Testing and Certification

TEST REPORT

FCC Sub6 n66 Test for TM19FNNAHD2
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2412-FC033

DATE OF ISSUE
December 13, 2024

Tested by
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Applicant	**LG Electronics Inc.** 128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Republic of Korea
Product Name Model Name	Telematics TM19FNNAHD2
Date of Test	September 30, 2024 ~ December 10, 2024
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	BEJTM19FNNAHD2
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
Test Standard Used	FCC Rule Part: § 27
Test Results	PASS

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	December 13, 2024	Initial Release

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 The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

CONTENTS

MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	LG Electronics Inc.
Address:	128, Yeoui-daero, Yeongdeungpo-gu, Seoul, Republic of Korea
FCC ID:	BEJTM19FNNAHD2
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§ 27
EUT Type:	Telematics
Model(s):	TM19FNNAHD2
SCS(kHz):	15
Bandwidth(MHz):	5, 10, 15, 20, 40
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:	1712.5 MHz – 1777.5 MHz (Sub6 n66(5 MHz)) 1715.0 MHz – 1775.0 MHz (Sub6 n66(10 MHz)) 1717.5 MHz – 1772.5 MHz (Sub6 n66(15 MHz)) 1720.0 MHz – 1770.0 MHz (Sub6 n66(20 MHz)) 1730.0 MHz – 1760.0 MHz (Sub6 n66(40 MHz))
Date(s) of Tests:	September 30, 2024 ~ December 10, 2024
Serial number:	Radiated : Honda MY26 #02 Conducted : Honda MY26 #01
Antenna Information	Please refer to the Antenna Approval 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 n66 (5)	1712.5 – 1777.5	4M51G7D	PI/2 BPSK	0.240	23.80
		4M50G7D	QPSK	0.224	23.51
		4M50W7D	16QAM	0.182	22.60
		4M50W7D	64QAM	0.127	21.05
		4M50W7D	256QAM	0.080	19.04
Sub6 n66 (10)	1715.0 – 1775.0	8M97G7D	PI/2 BPSK	0.238	23.76
		8M98G7D	QPSK	0.232	23.65
		8M99W7D	16QAM	0.183	22.63
		8M96W7D	64QAM	0.130	21.13
		9M00W7D	256QAM	0.083	19.19
Sub6 n66 (15)	1717.5 – 1772.5	13M5G7D	PI/2 BPSK	0.242	23.83
		13M5G7D	QPSK	0.240	23.81
		13M5W7D	16QAM	0.195	22.89
		13M5W7D	64QAM	0.134	21.26
		13M4W7D	256QAM	0.087	19.38
Sub6 n66 (20)	1720.0 – 1770.0	18M0G7D	PI/2 BPSK	0.244	23.88
		17M9G7D	QPSK	0.238	23.77
		17M9W7D	16QAM	0.191	22.82
		18M0W7D	64QAM	0.136	21.32
		17M9W7D	256QAM	0.085	19.31
Sub6 n66 (40)	1730.0 – 1760.0	38M7G7D	PI/2 BPSK	0.247	23.93
		38M6G7D	QPSK	0.242	23.84
		38M6W7D	16QAM	0.194	22.88
		38M5W7D	64QAM	0.137	21.37
		38M6W7D	256QAM	0.089	19.49

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Telematics with LTE, Sub 6.

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

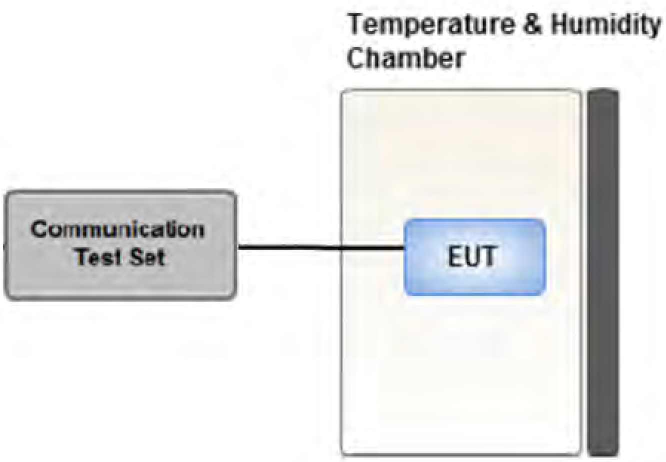
The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea.

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	- KDB 971168 D01 v03r01 – Section 5.2
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 CONDUCTED OUTPUT POWER



Test setup

Test Overview

When an average power meter is used to perform RF output power measurements, the fundamental condition that measurements be performed only over durations of active transmissions at maximum output power level applies.

Conducted Output Power was tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03r01, Section 5.2.

3.3 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 ≥ 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;

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

   Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.
3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value.
   These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.4 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 ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points > 2 x span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10^{th} harmonics from 9 kHz.

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious emissions above 1 GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.
   The spurious emissions is calculated by the following formula;

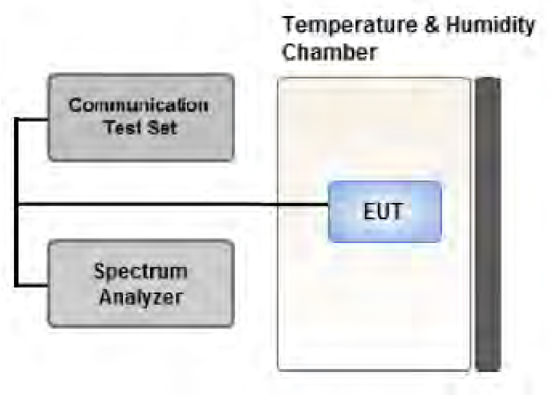
$$\text{Result}_{(dBm)} = Pg_{(dBm)} - \text{cable loss}_{(dB)} + \text{antenna gain}_{(dBi)}$$

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

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

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

3.5 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

1. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:

.- for continuous transmissions, set to 1 ms,

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

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

② Alternate Procedure for PAPR

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

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

Test Settings(Peak Power)

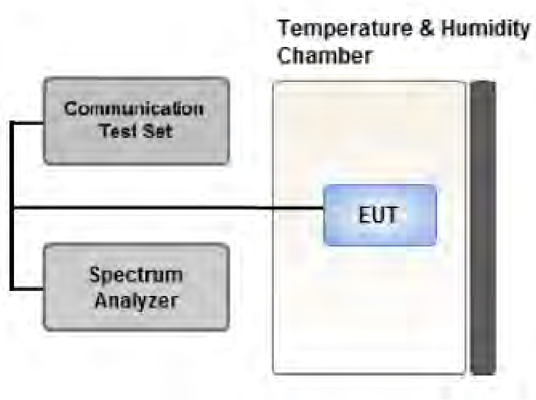
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW ≥ 3 × RBW.

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

Test Settings(Average Power)

1. Set span to 2 × to 3 × the OBW.
2. Set RBW ≥ OBW.
3. Set VBW ≥ 3 × RBW.
4. Set number of measurement points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   Set ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
6. Detector = power averaging (rms).
7. Set sweep trigger to "free run."
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. (To accurately determine the average power over the on and off period of the transmitter, it can be necessary to increase the number of traces to be averaged above 100 or, if using a manually configured sweep time, increase the sweep time.)
9. Use the peak marker function to determine the maximum amplitude level.
10. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25 %.

3.6 OCCUPIED BANDWIDTH.



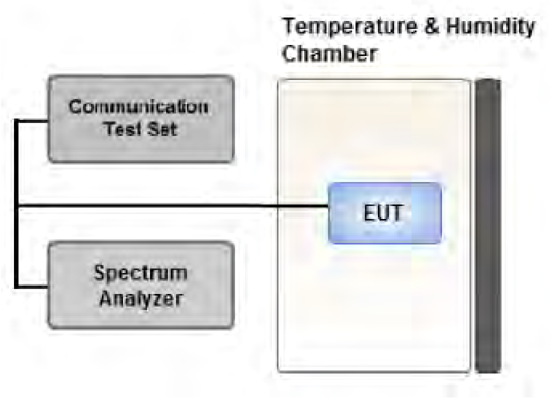
Test setup

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 ≥ 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

3.7 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

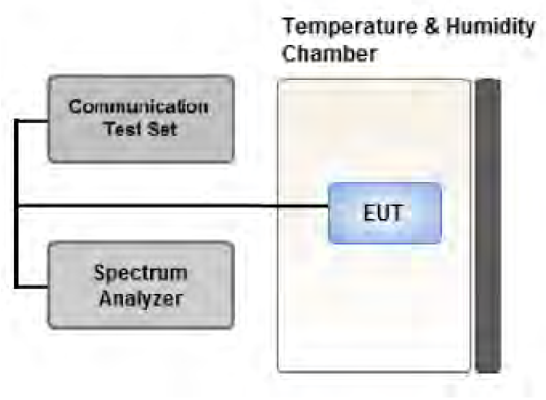
Test Overview

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

Test Settings

1. RBW = 1 MHz
2. VBW ≥ 3 MHz
3. Detector = Peak
4. Trace Mode = Max Hold
5. Sweep time = auto
6. Number of points in sweep ≥ 2 x Span / RBW

3.8 CHANNEL 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 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

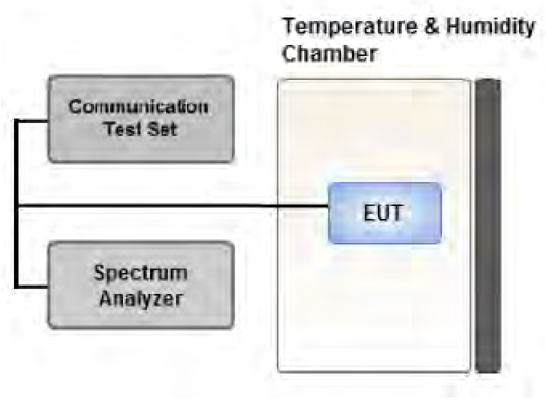
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. Within 1MHz of the channel edge the RBW should be 2 % of EBW, then 1 MHz after that.
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Notes

1. The attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge,
2. 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge.
3. 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge.
4. The attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz.
5. 55 + 10 log (P) dB at or below 2490.5 MHz.
6. X is the greater of 6MHz or the actual emission bandwidth
7. 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 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.

3.9 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.

3.10 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
  Mode : SA, NSA
  Worst case : SA
- 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.
- 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 was investigated and the worst case bandwidth results are reported. (Worst case : 5 MHz)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Equivalent Isotropic Radiated Power	PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM	See Section 8.2		Z
Radiated Spurious and Harmonic Emissions	PI/2 BPSK	See Section 8.3		X

3.11 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
- 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, 15, 20,40	Mid	Full RB	0
Band Edge	PI/2 BPSK	5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	51
		15	Low	1	0
			High	1	78
		20	Low	1	0
			High	1	105
		40	Low	1	0
			High	1	215
		5, 10, 15, 20,40	Low, High	Full RB	0
Spurious and Harmonic Emissions at Antenna Terminal	PI/2 BPSK	5, 10, 15, 20,40	Low, Mid, High	1	1

4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacture	Serial No.	Due to Calibration	Calibration Interval
Precision Dipole Antenna	UHAP	Schwarzbeck	01273	03/10/2026	Biennial
Precision Dipole Antenna	UHAP	Schwarzbeck	01274	03/10/2026	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	02289	02/14/2026	Biennial
Horn Antenna(1~18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1299	04/27/2025	Biennial
Horn Antenna(15~40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/20/2026	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	05/14/2025	Annual
RF Switching System	FBSR-06B (3G HPF + LNA)	T&M SYSTEM	F3L2	05/14/2025	Annual
RF Switching System	FBSR-06B (6G HPF + LNA)	T&M SYSTEM	F3L3	05/14/2025	Annual
RF Switching System	FBSR-06B (LNA)	T&M SYSTEM	F3L4	05/14/2025	Annual
Power Amplifier	CBL18265035	CERNEX	22966	11/07/2025	Annual
Power Amplifier	CBL26405040	CERNEX	25956	02/26/2025	Annual
DC Power Supply	E3632A	Hewlett Packard	MY40004427	08/22/2025	Annual
Power Splitter(DC~26.5 GHz)	11667B	Hewlett Packard	11275	02/29/2025	Annual
Chamber	SU-642	ESPEC	93008124	02/19/2025	Annual
Signal Analyzer(10 Hz~26.5 GHz)	N9020A	Agilent	MY51110063	04/04/2025	Annual
ATTENUATOR(20 dB)	8493C	Hewlett Packard	17280	04/17/2025	Annual
Spectrum Analyzer (10 Hz~40 GHz)	FSV40	REOHDE & SCHWARZ	101436	02/13/2025	Annual
Signal & Spectrum Analyzer (2 Hz~67 GHz)	FSW67	REOHDE & SCHWARZ	101736	23/05/2025	Annual
Base Station	8960 (E5515C)	Agilent	MY48360800	08/05/2025	Annual
Wideband Radio Communication Tester	MT8821C	Anritsu Corp.	6262287701	05/16/2025	Annual
Wideband Radio Communication Tester	MT8000A	Anritsu Corp.	6262302511	05/14/2025	Annual
Signal Analyzer(5 Hz~40.0 GHz)	N9030B	KEYSIGHT	MY55480167	05/17/2025	Annual
4-Way Divider	ZC4PD-K1844+	Mini-Circuits	942907	09/10/2025	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 (±dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.98 (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

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(h)	< 43 + 10log10 (P[Watts]) at Band Edge and for all out-of-band emissions	PASS
Conducted Output Power	§ 2.1046	N/A	PASS
Peak- to- Average Ratio	§ 27.50(d)(5)	< 13 dB	PASS
Frequency stability / variation of ambient temperature	§ 2.1055, § 27.54	Emission must remain in band	PASS

Note:
1. 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
Equivalent Isotropic Radiated Power	§ 27.50(d)(4)	< 1 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§ 2.1053, § 27.53(h)	< 43 + 10log10 (P[Watts]) for all out-of band emissions	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(m)(4)	Block Edge / Spurious and Harmonic Emissions at Antenna Terminal..	Y	-
§2.1051, §27.53(h)	Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	Y	-
§27.50(d)(5)	Peak- to- Average Ratio	Y	-
§2.1055, §27.54	Frequency stability / variation of ambient temperature	Y	-
§27.50(h)(2)	Effective Radiated Power Equivalent Isotropic Radiated Power	Y	Spot-check
§2.1053, §27.53(m)(4)	Radiated Spurious and Harmonic Emissions	Y	Spot-check
§2.1046	Conducted Output Power	Y	-

Spot-Check Result
1. Data was leveraged from model TM19FNNAHD4 for the certification of TM19FNNAHD2.
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

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

8.1 Conducted Output Power

Bandwidth	SCS(kHz)	OFDM	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
						342500	349000	355500
						1712.5 MHz	1745 MHz	1777.5 MHz
5 MHz	15	DFT-s	pi/2 BPSK	1	1	23.72	23.41	23.47
				1	13	23.80	23.44	23.56
				1	23	23.72	23.45	23.54
				12	0	23.19	22.87	22.85
				12	7	23.69	23.39	23.45
				12	13	23.24	22.93	23.01
				25	0	23.21	22.93	23.01
			QPSK	1	1	23.51	23.38	23.41
			16QAM	1	1	22.60	22.38	22.24
			64QAM	1	1	21.05	20.85	20.87
			256QAM	1	1	19.04	18.84	18.70
		CP	QPSK	1	1	21.97	21.78	21.82

Bandwidth	SCS(kHz)	OFDM	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
						343000	349000	355000
						1715 MHz	1745 MHz	1775 MHz
10 MHz	15	DFT-s	pi/2 BPSK	1	1	23.69	23.49	23.51
				1	26	23.76	23.44	23.40
				1	50	23.76	23.37	23.56
				25	0	23.20	22.95	22.88
				25	14	23.64	23.48	23.48
				25	27	23.26	22.97	23.09
				50	0	23.23	22.96	22.94
			QPSK	1	1	23.65	23.50	23.50
			16QAM	1	1	22.63	22.43	22.44
			64QAM	1	1	21.13	21.02	21.01
			256QAM	1	1	19.14	19.19	19.01
		CP	QPSK	1	1	22.06	22.00	22.02

Bandwidth	SCS(kHz)	OFDM	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
						343500	349000	354500
						1717.5 MHz	1745 MHz	1772.5 MHz
15 MHz	15	DFT-s	pi/2 BPSK	1	1	23.83	23.58	23.53
				1	40	23.79	23.47	23.44
				1	77	23.79	23.45	23.58
				36	0	23.30	23.09	22.97
				36	22	23.82	23.51	23.49
				36	43	23.33	22.92	23.00
				75	0	23.24	23.04	22.97
			QPSK	1	1	23.81	23.61	23.43
			16QAM	1	1	22.89	22.55	22.30
			64QAM	1	1	21.26	21.13	20.90
			256QAM	1	1	19.38	19.14	18.99
		CP	QPSK	1	1	22.42	22.27	21.84

Bandwidth	SCS(kHz)	OFDM	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
						344000	349000	354000
						1720 MHz	1745 MHz	1770 MHz
20 MHz	15	DFT-s	pi/2 BPSK	1	1	23.88	23.75	23.59
				1	53	23.82	23.58	23.56
				1	104	23.71	23.49	23.66
				50	0	23.25	23.15	23.00
				50	28	23.85	23.62	23.57
				50	56	23.29	23.03	23.03
				100	0	23.31	23.14	23.06
			QPSK	1	1	23.77	23.75	23.43
			16QAM	1	1	22.77	22.82	22.63
			64QAM	1	1	21.32	21.17	21.01
			256QAM	1	1	19.31	19.22	19.01
		CP	QPSK	1	1	22.28	22.19	21.91

Bandwidth	SCS(kHz)	OFDM	Modulation	RB Size	RB Offset	Max.Average Power (dBm)		
						346000	349000	352000
						1730 MHz	1745 MHz	1760 MHz
40 MHz	15	DFT-s	pi/2 BPSK	1	1	23.93	23.80	23.75
				1	108	23.81	23.71	23.65
				1	214	23.72	23.80	23.90
				108	0	23.46	23.33	23.10
				108	54	23.91	23.71	23.62
				108	108	23.36	23.30	23.27
				216	0	23.36	23.31	23.17
			QPSK	1	1	23.84	23.76	23.82
			16QAM	1	1	22.88	22.74	22.80
			64QAM	1	1	21.37	21.27	21.30
			256QAM	1	1	19.45	19.49	19.28
		CP	QPSK	1	1	22.35	22.21	22.20

8.2 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP		RB	
								W	W	dBm	Size	Offset
1712.5	Sub6 n66/ 5 MHz [15 kHz]	PI/2 BPSK	-17.57	15.51	10.12	2.06	V	< 1.00	0.228	23.57	1	23
		QPSK	-17.58	15.50	10.12	2.06	V		0.227	23.56		
		16-QAM	-18.58	14.50	10.12	2.06	V		0.180	22.56		
		64-QAM	-20.09	12.99	10.12	2.06	V		0.127	21.05		
		256-QAM	-22.07	11.01	10.12	2.06	V		0.081	19.07		
1745.0		PI/2 BPSK	-16.54	16.83	10.43	2.07	H		0.330	25.19	1	23
		QPSK	-16.59	16.78	10.43	2.07	H		0.327	25.14		
		16-QAM	-17.58	15.79	10.43	2.07	H		0.260	24.15		
		64-QAM	-19.08	14.29	10.43	2.07	H		0.184	22.65		
		256-QAM	-21.09	12.28	10.43	2.07	H		0.116	20.64		
1777.5		PI/2 BPSK	-15.30	18.06	10.50	2.09	H		0.444	26.47	1	23
		QPSK	-15.43	17.93	10.50	2.09	H		0.431	26.34		
		16-QAM	-16.41	16.95	10.50	2.09	H		0.344	25.36		
		64-QAM	-17.89	15.47	10.50	2.09	H		0.244	23.88		
		256-QAM	-19.83	13.53	10.50	2.09	H		0.156	21.94		

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP		RB	
								W	W	dBm	Size	Offset
1715.0	Sub6 n66/ 10 MHz [15 kHz]	PI/2 BPSK	-17.42	15.66	10.12	2.06	V	< 1.00	0.236	23.72	1	50
		QPSK	-17.47	15.61	10.12	2.06	V		0.233	23.67		
		16-QAM	-18.48	14.60	10.12	2.06	V		0.185	22.66		
		64-QAM	-19.96	13.12	10.12	2.06	V		0.131	21.18		
		256-QAM	-21.96	11.12	10.12	2.06	V		0.083	19.18		
1745.0		PI/2 BPSK	-16.32	17.05	10.43	2.07	H		0.348	25.41	1	50
		QPSK	-16.42	16.95	10.43	2.07	H		0.340	25.31		
		16-QAM	-17.40	15.97	10.43	2.07	H		0.271	24.33		
		64-QAM	-18.90	14.47	10.43	2.07	H		0.192	22.83		
		256-QAM	-20.90	12.47	10.43	2.07	H		0.121	20.83		
1775.0		PI/2 BPSK	-15.37	18.03	10.49	2.09	H		0.440	26.43	1	50
		QPSK	-15.38	18.02	10.49	2.09	H		0.439	26.42		
		16-QAM	-16.40	17.00	10.49	2.09	H		0.347	25.40		
		64-QAM	-17.89	15.51	10.49	2.09	H		0.246	23.91		
		256-QAM	-19.88	13.52	10.49	2.09	H		0.156	21.92		

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP		RB	
								W	W	dBm	Size	Offset
1717.5	Sub6 n66/ 15 MHz [15 kHz]	PI/2 BPSK	-17.24	15.92	10.18	2.06	V	< 1.00	0.254	24.04	1	77
		QPSK	-17.25	15.91	10.18	2.06	V		0.253	24.03		
		16-QAM	-18.41	14.75	10.18	2.06	V		0.194	22.87		
		64-QAM	-19.90	13.26	10.18	2.06	V		0.137	21.38		
		256-QAM	-21.86	11.30	10.18	2.06	V		0.088	19.42		
1745.0		PI/2 BPSK	-16.50	16.87	10.43	2.07	H		0.333	25.23	1	77
		QPSK	-16.55	16.82	10.43	2.07	H		0.330	25.18		
		16-QAM	-17.57	15.80	10.43	2.07	H		0.261	24.16		
		64-QAM	-19.04	14.33	10.43	2.07	H		0.186	22.69		
		256-QAM	-21.07	12.30	10.43	2.07	H		0.116	20.66		
1772.5		PI/2 BPSK	-15.38	18.02	10.49	2.09	H		0.439	26.42	1	77
		QPSK	-15.43	17.97	10.49	2.09	H		0.434	26.37		
		16-QAM	-16.42	16.98	10.49	2.09	H		0.345	25.38		
		64-QAM	-17.93	15.47	10.49	2.09	H		0.244	23.87		
		256-QAM	-19.90	13.50	10.49	2.09	H		0.155	21.90		

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP		RB	
								W	W	dBm	Size	Offset
1720.0	Sub6 n66/ 20 MHz [15 kHz]	PI/2 BPSK	-17.31	15.85	10.18	2.06	V	< 1.00	0.250	23.97	1	53
		QPSK	-17.35	15.81	10.18	2.06	V		0.247	23.93		
		16-QAM	-18.34	14.82	10.18	2.06	V		0.197	22.94		
		64-QAM	-19.82	13.34	10.18	2.06	V		0.140	21.46		
		256-QAM	-21.82	11.34	10.18	2.06	V		0.088	19.46		
1745.0		PI/2 BPSK	-16.25	17.12	10.43	2.07	H		0.353	25.48	1	104
		QPSK	-16.30	17.07	10.43	2.07	H		0.349	25.43		
		16-QAM	-17.28	16.09	10.43	2.07	H		0.279	24.45		
		64-QAM	-18.78	14.59	10.43	2.07	H		0.197	22.95		
		256-QAM	-20.77	12.60	10.43	2.07	H		0.125	20.96		
1770.0		PI/2 BPSK	-15.35	18.07	10.49	2.09	H		0.444	26.47	1	104
		QPSK	-15.38	18.04	10.49	2.09	H		0.441	26.44		
		16-QAM	-16.40	17.02	10.49	2.09	H		0.348	25.42		
		64-QAM	-17.88	15.54	10.49	2.09	H		0.248	23.94		
		256-QAM	-19.95	13.47	10.49	2.09	H		0.154	21.87		

Freq (MHz)	Mod/ Bandwidth [SCS (kHz)]	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP		RB	
								W	W	dBm	Size	Offset
1730.0	Sub6 n66/ 40 MHz [15 kHz]	PI/2 BPSK	-16.71	16.69	10.29	2.08	H	< 1.00	0.309	24.90	1	214
		QPSK	-16.81	16.59	10.29	2.08	H		0.302	24.80		
		16-QAM	-17.83	15.57	10.29	2.08	H		0.239	23.78		
		64-QAM	-19.30	14.10	10.29	2.08	H		0.170	22.31		
		256-QAM	-21.08	12.32	10.29	2.08	H		0.113	20.53		
1745.0		PI/2 BPSK	-16.00	17.37	10.43	2.07	H		0.374	25.73	1	214
		QPSK	-16.01	17.36	10.43	2.07	H		0.373	25.72		
		16-QAM	-17.03	16.34	10.43	2.07	H		0.295	24.70		
		64-QAM	-18.51	14.86	10.43	2.07	H		0.210	23.22		
		256-QAM	-20.33	13.04	10.43	2.07	H		0.138	21.40		
1760.0		PI/2 BPSK	-15.52	17.70	10.48	2.09	H		0.406	26.09	1	214
		QPSK	-15.54	17.68	10.48	2.09	H		0.405	26.07		
		16-QAM	-16.49	16.73	10.48	2.09	H		0.325	25.12		
		64-QAM	-17.98	15.24	10.48	2.09	H		0.231	23.63		
		256-QAM	-19.98	13.24	10.48	2.09	H		0.146	21.63		

8.3 RADIATED SPURIOUS EMISSIONS

- NR Band: N66
- Bandwidth: 5 MHz
- Modulation: PI/2 BPSK
- Distance: 3 meters
- SCS: 15 kHz

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	Limit (dBm)	RB	
									Size	Offset
342500 (1712.5)	3 425.00	-59.07	11.76	-60.29	2.99	V	-51.52	-13.00	1	23
	5 137.50	-60.70	11.45	-54.26	3.80	V	-46.61	-13.00		
	6 850.00	-63.99	11.04	-52.35	4.36	V	-45.67	-13.00		
349000 (1745.0)	3 490.00	-59.63	12.04	-60.37	3.04	V	-51.37	-13.00	1	23
	5 235.00	-60.65	11.76	-55.32	3.78	V	-47.34	-13.00		
	6 980.00	-63.85	11.16	-51.07	4.48	V	-44.39	-13.00		
355500 (1777.5)	3 555.00	-59.59	12.04	-60.48	3.09	V	-51.53	-13.00	1	23
	5 332.50	-61.67	11.92	-56.44	3.79	V	-48.31	-13.00		
	7 110.00	-64.23	10.80	-49.73	4.48	V	-43.41	-13.00		

8.4 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
Sub6 n66	5 MHz	1745.0	BPSK	25	0	3.94
			QPSK			4.50
			16-QAM			5.66
			64-QAM			6.05
			256-QAM			6.72
	10 MHz		BPSK	50		3.94
			QPSK			4.59
			16-QAM			5.59
			64-QAM			6.07
			256-QAM			6.64
	15 MHz		BPSK	75		4.12
			QPSK			4.56
			16-QAM			5.47
			64-QAM			5.98
			256-QAM			6.65
	20 MHz		BPSK	100		4.20
			QPSK			4.63
			16-QAM			5.54
			64-QAM			5.98
			256-QAM			6.64
	40 MHz		BPSK	216		3.81
			QPSK			4.56
			16-QAM			5.55
			64-QAM			5.99
			256-QAM			6.60

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 44 ~ 68.

8.5 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
Sub6 n66	5 MHz	1745.0	BPSK	25	0	4.5045
			QPSK			4.5035
			16-QAM			4.4988
			64-QAM			4.5005
			256-QAM			4.4991
	10 MHz		BPSK	50		8.9738
			QPSK			8.9821
			16-QAM			8.9854
			64-QAM			8.9622
			256-QAM			8.9990
	15 MHz		BPSK	75		13.465
			QPSK			13.456
			16-QAM			13.473
			64-QAM			13.486
			256-QAM			13.427
	20 MHz		BPSK	100		17.983
			QPSK			17.923
			16-QAM			17.930
			64-QAM			17.968
			256-QAM			17.886
	40 MHz		BPSK	216		38.648
			QPSK			38.552
			16-QAM			38.560
			64-QAM			38.521
			256-QAM			38.596

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 69 ~ 93.

