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TEST REPORT

Invenco G6-300 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

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 **Invenco G6-300 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 in between the 13th March and the 26th May 2020 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.

4. CLIENT INFORMATION

Company Name	Invenco Group Ltd
Address	7 – 11 Kawana Street Northcote
City	Auckland 0627
Country	New Zealand
Contact	Mr Michael Doh

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Invenco
Product	Payment Terminal
Model Number	G6-300
Hardware ID	XXX-XX2XXXXXXX
Manufacturer	Invenco Group Ltd
Country of Origin	New Zealand
Serial Number	KBHK003K
FCC ID	2AC7B-G6300V2OPT

The device tested is a Payment Terminal that contains a Near Field Contactless Secure Card Reader (NFC Card Reader) that operates on 13.560 MHz.

When operating this device would normally be installed with in a host device that would supply power and data processing capabilities.

Typically the terminal would be used for the payment of fuel at a petrol station.

The highest frequency in use in the digital device is greater than 500 MHz but less than 1000 MHz (796 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.

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 24 Vdc 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 dummy load 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.

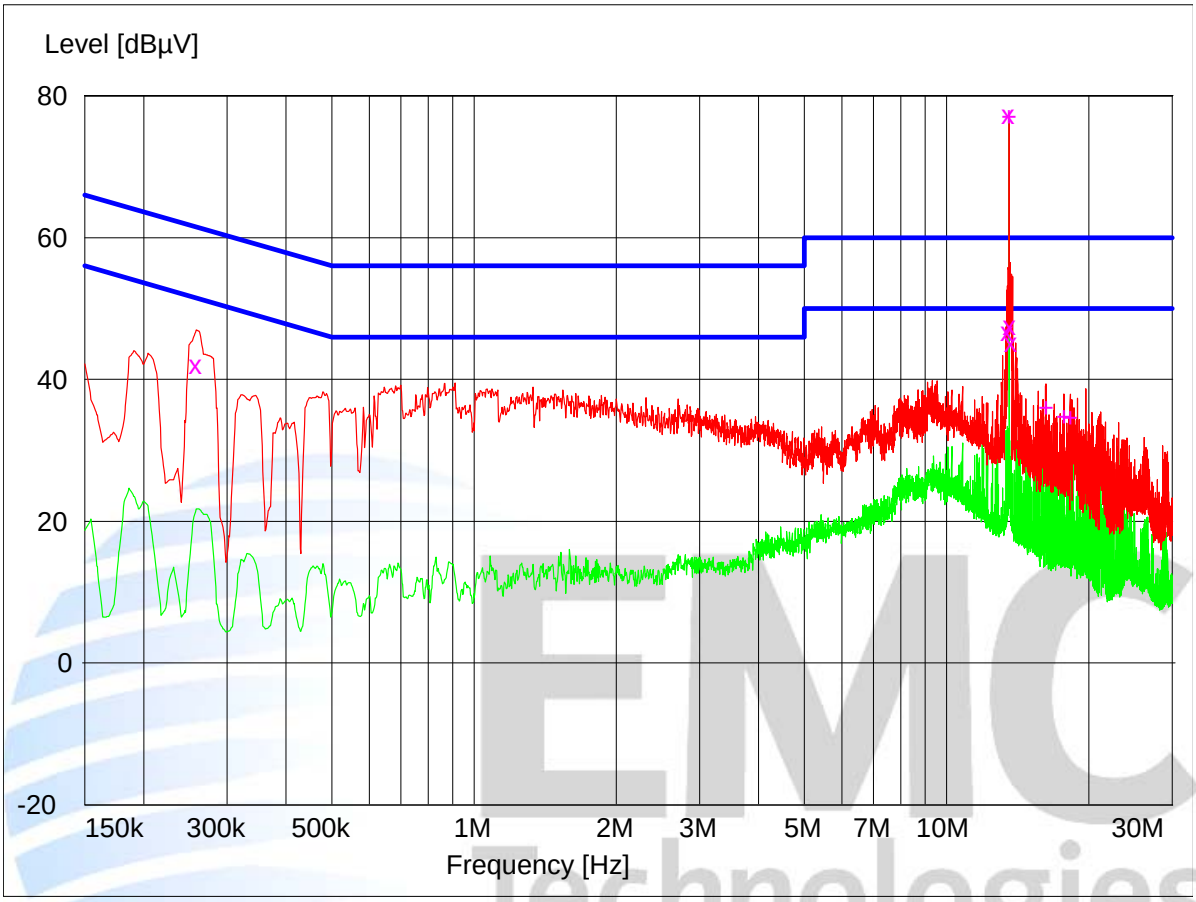
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

