FCC PART 15 SUBPART C
CERTIFICATION REPORT

FOR

307KHz/433.92 MHz Transceiver

MODEL: TAG LINK
FCC ID NO: HE7TGL
REPORT NO: 03U2119-1

ISSUE DATE: AUGUST 04, 2003

Prepared for

EXI WIRELESS SYSTEMS INC.
SUITE 100, 13551 COMMERCE PARKWAY
RICHMOND, BC
CANADA

Prepared by
COMPLIANCE ENGINEERING SERVICES, INC.
d.b.a.
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1. VERIFICATION OF COMPLIANCE

COMPANY NAME	:	EXI WIRELESS SYSTEMS INC.
		SUITE 100, 13551 COMMERCE PARKWAY
		RICHMOND BC, V6V 2L1 CANADA
EUT DESCRIPTION	:	307KHz / 433.92 MHz TRANSCEIVER
MODEL NO	:	TAG LINK
FCC ID	:	HE7TGL
DATE TESTED	:	8-04-2003

TYPE OF EQUIPMENT	RF TAGS
EQUIPMENT TYPE	307KHz / 433.92MHz TRANSCEIVERS
MEASUREMENT PROCEDURE	ANSI C63.4 / 2001
LIMIT TYPE	CERTIFICATION
FCC RULE	CFR 47, PART 15

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 15. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. **Warning** : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification will constitute fraud and shall nullify the document.

Tested By:

CHIN PANG
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

Approved & Released By:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

2. PRODUCT DESCRIPTION

Fundamental Frequency	**307KHz / 433.92 MHz**
Power Source	**9V Battery**
Transmitting Time	**Periodic $\geq$ 5 seconds**
Associated Receiver	**NA**
Manufacturer	**EXI Wireless Systems Inc.**

3. TEST FACILITY

The 3/10/30 meter open area test site and conducted measurement facility used to collect the radiated data is located at 561F Monterey Road, Morgan Hill, California, U.S.A. A detailed description of the test facility was submitted to the Commission on May 27,1994.

4. MEASUREMENT STANDARD

The site is constructed and calibrated in conformance with the requirements of ANSI C63.4/2001.

5. TEST METHODOLOGY

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 KHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. (CFR 47 Section 15.33)

6. MEASUREMENT EQUIPMENT USED

| TEST EQUIPMENT LIST				
Name of Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Due Date**
Antenna, Loop 9 kHz ~ 30 MHz	**EMCO**	**6502**	**9202-2722**	**4/23/2004**
SA Display Section 2	**HP**	**85662A**	**2816A16696**	**5/22/2004**
SA RF Section, 1.5 GHz	**HP**	**85680B**	**2732A03661**	**5/22/2004**
Quasi-Peak Adaptor	**HP**	**85650A**	**2811A01155**	**5/22/2004**
Antenna, Bilog	**Chase**	**CBL6112B**	**2586**	**3/6/2004**
Spectrum Analyzer	**Agilent**	**E4446A**	**NA**	**1/13/2004**
Preamplifier, 1300 MHz	**HP**	**8447D**	**2944A06589**	**8/22/2003**
Antenna, Horn 1 ~ 18 GHz	**EMCO**	**3115**	**6717**	**2/4/2004**
Preamplifier, 1-26GHz MHz	**Miteq**	**NSP10023988**	**63250761R**	**4/18/2004**

7. POWERLINE RFI LIMIT

CONNECTED TO AC POWER LINE	SECTION 15.207
CARRIER CURRENT SYSTEM IN THE FREQUENCY RANGE OF 150 KHzTO 30 MHz	SECTION 15.205 AND SECTION 15.209, 15.221, 15.223, 15.225 OR 15.227, AS APPROPRIATE.
BATTERY POWER	NOT REQUIRED

8. RADIATED EMISSION LIMITS

| GENERAL REQUIREMENTS	SECTION 15.209
RESTRICTED BANDS OF OPERATION	SECTION 15.205
PERIODIC OPERATION IN THE BAND 40.66 - 40.70 MHz AND ABOVE 70 MHz.	SECTION 15.231(e)

