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Certificate Number 1953-01

Test Report

Company: iSECUREtrac Corp
5022 S 114th Street
Omaha, NE, USA 68138

Contact: Jef Higgason

Product: 2130 Base Station

FCC ID: OAM2100-433

Test Report No: R031003-01

APPROVED BY:

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Total Pages: 17

NCEE is a FCC registered lab. Registration #100875

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1.0 Summary of test results

1.1 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

1.2 Test Methods

1.2.1 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.

1.2.2 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 2130 PTU and charging base

2.1.2 EUT received date: 20 March 2003

2.1.3 EUT tested dates: 20th and 21st March 2003

2.1.4 Manufacturer: iSecuretrac Corp, Omaha, NE

2.1.5 Serial number
PTU: 05-00006026
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 21 ± 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.*
1654	EMCO	3142B	Biconilog antenna	03-May-02
6415	EMCO	3115	DRG Horn	17-Sep-02
100037	Rohde & Schwarz	ESIB26	EMI Test Receiver	11-Jun-02
082001/003	Rohde & Schwarz	TS-PR18	Preamplifier	N/A
2575	Rohde & Schwarz	ES-K1	Software v1.60	N/A
100023	Rohde & Schwarz	ESH3-Z5	Artificial Mains	20-Sep-02

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 – 4.5GHz, 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 150kHz 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

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. No emissions were detected within 15dB of the limit.

4.3 FCC Part 15.209 Radiated Emissions

The EUT was found to not produce any emissions within 15dB of 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 transmitter was not active for these measurements.

4.4 FCC Part 15.231(e) Radiated Emissions

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. Figure 7 shows the bandwidth of the EUT set in continuous transmit mode is less than 100kHz, which is less than the 795kHz requirement of Part 15.231(c). Values, as measured with a peak detector (30MHz –1GHz) or an average detector (above 1GHz), to be within 15dB of the limits are shown below.

Frequency MHz	Av. Limit dBuV/m	Aver. factor	Corr. Level dBuV/m	Measured dBuV/m	Antenna dB	Cables dB	Limit dB	Margin dB	Height cm	Angle deg	Pol.
433.92	45.60	-18.40	64.00	43.84	16.70	-3.40	72.84	27.24	204	295	H
867.78	19.68	-18.40	38.08	9.67	23.50	-4.90	53.90	34.22	125	227	V
1301.5	26.01	-18.40	44.41	44.10	26.00	25.70	53.90	27.89	191	4	H
1735.5	25.38	-18.40	43.78	40.83	27.70	24.80	53.90	28.52	119	195	H
2169	40.32	-18.40	58.72	52.14	29.40	22.80	53.90	13.58	100	254	H
2603	34.51	-18.40	52.91	44.21	30.60	22.00	53.90	19.39	169	296	H
3037	30.58	-18.40	48.98	38.89	31.80	21.70	53.90	23.32	151	207	V
3471	33.63	-18.40	52.03	39.97	32.70	20.70	53.90	20.27	162	253	H

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 –18.4dB was applied to the peak measurement thus resulting in compliance with the limits. The averaging factor was calculated by the following:

$$AverageFactor = 20\log(\frac{12}{100}) = -18.4dB$$

Where 12msec is the longest duration of any pulse train (Figure 9) in a 100msec period, per the coding specifications for cuffs to work with this system. Figure 8 shows the duration between transmissions.

