Excellence in Compliance Testing

Certification Test Report

FCC ID: UP3ATX

FCC Rule Part: 90.217

ACS Report Number: 08-0319-LD

Manufacturer: Lathem Time Corporation
Model: ATX

Test Begin Date: August 13, 2008
Test End Date: September 12, 2008

Report Issue Date: September 26, 2008

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

Prepared by:
Jeff Woods
Wireless Certification Engineer
ACS, Inc.

Reviewed by:
J. Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 15 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J and Part 90 Subpart I of the FCC's Code of Federal Regulations.

1.2 Product Description

The ATX is a digital clock using a low power transceiver to send and receive Time Link signals.

Manufacturer Information:
Lathem Time Corporation
200 Selig Dr. S.W.
Atlanta, GA 30336

Test Sample Serial Numbers:
ACS# 1

Test Sample Condition:
The test samples were provided in good working order with no visible defects.

Detailed photographs of the EUT are filed separately with this filing.

1.3 Test Methodology and Configurations

The ATX meets the exemption requirements of Part 90.217(b). Therefore only limited tests where applied to show compliance.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831
- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

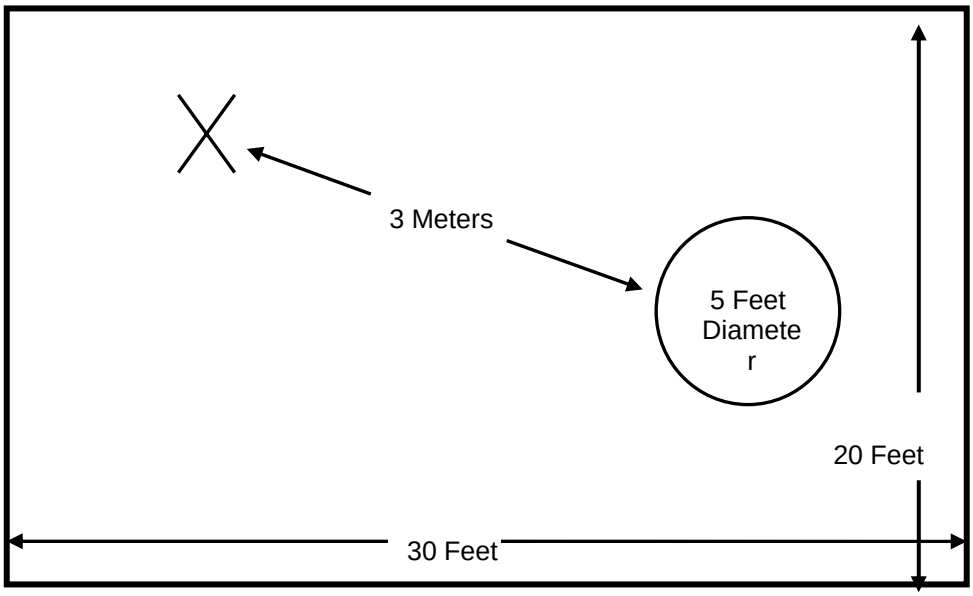

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

