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TEST REPORT

RF Technology 1U800CN-R UHF Base Station

tested to the

Code of Federal Regulations (CFR) 47

Part 90 –Private Land Mobile Services

Part 15 – Radio Frequency Device

for

RF Technology Pty 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

Table of Contents

1. CLIENT INFORMATION

Company Name	RF Technology Pty Ltd
Address	Unit 46/ 7 Sefton Rd Thornleigh
State	NSW
Country	Australia
Contact	Mr Guang Lou

2. DESCRIPTION OF TEST SAMPLE

Brand Name	RF Technology
Model Number	1U800CN-R
Product	UHF Base Station
Manufacturer	RF Technologies
Manufactured in	Australia
Serial Number	36329
FCC ID	KRE1UTR800CN

3. COMPLIANCE STATEMENT AND RESULT SUMMARY

The **RF Technology 1U800CN-R UHF Base Station <u>complies</u>** with the limits defined in 47 CFR Part 15, 47 CFR Part 90 and 47 CFR Part 2 when tested in-accordance with the test methods described in 47 CFR Part 2 and TIA-603-C.

Clause	Description	Result
90.203	Certification required	Noted
2.1046 90.205	RF power output Power and antenna height limits	Noted Complies
2.1047 2.1047(a) 2.1047(b)	Modulation Characteristics Low pass filter response Modulation limiting characteristics	Noted Noted Noted
2.1049 2.202 22.357 22.359(a) 90.207 90.209 90.210	Occupied bandwidth Bandwidths Emission types Emission masks Types of emissions Bandwidth limitations Emission masks	Noted Noted Complies Complies Complies Complies Complies
2.1051	Spurious emissions at antenna terminals	Complies
2.1053	Field strength of spurious radiation	Complies
2.1055 22.355 90.213	Frequency stability Frequency stability Frequency stability	Noted Complies Complies
15.111	Receiver local oscillator voltage	Complies
1.1310 2.1091	Radiation hazard assessment	Not applicable. Transmitter is a fixed base station.

4. TEST SAMPLE DESCRIPTION

The sample tested has the following specifications:

Rated Transmitter Output Power

1.0 Watt (30.0 dBm)

Test frequencies

Chl	Frequency MHz	Power Watts	Spacing kHz	Mode
1	935.9375	1.0	12.5	F1D
2	935.9375	1.0	12.5	F3E

FCC Bands

Part 90 transmitter range: 935 - 940 MHz
Part 90 receiver range: 896 - 901 MHz

Emission Designators / Modes of operation

11k0F1D – Data
11k0F3E – Analogue speech

Power Supply

DC voltage supply typically 12.0 Vdc

5. TEST CONDITIONS

Standard Temperature and Humidity

Temperature: +15°C to + 30° maintained.
Relative Humidity: 20% to 75% observed.

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

Low Voltage: 10.8 Vdc
High Voltage: 15.6 Vdc

6. ATTESTATION

The **RF Technology 1U800CN-R UHF Base station <u>complies</u>** with the Code of Federal Regulations (CFR) 47 Part 90 –Private Land Mobile Services and 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

Certification required

Certification of this device is sought for transmissions using 12.5 channel spacing.

12.5 kHz channel bandwidth certification is sought for this transmitter under section 90.203(j)(3) as:

- the equipment meets the spectrum efficiency standard of one voice channel per 12.5 kHz of channel bandwidth

- the equipment can operate with a data rate greater than 4.8 kbps per 6.25 kHz of channel bandwidth

Result: Complies.

RF power output

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

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

Measurements were made with the input voltage set to 13.8 Vdc and when decreased to 11.0 Vdc and increased 15.6 Vdc.

Testing was carried out at maximum power output.

Frequency (MHz)	Voltage (Vac)	Rated (dBm)	Measured (dBm)
935.9375	13.8	30.0	29.8

Frequency (MHz)	Voltage (Vac)	Rated (dBm)	Measured (dBm)
935.9375	10.8	30.0	29.8
935.9375	15.6	30.0	29.0

Results are within 1 dB of the manufacturer's rated transmitter output power.

Result: Complies
Measurement Uncertainty: ±0.5 dB

Part 90.207 – Emission types:

The following emission types are used:
- F3E: Frequency modulation with analogue speech
- F1D: Data

Part 90.209 – Bandwidth limitations:

The authorised bandwidth is taken to be the necessary bandwidth.

