

# FCC LTE REPORT

## Certification

<b>Applicant Name:</b> SAMSUNG Electronics Co., Ltd.	<b>Date of Issue:</b> October 16, 2023
<b>Address:</b> 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea	<b>Location:</b> HCT CO., LTD., 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA
<b>Report No.:</b> HCT-RF-2310-FC026	
<b>FCC ID:</b> A3LSMS926U	
<b>APPLICANT:</b> SAMSUNG Electronics Co., Ltd.	

Model(s): SM-S926U  
 Additional Model(s): SM-S926U1  
 EUT Type: Mobile phone  
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)  
 FCC Rule Part(s): §27

### Main 1 Ant

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 30 (5)	2307.5 – 2312.5	4 M51G7D	QPSK	0.060	17.77
		4 M52W7D	16QAM	0.049	16.94
		4 M51W7D	64QAM	0.039	15.88
		4 M51W7D	256QAM	0.019	12.73
LTE – Band 30 (10)	2310.0	9 M01G7D	QPSK	0.058	17.67
		8 M99W7D	16QAM	0.048	16.80
		8 M99W7D	64QAM	0.038	15.79
		8 M98W7D	256QAM	0.019	12.69

### Sub 2 Ant

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 30 (5)	2307.5 – 2312.5	4 M51G7D	QPSK	0.101	20.03
		4 M51W7D	16QAM	0.083	19.21
		4 M52W7D	64QAM	0.066	18.18
		4 M51W7D	256QAM	0.032	15.11
LTE – Band 30 (10)	2310.0	8 M98G7D	QPSK	0.101	20.03
		9 M01W7D	16QAM	0.082	19.14
		8 M98W7D	64QAM	0.065	18.11
		9 M00W7D	256QAM	0.031	14.92

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

Report No.: HCT-RF-2310-FC026

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REVIEWED BY



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

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Report approved by : Jong Seok Lee  
Manager of Telecommunication Testing Center

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

The report shall not be reproduced except in full(only partly) without approval of the laboratory.

## Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2310-FC026	October 16, 2023	- First Approval Report

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# MEASUREMENT REPORT

## 1. GENERAL INFORMATION

<b>Applicant Name:</b>	SAMSUNG Electronics Co., Ltd.
<b>Address:</b>	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
<b>FCC ID:</b>	A3LSMS926U
<b>Application Type:</b>	Certification
<b>FCC Classification:</b>	PCS Licensed Transmitter Held to Ear (PCE)
<b>FCC Rule Part(s):</b>	§27
<b>EUT Type:</b>	Mobile phone
<b>Model(s):</b>	SM-S926U
<b>Additional Model(s):</b>	SM-S926U1
<b>Tx Frequency:</b>	2307.5 MHz – 2312.5 MHz (LTE – Band30 (5 MHz)) 2310.0 MHz (LTE – Band30 (10 MHz))
<b>Date(s) of Tests:</b>	September 05, 2023 ~ October 11, 2023
<b>Serial number:</b>	Radiated: R3CW90B4EEV Conducted: 741c314dee0f7ece

## **2. INTRODUCTION**

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

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

It also supports IEEE 802.11 a/b/g/n/ac/ax (20/40/80/160 MHz), WIFI 6E, Bluetooth, BT LE, NFC, UWB, WPT.

### **2.2. MEASURING INSTRUMENT CALIBRATION**

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

### **2.3. TEST FACILITY**

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

### 3. DESCRIPTION OF TESTS

#### 3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
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 1 MHz
3. VBW  $\geq$  3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points  $>$  2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

### Test Note

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

The power is calculated by the following formula;

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

Where:  $P_d$  is the dipole equivalent power and  $P_g$  is the generator output power into the substitution antenna.

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference

between the gain of the horn and an isotropic antenna are taken into consideration

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



### 3.3 RADIATED SPURIOUS EMISSIONS

#### Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

#### Test Settings

1. RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
2. VBW  $\geq$  3 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<sup>th</sup> harmonics from 9 kHz.

#### Test Note

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

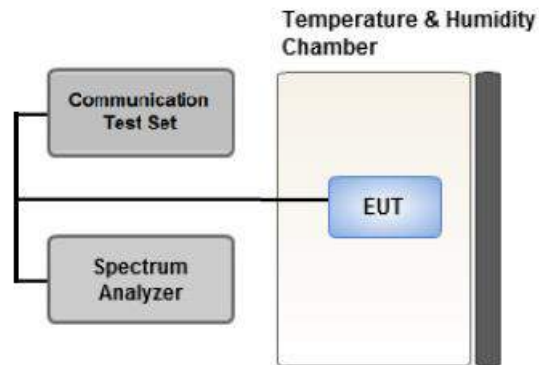
$$\text{Result}_{(dBm)} = P_g_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

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

### 3.4 PEAK- TO- AVERAGE RATIO



**Test setup**

① CCDF Procedure for PAPR

**Test Settings**

1. Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:
  - .- for continuous transmissions, set to 1 ms,
  - .- or burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR

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

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

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

**Test Settings(Peak Power)**

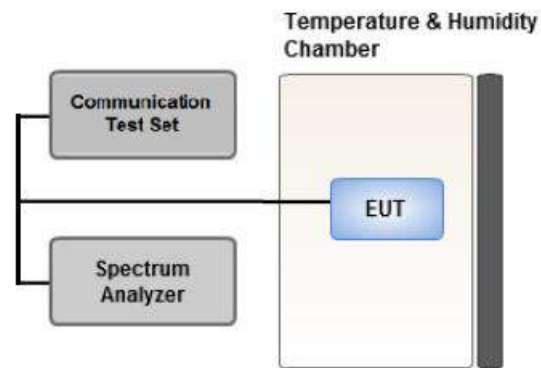
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW  $\geq 3 \times$  RBW.

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

**Test Settings(Average Power)**

1. Set span to 2  $\times$  to 3  $\times$  the OBW.
2. Set RBW  $\geq$  OBW.
3. Set VBW  $\geq 3 \times$  RBW.
4. Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
5. Sweep time:  
Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$  for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to "free run."
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add  $[10 \log (1/\text{duty cycle})]$  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.

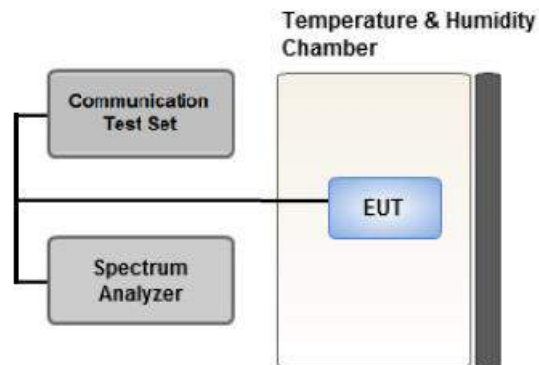
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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

### 3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



**Test setup**

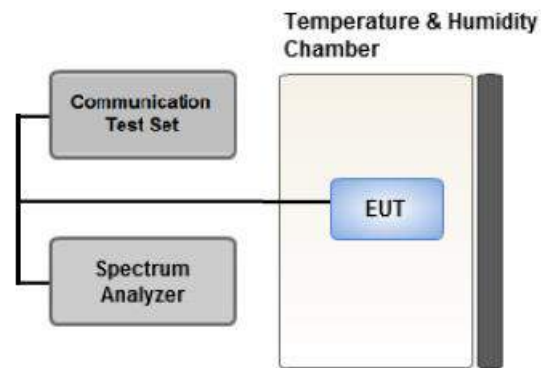
#### **Test Overview**

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

#### **Test Settings**

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

### 3.7 BAND EDGE



**Test setup**

#### **Test Overview**

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

#### **Test Settings**

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW > 1 % of the emission bandwidth
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq 2 \times \text{Span}/\text{RBW}$
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

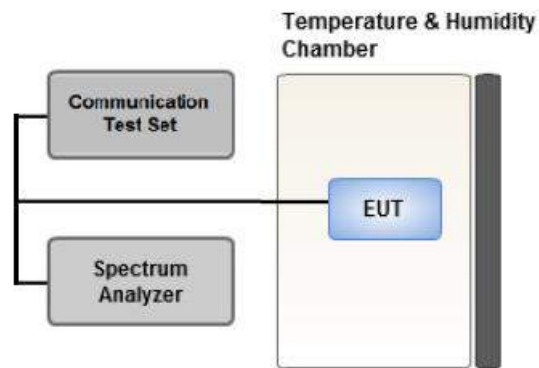
**Test Notes**

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.

Where Margin < 1 dB the emission level is either corrected by  $10 \log(1 \text{ MHz}/ \text{RB})$  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(RADIATED TEST)**

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.  
 Mode : Stand alone, Stand alone + External accessories (Earphone, AC adapter, etc)  
 Worst case : Stand alone
- We were performed the RSE test in condition of co-location.  
 Mode : Stand alone, Simultaneous transmission scenarios  
 Worst case : Stand alone
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- Please refer to the table below.
- SM-S926U & additional models were tested and the worst case results are reported.  
 (Worst case : SM-S926U)

[ Main 1 Ant Worst case ]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM, 256QAM	1	0	X
Radiated Spurious and Harmonic Emissions	QPSK	1	0	X

[ Sub 2 Ant Worst case ]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM, 256QAM	1	0	Z
Radiated Spurious and Harmonic Emissions	QPSK	1	0	Y

**3.10 WORST CASE(CONDUCTED TEST)**

- All modes of operation were investigated and the worst case configuration results are reported.
- SM-S926U & additional models were tested and the worst case results are reported.  
(Worst case : SM-S926U)

[ Worst case ]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
<b>Occupied Bandwidth</b>	QPSK, 16QAM, 64QAM, 256QAM	5, 10	Mid	Full RB	0
<b>Peak-To-Average Ratio</b>	QPSK, 16QAM, 64QAM, 256QAM	5, 10	Mid	Full RB	0
<b>Band Edge</b>	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
<b>Spurious and Harmonic Emissions at Antenna Terminal</b>	QPSK	5	Low, Mid, High	1	0
		10	Mid	1	0

#### 4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
RF Switching System	FBSR-02B(1.2G HPF+LNA)	T&M SYSTEM	F1L1	01/19/2024	Annual
RF Switching System	FBSR-02B(3.3G HPF+LNA)	T&M SYSTEM	F1L2	01/19/2024	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	5001	04/19/2024	Annual
DC Power Supply	E3632A	Agilent	MY40010147	06/23/2024	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	08/17/2025	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/11/2025	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	08/17/2024	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/10/2024	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	06/22/2024	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/24/2024	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

**Note:**

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

## 5. MEASUREMENT UNCERTAINTY

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

Parameter	Expanded Uncertainty ( $\pm$ dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	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)	5.16 (Confidence level about 95 %, $k=2$ )
Radiated Disturbance (1 GHz ~ 18 GHz)	5.57 (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, §27.53(a)	Section 3.7	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Frequency stability / variation of ambient temperature	§2.1055, §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
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 + 10log <sub>10</sub> (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 = 4 M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4 M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4 M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

### 8. TEST DATA (Main 1 Ant)

#### 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	-27.16	10.73	9.54	2.50	H	< 0.25	0.060	17.77
		16-QAM	-27.99	9.90	9.54	2.50	H		0.049	16.94
		64-QAM	-29.05	8.84	9.54	2.50	H		0.039	15.88
		256-QAM	-32.20	5.69	9.54	2.50	H		0.019	12.73
2310.0		QPSK	-27.24	10.65	9.54	2.50	H		0.059	17.69
		16-QAM	-28.08	9.81	9.54	2.50	H		0.048	16.85
		64-QAM	-29.16	8.73	9.54	2.50	H		0.038	15.77
		256-QAM	-32.34	5.55	9.54	2.50	H		0.018	12.59
2312.5		QPSK	-27.49	10.40	9.54	2.50	H		0.056	17.44
		16-QAM	-28.27	9.62	9.54	2.50	H		0.046	16.66
		64-QAM	-29.33	8.56	9.54	2.50	H		0.036	15.60
		256-QAM	-32.39	5.50	9.54	2.50	H		0.018	12.54

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	-27.26	10.63	9.54	2.50	H	< 0.25	0.058	17.67
		16-QAM	-28.13	9.76	9.54	2.50	H		0.048	16.80
		64-QAM	-29.14	8.75	9.54	2.50	H		0.038	15.79
		256-QAM	-32.24	5.65	9.54	2.50	H		0.019	12.69



### 8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY : 2307.5 MHz
- ▣ MEASURED OUTPUT POWER: 17.77 dBm = 0.060 W
- ▣ MODE: LTE B30
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: -40 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)
27685 (2307.5)	4 615.00	-58.87	12.55	-69.82	3.66	H	-60.94	-40.00
	6 922.50	-59.68	11.69	-61.40	4.53	V	-54.24	-40.00
	9 230.00	-61.77	10.62	-57.24	5.29	H	-51.91	-40.00
27710 (2310.0)	4 620.00	-58.00	12.54	-68.76	3.68	H	-59.90	-40.00
	6 930.00	-59.64	11.65	-61.13	4.52	H	-54.00	-40.00
	9 240.00	-60.14	10.59	-55.39	5.24	H	-50.04	-40.00
27735 (2312.5)	4 625.00	-58.76	12.54	-69.69	3.70	V	-60.85	-40.00
	6 937.50	-59.53	11.60	-61.39	4.51	H	-54.30	-40.00
	9 250.00	-60.56	10.56	-55.95	5.18	H	-50.57	-40.00

- ▣ OPERATING FREQUENCY : 2310.0 MHz
- ▣ MEASURED OUTPUT POWER: 17.67 dBm = 0.058 W
- ▣ MODE: LTE B30
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: -40 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)
27710 (2310.0)	4 620.00	-58.42	12.54	-69.18	3.68	V	-60.32	-40.00
	6 930.00	-59.45	11.65	-60.94	4.52	H	-53.81	-40.00
	9 240.00	-60.92	10.59	-56.17	5.24	V	-50.82	-40.00

**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	4.44
			16-QAM			5.51
			64-QAM			6.42
			256-QAM			6.83
	10 MHz		QPSK	50		4.52
			16-QAM			5.57
			64-QAM			6.40
			256-QAM			6.86

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 61 ~ 68.

**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	4.5081
			16-QAM			4.5177
			64-QAM			4.5110
			256-QAM			4.5046
	10 MHz		QPSK	50		9.0069
			16-QAM			8.9859
			64-QAM			8.9912
			256-QAM			8.9754

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 53 ~ 60.

**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	8.6147	28.591	-81.178	-52.587	-40.00
		2310.0	8.5972	28.591	-80.400	-51.809	
		2312.5	8.2742	28.591	-80.976	-52.385	
	10	2310.0	4.0559	27.976	-80.798	-52.822	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 181 ~ 188.
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(26.5)	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	-64.335	-40
				2288 - 2292	-55.573	-37
				2292 - 2296	-41.311	-31
				2296 - 2300	-34.799	-25
				2300 - 2304	-26.065	-13
				2304 - 2305	-26.936	-13
				2315 - 2320	-32.063	-13
				2320 - 2324	-42.721	-25
				2324 - 2328	-55.108	-31
				2328 - 2337	-64.417	-37
				2337 - 2341	-65.157	-31
				2341 - 2345	-65.165	-25
				2345 - 2365	-62.406	-13
				Above 2365	-65.273	-40
	2310.0	QPSK	25/0	Below 2288	-65.046	-40
				2288 - 2292	-60.75	-37
				2292 - 2296	-53.37	-31
				2296 - 2300	-43.225	-25
				2300 - 2305	-30.331	-13
				2315 - 2320	-25.101	-13
				2320 - 2324	-37.563	-25
				2324 - 2328	-51.121	-31
				2328 - 2337	-63.563	-37
				2337 - 2341	-65.296	-31
				2341 - 2345	-65.198	-25
				2345 - 2365	-62.79	-13
				Above 2365	-65.302	-40
				2312.5	QPSK	25/0
	2288 - 2292	-60.614	-37			
	2292 - 2296	-59.55	-31			
	2296 - 2300	-52.367	-25			
	2300 - 2305	-37.079	-13			
	2315 - 2316	-25.731	-13			

				2316 - 2320	-23.052	-13
				2320 - 2324	-35.521	-25
				2324 - 2328	-47.945	-31
				2328 - 2337	-63.702	-37
				2337 - 2341	-65.142	-31
				2341 - 2345	-65.218	-25
				2345 - 2365	-62.849	-13
				Above 2365	-65.297	-40
10	2310.0	QPSK	50/0	Below 2288	-54.697	-40
				2288 - 2292	-44.956	-37
				2292 - 2296	-39.232	-31
				2296 - 2300	-33.654	-25
				2300 - 2304	-24.192	-13
				2304 - 2305	-30.004	-13
				2315 - 2316	-27.082	-13
				2316 - 2320	-21.099	-13
				2320 - 2324	-28.341	-25
				2324 - 2328	-34.173	-31
				2328 - 2337	-42.869	-37
				2337 - 2341	-65.194	-31
				2341 - 2345	-65.185	-25
				2345 - 2365	-62.651	-13
				Above 2365	-65.322	-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	-64.546	-40
				2288 - 2292	-60.627	-37
				2292 - 2296	-56.037	-31
				2296 - 2300	-49.351	-25
				2300 - 2304	-30.538	-13
				2304 - 2305	-19.89	-13
			1/24	2315 - 2320	-48.775	-13
				2320 - 2324	-57.108	-25
				2324 - 2328	-60.397	-31
				2328 - 2337	-64.551	-37
				2337 - 2341	-65.175	-31
				2341 - 2345	-65.191	-25
				2345 - 2365	-62.475	-13
	Above 2365	-65.281	-40			
	2310.0	QPSK	1/0	Below 2288	-64.774	-40
				2288 - 2292	-61.296	-37
				2292 - 2296	-59.351	-31
				2296 - 2300	-53.776	-25
				2300 - 2305	-41.641	-13
				2315 - 2320	-42.126	-13
			1/24	2320 - 2324	-54.593	-25
2324 - 2328				-59.273	-31	
2328 - 2337				-64.506	-37	
2337 - 2341				-65.298	-31	
2341 - 2345				-65.291	-25	
2345 - 2365				-62.688	-13	
Above 2365				-65.378	-40	
2312.5	QPSK	1/0	Below 2288	-64.969	-40	
			2288 - 2292	-62.712	-37	
			2292 - 2296	-61.033	-31	
			2296 - 2300	-57.707	-25	
			2300 - 2305	-50.227	-13	
			2315 - 2316	-21.659	-13	
		1/24	2315 - 2316	-21.659	-13	



10	2310.0	QPSK		2316 - 2320	-33.588	-13
				2320 - 2324	-51.873	-25
				2324 - 2328	-57.289	-31
				2328 - 2337	-64.074	-37
				2337 - 2341	-65.133	-31
				2341 - 2345	-65.073	-25
				2345 - 2365	-62.707	-13
				Above 2365	-65.204	-40
			1/0	Below 2288	-63.833	-40
				2288 - 2292	-57.696	-37
				2292 - 2296	-53.84	-31
				2296 - 2300	-49.278	-25
				2300 - 2304	-34.527	-13
				2304 - 2305	-26.898	-13
				1/49	2315 - 2316	-29.349
2316 - 2320	-36.998	-13				
2320 - 2324	-50.792	-25				
2324 - 2328	-54.819	-31				
2328 - 2337	-62.864	-37				
2337 - 2341	-65.225	-31				
2341 - 2345	-65.259	-25				
2345 - 2365	-62.582	-13				
Above 2365	-65.276	-40				

