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TEST REPORT

ELPRO E2-450 UHF Radio Transceiver Module

tested to the

Code of Federal Regulations (CFR) 47

Part 90 –Private Land Mobile Services

for

ELPRO Technologies 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

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1. COMPLIANCE STATEMENT

The **ELPRO E2-450 UHF Radio Transceiver Module** 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 and ANSI C63.4, 2002.

2. RESULT SUMMARY

The results of testing carried out between the 23rd – 26th January 2006 and in August 2013 are summarised below.

Clause	Description	Result
90.203	Certification required	Noted
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	Noted
2.1047(b)	Modulation limiting characteristics	Complies
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 when retested
2.1055	Frequency stability	Noted
90.213	Frequency stability	Complies
2.1057	Frequency spectrum to be investigated	Noted
90.214	Transient frequency behaviour	Complies

3. CLIENT INFORMATION

Company Name ELPRO Technologies Pty Ltd

Address 9/12 Billabong Street

City Stafford

State Queensland 4053

Country Australia

Contact Mr John White

4. TEST SAMPLE DESCRIPTION

Brand Name ELPRO

Model Number E2-450

Product UHF Radio Transceiver Module

Manufacturer ELPRO Technologies Pty Ltd

Manufactured in Australia

Serial Number module not serialised

FCC ID O9P-E2-450

The transmitter contained within this module was originally tested and certified back in 2006 and was given the FCC ID of O9P450H.

Since the original certification a modular version of this transmitter has been designed and it is proposed that it be used with this range of transceivers along with various interface options.

The transmitting and receiving sections of the transceiver are electrically identical to the device that was originally tested in 2006 the results of which are contained in this test report.

Limited retesting was carried out to determine that the device does still comply in critical areas like the transmitter radiated spurious emissions.

Updated results are marked accordingly

The client is requesting limited modular certification

Testing was carried out when the module was inserted into an operating sample.

This sample had a model number of EL-450U-E-H-460-N and a serial number of #07130000315.

The sample tested has the following specifications:

Rated Transmitter Output Power

5.0 Watts (37.0 dBm)

FCC Bands

Part 90: 421-512 MHz

Channel Spacing:

12.5 kHz

Emission Designators / Modes of operation:

11k0F3E – Analogue speech
11k0F1D – Data at a rate of 9600 bps

Test frequencies

Analogue speech testing has been carried out at 380 MHz and 512 MHz using 2 separate samples in order to show compliance with the FCC Part 90 band.

Data transmission tests have been made with the transmitter operating on 446 MHz only

Updated transmitter spurious emissions measurements were made on 461.300 MHz

Power Supply

Rechargeable Lead acid battery DC voltage supply typically 12.0 Vdc

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

High Voltage: 15.9 Vdc
Low Voltage: 10.8 Vdc

5. ATTESTATION

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

6. TEST RESULTS

Certification required

The 996369 D01 Transmitter Module Equipment Authorisation Guide v01r03 has been followed.

The client is requesting Limited Single Modular Transmitter certification in accordance with Section III of the guide as this transmitter is subject to the Licensed Radio Service Rules.

In addition the rules as defined in FCC Part 15 section 15.212(1) have been followed.

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

12.5 kHz channel bandwidth certification is sought for this transmitter under section 90.203(j)(4) and (5) as:

- certification has been sought after January 1, 2011.

- 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

The original P450H results are stated below.

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.

Testing was carried out at maximum rated power output of 5 watts (37 dBm).

Frequency (MHz)	Voltage (Vdc)	Rated (dBm)	Measured (dBm)
380.000	13.8 Vdc	37.0	36.8
	15.6 Vdc	37.0	36.9
	10.8 Vdc	37.0	36.5
512.000	13.8 Vdc	37.0	36.7
	15.6 Vdc	37.0	36.7
	10.8 Vdc	37.0	36.2

Limits:

Clause 90.205(d) of Part 90 specifies that in the bands 421 – 430 MHz and 450 – 470 MHz the maximum allowable station effective radiated power (ERP) is dependent upon the station's antenna HAAT and the required service area.

Result: Complies
Measurement Uncertainty: ±0.5 dB

Modulation Characteristics

The original P450H results are stated below.

This transmitter is capable of producing analogue speech.

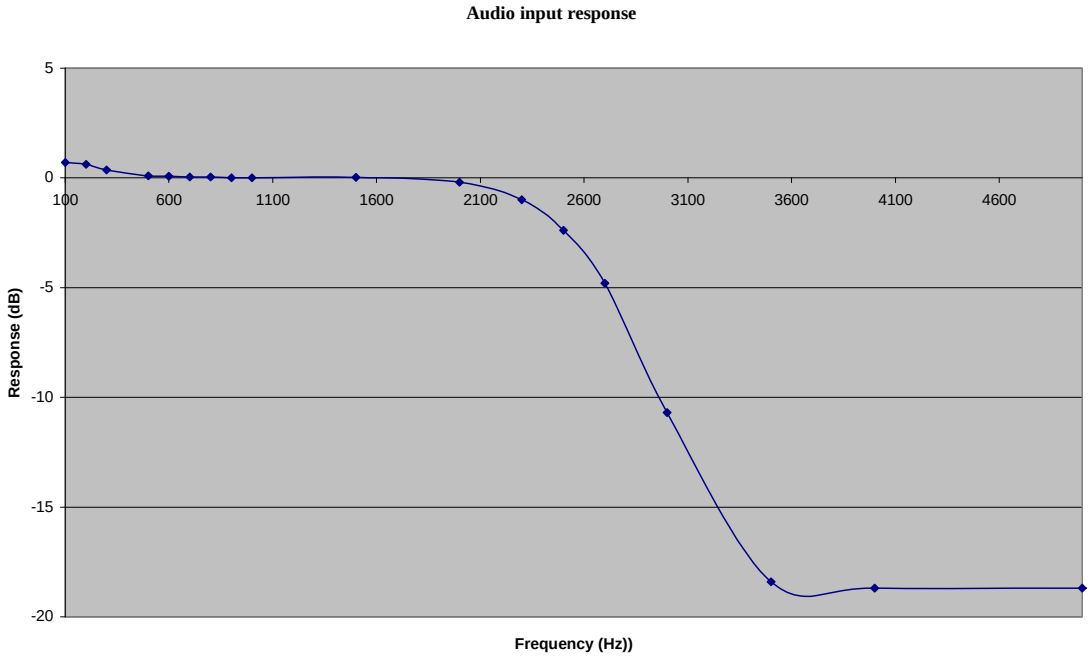
a. Frequency response of the audio frequency low pass filter between 100 Hz and 15 kHz.

This measurement was carried out using an audio signal generator and an audio modulation analyser.

At 1 kHz an audio signal was applied at a level to produce 60% deviation which was used as a 0 dB response reference.

The frequency of the input signal was then varied and the output response noted.

This measurement was carried out from 100 Hz to 15000 Hz with the graph showing between 100 – 5000 Hz.

