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Amendment to Test Report R040102-01

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Product: 2100NC
FCC ID: OAM2100NC

Test Report No: R040102-01A

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1.0 Summary of test results

1.1 Reason for Amendment

This report was amended to reflect a change in the FCC ID, to correctly provide data showing the correct limits for average readings above 1GHz and to provide more information concerning the measurement equipment and techniques.

1.2 Test Results

Test	Test Specification	Results
CFR 47, FCC Part 15.203	Part 15.203	Complies
CFR 47, FCC Part 15.207	Part 15.207, Class B	Complies
CFR 47, FCC Part 15.209	Part 15.209, Class B	Complies
CFR 47, FCC Part 15.231	Part 15.231	Complies

1.3 Test Methods

1.3.1 Conducted Emissions

Measurements of conducted emissions to the limits set in CFR 47 Part 15.207 were conducted using the methods shown in ANSI/IEEE C63.4, 2001. Several configurations were examined the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high, positioned 40cm from the vertical ground plane and 80cm or more away from any other conductive surface.

1.3.2 Radiated Emissions

Compliance to CFR 47 Parts 15.109/209 and 15.231(e) was tested in accordance with the methods of ANSI/IEEE C63.4, 2001. Several configurations were examined the results presented represent a worst-case scenario. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to maximize emissions. All measurements were taken at a distance of 3m from the EUT.

2.0 Description

2.1 Equipment under test

The iSecuretrac personal tracking unit (PTU) and base station work in conjunction with a cuff (worn by the detainee) and software as part of a home arrest system. A variety of cuff transmitters are available from several different manufacturers (i.e. FCC ID: LSQ-TX500) and are not part of this application for certification. The base station receives a signal, decodes it, re-encodes it and transmits it out for reception by the PTU, which is positioned in the base station. If the PTU is not in the base station, the base station is effectively powered off. The PTU receives information from the cuff and relays it to a remote server via a Part 68 approved modem. The PTU is worn at the waist or stored in the base station when applicable. The transmitter in the base station serves the purpose of providing diversified reception of the cuff signal. In many housing environments, there are signal reflections and blockages that cause dead zones of reception. This is caused by reflected signals mixing with the direct path signal and creating nulls, and sometimes just the fact that metal objects like a refrigerator may block either the horizontal or vertical component of the signal. Depending on the position of the cuff being worn by the individual, the signal can vary from one orientation to the other and anything in-between. By providing a repeater receiver with an external antenna that is vertical, a PTU receiver that is horizontal when docked, and retransmitting with an antenna that is horizontal, signals of both horizontal and vertical polarization have an enhanced chance of reception, thus improving overall reception and minimizing reporting to the customer a false loss of signal conditions.

2.1.1 Identification
iSecuretrac iTracker 2100NC PTU

2.1.2 EUT received date: 1 April 2002

2.1.3 EUT tested dates: 1 April 2002

2.1.4 Manufacturer: iSecuretrac Corp, Omaha, NE

2.1.5 Serial number
PTU: 0028
Base station: FCCb

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC registered lab. This site has been fully described in a report submitted to your office, and accepted in a letter dated May 4, 2001. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of 46 ± 4%
Temperature of 22 ± 3° Celsius

2.3 Special equipment or setup

The device was modified to enable the transmitter to be active continuously instead of waiting for a signal to repeat.

3.0 Test equipment used

Serial #	*Manufacturer*	*Model*	*Description*	*Last cal.*
1647	EMCO	3142B	Biconilog antenna	25-May-01
6415	EMCO	3115	DRG Horn	31-May-01
100037	Rohde & Schwarz	ESIB26	EMI Test Receiver	11-Jun-01
082001/003	Rohde & Schwarz	TS-PR18	Preamplifier	10-Aug-01
2575	Rohde & Schwarz	ES-K1	Software v1.60	N/A
100009	Rohde & Schwarz	ESH3-Z2	Pulse limiter	05-Jun-01
100023	Rohde & Schwarz	ESH3-Z5	Artificial Mains	21-May-01

4.0 Detailed Results

All measurement results are located in the corresponding interval with a probability of approximately 95% (coverage factor k=2). The interval for these measurements is U_x (expanded uncertainty).

Conducted Emissions, 150kHz – 30MHz: U_x = +/- 3.1 dB
Radiated Emissions, 30MHz – 1GHz, 3m distance: U_x = +/- 3.4 dB
Radiated Emissions, 1GHz – 4GHz, 3m distance: U_x = +/- 3.5 dB

Radiated emissions measurements were made by first using a spectrum analyzer getting a rough signal spectrum, any points were then measured using a CISPR 16 compliant receiver with the following bandwidth setting:

30MHz - 1GHz: 120kHz IF bandwidth, 60kHz steps
Above 1GHz: 1MHz IF bandwidth, 500kHz steps

Conducted measurements were made using a CISPR 16 compliant receiver with the IF bandwidth set to 9kHz taking 5kHz steps through the range 450kHz to 30MHz.
All results shown are corrected to incorporate cables losses, antenna factors, and any amplification.

4.1 FCC Part 15.203 unique connector for antenna

The antenna for the transmitter portion is a strip antenna that is a part of the circuit board itself and cannot be removed from the system. The antenna for the receiver portion of the device is attached via a screw to the circuit board.

4.2 FCC Part 15.207 Conducted Emissions for Class 'B' devices

The EUT was tested in two modes; one was with the transmitter continuously operating and the other, normal mode of operation, when no signal is present to be repeated. The setup can be seen in Figures 1 and 2. The continuously transmitting mode provided the highest emissions and those results can be seen in Figure 5. The highest peak was at 450kHz with a value of 20.6dBμV measured with the quasi-peak detector.

4.3 FCC Part 15.209 Radiated Emissions for Class 'B' devices

The EUT was found to not produce any emissions that exceeded the Class 'B' limits. The test setup can be seen in Figures 3 and 4. More information on the radiated emissions can be found in Section 4.4. The plots of the results can be seen in Figures 6 and 7. The maximum values as measured with the quasi-peak detector are shown below the transmitter was not active for these measurements.

