

EMISSION TEST REPORT

Report Number: 3082153BOX.002

Project Number: 3082153

Testing performed on the:

Transmitter

Model: M102

To:

Basic Standards from FCC Part 15 Subpart C, Section 231

and

FCC Part 15 Subpart B, Class B

For:

Timex Communication

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

Test Authorized by:
Timex Communication
555 Christian Road
PO Box 310
Middlebury, CT 06762

Prepared by: Vathana F. Ven
Vathana F. Ven

Date: 12/12/05

Reviewed by: Roland W. Gubisch
Roland W. Gubisch

Date: 12-20-2005

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company:	Timex Communication 555 Christian Road PO Box 310 Middlebury, CT 06762
Contact:	John Davino
Telephone:	(203) 346-4340
Fax:	(203) 346-7146
Email:	jdavino@timex.com

1.2 Equipment Under Test

Equipment Type:	Transmitter
Model Number(s):	M102
Serial number(s):	404C
Manufacturer:	Timex Communication
EUT receive date:	12/7/05
EUT received condition:	Good
Test start date:	12/7/05
Test end date:	12/9/05

1.3 Test Plan Reference: ANSI C63.4:2003

1.4 Test Configuration

1.4.1. Cables:

None - The unit powered from a fully charged battery.

1.4.2. Support Equipment:

None

1.4.2 Modifications Required For Compliance:

None

1.5 Mode(s) of Operation:

The device was wired to transmit continuously for the entire emission testing.

1.5.1 EUT Cycle Time:

Continuously on.

2.0 Test Summary

TEST STANDARD		RESULTS	
Basic Standards from FCC Part 15 Subpart C, Section 231 & FCC Part 15 Subpart B, Class B			
SUB-TEST	TEST PARAMETER	COMMENT	
FCC Part 15 Subpart C, Section 231	Per Standard Specifications	Pass	
FCC Part 15 Subpart B, Class B	Per Standard Specifications	Pass	

3.0 Test Results: Pass

3.1 Test Standard: Basic Standards from FCC Part 15 Subpart C, Section 231

3.2 Test: Radiated emissions

3.3 Performance Criterion: Not Applicable

3.4 Test Environment:

Temperature: 18 °C

Humidity: 29 %

Pressure: 1010 mbar

3.5 Maximum Test Disturbance Parameters: Per Standard Specifications

Test Date: 12/7/2005 & 12/9/ 2005 **Test Engineer Initial:** VFV **Date:** 12/12/05

Test Engineer: Vathana Ven **Reviewer Initial:** RWB **Date:** 12-20-2005

3.6 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
LOG2	EMCO	3142	9711-1223	12/13/2005
S2 10M FLR	ITS	RG214B/U	S2 10M FLR	09/02/2006
E404	Megaphase	TM40 K1K1 197	E404	05/13/06
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
ROS001	Rohde & Schwartz	FSEK-30	100225	07/26/2006
BAR2	Mannix	0ABA116	BAR2	08/02/2006
PRE8	MITEQ	NSP4000-NF	507145	11/21/2006
HORN2	EMCO	3115	9602-4675	09/13/2006

3.7 Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

3.8 Test Results:

Radiated Emissions / Interference

Company: Timex Communication
 Engineer: Vathana Ven
 Project #: 3082153
 Date: 12/07/05
 Standard: FCC Part 15 Subpart C
 Section: 231
 Limit Distance: 3 meters
 Voltage/Frequency: Battery
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW
 Model #: M102
 Serial #: 404C
 Receiver: HP 8542E (REC2/RECFL2)
 Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt
 PreAmp: NONE.
 Cable(s): S2 10M FLR 9-2-2006.cbl NONE.
 Test Distance: 10 meters
 Location: Site 2
 Frequency Range: 30-1000 MHz

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Average Factor dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
PK	H	311.996	52.0	13.6	3.0	9.7	0.0	-10.5	69.4	75.4	-6.0	120/300 kHz

Average factor: $((18.75/38.25)*(0.6/0.9)) = 9.7 \text{ dB}$

Test Results Continue

Duty Cycle (Average Factor)

Average factor is subtracted from peak readings to compare emissions readings to average limits. The average factor is calculated from duty cycle measurements from the following plots.