8.6 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 n66	5	1712.5	4.9552	30.200	-62.547	-32.347	-13.00
		1745.0	8.1057	30.815	-62.031	-31.216	
		1777.5	8.8734	30.815	-63.804	-32.989	
	10	1715.0	8.1755	30.815	-63.078	-32.263	
		1745.0	9.6610	30.815	-63.252	-32.437	
		1775.0	4.0579	30.200	-62.944	-32.744	
	15	1717.5	5.1745	30.815	-62.700	-31.885	
		1745.0	7.7468	30.815	-63.317	-32.502	
		1772.5	9.9900	30.815	-62.921	-32.106	
	20	1720.0	4.5364	30.200	-62.952	-32.752	
		1745.0	9.7308	30.815	-62.966	-32.151	
		1770.0	3.7688	30.200	-62.600	-32.400	
	40	1730.0	6.0619	0.000	-63.013	-63.013	
		1745.0	3.7688	0.000	-62.923	-62.923	
		1760.0	3.7987	0.000	-62.746	-62.746	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 94 ~ 123.
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

8.7 BAND EDGE

- Plots of the EUT's Band Edge are shown Page 124 ~ 153.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

- BandWidth: 5 MHz
- Voltage(100 %): 13.200 VDC
- LIMIT: Emission must remain in band

Test. Frequncy (MHz)	Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1712.5	100 %	+20(Ref)	1712 500 014	0.0	0.000 000	0.000
	100 %	-30	1712 500 025	10.9	0.000 001	0.006
	100 %	-20	1712 500 022	8.0	0.000 000	0.005
	100 %	-10	1712 500 019	4.4	0.000 000	0.003
	100 %	0	1712 500 016	1.3	0.000 000	0.001
	100 %	+10	1712 500 012	-1.9	0.000 000	-0.001
	100 %	+30	1712 500 011	-3.0	0.000 000	-0.002
	100 %	+40	1712 500 029	14.9	0.000 001	0.009
	100 %	+50	1712 500 026	11.9	0.000 001	0.007
	85 %	+20	1712 500 023	8.4	0.000 000	0.005
	115 %	+20	1712 500 022	7.7	0.000 000	0.004
1777.5	100 %	+20(Ref)	1777 500 014	0.0	0.000 000	0.000
	100 %	-30	1777 500 027	12.1	0.000 001	0.007
	100 %	-20	1777 500 023	9.0	0.000 001	0.005
	100 %	-10	1777 500 020	5.4	0.000 000	0.003
	100 %	0	1777 500 018	4.0	0.000 000	0.002
	100 %	+10	1777 500 015	0.5	0.000 000	0.000
	100 %	+30	1777 500 031	16.2	0.000 001	0.009
	100 %	+40	1777 500 027	12.8	0.000 001	0.007
	100 %	+50	1777 500 024	9.6	0.000 001	0.005
	85 %	+20	1777 500 023	8.9	0.000 001	0.005
	115 %	+20	1777 500 025	10.1	0.000 001	0.006

▣ BandWidth: 10 MHz

▣ Voltage(100 %): 13.200 VDC

▣ LIMIT: Emission must remain in band

Test. Frequncy (MHz)	Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1715.0	100 %	+20(Ref)	1715 000 004	0.0	0.000 000	0.000
	100 %	-30	1715 000 007	3.5	0.000 000	0.002
	100 %	-20	1715 000 007	3.6	0.000 000	0.002
	100 %	-10	1715 000 007	3.2	0.000 000	0.002
	100 %	0	1715 000 007	3.3	0.000 000	0.002
	100 %	+10	1715 000 007	3.1	0.000 000	0.002
	100 %	+30	1715 000 007	2.8	0.000 000	0.002
	100 %	+40	1715 000 006	2.4	0.000 000	0.001
	100 %	+50	1715 000 007	2.9	0.000 000	0.002
	85 %	+20	1715 000 006	2.0	0.000 000	0.001
	115 %	+20	1715 000 009	4.8	0.000 000	0.003
1775.0	100 %	+20(Ref)	1774 999 996	0.0	0.000 000	0.000
	100 %	-30	1774 999 992	-4.4	0.000 000	-0.002
	100 %	-20	1774 999 990	-6.0	0.000 000	-0.003
	100 %	-10	1774 999 993	-3.3	0.000 000	-0.002
	100 %	0	1774 999 988	-8.2	0.000 000	-0.005
	100 %	+10	1775 000 006	9.6	0.000 001	0.005
	100 %	+30	1774 999 986	-10.5	-0.000 001	-0.006
	100 %	+40	1775 000 003	6.8	0.000 000	0.004
	100 %	+50	1775 000 002	5.6	0.000 000	0.003
	85 %	+20	1775 000 001	4.4	0.000 000	0.002
	115 %	+20	1775 000 003	6.4	0.000 000	0.004

▣ BandWidth: 15 MHz

▣ Voltage(100 %): 13.200 VDC

▣ LIMIT: Emission must remain in band

Test. Frequncy (MHz)	Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1717.5	100 %	+20(Ref)	1717 500 003	0.0	0.000 000	0.000
	100 %	-30	1717 500 005	2.3	0.000 000	0.001
	100 %	-20	1717 500 005	2.1	0.000 000	0.001
	100 %	-10	1717 500 005	2.0	0.000 000	0.001
	100 %	0	1717 500 005	1.6	0.000 000	0.001
	100 %	+10	1717 500 004	1.2	0.000 000	0.001
	100 %	+30	1717 500 003	0.0	0.000 000	0.000
	100 %	+40	1717 500 003	0.0	0.000 000	0.000
	100 %	+50	1717 500 003	-0.5	0.000 000	0.000
	85 %	+20	1717 500 004	0.5	0.000 000	0.000
	115 %	+20	1717 500 006	2.4	0.000 000	0.001
1772.5	100 %	+20(Ref)	1772 499 988	0.0	0.000 000	0.000
	100 %	-30	1772 499 995	7.4	0.000 000	0.004
	100 %	-20	1772 499 977	-10.6	-0.000 001	-0.006
	100 %	-10	1772 499 960	-28.5	-0.000 002	-0.016
	100 %	0	1772 499 960	-28.4	-0.000 002	-0.016
	100 %	+10	1772 499 961	-27.3	-0.000 002	-0.015
	100 %	+30	1772 499 998	9.6	0.000 001	0.005
	100 %	+40	1772 499 998	9.8	0.000 001	0.006
	100 %	+50	1772 499 980	-7.7	0.000 000	-0.004
	85 %	+20	1772 499 996	8.0	0.000 000	0.005
	115 %	+20	1772 499 991	2.8	0.000 000	0.002

▣ BandWidth: 20 MHz

▣ Voltage(100 %): 13.200 VDC

▣ LIMIT: Emission must remain in band

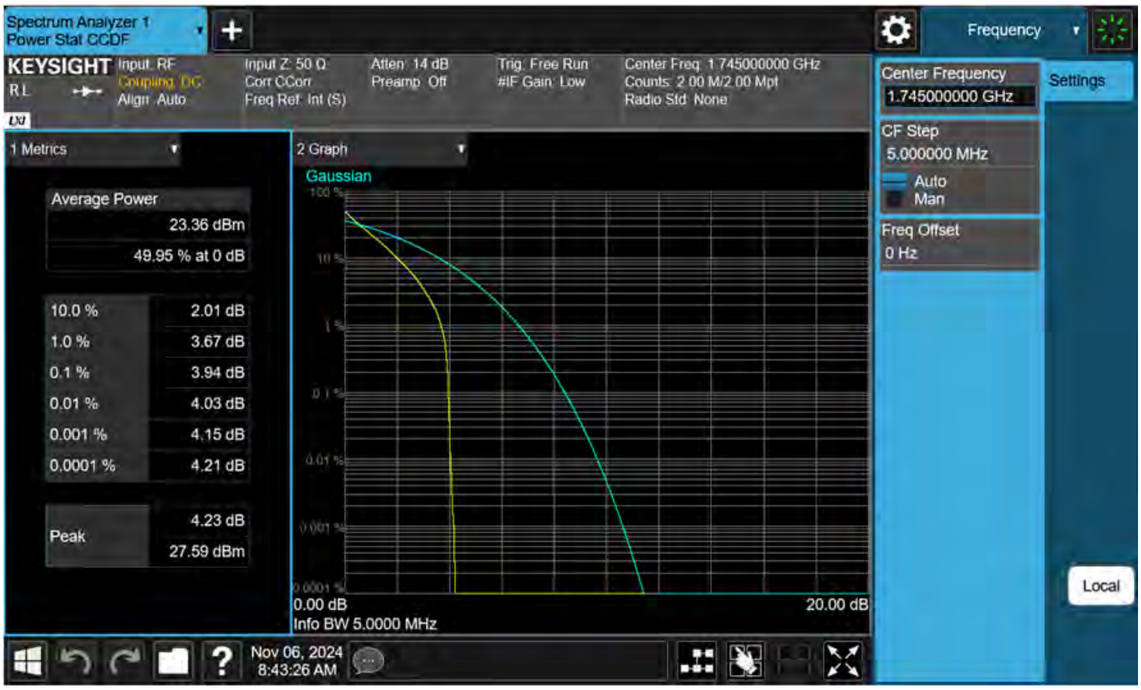
Test. Frequncy (MHz)	Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1720.0	100 %	+20(Ref)	1720 000 002	0.0	0.000 000	0.000
	100 %	-30	1720 000 009	6.2	0.000 000	0.004
	100 %	-20	1719 999 986	-16.0	-0.000 001	-0.009
	100 %	-10	1719 999 986	-16.7	-0.000 001	-0.010
	100 %	0	1720 000 007	4.7	0.000 000	0.003
	100 %	+10	1720 000 006	3.3	0.000 000	0.002
	100 %	+30	1720 000 006	3.5	0.000 000	0.002
	100 %	+40	1720 000 005	2.9	0.000 000	0.002
	100 %	+50	1720 000 005	2.3	0.000 000	0.001
	85 %	+20	1720 000 005	2.9	0.000 000	0.002
	115 %	+20	1720 000 008	5.5	0.000 000	0.003
1770.0	100 %	+20(Ref)	1770 000 003	0.0	0.000 000	0.000
	100 %	-30	1770 000 007	4.1	0.000 000	0.002
	100 %	-20	1770 000 008	4.8	0.000 000	0.003
	100 %	-10	1770 000 008	5.1	0.000 000	0.003
	100 %	0	1770 000 010	6.4	0.000 000	0.004
	100 %	+10	1770 000 007	3.8	0.000 000	0.002
	100 %	+30	1770 000 011	7.9	0.000 000	0.004
	100 %	+40	1769 999 994	-9.0	-0.000 001	-0.005
	100 %	+50	1770 000 013	9.6	0.000 001	0.005
	85 %	+20	1770 000 012	9.0	0.000 001	0.005
	115 %	+20	1770 000 007	4.2	0.000 000	0.002

- BandWidth: 40 MHz
- Voltage(100 %): 13.200 VDC
- LIMIT: Emission must remain in band

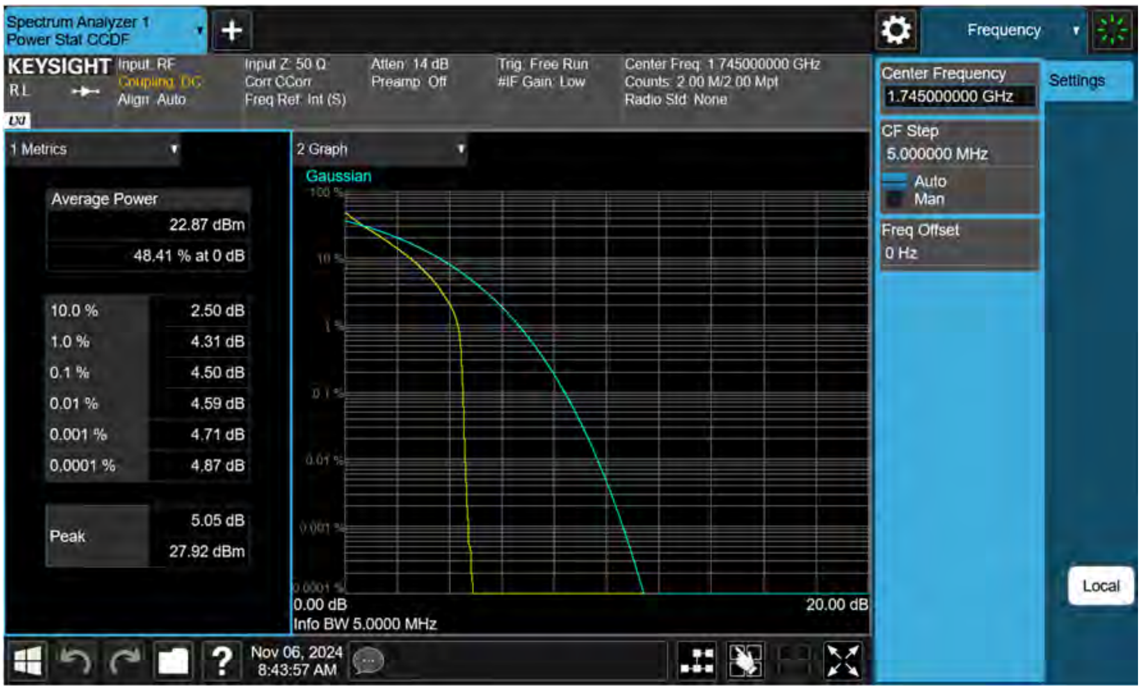
Test. Frequncy (MHz)	Voltage (%)	Temp. (℃)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1730.0	100 %	+20(Ref)	1729 999 995	0.0	0.000 000	0.000
	100 %	-30	1729 999 987	-7.3	0.000 000	-0.004
	100 %	-20	1730 000 007	13.0	0.000 001	0.008
	100 %	-10	1729 999 984	-10.3	-0.000 001	-0.006
	100 %	0	1729 999 983	-11.5	-0.000 001	-0.007
	100 %	+10	1729 999 985	-9.7	-0.000 001	-0.006
	100 %	+30	1730 000 001	6.3	0.000 000	0.004
	100 %	+40	1730 000 000	5.0	0.000 000	0.003
	100 %	+50	1729 999 998	3.8	0.000 000	0.002
	85 %	+20	1730 000 000	5.2	0.000 000	0.003
	115 %	+20	1730 000 001	6.6	0.000 000	0.004
1760.0	100 %	+20(Ref)	1760 000 001	0.0	0.000 000	0.000
	100 %	-30	1760 000 002	0.3	0.000 000	0.000
	100 %	-20	1760 000 001	-0.1	0.000 000	0.000
	100 %	-10	1760 000 001	-0.5	0.000 000	0.000
	100 %	0	1760 000 000	-0.8	0.000 000	0.000
	100 %	+10	1759 999 999	-2.0	0.000 000	-0.001
	100 %	+30	1759 999 999	-2.0	0.000 000	-0.001
	100 %	+40	1759 999 999	-2.5	0.000 000	-0.001
	100 %	+50	1759 999 998	-3.3	0.000 000	-0.002
	85 %	+20	1759 999 996	-4.8	0.000 000	-0.003
	115 %	+20	1759 999 996	-5.0	0.000 000	-0.003