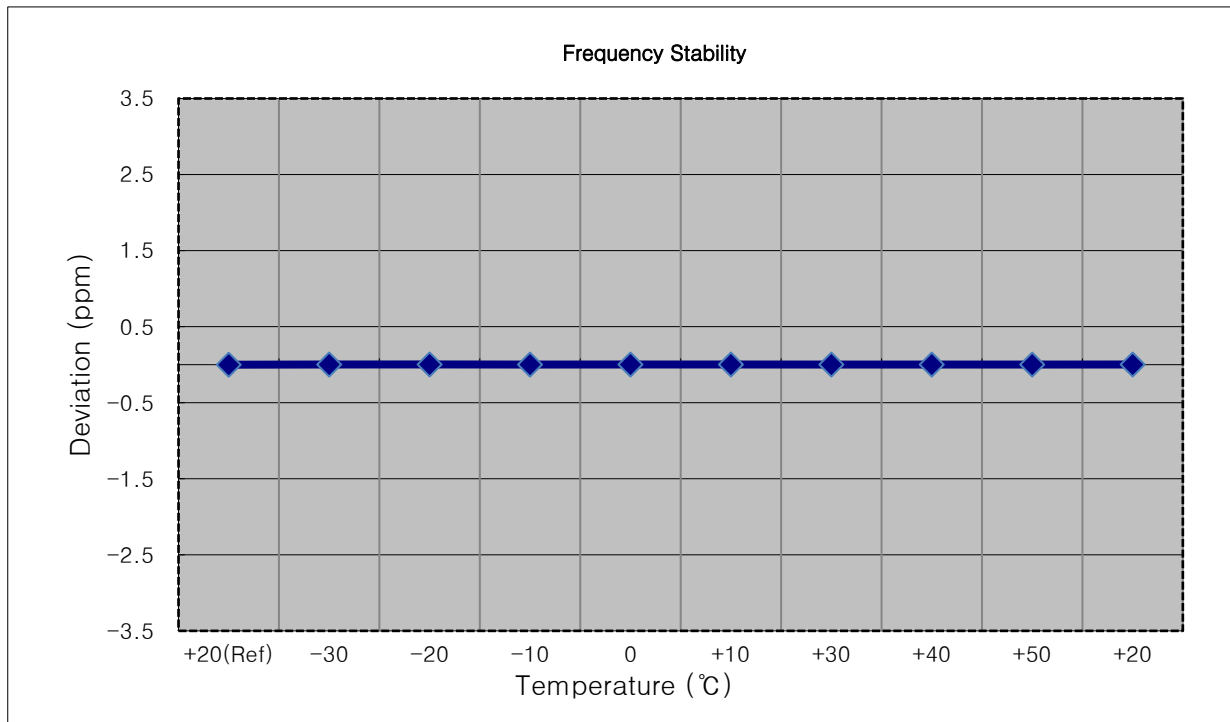
Note:

- Plots of the EUT's Band Edge are shown Page 69 ~ 180.

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

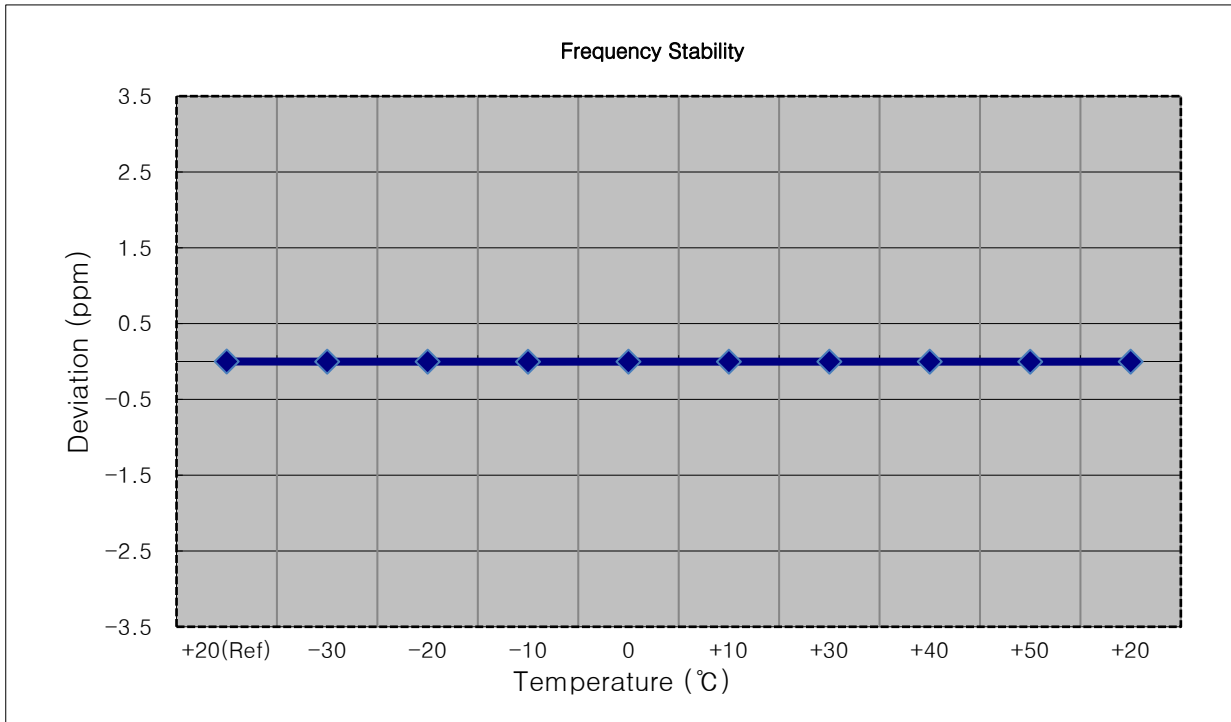
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2307,500,000 Hz
- ▣ BANDWIDTH: 27685 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2307 500 006	0.00	0.000 000	0.0000
100 %		-30	2307 500 012	6.20	0.000 000	0.0027
100 %		-20	2307 500 014	7.70	0.000 000	0.0033
100 %		-10	2307 500 011	4.70	0.000 000	0.0020
100 %		0	2307 500 012	5.90	0.000 000	0.0026
100 %		+10	2307 500 011	5.60	0.000 000	0.0024
100 %		+30	2307 500 010	4.60	0.000 000	0.0020
100 %		+40	2307 500 011	4.80	0.000 000	0.0021
100 %		+50	2307 500 010	4.20	0.000 000	0.0018
Batt. Endpoint		3.300	+20	2307 500 012	6.40	0.000 000



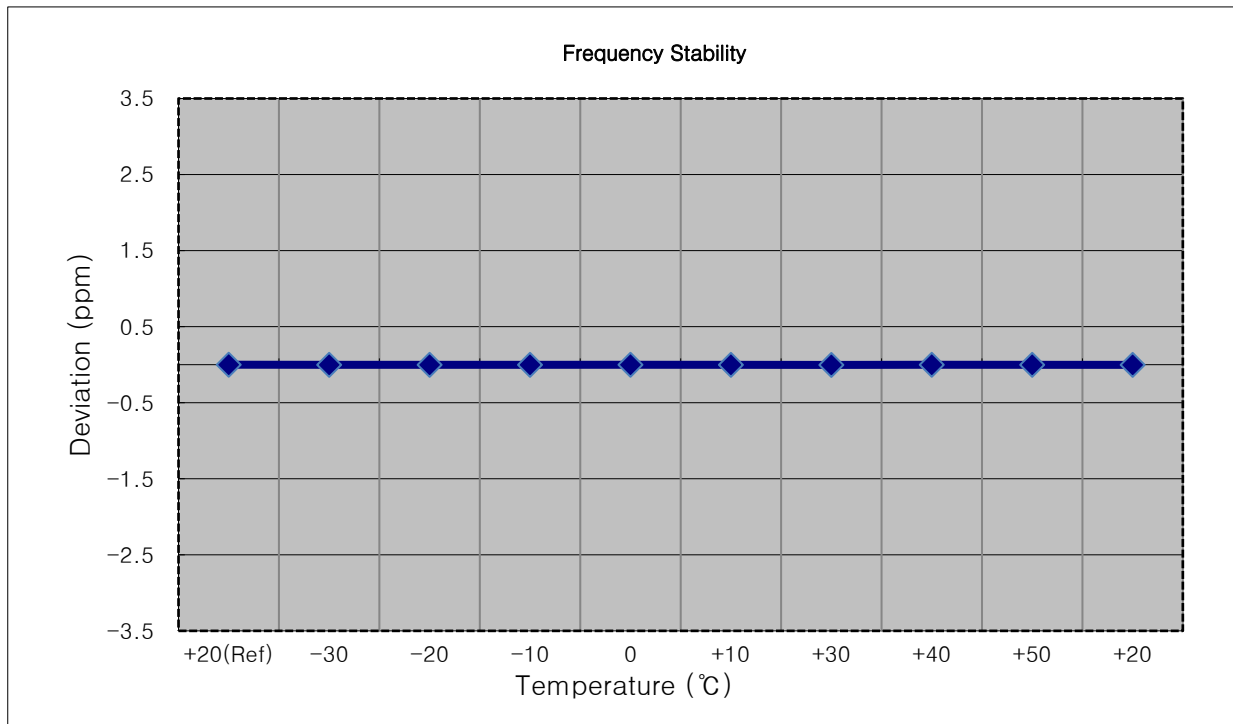
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2310,000,000 Hz
- ▣ BANDWIDTH: 27710 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2309 999 995	0.00	0.000 000	0.0000
100 %		-30	2309 999 990	-4.70	0.000 000	-0.0020
100 %		-20	2309 999 991	-3.70	0.000 000	-0.0016
100 %		-10	2309 999 990	-5.20	0.000 000	-0.0023
100 %		0	2309 999 990	-4.60	0.000 000	-0.0020
100 %		+10	2309 999 991	-3.60	0.000 000	-0.0016
100 %		+30	2309 999 991	-4.10	0.000 000	-0.0018
100 %		+40	2309 999 991	-4.20	0.000 000	-0.0018
100 %		+50	2309 999 989	-6.00	0.000 000	-0.0026
Batt. Endpoint		3.300	+20	2309 999 991	-4.30	0.000 000



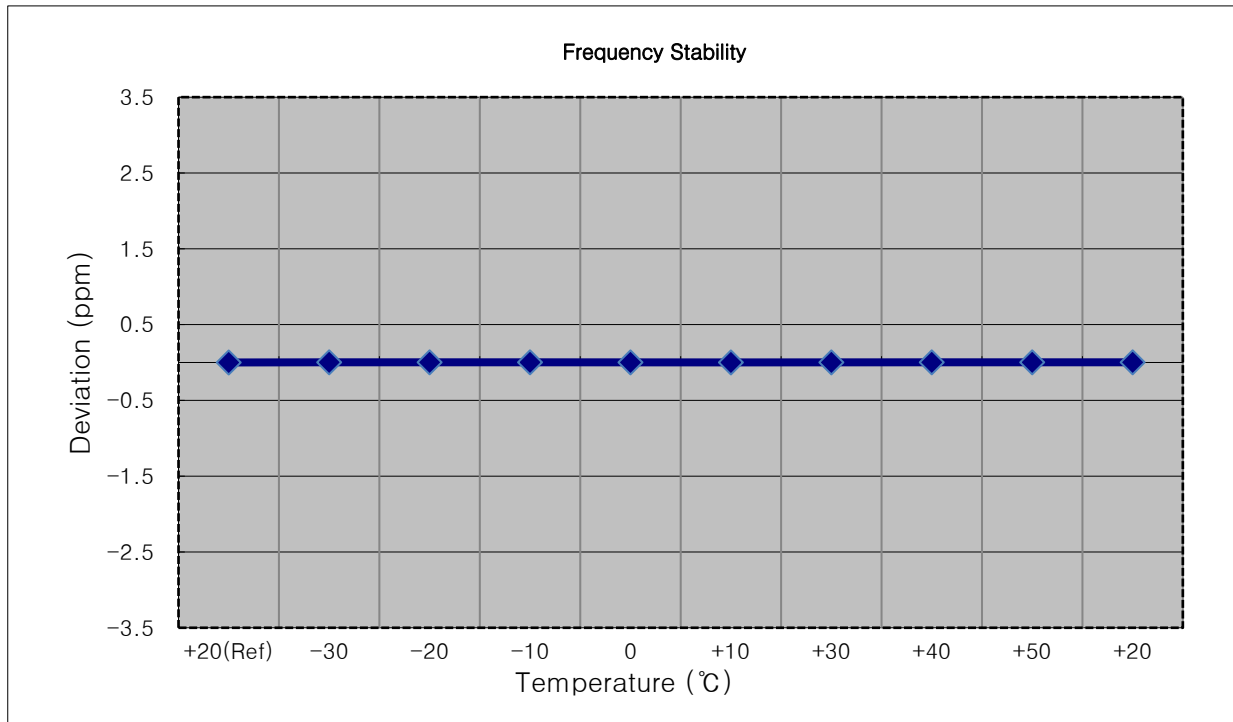
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2312,500,000 Hz
- ▣ BANDWIDTH: 27735 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2312 499 996	0.00	0.000 000	0.0000
100 %		-30	2312 499 992	-4.50	0.000 000	-0.0019
100 %		-20	2312 499 991	-4.60	0.000 000	-0.0020
100 %		-10	2312 499 992	-4.10	0.000 000	-0.0018
100 %		0	2312 499 993	-2.70	0.000 000	-0.0012
100 %		+10	2312 499 992	-3.70	0.000 000	-0.0016
100 %		+30	2312 499 989	-7.20	0.000 000	-0.0031
100 %		+40	2312 499 994	-2.40	0.000 000	-0.0010
100 %		+50	2312 499 992	-4.20	0.000 000	-0.0018
Batt. Endpoint		3.300	+20	2312 499 991	-5.10	0.000 000



- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2310,000,000 Hz
- ▣ BANDWIDTH: 27710 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2310 000 005	0.00	0.000 000	0.0000
100 %		-30	2310 000 010	5.40	0.000 000	0.0023
100 %		-20	2310 000 010	5.20	0.000 000	0.0023
100 %		-10	2310 000 010	5.20	0.000 000	0.0023
100 %		0	2310 000 009	4.00	0.000 000	0.0017
100 %		+10	2310 000 008	2.70	0.000 000	0.0012
100 %		+30	2310 000 009	3.90	0.000 000	0.0017
100 %		+40	2310 000 010	5.10	0.000 000	0.0022
100 %		+50	2310 000 010	5.30	0.000 000	0.0023
Batt. Endpoint		3.300	+20	2310 000 010	5.30	0.000 000



### 9. TEST DATA (Sub 2 Ant)

#### 9.1 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	-24.94	12.95	9.54	2.50	V	< 0.25	0.100	19.99
		16-QAM	-25.78	12.11	9.54	2.50	V		0.082	19.15
		64-QAM	-26.83	11.06	9.54	2.50	V		0.065	18.10
		256-QAM	-29.89	8.00	9.54	2.50	V		0.032	15.04
2310.0		QPSK	-24.90	12.99	9.54	2.50	V		0.101	20.03
		16-QAM	-25.74	12.15	9.54	2.50	V		0.083	19.19
		64-QAM	-26.81	11.08	9.54	2.50	V		0.065	18.12
		256-QAM	-29.89	8.00	9.54	2.50	V		0.032	15.04
2312.5		QPSK	-24.92	12.97	9.54	2.50	V		0.100	20.01
		16-QAM	-25.72	12.17	9.54	2.50	V		0.083	19.21
		64-QAM	-26.75	11.14	9.54	2.50	V		0.066	18.18
		256-QAM	-29.82	8.07	9.54	2.50	V		0.032	15.11

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	-24.90	12.99	9.54	2.50	V	< 0.25	0.101	20.03
		16-QAM	-25.79	12.10	9.54	2.50	V		0.082	19.14
		64-QAM	-26.82	11.07	9.54	2.50	V		0.065	18.11
		256-QAM	-30.01	7.88	9.54	2.50	V		0.031	14.92

**9.2 RADIATED SPURIOUS EMISSIONS**

- ▣ OPERATING FREQUENCY : 2310.0 MHz
- ▣ MEASURED OUTPUT POWER: 20.03 dBm = 0.101 W
- ▣ MODE: LTE B30
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: -40 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)
27685 (2307.5)	4 615.00	-56.45	12.55	-67.40	3.66	V	-58.52	-40.00
	6 922.50	-58.43	11.69	-60.15	4.53	V	-52.99	-40.00
	9 230.00	-59.57	10.62	-55.04	5.29	V	-49.71	-40.00
27710 (2310.0)	4 620.00	-56.41	12.54	-67.17	3.68	H	-58.31	-40.00
	6 930.00	-57.76	11.65	-59.25	4.52	H	-52.12	-40.00
	9 240.00	-59.41	10.59	-54.66	5.24	H	-49.31	-40.00
27735 (2312.5)	4 625.00	-55.96	12.54	-66.89	3.70	H	-58.05	-40.00
	6 937.50	-57.55	11.60	-59.41	4.51	H	-52.32	-40.00
	9 250.00	-59.92	10.56	-55.31	5.18	V	-49.93	-40.00

- ▣ OPERATING FREQUENCY : 2310.0 MHz
- ▣ MEASURED OUTPUT POWER: 20.03 dBm = 0.101 W
- ▣ MODE: LTE B30
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: -40 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)
27710 (2310.0)	4 620.00	-56.61	12.54	-67.37	3.68	H	-58.51	-40.00
	6 930.00	-58.50	11.65	-59.99	4.52	V	-52.86	-40.00
	9 240.00	-59.13	10.59	-54.38	5.24	H	-49.03	-40.00



**9.3 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	4.40
			16-QAM			5.41
			64-QAM			6.57
			256-QAM			6.57
	10 MHz		QPSK	50		4.61
			16-QAM			5.72
			64-QAM			6.56
			256-QAM			6.87

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 198 ~ 205.

**9.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data ( MHz )
30	5 MHz	2310.0	QPSK	25	0	4.5141
			16-QAM			4.5079
			64-QAM			4.5164
			256-QAM			4.5069
	10 MHz		QPSK	50		8.9834
			16-QAM			9.0092
			64-QAM			8.9829
			256-QAM			9.0015

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 190 ~ 197.

