057	17.54
		64-QAM	-27.90	8.26	9.76	1.53	H		0.045	16.49
2312.5		QPSK	-26.08	9.90	9.78	1.53	H		0.065	18.15
		16-QAM	-26.82	9.16	9.78	1.53	H		0.055	17.41
		64-QAM	-27.90	8.08	9.78	1.53	H		0.043	16.33

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2310.0	LTE B30/ 10 MHz	QPSK	-25.98	10.18	9.76	1.53	H	< 0.25	0.069	18.41
		16-QAM	-26.70	9.46	9.76	1.53	H		0.059	17.69
		64-QAM	-27.78	8.38	9.76	1.53	H		0.046	16.61

8.2 RADIATED SPURIOUS EMISSIONS

▣ OPERATING FREQUENCY : 2307.50 MHz

▣ MEASURED OUTPUT POWER: 18.45 dBm = 0.070 W

▣ MODE: LTE B30

▣ MODULATION SIGNAL: 5 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 58.45 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
27685 (2307.5)	4,615.00	-56.00	12.72	-71.49	2.34	H	-61.12	79.57
	6,922.50	-53.27	12.57	-59.79	2.86	H	-50.08	68.53
	9,230.00	-56.59	10.95	-61.11	3.36	V	-53.52	71.97
	11,537.50	-55.41	11.69	-58.80	3.81	V	-50.92	69.36
	13,845.00	-51.08	12.35	-51.77	4.12	V	-43.54	61.98
27710 (2310.0)	4,620.00	-56.63	12.71	-72.11	2.34	V	-61.74	80.19
	6,930.00	-55.45	12.46	-61.63	2.83	H	-52.00	70.45
	9,240.00	-56.58	10.94	-60.76	3.41	H	-53.23	71.68
	11,550.00	-54.06	11.73	-57.31	3.84	V	-49.42	67.87
	13,860.00	-51.57	12.30	-52.73	4.11	V	-44.54	62.99
27735 (2312.5)	4,625.00	-56.51	12.71	-72.02	2.35	V	-61.66	80.11
	6,937.50	-54.83	12.34	-61.30	2.81	V	-51.77	70.22
	9,250.00	-57.49	10.93	-61.19	3.32	V	-53.58	72.03
	11,562.50	-54.30	11.76	-57.41	3.83	V	-49.48	67.93
	13,875.00	-54.05	12.26	-54.65	4.17	V	-46.56	65.01

▣ OPERATING FREQUENCY : 2310.00 MHz

▣ MEASURED OUTPUT POWER: 18.41 dBm = 0.069 W

▣ MODE: LTE B30

▣ MODULATION SIGNAL: 10 MHz QPSK

▣ DISTANCE: 1 meters

▣ LIMIT: 55 + 10 log10 (W) = 58.41 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	EIRP (dBm)	dBc
27710 (2310.0)	4,620.00	-57.26	12.71	-72.74	2.34	V	-62.37	80.78
	6,930.00	-54.69	12.46	-60.87	2.83	H	-51.24	69.65
	9,240.00	-56.72	10.94	-60.90	3.41	H	-53.37	71.78
	11,550.00	-53.49	11.73	-56.74	3.84	V	-48.85	67.26
	13,860.00	-50.86	12.30	-52.02	4.11	V	-43.83	62.24

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
30	5 MHz	2310.0	QPSK	25	0	4.80
			16-QAM			5.99
			64-QAM			6.46
	10 MHz		QPSK	50		4.83
			16-QAM			5.98
			64-QAM			6.39

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 49 ~ 54.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
30	5 MHz	2310.0	QPSK	25	0	4.5170
			16-QAM			4.4985
			64-QAM			4.5222
	10 MHz		QPSK	50		8.9874
			16-QAM			8.9779
			64-QAM			8.9797

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 43 ~ 48.

8.5 CONDUCTED SPURIOUS EMISSIONS

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
30	5	2307.5	26.1650	30.131	-76.603	-46.472	-40.00
		2310.0	26.1234	30.131	-76.617	-46.486	
		2312.5	26.4068	30.131	-76.778	-46.647	
	10	2310.0	26.3560	30.131	-76.688	-46.557	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 168 ~ 175.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. 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

8.6 BAND EDGE

Band Width (MHz)	Frequency (MHz)	Modulation	RB (Size/ Offset)	Frequency Range (MHz)	Maximum Data (dBm)	Limit (dBm)
5	2307.5	QPSK	25/0	Below 2288	-52.728	-40
				2288 - 2292	-50.774	-37
				2292 - 2296	-40.049	-31
				2296 - 2300	-30.314	-25
				2300 - 2304	-23.721	-13
				2304 - 2305	-29.546	-13
				2315 - 2320	-29.590	-13
				2320 - 2324	-41.814	-25
				2324 - 2328	-51.306	-31
				2328 - 2337	-52.338	-37
				2337 - 2341	-52.509	-31
				2341 - 2345	-52.529	-25
				2345 - 2365	-52.341	-13
				Above 2365	-52.524	-40
	2310.0	QPSK	25/0	Below 2288	-52.749	-40
				2288 - 2292	-52.242	-37
				2292 - 2296	-45.680	-31
				2296 - 2300	-33.087	-25
				2300 - 2305	-24.455	-13
				2315 - 2320	-24.442	-13
				2320 - 2324	-32.636	-25
				2324 - 2328	-46.827	-31
				2328 - 2337	-52.175	-37
				2337 - 2341	-52.524	-31
				2341 - 2345	-52.531	-25
				2345 - 2365	-52.284	-13
				Above 2365	-52.532	-40
	2312.5	QPSK	25/0	Below 2288	-52.797	-40
				2288 - 2292	-52.633	-37
				2292 - 2296	-51.412	-31
				2296 - 2300	-42.949	-25
				2300 - 2305	-31.100	-13
				2315 - 2316	-28.682	-13
				2316 - 2320	-23.731	-13
				2320 - 2324	-30.713	-25
				2324 - 2328	-42.184	-31

				2328 - 2337	-51.373	-37
				2337 - 2341	-52.514	-31
				2341 - 2345	-52.510	-25
				2345 - 2365	-52.225	-13
				Above 2365	-52.524	-40
10	2310.0	QPSK	50/0	Below 2288	-47.813	-40
				2288 - 2292	-38.504	-37
				2292 - 2296	-33.893	-31
				2296 - 2300	-27.930	-25
				2300 - 2304	-25.848	-13
				2304 - 2305	-31.119	-13
				2315 - 2316	-29.945	-13
				2316 - 2320	-26.550	-13
				2320 - 2324	-28.910	-25
				2324 - 2328	-34.204	-31
				2328 - 2337	-38.050	-37
				2337 - 2341	-52.531	-31
				2341 - 2345	-52.522	-25
				2345 - 2365	-52.267	-13
				Above 2365	-52.544	-40

Band Width (MHz)	Frequency (MHz)	Modulation	RB (Size/ Offset)	Frequency Range (MHz)	Maximum Data (dBm)	Limit (dBm)
5	2307.5	QPSK	1/0	Below 2288	-52.549	-40
				2288 - 2292	-52.305	-37
				2292 - 2296	-47.537	-31
				2296 - 2300	-46.630	-25
				2300 - 2304	-29.240	-13
				2304 - 2305	-21.289	-13
			1/24	2315 - 2320	-46.704	-13
				2320 - 2324	-46.847	-25
				2324 - 2328	-52.259	-31
				2328 - 2337	-52.079	-37
				2337 - 2341	-52.483	-31
				2341 - 2345	-52.480	-25
				2345 - 2365	-52.324	-13
				Above 2365	-52.486	-40
	2310.0	QPSK	1/0	Below 2288	-52.390	-40
				2288 - 2292	-52.467	-37
				2292 - 2296	-51.958	-31
				2296 - 2300	-46.580	-25
				2300 - 2305	-39.562	-13
			1/24	2315 - 2320	-38.899	-13
				2320 - 2324	-47.582	-25
				2324 - 2328	-52.036	-31
				2328 - 2337	-52.402	-37
				2337 - 2341	-52.566	-31
				2341 - 2345	-52.504	-25
				2345 - 2365	-52.254	-13
				Above 2365	-52.484	-40
	2312.5	QPSK	1/0	Below 2288	-52.801	-40
				2288 - 2292	-52.154	-37
				2292 - 2296	-52.362	-31
				2296 - 2300	-46.176	-25
				2300 - 2305	-46.148	-13
			1/24	2315 - 2316	-20.522	-13
				2316 - 2320	-28.904	-13
				2320 - 2324	-48.375	-25
				2324 - 2328	-48.510	-31
				2328 - 2337	-52.242	-37
				2337 - 2341	-52.513	-31

				2341 - 2345	-52.480	-25
				2345 - 2365	-52.217	-13
				Above 2365	-52.496	-40
10	2310.0	QPSK	1/0	Below 2288	-52.311	-40
				2288 - 2292	-49.585	-37
				2292 - 2296	-47.407	-31
				2296 - 2300	-44.807	-25
				2300 - 2304	-29.405	-13
				2304 - 2305	-26.707	-13
			1/49	2315 - 2316	-26.801	-13
				2316 - 2320	-30.573	-13
				2320 - 2324	-48.591	-25
				2324 - 2328	-48.446	-31
				2328 - 2337	-50.720	-37
				2337 - 2341	-52.517	-31
				2341 - 2345	-52.476	-25
				2345 - 2365	-52.206	-13
				Above 2365	-52.490	-40

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

▣ MODE: LTE 30

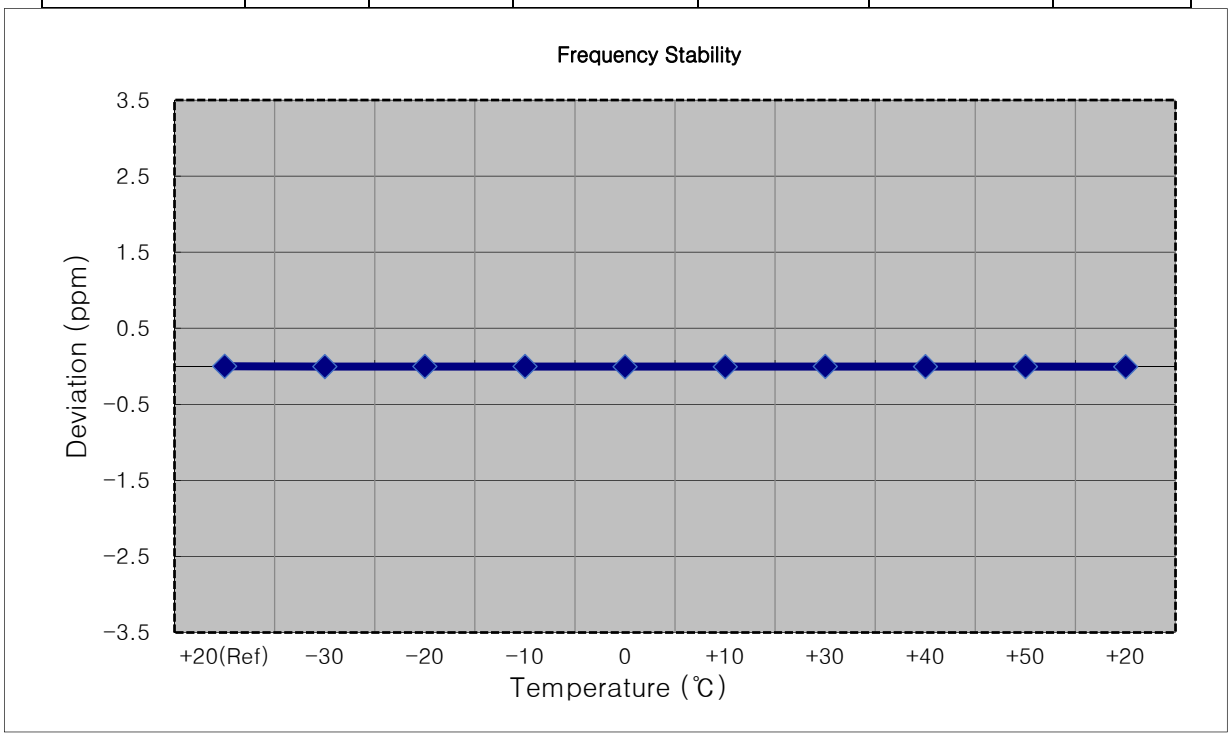
▣ OPERATING FREQUENCY: 2307,500,000 Hz

▣ BANDWIDTH: 27685 (5 MHz)

▣ 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)	2307 499 988	0.00	0.000 000	0.0000
100%		-30	2307 499 980	-8.50	0.000 000	-0.0037
100%		-20	2307 499 983	-4.90	0.000 000	-0.0021
100%		-10	2307 499 985	-2.80	0.000 000	-0.0012
100%		0	2307 499 975	-13.40	-0.000 001	-0.0058
100%		+10	2307 499 975	-13.50	-0.000 001	-0.0059
100%		+30	2307 499 984	-3.70	0.000 000	-0.0016
100%		+40	2307 499 981	-7.10	0.000 000	-0.0031
100%		+50	2307 499 978	-9.90	0.000 000	-0.0043
85%	3.400	+20	2307 499 975	-13.40	-0.000 001	-0.0058



