City Theatrical Inc

#5692 SHoW DMX Radio Transceiver International Version

Report of Measurements

per

Industry Canada RSS-210 Issue 7 Annex 8

and

FCC CFR47 Part 15/B; FCC CFR47 Part 15/C – 15.247

Revision 4.0

March 04, 2008

	Approved by	
Checked by	Dan Petrulian EMC Eng.	March 04th, 2008 Date

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Industry Canada O.A.T.S. Registration Number IC3384

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Section I: Report of Measurments Testing Information

Testing Details

TESTED BY: Dan Petrulian

TEST CONDITIONS: Temperature and Humidity: October 23, 2007 19°C in, 5.3°C out, 42%
November 17, 2007 18°C in, 6.1°C out, 50%
December 06, 2007 18°C in, 4.1°C out, 44%
December 11, 2007 20°C in 3.4°C out, 42%
December 13, 2007 21°C in 1.8°C out, 46%
February 20, 2008 19°C in 6.6°C out, 49%
February 21, 2008 19°C in 3.6°C out, 36%
March 04, 2008 20 °C in 8.5°C out, 48%

TEST VOLTAGE: +5Vdc via Power Supply Anatek 25-2D, delivered for the Under Test Equipment power supply having the local input voltage 120Vac, 60Hz.

Test Facilities

Protocol Data System Inc., Labs
28945 McTavish Rd.
Abbotsford BC, Canada, V4X 2E7

SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612
FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Equipment List

EMISSION:

Manufacturer	Model	Equipment Description	Serial No.	Next Cal
HP	85650A	CDN Quasi-Peak Adapter	2043A00240	12/09/09
HP	85662A	Spectrum Analyzer Display	2318A05184	18/09/09
HP	8566B	Spectrum Analyzer RF Section	2241A02102	18/09/09
HP	85685A	RF-Preselector	3107A01222	18/09/09
EMCO	3110B	Antenna Biconical 20-300MHz	1850	01/12/08
EMCO	LPA30	Ant. Log Periodic 200-1000MHz	563	05/12/08
EMCO	3115	Antenna Horn 1-18GHz	9005-3429	06/03/08
SOLAR	8012-50-R-24-BNC	LISN(25A 50Ω 50/250μH 10k-50MHz)	863092	28/09/08
Marconi	6960B	RF Power Meter	236966/013	12/06/08
Rhientech	Custom	Antenna Mast	N/A	N/A
Protocol EMC	Custom	Turntable	N/A	N/A

Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	±1 x 10-5
Total RF power, conducted	±1,5 dB
RF power density, conducted	±3 dB
Spurious emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

Company Under Test

NAME: City Theatrical Inc. (Manufacturer of Record)

ADDRESS: 475 Barell Avenue
Carlstadt, NJ, 07072-2809

CONTACT PERSON: Mr. Lauren E. Dunn

EMAIL: ldunn@citytheatrical.com

PHONE NUMBER: 201-549-1161

Company on Test Site

NAME: Pacific Design Engineering (Contract Manufacturer)

ADDRESS: 8505 Eastlake Dr

Burnaby, BC, V5A 4T7

CONTACT PERSON: Mr. Russ Fretenburg

EMAIL: fretenburg@pde.com

PHONE NUMBER: 604-421-1311 ext. 44

Equipment Under Test

THE TEST SYSTEM:

EQUIP Under Test 1: #5692 SHoW DMX Radio Transceiver-International Version
Manufacturer: City Theatrical Inc
Part Number: FB-4687-001

Test Jig: CTI Radio Test Board
Manufacturer: City Theatrical Inc
Part Number: P71677
Serial Number: FB-4687-003

Antenna1: Antenna 2.4-2.5 GHz ½ Wave, 50 Ω
Manufacturer: Nearson
Part Number: 2.4 GHz Swivel Antenna – 151 Model

Test Software: PC test Hyperterminal software
Manufacturer: City Theatrical Inc
Part Number: EMITest.exe

AUX EQUIP 1: 120Vac input +5Vdc output voltage, Power Supply
Manufacturer: Anatek Electronics Ltd.
Part Number: 25-2D

AUX EQUIP 2: Laptop Compaq Presario, Series CM2000.
Manufacturer: Compaq Computer Corp.
Part Number: LR109718-S54TY.

CABLING:

Ref	Cable	Pins	Connector	Termination	Shielded	Ferrites
1	Power Supply	2	2.4mm Coaxial plug	No	No	No
2	RS232	9	DB9	No	No	No

TEST SETUP: The #5692 SHoW DMX Radio Transceiver-International Version Module, is intended to be used as a module in a third party product, so was tested for Un-intentional, Intentional, radiated emissions and conducted emissions. The CTI Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test # 5692 SHoW DMX Radio Transceiver-International Version Module was plugged into the CTI Radio Test Board as can be observed in Figure 2. Appendix B. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with the FCC CFR47 Part 15/B, FCC CFR47 Part 15/C and Industry Canada RSS-210 Issue 6 Annex 8 a Category I device requirements.

For un-intentional emissions test, the CTI Radio International Module under test was tested in its normal mode of operation, when not in communication, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port. The un-intentional emissions testing used a Hyperterminal Program (using RS232 port) in order to set the Test Mode Command “e” - End of Transmit mode.

Both radiated and conducted emissions were evaluated to ensure compliance, with the Compaq Laptop not connected to the under test CTI Radio Test Module's RS 232. These emissions were evaluated while the unit was not in Transmission Mode of operation (for Receiver/Idle) and the Laptop not present in the setup as mentioned above. Then before testing the Jumper J5 and the RS 232 connector were removed from the CTI Radio Test Module.
Then Conducted Emissions for Transmit mode of operation were evaluated to ensure compliance, using the same Compaq Laptop not connected to the under test CTI Radio Test Module's RS 232. These emissions were evaluated while the unit was in Transmission Mode of operation and the Laptop not present in the setup as mentioned above.
Before testing the Jumper J5 and the RS 232 connector were removed from the CTI Radio Test Module.

For Intentional Conducted Emissions testing at the transmitters Antenna RF port of the # 5692 SHoW DMX Radio Transceiver-International Version Module under test, the tests were performed while the Spectrum Analyzer was connected directly to the Antenna port. For these tests, the laptop was connected via the RS232 port and the International Version Module was programmed to put the transmitter into its various modes of operation required for testing.

For the Spurious Radiated Emissions were performed while the # 5692 SHoW DMX Radio Transceiver-International Version Module under test was transmitting at full power while having the antenna connected to the Antenna Port.

Refer to Appendix B for photos about Cables and setup. Refer to Appendix A for the CISPR 22 Class B Radiated and Conducted Emission data.

MODIFICATIONS: This unit requires no modifications for it to pass.

CONCLUSION: The City Theatrical Inc. # 5692 SHoW DMX Radio Transceiver-International Version Module complies with the requirements of FCC CFR47 Part 15/B, FCC CFR47 Part 15/C and Industry Canada RSS-210 Issue 7 Annex 8 a Category I device. These test results are representative of the provided sample given to us for testing as documented above in the EUT section.

Section II: Report of Measurements for IC RSS-210 Issue 7 Annex 8 - Emissions Testing

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with IC ICES-003 – Interference-Causing Equipment Standard for Digital Apparatus, RSS-Gen Radio Standards General Requirements Issue 2, June 2007 and RSS-210 Low-power Licence-exempt Radiocommunication Devices, Issue 7, June 2007, Annex 8 Frequency Hopping Systems Operating in the 2400-2483.5 MHz Band.

The specific sections used for RSS-210 compliance is contained in the sections relating to Frequency Hopping Spread Systems. Testing was performed in accordance with procedures as outlined in RSS-Gen and RSS-210.

Requirements for Intentional Radiators

According to IC RSS-Gen 2.1.1 this product is classified as a Category I Transmitter and comprises radio devices where a TAC, issued by the Certification and Engineering Bureau of Industry Canada or, a certificate issued by a recognized Certification Body (CB), is required pursuant to sections 4(2) of the *Radio communication Act* and 21(1) of the *Radio communication Regulations*. A test report shall be required and the device shall be properly labelled. Additionally, this equipment is also covered by RSS-Gen 2.3 Licence-exempt Low-power Radio communication Devices (LPDs). Licence-exempt low-power radio communication devices are devices, which have intentional and unwanted emissions of very low signal levels such that they can co-exist with licensed radio services. LPDs are required to operate on a **"no-interference no-protection"** basis (i.e. they may not cause radio interference and cannot claim protection from interference).

Labeling and Markings

You should refer to the clauses of IC ICES-003, RSS-Gen and RSS-100 for information to be contained on the label as well as information about the label.

According to IC ICES-003 6.2 and the Annex the following statements, in both languages, must be included on the identification label:

> This Class B digital apparatus complies with Canadian ICES-003.
> Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

According to IC RSS-Gen Each Equipment subject to certification under the applicable RSSs, shall be permanently labelled on each item, or as an inseparable combination. The label must contain the following information for full compliance:

(a) the certification number, prefixed by the term "IC:";

(b) the manufacturer's name, trade name or brand name; and

(c) a model name or number.

According to IC RSS-100 Section 4. Labeling of Certified Radio Equipment, Certified radio equipment must be labelled with a unique certification/registration number, which consists of the Company Number (CN), assigned by the Bureau, followed by the Unique Product Number (UPN), assigned by the TAC or Certificate holder.
The certification/registration number shall appear as follows:
"IC:XXXXXX-YYYYYYYY"
Where:

- "XXXXXX-YYYYYYYY" is the certification/registration number;
- "XXXXXX" is the Company Number (CN), made of at most 6 alphanumeric characters (A-Z, 0-9), assigned by Industry Canada;
- "YYYYYYYY" is the Unique Product Number (UPN), made of at most 8 alphanumeric characters (A-Z, 0-9) assigned by the applicant; and
- The letters "IC" have no other meaning or purpose than to identify the Industry Canada certification number/registration number.

Permitted alphanumerical characters used in the CN and UPN are limited to capital letters (A-Z) and digits (0-9). Other characters, such as #, / or -, shall not be used.

All Categories I radio equipment intended for use in Canada must permanently display on each transmitter, receiver, or inseparable combination thereof, the information required above. This information must be affixed by Labeling or other means, in such a manner as not to be removable except by destruction or defacement.

User Manual Statements

According to IC ICES-003 6.2 and the Annex the following statements, in both languages, must be included on the identification label and could be included in the User Manual:

This Class B digital apparatus complies with Canadian ICES-003

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

According to IC RSS-Gen you will require the following statement:

"Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device."

Since you have a detachable Antenna, you will require the following statements (Replace [x] and [y] with the correct numbers)

"To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic ally radiated power (e.i.r.p.) is not more than that permitted for successful communication."

"This device has been designed to operate with the antennas listed below, and having a maximum gain of [x] dB. Antennas not included in this list or having a gain greater than [x] dB are strictly prohibited for use with this device. The required antenna impedance is [y] ohms."

(Include a list of Approved Antenna Manufacturers and Part Numbers)

According to IC RSS-102 Section 6.2, It must be noted that the certification applicant/grantee is responsible for providing proper instructions for the user of the radio device, as well as any usage restrictions. Since this is classified as a mobile unit, you will have to ensure that the user maintains a 20cm distance between the Antenna and the User when the unit is in operation. This could be the same information as outlined in you FCC statement According to FCC Section 2.1091, a caution statement about the RADIOFREQUENCY RADIATION EXPOSURE limitation of a separation of at least 20 centimetres is required.

§ 2.1091 (b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ''fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20-centimeter separation requirement.

Test Results - Summary

Testing was performed pursuant to Industry Canada RSS-Gen and RSS-210 Issue 6 Annex 8.

Test	Standard	Description	Result
Radiated Emissions Receiver Mode	RSS-Gen (6)(a)	The radiated emissions are measured in the 30-1000MHz range (same as FCC Class B Limits)	Complies
Conducted Emissions AC power lines in Receiver Mode	RSS-Gen (7.2.2)	The Conducted Emissions AC power lines are measured on the Phase and Neutral Power lines in Receiver mode for the 0.15 - 30.0 MHz range. (same as FCC Class B Limits)	Complies
Radiated Emissions Transmit Mode	RSS-210 (A8.5)	The radiated emissions are measured in the 30-20000MHz range	Complies
Conducted Emissions AC power lines Transmitter Mode	RSS-Gen (7.2.2)	The Conducted Emissions AC power lines are measured on the Phase and Neutral Power lines in the Transmitter Mode for the 0.15 - 30.0 MHz range (same as FCC Class B Limits)	Complies
Frequency Hopping Systems 20dB Emission Bandwidth Hopping channls carrier sep Number of Hopping channels Band-edge compliance	RSS-210 (A8.1)	20 dB Bandwidth Measurement performed with the Hopping stopped. Minimum Channel separation 25kHz or 20dB Bw of the channel, whichever is greater. For 2400-2483.5MHz FHSS system minimum 15 hopping channels are required And time of occupancy less then 0.4 sec	Complies
Transmitter Output Power and EIRP Emissions	RSS-210 (A8.4)	Output power shall not exceed 0.125 Watt	Complies

Part 1 - Unintentional Radiated Emission Testing

DATE: February 20, 2008

TEST STANDARD: RSS-Gen (6)(a)

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: (Same as RSS-Gen Issue 2, 6 (a), June 2007). TEST SETUP: The equipment under test, the CTI 5692 Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test International Module CTI 5692 was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B. Testing was performed in accordance with Canada RSS-210 Issue 7 Annex 8 a Category I device requirements.
For un-intentional emissions tests, the ShoW DMX Radio Transceiver-# 5692 International Version Module under test was tested in its normal mode of operation, when not in transmission (end of transmission mode) and not in communication, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: IC ICES 003, Class B limits, RSS Gen Issue 2, June 2007 (6.a) Table 1.

Frequency (MHz)	Maximum Field Strength μV/m at 3 m	Maximum Field Strength dBμV/m at 3 m
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0
Note 1. The lower limit shall apply at the transition frequency		

METHOD OF MEASUREMENT: The equipment was set up in a 10-meter open field test site; Tests were performed at 3 meters. Testing was performed using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. A typical application was tested.

Emissions in both horizontal and vertical polarization's were measured while rotating the EUT on a turntable to maximize the emissions signal strength.

This product was tested, as per RSS-Gen (6.a) procedures, in the 30 MHz – 1,000 MHz Band according to ANSI C63.4-2003, 4.1.5.3 Electric Field Measurements 30MHz to 1000 MHz.

EMISSIONS DATA: See Data Table 9 and 10 in Appendix A for corresponding frequencies and Figures 1, 2, and 3 in Appendix B for pictures.

PERFORMANCE: Complies.

Part 2 - Conducted Emission, AC power lines Testing

DATE: March 04, 2008

TEST STANDARD: RSS-General Requirements and Information for the Certification of Radio communication Equipment, 7.2.2. Transmitter and Receiver AC Power Lines Conducted Emissions Limits.

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus, as shown in Appendix B, Figures 4 and 5. The equipment was operated and tested at 120Vac 60Hz. The # 5692 SHoW DMX Radio Transceiver-International Version Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test International Module # 5692 was plugged into CTI Radio Test Board as can be observed in Appendix B, Figure 2. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with Industry Canada RSS-210 Issue 7 Annex 8 a Category I device requirements.
For un-intentional emissions tests, the # 5692 SHoW DMX Radio Transceiver-International Version Module under test was tested in its mode of operation, when not in communication, end of transmission mode, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: Same with RSS-General Requirements and Information for the Certification of Radio communication Equipment, 7.2.2. Transmitter and Receiver AC Power Lines Conducted Emissions Limits.

Frequency (MHz)	**Conducted Limit** (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66-56	56-46
0.50 - 5	56	46
5 - 30	60	50

METHOD OF MEASUREMENT: This product was tested, as per ANSI C63.4-2003, 7.2 AC powerline conducted emission measurements, Measurement Procedures.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 – Cabling.**

MEASUREMENT DATA: See Appendix A for corresponding frequencies, tables 11, 12 and plots 28, 29.

PERFORMANCE: Complies.

Part 3 - Radiated Emissions – Transmit Mode

DATE: December 06, 2007

TEST STANDARD: RSS-210 Iss.6 Annex 8 (A8.5)
Frequency Hopping Spread Spectrum 2400 to 2483.5 MHz

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

MINIMUM STANDARD: A8.5 Out-of-band Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4 (4) (The maximum peak power shall not exceed 0.125Watt), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section 2.7 Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.
According to RSS-210 Issue.7, General Field Strength Limits, Table 2, the limit For the Restricted Frequency Bands is etablied at 500uV (54dBuV).

TEST SETUP: Refer to setup in Section I, Test Setup above.

METHOD OF MEASUREMENT: Measurements were perforemd according to ANSI C63.4, 2003.

All frequencies up to 1GHz were tested at 3 meter in accordance with ANSI C63.4, 2003. Measurements higher then 1GHz frequency were made at 1 m distance, then adjusted to 3 Meter equivalent using the following formula:

20 Log (D1/D2)
Where D1 = New Distance D2 = Required Distance The result is added or subtracted, as required, to the required emission level to ensure compliance at the new distance.

These measurements were performed at 1m meter distance because the signal amplitude measured was close or lower then the ambient noise level for 3 meter distance.

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

EMISSIONS DATA: See Plots 1,2,3,4,5,6 and Tables 1,2,3,4,5,6 in Appendix A for corresponding frequencies.

Calculations used in tables 1,2 and 3. for Radiated Spurious Emissions:

1. Column four the Average Measured Signal with the minimum RBW of 1MHz, VBW is greater or equal to RBW for f > 1GHz.as recommended by the Public Notice DA 00-705, Spurious Radiated Emissions.
2. Column five is the Equipment Attenuation, considering here the Antenna Factor and Cable Loss measured for different frequencies.
3. Sixth column, Corrected Signal = Average Measured Signal + Equipment Attenuation.
4. Column eight is the Corrected Signal for 3 m = 20 x log(D1/D2) = 20 x log(1/3) = -9.5dB, corrected signal from 1m to 3m distance.
5. Column nine is the Calculated Average Signal with Duty Cycle Correction and the formula is: 20 x log.(Max Dwell Time/100ms) = -26.02 dB,
where Max Dwell time was considered 5 ms.

6. Column ten and thirteen are the FCC and IC Limits as it follows:
   Restricted Band: 54dBuV.
   The rest of the frequency band is Peak carrier – 30dBuV.
7. Column twelve is Delta from Peak carrier,
8. Columns eleven and fourteen, Delta Limit FCC and IC. For this column the formula is: Delta Limit = Limit Column – Calculated Average Signal with Duty Cycle Correction.

Calculations used in tables 4,5 and 6. for Conducted Spurious Emissions:

1. Column four is the Average Measured Signal measured with minimum RBW 100 kHz, minimum VBW 100 kHz as recommended by the Public Notice DA 00-705, for Spurious RF Conducted Emissions measurement.
2. Fifth column is the Equipment Attenuation, considering the Cable Loss measured for different frequencies measured.
3. Column six is the Corrected Signal = Average Measured Signal + Equipment Attenuation.
4. Seventh column is the Calculated Average Signal with Duty Cycle Correction, the formula used here is: 20 x log.(Max Dwell Time/100ms) = -26.02 dB, where Max Dwell time was considered 5 ms.
5. Column eight and eleven are the FCC and IC Limits as it follows:
   Restricted Band: 54dBuV.
   The rest of the frequency band is Peak carrier – 30dBuV.
6. Column ten is Delta from Peak carrier.
8. Columns nine and twelve, Delta Limit FCC and IC. For this column the formula is: Delta Limit = Calculated Average Signal with Duty Cycl - Limit Column.