**9.5 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	9.1306	28.591	-80.756	-52.165	-40.00
		2310.0	7.7059	28.591	-80.755	-52.164	
		2312.5	8.2991	28.591	-80.722	-52.131	
	10	2310.0	8.2872	28.591	-80.951	-52.360	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 318 ~ 325.
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(26.5)	30.131

**9.6 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	-65.581	-40
				2288 - 2292	-58.355	-37
				2292 - 2296	-47.555	-31
				2296 - 2300	-35.714	-25
				2300 - 2304	-22.574	-13
				2304 - 2305	-26.814	-13
				2315 - 2320	-34.841	-13
				2320 - 2324	-48.652	-25
				2324 - 2328	-57.519	-31
				2328 - 2337	-64.41	-37
				2337 - 2341	-65.305	-31
				2341 - 2345	-65.354	-25
				2345 - 2365	-64.234	-13
				Above 2365	-65.295	-40
	2310.0	QPSK	25/0	Below 2288	-65.361	-40
				2288 - 2292	-60.18	-37
				2292 - 2296	-46.501	-31
				2296 - 2300	-34.805	-25
				2300 - 2305	-28.857	-13
				2315 - 2320	-28.817	-13
				2320 - 2324	-32.958	-25
				2324 - 2328	-46.401	-31
				2328 - 2337	-60.872	-37
				2337 - 2341	-65.24	-31
				2341 - 2345	-65.261	-25
				2345 - 2365	-64.29	-13
				Above 2365	-65.337	-40
				2312.5	QPSK	25/0
	2288 - 2292	-63.238	-37			
	2292 - 2296	-57.175	-31			
	2296 - 2300	-48.804	-25			
	2300 - 2305	-37.288	-13			
	2315 - 2316	-26.097	-13			

				2316 - 2320	-21.572	-13
				2320 - 2324	-32.66	-25
				2324 - 2328	-44.875	-31
				2328 - 2337	-62.975	-37
				2337 - 2341	-65.251	-31
				2341 - 2345	-65.176	-25
				2345 - 2365	-64.098	-13
				Above 2365	-65.362	-40
10	2310.0	QPSK	50/0	Below 2288	-57.505	-40
				2288 - 2292	-42.53	-37
				2292 - 2296	-37.664	-31
				2296 - 2300	-30.923	-25
				2300 - 2304	-22.984	-13
				2304 - 2305	-29.155	-13
				2315 - 2316	-29.106	-13
				2316 - 2320	-22.917	-13
				2320 - 2324	-28.899	-25
				2324 - 2328	-35.919	-31
				2328 - 2337	-41.239	-37
				2337 - 2341	-64.709	-31
				2341 - 2345	-65.475	-25
2345 - 2365	-64.284	-13				
				Above 2365	-65.401	-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	-65.302	-40
				2288 - 2292	-61.151	-37
				2292 - 2296	-55.737	-31
				2296 - 2300	-50.074	-25
				2300 - 2304	-33.517	-13
				2304 - 2305	-22.042	-13
			1/24	2315 - 2320	-49.387	-13
				2320 - 2324	-55.745	-25
				2324 - 2328	-59.887	-31
				2328 - 2337	-63.979	-37
				2337 - 2341	-65.239	-31
				2341 - 2345	-65.251	-25
				2345 - 2365	-64.255	-13
				Above 2365	-65.347	-40
	2310.0	QPSK	1/0	Below 2288	-65.416	-40
				2288 - 2292	-62.941	-37
				2292 - 2296	-58.965	-31
				2296 - 2300	-53.471	-25
				2300 - 2305	-42.58	-13
				2315 - 2320	-40.307	-13
			1/24	2320 - 2324	-52.623	-25
				2324 - 2328	-58.338	-31
				2328 - 2337	-63.552	-37
				2337 - 2341	-65.131	-31
2341 - 2345				-65.208	-25	
2345 - 2365				-64.299	-13	
Above 2365				-65.292	-40	
2312.5				QPSK	1/0	Below 2288
	2288 - 2292	-62.379	-37			
	2292 - 2296	-59.047	-31			
	2296 - 2300	-56.049	-25			
	2300 - 2305	-49.396	-13			
	2315 - 2316	-22.427	-13			
	1/24					

10	2310.0	QPSK		2316 - 2320	-32.991	-13
				2320 - 2324	-49.504	-25
				2324 - 2328	-56.044	-31
				2328 - 2337	-62.937	-37
				2337 - 2341	-65.177	-31
				2341 - 2345	-65.136	-25
				2345 - 2365	-64.219	-13
				Above 2365	-65.227	-40
			1/0	Below 2288	-65.286	-40
				2288 - 2292	-59.833	-37
				2292 - 2296	-53.779	-31
				2296 - 2300	-49.471	-25
				2300 - 2304	-36.18	-13
				2304 - 2305	-30.733	-13
				1/49	2315 - 2316	-29.342
2316 - 2320	-34.154	-13				
2320 - 2324	-48.651	-25				
2324 - 2328	-54.287	-31				
2328 - 2337	-61.712	-37				
2337 - 2341	-65.091	-31				
2341 - 2345	-65.229	-25				
2345 - 2365	-64.099	-13				
Above 2365	-65.337	-40				

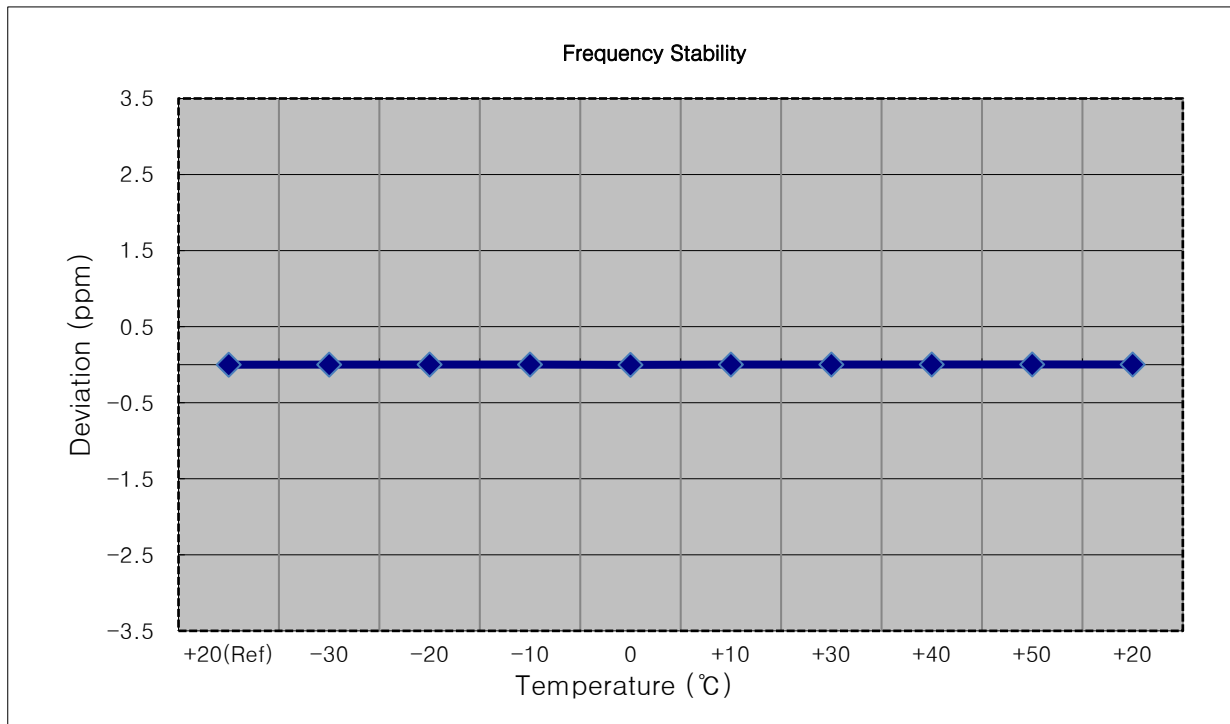
Note:

- Plots of the EUT's Band Edge are shown Page 206 ~ 317.

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

- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2307,500,000 Hz
- ▣ BANDWIDTH: 27685 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

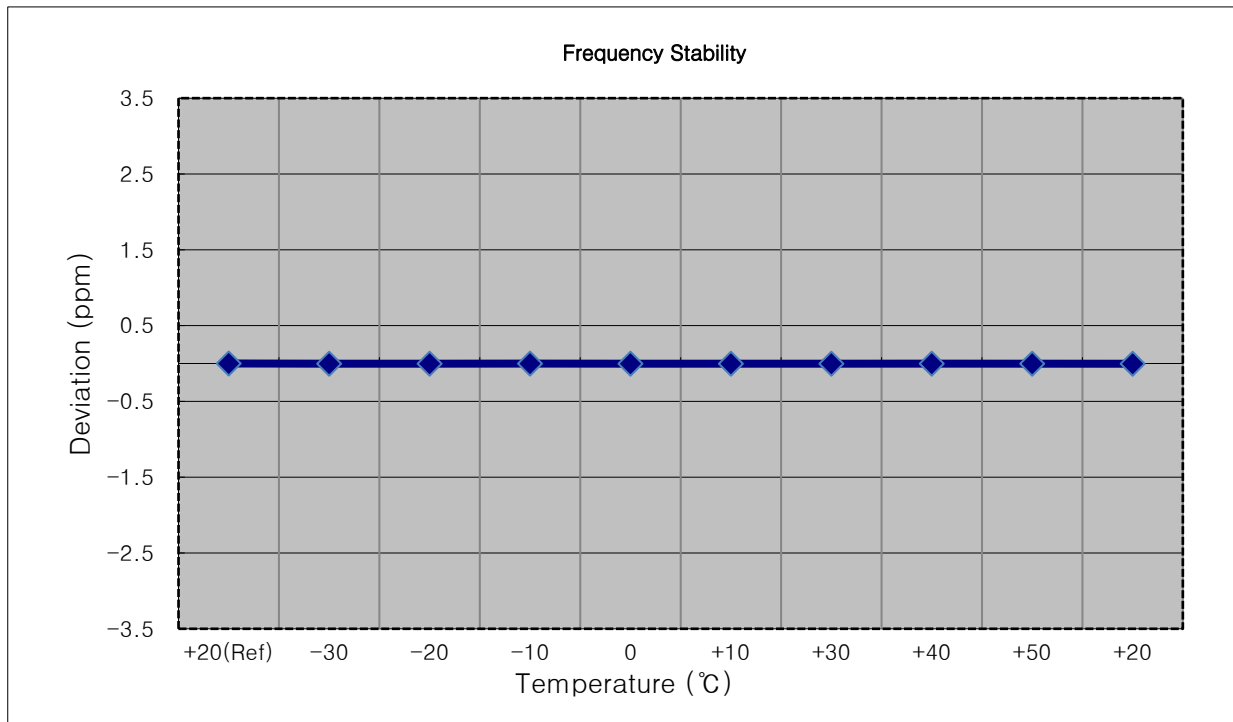
Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2307 500 005	0.00	0.000 000	0.0000
100 %		-30	2307 500 008	3.00	0.000 000	0.0013
100 %		-20	2307 500 008	3.60	0.000 000	0.0016
100 %		-10	2307 500 009	4.20	0.000 000	0.0018
100 %		0	2307 499 999	-5.30	0.000 000	-0.0023
100 %		+10	2307 500 009	4.20	0.000 000	0.0018
100 %		+30	2307 500 009	4.50	0.000 000	0.0020
100 %		+40	2307 500 011	6.50	0.000 000	0.0028
100 %		+50	2307 500 011	6.70	0.000 000	0.0029
Batt. Endpoint		3.300	+20	2307 500 010	5.20	0.000 000





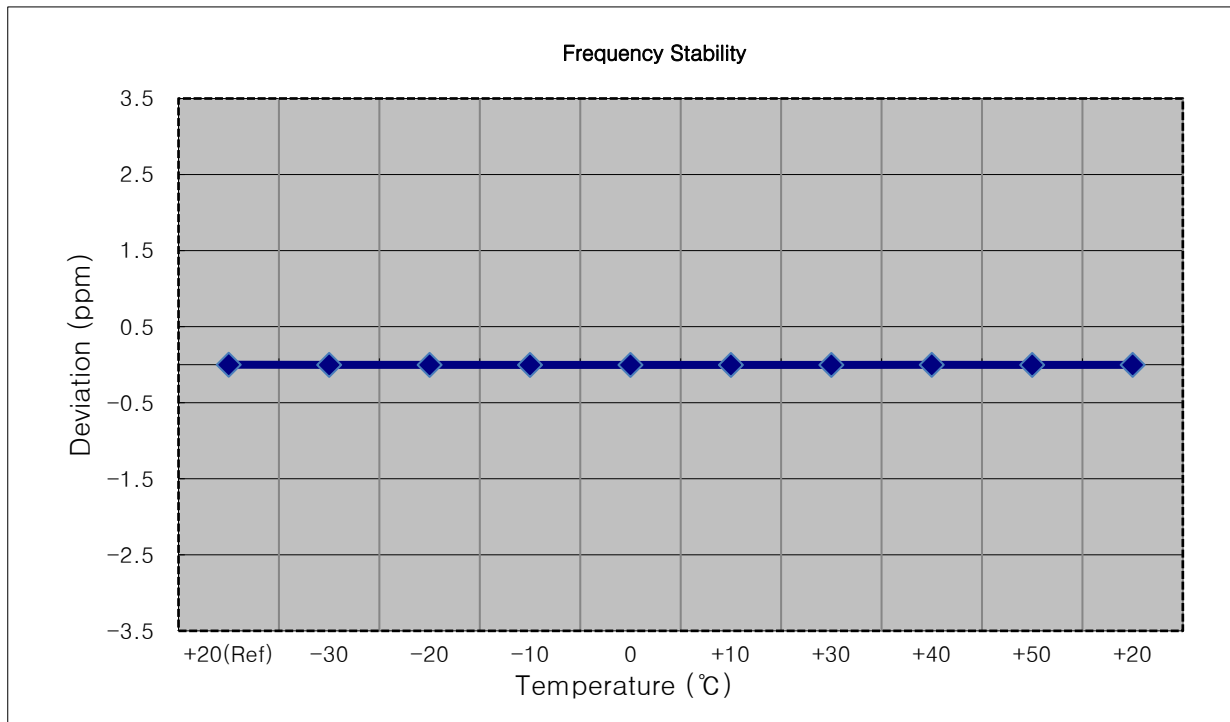
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2310,000,000 Hz
- ▣ BANDWIDTH: 27710 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2309 999 996	0.00	0.000 000	0.0000
100 %		-30	2309 999 991	-5.40	0.000 000	-0.0023
100 %		-20	2309 999 991	-5.30	0.000 000	-0.0023
100 %		-10	2309 999 993	-3.30	0.000 000	-0.0014
100 %		0	2309 999 991	-5.60	0.000 000	-0.0024
100 %		+10	2309 999 991	-5.60	0.000 000	-0.0024
100 %		+30	2309 999 991	-5.60	0.000 000	-0.0024
100 %		+40	2309 999 993	-3.80	0.000 000	-0.0016
100 %		+50	2309 999 990	-6.70	0.000 000	-0.0029
Batt. Endpoint		3.300	+20	2309 999 990	-6.80	0.000 000



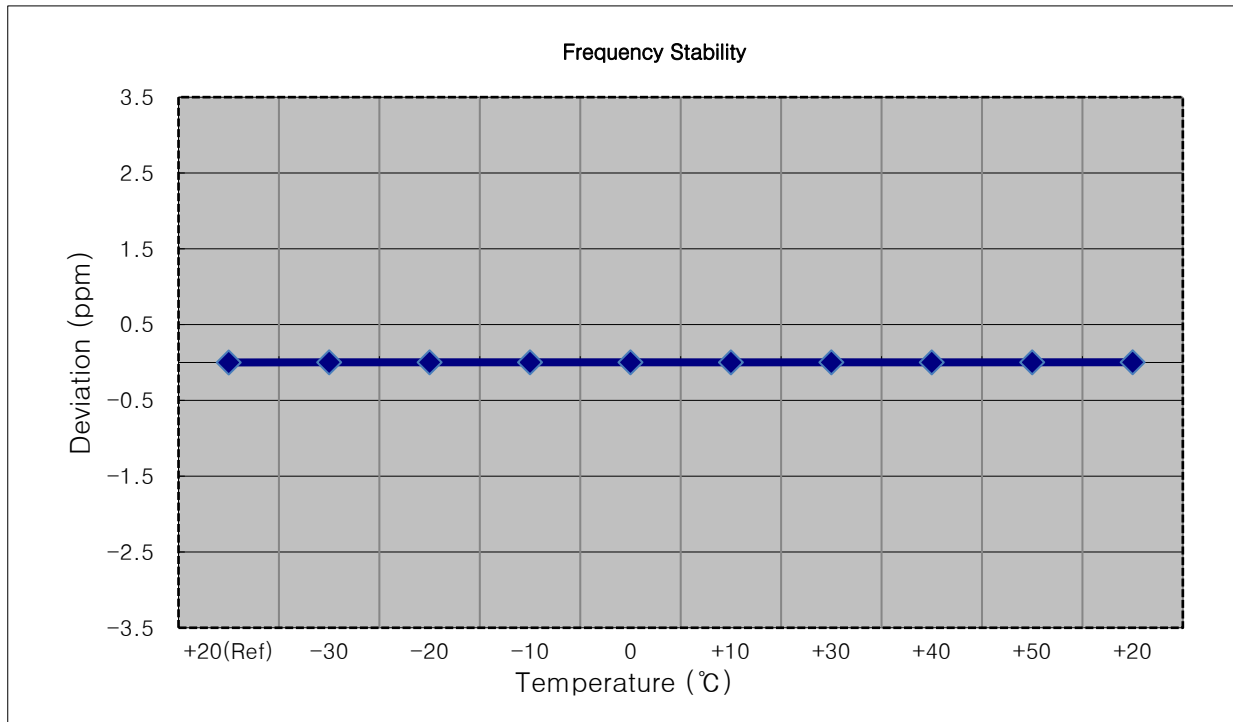
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2312,500,000 Hz
- ▣ BANDWIDTH: 27735 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2312 499 995	0.00	0.000 000	0.0000
100 %		-30	2312 499 990	-4.90	0.000 000	-0.0021
100 %		-20	2312 499 989	-6.10	0.000 000	-0.0026
100 %		-10	2312 499 988	-7.10	0.000 000	-0.0031
100 %		0	2312 499 988	-7.60	0.000 000	-0.0033
100 %		+10	2312 499 988	-7.70	0.000 000	-0.0033
100 %		+30	2312 499 988	-6.90	0.000 000	-0.0030
100 %		+40	2312 499 991	-3.90	0.000 000	-0.0017
100 %		+50	2312 499 988	-7.50	0.000 000	-0.0032
Batt. Endpoint		3.300	+20	2312 499 989	-6.00	0.000 000