▣ MODE: LTE 30

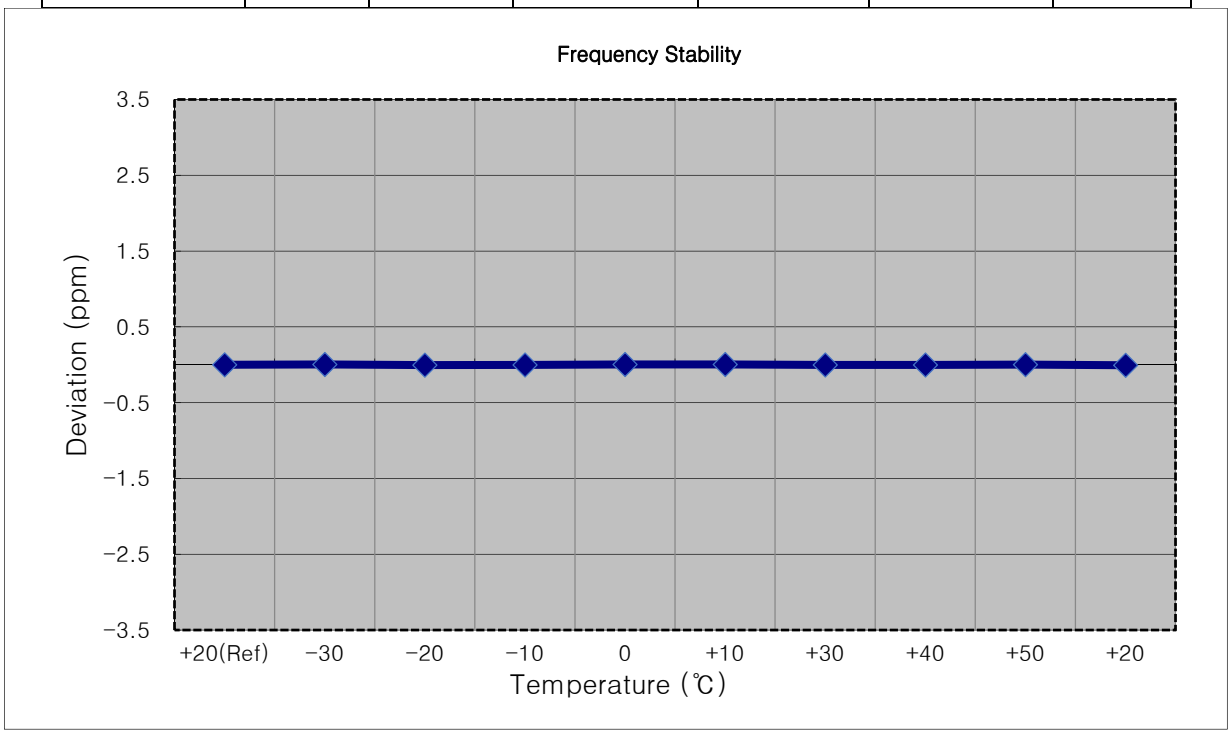
▣ OPERATING FREQUENCY: 2310,000,000 Hz

▣ BANDWIDTH: 27710 (5 MHz)

▣ 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)	2309 999 992	0.00	0.000 000	0.0000
100%		-30	2310 000 004	11.20	0.000 000	0.0048
100%		-20	2309 999 983	-9.20	0.000 000	-0.0040
100%		-10	2309 999 988	-4.30	0.000 000	-0.0019
100%		0	2310 000 002	9.90	0.000 000	0.0043
100%		+10	2310 000 000	7.70	0.000 000	0.0033
100%		+30	2309 999 985	-6.90	0.000 000	-0.0030
100%		+40	2309 999 986	-6.10	0.000 000	-0.0026
100%		+50	2309 999 998	5.60	0.000 000	0.0024
85%	3.400	+20	2309 999 978	-14.10	-0.000 001	-0.0061



▣ MODE: LTE 30

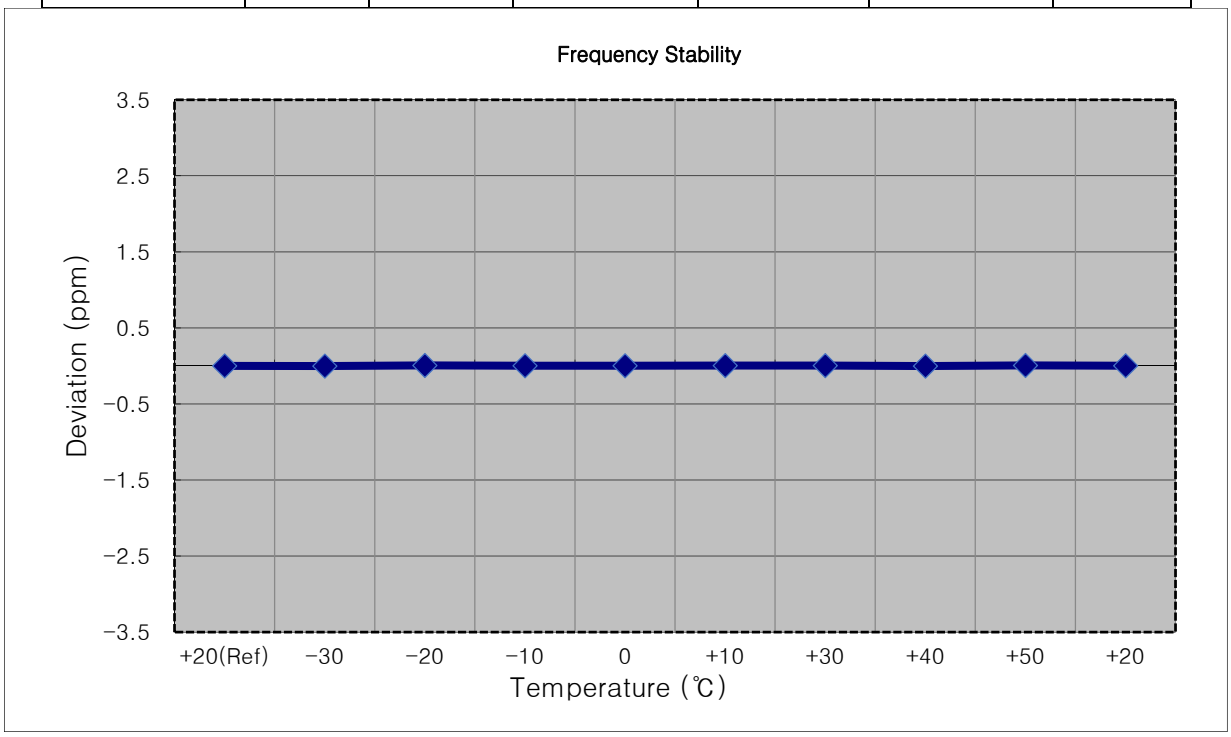
▣ OPERATING FREQUENCY: 2312,500,000 Hz

▣ BANDWIDTH: 27735 (5 MHz)

▣ 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)	2312 500 018	0.00	0.000 000	0.0000
100%		-30	2312 500 012	-5.30	0.000 000	-0.0023
100%		-20	2312 500 034	16.10	0.000 001	0.0070
100%		-10	2312 500 024	6.60	0.000 000	0.0029
100%		0	2312 500 022	4.70	0.000 000	0.0020
100%		+10	2312 500 029	11.40	0.000 000	0.0049
100%		+30	2312 500 031	13.20	0.000 001	0.0057
100%		+40	2312 500 016	-1.80	0.000 000	-0.0008
100%		+50	2312 500 034	16.40	0.000 001	0.0071
85%	3.400	+20	2312 500 025	7.00	0.000 000	0.0030



▣ MODE: LTE 30

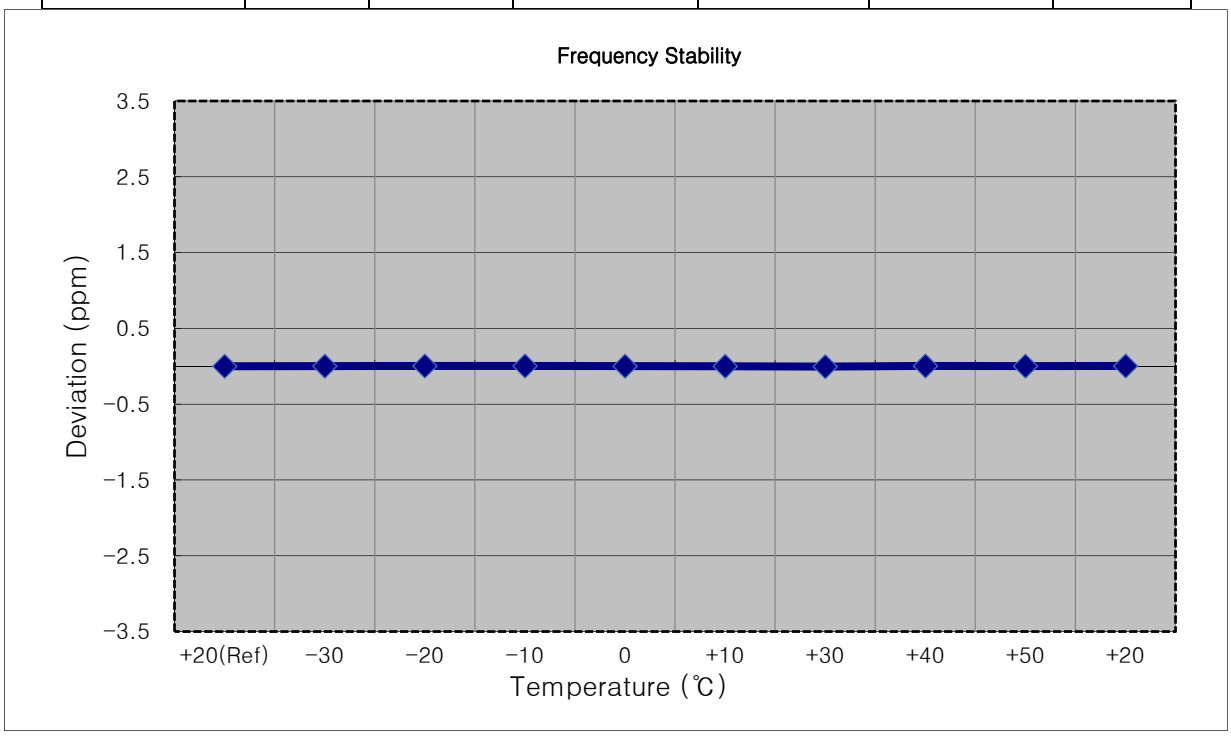
▣ OPERATING FREQUENCY: 2310,000,000 Hz

▣ BANDWIDTH: 27710 (10 MHz)

▣ REFERENCE VOLTAGE: 3.85 VDC

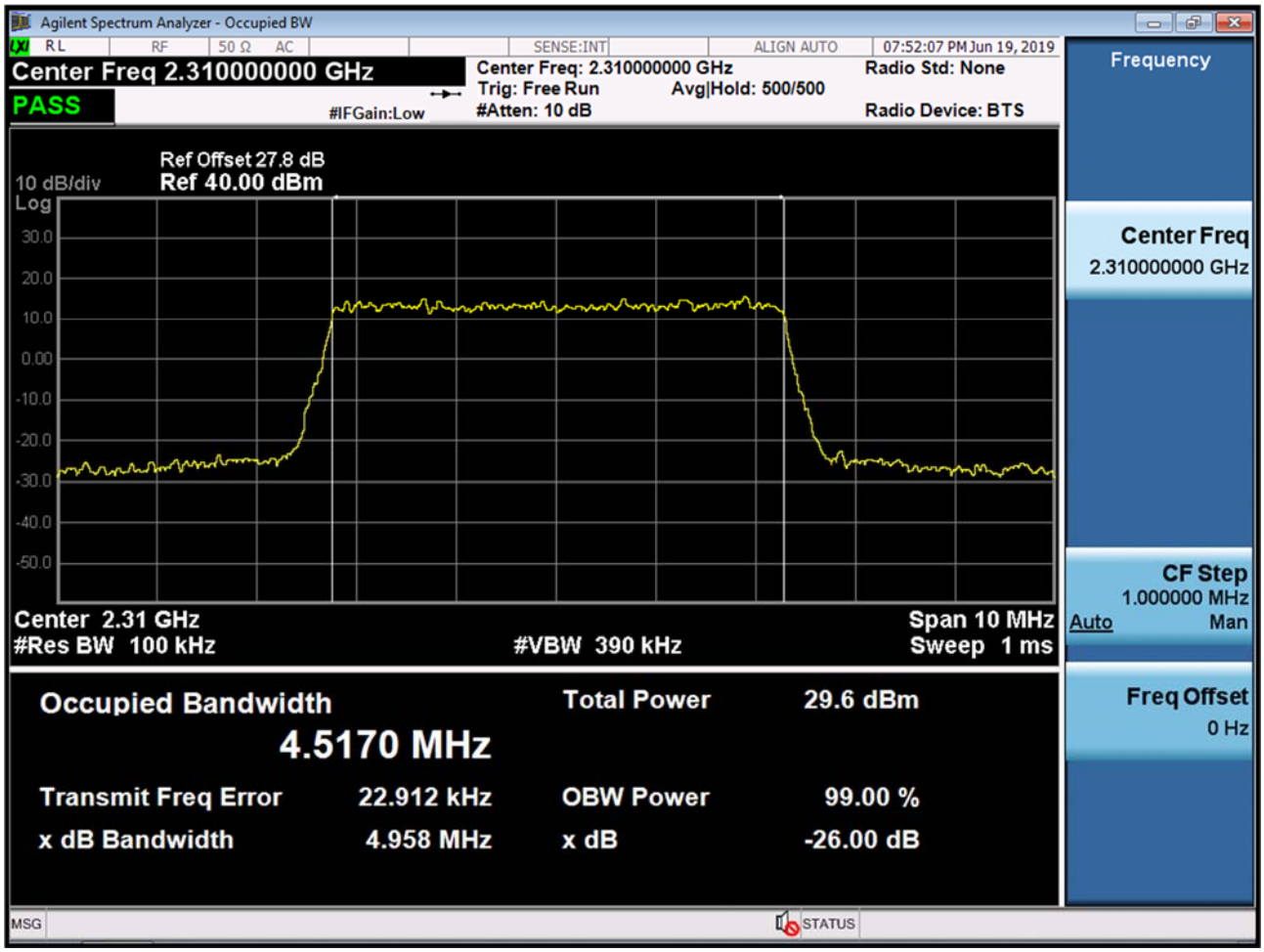
▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.850	+20(Ref)	2310 000 012	0.00	0.000 000	0.0000
100%		-30	2310 000 015	2.60	0.000 000	0.0011
100%		-20	2310 000 022	9.50	0.000 000	0.0041
100%		-10	2310 000 021	8.30	0.000 000	0.0036
100%		0	2310 000 018	5.70	0.000 000	0.0025
100%		+10	2310 000 010	-2.70	0.000 000	-0.0012
100%		+30	2310 000 005	-7.60	0.000 000	-0.0033
100%		+40	2310 000 022	10.10	0.000 000	0.0044
100%		+50	2310 000 016	3.90	0.000 000	0.0017
85%	3.400	+20	2310 000 020	7.40	0.000 000	0.0032

