NCEE

ACCREDITED
Certificate Number 1953-01

NEBRASKA CENTER FOR EXCELLENCE IN ELECTRONICS
4740 Discovery Drive
Lincoln, NE 68521
402-472-5880

Test Report

Company: Lester Electrical
625 West A Street
Lincoln, NE, USA 68522
Contact: Joe Krause
Product: DCM Model #22220
FCC ID: OBH22220

Test Report No: R070902-03

APPROVED BY:

Steve Cass
General Manager

Doug Kramer
Test Engineer

DATE: 1 August 2002
Total Pages: 16

Table of Contents

1.0 Summary of test results

1.1 Test Results

Test	Test Specification	Results
CFR 47, FCC Part 15.109, Rx verification	Part 15.109, Class B	Complies
CFR 47, FCC Part 15.203	Part 15.203	Complies
CFR 47, FCC Part 15.249	Part 15.249	Complies

1.2 Test Methods

1.2.1 Radiated Emissions

All measurements were taken at a distance of 3 meters using the methods outlined in ANSI/IEEE C63.4, 2001. Measurements were taken from 30MHz to 1Gz, then from 1GHz to 10GHz. The EUT was setup to provide a worst-case scenario. All data presented is the measured results with any applicable correction factors applied via the test software.

1.2.2 Conducted Emissions

Conducted emissions from the base station were measured in accordance with the procedures of ANSI/IEEE C63.4, 2001. The results were applied to the FCC limits for Class 'B' devices from 150kHz to 30MHz. All data presented is the measured results with any applicable correction factors applied via the test software.

2.0 Description

2.1 Equipment under test

The universal transceiver module receives data from data collection modules (FCC ID: OBH22240) and temperature sensor units (FCC ID: OBH22250). It also has the ability to poll the data collection modules for information. All information is stored in the base station (Model #31432) until an operator retrieves it. The transmitting module receives DC power from the base station.

2.1.1 Identification: DCM Model #22220 and Model #31432 base station

2.1.2 EUT received date: 29 July 2002

2.1.3 EUT tested dates: 29th and 30th July 2002

2.1.4 Manufacturer: Lester Electrical

2.1.5 Serial number: test1

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 the FCC, and accepted in a letter dated May 4, 2001. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of 48 ± 5%
Temperature of 22 ± 3° Celsius

2.3 Special equipment or setup

The EUT was configured for two modes of operation, continuous transmission and no transmissions. A fixture was constructed of wood to hold the EUT in the orientation of the highest emissions.

3.0 Test equipment used

Serial #	*Manufacturer*	*Model*	*Description*	*Last cal.*
1654	EMCO	3142B	Biconilog antenna	3-May-02
6415	EMCO	3115	DRG Horn	4-Oct-01
100037	Rohde & Schwarz	ESIB26	EMI Test Receiver	11-Jun-02
082001/003	Rohde & Schwarz	TS-PR18	Preamplifier	10-Aug-01
2575	Rohde & Schwarz	ES-K1	Software v1.60	N/A
100007	Rohde & Schwarz	ESIB7	EMI Test Receiver	27-Aug-01
836679/010	Rohde & Schwarz	ESH3-Z5	LISN	8-Nov-01

4.0 Detailed Results

4.1 FCC Part 15.109 Rx verification

The emissions from the EUT while not transmitting were verified to be below the limits for Class B unintentional radiators as shown in 15.109. Figure 6 shows the resulting plot. The red '+' denotes a measurement was made using a CISPR 16 compliant quasi-peak (QP) detector.

4.2 FCC Part 15.203, Tx

The antenna is permanently attached to the EUT and could only be removed if the unit were to be dismantled. The antenna construction has not changed from the original FCC filing for this product. The antenna is a model TRA9023NPTSMA from Antenex, Inc.

4.3 FCC Part 15.249 Radiated Emissions, Tx

The EUT was placed on a non-conducting table 80cm from the ground plane with the antenna positioned at a distance of 3m. The EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters. Measurements were made from 30 MHz to 10GHz in both horizontal and vertical polarizations. The setup can be seen in Figures 1 through 3. The occupied bandwidth, as shown in Figure 7, was less than 300kHz. The EUT typically operates at a carrier frequency of

916.5MHz the unit tested had a carrier frequency of 916.63MHz. The level at that frequency was 93.55dbµV/m. The table below shows the level of the carrier and the highest harmonics.

