



**Test Report:** 6W78398 Issue 2


**Applicant:** Mark IV Industries Corp.  
6020 Ambler Drive  
Mississauga, ON  
L4W 2P1

**Apparatus:** G4E Transponder

**FCC ID:** JQU801660

**In Accordance With:** FCC Part 90  
Private Land Mobile Radio Services

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

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

**Date:** January 23, 2006

**Total Number of Pages:** 23

## Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. 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>	G4E Transponder
<b>Specification:</b>	FCC Part 90 Private Land Mobile Radio Services
<b>Compliance Status:</b>	Complies
<b>Exclusions:</b>	None
<b>Non-compliances:</b>	None
<b>Report Release History:</b>	Original Release

Author: Xu Jin, 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: G4E Transponder

### **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>
1	G4E transponder	A5MA-07B11
2	G4E transponder	A5MA-09B07

The first samples were received on: Dec.14, 2006

### **1.3 Technical Specifications of the EUT**

<b>Manufacturer:</b>	Mark IV Industries Corp.
<b>Operating Frequency:</b>	915 MHz
<b>Measured Power:</b>	Conducted: -5.2dBm ERP: -13.0dBm
<b>Modulation:</b>	On-Off Keying
<b>Antenna Data:</b>	Internal antenna etched on the PCB
<b>Power Source:</b>	3.6 VDC Battery

## Section 2: Test Conditions

### 2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures  
FCC Part 90 Private Land Mobile Radio Services

### 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	FSP	FA001920	March 17/07
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 16/07
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 16/07
Horn Antenna	EMCO	3115	FA000649	Jan. 12/07
Log Periodic Antenna	EMCO	3148	FA001355	May 16/07
Biconical Antenna	EMCO	3109	FA000805	May 03/07
Directional Coupler	ARRA Inc.	3194-6	–	COU
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	Aug 02/07
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	Aug 02/07
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	Aug 02/07
5.0 - 18GHz Amplifier	Narda	DWT-186N23U40	FA001409	COU
Fixed Attenuator 6dB	Weinschel Corp.	AS-6	FA001734	COU
Climate Chamber	Thermotron	SM-16C	15649-S	COU
Thermometer	Fluke	52 <sup>KJ</sup>	FA001247	Jan 10, 2007

COU – Cal. On Use

## **Section 3: Observations**

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

No modifications were performed during assessment.

### **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 90: 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 90: Test Results**

Clause	Test Method	Test Description	Required	Result
90.205	2.1046	Output power	Y	Complies
90.209	2.1049	Occupied Bandwidth	Y	Complies
90.210	2.1053	Spurious Emission	Y	Complies
90.213	2.1055	Frequency stability	Y	Complies

## Appendix A: Test Results

### Clause 90.205 Output Power

LMS systems operating pursuant to Subpart M of this part in the 902-927.25 MHz band will be authorized a maximum of 30 watts ERP

#### Test Conditions:

<b>Sample Number:</b>	1, 2	<b>Temperature:</b>	24 °C
<b>Date:</b>	Dec. 16, 2006	<b>Humidity:</b>	51 %
<b>Modification State:</b>	0	<b>Tester:</b>	Xu Jin
		<b>Laboratory:</b>	Ottawa

