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Project No.: 10022750  
File No.: MC17256  
Report No.: 10022750-FCC-RF  
Date: June 21, 2013  
Model No.: XT

## **RF Test Report**

**in accordance with  
FCC Part 25 Subpart C Section 25.202, 25.204 & 25.216**

**for**

## **Satellite Mobile Hand Held Terminal**

**Asia Pacific Satellite Communication Inc.**

**9FL, Lotte IT Castle 2-Dong, #550-1, Gasan-dong,  
Geumcheon-gu, Seoul, 153-768, Korea**

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**Summary of Testing**

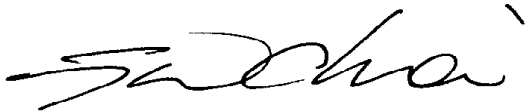
The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 25 Subpart C Section 25.202, 25204 & 25.216

No	Reference Clause No.	FCC Part15 Subpart C Conformance Requirements	Verdict	Remark
1	2.1049	20dB Bandwidth	-	Note 1
2	25.202(d)	Frequency tolerance of Earth stations	Complied	
3	2.1051 25.202(f)	Emission limitations Conducted measurement	Complied	
4	2.1053 25.202(f)	Emission limitations Radiated measurement	Complied	
5	2.1046 25.204(a)	Power limits	Complied	
6	25.216 (c)(h)(i)	Limits on emissions for aeronautical radio navigation-satellite service	Complied	

Note 1 : No Compliance limit. Just Reporting purpose.

**Conclusion:**

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.



Witnessed by  
Jeawoon, Choi, WiSE Operations Manager  
UL Verification Services- 3014ASEO  
UL Korea Ltd.  
June 21, 2013



Reviewed by  
Kyungyong, Kim, WiSE Korea Head  
UL Verification Services- 3014ASEO  
UL Korea Ltd.  
June 21, 2013

## **Test Report Details**

Witnessed By: UL Korea Ltd.  
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Test Site: ONETECH Corp.  
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862, Korea  
Test engineer's name: HongKyu Lee

Applicant: Asia Pacific Satellite Communication Inc.  
9FL, Lotte IT Castle 2-Dong, #550-1, Gasan-dong, Geumcheon-gu, Seoul,  
153-768, Korea

Applicant Contact: Jinhyo Park  
Title: Manager  
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Product Type: Satellite Mobile Hand Held Terminal

Model Number: XT

Trademark 

Test standards: FCC Part 25 Subpart C Satellite Communications

Sample Serial Number: N / A

Sample Receive Date: May 10, 2013

Testing Start Date: May 13, 2013

Testing Complete Date: June 7, 2013

**Overall Results: Pass**

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

## Report Directory

<b>1. GENERAL PRODUCT INFORMATION .....</b>	<b>5</b>
1.1. EQUIPMENT DESCRIPTION .....	5
1.2. DETAILS OF TEST EQUIPMENT (EUT) .....	5
1.3. EQUIPMENT CONFIGURATION .....	5
1.4. TECHNICAL DATA OF EUT .....	5
1.5. ANTENNA INFORMATION .....	6
1.6. EQUIPMENT TYPE: .....	6
1.7. TECHNICAL DESCRIPTIONS AND DOCUMENTS .....	6
1.8. EQUIPMENT MARKING PLATE.....	6
1.9. DESCRIPTION OF ADDITIONAL MODEL NAME.....	6
1.10. MAXIMUM OUTPUT POWER (BASELINE MEASUREMENT).....	7
<b>2. TEST SPECIFICATION .....</b>	<b>8</b>
<b>3. TEST CONDITIONS .....</b>	<b>9</b>
3.1. EQUIPMENT USED DURING TEST .....	9
3.2. INPUT/OUTPUT PORTS .....	9
3.3. POWER INTERFACE .....	9
3.4. OPERATING FREQUENCIES .....	9
3.5. OPERATION MODES .....	10
3.6. ENVIRONMENT CONDITIONS.....	10
3.7. TEST CONFIGURATIONS .....	11
3.8. LIST OF TEST EQUIPMENT.....	12
<b>4. OVERVIEW OF TECHNICAL REQUIREMENTS .....</b>	<b>13</b>
<b>5. TEST RESULTS.....</b>	<b>14</b>
5.1. 20 dB & OCCUPIED BANDWIDTH .....	14
5.2. FREQUENCY TOLERANCE OF EARTH STATIONS .....	21
5.3. EMISSION LIMITATIONS (CONDUCTED MEASUREMENT) .....	23
5.4. EMISSION LIMITATIONS (RADIATED MEASUREMENT) .....	26
5.5. POWER LIMITS .....	28
5.6. LIMITS ON EMISSIONS FOR AERONAUTICAL RADIO NAVIGATION-SATELLITE SERVICE .....	30

## 1. General Product Information

### 1.1. Equipment Description

XT is the **Satellite Mobile Hand Held Terminal** for Thuraya satellite mobile communication service based on GMR-1 and GMPRS-1. It supports various services such as voice, circuit data, packet data and fax etc.

### 1.2. Details of Test Equipment (EUT)

- Equipment Type : Satellite Mobile Hand Held Terminal
- Model No. : XT
- Trade name :  APSI  
Asia Pacific Satellite communications Inc.
- Type of test Equipment : Portable Equipment
- Operating characteristic : MES(Mobile Earth Station) used in the S-PCN
- Manufacturer : Asia Pacific Satellite Communication Inc.  
9FL, Lotte IT Castle 2-Dong, #550-1, Gasan-dong, Geumcheon-gu, Seoul, 153-768, Korea

### 1.3. Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	Satellite Mobile Hand Held Terminal	Asia Pacific Satellite Communication Inc.	XT	-
<b>Note:</b> Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

### 1.4. Technical Data of EUT

Item	Type of SATELLITE PHONE
Frequency Ranges	Tx : 1626.5 – 1660.5 MHz, Rx : 1525 – 1559 MHz
Rated power	Max 2 W
Kind of modulation (s)	$\pi/4$ -CQPSK, $\pi/4$ -CBPSK, $\pi/4$ -DBPSK
Channel	1,087
Channel Separation	31.25 kHz
Antenna Gain	Max. 3.41 dBi
Antenna information	Fixed Type (Quadrifilar Helical Type)
Working temperature	-20 ~ 60 °C
Supply Voltage	DC 3.7 V

Note ;

1. All the technical data described above were provided by the manufacturer.

### 1.5. Antenna Information

Antenna Type : Passive, Quadrifilar Helical Type  
 Manufacturer : Asia Pacific Satellite Communication Inc.  
 Transmit Gain dBi : Max. 3.41 dBi  
 Feature : Extendable / retractable

### 1.6. Equipment Type:

- Radio and ancillary equipment for fixed or semi-fixed use
- Radio and ancillary equipment for vehicular mounted use
- Radio and ancillary equipment for portable or handheld use
  
- Stand alone     Host connected     Host connected
- Self contained single unit     Module with associated connection or interface

### 1.7. Technical descriptions and documents

The following document was provided by the manufacturer.

