

# RADIO TEST REPORT – 442937-1TRFWL

Type of assessment:

**Final product testing**

Applicant:

**ORBCOMM Inc.**

Product:

**SCU Mobile Satellite Earth Station Terminal**

Model:

**SCU**

FCC ID:

**XGS-SCU**

IC Registration number:

**11881A-SCU**

Specifications:

- ◆ **FCC 47 CFR Part 25**
- ◆ **RSS-170 Issue 3, July 9 2015**

Date of issue: September 29, 2021

**Alvin Liu, EMC/RF Specialist**

Tested by



Signature

**Tarek Elkholy, EMC/RF Specialist**

Reviewed by



Signature

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The SCC Accreditation Symbol is an official symbol of the Standards Council of Canada, used under licence.

SCC File Number: 15064 (Ottawa/Almonte); 151100 (Montreal); 151097 (Cambridge)

FCC Part 25 and RSS-170 Issue 3; Date: September, 2021



Test location

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Company name	Nemko Canada Inc.			
Facilities	<i>Ottawa site:</i> 303 River Road Ottawa, Ontario Canada K1V 1H2  Tel: +1 613 737 9680 Fax: +1 613 737 9691	<i>Montréal site:</i> 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8  Tel: +1 514 694 2684 Fax: +1 514 694 3528	<i>Cambridge site:</i> 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2  Tel: +1 519 650 4811	<i>Almonte site:</i> 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0  Tel: +1 613 256-9117
	<b>Test site registration</b>	<b>Organization</b> FCC/ISED	<b>Recognition numbers and location</b> FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)	
Website	<a href="http://www.nemko.com">www.nemko.com</a>			

Limits of responsibility

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Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant/Manufacturer

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Applicant name	ORBCOMM Inc.
Applicant address	395 W Passaic Street, Suite 325, Rochelle Park, NJ 07662 USA
Manufacturer name	Same as applicant
Manufacturer address	Same as applicant

### 1.2 Test specifications

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FCC 47 CFR Part 25	Satellite communications
RSS-170, Issue 3, July 9, 2015	Mobile Earth Stations (MESs) and Ancillary Terrestrial Component (ATC) Equipment Operating in the Mobile-Satellite Service (MSS) Bands

### 1.3 Test methods

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ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio services
273109 D01 Equip Auth Guide Part 25 TXReceiver v02r02 (2011)	Equipment Authorization Guidance for Part 25 Transceivers

### 1.4 Exclusions

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None

### 1.5 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

### 1.6 Test report revision history

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Revision #	Date of issue	Details of changes made to test report
TRF	September 29, 2021	Original report issued

## Section 2. Summary of test results

### 2.1 Testing location

Test location (s) Cambridge

### 2.2 Testing period

Test start date September 22, 2021 Test end date September 27, 2021

### 2.3 Sample information

Receipt date September 21, 2021 Nemko sample ID number(s) 1, 2, 3

### 2.4 FCC Part 25 test results

Part	Test description	Verdict
§2.1046	Occupied bandwidth	Pass
§25.204	Power limit	Pass
§25.202(f)	Spurious emissions at the antenna terminal	Pass
§25.202(f)	Field strength of spurious emissions	Pass
§25.202(d)	Frequency tolerance, earth stations	Pass

Notes: None

### 2.5 ISED RSS-GEN, Issue 5 test results

Part	Test description	Verdict
6.7	Occupied bandwidth	Pass
7.3	Receiver radiated emission limits	Not applicable <sup>1</sup>
7.4	Receiver conducted emission limits	Not applicable <sup>1</sup>
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not applicable <sup>2</sup>

Notes: <sup>1</sup> According to sections 5.2 and 5.3 of RSS-Gen Issue 5, the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

<sup>2</sup> EUT is a battery-operated device intended to be installed in a vehicle.

### 2.6 ISED RSS-170, Issue 3 test results

Part	Test description	Verdict
5.1	Frequency bands	Pass
5.2	Frequency stability	Pass
5.3.2	Transmitter e.i.r.p. for mobile earth stations (MESs)	Pass
5.4.3.1	Transmitter unwanted emissions for MESs in all frequency bands	Pass

Notes: None

## Section 3. Information provided by the applicant

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### 3.1 Disclaimer

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This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

### 3.2 EUT information

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Product name	SCU Mobile Satellite Earth Station Terminal
Model	SCU
Serial number	53351 21353048
Product description and theory of operation	The device consists of a mobile Satellite communication modem and its antenna. The device is operated with Orbcomm's OG satellite network in VHF band at 148-150.05MHz. The device is designed for industrial equipment control, monitoring and management.

### 3.3 Technical information

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Applicant IC company number	11881A
IC UPN number	SCU
All used IC test site(s) Reg. number	24676
RSS number and Issue number	RSS-170, Issue 3, July 9, 2015
Frequency band	148-150.05 MHz
Frequency Min (MHz)	148.0275
Frequency Max (MHz)	150.0200
RF power Max (W), Conducted	6.3 (38.0 dBm)
Field strength, Units @ distance	N/A
Measured BW (kHz), 99% OBW	2.924
Type of modulation	SDPSK
Emission classification (F1D, G1D, D1D)	G1D
Power requirements	12 V <sub>DC</sub>
Antenna information	Gain: 2.2 dBi peak, Model: VOE17480786, connector type: Fakra EUT is designed so that the end user may replace a broken antenna. (The EUT has a non-standard antenna jack or electrical connector.)
Stated EIRP, dBm	40.0

### 3.4 EUT exercise details

- EUT was connected with cable harness provided external power supply port to a DC supply, serial communication interface port to a laptop and I/O ports connection.
- EUT was controlled by application SCAPI to run the satellite module to transmit a modulated signal
- The transmitting signal was set at full power with 4 sec ON and 10 sec OFF.