9. TEST PLOTS

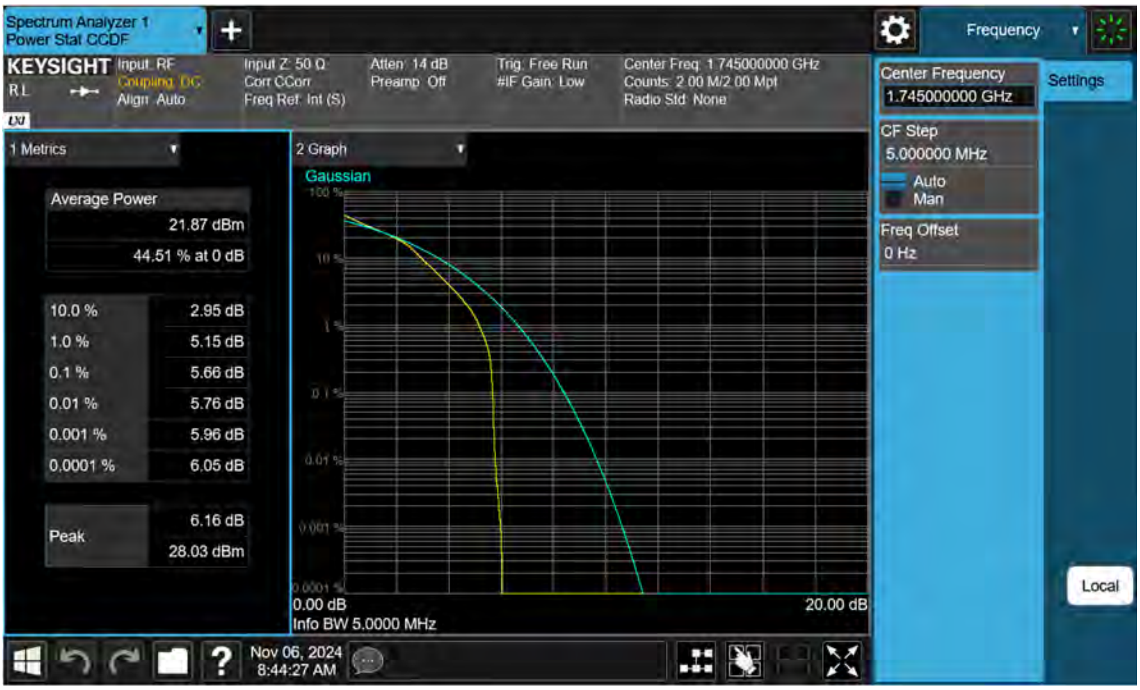
NR66_5 M_PAR_Mid_BPSK_FullRB



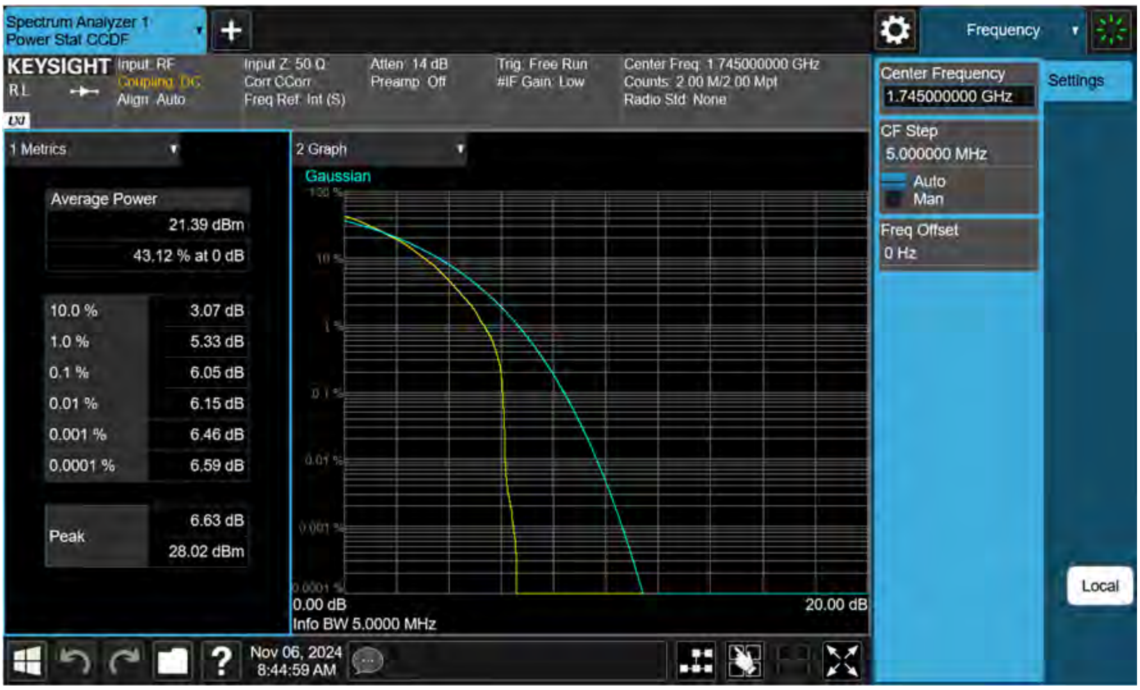
NR66_5 M_PAR_Mid_QPSK_FullRB



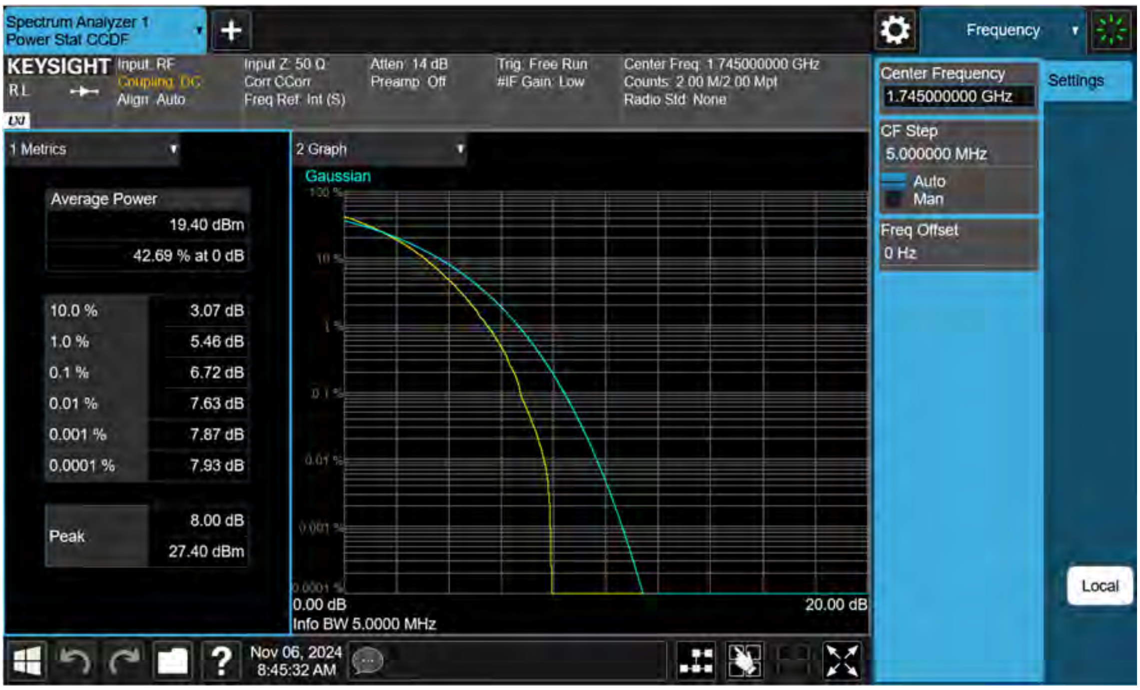
NR66_5 M_PAR_Mid_16QAM_FullRB



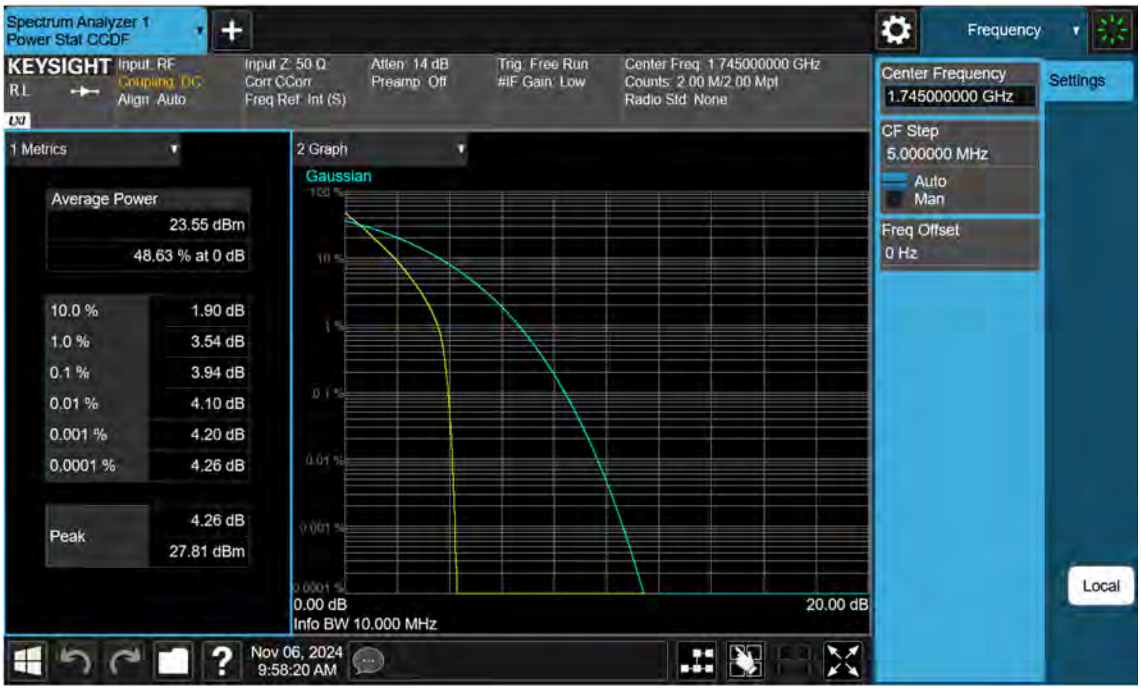
NR66_5 M_PAR_Mid_64QAM_FullRB



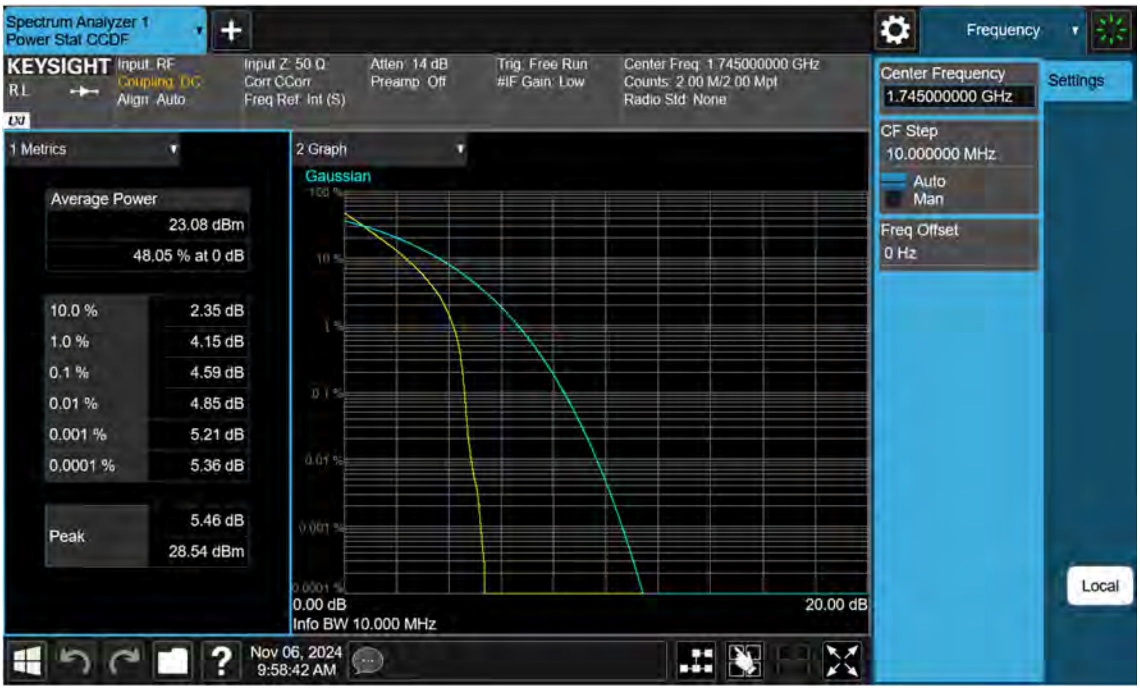
NR66_5 M_PAR_Mid_256QAM_FullRB



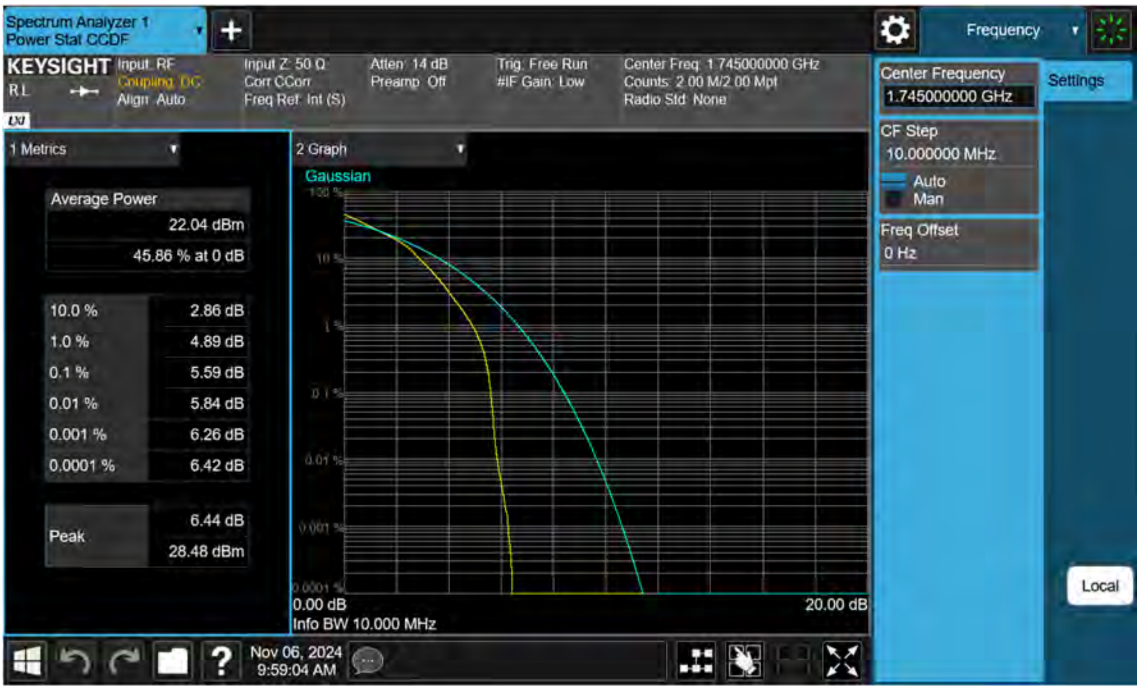
NR66_10 M_PAR_Mid_BPSK_FullRB



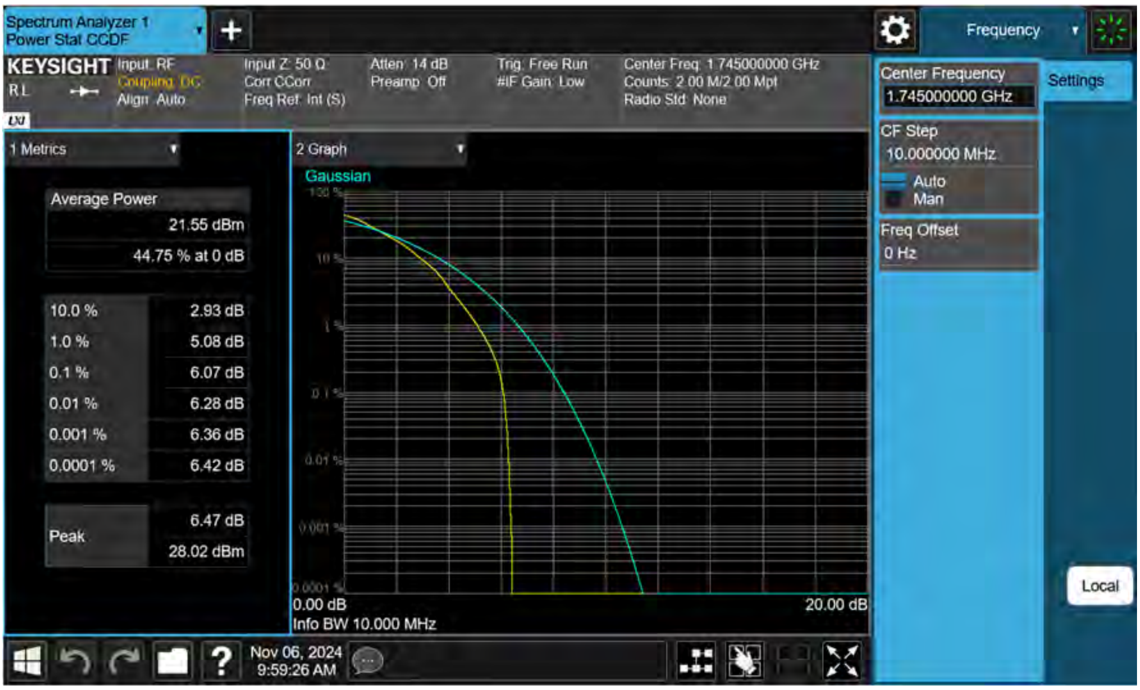
NR66_10 M_PAR_Mid_QPSK_FullRB



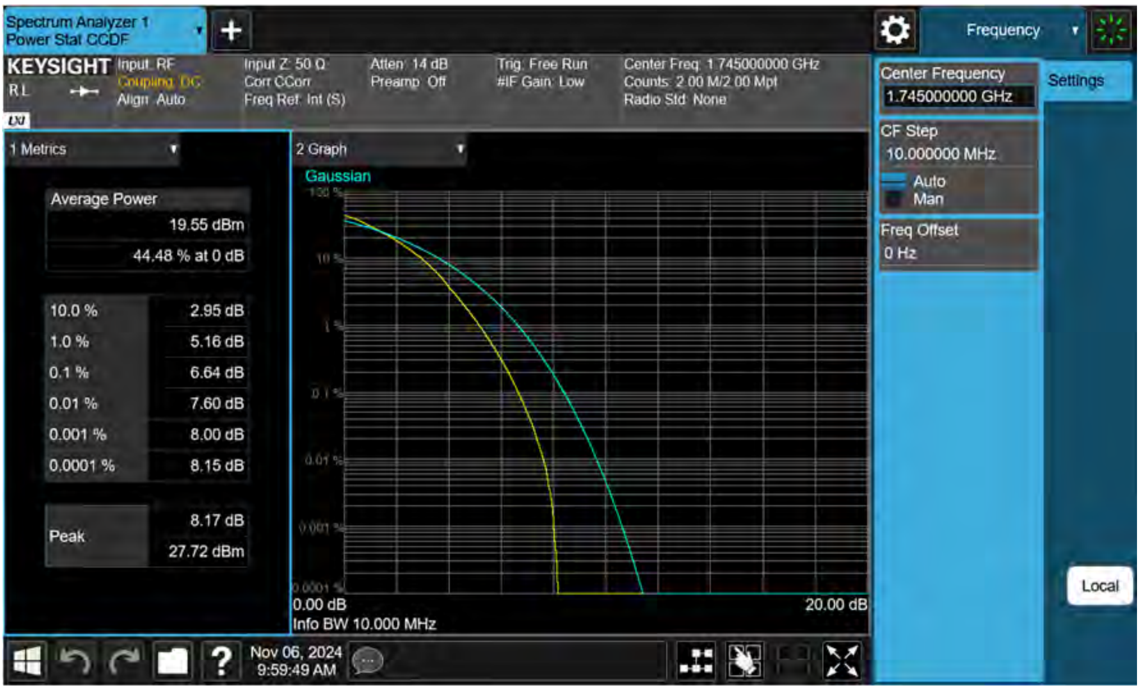
NR66_10 M_PAR_Mid_16QAM_FullRB



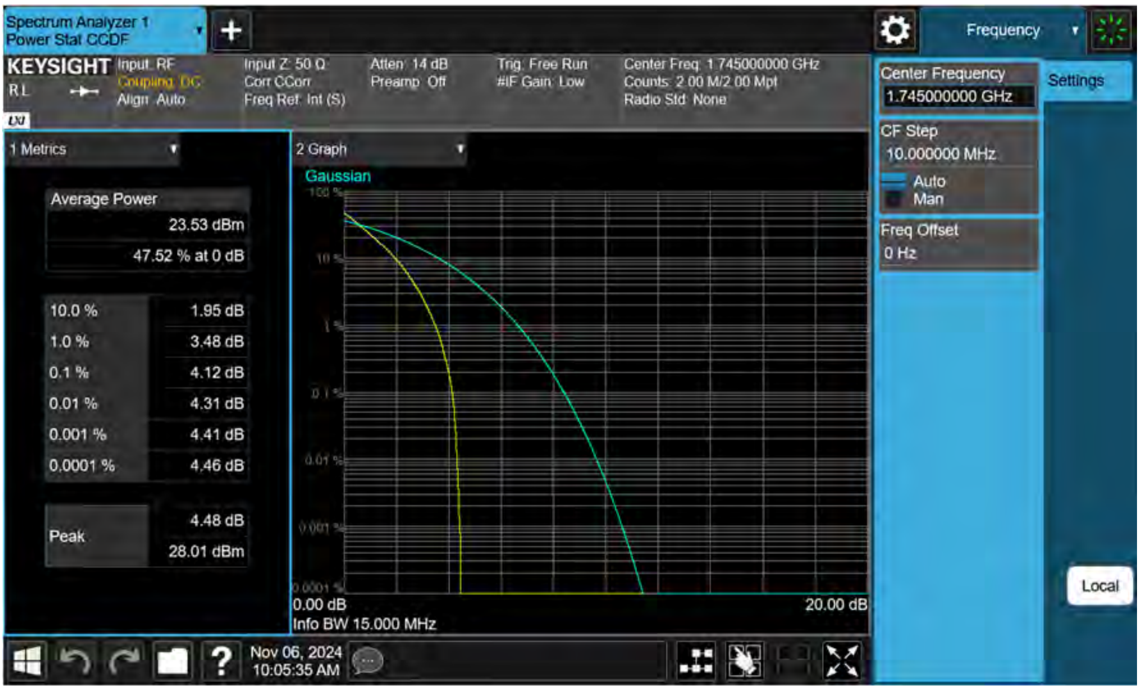
NR66_10 M_PAR_Mid_64QAM_FullRB



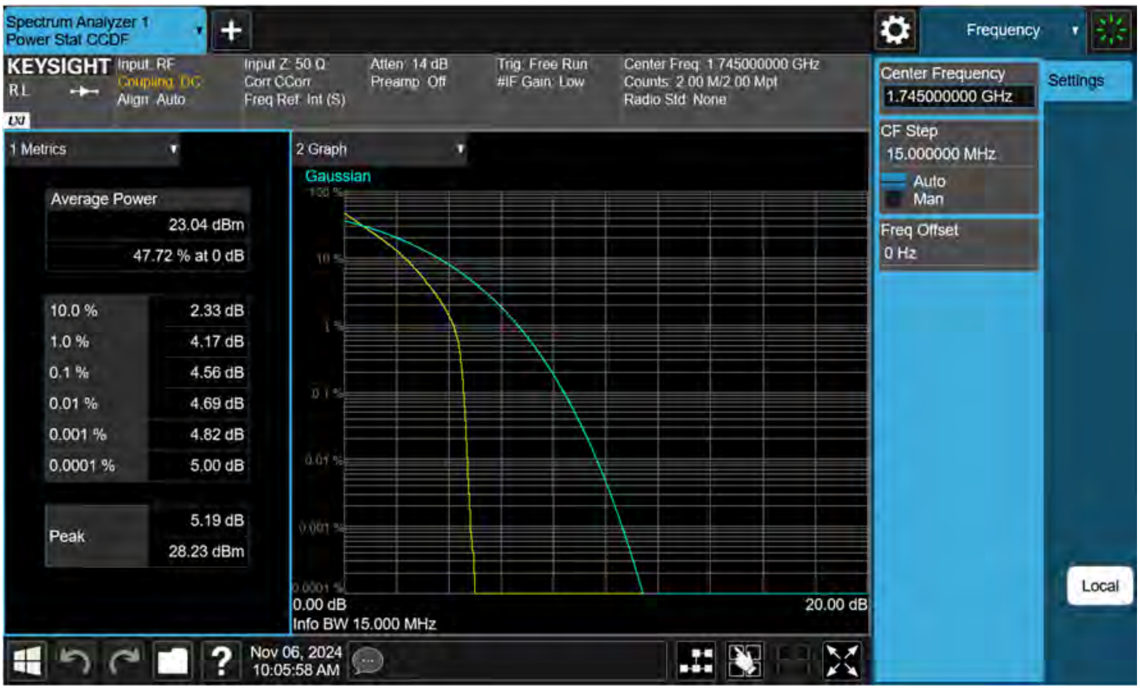
NR66_10 M_PAR_Mid_256QAM_FullRB



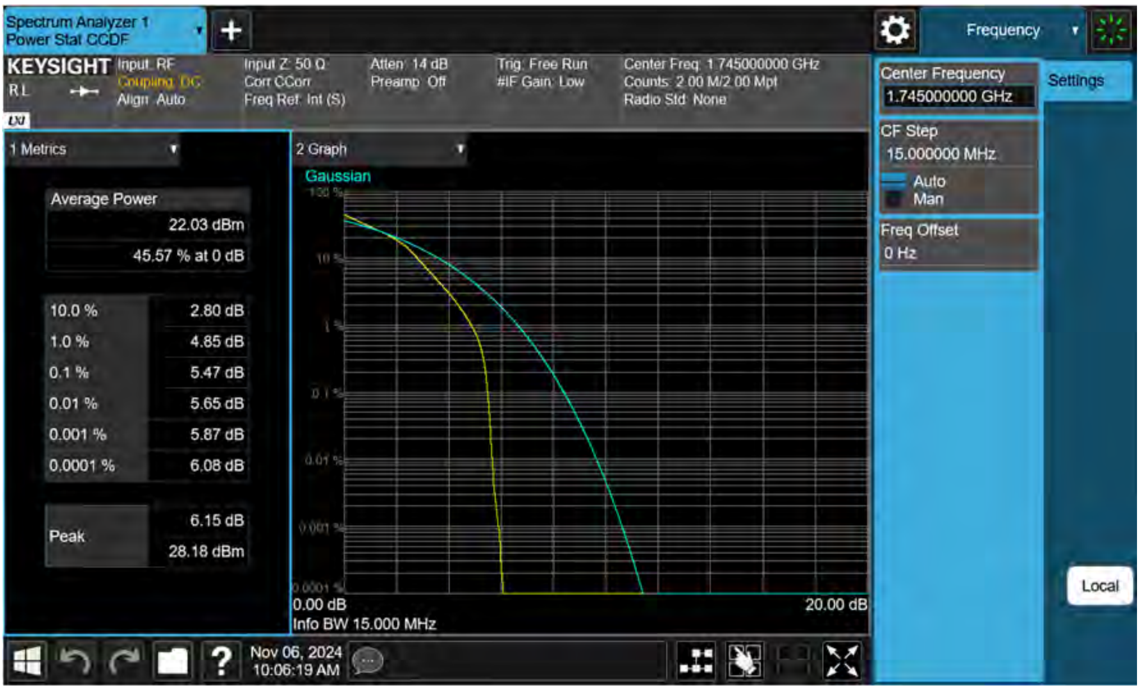
NR66_15 M_PAR_Mid_BPSK_FullRB



NR66_15 M_PAR_Mid_QPSK_FullRB



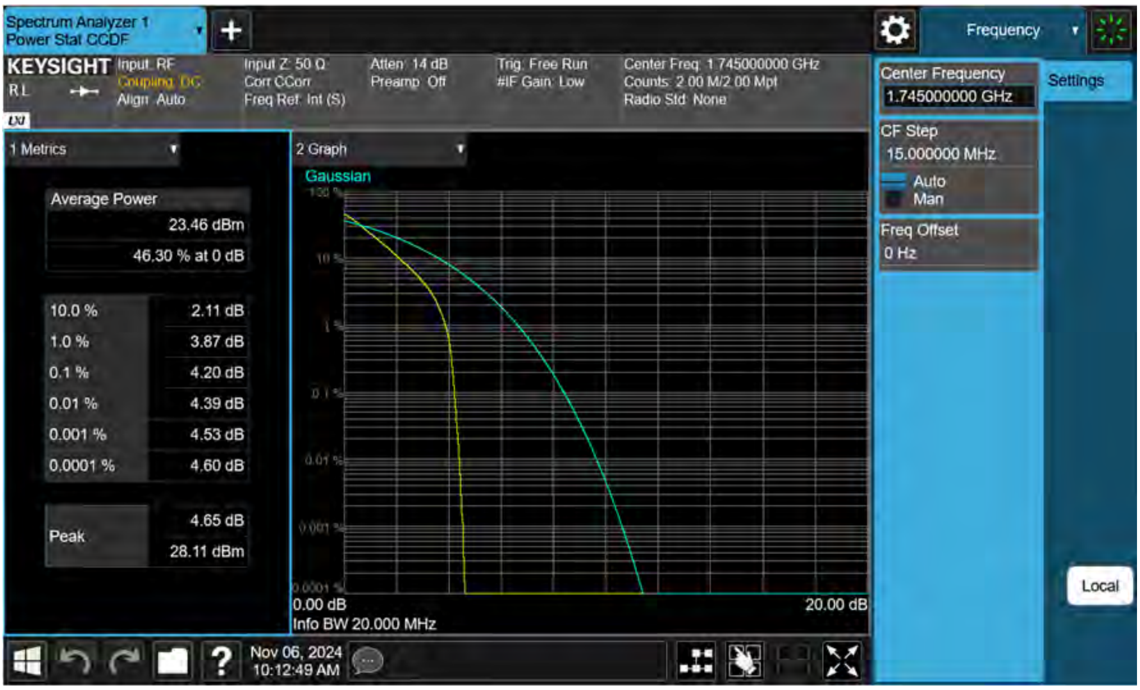
NR66_15 M_PAR_Mid_16QAM_FullRB



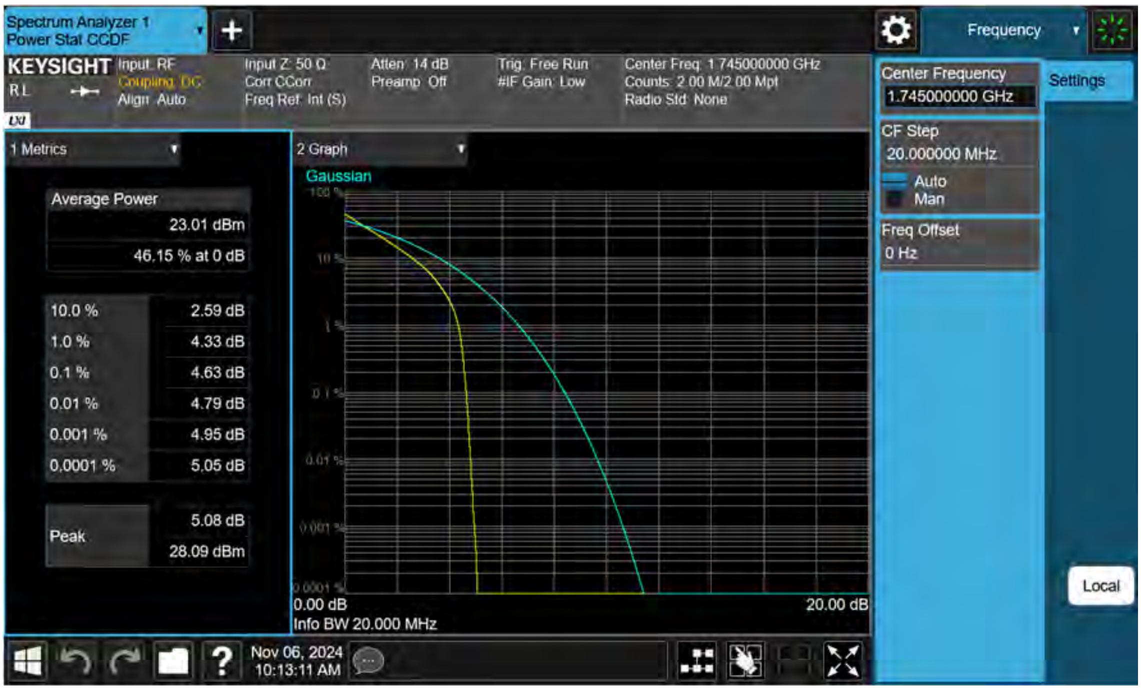
NR66_15 M_PAR_Mid_64QAM_FullRB

NR66_15 M_PAR_Mid_256QAM_FullRB

NR66_20 M_PAR_Mid_BPSK_FullRB



NR66_20 M_PAR_Mid_QPSK_FullRB

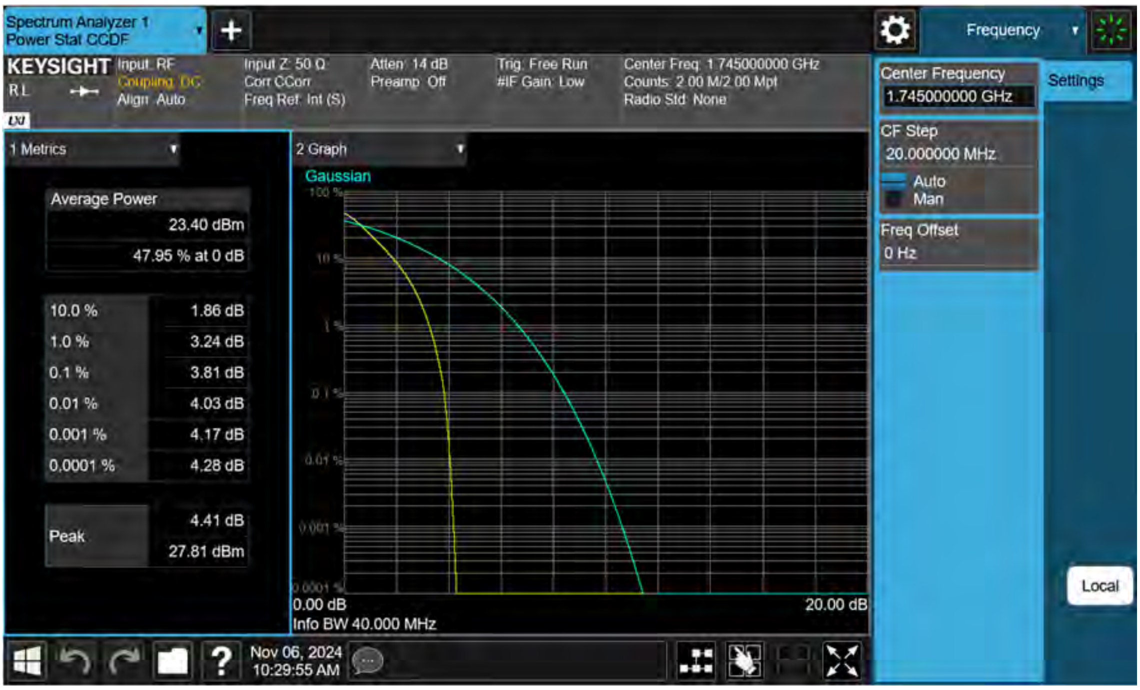


NR66_20 M_PAR_Mid_16QAM_FullRB

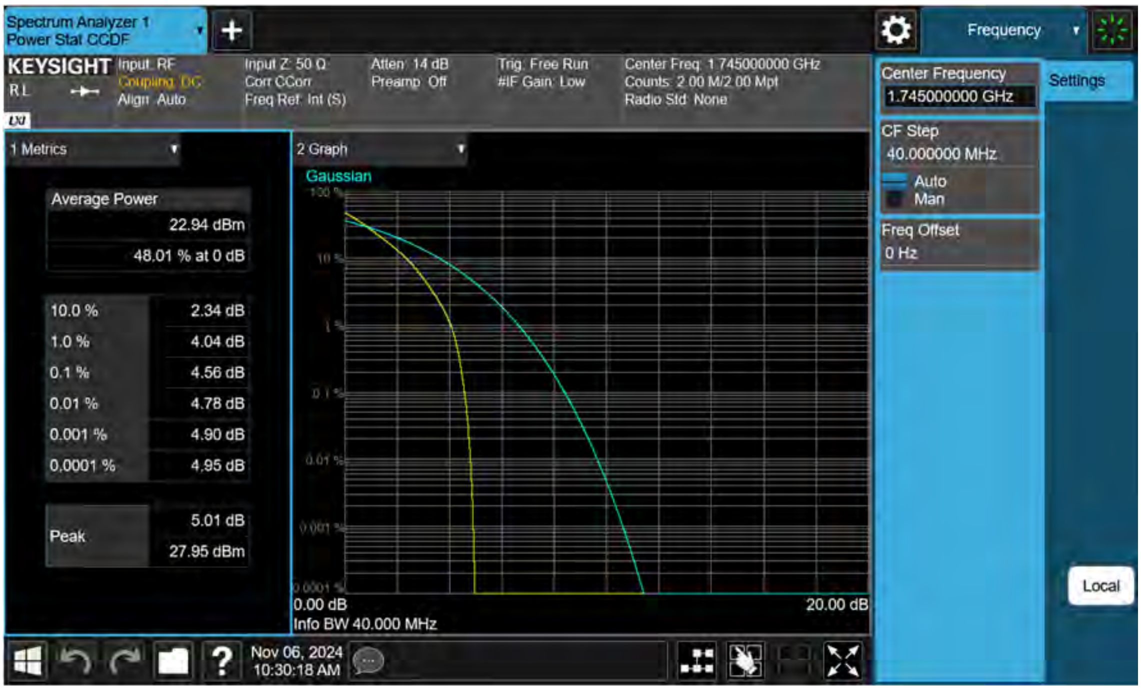
NR66_20 M_PAR_Mid_64QAM_FullRB

NR66_20 M_PAR_Mid_256QAM_FullRB

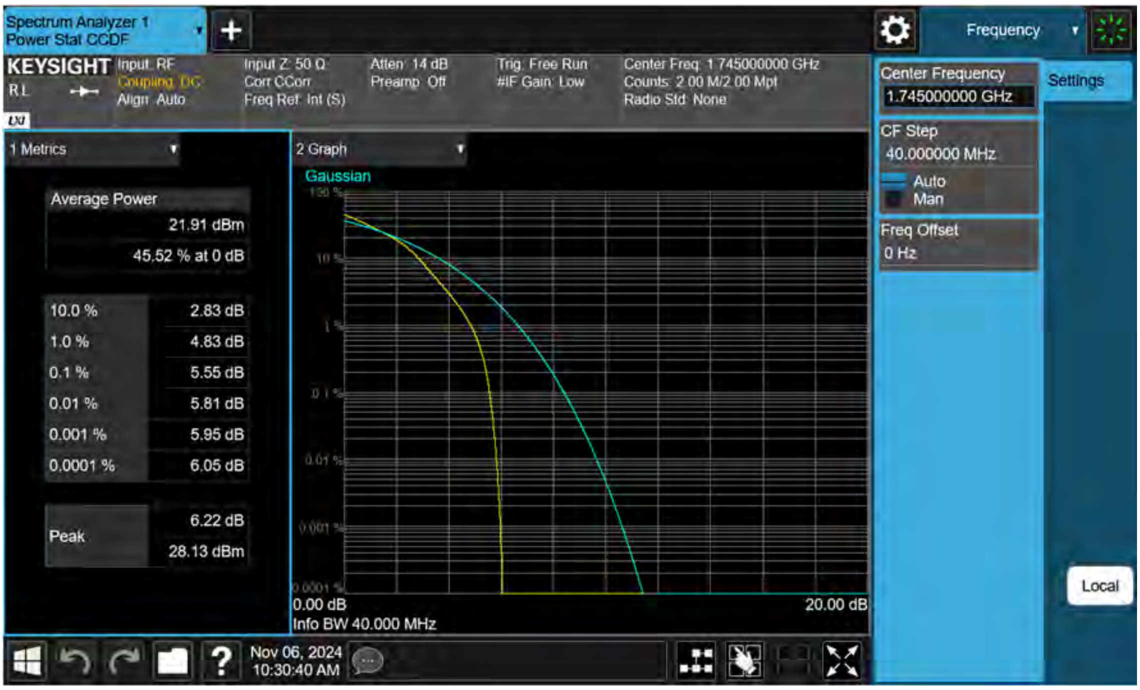
NR66_40 M_PAR_Mid_BPSK_FullRB



NR66_40 M_PAR_Mid_QPSK_FullRB

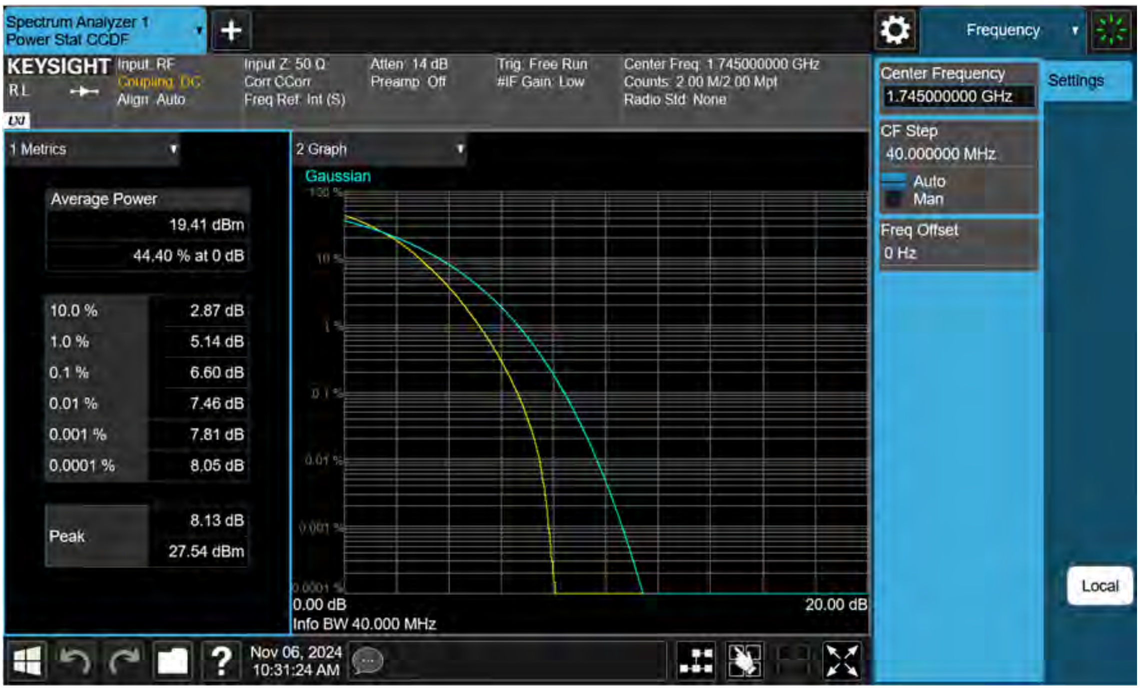


NR66_40 M_PAR_Mid_16QAM_FullRB



NR66_40 M_PAR_Mid_64QAM_FullRB

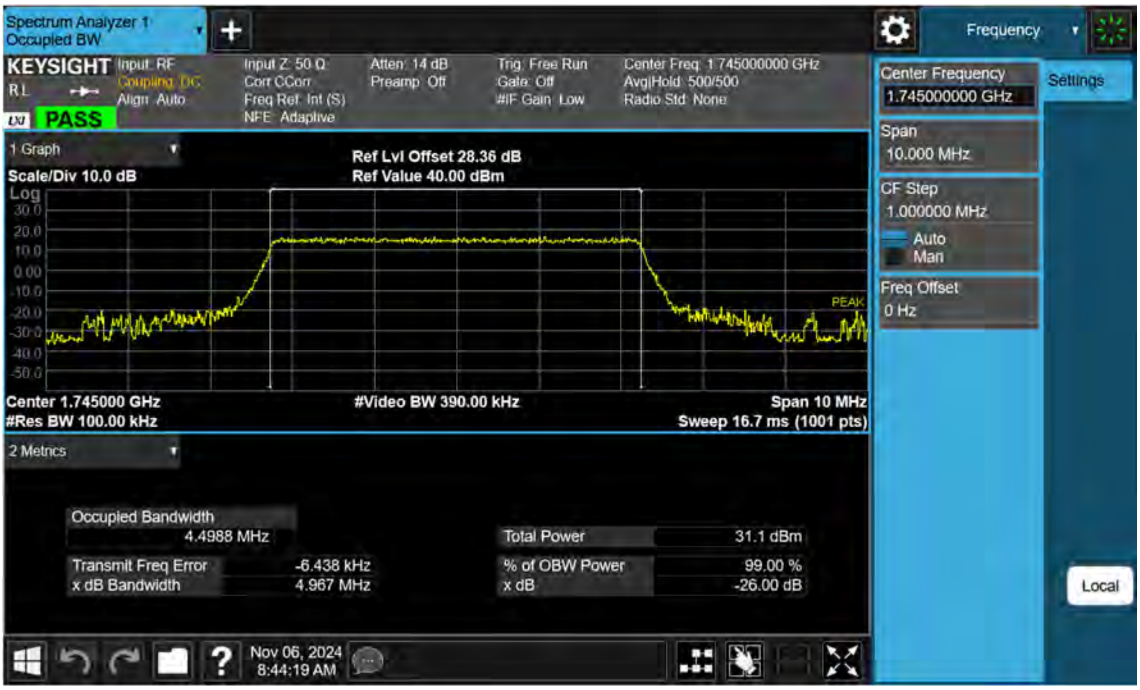