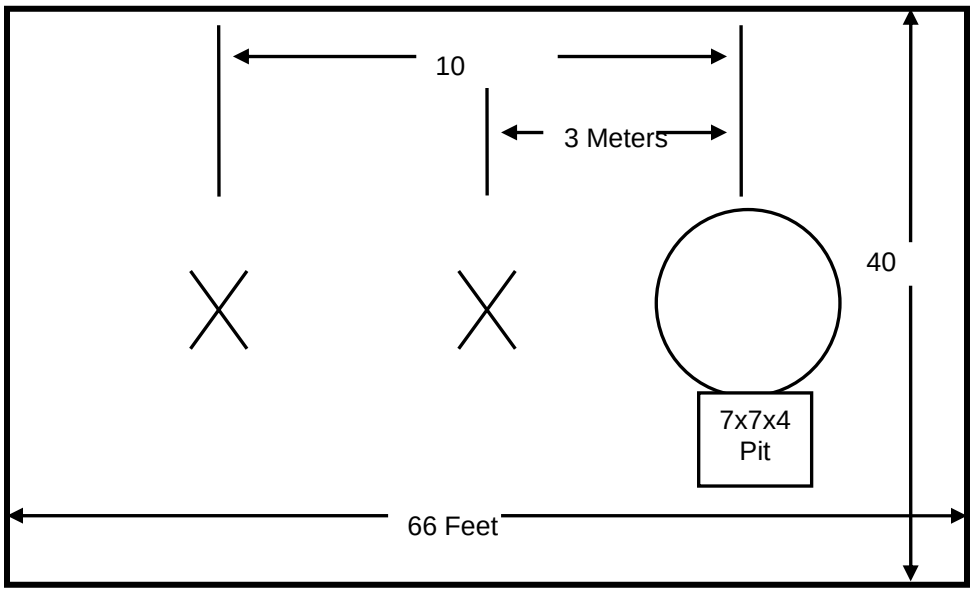

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

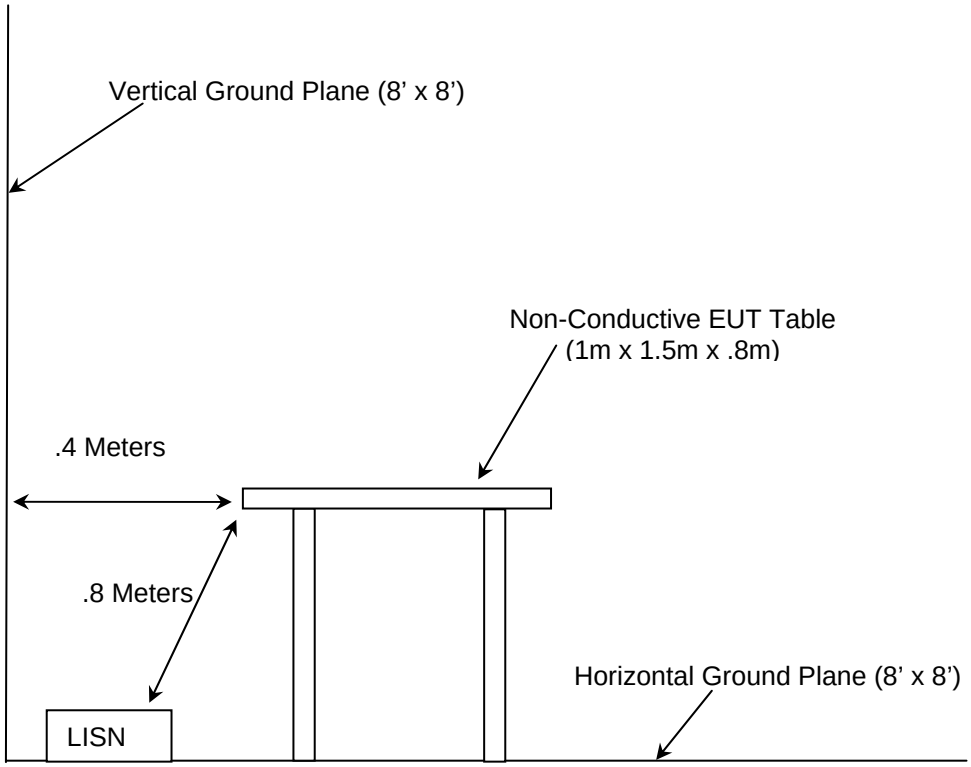

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz - 2003
2 - US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2008
3 - 4 - US Code of Federal Regulations (CFR): Title 47, Part 90, Subpart I: Private Land Mobile Radio Services - 2008
4 - 6 – TIA-603-C: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2004

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
3	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	839379/011	10/26/08
4	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	833827/003	10/26/08
22	Agilent	Amplifiers	8449B	3008A00526	10/25/08
140	Thermotron	Environmental Chamber	SM-16C	19639	8/30/09
222	Andrew	Cables	F1-SMSM	473703-A0138A	8/27/09
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11/9/08
291	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	None	11/21/08
292	Florida RF Cables	Cables	SMR-290AW-480.0-SMR	None	11/21/08
329	A.H.Systems	Antennas	SAS-571	721	8/6/09
331	Microwave Circuits	Filters	H1G513G1	31417	7/28/09
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10/24/08
73	Agilent	Amplifier	8447D	2727A05624	12/19/08
354	ETS Lindgren	Antenna	3142C	00078838	6/11/09
422	Florida RF	Cables	SMS-200AW-72.0-SMR	0805	2/25/09
412	Electro Metrics	Antenna	LPA-25	1241	7/8/09
338	Hewlett Packard	Pre-Amp	8449B	3008A01111	10/24/08

