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TEST REPORT

ICT PRX-TSEC-DF
Multi Technology RFID Reader

tested to

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

Integrated Control Technology Ltd

This Test Report is issued with the authority of:

Andrew Cutler - General Manager

IANZ ACCREDITED LABORATORY

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

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1. STATEMENT OF COMPLIANCE

The **ICT PRX-TSEC-DF Multi Technology RFID Reader** complies with FCC Part 15 Subpart C Section 15.225 as an Intentional Radiator when the methods as described in ANSI C63.13 - 2013 are applied.

2. RESULTS SUMMARY

The results from testing carried out in January and February 2017 are detailed in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required.
15.203	Antenna requirement	Complies. Antennas 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 13.562 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.

4. CLIENT INFORMATION

Company Name	Integrated Control Technology Ltd
Address	4 John Glenn Ave Albany
City	Auckland 0632.
Country	New Zealand
Contact	Mr Stephen Hayes

5. DESCRIPTION OF TEST SAMPLE

Brand Name	ICT
Model Number Tested	PRX - TSEC-DF
Product	Multi Technology RFID Reader
Manufacturer	Integrated Control Technology Ltd
Country of Origin	New Zealand
Serial Number	AANWOO
FCC ID	UAUTSEC13560KHZ

The device tested is a RFID card reader that can be used with many different types of card reader protocols.

It 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 C63.13 - 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 an internal antenna for the 13.560 MHz transmitters.

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.

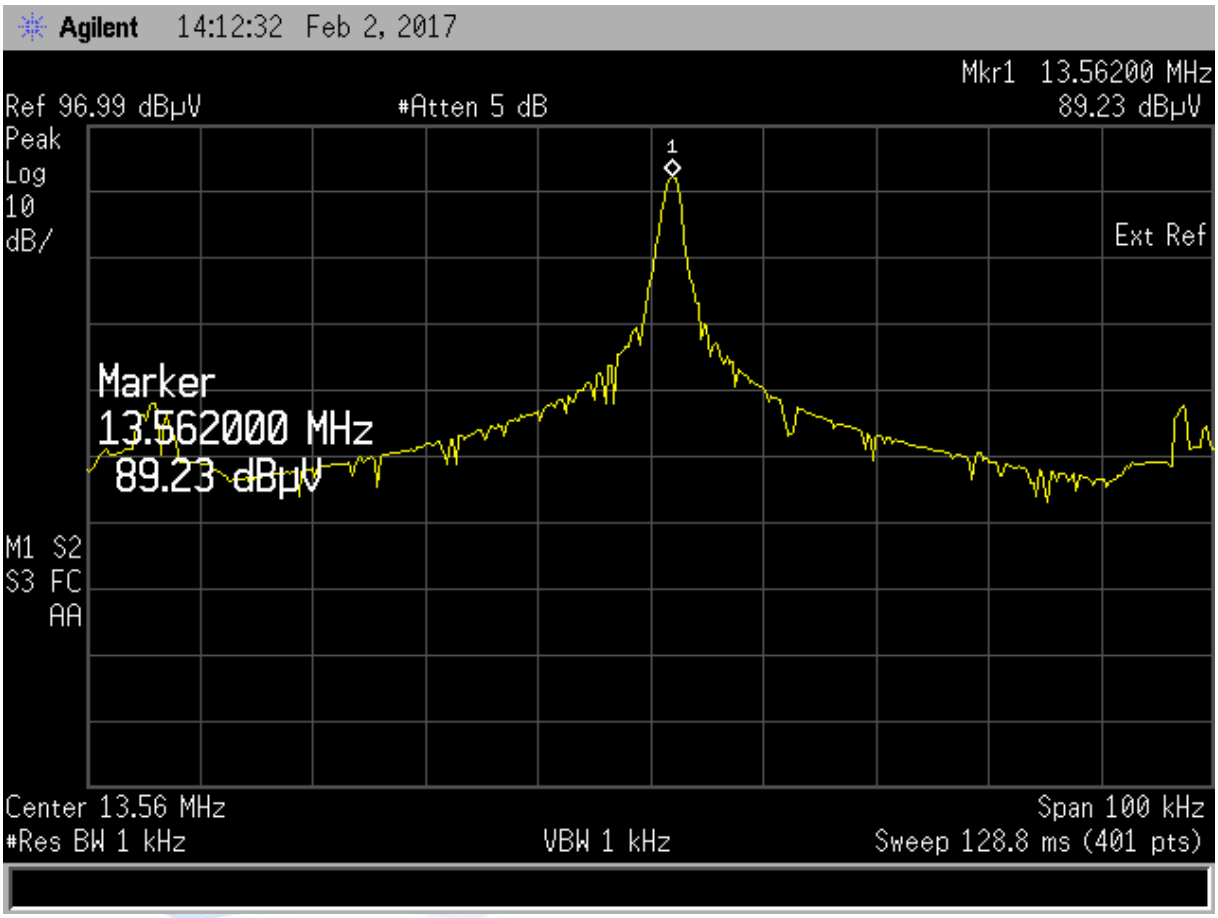
Result: Complies.

