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TEST REPORT

Protégé PRT-TS50V2 Touch Screen Thermostat Controller

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.249

Operation in the band 2400 – 2483.5 MHz

for

Integrated Control Technology

This Test Report is issued with the authority of:

Andrew Cutler- General Manager

ACCREDITED TESTING 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 **Protégé PRT-TS50V2 Touch Screen Thermostat Controller** complies with FCC Part 15 Subpart C Section 15.249 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 between the 13th March and the 10th April 2024 are summarised 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.
15.207	Conducted limit	Complies
15.209	Radiated emission limits - Emissions < 30 MHz	Complies.
15.249 (a)	Field strength of fundamental	Complies.
15.249 (a)	Field strength of harmonics	Complies.
15.249 (b)	Fixed, point to point operations	Not applicable.
15.249 (c)	3 metre measurement distance	Noted
15.249 (d)	Spurious emission levels except harmonics	Complies.
15.249 (e)	Detectors above 1000 MHz	Noted.
15.249 (f)	Reference to section 15.37(d)	Noted.

3. INTRODUCTION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

The client selected the test sample.

The report relates only to the sample tested.

This report does not contain 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.

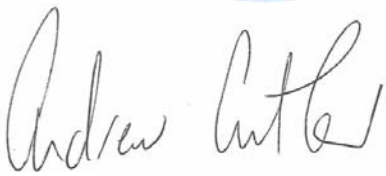
All compliance statements have been made with respect of the specification limit with no reference to the measurement uncertainty.

All testing was carried out as per the standard in the worst-case configuration with no deviations being applied.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations.

To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler
General Manager
EMC Technologies NZ Ltd

Report Revision Table

Version	Change Made	Date
240209.1	Initial Issue	16/04/24

4. CLIENT INFORMATION

Company Name	Integrated Control Technology
Address	4 John Glenn Avenue, Rosedale
City	Auckland 6032
Country	New Zealand
Contact	Gary Fleming

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Protégé
Model Number	PRT-TS50V2
Product	Touch Screen Thermostat Controller
Manufacturer	Integrated Control Technology Ltd. (ICT)
Country of Origin	New Zealand
Serial Number	Sample not serialised
FCC ID	UAUTS50V2

Product Description:

The device that was tested is a Touch Screen Thermostat Controller which would typically be used to control the temperature and operations of an air conditioning system.

The device also contains a Bluetooth device which can provide set up and control of the system.

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

This device has internal antennas for the 2.4 GHz Bluetooth 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.

