Application for Certification

Axonn Corporation

Model: AX551

47 CFR, Part 15, Subpart C, §15.247

Spread Spectrum Transmitters

FCC ID: L2VAX551

April 21, 1999

J99009920
RPT# AXO09920.CER
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1.0 General Description

1.1 Product Description

The AX551 is a transceiver. The AX551 (1) transmits signals to and (2) receives transmitted signals from various Itero designed and 3rd party transmitters, receivers, and transceivers. The transceiver communicates to a host device (which may be either an off-the-shelf personal computer or a specially designed microcontroller or microcomputer based device such as a control or alarm panel) via serial data communications, sending demodulated data from the receiver digital section to the host device for further processing. The system utilizes spread spectrum technology for communication in the 902 – 928 MHz band. The device transmits signals, which indicate the status of various alarm detector sensors input to various Itero designed receivers. The transceiver utilizes spread spectrum technology for communication at 923.58 MHz.

1.2 Related Submittal(s) Grants

This is a single Application for Certification.

1.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Open Area Test Sites only to determine worst case modes. For each scan, the procedures for maximizing emissions in Section 4.3 were followed. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 4317-A Park Drive NW, Norcross, Georgia. This test facility has been fully described in a report dated Jan. 8, 1993 submitted to your office. Please reference the site filing number: 31040/SIT 1300F2, dated April 26, 1996. The NVLAP program accredits this facility (NVLAP Code: 100409-0).

2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The transceiver was placed on a non-conductive table 80 cm above a ground plane.. The support equipment was located below the ground plane. During testing, all cables were manipulated to produce the worst case emissions.

For simplicity of testing, the EUT was configured to transmit continuously. The EUT was configured to transmit a typical maximum data stream during testing. A high (926.58MHz), mid (914-58MHz), and low (905.58 MHz) frequency plan offered with this device was tested. The frequency plan was selected via the remote computer located below the ground plane.

2.2 EUT Exercising Software

Special software to exercise the device was provided by Axonn Corporation. For simplicity of testing, the unit was configured to transmit continuously.

2.3 Special Accessories

There are no special accessories for compliance of this product.

Confirmed by:

David J. Schramm
EMC Team Leader
Intertek Testing Services
Agent for Axonn Corporation

____ Signature

____ Date

2.4 Equipment Modifications

Any modifications installed previous to testing by Axonn Corporation will be incorporated in each production model sold/leased in United States.

Intertek Testing Services installed no modifications.

Confirmed by:

David J. Schramm
EMC Team Leader
Intertek Testing Services
Agent for Axonn Corporation

____ Signature

____ Date

2.5 Support Equipment List and Description

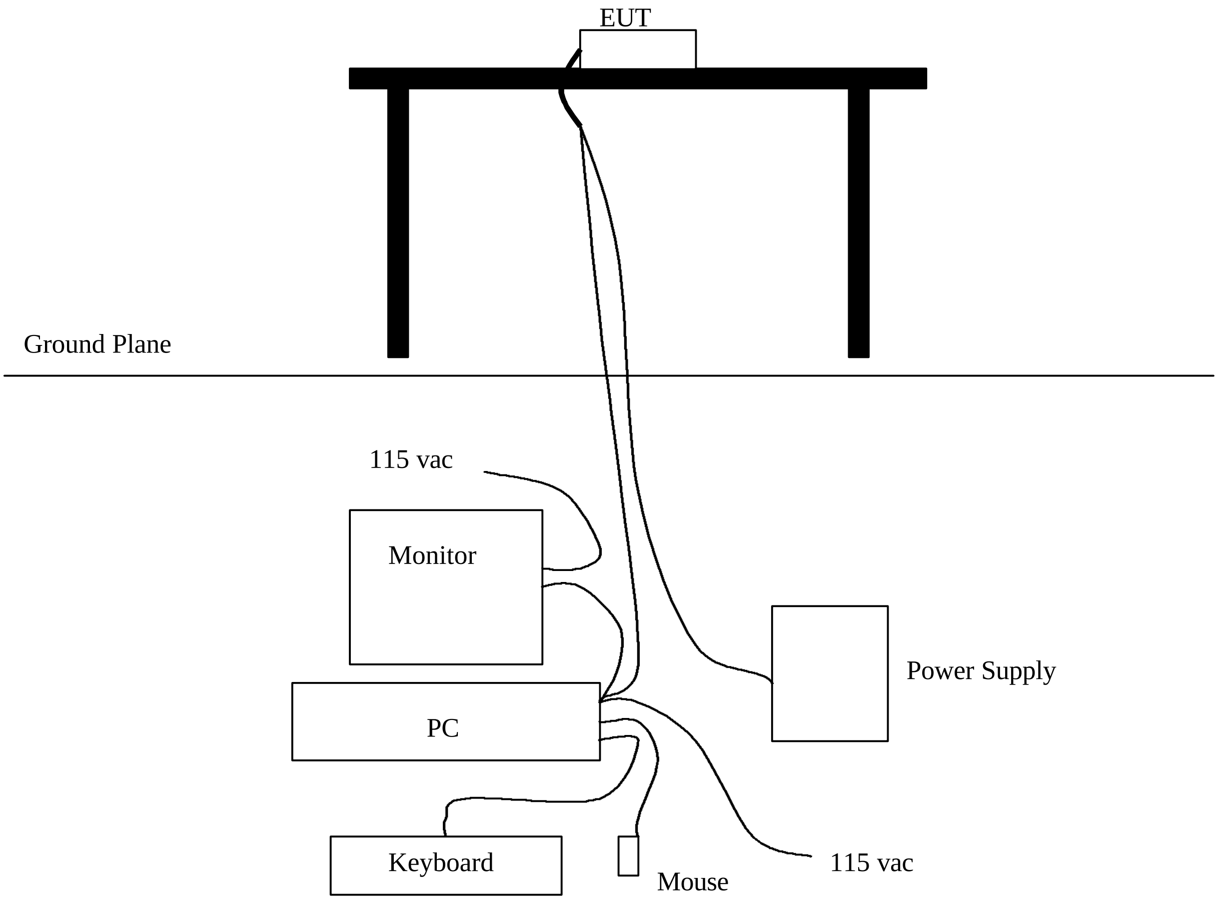
The FCC ID's for all equipment, plus descriptions of all cables used in the tested system (including inserted cards, which have grants) are:

Personal Computer	Compaq
Model Number:	Presario
Serial number:	Unknown
FCC ID:	None
Monitor	Hewlett Packard
Model Number:	D11941A
Serial number:	KR31953155
FCC ID:	None
Keyboard	Compaq Presario
Model Number:	SK-2700
Serial number:	None
FCC ID:	GYUR55SK
Mouse	Compaq Presario
Model Number:	MUS9JN
Serial number:	None
FCC ID:	EMJMUSJR
DC Power Supply	Topward
Model Number:	3603D
Serial Number:	None
FCC ID:	None

Cables:

1 Wiring Harness, 6 inches, unshielded
2 Single conductor wires, 5 meter, unshielded, (DC Power)
1 Serial cable, 4 meters, shielded
2 Power cables, 1.5 meters, unshielded, (remote equipment)

2.6 Test Configuration Block Diagram



Configuration of Tested System

3.0 Test Results

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and plots of the emissions are included.