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarization
3879.5	41.19	53.9	12.7	249	337	VERTICAL
2535	37.76	53.9	16.1	249	162	HORIZONTAL
1246.5	33.92	53.9	20	162	55	VERTICAL
112.02	29.59	43.5	13.9	100	258	VERTICAL
3991.5	28.84	53.9	25.1	246	226	VERTICAL
3862	28.61	53.9	25.3	399	313	VERTICAL
3955	28.03	53.9	25.9	281	183	HORIZONTAL
3913.5	27.66	53.9	26.2	252	181	VERTICAL
30.48	25.3	40	14.7	150	235	HORIZONTAL
31.98	22.27	40	17.7	99	252	VERTICAL
30.66	20.14	40	19.9	101	202	HORIZONTAL
30.9	20.12	40	19.9	346	230	HORIZONTAL
31.32	20.09	40	19.9	181	253	HORIZONTAL
30.06	20.07	40	19.9	350	227	HORIZONTAL
32.46	19.44	40	20.6	400	21	VERTICAL

4.4 FCC Part 15.231 Radiated Emissions for Class ‘B’ devices

The EUT was tested in two modes; one was with the transmitter continuously operating and the other normal mode of operation when no signal is present to be repeated. The cuff determines the duty cycle of the transmitted pulses. The cuff is a Part 15 approved device from a different source. The bandwidth of the signal would be determined in a similar fashion. Figure 10 shows the bandwidth of the EUT set in continuous transmit mode, which is clearly less than 200kHz, which is less than the 795kHz requirement of Part 15.231(c). The maximum values, within 25dB of the limit, as measured with a quasi-peak detector (30MHz –1GHz) or an average detector (above 1GHz), are shown below.

Frequency MHz	QP/AV Level dBµV/m	Peak Level dBµV/m	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarization
30.36	20.2	27.71	40	19.8	301	49	HORIZONTAL
31.74	20.08	26.49	40	19.92	249	40	HORIZONTAL
36	22.02	26.12	40	17.98	149	118	VERTICAL
40.02	28.82	28.82	40	11.18	100	2	VERTICAL
43.98	23.74	24.47	40	16.26	99	303	VERTICAL
112.02	29.91	30.44	43.5	13.59	100	237	VERTICAL
317.94	38.69	38.69	46	7.31	99	100	HORIZONTAL
391.98	23.55	23.55	46	22.45	128	355	VERTICAL
954.12	43.12	43.54	46	2.88	100	0	VERTICAL
1590	31.4	51.4	53.9	22.5	109	319	VERTICAL
1908	22.1	42.1	53.9	31.8	99	188	VERTICAL
1937	20.2	40.2	53.9	33.7	250	329	HORIZONTAL
2226	29.72	49.72	53.9	24.18	100	108	VERTICAL
2862	34.11	54.11	53.9	19.79	165	207	HORIZONTAL
3498.5	28.32	48.32	53.9	25.58	172	276	HORIZONTAL
4001	24.1	44.1	53.9	29.8	100	61	HORIZONTAL

The peak and quasi-peak measurements below 1GHz were found not to exceed the limits. For the average measurements above 1GHz an average correction factor of –20dB was applied to the peak measurement thus resulting in compliance with the limits. The averaging factor was calculated by the following:

$$AverageFactor = 20\log(\frac{10}{100}) = -20dB$$

Where 10msec is the longest duration of any pulse train in a 100msec period, per the coding specifications for cuffs to work with this system.

