

# EMC Technologies (NZ) Ltd

Test Report No **70536.1**

Report date: 8 June 2007

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## **TEST REPORT**

### **Fortronics MTX5 Choker Release Transmitter**

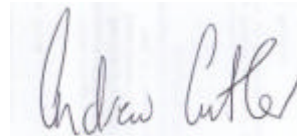
*tested to the*

### **Code of Federal Regulations (CFR) 47**

### **Part 90 –Private Land Mobile Services**

*for*

### **Fortronics Ltd**



This Test Report is issued with the authority of:

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**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 (NZ) Ltd**

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## 1. CLIENT INFORMATION

**Company Name** Fortronics Ltd

**Address** Unit 3, 78 Austin Street  
Onekawa

**City** Napier

**Country** New Zealand

**Contact** Mr Ross Lumsden

## 2. DESCRIPTION OF TEST SAMPLE

**Brand Name** Fortronics

**Model Number** MTX5

**Product** Choker Release Transmitter

**Manufacturer** Fortonics Ltd

**Designed in** New Zealand

**Manufactured in** New Zealand

**Serial Number** TTX06966015

**FCC ID** U44-MTX5US

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## 3. COMPLIANCE STATEMENT AND RESULT SUMMARY

The **Fortronics MTX5 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.

<u>CLAUSE</u>	<u>TEST PERFORMED</u>	<u>RESULT</u>
90.203	Certification required	Complies
2.1046	RF power output	Noted
90.205	Power and antenna height limits	Complies
2.1047	Modulation Characteristics	
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

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## 4. TEST SAMPLE DESCRIPTION

The sample tested has the following specifications:

### Rated Transmitter Output Power

400 mW (26.0 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

External DC voltage supply. Typically 13.8 Vdc

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## 5. TEST CONDITIONS

### Standard Temperature and Humidity

Temperature Range: 15°C - 30°C

Humidity Range: 40% - 75%

### Standard Test Power Source

Standard Test Voltage: 13.8 Vdc.

### Extreme Temperature

High Temperature: + 50°C maintained.

Low Temperature: - 30 °C maintained.

### Extreme Test Voltages

High Voltage: 11.7 Vdc

Low Voltage: 15.9 Vdc

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## 6. ATTESTATION

The **Fortronics MTX5 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

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## 7. TEST RESULTS

### Certification required

This transmitter sends bursts of data on 462.8125 MHz having a rated power of 400 mW (26 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  $\Omega$  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 13.8 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	11.7	26.0	25.9
462.8125	13.8	26.0	26.0
462.8125	15.9	26.0	26.1

### *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:  $\pm 0.5$  dB***

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## **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:

$$B_n = B * K$$

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

$$B_n = 2400 \text{ Hz} * 5 = 12 \text{ kHz}$$

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

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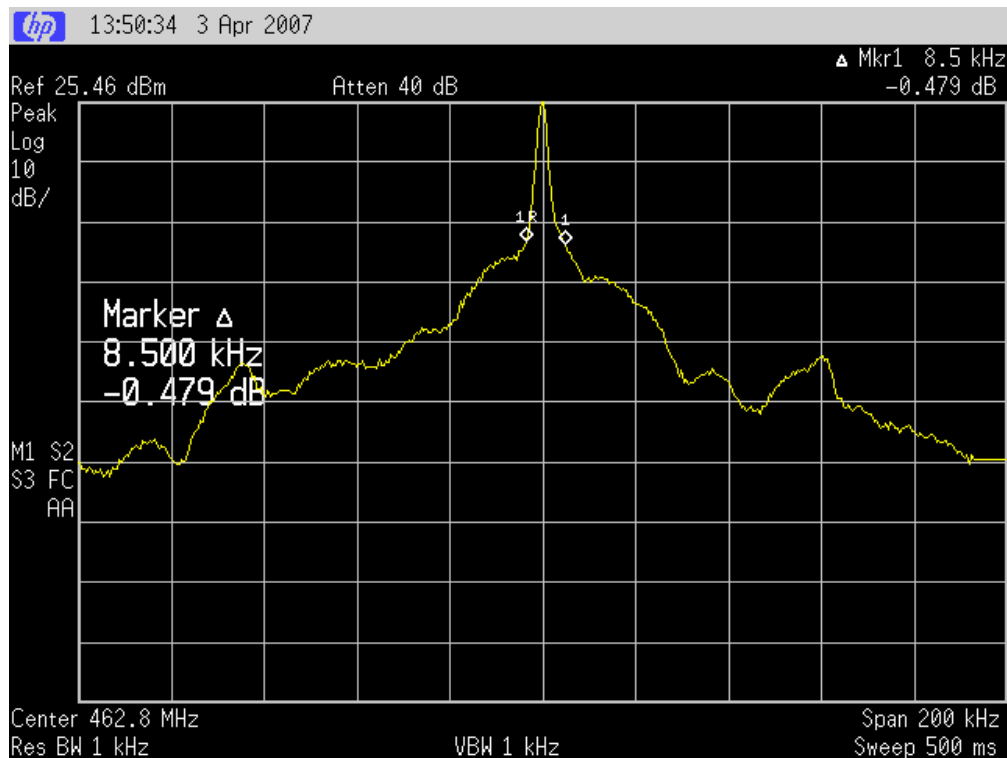
Measurements have been made of each modulation type using a spectrum analyser operating in peak hold mode.

