



EMC Technologies (NZ) Ltd
PO Box 68-307
Newton, Auckland
47 MacKelvie Street
Grey Lynn, Auckland
New Zealand
Phone 09 360 0862
Fax 09 360 0861
E-Mail Address: aucklab@ihug.co.nz
Web Site: www.emctech.com.au

TEST REPORT

Invenco G6 OPT Outdoor Payment Terminal

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subparts A + B + C

Digital Devices and Intentional Radiators

Section 15.225

Operation within the band 13.110 -14.010 MHz

for

Invenco Group Ltd

A handwritten signature in black ink, appearing to read "Andrew Cutler".

This Test Report is issued with the authority of:

Andrew Cutler- General Manager



All tests reported
herein have been
performed in accordance
with the laboratory's
scope of accreditation

Table of Contents

1. STATEMENT OF COMPLIANCE	3
2. RESULTS SUMMARY	3
3. INTRODUCTION	4
4. CLIENT INFORMATION	5
5. DESCRIPTION OF TEST SAMPLE	5
6. SETUPS AND PROCEDURES	6
7. TEST EQUIPMENT USED	18
8. ACCREDITATIONS	18
9. PHOTOGRAPHS	19

1. STATEMENT OF COMPLIANCE

The **Invenco G6 OPT Outdoor Payment Terminal** complies with FCC Part 15 Subpart A and B and Subpart C Section 15.225 as an Intentional Radiator when the methods as described in ANSI C63.4 - 2003 are applied.

2. RESULTS SUMMARY

The results of testing carried out in August 2014 are summarised below.

Clause	Parameter	Result
15.101	Equipment authorisation requirement.	Verification required. Device is a Class A device that complies with the Class B limits.
15.103	Exempted devices.	Device contains a digital device along with a 13.560 MHz transmitter.
15.107	Conducted Emissions 0.15 - 30 MHz	See section 15.207
15.109	Radiated Emissions 30 - 2000 MHz	See section 15.209
15.111	Antenna Terminal Disturbance 30 – 950 MHz	Not applicable. Device does not have an antenna port.
15.201	Equipment authorisation requirement	Certification required of the 13.560 MHz transmitter
15.203	Antenna requirement	Complies. Antenna internal to the device.
15.204	External PA and antenna modifications	Not applicable. No external devices.
15.205	Restricted bands of operation	Complies. Device transmits on 13.560 MHz
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies.
15.225	Radiated emission limits - Fundamental	Complies.
15.225	Frequency stability	Complies.

3. INTRODUCTION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification.

The client selected the test sample.

This report relates only to the sample tested.

This report contains no corrections or erasures.

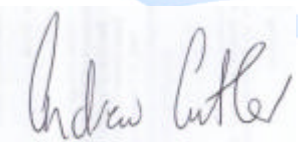
Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

All compliance statements have been made with respect of the specification limit with no reference to the measurement uncertainty.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations.

To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler
General Manager
EMC Technologies NZ Ltd

4. CLIENT INFORMATION

Company Name Invenco Group Ltd
Address 111 Franklin Road
 Freemans Bay
City Auckland
Country New Zealand
Contact Mr Justin Davies

5. DESCRIPTION OF TEST SAMPLE

Brand Name Invenco
Model Number G6 OPT
Product Outdoor Payment Terminal
Manufacturer Invenco Group Ltd
Country of Origin New Zealand
Serial Number 4001277
FCC ID 2AC7B-G6OPT

The device tested is an outdoor credit card payment terminal that would typically be installed at a petrol station allowing payment for petrol and the petrol pump.

Along with the standard payment methods the device also has a 13.560 MHz contactless card reader that uses NFC technologies.

The following frequencies are used in this device:

Clock oscillator: 26 MHz
Fastest Processor Clock: 403 MHz
Contactless Card Reader: 13.560 MHz
USB 2.0 PHY: 480 MHz
Ethernet PHY: 25 MHz

6. SETUPS AND PROCEDURES

Standard

The sample was tested in accordance with 47 CFR Part 15 Subpart C.

Methods and Procedures

The measurement methods and procedures as described in ANSI C63.4 - 2003 were used.

Section 15.201 + 15.101: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for the contactless transmitting device.

The remainder of the device would be classed as a Class A digital device, a digital device marketed for use in a commercial, industrial or business environment, and therefore the verification process has been applied.

Section 15.203: Antenna requirement

This device has an internal antenna.

Result: Complies.

Section 15.204: External radio frequency power amplifiers and antenna modifications

It is not possible to attach an external power amplifier to this transmitter.

Result: Complies.

Section 15.205: Restricted bands of operation

The transmitter transmits on approximately 13.561 MHz.

This falls into the band 13.110 – 14.010 MHz that is covered by Section 15.225.

Result: Complies.

Section 15.207 + 15.107: Conducted emissions testing

Conducted Emissions testing was carried out over the frequency range of 150 kHz to 30 MHz which was carried out at the laboratory's MacKelvie Street premises in a 2.4 m x 2.4 m x 2.4 m screened room

Testing was carried out using an AC power supply that was powered at 120 Vac 60 Hz which supplied the device with 24 Vdc.

Testing was carried out with the transmitter operating with the antenna attached and with the antenna removed and replaced with a dummy load.

The transmitter operates on 13.561 MHz.

The device is deemed to comply providing it complies when the test is carried out with the dummy load attached and the overall emission signature for the product remains similar with no additional emissions being detected.

This is the case with this device.

The device was placed on top of the emissions table, which is 1 m x 1.5 m, 80 cm above the screened room floor which acts as the horizontal ground plane.

In addition the device was positioned 40cm away from the screened room wall which acts as the vertical ground plane.

The artificial mains network was bonded to the screened room floor.

At all times the device was kept more than 80 cm from the artificial mains network.

The Class B limits have been applied.

