www.nemko.com

Compliance test report ID **180452-3R1TRFWL**

Date of issue
March 8, 2012

FCC 47 CFR Part 25

Satellite Communications

Applicant **Skywave Mobile Communications**
Product **Satellite Terminal Device (OEM)**
Model **IDP-180, IDP-190**
FCC ID **B92IDP1XX**

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada. The tests included in this report are within the scope of this accreditation

SCC Accredited LAB
LAB Accrédité CCN

Test location

Nemko Canada Inc.
303 River Road
Ottawa, ON, K1V 1H2
Canada
Test site FCC ID: 176392 (3 m semi anechoic chamber)

Telephone +1 613 737 9680
Facsimile +1 613 737 9691
Toll free +1 800 563 6336
Website www.nemko.com

Tested by Andrey Adelberg, EMC/Wireless Specialist

Reviewed by

David Duchesne, Senior EMC/Wireless Specialist

March 8, 2012
Date

Limits of responsibility

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

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

Copyright notification

Table of contents

Section 1: Report summary

1.1 Applicant

SkyWave Mobile Communications Inc.
750 Palladium Drive, Suite 368
Ottawa, ON, K2V 1C7
Canada

1.2 Test specifications

FCC 47 CFR Part 25
Satellite Communications

1.3 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See "Summary of test results" for full details.

1.4 Test report revision history

Revision #	Details of changes made to test report
R1TRF	Revision 1 – model number correction

Section 2: Summary of test results

2.1 FCC Part 25, test results

Part	Test description	Verdict
25.204	Power limit	Pass
2.1046	Occupied bandwidth	Pass
25.202(f)	Spurious emissions at the antenna terminal	N/A[1]
25.202(f)	Field strength of spurious emissions	Pass
25.202(d)	Frequency tolerance, earth stations	Pass
25.216	Limits for emissions from mobile earth stations for protection of aeronautical radionavigation satellite service	Pass
Notes: [1] The EUT uses an integral antenna and does not provide a means of directly connecting to the antenna terminal.		

Section 3: Equipment under test (EUT) details

3.1 Sample information

Receipt date	June 30, 2011
Nemko sample ID number	3, 4 and 5

3.2 EUT information

Product	Satellite Terminal Device (OEM)
Model	IDP-180, IDP-190
Part	SM201013 (IDP-180), SM201015 (IDP-190)
Model variants	**IDP-180-xxx:** IDP-180-XXG, IDP-180-XXH **IDP-190-xxx:** IDP-190-XXG
Serial number	None

3.3 Technical information

Operating band	Receive band: 1525.0–1559.0 MHz Transmit band: 1626.5–1660.5 MHz
Operating frequencies	Receive band (space to earth): 1525.0–1559.0 MHz Transmit band (earth to space): 1626.5–1660.5 MHz
Modulation type	Tx: OQPSK, 900 symbol/second, Rx: OQPSK, 3000 symbol/second
Occupied bandwidth	Rx: 5 kHz, Tx: 10 kHz
Emission designator	G1D
Power requirements	9–32 V_{DC}
Antenna information	IDP-180, Low profile antenna (Patch antenna, 4.4 dBiC), maximum EIRP: 7 dBW. IDP-190, Lower elevation antenna (Quadrifilar antenna, 3.2 dBiC), maximum EIRP: 5 dBW. – The IDP-180 and IDP-190 models use a non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is an OEM variant of low data rate land mobile satellite earth station (LMES) that operates in microwave L-band (1.5/1.6 GHz) and it is designed to be used within Inmarsat global satellite network for asset tracking and management systems.
Model variants: XXG – low sensitivity GPS; XXH – high sensitivity GPS.

3.5 EUT exercise details

The EUT was energized and using computer terminal via RS-232 port, transmission was set continuously on low, mid and high channels.

3.6 EUT setup diagram

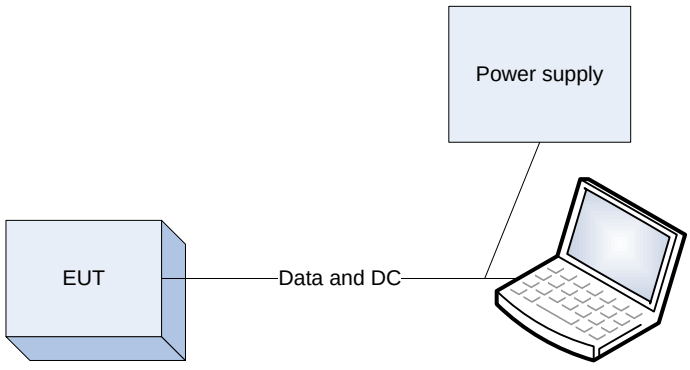


Diagram 3.6-1: Setup diagram

Section 4: Engineering considerations

1.4 Modifications incorporated in the EUT

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

1.5 Technical judgment

None

1.6 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

Section 5: Test conditions

5.1 Atmospheric conditions

Temperature: 15–30 °C
Relative humidity: 20–75 %
Air pressure: 86–106 kPa

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

5.2 Power supply range

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

Section 6: Measurement uncertainty

6.1 Uncertainty of measurement

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 “Uncertainty in EMC measurements.” Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model No.	Asset/Serial No.	Cal. cycle	Next cal.
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Dec.06/11
Temperature chamber	Thermotron	SM-16C	FA001030	1 year	NCR
Multimeter	Fluke	16	FA001831	1 year	Jan. 26/12
International power supply	California Inst.	3001I	FA001021	1 year	Jan. 26/12
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Mar. 09/12
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Bilog antenna	Sunol	JB3	FA002108	1 year	Jan. 31/12
Horn antenna #2	EMCO	3115	FA000825	1 year	Feb. 04/12
1–18 GHz pre-amplifier	JCA	JCA118-503	FA002091	1 year	Sept. 23/11
Note: NCR = No Calibrate Required					

Section 8: Testing data

8.1 Clause 25.204 Power limits

(a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1 and 15 GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:

+40 dBW (70 dBm) in any 4 kHz band for Θ ≤ 0°
+40 + 3Θ dBW in any 4 kHz band for 0° < Θ ≤ 5°
where Θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.

(b) In bands shared coequally with terrestrial radiocommunication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands above 15 GHz shall not exceed the following limits except as provided for in paragraph (c) of this section:

+64 dBW (94 dBm) in any 1 MHz band for Θ ≤ 0°
+64 + 3 Θ dBW in any 1 MHz band for 0° < Θ ≤ 5°
where Θ is as defined in paragraph (a) of this section.