Frequency MHz	PK Level dBuV/m	AV Level dBuV/m	PK Limit dBuV/m	AV Limit dBuV/m	Margin dB	Height cm	Azimuth deg	Pol.
916.63	93.55	--------	94	--------	0.5	99	0	V
1832.50	60.86	40.15	74	54	13.1	99	0	V
2750.00	67.10	51.29	74	54	2.7	100	0	V
3666.50	50.87	35.95	74	54	18.1	106	359	V

The margin was determined by comparing the measurement to the limit that would produce the least margin. For frequencies under 1GHz the measurement receiver was set to 120kHz bandwidth with a measurement time of 2s using a peak detector. For frequencies over 1GHz the measurement receiver was set to 1MHz bandwidth with a measurement time of 2s using both a peak detector and an average detector.

4.4 Conducted Emissions

Conducted emissions from the base station were measured in accordance with the procedures of ANSI/IEEE C63.4, 2001. The results were applied to the FCC limits for Class 'B' devices from 150kHz to 30MHz. Measurements were made using a CISPR 16 compliant receiver set to 9kHz bandwidth taking 5kHz steps through the frequency range. The test setup photos can be seen in Figures 4 and 5. No emissions were found to be in excess of the limits as shown in Figure 9.

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 = +/- 2.7 dB
Radiated Emissions, 30MHz – 1GHz, 3m distance: U_x = +/- 3.4 dB
Radiated Emissions, 1GHz – 10GHz, 3m distance: U_x = +/- 3.6 dB