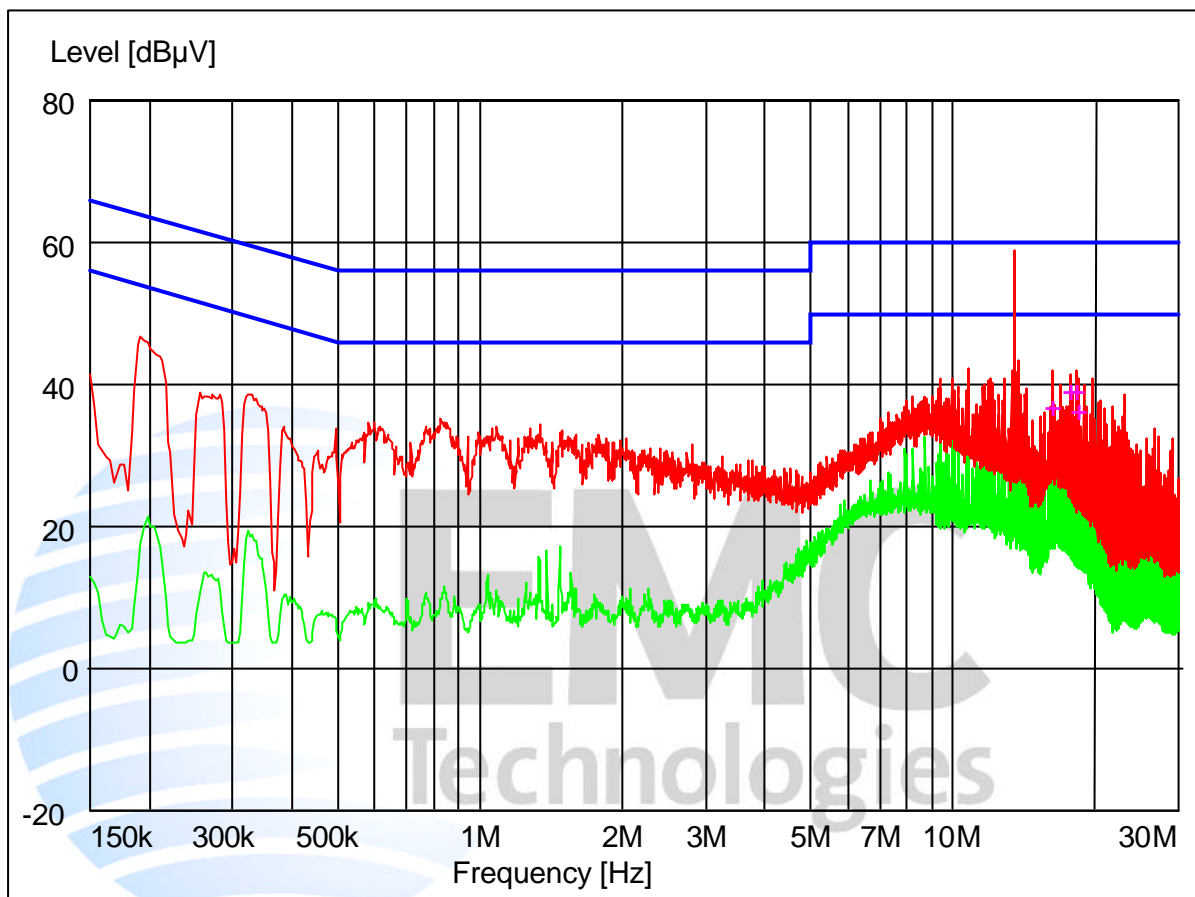
Measurement uncertainty with a confidence interval of 95% is:

- AC Mains port (0.15-30 MHz) \pm 2.8 dB

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz with the 13.560 MHz Reader operating continuously with a card presented and when the Ethernet port was being addressed continuously using a programme supplied by the client.
---------------	---

Peak ---
 Average --
 Quasi Peak X
 Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
13.560000	69.4	60.0	-9.4	L1	69.6

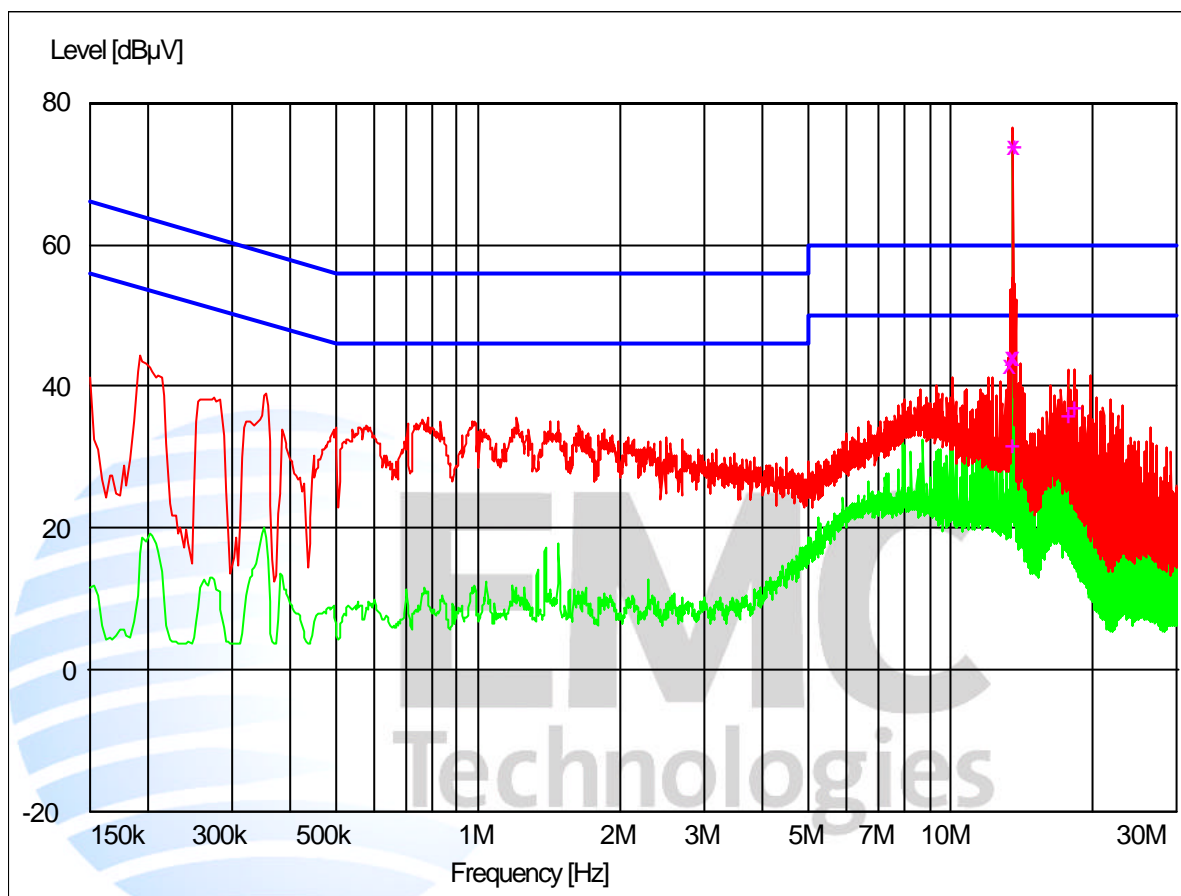
Final Average Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
13.560000	45.10	50.0	4.9	L1	
16.229000	37.30	50.0	12.7	L1	
17.696000	39.50	50.0	10.5	L1	
18.245000	39.70	50.0	10.3	L1	
18.366500	36.90	50.0	13.1	L1	

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz with the 13.560 MHz Reader operating continuously with a card not being presented and when the Ethernet port was being addressed using a programme supplied by the client.
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--- Peak
 -- Average
 X Quasi Peak
 + Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
13.349000	43.20	60.0	16.8	L1	
13.493000	44.10	60.0	15.9	L1	
* 13.560500	73.70	60.0	-13.7	L1	73.5
13.628000	44.10	60.0	15.9	L1	