(c) For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

(d) Notwithstanding the e.i.r.p. and e.i.r.p. density limits specified in the station authorization, each earth station transmission shall be conducted at the lowest power level that will provide the required signal quality as indicated in the application and further amended by coordination agreements.

8.1.1 Test summary

Test date	July 14, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1004 mbar	**Relative humidity**	39 %

8.1.2 Observations/special notes

Peak detector of the spectrum analyzer with RBW wider than occupied bandwidth was used for power measurements.

Test was performed radiated in anechoic chamber at 3 m, using a substitution method for EIRP calculation.

8.1.3 Test data

Table 8.1-1: EIRP results for IDP-180

Frequency (MHz)	Received (dBµV)	Sig Gen Level (dBm)	Cable loss (dB)	Antenna gain (dBi)	EIRP (dBm)
1626.5	103.25	24.74	0.57	8.55	32.72
1642.0	102.81	24.47	0.57	8.55	32.45
1660.5	102.22	24.09	0.57	8.55	32.07

Table 8.1-2: EIRP results for IDP-190

Frequency (MHz)	Received (dBµV)	Sig Gen Level (dBm)	Cable loss (dB)	Antenna gain (dBi)	EIRP (dBm)
1626.5	103.20	24.69	0.57	8.55	32.67
1642.0	102.66	24.32	0.57	8.55	32.30
1660.5	102.33	24.20	0.57	8.55	32.18

EIRP = Signal generator level – cable loss + antenna gain

8.2 Clause 2.1049 Occupied bandwidth

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

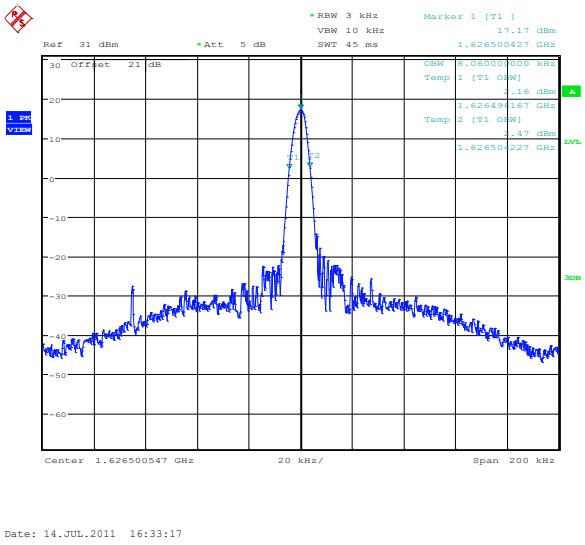
8.2.1 Test summary

Test date	July 14, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	23 °C	**Air pressure**	1003 mbar	**Relative humidity**	46 %

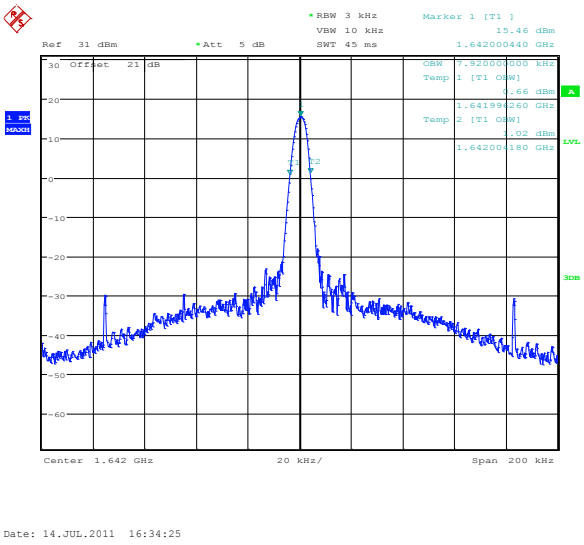
8.2.2 Observations/special notes

The test was performed using 3 kHz RBW / 10 kHz VBW

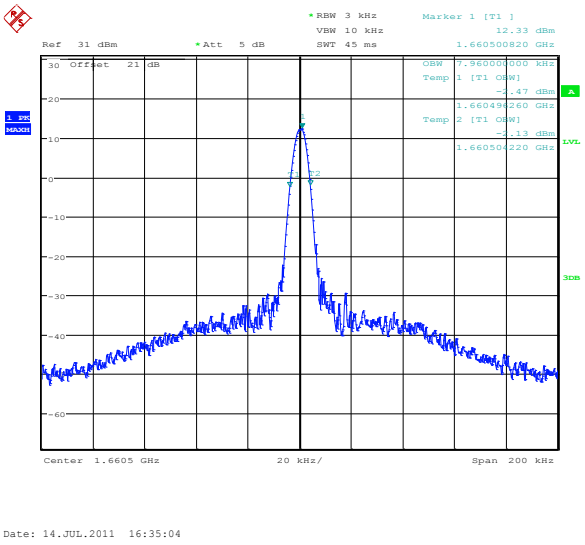
8.2.3 Test data



Plot 8.2-1: 99 % OBW, low channel



Plot 8.2-2: 99 % OBW, mid channel



Plot 8.2-3: 99 % OBW, high channel

Table 8.2-1: 99 % Occupied bandwidth results

Channel/Frequency, (MHz)	99 % Occupied bandwidth, (kHz)
1626.5	8.06
1642.0	7.92
1660.5	7.96

8.3 Clause 25.202(f) Field strength of spurious emissions

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

(1) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: 25 dB;

(2) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: 35 dB;

(3) In any 4 kHz band, the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: An amount equal to 43 dB plus 10 times the logarithm (to the base 10) of the transmitter power in watts (−13 dBm fixed);

(4) In any event, when an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in paragraphs (f) (1), (2) and (3) of this section.

8.3.1 Test summary

Test date	July 14, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1005 mbar	**Relative humidity**	41 %

8.3.2 Observations/special notes

The Spectrum was searched from 30 MHz to the 10th harmonic in the carrier-on mode. No emissions were found within 20 dB below the limit.

