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Report On

FCC and Industry Canada Testing of the
Iridium Communications Inc 9602N
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and
Industry Canada RSS-170

COMMERCIAL-IN-CONFIDENCE

FCC ID: Q639603N
IC: 4629A-9603N

Document 75928154 Report 03 Issue 2 December 2014

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REPORT ON

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Iridium Communications Inc 9602N
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170

Document 75928154 Report 03 Issue 2

December 2014

PREPARED FOR

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United States

PREPARED BY

Natalie Bennett
Senior Administrator, Project Support

APPROVED BY

Simon Bennett
Authorised Signatory

DATED 09 December 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 and Industry Canada RSS-170. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

A Guy J Tuckwell M Russell M Toubella

UKAS TESTING 0141

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CONTENTS

Section		Page No
1	**REPORT SUMMARY**	**3**
1.1	Introduction	4
1.2	Brief Summary of Results	5
1.3	Application Form	6
1.4	Product Information	8
1.5	Test Conditions	8
1.6	Deviations from the Standard	8
1.7	Modification Record	8
2	**TEST DETAILS**	**9**
2.1	Emission Limitations	10
2.2	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	17
3	**TEST EQUIPMENT USED**	**24**
3.1	Test Equipment Used	25
3.2	Measurement Uncertainty	26
4	**ACCREDITATION, DISCLAIMERS AND COPYRIGHT**	**27**
4.1	Accreditation, Disclaimers and Copyright	28

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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Iridium Communications Inc 9602N
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170

1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC and Industry Canada Testing of the Iridium Communications Inc 9602N to the requirements of FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170.

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	Iridium Communications Inc
Model Number(s)	9602N
Serial Number(s)	0000000010 0000000018
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2013) FCC CFR 47 Part 25 (2013) Industry Canada RSS-170 (2011)
Incoming Release Date	Application Form 10 October 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	25823 01 October 2014
Start of Test	13 November 2014
Finish of Test	18 November 2014
Name of Engineer(s)	A Guy J Tuckwell M Russell M Toubella
Related Document(s)	ANSI C63.4: 2009

This report has been up issued to Issue 2 and should be read in place of Issue 1. This report has been up issued to Issue 2 and is to correct the model number in sections 2.1.2 and 2.2.2 and correct the applicant name.

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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 and Industry Canada RSS-170 is shown below.

Section	Spec Clause			Test Description	Result	Comments/Base Standard
	FCC Pt 2	FCC Pt 25	RSS-170			
Transmit						
2.1	2.1053	25.202(f)	5.4.3.1	Emission Limitations	Pass	
2.2	-	25.216	5.4.3	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Pass	

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1.3 APPLICATION FORM

APPLICATION FORM FOR TESTING TO FCC/INDUSTRY CANADA REQUIREMENTS

APPLICANT'S DETAILS

COMPANY NAME : Cambridge Consultants Ltd.
ADDRESS : Science Park, Milton Road
Cambridge
England, CB5 0DW

NAME FOR CONTACT PURPOSES : Jonathan Jones

TELEPHONE NO: +44 1223 392446 FAX NO: +44 1223 423373
E-MAIL: jonathan.jones@cambridgeconsultants.com

EQUIPMENT INFORMATION

Model name/number	9602N	Identification/Part number	9602N
Hardware Version	rev A (P2049-CN-001 V0.7)	Software Version	TA14002 Candidate
Manufacturer	Iridium Communications Inc.	Country of Origin	UK
FCC ID	Q639603N	Industry Canada ID	4629A-9603N

Technical description (a brief description of the intended use and operation)

Satellite short burst data transceiver.

Supply Voltage:

[ ]	AC mains	State AC voltage V	and AC frequency ..... Hz
[X]	DC (external)	State DC voltage 5.0 V	and DC current 2.0 A
[ ]	DC (internal)	State DC voltage V	and Battery type .....