Appendix A

Test setup photos

Figure 1 Conducted Emissions test setup

Figure 2 Conducted Emissions test setup

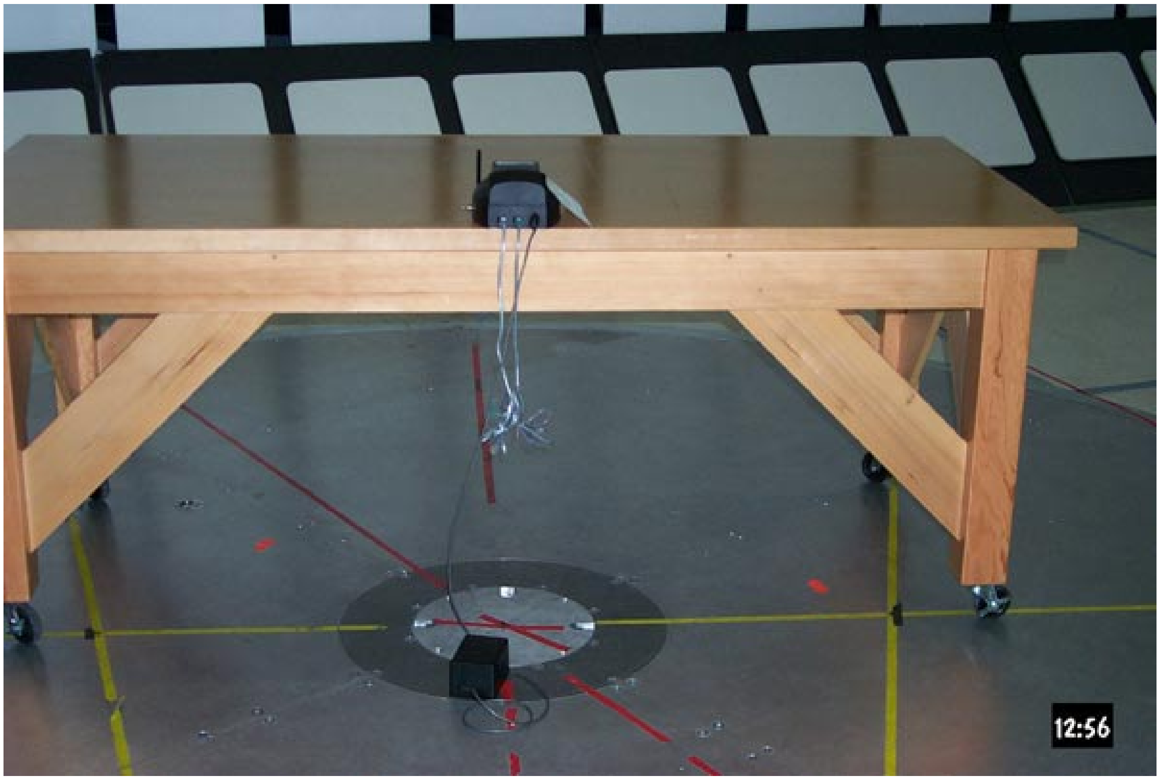

Figure 3 Radiated Emissions test setup

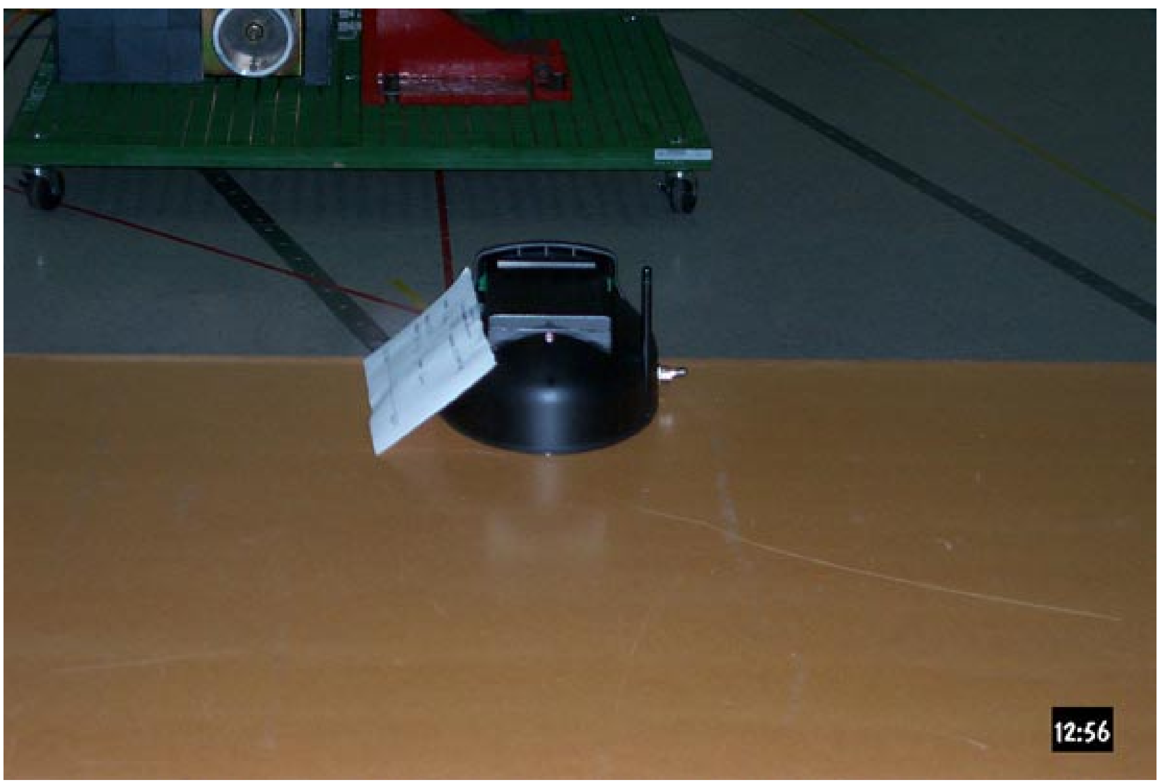