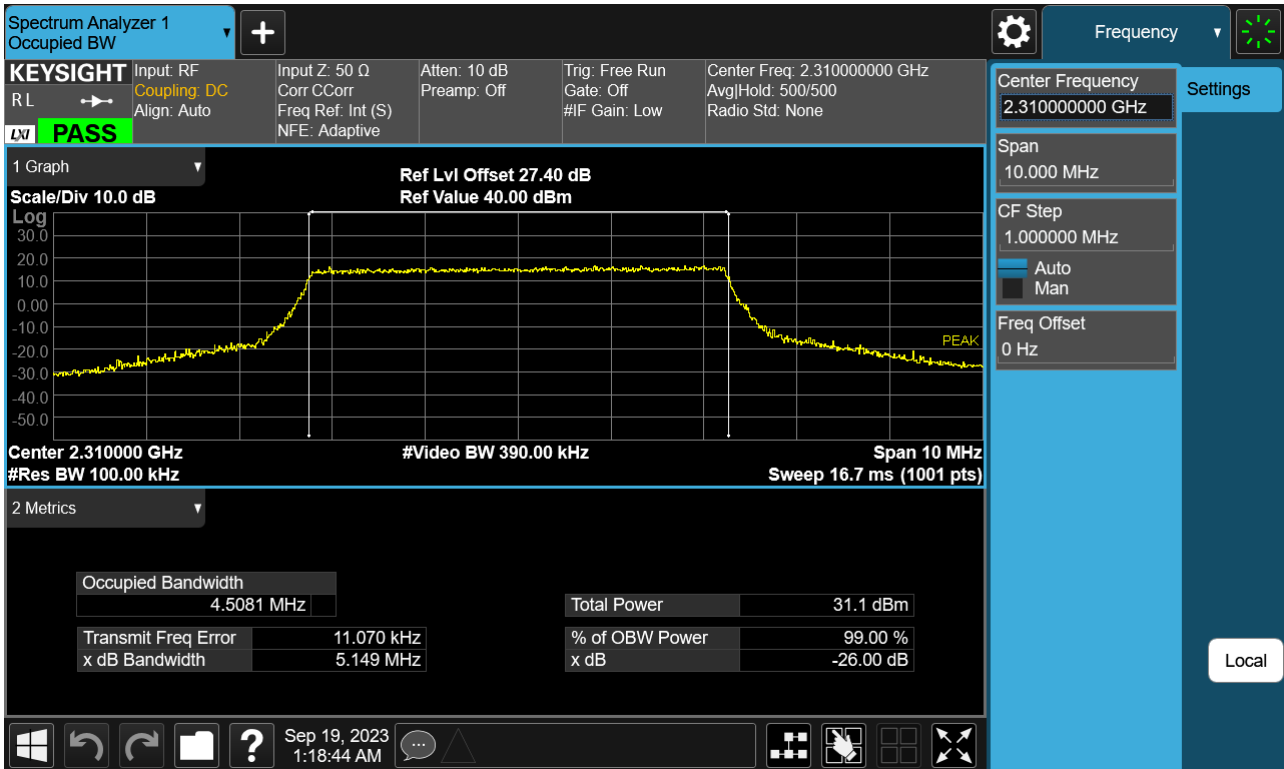
- ▣ MODE: LTE 30
- ▣ OPERATING FREQUENCY: 2310,000,000 Hz
- ▣ BANDWIDTH: 27710 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.880 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100 %	3.880	+20(Ref)	2310 000 005	0.00	0.000 000	0.0000
100 %		-30	2310 000 010	5.10	0.000 000	0.0022
100 %		-20	2310 000 011	5.80	0.000 000	0.0025
100 %		-10	2310 000 011	5.60	0.000 000	0.0024
100 %		0	2310 000 011	5.60	0.000 000	0.0024
100 %		+10	2310 000 009	3.90	0.000 000	0.0017
100 %		+30	2310 000 010	4.70	0.000 000	0.0020
100 %		+40	2310 000 009	3.60	0.000 000	0.0016
100 %		+50	2310 000 011	5.60	0.000 000	0.0024
Batt. Endpoint	3.300	+20	2310 000 012	7.10	0.000 000	0.0031

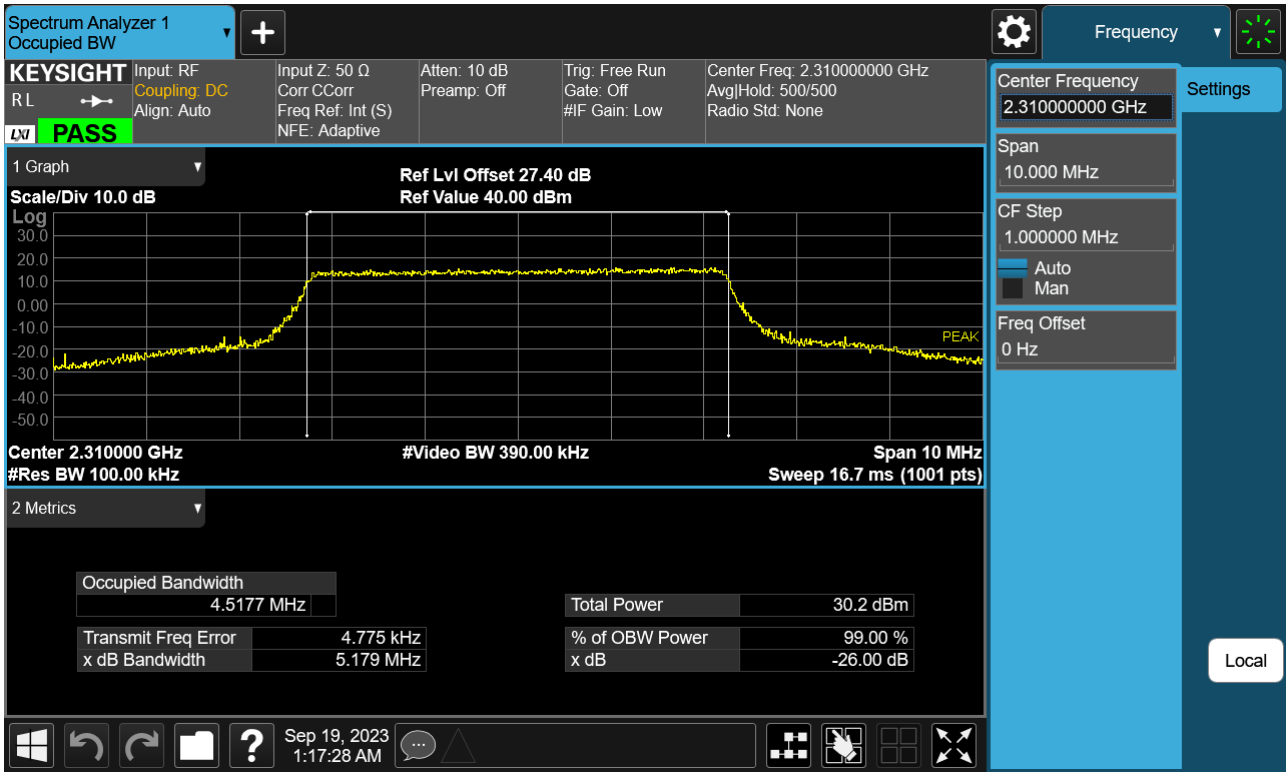


## 10. TEST PLOTS (Main 1 Ant)

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



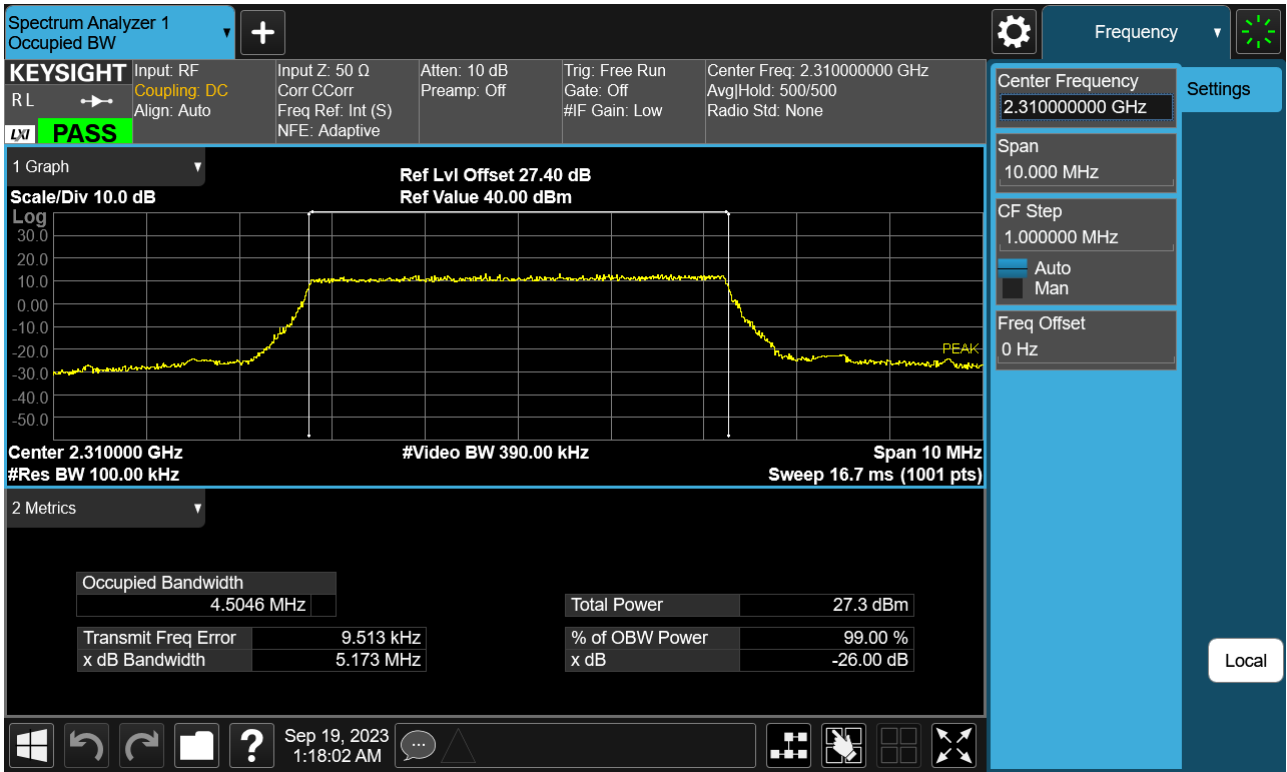
BAND 30. Occupied Bandwidth Plot (5 MHz Ch.27710 16-QAM RB 25)



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

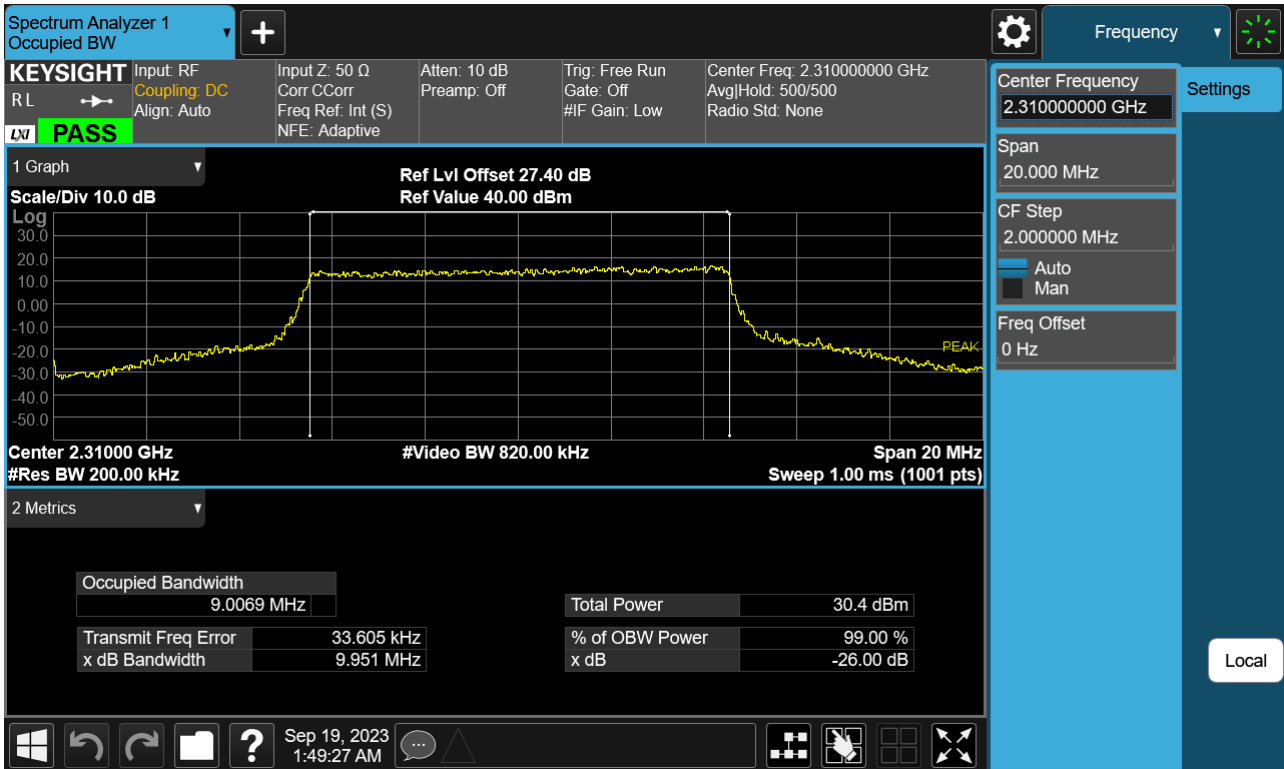


BAND 30. Occupied Bandwidth Plot (5 MHz Ch.27710 256-QAM RB 25)

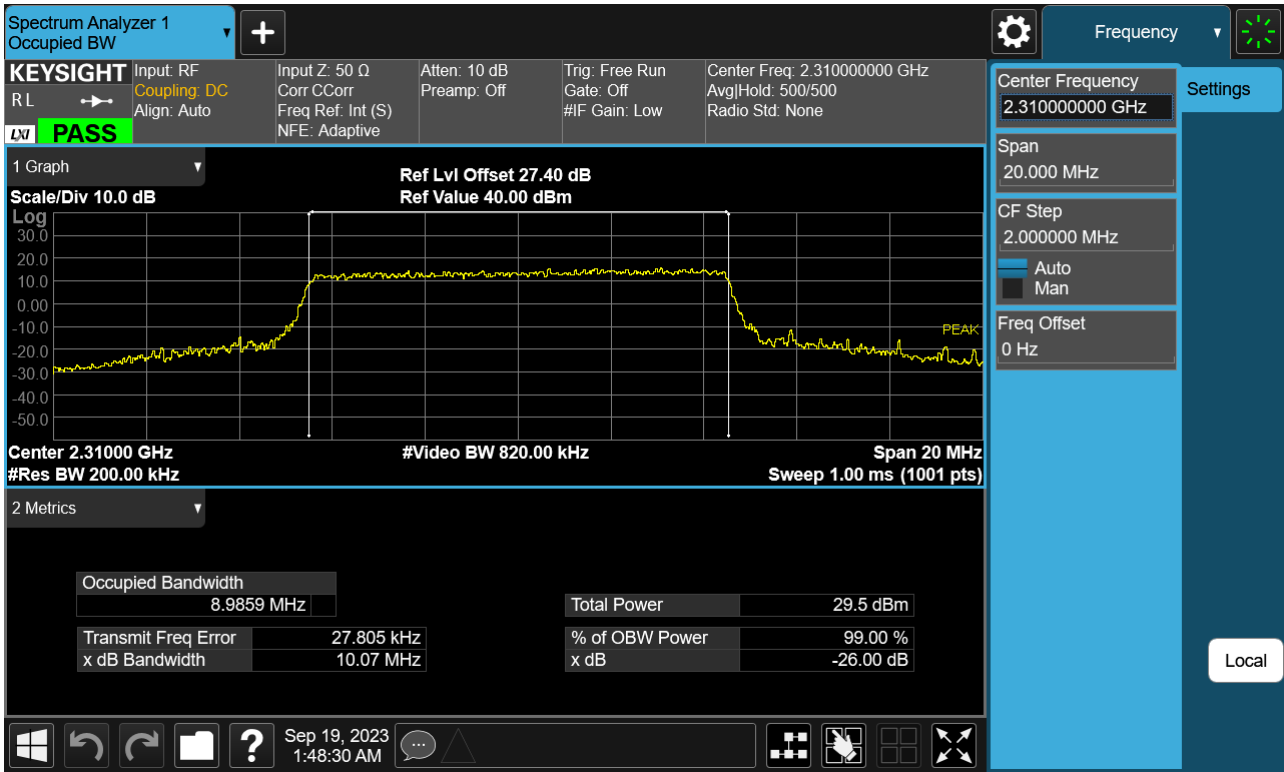




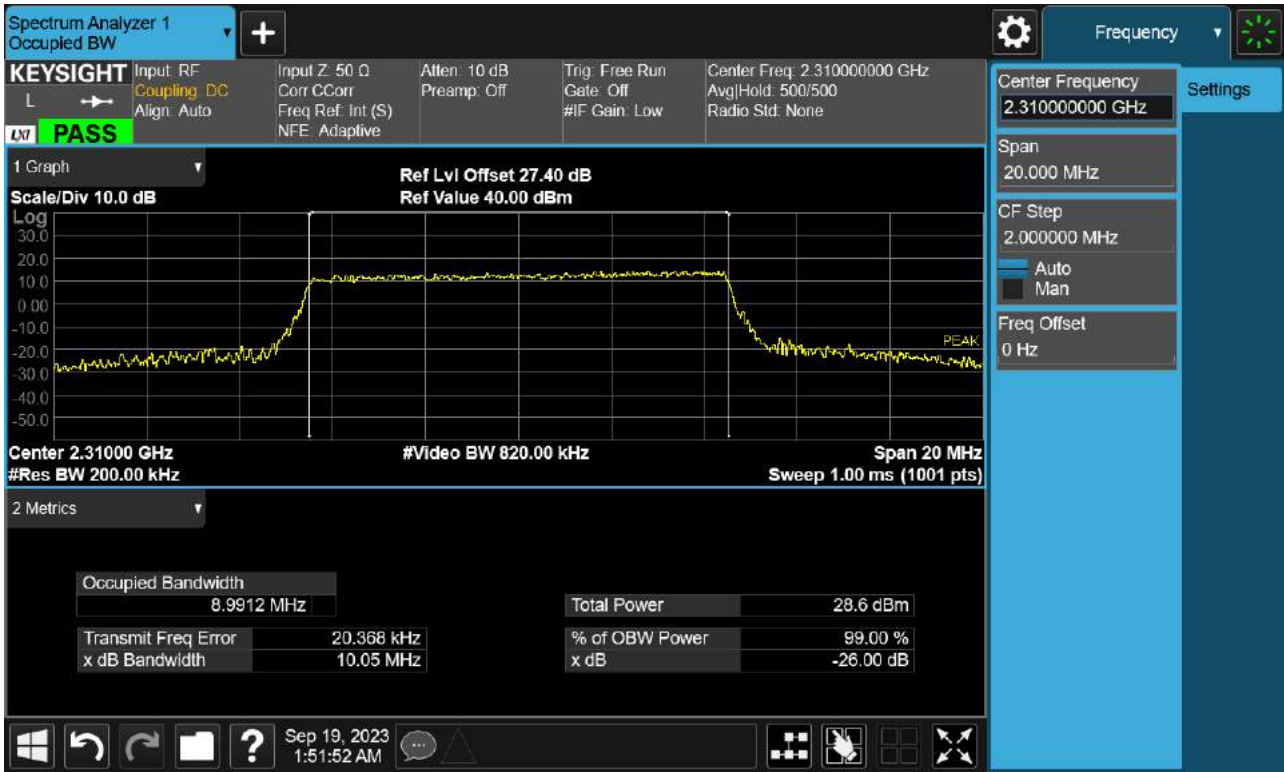
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 QPSK RB 50)