NOTES:

According to RSS Gen Issue 2 June 2007, Annex 8.5, Out of Band Emissions, In any 100kHz bandwidth outside the frequency band in which the spread spectrum device is operating, the radio frequency power that is produced shall be at least 20 dB bellow that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

The equipment was set up in a 10-meter open field test site; tests were performed at 3 meters. Testing was performed using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. Emissions in both horizontal and vertical polarization's were measured while rotating the EUT on a turntable to maximize the emissions signal strength.

RSS Gen Issue 2 June 2007 recommends the search for spurious emissions for Transmitters, from the lowest frequency internally generated, or 30MHz, whichever is lower, to the 5^{th} harmonic of the highest frequency generated without exceeding 40GHz.
All results obtained for 30MHz to 24GHz are 20 dB bellow the allowable limit, so these plots do not need to be reported.

PERFORMANCE: Complies.

Part 4 - Conducted Emission Transmit ModeTesting

DATE: March 04, 2008

TEST STANDARD: RSS-General Requirements and Information for the Certification of Radio communication Equipment, 7.2.2. Transmitter and Receiver AC Power Lines Conducted Emissions Limits.

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus. The equipment was operated and tested at 120Vac 60Hz. The # 5692 SHoW DMX Radio Transceiver-International Version Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test # 5692 International Version Module was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with Industry Canada RSS-210 Issue 7 Annex 8 a Category I device requirements.
For un-intentional emissions tests, the # 5692 SHoW DMX Radio Transceiver-International Version Module under test was tested when in communication mode, Transmitting Even Full Band, mode of operation, Test mode Command A, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: Same with RSS-General Requirements and Information for the Certification of Radio communication Equipment, 7.2.2. Transmitter and Receiver AC Power Lines Conducted Emissions Limits.

Frequency (MHz)	**Conducted Limit** (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66-56	56-46
0.50 - 5	56	46
5 - 30	60	50

METHOD OF MEASUREMENT: This product was tested, as per ANSI C63.4-2003, 7.2 AC powerline conducted emission measurement.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section I, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 - Cabling**

MEASUREMENT DATA: See Appendix A for corresponding frequencies tables 13, 14 and plots 30,31. For photos please see Appendix B, Figures 4 and 5.

PERFORMANCE: Complies.

Part 5 - Frequency Hopping System operating within the 2400 – 2483.5 MHz band

DATE: December 13, 2007 and February 21, 2008.

TEST STANDARD: RSS-210 Iss.6 Annex 8 (A8.1) –
Frequency Hopping Spread Spectrum 2400 to 2483.5 MHz

A 8.1 Frequency Hopping System
Frequency hopping systems are spread spectrum systems in which the carrier is modulated with coded information in a conventional manner causing a conventional spreading of the RF energy about the carrier frequency. Frequency hopping systems are not required to employ all available hopping frequencies during each transmission. However the system, consisting of both the transmitter and the receiver, must be designed to comply with all the regulation in this section should the transmitter be presented with a continuous data stream.

(a) The bandwidth of a frequency-hopping channel is the 20-dB-emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset.

(b) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dBbandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 0.125W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(d) Frequency hopping systems operating in the 2400–2483.5 MHz band shall use at least 15 channels. The Average time of occupancy on any channel shall be not be greater than 0.4 second as within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency Hopping Systems may avoid or suppress the transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The equipment was operated and tested at 120Vac 60Hz. The # 5692 SHoW DMX Radio Transceiver-International Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test International Version Module # 5692 International Module was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with Industry Canada RSS-210 Issue 7 Annex 8 a Category I device requirements.
For Intentional Conducted Emissions testing at the transmitters Antenna RF port of the # 5692 SHoW DMX Radio Transceiver-International Version Module under test, the tests were performed while the Spectrum Analyzer was connected directly to the Antenna port. For these tests, the laptop was connected via the RS232 port and the # 5692 SHoW DMX Radio Transceiver-International Version Module was programmed to put the transmitter into its various modes of operation required for testing.

MINIMUM STANDARD: The Bandwidth of a frequency hopping channel is 20 dB emission bandwidth measured with hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. (A8.1 (1)).

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section I, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 - Cabling**

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with 10kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 10kHz bandwidth, CISPR Quasi-Peak detector as well as an average detector meter. This product was tested, as per ANSI C63.4-2003, 13 Measurement of Intentional Radiators.

BAND-EDGE compliance of RF Radiated Emissions used the measurement settings as outlined in the Public Notice DA 00-705, 2000: Span wide enough to capture the peak level on the channel closest to the bend-edge, RBW>=1% of the Span, Sweep = auto, VBW >=RBW, Peak detector, trace = Max Hold. Span used here was 15 MHz, RBW is 300kHz, VBW is 300kHz as well.The EUT was investigated at the low and high channels of operation to determine band-edge compliance. The Radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the limits of 15.209.

MEASUREMENT DATA: See Appendix A, tables 7, 8, and plots 10, 11.

PERFORMANCE: Complies.

20 dB BANDWIDTH compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are: Span approx. 2 to 3 times the 20dB bandwidth, RBW>=1% of the 20dB Bandwidth (1.3MHz/100=130kHzI), VBW >=RBW, Peak detector, Trace Max Hold.
The 20 dB Bandwidth for Low Channel 2406MHz test result is: 1.300 MHz.
The 20 dB Bandwidth for Mid Channel 2440MHz test result is: 1.265 MHz.
The 20 dB Bandwidth for High Channel 2477MHz test result is: 1.280 MHz.

MEASUREMENT DATA: See Appendix A, plots 12, 13 and 14.

PERFORMANCE: Complies.

HOPPING CHANNEL CARRIER FREQUENCY SEPARATION, compliance measurement settings recommended by the Public Notice DA 00-705, 2000 are:Span is the frequency band of operation, RBW>=1% of the span, VBW >=RBW, Peak detector, Trace Max Hold.
Hopping Channel Carrier frequencies (Plot 15) shall be separated by a minimum of 25kHz or 20dB bandwidth, whichever is greater, now considering 2.03 MHz > 1.300 MHz the FHSS system under test complies the requirement.

MEASUREMENT DATA: See Appendix A, plot 15.

PERFORMANCE: Complies.

TIME OF OCUPANCY, DWELL TIME, compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are:RBW =1MHz, VBW >=RBW, Peak detector, Trace Max Hold, hopping Enabled.
As can observed in table 5.2 the Total Time of occupancy less than 0.4 second and Number of Hopping Channels at least 15 channels complies the Frequency Hopping Systems operating in the 2400 – 2483.5 MHz requirement.

MEASUREMENT DATA: See Appendix A, plots 16, 17, 18 and 19.

PERFORMANCE: Complies as can be observed in Table 5.2

NUMBER OF HOPPING FREQUENCIES, compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are: Span = frequency band of operation, RBW>=1% of the span, VBW >=RBW, Peak detector, Trace Max Hold.

MEASUREMENT DATA: See Appendix A, plots 20 to 27.

PERFORMANCE: Complies.as can be seen in Table 5.2.

TEST MODE COMMANDS: For CW and Modulated Channels are presented in the following table:

Table 5.1

Test Mode Command	Type of Frequency Mode	Frequency
1	CW-Low Channel	2406 MHz
2	Modulated-Low Channel	2406 MHz
3	CW-Mid Channel	2440 MHz
4	Modulated-Mid Channel	2440 MHz
5	CW-High Channel	2477 MHz
6	Modulated-High Channel	2477 MHz

TEST MODE COMANDS: of the hopping channels and test results obtained are presented in the next table:

Table 5.2

Test Mode Command	Type of Frequency Mode	Frequency Range	Nr. of Channels	Dwell Time measured	Total ON Time
Simbol	Range Name	MHz	#	ms	ms
A	Even Full Band	2406-2476 MHz	36	4.932ms	191.11
B	Odd Full Band	2407-2477 MHz	36	4.915ms	189.54
C	Even Low Sub-band	2406-2434 MHz	15	4.925m	193.49
D	Odd Low Sub-band	2407-2435 MHz	15	4.945m	194.50
E	Even Mid Sub-band	2428-2456 MHz	15	4.911m	193.21
F	Odd Mid Sub-band	2429-2457 MHz	15	4.921ms	193.46
G	Even High Sub-band	2448-2476 MHz	15	4.945ms	194.37
H	Odd High Sub-band	2449-2477 MHz	15	4.913ms	194.79

Part 6 - Output Power and EIRP Emissions

DATE: December 06, 2007

TEST STANDARD: RSS-210 Issue.7 A8.4 – Transmitter Output Power and e.i.r.p. Requirements, for Frequency Hopping Spread Spectrum Systems 2400-2483.5MHz

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

MINIMUM STANDARD: RSS-210 A8.4 (2) and A8.4 (4) and RSS-Gen (4.6)
A8.4 (2) For frequency hopping systems operating in the 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1W: for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A.8.4(5), the e.i.r.p. shall not exceed 4W.

TEST SETUP: Refer to Test Setup in Section 1 above.

METHOD OF MEASUREMENT: Measurements were made using a Peak detector spectrum analyzer.
Peak Output Power compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are:
Span approx 5 times 20dB bandwidth, centered on hopping channel,
RBW > 20 dB bandwidth of the emission measured (1.3MHz), VBW >=RBW,
Peak detector, Trace Max Hold, Hopping Enabled. (RBW used was 3MHz, VBW 3MHz as well)
Since the antenna is detachable, a conducted measurement was performed at the antenna terminal.
This product was tested, as per ANSI C63.4-2003, 13.1 Measurement of intentional radiators.

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

MEASUREMENT DATA:

Frequency	Measured Signal – Peak at Ant. Terminal	Equipment correction	Corrected Signal - Peak at Ant. Terminal	Signal Power Level	Limit Line per RSS-210
(MHz)	(dBμV)	(dB)	(dBμV)	(mW)	(mW)
2406.00	115.8	2.45	118.25	13.34	125
2439.94	116.80	3.30	120.10	20.42	125
2476.94	116.8	4.13	120.93	24.72	125

EMISSIONS DATA: See Plots 7, 8 and 9 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Section III: Report of Measurements for FCC CFR47 Part 15/C

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15 – Subpart B – Unintentional Radiators Class B and Subpart C - Part 15.247 Intentional Radiators Operating within the band 2400-2483.5 MHz.

The specific sections used for Part 15.247 compliance is contained in the sections relating to Frequency Hopping Spread Spectrum Systems (FHSS). Testing was performed in accordance with the Guidelines from the FCC, Public Notice DA 00-705, Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.
The specific sections used for Part 15.247 compliance is contained in the sections relating to Digital Modulation Systems and references to Digital Sequence Spread Spectrum (DSSS). Testing was performed in accordance with the Guidelines from the FCC Knowledge Database 558074 Measurement of Digital Transmission Systems Operating under Section 15.247.

Requirements for Intentional Radiators

According to 47CFR Ch. I FCC 15.201 Equipment authorization requirement paragraph
(b) *"Except as otherwise exempted in paragraph (c) of this section and in § 15.23 of this part, all intentional radiators operating under the provisions of this part shall be certificated by the Commission pursuant to the procedures in subpart J of part 2 of this chapter prior to marketing."*

Labeling and Markings

You should refer to the clauses of FCC part 2 Section 2.925 and FCC part 15 Section 15.19 for information to be contained on the label as well as information about the label. Any other statements or Labeling requirements may appear on a separate label at the option of the applicant/grantee.

According to FCC Part 2 Section 2.925(a)." Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

> (1) FCC Identifier consisting of the two elements in the exact order specified in § 2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification. Example: FCC ID XXX123. XXX—Grantee Code and 123—Equipment Product Code "

According to FCC Section 15.19(a)(3), the following statement must be included on the identification label:

> "This equipment complies with FCC Rules, Part 15 Digital Device. Operation is subject to the following two conditions: 1) This device may not cause harmful interference, and 2) This device must accept any interference that may cause any undesired operation"

According to FCC Section 15.19(b) the FCC logo is not required for this product since it does not fall under the rules for a Product subject to authorization under a Declaration of Conformity.

User Manual Statements

According to FCC Section 15.105 (b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
>
> If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
> - Reorient or relocate the receiving antenna.
> - Increase the separation between the equipment and receiver.
> - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> - Consult the dealer or an experienced radio/ TV technician for help.

According to FCC Section 15.21, a caution statement is to be included. It can be similar to:

"Caution: Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment. "

According to FCC Section 2.1091, a caution statement about the RADIOFREQUENCY RADIATION EXPOSURE limitation of a separation of at least 20 centimetres is required.

§ 2.1091 (b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term ''fixed location'' means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20-centimeter separation requirement.

Test Results – Summary

Testing was performed pursuant to FCC Part 15 – Subpart B – Unintentional Radiators Class B and Subpart C - Part 15.247 Intentional Radiators Operating within the band 2400-2483.5 MHz.

Test	Standard	Description	Result
Radiated Emissions Idle/Receiving Mode	FCC PART 15 Subpart B 15.109 Class B Limits	The radiated emissions are measured in the 30-2000MHz range	Complies
Conducted Emissions AC Mains Idle/Receiving Mode	FCC PART 15 Subpart B 15.107,Class B Limits	The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.15 - 30.0 MHz range.	Complies
Radiated Emissions Transmit Mode	FCC Part 15 Subpart C 15.247, d)	Radiated emission characterstics for Spread Spectrum devices operating in the range 2400-2483.5 MHz that use the Frequency Hopping technique. Emissions are measured in the 30-20000MHz range	Complies
Conducted Emissions AC MainsTransmit Mode	FCC PART 15 Subpart C 15.207 Class B Limits	The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.15 - 30.0 MHz range.	Complies
Antenna Requirement	FCC Part 15 Subpart C 15.203	Proper Antenna is specified and used.	Complies
Frequency Hopping Spread Spectrum	FCC PART 15 Subpart C 15.247	Carrier Frequency Separation, Number of Hopping Channels, Time,of occupancy, 20dB Bandwidth, Band-edge compliance	Complies
Output Power and EIRP Emission	FCC PART 15 Subpart C 15.247	Maximum, peak conducted output power.	Complies

Part 1 - Unintentional Radiated Emission Testing

DATE: February 20, 2008

TEST STANDARD: FCC CFR47, Part 15, Subpart B – Class B

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The equipment under test, the CTI # 5692 Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test International Module was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B. Testing was performed in accordance with the FCC CFR47 Part 15/B, Category I device requirements.
For un-intentional emissions tests, the ShoW DMX Radio Transceiver-# 5692 International Version Module under test was tested in its normal mode of operation, when not in transmission (end of transmission mode) and not in communication, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: FCC PART 15 Subpart B 15.109 Class B Limits.

Frequency MHz	Field Strength at 10m	
	Microvolts/Meter	dB microvolts per meter
30 - 88	100	40.00
88 - 216	150	43.52
216 - 960	200	46.00
960 - above	500	54.00

METHOD OF MEASUREMENT: The equipment was set up in a 10-meter open field test site; Tests were performed at 3 meters. Testing was performed using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. A typical application was tested.

Emissions in both horizontal and vertical polarization's were measured while rotating the EUT on a turntable to maximize the emissions signal strength.

This product was tested, as per ANSI C63.4-2003, 4.1.5.3 Electric Field Measurement 30MHz to 1000 MHz according to FCC PART 15 Subpart B unintentional radiators, 15.109 Class B Limits in the 30 MHz – 1,000 MHz Band.

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section I.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING DESCRIPTIONS: Please refer to Equipment Under Test Section 1.

EMISSIONS DATA: See Tables 9 and 10 in Appendix A for corresponding frequencies and Figures 1, 2, 3 in Appendix B for pictures.

PERFORMANCE: Complies.

Part 2 - Conducted Emission AC Mains Testing

DATE: March 04, 2008.

TEST STANDARD: FCC 47CFR, Part 15, Subpart B 15.107– Class B
FCC 47CFR, Part 15, Subpart C 15.207

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus as shown in Appendix B, Figures 4 and 5. The equipment was operated and tested at 120Vac 60Hz. The CTI # 5692 Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test # 5692 SHoW DMX Radio Transceiver-International Version Module was plugged into the CTI Radio Test Board as can be observed in Figure 2, Appendix B. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with the FCC CFR47 Part 15/B, FCC CFR47 Part 15/C, requirements.
For un-intentional emissions tests, the # 5692 SHoW DMX Radio Transceiver-International Version Module under test was tested in its normal mode of operation, end of transmission mode, not in communication, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: FCC 47CFR, Part 15, Subpart B 15.107– Class B Limit:

Frequency (MHz)	**Conducted Limit** (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66-56	56-46
0.50 - 5	56	46
5 - 30	60	50

METHOD OF MEASUREMENT: This product was tested asper ANSI C63.4-2003, 7.2 AC powerline conducted emission measurements, Measurements Procedures.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 – Cabling.**

MEASUREMENT DATA: See Appendix A for corresponding frequencies tables 11, 12 and plots 28, 29.

PERFORMANCE: Complies.

Part 3 - Radiated Emissions – Transmit Mode Testing

DATE: December 06, 2007

TEST STANDARD: FCC 47CFR, Part 15, Subpart C 15.247 (d)
Frequency Hopping Spread Spectrum 2400 to 2483.5 MHz

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply.

MINIMUM STANDARD: FCC 47CFR, Part 15, Subpart C 15.247 (d) Out-of-band Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4 (4) (The maximum peak power shall not exceed 0.125Watt), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a) must also comply with the radiated emissions limits specified in § 15.209(a)

TEST SETUP: Refer to Test Setup in Section I, above.

METHOD OF MEASUREMENT: Measurements were performed according to ANSI C63.4, 2003.

All frequencies up to 1GHz were tested at 3 meter in accordance with ANSI C63.4, 2003. Measurements higher then 1GHz frequency were made at 1 m distance, then adjusted to 3 Meter equivalent using the following formula:

20 Log (D1/D2)
Where D1 = New Distance D2 = Required Distance The result is added or subtracted, as required, to the required emission level to ensure compliance at the new distance.

These measurements were performed at 1m meter distance because the signal amplitude measured was close or lower then the ambient noise level for 3 meter distance.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test, Section I, above.

EMISSIONS DATA: See Plots 1,2,3,4,5,6 and Tables 1,2,3,4,5,6 in Appendix A for corresponding frequencies.

Calculations used in tables 1,2 and 3. for Radiated Spurious Emissions:

1. Column four the Average Measured Signal with the minimum RBW of 1MHz, VBW is greater or equal to RBW for f > 1GHz.as recommended by the Public Notice DA 00-705, Spurious Radiated Emissions.
2. Column five is the Equipment Attenuation, considering here the Antenna Factor and Cable Loss measured for different frequencies.
3. Sixth column, Corrected Signal = Average Measured Signal + Equipment Attenuation.
4. Column eight is the Corrected Signal for 3 m = 20 x log(D1/D2) = 20 x log(1/3) = -9.5dB, corrected signal from 1m to 3m distance.
5. Column nine is the Calculated Average Signal with Duty Cycle Correction and the formula is: 20 x log.(Max Dwell Time/100ms) = -26.02 dB,
where Max Dwell time was considered 5 ms.

6. Column ten and thirteen are the FCC and IC Limits as it follows:
Restricted Band: 54dBuV.
The rest of the frequency band is Peak carrier – 30dBuV.
7. Column twelve is Delta from Peak carrier.
8. Columns eleven and fourteen, Delta Limit FCC and IC. For this column the formula is: Delta Limit = Limit Column – Calculated Average Signal with Duty Cycle Correction.

