

TEST REPORT

FCC Sub6 n13 Test for TM15FNEUJL1
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2502-FC095-R1

DATE OF ISSUE
April 8, 2025

Tested by
Beom Jin Cho



Technical Manager
Jong Seok Lee



Accredited by KOLAS, Republic of KOREA

HCT CO., LTD.
BongJai Huh
BongJai Huh / CEO

**HCT CO.,LTD.**

2-6, 73, 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Tel. +82 31 645 6300 Fax. +82 31 645 6401

TEST REPORT

REPORT NO.

HCT-RF-2502-FC095-R1

DATE OF ISSUE

April 08, 2025

Applicant

LG Electronics Inc.

128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Republic of Korea

Product Name

Telematics

Model Name

TM15FNEUJL1

Date of Test

December 9, 2024 ~ February 24, 2025

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea)

FCC ID

BEJTM15FNEUJL1

FCC Classification

PCS Licensed Transmitter (PCB)

Test Standard Used

FCC Rule Part(s) : § 27

Test Results

PASS

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	February 24, 2025	Initial Release
1	April 08, 2025	Revised the Product Name.

Notice

Content

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)

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

This test report provides test result(s) under the scope accredited by the Korea Laboratory Accreditation Scheme (KOLAS), which signed the ILAC-MRA.
(KOLAS (KS Q ISO/IEC 17025) Accreditation No. KT197)

CONTENTS

1. GENERAL INFORMATION	5
1.1. MAXIMUM OUTPUT POWER.....	6
2. INTRODUCTION	7
2.1. DESCRIPTION OF EUT	7
2.2. MEASURING INSTRUMENT CALIBRATION.....	7
2.3. TEST FACILITY	7
3. DESCRIPTION OF TESTS.....	8
3.1 TEST PROCEDURE	8
3.2 RADIATED POWER	9
3.3 RADIATED SPURIOUS EMISSIONS	10
3.4 PEAK- TO- AVERAGE RATIO	11
3.5 OCCUPIED BANDWIDTH.	13
3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL	14
3.7 BAND EDGE	15
3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE.....	17
3.9 WORST CASE(RADIATED TEST).....	18
3.10 WORST CASE(CONDUCTED TEST)	19
4. LIST OF TEST EQUIPMENT	20
5. MEASUREMENT UNCERTAINTY	21
6. SUMMARY OF TEST RESULTS.....	22
7. SAMPLE CALCULATION	24
8. TEST DATA.....	26
8.1 EFFECTIVE RADIATED POWER	26
8.2 RADIATED SPURIOUS EMISSIONS	27
8.3 PEAK-TO-AVERAGE RATIO.....	29
8.4 OCCUPIED BANDWIDTH	30
8.5 CONDUCTED SPURIOUS EMISSIONS.....	31
8.6 BAND EDGE	31
8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE.....	32
9. TEST PLOTS	34
10. ANNEX A_ TEST SETUP PHOTO	71

MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	LG Electronics Inc.
Address:	128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Republic of Korea
FCC ID:	BEJTM15FNEUJL1
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter (PCB)
FCC Rule Part(s):	§ 27
EUT Type:	Telematics
Model(s):	TM15FNEUJL1
SCS(kHz):	15
Bandwidth(MHz):	5, 10
Waveform:	CP-OFDM, DFT-S-OFDM
Modulation:	DFT-S-OFDM: PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM
Tx Frequency:	779.5 MHz – 784.5 MHz (Sub6 n13 (5 MHz)) 782 MHz (Sub6 n13 (10 MHz))
Date(s) of Tests:	December 9, 2024 ~ February 24, 2025
Serial number:	Radiated : 410VIXV000304(NAD) Conducted : 410VIXV000305(NAD)
Antenna Information	Please refer to the Antenna Specification document.

1.1. MAXIMUM OUTPUT POWER

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	Conducted Output Power	
				Max. Power (W)	Max. Power (dBm)
Sub6 n13 (5)	779.5 –784.5	4M51G7D	PI/2 BPSK	0.217	23.36
		4M50G7D	QPSK	0.217	23.36
		4M50W7D	16QAM	0.171	22.33
		4M50W7D	64QAM	0.121	20.84
		4M51W7D	256QAM	0.077	18.87
Sub6 n13 (10)	782.0	8M95G7D	PI/2 BPSK	0.217	23.37
		8M96G7D	QPSK	0.216	23.34
		8M96W7D	16QAM	0.168	22.26
		8M95W7D	64QAM	0.119	20.75
		8M96W7D	256QAM	0.075	18.75

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

Please refer to the [2G3G] Test Report.

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, Republic of Korea**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Radiated Power	- ANSI C63.26-2015 – Section 5.2.4.4 - KDB 971168 D01 v03r01 – Section 5.8
Radiated Spurious and Harmonic Emissions	- ANSI C63.26-2015 – Section 5.5.3 - KDB 971168 D01 v03r01 – Section 5.8

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.

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.

Test Settings

1. RBW = 100 kHz for emissions below 1 GHz and 1 MHz 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 10th harmonics from 9 kHz.

Test Note

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

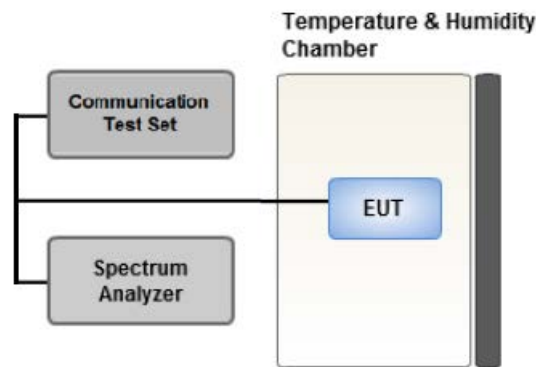
$$\text{Result}_{(\text{dBm})} = P_g_{(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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.

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

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)

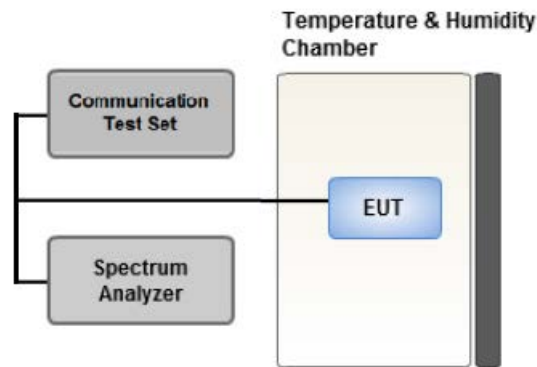
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW $\geq 3 \times$ RBW.

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 $[10 \log (1/0.25)] = 6 \text{ dB}$ 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.

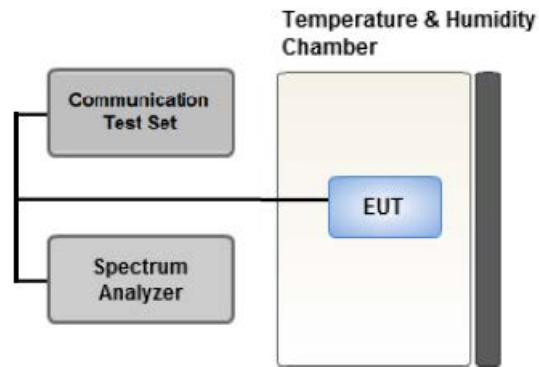
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

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 $\geq 3 \times$ 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.

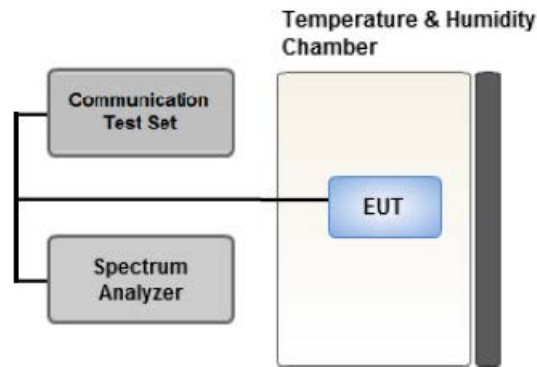
All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

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 = Peak
4. Trace Mode = Max Hold
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.

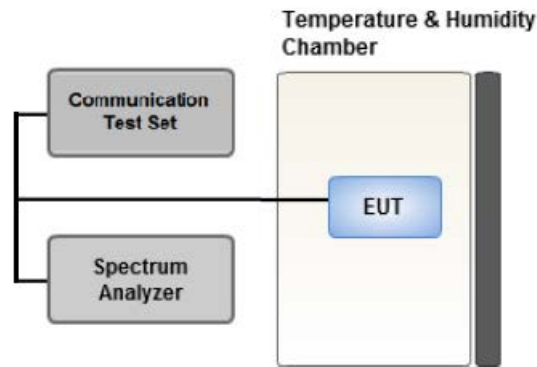
In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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 $10 \log(1 \text{ MHz} / \text{RB})$ 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 : SA, NSA
Worst case : SA
- JIG was used to test the EUT. (EUT + JIG)
- All simultaneous transmission scenarios of operation were investigated, and the test results showed no additional significant emissions relative to the least restrictive limit were observed.
Therefore, only the worst case(stand-alone) results were reported.
- 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 was not reported.
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data. (Worst case : 5 MHz)
- Please refer to the table below.

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Radiated Power	PI/2 BPSK, QPSK, 16QAM, 64QAM 256QAM	See Section 8.1		Y
Radiated Spurious and Harmonic Emissions	PI/2 BPSK	See Section 8.2		Y

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 : SA, NSA
Worst case : SA
- JIG was used to test the EUT. (EUT + JIG)
- All RB sizes, offsets of operation were investigated and the worst case configuration results are reported.
Please refer to the table below.

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth Peak- to- Average Ratio	PI/2 BPSK QPSK, 16QAM, 64QAM 256QAM	5, 10	Mid	Full RB	0
Band Edge	PI/2 BPSK	5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	51
		5, 10	Low, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	PI/2 BPSK	5, 10	Low, Mid, High	1	0

4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacturer	Serial No.	Due to Calibration	Calibration Interval
RF Switching System	Switch box(1 G HPF+LNA)	HCT CO., LTD.,	F2L2	12/12/2025	Annual
RF Switching System	Switch box(3 G HPF+LNA)	HCT CO., LTD.,	F2L3	12/12/2025	Annual
RF Switching System	Switch box(LNA)	HCT CO., LTD.,	F2L5	12/12/2025	Annual
RF Switching System	Switch box(6 G HPF+LNA)	HCT CO., LTD.,	F2L14	12/12/2025	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/07/2025	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
Power Splitter(DC ~ 26.5 GHz)	11667B	Hewlett Packard	5001	04/17/2025	Annual
DC Power Supply	E3632A	Agilent	MY40010147	08/06/2025	Annual
Dipole Antenna	UHAP	Schwarzbeck	01274	03/10/2026	Biennial
Dipole Antenna	UHAP	Schwarzbeck	01288	08/07/2026	Biennial
Chamber	SU-642	ESPEC	93022487	06/27/2025	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	03197	11/28/2025	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	03201	11/28/2025	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/20/2026	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170124	03/28/2025	Biennial
Signal Analyzer(10 Hz ~ 26.5 GHz)	N9020A	Agilent	MY52090906	04/19/2025	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/17/2025	Annual
Spectrum Analyzer(10 Hz ~ 40 GHz)	FSV40	ROHDE & SCHWARZ	101733	09/19/2025	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/05/2025	Annual
Loop Antenna(9 kHz ~ 30 MHz)	FMZB1513	Schwarzbeck	1513-333	03/07/2026	Biennial
Trilog Broadband Antenna	VULB9168	Schwarzbeck	895	08/28/2026	Biennial
Trilog Broadband Antenna	VULB9168	Schwarzbeck	1135	08/19/2026	Biennial
Radio Communication Test Station	MT8000A	Anritsu Corp.	6272613402	08/28/2025	Annual
SIGNAL GENERATOR (100 kHz ~ 40 GHz)	SMB100A	REOHDE & SCHWARZ	177633	07/26/2025	Annual
Signal Analyzer(5 Hz ~ 40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/17/2025	Annual
Signal & Spectrum Analyzer (2 Hz~67 GHz)	FSW67	REOHDE & SCHWARZ	101736	05/23/2025	Annual
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

Note:

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

5. MEASUREMENT UNCERTAINTY

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

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

Parameter	Expanded Uncertainty (\pm kHz)
Occupied Bandwidth	95 (Confidence level about 95 %, $k=2$)
Frequency stability	28 (Confidence level about 95 %, $k=2$)

Parameter	Expanded Uncertainty (\pm dB)
Block Edge	0.70 (Confidence level about 95 %, $k=2$)
Conducted Spurious Emissions	1.18 (Confidence level about 95 %, $k=2$)
Peak- to- Average Ratio	0.68 (Confidence level about 95 %, $k=2$)
Radiated Power	4.74 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (9 kHz ~ 30 MHz)	4.36 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (30 MHz ~ 1 GHz)	5.70 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (1 GHz ~ 18 GHz)	5.52 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (18 GHz ~ 40 GHz)	5.66 (Confidence level about 95 %, $k=2$)
Radiated Disturbance (Above 40 GHz)	5.58 (Confidence level about 95 %, $k=2$)

