



EMC Technologies (NZ) Ltd
47 Mackelvie St, Grey Lynn
Auckland 1021
New Zealand
Phone 09 360 0862
Fax 09 360 0861
E-Mail Address: aucklab@emctech.co.nz
Web Site: www.emctech.co.nz

TEST REPORT

Gallagher T30 Reader

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

Gallagher Group Ltd

A handwritten signature in black ink, appearing to read "Andrew Cutler", is positioned above a horizontal line.

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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EMC
Technologies

1. STATEMENT OF COMPLIANCE

The **Gallagher T30 Reader** 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 27th May and the 2nd June 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 erasures.

This report contains following corrections and overrides the previous report no 200301_1B issued on 7th August 2020.

1. Revised test sample identification details added.

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	Gallagher Group Ltd
Address	181 Kahikatea Drive Melville
City	Hamilton 3206
Country	New Zealand
Contact	Mr Menardo Lazaro

5. DESCRIPTION OF TEST SAMPLE

Brand Name Gallagher

Model Number T30

The model number of sample tested is C300490 (T30 Multi Tech Keypad Reader Black).

Product Reader

Manufacturer Gallagher Group Ltd

Country of Origin New Zealand

Serial Number 123456789

FCC ID M5VC30049X

Software version v1.00.24.

The device tested is a RFID card reader that operates on 13.560 MHz that would typically be used to allow security access to buildings and locations.

The product under test was powered at 12Vdc that was supplied from Gallagher 6000 HS controller. The controller inturn was powered from a 120 Vac to 12 Vdc convertor pictured in figure-3.

The connections to the product from ancillaries have been represented in figure-1, 2 & 3.

The laptop computer shown in the conducted emissions tests set up played no role in the carryout of the emissions testing but was supplied for completeness in this test.

The laptop computer was was not required for the radiated emissions testing and hence this test was carried out without it being attached to the ancillary equipment.

Figure-1: showing the tested product and ancillaries

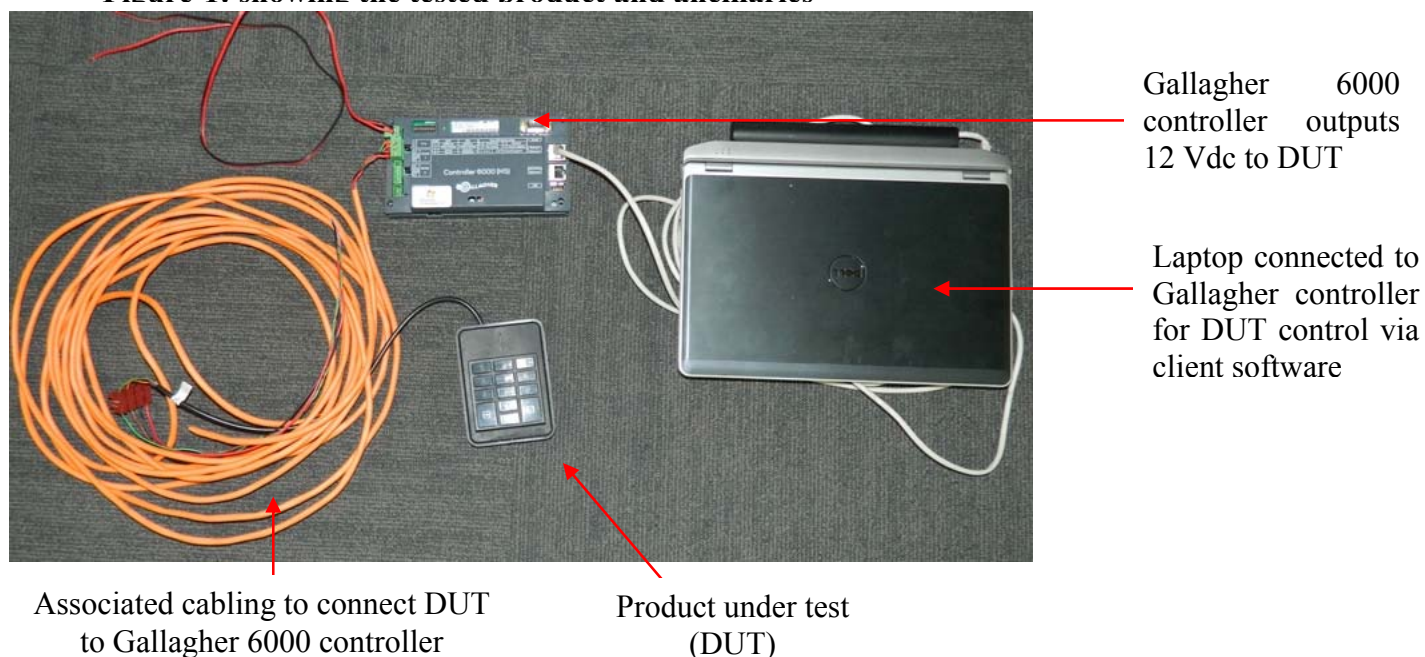
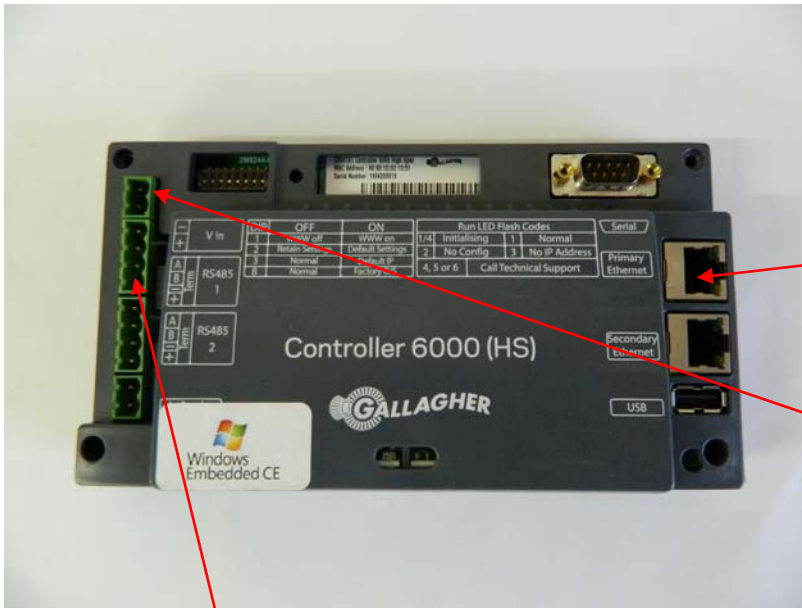