8.3.3 Test data

Table 8.3-1: Emission mask results for IDP-180

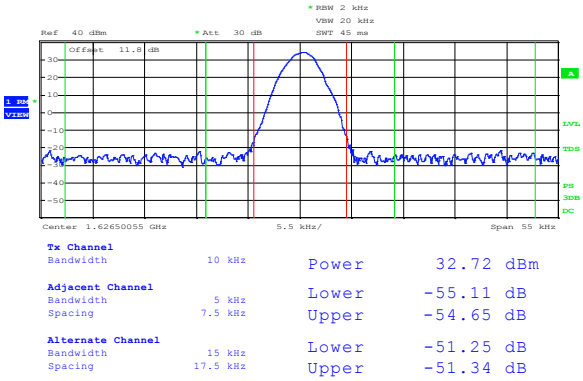
Frequency offset (%)	Attenuation lower (dB)	Limit (dB)	Margin (dB)	Attenuation upper (dB)	Limit (dB)	Margin (dB)
Low channel						
50–100	55.11	25.00	30.11	54.65	25.00	29.65
100–250	51.25	35.00	16.25	51.34	35.00	16.34
Mid channel						
50–100	55.14	25.00	30.14	54.15	25.00	29.15
100–250	51.42	35.00	16.42	51.22	35.00	16.22
High channel						
50–100	55.62	25.00	30.62	54.01	25.00	29.01
100–250	51.22	35.00	16.22	51.29	35.00	16.29

Table 8.3-2: Emission mask results for IDP-190

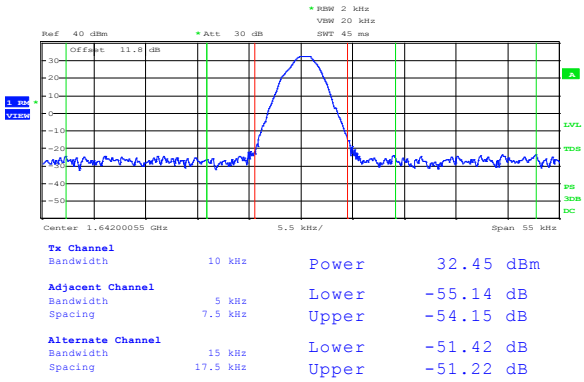
Frequency offset (%)	Attenuation lower (dB)	Limit (dB)	Margin (dB)	Attenuation upper (dB)	Limit (dB)	Margin (dB)
Low channel						
50–100	54.02	25.00	29.02	54.61	25.00	29.61
100–250	51.33	35.00	16.33	51.08	35.00	16.08
Mid channel						
50–100	54.12	25.00	29.12	54.45	25.00	29.45
100–250	51.10	35.00	16.10	51.18	35.00	16.18
High channel						
50–100	55.31	25.00	30.31	54.55	25.00	29.55
100–250	50.89	35.00	15.89	51.01	35.00	16.01

8.3.3 Test data, continued

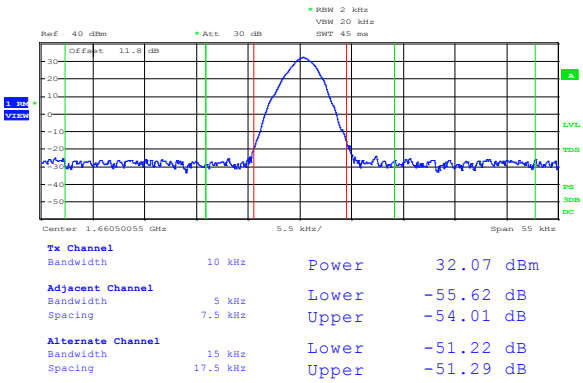
Channel bandwidth is 10 kHz
Adjacent channel: 50 % to 100 % (from 5 to 10 kHz frequency offset from the center frequency)
Alternative channel: 100 % to 250 % (from 10 kHz to 25 kHz frequency offset from the center frequency



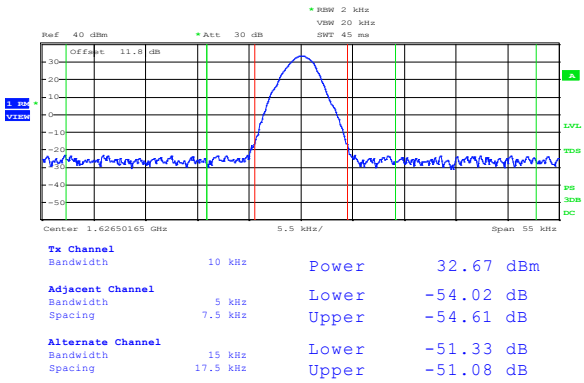
Plot 8.3-1: Emission mask for IDP-180, low channel



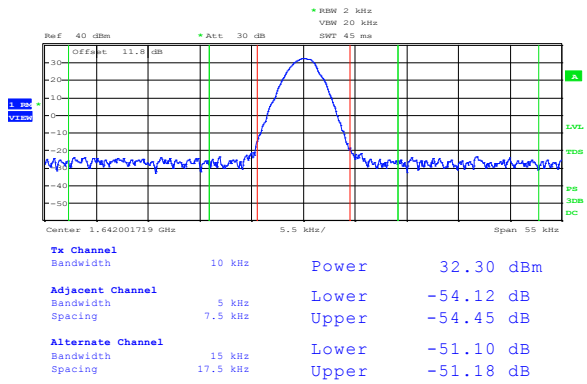
Plot 8.3-2: Emission mask for IDP-180, mid channel



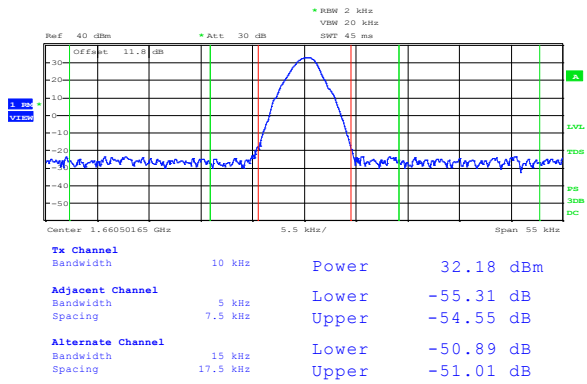
Plot 8.3-3: Emission mask for IDP-180, high channel



Plot 8.3-4: Emission mask for IDP-190, low channel



Plot 8.3-5: Emission mask for IDP-190, mid channel



Plot 8.3-6: Emission mask for IDP-190, high channel

8.4 Clause 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 (±10 ppm) of the reference frequency.

§2.1055 Frequency stability

(a) The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to +50° centigrade for all equipment except that specified in paragraphs (a)(2) and (3) of this section

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

8.4.1 Test summary

Test date	July 18, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	24 °C	**Air pressure**	1002 mbar	**Relative humidity**	48 %

8.4.2 Observations/special notes

The IDP-180 uses the same circuitry as IDP-190 except for the RF antenna type.

It was judged that the results from the IDP-180 would be representative for both models and have been included for completeness.

