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**Test Report:** 94640-1TRFWL


**Applicant:** Hortau Inc.  
735 rue de l'Eglise  
St-Romuald, QC  
G1N 1S7

**Apparatus:** Tx-07, Tx-35 and Tx-80

**FCC ID:** S4TIRS04183

**In Accordance With:** FCC Part 15 Subpart C, 15.231  
Periodic operation in the band 40.66-40.70MHz and  
above 70 MHz.

**Tested By:** Nemko Canada Inc.  
303 River Road  
Ottawa, Ontario  
K1V 1H2

**Authorized By:**   
Jason Nixon, Telecom/Wireless Specialist

**Date:** January 25, 2008

**Total Number of Pages:** 20

## Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

<b>Apparatus Assessed:</b>	Tx-07, Tx-35 and Tx-80
<b>Specification:</b>	FCC Part 15 Subpart C, 15.231
<b>Compliance Status:</b>	Complies
<b>Exclusions:</b>	None
<b>Non-compliances:</b>	None
<b>Report Release History:</b>	Original Release

Author: Roman Kuleba, EMC/Wireless Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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## **Section 1 : Equipment Under Test**

### **1.1 Product Identification**

The Equipment Under Test was identified as follows:

Irrolis Sense Tx, Models: Tx-07, Tx-35 and Tx-80

### **1.2 Samples Submitted for Assessment**

The following samples of the apparatus have been submitted for type assessment:

<b>Sample No.</b>	<b>Description</b>	<b>Serial No.</b>
14	Irrolis Sense Tx (Transmitter)	—

The first samples were received on: October 4<sup>th</sup>, 2007

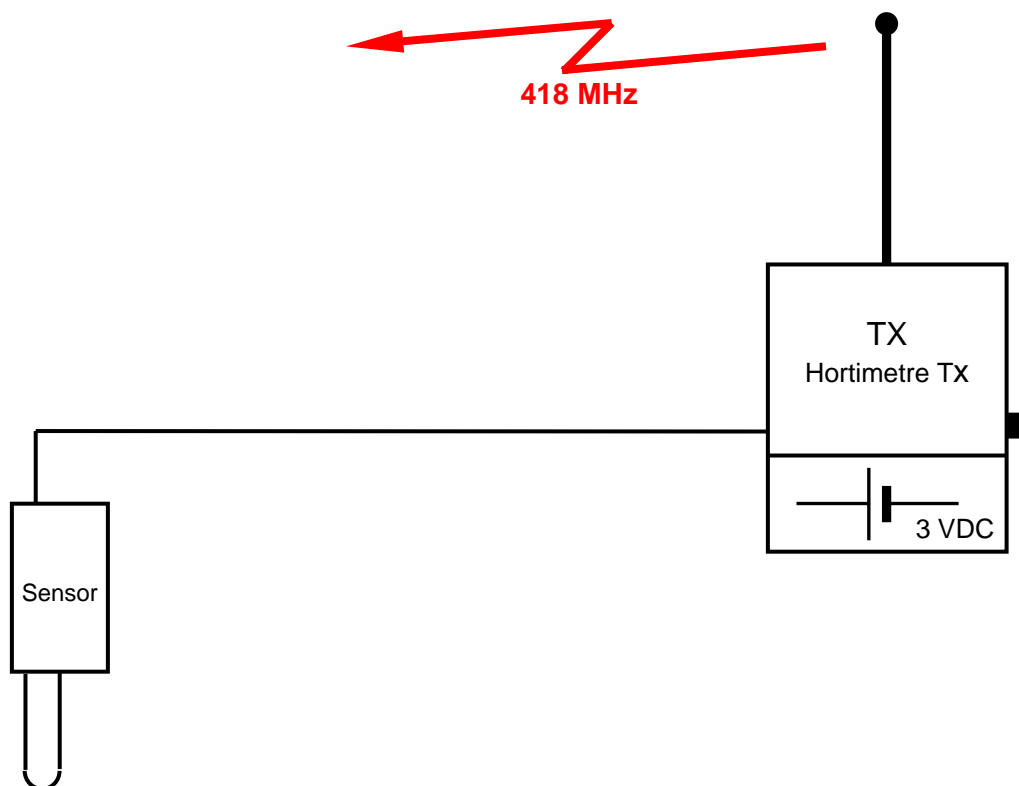
### **1.3 Theory of Operation**

The EUT is a wireless probe for soil water measurement. It delivers measurement data/information to the IRRICOM WR through wireless link operating on 418 MHz. The IRRICOM WR translates received data into RS-232 signal and sends it to PC where it can be processed by software.

