



EMISSIONS TEST REPORT

Report Number: 3159179BOX-001a

Project Number: 3159179

Testing performed on the

Transmitter

Model: RT30

To

FCC Part 15 Subpart C Section 15.249

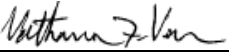
FCC Part 15 Subpart B

For


Extech Instruments Corp

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
Extech Instruments Corp
285 Bear Hill Road
WALTHAM, MA 02454

Prepared by: 
Vathana Ven

Date: 12/19/08

Reviewed by: 
Jeff Goulet

Date: 12/19/08

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: Extech Instruments Corp
285 Bear Hill Road
WALTHAM, MA 02454
Contact: Mr. Roger Mavrides
Telephone: (781) 890-7440 ext. 152
Fax: (781) 890-7864
Email: roger.mavrides@extech.com

1.2 Equipment Under Test

Equipment Type: Transmitter
Model Number(s): RT30
Serial number(s): H075232
Manufacturer: Extech Instruments Corp
EUT receive date: 08/13/ 2008
EUT received condition: Production unit was received with no visible damage.
Test start date: 08/18/2008
Test end date: 08/19/2008

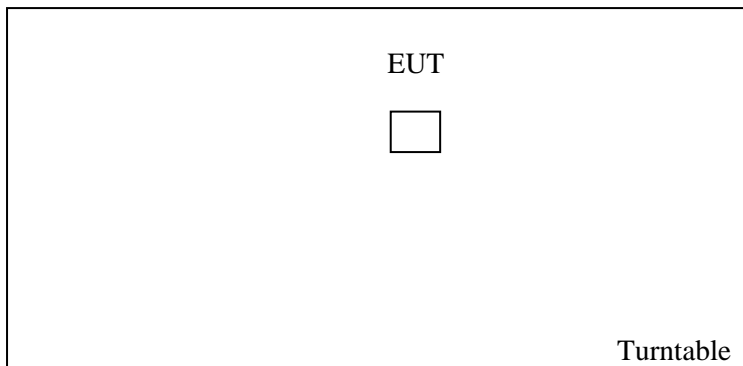
1.3 Test Plan Reference: FCC Part 15 Subpart C Section 15.249

1.4 Test Configuration:

1.4.1 EUT Voltage Range:

Battery operated

1.4.2 Block Diagram:





1.4.3 Cables:

Cable	Shielding	Connector	Length (m)	Qty.
Sensor	None	Plastic	>3	1

1.4.4 Support Equipment:

None

1.5 Mode(s) of Operation:

The transmitter was always broadcasting data burst duration of 10 msec 4 times per second.

1.5a EUT Cycle Time:

Continuous



2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C Section 15.249		
SUB-TEST	TEST PARAMETER	COMMENT
15.249(a) – Fundamental Field Strength	902–928 MHz: The field strength of emission within this band shall not exceed 50 (millivolts/meter) or 94 (dBuV/m) at a distance of 3 meters	Pass
15.249(a) – Harmonics Field Strength	The field strength of harmonics shall not exceed 500 (microvolts/meter) or 54 (dBuV/m) at a distance of 3 meters	Pass
15.249(d) – Spurious Field Strength	FCC Part 15 Subpart B Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.	Pass
15.207 – AC Line-Conducted Emissions	Not Applicable – Battery power	
20 dB Bandwidth	No limit	

REVISION SUMMARY – The following changes have been made to this Report:

<u>Date</u>	<u>Project</u> <u>No.</u>	<u>Project</u> <u>Handler</u>	<u>Page(s)</u>	<u>Item</u>	<u>Description of Change</u>
12/19/08	3159179	Vathana Ven	12	1	Corrected QP limit

3.0 Sample Calculations

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:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m}$$

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:

± 3.5 dB at 10m, ± 3.8 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

The expanded uncertainty ($k = 2$) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 3.2 for ISN and voltage probe measurements

± 3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.