Appendix A

Test setup photos

Figure 1 Conducted emissions test setup

Figure 2 Conducted emissions test setup

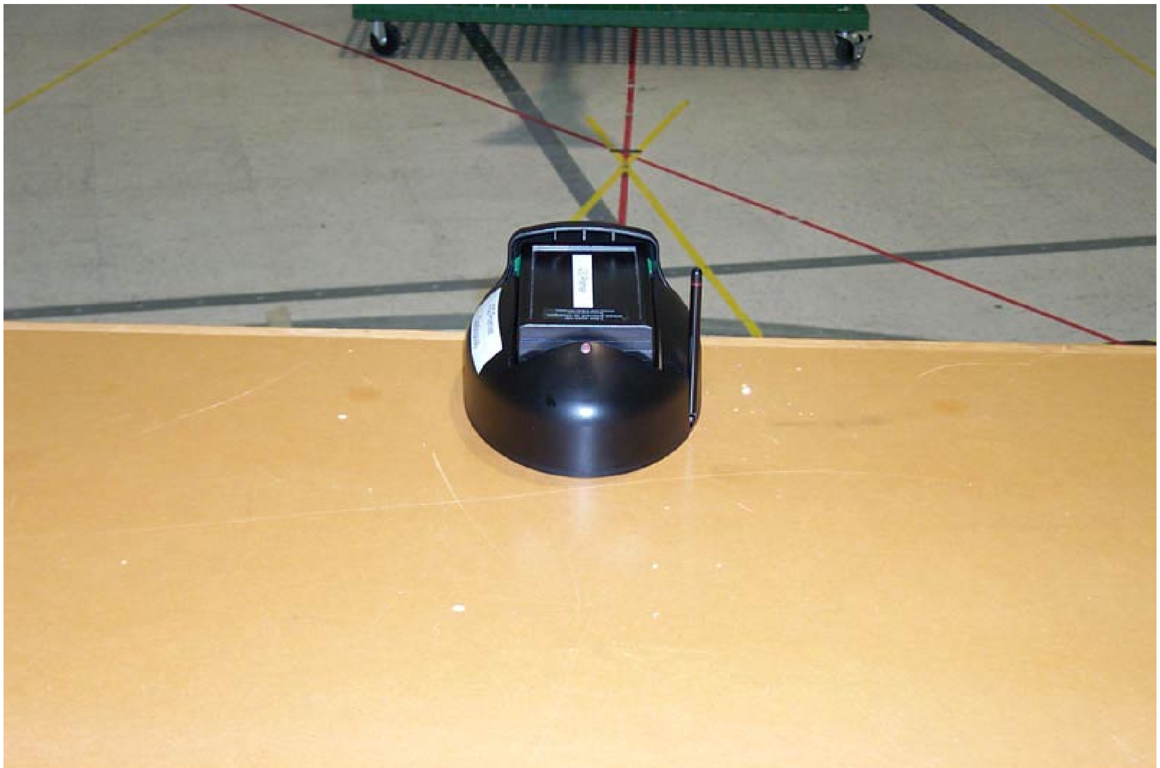