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	8.500 kHz	12k00A1D



**Result:** Complies

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## 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).

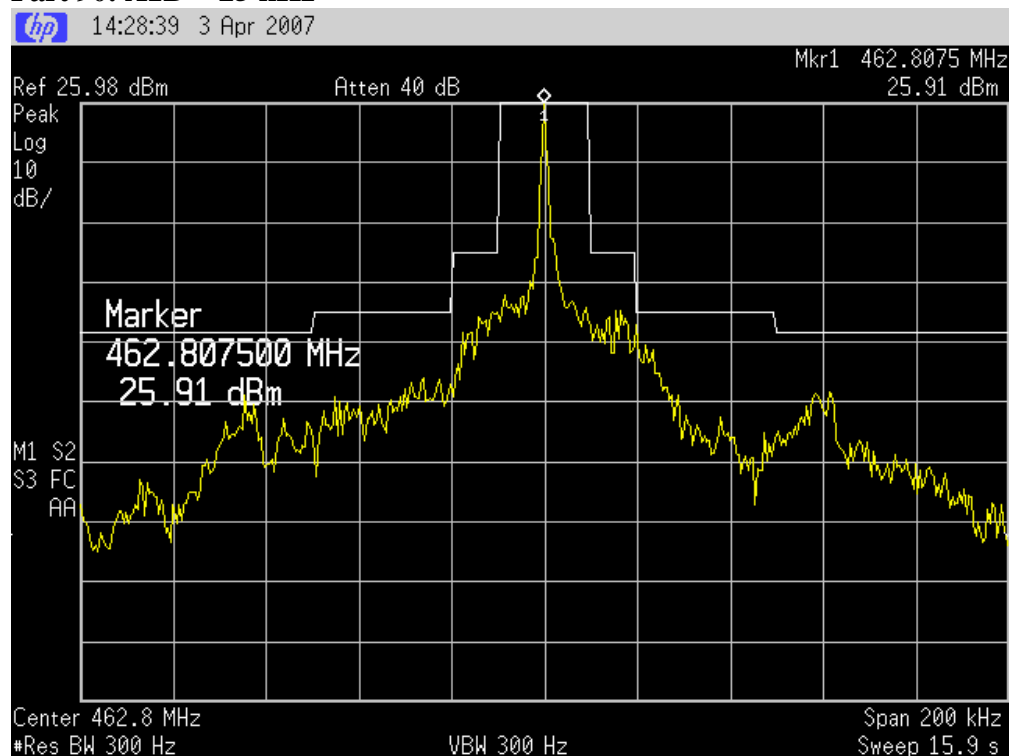
Mask B has been applied as the transmitter has a low pass filter that consists of components R28, C18 and C19.

