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TEST REPORT

Payment Express CHU200M Release A
Handheld 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

Payment Express 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 **Payment Express CHU200M Release A Handheld 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 the testing carried out in September 2018 are summarised 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.

4. CLIENT INFORMATION

Company Name	Payment Express Ltd
Address	PO Box 8400 33 Wilkinson Rd Ellerslie
City	Auckland 1060
Country	New Zealand
Contact	Mr Jonathan Bradshaw

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Payment Express
Product	Handheld Payment Terminal
Model Number	CHU200M Release A
Manufacturer	Payment Express Ltd
Country of Origin	New Zealand
Serial Number	2618250007
FCC ID	2AC2O-CHU200M

The device tested is a handheld NFC card reader that operates on 13.560 MHz. This device can be used as a standalone or can also be connected to a laptop/ computer.

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.

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

The device gets powered via a 3m long cable connected to the USB port of the laptop computer. The conducted emissions measurements were done with the laptop computer powered at 120Vac, 60Hz.

The device has NFC (Near Field Communications) which operates at 13.560 MHz.

The NFC transmitter was connected to its antenna and was operating while periodically reading a card that was placed close to the device.

Then NFC transmitter was disconnected from its antenna and its output was terminated onto a dummy load.

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 in both the 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.

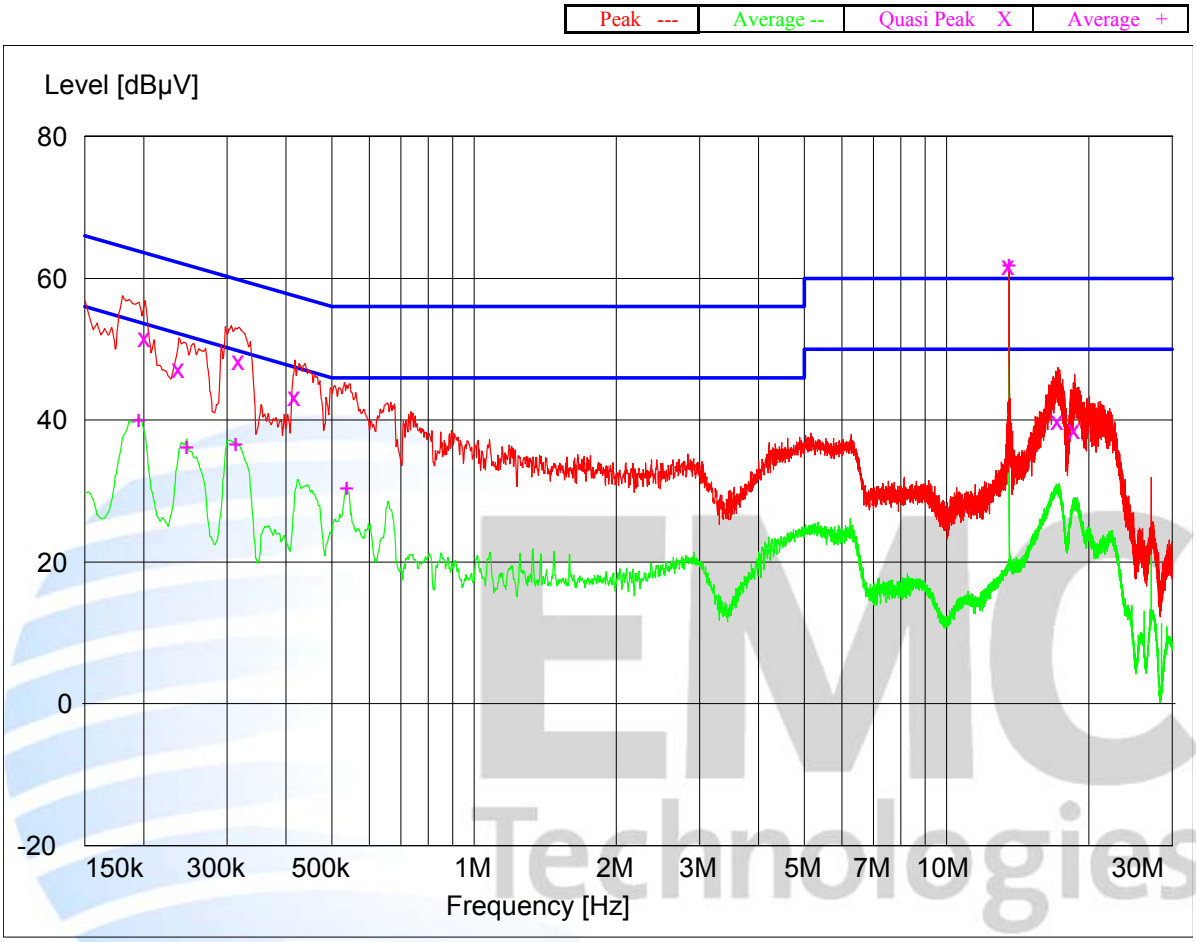
The supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC power supply.

