Nebraska Center for Excellence in Electronics
4740 Discovery Drive
Lincoln, NE 68521
Phone: 402-472-5880
Fax: 402-472-5881

EMC Test Report

Company:	Senior Technologies A Division of Stanley Security Solutions 1620 N. 20th Circle Lincoln, NE 68503
Contact:	Randy Nuss
Product:	WanderGuard Universal Tester Model 18029
FCC ID:	LA5IDUT002
Test Report No:	R072506-30A
APPROVED BY:	Doug Kramer Senior Test Engineer
DATE:	11 September 2006
Total Pages:	27

1.0 Summary of test results

1.1 Test Results

Based on the data collected with the unit as configured:

Test	Test Specification	Results
CFR 47, FCC Part 15.203	Part 15.203	Complies
47 CFR Part 15.207	Conducted Emissions	N/A
47 CFR Part 15.209	Radiated Emissions	Complies

1.2 Test Methods

1.2.1 Conducted Emissions

The EUT was powered by an internal battery. There was no connection to the AC mains supply network, nor is it an option, the user manual instructs the owner to dispose of the EUT when the battery is low on charge.

1.2.2 Radiated Emissions

Compliance to 47 CFR Part 15.209 was tested in accordance with the methods of ANSI/IEEE C63.4, 2003 and the FCC required technique for measurements under 30MHz. The EUT was placed on a wooden table approximately 80cm high and centered on a 4m diameter turntable. The table was rotated to find the angles of maximum emissions and the antenna was moved from 1m to 4m in both vertical and horizontal positions. All measurements were taken at a distance of 3 meters or closer when specified in the report. The EUT was oriented in 3-orthogonal axis in order to maximize emissions.

490kHz – 30MHz:
Measurements from 490kHz – 30MHz were done with a loop antenna positioned 1m above the ground plane at a 3m distance from he EUT. The emissions from the EUT were examined with the loop antenna perpendicular, parallel and 45º in between to the line of sight to the EUT. The EUT was also tested upright, and lying on its back. It was found that the perpendicular orientation with the EUT upright produced the highest emissions and this configuration was used for testing.

30MHz – 1GHz:
Measurements from 30MHz – 1GHz were done with a biconilog antenna oriented in the vertical and horizontal positions, and from 1m to 4m heights. Measurements were made and recorded with the EUT upright and laying on its back.

2.0 Description

2.1 Equipment under test

The equipment under test was a WanderGuard universal tester Model 18029, from Senior Technologies, a division of Stanley Security Solutions. The EUT sends out a test signal to WanderGuard door monitors to detect if they are operational, as well as receives signals from WanderGuard bracelets to detect if they are operational. The EUT transmits at 508kHz.

2.1.1 Identification: WanderGuard Universal Tester Model 18029

2.1.2 EUT received date: 30 August 06

2.1.3 EUT tested dates: 30, 31 August 06

2.1.4 Manufacturer: Stanley Senior Technologies

2.1.5 Serial number: Test01

2.2 Laboratory description

All testing was performed at the NCEE Lincoln facility, which is a FCC (100875) and Industry Canada (4294) registered lab. Laboratory environmental conditions varied slightly throughout the tests:

Relative humidity of 45 ± 4%

Temperature of 20 ± 3° Celsius

2.3 Special equipment or setup

The EUT was set to continuously transmit the test signal. The EUT contains no connection to the AC mains supply network or any auxiliary equipment.

3.0 Test equipment used

Serial #	*Manufacturer*	*Model*	*Description*	*Last cal.*
1647	EMCO	3142B	Biconilog antenna	3/13/06
6515	EMCO	6515	Loop antenna	12/27/05
100007	Rohde & Schwarz	ESI7	EMI Test Receiver	12/28/05
2575	Rohde & Schwarz	ES-K1	Software v1.60	N/A

4.0 Detailed Results

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:

490kHz – 30MHz: 9kHz IF bandwidth, 5kHz steps
30MHz - 1 GHz: 120 kHz IF bandwidth, 60kHz steps

4.1 Unique connector for antenna

The antenna is inside of the EUT and is permanently attached to the EUT as shown in Figure 17.

4.2 Part 15.207 Conducted Emissions

Conducted Emissions testing was not applicable to this product.

4.3 Part 15.209 Radiated Emissions (intentional)

The EUT was found to comply with the published limits for Class 'B' digital devices. The EUT was tested at 3m. The EUT was tested in 3-orthogaonal axis. Radiated emissions measurements of the EUT running in both transmit and receive modes from 490kHz to 1GHz can be found in Appendix B. Figures 4 through 9 are the radiated emissions plots and Tables 1 and 2 contain the tabular data from these plots. The peak levels of the transmitter were not above the ambient limits for an intentional radiator. Figures 10 through 13 show uncorrected screen captures of the maximized fundamental transmission frequency at various distances from the antenna (3m, 2m, 1m, and 50cm). This shows that the EUT is indistinguishable from the general ambient noise at distances greater than 1m from the antenna.

The fundamental frequency of 0.508MHz had a maximum reading of 20.79dBµV/m at 1m uncorrected. The antenna position and EUT orientation were chosen to produce the maximum emission from the EUT. The uncorrected reading can be seen in Figure 12. This corresponds to a field of 1.71dBµV/m at 3m distance. The antenna correction factor at this frequency is 51.80 and cable attenuation is negligible. The corrected measurement at 3m is then 53.51dBµV/m The 15.209 limit at this frequency and distance is 73.49dBµV/m, for a margin of 21.7dB. Figure 14 shows the 6dB bandwidth of the fundamental (16.43kHz). Figure 14 shows spurious emissions in the restricted band under 505kHz are below that of the fundamental, which is below the Part 15.209 limits.

