# RF MEASUREMENT REPORT

| | |
|---|---|
| **FCC ID:** | 2AUBBV9OTM45 |
| **Applicant:** | China Starwin Science & Technology Co., Ltd |
| **Product:** | mobile satellite communication terminal |
| **Model No.:** | V9 OTM45 |
| **Trademark:** | StarWin |
| **FCC Classification:** | Licensed Non-Broadcast Station Transmitter (TNB) |
| **FCC Rule Part(s):** | FCC CFR 47 Part 2, FCC CFR 47 Part 25 |
| **Test Procedure(s):** | ANSI C63.26-2015, KDB 971168 D01v03r01<br>ANSI C63.4-2014 |
| **Test Date:** | October 13, 2021 ~ February 24, 2022 |

**Reviewed By:** Jame Yuan

**Approved By:** Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.01

The test results relate only to the samples tested.
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.
The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

## Revision History

| Report No. | Version | Description | Issue Date | Note |
|---|---|---|---|---|
| 2107RSU044-U3 | Rev. 01 | Initial Report | 03-02-2022 | Valid |
| | | | | |

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# 1. General Information

## 1.1. Applicant

China Starwin Science & Technology Co., Ltd

Floor 3th, Building B, No. 2 Keyuannan 2nd Road, High-tech Zone, Chengdu, China

## 1.2. Manufacturer

China Starwin Science & Technology Co., Ltd

Floor 3th, Building B, No. 2 Keyuannan 2nd Road, High-tech Zone, Chengdu, China

## 1.3. Testing Facility

| | | | | | |
|---|---|---|---|---|---|
| ☒ | **Test Site – MRT Suzhou Laboratory** | | | | |
| | **Laboratory Location (Suzhou - Wuzhong)**<br>D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China<br>**Laboratory Location (Suzhou - SIP)**<br>4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China | | | | |
| | **Laboratory Accreditations** | | | | |
| | A2LA: 3628.01 | | CNAS: L10551 | | |
| | FCC: CN1166 | | ISED: CN0001 | | |
| | VCCI: | ☐R-20025 | ☐G-20034 | ☐C-20020 | ☐T-20020 |
| | | ☐R-20141 | ☐G-20134 | ☐C-20103 | ☐T-20104 |
| ☐ | **Test Site – MRT Shenzhen Laboratory** | | | | |
| | **Laboratory Location (Shenzhen)**<br>1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China | | | | |
| | **Laboratory Accreditations** | | | | |
| | A2LA: 3628.02 | | CNAS: L10551 | | |
| | FCC: CN1284 | | ISED: CN0105 | | |
| ☐ | **Test Site – MRT Taiwan Laboratory** | | | | |
| | **Laboratory Location (Taiwan)**<br>No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) | | | | |
| | **Laboratory Accreditations** | | | | |
| | TAF: L3261-190725 | | | | |
| | FCC: 291082, TW3261 | | ISED: TW3261 | | |

### 1.4. Product Information

| | |
|---|---|
| Product Name | mobile satellite communication terminal |
| Model No. | V9 OTM45 |
| Hardware Version | XY-V9-OTM45-202111 |
| Software Version | XY-V9-OTM45-V1.17B |
| Wi-Fi Specification | 802.11b/g/n |
| Bluetooth Version | V4.2 single mode, BLE only |
| Satellite Specification | Transmit: 13.75~14.50GHz<br>Receive: 10.70~12.75GHz |
| Antenna Information | Refer to section 1.5 |
| GNSS Specification | GPS, BDS |
| Operating Temperature | -25 ~ 50 °C |
| Remark:<br>1, The product is made up of In-cabin Unit (Support Wi-Fi and Bluetooth) and Out-cabin Unit (Support Satellite). They cannot operate independently, and both operate together as a system, Out-cabin Unit is powered by In-cabin Unit. In-cabin Unit is responsible for interacting with the user, and Out-cabin Unit is to realize the functions of satellite signal sending and receiving, aligning the satellite<br>2, The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer. | |

### 1.5. Product Specification

| | |
|---|---|
| Frequency Range | Transmit: 13.75 ~ 14.50 GHz<br>Receive: 10.70 ~ 12.75 GHz |
| Test Frequency | Low channel: 13.75 GHz<br>Mid channel: 14.25 GHz<br>High channel: 14.50 GHz |
| Type of Modulation | 8PSK, BPSK, QPSK |
| Data Rate | 128kbps ~ 7500kbps |
| Antenna Type | Slotted Waveguide Array |
| Antenna Gain | 33.21 dBi (in range of ±10 degree)<br>3.69 dBi (out range of ±10 degree) |

Note: For other features of this EUT, test report will be issued separately.

### 1.6. Working Frequencies

| Channel | Frequency |
|---|---|
| Low Channel | 13750 MHz |
| … | … |
| Middle Channel | 14250 MHz |
| … | … |
| High Channel | 14500 MHz |

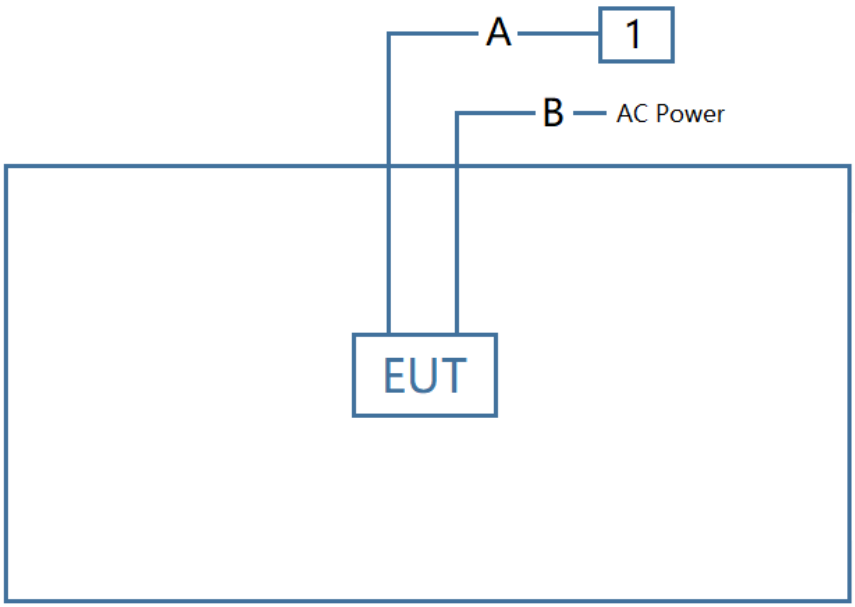
# 2. Test Configuration

## 2.1. Test Mode

| |
|---|
| Mode 1: Transmit at Channel 13.75 GHz |
| Mode 2: Transmit at Channel 14.25 GHz |
| Mode 3: Transmit at Channel 14.50 GHz |

## 2.2. Test System Connection Diagram

The device was tested per the guidance ANSI C63.26: 2015 was used to reference the appropriate EUT setup for radiated emissions testing.

| Connection Diagram | | | |
|---|---|---|---|
|   | | | |
| Cable Type | | Cable Description | |
| A | LAN Cable | Shielded, > 10.0m | |
| B | Power Cable | Non-Shielded, <3.0m | |
| Product | | Manufacturer | Model No. |
| 1 | Notebook | DELL | P62G |

### 2.3. Test Software

The device connected with notebook, then set data rate and frequency in specified web pages.

| Test Mode | Type of Modulation | Data Rate (kbps) | Channel No. | Test Frequency (MHz) | Power Parameter Value | | |
|---|---|---|---|---|---|---|---|
| | | | | | Ant 0 | Ant 1 | Ant 0 + 1 |
| Satellite | 8PSK | 128 | Low | 13750 | -34.0 | -33.5 | -35.0 |
| | | | Middle | 14250 | -35.0 | -35.0 | -35.0 |
| | | | High | 14500 | -34.5 | -34.5 | -35.0 |
| | | 7500 | Low | 13750 | -14.0 | -14.5 | -19.0 |
| | | | Middle | 14250 | -9.5 | -10.5 | -15.5 |
| | | | High | 14500 | -9.0 | -9.5 | -14.0 |
| | BPSK | 128 | Low | 13750 | -33.5 | -34.5 | -35.0 |
| | | | Middle | 14250 | -35.0 | -35.0 | -35.0 |
| | | | High | 14500 | -34.0 | -34.0 | -35.0 |
| | | 7500 | Low | 13750 | -13.5 | -14.5 | -19.0 |
| | | | Middle | 14250 | -10.0 | -10.5 | -15.5 |
| | | | High | 14500 | -9.0 | -9.0 | -14.0 |
| | QPSK | 128 | Low | 13750 | -33.5 | -34.0 | -35.0 |
| | | | Middle | 14250 | -35.0 | -35.0 | -35.0 |
| | | | High | 14500 | -34.5 | -34.5 | -35.0 |
| | | 7500 | Low | 13750 | -13.5 | -14.5 | -19.0 |
| | | | Middle | 14250 | -10.0 | -10.5 | -15.5 |
| | | | High | 14500 | -9.0 | -9.5 | -14.0 |

### 2.4. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 25
- ANSI C63.26-2015
- KDB 971168 D01v03r01
- ANSI C63.4-2014

### 2.5. Test Environment Condition

| | |
|---|---|
| Ambient Temp. | 15 ~ 35 °C |
| Relative Humidity | 20 ~ 75% RH |

## 3. Antenna Requirements

**Excerpt from §25.209 of the FCC Rules/Regulations:**

Except as provided in paragraph (f) of the §25.209, the co-polarization gain of any earth station antenna operating in the FSS and transmitting to a GSO satellite, including earth stations providing feeder links for satellite services other than FSS, may not exceed the specified limits.

**Conclusion:**

The unit complies with the requirement of §25.209, and the details refer to the “Antenna Specification” file.

## 4. Measuring Instrument

| Instrument Name | Manufacturer | Model No. | Asset No. | Cali. Interval | Cal. Due Date | Test Site |
|---|---|---|---|---|---|---|
| Signal Analyzer | Keysight | N9010B | MRTSUE06603 | 1 year | 2022/10/31 | SIP-AC2 |
| Signal Analyzer | Keysight | N9020B | MRTSUE06604 | 1 year | 2022/9/7 | SIP-AC2 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06623 | 1 year | 2022/11/28 | SIP-AC2 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06624 | 1 year | 2022/11/28 | SIP-AC2 |
| Anechoic Chamber | RIKEN | SIP-AC2 | MRTSUE06781 | 1 year | 2022/12/23 | SIP-AC2 |
| Signal Analyzer | Keysight | N9030B | MRTSUE06395 | 1 year | 2022/8/8 | SIP-AC2 |
| Waveguide Harmonic Mixer | Keysight | M1970V | MRTSUE06271 | / | / | SIP-AC2 |
| Waveguide Harmonic Mixer | Keysight | M1970W | MRTSUE06272 | / | / | SIP-AC2 |
| mmWave Antenna | MI-WWAVE | 261U-25/383 | MRTSUE06273 | / | / | SIP-AC2 |
| mmWave Antenna | MI-WWAVE | 261G/387 | MRTSUE06274 | / | / | SIP-AC2 |
| mmWave Antenna | MI-WWAVE | 261F/387 | MRTSUE06275 | / | / | SIP-AC2 |
| mmWave Antenna | MI-WWAVE | 261E-25/387 | MRTSUE06276 | / | / | SIP-AC2 |
| mmWave Antenna | VDI | WR3/4 | MRTSUE06277 | / | / | SIP-AC2 |
| mmWave Antenna | VDI | WR2/2 | MRTSUE06278 | / | / | SIP-AC2 |
| mmWave Antenna | A-INFO | LB-15-25-A | MRTSUE06409 | / | / | SIP-AC2 |
| mmWave Antenna | A-INFO | LB-10-25-A | MRTSUE06410 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | N9029AV03 | MRTSUE06366 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | N9029AV05 | MRTSUE06367 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | N9029AV06 | MRTSUE06368 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | N9029AV02 | MRTSUE06369 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | E8257DV15 | MRTSUE06456 | / | / | SIP-AC2 |
| mmWave Extension Module | Keysight | E8257DV10 | MRTSUE06458 | / | / | SIP-AC2 |
| EMI Test Receiver | R&S | ESR7 | MRTSUE06001 | 1 year | 2022/12/29 | WZ-AC1 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | MRTSUE06023 | 1 year | 2022/9/16 | WZ-AC1 |
| Preamplifier | Agilent | 83017A | MRTSUE06076 | 1 year | 2022/11/12 | WZ-AC1 |
| TRILOG Antenna | Schwarzbeck | VULB 9168 | MRTSUE06172 | 1 year | 2022/8/5 | WZ-AC1 |
| Anechoic Chamber | TDK | WZ-AC1 | MRTSUE06212 | 1 year | 2022/4/29 | WZ-AC1 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06403 | 1 year | 2022/6/28 | WZ-AC1 |
| Signal Analyzer | Keysight | N9010B | MRTSUE06607 | 1 year | 2022/12/29 | WZ-AC1 |
| Thermohygrometer | testo | Testo 608-H1 | MRTSUE11039 | 1 year | 2022/11/11 | WZ-AC1 |
| Loop Antenna | Schwarzbeck | FMZB 1519 | MRTSUE06025 | 1 year | 2022/10/28 | WZ-AC1/WZ-AC2 |
| Horn Antenna | ETS | 3117 | MRTSUE06257 | 1 year | 2022/9/25 | WZ-AC1/WZ-AC2 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | MRTSUE06597 | 1 year | 2022/12/1 | WZ-AC1/WZ-AC2 |
| Preamplifier | EMCI | EMC184045SE | MRTSUE06640 | 1 year | 2022/1/14 | WZ-AC1/WZ-AC2 |