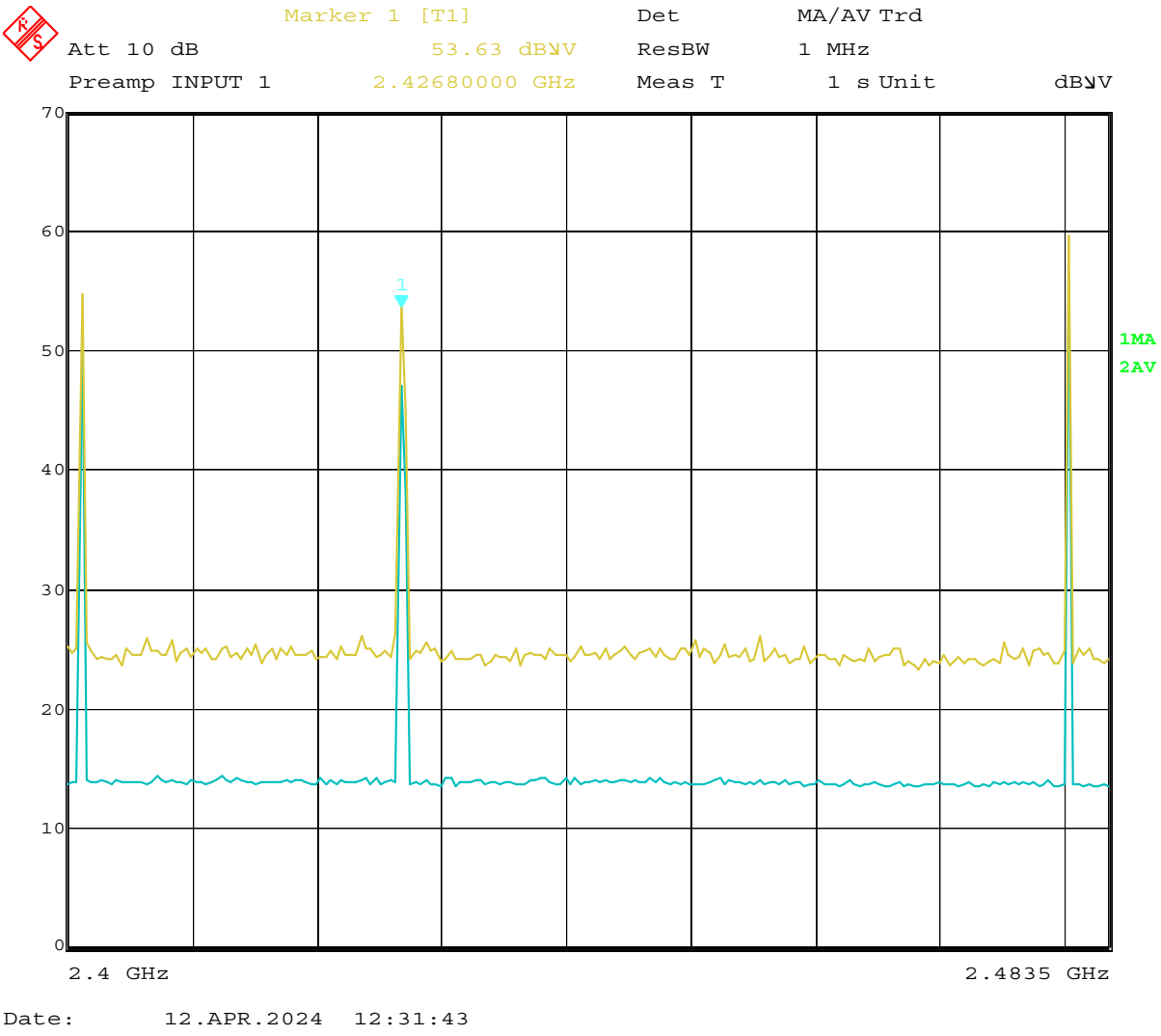
Result: Complies.

Section 15.205: Restricted bands of operation

The Bluetooth transmitter was observed transmitting on 2402, 2426 and 2480 MHz.

This device would therefore fall into the band of 2400.0 – 2483.5 MHz band that is covered by Section 15.249.

This is shown below using an indicative scan



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 powered the device under test.

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.

Initially a conducted emissions pre scan is carried out using a Peak detector (red trace) and an Average detector (green trace).

Worst case measurements are then made on the highest pre-scan emission levels on a limited number of frequencies using a Quasi Peak detector and an Average detectors with the results of both the phase and neutral lines being recorded in the results table.

When either the Peak or Average detector pre scan emissions appear to be over the Quasi Peak or Average limit line each peak is individually checked and confirmed to be below the applicable limit.

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.