Calculations used in tables 4,5 and 6. for Conducted Spurious Emissions:

1. Column four is the Average Measured Signal measured with minimum RBW 100 kHz, minimum VBW 100 kHz as recommended by the Public Notice DA 00-705, for Spurious RF Conducted Emissions measurement.
2. Fifth column is the Equipment Attenuation, considering the Cable Loss measured for different frequencies measured.
3. Column six is the Corrected Signal = Average Measured Signal + Equipment Attenuation.
4. Seventh column is the Calculated Average Signal with Duty Cycle Correction, the formula used here is: 20 x log.(Max Dwell Time/100ms) = -26.02 dB, where Max Dwell time was considered 5 ms.
5. Column eight and eleven are the FCC and IC Limits as it follows:
Restricted Band: 54dBuV.
The rest of the frequency band is Peak carrier – 30dBuV.
6. Column ten is Delta from Peak carrier.
8. Columns nine and twelve, Delta Limit FCC and IC. For this column the formula is: Delta Limit = Calculated Average Signal with Duty Cycl - Limit Column.METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with 100kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 120kHz bandwidth, CISPR Quasi-Peak detector as well as an averaging meter.

NOTES:

According to FCC 47CFR, Part 15, Subpart C 15.247 (d) Out-of-band Emissions,
In any 100kHz bandwidth outside the frequency band in which the spread spectrum device is operating, the radio frequency power that is produced shall be at least 20 dB bellow that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. The equipment was set up in a 10-meter open field test site; tests were performed at 3 meters. Testing was performed using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. Emissions in both horizontal and vertical polarization's were measured while rotating the EUT on a turntable to maximize the emissions signal strength. The 47CFR Parts 15.247(d) and 15.205(a)(b)(c) recommends the search for spurious emissions from the lowest frequency internally generated, or 30MHz, whichever is higher, to at least 10^{th} harmonic or 40 GHz whichever is lower.. All results obtained for 30MHz to 24GHz are 20 dB bellow the allowable limit, so these plots do not need to be reported.
Regarding Plots 1,2 and 3, Radiated Spurious Emission, according to 47CFR Part 15.35 b, the minimum Resolution Bandwidth recommended is 1 MHz for measurements above 1000 MHz.
Regarding not the Plots 3,4 and 5 Conducted Spurious Emissions according to Public Notice DA 00-705, the minimum RBW recommended is 100kHz, VBW greater or equal to RBW, Trace Max Hold, Peak Detector.

PERFORMANCE: Complies.

Part 4 - Conducted Emission Transmit ModeTesting

DATE: March 04, 2008

TEST STANDARD: FCC 47CFR, Part 15, Subpart C 15.207, Conducted Limits.

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus as shown in Appendix B, Figures 4 and 5. The equipment was operated and tested at 120Vac 60Hz. The CTI Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage. The Under Test # 5692 SHoW DMX Radio Transceiver-International Version Module was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B. The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with the FCC CFR47 Part 15/B, FCC CFR47 Part 15/C requirements.
For un-intentional emissions tests, the # 5692 SHoW DMX Radio Transceiver-International Module under test was tested in communication mode, Transmitting Even Full Band, Test mode Command A, having the Nearson 2.4 GHz Swivel Antenna connected to the Antenna Port.

MINIMUM STANDARD: Same with FCC 47 CFR Part Subpart C, 15.205, Class B Limit:

Frequency (MHz)	**Conducted Limit** (dBμV)	
	Quasi-Peak	Average
0.15 - 0.50	66-56	56-46
0.50 - 5	56	46
5 - 30	60	50

METHOD OF MEASUREMENT: This product was tested, as per ANSI C63.4-2003, 7.2 AC powerline conducted emission measurements, Measurement Procedures.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section I, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 - Cabling**

MEASUREMENT DATA: See Appendix A for corresponding frequencies tables 13,14 and plots 30,31. For photos please see Appendix B, Figures 4 and 5.

PERFORMANCE: Complies.

Part 5 - Antenna Requirement - 15.203

APPLICABLE REGULATIONS: 15.203 - An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators, which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

RESULT: This unit meets this requirement. The antenna tested is:
NEARSON, Model: S151AH-2450S,
5dBi Gain, 2.4GHz Swivel Antenna with an SMA plug reverse polarity that meets the requirement of a unique connector.

The other two Antennas listed in the User Manual can be used considering their Antenna Gain is lower then the tested Antenna Gain 5dBi, mentioned above. The antenna can only be replaced with the appropriate antenna elements as specified by the NEARSON manufacturer and is only installed or replaced by authorized, factory trained personnel.

Part 6 - Frequency Hopping Spectrum Operation within the 2400-2483.5 MHz band

DATE: December 13, 2007 and February 21, 2008.

TEST STANDARD: FCC CFR47, Part 15, Subpart C 15.247
Public Notice DA 00-705 March 20, 2000 – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

15.247(a) - Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions. (Please note that only the applicable regulations are listed):

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system-hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(iii) For frequency hopping systems operating in the 2400–2483.5 MHz band shall use at least 15 channels. The Average time of occupancy on any channel shall be not be greater than 0.4 second as within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency Hopping Systems may avoid or suppress the transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400–2483.5 MHz band: employing at least 75 non-overlapping hopping channels and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems operating in the 2400–2483.5 MHz band: 0.125 Watts.

4) The Conducted output power limits specified in paragraph (b) of this section are based on the use of antennas with directional gains that do not exceed 6dBi.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a) must also comply with the radiated emissions limits specified in § 15.209(a)

The limits used for this EUT, for emissions that do not fall within the restricted bands of 15.205(a), the limit for the emissions is 20dB below the highest peak. For emissions that do fall within the restricted bands, the limit is 53.98dBμV/m at 3meters. Where measured frequencies of concern are over 1.0Ghz, we used the Average measurement procedure as outlined in FCC 97-114 Appendix C.

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D,Power Supply

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

TEST SETUP: The equipment was operated and tested at 120Vac 60Hz. The CTI # 5692 Radio Test Board was supplied with +5Vdc using the Anatek Electronics Ltd, Model 25-2D, 120Vac, 60Hz input and 0 to 25Vdc output adjustable voltage.

The # 5692 SHoW DMX Radio Transceiver-International Version Module was plugged into CTI Radio Test Board as can be observed in Figure 2, Appendix B.

The method of wireless communications is a 2.4GHz Frequency Hopping Spread Spectrum signal operating in accordance with the FCC CFR47 Part 15/B, FCC CFR47 Part 15/C Category I device requirements.

For Intentional Conducted Emissions testing at the transmitters Antenna RF port of the CTI International Module under test, the tests were performed while the Spectrum Analyzer was connected directly to the Antenna port. For these tests, the laptop was connected via the RS232 port and the CTI International Module was programmed to put the transmitter into its various modes of operation required for testing.

MINIMUM STANDARD: The Bandwidth of a frequency hopping channel is 20 dB emission bandwidth measured with hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset.

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section I, above.

CABLE DESCRIPTIONS: cables as specified in **Section 1 – Cabling.**

METHOD OF MEASUREMENT: This product was tested, as per ANSI C63.4-2003, 13 Measurement of Intentional Radiators.

BAND-EDGE compliance of RF Radiated Emissions used the measurement settings as outlined in the Public Notice DA 00-705, 2000: Span wide enough to capture the peak level on the channel closest to the bend-edge, RBW>=1% of the Span, Sweep = auto, VBW >=RBW, Peak detector, trace = Max Hold. Span used here was 15 MHz, RBW is 300kHz, VBW is 300kHz as well. The EUT was investigated at the low and high channels of operation to determine band-edge compliance. The Radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions as compared to the limits of 15.209.

MEASUREMENT DATA: See Appendix A, tables 7, 8, and plots 10, 11.

PERFORMANCE: Complies.

20 dB BANDWIDTH compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are: Span approx. 2 to 3 times the 20dB bandwidth, RBW>=1% of the 20dB Bandwidth (1.3MHz/100=130kHzI), VBW >=RBW, Peak detector, Trace Max Hold.
The 20 dB Bandwidth for Low Channel 2406MHz test result is: 1.300 MHz.
The 20 dB Bandwidth for Mid Channel 2440MHz test result is: 1.265 MHz.
The 20 dB Bandwidth for High Channel 2477MHz test result is: 1.280 MHz.

MEASUREMENT DATA: See Appendix A, plots 12, 13 and 14.

PERFORMANCE: Complies.

HOPPING CHANNEL CARRIER FREQUENCY SEPARATION, compliance measurement settings recommended by the Public Notice DA 00-705, 2000 are:Span is the frequency band of operation, RBW>=1% of the span, VBW >=RBW, Peak detector, Trace Max Hold.
Hopping Channel Carrier frequencies (Plot 15) shall be separated by a minimum of 25kHz or 20dB bandwidth, whichever is greater, now considering 2.03 MHz > 1.300 MHz the FHSS system under test complies the requirement.

MEASUREMENT DATA: See Appendix A, plot 15.

PERFORMANCE: Complies.

TIME OF OCUPANCY, DWELL TIME, compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are:RBW =1MHz, VBW >=RBW, Peak detector, Trace Max Hold, hopping Enabled.
As can observed in table 5.2 the Total Time of occupancy less than 0.4 second and Number of Hopping Channels at least 15 channels complies the Frequency Hopping Systems operating in the 2400 – 2483.5 MHz requirement.

MEASUREMENT DATA: See Appendix A, plots 16, 17, 18 and 19.

PERFORMANCE: Complies as can be observed in Table 5.2

NUMBER OF HOPPING FREQUENCIES, compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are: Span = frequency band of operation, RBW>=1% of the span, VBW >=RBW, Peak detector, Trace Max Hold.

MEASUREMENT DATA: See Appendix A, plots 20 to 27.
PERFORMANCE: Complies.as can be seen in Table 5.2.

TEST MODE COMANDS For CW and Modulated Channels are presented in the following table:
Table 6.1

Test Mode Command	Type of Frequency Mode	Frequency
1	CW-Low Channel	2406 MHz
2	Modulated-Low Channel	2406 MHz
3	CW-Mid Channel	2440 MHz
4	Modulated-Mid Channel	2440 MHz
5	CW-High Channel	2477 MHz
6	Modulated-High Channel	2477 MHz

TEST MODE COMANDS Of the Hopping Channels and Test Results obtained are presented in the following table:

Table 6.2

Test Mode Command	Type of Frequency Mode	Frequency Range	Nr. of Channels	Dwell Time measured	Total ON Time
Simbol	Range Name	MHz	#	ms	ms
A	Even Full Band	2406-2476 MHz	36	4.932ms	191.11
B	Odd Full Band	2407-2477 MHz	36	4.915ms	189.54
C	Even Low Sub-band	2406-2434 MHz	15	4.925m	193.49
D	Odd Low Sub-band	2407-2435 MHz	15	4.945m	194.50
E	Even Mid Sub-band	2428-2456 MHz	15	4.911m	193.21
F	Odd Mid Sub-band	2429-2457 MHz	15	4.921ms	193.46
G	Even High Sub-band	2448-2476 MHz	15	4.945ms	194.37
H	Odd High Sub-band	2449-2477 MHz	15	4.913ms	194.79

Part 7 - Output Power and EIRP Emissions

DATE: December 06, 2007

TEST STANDARD: FCC 47CFR, Part 15, Subpart C 15.247 (d)

TEST VOLTAGE: +5Vdc output voltage, 120Vac input, Anatek Electronics Ltd., Model: 25-2D, Power Supply

MINIMUM STANDARD: FCC 47CFR, Part 15, Subpart C 15.247 (a)(1)
For frequency hopping systems operating in the 2400-2483.5 MHz band, the maximum peak conducted output power is not to exceed 1.0 W if the hopset uses 50 or more hopping channels and 0.125 W if the hopset uses less than 50 hopping channels.

TEST SETUP: Refer to setup in Section 1 above.

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with 100kHz RBW, Peak detector. Peak Output Power compliance measurement setting recommended by the Public Notice DA 00-705, 2000 are:
Span approx 5 times 20dB bandwidth, centered on hopping channel,
RBW > 20 dB bandwidth of the emission measured (1.3MHz), VBW >=RBW,
Peak detector, Trace Max Hold, hopping Enabled. (RBW used was 3MHz, VBW 3MHz as well)
Since the antenna is detachable, a conducted measurement was performed at the antenna terminal.
This product was tested, as per ANSI C63.4-2003, 13.1 Measurement of intentional radiators.

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

MEASUREMENT DATA:

Frequency	Measured Signal – Peak at Ant. Terminal	Equipment correction	Corrected Signal - Peak at Ant. Terminal	Signal Power Level	Limit Line per FCC47CFR Part 15.247
(MHz)	(dBμV)	(dB)	(dBμV)	(mW)	(mW)
2406.00	115.8	2.45	118.25	13.34	125
2439.94	116.80	3.30	120.10	20.42	125
2476.94	116.8	4.13	120.93	24.72	125

EMISSIONS DATA: See Plots 7, 8 and 9 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Appendix A: Report of Measurements Data and Plots

City Theatrical Inc – #5692 SHoW DMX Radio Transceiver-International Module

Data Table 1: 15.247(b, d) / IC RSS-210 Appendix 8, 2406 MHz, Low Channel Radiated Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Measured Distance	Corrected Signal for 3m (-9.5dB)	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)			(dBuV)	(dB)	(dBuV)	(m)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2406.000	fund	N/A	88.0	23.24	111.24	1.0	101.74	75.62	N/A	N/A	N/A	N/A	N/A
4811.210	2nd	4500-5150	11.8	37.97	49.77	1.0	40.27	14.15	54.00	-39.85	-67.59	54.00	-39.85
7217.320	3rd	N/A	14.9	39.90	54.80	1.0	45.30	19.18	45.62	-26.44	-62.56	45.62	-26.44
9624.460	4th	N/A	9.2	43.20	52.40	1.0	42.90	16.78	45.62	-28.84	-64.96	45.62	-28.84
12030.330	5th	10600-12700	12.3	46.21	58.51	1.0	49.01	22.89	54.00	-31.11	-58.85	54.00	-31.11
14436.210	6th	N/A	9.0	47.61	56.61	1.0	47.11	20.99	45.62	-24.63	-60.75	45.62	-24.63
16842.410	7th	N/A	11.2	48.07	57.27	1.0	49.77	23.65	45.62	-21.97	-58.08	45.62	-21.97
19248.330	8th	17700-21400	8.8	54.80	63.60	1.0	54.10	27.98	54.00	-26.02	-53.76	54.00	-26.02
21651.620	9th	N/A	10.9	54.80	65.70	1.0	56.20	30.08	45.62	-15.54	-51.66	45.62	-15.54
24060	10th	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Data Table 2: 15.247(b, d) / IC RSS-210 Appendix 8, 2440 MHz, Middle Channel Radiated Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Measured Distance	Corrected Signal for 3m (-9.5dB)	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)			(dBuV)	(dB)	(dBuV)	(m)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2439.990	fund	N/A	85.7	23.48	109.18	1.0	99.68	73.56	N/A	N/A	N/A	N/A	N/A
4880.026	2nd	4500-5150	10.8	37.34	48.14	1.0	38.64	12.52	54.00	-41.48	-87.16	54.00	-41.48
7320.120	3rd	7250-7750	12.1	40.62	52.72	1.0	43.22	17.10	54.00	-36.90	-82.58	54.00	-36.90
9760.180	4th	N/A	10.3	44.31	54.61	1.0	45.11	18.99	43.56	-24.57	-80.69	43.56	-24.57
12204.210	5th	10600-12700	11.4	46.24	57.64	1.0	48.14	22.02	54.00	-31.98	-77.66	54.00	-31.98
14640.320	6th	N/A	10.0	47.06	57.06	1.0	57.56	21.44	43.56	-22.12	-78.24	43.56	-22.12
17080.240	7th	N/A	11.1	49.31	60.41	1.0	50.91	24.79	43.56	-18.77	-74.89	43.56	-18.77
19520.340	8th	17700-21400	9.7	54.80	64.50	1.0	55.00	28.88	54.00	-25.12	-70.80	54.00	-25.12
21961.420	9th	N/A	10.0	54.80	64.80	1.0	55.30	29.18	43.56	-14.38	-70.50	43.56	-14.38
24400	10th	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Data Table 3: 15.247(b, d) / IC RSS-210 Appendix 8, 2477MHz, High Channel Radiated Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Measured Distance	Corrected Signal for 3m (-9.5dB)	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)			(dBuV)	(dB)	(dBuV)	(m)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2476.940	fund	N/A	86.0	23.64	109.64	0.0	100.14	74.02	N/A	N/A	N/A	N/A	
4954.025	2nd	4500-5150	9.6	38.27	47.87	1.0	38.37	12.25	54.00	-41.75	-87.89	54.00	-41.75
7431.084	3rd	7250-7750	10.2	40.98	51.18	1.0	41.68	15.56	54.00	-38.44	-84.58	54.00	-38.44
9908.012	4th	N/A	9.1	44.43	53.53	1.0	44.03	17.91	44.02	-26.11	-82.23	44.02	-26.11
12385.140	5th	10600-12700	9.9	47.53	57.43	1.0	47.93	21.81	54.00	-32.19	-78.33	54.00	-32.19
14862.100	6th	N/A	9.0	44.48	53.48	1.0	43.98	17.86	44.02	-26.11	-82.28	44.02	-26.11
17339.15	7th	N/A	9.5	50.62	60.12	1.0	50.62	24.50	44.02	-19.52	-75.64	44.02	-19.52
19814.305	8th	17700-21400	6.5	54.8	61.30	1.0	51.80	25.68	54.0	-28.32	-74.46	54.0	-28.32
22293	9th	22010-23120	N/A	N/A	N/A	1.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24770	10th	N/A	N/A	N/A	N/A	1.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: For Low Channel 2406 MHz the Peak Carrier is: 75.62 dBuV, for Middle Channel 2440 MHz the Peak Carrier is: 73.56 dBuV and for High Channel 2477 MHz the Peak Carrier is: 74.02 dBuV.