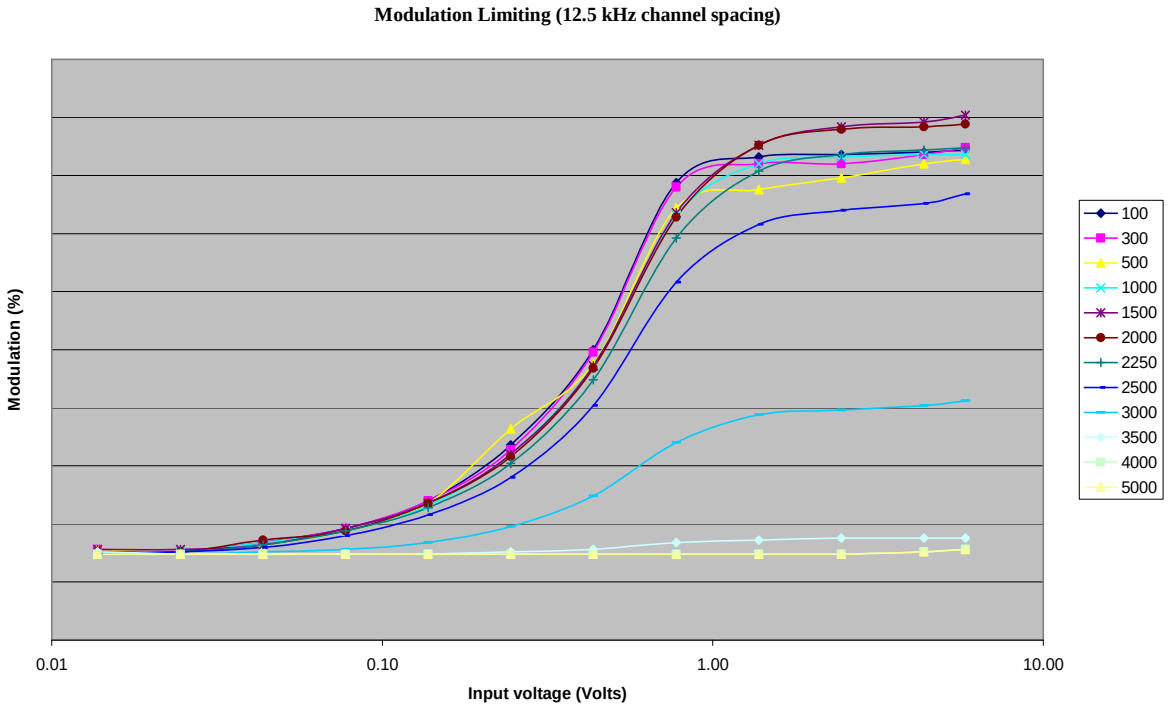


b. A family of curves showing the percentage of modulation versus the modulation input voltage.

Measurements were made between 100 Hz to 5 kHz.

At each frequency the input voltage was slowly increased with the resulting frequency deviation of the transmitter being recorded.

This deviation was then converted to a modulation percentage where 2.5 kHz deviation is 100% for 12.5 kHz channels.



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

Measurement Uncertainty: ±1%.

Part 90.207 – Emission types:

The original P450H results are stated below.

The following emission types are used:

F3E: Frequency modulation with analogue speech.
F1D: Frequency shift keying for data transmission

Part 90.209 – Bandwidth limitations:

The original P450H results are stated below.

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: 2.5 kHz
Where M = maximum modulation frequency: 3 kHz
$B_n = 11$ kHz

This is confirmed in the emission designation, 11k0F3E, declared by the client.

Result: Complies

Occupied Bandwidth

The original P450H the spectrum mask results are defined below:

Section 90.210 – Mask D has been applied as the transmitter can operate in the band 421 - 512 MHz using an authorised bandwidth of 11.25 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 30 kHz with the transmitter not being modulated.

All measurements have been made with a 30 dB attenuator being placed between the transmitter and the spectrum analyser.

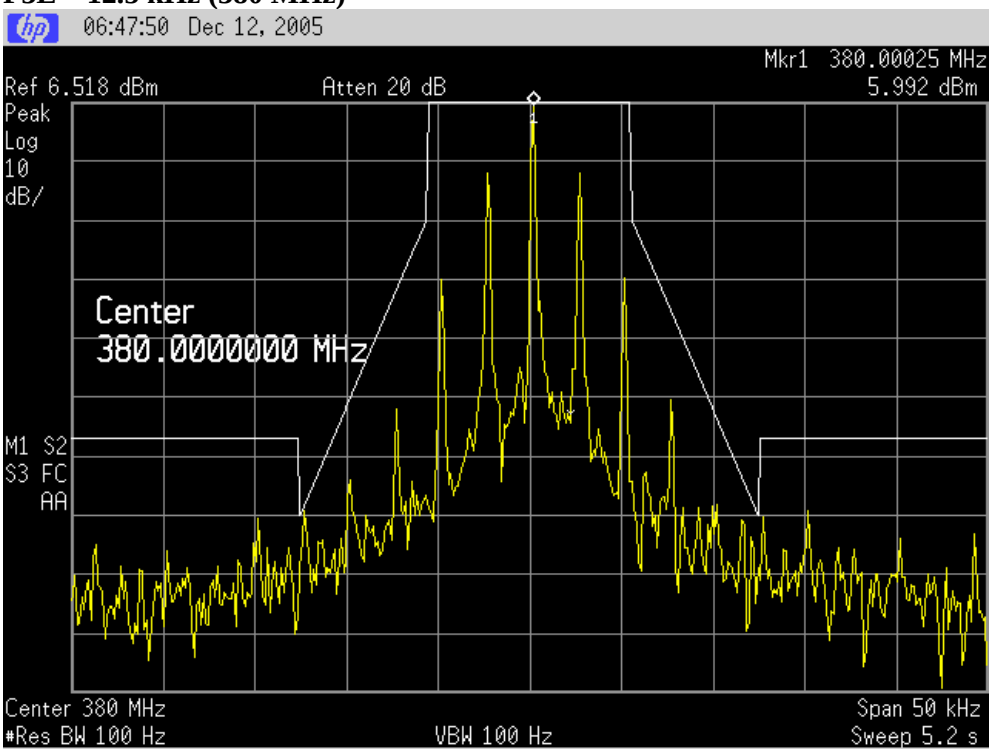
Measurements were made in peak hold with the transmitter operating on 380.000 MHz and 512.000 MHz

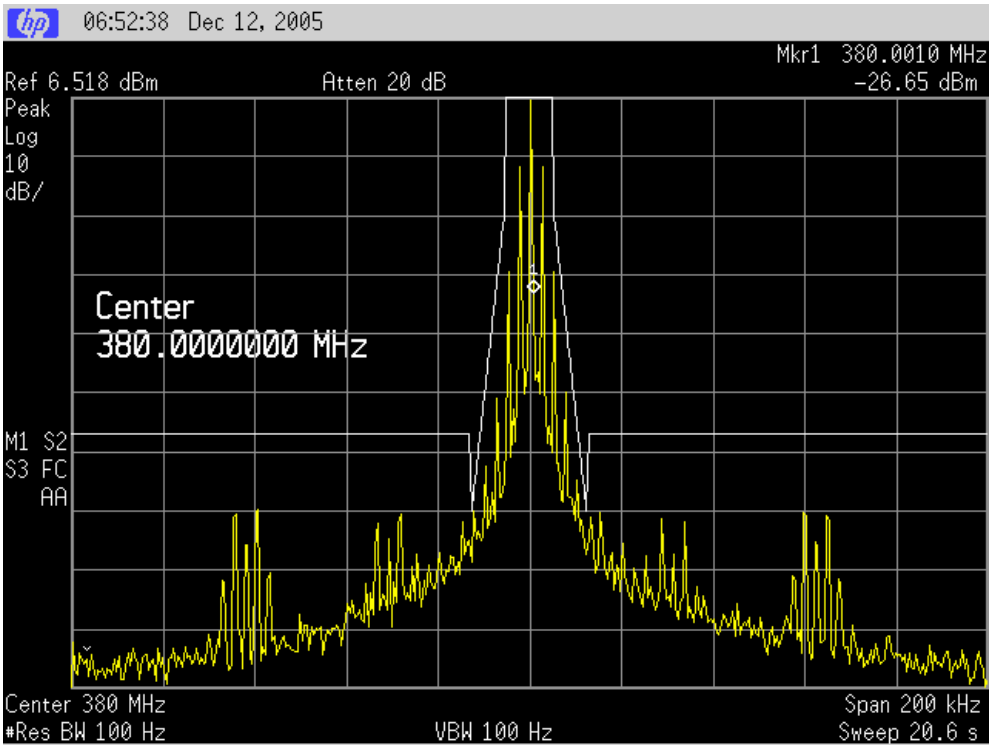
For speech transmissions a 2500 Hz tone, which was found to be the frequency of maximum response, was applied at a level 16 dB higher than that required to achieve 50% modulation.