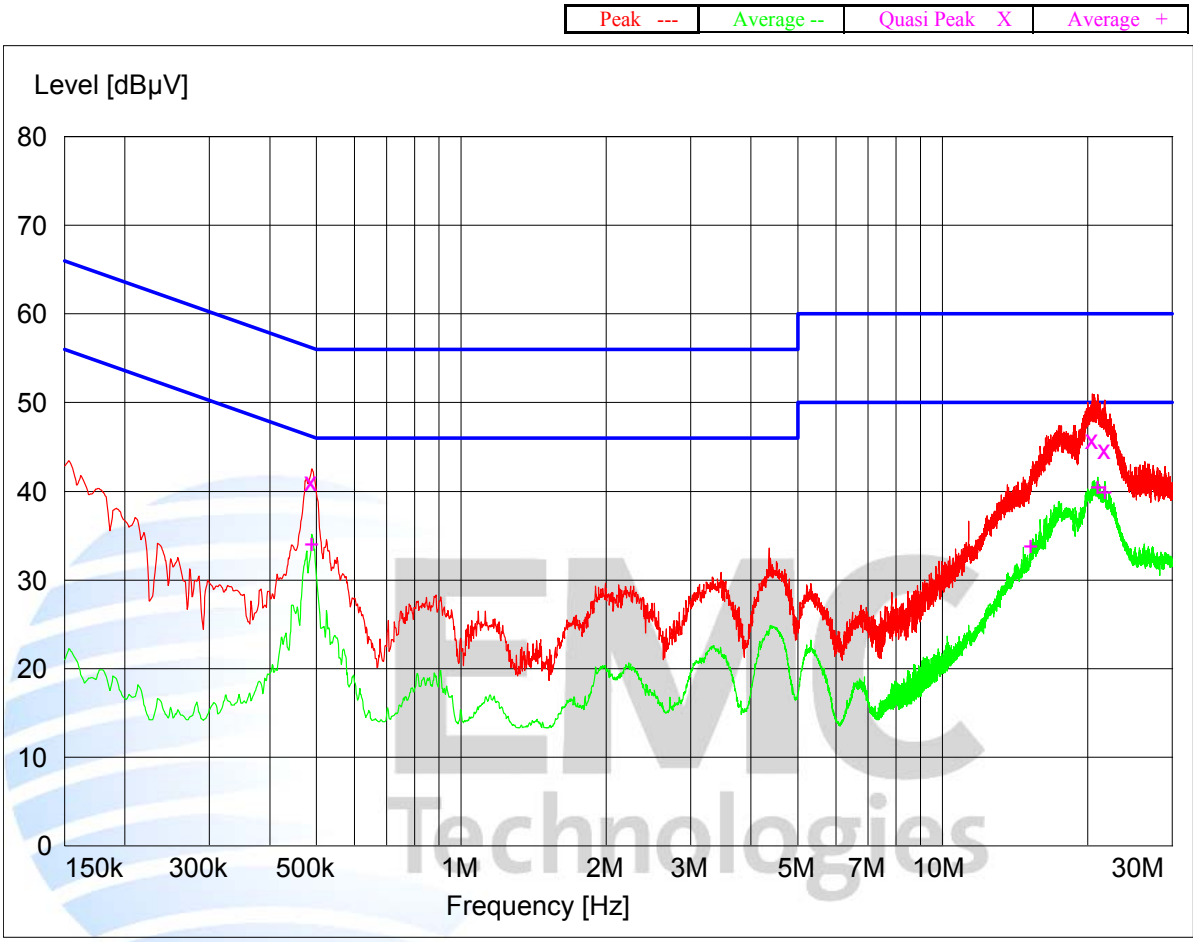
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

Result: Complies

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 12 VDC using a representative power supply that was powered at 120 VAC 60 Hz. Testing carried out with the Touch Screen remaining active with a laptop computer attached to the USB power which also displayed the time and temperature information.



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.489000	41.10	56.1	15.0	N	
20.477000	45.80	60.0	14.2	N	
21.719000	44.70	60.0	15.3	N	44.8

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
0.489000	34.00	46.2	12.2	N	
15.239000	33.80	50.0	16.2	L1	
21.039500	40.40	50.0	9.6	N	
21.719000	39.80	50.0	10.2	N	39.1

Section 15.209: Radiated Emission Limits, General Requirements

Radiated emissions testing was carried out over the frequency range of 100 kHz to 25,000 MHz as the device contains a Bluetooth Transmitter operating on 2.4 GHz.

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

An enclosure containing absorber material, Panashield HYB-NF-12, has been placed between the turntable and the measurement antenna for when measurements are made above 1 GHz.

This material has no absorbing affect below 1 GHz with site verification measurements confirming this.

Testing carried out when the device was placed in the centre of the table standing upright.

Below 1000 MHz the top of the test table was 80 cm above the test site ground plane.

Above 1000 MHz the top of the test table was 150 cm above the test site ground plane.

