RF MEASUREMENT REPORT

FCC ID:	2AUBBHSA-FUF
Applicant:	China Starwin Science & Technology Co., Ltd
Product:	Phased Array Satellite Communication Terminal
Model No.:	HSA-FUF
Brand Name:	StarWin
FCC Classification:	Licensed Non-Broadcast Station Transmitter (TNB)
FCC Rule Part(s):	FCC CFR 47 Part 2, FCC CFR 47 Part 25
Result:	Complies
Received Date:	2023-02-13
Test Date:	2023-02-17 ~ 2023-03-21

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.

Revision History

Report No.	Version	Description	Issue Date	Note
2302RSU009-U4	V01	Initial Report	2023-04-07	Invalid
2302RSU009-U4	V02	Revised some information	2023-04-17	Valid

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Description Page

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

<table>
<tr><td>☒</td><td colspan="5">Test Site – MRT Suzhou Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Suzhou - Wuzhong)
D8 Building, No.2 Tian’edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Laboratory Location (Suzhou - SIP)
4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="5">A2LA: 3628.01 CNAS: L10551
FCC: CN1166 ISED: CN0001</td></tr>
<tr><td></td><td>VCCI:</td><td>☐R-20025</td><td>☐G-20034</td><td>☐C-20020</td><td>☐T-20020</td></tr>
<tr><td></td><td></td><td>☐R-20141</td><td>☐G-20134</td><td>☐C-20103</td><td>☐T-20104</td></tr>
<tr><td>☐</td><td colspan="5">Test Site – MRT Shenzhen Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Shenzhen)
1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
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FCC: CN1284 ISED: CN0105</td></tr>
<tr><td>☐</td><td colspan="5">Test Site – MRT Taiwan Laboratory</td></tr>
<tr><td></td><td colspan="5">Laboratory Location (Taiwan)
No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)</td></tr>
<tr><td></td><td colspan="5">Laboratory Accreditations</td></tr>
<tr><td></td><td colspan="5">TAF: L3261-190725
FCC: 291082, TW3261 ISED: TW3261</td></tr>
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1.4. Product Information

Product Name	Phased Array Satellite Communication Terminal
Model No.	HSA-FUF
EUT Identification No.	Eleph23020070
Wi-Fi Specification	802.11b/g/n
Antenna Information	Refer to section 1.5
Satellite Specification	Transmit: 14.00~14.50GHz Receive: 10.70~12.75GHz
GNSS Specification	GPS, BDS
Hardware Version	ACU-2.0, ESA-DRV-V1.0, ZL60P-DRV-V5.1
Software Version	KU_1.1.2B
Working Voltage	By Adapter
Operating Temperature	-40 ~ 70 °C
Accessories	
Adapter	Model: HEP-480-36A Input: 100-240V ~ 50/60Hz 2.0A Output: 36V=13.3A Rated Power: 478.8W
Note: 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 under Test

Frequency Range	Transmit: 14.00 ~ 14.50 GHz Receive: 10.70 ~ 12.75 GHz
Test Frequency	Low channel: 14.00 GHz Mid channel: 14.25 GHz High channel: 14.50 GHz
Type of Modulation	8PSK
Data Rate	7500kbps
Antenna Type	Phased-array antenna
Antenna Gain	33.1dBi(in range of ±5 degree) 8.6dBi (out range of ±5 degree)

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

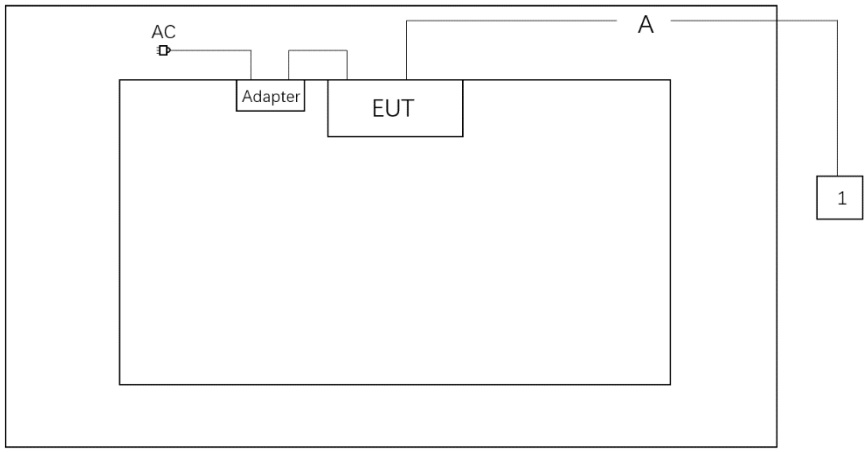
2. Test Configuration

2.1. Test Mode

Mode 1: Transmit by 8PSK at Channel 14.00 GHz
Mode 2: Transmit by 8PSK at Channel 14.25 GHz
Mode 3: Transmit by 8PSK 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 – Radiated Emission testing & AC Conducted Emissions


Cable Type		Cable Description
A	LAN Cable	Non shielded, > 10m

Product		Manufacturer	Model No.
1	Notebook	Lenovo	E431

2.3. Test Software

The device is connected to the notebook through a network cable, the frequency and rate set on the web page of the EUT IP address. The off-axis test is to modify the off-axis Angle and polarization direction in the ESA_TOOL_V1.04 software through the special order provided by the customer.

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
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2023-12-28	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2023-08-22	WZ-AC1
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2023-05-08	WZ-AC1
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2023-06-21	WZ-AC1
Anechoic Chamber	TDK	WZ-AC1	MRTSUE06212	1 year	2023-04-21	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE06403	1 year	2023-06-06	WZ-AC1
Signal Analyzer	Keysight	N9010B	MRTSUE06607	1 year	2023-12-28	WZ-AC1
Thermohygrometer	testo	608-H1	MRTSUE11039	1 year	2023-11-01	WZ-AC1
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2023-09-29	WZ-AC1
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06597	1 year	2023-11-05	WZ-AC1
Preamplifier	EMCI	EMC184045SE	MRTSUE06640	1 year	2024-01-12	WZ-AC1
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2023-06-04	WZ-SR2
Shielding Room	MIX-BEP	WZ-SR2	MRTSUE06215	5 years	2026-12-20	WZ-SR2
Thermohygrometer	testo	608-H1	MRTSUE06404	1 year	2023-06-06	WZ-SR2
EMI Test Receiver	R&S	ESR3	MRTSUE06909	1 year	2023-10-27	WZ-SR2
mmWave Antenna	MI-WWAVE	261U-25/383	MRTSUE06273	N/A	N/A	SIP-AC3
mmWave Antenna	A-INFO	LB-15-25-A	MRTSUE06409	N/A	N/A	SIP-AC3
Waveguide Harmonic Mixer	Keysight	M1970V	MRTSUE06271	3 years	2025-09-22	SIP-AC3
Signal Analyzer	Keysight	N9020B	MRTSUE06604	1 year	2023-11-07	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2023-11-01	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2023-11-27	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2023-12-22	SIP-AC3

Software	Version	Function
EMI Software	V3.0.0	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable

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)): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~75GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~75GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.3dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.5dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.3dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 3.2%

6. Test Result

6.1. Summary

FCC Section(s)	Test Description	Test Condition	Verdict
2.1049	Occupied Bandwidth	Radiated	Pass
2.1046(a), 25.204(a)	Power Spectral Density & Output Power		Pass
25.218	Off-axis EIRP density		Pass
2.1055, 25.202(d)	Frequency Tolerance		Pass
2.1053, 25.202(f)	Radiated Spurious Emission		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