8.4.3 Test data

Table 8.4-1: Frequency stability results

Test conditions	Frequency (Hz)	Offset* (ppm)	Limit (ppm)	Margin (ppm)
+50 °C, Nominal	1642004758	2.79	±10	7.21
+40 °C, Nominal	1642004561	2.67	±10	7.33
+30 °C, Nominal	1642002295	1.29	±10	8.71
+20 °C, +15 %	1642002262	1.27	±10	8.73
+20 °C, Nominal	1642000177	Reference		
+20 °C, -15 %	1642001835	1.01	±10	8.99
+10 °C, Nominal	1641996663	-2.14	±10	7.86
0 °C, Nominal	1641996400	-2.30	±10	7.70
−10 °C, Nominal	1641995678	-2.74	±10	7.26
−20 °C, Nominal	1641996351	-2.33	±10	7.67
−30 °C, Nominal	1641996778	-2.07	±10	7.93

* Note: Offset calculation: $\frac{F_{Measured} - F_{reference}}{F_{reference}} \times 1 \cdot 10^{6}$

8.5 Clause 25.216 Limits on emissions from mobile earth stations for protection of aeronautical radionavigation-satellite service

(c) 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 (−40 dBm/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 (−50 dBm), averaged over any 2 millisecond active transmission interval, in the 1559–1605 MHz band.

(f) Mobile earth stations 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 (−40 dBm/MHz) at 1605 MHz to −10 dBW/MHz (20 dBm/MHz) at 1610 MHz.

8.5.1 Test summary

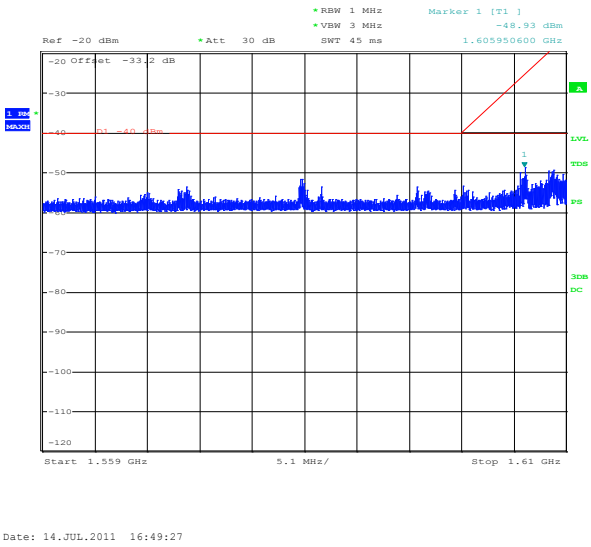
Test date	July 14, 2011	**Test engineer**	Andrey Adelberg	**Verdict**	Pass
Temperature	25 °C	**Air pressure**	1005 mbar	**Relative humidity**	41 %

8.5.2 Observations/special notes

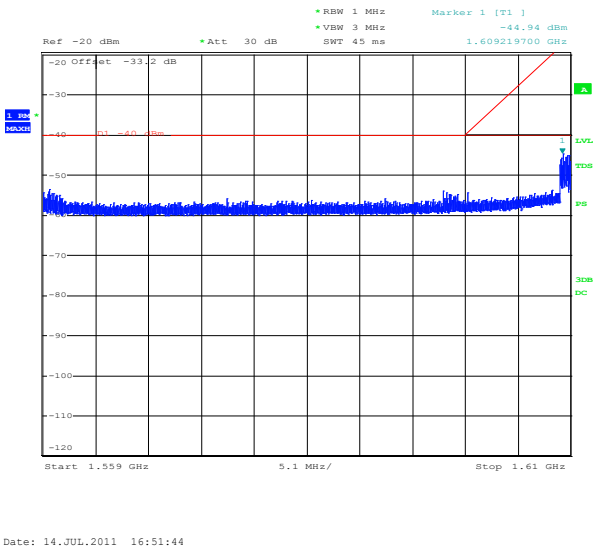
The Spectrum was searched from the 1.559–1.610 GHz.

RMS detector of spectrum analyzer was used with 1 MHz RBW and 3 MHz VBW.

