EMC Technologies (NZ) Ltd
47 Mackelvie St, Grey Lynn
Auckland 1021
New Zealand
Phone 09 360 0862
E-Mail Address: aucklab@emctech.co.nz
Web Site: www.emctech.co.nz

TEST REPORT

Invenco G6-400 Payment Terminal

tested to the specification

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.225
Operation within the band 13.110 -14.010 MHz

for

Invenco Group Ltd

This test report is issued with the authority of:

Andrew Cutler - General Manager

ACCREDITED
IANZ
TESTING LABORATORY

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

Table of Contents

1. STATEMENT OF COMPLIANCE

The **Invenco G6-400 Payment Terminal** complies with FCC Part 15 Subpart C Section 15.225 as an Intentional Radiator when the methods as described in ANSI C63.10 –2013 are applied.

2. RESULTS SUMMARY

The results from testing carried out between the 16th March and the 18th May 2023 are detailed in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required
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 a nominal frequency of 13.560 MHz
15.207	Conducted limits	Complies
15.209	Radiated emission limits - Emissions < 30 MHz	Complies
15.209	Radiated emission limits – 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.

All testing was carried out as per the standard in the worst-case configuration with no deviations being applied.

Version	Change Made	Date
230104.2	Initial Issue	15/08/23

4. CLIENT INFORMATION

Company Name	Invenco Group Ltd
Address	7-11 Kawana Street, Northcote, 0627
City	Auckland
Country	New Zealand
Contact	Mr Chris Henry

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Invenco
Model Number	G6-400
Hardware ID	-
Product	Payment Terminal
Manufacturer	Invenco Group Ltd
Country of Origin	New Zealand
Serial Number	SBLB0006
FCC ID	2AC7B-G6400OPT

The device tested is Payment Terminal with a number of features that would typically be used for the payment of fuel at a petrol station.

The device contains a NFC Card Reader that operates on 13.560 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 C63.10 –2013 were used.

Section 15.201: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for this device.

Section 15.203: Antenna requirement

The device has a permanently attached internal 13.560 MHz 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.

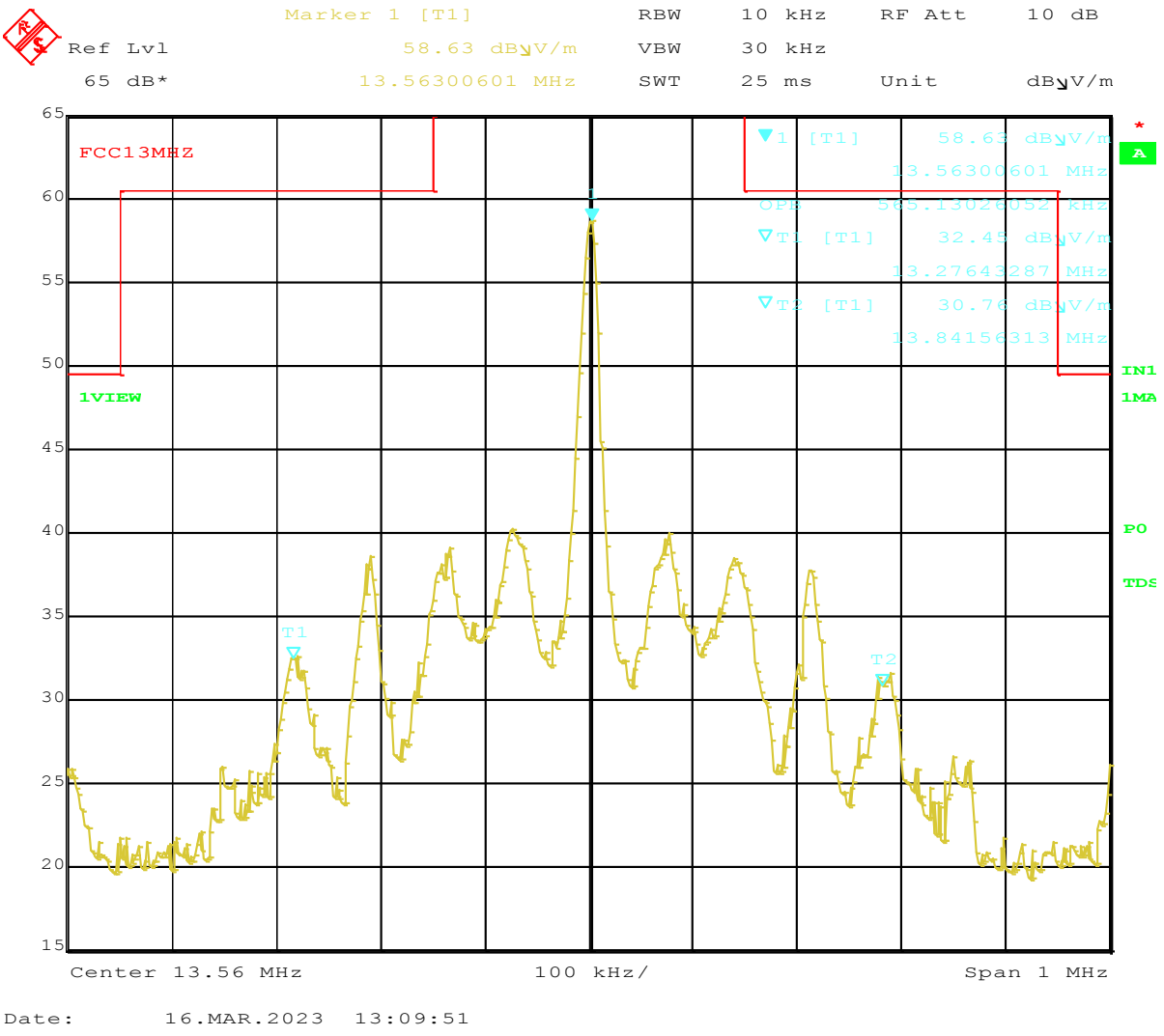
Result: Complies.