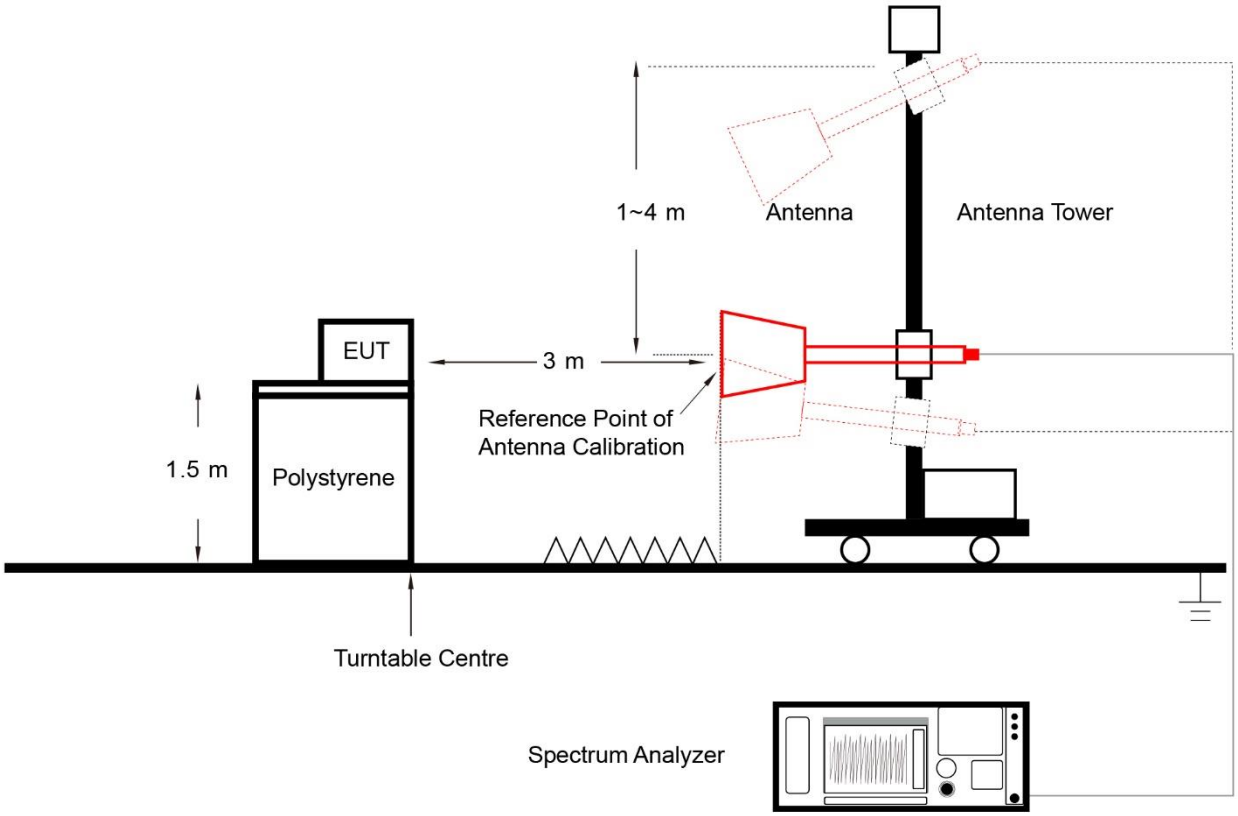
6.2.2. Test Procedure used

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.

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 5.2.4.4 (Output Power Measurement)

6.3.3. Test Setting

Power Spectral Density Measurement using spectrum analyzer

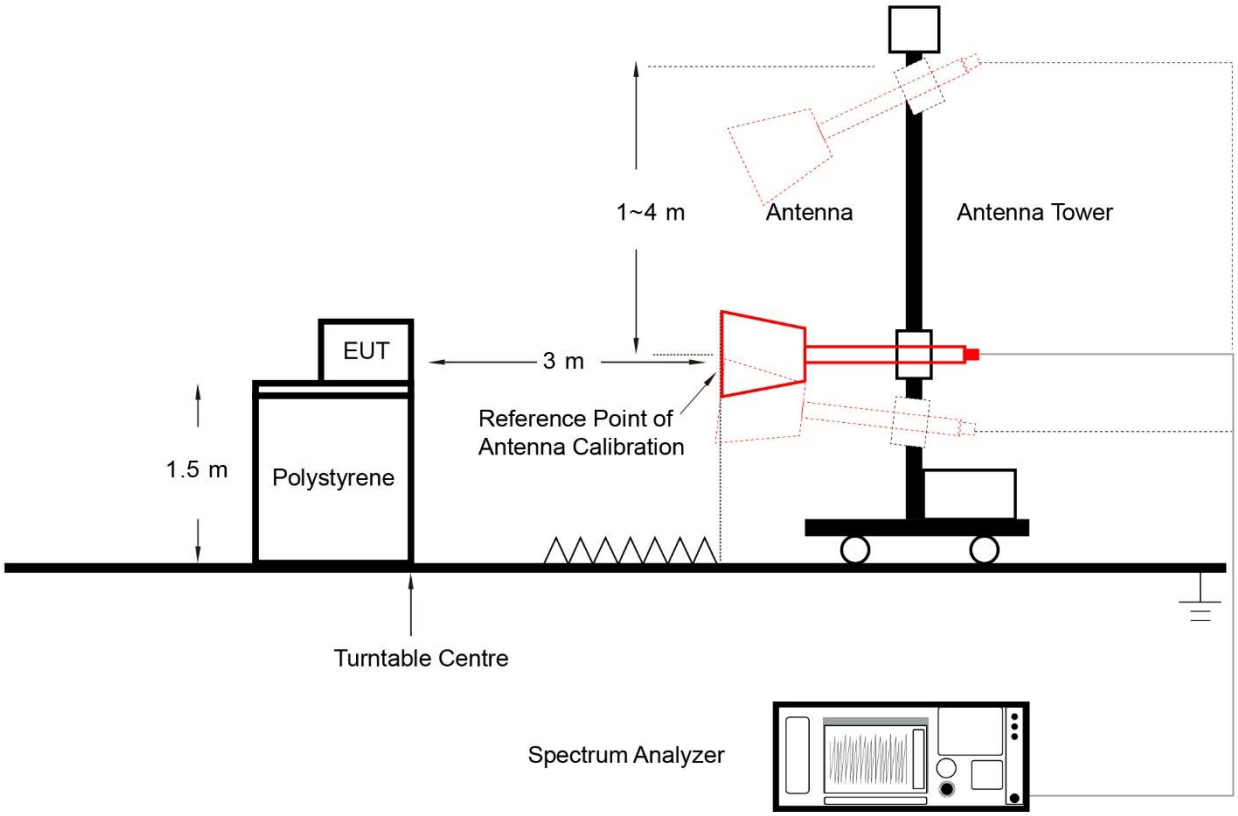
1. Set span to 2 to 3 times the OBW
2. Set RBW = 1% to 5% of the OBW

   (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. Detector = power averaging (RMS)
5. Trace mode = Trace average
6. Trace was allowed to stabilize
7. 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 spectrum analyzer

1. Set span to 2 to 3 times the OBW
2. Set RBW = 1% to 5% of the OBW
3. Set VBW ≥ 3 × RBW
4. Detector = power averaging (RMS)
5. Trace mode = Trace average
6. Trace was allowed to stabilize
7. Compute power by integrating the spectrum across the OBW of the signal using the channel power measurement function with channel limits set equal to the OBW band edges.