### 3.5 EUT test configuration

**Table 3.5-1: EUT sub assemblies**

Description	Brand name	Model/Part number
Antenna	VOLVO	MN: VOE17480786

**Table 3.5-2: EUT interface ports**

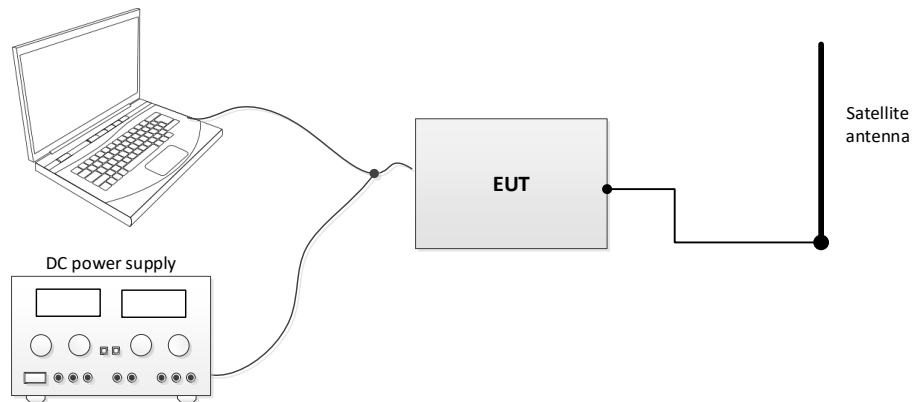
Description	Qty.
Power/signal Port	1
Antenna Port	1

**Table 3.5-3: Support equipment**

Description	Brand name	Serial number, Part number, Model, Revision level
Laptop	Dell	Latitude E6420
DC power supply	GWInstek	GPR-3060D

**Table 3.5-4: Inter-connection cables**

Cable description	From	To	Length (m)
Cable harness	EUT	DC Supply / Laptop	1.5
Antenna cable	EUT	Antenna	5.0



**Figure 3.5-1: Block diagram**

## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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There were no modifications performed to the EUT during this assessment.

### 4.2 Technical judgment

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None

### 4.3 Model variant declaration

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There were no model variants declared by the applicant.

### 4.4 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.



## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

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When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

### 5.2 Power supply range

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The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.

## Section 6. Measurement uncertainty

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### 6.1 Uncertainty of measurement

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UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of  $K = 2$  with 95% certainty.

**Table 6.1-1: Measurement uncertainty**

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Occupied bandwidth	4.45
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

## Section 7. Test equipment

### 7.1 Test equipment list

**Table 7.1-1: Equipment list**

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA003012	1 year	April 12, 2022
Flush mount turntable	SUNAR	FM2022	FA003006	—	NCR
Controller	SUNAR	SC110V	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	FA003007	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	FA002969	1 year	November 12, 2021
Receiver/spectrum analyzer	Rohde & Schwarz	FSW43	FA002971	1 year	November 13, 2021
Bilog antenna (30–2000 MHz)	SUNAR	JB1	FA003010	1 year	April 28, 2022
Horn antenna (1–18 GHz)	ETS Lindgren	3117	FA002911	1 year	April 21, 2022
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002956	1 year	April 5, 2022
50 Ω coax cable	Huber + Suhner	None	FA003047	1 year	December 17, 2021
50 Ω coax cable	Huber + Suhner	None	FA003043	1 year	December 17, 2021
Temperature humidity test chamber	LIK	LKPTH-100E	None	—	VOU

Note: NCR - no calibration required; VOU – verification on use



## Section 8. Testing data

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### 8.1 FCC 2.1049 and RSS-Gen 6.7 Occupied bandwidth

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#### 8.1.1 Definitions and limits

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**FCC:**

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

**ISED:**

The emission bandwidth ( $\times$  dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated  $\times$  dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least  $3\times$  the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

#### 8.1.2 Test summary

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Test date	September 23, 2021
Test engineer	Alvin Liu
Verdict	Pass

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#### 8.1.3 Observations, settings and special notes

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Measurement performed with reference to ANSI 63.26 section 5.4.4

Spectrum analyser settings for 99% occupied bandwidth:

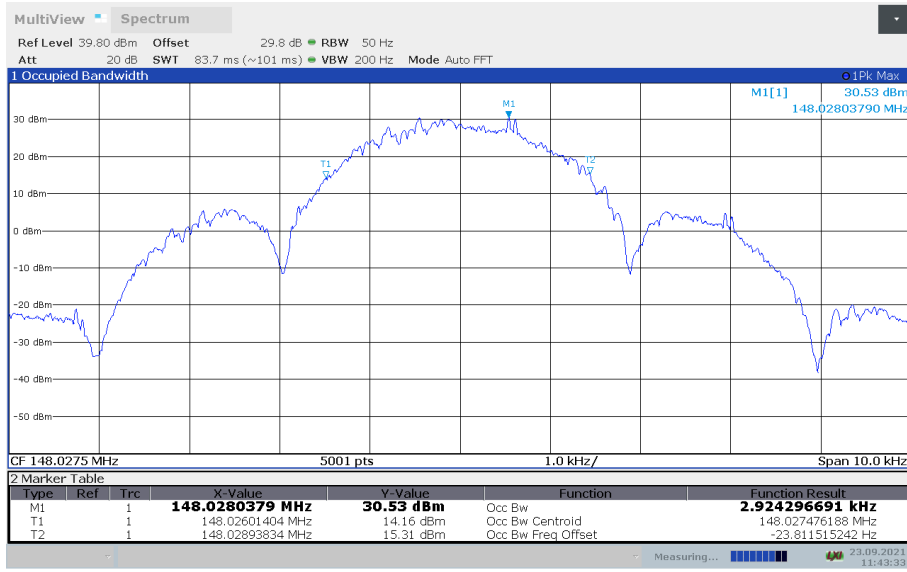
Resolution bandwidth:	1 – 5 % OBW
Video bandwidth:	$\geq 3 \times$ RBW
Detector mode:	Peak
Trace mode:	Max Hold