6. SUMMARY OF TEST RESULTS

Note. The decision rule applies 'simple acceptance'

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(c)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
On all frequencies between 763-775 MHz and 793-805 MHz.	§ 27.53(c)(4)	< 65 + 10log10 (P[Watts])	PASS (See Note2)
Conducted Output Power	§ 2.1046	N/A	See Note1
Frequency stability / variation of ambient temperature	§ 2.1055, § 27.54	Emission must remain in band	PASS

Note:

1. See SAR Report
2. Since it was not possible to set the resolution bandwidth to 6.25 kHz with the available equipment, a bandwidth of 10 kHz was used instead to show compliance.
3. All conducted tests 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	§ 27.50(b)(10)	< 3 Watts max. ERP	PASS
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 27.53(c)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	PASS
Undesirable Emissions in the 1559 – 1610 MHz band	§ 2.1053, § 27.53(f)	< -70dBW/MHz EIRP (wideband) < -80dBW EIRP (narrowband)	PASS

Note:

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

6.3. Data Referencing

Rule Part	Test item	Data Referencing	Comments
§2.1049	Occupied Bandwidth	Y	-
§2.1051, §27.53(c)	Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	Y	-
§2.1055, § 27.54	Frequency stability / variation of ambient temperature	Y	-
§27.50(b)(10)	Effective Radiated Power Equivalent Isotropic Radiated Power	Y	Spot-check
§2.1053, §27.53(c)	Radiated Spurious and Harmonic Emissions	Y	Spot-check
§2.1046	Conducted Output Power	Y	-

Spot-Check Result

1. Data was leveraged from model TM15FNEUJL0 for the certification of TM15FNEUJL1.
2. Please refer to the [FCC Evaluation] Report

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

$$\text{ERP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

- 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

$$\text{EIRP} = \text{Substitute LEVEL(dBm)} + \text{Ant. Gain} - \text{CL(Cable Loss)}$$

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

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EFFECTIVE RADIATED POWER

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured	Substitute	Ant.	C.L	Pol.	Limit	ERP		RB	
			Level (dBm)	Level (dBm)	Gain (dBd)			W	W	dBm	Size	Offset
779.5	Sub6 n13 (5 MHz) [15 kHz]	PI/2 BPSK	-28.40	33.59	-9.90	1.39	H	< 3.00	0.170	22.30	1	1
		QPSK	-28.46	33.53	-9.90	1.39	H		0.168	22.24		
		16-QAM	-29.52	32.47	-9.90	1.39	H		0.131	21.18		
		64-QAM	-30.93	31.06	-9.90	1.39	H		0.095	19.77		
		256-QAM	-32.84	29.15	-9.90	1.39	H		0.061	17.86		
782.0		PI/2 BPSK	-28.53	33.66	-9.95	1.40	H		0.170	22.31	1	23
		QPSK	-28.62	33.57	-9.95	1.40	H		0.167	22.22		
		16-QAM	-29.62	32.57	-9.95	1.40	H		0.132	21.22		
		64-QAM	-31.09	31.10	-9.95	1.40	H		0.094	19.75		
		256-QAM	-32.95	29.24	-9.95	1.40	H		0.062	17.89		
784.5		PI/2 BPSK	-28.52	33.77	-9.95	1.40	H	0.175	22.42	1	12	
		QPSK	-28.62	33.67	-9.95	1.40	H	0.171	22.32			
		16-QAM	-29.58	32.71	-9.95	1.40	H	0.137	21.36			
		64-QAM	-31.10	31.19	-9.95	1.40	H	0.096	19.84			
		256-QAM	-33.10	29.19	-9.95	1.40	H	0.061	17.84			

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured	Substitut	Ant. Gain (dBd)	C.L	Pol.	Limit	ERP		RB	
			Level (dBm)	e Level (dBm)				W	W	dBm	Size	Offset
782.0	Sub6 n13 (10 MHz) [15 kHz]	PI/2 BPSK	-28.43	33.76	-9.95	1.40	H	< 3.00	0.174	22.41	1	1
		QPSK	-28.51	33.68	-9.95	1.40	H		0.171	22.33		
		16-QAM	-29.46	32.73	-9.95	1.40	H		0.137	21.38		
		64-QAM	-30.97	31.22	-9.95	1.40	H		0.097	19.87		
		256-QAM	-33.00	29.19	-9.95	1.40	H		0.061	17.84		

8.2 RADIATED SPURIOUS EMISSIONS

■ MODE: Sub6 n13
 ■ MODULATION SIGNAL: 5 MHz BPSK
 ■ DISTANCE: 3 meters

Ch	Freq (MHz)	Measured Level [dBm]	Ant. Gain (dBi)	Substitute Level [dBm]	C.L	Pol.	Result (dBm)	Limit (dBm)	RB	
									Size	Offset
155900 (779.5)	1 559.0	-52.49	8.59	-65.70	1.94	H	-59.05	-13.00	1	1
	2 338.5	-52.51	10.41	-65.11	2.42	H	-57.12	-13.00		
	3 118.0	-53.23	10.49	-61.10	2.83	H	-53.44	-13.00		
	3 897.5	-54.79	11.08	-60.93	3.26	H	-53.11	-13.00		
	4 677.0	-54.03	11.88	-58.21	3.58	H	-49.91	-13.00		
156400 (782.0)	1 564.0	-52.21	8.63	-65.48	1.95	H	-58.80	-13.00	1	23
	2 346.0	-52.66	10.41	-65.18	2.45	H	-57.22	-13.00		
	3 128.0	-53.49	10.49	-61.33	2.86	H	-53.70	-13.00		
	3 910.0	-54.76	11.11	-61.00	3.29	H	-53.18	-13.00		
	4 692.0	-54.75	11.85	-58.72	3.59	H	-50.46	-13.00		
156900 (784.5)	1 569.0	-52.44	8.63	-65.71	1.95	H	-59.03	-13.00	1	12
	2 353.5	-52.59	10.41	-65.11	2.45	H	-57.15	-13.00		
	3 138.0	-53.80	10.49	-61.64	2.86	H	-54.01	-13.00		
	3 922.5	-54.84	11.11	-61.08	3.29	H	-53.26	-13.00		
	4 707.0	-54.44	11.85	-58.41	3.59	H	-50.15	-13.00		

1559 MHz ~ 1610 MHz BAND

▣ OPERATING FREQUENCY:	<u>779.5 MHz, 782.0 MHz, 784.5 MHz</u>
▣ MEASURED OUTPUT POWER:	<u>5 MHz BPSK</u>
▣ DISTANCE:	<u>3 meters</u>
▣ WIDEBAND EMISSION LIMIT:	<u>-70 dBW/ MHz (= -40 dBm/ MHz)</u>

Operating Frequency (MHz)	Measured Frequency (MHz)	EMISSION TYPE	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)
779.5	1559~1610	Wide Band	-51.88	8.59	-65.09	1.94	H	-58.44
782.0	1559~1610		-53.18	8.63	-66.45	1.95	H	-59.77
784.5	1559~1610		-52.93	8.63	-66.20	1.95	H	-59.52

Note:

Since the bandwidth of that Spurious emission is greater than 700 Hz, we applied -70 dBW/MHz according to § 27.53(f).

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
Sub6 n13	5 MHz	782.0	BPSK	25	0	3.95
			QPSK			4.50
			16-QAM			5.67
			64-QAM			6.05
			256-QAM			6.62
	10 MHz		BPSK	50		3.84
			QPSK			4.71
			16-QAM			5.65
			64-QAM			6.07
			256-QAM			6.49

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 45 ~ 54.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
Sub6 n13	5 MHz	782.0	BPSK	25	0	4.5055
			QPSK			4.4984
			16-QAM			4.5000
			64-QAM			4.5042
			256-QAM			4.5046
	10 MHz		BPSK	50		8.9452
			QPSK			8.9584
			16-QAM			8.9560
			64-QAM			8.9503
			256-QAM			8.9559

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 35 ~ 44.

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)
Sub6 n13	5	779.5	5.9622	27.520	-61.337	-33.817	-13.00
		782.0	4.0778	26.600	-61.392	-34.792	
		784.5	3.7588	26.600	-61.593	-34.993	
	10	782.0	5.1745	27.520	-60.943	-33.423	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 55 ~ 58.
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	26.080
1 – 5	26.600
5 – 10	27.520
10 – 15	29.120
15 – 20	31.710
Above 20	32.350

8.6 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 59 ~ 70.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

- ☐ BandWidth: 5 MHz
☐ Voltage(100 %): 12.000 VDC
☐ LIMIT: Emission must remain in band

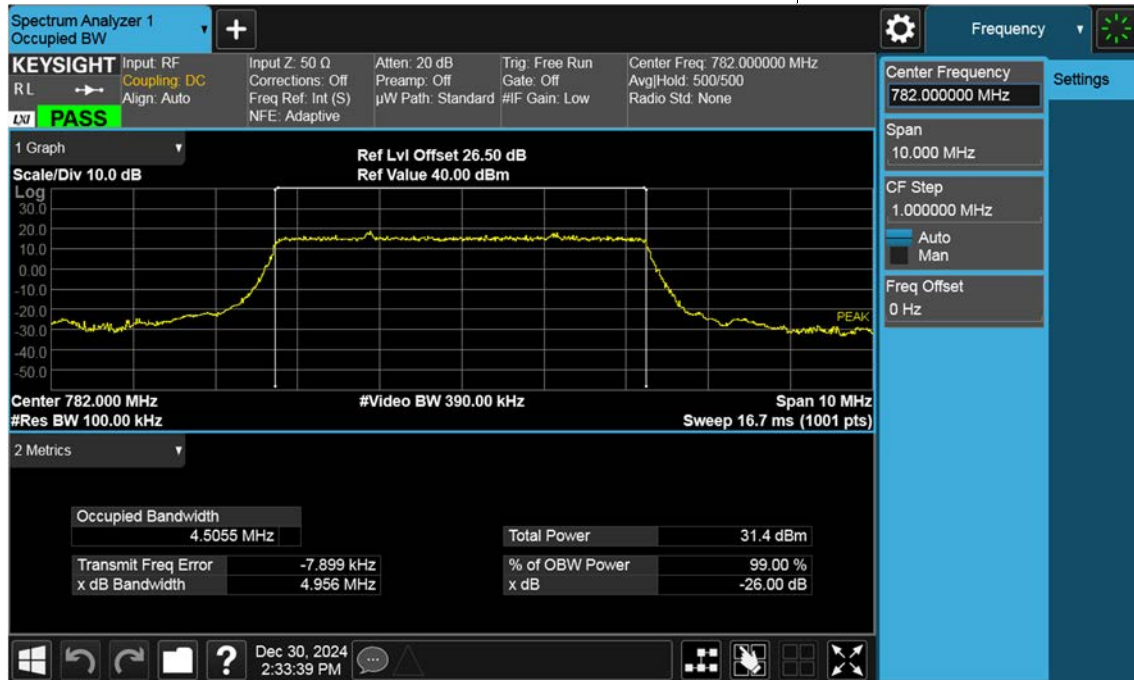
Test. Frequency	Voltage	Temp.	Frequency	Frequency	Deviation	ppm
(MHz)	(%)	(°C)	(Hz)	Error (Hz)	(%)	
779.5	100 %	+20(Ref)	779 499 996	0.0	0.000 000	0.000
	100 %	-30	779 499 991	-4.7	-0.000 001	-0.006
	100 %	-20	779 500 000	3.6	0.000 000	0.005
	100 %	-10	779 499 999	3.0	0.000 000	0.004
	100 %	0	779 499 998	2.3	0.000 000	0.003
	100 %	+10	779 499 997	1.3	0.000 000	0.002
	100 %	+30	779 499 996	0.5	0.000 000	0.001
	100 %	+40	779 499 996	-0.2	0.000 000	0.000
	100 %	+50	779 499 995	-0.8	0.000 000	-0.001
	85 %	+20	779 499 998	1.6	0.000 000	0.002
	115 %	+20	779 499 999	3.3	0.000 000	0.004
784.5	100 %	+20(Ref)	784 500 008	0.0	0.000 000	0.000
	100 %	-30	784 500 016	8.3	0.000 001	0.011
	100 %	-20	784 500 016	8.1	0.000 001	0.010
	100 %	-10	784 500 016	8.1	0.000 001	0.010
	100 %	0	784 500 016	7.9	0.000 001	0.010
	100 %	+10	784 500 016	8.0	0.000 001	0.010
	100 %	+30	784 500 016	8.0	0.000 001	0.010
	100 %	+40	784 500 016	7.7	0.000 001	0.010
	100 %	+50	784 500 015	7.3	0.000 001	0.009
	85 %	+20	784 500 014	5.9	0.000 001	0.008
	115 %	+20	784 500 016	7.5	0.000 001	0.010

- ☐ BandWidth: 10 MHz
☐ Voltage(100 %): 12.000 VDC
☐ LIMIT: Emission must remain in band