The reference level for the following emission mask measurements has been determined using a resolution bandwidth of 30 kHz with the transmitter not 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**



**Result:** Complies

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## Transmitter spurious emissions at the antenna terminals

Frequency: 462.8125 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
925.6250	-37.4	-13.0
1388.4375	-52.1	-13.0
1851.2500	-54.8	-13.0
2314.0625	-23.5	-13.0
2776.8750	-51.2	-13.0
3239.6875	-50.3	-13.0
3702.5000	-59.1	-13.0
4165.3125	-31.8	-13.0
4628.1250	-56.4	-13.0
578.498	-35.0	-13.0

No standby emissions were detected.

When operating in transmit mode no significant emissions were detected between the harmonic emissions except for the emission at 578 MHz that is listed.

### *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<sup>th</sup> harmonic if the transmitter operates below 10 GHz.

A rated power of 400.0 mW gives a limit of -13 dBm.

Some emissions less than -40 dBm have been reported for completeness.

No measurements were made above the 10<sup>th</sup> harmonic.

**Result:** Complies

**Measurement Uncertainty:**  $\pm 3.3$  dB

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## 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)
925.6125	65.1	-30.1	-20.0	Vertical	10.1
925.6125	64.5	-30.7	-20.0	Horizontal	10.7
1388.4200	64.1	-31.1	-20.0	Vertical	11.1
1388.4200	65.5	-29.7	-20.0	Horizontal	9.7
1851.2275	64.9	-30.3	-20.0	Vertical	10.3
1851.2275	59.7	-35.5	-20.0	Horizontal	15.5
2314.0350	66.9	-28.3	-20.0	Vertical	8.3
2314.0350	64.5	-30.7	-20.0	Horizontal	10.7
2776.8425	50.5	-44.7	-20.0	Vertical	24.7
2776.8425	49.2	-46.0	-20.0	Horizontal	26.0
3239.6500	44.3	-50.9	-20.0	Vertical	30.9
3239.6500	48.3	-46.9	-20.0	Horizontal	26.9
3702.4575	40.9	-54.3	-20.0	Vertical	34.3
3702.4575	42.8	-52.4	-20.0	Horizontal	32.4
4165.2650	50.0	-45.2	-20.0	Vertical	25.2
4165.2650	49.2	-46.0	-20.0	Horizontal	26.0
4628.0725	32.6	-62.6	-20.0	Vertical	42.6
4628.0725	40.9	-54.3	-20.0	Horizontal	34.3

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.

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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 400 mW gives a limit of  $-20$  dBm.

No measurements were made above the 10<sup>th</sup> harmonic.

**Result:** Complies

**Measurement Uncertainty:**  $\pm 4.1$  dB

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## **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 (13.8 Vdc).

Nominal Frequency: 462.8125 MHz

Temp.	11.7 Vdc	13.8 Vdc	15.9 Vdc
+50° C	-605.0	-605.0	-607.0
+40° C	-537.0	-535.0	-537.0
+30° C	-487.0	-486.0	-485.0
+20° C	-463.0	-460.0	-465.0
+10° C	-465.0	-461.0	-466.0
0° C	-407.0	-408.0	-407.0
-10° C	-357.0	-355.0	-357.0
-20° C	-77.0	-80.0	-79.0
-30° C	+63.0	+61.0	+63.0

### *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.  $5 \text{ ppm} = 5 \times 462.8125 = 2314 \text{ Hz}$ .

**Result:** Complies

**Measurement Uncertainty:**  $\pm 30 \text{ Hz}$

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## **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)
< 6.25	< 6.25	Nil

Limits: 25 kHz Channel Spacing

Time Interval	Period	Deviation (kHz)
$t_1$	10 mS	$\pm 25.0$
$t_2$	25 mS	$\pm 12.5$
$t_3$	10 mS	$\pm 25.0$

**Result:** Complies

**Measurement Uncertainty:** Frequency difference  $\pm 1.6$  kHz  
Time period  $\pm 1$  ms

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## 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  $\pm 25$  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.

