# EMC Technologies (NZ) Ltd

Test Report No **70801.1**

Report date: 22 August 2007

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# TEST REPORT

## Fortronics PTX5 Choker Release Transmitter

*tested to the*

## Code of Federal Regulations (CFR) 47

## Part 90 –Private Land Mobile Services

*for*

## Fortronics Ltd

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

**EMC Technologies (NZ) Ltd**

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## 1. CLIENT INFORMATION

| | |
|---|---|
| **Company Name** | Fortronics Ltd |
| **Address** | Unit 3, 78 Austin Street<br>Onekawa |
| **City** | Napier |
| **Country** | New Zealand |
| **Contact** | Mr Ross Lumsden |

## 2. DESCRIPTION OF TEST SAMPLE

| | |
|---|---|
| **Brand Name** | Fortronics |
| **Model Number** | PTX5 |
| **Product** | Choker Release Transmitter |
| **Manufacturer** | Fortonics Ltd |
| **Designed in** | New Zealand |
| **Manufactured in** | New Zealand |
| **Serial Number** | Not serialised |
| **FCC ID** | U44-PTX5US |

# 3. COMPLIANCE STATEMENT AND RESULT SUMMARY

The **Fortronics PTX5 Choker Release Transmitter** complies with the limits defined in 47 CFR Part 90 and 47 CFR Part 2 when tested in-accordance with the test methods described in 47 CFR Part 2.

| CLAUSE | TEST PERFORMED | RESULT |
|---|---|---|
| 90.203 | Certification required | Complies |
| 2.1046 | RF power output | Noted |
| 90.205 | Power and antenna height limits | Complies |
| 2.1047 | Modulation Characteristics | Noted |
| 2.1047(a) | Low pass filter response | Not applicable |
| 2.1047(b) | Modulation limiting characteristics | Not applicable |
| 90.211(a) | Modulation characteristics | Complies |
| 2.1049 | Occupied bandwidth | Noted |
| 2.202 | Bandwidths | Noted |
| 90.207 | Types of emissions | Complies |
| 90.209 | Bandwidth limitations | Complies |
| 90.210 | Emission masks | Complies |
| 2.1051 | Spurious emissions at antenna terminals | Complies |
| 2.1053 | Field strength of spurious radiation | Complies |
| 2.1055 | Frequency stability | Noted |
| 90.213 | Frequency stability | Complies |
| 90.214 | Transient frequency behaviour | Complies |
| 1.1310 | Radio frequency radiation exposure limits | Complies |

# 4. TEST SAMPLE DESCRIPTION

The sample tested has the following specifications:

Rated Transmitter Output Power

70 uW (-11.5 dBm)

Transmitter Frequency

462.8125 MHz

FCC Bands

Part 90: As per section 90.267 Group C Industrial / Business Pool

Emission Designators / Modes of operation

12k00A1D

Power Supply

Internal Lithium Battery at 6.0 Vdc

# 5. TEST CONDITIONS

Standard Temperature and Humidity

Temperature Range: 15°C - 30°C
Humidity Range: 40% - 75%

Standard Test Power Source

Standard Test Voltage: 6.0 Vdc.

Extreme Temperature

High Temperature: + 50°C maintained.
Low Temperature: - 30 °C maintained.

Extreme Test Voltages

High Voltage: 6.9 Vdc
Low Voltage: 5.1 Vdc

# 6. ATTESTATION

The **Fortronics PTX5 Coker Release Transmitter** complies with the Code of Federal Regulations (CFR) 47 Part 90 –Private Land Mobile Services.

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.**

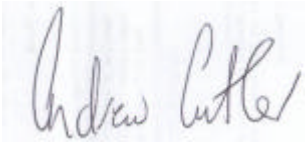
**This report does not contain corrections or erasures.**

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.

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

# 7. TEST RESULTS

**Certification required**

This transmitter sends bursts of data on 462.8125 MHz having a rated power of 70 uW (-11.5 dBm).

Compliance with the spectrum efficiency requirement of 4800 bit/s per 6.25 kHz of channel bandwidth according to Section 90.203(j)(3) when the power exceeds 500 mW is required.

However as the power does not exceed 500 mW the spectrum efficiency requirement is not applicable.

**Result:** Complies.

**RF power output**

Measurements were carried out at the RF output terminals of the transmitter using a 50 O load.

Measurements were carried out when the transmitter was not being modulated as this gave a worst case result.

Measurements were made with the input voltage set to 6.0 Vdc and when varied +/- 15%.

The transmitter is usually operated using a quarter wave omni directional whip antenna.

| Frequency | Voltage (Vdc) | Rated (dBm) | Measured (dBm) |
|---|---|---|---|
| 462.8125 | 5.1 | -11.5 | -11.7 |
| 462.8125 | 6.0 | -11.5 | -11.7 |
| 462.8125 | 6.9 | -11.5 | -11.7 |

*Limits:*
As per Section 90.267 (e)(2) Group C Industrial / Business Pool the maximum output power for mobile unit is 6 watts ERP (37.8 dBm).

