



TEST REPORT NO.: 14990

Evaluation of MIWINGMAN

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Report no.: 14990

STATEMENT OF AUTHORITY

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This report relates only to the specific samples tested as identified herein. The test results do not apply to any similar item that has not been tested. GTF accepts no liability for losses or legal matters arising from misinterpretation, misunderstanding or misuse of this test report.

TEST OFFICIAL:

PP Govender
TECHNICAL SIGNATORY

2017-11-15
Date

APPROVAL:

MI Myaluza
ACTING MANAGER:
EMC AND ANTENNA TESTING

2017-11-15
Date

TEST INFORMATION

Test specification used:	✚ RTCA DO 160G : Section 21 : Emission of radio frequency energy (2010)
Type of test(s):	<ol style="list-style-type: none">1. Section 21 - Conducted RF emissions – 0,15 MHz to 150 MHz2. Section 21 - Radiated RF emissions – 100 MHz to 6000 MHz
Test result:	Compliant
Test item description:	Miwingman
Manufacturer:	IndigoSat (South Africa) (Pty) Ltd
Model no.:	IOS ATU-A
Serial no.:	0003
Remarks:	<ol style="list-style-type: none">1. Tests performed at the Centurion site.2. Tested items have to be collected within three months; otherwise it will be disposed of.
Referral:	None
Date received:	2017-11-01
Test commencement date:	2017-11-04
Test completion date:	2017-11-04
Ambient temperature:	18 °C – 22 °C
Relative Humidity:	33 % - 38 %

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1. DEFINITIONS

EUT	Equipment under test
N/A:	Not applicable
P:	Compliance
F:	Non-compliance
ITU:	International telecommunications union

2. TEST RESULTS

2.1 Test equipment utilised

Type of Instrument	Asset/Serial No.	Calibration Certificate No.
R&S ESU8 EMI Test Receiver	13000367	222942
Semi-anechoic Chamber 10 m (L) X 8 m (W) X 6 m (H)	VTB 2184	Verified before use
Open Area Test Site - OATS 16 m (L) X 8,4 m (W)	13000285	C 745 352
Eaton Bi-Conical Antenna, 30 MHz - 200 MHz	VTB 2142	C-745-400
EMCO Log Periodic Antenna, 200 MHz - 1000 MHz	OTF 512	C-745-390
Electro-Metrics Double Ridged Guide Antenna, 1GHz – 18GHz	2916	C-745-234
Solar Electronics LISN	OTF 417	82692
Solar Electronics LISN	OTF 418	Verified before use
Eaton RF Current Clamp	OTF 2135	114802
Tape Measure	-	N/A
Rotronic Hygrolog	13002078	83731
Fluke Multimeter	OTF 511	85343

Traceability: All test equipment utilised to conduct tests were calibrated in terms of standards, the accuracy of which is traceable to the national measuring standards kept and maintained by the NMISA.

2.2 Summary of test results

Emissions Test	Reference Specification	Compliance	Category
Conducted RF emissions 150 kHz to 150 MHz	RTCA DO 160G	P	M
Radiated RF emissions 100 MHz to 960 MHz	RTCA DO 160G	P	M
Radiated RF emissions 960 MHz to 6000 MHz	RTCA DO 160G	P	L

2.2.1 Equipment classification

Category	Description
----------	-------------

L	This category is defined for equipment and interconnecting wiring located in areas far from apertures of the aircraft (such as windows) and far from radio receiver's antenna. This category may be suitable for equipment and associated interconnecting wiring located in the electronic bay of an aircraft
M	This category is defined for equipment and interconnecting wiring located in areas where apertures are electromagnetically significant and not directly in view of radio receiver's antenna. This category may be suitable for equipment and associated interconnecting wiring located in the passenger cabin or in the cockpit of a transport aircraft.

2.3 Test Set-up

The EUT was tested in accordance with the test specifications listed on page 3.

The system set-up:

1. Miwingman

The EUT was powered up from + 12 VDC. During all tests the EUT was searching for satellites.

2.4 Deviation from standard

The conducted emission tests were performed up to 150 MHz and not 152 MHz as required by the standard due to test equipment limitations.