Figure-2: Gallagher supplied controller (Ancillary)



Gallagher controller 6000 (HS) has been supplied by the client to assist in the testing of DUT.

Ethernet port is connected to a test laptop than runs client supplied control software

The controller gets powered at 12Vdc using client supplied 120 Vac to 12Vdc convertor (as shown in figure 3).

RS485 port connects this controller to the DUT

Figure-3: 120 Vac to 12 Vdc convertor (Ancillary)



120 Vac to 12 Vdc convertor which interfaces with Gallagher 6000 HS controller.

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 12 Vdc to the device under test via a Gallagher 6000 Controller Module.

The Reader operates on 13.560 MHz.

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

A second test was then carried out with the internal antenna in the Reader being replaced with a resistive dummy load.

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.

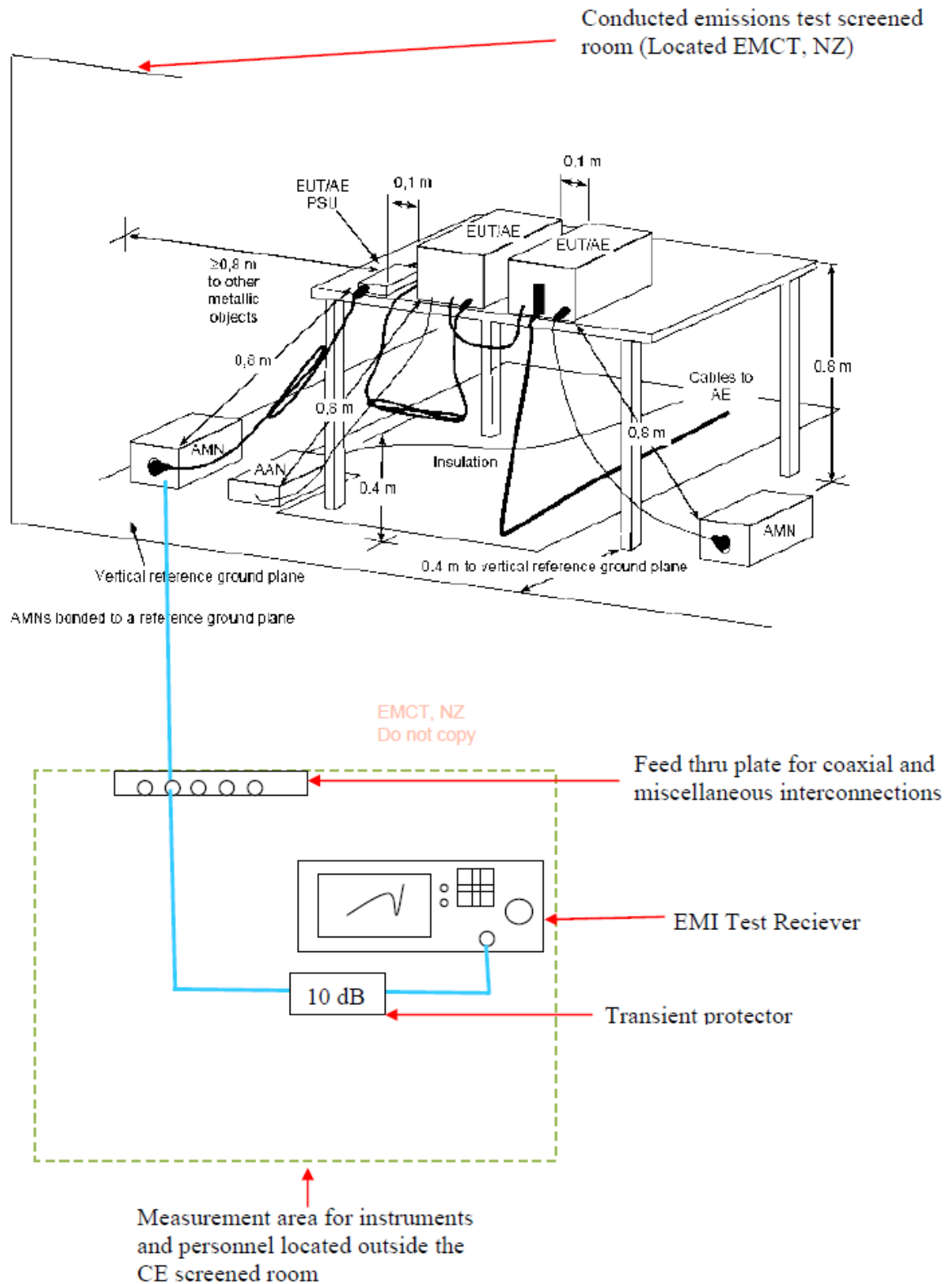
Measurement uncertainty with a confidence interval of 95% is:

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

Test equipment and associated calibration information is presented in section 7 of this test report.

EMI Receiver used: ESHS 10

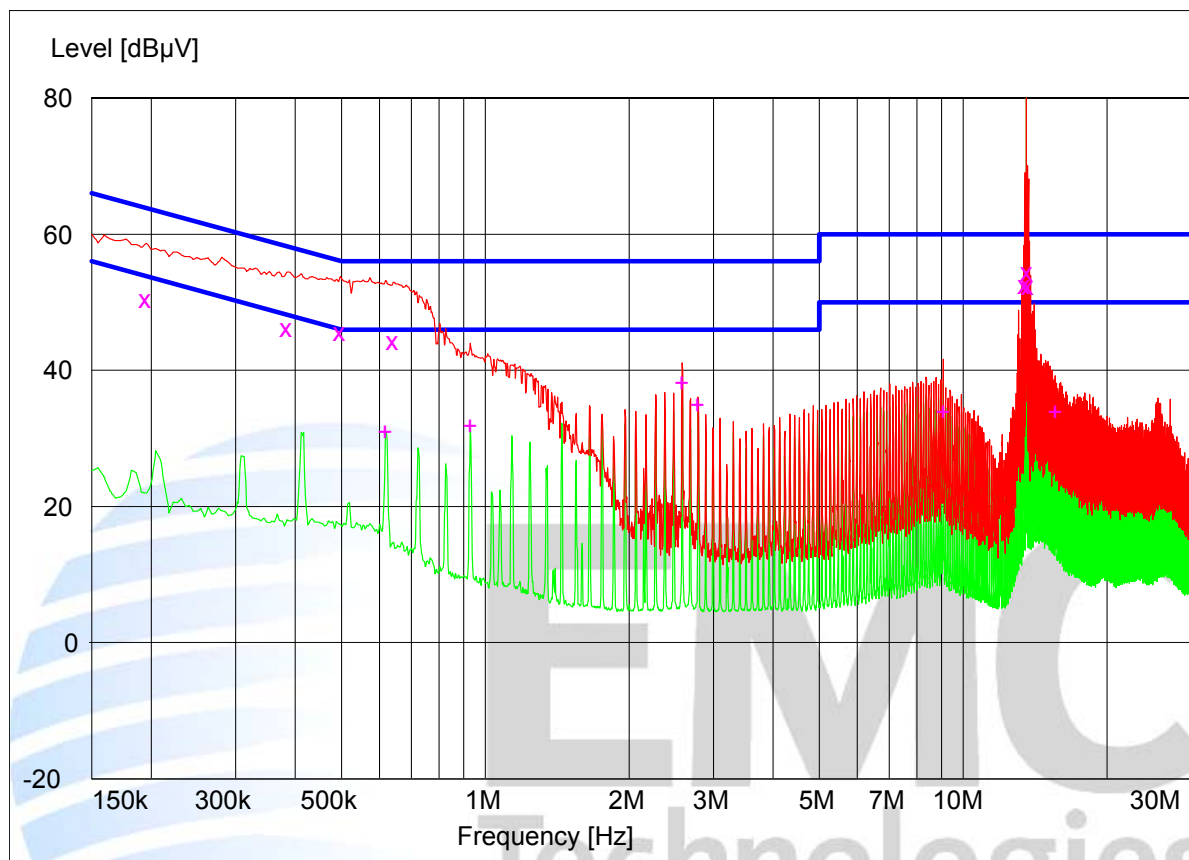
Block Diagram showing the conducted emission test setup



