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Report On

FCC and Industry Canada Testing of the
Quake Global Inc QLOCATE

In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry
Canada RSS-170 and Industry Canada RSS-GEN

COMMERCIAL-IN-CONFIDENCE

FCC ID: PB5QLOCATE
IC: 4650A-QLOCATE

Document 75928153 Report 05 Issue 1

November 2014



Product Service

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Document 75928153 Report 05 Issue 1

November 2014

PREPARED FOR

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4933 Paramount Drive
92123
USA

PREPARED BY

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Senior Administrator, Project Support

APPROVED BY

Ryan Henley
Authorised Signatory

DATED

21 November 2014

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

M Russell

G Lawler





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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Quake Global Inc QLOCATE
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and
Industry Canada RSS-GEN



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1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC and Industry Canada Testing of the Quake Global Inc QLOCATE to the requirements of FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Quake Global Inc
Model Number(s)	QLOCATE 1158-5000
Serial Number(s)	142105180
Number of Samples Tested	1
Non Tested Variant	1158-5001 (Non GPS)
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2013) FCC CFR 47 Part 25 (2013) Industry Canada RSS-170 (2011) Industry Canada RSS-GEN (2010)
Incoming Release Date	Application Form 05 October 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	PO7195 1 October 2014
Start of Test	9 October 2014
Finish of Test	13 October 2014
Name of Engineer(s)	M Russell G Lawler
Related Document(s)	ANSI C63.4: 2009



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN is shown below.

Section	Spec Clause				Test Description	Result	Comments/Base Standard
	Pt 2	Pt 25	RSS-170	RSS-GEN			
Transmit							
2.1	2.1055	25.202(d)	5.2	-	Frequency Tolerance	Pass	
2.2	2.1053	25.202(f)	5.4.3.1	-	Emission Limitations	Pass	
2.3	-	25.204	5.3	-	Power Limits	Pass	
2.4	-	25.216	5.4.3	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Pass	
2.5	2.1047(d)	-	-	-	Modulation Characteristics	Pass	
2.6	2.1049	-	-	4.6.1	Occupied Bandwidth	Pass	



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1.3 APPLICATION FORM

APPLICANT'S DETAILS	
COMPANY NAME :	QUAKE GLOBAL.....
ADDRESS :	4933 Paramount Dr, San Diego, CA, 92123.....
NAME FOR CONTACT PURPOSES : Enrique Valdez.....	
TELEPHONE NO: (858) 277-7290 EXT 253.....	FAX NO: (858) 277-7259
	E-MAIL: evaldez @quakeglobal.com...

EQUIPMENT INFORMATION			
Model name/number	QLOCATE.....	Identification/Part number	1158-1000.....
Hardware Version		Software Version	TA13001.....
Manufacturer	QUAKE GLOBAL..	Country of Origin	United States of America....
FCC ID	PB5QLOCATE.....	Industry Canada ID	4650A-QLOCATE.....
Technical description (a brief description of the intended use and operation).....			
<u>Supply Voltage:</u>			
☐	AC mains	State AC voltage	and AC frequency
☒	DC (external)	State DC voltage ...5... V	and DC current1.5..... A
☐	DC (internal)	State DC voltage	and Battery type
<u>Frequency characteristics:</u>			
Transmitter Frequency range 1616.... MHz to 1626.5.... MHz		Channel spacing 41.667 kHz.....	
		(if channelized)	
Receiver Frequency range 1616.... MHz to 1626.5.... MHz		Channel spacing 41.667 kHz.....	
(if different)		(if channelized)	
Designated test frequencies:			
Bottom:1616..... MHz Middle: ...1621.0004..... MHz		Top:1626.500084... MHz	
Intermediate Frequencies :		MHz	
Highest Internally Generated Frequency :		1626.500084 ... MHz	
<u>Power characteristics:</u>			
Maximum transmitter power		Minimum transmitter power	
.....1.6... W		(if variable)	
☒	Continuous transmission		
☐	Intermittent transmission	State duty cycle	
If intermittent, can transmitter be set to continuous transmit test mode? Y/N			
<u>Antenna characteristics:</u>			
☒	Antenna connector	State impedance50... ohm	
☐	Temporary antenna connector	State impedance ohm	
☐	Integral antenna Type	State gain dBi	
☐	External Antenna Type	State gain3..... dBi	
<u>Modulation characteristics:</u>			
☐	Amplitude	☒ Other	
☐	Frequency	Details: ...TDMA FDMA.....	
☐	Phase	(GMSK, QSPK etc)	
Can the transmitter operate un-modulated?		Y/N	
ITU Class of emission:			
<u>Battery/Power Supply</u>			
Model name/number		Identification/Part number	
Manufacturer		Country of Origin	
<u>Ancillaries (if applicable)</u>			
Model name/number		Identification/Part number	
Manufacturer		Country of Origin	
<u>Extreme conditions:</u>			
Maximum temperature	...85..... °C	Minimum temperature	...-40..... °C
Maximum supply voltage	...5.5..... V	Minimum supply voltage	...4.5 V



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I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature : 

Name : Darrin Calin

Position held : Vice President of Operations

Date : October 5, 2014



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Quake Global Inc QLOCATE. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 5.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

Industry Canada Company Address Code
IC2932B-1 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



Product Service

SECTION 2

TEST DETAILS

FCC and Industry Canada Testing of the
Quake Global Inc QLOCATE
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and
Industry Canada RSS-GEN



Product Service

2.1 FREQUENCY TOLERANCE

2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055
FCC CFR 47 Part 25, Clause 25.202(d)
Industry Canada RSS-170, Clause 5.2

2.1.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.1.3 Date of Test

13 October 2014

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

This test was performed in accordance with the requirements of FCC CFR 47 Part 2.1055 (a) and (d). The result was compared against the limit specified in 25.202(d).

The EUT was connected to a spectrum analyser via an attenuator which was configured to transmit modulated on the centre channel. Using an RBW of 3 kHz the upper and lower points containing the 20 dB bandwidth were found and the mid-point was determined as the frequency error.

The measurement was performed over the temperature range of +50 to -30 in 10degree steps. Additionally at +20degrees, measurements were performed at 85% and 115% of the primary supply voltage.

2.1.6 Environmental Conditions

Ambient Temperature	23.9°C
Relative Humidity	47.4%



2.1.7 Test Results

5.0 V DC Supply

Under Temperature Variations

1621.020833 MHz

Temperature Interval °C	Frequency Error	
	%	ppm
-30	-0.00016	-1.587
-20	-0.00014	-1.399
-10	-0.00010	-1.035
0	-0.00013	-1.303
+10	-0.00009	-0.949
+20	-0.00009	-0.918
+30	-0.00010	-1.026
+40	-0.00009	-0.881
+50	-0.00007	-0.699

Under Voltage Variations

1621.020833 MHz

DC Voltage	Frequency Error	
	%	ppm
4.25	-0.00010	-1.014
5.0	-0.00009	-0.918
5.75	-0.00009	-0.912

Limit Clause FCC CFR 47, 25.202(d)

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

Limit Clause RSS-170, 5.2

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



2.2 EMISSION LIMITATIONS

2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1053,
FCC CFR 47 Part 25, Clause 25.202(f)
and Industry Canada RSS-170, Clause 5.4.3.1

2.2.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.2.3 Date of Test

10 October 2014, 12 October 2014 & 13 October 2014

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 25.202(f), FCC CFR 47 Part 2.1051 and 2.1053.

For emissions removed less than 250% of the authorized bandwidth from the assigned frequency, measurements were performed conducted as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was transmitting at maximum power, for bottom, middle and top channels. The EUT was modulated as stated in the manufactures application form. The sum of the path loss, a 4 kHz correction factor of 1.71 dB, as the RBW was set as 2.7 kHz on the spectrum analyser, plus the antenna gain as declared by the manufacturer was entered as a reference level offset in to the spectrum analyser. The gated trigger of the analyser was used so that average measurements were taken over the active part of the burst using an RMS detector. The reference level for the mask was set to the mean output power measured in a 4kHz bandwidth. The mask as specified in clause 25.202(f) was then applied.

For emissions removed more than 250% of the authorized bandwidth from the assigned frequency, measurements were performed both conducted and radiated as follows:

Conducted: A network analyser was used to measure the path loss. The sum of the path loss and the antenna gain as declared by the manufacturer was entered as a reference level offset in to the spectrum analyser. From 9 kHz to 3 GHz, the EUT was connected to a spectrum analyser via an attenuator and cable. Between 3 GHz and 18 GHz a 3 GHz high pass filter was used. The EUT was configured to maximum power on bottom, middle or top channel with modulation as described in the manufactures application form. The spectrum analyser was configured with an RBW and VBW of 1 MHz and 3 MHz respectfully with the trace set to max hold using an RMS detector.



Product Service

Radiated; A preliminary profile of the Spurious Radiated Emissions was obtained up to a minimum of the 10th harmonic of the highest internally generated frequency by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The EUT was set to transmit on maximum power in turn on bottom, middle and top channels.

For any emissions found the EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

2.2.6 Environmental Conditions

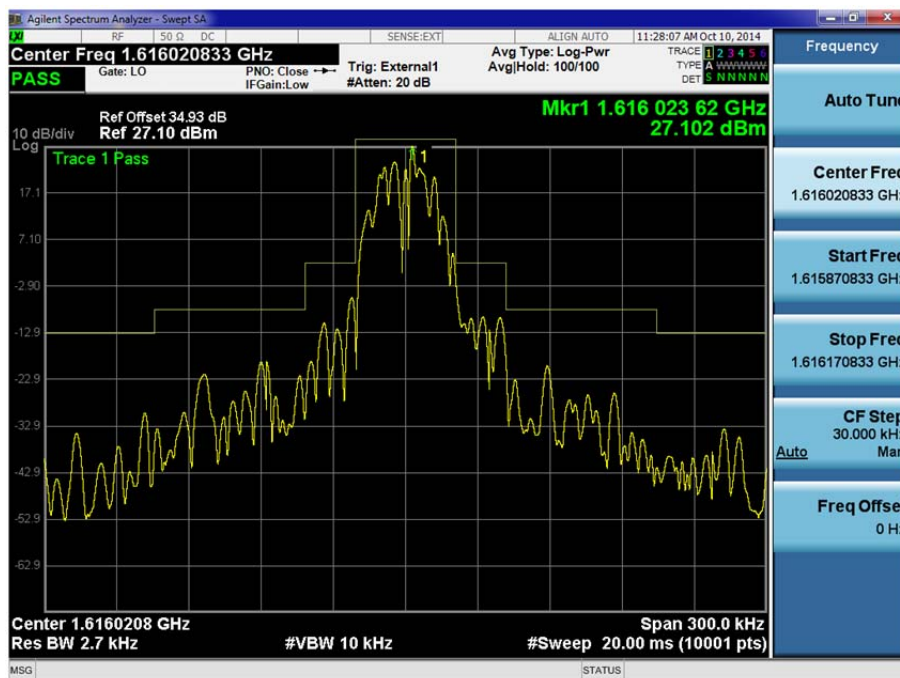
Ambient Temperature	18.8 - 25.5°C
Relative Humidity	42.9 - 44.0%