If an antenna is sold with this device the gain will need to be limited to ensure that the ERP does not exceed 6 watts (37.8 dBm)

**Result:** Complies
***Measurement Uncertainty***: *±0.5 dB*

## Modulation Characteristics

This transmitter is not capable of producing analogue speech or digital speech modulations.

A spectrum plot on page 10 of this report has been provided for the following:

(d) A curve or equivalent data that shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

The type of modulation used by this transmitter is ASK modulation which achieves a data transmission with the emission designator of A1D.

*Limit:*
Part 90.211 – Modulation requirements states the transmitter must meet the emission requirements of 90.210. Refer to the Occupied Bandwidth measurements in this report.

**Result:** Complies

## Part 90.207 – Emission types:

The following emission types are used:

- A1D: Data transmission.

## Part 90.209 – Bandwidth limitations:

This transmitter transmits data using A1D.

Using the tables in Part 2.202 – Bandwidth, the bandwidth for A1D was determined as follows:

Bn = B*K

Where B = Baud Rate = 2400 Hz and K = 5

Bn = 2400 Hz * 5 = 12 kHz

To confirm this the occupied bandwidth has been measured and compared against the occupied bandwidth declared by the client.

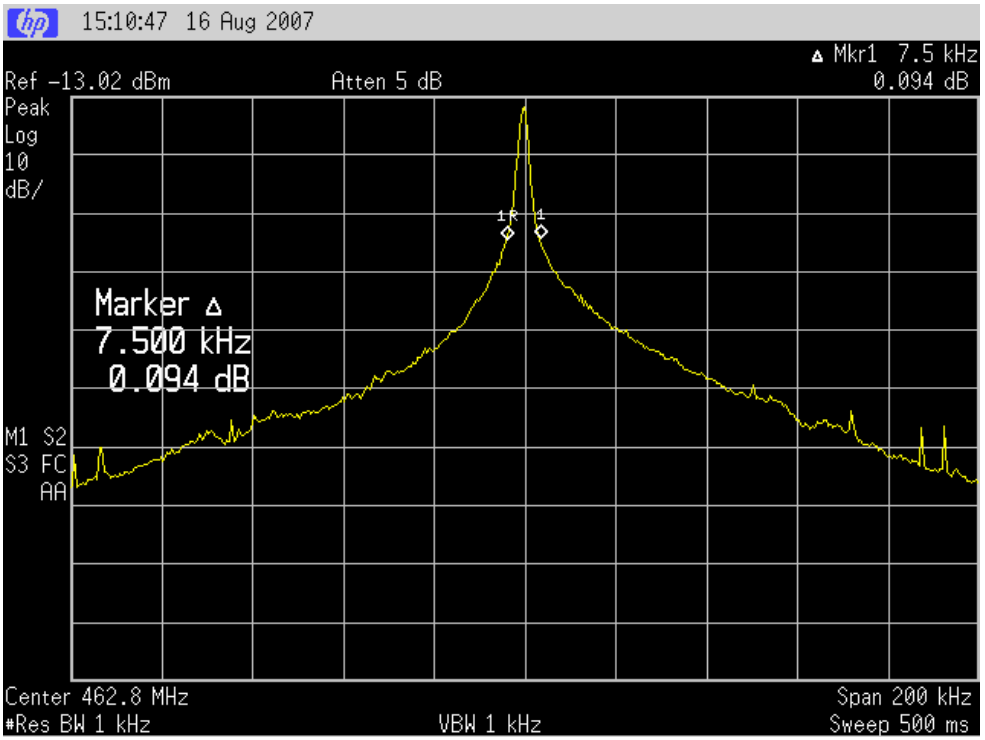
Measurements have been made of each modulation type using a spectrum analyser operating in peak hold mode.

Initially power measurements are made using a resolution bandwidth of 120 kHz.

This level is used as a reference level on the spectrum analyser.

The resolution bandwidth is then changed to 1 kHz and the reference level minus 23 dB (99%) absolute bandwidth points determined

| Emission | Channel Spacing | Measured | Designation |
|---|---|---|---|
| A1D | 25.0 kHz | 7.500 kHz | 12k0A1D |




**Result:** Complies

## Occupied Bandwidth

The spectrum masks are defined in:

Section 90.210(d) – Mask B has been applied as the transmitter can operate in the band 421 – 512 MHz using an authorised bandwidth of 20.0 kHz as per Section 90.209(b)(5).