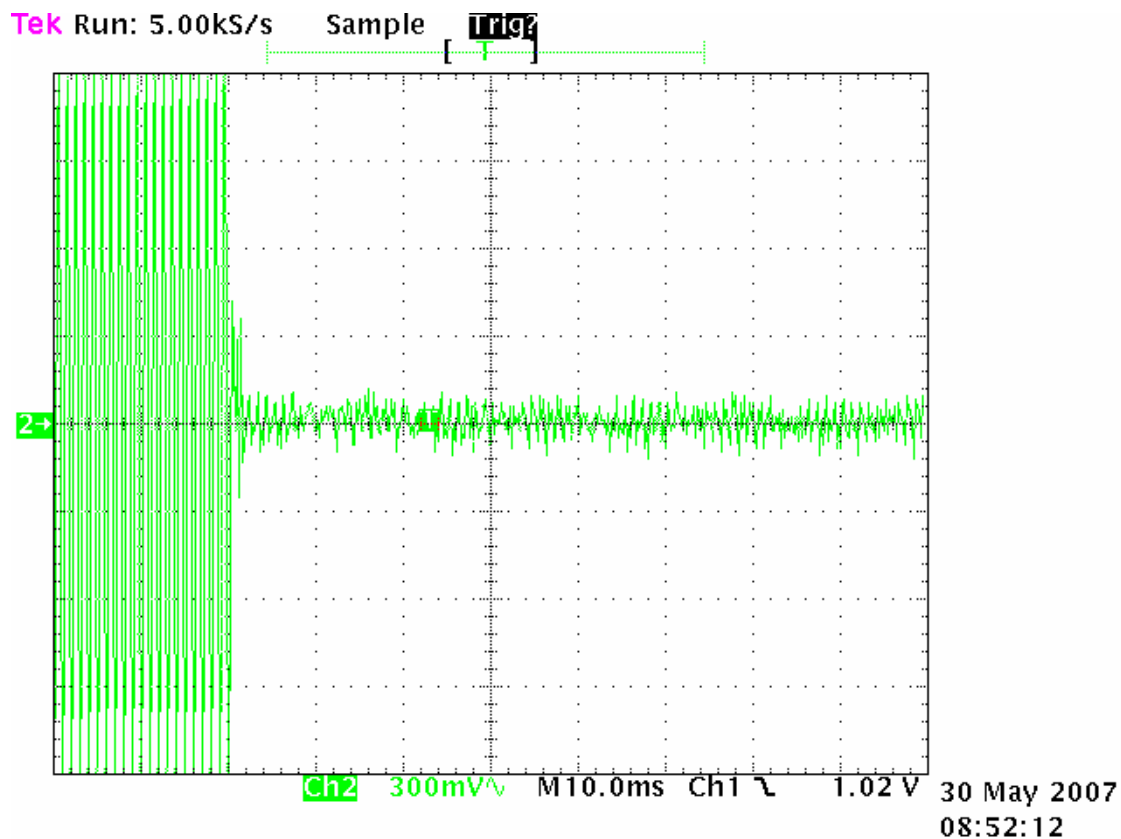
Triggering has been set to occur 2 divisions from the left hand edge (20 mS).

This is position  $t_{on}$ .

$t_1$  occurs between 2.0 and 3.0 divisions from the left-hand edge.

$t_2$  occurs between 3.0 and 5.5 divisions from the left-hand edge.

Several small transients can be observed just after  $t_{on}$ .



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## 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  $\pm 25$  kHz.

Therefore each Y axis division = 6.25 kHz per division.

