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## **TEST REPORT**

### **MGL Avionics V6 VHF Air Band Transceiver**

*tested for compliance with the*

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

**Part 87 –Aviation Services**

**Part 15 – Radio Frequency Devices**

*for*

**MGL Avionics cc**

This Test Report is issued with the authority of:

A handwritten signature in black ink, appearing to read "Andrew Cutler".

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**Andrew Cutler - General Manager**



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## **1. CLIENT INFORMATION**

<b>Company Name</b>	MGL Avionics cc
<b>Address</b>	5 Fuchsia Street Somerset West 7130
<b>Country</b>	South Africa
<b>Contact</b>	Mr Rainer Lamers

## **2. DESCRIPTION OF TEST SAMPLE**

<b>Brand Name</b>	MGL Avionics
<b>Model Tested</b>	V6
<b>Product</b>	VHF Aircraft Transceiver
<b>Manufacturer</b>	MGL Avionics
<b>Country of Origin</b>	South Africa
<b>Serial Number</b>	V6 110700103
<b>FCC ID</b>	WSJV6

### 3. COMPLIANCE STATEMENT & RESULT SUMMARY

The **MGL Avionics V10 VHF Airband Transceiver** complies with 47 CFR Part 87 and Part 15 when tested in accordance with 47 CFR Part 2, Part 15 and Part 87 when the test methods as described in ANSI C63.4 – 2003 were applied.

A summary of the applicable clauses is detailed below

Clause	Test Performed	Result
2.1041	Measurement procedures	Noted
2.1057	Frequency spectrum to be investigated	Noted
87.131	Power and emissions	Complies
2.1046	RF power output	Noted
87.133	Frequency stability	Complies
2.1055	Frequency stability	Noted
87.135	Bandwidth of emission	Complies
2.202	Bandwidths	Noted
87.137	Types of emissions	Complies
87.139	Emission limitations	Complies
2.1049	Occupied bandwidth	Noted
2.1051	Spurious emissions at antenna terminals	Complies
2.1053	Field strength of spurious radiation	Complies
87.141	Modulation requirements	Complies
2.1047	Modulation Characteristics	Noted
2.1047(a)	Low pass filter response	Complies
2.1047(b)	Modulation limiting characteristics	Complies
15.111	Antenna conducted power measurement	Complies
1.1310	Radio frequency radiation exposure limits	Complies

## **4. TEST SAMPLE DESCRIPTION**

The sample tested has the following specifications:

### **Rated Transmitter Output Power**

6.5 watts (38.1 dBm) at 13.8 Vdc

5.0 watts (37.0 dBm) at 12.0 Vdc

3.5 watts (35.4 dBm) at 10.0 Vdc

### **Transmitter frequency range**

118.0000 – 136.9750 MHz

### **Receiver frequency range**

108.0000 – 136.9750 MHz

### **Test frequency**

127.0000 MHz

### **Channel spacing**

25.0 kHz

The transceiver is capable of tuning in steps of 1 MHz, 50 kHz or 25 kHz.

### **FCC Bands**

Part 87: 118.000 – 137.000 MHz

### **Emission Designators / Modes of operation**

6K00A3E

### **Power Supply**

External supply between 10 – 28 Vdc supply.

Typical operating voltage would be 13.8 Vdc

## **5. TEST CONDITIONS**

### **Standard Temperature and Humidity**

Temperature: +25°C ± 4° maintained.  
Relative Humidity: 60% ± 10% observed.

### **Standard Test Power Source**

Standard Test Voltage: 13.8 Vdc.

### **Extreme Temperature**

High Temperature: + 50°C maintained.  
Low Temperature: - 20 °C maintained.

### **Extreme Test Voltages**

High Voltage: 28.0 Vdc  
Low Voltage: 10.0 Vdc

Testing carried out at the extremes of voltages as stated by customer

## 6. ATTESTATION

Testing of the **MGL Avionics V10 VHF Aircraft Transceiver** complies with the Code of Federal Regulations (CFR) 47 Part 87 – Aviation Services and (CFR) 47 Part 15 – Radio Frequency Devices.