For data modulation the transmitter was operated continuously.

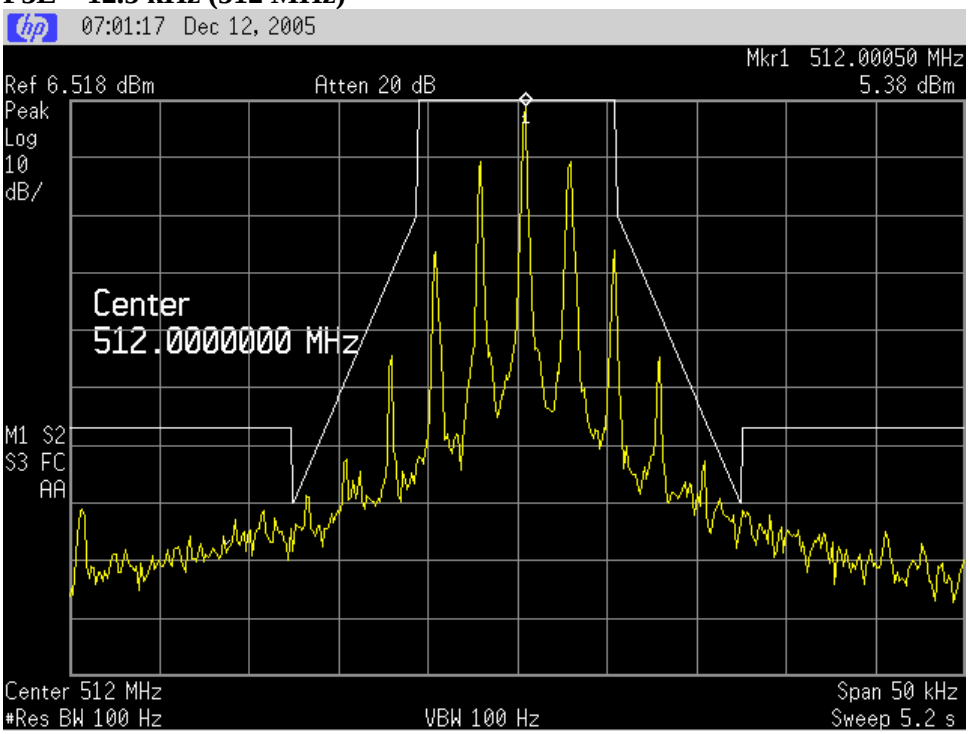
Result: Complies

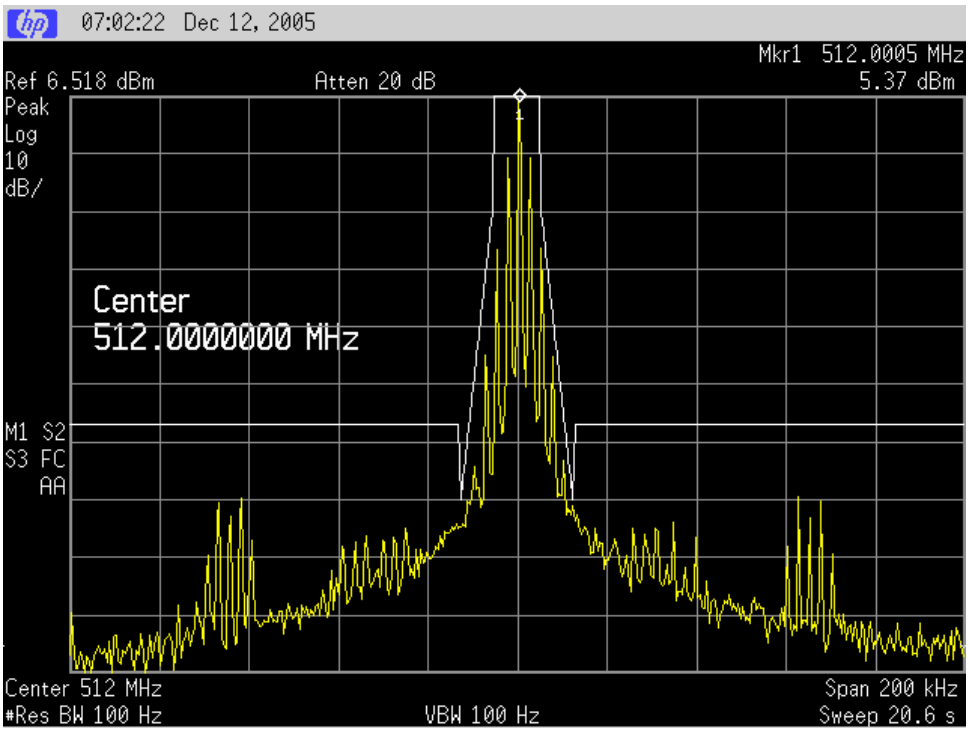
F3E – 12.5 kHz (380 MHz)



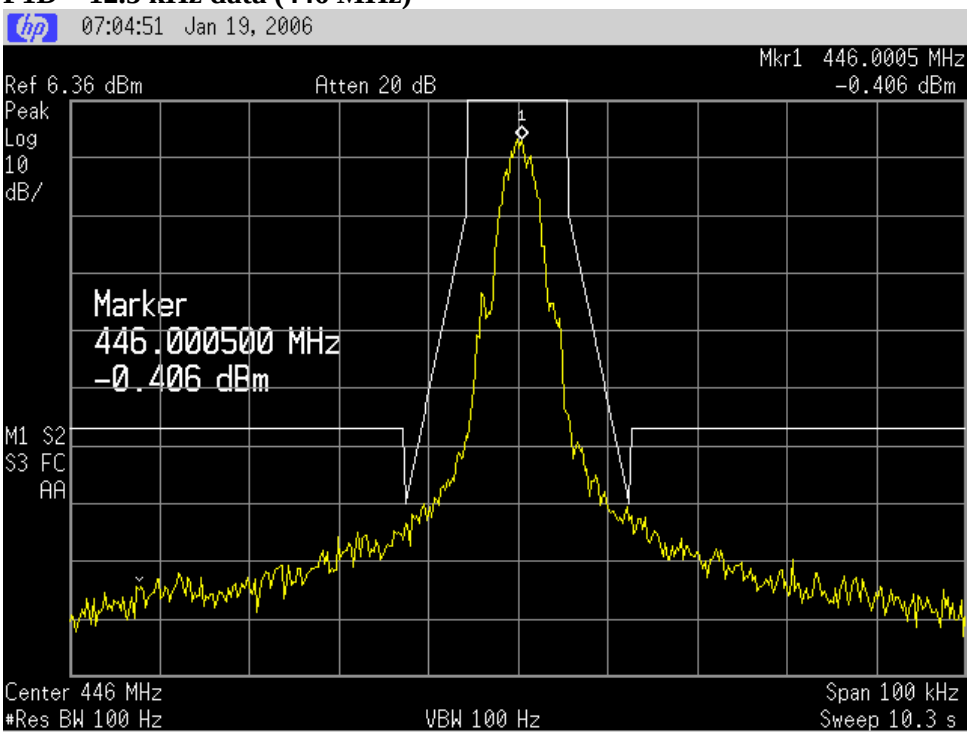


F3E – 12.5 kHz (512 MHz)





F1D – 12.5 kHz data (446 MHz)



Transmitter spurious emissions at the antenna terminals

The original P450H results are stated below.