2.5 Deviation from customer requirements

The customer requested that the EUT be tested to the requirements for category M. Above 960 MHz the receiver noise floor exceeds the limit and therefore the radiated emission tests above 960 MHz was performed to the requirements for category L.

2.6 Test locations description

Semi anechoic chamber – 10 m (L) x 8 m (W) x 6 m (H)

2.7 EUT mode(s) of operation

2.7.1 Emission testing

The worst case scenario (highest emissions) was determined by investigation of the highest emissions level generated by the EUT namely:

The final emissions evaluation was performed with the EUT fully operational as per manufacturer's instructions.

2.8 RTCA DO 160 G: Radiated Emissions – 100 MHz to 6000 MHz

Test location	Semi-anechoic chamber
DC supply voltage	+ 12 VDC
Length of power cable	1,0 m (EUT to LISN)
Operating condition	Searching for satellites
Signal line 1	None

The radiated emissions test was performed in accordance with the specification listed on page 3. The test guidelines were performed in accordance with RTCA DO 160 G.

All measurements were performed with a full compliance test receiver equipped with a quasi-peak detector, average detector and peak detector utilising a measuring bandwidth of 10 kHz, 100 kHz and 1 MHz.

Three antennas were used to perform the test. The first was a bi-conical antenna covering a frequency range of 30 MHz to 200 MHz. The second was a log periodic antenna covering a frequency range of 200 MHz to 1000 MHz. The third was a horn antenna covering a frequency range of 1000 MHz to 6000 MHz. The following table illustrates the results of these tests.

Frequency (MHz)	Polarisation	Graph/plots	Result
100 to 200	Horizontal	01	P
100 to 200	Vertical	02	P
200 to 960	Horizontal	03	P
200 to 960	Vertical	04	P
960 to 1000	Horizontal	05	P
960 to 1000	Vertical	06	P
1000 to 6000	Horizontal	07	P
1000 to 6000	Vertical	08	P

Test result: Passed. The EUT has Bluetooth connectivity. The intentional transmissions in the band 2,4 GHz to 2,483 GHz are excluded from the test. This is the ITU designated band for Bluetooth devices.

2.9 RTCA DO 160 G: Conducted Emissions – 0,15 MHz to 150 MHz

Test location	Semi-anechoic chamber
DC supply voltage	+ 12 VDC
Length of power cable	1,0 m (EUT to LISN)
Operating condition	Searching for satellites
Signal line 1	None

The conducted emission tests were performed with a current clamp. The EUT was powered via 50 W/5 mH line impedance stabilisation networks (LISNs). Tests were performed on both power leads. The measuring bandwidths for the test was 1 kHz and 10 kHz. A full compliance test receiver (peak detector) was used to perform the tests. The following table illustrates the results of these tests.

Frequency (MHz)	Measurement port	Graph/plots	Compliance
0,15 to 150	+ 12 VDC	09	P
0,15 to 150	0 VDC	10	P

Test result: Passed.