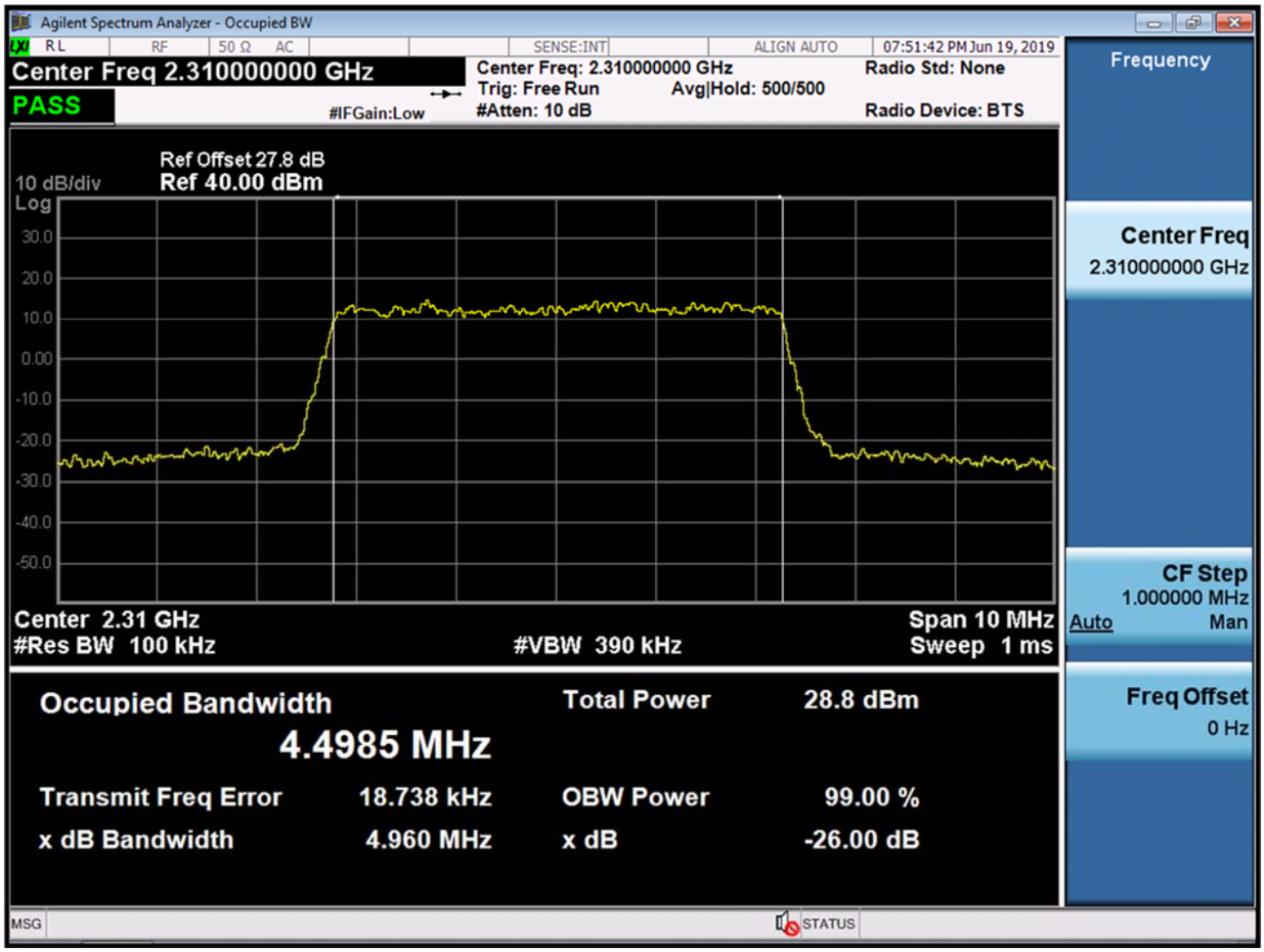


9. TEST PLOTS

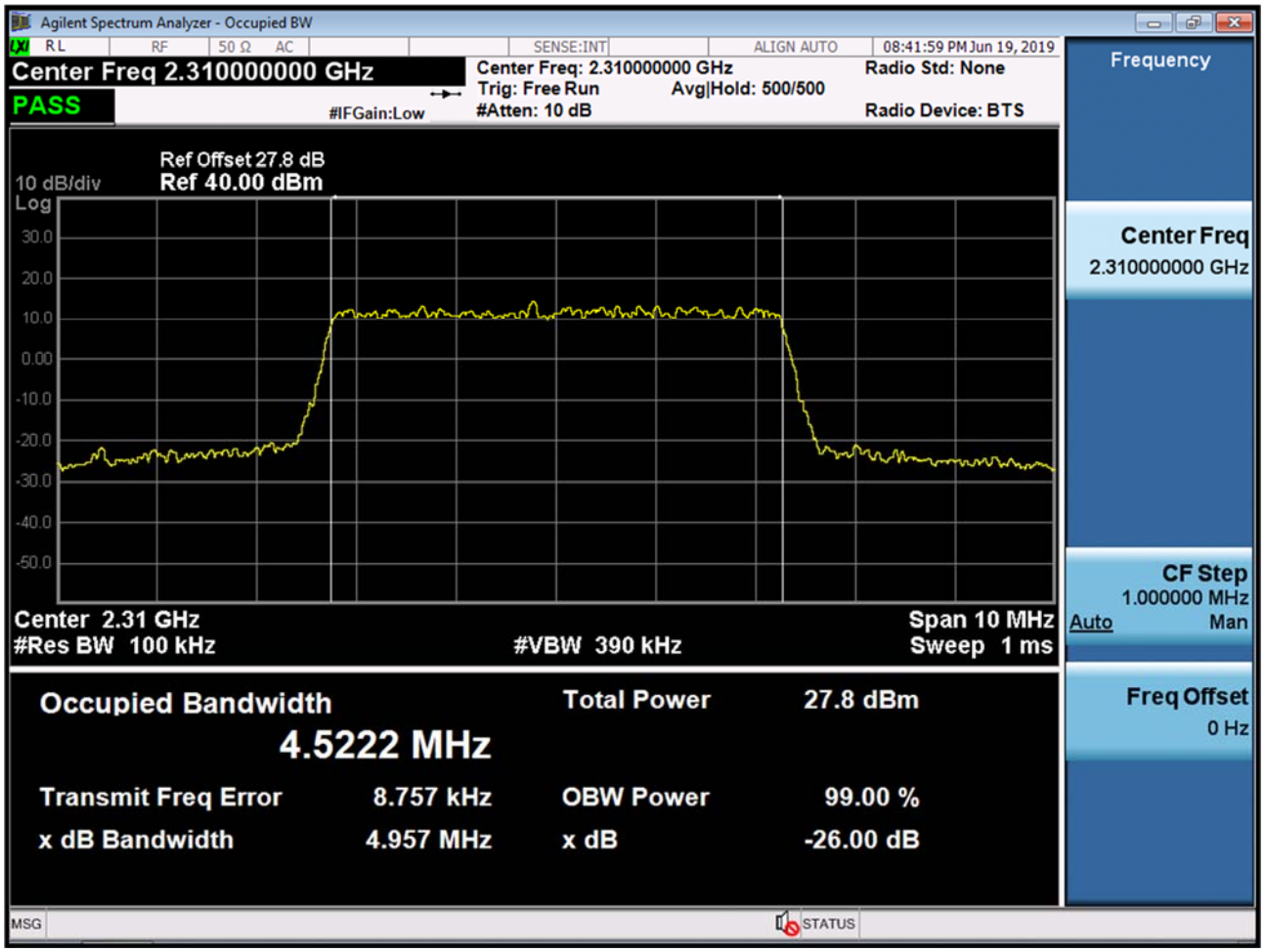
BAND 30. Occupied Bandwidth Plot (5 MHz Ch.27710 QPSK RB 25)



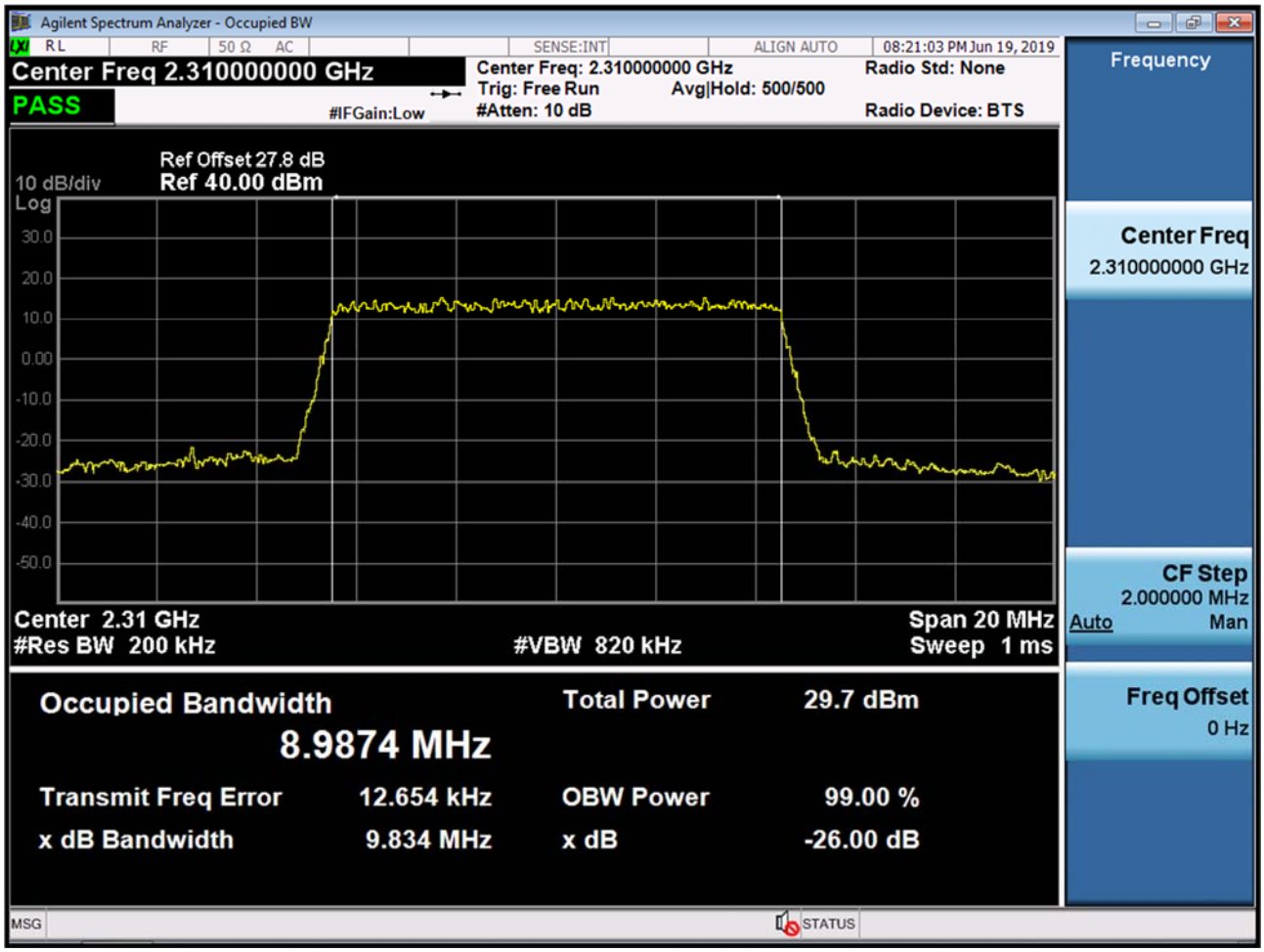
BAND 30. Occupied Bandwidth Plot (5 MHz Ch.27710 16-QAM RB 25)



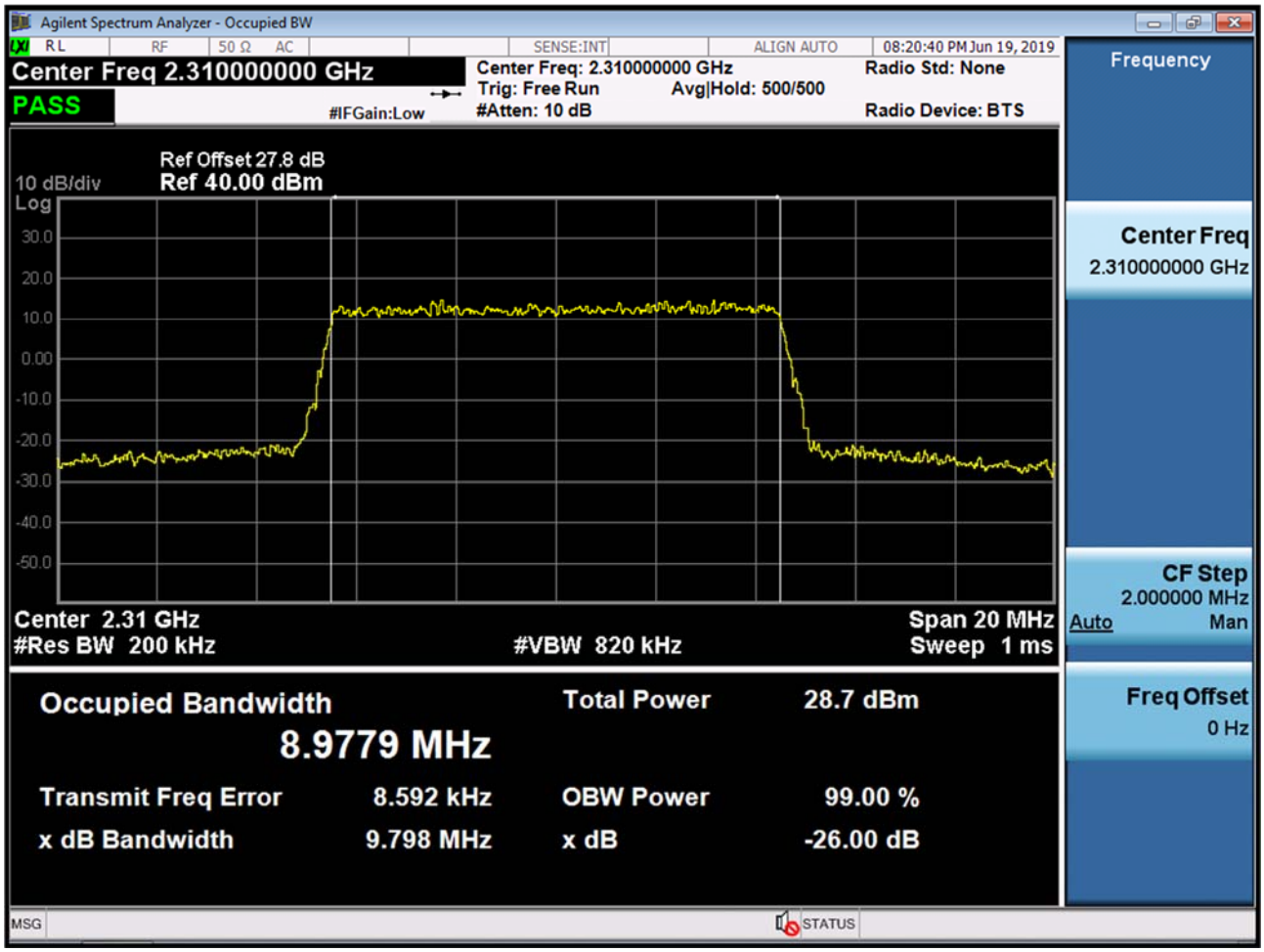
BAND 30. Occupied Bandwidth Plot (5 MHz Ch.27710 64-QAM RB 25)