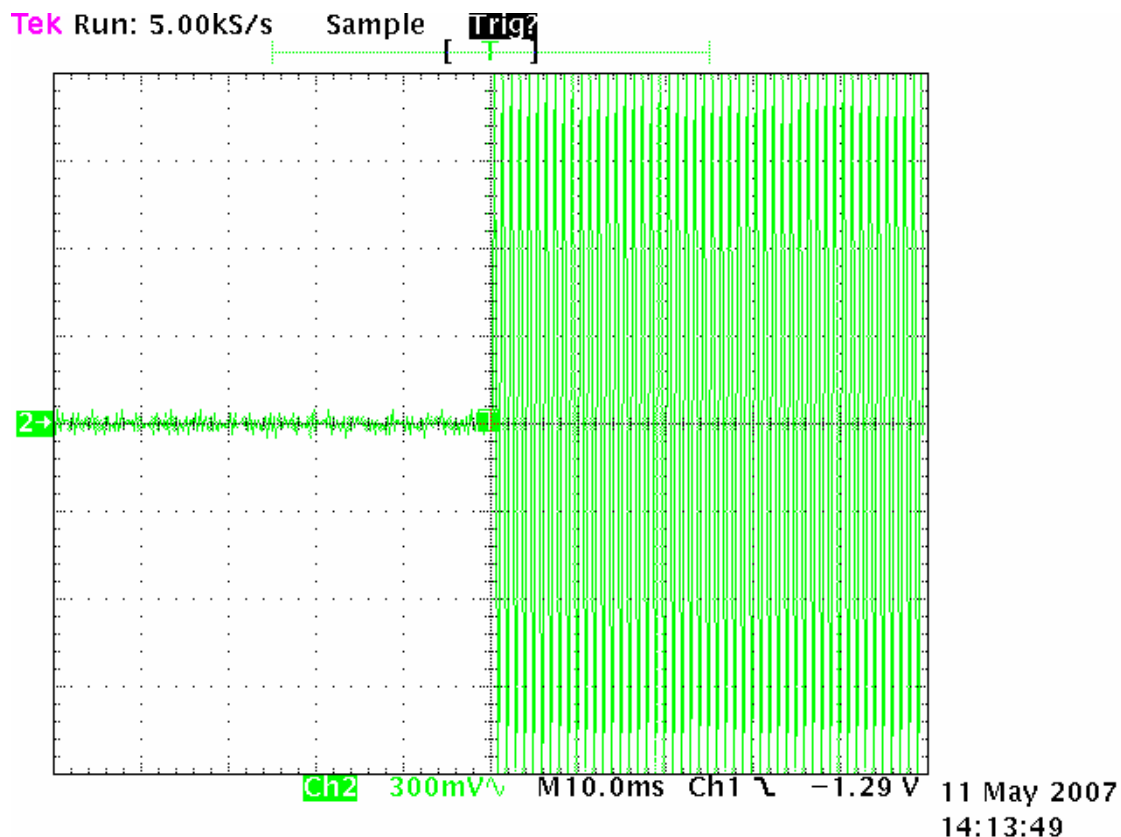
The X axis has been set to a sweep rate of 10 mS/division.

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  $t_{off}$ .



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## **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:

$$E, V/m = (\sqrt{30 * P * G}) / d$$

### **Controlled**

$$E = 1.46 mW/cm^2 = E^2/3770$$

$$E = \sqrt{1.46 * 3770}$$

$$E = 74.2 V/m$$

### **Uncontrolled**

$$E = 0.29 mW/cm^2 = E^2/3770$$

$$E = \sqrt{0.29 * 3770}$$

$$E = 33.1 V/m$$

The rated maximum transmitter power = 0.4 watts.

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**

$$d = \sqrt{30 * P * G * DC} / E$$

$$d = \sqrt{30 * 0.4 * 1.64 * 0.5} / 74.2$$

$$d = 0.042 \text{ metres or } 4.2 \text{ cm}$$

### **Uncontrolled**

$$d = \sqrt{30 * 0.4 * 1.64 * 0.5} / 33.1$$

$$d = 0.095 \text{ metres or } 9.5 \text{ cm}$$

**Result:** Complies

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## 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
Attenuator 10 dB	Hewlett Packard	HP8491A	24838	E1329
Attenuator 20 dB	Weinschel	49-20-43	GC-104	E1308
Audio Analyzer	Hewlett Packard	8903A	2216A01713	E1146
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612
Frequency Counter	Hewlett Packard	HP 5342A	1916A01713	E1224
Level generator	Anritsu	MG443B	M61689	E1143
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
Modulation Analyzer	Hewlett Packard	8901B	2608A00782	E1090
Oscilloscope	Tektronics	745A	B010643	1569
Power Attenuator	Weinschel	49-20-43	GC104	E1308
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069
RF Power Meter	Hewlett Packard	HP 436A	2512A22439	E1198
Rubidium Oscillator	Ball Efratom	FRS – C	4287	E1053
Selective Level Meter	Anritsu	ML422C	M35386	E1140
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 18<sup>th</sup>, 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.