8.5.3 Test data

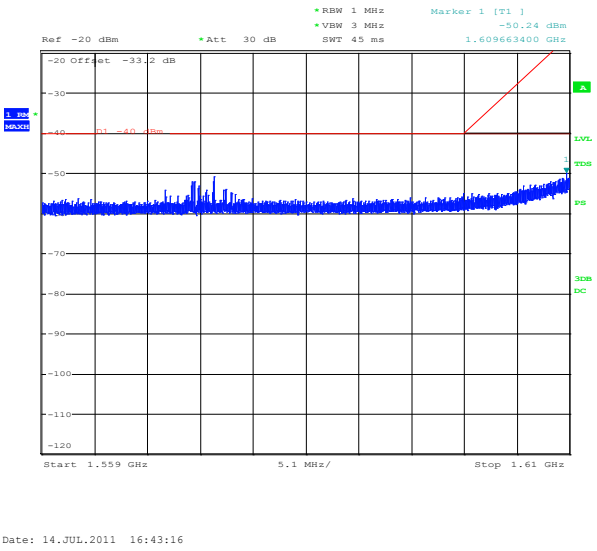


Plot 8.5-1: 1559–1610 MHz for IDP-180, low channel

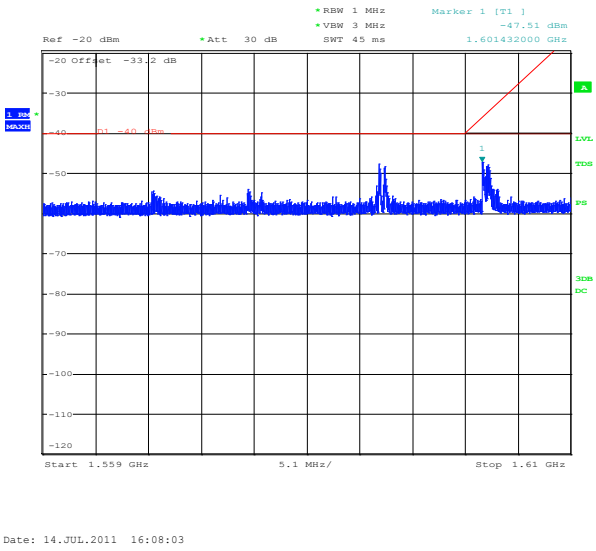


Plot 8.5-2: 1559–1610 MHz for IDP-180, mid channel

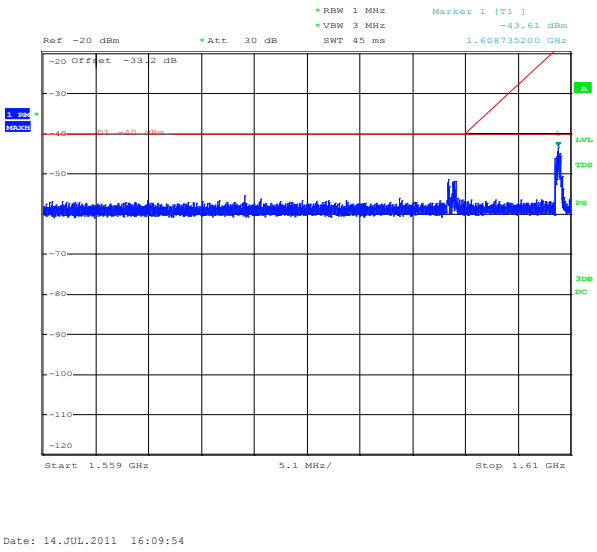
8.5.3 Test data, continued



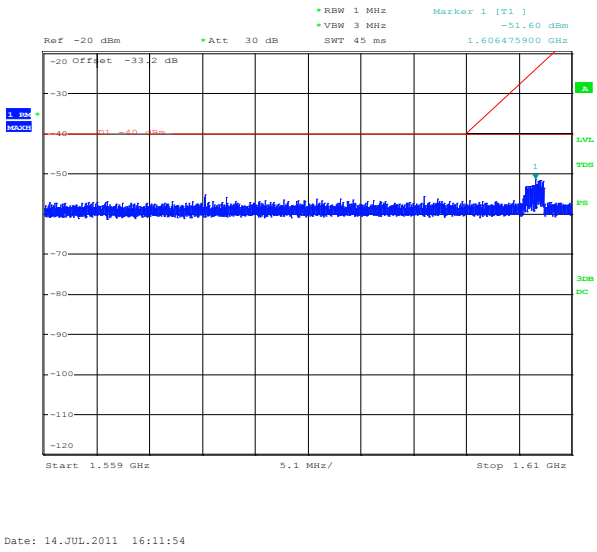
Plot 8.5-3: 1559–1610 MHz for IDP-180, high channel



Plot 8.5-4: 1559–1610 MHz for IDP-190, low channel



Plot 8.5-5: 1559–1610 MHz for IDP-190, mid channel



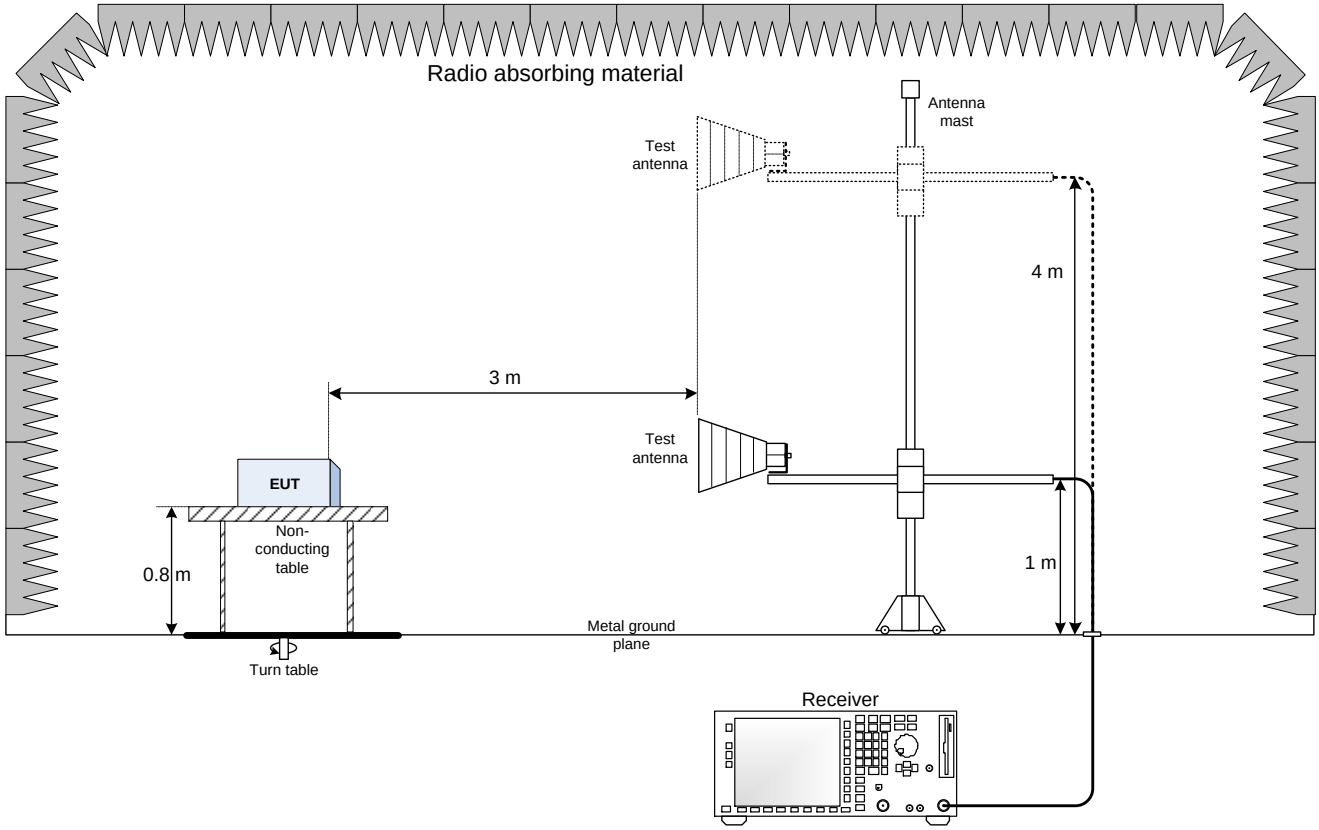
Plot 8.5-6: 1559–1610 MHz for IDP-190, high channel

Table 8.5-1: Broadband emissions within 1605–1610 MHz results

Channel	Frequency (MHz)	Emission Level (dBm/MHz)	Antenna gain (dBi)	EIRP (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
IDP-180						
Low	1605.95	-48.93	4.4	-44.53	-35.44	9.09
Mid	1609.22	-44.94	4.4	-40.54	-19.74	20.80
High	1609.66	-50.24	4.4	-45.84	-17.63	28.21
IDP-190						
Low	1601.43	-47.51	3.2	-44.31	-40.00	4.31
Mid	1608.74	-43.61	3.2	-40.41	-22.05	18.36
High	1606.48	-51.60	3.2	-48.40	-32.90	15.50