Appendix A: Test Photos

Figure 1 - Radiated Emissions Test Setup, Horizontal EUT Position

Figure 2 - Radiated Emissions Test Setup, Vertical EUT Position

Figure 3 - Test setup, loop antenna at 3m test distance

Appendix B: Emissions Plots

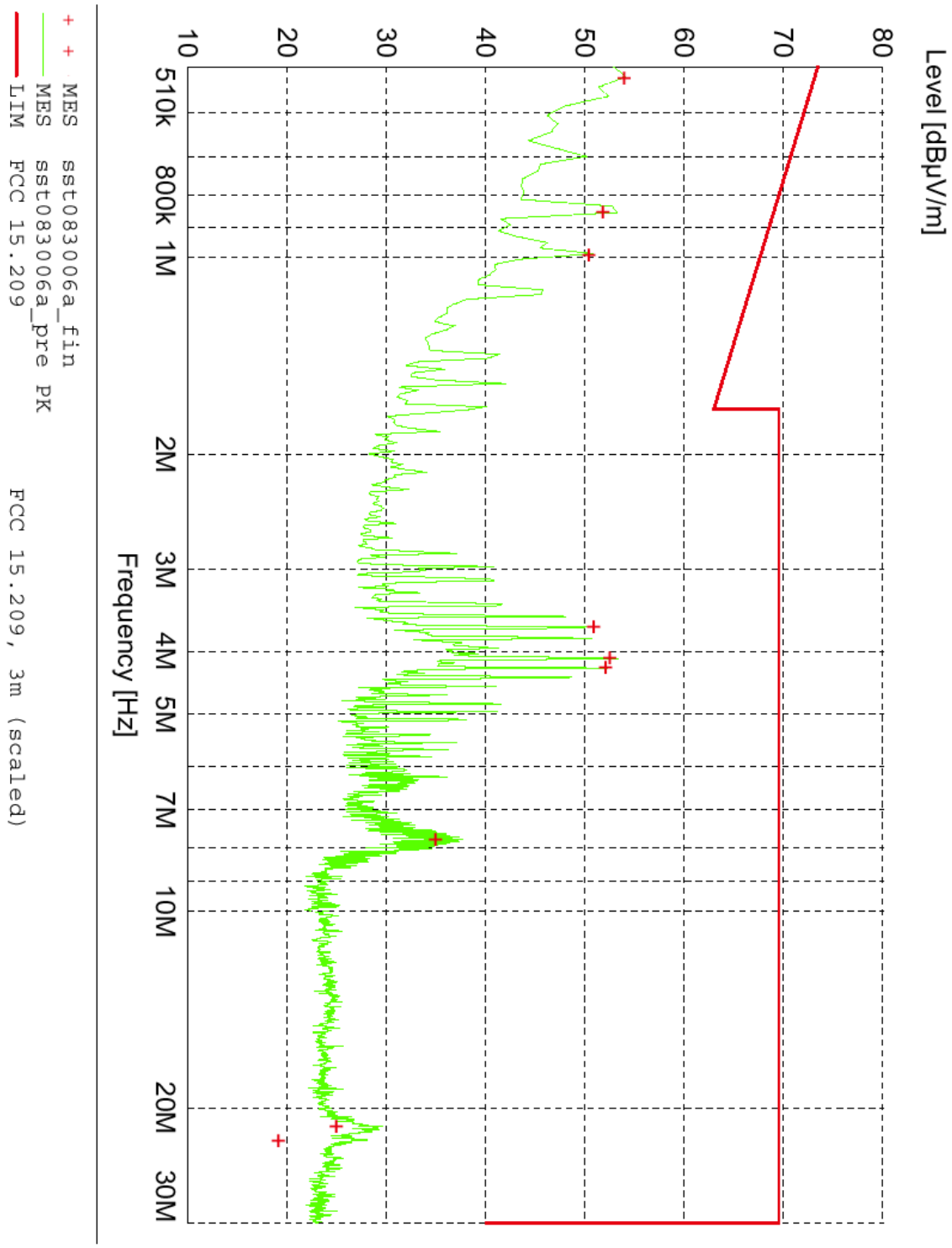

Figure 4 - Radiated Emissions Plot, 490kHz - 30MHz, Transmit ON

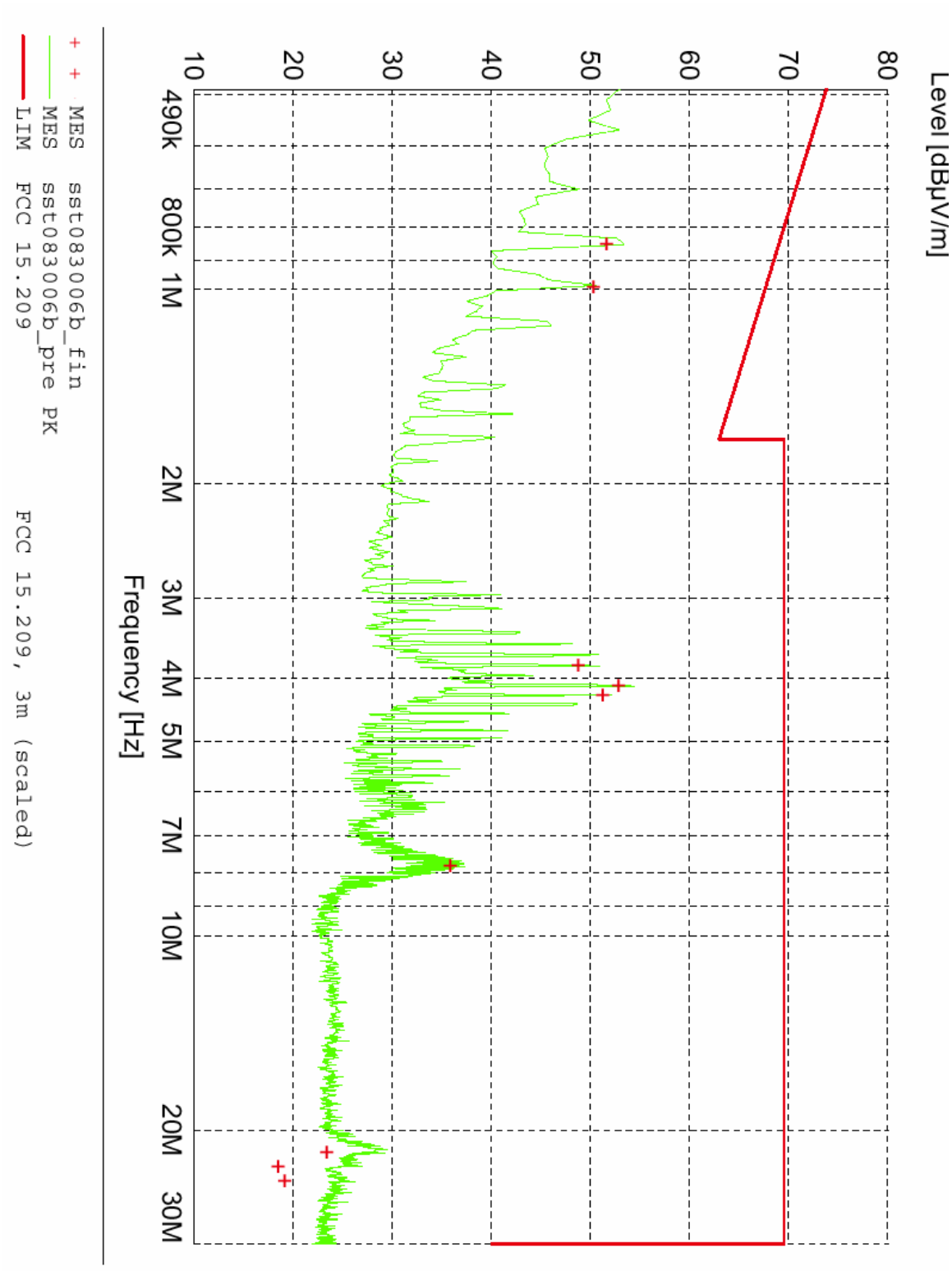

Figure 5 - Radiated Emissions Plot, 490kHz - 30MHz, Receive ON

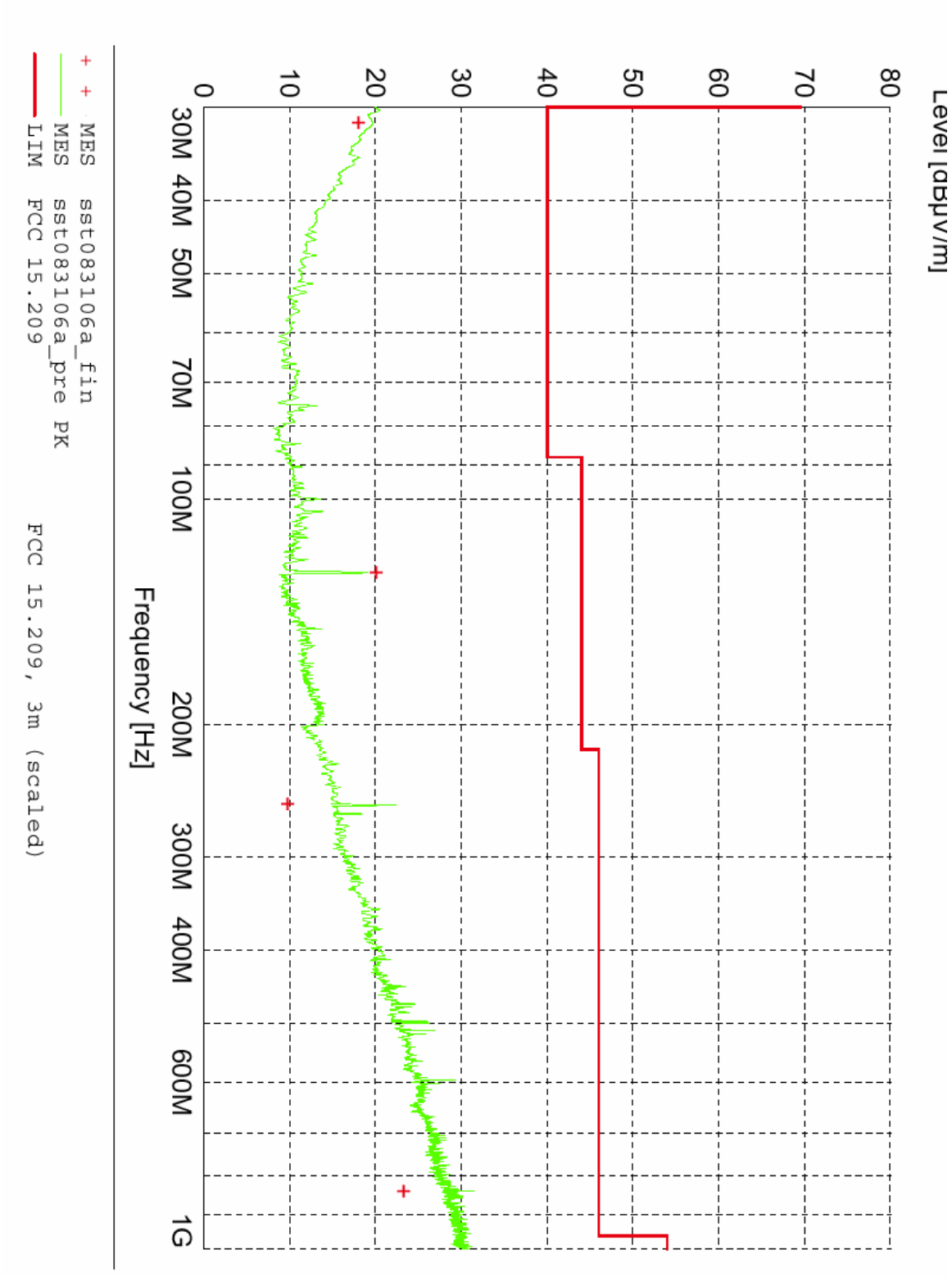

Figure 6 - Radiated Emissions Plot, 30MHz - 1GHz, Transmit ON, EUT Vertical

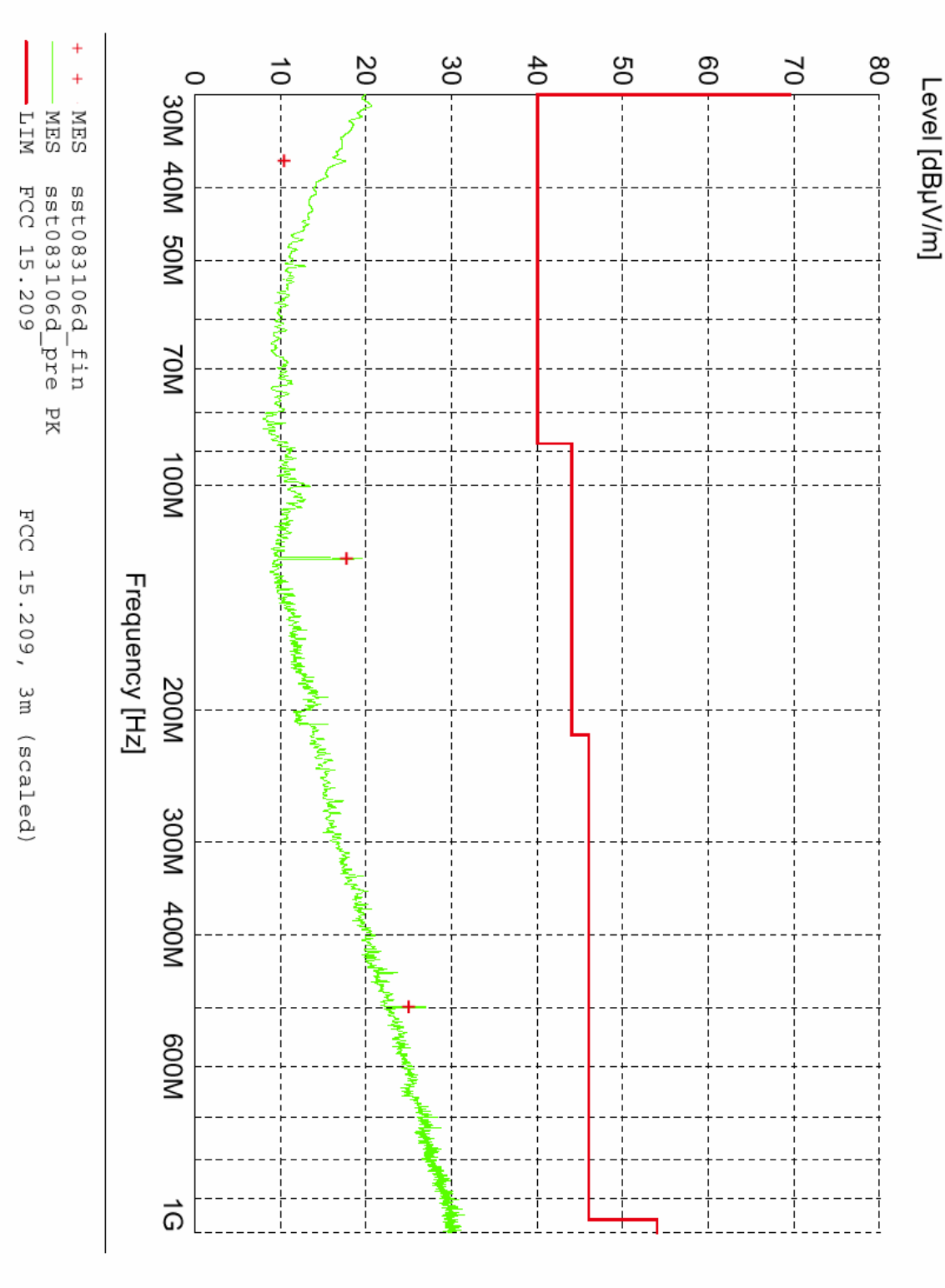

Figure 7 - Radiated Emissions Plot, 30MHz - 1GHz, Transmit ON, EUT Horizontal