Section 15.205: Restricted bands of operation

The device transmits on a nominal frequency of 13.560 MHz.

13.560 MHz transmissions would fall into the 13.110 – 14.010 MHz band that is covered by Section 15.225.

Below is a plot of the device transmitting on 13.560 MHz with a 99% occupied power bandwidth of 565.1302 kHz



Result: Complies.

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

As it is possible for this device to be directly or indirectly connected to the Public AC mains supply testing was carried out using a representative AC power supply system that was powered at 120 Vac 60 Hz which supplied DC to the device under test.

The NFC Card Reader operates at 13.560 MHz.

Initial testing was carried out when the NFC Card Reader was operating normally with the internal antenna connected.

A second test was then carried out with the NFC Card Reader was de-activated.

The device is deemed to comply providing if the deactivated test complies and the overall emission signature for the product remains similar in both test configurations with no additional emissions being detected.

The device was placed on top of the emissions table, which is 0.8 m x 0.8 m, 80 cm above the screened room floor which acts as the horizontal ground plane.

In addition the device was positioned 40 cm 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 supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC power supply.

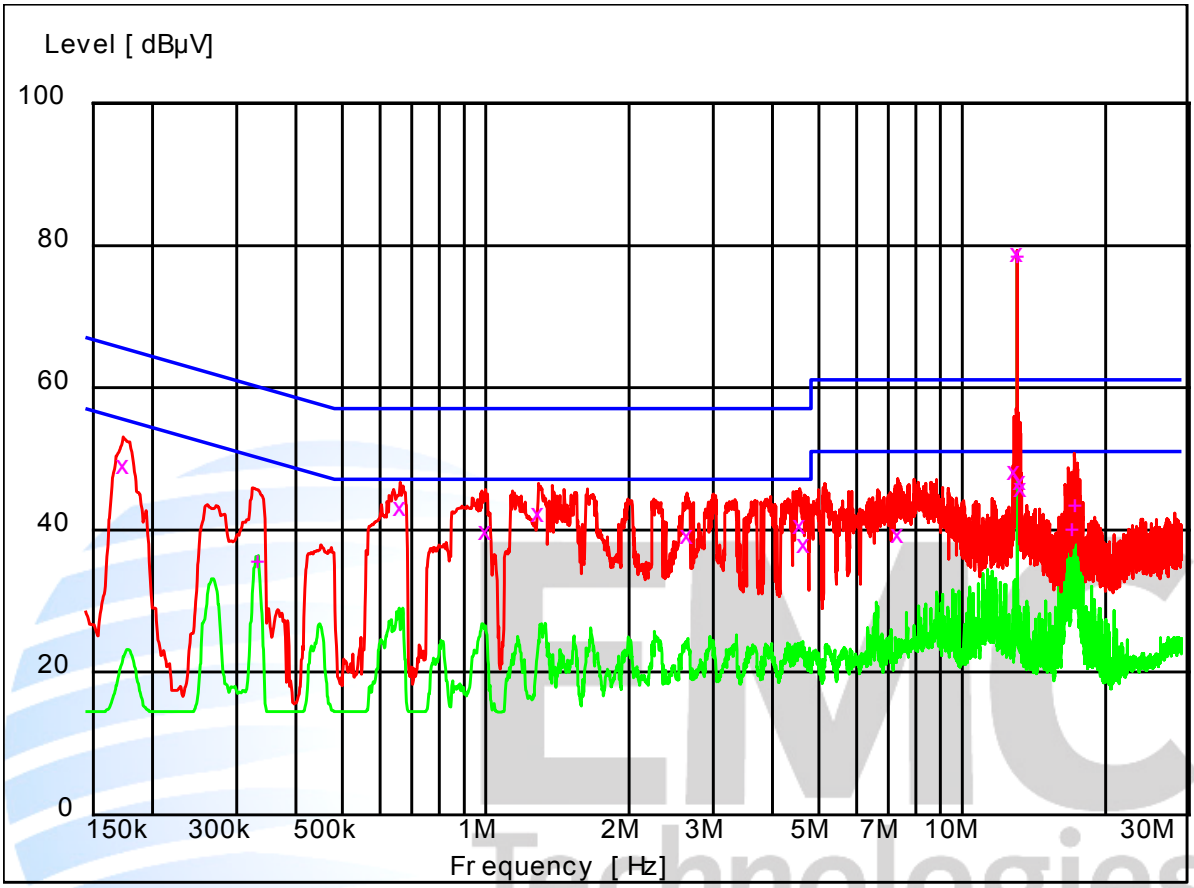
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

Measurement uncertainty with a confidence interval of 95% is:
- AC Mains port (0.15-30 MHz) ± 2.8 dB