No.	Document Title and Description
1	User Manual

### 1.8. Equipment Marking Plate



### 1.9. Description of additional model name

Model name	Model name Designation	Description of design
XT	Basic model	-

### 1.10. Maximum Output Power (Baseline Measurement)

Modulation	Channel	Frequency (MHz)	Cable Loss (dB)	Measured Average Power (dBm)	Duty Cycle C.F* (dB)	Result Average Power (dBm)	Antenna gain (dBi)	EIRP (dBm e.i.r.p.)
$\pi/4$ -QPSK	1	1626.53125	0.3	23.08	9.37	32.75	3.41	36.16
	544	1643.5	0.3	22.99		32.66		36.07
	1087	1660.46875	0.3	22.89		32.56		35.97
$\pi/4$ -CBPSK	1	1626.53125	0.3	22.96	9.31	32.57		35.98
	544	1643.5	0.3	22.88		32.49		35.90
	1087	1660.46875	0.3	22.78		32.39		35.80
$\pi/4$ -DBPSK	1	1626.53125	0.3	13.96	19.67	33.93		37.34
	544	1643.5	0.3	12.81		32.78		36.19
	1087	1660.46875	0.3	13.11		33.08		36.49

**Note :**

Result Average Power (dBm) = Cable Loss(dB)+ Measured AveragePower (dBm)+ Duty Cycle C. F(dB)

\* Duty Cycle Correction Factor =  $10 \log(1/x)$   
 $x = \text{Tx period} / \text{Tx on time}$

## 2. Test Specification

The following test specifications and standards have been applied and used for testing.

- 1) FCC Part 25 Subpart C: Satellite Communications
- 2) KDB 273109: Guidance for Part 25 Transceiver
- 3) ANSI/TIA-603-C-2004: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards



### 3. Test Conditions

#### 3.1. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Satellite Phone	Asia Pacific Satellite Communication Inc.	XT	-
AE	Note PC	LG	R510	-

**Note:** Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)

#### 3.2. Input/Output Ports

No	Port Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
1	Power Input	DC	N	N	Connected to DC Power supply
2	Radio Antenna	I/O	N	Y	-
-	-	-	-	-	-

Note:  
 \*AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 TP = Telecommunication Ports

#### 3.3. Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	100-240Vac	0.4 A	10 W	AC 50-60 Hz	-	AC/DC Adaptor
Rated	3.7 Vdc	-	-	DC	-	Internal Battery Rating
1	3.7 Vdc	-	-	DC	-	Normal operating voltage
2	3.5 Vdc	-	-	DC	-	Battery End Point
3	4.2 Vdc	-	-	DC	-	Battery Full charged voltage
4	120 Vac	-	-	60 Hz	-	-

#### 3.4. Operating Frequencies

Mode #	Frequency tested
1	Carrier on state for 3 frequencies in the Transmitter band -. Low : 1626.53125 MHz / CH = 1 -. Mid : 1643.5 MHz / CH = 544 -. Top : 1660.46875 MHz / CH= 1087
2	Carrier off state for Idle-mode

Note :  
 -. Modulation :  $\pi/4$  CQPSK, Bits/ Symbol : 2, SymRate : 23.4 kbps

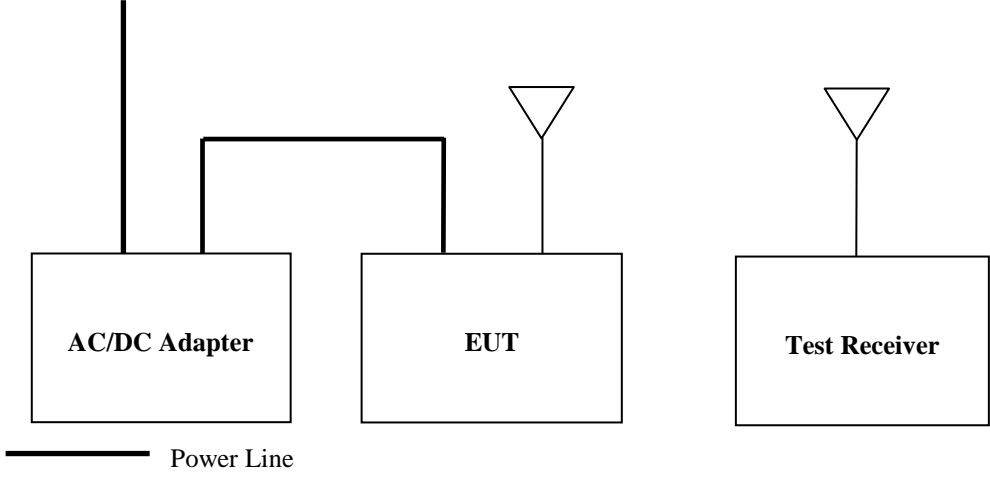
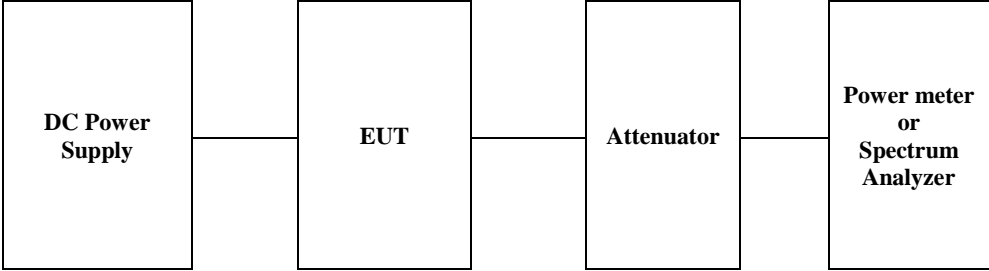
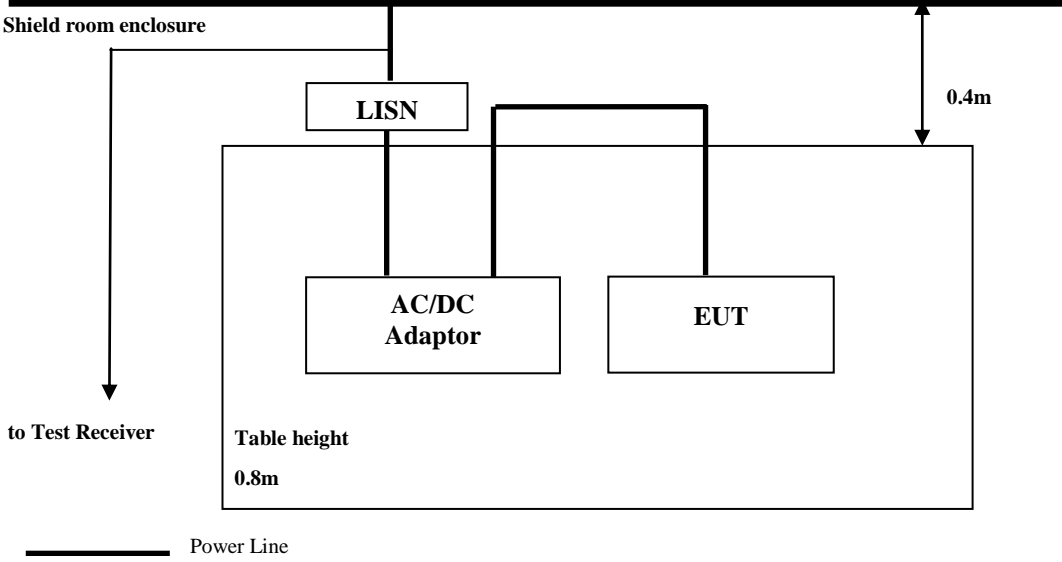
### 3.5. Operation Modes

