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TEST REPORT

**DPS SCR200E-VM-W3G
Secure Vending 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

Direct Payment Solutions Ltd

A handwritten signature in blue ink that reads "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

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1. STATEMENT OF COMPLIANCE

The **DPS SCR200E-VM-W3G Secure Vending Reader** complies with FCC Part 15 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 from testing carried out in August and September 2015 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 13.560 MHz with an occupied bandwidth of 5 kHz
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.

4. CLIENT INFORMATION

Company Name	Direct Payment Solutions Ltd
Address	PO Box 8400
City	Auckland 1150
Country	New Zealand
Contact	Mr Ameer Ivoghlian

5. DESCRIPTION OF TEST SAMPLE

Brand Name	DPS
Model Number	SCR200E-VM-W3G
Product	Secure Vending Reader
Manufacturer	Direct Payment Solutions (DPS) Ltd
Country of Origin	New Zealand
Serial Number	1615210001
FCC ID:	2AC2O-SCR200E-VM

The device tested is a contactless card reader that is used with for financial transactions from credit cards that operates on 13.560 MHz.

The device also contains WiFi and Cellular transmitters that have modular approval and were not specifically tested for.

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: 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 transmitter.

Result: Complies.

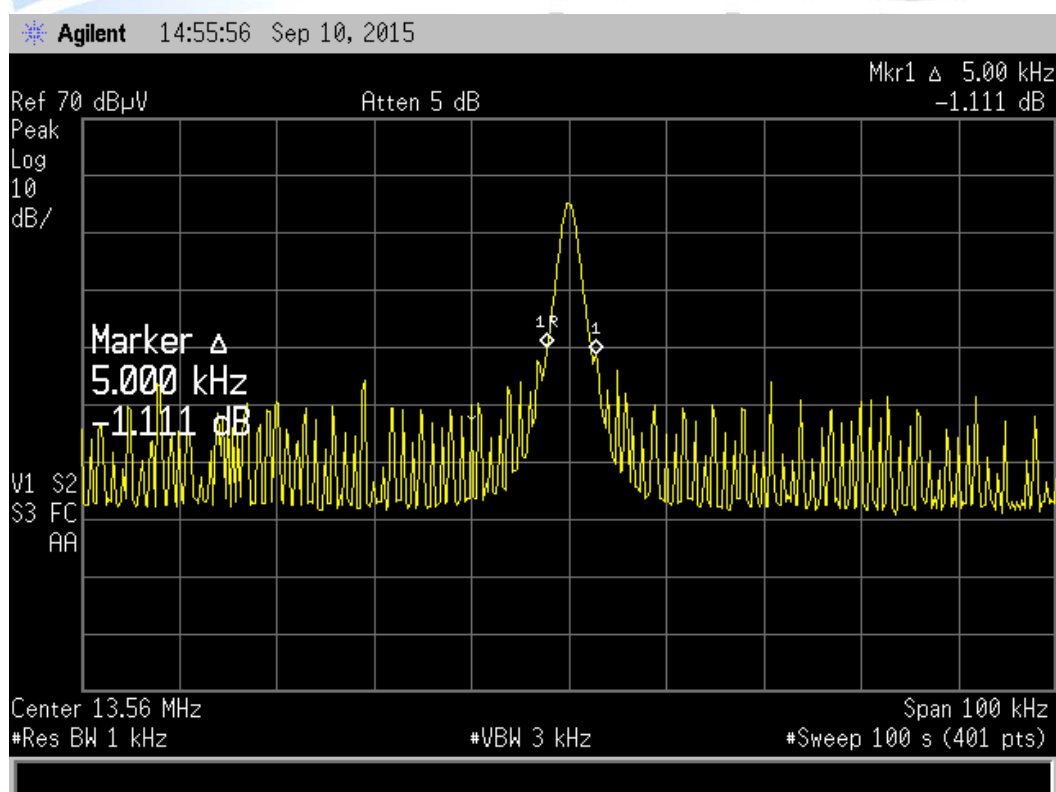
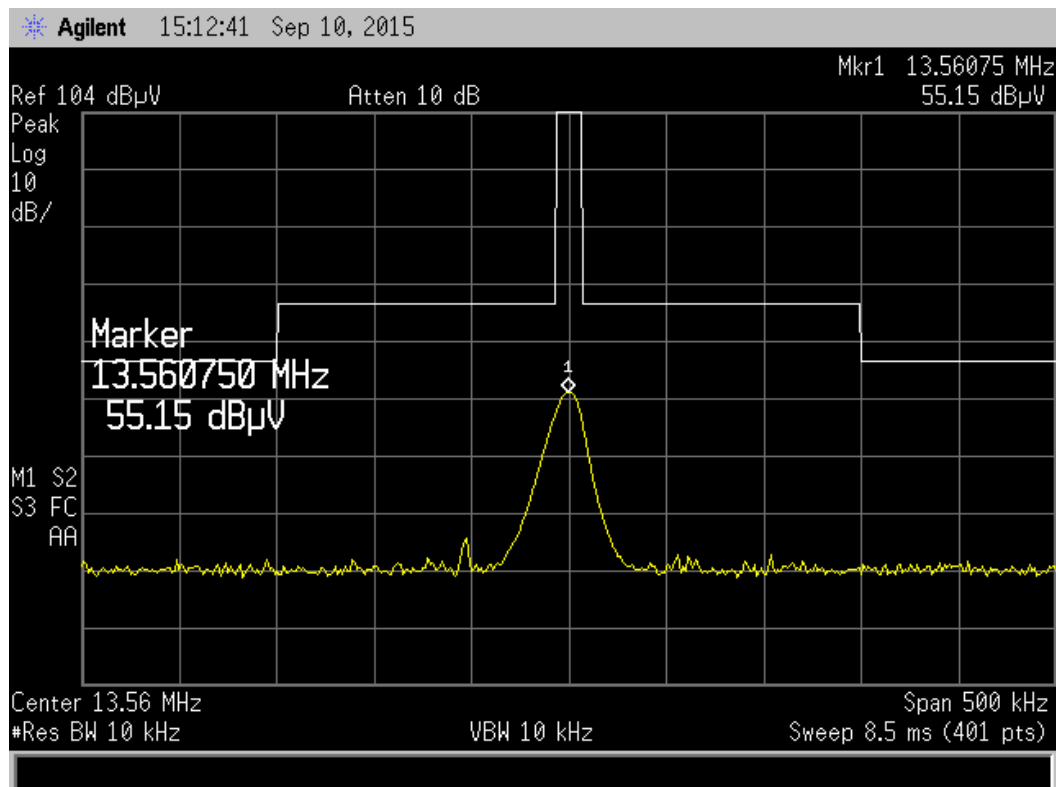
Section 15.204: External radio frequency power amplifiers and antenna modifications

