

TEST REPORT

FCC MSS Test for SM-S931U
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-2410-FC064-R2

DATE OF ISSUE
November 25, 2024

Tested by
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Applicant

SAMSUNG Electronics Co., Ltd.

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

Product Name

Mobile Phone

Model Name

SM-S931U

Date of Test

August 26, 2024 ~ November 07, 2024

FCC ID

A3LSMS931U

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 Classification:

Licensed Non-Broadcast Station Transmitter (TNB)

Test Standard Used

FCC Rule Part(s) : § 25

Test Results

PASS

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	October 29, 2024	Initial Release
1	November 07, 2024	Retested the Emission Mask on page 56 - 70.
2	November 25, 2024	Revised the FCC Classification on page 2, 5.

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).

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMS931U
Application Type:	Certification
FCC Classification:	Licensed Non-Broadcast Station Transmitter (TNB)
FCC Rule Part(s):	§ 25
EUT Type:	Mobile phone
Model(s):	SM-S931U
Additional Model(s):	SM-S931U1
Band	Mobile Satellite Service (MSS)
Modulation:	BPSK, QPSK
Peak antenna gain:	4.0 dBi
Authorized bandwidth:	230 kHz
Sub carrier spacing:	3.75 kHz, 15 kHz
Frequency range:	1626.5MHz ~ 1660.5MHz
Test frequency:	1626.6 MHz, 1643.5 MHz, 1660.4 MHz
Date(s) of Tests:	August 26, 2024 ~ November 07, 2024
Serial number:	Radiated: R3CX80BGDYZ Conducted : R3CX80PDYJH

1.1. MAXIMUM OUTPUT POWER

SCS (kHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
3.75	1626.6 – 1660.4	78K9G7D	BPSK	0.153	21.85
		99K0G7D	QPSK	0.155	21.89
15	1626.6 – 1660.4	132KG7D	BPSK	0.157	21.97
		189KG7D	QPSK	0.159	22.01

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS and LTE, Sub 6, MSSmmWave. It also supports IEEE 802.11 a/b/g/n/ac/ax/be (20/40/80/160/320 MHz), Bluetooth(iPA, ePA), BT LE(iPA, ePA), NFC, WPT, WIFI 6E.

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
Conducted Output Power	- N/A (See SAR Report)
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Conducted Emission Mask	- 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
Emission limits for protection of aeronautical service	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RF OUTPUT POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5 % of the expected OBW, not to exceed 1 MHz
3. VBW $\geq$ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $>$ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

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

The power is calculated by the following formula;

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

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

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

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

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

Test Settings

1. RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz
2. VBW $\geq 3 \times$ 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;

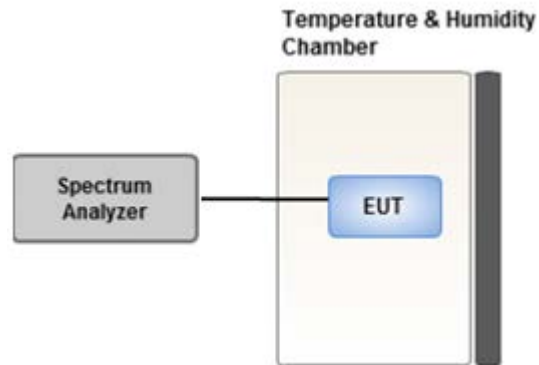
$$\text{Result}_{(\text{dBm})} = P_g_{(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

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 CONDUCTED EMISSION MASK



Test setup

Test Procedure

The conducted emission mask was connected to a calibrated Splitter and Communication Test equipment, the other end of which was connected to a spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

The mean power of the emissions shall be attenuated below the mean output power.

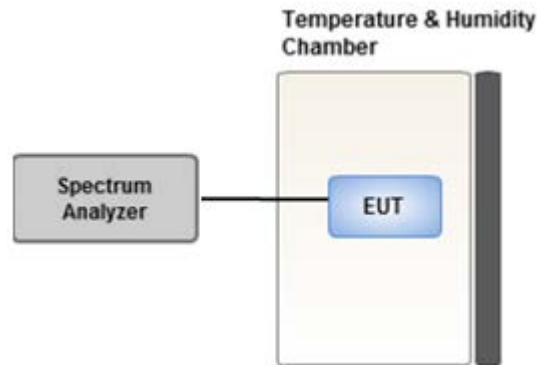
Test Settings

1. RBW $\geq$ 4 kHz
2. VBW $\geq$ 3 x RBW
3. Detector = RMS
4. Trace mode = Average
5. Sweep = auto couple
6. The trace was allowed to stabilize

Test Note

1. Mean output power = Conducted Output Power

3.5 OCCUPIED BANDWIDTH.



Test setup

Test Overview

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

The EUT makes a call to the communication simulator.

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

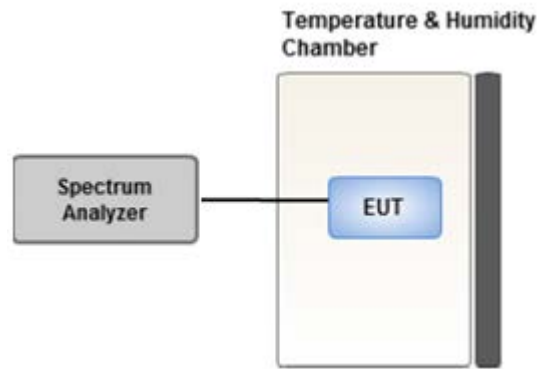
The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5 % of the expected OBW
3. VBW $\geq$ 3 x RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

Test Overview

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

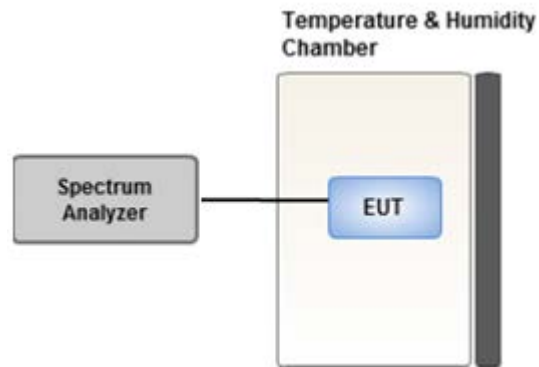
Test Settings

1. RBW = 1 MHz
2. VBW $\geq$ 3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto couple
6. Number of points in sweep $\geq 2 \times \text{Span} / \text{RBW}$

Test Note

1. Mean output power = Conducted Power
2. Ref. offset of spectrum analyzer $_{(dB)} = \text{Path loss }_{(dB)} + \text{Duty Cycle Factor }_{(dB)}$

3.7 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.

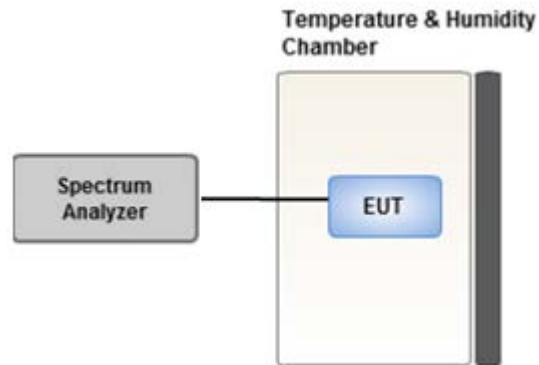
The frequency stability of the transmitter is measured by:

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.

3.8 EMISSION LIMITS FOR PROTECTION OF AERONAUTICAL SERVICE



Test setup

Test Overview

Additional Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service and Special requirements for ancillary terrestrial components operating in the 1626.5-1660.5 MHz band.

Test Procedure

The testing follows ANSI C63.26 section 5.7

The conducted emission mask was connected to a calibrated Splitter and Communication Test equipment, the other end of which was connected to a spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

Test Settings

1. RBW = 1MHz (Narrow Band: 10kHz)
2. VBW $\geq$ 3 MHz
3. Detector = RMS
4. Trace Mode = Average

Test Note

1. Narrow Band should be measured with an RBW=700Hz, but for testing convenience, it was measured with 10kHz.
2. Carrier-off state = Idle mode
3. Ref. offset of spectrum analyzer $_{(dB)} = \text{Path loss}_{(dB)} + \text{Peak. antenna gain}_{(dBi)} + \text{Duty Cycle Factor}_{(dB)}$
4. Result $_{(dBm)} = \text{Ref. Offset}_{(dB)} + \text{Measured value}_{(dBm)}$

3.9 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
Mode : Stand alone, Stand alone + External accessories (Earphone, AC adapter, etc)
Worst case : Stand alone
- All SCS & **SC size** of operation were investigated and the worst case bandwidth results are reported.
- The worst case is reported with the EUT positioning, modulations, and paging service configurations shown in the test data.
- SM-S931U & additional models were tested and the worst case results are reported.
(Worst case : SM-S931U)

[Worst case]				
Test Description	Modulation	SCS (kHz)	SC size	Axis
Effective Isotropic Radiated Power	BPSK, QPSK	3.75, 15	1SC47, 1SC11	Z
Radiated Spurious and Harmonic Emissions	QPSK	15	1SC11	Z

3.10 WORST CASE(CONDUCTED TEST)

- All modes of operation were investigated and the worst case configuration results are reported.
 - SM-S931U & additional models were tested and the worst case results are reported.
- (Worst case : SM-S931U)

[Worst case]				
Test Description	Modulation	SCS (kHz)	Frequency	SC size
Occupied Bandwidth	BPSK, QPSK	3.75	Mid	1SC23
		15		1SC5, 12SC0
Emission Mask	BPSK	3.75	Low, Mid, High	1SC0, 1SC47
		15	Low, Mid, High	1SC0, 1SC11, 12SC0
Emission limits for protection of aeronautical service (1559 MHz – 1610 MHz)	BPSK	3.75	Low	1SC0
	BPSK, QPSK	15	Low	1SC0, 12SC0
Emission limits for protection of aeronautical service (Carrier-off state)	BPSK	3.75, 15	Low, Mid, High	1SC0
Spurious and Harmonic Emissions at Antenna Terminal	BPSK	3.75	Low, Mid, High	1SC0
	BPSK, QPSK	15		1SC0, 12SC0

4. LIST OF TEST EQUIPMENT

Equipment	Model	Manufacture	Serial No.	Due to Calibration	Calibration Interval
RF Switching System	Switch box(1.2 G HPF+LNA)	HCT CO., LTD.,	F1L1	08/21/2025	Annual
RF Switching System	Switch box(3.3 G HPF+LNA)	HCT CO., LTD.,	F1L2	08/21/2025	Annual
RF Switching System	Switch box(LNA)	HCT CO., LTD.,	F1L4	08/21/2025	Annual
RF Switching System	Switch box(6 G HPF+LNA)	HCT CO., LTD.,	F1L7	08/21/2025	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	93008124	02/19/2025	Annual
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	147	08/17/2025	Biennial
Horn Antenna(1 ~ 18 GHz)	BBHA 9120D	Schwarzbeck	9120D-1298	09/11/2025	Biennial
Horn Antenna(15 ~ 40 GHz)	BBHA 9170	Schwarzbeck	BBHA9170342	09/20/2026	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	REOHDE & SCHWARZ	100931	08/06/2025	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
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
FCC LTE Mobile Conducted RF Automation Test Software	-	HCT CO., LTD.,	-	-	-

Note:

- Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
- 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 ($\pm$ 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
Emissions Mask	§ 25.202(f)	<u>Note 1</u>	PASS
Conducted Output Power	§ 2.1046	N/A	<u>See Note4</u>
Emission limits for protection of aeronautical service (1559 MHz – 1610 MHz)	§ 25.216(c)(h)	<u>Note 2, 3</u>	PASS
Emission limits for protection of aeronautical service (Carrier-off state)	§ 25.216(i)	e.i.r.p. density < –80 dBW/MHz(= -50 dBm)	PASS
Conducted Spurious Emissions	§ 25.202(f)(3)	< 43 + 10 log (P) dB (= -13dBm)	PASS
Frequency stability / variation of ambient temperature	§ 25.202(d)	0.001 % or 10 ppm	PASS

Note

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB
- (2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
- (3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts;
2. Wide Band(e.i.r.p. density): Linear interpolation from –70 dBW/MHz(= -40dBm/MHz) at 1605 MHz to –46dBW/MHz(= -16 dBm/MHz) at 1610 MHz.
3. NarrowBand(e.i.r.p.): Linear interpolation from –80 dBW(= -50dBm) at 1605 MHz to –56 dBW(= -26 dBm) at 1610 MHz.
4. See SAR Report

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§ 25.204 (a)	<u>Note 1</u>	PASS
Radiated Spurious and Harmonic Emissions	§ 25.202(f)(3)	$< 43 + 10 \log (P) \text{ dB } (= -13\text{dBm})$	PASS

Note

1. + 40 dBW in any 4 kHz band for $\theta \leq 0^\circ$
+ 40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

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 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	SCS /SC Size	Modulation	Measured Level (dBm)	Substitut e Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
									W	dBm
1626.6	3.75 kHz /1SC47	BPSK	-19.42	14.38	9.45	1.98	V	<u>Note1</u>	0.153	21.85
		QPSK	-19.38	14.42	9.45	1.98	V		0.155	21.89
1643.5		BPSK	-19.95	13.71	9.65	2.00	V		0.137	21.36
		QPSK	-19.88	13.78	9.65	2.00	V		0.139	21.43
1643.5		BPSK	-20.84	12.65	9.76	2.03	V		0.109	20.38
		QPSK	-20.81	12.68	9.76	2.03	V		0.110	20.41

Freq (MHz)	SCS /SC Size	Modulation	Measured Level (dBm)	Substitut e Level (dBm)	Ant. Gain (dBi)	C.L	Pol	Limit	EIRP	
									W	dBm
1626.6	15 kHz /1SC11	BPSK	-19.30	14.50	9.45	1.98	V	<u>Note1</u>	0.158	21.97
		QPSK	-19.26	14.54	9.45	1.98	V		0.159	22.01
1643.5		BPSK	-19.77	13.89	9.65	2.00	V		0.143	21.54
		QPSK	-19.79	13.87	9.65	2.00	V		0.142	21.52
1660.4		BPSK	-20.57	12.92	9.76	2.03	V		0.116	20.65
		QPSK	-20.53	12.96	9.76	2.03	V		0.117	20.69

Note:

- + 40 dBW in any 4 kHz band for $\theta \leq 0^\circ$
+ 40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

8.2 RADIATED SPURIOUS EMISSIONS

☐ Modulation: QPSK
☐ Distance: 3 meters
☐ SC Size: 1SC11
☐ Limit: -13 dBm

Frequency (MHz)	Measured Frequency (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)
1626.6	3 253.20	-48.60	11.68	-53.08	11.80	H	-53.20
	4 879.80	-49.48	12.70	-56.14	3.69	H	-47.13
	6 506.40	-52.12	11.80	-52.73	4.25	H	-45.18
1643.5	3 287.00	-47.68	12.04	-61.12	2.94	H	-52.02
	4 930.50	-50.07	12.70	-57.24	3.64	H	-48.18
	6 574.00	-50.54	11.75	-50.81	4.35	H	-43.41
1660.4	3 320.80	-47.10	12.22	-61.20	3.00	H	-51.98
	4 981.20	-49.79	12.64	-56.55	3.69	H	-47.60
	6 641.60	-53.39	11.78	-53.57	4.33	H	-46.12

8.3 OCCUPIED BANDWIDTH

SCS (kHz)	Frequency (MHz)	Modulation	SC Size	Result (kHz)
3.75	1643.5	BPSK	1SC23	78.863
		QPSK	1SC23	98.982
15		BPSK	1SC5	131.51
		QPSK	1SC5	141.36
		QPSK	12SC0	189.16

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 33 ~ 37.