### EMC Technologies (NZ) Ltd

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# EMC Technologies (NZ) Ltd

Test Report No 70536.1

Report date: 8 June 2007

## 10. PHOTOGRAPH (S)

### External views



### EMC Technologies (NZ) Ltd

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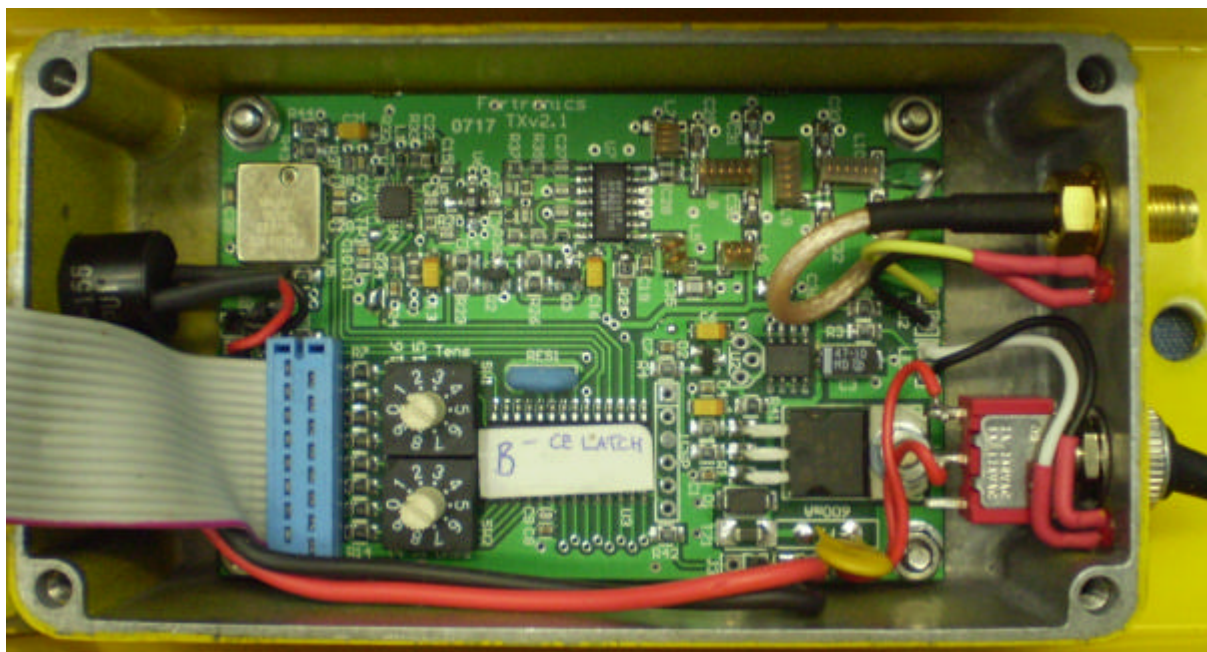
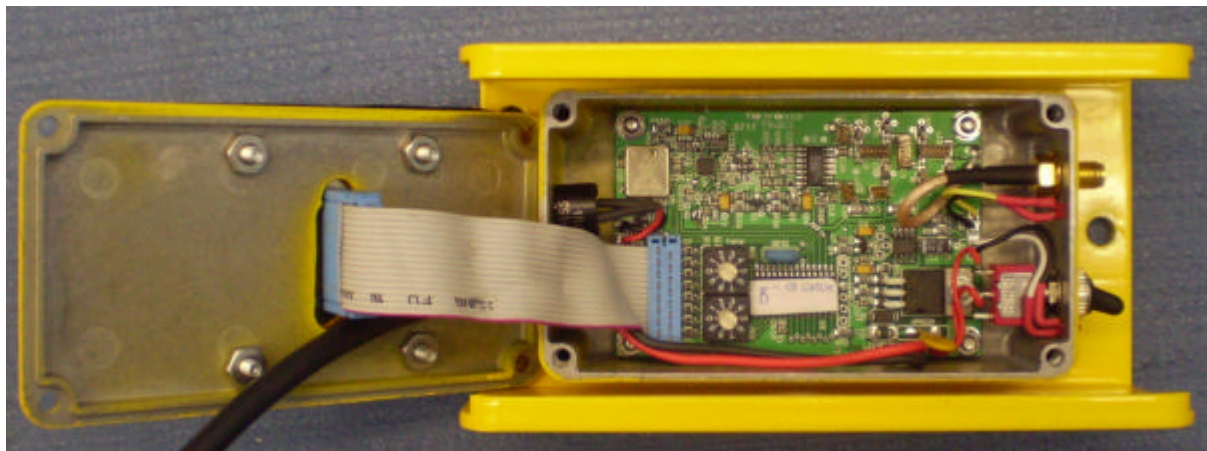
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## Internal views