Final Average Measurements

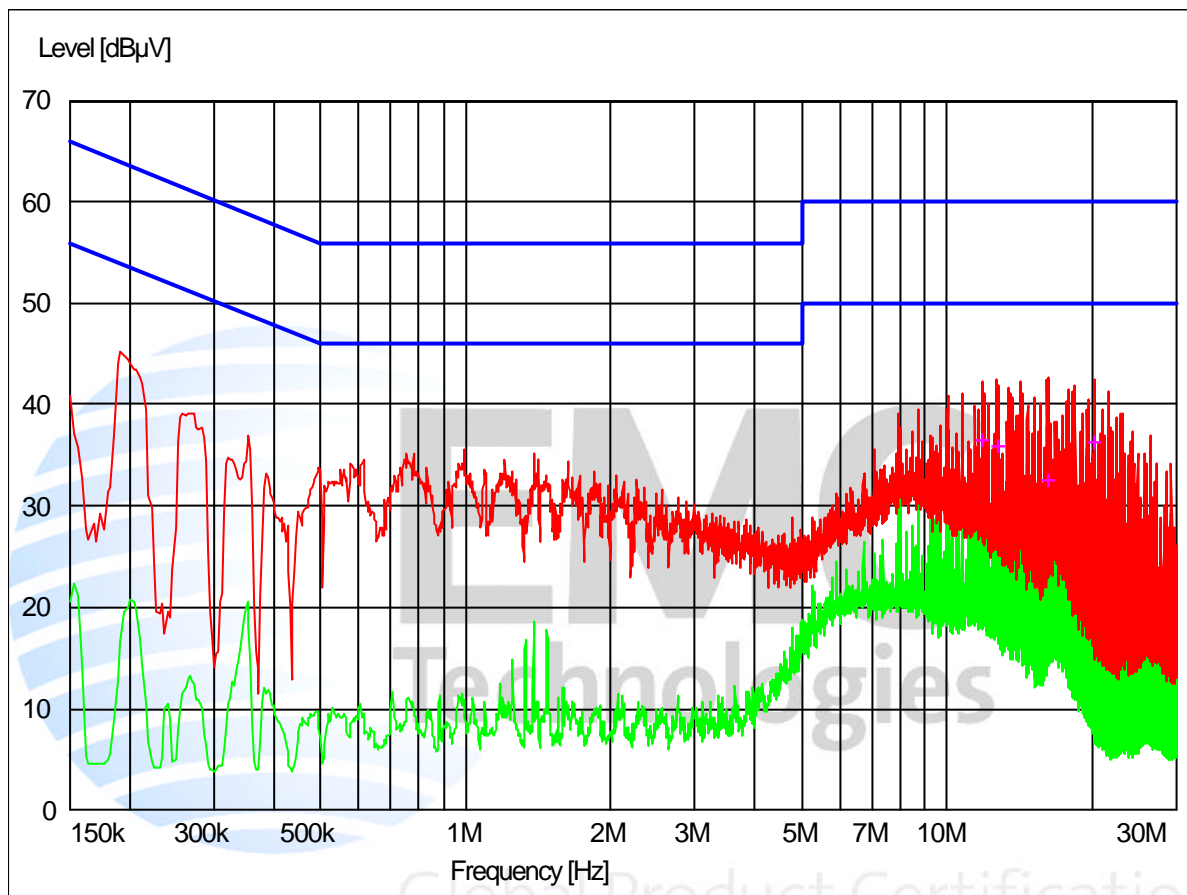
Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
13.421000	31.90	50.0	18.1	L1	
* 13.560500	73.70	50.0	-23.7	L1	73.4
17.696000	36.20	50.0	13.9	L1	
18.245000	37.20	50.0	12.8	L1	

* Device transmit frequency.

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz with the 13.560 MHz Reader antenna being terminated with a dummy load. The Ethernet port was being addressed continuously using a programme supplied by the client.
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Peak ---
 Average--
 Quasi Peak X
 Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
No results recorded within 15 dB of the limit					

Final Average Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
11.891000	36.70	50.0	13.3	L1	
12.746000	36.10	50.0	13.9	L1	
16.229000	32.70	50.0	17.3	L1	
20.261000	36.40	50.0	13.6	L1	

Section 15.209 + 15.109: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 100 kHz to 2,000 MHz as the highest frequency in use has been declared by the client to be less than 500 MHz.

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand.

Testing was carried out when the device was powered at 120 Vac 60 Hz using a power supply supplied by the client that provided the device with 24 Vdc.

Testing was carried out when the 13.560 MHz transmitter was operating continuously while the Ethernet port was being addressed.

The device was placed in the centre of the test table standing vertically upright with the display facing the test antenna at the zero degree position on the turntable.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height, where appropriate, with an automated antenna tower.

Below 30 MHz a magnetic loop is used with the centre of the loop being 1 metre above the ground.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations, where appropriate.

The emission level was determined in field strength by taking the following into consideration:

$$\text{Level (dB}\mu\text{V/m)} = \text{Receiver Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Coax Loss (dB)}$$

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz) \pm 4.1 dB
- Free radiation tests (100 kHz – 30 MHz) \pm 4.8 dB

Section 15.209: Spurious Emissions (below 30 MHz)

As this device contains digital devices that operate using frequencies below 30 MHz, low frequency measurements were attempted between 10 kHz – 30 MHz at the open area test site over a distance of 10 metres using a loop antenna the centre of which was 1 metre above the ground.

Details of the general test set up are provided in the photograph section of this report.

The general limits described in 15.209 have been applied with the 300 metre and 30 metre limits being extrapolated by a factor of 40 dB per decade as allowed for in section 15.31(d)(2).

Between 10 – 90 kHz and between 110 – 490 kHz an Average detector and a Peak detector were used.

Where a peak detector was used the limit was increased by +20 dB.

Between 90 kHz and 110 kHz band between 490 kHz and 30 MHz a Quasi Peak detector was used.

The following measurements were made when the 13.560 MHz transmitter was transmitting continuously.

Frequency MHz	Level dBuV/m	Distance metres	Limit (dBuV/m)	Margin (dB)
27.122	19.1	10.0	48.6	29.5

The limit at 27.122 MHz when measured at 30 metres is 30 uV/m or 29.54 dBuV/m.

Therefore when scaled the limit at 10 metres will be 48.6 dBuV/m as detailed below.

$$\begin{aligned} &= 29.54 \text{ dBuV/m} + -40 \text{ dB/decade} * (\log(10) - \log(30)) \\ &= 29.54 \text{ dBuV/m} + -40 \text{ dB/decade} * (1.000 - 1.477) \\ &= 29.54 \text{ dBuV/m} + -40 \text{ dB/decade} * -0.477 \\ &= 29.54 \text{ dBuV/m} + 19.08 \\ &= 48.62 \text{ dBuV/m or } 48.6 \text{ dBuV/m} \end{aligned}$$

The spurious emission observed does not exceed the level of the fundamental emission.

No other emissions were detected from this device over the range of 9 kHz – 30 MHz.

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (10 kHz – 30 MHz) ± 4.8 dB

Section 15.209: Spurious Emissions (above 30 MHz)

Measurements between 30 –2,000 MHz have been made at a distance of 3 metres.

Below 1000 MHz a quasi peak detector with a bandwidth of 120 kHz was used.

Above 1000 MHz an average detector and a peak detector were used with a bandwidth of 1 MHz.

The spurious emissions observed do not exceed the level of the fundament emission.

The limits as described in Section 15.209 have been applied.

All other emissions observed had a margin to limit that exceeded 20 dB when measurements were attempted using vertical and horizontal polarisations.