6.3.4. Test Setup



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

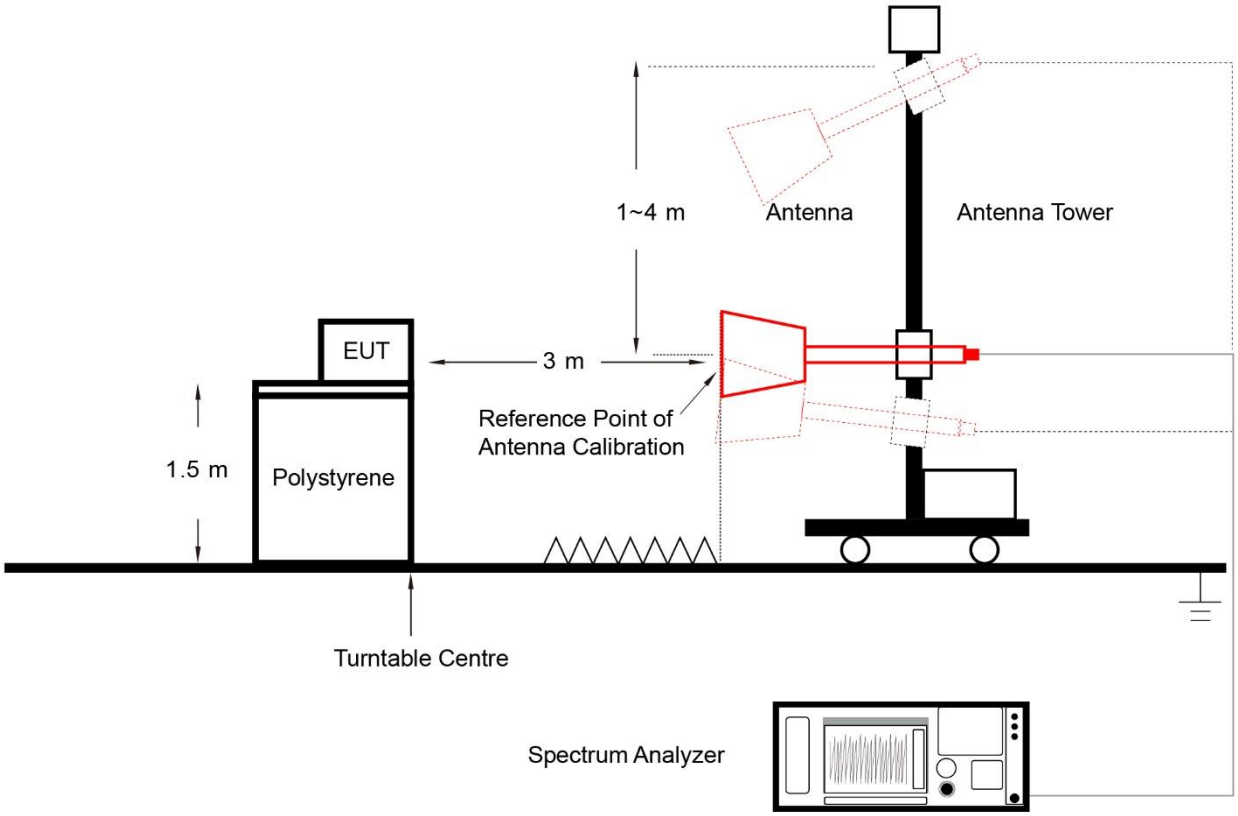
6.4.3. Test Setting

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. Detector = power averaging (RMS)
5. Trace mode = Trace average
6. Trace was allowed to stabilize
7. 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. Frequency Tolerance

6.5.1. 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.

6.5.2. Test Procedure used

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

6.5.3. 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:

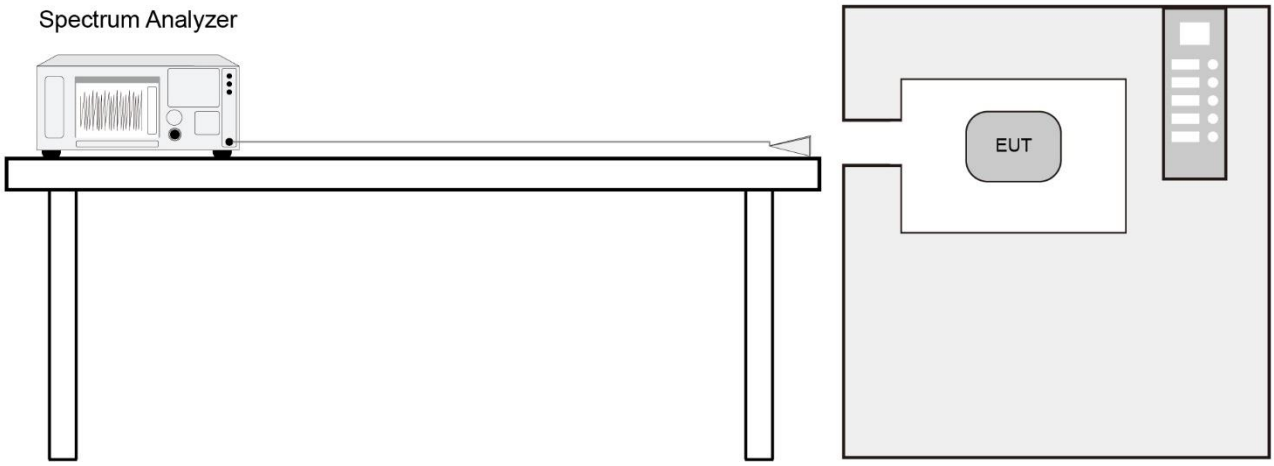
a) At 10°C intervals of temperatures between -30°C and +50°C at the manufacturer's rated supply voltage, and

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).

6.5.4. Test Setup



6.5.5. Test Result

Refer to Appendix A.5.

6.6. Radiated Spurious Emission

6.6.1. 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:

(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;

(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.

For Out-Of-Band Emission, The emission limit equal to 82.3dBμV/m.

E (dBμV/m) = EIRP (dBm) - 20 log D + 104.8; where D is the measurement distance in meters.

6.6.2. Test Procedure used

ANSI C63.26-2015 - Section 5.7

6.6.3. Test Setting

Spurious Emission – In-Band Emission

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 3kHz for in-band mask
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).

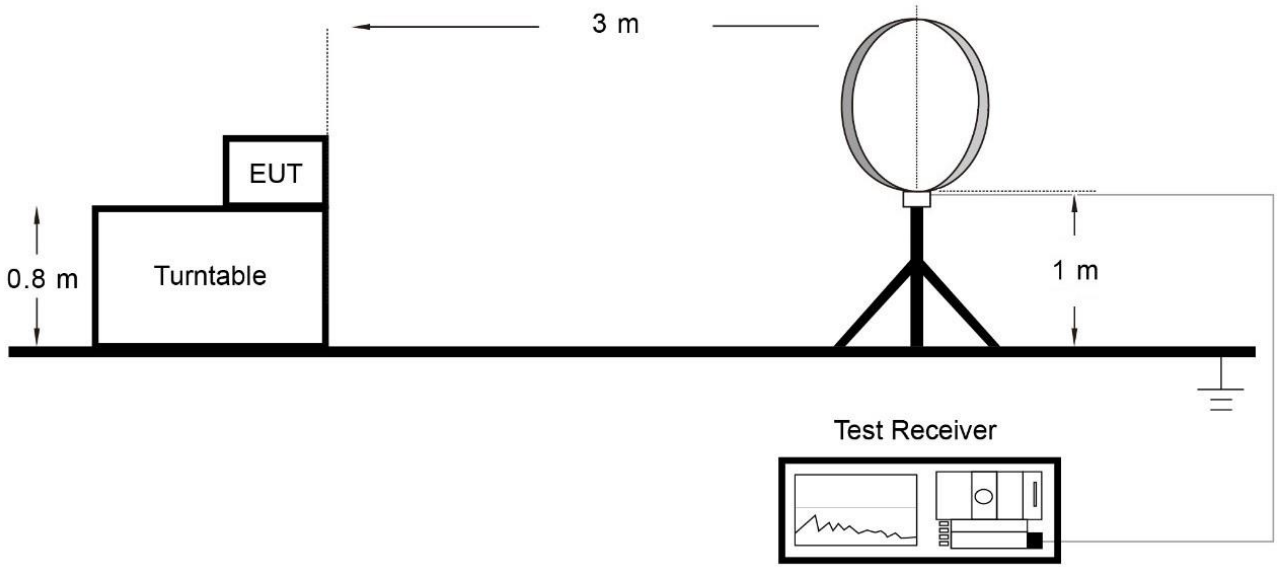
Spurious Emission – Out-of-Band Emission

