



**FCC CFR47 PART 15 SUBPART C  
CERTIFICATION  
TEST REPORT**

**FOR**

**433.92MHz EXTERNAL VALVE MOUNT TRANSMITTER**

**MODEL NUMBER: 200.0172**

**FCC ID: NATTX172**

**REPORT NUMBER: 06U10676-1B**

**ISSUE DATE: DECEMBER 05, 2006**

*Prepared for*

**SMARTIRE SYSTEMS INC.  
#150-13151 VANIER PLACE  
RICHMOND, BC V6V2J1, CANADA**

*Prepared by*

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**LAB CODE:200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	11/20/06	Initial Issue	Thu
B	12/05/06	Updated Section 7.1.2	Thu

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SMARTIRE SYSTEMS INC  
#150 13151 VANIER PLACE  
RICHMOND, BC V6V2J1, CANADA

**EUT DESCRIPTION:** 433.92 MHz EXTERNAL VALVE MOUNT TRANSMITTER

**MODEL:** 200.0172

**SERIAL NUMBER:** 73084

**DATE TESTED:** NOVEMBER 07 and DECEMBER 04, 2006

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. 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 Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



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THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

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CHIN PANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

Equipment Type	433.92 MHz Transmitter
Fundamental Frequency	433.92 MHz
Power Source	3V Battery
Transmitting Time	Periodic $\leq$ 5 seconds
Transmitting Interval	3 –5 minutes
Manufacturer	SmarTire Systems Inc.

### 5.2. SOFTWARE AND FIRMWARE

To activate continuous transmission, a LF Initiator was used to send a command to initiate the transmitter.

### 5.3. WORST-CASE CONFIGURATION AND MODE

In our opinion the worst-case channel is determined by X, Y, and Z-axis. The highest measured output power was at 433.92 MHz Y-axis.