Transmitter harmonic emissions

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Result	Antenna
40.682	28.8		40.0	11.2	Pass	Vertical
54.243	27.5		40.0	12.5	Pass	Vertical
67.804	15.5		40.0	24.5	Pass	Vertical
81.365	20.4		40.0	19.6	Pass	Vertical
108.486	28.1	32.0	43.5	11.5	Pass	Horizontal
122.047	31.1	30.3	43.5	12.4	Pass	Vertical
135.608	27.1	35.3	43.5	8.2	Pass	Horizontal
149.168	35.2	35.9	43.5	7.6	Pass	Horizontal
162.729	34.4	36.4	43.5	7.1	Pass	Horizontal
176.290	35.5	42.1	43.5	1.4	Pass	Horizontal
189.851	33.6	37.7	43.5	5.8	Pass	Horizontal
203.411	35.7	42.4	43.5	1.1	Pass	Horizontal
216.972	36.1	42.8	46.0	3.2	Pass	Horizontal
230.533	33.3	38.9	46.0	7.1	Pass	Horizontal
244.094	28.3	35.7	46.0	10.3	Pass	Horizontal
257.654	28.3	37.8	46.0	8.2	Pass	Horizontal
271.215		32.9	46.0	13.1	Pass	Horizontal
284.776		31.6	46.0	14.4	Pass	Horizontal
298.337		29.1	46.0	16.9	Pass	Horizontal

Other emissions observed

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Result	Antenna
55.000	30.0		40.0	10.0	Pass	Vertical
56.600	33.3		40.0	6.7	Pass	Vertical
63.439	30.3		40.0	9.7	Pass	Vertical
58.482	31.4		40.0	8.6	Pass	Vertical
58.847	32.1		40.0	7.9	Pass	Vertical
72.000	27.3		40.0	12.7	Pass	Vertical
192.000		41.1	43.5	2.4	Pass	Horizontal
216.000		42.2	43.5	1.3	Pass	Horizontal
255.631		40.3	46.0	5.7	Pass	Horizontal
278.898		41.9	46.0	4.1	Pass	Horizontal
312.000	36.2	36.0	46.0	9.8	Pass	Vertical
325.000	36.1	41.6	46.0	4.4	Pass	Horizontal
336.000	41.0	39.2	46.0	5.0	Pass	Vertical
348.000		35.8	46.0	10.2	Pass	Horizontal
360.000	43.3	39.6	46.0	2.7	Pass	Vertical
372.000		36.7	46.0	9.3	Pass	Horizontal
384.000	41.2	35.7	46.0	4.8	Pass	Vertical
432.000	41.2	41.7	46.0	4.3	Pass	Horizontal
456.000	40.1	34.2	46.0	5.9	Pass	Vertical
480.000	42.6	37.3	46.0	3.4	Pass	Vertical
487.453		38.5	46.0	7.5	Pass	Horizontal
528.000	40.4	42.6	46.0	3.4	Pass	Horizontal
576.000	37.6	38.6	46.0	7.4	Pass	Horizontal
625.000	36.9	38.9	46.0	7.1	Pass	Horizontal
768.000	38.8	39.0	46.0	7.0	Pass	Horizontal
816.000	37.3	38.0	46.0	8.0	Pass	Horizontal
875.000	37.2		46.0	8.8	Pass	Vertical
975.000	38.3		54.0	15.7	Pass	Vertical

Section 15.225: Fundamental emission:

Measurements were made using a magnetic loop antenna and a receiver with a quasi peak detector using a 9 kHz bandwidth

Measurements were made at a distance of 10 metres with the limit being determined by using the extrapolation factor of 40 dB per decade limit, as detailed in section 15.31 f (2).

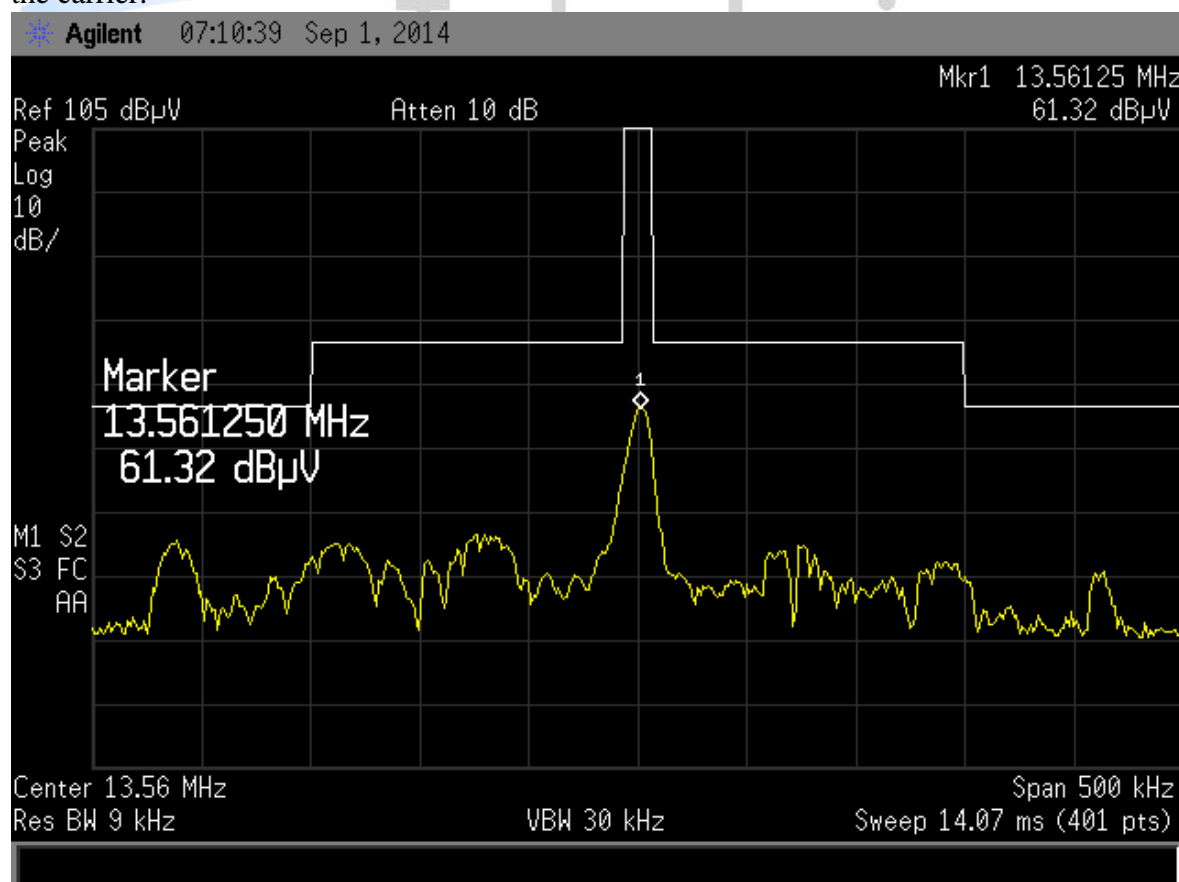
The limit at 30 m at 13.561 MHz is 15,848 uV/m or 84.0 dBuV/m.