9. SYSTEM TEST CONFIGURATION

Use a block of foam and combined it with EUT wrapping rubber band around it. This way it can test X.Y, and Z axis. To activate continuous transmission, place a small plastic block between rubber band and EUT push button.
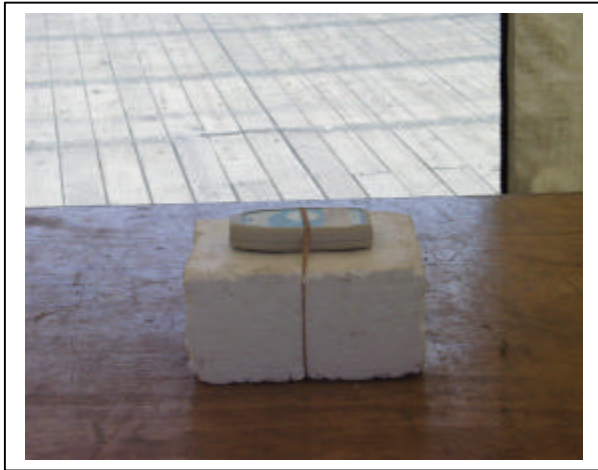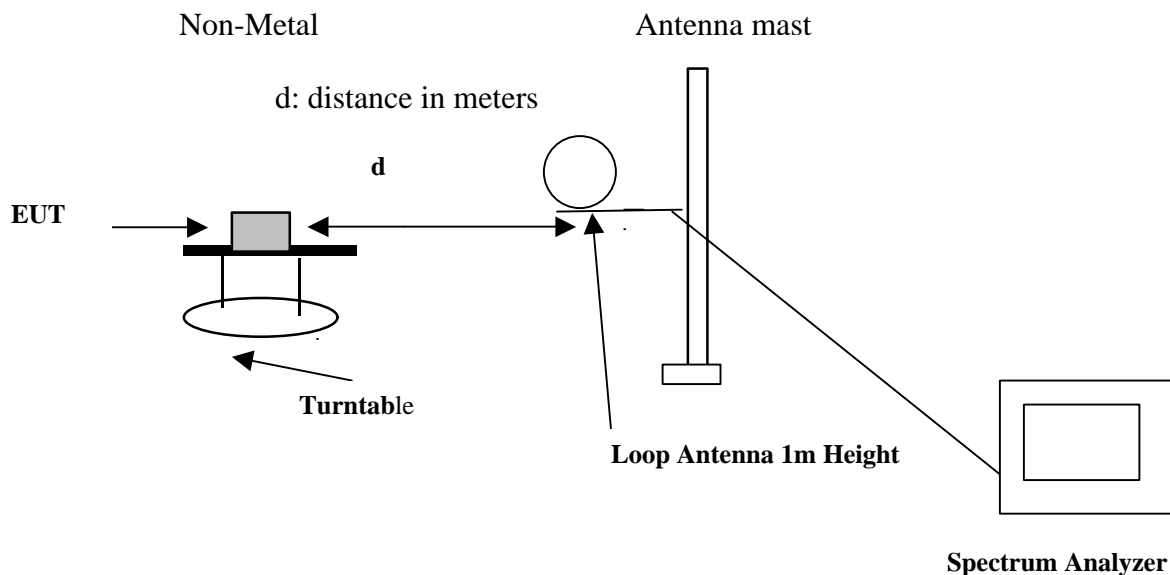

X-Axis

Y-Axis
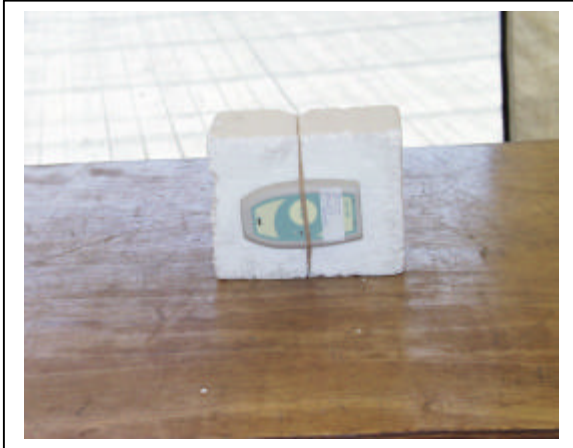
Z-Axis

Radiated Open Site Test Set-up

10. TEST PROCEDURE

Radiated Emissions, 15.209

Test Set-up for frequency range below 30 MHz

Non-Metal   Antenna mast

d: distance in meters

d

EUT

Turntable

Loop Antenna 1m Height

Spectrum Analyzer

Test Procedure:

The measurement is made on open field test site, the H field produced by the EUT is measured using an active loop antenna, measurement is done at 3m distances from the EUT with an extrapolation of corrected distance factor. The loop antenna is rotated around it's axis to maximize the emission, the antenna of the EUT was placed at three different orientations, X, Y and Z to find the worst orientation, the worst orientation was found to be when the antenna of the EUT is in vertical position and the plane of the loop antenna is in parallel with the antenna of the EUT.
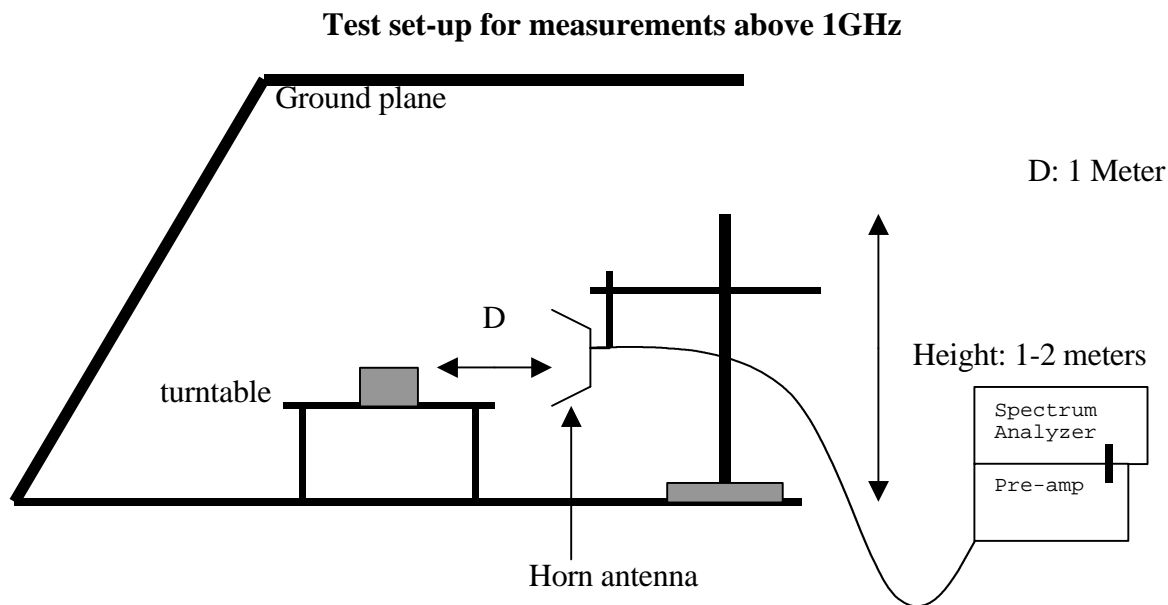
The RBW of the spectrum analyzer is set to 10kHz, VBW is set to 10kHz, reading on the analyzer in dBuV was added to cable loss and antenna factor in dBS/m to get the H field in dBuA/m.