Using the formulas contained in Part 2.202 the necessary bandwidth calculation for the 12.5 kHz channel step emission is:

$B_n = 2 \times D + 2 \times M$
Where D = maximum deviation: 3.0 kHz
Where M = maximum modulation frequency: 2.4 kHz
$B_n =$ 10.8 kHz

This is confirmed in the emission designation 11k0F3E

For F1D where,

$B_n = 2 \times D + 2 \times M$
Where D = high deviation pattern: 3.0 kHz
Where M = symbol rate: 2.4 kHz
$B_n =$ 10.8 kHz

This is confirmed in the emission designation 11k0F1D

Spectrum Masks

The spectrum masks are defined in:

Section 90.210(i) – Mask I has been applied as the transmitter can operate in the band 896-901/ 935-940 MHz using an authorised bandwidth of 12.5 kHz as per Section 90.209(b)(5).

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

All measurements have been made with a -30 dB correction factor as a 30dB attenuator is placed between the transmitter and the spectrum analyser.

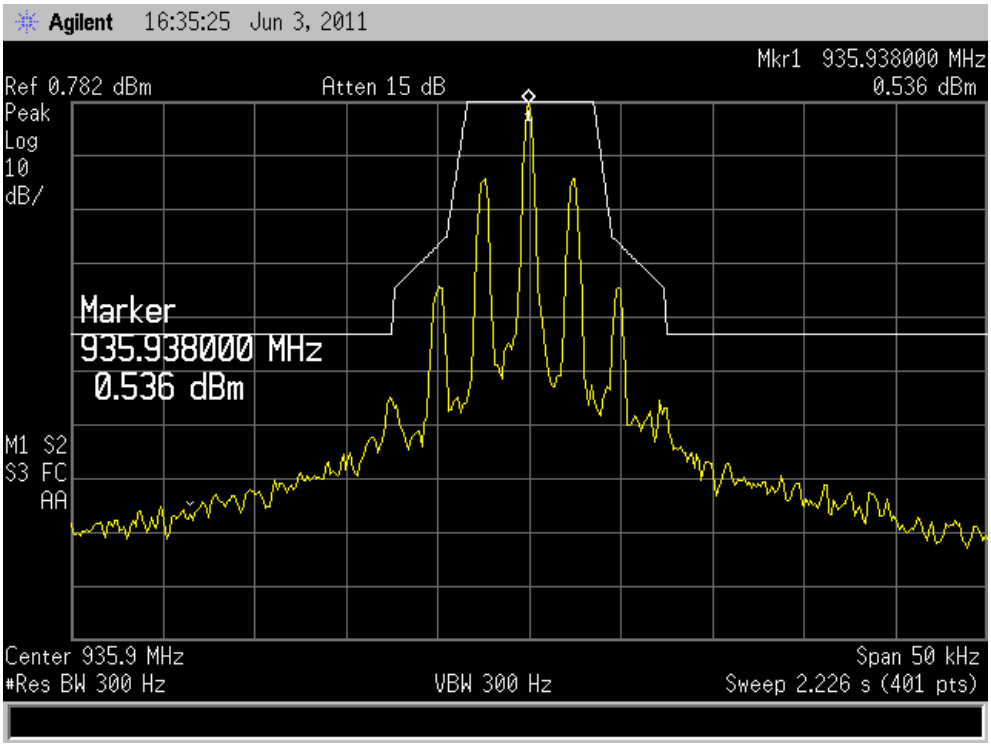
Measurements were made in peak hold with the transmitter operating on 935.9375 MHz.

When operating in F3E mode a 2300 Hz tone, which was found to be the frequency of maximum response, that was applied at a level 16 dB higher than that required to achieve 50% modulation.