Section 15.205: Restricted bands of operation

The device transmits on a nominal frequency of 13.560 MHz.

Device actually observed to have a centre frequency of 15.562 MHz

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



Result: Complies.

Section 15.207: 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 12 Vdc to the device in order to test it.

The device operates on 13.560 MHz.

Testing was carried out with the transmitter operating with a standard antenna attached.

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 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 Class B limits have been applied.

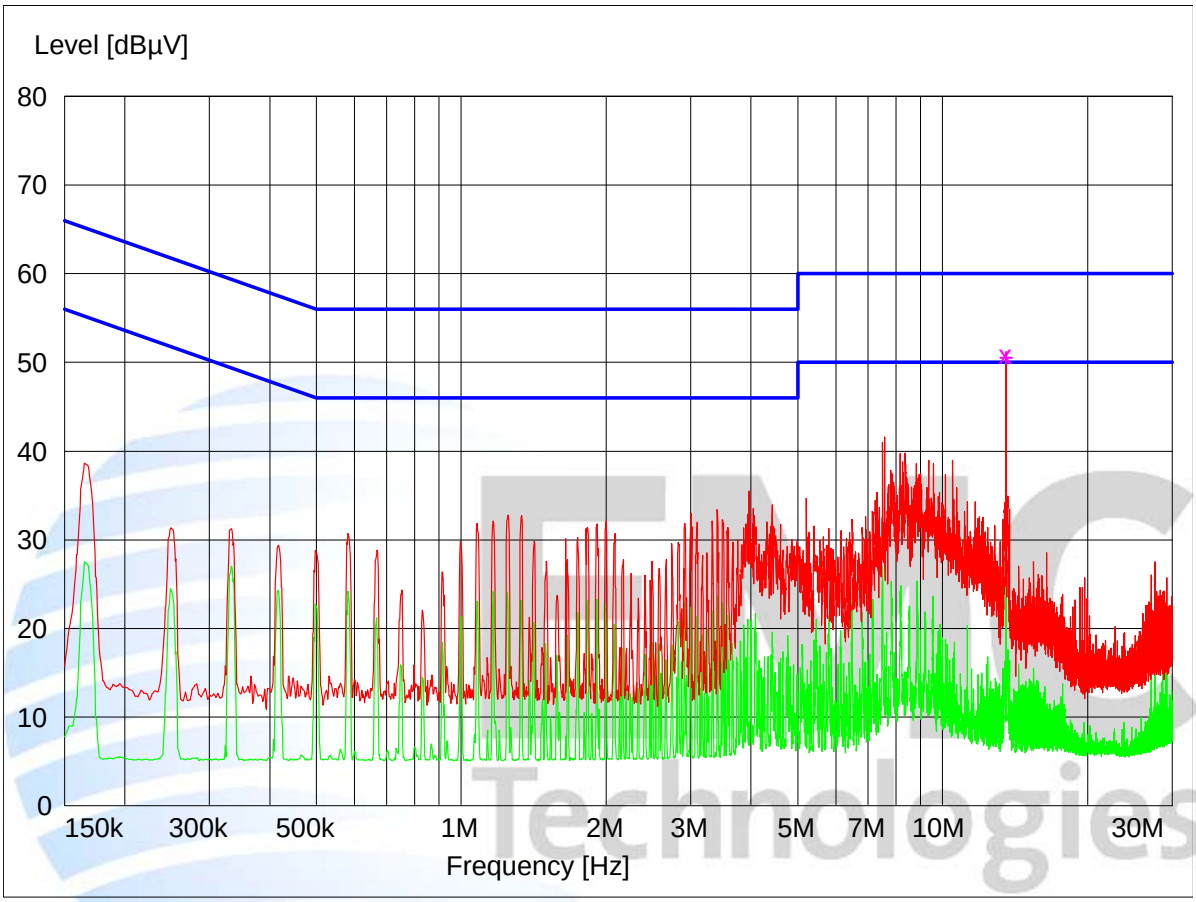
The supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC power supply.