2.2.7 Test Results

5.0 V DC Supply

Conducted

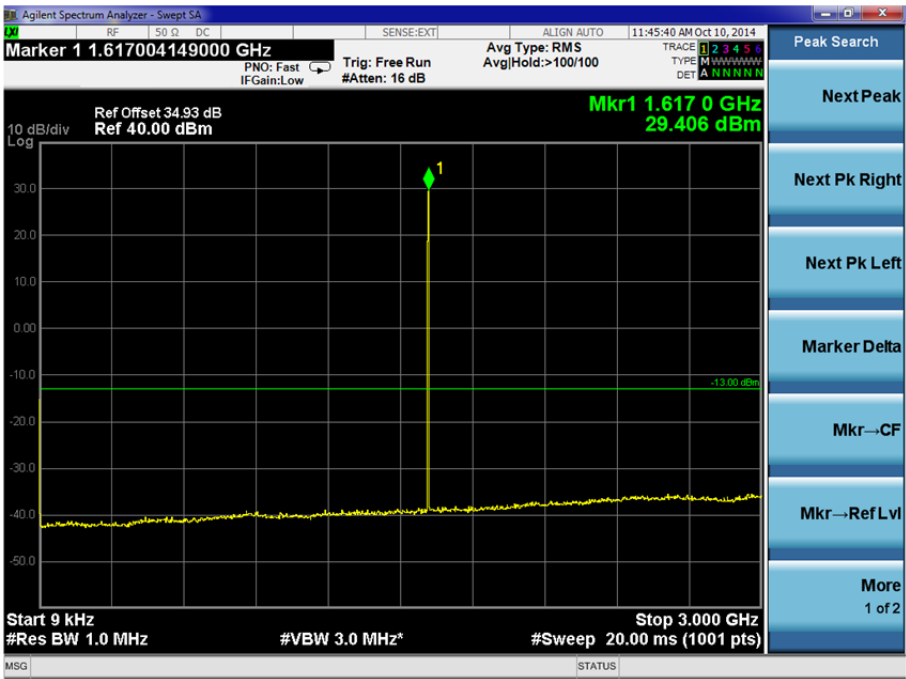
1616.020833 MHz

Mask

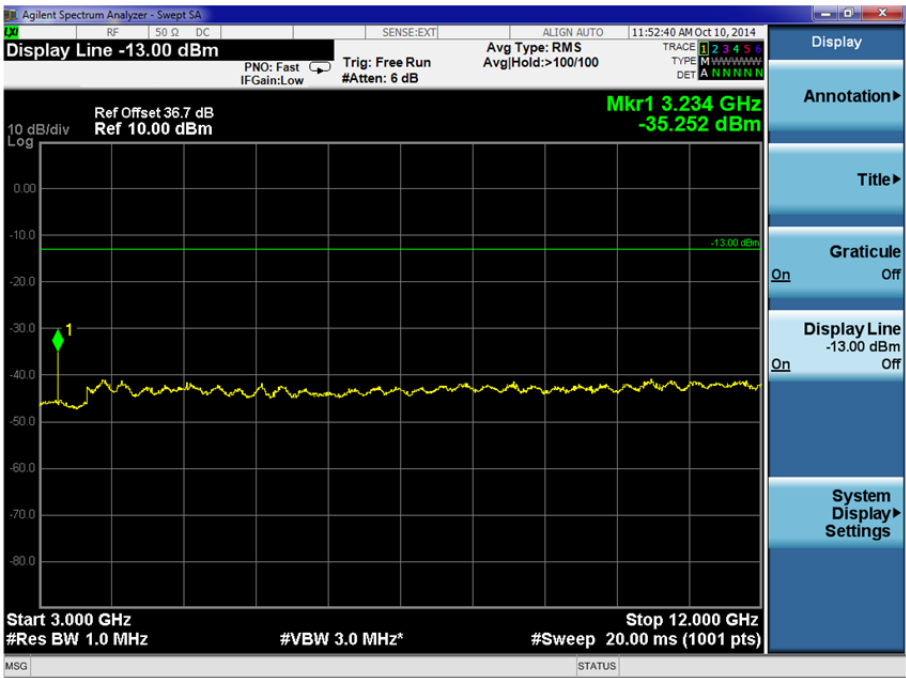


Product Service

9 kHz to 3 GHz



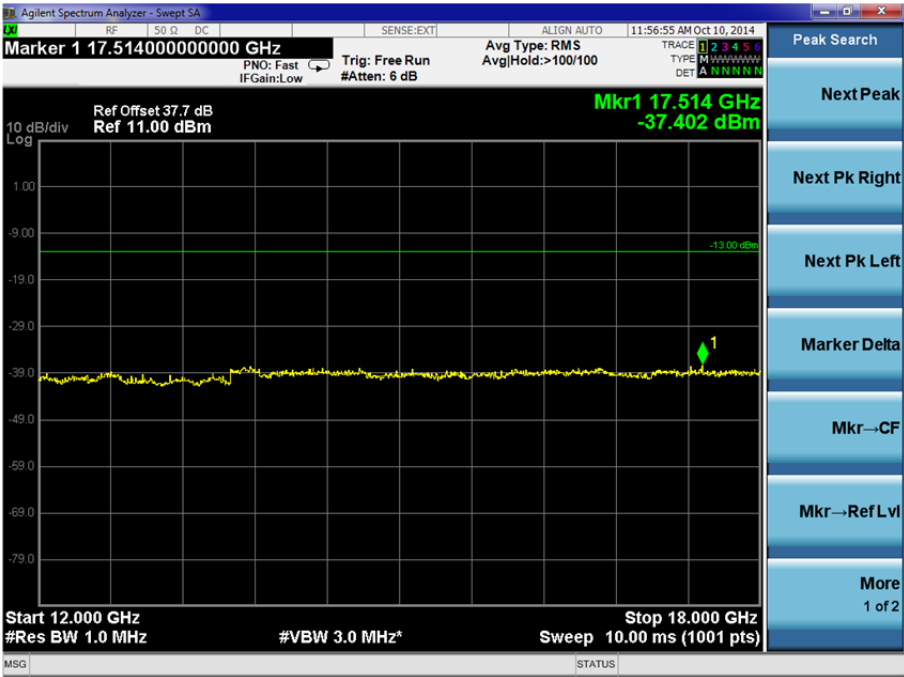
3 GHz to 12 GHz





Product Service

12 GHz to 18 GHz





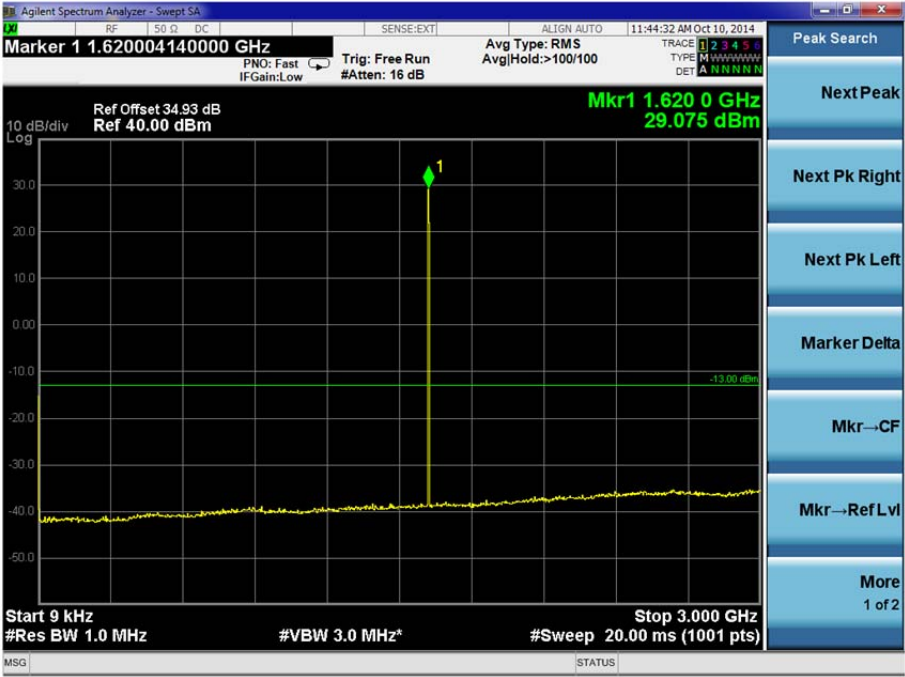
Product Service

1621.020833 MHz

Mask



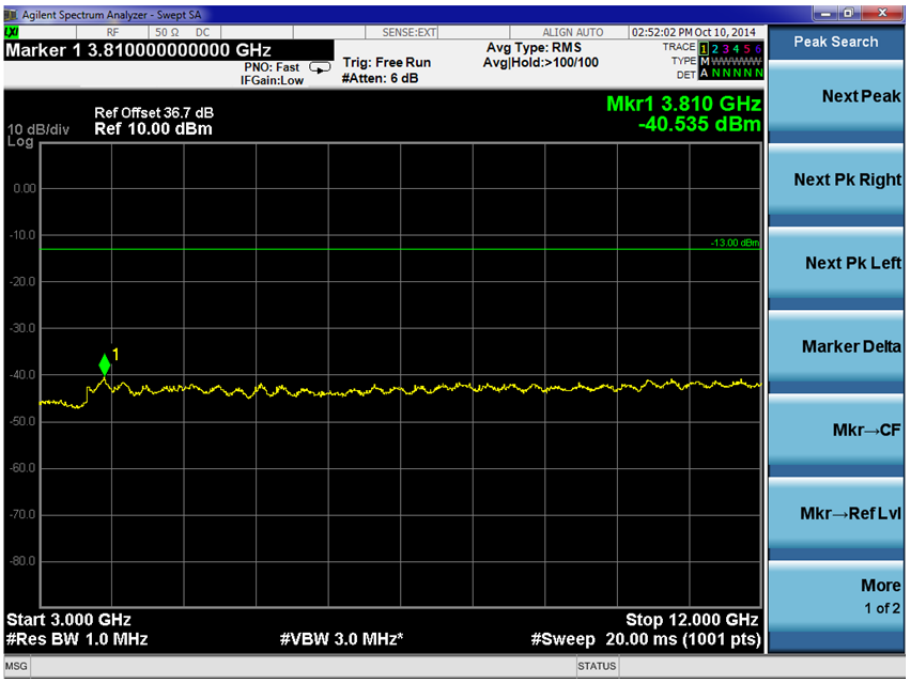
9 kHz to 3 GHz



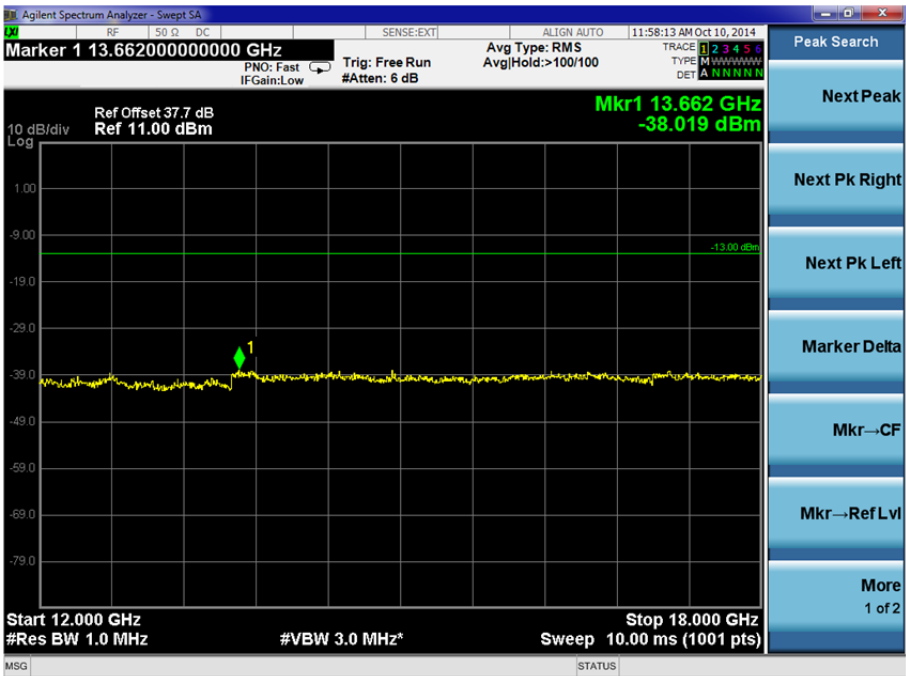


Product Service

3 GHz to 12 GHz



12 GHz to 18 GHz