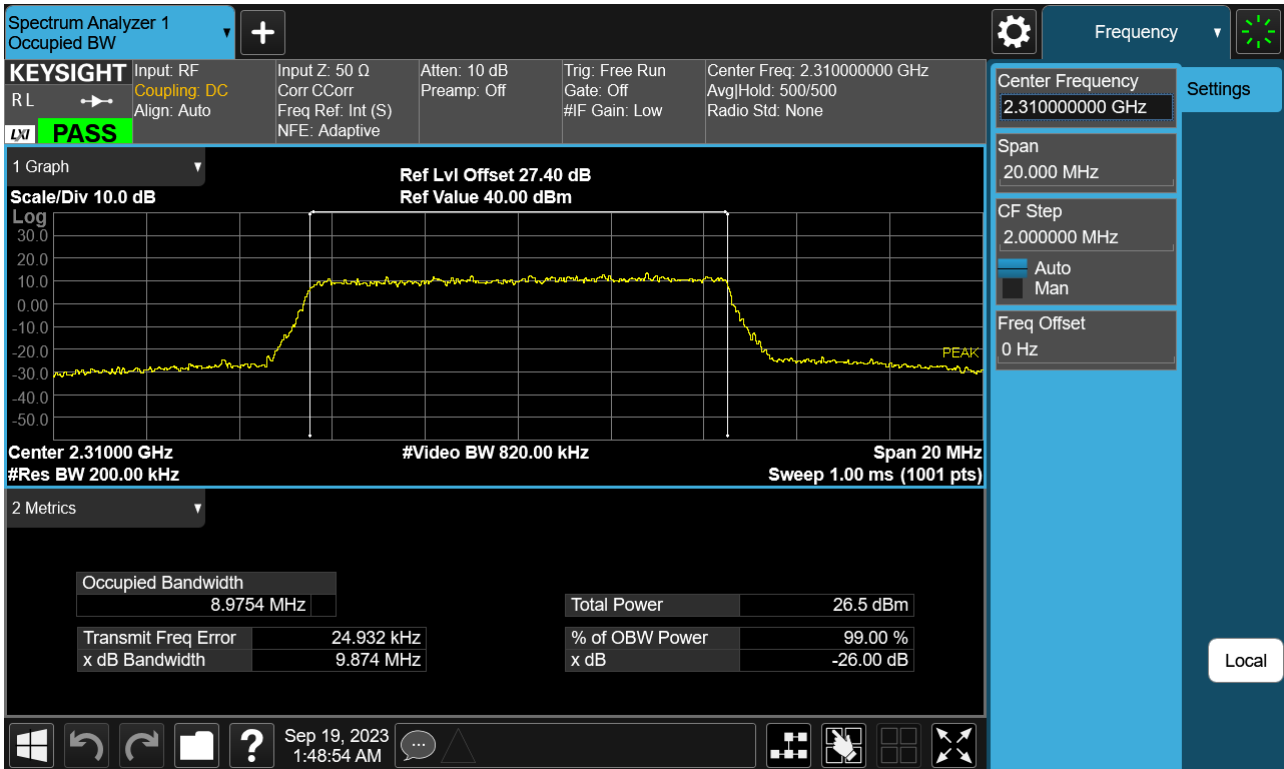
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 16-QAM RB 50)



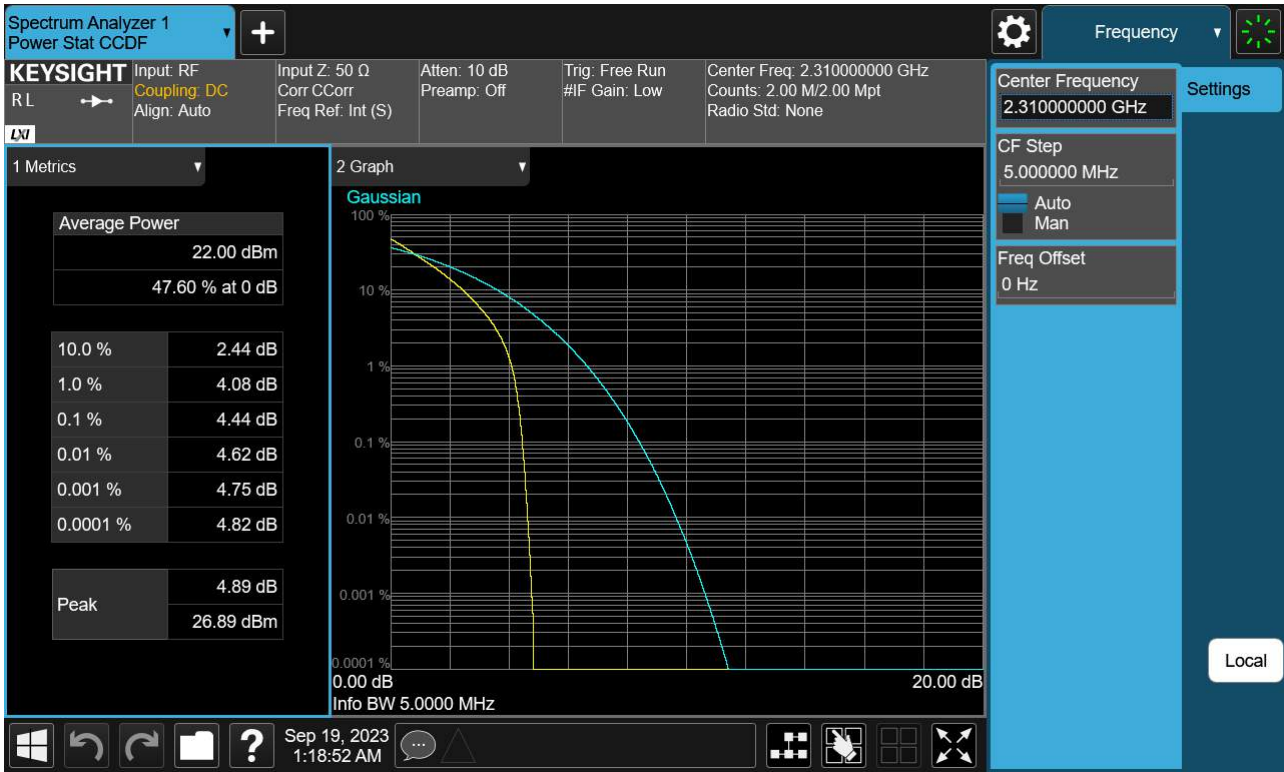
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 64-QAM RB 50)



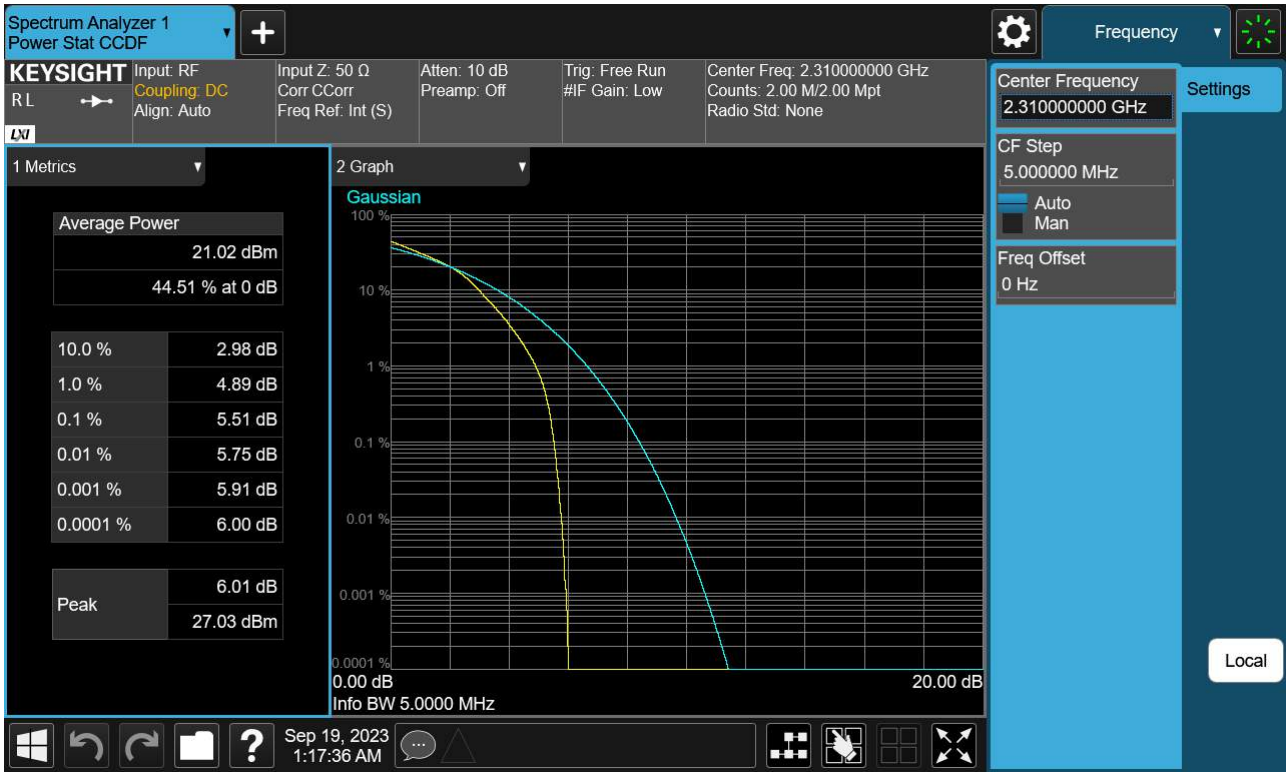
BAND 30. Occupied Bandwidth Plot (10 MHz Ch.27710 256-QAM RB 50)



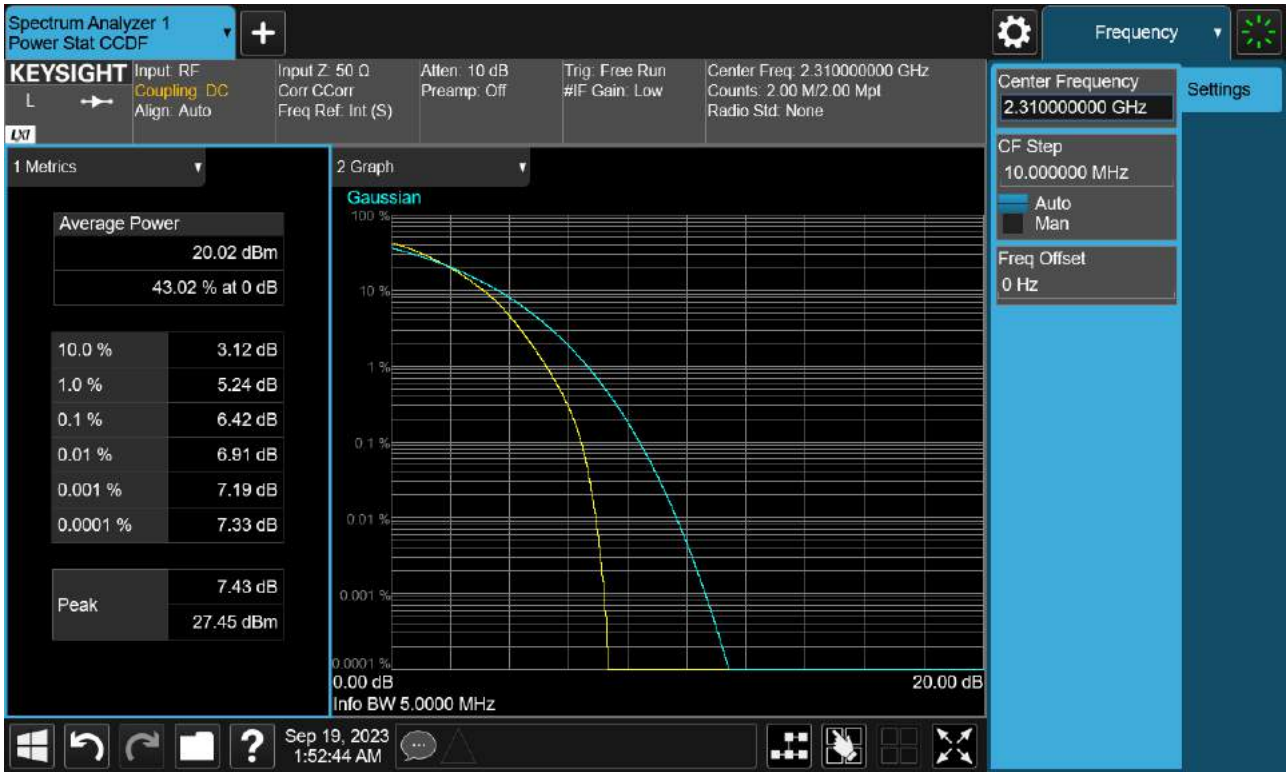
BAND 30. PAR Plot (5 M BW\_Ch.27710\_QPSK\_RB25\_0)



BAND 30. PAR Plot (5 M BW\_Ch.27710\_16QAM\_RB25\_0)



BAND 30. PAR Plot (5 M BW\_Ch.27710\_64QAM\_RB25\_0)



BAND 30. PAR Plot (5 M BW\_Ch.27710\_256QAM\_RB25\_0)





BAND 30. PAR Plot (10 M BW\_Ch.27710\_QPSK\_RB50\_0)



BAND 30. PAR Plot (10 M BW\_Ch.27710\_16QAM\_RB50\_0)



BAND 30. PAR Plot (10 M BW\_Ch.27710\_64QAM\_RB50\_0)



BAND 30. PAR Plot (10 M BW\_Ch.27710\_256QAM\_RB50\_0)



BAND 30. 5 M\_BandEdge(2280 MHz-2288 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2280 MHz-2288 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



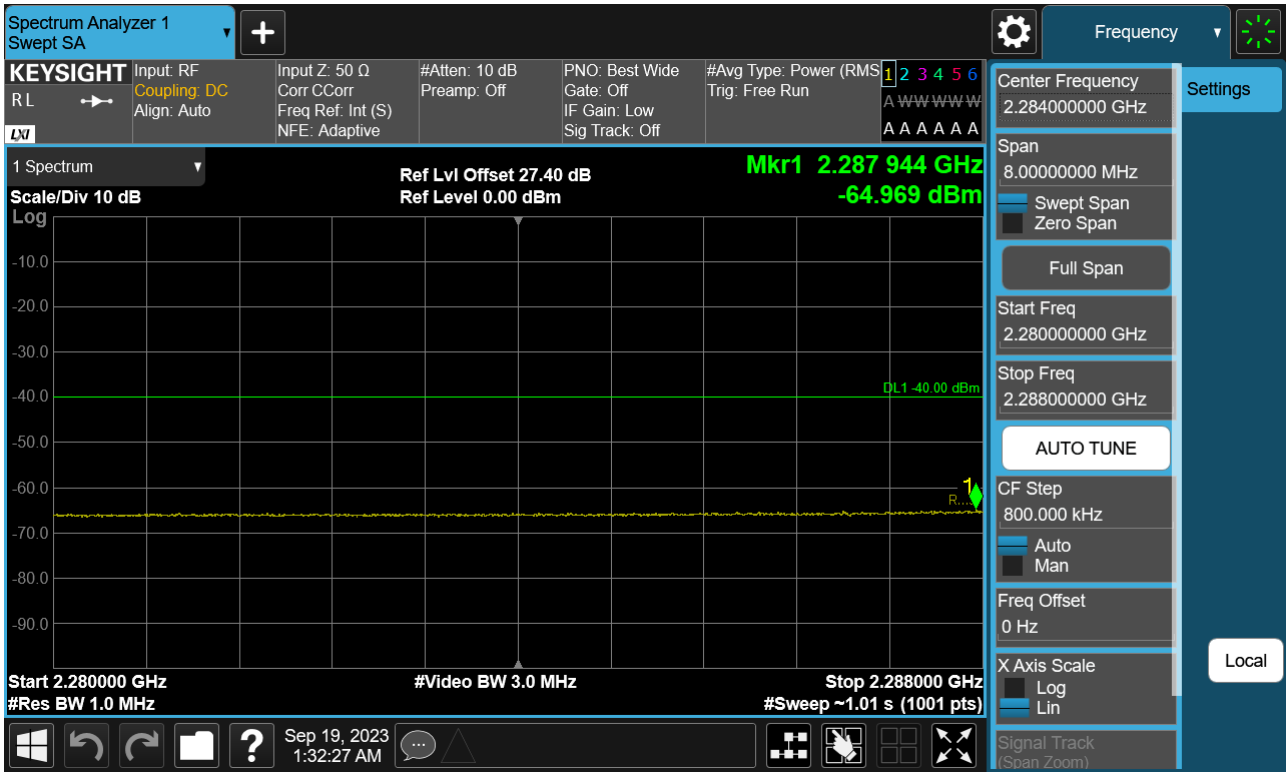
BAND 30. 5 M\_BandEdge(2280 MHz-2288 MHz)\_Mid\_2310 MHz\_QPSK\_1RB







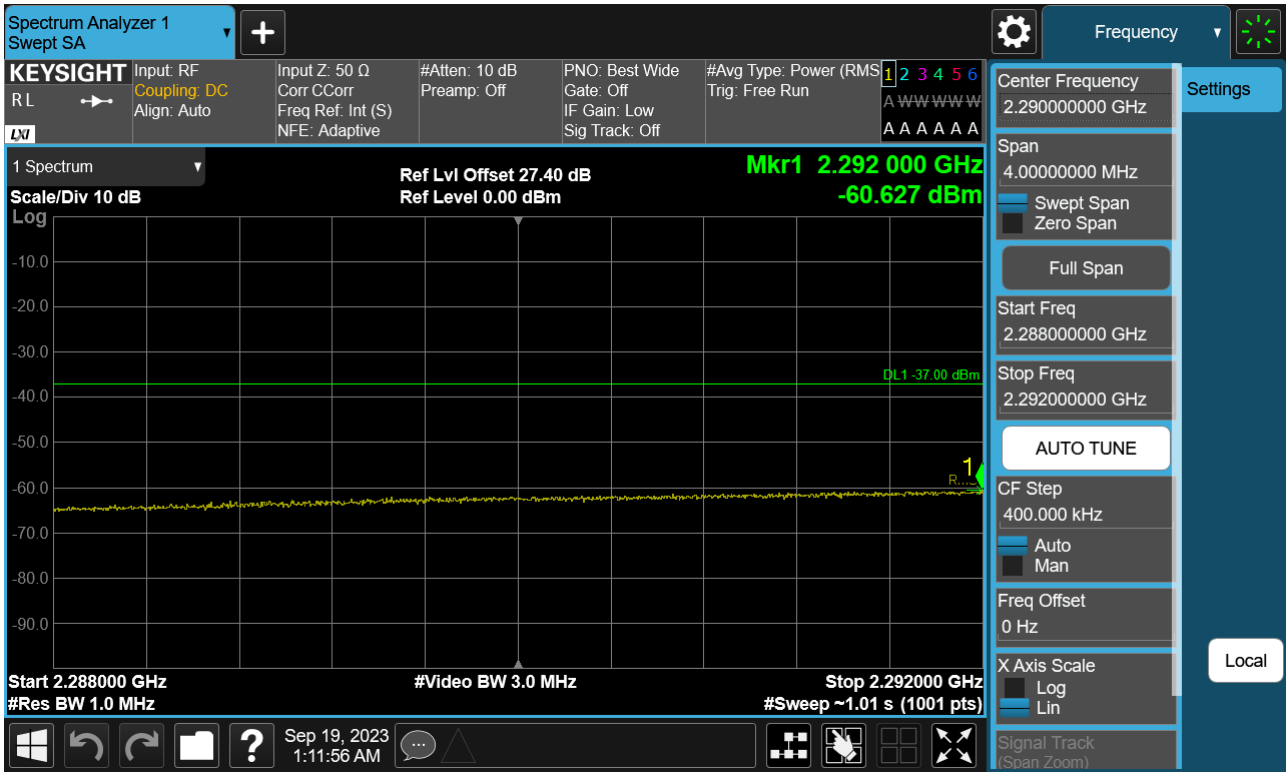
BAND 30. 5 M\_BandEdge(2280 MHz-2288 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