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 transmitting continuously on 13.560 MHz when powered at 120 Vac 60 Hz using a representative 12 Vdc power supply when attached to a laptop computer running Hyperterminal when using a RS-485 to serial data convertor.



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560500	50.80	60.0	9.2	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560500	50.00	50.0	0.0	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 10 kHz to 1000 MHz as the highest frequency declared by the client is less than 108 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 using a representative AC power supply at 120 Vac 60 Hz that supplied 12.0 Vdc to the device under test.

Initial testing was carried out with the device being placed in the centre of the test table laying flat, standing vertically upright and when laying on an edge.

Final testing was carried out in the worst case orientation which was determined to be when it was standing vertically upright.

Attached to the device was a data interface board that supplied voltage to the device and allowed a serial interface to a laptop computer that was attached to the serial port on this interface board.

The device was transmitting continuously on 13.560 MHz with correct operation being confirmed periodically by placing various RFID cards in close proximity to the reader.

Correct operations were indicated by a beep.

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, where appropriate, using a quasi peak detector at a distance of 3 metres

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)

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 2000 MHz) ± 4.1 dB
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

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

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
27.120	10.0	48.6	38.6

Testing was carried out when the device was transmitting continuously.

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

A receiver with a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

The 30 metre limit between 1.705 MHz – 30 MHz 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.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: Spurious Emissions (above 30 MHz)

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

A receiver with a quasi peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz.

The limits as described in Section 15.209 have been applied.

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	BW
40.680	26.8		40.0	13.2	Quasi Peak	120 kHz
81.360	24.2		40.0	15.8	Quasi Peak	120 kHz
108.480	38.3	35.4	43.5	5.2	Quasi Peak	120 kHz
162.720		32.4	43.5	11.1	Quasi Peak	120 kHz
244.080		29.7	46.0	16.3	Quasi Peak	120 kHz
257.640	20.1		46.0	25.9	Quasi Peak	120 kHz
271.200	23.5	35.1	46.0	10.9	Quasi Peak	120 kHz
284.760		31.4	46.0	14.6	Quasi Peak	120 kHz
298.320		33.3	46.0	12.7	Quasi Peak	120 kHz
311.932	35.1	39.9	46.0	6.1	Quasi Peak	120 kHz
325.489	36.3	42.2	46.0	3.8	Quasi Peak	120 kHz
339.000	28.3	33.1	46.0	12.9	Quasi Peak	120 kHz
352.560	31.2	36.3	46.0	9.7	Quasi Peak	120 kHz
366.120	30.2		46.0	15.8	Quasi Peak	120 kHz
379.680		30.4	46.0	15.6	Quasi Peak	120 kHz
433.920	30.3		46.0	15.7	Quasi Peak	120 kHz
488.160	32.1		46.0	13.9	Quasi Peak	120 kHz
501.720	32.7		46.0	13.3	Quasi Peak	120 kHz
515.280	33.4	37.5	46.0	8.5	Quasi Peak	120 kHz
542.400	35.8	40.7	46.0	5.3	Quasi Peak	120 kHz
555.960		36.7	46.0	9.3	Quasi Peak	120 kHz
569.520	38.4	42.8	46.0	3.2	Quasi Peak	120 kHz
596.640	35.8	39.0	46.0	7.0	Quasi Peak	120 kHz
610.200		34.3	46.0	11.7	Quasi Peak	120 kHz
623.760	37.6	39.3	46.0	6.7	Quasi Peak	120 kHz
650.880	34.4	38.3	46.0	7.7	Quasi Peak	120 kHz
678.000	34.5	37.8	46.0	8.2	Quasi Peak	120 kHz
732.240	33.7		46.0	12.3	Quasi Peak	120 kHz

All other emissions observed had a margin to the limit that exceeded 20 dB when measurements were attempted over the range of 30 – 1000 MHz using both vertical and horizontal polarisations.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 MHz – 1000 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.