NR66_40 M_PAR_Mid_256QAM_FullRB



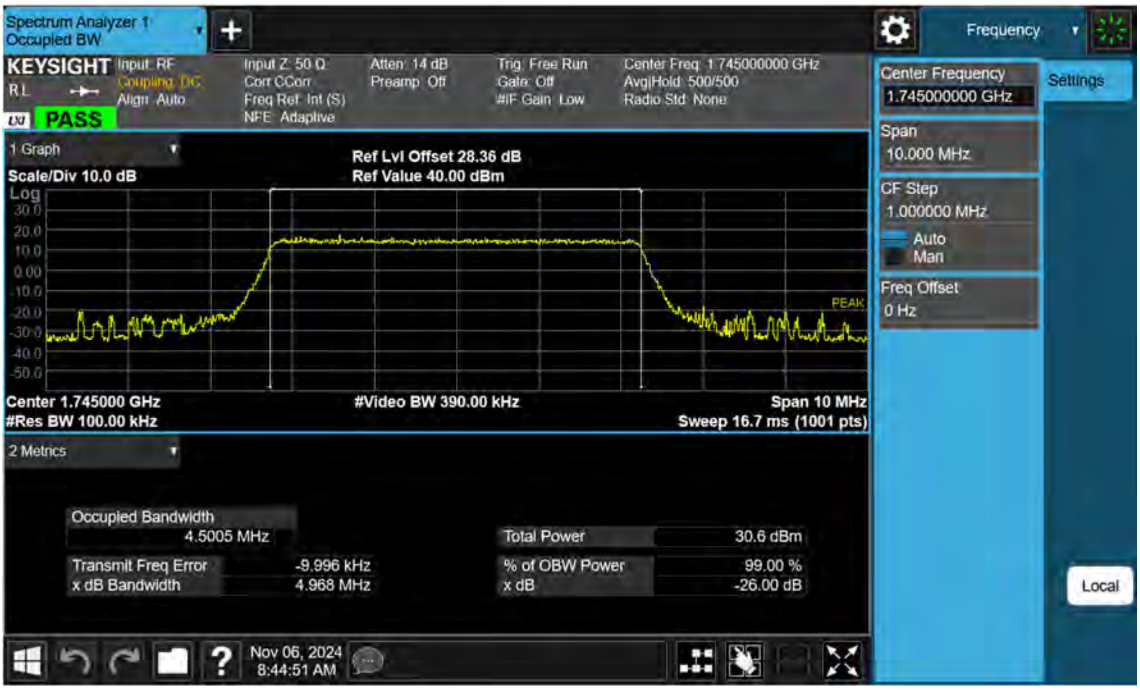
NR66_5 M_OBW_Mid_BPSK_FullRB

NR66_5 M_OBW_Mid_QPSK_FullRB

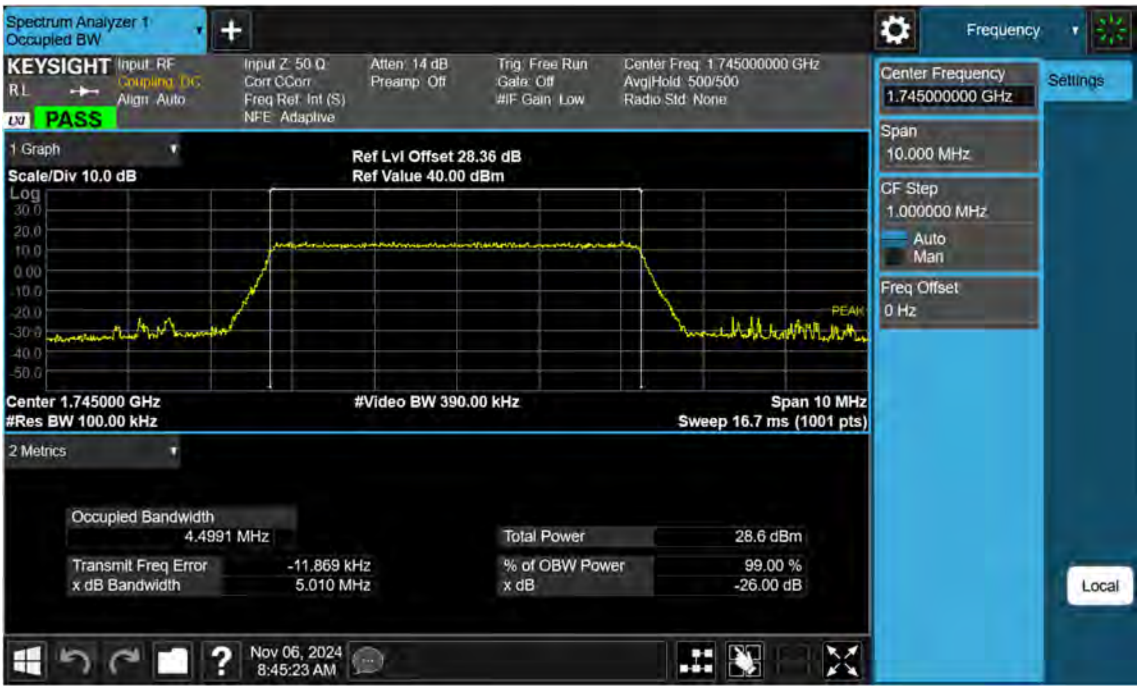
NR66_5 M_OBW_Mid_16QAM_FullRB



NR66_5 M_OBW_Mid_64QAM_FullRB



NR66_5 M_OBW_Mid_256QAM_FullRB



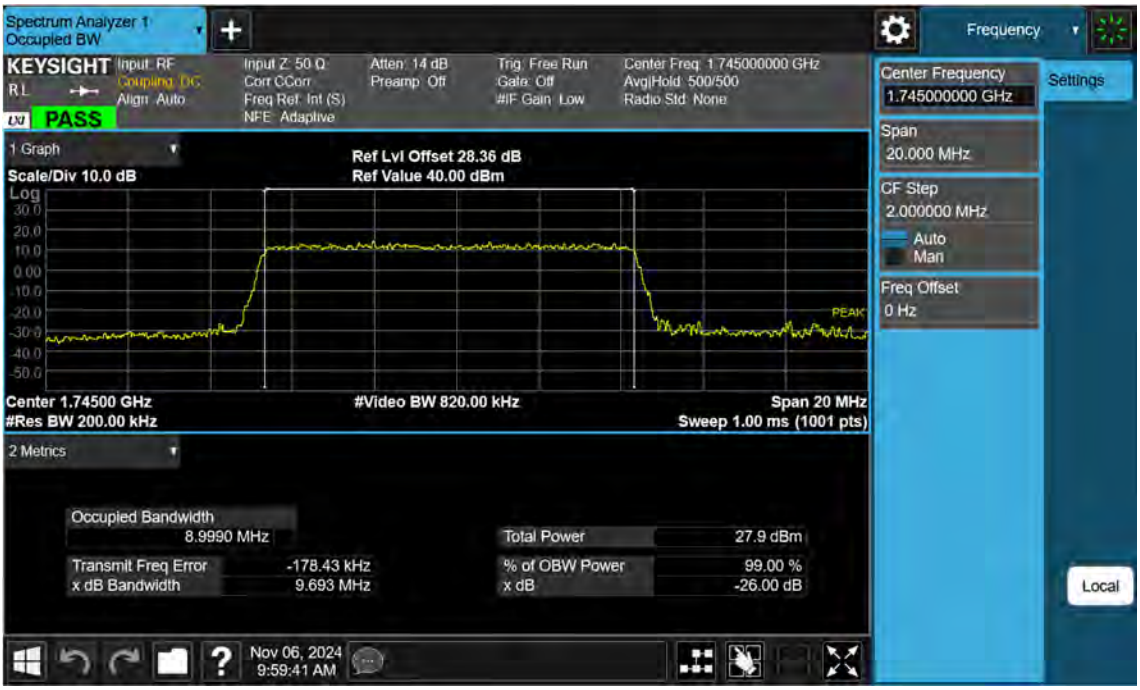
NR66_10 M_OBW_Mid_BPSK_FullRB

NR66_10 M_OBW_Mid_QPSK_FullRB

NR66_10 M_OBW_Mid_16QAM_FullRB

NR66_10 M_OBW_Mid_64QAM_FullRB

NR66_10 M_OBW_Mid_256QAM_FullRB

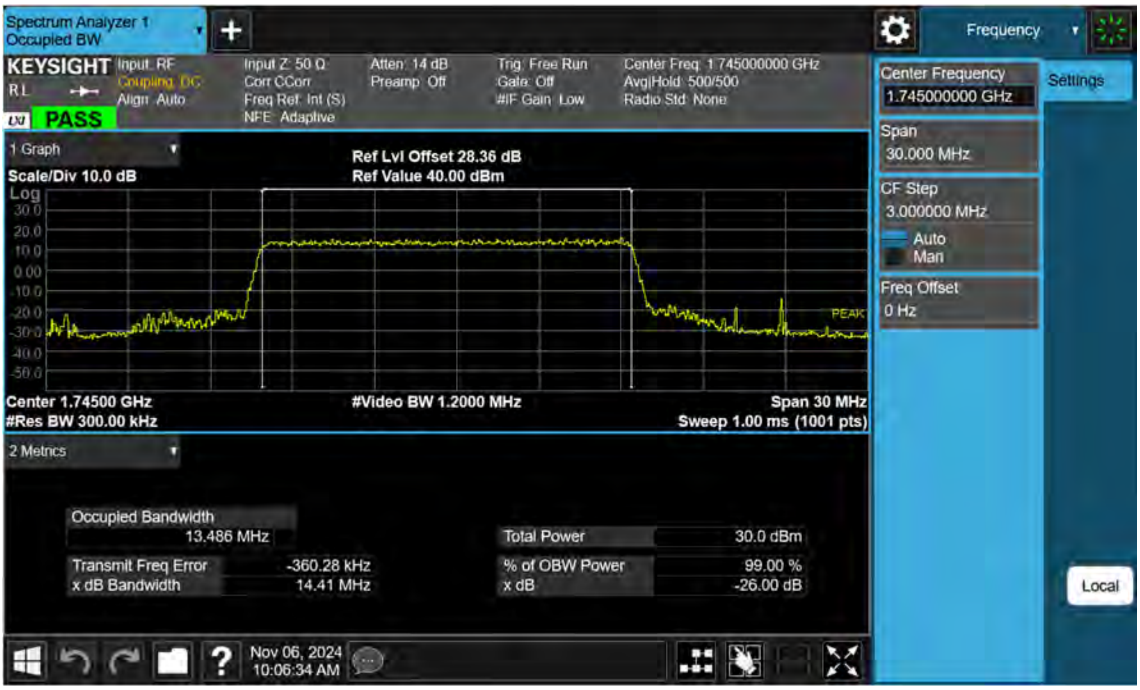


NR66_15 M_OBW_Mid_BPSK_FullRB

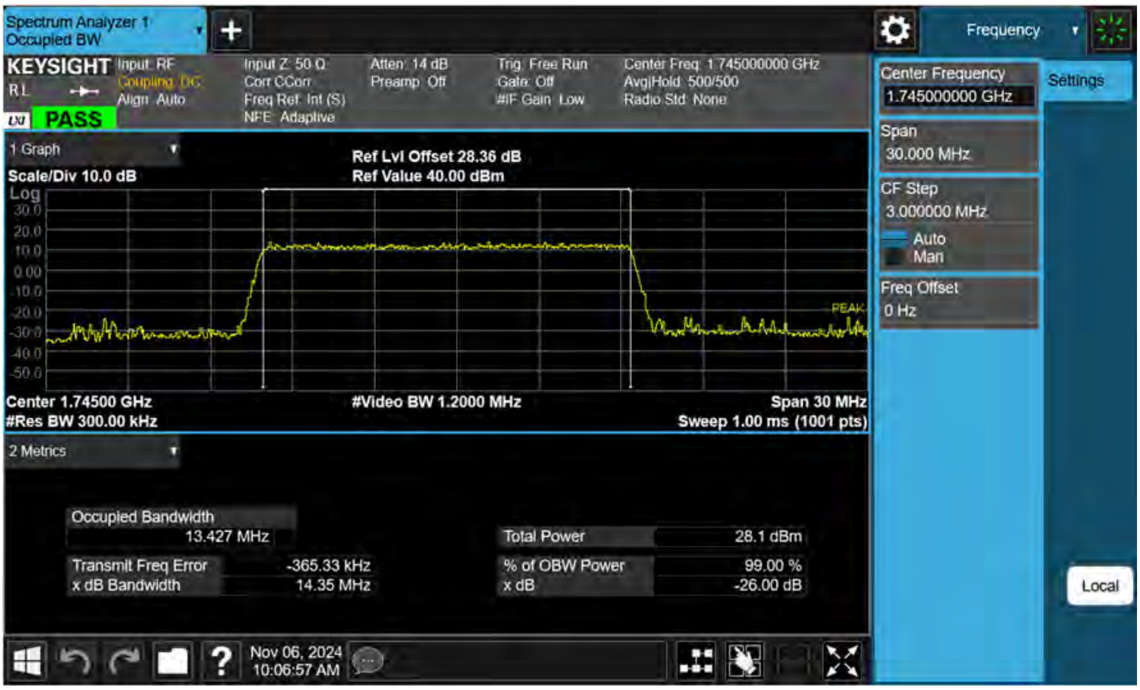
NR66_15 M_OBW_Mid_QPSK_FullRB

NR66_15 M_OBW_Mid_16QAM_FullRB

NR66_15 M_OBW_Mid_64QAM_FullRB



NR66_15 M_OBW_Mid_256QAM_FullRB

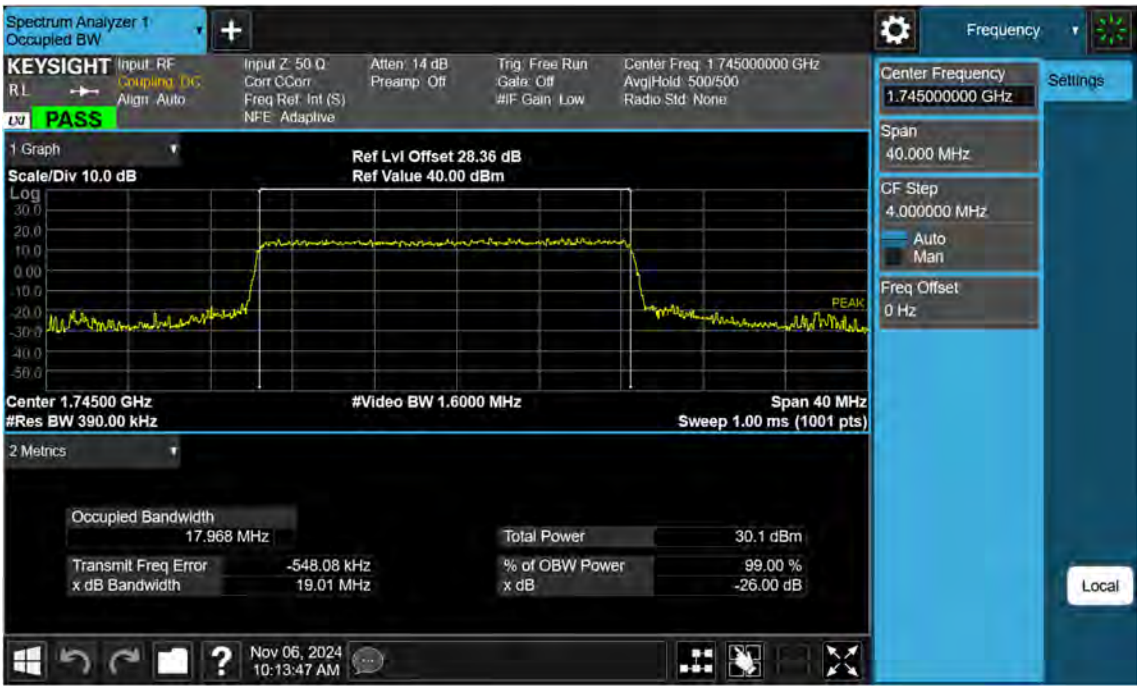


NR66_20 M_OBW_Mid_BPSK_FullRB

NR66_20 M_OBW_Mid_QPSK_FullRB

NR66_20 M_OBW_Mid_16QAM_FullRB

NR66_20 M_OBW_Mid_64QAM_FullRB



NR66_20 M_OBW_Mid_256QAM_FullRB

NR66_40 M_OBW_Mid_BPSK_FullRB

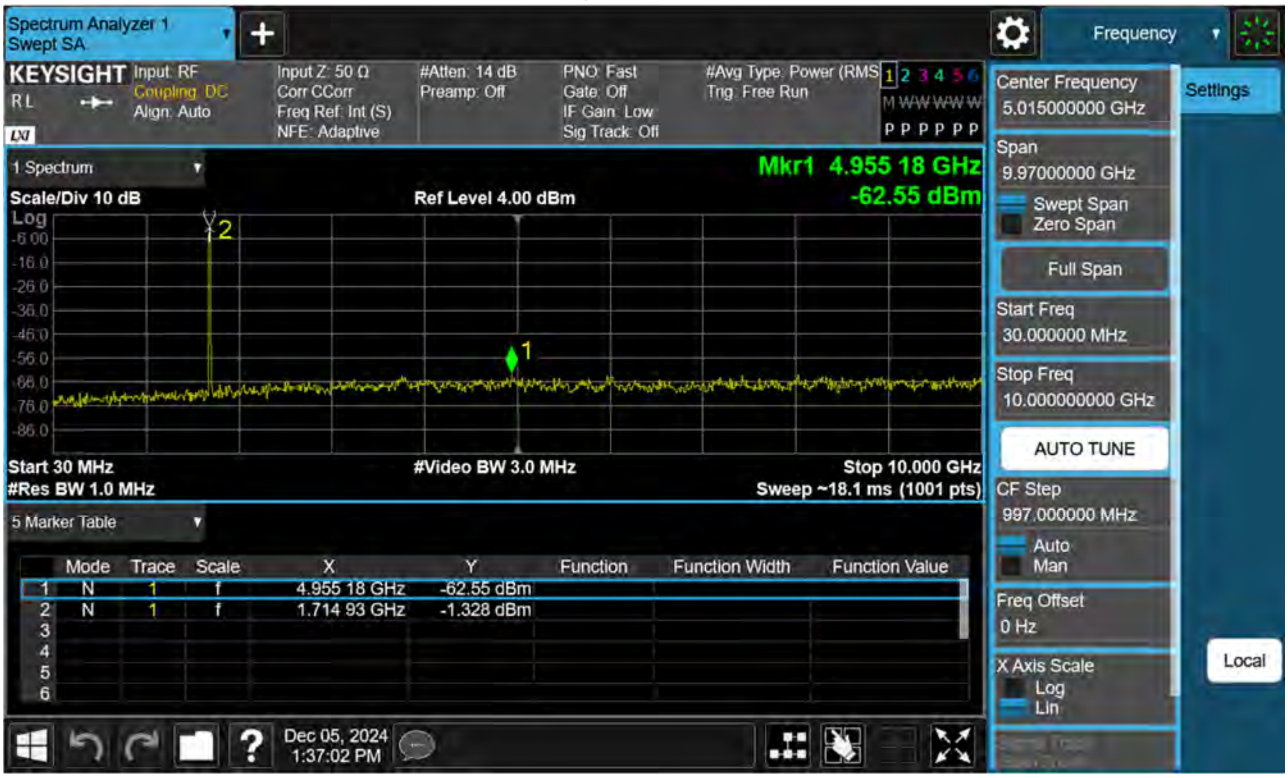
NR66_40 M_OBW_Mid_QPSK_FullRB

NR66_40 M_OBW_Mid_16QAM_FullRB

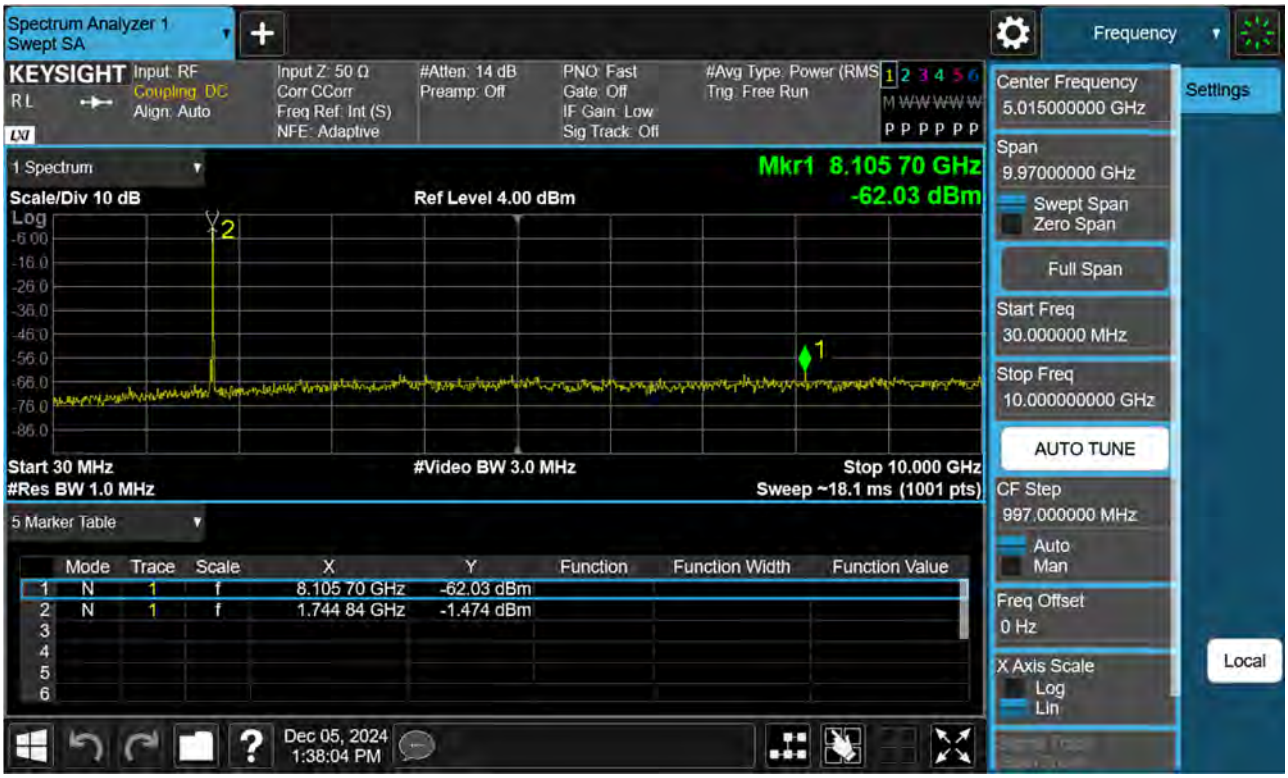
NR66_40 M_OBW_Mid_64QAM_FullRB

NR66_40 M_OBW_Mid_256QAM_FullRB

NR66_5 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB

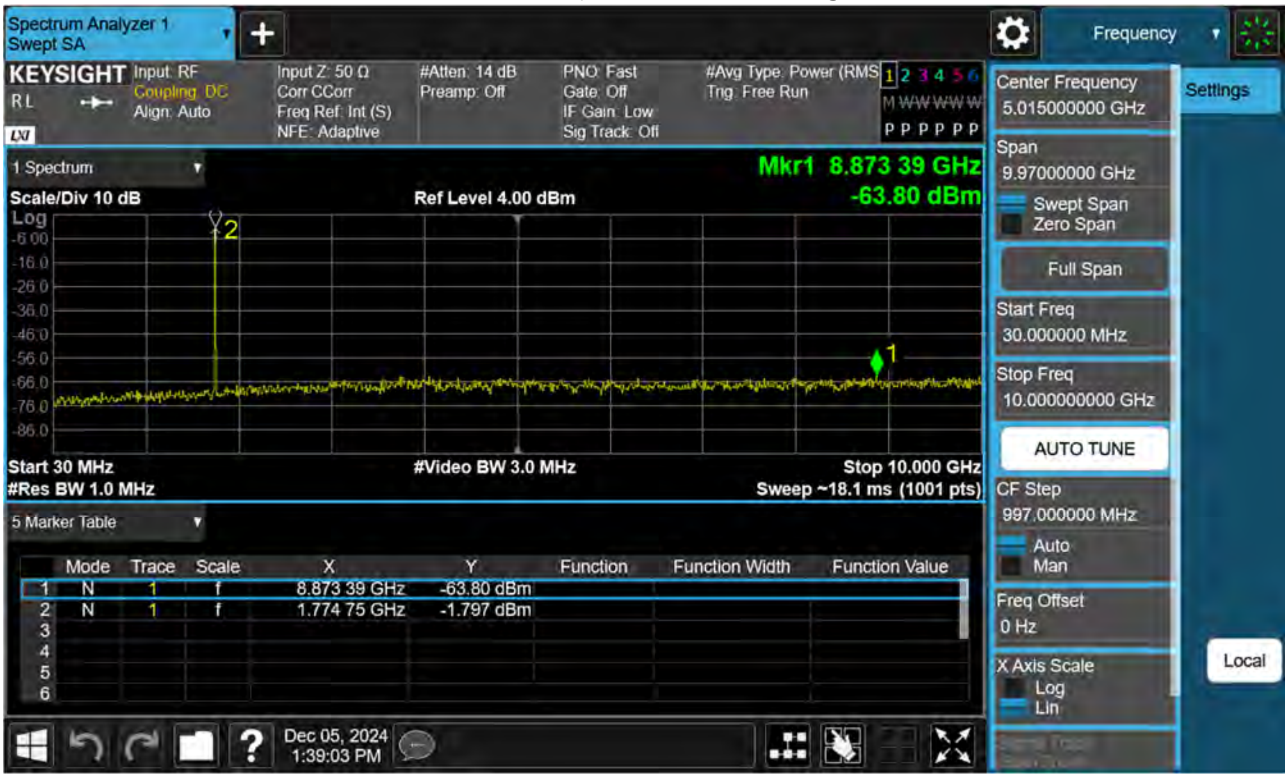


NR66_5 M_Conducted Spurious(30 M-10 G)_Mid_BPSK_1RB

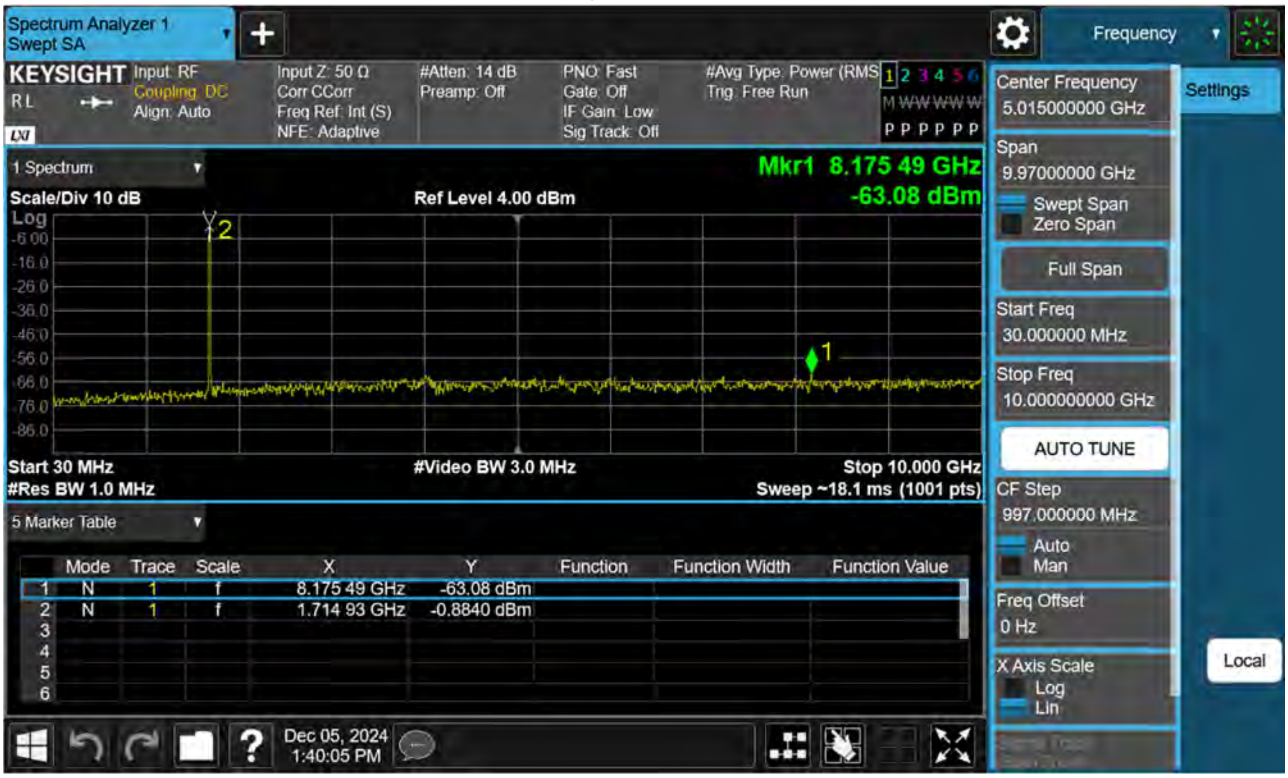


	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	8.105 70 GHz	-62.03 dBm			
2	N	1	f	1.744 84 GHz	-1.474 dBm			
3								
4								
5								
6								

