
# 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

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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

Document 75928153 Report 05 Issue 1

November 2014

**PREPARED FOR**

Quake Global Inc
4933 Paramount Drive
92123
USA

**PREPARED BY**

**Natalie Bennett**
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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**CONTENTS**

Product Service

**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

## 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<br>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)<br>FCC CFR 47 Part 25 (2013)<br>Industry Canada RSS-170 (2011)<br>Industry Canada RSS-GEN (2010) |
| Incoming Release<br>Date | Application Form<br>05 October 2014 |
| Disposal<br>Reference Number<br>Date | Held Pending Disposal<br>Not Applicable<br>Not Applicable |
| Order Number<br>Date | PO7195<br>1 October 2014 |
| Start of Test | 9 October 2014 |
| Finish of Test | 13 October 2014 |
| Name of Engineer(s) | M Russell<br>G Lawler |
| Related Document(s) | ANSI C63.4: 2009 |

Product Service

## 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)……

Supply Voltage:

| | | | |
|---|---|---|---|
| [ ] | AC mains | State AC voltage …… V | and AC frequency …… Hz |
| [ X ] | DC (external) | State DC voltage …5… V | and DC current ……1.5……. A |
| [ ] | DC (internal) | State DC voltage …… V | and Battery type ……. |

Frequency characteristics:

Transmitter Frequency range 1616…. MHz to 1626.5…. MHz — Channel spacing 41.667 kHz……. (if channelized)

Receiver Frequency range (if different) 1616…. MHz to 1626.5…. MHz — Channel spacing 41.667 kHz……. (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

Power characteristics:

Maximum transmitter power ……1.6… W — Minimum transmitter power (if variable) …… W

| | | |
|---|---|---|
| [ X ] | Continuous transmission | |
| [ ] | Intermittent transmission | State duty cycle …… |

If intermittent, can transmitter be set to continuous transmit test mode? Y/N

Antenna characteristics:

| | | |
|---|---|---|
| [ X ] | Antenna connector | State impedance ……50… ohm |
| [ ] | Temporary antenna connector | State impedance …… ohm |
| [ ] | Integral antenna Type ……..…… | State gain …… dBi |
| [ ] | External Antenna Type ……..……. | State gain ……3…… dBi |

Modulation characteristics:

| | | |
|---|---|---|
| [ ] | Amplitude | [ X ] Other |
| [ ] | Frequency | Details: …TDMA FDMA….. |
| [ ] | Phase | (GMSK, QSPK etc) |

Can the transmitter operate un-modulated? Y/N

ITU Class of emission: ……

Battery/Power Supply

Model name/number ……..……. — Identification/Part number ……..…….

Manufacturer ……..……. — Country of Origin ……..…….

Ancillaries (if applicable)

Model name/number ……..……. — Identification/Part number ……..…….

Manufacturer ……..……. — Country of Origin ……..…….

Extreme conditions:

Maximum temperature …85…… ºC — Minimum temperature …-40…… ºC

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% |

Product Service

### 2.1.7 Test Results

5.0 V DC Supply

Under Temperature Variations

1621.020833 MHz

| Temperature Interval ºC | 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.