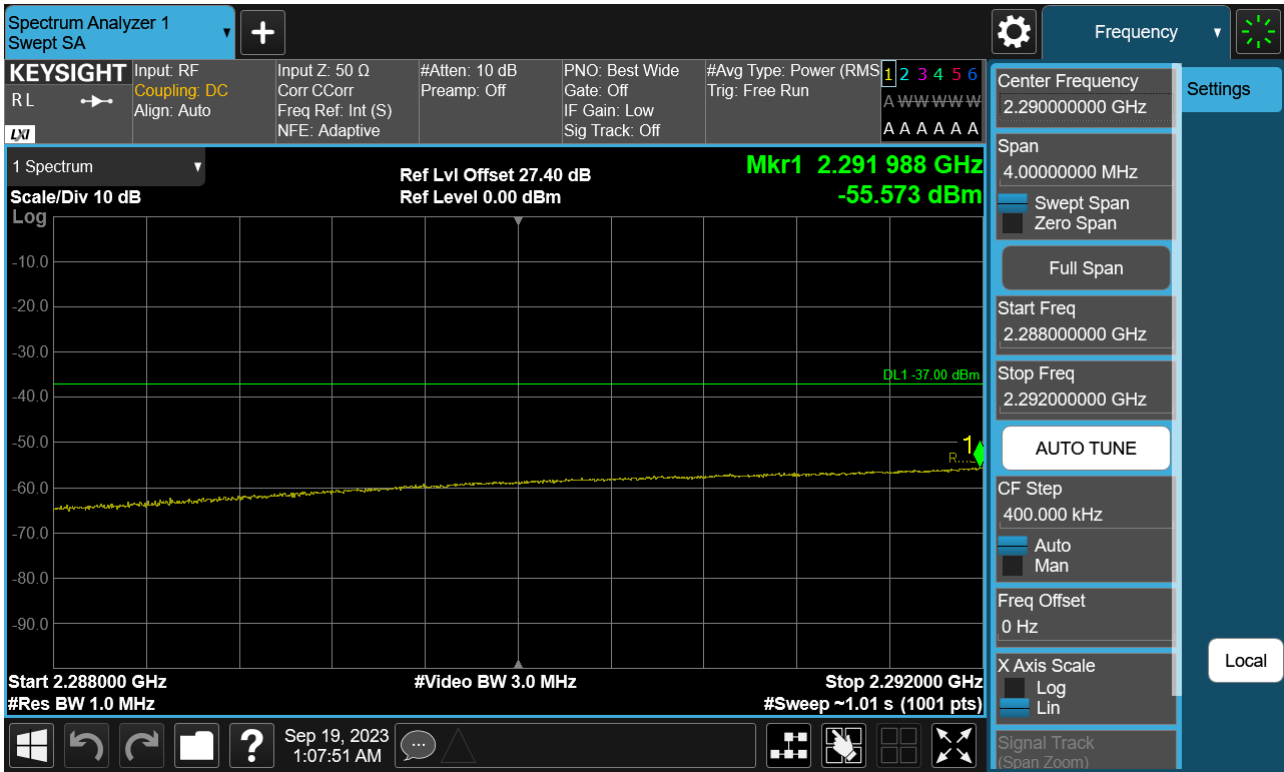
BAND 30. 5 M\_BandEdge(2280 MHz-2288 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



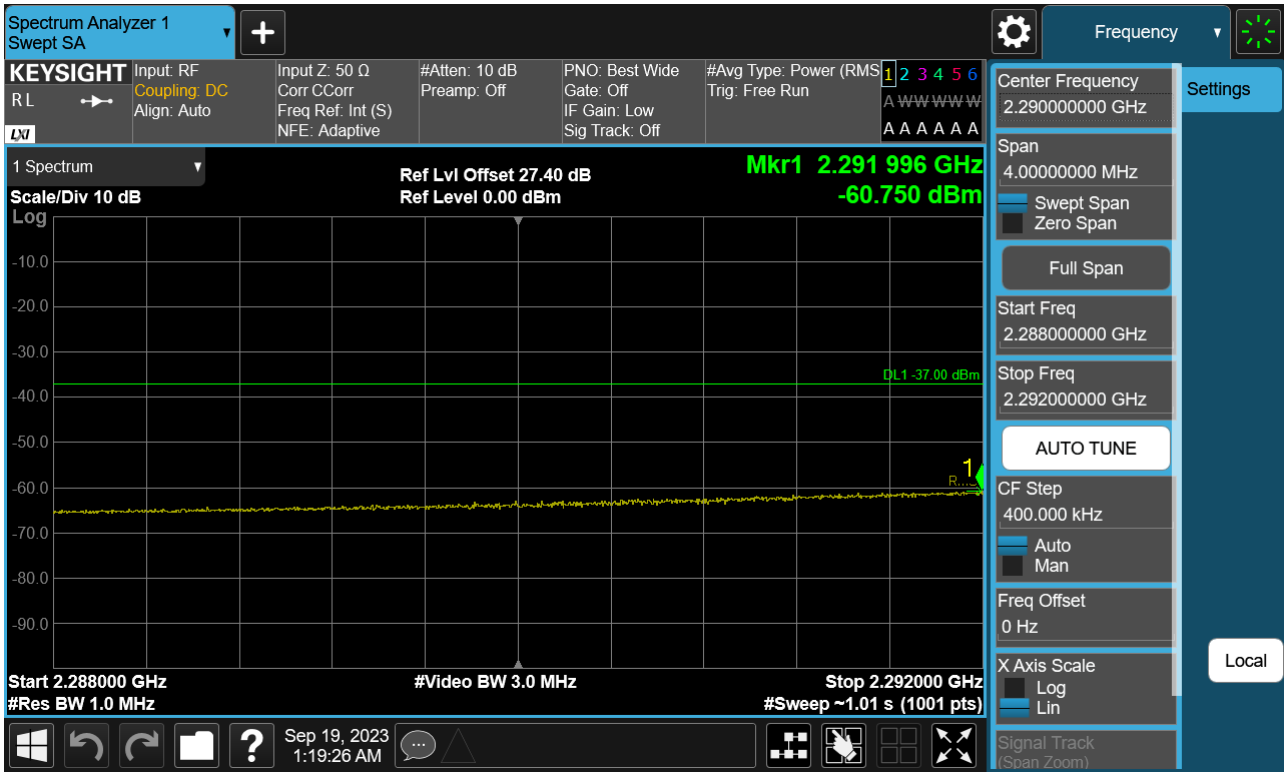
BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_Mid\_2310 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2288 MHz-2292 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB





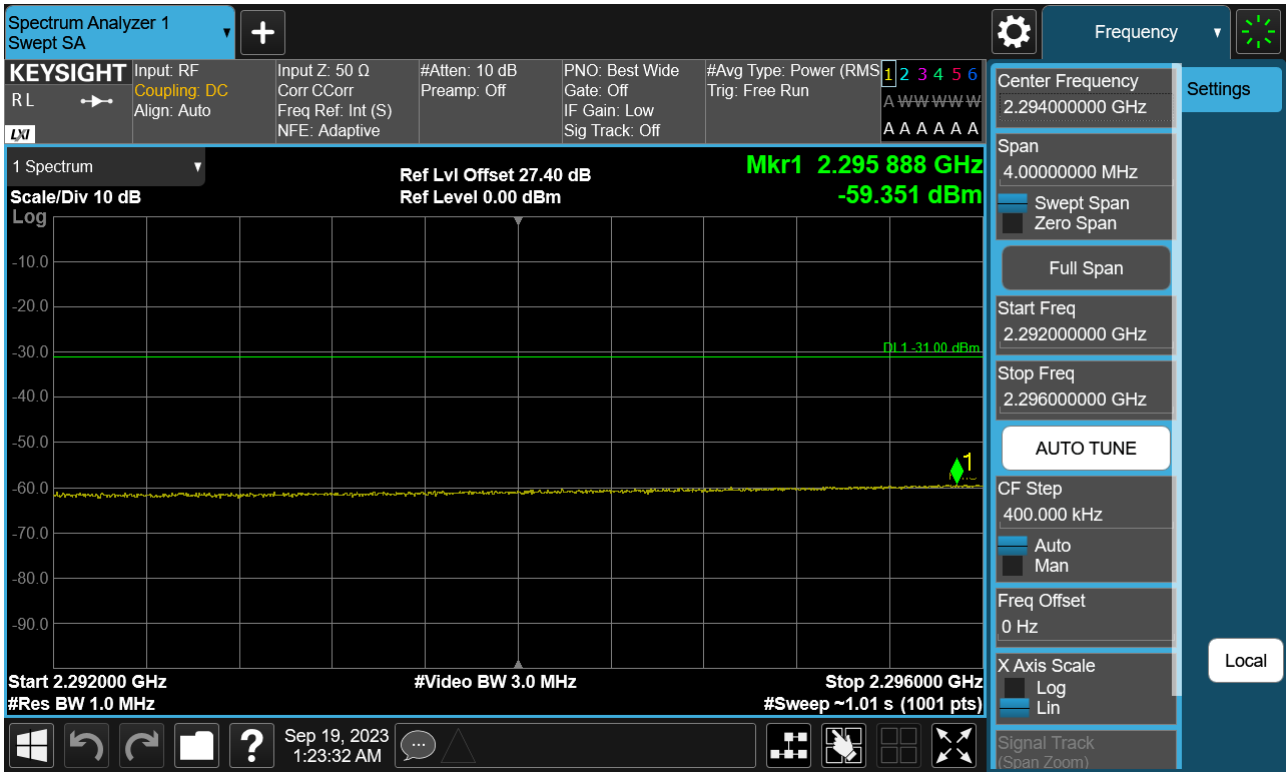
BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



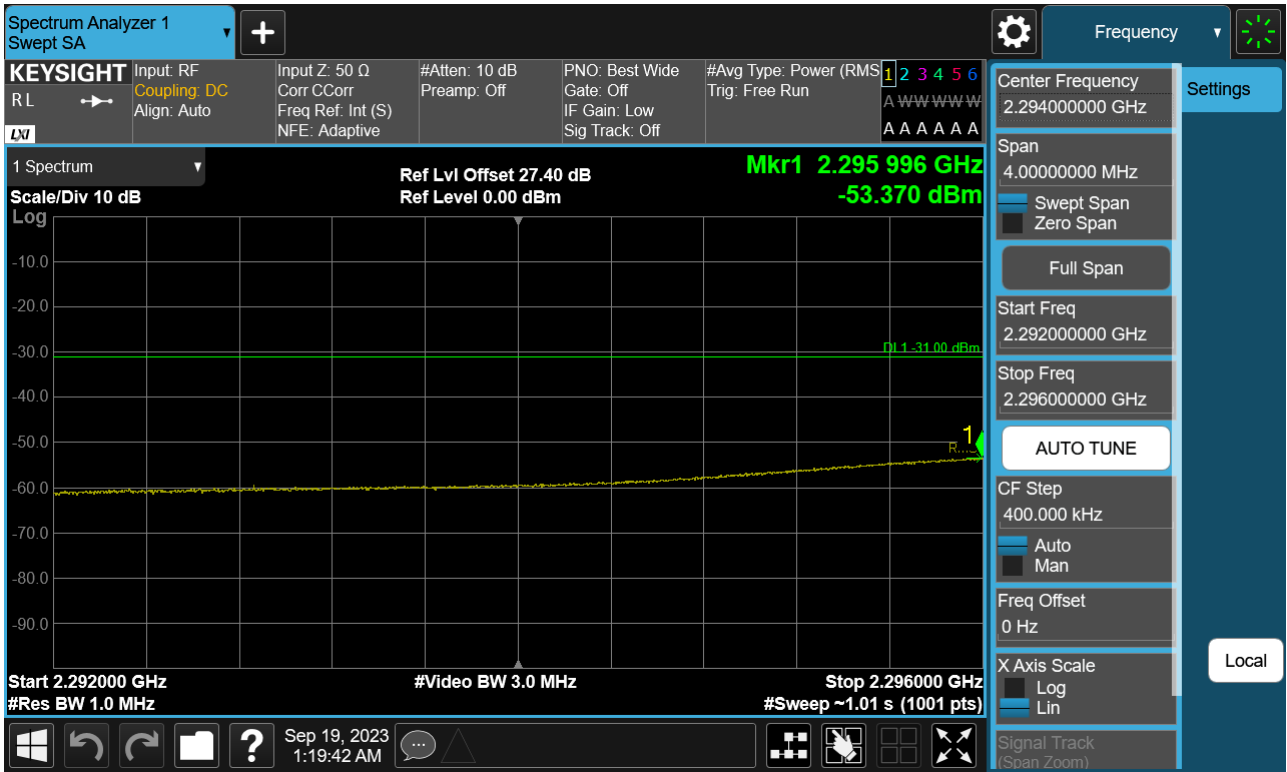
BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



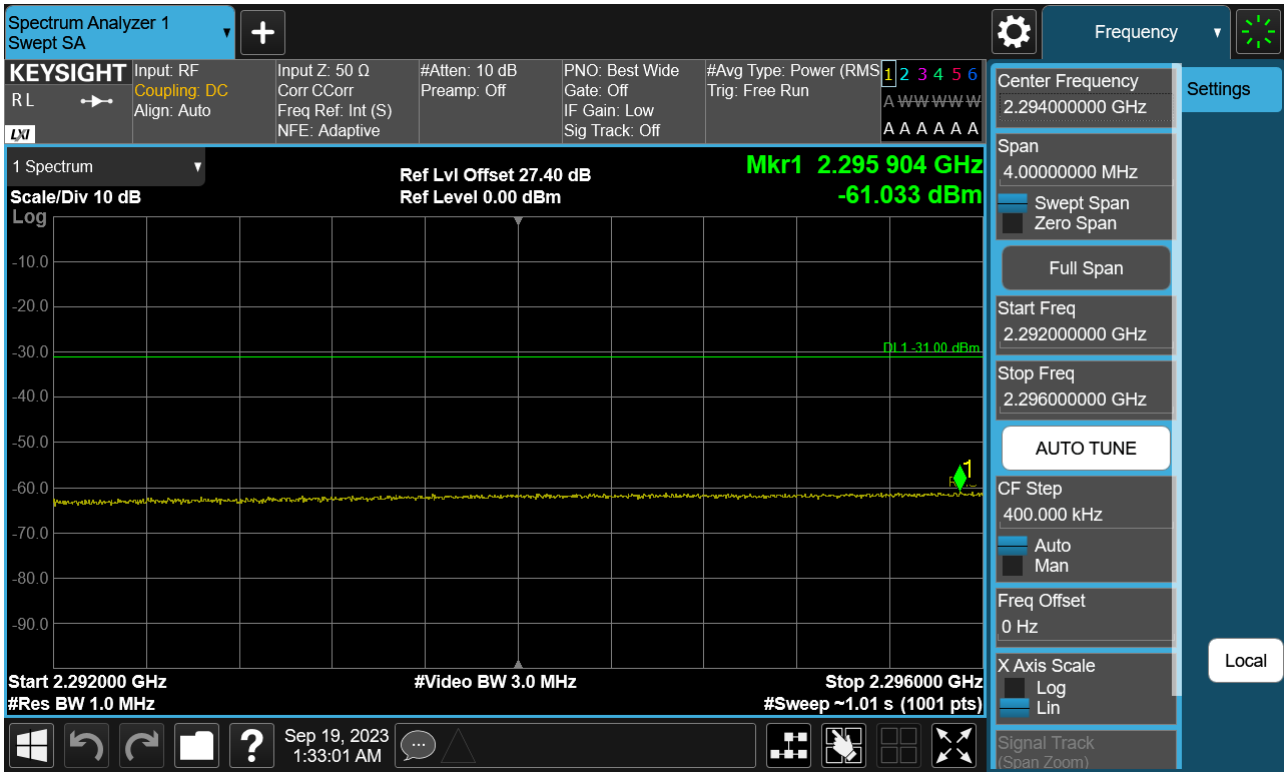
BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_Mid\_2310 MHz\_QPSK\_1RB



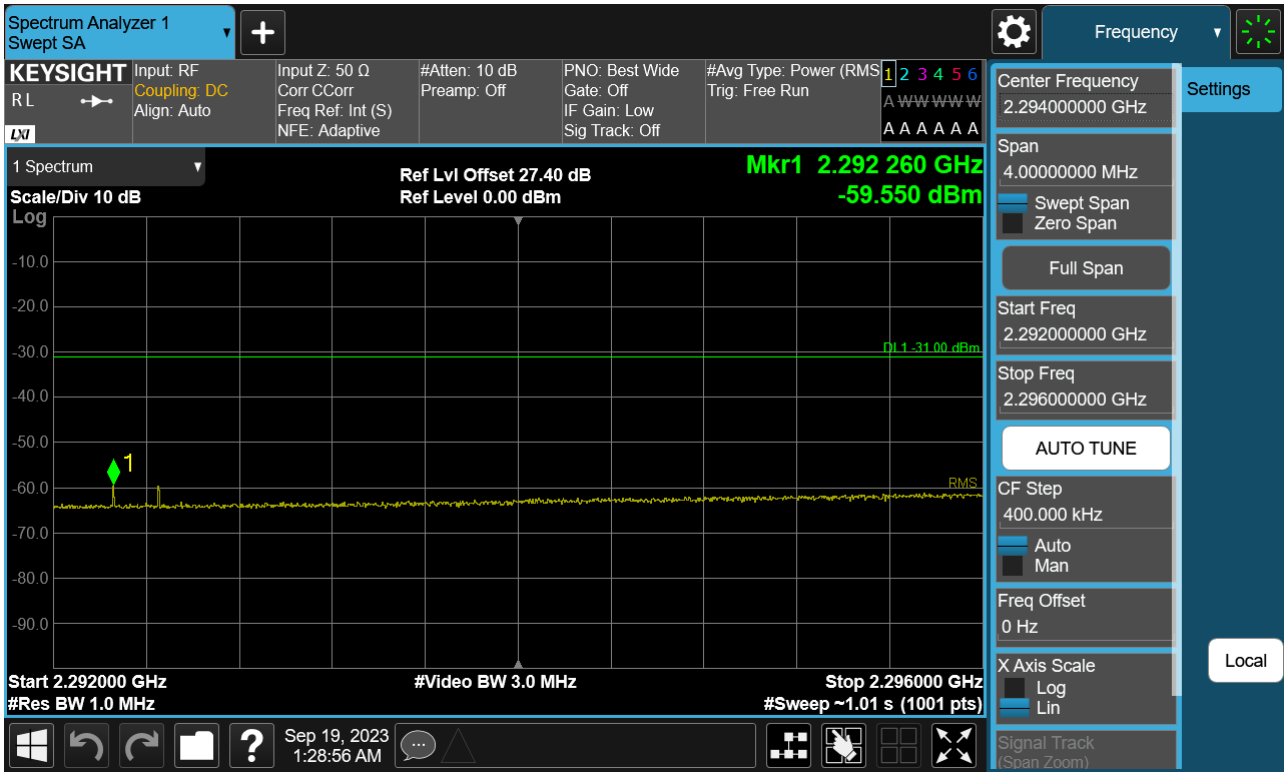
BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