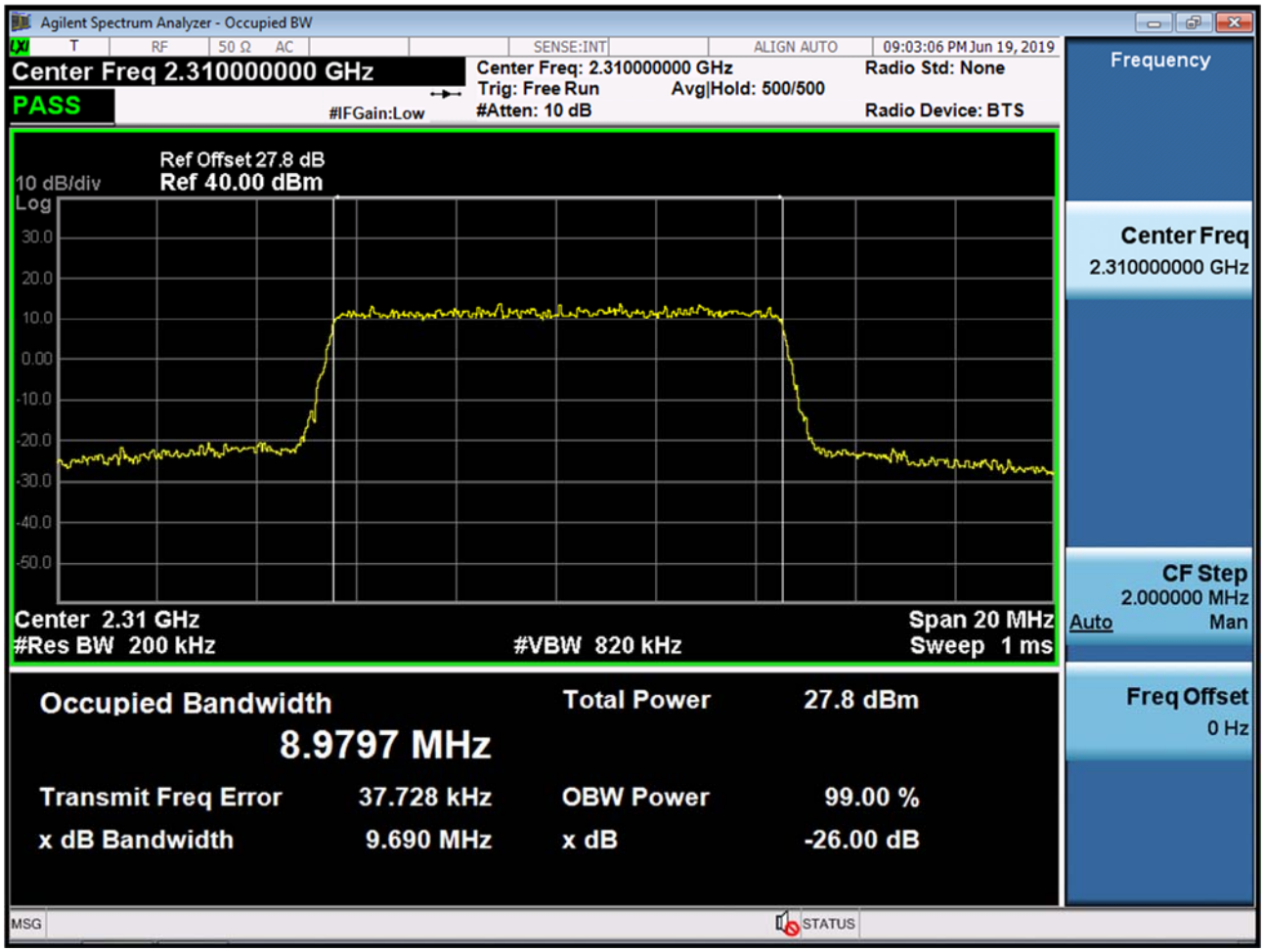
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 QPSK RB 50)



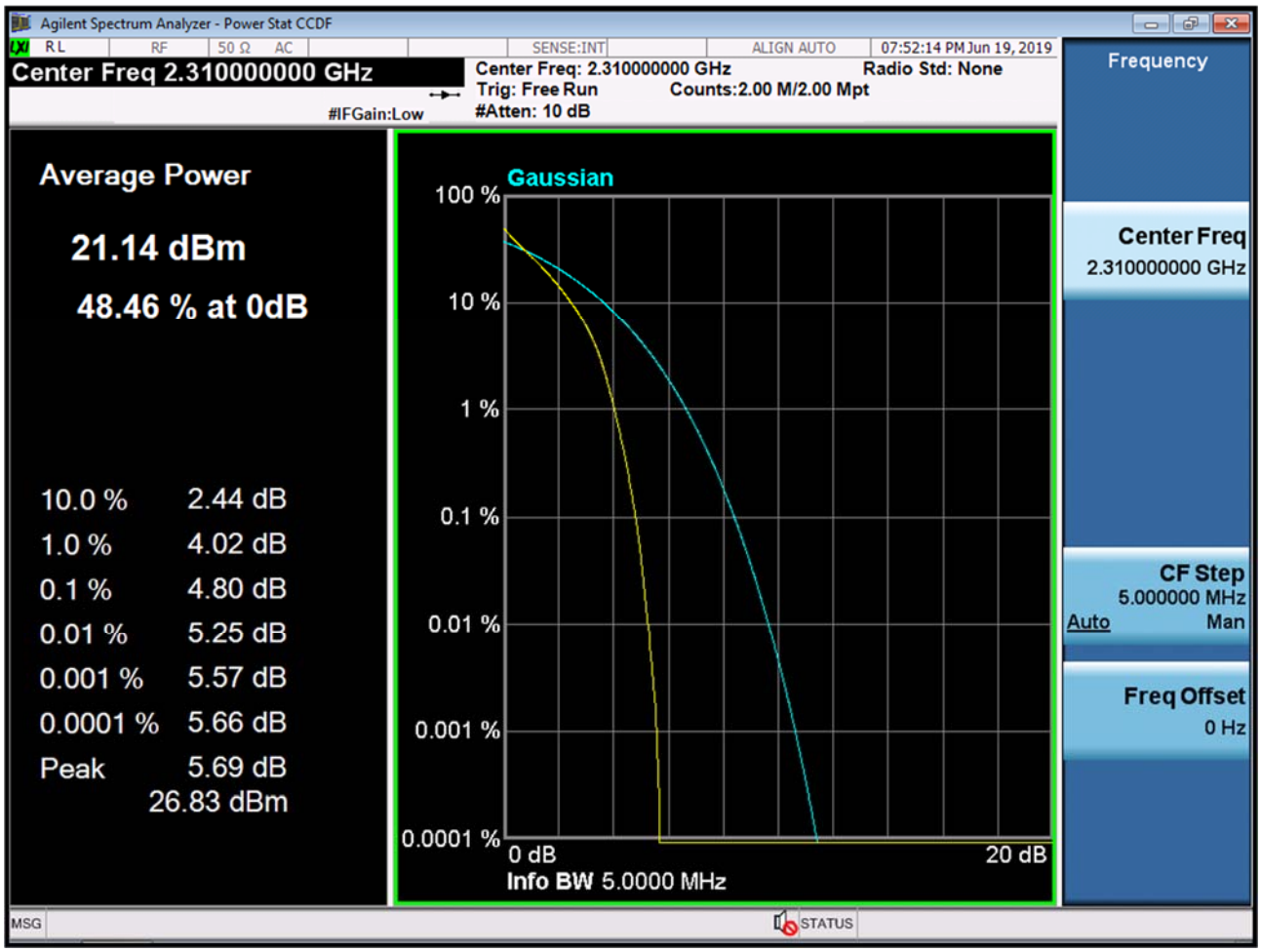
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 16-QAM RB 50)



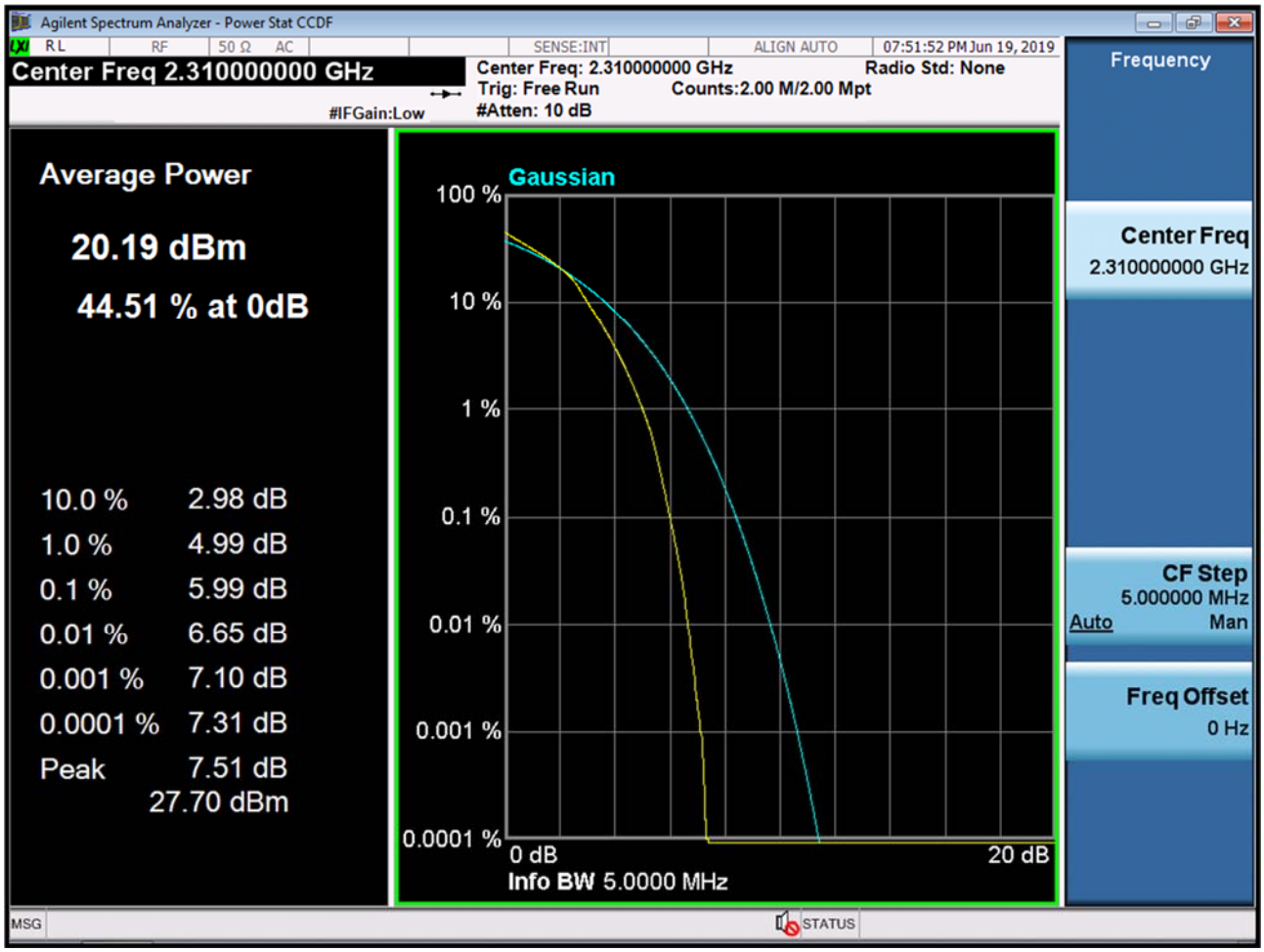
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 64-QAM RB 50)



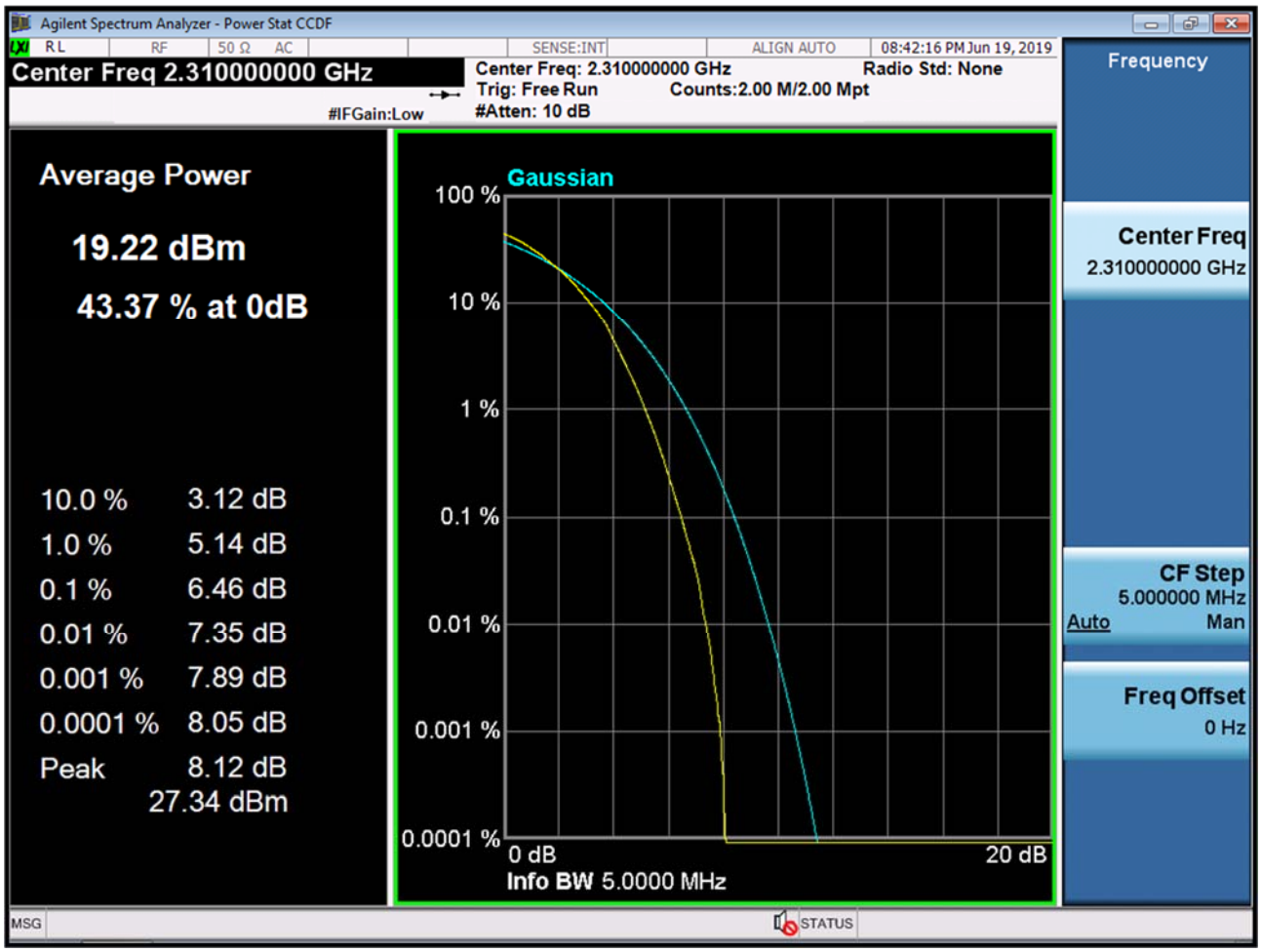
BAND 30. PAR Plot (5M BW_Ch.27710_QPSK_RB25_0)