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

Result: Complies.

Section 15.205: Restricted bands of operation

The transmitter has been measured to nominally transmit on 13.560 MHz and would fall into the 13.110 – 14.010 MHz band that is covered by Section 15.225.



The device can be seen to have a 99% power bandwidth of 5.750 kHz

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.

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.

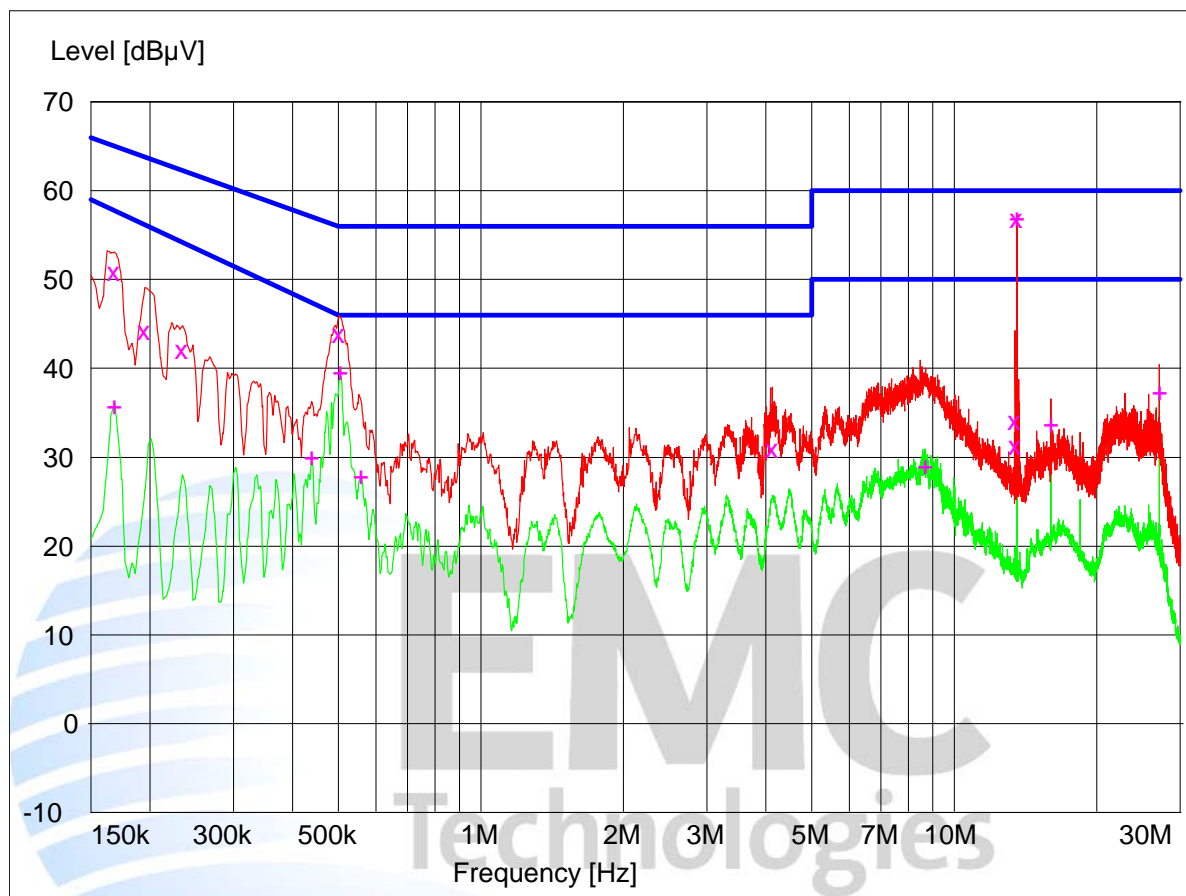
Measurement uncertainty with a confidence interval of 95% is:

- AC Mains port (0.15-30 MHz) ± 2.8 dB

Conducted Emissions – AC Input Power Port

Setup: Device tested when powered at 120 Vac 60 Hz while reading a card continuously using a 13.560 MHz card reader

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.168000	50.90	65.1	14.2	N	
0.195000	44.30	63.9	19.6	N	
0.234000	42.10	62.3	20.2	N	
0.501000	44.00	56.0	12.0	N	
4.128500	31.00	56.0	25.0	L1	
13.452500	34.20	60.0	25.8	N	
13.461500	31.30	60.0	28.7	N	
13.560500	56.90	60.0	3.1	L1	

Final Average Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.168000	35.80	55.1	19.3	N	
0.438000	30.10	47.1	17.0	L1	
0.504000	39.70	46.0	6.3	N	
0.558000	27.90	46.0	18.1	L1	
8.664500	29.10	50.0	20.9	L1	
13.560500	57.00	50.0	-7.0	L1	
15.999500	33.80	50.0	16.2	N	
27.123500	37.40	50.0	12.6	N	

Conducted Emissions – AC Input Power Port

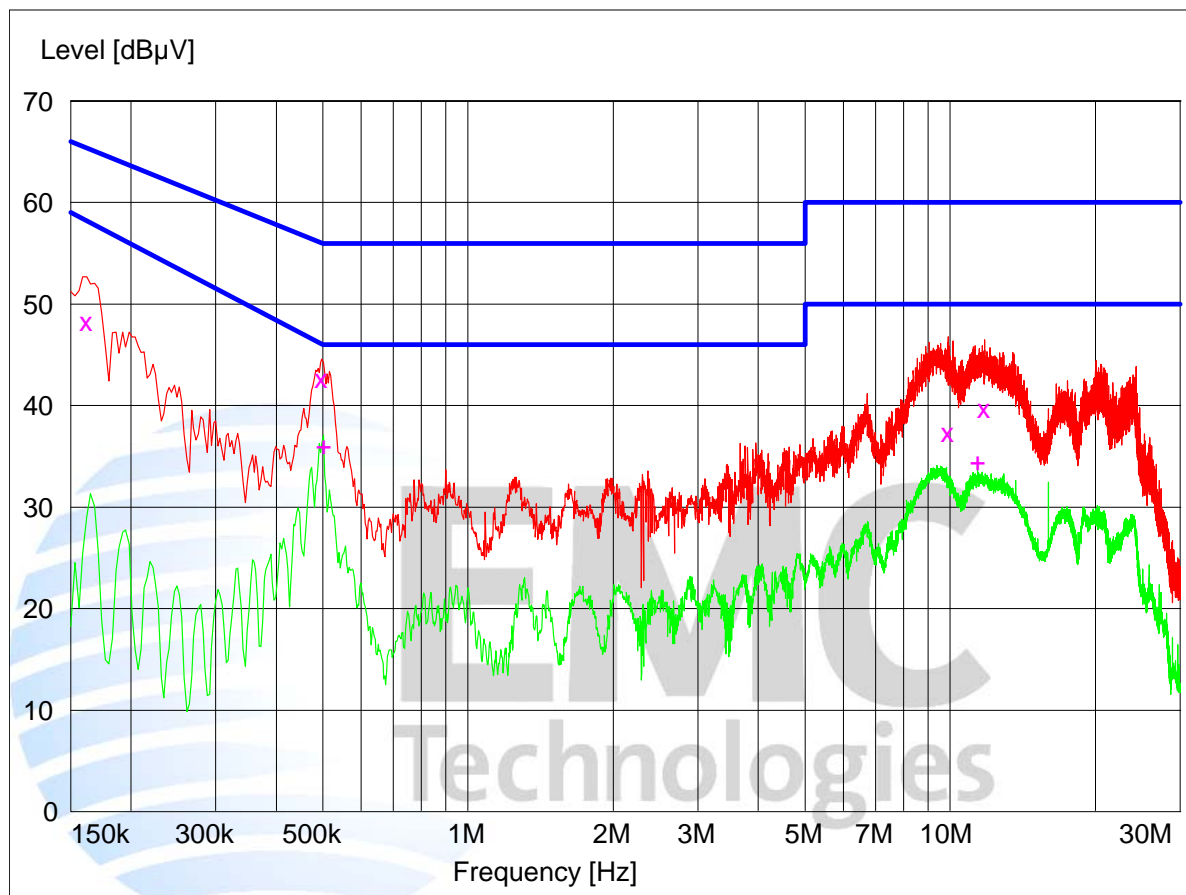
Setup: Device tested when powered at 120 Vac 60 Hz with the card reader operating on 13.560 MHz however the antenna was replaced with a resistive dummy load.