END OF REPORT

Appendix A Graphs/plots



Radiated emissions

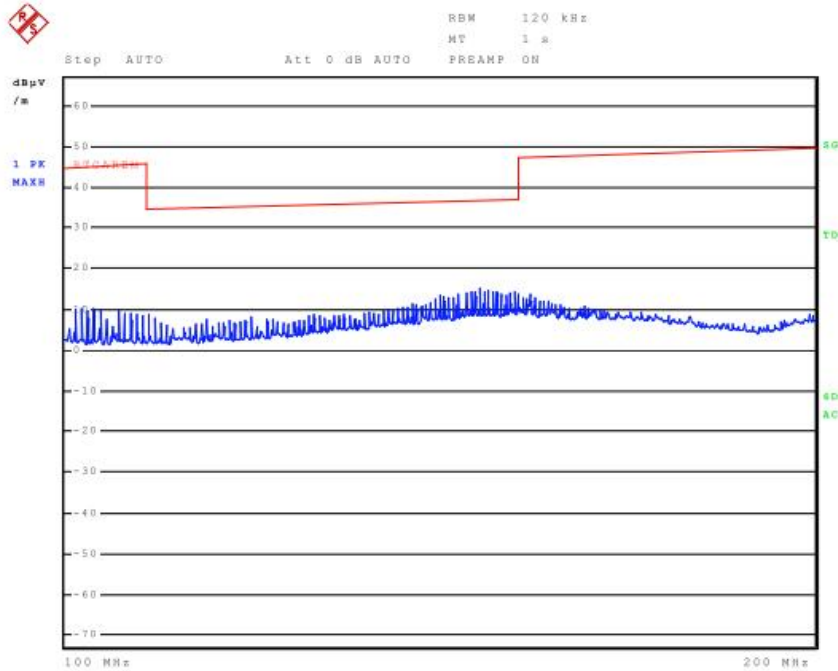
04.Nov 17 11:14

Meas Type Peak H=1.0 m P=H
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
RTCA DO 160 G : Section 21 - Category M

Stepped Scan (1 Range)

Scan Start: 100 MHz
Scan Stop: 200 MHz
Detector: Trace 1: MAX PEAK
Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
100.000000 MHz	200.000000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1



Graph 01



Radiated emissions

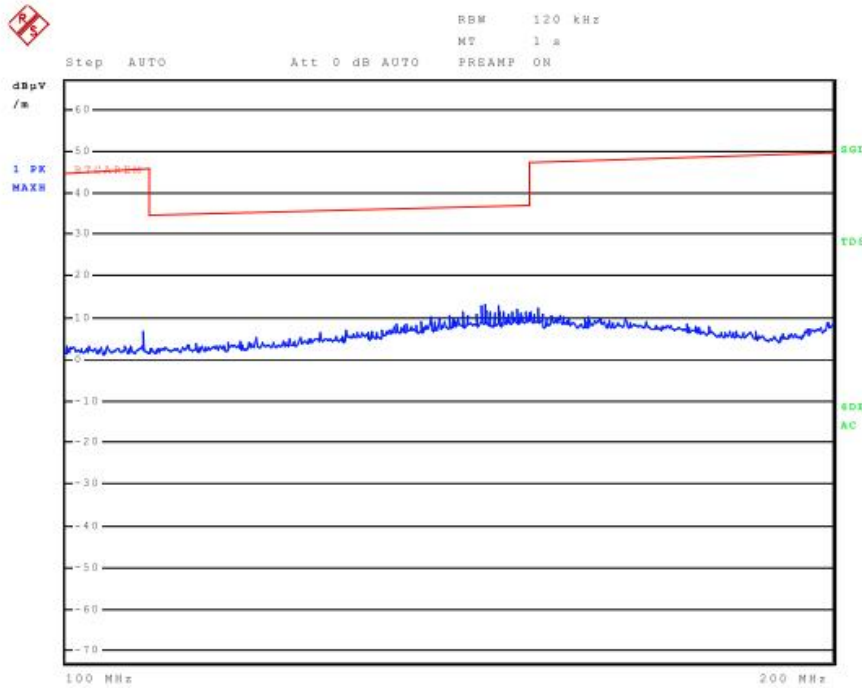
04.Nov 17 11:29

Meas Type Peak H=1.0 m P=V
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
 RTCA DO 160 G : Section 21 - Category M

Stepped Scan (1 Range)

Scan Start: 100 MHz
 Scan Stop: 200 MHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
100.000000 MHz	200.000000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1