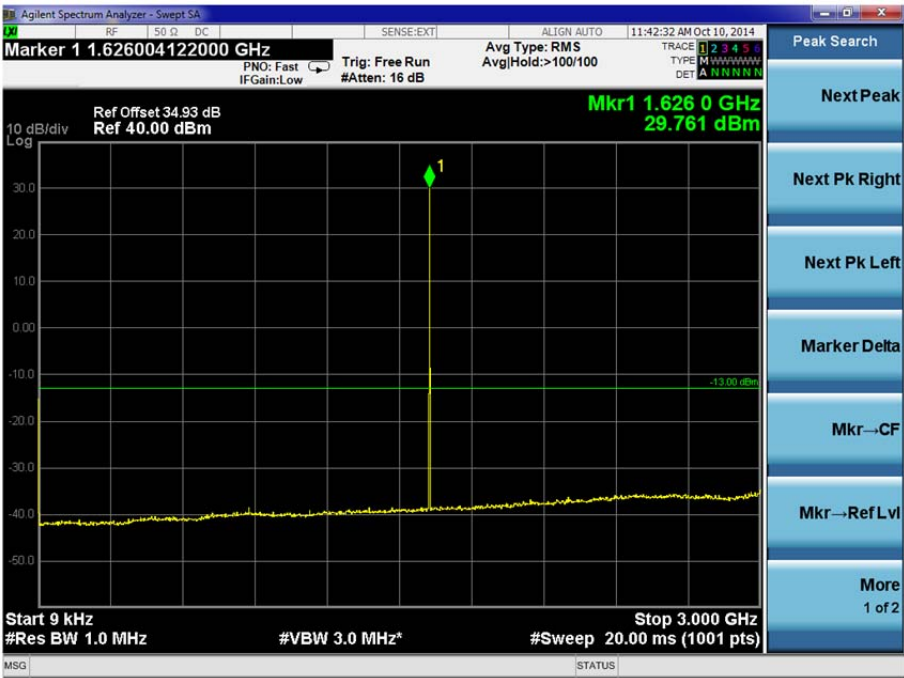
Product Service

1625.969667 MHz

Mask



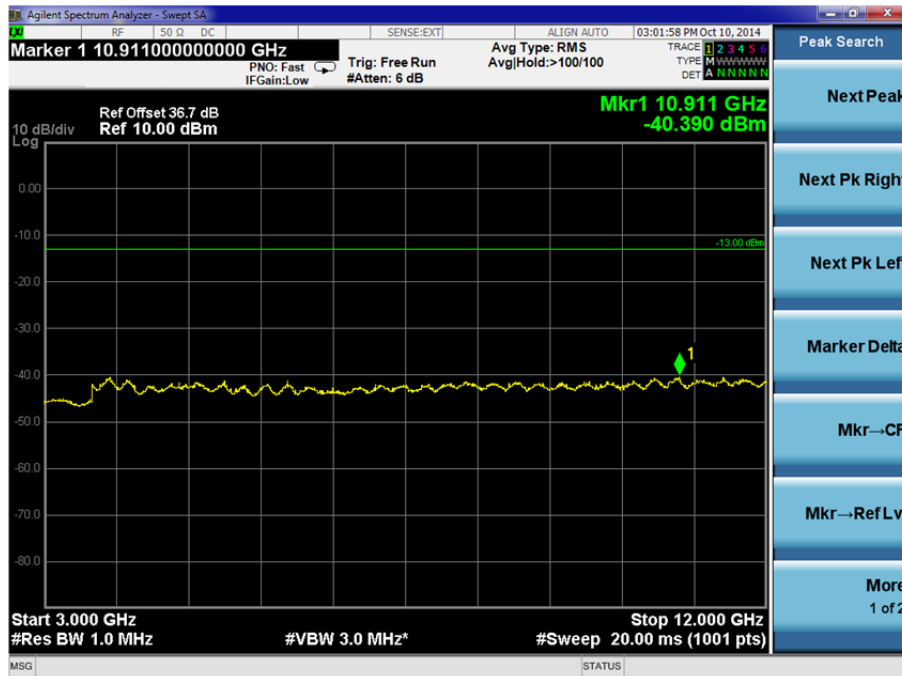
9 kHz to 3 GHz



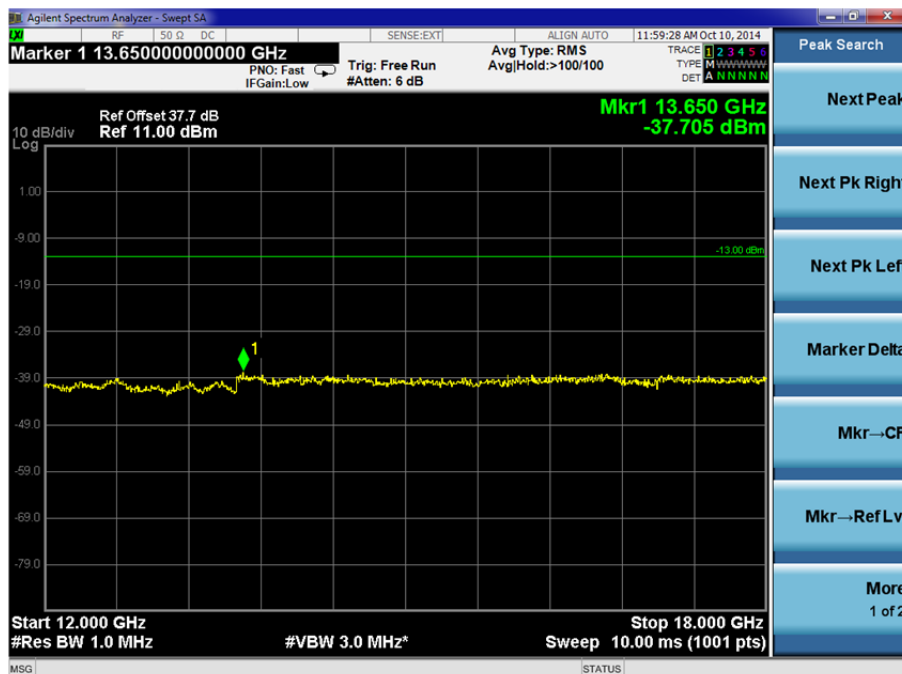


Product Service

3 GHz to 12 GHz



12 GHz to 18 GHz



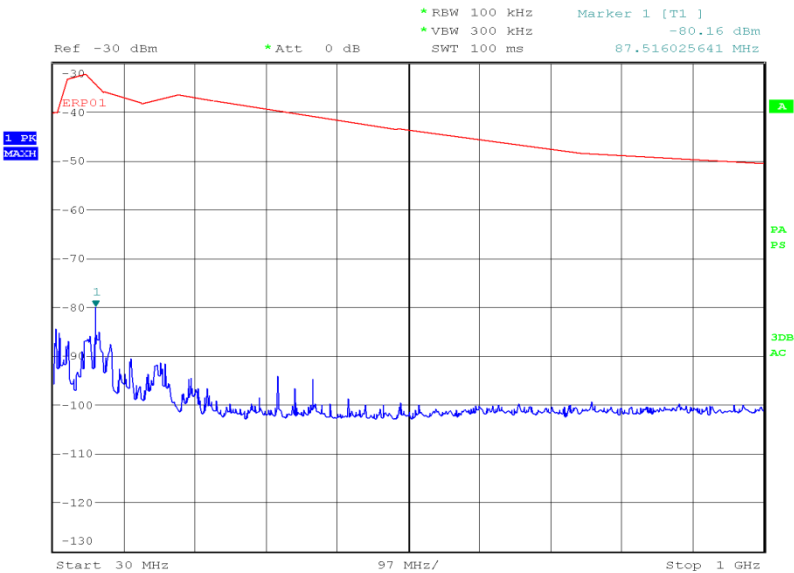


Product Service

Radiated

1616.020833 MHz

30 MHz to 1 GHz



Date: 12.OCT.2014 08:42:53

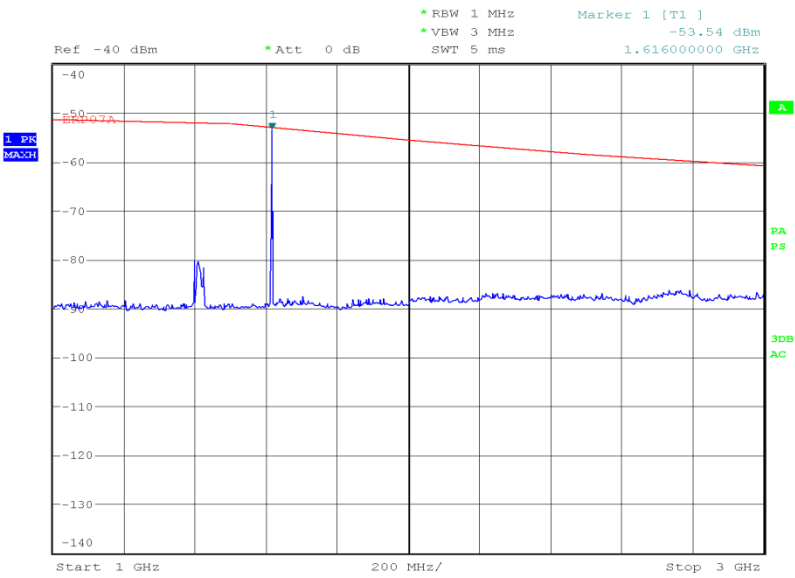
1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3232.049	Vertical	100	185	-17.82
4848.065	Vertical	100	141	-28.21
9693.130	Vertical	100	28	-36.45