Frequency characteristics:

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

Receiver Frequency range (if different) 1616 MHz to 1626.5 MHz Channel spacing 41.667kHz (if channelized)

Designated test frequencies:
Bottom: 1616.020833 MHz Middle: 1621.020833 MHz Top: 1625.979167 MHz
Intermediate Frequencies : 0.6 MHz
Highest Internally Generated Frequency : 3252 MHz

Power characteristics:

Maximum transmitter power 1.479 W Minimum transmitter power (if variable) ..... W

[ ] Continuous transmission
[X] Intermittent transmission State duty cycle 9.2%
If intermittent, can transmitter be set to continuous transmit test mode? N

Antenna characteristics:

[X]	Antenna connector	State impedance 50 ohm
[ ]	Temporary antenna connector	State impedance ..... ohm
[ ]	Integral antenna Type	State gain ..... dBi
[X]	External Antenna Type	State gain 3.0 dBi

Modulation characteristics:

[ ] Amplitude [X] Other
[ ] Frequency Details: DE-QPSK, DE-BPSK
Can the transmitter operate un-modulated? Y
ITU Class of emission: 41K7Q7D

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 °C	Minimum temperature	-40 °C
Maximum supply voltage	5.5 V	Minimum supply voltage	4.5 V

Product Service

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: Jonathan Jones

Position held: Senior Engineer

Date: 25/11/2014

COMMERCIAL-IN-CONFIDENCE

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Iridium Communications Inc 9602N. 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
Iridium Communications Inc 9602N
In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25 and Industry Canada RSS-170

2.1 EMISSION LIMITATIONS

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

9602N S/N: 0000000010 - Modification State 0

2.1.3 Date of Test

13 November 2014 & 14 November 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

For radiated testing, a preliminary profile of the Spurious Radiated Emissions was obtained up to the 10th harmonic 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. For 30 MHz to 1 GHz, a resolution and video bandwidth of 100 kHz and 300 kHz were used respectively. For measurements above 1 GHz, a resolution and video bandwidth of 1 MHz were used. These bandwidths were used as a worst case compared to the 4 kHz specification requirement.

The EUT was set to transmit on maximum power with both channels operating simultaneously.

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.

