FCC & IC Certification Test Report

FCC & Industry Canada Certification Test Report

for

Hetronic USA

FCC ID: LW9-CS434TXN

IC ID: 2219A-CS434TXN

March 3, 2005

Prepared for:

Hetronic USA
4300 Highline Blvd Building 4
Oklahoma City, OK 73108

Prepared By:

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7560 Lindbergh Drive
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FCC & Industry Canada Certification Test Report for the Hetronic USA CS434TXN Transmitter Module FCC ID: LW9-CS434TXN IC ID: 2219A-CS434TXN

March 3, 2005

WLL JOB# 8324/5

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Abstract

This report has been prepared on behalf of Hetronic USA to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 90 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-119 of Industry Canada. This Certification Test Report documents the test configuration and test results for a Hetronic USA CS434TXN Transmitter Module.

The transmitter was tested under §90.217 of the FCC Rules and Regulations.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Hetronic USA CS434TXN Transmitter Module complies with the limits for an Intentional Radiator device under FCC Part 90 and Industry Canada RSS-119.

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1 Introduction

1.1 Compliance Statement

The Hetronic USA CS434TXN Transmitter Module complies with the limits for an Intentional Radiator device under Part 90 of the FCC Rules and Regulations and Industry Canada RSS-119.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed according to the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Hetronic USA 4300 Highline Blvd Building 4 Oklahoma City, OK 73108
Purchase Order Number:	14409
Quotation Number:	61833

1.4 Test Dates

Testing was performed from September 2 to September 9, 2004.

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter

2 Equipment Under Test

2.1 EUT Identification & Description

CS434TXN is a Low power multi- channel Transmitter Device. The CS434TXN is an improved version of the previously-approved CS434TX module. The improvement in this module is to make the module more robust against environment effects like antenna feedback.

The module is also capable of use of up to 9600 baud. Another change made into this module is to incorporate the AUTX/FCS function into the sub-board such that this board can be used in different modes.

The frequency grouping in the FCS/AUTX is calculated based on third inter-modulation technique so that it is possible to use all channels within the group in close proximity. CS434RXN is a standard Hetronic RF-Receiver module with 434MHz frequency. The module uses FSK narrow modulation. The change from previous version (CS434RX) is the antenna connector, which is incorporated into the RF module directly.

CS434TRR can work with serial data of 2400 to 9600 baud

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Hetronic USA
FCC ID Number	LW9-CS434TXN
IC ID Number:	2219A-CS434TXN
EUT Name:	Transmitter Module
Model:	CS434TXN
FCC Rule Parts:	§90.217
IC Rule Parts:	RSS119
Frequency Range:	433.1M to 434.75MHz
Maximum Output Power:	12.9 mW (EIRP)
Modulation:	FM
Necessary Bandwidth:	10.8kHz
Keying:	Manual
Type of Information:	Control
Number of Channels:	28
Power Output Level	Fixed
Antenna Type	Integral
Frequency Tolerance:	<5ppm
Emission Type(s):	15K9F1D
Interface Cables:	None
Power Source & Voltage:	3.4 – 12Vdc from battery – tested at 5.5Vdc

2.2 Test Configuration

The CS434TXN was tested in a stand-alone configuration. A power supply provided 5.5Vdc. The unit was set to Channel 16 @ 434.9 MHz via board dip switches.

2.3 Testing Algorithm

The CS434TXN was provided 5.5 Vdc input to the power board. In addition a 4.8kHz TTL signal was injected into the TTL input on board. This input caused a 2.64kHz FM deviation measured by a Boonton Modulation meter. As the antenna was permanently attached all measurements were performed radiated.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Equipment	**Identification**	**Calibration Due**
Hewlett-Packard 8563A Spectrum Analyzer	2634A02888	4/14/05
Boonton 82AD/01A/S10/S13 FM/AM Modulation Meter	167219	4/14/05
Hewlett-Packard 8449B Microwave Preamp	3008A00385	9/29/05
B&K Precision 4040A Sweep/Function Generator	0110-0132	N/A
Tektronix Oscilloscope; 1GHz, 4 CH, DPO	B010043	9/5/04
Hewlett-Packard 8672A Synthesized. Signal Generator	2311A03131	3/23/05
A.H. Systems SAS-200/518 Log Periodic Antenna	117	3/11/06
ARA DRG118/A Microwave Horn Antenna	1010	2/17/06
Hewlett-Packard 85685A RF Preselector	3221A01395	7/08/05
Sunol JB1 Biconlog Antenna	A090501	10/21/04
EMCO 3146A Log Periodic Antenna	8912-1129	6/24/05
DANA- RACAL 1992 Frequency Counter	2806	5/10/05
Global specialties 1337 DC Power Supply	99503012	N/A

4 Test Results

4.1 RF Power Output: (FCC Part §2.1046, Industry Canada RSS-119 Sec. 6.7)

As the EUT contains a permanently attached antenna the RF power was measured using the signal substitution method to determine the EIRP level.