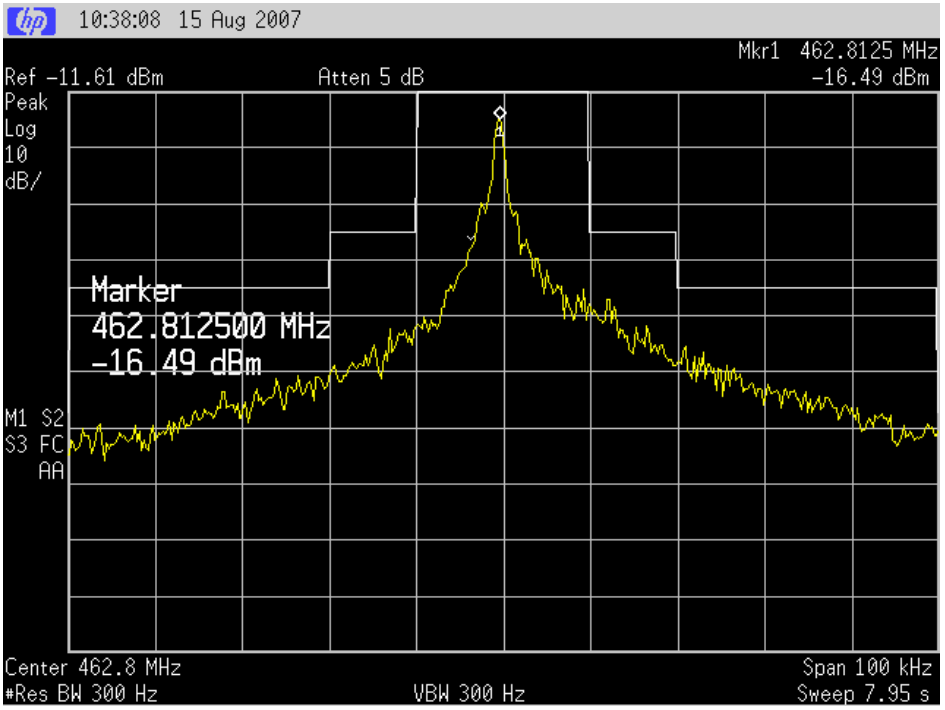
Mask B has been applied as the transmitter has a low pass filter that consists of components R28, C18 and C19.

The reference level for the following emission mask measurements has been determined using a resolution bandwidth of 120 kHz with the transmitter being modulated.

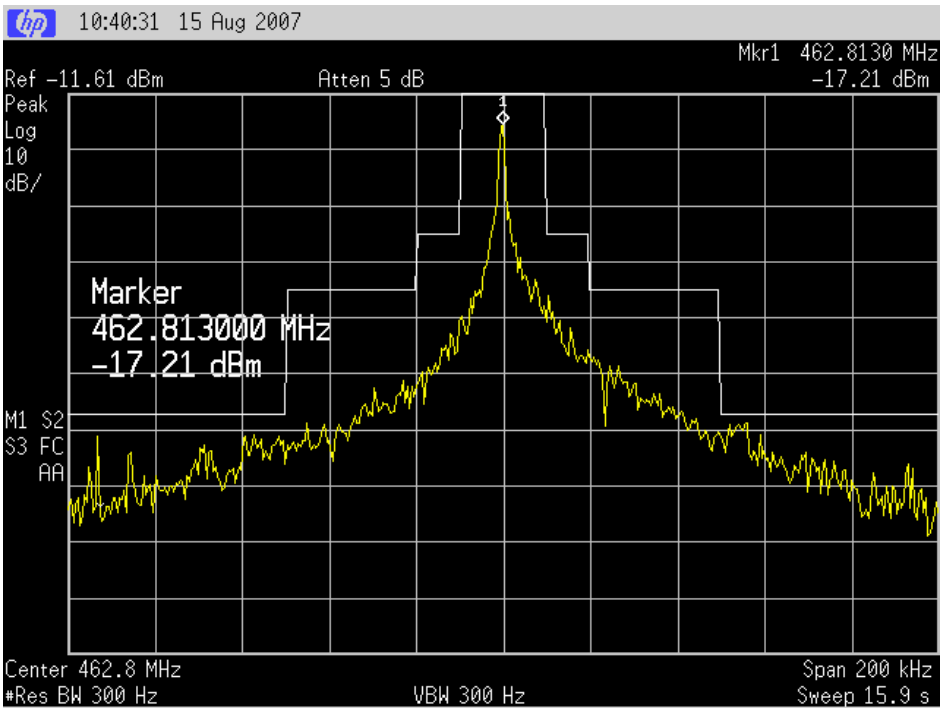
Measurements were made in peak hold with the transmitter operating with modulation applied.

The transmitter was modulated using a modulation source internal to the transmitter.

### Part 90: A1D – 25 kHz with a 100 kHz span



**Part 90: A1D – 25 kHz with a 200 kHz span**




A nominal limit of approximately -57 dBc has been applied beyond +/- 50 kHz as the limit is 43 + 10*log P.

Using this formula the limit is -13 dBm which is only 1.5 dBc.