8.4 CONDUCTED SPURIOUS EMISSIONS

SCS (kHz)	SC Size	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
3.75	1SC0	1626.6	3.2538	22.115	-63.122	-41.007	-13.00
	1SC0	1643.5	3.2877	22.115	-63.739	-41.624	
	1SC0	1660.4	3.8370	22.115	-63.798	-41.683	
15	1SC0	1626.6	3.2538	22.115	-62.444	-40.329	
	1SC0	1643.5	3.2877	22.115	-63.060	-40.945	
	1SC0	1660.4	3.8181	22.115	-63.885	-41.770	
15	12SC0	1626.6	3.2538	22.115	-62.902	-40.787	
	12SC0	1643.5	3.2877	22.115	-62.027	-39.912	
	12SC0	1660.4	3.3216	22.115	-62.446	-40.331	

Note:

- Plots of the EUT's Conducted Spurious Emissions are shown Page 38 ~ 55.
- Duty Cycle factor already applied on the factor.

- Factor(dB) = Cable Loss + Ext. Attenuator + Duty Cycle Factor

- Result(dBm) = Reading + Factor

Frequency Range (GHz)	Factor [dB]
0.03 – 1	20.409
1 – 5	22.115
5 – 10	22.730
10 – 15	23.255
15 – 20	23.628
Above 20	24.270

8.5 Emission Mask

- Plots of the EUT's Emission Mask are shown Page 56 ~ 70.

8.6 Emission limits for protection of aeronautical service

Wide Band

SCS (kHz)	Test. Frequency (MHz)	Modulation	SC Size	Mea. Frequency (MHz)	Result (dBm)	Limit (dBm/MHz)
3.75	1626.6	BPSK	1SC0	1559 – 1605	-48.721	-40
				1605 – 1610	-49.001	-40 ~ -16
15	1626.6	BPSK	1SC0	1559 – 1605	-48.898	-40
				1605 – 1610	-49.183	-40 ~ -16
		QPSK	12SC0	1559 – 1605	-48.909	-40
				1605 – 1610	-49.170	-40 ~ -16

Note:

1. Plots of the EUT's Emission limits for protection of aeronautical service(Wide Band) are shown Page 71 ~ 76.

Narrow Band

SCS (kHz)	Test. Frequency (MHz)	Modulation	SC Size	Mea. Frequency (MHz)	Result (dBm)	Limit (dBm/MHz)
3.75	1626.6	BPSK	1SC0	1559 – 1605	-68.153	-50
				1605 – 1610	-68.248	-50 ~ -26
15	1626.6	BPSK	1SC0	1559 – 1605	-68.121	-50
				1605 – 1610	-68.486	-50 ~ -26
		QPSK	12SC0	1559 – 1605	-68.132	-50
				1605 – 1610	-68.515	-50 ~ -26

Note:

1. Plots of the EUT's Emission limits for protection of aeronautical service(Narrow Band) are shown Page 77 ~ 82.

8.7 Emission limits for protection of aeronautical service - Carrier-off state

SCS (kHz)	Modulation	Mea. Frequency (MHz)	Test. Frequency (MHz)	Result (dBm)	Limit (dBm/MHz)
3.75	Carrier-off	1559 – 1610	1626.600	-62.080	-50
			1643.500	-62.033	-50
			1660.400	-62.145	-50
15	Carrier-off	1559 – 1610	1626.600	-62.264	-50
			1643.500	-62.234	-50
			1660.400	-62.339	-50

Note:

1. Plots of the EUT's Emission limits for protection of aeronautical service - Carrier-off state are shown Page 83 ~ 88.

8.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

Mode:	<u>CW</u>
Voltage(100 %):	<u>3.88 VDC</u>
Batt. Endpoint:	<u>3.30 VDC</u>
Limit:	<u>± 0.001 % or 10 ppm</u>

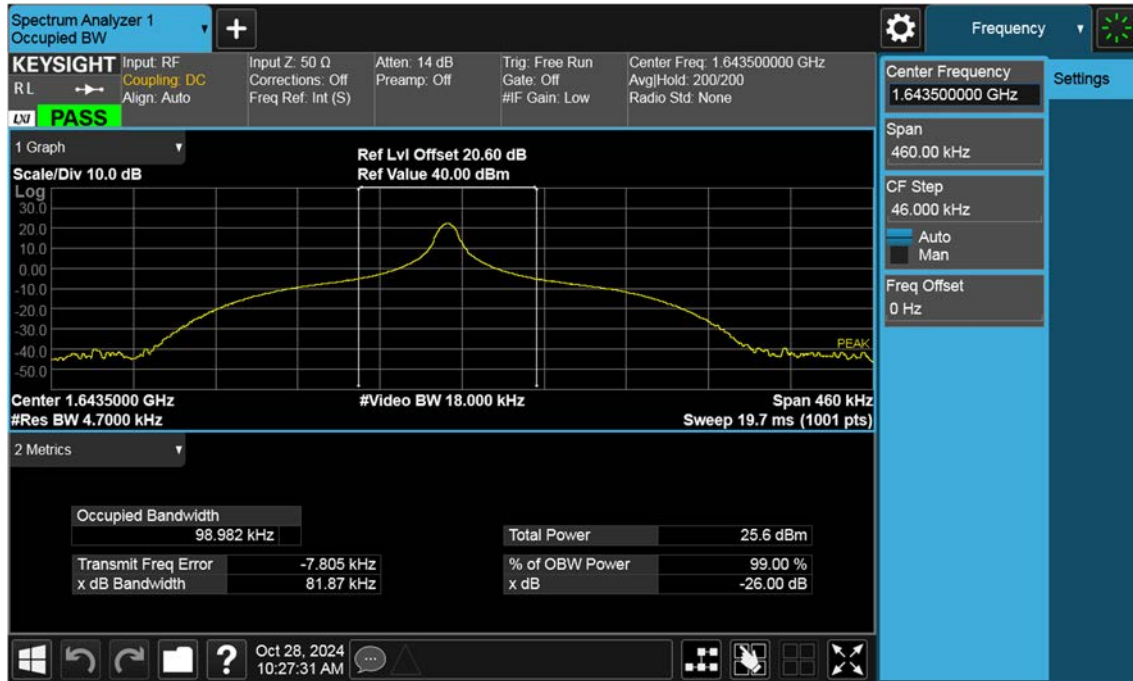
Test. Frequency (MHz)	Voltage (%)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
1626.600	100 %	+20(Ref)	1626 594 420	0.0	0.000 000	0.000
	100 %	-30	1626 594 220	-200.0	-0.000 012	-0.123
	100 %	-20	1626 594 281	-138.7	-0.000 009	-0.085
	100 %	-10	1626 594 324	-96.1	-0.000 006	-0.059
	100 %	0	1626 594 386	-33.8	-0.000 002	-0.021
	100 %	+10	1626 594 432	11.7	0.000 001	0.007
	100 %	+30	1626 594 430	9.6	0.000 001	0.006
	100 %	+40	1626 594 477	57.0	0.000 004	0.035
	100 %	+50	1626 594 538	117.9	0.000 007	0.072
	Batt. Endpoint	+20	1626 594 586	166.5	0.000 010	0.102
1643.500	100 %	+20(Ref)	1643 494 225	0.0	0.000 000	0.000
	100 %	-30	1643 494 040	-185.1	-0.000 011	-0.113
	100 %	-20	1643 494 079	-146.5	-0.000 009	-0.089
	100 %	-10	1643 494 142	-82.8	-0.000 005	-0.050
	100 %	0	1643 494 189	-35.8	-0.000 002	-0.022
	100 %	+10	1643 494 235	10.3	0.000 001	0.006
	100 %	+30	1643 494 231	6.1	0.000 000	0.004
	100 %	+40	1643 494 275	50.3	0.000 003	0.031
	100 %	+50	1643 494 327	101.8	0.000 006	0.062
	Batt. Endpoint	+20	1643 494 382	157.3	0.000 010	0.096
1660.400	100 %	+20(Ref)	1660 393 723	0.0	0.000 000	0.000
	100 %	-30	1660 393 526	-197.1	-0.000 012	-0.119
	100 %	-20	1660 393 576	-146.7	-0.000 009	-0.088
	100 %	-10	1660 393 643	-80.2	-0.000 005	-0.048
	100 %	0	1660 393 682	-41.1	-0.000 002	-0.025
	100 %	+10	1660 393 725	2.4	0.000 000	0.001
	100 %	+30	1660 393 723	0.1	0.000 000	0.000
	100 %	+40	1660 393 773	50.2	0.000 003	0.030
	100 %	+50	1660 393 831	107.6	0.000 006	0.065
	Batt. Endpoint	+20	1660 393 884	160.6	0.000 010	0.097