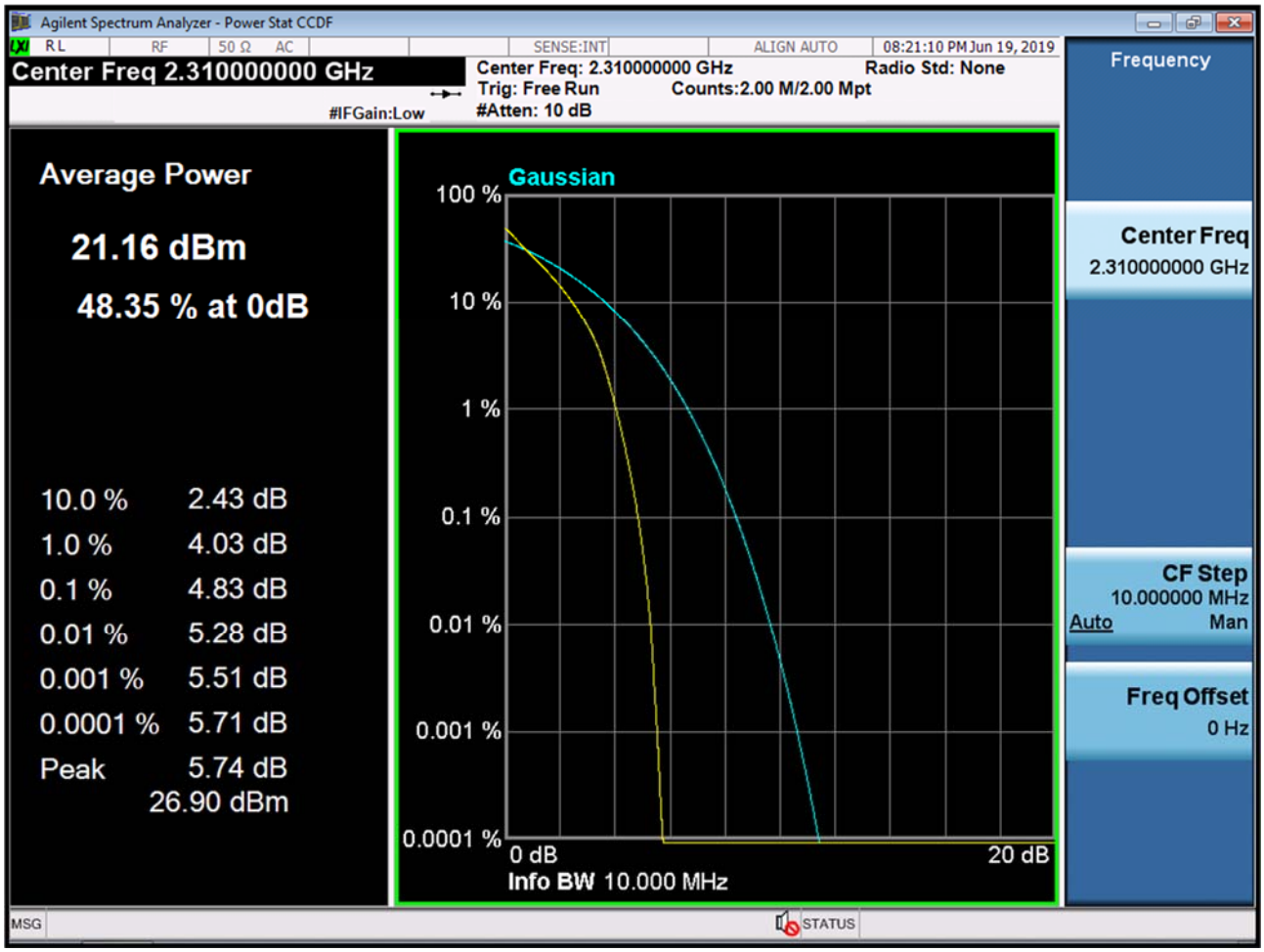
BAND 30. PAR Plot (5M BW_Ch.27710_16QAM_RB25_0)



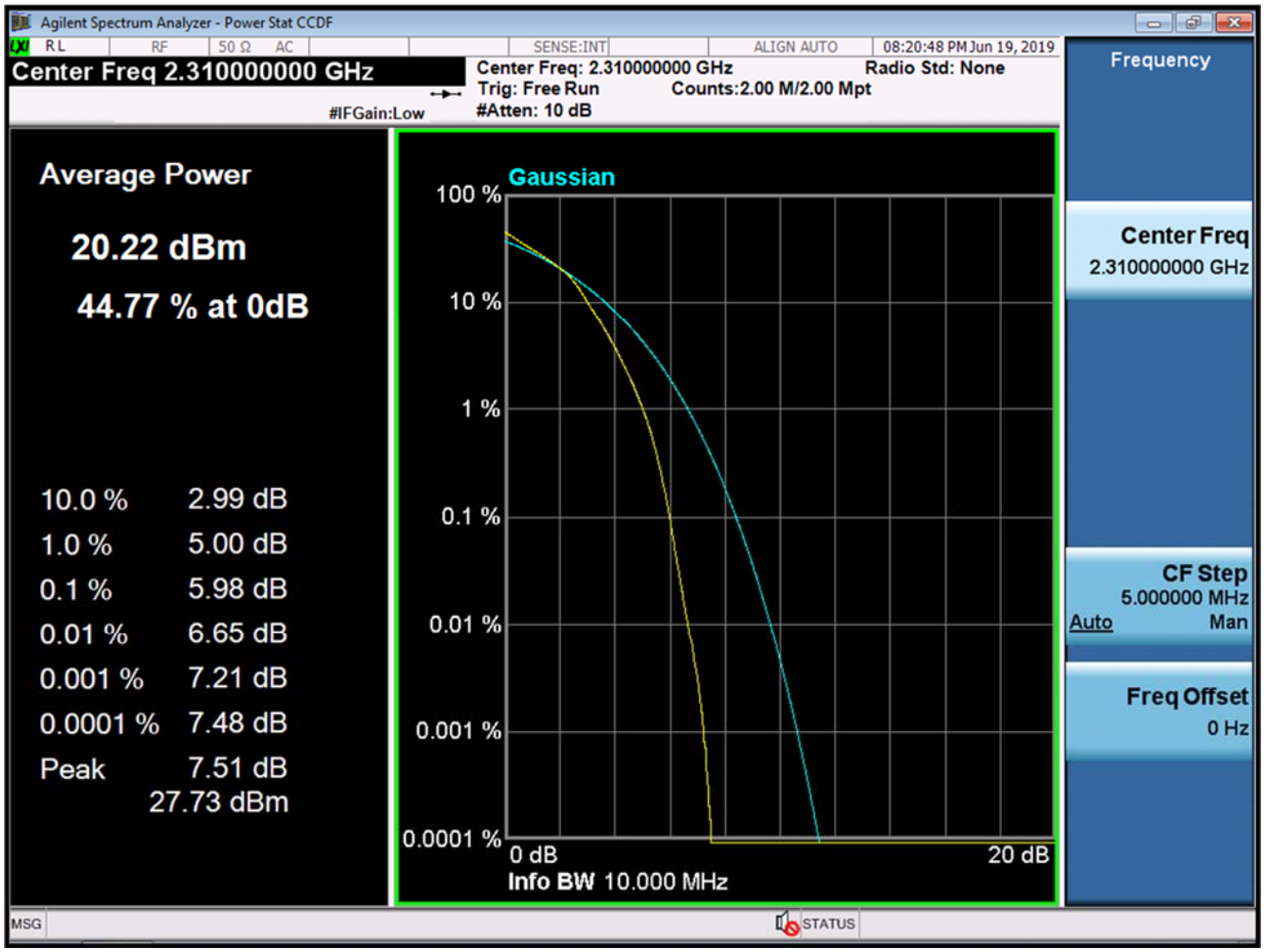
BAND 30. PAR Plot (5M BW_Ch.27710_64QAM_RB25_0)



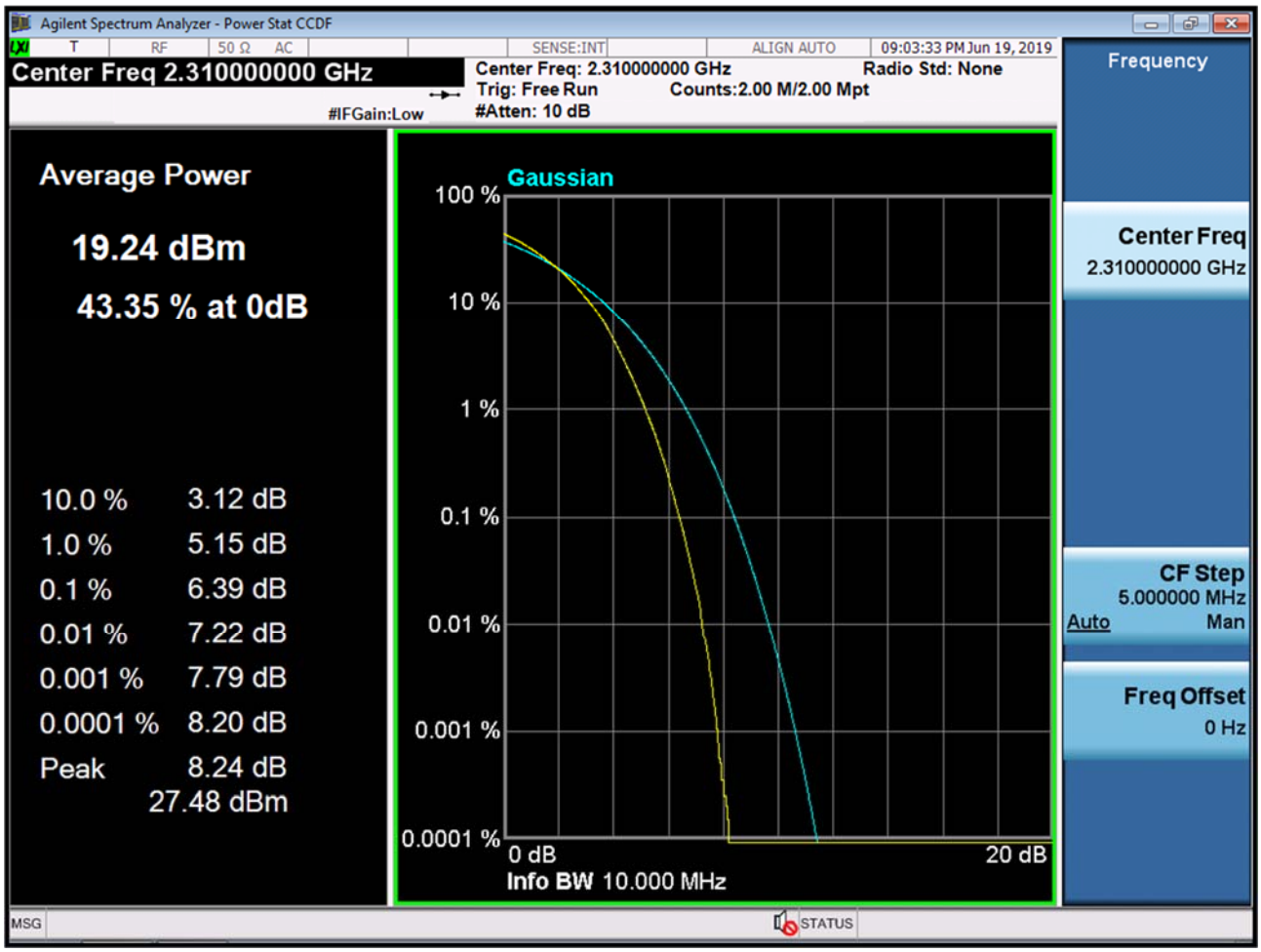
BAND 30. PAR Plot (10M BW_Ch.27710_QPSK_RB50_0)