Average Factor Calculation:

Word On Time = 18.75 ms

Word Cycle Time = 38.25 ms

Word Duty Cycle = $18.75/38.25 = 0.490196$

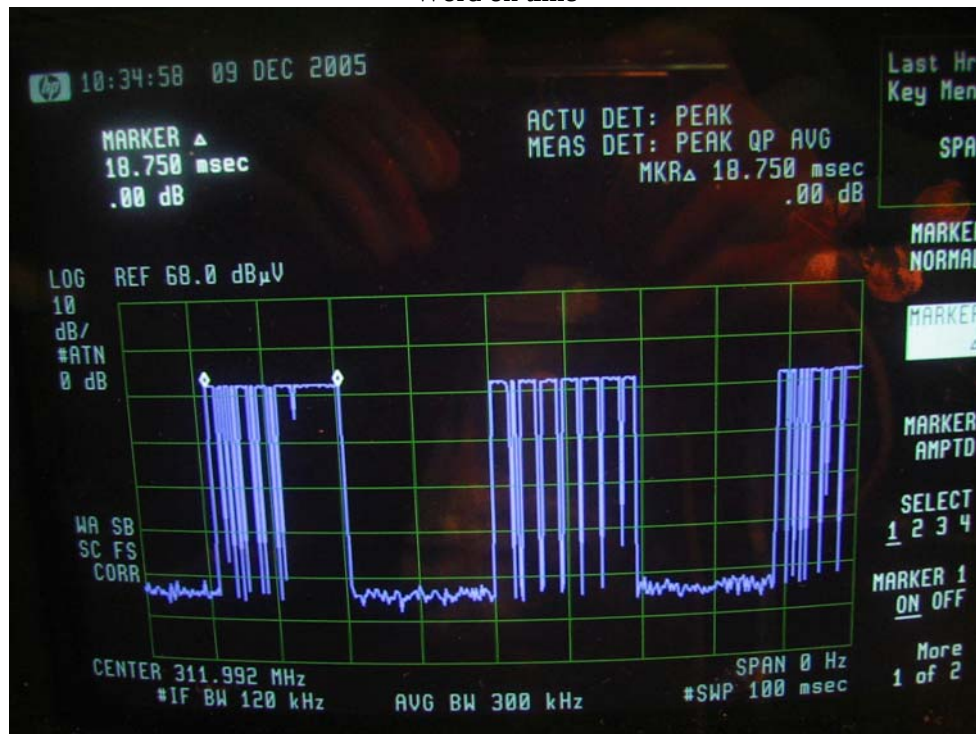
Bit On Time = 0.6 ms

Bit Cycle Time = 0.9 ms

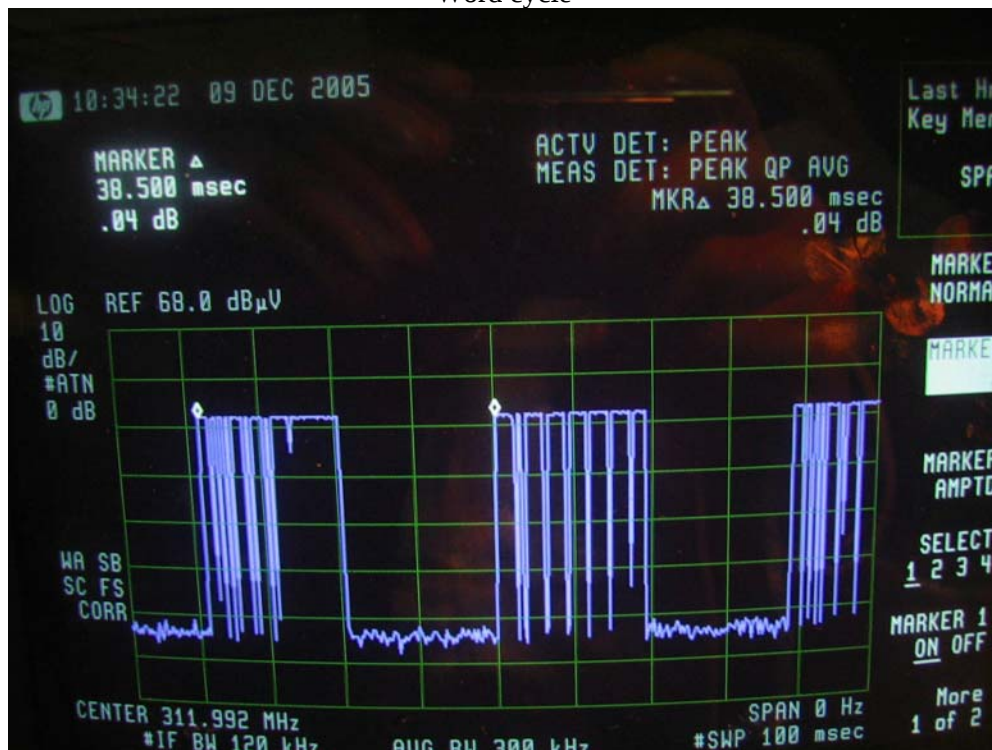
Bit Duty Cycle = $0.6/0.9 = 0.666667$

Average Factor = $20 \cdot \log(0.490196 \cdot 0.666667) = 9.7 \text{ dB}$

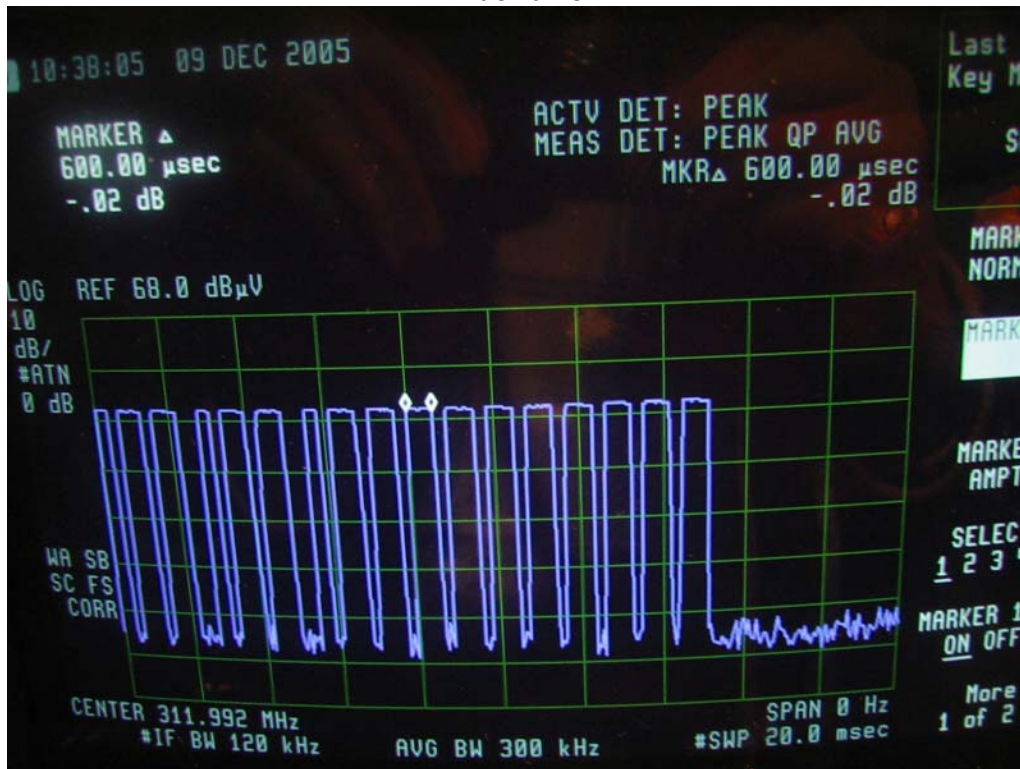