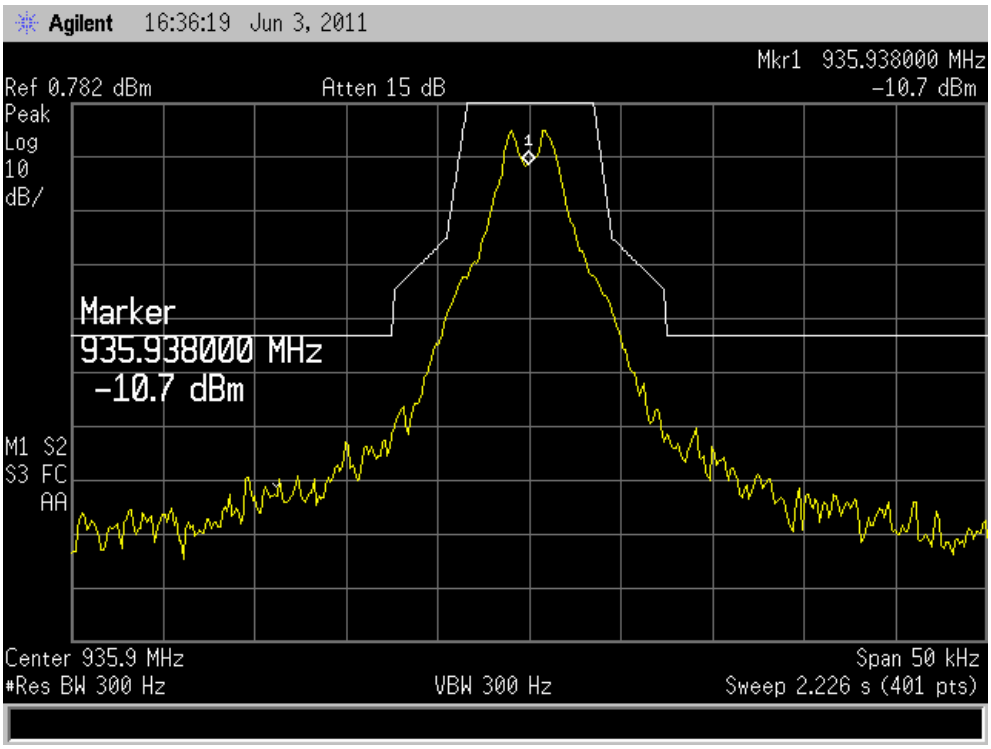
For the F1D mode the transmitter as instructed by the client was modulated using a 2.4 kHz square wave using external modulation.

Result: Complies

Part 90: F3E 12.5 kHz



Part 90: F1D 12.5 kHz



Transmitter spurious emissions at the antenna terminals

Frequency: 935.9375 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
1871.875	-60.4	-20.0
2807.813	-59.0	-20.0
3743.750	-34.2	-20.0
4679.687	-36.1	-20.0
5615.625	-31.7	-20.0
6551.563	-56.5	-20.0
7487.500	-50.0	-20.0
8423.438	-57.6	-20.0
9359.375	-88.4	-20.0

Limit:
Part 90.210(i) Mask I, (3) on any frequency removed from the centre of the authorised bandwidth by a displacement frequency of more than 12.5 kHz shall be attenuated by at least 43 + 10 log (P) or 70 dB whichever is the lesser attenuation.

The spurious emission limit defined by Mask I has been applied as this transmitter can operate using channel spacings of 12.5 kHz.

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 1.0 watt gives a limit of –20.0 dBm.

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

Result: Complies
Measurement Uncertainty: ±3.3 dB

Receiver spurious emissions at antenna terminals

Receive frequency: 869.9375 MHz

Frequency (MHz)	Level (dBm)	Limit (dBm)
851.940	-73.4	-57.0
1703.880	-77.0	-57.0
255.825	-71.3	-57.0
3407.765	-71.1	-57.0
4259.700	-80.8	-57.0
5111.645	-78.5	-57.0
5963.585	-90.2	-57.0
6815.525	-	-57.0
7667.465	-	-57.0
8519.400	-	-57.0

The receiver has an intermediate frequency of 45 MHz

No other emissions within 30 dB of the limit were observed.

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 (–57.0 dBm).