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.**

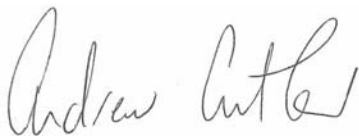
**This report does not contain corrections or erasures.**

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

### Power and emissions

Measurements were carried out at the RF output terminals of the transmitter using a 30 dB power attenuator and a 50  $\Omega$  dummy load.

Measurements were carried out when the transmitter was not being modulated.

Frequency (MHz)	Voltage (Vdc)	Rated (dBm)	Measured (dBm)
127.000	10.0	35.4	36.1
127.000	13.8	38.1	37.8
127.000	28.0	38.1	37.9

The manufacturer's specification is 6.5 watts (38.1 dBm) with a tolerance of +/- 10% when powered at 13.8 Vdc.

This gives a range of 5.85 watts to 7.15 watts that equates to 37.6 dBm to 38.5 dBm.

Testing was carried out at maximum power output.

The transmitter is used for aircraft communications in the VHF band.

#### Limit:

Section 87.131 specifies a limit of 55 watts for A3E emissions in the VHF band.

**Result:** Complies

**Measurement Uncertainty:**  $\pm 0.5$  dB



## Frequency Stability

Frequency stability measurements were between - 20 °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 at 10 Vdc, 13.8 Vdc and 28.0 Vdc which are the stated voltage extremes with the frequency error being displayed in Hz.

Nominal Frequency: 127.000 MHz

Temp.	10.0 Vdc	13.8 Vdc	28.0 Vdc
+50°C	0.0	+1.0	+1.0
+40°C	-8.0	-7.0	-7.0
+30°C	-22.0	-22.0	-21.0
+20°C	-83.0	-83.0	-84.0
+10°C	-55.0	-56.0	-56.0
0°C	-23.0	-22.0	-22.0
-10°C	+4.0	+3.0	+5.0
-20°C	+11.0	+11.0	+11.0

### Limit:

Part 87.133 states that aircraft stations operating in the band 108 – 137 MHz after 1 January 1990 are required to have frequency tolerance of 20 ppm.

Testing was carried out on 127.000 MHz.  $20 \text{ ppm} = 20 \times 127 = 2540 \text{ Hz}$ .

**Result:** Complies

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

### **Bandwidth of emission**

In accordance with Section 87.135 the following will apply.

- (a) Occupied bandwidth measurements have been made in accordance with Section 87.139(a)
- (b) As the transmitter operates in the 117.975 – 137.000 MHz band after January 1, 1974 using A3E, the authorised bandwidth will be 25.0 kHz. See the table in Section 87.137(a)
- (c) The necessary bandwidth has been calculated as follows:

The table in Section 87.137(a) defines an emission bandwidth of 6 kHz.

Using the formula in Section 2.202(g) where  $B_n = 2 * M$

$M = 3$  kHz which is the maximum modulation frequency

$B_n$  therefore equals 6 kHz.

Using the results obtained for the low pass filter it can be seen that this filter has a cut off point of 2.9 kHz

$B_n$  therefore equals 5.8 kHz

### **Types of emissions**

In accordance with Section 87.137(a):