**Result:** Complies

**Transmitter spurious emissions at the antenna terminals**

**Frequency:** 462.8125 MHz

| Spurious emission (MHz) | Emission level (dBm) | Limit (dBm) |
|---|---|---|
| 925.6250 | -65.0 | -13.0 |
| 1388.4375 | -82.0 | -13.0 |
| 1851.2500 | -82.0 | -13.0 |
| 2314.0625 | -82.0 | -13.0 |
| 2776.8750 | -82.0 | -13.0 |
| 3239.6875 | -60.0 | -13.0 |
| 3702.5000 | -67.5 | -13.0 |
| 4165.3125 | -69.4 | -13.0 |
| 4628.1250 | -63.7 | -13.0 |

No standby emissions were detected.

When operating in transmit mode no significant emissions were detected between the harmonic emissions.

*Limit:*
Part 90.210(b) Mask B, (3) On any frequency removed from the assigned frequency by more than 250% of the authorised bandwidth shall be attenuated by at least 43 + 10 log (P) dB.

Part 2.1051 states that emissions greater than 20 dB below the limit need not be specified.

Part 2.1057 states that the spectrum should be investigated up to the $10^{th}$ harmonic if the transmitter operates below 10 GHz.

A rated power of 70.0 mW gives a limit of –13 dBm.

Some emissions less that –40 dBm have been reported for completeness.

No measurements were made above the $10^{th}$ harmonic.

**Result:** Complies
**Measurement Uncertainty**: ±3.3 dB

**Field strength of the transmitter spurious emissions**

**Frequency:** 462.8125 MHz

Transmit emissions

| Frequency (MHz) | Level (dBuV/m) | Power (dBm) | Limit (dBm) | Polarity | Margin (dB) |
|---|---|---|---|---|---|
| 925.6250 | 24.1 | -71.1 | -20.0 | Vertical | 51.1 |
| 925.6250 | 27.8 | -67.4 | -20.0 | Horizontal | 47.4 |
| 1388.4375 | - | - | -20.0 | Vertical | - |
| 1388.4375 | 37.0 | -58.2 | -20.0 | Horizontal | 38.2 |
| 1851.2500 | - | - | -20.0 | Vertical | - |
| 1851.2500 | - | - | -20.0 | Horizontal | - |
| 2314.0625 | - | - | -20.0 | Vertical | - |
| 2314.0625 | - | - | -20.0 | Horizontal | - |
| 2776.8750 | - | - | -20.0 | Vertical | - |
| 2776.8750 | - | - | -20.0 | Horizontal | - |
| 3239.6875 | - | - | -20.0 | Vertical | - |
| 3239.6875 | - | - | -20.0 | Horizontal | - |
| 3702.5000 | - | - | -20.0 | Vertical | - |
| 3702.5000 | - | - | -20.0 | Horizontal | - |
| 4165.3125 | - | - | -20.0 | Vertical | - |
| 4165.3125 | - | - | -20.0 | Horizontal | - |
| 4628.1250 | - | - | -20.0 | Vertical | - |
| 4628.1250 | - | - | -20.0 | Horizontal | - |

No standby emissions were detected.

When operating in transmit mode no significant emissions were detected between the harmonic emissions.

Device was tested on an open area test site at a distance of 3 metres.

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

Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on January 18th, 2007

The transmitter was tested while transmitting continuously while attached to a dummy load.

The power level of each emission was determined by replacing the transmitter with a dipole antenna that was connected to a signal generator.

The signal generator output level was increased until the same field strength level was observed at each emission frequency.

The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

*Limit:*
All spurious emissions are to be attenuated by at least 50 + 10 log (P).

The rated power of 70 uW gives a limit of –20 dBm.

No measurements were made above the $10^{th}$ harmonic.

**Result:** Complies
**Measurement Uncertainty**: ±4.1 dB

## Frequency Stability

Frequency stability measurements were between - 30 °C and + 50°C in 10°C increments.

At each temperature the transmitter was given a period of 30 minutes to stabilise. The transmitter was then turned on and the frequency error measured after a period of 1 minute.

Measurements were made with the supply varied between 115% and 85% of the nominal supply voltage (6.0 Vdc).

Nominal Frequency: 462.8125 MHz

| Temp. | 5.1 Vdc | 6.0 Vdc | 6.9 Vdc |
|---|---|---|---|
| **+50° C** | -61.0 | -51.0 | -59.0 |
| **+40° C** | -59.0 | -54.0 | -59.0 |
| **+30° C** | -96.0 | -86.0 | -96.0 |
| **+20° C** | -284.0 | -306 | -276 |
| **+10° C** | +121.0 | +131.0 | +124.0 |
| **0° C** | +184.0 | +191.0 | +186.0 |
| **-10° C** | +261.0 | +276.0 | +266.0 |
| **-20° C** | +441.0 | +466.0 | +438.0 |
| **-30° C** | +693.0 | +650.0 | +680.0 |

*Limit:*
Part 90.213 state that mobile station transmitters operating between 421 – 512 MHz with 25 kHz channelling are required to have a frequency tolerance of 5 ppm.