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8.1.4 Test data

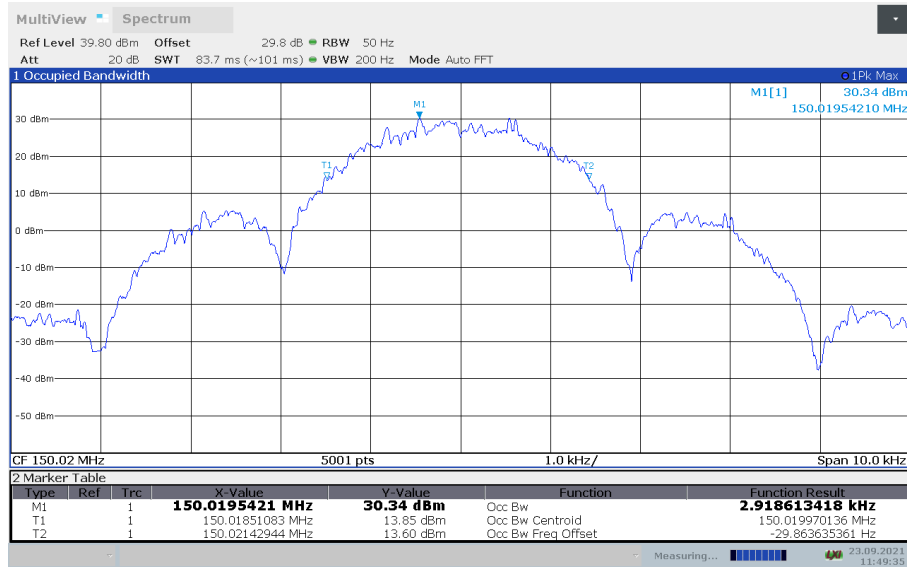
**Table 8.1-1: 99 % bandwidth results**

Frequency, MHz	99 % occupied bandwidth, kHz
148.0275	2.924
150.0200	2.919



11:43:33 23.09.2021

**Figure 8.1-1: 99 % bandwidth on low channel**



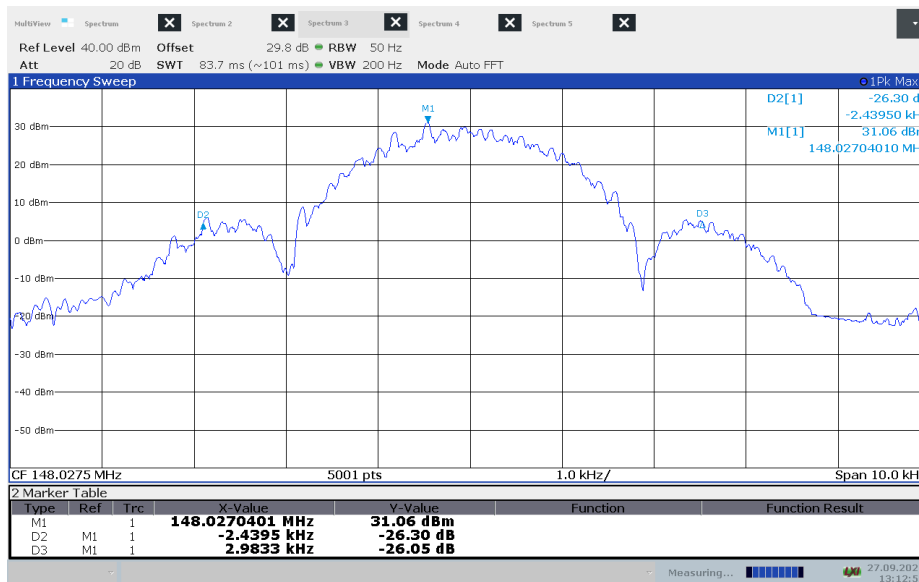
11:49:36 23.09.2021

**Figure 8.1-2: 99 % bandwidth on high channel**

Test data, continued

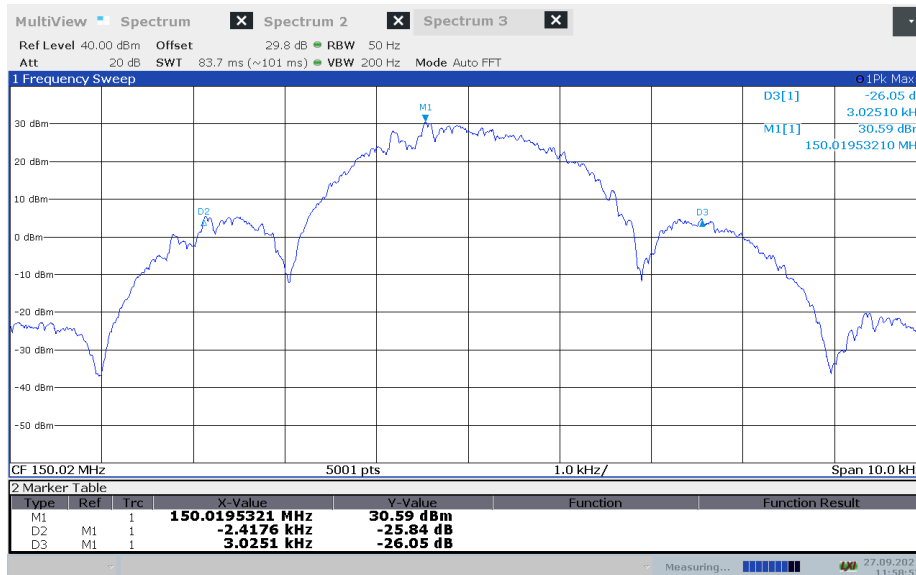
**Table 8.1-2: 26 dB bandwidth results**

Frequency, MHz	26 dB bandwidth, kHz
148.0275	5.423
150.0200	5.443



13:12:57 27.09.2021

**Figure 8.1-3: 26 dB bandwidth on low channel**



11:58:53 27.09.2021

**Figure 8.1-4: 26 dB bandwidth on high channel**

## 8.2 FCC 25.204 and RSS-170 5.3.2 Transmitter e.i.r.p. for mobile earth stations

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### 8.2.1 Definitions and limits

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**FCC:**

- (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 the following limits except as provided for in paragraph (c) below:  
 +40 dBW (70 dBm) in any 4 kHz band for  $\Theta \leq 0^\circ$   
 +40 + 3 $\Theta$  dBW in any 4 kHz band for  $0^\circ < \Theta \leq 5^\circ$   
 where  $\Theta$  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.
- (b) In bands shared coequally with terrestrial radiocommunication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands above 15 GHz shall not exceed the following limits except as provided for in paragraph (c) below:  
 +64 dBW (94 dBm) in any 1 MHz band for  $\Theta \leq 0^\circ$   
 +64 + 3  $\Theta$  dBW in any 1 MHz band for  $0^\circ < \Theta \leq 5^\circ$   
 where  $\Theta$  is as defined in paragraph (a) above.
- (c) For angles of elevation of the horizon greater than  $5^\circ$  there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.
- (d) Notwithstanding the e.i.r.p. and e.i.r.p. density limits specified in the station authorization, each earth station transmission shall be conducted at the lowest power level that will provide the required signal quality as indicated in the application and further amended by coordination agreements.

**ISED:**

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

### 8.2.2 Test summary

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Test date	September 23, 2021
Test engineer	Alvin Liu
Verdict	Pass

### 8.2.3 Observations, settings and special notes

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Measurements performed with reference to ANSI 63.26 section 5.2.3.3 for peak power of narrowband signal using a spectrum analyzer. Resolution bandwidth of 5 kHz selected in lieu of a 4kHz to satisfy FCC requirement.