Graph 02



Radiated emissions

04.Nov 17 11:49

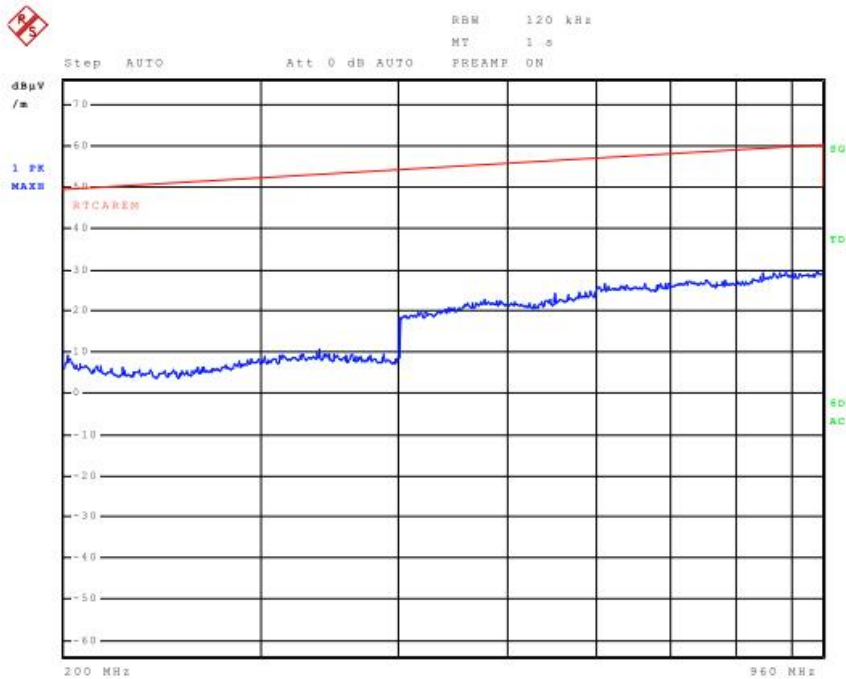
Meas Type Peak H=1.0m P=H
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender

Test Spec
 RTCA DO 160 G : Section 21 - Category M

Stepped Scan (2 Ranges)

Scan Start: 200 MHz
 Scan Stop: 960 MHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
200.000000 MHz	399.996000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1
400.000000 MHz	960.000000 MHz	40.00 kHz	100.00 kHz	15 ms	Auto	20 dB	INPUT1



Graph 03



Radiated emissions

04.Nov 17 12:13

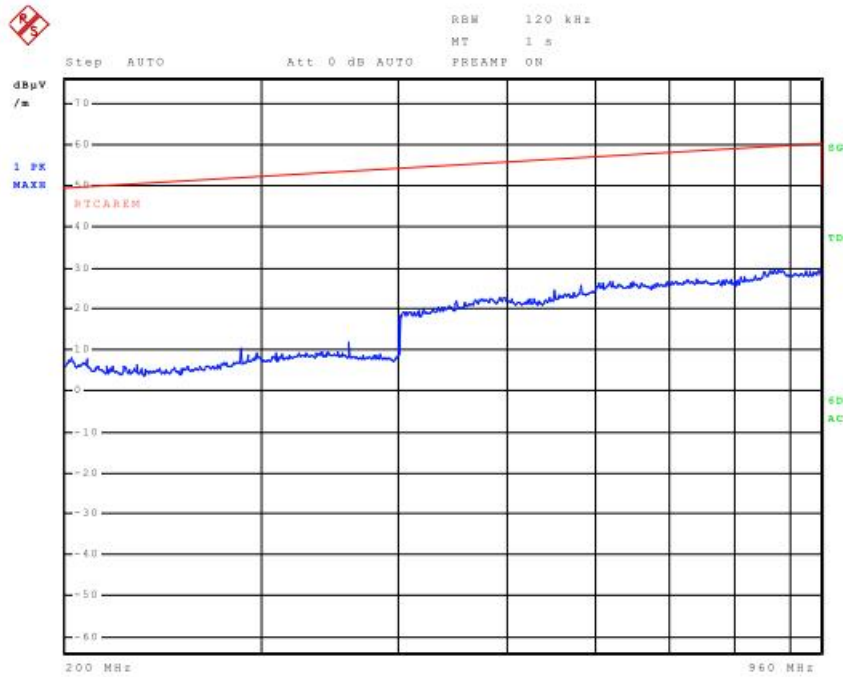
Meas Type Peak H=1.0m P=V
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender

Test Spec
 RTCA DO 160 G : Section 21 - Category M

Stepped Scan (2 Ranges)

Scan Start: 200 MHz
 Scan Stop: 960 MHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
200.000000 MHz	399.996000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1
400.000000 MHz	960.000000 MHz	40.00 kHz	100.00 kHz	15 ms	Auto	20 dB	INPUT1