## 5.4. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
LF Initiator	SmarTire Systems	SmarTire	NA	NA

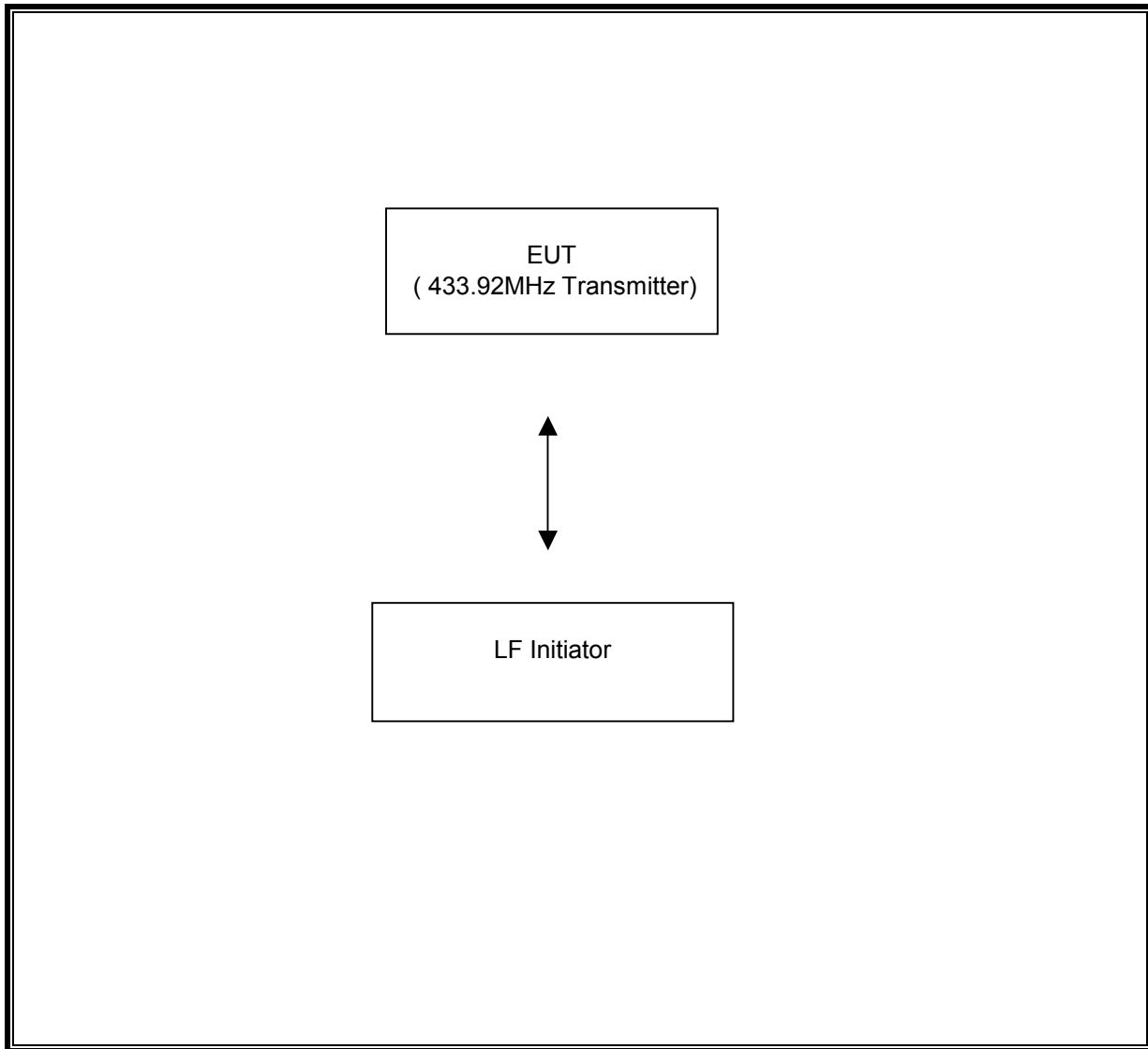
### I/O CABLES

N/A

### TEST SETUP

The EUT is a stand-alone unit.

**SETUP DIAGRAM FOR TESTS**





## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

<b>TEST EQUIPMENT LIST</b>				
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Due Date</b>
<b>Antenna, Log Periodic 200 ~ 1000 MHz</b>	<b>EMCO</b>	<b>3146</b>	<b>2120</b>	<b>3/1/2007</b>
<b>SA Display Section 2</b>	<b>Agilent / HP</b>	<b>85662A</b>	<b>2816A16696</b>	<b>4/7/2008</b>
<b>SA RF Section, 1.5 GHz</b>	<b>Agilent / HP</b>	<b>85680B</b>	<b>2814A04227</b>	<b>1/7/2008</b>
<b>Quasi-Peak Adaptor</b>	<b>Agilent / HP</b>	<b>85650A</b>	<b>2521A01038</b>	<b>1/11/2008</b>
<b>Preamplifier, 1 ~ 26.5 GHz</b>	<b>Agilent / HP</b>	<b>8449B</b>	<b>3008A00369</b>	<b>8/17/2007</b>
<b>Antenna, Horn 1 ~ 18 GHz</b>	<b>ETS</b>	<b>3117</b>	<b>29310</b>	<b>4/22/2007</b>
<b>Spectrum Analyzer 3 Hz ~ 44 GHz</b>	<b>Agilent / HP</b>	<b>E4446A</b>	<b>MY43360112</b>	<b>5/3/2007</b>
<b>Preamplifier, 1300 MHz</b>	<b>Agilent / HP</b>	<b>8447D</b>	<b>2944A06550</b>	<b>9/1/2007</b>

## 7. LIMITS AND RESULTS

### 7.1.1. 20dB BANDWIDTH

#### LIMIT

§15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer.

20dB Bandwidth: The RBW is set to 10 KHz. The VBW is set to 100 KHz. The sweep time is coupled. Bandwidth is determined at the points 20 dB down from the modulated carrier.

99% Bandwidth: The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

No non-compliance noted:

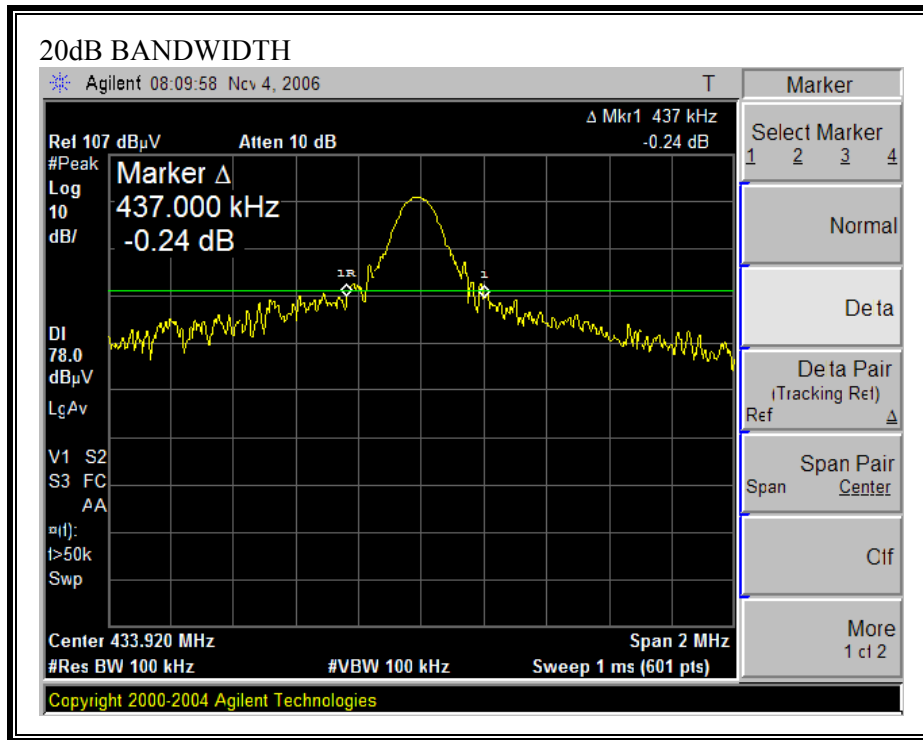
##### 20dB Bandwidth

Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Margin (KHz)
433.92	437	1084.8	-647.8

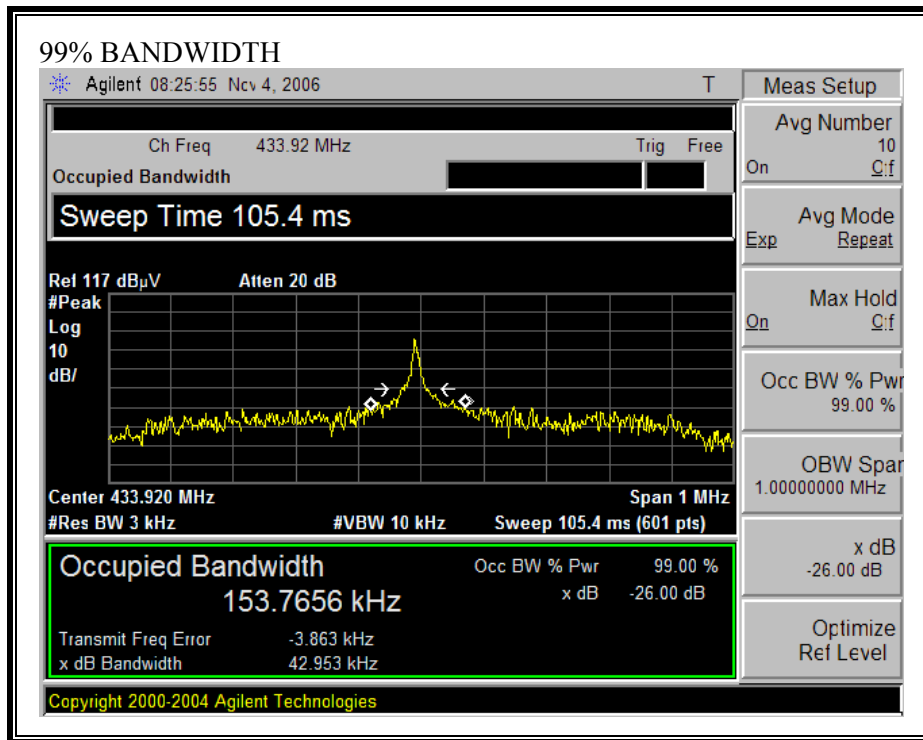
##### 99% Bandwidth

Frequency (MHz)	99% Bandwidth (KHz)	Limit (KHz)	Margin (KHz)
433.92	153.7656	1084.8	-931.0344