2.1.6 Environmental Conditions

Ambient Temperature	19.9°C
Relative Humidity	48.3%

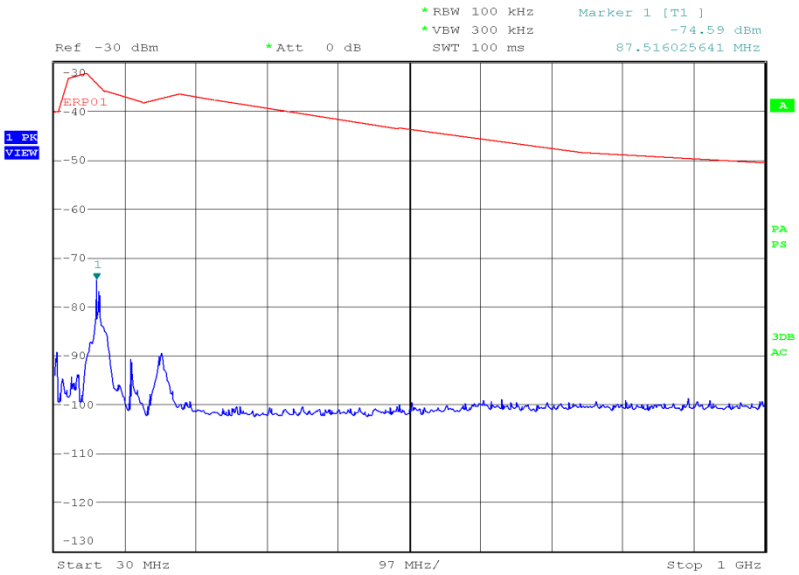
2.1.7 Test Results

5.0 V DC Supply

Radiated

1616.020833 MHz

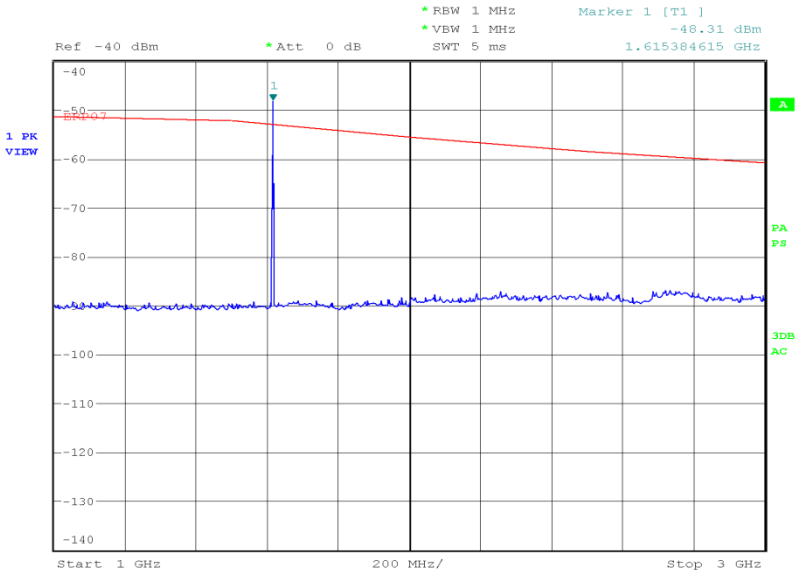
30 MHz to 1 GHz



Date: 13.NOV.2014 18:40:03

Product Service

1 GHz to 3 GHz



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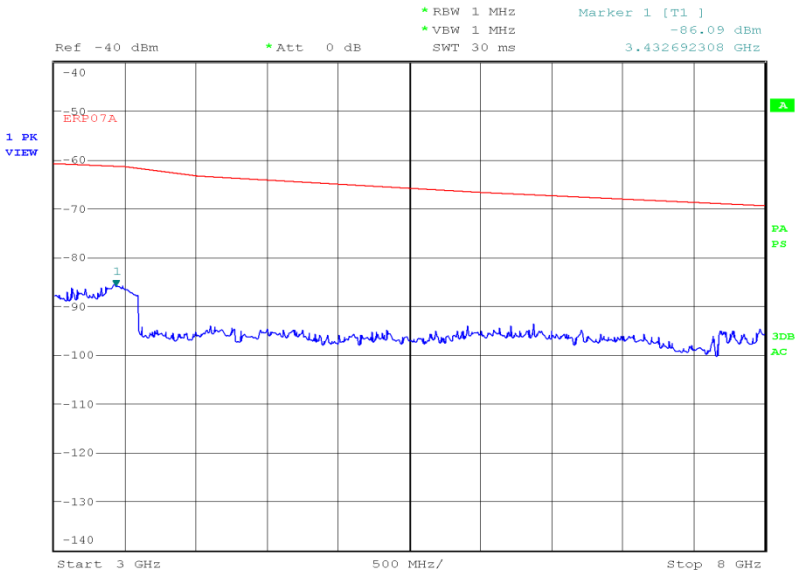
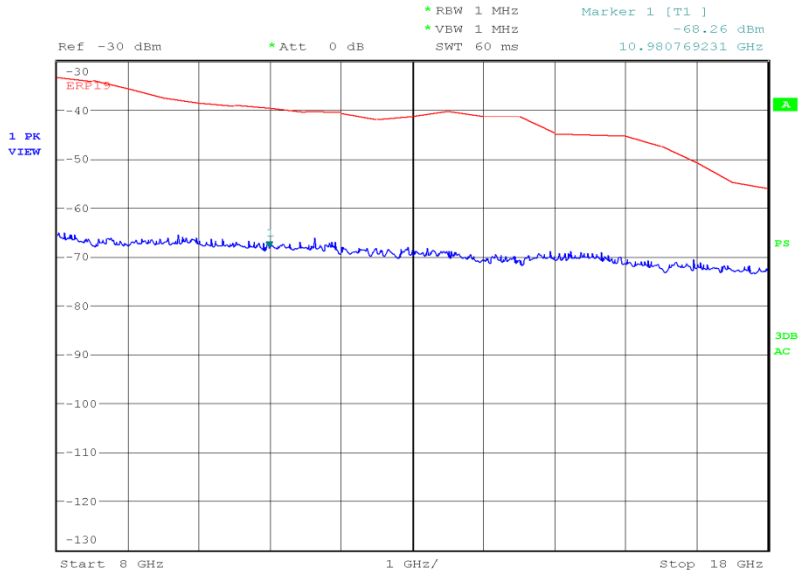
3 GHz to 8 GHz