Section 9: Block diagrams of test set-ups

9.1 Radiated emissions set-up



Section 10: EUT and setup photos

10.1 EUT photo

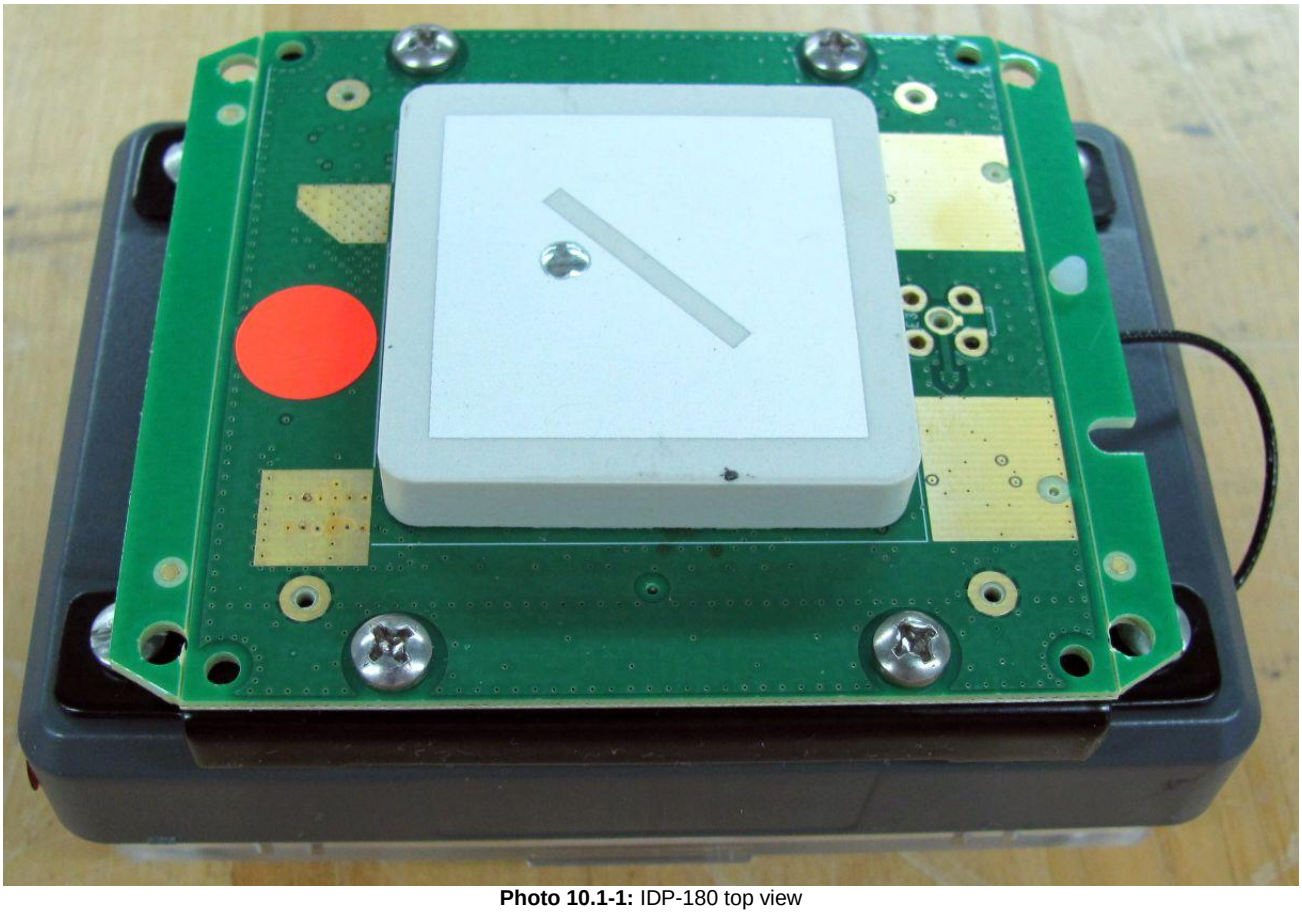


Photo 10.1-1: IDP-180 top view

10.1 EUT photo, continued