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz running a script to produce Video and Audio and to print a receipt print with the NFC device ON.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.180000	48.00	64.5	16.5	L1	
0.687000	42.20	56.0	13.8	L1	
1.038000	38.70	56.0	17.3	L1	
1.341000	41.20	56.0	14.8	N	
2.751500	38.10	56.0	17.9	N	
4.745000	39.60	56.0	16.4	L1	
4.835000	37.00	56.0	19.0	L1	
7.616000	38.30	60.0	21.7	L1	
13.349000	47.20	60.0	12.8	N	
13.560500	77.80	60.0	-17.8	L1	Fundamental
13.767500	45.80	60.0	14.2	L1	
13.776500	44.80	60.0	15.2	L1	

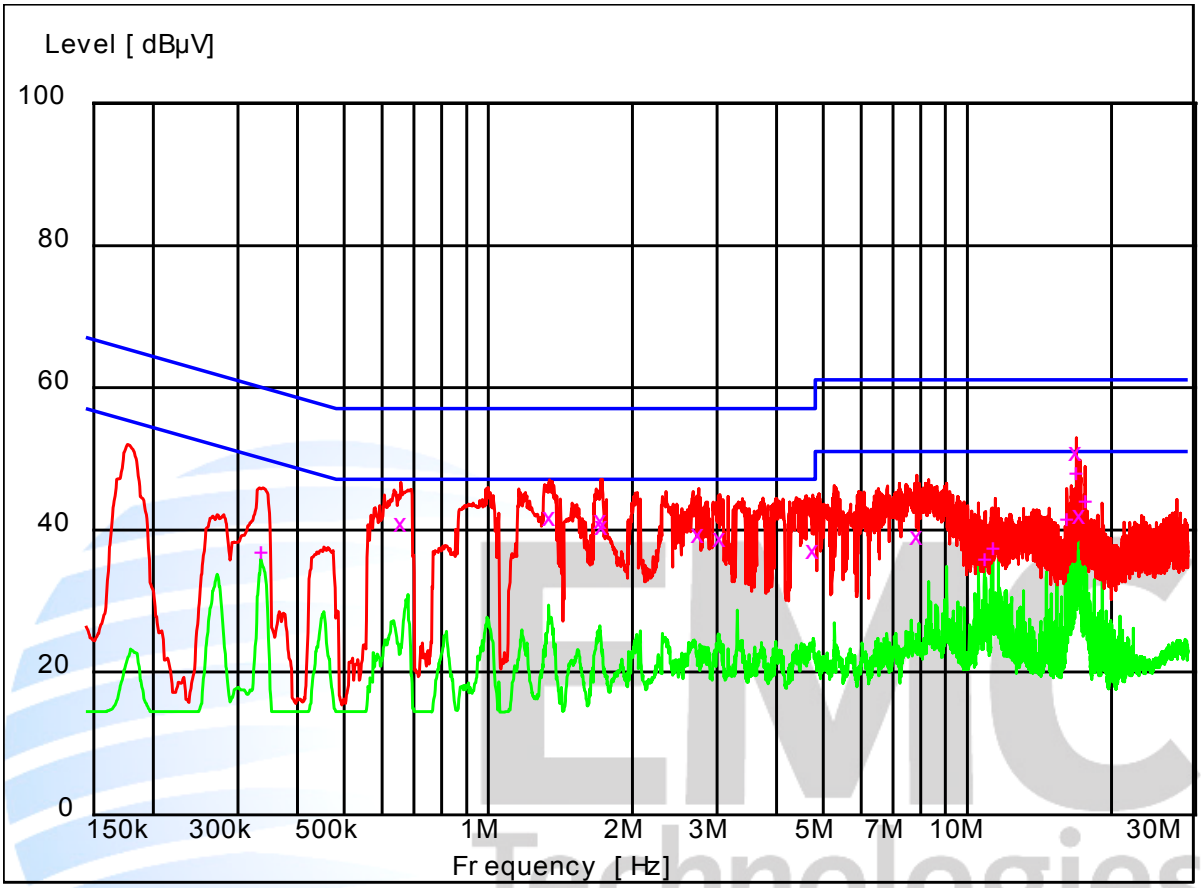
Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.345000	34.40	49.1	14.7	L1	
13.560500	77.30	50.0	-27.3	L1	
17.633000	38.90	50.0	11.1	N	
17.880500	42.30	50.0	7.7	N	

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz running a script to produce Video and Audio and to print a receipt print with the NFC device OFF

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.681000	39.90	56.0	16.1	L1	
1.395000	40.70	56.0	15.3	L1	
1.785000	40.30	56.0	15.7	N	
1.794000	39.40	56.0	16.6	L1	
2.855000	38.30	56.0	17.7	L1	
3.161000	37.70	56.0	18.3	L1	
4.943000	36.10	56.0	19.9	N	
8.151500	38.00	60.0	22.0	L1	
17.552000	49.90	60.0	10.1	L1	
17.840000	41.10	60.0	19.0	L1	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.348000	35.60	49.0	13.4	L1	
11.279000	34.70	50.0	15.3	L1	
11.760500	36.30	50.0	13.7	L1	
16.769000	40.20	50.0	9.8	L1	
17.547500	46.80	50.0	3.2	L1	
18.335000	42.80	50.0	7.2	L1	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 30 MHz to 6000 MHz at the request of the client.