Peak ---

Average --

Quasi Peak X

Average +



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.162000	48.30	65.4	17.1	N	
0.498000	42.70	56.1	13.4	N	
9.911000	37.40	60.0	22.6	N	
11.787500	39.70	60.0	20.3	L1	

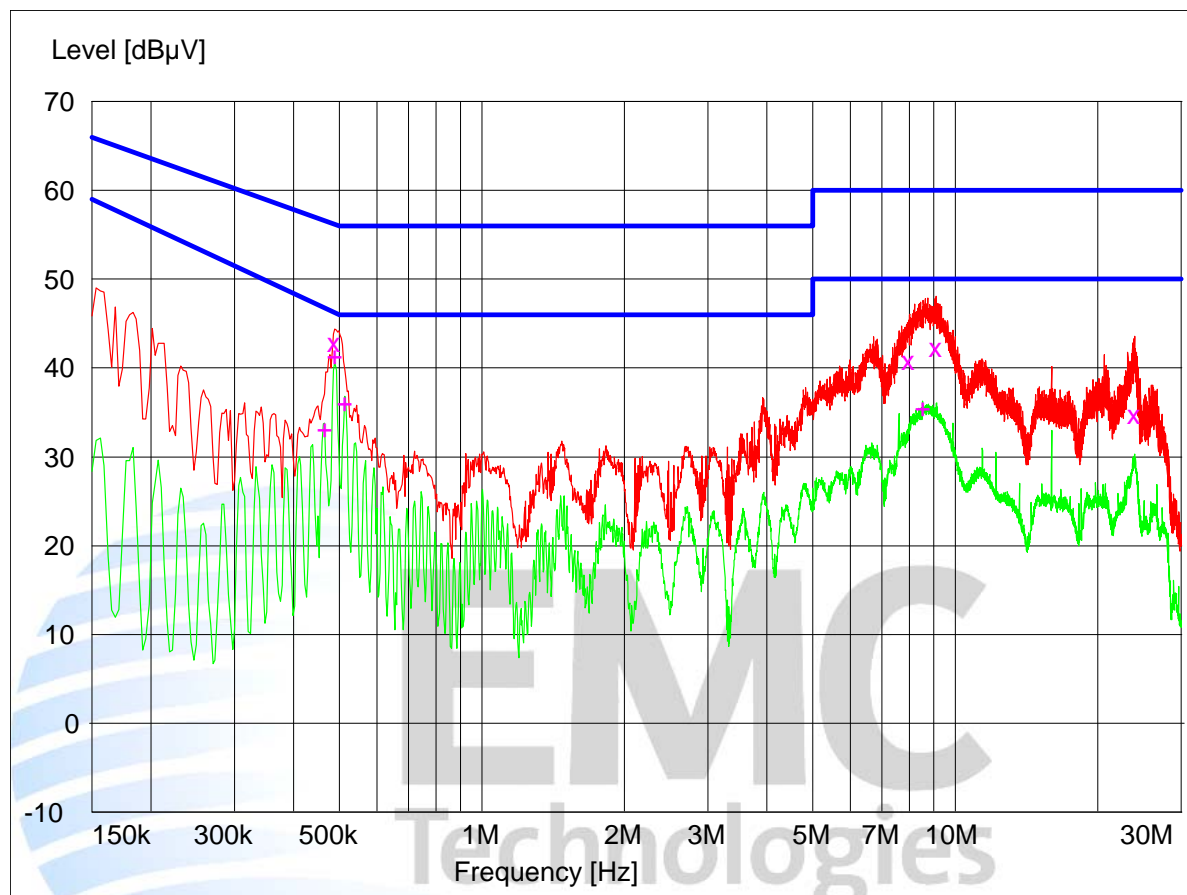
Final Average Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.501000	36.10	46.0	9.9	L1	
11.400500	34.50	50.0	15.5	L1	