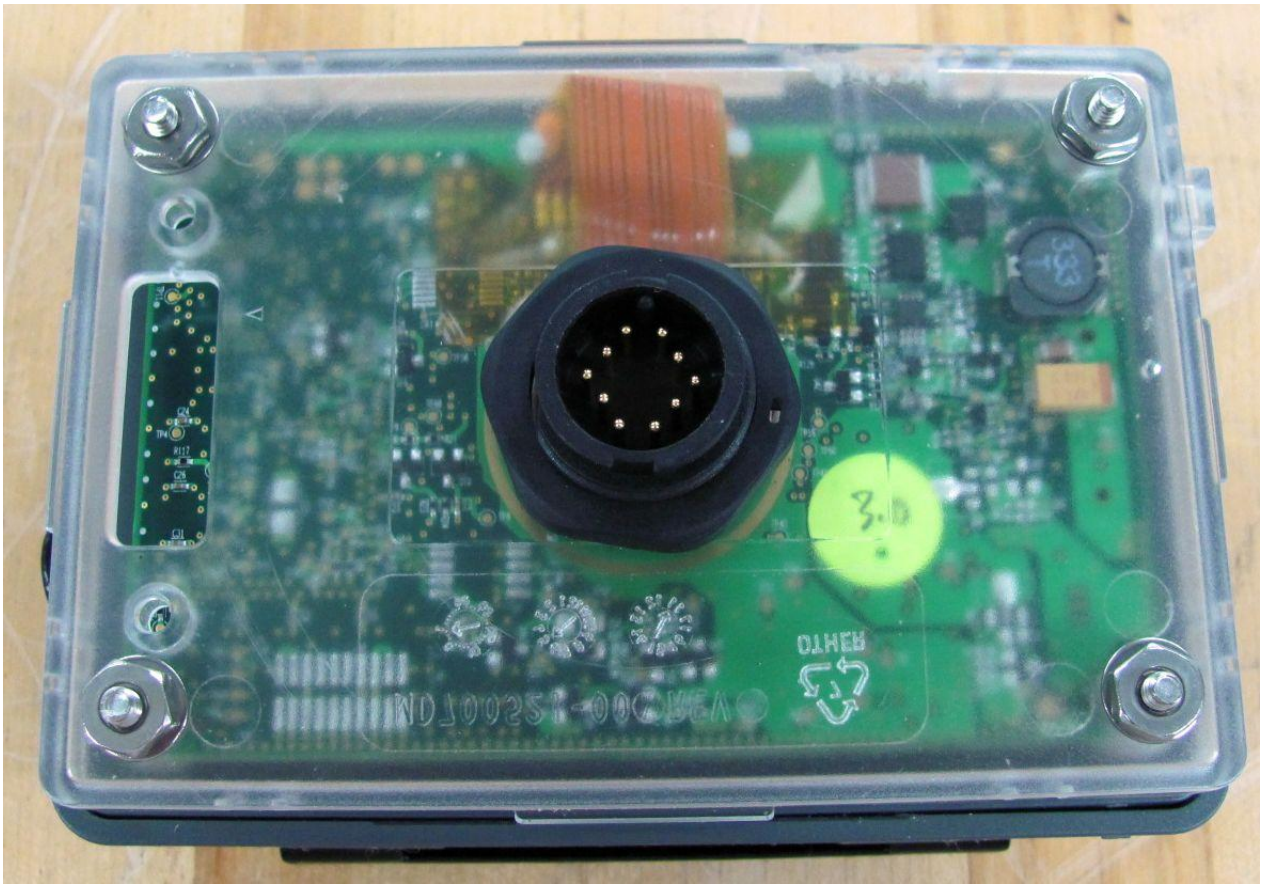


Photo 10.1-2: IDP-180 bottom view

10.1 EUT photo, continued

Photo 10.1-3: IDP-190 top view

10.1 EUT photo, continued

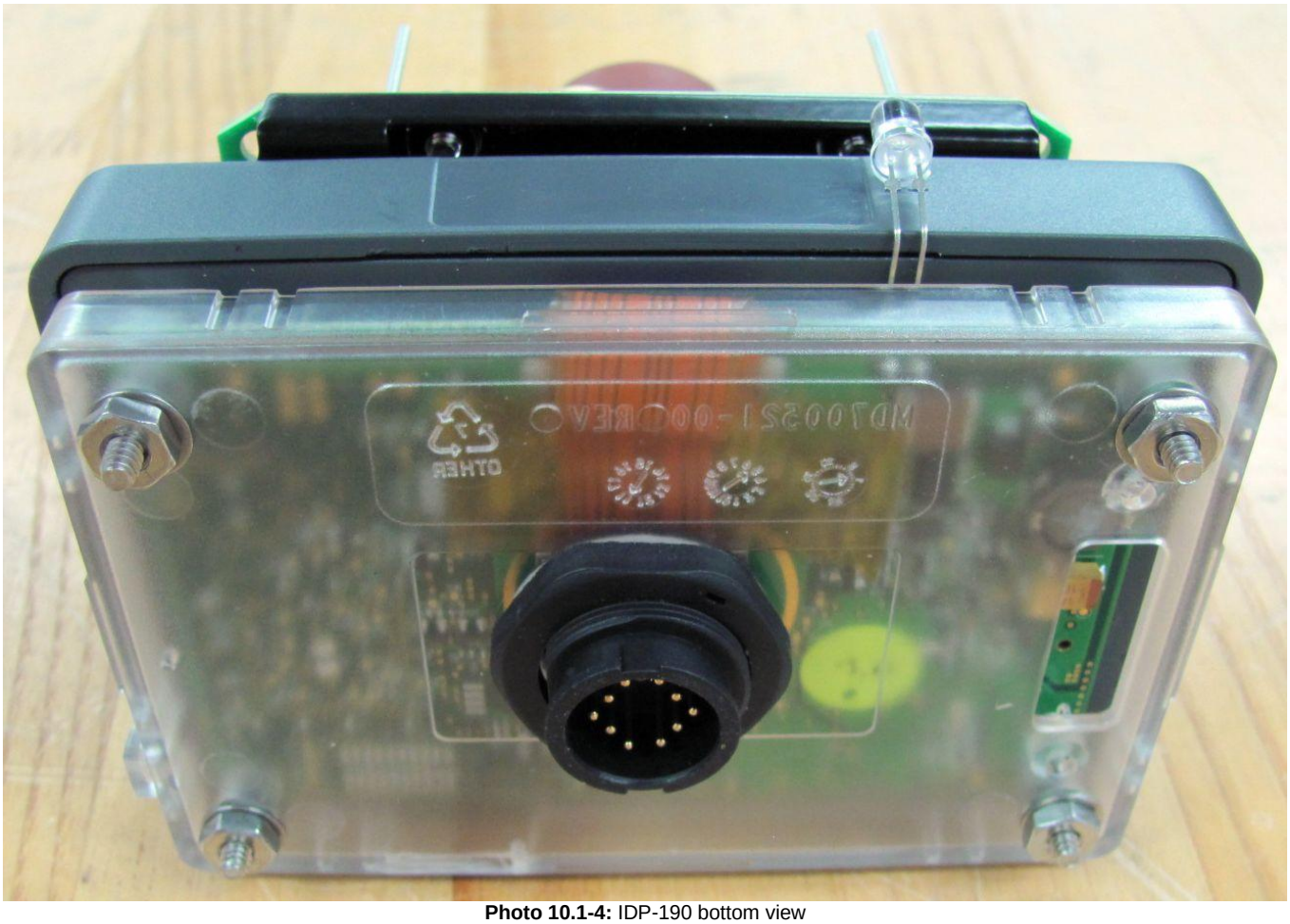