Graph 04



Radiated emissions

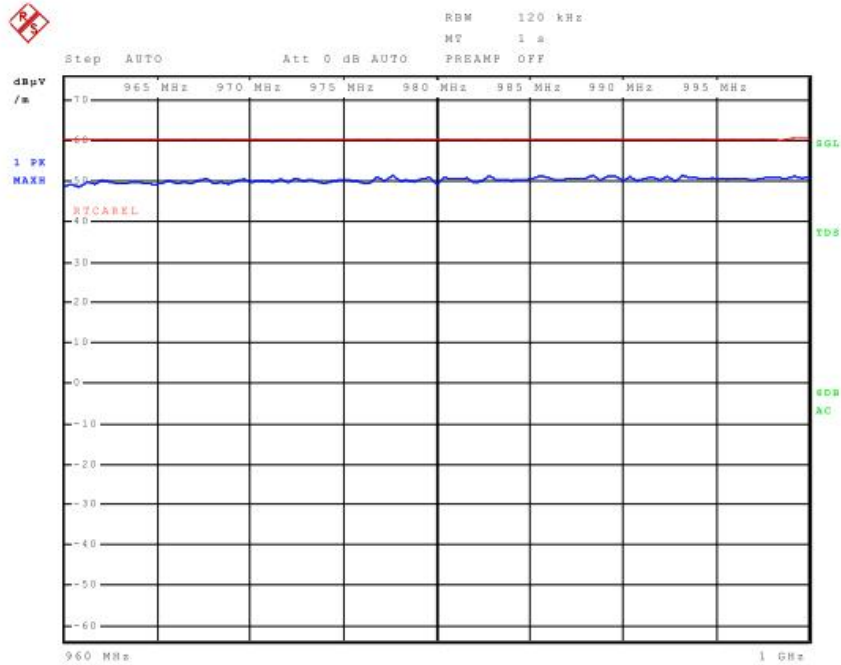
04.Nov 17 12:35

Meas Type Peak H=1.0m P=H
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
 RTCA DO 160 G : Section 21 - Category L

Stepped Scan (1 Range)

Scan Start: 960 MHz
 Scan Stop: 1 GHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
960.000000 MHz	1.000000 GHz	400.00 kHz	1.00 MHz	15 ms	Auto	0 dB	INPUT1



Graph 05



Radiated emissions

04.Nov 17 12:33

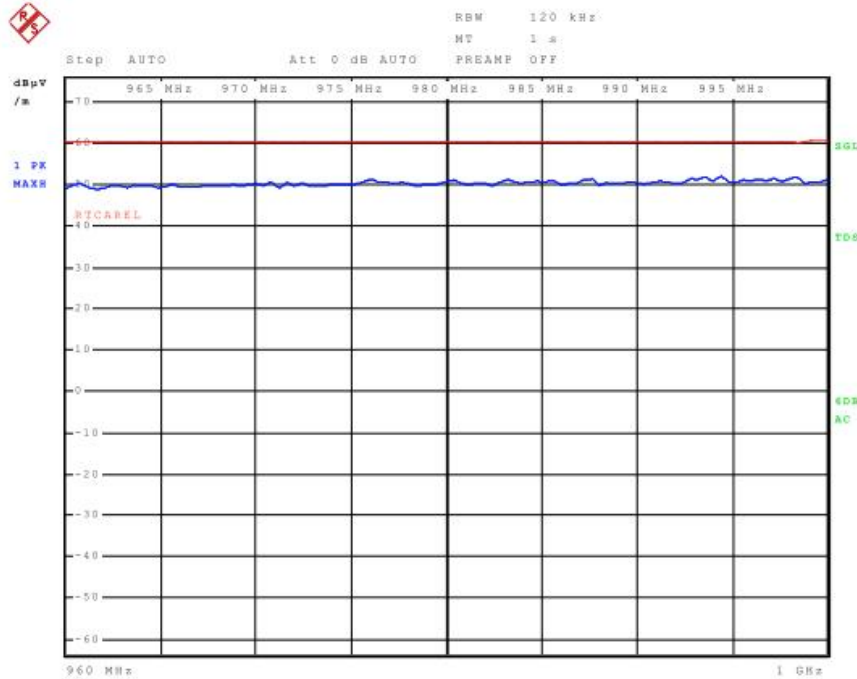
Meas Type Peak H=1.0m P=V
 Equipment under Test MIWINGMAN
 Manufacturer Indigosat
 OP Condition Powered up. GPS and Satellite navigation on without comms.
 Operator PP Govender