Conducted Emissions – AC Input Power Port

Setup: Device tested when powered at 120 Vac 60 Hz with the card reader disabled.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.489000	42.90	56.1	13.2	N	
7.967000	40.90	60.0	19.1	L1	
9.119000	42.40	60.0	17.6	L1	
23.906000	34.80	60.0	25.2	N	

Final Average Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.465000	33.20	46.6	13.4	N	
0.489000	41.40	46.2	4.8	N	
0.513000	36.10	46.0	9.9	L1	
8.529500	35.60	50.0	14.4	L1	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 150 kHz to 1000 MHz.

The client has declared that the device operates using frequencies of 32.768 kHz, 8 MHz, 27.120 MHz, and 72 MHz.

The device also contains radio transmitting devices that operate on 13.560 MHz, 900 MHz and 2400 MHz.

As the device contains a device that operates in the 2.4 GHz measurements were attempted up to 24 GHz.

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand. This site conforms to the requirements of CISPR 16 and ANSI C63.4 - 2003.

Testing was carried out at 12.0 Vdc using a 120 Vac to 12 Vdc representative power supply.

The device was placed on the test table and was attached to a laptop computer using a USB to Serial convertor using a 1 metre long data cable.

Testing was carried out when transmitter under test was transmitting continuously on 13.560 MHz while interacting with the supplied card with a card read indication, along with a status indication relating to the WiFi and Cellular transmitter modules, being displayed on the laptop computer.

The WiFi and Cellular Transmitter modules were activated but were not specifically tested.

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.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations, where appropriate, using a quasi peak detector.

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: Spurious Emissions (below 30 MHz)

A receiver with an average detector and a peak detector using a 9 kHz bandwidth was used between 10 – 490 kHz and a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
27.120	13.1	49.5	36.4	Quasi Peak

Magnetic loop measurements were made a distance of 10 metres.

At each frequency the measurement antenna was further adjusted to give the highest field strength.

The 300 metre limit between 125 – 490 kHz was scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The 30 metre limit between 490 kHz – 30.0 MHz was scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The limit between 110 – 490 kHz was increased by 20 dB when the peak detector was used.

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

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 – 24000 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 and with a peak and average detector with a 1 MHz bandwidth was used between 1000 – 24000 MHz.

The limits as described in Section 15.209 have been applied.

Testing was carried out when the supplied card was being continuously read and the read data was displayed on the laptop computer.

Radio emissions

Frequency (MHz)	Vertical (dB μ V/m)	Horizontal (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	BW (kHz)
45.210	39.2		40.0	0.8	Quasi Peak	120
48.132	29.9		40.0	10.1	Quasi Peak	120
62.545	38.3		40.0	1.7	Quasi Peak	120
64.870	33.9	32.3	40.0	6.1	Quasi Peak	120
68.822	34.1		40.0	5.9	Quasi Peak	120
72.076	29.6		40.0	10.4	Quasi Peak	120
81.142	31.7		40.0	8.3	Quasi Peak	120
108.016	34.5		43.5	9.0	Quasi Peak	120
112.945	35.5	35.7	43.5	7.8	Quasi Peak	120
120.080	33.1	35.5	43.5	8.0	Quasi Peak	120
132.000		36.3	43.5	7.2	Quasi Peak	120
144.000		35.5	43.5	8.0	Quasi Peak	120
178.116		36.8	43.5	6.7	Quasi Peak	120
245.786	31.1	40.1	46.0	5.9	Quasi Peak	120
353.000	27.1		46.0	18.9	Quasi Peak	120
428.975	30.6		46.0	15.4	Quasi Peak	120
473.040	30.3		46.0	15.7	Quasi Peak	120
491.200	34.4	37.7	46.0	8.3	Quasi Peak	120
560.950		29.1	46.0	16.9	Quasi Peak	120
582.960		38.7	46.0	7.3	Quasi Peak	120
605.015		34.8	46.0	11.2	Quasi Peak	120
913.031		37.7	46.0	8.3	Quasi Peak	120