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

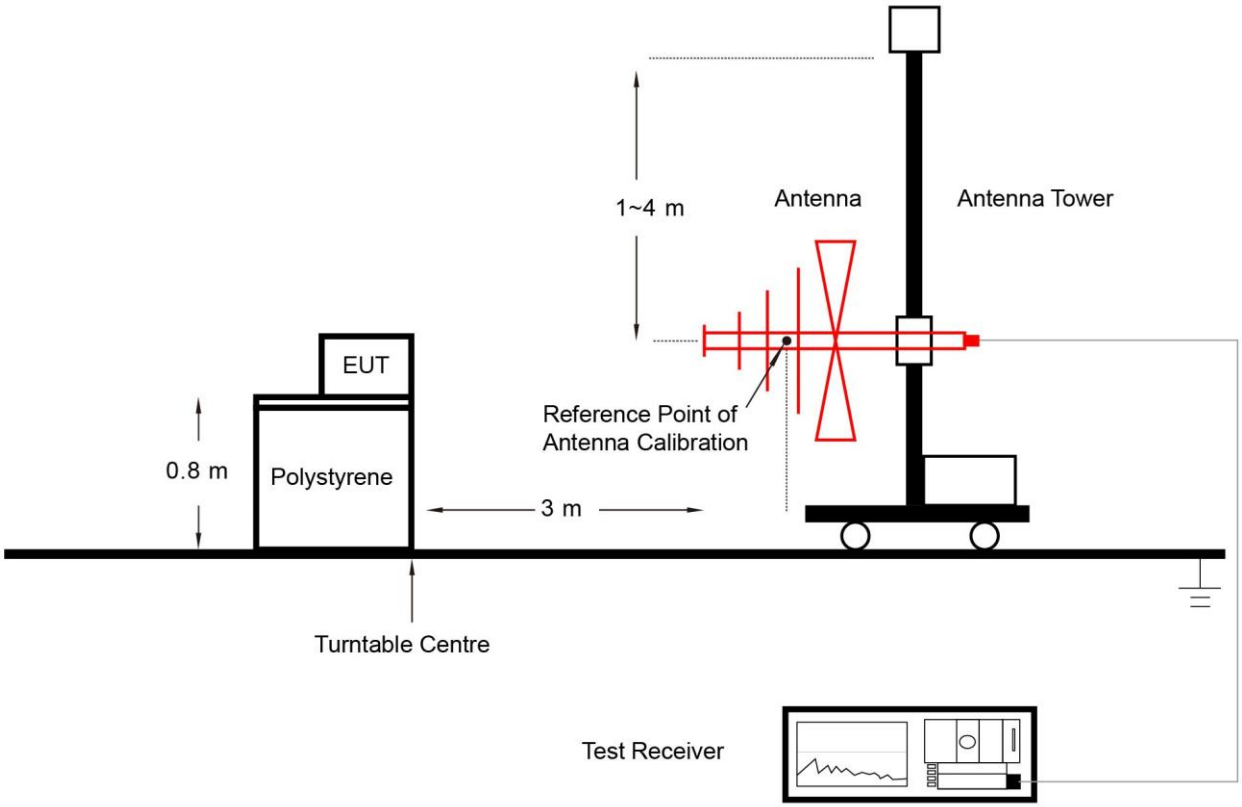
   Set the RBW greater than 4kHz in order to increase the measurement speed
3. VBW = 3 * RBW
4. Detector = power averaging (RMS)
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize

6.6.4. Test Setup

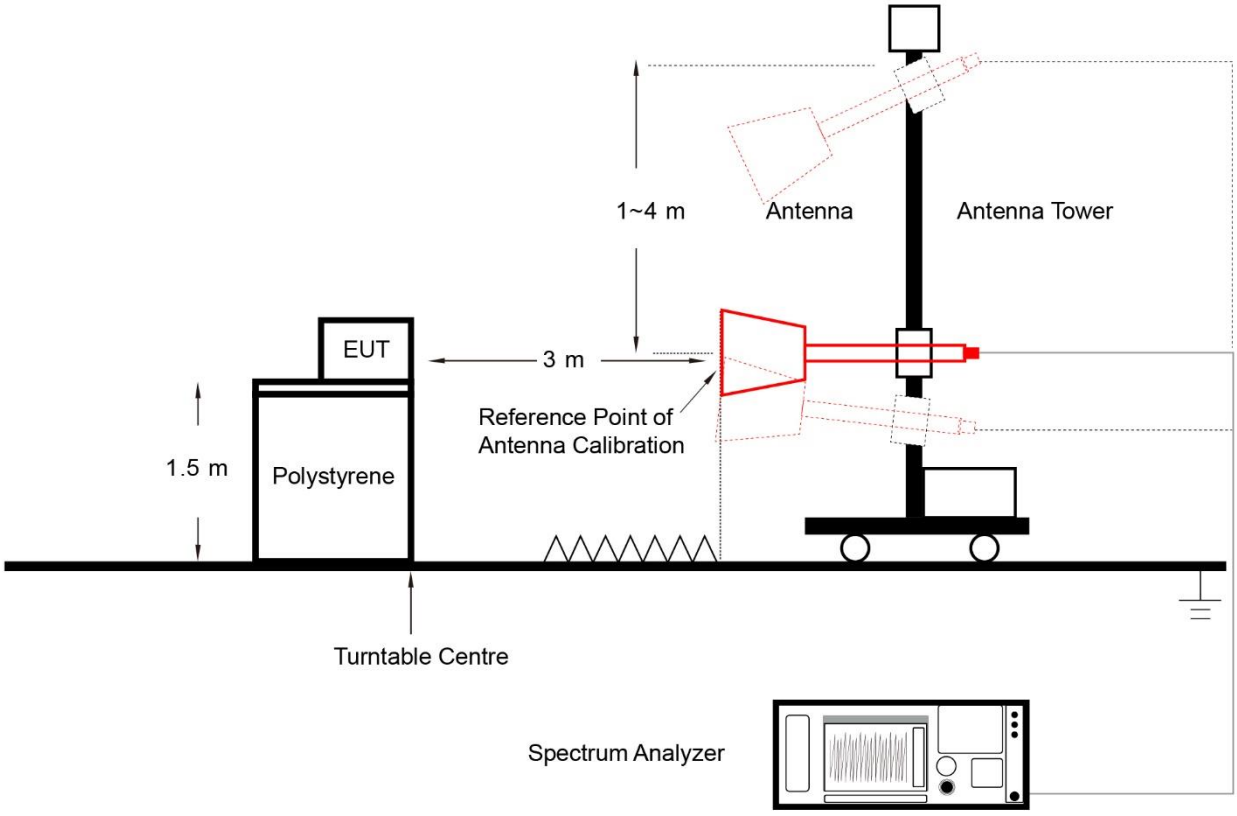
9kHz ~ 30MHz Test Setup



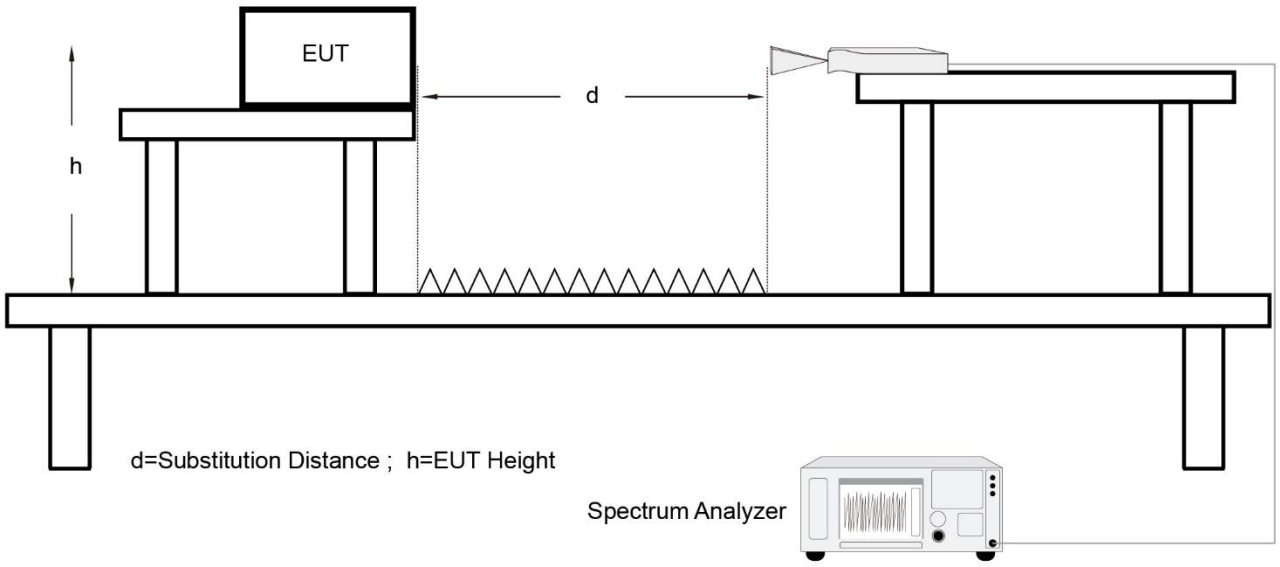
30MHz ~ 1GHz Test Setup



1GHz ~ 40GHz Test Setup



40GHz ~ 75GHz Test Setup



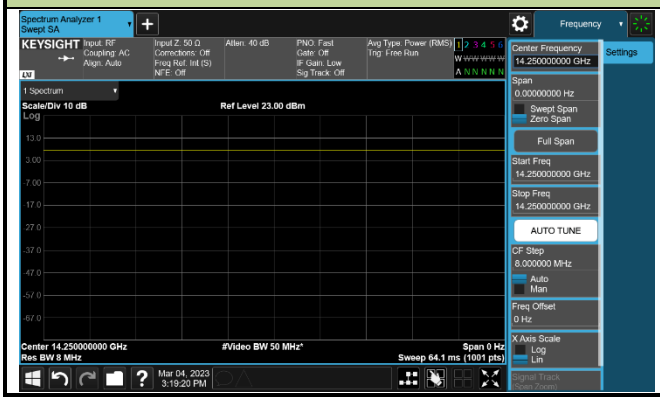
6.6.5. Test Result

Refer to Appendix A.6.

Appendix A - Test Result

A.1 Duty Cycle Test Result

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-03-04		

Test Mode	Duty Cycle
8PSK	100%
8PSK - 14250 MHz	
	

A.2 Occupied Bandwidth Test Result

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25		

Test Mode	Date Rate (kbps)	Test Channel	Test Frequency (MHz)	99% Bandwidth (MHz)
8PSK	7500	Low	14000	14.353
	7500	Mid	14250	13.768
	7500	High	14500	14.674

Occupied Bandwidth

14000 MHz

14250 MHz

14500 MHz

A.3 Power Spectral Density & Output Power Test Result

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-03-01	Test Item	Power Spectral Density

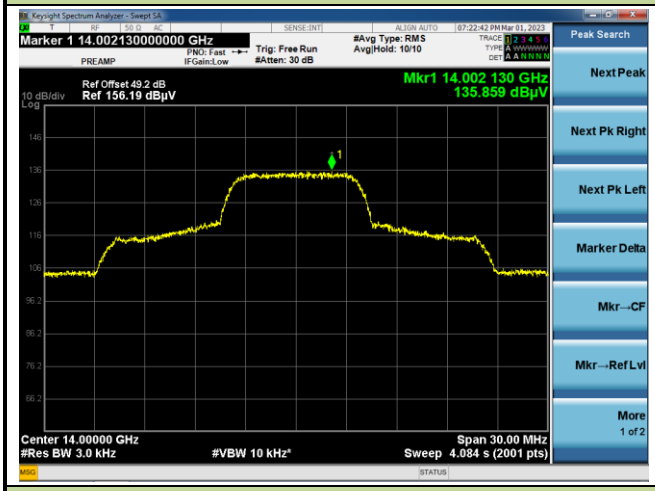
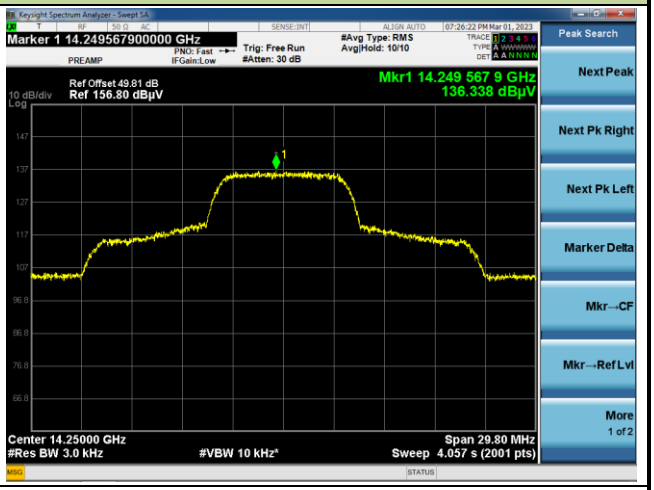
Test Mode	Date Rate (kbps)	Test Channel	Test Freq. (MHz)	AVPSD (dBμV/3kHz)	AVPSD (dBm/3kHz)	EIRP PSD (dBm/4kHz)	EIRP PSD (dBW/4kHz)	Limit (dBW/4kHz)	Result
8PSK	7500	Low	14000	135.859	40.659	41.909	11.909	≤ 40	Pass
	7500	Mid	14250	136.338	41.138	42.388	12.388	≤ 40	Pass
	7500	High	14500	137.018	41.818	43.068	13.068	≤ 40	Pass

Note 1: AVPSD (dBm/3KHz) = AVPSD (dBμV/m/3kHz) + Correction Factor @ 3m, Correction Factor @ 3m = 20log(D) - 104.7; where D is the measurement distance @3m = -95.2dB

Note 2: EIRP PSD (dBm/4kHz) = AVPSD (dBm/3kHz) + Factor (dB).

Note 3: Factor = 10*log(4kHz/3kHz) = 1.25dB.

Note 4: EIRP PSD (dBW/4kHz) = EIRP PSD (dBm/4kHz) - 30.

Average PSD	
14000 MHz	14250 MHz
	
14500 MHz	
	

Note: The measured level was in dBµV/m, which had compensated cable loss (dB), antenna factor (dB/m) in SA's Ref offset, but showed dBµV in SA's screen.

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Item	Output Power

Test Mode	Date Rate (kbps)	Test Channel	Test Freq. (MHz)	E.I.R.P. (dBm)
8PSK	7500	Low	14000	73.00
	7500	Mid	14250	73.80
	7500	High	14500	74.70

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

A.4 Off-axis EIRP Density Test Result

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-03-01 ~ 03-21	Test Item	Off-axis EIRP Density

Test Mode	Test Freq. (MHz)	EIRP PSD (dBμV/3kHz)	EIRP PSD (dBm/3kHz)	EIRP PSD (dBm/4kHz)	EIRP PSD (dBW/4kHz)	Angle (°)	Limit (dBW/4kHz)	Result
Conventional Ku-band								
8PSK	14000	126.804	31.604	32.854	2.854	1.5	10.60	Pass
		118.753	23.553	24.803	-5.197	8.6	-6.00+3 Note4	
		116.665	21.465	22.715	-7.285	9.2	-6.09	
		108.978	13.778	15.028	-14.972	19.1	-14.00+3 Note4	
	14250	128.48	33.28	34.53	4.53	1.5	10.60	
		118.699	23.499	24.749	-5.251	8.6	-6.00+3 Note4	
		116.742	21.542	22.792	-7.208	9.2	-6.09	
		110.568	15.368	16.618	-13.382	19.1	-14.00+3 Note4	
	14500	128.831	33.631	34.881	4.881	1.5	10.60	
		117.547	22.347	23.597	-6.403	8.6	-6.00	
		115.628	20.428	21.678	-8.322	9.2	-6.09	
		110.299	15.099	16.349	-13.651	19.1	-14.00+3Note4	