| Instrument Name | Manufacturer | Model No. | Asset No. | Cali. Interval | Cal. Due Date | Test Site |
|---|---|---|---|---|---|---|
| Preamplifier | EMCI | EMC051845SE | MRTSUE06987 | 1 year | 2022/9/9 | WZ-AC1/WZ-AC2 |
| TRILOG Antenna | Schwarzbeck | VULB 9162 | MRTSUE06022 | 1 year | 2022/5/24 | WZ-AC2 |
| EMI Test Receiver | Agilent | N9038A | MRTSUE06125 | 1 year | 2022/6/24 | WZ-AC2 |
| Thermohygrometer | Mingle | ETH529 | MRTSUE06170 | 1 year | 2022/12/1 | WZ-AC2 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | MRTSUE06171 | 1 year | 2022/10/21 | WZ-AC2 |
| Preamplifier | Schwarzbeck | BBV 9718 | MRTSUE06176 | 1 year | 2022/11/12 | WZ-AC2 |
| Anechoic Chamber | RIKEN | WZ-AC2 | MRTSUE06213 | 1 year | 2022/4/29 | WZ-AC2 |
| Thermohygrometer | testo | Testo 608-H1 | MRTSUE11038 | 1 year | 2022/11/11 | WZ-AC2 |
| USB Power Sensor | Agilent | U2021XA | MRTSUE06030 | 1 year | 2022/10/10 | WZ-SR5 |
| USB Power Sensor | Keysight | U2021XA | MRTSUE06582 | 1 year | 2022/8/8 | WZ-SR5 |
| Signal Analyzer | Keysight | N9010B | MRTSUE06558 | 1 year | 2022/6/24 | WZ-SR5 |
| Signal Analyzer | Agilent | N9020A | MRTSUE06106 | 1 year | 2022/4/13 | WZ-SR5 |
| Thermohygrometer | testo | 608-H1 | MRTSUE06402 | 1 year | 2022/6/28 | WZ-SR5 |
| Shielding Room | HUAMING | WZ-SR5 | MRTSUE06442 | / | / | WZ-SR5 |
| Signal Analyzer | Keysight | N9010B | MRTSUE06457 | 1 year | 2022/6/24 | WZ-SR5 |

| Software | Version | Function |
|---|---|---|
| EMI Software | V3 | EMI Test Software |

## 5. Measurement Uncertainty

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

| Radiated Disturbance |
|---|
| Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>Horizontal:<br>30MHz~300MHz: 5.04dB<br>300MHz~1GHz: 4.95dB<br>1GHz~75GHz: 6.40dB<br>Vertical:<br>30MHz~300MHz: 5.24dB<br>300MHz~1GHz: 6.03dB<br>1GHz~75GHz: 6.40dB |
| Spurious Emissions, Conducted |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>0.78dB |
| Output Power |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>1.13dB |
| Power Spectrum Density |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>1.15dB |
| Occupied Bandwidth |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>0.28% |

# 6. Test Result

## 6.1. Summary

| FCC Section(s) | Test Description | Test Condition | Verdict |
|---|---|---|---|
| 2.1049 | Occupied Bandwidth | Conducted | Pass |
| 2.1046(a), 25.204(a) | Power Spectral Density & Output Power | | Pass |
| 25.218 | Od-axis EIRP density | | Pass |
| 2.1051, 25.202(f) | Unwanted Emission at Antenna Terminal. | | Pass |
| 2.1055, 25.202(d) | Frequency Tolerance | | Pass |
| 2.1053, 25.202(f) | Radiated Spurious Emission | Radiated | Pass |

**Remark:**

The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

## 6.2. Occupied Bandwidth

### 6.2.1.Test Limit

N/A

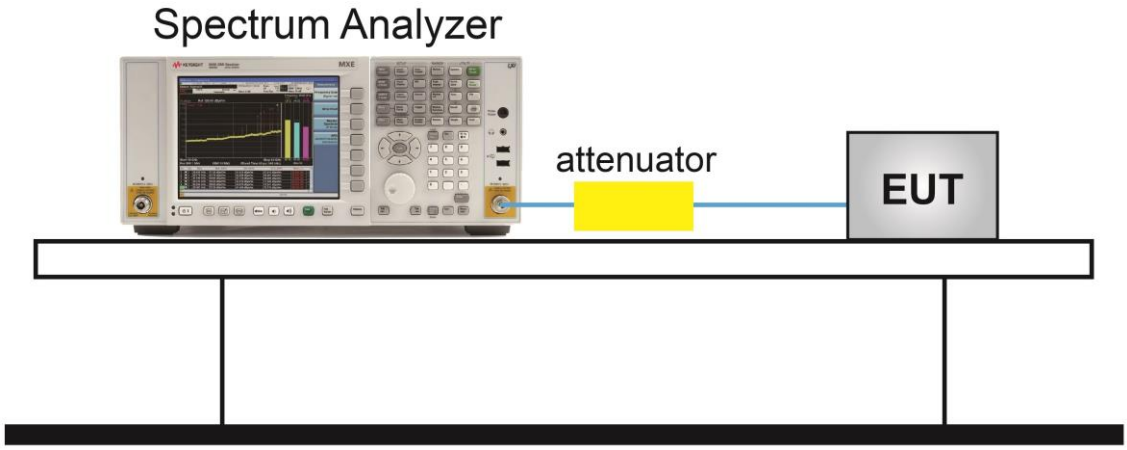
### 6.2.2.Test Procedure used

ANSI C63.26-2015 - Section 5.4.4

### 6.2.3.Test Setting

1. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of 1.5 × OBW is sufficient)
2. Set RBW = 1% to 5% of the OBW
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace was allowed to stabilize

### 6.2.4.Test Setup




### 6.2.5.Test Result

Refer to Appendix A.2.

## 6.3. Power Spectral Density & Output Power

### 6.3.1.Test Limit

**Part 25.203(c)(2)(ix)**

Maximum equivalent isotropically radiated power (e.i.r.p.) density in the main beam in any 4kHz band, (dBW/4kHz) for frequency bands below 15GHz or in any 1MHz band (dBW/MHz) for frequency band above 15GHz,

**Part 25.204(a)**

In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15GHz, shall not exceed the following limits except as provided for in paragraph(c) of this section:

+ 40 dBW in any 4 kHz band for $\theta \leq 0°$

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

where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

Note: 0 dBw = 10*log(W) = 30 dBm, 40 dBW = 70 dBm.

### 6.3.2.Test Procedure used

ANSI C63.26-2015 - Section 5.2.4.5 & 5.2.4.4.1 (Power Spectral Density Measurement)

ANSI C63.26-2015 - Section 5.2.4.2 (Output Power Measurement)

### 6.3.3.Test Setting

**Power Spectral Density Measurement using spectrum analyzer**

1. Set span to 2 to 3 times the OBW
2. Set RBW = 1% to 5% of the OBW

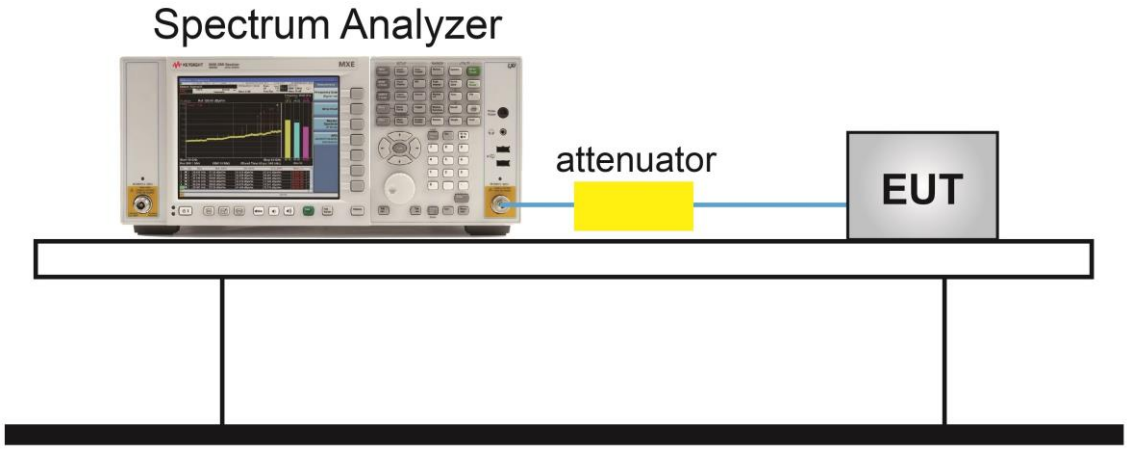
   (RBW shall set to the reference bandwidth specified by the applicable regulatory requirement, so set RBW = 3 kHz herein for measurement)
3. Set VBW ≥ 3 × RBW
4. Set number of measurement points in sweep ≥ 2 × span / RBW
5. Detector = power averaging (RMS)
6. Trace mode = Trace average
7. Trace was allowed to stabilize
8. 10*log(4kHz/3kHz) = 1.25dB was added to the reference offset to correct the result relative to any 4kHz band as per the requirement in 25.202(f).

**Output Power Measurement using a gated RF average-reading power meter**

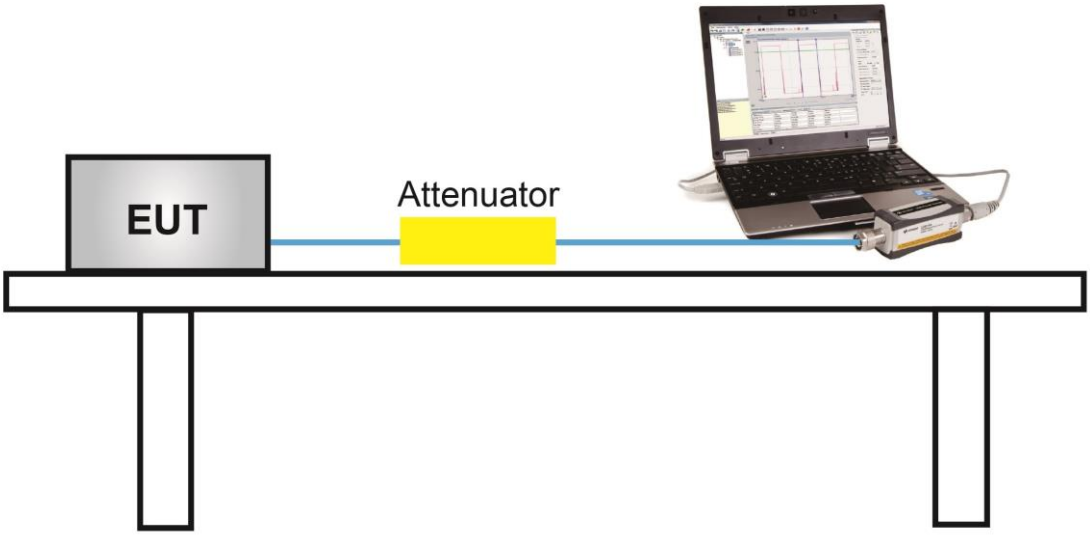
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

### 6.3.4.Test Setup

Power Spectral Density Measurement




Output Power Measurement




### 6.3.5.Test Result

Refer to Appendix A.3.