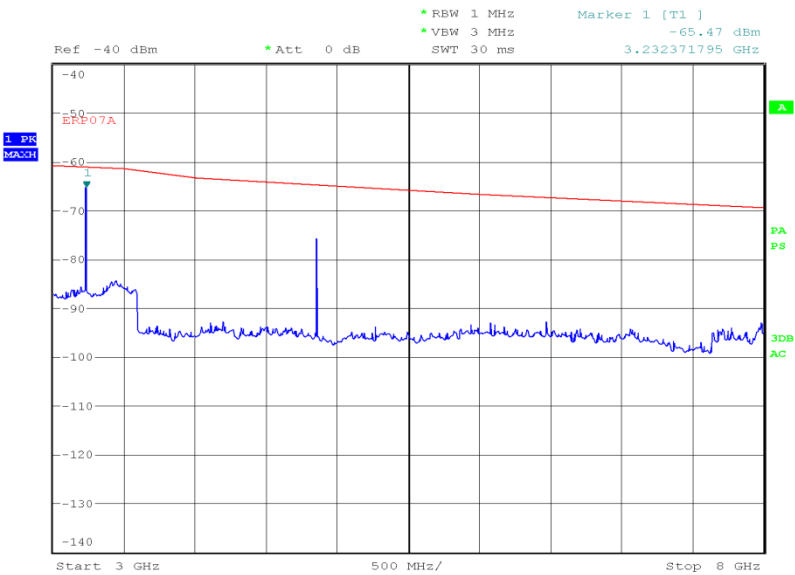
Product Service

1 GHz to 3 GHz



Date: 12.OCT.2014 10:28:58

3 GHz to 8 GHz

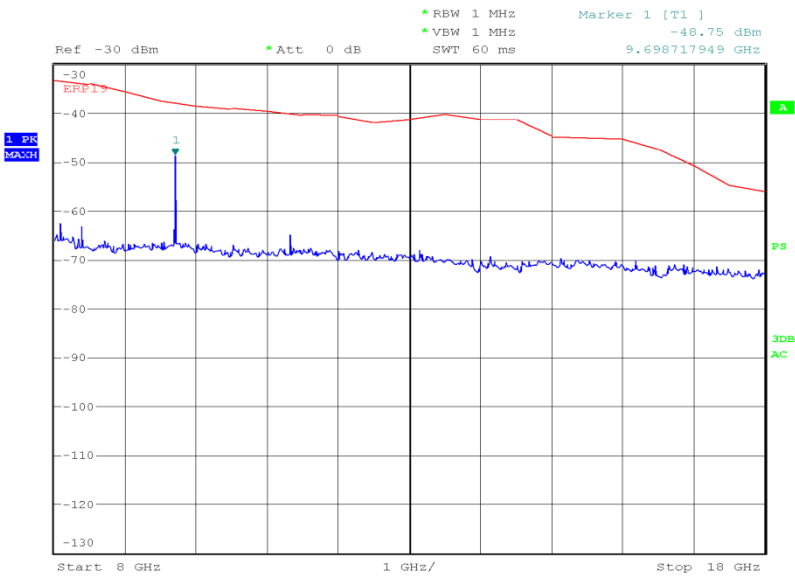


Date: 12.OCT.2014 11:44:27



Product Service

8 GHz to 18 GHz



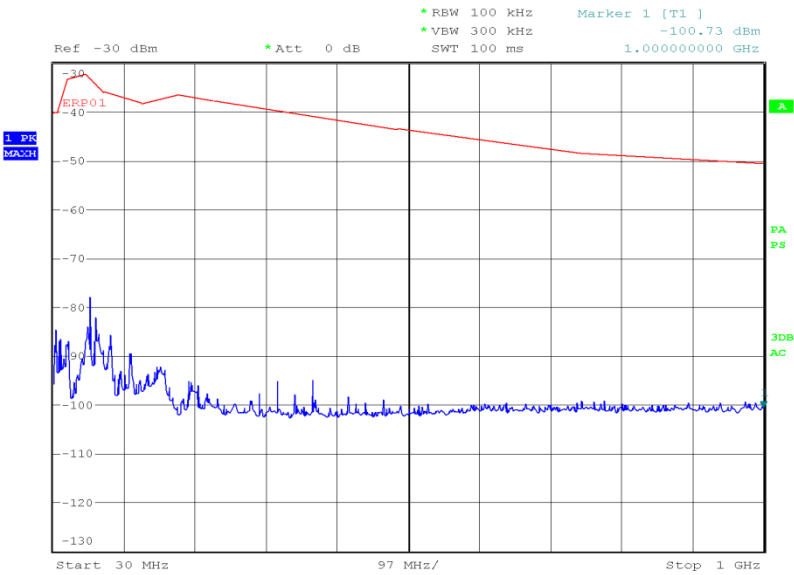
Date: 13.OCT.2014 18:39:25



Product Service

1621.020833 MHz

30 MHz to 1 GHz



Date: 12.OCT.2014 08:48:15

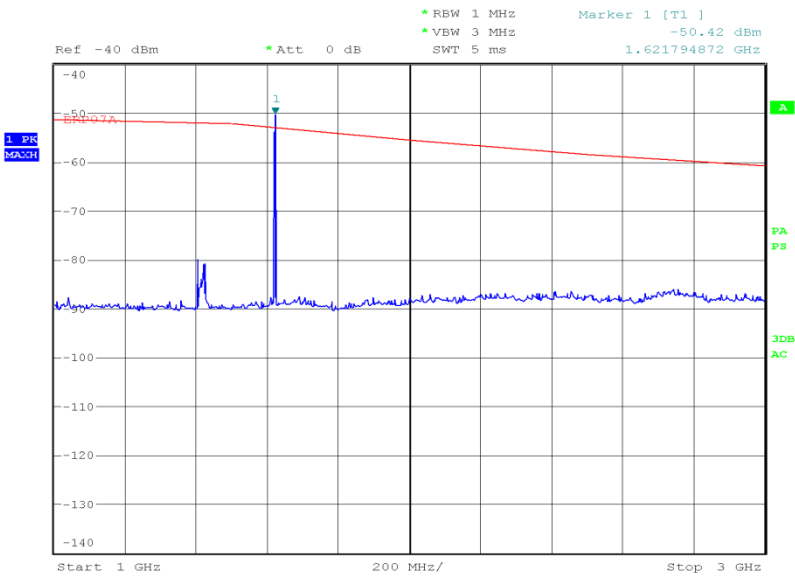
1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3242.043	Vertical	100	183	-17.55
4863.064	Vertical	100	270	-30.86
9726.130	Vertical	100	344	-36.59