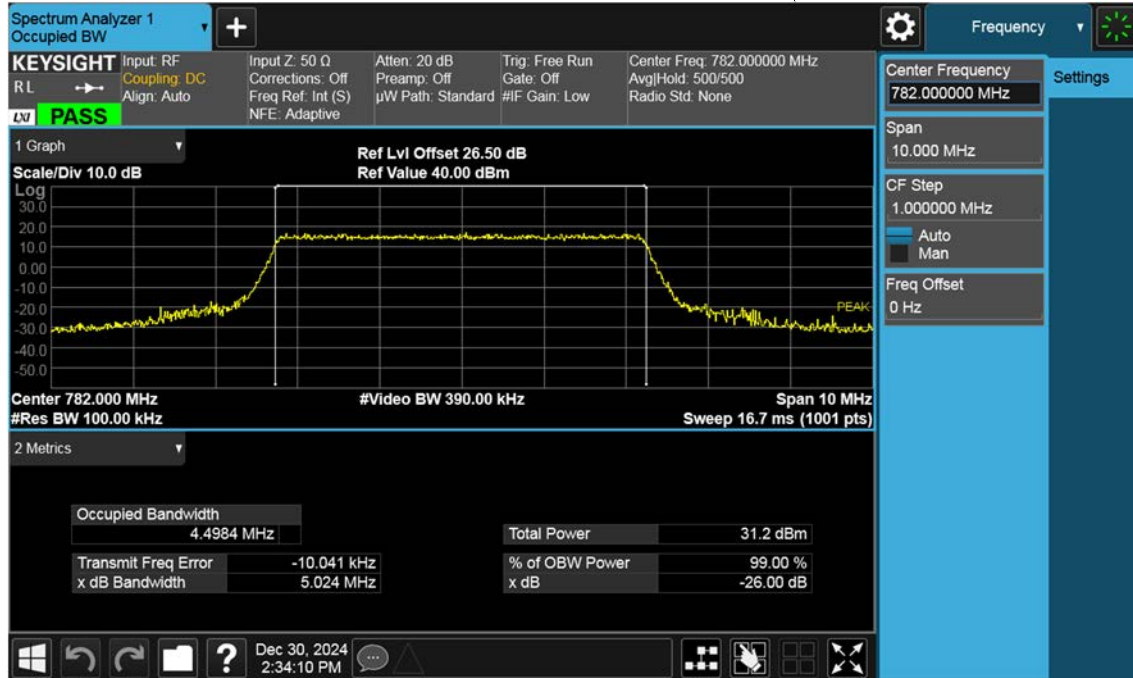
Test. Frequency	Voltage	Temp.	Frequency	Frequency	Deviation	ppm
(MHz)	(%)	(°C)	(Hz)	Error (Hz)	(%)	
782.0	100 %	+20(Ref)	782 000 004	0.0	0.000 000	0.000
	100 %	-30	782 000 008	3.9	0.000 000	0.005
	100 %	-20	782 000 008	3.4	0.000 000	0.004
	100 %	-10	782 000 008	3.2	0.000 000	0.004
	100 %	0	782 000 007	2.6	0.000 000	0.003
	100 %	+10	782 000 007	2.4	0.000 000	0.003
	100 %	+30	782 000 006	1.8	0.000 000	0.002
	100 %	+40	782 000 006	1.7	0.000 000	0.002
	100 %	+50	782 000 005	1.1	0.000 000	0.001
	85 %	+20	782 000 005	0.8	0.000 000	0.001
	115 %	+20	782 000 006	2.2	0.000 000	0.003