## 6.4. Off-axis EIRP Density

### 6.4.1.Test Limit

**Part 25.203(c)(2)(ix)**

Maximum equivalent isotropically radiated power (e.i.r.p.) density in the main beam in any 4kHz band, (dBW/4kHz) for frequency bands below 15GHz or in any 1MHz band (dBW/MHz) for frequency band above 15GHz,

**Part 25.218**

**(f)** ***Digital earth station operation in the conventional Ku-band.***

(1) For co-polarized transmissions in the plane tangent to the GSO arc:

| | | |
|---|---|---|
| 15 - 25*log θ | dBW /4 kHz | for 1.5° ≤ θ ≤ 7° |
| -6 | dBW /4 kHz | for 7° < θ ≤ 9.2° |
| 18 - 25*log θ | dBW /4 kHz | for 9.2° < θ ≤ 19.1° |
| -14 | dBW /4 kHz | for 19.1° < θ ≤ 180° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite. The EIRP density levels specified for θ > 7° may be exceeded by up to 3 dB in up to 10% of the range of theta (θ) angles from ±7-180°, and by up to 6 dB in the region of main reflector spillover energy.

(2) For co-polarized transmissions in the plane perpendicular to the GSO arc:

| | | |
|---|---|---|
| 18 - 25*log θ | dBW /4 kHz | for 3° < θ ≤ 19.1° |
| -14 | dBW /4 kHz | for 19.1° < θ ≤ 180° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite. These EIRP density levels may be exceeded by up to 6 dB in the region of main reflector spillover energy and in up to 10% of the range of θ angles not included in that region, on each side of the line from the earth station to the target satellite.

(3) For cross-polarized transmissions in the plane tangent to the GSO arc and in the plane perpendicular to the GSO arc:

| | | |
|---|---|---|
| 5 - 25*log θ | dBW /4 kHz | for 1.5° < θ ≤ 7° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite.

**(h)** ***Digital earth station operation in the extended Ku-band.***

(1) For co-polarized transmissions in the plane tangent to the GSO arc:

| | | |
|---|---|---|
| 15 - 25*log θ | dBW /4 kHz | for 1.5° ≤ θ ≤ 7° |
| -6 | dBW /4 kHz | for 7° < θ ≤ 9.2° |
| 18 - 25*log θ | dBW /4 kHz | for 9.2° < θ ≤ *48*° |
| -24 | dBW /4 kHz | for 48° < θ ≤ 180° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite. The EIRP density levels specified for θ > 7° may be exceeded by up to 3 dB in up to 10% of the range of theta (θ) angles from ±7-180°, and by up to 6 dB in the region of main reflector spillover energy.

(2) For co-polarized transmissions in the plane perpendicular to the GSO arc:

| | | |
|---|---|---|
| 18 - 25*log θ | dBW /4 kHz | for 3° < θ ≤ *48*° |
| -24 | dBW /4 kHz | for 48° < θ ≤ *85*° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite. These EIRP density levels may be exceeded by up to 6 dB in the region of main reflector spillover energy and in up to 10% of the range of θ angles not included in that region, on each side of the line from the earth station to the target satellite.

(3) For cross-polarized transmissions in the plane tangent to the GSO arc and in the plane perpendicular to the GSO arc:

| | | |
|---|---|---|
| 5 - 25*log θ | dBW /4 kHz | for 1.5° < θ ≤ *7*° |

Where θ is the angle in degrees from a line from the earth station antenna to the assigned orbital location of the target satellite.

### 6.4.2.Test Procedure used

ANSI C63.26-2015 - Section 5.2.4.5 & 5.2.4.4.1

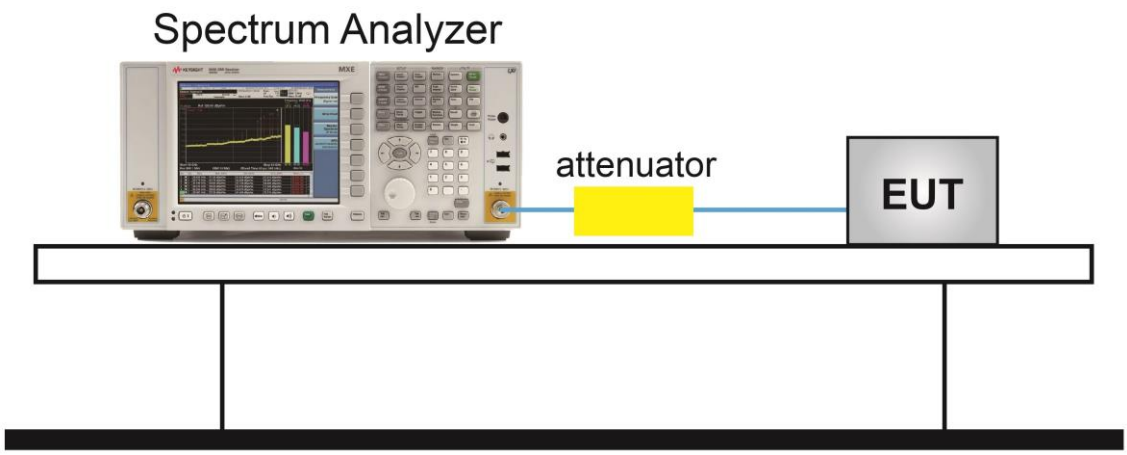
### 6.4.3.Test Setting

**Power Spectral Density Measurement using spectrum analyzer**

1. Set span to 2 to 3 times the OBW
2. Set RBW = 1% to 5% of the OBW

   (RBW shall set to the reference bandwidth specified by the applicable regulatory requirement, so set RBW = 3 kHz herein for measurement)
3. Set VBW ≥ 3 × RBW
4. Set number of measurement points in sweep ≥ 2 × span / RBW
5. Detector = power averaging (RMS)
6. Trace mode = Trace average
7. Trace was allowed to stabilize
8. 10*log(4kHz/3kHz) = 1.25dB was added to the reference offset to correct the result relative to any 4kHz band as per the requirement in 25.202(f).

### 6.4.4.Test Setup




### 6.4.5.Test Result

Refer to Appendix A.4.

## 6.5. Unwanted Emission at Antenna Terminal

### 6.5.1.Test Limit

**Part 25.202(f)**

The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule:

(1) In any 4kHz 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: 25dB;

(2) In any 4kHz 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: 35dB;

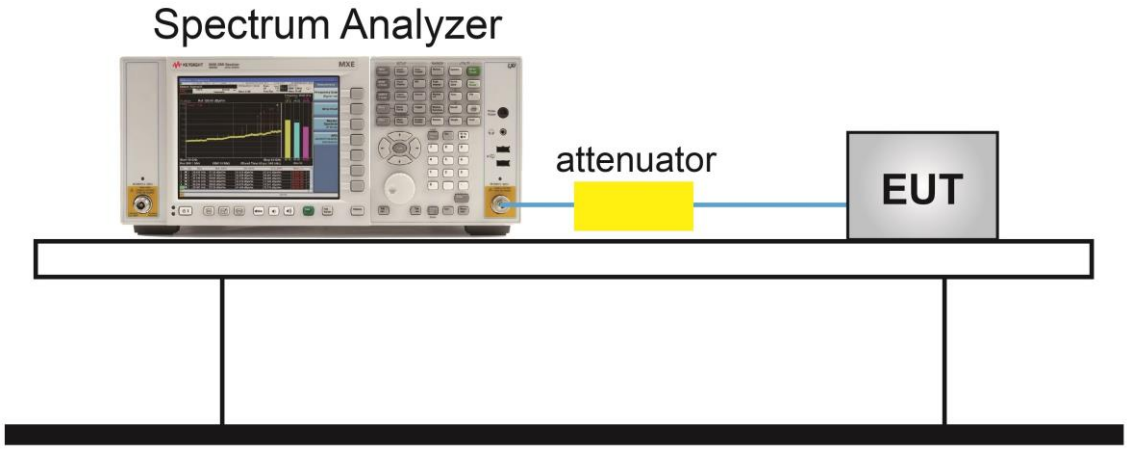
### 6.5.2.Test Procedure used

ANSI C63.26-2015 - Section 5.7

### 6.5.3.Test Setting

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 3kHz for in-band mask or 10kHz for below 30MHz or 100kHz for below 1GHz or 1MHz for above 1GHz, Set the RBW greater than 4kHz in order to increase the measurement speed
3. VBW ≥ 3 × RBW
4. Detect = power averaging (RMS)
5. Sweep time = Auto couple
6. Trace mode = Trace average
7. Trace was allowed to stabilize
8. 10*log(4kHz/3kHz) = 1.25dB was added to the reference offset for in-band mask measurement to correct the result relative to any 4kHz band as per the requirement in 25.202(f)(1)&(2).

### 6.5.4.Test Setup




### 6.5.5.Test Result

Refer to Appendix A.5.

## 6.6. Frequency Tolerance

### 6.6.1.Test Limit

**FCC Part 25.202(d)**

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

### 6.6.2.Test Procedure used

ANSI C63.26-2015 - Section 5.6.3 & 5.6.4 & 5.6.5

### 6.6.3.Test Setting

The EUT was set to transmit an unmodulated carrier. The EUT was connected to a spectrum analyzer via a cable and attenuator.

Adjust the temperature and supply voltage follow below:

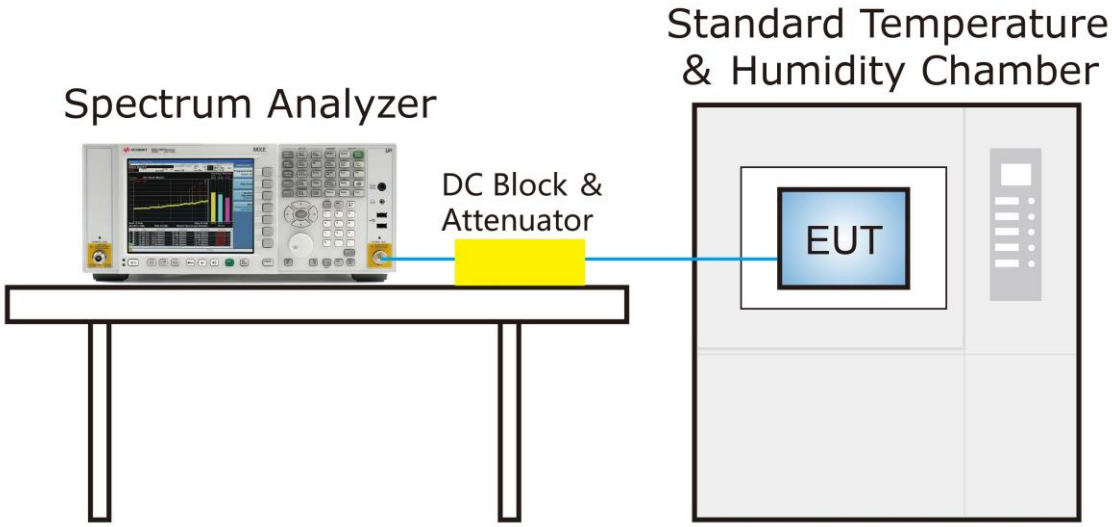
a) At 10°C intervals of temperatures between -30°C and +50°C at the manufacturer's rated supply voltage, and

b) At +20°C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.

Adjust the detector bandwidth and span settings to achieve a resolution capable of accurate frequency measurements over the applicable frequency stability limits. Mark the highest point and record it.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy).

### 6.6.4.Test Setup




### 6.6.5.Test Result

Refer to Appendix A.6.

## 6.7. Radiated Spurious Emission

### 6.7.1.Test Limit

**Part 25.202(f) Emission Limitations**

The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule:

(3) In any 4kHz 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 43dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts.