Test Spec
 RTCA DO 160 G : Section 21 - Category L

Stepped Scan (1 Range)

Scan Start: 960 MHz
 Scan Stop: 1 GHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
960.000000 MHz	1.000000 GHz	400.00 kHz	1.00 MHz	15 ms	Auto	0 dB	INPUT1



Graph 06



Radiated emissions

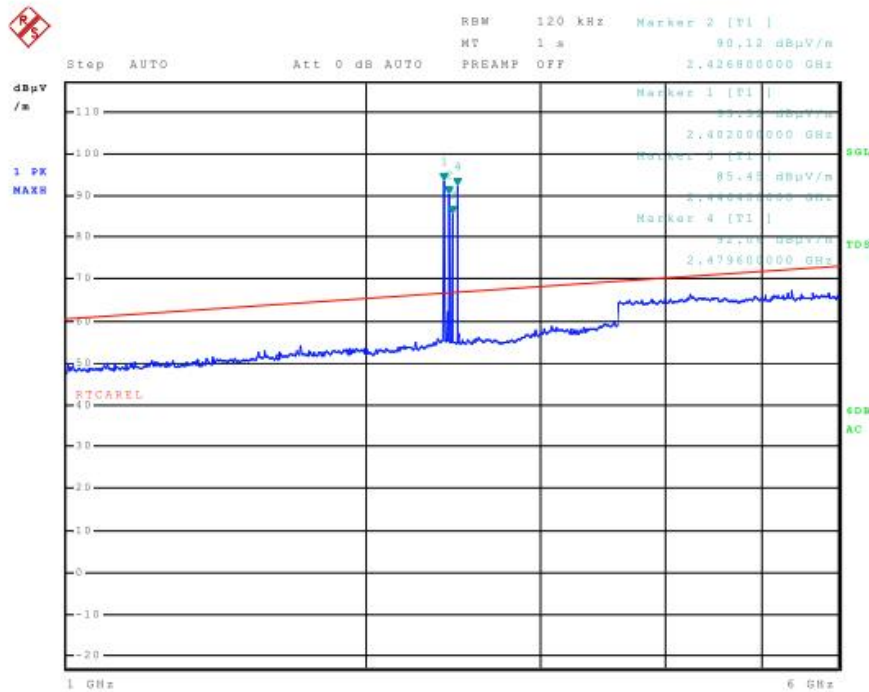
04.Nov 17 13:11

Meas Type Peak H=1.0m P=H
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
 RTCA DO 160 G : Section 21 - Category L

Stepped Scan (1 Range)

Scan Start: 1 GHz
Scan Stop: 6 GHz
Detector: Trace 1: MAX PEAK
Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
1.000000 GHz	6.000000 GHz	400.00 kHz	1.00 MHz	15 ms	Auto	0 dB	INPUT1