Result: Complies
Measurement Uncertainty: ±3.3 dB

Field strength of the transmitter spurious emissions

Frequency: 935.9375 MHz

Frequency (MHz)	Level (dBµV/m)	Level (dBm)	Limit (dBm)	Polarity	Margin (dB)
1871.8750	72.5	-22.7	-20.0	Vertical	2.7
1871.8750	68.8	-26.4	-20.0	Horizontal	6.4
2807.8125	62.5	-32.7	-20.0	Vertical	12.7
2807.8125	59.4	-35.8	-20.0	Horizontal	15.8
3743.7500	65.8	-29.4	-20.0	Vertical	9.4
3743.7500	46.5	-48.7	-20.0	Horizontal	28.7
4679.6875	46.0	-49.2	-20.0	Vertical	29.2
4679.6875	46.0	-49.2	-20.0	Horizontal	29.2
5615.6250	51.0	-44.2	-20.0	Vertical	24.2
5615.6250	41.4	-53.8	-20.0	Horizontal	33.8
6551.5625	43.5	-51.7	-20.0	Vertical	31.7
6551.5625	33.8	-61.4	-20.0	Horizontal	41.4
7487.5000	38.5	-56.7	-20.0	Vertical	36.7
7487.5000	<50.0	-	-20.0	Horizontal	-
8423.4375	<50.0	-	-20.0	Vertical	-
8423.4375	<50.0	-	-20.0	Horizontal	-
9359.3750	<50.0	-	-20.0	Vertical	-
9359.3750	<50.0	-	-20.0	Horizontal	-

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

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

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 in February 2011.

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

The rated power of 1.0 watt 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 input voltage set to 13.8 Vdc and when decreased to 10.8 Vdc and increased 15% to 15.6 Vdc.

Testing was carried out at maximum power output.

Frequency: 935.9375 MHz

Temperature	Voltage 10.8 Vdc	Voltage 13.8 Vdc	Voltage 15.6 Vdc
+50°C	+67.0	+67.0	+67.0
+40°C	+46.0	+46.0	+46.0
+30°C	+41.0	+41.0	+41.0
+20°C	+33.0	+33.0	+33.0
+10°C	+29.0	+29.0	+29.0
0°C	+6.0	+6.0	+6.0
-10°C	-1.0	-1.0	-1.0
-20°C	-7.0	-7.0	-7.0
-30°C	-68.0	-68.0	-68.0

Limit:
Part 90.213 state that mobile station transmitters operating between 935-940 MHz with 12.5 kHz channelling are required to have a frequency tolerance of 0.1 ppm.

This transmitter was tested on 935.9375 MHz. 0.1 ppm = 0.1 x 935.9375 = 93.6 Hz.

Result: Complies
Measurement Uncertainty: ±30 Hz

8. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset	Cal due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	N/a
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	N/a
Attenuator 20 dB	Tenuline	8323	1045	E1217	N/a
Audio Analyzer	Hewlett Packard	8903A	2216A01713	E1146	29/09/11
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	17/01/14
Frequency Counter	Hewlett Packard	HP 5342A	1916A01713	E1224	17/12/12
Level generator	Anritsu	MG443B	M61689	E1143	10/11/13
Log Periodic	Schwarzbeck	VUSLP9111	9111-228	3785	03/03/13
Modulation Analyzer	Rohde & Schwarz	FMA	837807/020	E1552	07/12/12
Modulation Analyzer	Hewlett Packard	8901B	2608A00782	E1090	27/01/12
Oscilloscope	Tektronics	745A	B010643	1569	07/12/12
Power Attenuator	Weinschel	49-20-43	GC104	E1308	N/a
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069	N/a
RF Power Meter	Hewlett Packard	HP 436A	2512A22439	E1198	29/10/11
Selective Level Meter	Anritsu	ML422C	M35386	E1140	29/09/11
Signal Generator	Rohde & Schwarz	SMHU.58	838923/028	E1493	07/12/12
Spectrum Analyzer	Hewlett Packard	E7405	US39150142	3776	14/12/12
Receiver	Rohde & Schwarz	ESIB40	100171	EMC4003	18/04/13
Thermal chamber	Contherm	M180F	86025	E1129	01/06/12
Thermometer	DSIR	RT200	035	E1049	01/06/12
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	N/a
Horn antenna	EMCO	3115	9511-4629	E1526	21/02/14

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 February, 2011.