This transmitter operates on 462.8125 MHz. 5 ppm = 5 x 462.8125 = 2314 Hz.

**Result:** Complies
**Measurement Uncertainty:** ±30 Hz

## Transient frequency behaviour

Transient frequency behaviour measurements are applicable to wide band and narrow band transmitters operating in the frequency band 421 – 512 MHz.

Measurements were carried out at 462.8125 MHz using the method described in TIA-603 and EN 300-086.

In summary this method calls for the use of an external signal generator tuned to 462.8125 MHz with a output level 0.1 % (-30 dB) of the level from the transmitter with a 1 kHz tone with a frequency deviation of 25 kHz being applied to the input of a modulation analyser along with the output from the transmitter.

The modulation analyser produces an amplitude difference signal and a frequency difference signal, which are applied to the input of a storage oscilloscope.

The unmodulated transmitter is then keyed which produces a trigger pulse that is AC coupled to the oscilloscope that produces a display on the screen.

The result of the change in the ratio of power between the test signal from the signal generator and the transmitter output will produce 2 separate sides on the oscilloscope picture.

One will show the 1000 Hz test modulation and the other will be the frequency difference of the transmitter versus time.

Results

| Period $t_1$ (kHz) | Period $t_2$ (kHz) | Period $t_3$ (kHz) |
|---|---|---|
| Nil | Nil | Nil |

Limits: 25 kHz Channel Spacing

| Time Interval | Period | Deviation (kHz) |
|---|---|---|
| $t_1$ | 10 mS | ± 25.0 |
| $t_2$ | 25 mS | ± 12.5 |
| $t_3$ | 10 mS | ± 25.0 |

**Result:** Complies

**Measurement Uncertainty**: Frequency difference ±1.6 kHz
Time period ±1 ms

**25 kHz transmitter turn on**

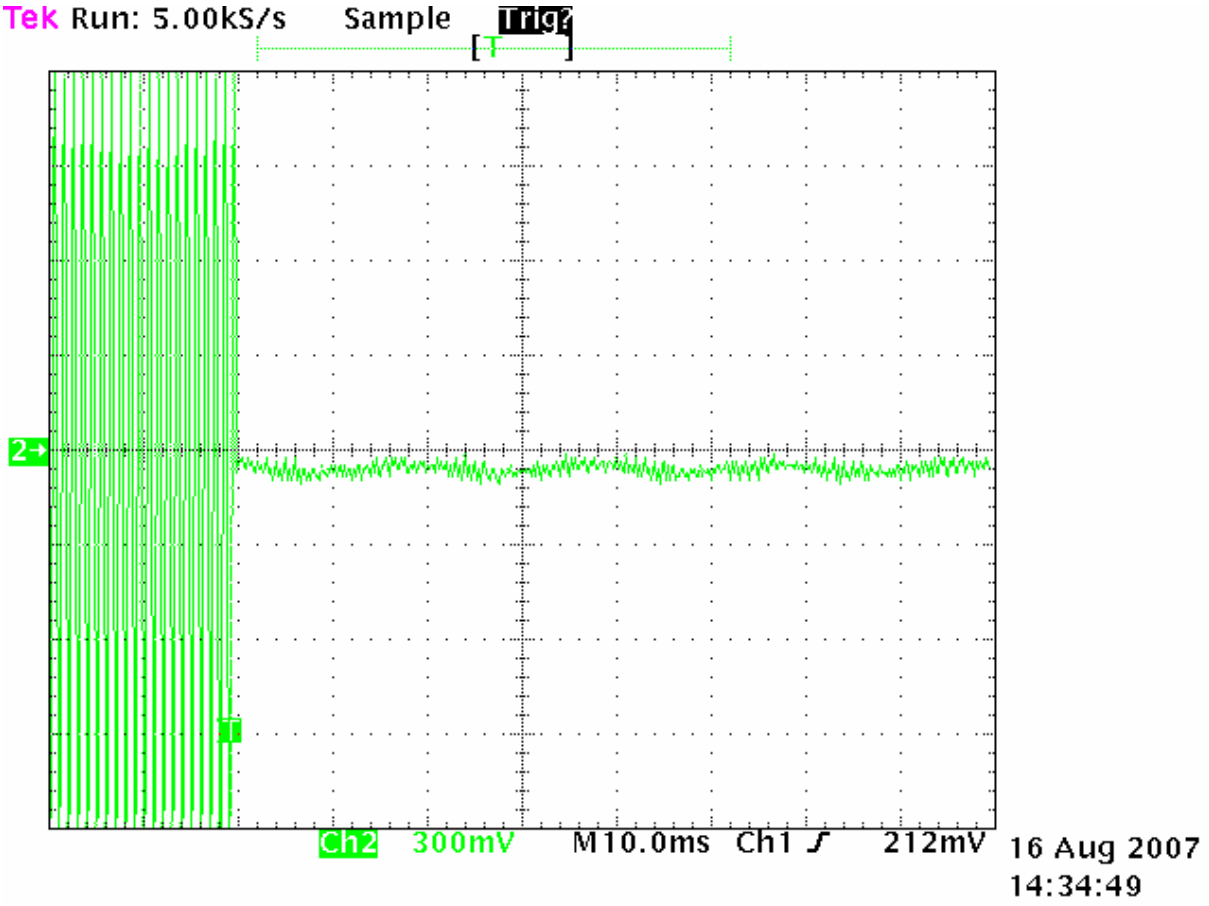
Green Trace = 1 kHz tone with FM deviation of 25 kHz and any transient.