The device also supports Bluetooth functionality in the 2.4 GHz band which was active during the test.

Device was tested when powered 120 VAC using a representative power supply.

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.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations, where appropriate at a test distance of 3 metres.

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

Above 1000 MHz an Average and a Peak detector were used which used a bandwidth of 1 MHz

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 (30 – 25000 MHz) ± 4.1 dB

Section 15.209: Spurious Emissions (above 30 MHz)

Measurements between 30 – 25000 MHz have been made at a distance of 3 metres.

A receiver using a Quasi Peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz

Above 1000 MHz a Peak detector and an Average detector with a 1 MHz bandwidth was used.

The limits as described in Section 15.209 have been applied.

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Pol	Detector	BW (kHz)
30.160	39.1	-	40.0	0.9	Vertical	QP	120
30.600	39.0	-	40.0	1.0	Vertical	QP	120
44.800	37.1	-	40.0	2.9	Vertical	QP	120
48.600	38.9	-	40.0	1.1	Vertical	QP	120
51.320	37.8	-	40.0	2.2	Vertical	QP	120
52.200	-	37.3	40.0	2.7	Horizontal	QP	120
72.360	33.5	-	40.0	6.5	Vertical	QP	120
75.200	32.8	-	40.0	7.2	Vertical	QP	120
192.320	29.4	39.1	43.5	4.4	Horizontal	QP	120
210.200	29.0	38.7	46.0	7.3	Horizontal	QP	120
240.200	-	36.1	46.0	9.9	Horizontal	QP	120
260.240	-	36.6	46.0	9.4	Horizontal	QP	120
270.280	26.4	38.2	46.0	7.8	Horizontal	QP	120
326.160	33.0	38.9	46.0	7.1	Horizontal	QP	120
330.400	38.7	39.8	46.0	6.2	Horizontal	QP	120
390.300	37.0	41.7	46.0	4.3	Horizontal	QP	120
420.480	33.0	36.0	46.0	10.0	Horizontal	QP	120
450.400	-	36.2	46.0	9.8	Horizontal	QP	120
480.360	-	34.1	46.0	11.9	Horizontal	QP	120

Above 1000 MHz the only emissions observed were from the Bluetooth transmitter that was observed advertising on 2402, 2426 and 2480 MHz.

All other emissions observed had a margin to the limit that exceeded 15 dB when measurements were made between 30 – 25000 MHz using both vertical and horizontal polarisations.

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 MHz – 25000 MHz) ± 4.1 dB

Section 15.249 (a) – Field Strength of the Fundamental and Harmonics

Radiated emission measurements were carried out with the limits as per section 15.249 (a) being applied to the Fundamental and Harmonics of each transmitter.

Testing was carried out at EMC Technologies (NZ) Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland.

An enclosure containing absorber material, Panashield HYB-NF-12, has been placed between the turntable and the measurement antenna for when measurements are made above 1 GHz.

This material has no absorbing affect below 1 GHz with site verification measurements.

Below 1000 MHz the transmitter was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Above 1000 MHz the transmitter was placed on the test table top which was a total of 1.5 m above the test site ground plane.

Measurements of the radiated field were made 3 metres from the transmitting antenna.

Measurements below 1000 MHz were made using a Quasi Peak Detector with a bandwidth of 120 kHz.

Measurements above 1000 MHz were made using an average detector with a bandwidth of 1.0 MHz and also a peak detector with a bandwidth of 1.0 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 with an automated antenna tower.

All emissions were measured in both vertical and horizontal antenna polarisations.

The emission is measured in both vertical and horizontal antenna polarisations with no measurements were made above the 10^{th} harmonic.

Testing was carried at 120 VAC using a representative AC power supply.

Testing was carried out with the device being placed in the centre of the test table standing vertically upright.