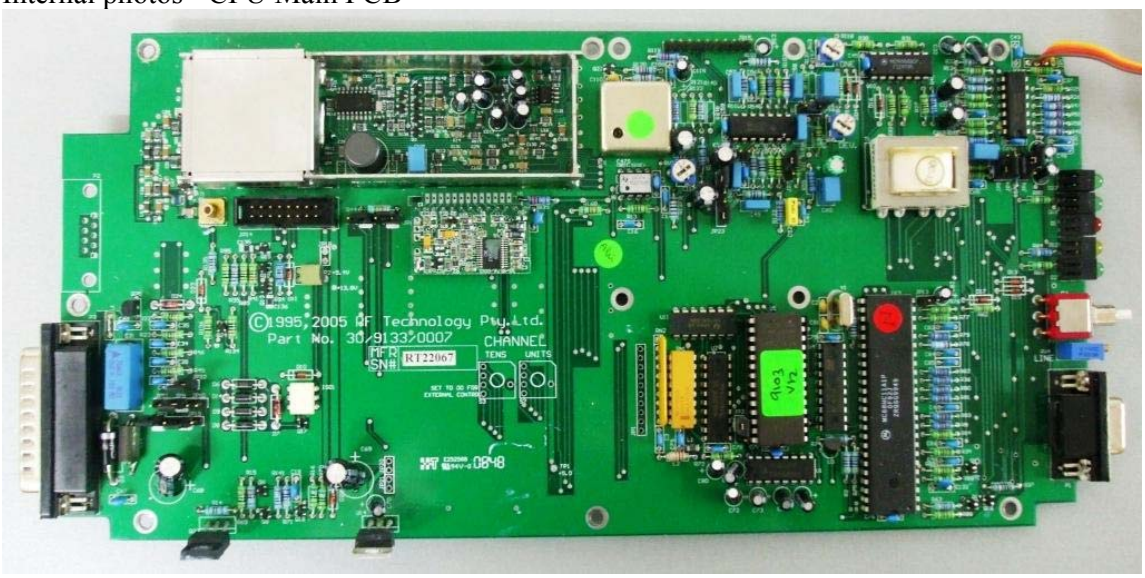
All testing has been carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to ISO/IEC 17025.

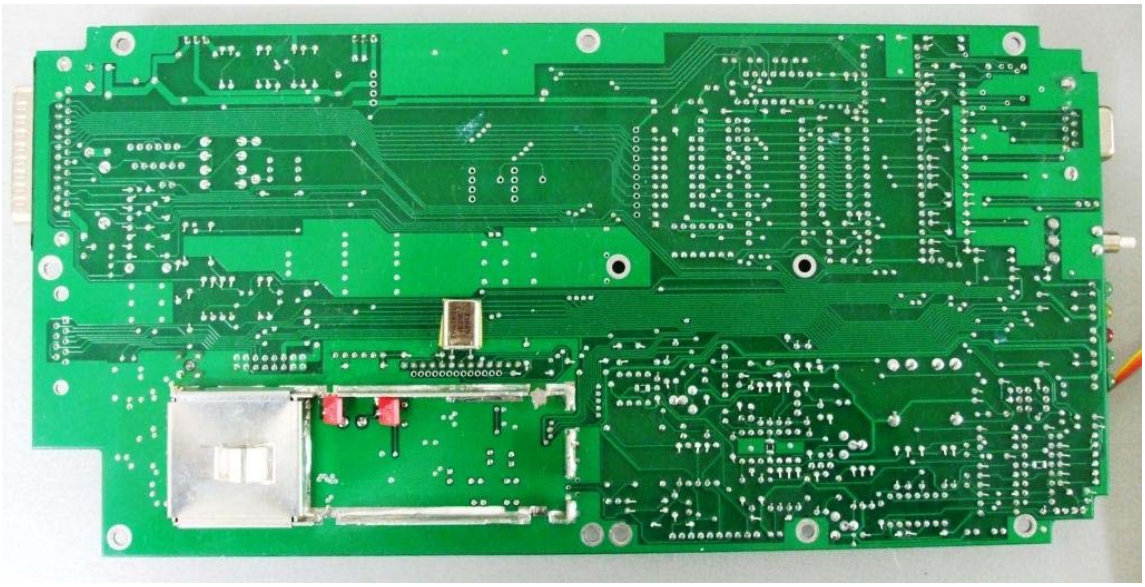
All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to ISO/IEC 17025.