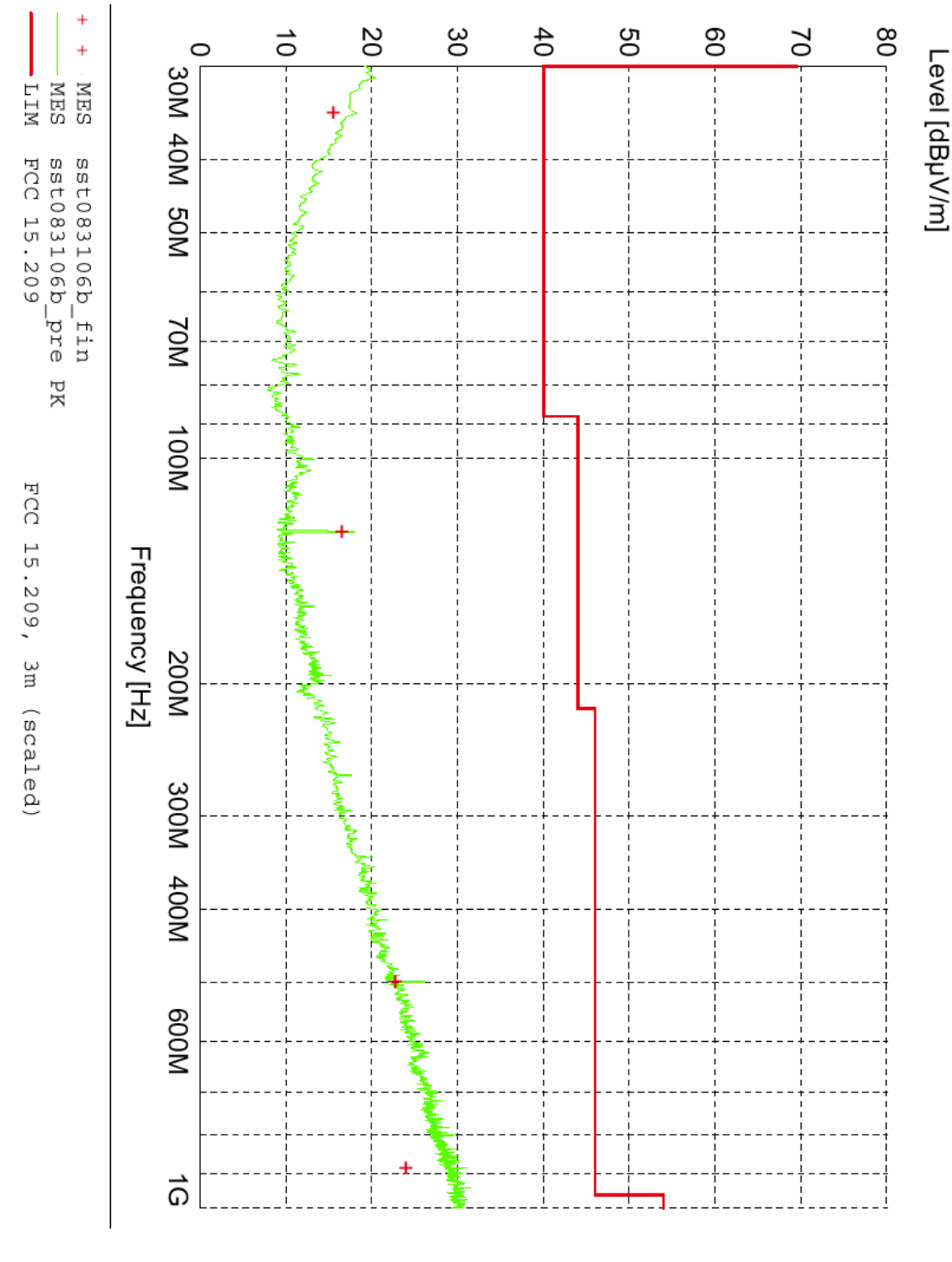

Figure 8 - Radiated Emissions Plot, 30MHz - 1GHz, Receive ON, EUT Vertical

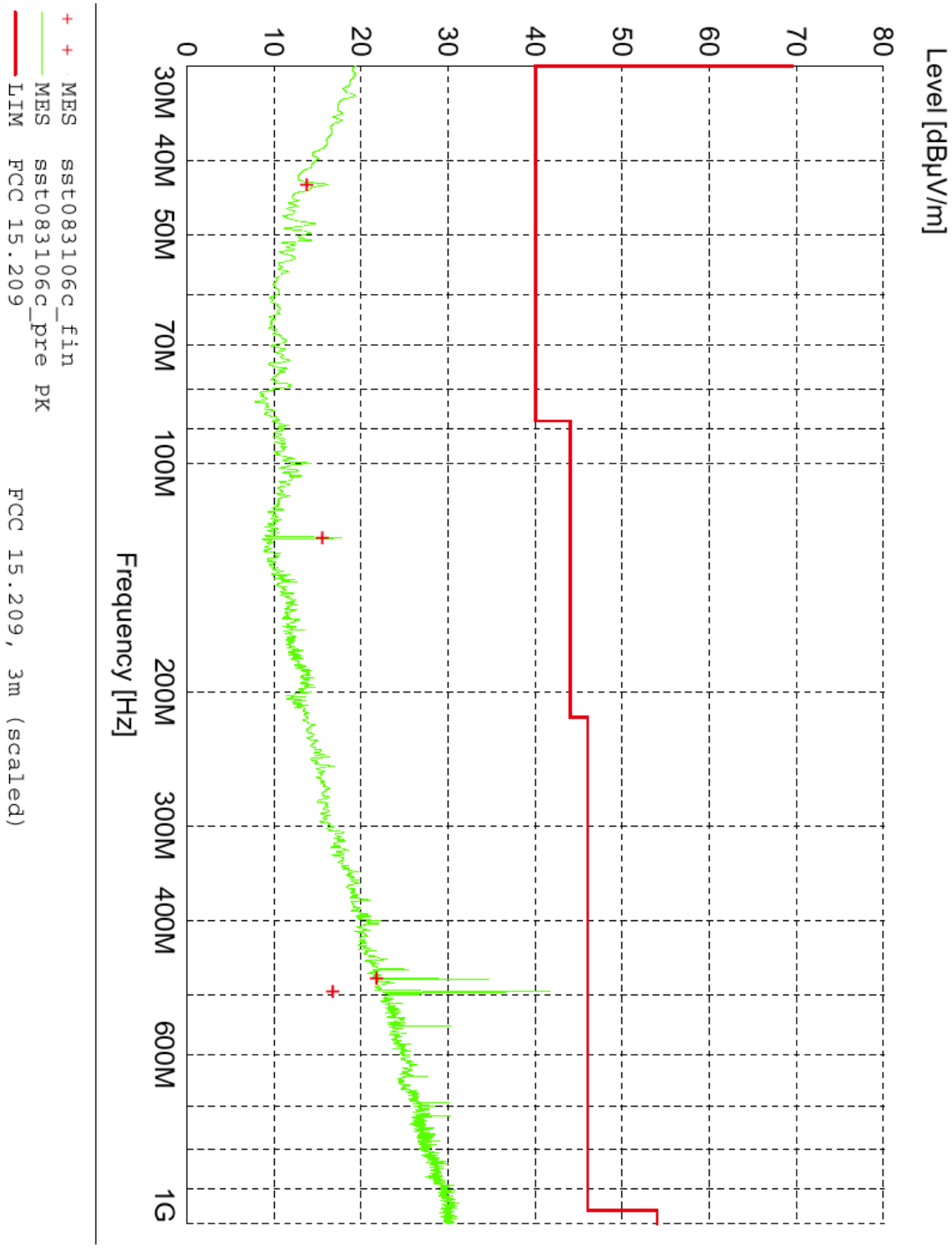

Figure 9 - Radiated Emissions Plot, 30MHz - 1GHz, Receive ON, EUT Horizontal

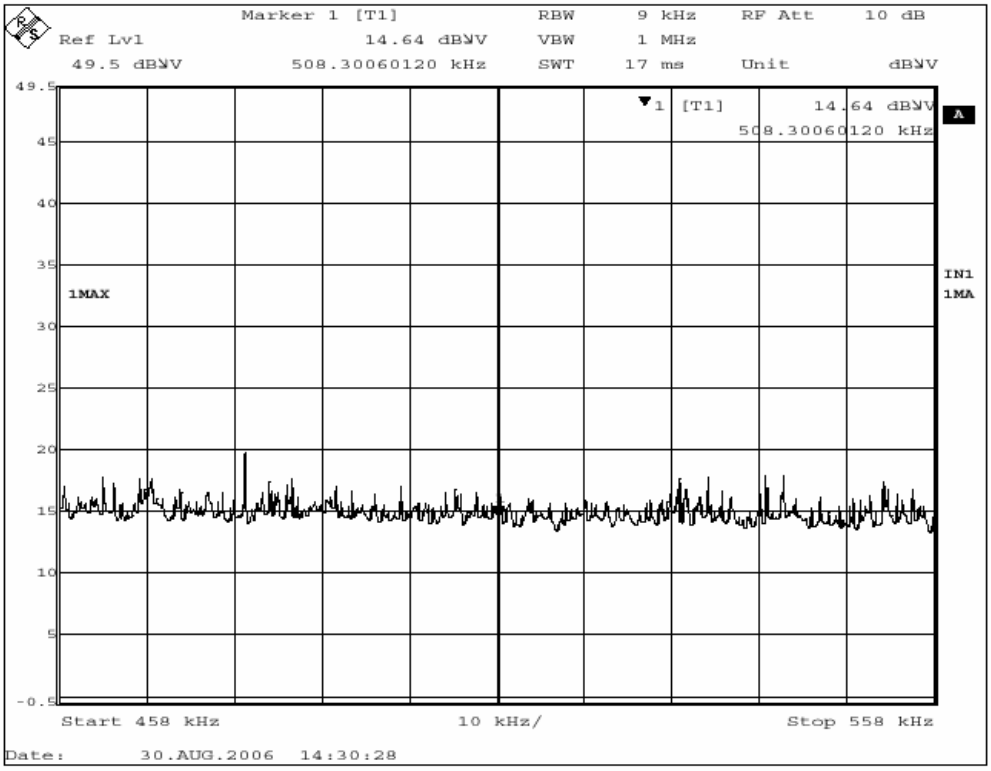

Figure 10 - Measurement of 508kHz Fundamental Transmission at 3m Distance

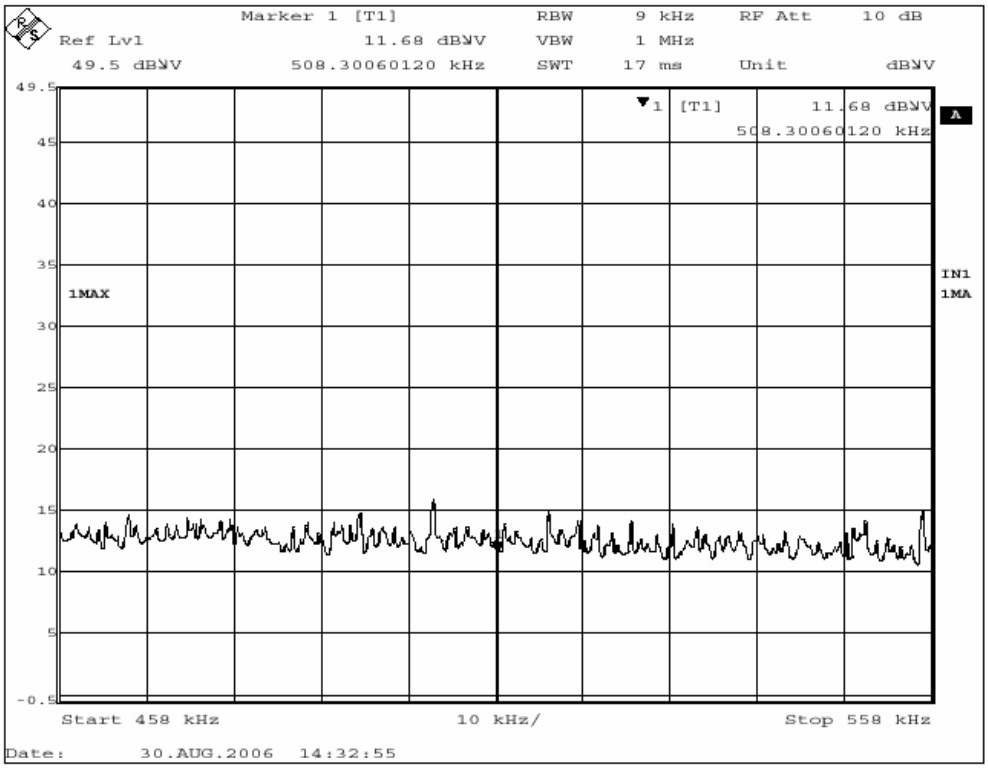

Figure 11 - Measurement of 508kHz Fundamental Transmission at 2m Distance

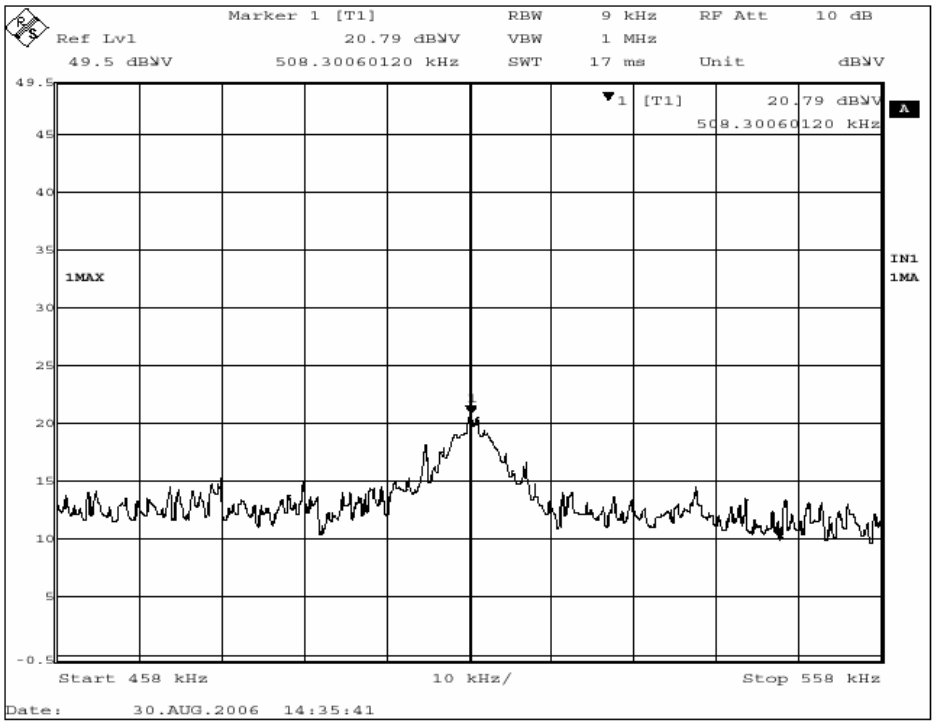

Figure 12 - Measurement of 508kHz Fundamental Transmission at 1m Distance

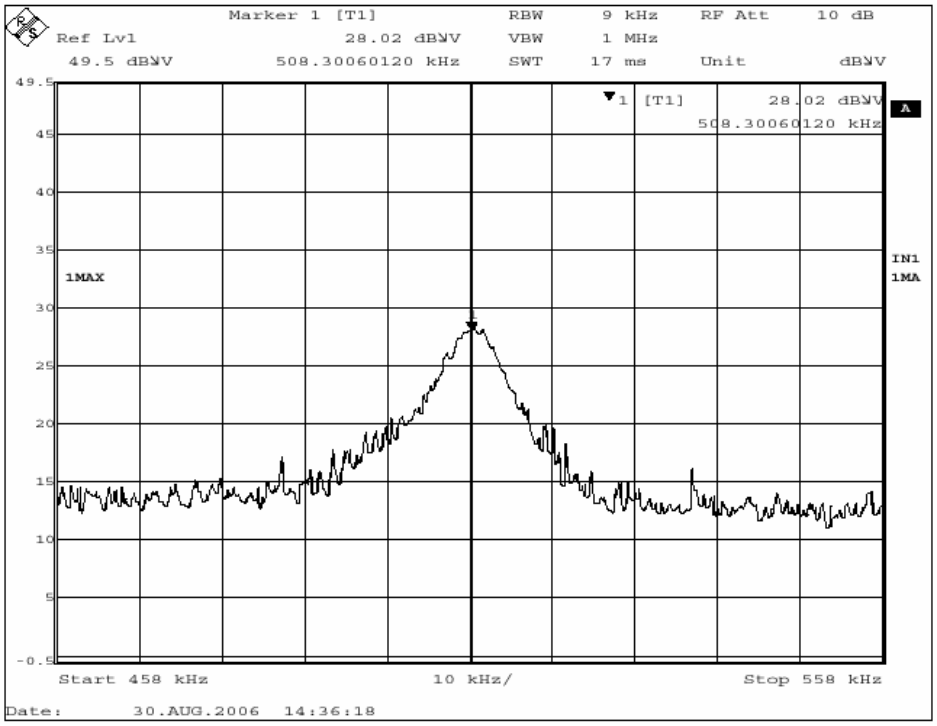

Figure 13 - Measurement of 508kHz Fundamental Transmission at 50cm Distance

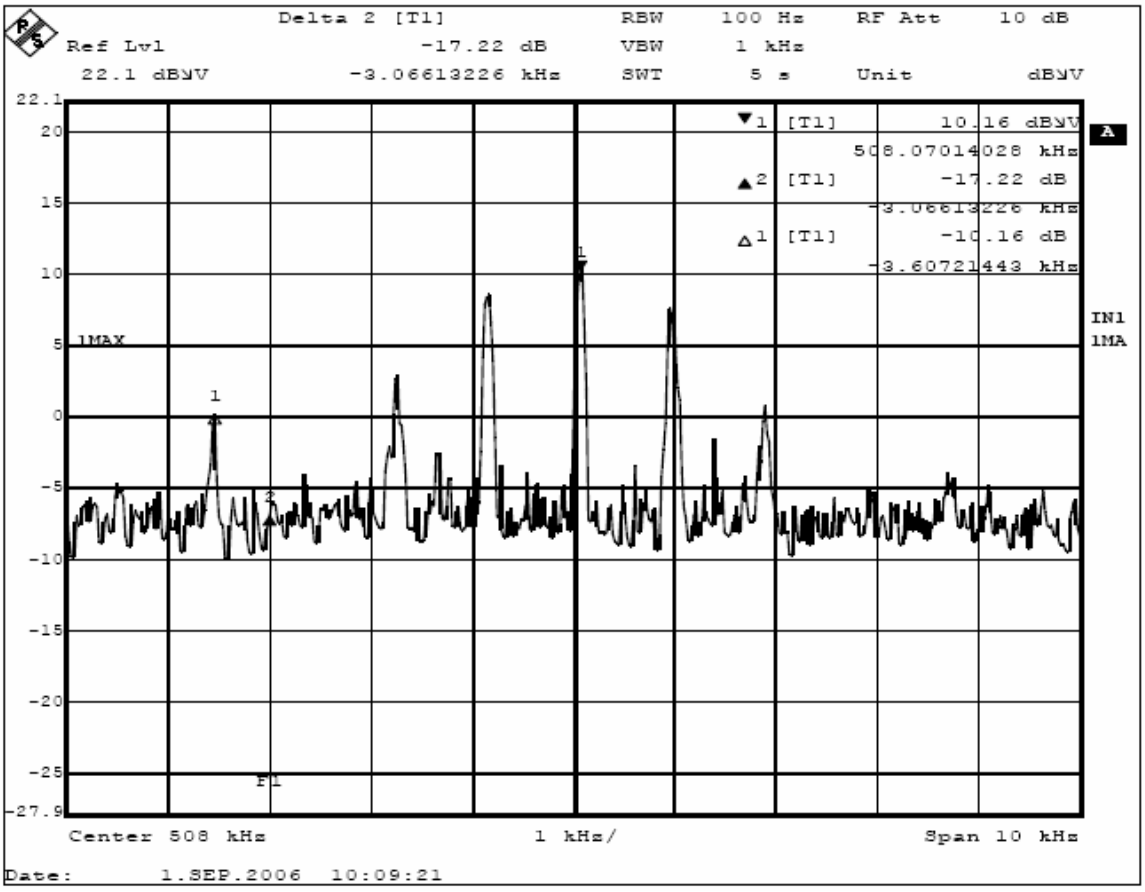