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 when operating with the chicken dance playing and the printer operating with the NFC transmitter activated.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.258000	42.10	62.5	19.4	L1	
13.490000	46.70	60.0	13.3	N	
13.560000	77.40	60.0	-17.4	N	NFC TX ON
13.630000	47.60	60.0	12.4	L1	
13.695000	45.20	60.0	14.8	L1	

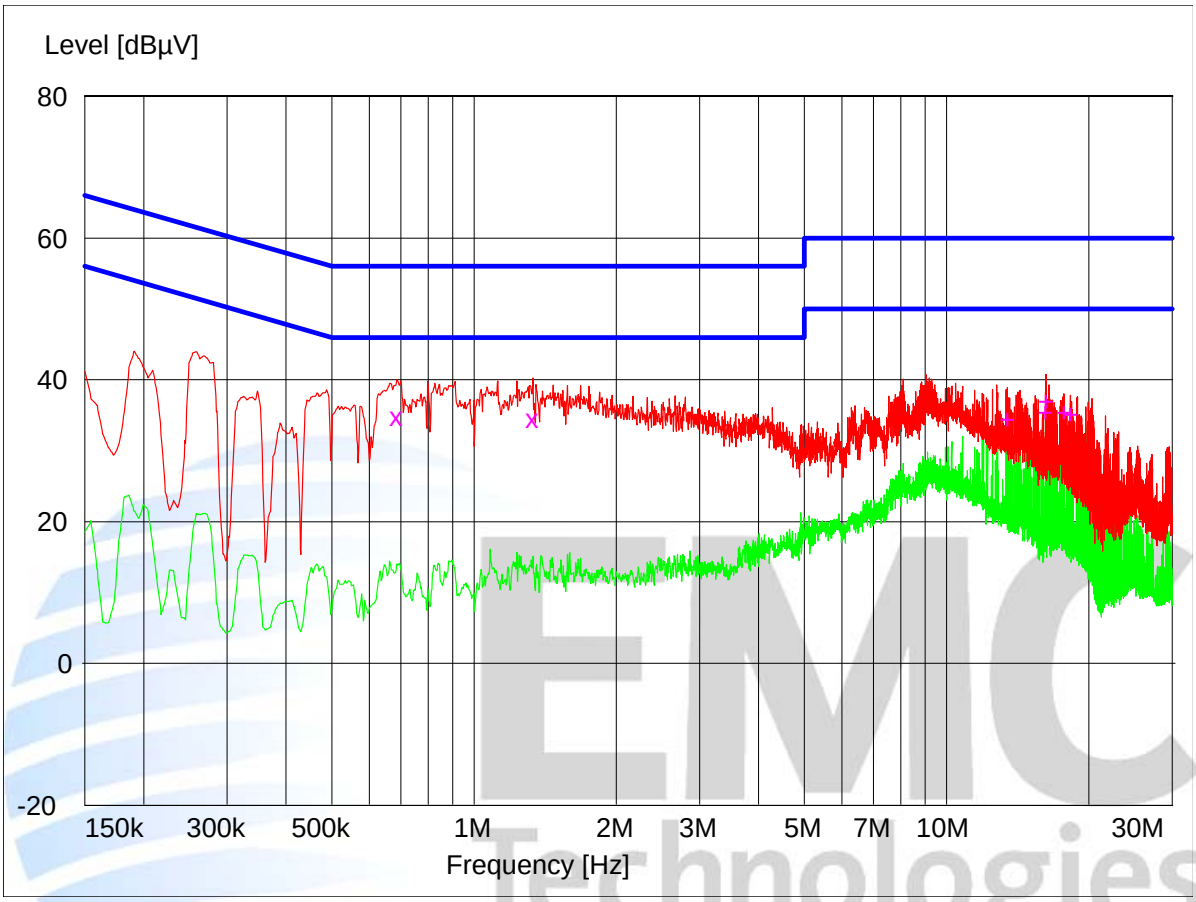
Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560000	77.10	50.0	-27.1	N	NFC TX ON
16.230000	36.00	50.0	14.0	L1	
17.695000	34.80	50.0	15.2	N	
18.245000	34.60	50.0	15.4	N	

Conducted Emissions – AC Input Power Port

Setup:	Device tested when powered at 120 Vac 60 Hz when operating with the chicken dance playing and the printer operating with the NFC transmitter not active.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.685500	34.80	56.0	21.2	L1	
1.330000	34.60	56.0	21.4	L1	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.420000	34.40	50.0	15.6	N	
16.170000	35.30	50.0	14.7	N	
16.230000	36.90	50.0	13.1	L1	
17.695000	35.30	50.0	14.7	N	
18.245000	35.10	50.0	14.9	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 30 MHz to 5000 MHz as the device contains a 13.560 MHz NFC transceiver and the digital device is greater than 500 MHz but less than 1000 MHz (796 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 24 Vdc to the device under test.