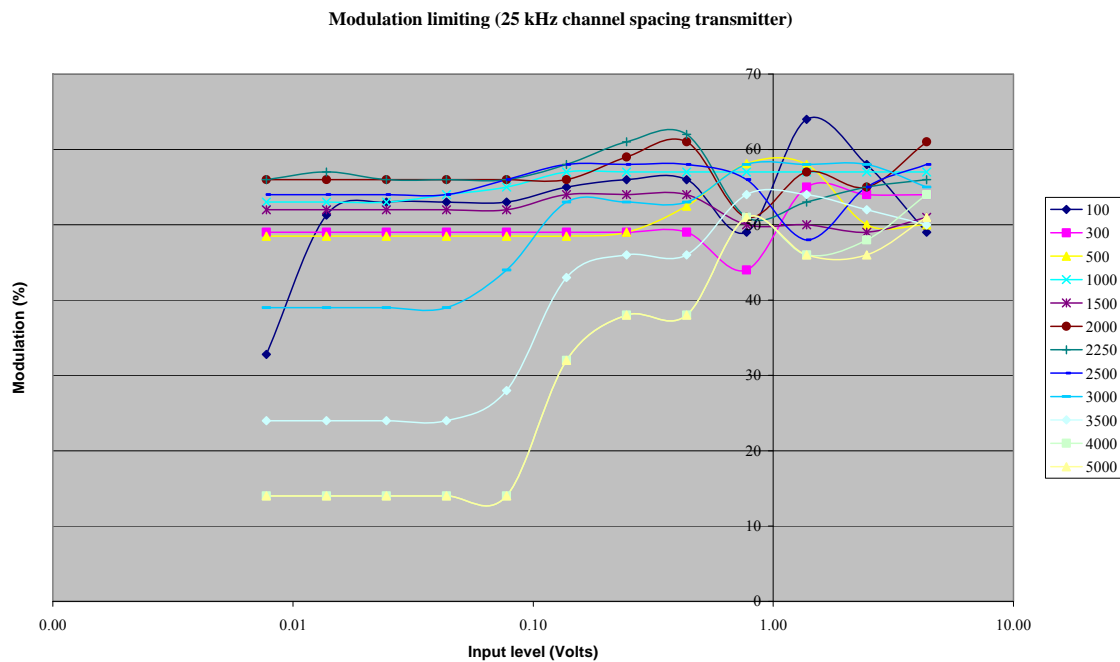
- Class of emission is A3E
- Emission designator is 6K00A3E
- Transmitter operates above 50 MHz and operates in the band 118.000 – 137.000 MHz
- Transmitter is to be approved after January 1<sup>st</sup>, 1974
- Therefore the authorised bandwidth will be 25.0 kHz.

## Modulation Requirements

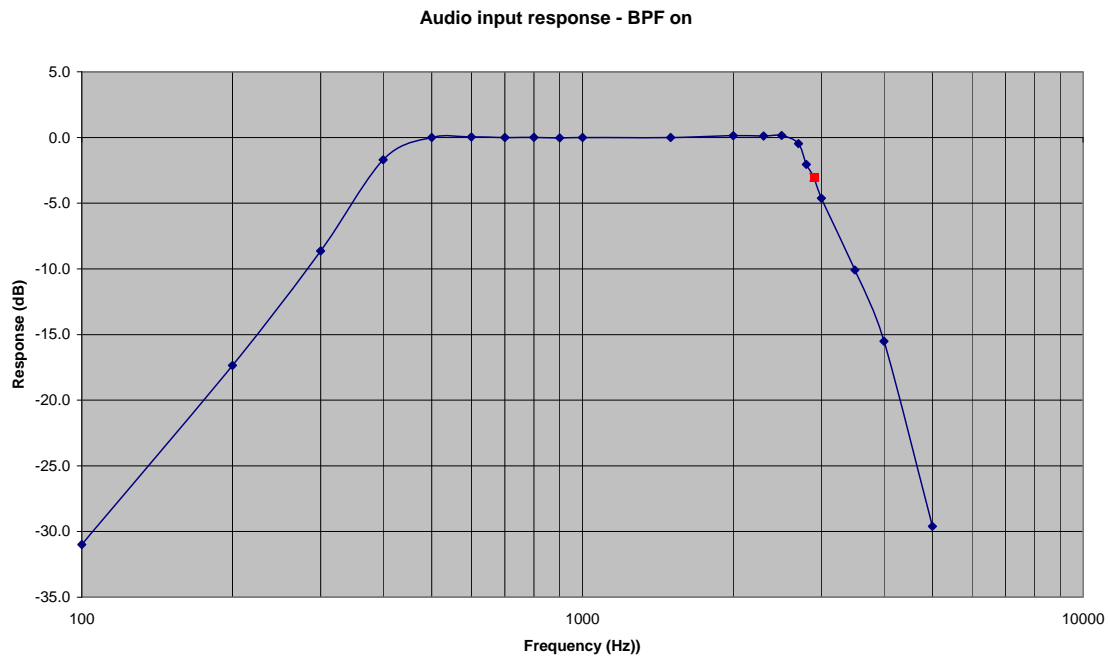
In accordance with Section 87.141 the following will apply:

The transmitter tested has been designed to transmit speech in the range 118.0 – 136.975 MHz using amplitude modulation (A3E) with 25.0 kHz channel steps.

- (a) A family of curves showing the percentage of modulation versus the modulation input voltage that shows that when using A3E the modulation percentage does not exceed 100%.



This equipment has a audio low pass filter, below is a curve showing the frequency response of the LP filter.



**Limit:**

As per section 87.141(a), when A3E emission is used the modulation percentage must not exceed 100%

**Result:** Complies

**Measurement Uncertainty:**  $\pm 1\%$ .

## Emission limitations

Section 87.139 (a) defines the emission mask for this type of transmitter.

Measurements have been made using a modulation frequency of 2500 Hz at a level 16 dB higher than that needed to provide 50% modulation.

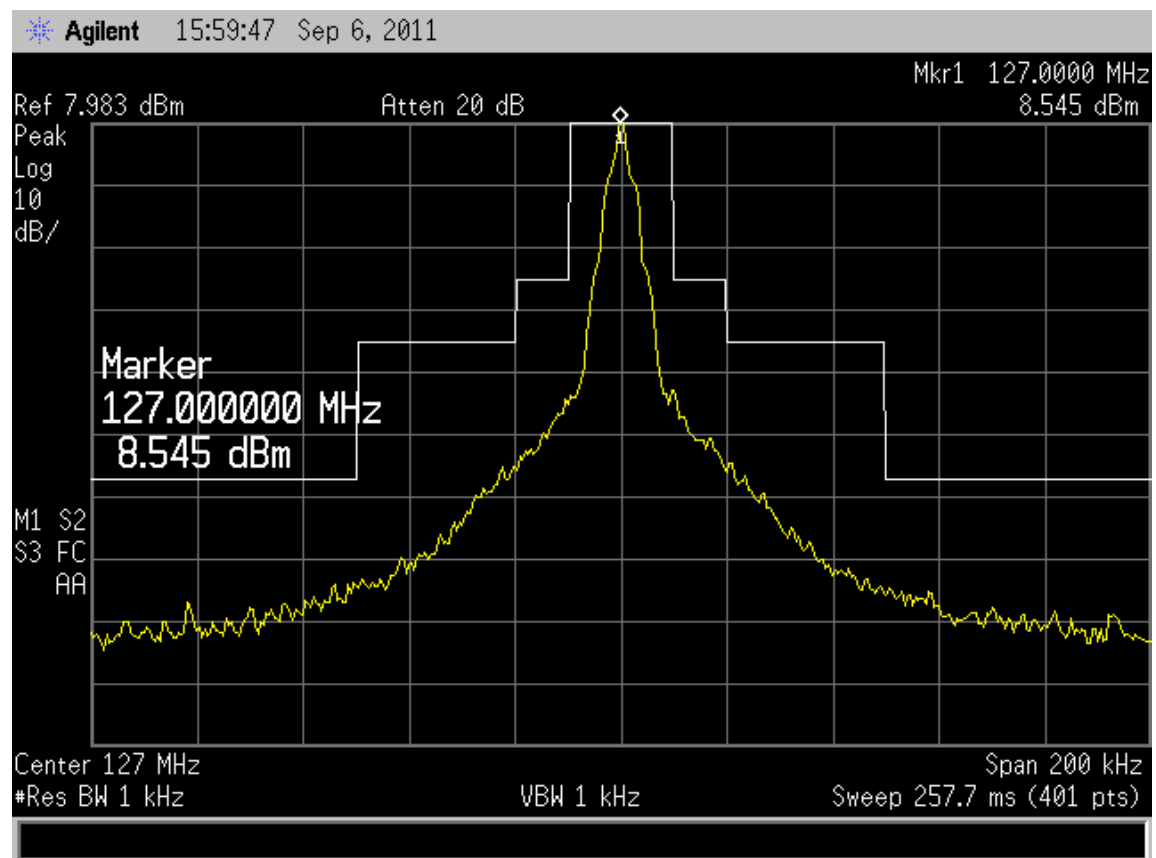
Measurements have been made with an authorised bandwidth of 25 kHz applied.