Green trace has been maximised to give full screen indication of a ±25 kHz.
Therefore each Y axis division = 6.25 kHz per division.
The X axis has been set to a sweep rate of 10 mS/division.

Triggering has been set to occur 2 divisions from the left hand edge (20 mS).
This is position *t*on.

*t*1 occurs between 2.0 and 3.0 divisions from the left-hand edge.
*t2* occurs between 3.0 and 5.5 divisions from the left-hand edge.

No transients can be observed just after *t*on.



**25 kHz transmitter turn off**

Green Trace = 1 kHz tone with FM deviation of 25 kHz and any transient.

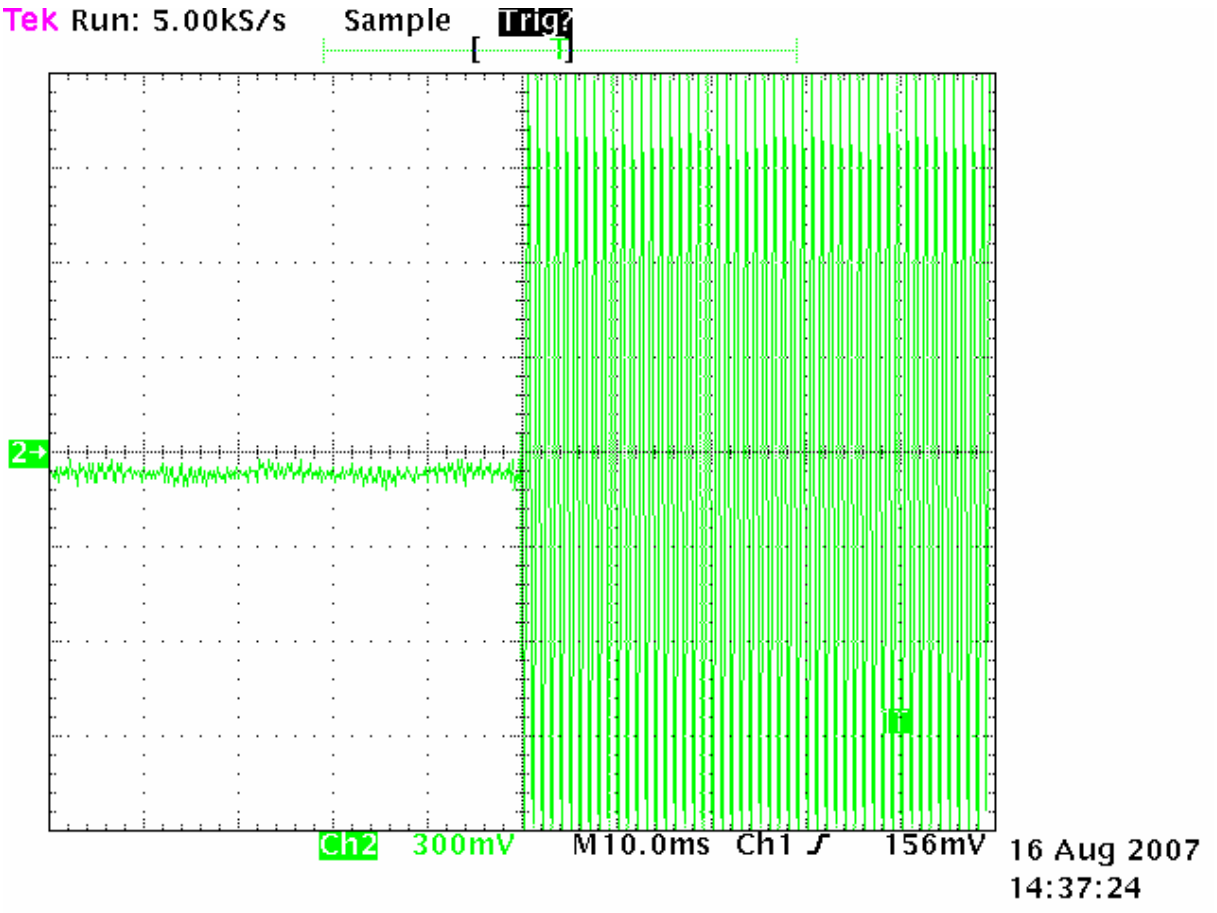
Green trace has been maximised to give full screen indication of a ± 25 kHz.
Therefore each Y axis division = 6.25 kHz per division.
The X axis has been set to a sweep rate of 10 mS/division.