Frequency: 380.000 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
760.000	-38.0	-20.0
1140.000	-37.2	-20.0
1520.000	-46.3	-20.0
1900.000	<-60dBm	-20.0
2280.000	<-60dBm	-20.0
2660.000	<-60dBm	-20.0
3040.000	<-60dBm	-20.0
3420.000	<-60dBm	-20.0
3800.000	<-60dBm	-20.0

Frequency: 512.000 MHz

Spurious emission (MHz)	Emission level (dBm)	Limit (dBm)
1024.000	-37.5	-20.0
1536.000	-54.5	-20.0
2048.000	-59.9	-20.0
2560.000	<-60.0	-20.0
3072.000	-40.3	-20.0
3584.000	-53.6	-20.0
4096.000	-53.0	-20.0
4608.000	<-60.0	-20.0
1024.000	-37.5	-20.0

Limit:
Applied mask D, 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 50 + 10 log (P) or 70.0 dB whichever is the lesser attenuation.

The spectrum has been investigated up to the 10th harmonic of the transmitter.

A rated power of 5.0 watts gives a limit of –20 dBm.

The spurious emission limit defined by Mask D has been applied as this transmitter can operate using channel spacing 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 10th harmonic if the transmitter operates below 10 GHz.

Result: Complies
Measurement Uncertainty: ±3.3 dB

Field strength of the transmitter spurious emissions

The original P450H results are stated below.

Frequency: 380.000 MHz

Frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
760.000	44.1	-53.3	-20.0	Horizontal	33.3
760.000	46.3	-51.1	-20.0	Vertical	31.1
1140.000	45.9	-51.5	-20.0	Horizontal	31.5
1140.000	53.7	-43.7	-20.0	Vertical	23.7
1520.000	-	-	-20.0	Horizontal	-
1520.000	49.1	-48.3	-20.0	Vertical	28.3
1900.000	-	-	-20.0	Horizontal	-
1900.000	-	-	-20.0	Vertical	-
2280.000	-	-	-20.0	Horizontal	-
2280.000	-	-	-20.0	Vertical	-
2660.000	-	-	-20.0	Horizontal	-
2660.000	-	-	-20.0	Vertical	-
3040.000	-	-	-20.0	Horizontal	-
3040.000	-	-	-20.0	Vertical	-
3420.000	-	-	-20.0	Horizontal	-
3420.000	-	-	-20.0	Vertical	-
3800.000	-	-	-20.0	Horizontal	-
3800.000	-	-	-20.0	Vertical	-

Frequency: 512.000 MHz

Frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
1024.000	40.5	-56.9	-20.0	Horizontal	36.9
1024.000	35.6	-61.8	-20.0	Vertical	41.8
1536.000	46.9	-50.5	-20.0	Horizontal	30.5
1536.000	41.3	-56.1	-20.0	Vertical	36.1
2048.000	44.0	-53.4	-20.0	Horizontal	33.4
2048.000	41.0	-56.4	-20.0	Vertical	36.4
2560.000	45.3	-52.1	-20.0	Horizontal	32.1
2560.000	44.2	-53.2	-20.0	Vertical	33.2
3072.000	-	-	-20.0	Horizontal	-
3072.000	-	-	-20.0	Vertical	-
3584.000	-	-	-20.0	Horizontal	-
3584.000	-	-	-20.0	Vertical	-
4096.000	-	-	-20.0	Horizontal	-
4096.000	-	-	-20.0	Vertical	-
4608.000	-	-	-20.0	Horizontal	-
4608.000	-	-	-20.0	Vertical	-
5120.000	-	-	-20.0	Horizontal	-
5120.000	-	-	-20.0	Vertical	-

Standby mode

Frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
54.850	9.5	-87.9	-20.0	Vertical	67.9
56.020	10.3	-87.1	-20.0	Vertical	67.1
57.800	9.0	-88.4	-20.0	Vertical	68.4
58.170	9.5	-87.9	-20.0	Vertical	67.9
58.550	9.2	-88.2	-20.0	Vertical	68.2
59.100	9.4	-88.0	-20.0	Vertical	68.0
59.500	9.8	-87.6	-20.0	Vertical	67.6
59.900	10.0	-87.4	-20.0	Vertical	67.4
60.300	10.2	-87.2	-20.0	Vertical	67.2
136.100	21.4	-76.0	-20.0	Vertical	56.0
136.350	21.8	-75.6	-20.0	Vertical	55.6
136.610	22.4	-75.0	-20.0	Vertical	55.0
136.870	22.4	-75.0	-20.0	Vertical	55.0
137.130	22.2	-75.2	-20.0	Vertical	55.2
137.400	23.0	-74.4	-20.0	Vertical	54.4
137.650	21.5	-75.9	-20.0	Vertical	55.9
140.000	21.5	-75.9	-20.0	Vertical	55.9
141.050	23.0	-74.4	-20.0	Vertical	54.4
141.570	23.1	-74.3	-20.0	Vertical	54.3
141.830	23.0	-74.4	-20.0	Vertical	54.4
142.080	22.9	-74.5	-20.0	Vertical	54.5
142.090	23.0	-74.4	-20.0	Vertical	54.4
142.350	23.0	-74.4	-20.0	Vertical	54.4
143.400	22.0	-75.4	-20.0	Vertical	55.4
143.650	21.8	-75.6	-20.0	Vertical	55.6
152.040	19.5	-77.9	-20.0	Vertical	57.9

The following recheck measurements were made on the sample containing the module

Frequency: 461.300 MHz

Frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
922.600	60.5	-36.9	-20.0	Vertical	16.9
922.600	62.3	-35.1	-20.0	Horizontal	15.1
1383.900	48.5	-48.9	-20.0	Vertical	28.9
1383.900	53.1	-44.3	-20.0	Horizontal	24.3
1845.200	-	-	-20.0	Vertical	-
1845.200	-	-	-20.0	Horizontal	-
2306.500	-	-	-20.0	Vertical	-
2306.500	-	-	-20.0	Horizontal	-
2767.800	-	-	-20.0	Vertical	-
2767.800	-	-	-20.0	Horizontal	-
3229.100	-	-	-20.0	Vertical	-
3229.100	-	-	-20.0	Horizontal	-
3690.400	-	-	-20.0	Vertical	-
3690.400	-	-	-20.0	Horizontal	-
4151.700	-	-	-20.0	Vertical	-
4151.700	-	-	-20.0	Horizontal	-
4613.000	-	-	-20.0	Vertical	-
4613.000	-	-	-20.0	Horizontal	-

Standby mode

Frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Polarity	Margin (dB)
250.000	35.8	-61.6	-20.0	Horizontal	41.6
282.000	37.3	-60.1	-20.0	Horizontal	40.1
375.000	30.9	-66.5	-20.0	Horizontal	46.5
416.300	41.6	-55.8	-20.0	Horizontal	35.8
500.000	30.7	-66.7	-20.0	Horizontal	46.7
625.000	31.6	-65.8	-20.0	Horizontal	45.8
875.000	34.8	-62.6	-20.0	Horizontal	42.6
1000.000	34.3	-63.1	-20.0	Horizontal	43.1

Re-testing of the module shows that while there is a difference in the levels observed, especially at 2fc, compliance has been retained and the margin to the limit is still greater than 15 dB.