The device was tested when transmitting continuously on 2402, 2426 and 2480 MHz

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

Level (dBµV/m) = Receiver Reading (dBµV) + Antenna Factor (dB/m) + Coax Loss (dB) – Amplifier Gain (dB)

Fundamental Emission

Testing was carried out as detailed below

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Pol.	Detector	BW
2402.000	91.8	93.6	114.0	20.4	Horizontal	Peak	1 MHz
2402.000	47.5	47.5	94.0	46.5	Vertical	Average	1 MHz
-	-	-	-	-	-	-	-
2426.000	91.3	94.1	114.0	19.9	Horizontal	Peak	1 MHz
2426.000	47.8	48.1	94.0	45.9	Vertical	Average	1 MHz
-	-	-	-	-	-	-	-
2480.000	92.5	94.5	114.0	19.5	Vertical	Peak	1 MHz
2480.000	47.7	47.7	94.0	46.3	Vertical	Average	1 MHz

Section 15.249 specifies a limit of 50 mV/m (94 dBuV/m) when an average detector is used for devices operating in the band of 2400 – 2483.5 MHz.

A peak limit of 114 dBuV/m has also been applied.

This limit has been converted to dBuV/m using the formula 20 * (log 0.050 / 0.000001)

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 25,000 MHz) ± 4.1 dB

Spurious Emissions

Transmitting on 2402 MHz

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna	BW
4804.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
4804.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
7206.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
7206.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
9608.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
9608.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
12010.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
12010.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
14413.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
14413.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
16814.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
16814.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
19216.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
19216.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
21618.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
21618.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
24020.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
24020.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz

Spurious Emissions

Transmitting on 2426 MHz

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna	BW
4852.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
4852.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
7278.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
7278.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
9704.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
9704.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
12130.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
12130.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
14556.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
14556.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
16982.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
16982.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
19408.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
19408.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
21834.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
21834.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
24260.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
24260.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz

Spurious Emissions

Transmitting on 2480 MHz

Frequency (MHz)	Vertical (dBuV/m)	Horizontal (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna	BW
4960.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
4960.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
7440.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
7440.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
9920.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
9920.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
12400.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
12400.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
14880.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
14880.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
17360.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
17360.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
19840.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
19840.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
22320.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
22320.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz
-	-	-	-	-	-	-	-
24800.000	< 59	< 59	74.0	> 15	Peak	Vert/Horiz	1 MHz
24800.000	< 46	< 46	54.0	> 8	Average	Vert/Horiz	1 MHz

Measurements were performed at a distance of 3 metres using vertical and horizontal polarisations with a peak and an average detector with a 1 MHz bandwidth being used.

As per section 15.249 a limit of 500 uV/m applies to the harmonic emissions when an average detector is used.

This limit has been converted to dBuV/m using the formula 20 * (log 500) with a factor of + 20 dB being added to determine the peak limit.

Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 25,000 MHz) ± 4.1 dB

Section 15.215 (c) – Additional Provisions to the General Radiated Emissions Limitations

The device operates in the 2400 – 2483.5 MHz band.