Test Results: Pass

Test Standard: FCC Part 15 Subpart C Section 15.249

Test: Fundamental Field Strength

Performance Criterion: Not Applicable

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	21	Humidity (%):	57	Pressure (hPa):	1005
Pretest Verification Performed	Yes	Equipment under Test:		RT30		
Test Engineer(s):	Vathana Ven		EUT Serial Number:		H075232	

Maximum Test Disturbance Parameters: Emissions below 15.249(a)

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009
2	ANTENNA	EMCO	3142	9711-1223	02/22/2009
3	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008
4	4 Line Digital Barometer *	Mannix	0ABA116	SAF291	01/30/2009

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision

Test Details:

Test Point	Standard Limit (as published)	Compliance Level	Pass/Fail	Comment
Around the EUT	Specified limits	Below specified limits	Pass	None

Test Results:

Fundamental Field Strength

Special Radiated Emissions

Company: Exttech Instruments Corp
 Model #: RT30
 Serial #: H075232
 Engineers: Vathana Ven
 Project #: 3159179
 Standard: FCC Part 15 Subpart C 15.249
 Receiver: R&S FSEK-30 (ROS001)/R&S ESCI (ROS002)
 PreAmp: PRE9 03-27-09.txt
 PreAmp Used? (Y or N): N
 Date(s): 08/18/08
 Location: Site 2
 Temp/Humidity/Pressure: 21 deg. C 57% 1005 mB
 Antenna & Cables: N Bands: N, LF, HF, SHF
 Antenna: LOG2 2-22-09 V3m.txt LOG2 2-22-09 H3m.txt
 Cable(s): S2 3M FLR 9-17-08.txt NONE.
 Barometer: SAF291
 Limit Distance (m): 3
 Test Distance (m): 3
 Voltage/Frequency: Battery
 Frequency Range: 914.094 MHz
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS: NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
Max PK	H	914.094	68.4	24.1	4.5	0.0	20.0	77.0	94.0	-17.0	120/300 kHz
AVG	H	914.094	34.0	24.1	4.5	0.0	0.0	62.6	74.0	-11.4	120/300 kHz

FCC IC Harmonic?

Notes: A maximum average factor of 20 dB was applied to Maxh PK readings to get AVG readings.



Test Results: Pass

Test Standard: FCC Part 15 Subpart C Section 15.249 and FCC Part 15 Subpart B

Test: Harmonics/Spurious Field Strength

Performance Criterion: Not Applicable

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	21	Humidity (%):	66	Pressure (hPa):	1000
Pretest Verification Performed	Yes		Equipment under Test:	RT30		
Test Engineer(s):	Vathana Ven		EUT Serial Number:	H075232		

Maximum Test Disturbance Parameters: Emissions below 15.249(a), 15.249(d) and 15.209

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	HORN ANTENNA	EMCO	3115	9610-4980	03/03/2009
2	4 Line Digital Barometer *	Mannix	0ABA116	SAF291	01/30/2009
3	Spectrum Analyzer 20Hz - 40 GHz	Rohde & Schwartz	FSEK-30	100225	11/26/2008
4	40GHz Cable	Megaphase	TM40-K1K1-197	7030801 001	06/05/2009
5	40 GHz Cable	Megaphase	TM40-K1K1-197	7030801 002	06/05/2009
6	100MHz-40GHz Preamp	MITEQ	NSP4000-NFG	1260417	03/27/2009
7	3GHz High Pass Filter	Reactel, Inc	7HSX-3G/18G-S11	06-1	09/18/2008
8	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009
9	ANTENNA	EMCO	3142	9711-1223	02/22/2009
10	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008

Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	3/07/07 Revision



Test Details:

Test Point	Standard Limit (as published)	Compliance Level	Pass/Fail	Comment
Around the EUT	Specified limits	Below specified limits	Pass	None



Test Results:

Radiated Emissions From 30-1000MHz

Radiated Emissions

Company: Exttech Instruments Corp
Model #: RT30
Serial #: H075232
Engineers: Vathana Ven
Project #: 3159179
Standard: FCC Part 15 Subpart C 15.249
Receiver: R&S FSEK-30 (ROS001)/R&S ESCI (ROS002)
PreAmp: PRE9 03-27-09.txt
Antenna & Cables: N Bands: N, LF, HF, SHF
Antenna: LOG2 2-22-09 V3m.txt LOG2 2-22-09 H3m.txt
Cable(s): S2 3M FLR 9-17-08.txt NONE.
Barometer: SAF291
Location: Site 2
Date(s): 08/18/08
Temp/Humidity/Pressure: 21 deg. C 66% 1000 mB
Limit Distance (m): 3
Test Distance (m): 3
PreAmp Used? (Y or N): N Voltage/Frequency: Fresh Battery Frequency Range: 30 MHz - 1 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
QP	V	30.000	-7.0	17.1	0.6	0.0	0.0	10.7	40.0	-58.8	120/300 kHz
QP	V	150.000	-1.0	11.6	1.5	0.0	0.0	12.1	43.5	-31.4	120/300 kHz
QP	V	250.000	3.3	14.1	2.0	0.0	0.0	19.4	46.0	-26.6	120/300 kHz
QP	V	350.000	-3.0	16.8	2.5	0.0	0.0	16.3	46.0	-29.7	120/300 kHz
QP	V	600.000	7.5	21.8	3.4	0.0	0.0	32.7	46.0	-13.3	120/300 kHz
QP	V	900.000	-3.0	24.0	4.4	0.0	0.0	25.5	46.0	-20.5	120/300 kHz

FCC

IC

Harmonic?

Noise Floor

Noise Floor

RB

RB

Noise Floor

Noise Floor

Noise Floor



Test Results Continued:

Radiated Emissions From 1-9.14GHz Special Radiated Emissions

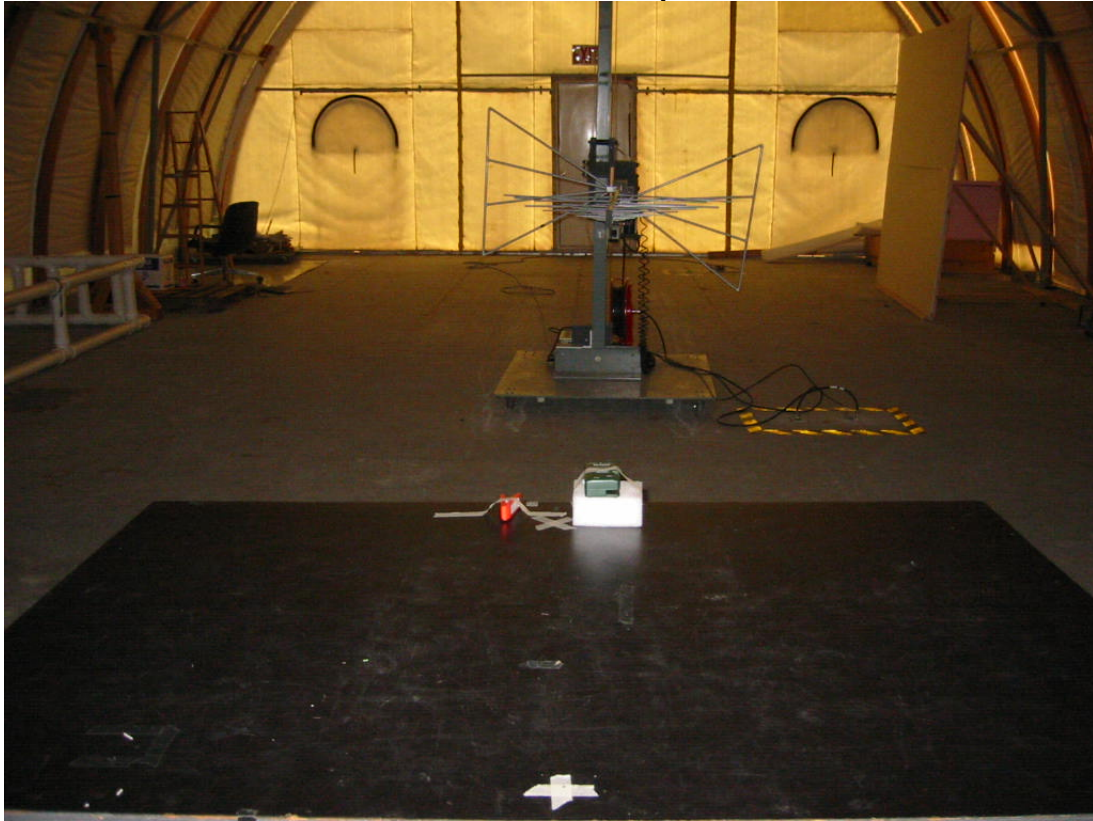
Company: Exttech Instruments Corp
Model #: RT30
Serial #: H075232
Engineers: Vathana Ven
Project #: 3159179
Standard: FCC Part 15 Subpart C 15.249
Receiver: R&S FSEK-30 (ROS001)/R&S ESCI (ROS002)
PreAmp: PRE9 03-27-09.txt
PreAmp Used? (Y or N): Y
Limit Distance (m): 3
Test Distance (m): 3
Voltage/Frequency: Battery
Frequency Range: 1-9.14 GHz
Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: HF Bands: N, LF, HF, SHF
Antenna: HORN3 V3m 3-03-09.txt HORN3 H3m 3-03-09.txt
Cable(s): MEG001.txt MEG002.txt
Barometer: SAF291
Location: Site 2
Temp/Humidity/Pressure: 21 deg. C 57% 1005 mB