**20dB BANDWIDTH**



**99% BANDWIDTH**



### 7.1.2. TRANSMISSIONS PLOT

#### LIMIT

§15.231 (e) In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

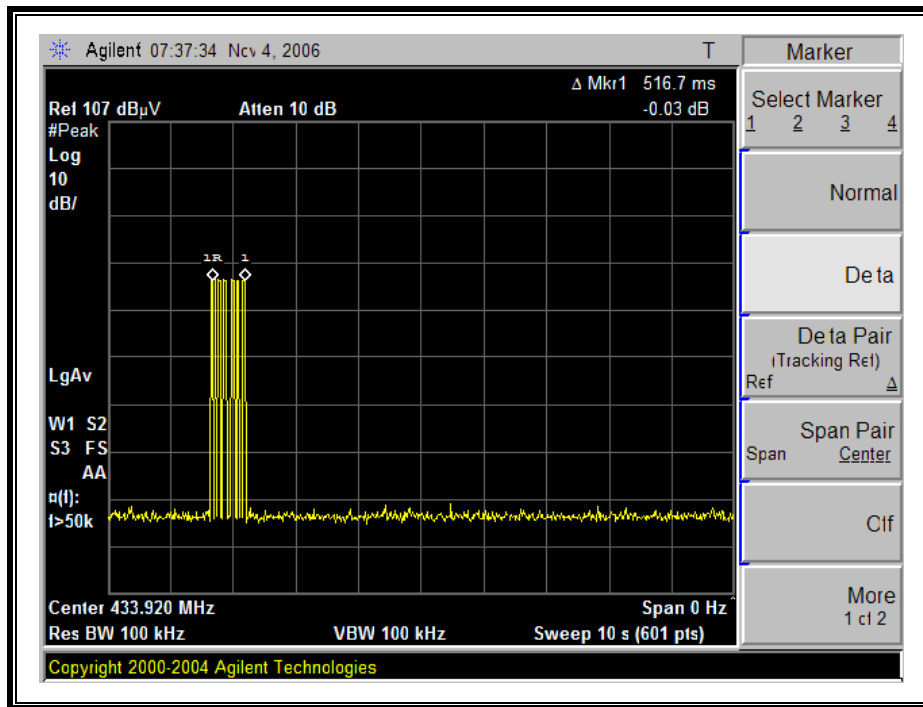
#### TEST PROCEDURE

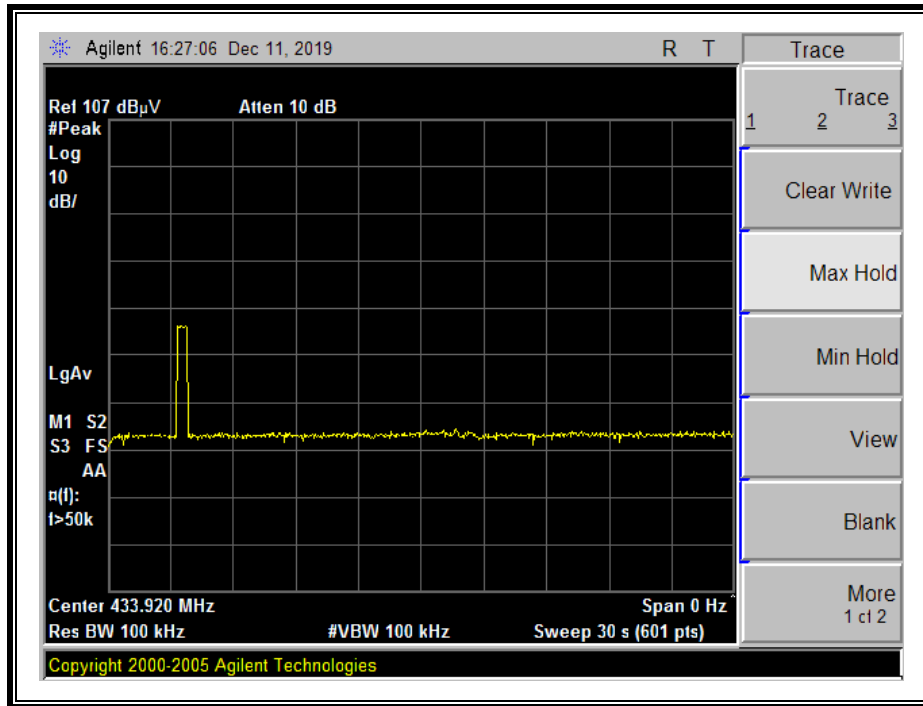
The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is set to 10 & 30 seconds and the span is set to 0 Hz.

#### RESULTS

No non-compliance noted:

Transmission begins approximately 1.65 seconds after activation and transmission ceases approximately 2.18 seconds after activation. The Transmitting Interval every 3 - 5 minutes.





### **7.1.3. MAXIMUM MODULATION PERCENTAGE (M%)**

#### **LIMIT**

§15.35 (c) the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in a 100 ms scan.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to 10 \* (# of pulses in 3.16 s) \* pulse width.

#### **CALCULATION:**

Average Reading = Peak Reading (dBuV/m) + 20log (Duty Cycle), Where Duty Cycle is (# of long pulses \* long pulse width) + (# of short pulses \* short pulse width) / 100 or T