Conducted Emissions – AC Input Power Port – Antenna Attached Test

Setup: Device was tested transmitting continuously when attached to a representative power supply that was powered at 120 Vac 60 Hz which supplied 12 Vdc to a Gallagher controller 6000 device which in turn supplied 12 Vdc to the reader.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.195000	50.50	63.8	13.3	N	50.6
0.384000	46.30	58.2	11.9	N	46.6
0.496500	45.70	56.1	10.4	L1	
0.640500	44.30	56.0	11.7	L1	
13.485000	52.50	60.0	7.5	L1	
13.560000	89.50	60.0	-29.5	L1	Fundamental
13.640000	54.40	60.0	5.6	L1	
13.695000	52.40	60.0	7.6	L1	

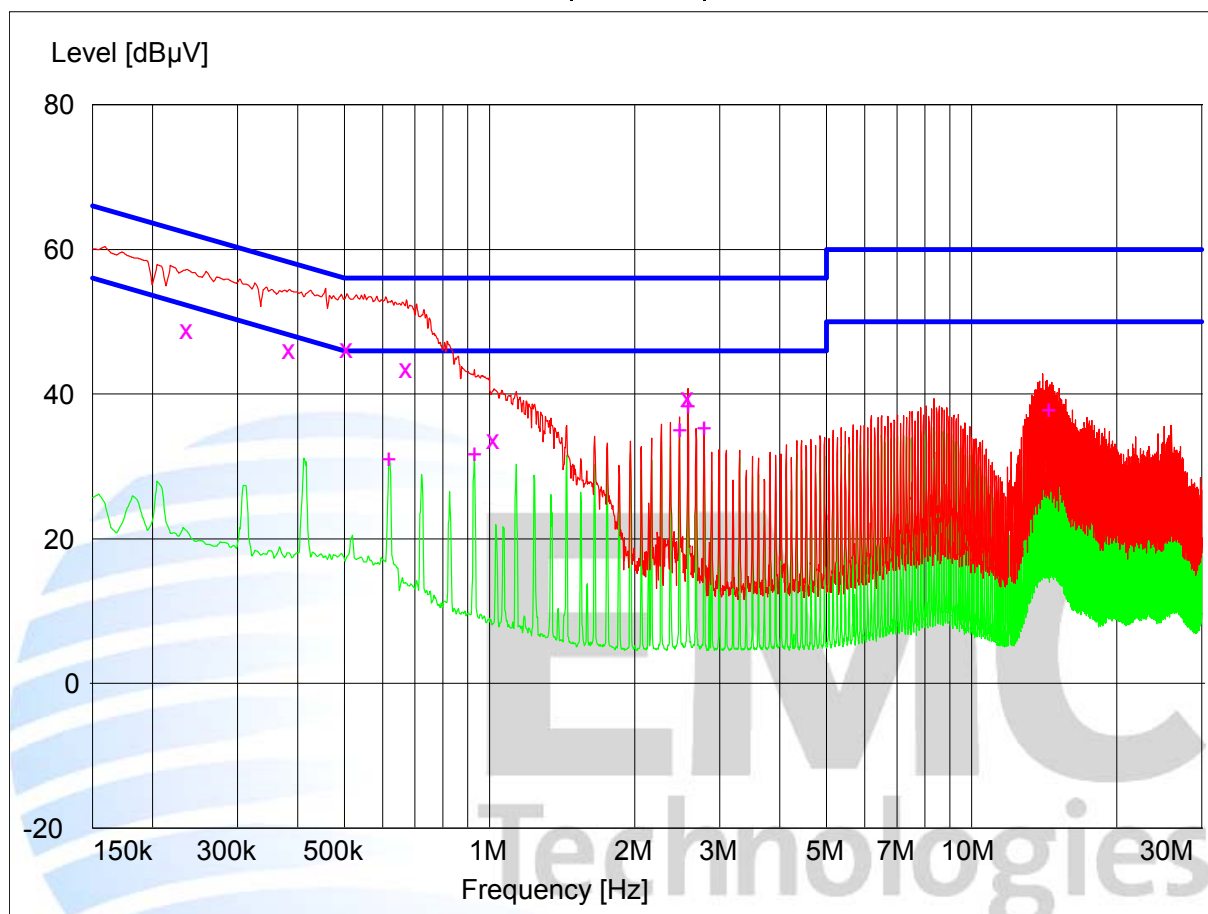
Final Average Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.618000	31.00	46.0	15.0	N	
0.928500	31.80	46.0	14.2	N	
2.580000	38.20	46.0	7.8	N	
2.785000	35.00	46.0	11.0	N	
9.080000	33.90	50.0	16.1	N	
13.560000	89.00	50.0	-39.0	L1	Fundamental
15.575000	34.00	50.0	16.0	L1	

Conducted Emissions – AC Input Power Port – Dummy Load

Setup: Device was tested transmitting continuously when attached to a representative power supply that was powered at 120 Vac 60 Hz which supplied 12 Vdc to a Gallagher controller 6000 device which in turn supplied 12 Vdc to the reader.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.235500	48.90	62.3	13.4	N	49.0
0.384000	46.10	58.2	12.1	N	46.3
0.505500	46.30	56.0	9.7	L1	45.6
0.672000	43.60	56.0	12.4	N	
1.020000	33.70	56.0	22.3	L1	
2.580000	39.60	56.0	16.4	N	

Final Average Measurements

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Phase	Rechecks (dBμV)
0.618000	31.00	46.0	15.0	N	32.0
0.928500	31.60	46.0	14.4	N	
2.475000	35.10	46.0	10.9	N	
2.580000	38.30	46.0	7.7	N	
2.785000	35.20	46.0	10.8	N	
14.435000	37.80	50.0	12.2	L1	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 30 MHz to 2000 MHz as the device contains a 13.560 MHz NFC transceiver and the client has declared that the digital device is greater than 108 MHz but less than 500 MHz (133 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 Vdc to a Gallagher 6000 Controller Module that in turn powered the device under test.