### 6.7.2.Test Procedure used

ANSI C63.26-2015 - Section 5.7

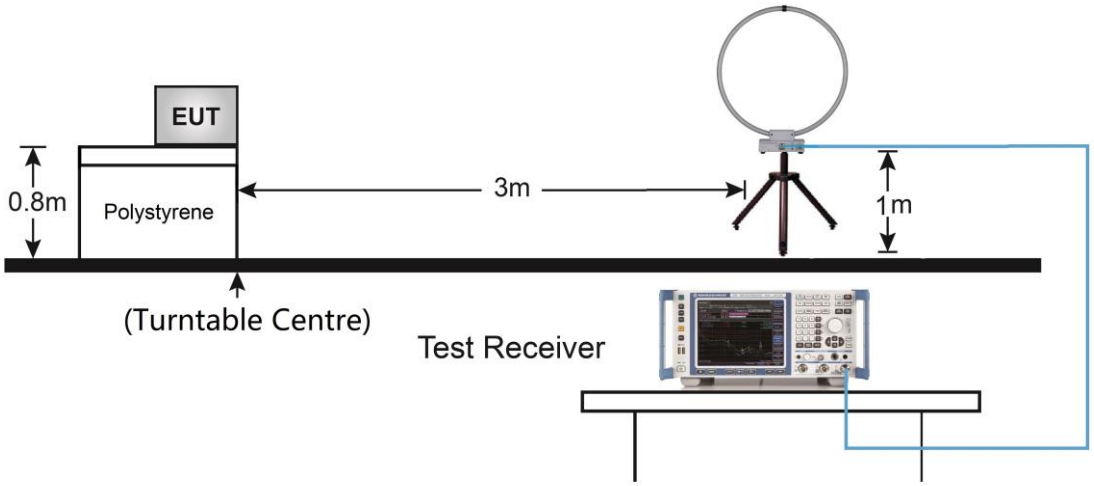
### 6.7.3.Test Setting

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 100kHz for below 1GHz or 1MHz for above 1GHz

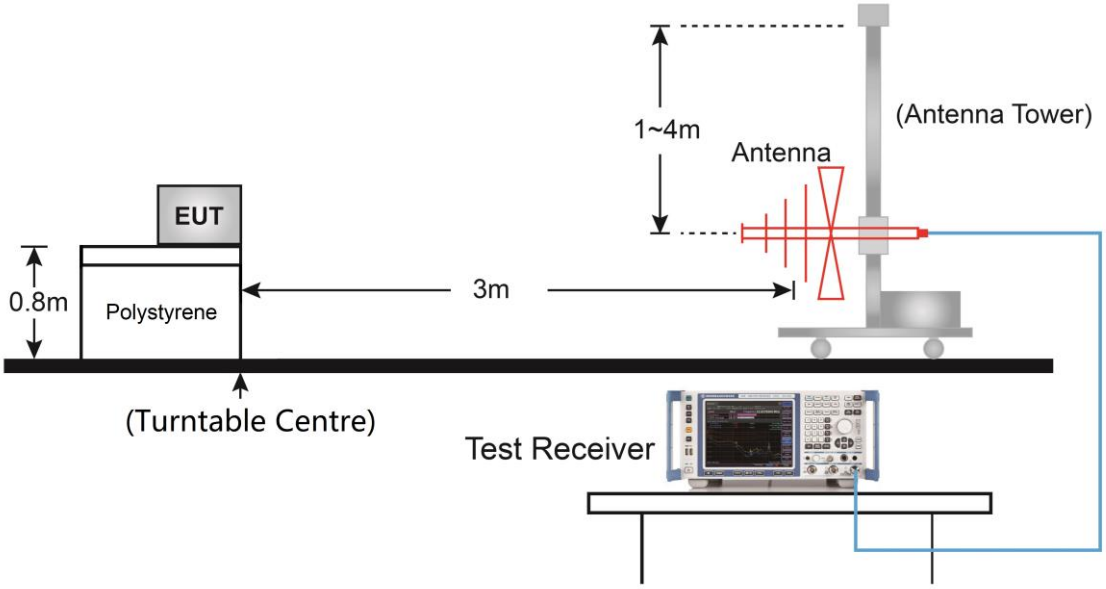
   Set the RBW greater than 4kHz in order to increase the measurement speed
3. VBW = 3 * RBW
4. Detector = power averaging (RMS)
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

### 6.7.4.Test Setup

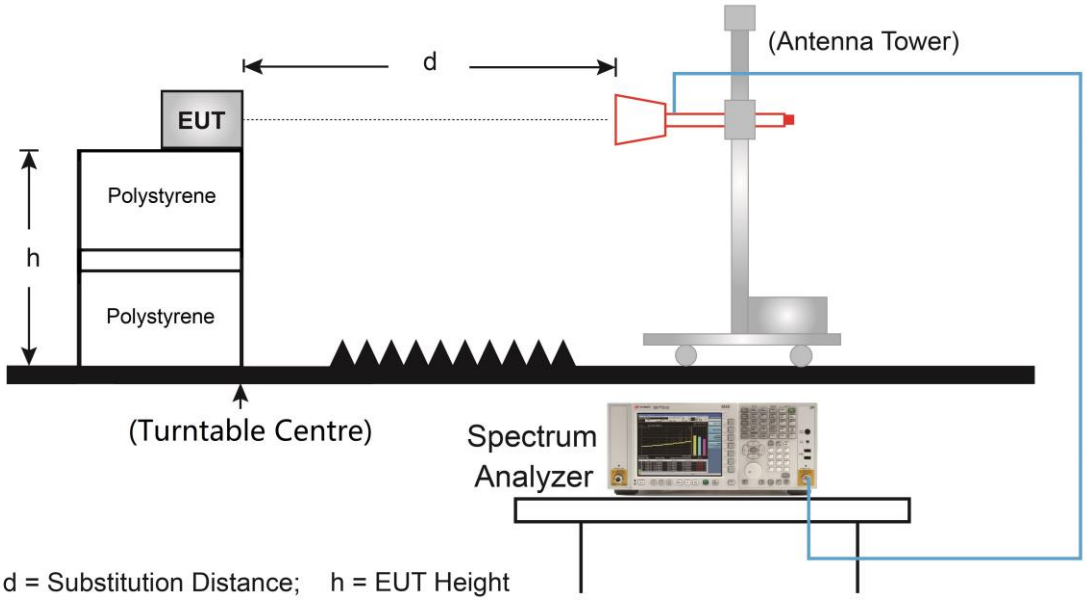
9kHz ~ 30MHz Test Setup



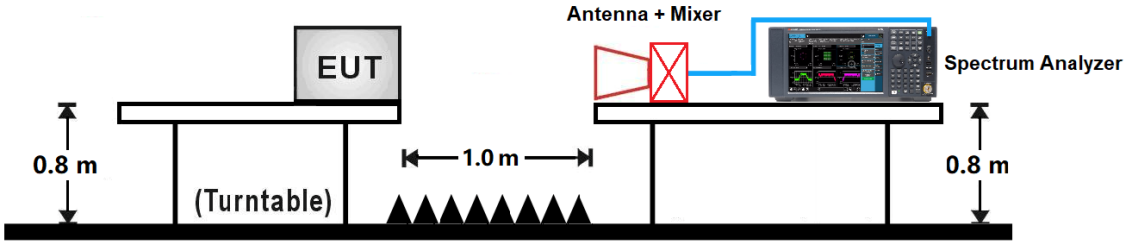

30MHz ~ 1GHz Test Setup



1GHz ~ 40GHz Test Setup




40GHz ~ 75GHz Test Setup




### 6.7.5.Test Result

Refer to Appendix A.7.

## Appendix A – Test Result

## A.1 Duty Cycle Test Result

| | | | |
|---|---|---|---|
| Test Site | WZ-SR5 | Test Engineer | Luis Yang |
| Test Date | 2021/10/29 | | |

| Test Mode | Duty Cycle |
|---|---|
| 8PSK | 100% |
| BPSK | 100% |
| QPSK | 100% |
| 8PSK - 14250 MHz | BPSK - 14250 MHz |
| | |
| QPSK - 14250 MHz | |
| | |

### A.2 Occupied Bandwidth Test Result

| | | | |
|---|---|---|---|
| Test Site | WZ-SR5 | Test Engineer | Luis Yang |
| Test Date | 2021/10/29 | | |

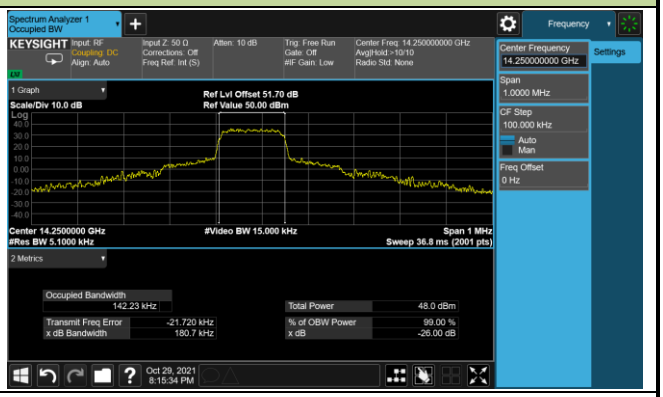
| Test Mode | Date Rate (kbps) | Test Channel | Test Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Ant 0 | | | | |
| 8PSK | 128 | Low | 13750 | 0.141 |
| | 128 | Mid | 14250 | 0.142 |
| | 128 | High | 14500 | 0.143 |
| | 7500 | Low | 13750 | 8.078 |
| | 7500 | Mid | 14250 | 8.145 |
| | 7500 | High | 14500 | 8.112 |
| BPSK | 128 | Low | 13750 | 0.142 |
| | 128 | Mid | 14250 | 0.144 |
| | 128 | High | 14500 | 0.149 |
| | 7500 | Low | 13750 | 8.187 |
| | 7500 | Mid | 14250 | 8.264 |
| | 7500 | High | 14500 | 8.374 |
| QPSK | 128 | Low | 13750 | 0.141 |
| | 128 | Mid | 14250 | 0.142 |
| | 128 | High | 14500 | 0.142 |
| | 7500 | Low | 13750 | 8.127 |
| | 7500 | Mid | 14250 | 8.123 |
| | 7500 | High | 14500 | 8.213 |

| Test Mode | Date Rate (kbps) | Test Channel | Test Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Ant 1 | | | | |
| 8PSK | 128 | Low | 13750 | 0.139 |
| | 128 | Mid | 14250 | 0.140 |
| | 128 | High | 14500 | 0.139 |
| | 7500 | Low | 13750 | 8.069 |
| | 7500 | Mid | 14250 | 8.090 |
| | 7500 | High | 14500 | 8.127 |
| BPSK | 128 | Low | 13750 | 0.140 |
| | 128 | Mid | 14250 | 0.140 |
| | 128 | High | 14500 | 0.141 |
| | 7500 | Low | 13750 | 8.084 |
| | 7500 | Mid | 14250 | 8.139 |
| | 7500 | High | 14500 | 8.184 |
| QPSK | 128 | Low | 13750 | 0.140 |
| | 128 | Mid | 14250 | 0.140 |
| | 128 | High | 14500 | 0.141 |
| | 7500 | Low | 13750 | 8.113 |
| | 7500 | Mid | 14250 | 8.067 |
| | 7500 | High | 14500 | 8.052 |