#### **RESULTS**

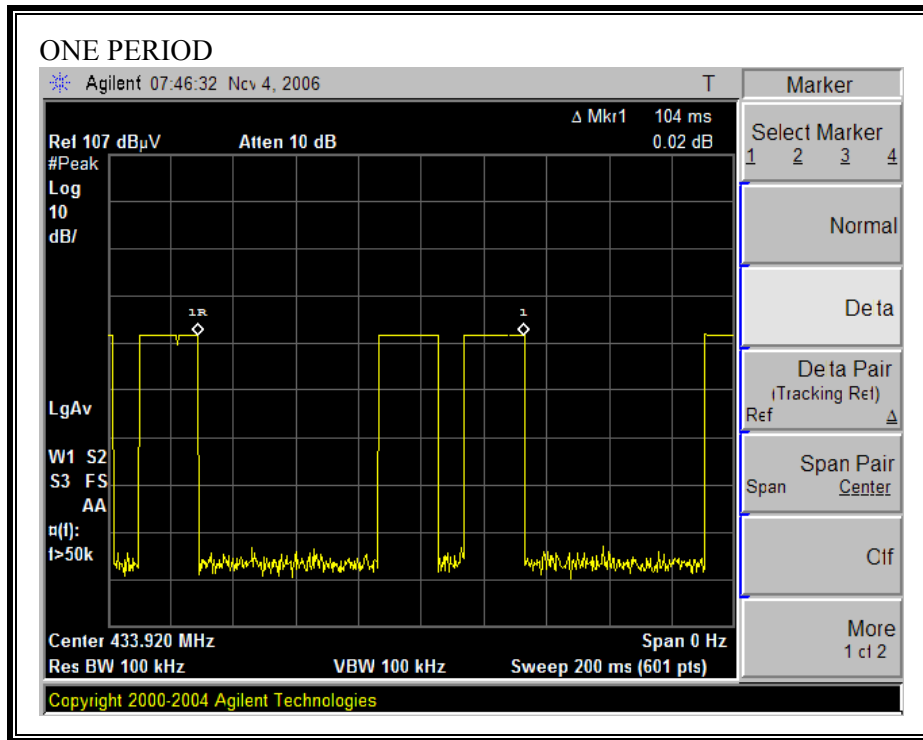
No non-compliance noted:

**MAXIMUM MODULATION PERCENTAGE**

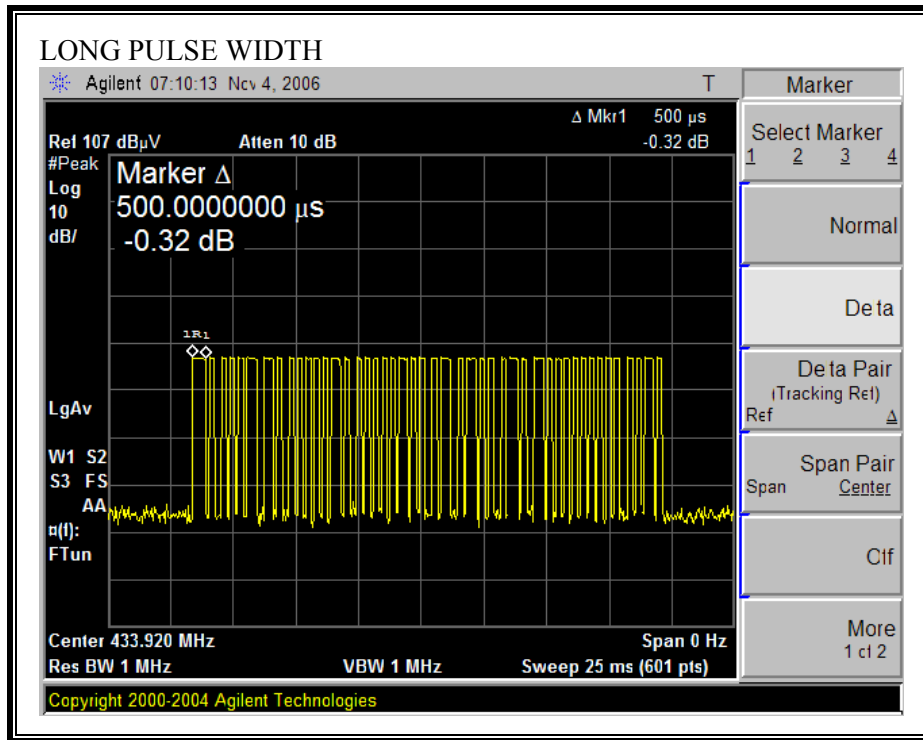
<b>One Period (ms)</b>	<b>Long Width (ms)</b>	<b># of Long Pulses</b>	<b>Long Width (ms)</b>	<b># of 2nd Long Pulses</b>	<b>Short Width (ms)</b>	<b># of Short Pulses</b>	<b>Duty Cycle</b>	<b>20*Log Duty Cycle (dB)</b>
100	0.5	2	0.333	18	0.17	72	0.190	-14.43