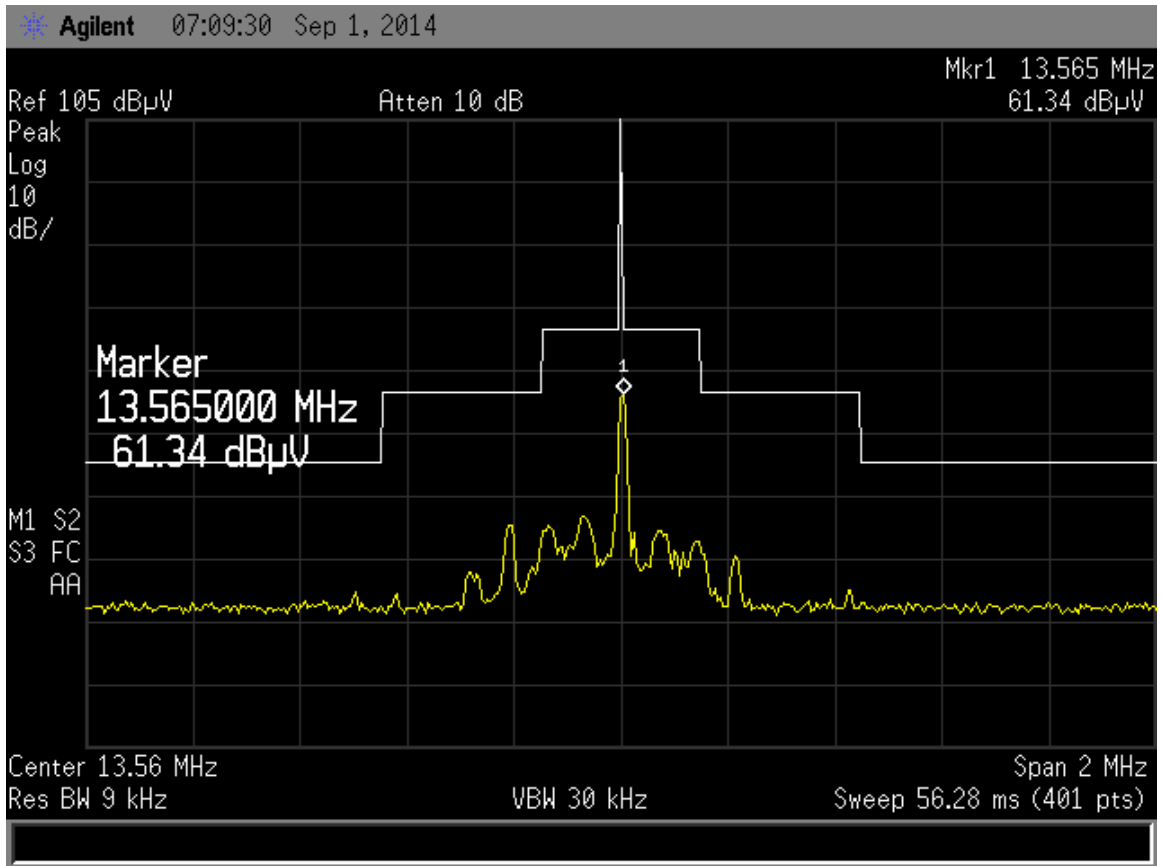
Therefore the limit at 10 metres will be
 $= 84.0 \text{ dBuV/m} + -40 \text{ dB/decade} * (\log(10) - \log(30))$
 $= 84.0 \text{ dBuV/m} + -40 \text{ dB/decade} * (1.000 - 1.477)$
 $= 84.0 \text{ dBuV/m} + -40 \text{ dB/decade} * -0.477$
 $= 84.0 \text{ dBuV/m} + 19.08$
 $= 103.08 \text{ dBuV/m}$ or 103.1 dBuV/m

Testing was carried out when the device was transmitting continuously.

Frequency MHz	Level dBuV/m	Distance metres	Limit (dBuV/m)	Margin (dB)
13.561	61.3	10.0	103.1	41.8

A representative spectrum analyser plot shows that the carrier and modulation peaks do not exceed the spurious emission limits within +/- 500 kHz of the carrier and within +/- 2 MHz of the carrier.





Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.225: Frequency tolerance:

The frequency tolerance of carrier is required to be +/- 0.01% of operating frequency when the temperature is varied between -20 degrees and +50 degrees.

The device operates on approximately 13.560 MHz which gives a frequency tolerance of +/- 1,356 Hz.

Temperature	Frequency (MHz)	Difference (Hz)
-20.0	13.560 750	+750.0
-10.0	13.560 750	+750.0
+0.0	13.560 700	+700.0
+10.0	13.560 650	+650.0
+20.0	13.560 650	+650.0
+30.0	13.560 650	+650.0
+40.0	13.560 650	+650.0
+50.0	13.560 600	+600.0

Variation of the 120 Vac supply to the device at +20 degrees did not vary the frequency output.

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Frequency tolerance \pm 50 Hz

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due	Period
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applic	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic	Not applic
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2015	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2015	3 years
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2015	1 year
Receiver	R & S	ESIB 40	100171	R-27-1	28 Jan 2015	1 year
Receiver	R & S	ESHS 10	828404/005	3728	21 Aug 2015	1 year
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3771	20 Mar 2015	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic	Not applic
Loop Antenna	EMCO	6502	9003-2485	3798	4 Jul 2017	3 years
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2015	1 year

At the time of testing all test equipment was within calibration

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies Ltd registration with the Federal Communications Commission as a listed facility, registration number: 90838, which was last updated in June, 2014.

All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

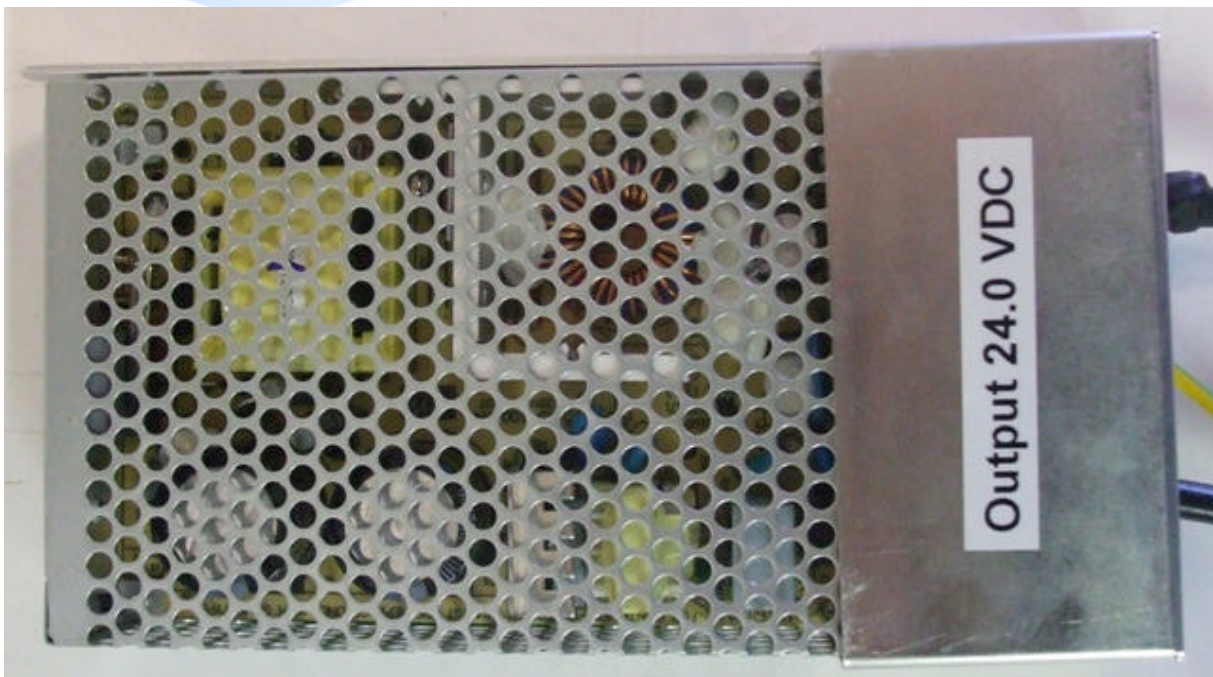
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies.