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:	The card reader gets powered from a curly USB serial cable by the Laptop computer. The Laptop was powered from 120 Vac mains via AMN. The test was done with the product configured with NFC enabled continuously.



Final Quasi-Peak Measurements

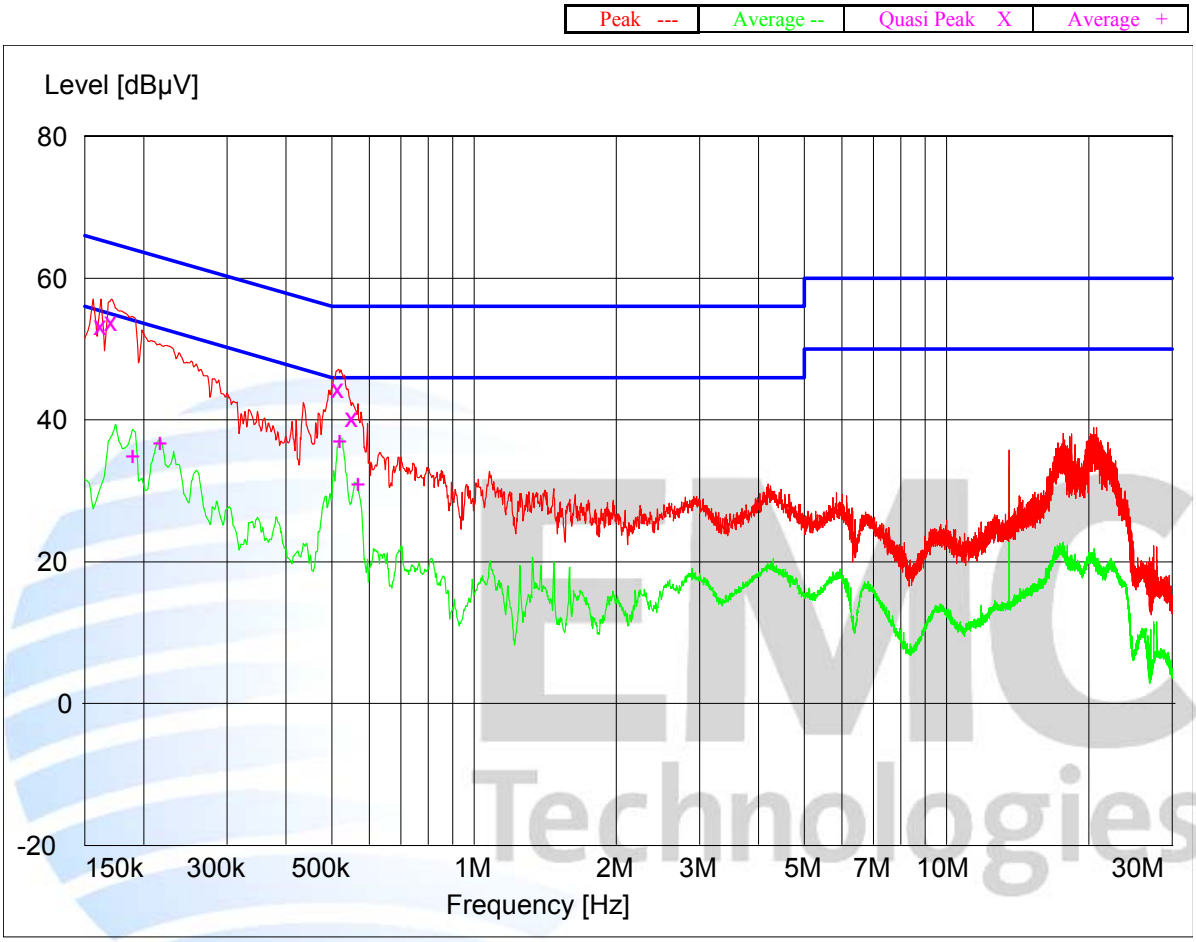
Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.201000	51.70	63.6	11.9	N	50.4
0.237000	47.30	62.2	14.9	L1	
0.318000	48.40	59.8	11.4	L1	
0.417000	43.30	57.5	14.2	N	
13.560500	61.70	60.0	-1.7	N	60.7
17.169500	39.90	60.0	20.1	N	
18.668000	38.70	60.0	21.3	L1	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.195000	39.90	53.9	14.0	N	
0.246000	36.20	51.9	15.7	N	
0.312000	36.50	49.9	13.4	L1	
0.537000	30.30	46.0	15.8	L1	
13.560500	61.70	50.0	-11.7	N	60.6