10. PHOTOGRAPH (S)

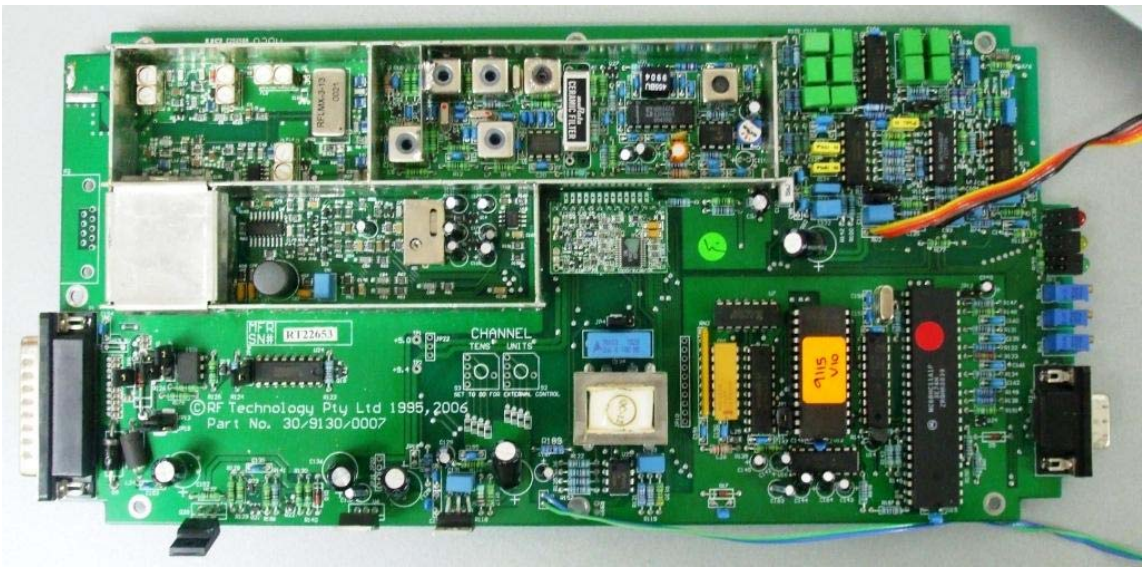
Base station label and external views

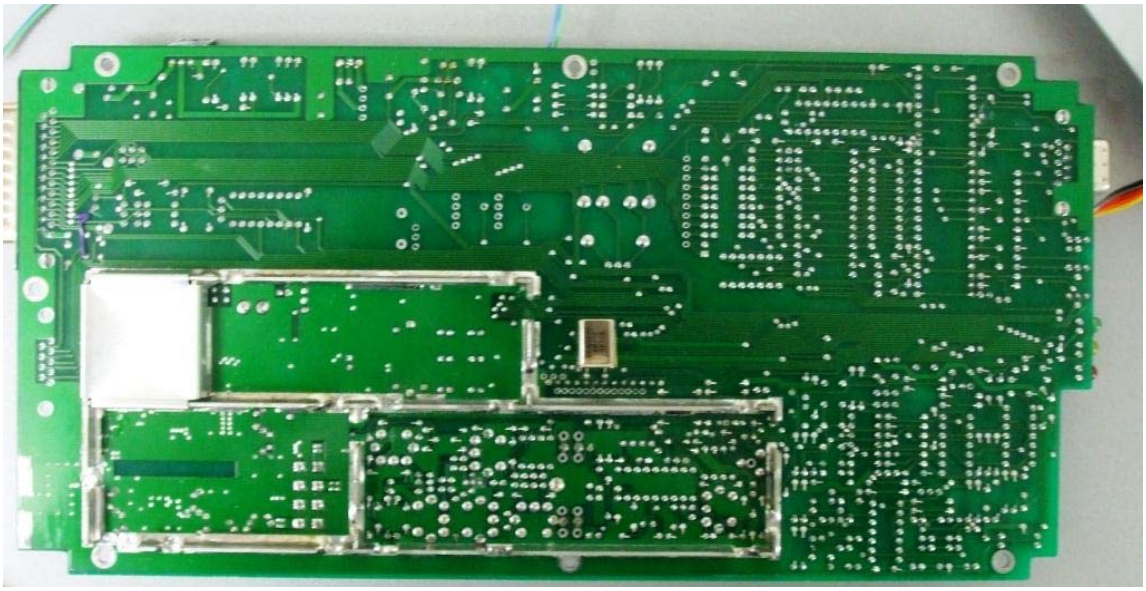
Internal photos - CPU Main PCB



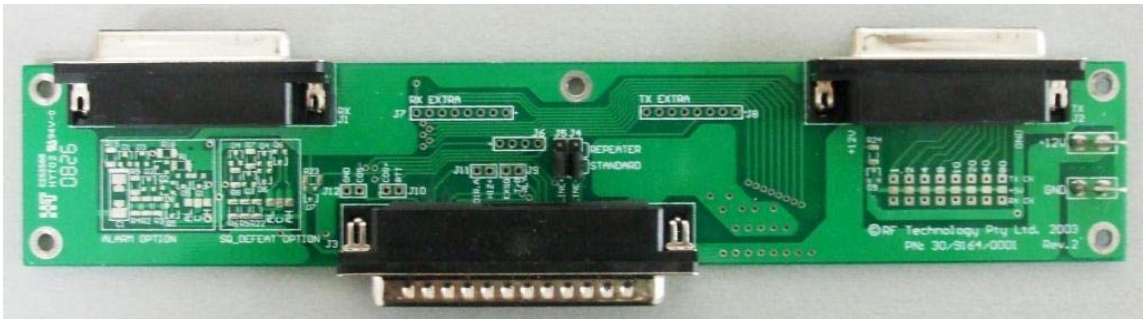