Figure 3 Radiated emissions test setup

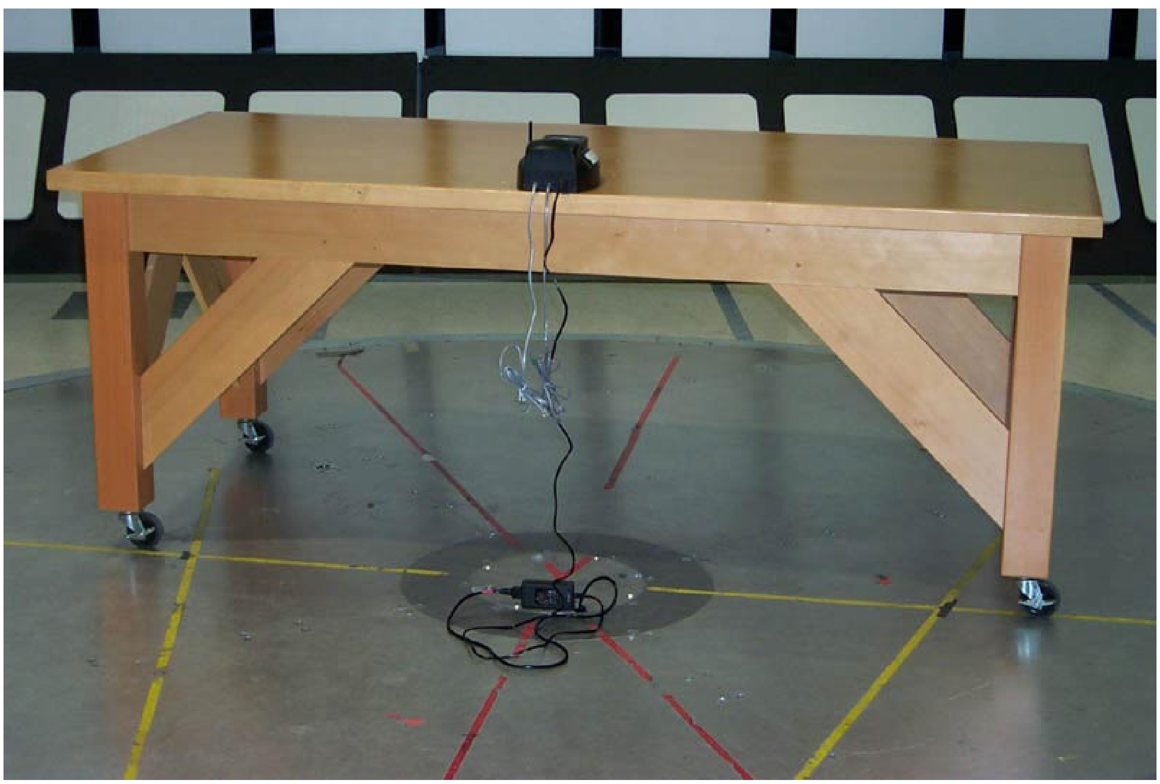

Figure 4 Radiated emissions test setup

Appendix B

Emissions plots