3.1 Emission Bandwidth (low Channel)

§15.247(a)(2) specifies that direct sequence systems shall have a 6 dB bandwidth of at least 500 kHz. The following plots show the bandwidth measurements for the high (926.58 MHz), mid (914.58 MHz) and low (905.58 MHz) channels. The bandwidth measurement for the low (905.58 MHz) channel was measured to be approximately 960 kHz. The following plot was taken with a resolution bandwidth (RBW) of 100 kHz and a video bandwidth (VBW) of 1 MHz. The level of the emission was measured to be 73dBuV (-34 dBm). Markers were displayed 6 dB down from the peak of the fundamental.

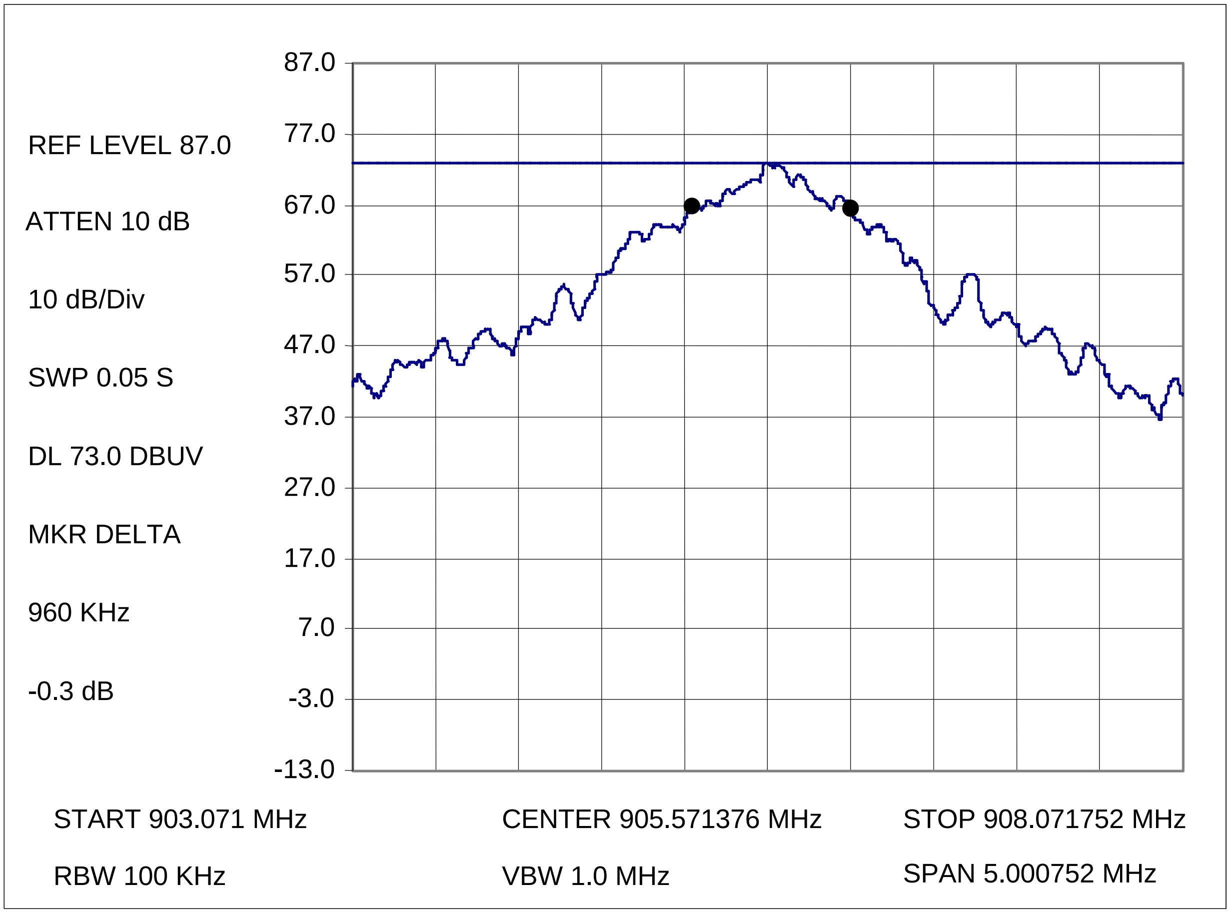


Figure 3.1 - 1: Emission Bandwidth Plot (low channel)

3.1 Emission Bandwidth (mid channel)

The bandwidth measurement for the mid (914.58 MHz) channel was measured to be approximately 955 kHz. The following plot was taken with a resolution bandwidth (RBW) of 100 kHz and a video bandwidth (VBW) of 1 MHz. The level of the emission was measured to be 71.6dBuV (-35.4 dBm). Markers were displayed 6 dB down from the peak of the fundamental.