## 8PSK (128kbps) - Occupied Bandwidth - Ant 0

### 13750 MHz

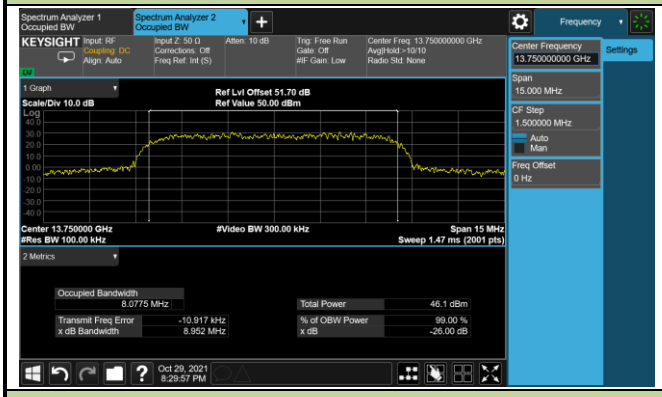
### 14250 MHz



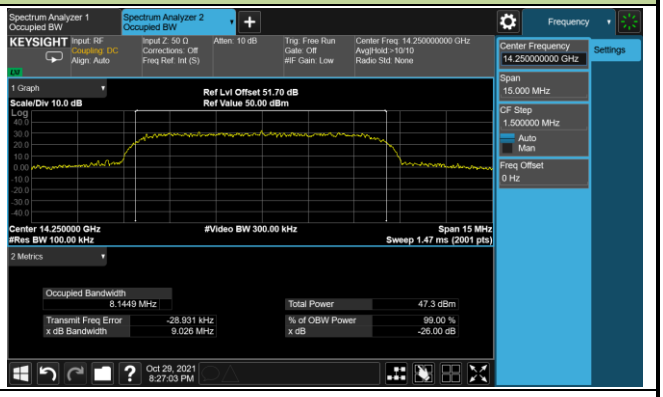

### 14500 MHz

## 8PSK (7500kbps) - Occupied Bandwidth - Ant 0

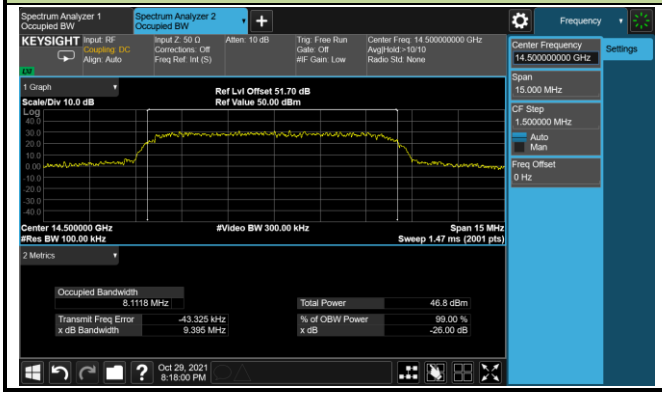
### 13750 MHz




### 14250 MHz

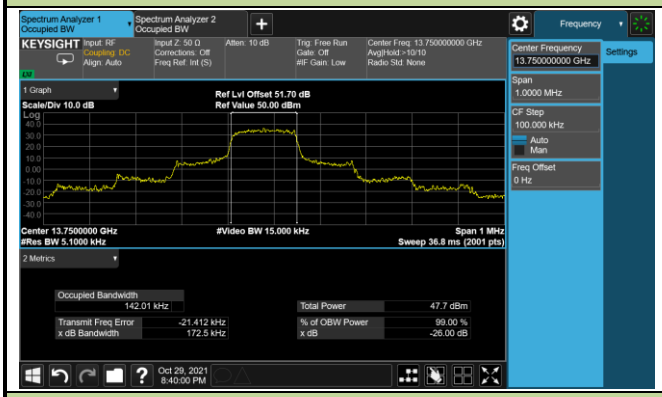



### 14500 MHz



## BPSK (128kbps) - Occupied Bandwidth - Ant 0

### 13750 MHz



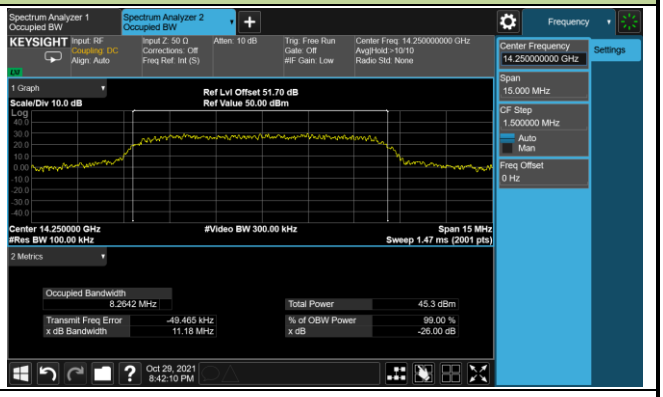

### 14250 MHz

### 14500 MHz

## BPSK (7500kbps) - Occupied Bandwidth - Ant 0

### 13750 MHz

### 14250 MHz



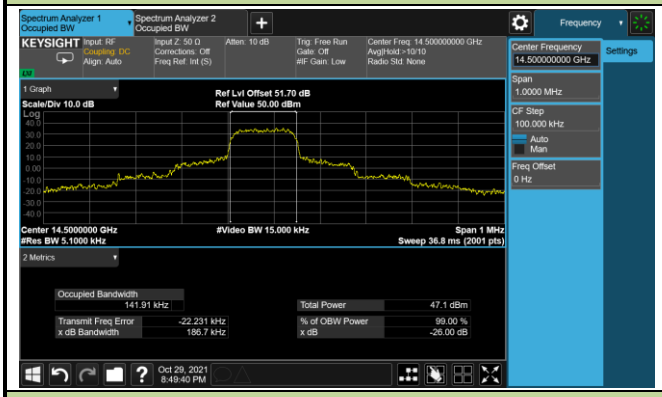

### 14500 MHz

## QPSK (128kbps) - Occupied Bandwidth - Ant 0

### 13750 MHz

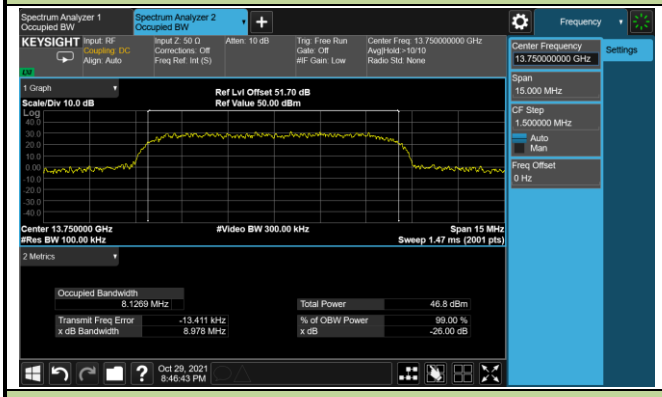
### 14250 MHz

### 14500 MHz

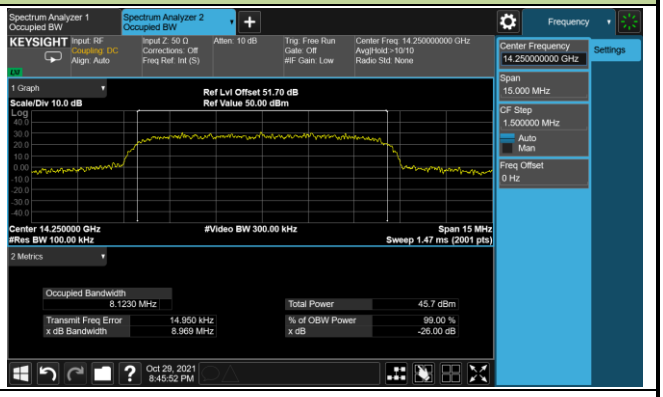



## QPSK (7500kbps) - Occupied Bandwidth - Ant 0

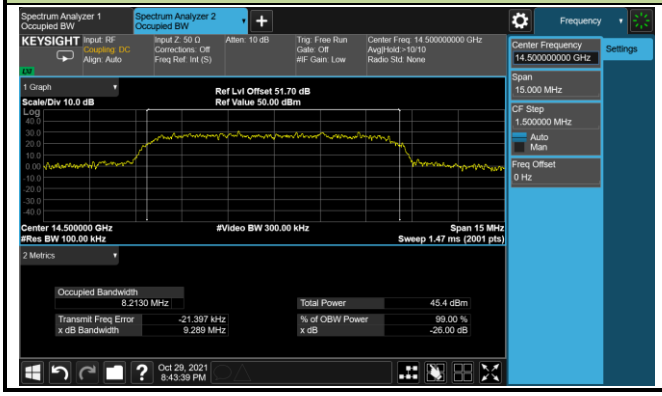
### 13750 MHz




### 14250 MHz




### 14500 MHz



## 8PSK (128kbps) - Occupied Bandwidth - Ant 1

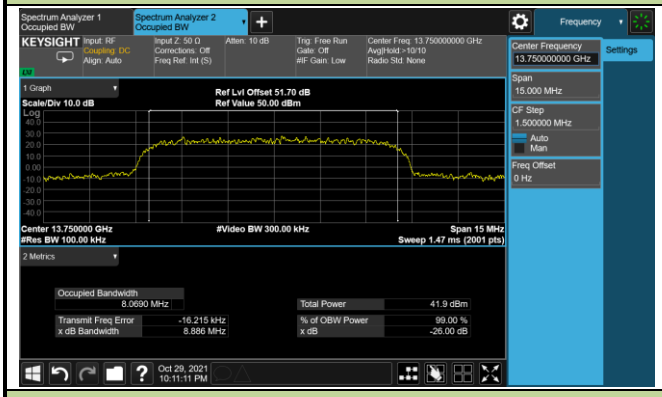
### 13750 MHz

### 14250 MHz

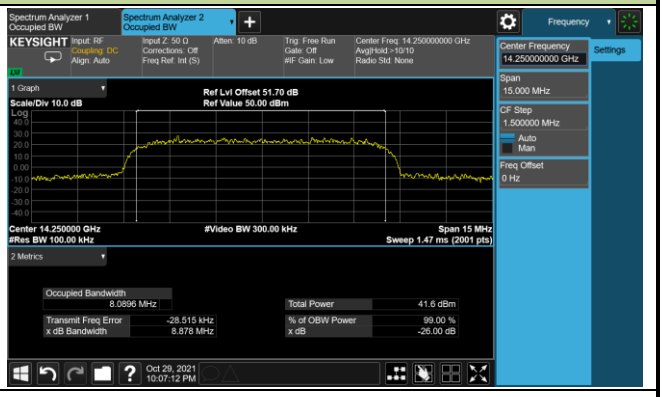
### 14500 MHz

## 8PSK (7500kbps) - Occupied Bandwidth - Ant 1

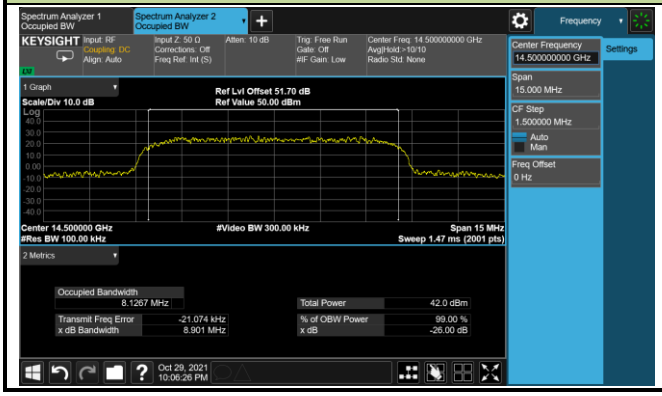
### 13750 MHz




### 14250 MHz

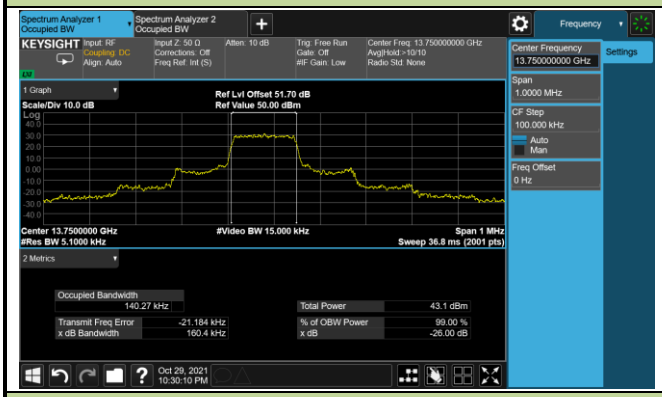



### 14500 MHz



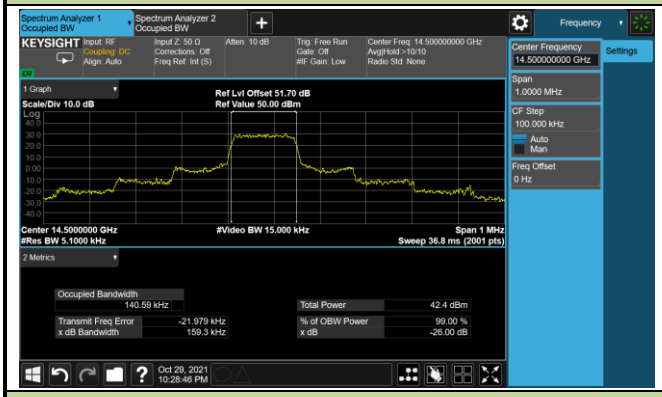
## BPSK (128kbps) - Occupied Bandwidth - Ant 1