Date: 13.NOV.2014 21:42:18

Product Service

8 GHz to 18 GHz

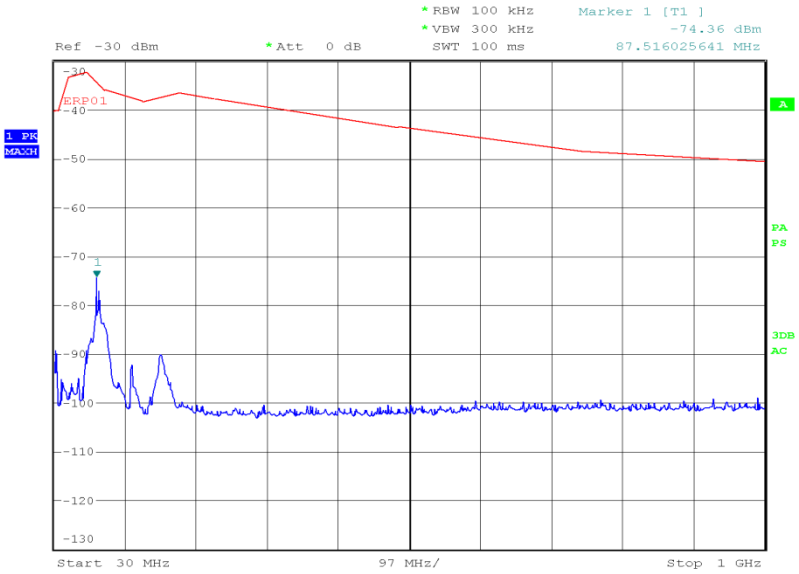


Date: 13.NOV.2014 23:50:11

Product Service

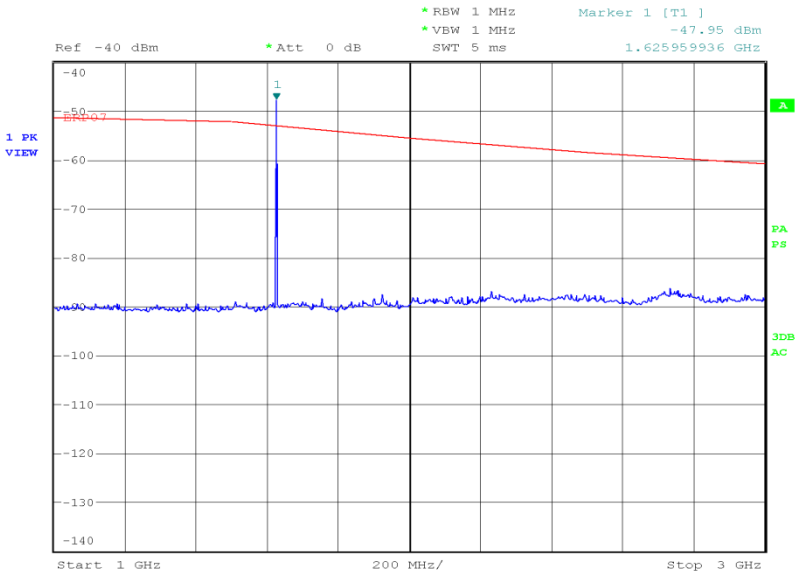
1625.979167 MHz

30 MHz to 1 GHz



Date: 13.NOV.2014 19:26:22

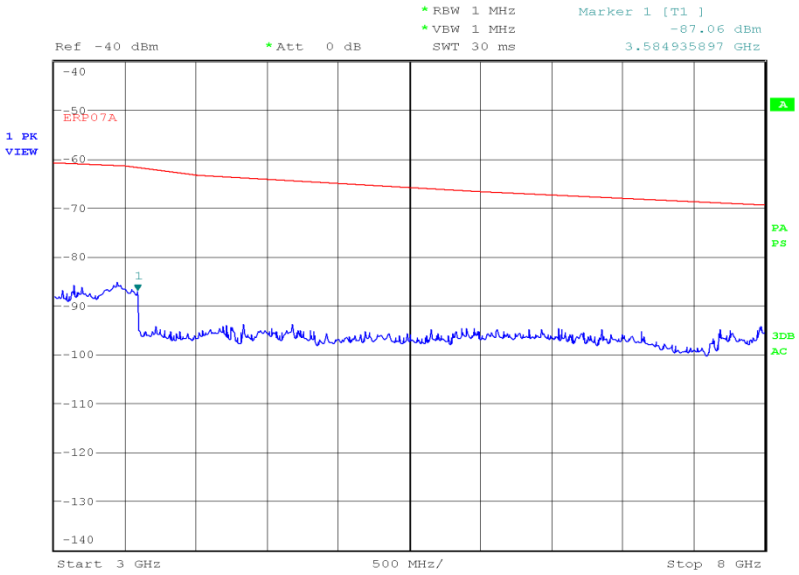
1 GHz to 3 GHz



Date: 13.NOV.2014 21:33:41

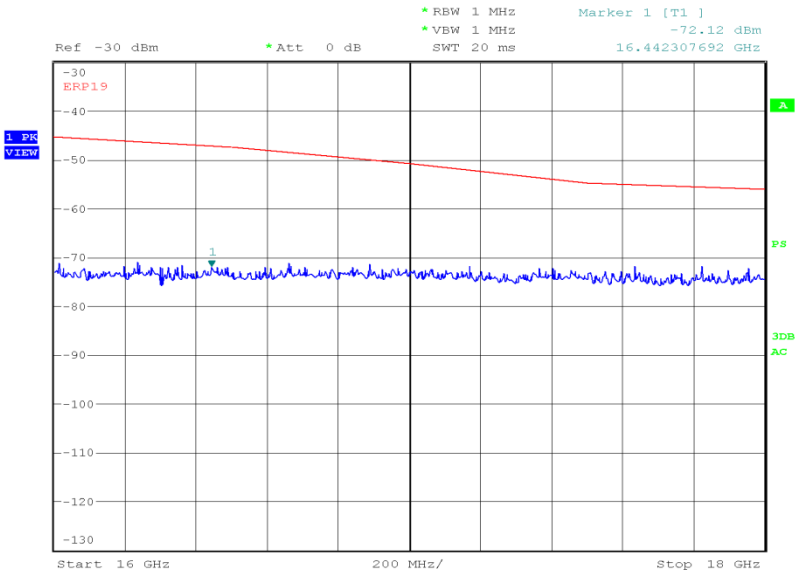
Product Service

3 GHz to 8 GHz



Date: 13.NOV.2014 21:51:06

8 GHz to 18 GHz



Date: 14.NOV.2014 00:54:59

Product Service

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) 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.

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

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

9602N S/N: 0000000018 - Modification State 0

2.2.3 Date of Test