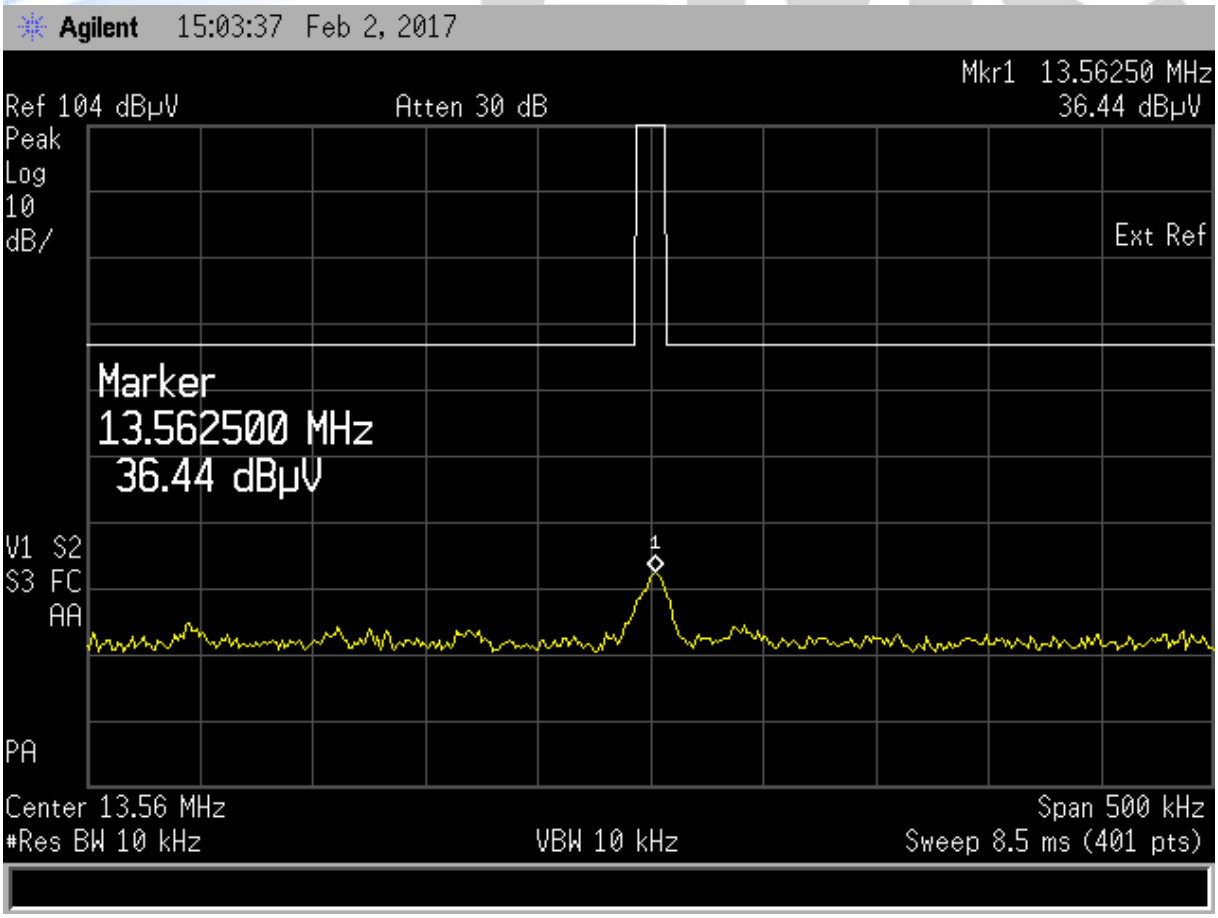
Applying the extrapolation factor of 40 dB/ per decade, the limit is 103.1 dBuV/m.

Testing was also carried out to determine whether a variation in the supply voltage would cause a significant change in field strength with the 120 Vac supply being varied by +/- 15% between 102 Vac and 138 Vac however no variation was observed as detailed below.