Radiated Emissions, 15.231(e)

Test Set-up for frequency range 30 – 1000 MHz

Antenna mast

Ground plane

1 - 4 meters
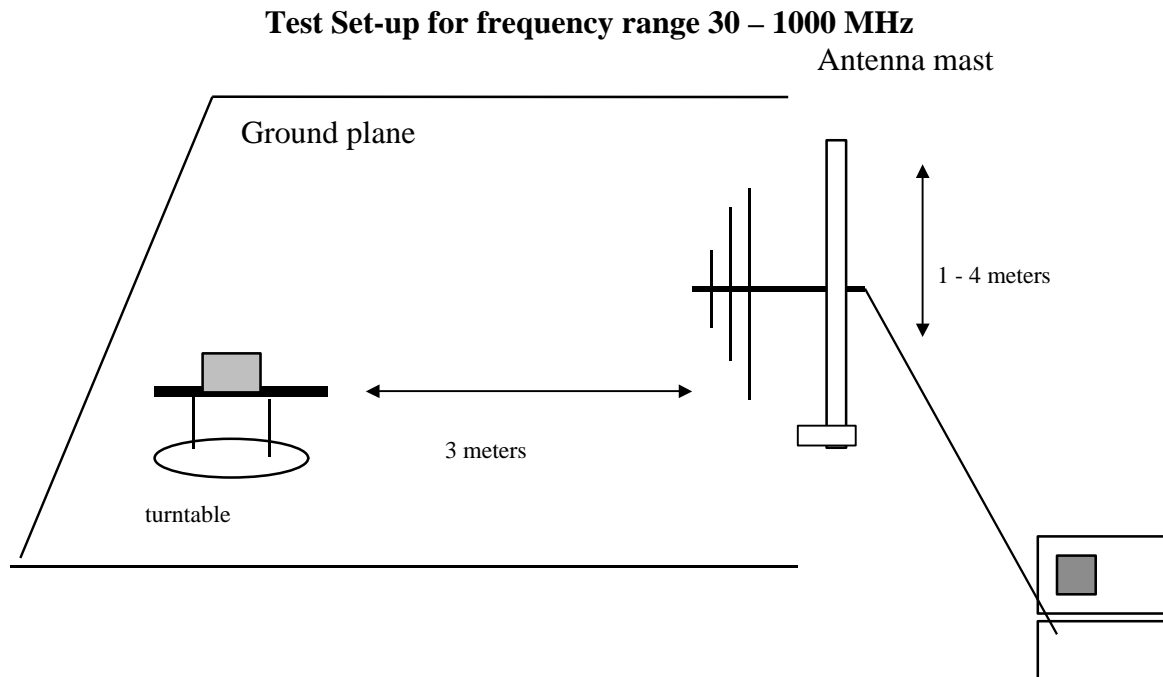
3 meters

turntable

preamplifier/spectrum analyzer

1. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3-meters from the EUT.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205. The EUT was moved throughout the XY, XZ, and YZ planes to maximize emissions received by the search antenna.

3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

Test set-up for measurements above 1GHz

Ground plane

D: 1 Meter

D

turntable

Height: 1-2 meters

Spectrum
Analyzer

Pre-amp

Horn antenna

1. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 1-meters from the EUT.   The EUT antenna was mounted vertically as per normal installation.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205. The EUT was moved throughout the XY, XZ, and YZ planes to maximize emissions received by the search antenna.

3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

11. EQUIPMENT MODIFICATIONS

To achieve compliance to FCC Section 15.231 technical limits, the following change(s) were made during compliance testing:

No changes were required in order to achieve compliance to Section 15.231 levels.

12. TEST RESULT

Powerline RFI Class B	Eut	Radiated Emission Limits	Eut
SECTION 15.207		SECTION 15.209	X
SECTION 15.205, 15.209, 15.221, 15.223, x 15.225 OR 15.227		SECTION 15.205	X
BATTERY POWER	X	SECTION 15.231 (e)	X

12.1 MAXIMUM MODULATION PERCENTAGE (M%)

CALCULATION:

Average Reading =   Peak Reading (dBuV/m)+ 20log (Duty Cycle)

In order to determine possible Maximum Modulation percentage, alternations are made to the EUT. We measured:

WHERE   1 Period   = 78.5ms
            Long pulse   = 0.5 ms
            Short pulse   =0.2333 ms
            No of Long pulse   = 6
            No of Short pulse   = 48