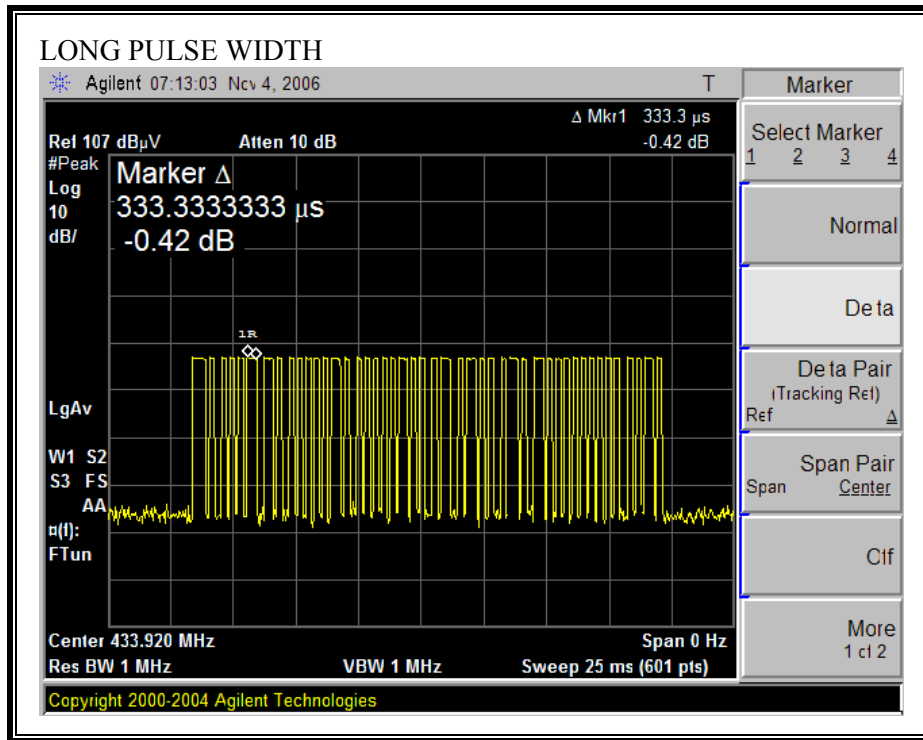
**ONE PERIOD**



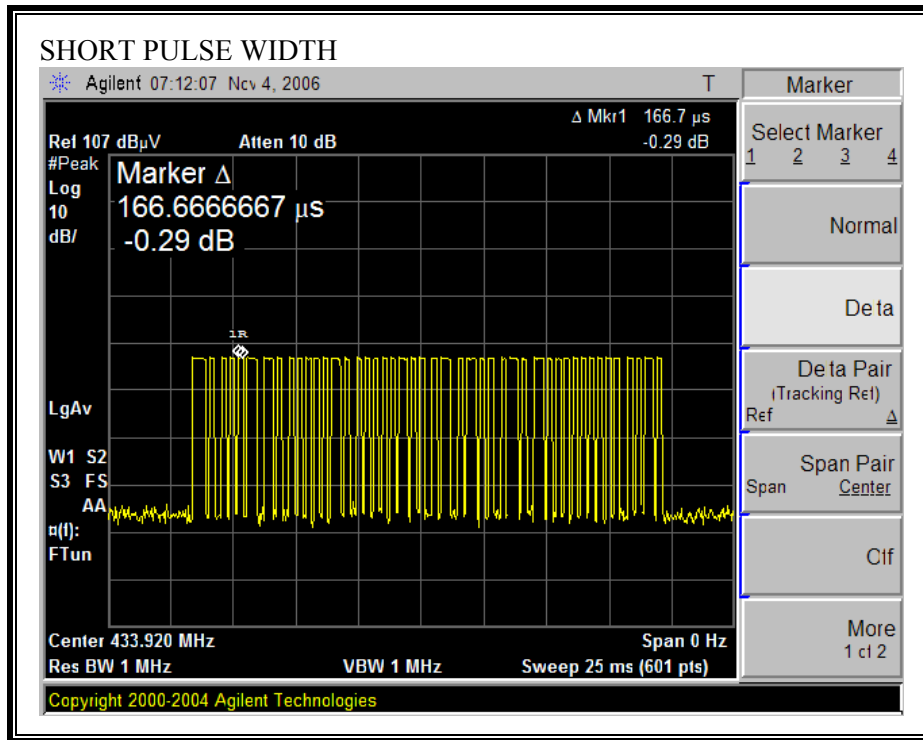
**LONG PULSE WIDTH**



**LONG PULSE TWO WIDTH**



**SHORT PULSE WIDTH**



## 7.2. RADIATED EMISSIONS

### 7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

§15.231(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental Frequency (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174 - 260	1,500	150
260 - 470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

<sup>1</sup>Linear interpolation

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

## **TEST PROCEDURE**


The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

**FUNDAMENTAL, HARMONICS AND SPURIOUS EMISSIONS 30 – 1000 MHz**



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

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*Project #:* 061107C1  
*Report #:* 06U10676-1  
*Date & Time:* 11/07/06  
*Test Engr:* Chin Pang