Data Table 4: 15.247(b, d) / IC RSS-210 Appendix 8, 2406 MHz, Low Channel Conducted Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)			(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2406.023	fund	N/A	114.7	2.45	117.15	91.03	N/A	N/A	N/A	N/A	N/A
4813.471	2nd	4500-5150	50.4	4.00	54.40	28.28	54.00	-25.72	-62.75	54.00	-25.72
7219.510	3rd	N/A	50.2	2.80	53.00	26.88	61.03	-34.15	-64.15	61.03	-34.15
9624.090	4th	N/A	55.3	4.40	59.70	33.58	61.03	-27.45	-57.45	61.03	-27.45
12030.380	5th	10600-12700	54.9	6.80	61.70	35.58	54.00	-18.42	-55.45	54.00	-18.42
14437.553	6th	N/A	58.0	5.75	63.75	37.63	61.03	-23.40	-53.40	61.03	-23.40
16843.250	7th	N/A	58.4	6.60	65.00	38.88	61.03	-22.15	-52.15	61.03	-22.15
19248.113	8th	17700-21400	61.1	8.00	69.10	42.98	54.00	-11.02	-48.05	54.00	-11.02
21655.172	9th	N/A	61.3	8.00	69.30	43.18	61.03	-17.85	-47.85	61.03	-17.85
24060	10th	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Data Table 5: 15.247(b, d) / IC RSS-210 Appendix 8, 2440 MHz, Middle Channel Conducted Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)	0		(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2440.019	fund	N/A	114.3	3.30	117.60	91.48	N/A	N/A	N/A	N/A	N/A
4880.011	2nd	4500-5150	50.9	4.00	54.90	28.78	54.00	-25.22	-62.70	54.00	-25.22
7320.032	3rd	7250-7750	55.2	3.20	58.40	32.28	54.00	-21.72	-59.20	54.00	-21.72
9760.024	4th	N/A	55.6	5.40	61.00	34.88	61.48	-26.60	-56.60	61.48	-26.60
12200.085	5th	10600-12700	54.8	6.80	61.60	35.48	54.00	-18.52	-56.00	54.00	-18.52
14639.953	6th	N/A	58.1	5.75	63.85	37.73	61.48	-23.75	-53.75	61.48	-23.75
17080.006	7th	N/A	58.4	6.60	65.00	38.88	61.48	-22.60	-52.60	61.48	-22.60
19520.049	8th	17700-21400	61.5	8.00	69.50	43.38	54.00	-10.62	-48.10	54.00	-10.62
21960.032	9th	N/A	62.1	8.00	70.20	43.98	61.48	-17.50	-47.50	61.48	-17.50
24400	10th	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Data Table 6: 15.247(b, d) / IC RSS-210 Appendix 8, 2477 MHz, High Channel Conducted Spurious Emissions

Freq.	Harmonic	Restricted Bands	Measured Signal Average (RBW=1MHz / VBW=10Hz)	Equipment Attenuation	Corrected Signal	Calculated Averaged Signal with Duty Cycle Correction (-26.12dB)	Limit - FCC 15.247	Delta Limit - FCC 15.247	Delta from Peak Carrier	Limit - IC RSS-210 Appendix 8	Delta Limit - IC RSS-210
(MHz)	0		(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dBc)	(dBuV)	(dB)
2477.014	fund	N/A	114.4	4.13	118.53	92.41	N/A	N/A	N/A	N/A	N/A
4954.089	2nd	4500-5150	51.7	4.00	55.70	29.58	54.00	-24.42	-62.83	54.00	-24.42
7431.034	3rd	7250-7750	55.6	3.20	58.80	32.68	54.00	-21.32	-59.73	54.00	-21.32
9908.012	4th	N/A	56.1	5.40	61.50	35.38	62.41	-27.03	-57.03	62.41	-27.03
12385.022	5th	10600-12700	55.6	8.05	63.65	37.53	54.00	-16.47	-54.88	54.00	-16.47
14862.090	6th	N/A	58.8	4.10	62.90	36.78	62.41	-25.63	-55.63	62.41	-25.63
17339.074	7th	N/A	59.2	6.25	65.45	39.33	62.41	-23.08	-53.08	62.41	-23.08
19816.047	8th	17700-21400	62.1	8.00	70.10	43.98	54.00	-10.02	-48.43	54.00	-10.02
22293	9th	22010-23120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
24770	10th	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: For Low Channel 2406 MHz the Peak Carrier is: 91.03 dBuV, for Middle Channel 2440 MHz the Peak Carrier is: 91.48 dBuV and for High Channel 2477 MHz the Peak Carrier is: 92.41 dBuV.

Data Table 7: Lower, Band-edge Marker Delta method test results:

Frequency (MHz)	Level (dBuV)		Antenna Polarity H/V	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)		Delta Marker (dB)	Band-edge Field Strength (dBuV/n)		Margin to Linit (dBuV/m) 45.62	54
	Peak	Avg			Peak	Avg		Peak	Avg	Peak	Avg
Fundamental Frequency											
2406	69.10	69.00	V	-7.20	61.90	61.80	43.20	18.70	18.60	26.92	35.40

Data Table 8: Upper, Band-edge Marker Delta method test results:

Frequency (MHz)	Level (dBuV)		Antenna Polarity H/V	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)		Delta Marker (dB)	Band-edge Field Strength (dBuV/n)		Margin to Linit (dBuV/m) 44.02	54
	Peak	Avg			Peak	Avg		Peak	Avg	Peak	Avg
Fundamental Frequency											
2477	68.30	68.20	V	-6.50	61.80	61.90	42.80	19.00	18.90	25.02	35.10

Un-Intentional Radiated Emissions

City Theatrical Inc – #5692 SHoW DMX Radio Transceiver-International Version Module
Tested for Normal Mode (End of Transmission Mode)

Table 7: FCC Class B - 3m

Frequency (MHz)	Pol	Hgt (m)	Angle (deg)	Uncor-Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	QP Lmt (dBμV/m)	DelLim-Pk (dB)	Quasi-Peak (dBμV/m)	DelLim-QPk (dB)
47.35739	Vert	1	0	7.9	11.29	19.19	40	-20.81	17.38	-22.62
86.82910	Horz	2	270	12.6	11.3	23.9	40	-16.10	19.29	-20.71
125.0024	Vert	1	0	10.0	13.42	23.42	43.5	-20.08	20.92	-22.58
180.2835	Horz	1	270	14.6	15.12	29.72	43.5	-13.78	26.79	-16.71
422.3857	Horz	3.0	180	12.9	19.24	32.14	46	-13.86	28.76	-17.24

Table 8: CISPR 22 Class B – 3m

Frequency (MHz)	Pol	Hgt (m)	Angle (deg)	Uncor-Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	QP Lmt (dBμV/m)	DelLim-Pk (dB)	Quasi-Peak (dBμV/m)	DelLim-QPk (dB)
47.35739	Vert	1	0	7.9	11.29	19.19	39.5	-20.31	17.38	-22.12
86.82910	Horz	2	270	12.6	11.3	23.9	39.5	-15.60	19.29	-20.21
125.0024	Vert	1	0	10.0	13.42	23.42	39.5	-16.08	20.92	-18.58
180.2835	Horz	1	270	14.6	15.12	29.72	39.5	-9.78	26.79	-12.71
422.3857	Horz	3.0	180	12.9	19.24	32.14	46.5	-13.36	28.76	-17.74

AC MAINS Conducted Emissions Testing.
City Theatrical Inc – #5692 SHoW DMX Radio Transceiver-International Version Module using the "Anatek 25-2D" power supply set on +5Vdc – while operating in End of Transmission Mode.

Table 9: Line 1- Peaks 120Vac, 60Hz

Frequency (MHz)	Peak (dBμV)	DelLim-Pk (dB)
.1914	49.4	-4.5
.2184	48.3	-4.5
.1694	50.2	-4.7
.2127	48.3	-4.7
.2315	47.5	-4.8
.2929	46.5	-4.8

Table 10: Line 2- Peaks 120Vac, 60Hz

Frequency (MHz)	Peak (dBμV)	DelLim-Pk (dB)
.2105	48.9	-4.2
.2207	48.4	-4.3
.2365	47.7	-4.5
.1834	49.7	-4.6
.2520	47.0	-4.6
.3001	45.6	-4.6

AC MAINS Conducted Emissions in Transmit Mode of operation.
City Theatrical Inc – #5692 SHoW DMX Radio Transceiver-International Version Module operating in Transmission Mode using the "Anatek 25-2D" power supply +5Vdc output voltage.

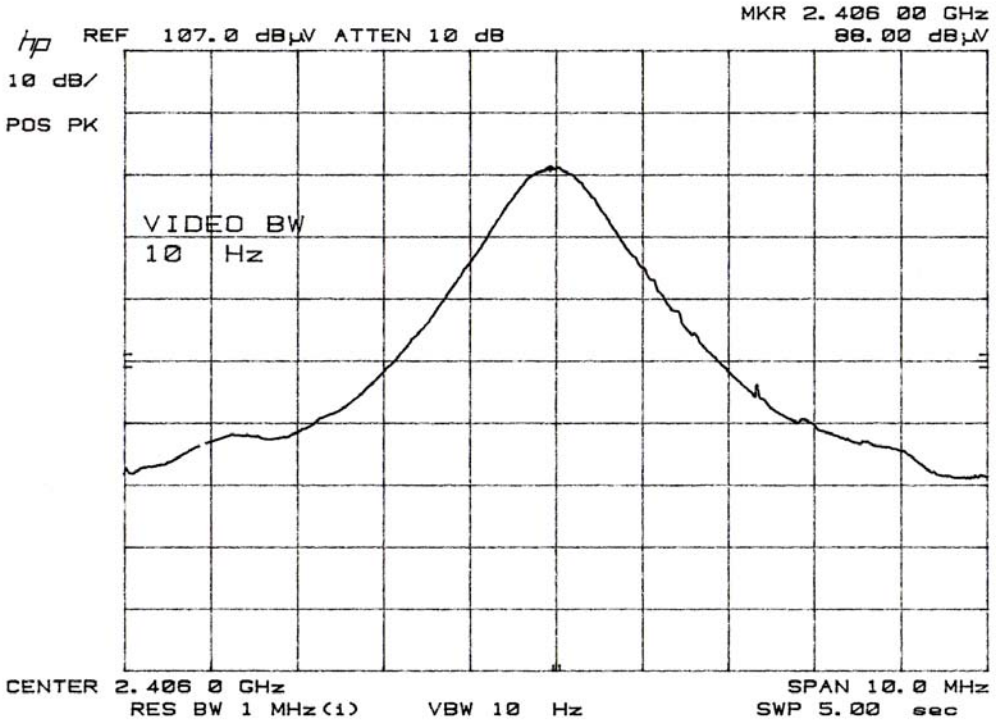
Table 11: Line 1- Peaks 120Vac, 60Hz

Frequency (MHz)	Peak (dBμV)	DelLim-Pk (dB)
.2150	49.1	-3.9
.2196	48.6	-4.2
.2039	49.1	-4.3
.1688	50.6	-4.5
.1721	58.1	-4.7
.1883	49.4	-4.7

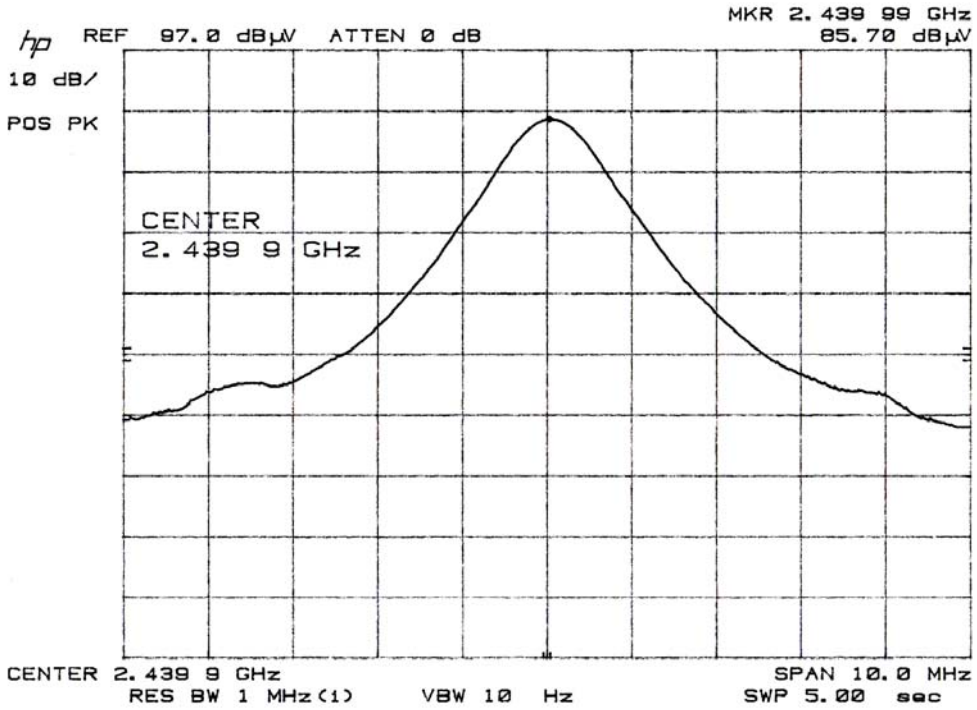
Table 12: Line 2- Peaks 120Vac, 60Hz

Frequency (MHz)	Peak (dBμV)	DelLim-Pk (dB)
.2072	49.3	-4.0
.2173	48.4	-4.5
.1694	50.3	-4.6
.1805	49.8	-4.6
.2231	48.8	-4.6
.2390	47.5	-4.6