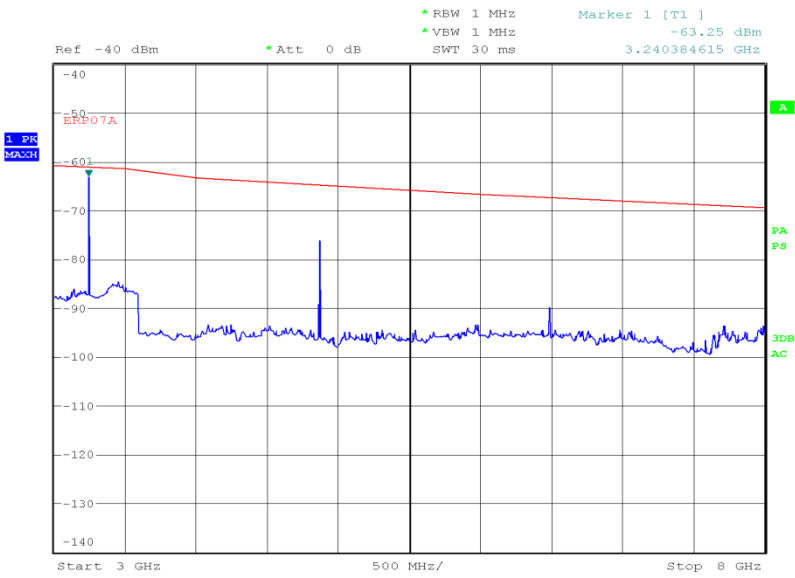
Product Service

1 GHz to 3 GHz



Date: 12.OCT.2014 10:33:11

3 GHz to 8 GHz

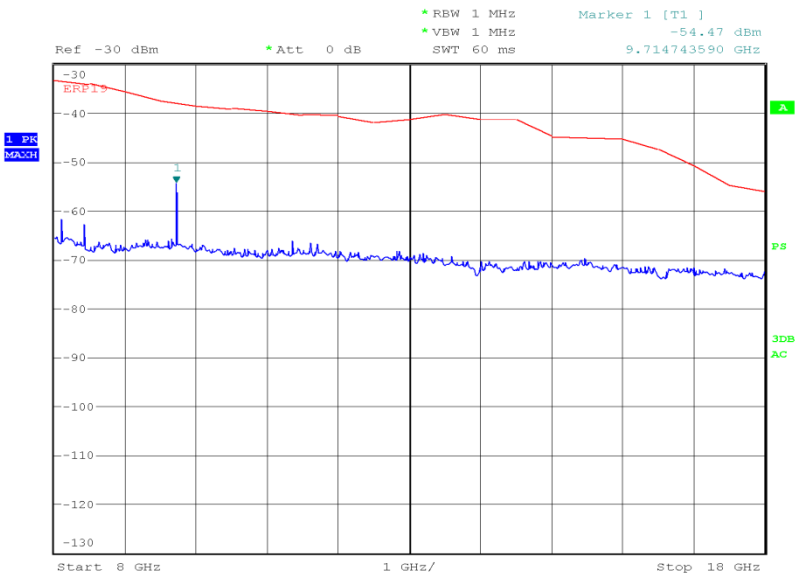


Date: 12.OCT.2014 11:19:04



Product Service

8 GHz to 18 GHz



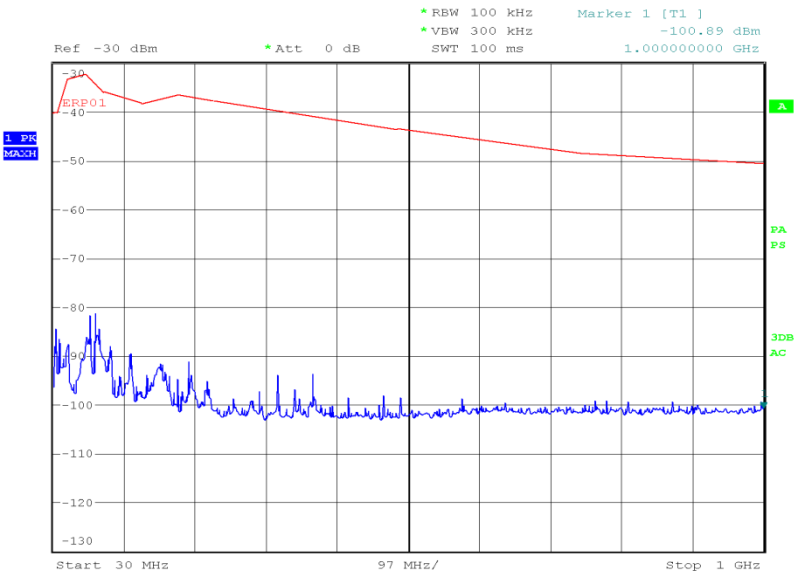
Date: 13.OCT.2014 18:56:59



Product Service

1625.969667 MHz

30 MHz to 1 GHz



Date: 12.OCT.2014 08:52:05

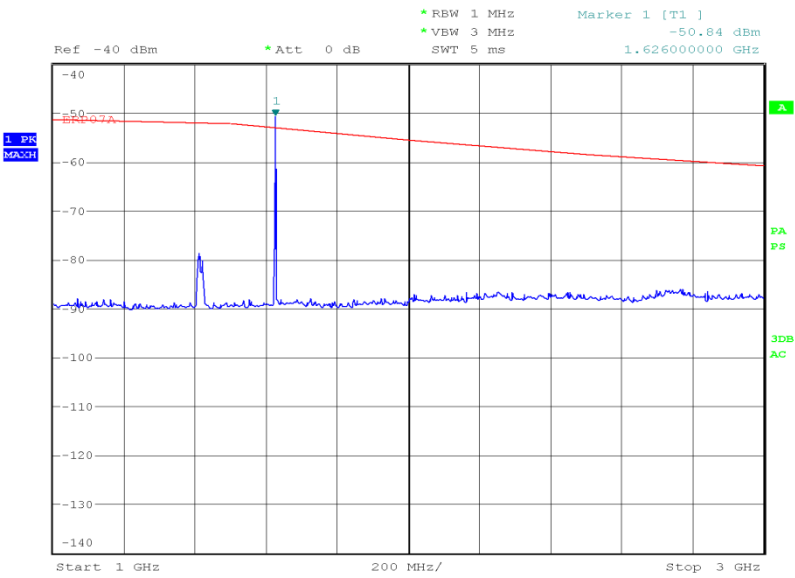
1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3251.960	Vertical	106	171	-18.63
4877.939	Vertical	100	271	-27.61
9755.880	Vertical	100	343	-37.55



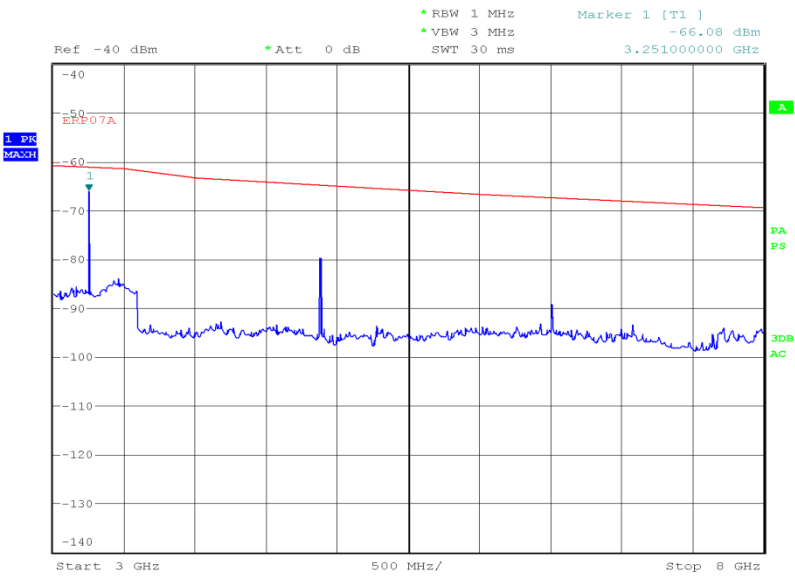
Product Service

1 GHz to 3 GHz



Date: 12.OCT.2014 10:36:55

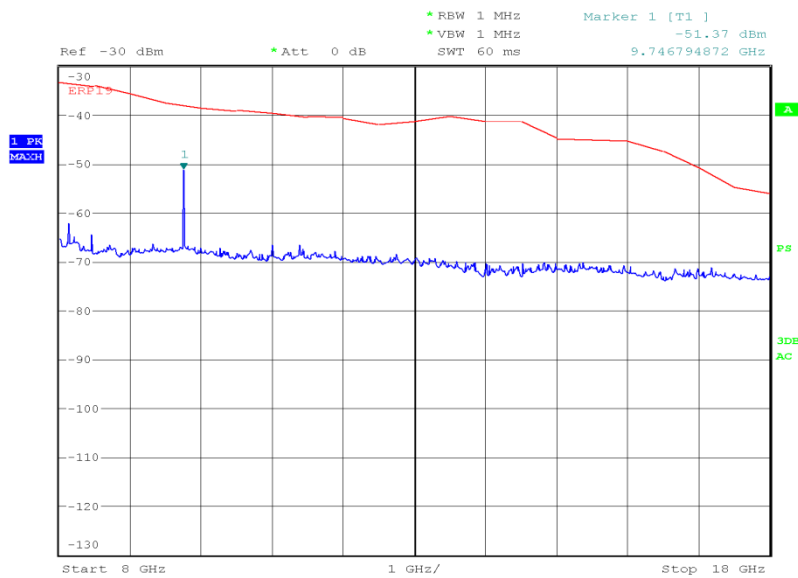
3 GHz to 8 GHz



Date: 12.OCT.2014 11:34:54



Product Service

8 GHz to 18 GHz

Date: 13.OCT.2014 19:26:18

Limit Clause FCC CFR 47, 25.202(f) and RSS-170, 5.4.3.1

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;
- 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;
- 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.



Product Service

2.3 POWER LIMITS

2.3.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.204
Industry Canada RSS-170, Clause 5.3

2.3.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.3.3 Date of Test

9 October 2014 & 10 October 2014

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

For conducted power, the EUT was connected to a spectrum analyser via a cable and 30dB attenuator. An RBW of 3 kHz and VBW of 10 kHz was used and the correction factor was calculated as $10\log(4/3) = 1.25$ dB so that the final result was relative to any 4 kHz band as per the requirement in 25.204(a). A reference level offset equal to the sum of the path loss, antenna gain as declared by the manufacturer and the above correction factor was entered on the spectrum analyser. The transmit power was measured over the active part of the burst using an RMS detector, the spectrum analyser was set to max hold and the peak result recorded.

For radiated power, the EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT through 360° and a height search of the measuring antenna. A substitution was then performed using a suitable calibrated antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor.

A calculation was then performed to obtain the final figure.

2.3.6 Environmental Conditions

Ambient Temperature	25.7°C
Relative Humidity	40.1%



Product Service

2.3.7 Test Results

5.0 V DC Supply

Conducted

EIRP (dBW)		
1616.020833 MHz	1621.020833 MHz	1625.969667 MHz
-1.32	-1.44	-1.54

Limit Clause FCC CFR 47, 25.204

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

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

Limit Clause RSS-170, 5.3

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 necessary 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.



2.4 LIMITS ON EMISSIONS FROM MOBILE EARTH STATIONS FOR PROTECTION OF AERONAUTICAL RADIONAVIGATION-SATELLITE SERVICE

2.4.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.216
Industry Canada RSS-170, Clause 5.4.3

2.4.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.4.3 Date of Test

9 October 2014 & 10 October 2014

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

This test was performed in accordance with the test method requirements as stated in FCC CFR 47 Part 25.216 (c), (f), (i) & (j).

The EUT was set to transmit at maximum power using modulation as described in the manufacturers application form. The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss was measured using a vector network analyser and the sum of the path loss and antenna gain as declared by the manufacturer was entered as a reference level offset in the analyser. The gated trigger of the analyser was used so that average measurements were taken over a 2 ms period of the active burst. The spectrum analyser was adjusted to show the frequency range of interest on screen with an RBW & VBW of 1 MHz and 3 MHz respectfully. The analyser was set with an RMS detector and average trace.

Any spur within 10 dB of -70 dBW/MHz was investigated further to determine the bandwidth of the emission. Each spur was individually investigated and the RBW of the analyser was reduced to allow an approximation of the emission bandwidth of the spur. It was confirmed that all discrete emissions have a power density less than -80 dBW.

For emissions in the carrier off state, the EUT was configured in a state of continuous non-transmission. The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss was measured using a vector network analyser and entered as a reference level offset in the analyser. The spectrum analyser was adjusted to show the frequency range of interest on screen with an RBW & VBW of 1 MHz and 3 MHz respectfully. The analyser was set with an RMS detector and average trace.

