Excellence in Compliance Testing

FCC Part 15.249
Transmitter Certification

Test Report

FCC ID: KJ8-0001142

FCC Rule Part: 15.249

ACS Report Number: 07-0047 - 15C

Manufacturer: Wayne-Dalton Corporation
Model(s): 3220C-Z, 3222C-Z, 3224C-Z,
3320B-Z, 3322B-Z, 3324B-Z, 3221C-Z

Test Begin Date: February 7, 2007
Test End Date: February 8, 2007

Report Issue Date: March 13, 2007

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

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

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This report contains 16 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General

The models referenced in this report, 3220C-Z, 3222C-Z, 3224C-Z, 3320B-Z, 3322B-Z, 3324B-Z, and 3221C-Z, are garage door openers part of the Wayne-Dalton Z-Wave™ enabled prodrive™ system.

The ProDrive™ series of garage door openers opens your garage door(s) via a directly wired-wallstation (button pad) located near the interior door, or a wireless keypad typically located outside the garage door (PIN req'd), or a 3-button RKE (Remote Keyless Entry) keyfob typically found in the car or on the keychain.

The Z-Wave enabled ProDrive takes the original ProDrive version a step further. In addition to the features of ProDrive, the Z-Wave enabled ProDrive allows users to remotely access electronics and luminaries in their home via a 908.42 MHz Z-Wave transceiver.

Applicant Information:
Wayne-Dalton Corporation
3395 Addison Drive
Pensacola, FL 32514
850-474-9890

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

1.2.2 Intended Use

The models referenced in this report, 3220C-Z, 3222C-Z, 3224C-Z, 3320B-Z, 3322B-Z, 3324B-Z, and 3221C-Z, are garage door openers part of the Wayne-Dalton Z-Wave™ enabled prodrive™ system.

1.2.3 Model Designations

The major differences in models 3220C-Z, 3222C-Z, 3224C-Z, 3320B-Z, 3322B-Z, 3324B-Z, and 3221C-Z are described below. The model designators are provided to distinguish between the accessories, drive method, and HP offered for each system package. The garage door opener in each system identified by the model designation is electrically identical according to 47 CFR Part 2.924.

ITEM	Model	P/N	Portable Transmitters	Wall Station Type	Motor HP	Keyless entry
NETWORK - PRODRIVE:						
prodrive chain 3220C-Z (Z-wave Enabled)	3220C-Z	326581	1	2-button deluxe	1/2 6 pole	no
prodrive chain 3222C-Z (Z-wave Enabled)	3222C-Z	327227	1	7-function wireless	1/2 6 pole	no
prodrive chain 3224C-Z (Z-wave Enabled)	3224C-Z	327228	2	7-function wireless	1/2 6 pole	yes
prodrive belt 3320B-Z (Z-wave Enabled)	3320B-Z	327229	1	2-button deluxe	1/2 6 pole	no
prodrive belt 3322B-Z (Z-wave Enabled)	3322B-Z	327230	1	7-function wireless	1/2 6 pole	no
prodrive belt 3324B-Z (Z-wave Enabled)	3324B-Z	327231	2	7-function wireless	1/2 6 pole	yes
prodrive 1/3 promo chain 3221C-Z (Z-wave Enabled)	3221C-Z	327232	1	2-button deluxe	1/3HP	no

1.3 Test Methodology and Considerations

The Z-Wave Prodrive contains a 908.42 MHz transceiver and a separate 372 MHz discrete IC receiver. This report covers the 908.42 MHz Z-Wave operation only. The 372 MHz discrete IC receiver is addressed in a separate Declaration of Conformity equipment authorization.