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.

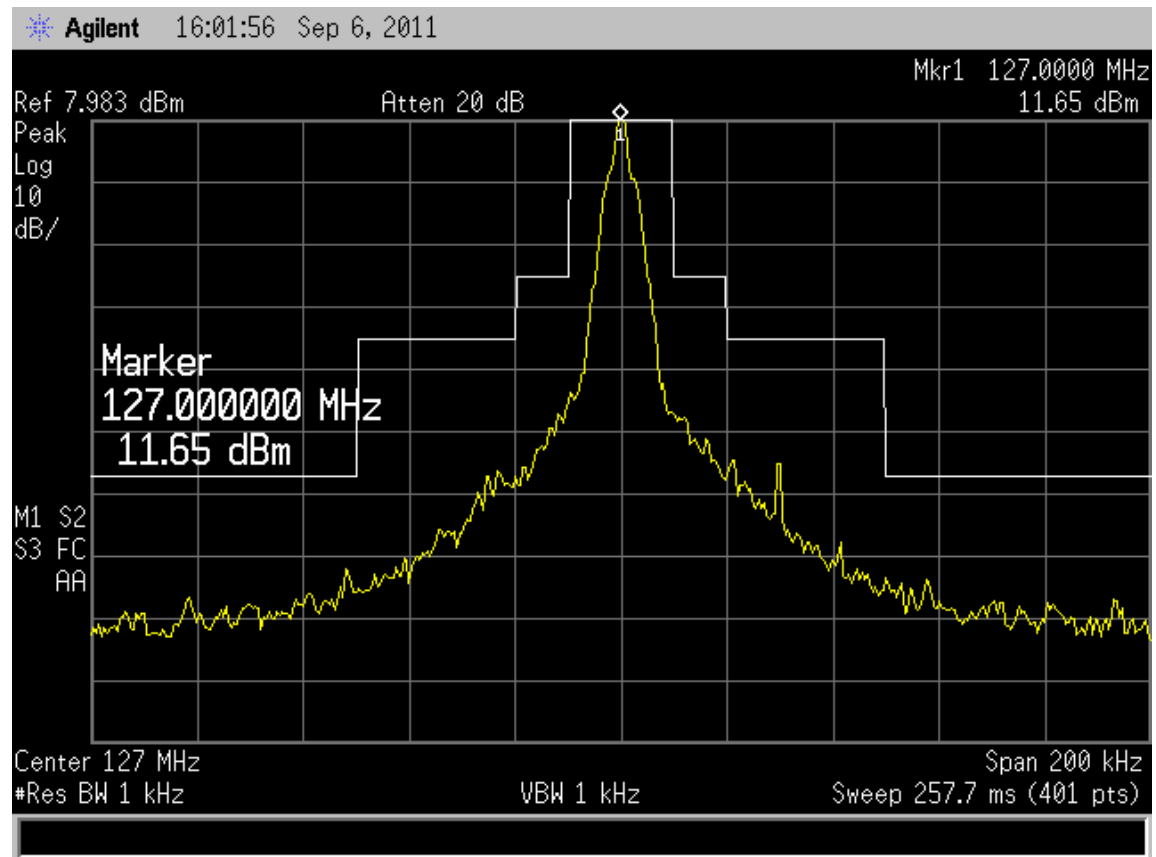
Measurements were made with the spectrum analyser operating in peak hold centred on the allocated frequency.