Word on time



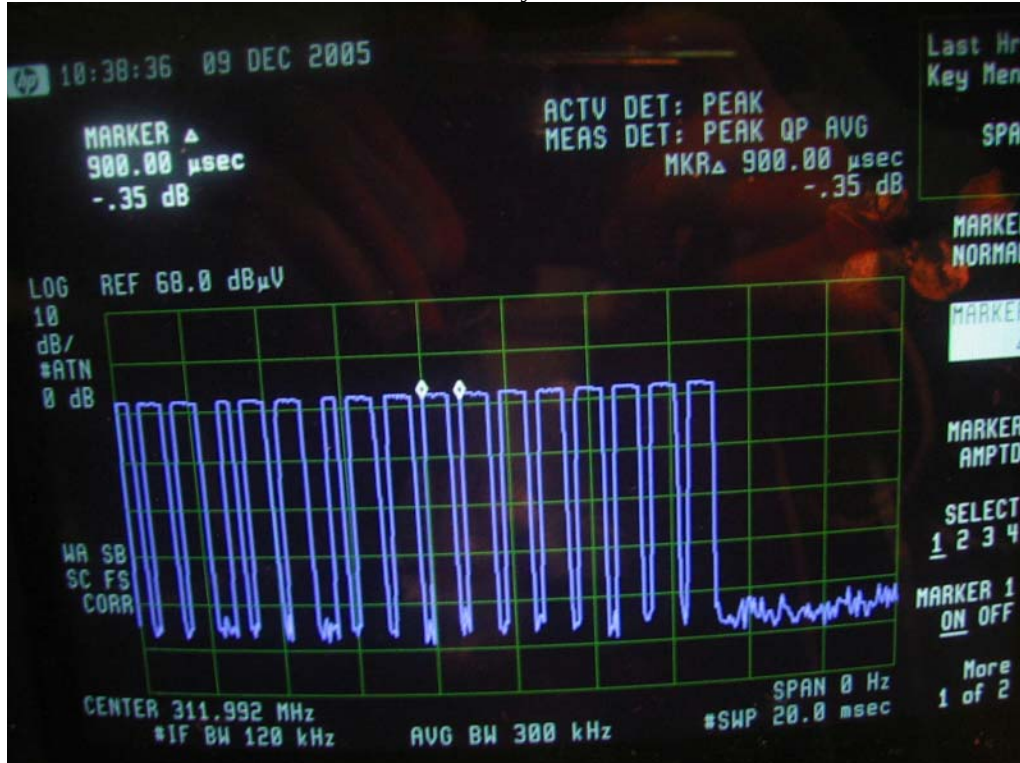
Word cycle



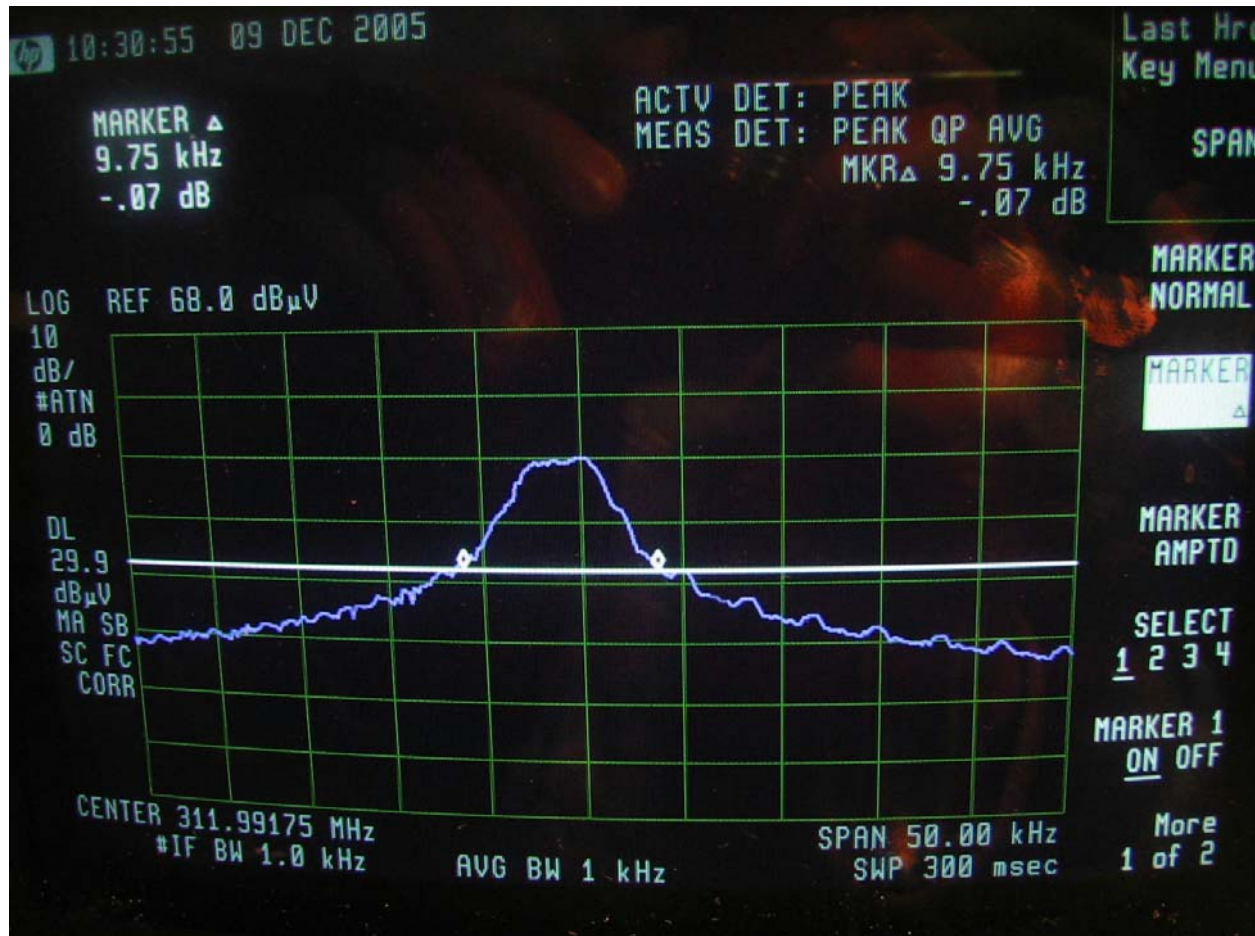
Bit on time



Bit cycle



Bandwidth Plot



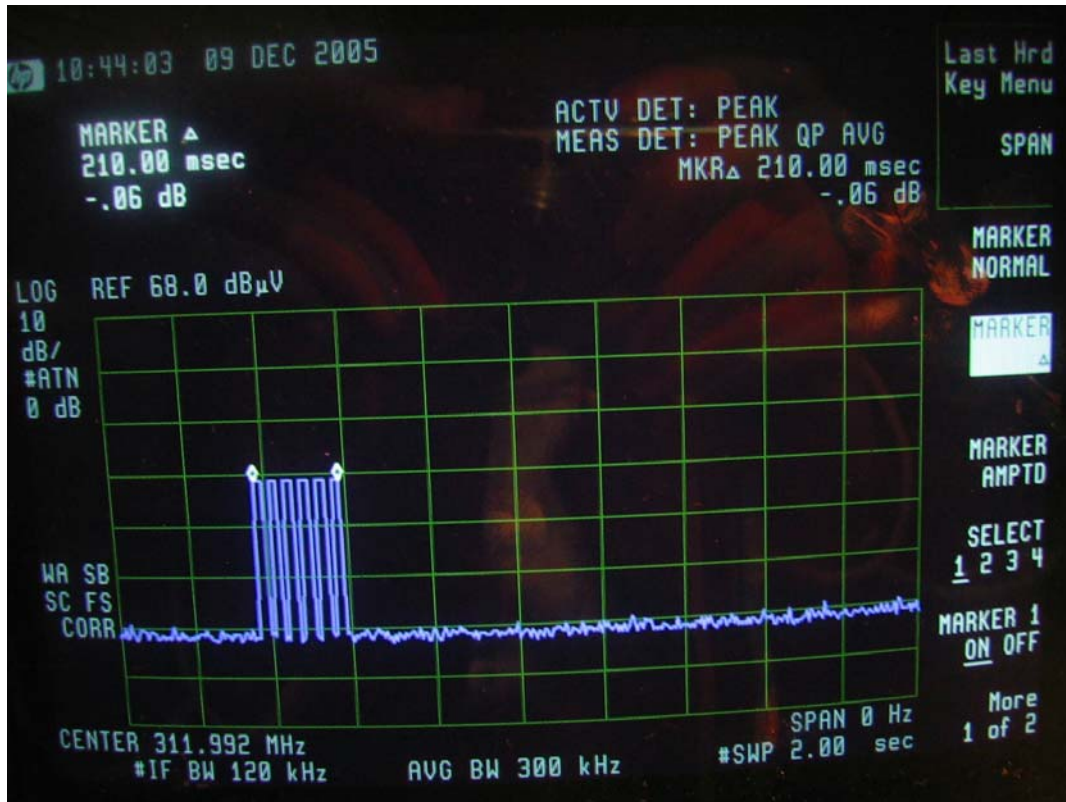
Bandwidth Requirement:

Bandwidth Limit = $0.0025 \times 312 \text{ MHz} = 0.78 \text{ MHz}$ or 780 kHz

Measured 20 dB Bandwidth = 9.75 kHz.

The unit met the 20 dB bandwidth requirements.

Transmission Duration