2.4.6 Environmental Conditions

Ambient Temperature	23.1 - 25.7°C
Relative Humidity	40.1 - 45.6%



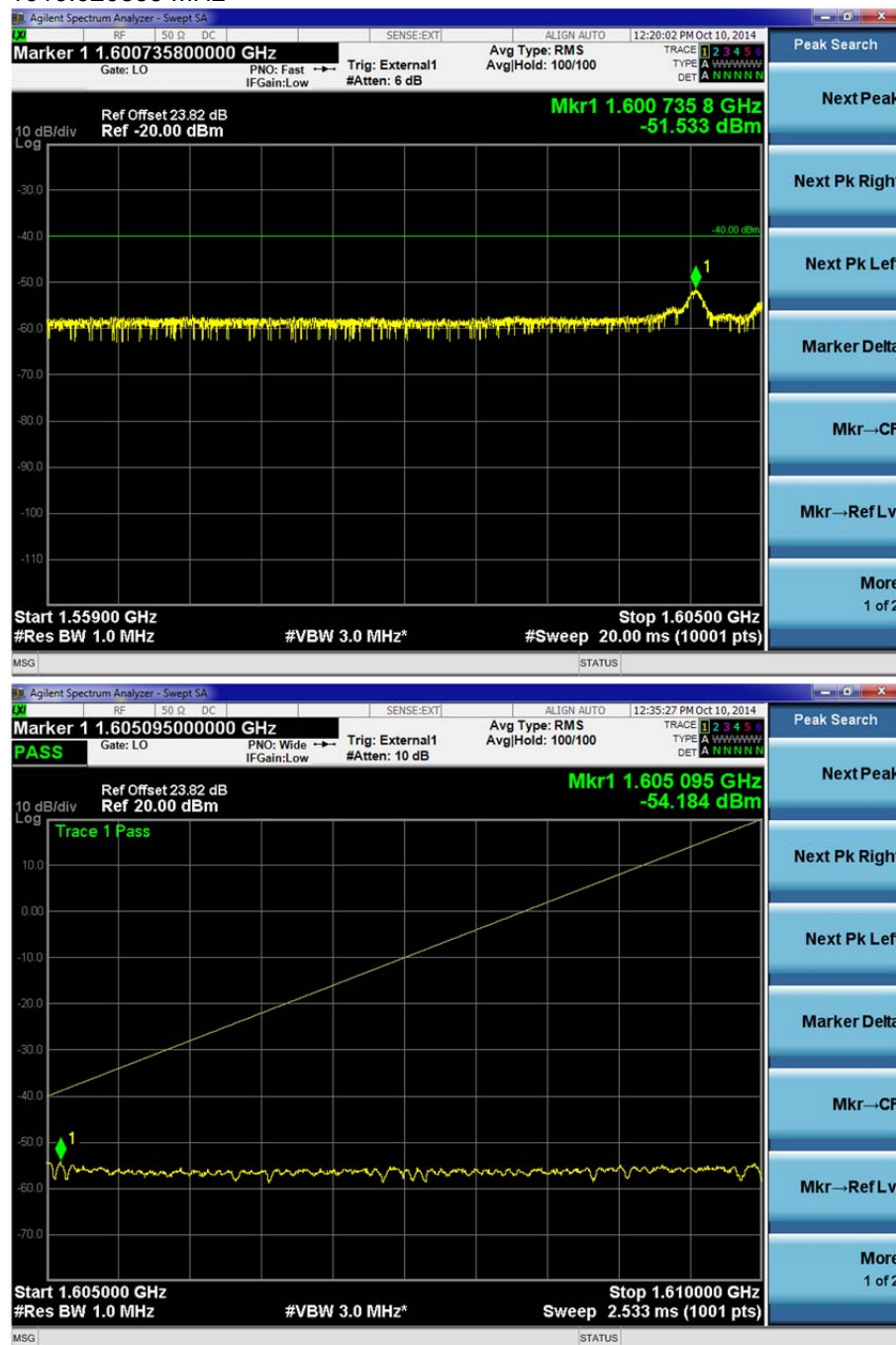
Product Service

2.4.7 Test Results

5.0 V DC Supply

EIRP Density – Broadband Emissions (dBW/MHz)		
1616.020833 MHz	1621.020833 MHz	1625.969667 MHz
-81.533	-85.250	-87.198

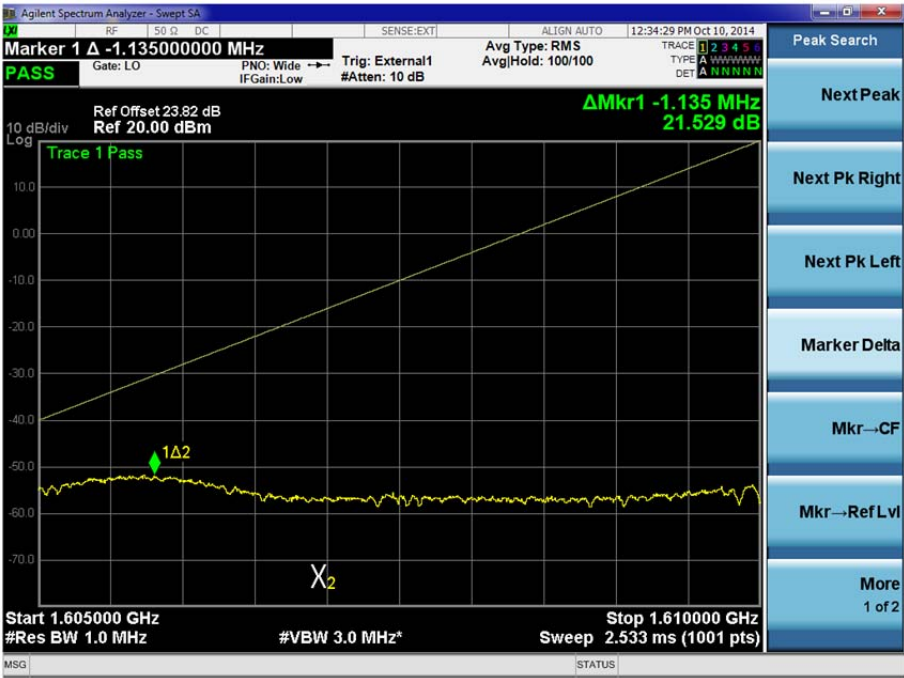
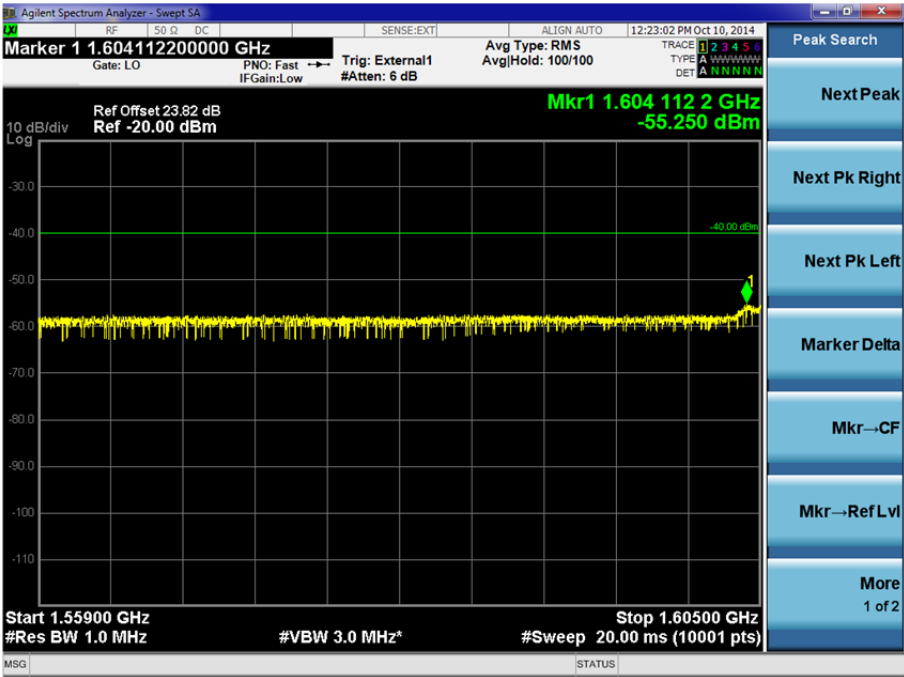
1616.020833 MHz





Product Service

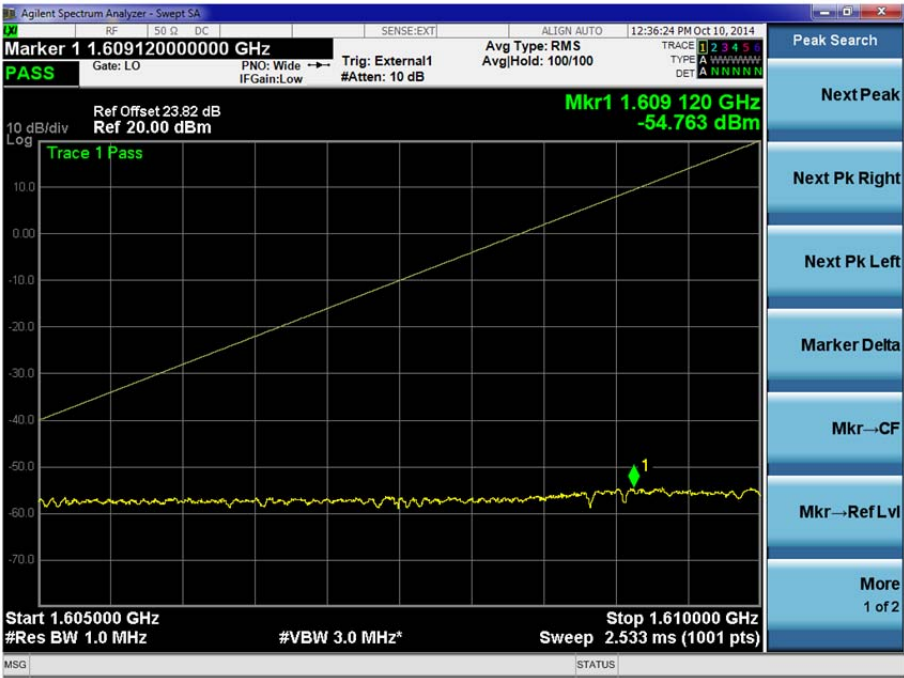
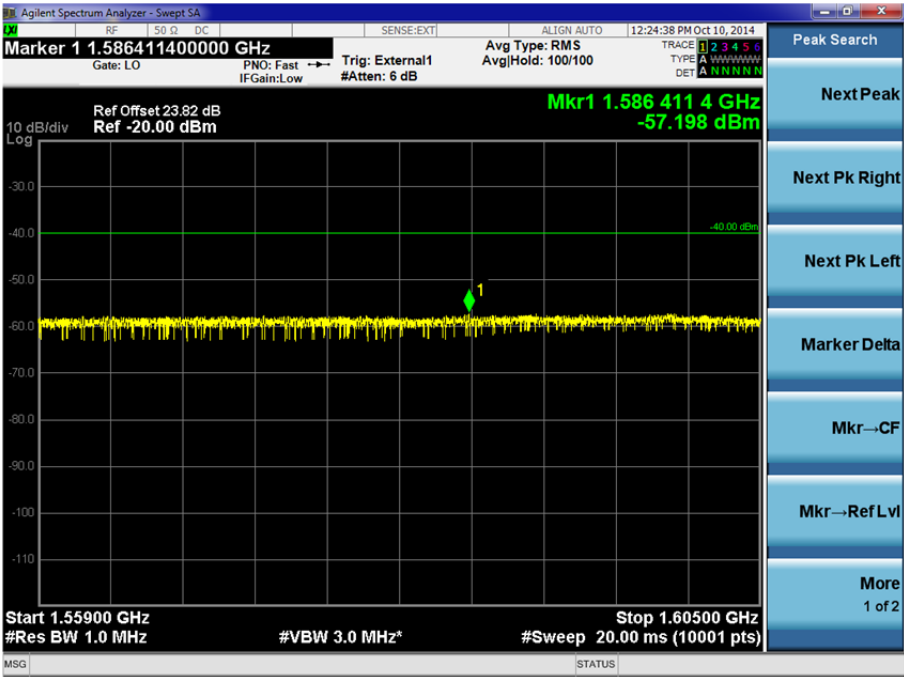
1621.020833 MHz