All interconnecting cables were bundled in 40 cm long bundles.

A USB dongle was inserted in the USB port.

The Ethernet port was connected to an Ethernet Hub device that was placed to the left of the device on the test table which also included the representative power supply.

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 (100 kHz – 30 MHz) ± 4.8 dB
- Free radiation tests (30 – 5000 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	10.1	48.6	38.5	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 (above 30 MHz)

Measurements between 30 – 5000 MHz have been made at a distance of 3 metres.

The limits as described in Section 15.209 have been applied.

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result	Antenna Polarisation
32.760	20.5		40.0	19.5	Pass	Vertical
43.480	35.1	24.8	40.0	4.9	Pass	Vertical
57.520	27.9		40.0	12.1	Pass	Vertical
64.520	25.6		40.0	14.4	Pass	Vertical
86.040	34.2	34.1	40.0	5.8	Pass	Vertical
87.480	33.7	34.1	40.0	5.9	Pass	Horizontal
122.040	28.6	33.0	40.0	7.0	Pass	Horizontal
125.000	27.0	29.7	43.5	13.8	Pass	Horizontal
149.160		32.6	43.5	10.9	Pass	Horizontal
203.400		28.8	43.5	14.7	Pass	Horizontal
250.000	31.4	32.7	46.0	13.3	Pass	Horizontal
256.960		32.0	46.0	14.0	Pass	Horizontal
268.240		33.1	46.0	12.9	Pass	Horizontal
311.880	28.2	33.5	46.0	12.5	Pass	Horizontal
332.000	30.8		46.0	15.2	Pass	Vertical
336.000	31.9		46.0	14.1	Pass	Vertical
346.680	34.1	31.6	46.0	11.9	Pass	Vertical
373.320	38.4		46.0	7.6	Pass	Vertical
375.000	36.4	36.0	46.0	9.6	Pass	Vertical
384.000		37.6	46.0	8.4	Pass	Horizontal
400.000	32.5	32.5	46.0	13.5	Pass	Vertical
426.720	36.4	31.0	46.0	9.6	Pass	Vertical
453.320	32.6	31.5	46.0	13.4	Pass	Vertical
488.000	33.3	35.5	46.0	10.5	Pass	Horizontal
500.000	32.2	32.0	46.0	13.8	Pass	Vertical
525.000		35.0	46.0	11.0	Pass	Horizontal
528.000	35.8	36.9	46.0	9.1	Pass	Horizontal
533.320		35.2	46.0	10.8	Pass	Horizontal
544.920	36.3	35.2	46.0	9.7	Pass	Vertical
550.028	38.5	34.9	46.0	7.5	Pass	Vertical
550.569	36.9		46.0	9.1	Pass	Vertical
556.000	37.9	35.4	46.0	8.1	Pass	Vertical
562.000	37.9	34.5	46.0	8.1	Pass	Vertical
567.935	37.3	32.7	46.0	8.7	Pass	Vertical
574.000	35.7	32.1	46.0	10.3	Pass	Vertical
579.158	35.0	31.2	46.0	11.0	Pass	Vertical
584.770	33.5		46.0	12.5	Pass	Vertical
600.000	35.1	33.5	46.0	10.9	Pass	Vertical

No further emissions were detected within 15 dB of the limit when the measurements were made between 30 - 5000 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.