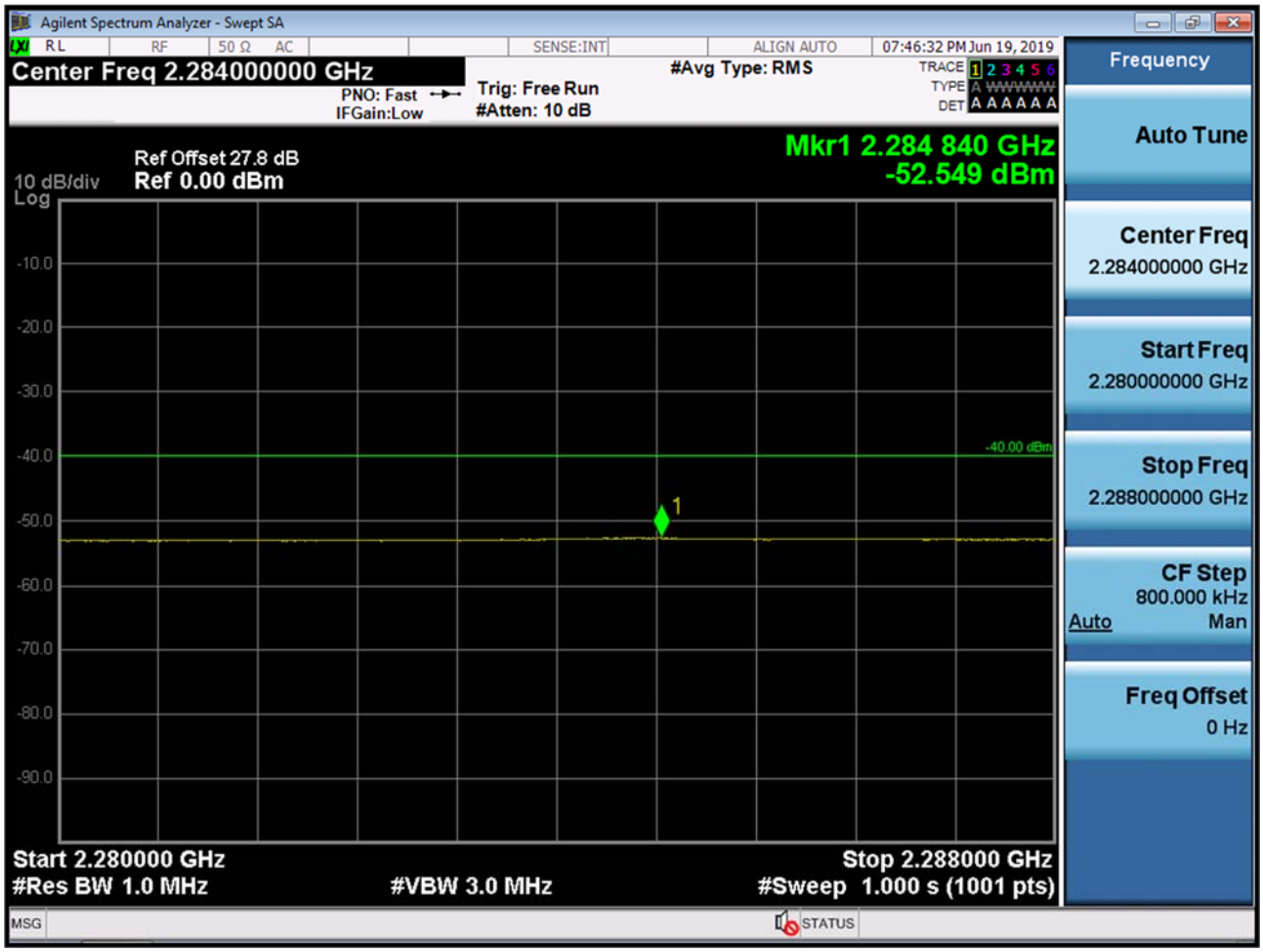
BAND 30. PAR Plot (10M BW_Ch.27710_16QAM_RB50_0)



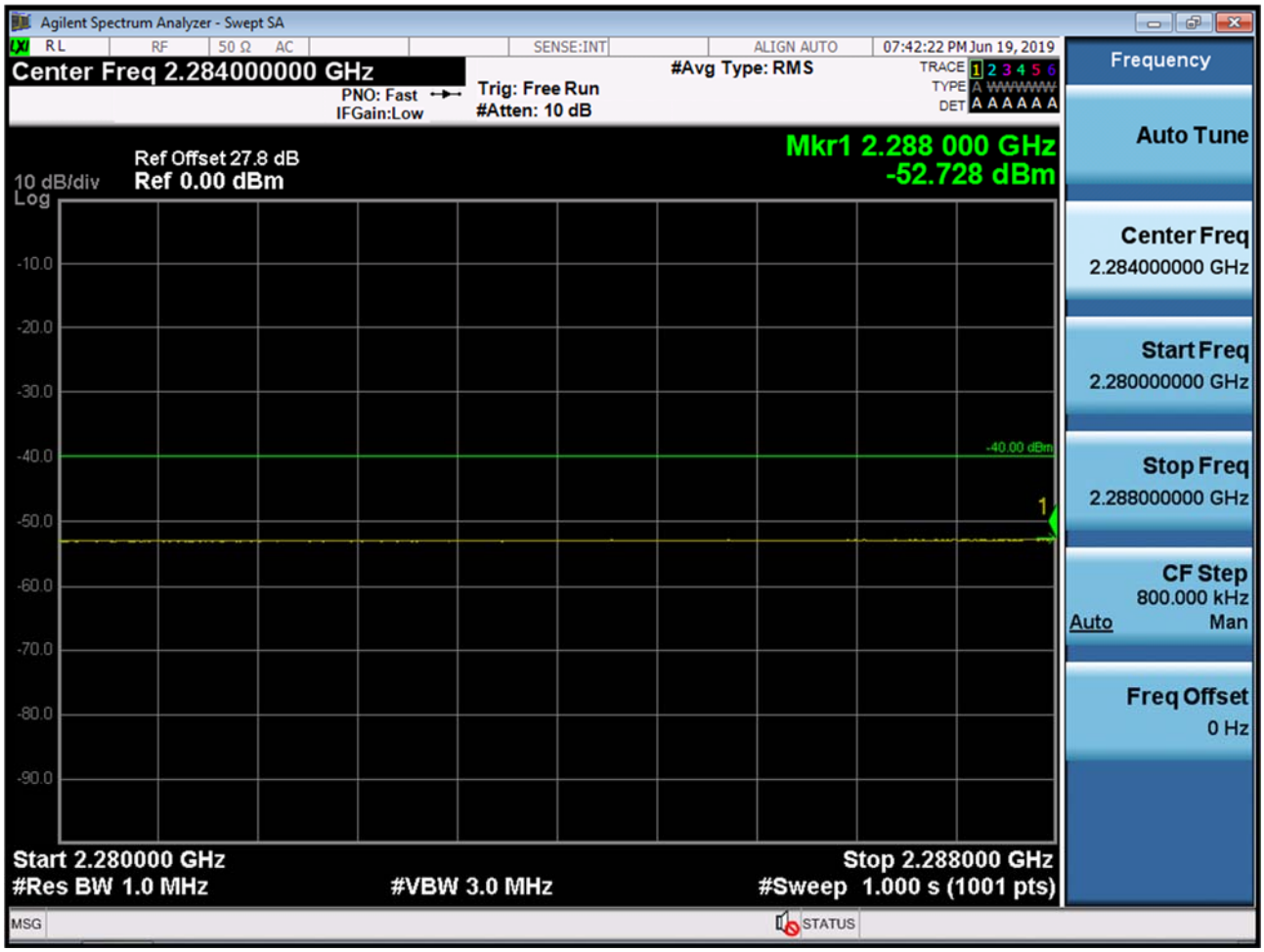
BAND 30. PAR Plot (10M BW_Ch.27710_64QAM_RB50_0)



BAND 30. 5M_BandEdge(2280MHz-2288MHz)_Low_2307.5MHz_QPSK_1RB

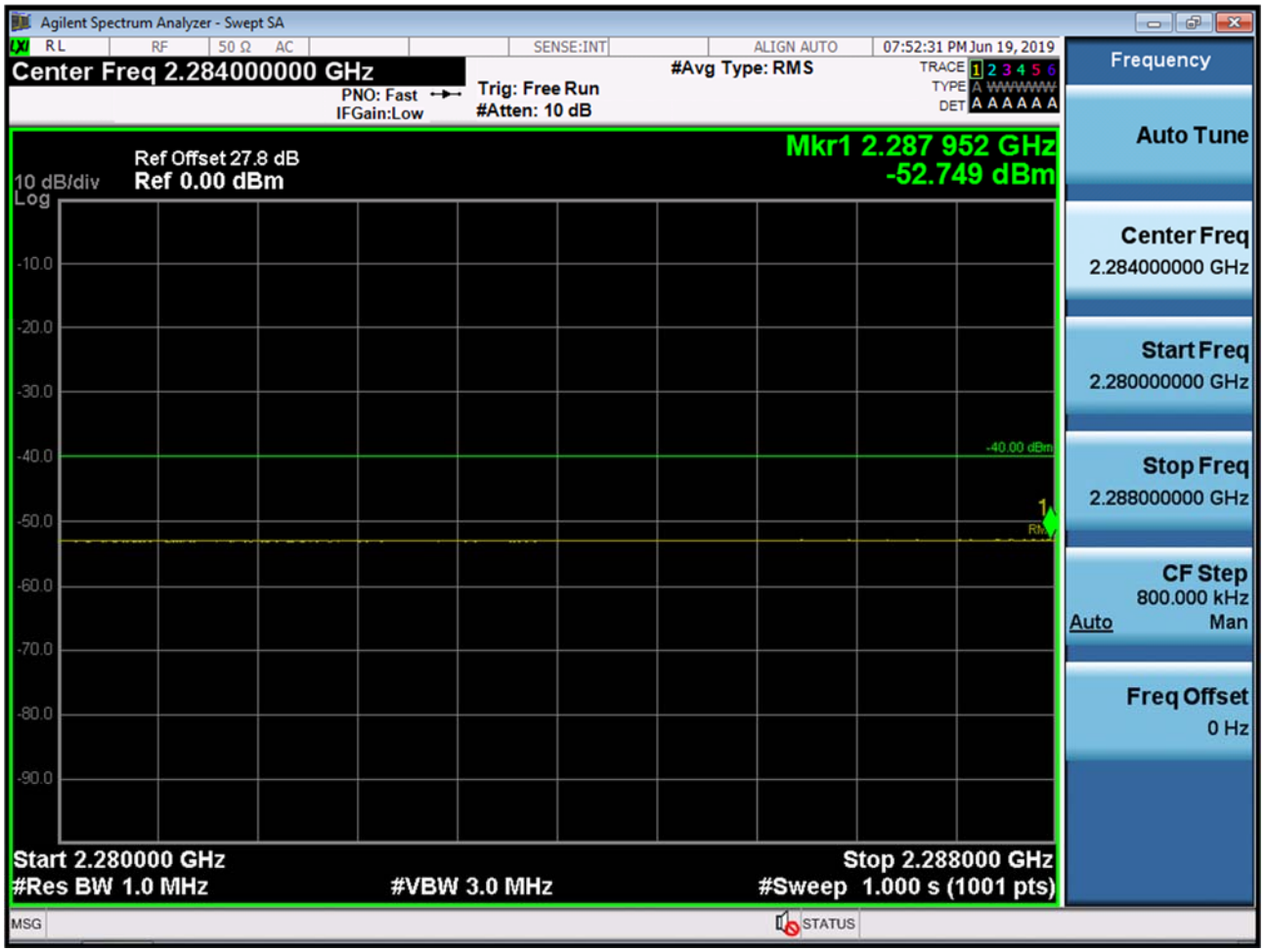


BAND 30. 5M_BandEdge(2280MHz-2288MHz)_Low_2307.5MHz_QPSK_FullRB



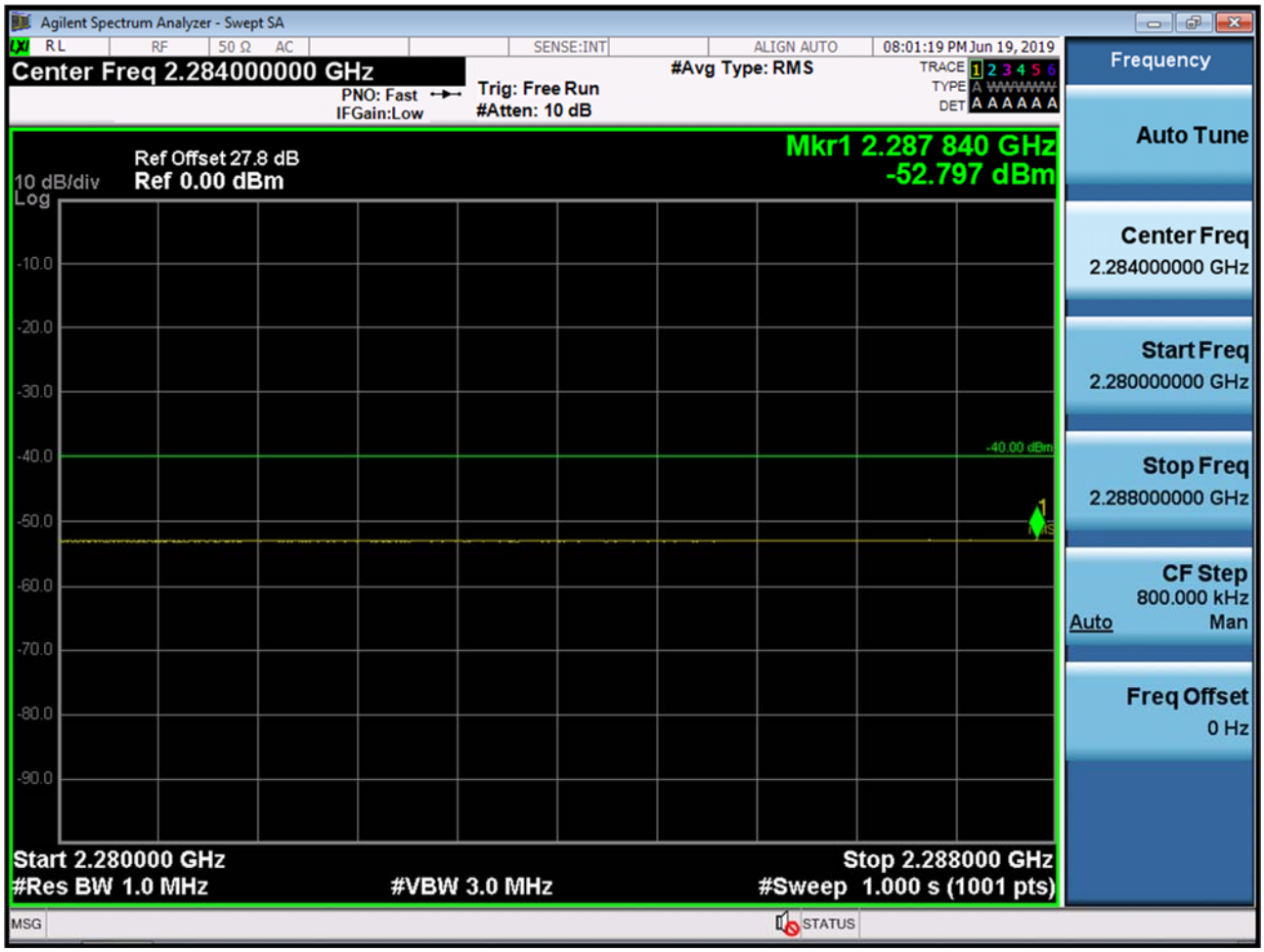
BAND 30. 5M_BandEdge(2280MHz-2288MHz)_Mid_2310MHz_QPSK_1RB

