

# FCC Sub6 REPORT

## Certification

**Applicant Name:**

SAMSUNG Electronics Co., Ltd.

**Date of Issue:**

October 16, 2023

**Address:**

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

**Location:**

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

**Report No.:** HCT-RF-2310-FC037

**FCC ID:** A3LSMS926U

**APPLICANT:** SAMSUNG Electronics Co., Ltd.

Model(s): SM-S926U  
 Additional Model(s): SM-S926U1  
 EUT Type: Mobile phone  
 FCC Classification: PCS Licensed Transmitter (PCB)  
 FCC Rule Part(s): §22

**Ant A**

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
Sub6 n5 (5)	826.5 – 846.5	4M51G7D	PI/2 BPSK	0.043	16.36
		4M51G7D	QPSK	0.042	16.25
		4M48W7D	16QAM	0.032	15.10
		4M51W7D	64QAM	0.024	13.82
		4M51W7D	256QAM	0.013	11.17
Sub6 n5 (10)	829.0 – 844.0	8M98G7D	PI/2 BPSK	0.041	16.15
		9M00G7D	QPSK	0.040	16.04
		8M98W7D	16QAM	0.031	14.92
		8M96W7D	64QAM	0.022	13.38
		9M00W7D	256QAM	0.013	11.00
Sub6 n5 (15)	831.5 – 841.5	13M5G7D	PI/2 BPSK	0.041	16.16
		13M5G7D	QPSK	0.041	16.10
		13M5W7D	16QAM	0.033	15.19
		13M5W7D	64QAM	0.023	13.60
		13M5W7D	256QAM	0.013	11.04
Sub6 n5 (20)	834.0 – 839.0	18M0G7D	PI/2 BPSK	0.045	16.54
		18M0G7D	QPSK	0.044	16.43
		17M9W7D	16QAM	0.034	15.27
		18M0W7D	64QAM	0.024	13.83
		18M0W7D	256QAM	0.013	11.18

**Ant E**

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
Sub6 n5 (5)	826.5 – 846.5	4M51G7D	PI/2 BPSK	0.096	19.82
		4M52G7D	QPSK	0.093	19.69
		4M49W7D	16QAM	0.073	18.64
		4M51W7D	64QAM	0.054	17.30
		4M51W7D	256QAM	0.030	14.70
Sub6 n5 (10)	829.0 – 844.0	9M01G7D	PI/2 BPSK	0.092	19.64
		9M00G7D	QPSK	0.090	19.53
		9M00W7D	16QAM	0.068	18.31
		9M04W7D	64QAM	0.050	17.01
		9M04W7D	256QAM	0.027	14.36
Sub6 n5 (15)	831.5 – 841.5	13M5G7D	PI/2 BPSK	0.089	19.47
		13M5G7D	QPSK	0.088	19.43
		13M5W7D	16QAM	0.070	18.46
		13M5W7D	64QAM	0.050	17.02
		13M5W7D	256QAM	0.028	14.40
Sub6 n5 (20)	834.0 – 839.0	18M0G7D	PI/2 BPSK	0.090	19.55
		18M1G7D	QPSK	0.086	19.37
		18M0W7D	16QAM	0.067	18.28
		18M0W7D	64QAM	0.048	16.85
		18M0W7D	256QAM	0.026	14.23

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-FC037

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REVIEWED BY



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Report prepared by : Jae Ryang 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-FC037	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 (PCB)
<b>FCC Rule Part(s):</b>	§22
<b>EUT Type:</b>	Mobile phone
<b>Model(s):</b>	SM-S926U
<b>Additional Model(s):</b>	SM-S926U1
<b>SCS(kHz):</b>	15
<b>Bandwidth(MHz):</b>	5, 10, 15, 20
<b>Waveform:</b>	CP-OFDM, DFT-S-OFDM
<b>Modulation:</b>	DFT-S-OFDM: PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM
<b>Tx Frequency:</b>	826.5 MHz – 846.5 MHz (Sub6 n 5 (5 MHz)) 829.0 MHz – 844.0 MHz (Sub6 n 5 (10 MHz)) 831.5 MHz – 841.5 MHz (Sub6 n 5 (15 MHz)) 834.0 MHz – 839.0 MHz (Sub6 n 5 (20 MHz))
<b>Date(s) of Tests:</b>	August 31, 2023 ~ October 11, 2023
<b>Serial number:</b>	Radiated: R3CW90B4EDB Conducted: R3CW80MBXVP

## **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
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4
Conducted Output Power	- N/A (See SAR Report)
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 1MHz for emissions above 1 GHz
2. VBW  $\geq 3 \times$  RBW
3. Span = 1.5 times the OBW
4. No. of sweep points  $> 2 \times$  span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 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 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The spurious emissions is calculated by the following formula;

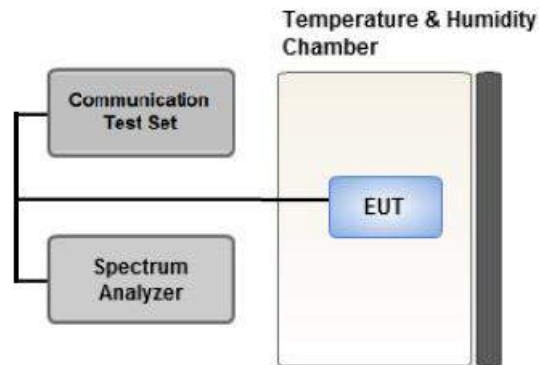
$$\text{Result}_{(\text{dBm})} = P_g_{(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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

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

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

### 3.4 PEAK- TO- AVERAGE RATIO



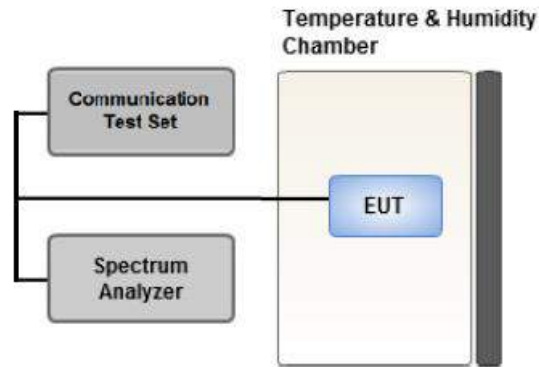
**Test setup**

#### 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 %.

### 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.

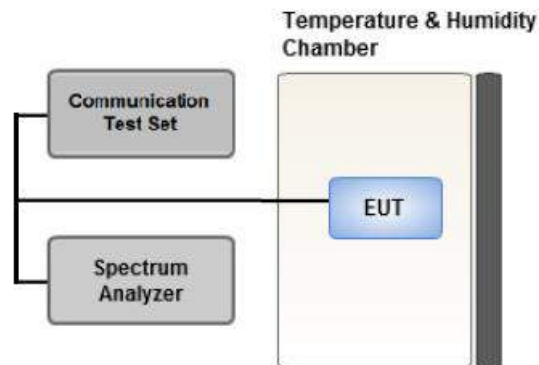
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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.

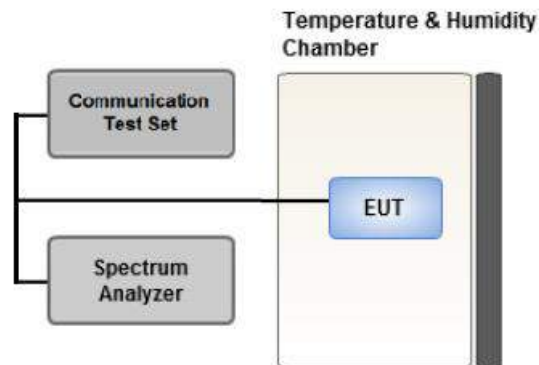
All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

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 x Span / RBW

### 3.7 BAND EDGE



**Test setup**

#### **Test Overview**

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

#### **Test Settings**

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

#### **Test Notes**

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

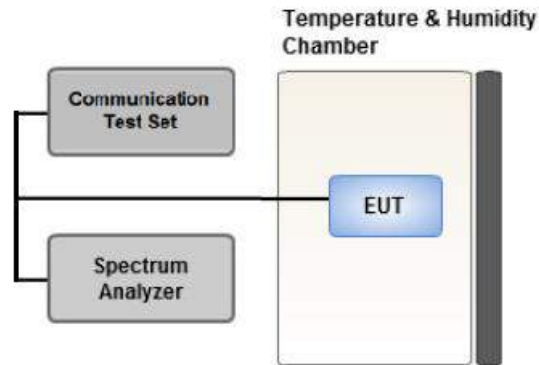
In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

Where Margin < 1 dB the emission level is either corrected by  $10 \log(1 \text{ MHz/ RB})$  or the emission is integrated over a 1 MHz bandwidth to determine the final result. When using the integration method the integration window is either centered on the emission or, for emissions at the band edge, centered by an offset of 500 kHz from the block edge so that the integration window is the 1 MHz adjacent to the block edge.

### 3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



#### Test setup

#### Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

The temperature is varied from -30 °C to +50 °C in 10 °C increments using an environmental chamber.

2. Primary Supply Voltage:

.- Unless otherwise specified, vary primary supply voltage from 85 % to 115 % of the nominal value for other than hand carried battery equipment.

.- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

#### Test Settings

1. The carrier frequency of the transmitter is measured at room temperature

(20 °C to provide a reference).

2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter.

Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.

3. Frequency measurements are made at 10 °C intervals ranging from -30 °C to +50 °C. A period of at

least one half-hour is provided to allow stabilization of the equipment at each temperature level.

**3.9 WORST CASE(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: NSA, SA  
 Worst case : SA  
 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
- Radiated Spurious emissions are measured while operating in EN-DC mode with Sub 6 NR carrier as well as an LTE carrier (anchor).  
 All EN-DC mode of operation (=anchor) were investigated and the test results were measured No Peak Found.  
 The test results which are attenuated more than 20 dB below the permissible value, so it were not reported.
- All RB sizes, offsets of operation were investigated and the worst case configuration results are reported.  
 Please refer to the table below.
- In the case of radiated spurious emissions, all bandwidth of operation were investigated and the worst case bandwidth results are reported.  
 (Worst case : 20 MHz(Ant A), 5 MHz(Ant E))
- SM-S926U & additional models were tested and the worst case results are reported.  
 (Worst case : SM-S926U)

[ Ant A Worst case ]

Test Description	Modulation	RB size	RB offset	Axis
Effective Radiated Power	Pi2/BPSK QPSK, 16QAM, 64QAM, 256QAM	See Section 8.1		X
Radiated Spurious and Harmonic Emissions	Pi2/BPSK	See Section 8.2		X

[ Ant E Worst case ]

Test Description	Modulation	RB size	RB offset	Axis
Effective Radiated Power	Pi2/BPSK QPSK, 16QAM, 64QAM, 256QAM	See Section 8.1		X
Radiated Spurious and Harmonic Emissions	Pi2/BPSK	See Section 8.2		X



### 3.10 WORST CASE(CONDUCTED TEST)

- Waveform : All Waveform of operation were investigated and the worst case configuration results are reported.  
(Worst case: DFT-S-OFDM)
- Modulation : All Modulation of operation were investigated and the worst case configuration results are reported.  
(Worst case: PI/2 BPSK)
- All modes of operation were investigated and the worst case configuration results are reported.  
Mode: NSA, SA  
Worst case : SA
- All RB sizes, offsets of operation were investigated and the worst case configuration results are reported.  
Please refer to the table below.
- 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>	Pi2/BPSK QPSK, 16QAM, 64QAM, 256QAM	5, 10, 15, 20	Mid	Full RB	0
<b>Peak-To-Average Ratio</b>	Pi2/BPSK QPSK, 16QAM, 64QAM, 256QAM	5, 10, 15, 20	Mid	Full RB	0
<b>Band-edge</b>	Pi2/BPSK	5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	49
		15	Low	1	0
			High	1	74
		20	Low	1	0
			High	1	99
5, 10, 15, 20	Low, High	Full RB	0		
	<b>Spurious and Harmonic Emissions at Antenna Terminal</b>	Pi2/BPSK	5, 10, 15, 20	Low, Mid, High	1

#### 4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacture	Serial No.	Due to Calibration	Calibration Interval
Precision Dipole Antenna	UHAP	Schwarzbeck	01273	03/27/2024	Biennial
Precision Dipole Antenna	UHAP	Schwarzbeck	01274	03/27/2024	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	02289	03/21/2024	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1299	04/27/2025	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
Loop Antenna(9 kHz~30 MHz)	FMZB1513	Rohde & Schwarz	1513-175	01/16/2025	Biennial
Bilog Antenna	VULB9160	Schwarzbeck	3150	03/09/2025	Biennial
Hybrid Antenna	VULB9160	Schwarzbeck	760	02/24/2025	Biennial
RF Switching System	FBSR-06B (1G HPF + LNA)	T&M SYSTEM	F3L1	05/22/2024	Annual
RF Switching System	FBSR-06B (3G HPF + LNA)	T&M SYSTEM	F3L2	05/22/2024	Annual
RF Switching System	FBSR-06B (6G HPF + LNA)	T&M SYSTEM	F3L3	05/22/2024	Annual
RF Switching System	FBSR-06B (LNA)	T&M SYSTEM	F3L4	05/22/2024	Annual
Power Amplifier	CBL18265035	CERNEK	22966	12/01/2023	Annual
Power Amplifier	CBL26405040	CERNEK	25956	03/02/2024	Annual
DC Power Supply	E3632A	Hewlett Packard	MY40004427	08/25/2024	Annual
Power Splitter(DC~26.5 GHz)	11667B	Hewlett Packard	11275	03/02/2024	Annual
Chamber	SU-642	ESPEC	93008124	02/22/2024	Annual
Signal Analyzer(10 Hz~26.5 GHz)	N9020A	Agilent	MY51110063	04/11/2024	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/19/2024	Annual
Spectrum Analyzer(10 Hz~40 GHz)	FSV40	REOHDE & SCHWARZ	101436	02/22/2024	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/10/2024	Annual
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262287701	05/22/2024	Annual
Wideband Radio Communication Tester	MT8000A	Anritsu Corp.	6262302511	05/23/2024	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
4-Way Divider	ZC4PD-K1844+	Mini-Circuits	942907	09/19/2024	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, §22.917(a)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Peak- to- Average Ratio	§22.913(d)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§2.1055, §22.355	< 2.5 ppm	PASS

Note:

1. See SAR Report
2. Conducted test were tested using 5G Wireless Tester.

### 6.2 Test Condition: Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Effective Radiated Power	§22.913(a)(5)	< 7 Watts max. ERP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §22.917(a)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS

Note:

1. Radiated tests were tested using 5G Wireless Tester.

## 7. SAMPLE CALCULATION

### 7.1 ERP Sample Calculation

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

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

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

### 7.2 EIRP Sample Calculation

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

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

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter's level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter's level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

### 8. TEST DATA(Ant A)

#### 8.1 EFFECTIVE RADIATED POWER

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
826.5	Sub6 n5 5 MHz [15 kHz]	PI/2 BPSK	-33.57	27.33	-10.05	1.39	H	< 7.00	0.039	15.89	1	1
		QPSK	-33.63	27.27	-10.05	1.39	H		0.038	15.83		
		16-QAM	-34.65	26.25	-10.05	1.39	H		0.030	14.81		
		64-QAM	-36.15	24.75	-10.05	1.39	H		0.021	13.31		
		256-QAM	-38.52	22.38	-10.05	1.39	H		0.012	10.94		
836.5		PI/2 BPSK	-34.12	27.17	-10.05	1.40	H		0.037	15.72	1	23
		QPSK	-34.18	27.11	-10.05	1.40	H		0.037	15.66		
		16-QAM	-35.13	26.16	-10.05	1.40	H		0.030	14.71		
		64-QAM	-36.66	24.63	-10.05	1.40	H		0.021	13.18		
		256-QAM	-39.79	21.50	-10.05	1.40	H		0.010	10.05		
846.5	PI/2 BPSK	-33.86	27.82	-10.05	1.41	H	0.043	16.36	1	12		
	QPSK	-33.97	27.71	-10.05	1.41	H	0.042	16.25				
	16-QAM	-35.12	26.56	-10.05	1.41	H	0.032	15.10				
	64-QAM	-36.40	25.28	-10.05	1.41	H	0.024	13.82				
	256-QAM	-39.05	22.63	-10.05	1.41	H	0.013	11.17				

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
829.0	Sub6 n5 10 MHz [15 kHz]	PI/2 BPSK	-33.70	27.32	-10.05	1.39	H	< 7.00	0.039	15.88	1	1
		QPSK	-33.82	27.20	-10.05	1.39	H		0.038	15.76		
		16-QAM	-34.69	26.33	-10.05	1.39	H		0.031	14.89		
		64-QAM	-36.41	24.61	-10.05	1.39	H		0.021	13.17		
		256-QAM	-38.58	22.44	-10.05	1.39	H		0.013	11.00		
836.5		PI/2 BPSK	-33.69	27.60	-10.05	1.40	H		0.041	16.15	1	1
		QPSK	-33.80	27.49	-10.05	1.40	H		0.040	16.04		
		16-QAM	-35.06	26.23	-10.05	1.40	H		0.030	14.78		
		64-QAM	-36.47	24.82	-10.05	1.40	H		0.022	13.37		
		256-QAM	-39.12	22.17	-10.05	1.40	H		0.012	10.72		
844.0	PI/2 BPSK	-34.10	27.38	-10.05	1.41	H	0.039	15.92	1	50		
	QPSK	-34.22	27.26	-10.05	1.41	H	0.038	15.80				
	16-QAM	-35.10	26.38	-10.05	1.41	H	0.031	14.92				
	64-QAM	-36.64	24.84	-10.05	1.41	H	0.022	13.38				
	256-QAM	-39.05	22.43	-10.05	1.41	H	0.013	10.97				



Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
831.5	Sub6 n5 15 MHz [15 kHz]	PI/2 BPSK	-33.53	27.60	-10.05	1.39	H	< 7.00	0.041	16.16	1	1
		QPSK	-33.59	27.54	-10.05	1.39	H		0.041	16.10		
		16-QAM	-34.50	26.63	-10.05	1.39	H		0.033	15.19		
		64-QAM	-36.09	25.04	-10.05	1.39	H		0.023	13.60		
		256-QAM	-38.66	22.47	-10.05	1.39	H		0.013	11.03		
836.5		PI/2 BPSK	-33.83	27.46	-10.05	1.40	H		0.040	16.01	1	1
		QPSK	-33.95	27.34	-10.05	1.40	H		0.039	15.89		
		16-QAM	-35.10	26.19	-10.05	1.40	H		0.030	14.74		
		64-QAM	-36.37	24.92	-10.05	1.40	H		0.022	13.47		
		256-QAM	-38.80	22.49	-10.05	1.40	H		0.013	11.04		
841.5	PI/2 BPSK	-33.97	27.45	-10.05	1.41	H	0.040	15.99	1	1		
	QPSK	-34.15	27.27	-10.05	1.41	H	0.038	15.81				
	16-QAM	-35.25	26.17	-10.05	1.41	H	0.030	14.71				
	64-QAM	-36.46	24.96	-10.05	1.41	H	0.022	13.50				
	256-QAM	-39.08	22.34	-10.05	1.41	H	0.012	10.88				

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W dBm	Size	Offset
834.0	Sub6 n5 20 MHz [15 kHz]	PI/2 BPSK	-33.23	27.98	-10.05	1.39	H	< 7.00	0.045	16.54	1	1
		QPSK	-33.34	27.87	-10.05	1.39	H		0.044	16.43		
		16-QAM	-34.50	26.71	-10.05	1.39	H		0.034	15.27		
		64-QAM	-35.94	25.27	-10.05	1.39	H		0.024	13.83		
		256-QAM	-38.59	22.62	-10.05	1.39	H		0.013	11.18		
836.5		PI/2 BPSK	-33.59	27.70	-10.05	1.40	H		0.042	16.25	1	1
		QPSK	-33.69	27.60	-10.05	1.40	H		0.041	16.15		
		16-QAM	-34.75	26.54	-10.05	1.40	H		0.032	15.09		
		64-QAM	-36.19	25.10	-10.05	1.40	H		0.023	13.65		
		256-QAM	-38.79	22.50	-10.05	1.40	H		0.013	11.05		
839.0	PI/2 BPSK	-33.78	27.67	-10.05	1.40	H	0.042	16.22	1	1		
	QPSK	-33.79	27.66	-10.05	1.40	H	0.042	16.21				
	16-QAM	-34.98	26.47	-10.05	1.40	H	0.032	15.02				
	64-QAM	-36.27	25.18	-10.05	1.40	H	0.024	13.73				
	256-QAM	-39.00	22.45	-10.05	1.40	H	0.013	11.00				

### 8.2 RADIATED SPURIOUS EMISSIONS

- ▣ NR Band: N5
- ▣ Bandwidth: 20 MHz
- ▣ Modulation: PI/2 BPSK
- ▣ Distance: 3 meters
- ▣ SCS: 15 kHz
- ▣ Limit: -13.00 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)	RB	
									Size	Offset
166800 (834.0)	1 668.00	-57.76	9.20	-66.90	2.04	V	-59.74	-13.00	1	1
	2 502.00	-60.97	10.30	-65.91	2.47	V	-58.08	-13.00		
	3 336.00	-62.47	10.90	-64.94	2.90	V	-56.94	-13.00		
	4 170.00	-61.60	11.30	-60.71	3.26	V	-52.67	-13.00		
	5 004.00	-61.76	10.70	-56.61	3.61	V	-49.52	-13.00		
167300 (836.5)	1 673.00	-58.15	9.20	-67.33	2.03	V	-60.16	-13.00	1	1
	2 509.50	-59.68	10.30	-64.21	2.50	V	-56.41	-13.00		
	3 346.00	-61.73	10.95	-64.62	2.89	V	-56.56	-13.00		
	4 182.50	-60.59	11.30	-60.44	3.30	V	-52.44	-13.00		
	5 019.00	-61.92	10.70	-56.86	3.55	V	-49.71	-13.00		
167800 (839.0)	1 678.00	-58.37	9.20	-67.58	2.03	V	-60.41	-13.00	1	1
	2 517.00	-58.70	10.30	-62.95	2.51	V	-55.16	-13.00		
	3 356.00	-61.51	11.00	-64.16	2.91	V	-56.07	-13.00		
	4 195.00	-61.39	11.25	-61.24	3.30	V	-53.29	-13.00		
	5 034.00	-61.84	10.70	-57.33	3.58	V	-50.21	-13.00		

**8.3 PEAK-TO-AVERAGE RATIO**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
5	5 MHz	836.5	BPSK	25	0	4.12
			QPSK			4.63
			16QAM			5.49
			64QAM			6.20
			256QAM			6.78
	10 MHz		BPSK	50		4.02
			QPSK			4.55
			16QAM			5.34
			64QAM			5.84
			256QAM			6.74
	15 MHz		BPSK	75		4.01
			QPSK			4.52
			16QAM			5.39
			64QAM			5.80
			256QAM			6.57
	20 MHz		BPSK	100		4.28
			QPSK			4.81
			16QAM			5.68
			64QAM			6.13
			256-QAM			6.84

Note:

1. Plots of the EUT's Peak-to-Average Ratio are shown Page 69 ~ 88.

**8.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
5	5 MHz	836.5	BPSK	25	0	4.5067
			QPSK			4.5144
			16QAM			4.4832
			64QAM			4.5123
			256QAM			4.5078
	10 MHz		BPSK	50		8.9844
			QPSK			9.0000
			16QAM			8.9759
			64QAM			8.9626
			256QAM			8.9949
	15 MHz		BPSK	75		13.477
			QPSK			13.462
			16QAM			13.502
			64QAM			13.474
			256QAM			13.504
	20 MHz		BPSK	100		17.974
			QPSK			17.960
			16QAM			17.932
			64QAM			17.982
			256QAM			17.997

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 49 ~ 68.