Testing was carried out at the laboratory's open area test site - located at 670 Kawakawa-Orere Road, RD5, Papakura, New Zealand.

Before testing was carried out a receiver self-calibration was undertaken along with a check of all cables and programmed antenna factors were carried out.

Testing was carried out using a representative AC power supply at 120 Vac 60 Hz that powered the device under test.

The device tested when placed in the centre of the test table flat 0.8 m above the test site ground plane.

All interconnecting cables were bundled in 40 cm long bundles.

The NFC device was transmitting continuously on 13.560 MHz.

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 with measurements being made using a Quasi Peak detector at a distance of 10 metres.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations at a distance of 3 metres.

Below 1000 MHz a Quasi Peak detector with a 120 kHz bandwidth is used.

Above 1000 MHz an Average detector and a Peak detector with bandwidths of 1 MHz are used.

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

Level (dBµV/m) = Receiver Reading (dBµV) + Antenna Factor (dB/m) + Coax Loss (dB)

For example, if an emission of 30 dBµV was observed at 30 MHz.

45.5 dBµV/m = 30.0 dBµV + 14 dB/m + 1.5 dB

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 6000 MHz) ± 4.1 dB

Section 15.209: 13.560 MHz transmitter below 30 MHz spurious emission measurements

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
27.120	14.5	48.6	34.1	Pass

The NFC device was transmitting continuously on 13.560 MHz.

Magnetic loop measurements were made at a distance of 10 metres.

Measurement receiver with a quasi-peak detector with a 9 kHz bandwidth was used.

The 30 metre limit has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The limit at 27.120 MHz when measured at 30 metres is 30 uV/m or 29.54 dBuV/m.

Therefore the scaled limit at 10 metres will be 48.6 dBuV/m.

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

No other low frequency spurious emissions were detected from the device when measurements were attempted from 10 kHz - 30.0 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 (30 – 1000 MHz)

Measurements between 30 – 1000 MHz have been made at a distance of 3 metres.

The limits as described in Section 15.209 have been applied.

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna	Detector
34.640	28.6		40.0	11.4	Vertical	Quasi Peak
57.480	23.1		40.0	16.9	Vertical	Quasi Peak
76.960	26.8		40.0	13.2	Vertical	Quasi Peak
197.560		26.8	43.5	16.7	Horizontal	Quasi Peak
216.960		35.6	46.0	10.4	Horizontal	Quasi Peak
236.320		36.6	46.0	9.4	Horizontal	Quasi Peak
244.000	29.1	40.7	46.0	5.3	Horizontal	Quasi Peak
257.640	26.3		46.0	19.7	Vertical	Quasi Peak
271.200		38.8	46.0	7.2	Horizontal	Quasi Peak
298.320	34.7		46.0	11.3	Vertical	Quasi Peak
325.440	41.2	40.9	46.0	4.8	Vertical	Quasi Peak
352.560	39.1	41.7	46.0	4.3	Horizontal	Quasi Peak
379.680	41.8	36.8	46.0	4.2	Vertical	Quasi Peak
433.960	36.3		46.0	9.7	Vertical	Quasi Peak
450.040	37.2	40.7	46.0	5.3	Horizontal	Quasi Peak
488.040	35.5	40.4	46.0	5.6	Horizontal	Quasi Peak
515.200	35.1		46.0	10.9	Vertical	Quasi Peak
542.400	37.3	38.6	46.0	7.4	Horizontal	Quasi Peak
569.480	38.3		46.0	7.7	Vertical	Quasi Peak
576.040	37.4		46.0	8.6	Vertical	Quasi Peak
623.740	35.7		46.0	10.3	Vertical	Quasi Peak
705.080	35.4		46.0	10.6	Vertical	Quasi Peak
732.200	36.3		46.0	9.7	Vertical	Quasi Peak
750.000		37.8	46.0	8.2	Horizontal	Quasi Peak
1000.000		39.6	46.0	6.4	Horizontal	Quasi Peak

All other emissions detected had a margin to the limit that exceeded at least 15 dB when measurements were made between 30 - 1000 MHz using both vertical and horizontal polarisations.

Section 15.209: Spurious Emissions (1000 - 6000 MHz)

Measurements between 1000 - 6000 MHz have been made at a distance of 3 metres.

The limits as described in Section 15.209 have been applied.

Frequency MHz	Vertical dBuV/m	Horizontal dBuV/m	Limit dBuV/m	Margin dB	Antenna	Detector
1030.000	52.1	-	74.0	21.9	Vertical	Peak
1030.000	35.8	-	54.0	18.2	Vertical	Average
1041.600	-	42.3	74.0	31.7	Horizontal	Peak
1050.000	36.8	34.2	54.0	17.2	Vertical	Average
1093.200	44.0	43.8	74.0	30.0	Vertical	Peak
1093.200	32.5	33.8	54.0	20.2	Horizontal	Average
1136.000	53.5	45.9	74.0	20.5	Vertical	Peak
1136.400	33.3	-	54.0	20.7	Vertical	Average
1150.000	34.2	33.5	54.0	19.8	Vertical	Average
1500.000	48.3	48.7	74.0	25.3	Horizontal	Peak
1500.000	33.4	37.3	54.0	16.7	Horizontal	Average
1837.200	37.2	-	54.0	16.8	Vertical	Average

All other emissions detected had a margin to the limit that exceeded at least 15 dB when measurements were made between 1000 - 6000 MHz using both vertical and horizontal polarisations.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 - 6000 MHz) ± 4.1 dB

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).