Product Service

## 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% |

Product Service

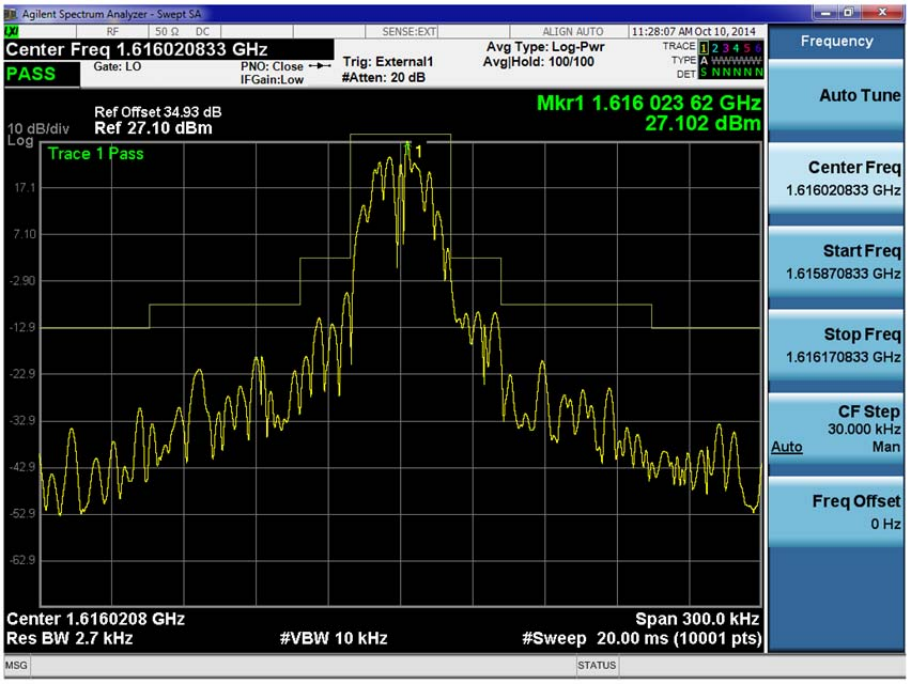
### 2.2.7 Test Results

5.0 V DC Supply

Conducted

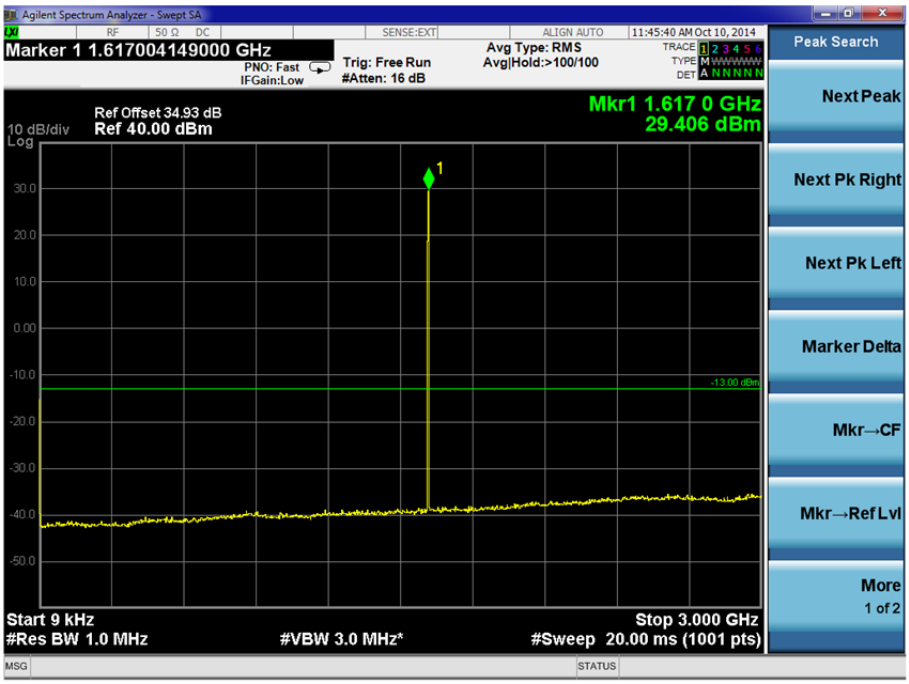
1616.020833 MHz

Mask

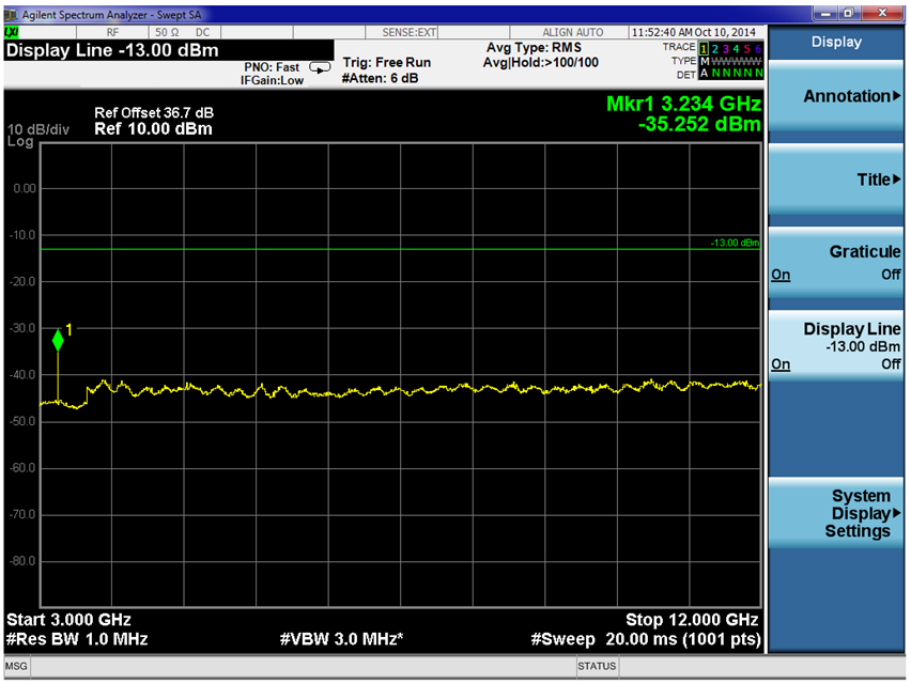


Product Service

9 kHz to 3 GHz

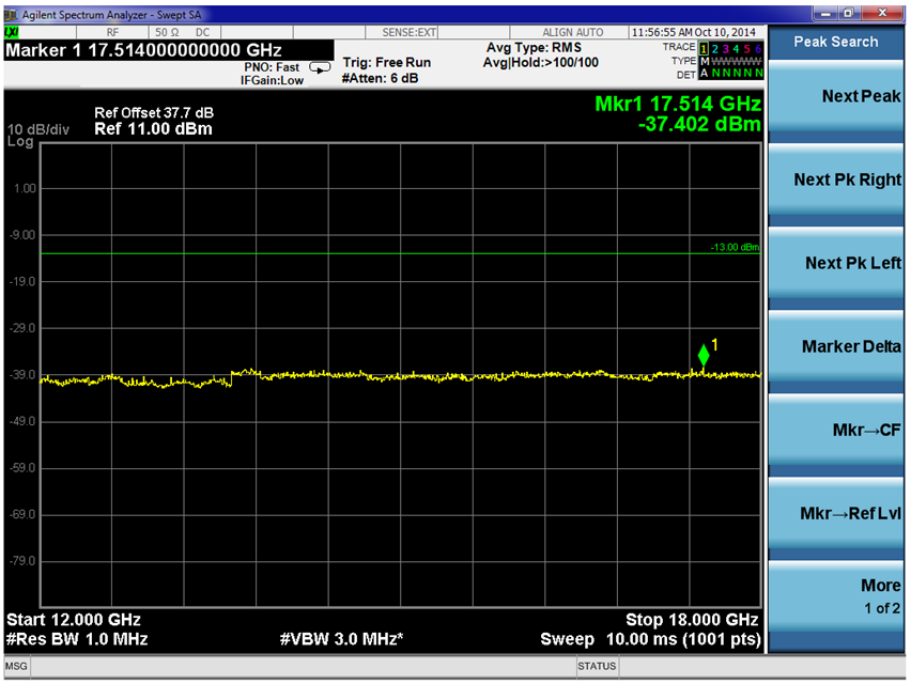



3 GHz to 12 GHz



Product Service

12 GHz to 18 GHz

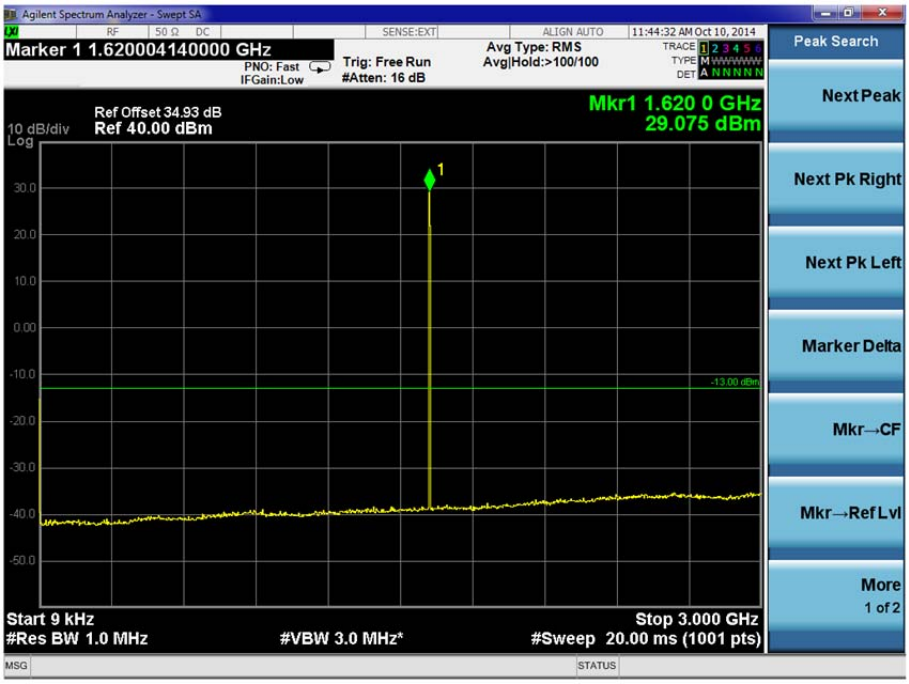


Product Service

1621.020833 MHz

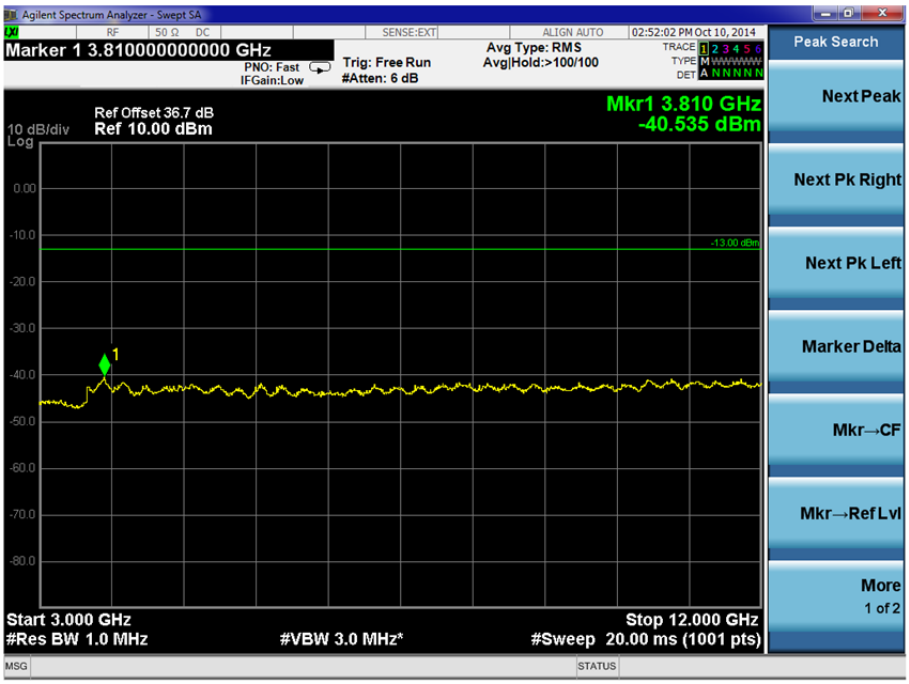
Mask


9 kHz to 3 GHz

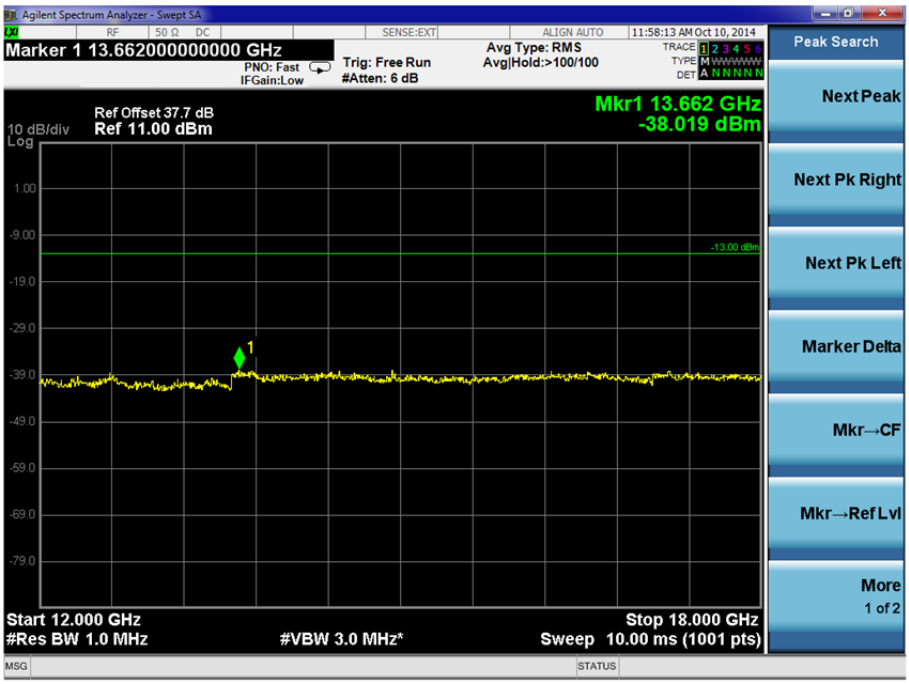