### 13750 MHz



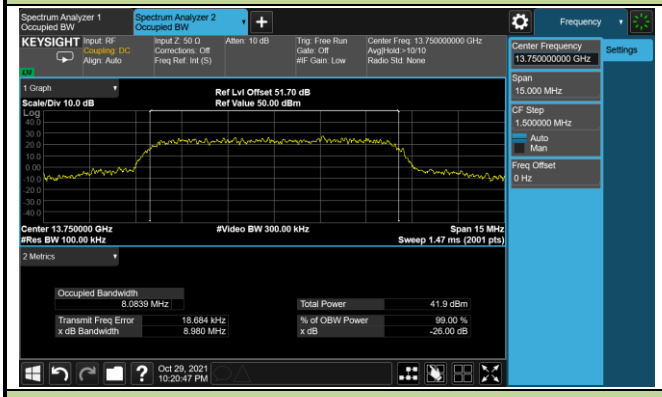

### 14250 MHz

### 14500 MHz

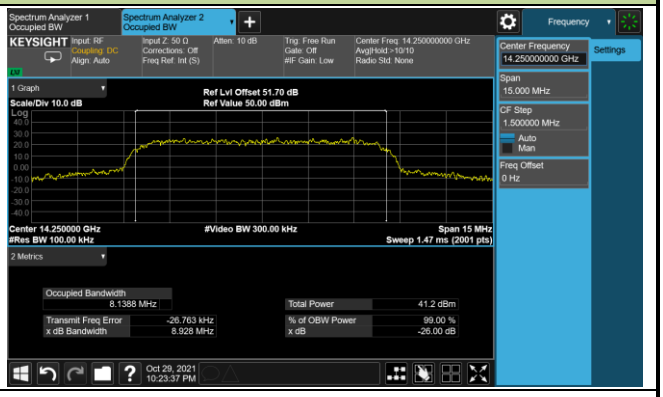



## BPSK (7500kbps) - Occupied Bandwidth - Ant 1

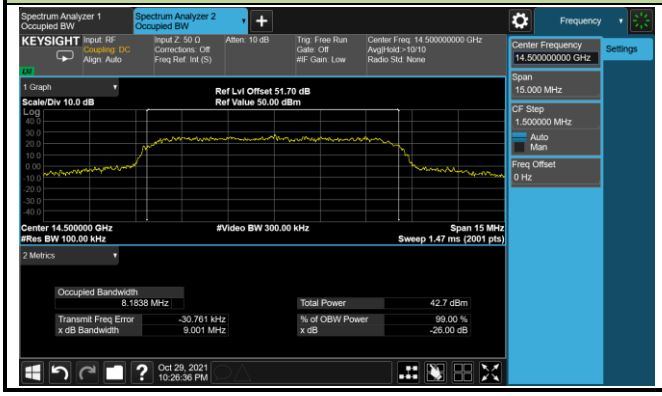
### 13750 MHz




### 14250 MHz



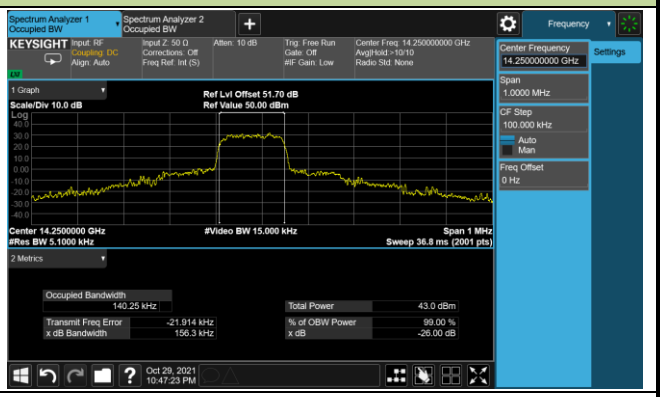

### 14500 MHz



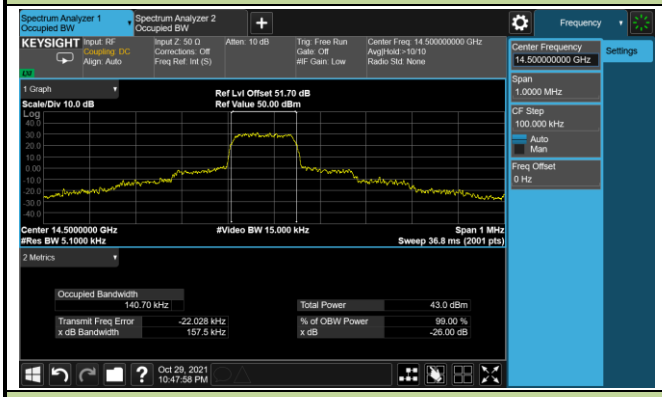
## QPSK (128kbps) - Occupied Bandwidth - Ant 1

### 13750 MHz

### 14250 MHz

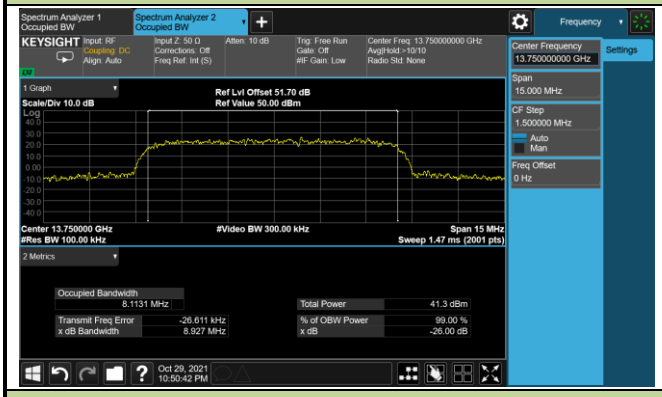



### 14500 MHz

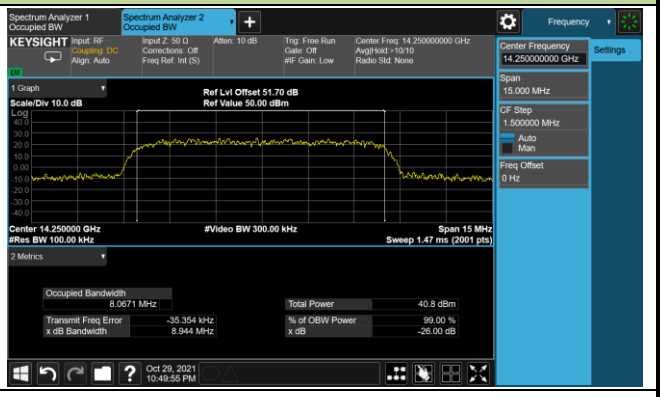



## QPSK (7500kbps) - Occupied Bandwidth - Ant 1

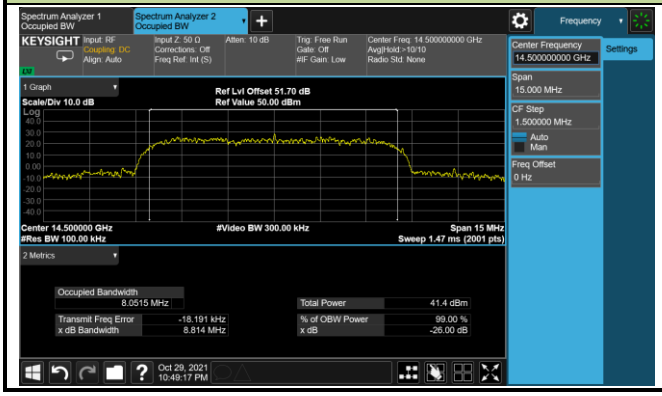
### 13750 MHz




### 14250 MHz




### 14500 MHz



### A.3 Power Spectral Density & Output Power Test Result

| | | | |
|---|---|---|---|
| Test Site | WZ-SR5 | Test Engineer | Luis Yang |
| Test Date | 2021/11/07 ~ 2022/02/24 | Test Item | Power Spectral Density |

| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 0 AVPSD (dBm/4kHz) | EIRP PSD (dBm/4kHz) | Limit (dBm/4kHz) | Result |
|---|---|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 7.147 | 40.357 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.183 | 38.393 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.617 | 36.827 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 7.245 | 40.455 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 3.465 | 36.675 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 3.618 | 36.828 | ≤ 70 | Pass |
| BPSK | 128 | Low | 13750 | 7.622 | 40.832 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.307 | 38.517 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.871 | 37.081 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 8.074 | 41.284 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 3.405 | 36.615 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 4.000 | 37.210 | ≤ 70 | Pass |
| QPSK | 128 | Low | 13750 | 7.669 | 40.879 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.594 | 38.804 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.627 | 36.837 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 7.919 | 41.129 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 3.237 | 36.447 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 3.975 | 37.185 | ≤ 70 | Pass |

Note 1: EIRP PSD (dBm/4kHz) = Ant 0 AVPSD (dBm/4kHz) + Antenna Gain (dBi).

Note 2: 10*log(4kHz/3kHz) = 1.25dB was added to the spectrum analyzer reference offset to correct the result.

| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 1 AVPSD (dBm/4kHz) | EIRP PSD (dBm/4kHz) | Limit (dBm/4kHz) | Result |
|---|---|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 6.373 | 39.583 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.511 | 38.721 | ≤ 70 | Pass |
| | 128 | High | 14500 | 2.676 | 35.886 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 6.436 | 39.646 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 3.206 | 36.416 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 2.966 | 36.176 | ≤ 70 | Pass |
| BPSK | 128 | Low | 13750 | 6.051 | 39.261 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 4.878 | 38.088 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.136 | 36.346 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 6.522 | 39.732 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 2.846 | 36.056 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 3.632 | 36.842 | ≤ 70 | Pass |
| QPSK | 128 | Low | 13750 | 6.382 | 39.592 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 4.872 | 38.082 | ≤ 70 | Pass |
| | 128 | High | 14500 | 2.919 | 36.129 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 6.730 | 39.940 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | 2.837 | 36.047 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 3.228 | 36.438 | ≤ 70 | Pass |

Note 1: EIRP PSD (dBm/4kHz) = Ant 1 AVPSD (dBm/4kHz) + Antenna Gain (dBi).

Note 2: 10*log(4kHz/3kHz) = 1.25dB was added to the spectrum analyzer reference offset to correct the result.

| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 0 AVPSD (dBm/4kHz) | Ant 1 AVPSD (dBm/4kHz) | EIRP PSD (dBm/4kHz) | Limit (dBm/4kHz) | Result |
|---|---|---|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 6.656 | 5.590 | 42.376 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.658 | 5.429 | 41.765 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.522 | 2.075 | 39.079 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 3.135 | 2.728 | 39.157 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | -1.052 | -0.744 | 35.325 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 0.283 | -0.744 | 36.020 | ≤ 70 | Pass |
| BPSK | 128 | Low | 13750 | 6.396 | 5.342 | 42.121 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.796 | 5.184 | 41.721 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.288 | 1.859 | 38.852 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 2.956 | 2.980 | 39.188 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | -1.097 | -0.589 | 35.385 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 0.242 | -0.375 | 36.165 | ≤ 70 | Pass |
| QPSK | 128 | Low | 13750 | 6.176 | 5.584 | 42.110 | ≤ 70 | Pass |
| | 128 | Mid | 14250 | 5.707 | 5.578 | 41.863 | ≤ 70 | Pass |
| | 128 | High | 14500 | 3.346 | 2.127 | 38.999 | ≤ 70 | Pass |
| | 7500 | Low | 13750 | 3.469 | 2.733 | 39.337 | ≤ 70 | Pass |
| | 7500 | Mid | 14250 | -0.902 | -0.594 | 35.475 | ≤ 70 | Pass |
| | 7500 | High | 14500 | 0.181 | -0.870 | 35.908 | ≤ 70 | Pass |

Note 1: EIRP PSD (dBm/4kHz) = 10*log {$10^{(\text{Ant 0 AVPSD}/10)}$ + $10^{(\text{Ant 1 AVPSD}/10)}$} (dBm/4kHz) + Antenna Gain (dBi).

Note 2: 10*log(4kHz/3kHz) = 1.25dB was added to the spectrum analyzer reference offset to correct the result.

| Test Site | WZ-SR5 | Test Engineer | Luis Yang |
|---|---|---|---|
| Test Date | 2021/10/13 ~ 2022/02/24 | Test Item | Output Power |

| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 0 AV Power (dBm) | E.I.R.P. (dBm) |
|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 21.77 | 54.98 |
| | 128 | Mid | 14250 | 19.84 | 53.05 |
| | 128 | High | 14500 | 17.97 | 51.18 |
| | 7500 | Low | 13750 | 39.20 | 72.41 |
| | 7500 | Mid | 14250 | 39.00 | 72.21 |
| | 7500 | High | 14500 | 39.02 | 72.23 |
| BPSK | 128 | Low | 13750 | 22.33 | 55.54 |
| | 128 | Mid | 14250 | 19.87 | 53.08 |
| | 128 | High | 14500 | 18.38 | 51.59 |
| | 7500 | Low | 13750 | 39.10 | 72.31 |
| | 7500 | Mid | 14250 | 39.11 | 72.32 |
| | 7500 | High | 14500 | 38.95 | 72.16 |
| QPSK | 128 | Low | 13750 | 22.34 | 55.55 |
| | 128 | Mid | 14250 | 19.81 | 53.02 |
| | 128 | High | 14500 | 17.96 | 51.17 |
| | 7500 | Low | 13750 | 39.25 | 72.46 |
| | 7500 | Mid | 14250 | 39.12 | 72.33 |
| | 7500 | High | 14500 | 39.08 | 72.29 |

Note 1: E.I.R.P (dBm) = AV Power (dBm) + Antenna Gain (dBi).