Mode #	Description
1	Carrier on mode: RF signal from the MES was generated continuously for the representative channels (Low, Mid, High) by the test program connected to the notebook PC
2	Carrier off (Idle) mode: RF carrier was not activated by the MES
Note : N/A -. The worst-case condition is determined by the baseline measurement of RF output power out of various modulations. $\pi/4$ CQPSK was used for final measurement.	

### 3.6. Environment Conditions

Parameters	Normal condition	Extreme condition
Temperature	+ 15 °C ~ +35 °C	-20 °C / +60 °C
Humidity	20% ~ 75%	No excessive condensation occur
Supply voltage	3.7Vdc (Rated nominal voltage)	3.5 Vdc / 4.2 Vdc
Note ; -. The extreme condition is applied to the boundary limits of the declared operational environmental condition by the manufacturer. -. The operating condition for humidity requirement has not been declared in the manufacturer's specification. -. Test has been carried out for three frequencies specified above under the normal condition and for the extreme condition, minimum and maximum frequencies has been tested.		

### 3.7. Test Configurations

Mode #	Description
1	 <p>The diagram shows three rectangular boxes: 'AC/DC Adapter', 'EUT', and 'Test Receiver'. A thick horizontal line at the top represents the 'Power Line'. A vertical line descends from the power line to the AC/DC Adapter. A horizontal line connects the AC/DC Adapter to the EUT. A vertical line descends from the EUT to a triangular antenna symbol. Another vertical line descends from the power line to the Test Receiver, which also has a triangular antenna symbol. A legend below shows a thick line for 'Power Line'.</p>
2	 <p>The diagram shows four rectangular boxes in a horizontal line, connected by lines. From left to right: 'DC Power Supply', 'EUT', 'Attenuator', and 'Power meter or Spectrum Analyzer'.</p>
1	 <p>The diagram shows a 'Shield room enclosure' represented by a thick horizontal line at the top. Inside, a table is shown with a height of 0.8m. On the table are two boxes: 'AC/DC Adaptor' and 'EUT'. A box labeled 'LISN' is positioned above the AC/DC Adaptor. A vertical line connects the LISN to the AC/DC Adaptor. A horizontal line connects the AC/DC Adaptor to the EUT. A vertical line descends from the EUT to a triangular antenna symbol. A vertical line descends from the power line to the LISN. A vertical double-headed arrow on the right indicates a distance of 0.4m between the power line and the top of the table. A legend below shows a thick line for 'Power Line' and an arrow pointing down labeled 'to Test Receiver'.</p>

### 3.8. List of Test Equipment

No	Description	Manufacturer	Model	Identifier	Cal. Due
1	Signal Generator	Rohde & Schwarz	SMJ100A	101038	2014.02.02
2	FSV30 SIGNAL ANALYZER	Rohde & Schwarz	FSV30	101372	2014.05.20
3	Power Meter	HP	437B	3125U25121	2014.05.20
4	CW Microwave Frequency Counter	HP	53152A	US39270295	2013.12.10
5	Power Sensor	HP	8481A	1550A14928	2013.12.29
6	Fixed Coaxial Attenuator	Weinschel Associates	WA49-20-43	A192	2014.05.21
7	POWER ATTENUATOR	Aeroflex/Weinschel, Inc.,	67-30-43	CA5760	2013.12.10
8	Temperature and humidity chamber	Samkun Tech	SSE-43CI-A	060712	2014.05.20
4	EMI Test Receiver	Rohde & Schwarz	ESU	100261	2014.05.27
5	AMPLIFIER	Sonoma Instrument	310N	312544	2014.05.21
6	PRE-AMPLIFIER	Rohde & Schwarz	SCU-18	10041	2014.12.15
7	Antenna Master	HD GmbH	MA240	N/A	N/A
8	Position Controller	HD GmbH	HD100	N/A	N/A
9	Turn Table	HD GmbH	DS420S	N/A	N/A
10	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	VULB9163-202	N/A
11	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D294	2014.06.17
12	Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170178	2014.06.17
13	DC Power supply	DIGITAL Elec.	DRP-305DN	4030191	2014.09.03

#### 4. Overview of Technical requirements

The following essential requirements and test specifications are relevant to the presumption of conformity FCC Part 25 Subpart C Satellite Communications.			Reported
Reference Clause No.	Essential technical requirements	Test method	
2.1049	20dB Bandwidth	ANSI C63.4-2009	[ X ]
25.202(d)	Frequency tolerance of Earth stations	ANSI C63.4-2009	[ X ]
2.1051 25.202(f)	Emission limitations Conducted measurement	ANSI C63.10-2009	[ X ]
2.1053 25.202(f)	Emission limitations Radiated measurement	ANSI C63.4-2009	[ X ]
2.1046 25.204(a)	Power limits	ANSI C63.10-2009	[ X ]
25.216 (c)(h)(i)	Limits on emissions for aeronautical radio navigation-satellite service	ANSI C63.10-2009	[ X ]

## 5. Test Results

### 5.1. 20 dB & Occupied Bandwidth

TEST: 20 dB Bandwidth		
Method	<p>The transmitter output is connected to the Spectrum analyzer. 20 dB Bandwidth from the EUT was measured under the below setting condition.</p> <ol style="list-style-type: none"> <li>1. Set resolution bandwidth (RBW) <math>\geq 1\%</math> of 20 dB Bandwidth.</li> <li>2. Set the video bandwidth (VBW) <math>\geq</math> RBW.</li> <li>3. Detector = Peak.</li> <li>4. Trace mode = max hold.</li> <li>5. Sweep = auto couple.</li> <li>7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.</li> </ol>	
Reference Clause	FCC Part 2 §2.1049	
Parameters recorded during the test	Laboratory Ambient Temperature	25 °C
	Relative Humidity	39 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	1626.53125 – 1660.46875 MHz	Antenna port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