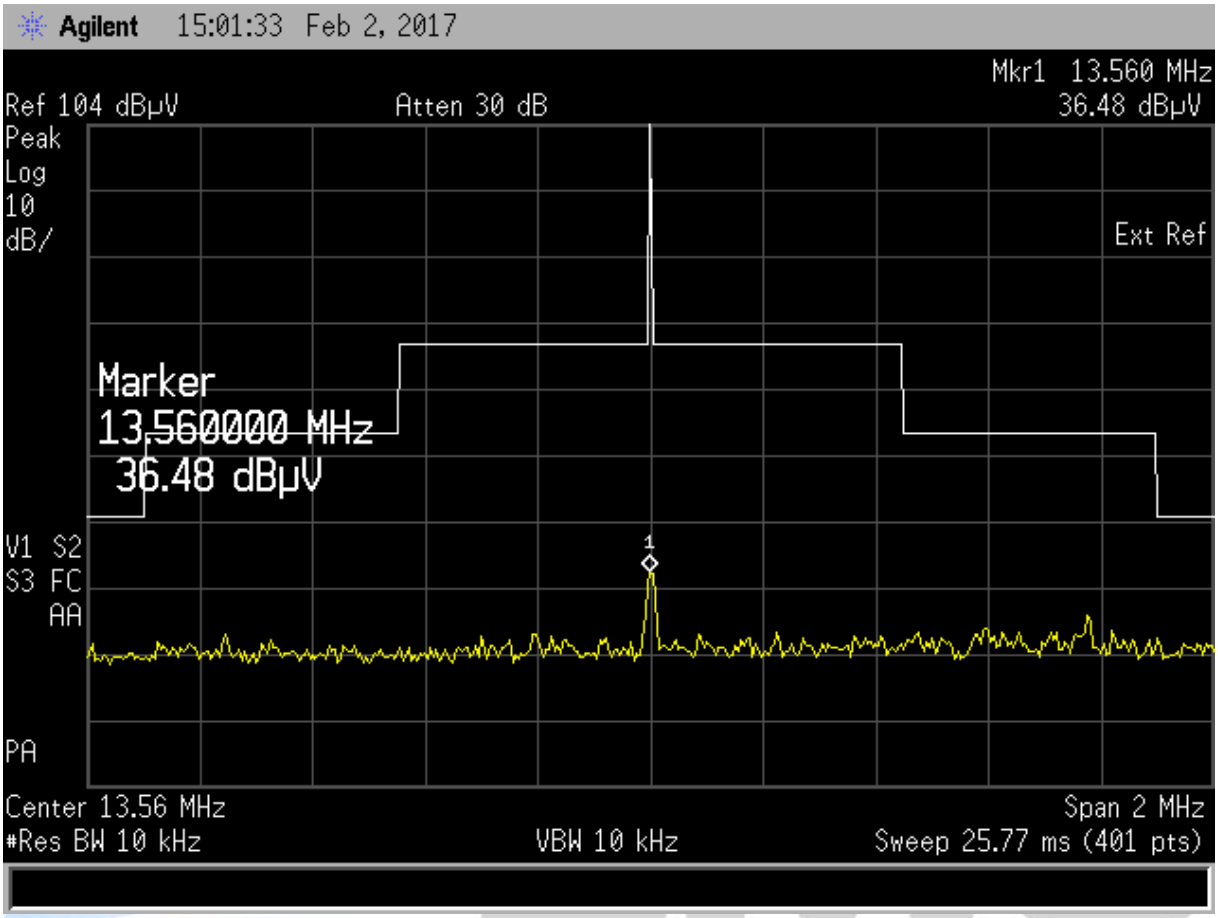
Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
102.0	13.560	36.1	103.1	67.0
120.0	13.560	36.1	103.1	67.0
138.0	13.560	36.1	103.1	67.0

Representative spectrum analyser plots show the carrier and modulation peaks within +/- 250 kHz and +/- 1 MHz of the carrier.

+/- 250 kHz



+/- 1 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 and +50 degrees.

The device operates nominally on 13.562 MHz which gives a frequency tolerance of +/- 1,356.2 Hz.

Temperature (°C)	Frequency (MHz)	Difference (Hz)
50.0	13.561 950	-50
40.0	13.561 925	-75
30.0	13.561 950	-50
20.0	13.561 950	-50
10.0	13.561 975	-25
0.0	13.561 975	-25
-10.0	13.562 025	+25
-20.0	13.562 050	+50

The device normally operates on 12 Vdc.

The DC supply was varied by +/- 15% at an ambient temperature of 20 degrees.

Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
10.2	13.561 950	-50
12.0	13.561 950	-50
13.8	13.561 950	-50

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 applic	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic	Not applic
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic	Not applic
Loop Antenna	EMCO	6502	9003-2485	3798	4 July 2017	3 years
VHF Balun	Schwarzbeck	VHA 9103	9594	3696	3 Feb 2018	3 years
Biconical Antenna	Schwarzbeck	BBA 9106	-	3680	3 Feb 2018	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	1 Dec 2017	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	4 June 2017	3 years
Mains Network	R & S	ESH2-Z5	881362/001	3805	4 August 17	2 years
Receiver	R & S	ESHS 10	828404/005	3728	9 June 2018	2 years
Receiver	R & S	ESIB 40	100171	EMC4003	15 Feb 2017	1 year

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 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.