**Test Results:** Complies.

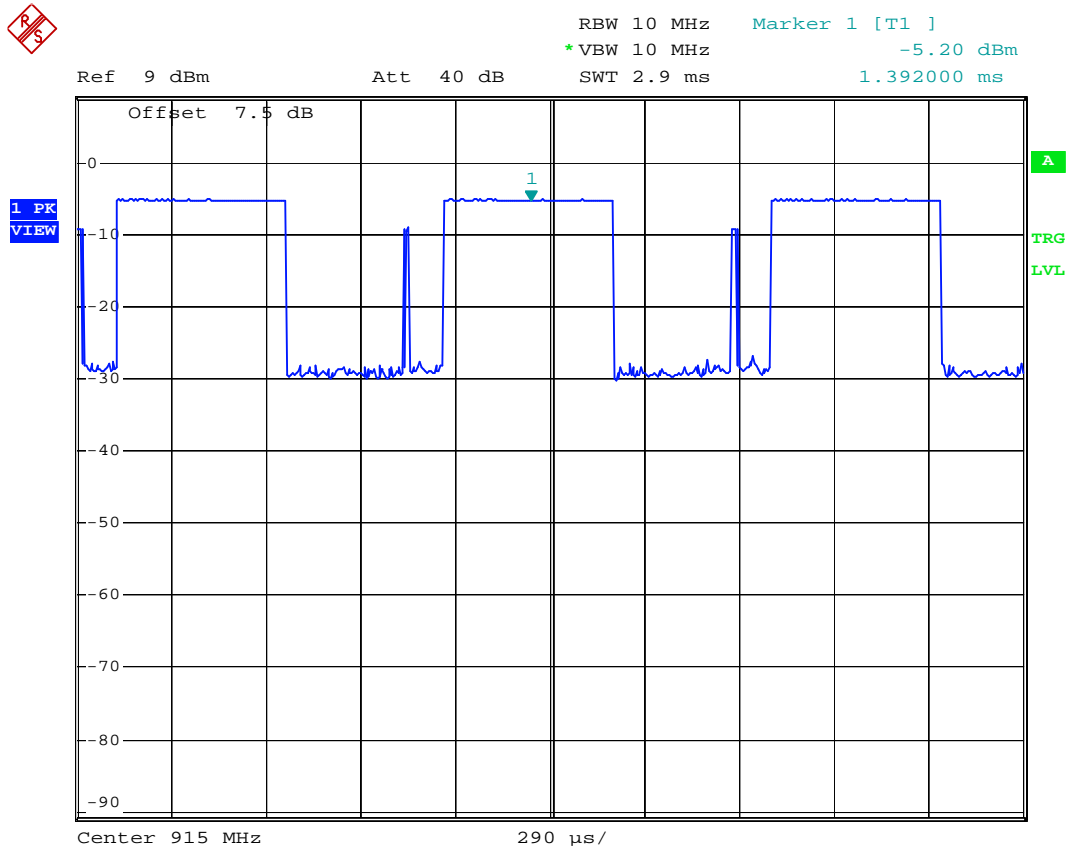
**Test Data:** See plots and table.

#### Additional Observations:

Both conducted measurement and radiated measurement have been performed for output power test.

The EUT was tested with a fresh battery.

Conducted Output Power Measurement:



Date: 15.DEC.2006 18:56:14

The maximum measured conducted output power = -5.2dBm

**Radiated Output power Measurement (ERP)**

The EUT was tested with a fresh battery.

For radiated measurement, the EUT was searched in 3 orthogonal axes to determine worst-case emissions.

The signal substitution method was used to determine the out power level (ERP).

The radiated test was performed using a Peak Detector with 10MHz/10MHz RBW/VBW, at a distance of 3 meters.

**Radiated Output power Measurement Data (ERP)**

Frequency (MHz)	Antenna	Polarity	RCVD Signal (dBµV)	Sig. Sub. Factor (dB)	ERP (dBm)	Limit (dBm)	Margin (dB)	Detector
915.0000	LP	H	55.1	-72.8	-17.7	44.77	62.47	Peak
915.0000	LP	V	59.6	-72.7	-13.0	44.77	57.77	Peak

RF Output Signal Level (ERP)= Receiver Signal Level + Signal Substitution Factor.

Signal Substitution Factor = Reference signal level from signal generator  
-Reference signal level received from spectrum analyzer reading  
+Antenna gain  
-Cable loss

**Clause 90.209 Occupied Bandwidth**

(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following Table.