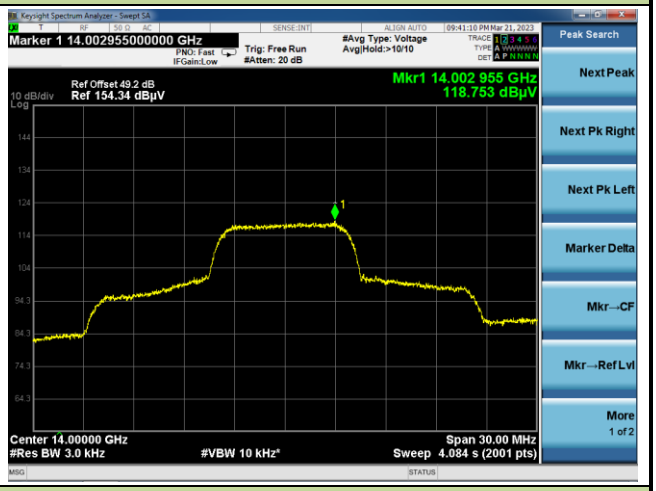
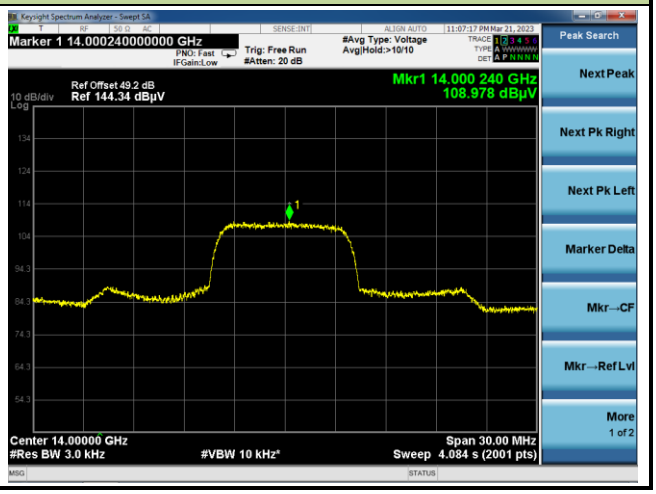
Note 1: EIRP PSD (dBm/3KHz) = EIRP PSD (dBμV/m/3kHz) + Correction Factor @ 3m, Correction Factor @ 3m = 20log(D) - 104.7; where D is the measurement distance @3m = -95.2dB

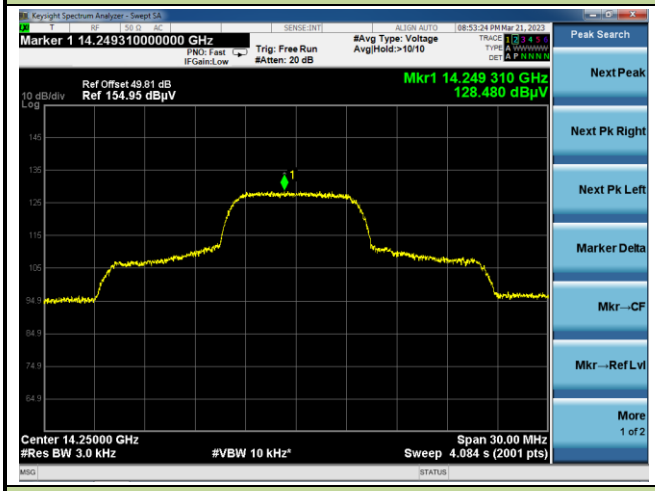
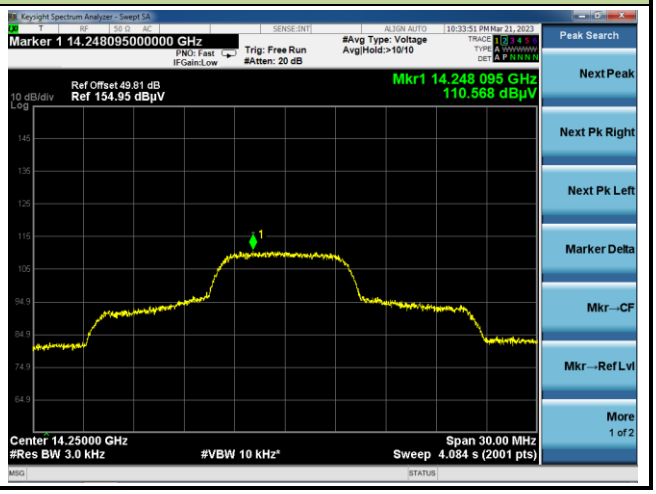
Note 2: EIRP PSD (dBm/4kHz) = EIRP PSD (dBm/3kHz) + Factor (dB).

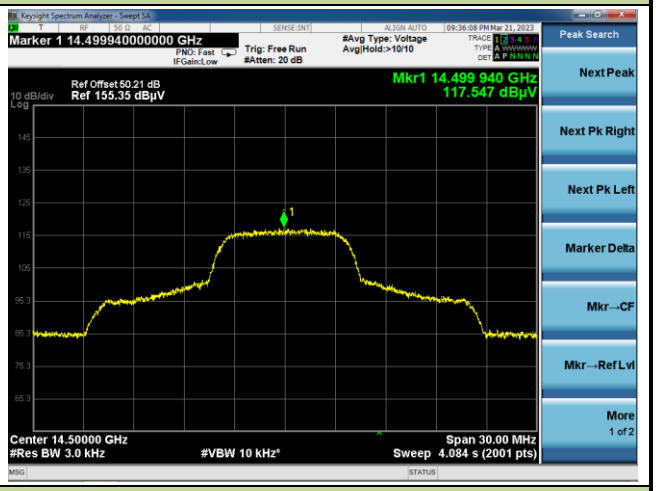
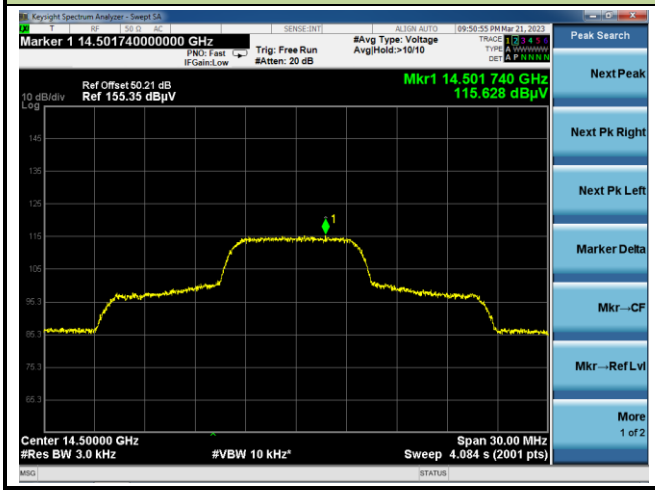
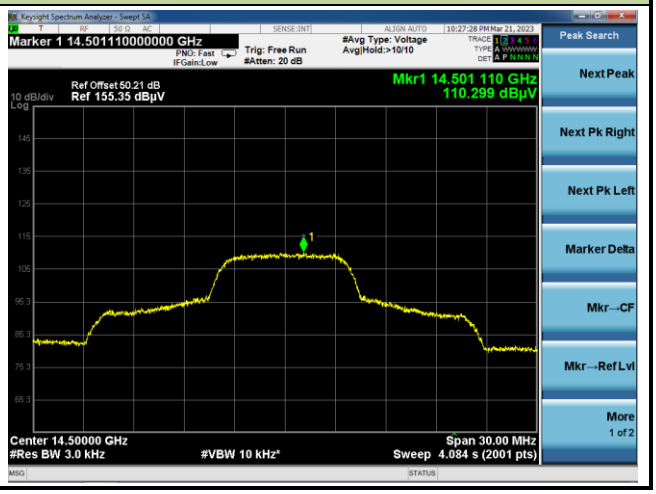
Note 3: Factor = 10*log(4kHz/3kHz) = 1.25dB.

Note 4: 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°, as required by regulation Part 25.218(f) & (h).

Note 5: The off-axis Angle of the test is determined according to the off-axis antenna gain provided by the customer.

Off-axis EIRP Density – 14000MHz	
Angle (1.5°)	Angle (8.6°)
	
Angle (9.2°)	Angle (19.1°)
	

Off-axis EIRP Density – 14250MHz	
Angle (1.5°)	Angle (8.6°)
	
Angle (9.2°)	Angle (19.1°)
	

Off-axis EIRP Density – 14500MHz	
Angle (1.5°)	Angle (8.6°)
	
Angle (9.2°)	Angle (19.1°)
	

Note 1: The measured level was in dBµV/m, which had compensated cable loss (dB), antenna factor (dB/m) in SA's Ref offset, but showed dBµV in SA's screen.

Note 2: This is the radiated measurement results, only the results of the maximum polarization direction.