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Lathem Time	ATX	ACS# 1

6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

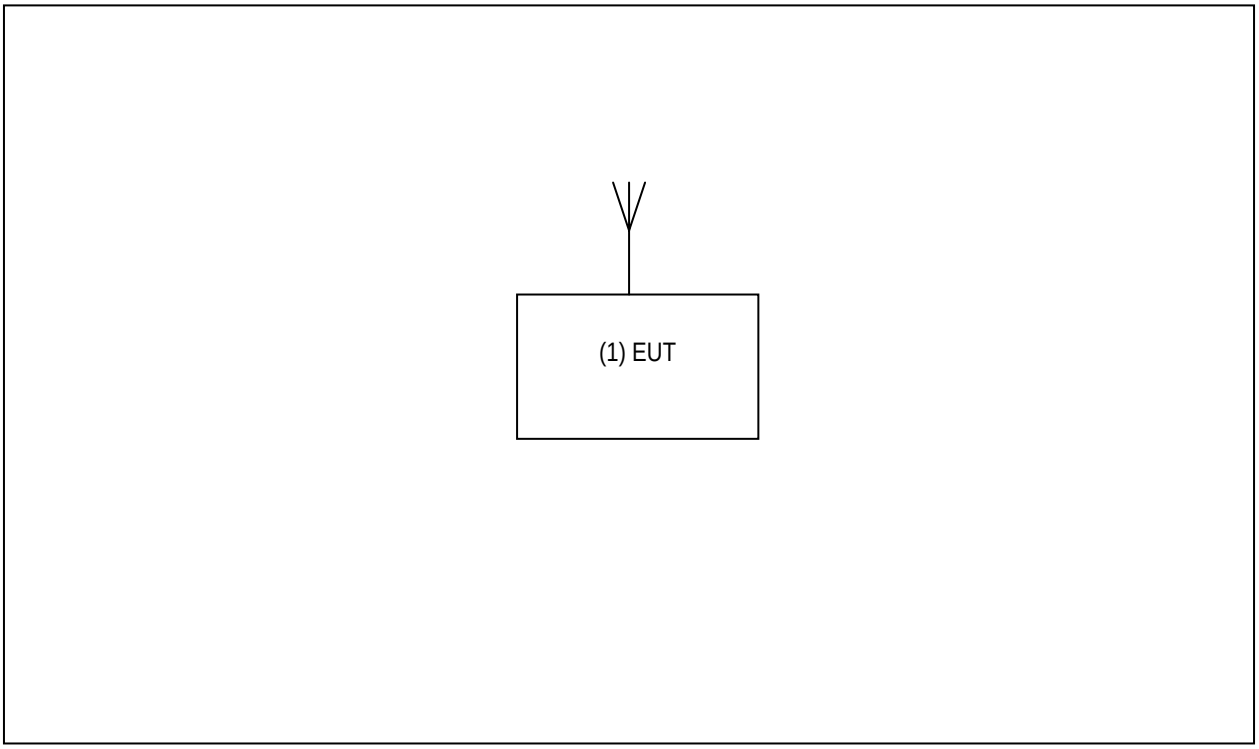

Figure 6-1: EUT Test Setup

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 RF Power Output – FCC Section 90.217 (Radiated ERP)

7.1.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For the fundamental emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of the fundamental emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole.

In order to be certified under 90.217 the output power must not exceed 120mW, which equates to 20.79 dBm. The peak output power below shows a maximum power of -11.57 dBm. Therefore the EUT can be certified under 90.217.

7.1.2 Measurement Results

Table 7.1.2-1: Radiated Peak Output Power

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
452.31	-50.66	-24.00	H	3.82	-20.18	20.79	40.97
452.31	-36.8	-15.7	V	4.13	-11.57	20.79	32.36

7.2 Occupied Bandwidth (Emission Limits) – FCC Section 90.217(b)

7.2.1 Measurement Procedure

The radiated RF output of the equipment under test was measured using a Spectrum Analyzer. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 1 kHz respectively. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results are shown below in Figure 7.2.2-1.

Section 90.217(b) requires that any emissions on a frequency 25 KHz or more removed from the assigned frequency is attenuated at least 30 dB below the carrier.