Figure 4 Radiated Emissions test setup

Appendix B

Emissions peak plots

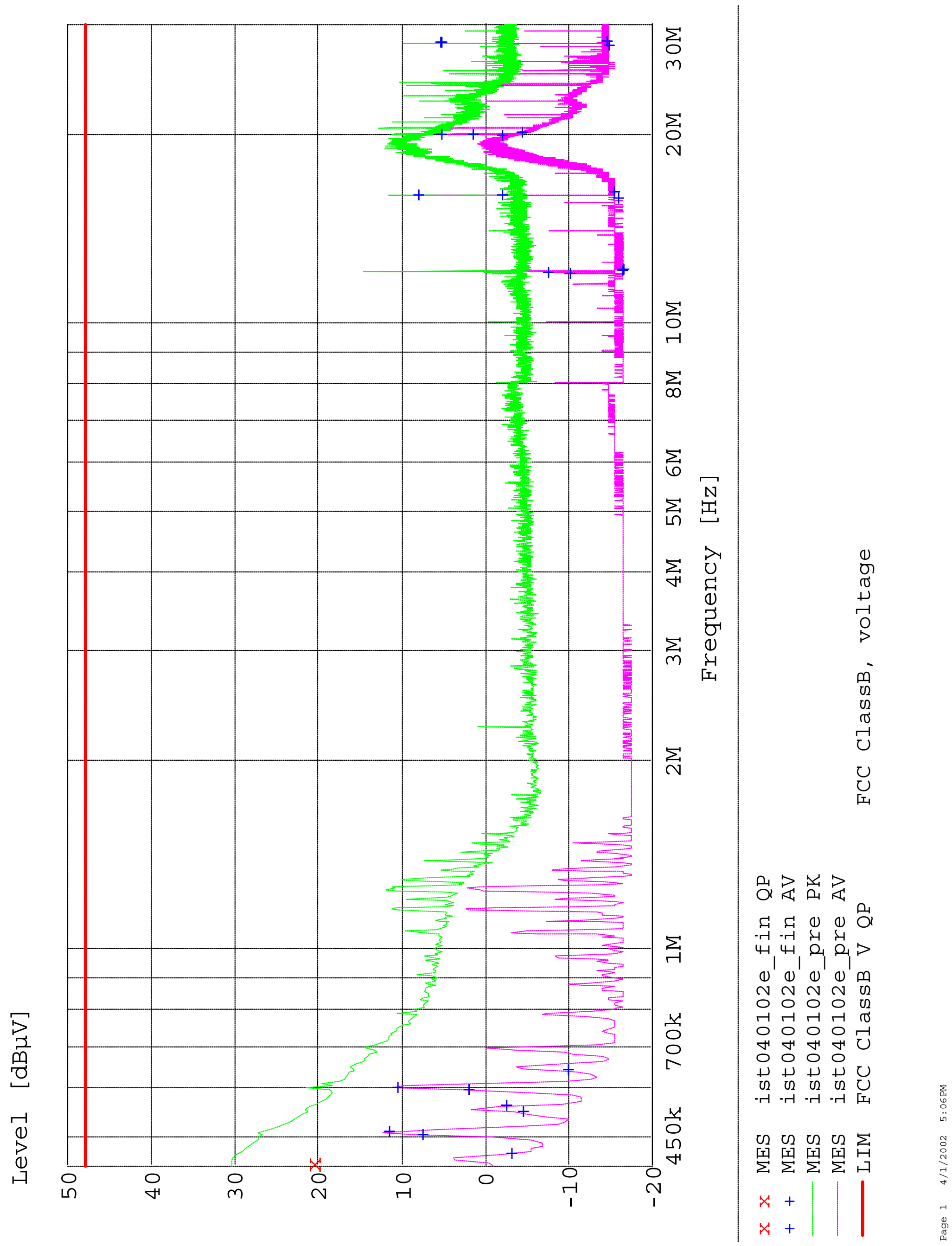

Figure 5 Conducted Emissions plot

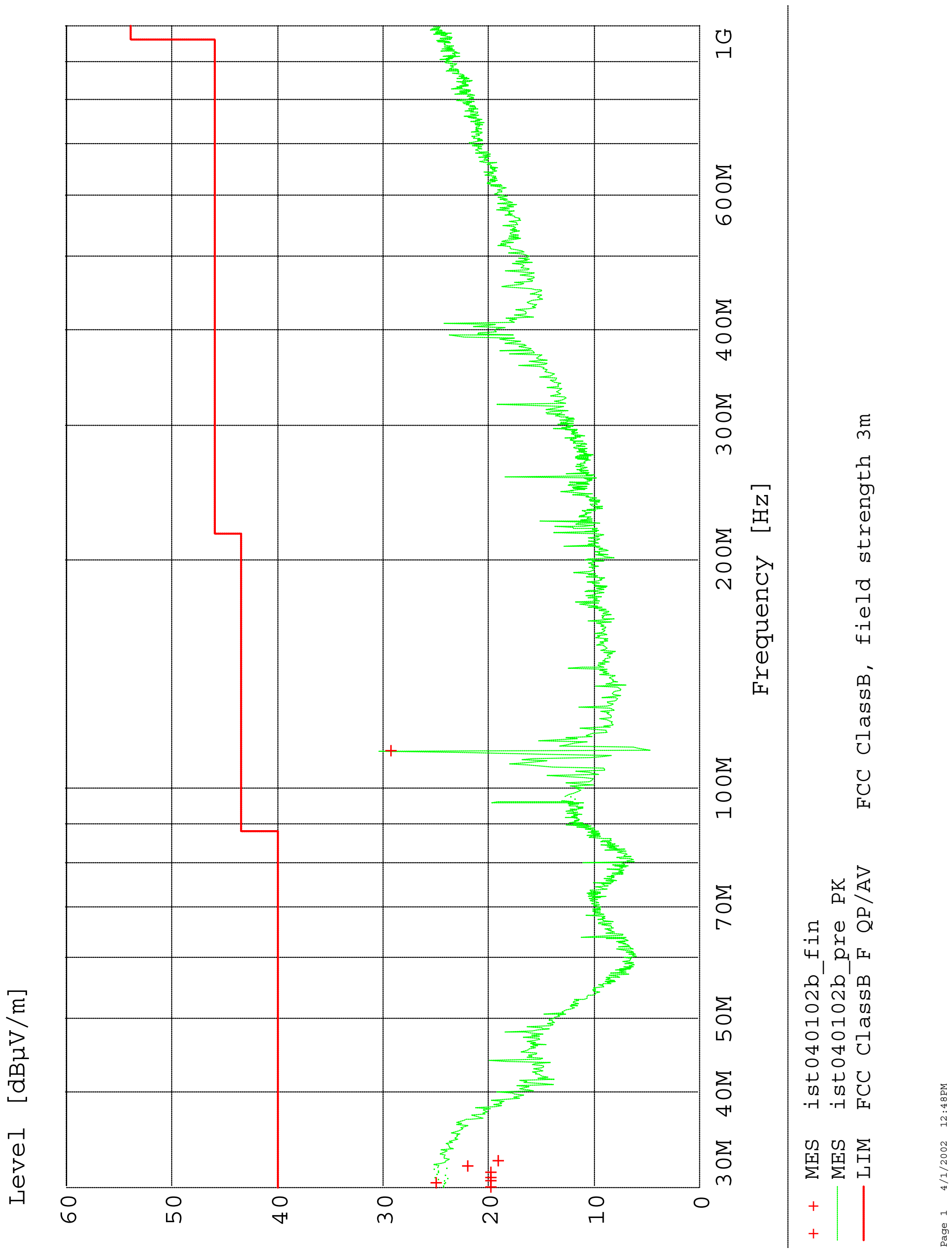

Figure 6 Radiated Emissions, 15.209, 30MHz - 1GHz