### Limits

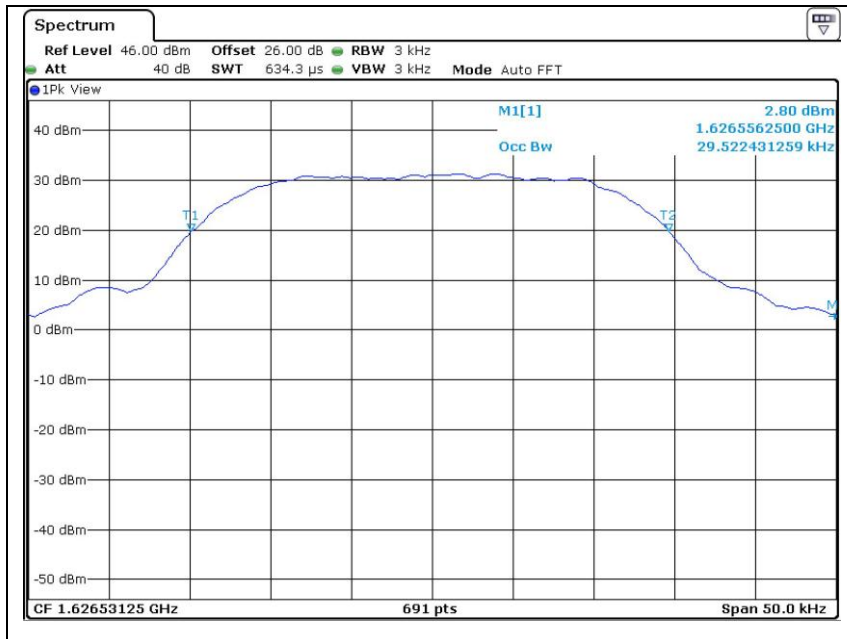
2.1049 : No limit apply.

**5.1.1. Measurement Result**

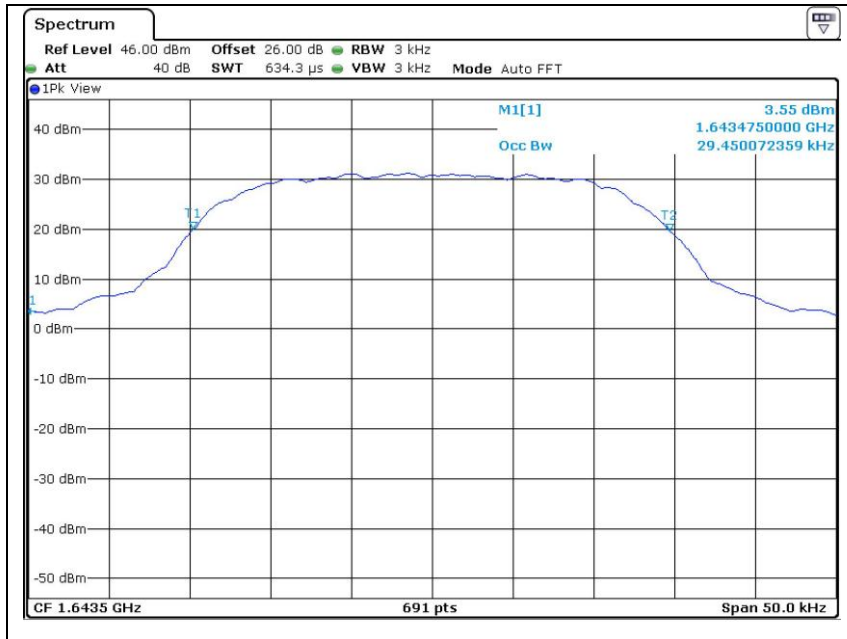
Operating Mode	Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99 % Bandwidth (kHz)	Minimum Limit (MHz)
$\pi/4$ -CQPSK	Low	1626.53125	33.86	29.52	N/A
	Middle	1643.5	34.08	29.45	
	High	1660.46875	34.15	29.52	
$\pi/4$ -CBPSK	Low	1626.53125	33.43	30.10	
	Middle	1643.5	33.58	30.10	
	High	1660.46875	33.29	30.03	
$\pi/4$ -DBPSK	Low	1626.53125	33.07	29.88	
	Middle	1643.5	32.85	29.30	
	High	1660.46875	32.85	29.45	