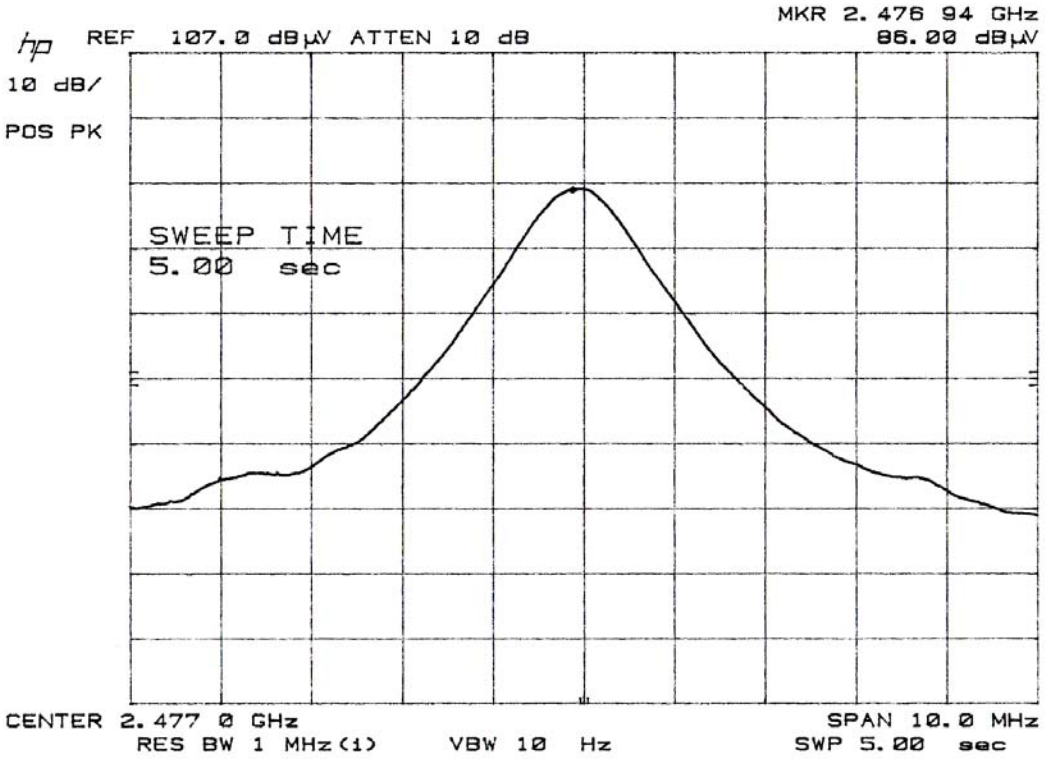
15.247 Radiated Spurious Emission



Plot 1: Radiated Spurious Emission - Low Channel 2406MHz Level

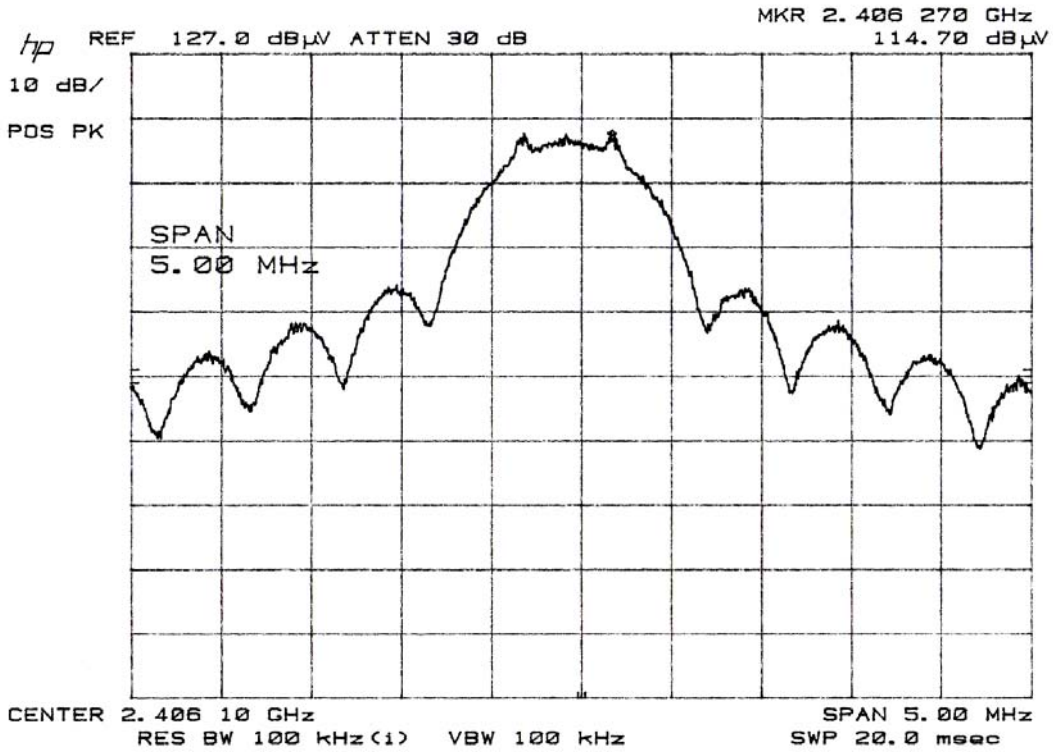


Plot 2: Radiated Spurious Emission Middle Channel 2440MHz Level

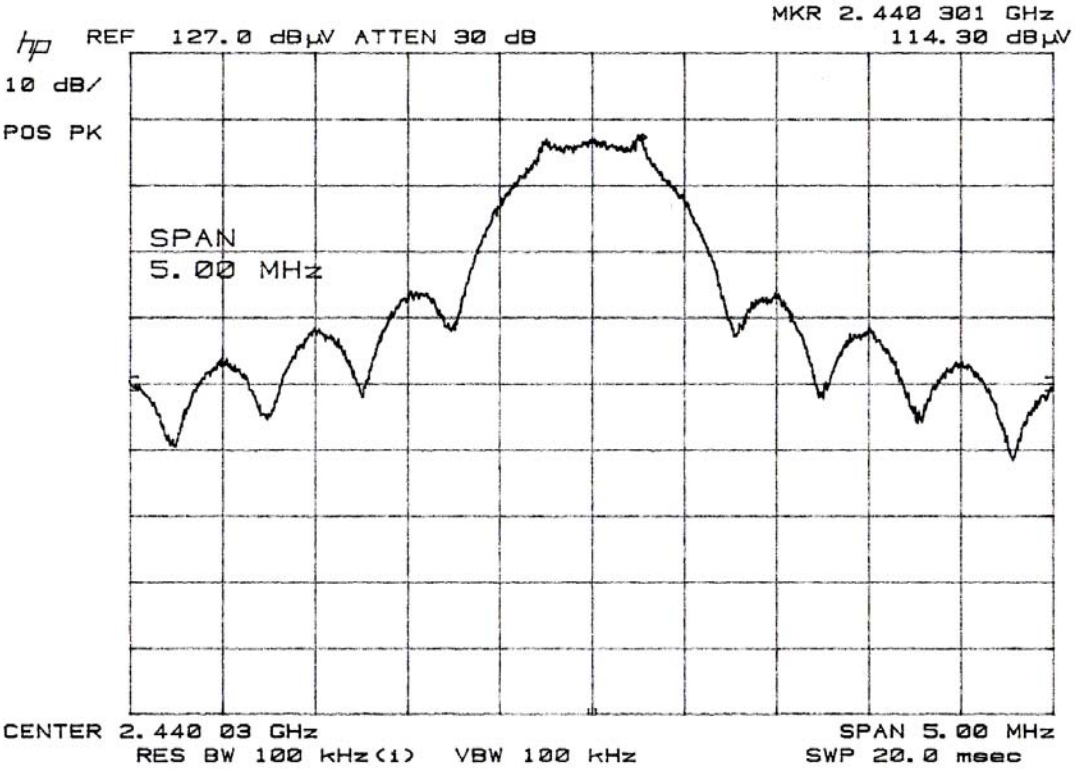


Plot 3: Radiated Spurious Emission High Channel 2477 MHz Level

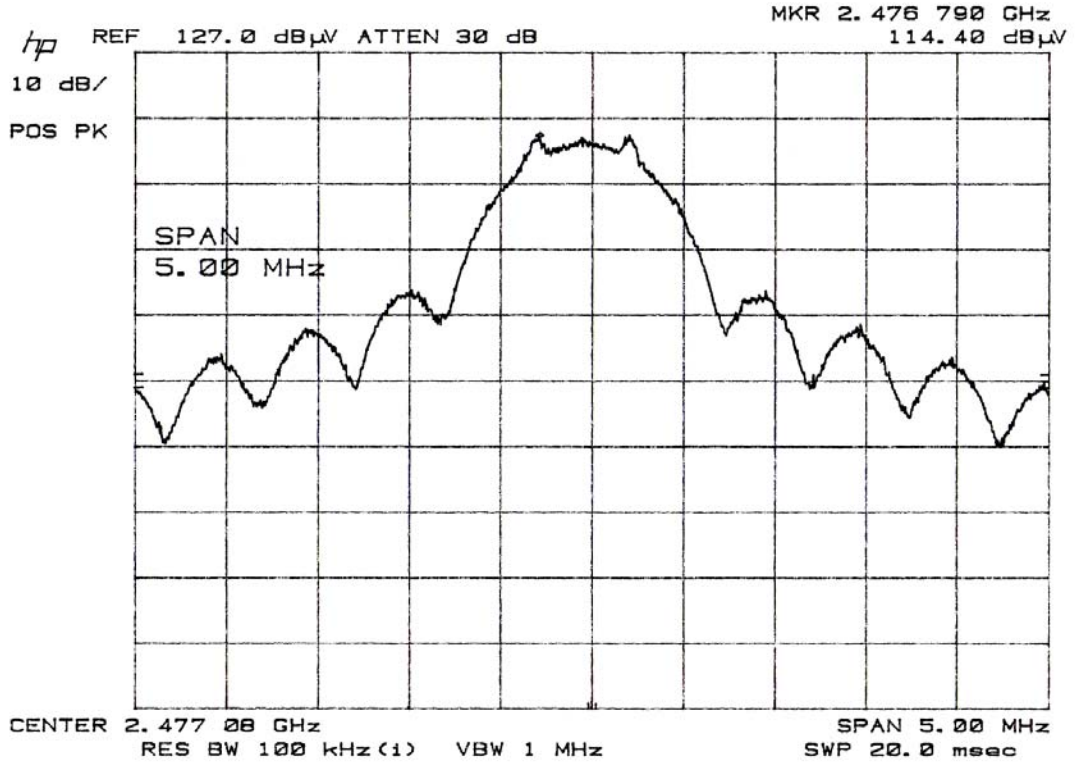
15.247 Conducted Spurious Emission



Plot 4: Conducted Spurious Emission - Low Channel 2406 MHz Level

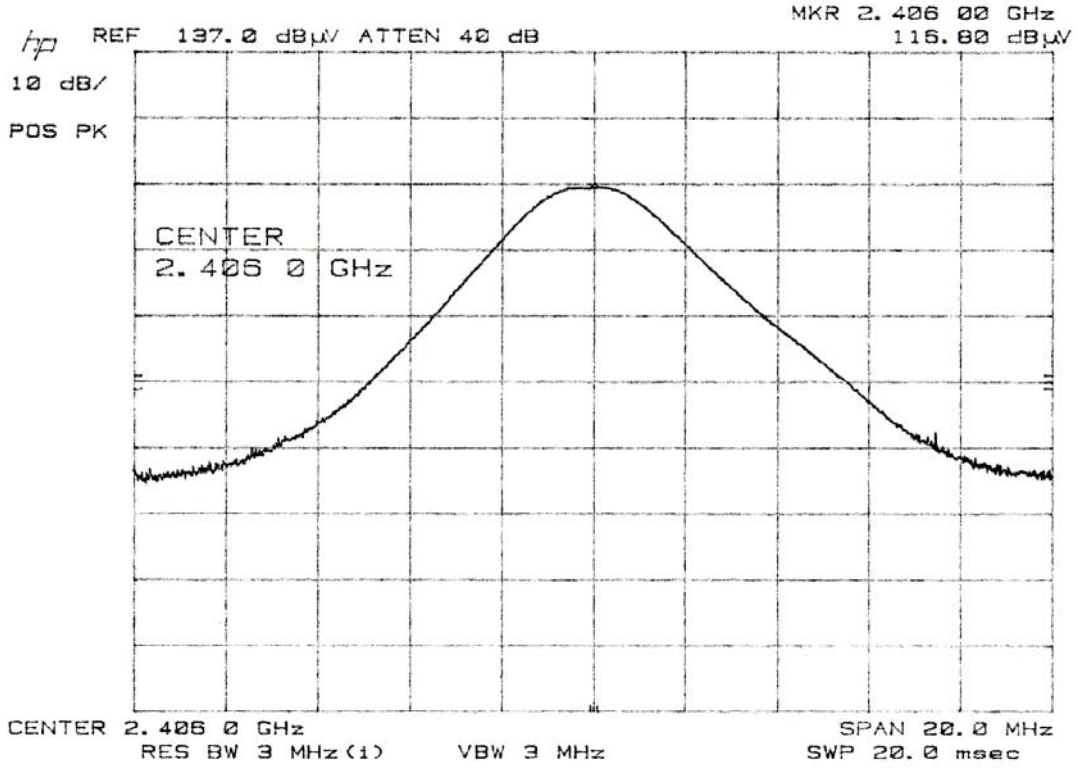


Plot 5: Conducted Spurious Emission Middle Channel 2440MHz Level

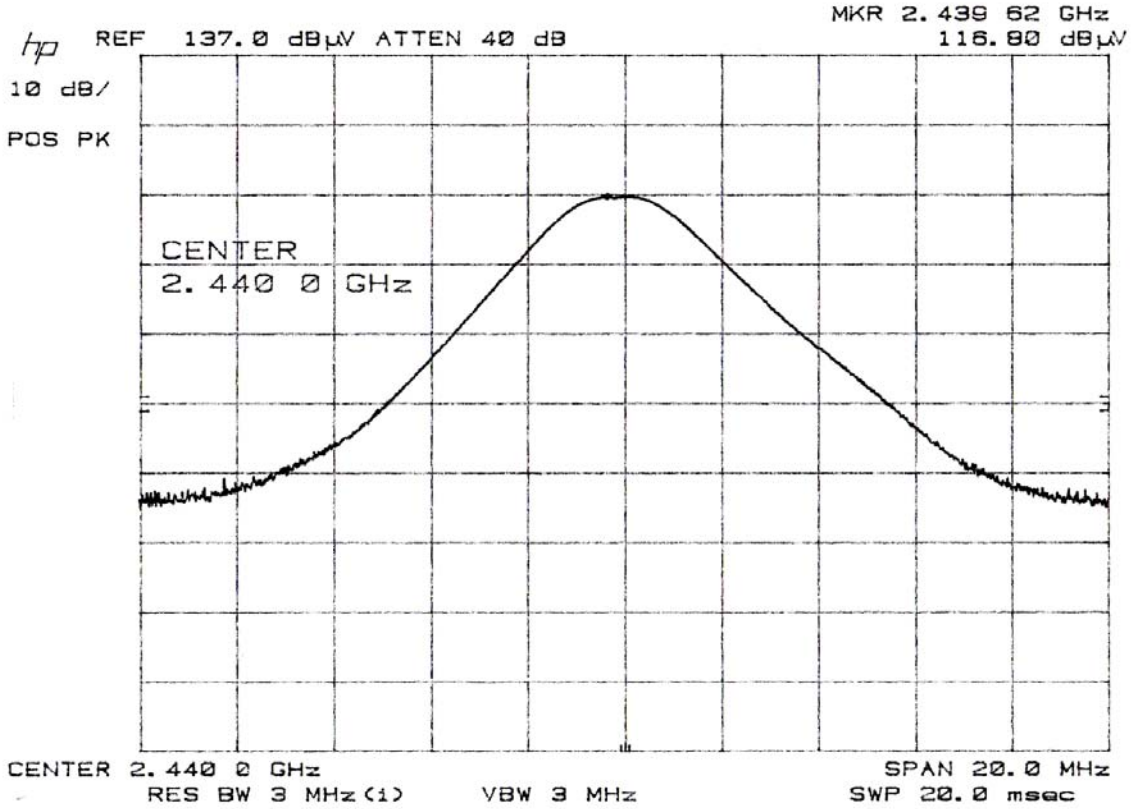


Plot 6: Conducted Spurious Emission High Channel 2477 MHz Level

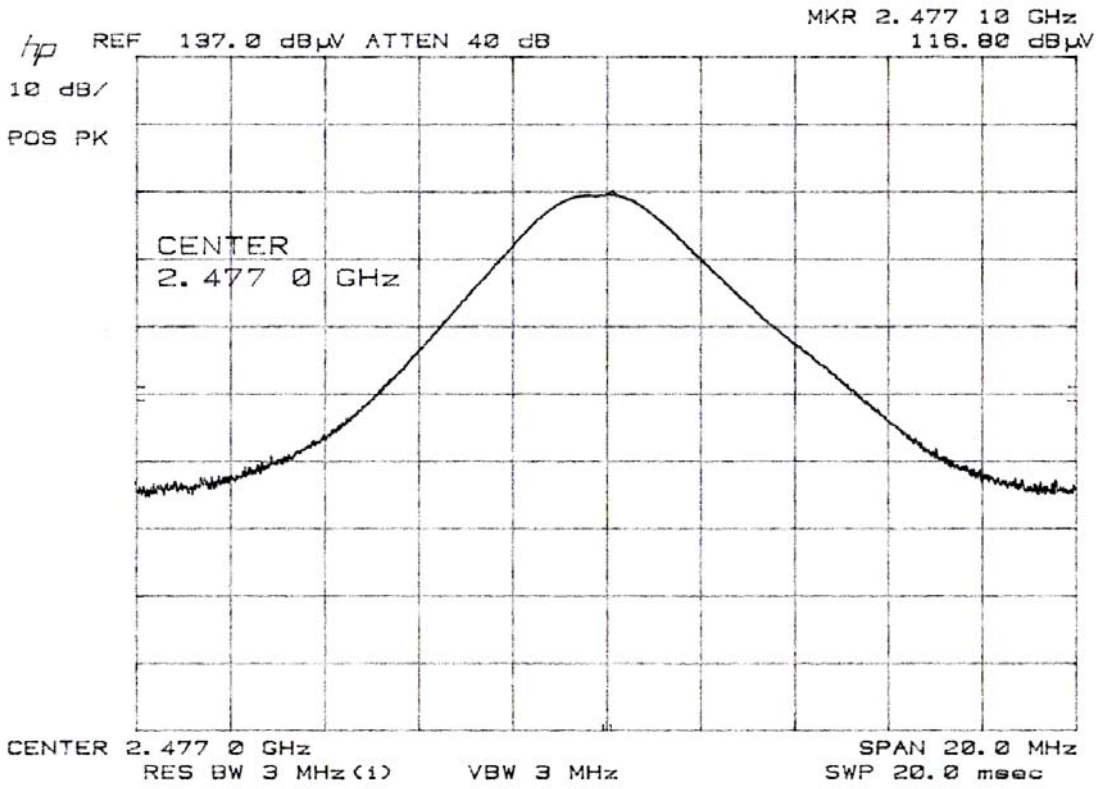
15.247 Peak Output Level



Plot 7: Peak Output Level – Low Channel 2406 MHz Level

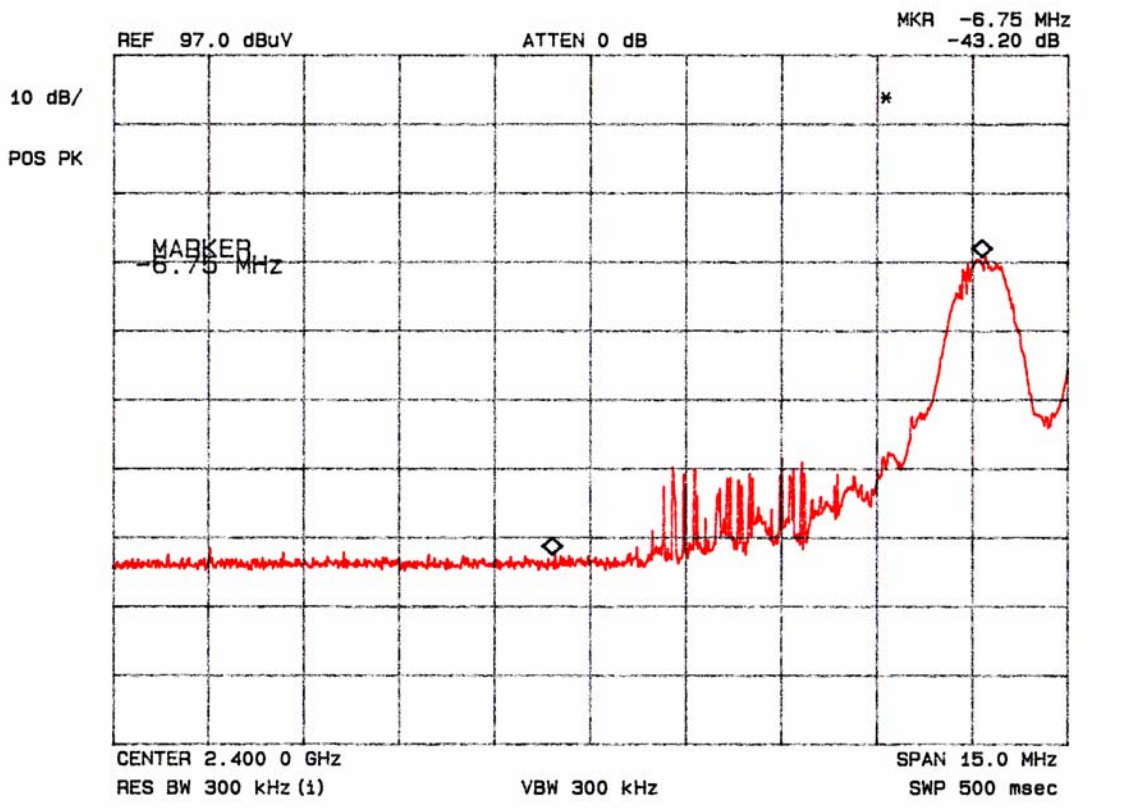


Plot 8: Peak Output Level – Middle Channel 2440 MHz Level