Figure 14 – Measurement at 505kHz Restricted Band (10.16dB Below Fundamental at Highest Point), 100Hz RBW

Table 1

Quasi-peak Radiated Measurements from 490kHz – 30MHz

Frequency	Level	Limit	Margin	Height	Angle	Antenna	Mode	EUT
MHz	dBµV/m	dBµV/m	dB	cm	deg	deg		Orientation
*0.508000	53.51	73.49	19.98	100	90	0	Transmit	HOR
0.530000	53.93	73.12	19.19	100	333	0	Transmit	HOR
0.850000	51.76	69.02	17.26	100	144	0	Transmit	HOR
0.990000	50.36	67.69	17.33	100	169	0	Transmit	HOR
3.675000	50.85	69.54	18.7	100	58	0	Transmit	HOR
4.100000	52.45	69.54	17.1	100	4	0	Transmit	HOR
4.240000	52.05	69.54	17.5	100	164	0	Transmit	HOR
7.760000	34.92	69.54	34.6	100	29	0	Transmit	HOR
21.390000	24.93	69.54	44.6	100	25	0	Transmit	HOR
22.440000	19.09	69.54	50.5	100	286	0	Transmit	HOR
**0.530000	53.54	73.12	19.58	100	333	0	Receive	HOR
.850000	51.59	69.02	17.43	100	309	0	Receive	HOR
.990000	50.26	67.69	17.33	100	316	0	Receive	HOR
3.815000	48.74	69.54	20.8	100	27	0	Receive	HOR
4.100000	52.82	69.54	16.7	100	205	0	Receive	HOR
4.240000	51.21	69.54	18.3	100	104	0	Receive	HOR
7.810000	35.81	69.54	33.7	100	175	0	Receive	HOR
21.610000	23.35	69.54	46.2	100	43	0	Receive	HOR
22.755000	18.45	69.54	51.1	100	178	0	Receive	HOR
24.010000	19.12	69.54	50.4	100	262	0	Receive	HOR

*Fundamental frequency, extrapolated from measurement at 1m (see Figure 12, page 17)