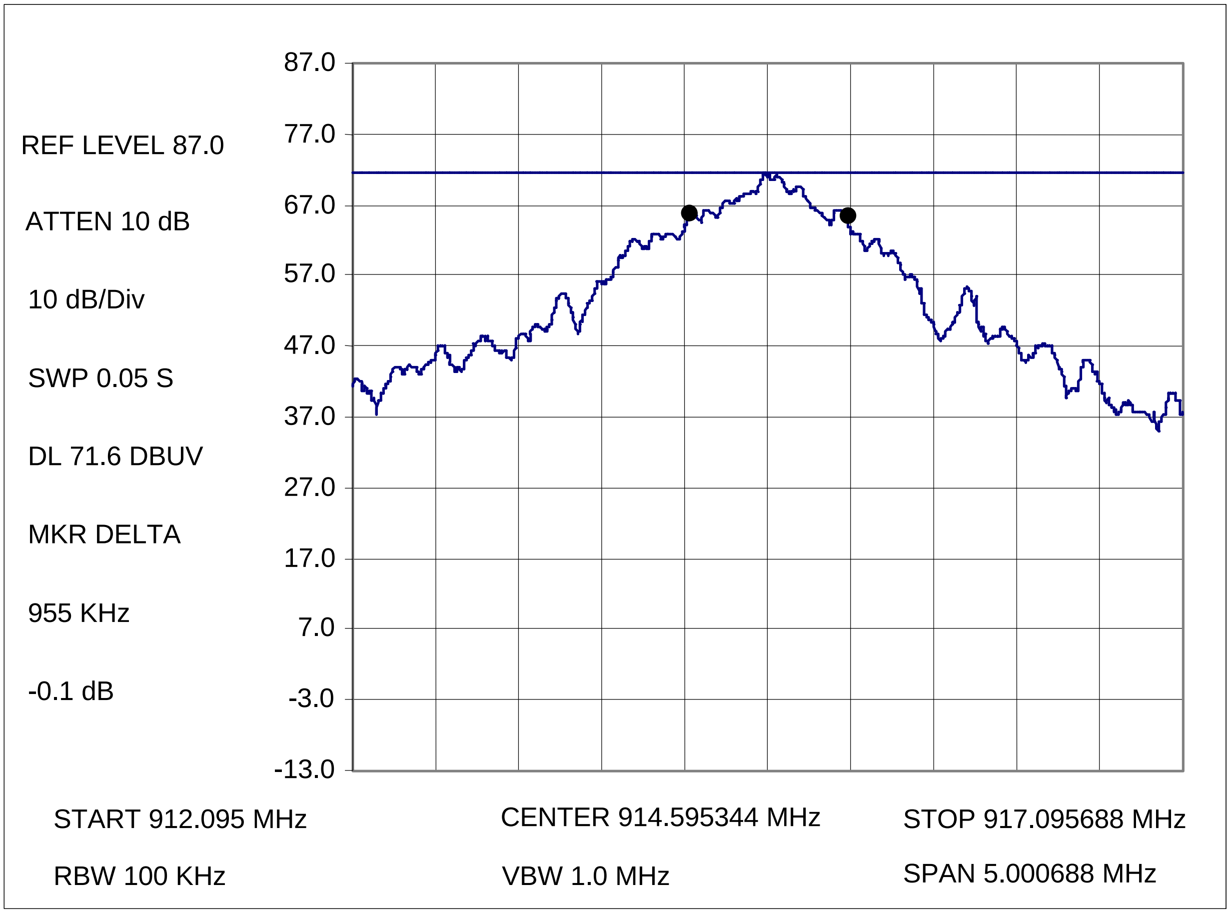


Figure 3.1 - 2: Emission Bandwidth Plot (mid channel)

3.1 Emission Bandwidth (high channel)

The bandwidth measurement for the high (926.58 MHz) channel was measured to be approximately 950 kHz. The following plot was taken with a resolution bandwidth (RBW) of 100 kHz and a video bandwidth (VBW) of 1 MHz. The level of the emission was measured to be 74 dBuV (-33 dBm). Markers were displayed 6 dB down from the peak of the fundamental.

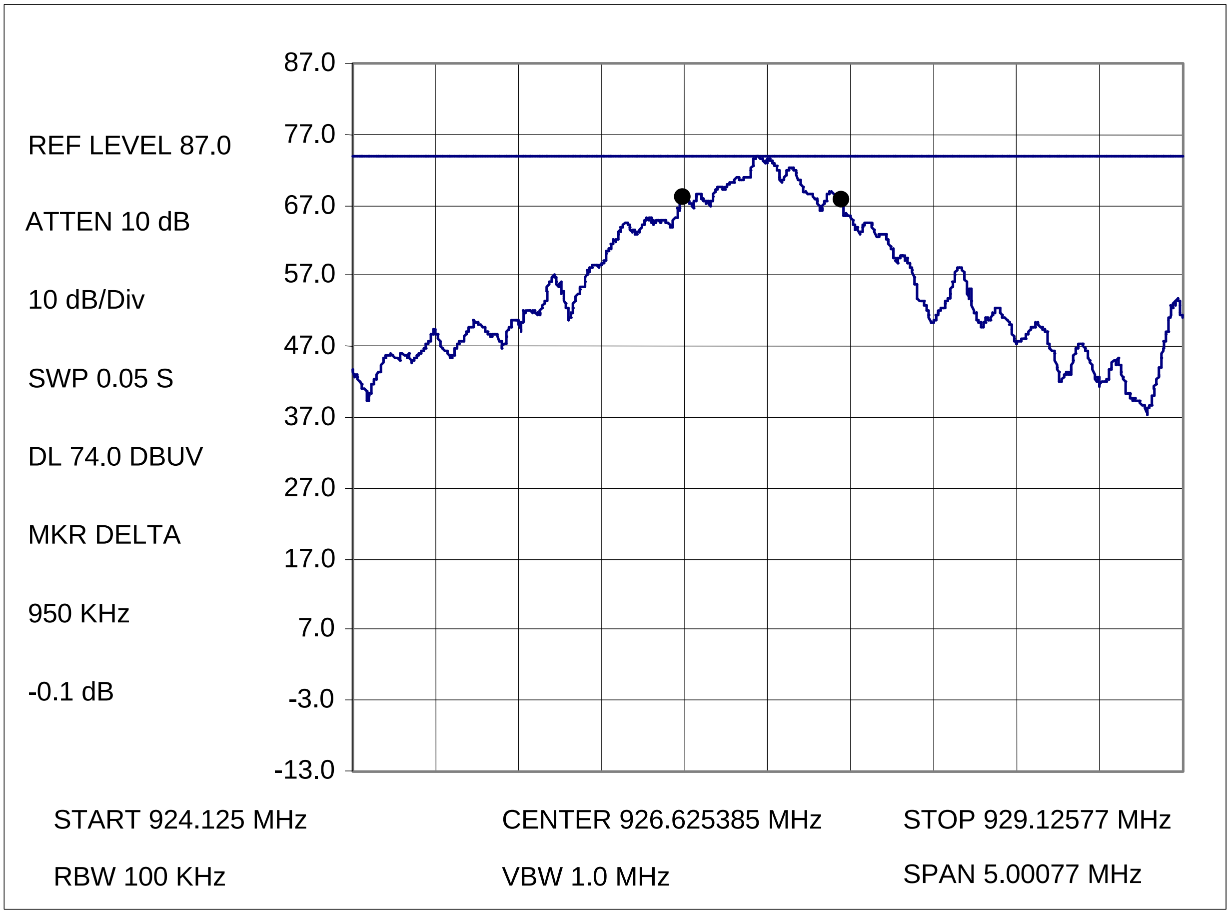


Figure 3.1 – 3 : Emission Bandwidth Plot (high channel)

3.2 Power Output

§15.247(b)(1) specifies power output requirements for direct sequence spread spectrum transmitters. The maximum peak output power for these devices shall not exceed one watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by one dB for every three dB that the directional gain of the antenna exceeds 6 dBi.