Appendix A

Test setup photos

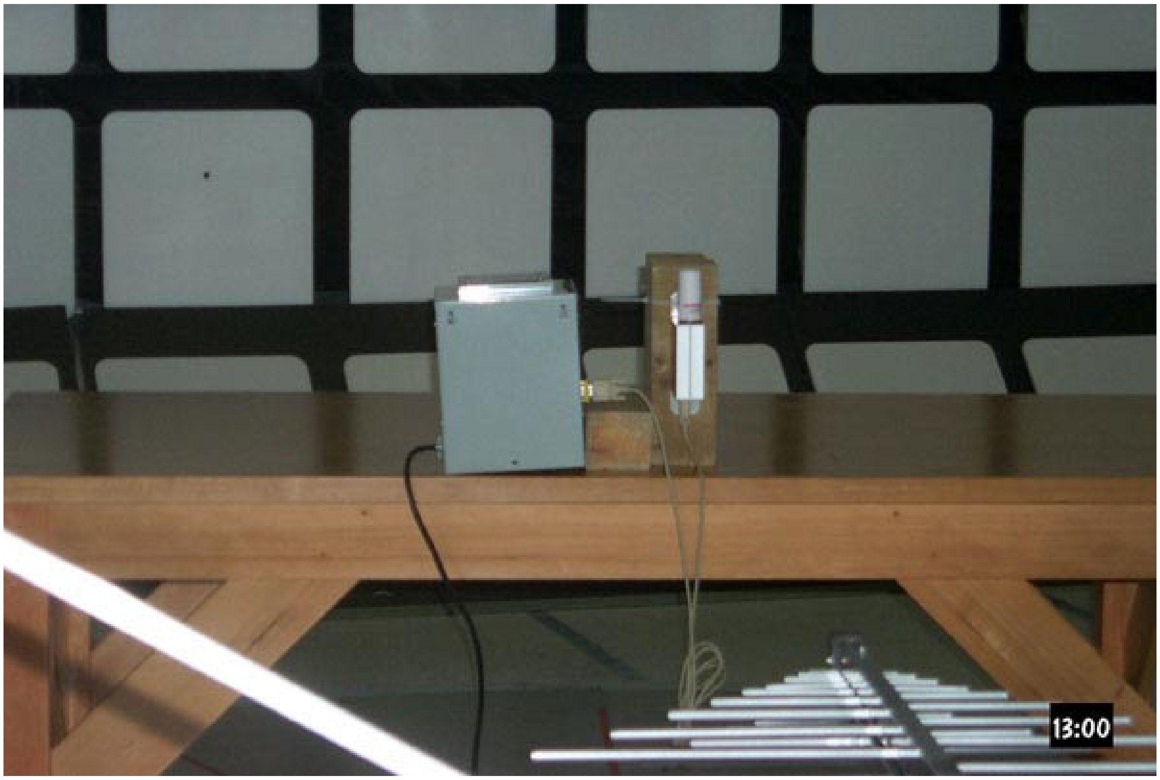

Figure 1 Radiated emissions test setup

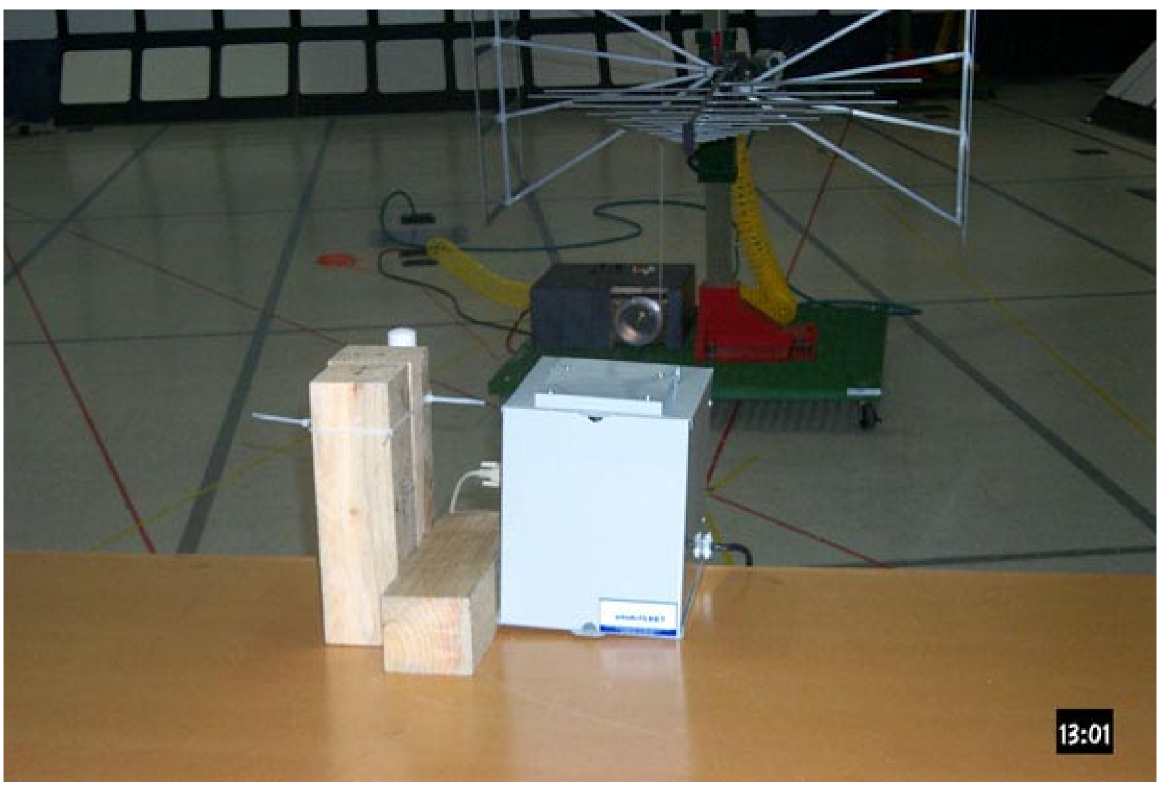