## 1.4 Technical Specifications of the EUT

<b>Operating Frequency:</b>	418 MHz
<b>Emission Designator:</b>	L1D
<b>Modulation:</b>	OOK
<b>Antenna Data:</b>	Monopole (Whip)
<b>Antenna Connector:</b>	RP-SMA-M
<b>Power Source:</b>	Two 'AA' Batteries ( $2 \times 1.5$ VDC)

## 1.5 Block Diagram of the EUT



## Section 2 : Test Conditions

### 2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.231

Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

### 2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

### 2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 °C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

### 2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSU46	FA001877	Jan 16/08
RF AMP	JCA	1-2 GHz	FA001498	Aug. 21/08
RF AMP	JCA	2-4 GHz	FA001496	Aug. 21/08
RF AMP	JCA	4-8 GHz	FA001497	Aug. 21/08
Horn Antenna #2	EMCO	3115	FA000825	Jan. 30/08
Biconical (1) Antenna	EMCO	3109	FA000805	May 05/08
Log Periodic Antenna #1	EMCO	LPA-25	FA000477	Sept. 27/08

COU – Calibrate on Use

NCR – No Calibration Required

### 2.5 Measurement Uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95% and can be found in Nemko Canada document MU-003.

## **Section 3 : Observations**

### **3.1 Modifications Performed During Assessment**

To maintain emission level on the fundamental frequency (418 MHz) compliant with the standard specifications, a resistor of 1.2 k $\Omega$  was installed as LADJ-resistor between pins 3 and 4 on the RF module chip.

### **3.2 Record Of Technical Judgements**

No technical judgements were made during the assessment.

### **3.3 EUT Parameters Affecting Compliance**

The user of the apparatus could not alter parameters that would affect compliance.

### **3.4 Test Deleted**

No Tests were deleted from this assessment.

### **3.5 Additional Observations**

There were no additional observations made during this assessment.

## **Section 4 : Results Summary**

This section contains the following:

FCC Part 15 Subpart C : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N      No : not applicable / not relevant.
- Y      Yes : Mandatory i.e. the apparatus shall conform to these tests.
- N/T    Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.



**4.1 FCC Part 15 Subpart C : Test Results**

Part 15	Test Description	Required	Result
15.31(e)	Variation of Power source	N	N/A
15.207(a)	Powerline Conducted Emissions	N	N/A
15.209(a)	Radiated Emissions within Restricted Bands	YES	PASS
15.231(a)(1)	Manually operated transmitter	N	N/A
15.231(a)(2)	Automatically activated transmitter	N	N/A
15.231(a)(3)	Periodic transmissions at regular predetermined intervals	YES	PASS
15.231(a)(4)	Radiators used in cases of emergency	N	N/A
15.231(a)(5)	Set-up information for security systems	N	N/A
15.231(b)	Radiated Emissions	N	N/A
15.231(c)	20dB Bandwidth	YES	PASS
15.231(d)	Devices operating within the frequency band 40.66-40.70 MHz	N	N/A
15.231(e)	Radiated emissions for Periodic radiators	YES	PASS

Notes:

## Appendix A : Test Results

### Clause 15.209(a) Radiated Emissions within Restricted Bands

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)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

### Test Conditions:

<b>Sample Number:</b>	14	<b>Temperature (°C):</b>	15 °C
<b>Date:</b>	November 28, 2007	<b>Humidity (%):</b>	54 %
<b>Modification State:</b>	0	<b>Tester:</b>	Roman Kuleba
		<b>Laboratory:</b>	Ottawa

### Test Results:

See Attached Table for Results

### Additional Observations:

The Spectrum was searched from 30MHz to the 10<sup>th</sup> Harmonic.

These results apply to emissions found in the Restricted Bands defined in FCC Part 15 Subpart C, 15.205.

All measurements were performed using a Peak Detector with 120 kHz IF-bandwidth on frequencies below 1GHz and 1MHz RBW/VBW on frequencies above 1GHz, at a distance of 3 meters.