Other emissions

Frequency (MHz)	Vertical (dB μ V/m)	Horizontal (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	BW (kHz)
40.680	38.3	32.7	40.0	1.7	Quasi Peak	120
54.240	27.9		40.0	12.1	Quasi Peak	120
67.800	33.3	31.4	40.0	6.7	Quasi Peak	120
81.360	33.1		40.0	6.9	Quasi Peak	120
94.920	< 33		43.5	> 10	Quasi Peak	120
108.480	31.3		43.5	12.2	Quasi Peak	120
122.040	29.5		43.5	14.0	Quasi Peak	120
135.600	26.3		43.5	17.2	Quasi Peak	120
149.160	25.4	34.2	43.5	9.3	Quasi Peak	120
162.720	22.8		43.5	20.7	Quasi Peak	120
176.280	26.1		43.5	17.4	Quasi Peak	120
189.840	26.5		43.5	17.0	Quasi Peak	120
203.400	29.3		43.5	14.2	Quasi Peak	120
216.960	29.1	33.8	46.0	12.2	Quasi Peak	120
230.520		25.8	46.0	20.2	Quasi Peak	120
244.080		35.1	46.0	10.9	Quasi Peak	120
352.560	29.9		46.0	16.1	Quasi Peak	120
406.800	24.6		46.0	21.4	Quasi Peak	120
433.920	27.3		46.0	18.7	Quasi Peak	120
583.080		38.7	46.0	7.3	Quasi Peak	120

All other emissions observed had a margin to the limit that exceeded 20 dB when measurements were attempted over the range of 30 – 24000 MHz using both vertical and horizontal polarisations.

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 MHz – 24000 MHz) \pm 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 104.0 dBuV/m.

Testing was also carried out to determine whether a variation in the supply voltage would cause a significant change in field strength.

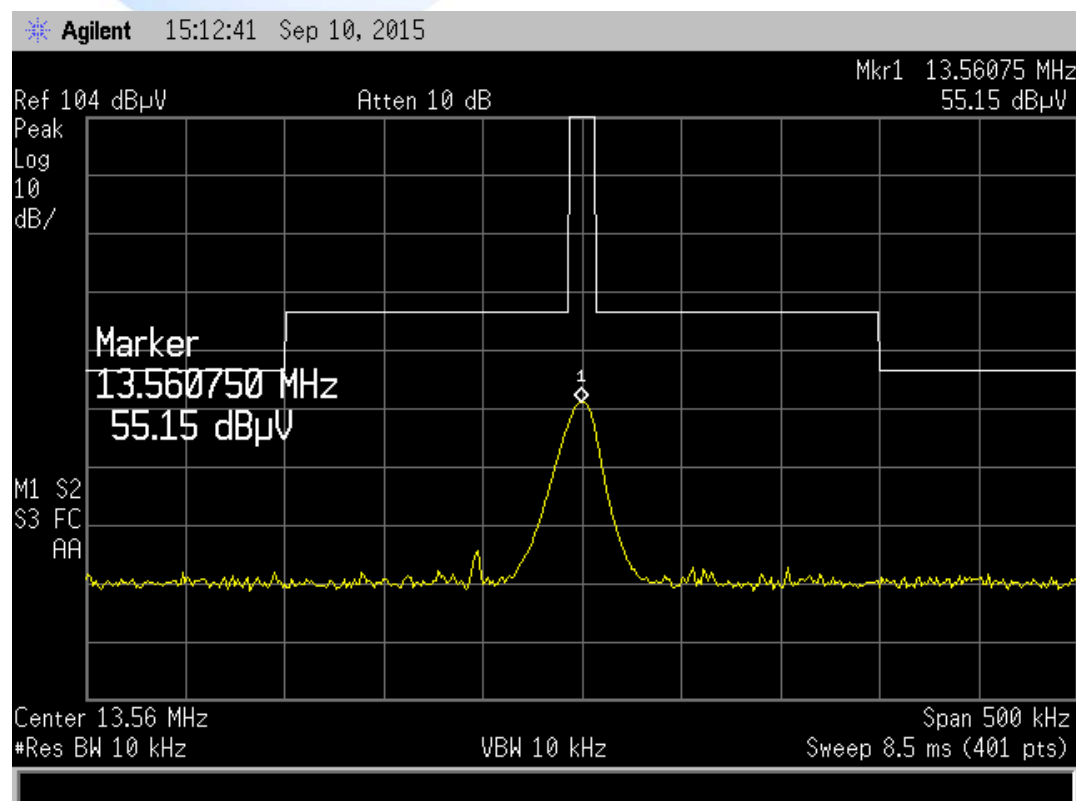
The device will normally operate at 12 Vdc from a 120 Vac supply.