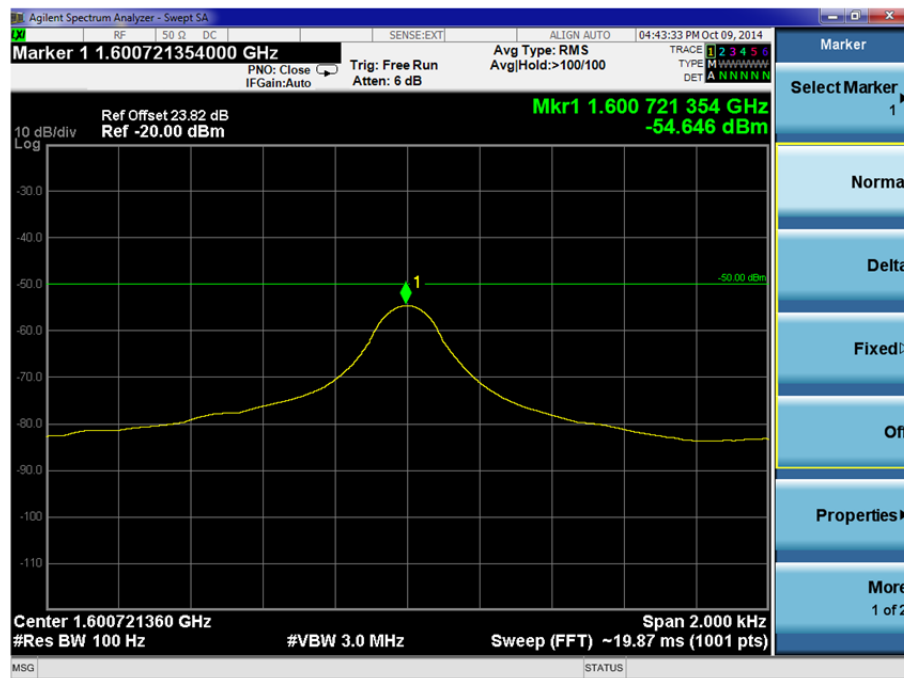
Product Service

1625.969667 MHz



EIRP Density – Discrete Emissions (dBW/MHz)		
1616.020833 MHz	1621.020833 MHz	1625.969667 MHz
-84.646	-93.953	No discrete emissions found

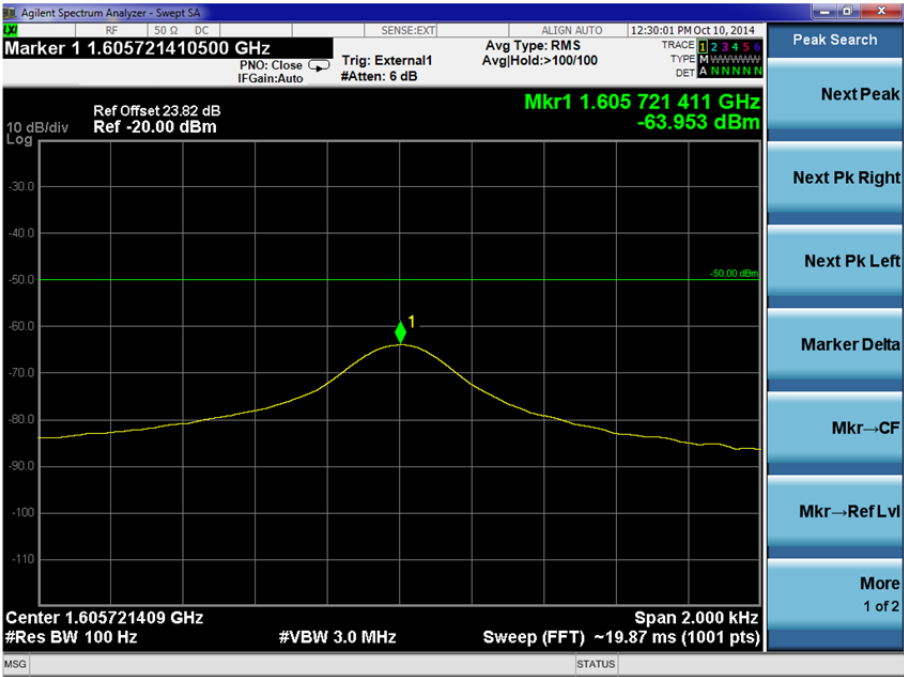
1616.020833 MHz





Product Service

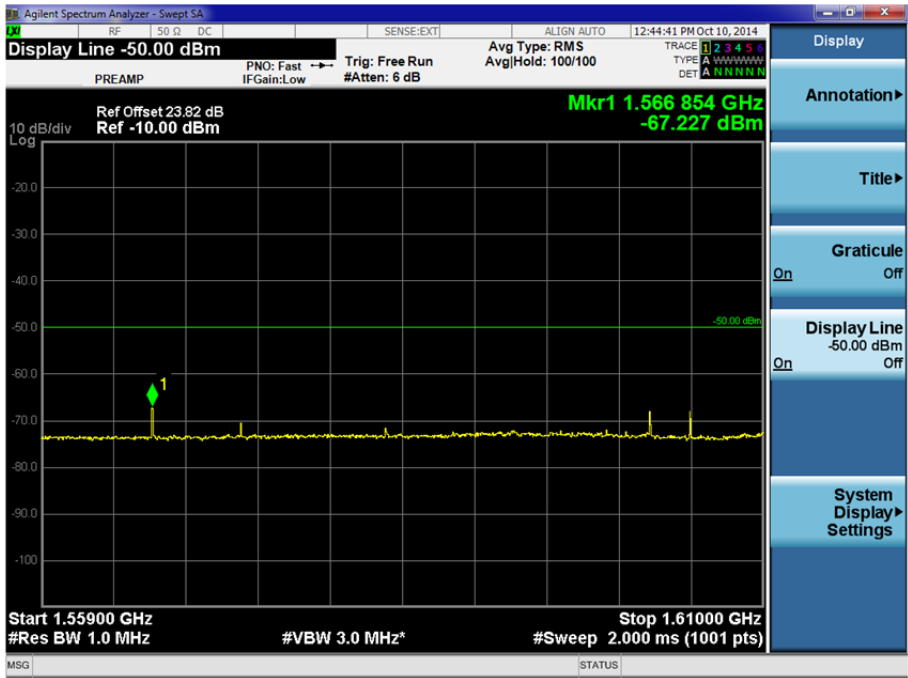
1621.020833 MHz





Product Service

EIRP Density- Carrier-off State Emissions (dBW/MHz)
-97.667



Limit Clause FCC CFR 47, 25.216 and IC RSS-170, 5.4.3

The e.i.r.p density of emissions from mobile earth stations with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW.

Mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies in the 1610-1660.5 MHz band shall suppress the power density of emissions in the 1605-1610 MHz band to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz.

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 milli-second interval.



Product Service

2.5 MODULATION CHARACTERISTICS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047(d)

2.5.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.5.3 Date of Test

9 October 2014

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

The description below of the modulation used was declared by the manufacturer.

To support this description, plots of the transmitted burst in the time and frequency domains have been provided.

2.5.6 Environmental Conditions

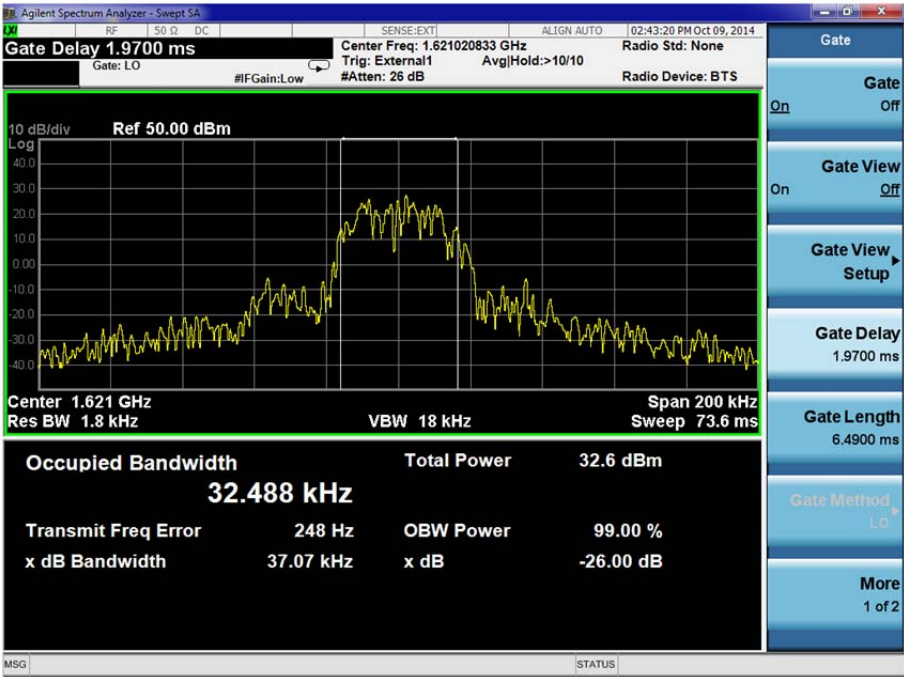
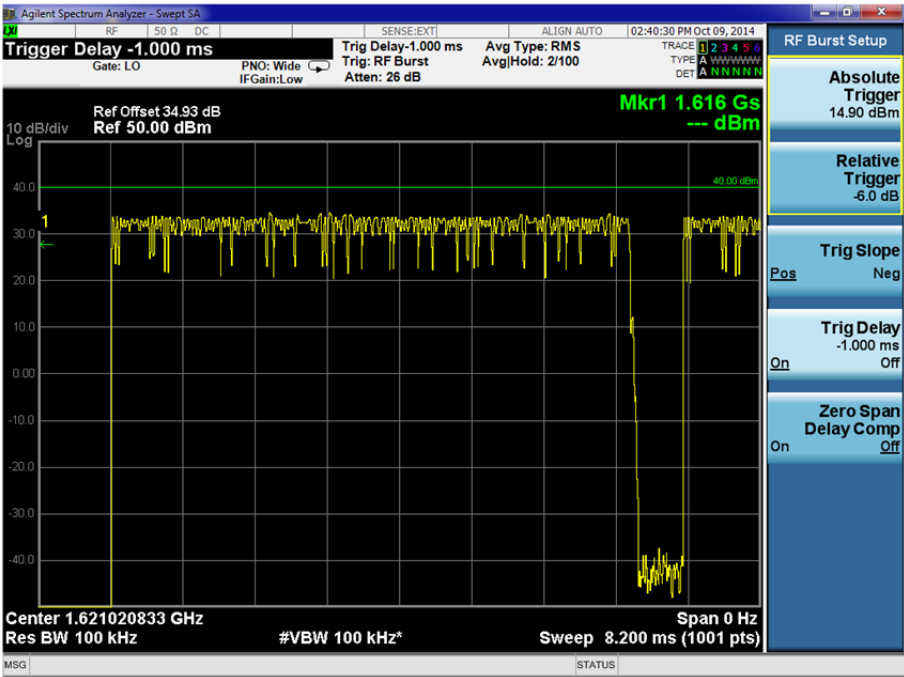
Ambient Temperature	25.7°C
Relative Humidity	40.1%