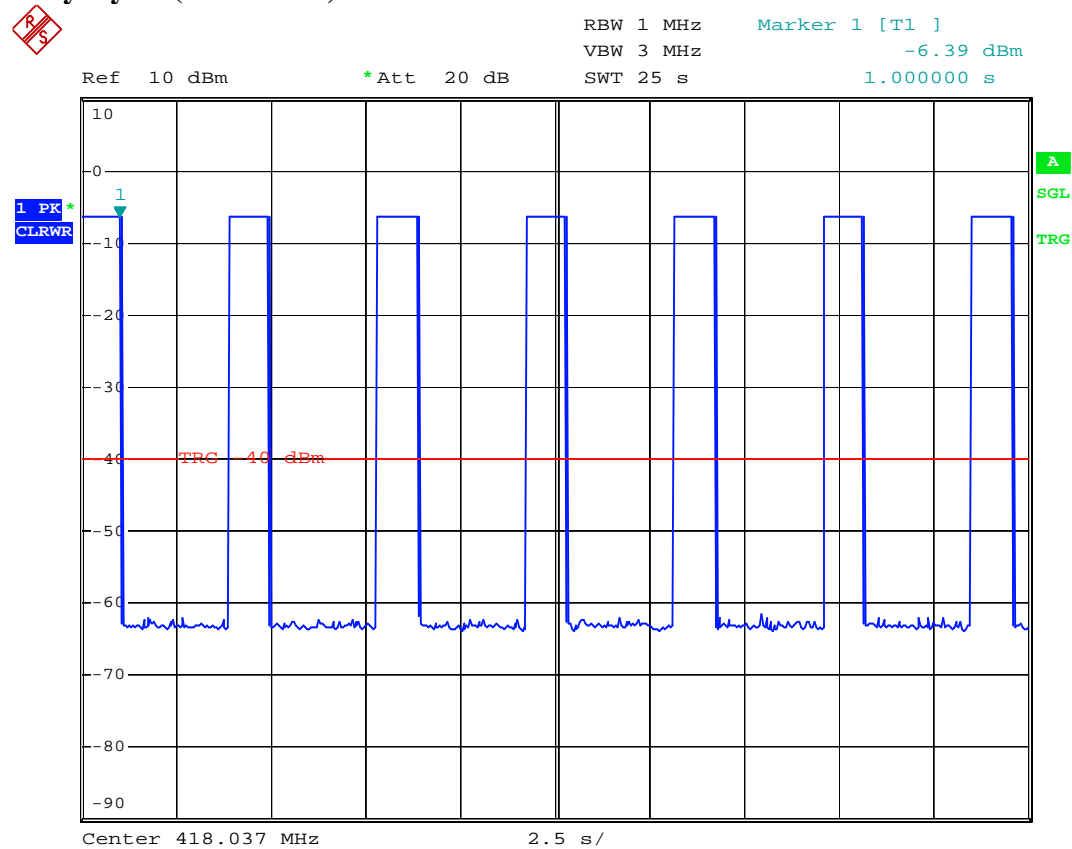
The EUT was assessed using fresh new batteries and on three orthogonal axis.

Radiated Emissions within Restricted Bands, continued

Frequency (MHz)	Antenna	Pol.	RCVD Signal (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	Duty Cycle Corr.	Cable Loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	
Peak Results												
1	3762.00	Horn1	V	58.0	32.4	55.3	0.0	7.2	42.3	74.0	31.7	Peak
2	4180.00	Horn1	V	60.0	32.5	52.4	0.0	7.6	47.7	74.0	26.3	Peak
3	3762.00	Horn1	H	45.0	32.4	55.3	0.0	7.2	29.3	74.0	44.7	Peak
4	4180.00	Horn1	H	60.0	32.3	52.4	0.0	7.6	47.6	74.0	26.4	Peak
Average Results												
5	3762.00	Horn1	V	58.0	32.4	55.3	-18.2	7.2	24.1	54.0	29.9	Peak
6	4180.00	Horn1	V	60.0	32.5	52.4	-18.2	7.6	29.5	54.0	24.5	Peak
7	3762.00	Horn1	H	45.0	32.4	55.3	-18.2	7.2	11.1	54.0	42.9	Peak
8	4180.00	Horn1	H	60.0	32.3	52.4	-18.2	7.6	29.4	54.0	24.6	Peak
Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole Note 2: Positive Peak detector used												