Product Service

3 GHz to 12 GHz




12 GHz to 18 GHz

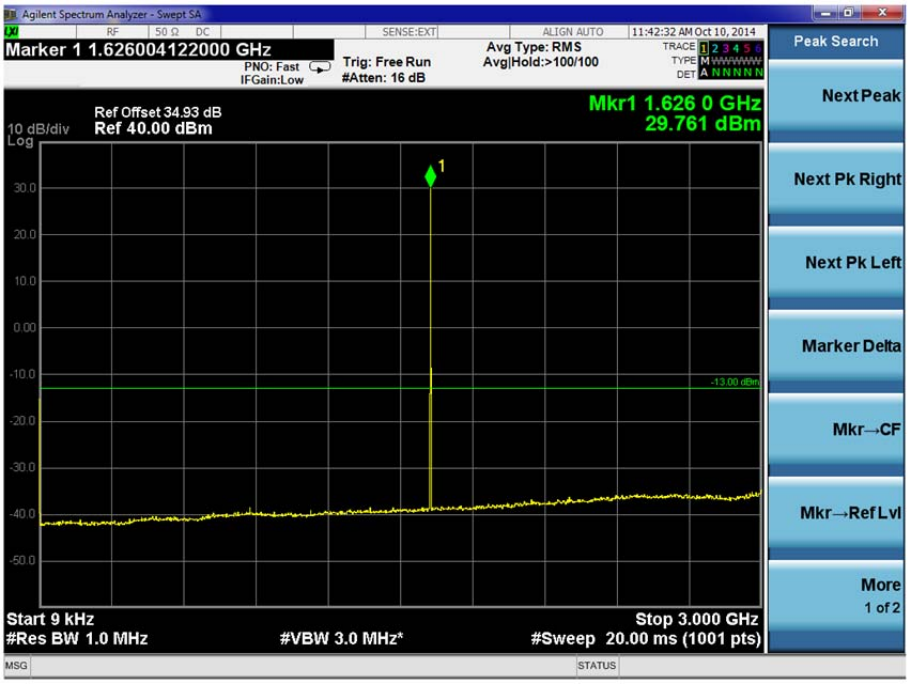


Product Service

1625.969667 MHz

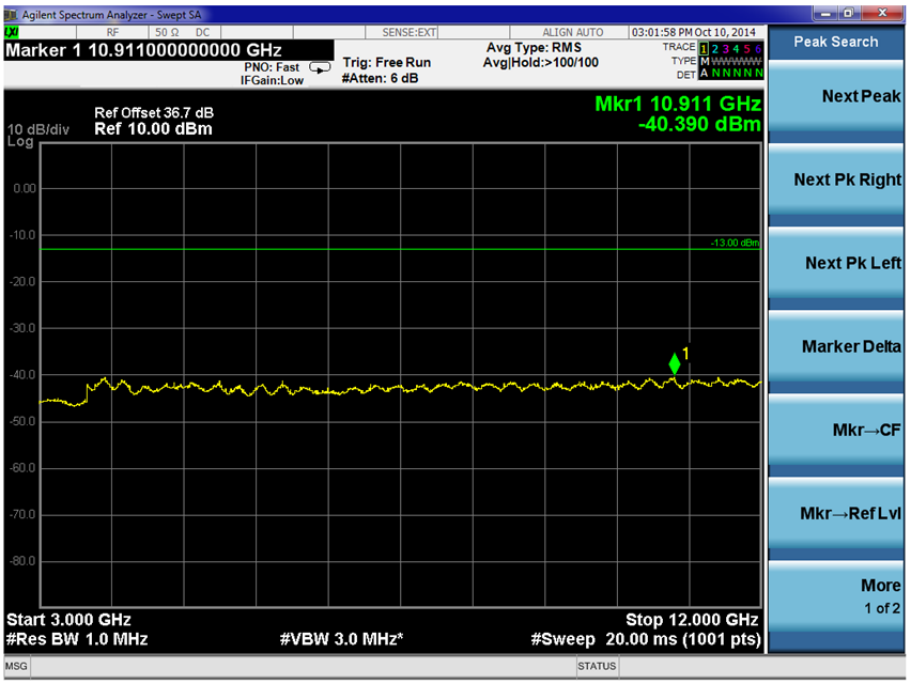
Mask


9 kHz to 3 GHz

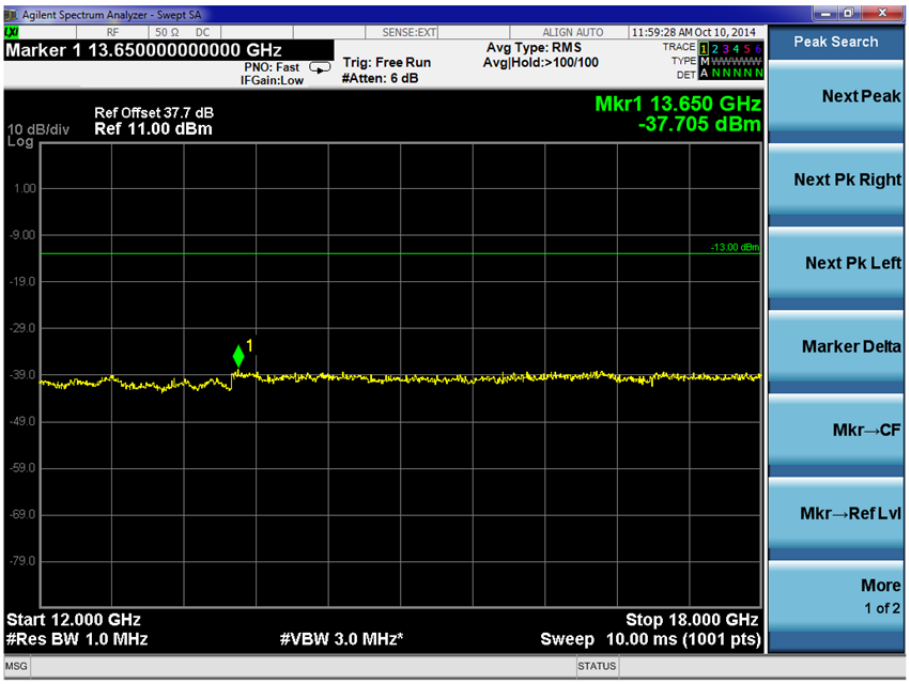


Product Service

3 GHz to 12 GHz



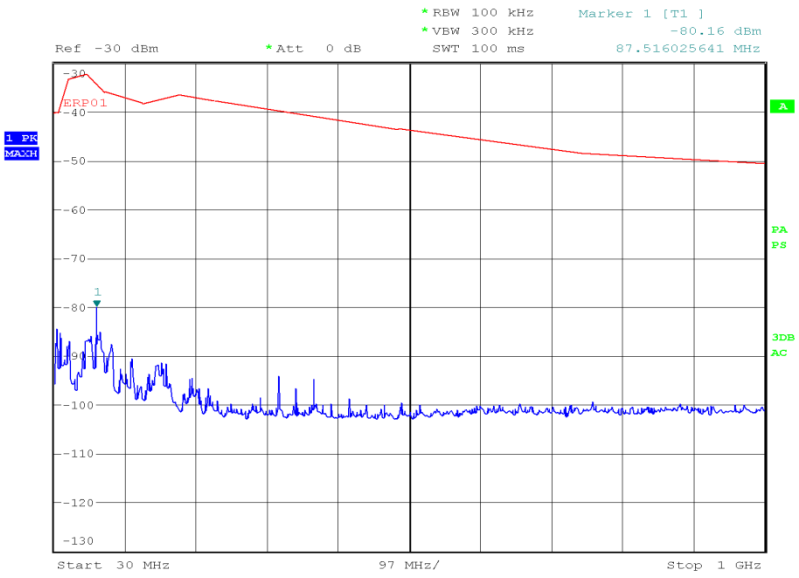

12 GHz to 18 GHz



Radiated

1616.020833 MHz

30 MHz to 1 GHz



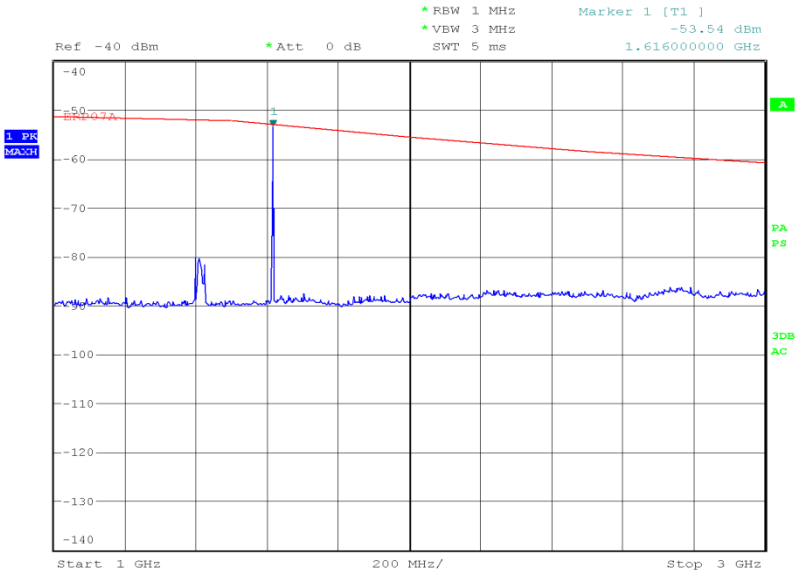

Date: 12.OCT.2014 08:42:53

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

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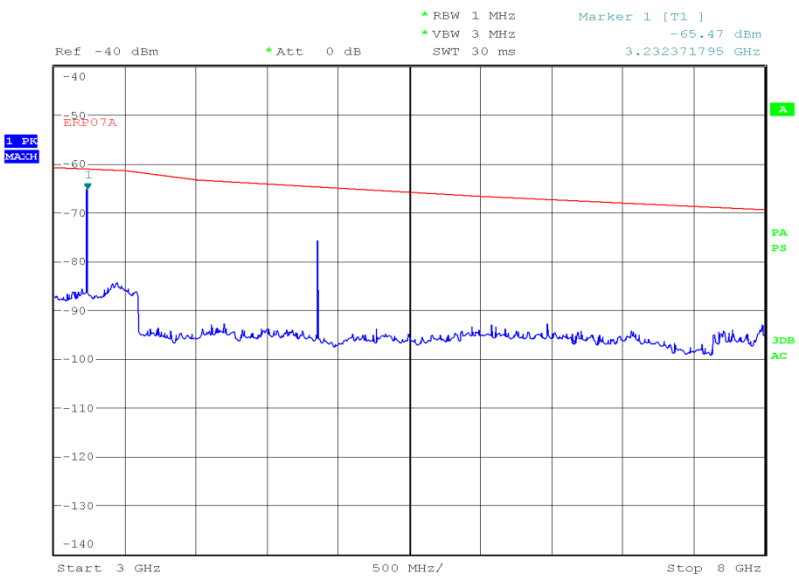