Figure 2 Radiated emissions test setup

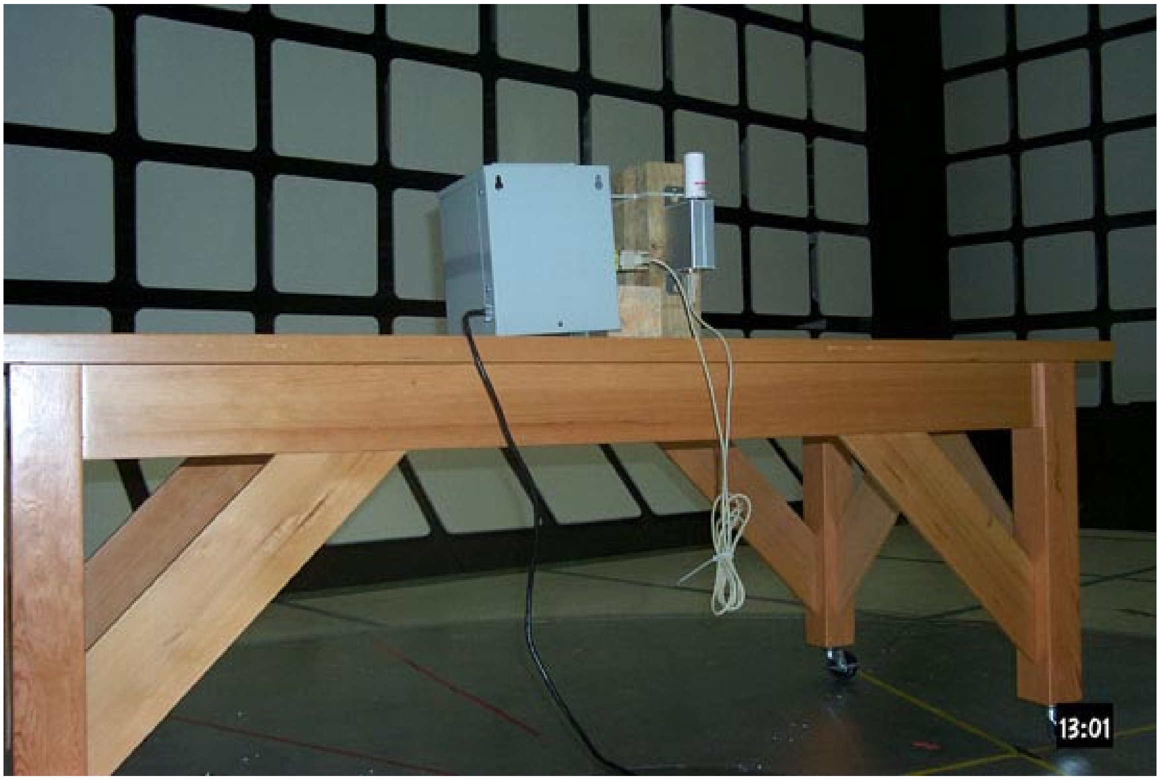

Figure 3 Radiated emissions test setup

Figure 4 Conducted emissions test setup