9. TEST PLOTS

3.75K_OBW_Mid_1643.5MHz_BPSK_1SC23



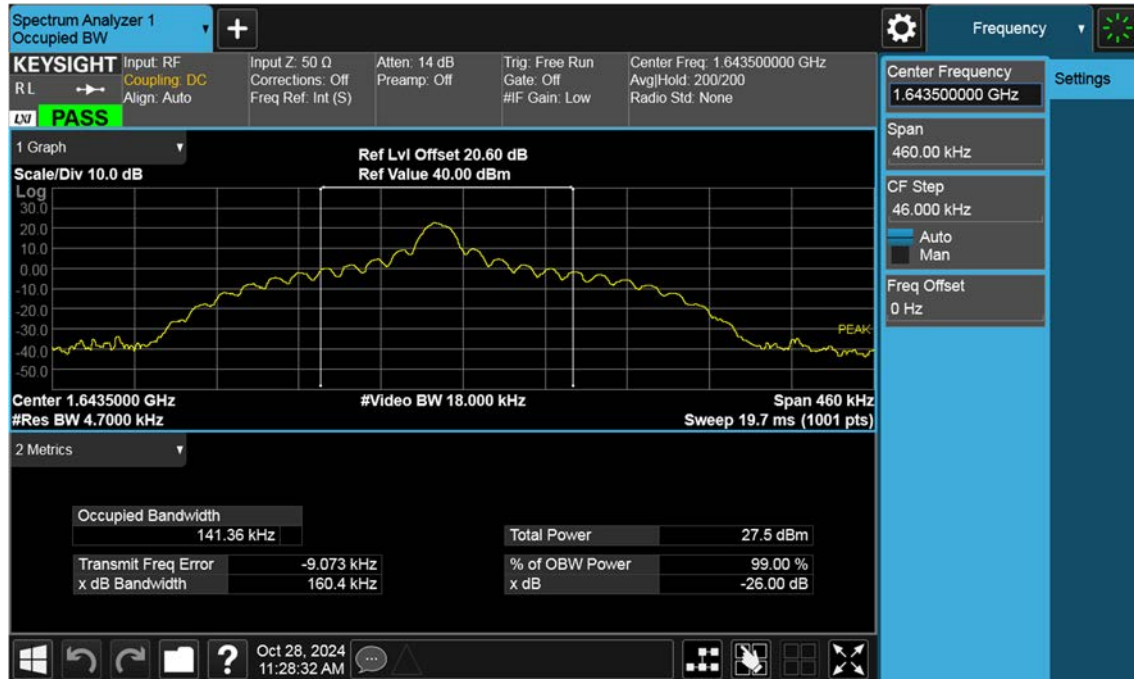
3.75K_OBW_Mid_1643.5MHz_QPSK_1SC23



15K_OBW_Mid_1643.5MHz_BPSK_1SC5



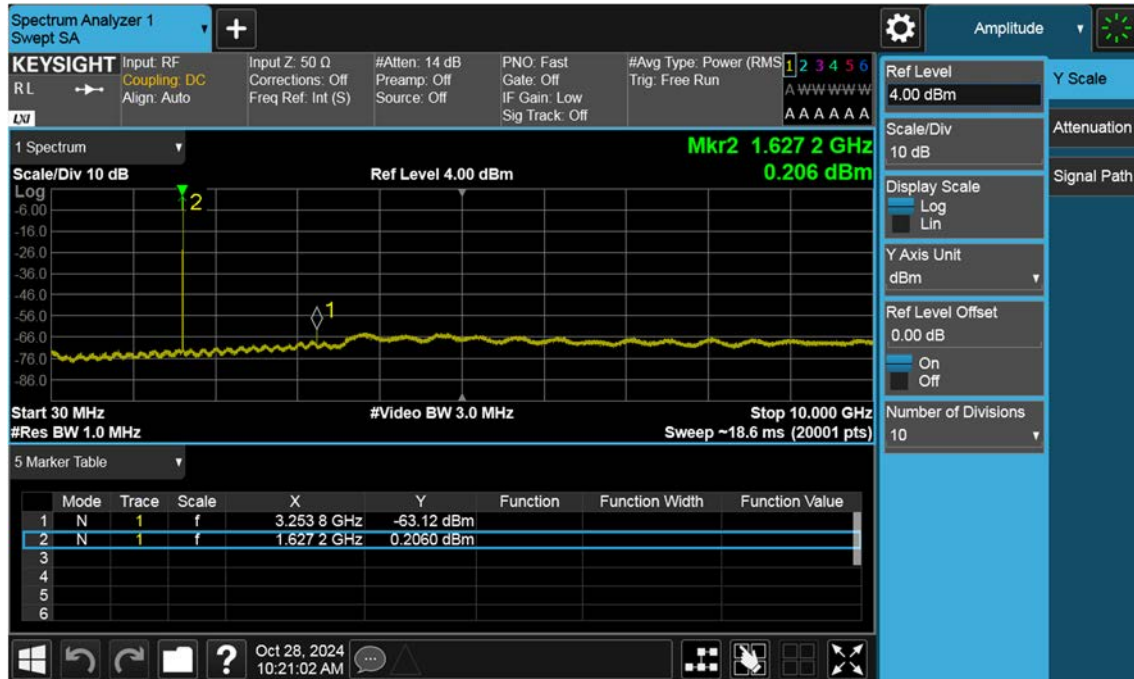
15K_OBW_Mid_1643.5MHz_QPSK_1SC5



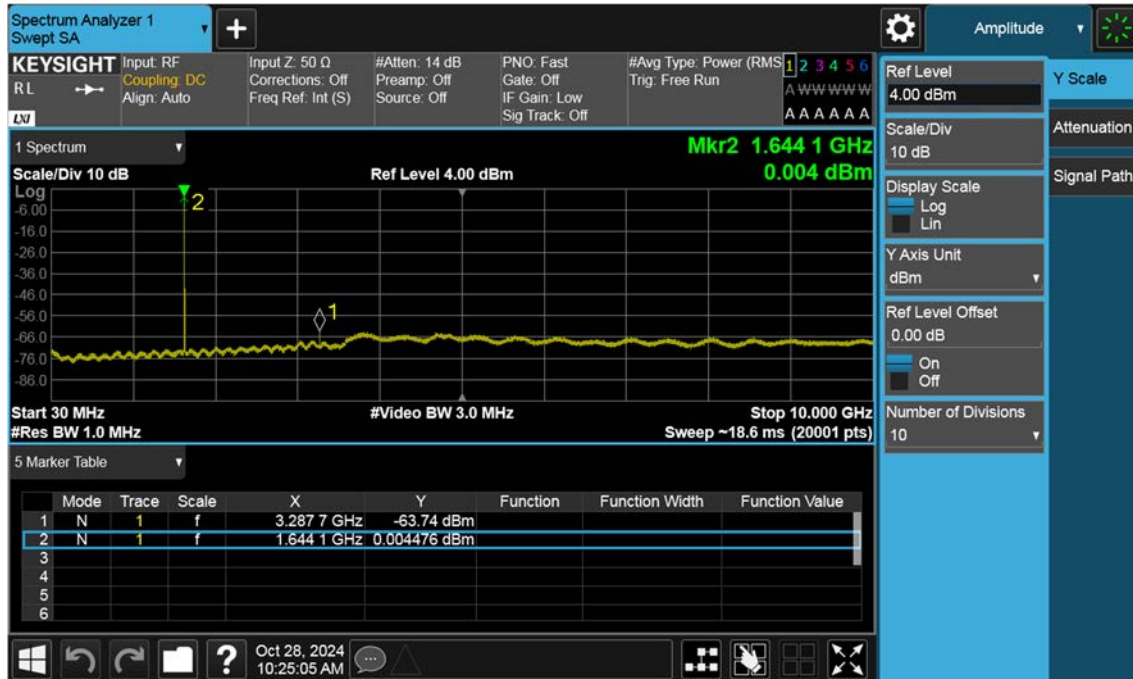
15K_OBW_Mid_1643.5MHz_QPSK_12SC0



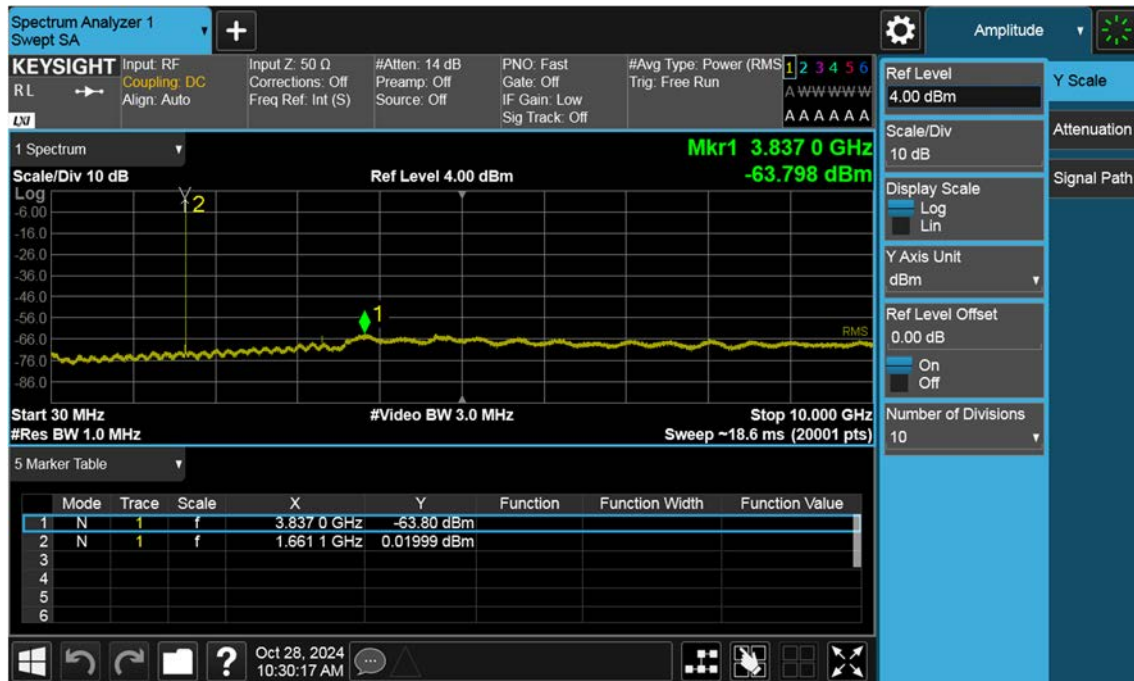
3.75K_CSE(30M-10G)_Low_1626.6MHz_BPSK_1SC0



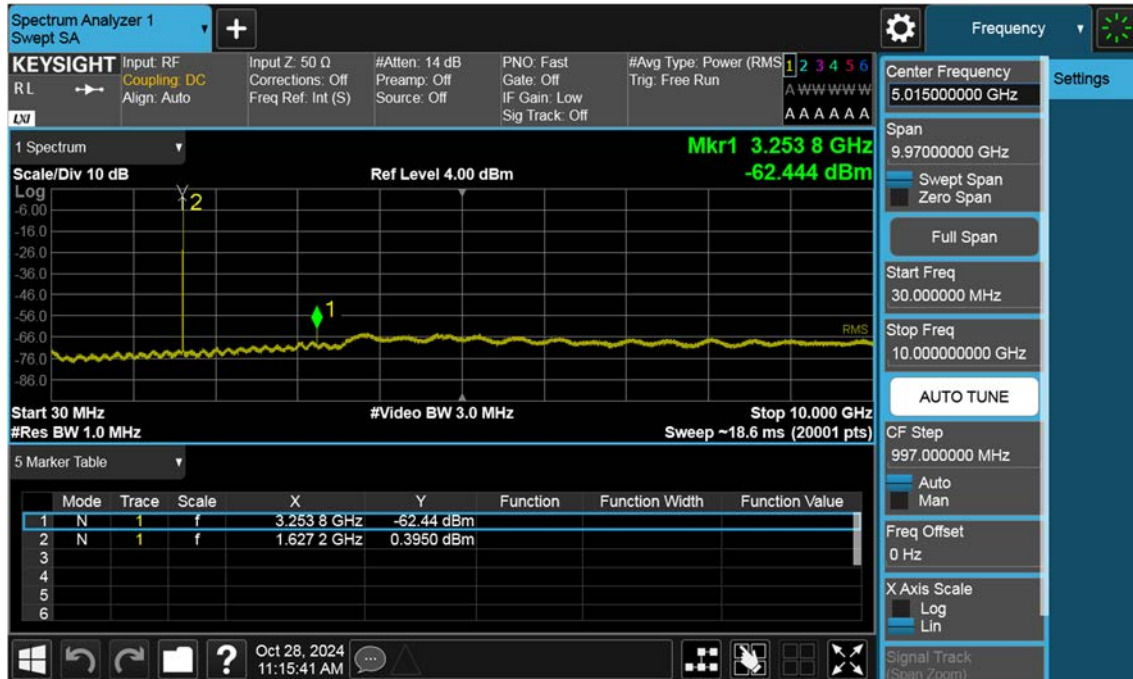
3.75K_CSE(30M-10G)_Mid_1643.5MHz_BPSK_1SC0



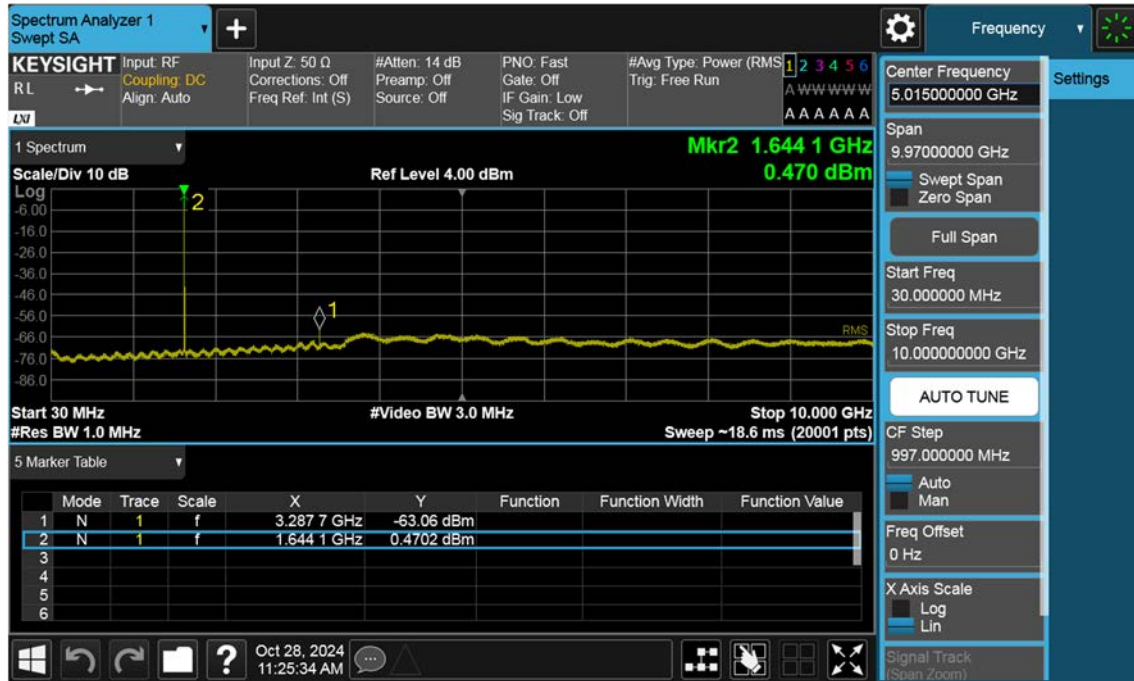
3.75K_CSE(30M-10G)_High_1660.4MHz_BPSK_1SC0



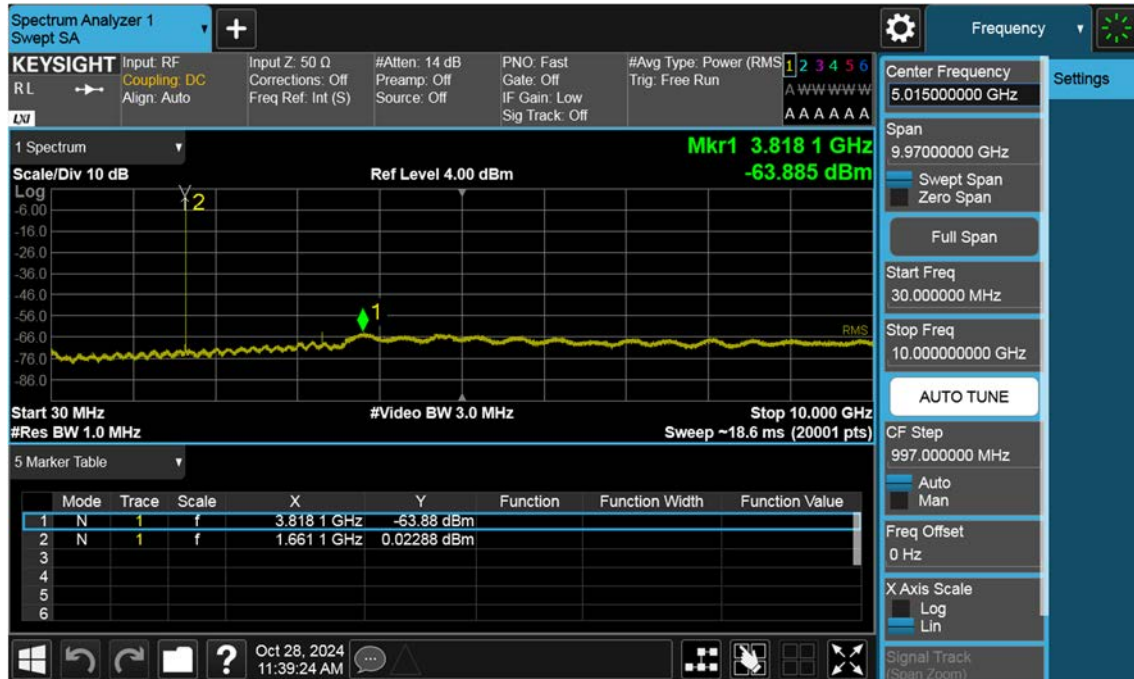
15K_CSE(30M-10G)_Low_1626.6MHz_BPSK_1SCO



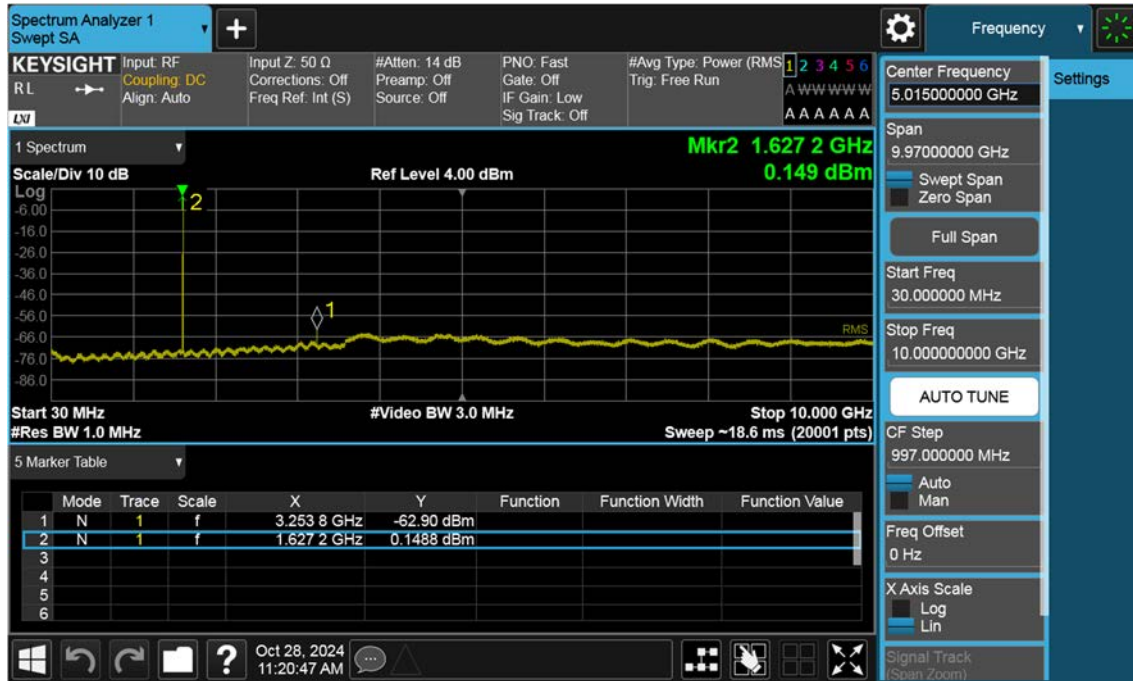
15K_CSE(30M-10G)_Mid_1643.5MHz_BPSK_1SC0