## 3 GHz to 8 GHz

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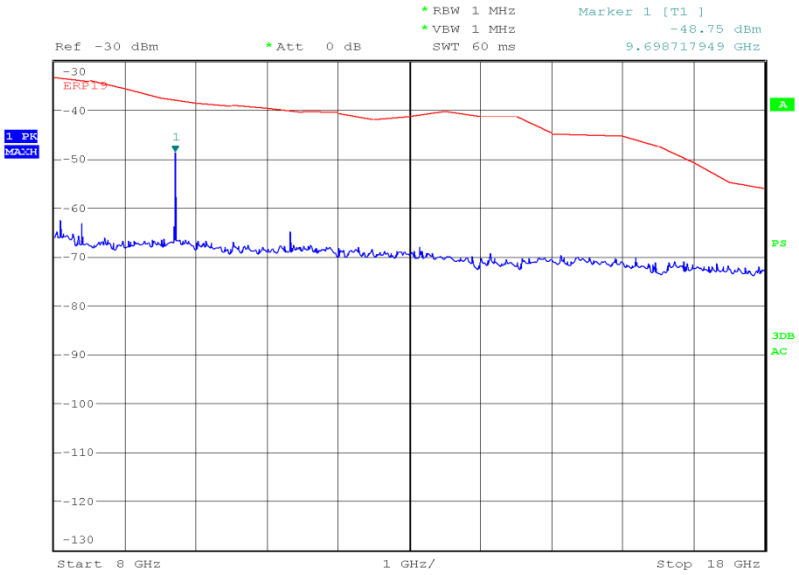
Product Service

8 GHz to 18 GHz

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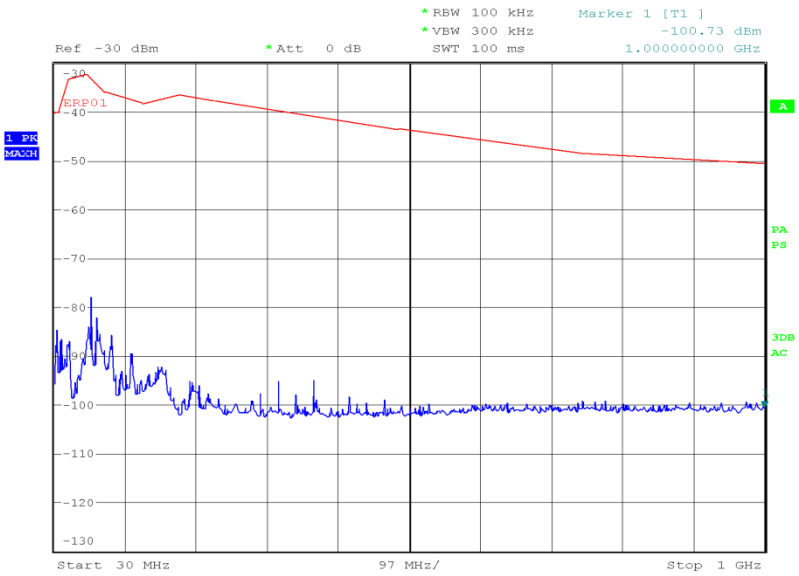
1621.020833 MHz

30 MHz to 1 GHz



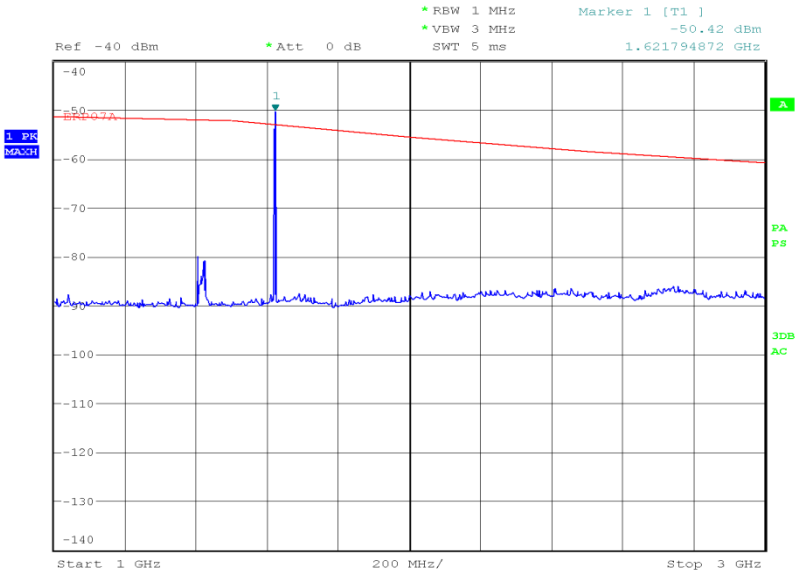

Date: 12.OCT.2014 08:48:15

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

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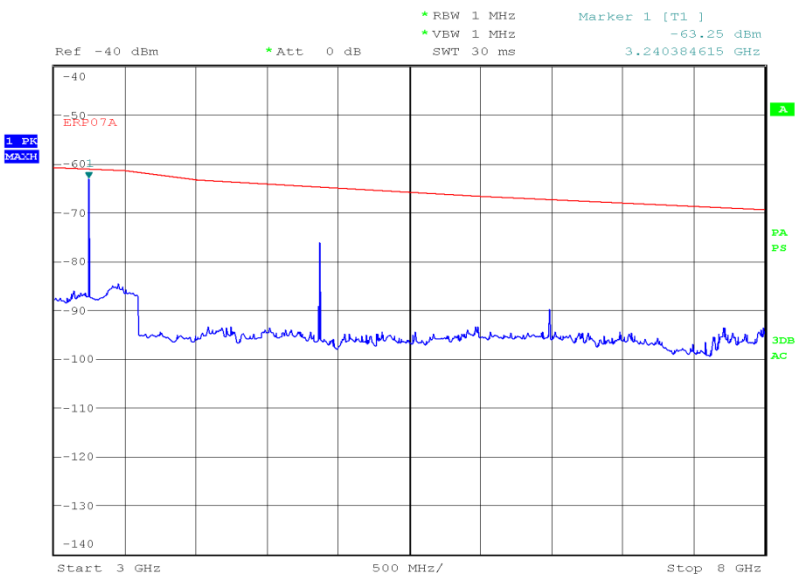
## 3 GHz to 8 GHz

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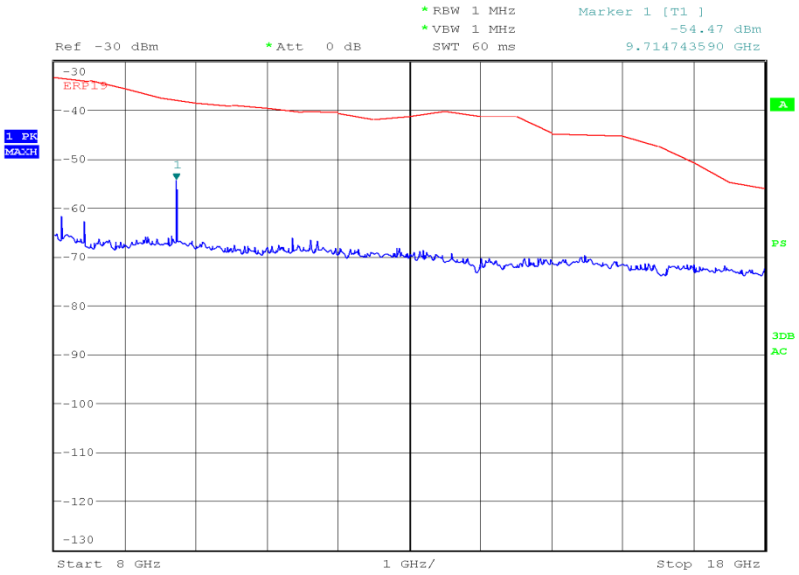
Product Service