Note 2: Output power result is only for RF exposure evaluation.

| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 1 AV Power (dBm) | E.I.R.P. (dBm) |
|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 21.43 | 54.64 |
| | 128 | Mid | 14250 | 19.51 | 52.72 |
| | 128 | High | 14500 | 16.75 | 49.96 |
| | 7500 | Low | 13750 | 39.15 | 72.36 |
| | 7500 | Mid | 14250 | 39.03 | 72.24 |
| | 7500 | High | 14500 | 39.00 | 72.21 |
| BPSK | 128 | Low | 13750 | 20.23 | 53.44 |
| | 128 | Mid | 14250 | 19.49 | 52.70 |
| | 128 | High | 14500 | 17.28 | 50.49 |
| | 7500 | Low | 13750 | 39.08 | 72.29 |
| | 7500 | Mid | 14250 | 38.98 | 72.19 |
| | 7500 | High | 14500 | 39.20 | 72.41 |
| QPSK | 128 | Low | 13750 | 20.90 | 54.11 |
| | 128 | Mid | 14250 | 19.43 | 52.64 |
| | 128 | High | 14500 | 16.78 | 49.99 |
| | 7500 | Low | 13750 | 39.15 | 72.36 |
| | 7500 | Mid | 14250 | 39.08 | 72.29 |
| | 7500 | High | 14500 | 39.00 | 72.21 |

Note 1: E.I.R.P (dBm) = AV Power (dBm) + Antenna Gain (dBi).

Note 2: Output power result is only for RF exposure evaluation.

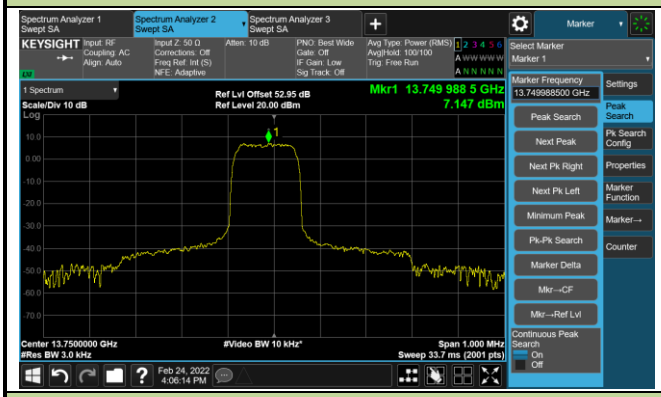
| Test Mode | Date Rate (kbps) | Test Channel | Test Freq. (MHz) | Ant 0 AV Power (dBm) | Ant 1 AV Power (dBm) | E.I.R.P. (dBm) |
|---|---|---|---|---|---|---|
| 8PSK | 128 | Low | 13750 | 20.73 | 19.98 | 56.59 |
| | 128 | Mid | 14250 | 19.83 | 19.42 | 55.85 |
| | 128 | High | 14500 | 17.43 | 16.11 | 53.04 |
| | 7500 | Low | 13750 | 35.88 | 36.02 | 72.17 |
| | 7500 | Mid | 14250 | 36.29 | 35.96 | 72.35 |
| | 7500 | High | 14500 | 36.60 | 35.23 | 72.19 |
| BPSK | 128 | Low | 13750 | 20.47 | 19.92 | 56.42 |
| | 128 | Mid | 14250 | 19.63 | 19.47 | 55.77 |
| | 128 | High | 14500 | 17.45 | 16.25 | 53.11 |
| | 7500 | Low | 13750 | 35.95 | 36.08 | 72.24 |
| | 7500 | Mid | 14250 | 36.28 | 35.95 | 72.34 |
| | 7500 | High | 14500 | 36.43 | 35.91 | 72.40 |
| QPSK | 128 | Low | 13750 | 20.52 | 19.74 | 56.37 |
| | 128 | Mid | 14250 | 19.62 | 19.11 | 55.59 |
| | 128 | High | 14500 | 17.32 | 16.28 | 53.05 |
| | 7500 | Low | 13750 | 35.83 | 36.00 | 72.14 |
| | 7500 | Mid | 14250 | 36.24 | 35.86 | 72.27 |
| | 7500 | High | 14500 | 36.30 | 35.86 | 72.31 |

Note 1: E.I.R.P (dBm) = $10*\log \{10^{(\text{Ant 0 AV Power}/10)} + 10^{(\text{Ant 1 AV Power}/10)}\}$ (dBm) + Antenna Gain (dBi).

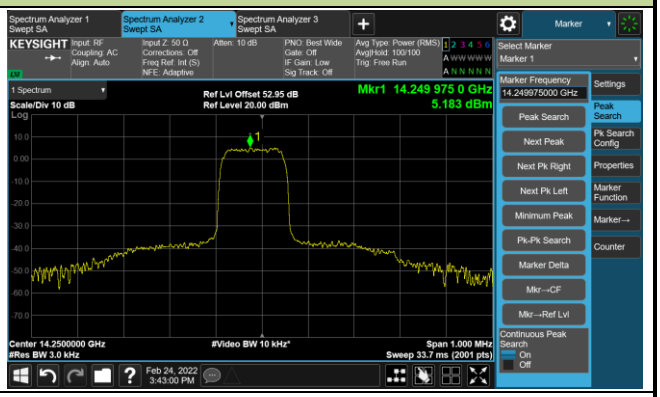
Note 2: Output power result is only for RF exposure evaluation.