**A measurement was made with the EUT not present at this frequency with the same setup. The level was found to be 53.54dBµV/m (corrected), which is within 1dB of the level when the EUT was present. Since the emission is present without the EUT, It can be assumed that it is not emanating from the EUT.

Table 2

Quasi-peak Radiated Emissions Measurements from 30MHz – 1GHz

Frequency	Level	Limit	Margin	Height	Angle	Antenna	EUT	EUT
MHz	dBµV/m	dBµV/m	dB	cm	deg	Pol.	Mode	Orientation
31.560000	18.00	40.00	22	100	0	HORI	Transmit	VERT
125.280000	20.04	43.52	24	400	252	HORI	Transmit	VERT
255.600000	9.73	46.02	36.3	349	73	HORI	Transmit	VERT
838.980000	23.25	46.02	22.7	368	136	HORI	Transmit	VERT
36.840000	10.37	40.00	29.6	349	219	HORI	Transmit	HORI
125.280000	17.64	43.52	26.4	249	176	HORI	Transmit	HORI
500.040000	24.94	46.02	21.1	100	184	VERT	Transmit	HORI
34.680000	15.46	40.00	24.5	201	94	HORI	Receive	VERT
125.280000	16.48	43.52	27.5	350	319	VERT	Receive	VERT
500.040000	22.70	46.02	23.3	250	231	VERT	Receive	VERT
885.120000	23.95	46.02	22.1	400	132	HORI	Receive	VERT
43.020000	13.71	40.00	26.3	394	331	VERT	Receive	HORI
125.280000	15.50	43.52	28.5	349	95	VERT	Receive	HORI
476.820000	21.73	46.02	24.3	400	330	HORI	Receive	HORI
495.960000	16.71	46.02	29.3	288	82	VERT	Receive	HORI

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

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

Is this case, T_{on} is less than 50mSec for a 100mSec window. An average correction factor of 6dB was applied where noted.