Spectrum analyzer settings:

Resolution bandwidth	5 kHz
Video bandwidth	20 kHz
Detector mode	Peak
Trace mode	Max Hold



8.2.4 Test data

**Table 8.2-1: Conducted peak output power measurement results – ISED**

Frequency, MHz	Output power, dBm	Gain, dBi	EIRP, dBm	Stated EIRP, dBm	Maximum permissible EIRP, dBm	Margin, dB
148.0275	37.8	2.2	40.0	40.0	42.0	2.0
150.0200	37.3	2.2	39.5	40.0	42.0	2.5

Note: Maximum permissible EIRP = Stated EIRP + 2 dB

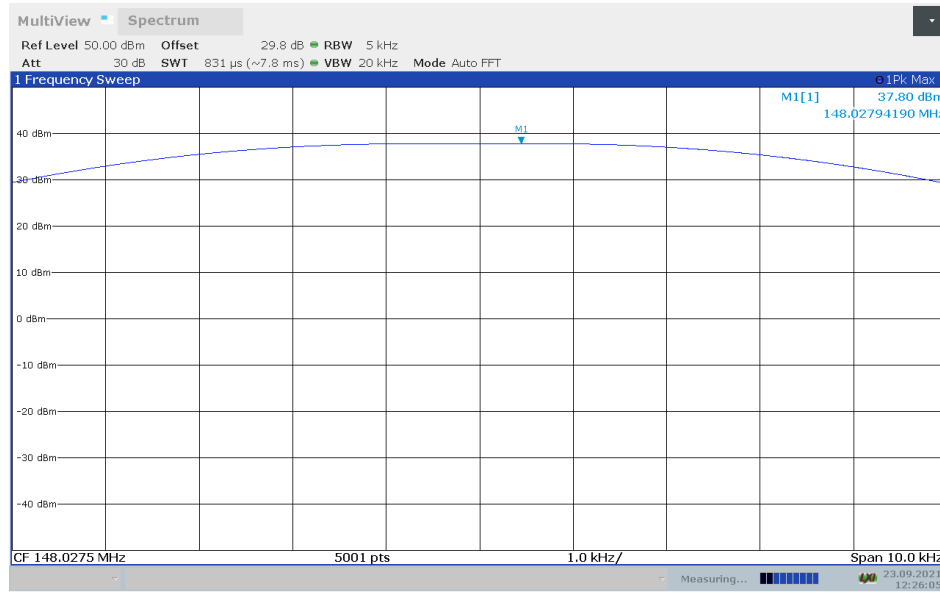
**Table 8.2-2: Conducted peak output power measurement results – FCC**

Frequency, MHz	Output power, dBm/5 kHz	Gain, dBi	EIRP, dBm/5 kHz	EIRP limit, dBm/4kHz	Margin, dB
148.0275	37.8	2.2	40.0	70.0	30.0
150.0200	37.3	2.2	39.5	70.0	30.5

Note: EIRP limit, dBm/4kHz calculated as follows: 40 dBW = 70 dBm

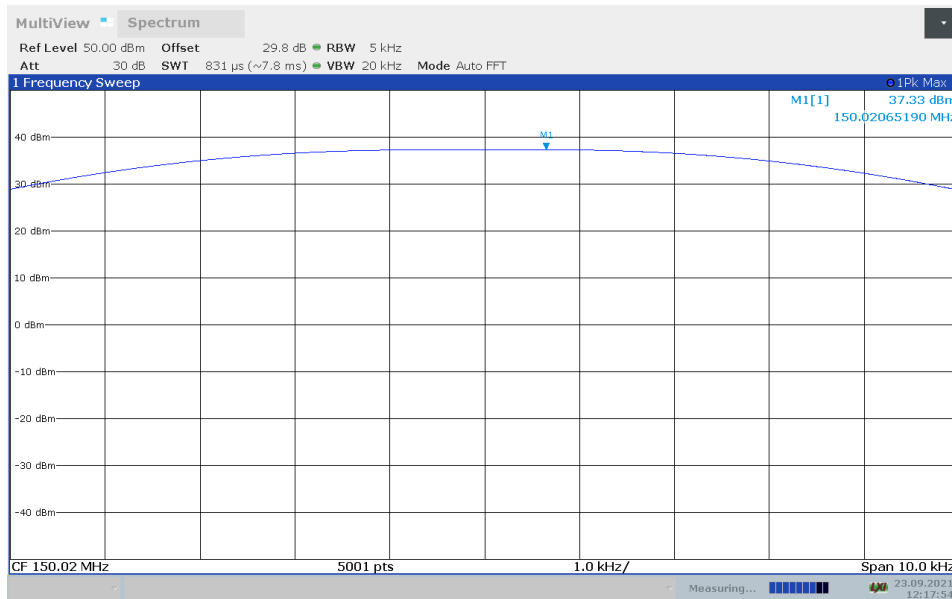


Test data, continued



12:26:06 23.09.2021

**Figure 8.2-1: Conducted peak output power on low channel**



12:17:54 23.09.2021

**Figure 8.2-2: Conducted peak output power on high channel**

## 8.3 FCC 25.202(f) and RSS-170 5.4 Field strength of spurious emissions

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### 8.3.1 Definitions and limits

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**FCC:**

(f) Emission limitations. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;
- (2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;
- (3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts (-13 dBm fixed);
- (4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

**ISED:**

The transmitter unwanted emissions shall be measured with the carrier frequency set at both the highest and lowest channels in which the equipment is designed to operate.

The e.i.r.p. density of unwanted and carrier-off emissions in this section shall be averaged over any 2 ms active transmission using a root-mean-square detector with a resolution bandwidth of 1 MHz for broadband emissions and a resolution bandwidth of 1 kHz for discrete emissions, unless stated otherwise.

#### 5.4.3 Mobile Earth Stations

##### 5.4.3.1 Mobile Earth Stations in All Frequency Bands

The average power of unwanted emissions shall be attenuated below the average output power, P (dBW), of the transmitter, as specified below:

- (1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;
- (2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater;
- (3)  $43 + 10 \log p$  (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

### 8.3.2 Test summary

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Test date	September 22, 2021
Test engineer	Alvin Liu
Verdict	Pass

### 8.3.3 Observations, settings and special notes

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The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.

Radiated spurious measurements were performed at a distance of 3 m per ANSI 63.26 section 5.5.2 on a test site validated to the requirements of ANSI 63.10

Conducted spurious measurements were performed with reference to ANSI 63.26 section 5.7.4

Conducted out-of-band emissions measurements performed with using the power integration method per ANSI 63.26 section 5.7.2(a) and 5.7.3; the measured value is scaled using 10 log (Reference bandwidth/Measurement bandwidth).

Authorized bandwidth (6 kHz) > Occupied bandwidth. Therefore, the authorized bandwidth was used to calculate spurious emission mask.