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2001. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Additionally the EUT and antenna were rotated in 3 orthogonal planes to determine the maximum emission.

The Effective Isotropic Radiated Power (EIRP) levels were measured for determining the output power of the EUT.

Table 3. RF Power Output

Frequency	Level	Limit to claim compliance with 90.217	Pass/Fail
Mid Channel: 434.90MHz	12.9 mW	120mW	Pass

The radiated power output from this device is less than 125 mW and hence the device need only comply with the requirements of FCC Part 90.217, following:

> Except as noted herein, transmitters used at stations licensed below 800 MHz on any frequency listed in subparts B and C of this part or licensed on a business category channel above 800 MHz which have an output power not exceeding 120 milliwatts are exempt from the technical requirements set out in this subpart, but must instead comply with the following:
>
> (a) For equipment designed to operate with a 25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.
>
> (b) For equipment designed to operate with a 12.5 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

(c) For equipment designed to operate with a 6.25 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 12.5 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

(d) Transmitters may be operated in the continuous carrier transmit mode.

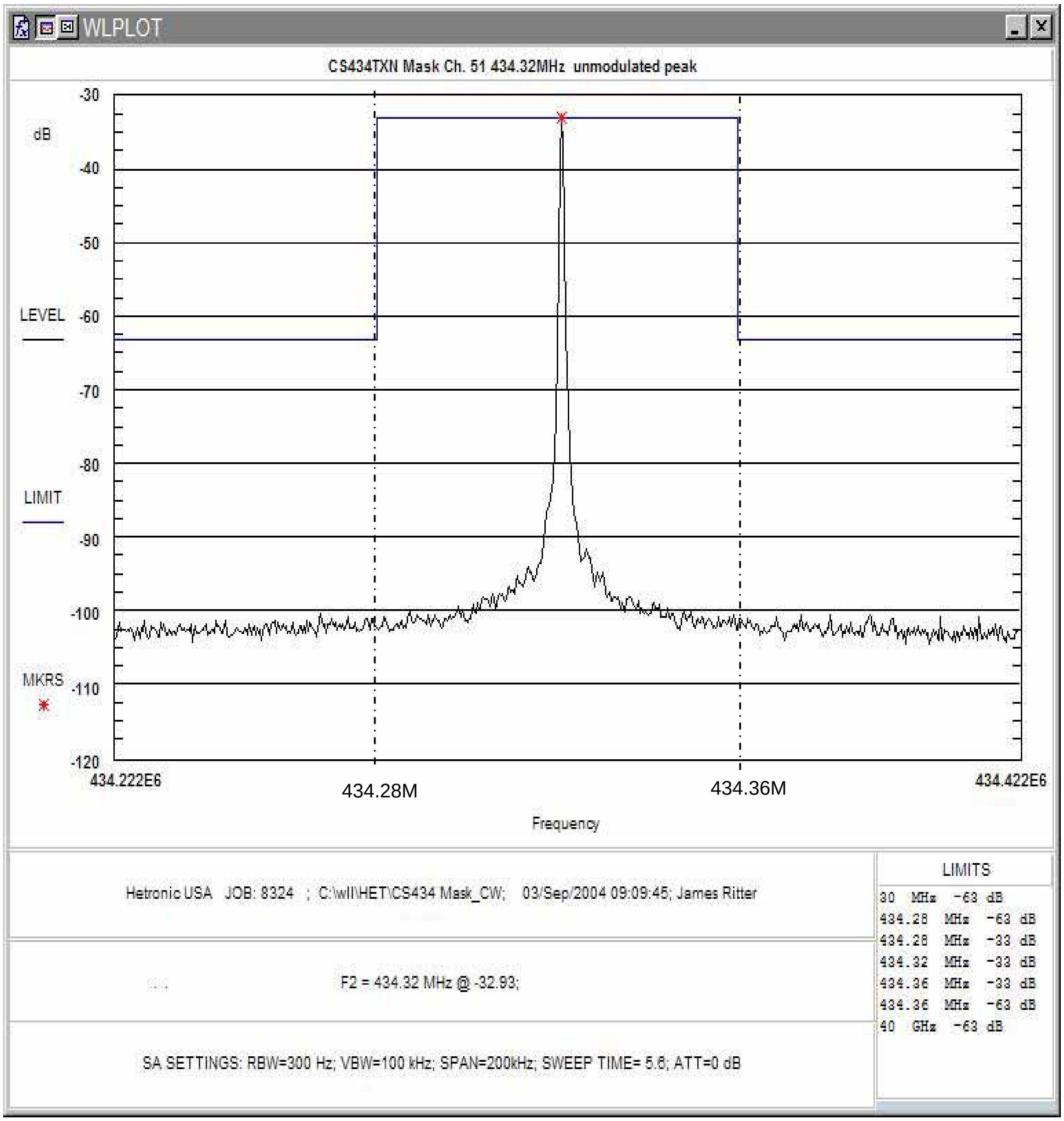

Figure 1. Part 90.217 Mask. Unmodulated Carrier

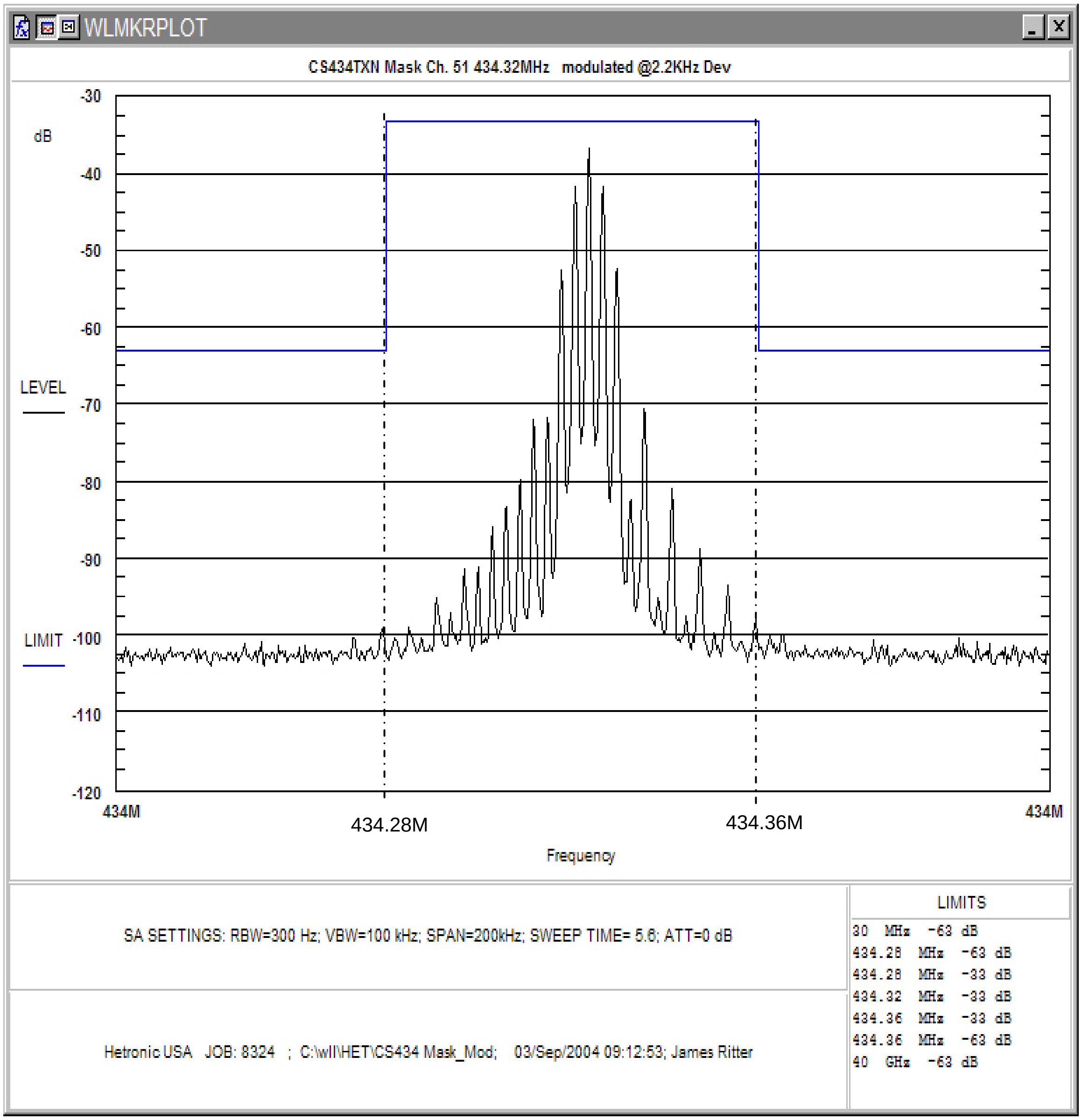

Figure 2. Part 90.217 Mask. Modulated Carrier

4.2 Occupied Bandwidth: (FCC Part §2.1049, Industry Canada RSS-119 Sec. 6.7)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer via an antenna.

At the maximum data rate of 9600bps the occupied bandwidth was measured as shown in Figure 3. The modulating signal used to supply the 9600bps was a 4800 Hz TTL signal. This input caused a 2.64kHz FM deviation measured by a Boonton Modulation analyzer. Calculations of the necessary bandwidth follow the bandwidth plot.