Measurements were made when the transmitter was modulated by a single 2500 Hz tone and when the transmitter was modulated by a tone in the range of 100 Hz to 5000 Hz.

Modulated by a 2500 Hz tone



Modulated by a range of tones from 100 to 5000 Hz



**Result:** Complies

## Transmitter spurious emissions at the antenna terminals

**Frequency:** 127.00 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
254.000	-48.0	-13.0
380.100	-46.4	-13.0
508.000	-45.9	-13.0
635.000	-45.5	-13.0
762.000	-55.2	-13.0
889.000	-47.7	-13.0
1016.000	-55.2	-13.0
1143.000	-56.0	-13.0
1270.000	Less than -60 dBm	-13.0

### Limit:

Part 87.139(a) states that any spurious emission must be attenuated by at least  $43 + 10 \log pY$  dB

The transmitter power is 6.5 watts. This gives an attenuation of 51.1 dB and a limit of -13.0 dBm.

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.

Emissions less than -40 dBm have been reported for completeness.

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

Measurements have been made with the transmitter transmitting continuously with no modulation when powered at 13.8 Vdc.

**Result:** Complies

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

## Field strength of the transmitter spurious emissions

**Frequency:** 127.000 MHz

Transmit Mode – Spurious emissions including harmonics

Frequency (MHz)	Level (dBμV/m)	Level (dBm)	Limit (dBm)	Polarity	Margin (dB)
254.000	63.6	-33.8	-20.0	Vertical	13.8
254.000	66.4	-31.0	-20.0	Horizontal	11.0
381.000	64.2	-33.2	-20.0	Vertical	13.2
381.000	64.0	-33.4	-20.0	Horizontal	13.4
508.000	59.3	-38.1	-20.0	Vertical	18.1
508.000	53.2	-44.2	-20.0	Horizontal	24.2
635.000	49.8	-47.6	-20.0	Vertical	27.6
635.000	53.1	-36.0	-20.0	Horizontal	16.0
762.000	38.8	-58.6	-20.0	Vertical	38.6
762.000	46.2	-51.2	-20.0	Horizontal	31.2
889.000	42.1	-55.3	-20.0	Vertical	35.3
889.000	44.0	-53.4	-20.0	Horizontal	33.4
1016.000	41.8	-55.6	-20.0	Vertical	35.6
1016.000	40.8	-56.6	-20.0	Horizontal	36.6
1143.000	46.5	-50.9	-20.0	Vertical	30.9
1143.000	50.5	-46.9	-20.0	Horizontal	26.9
1270.000	43.6	-53.8	-20.0	Vertical	33.8
1270.000	50.1	-47.3	-20.0	Horizontal	27.3

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 in February 2011.

The transmitter was tested while transmitting continuously while attached to a dummy load when powered at 13.8 Vdc.

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

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 5.5 watts gives a limit of -20 dBm.

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

**Result:** Complies

**Measurement Uncertainty:** ±4.1 dB



## Receiver Spurious emissions at antenna terminals

**Receive frequency:** 127.000 MHz

**Intermediate frequencies:** 45.0 MHz and 455 kHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
172.000	-64.0	-57.0
344.000	-82.4	-57.0
516.000	-70.2	-57.0
688.000	-75.5	-57.0
860.000	-68.0	-57.0
1032.000	-85.4	-57.0
1204.000	-81.0	-57.0
1376.000	-85.2	-57.0
1548.000	-85.4	-57.0
1720.000	Less than -90 dBm	-57.0

Testing was carried out at the antenna terminals in accordance with CFR 47 Part 15, section 15.111 using a spectrum analyser.

All other emissions observed less than -90.0 dBm.

### Limit:

In accordance with CFR 47 Part 15, section 15.111 the power of any emission at the antenna terminal should not exceed 2 nW.

This gives a limit of -57.0 dBm.

**Result:** Complies.

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

## Radio Frequency Hazard Information

As per Section 1.1310 mobile transmitters are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with OST/OET Bulletin Number 65.