Spectrum analyser settings for conducted spurious emissions measurements 30 MHz – 2 GHz:

Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for conducted out-of-band emissions measurements outside assigned channel

Span	40 kHz
Resolution bandwidth	50 Hz
Video bandwidth	200 Hz
Detector mode	RMS
Trace mode	Max Hold
Integration bandwidth	Fundamental dBm/4 kHz, 50–100% BW dBm/3 kHz, 100–250% BW dBm/4 kHz, ≥ 250% BW dBm/4 kHz

Spectrum analyser settings for radiated spurious emissions measurements below 1 GHz:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for radiated spurious emissions measurements above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak
Trace mode	Max Hold

8.3.4 Test data

**Table 8.3-1: Out-of-band unwanted emissions in 50 – 100 % Authorized bandwidth**

Frequency, (MHz)	Mean output power, (dBm/4 kHz)	Mean adjacent power 50–100% BW, (dBm/3 kHz)	Scaled mean adjacent power 50–100% BW, (dBm/4 kHz)	Limit, 50–100% BW, (dBm/4 kHz)	Margin, (dB)
148.0275	37.52	2.31	3.56	12.52	8.96
150.0200	37.09	1.67	2.92	12.09	9.17

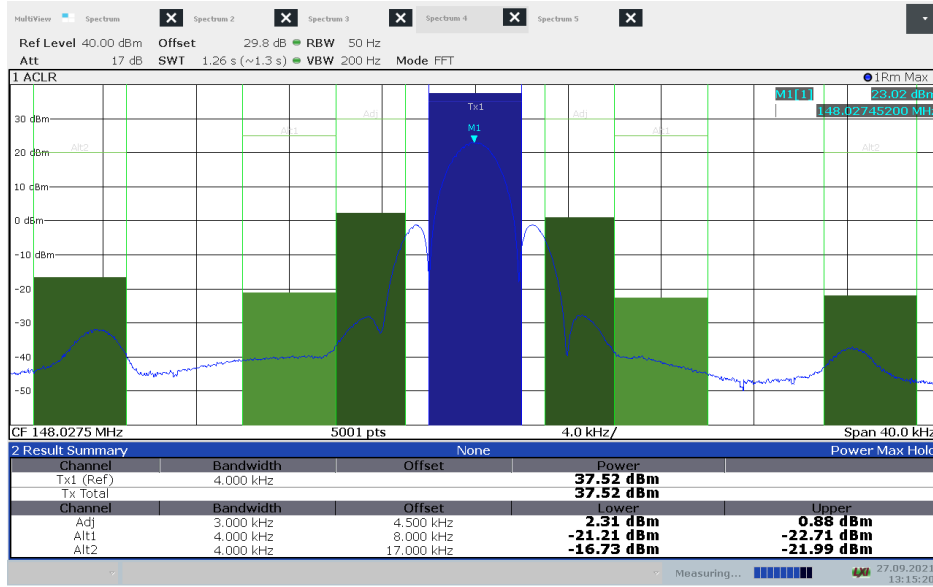
Note: Scaled power = measured power + 10log(Reference BW/Measurement BW), Limit = mean output power, dBm/4 kHz - 25 dB

**Table 8.3-2: Out-of-band unwanted emissions in 100 – 250 % Authorized bandwidth**

Frequency, (MHz)	Mean output power, (dBm/4 kHz)	Mean adjacent power 100 – 250% BW, (dBm/4 kHz)	Limit, 100–250% BW, (dBm/4 kHz)	Margin, (dB)
148.0275	37.52	-21.21	2.52	23.73
150.0200	37.09	-20.33	2.09	22.42

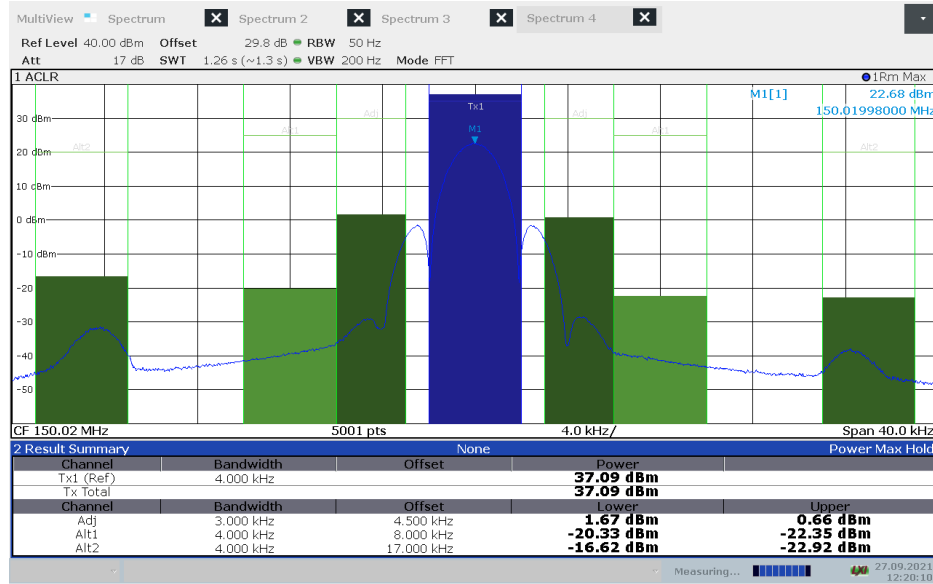
Note: Limit = mean output power, dBm/4 kHz - 35 dB

Test data, continued



13:15:21 27.09.2021

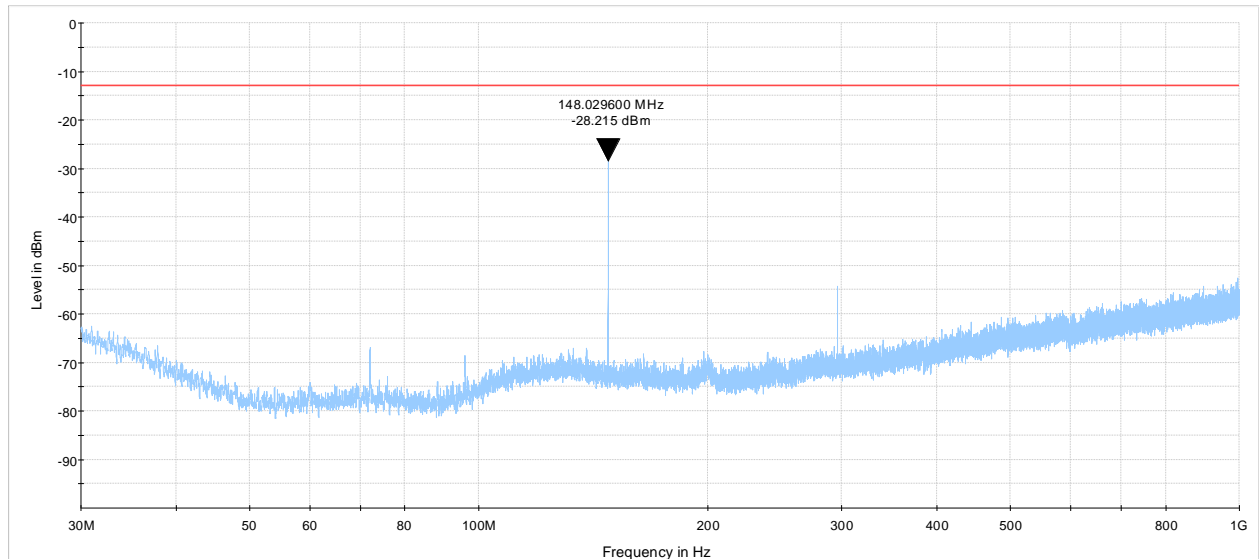
**Figure 8.3-1: Out-of-band unwanted emissions, low channel**