Figure 1. 20 dB & 99 % Bandwidth

$\pi/4$ -CQPSK  
Low

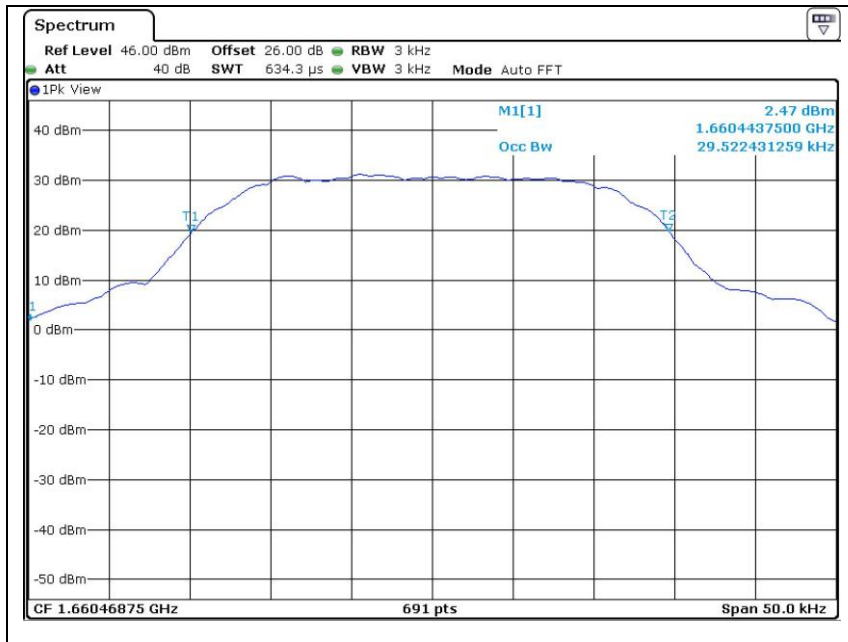


Middle

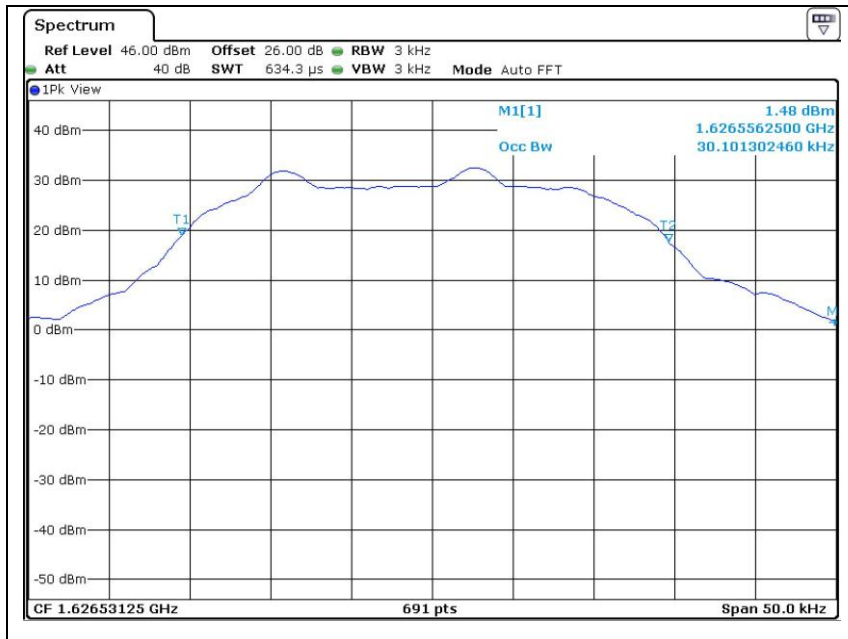




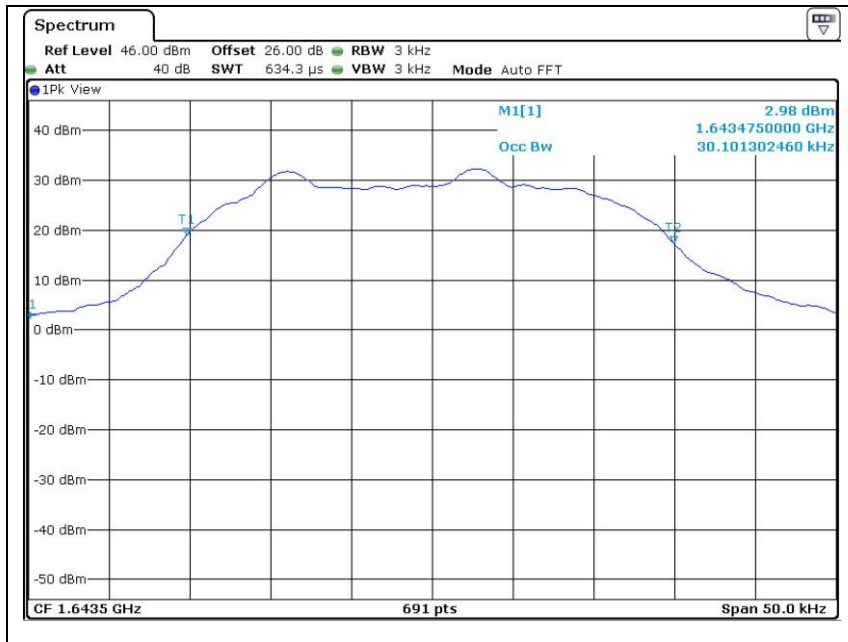
High



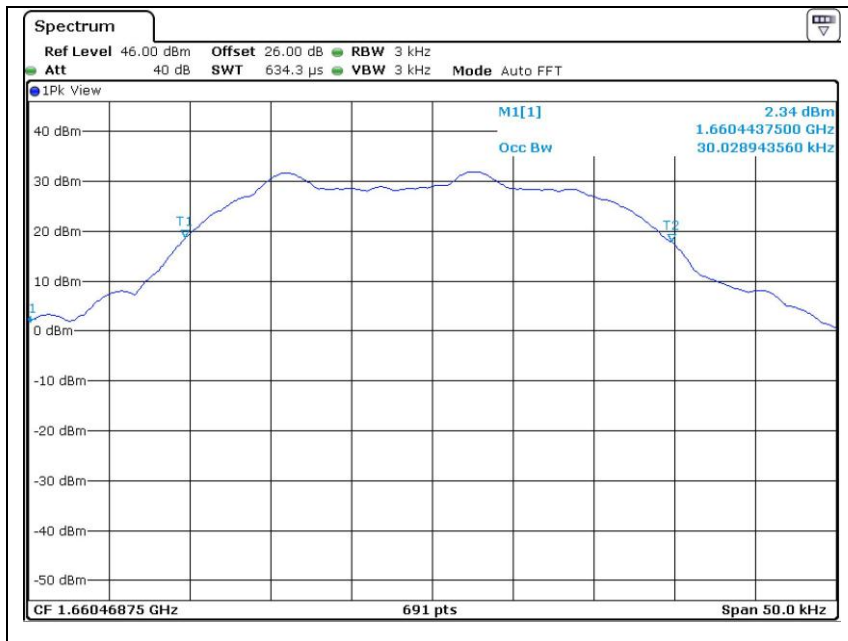
$\pi/4$ -CBPSK  
Low



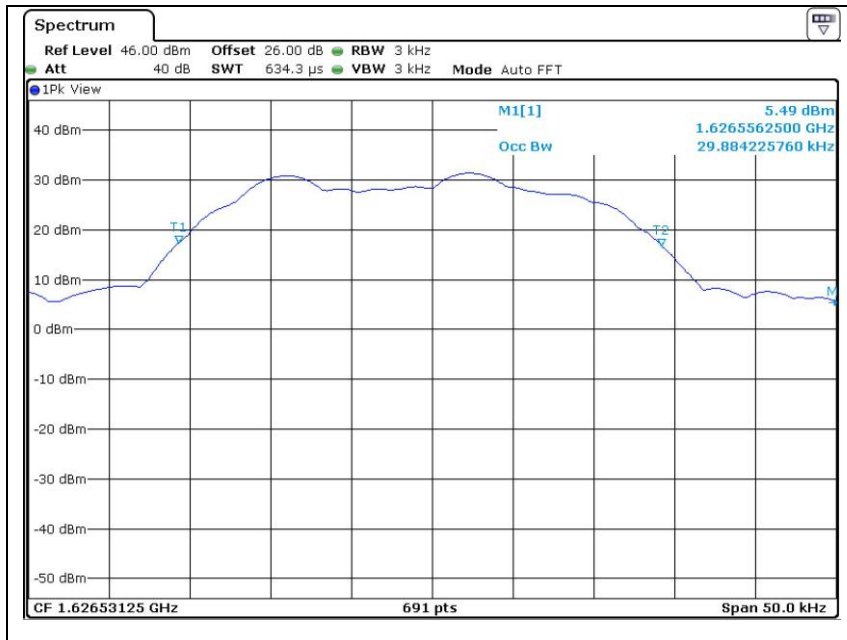
Middle



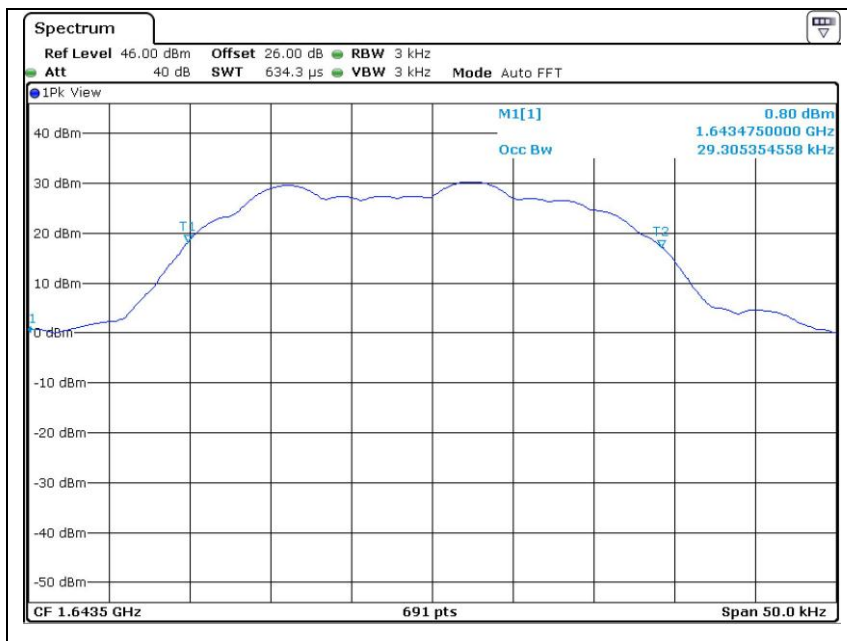
High



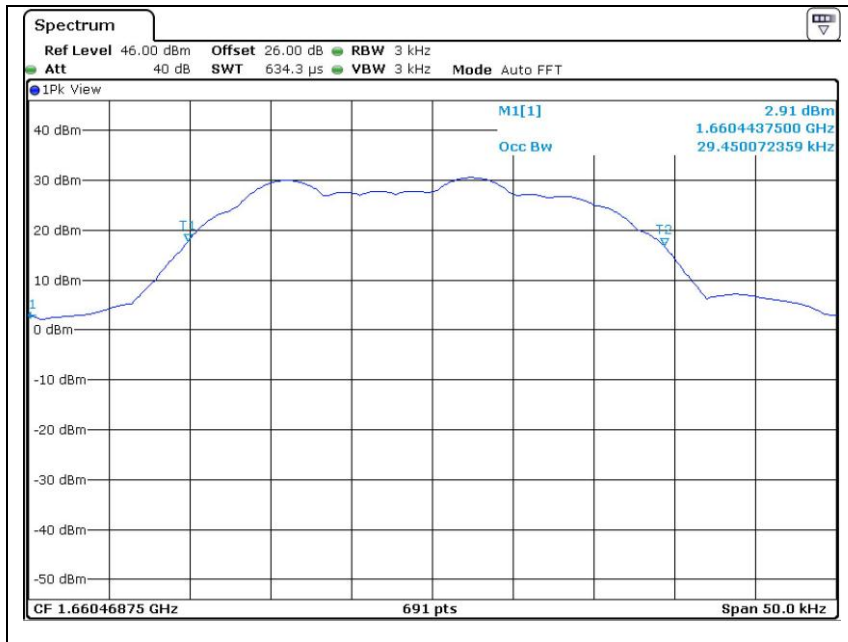
$\pi/4$ -DBPSK  
Low



Middle



High



## 5.2. Frequency tolerance of Earth stations

<b>TEST: Frequency tolerance of Earth stations</b>		
Method	1. The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the CW Microwave Frequency Counter. The test was performed at frequency using all applicable un-modulation. 2. The EUT was placed inside the temperature chamber. 3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.	
Reference Clause	Part25 Subpart C Section 25.202(d)	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	25 °C
	Relative Humidity	39 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	1643.5 MHz	Antenna port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1,2,3	1	2
Supplementary information: None		

### Limits

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

Measurement method :  Radiated  Conducted  
 Mode of operation : Continuous Wave

**Table 1. Test Result (1643.5 MHz)**

Frequency Stability versus Temperature				
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse		
		Measured Frequency (MHz)	Frequency Error (Hz)	%
60	3.7	1643.504154	4154	0.0002527533
50		1643.503429	3429	0.0002086401
40		1643.502646	2646	0.0001609979
30		1643.501352	1352	0.0000822635
20		1643.499942	-58	-0.0000035291
10		1643.499216	-784	-0.0000477031
0		1643.498931	-1069	-0.0000650441
-10		1643.498669	-1331	-0.0000809857
-20		1643.498632	-1368	-0.0000832370
Frequency Stability versus power Supply				
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapse		
		Measured Frequency (MHz)	Frequency Error (Hz)	%
24	3.5	1643.499791	-209	-0.0000127168
	3.7	1643.499767	-233	-0.0000141771