Appendix D: EUT Photos

Figure 15 - Outside View of EUT, Front

Figure 16 - Outside View of EUT, Back

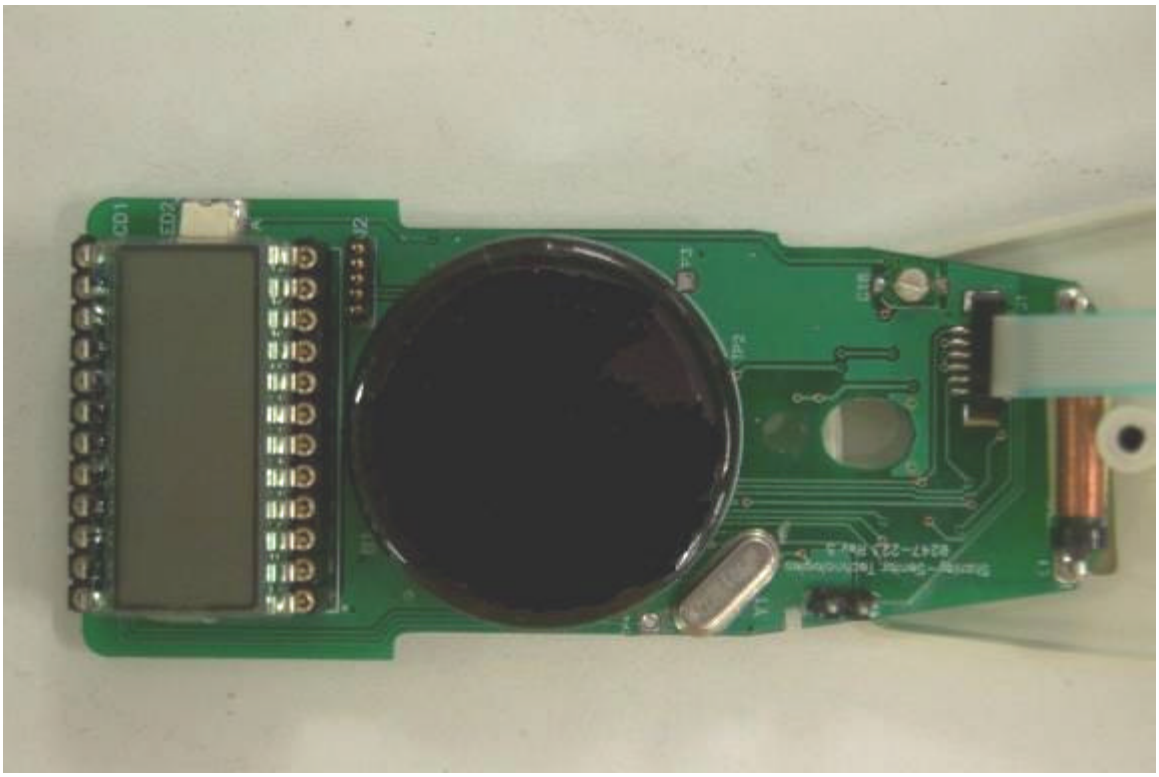

Figure 17 - Internal View of Front Side of EUT

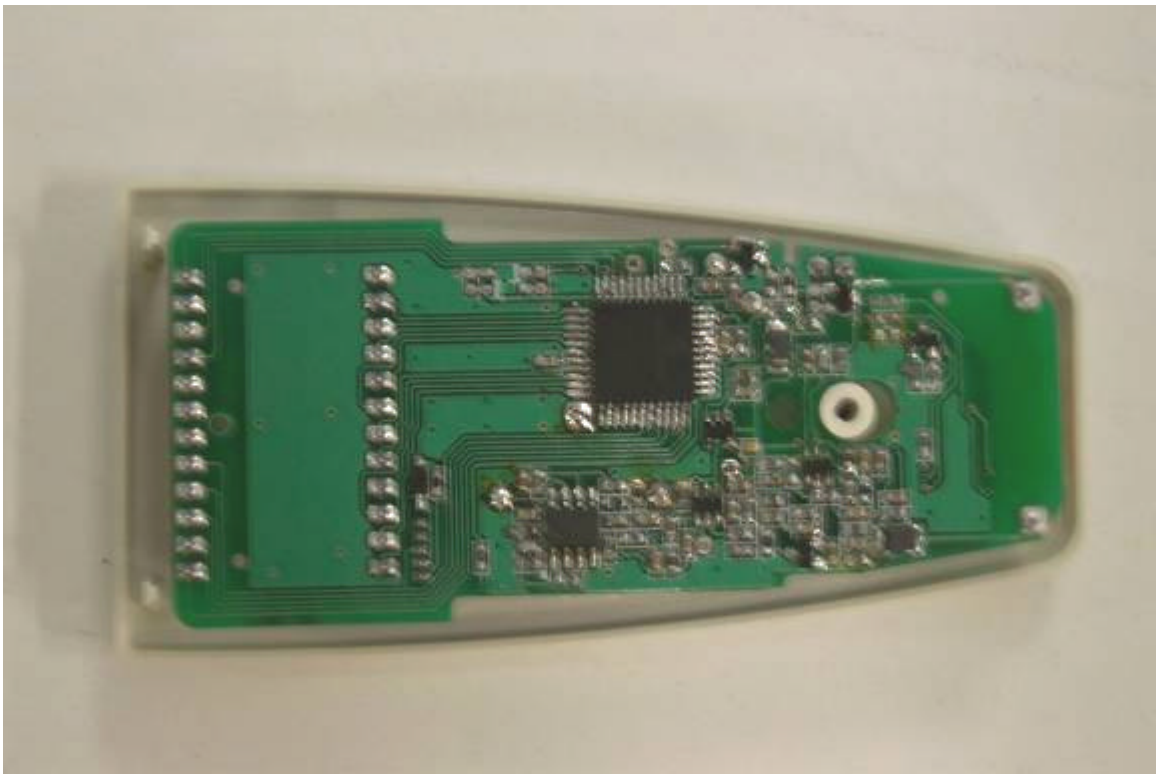

Figure 18 - Internal View of Back Side of EUT

Appendix E: Table of Figures

Figure **Page Number**