The display of the 1 kHz signal rising has been positioned 5 divisions from the left hand edge (50 mS).

This is position *t*off.

*t*3 occurs between 4.0 and 5.0 divisions from the left hand edge.

No transients can be observed just before toff.



## Radio Frequency Hazard Information

As per Section 1.1310 and Section 2.1091 certification of this transmitter is sought using the Controlled / Occupational exposure limits as detailed in OST/OET Bulletin Number 65 as a power of 25 watts is to be used in a mobile environment where the use of the transmitter will be employment related.

Calculations have been made using the General Public/Uncontrolled Exposure limits.

Minimum safe distances have been calculated below.

Power density, $W/m^2 = E^2/3770$

- Occupational / Controlled Exposure limit will be 1.46 $mW/cm^2$ (f/300 = 440 MHz/300)
- General Population / Uncontrolled exposure limit will be 0.29 $mW/cm^2$ (f/1500 = 440 MHz/1500)

The minimum distance from the antenna at which the MPE is met is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain, transmitter duty cycle and separation distance in metres:

E, V/m = (√ (30 * P * G)) / d

| **Controlled** | **Uncontrolled** |
|---|---|
| $E = 1.46\ mW/cm^2 = E^2/3770$ | $E = 0.29\ mW/cm^2 = E^2/3770$ |
| $E = \sqrt{1.46*3770}$ | $E = \sqrt{0.29*3770}$ |
| E = 74.2 V/m | E = 33.1 V/m |

The rated maximum transmitter power = 70 microwatts (-11.5 dBm).

Transmitter operated using a quarter wave whip antenna with a gain of 2.15 dBi (1.64).

The transmitter is keyed using a manual keypad and would typically be used with a duty cycle of 50%.

| **Controlled** | **Uncontrolled** |
|---|---|
| d = √ (30 * P * G*DC) / E | |
| d = √ (30 * 7e-5 * 1.64 * 0.5) / 74.2 | d = √ (30 * 7e-5 * 1.64 * 0.5) / 33.1 |
| d = 0.0002 metres or 0.02 cm | d = 0.001 metres or 0.1 cm |

**Result:** Complies

# 8. TEST EQUIPMENT USED

| Instrument | Manufacturer | Model | Serial # | Asset |
|---|---|---|---|---|
| Controller | EMCO | 1090 | 9112-1062 | RFS 3710 |
| Aerial Mast | EMCO | 1070-1 | 9203-1661 | RFS 3708 |
| Biconical Antenna | Schwarzbeck | BBA 9106 | - | RFS 3612 |
| Log Periodic Antenna | Schwarzbeck | VUSLP9111 | 9111-228 | 3785 |
| Measurement Receiver | Rohde & Schwarz | ESCS 30 | 847124/020 | E1595 |
| Modulation Analyzer | Rohde & Schwarz | FMA | 837807/020 | E1552 |
| Oscilloscope | Tektronics | 745A | B010643 | 1569 |
| Signal Generator | Rohde & Schwarz | SMHU.58 | 838923/028 | E1493 |
| Spectrum Analyzer | Hewlett Packard | E7405A | US39150142 | 3776 |
| Thermal chamber | Contherm | M180F | 86025 | E1129 |
| Thermometer | DSIR | RT200 | 035 | E1049 |
| Turntable | EMCO | 1080-1-2.1 | 9109-1578 | RFS 3709 |
| Horn antenna | Electrometrics | RGA-60 | 6234 | E1494 |
| Microwave Pre Amplifier | Hewlett Packard | 8349B | 2644A01659 | - |