2.0 TEST FACILITIES

2.1 Location

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

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

2.2 Laboratory Accreditations/Recognitions/Certifications

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

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

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

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

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

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

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

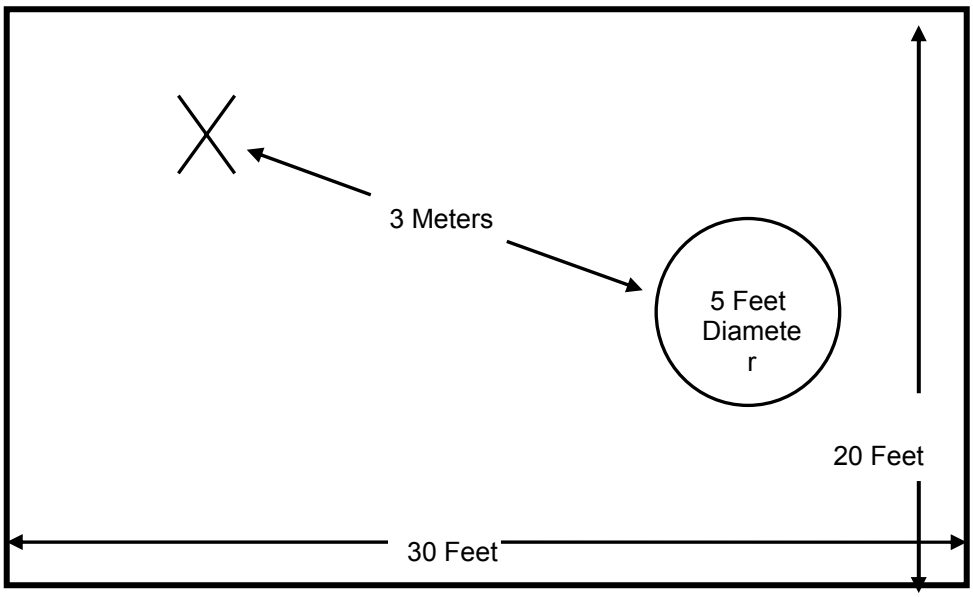

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

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

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

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

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

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

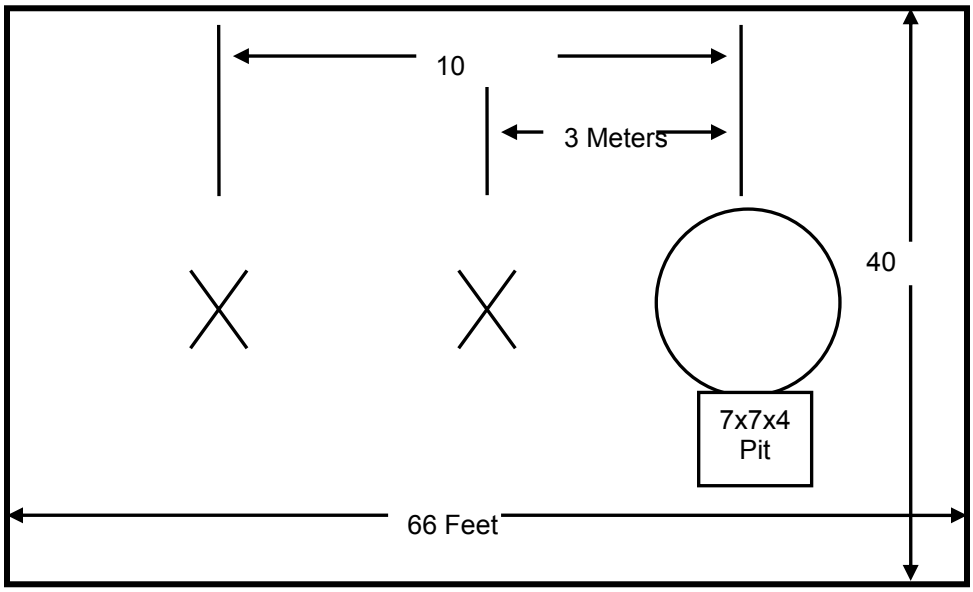

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

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

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

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

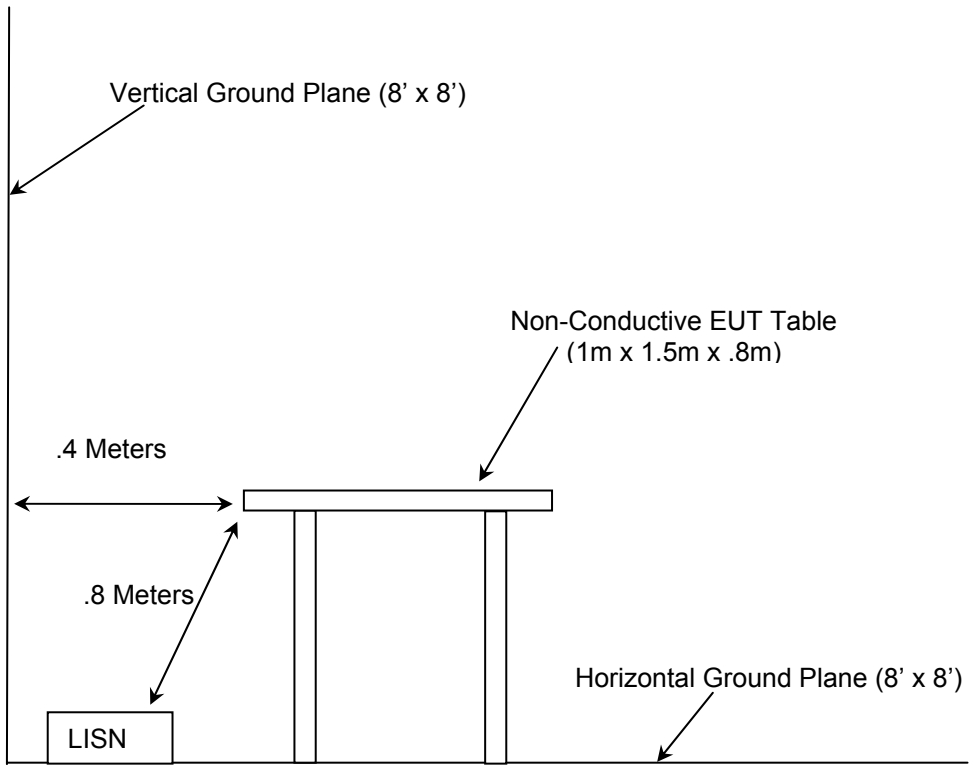

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006

4.0 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS #	**Mfg.**	**Model**	**S/N**	**Equipment Type**	**Cal. Due**