8 GHz to 18 GHz

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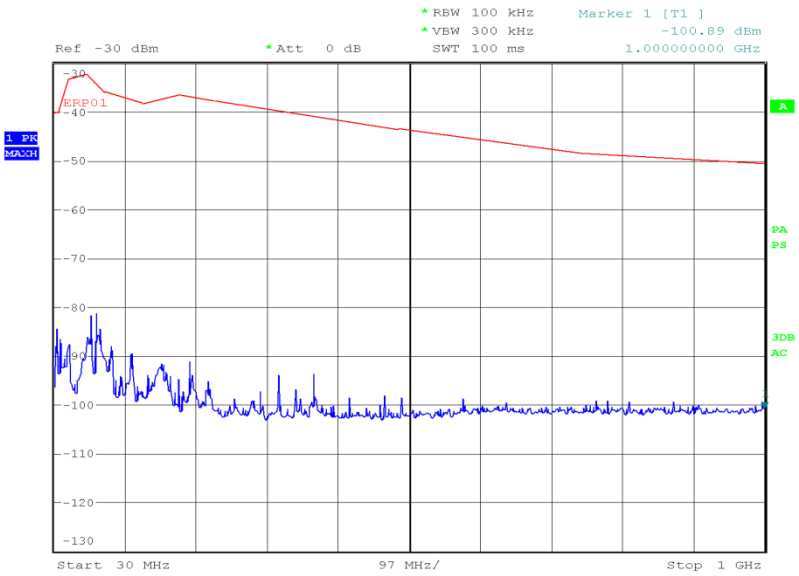
1625.969667 MHz

30 MHz to 1 GHz

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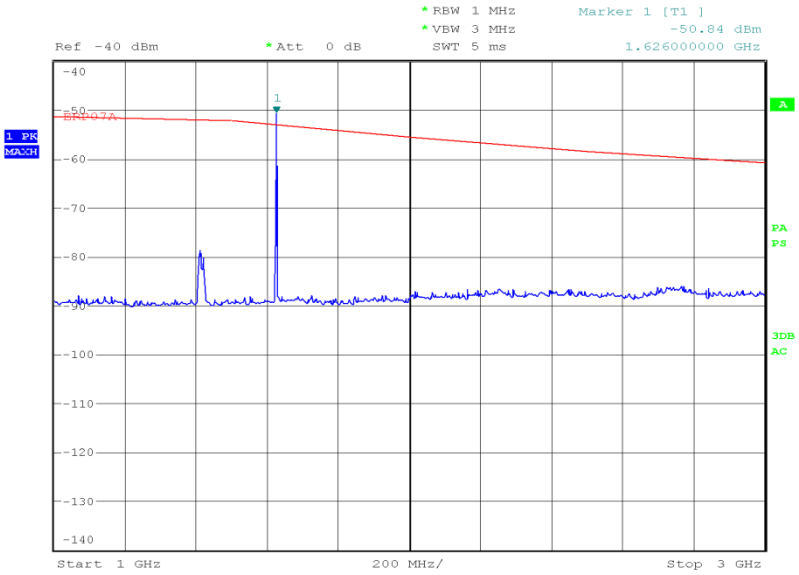
1 GHz to 40 GHz

| 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

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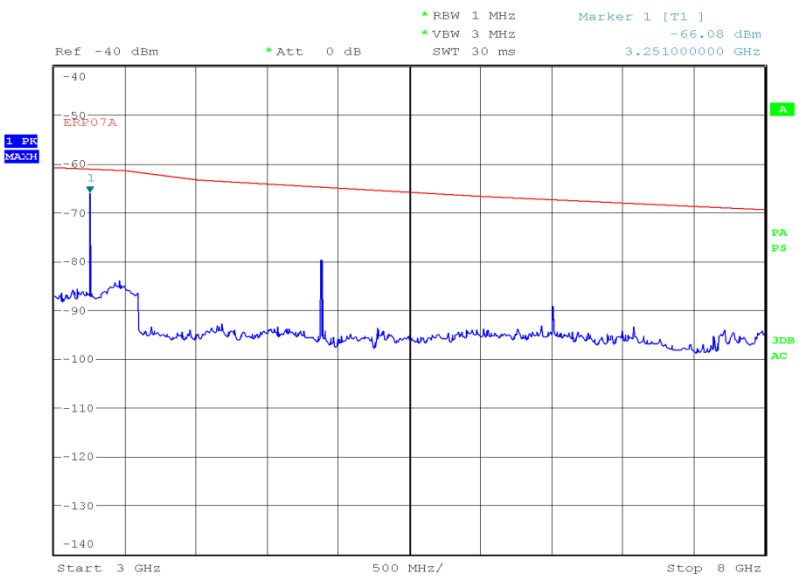
## 3 GHz to 8 GHz

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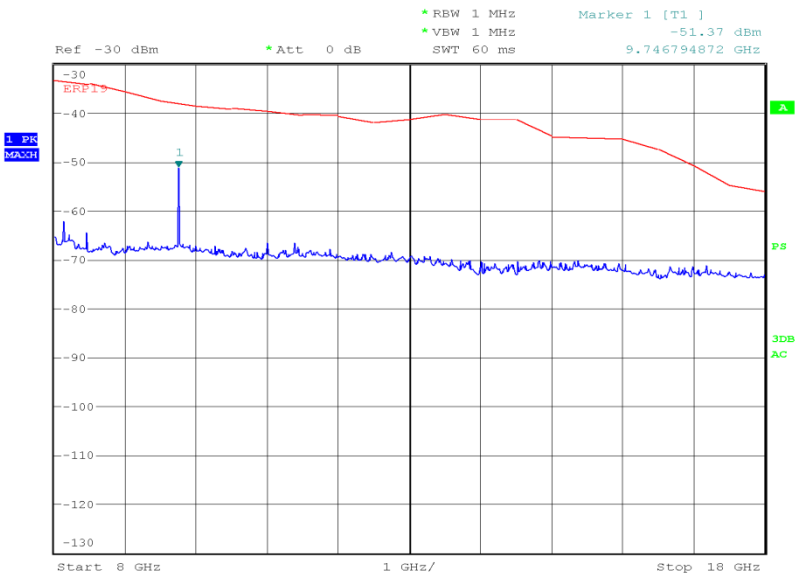
8 GHz to 18 GHz

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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.

## 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 10Log(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 $\theta \leq 0°$
+40 + 3θ dBW in any 4 kHz band for $0° < \theta \leq 5°$

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.