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth	FCC	IC	Harmonic?
MaxPK	V	1828.188	61.5	26.9	5.1	29.1	20.0	44.3	74.0	-29.7	120/300 kHz			
AVG	V	1828.188	23.0	26.9	5.1	29.1	0.0	25.8	54.0	-28.2	120/300 kHz			
MaxPK	H	2742.260	59.4	29.4	6.4	29.2	20.0	46.0	54.0	-8.0	120/300 kHz	RB	RB	
AVG	H	2742.260	12.0	29.4	6.4	29.2	0.0	18.6	54.0	-35.4	120/300 kHz	RB	RB	
MaxPK	H	3655.093	51.3	31.6	7.5	29.2	20.0	41.2	54.0	-12.8	120/300 kHz	RB	RB	
AVG	H	3655.093	27.0	31.6	7.5	29.2	0.0	36.9	54.0	-17.1	120/300 kHz	RB	RB	
MaxPK	H	4570.500	42.3	32.8	8.6	29.3	20.0	34.4	54.0	-19.6	120/300 kHz	RB	RB	
AVG	H	4570.500	25.0	32.8	8.6	29.3	0.0	37.1	54.0	-16.9	120/300 kHz	RB	RB	
MaxPK	H	5484.276	47.1	35.1	9.5	29.1	20.0	42.6	74.0	-31.4	120/300 kHz			
AVG	H	5484.276	27.0	35.1	9.5	29.1	0.0	42.5	54.0	-11.5	120/300 kHz			
MaxPK	H	6398.486	46.0	34.7	10.4	28.7	20.0	42.4	74.0	-31.6	120/300 kHz			
AVG	H	6398.486	26.0	34.7	10.4	28.7	0.0	42.4	54.0	-11.6	120/300 kHz			
MaxPK	H	7312.000	33.7	36.3	11.3	28.4	20.0	32.9	54.0	-21.1	120/300 kHz	RB	RB	
AVG	H	7312.000	22.5	36.3	11.3	28.4	0.0	41.7	54.0	-12.3	120/300 kHz	RB	RB	
MaxPK	H	8227.227	38.7	37.2	12.1	28.0	20.0	40.0	54.0	-14.0	120/300 kHz	RB	RB	
AVG	H	8227.227	24.8	37.2	12.1	28.0	0.0	46.1	54.0	-7.9	120/300 kHz	RB	RB	
MaxPK	H	9141.950	34.8	38.7	12.9	27.6	20.0	38.7	54.0	-15.3	120/300 kHz	RB	RB	
AVG	H	9141.950	22.0	38.7	12.9	27.6	0.0	45.9	54.0	-8.1	120/300 kHz	RB	RB	

Notes: A maximum average factor of 20 dB was applied to Maxh PK readings to get AVG readings.