Figure 5 Conducted emissions test setup

Appendix B

Emissions

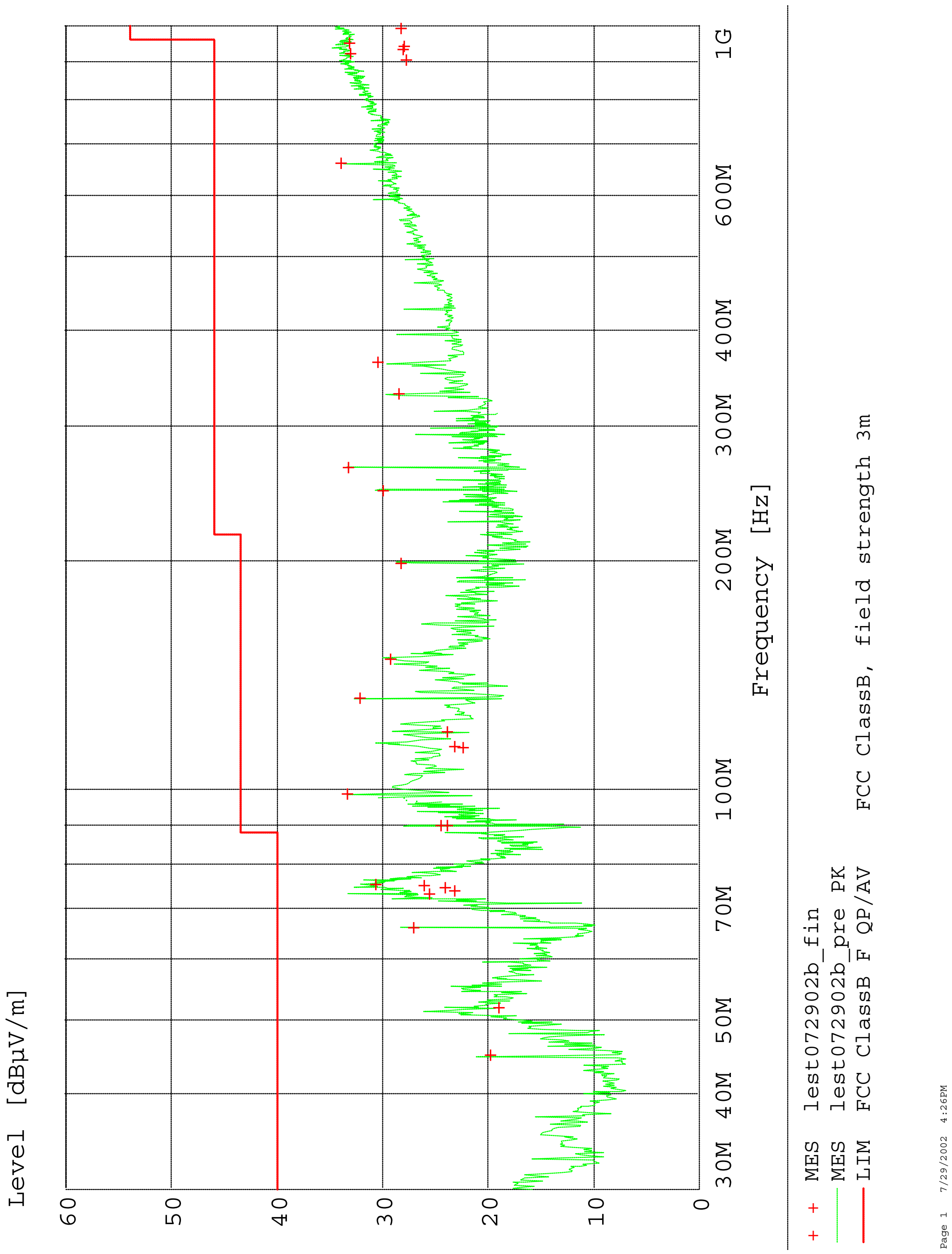

Figure 6 Radiated emissions, Rx verification

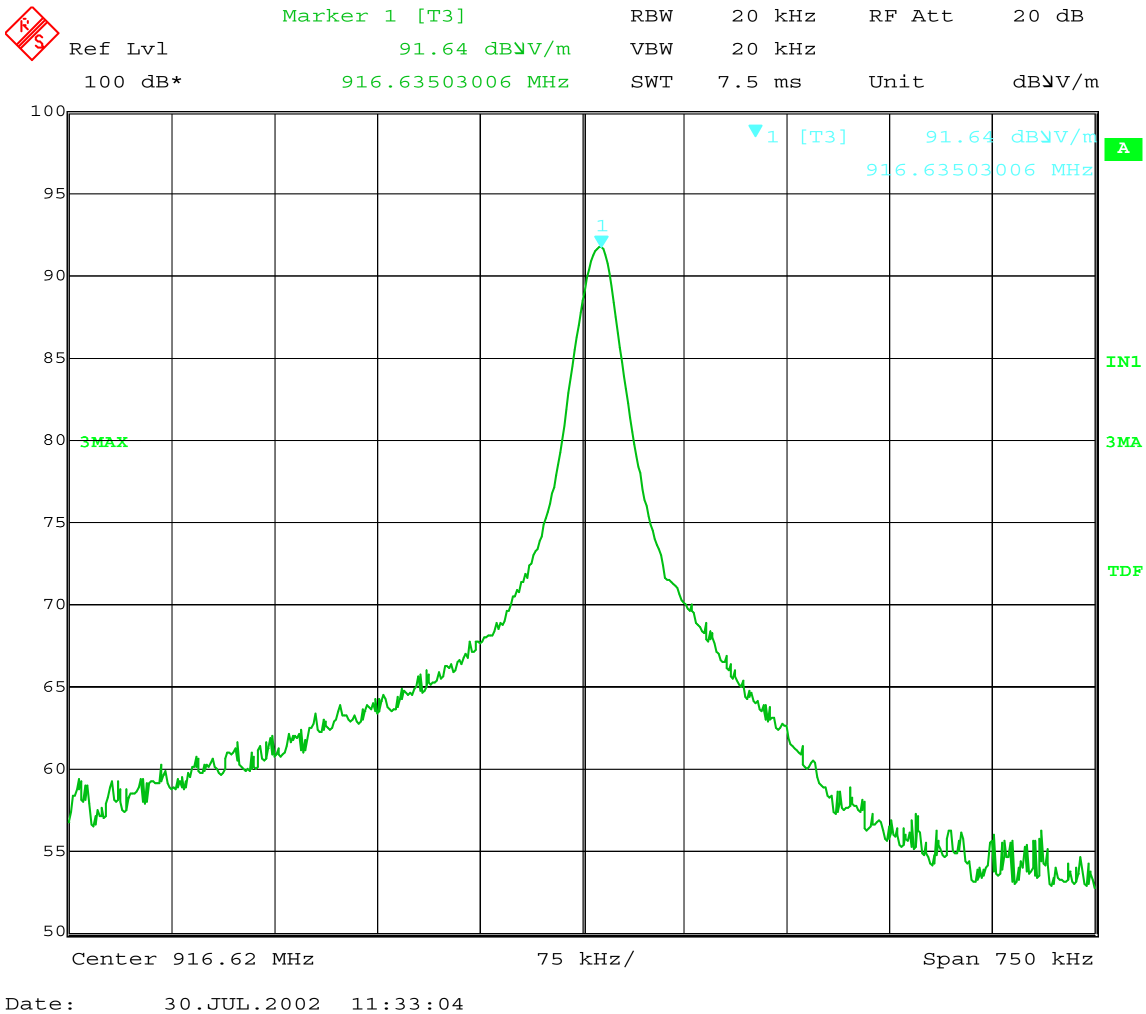