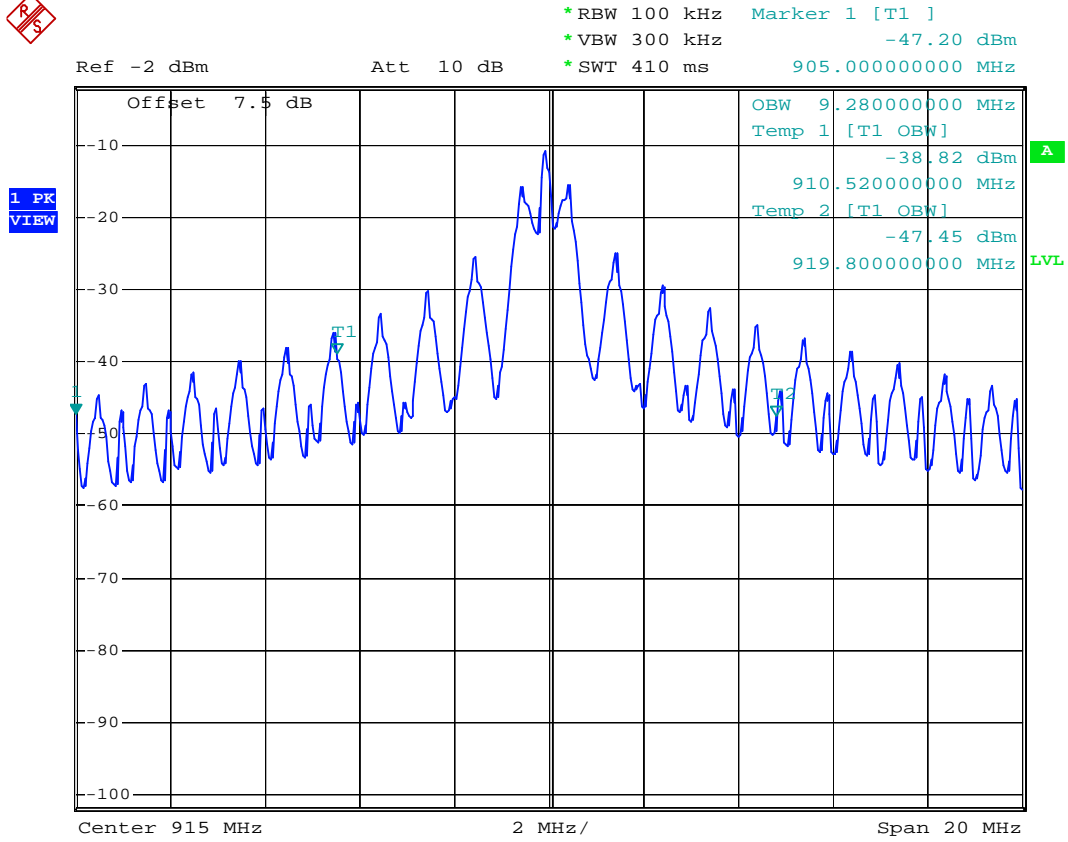
Standard Channel Spacing/Bandwidth

Frequency Band (MHz)	Channel Spacing (kHz)	Authorized Bandwidth (kHz)
Below 25	--	--
25-50	20	20
72-76	20	20
150-174	7.5	20/11.25/6
216-220	6.25	20/11.25/6
220-222	5	4
406-512	6.25	20/11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	20
896-901/935-940	12.5	13.6
902-928	--	--
929-930	25	20
1427-1432	12.5	12.5
2450-2483.5	--	--
Above 2500	--	--

<b>Sample Number:</b>	1, 2	<b>Temperature:</b>	24 °C
<b>Date:</b>	Dec. 16, 2006	<b>Humidity:</b>	51 %
<b>Modification State:</b>	0	<b>Tester:</b>	Xu Jin
		<b>Laboratory:</b>	Ottawa

**Test Results:** Complies.

**Test Data:** The Occupied Bandwidth is 9.28MHz (see attached plot).



Date: 15.DEC.2006 19:05:46

**Clause 90.210 Spurious Emissions**

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere, the Table below specifies the emission masks for equipment operating in the frequency bands governed under this part.

**Test Conditions:**

<b>Sample Number:</b>	1,2	<b>Temperature:</b>	24 °C
<b>Date:</b>	Dec 16, 2006	<b>Humidity:</b>	51 %
<b>Modification State:</b>	0	<b>Tester:</b>	Xu Jin
		<b>Laboratory:</b>	Ottawa

**Test Results:** Complies

**Test Data:** See Attached Plots and tables.

**Note:**

Both conducted measurement and radiated measurement have been performed for spurious emissions tests.

The EUT was tested with a fresh battery.