A.5 Frequency Tolerance Test Result

Test Site	WZ-TR3	Test Engineer	Dandy Li
Test Date	2023-02-20	Temperature	-30 ~ 50 °C

Test Freq. (MHz)	Voltage (V_{AC})	Temp. (°C)	Measured Freq. (MHz)	Freq. Tolerance (ppm)	Limit (ppm)	Result
14250	120	-30	14249.983093	-1.1865	≤ 10	Pass
		-20	14249.983302	-1.1718	≤ 10	Pass
		-10	14249.983460	-1.1607	≤ 10	Pass
		0	14249.981684	-1.2853	≤ 10	Pass
		+10	14249.981744	-1.2811	≤ 10	Pass
		+20	14249.981138	-1.3237	≤ 10	Pass
		+30	14249.980648	-1.3581	≤ 10	Pass
		+40	14249.988964	-0.7745	≤ 10	Pass
		+50	14250.018466	1.2959	≤ 10	Pass
	102	+20	14249.992032	-0.5591	≤ 10	Pass
	138	+20	14250.006913	0.4851	≤ 10	Pass

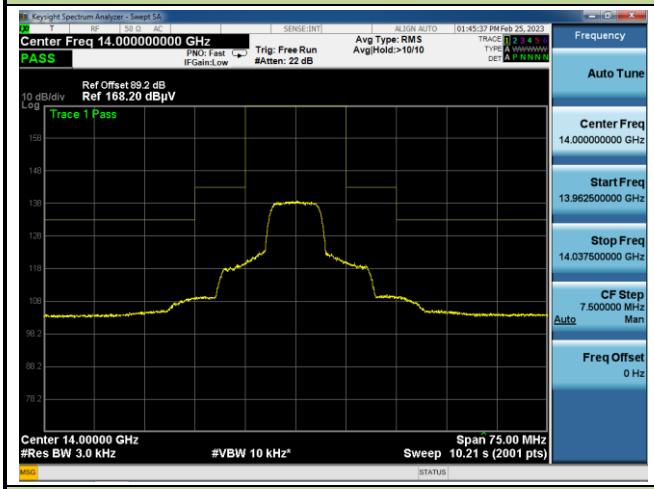
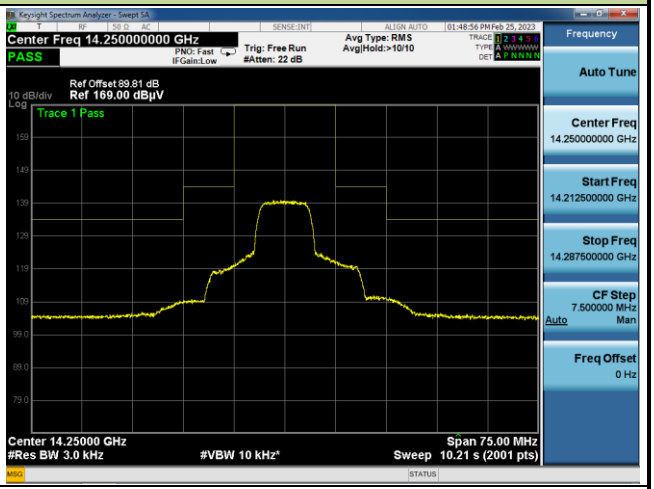
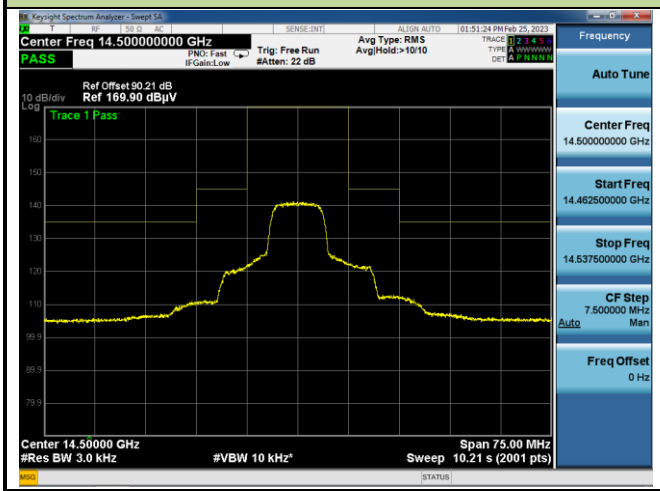
Note: Frequency Tolerance (ppm) = {[Measured Frequency (MHz) - Test Frequency (MHz)] / Test Frequency (MHz)} * 10^6.

A.6 Radiated Spurious Emission Test Result

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Item	In-band Mask

For High Data Rate (7500kbps):

Authorization Bandwidth = 15MHz

In-band Mask	
14000 MHz	14250 MHz
	
14500 MHz	
	

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Channel	14000MHz
Test Mode	Out-of-Band Emission		
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 9kHz to 30MHz and 40GHz to 75GHz, there is not show in the report.		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB/m)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
10877.0	48.6	13.4	62.0	82.3	-20.3	Peak	Horizontal
16852.5	51.0	15.1	66.1	82.3	-16.2	Peak	Horizontal
22290.0	65.7	-7.3	58.4	82.3	-23.9	Peak	Horizontal
27999.0	82.8	-8.1	74.7	82.3	-7.6	Average	Horizontal
11217.0	49.8	12.5	62.3	82.3	-20.0	Peak	Vertical
16937.5	51.1	15.0	66.1	82.3	-16.2	Peak	Vertical
22191.0	66.0	-7.7	58.3	82.3	-24.0	Peak	Vertical
27999.0	77.3	-8.1	69.2	82.3	-13.1	Average	Vertical

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 2: Average measurement was not performed when peak measure level was lower than the average limit.

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Channel	14250MHz
Test Mode	Out-of-Band Emission		
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 9kHz to 30MHz and 40GHz to 75GHz, there is not show in the report.		

Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
10741.0	48.0	13.6	61.6	82.3	-20.7	Peak	Horizontal
16844.0	50.4	15.2	65.6	82.3	-16.7	Peak	Horizontal
24710.0	66.5	-6.0	60.5	82.3	-21.8	Peak	Horizontal
28494.0	83.6	-8.2	75.4	82.3	-6.9	Average	Horizontal
11157.5	48.8	13.1	61.9	82.3	-20.4	Peak	Vertical
16648.5	51.0	14.2	65.2	82.3	-17.1	Peak	Vertical
26162.0	66.8	-6.7	60.1	82.3	-22.2	Peak	Vertical
28505.0	82.5	-7.9	74.6	82.3	-7.7	Average	Vertical

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 2: Average measurement was not performed when peak measure level was lower than the average limit.

Test Site	WZ-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Channel	14500MHz
Test Mode	Out-of-Band Emission		
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 9kHz to 30MHz and 40GHz to 75GHz, there is not show in the report.		

Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
10715.5	47.9	13.4	61.3	82.3	-21.0	Peak	Horizontal
16631.5	51.0	13.9	64.9	82.3	-17.4	Peak	Horizontal
29000.0	80.6	-8.3	72.3	82.3	-10.0	Average	Horizontal
38922.0	68.0	-1.7	66.3	82.3	-16.0	Peak	Horizontal
10341.5	48.4	13.3	61.7	82.3	-20.6	Peak	Vertical
16997.0	50.4	14.9	65.3	82.3	-17.0	Peak	Vertical
29000.0	87.6	-8.3	79.3	82.3	-3.0	Average	Vertical
39043.0	68.6	-1.3	67.3	82.3	-15.0	Peak	Vertical

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 2: Average measurement was not performed when peak measure level was lower than the average limit.

Test Site	SIP-AC1	Test Engineer	Dandy Li
Test Date	2023-02-25	Test Mode	Out-of-Band Emission - 40G ~ 50G
Remark	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 9kHz to 30MHz and 40GHz to 75GHz, there is not show in the report.		