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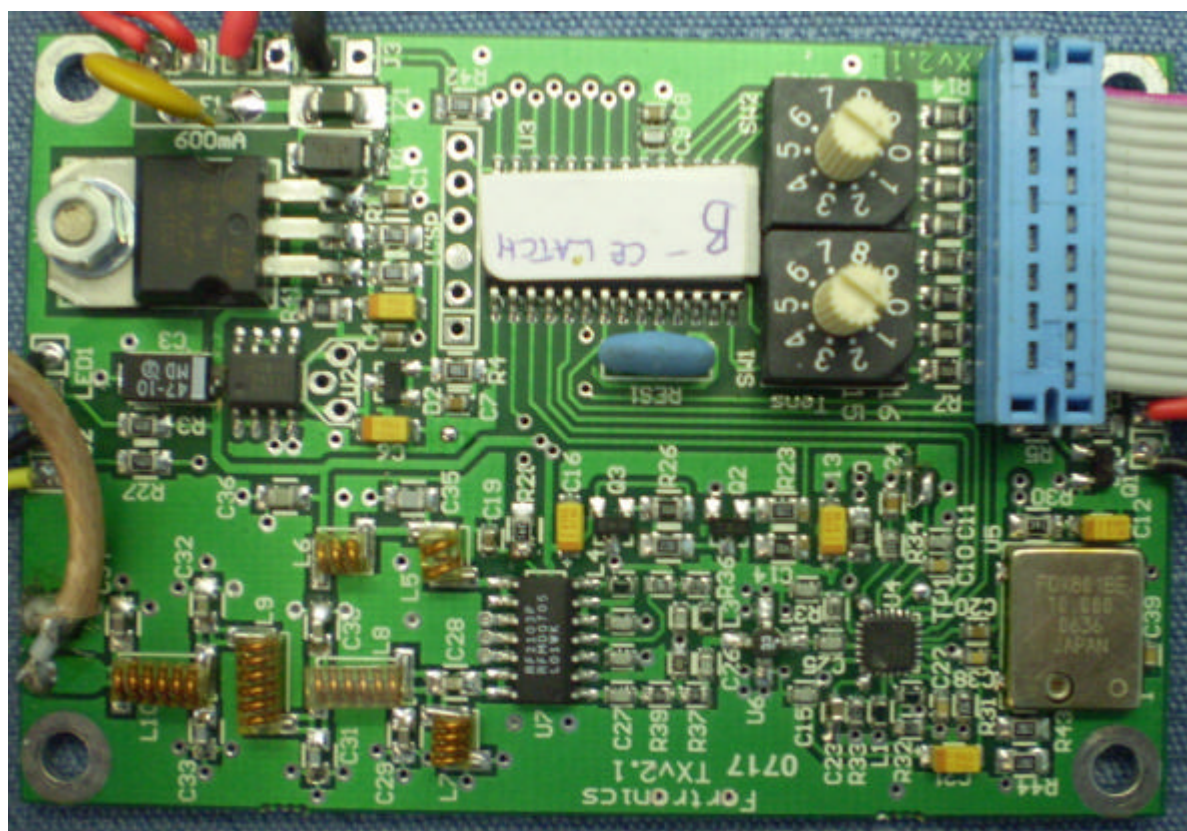
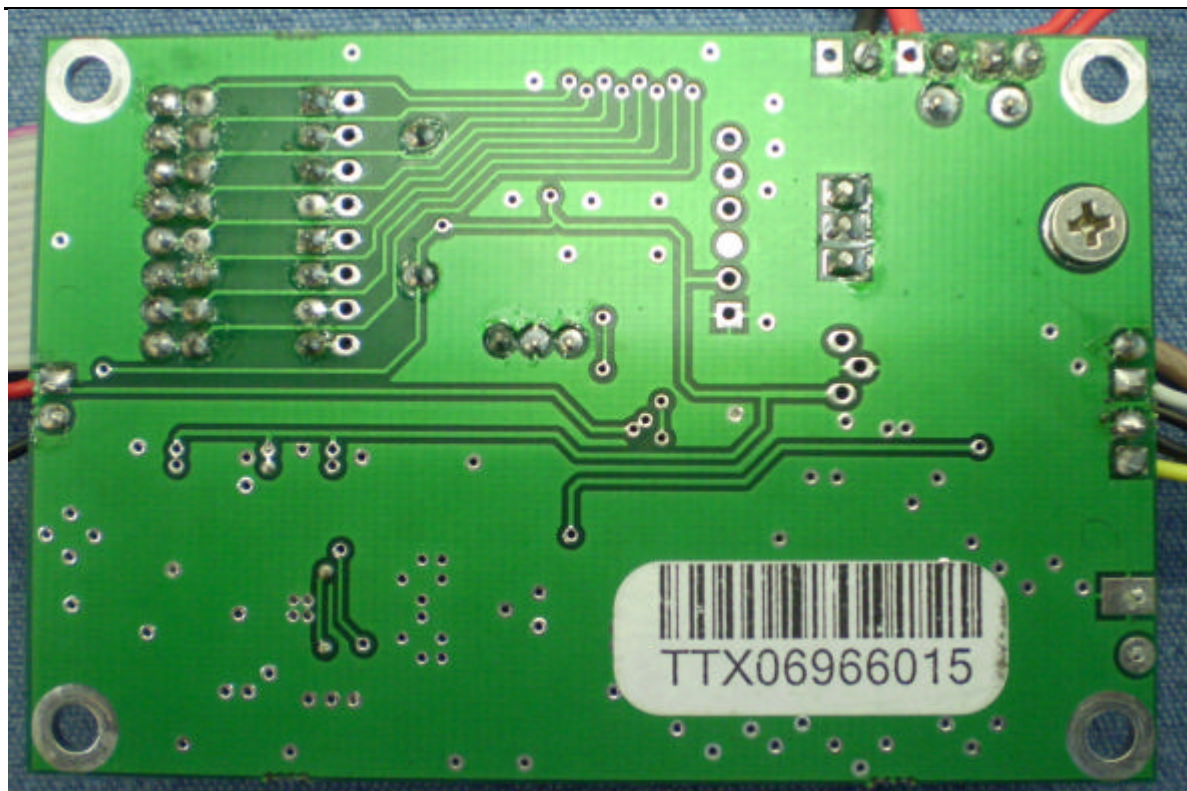
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