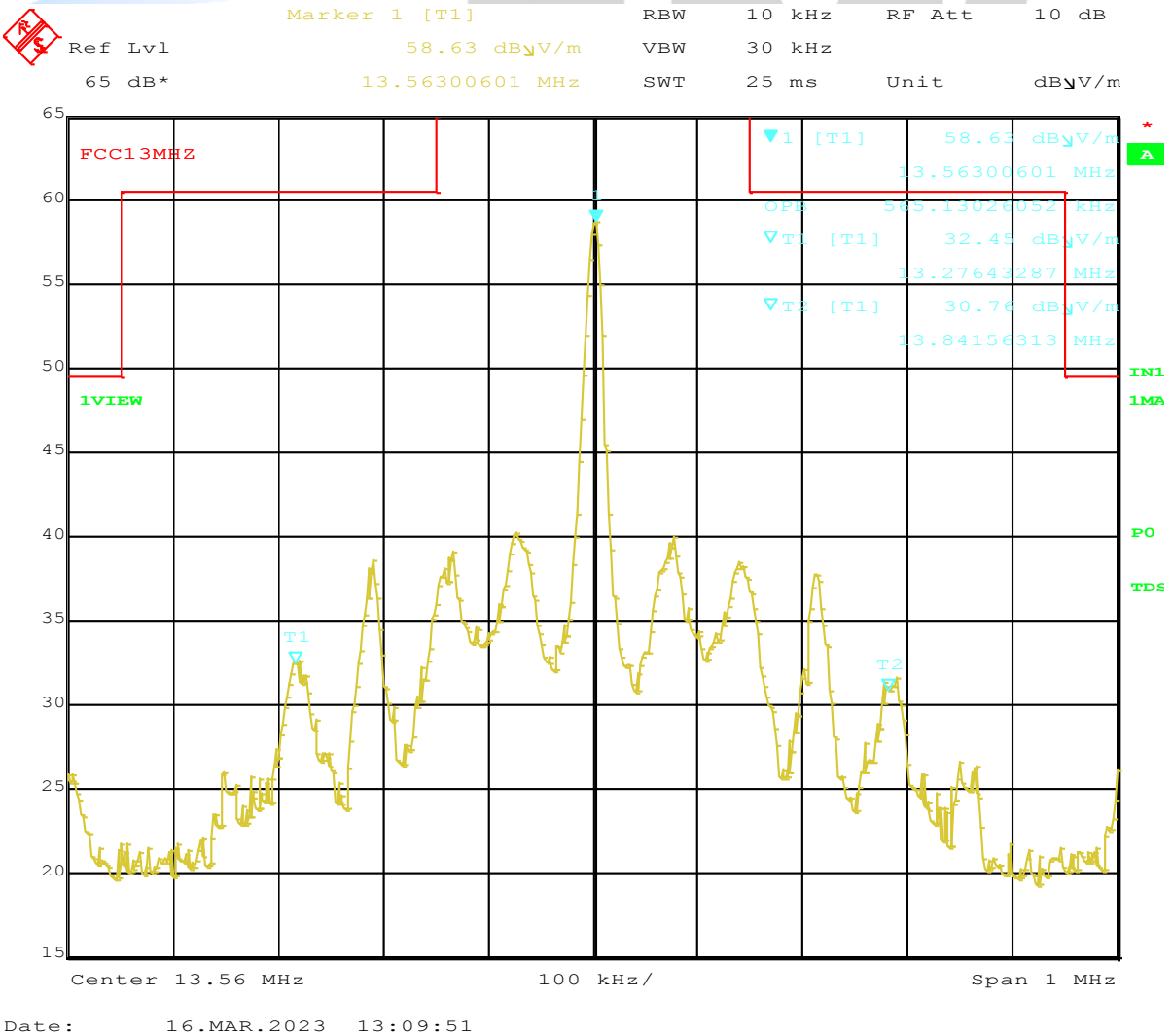
The limit at 30 m at 13.560 MHz is 15,848 uV/m or 84.0 dBuV/m.

Applying the extrapolation factor of 40 dB/ per decade, the limit at 10 m is 103.1 dBuV/m.