Graph 07



Radiated emissions

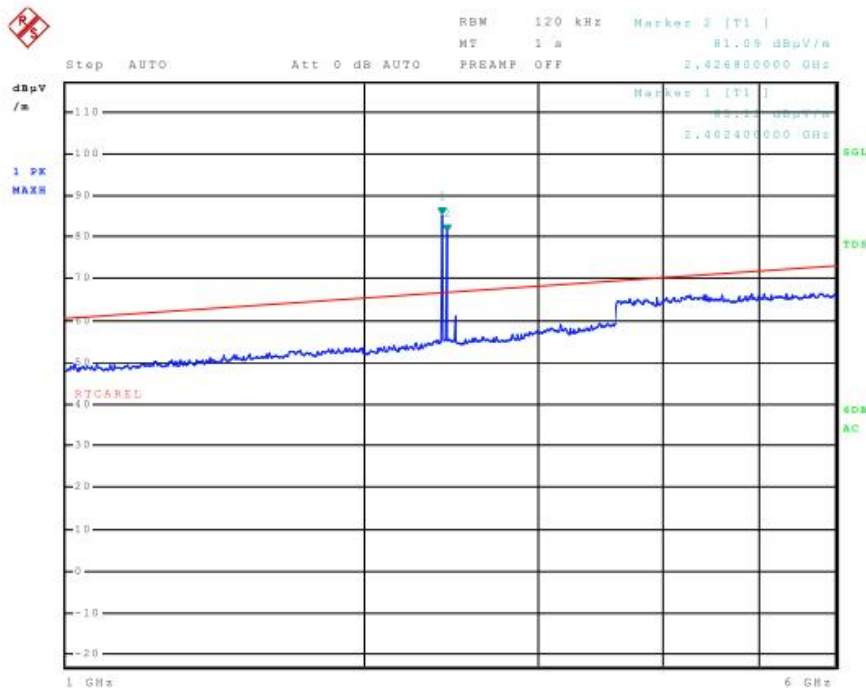
04.Nov 17 12:38

Meas Type Peak H=1.0m P=V
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
 RTCA DO 160 G : Section 21 - Category L

Stepped Scan (1 Range)

Scan Start: 1 GHz
 Scan Stop: 6 GHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-RE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
1.000000 GHz	6.000000 GHz	400.00 kHz	1.00 MHz	15 ms	Auto	0 dB	INPUT1



Graph 08



Conducted emissions

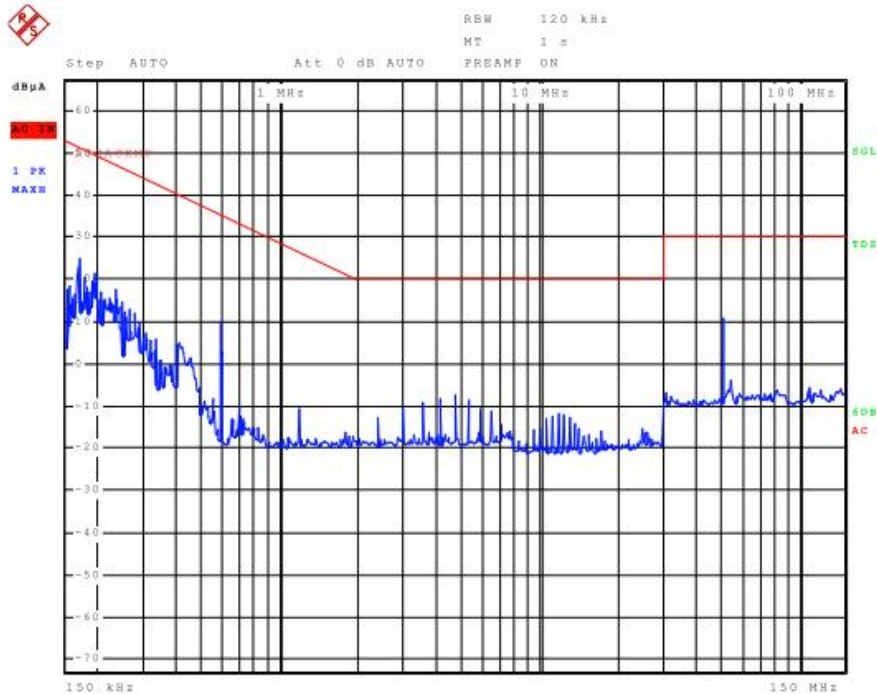
04.Nov 17 09:35

Meas Type Peak + 12 VDC power lead
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender
Test Spec
 RTCA DO 160 G : Section 21 - Category M

Stepped Scan (2 Ranges)

Scan Start: 150 kHz
 Scan Stop: 150 MHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-CE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	29.999600 MHz	400.00 Hz	1.00 kHz	15 ms	Auto	20 dB	INPUT1
30.000000 MHz	150.000000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1