**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)
5	5	826.5	9.6830	30.815	-75.697	-44.882	-13.00
		836.5	3.8316	30.200	-75.131	-44.931	
		846.5	8.2333	30.815	-75.533	-44.718	
	10	829.0	8.3036	30.815	-75.169	-44.354	
		836.5	5.2099	30.815	-74.528	-43.713	
		844.0	3.7787	30.200	-74.580	-44.380	
	15	831.5	9.9771	30.815	-74.275	-43.460	
		836.5	4.9273	30.200	-75.251	-45.051	
		841.5	3.7683	30.200	-74.939	-44.739	
	20	834.0	8.2742	30.815	-74.279	-43.464	
		836.5	3.8236	30.200	-73.909	-43.709	
		839.0	5.1935	30.815	-74.640	-43.825	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 113 ~ 124.
2. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
3. Factor (dB) = Cable Loss + Ext. Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	27.494
1 – 5	30.200
5 – 10	30.815
10 – 15	31.340
15 – 20	31.713
Above 20	32.355

**8.6 BAND EDGE**

- Plots of the EUT's Band Edge are shown Page 89 ~ 112.

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

- ▣ BandWidth: 5 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 000	0.0	0.000 000	0.000
	100 %	-30	836 500 001	1.9	0.000 000	0.002
	100 %	-20	836 499 999	-0.2	0.000 000	0.000
	100 %	-10	836 499 999	-0.3	0.000 000	0.000
	100 %	0	836 500 001	1.2	0.000 000	0.001
	100 %	+10	836 499 999	-0.3	0.000 000	0.000
	100 %	+30	836 500 000	0.2	0.000 000	0.000
	100 %	+40	836 500 000	1.0	0.000 000	0.001
	100 %	+50	836 499 999	-0.8	0.000 000	-0.001
	Batt. Endpoint	+20	836 499 999	-0.3	0.000 000	0.000

- ▣ BandWidth: 10 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 003	0.0	0.000 000	0.000
	100 %	-30	836 500 005	2.0	0.000 000	0.002
	100 %	-20	836 500 006	3.0	0.000 000	0.004
	100 %	-10	836 500 006	3.3	0.000 000	0.004
	100 %	0	836 500 007	4.2	0.000 001	0.005
	100 %	+10	836 500 006	3.2	0.000 000	0.004
	100 %	+30	836 500 007	4.2	0.000 001	0.005
	100 %	+40	836 500 007	3.8	0.000 000	0.005
	100 %	+50	836 500 008	5.1	0.000 001	0.006
	Batt. Endpoint	+20	836 500 007	4.0	0.000 000	0.005



- ▣ BandWidth: 15 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 003	0.0	0.000 000	0.000
	100 %	-30	836 500 005	2.0	0.000 000	0.002
	100 %	-20	836 500 004	0.8	0.000 000	0.001
	100 %	-10	836 500 005	2.4	0.000 000	0.003
	100 %	0	836 500 004	1.2	0.000 000	0.001
	100 %	+10	836 500 004	0.9	0.000 000	0.001
	100 %	+30	836 500 005	1.7	0.000 000	0.002
	100 %	+40	836 500 004	1.0	0.000 000	0.001
	100 %	+50	836 500 005	2.5	0.000 000	0.003
	Batt. Endpoint	+20	836 500 005	2.0	0.000 000	0.002

- ▣ BandWidth: 20 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 002	0.0	0.000 000	0.000
	100 %	-30	836 500 002	0.3	0.000 000	0.000
	100 %	-20	836 500 001	-0.3	0.000 000	0.000
	100 %	-10	836 500 002	0.4	0.000 000	0.000
	100 %	0	836 500 001	-0.8	0.000 000	-0.001
	100 %	+10	836 500 002	-0.2	0.000 000	0.000
	100 %	+30	836 500 003	1.1	0.000 000	0.001
	100 %	+40	836 500 002	0.4	0.000 000	0.001
	100 %	+50	836 500 001	-0.4	0.000 000	0.000
	Batt. Endpoint	+20	836 500 001	-1.1	0.000 000	-0.001

### 9. TEST DATA(Ant E)

#### 9.1 EFFECTIVE RADIATED POWER

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
826.5	Sub6 n5 5 MHz [15 kHz]	PI/2 BPSK	-30.84	30.06	-10.05	1.39	H	< 7.00	0.073	18.62	1	23
		QPSK	-30.97	29.93	-10.05	1.39	H		0.071	18.49		
		16-QAM	-32.10	28.80	-10.05	1.39	H		0.055	17.36		
		64-QAM	-33.36	27.54	-10.05	1.39	H		0.041	16.10		
		256-QAM	-35.94	24.96	-10.05	1.39	H		0.023	13.52		
836.5		PI/2 BPSK	-30.68	30.61	-10.05	1.40	H		0.082	19.16	1	23
		QPSK	-30.70	30.59	-10.05	1.40	H		0.082	19.14		
		16-QAM	-31.81	29.48	-10.05	1.40	H		0.064	18.03		
		64-QAM	-33.20	28.09	-10.05	1.40	H		0.046	16.64		
		256-QAM	-35.80	25.49	-10.05	1.40	H		0.025	14.04		
846.5	PI/2 BPSK	-30.40	31.28	-10.05	1.41	H	0.096	19.82	1	1		
	QPSK	-30.53	31.15	-10.05	1.41	H	0.093	19.69				
	16-QAM	-31.58	30.10	-10.05	1.41	H	0.073	18.64				
	64-QAM	-32.92	28.76	-10.05	1.41	H	0.054	17.30				
	256-QAM	-35.52	26.16	-10.05	1.41	H	0.030	14.70				

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W dBm	Size	Offset
829.0	Sub6 n5 10 MHz [15 kHz]	PI/2 BPSK	-30.77	30.25	-10.05	1.39	H	< 7.00	0.076	18.81	1	26
		QPSK	-30.92	30.10	-10.05	1.39	H		0.074	18.66		
		16-QAM	-32.03	28.99	-10.05	1.39	H		0.057	17.55		
		64-QAM	-33.45	27.57	-10.05	1.39	H		0.041	16.13		
		256-QAM	-36.05	24.97	-10.05	1.39	H		0.023	13.53		
836.5		PI/2 BPSK	-30.46	30.83	-10.05	1.40	H		0.087	19.38	1	50
		QPSK	-30.61	30.68	-10.05	1.40	H		0.084	19.23		
		16-QAM	-31.84	29.45	-10.05	1.40	H		0.063	18.00		
		64-QAM	-33.00	28.29	-10.05	1.40	H		0.048	16.84		
		256-QAM	-35.69	25.60	-10.05	1.40	H		0.026	14.15		
844.0	PI/2 BPSK	-30.38	31.10	-10.05	1.41	H	0.092	19.64	1	26		
	QPSK	-30.49	30.99	-10.05	1.41	H	0.090	19.53				
	16-QAM	-31.71	29.77	-10.05	1.41	H	0.068	18.31				
	64-QAM	-33.01	28.47	-10.05	1.41	H	0.050	17.01				
	256-QAM	-35.66	25.82	-10.05	1.41	H	0.027	14.36				

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
831.5	Sub6 n5 15 MHz [15 kHz]	PI/2 BPSK	-30.77	30.36	-10.05	1.39	H	< 7.00	0.078	18.92	1	1
		QPSK	-30.81	30.32	-10.05	1.39	H		0.077	18.88		
		16-QAM	-31.97	29.16	-10.05	1.39	H		0.059	17.72		
		64-QAM	-33.46	27.67	-10.05	1.39	H		0.042	16.23		
		256-QAM	-35.98	25.15	-10.05	1.39	H		0.024	13.71		
836.5		PI/2 BPSK	-30.52	30.77	-10.05	1.40	H		0.086	19.32	1	77
		QPSK	-30.57	30.72	-10.05	1.40	H		0.085	19.27		
		16-QAM	-31.62	29.67	-10.05	1.40	H		0.066	18.22		
		64-QAM	-32.97	28.32	-10.05	1.40	H		0.049	16.87		
		256-QAM	-35.57	25.72	-10.05	1.40	H		0.027	14.27		
841.5	PI/2 BPSK	-30.49	30.93	-10.05	1.41	H	0.089	19.47	1	77		
	QPSK	-30.53	30.89	-10.05	1.41	H	0.088	19.43				
	16-QAM	-31.50	29.92	-10.05	1.41	H	0.070	18.46				
	64-QAM	-32.94	28.48	-10.05	1.41	H	0.050	17.02				
	256-QAM	-35.56	25.86	-10.05	1.41	H	0.028	14.40				

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBd)	C.L	Pol	Limit	ERP		RB	
									W	W	dBm	Size
834.0	Sub6 n5 20 MHz [15 kHz]	PI/2 BPSK	-30.35	30.86	-10.05	1.39	H	< 7.00	0.088	19.42	1	104
		QPSK	-30.55	30.66	-10.05	1.39	H		0.084	19.22		
		16-QAM	-31.84	29.37	-10.05	1.39	H		0.062	17.93		
		64-QAM	-33.14	28.07	-10.05	1.39	H		0.046	16.63		
		256-QAM	-35.65	25.56	-10.05	1.39	H		0.026	14.12		
836.5		PI/2 BPSK	-30.36	30.93	-10.05	1.40	H		0.089	19.48	1	104
		QPSK	-30.49	30.80	-10.05	1.40	H		0.086	19.35		
		16-QAM	-31.58	29.71	-10.05	1.40	H		0.067	18.26		
		64-QAM	-33.04	28.25	-10.05	1.40	H		0.048	16.80		
		256-QAM	-35.66	25.63	-10.05	1.40	H		0.026	14.18		
839.0	PI/2 BPSK	-30.45	31.00	-10.05	1.40	H	0.090	19.55	1	53		
	QPSK	-30.63	30.82	-10.05	1.40	H	0.086	19.37				
	16-QAM	-31.72	29.73	-10.05	1.40	H	0.067	18.28				
	64-QAM	-33.15	28.30	-10.05	1.40	H	0.048	16.85				
	256-QAM	-35.77	25.68	-10.05	1.40	H	0.026	14.23				

**9.2 RADIATED SPURIOUS EMISSIONS**

- ▣ NR Band: N5
- ▣ Bandwidth: 5 MHz
- ▣ Modulation: PI/2 BPSK
- ▣ Distance: 3 meters
- ▣ SCS: 15 kHz
- ▣ Limit: -13.00 dBm

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)	RB	
									Size	Offset
165300 (826.5)	1 653.00	-58.16	9.20	-67.07	2.03	V	-59.90	-13.00	1	23
	2 479.50	-57.79	10.20	-61.04	2.45	V	-53.29	-13.00		
	3 306.00	-60.91	10.90	-62.95	2.92	V	-54.97	-13.00		
	4 132.50	-61.30	11.30	-61.15	3.25	V	-53.10	-13.00		
	4 959.00	-60.98	10.90	-56.69	3.58	V	-49.37	-13.00		
167300 (836.5)	1 673.00	-58.39	9.20	-67.57	2.03	V	-60.40	-13.00	1	23
	2 509.50	-60.53	10.30	-65.06	2.50	V	-57.26	-13.00		
	3 346.00	-60.42	10.95	-63.31	2.89	V	-55.25	-13.00		
	4 182.50	-61.05	11.30	-60.90	3.30	V	-52.90	-13.00		
	5 019.00	-62.05	10.70	-56.99	3.55	V	-49.84	-13.00		
169300 (846.5)	1 693.00	-57.37	9.40	-65.99	2.00	V	-58.59	-13.00	1	1
	2 539.50	-59.75	10.30	-64.58	2.52	V	-56.80	-13.00		
	3 386.00	-61.08	11.00	-63.56	2.94	V	-55.50	-13.00		
	4 232.50	-58.84	11.20	-57.92	3.28	V	-50.00	-13.00		
	5 079.00	-62.45	10.70	-57.29	3.61	V	-50.20	-13.00		

**9.3 PEAK-TO-AVERAGE RATIO**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
5	5 MHz	836.5	BPSK	25	0	4.10
			QPSK			4.63
			16QAM			5.46
			64QAM			6.17
			256QAM			6.72
	10 MHz		BPSK	50		3.97
			QPSK			4.53
			16QAM			5.38
			64QAM			5.86
			256QAM			6.68
	15 MHz		BPSK	75		4.00
			QPSK			4.58
			16QAM			5.50
			64QAM			6.05
			256QAM			6.73
	20 MHz		BPSK	100		4.35
			QPSK			4.80
			16QAM			5.57
			64QAM			5.92
			256-QAM			6.79

Note:

1. Plots of the EUT's Peak-to-Average Ratio are shown Page 146 ~ 165.



**9.4 OCCUPIED BANDWIDTH**

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
5	5 MHz	836.5	BPSK	25	0	4.5074
			QPSK			4.5164
			16QAM			4.4847
			64QAM			4.5142
			256QAM			4.5098
	10 MHz		BPSK	50		9.0127
			QPSK			9.0015
			16QAM			8.9974
			64QAM			9.0368
			256QAM			9.0366
	15 MHz		BPSK	75		13.472
			QPSK			13.503
			16QAM			13.448
			64QAM			13.499
			256QAM			13.521
	20 MHz		BPSK	100		17.996
			QPSK			18.049
			16QAM			18.009
			64QAM			17.951
			256QAM			17.980

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 126 ~ 145.

**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)
5	5	826.5	8.8883	30.815	-76.145	-45.330	-13.00
		836.5	4.8789	30.200	-75.733	-45.533	
		846.5	5.1810	30.815	-76.119	-45.304	
	10	829.0	8.2647	30.815	-75.316	-44.501	
		836.5	9.9357	30.815	-74.329	-43.514	
		844.0	9.7104	30.815	-75.122	-44.307	
	15	831.5	9.9616	30.815	-75.100	-44.285	
		836.5	4.0434	30.200	-74.973	-44.773	
		841.5	7.9871	30.815	-75.306	-44.491	
	20	834.0	8.0534	30.815	-75.392	-44.577	
		836.5	9.7084	30.815	-75.040	-44.225	
		839.0	9.1979	30.815	-75.143	-44.328	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 190 ~ 201.
2. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
3. Factor (dB) = Cable Loss + Ext. Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	27.494
1 – 5	30.200
5 – 10	30.815
10 – 15	31.340
15 – 20	31.713
Above 20	32.355

**9.6 BAND EDGE**

- Plots of the EUT's Band Edge are shown Page 166 ~ 189.

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

- ▣ BandWidth: 5 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 000	0.0	0.000 000	0.000
	100 %	-30	836 500 000	0.3	0.000 000	0.000
	100 %	-20	836 500 001	1.1	0.000 000	0.001
	100 %	-10	836 500 000	-0.3	0.000 000	0.000
	100 %	0	836 500 000	-0.1	0.000 000	0.000
	100 %	+10	836 500 001	1.0	0.000 000	0.001
	100 %	+30	836 500 000	-0.3	0.000 000	0.000
	100 %	+40	836 499 998	-1.7	0.000 000	-0.002
	100 %	+50	836 500 001	1.0	0.000 000	0.001
	Batt. Endpoint	+20	836 500 000	-0.3	0.000 000	0.000

- ▣ BandWidth: 10 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 001	0.0	0.000 000	0.000
	100 %	-30	836 500 003	2.3	0.000 000	0.003
	100 %	-20	836 500 007	6.0	0.000 001	0.007
	100 %	-10	836 500 004	3.1	0.000 000	0.004
	100 %	0	836 500 005	4.2	0.000 001	0.005
	100 %	+10	836 500 005	3.5	0.000 000	0.004
	100 %	+30	836 500 006	4.8	0.000 001	0.006
	100 %	+40	836 500 005	3.8	0.000 000	0.005
	100 %	+50	836 500 004	3.0	0.000 000	0.004
	Batt. Endpoint	+20	836 500 005	4.2	0.000 001	0.005

- ▣ BandWidth: 15 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 500 000	0.0	0.000 000	0.000
	100 %	-30	836 500 002	1.7	0.000 000	0.002
	100 %	-20	836 500 001	0.9	0.000 000	0.001
	100 %	-10	836 500 000	0.4	0.000 000	0.001
	100 %	0	836 500 002	2.5	0.000 000	0.003
	100 %	+10	836 500 002	2.2	0.000 000	0.003
	100 %	+30	836 500 002	2.0	0.000 000	0.002
	100 %	+40	836 500 001	1.3	0.000 000	0.002
	100 %	+50	836 500 001	0.9	0.000 000	0.001
	Batt. Endpoint	+20	836 500 000	0.6	0.000 000	0.001

- ▣ BandWidth: 20 MHz
- ▣ Voltage(100 %): 3.880 VDC
- ▣ Batt. Endpoint: 3.300 VDC
- ▣ Deviation Limit: ± 0.000 25 % or 2.5 ppm

Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
836.5	100 %	+20(Ref)	836 499 999	0.0	0.000 000	0.000
	100 %	-30	836 500 000	0.7	0.000 000	0.001
	100 %	-20	836 500 000	0.3	0.000 000	0.000
	100 %	-10	836 499 999	-0.1	0.000 000	0.000
	100 %	0	836 499 999	-0.6	0.000 000	-0.001
	100 %	+10	836 500 000	0.8	0.000 000	0.001
	100 %	+30	836 500 000	0.3	0.000 000	0.000
	100 %	+40	836 499 999	-0.1	0.000 000	0.000
	100 %	+50	836 500 001	1.8	0.000 000	0.002
	Batt. Endpoint	+20	836 500 001	1.4	0.000 000	0.002

## 10. TEST DATA (Ant E, Ant F)

### 10.1 UPLINK CARRIER AGGREGATION

Test Note

1. All tests were evaluated for the two bands using various combinations of RB size, RB offset, modulation, and channel bandwidth.

2. All modes of operation were investigated and the worst case configuration results are reported in this section.

Please refer to the table below.

3. The worst case is reported with the modulations, RB sizes and offsets.

- N5A(ANT E)-N30A(ANT F)

(PCC - Modulation: BPSK, RB: 1, RB Offset: 1, SCC - Modulation: BPSK, RB: 1, RB Offset: 1)

**Radiated Spurious Emissions**

PCC	SCC	PCC		SCC	
		BW(MHz)	Channel	BW(MHz)	Channel
N5A(ANT E)	N30A(ANT F)	5	169300	5	462000

#### 10.1.1 RADIATED SPURIOUS EMISSIONS

N5A(ANT E)(PCC)- N30A(ANT F)(SCC)

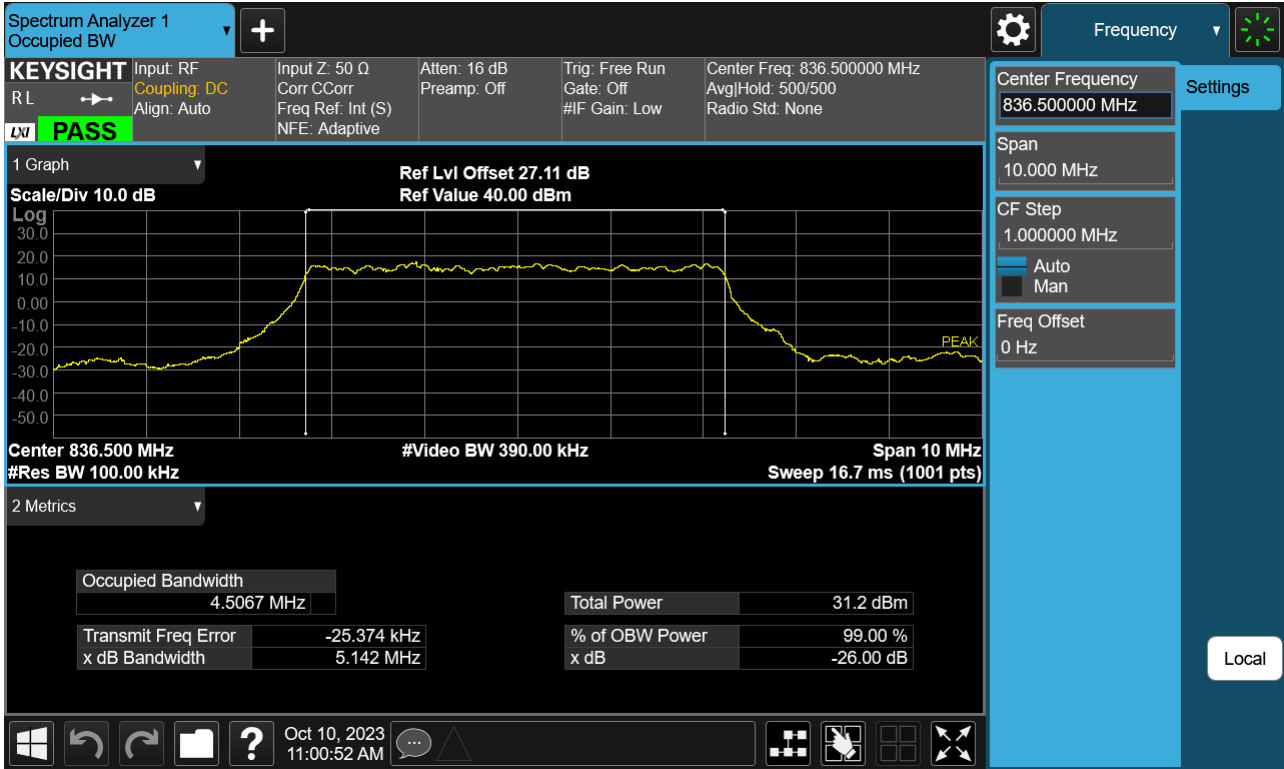
Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit (dBm)
1 693.00	-58.45	11.10	-66.27	4.50	V	-59.67	-13.00
2 539.50	-59.06	11.40	-61.87	5.64	V	-56.11	-13.00
3 386.00	-60.57	13.80	-62.14	6.65	V	-54.99	-13.00

Freq.(MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit (dBm)
4 620.00	-61.50	11.50	-65.35	3.43	H	-57.28	-40.00
6 930.00	-63.84	10.90	-58.60	4.32	H	-52.02	-40.00
9 240.00	-61.10	10.80	-53.02	5.06	H	-47.28	-40.00