18 November 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

This test was performed in accordance with the requirements as stated in FCC CFR 47 Part 25.202 (c), (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 entered as a reference level offset in the EUT. 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 dBm/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 any discrete emissions have a power density less than -80 dBm/MHz.

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 EUT. 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.

2.2.6 Environmental Conditions

Ambient Temperature	24.0°C
Relative Humidity	35.7%

2.2.7 Test Results

5.0 V DC Supply

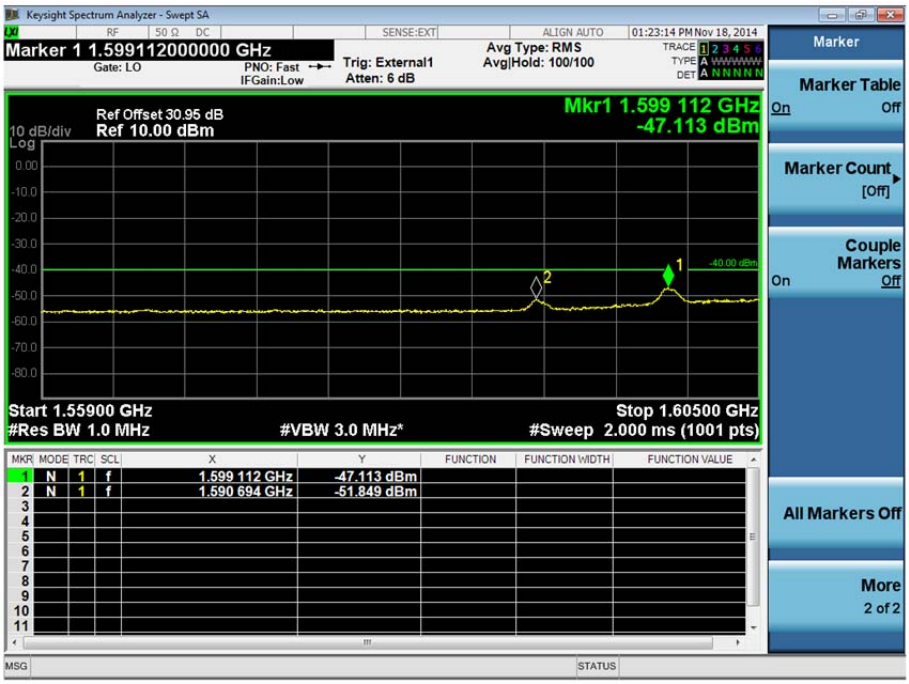
EIRP Density – Broadband Emissions (dBW/MHz)		
1616.020833 MHz	1619.312500 MHz	1625.979167 MHz
-74.11	-72.96	-75.24