The Reader was observed transmitting continuously on 13.560 MHz.

Attached to the reader was a single 4 wire cable which enable DC supply voltage and RS-485 communications between the reader and controller.

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 were 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.

$$45.5 \text{ dB}\mu\text{V/m} = 30.0 \text{ dB}\mu\text{V} + 14 \text{ dB/m} + 1.5 \text{ dB}$$

Result: Complies

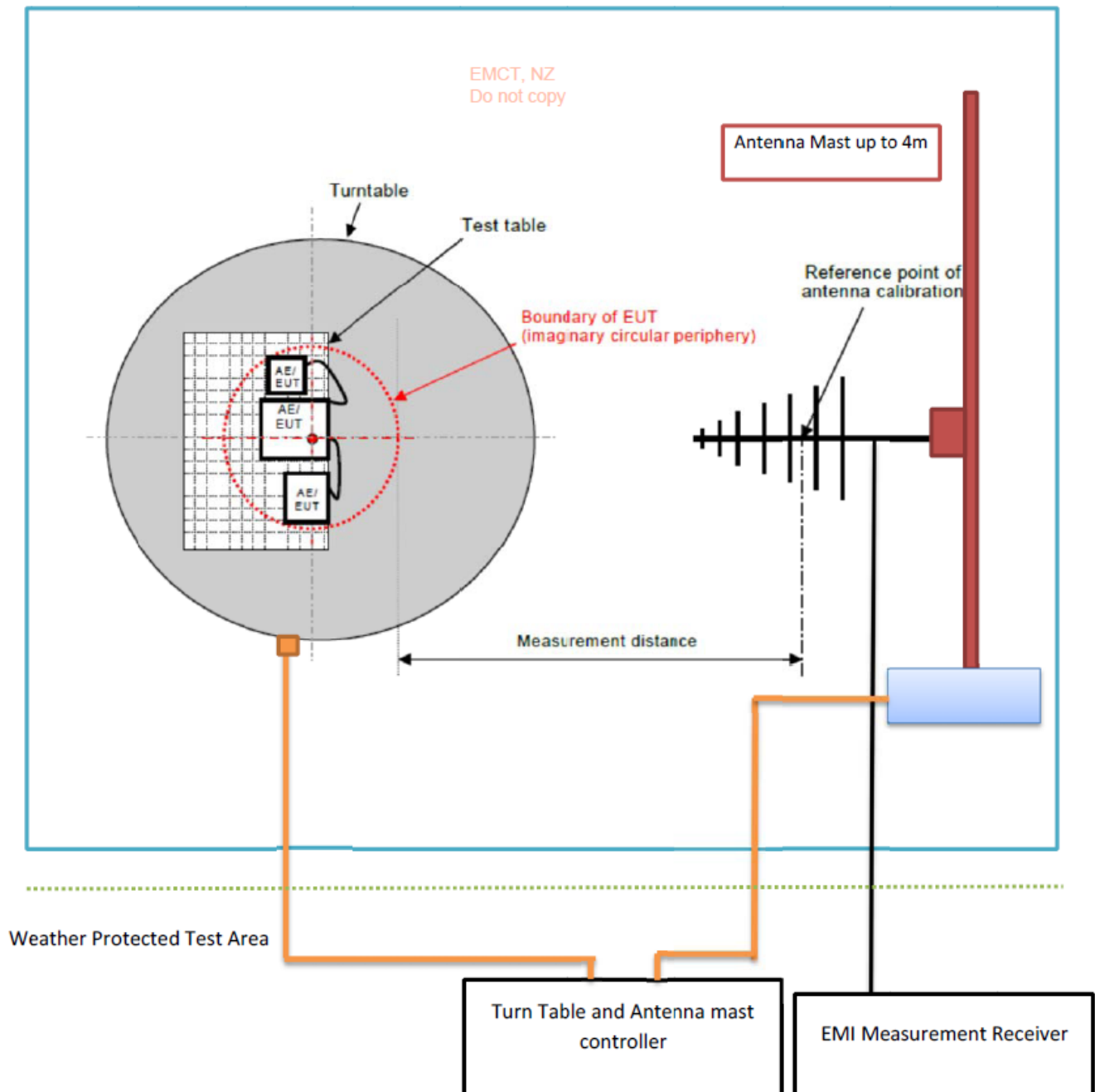
Measurement uncertainty with a confidence interval of 95% is:

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

Test equipment and associated calibration information is presented in section 7 of this test report.