## 8PSK (128kbps) - Average PSD - Ant 0

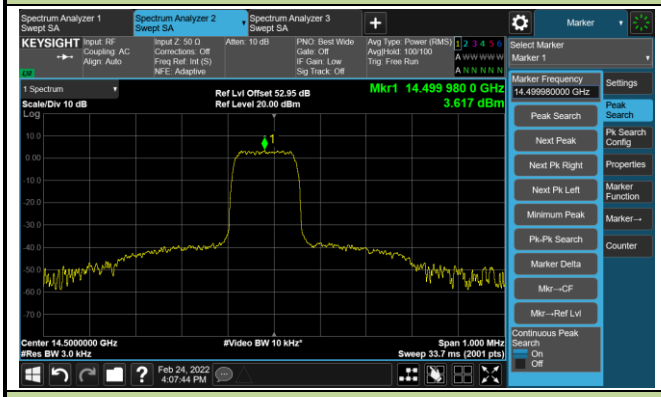
### 13750 MHz




### 14250 MHz

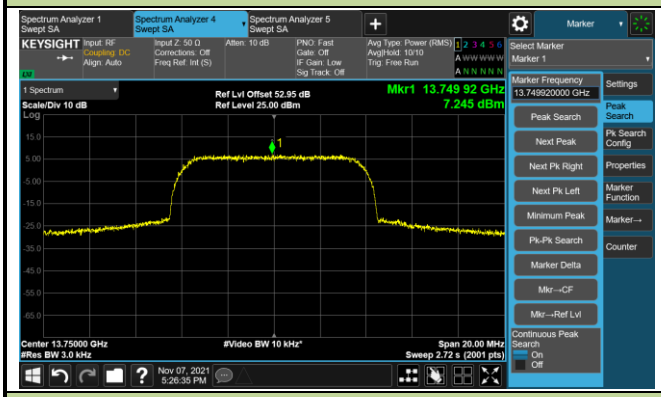



### 14500 MHz

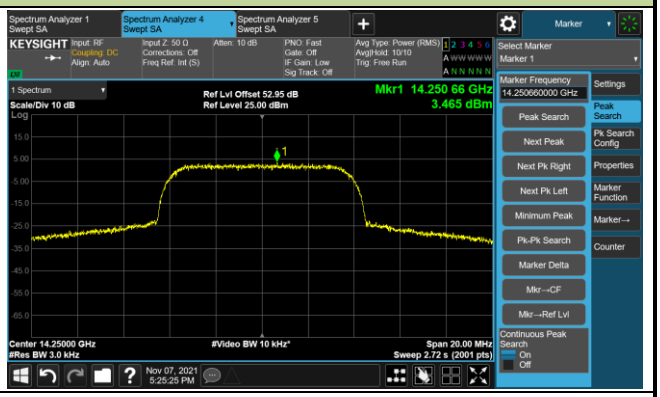



## 8PSK (7500kbps) - Average PSD - Ant 0

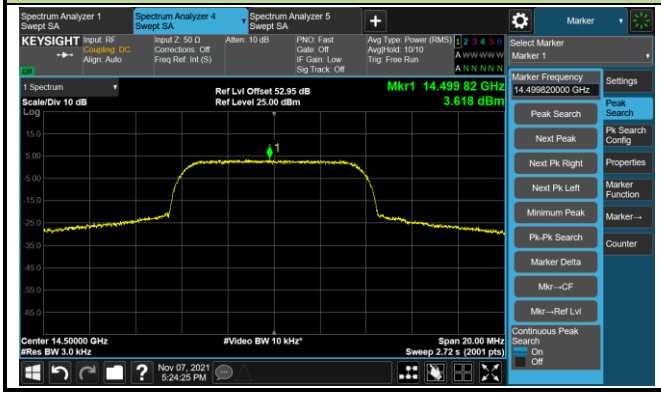
### 13750 MHz




### 14250 MHz

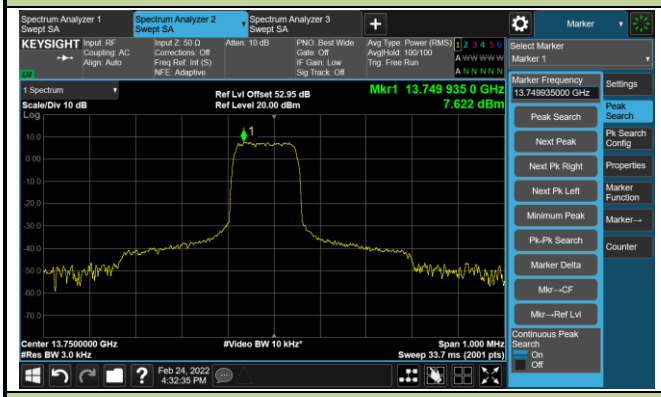



### 14500 MHz

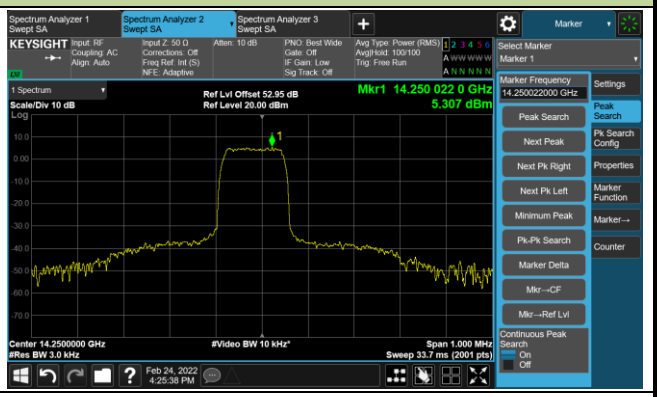


## BPSK (128kbps) - Average PSD - Ant 0

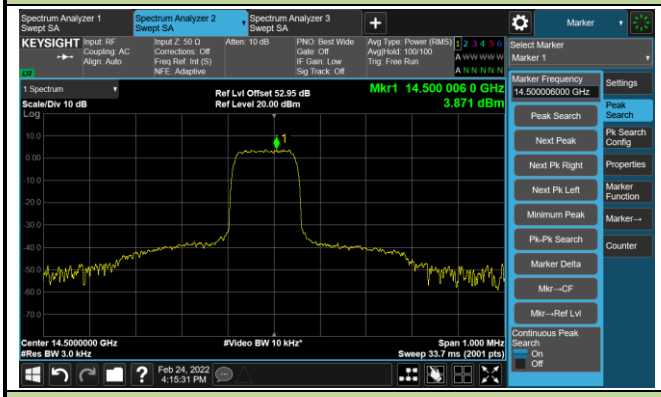
### 13750 MHz




### 14250 MHz

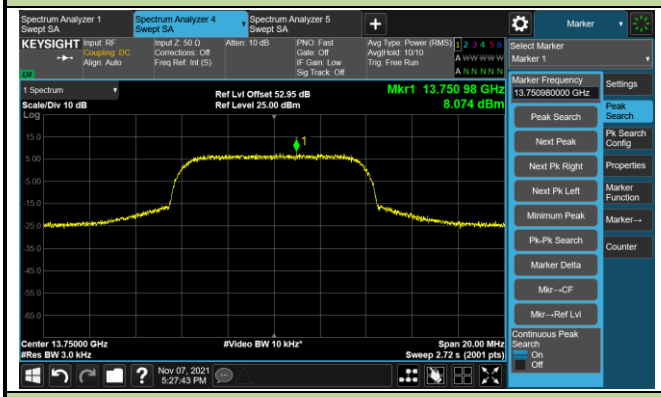



### 14500 MHz



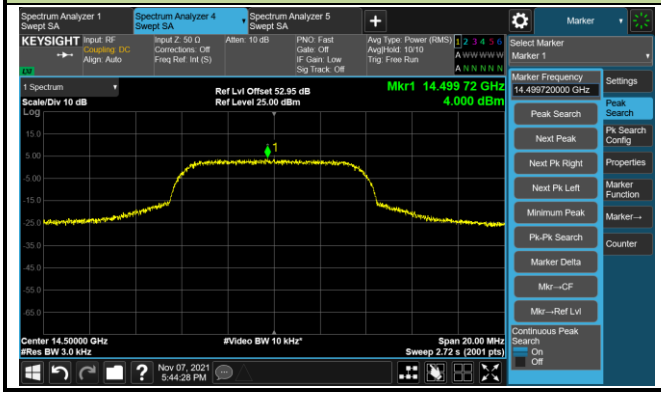

## BPSK (7500kbps) - Average PSD - Ant 0

### 13750 MHz



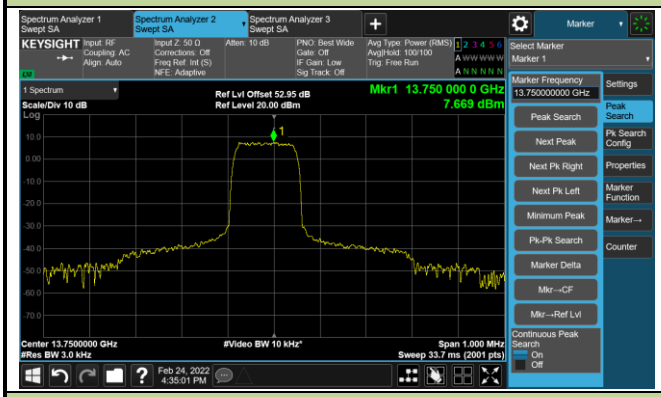

### 14250 MHz

### 14500 MHz

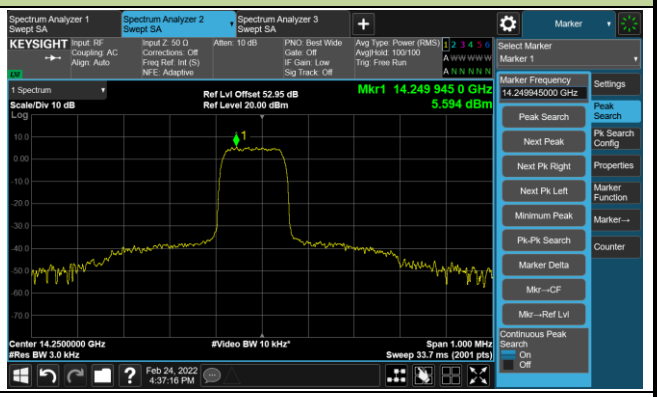


## QPSK (128kbps) - Average PSD - Ant 0

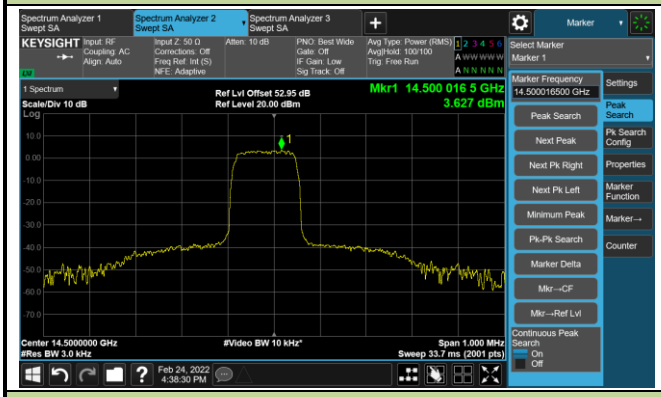
### 13750 MHz




### 14250 MHz

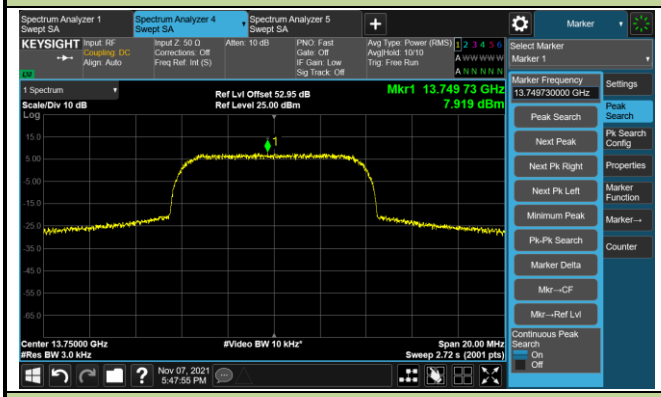



### 14500 MHz

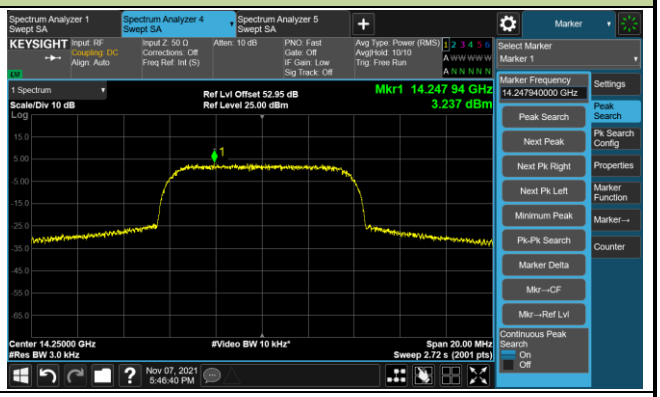



## QPSK (7500kbps) - Average PSD - Ant 0

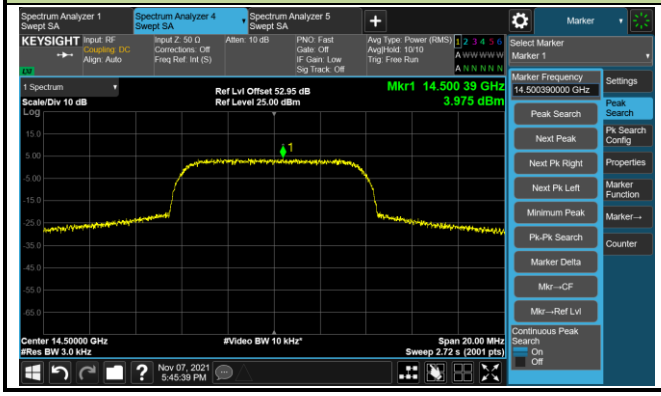
### 13750 MHz




### 14250 MHz

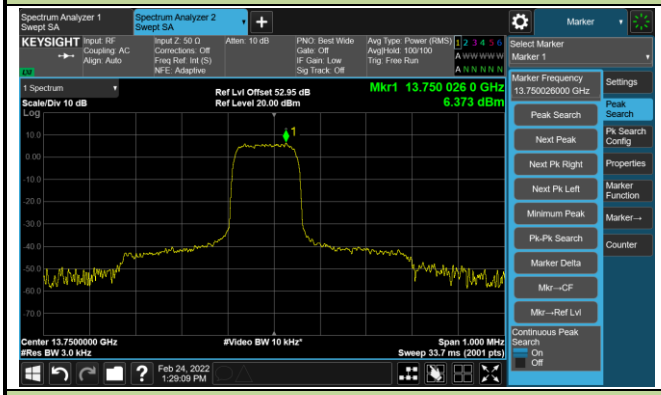



### 14500 MHz

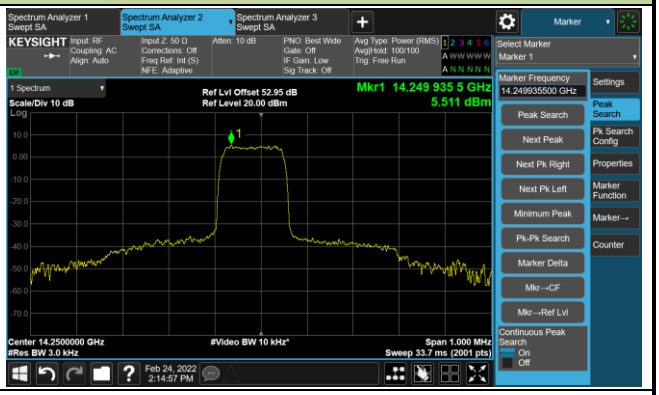


## 8PSK (128kbps) - Average PSD - Ant 1

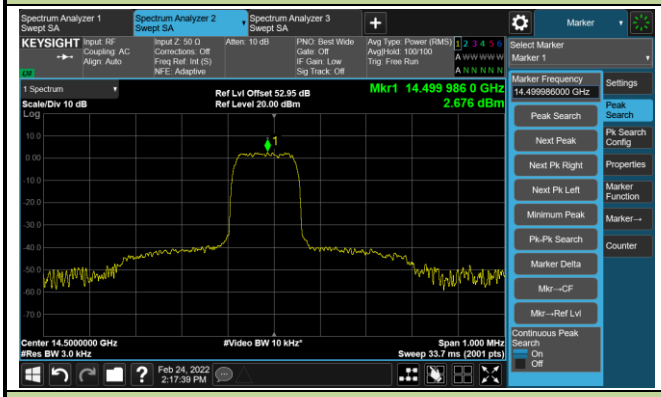
### 13750 MHz




### 14250 MHz

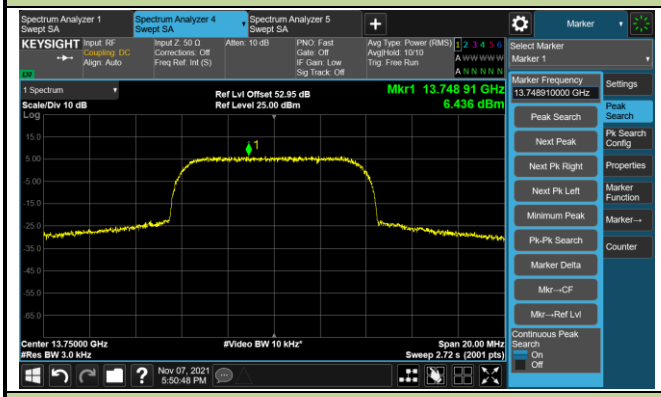



### 14500 MHz

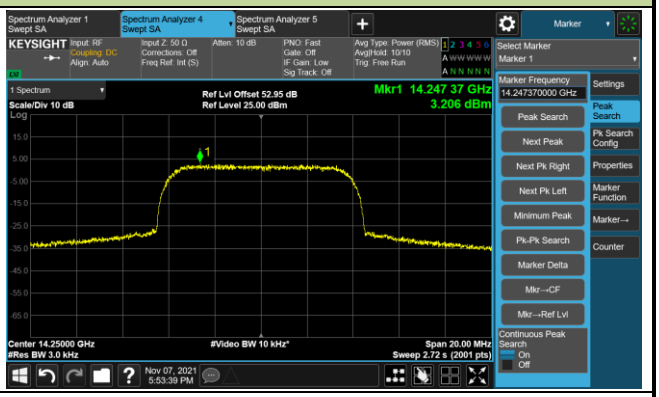


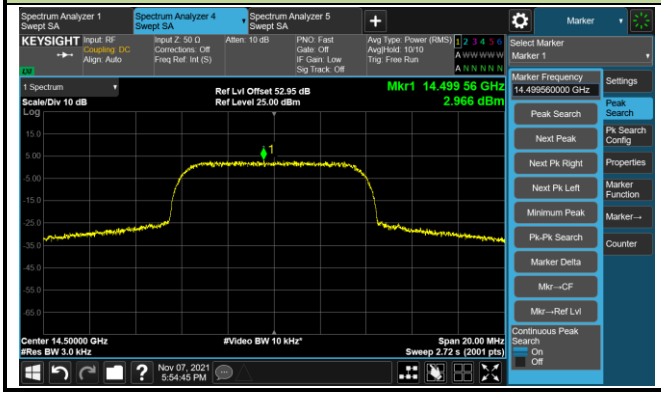

## 8PSK (7500kbps) - Average PSD - Ant 1

### 13750 MHz




### 14250 MHz




### 14500 MHz