The peak output power for the low channel (905.58 MHz) was measured to be **5.9 dBm** (3.9 mW) as measured at the end of a 1.5' coaxial cable installed on the transmitter section.

The peak output power for the mid channel (914.58 MHz) was measured to be **5.8 dBm** (3.8 mW) as measured at the end of a 1.5' coaxial cable installed on the transmitter section.

The peak output power for the High channel (926.58 MHz) was measured to be **5.6 dBm** (3.6 mW) as measured at the end of a 1.5' coaxial cable installed on the transmitter section.

The power was determined by directly measuring the signal at the antenna terminal. The measurements were made with a HP power meter Model Number 436A, and verified with a HP 8566 Spectrum Analyzer.

3.2.1 Specific Absorption Rate and Maximum Permissible Exposure

The calculations for maximum transmitted power to be compared to the MPE limits are based on OET 65 (97-01). The AX551is designed for a maximum transmit power of 20 dBm (100 mW). Assume the highest gain antenna of 35 dBi (3161) for the 10'parabolic dish is used

Using the equation for power density $S=PG/4BR^2$

Where S = power density in mW/cm^2

P = transmit power in milliwatts

G = numeric gain of transmit antenna

R = distance (cm)

$S = \{(100)(3163)\}/\{4B(100)^2\}$

$S = 2.5\ mW/cm^2$ at a distance of 1 meter.

This power density is for the worst case with maximum beam exposure. This level is below the 5 mW/cm^2 MPE for Occupational Controlled Access. This device is designed for telecommunications transmission for distances up to 20 miles. The design requires the use of relatively large antennas (10' dish) and the transmitter section is designed for mounting on an antenna mast. Only professionals install this device. The device is therefore limited by practice to installation in a rooftop to tower installation. Warnings are provided in the installation manual to limit exposure to the direct beam during installation and maintenance. These warnings to the installers insure the installation does not expose the general public to the RF energy.

3.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dB(uV/m)
RA = Receiver Amplitude (including preamplifier) in dB(uV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(1/m)
AG = Amplifier Gain in dB

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

Assume a receiver reading of 52.0 dB (uV) is obtained. The antenna factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB(uV/m). This value in dB(uV/m) was converted to its corresponding level in uV/m.

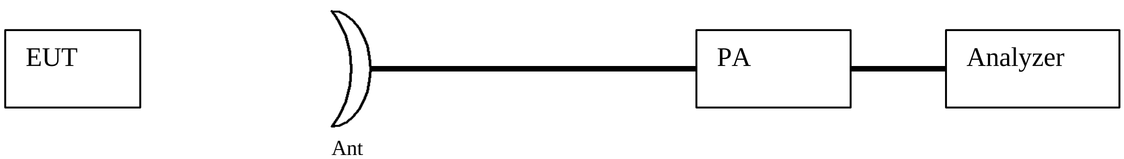
RA = 52.0 dB(uV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB

FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 dB(uV/m)

Level in uV/m = Common Antilogarithm [(32 dB(uV/m))/20] = 39.8 uV/m

3.4 Transmitter Spurious Emissions

§15.247(c) specifies requirements for spurious emissions from direct sequence spread spectrum transmitters. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in the §15.209(a) is not required. In addition, radiated emissions that fall within the restricted bands, as defined in §15.205(a), must also comply with the radiates emissions limits specified in §15.209(a).



3.5 Transmitter Spurious Emission Data:

Table 3.5 - 1: Antenna Conducted Emissions

Note: The antenna is permanently attached wire antenna. This test was not performed

3.5 Transmitter Spurious Emission Data:

Radiated Emission

The data shown below lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Table 3.5 - 2: Radiated Spurious Emissions, 30 – 10000 MHz

Company:	Axonn Corp.	Tested by:	Candy L. Campbell
Model:	AX551	Location:	Norcross
Job No.:	J99009920	Detector:	HP 8566
Date:	04/29/99	Antenna:	chase245
Standard:	FCC15	PreAmp:	cdi2-1g
Class:	B Group: None	Cable(s):	cable1 cable2
Notes:	Receive Mode Rx 905.58	Distance:	3
		Signature:	