9. TEST PLOTS

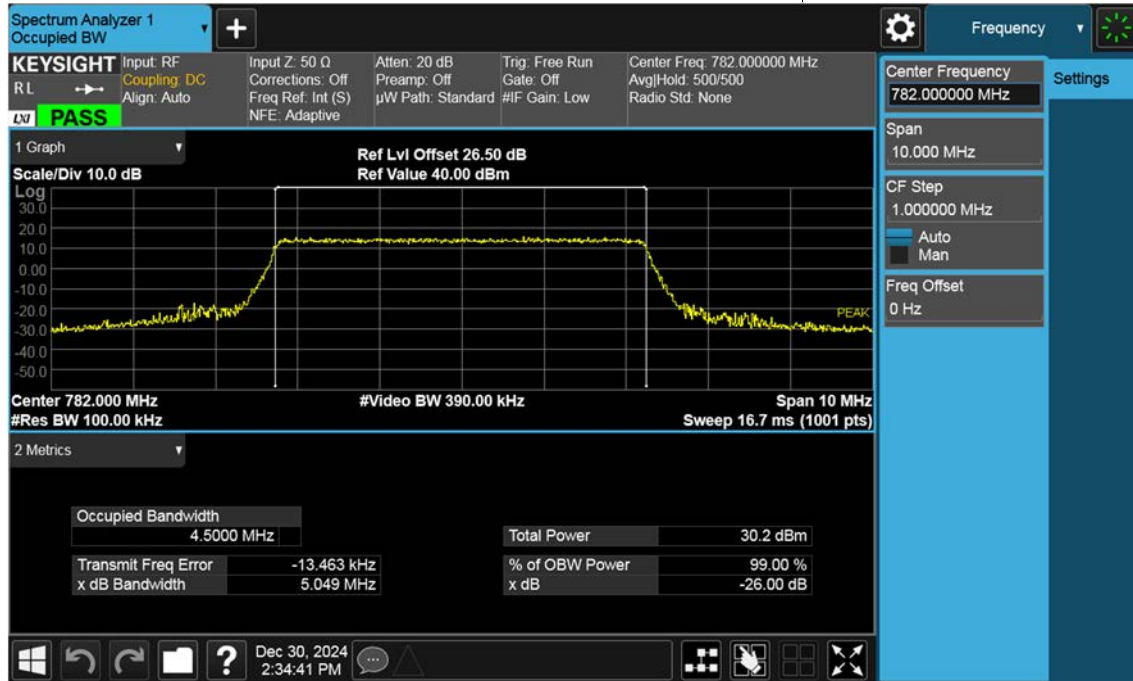
Sub6 n13_5 M_OBW_Mid_ BPSK_FullRB



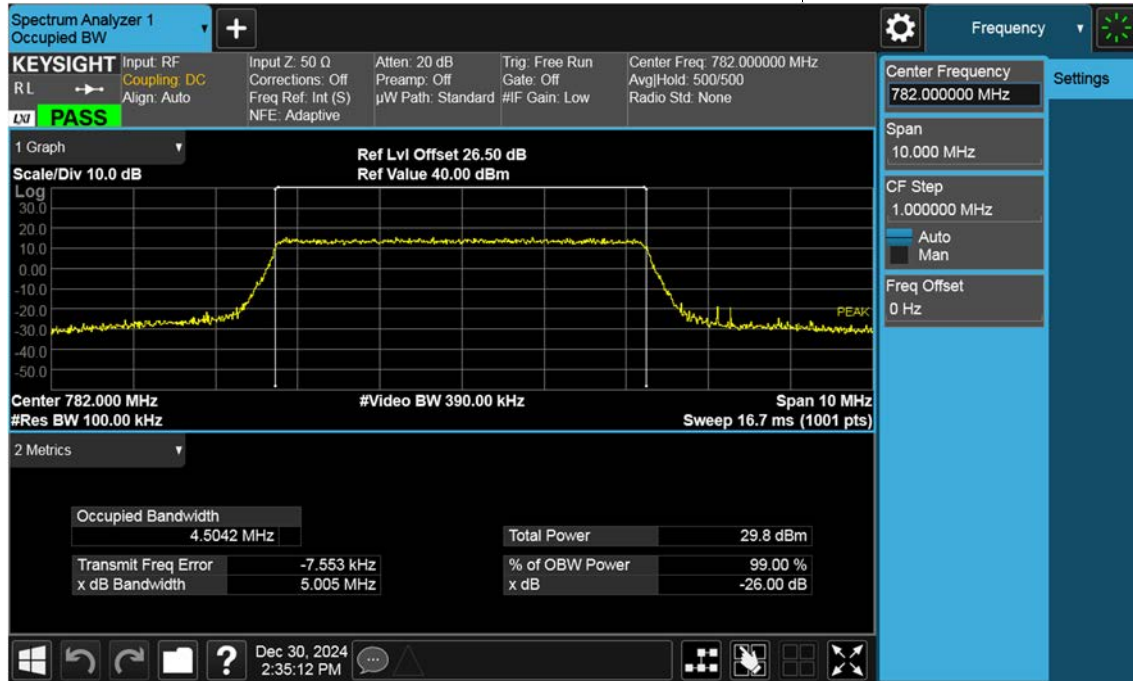
Sub6 n13_5 M_OBW_Mid_QPSK_FullRB



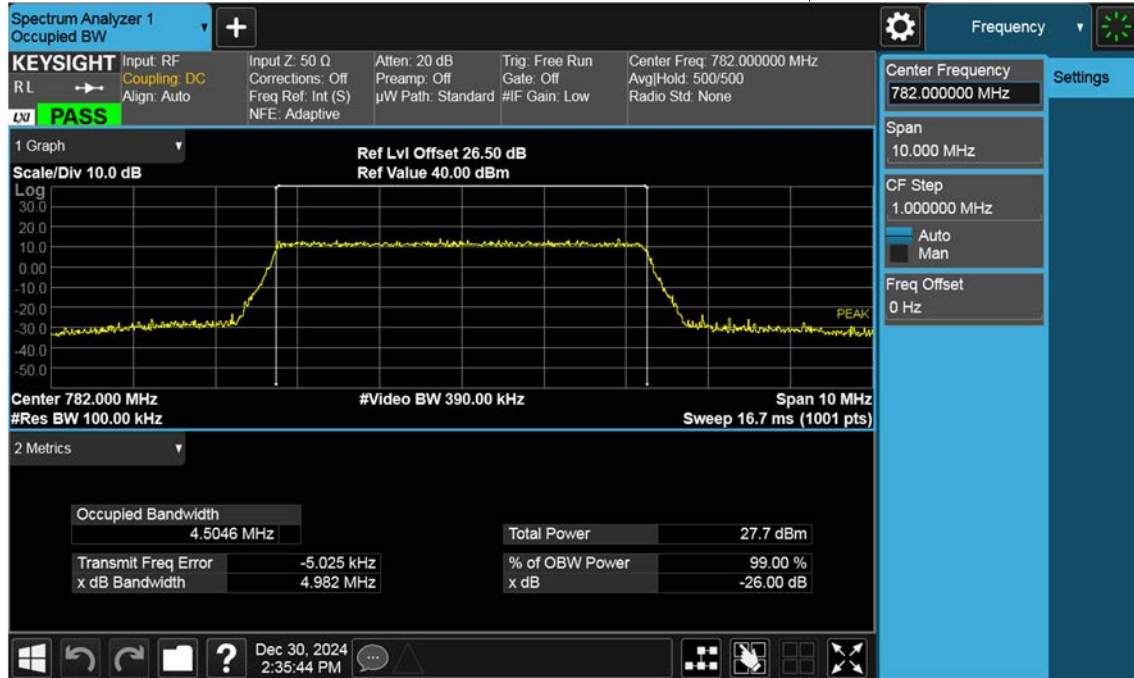
Sub6 n13_5 M_OBW_Mid_16QAM_FullIRB



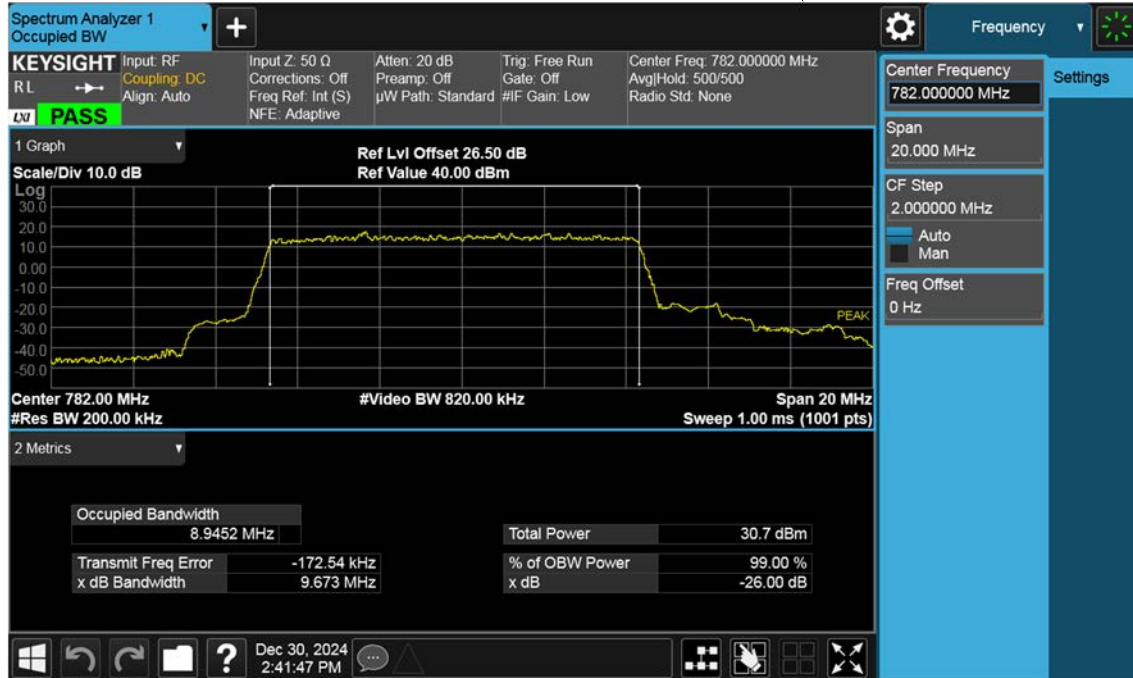
Sub6 n13_5 M_OBW_Mid_64QAM_FullIRB



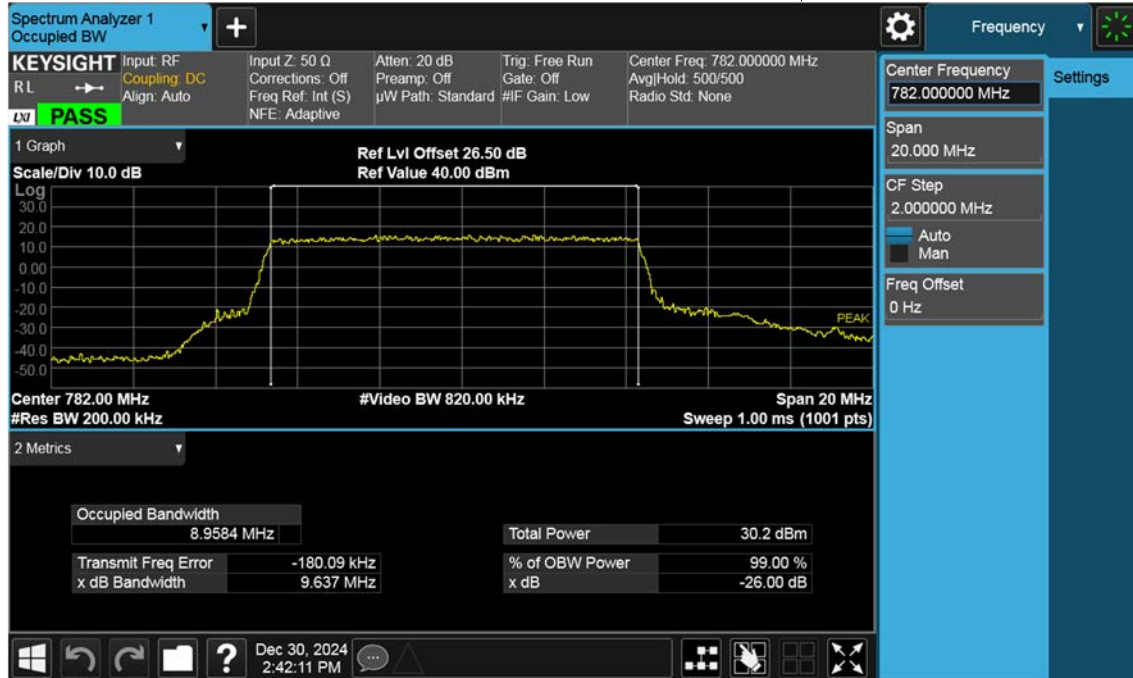
Sub6 n13_5 M_OBW_Mid_256QAM_FullRB



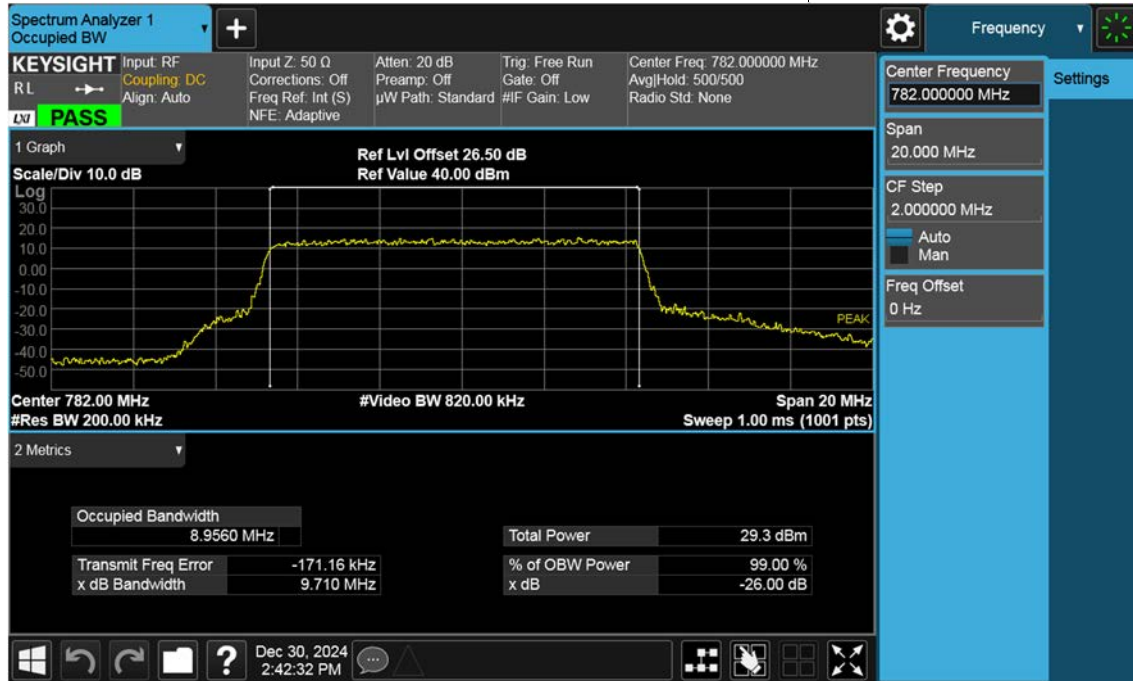