*Company:* SmartTire Systems Inc.  
*EUT Description:* 433.92MHz External Valve Mount Transmitter  
*Test Configuration:* EUT Only  
*Type of Test:* FCC 15.231e  
*Mode of Operation:* Transmitting

M% = ((I1+I2+I3+...)/T) \* 100% = 19.00%

Av Reading = Pk Reading + 20*log(M%)
20 * log (M%) = -14.42

Freq. (MHz)	Pk Rdg (dBuV)	Av Rdg (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Pk Level (dBuV/m)	Av Level (dBuV/m)	Pk Limit FCC_B	Av Limit FCC_B	Pk Margin (dB)	Avg Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)
X-Position ( EUT Lay down )														
433.92	84.40	69.98	17.00	3.43	27.32	77.51	63.08	92.87	72.87	-15.36	-9.78	3mV	0.00	1.00
433.92	82.10	67.68	17.00	3.43	27.32	75.21	60.78	92.87	72.87	-17.66	-12.08	3mH	0.00	2.00
Y-Position ( EUT Standup )														
433.92	86.00	71.58	17.00	3.43	27.32	79.11	64.68	92.87	72.87	-13.76	-8.18	3mV	0.00	1.00
433.92	79.00	64.58	17.00	3.43	27.32	72.11	57.68	92.87	72.87	-20.76	-15.18	3mH	0.00	2.00
Z-Position ( EUT Side Lay down )														
433.92	76.00	61.58	17.00	3.43	27.32	69.11	54.68	92.87	72.87	-23.76	-18.18	3mV	0.00	1.00
433.92	84.70	70.28	17.00	3.43	27.32	77.81	63.38	92.87	72.87	-15.06	-9.48	3mH	0.00	2.00
Worst Position:														
867.00	55.60	41.18	22.65	7.61	27.31	58.55	44.13	72.87	52.87	-14.32	-8.74	3mV	0.00	1.00
867.00	57.90	43.48	22.65	7.61	27.31	60.85	46.43	72.87	52.87	-12.02	-6.44	3mH	0.00	2.00



**HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz**

**High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

Company: SmarTire Systems Inc.  
 Project #: 06U10676-1  
 Date: 11/7/2006  
 Test Engineer: Chin Pang  
 Configuration: EUT Only  
 Mode: TX

**Test Equipment:**

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T120; S/N: 29310 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz ; VBW=10Hz
Chin 177079003		Chin 200354001			