12:20:10 27.09.2021

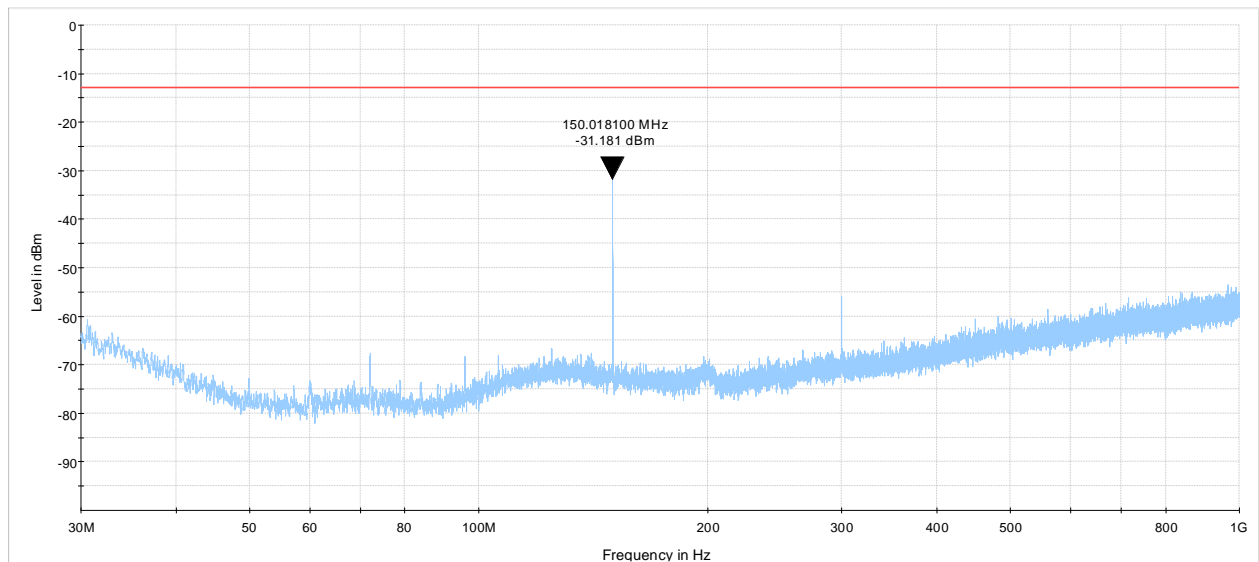
**Figure 8.3-2: Out-of-band unwanted emissions, high channel**

Test data, continued



NEX-442937 Radiated spurious 30 - 1000 MHz, low channel  
Preview Result 1-PK+ -13 dBm Limit

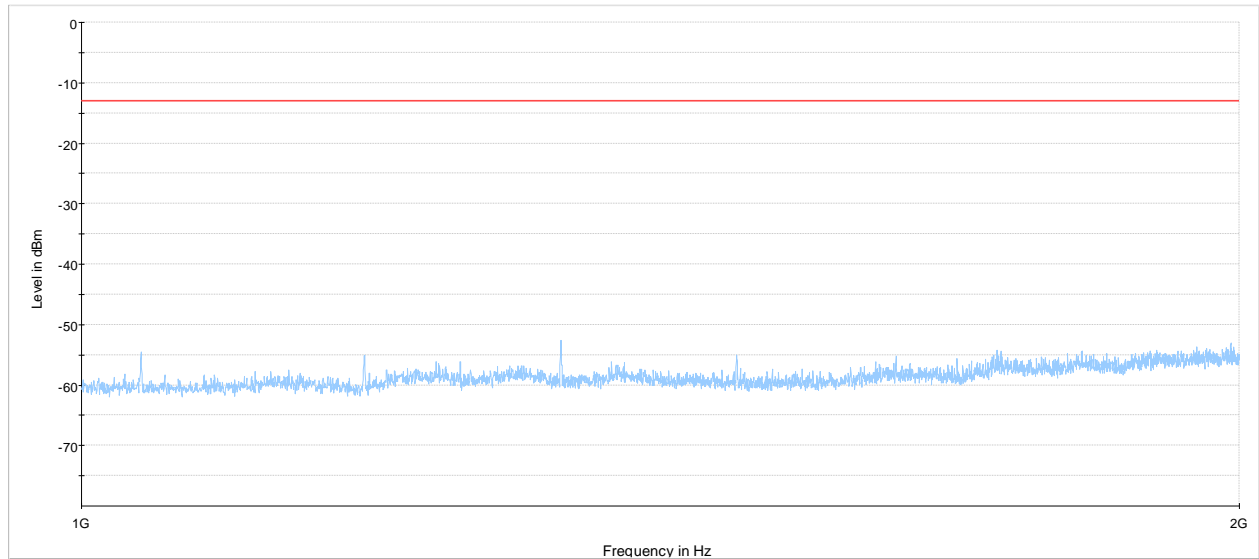
Figure 8.3-2: Spurious emissions below 1 GHz, low channel



NEX-442937 Radiated spurious 30 - 1000 MHz, high channel  
Preview Result 1-PK+ -13 dBm Limit