	4.2	1643.499743	-257	-0.0000156374

Supplementary information:

The percent of the reference frequency (%) = (Measured frequency – Reference frequency) / Reference frequency

### 5.3. Emission Limitations (Conducted Measurement)

<b>TEST: Emission Mask &amp; Spurious emissions : Conducted Measurement</b>		
Method	Measurements were made in the laboratory environment. Emission mask measurement was made using a direct connection between RF output of the EUT and spectrum analyzer. Measurement has been performed with the EUT set to maximum output level at low, mid and high channel frequencies.	
Reference Clause	FCC Part 25 §25.202(f)(1), (2) and (3). FCC Part 2 §2.1051	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	25 °C
	Relative Humidity	39 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 20 GHz	Antenna port

#### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

#### Limits

Frequency Range (MHz)	Attenuation to Carrier power (dBc)	Measurement Bandwidth	Measurement method
50 – 100% of assigned BW	-25	4 kHz	Peak Hold
100 – 250% of assigned BW	-35	4 kHz	Peak Hold
> 250 % of assigned BW	-(43+10log(Pmax))	4 kHz	Peak Hold

NOTE : §25.202(f)(1), (2) and (3)

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

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 % up to and including 100 % 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 % up to and including 250 % 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 % 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;

Measurement method :  Radiated  Conducted  
 Mode of operation : Continuous Wave  
 Power setting : Max. Power condition declared by the manufacturer

**5.3.1. Low channel (1626.53125 MHz)**

50 – 250% of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Result (dBm/4kHz)	Relative to Carrier (dBc)	Limit (dBc)
Fundamental	1626.53	3	30.57	1.25	31.82	-	-
50 – 100% of assigned BW	1626.50	3	2.85	1.25	4.1	-27.72	-25
100 – 250% of assigned BW	1626.48	3	-7.72	1.25	-6.47	-38.29	-35