Sub6 n13_10 M_OBW_Mid_BPSK_FullRB



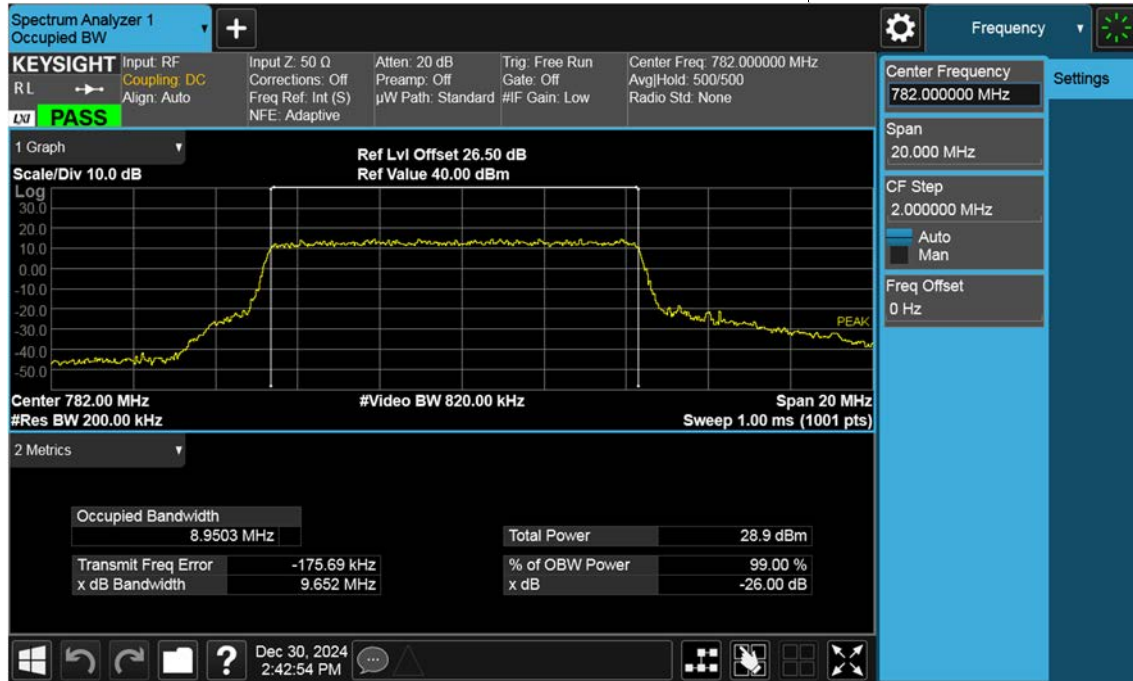
Sub6 n13_10 M_OBW_Mid_QPSK_FullRB



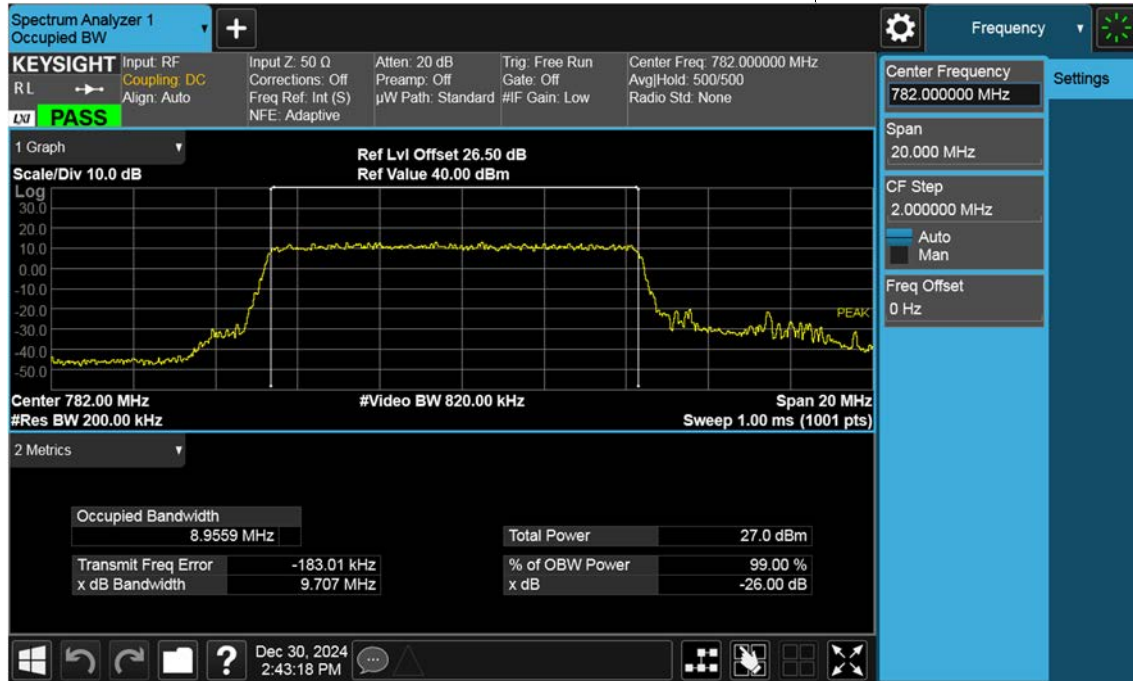
Sub6 n13_10 M_OBW_Mid_16QAM_FullRB



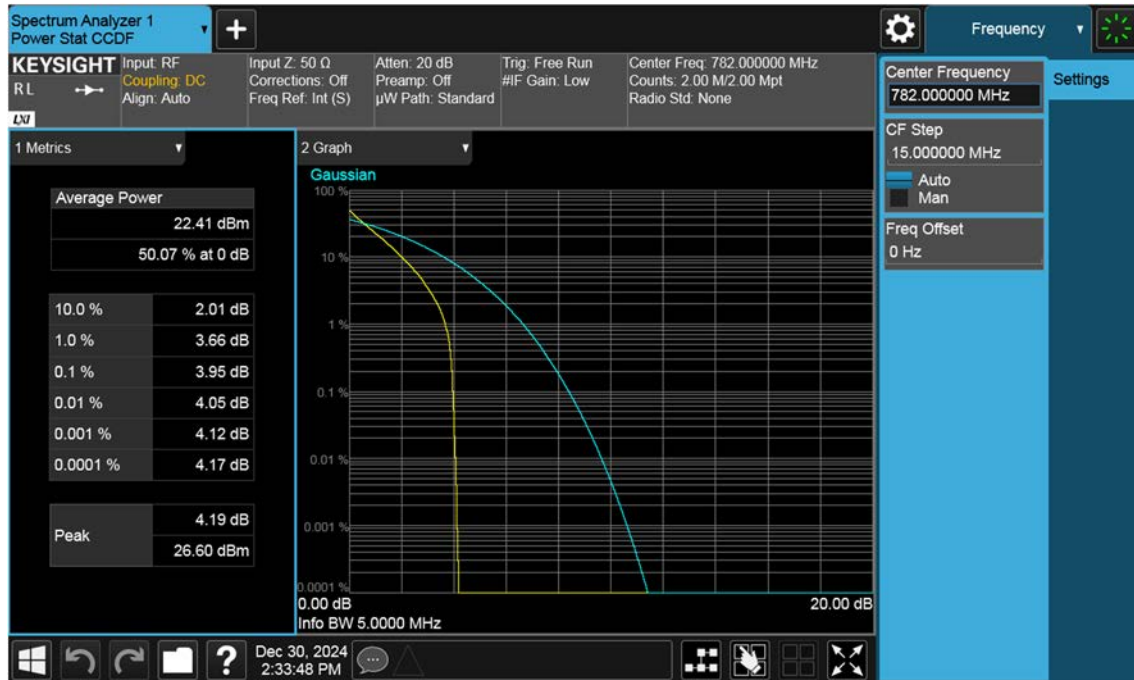
Sub6 n13_10 M_OBW_Mid_64QAM_FullRB



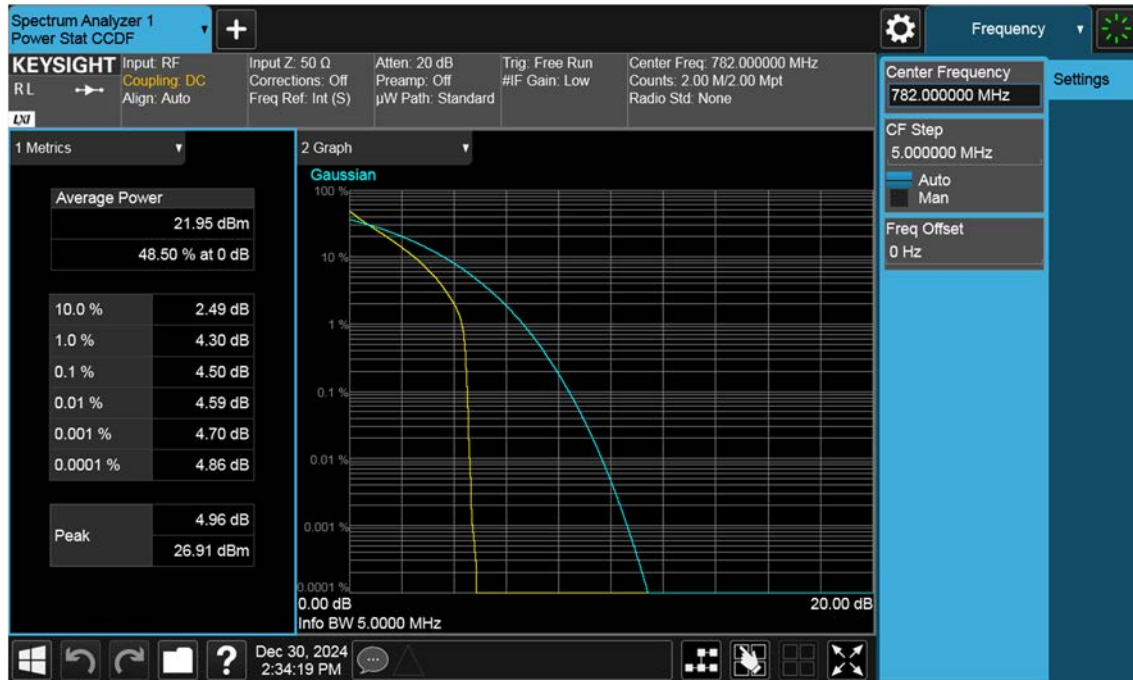
Sub6 n13_10 M_OBW_Mid_256QAM_FullIRB



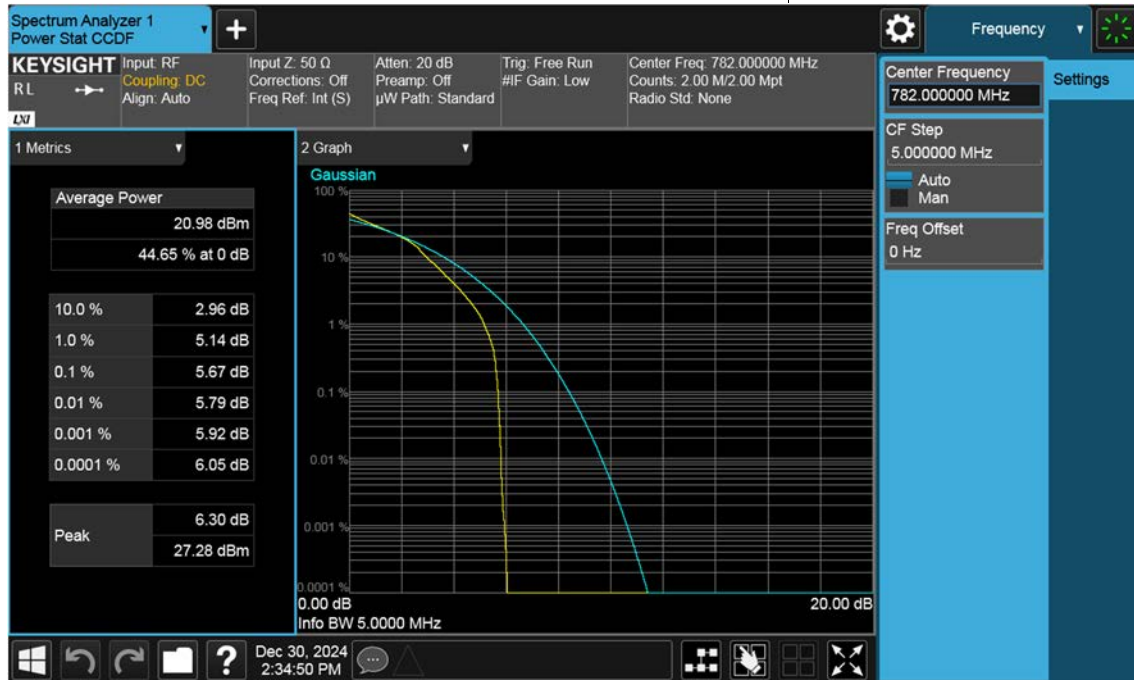
5 M_PAR_Mid Channel_ BPSK _FullRB



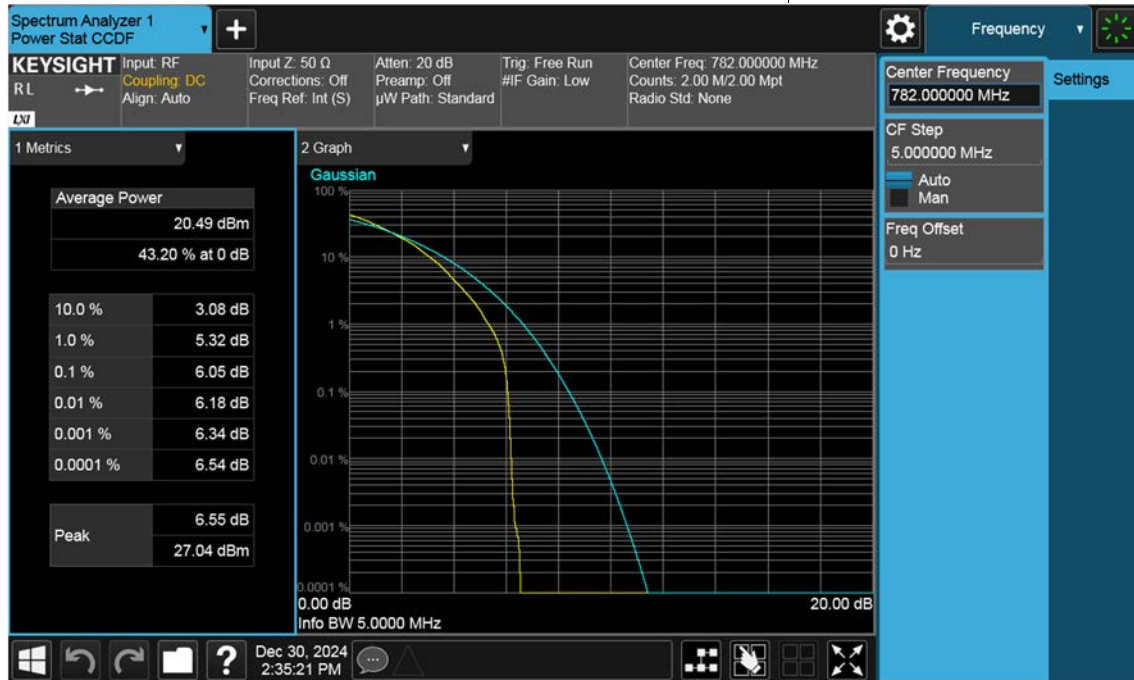