EMI Receiver used: ESIB40

Radiated Emissions Test setup at Open area test site



Below 30 MHz:	Loop Antenna;	Measurement distance: 10m
30 MHz-300 MHz:	Bi conical Antenna;	Measurement distance: 3m
300 MHz- 2 GHz:	Log Periodic;	Measurement distance: 3m
Above 2 GHz:	Horn Antenna;	Measurement distance: 3m

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

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
27.120	10.5	48.6	38.1	Pass

The Reader 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) $\pm$ 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.

The limits as described in Section 15.209 have been applied.

Frequency (MHz)	Vertical (dB μ V/m)	Horizontal (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result	Antenna Polarisation
40.680	36.5	-	40.0	3.5	Pass	Vertical
54.240	23.4	-	40.0	16.6	Pass	Vertical
67.800	30.2	-	40.0	9.8	Pass	Vertical
244.080	25.0	-	46.0	21.0	Pass	Vertical
296.540	28.0	-	46.0	18.0	Pass	Vertical
301.520	-	30.3	46.0	15.7	Pass	Horizontal
304.480	27.5	-	46.0	18.5	Pass	Vertical
346.360	25.1	26.1	46.0	19.9	Pass	Horizontal

No further emissions were detected within 15 dB of the limit when 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.

The device was powered using a client supplied 120 Vac to 12 Vdc power supply, which in turn powered the Gallagher 6000 controller which in turn powered the device under test.

As a worst case test the 12 Vdc supply voltage to the Gallagher 6000 Controller which in turn powered the device under test was varied by +/- 15% at 20 degrees C (ambient).

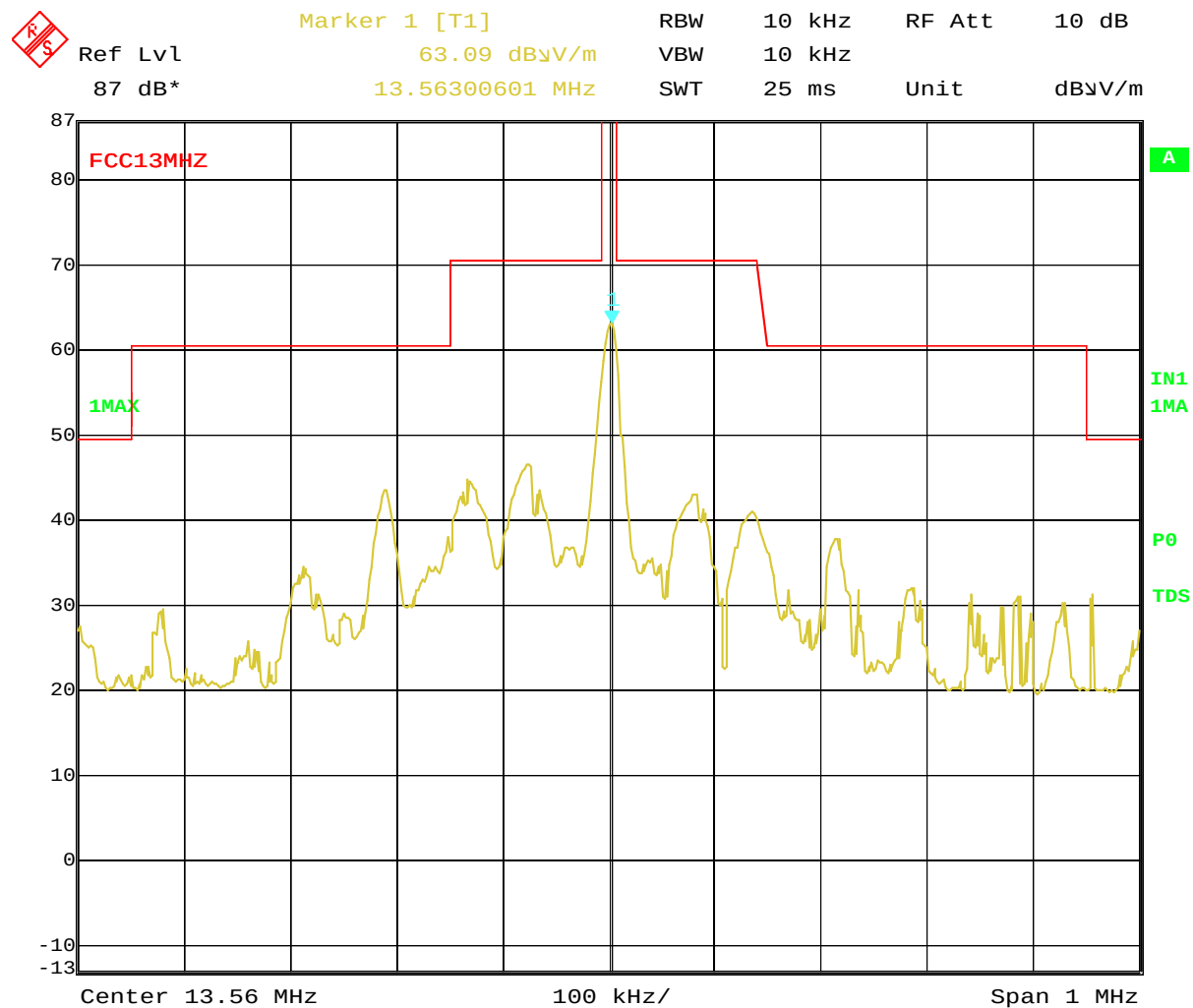
Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10.2	13.560	63.1	103.1	40.0
12.0	13.560	63.1	103.1	40.0
13.8	13.560	63.1	103.1	40.0