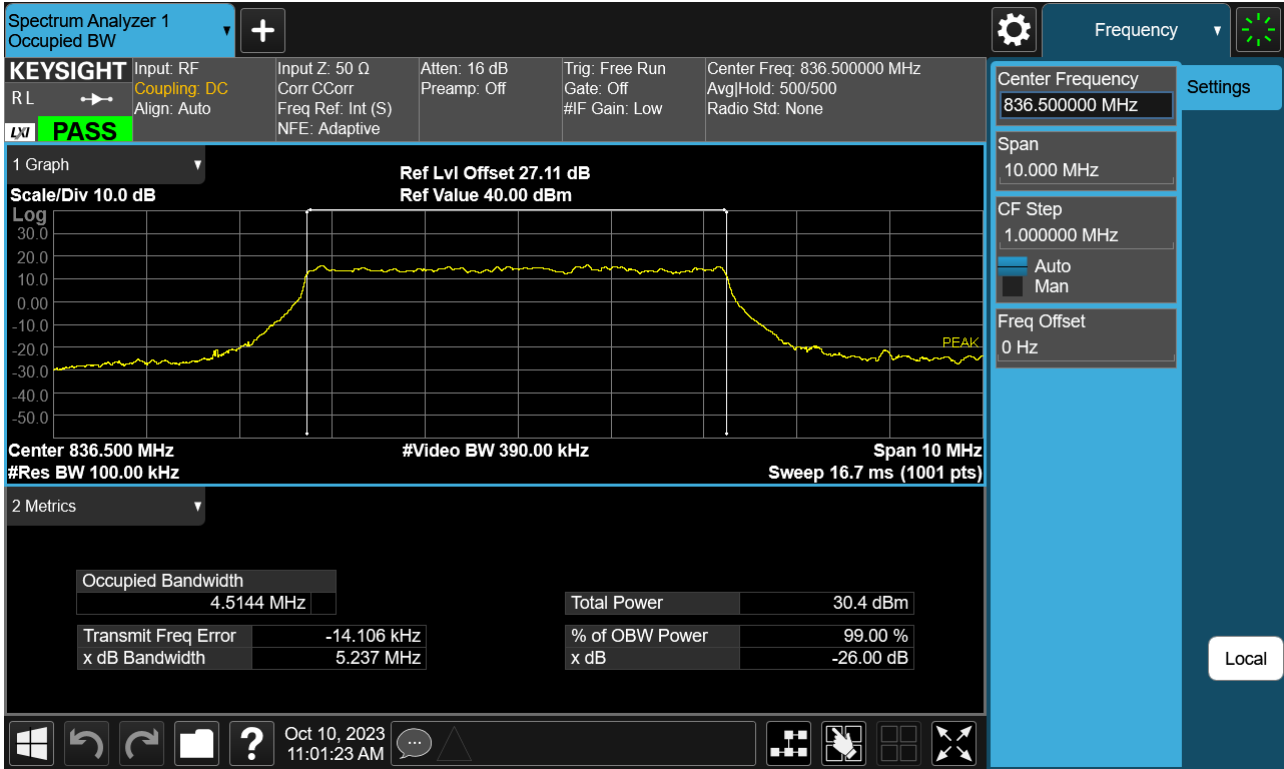
## 11. TEST PLOTS(Ant A)



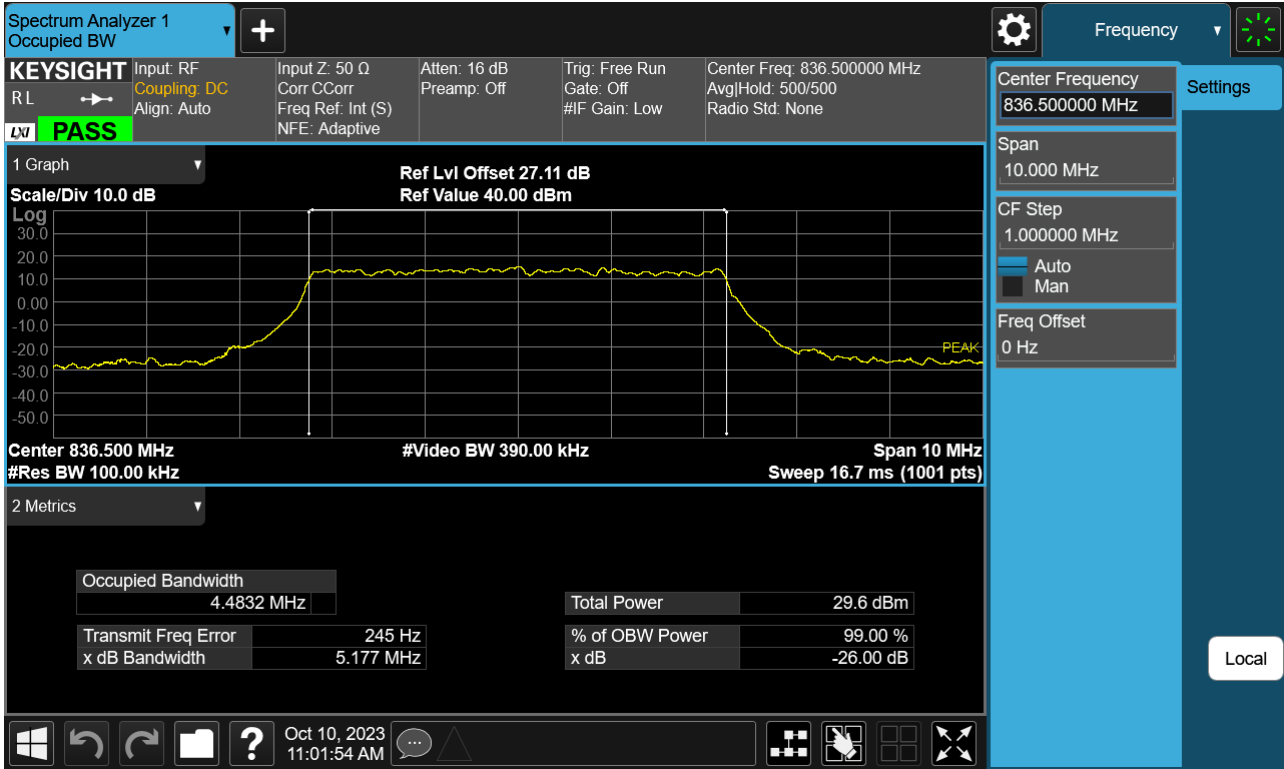
Sub6 n5. Occupied Bandwidth Plot (5 M BW Ch.167300 BPSK\_RB 25\_0)



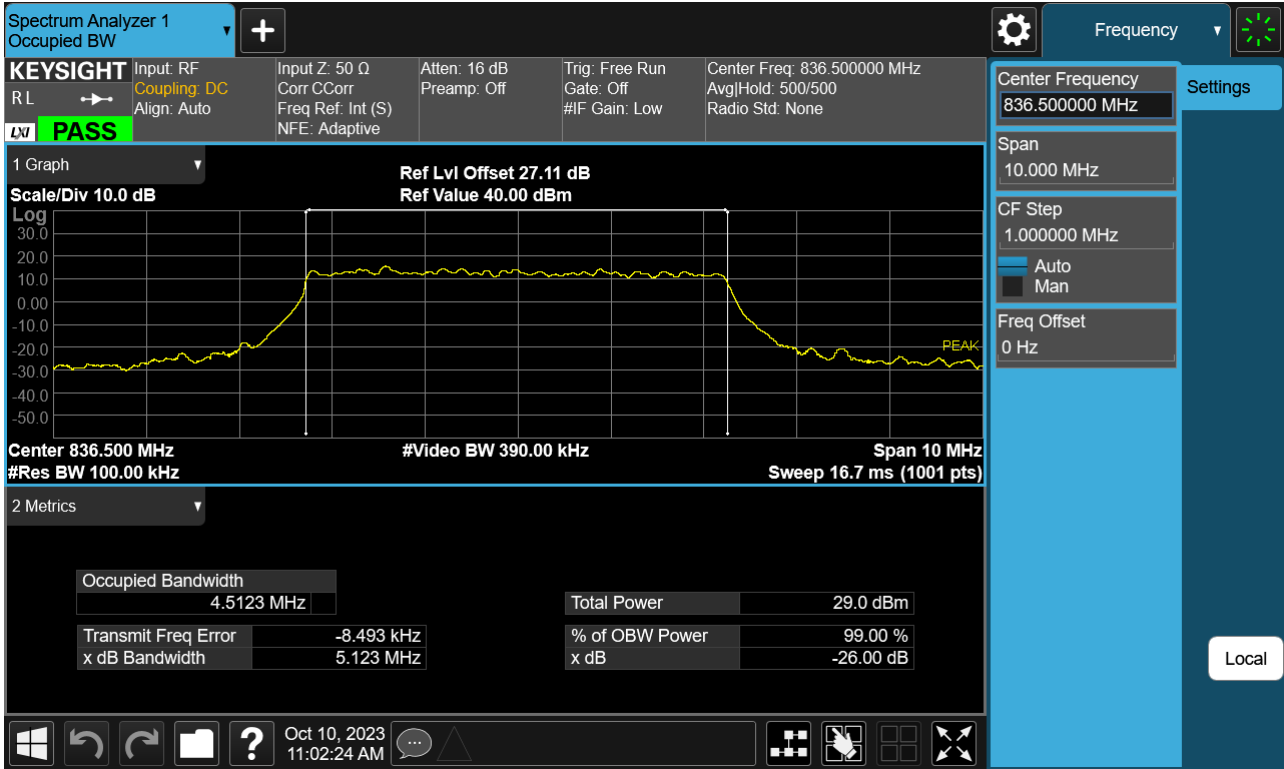
Sub6 n5. Occupied Bandwidth Plot (5 M BW Ch.167300 QPSK\_RB 25\_0)



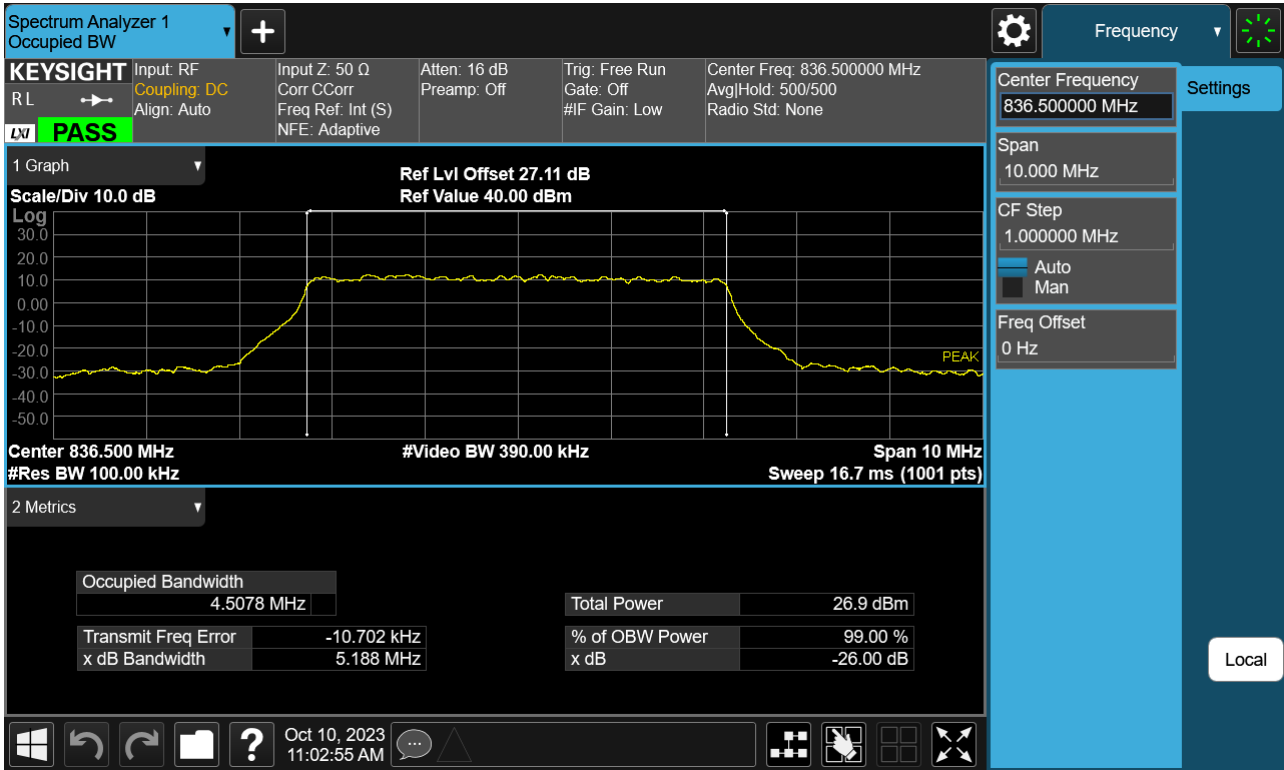
Sub6 n5. Occupied Bandwidth Plot (5 M BW Ch.167300 16QAM\_RB 25\_0)



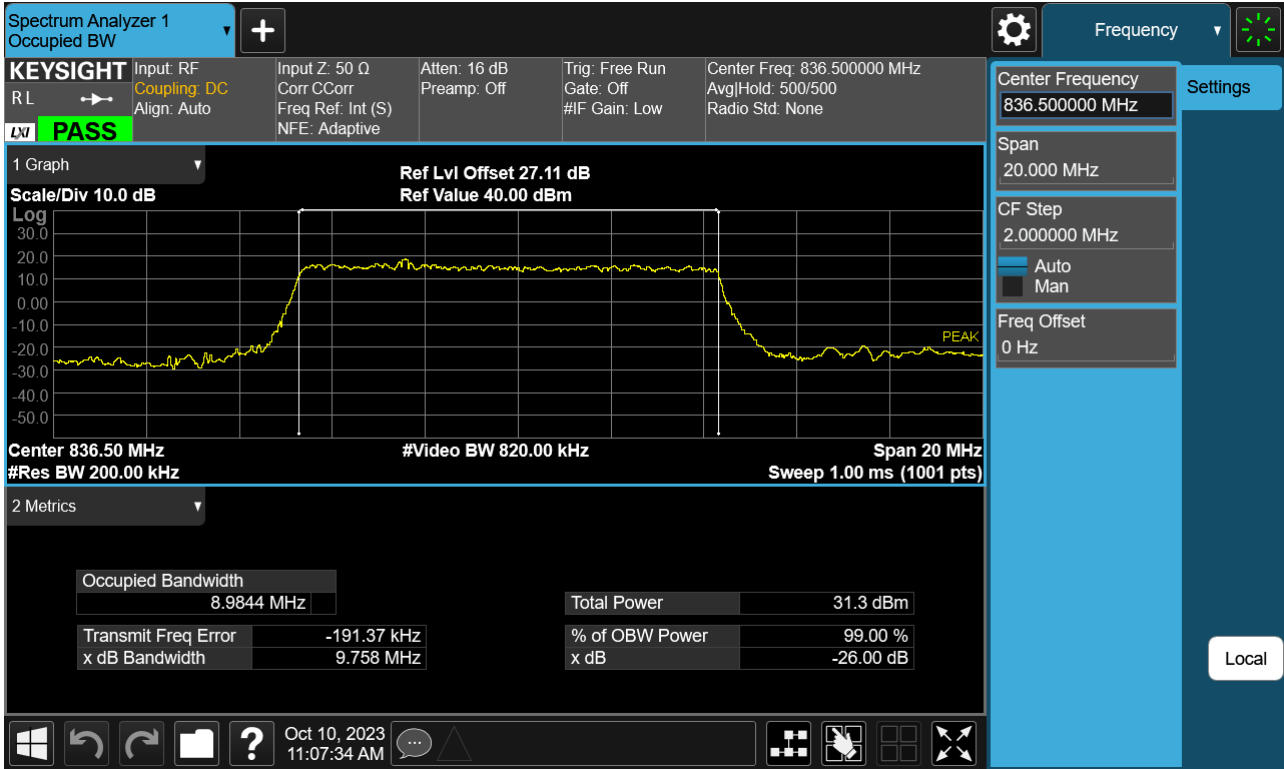
Sub6 n5. Occupied Bandwidth Plot (5 M BW Ch.167300 64QAM\_RB 25\_0)



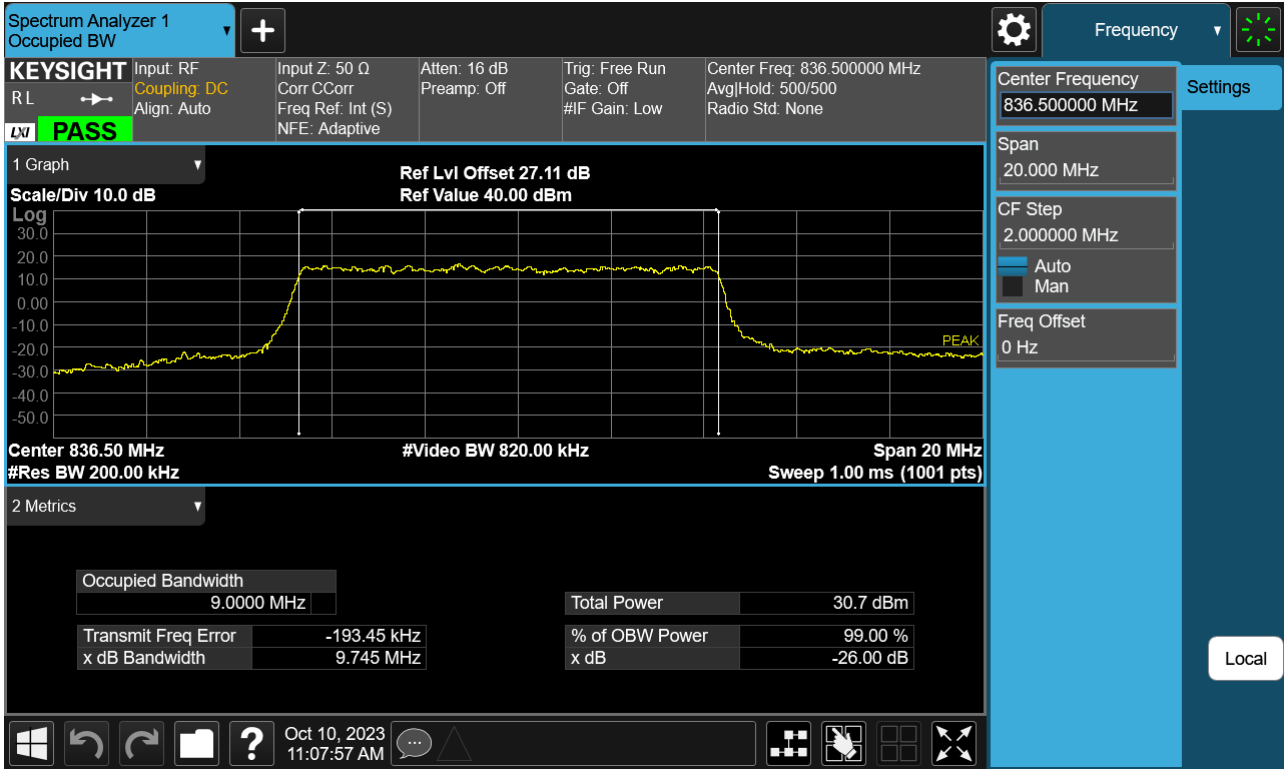
Sub6 n5. Occupied Bandwidth Plot (5 M BW Ch.167300 256QAM\_RB 25\_0)



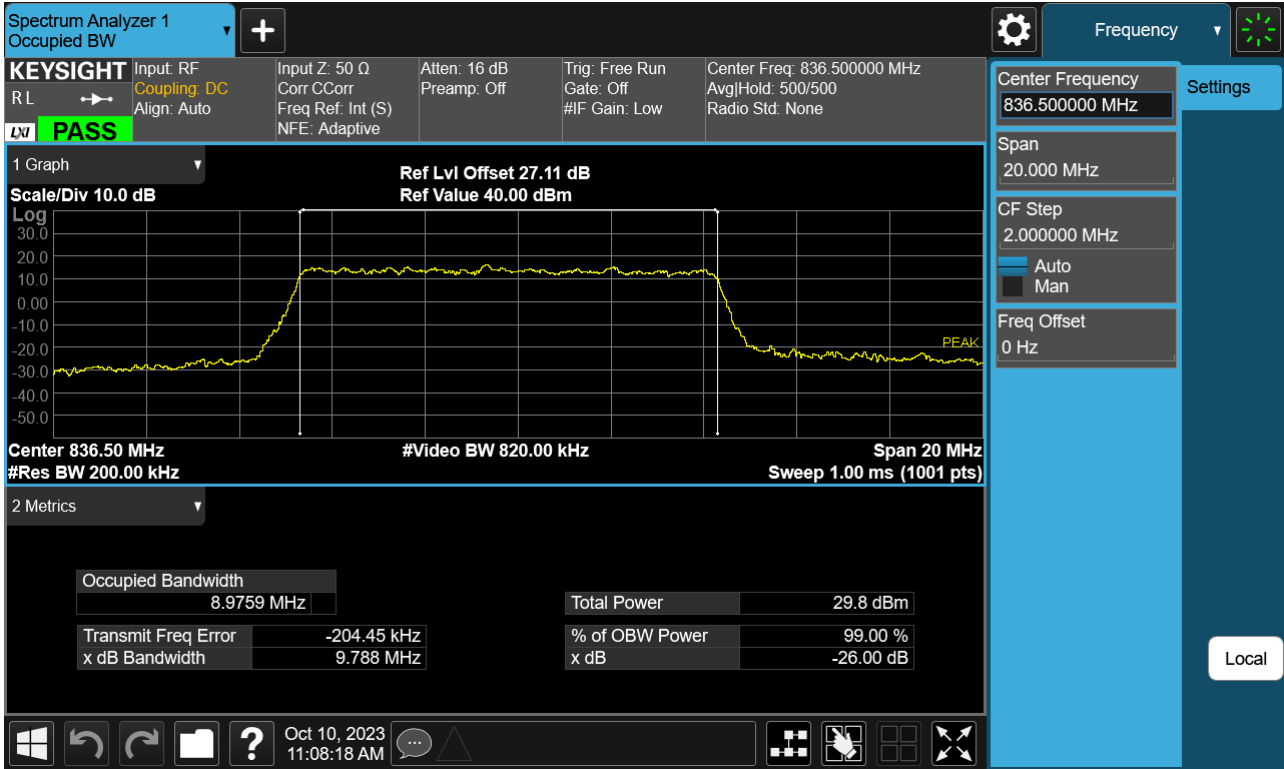
Sub6 n5. Occupied Bandwidth Plot (10 M BW Ch.167300 BPSK\_RB 50\_0)



Sub6 n5. Occupied Bandwidth Plot (10 M BW Ch.167300 QPSK\_RB 50\_0)