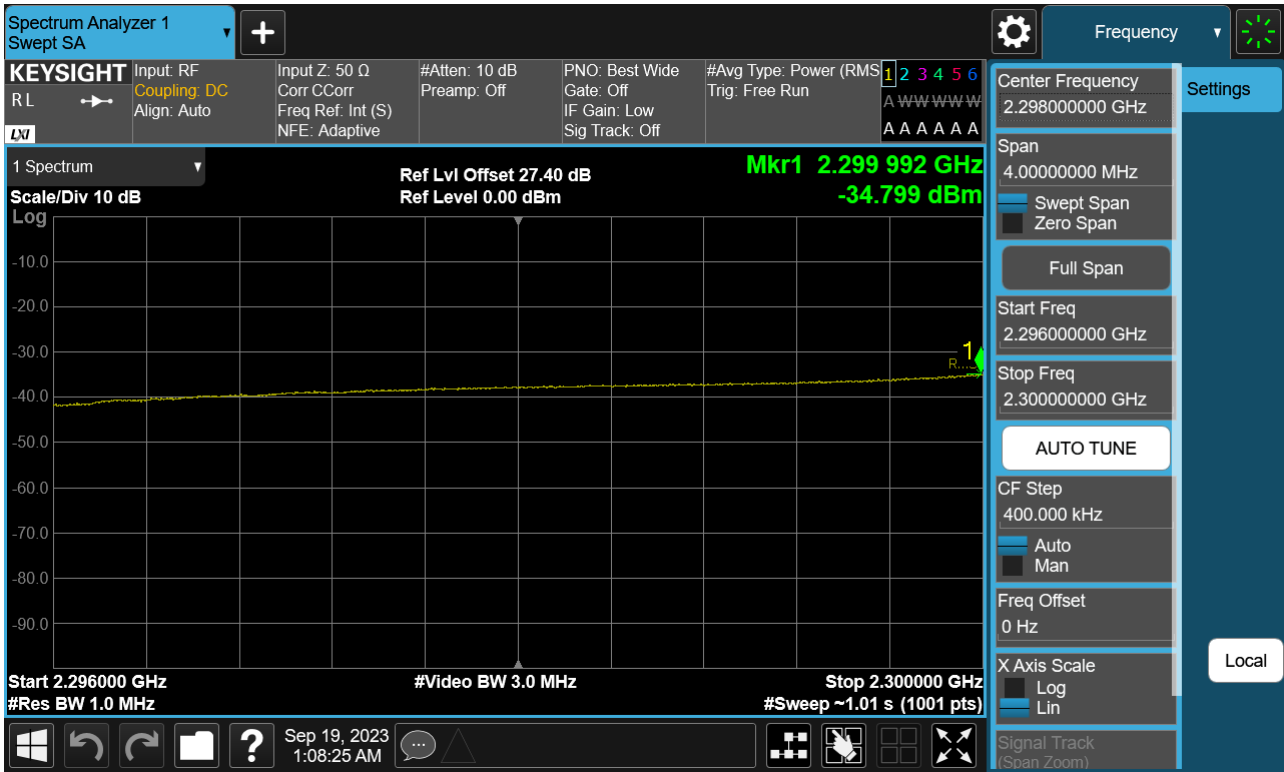
BAND 30. 5 M\_BandEdge(2292 MHz-2296 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB





BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_Mid\_2310 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2296 MHz-2300 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



BAND 30. 5 M\_BandEdge(2300 MHz-2304 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



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

$$\text{Calculation} = \text{Reading Value} + 10 \times \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -40.538 \text{ dBm} + 10 \text{ dB} = -30.538 \text{ dBm}$$

BAND 30. 5 M\_BandEdge(2300 MHz-2304 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



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

$$\text{Calculation} = \text{Reading Value} + 10 \times \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -36.065 \text{ dBm} + 10 \text{ dB} = -26.065 \text{ dBm}$$

BAND 30. 5 M\_BandEdge(2300 MHz-2305 MHz)\_Mid\_2310 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2300 MHz-2305 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB





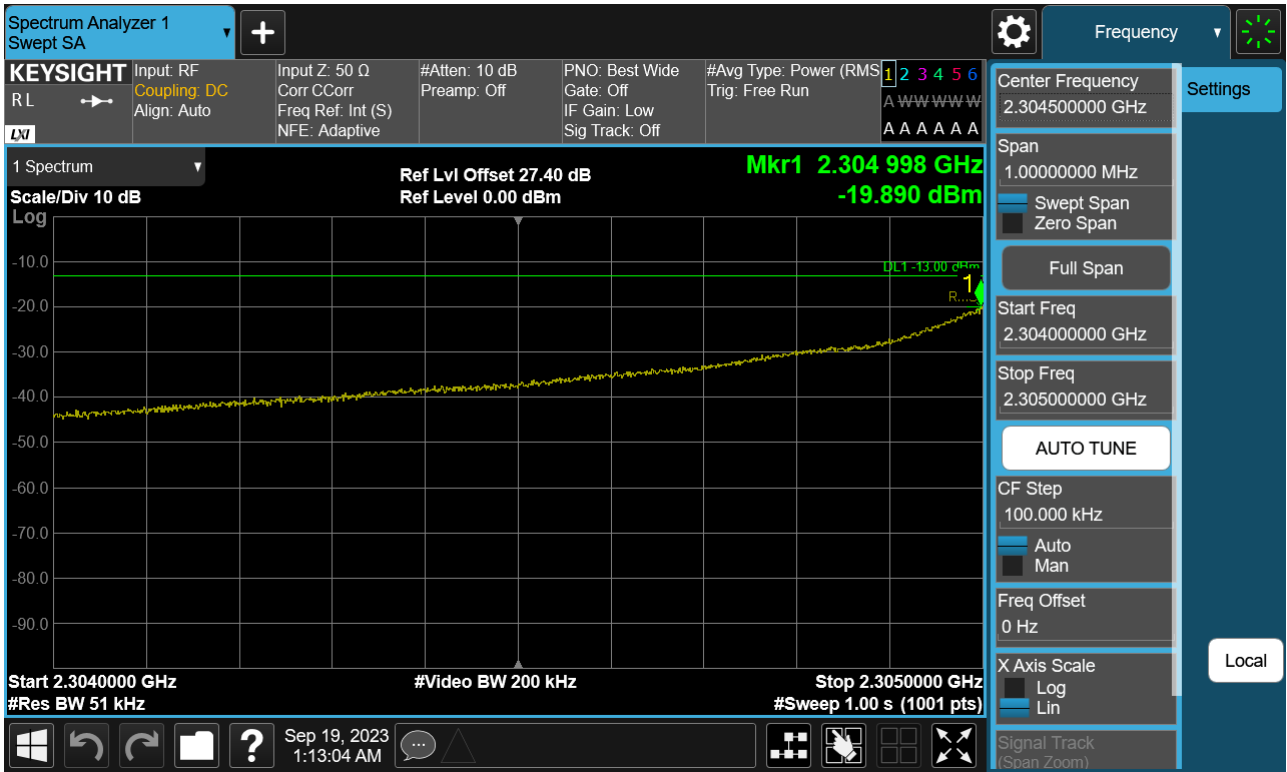
BAND 30. 5 M\_BandEdge(2300 MHz-2305 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



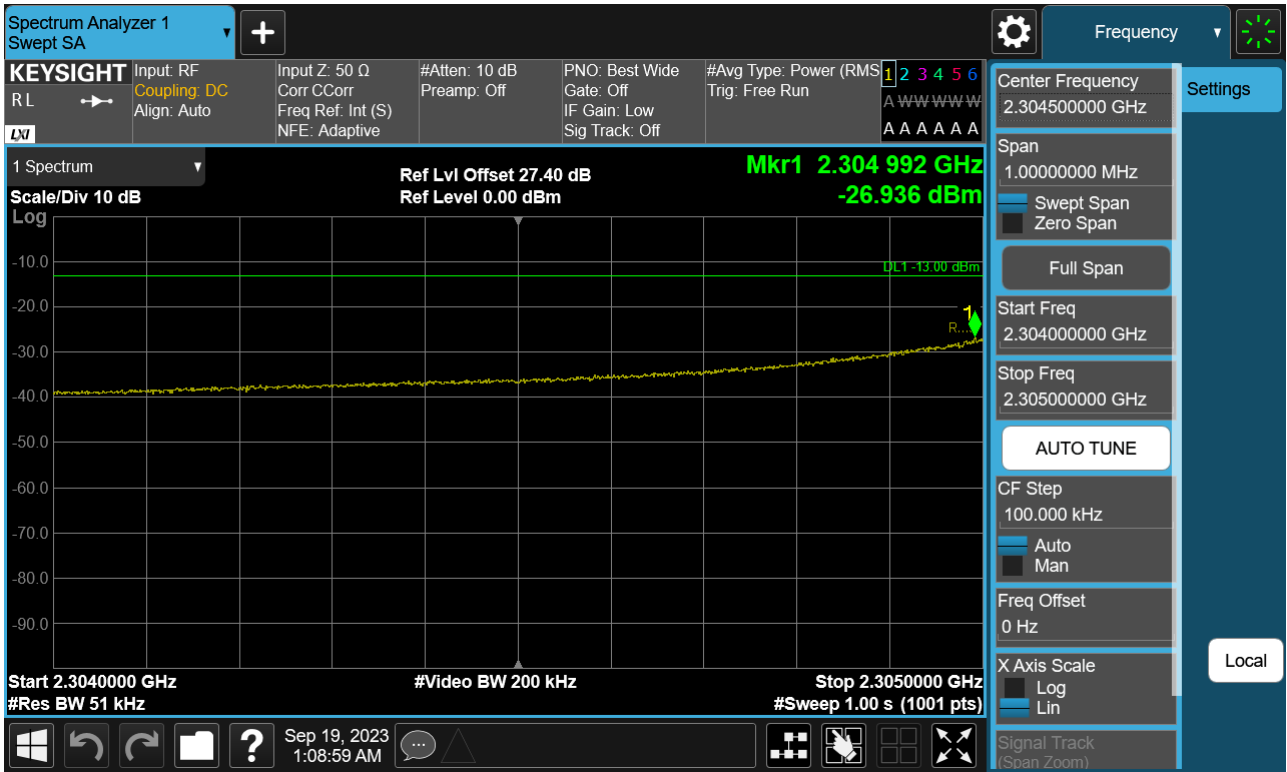
BAND 30. 5 M\_BandEdge(2300 MHz-2305 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



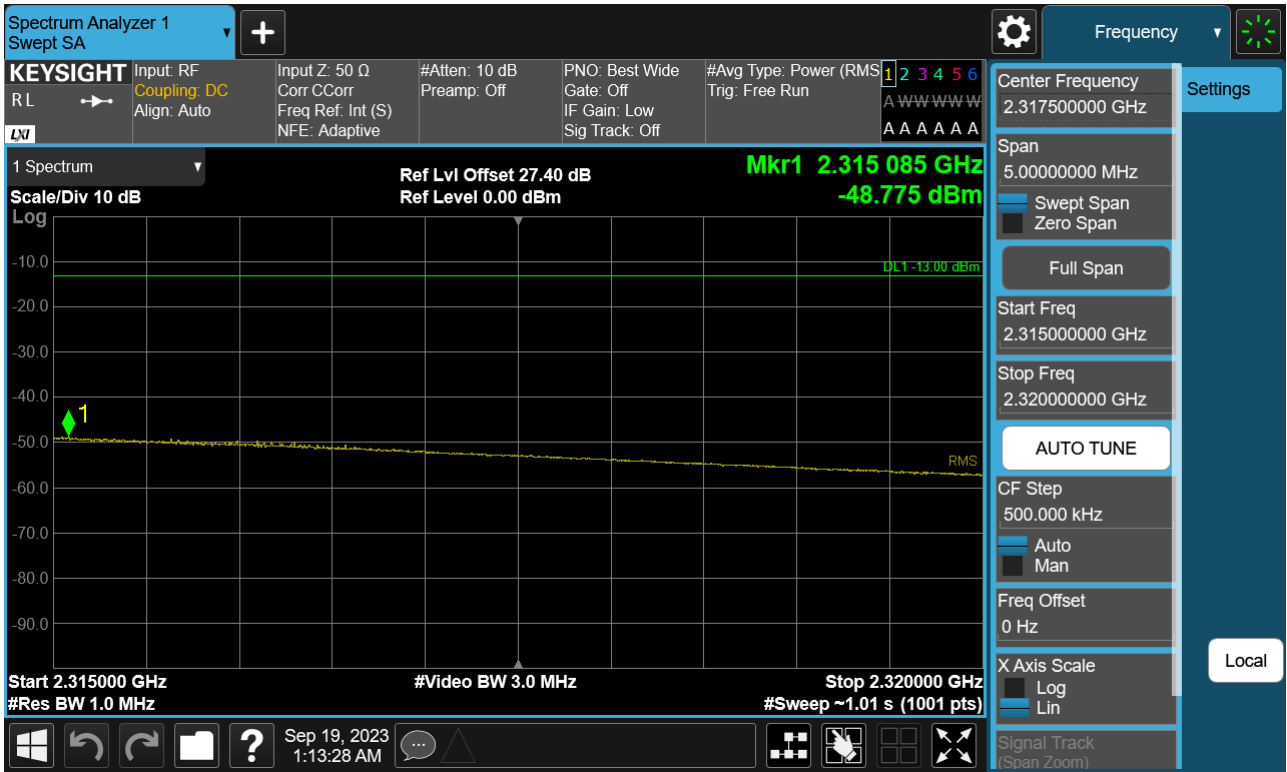
BAND 30. 5 M\_BandEdge(2304 MHz-2305 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



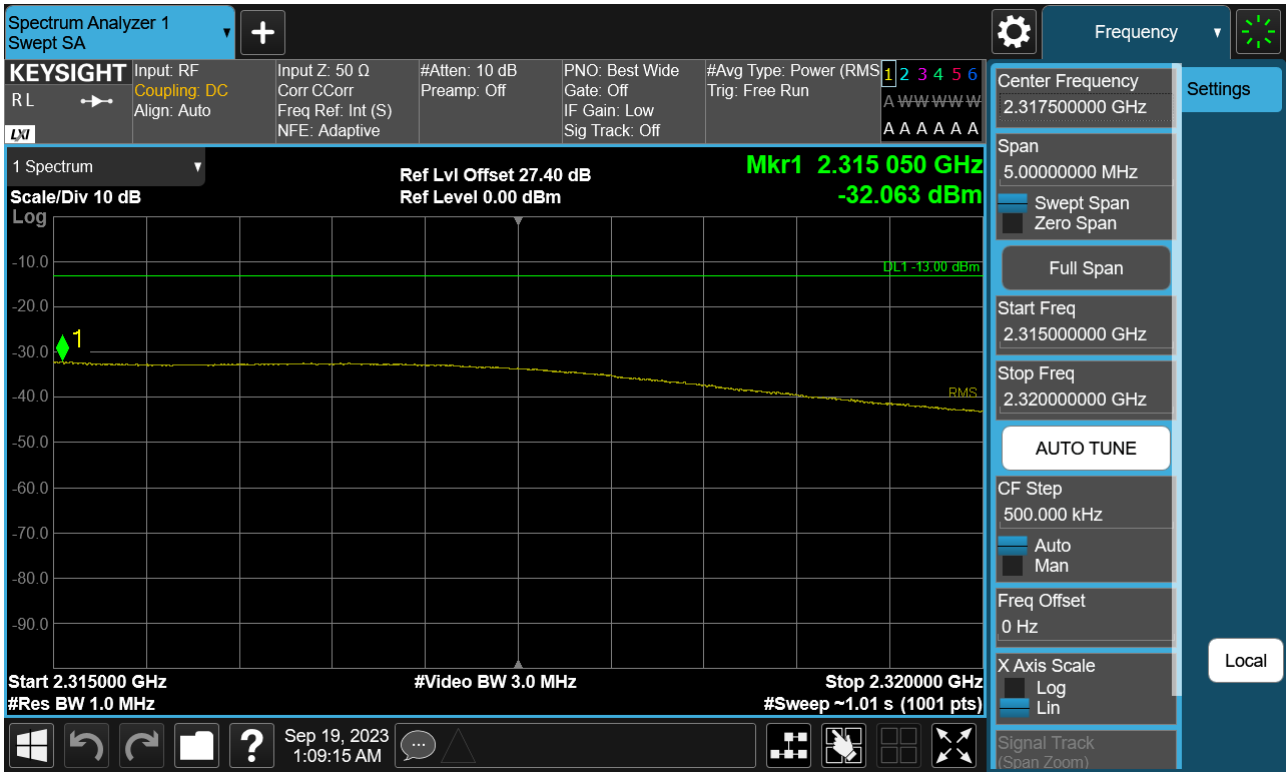
BAND 30. 5 M\_BandEdge(2304 MHz-2305 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



BAND 30. 5 M\_BandEdge(2315 MHz-2320 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2315 MHz-2320 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