Product Service

2.5.7 Test Results

1621.020833 MHz





Product Service

Traffic, broadcast, and ring alert channels use differentially encoded quaternary phase shift keyed (DE-QPSK) modulation with 40% square root raised cosine pulse shaping. The burst transmission rate is 25ksps or 50 kbps. The phase of the QPSK symbol states relative to the carrier phase is (Symbol State/Phase in deg): 00/0, 01/-90, 10/+90, 11/180.

The acquisition channel uses differentially encoded binary phase shift keyed (DE-BPSK) with 40% square root raised cosine pulse shaping. The burst rate on these channels is 25 kbps.

The sync channel uses 25 kbps DE-BPSK on the uplink and 50 kbps DE-QPSK on the downlink. Both with 40% square root raised cosine pulse shaping.



Product Service

2.6 OCCUPIED BANDWIDTH

2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049
Industry Canada RSS-GEN, Clause 4.6.1

2.6.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

2.6.3 Date of Test

9 October 2014

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

The test was applied in accordance with the test method requirements of Part 2.1051 and KDB 971168.

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was configured to transmit on bottom, middle and top channels at maximum power. The spectrum analyser was configured to measure only over the active part of the burst. The settings of the analyser were configured with an RBW of 1.8 kHz and VBW of 18 kHz using an RMS detector and average trace. The Occupied bandwidth measurement function of the analyser was then utilized to make the measurement and the 99% occupied bandwidth was recorded.

2.6.6 Environmental Conditions

Ambient Temperature	25.7°C
Relative Humidity	40.1%



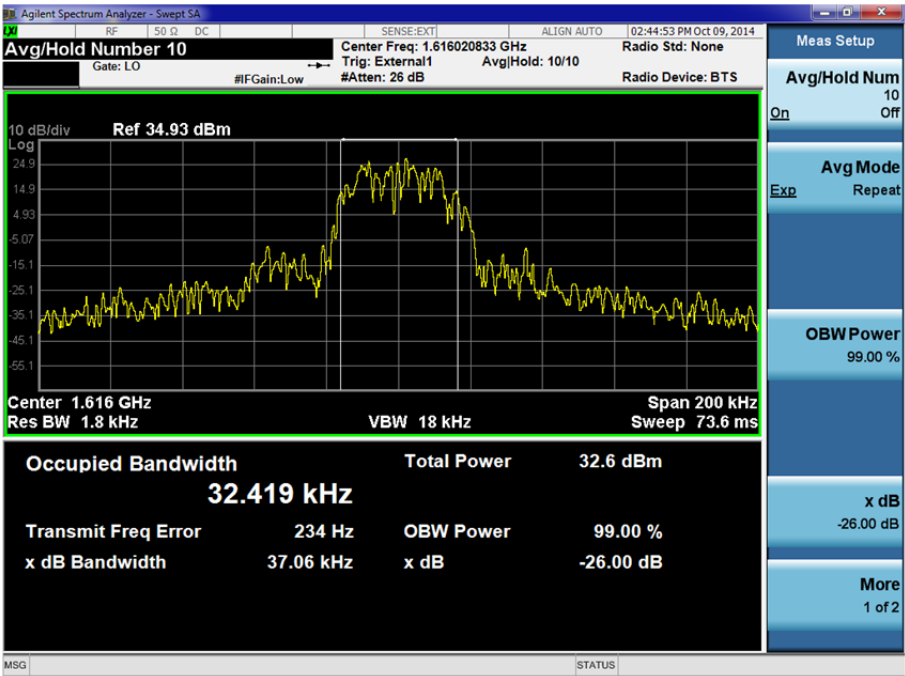
Product Service

2.6.7 Test Results

5.0 V DC

Frequency	Occupied Bandwidth (kHz)
1616.020833 MHz	32.419
1621.020833 MHz	32.488
1625.969667 MHz	31.993

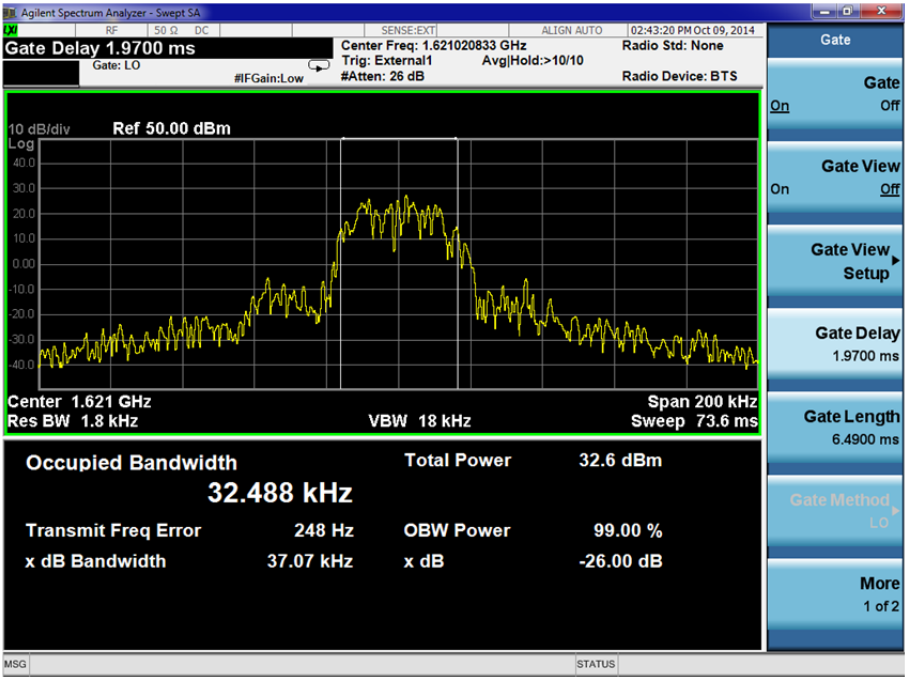
1616.020833 MHz



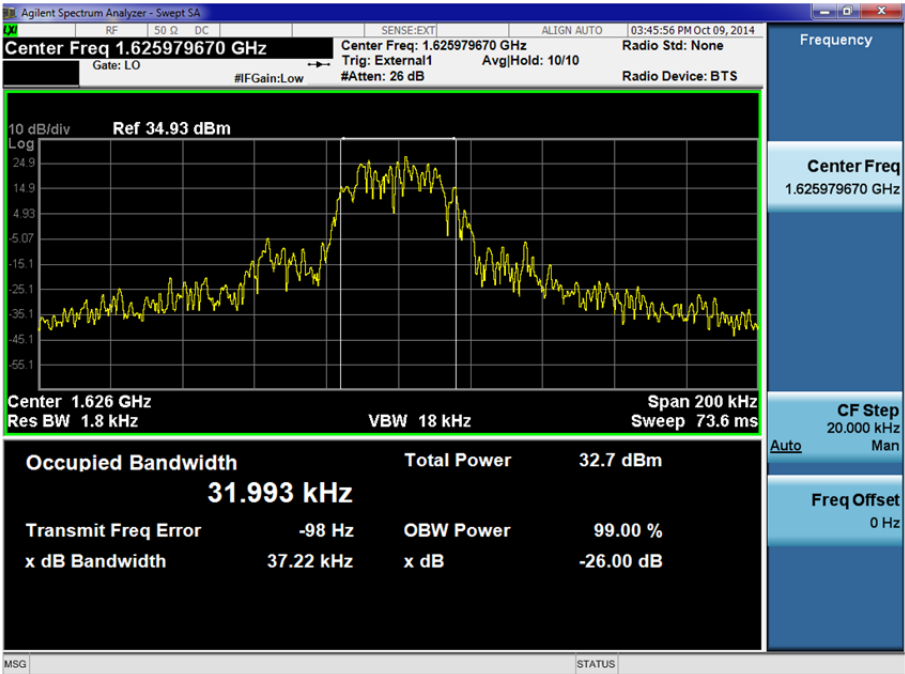


Product Service

1621.020833 MHz



1625.969667 MHz



Limit Clause FCC CFR 47 Part 25.202(b)

(b) Other frequencies and associated bandwidths of emission may be assigned on a case-by-case basis to space systems under this part in conformance with § 2.106 of this chapter and the Commission's rules and policies.



Product Service

SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - Frequency Tolerance					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Digital Thermometer	Digitron	T208	2831	12	31-Jul-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.2 - Emission Limitations					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	8-Nov-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	19-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Pre-Amplifier	Phase One	PS04-0086	1533	12	19-Dec-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Amplifier (1kW)	EMV	1000W1000M7	1633	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	12-Dec-2014
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3697	12	28-Feb-2015
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	21-Mar-2015



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.3 - Power Limits					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.4- Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	28-May-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.5 - Modulation Characteristics					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.6 - Occupied Bandwidth					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Power Limits	Conducted: ± 0.70 dB Radiated: ± 6.3 dB
Modulation Characteristics	-
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	± 3.08 dB
Frequency Tolerance	± 3.54 Hz
Emission Limitations	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 17 GHz: ± 6.3 dB
Occupied Bandwidth	± 16.74 kHz



Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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