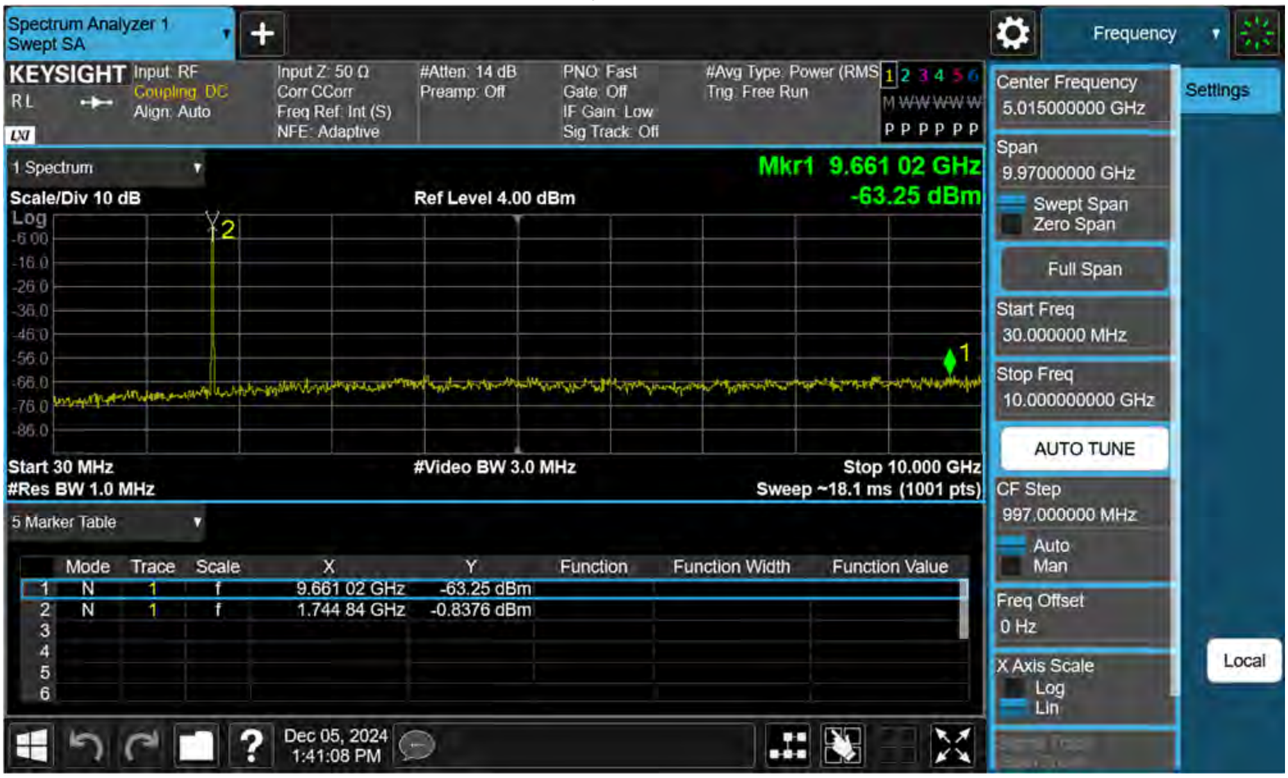
NR66_5 M_Conducted Spurious(30 M-10 G)_High_BPSK_1RB



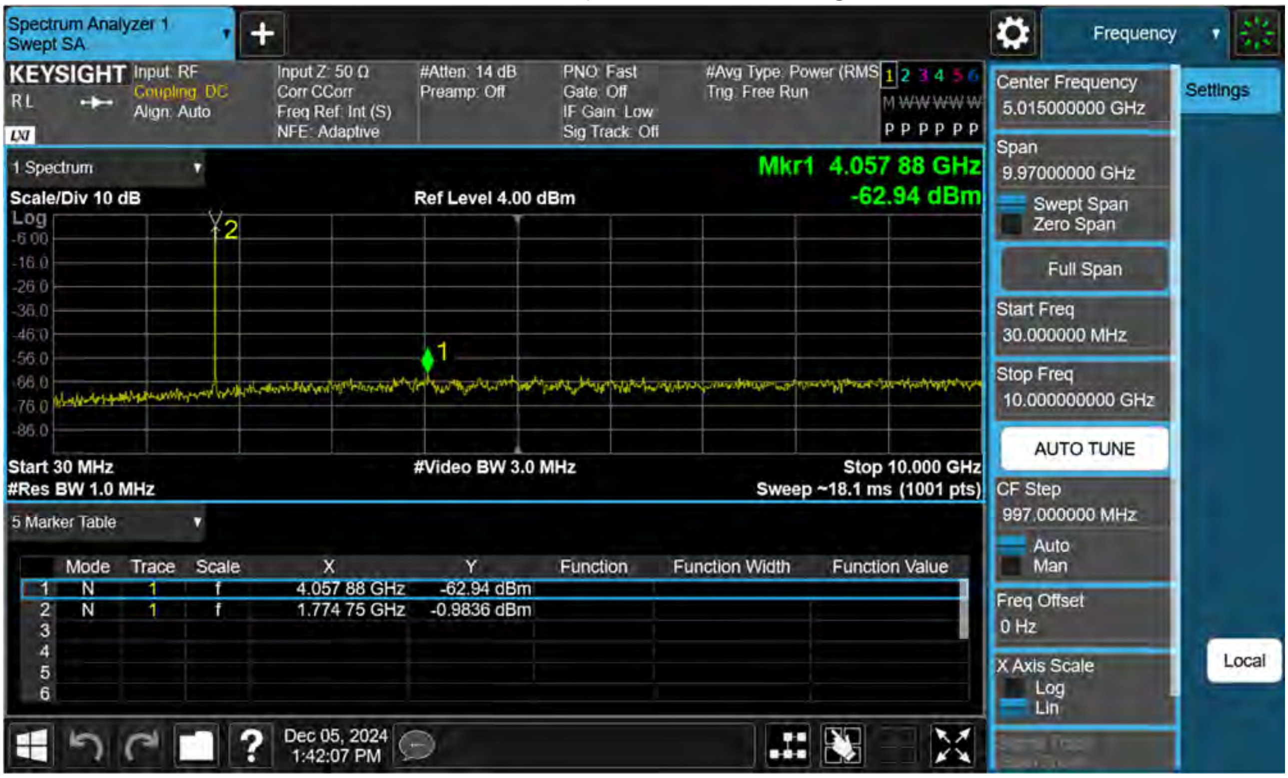
NR66_10 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB



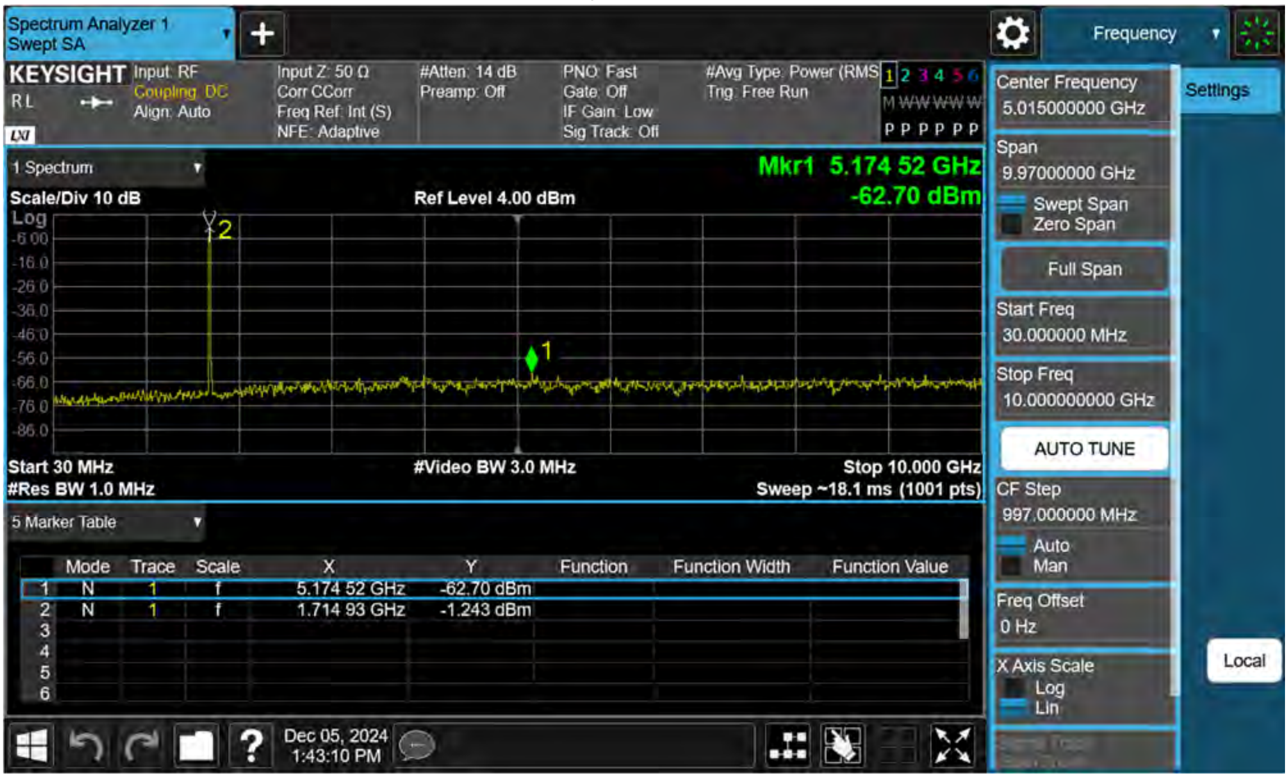
NR66_10 M_Conducted Spurious(30 M-10 G)_Mid_BPSK_1RB



NR66_10 M_Conducted Spurious(30 M-10 G)_High_BPSK_1RB

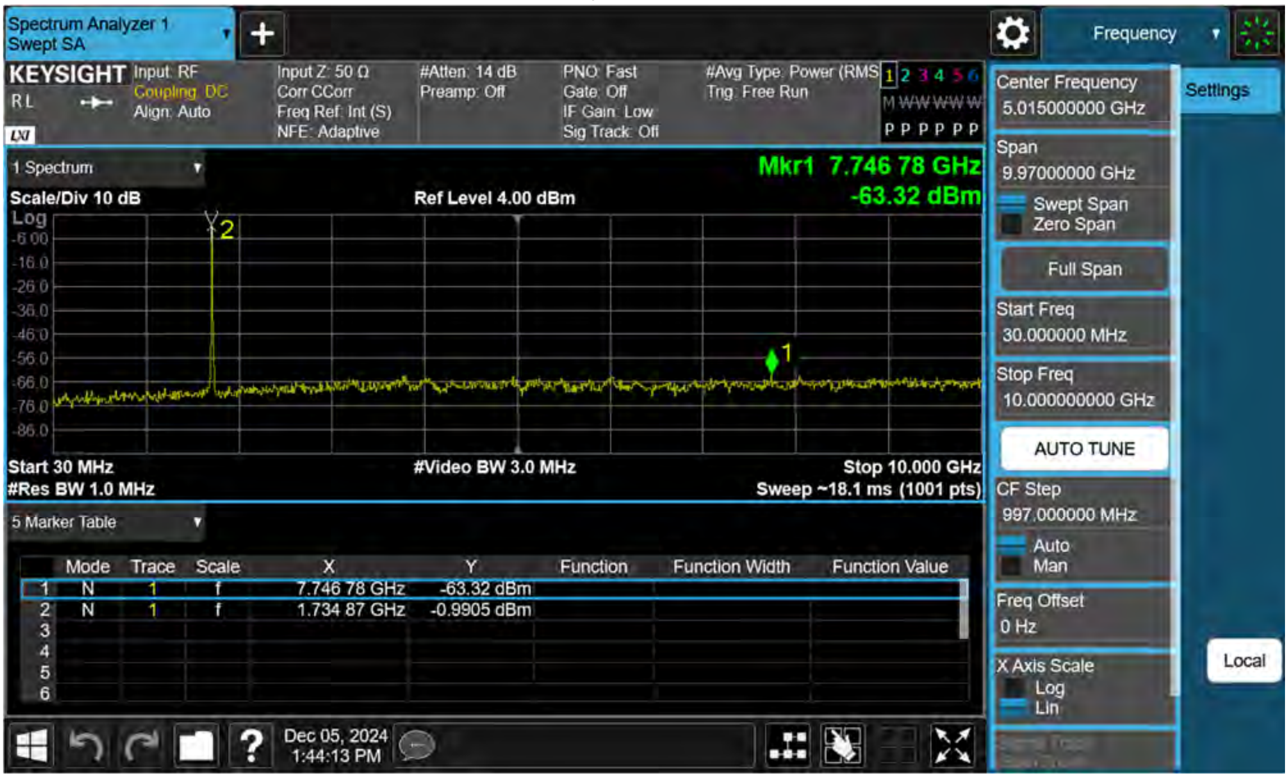


NR66_15 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB



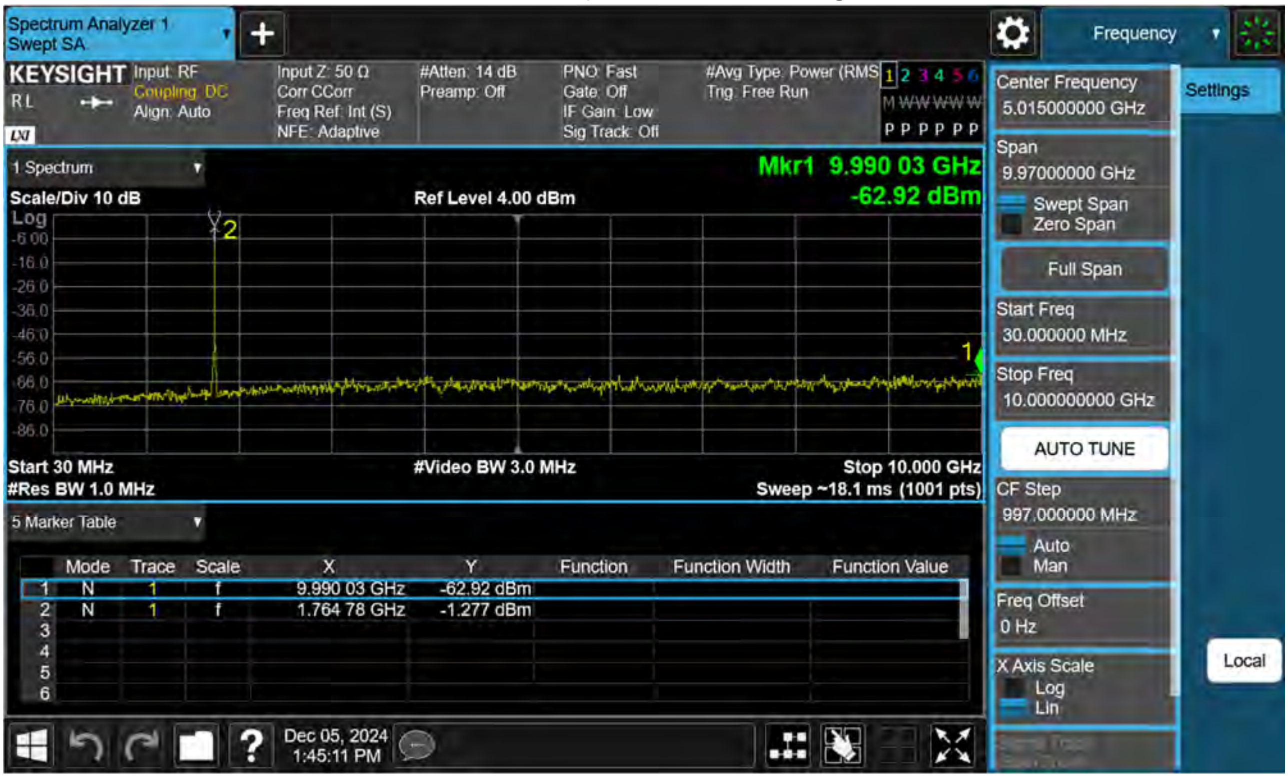
	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	5.174 52 GHz	-62.70 dBm			
2	N	1	f	1.714 93 GHz	-1.243 dBm			
3								
4								
5								
6								

NR66_15 M_Conducted Spurious(30 M-10 G)_Mid_BPSK_1RB

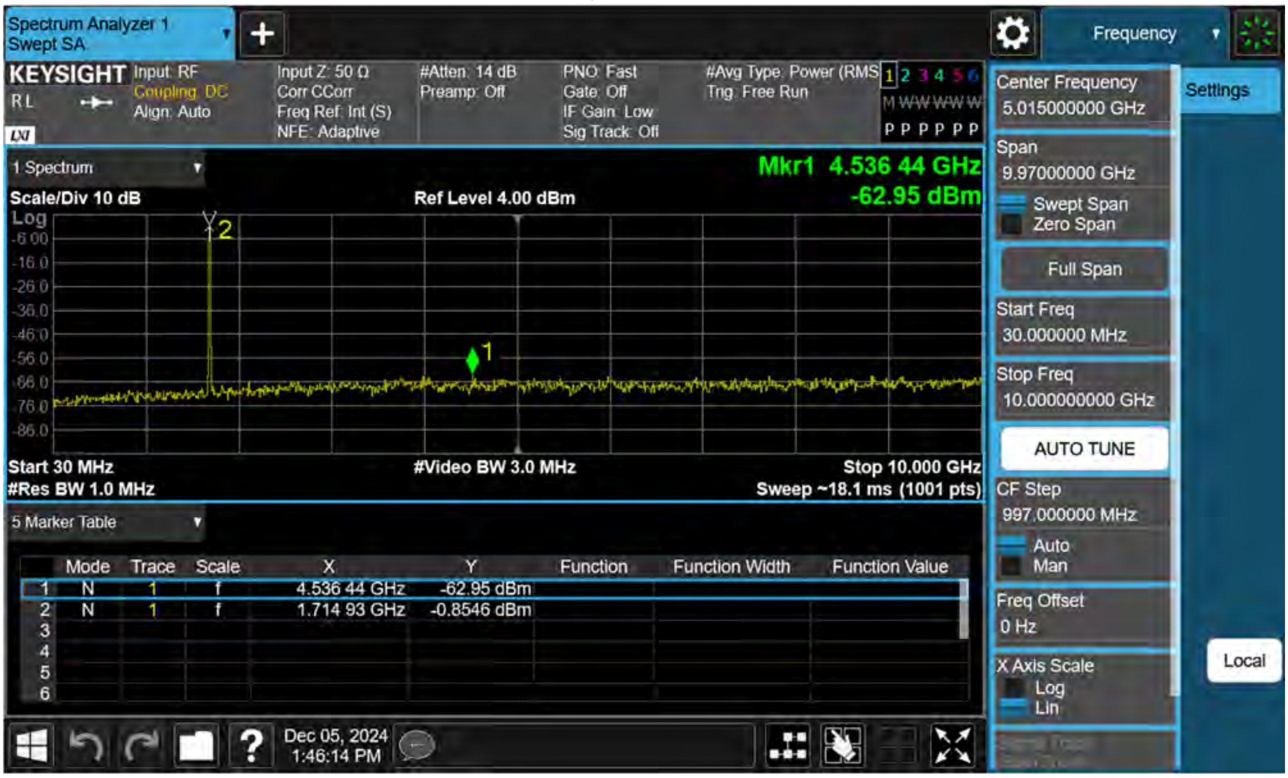


	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	7.746 78 GHz	-63.32 dBm			
2	N	1	f	1.734 87 GHz	-0.9905 dBm			
3								
4								
5								
6								

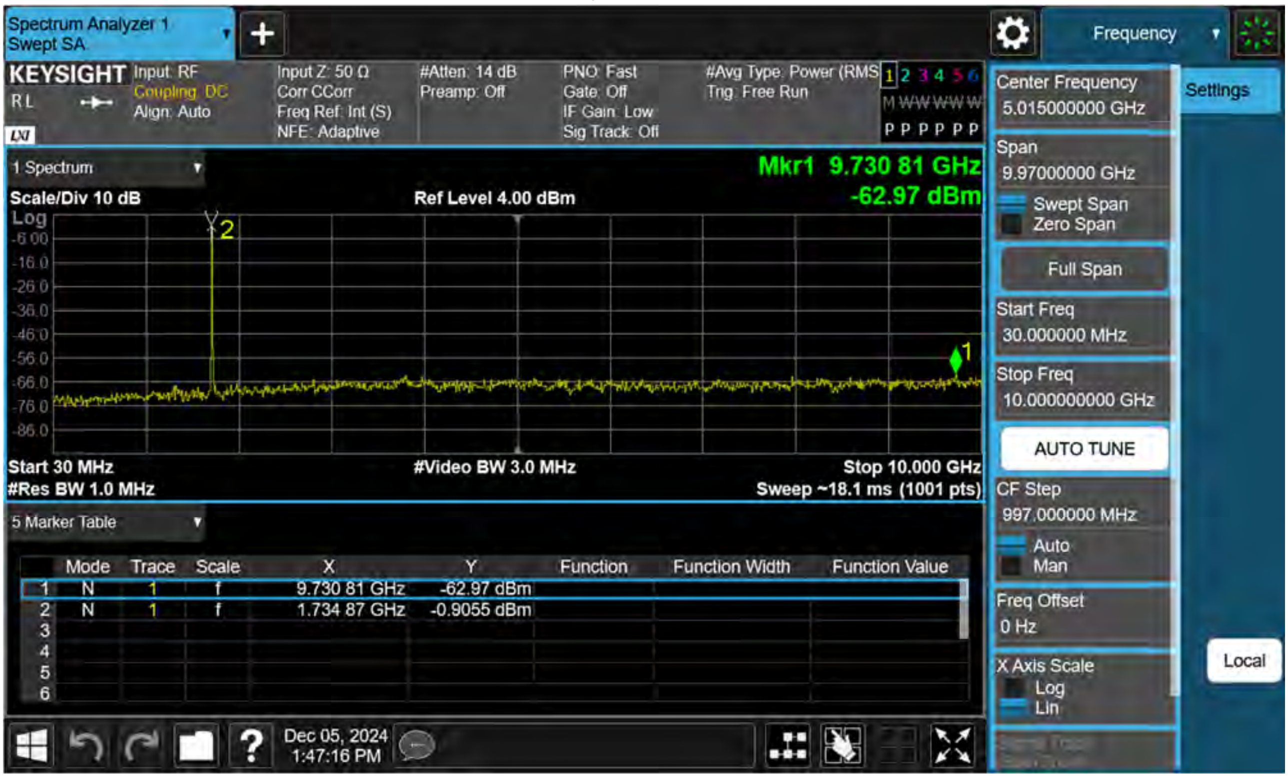
NR66_15 M_Conducted Spurious(30 M-10 G)_High_BPSK_1RB