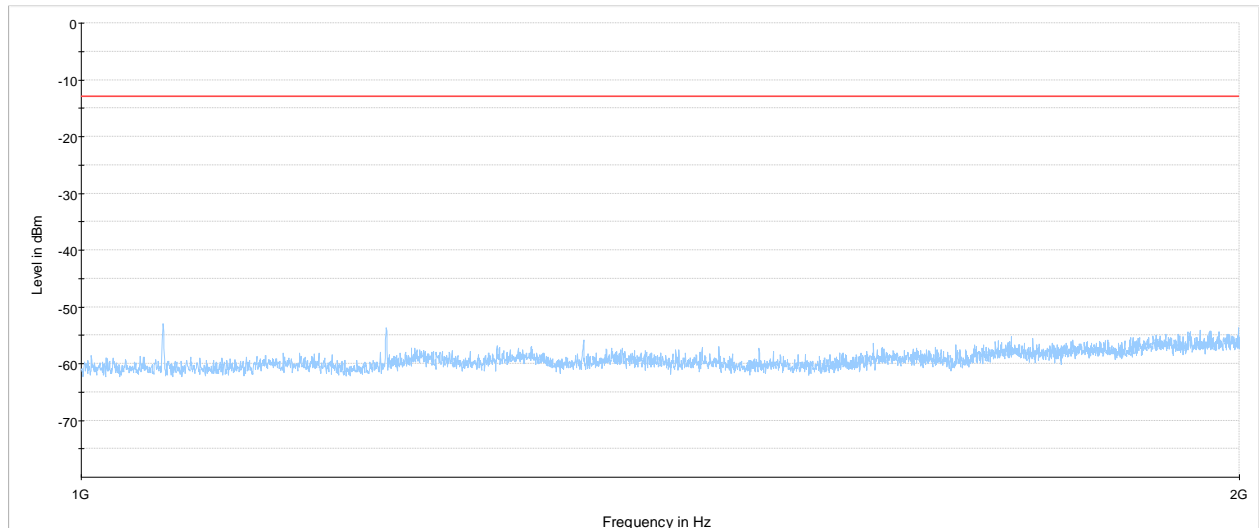
Figure 8.3-3: Spurious emissions below 1 GHz, high channel

Test data, continued



NEX-442937 Radiated spurious above 1GHz, low channel  
Preview Result 1-PK+ -13 dBm Limit

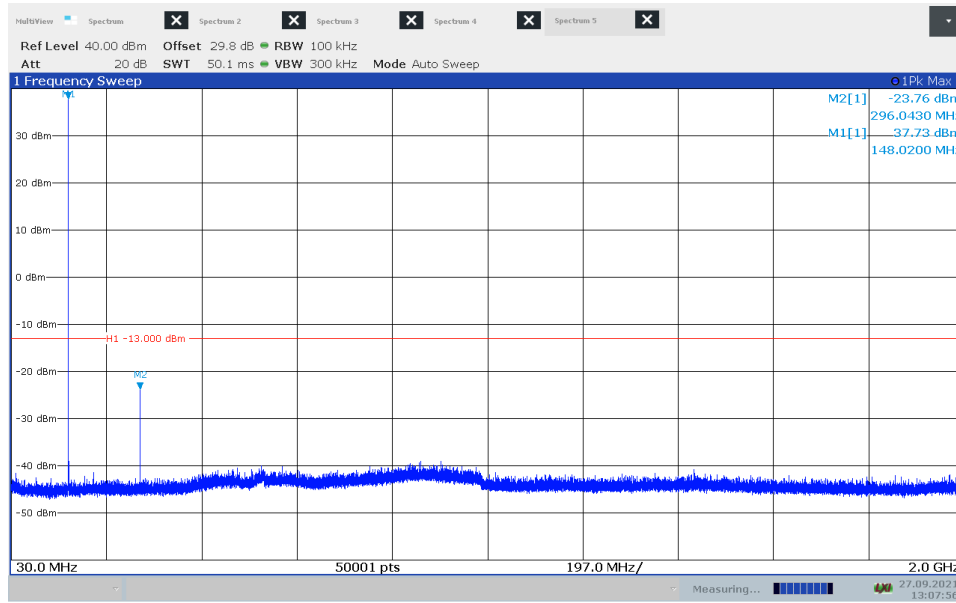
Figure 8.3-4: Radiated spurious emissions 1–2 GHz, low channel



NEX-442937 Radiated spurious above 1GHz, high channel  
Preview Result 1-PK+ -13 dBm Limit

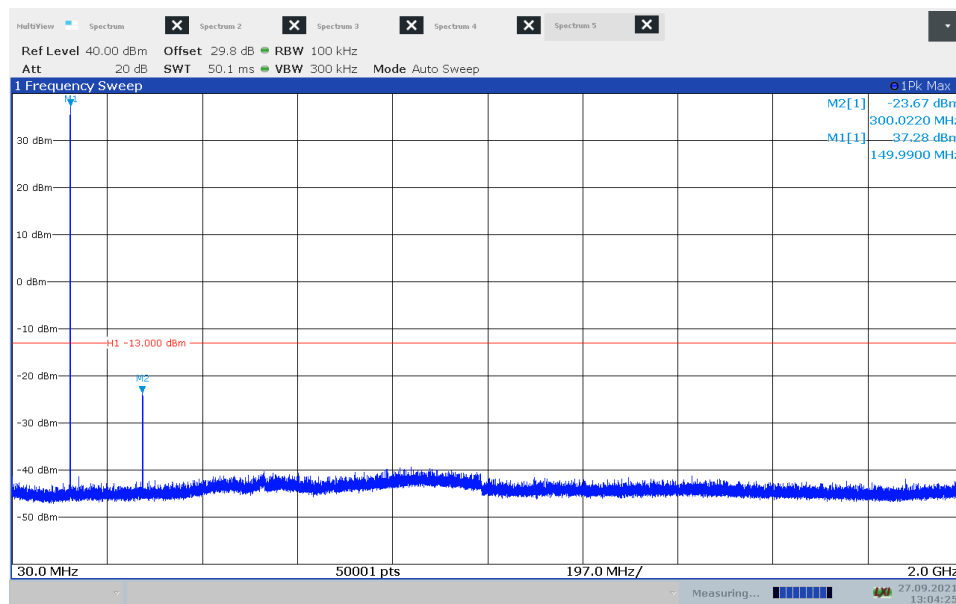
Figure 8.3-5: Radiated spurious emissions 1–2 GHz, high channel

Test data, continued



13:07:57 27.09.2021

**Figure 8.3-6: Conducted spurious emissions, low channel**



13:04:26 27.09.2021

**Figure 8.3-7: Conducted spurious emissions, high channel**



## 8.4 FCC 25.202(d) and RSS-170 5.2 Frequency tolerance, Earth stations

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### 8.4.1 Definitions and limits

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**FCC:**

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent ( $\pm 10$  ppm) of the reference frequency.

**§2.1055 Frequency stability**

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  for all equipment except that specified in paragraphs (a)(2) and (3) of this section

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than  $10^{\circ}\text{C}$  through the range.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

**ISED:**

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than  $\pm 10$  ppm.