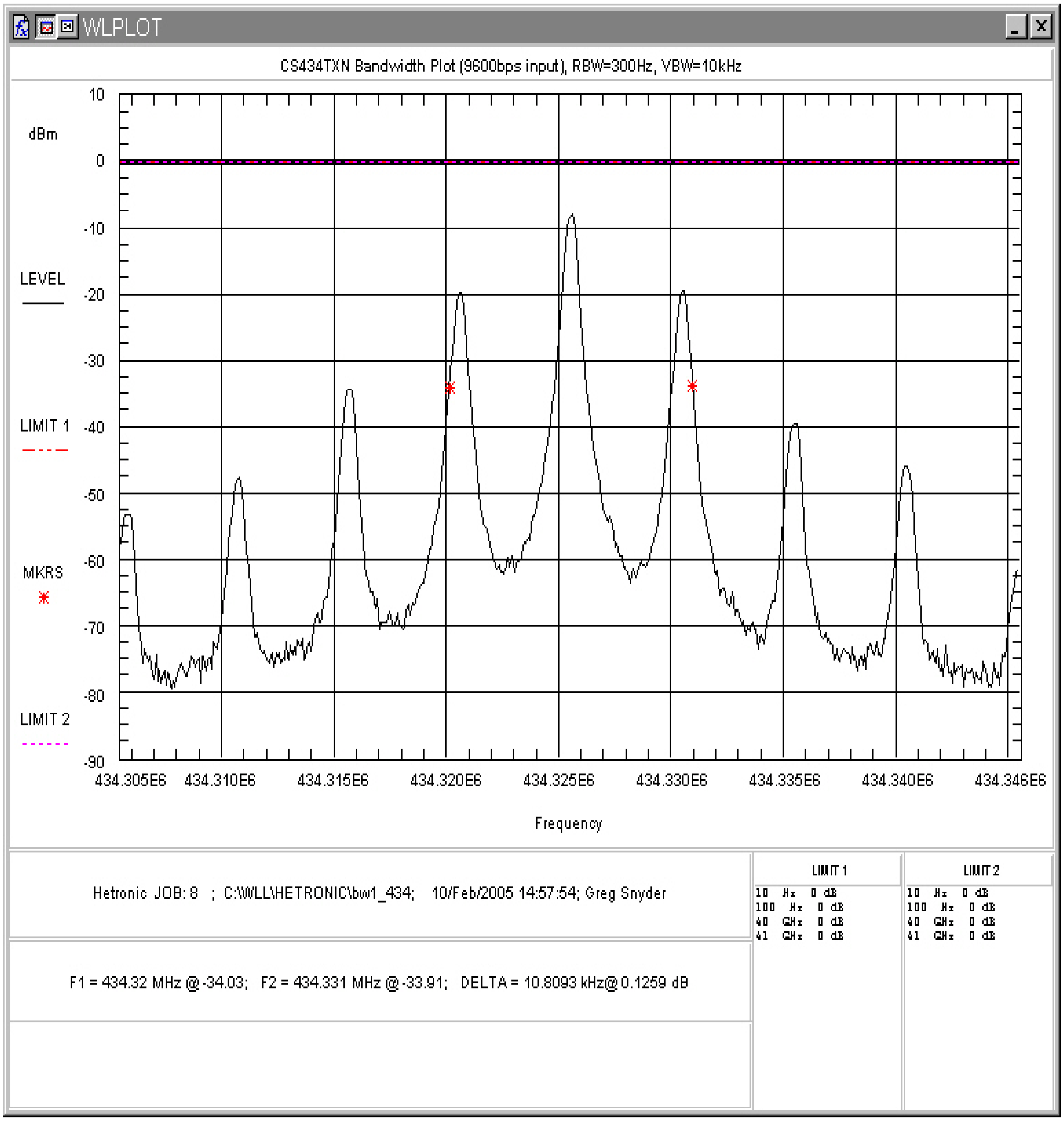

Figure 3. Occupied Bandwidth

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	**Bandwidth**
Mid Channel: 434.33 MHz	10.8 kHz

The necessary bandwidth is then calculated as follows:

Bn = 2M + 2DK (K = 1.2)

2(4800) + 2(2640)(1.2) = 15.9kHz

The emission designator is then determined to be:

15K9F1D

4.3 Radiated Spurious Emissions: (FCC Part §2.1053, Industry Canada RSS-119 Sec. 6.7)

The EUT must comply with requirements for radiated spurious emissions.

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2001. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The Effective Isotropic Radiated Power (EIRP) levels were measured and compared with the limit of 30 dBc per FCC Part 90. Based on an output power of 12.9mW the limit for spurious radiated emissions is calculated to be -18.9dBm.

Emissions were scanned up to the 10^{th} harmonic of the fundamental. The unit was tested in three orthogonal planes with the highest emissions for each emission detected reported. The signal substitution method per TIA/EIA-603 was used to obtain EIRP levels.

The limit is calculated as follows:

Output Power = 12.9mW = 11.1dBm

Limit = 11.1dBm – 30dB = -18.9dBm

Table 5: Radiated Emission Test Data

CLIENT: Hetronic USA DATE: 9/7/04
TESTER: James Ritter JOB #: 8324

EUT Information

EUT: CS434TXN TEST STANDARD: FCC Part 90.217, RSS-119 6.7
CONFIGURATION: CH 51 434.33MHz DISTANCE: 3m

Test Equipment/Limit: **Limit is 30 dB below fundamental**

ANTENNA: A_00382 LIMIT: EIRP
CABLE: CSITE2_3m AMPLIFIER (dB) N/A

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Gain dBi	Sig. Gen. Level dBm	EIRP Level dBm	Limit dBm	Margin dB