In transmit mode 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.

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 July 2013

Limit:

All spurious emissions are to be attenuated by at least 50 + 10 log (P). The rated power of 5 watts gives a limit of –20 dBm.

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

Result: Complies
Measurement Uncertainty: ±4.1 dB

Frequency Stability

The original P450H results are stated below.

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.

Frequency: 380.000 MHz

Temperature	Voltage 10.8 Vdc	Voltage 13.8 Vdc	Voltage 15.6 Vdc
+50°C	+17.0	+19.0	+16.0
+40°C	+7.0	+7.0	+7.0
+30°C	-20.0	-19.0	-19.0
+20°C	-51.0	-55.0	-55.0
+10°C	-41.0	-43.0	-43.0
0°C	-105.0	-103.0	-103.0
-10°C	-49.0	-50.0	-47.0
-20°C	-77.0	-68.0	-70.0
-30°C	+11.0	+19.0	+7.0

Frequency: 512.000 MHz

Temperature	Voltage 10.8 Vdc	Voltage 13.8 Vdc	Voltage 15.6 Vdc
+50°C	-115.0	-105.0	-110.0
+40°C	-39.0	-35.0	-27.0
+30°C	+48.0	+49.0	+49.0
+20°C	+76.0	+75.0	+75.0
+10°C	+115.0	+117.0	+115.0
0°C	+61.0	+61.0	+61.0
-10°C	+35.0	+35.0	+35.0
-20°C	+181.0	+181.0	+179.0
-30°C	+605.0	+599.0	+595.0

Limit:
Part 90.213 states that base / fixed transmitters operating between 421 – 512 MHz with 12.5 kHz channelling are required to have a frequency tolerance of 1.5 ppm.

At 380.0 MHz the limit will be - 1.5 ppm = 1.5 x 380 = 570 Hz.

At 512.0 MHz the limit will be - 1.5 ppm = 1.5 x 512 = 768 Hz

Result: Complies
Measurement Uncertainty: ±30 Hz

Transient frequency behaviour

The original P450H results are stated below.

Measurements were carried out 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 transmitter transmit frequency with a output level 0.1 % (-30 dB) of the level from the transmitter with a 1 kHz tone with a frequency deviation of 12.5 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.

Channel Spacing	Period t_1 (kHz)	Period t_2 (kHz)	Period t_3 (kHz)
12.5 kHz	nil	nil	nil
25.0 kHz	n/a	n/a	n/a

Limits:

Time Interval	Period	12.5 kHz Deviation (kHz)	25 kHz Deviation (kHz)
t_1	5 mS	± 12.5	± 25.0
t_2	20 mS	± 6.25	± 12.5
t_3	5 mS	± 12.5	± 25.0

Result: Complies
Measurement Uncertainty: Frequency difference ±1.6 kHz, Time period ±1 ms

12.5 kHz transmitter turn on

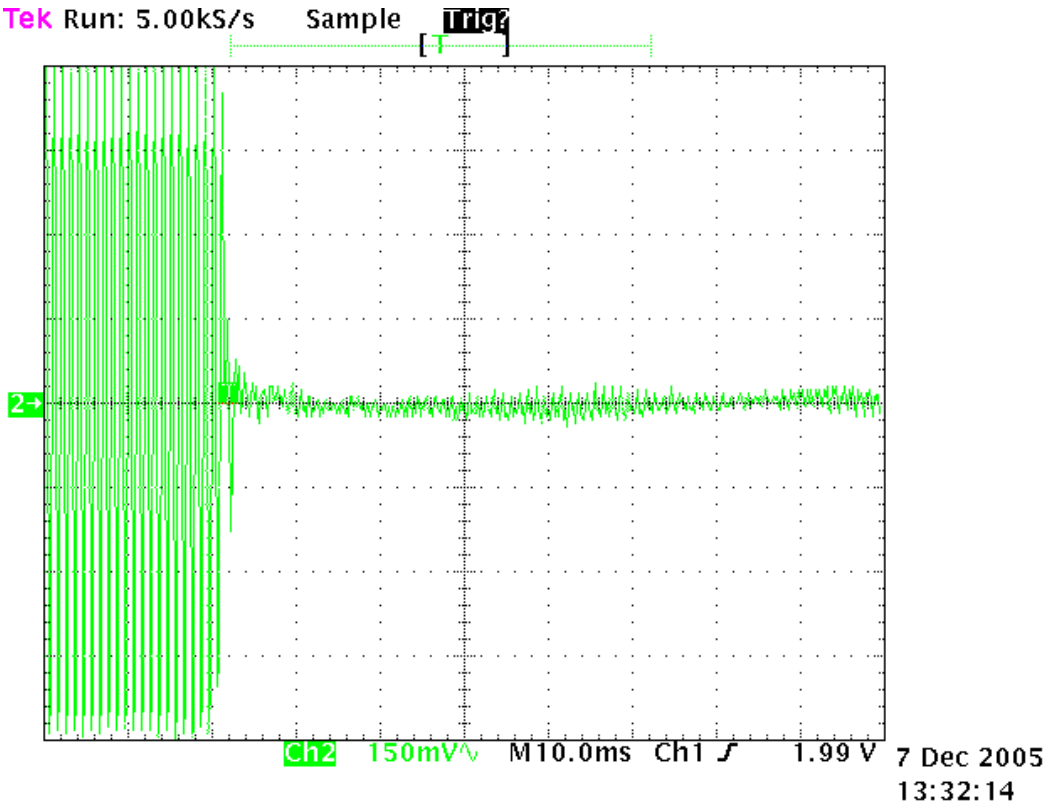
Green Trace = 1 kHz tone with FM deviation of 12.5 kHz and any transient.

Green trace has been maximised to give full screen indication of a ±12.5 kHz.
Therefore each Y axis division = 3.125 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 2.5 divisions from the left-hand edge.
t2 occurs between 2.5 and 4.5 divisions from the left-hand edge.

A small transient can be observed just after *t*on.



12.5 kHz transmitter turn off

Green Trace = 1 kHz tone with FM deviation of 12.5 kHz and any transient.