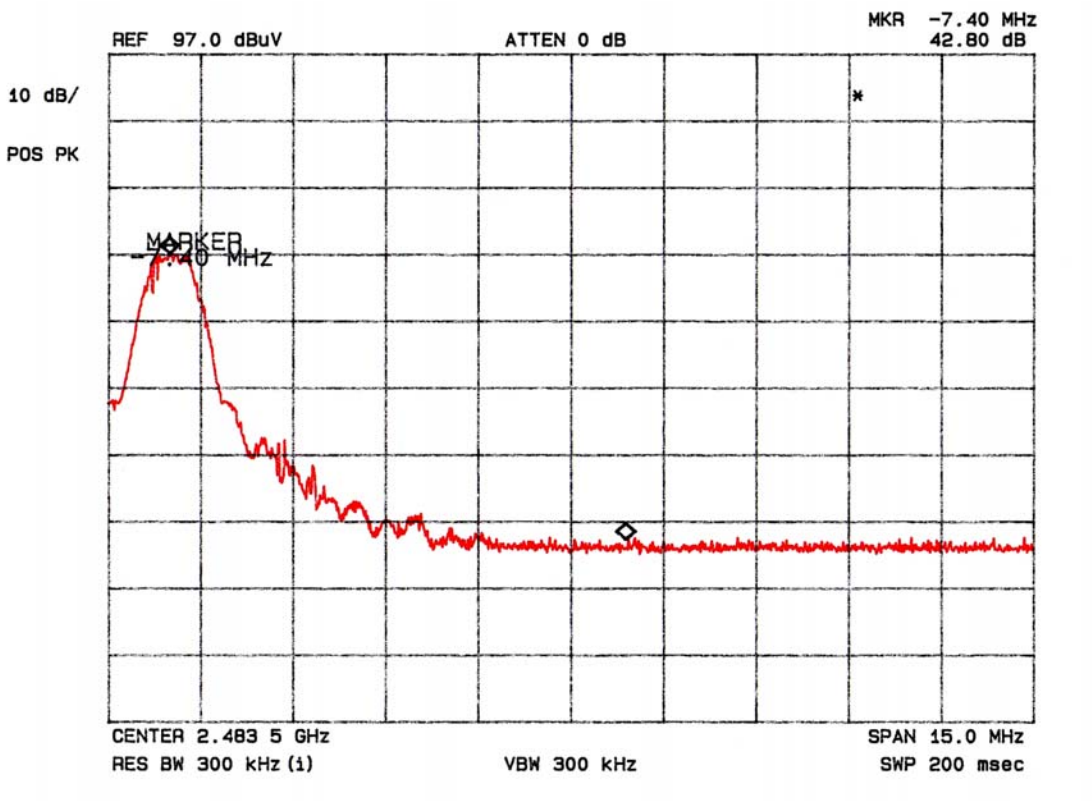


Plot 9: Plot 9: Peak Output Level – High Channel 2477 MHz Level

15.247(d) Band edge

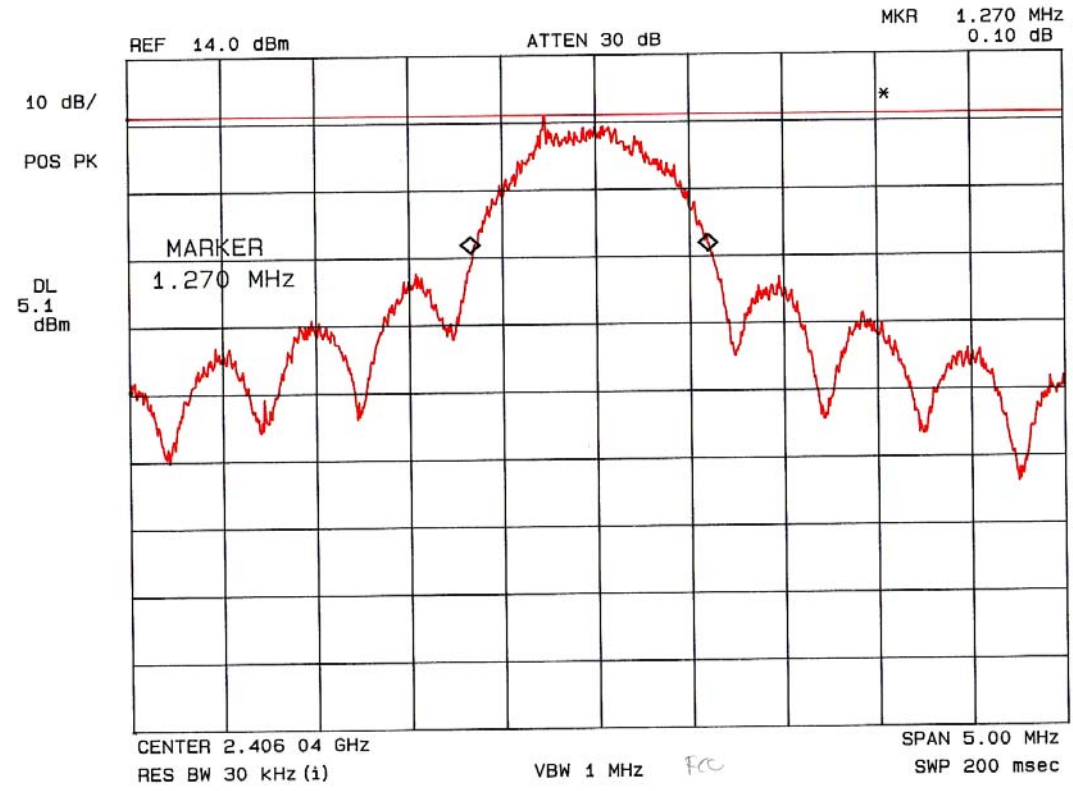


Plot 10: Low Channel Bandedge

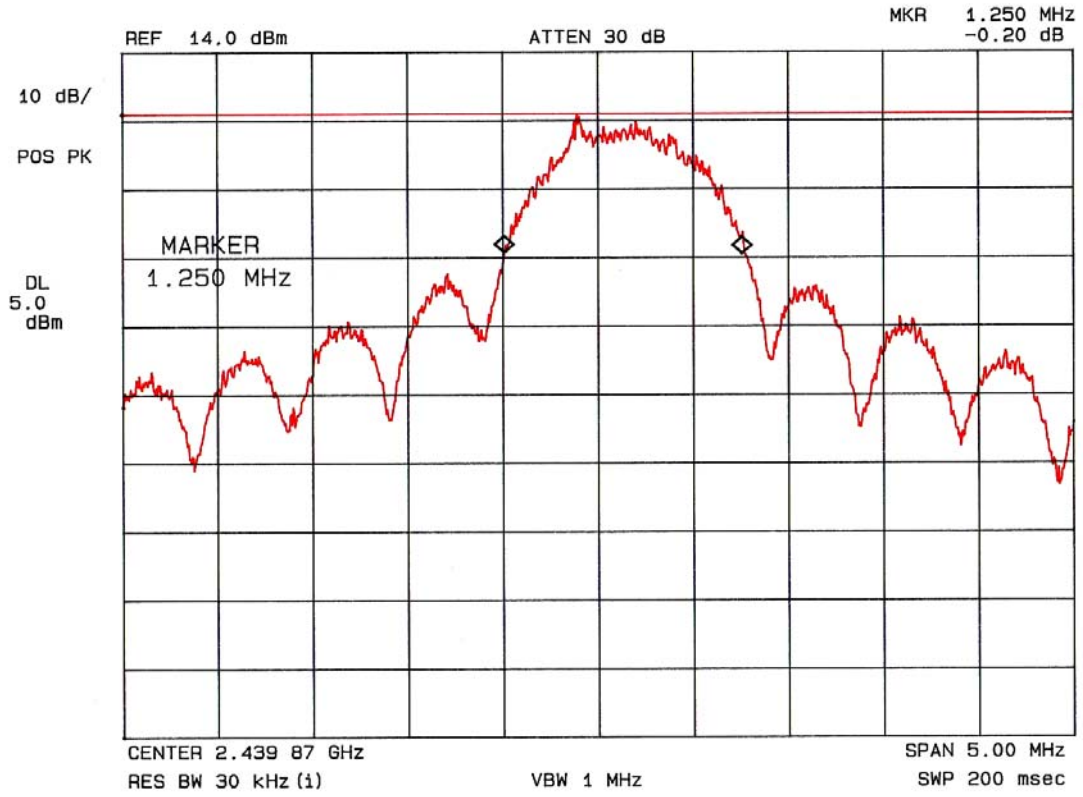


Plot 11: High Channel Bandedge

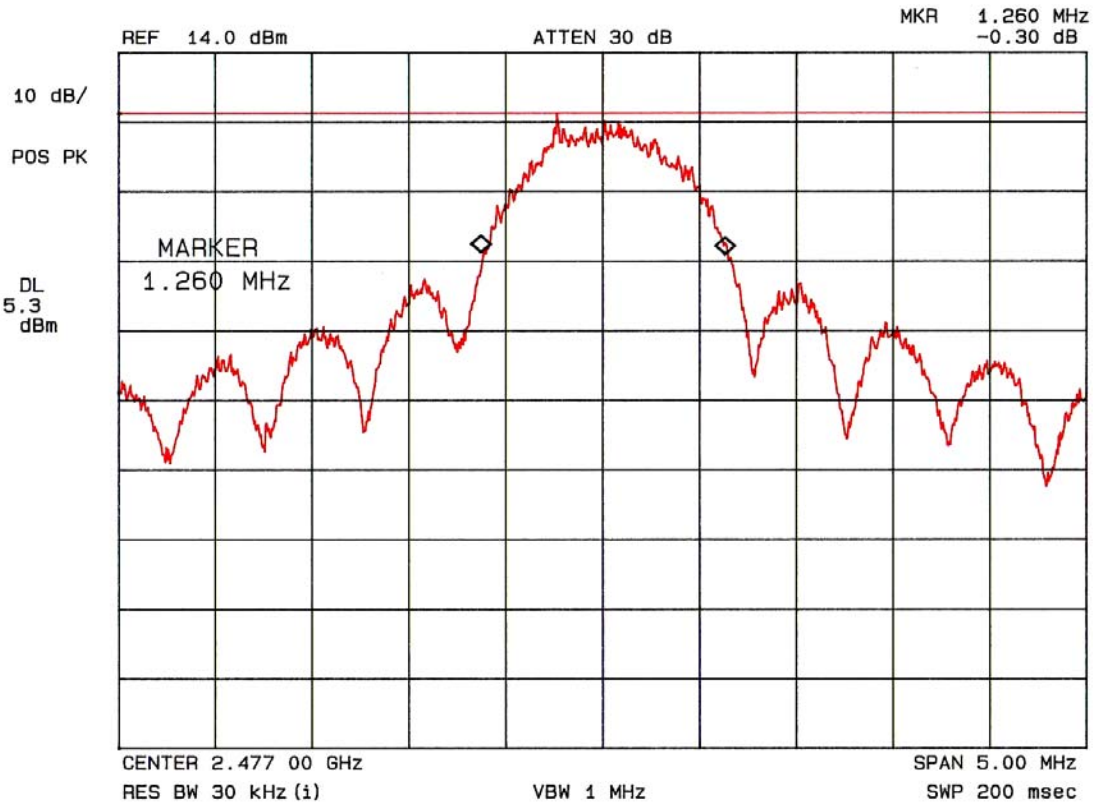
15.247(a) 20dB Bandwidth



Plot 12: 20dB Bandwidth Low Channel 2406MHz

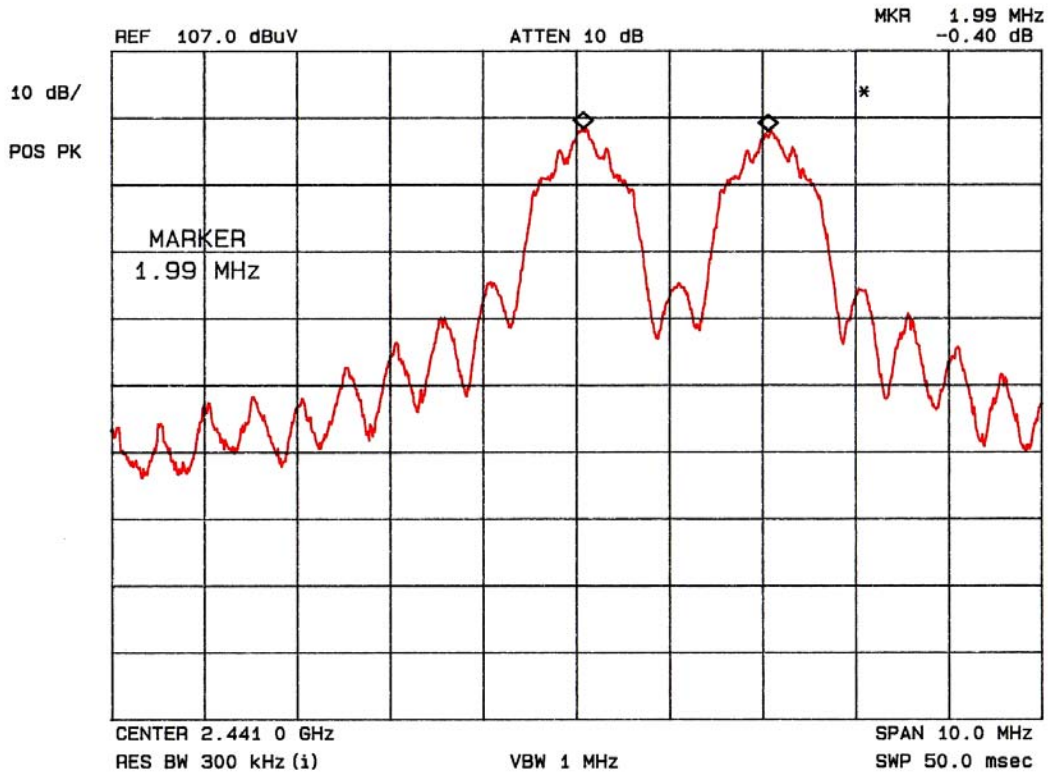


Plot 13: 20dB Bandwidth Middle Channel 2440MHz



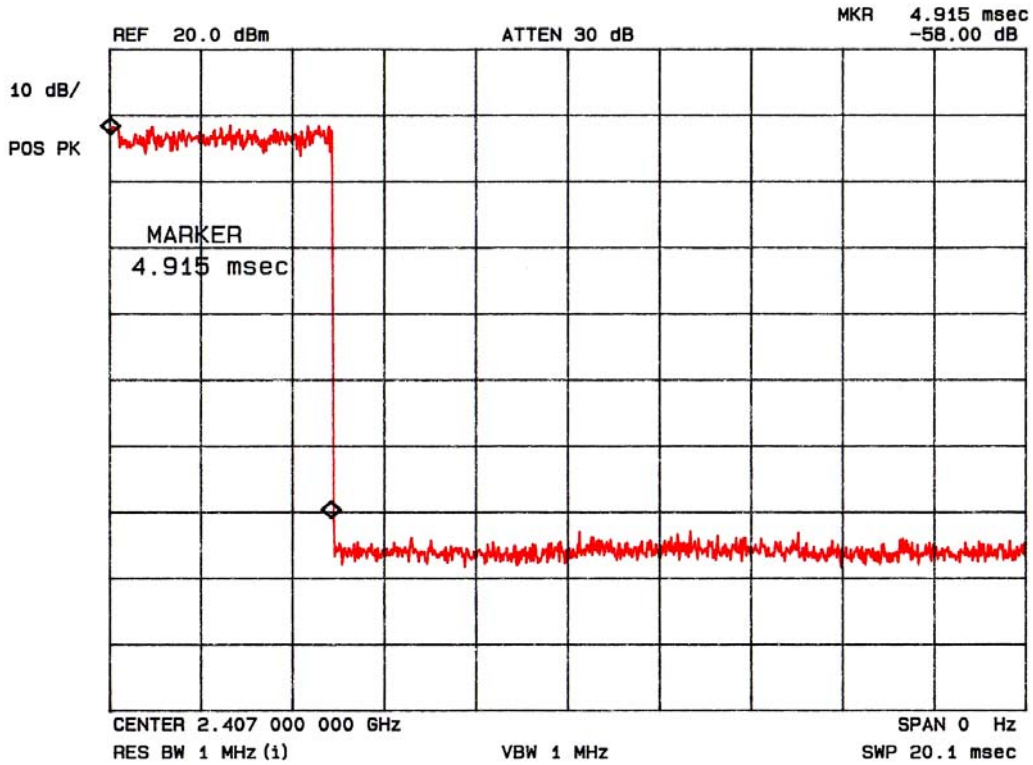
Plot 14: 20dB Bandwidth High Channel 2477MHz

15.247(a) (1) Hopping Channel Carrier Frequencies Separation

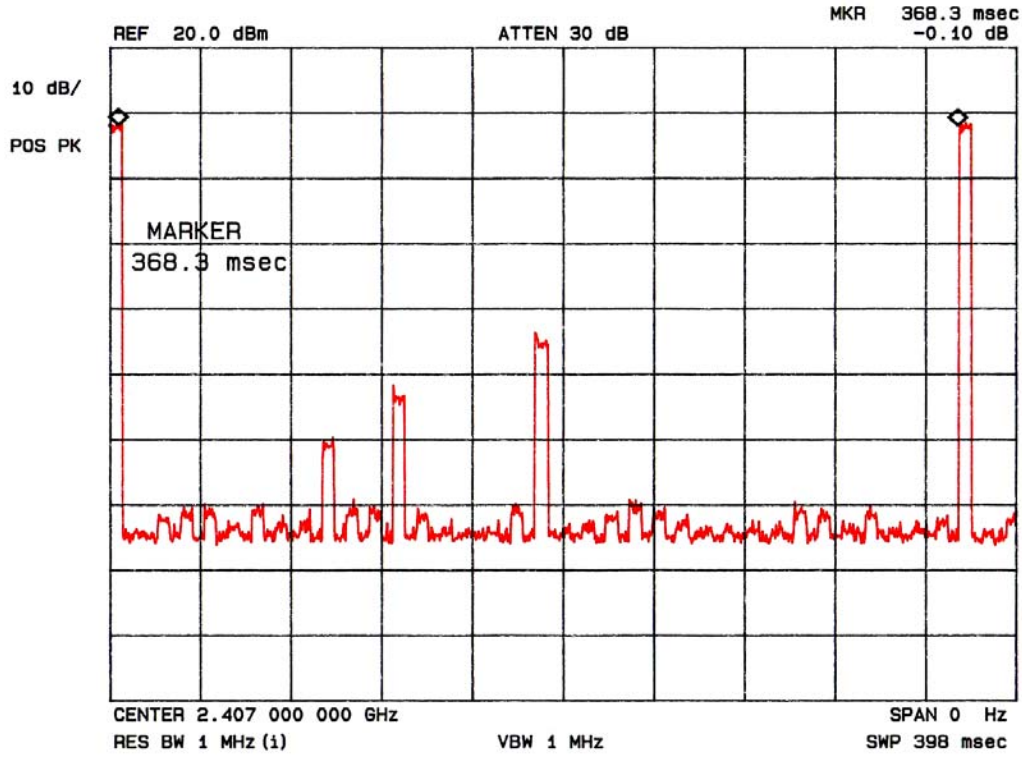


Plot 15: Hopping Channel Carrier Frequency Separation

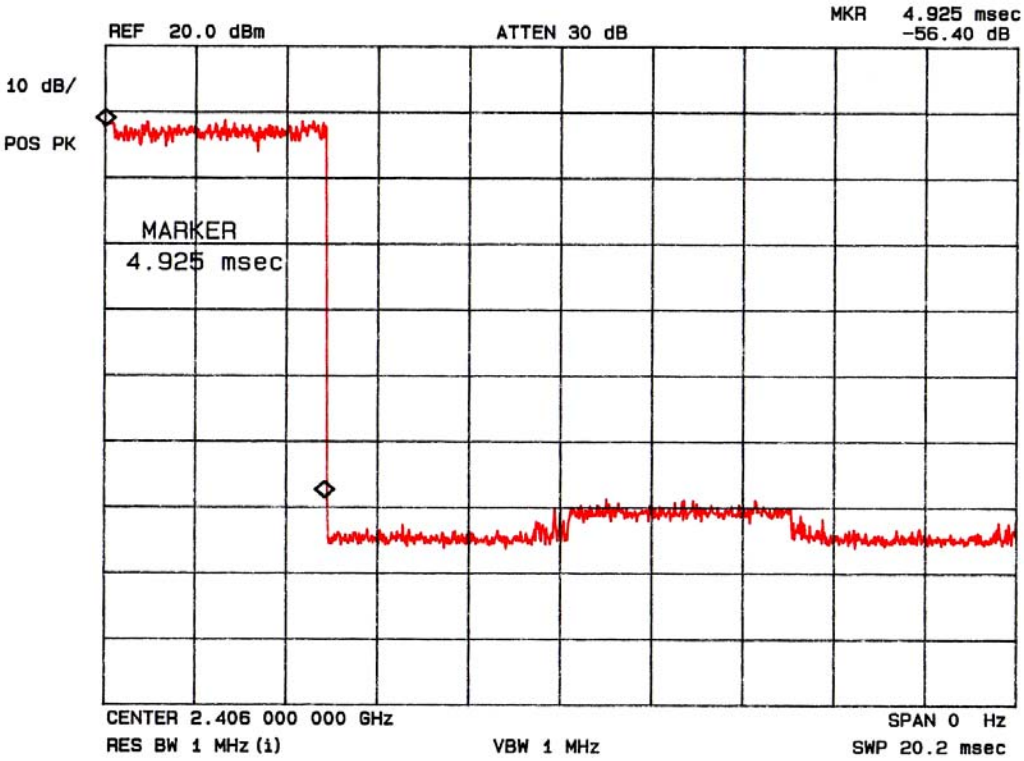
15.247(d) Time of Occupancy, Dwell Time



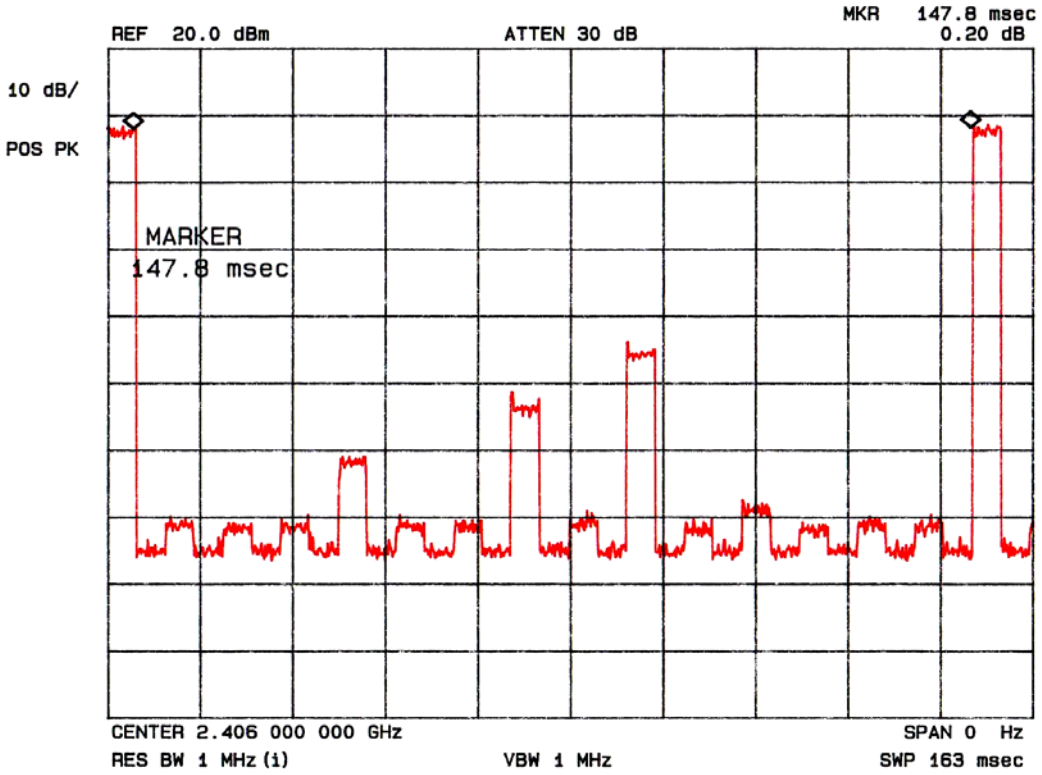
Plot 16: Time of Occupancy Pulse Width - Test Mode Command B.