5 M_PAR_Mid Channel_QPSK_FullRB



5 M_PAR_Mid Channel_16QAM_FullRB



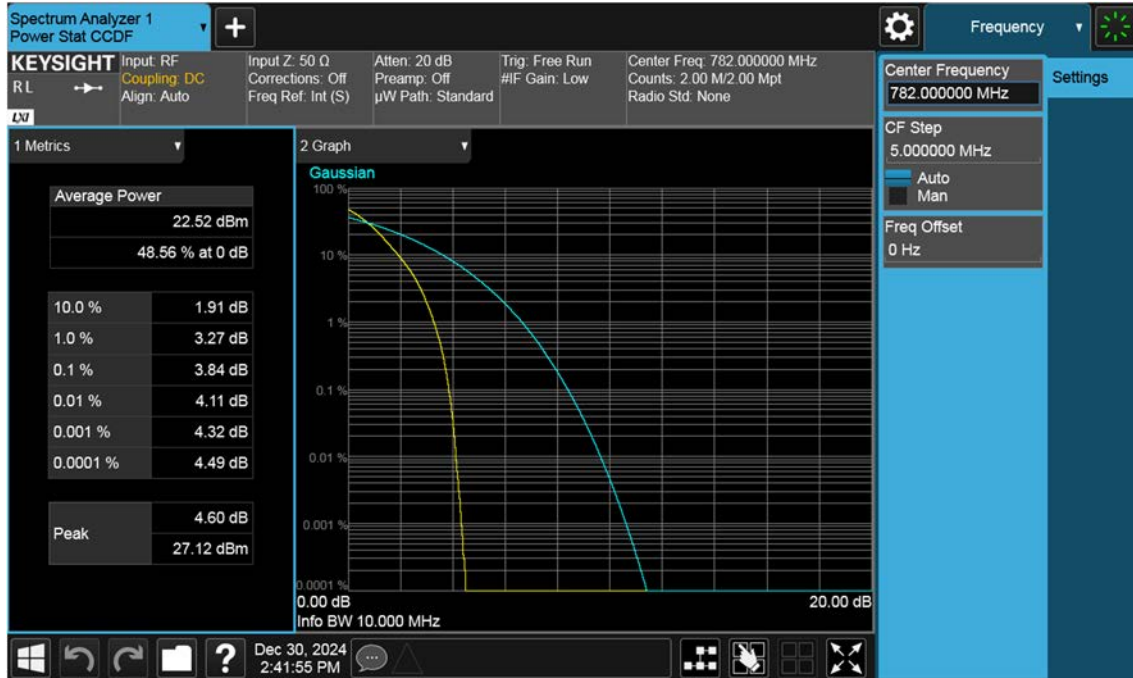
5 M_PAR_Mid Channel_64QAM_FullRB



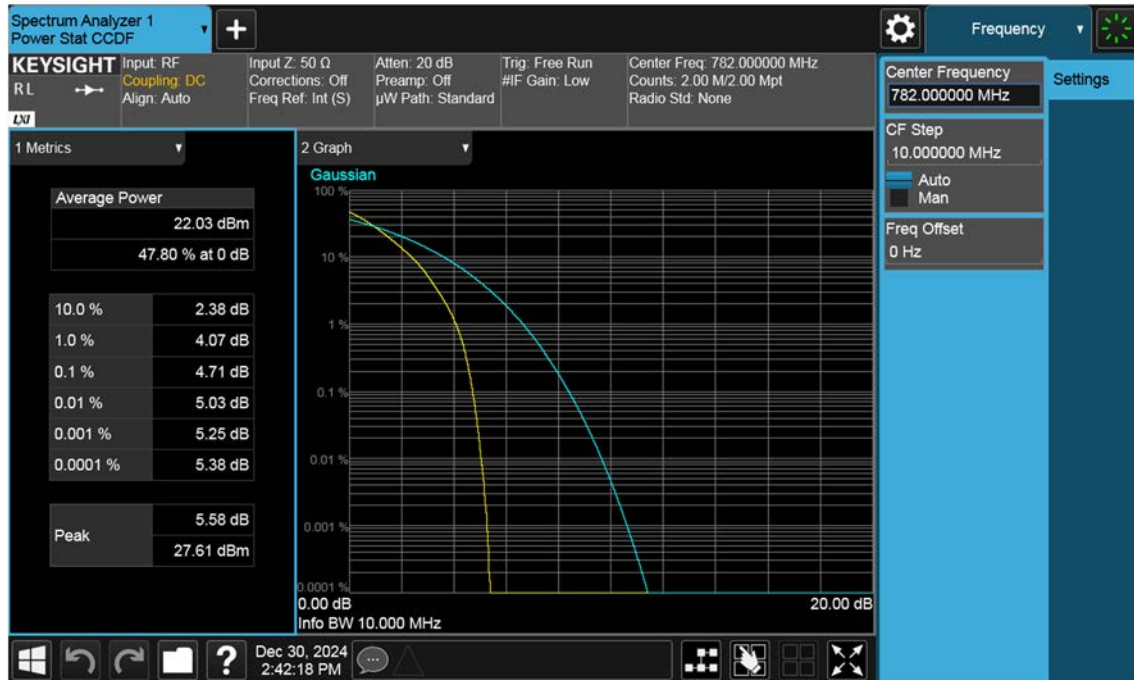
5 M_PAR_Mid Channel_256QAM_FullRB



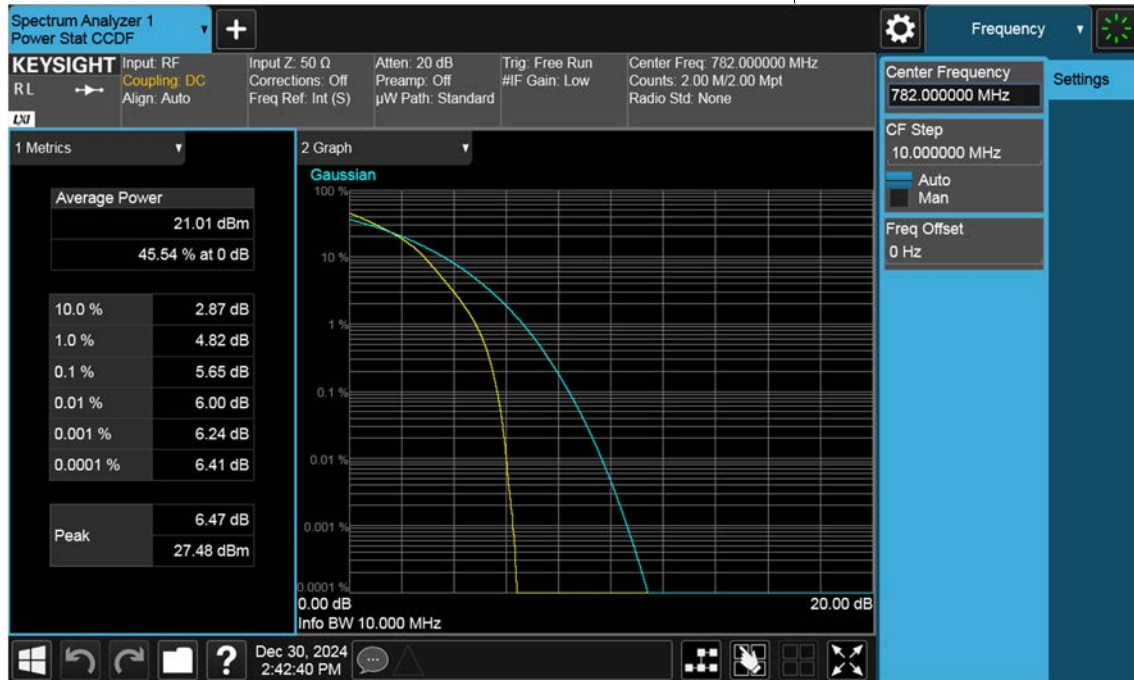
10 M_PAR_Mid Channel_ BPSK_FullRB



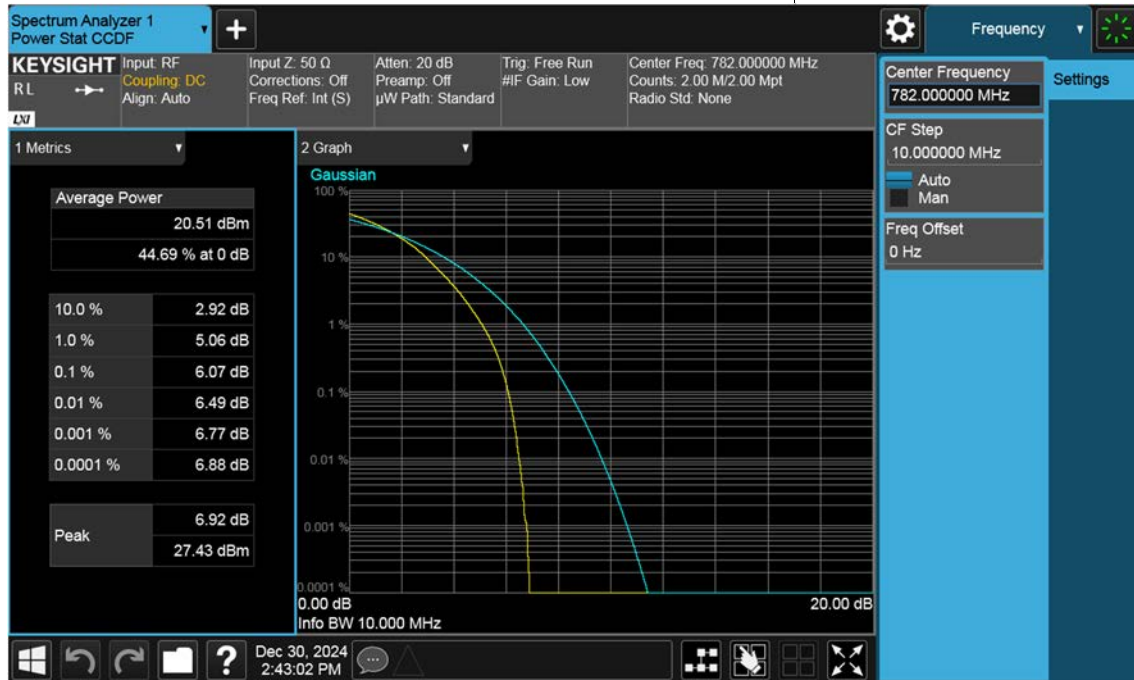
10 M_PAR_Mid Channel_QPSK_FullRB



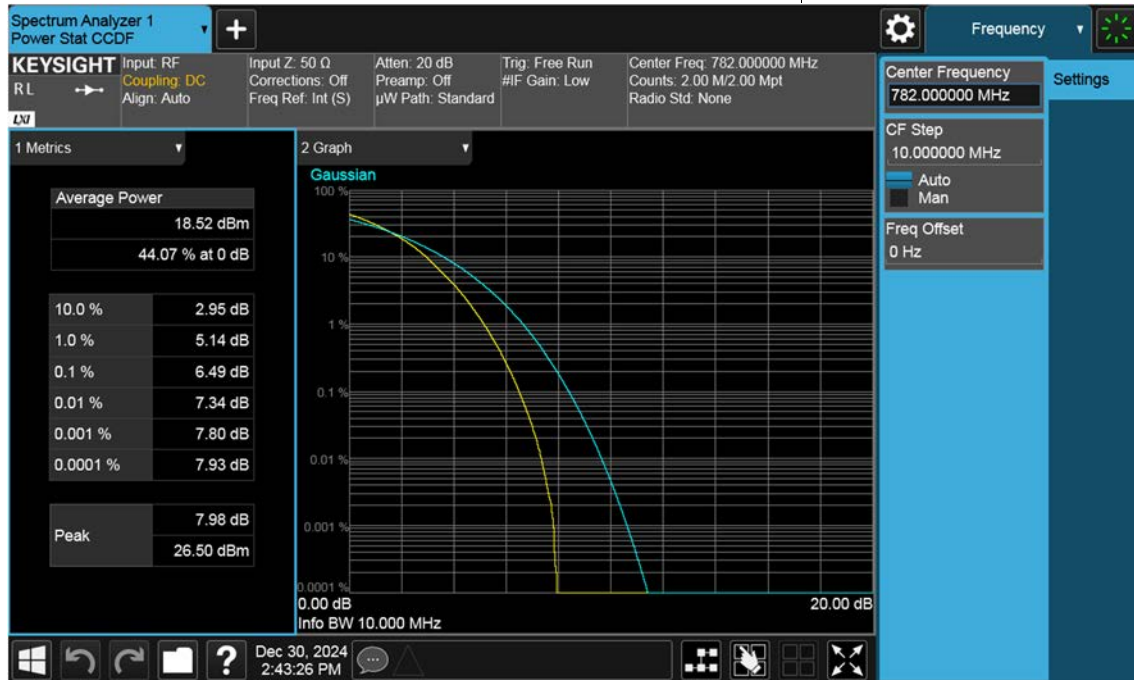
10 M_PAR_Mid Channel_16QAM_FullRB