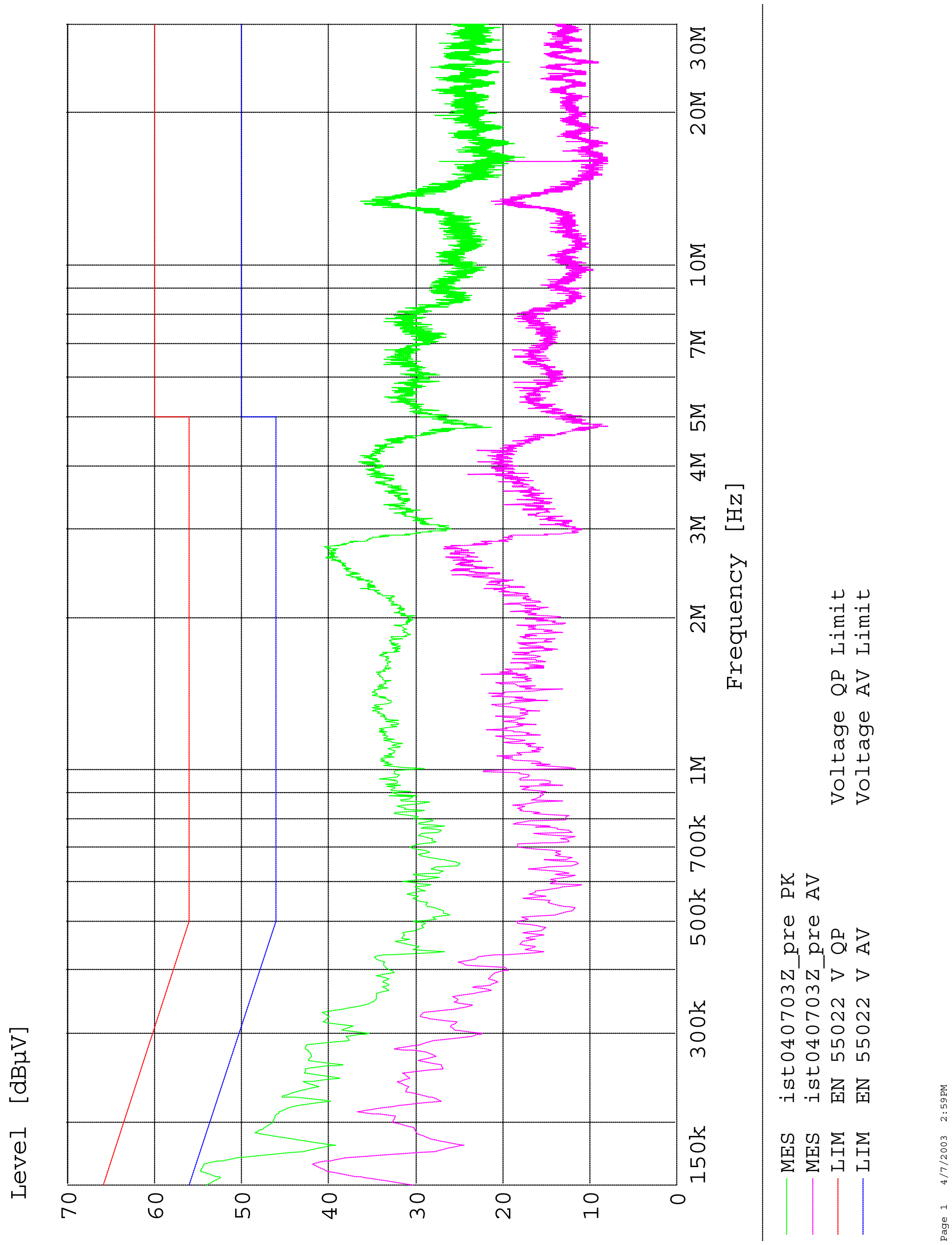

Figure 5 Conducted emissions

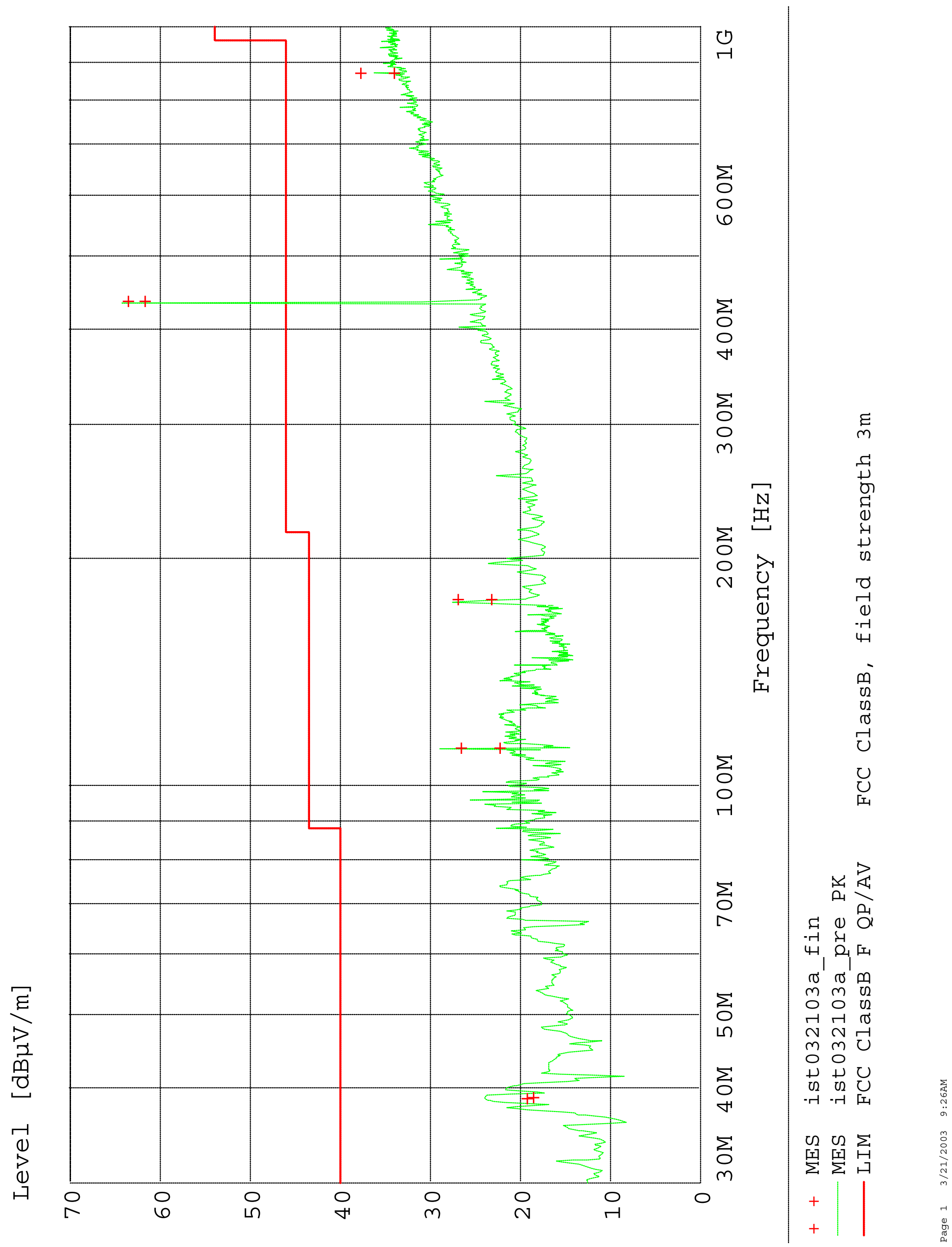

Figure 6 Radiated emissions below 1GHz