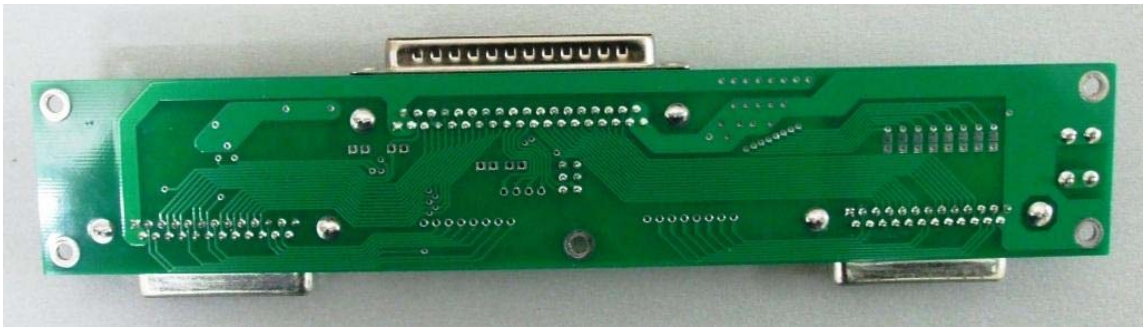
RX Main PCB





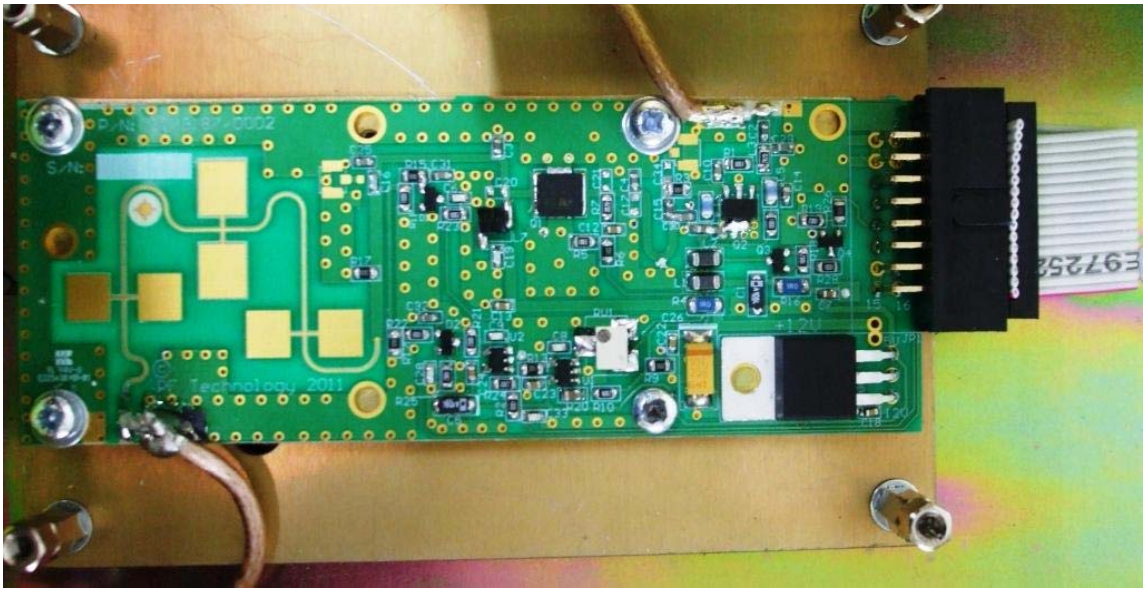
Interface board





Front panel

Tx board



Radiated emissions test set up photos