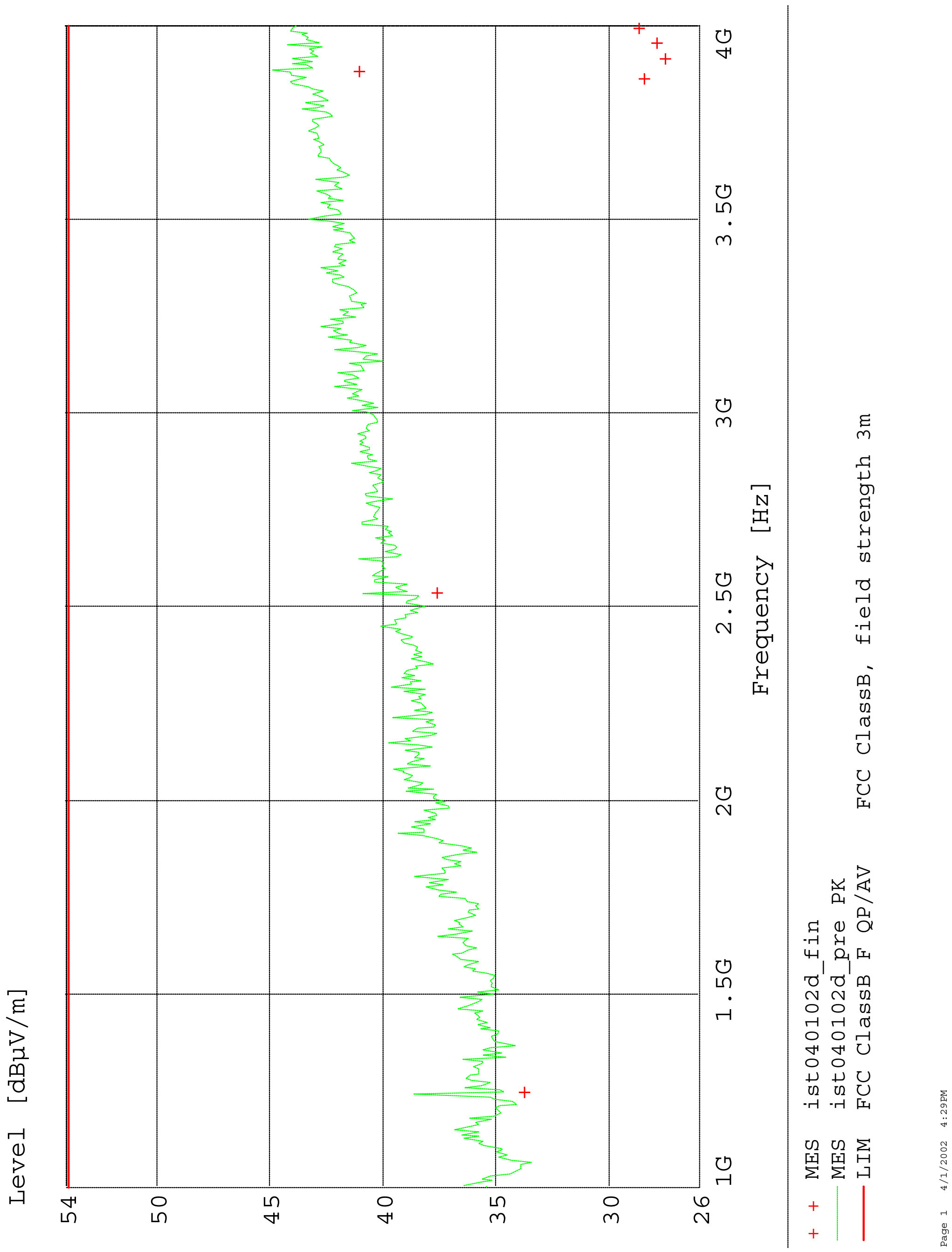

Figure 7 Radiated Emissions, 15.209, 1GHz - 4GHz

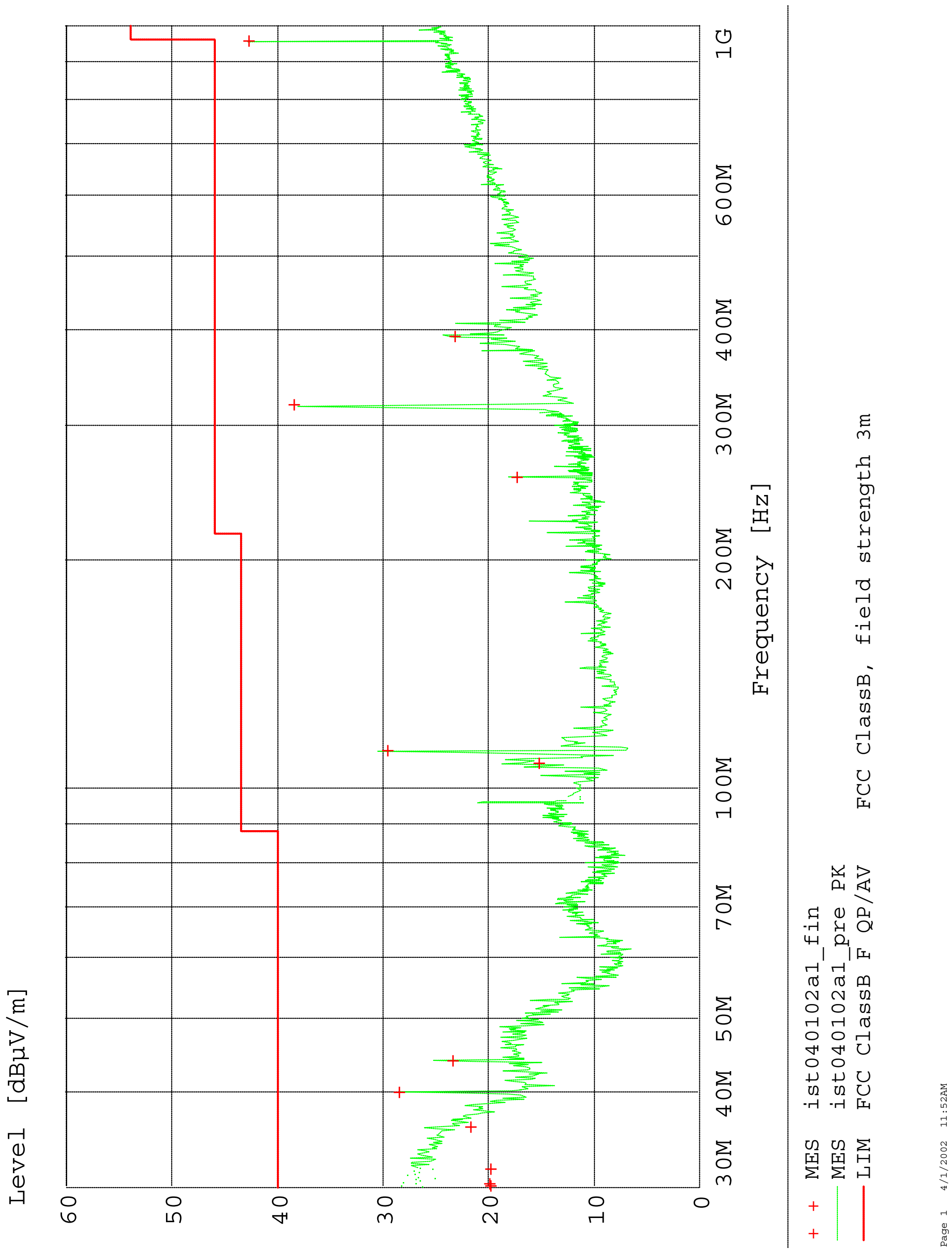

Figure 8 Radiated Emissions, 15.231(e), 30MHz - 1GHz

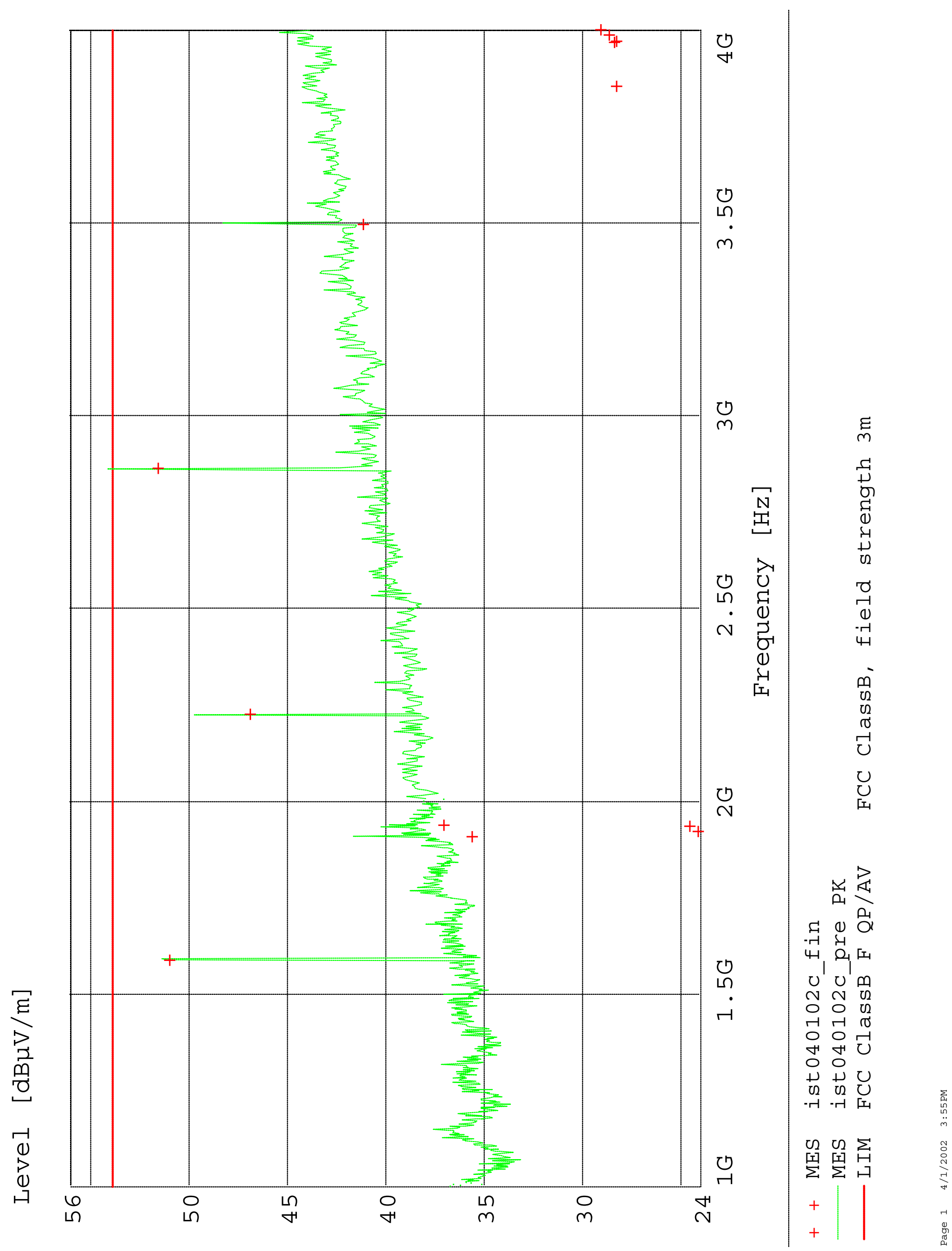