## Radiated Emissions within Restricted Bands, continued

## Duty Cycle (Test Mode):

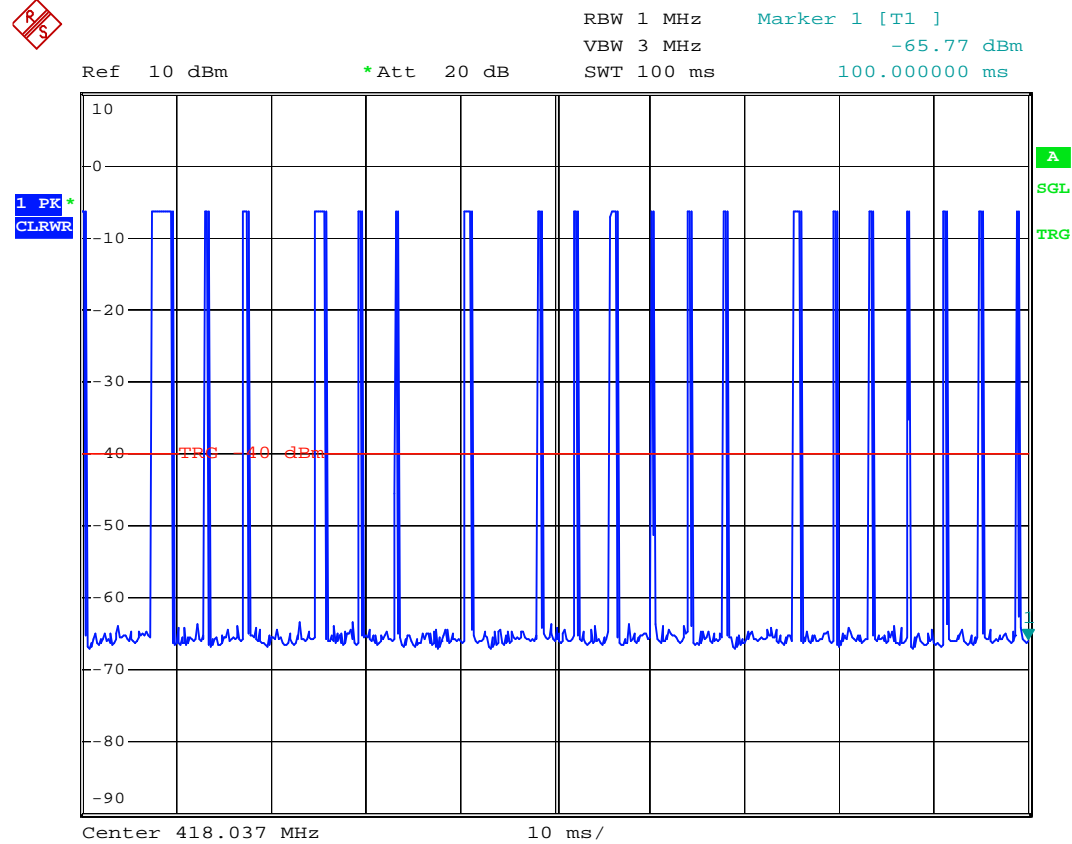


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Note: The plot above was obtained with the EUT operating (transmitting) in the test mode.  
In normal operation mode the EUT uses pulse transmission as specified in 15.231(e).

Radiated Emissions within Restricted Bands, continued

Duty Cycle:



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Radiated Emissions within Restricted Bands, continued
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**Duty Cycle:**Total TX-ON Time ( $T_{ON}$ ):

Pulse #	Pulse Duration (ms)
1	0.481
2	2.243
3	0.401
4	0.721
5	1.122
6	0.401
7	0.401
8	0.721
9	0.401
10	0.401
11	0.721
12	0.401
13	0.401
14	0.401
15	0.721
16	0.401
17	0.401
18	0.401
19	0.401
20	0.401
21	0.401
Total TX-ON Time: 12.344 ms	

$$\text{Duty Cycle Correction} = 20 \cdot \log_{10}(T_{ON}/100\text{ms})$$

$$\text{Duty Cycle Correction} = 20 \cdot \log_{10}(12.344\text{ms} / 100\text{ms}) = -18.17 \text{ dB}$$