# 9. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was last updated on January 18th, 2007.

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

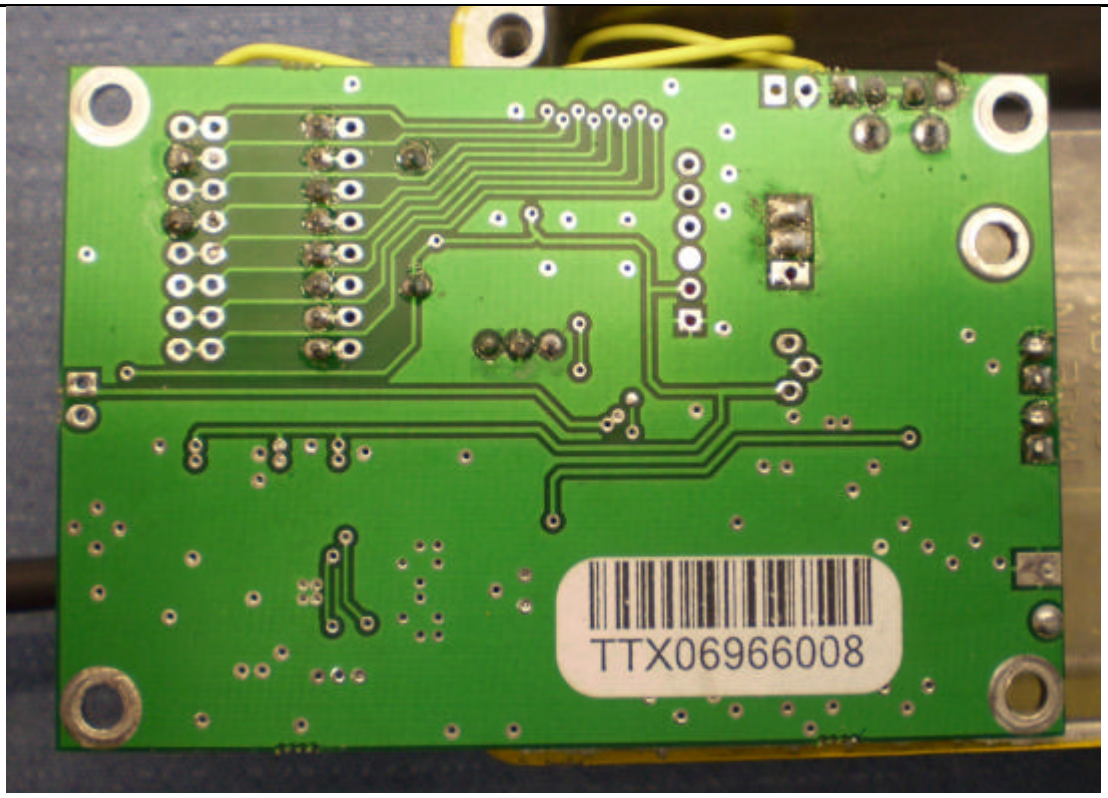
All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to ISO/IEC 17025.

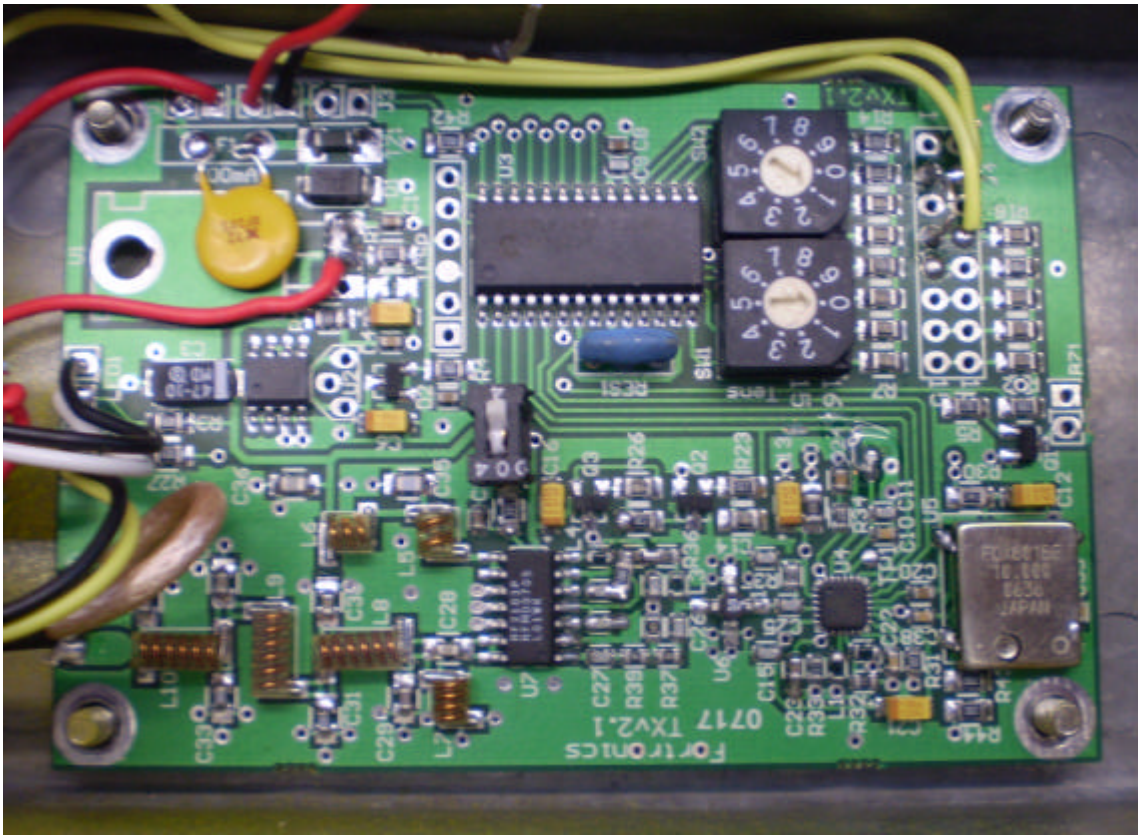
 

## 10. PHOTOGRAPH (S) External views

**Internal views**

## Radiated emissions test set up