Photo 10.1-4: IDP-190 bottom view

10.2 Setup photo

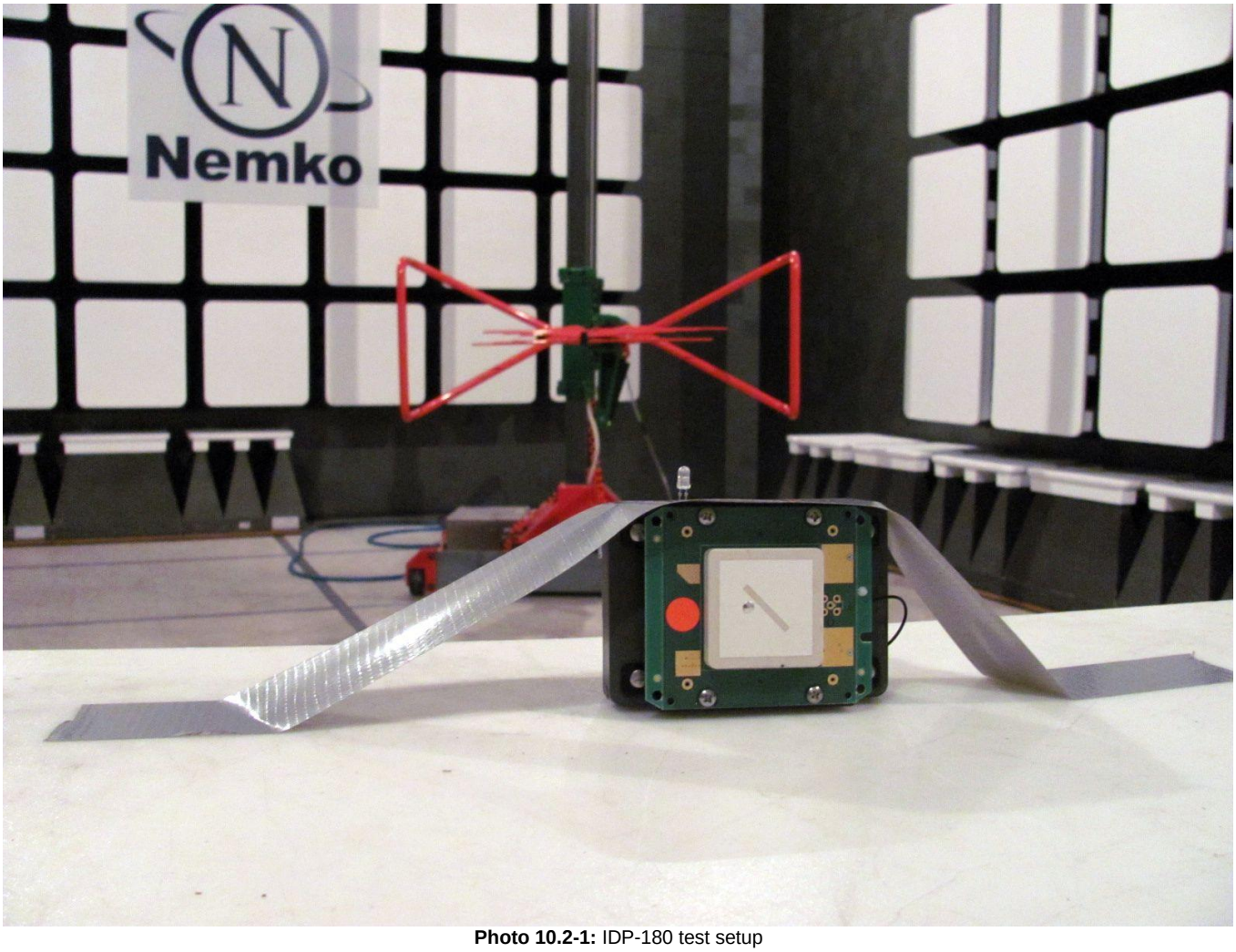


Photo 10.2-1: IDP-180 test setup

10.2 Setup photo, continued

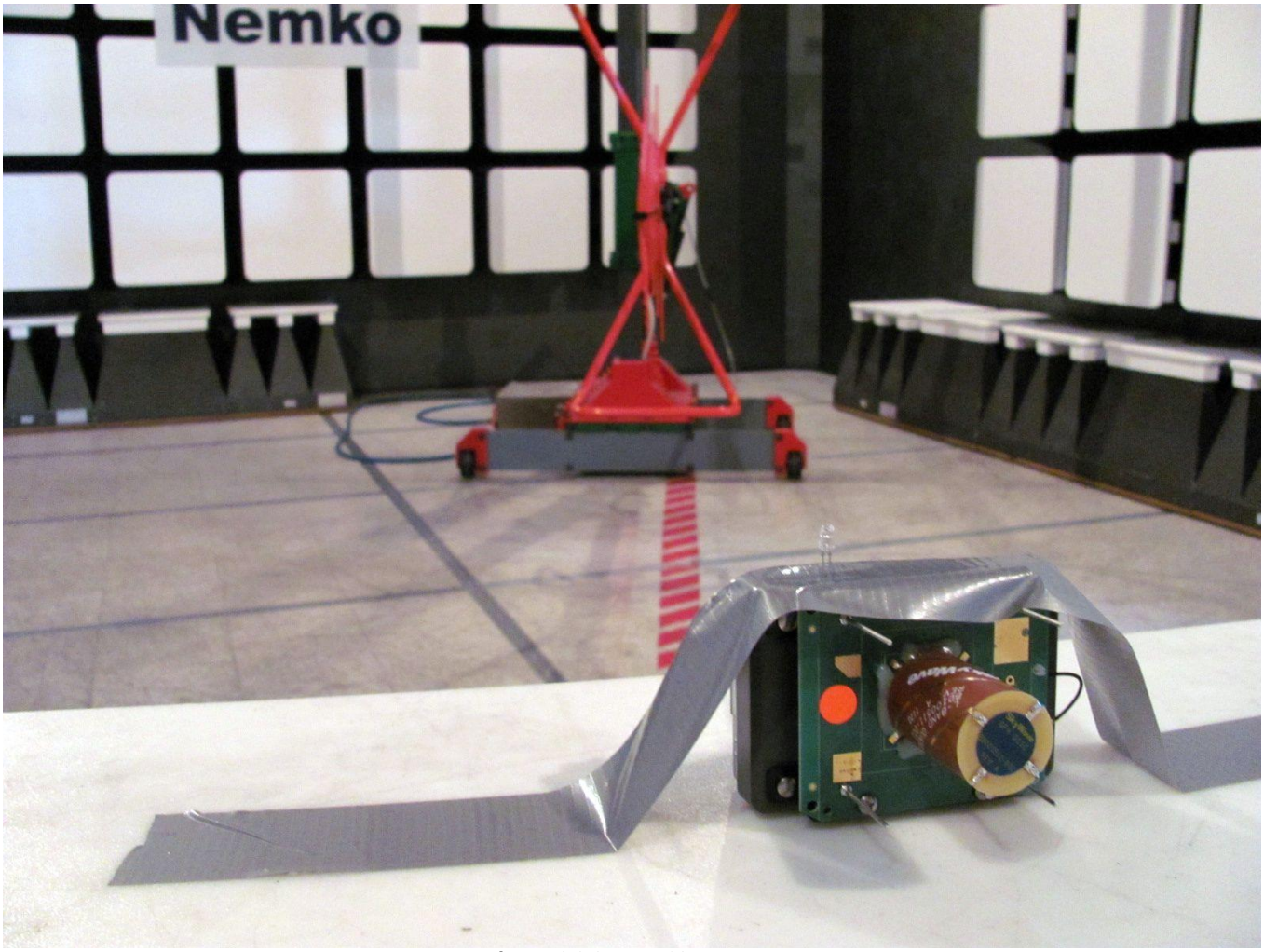


Photo 10.2-2: IDP-190 test setup