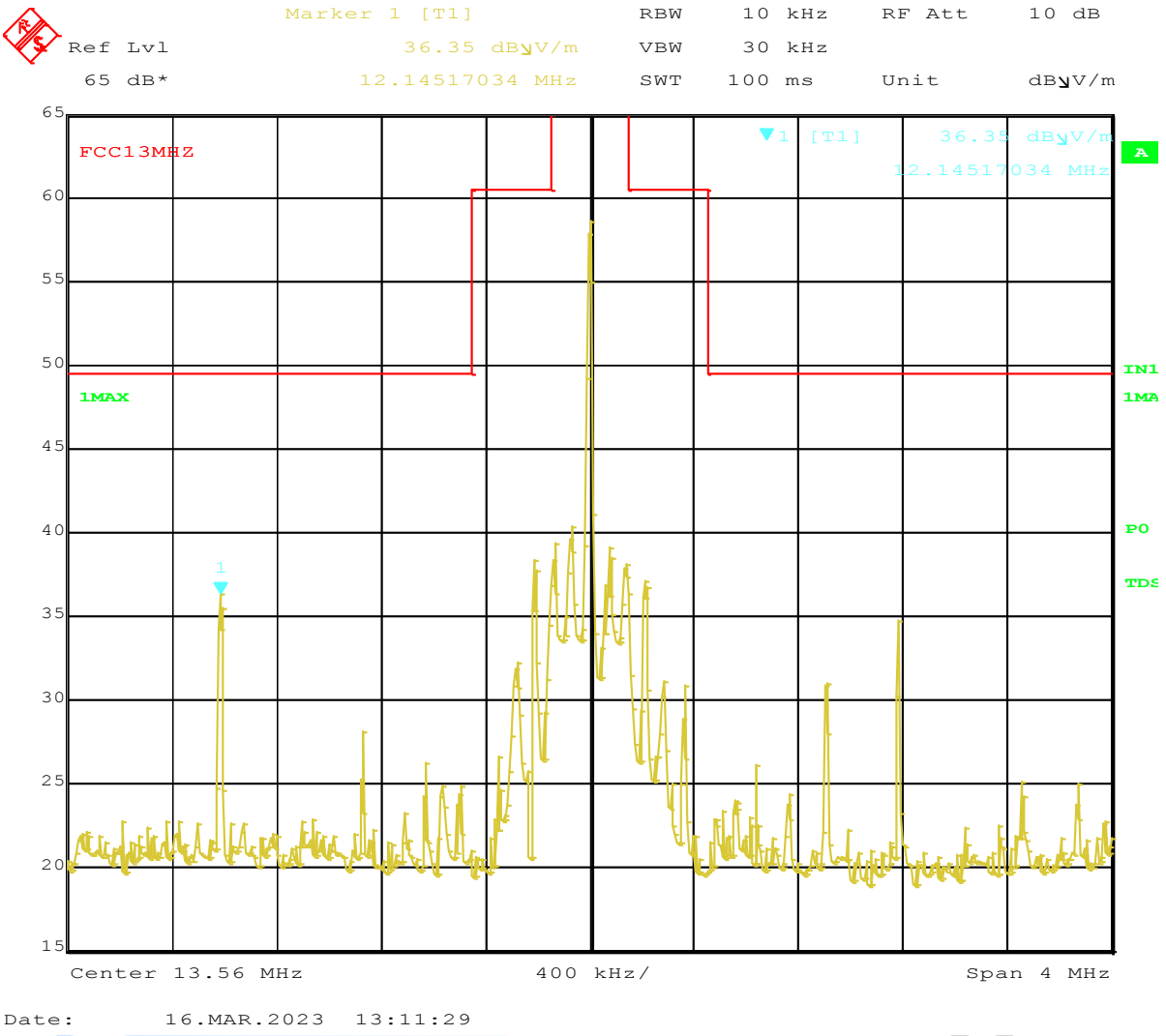
The 24 Vdc supply to the device was varied by +/- 15% to determine whether a change in field strength would occur.

Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
20.4	13.560	58.2	103.1	44.9
24.0	13.560	58.2	103.1	44.9
27.6	13.560	58.2	103.1	44.9

Spectrum analyser plot showing the carrier and modulation peaks within +/- 500 kHz.



Spectrum analyser plot showing the carrier and modulation peaks within +/- 2 MHz



Measurement was made at the open area test site with high level ambient emissions detected and confirmed at 12.145 MHz and 14.742 MHz.

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

The device operates nominally on 13.560 MHz which gives a frequency tolerance of +/- 1,356.0 Hz.

Temperature (°C)	Frequency (MHz)	Difference (Hz)
50.0	13.559 605	-395
40.0	13.559 640	-360
30.0	13.559 570	-430
20.0	13.559 538	-462
10.0	13.559 542	-458
0.0	13.559 548	-452
-10.0	13.559 571	-429
-20.0	13.559 643	-357

As a worst case scenario the 24 Vdc supply to the device was varied by +/- 15% at 20 degrees C (ambient).

Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
20.4	13.559 547	-453
24.0	13.559 552	-448
27.6	13.559 543	-457

The frequency tolerance above has been calculated by subtracting the Measured Frequency from the Nominal Frequency (13.560 MHz).

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
Frequency tolerance ± 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 applicable	N/a
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applicable	N/a
Biconical Antenna	Schwarzbeck	BBA 9106	-	3680	29 Mar 2024	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	1 June 2023	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-112	EMC4025	25 Mar 2024	3 years
Loop Antenna	EMCO	6502	9003-2485	3798	12 Feb 2024	3 years
Mains Network	R & S	ESH2-Z5	881362/032	3628	17 May 2024	2 years
Receiver	R & S	ESHS 10	828404/005	3728	23 Nov 2023	2 year
Receiver	R & S	ESIB 40	100295	INV0818	03 Jun 2023	2 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable	N/a
VHF Balun	Schwarzbeck	VHA 9103	9594	3696	29 Mar 2024	3 years
Heliax cable	Andrews	L6PNM-RPD	22869	Oats Cable	30 Dec 2023	1 year
Power Supply	APT	7008	4170003	-	Not applicable	N/a
Thermal chamber	Contherm	M180F	86025	N/a	Not applicable	N/a
Thermometer	DSIR	RT200	35	EMC4029	9 April 2024	5 years
Voltage Variac	Powerteck	SRV-5	RFS3800	-	Not applicable	N/a

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd designation as a FCC Accredited Laboratory by International Accreditation New Zealand, designation number: NZ0002 under the APEC TEL MRA.