Product Service

## 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% |

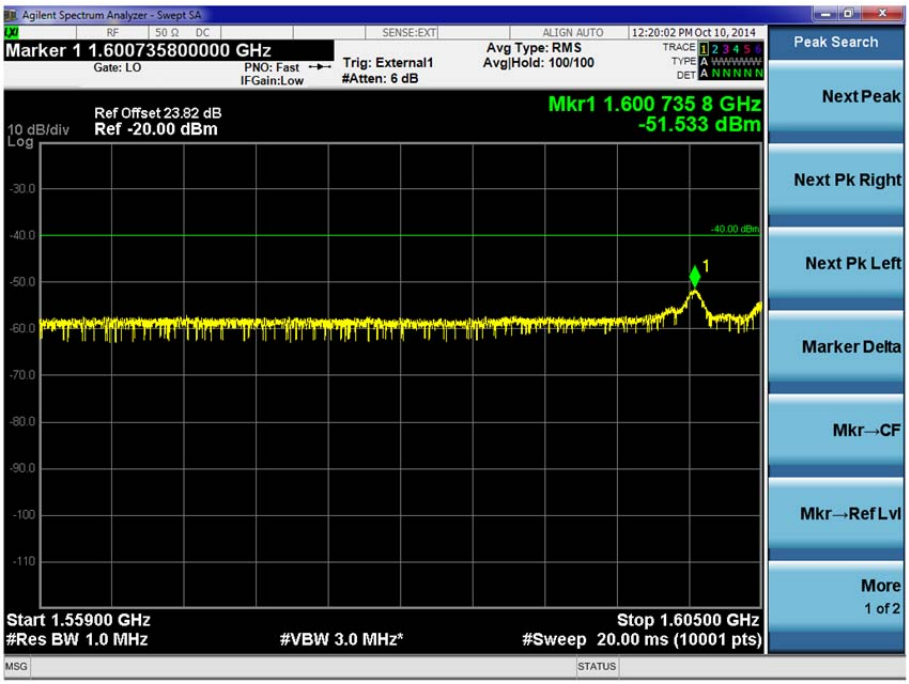
Product Service

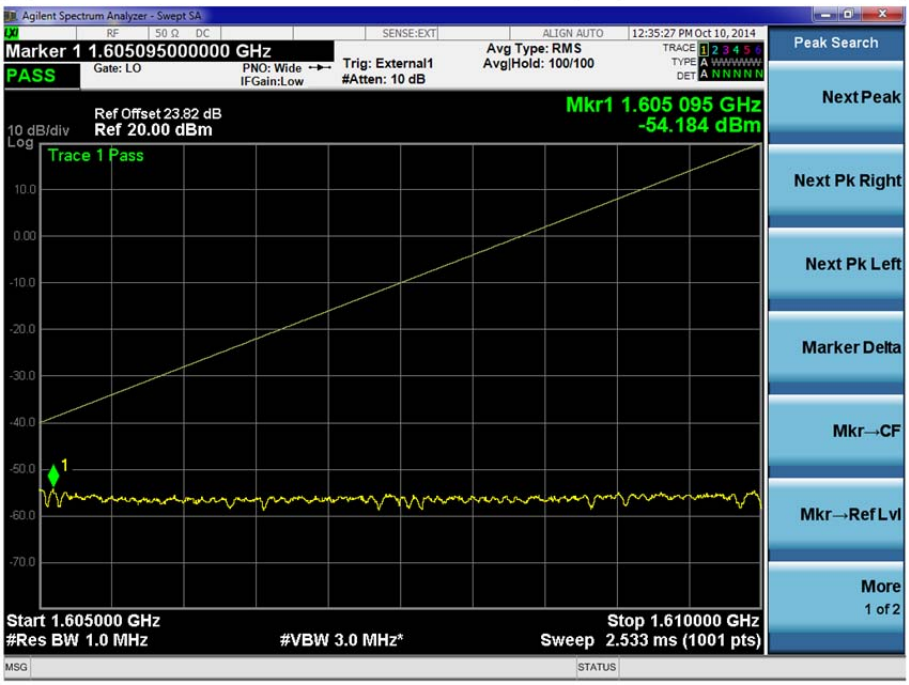
### 2.4.7 Test Results

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 |

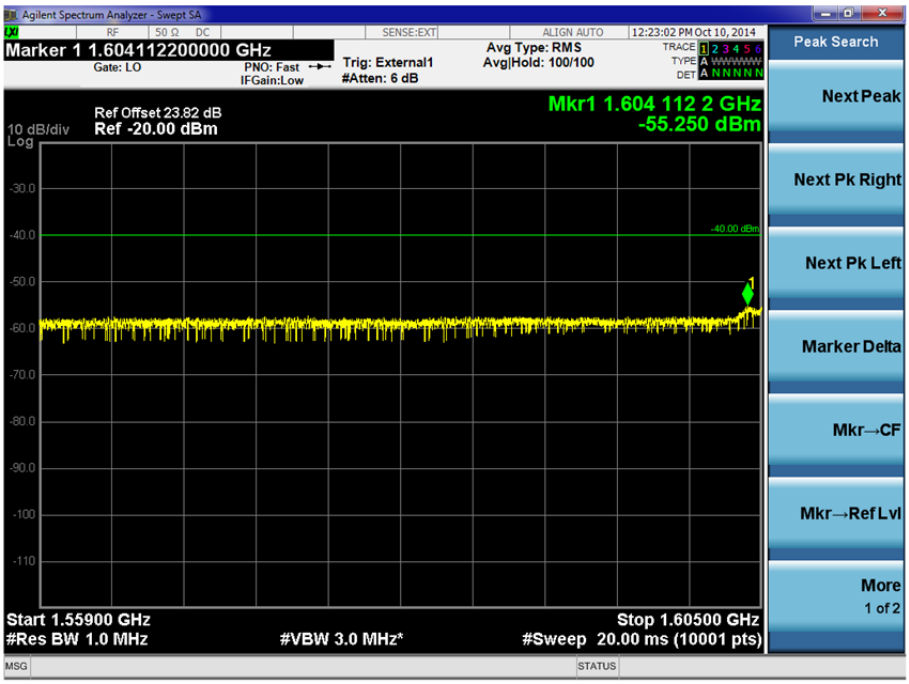
1616.020833 MHz

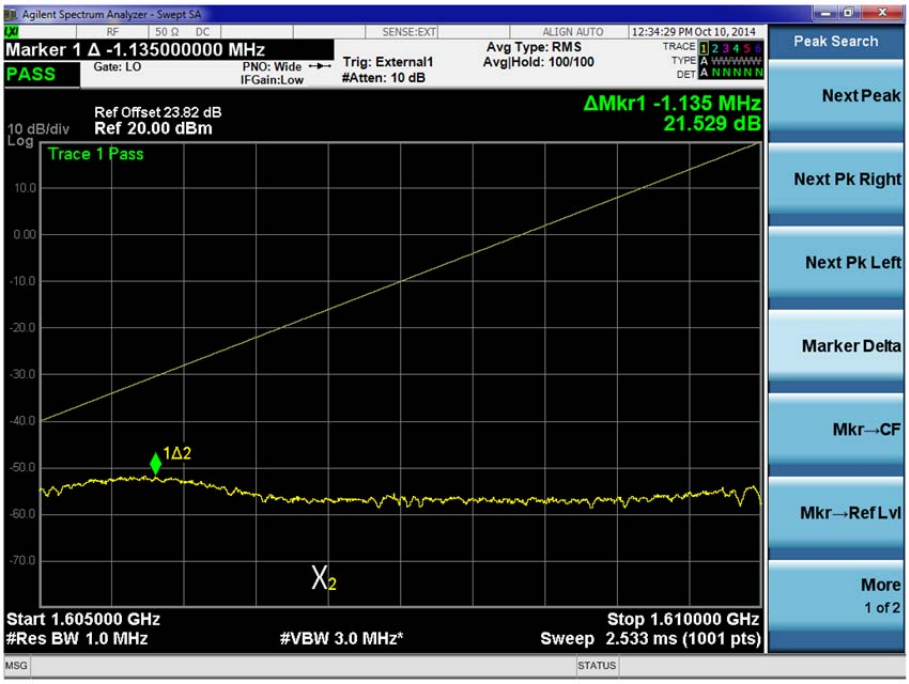


Product Service

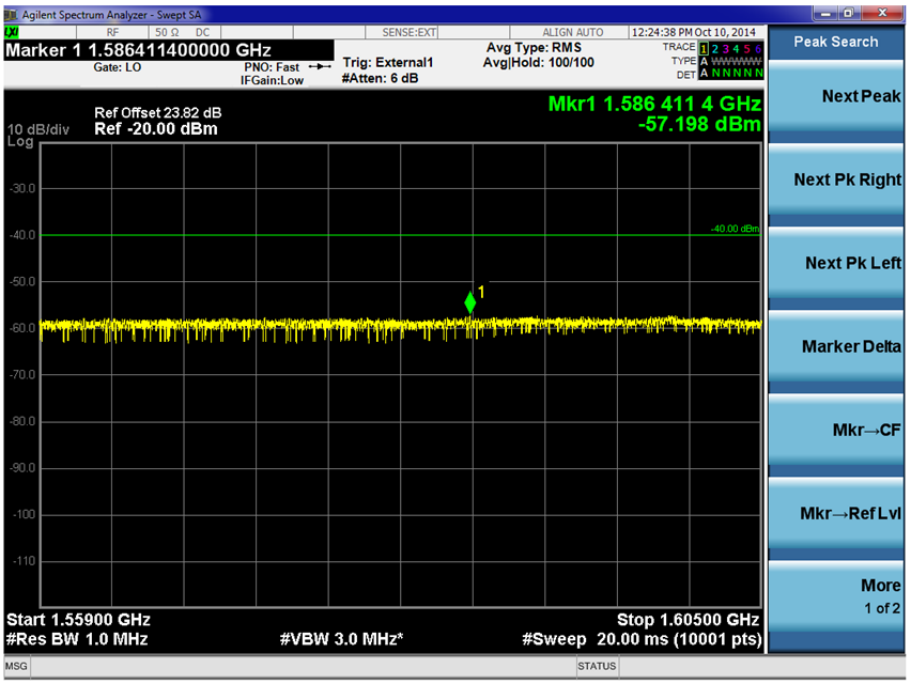
1621.020833 MHz

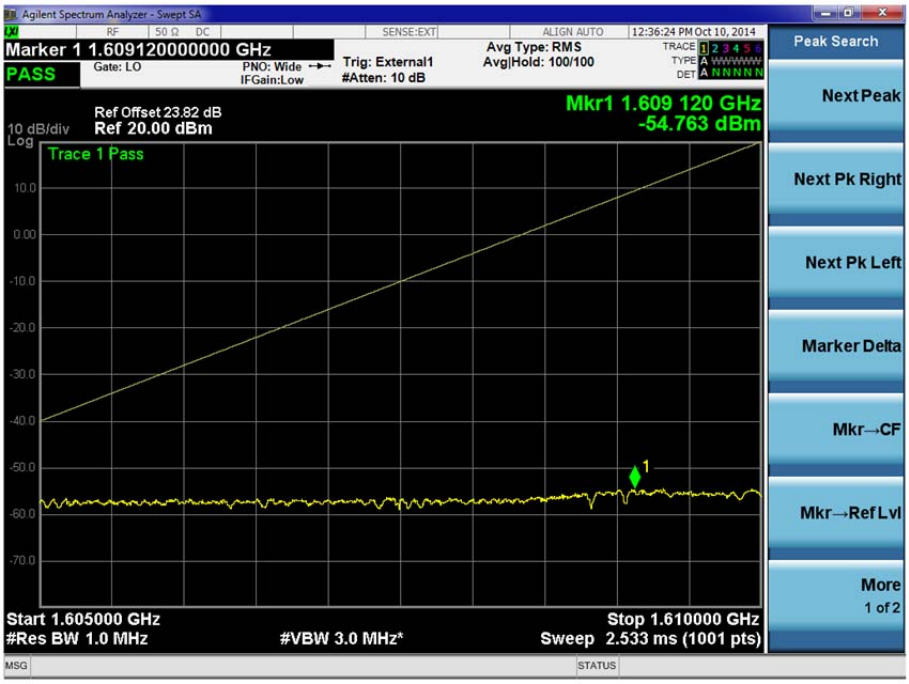