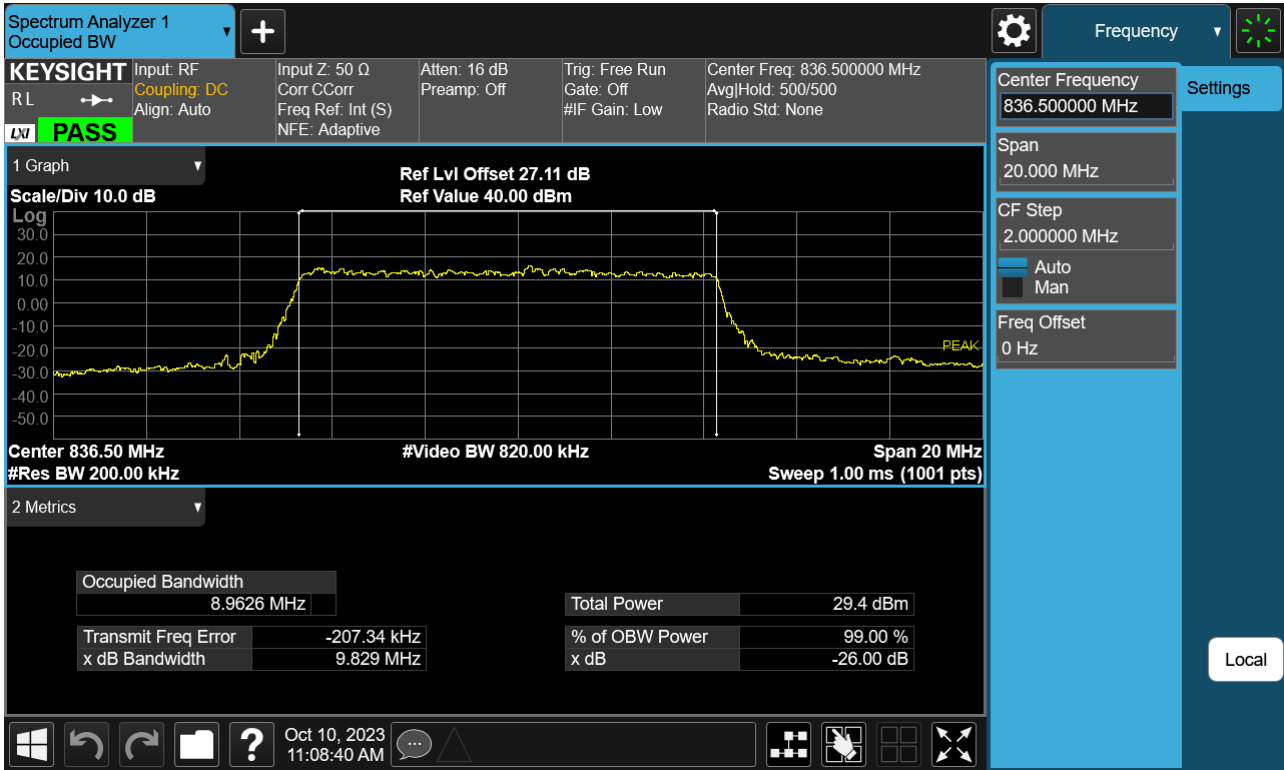


Sub6 n5. Occupied Bandwidth Plot (10 M BW Ch.167300 16QAM\_RB 50\_0)

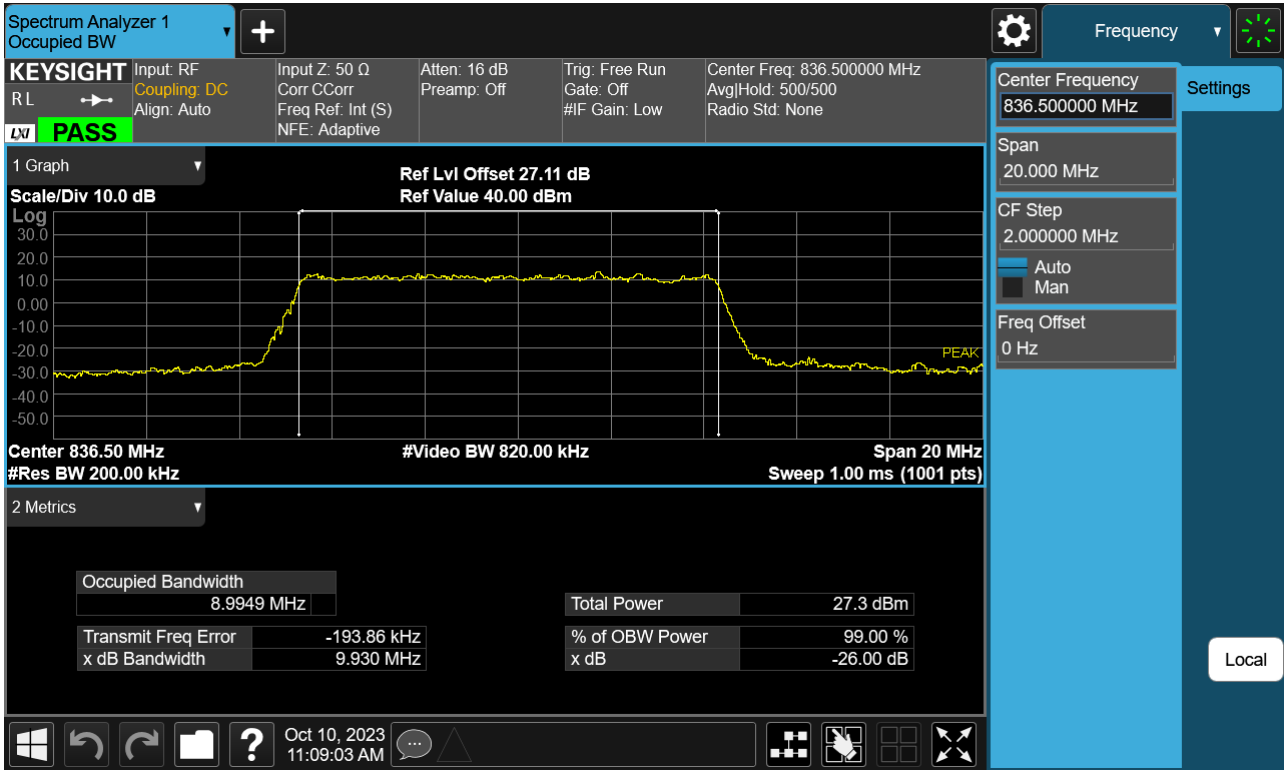




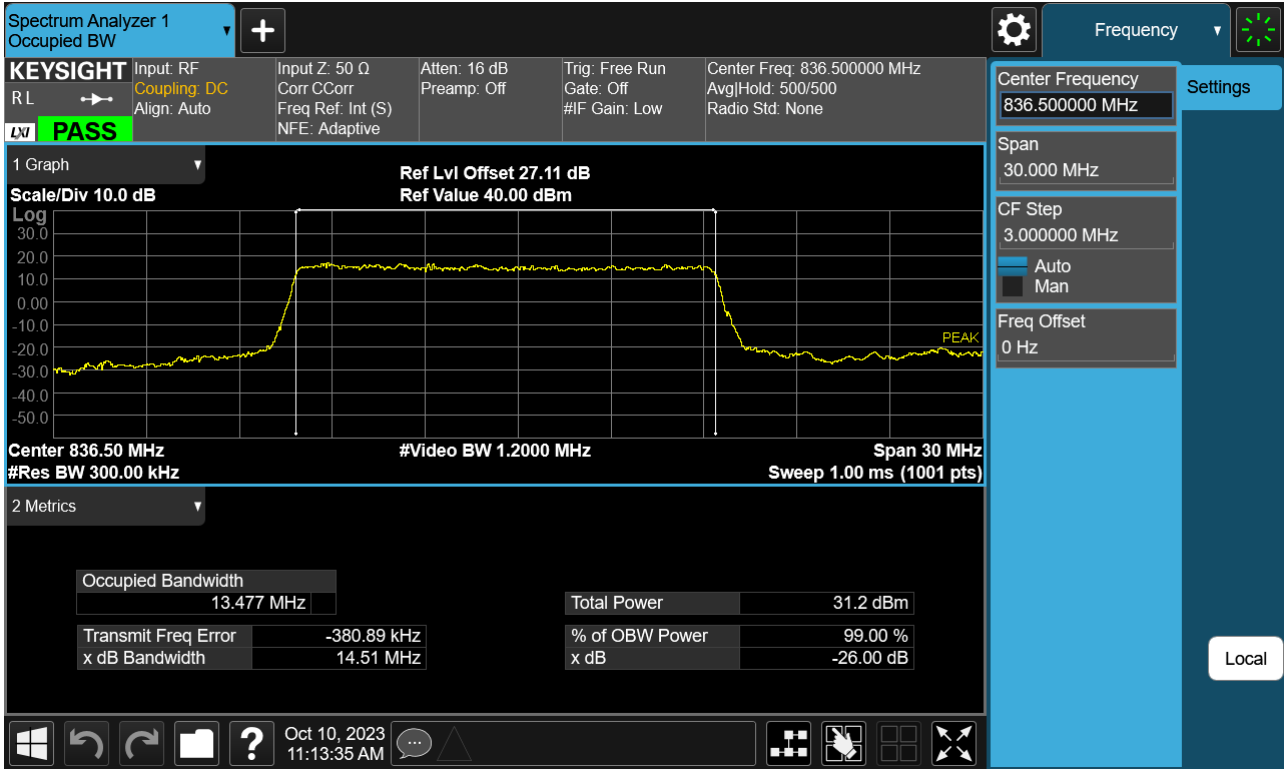
Sub6 n5. Occupied Bandwidth Plot (10 M BW Ch.167300 64QAM\_RB 50\_0)



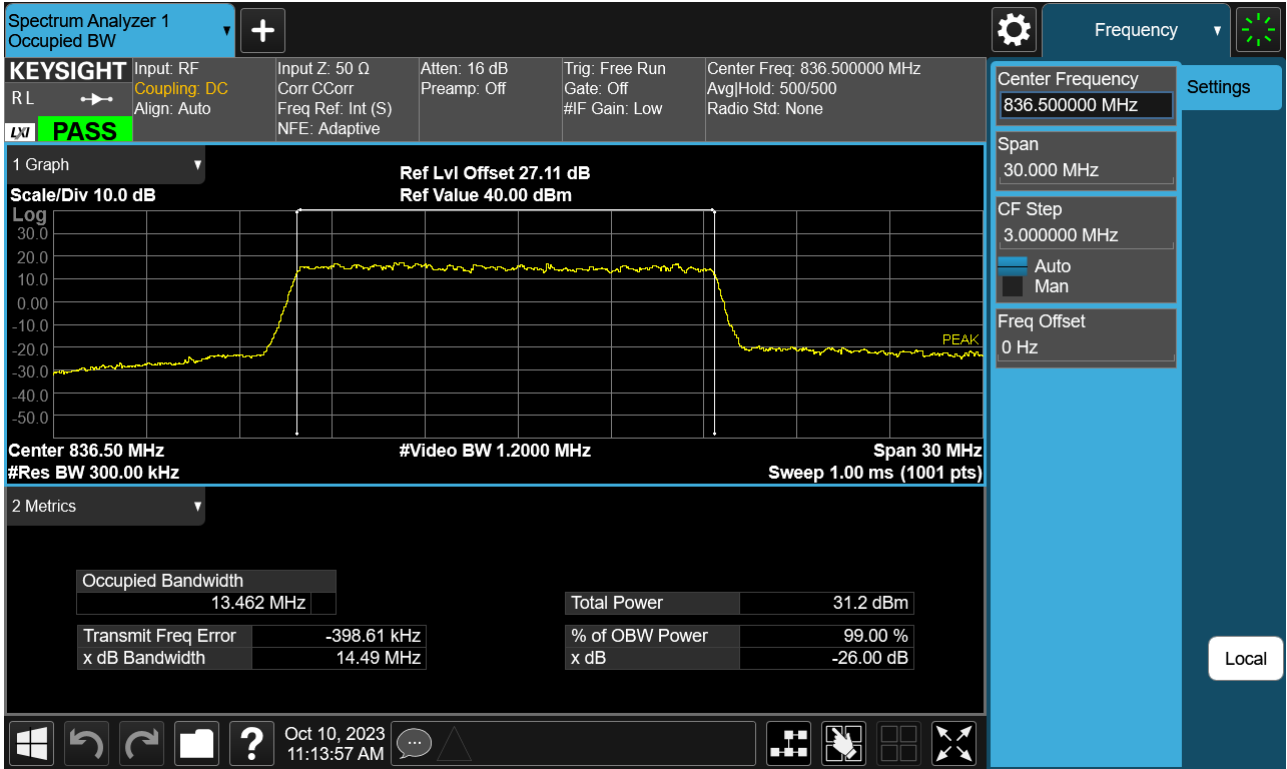
Sub6 n5. Occupied Bandwidth Plot (10 M BW Ch.167300 256QAM\_RB 50\_0)



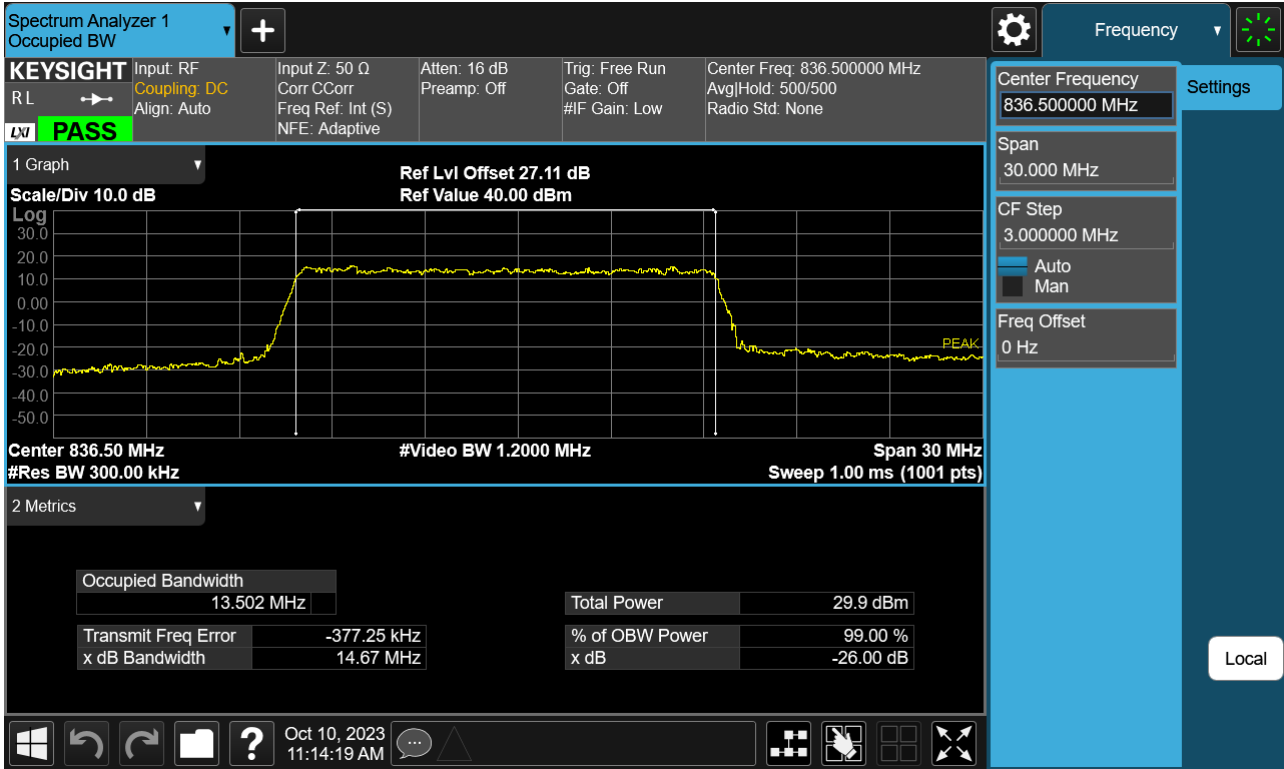
Sub6 n5. Occupied Bandwidth Plot (15 M BW Ch.167300 BPSK RB 75\_0)



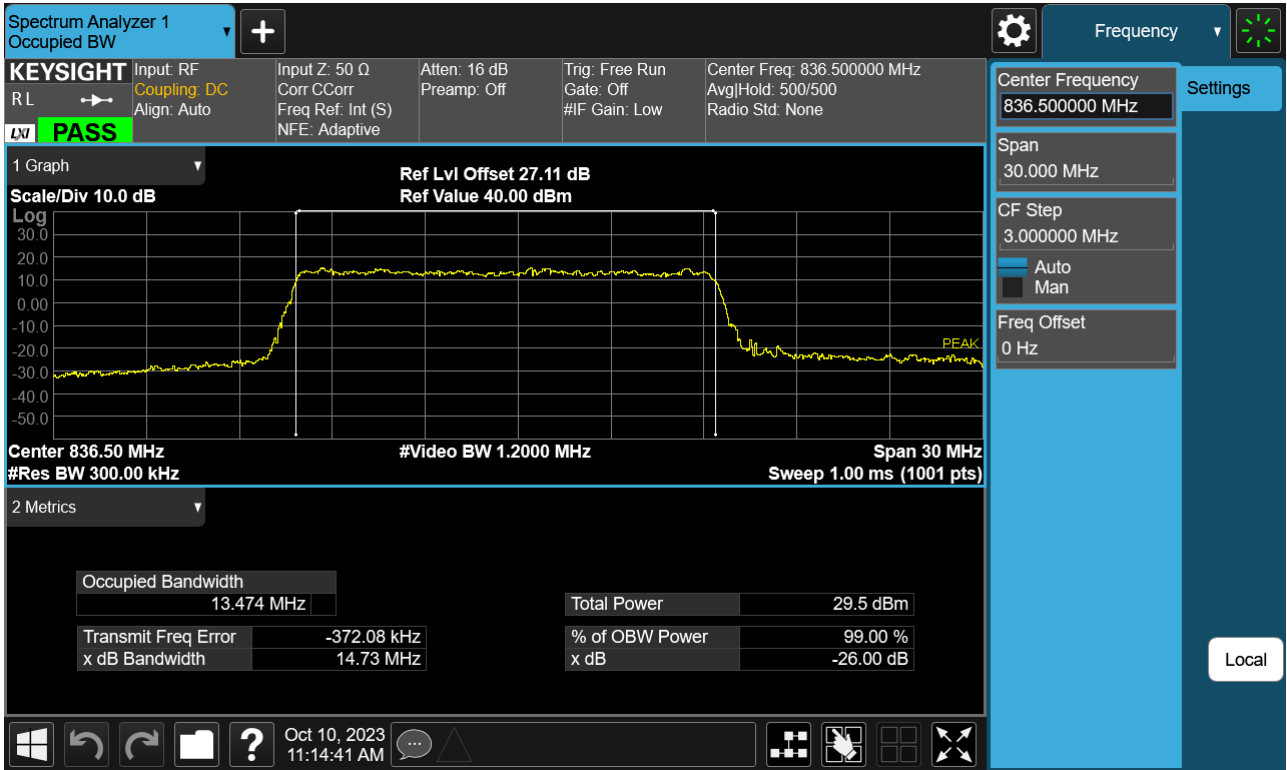
Sub6 n5. Occupied Bandwidth Plot (15 M BW Ch.167300 QPSK RB 75\_0)



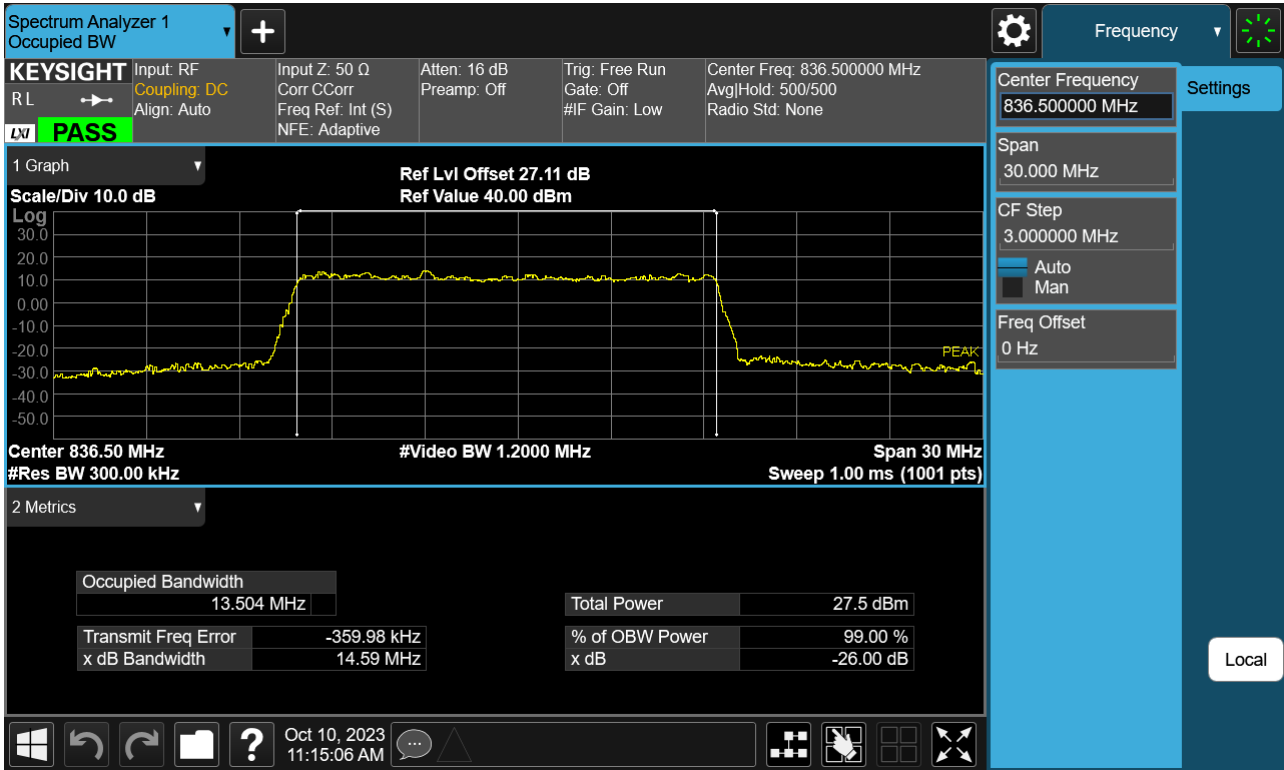
Sub6 n5. Occupied Bandwidth Plot (15 M BW Ch.167300 16QAM RB 75\_0)