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

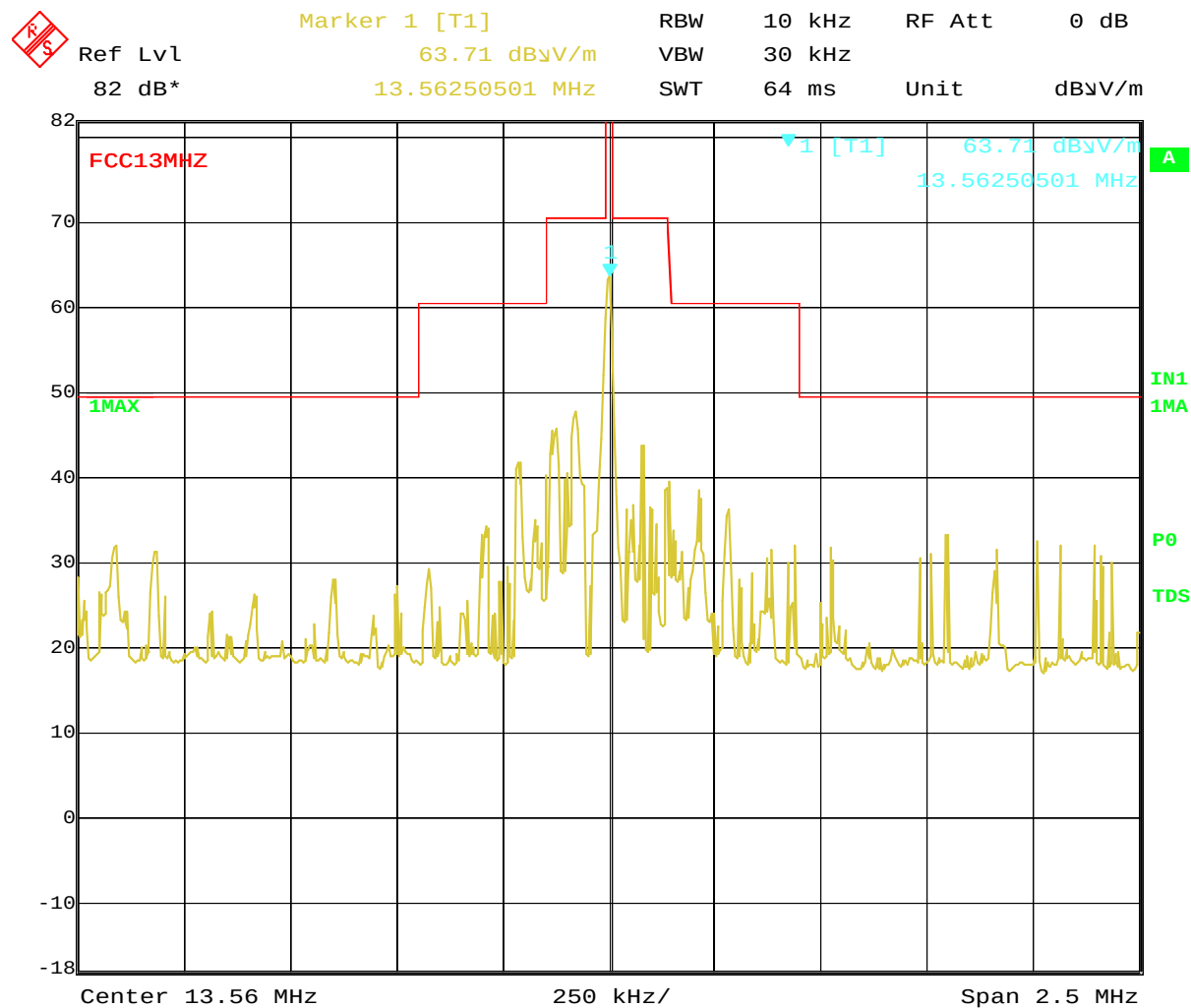
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

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



Date: 28.MAY.2020 14:44:36

Spectrum analyser plot showing the carrier and modulation peaks within +/- 1.25 MHz.



Date: 28.MAY.2020 15:11:48

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	13.559 502	-498
40.0	13.559 485	-515
30.0	13.559 498	-502
20.0	13.559 509	-491
10.0	13.559 505	-495
0.0	13.559 529	-471
-10.0	13.559 541	-459
-20.0	13.559 527	-473

As a worst case test the 12 Vdc supply voltage to the Gallagher 6000 Controller which in turn powered the device under test was varied by +/- 15% at 20 degrees C (ambient).