Ant. Pol. (V/H)	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-amp Factor (dB)	Distance Factor (dB)	Net dBuV/m	Limit dBuV/m	Margin (dB)
V	58.640	43.2	6.5	1.9	16.8	0.0	34.8	40.0	-5.2
V	97.731	33.0	9.7	2.3	16.8	0.0	28.2	43.5	-15.3
V	955.580	23.0	20.9	8.3	16.1	0.0	36.1	46.0	-9.9
V	1911.160	58.7	26.8	1.9	37.2	0.0	50.2	54.0	-3.8
V	2866.740	45.5	32.0	2.2	36.6	0.0	43.1	54.0	-10.9
V	3822.300	49.5	34.2	2.3	36.7	0.0	49.3	54.0	-4.7
H	215.012	35.0	10.1	3.6	16.5	0.0	32.2	43.5	-11.3
H	293.200	34.5	13.1	4.1	16.3	0.0	35.4	46.0	-10.6
H	955.580	25.2	20.9	8.3	16.1	0.0	38.3	46.0	-7.7
H	1911.160	55.6	26.8	1.9	37.2	0.0	47.1	54.0	-6.9
H	2866.740	44.1	32.0	2.2	36.6	0.0	41.7	54.0	-12.3
H	3822.300	39.3	34.2	2.3	36.7	0.0	39.1	54.0	-14.9
Tx low channel (905.58 MHz)									
V	1811.120	47.2	28.3	1.8	37.0	10.0	50.4	54.0	-3.6
V	2716.640	41.1	31.9	2.2	36.6	10.0	48.5	54.0	-5.5
V	3622.160	31.0	32.0	2.2	36.5	10.0	38.7	54.0	-15.3
V	4527.700	27.6	33.6	2.7	36.2	10.0	37.7	54.0	-16.3
H	1811.150	45.0	28.3	1.8	37.0	10.0	48.1	54.0	-5.9
H	2716.679	37.9	31.9	2.2	36.6	10.0	25.4	54.0	-28.6
H	3622.199	27.6	32.0	2.2	36.5	10.0	15.3	54.0	-38.7
H	4527.700	26.8	33.6	2.7	36.2	10.0	16.8	54.0	-37.2
Tx mid channel (914.58 MHz)									
V	1829.130	45.7	28.4	1.8	36.9	10.0	49.0	54.0	-5.0
V	2743.734	41.6	32.0	2.2	36.6	10.0	49.1	54.0	-4.9
V	3658.190	30.0	32.1	2.2	36.4	10.0	37.9	54.0	-16.1
V	4572.700	26.2	33.8	2.7	36.2	10.0	36.5	54.0	-17.5
H	1829.130	43.5	28.4	1.8	36.9	10.0	46.8	54.0	-7.2
H	2743.734	41.3	32.0	2.2	36.6	10.0	28.8	54.0	-25.2
H	3658.190	29.7	32.1	2.2	36.4	10.0	17.6	54.0	-36.4
H	4572.700	26.4	33.8	2.7	36.2	10.0	36.7	54.0	-17.3
Tx high channel (926.58 MHz)									
V	1853.055	45.4	28.6	1.9	36.9	10.0	48.9	54.0	-5.1
V	2779.356	41.0	32.1	2.2	36.7	10.0	28.6	54.0	-25.4
V	3705.650	30.2	32.3	2.3	36.4	10.0	18.4	54.0	-35.6
V	4631.900	28.5	34.1	2.7	36.3	10.0	39.1	54.0	-14.9
H	1853.056	42.4	28.6	1.9	36.9	10.0	45.9	54.0	-8.1
H	2779.356	40.7	32.1	2.2	36.7	10.0	28.3	54.0	-25.7
H	3705.650	30.4	32.3	2.3	36.4	10.0	18.6	54.0	-35.4
H	4631.900	28.5	34.1	2.7	36.3	10.0	39.1	54.0	-14.9

3.6 AC Power Line-Conducted Emissions

For AC powered devices, line-conducted emissions testing is performed based on the requirements in §15.207.

Table 3.6 - 1: Power Line Conducted Emissions

Note: The EUT is DC powered this test is not required.

3.7 Power Spectral Density, §15.247(d) (low channel)

For direct sequence systems, the peak power spectral density conducted from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The following plots show the power spectral density for the high (926.58 MHz), mid (914.58 MHz) and low (905.58 MHz) channels. This measurement was made with the antenna port of the transmitter directly connected to the spectrum analyzer.

The resolution bandwidth is set to 3 kHz, the span is set to 300 kHz, and the sweep time is 100 seconds. The highest peak measurement for the low (905.58 MHz) channel was 100.2 dBuV (-6.8 dBm). See Figure 3.7-1 for plot.

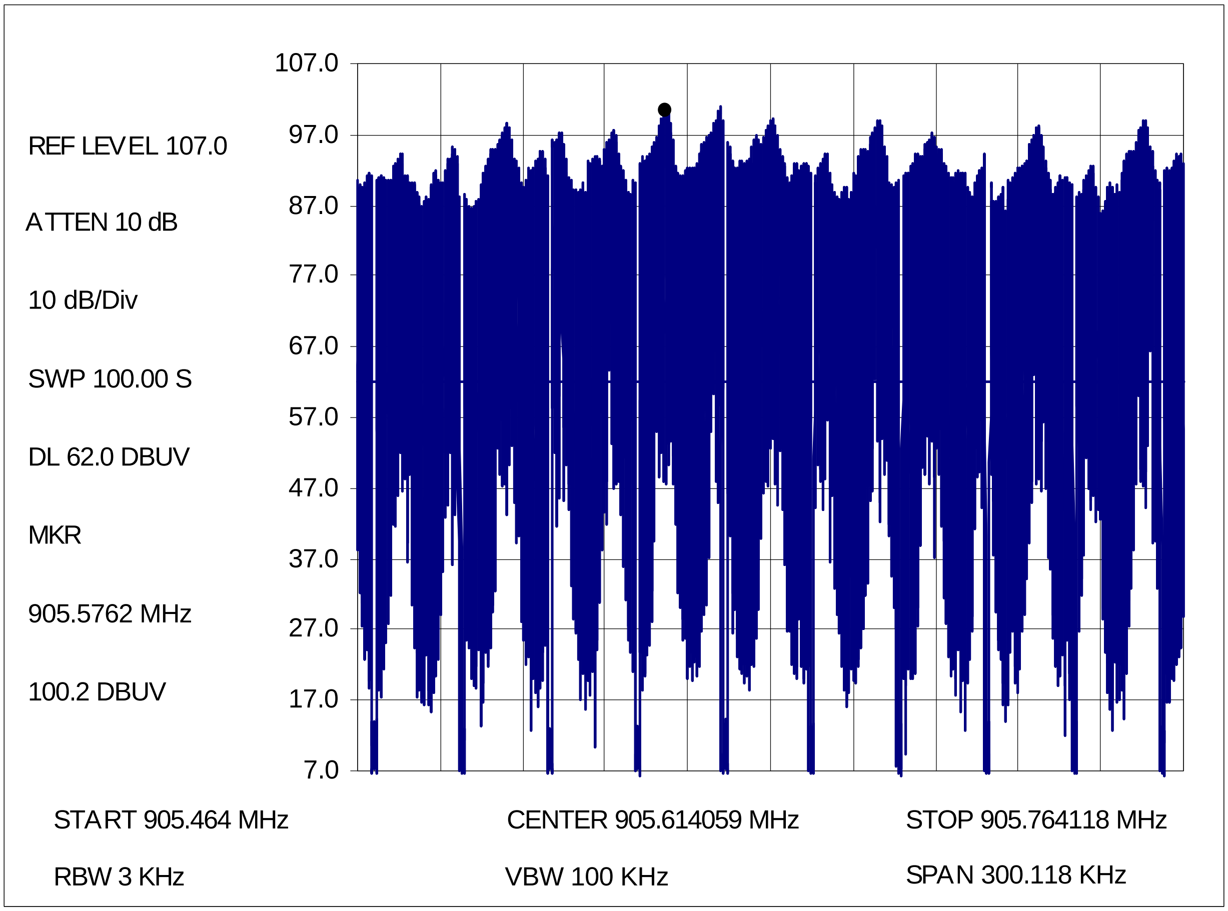


Figure 3.7 - 1: Power Spectral Density – Low (905.58 MHz) Channel

3.7 Power Spectral Density, §15.247(d) (mid channel)

The resolution bandwidth is set to 3 kHz, the span is set to 300 kHz, and the sweep time is 100 seconds. This measurement was made with the antenna port of the transmitter directly connected to the spectrum analyzer.