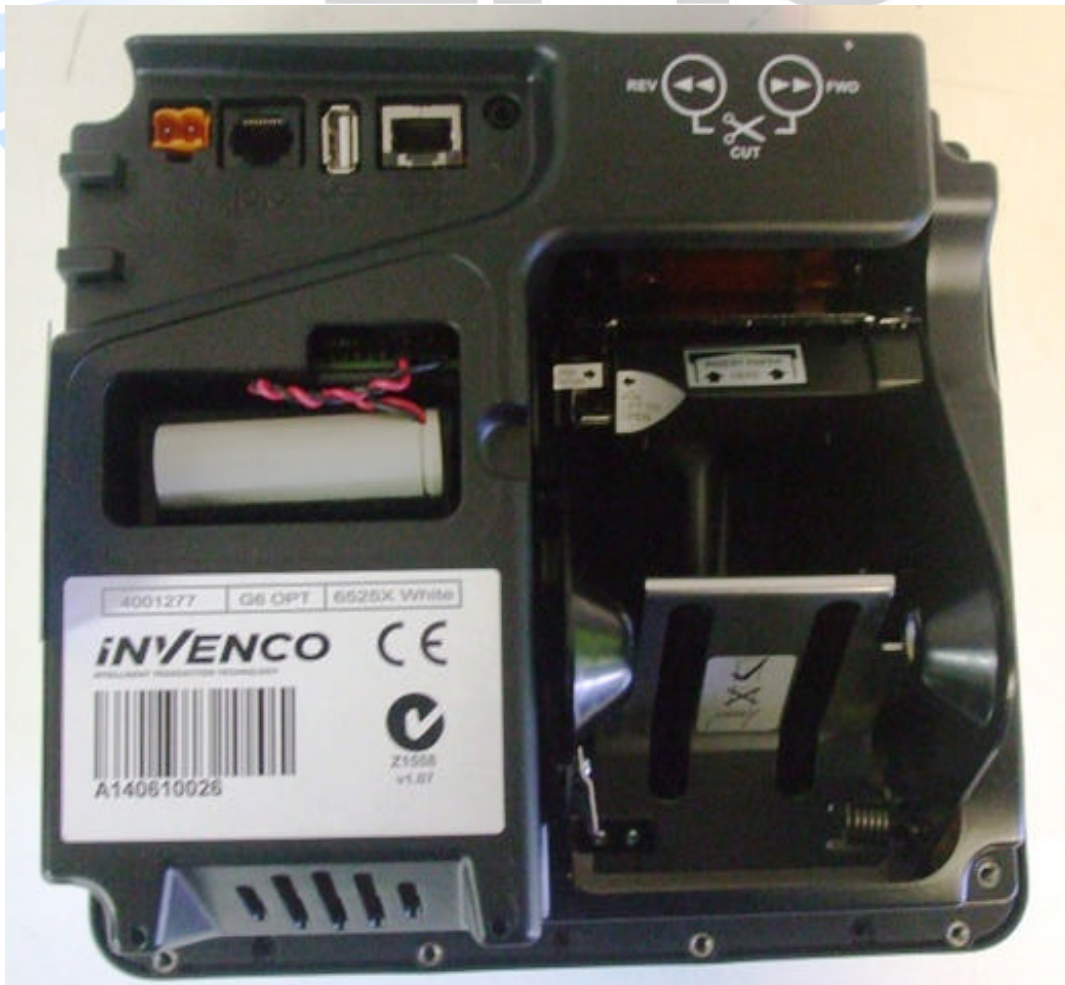
This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

9. PHOTOGRAPHS

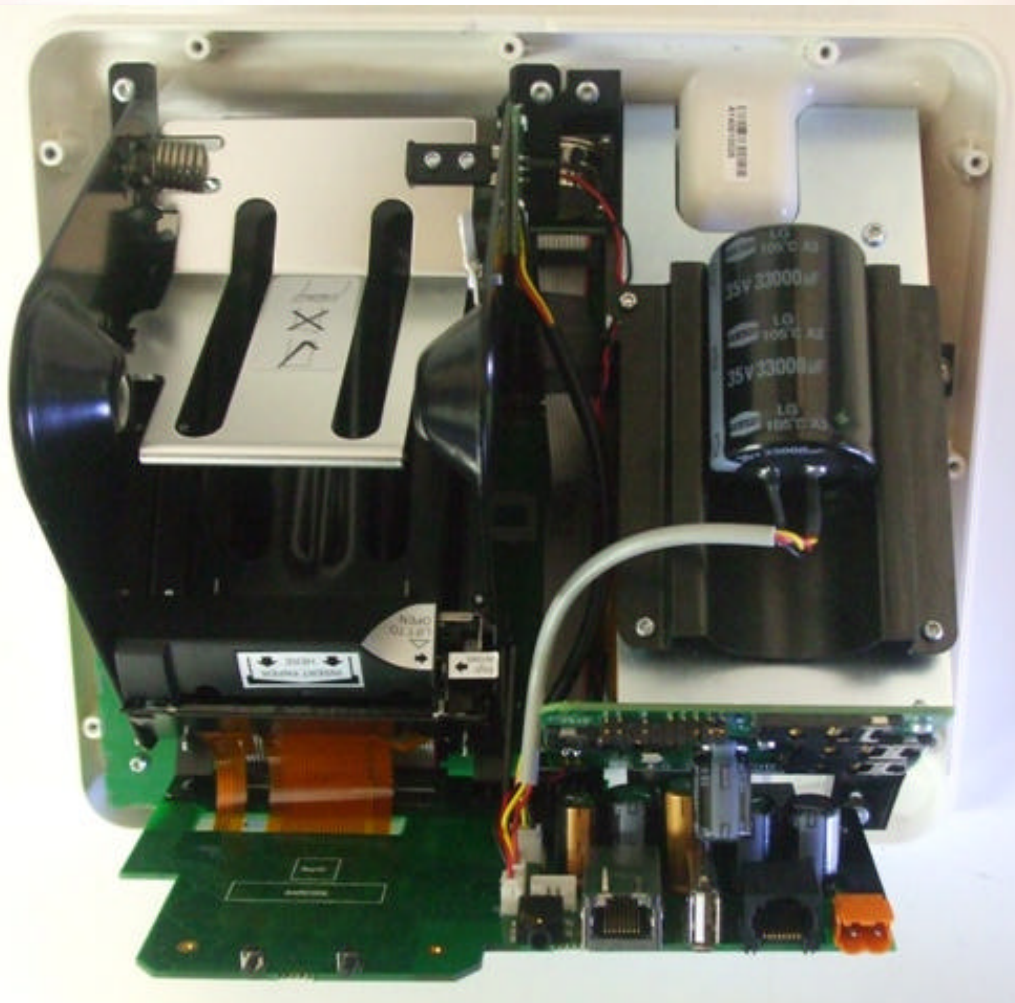
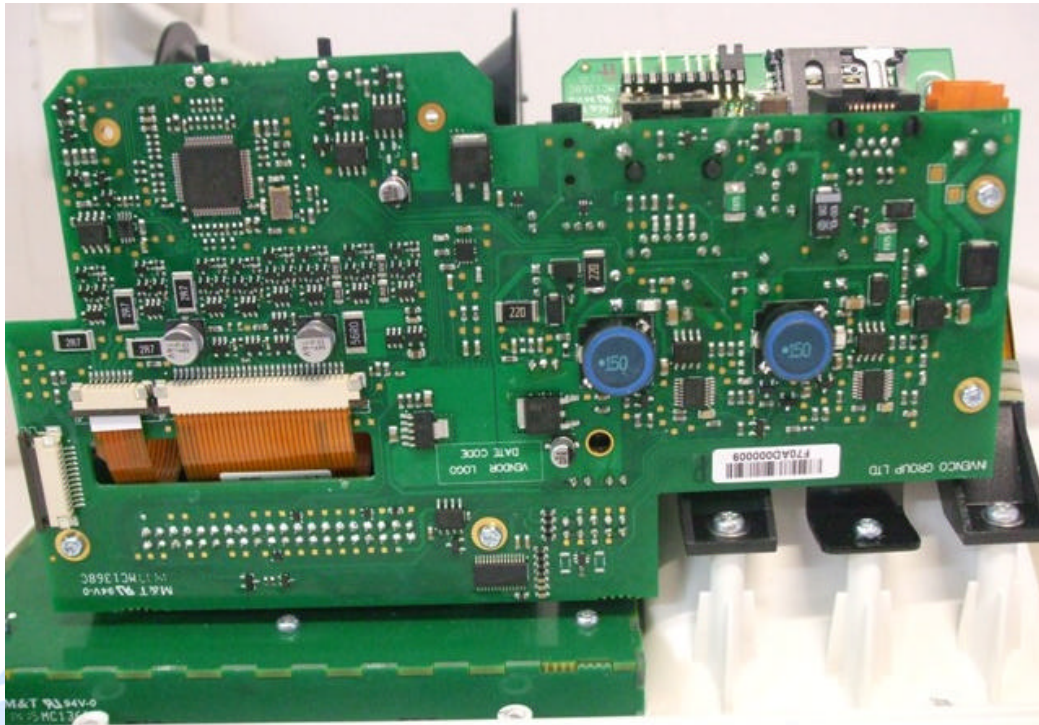
External Photos of the Representative Power Supply