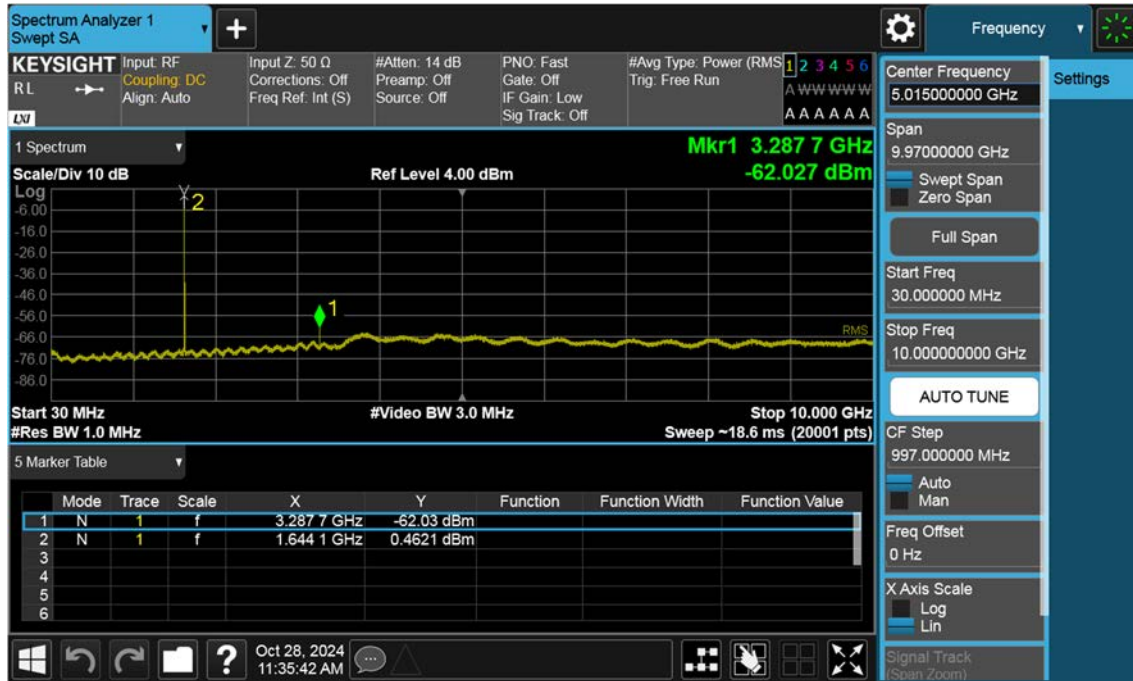
15K_CSE(30M-10G)_High_1660.4MHz_BPSK_1SC0



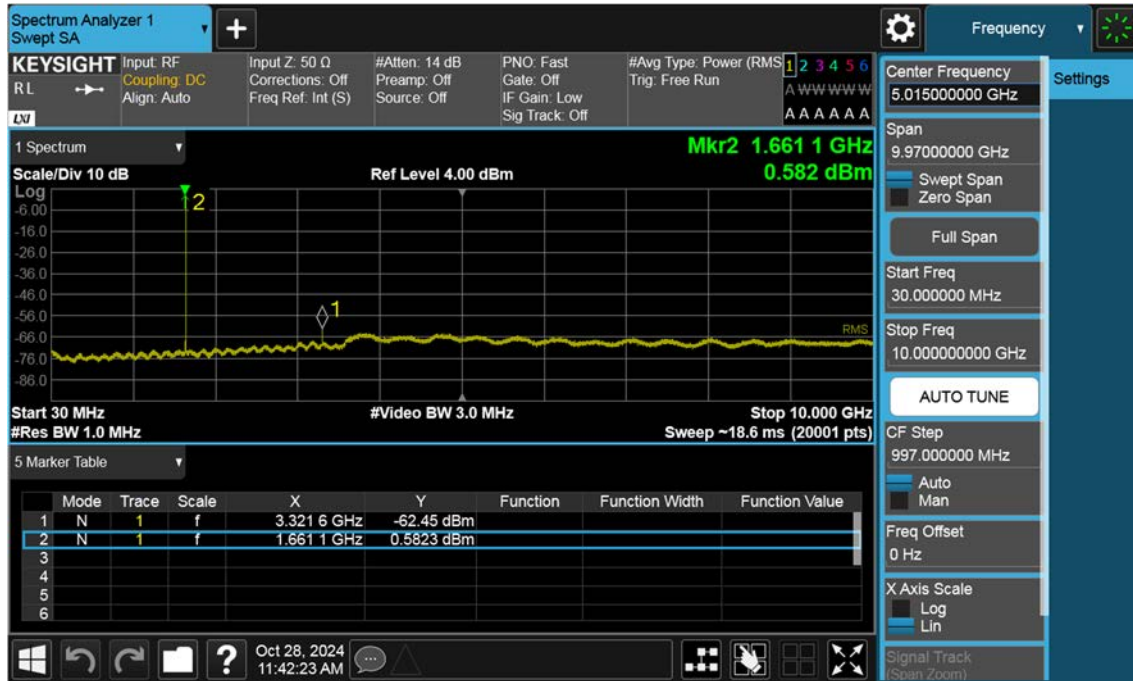
15K_CSE(30M-10G)_Low_1626.6MHz_QPSK_12SC0



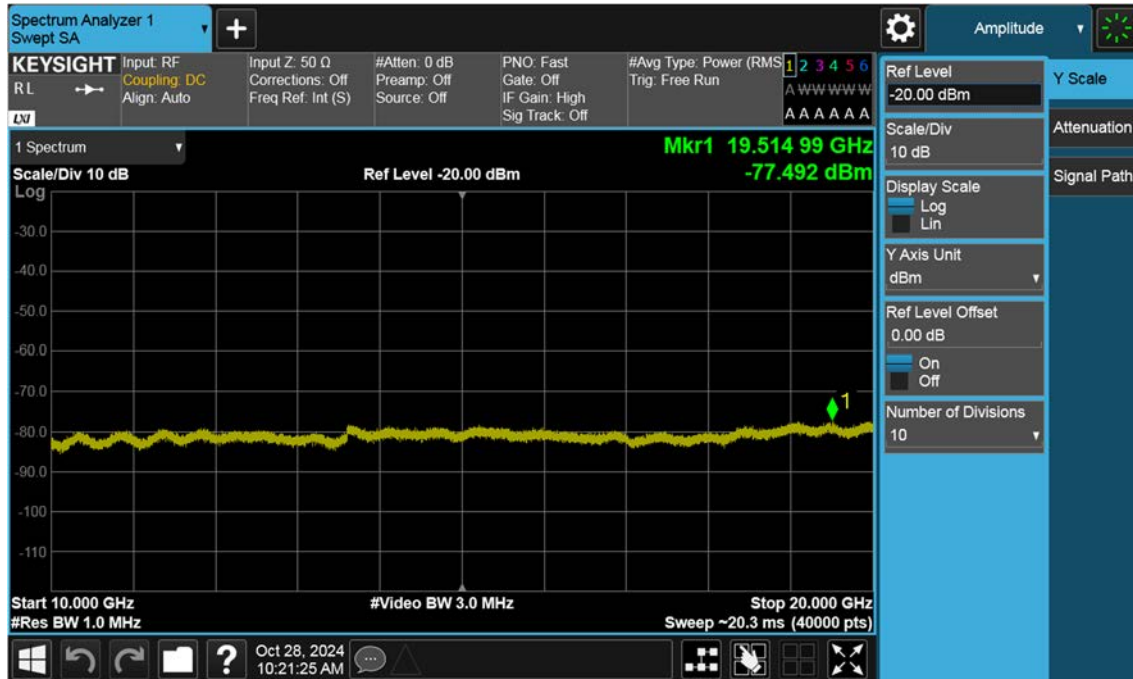
15K_CSE(30M-10G)_Mid_1643.5MHz_QPSK_12SC0



15K_CSE(30M-10G)_High_1660.4MHz_QPSK_12SC0



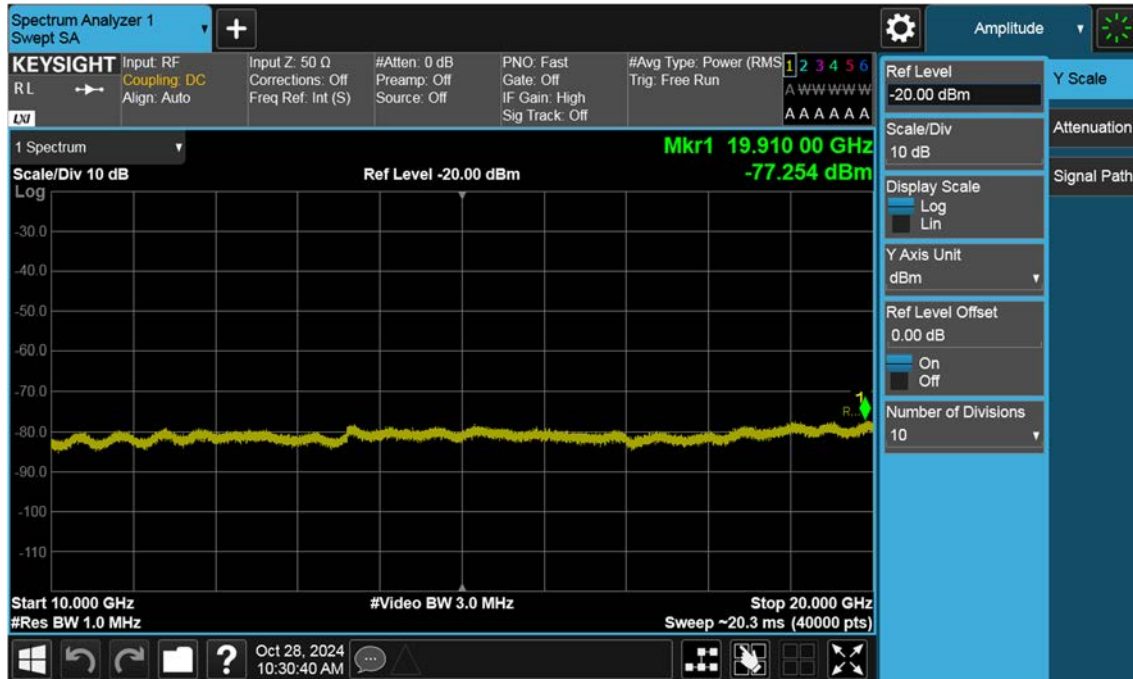
3.75K_CSE(Above10G)_Low_1626.6MHz_BPSK_1SC0



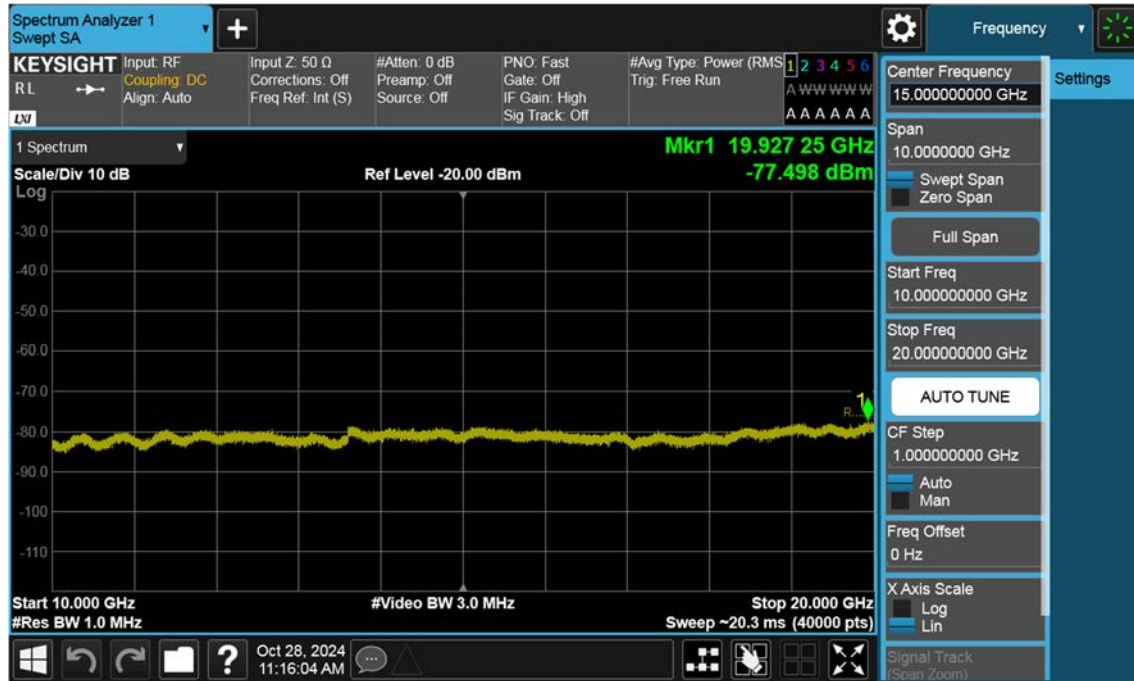
3.75K_CSE(Above10G)_Mid_1643.5MHz_BPSK_1SC0



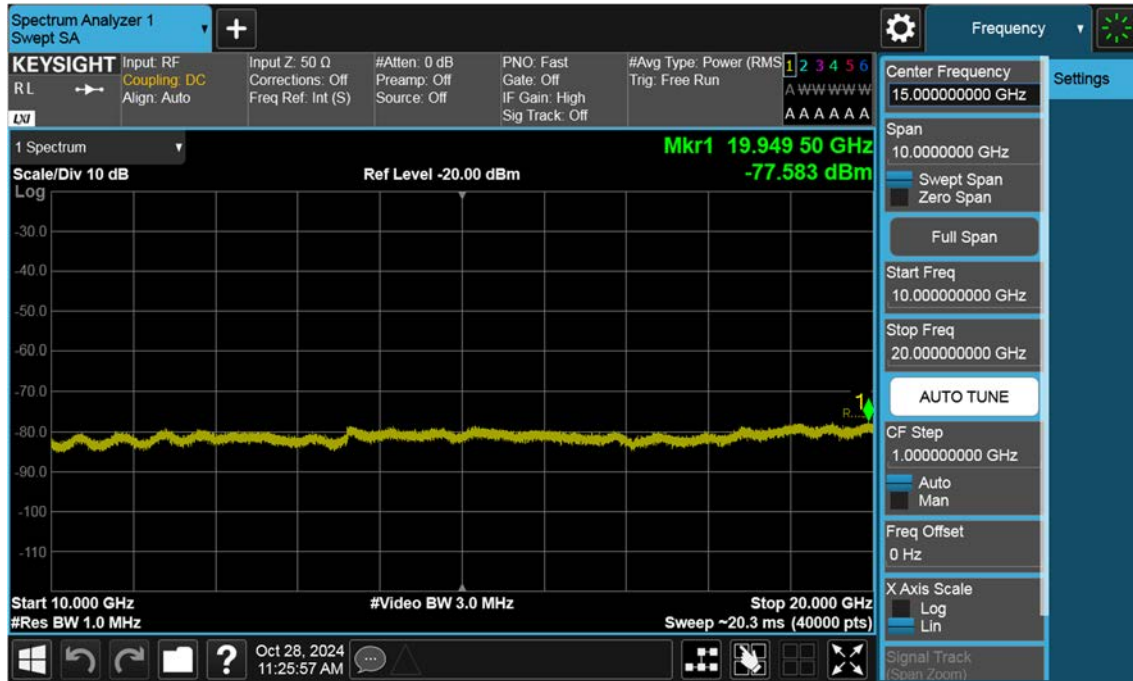
3.75K_CSE(Above10G)_High_1660.4MHz_BPSK_1SC0