Duty Cycle = (N1L1+N2L2+…+Nn-1Ln-1+NnLn)/100 or T
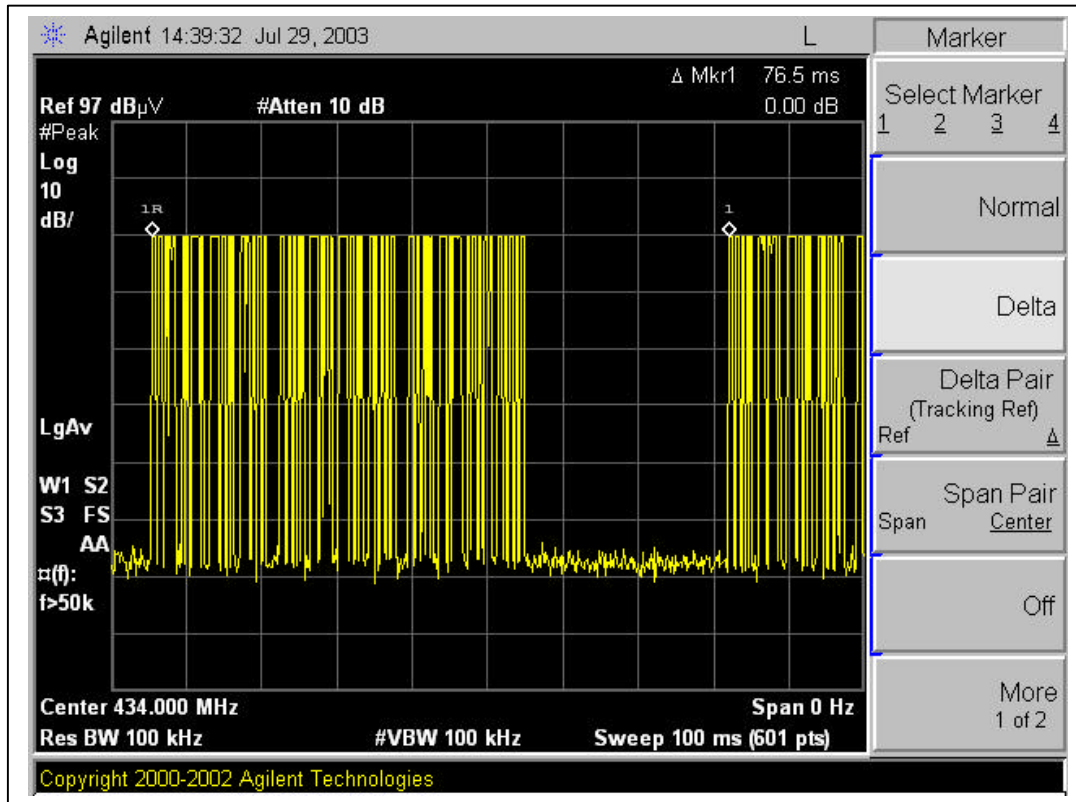
Duty Cycle = ((6x0.500)+(48x0.2333))/78.50=0.219=.21.9%

For duty cycle refer to plot #1, 2, 3,4, 5.
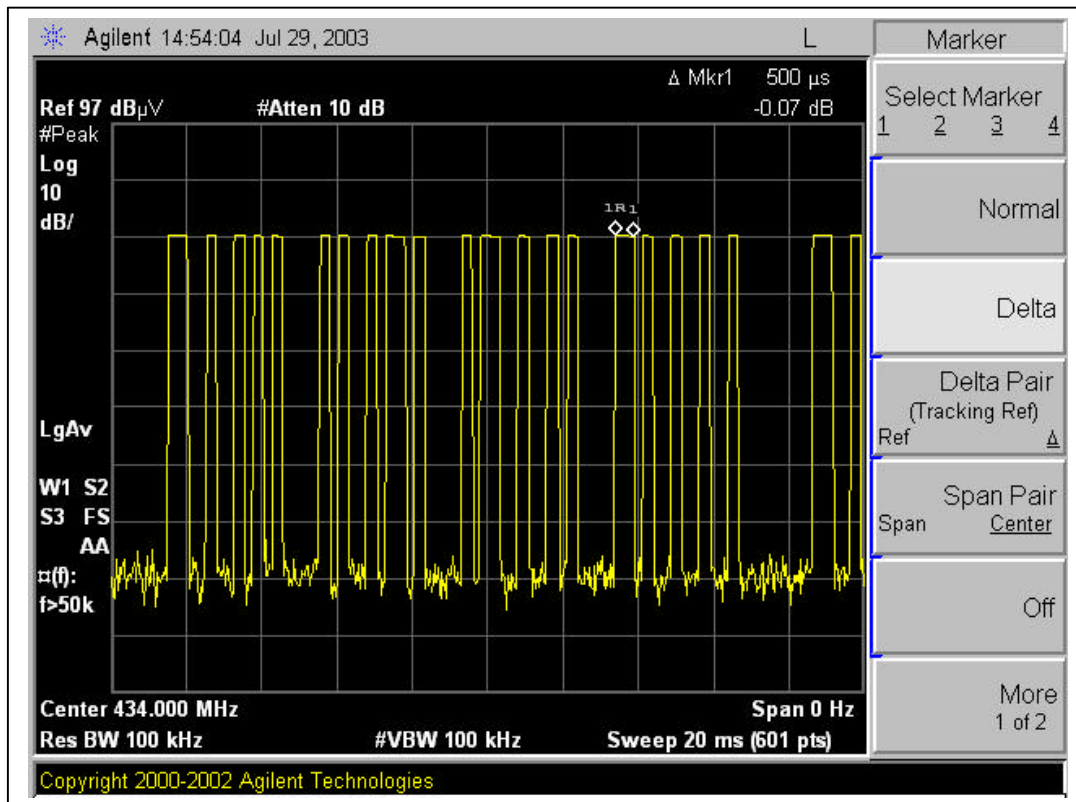
12.2 EMISSION BANDWIDTH

The bandwidth of the emissions were investigated per 15.231(c)

Center Frequency	Measured	Limits
433.92 MHz	**513 KHz** **(refer to plot)**	**433.92 x 0.25%= 1.0848MHz**