Average=Peak-Duty Cycle

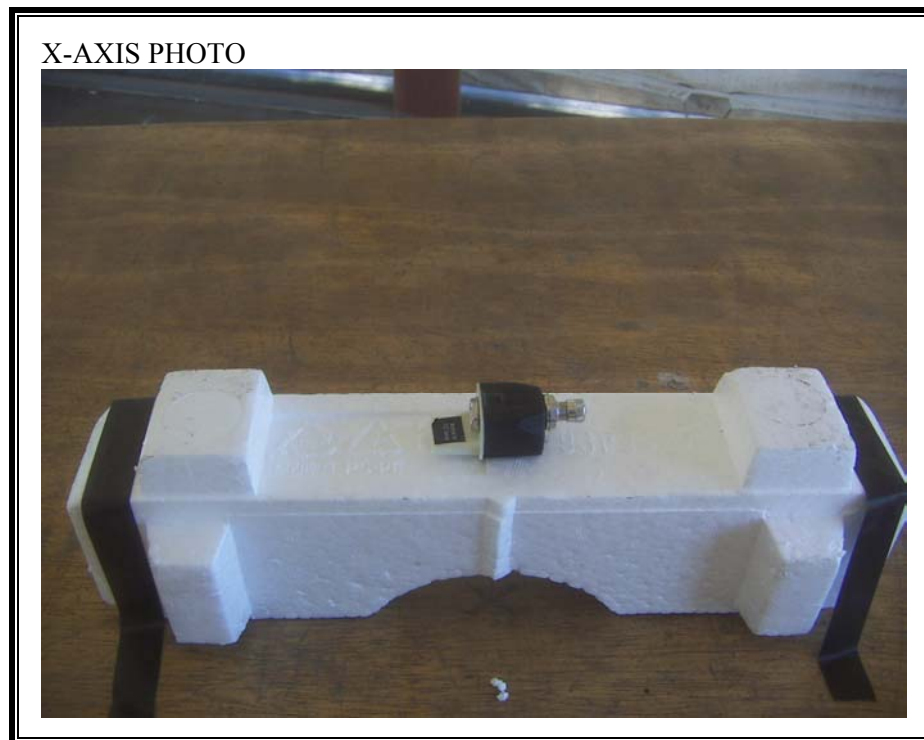
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.301	3.0	68.7	54.3	29.0	2.0	-37.8	0.0	0.0	61.8	47.4	74	54	-12.2	-6.6	V
1.735	3.0	65.0	50.6	30.6	2.2	-37.2	0.0	0.0	60.6	46.1	74	54	-13.4	-7.9	V
2.169	3.0	60.5	46.1	31.6	2.4	-36.6	0.0	0.0	57.8	43.4	74	54	-16.2	-10.6	V
2.603	3.0	61.0	46.6	32.0	2.6	-36.2	0.0	0.0	59.4	45.0	74	54	-14.6	-9.0	V
3.037	3.0	56.0	41.6	32.8	2.7	-35.9	0.0	0.0	55.7	41.3	74	54	-18.3	-12.7	V
3.471	3.0	50.0	35.6	32.9	2.9	-35.5	0.0	0.0	50.3	35.9	74	54	-23.7	-18.1	V
3.905	3.0	48.4	34.0	32.9	3.0	-35.1	0.0	0.0	49.3	34.8	74	54	-24.7	-19.2	V
4.339	3.0	54.0	39.6	33.2	3.2	-34.9	0.0	0.0	55.5	41.1	74	54	-18.5	-12.9	V
1.301	3.0	67.0	52.6	29.0	2.0	-37.8	0.0	0.0	60.1	45.7	74	54	-13.9	-8.3	H
1.735	3.0	64.0	49.6	30.6	2.2	-37.2	0.0	0.0	59.6	45.1	74	54	-14.4	-8.9	H
2.169	3.0	62.0	47.6	31.6	2.4	-36.6	0.0	0.0	59.3	44.9	74	54	-14.7	-9.1	H
2.603	3.0	65.0	50.6	32.0	2.6	-36.2	0.0	0.0	63.4	49.0	74	54	-10.6	-5.0	H
3.037	3.0	54.0	39.6	32.8	2.7	-35.9	0.0	0.0	53.7	39.3	74	54	-20.3	-14.7	H
3.471	3.0	59.0	44.6	32.9	2.9	-35.5	0.0	0.0	59.3	44.9	74	54	-14.7	-9.1	H
3.905	3.0	57.0	42.6	32.9	3.0	-35.1	0.0	0.0	57.9	43.4	74	54	-16.1	-10.6	H
4.339	3.0	60.0	45.6	33.2	3.2	-34.9	0.0	0.0	61.5	47.1	74	54	-12.5	-6.9	H

Rev. 5.1.6

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

## 8. SETUP PHOTOS

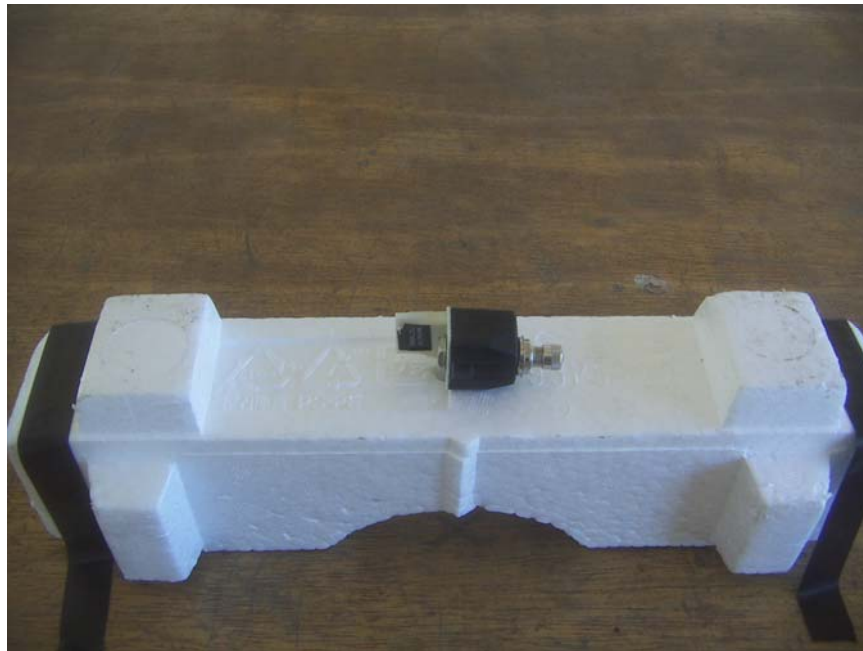
### RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION



Y-AXIS PHOTO



Z-AXIS PHOTO



**END OF REPORT**