7.2.2 Measurement Results

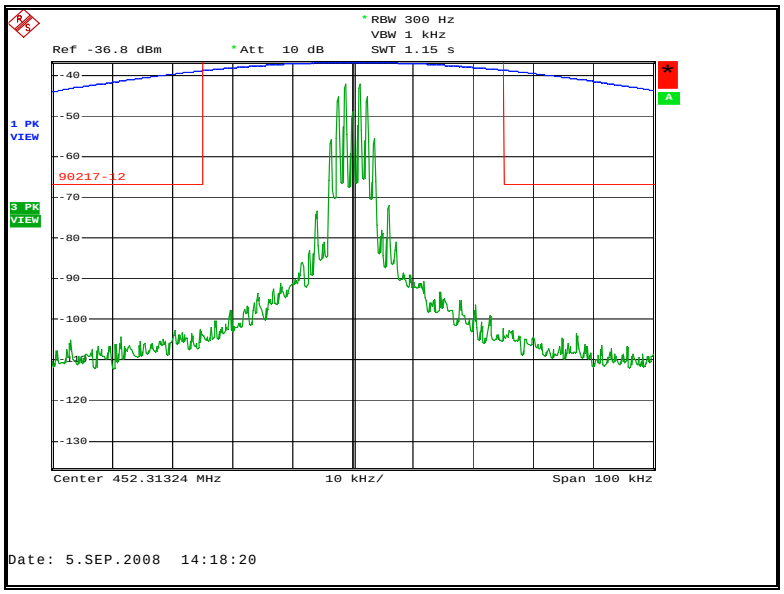

Figure 7.2.2-1: Emission Limits – 452.3125 MHz – 25 kHz Channel

7.3 Spurious Emissions at Antenna Terminals – FCC Section 2.1051

7.3.1 Measurement Procedure

Conducted spurious emissions could not be measured at the EUT has a non-removable antenna. Therefore all spurious emissions were evaluated radiated in section 7.4.

7.4 Field Strength of Spurious Emissions – FCC Section 90.217

7.4.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This was repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded. The power in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated up to 10 times the fundamental emission.

Data was collected at frequencies according to Section 1.3.2. Results of the test are shown below. The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report.

Section 90.217 requires that any emissions on a frequency 25 KHz or more removed from the assigned frequency is attenuated at least 30 dB below the carrier. In section 7.1 the peak output power was found to be -11.57 dBm. Therefore the emission limit for radiated spurious is 30 dB below this level which equals -41.47 dBm.

7.4.2 Measurement Results

Table 7.4.2-1: Field Strength of Spurious Emissions

Frequency (MHz)	Spectrum Analyzer Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBm)	Limit (dBm)	Margin (dB)
904.62	-82.87	-64.00	H	3.25	-60.75	-41.57	19.18
904.62	-80.3	-66.00	V	3.85	-62.15	-41.57	20.58
1809.24	-55.91	-55.00	H	5.09	-49.91	-41.57	8.34
1809.24	-50.81	-49.22	V	5.15	-44.07	-41.57	2.50

Note: Frequencies not reported were below the noise floor of the measurement system.

7.5 Frequency Stability – FCC Section 90.217

7.5.1 Measurement Procedure

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment.

Frequency measurements were made at the extremes of the of temperature range -30º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the battery drop-out voltage was tested. The maximum variation of frequency was recorded.

The EUT is battery operated at 6VDC therefore the frequency stability was also tested at the battery drop-out voltage of 3.6 VDC.

The frequency deviation found below is applied to the results in Section 7.2 Emissions Limits to make sure that when the frequency stability is taken into account the emissions are still attenuated by 30dB on frequencies 25 KHz removed from the carrier.

Results of the test are shown below in Figures 7.5.2-1.

7.5.2 Measurement Results

Frequency Stability

Frequency (MHz): 452.3132
Deviation Limit (PPM): None

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**452.315262**	**4.559**	100%	6.0 VDC
-20 C	**452.314912**	**3.785**	100%	6.0 VDC
-10 C	**452.314100**	**1.990**	100%	6.0 VDC
0 C	**452.313562**	**0.800**	100%	6.0 VDC
10 C	**452.313500**	**0.663**	100%	6.0 VDC
20 C	**452.313307**	**0.237**	100%	6.0 VDC
30 C	**452.313194**	**-0.013**	100%	6.0 VDC
40 C	**452.313073**	**-0.281**	100%	6.0 VDC
50 C	**452.313013**	**-0.413**	100%	6.0 VDC
20 C	**452.313175**	**-0.055**	Battery Drop Out	3.6 VDC