Remarks

The results in the table above show results which have been converted into dBW. A 3.0 dB correction has also been added to the results in the table to correct for a 3.0 dBi gain antenna.

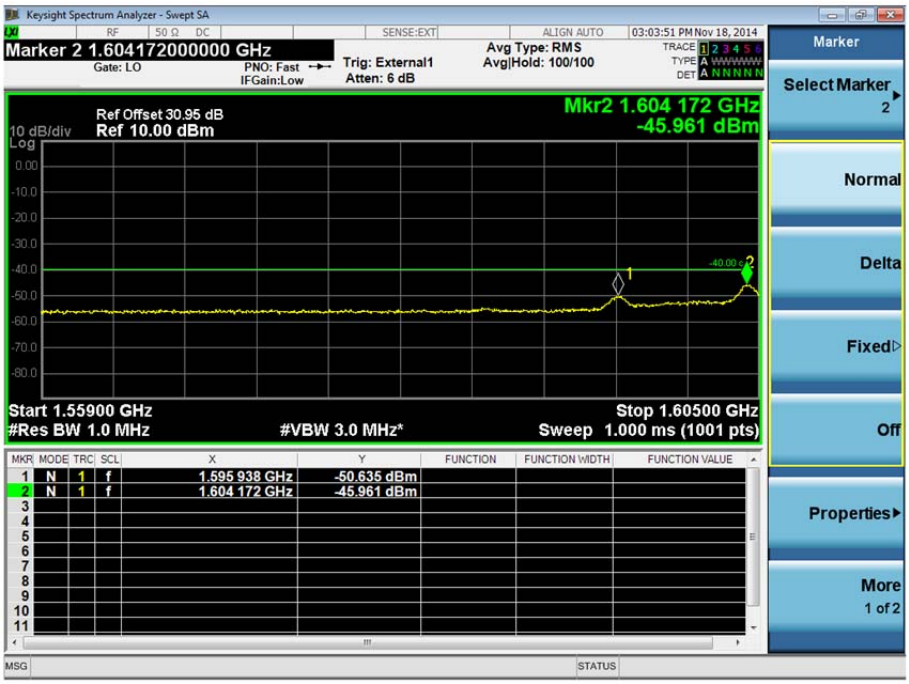
Product Service

1616.020833 MHz



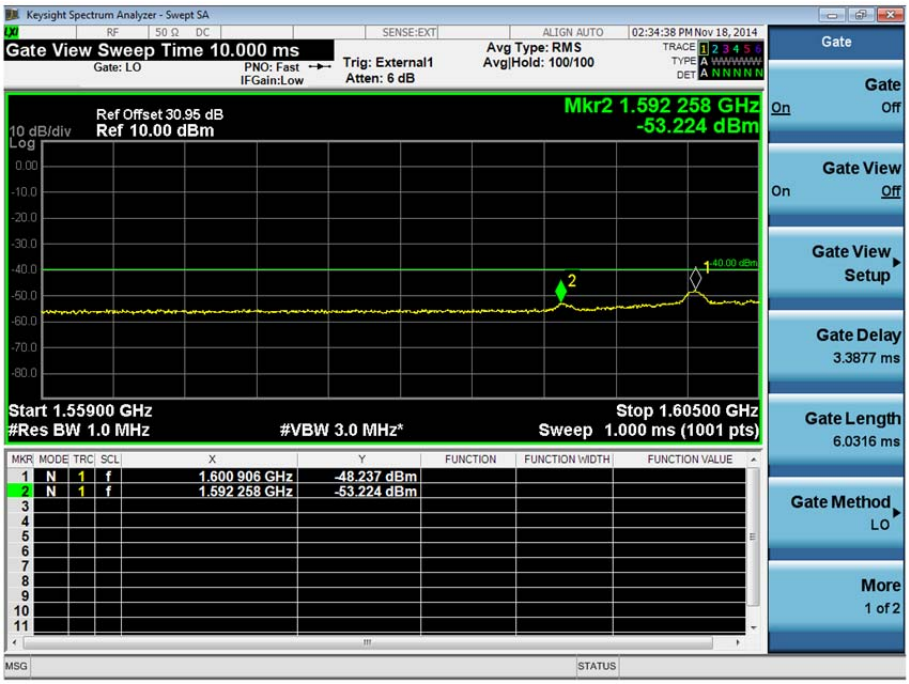
Product Service

1619.312500 MHz



Product Service

1625.979167 MHz

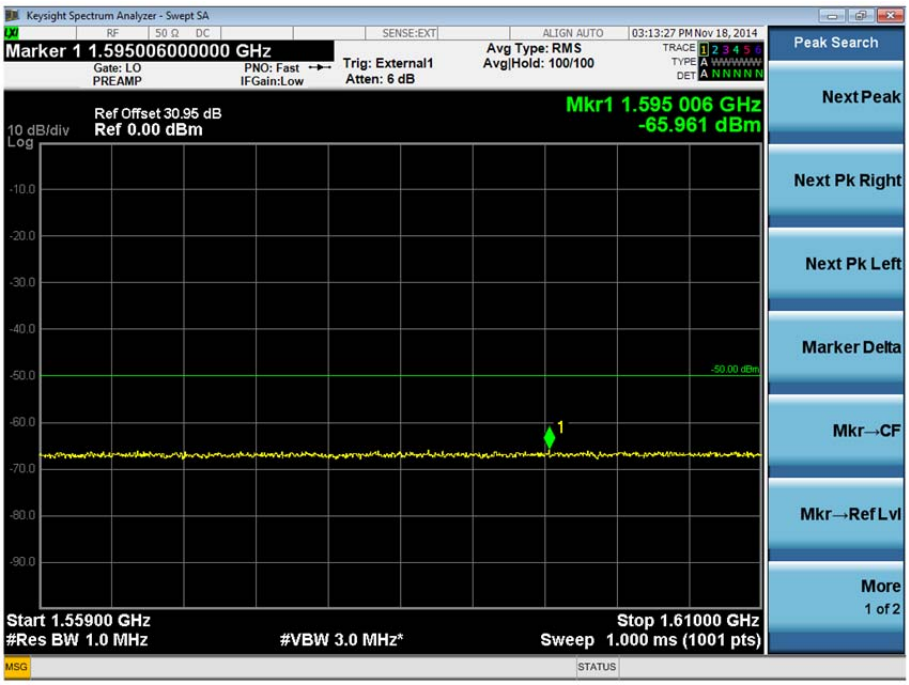


EIRP Density – Discrete Emissions (dBW/MHz)		
1616.020833 MHz	1619.312500 MHz	1625.979167 MHz
No emissions found	No emissions found	No emissions found

EIRP Density- Carrier-off State Emissions (dBW/MHz)
-92.96

Remarks

The results in the table above show results which have been converted into dBW. A 3.0 dB correction has also been added to the results in the table to correct for a 3.0 dBi gain antenna.



Limit Clause FCC CFR 47, 25.216

25.216(c) The e.i.r.p. density of emissions from mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1559–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW, averaged over any 2 millisecond active transmission interval, in the 1559–1605 MHz band.

25.216(g) Mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz averaged over any 2 millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -20 dBW at 1610 MHz, averaged over any 2 millisecond active transmission interval.

25.216(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any two millisecond interval.

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 - Emission Limitations					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Pre-Amplifier	Phase One	PS04-0086	1533	12	19-Dec-2014
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Suspended Subtrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	21-Mar-2015
Section 2.2 - Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service					
Power Supply Unit	Farnell	LT30-2	41	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Signal Generator	Thurlby Thandar Instruments	TG2000	3334	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000-3PS	3696	12	28-Feb-2015
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	7-Nov-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-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
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	± 3.08 dB
Emission Limitations	Radiated: 30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 17 GHz: ± 6.3 dB

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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).

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