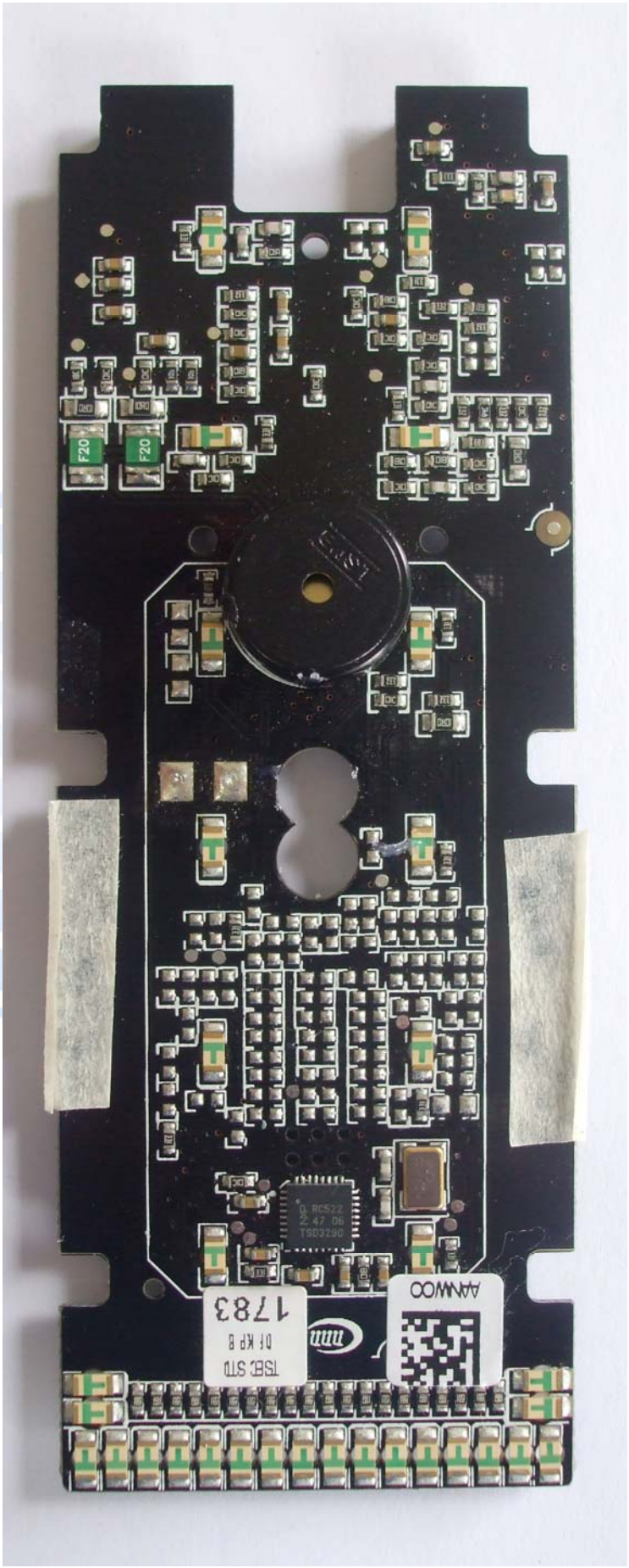
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

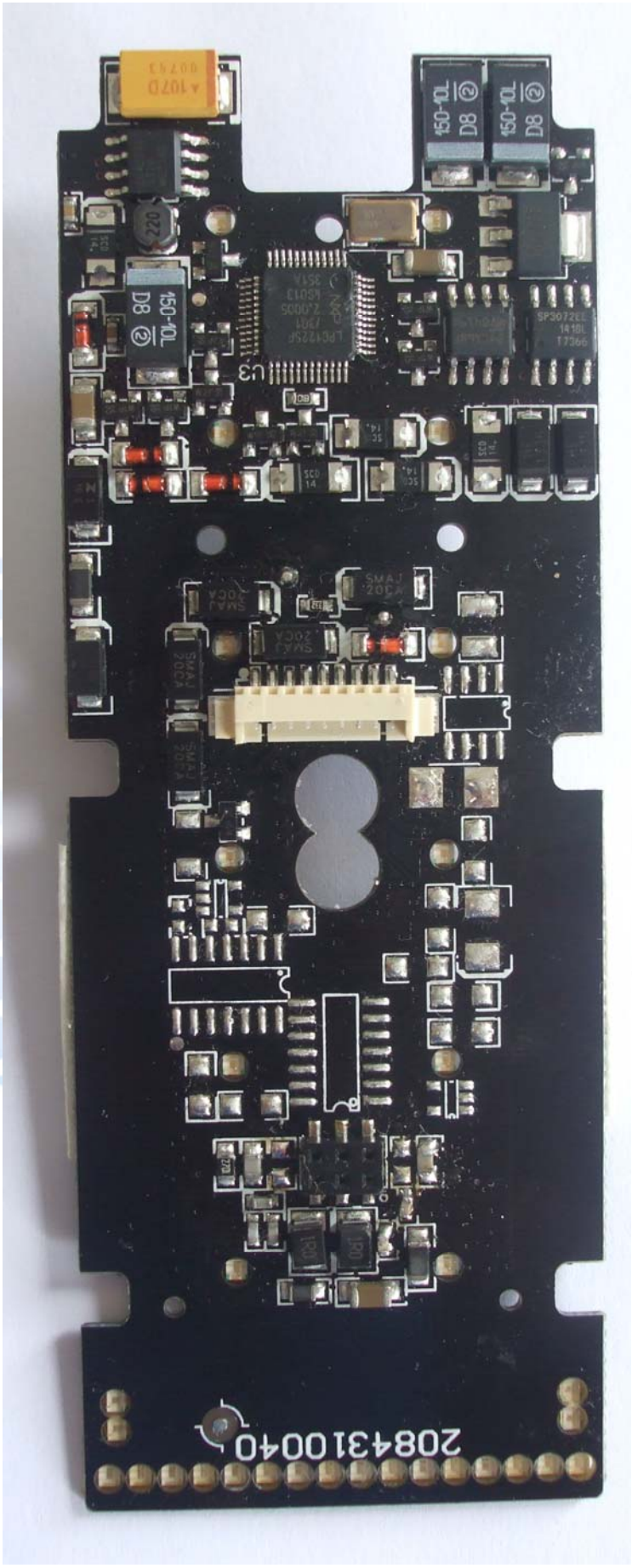
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