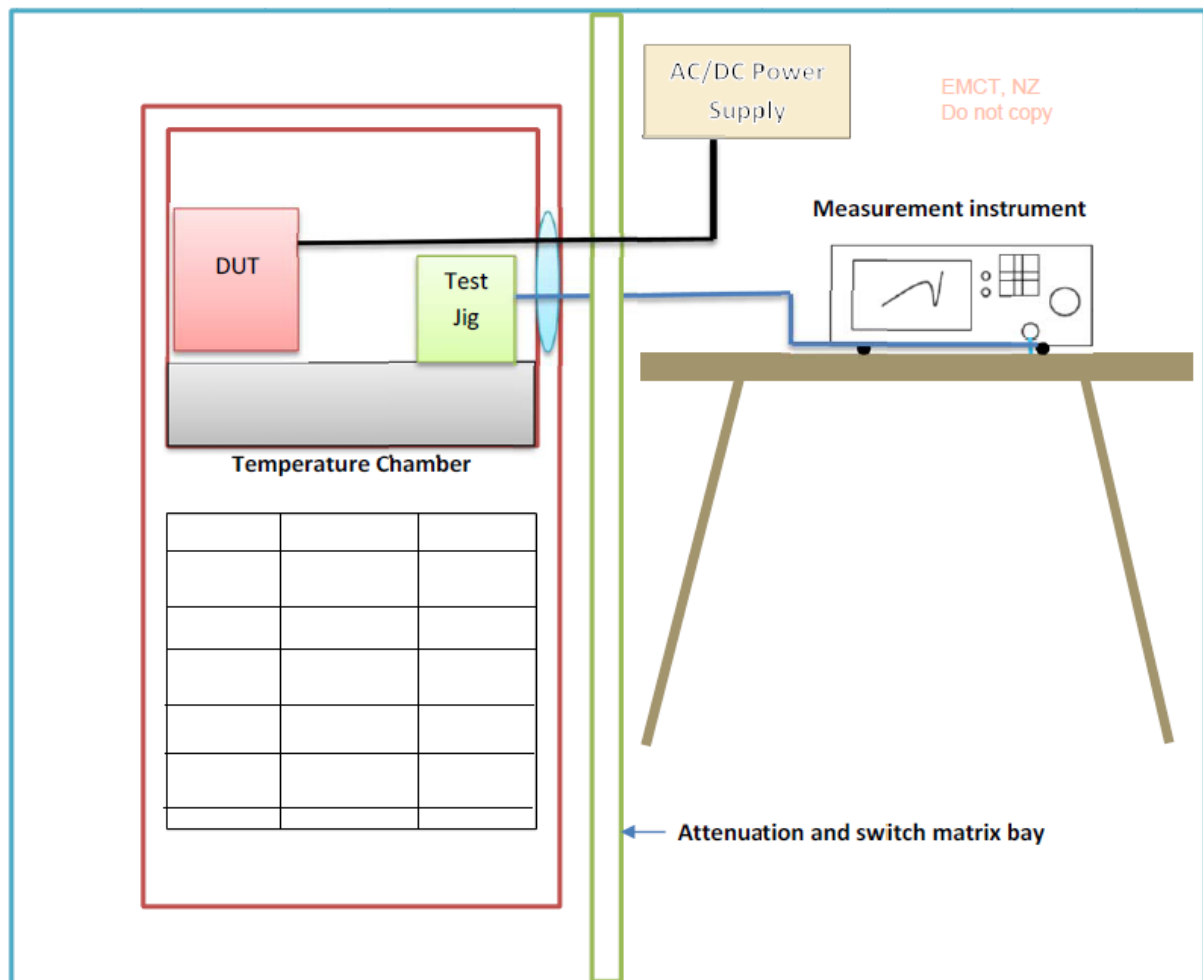
Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
10.2	13.559 509	-491
12.0	13.559 509	-491
13.8	13.559 509	-491

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

Frequency tolerance ± 50 Hz

Radio bay measurement setup



The following test instruments were used to carry out this test.

For calibration details refer section 7 of this test report.

Instrument	Manufacturer	Model
Thermal chamber	Contherm	M180F
Thermometer	DSIR	RT200
EMI Receiver/Spectrum Analyser	R&S	ESIB40
Coaxial cables (1m+3m)	Huber and Suhner Succoflex	340521/4 39901/4
Voltage Variac	Powerteck	SRV-5 RFS3800

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
Helix cable	Andrews	L6PNM-RPD	22869	Oats Cable	31st Dec 2020	1 year
Succoflex cable	Huber and Suhner	104 3m n-n	339901/4	13938	20 Nov 2020	1 year
Succoflex cable	Huber and Suhner	104 1m n-n	340521/4	13937	20 Nov 2020	1 year
Thermal chamber	Contherm	M180F	86025	N/a	N/a	Not applic
Thermometer	DSIR	RT200	35	EMC4029	10/10/2021	5 years
Voltage Variac	Powerteck	SRV-5	RFS3800	-	-	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

External Photos



Radiated emissions test set ups









Ancillary Test Equipment – Conducted and Radiated Emissions