434.33	**V**	**45.0**	**1.4**	**82.6**	**6.3**	**4.8**	**11.1**	**Fundamental**	
31.44	V	0.0	1.0	11.7	-12.0	-55.9	-67.9	-18.9	-49.0
52.86	V	0.0	1.0	15.2	-6.9	-62.2	-69.1	-18.9	-50.2
347.52	V	270.0	1.5	7.7	6.7	-73.0	-66.3	-18.9	-47.4
390.91	V	90.0	1.6	12.9	7.8	-69.4	-61.6	-18.9	-42.7
412.60	V	0.0	1.2	20.3	7.3	-58.9	-51.6	-18.9	-32.7
429.06	V	180.0	2.0	6.8	7.5	-72.0	-64.5	-18.9	-45.6
446.52	V	270.0	2.0	6.3	7.5	-70.6	-63.1	-18.9	-44.2
456.00	V	80.0	1.7	23.0	7.3	-54.3	-47.0	-18.9	-28.1
477.71	V	90.0	1.7	15.7	6.8	-62.3	-55.5	-18.9	-36.6
868.66	V	0.0	2.4	7.8	7.7	-71.2	-63.5	-18.9	-44.6
891.97	V	0.0	2.6	16.2	7.2	-50.8	-43.6	-18.9	-24.7
1302.97	V	45.0	1.0	40.8	6.0	-68.0	-62.0	-18.9	-43.1
1737.28	V	315.0	1.0	40.7	5.8	-68.5	-62.7	-18.9	-43.8
2171.76	V	180.0	1.0	39.2	5.6	-66.0	-60.4	-18.9	-41.5
2605.93	V	180.0	1.0	49.5	4.6	-60.5	-55.9	-18.9	-37.0
3040.29	V	0.0	1.0	44.2	3.7	-56.0	-52.3	-18.9	-33.4
3474.57	V	0.0	1.0	38.5	6.4	-57.0	-50.6	-18.9	-31.7
3908.92	V	180.0	1.0	36.9	6.0	-64.5	-58.5	-18.9	-39.6
4343.24	V	0.0	1.0	34.6	6.9	-66.1	-59.2	-18.9	-40.3
434.33	**H**	**45.0**	**2.5**	**79.1**	**6.3**	**3.3**	**9.6**	**Fundamental**	
31.44	H	0.0	3.5	10.1	-12.0	-52.1	-64.1	-20.4	-43.7
52.86	H	0.0	3.6	13.6	-6.9	-60.9	-67.8	-20.4	-47.4
347.52	H	180.0	1.8	8.4	6.7	-68.4	-61.7	-20.4	-41.3
390.91	H	130.0	2.4	13.5	7.8	-58.2	-50.4	-20.4	-30.0
412.60	H	45.0	1.6	23.6	7.3	-51.5	-44.2	-20.4	-23.8
429.06	H	180.0	2.2	5.8	7.5	-70.7	-63.2	-20.4	-42.8
446.52	H	270.0	2.0	7.6	7.5	-71.8	-64.3	-20.4	-43.9
456.00	H	90.0	1.8	20.4	7.3	-57.9	-50.6	-20.4	-30.2
477.71	H	90.0	1.7	12.5	6.8	-67.5	-60.7	-20.4	-40.3
868.66	H	90.0	1.4	9.8	7.7	-68.4	-60.7	-20.4	-40.3
891.97	H	270.0	1.5	8.7	7.2	-63.7	-56.5	-20.4	-36.1