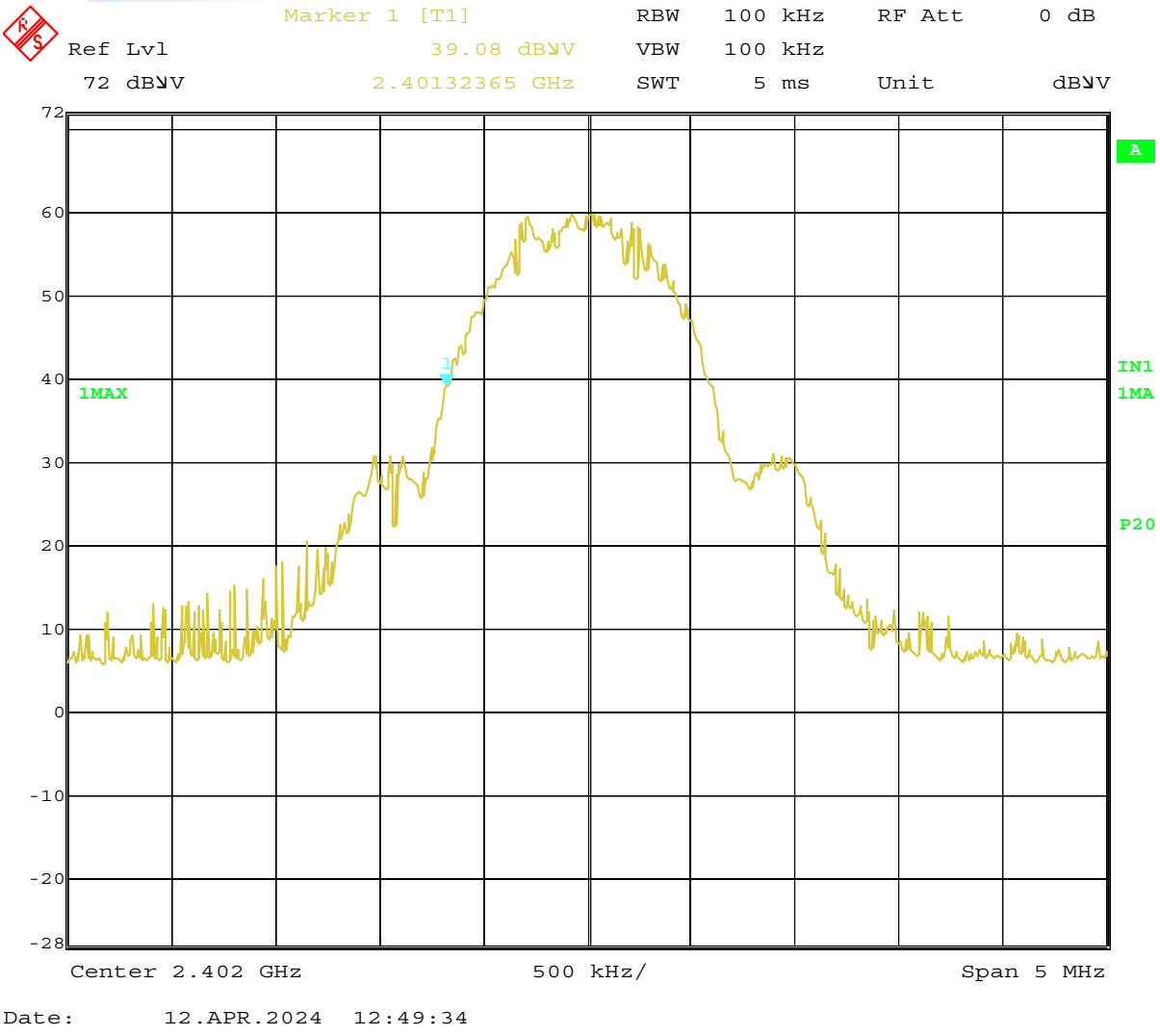
Relative spectrum mask measurements have been made when the device was operating on 2402 MHz, 2426 MHz and 2480 MHz

Measurements made at the -20 dB points.