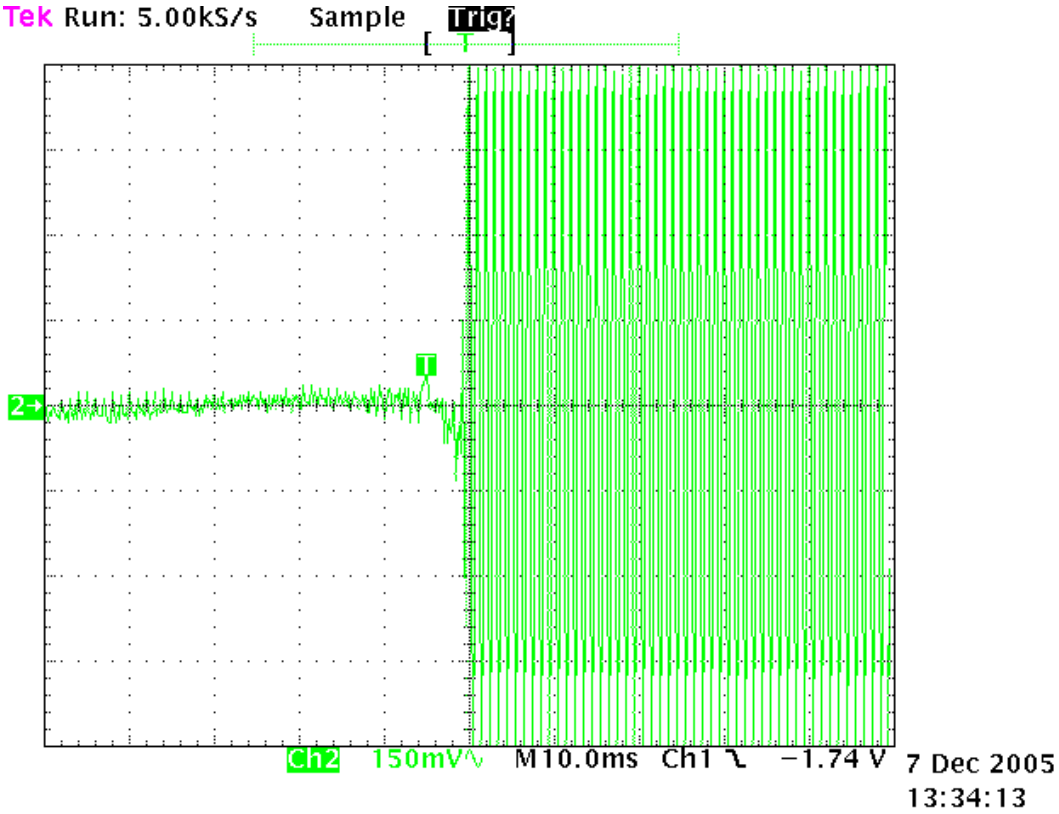
Green trace has been maximised to give full screen indication of a ± 12.5 kHz.
Therefore each Y axis division = 3.125 kHz per division.
The X axis has been set to a sweep rate of 10 mS/division.

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 4.5 and 5.0 divisions from the left hand edge.

A small transient response can be observed just before toff.



Exposure of humans to RF fields

The original P450H results are stated below.

As per Section 1.1310 and Section 2.1091 certification of this transmitter is sought using the General Public / Uncontrolled exposure limits as detailed in OST/OET Bulletin Number 65 as a power of 5 watts is to be used in a base / fixed environment.

In addition calculations have been made using the Occupational / Controlled Exposure limits as it is possible that this transmitter could be used during the course of employment.

In accordance with Section 1.1310 the following Maximum Permissible Exposure (MPE) power density limits have been applied:

Occupational / Controlled Exposure of 1.20 mW/cm^2 (f/300 = 380 MHz / 300)

General Population / Uncontrolled exposure of 0.25 mW/cm^2 (f/1500 = 380 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	**Uncontrolled**
E = 1.20 mW/cm^2 = $E^2/3770$	E = 0.25 mW/cm^2 = $E^2/3770$
E= $\sqrt{}$1.20*3770	E= $\sqrt{}$0.25*3770
E = 67.2 V/m	E = 30.7 V/m

The rated maximum transmitter power = 5 watts.

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

The transmitter is a push to talk device that would typically be used with a duty cycle of 50% in a 6 minute period or a 30 minute period.

Controlled	**Uncontrolled**
d = $\sqrt{}$ (30 * P * G*DC) / E	
d = $\sqrt{}$ (30 * 5.0 * 1.64 * 0.5) / 67.2	d = $\sqrt{}$ (30 * 5.0 * 1.64 * 0.5) / 30.7
d = 0.165 metres or 16.5 cm	d = 0.361 metres or 36.1 cm

Result: Complies

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset	Cal Due
Aerial Controller	EMCO	1090	9112-1062	3710	N/a
Aerial Mast	EMCO	1070-1	9203-1661	3708	N/a
Turntable	EMCO	1080-1-2.1	9109-1578	3709	N/a
VHF Balun	Schwarzbeck	VHA9103	-	3603	12/01/2015
Biconical Antenna	Schwarzbeck	BBA 9106	-	3612	12/01/2015
Log Periodic Antenna	Schwarzbeck	VUSLP 91111	9111-228	3785	12/01/2015
Horn Antenna	Electrometrics	RGA-60	6234	E1494	04/07/2014
Measuring receiver	Rohde & Schwarz	ESIB-40	100171	EMC4003	20/10/2013
Level generator	Anritsu	MG443B	M61689	E1143	10/07/2014
Modulation Analyzer	Rohde & Schwarz	FMA	837807/020	E1552	15/01/2015
Modulation Analyzer	Hewlett Packard	8901B	2608A00782	E1090	10/07/2014
Oscilloscope	Tektronics	745A	B010643	E1569	15/01/2015
Power Attenuator	Weinschel	49-20-43	GC104	E1308	N/a
Power Supply	Hewlett Packard	6032A	2743A-02859	E1069	N/a
Selective Level Meter	Anritsu	ML422C	M35386	E1140	03/07/2015
Signal Generator	Rohde & Schwarz	SMHU	838923/028	E1493	22/01/2015
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	RFS 3776	26/02/2015
Thermal chamber	Contherm	M180F	86025	E1129	01/06/2015
Thermometer	DSIR	RT200	035	E1049	01/06/2015

8. 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 July 2013.

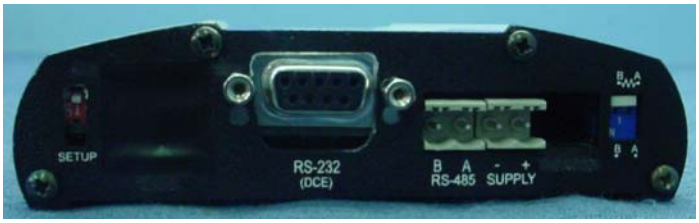
All testing has been carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to ISO/IEC 17025.

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 a number of accreditation bodies in various economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