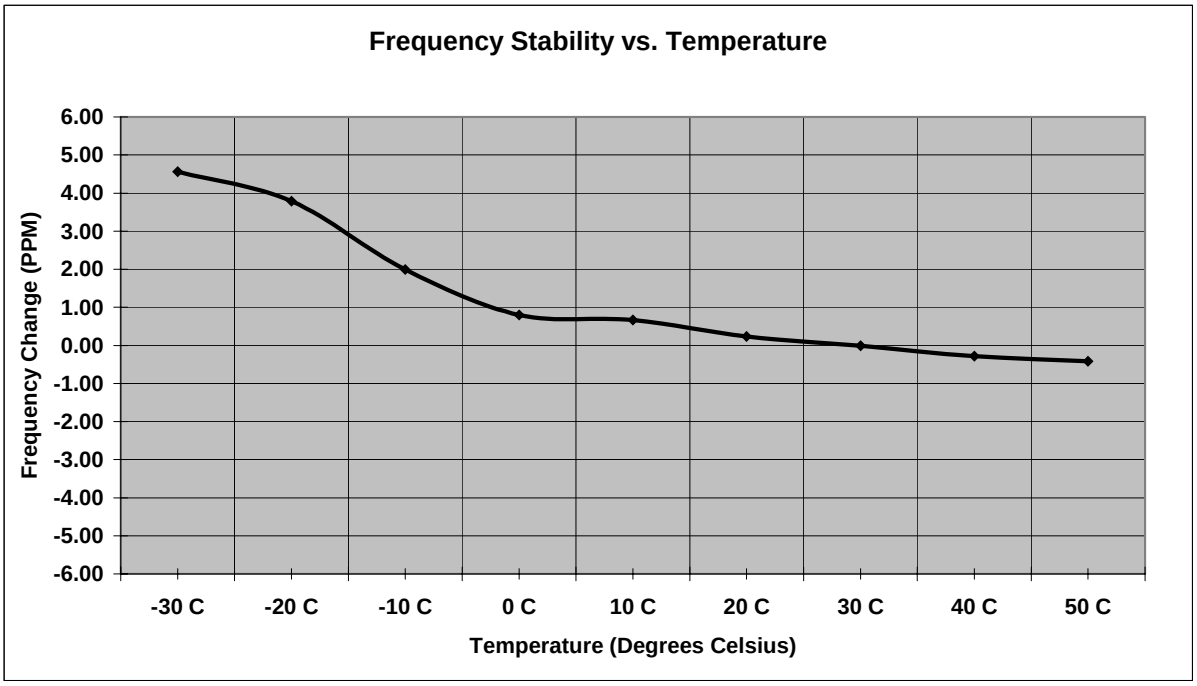

Figure 7.5.2-1: Frequency Stability

7.6 Radiated Emissions (Unintentional Radiators) – FCC Section 15.109

7.6.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) on a wooden table at the turntable center. For each radiated emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º to obtain a maximum peak reading on the spectrum analyzer. The radiated emissions are then measured using an EMI receiver employing a CISPR quasi-peak detector for frequencies below 1000 MHz and an Average detector function for frequencies above 1000 MHz. This repeated for both horizontal and vertical polarizations of the receive antenna.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) – Amplifier Gain (dB) + Antenna Correction Factor (1/m)

Results of the test are shown below in Table 7.6.2-1.

7.6.2 Measurement Results

Table 7.6.2-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
31.08	---------	28.11	H	-9.80	---------	18.31	--------	40.0	---------	21.69
97.9	---------	29.61	V	-16.77	---------	12.84	--------	43.5	---------	30.66
340.4	---------	31.29	V	-9.67	---------	21.62	--------	46.0	---------	24.38
481.59	---------	32.30	H	-6.32	---------	25.98	--------	46.0	---------	20.02
591.25	---------	33.14	V	-3.48	---------	29.67	--------	46.0	---------	16.34
928.87	---------	32.10	V	0.69	---------	32.79	--------	46.0	---------	13.21

Measurements taken above 928.87 MHz were below the noise floor of the measurement equipment.

8.0 CONCLUSION

In the opinion of ACS, Inc. the model ATX, manufactured by Lathem Time Corporation, meets all the requirements of FCC Part 90.217.

End Report