Conducted Emissions – AC Input Power Port

Setup:	The card reader gets powered from a curly USB serial cable by the Laptop computer. The Laptop was powered from 120 Vac mains via AMN. The test was done with the product configured with NFC enabled continuously. The antenna has been terminated onto a dummy load.



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.162000	53.30	65.4	12.1	N	54.0
0.171000	53.90	64.9	11.0	L1	
0.516000	44.50	56.0	11.5	N	
0.552000	40.30	56.0	15.7	N	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.189000	34.80	54.0	19.3	L1	
0.216000	36.70	53.0	16.3	L1	
0.519000	37.00	46.0	9.0	L1	37.2
0.567000	30.90	46.0	15.1	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 30 MHz to 1000 MHz as the device contains a 13.560 MHz NFC transceiver.

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

The device was attached to the USB port of a laptop computer using a 3m long cable.

A custom programme was run on the computer which exercised all operation aspects of the device.

The device was transmitting continuously on 13.560 MHz with a NFC card being placed close to the card reader which was periodically read by the card reader.

Correct operations were indicated by an indication on the computer screen.

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.

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

Receiver reading (dBµV/m) = Level (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 (100 kHz – 30 MHz) ± 4.8 dB
- Free radiation tests (30 – 1000 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	18.9	48.6	29.7	Pass

The device was transmitting continuously on 13.560 MHz with a NFC card being placed close to the card reader which was periodically read by the card reader.

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.

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 dBmV/m	Horizontal dBmV/m	Limit dBmV/m	Margin dB	Result	Antenna
40.680	28.3	32.4	40.0	7.6	Pass	Horizontal
67.800	16.0	29.0	40.0	11.0	Pass	Horizontal
122.040	25.6	24.9	43.5	17.9	Pass	Vertical
149.160	20.0	27.3	43.5	16.2	Pass	Horizontal
176.280	22.5	36.5	43.5	7.0	Pass	Horizontal
189.840	26.0	24.5	43.5	17.5	Pass	Vertical
203.400	19.4	31.0	43.5	12.5	Pass	Horizontal
257.000	26.0	30.8	46.0	15.2	Pass	Horizontal
311.222	28.0	25.6	46.0	18.0	Pass	Vertical

No further emissions were detected within 20 dB of the limit when the measurements were made between 30 - 1000 MHz using both vertical and horizontal polarisations.