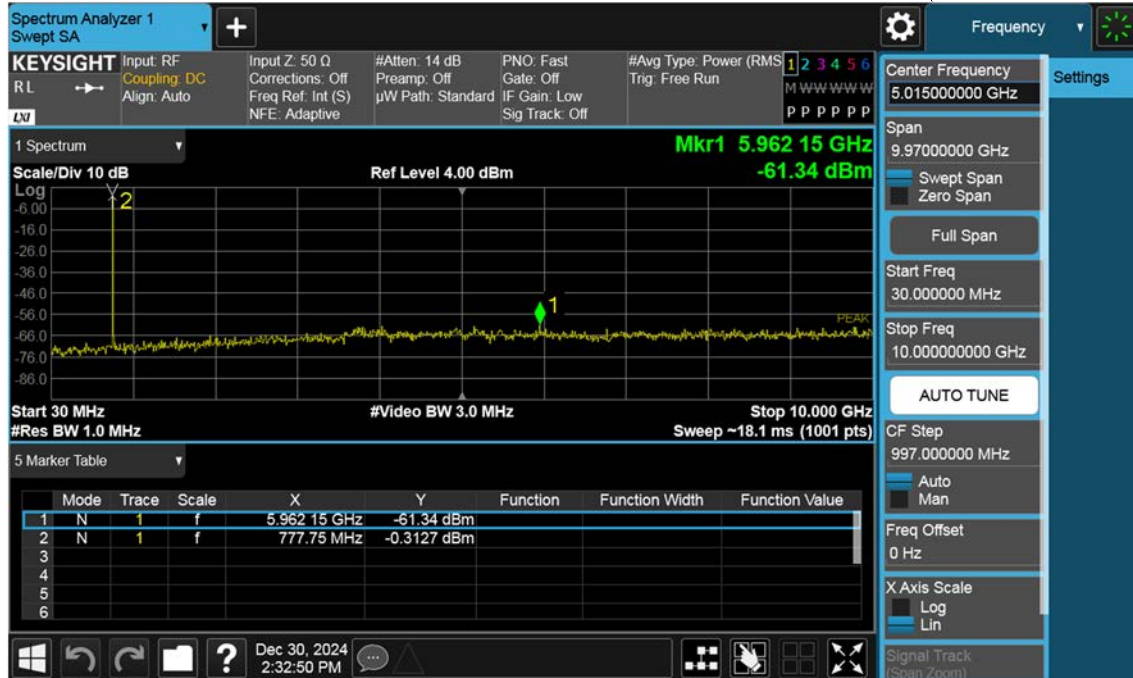
10 M_PAR_Mid Channel_64QAM_FullRB



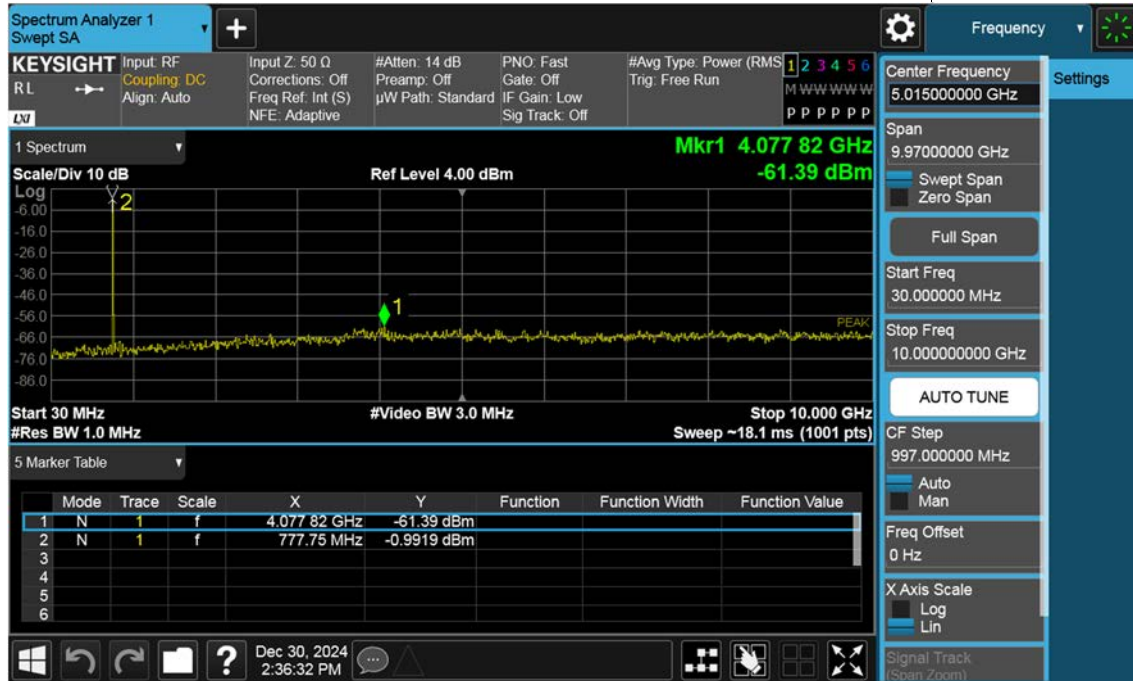
10 M_PAR_Mid Channel_256QAM_FullRB



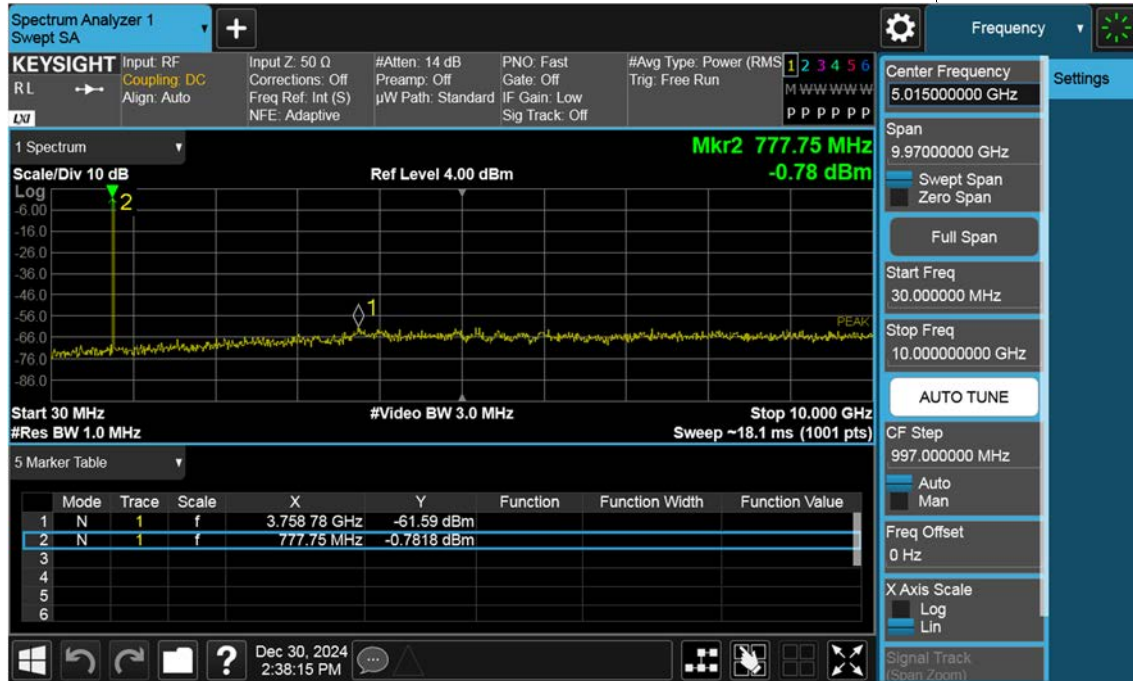
Sub6 n13_5 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB



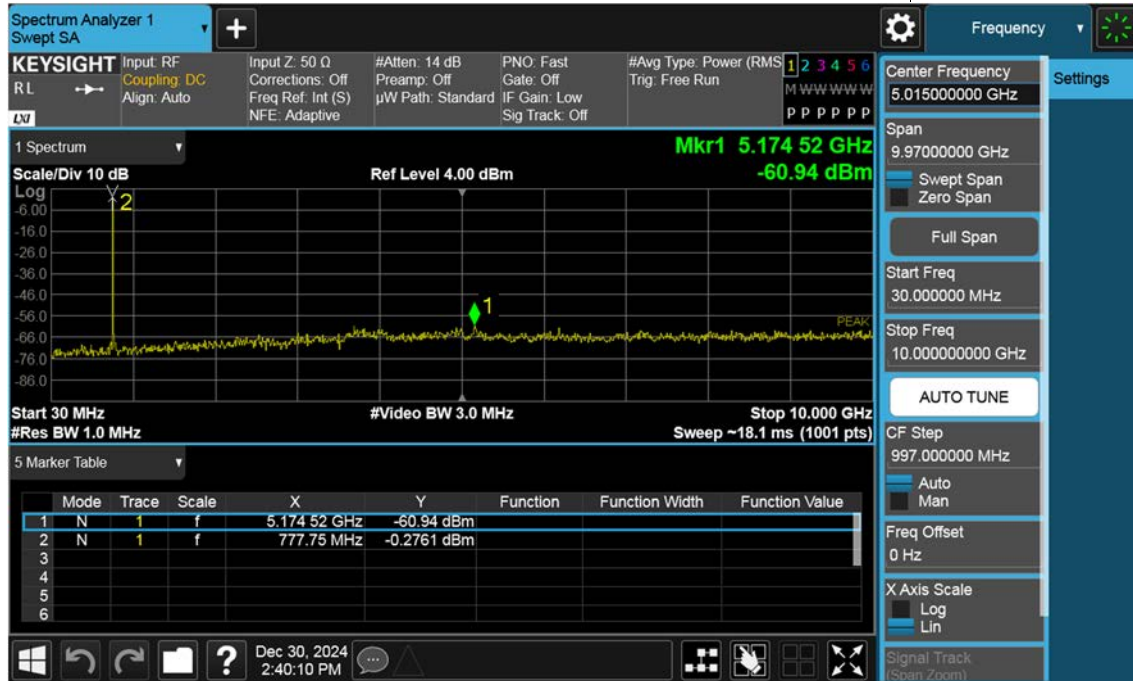
Sub6 n13_5 M_Conducted Spurious(30 M-10 G)_Mid_ BPSK_1RB



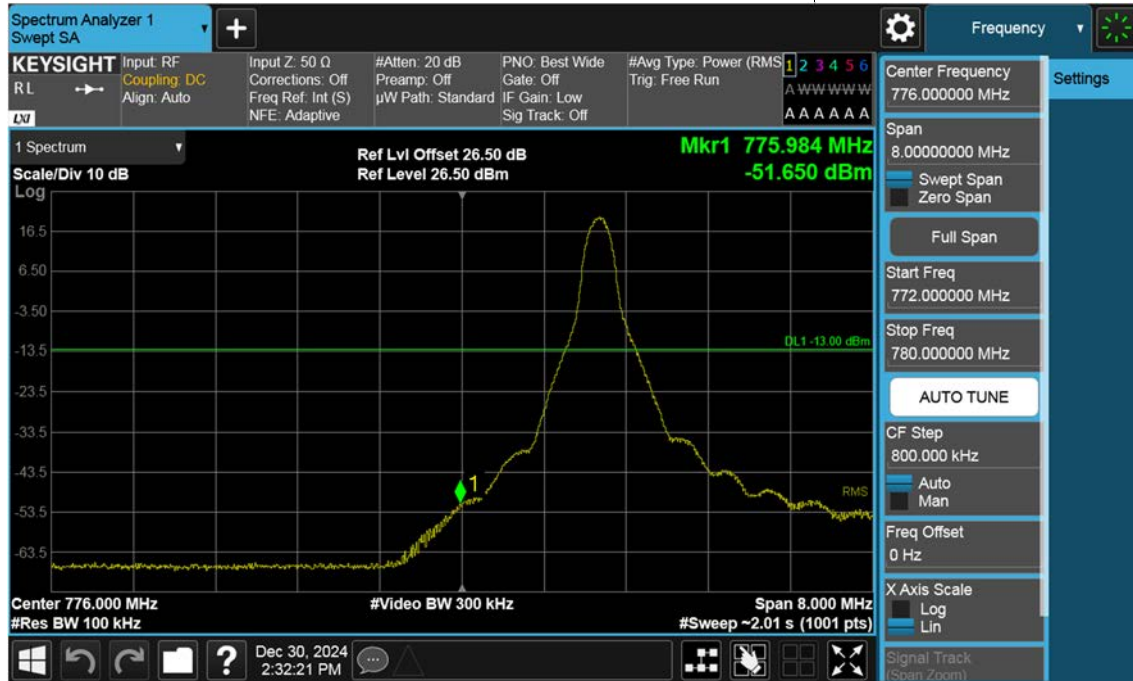
Sub6 n13_5 M_Conducted Spurious(30 M-10 G)_High_ BPSK_1RB