NR66_20 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB

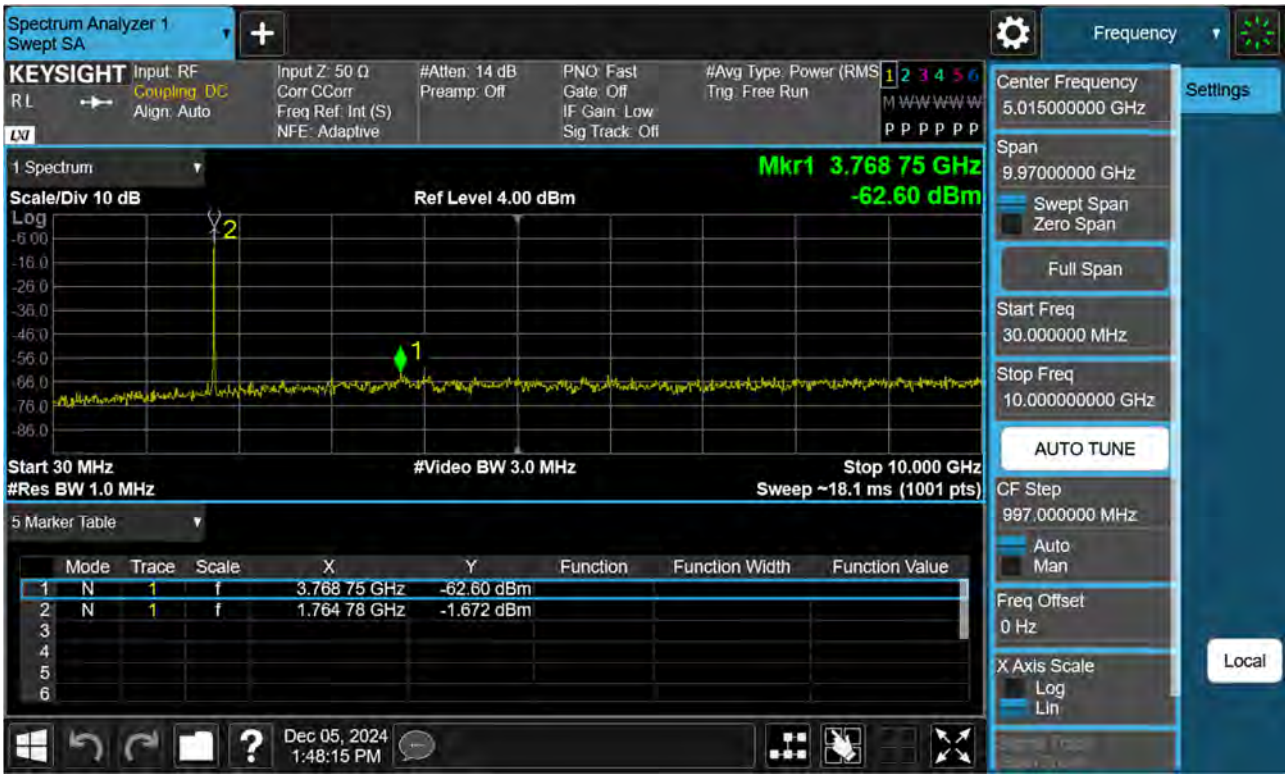


NR66_20 M_Conducted Spurious(30 M-10 G)_Mid_BPSK_1RB

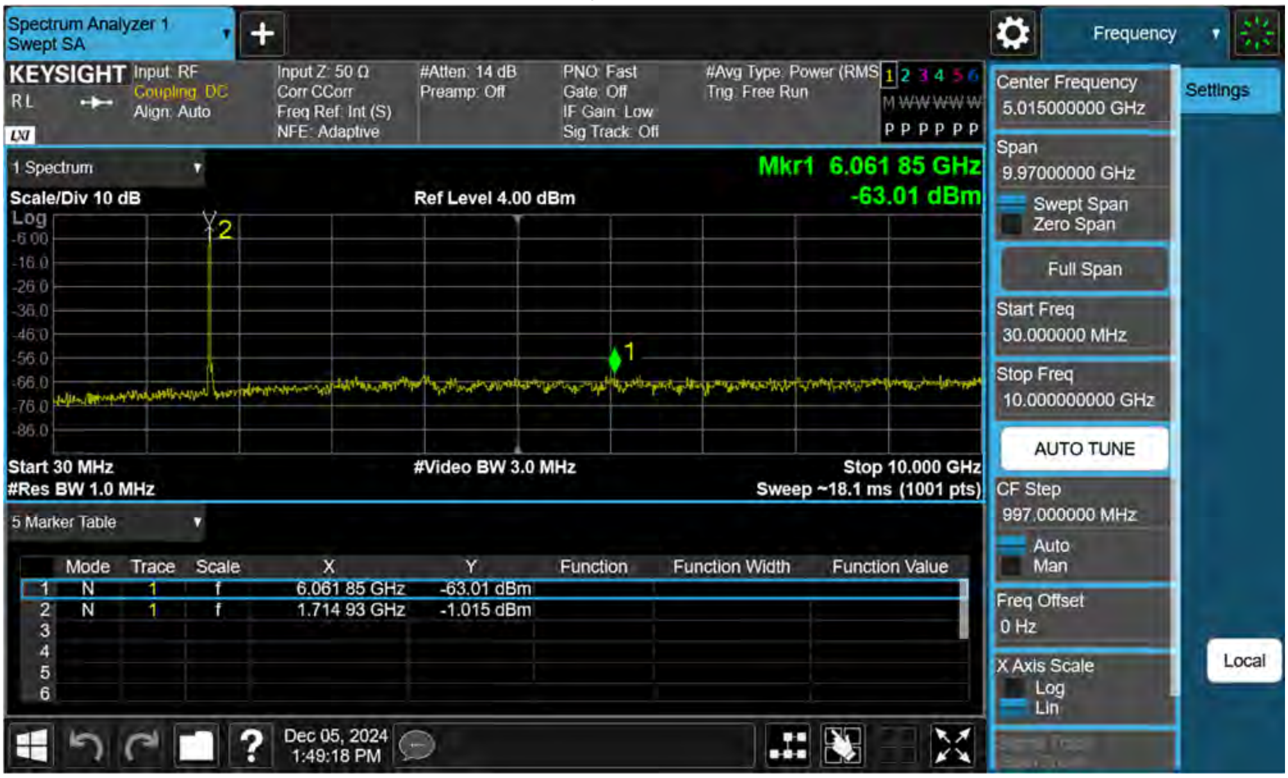


	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	9.730 81 GHz	-62.97 dBm			
2	N	1	f	1.734 87 GHz	-0.9055 dBm			
3								
4								
5								
6								

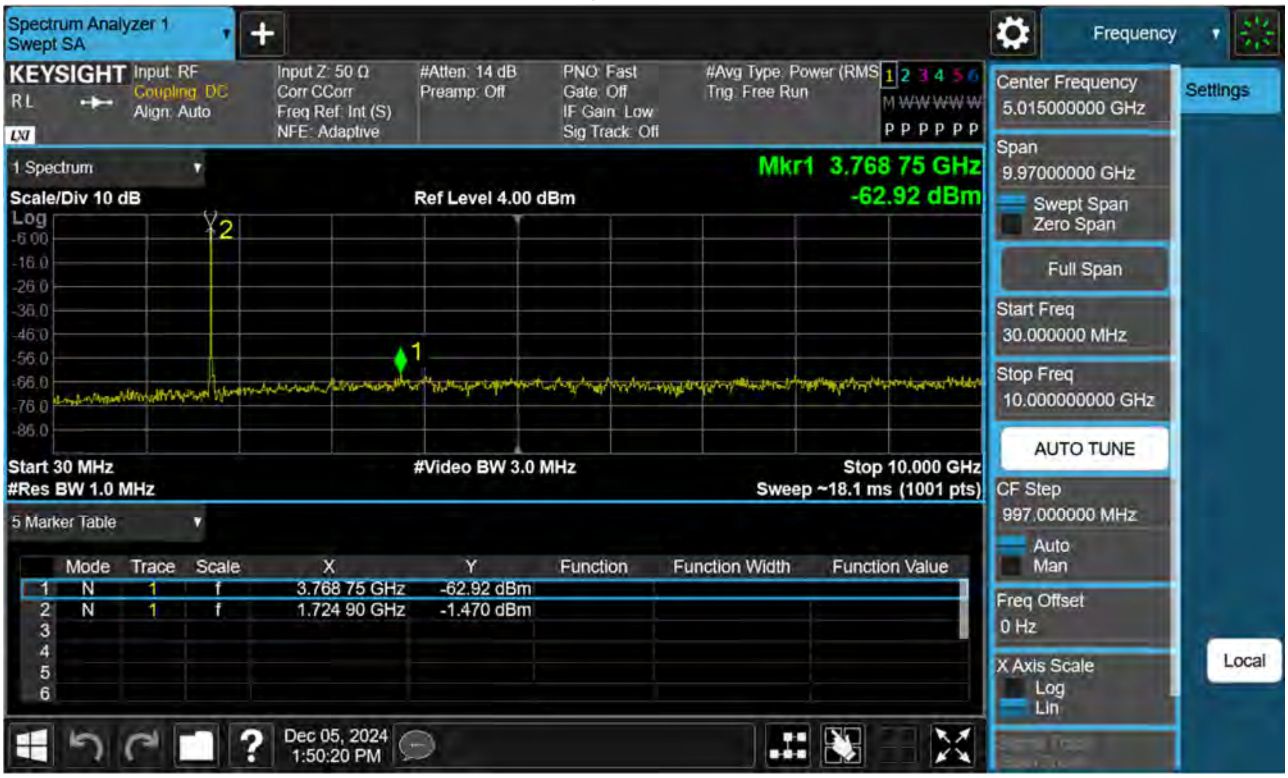
NR66_20 M_Conducted Spurious(30 M-10 G)_High_BPSK_1RB



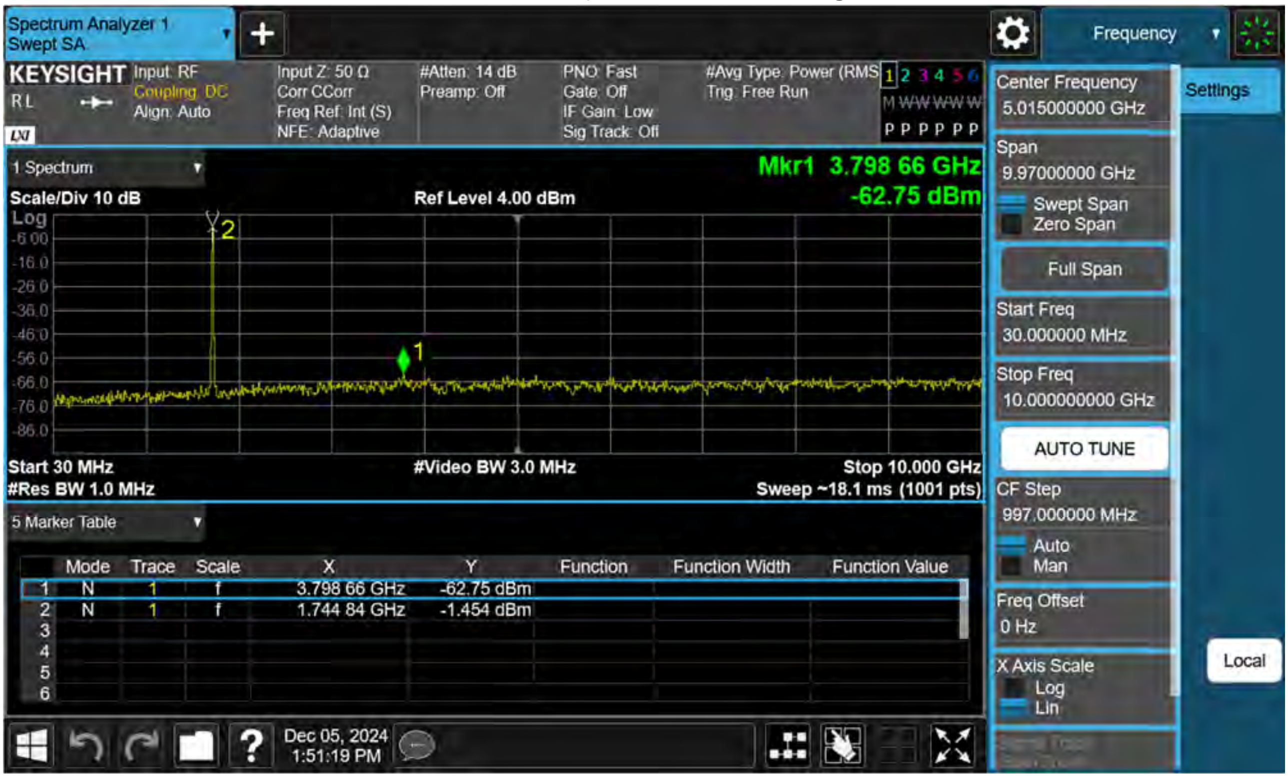
NR66_40 M_Conducted Spurious(30 M-10 G)_Low_BPSK_1RB



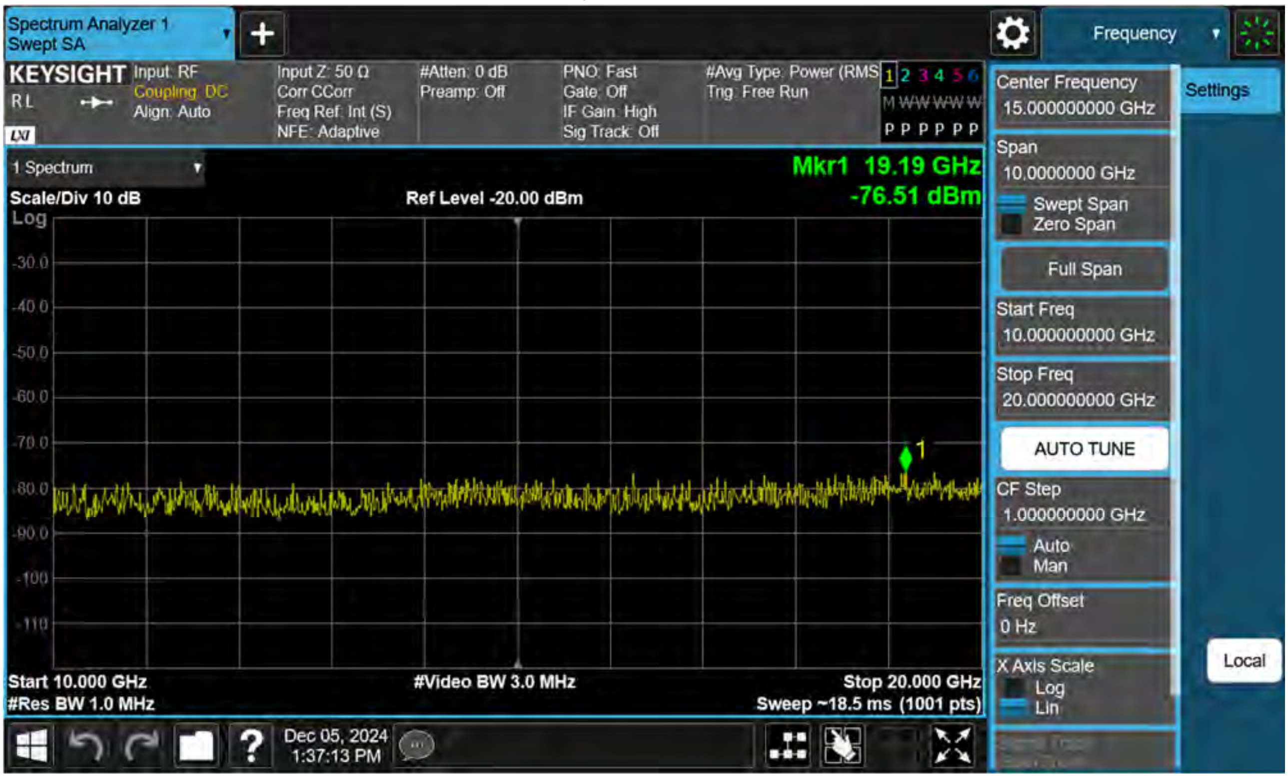
NR66_40 M_Conducted Spurious(30 M-10 G)_Mid_BPSK_1RB



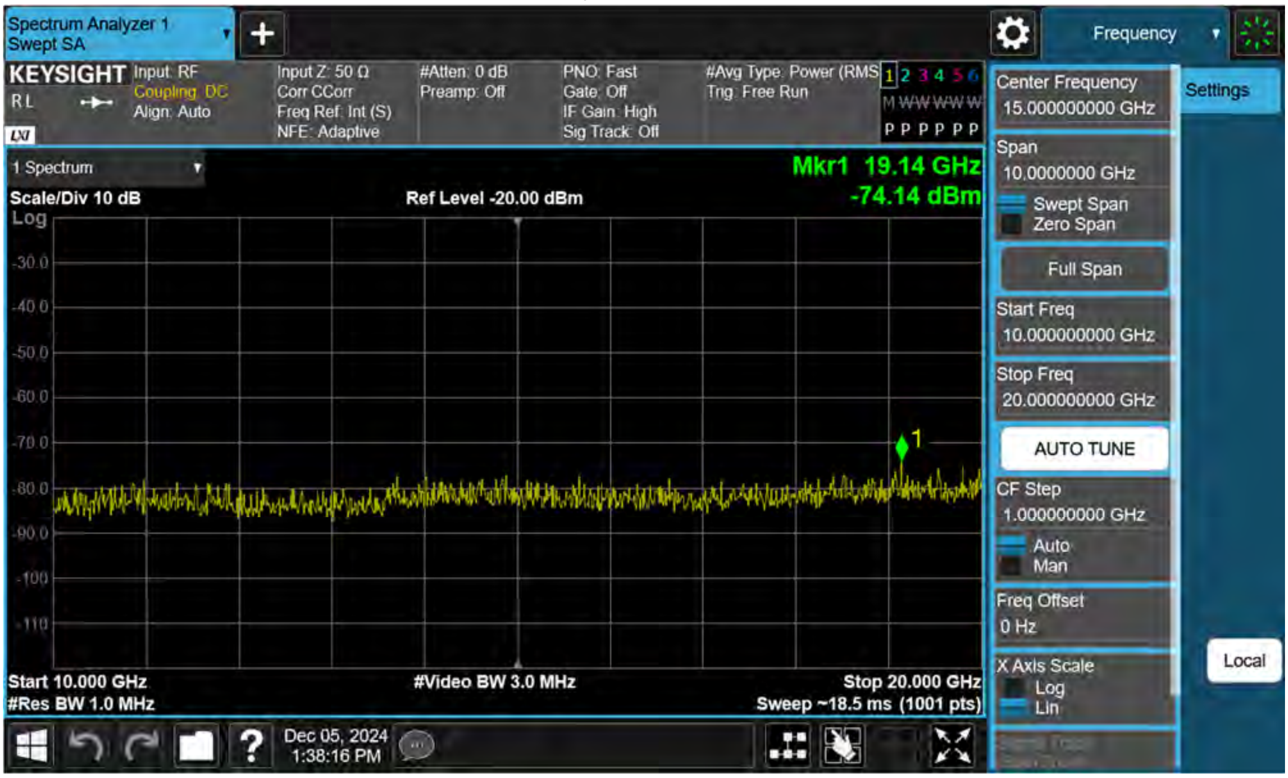
NR66_40 M_Conducted Spurious(30 M-10 G)_High_BPSK_1RB



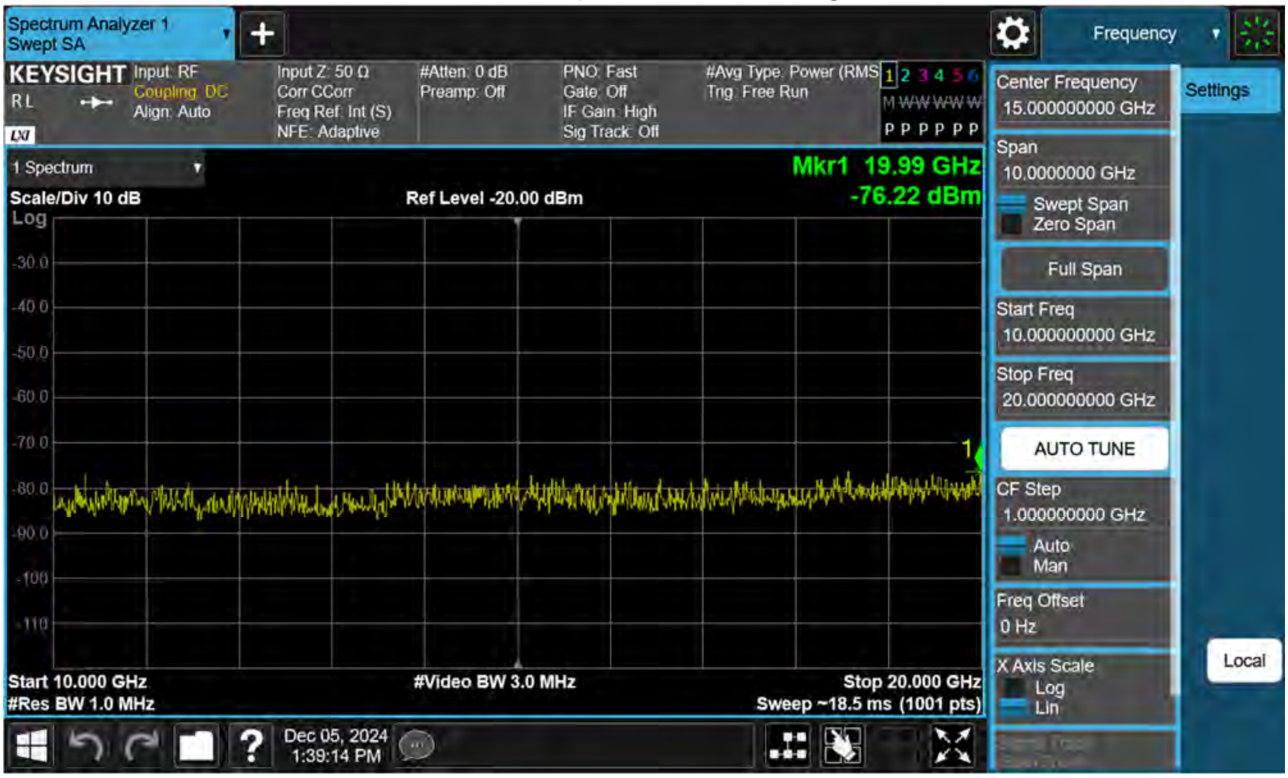
NR66_5 M_Conducted Spurious(Above10 G)_Low_BPSK_1RB



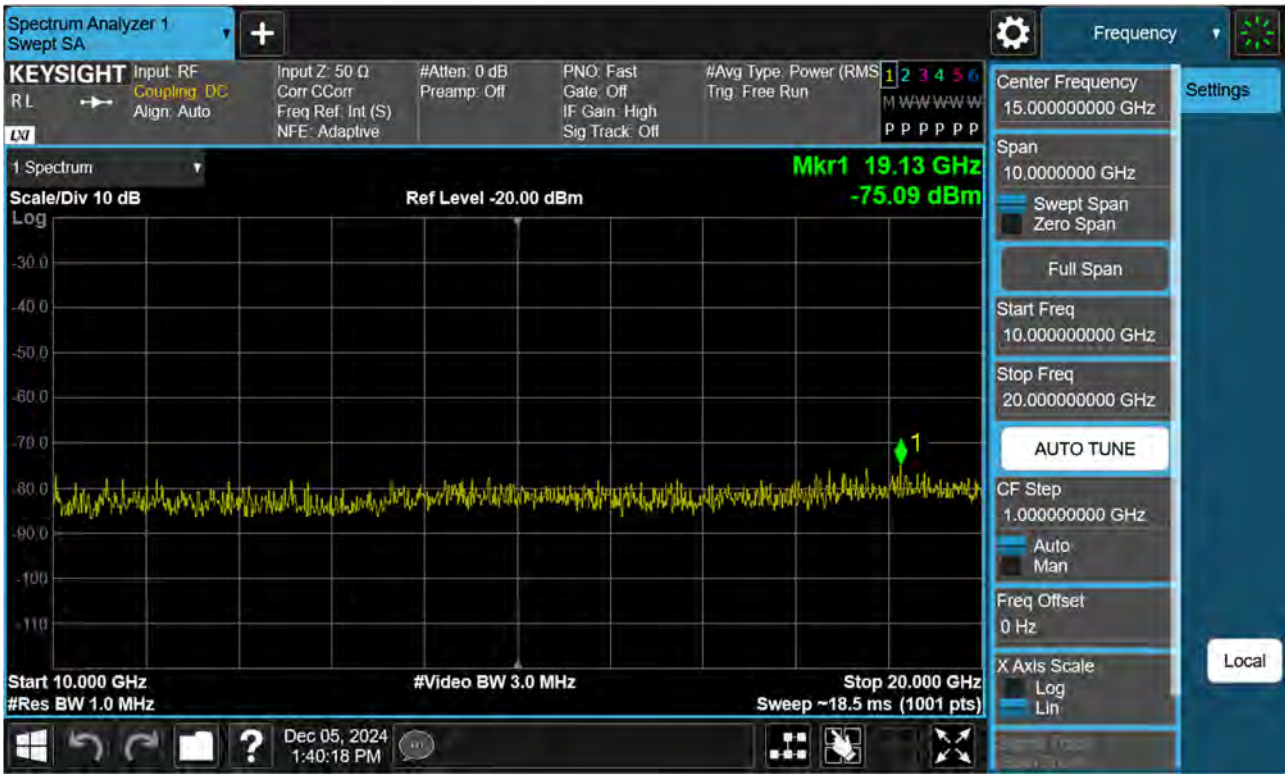
NR66_5 M_Conducted Spurious(Above10 G)_Mid_BPSK_1RB



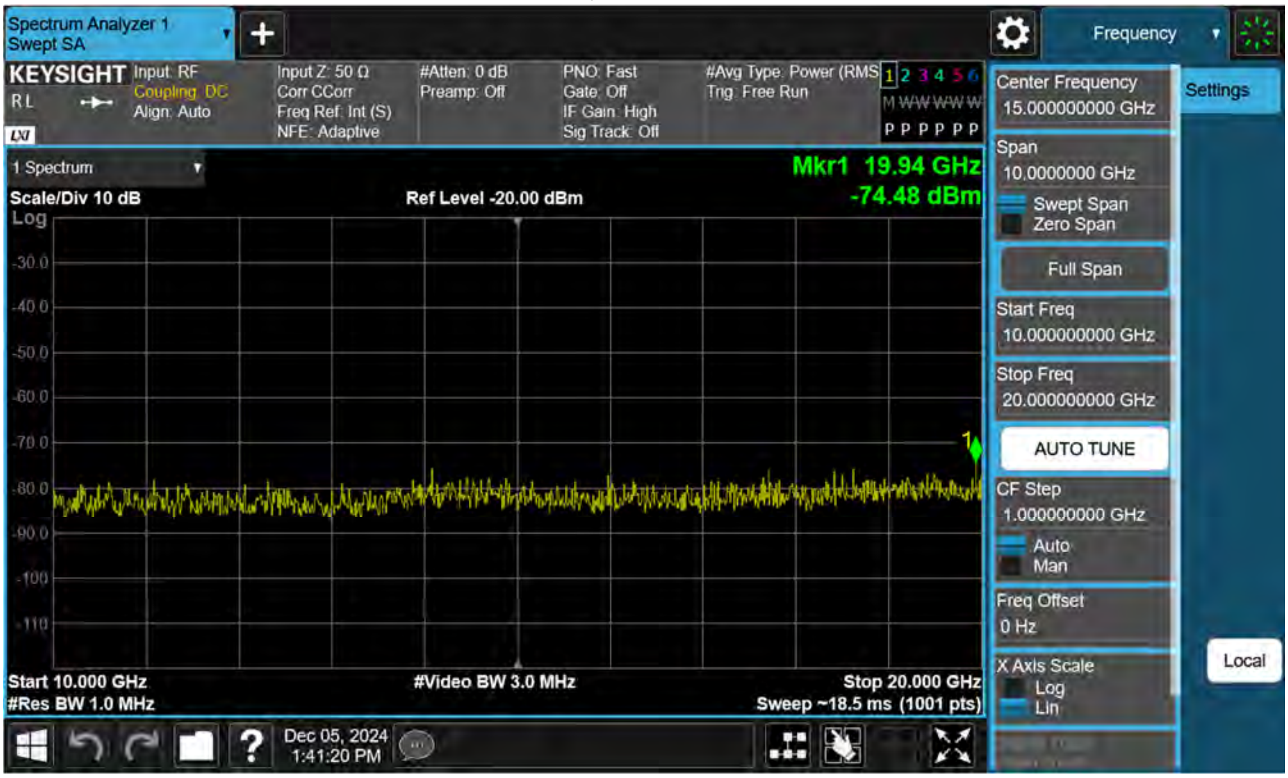
NR66_5 M_Conducted Spurious(Above10 G)_High_BPSK_1RB