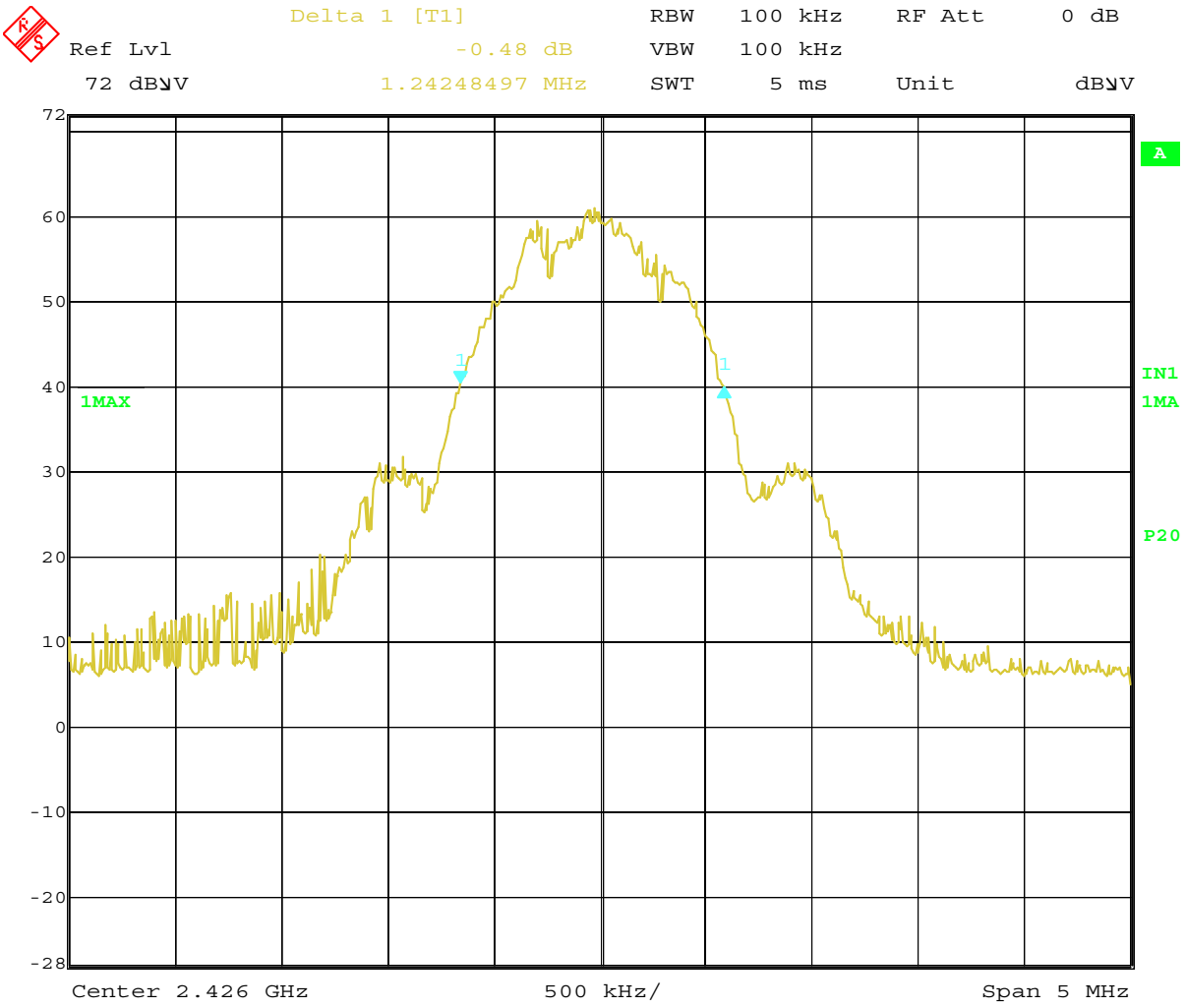
Frequency (MHz)	F low (MHz)	F high (MHz)
2402.000	2401.32365	-
2480.000	-	2480.63126

The device can be seen to stay within the band of 2400 – 2483.5 MHz at the -20 dB points