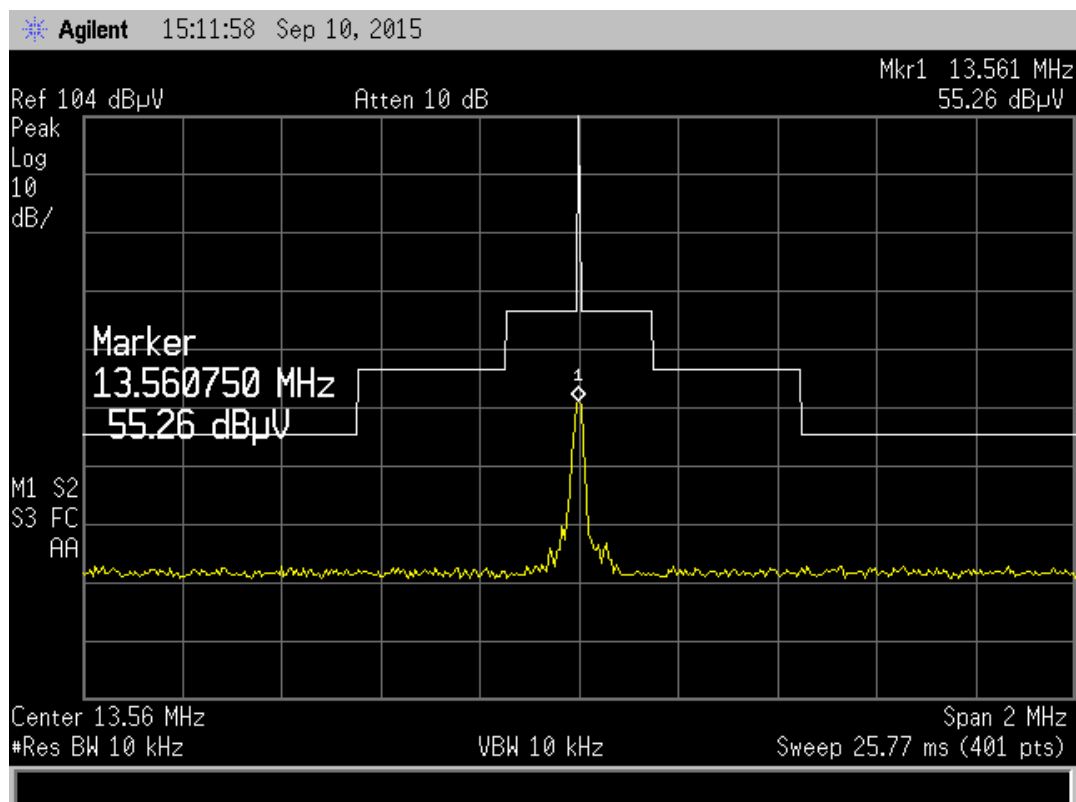
Testing was carried out at 12 Vdc as a +/- 15 % variation of the 120 Vac supply voltage to the representative power supply caused no variation to the 12 Vdc supply voltage to the device.

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

Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Distance (m)
10.2	13.560	55.1	104.0	48.9	Quasi Peak	10.0
12.0	13.560	55.1	104.0	48.9	Quasi Peak	10.0
13.8	13.560	55.1	104.0	48.9	Quasi Peak	10.0

A representative spectrum analyser plot shows that the carrier and modulation peaks within +/- 100 kHz and +/- 1 MHz of the carrier.





Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests $(100 \text{ kHz} - 30 \text{ MHz}) \pm 4.8 \text{ dB}$

Section 15.225: Frequency tolerance:

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

The device operates nominally on 13.560 MHz which gives a frequency tolerance of $\pm 1,356$ Hz.

Temperature (°C)	Frequency (MHz)	Difference (Hz)
-20.0	13.560 865	+895
-10.0	13.560 822	+822
0.0	13.560 790	+790
10.0	13.560 720	+720
20.0	13.560 712	+712
30.0	13.560 665	+665
40.0	13.560 630	+630
50.0	13.560 595	+595

The device will normally operate at 12 Vdc from a 120 Vac supply.

Testing was carried out at 12 Vdc as a $\pm 15\%$ variation of the 120 Vac supply voltage to the representative power supply caused no variation to the 12 Vdc supply voltage to the device.

The DC supply was varied by $\pm 15\%$ at an ambient temperature of 20 degrees.

Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
10.2	13.560 712	+712
12.0	13.560 712	+712
13.8	13.560 712	+712

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	Int
AC Supply	APT	7008	4170003	-	N/a	
AC Supply	APT	7008	4170003	-	N/a	-
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	N/a	-
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	N/a	-
Biconical	Schwarzbeck	BBA 9106	-	RFS 3697	3 Feb 2018	3 year
Horn Antenna	EMCO	3115	9511-4629	E1526	4 June 2017	3 years
Horn Antenna	EMCO	3116	92035	-	4 June 2017	3 year
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	1 Dec 2017	3 year
Loop Antenna	EMCO	6502	9003-2485	3798	4 July 2017	3 year
Mains Network	R & S	ESH2-Z5	881362/032	3628	2 Oct 2016	2 year
Receiver	R & S	ESHS 10	828404/005	3728	26 June 2016	2 year
Receiver	R & S	ESIB-40	100171	R-27-1	16 April 2016	1 year
Spec Analyser	Hewlett Packard	E7405A	US39150142	3771	7 Oct 2015	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	N/a	-
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3680	3 Feb 2018	3 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.

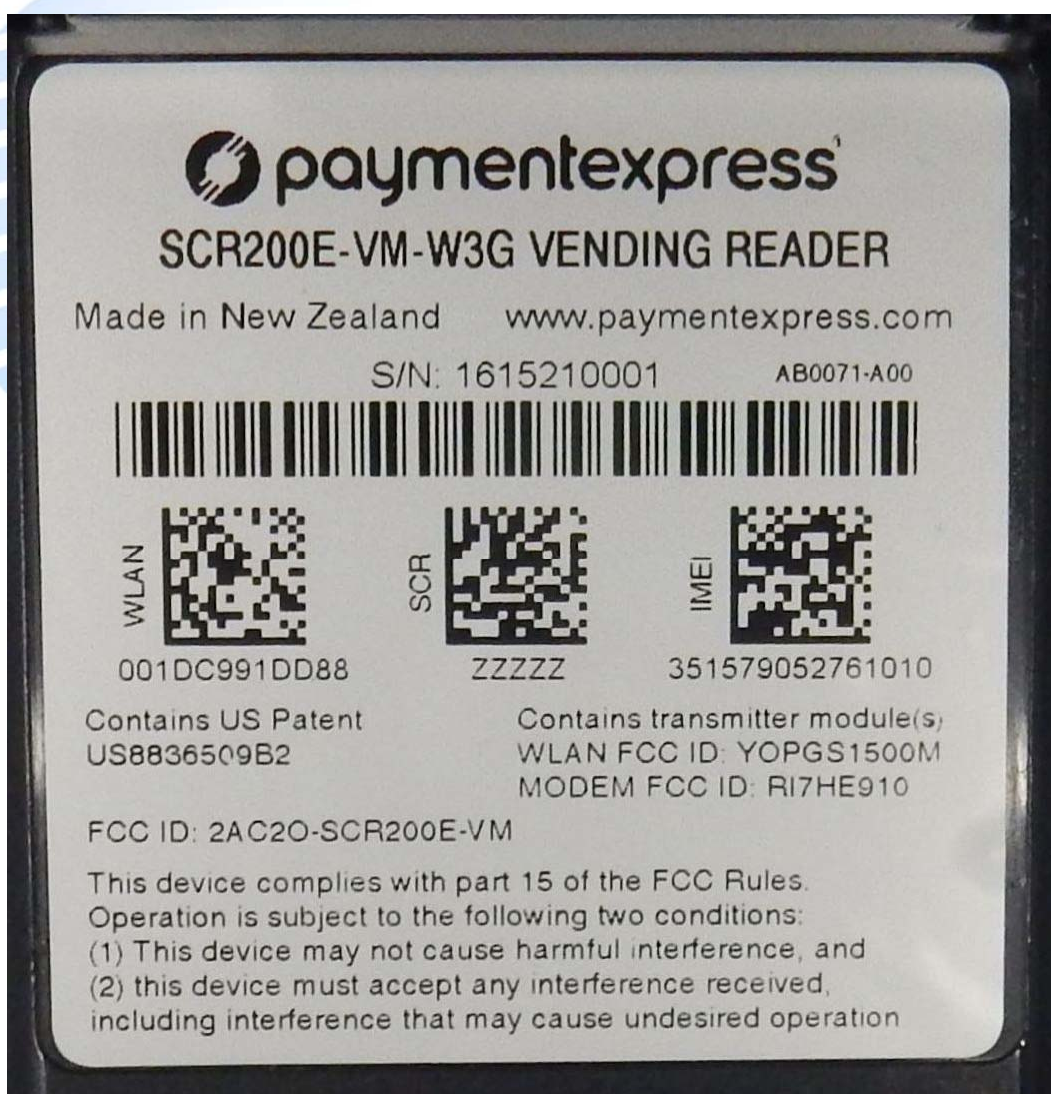
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

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

Labels



External Views











Radiated Emissions Test Set Up







Conducted Emissions Test Set Up





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Global Product Certification