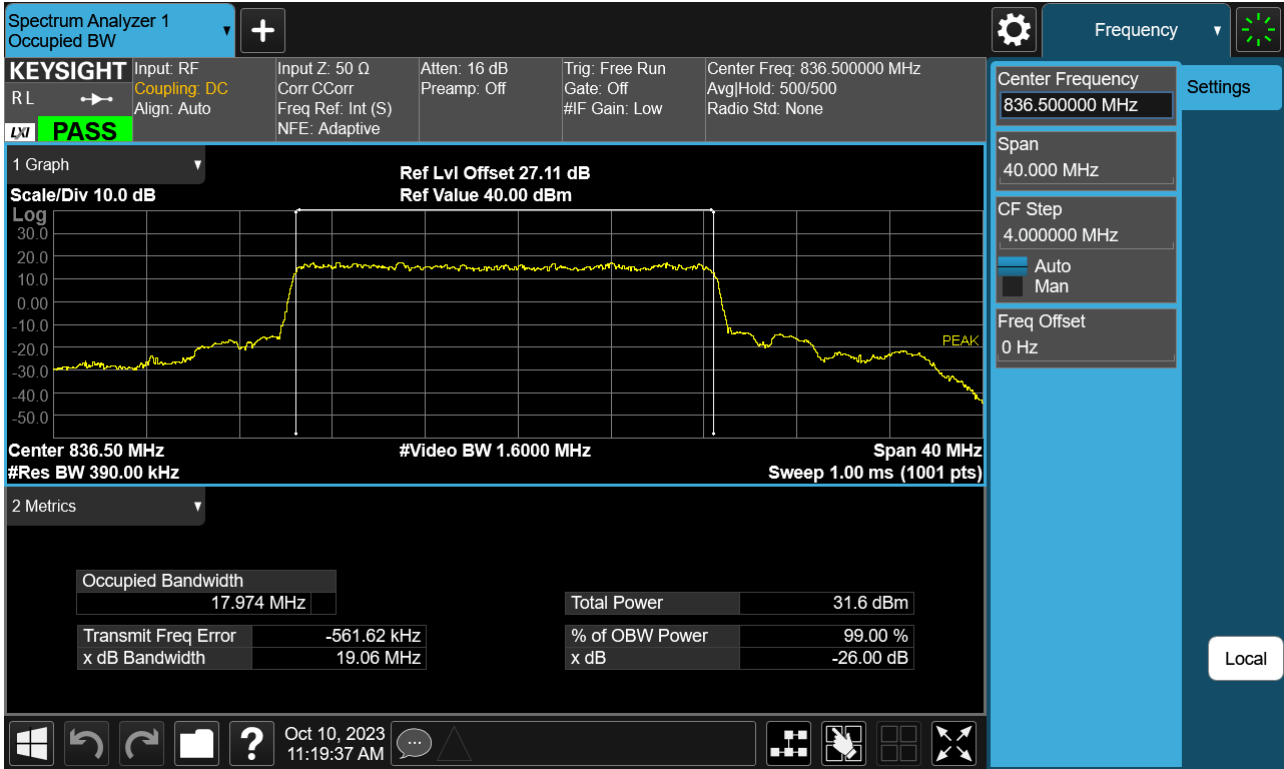
Sub6 n5. Occupied Bandwidth Plot (15 M BW Ch.167300 64QAM RB 75\_0)



Sub6 n5. Occupied Bandwidth Plot (15 M BW Ch.167300 256QAM RB 75\_0)

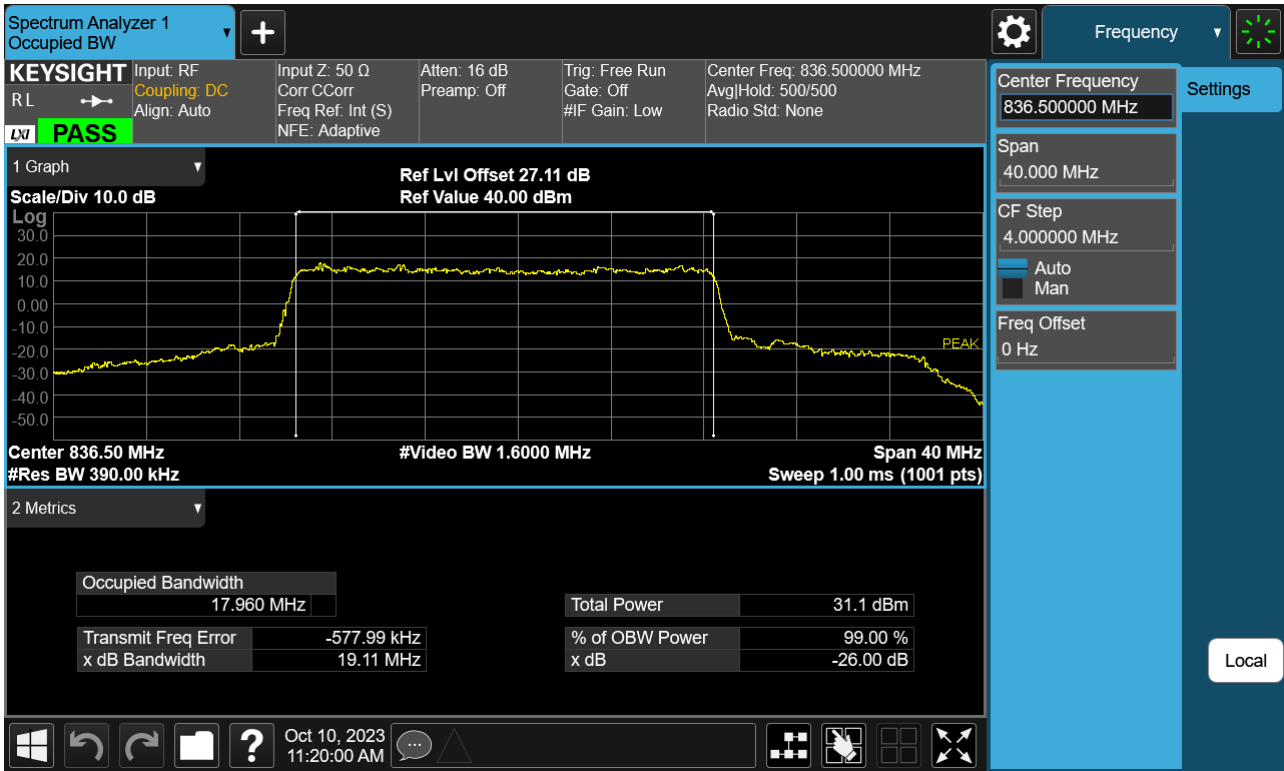


Sub6 n5. Occupied Bandwidth Plot (20 M BW Ch.167300 BPSK RB 100\_0)

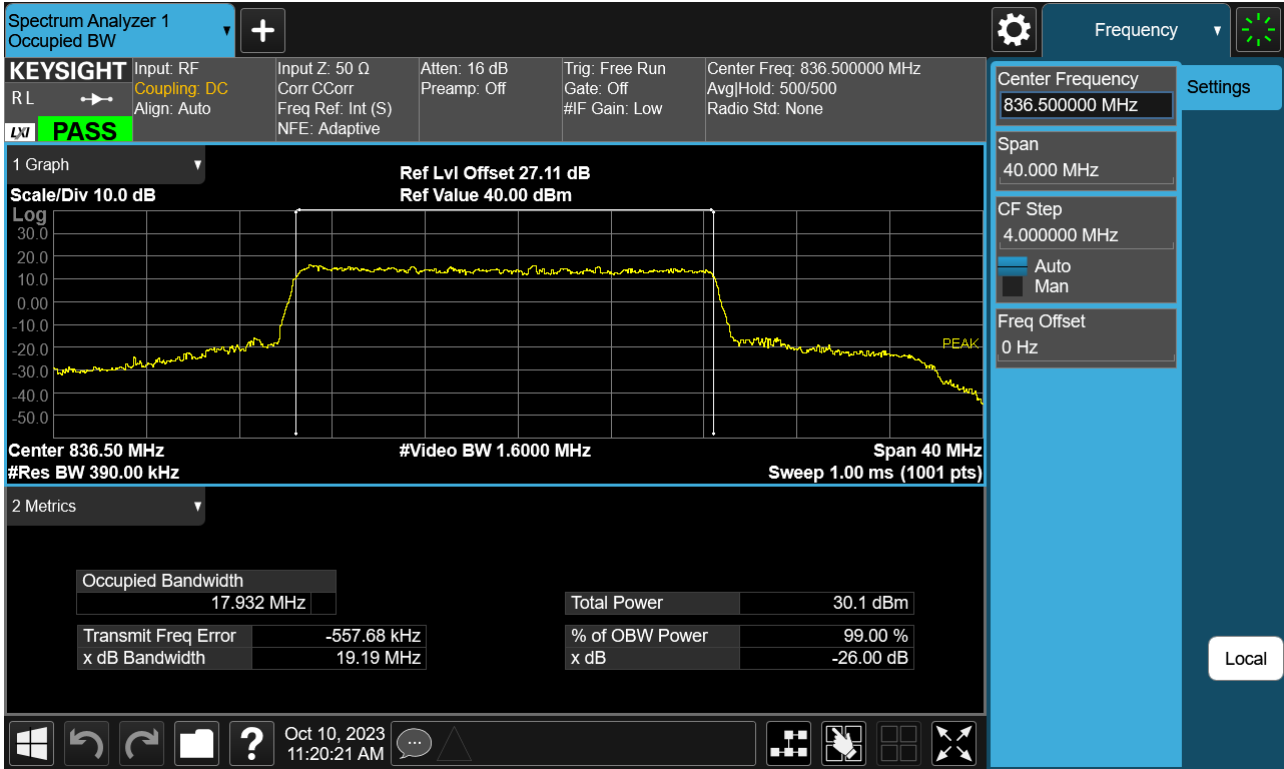




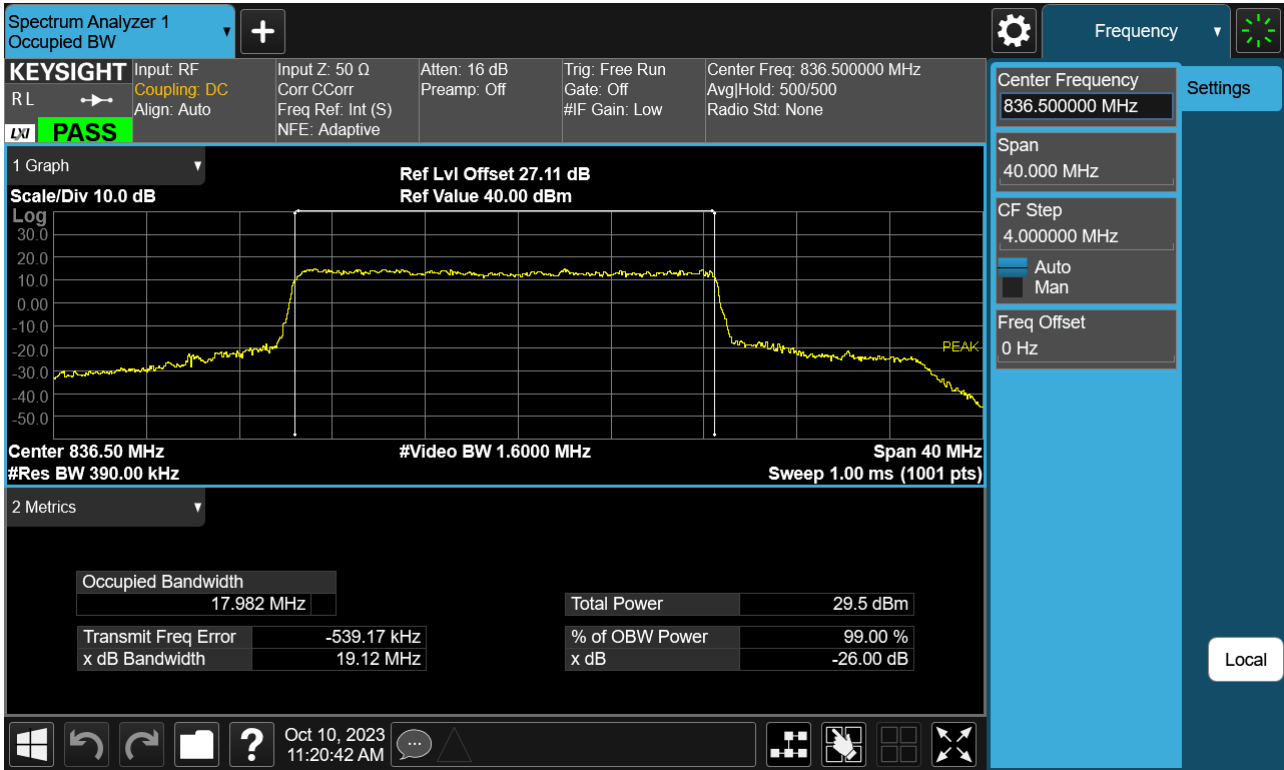
Sub6 n5. Occupied Bandwidth Plot (20 M BW Ch.167300 QPSK RB 100\_0)



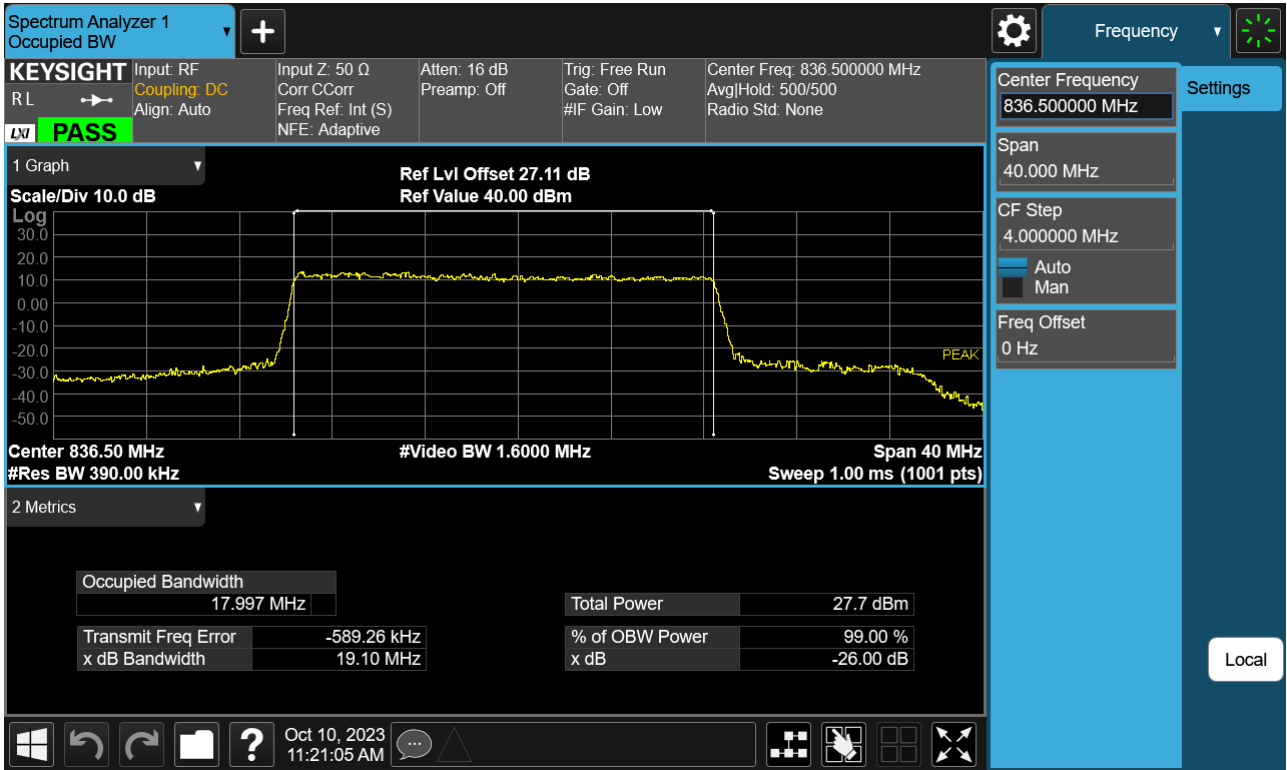
Sub6 n5. Occupied Bandwidth Plot (20 M BW Ch.167300 16QAM RB 100\_0)



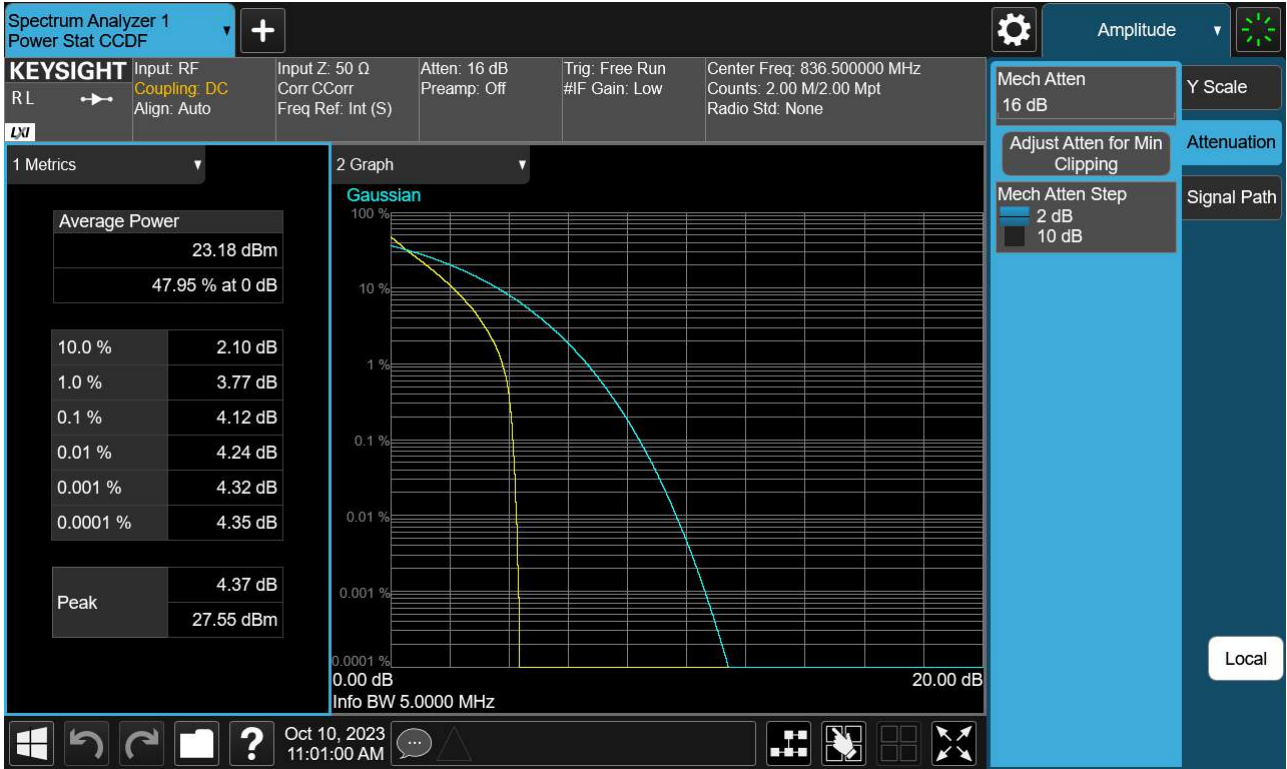
Sub6 n5. Occupied Bandwidth Plot (20 M BW Ch.167300 64QAM RB 100\_0)



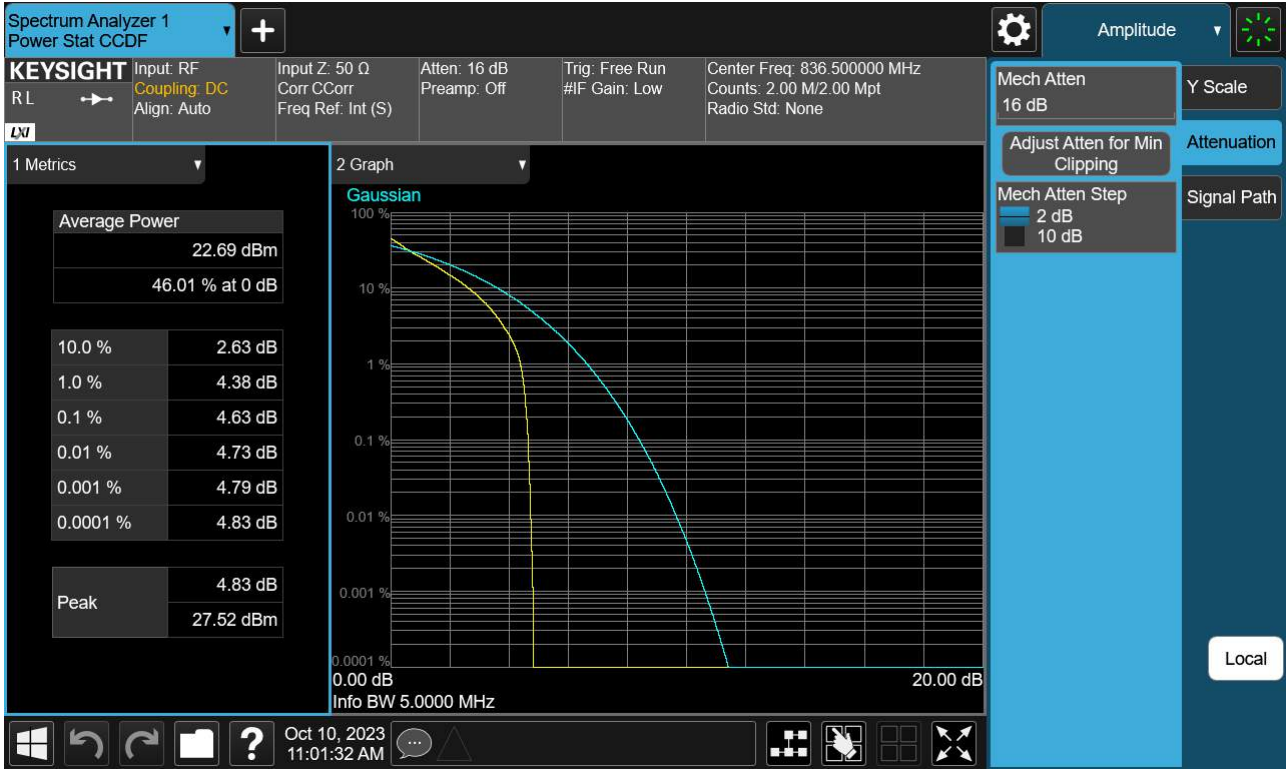
Sub6 n5. Occupied Bandwidth Plot (20 M BW Ch.167300 256QAM RB 100\_0)