9. PHOTOGRAPHS

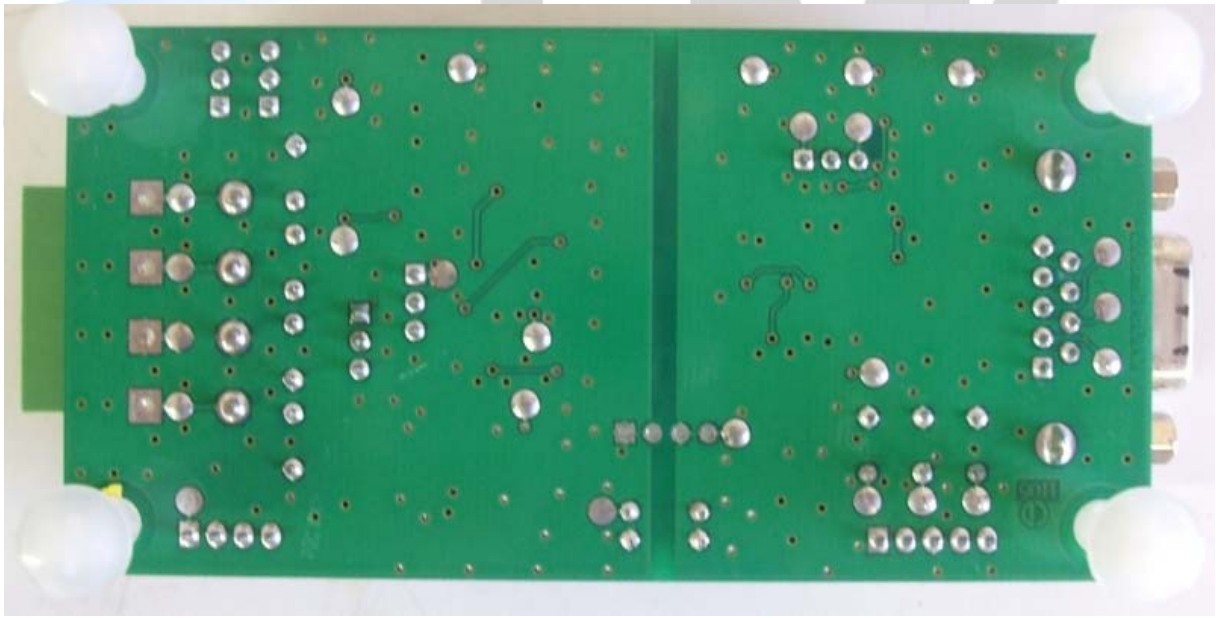
External View Device Under Test

Internal Views

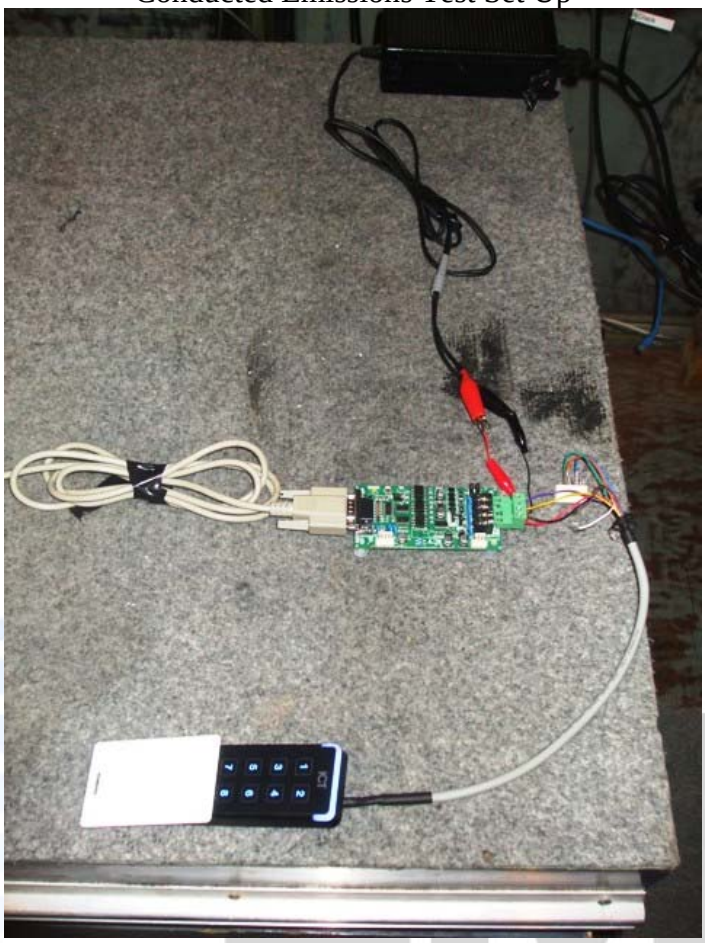