Requirement:

A manually operated transmitter shall employ a switch that will automatically deactivate within not more than 5 seconds after activation.

Measured: 0.21 Seconds

4.0 FCC Part 15 Subpart C Radiated Emissions Setup Photos



Photo 1

FCC Part 15 Subpart C Radiated Emissions Setup Photos cont.



Photo 2

5.0 Test Results: Pass**5.1 Test Standard:** Basic Standards from FCC Part 15 Subpart B, Class B**5.2 Test:** Radiated emissions**5.3 Performance Criterion:** Not Applicable**5.4 Test Environment:****Temperature:** 18 °C**Humidity:** 29 %**Pressure:** 1010 mbar**5.5 Maximum Test Disturbance Parameters:** Per Standard Specifications**Test Date:** 12/7/2005 & 12/9/2005**Test Engineer Initial:** VFV**Date:** 12/12/05**Test Engineer:** Vathana Ven**Reviewer Initial:** RWH**Date:** 12-20-2005**5.6 Test Equipment Used:**

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
LOG2	EMCO	3142	9711-1223	12/13/2005
S2 10M FLR	ITS	RG214B/U	S2 10M FLR	09/02/2006
E404	Megaphase	TM40 K1K1 197	E404	05/13/06
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
ROS001	Rohde & Schwartz	FSEK-30	100225	07/26/2006
BAR2	Mannix	0ABA116	BAR2	08/02/2006
PRE8	MITEQ	NSP4000-NF	507145	11/21/2006
HORN2	EMCO	3115	9602-4675	09/13/2006