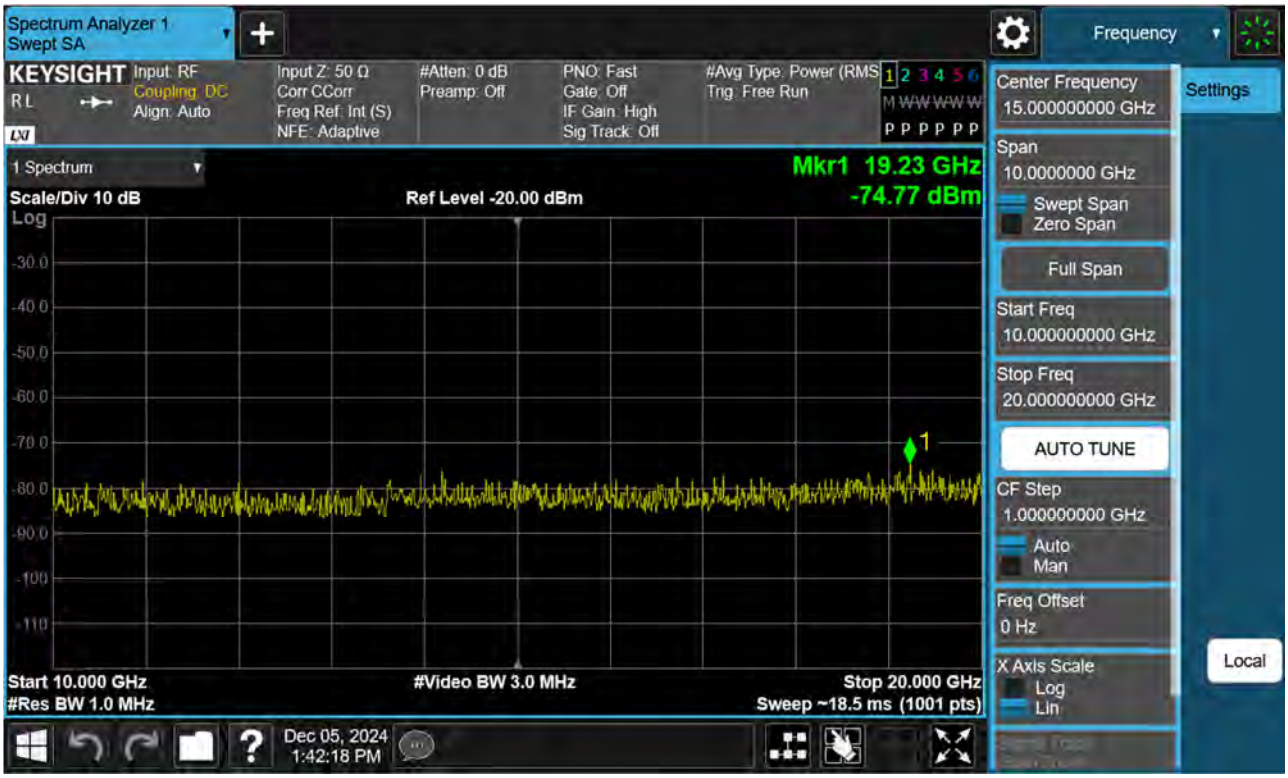
NR66_10 M_Conducted Spurious(Above10 G)_Low_BPSK_1RB



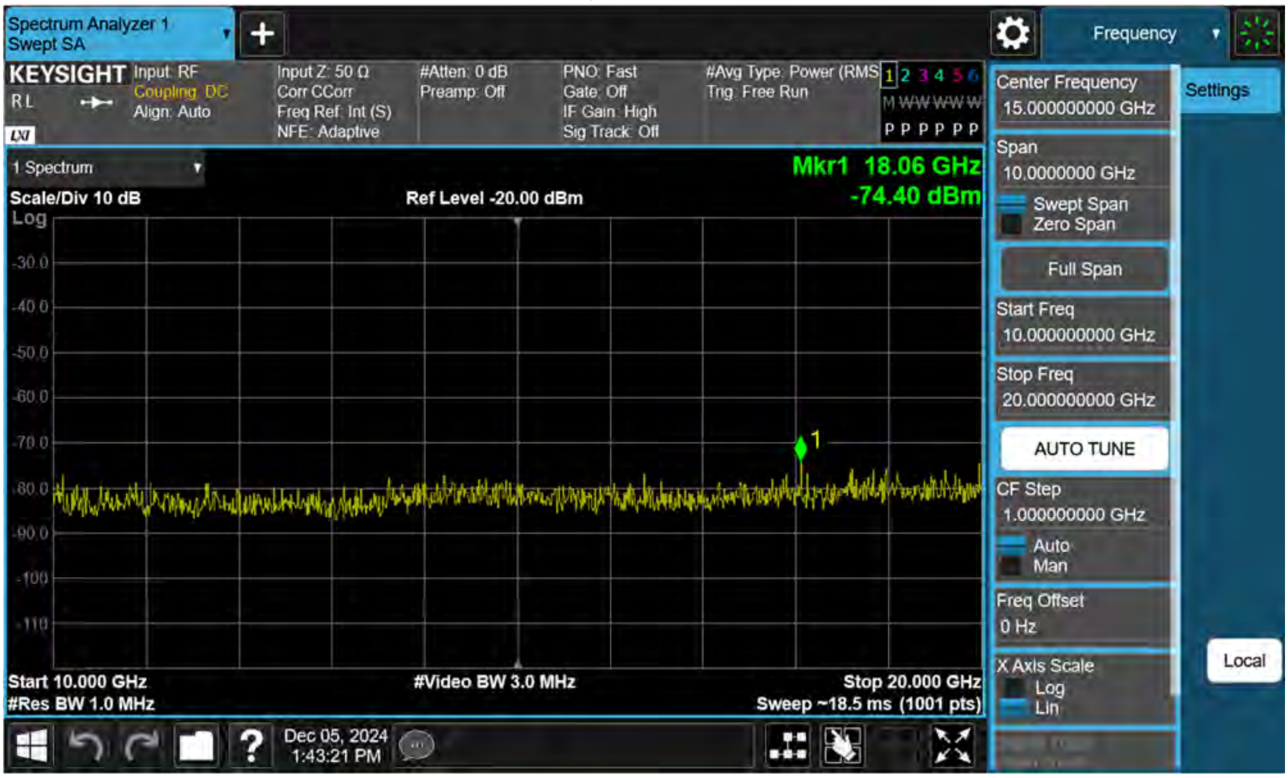
NR66_10 M_Conducted Spurious(Above10 G)_Mid_BPSK_1RB



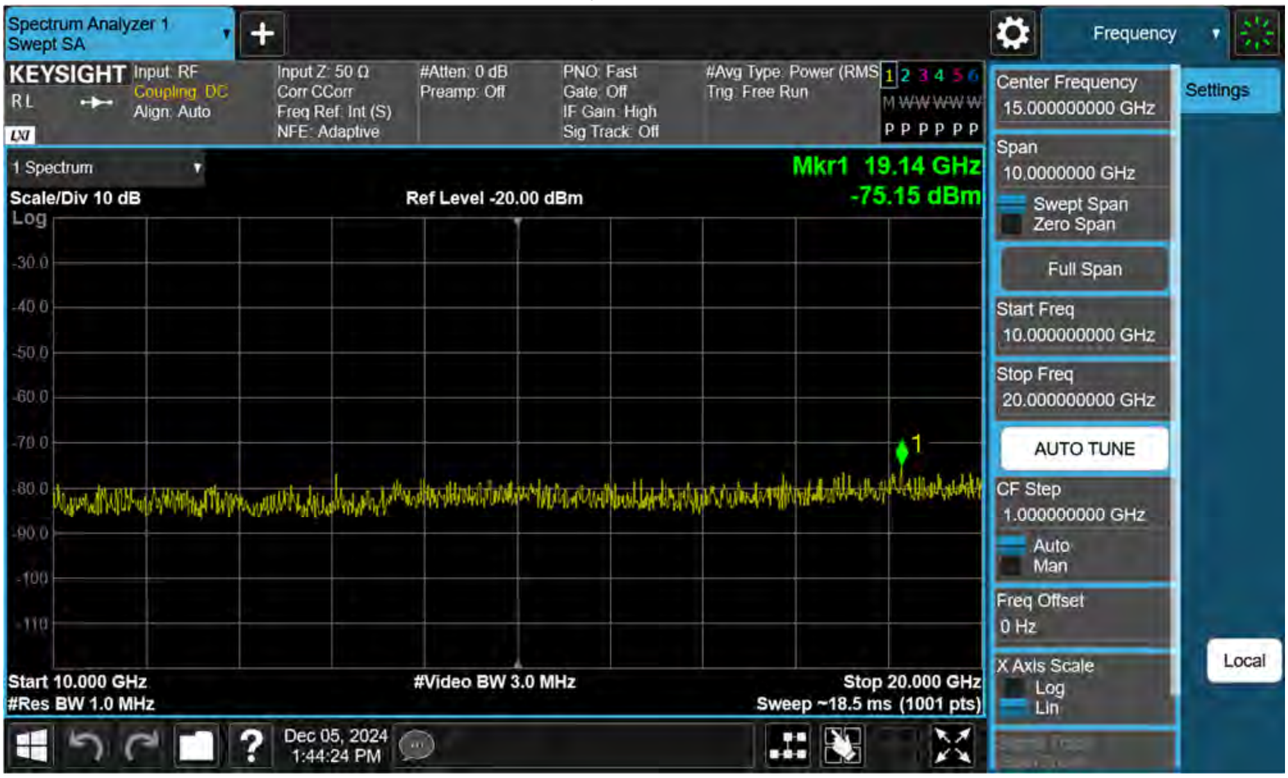
NR66_10 M_Conducted Spurious(Above10 G)_High_BPSK_1RB



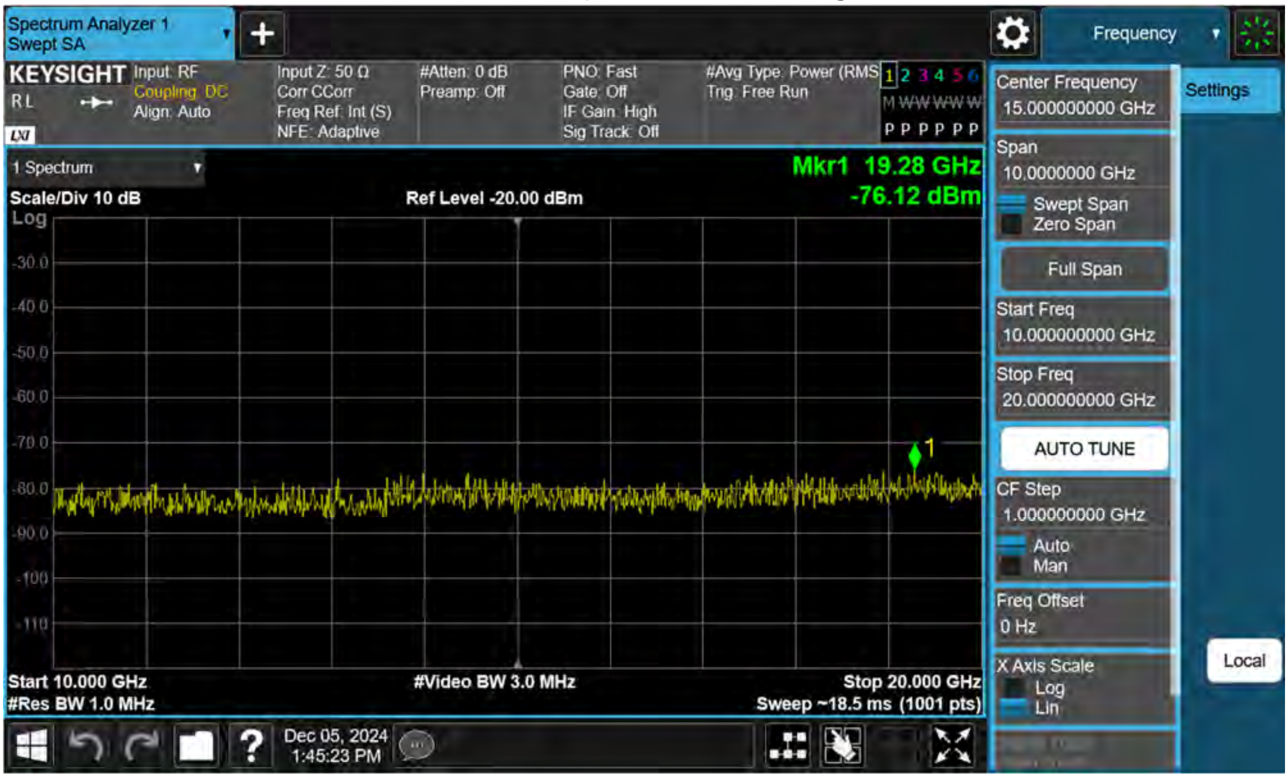
NR66_15 M_Conducted Spurious(Above10 G)_Low_BPSK_1RB



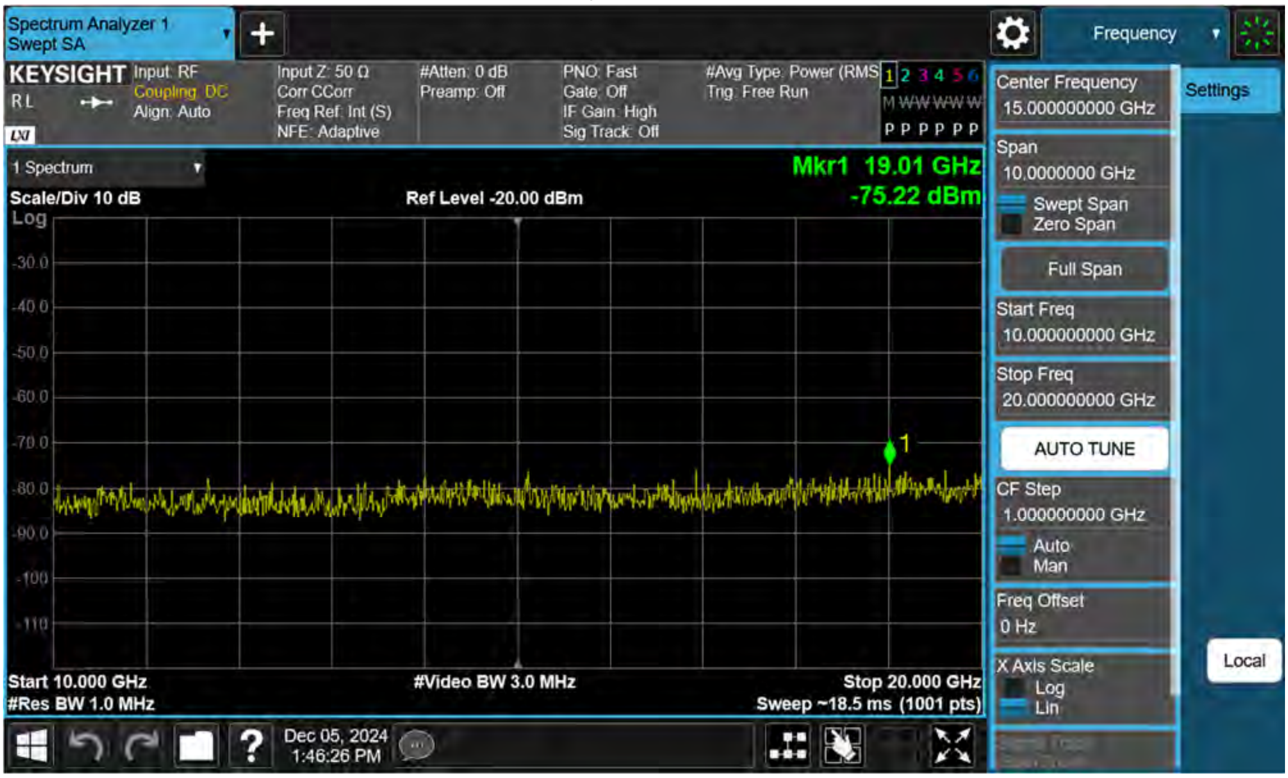
NR66_15 M_Conducted Spurious(Above10 G)_Mid_BPSK_1RB



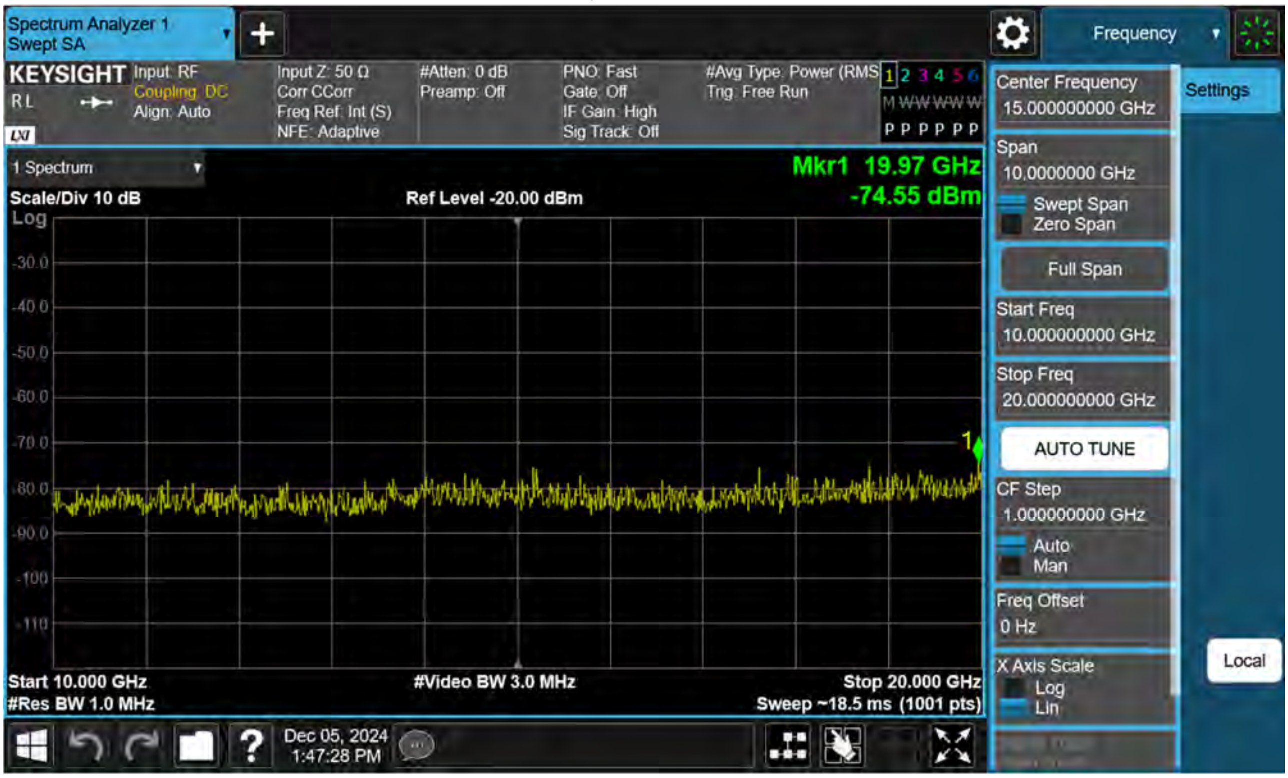
NR66_15 M_Conducted Spurious(Above10 G)_High_BPSK_1RB



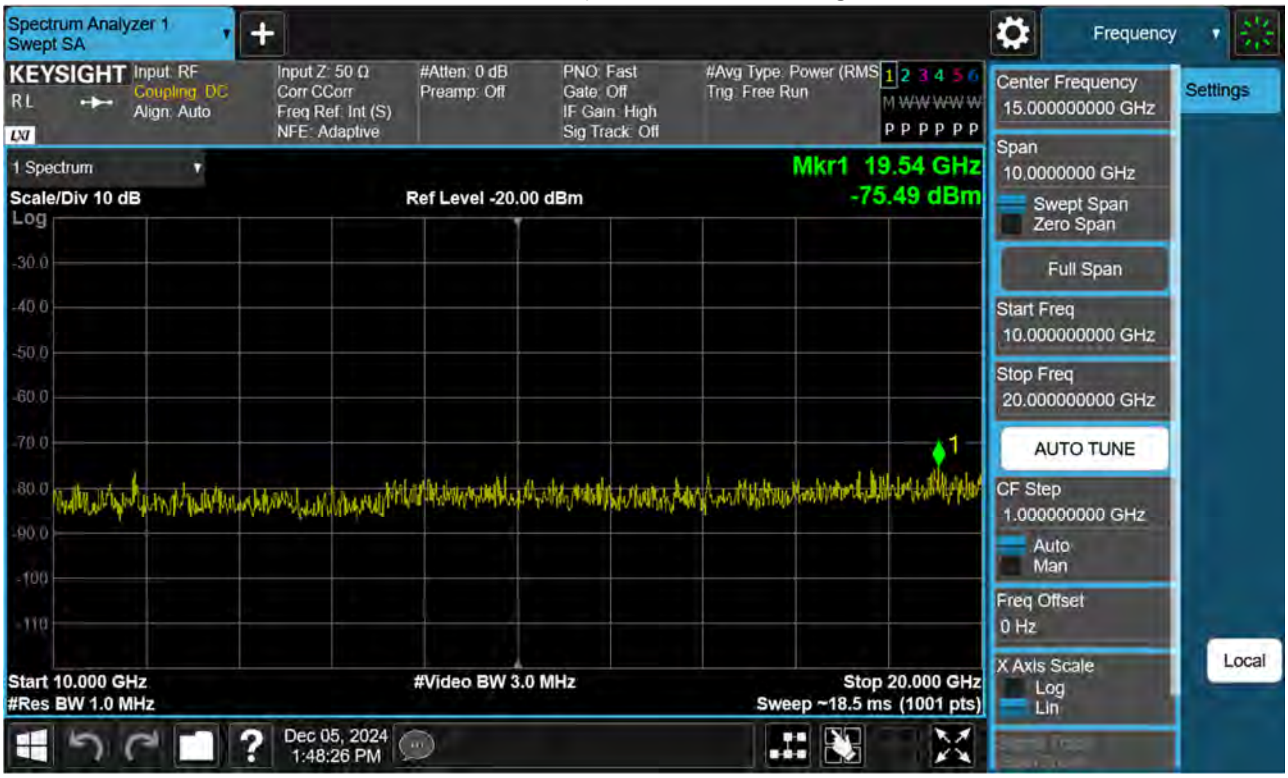
NR66_20 M_Conducted Spurious(Above10 G)_Low_BPSK_1RB



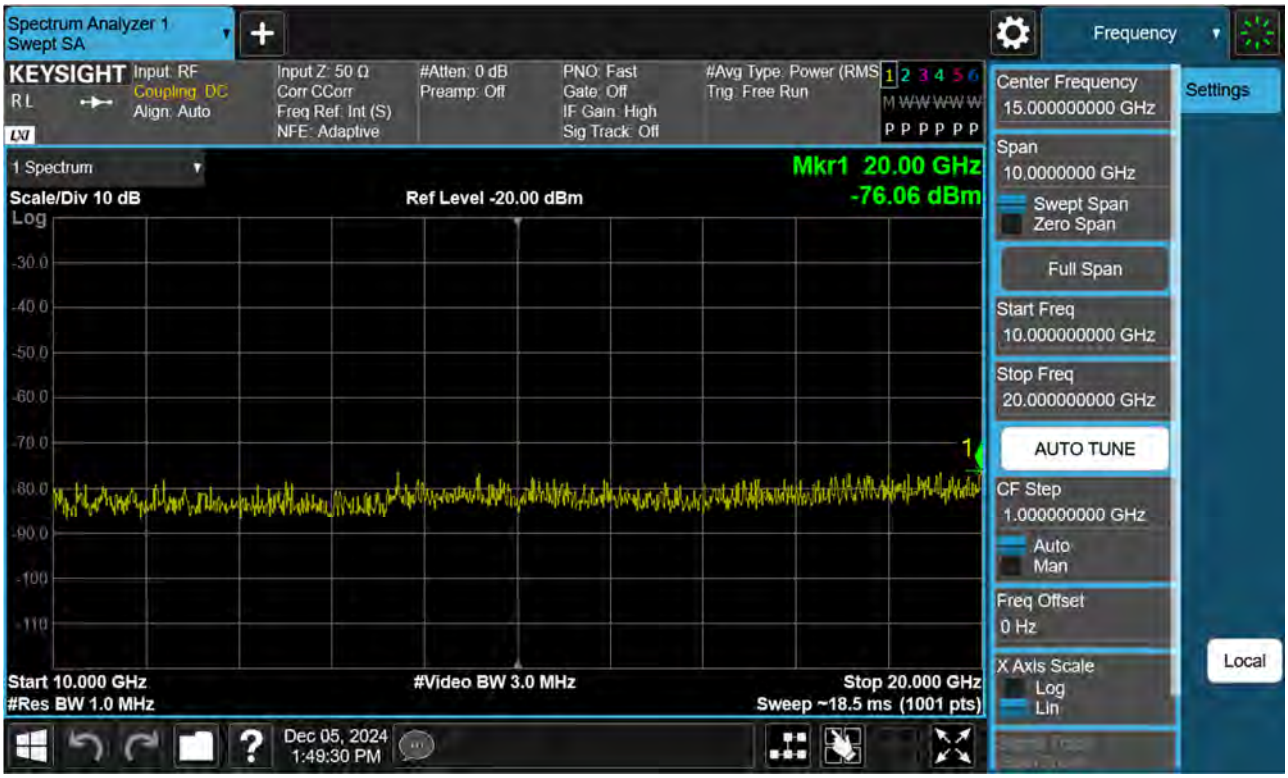
NR66_20 M_Conducted Spurious(Above10 G)_Mid_BPSK_1RB



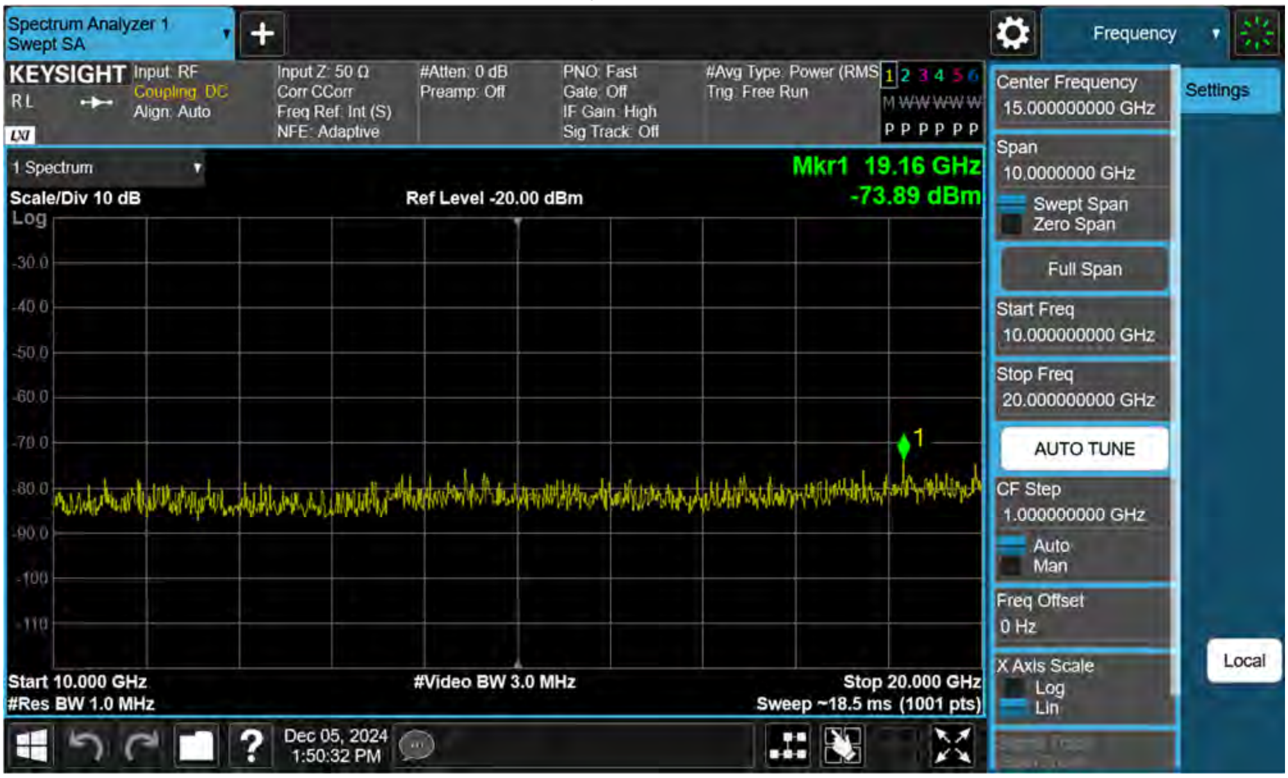
NR66_20 M_Conducted Spurious(Above10 G)_High_BPSK_1RB