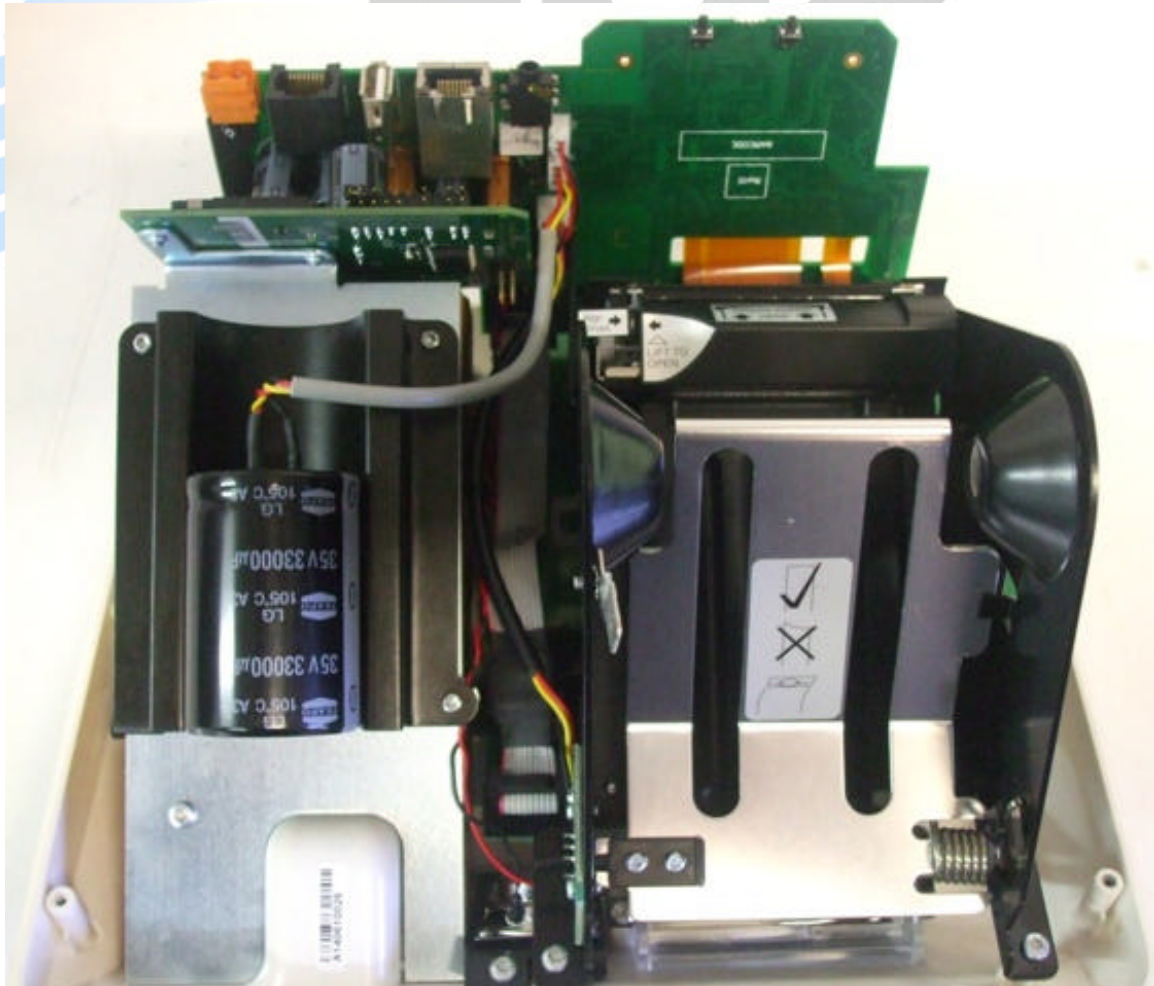
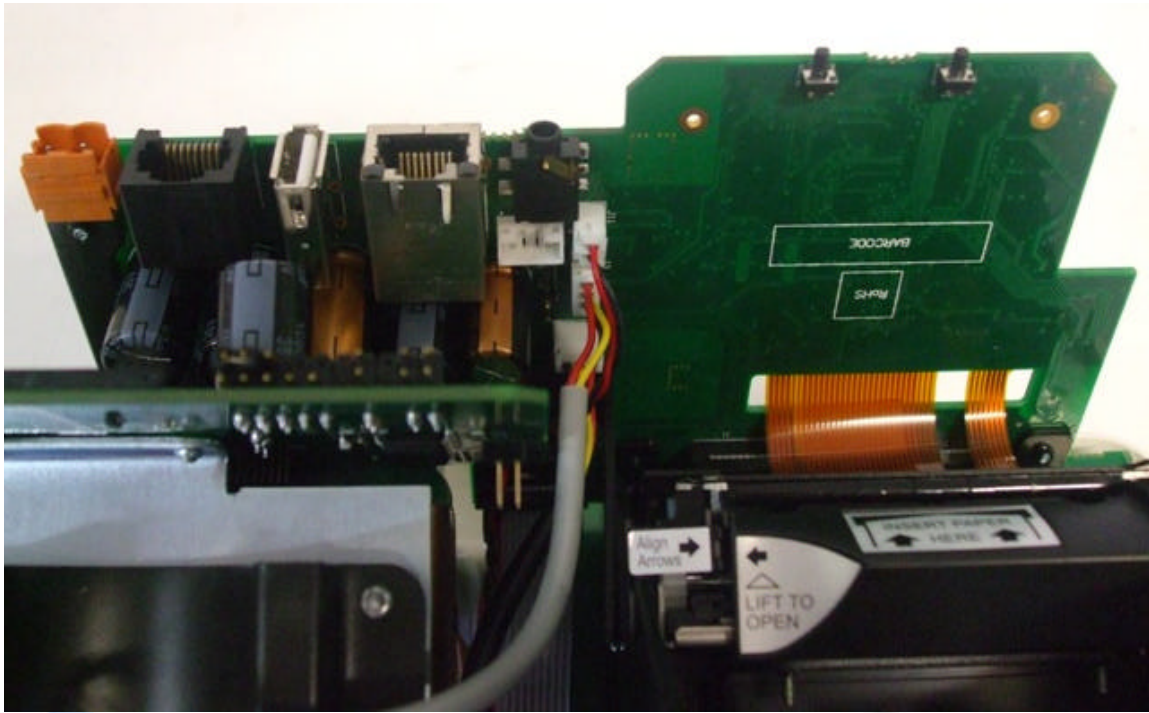