Result: Complies.

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.

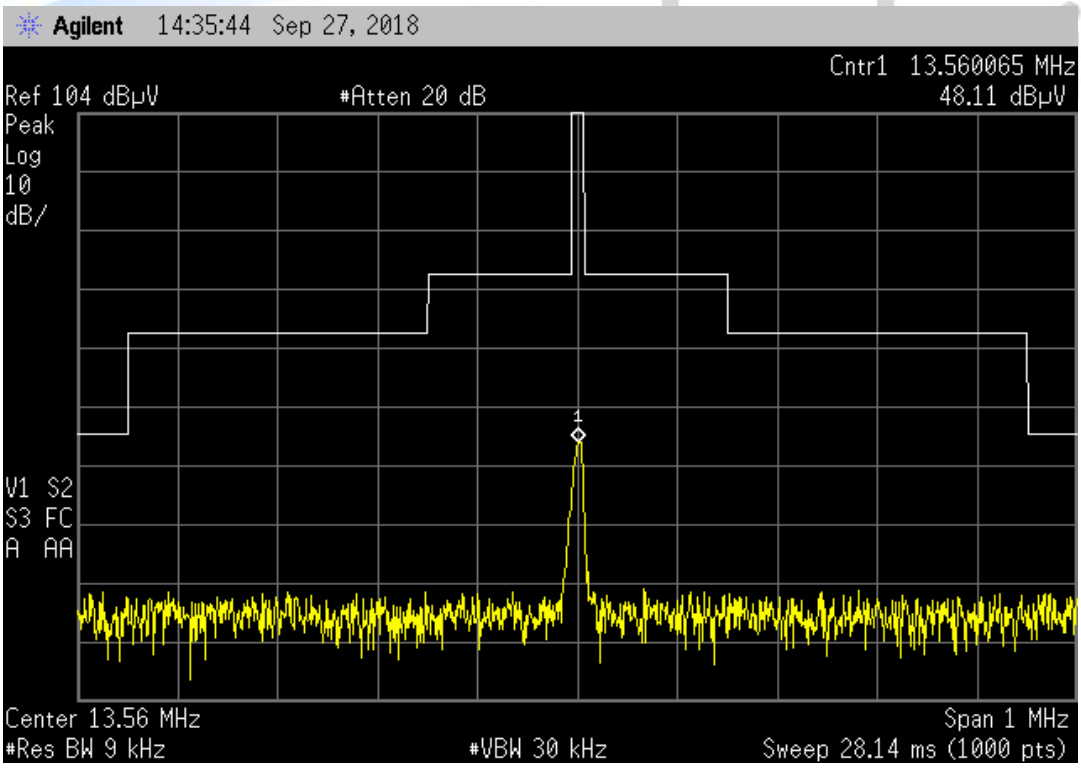
Applying the extrapolation factor of 40 dB/ per decade, the limit at 10 m is 103.1 dBuV/m.

Measurements at extreme voltages are not applicable as the product is internal battery powered.