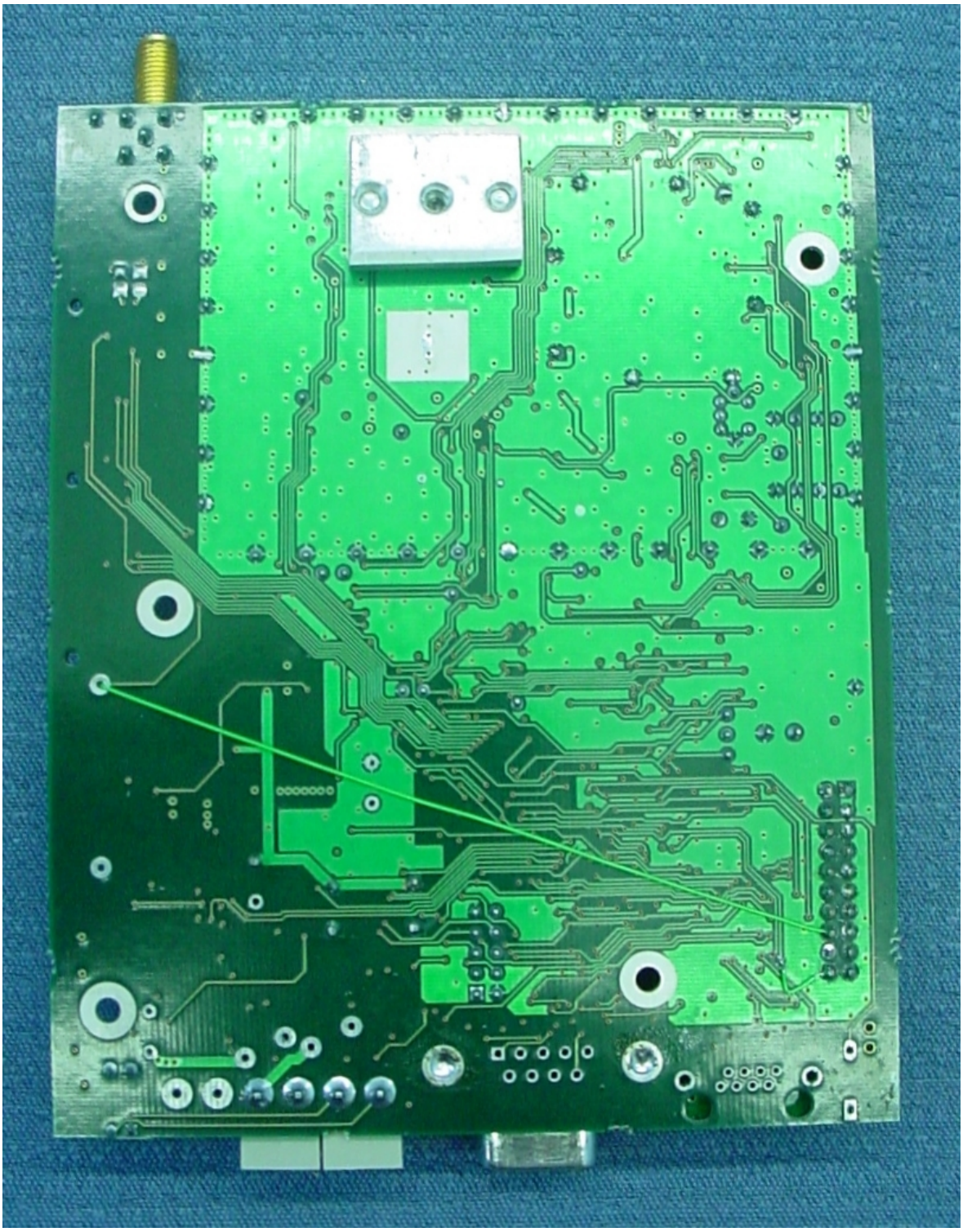
9. PHOTOGRAPHS

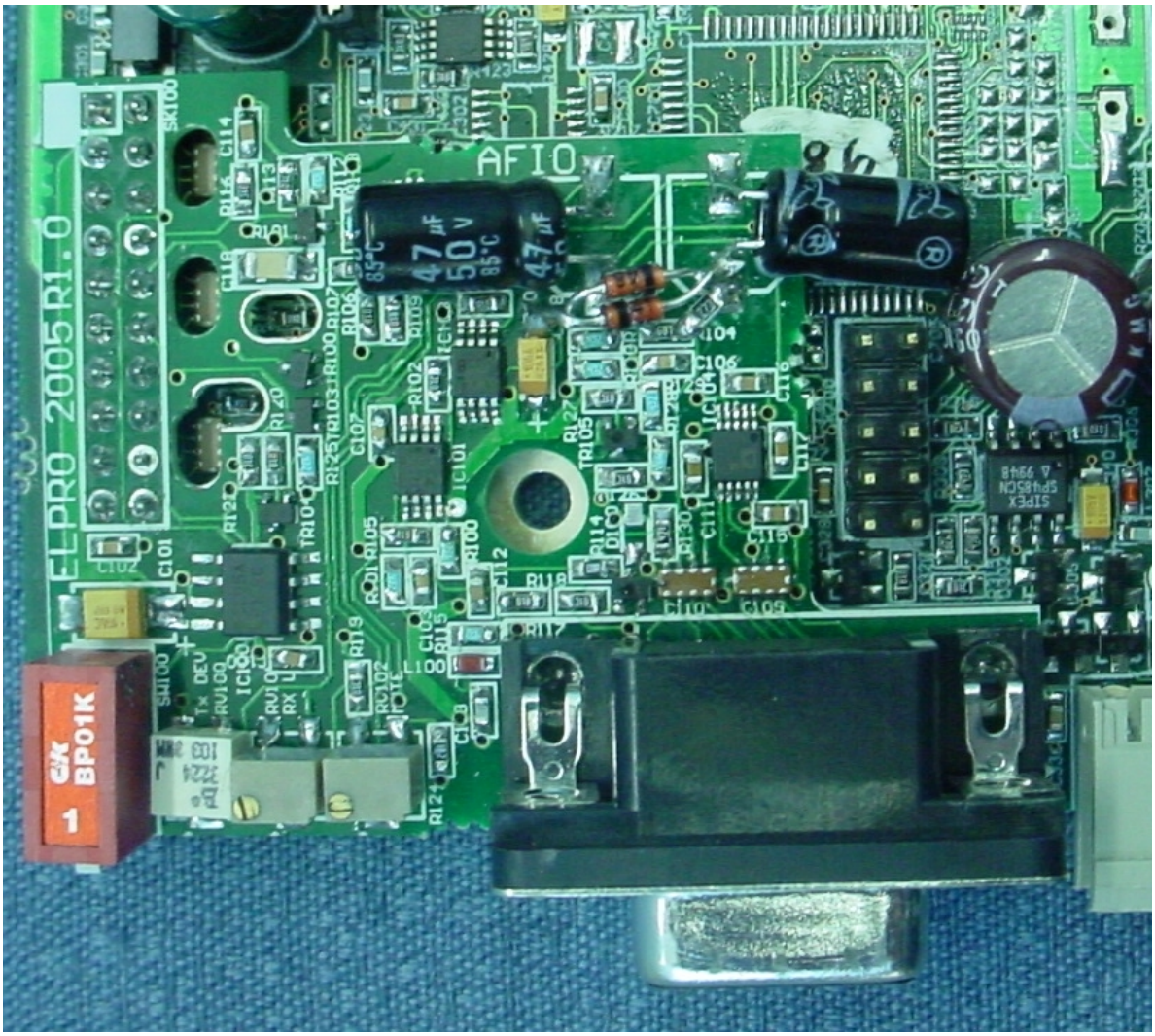
Original sample external views



Retest sample containing transmitter module

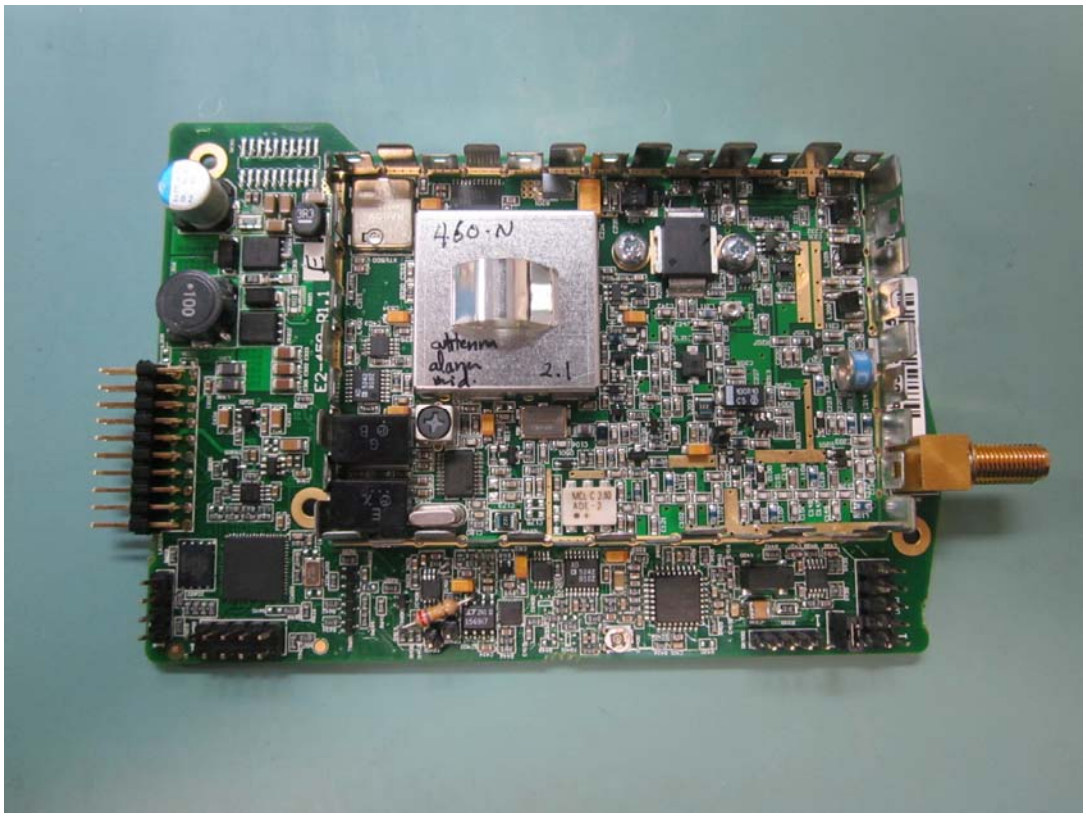
Original internal photos with shields attached