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.

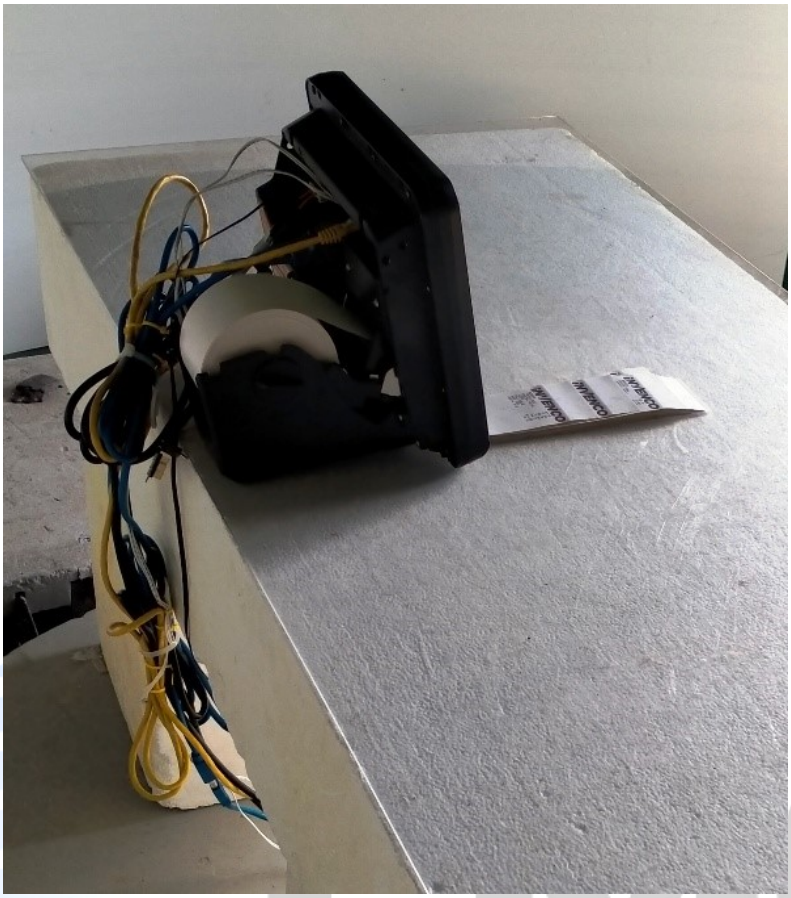
International Accreditation New Zealand has International Laboratory Accreditation Council (ILAC) Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies.

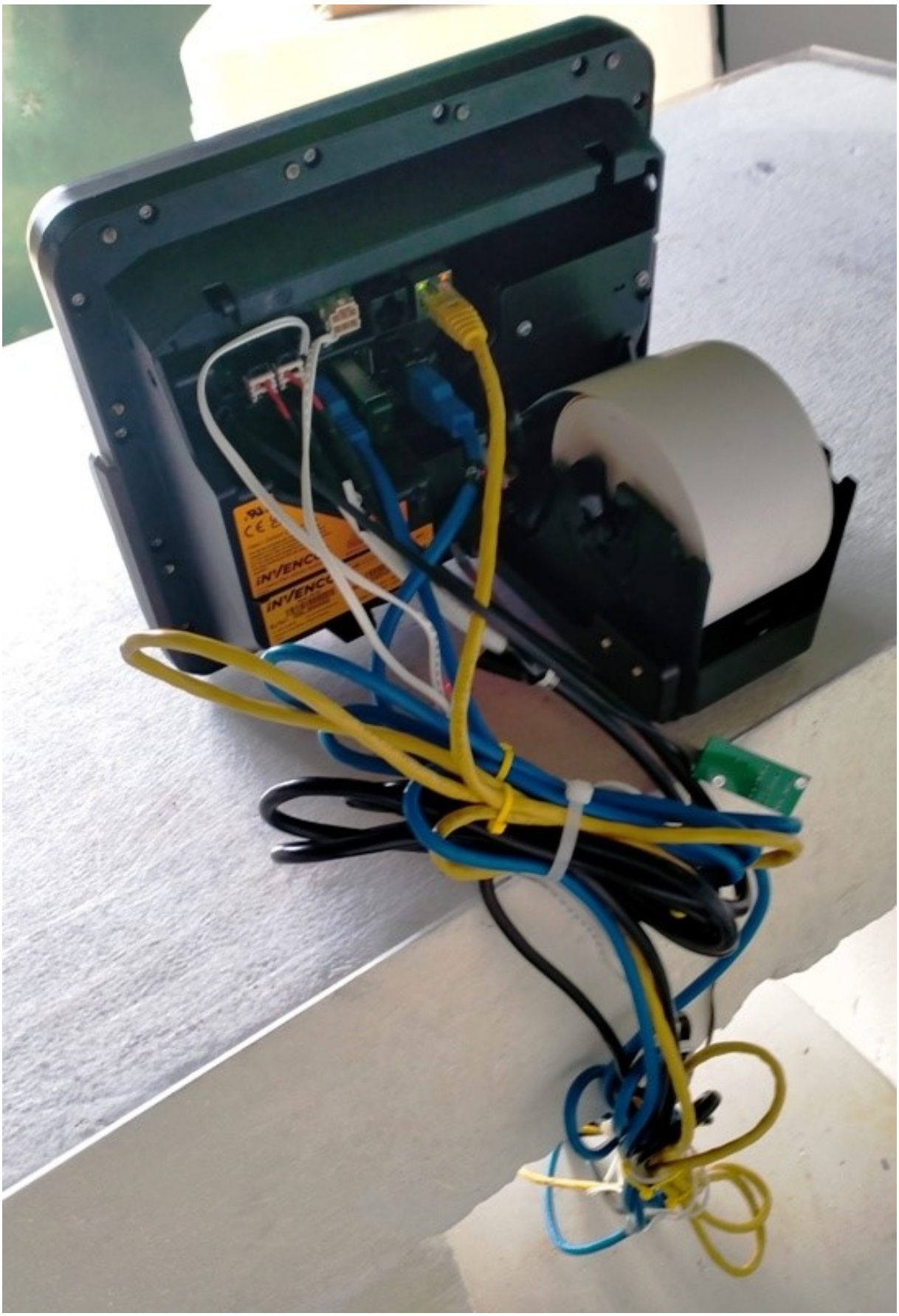
This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden).