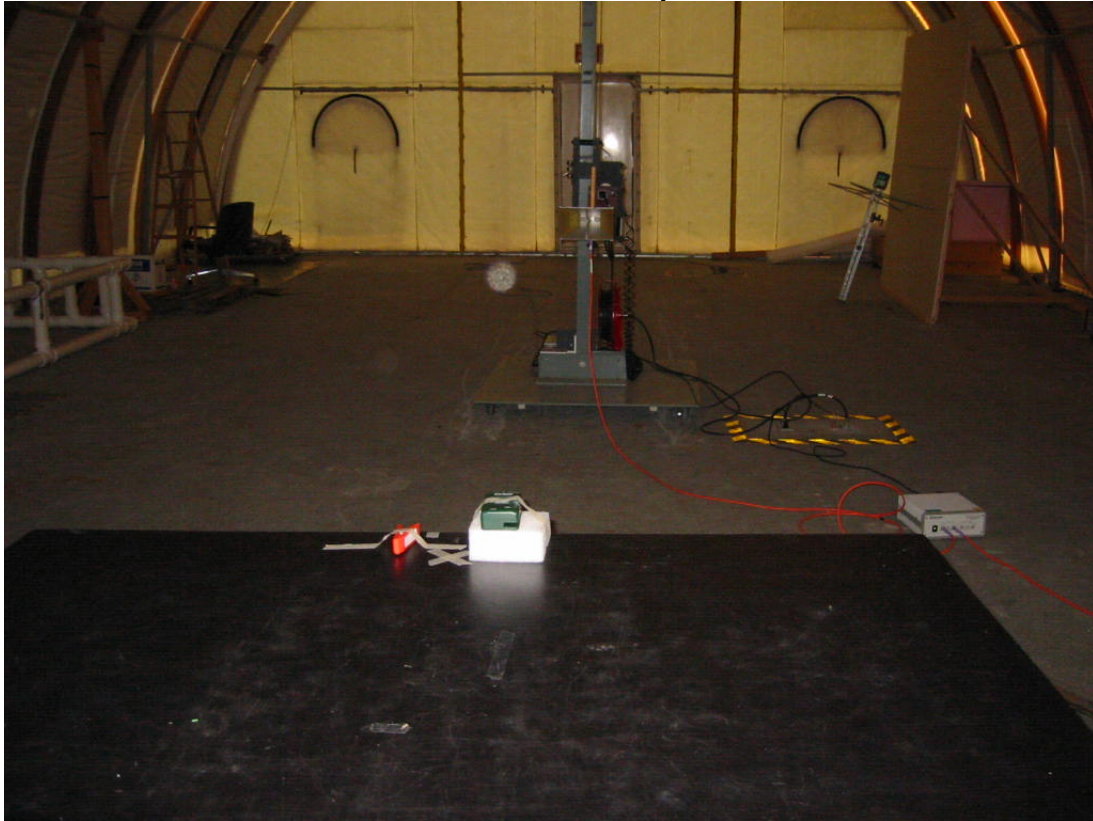
Radiated Emissions Setup Photo 1



Radiated Emissions Setup Photo 2



Radiated Emissions Setup Photo 3



Radiated Emissions Setup Photo 4





Test Results: No limit

Test Standard: FCC Part 15 Subpart C Section 15.249

Test: 20 dB Bandwidth

Performance Criterion: Not Applicable

Test Environment:

Environmental Conditions During Testing:	Ambient (°C):	21	Humidity (%):	66	Pressure (hPa):	1000
Pretest Verification Performed	Yes		Equipment under Test:	RT30		
Test Engineer(s):	Vathana Ven		EUT Serial Number:	H075232		

Maximum Test Disturbance Parameters: No limit

Test Equipment Used:

TEST EQUIPMENT LIST					
Item	Equipment Type	Make	Model No.	Serial No.	Next Cal. Due
1	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	01/25/2009
2	ANTENNA	EMCO	3142	9711-1223	02/22/2009
3	3 Meter In floor cable for site 2	ITS	RG214B/U	S2 3M FLR	09/17/2008
4	4 Line Digital Barometer *	Mannix	0ABA116	SAF291	01/30/2009

Test Details:

Test Point	Standard Limit (as published)	Compliance Level	Pass/Fail	Comment
Fundamental Frequency	No limit	No limit	No limit	None



Date: 18.AUG.2008 09:25:19