The highest peak measurement for the mid (914.58 MHz) channel was 100.2 dBuV (-6.8 dBm). See Figure 3.7-2 for plot.

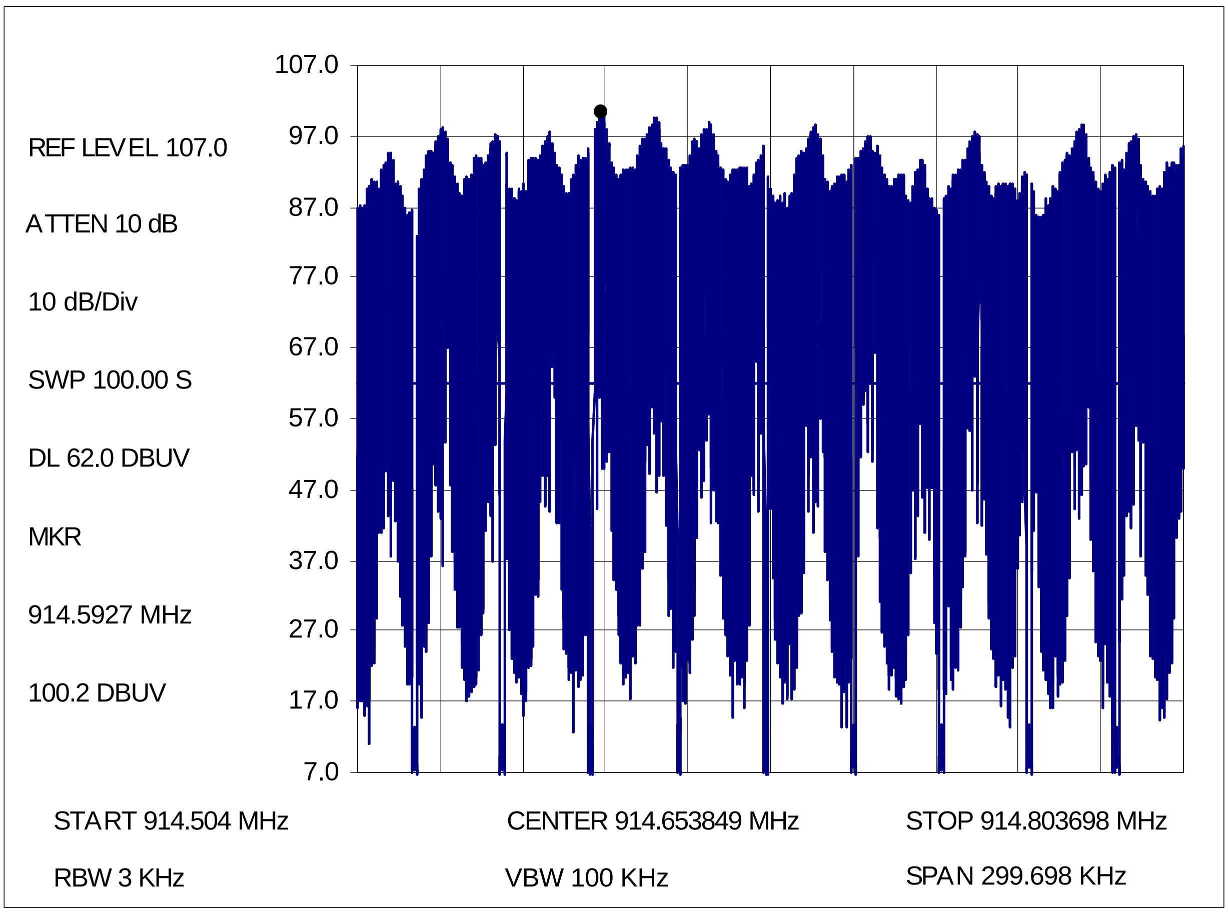


Figure 3.7 - 2: Power Spectral Density – Mid (914.58 MHz) Channel

3.7 Power Spectral Density, §15.247(d) (high channel)

The resolution bandwidth is set to 3 kHz, the span is set to 300 kHz, and the sweep time is 100 seconds. This measurement was made with the antenna port of the transmitter directly connected to the spectrum analyzer.

The highest peak measurement for the high (926.58 MHz) channel was 100.2 dBuV (-6.8 dBm). See Figure 3.7-3 for plot.