5.7 Software Utilized:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

5.8 Test Results:

Radiated Emissions / Interference

Company: Timex Communication Model #: M102
 Engineer: Vathana Ven Barometer: BAR2 Serial #: 404C
 Project #: 3082153 Pressure: 1010 mb Receiver: HP 8542E (REC2/RECFL2)
 Date: 12/07/05 Temp: 18 C Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt
 Standard: FCC Part 15 Subpart B Humidity: 29% PreAmp: NONE.
 Class: B Group: None Cable(s): S2 10M FLR 9-2-2006.cbl NONE.
 Limit Distance: 3 meters Test Distance: 10 meters Location: Site 2
 Voltage/Frequency: Battery Frequency Range: 30-1000 MHz
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Average Factor dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
PK	H	623.990	26.7	21.2	4.6	9.7	0.0	-10.5	53.2	55.4	-2.2	120/300 kHz
PK	V	935.978	24.7	23.7	5.6	9.7	0.0	-10.5	54.8	55.4	-0.6	120/300 kHz

Average factor: ((18.75/38.25)*(0.6/0.9)) = 9.7 dB

Radiated Emissions / Interference

Company: Timex Communication Model #: M102
 Engineer: Vathana Ven Barometer: BAR2 Serial #: 404C
 Project #: 3082153 Pressure: 1010 mb Receiver: HP 8542E (REC2/RECFL2) RS001
 Date: 12/07/05 Temp: 18 C Antenna: HORN2 9-13-06 V1m.txt HORN2 9-13-06 H1m.txt
 Standard: FCC Part 15 Subpart B Humidity: 29% PreAmp: PRE8 11-21-06.amp
 Class: B Group: None Cable(s): E404 5-13-06.cbl E405 5-13-06.cbl
 Limit Distance: 3 meters Test Distance: 3 meters Location: Site 2
 Voltage/Frequency: Battery Frequency Range: 1-3.12 GHz
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Average Factor dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
PK	V	1247.913	43.3	25.5	1.8	9.7	20.8	0.0	40.1	55.4	-15.3	1Mz/3 MHz
PK	V	1559.690	39.3	25.7	2.2	9.7	20.9	0.0	36.5	54.0	-17.5	1Mz/3 MHz
PK	V	1871.920	49.7	27.3	2.5	9.7	21.0	0.0	48.9	55.4	-6.5	1Mz/3 MHz
PK	V	2183.903	51.5	28.3	2.8	9.7	21.1	0.0	51.8	55.4	-3.6	1Mz/3 MHz
PK	V	2495.903	39.1	28.7	3.0	9.7	21.1	0.0	39.9	54.0	-14.1	1Mz/3 MHz

Average factor: ((18.75/38.25)*(0.6/0.9)) = 9.7 dB

FCC Part 15 Subpart B Radiated Emissions Setup Photo



6.0 Sample calculation:

The following is how net radiated field strength readings were determined:

$$NF = RF + AF + CF - PF - AVF - DF$$

Where,

- NF = Net Reading in dB μ V/m
- RF = Reading from receiver in dB μ V
- AF = Antenna Correction Factor in dB(1/m)
- CF = Cable Correction Factor in dB
- PF = Pre-Amplifier Correction Factor in dB
- AVF = Duty Cycle Correction Factor in dB (only if applicable)
- DF = Distance Factor in dB (using 20 dB/decade unless otherwise specified)

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

$$UF = 10^{(NF / 20)}$$

Where,

UF = Net Reading in μ V/m

Example:

$$NF = RF + AF + CF - PF - AVF - DF = 62.9 + 13.7 + 2.1 - 16.1 - 0.0 - 10.5 = 52.1 \text{ dB}\mu\text{V/m}$$

$$UF = 10^{(52.1 \text{ dB}\mu\text{V} / 20)} = 403 \mu\text{V/m}$$

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:

$$UF = 10^{(NF / 20)}$$

Where,

UF = Net Reading in μ V

Sample Calculation cont.

Example:

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

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

7.0 Emissions Site Description:

Site 2C (Middle Site) is a 3m and 10m sheltered EMI measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 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 of metal 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 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. It is 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.

Measurement Uncertainty:

Note that the measurement uncertainty contained herein is ± 4.0 dB for radiated emissions and ± 2.0 dB for line-conducted emissions.