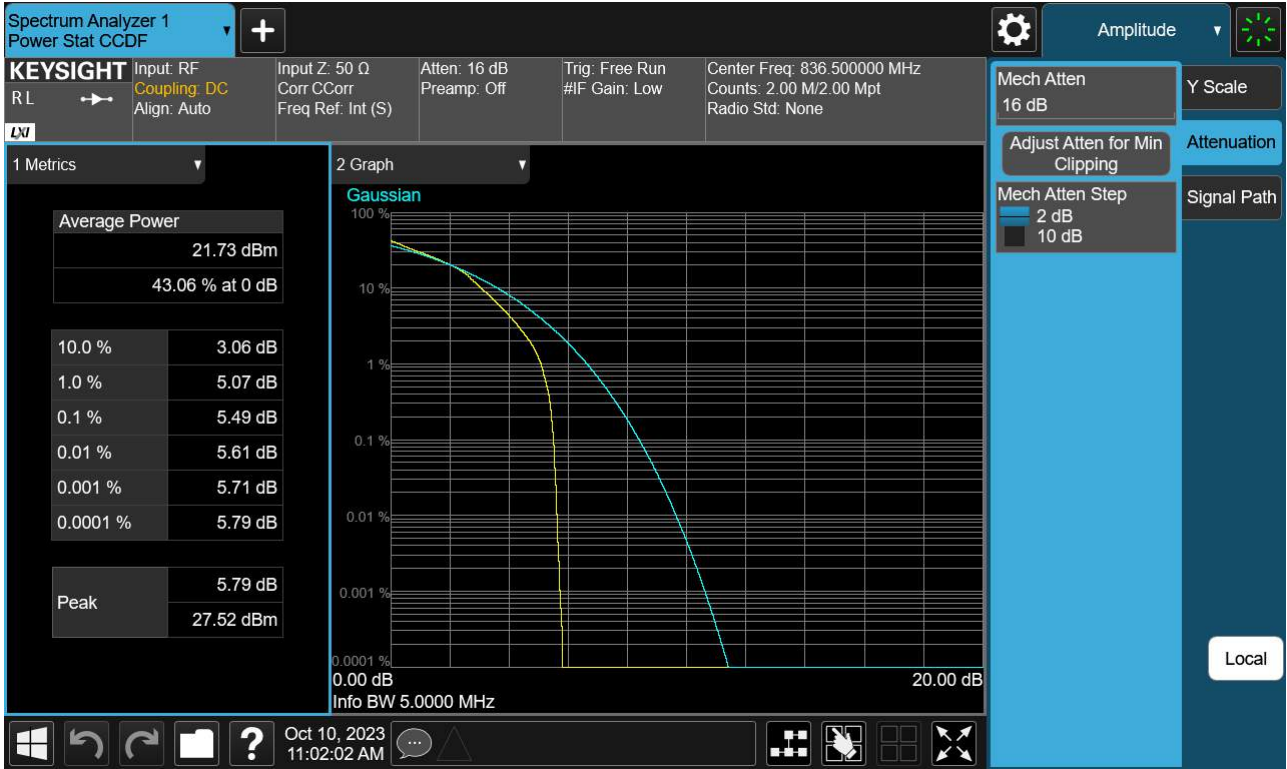
Sub6 n5. PAR Plot (5 M BW Ch.167300 BPSK\_RB 25\_0)



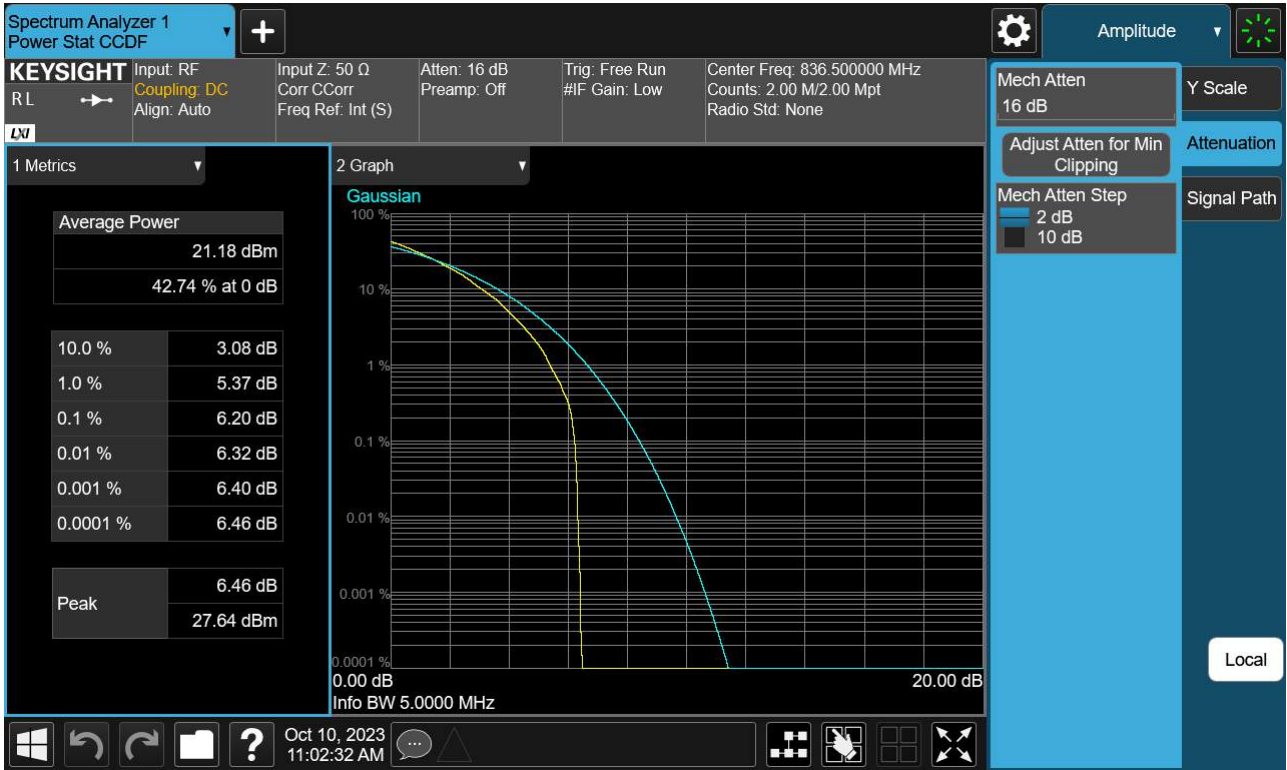
Sub6 n5. PAR Plot (5 M BW Ch.167300 QPSK\_RB 25\_0)



Sub6 n5. PAR Plot (5 M BW Ch.167300 16QAM\_RB 25\_0)



Sub6 n5. PAR Plot (5 M BW Ch.167300 64QAM\_RB 25\_0)





Sub6 n5. PAR Plot (5 M BW Ch.167300 256QAM\_RB 25\_0)



Sub6 n5. PAR Plot (10 M BW Ch.167300 BPSK\_RB 50\_0)



Sub6 n5. PAR Plot (10 M BW Ch.167300 QPSK\_RB 50\_0)



Sub6 n5. PAR Plot (10 M BW Ch.167300 16QAM\_RB 50\_0)



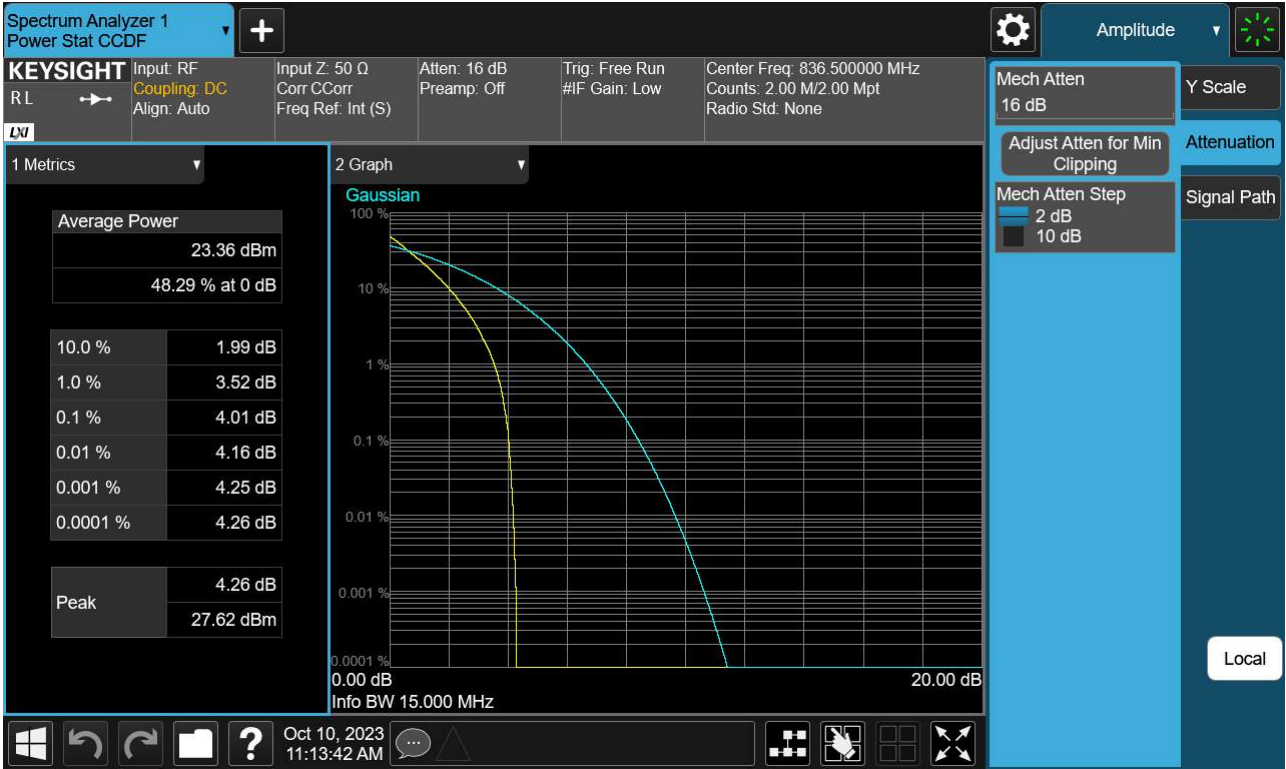
Sub6 n5. PAR Plot (10 M BW Ch.167300 64QAM\_RB 50\_0)



Sub6 n5. PAR Plot (10 M BW Ch.167300 256QAM\_RB 50\_0)



Sub6 n5. PAR Plot (15 M BW Ch.167300 BPSK RB 75\_0)



Sub6 n5. PAR Plot (15 M BW Ch.167300 QPSK RB 75\_0)





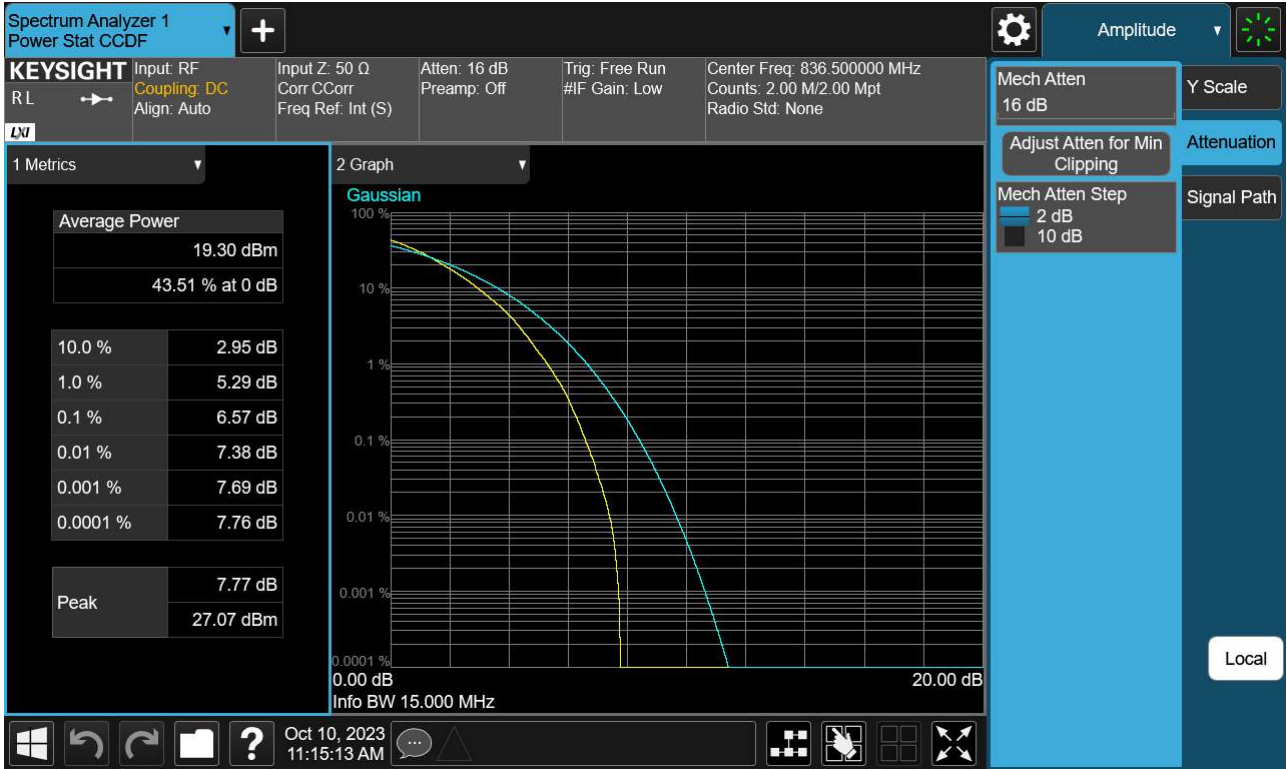
Sub6 n5. PAR Plot (15 M BW Ch.167300 16QAM RB 75\_0)



Sub6 n5. PAR Plot (15 M BW Ch.167300 64QAM RB 75\_0)



Sub6 n5. PAR Plot (15 M BW Ch.167300 256QAM RB 75\_0)



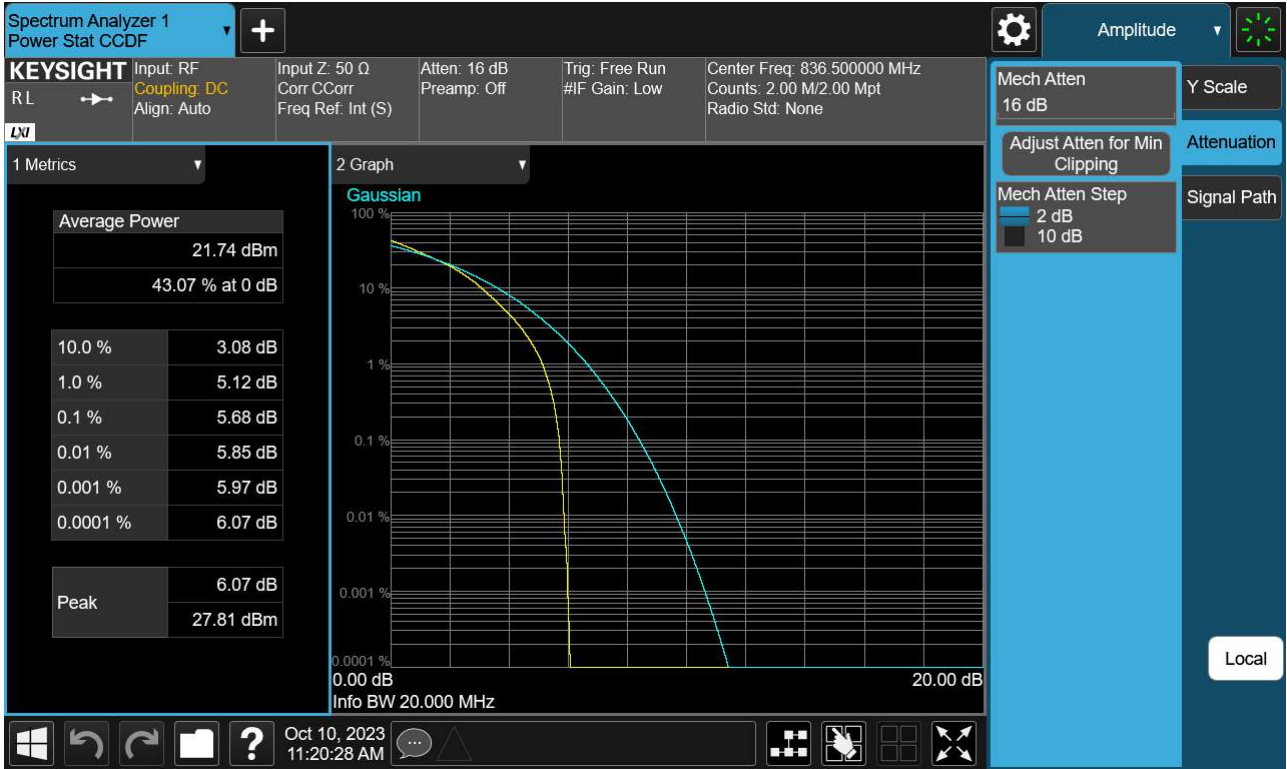
Sub6 n5. PAR Plot (20 M BW Ch.167300 BPSK RB 100\_0)



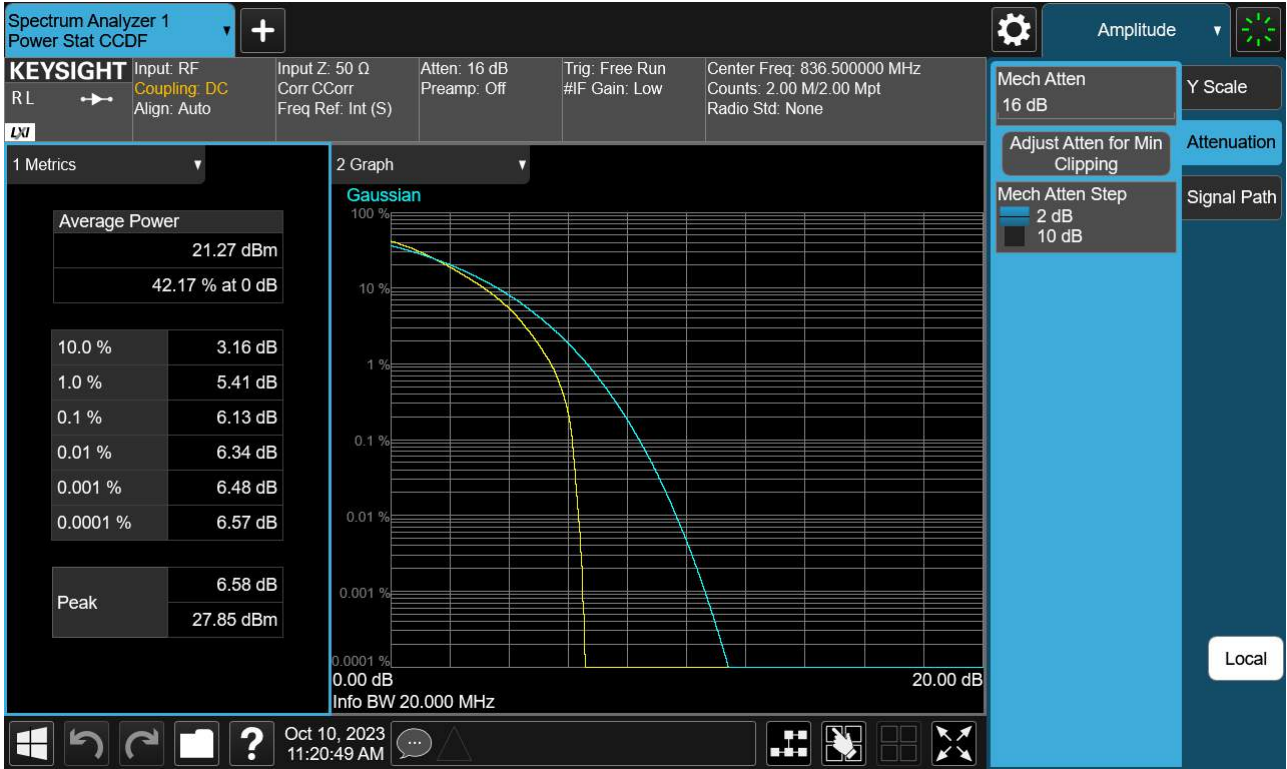
Sub6 n5. PAR Plot (20 M BW Ch.167300 QPSK RB 100\_0)



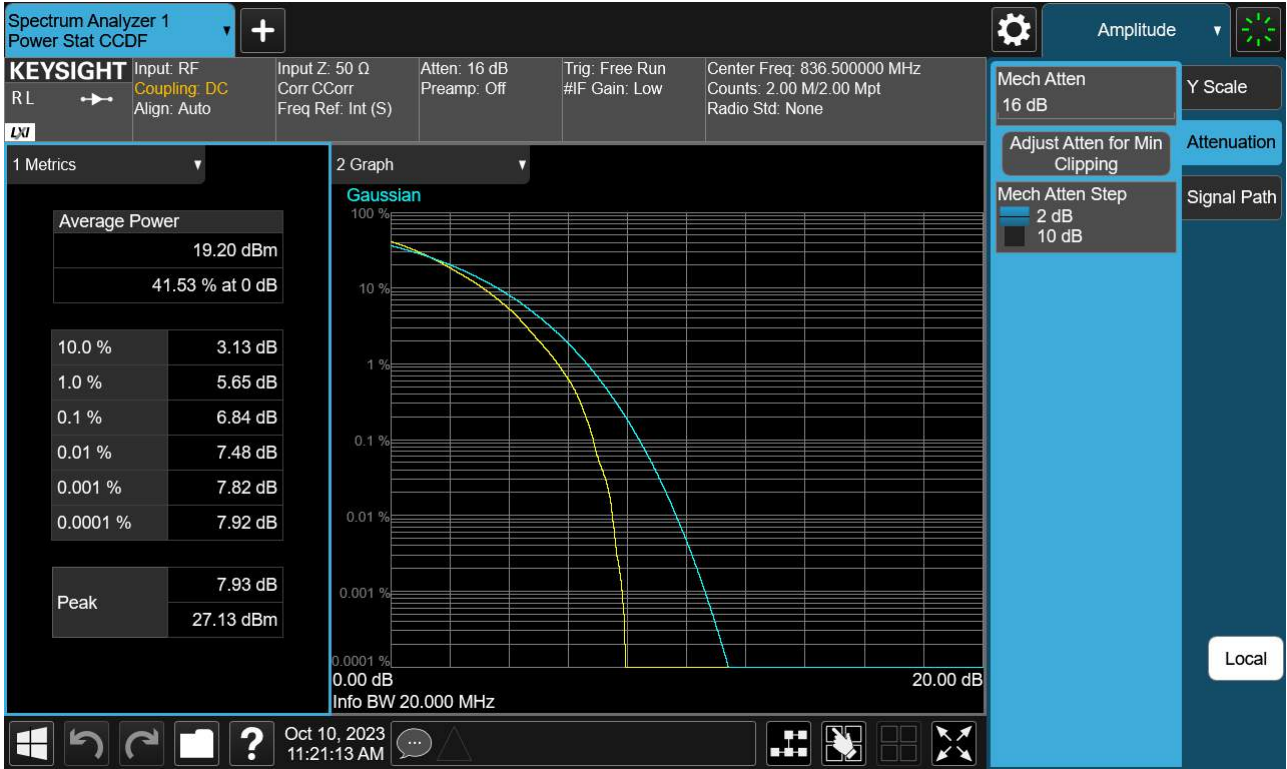
Sub6 n5. PAR Plot (20 M BW Ch.167300 16QAM RB 100\_0)



Sub6 n5. PAR Plot (20 M BW Ch.167300 64QAM RB 100\_0)