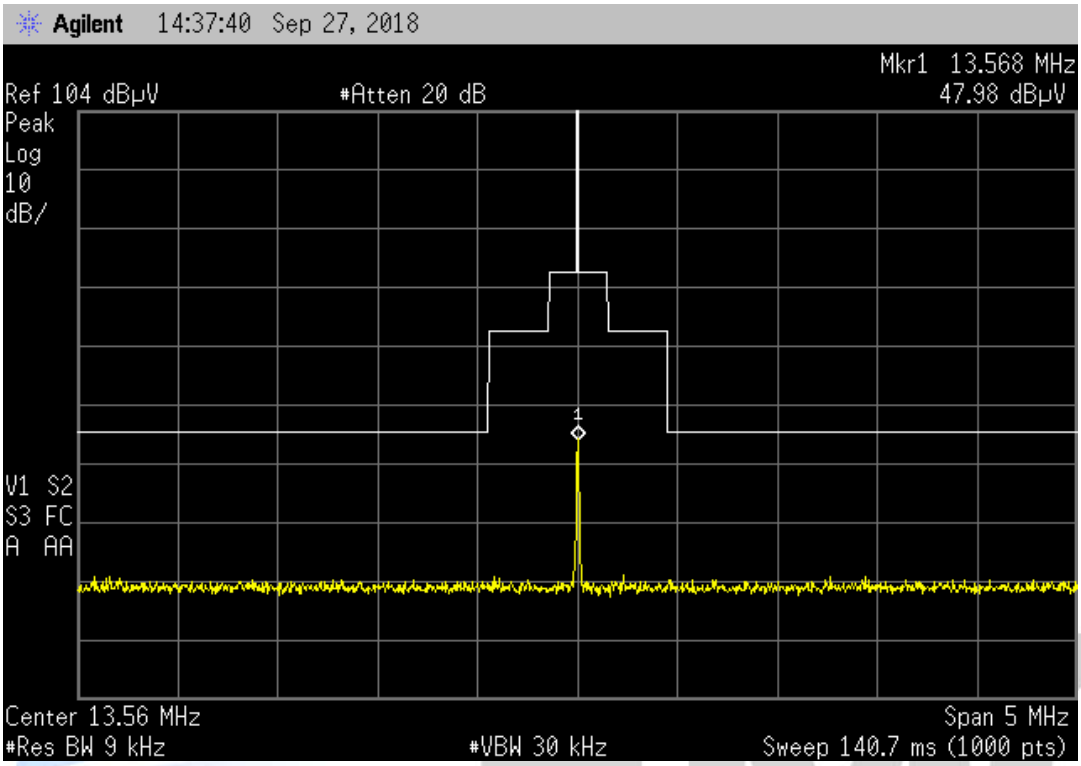
Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
13.560	48.1	103.1	55.0

Representative spectrum analyser plots show the carrier and modulation peaks within +/- 500 kHz and +/- 2500 kHz of the carrier.

Measurement Span: 1 MHz Reference level: 104 dBuV/m



Measurement Span: 5 MHz. Reference level: 104 dBuV/m



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	13.560140	+140
40.0	13.560140	+140
30.0	13.560175	+175
20.0	13.560106	+106
10.0	13.560140	+140
0.0	13.560210	+210
-10.0	13.560210	+210
-20.0	13.560245	+245

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
Frequency tolerance ± 50 Hz

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Last Cal	Cal Due	Period
Aerial Controller	EMCO	1090	9112-1062	Not applic	Not applic	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	Not applic	Not applic	Not applic
Turntable	EMCO	1080-1-2.1	9109-1578	Not applic	Not applic	Not applic
OATS Cable	Andrew	L6PNM-RPD	22869	1 June 2018	31 Dec 2019	6 months
VHF Balun	Schwarzbeck	VHA 9103	9594	29 Sept 2017	29 Sept 2020	3 years
Biconical Antenna	Schwarzbeck	BBA 9106	3680	28 Sept 2017	28 Sept 2020	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-112	24 Sept 2017	24 Sept 2020	3 years
Loop Antenna	EMCO	6502	9003-2485	4 July 2017	4 July 2020	3 years
Mains Network	R & S	ESH2-Z5	881362/032	12 Oct 2017	12 Oct 2019	2 years
Receiver	R & S	ESHS 10	828404/005	27 Sept 2018	27 Sept 2019	1 year
Receiver	R & S	ESIB 40	100295	28 Aug 2018	28 Aug 2019	1 year
Power Supply	APT	7008	4170003	Not applic	Not applic	Not applic
Test Chamber	Contherm	M180F	86025	Not applic	Not applic	Not applic
Thermometer	DSIR	RT200	35	4 Sept 2018	4 March 2019	6 months

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, which expires on the 15th August 2019.

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.