Figure 7 Bandwidth of maximized fundamental

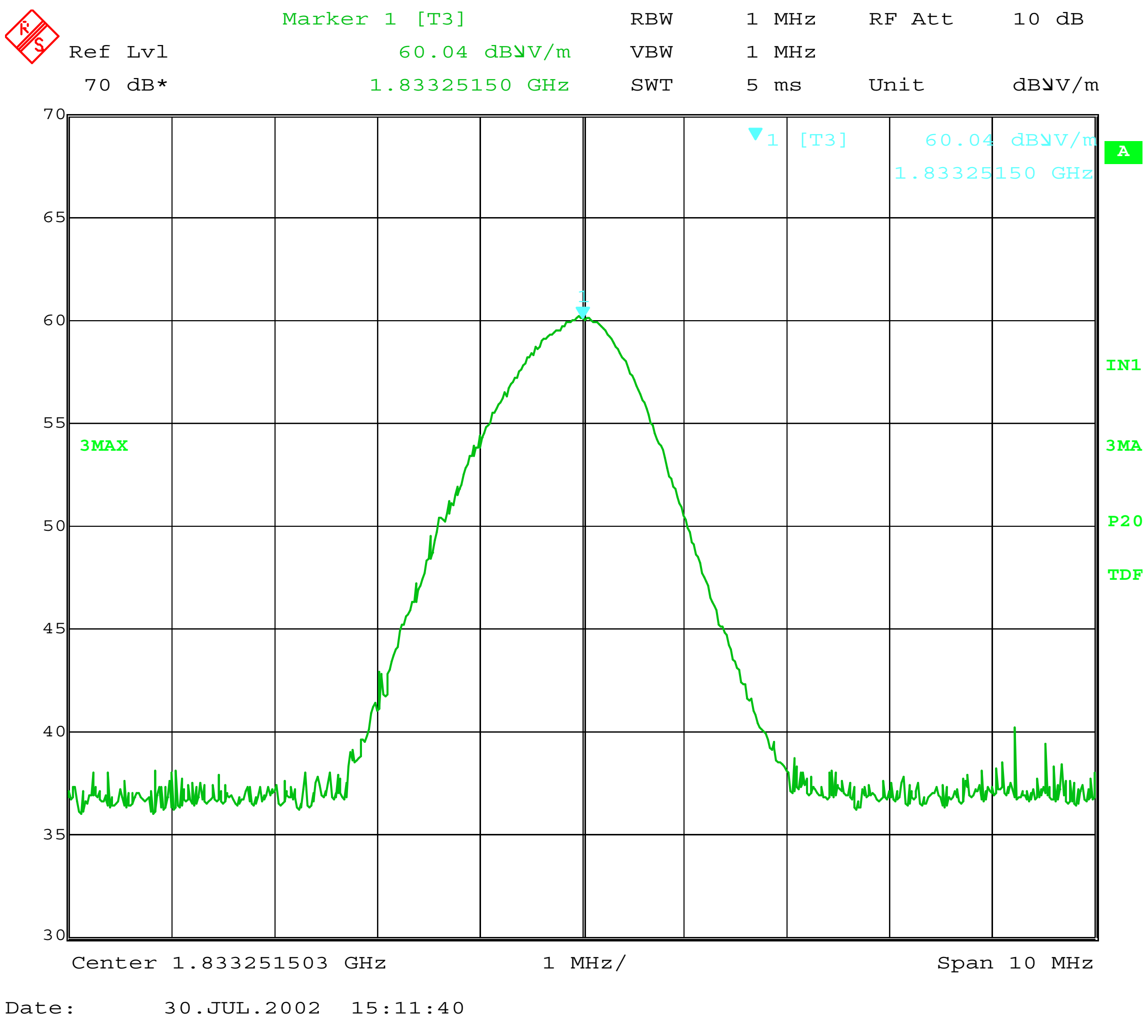

Figure 8 First harmonic

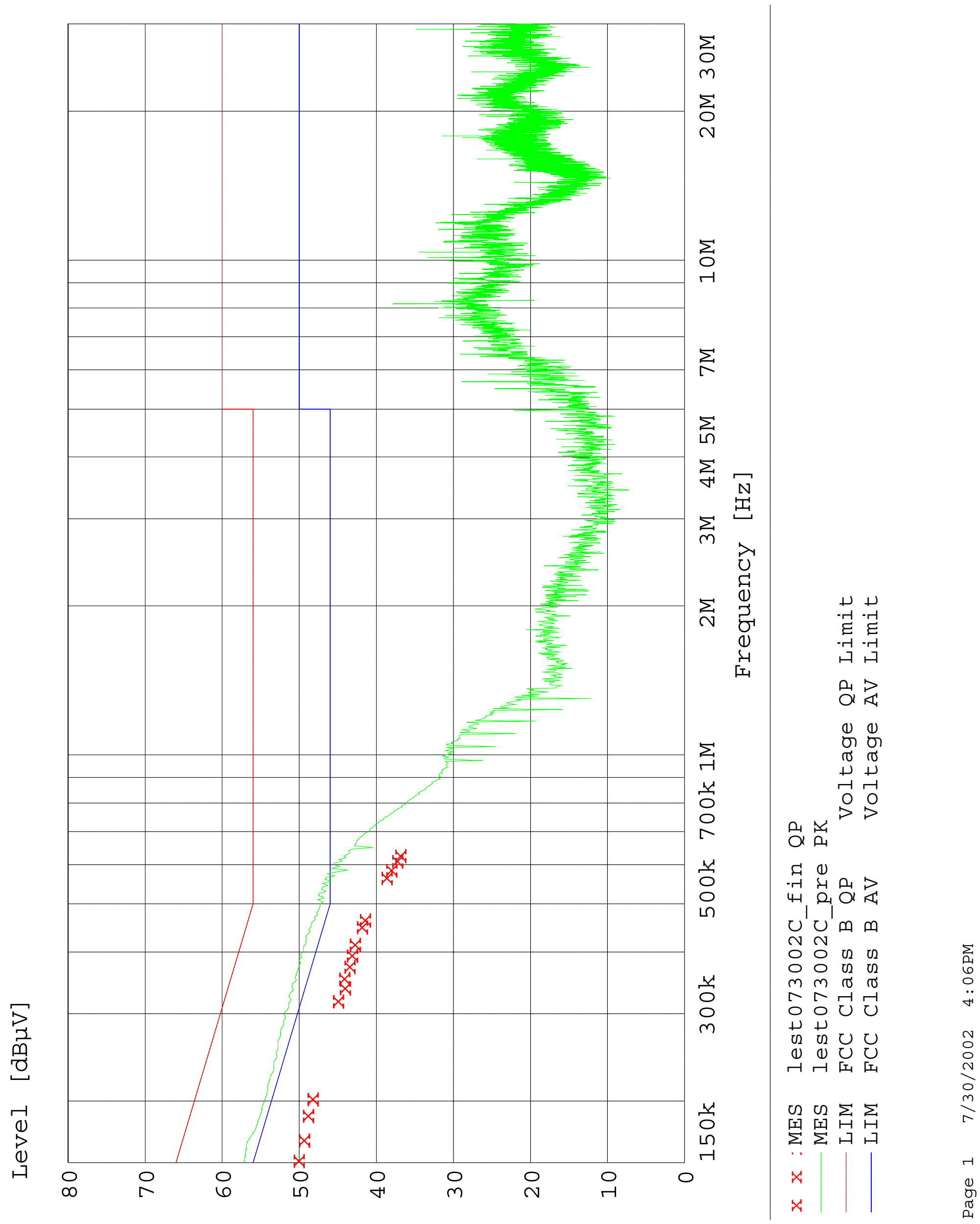

Figure 9 Conducted emissions results, Tx active

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

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