BAND 30. 5M_BandEdge(2280MHz-2288MHz)_Mid_2310MHz_QPSK_FullRB

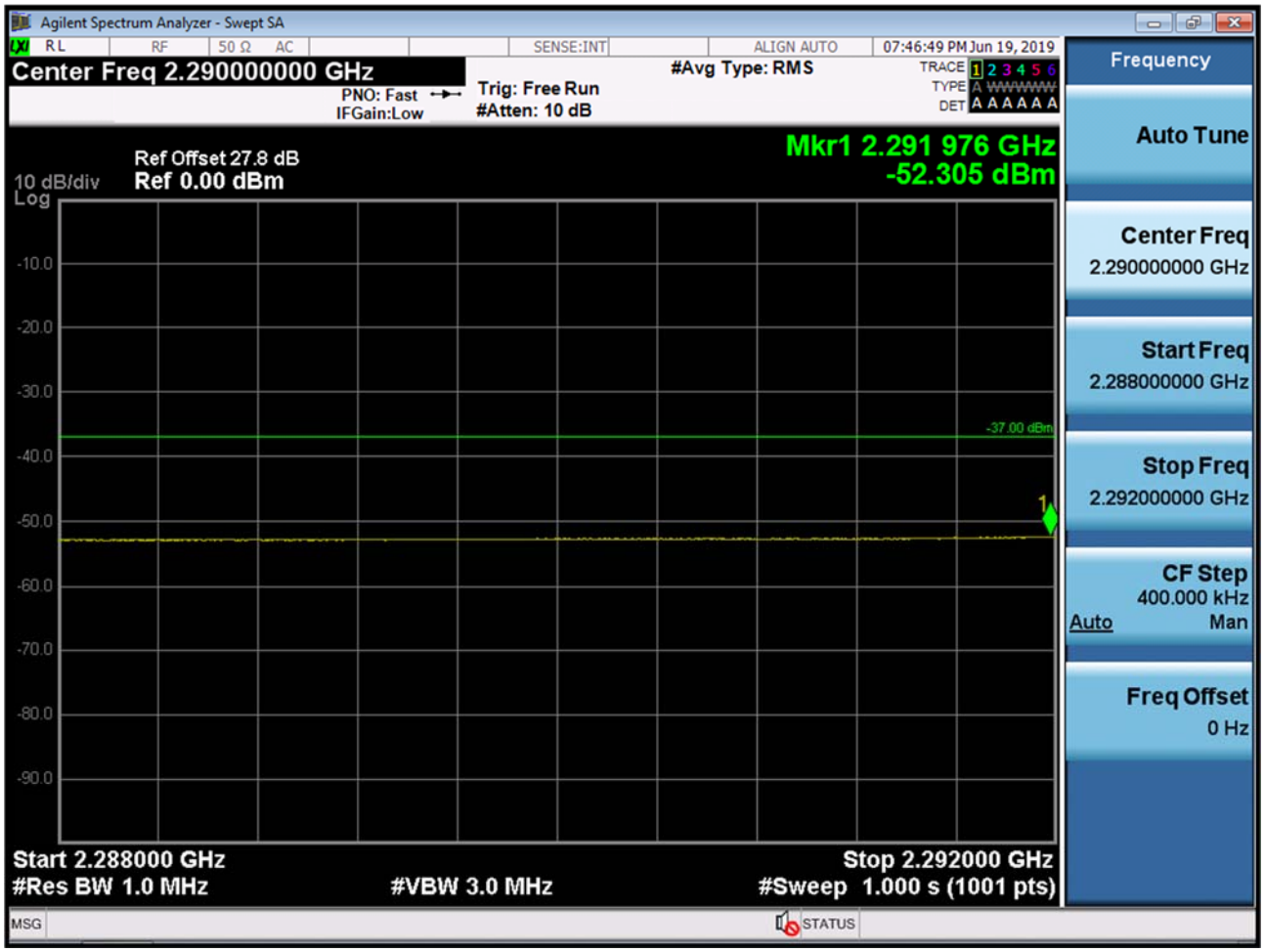


BAND 30. 5M_BandEdge(2280MHz-2288MHz)_High_2312.5MHz_QPSK_1RB

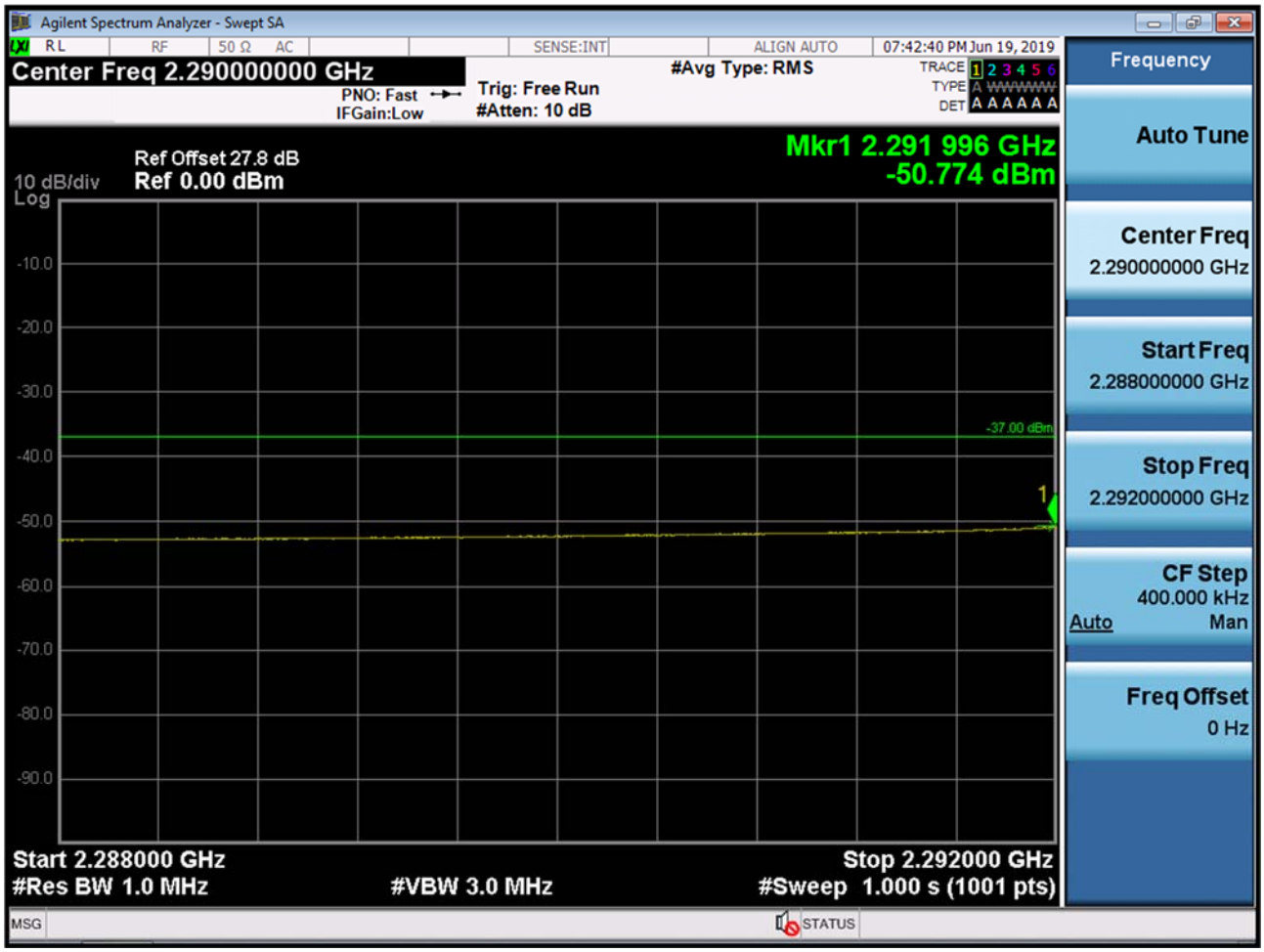
BAND 30. 5M_BandEdge(2280MHz-2288MHz)_High_2312.5MHz_QPSK_FullRB



BAND 30. 5M_BandEdge(2288MHz-2292MHz)_Low_2307.5MHz_QPSK_1RB



BAND 30. 5M_BandEdge(2288MHz-2292MHz)_Low_2307.5MHz_QPSK_FullRB

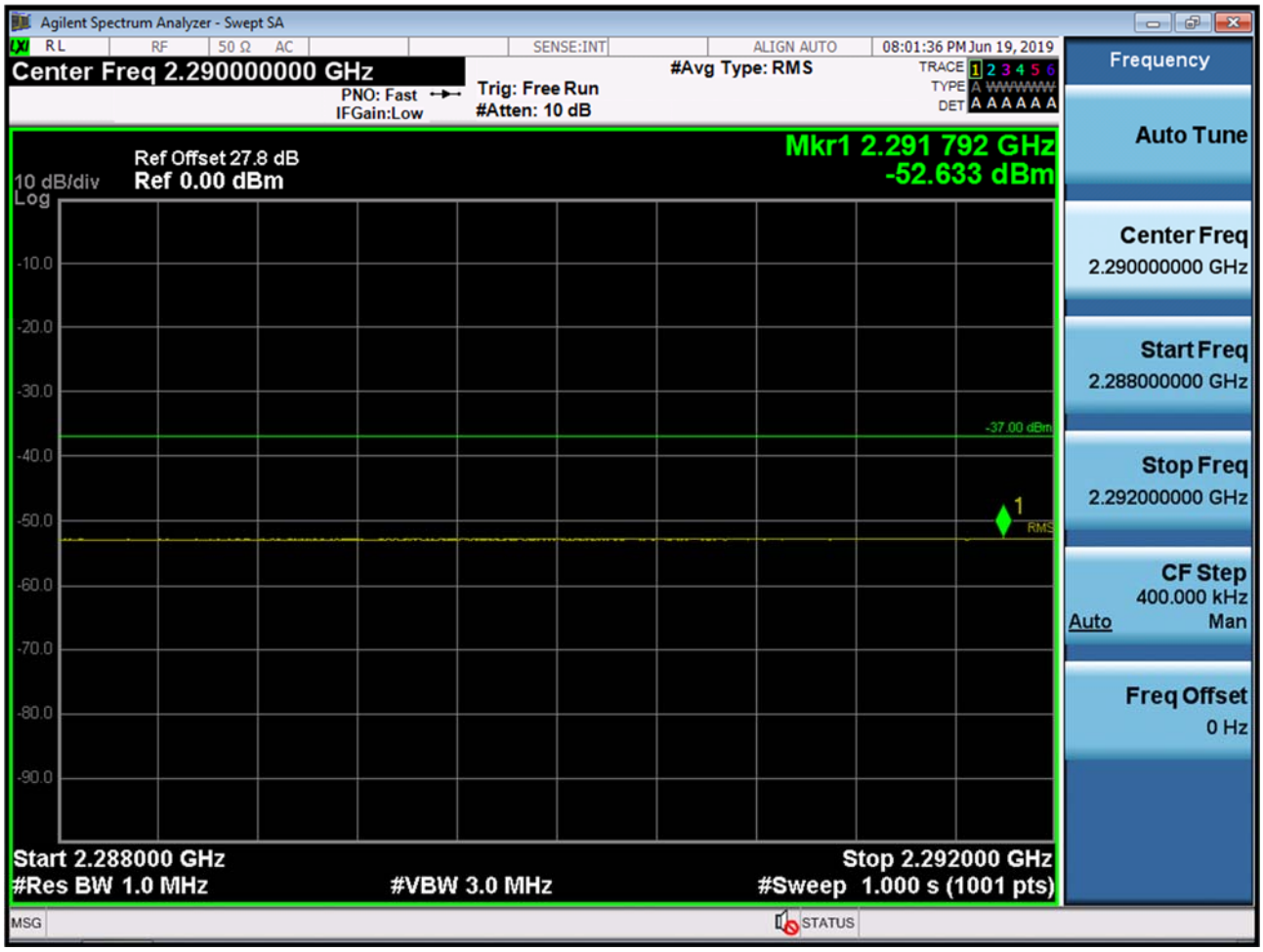


BAND 30. 5M_BandEdge(2288MHz-2292MHz)_Mid_2310MHz_QPSK_1RB

BAND 30. 5M_BandEdge(2288MHz-2292MHz)_Mid_2310MHz_QPSK_FullRB

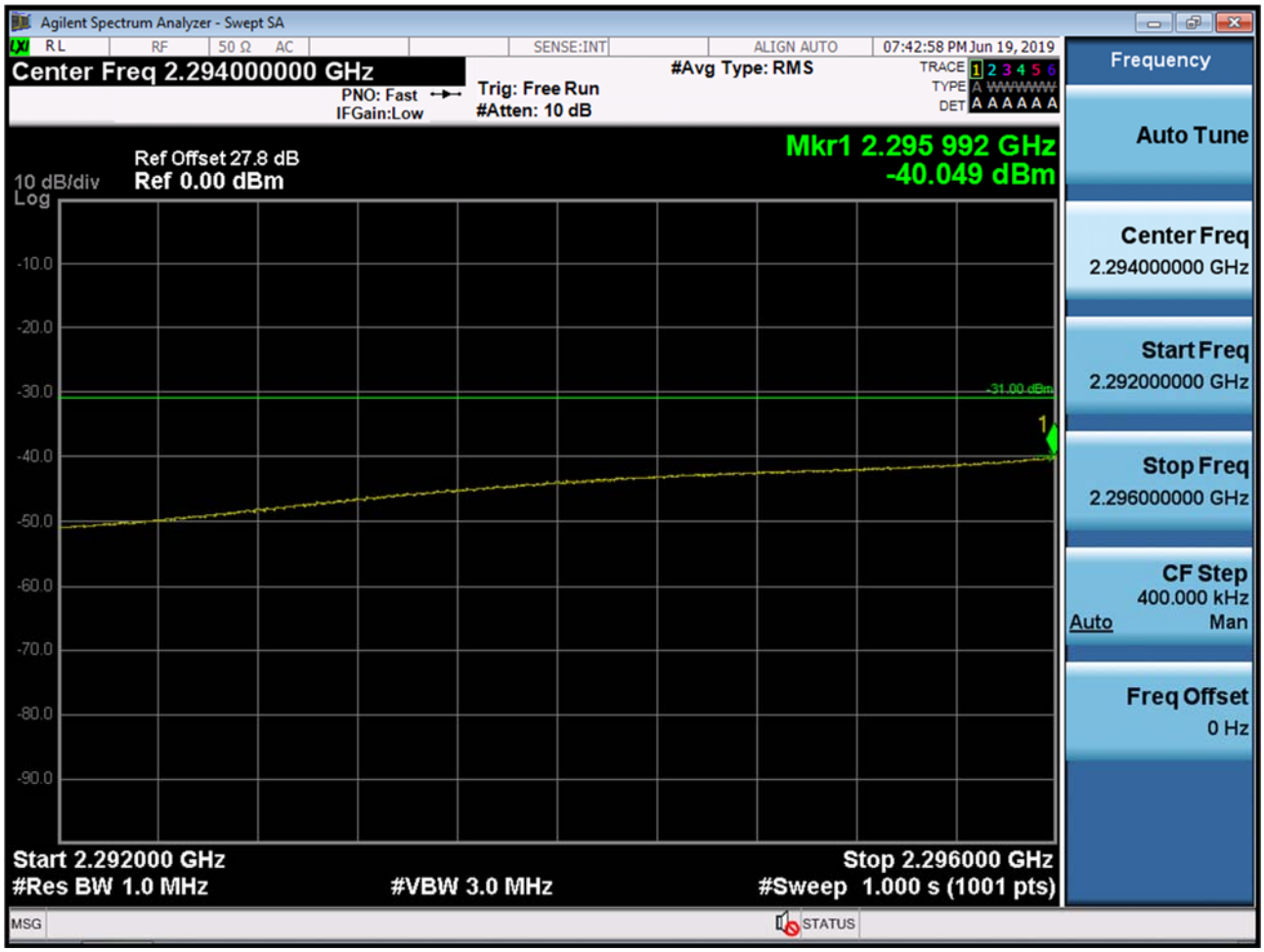
BAND 30. 5M_BandEdge(2288MHz-2292MHz)_High_2312.5MHz_QPSK_1RB