Plot 17: Time of Occupancy Silent Period - Test Mode Command B.



Plot 18: Time of Occupancy Pulse Width - Test Mode Command C.



Plot 19: Time of Occupancy Silent Period - Test Mode Command C

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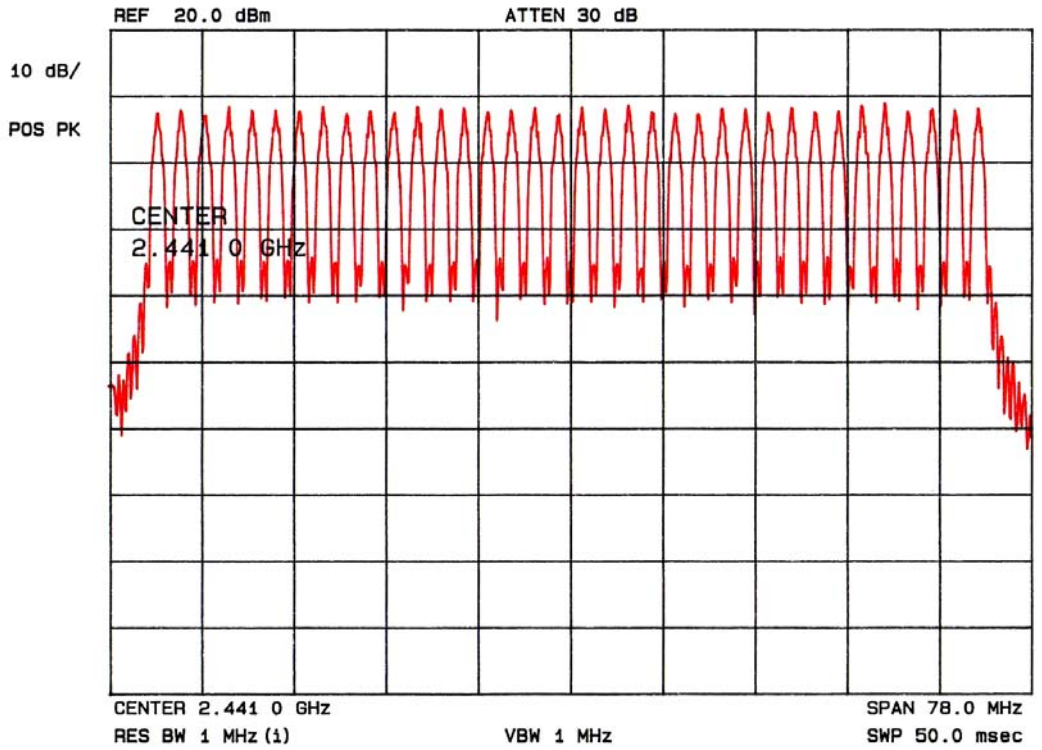
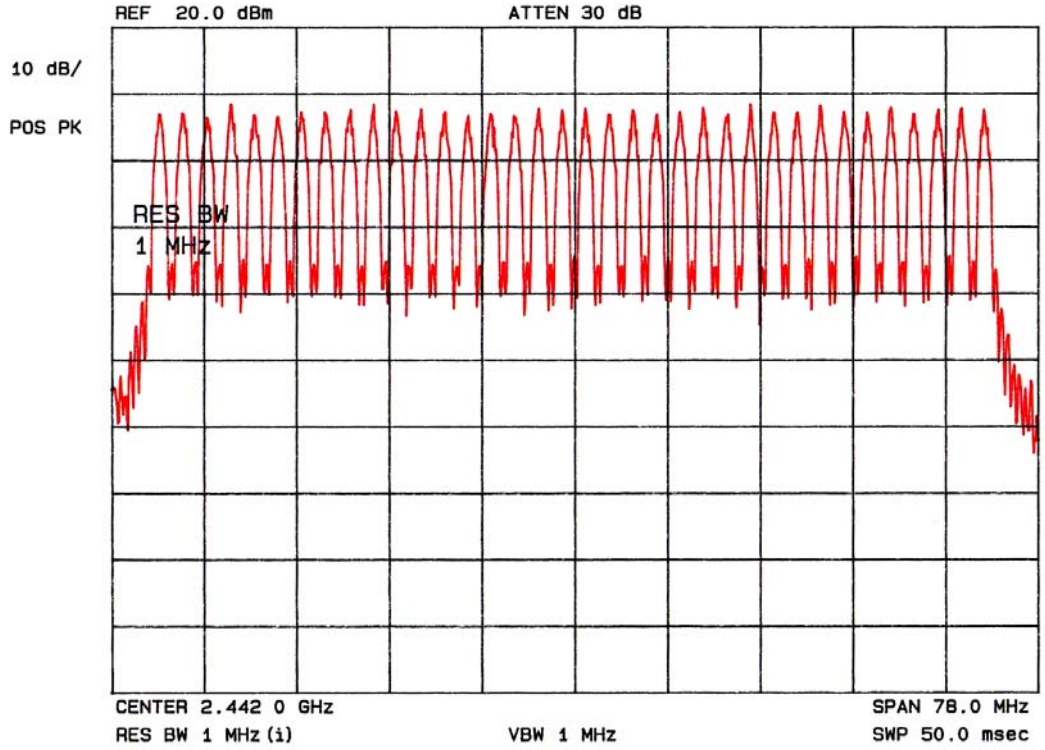
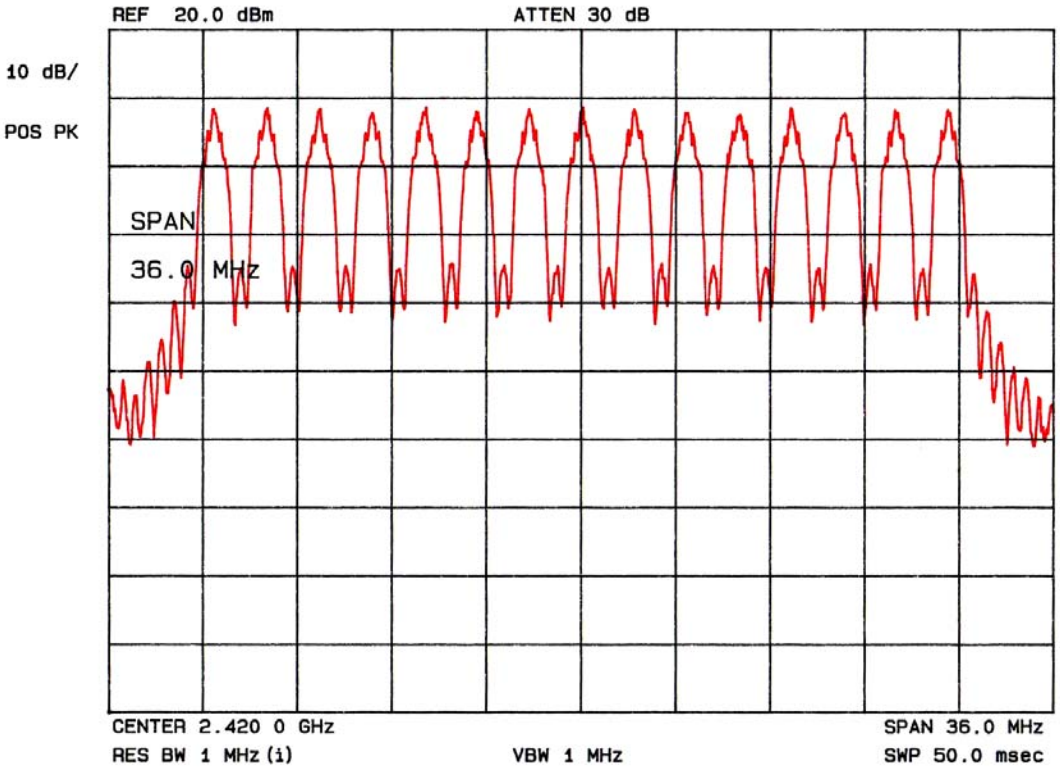
15.247(a) (1) (iii) Number of Hopping Channels



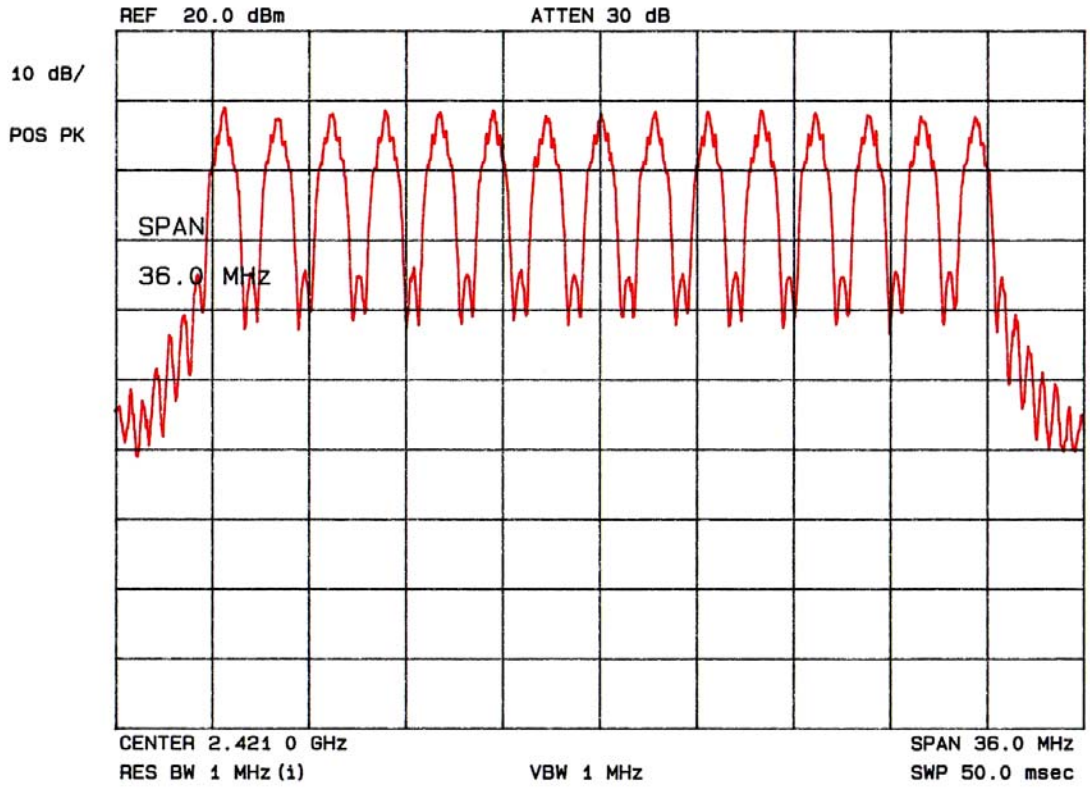
Plot 20: Number of Hopping Frequencies – Test Mode Command A



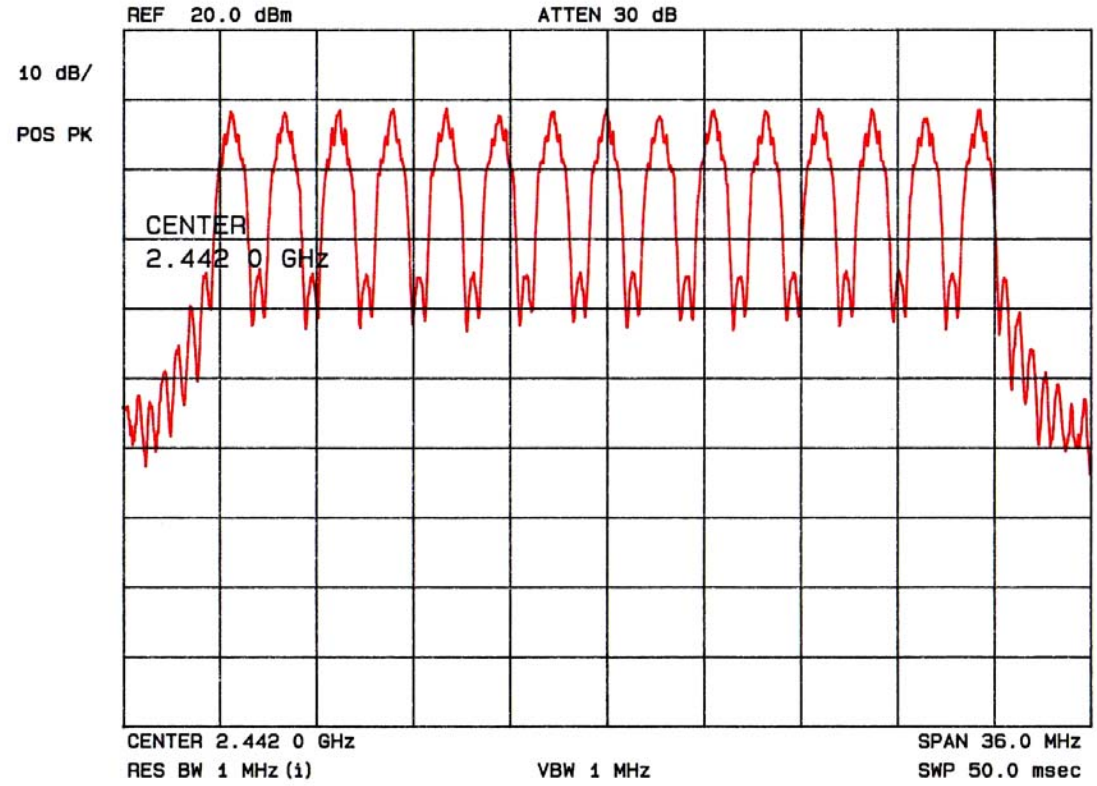
Plot 21: Number of Hopping Frequencies, - Test Mode Command B



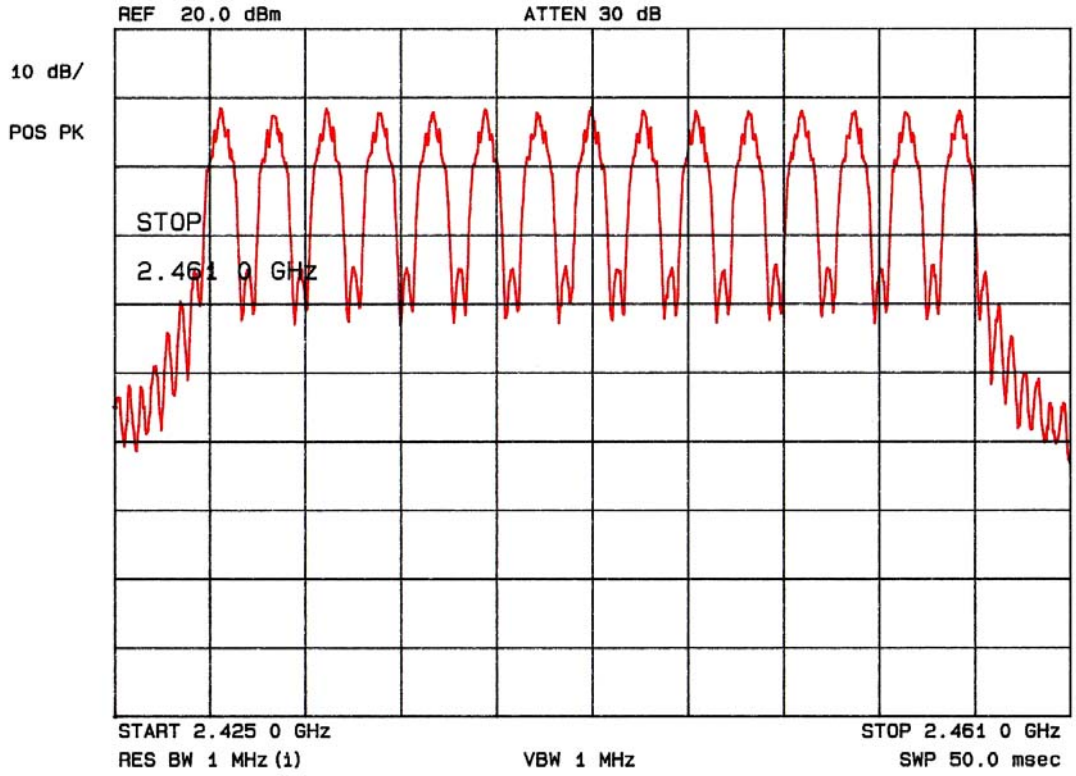
Plot 22: Number of Hopping Frequencies, - Test Mode Command C



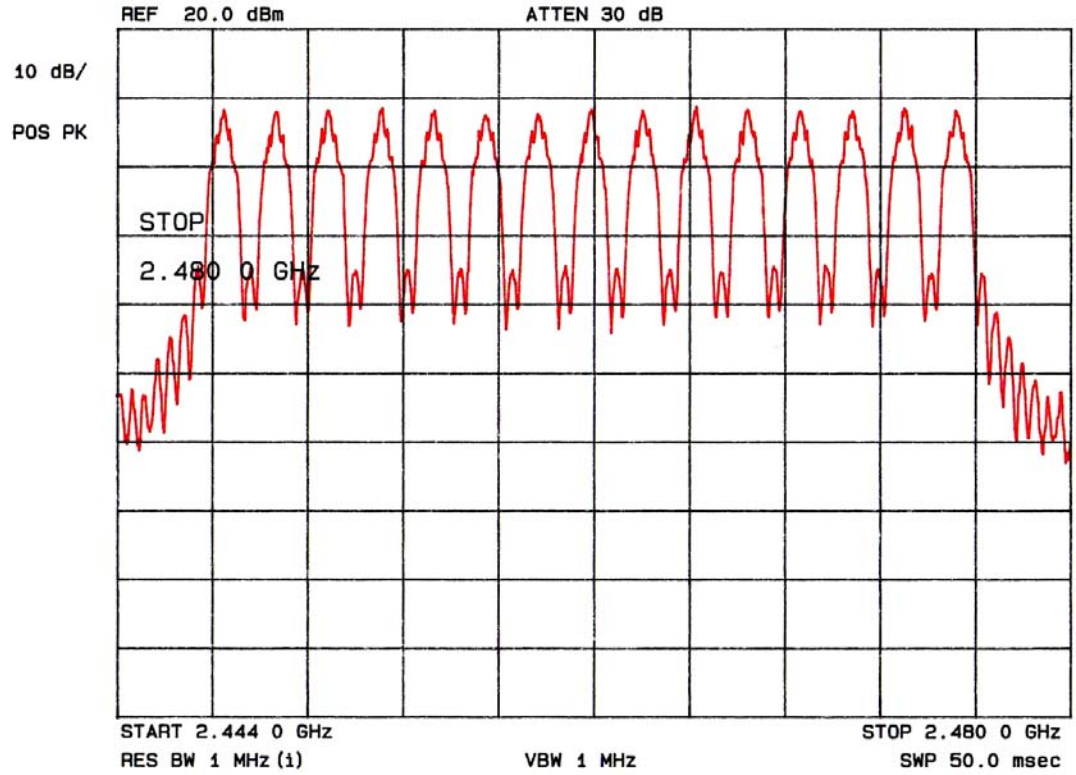
Plot 23: Number of Hopping Frequencies, - Test Mode Command D