### 8.4.2 Test summary

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Test date	September 27, 2021
Test engineer	Alvin Liu
Verdict	Pass

### 8.4.3 Observations, settings and special notes

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Frequency stability measurements were performed with reference to ANSI 63.26 section 5.6.3 and section 5.6.5

Offset was calculated as per the following formula:

$$\frac{F_{\text{Measured}} - F_{\text{reference}}}{F_{\text{reference}}} \times 1 \cdot 10^6$$

Spectrum analyzer settings:

Resolution bandwidth:	50 Hz
Video bandwidth:	$\geq 3 \times \text{RBW}$
Detector mode:	Peak
Trace mode:	Max Hold

8.4.4 Test data

**Table 8.4-1: Frequency tolerance measurement result – Low channel**

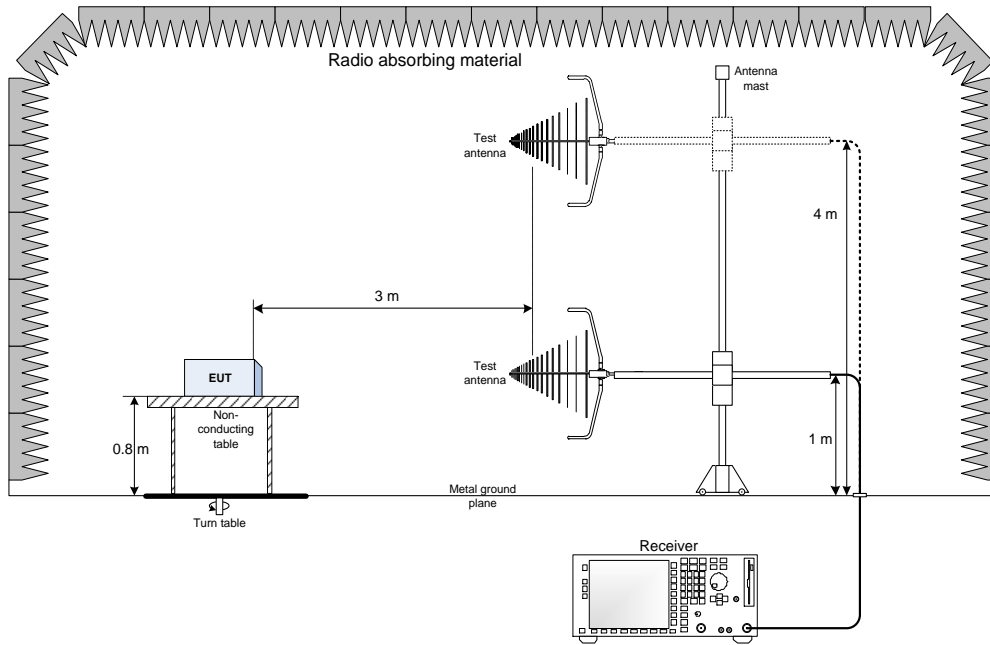
Test conditions	Frequency, Hz	Offset, ppm	Limit, $\pm$ ppm	Margin, ppm
+50 °C, Nominal	148027350	2.2	10.0	7.8
+40 °C, Nominal	148026994	-0.2	10.0	9.8
+30 °C, Nominal	148027028	0.0	10.0	10.0
+20 °C, +15 %	148027032	0.1	10.0	9.9
+20 °C, Nominal	<b>148027021</b>		<b>Reference</b>	
+20 °C, -15 %	148027032	0.1	10.0	9.9
+10 °C, Nominal	148027040	0.1	10.0	9.9
0 °C, Nominal	148027358	2.3	10.0	7.7
-10 °C, Nominal	148027000	-0.1	10.0	9.9
-20 °C, Nominal	148026994	-0.2	10.0	9.8
-30 °C, Nominal	148026990	-0.2	10.0	9.8

**Table 8.4-3: Frequency tolerance measurement result – High channel**

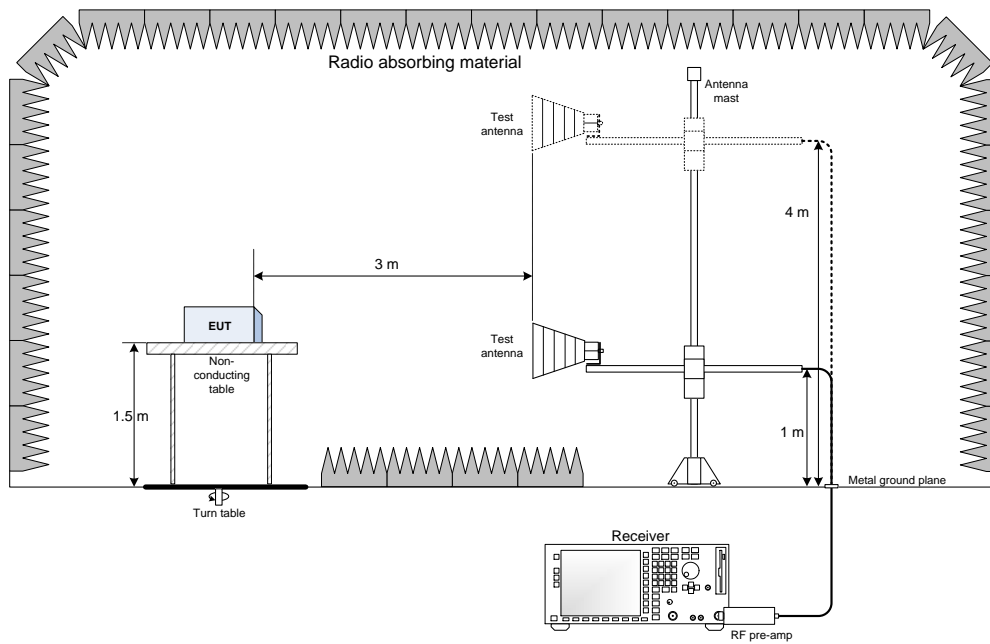
Test conditions	Frequency, Hz	Offset, ppm	Limit, $\pm$ ppm	Margin, ppm
+50 °C, Nominal	150019840	2.1	10.0	7.9
+40 °C, Nominal	150019502	-0.1	10.0	9.9
+30 °C, Nominal	150019504	-0.1	10.0	9.9
+20 °C, +15 %	150019534	0.1	10.0	9.9
+20 °C, Nominal	<b>150019520</b>		<b>Reference</b>	
+20 °C, -15 %	150019510	-0.1	10.0	9.9
+10 °C, Nominal	150019556	0.2	10.0	9.8
0 °C, Nominal	150019526	0.0	10.0	10.0
-10 °C, Nominal	150019528	0.1	10.0	9.9
-20 °C, Nominal	150019496	-0.2	10.0	9.8
-30 °C, Nominal	150019504	-0.1	10.0	9.9

## Section 9. Block diagrams of test set-ups

### 9.1 Radiated emissions set-up for frequencies below 1 GHz



### 9.2 Radiated emissions set-up for frequencies above 1 GHz



### 9.3 Conducted measurement set-up

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