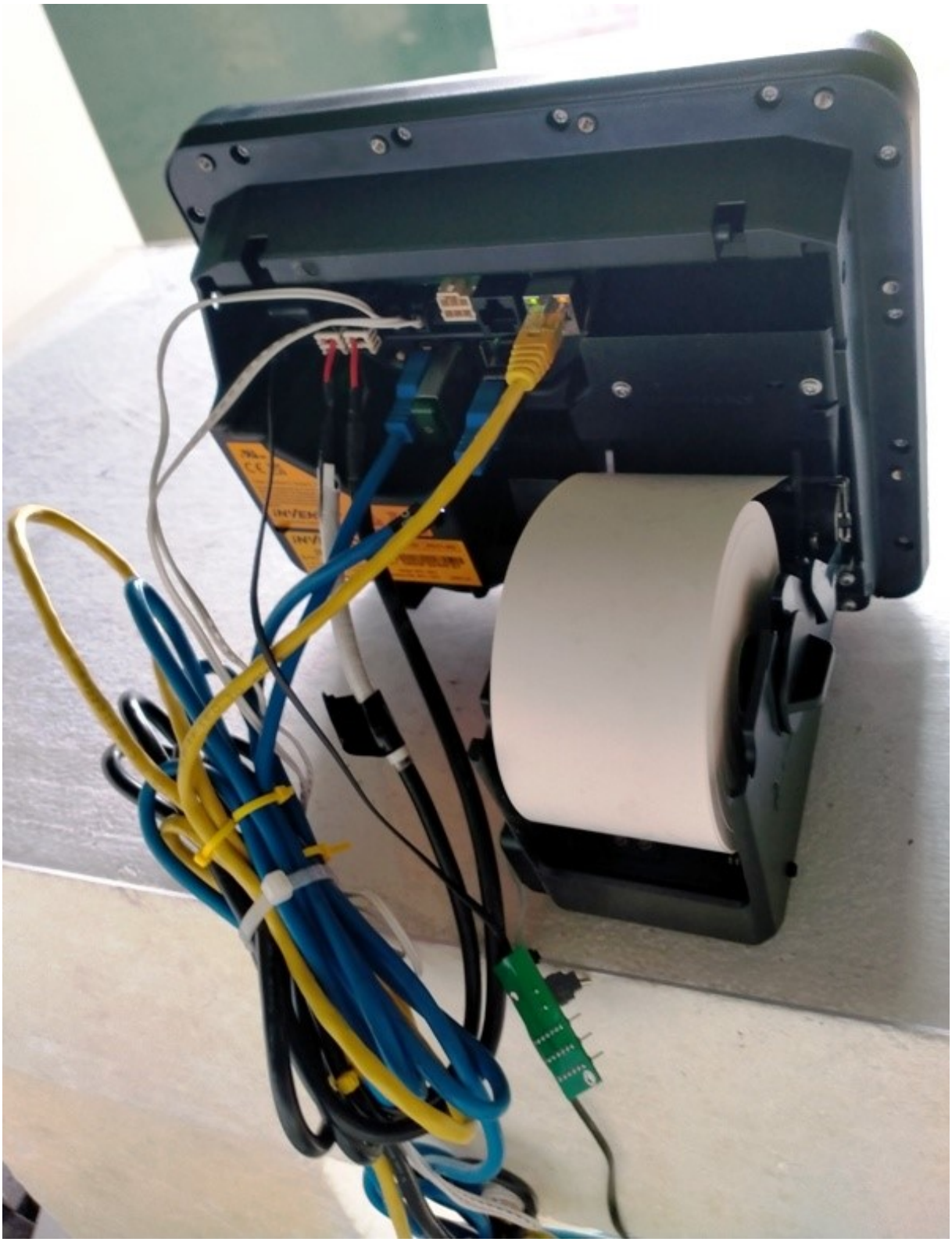
Further details can be supplied on request.

9. PHOTOGRAPHS

Radiated Emissions Test Set Up







Conducted Emissions Test Set Up