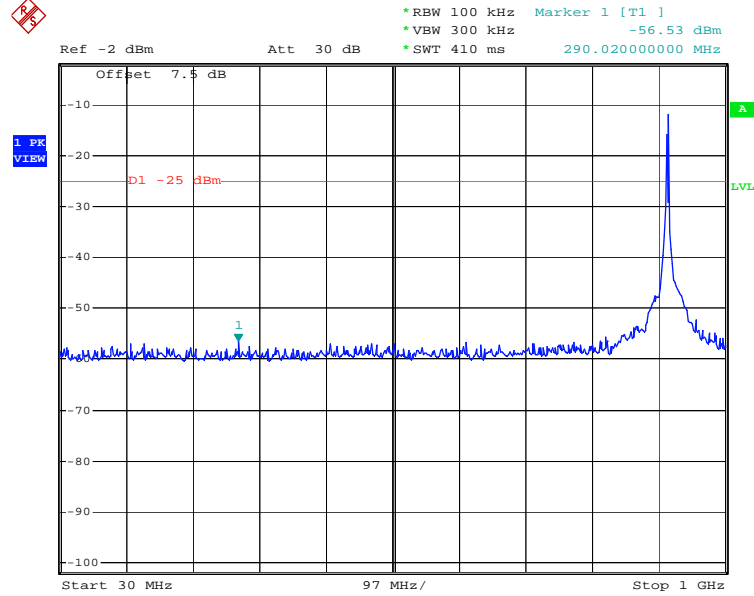
The EUT was searched in 3 orthogonal axes to determine worst-case emissions.

The spectrum was searched for emissions from 30MHz to 10GHz.

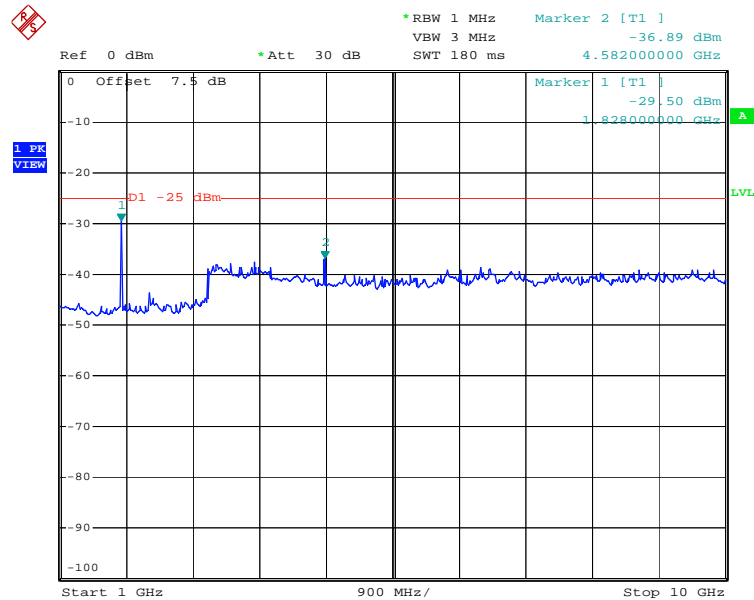
All measurements were performed using a Peak Detector with 100kHz/300KHz RBW/VBW below 1GHz and a 1MHz/3MHz RBW/VBW above 1GHz, at a distance of 3 meters.

Only the worst case has been presented.