A minimum safe distance between the user / general public and the device has been calculated below.

In accordance with Section 1.1310 the Maximum Permissible Exposure (MPE) power density limit for the General Population / Uncontrolled Exposure of 0.2 mW/m<sup>2</sup> or 27.5 V/m has been applied.

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 and separation distance in metres:

The rated power of this transmitter is 6.5 watts which has been measured to be 5.9 watts when powered at 13.8 Vdc.

In a typically mobile installation this transceiver would be used with a whip ¼ wave dipole type of antenna with a gain of 1.64.

$$\begin{aligned}d &= \sqrt{(30 * P * G) / E} \\&= \sqrt{(30 * 6.5 * 1.64) / 27.5} \\&= \underline{0.65 \text{ metres or } 65 \text{ cm}}\end{aligned}$$

The above calculations show that this device will meet the MPE requirement for mobile devices providing a safe distance of at least 65 cm is provided.

A warning to this affect will need to be inserted in the equipment manual.

**Result:** Complies

## 8. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset	Cal Due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	-
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	-
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	-
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	03/03/13
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	17/01/14
Log Periodic Antenna	Schwarzbeck	VUSLP 9111	9111-228	3785	03/03/13
Horn Antenna	Electrometrics	RGA-60	6234	E1494	04/07/14
Measurement Receiver	Rohde & Schwarz	ESCS 30	847124/020	E1595	09/02/12
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	3776	14/12/12
Frequency Counter	Hewlett Packard	HP 5342A	1916A01713	E1224	17/12/12
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069	-
Thermal chamber	Contherm	M180F	86025	E1129	-
Thermometer	DSIR	RT200	035	E1049	27/09/11

## 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 in February 2011.

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.

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.

## 10. PHOTOGRAPH (S)

### External Photographs



## Internal Photographs

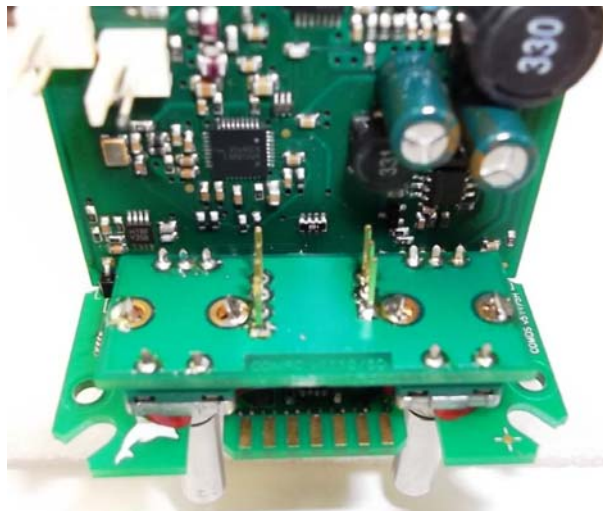
Front View LCD Panel



Front cover



Front PCB connections



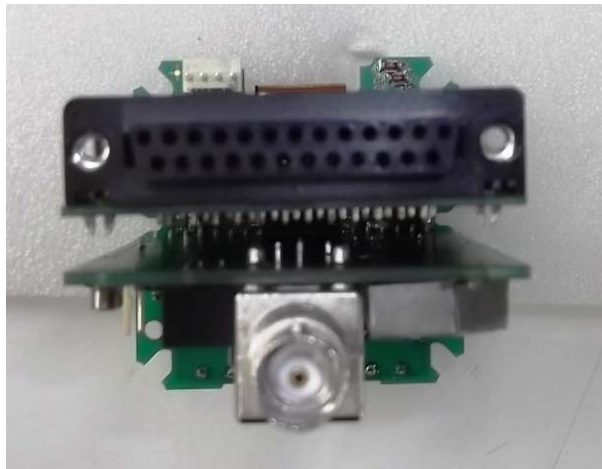
Main PCB – Control



Main PCB – RF PCB



Rear View RF connector and D25 connector





## Open Air Test Site Photographs