Figure 9 Radiated Emissions, 15.231(e), 1GHz - 4GHz

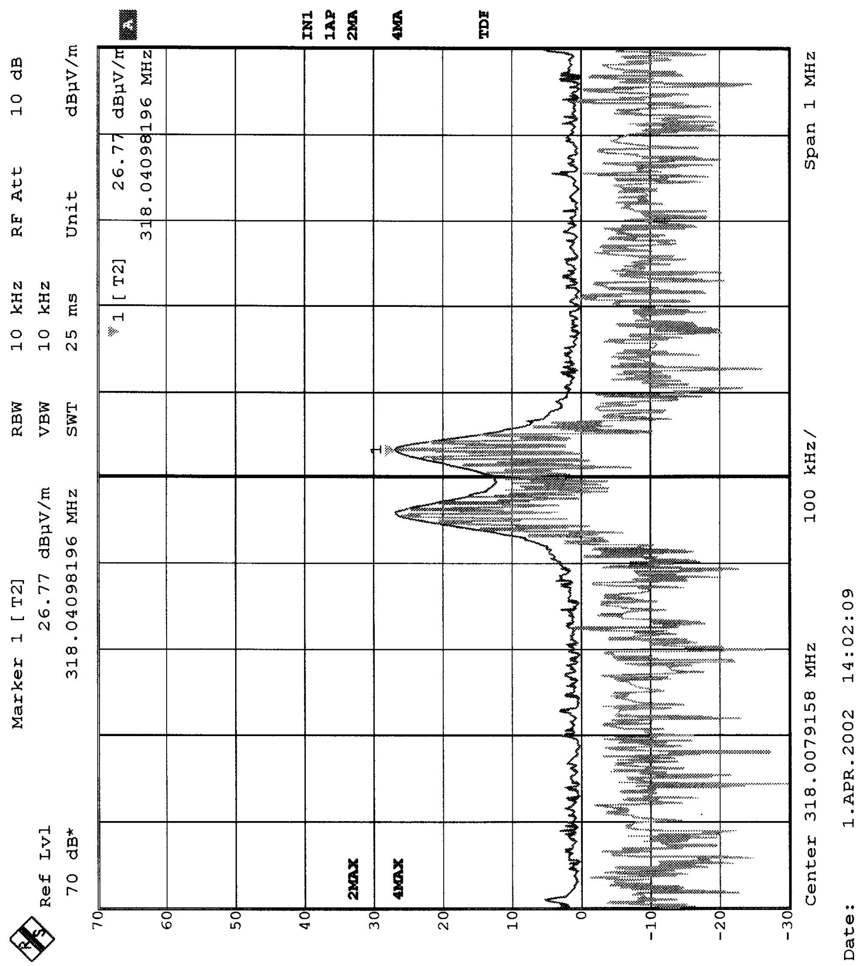

Figure 10 Radiated Emissions, 15.231(c), bandwidth of transmitted signal

Appendix C

External photos

Figure 11 PTU and base (switch on side for testing)