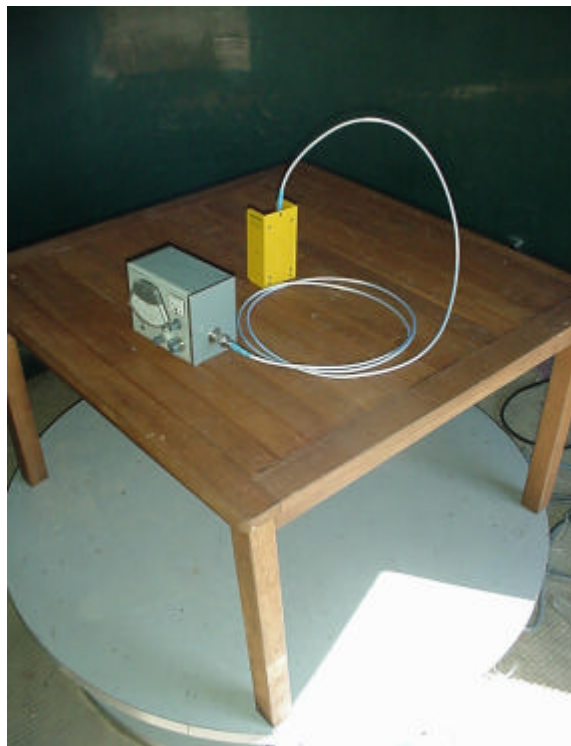
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## Radiated emissions test set up



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