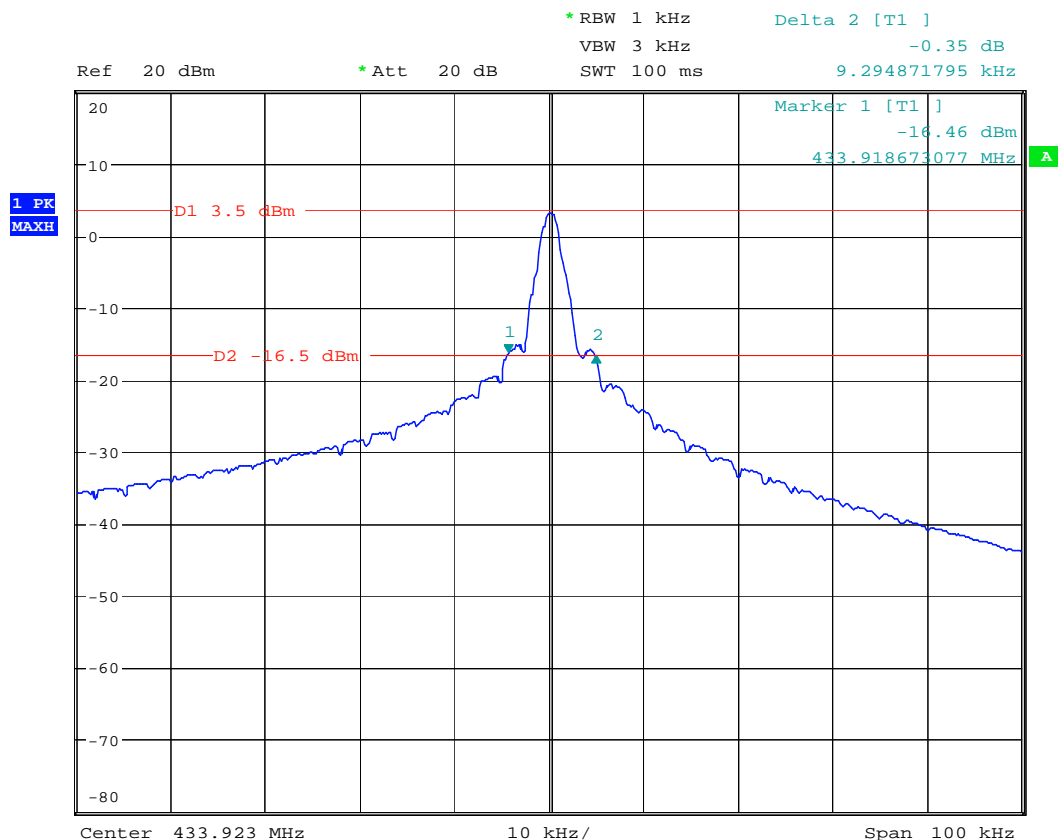
**Clause 15.231(c) 20dB Bandwidth**

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 Conditions:**

Sample Number:	14	Temperature (°C):	23 °C
Date:	November 5, 2007	Humidity (%):	45 %
Modification State:	0	Tester:	Roman Kuleba
		Laboratory:	Ottawa

**Test Results:** See plot.

**20dB Bandwidth:**

Date: 5.NOV.2007 17:17:27

**Clause 15.231(e) Radiated emissions for Periodic radiators**

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 (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	50 to 150
174-260	1,500	150
260-470	1,500 to 5,000	150 to 500
Above 470	5,000	500

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 Conditions:**

<b>Sample Number:</b>	14	<b>Temperature (°C):</b>	15 °C
<b>Date:</b>	November 28, 2007	<b>Humidity (%):</b>	54 %
<b>Modification State:</b>	0	<b>Tester:</b>	Roman Kuleba
		<b>Laboratory:</b>	Ottawa

**Test Results:**

See Attached Table for Results

**Additional Observations:**

The Spectrum was searched from 30MHz to the 10<sup>th</sup> Harmonic.

All measurements were performed using a Peak Detector with 100kHz RBW/VBW below 1GHz and a 1MHz RBW/VBW above 1GHz at a distance of 3 meters.