BAND 30. 5M_BandEdge(2288MHz-2292MHz)_High_2312.5MHz_QPSK_FullRB

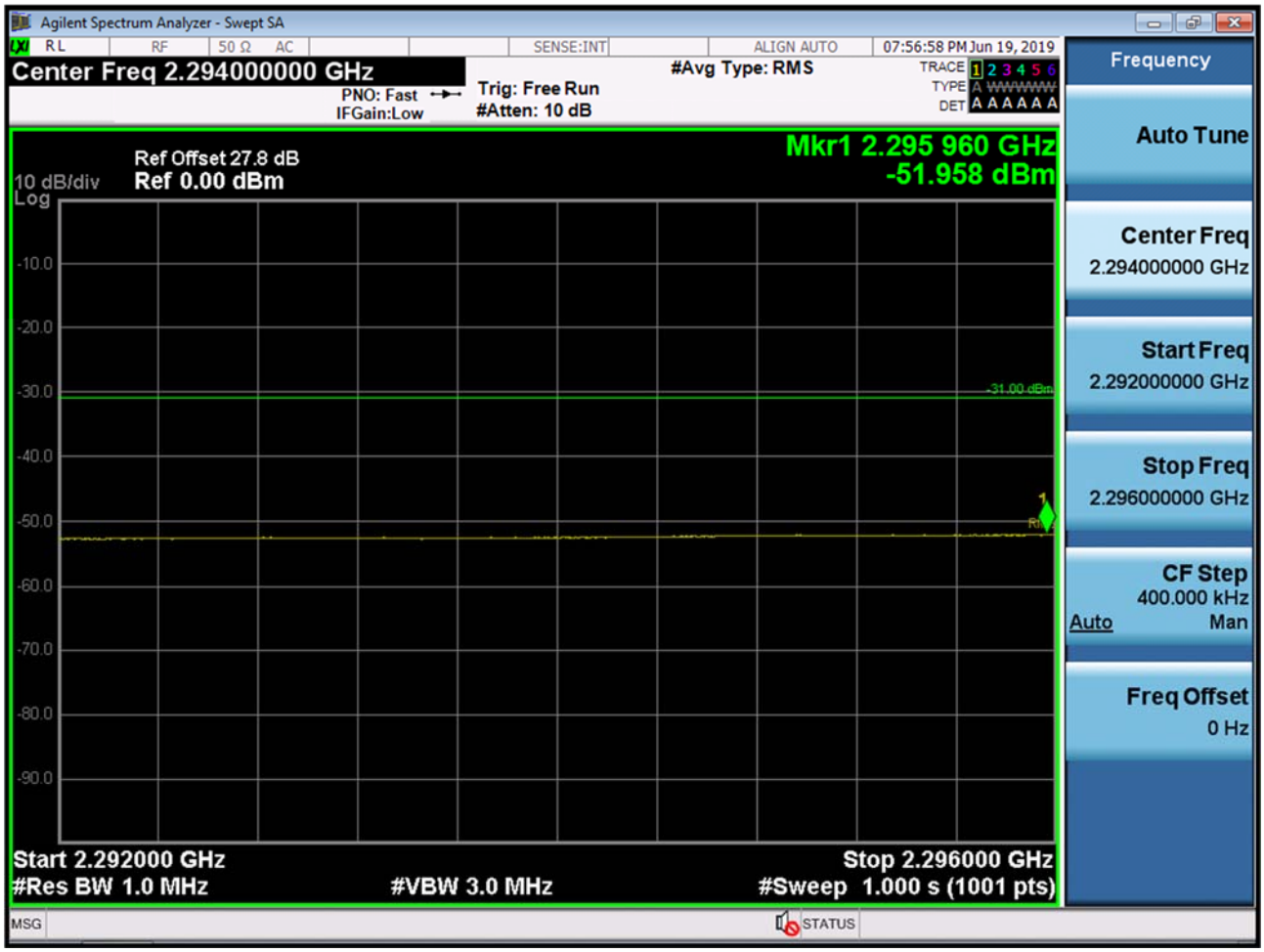


BAND 30. 5M_BandEdge(2292MHz-2296MHz)_Low_2307.5MHz_QPSK_1RB

BAND 30. 5M_BandEdge(2292MHz-2296MHz)_Low_2307.5MHz_QPSK_FullRB



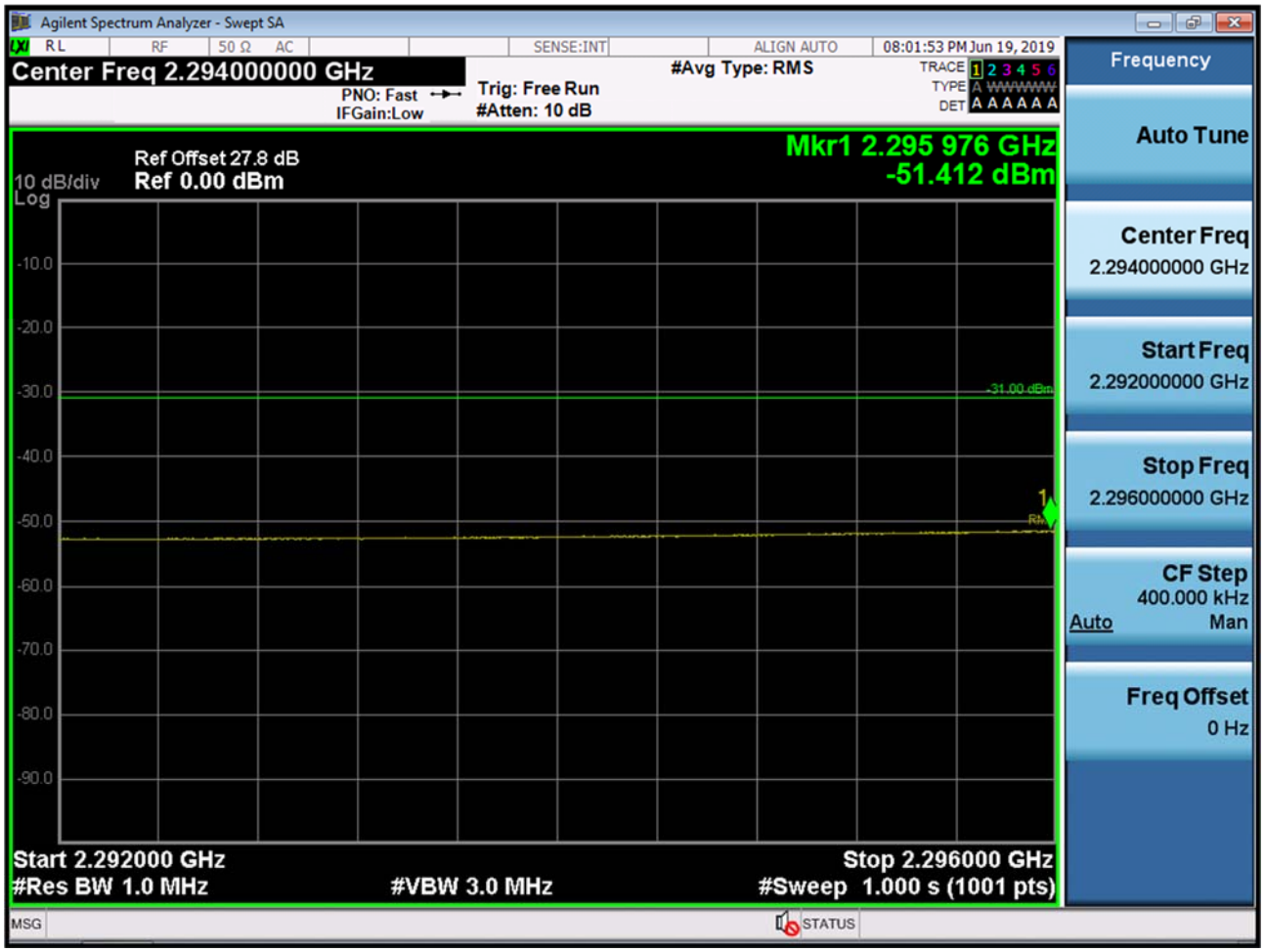
BAND 30. 5M_BandEdge(2292MHz-2296MHz)_Mid_2310MHz_QPSK_1RB



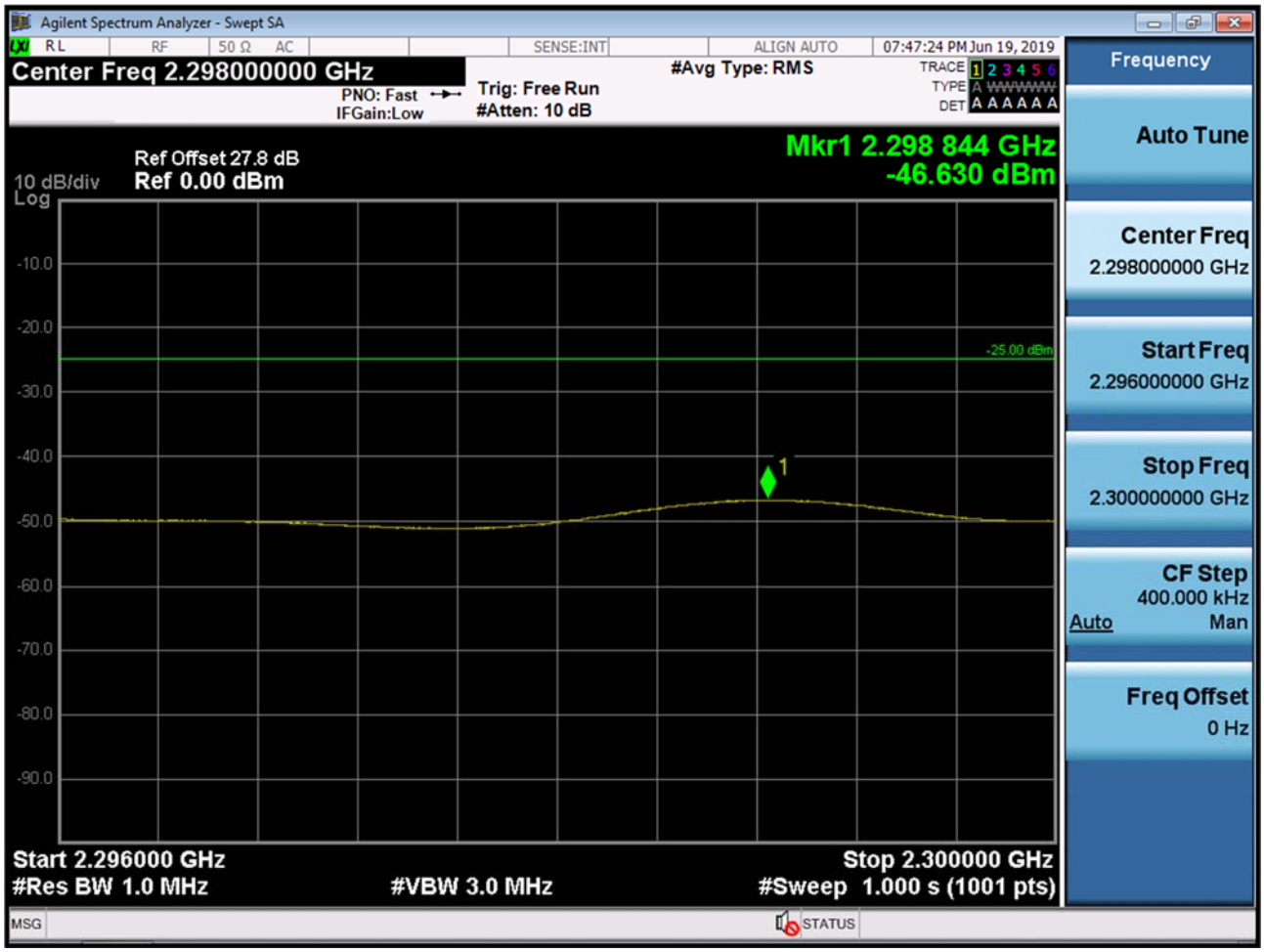
BAND 30. 5M_BandEdge(2292MHz-2296MHz)_Mid_2310MHz_QPSK_FullRB

BAND 30. 5M_BandEdge(2292MHz-2296MHz)_High_2312.5MHz_QPSK_1RB

BAND 30. 5M_BandEdge(2292MHz-2296MHz)_High_2312.5MHz_QPSK_FullRB



BAND 30. 5M_BandEdge(2296MHz-2300MHz)_Low_2307.5MHz_QPSK_1RB



BAND 30. 5M_BandEdge(2296MHz-2300MHz)_Low_2307.5MHz_QPSK_FullRB