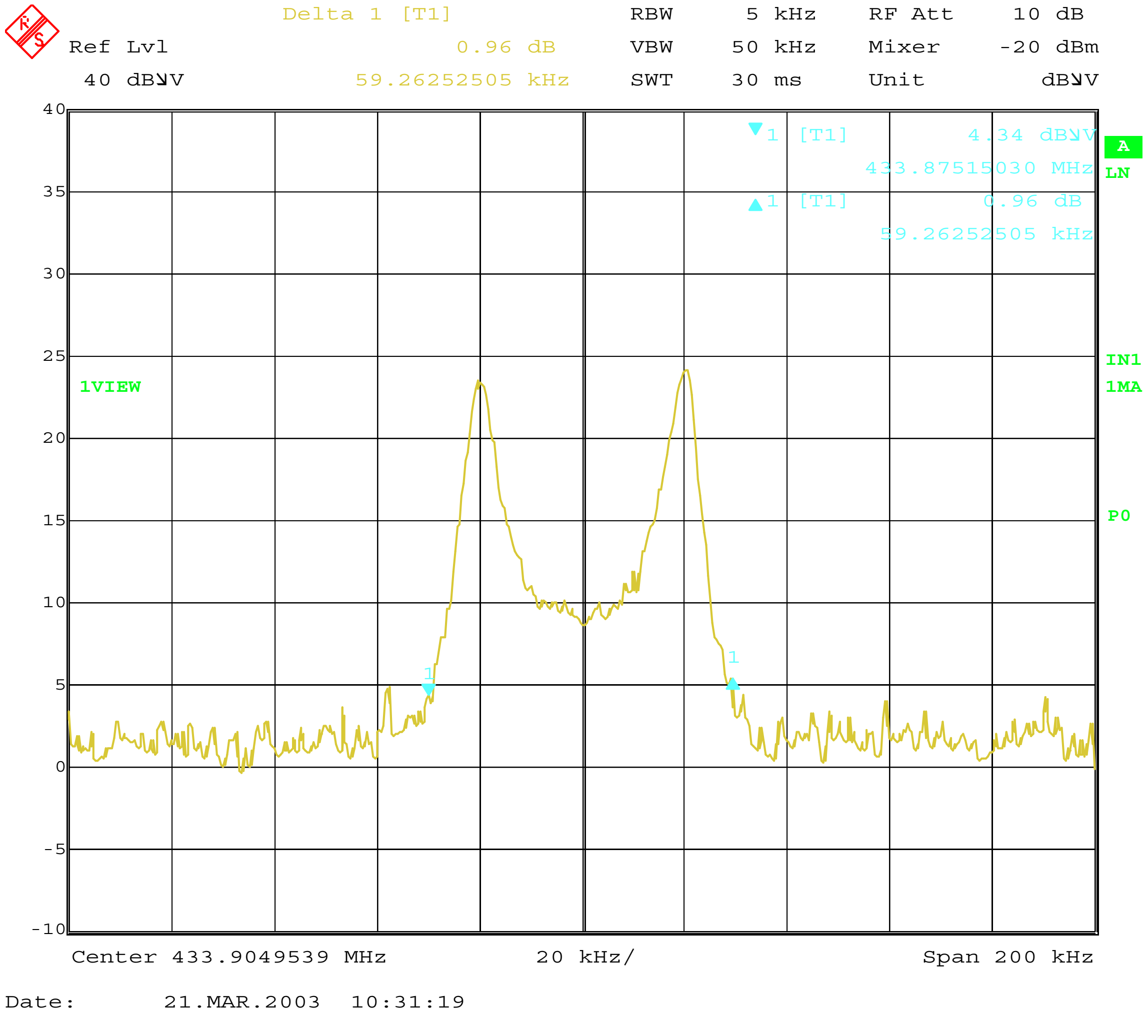

Figure 7 Bandwidth of fundamental signal

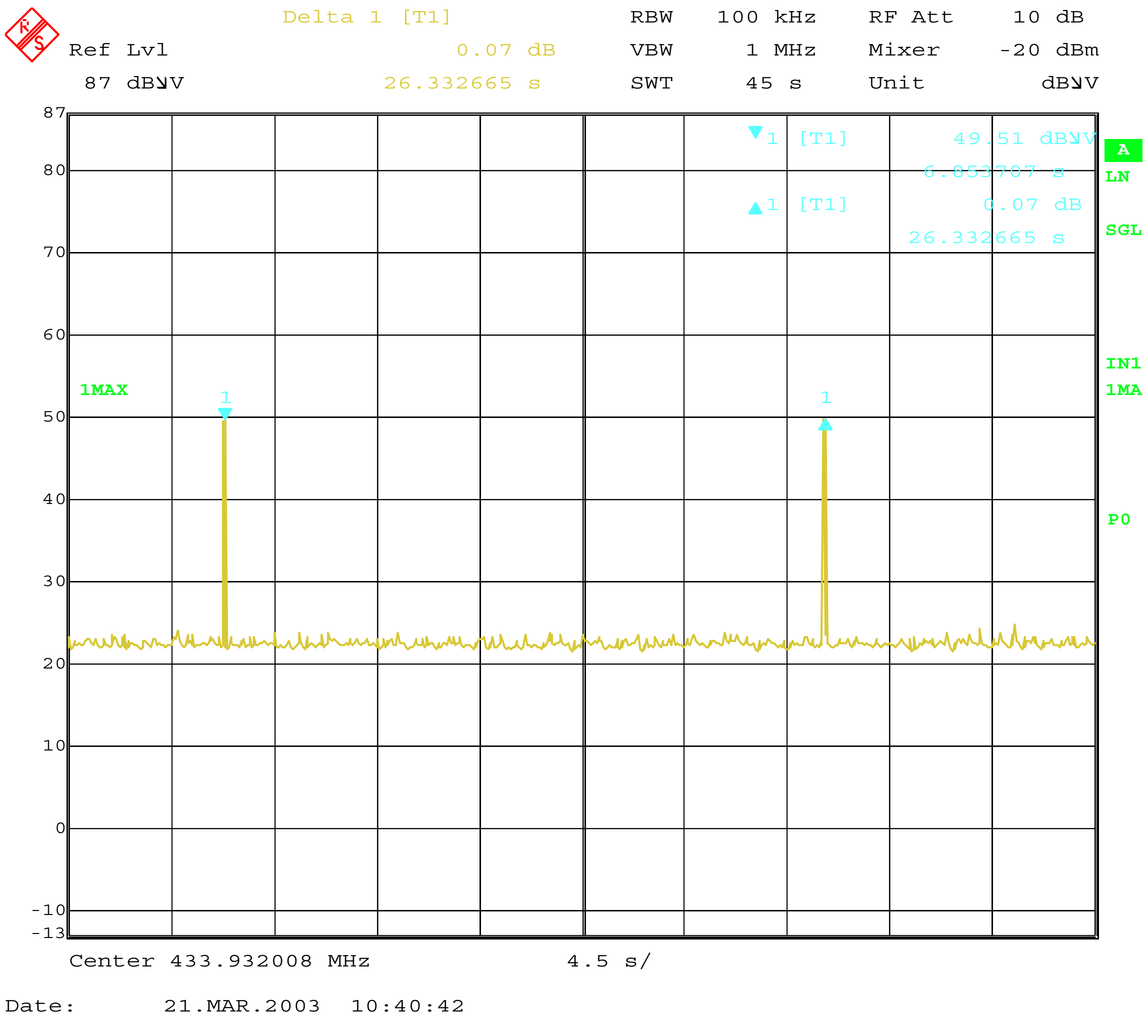

Figure 8 Time between transmissions