The EUT was assessed with fresh new batteries and on three orthogonal axis.

The EUT can use an antenna extender, which was investigated, worst case results are included.



**Peak Results**

	Frequency (MHz)	Antenna	Pol.	RCVD Signal (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	Duty Cycle Corr.	Cable Loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	418.0000	LP1	V	72.0	16.2	–	0.0	2.1	90.4	92.3	1.9	Peak
2	836.0000	LP1	V	12.0	21.9	–	0.0	3.0	36.9	72.3	35.4	Peak
3	1254.0000	Horn1	V	53.8	25.0	47.5	0.0	3.8	35.2	72.3	37.1	Peak
4	1672.0000	Horn1	V	56.8	27.1	46.9	0.0	4.4	41.4	72.3	30.9	Peak
5	2090.0000	Horn1	V	72.0	28.6	56.6	0.0	5.1	49.1	72.3	23.2	Peak
6	2508.0000	Horn1	V	62.0	30.0	58.4	0.0	5.6	39.2	72.3	33.1	Peak
7	2926.0000	Horn1	V	58.0	30.2	57.5	0.0	6.2	36.8	72.3	35.5	Peak
8	3344.0000	Horn1	V	65.0	31.3	56.5	0.0	6.7	46.5	72.3	25.9	Peak
11	418.0000	LP1	H	71.0	16.2	–	0.0	2.1	89.4	92.3	2.9	Peak
12	836.0000	LP1	H	4.0	22.5	–	0.0	3.0	29.5	72.3	42.8	Peak
13	1254.0000	Horn1	H	45.0	25.0	47.5	0.0	3.8	26.4	72.3	45.9	Peak
14	1672.0000	Horn1	H	49.5	27.2	46.9	0.0	4.4	34.2	72.3	38.1	Peak
15	2090.0000	Horn1	H	58.5	28.6	56.6	0.0	5.1	35.6	72.3	36.7	Peak
16	2508.0000	Horn1	H	54.0	30.0	58.4	0.0	5.6	31.2	72.3	41.1	Peak
17	2926.0000	Horn1	H	53.0	30.2	57.5	0.0	6.2	31.8	72.3	40.5	Peak
18	3344.0000	Horn1	H	64.0	31.3	56.5	0.0	6.7	45.5	72.3	26.8	Peak