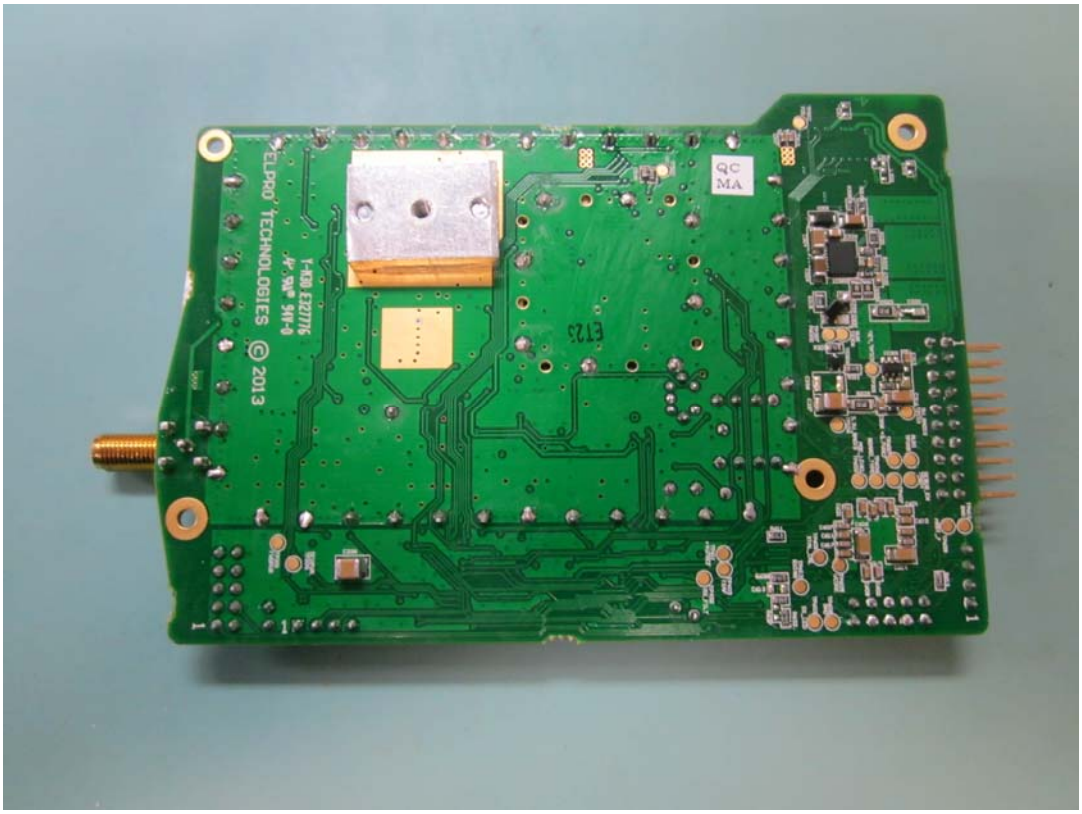


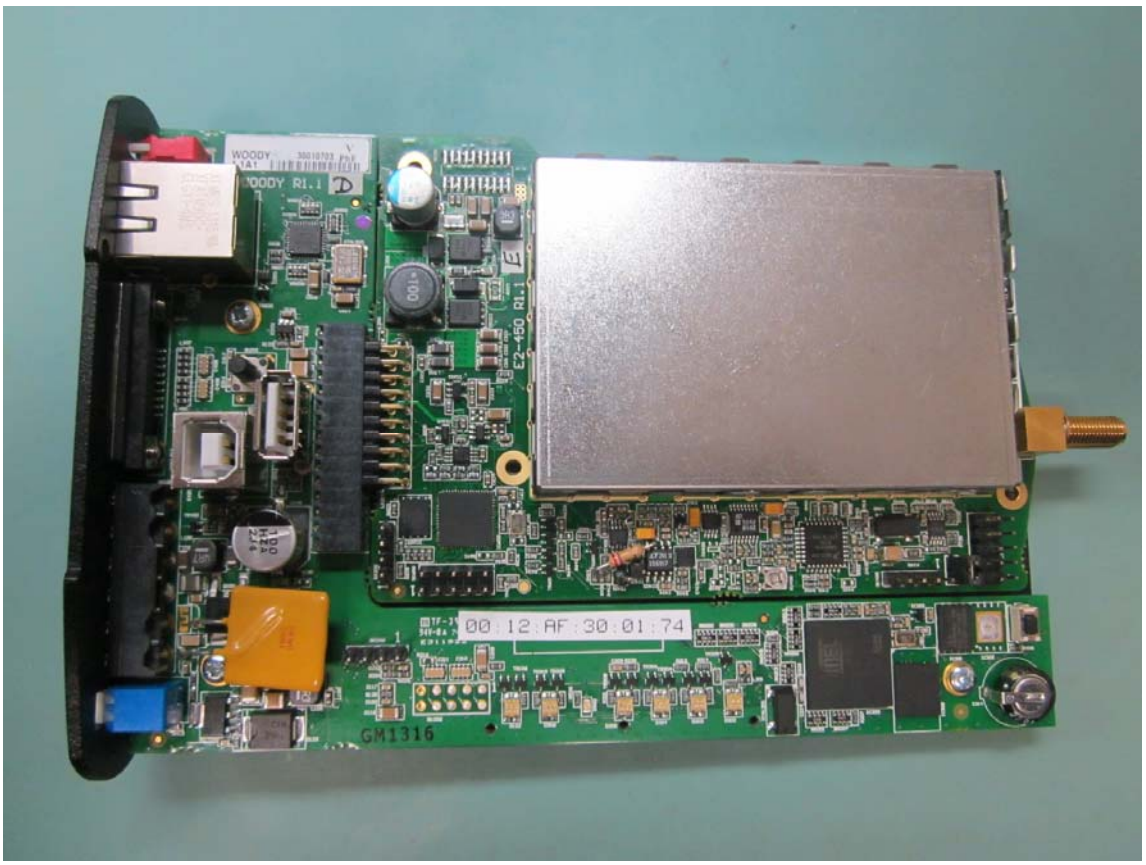


Internal photos with the shields removed

Internal photographs showing the radio module







Radiated emissions retest test set up photos