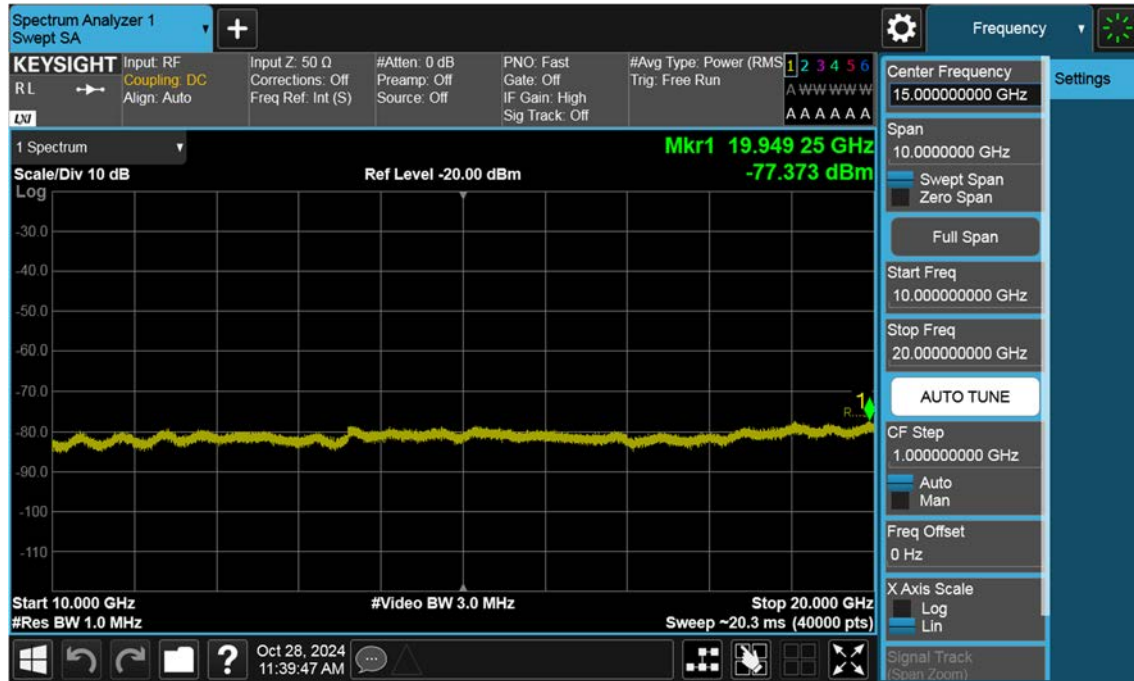
15K_CSE(Above10G)_Low_1626.6MHz_BPSK_1SC0



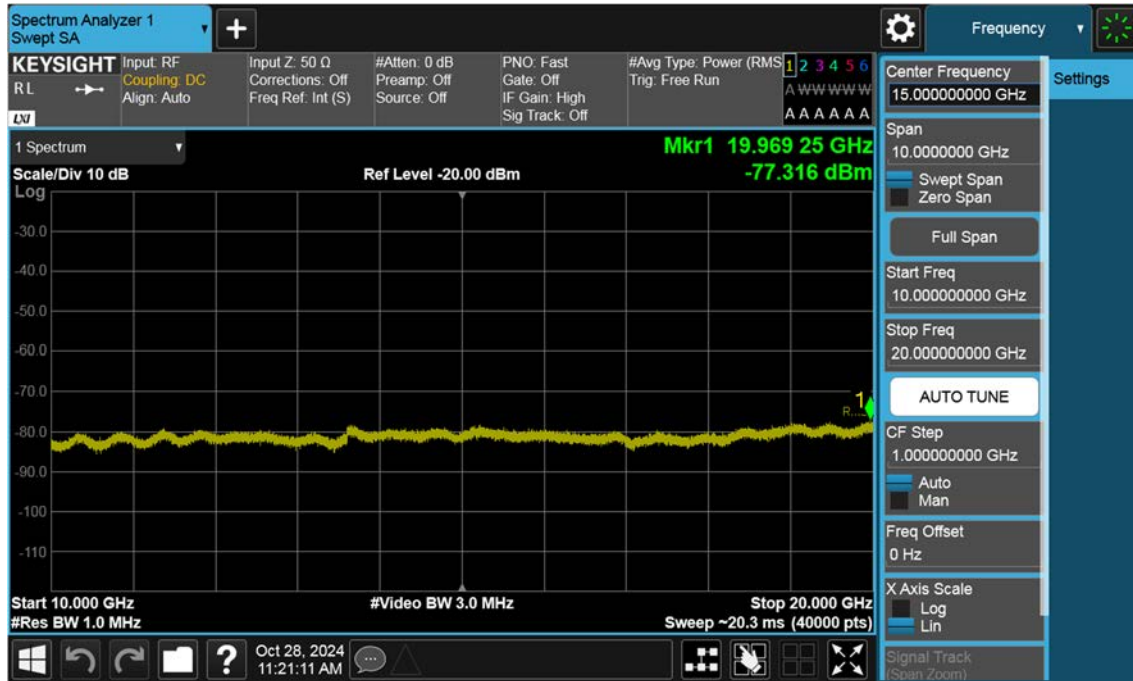
15K_CSE(Above10G)_Mid_1643.5MHz_BPSK_1SCO



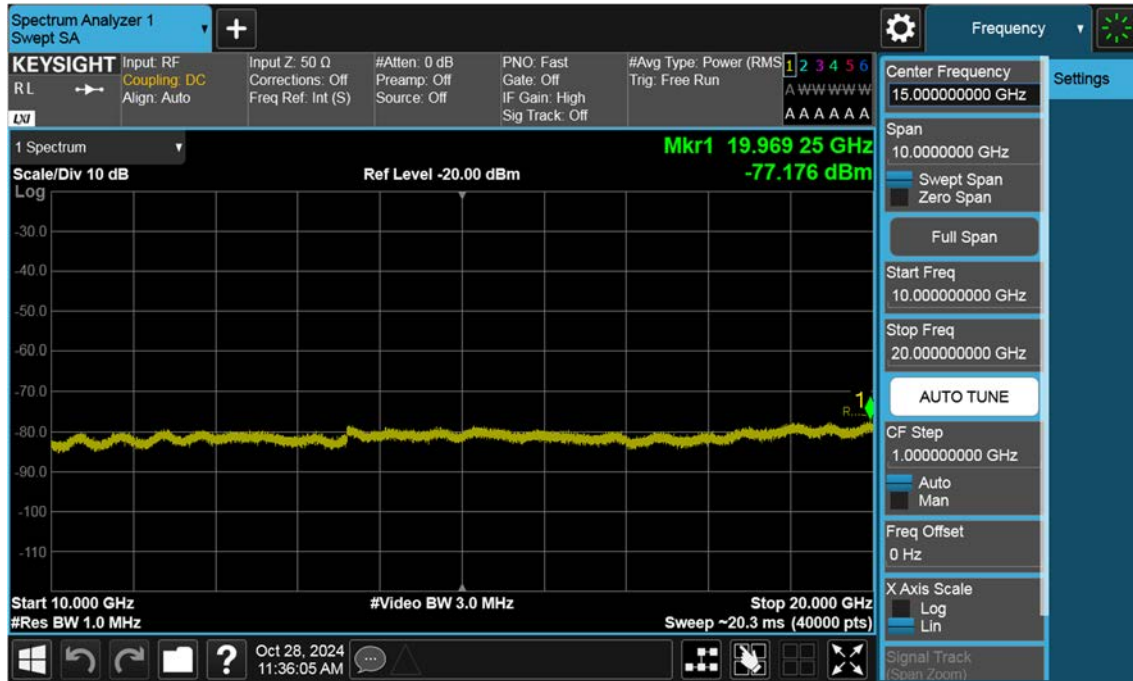
15K_CSE(Above10G)_High_1660.4MHz_BPSK_1SC0



15K_CSE(Above10G)_Low_1626.6MHz_QPSK_12SC0



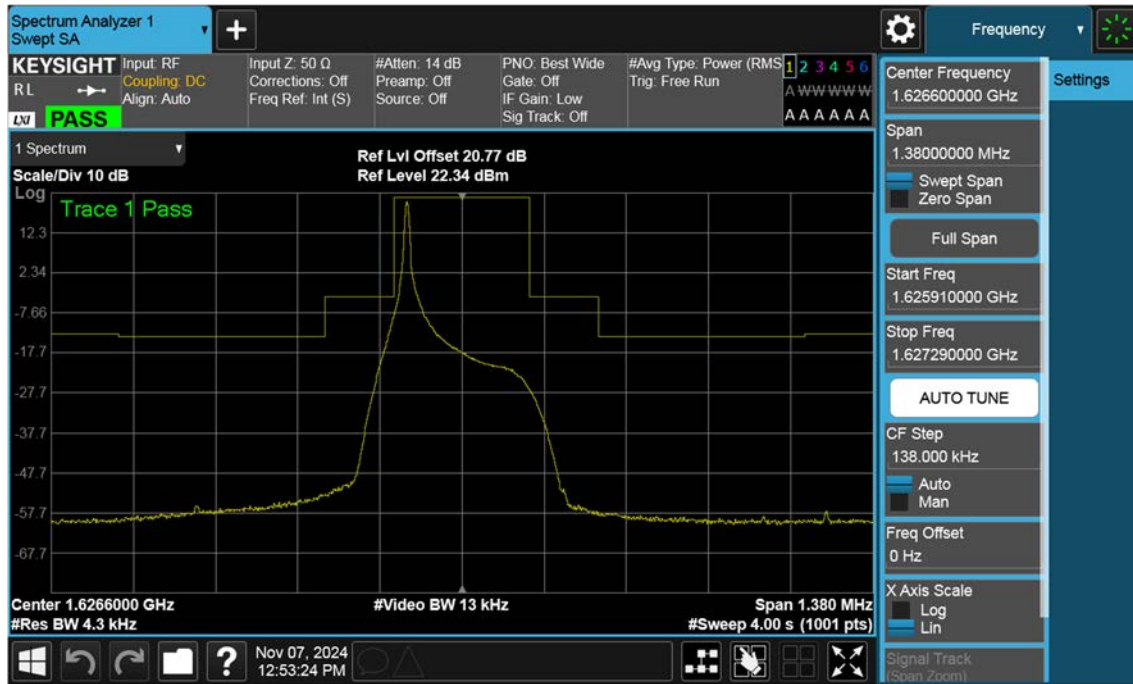
15K_CSE(Above10G)_Mid_1643.5MHz_QPSK_12SC0



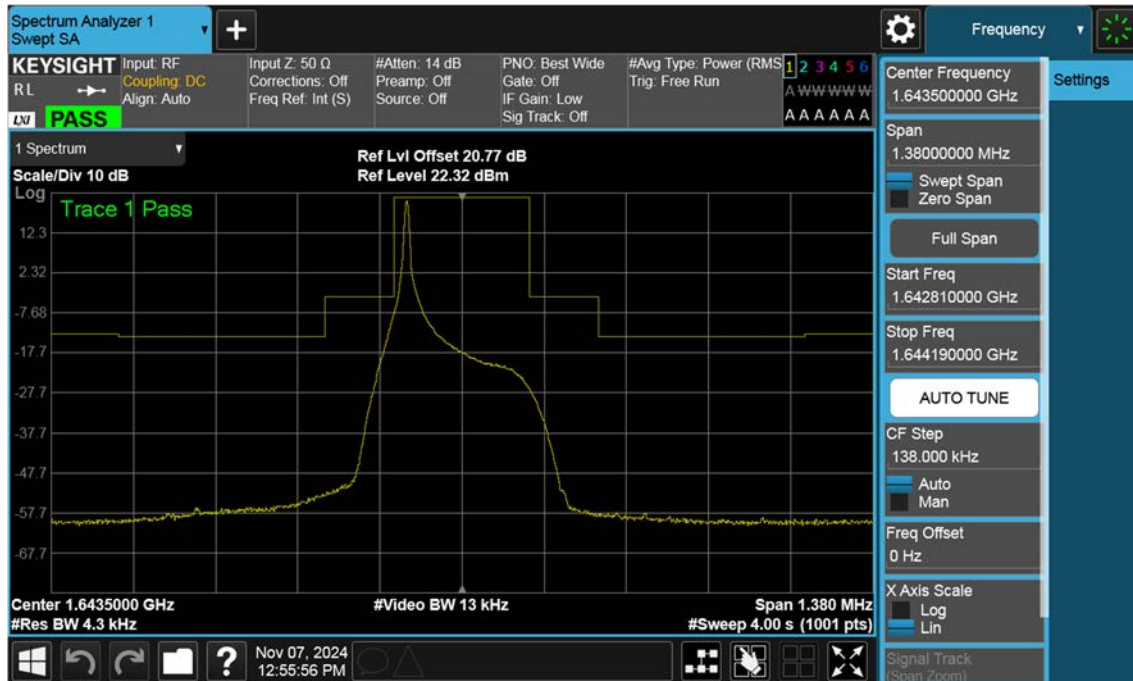
G15K_CSE(Above10G)_High_1660.4MHz_QPSK_12SC0