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole

Note 2: Positive Peak detector used

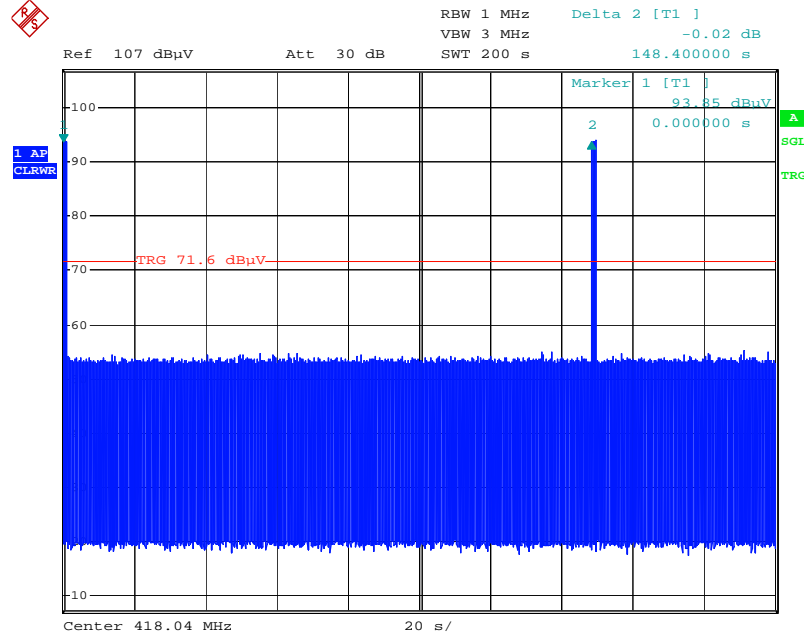
**Average results**

	Frequency (MHz)	Antenna	Pol.	RCVD Signal (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	Duty Cycle Corr.	Cable Loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	418.0000	LP1	V	72.0	16.2	–	-18.2	2.1	72.2	72.3	0.2	Peak
2	836.0000	LP1	V	12.0	21.9	–	-18.2	3.0	18.7	52.3	33.6	Peak
3	1254.0000	Horn1	V	53.8	25.0	47.5	-18.2	3.8	17.0	54.0	37.0	Peak
4	1672.0000	Horn1	V	56.8	27.1	46.9	-18.2	4.4	23.2	52.3	29.1	Peak
5	2090.0000	Horn1	V	72.0	28.6	56.6	-18.2	5.1	30.9	52.3	21.4	Peak
6	2508.0000	Horn1	V	62.0	30.0	58.4	-18.2	5.6	21.0	52.3	31.3	Peak
7	2926.0000	Horn1	V	58.0	30.2	57.5	-18.2	6.2	18.6	52.3	33.7	Peak
8	3344.0000	Horn1	V	65.0	31.3	56.5	-18.2	6.7	28.3	52.3	24.1	Peak
11	418.0000	LP1	H	71.0	16.2	–	-18.2	2.1	71.2	72.3	1.2	Peak
12	836.0000	LP1	H	4.0	22.5	–	-18.2	3.0	11.3	52.3	41.0	Peak
13	1254.0000	Horn1	H	45.0	25.0	47.5	-18.2	3.8	8.2	54.0	45.8	Peak
14	1672.0000	Horn1	H	49.5	27.2	46.9	-18.2	4.4	16.0	52.3	36.3	Peak
15	2090.0000	Horn1	H	58.5	28.6	56.6	-18.2	5.1	17.4	52.3	34.9	Peak
16	2508.0000	Horn1	H	54.0	30.0	58.4	-18.2	5.6	13.0	52.3	39.3	Peak
17	2926.0000	Horn1	H	53.0	30.2	57.5	-18.2	6.2	13.6	52.3	38.7	Peak
18	3344.0000	Horn1	H	64.0	31.3	56.5	-18.2	6.7	27.3	52.3	25.0	Peak