Product Service

1625.969667 MHz

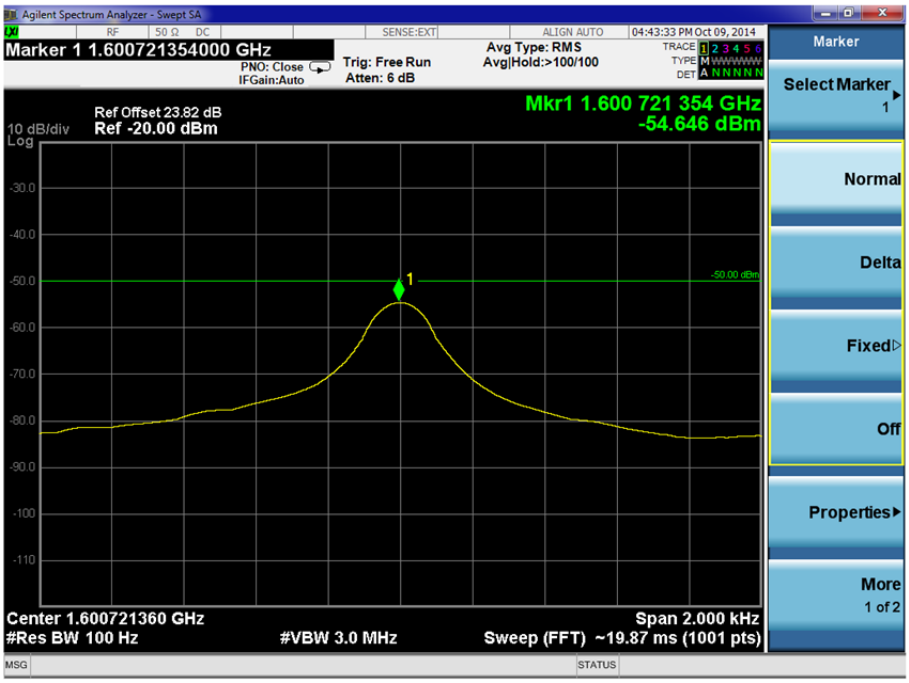


Product Service

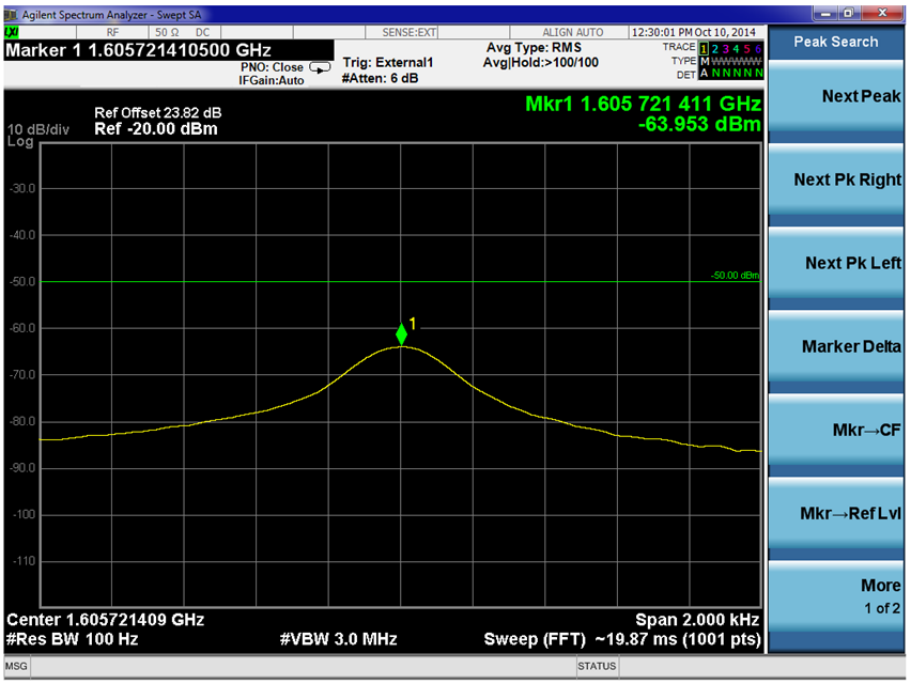
| EIRP Density – Discrete Emissions (dBW/MHz) | | |
|---|---|---|
| 1616.020833 MHz | 1621.020833 MHz | 1625.969667 MHz |
| -84.646 | -93.953 | No discrete emissions found |

1616.020833 MHz



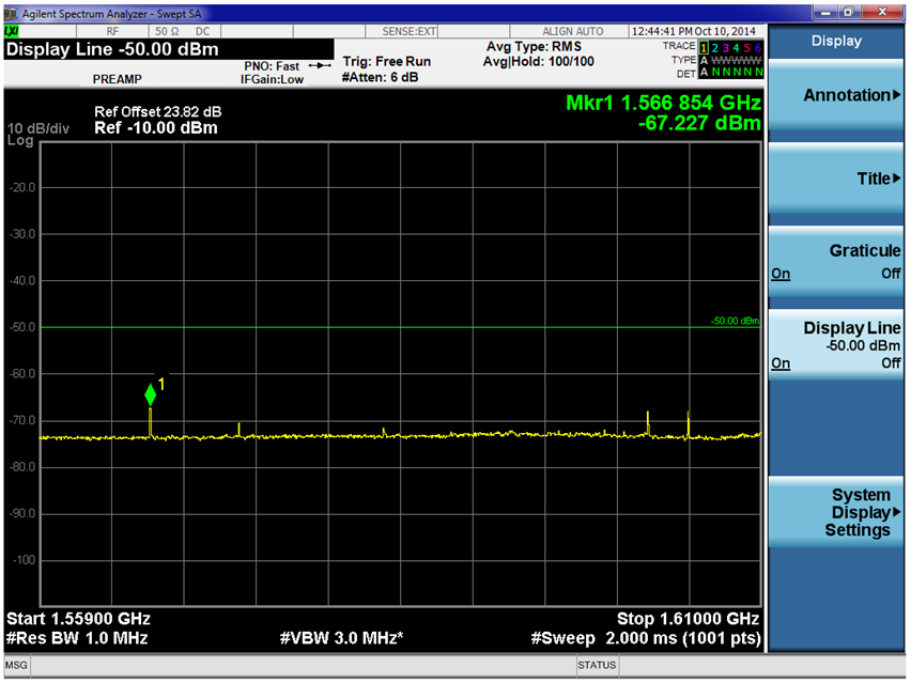
Product Service

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.