Sub6 n13_10 M_Conducted Spurious(30 M-10 G)_ BPSK_1RB



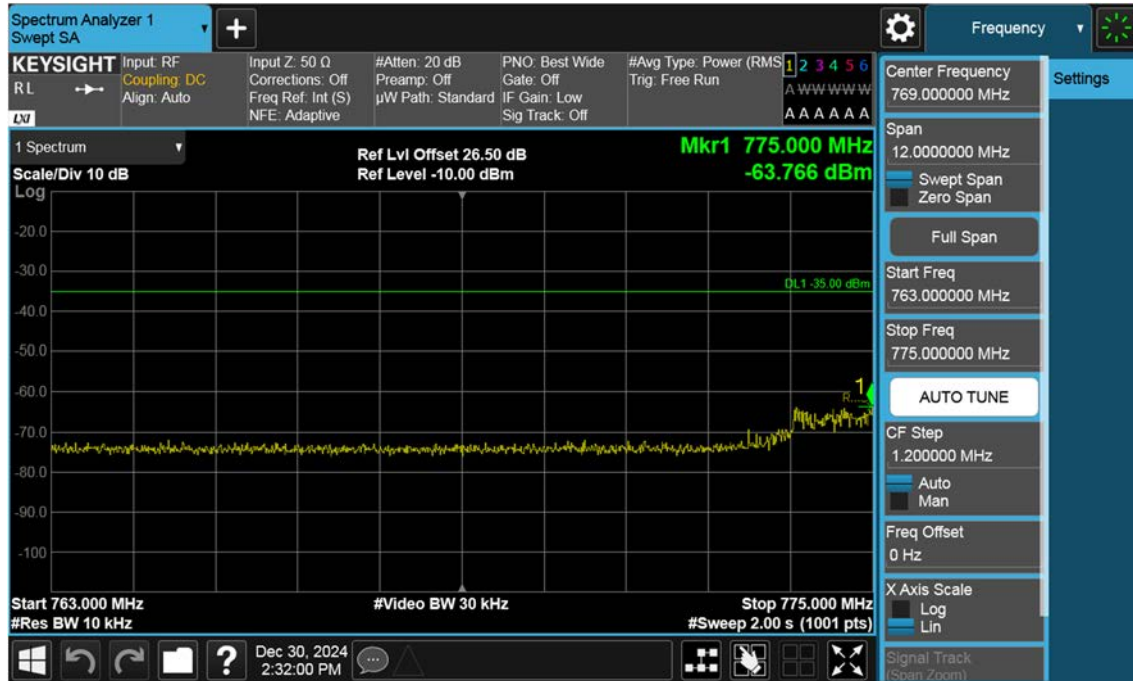
Sub6 n13_5 M_Band Edge_Low_BPSK_1RB



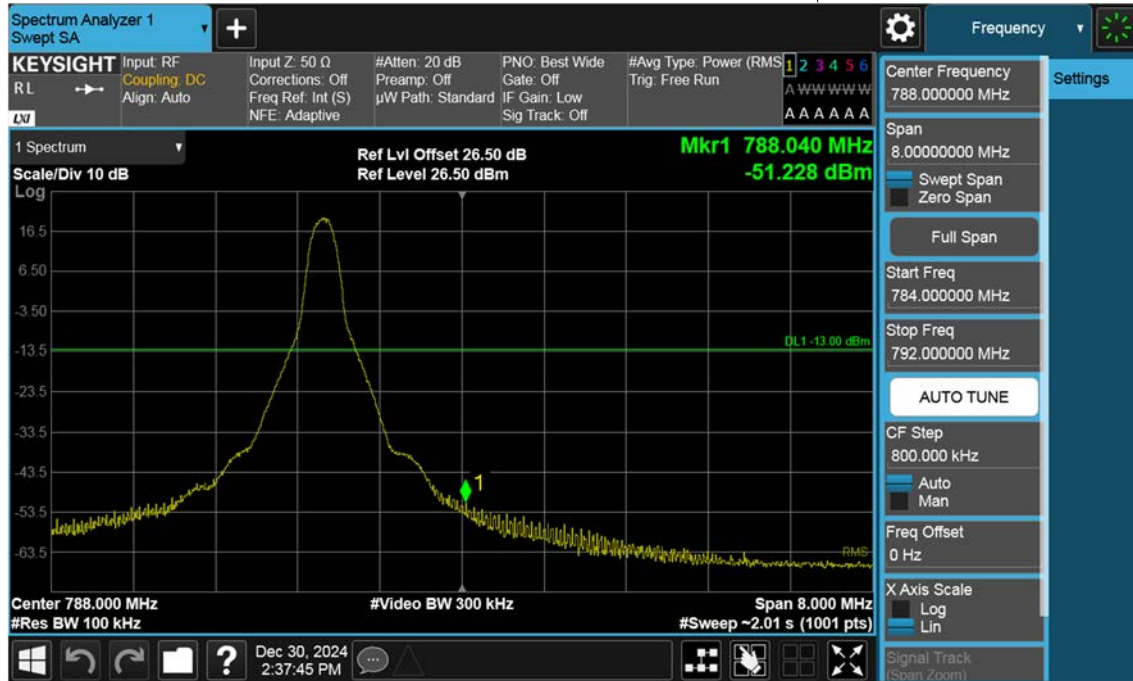
Sub6 n13_5 M_Band Edge_Low_BPSK_FullRB



Sub6 n13_5 M_Extended Band Edge_Low_BPSK_FullRB



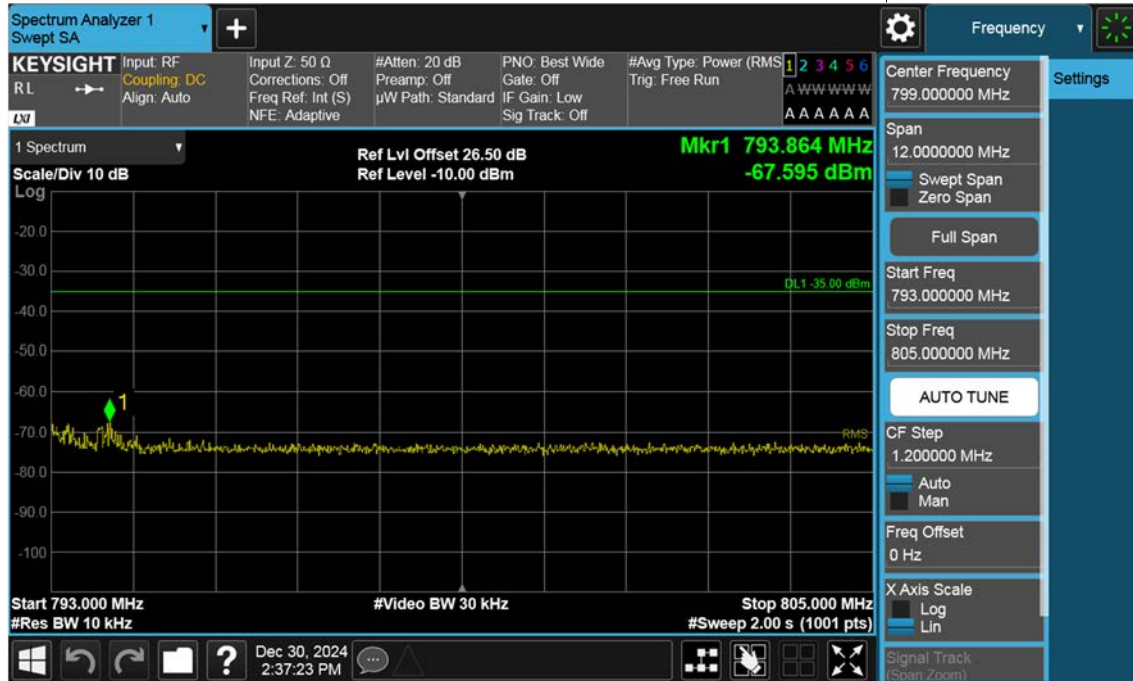
Sub6 n13_5 M_Band Edge_High_BPSK_1RB



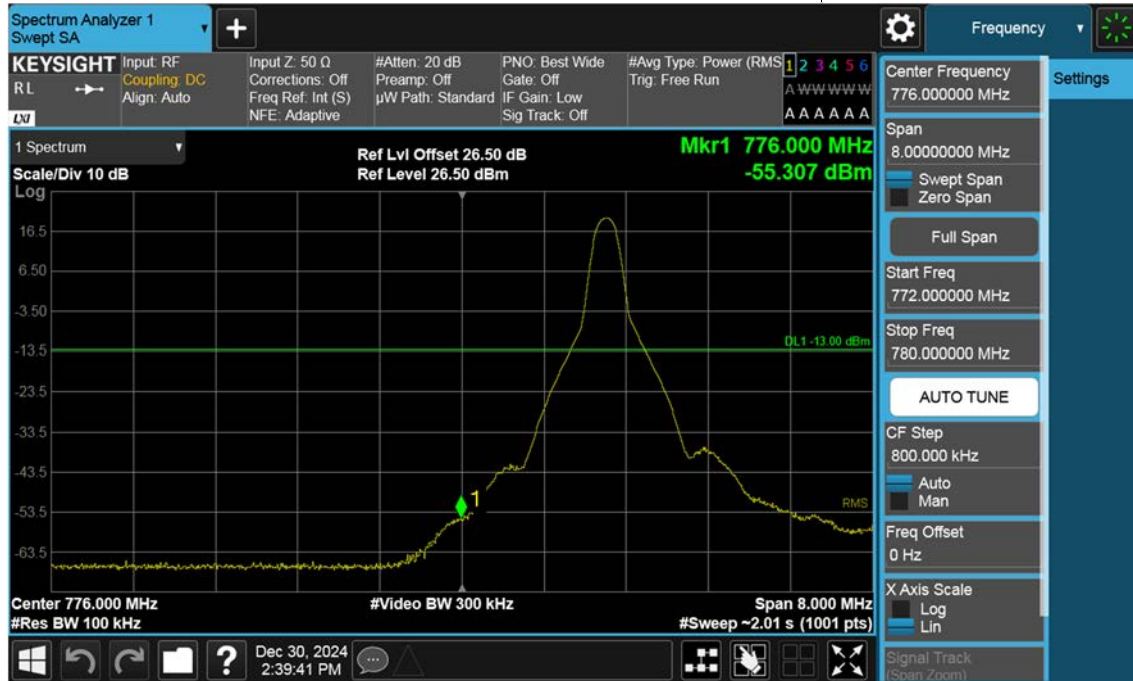
Sub6 n13_5 M_Band Edge_High_BPSK_FullRB



Sub6 n13_5 M_Extended Band Edge_High_BPSK_FullIRB



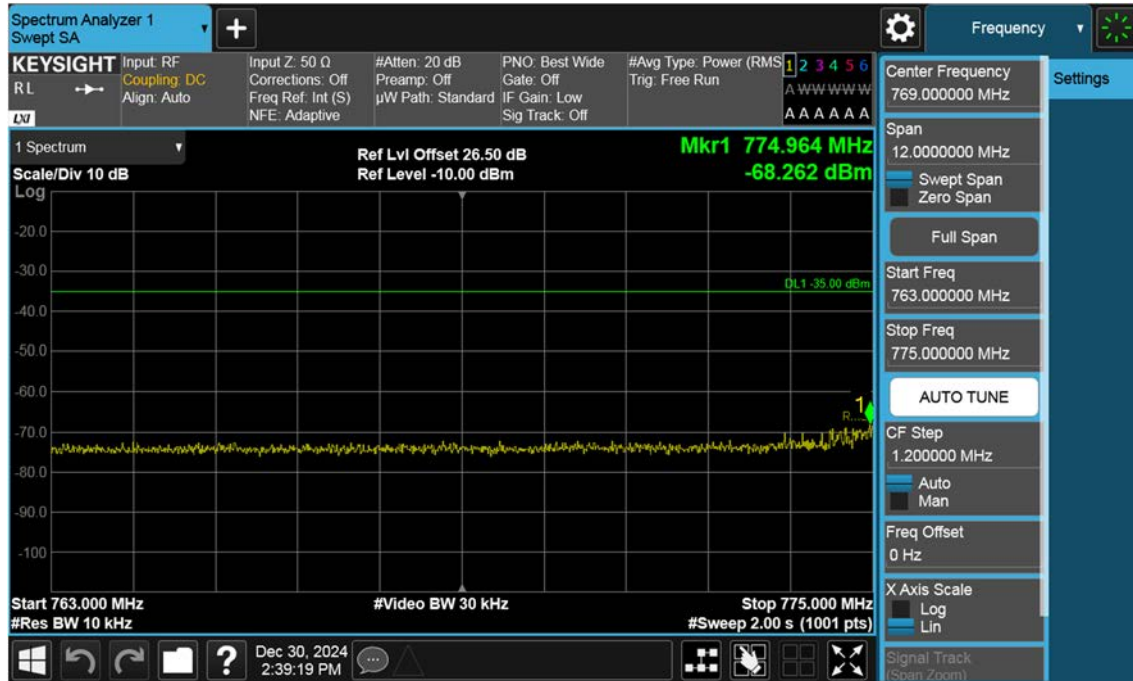
Sub6 n13_10 M_Band Edge_Low_BPSK_1RB



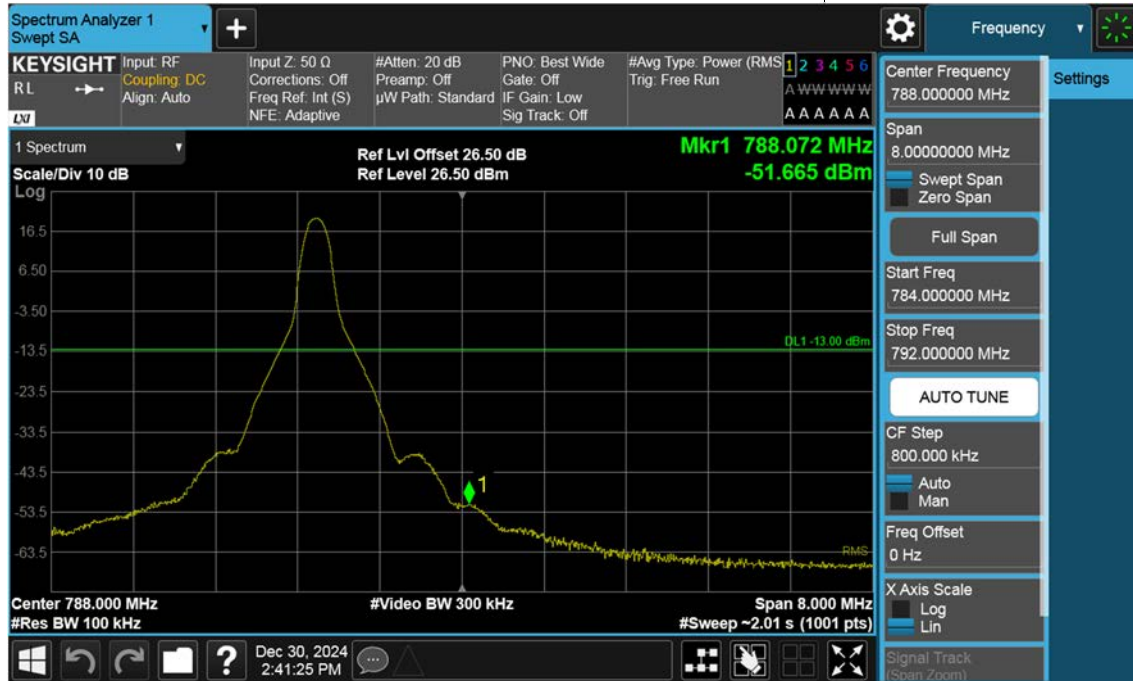
Sub6 n13_10 M_Band Edge_Low_BPSK_FullIRB



Sub6 n13_10 M_Extended Band Edge_Low_BPSK_FullRB



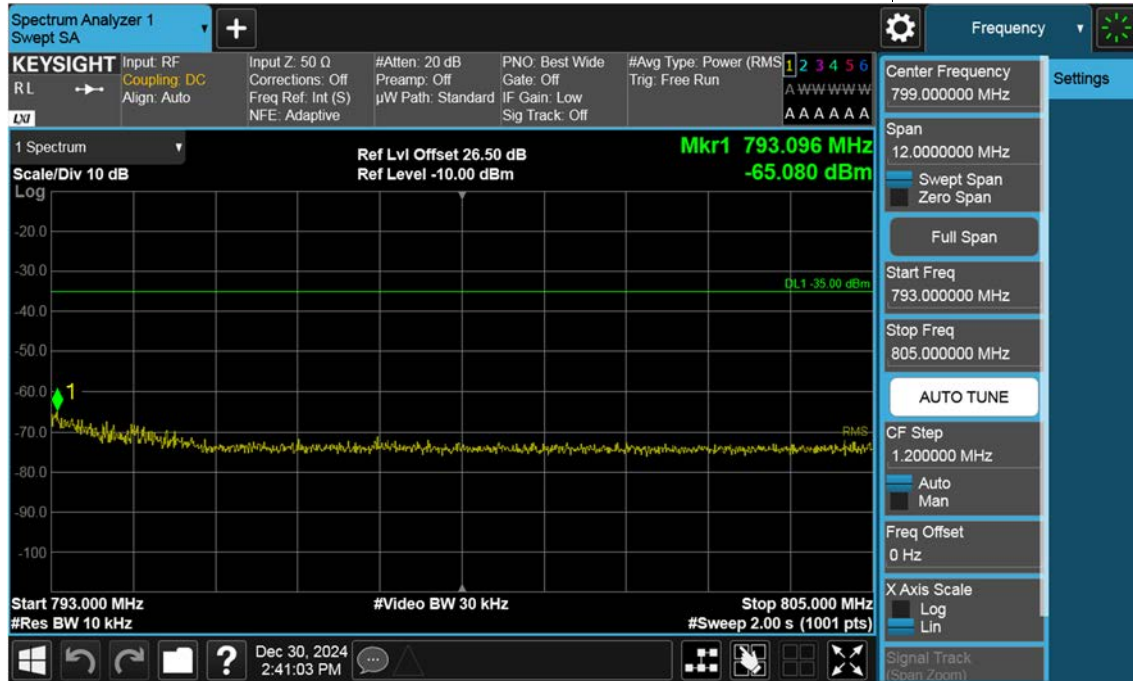
Sub6 n13_10 M_Band Edge_High_BPSK_1RB



Sub6 n13_10 M_Band Edge_High_BPSK_FullRB



Sub6 n13_10 M_Extended Band Edge_High_BPSK_FullRB



10. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2502-FC095-P