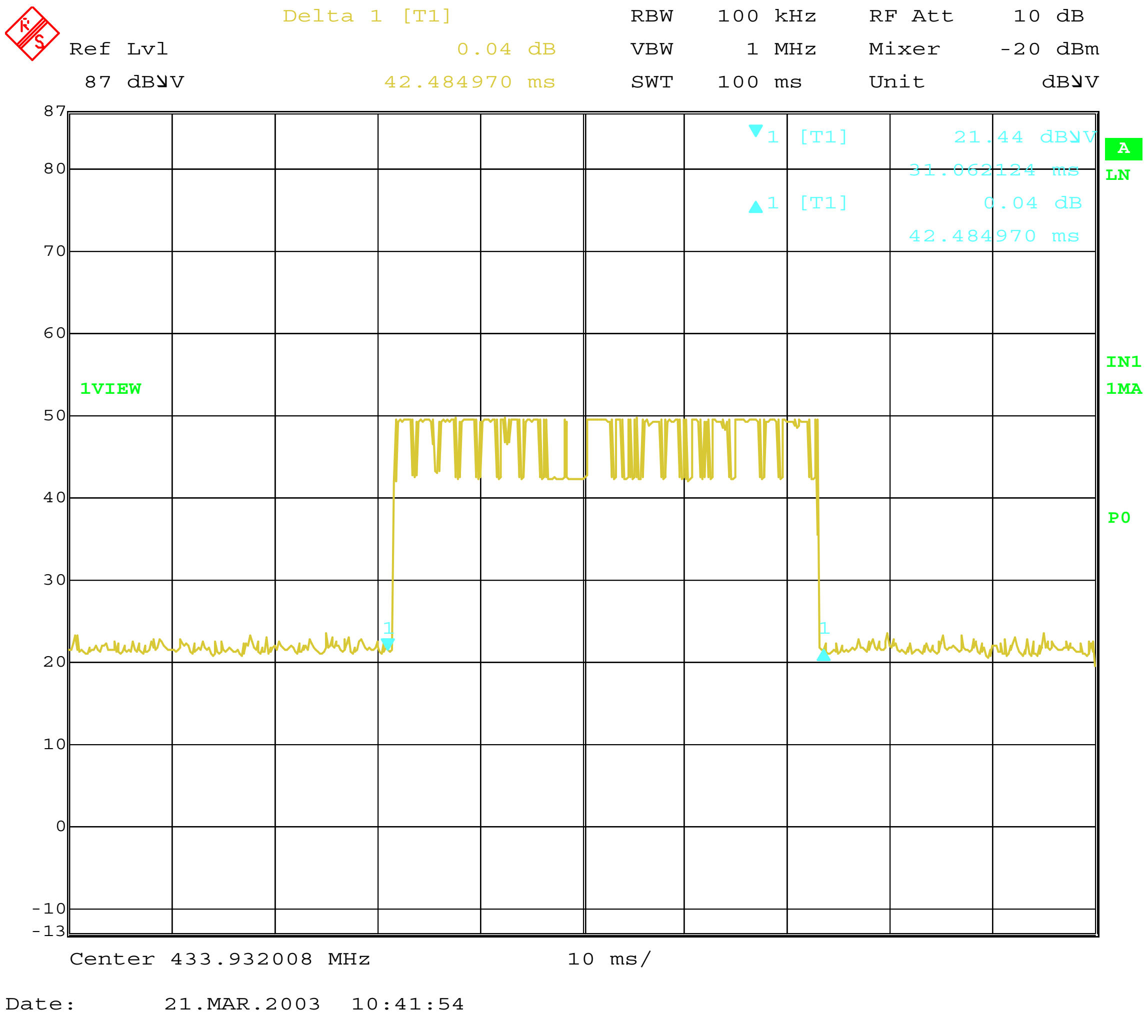

Figure 9 Duration of transmitted pulse

Appendix C

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) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

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) + 0 = 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