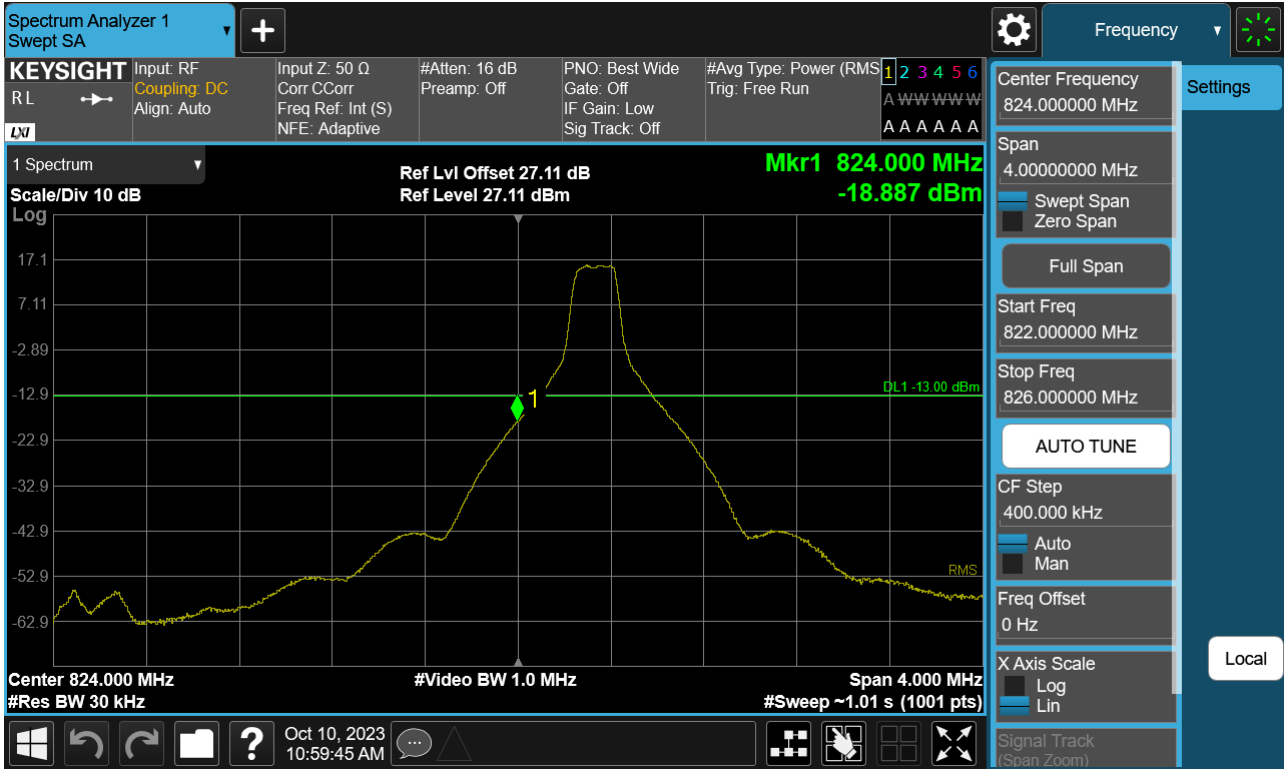


Sub6 n5. PAR Plot (20 M BW Ch.167300 256QAM RB 100\_0)





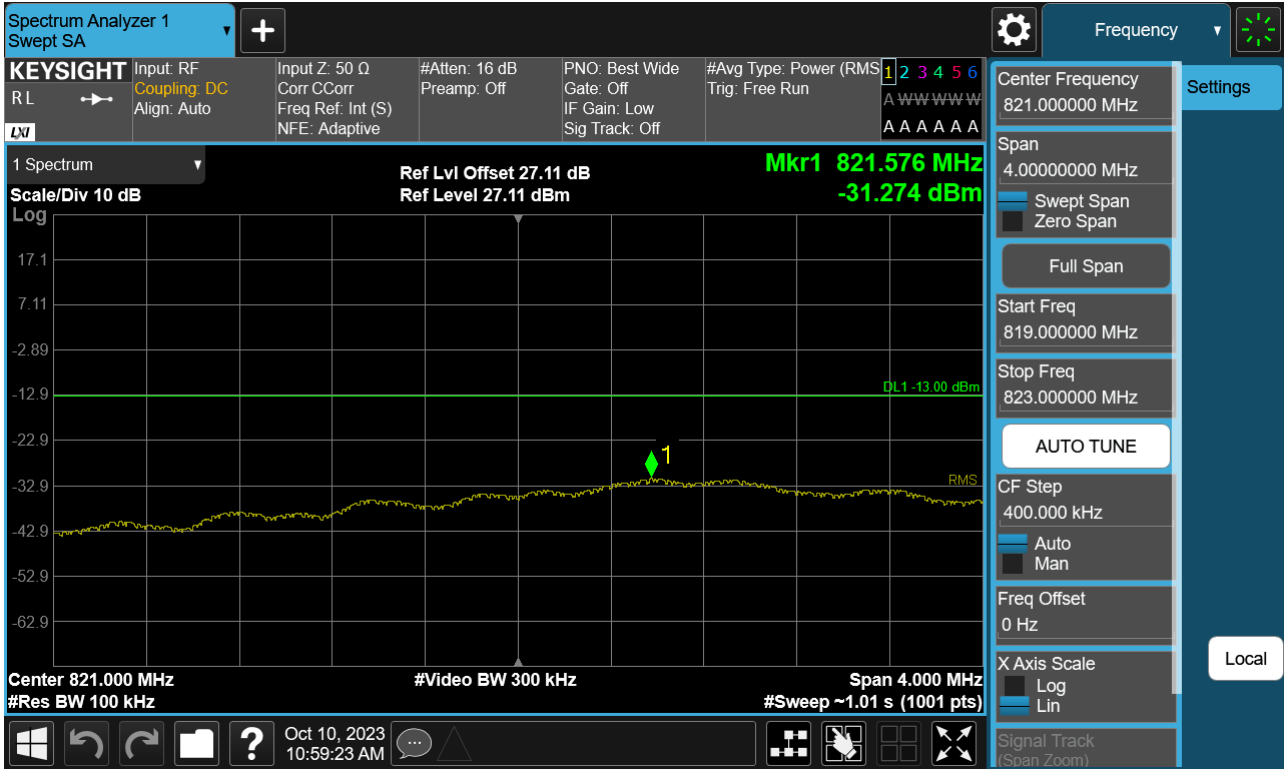
Sub6 n5. Lower Band Edge Plot (5 M BW Ch.165300 BPSK\_RB 1\_Offset 0)



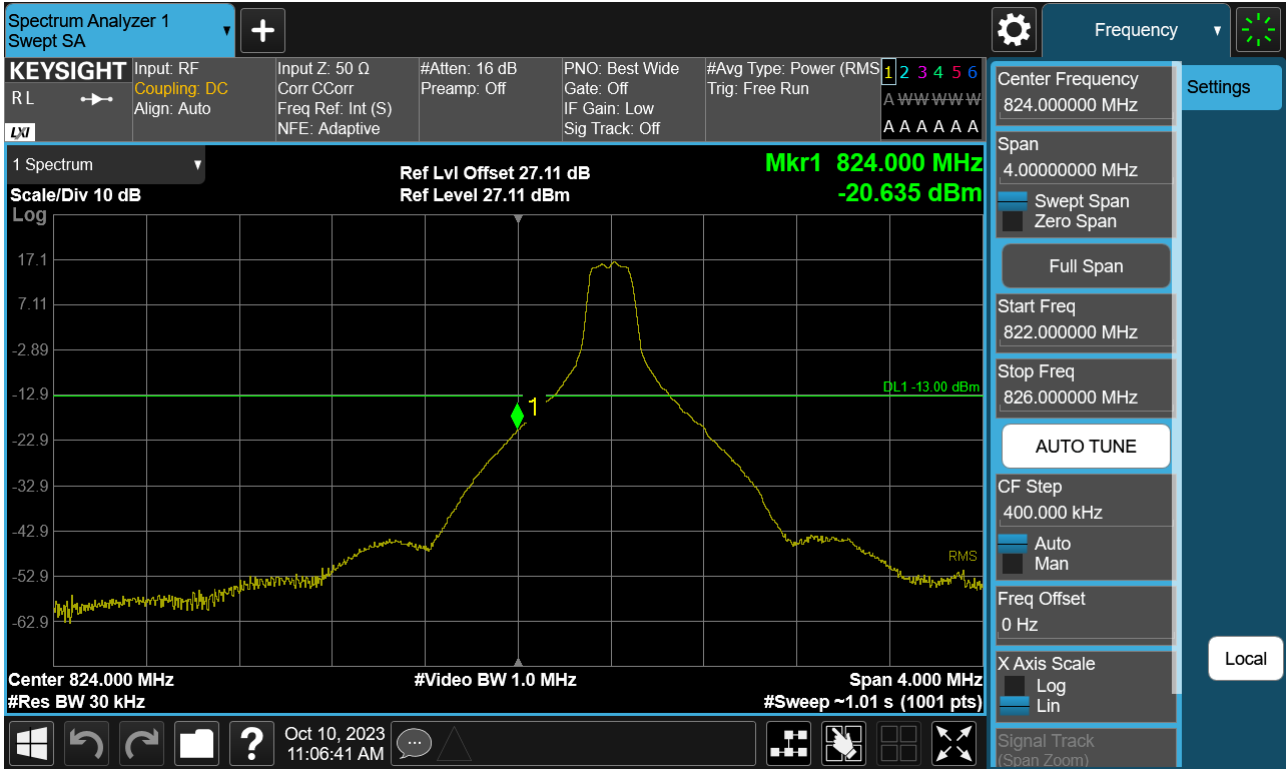
Sub6 n5. Lower Band Edge Plot (5 M BW Ch.165300 BPSK\_RB 25\_Offset 0)



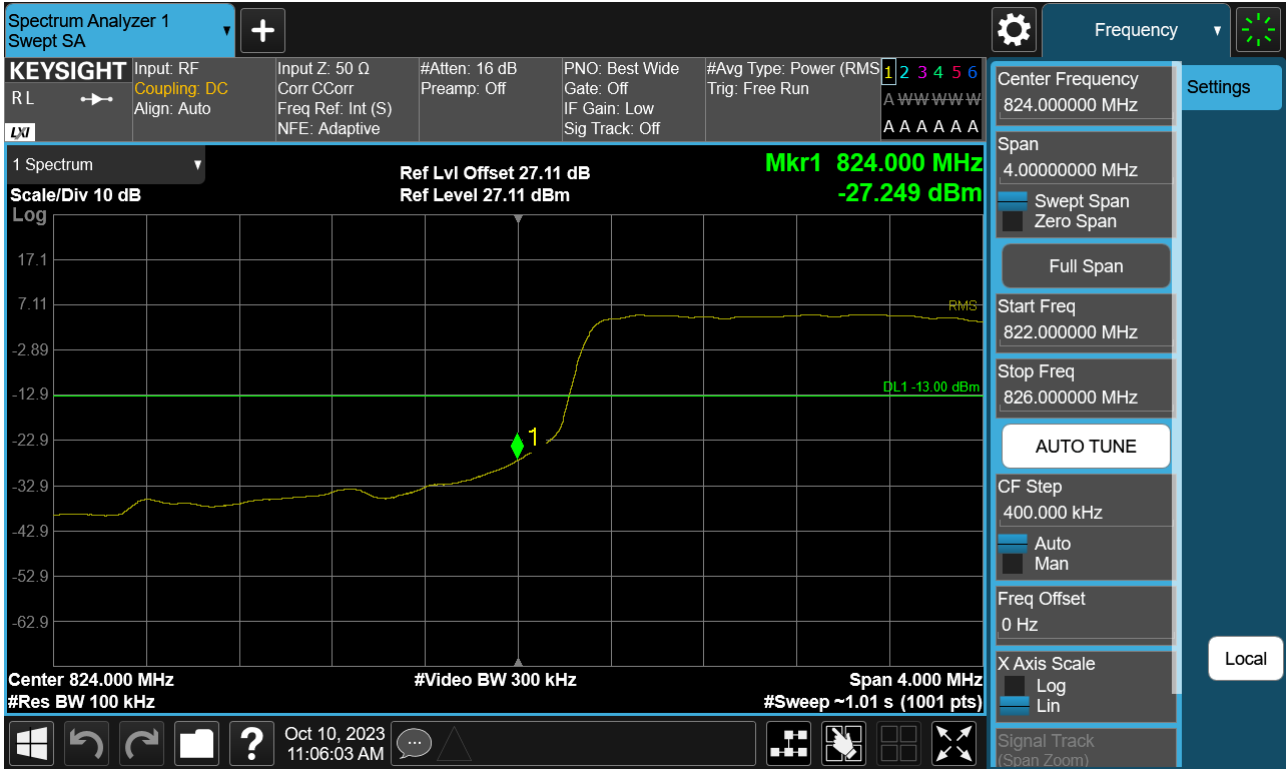
Sub6 n5. Lower Extended Band Edge Plot (5 M BW Ch.165300 BPSK\_RB 25\_0)



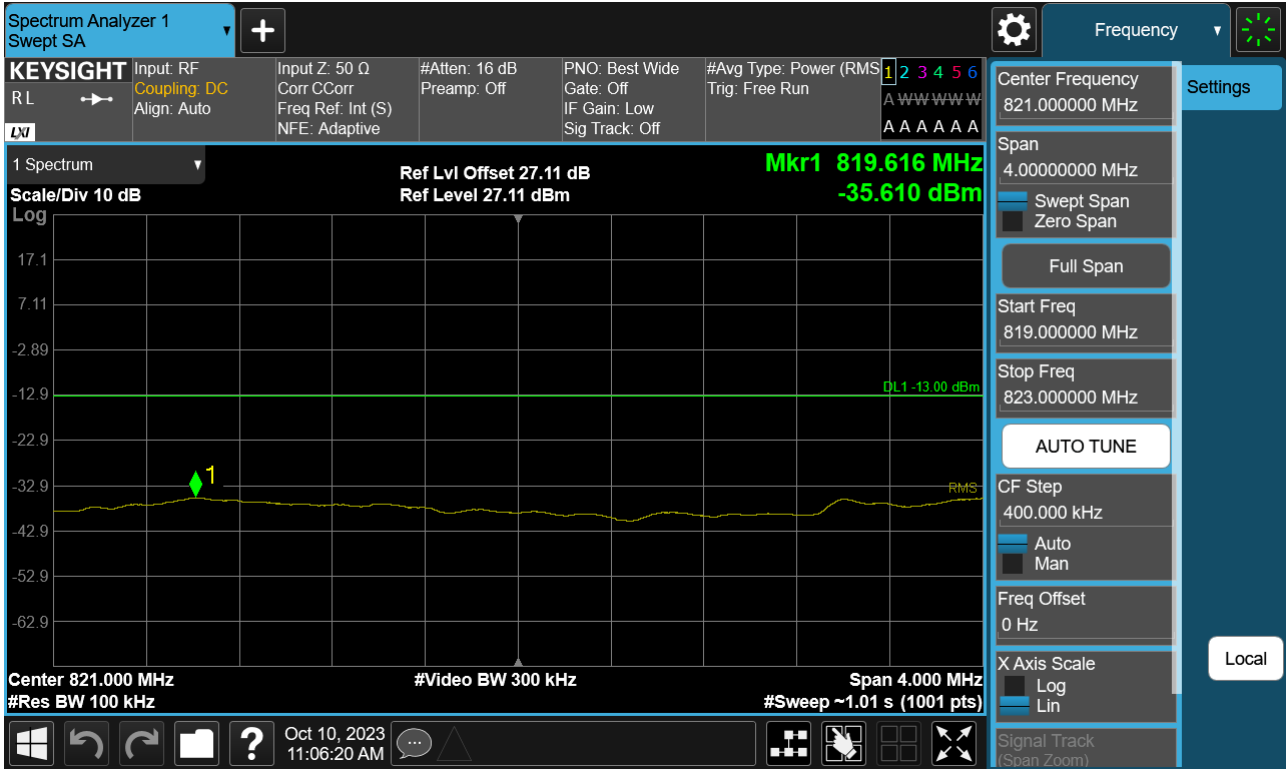
Sub6 n5. Lower Band Edge Plot (10 M BW Ch.165800 BPSK\_RB 1\_Offset 0)



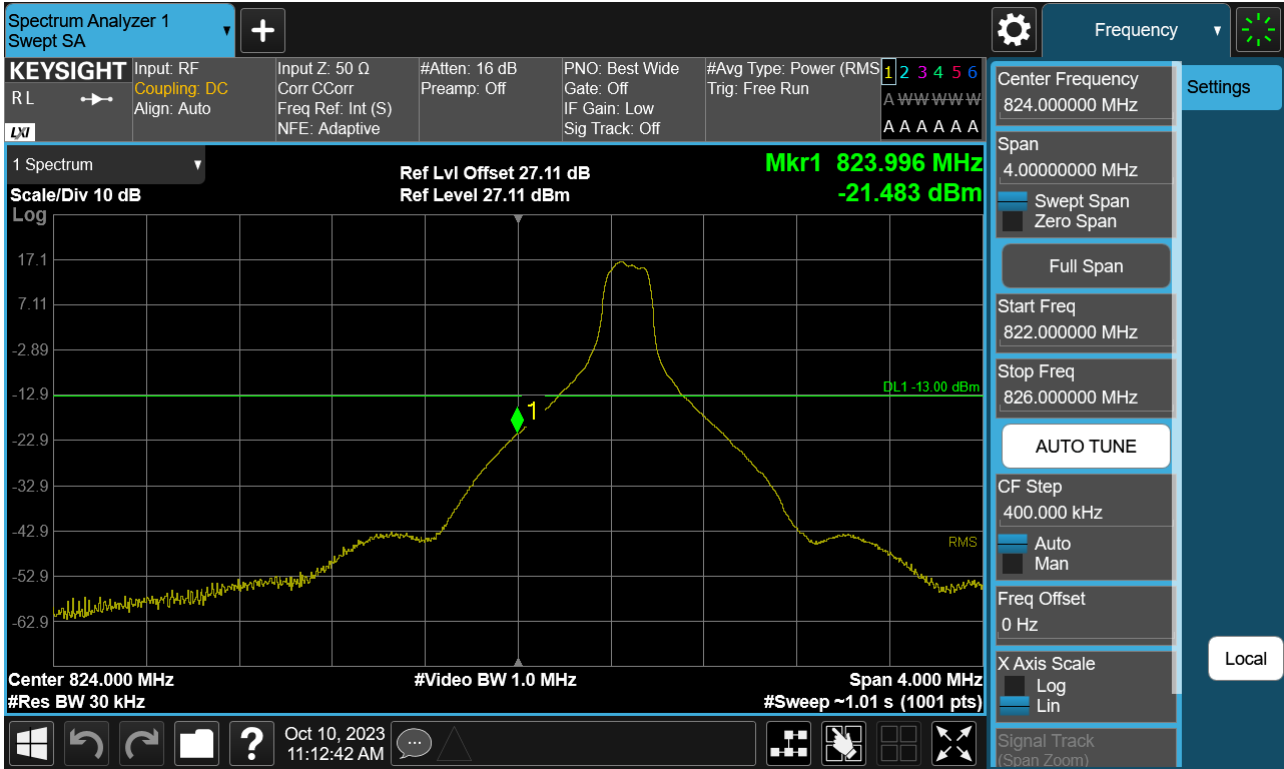
Sub6 n5. Lower Band Edge Plot (10 M BW Ch.165800 BPSK\_RB 50\_Offset 0)



Sub6 n5. Lower Extended Band Edge Plot (10 M BW Ch.165800 BPSK\_RB 50\_0)



Sub6 n5. Lower Band Edge Plot (15 M BW Ch.166300 BPSK\_RB 1\_Offset 0)

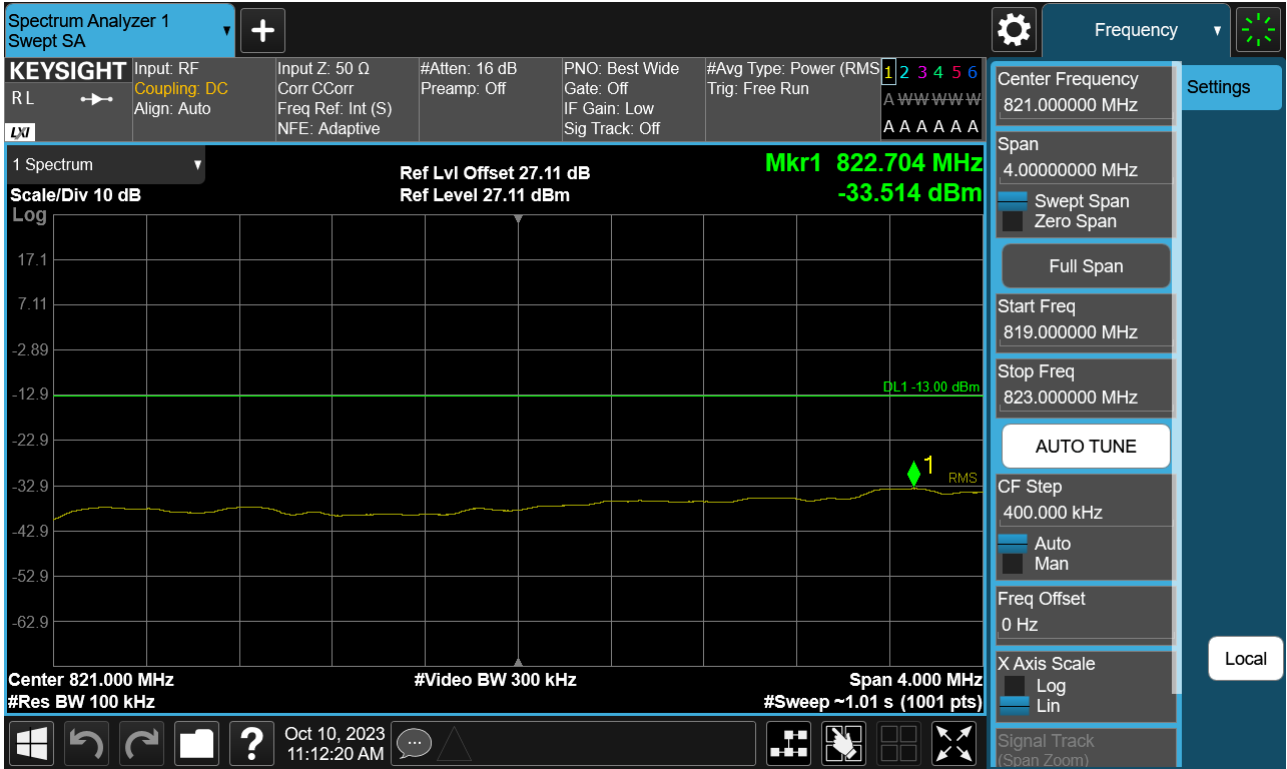


Sub6 n5. Lower Band Edge Plot (15 M BW Ch.166300 BPSK\_RB 75\_Offset 0)