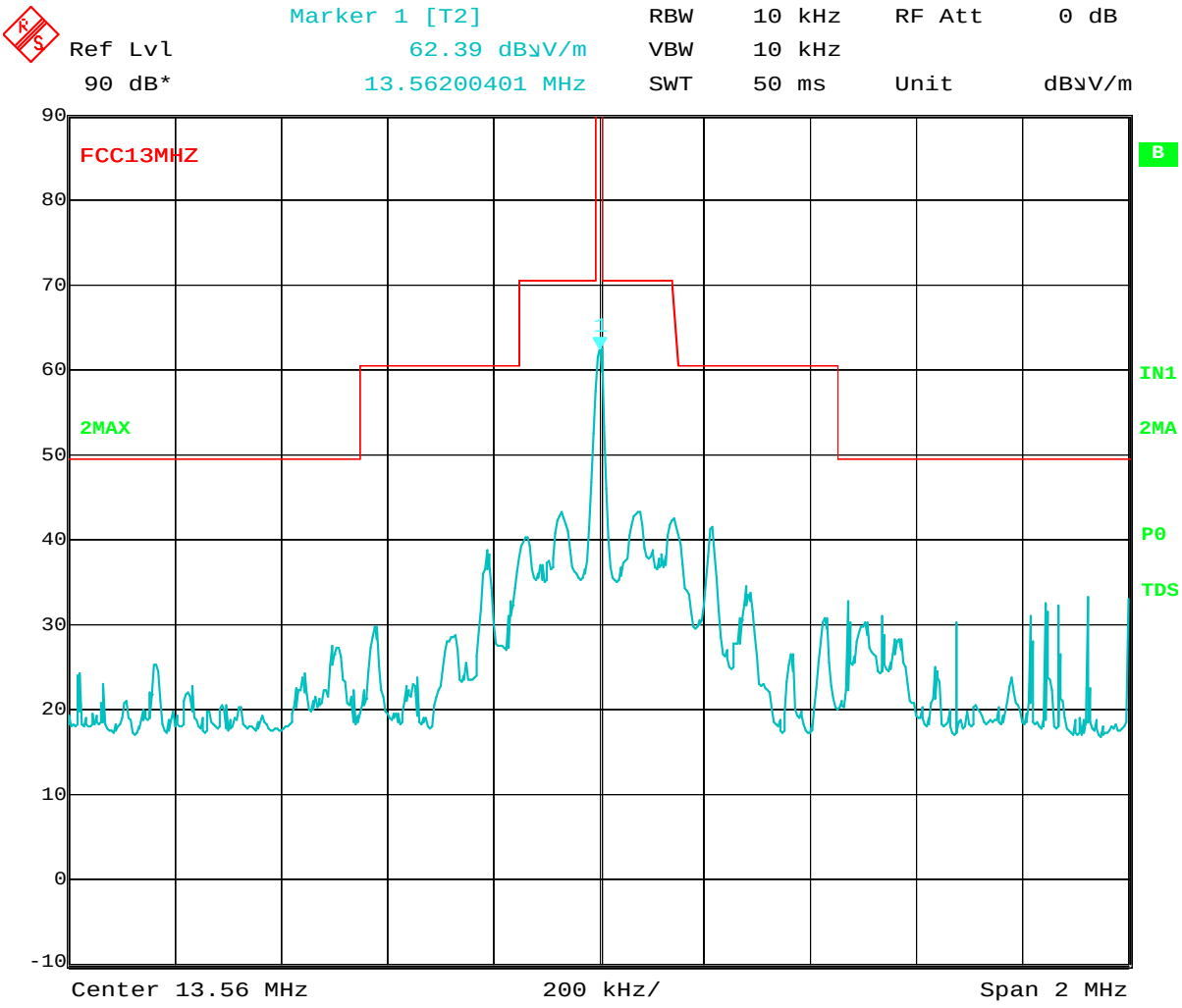
Applying the extrapolation factor of 40 dB/ per decade, the limit at 10 m is 103.1 dBuV/m.

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 to the device being varied by +/- 15% between 102 Vac and 138 Vac.

Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
102.0	13.560	62.3	103.1	40.9
120.0	13.560	62.3	103.1	47.7
138.0	13.560	62.3	103.1	47.7

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

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



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	13.559 735	-265
40.0	13.559 750	-250
30.0	13.559 760	-240
20.0	13.559 765	-235
10.0	13.559 750	-250
0.0	13.559 775	-225
-10.0	13.559 815	-185
-20.0	13.559 855	-145

The 120 Vac supply voltage was varied by +/- 15% at 20 degrees C (ambient).

Voltage (Vac)	Frequency (MHz)	Difference (Hz)
102	13.559 765	-235
120	13.559 765	-235
138	13.559 765	-235

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
Biconical Antenna	Schwarzbeck	BBA 9106	-	3680	28 Sept 2020	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	8 Aug 2020	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-112	EMC4025	24 Sept 2020	3 years
Loop Antenna	EMCO	6502	9003-2485	3798	4 July 2020	3 years
Mains Network	R & S	ESH2-Z5	881362/032	3628	12 Oct 2020	2 years
Receiver	R & S	ESHS 10	828404/005	3728	27 Sept 2020	1 year
Receiver	R & S	ESIB 40	100295	INV0818	28 Aug 2020	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic	Not applic
VHF Balun	Schwarzbeck	VHA 9103	9594	3696	29 Sept 2020	3 years
Power Supply	APT	7008	4170003	-	Not applic	Not applic

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 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

Device under Test

Ancillary Equipment – Representative power Supply + Ethernet Hub

Conducted emissions test set up

Radiated emissions test set up