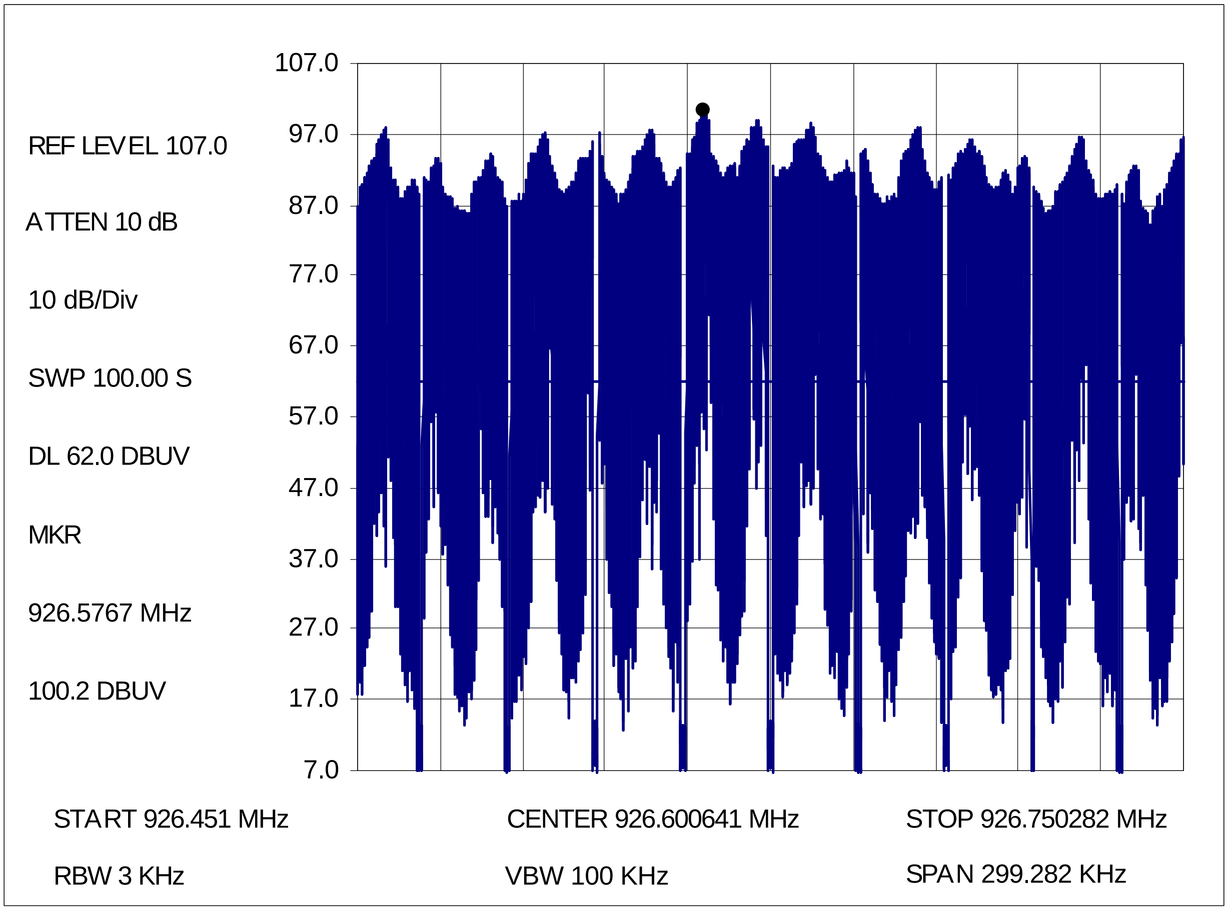


Figure 3.7 - 3: Power Spectral Density – High (926.58 MHz) Channel

3.9 Radiated and Line-Conducted Emission Configuration Photographs

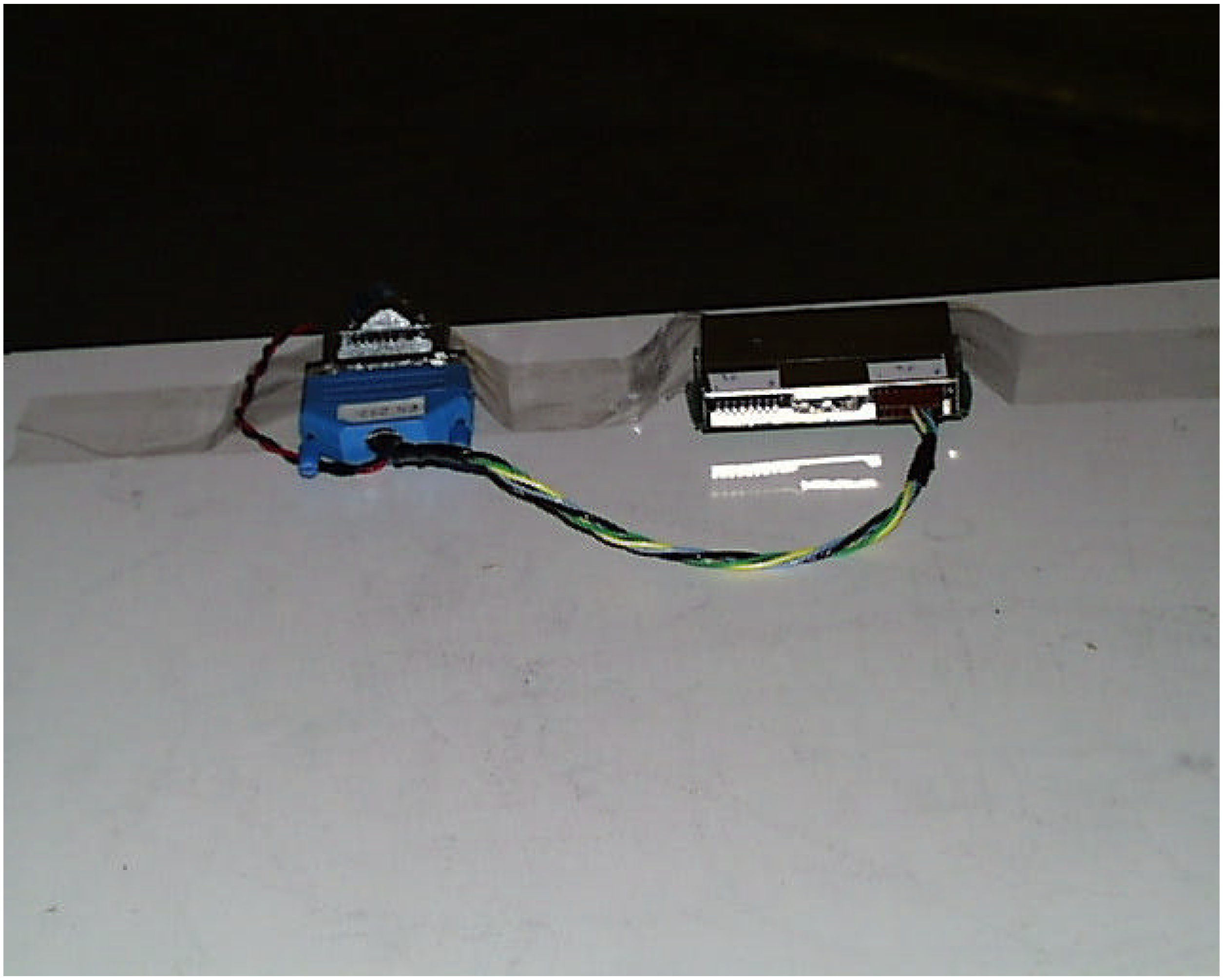


Figure 3.9 - 1: Worst Case Radiated Emission, Front View

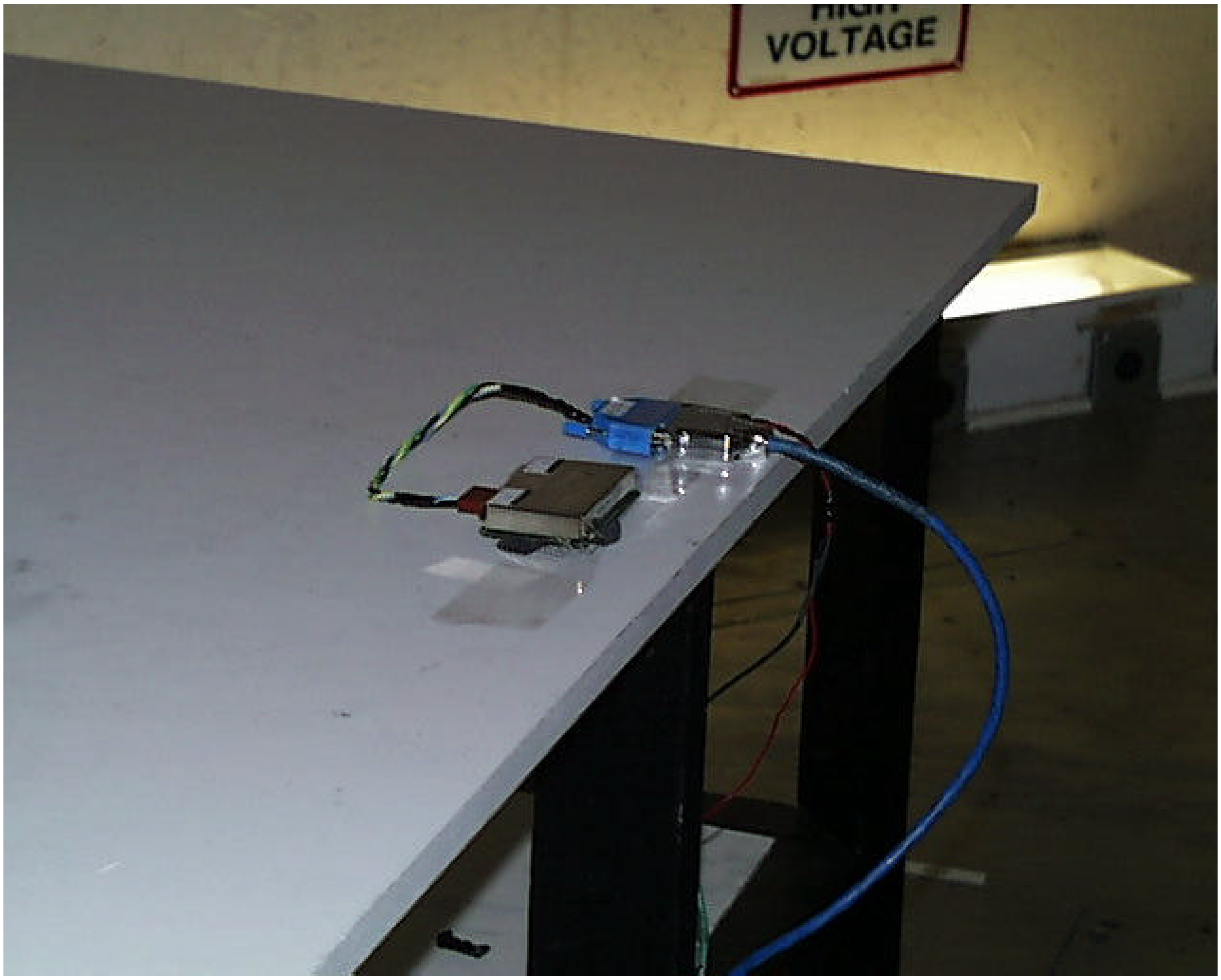


Figure 3.9 - 2: Worst Case Radiated Emission, Rear View

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Figure 3.9 - 3: Worst Case Line-Conducted Emission, Front View

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Figure 3.9 - 4: Worst Case Line-Conducted Emission, Rear View

4.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandwidth, the test procedure and calculation of factors such as pulse desensitization and averaging factor.

4.1 Discussion of Pulse Desensitization

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

4.2 Calculation of Average Factor

Detector function for radiated emission measurements is peak or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

Average Factor in dB = 20 LOG (duty cycle)

The time over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the calculation contained in this section. A plot of the worst case duty cycle, if applicable, is also provided in this report.

Note: This EUT has a 100% duty cycle, therefore no correction applies.

Figure 4.2 - 1: Duty Cycle Plot

4.3 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules. The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4: 1992.

The transceiver was placed on a non-conductive table 80 cm above a ground plane. The support equipment was located below the ground plane. During testing, all cables were manipulated to produce the worst case emissions. . During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

For small, battery powered transmitters, the transmitter is attached to a cardboard box and placed in each of it orthogonal axis during the procedure described above.

Detector function for radiated emissions is in peak mode (the data tables show peak measurements unless other indication is given in the table). Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.2. Alternatively, the average detector of the receiver may be used.