Channel	Frequency (MHz)	Factor (dB/m)	Measure Level @1m(dBμV/m)	Measure Level @3m(dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
14000	42003.0	44.9	85.7	76.2	82.3	-6.1	Average	Horizontal
	42001.0	44.9	88.2	78.7	82.3	-3.6	Average	Vertical
14250	42751.0	45.2	87.0	77.4	82.3	-4.9	Average	Vertical
	42751.0	45.2	85.1	75.6	82.3	-6.7	Average	Vertical
14500	43499.0	45.6	82.4	72.8	82.3	-9.5	Average	Vertical
	43398.0	45.6	81.7	72.2	82.3	-10.1	Average	Vertical

Note 1: Measure Level @1m = Reading Level @1m + Factor

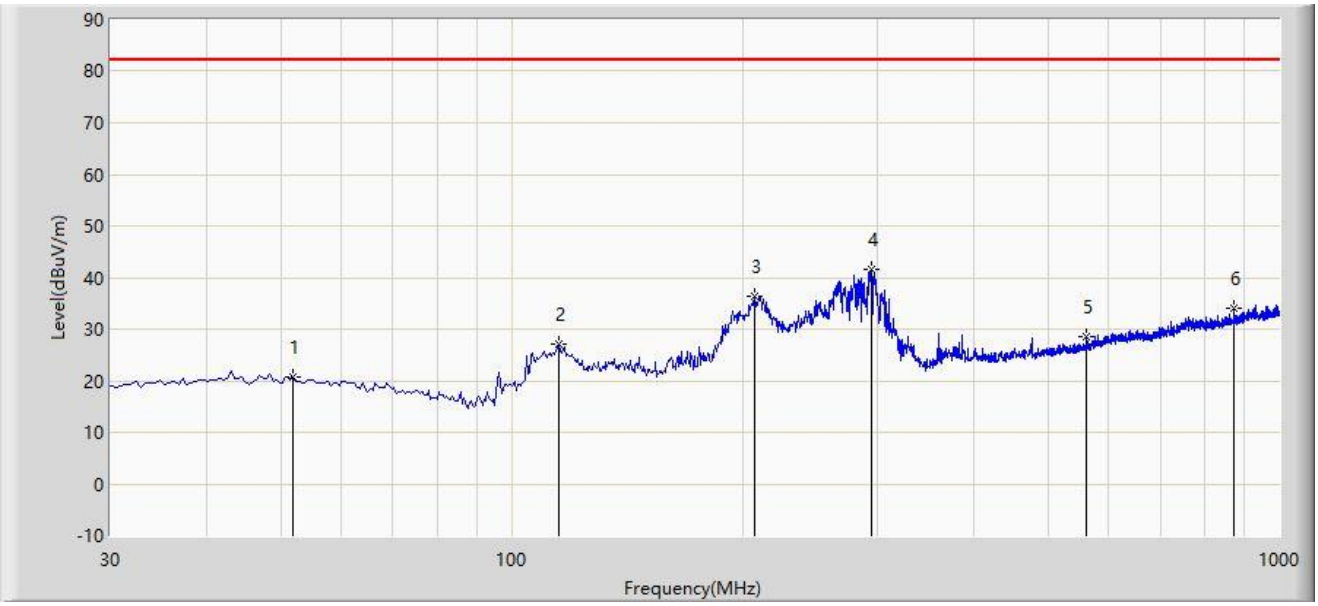
Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m) + Mixer Conversion Loss (dB)

Note 1: Measure Level @3m = Measure Level @1m + 20 * log(1m / 3m).

Note 2: The Vertical and Horizontal polarization were evaluated, only the worst case test results are shown in the table.

Radiated Spurious Emission For below 1GHz:

Site: WZ-AC1	Test Date: 2023-02-16
Limit: FCC Part 25_RE	Engineer: Bob Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Horizontal
EUT: Phased Array Satellite Communication Terminal	Power: AC 120V/60Hz
Test Mode: Transmit by 8PSK 7500kbps at Channel 14500MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		51.825	20.772	2.650	-61.528	82.300	18.122	PK
2		115.360	27.046	11.778	-55.254	82.300	15.268	PK
3		207.510	36.362	21.730	-45.938	82.300	14.632	PK
4	*	293.840	41.535	23.259	-40.765	82.300	18.276	PK
5		560.105	28.568	4.438	-53.732	82.300	24.130	PK
6		871.960	34.189	5.141	-48.111	82.300	29.048	PK

Note 1: " * ", means this data is the worst emission level.

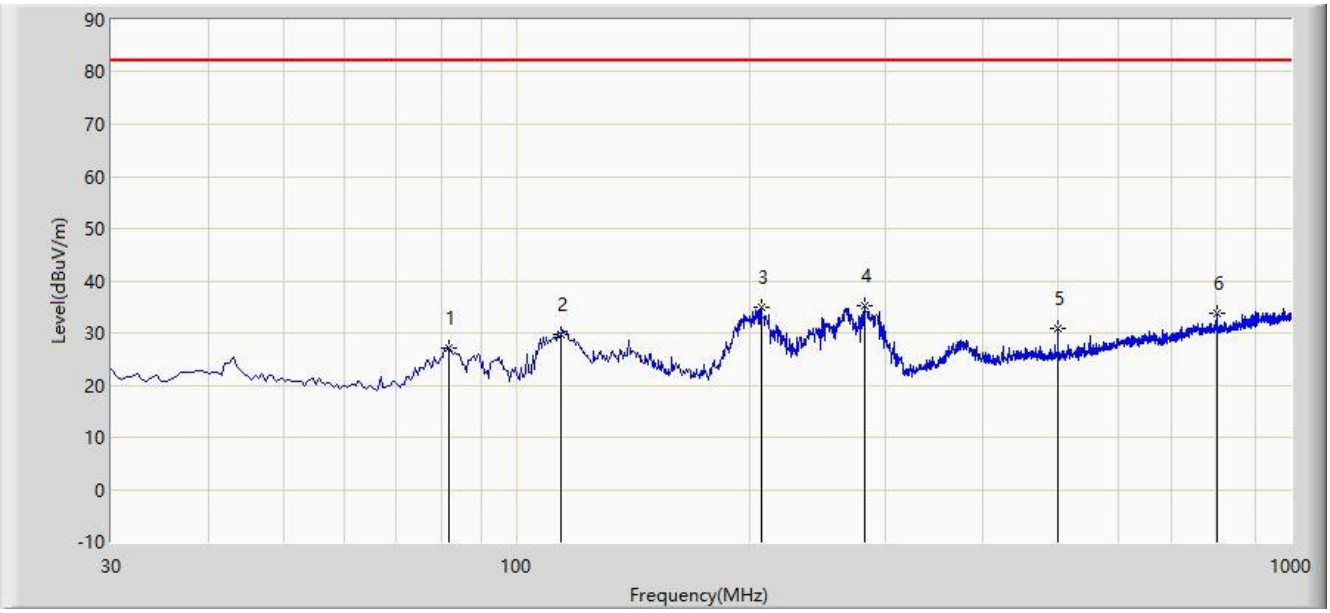
Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: RMS measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 40GHz to 75GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Site: WZ-AC1	Test Date: 2023-02-16
Limit: FCC Part 25_RE	Engineer: Bob Zhang
Probe: VULB 9168_25-2000MHz	Polarity: Vertical
EUT: Phased Array Satellite Communication Terminal	Power: AC 120V/60Hz
Test Mode: Transmit by 8PSK 7500kbps at Channel 14500MHz	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		81.895	27.236	13.746	-55.064	82.300	13.490	PK
2		114.390	29.848	14.681	-52.452	82.300	15.167	PK
3		207.025	34.783	20.154	-47.517	82.300	14.629	PK
4	*	281.715	35.108	17.058	-47.192	82.300	18.049	PK
5		499.965	30.891	7.762	-51.409	82.300	23.129	PK
6		804.060	33.652	5.324	-48.648	82.300	28.328	PK

Note 1: " * ", means this data is the worst emission level.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB/m).

Note 3: Factor (dB/m) = Cable Loss (dB) + Antenna Factor (dB/m).

Note 4: RMS measurement was not performed when peak measure level was lower than the quasi-peak limit.

Note 5: The amplitude of radiated emissions (frequency range from 9kHz to 30MHz and 40GHz to 75GHz) is that proximity to ambient noise, which also are attenuated more than 20 dB below the permissible value. Therefore, the data is not presented in the report.

Appendix B - Test Setup Photograph

Refer to “2302RSU009-UT” file.

Appendix C - EUT Photograph

Refer to “2302RSU009-UE” file.

The End