> 250 % of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Antenna Gain (dBi)	Result (dBm/4kHz e.i.r.p)	Limit (dBm e.i.r.p)
30 MHz – 100 MHz	34.10	3	-58.37	1.25	-38.16	-95.28	-13
100 MHz – 1 GHz	725.80	10	-54.01	-3.98	-25.16	-83.15	-13
1 GHz – 1.6265 GHz	1626.05	10	-30.63	-3.98	2.92	-31.69	-13
1.6265 – 1.6605 GHz	1626.87	10	-38.45	-3.98	2.9	-39.53	-13
1.6605 – 2.5 GHz	1877.40	10	-53.55	-3.98	-7.63	-65.16	-13
Second Harmonic	3253.07	10	-35.13	-3.98	-30.13	-69.24	-13
Third Harmonic	4879.60	10	-48.48	-3.98	-26.82	-79.28	-13

**5.3.2. Middle channel (1643.5 MHz)**

50 – 250% of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Result (dBm/4kHz)	Relative to Carrier (dBc)	Limit (dBc)
Fundamental	1643.50	3	30.40	1.25	31.65	-	-
50 – 100% of assigned BW	1643.53	3	-0.03	1.25	1.22	-30.60	-25
100 – 250% of assigned BW	1643.55	3	-9.95	1.25	-8.70	-40.52	-35

> 250 % of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Antenna Gain (dBi)	Result (dBm/4kHz e.i.r.p)	Limit (dBm e.i.r.p)
30 MHz – 100 MHz	72.80	3	-59.00	1.25	-38.16	-95.91	-13
100 MHz – 1 GHz	732.30	10	-54.16	-3.98	-25.18	-83.32	-13
1 GHz – 1.6265 GHz	1200.82	10	-53.50	-3.98	-24.71	-82.19	-13
1.6265 – 1.6605 GHz	1643.84	10	-39.08	-3.98	2.42	-40.64	-13
1.6605 – 2.5 GHz	1876.10	10	-53.20	-3.98	-7.59	-64.77	-13
Second Harmonic	3287.00	10	-30.75	-3.98	-31.65	-66.38	-13
Third Harmonic	4930.51	10	-35.02	-3.98	-26.66	-65.66	-13



**5.3.3. High channel (1660.46875 MHz)**

50 – 250% of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Result (dBm/4kHz)	Relative to Carrier (dBc)	Limit (dBc)
Fundamental	1660.47	3	30.5	1.25	31.75	-	-
50 – 100% of assigned BW	1660.50	3	1.26	1.25	2.51	-29.31	-25
100 – 250% of assigned BW	1660.42	3	-9.26	1.25	-8.01	-39.83	-35

> 250 % of assigned BW

Frequency Range	Measured Frequency (MHz)	RBW (kHz)	Reading (dBm)	Correction factor (dB)	Antenna Gain (dBi)	Result (dBm/4kHz e.i.r.p)	Limit (dBm e.i.r.p)
30 MHz – 100 MHz	74.62	3	-59.12	1.25	-38.16	-96.03	-13
100 MHz – 1 GHz	725.80	10	-53.95	-3.98	-25.16	-83.09	-13
1 GHz – 1.6265 GHz	1198.10	10	-53.75	-3.98	-24.74	-82.47	-13
1.6265 – 1.6605 GHz	1660.28	10	-29.75	-3.98	1.37	-32.36	-13
1.6605 – 2.5 GHz	1661.10	10	-33.63	-3.98	1.34	-36.27	-13
Second Harmonic	3320.94	10	-23.56	-3.98	-32.05	-59.59	-13
Third Harmonic	4981.39	10	-26.57	-3.98	-26	-56.55	-13
Forth Harmonic	6641.86	10	-37.51	-3.98	-3.65	-45.14	-13

Supplementary information:

1. Correction factor(dB) =  $10\log(4/RBW)$
2. Result (dBm/4kHz e.i.r.p.) = Reading (dBm)+ Correction factor(dB) + Antenna Gain (dBi)

#### 5.4. Emission Limitations (Radiated Measurement)

<b>TEST: Emission Mask &amp; Spurious emissions : Radiated Measurement</b>		
Method	Measurements were made in the laboratory environment. Emission mask measurement was made using a direct connection between RF output of the EUT and spectrum analyzer. Measurement has been performed with the EUT set to maximum output level at low, mid and high channel frequencies.	
Reference Clause	FCC Part 25 §25.202(f)(1), (2) and (3). FCC Part 2 §2.1053	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	25 °C
	Relative Humidity	39 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 20 GHz	Antenna port

#### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	1
Supplementary information: None		

#### Limits

Frequency Range (MHz)	Attenuation to Carrier power (dBc)	Measurement Bandwidth	Measurement method
50 – 100% of assigned BW	-25	4 kHz	Peak Hold
100 – 250% of assigned BW	-35	4 kHz	Peak Hold
> 250 % of assigned BW	-(43+10log(Pmax))	4 kHz	Peak Hold

NOTE : §25.202(f)(1), (2) and (3)

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

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 % up to and including 100 % 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 % up to and including 250 % 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 % 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;

Measurement method :  Radiated       Conducted  
 Mode of operation : Continuous Wave  
 Power setting : Max. Power condition declared by the manufacturer

**5.4.1. Low channel (1626.53125 MHz)**

Measured Frequency (MHz)	Reading (dBuV)	SG Level (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Result (dBm e.i.r.p.)	Limit (dBm e.i.r.p.)
68.80	36.80	-79.59	0.46	1.2	-78.85	-13
77.53	37.80	-80.00	0.52	1.89	-78.63	-13
99.84	40.70	-74.83	0.57	2.46	-72.94	-13
245.34	39.30	-75.39	0.89	1.49	-74.79	-13
246.31	43.00	-73.33	0.9	1.49	-72.74	-13
287.05	44.20	-71.04	0.98	1.41	-70.61	-13

**5.4.2. Middle channel (1643.5 MHz)**

Measured Frequency (MHz)	Reading (dBuV)	SG Level (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Result (dBm e.i.r.p.)	Limit (dBm e.i.r.p.)
99.84	37.90	-78.97	0.57	2.46	-77.08	-13
245.34	42.90	-73.43	0.89	1.49	-72.83	-13
288.99	45.80	-69.44	0.98	1.41	-69.01	-13
311.30	43.20	-72.57	1.02	1.32	-72.27	-13
322.94	33.90	-79.76	1.05	1.24	-79.57	-13

**5.4.3. High channel (1660.46875 MHz)**

Measured Frequency (MHz)	Reading (dBuV)	SG Level (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Result (dBm e.i.r.p.)	Limit (dBm e.i.r.p.)
85.29	40.90	-75.97	0.54	2.43	-95.18	-13
99.84	38.90	-76.63	0.57	2.46	-92.04	-13
245.34	44.70	-71.63	0.89	1.49	-87.33	-13
272.50	46.20	-69.04	0.96	1.44	-83.96	-13
290.93	44.30	-71.47	0.99	1.41	-85.75	-13

Supplementary information:

- Limit §25.202(f) : 43+10log P max dBc
- Any emission having a level below than the above listed level was not reported.
- Emission Level (dBm e.i.r.p.) = Signal Generator output level (dBm) - Cable loss(dB) + Antenna Gain(dBi)
- Spectrum analyser setting : RBW as specified in limit table, VBW as 3 times RBW, Peak Hold
- Spectrum analyser noise floor was at least 6 dB below the specified limits.
- EUT was positioned to 3 axis and worst case was Top side front ( x-axis ) position.