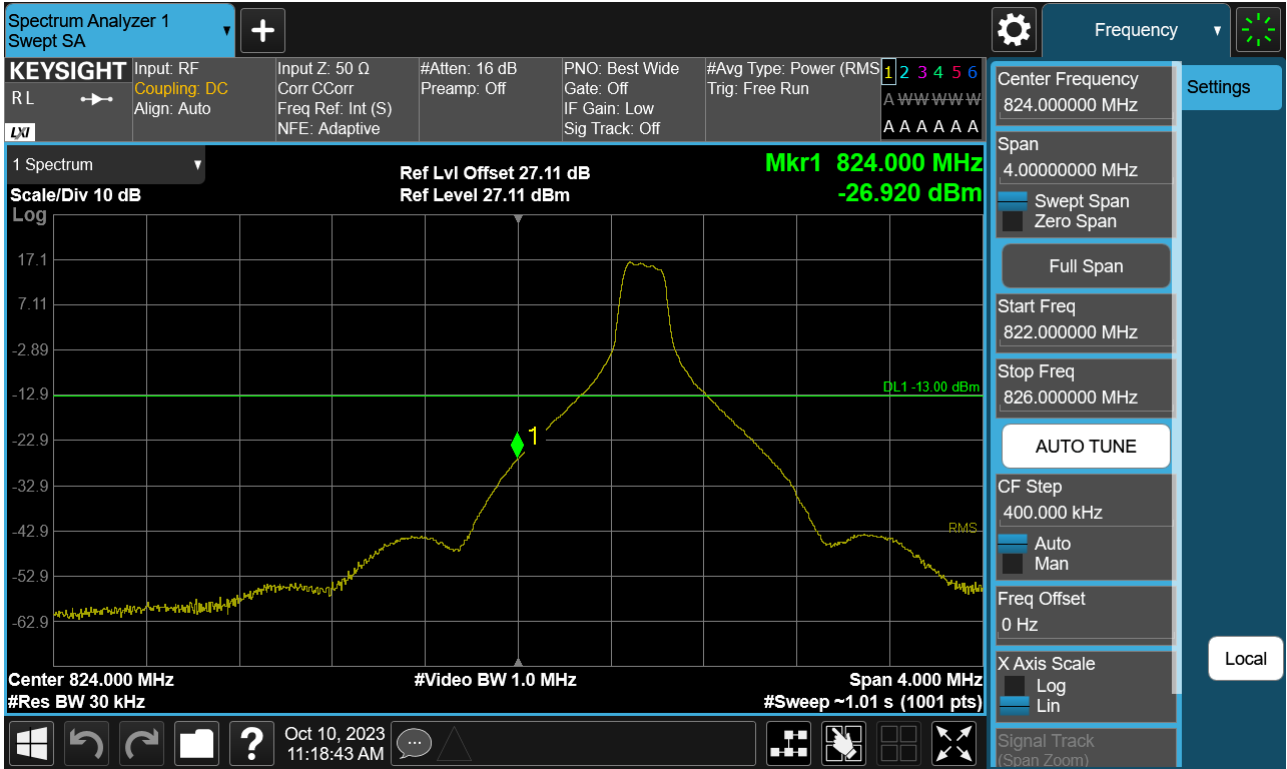




Sub6 n5. Lower Extended Band Edge Plot (15 M BW Ch.166300 BPSK\_RB 75\_0)



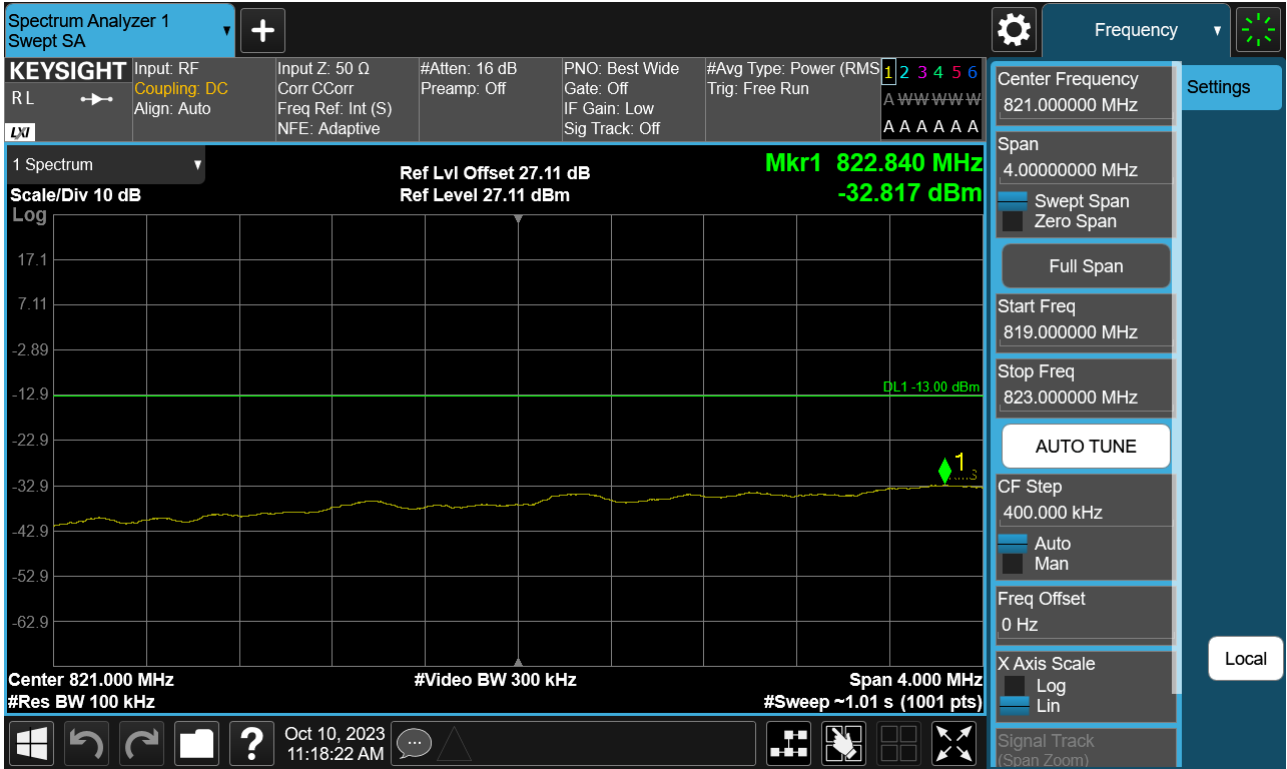
Sub6 n5. Lower Band Edge Plot (20 M BW Ch.166800 BPSK\_RB 1\_Offset 0)



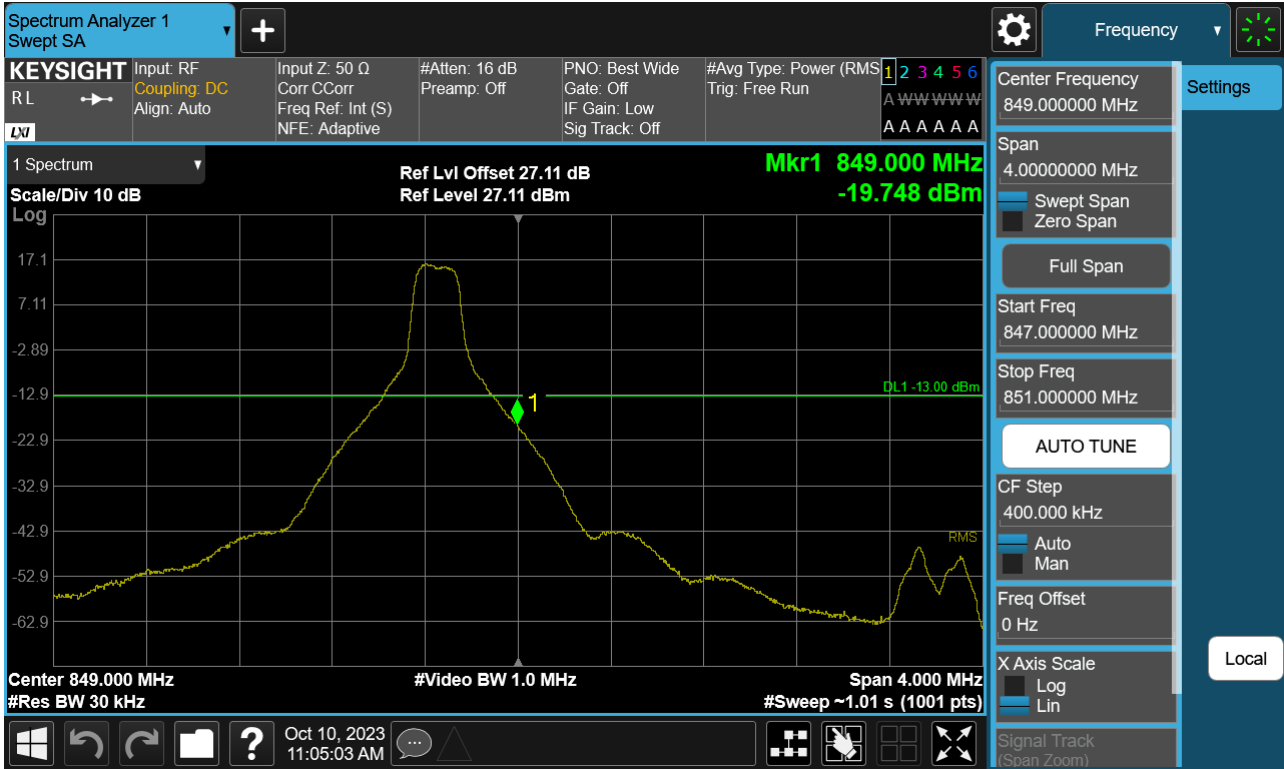
Sub6 n5. Lower Band Edge Plot (20 M BW Ch.166800 BPSK\_RB 100\_Offset 0)



Sub6 n5. Lower Extended Band Edge Plot (20 M BW Ch.166800 BPSK\_RB 100\_0)



Sub6 n5. Upper Band Edge Plot (5 M BW Ch.169300 BPSK\_RB 1\_Offset 24)



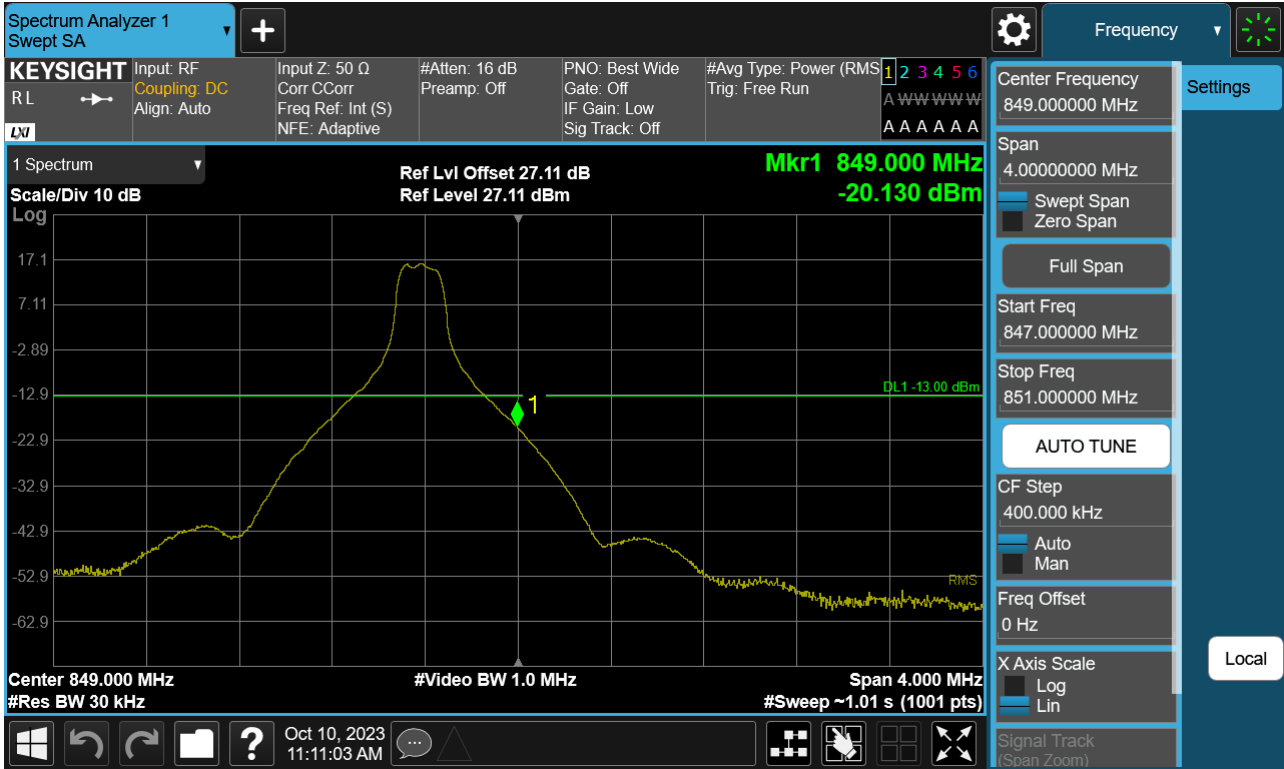
Sub6 n5. Upper Band Edge Plot (5 M BW Ch.169300 BPSK\_RB 25\_Offset 0)



Sub6 n5. Upper Extended Band Edge Plot (5 M BW Ch.169300 BPSK\_RB 25\_0)

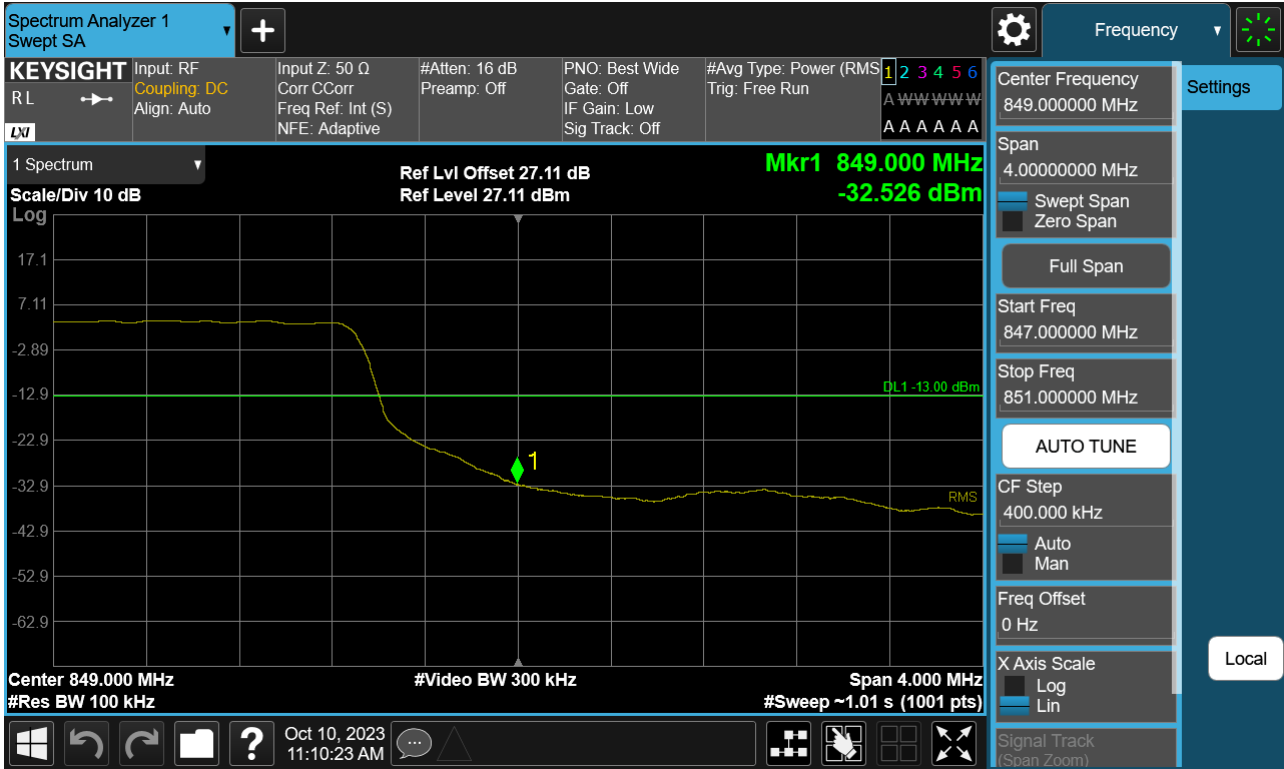


Sub6 n5. Upper Band Edge Plot (10 M BW Ch.168800 BPSK\_RB 1\_Offset 49)

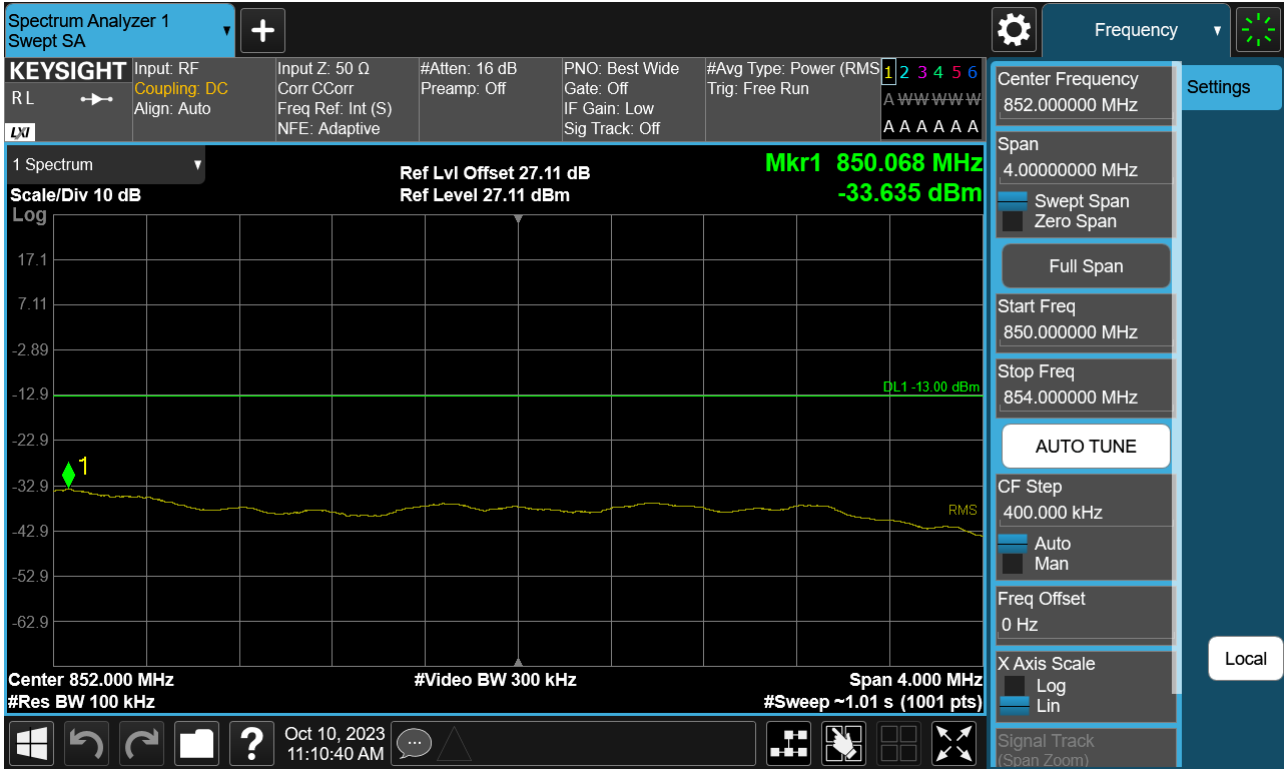




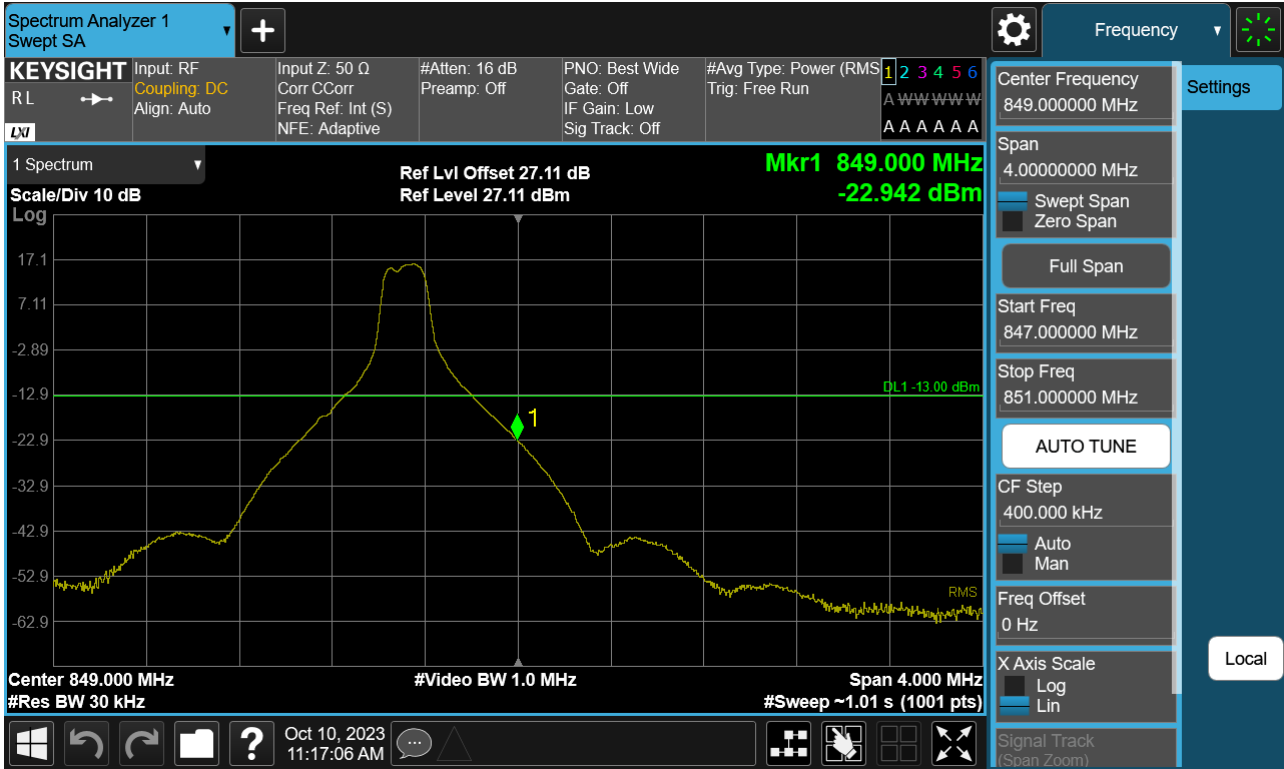
Sub6 n5. Upper Band Edge Plot (10 M BW Ch.168800 BPSK\_RB 50\_Offset 0)



Sub6 n5. Upper Extended Band Edge Plot (10 M BW Ch.168800 BPSK\_RB 50\_0)



Sub6 n5. Upper Band Edge Plot (15 M BW Ch.168300 BPSK\_RB 1\_Offset 74)



Sub6 n5. Upper Band Edge Plot (15 M BW Ch.168300 BPSK\_RB 75\_Offset 0)



Sub6 n5. Upper Extended Band Edge Plot (15 M BW Ch.168300 BPSK\_RB 75\_0)