The frequency range scanned is from the lowest radio frequency signal generated in the device, which is greater than 9 kHz, to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 450 kHz to 30 MHz.

The EUT is warmed up for 15 minutes prior to the test. AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.4: 1992. An IF bandwidth of 9 kHz is used, and quasi-peak detection is employed.

The IF bandwidth used for measurement of radiated signal strength was 120 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise-floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

ITS Intertek Testing Services

4317-A Park Drive, NW
Norcross, GA 30093
Phone: 770-925-2444
FAX: 770-925-7294

Federal Communications Commission
Authorization and Evaluation Division
Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

RE: FCC Part 15 Application for Certification
Axonn Corporation (FCC ID: L2VAX551)

Dear Sir or Madam:

Enclosed please find the above-referenced Application, along with a check in the amount of $1075.00 to cover the filing and confidentiality fees.

Also referenced on the Form 731, as outlined in 0.459 of the FCC rules, is Axonn's request to withhold Exhibit 4: Photographs and Exhibit 6: Technical Specifications from public inspection. The subject device employs spread spectrum technology. Professionals shall install this device and Axonn does not currently foresee them making this product available over-the-counter to the average consumer.

The enclosed, close-up photographs of the circuit board clearly show each component and provide the ability to extract cost estimates with a high degree of accuracy. Additionally, these photographs provide enough information to allow an experienced engineer to extract a block diagram of the digital and RF portions of this circuit. If made public, these photographs and the information that can be derived from them might be used to the disadvantage of the applicant in the market place.

To assist in assuring that Axonn Corporation receives full value of its license and protects its competitive posture, Axonn Corporation. respectfully requests grant of confidentiality for Exhibits 4 and 6.

Please feel free to contact me with any questions.

Sincerely,

Candy L. Campbell
Associate Engineer