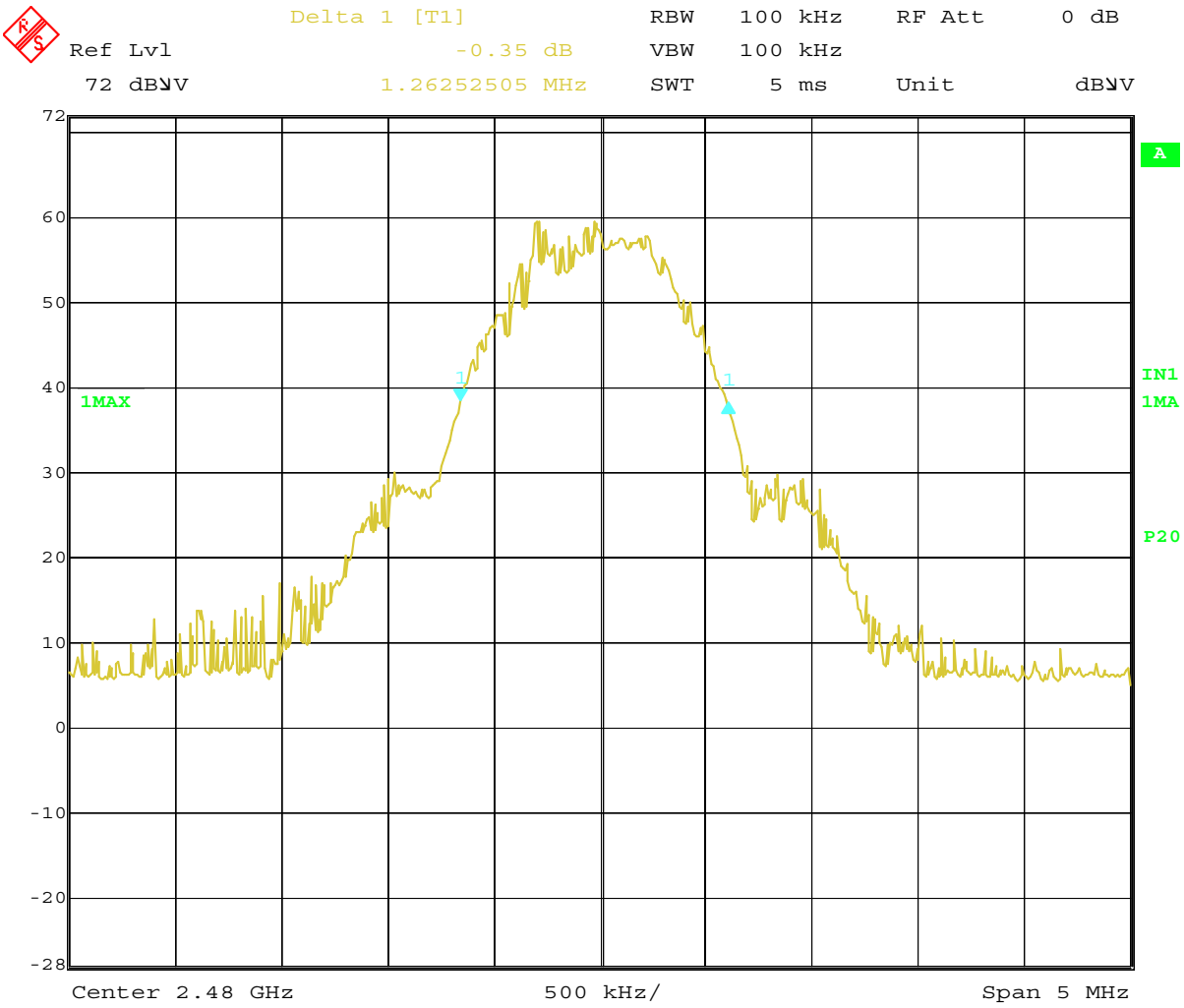
Transmitting on 2402 MHz



Transmitting on 2426 MHz. 20 dB bandwidth = 1.2425 MHz



Transmitting on 2480 MHz



Result: Complies

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due	Period
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applic	N/a
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic	N/a
VHF Balun	Schwarzbeck	VHA 9103	11042021A	3696	23 Nov 2024	3 years
Biconical Antenna	Schwarzbeck	BBA 9106	11042021A	3697	23 Nov 2024	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	3 April 2025	3 years
Horn Antenna	EMCO	3116	92035	-	21 Sept 2024	3 years
Log Periodic	Schwarzbeck	VUSLP 9111B	112+11042021B	4025	16 Nov 2024	3 years
Receiver	R & S	ESIB 40	100295	4030	6 Oct 2024	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic	N/a
Heliax cable	Andrews	L6PNM-RPD	22869	Oats Cable	30 Dec 2024	1 year
Mains Network	R & S	ESH 2-Z5	881362/034	3628	02 Jun 2024	3 years
Receiver	R & S	ESHS 10	828404/005	RFS 3728	23 Nov 2024	3 years
Power Supply	APT	7008	4170003	-	Not applicable	N/a

At the time of testing all equipment was within calibration.

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 International Laboratory Accreditation Council (ILAC) 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.