Graph 09



Conducted emissions

04.Nov 17 10:23

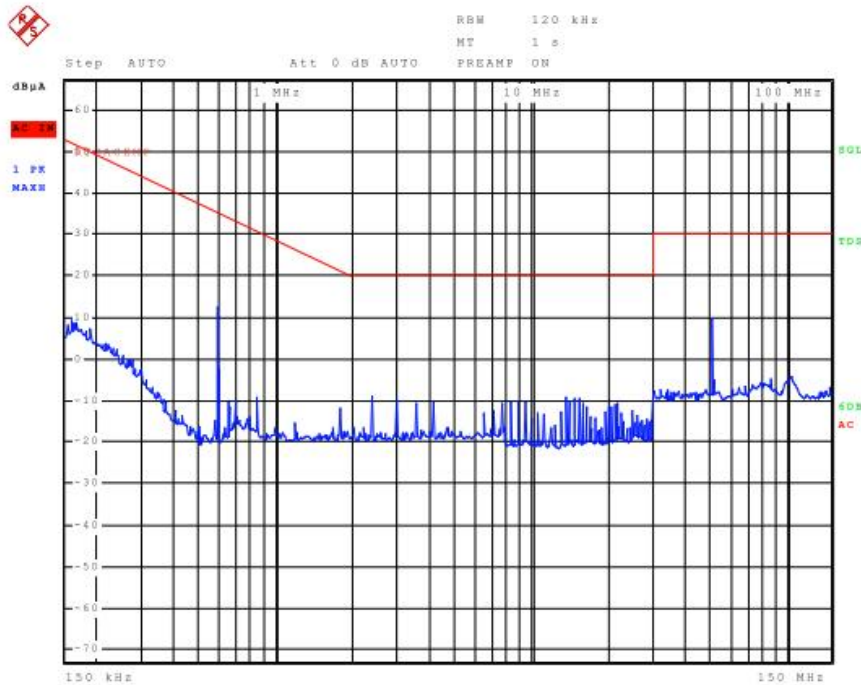
Meas Type Peak 0 VDC power lead
Equipment under Test MIWINGMAN
Manufacturer Indigosat
OP Condition Powered up. GPS and Satellite navigation on without comms.
Operator PP Govender

Test Spec
 RTCA DO 160 G : Section 21 - Category M

Stepped Scan (2 Ranges)

Scan Start: 150 kHz
 Scan Stop: 150 MHz
 Detector: Trace 1: MAX PEAK
 Transducer: RTCA-CE

Start Frequency	Stop Frequency	Step Size	Res BW	Meas Time	RF Atten	Preamp	Input
150.000000 kHz	29.999600 MHz	400.00 Hz	1.00 kHz	15 ms	Auto	20 dB	INPUT1
30.000000 MHz	150.000000 MHz	4.00 kHz	10.00 kHz	15 ms	Auto	20 dB	INPUT1

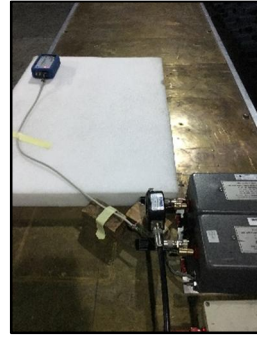


Graph 10

Appendix B Photographs



Radiated emissions test setup – 100 MHz to 200 MHz



Conducted emission test setup – 0,15 MHz to 150 MHz



EUT



Identification label

Appendix C

Certificate of conformance

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Mr Gareth Willers
 IndigoSat (South Africa) (Pty) Ltd
 260 Surrey Avenue
FERNDALE
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e-mail address: gareth@indigosat.com
 Telephone No.: 086 002 2121

Date: 2017-11-15
 Enquiries: PP Govender
 Cell no.: 084 430 4556
 e-mail address: vernong@gerotek.co.za
 Report no.: 14990

CERTIFICATE OF CONFORMANCE

Test item description : Miwingman
Model no. : IOS ATU-A
Serial no. : 0003
Specification number : RTCA DO 160G : Section 21 : Emission of radio frequency energy (2010)
Category : Radiated emissions 100 MHz to 960 MHz – Category M
Category : Radiated emissions 960 MHz to 6 GHz – Category L
Category : Conducted emissions 150 kHz to 150 MHz – Category M
Conformance result : Compliant
Test date : 2017-11-04

TEST OFFICIAL:

PP Govender
 TECHNICAL SIGNATORY

2017-11-15
 Date

APPROVAL:

MI Myaluza
 ACTING MANAGER:
 EMC AND ANTENNA TESTING

2017-11-15
 Date