DUTY CYCLE 1

DUTY CYCLE 2

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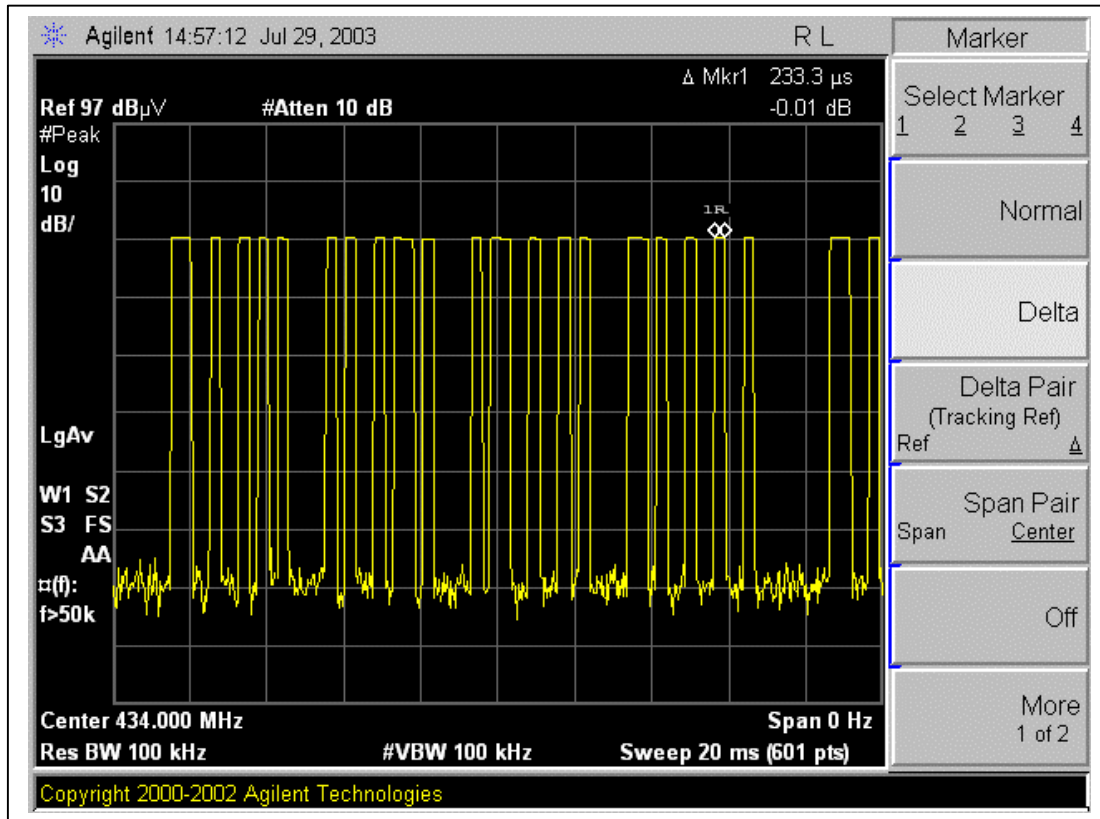
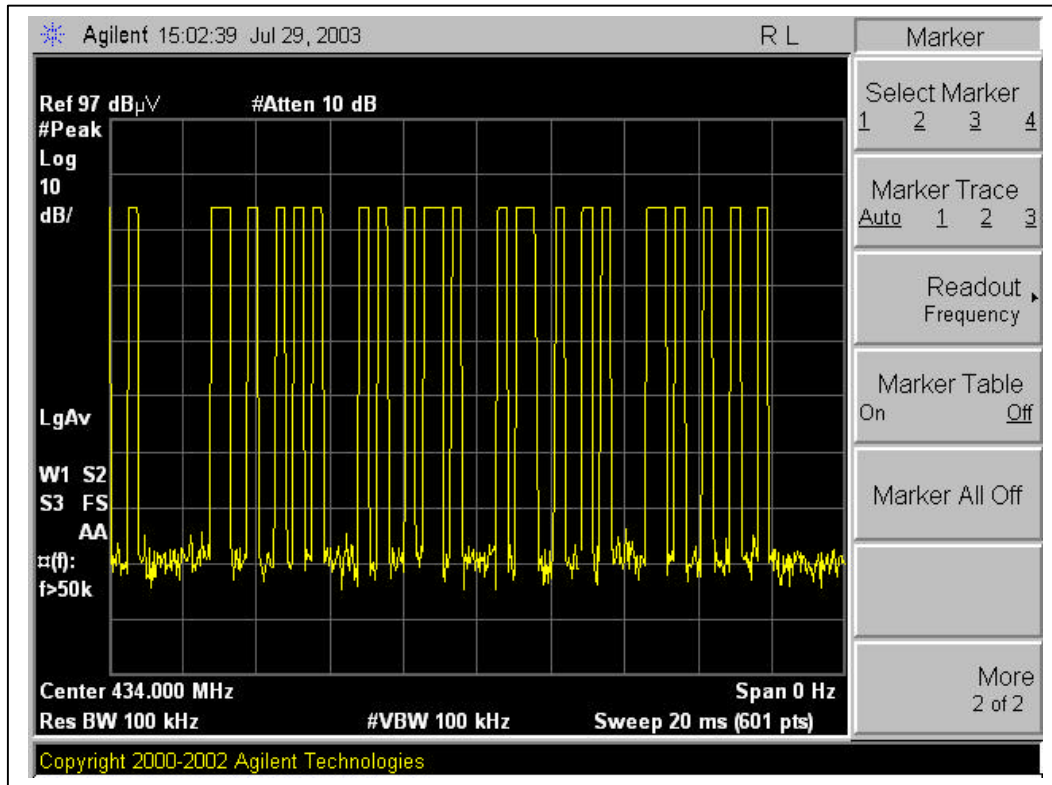# DUTY CYCLE 3
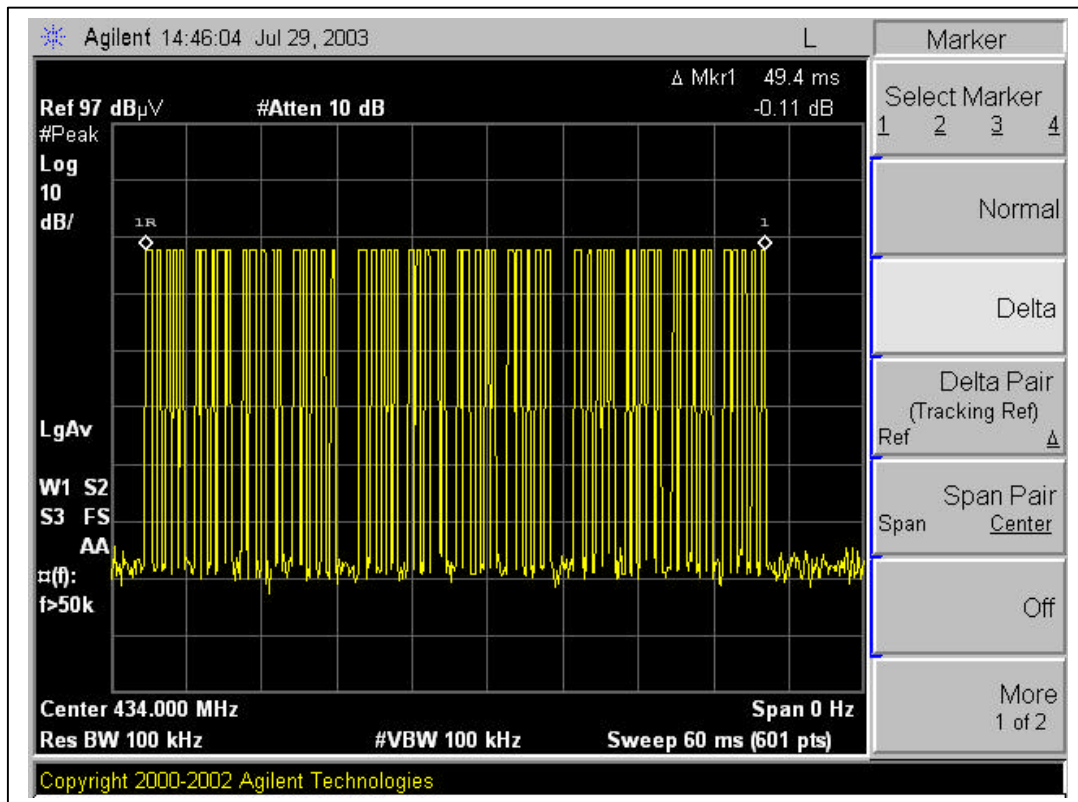
DUTY CYCLE 4