## 5.5. Power Limits

<b>TEST: RF Power limits</b>		
Method	To measure the EIRP, the EUT was placed on a table in a 10 meter test chamber. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. The receiving antenna was placed in 3 meter distance on the antenna mast. Both horizontal and vertical polarization of the antenna were measured by rotating the EUT. Measurement were performed on three orthogonal axis. The receiving level was recorded. The EUT was replaced with a substitution transmit antenna and signal generator. The TX power from the signal generator was tuned to get the same reading level of the predetermined receiving level. The signal generator output level, cable loss and substitution antenna gain were considered to calculate the EIRP..	
Reference Clause	§25.204(a), §2.1046	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C
	Relative Humidity	45 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	1,624.5 MHz – 1,662.5 MHz	Antenna out port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	1
Supplementary information: None		

### Limits

(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 15 GHz, shall not exceed +40 dBW in any 4 kHz band.

Project Number: 10022750  
Model Number: XT

File Number : MC17256

Page : 29 of 31

Measurement method :  Radiated  Conducted

Mode of operation : Continuous Wave

Power setting : Max. Power condition declared by the manufacturer

### 5.5.1. Test Result

Measured Frequency (MHz)	Reading (dBuV)	SG Level (dBm)	Cable Loss (dB)	Substituti on Antenna Gain (dBi)	Result (dBm e.i.r.p.)	Correction Factor (dB)	Result (dBm e.i.r.p./ 4kHz)	Result (dBW e.i.r.p./ 4kHz)	Limit (dBW)
1626.53125	109.84	25.70	2.49	8.14	31.35	1.25	32.6	2.6	40
1643.5	109.17	25.03	2.50		30.67	1.25	31.92	1.92	40
1660.46875	109.54	25.40	2.52		31.02	1.25	32.27	2.27	40

Supplementary information:

- Reading (dBuV) is measured as RBW 3 kHz.
- Correction Factor (dB) =  $10 \log (4 \text{ kHz} / 3 \text{ kHz})$
- Result (dBW e.i.r.p.) = Signal Generator output level (dBm) - Cable loss(dB) + Antenna Gain(dBi) - 30 (dB)
- Spectrum analyser setting : RBW as specified in limit table, VBW as 3 times RBW, Peak Hold
- Spectrum analyser noise floor was at least 6 dB below the specified limits.
- EUT was positioned to 3 axis and worst case was Top side front ( x-axis ) position.

## 5.6. Limits on emissions for aeronautical radio navigation-satellite service

<b>TEST: Conducted emissions at Antenna port</b>		
Method	Measurements were made in the laboratory environment. Conducted spurious emission measurement was made using a direct connection between RF output of the EUT and spectrum analyzer through RF attenuator. Measurement has been performed with the EUT set to maximum output level at lowest and highest channel frequencies. The spectrum was investigated from 1,559 MHz to 1,610 MHz.	
Reference Clause	§25.216 (c), (h) & (i)	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	25 °C
	Relative Humidity	39 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	1,559 MHz – 1,610 MHz	Antenna port

### Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1, 2	2
Supplementary information: None		

### Limits

Frequency (MHz)	Maximum EIRP (dBW)	Resolution Bandwidth	Condition
1559 - 1605	-70	1 MHz	Carrier-on
1559 - 1605	-80	700 Hz	discrete
1605 - 1610	-70 to -46	1 MHz	Carrier-on
1605 - 1610	-80 to -56	700 Hz	discrete
1559 - 1610	-80	1 MHz	Carrier-off

Supplementary information: §25.216 (c), (h) & (i)

(c) The e.i.r.p. density of emissions from mobile earth stations with assigned uplink frequencies between 1610 MHz - 1660.5 MHz shall not exceed -70 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1559–1605 MHz.

The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW, averaged over any 2 millisecond active transmission interval, in the 1559–1605 MHz band.

(h) Mobile earth stations with assigned uplink frequencies in the 1626.5–1660.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -46 dBW/MHz at 1610 MHz, averaged over any 2 millisecond active transmission interval.

The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -56 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

(i) The e.i.r.p. density of carrier-off state emissions from mobile earth stations with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any two millisecond interval.

Measurement method :  Radiated  Conducted  
 Mode of operation : Continuous Wave or idle mode  
 Power setting : Max. Power condition declared by the manufacturer

**5.6.1. Low channel (1626.53125 MHz)**

Operation Mode	Frequency Range	Measured Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	Result (dBm/MHz e.i.r.p)	Result (dBW/MHz e.i.r.p)	Limit (dBW/MHz e.i.r.p)
Carrier On	1559 - 1605	1602.6	-47.94	3.41	-44.53	-74.53	-70
	1605 - 1610	1605	-50.41		-47.00	-77.00	-70
Carrier Off	1559 - 1605	1602.17	-80.42		-77.01	-107.01	-80

**5.6.2. Middle channel (1643.5 MHz)**

Operation Mode	Frequency Range	Measured Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	Result (dBm/MHz e.i.r.p)	Result (dBW/MHz e.i.r.p)	Limit (dBW/MHz e.i.r.p)
Carrier On	1559 - 1605	1604.97	-49.44	3.41	-46.03	-76.03	-70
	1605 - 1610	1605	-50.28		-46.87	-76.87	-70
Carrier Off	1559 - 1605	1587.33	-81.67		-78.26	-108.26	-80

**5.6.3. High channel (1660.46875 MHz)**

Operation Mode	Frequency Range	Measured Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	Result (dBm/MHz e.i.r.p)	Result (dBW/MHz e.i.r.p)	Limit (dBW/MHz e.i.r.p)
Carrier On	1559 - 1605	1604.97	-51.78	3.41	-48.37	-78.37	-70
	1605 - 1610	1605	-50.83		-47.42	-77.42	-70
Carrier Off	1559 - 1605	1601.77	-81.44		-78.03	-108.03	-80

Supplementary information:

$$\text{Result (dBW/MHz e.i.r.p.)} = \text{Reading (dBm)} + \text{Antenna Gain (dBi)} - 30 \text{ (dB)}$$