External Photos of Device

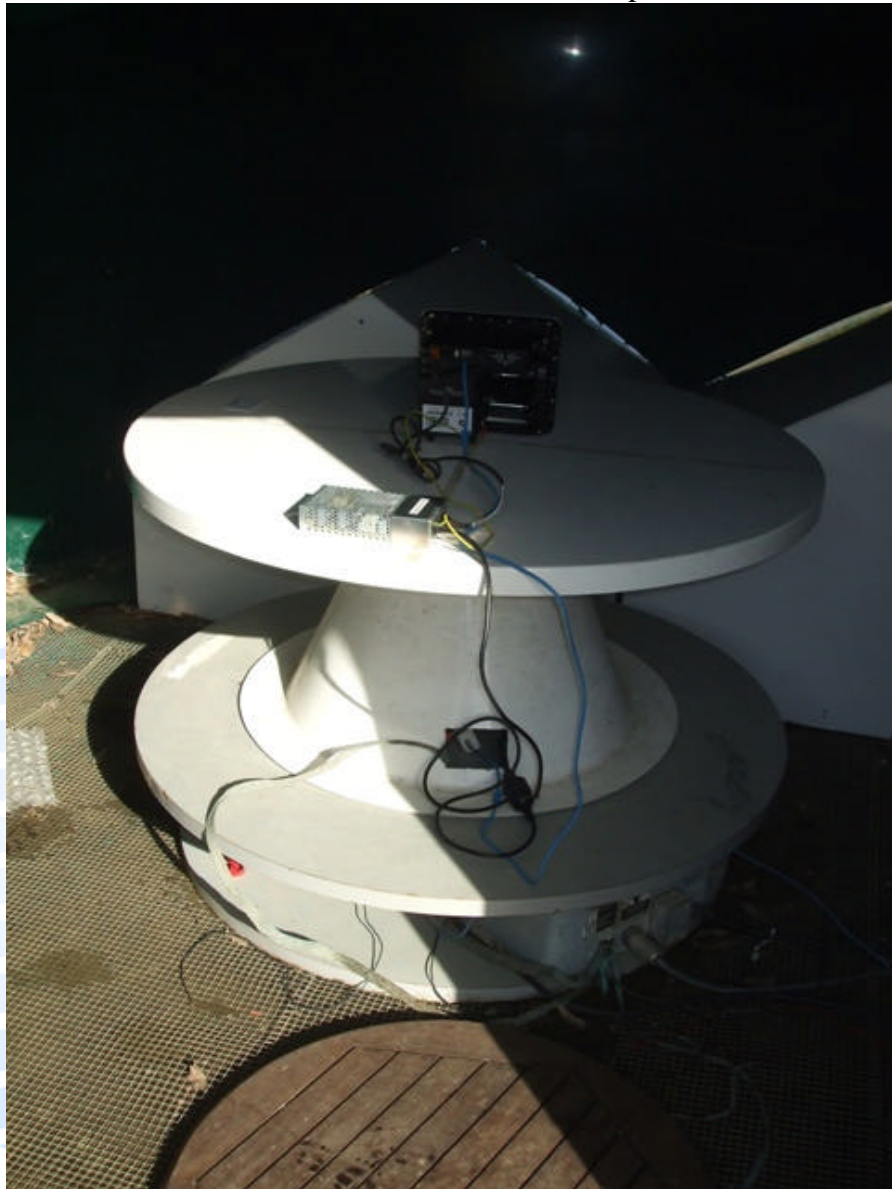


Internal Photos (Limited range of photos for report purposes only)

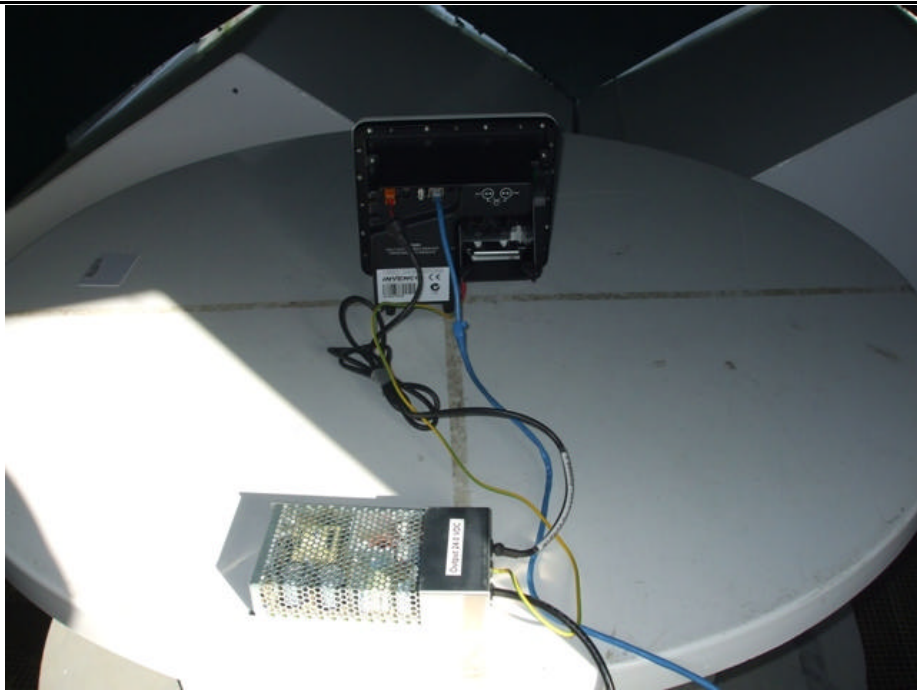




Radiated Emission Test Set Ups



Global Product Certification





Conducted emissions test set up