DUTY CYCLE 5

EMISSION BANDWIDTH

RADIATED DATA

COMPLIANCE
Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885   FAX: (408) 463-0888

Project #:	03u2095-1
Report #:	030715C2
Date& Time:	07/15/03 3:46 PM
Test Engr:	Chin Pang

Company:	EXI Wireless Systems Inc.
EUT Description:	RF Tag Reader (307KHz Transmitting)
Test Configuration :	EUT Only
Type of Test:	FCC 15.209 / 15.231
Mode of Operation:	TX

☐ A-Site   ☐ B-Site   ☑ C-Site   ☐ F-Site   6 Worst Data   Descending

Freq.	Reading	AF	Closs	Dist	Level	Limit	Margin	Pol	Az	Height	Mark
(KHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	FCC_B	(dB)	(H/V)	(Deg)	(Meter)	(P/Q/A)
Test at worst position:											
307.00	58.70	10.80	0.30	80.00	-10.20	17.86	-28.06	3mV	0.00	1.00	P
614.00	56.40	10.60	0.30	40.00	27.30	31.84	-4.54	3mV	0.00	1.00	P
921.00	38.40	10.60	0.30	40.00	9.30	28.32	-19.02	3mV	0.00	1.00	P
1228.00	50.80	10.60	0.30	40.00	21.70	25.82	-4.12	3mV	0.00	1.00	P
1535.00	45.40	10.60	0.30	40.00	16.30	23.88	-7.58	3mV	0.00	1.00	P
307.00	48.20	10.80	0.30	80.00	-20.70	17.86	-38.56	3mH	0.00	1.00	P
614.00	50.10	10.60	0.30	40.00	21.00	31.84	-10.84	3mH	0.00	1.00	P
921.00	34.10	10.60	0.30	40.00	5.00	28.32	-23.32	3mH	0.00	1.00	P
1228.00	48.00	10.60	0.30	40.00	18.90	25.82	-6.92	3mH	0.00	1.00	P
1535.00	36.80	10.60	0.30	40.00	7.70	23.88	-16.18	3mH	0.00	1.00	P

No other emissions were found up to 30MHz.

COMPLIANCE
Certification Services

FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885　　　　FAX: (408) 463-0888

Project #:	03U2096-1
Report #:	030722B1
Date& Time:	07/22/03 1:53PM
Test Engr:	Chin Pang

Company:	EXI Wireless Systems Inc
EUT Description:	433.92MHz RFID Tag Reader (307KHz/433MHz Transceiver)
Test Configuration :	EUT only
Type of Test:	FCC 15.231
Mode of Operation:	Tx

M% = ((t1+t2+t3+…)/100% = 16.5%　　　　　　　Av Reading = Pk Reading + 20*log(M%)
RBW=100KHZ, VBW=100KHz　　　　　　　　　　　　20*log(M%) = -15.65