### Conducted Emissions\_ Tx was operated at 915MHz

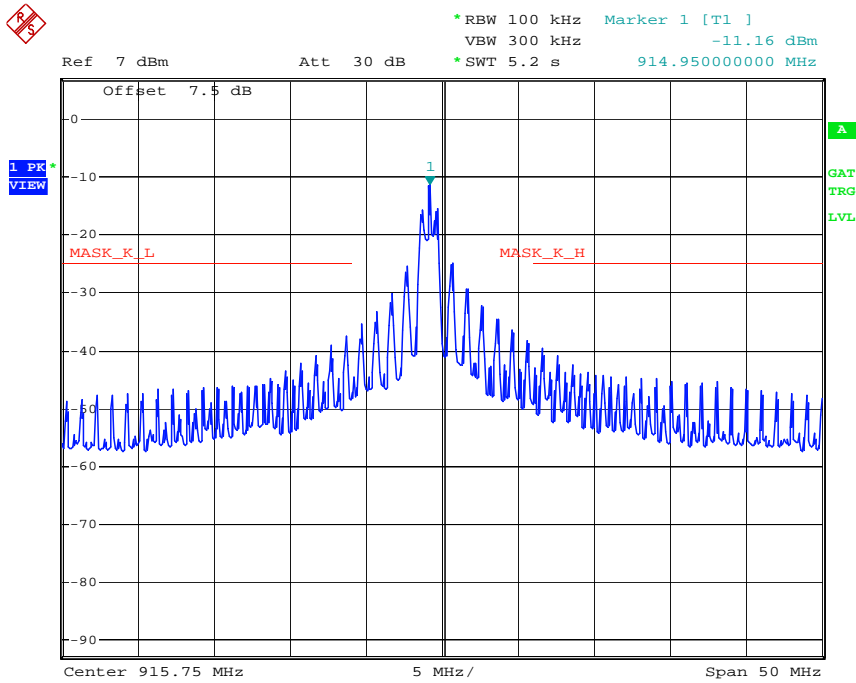


Date: 15.DEC.2006 19:12:21



Date: 23.JAN.2007 10:42:26





Date: 16.DEC.2006 00:21:33

**Radiated Spurious Emissions**

<b>Frequency (MHz)</b>	<b>Antenna</b>	<b>Polarity</b>	<b>RCVD Signal (dBµV)</b>	<b>Sig. Sub. Factor</b>	<b>Emission Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Detector</b>
1830.0000	Horn2	H	65.9	-114.8	-48.9	-25	23.9	Peak
1830.0000	Horn2	V	73.8	-115.8	-42.0	-25	17	Peak
2745.0000	Horn2	H	72.7	-123.6	-50.9	-25	25.9	Peak
2745.0000	Horn2	V	75.0	-121.8	-46.8	-25	21.8	Peak

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole  
 Note 2: Detector Legend: Q-Peak = 120 kHz RBW, Average = 1.0 MHz RBW  
 Below 1GHz, Peak detector with 100 kHz RBW, 100KHz VBW  
 Above 1GHz, Peak detector with 1.0MHz RBW, 1.0MHz VBW

**Clause 90.213 Frequency Stability**

a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following Table.

Minimum Frequency Stability  
parts per million (ppm)

Frequency range (MHz)	Fixed and base stations 2 watts output power	Mobile stations Over power	2 watts or less output
Below 25	100	100	200
25-50	20	20	50
72-76	5	---	50
150-174	50	5	50
216-220	1.0	---	1.0
220-222	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5

Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency stability restrictions.

929-930	1.5	---	---
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450	---	---	---

**Test Conditions:**

<b>Sample Number:</b>	1,2	<b>Temperature:</b>	23°
<b>Date:</b>	Dec. 18, 2006	<b>Humidity:</b>	51%
<b>Modification State:</b>	0	<b>Tester:</b>	Xu Jin
		<b>Laboratory:</b>	Ottawa

**Test Results:** See Attached Table.

**Test Conditions** Ambient Temperature: 23°C  
Extreme Temperature: -30°C to +50°C  
The EUT was tested with a fresh battery.

**Test Data:** See Attached tables

Note: Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency stability restrictions.