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole

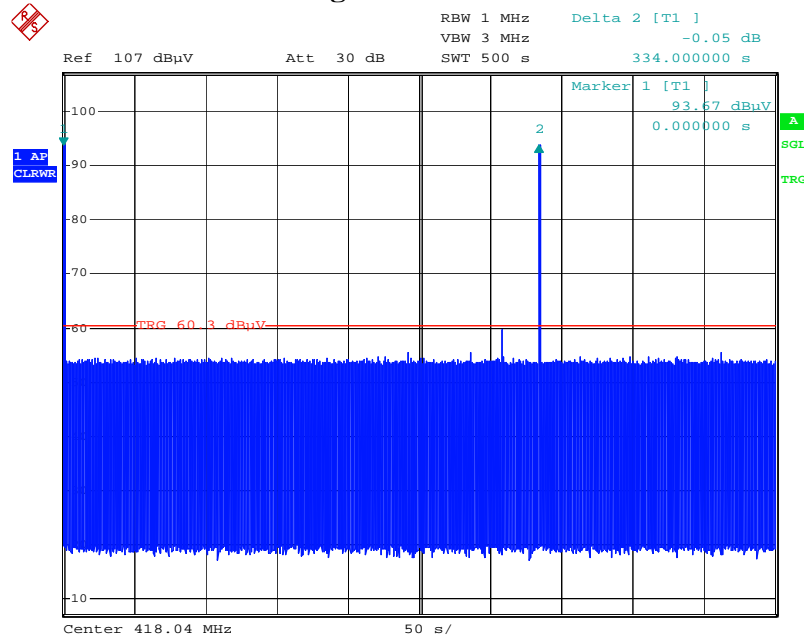
Note 2: Positive Peak detector used

## Tx-07 Timing



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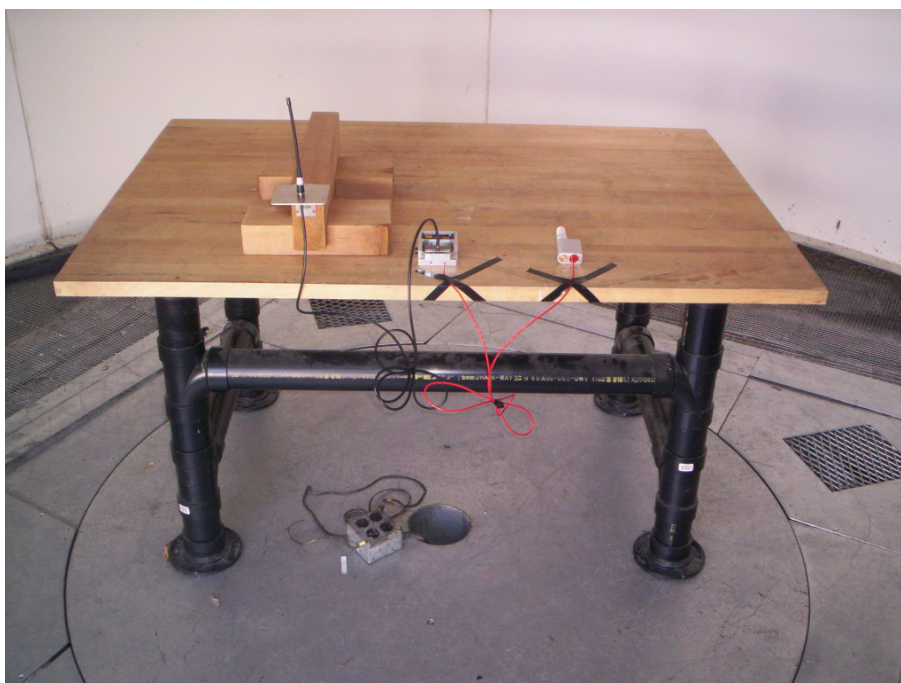
## Tx-35 and Tx-80 Timing



Date: 25.JAN.2008 16:09:55

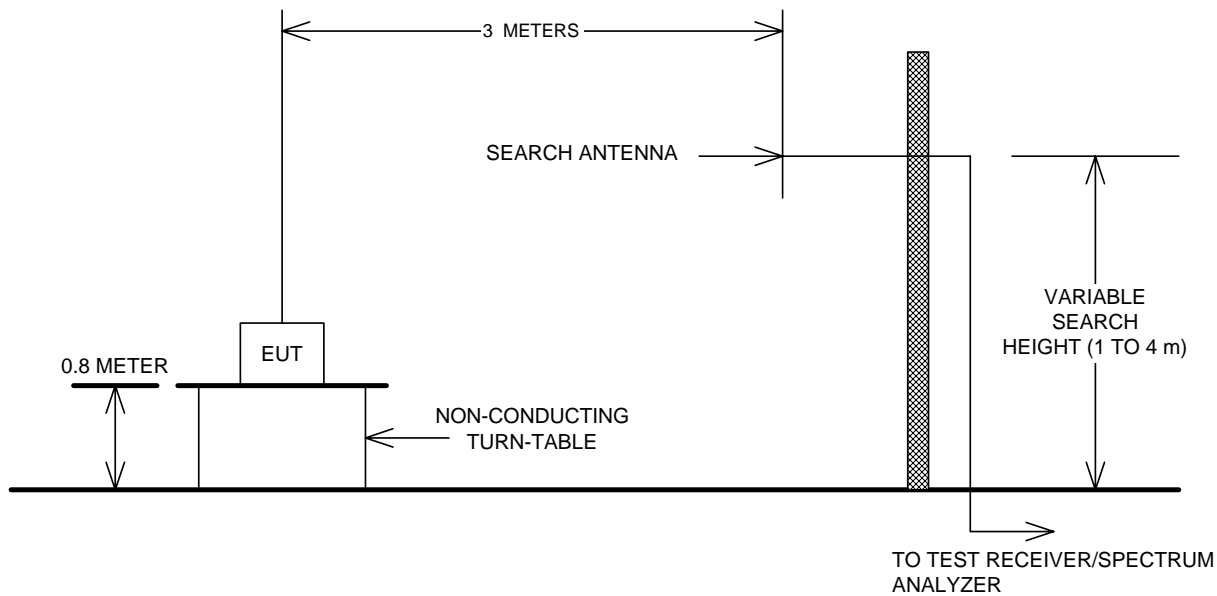
## **Appendix B : Setup Photographs**

### **Spurious Emissions Setup:**



Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions