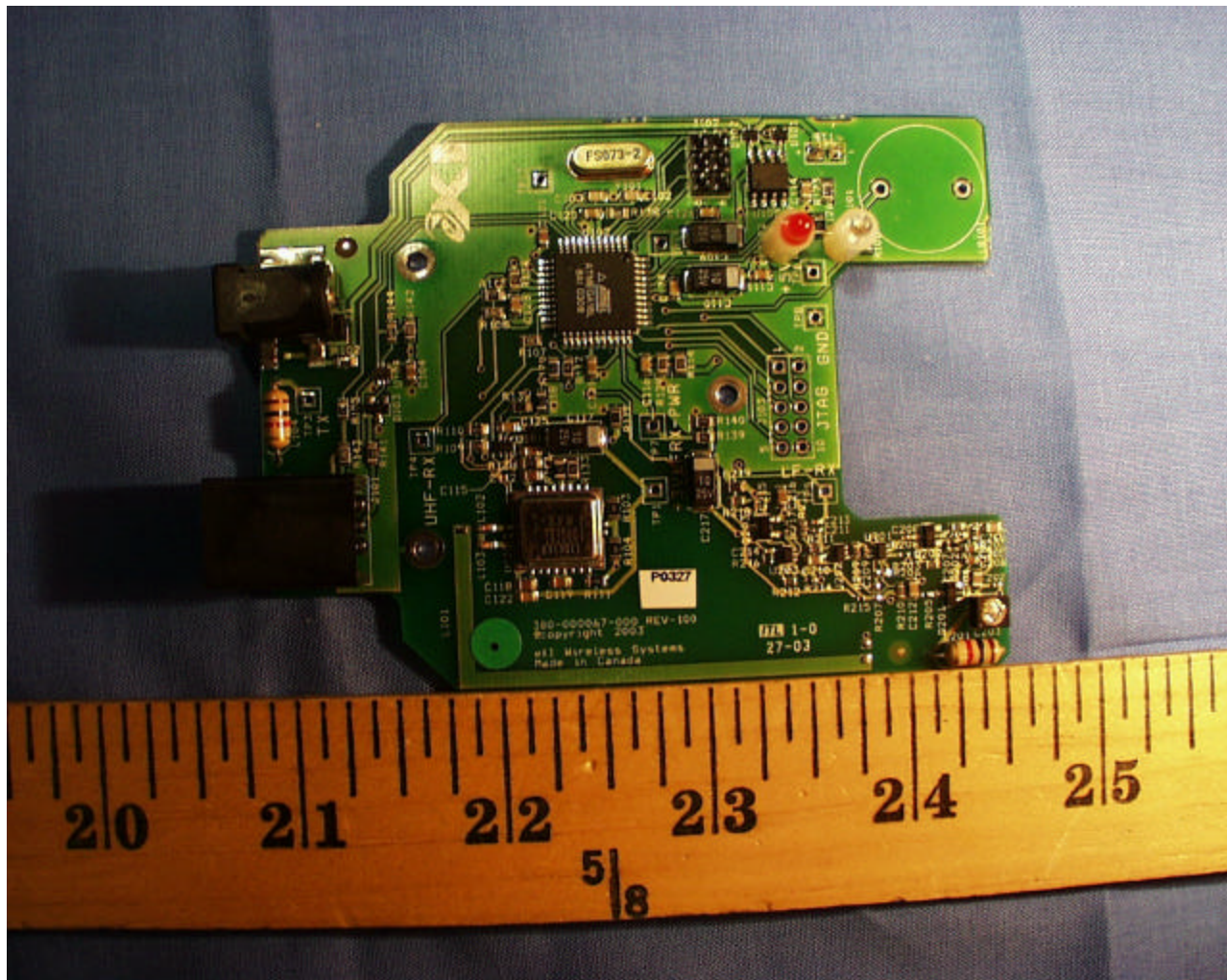| Freq.	Pk Rdg	Av Rdg	AF	Closs	Pre-amp	Level	Limit	Margin	Pol	Az	Height	Mark
(MHz)	(dBuV)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	FCC_B	(dB)	(H/V)	(Deg)	(Meter)	(P/Q/A)
433.92Mhz Fundamental frequency												
Y-Position (stand Up)												
433.92	76.20	60.55	16.22	5.19	28.63	53.33	72.86	-19.53	3mV	0.00	1.00	P
433.92	72.70	57.05	16.22	5.19	28.63	49.83	72.86	-23.03	3mH	0.00	1.00	P
X-Position (EUT Lay Down)												
433.92	75.10	59.45	16.22	5.19	28.63	52.23	72.86	-20.63	3mV	0.00	1.00	P
433.92	70.50	54.85	16.22	5.19	28.63	47.63	72.86	-25.23	3mH	0.00	2.00	P
Z-Position (EUT Place Side Way)												
433.92	75.50	59.85	16.22	5.19	28.63	52.63	72.86	-20.23	3mV	0.00	1.00	P
433.92	75.40	59.75	16.22	5.19	28.63	52.53	72.86	-20.33	3mH	0.00	1.50	P
The Data show Y-Position is the worst case												
868.60	45.00	29.35	20.19	7.66	28.63	28.57	52.86	-24.29	3mV	0.00	1.00	P
868.60	41.70	26.05	20.19	7.66	28.63	25.27	52.86	-27.59	3mH	0.00	1.50	P

RADIATED EMISSIONS (HARMONIC)

08/04/03   **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr:Chin Pang
Project #:03U2119-1
Company:EXI Wireless Systems Inc.
EUT Descrip.:307KHz / 433.92MHz Transceiver
EUT M/N:Tag Link
Test Target: FCC Class B
Mode Oper:Tx

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Spectrum Analyzer	Horn > 18GHz
T60; S/N: 2238 @1m	T87 Miteq 924342	Agilent 8564E Analyzer	

Hi Frequency Cables
☐ (2 ft)   ☑ (2 ~ 3 ft)   ☐ (4 ~ 6 ft)   ☑ (12 ft)

Peak Measurements: Average Measurements:
1 MHz Resolution Bandwidth   1 MHz Resolution Bandwidth
1MHz Video Bandwidth   10Hz Video Bandwidth

Average=Peak-Duty Cycle

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
1.302	3.3	58.3	45.1	25.8	1.5	-43.4	-9.5	0.0	32.7	19.5	74.0	54.0	-41.3	-34.5	V
1.736	3.3	55.0	41.8	27.9	1.9	-43.3	-9.5	1.0	33.0	19.8	74.0	54.0	-41.0	-34.2	V
2.170	3.3	51.8	38.6	29.6	2.3	-43.2	-9.5	1.0	31.9	18.7	74.0	54.0	-42.1	-35.3	V
2.604	3.3	50.9	37.7	30.5	2.7	-43.2	-9.5	1.0	32.4	19.2	74.0	54.0	-41.6	-34.8	V
3.038	3.3	46.6	33.4	31.4	3.1	-43.2	-9.5	1.0	29.4	16.2	74.0	54.0	-44.6	-37.8	V
1.302	3.3	59.0	45.8	25.8	1.5	-43.4	-9.5	0.0	33.4	20.2	74.0	54.0	-40.6	-33.8	H
1.736	3.3	56.0	42.8	27.9	1.9	-43.3	-9.5	1.0	34.0	20.8	74.0	54.0	-40.0	-33.2	H
2.170	3.3	52.4	39.2	29.6	2.3	-43.2	-9.5	1.0	32.5	19.3	74.0	54.0	-41.5	-34.7	H
2.604	3.3	51.3	38.1	30.5	2.7	-43.2	-9.5	1.0	32.8	19.6	74.0	54.0	-41.2	-34.4	H
3.038	3.3	47.3	34.1	31.4	3.1	-43.2	-9.5	1.0	30.1	16.9	74.0	54.0	-43.9	-37.1	H

No other emissions were detected above the system noise floor

f	Measurement Frequency	Amp	Preamp Gain
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m
AF	Antenna Factor	Peak	Calculated Peak Field Strength
CL	Cable Loss	HPF	High Pass Filter

Avg Lim   Average Field Strength Limit
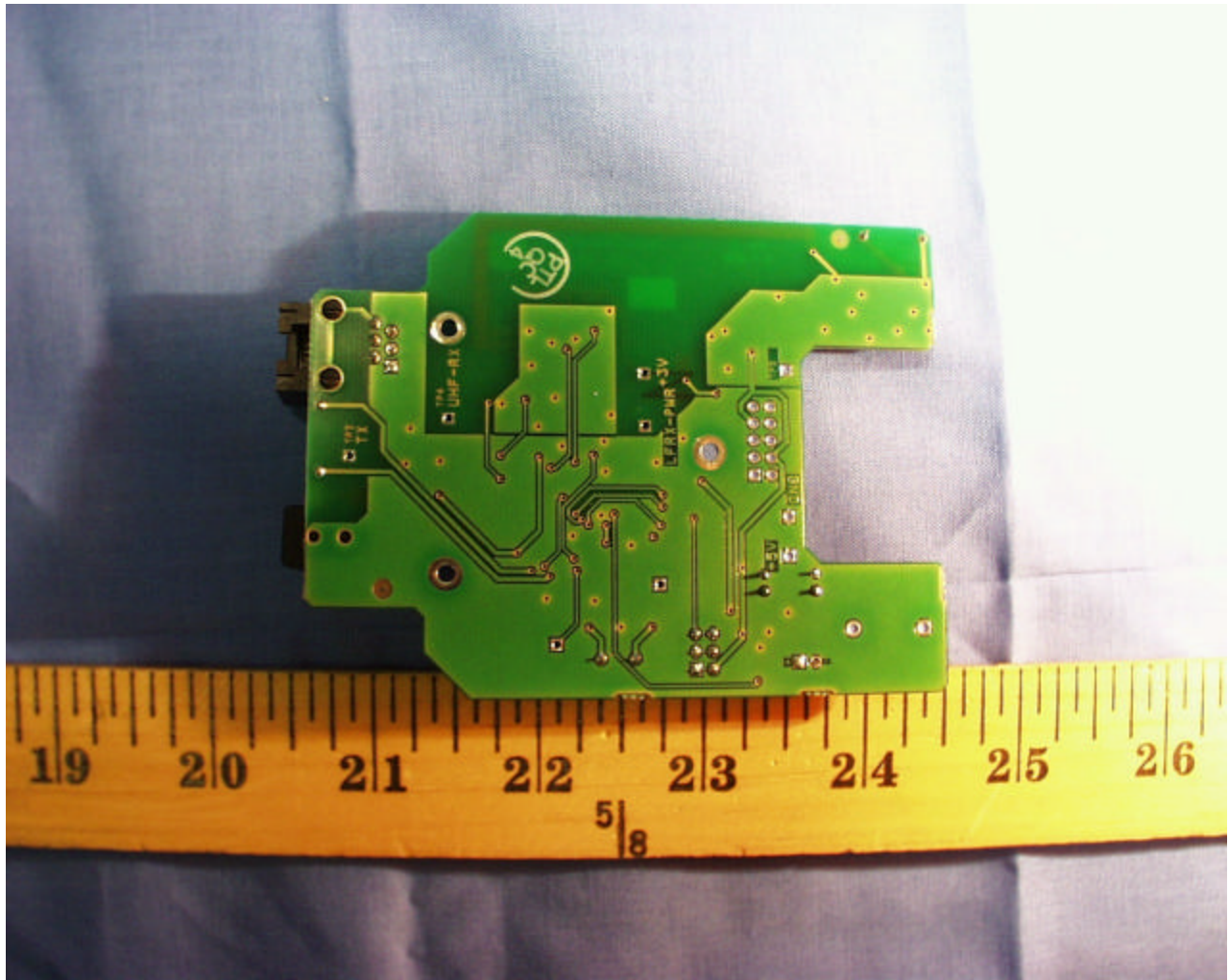Pk Lim   Peak Field Strength Limit
Avg Mar   Margin vs. Average Limit
Pk Mar   Margin vs. Peak Limit

EUT PHOTOGRAPHS

END OF REPORT