## 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.

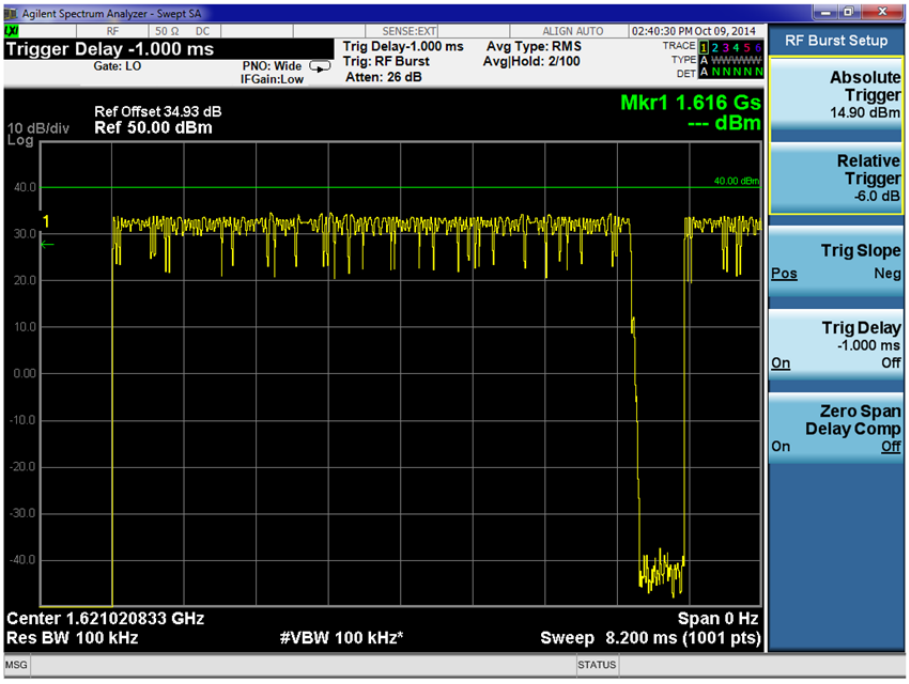
### 2.5.6 Environmental Conditions

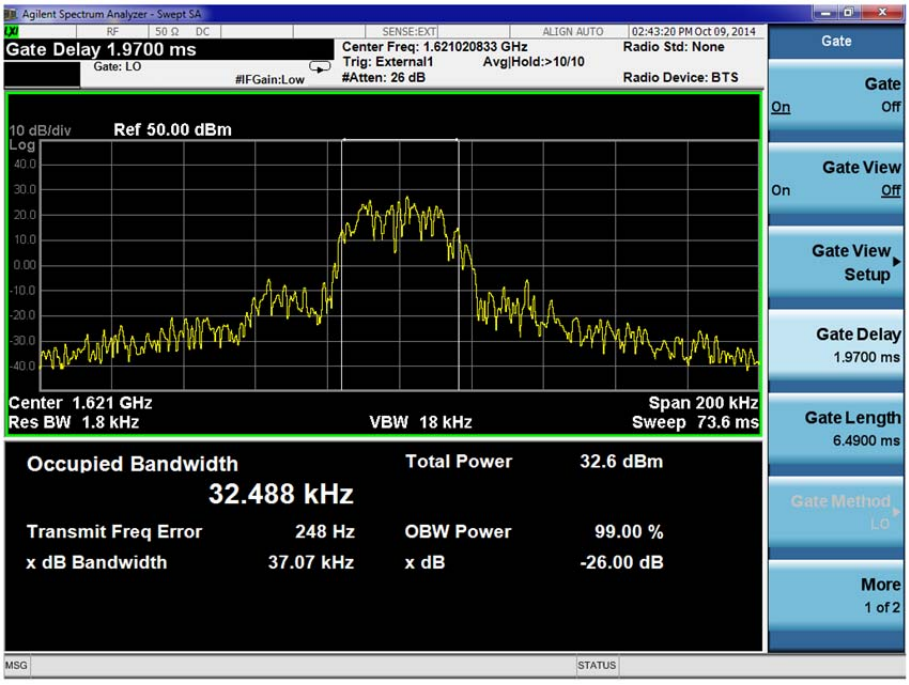
| | |
|---|---|
| Ambient Temperature | 25.7°C |
| Relative Humidity | 40.1% |

Product Service

### 2.5.7 Test Results

1621.020833 MHz



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.

## 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% |

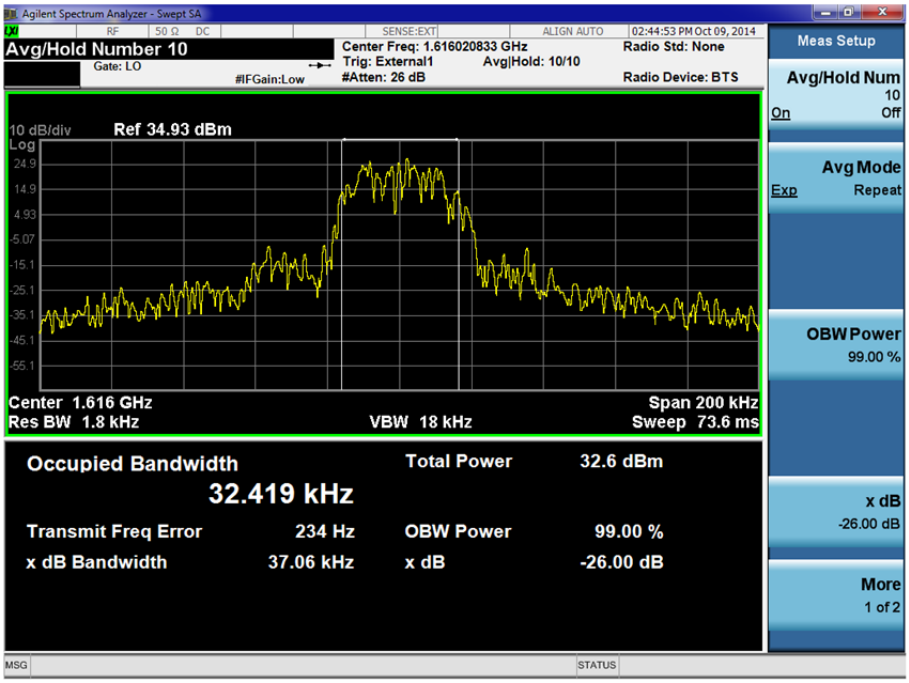
Product Service

### 2.6.7 Test Results

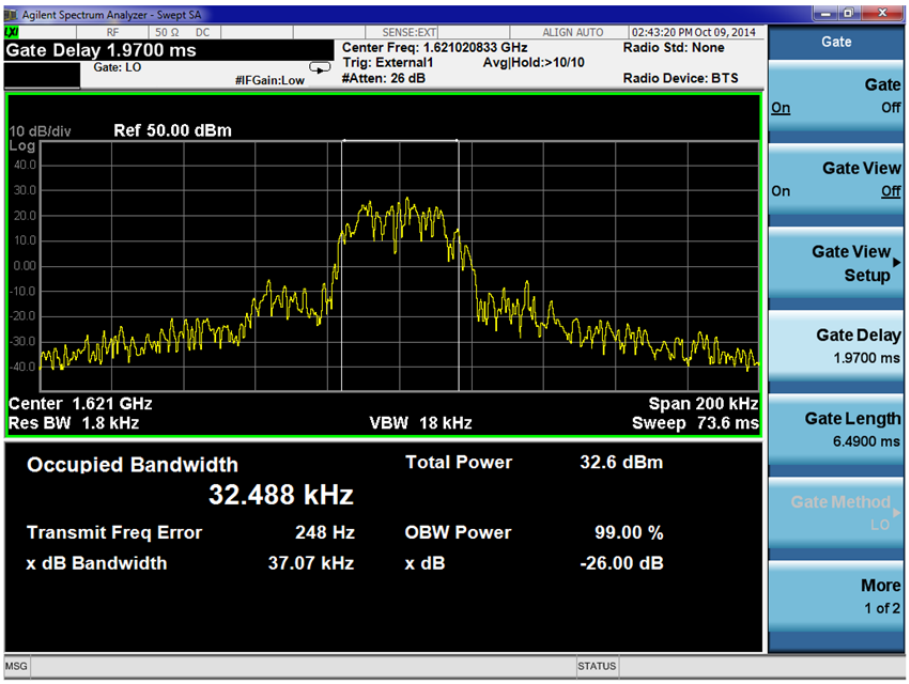
5.0 V DC

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

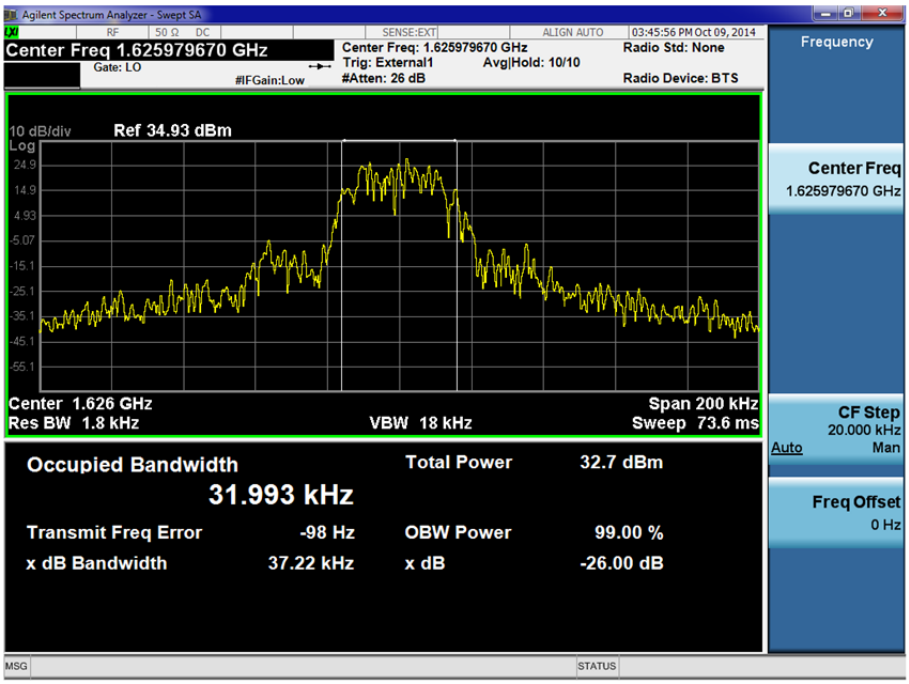
1616.020833 MHz



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**

Product Service

## 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 Subtrate Highpass Filter | Advance Power Components | 11SH10-3000/X18000-O/O | 4411 | 12 | 21-Mar-2015 |

Product Service

| 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

Product Service

## 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<br>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<br>Radiated:<br>30 MHz to 1 GHz: ± 5.1 dB<br>1 GHz to 17 GHz: ± 6.3 dB |
| Occupied Bandwidth | ± 16.74 kHz |

## SECTION 4

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

## 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT


This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).