Figure 12 Base station

Figure 13 PTU

Figure 14 PTU rear

Figure 15 FCC label on back of PTU

Appendix D

Internal photos

Figure 16 PTU

Figure 17 PTU

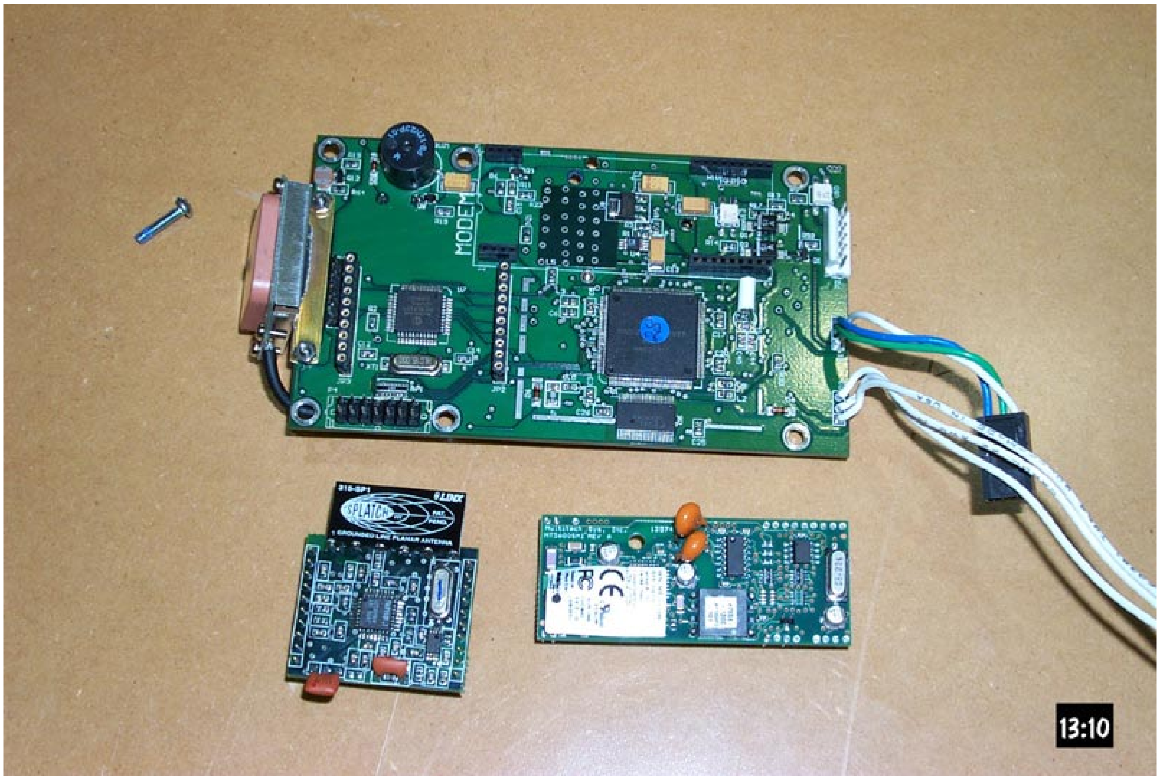

Figure 18 PTU

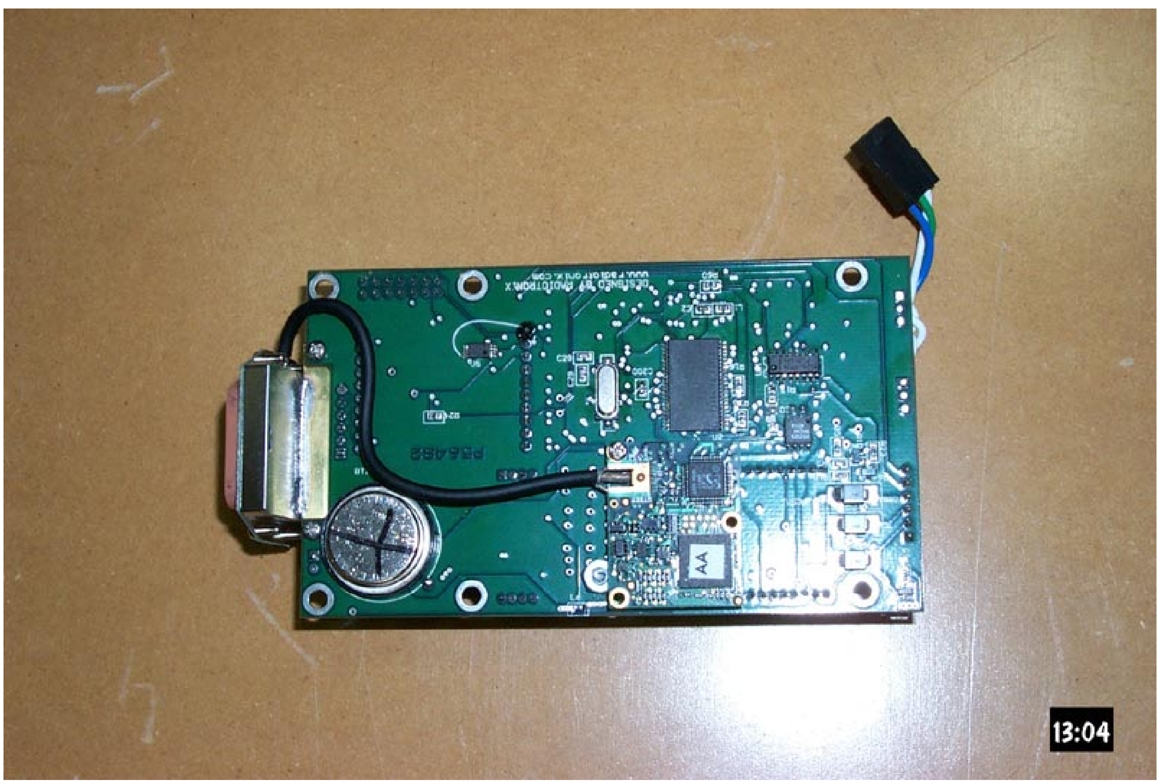

Figure 19 PTU

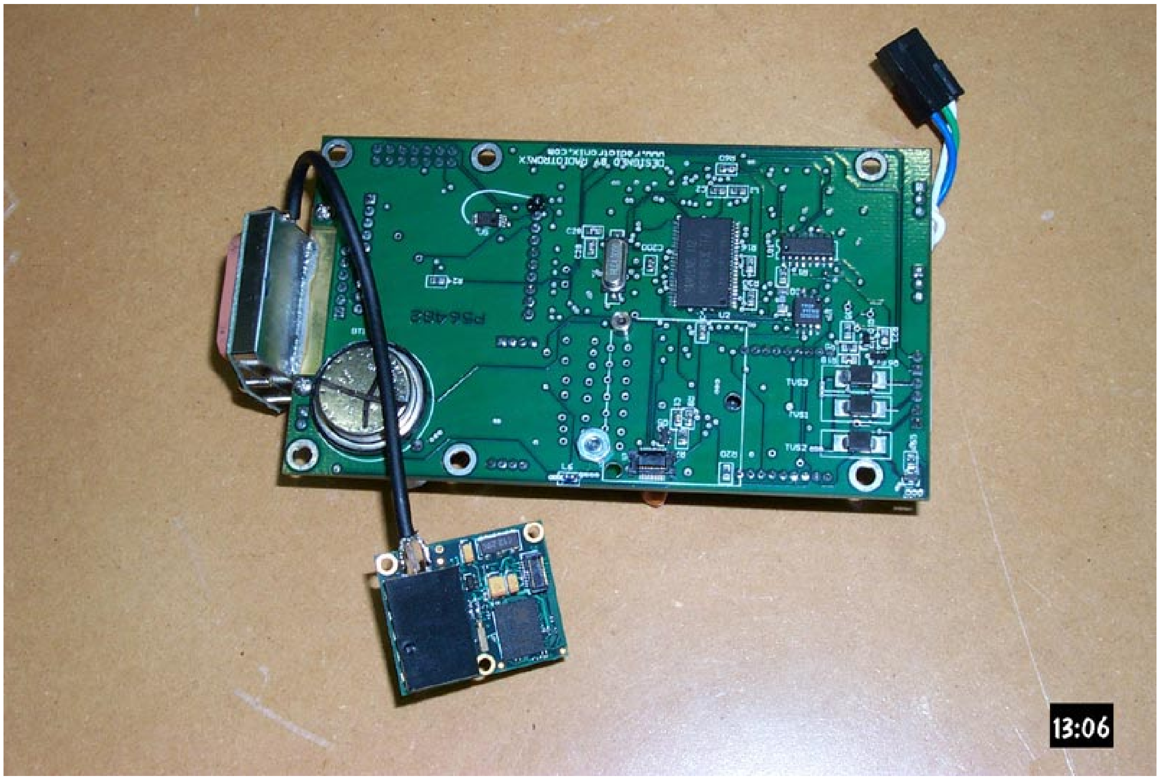

Figure 20 PTU

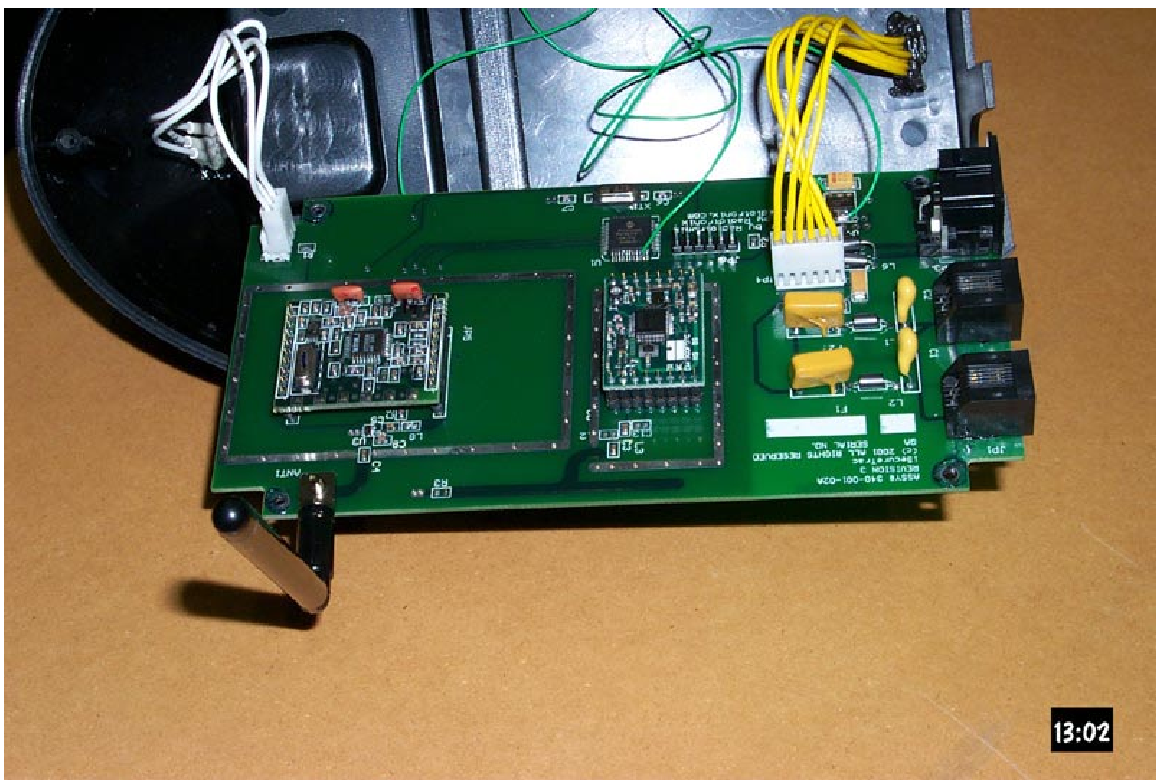