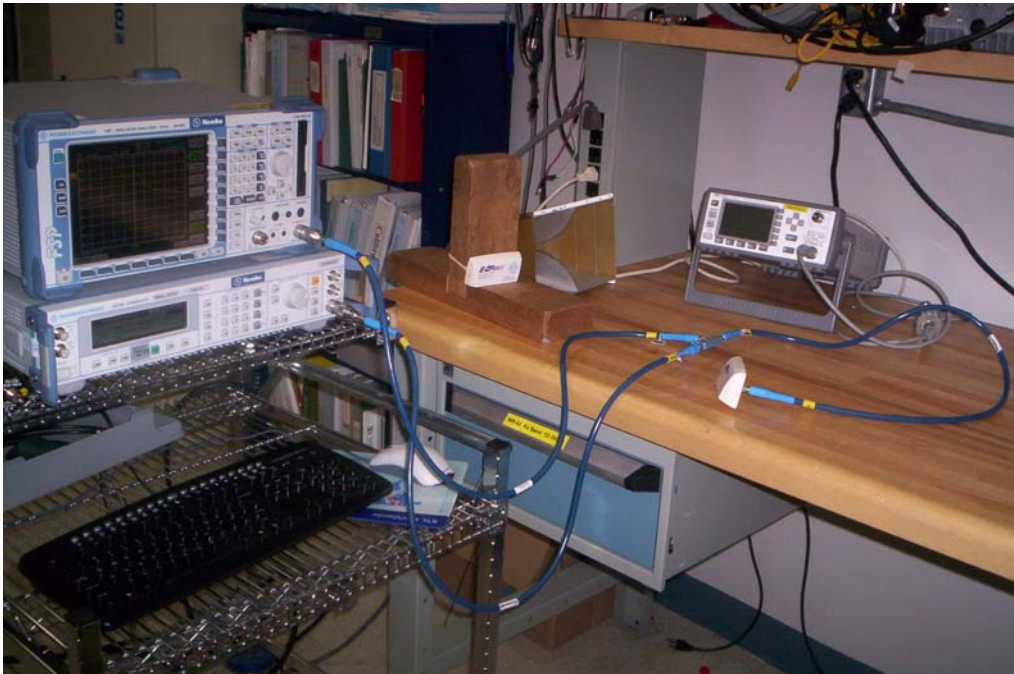
Temperature (°C)	Measured Frequency (MHz)	Frequency Draft (PPM)
Ambient	914.9219009	---
50	914.8905974	-34.21
40	914.9038841	-19.69
30	914.9155645	-6.93
20	914.9226511	0.82
10	914.9280860	6.76
0	914.9238340	2.11
-10	914.9119572	-10.87
-20	914.8968524	-27.38
-30	914.8653518	-61.81

## Appendix B: Set-up Photographs

### Radiated Emissions Setup:



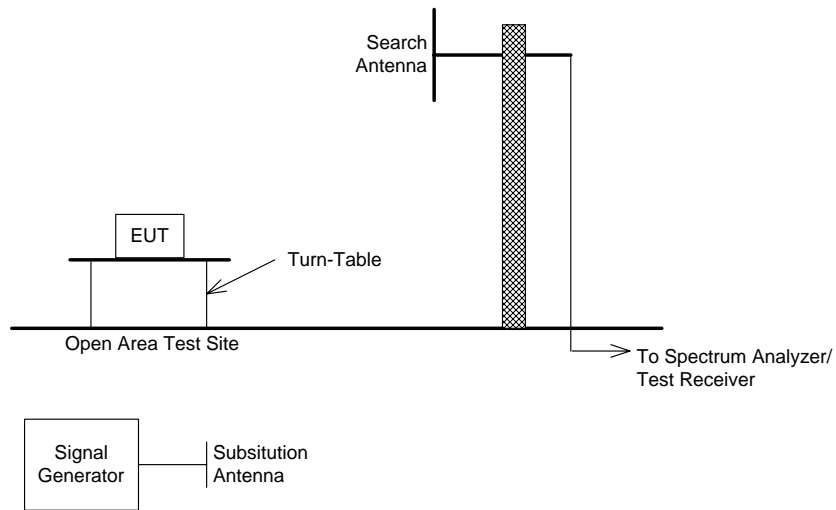
### Conducted Measurement Setup:



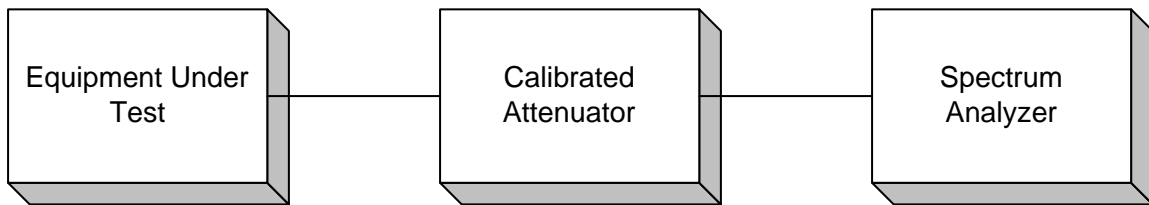
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## Appendix C : Block Diagram of Test Setups

### Effective Radiated Power of Spurious Emissions by Substitution Method (TIA/EIA 603)



**RF Conducted Emissions**



**Frequency Stability (Para. No. 2.1055)**