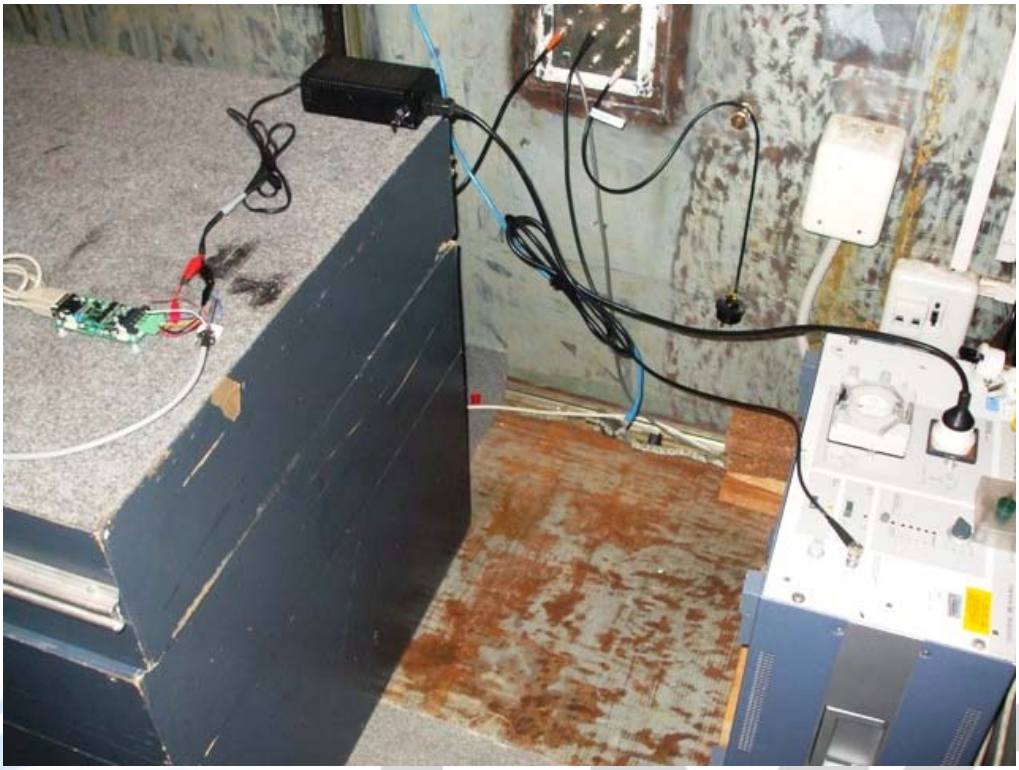


Peripheral device external and internal view



Conducted Emissions Test Set Up





Radiated Emissions Test Set Up