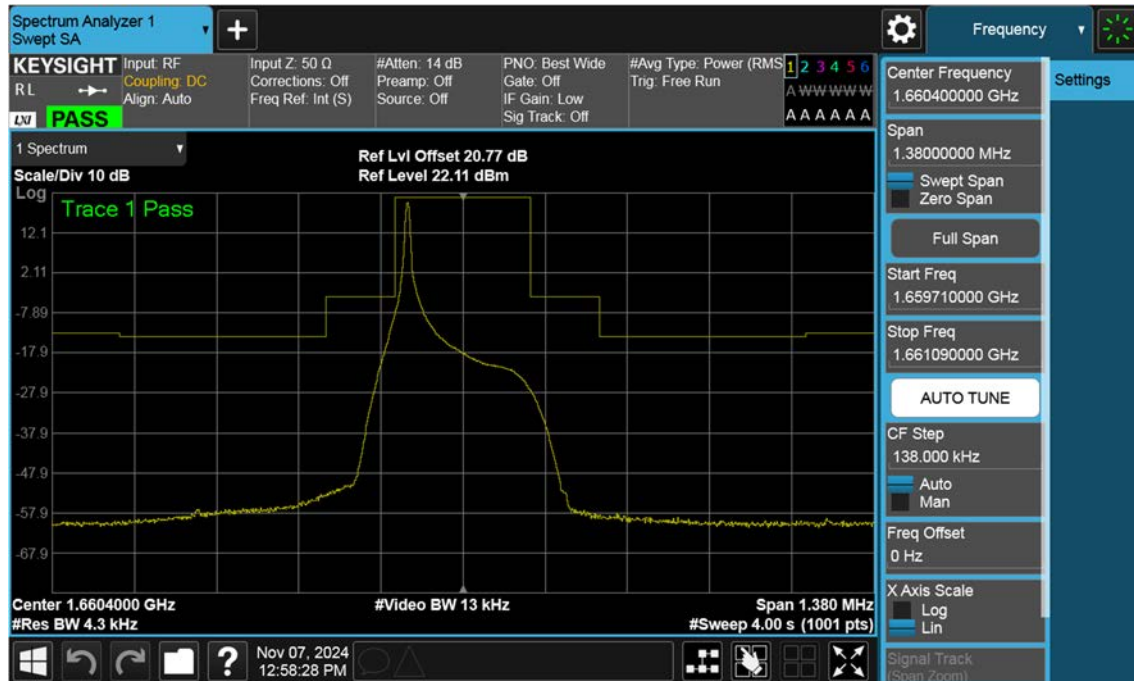
3.75K_Mask_Low_1626.6MHz_BPSK_1SC0



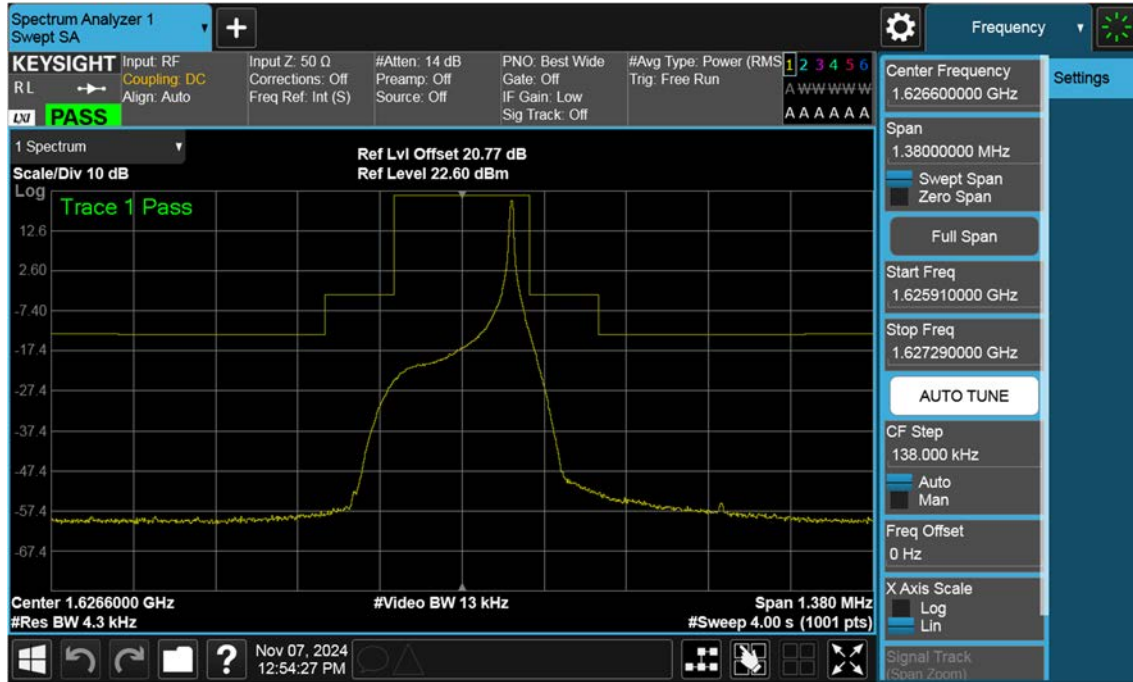
3.75K_Mask_Mid_1643.5MHz_BPSK_1SC0



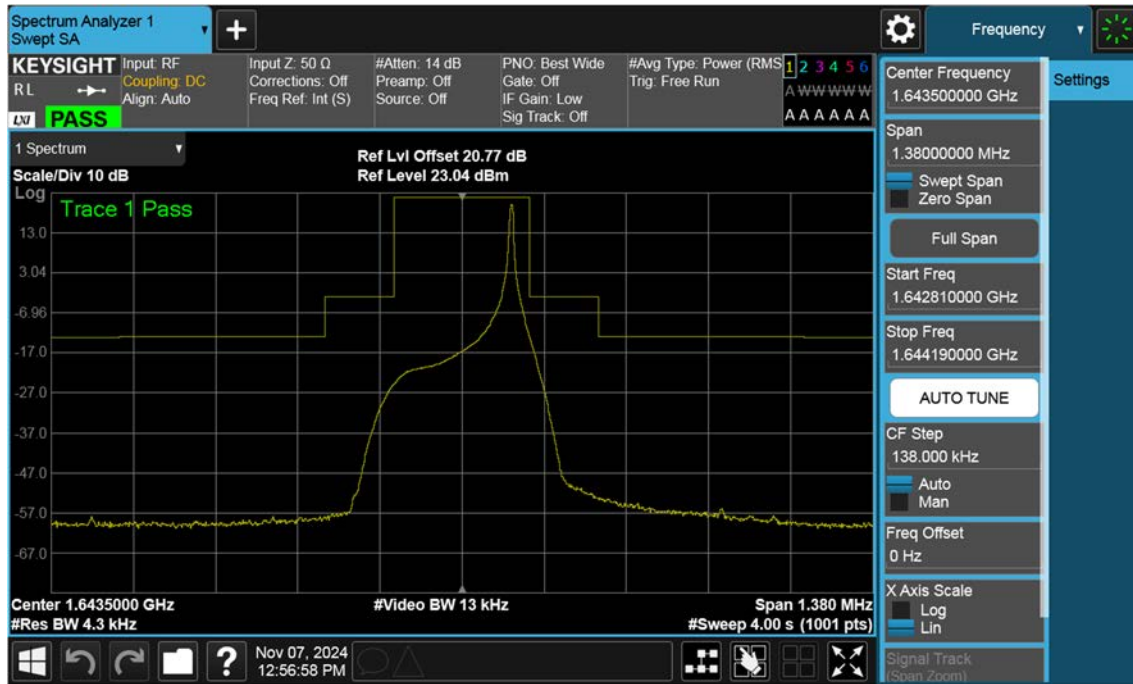
3.75K_Mask_High_1660.4MHz_BPSK_1SC0



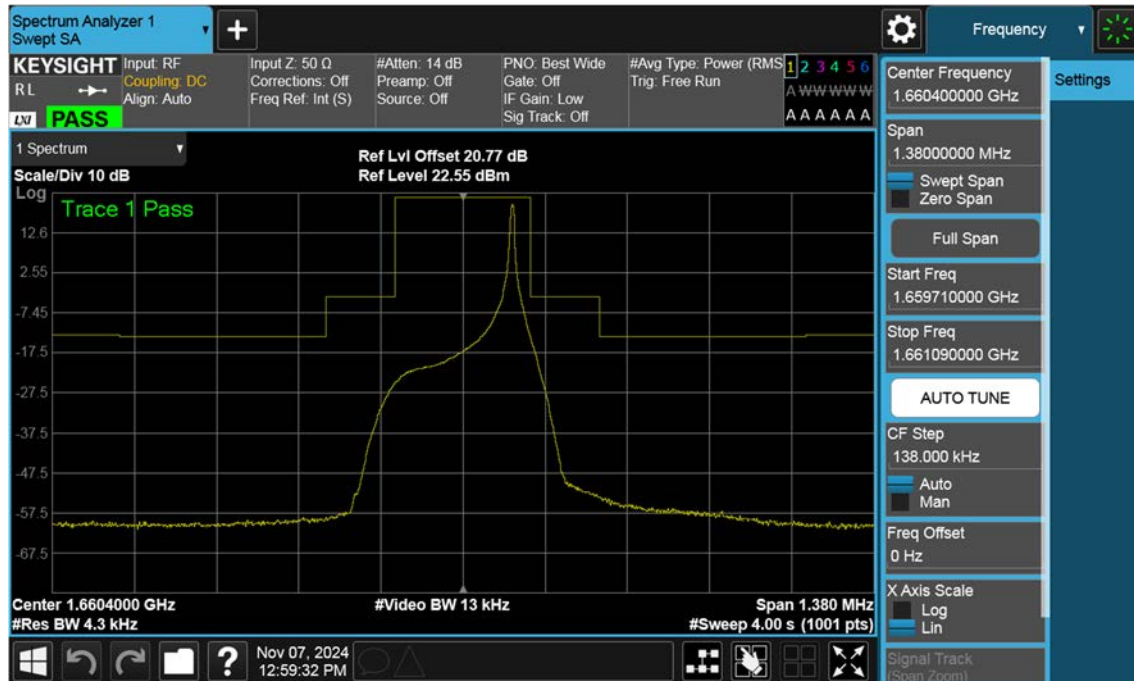
3.75K_Mask_Low_1626.6MHz_BPSK_1SC47



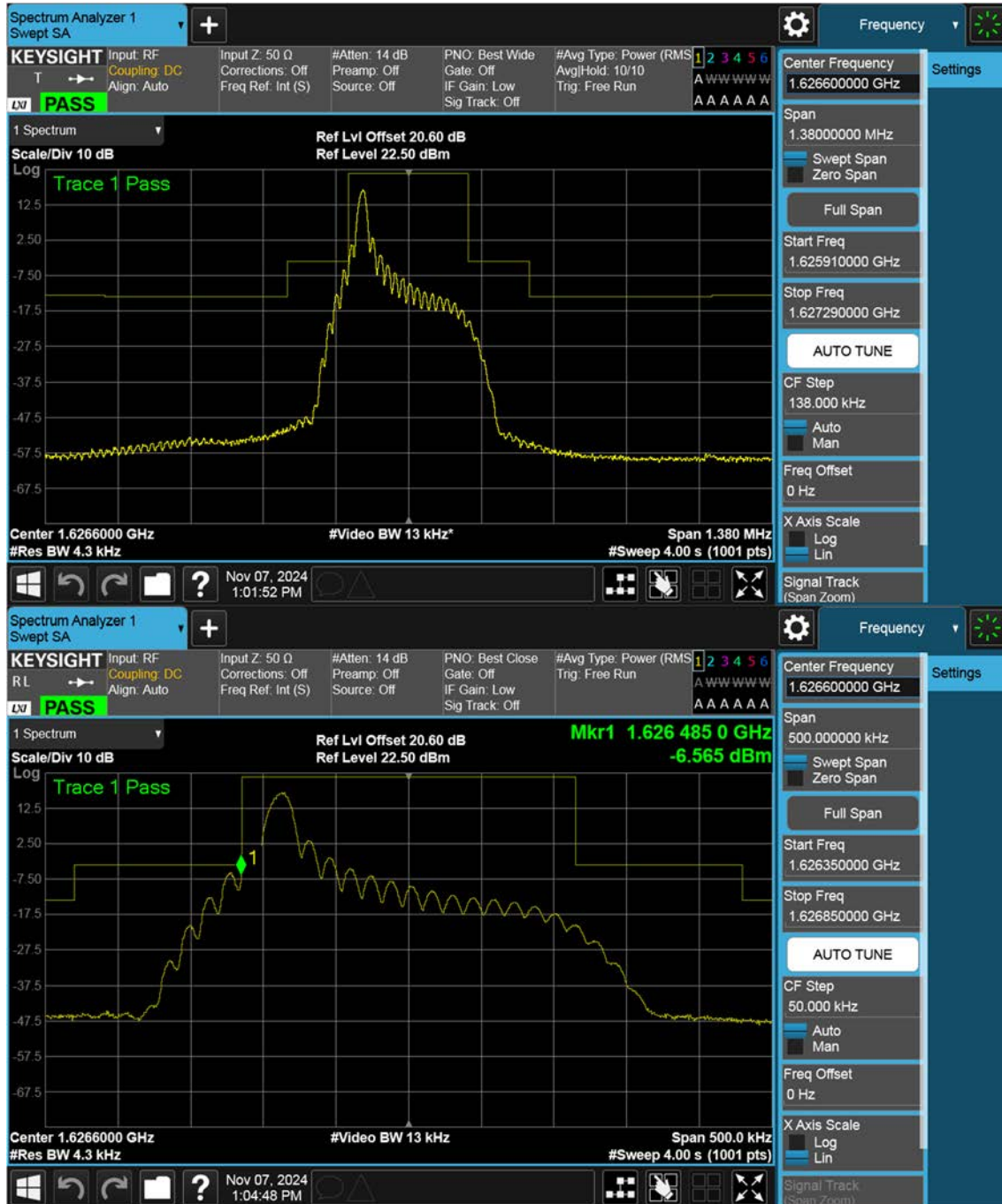
3.75K_Mask_Mid_1643.5MHz_BPSK_1SC47



3.75K_Mask_High_1660.4MHz_BPSK_1SC47



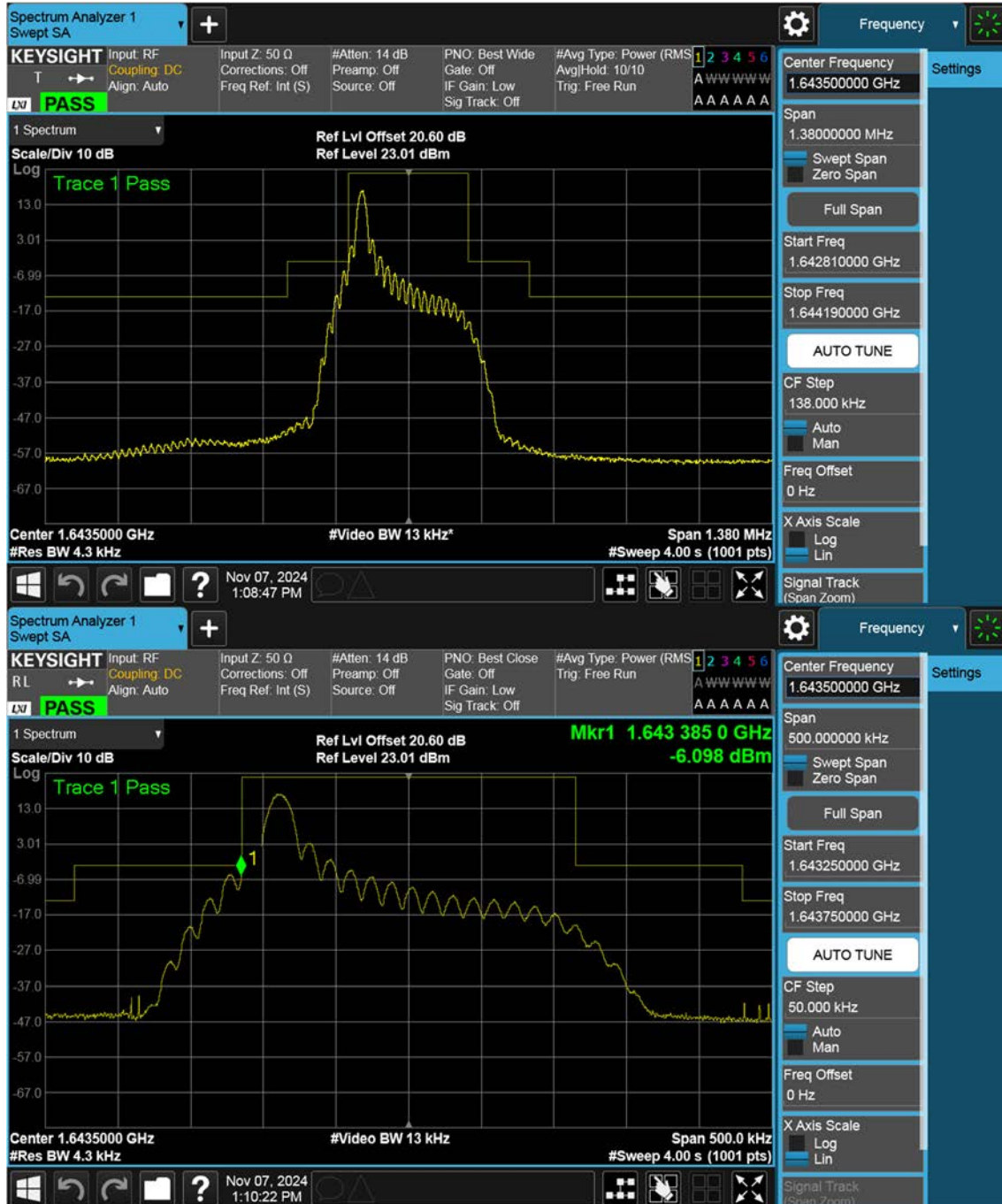
15K_Mask_Low_1626.6MHz_BPSK_1SC0



Note:

1. Limit(dBm) = Conducted output power(dBm) – 25(dB) = 21.50 – 25 = -3.50
2. Margin(dB) = -3.50 – (-6.565) = 3.065

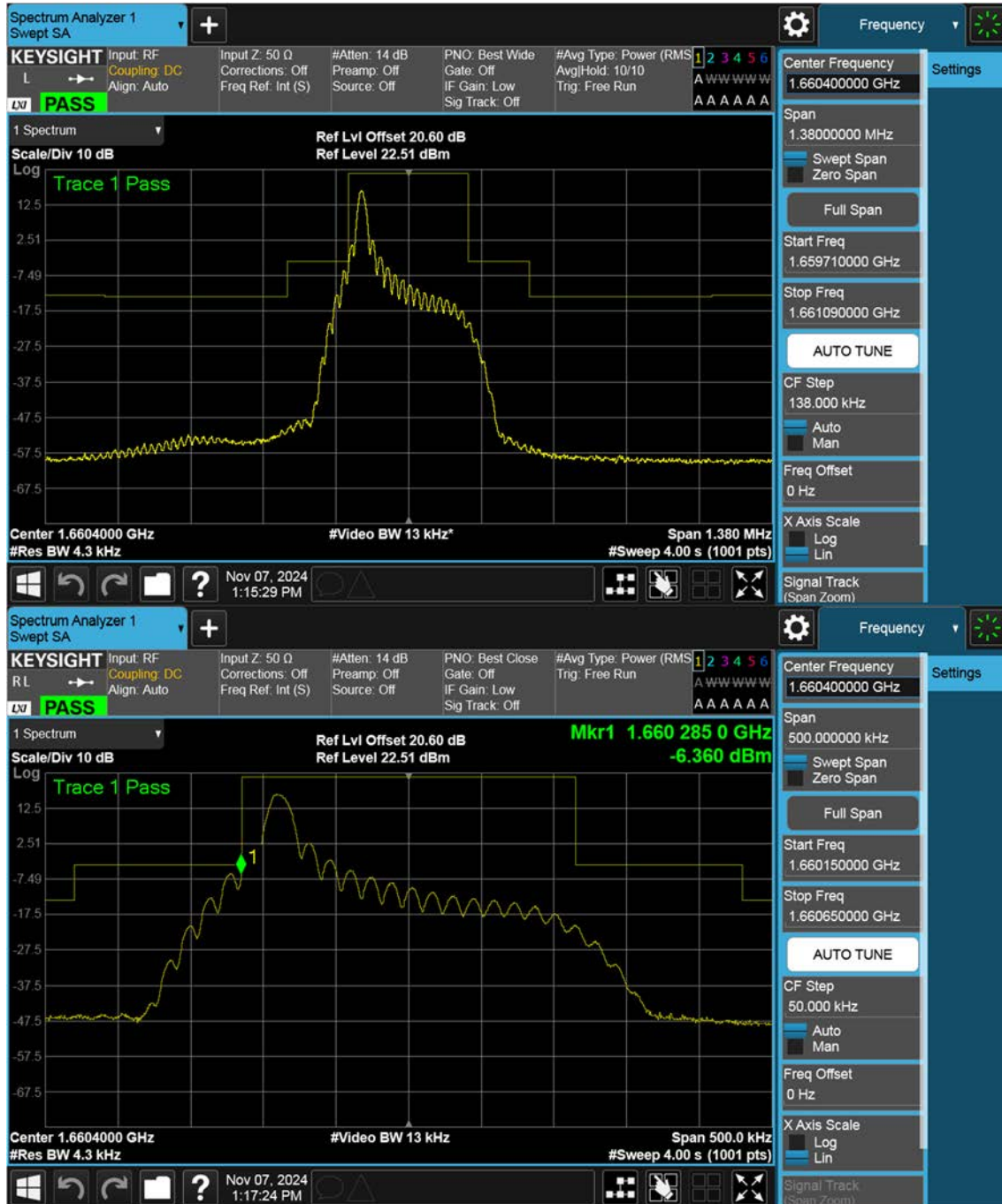
15K_Mask_Mid_1643.5MHz_BPSK_1SC0



Note:

1. Limit(dBm) = Conducted output power(dBm) – 25(dB) = 22.01 – 25 = -2.99
2. Margin(dB) = -2.99 – (-6.098) = 3.108

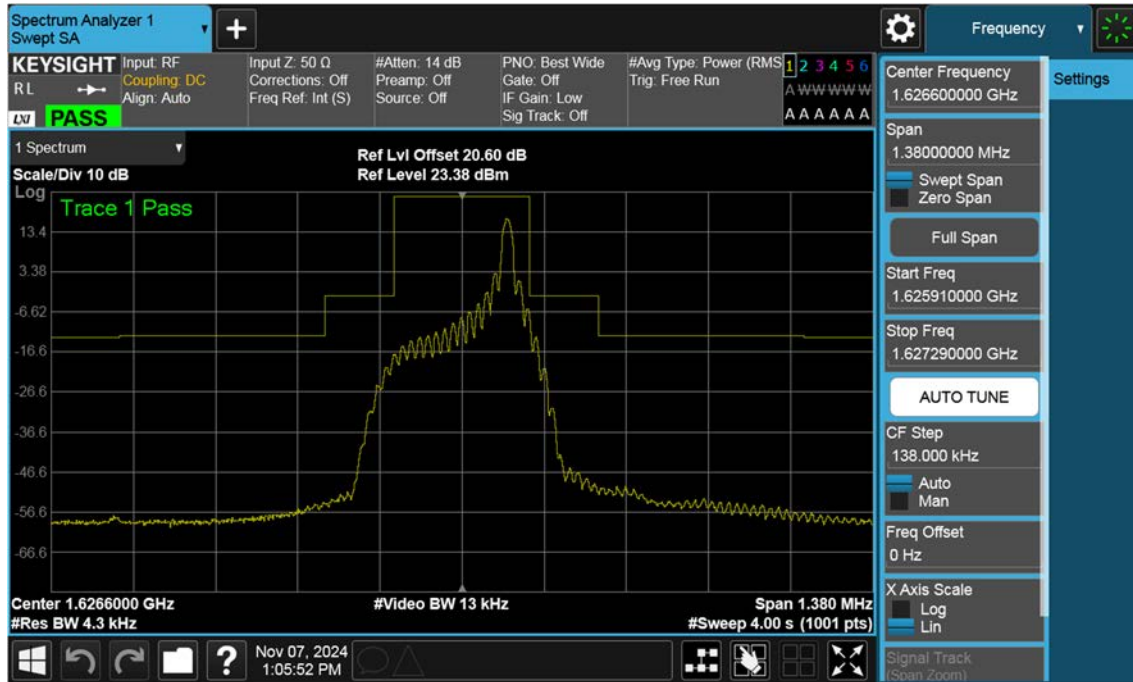
15K_Mask_High_1660.4MHz_BPSK_1SC0



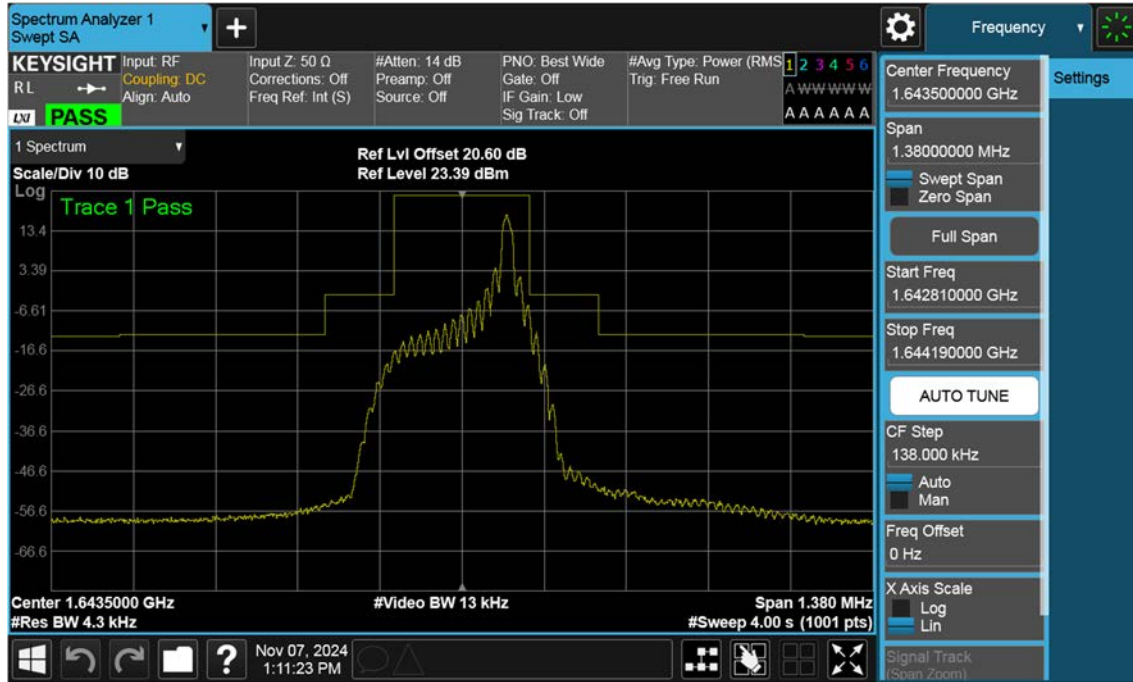
Note:

1. Limit(dBm) = Conducted output power(dBm) – 25(dB) = 21.51 – 25 = -3.49
2. Margin(dB) = -3.49 – (-6.360) = 2.87

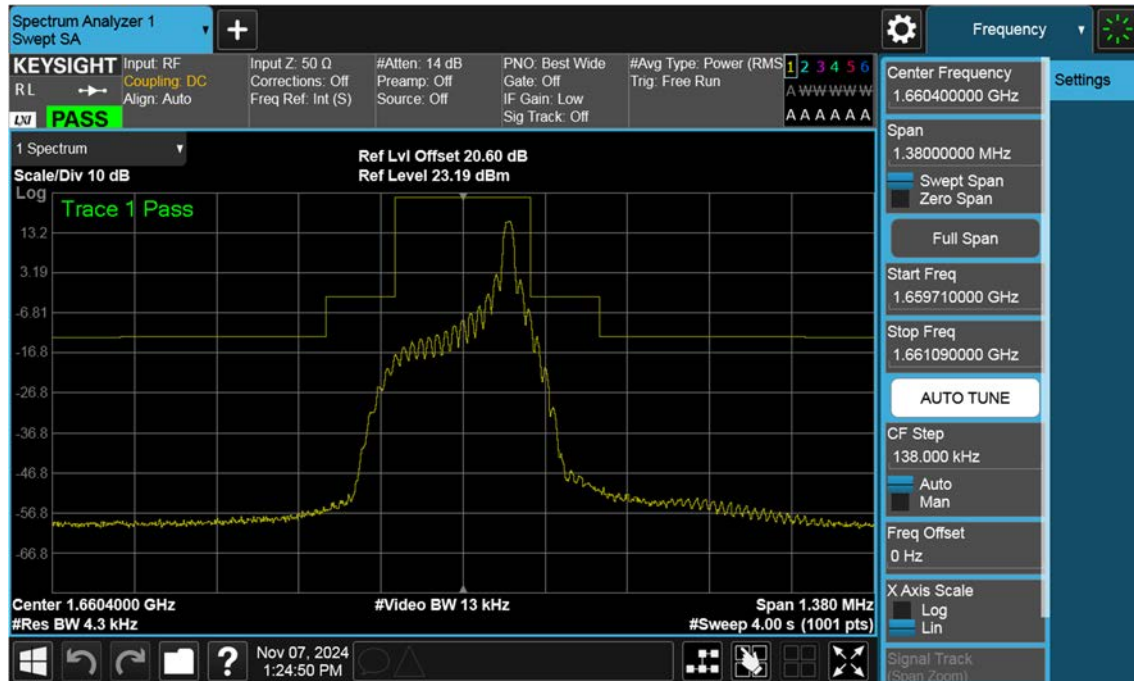
15K_Mask_Low_1626.6MHz_BPSK_1SC11



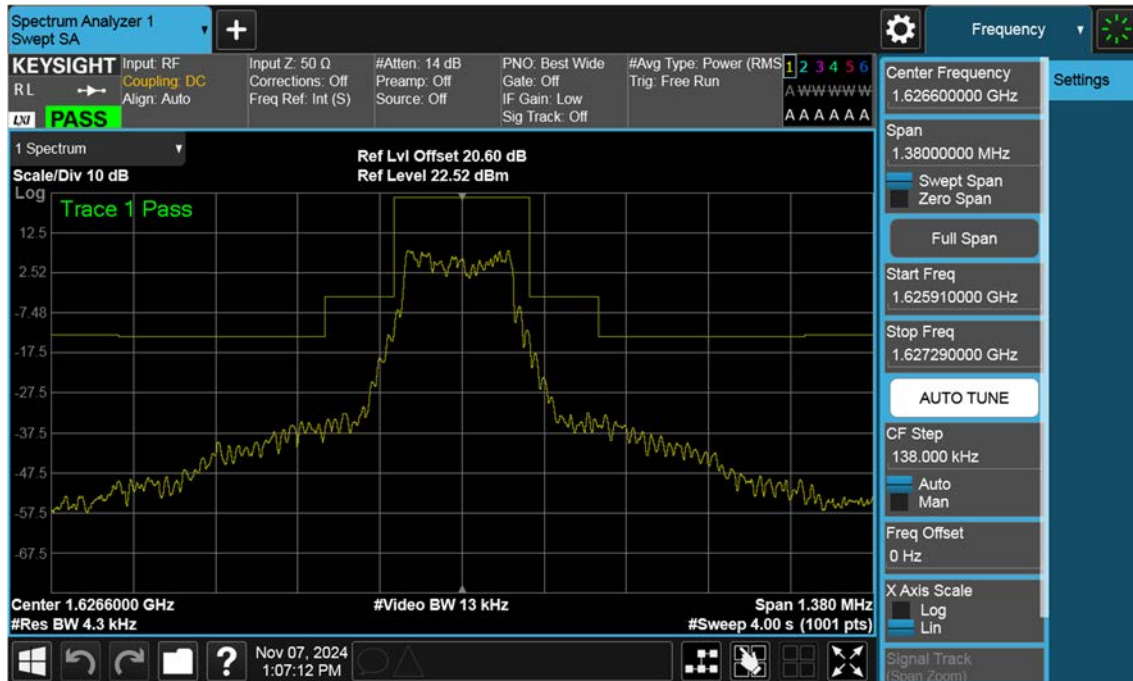
15K_Mask_Mid_1643.5MHz_BPSK_1SC11



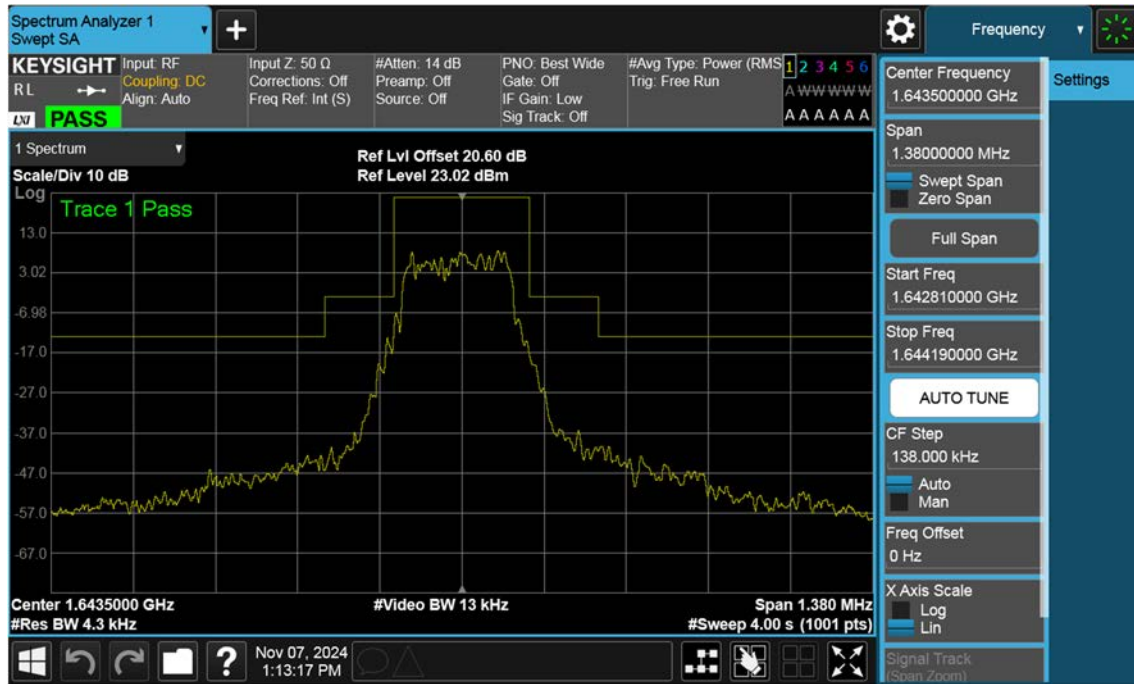
15K_Mask_High_1660.4MHz_BPSK_1SC11



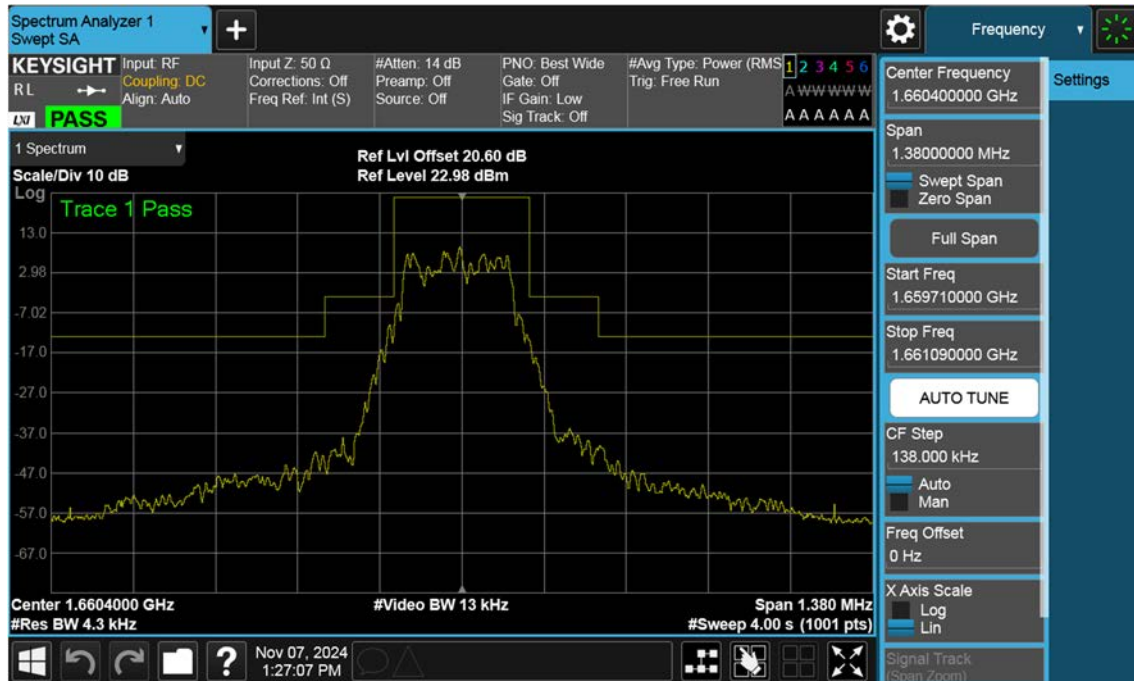
15K_Mask_Low_1626.6MHz_QPSK_12SC0



15K_Mask_Mid_1643.5MHz_QPSK_12SC0



15K_Mask_High_1660.4MHz_QPSK_12SC0



3.75K_Protection_Wide(1)_Low_1626.6MHz_BPSK_1SC0



3.75K_Protection_Wide(2)_Low_1626.6MHz_BPSK_1SC0



15K_Protection_Wide(1)_Low_1626.6MHz_BPSK_1SC0



15K_Protection_Wide(2)_Low_1626.6MHz_BPSK_1SC0



15K_Protection_Wide(1)_Low_1626.6MHz_QPSK_12SC0



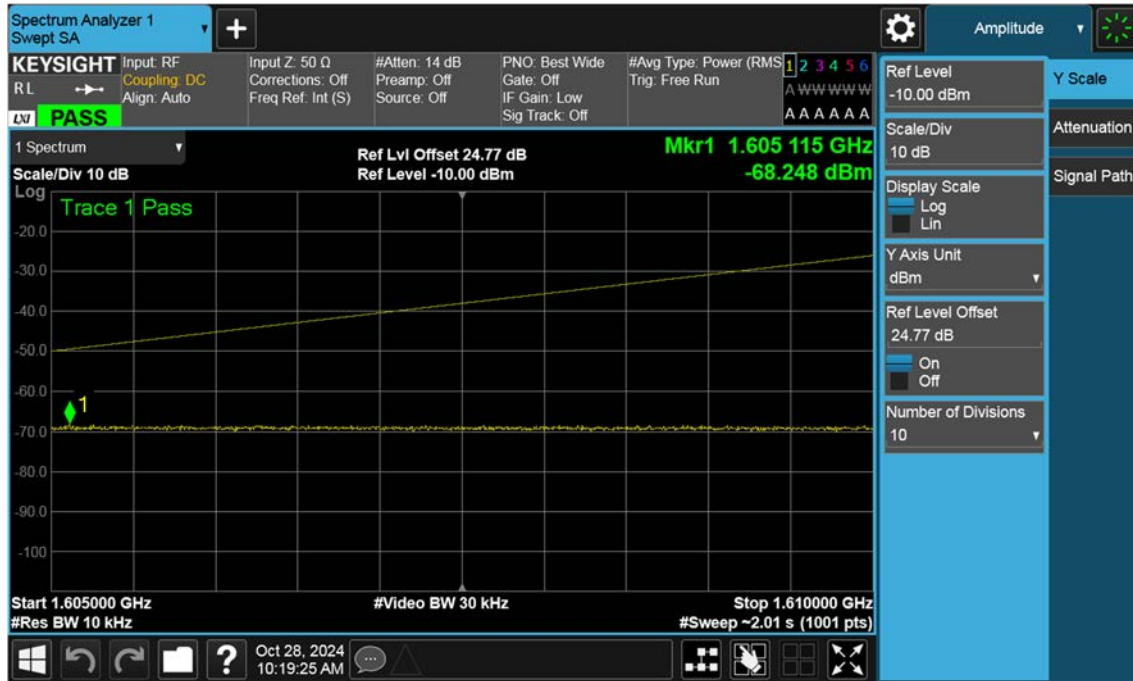
15K_Protection_Wide(2)_Low_1626.6MHz_QPSK_12SC0



3.75K_Protection_Narrow(1)_Low_1626.6MHz_BPSK_1SC0



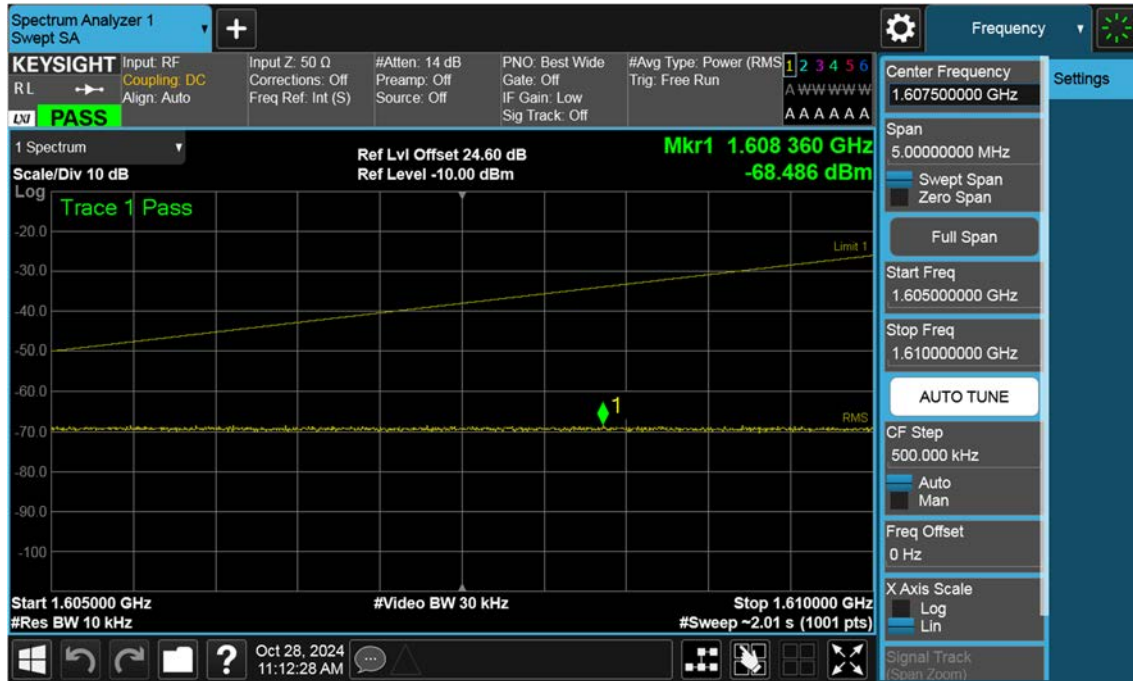
3.75K_Protection_Narrow(2)_Low_1626.6MHz_BPSK_1SC0



15K_Protection_Narrow(1)_Low_1626.6MHz_BPSK_1SC0



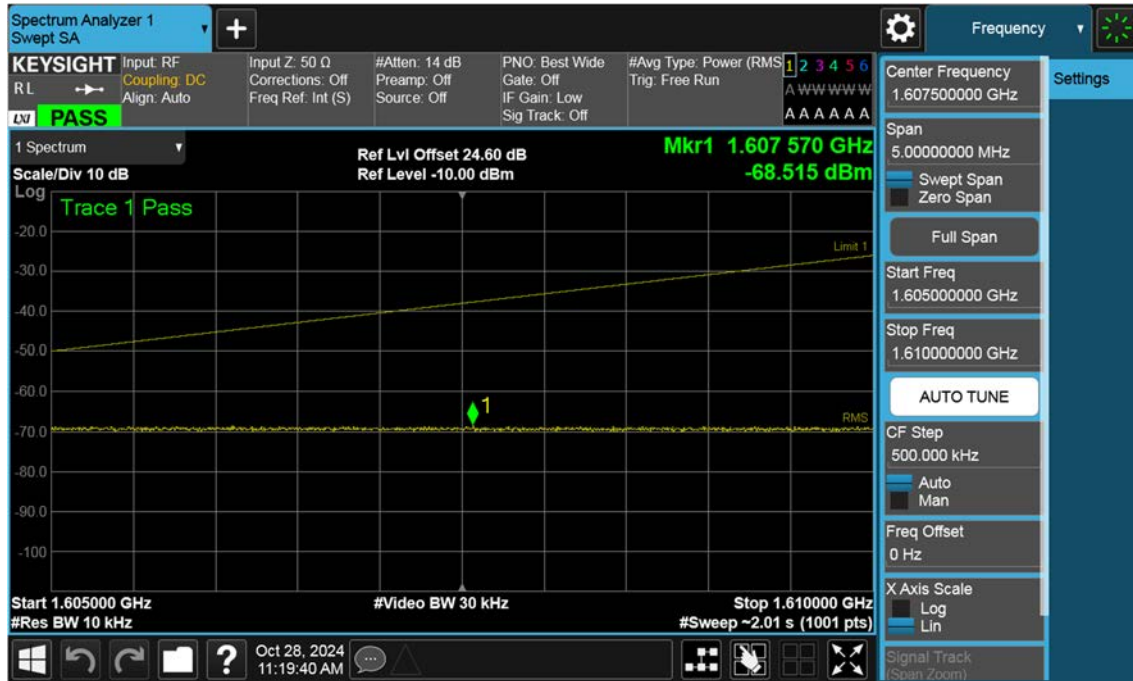
15K_Protection_Narrow(2)_Low_1626.6MHz_BPSK_1SC0



15K_Protection_Narrow(1)_Low_1626.6MHz_QPSK_12SC0



15K_Protection_Narrow(2)_Low_1626.6MHz_QPSK_12SC0



3.75K_Protection_CarrierOff_Low_1626.6MHz_BPSK_1SC0



3.75K_Protection_CarrierOff_Mid_1643.5MHz_BPSK_1SCO



3.75K_Protection_CarrierOff_High_1660.4MHz_BPSK_1SC0



15K_Protection_CarrierOff_Low_1626.6MHz_BPSK_1SC0



15K_Protection_CarrierOff_Mid_1643.5MHz_BPSK_1SC0



15K_Protection_CarrierOff_High_1660.4MHz_BPSK_1SC0



12. ANNEX A_ TEST SETUP PHOTO

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

No.	Description
1	HCT-RF-2410-FC064-P