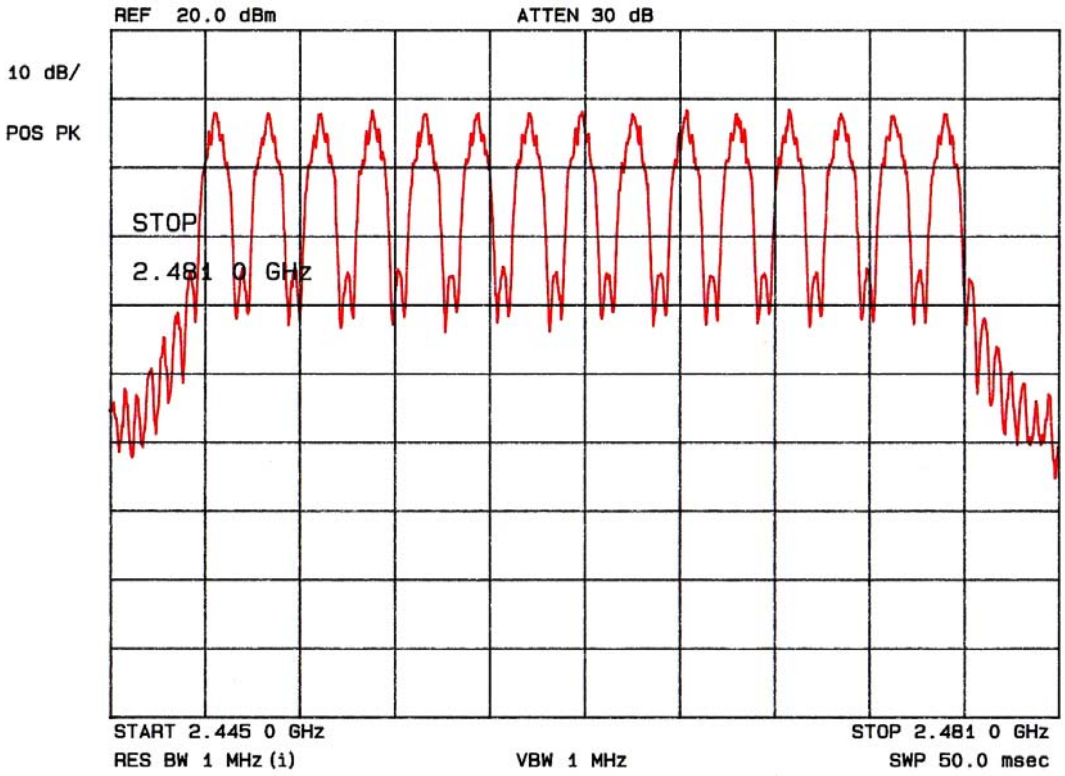
Plot 24: Number of Hopping Frequencies, - Test Mode Command E



Plot 25: Number of Hopping Frequencies, - Test Mode Command F

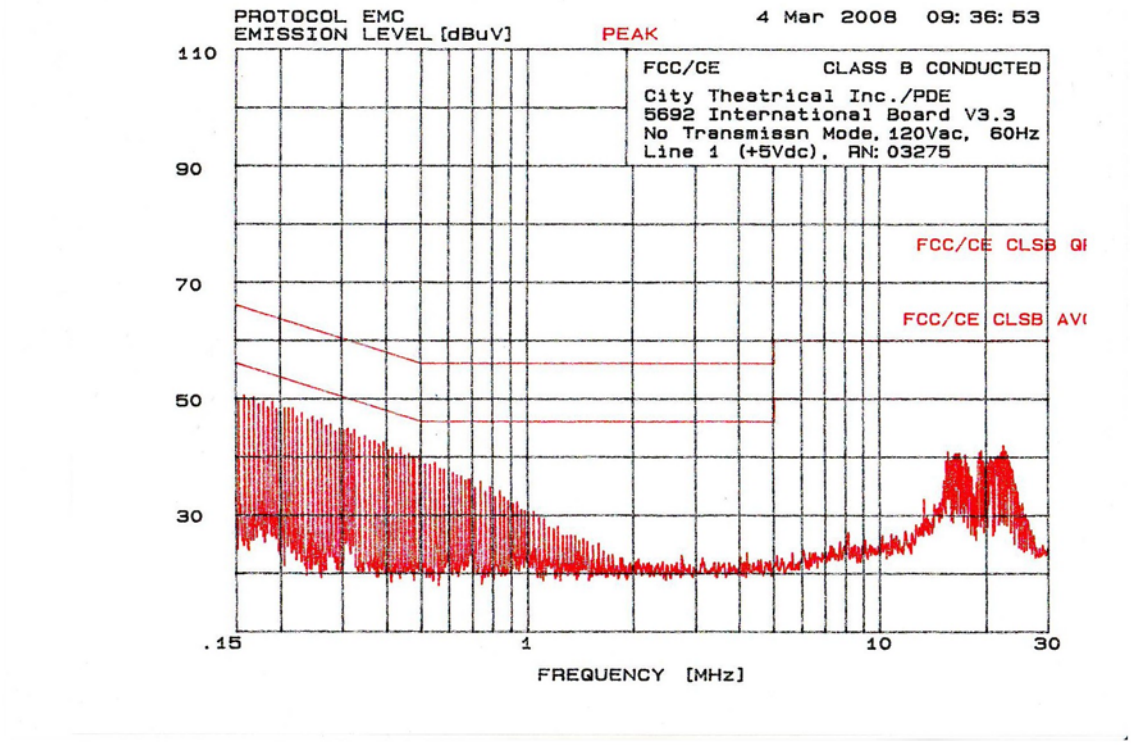


Plot 26: Number of Hopping Frequencies, - Test Mode Command G

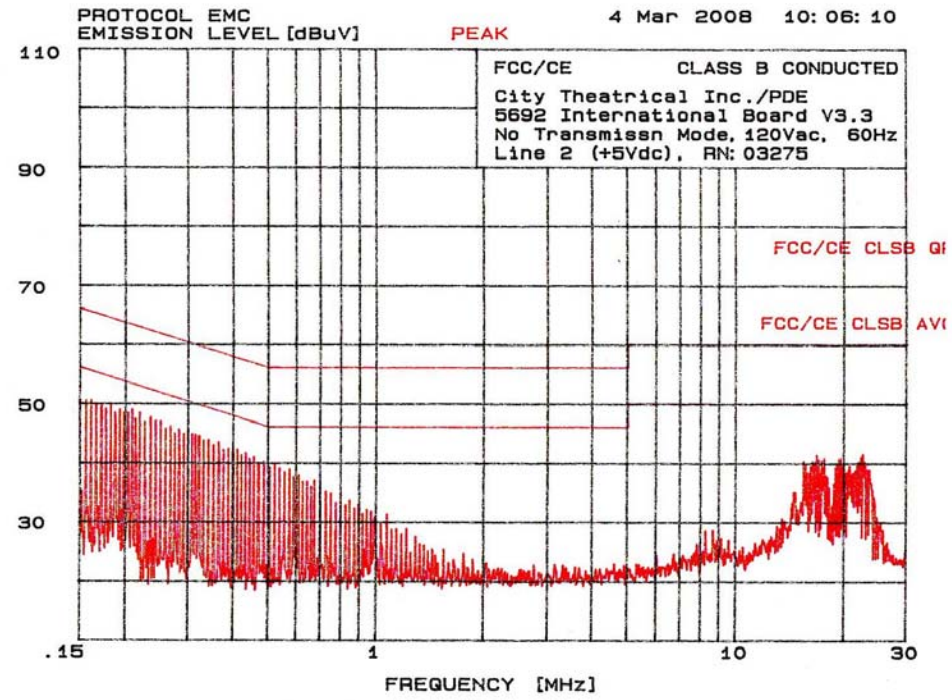


Plot 27: Number of Hopping Frequencies, - Test Mode Command H

AC Mains Conducted Emissions Testing Plots using Anatek 25-2D Power Supply, 120Vac input and +5Vdc output voltage delivered

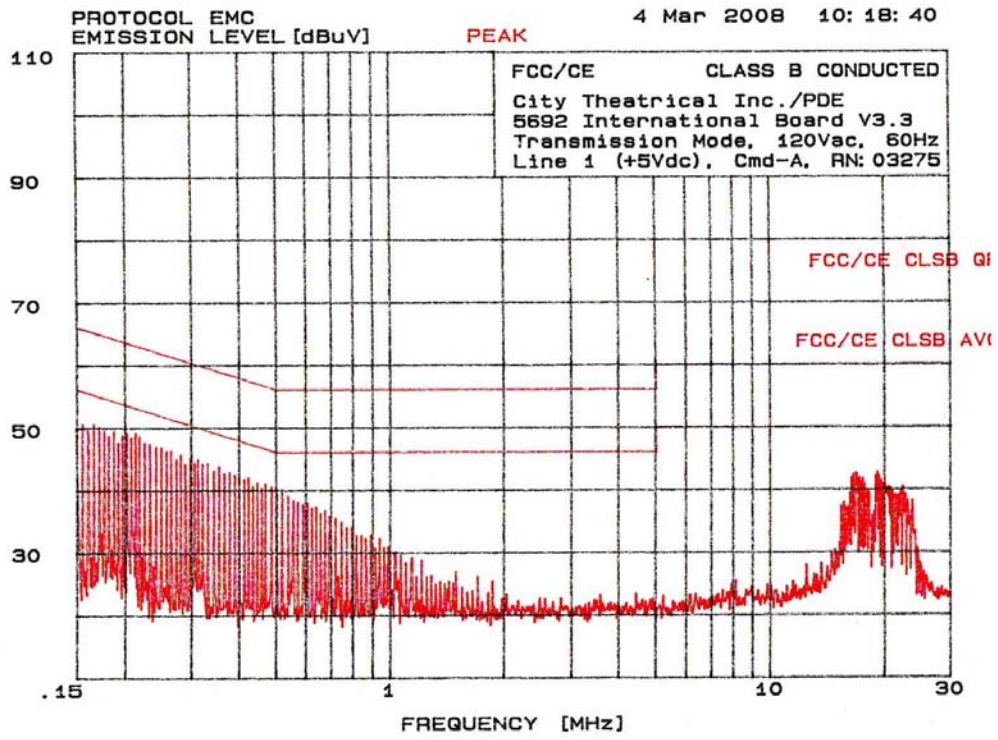


Plot 28 – Line 1 – 120Vac, 60Hz Line – in End of Transmission, Normal Mode

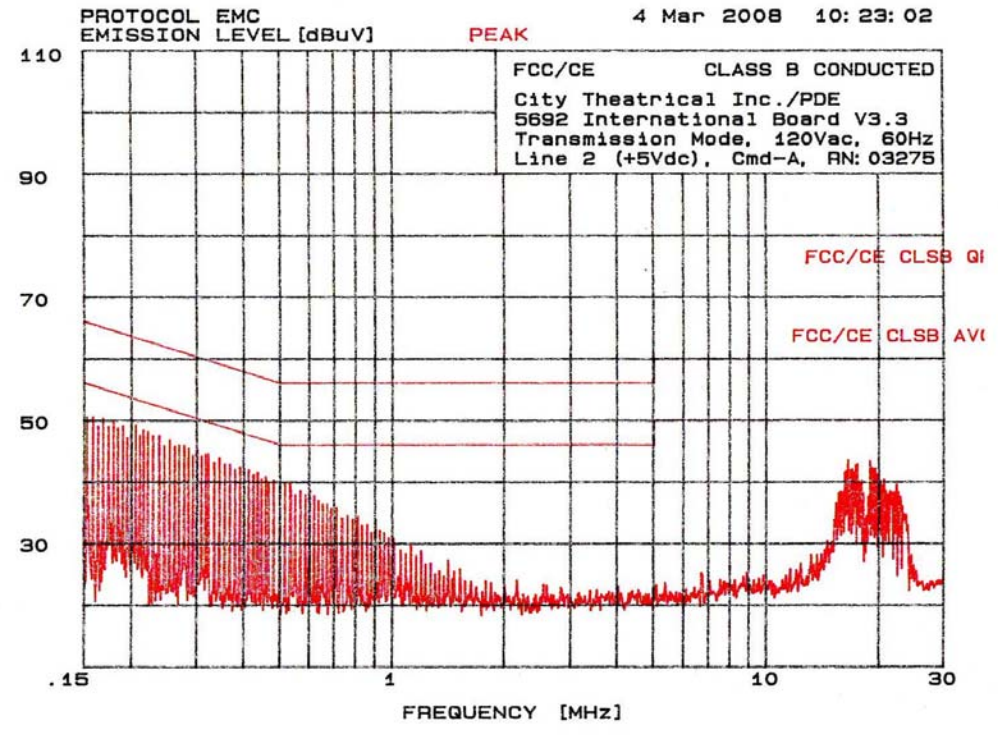


Plot 29 - Line 2 – 120Vac, 60Hz Neutral – in End of Transmission, Normal Mode

AC Mains Conducted Emissions Plots, in Transmission Mode, using Anatek 25-2D Power Supply, 120Vac input and +5Vdc output voltage delivered



Plot 30 – Line 1 – 120Vac, 60Hz Line – in Transmission Mode



Plot 31 - Line 2 – 120Vac, 60Hz Neutral – in Transmission Mode

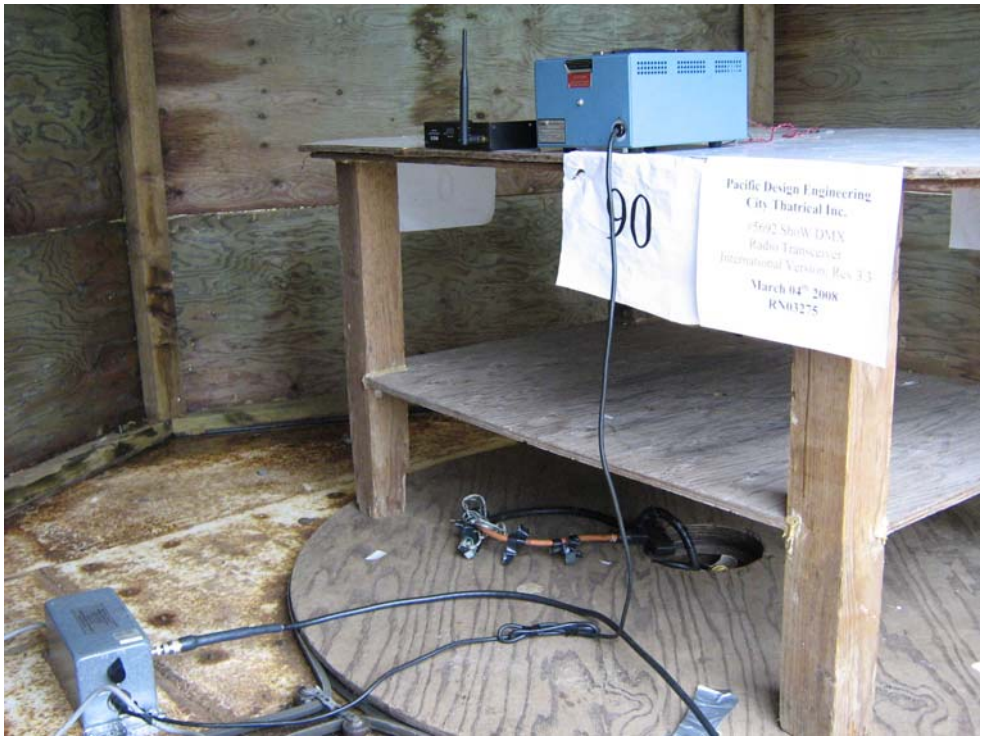
Appendix B: EUT Photos Unintentional Radiated Emissions Test Set-up

City Theatrical Inc. # 5692 SHoW DMX Radio Transceiver International Version Front View - Figure 1.

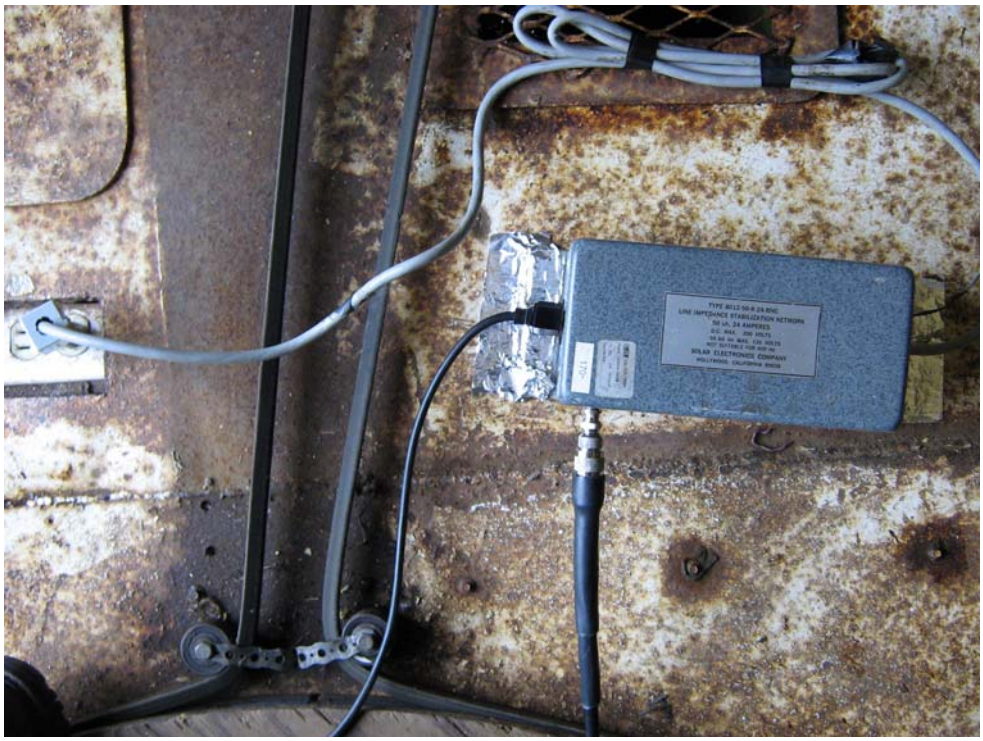
City Theatrical Inc. # 5692 SHoW DMX Radio Transceiver International Version Close-up - Figure 2.

City Theatrical Inc. ShoW DMX Radio Transceiver # 5692, Mode of Operation before testing, Set-up Figure 3.

EUT Photos – AC Conducted Power Line Emissions Test Set-up



City Theatrical Inc.ShoW DMX Radio Transceiver-# 5692 International Version, AC Conducted Set-up-Figure 4



City Theatrical Inc. ShoW DMX Radio Transceiver-# 5692 International Version Line Impedance Stabilization Network used for AC Conducted Emission Measurement – Figure 5