BAND 30. 5 M\_BandEdge(2315 MHz-2320 MHz)\_Mid\_2310 MHz\_QPSK\_1RB

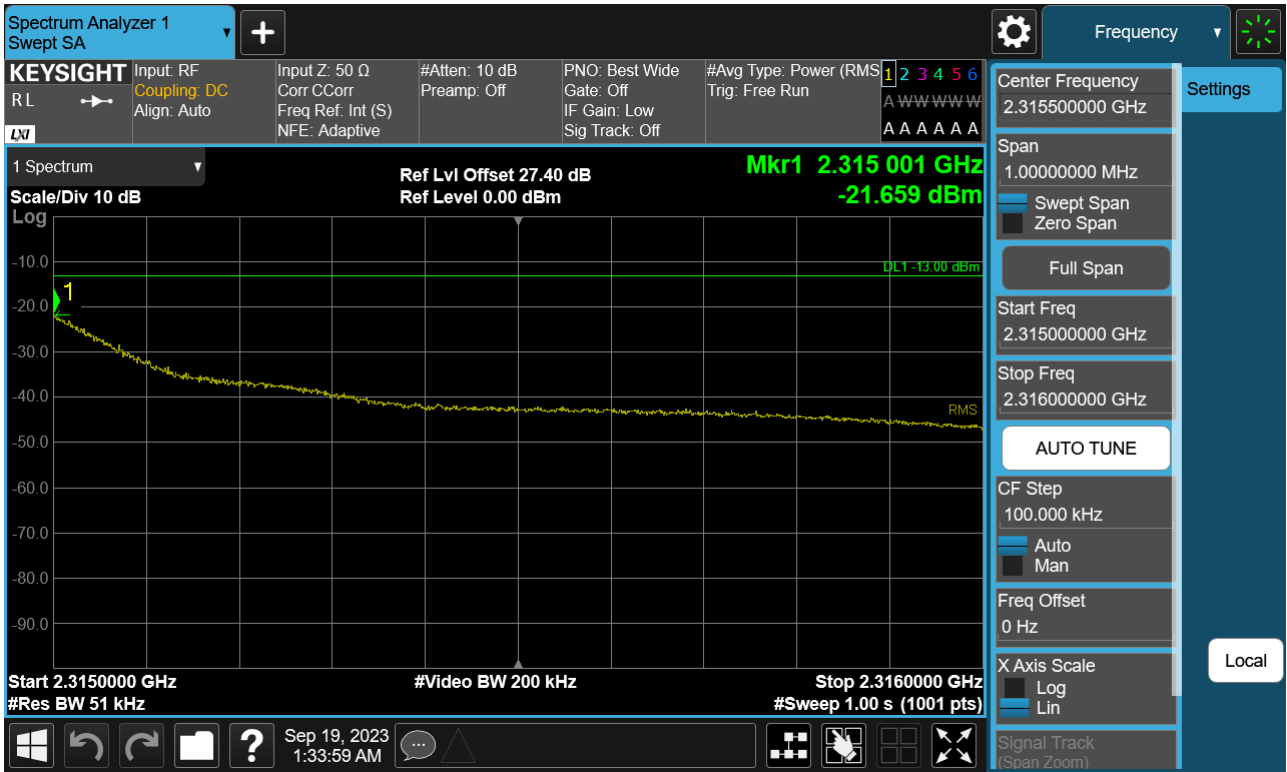


BAND 30. 5 M\_BandEdge(2315 MHz-2320 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB

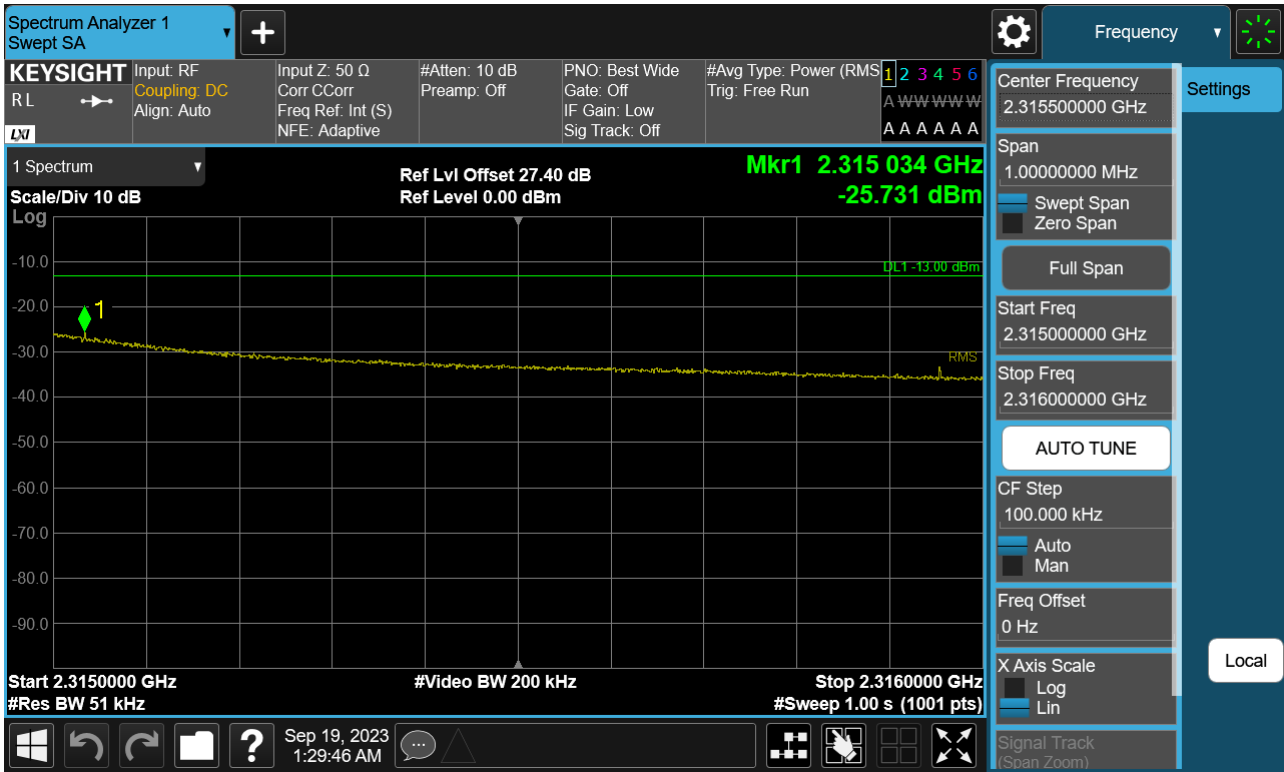




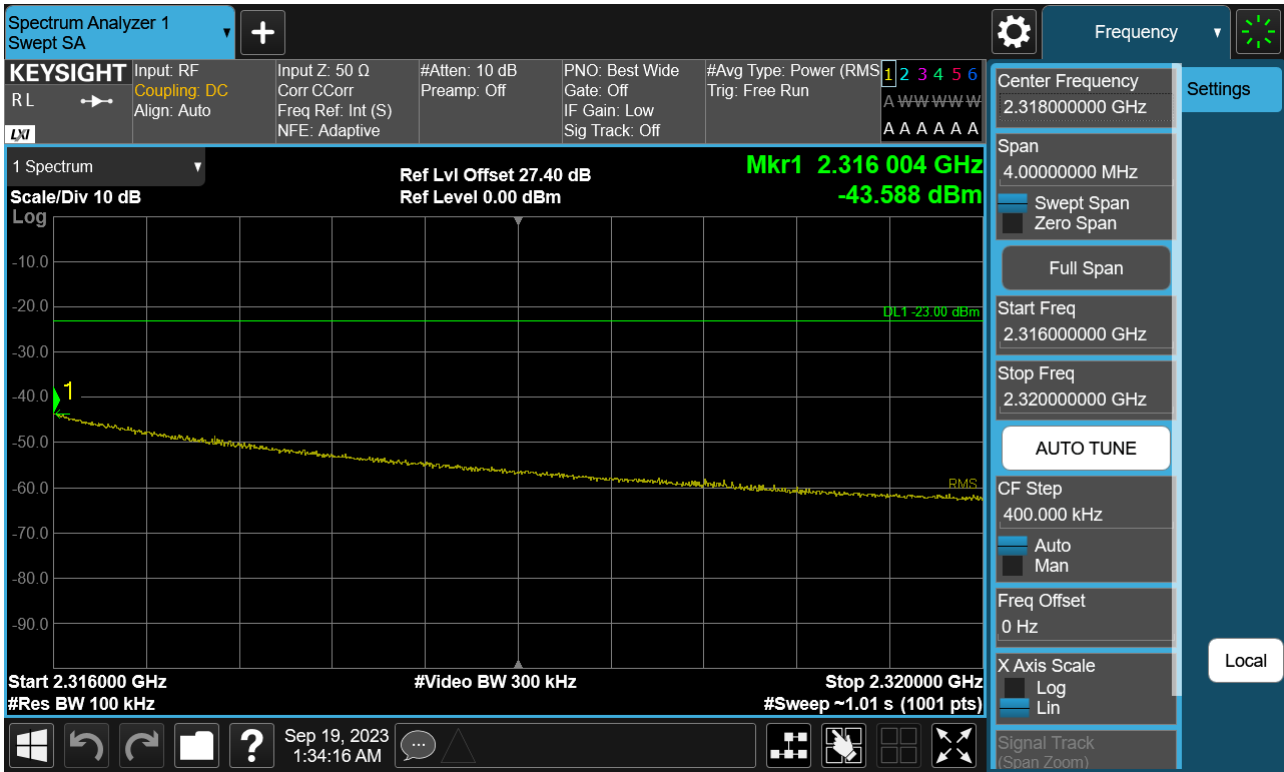
BAND 30. 5 M\_BandEdge(2315 MHz-2316 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2315 MHz-2316 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



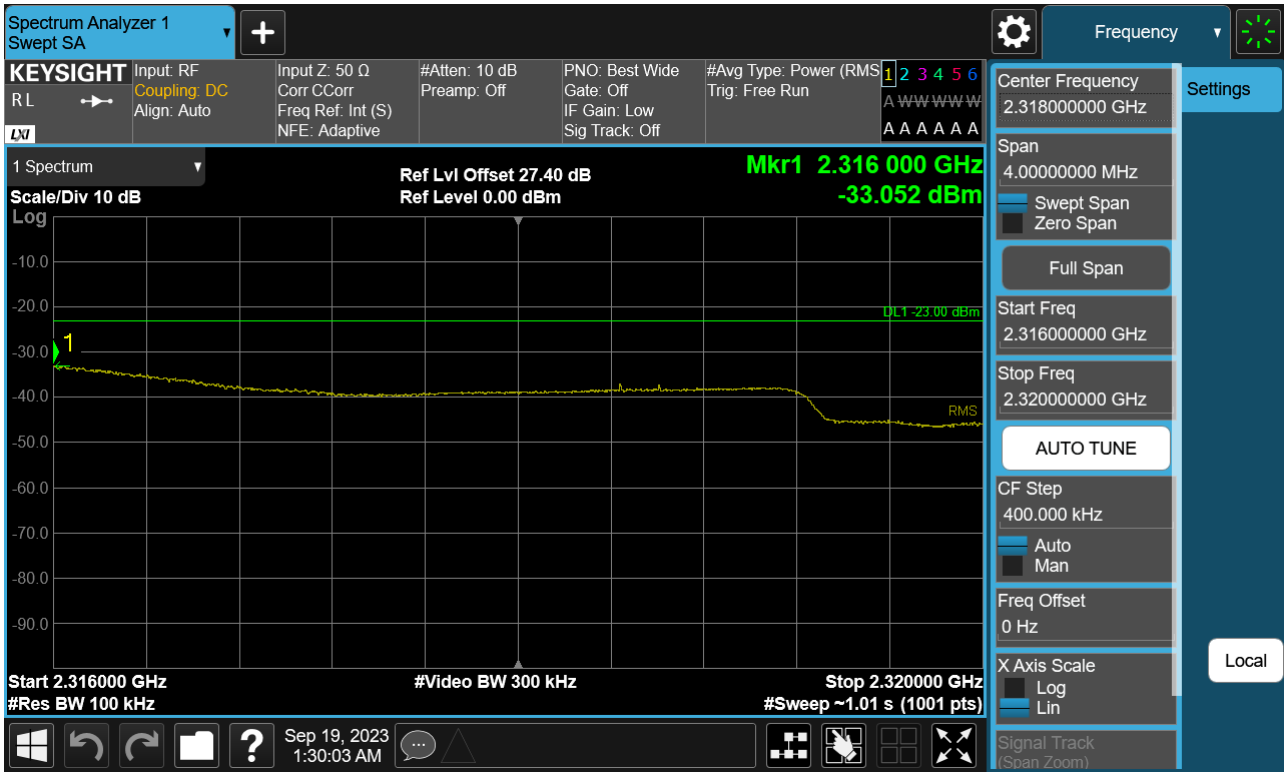
BAND 30. 5 M\_BandEdge(2316 MHz-2320 MHz)\_High\_2312.5 MHz\_QPSK\_1RB



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

Calculation = Reading Value + 10 x log(1 MHz/100 kHz) dB = -43.588 dBm + 10 dB = -33.588 dBm

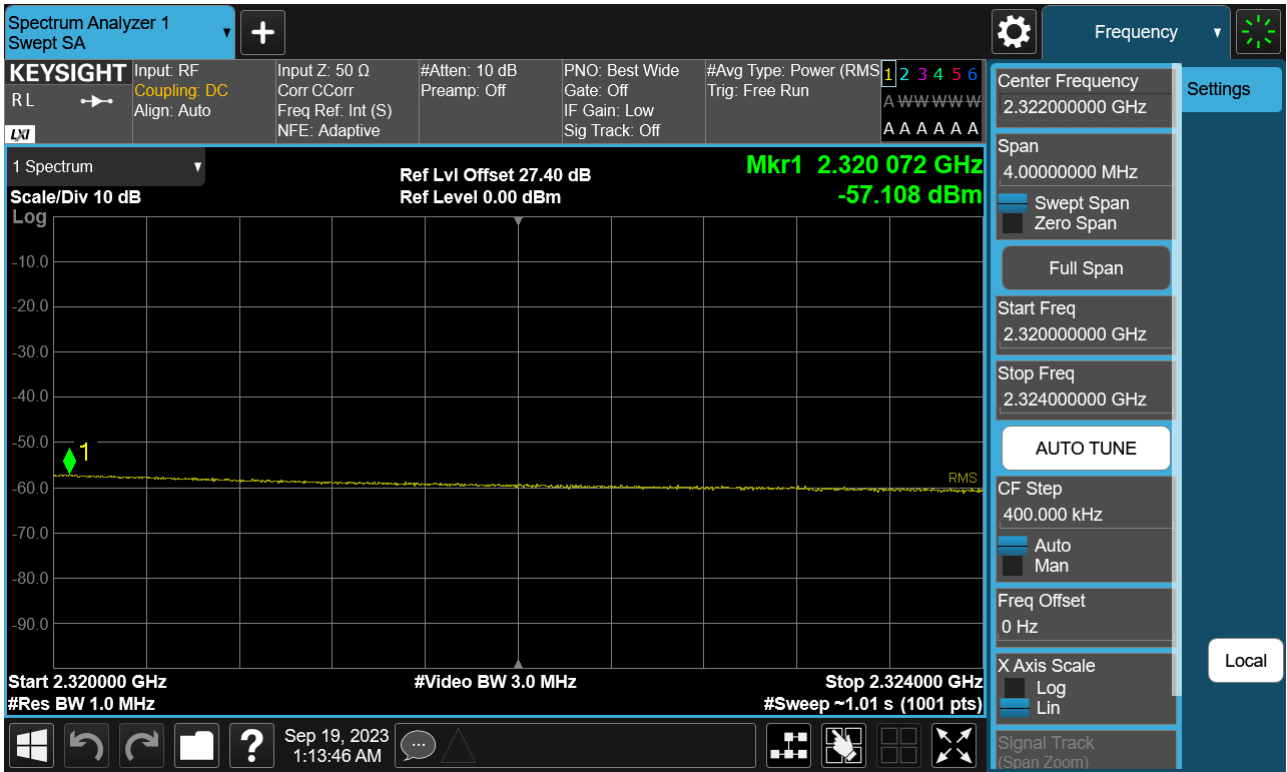
BAND 30. 5 M\_BandEdge(2316 MHz-2320 MHz)\_High\_2312.5 MHz\_QPSK\_FullRB



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

$$\text{Calculation} = \text{Reading Value} + 10 \times \log(1 \text{ MHz}/100 \text{ kHz}) \text{ dB} = -33.052 \text{ dBm} + 10 \text{ dB} = -23.052 \text{ dBm}$$

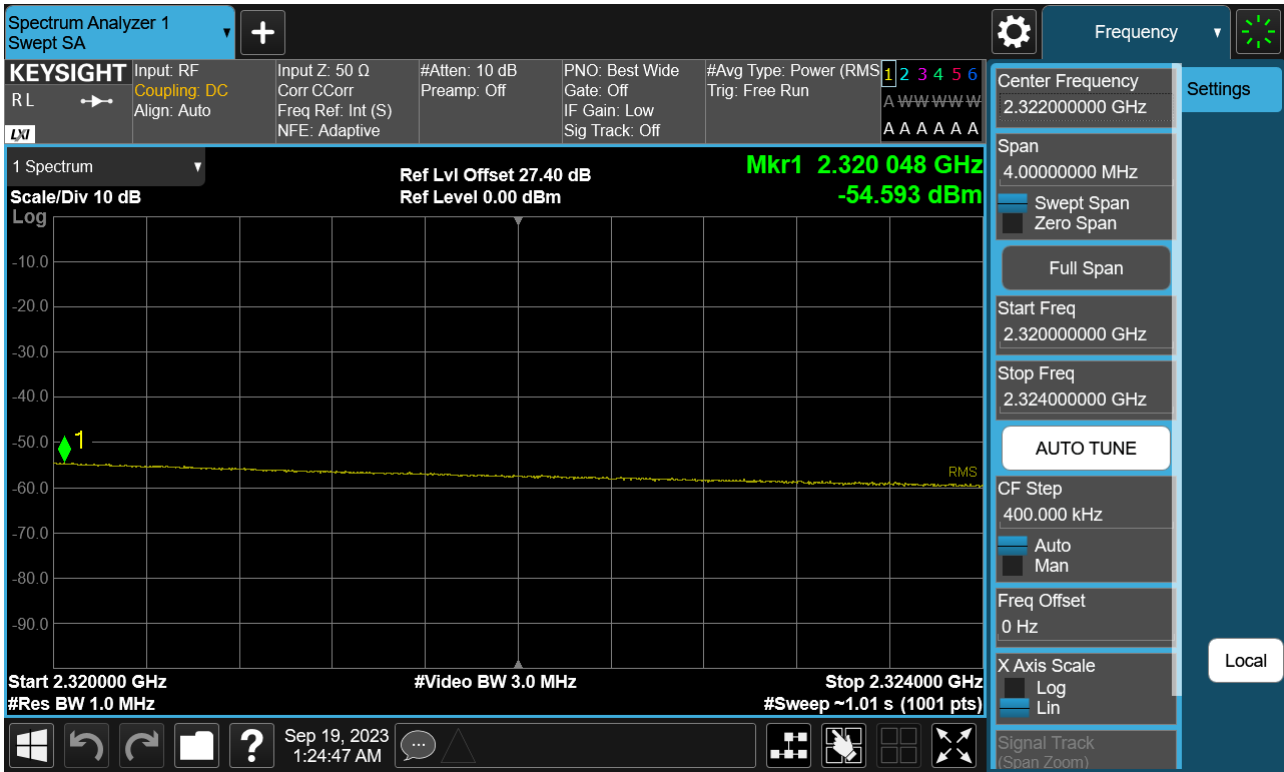
BAND 30. 5 M\_BandEdge(2320 MHz-2324 MHz)\_Low\_2307.5 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2320 MHz-2324 MHz)\_Low\_2307.5 MHz\_QPSK\_FullIRB



BAND 30. 5 M\_BandEdge(2320 MHz-2324 MHz)\_Mid\_2310 MHz\_QPSK\_1RB



BAND 30. 5 M\_BandEdge(2320 MHz-2324 MHz)\_Mid\_2310 MHz\_QPSK\_FullRB





BAND 30. 5 M\_BandEdge(2320 MHz-2324 MHz)\_High\_2312.5 MHz\_QPSK\_1RB