Figure 21 Base (green wires for test switch)

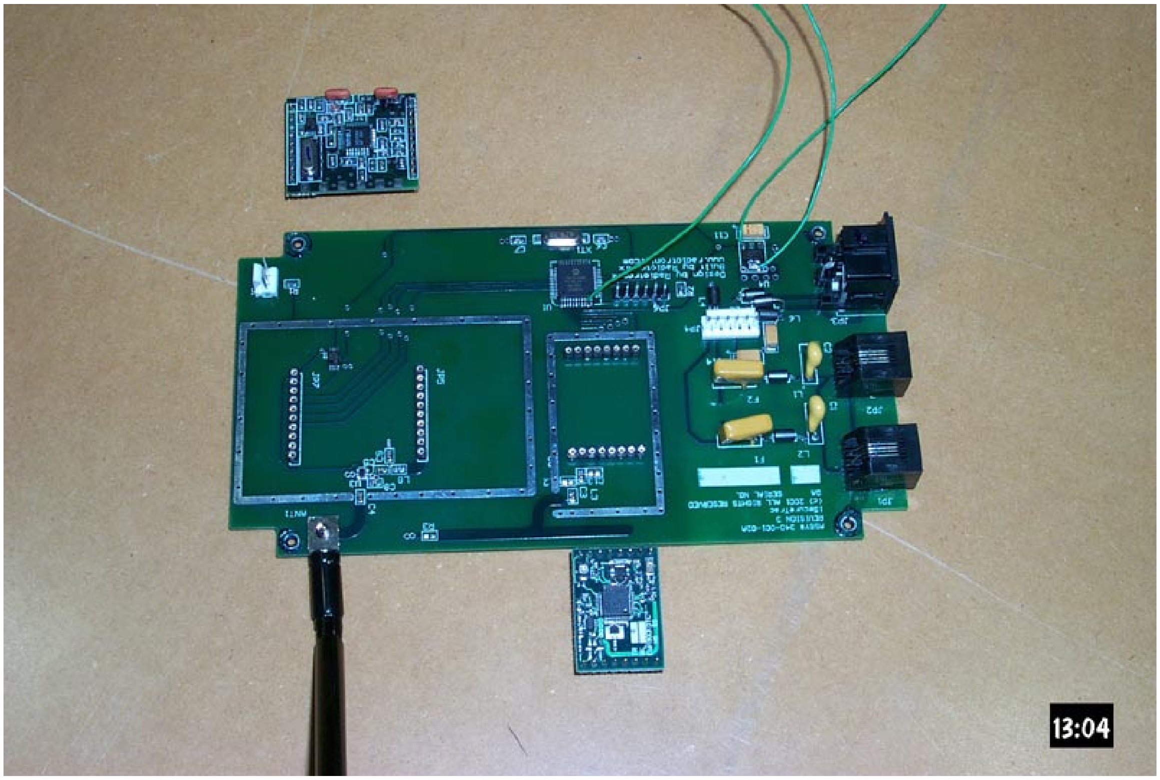

Figure 22 Base (green wires for test switch)

Appendix E

Sample calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 55 dBµV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBµV/m.

FS = 55 + 12 + 1.1 - 20 = 48.1 dBµV/m

The 48.1 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm [(48.1 dBµV/m)/20]= 254.1 µV/m