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Gain dBi	Sig. Gen. Level dBm	EIRP Level dBm	Limit dBm	Margin dB
1302.97	H	90.0	1.0	36.8	6.0	-68.5	-62.5	-20.4	-42.1
1737.28	H	90.0	1.0	36.0	5.8	-63.5	-57.7	-20.4	-37.3
2171.76	H	0.0	1.0	36.0	5.6	-64.0	-58.4	-20.4	-38.0
2605.93	H	10.0	1.0	42.5	4.6	-67.5	-62.9	-20.4	-42.5
3040.29	H	170.0	1.0	40.0	3.7	-65.0	-61.3	-20.4	-40.9
3474.57	H	180.0	1.0	31.7	6.4	-69.5	-63.1	-20.4	-42.7
3908.92	H	0.0	1.0	31.1	6.0	-74.0	-68.0	-20.4	-47.6
4343.24	H	0.0	1.0	33.9	6.9	-64.0	-57.1	-20.4	-36.7

4.4 Frequency Stability: (FCC Part §2.1055 and Industry Canada RSS-119, 6.7)

Frequency as a function of temperature and voltage variation shall be maintained within the FCC-prescribed tolerances.

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize.

The EUT is powered by DC voltage supplied externally. The manufacturer's power requirements for the EUT include the following:

Low DC Voltage of 3.4 VDC (manufacturer's specification)

High DC Voltage of 12 VDC (manufacturer's specifications)

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -30°C to +50°C. The carrier frequency was measured while the EUT was in the temperature chamber. The reference frequency of the EUT was measured at the ambient room temperature with the frequency counter. The following are the reference frequencies at ambient for the channel tested.

Mid Channel: 434.3 MHz

Frequency Stability: 5ppm = 5*434.3 = 2171.5 Hz

Table 6. Frequency Deviation as a Function of Temperature

CLIENT:	Hetronic USA	JOB #:	8324
MODEL NO:	CS434TXN	DATE:	9/9/2004
BY:	James Ritter	Limit:	5ppm

Temperature Degrees C	Frequency MHz	Difference Hz	Max Limit Deviation Hz
Ambient	434.322520	0.0	2171.5
-30	434.320950	-1570.0	2171.5
-20	434.321980	-540.0	2171.5
-10	434.322960	440.0	2171.5
0	434.323310	790.0	2171.5
10	434.323260	740.0	2171.5
20	434.322820	300.0	2171.5
30	434.322240	-280.0	2171.5
40	434.321670	-850.0	2171.5
50	434.321350	-1170.0	2171.5

Table 7. Frequency Deviation as a Function of Voltage

Voltage Volts	Frequency MHz	Difference Hz	Limit Max Deviation Hz
At rated	434.322480	0	2171.5
3.4 VDC	434.321980	500	2171.5
12VDC	434.321890	590	2171.5