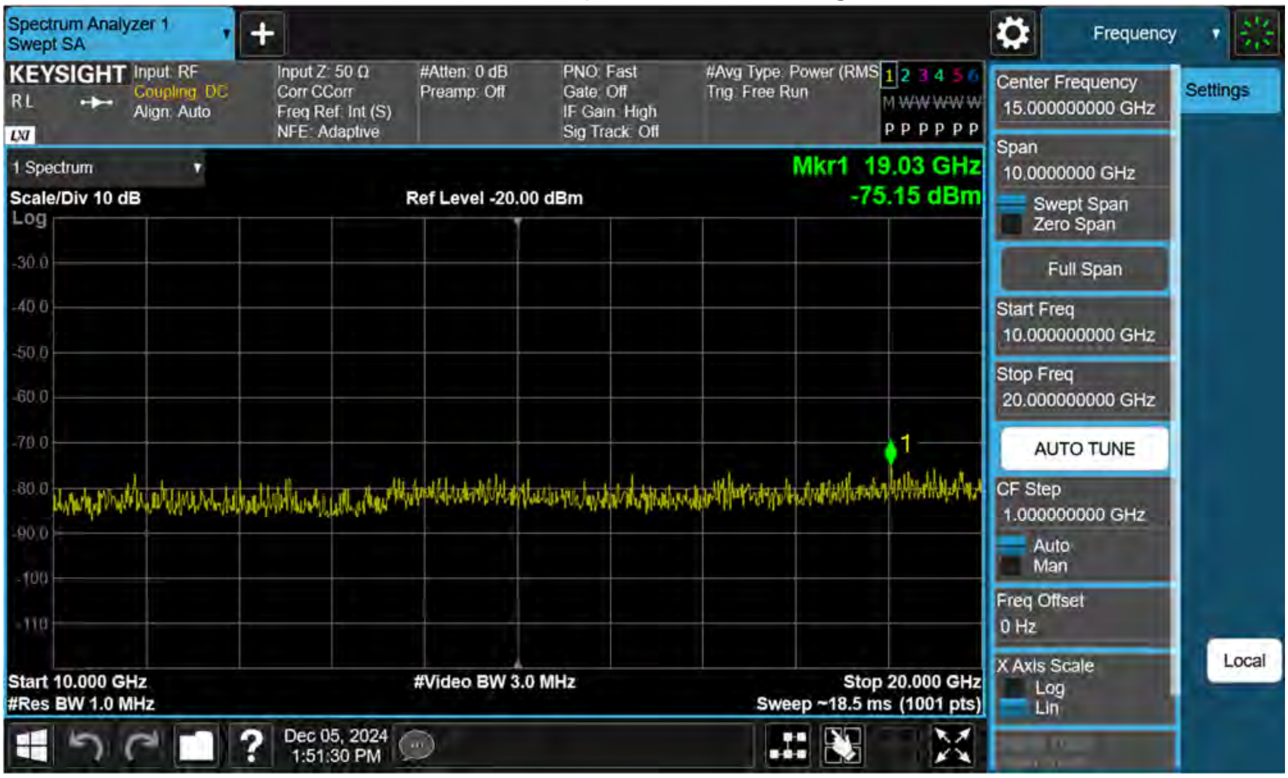
NR66_40 M_Conducted Spurious(Above10 G)_Low_BPSK_1RB



NR66_40 M_Conducted Spurious(Above10 G)_Mid_BPSK_1RB



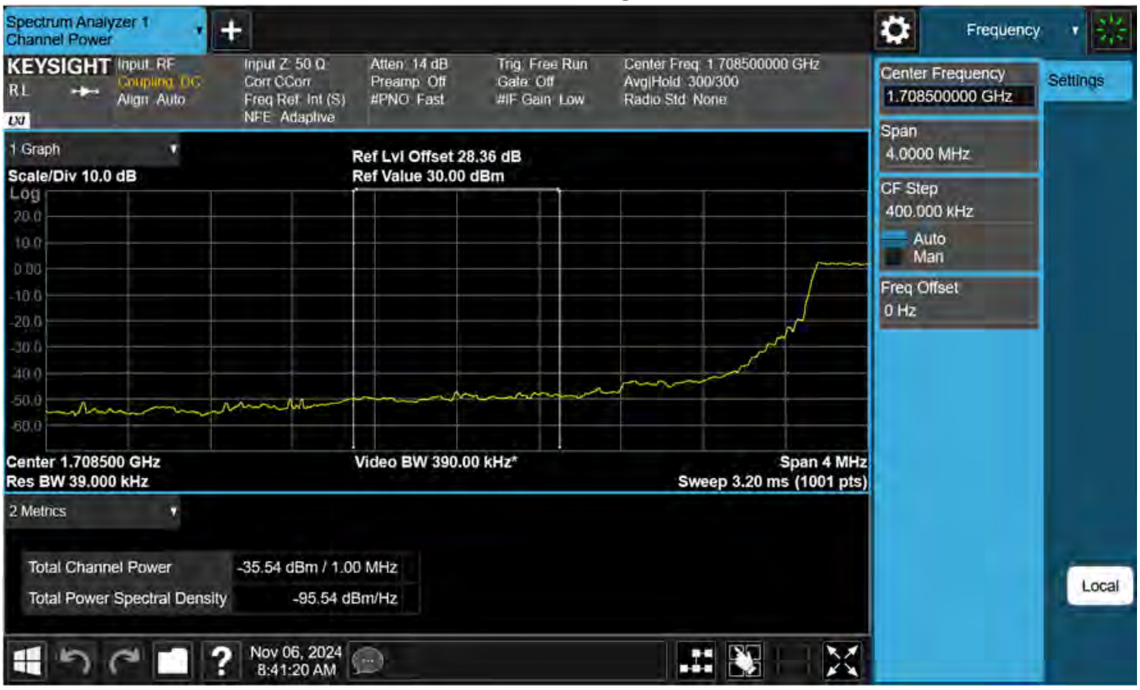
NR66_40 M_Conducted Spurious(Above10 G)_High_BPSK_1RB



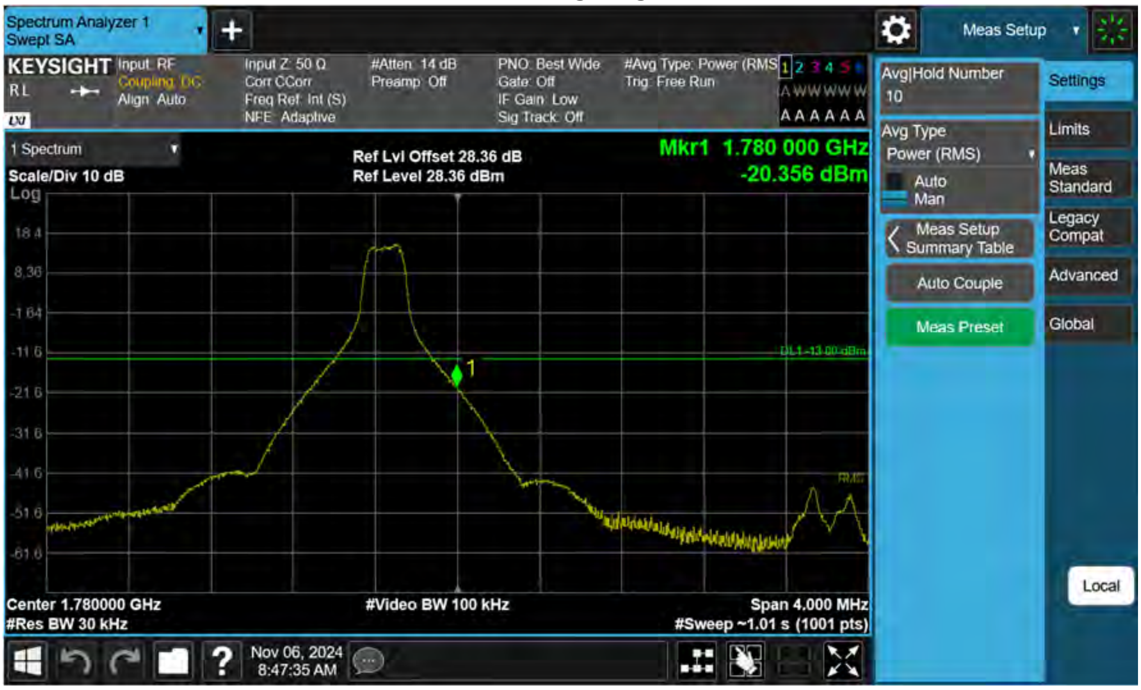
NR66_5 M_Band Edge_Low_BPSK_1RB

NR66_5 M_Band Edge_Low_BPSK_FullRB

NR66_5 M_Extended Band Edge_Low_BPSK_FullRB



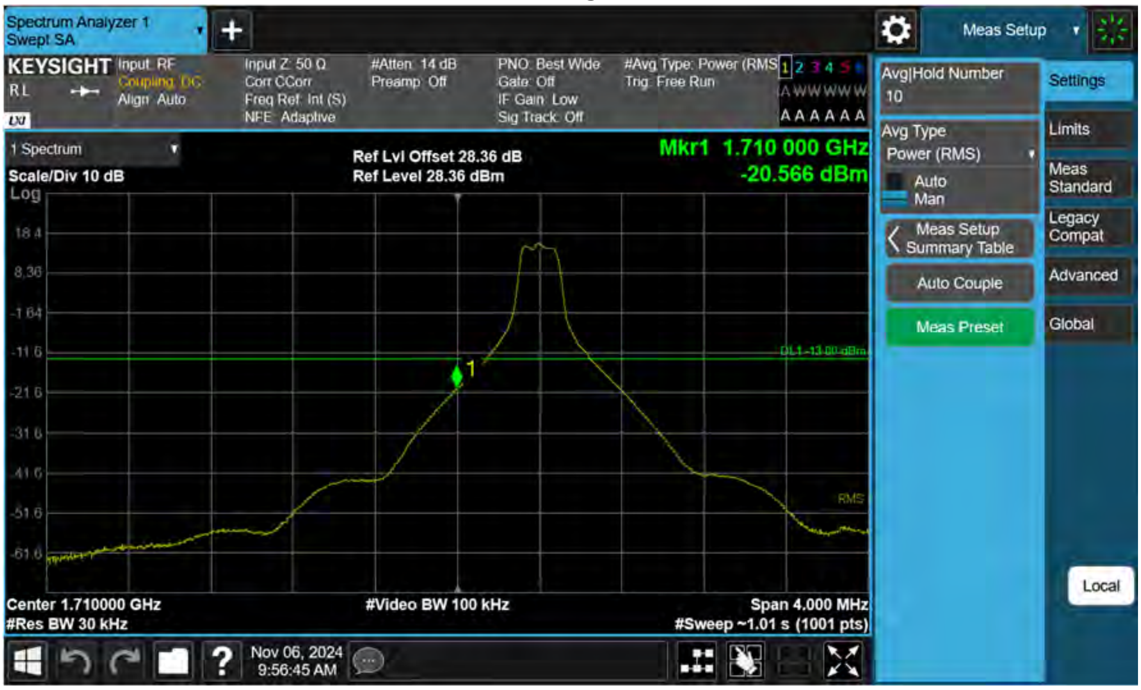
NR66_5 M_Band Edge_High_BPSK_1RB



NR66_5 M_Band Edge_High_BPSK_FullRB

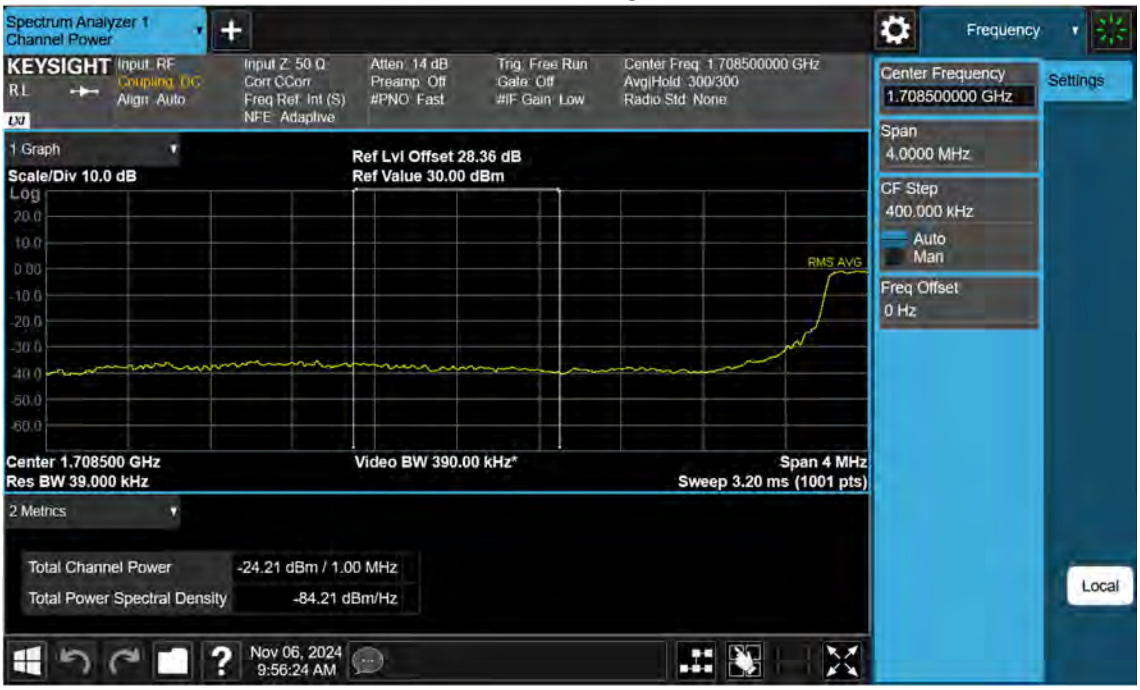
NR66_5 M_Extended Band Edge_High_BPSK_FullRB

NR66_10 M_Band Edge_Low_BPSK_1RB



NR66_10 M_Band Edge_Low_BPSK_FullRB

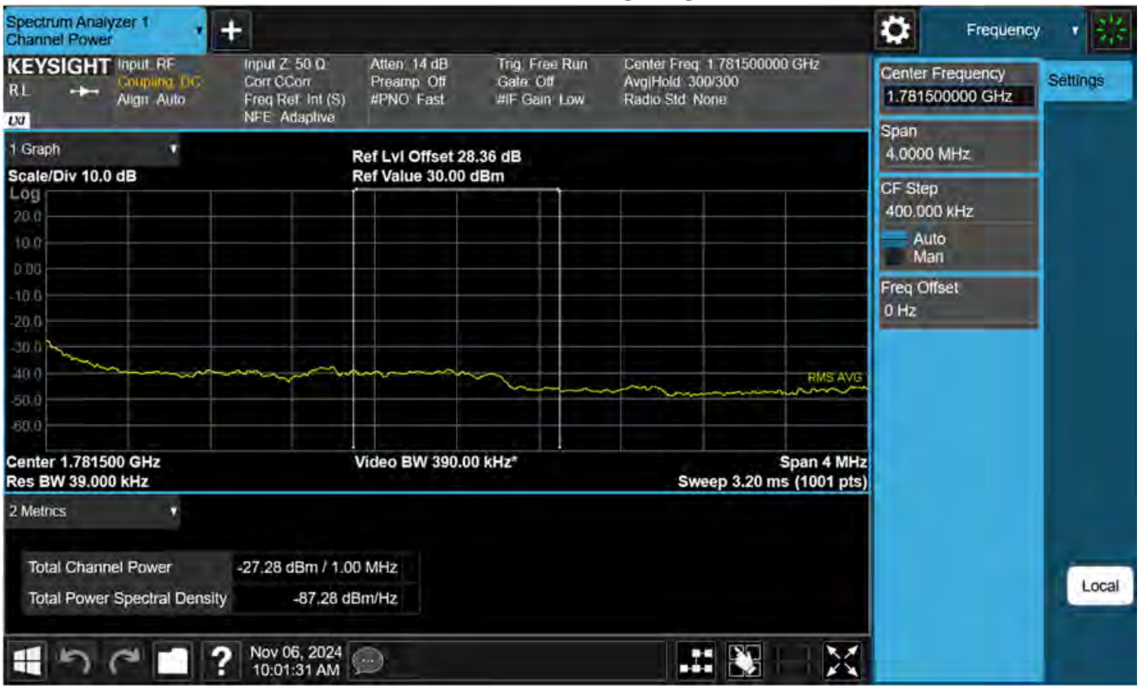
NR66_10 M_Extended Band Edge_Low_BPSK_FullRB



NR66_10 M_Band Edge_High_BPSK_1RB

NR66_10 M_Band Edge_High_BPSK_FullRB

NR66_10 M_Extended Band Edge_High_BPSK_FullRB



NR66_15 M_Band Edge_Low_BPSK_1RB

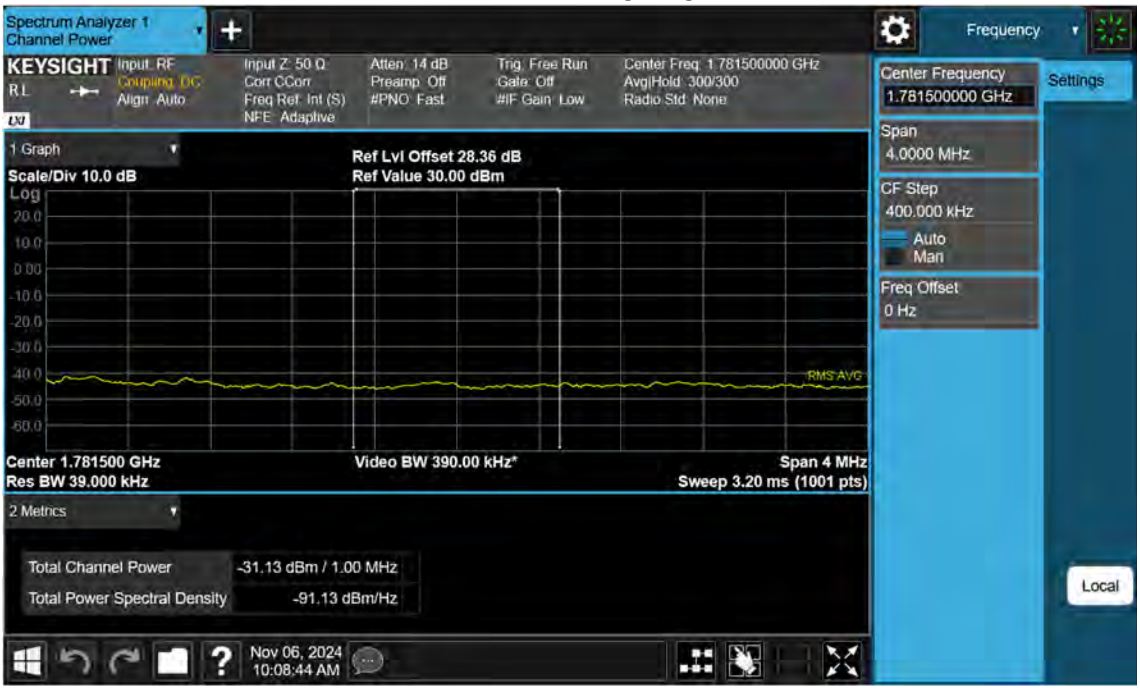
NR66_15 M_Band Edge_Low_BPSK_FullRB

NR66_15 M_Extended Band Edge_Low_BPSK_FullRB

NR66_15 M_Band Edge_High_BPSK_1RB

NR66_15 M_Band Edge_High_BPSK_FullRB

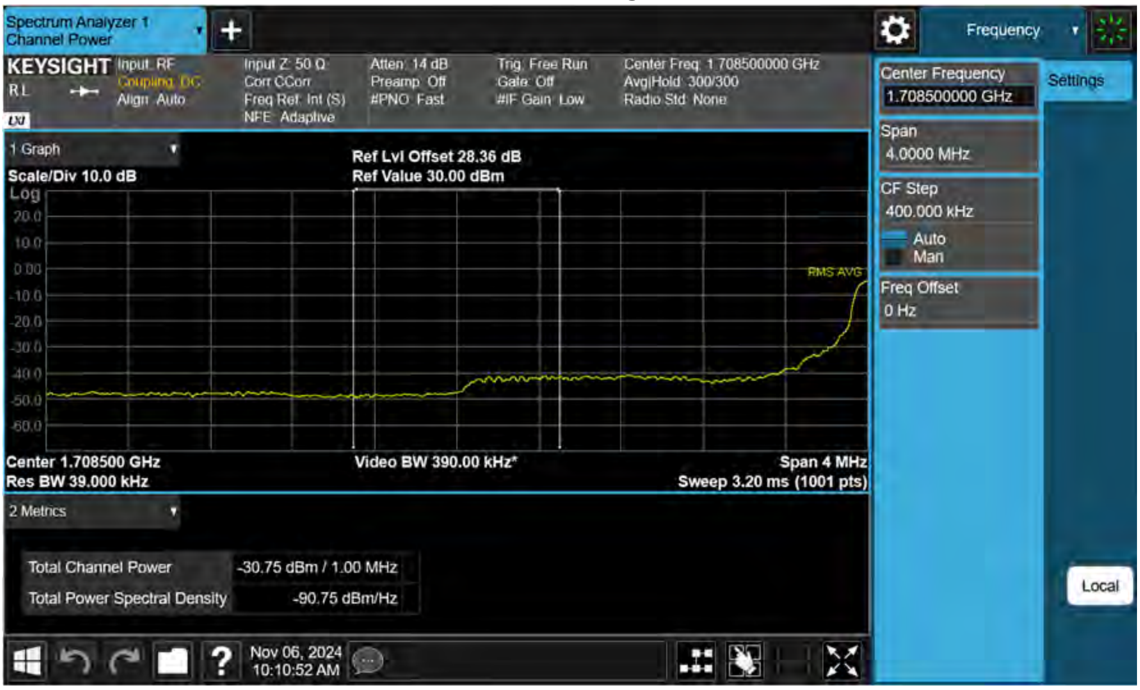
NR66_15 M_Extended Band Edge_High_BPSK_FullRB



NR66_20 M_Band Edge_Low_BPSK_1RB

NR66_20 M_Band Edge_Low_BPSK_FullRB

NR66_20 M_Extended Band Edge_Low_BPSK_FullRB

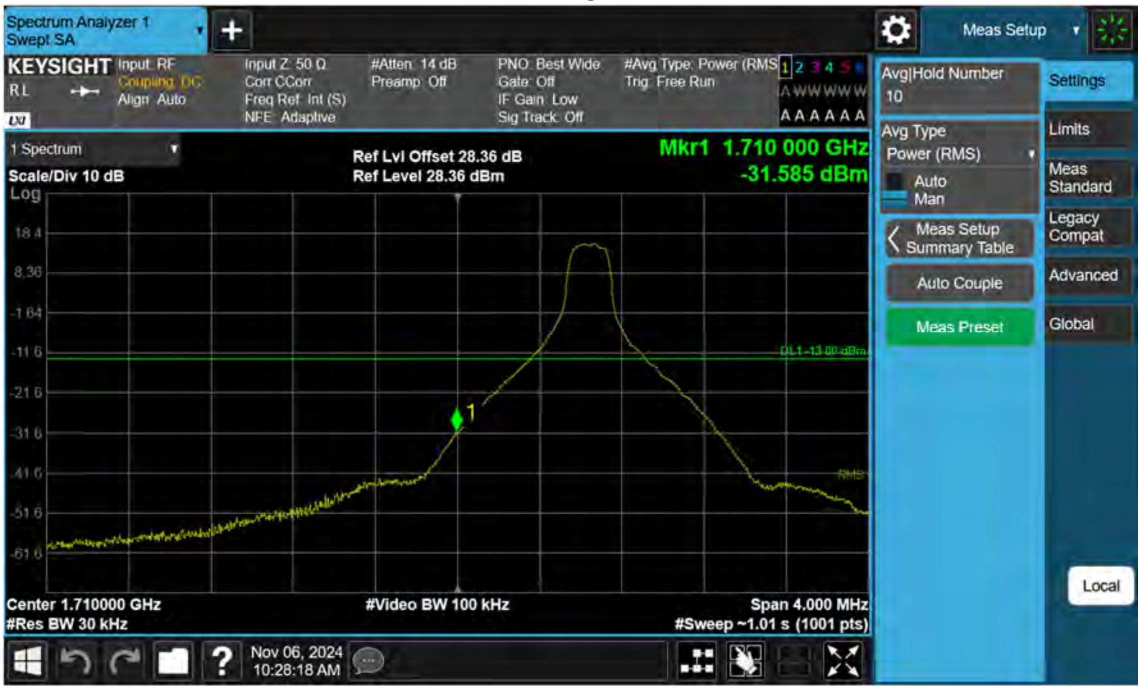


NR66_20 M_Band Edge_High_BPSK_1RB

NR66_20 M_Band Edge_High_BPSK_FullRB

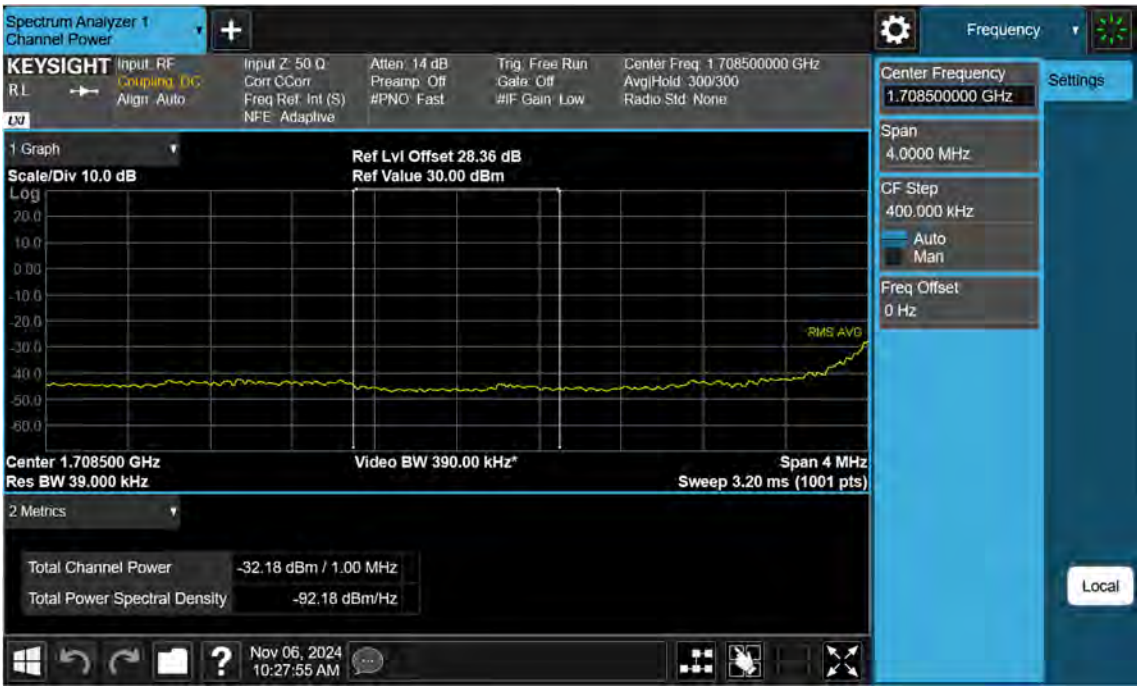
NR66_20 M_Extended Band Edge_High_BPSK_FullRB

NR66_40 M_Band Edge_Low_BPSK_1RB



NR66_40 M_Band Edge_Low_BPSK_FullRB

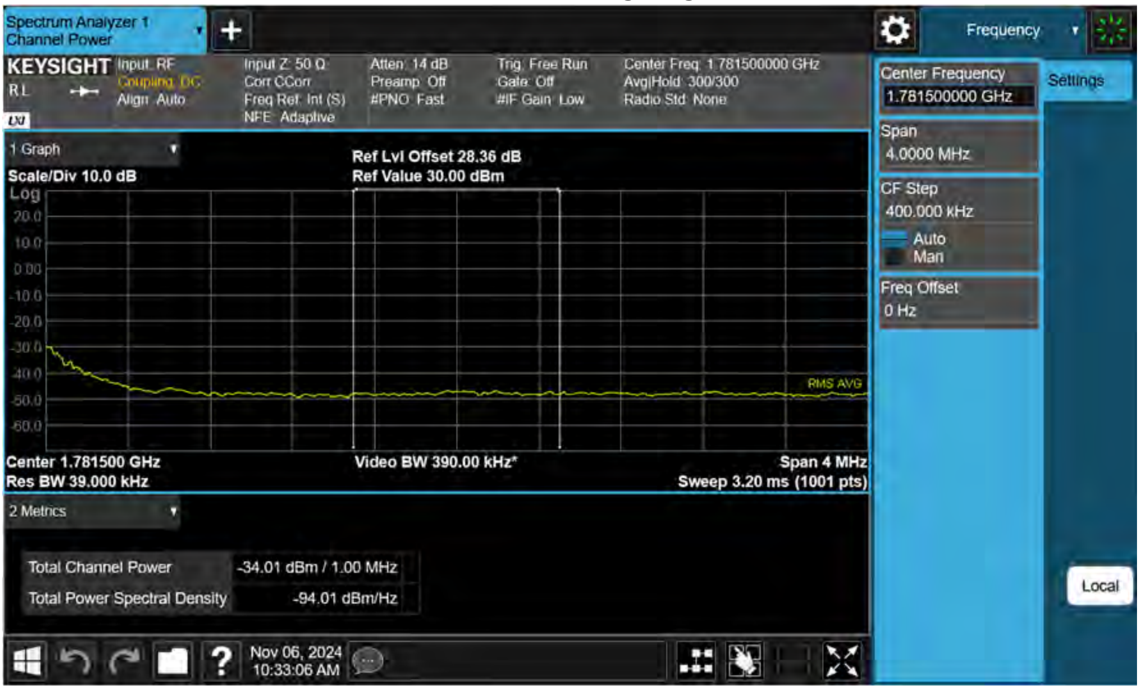
NR66_40 M_Extended Band Edge_Low_BPSK_FullRB



NR66_40 M_Band Edge_High_BPSK_1RB

NR66_40 M_Band Edge_High_BPSK_FullRB

NR66_40 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-2412-FC033-P