1	Rohde & Schwarz	ESMI - Display	833771/007	Spectrum Analyzers	01-Mar-07
2	Rohde & Schwarz	ESMI-Receiver	839587/003	Spectrum Analyzers	01-Mar-07
22	Agilent	8449B	3008A00526	Amplifiers	07-Apr-07
25	Chase	CBL6111	1043	Antennas	30-May-07
30	Spectrum Technologies	DRH-0118	970102	Antennas	09-May-07
40	EMCO	3104	3211	Antennas	02-Jan-08
41	Electro-Metrics	BIA-25	2925	Antennas	16-May-07
73	Agilent	8447D	2727A05624	Amplifiers	10-May-07
78	EMCO	6502	9104-2608	Antennas	15-Jan-08
90	Electro-Metrics	LPA25	1476	Antennas	17-May-07
167	ACS	Chamber EMI Cable Set	167	Cables	05-Jan-08
193	ACS	OATS cable Set	0193	Cable Set	16-Feb-08
211	Eagle	C7RFM3NFNM	HLC-700	Filters	08-Jan-08
213	TEC	PA 102	44927	Amplifiers	28-Feb-07
253	Florid RF Labs	Lab-Flex 290	253	Cables	01-Aug-07
283	Rohde & Schwarz	FSP40	1000033	Spectrum Analyzers	24-Mar-07
290	Florida RF Cables	SMSE-200-72.0-SMRE	None	Cables	03-May-07
291	Florida RF Cables	SMRE-200W-12.0-SMRE	None	Cables	03-May-07
292	Florida RF Cables	SMR-290AW-480.0-SMR	None	Cables	24-May-07
329	A.H.Systems	SAS-571	721	Antennas	24-Aug-07
331	Microwave Circuits	H1G513G1	31417	Filters	29-Aug-07
338	Hewlett Packard	8449B	3008A01111	Amplifiers	26-Sep-07

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number	FCC ID
The EUT was tested as a stand alone device and no support equipment was utilized.					

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

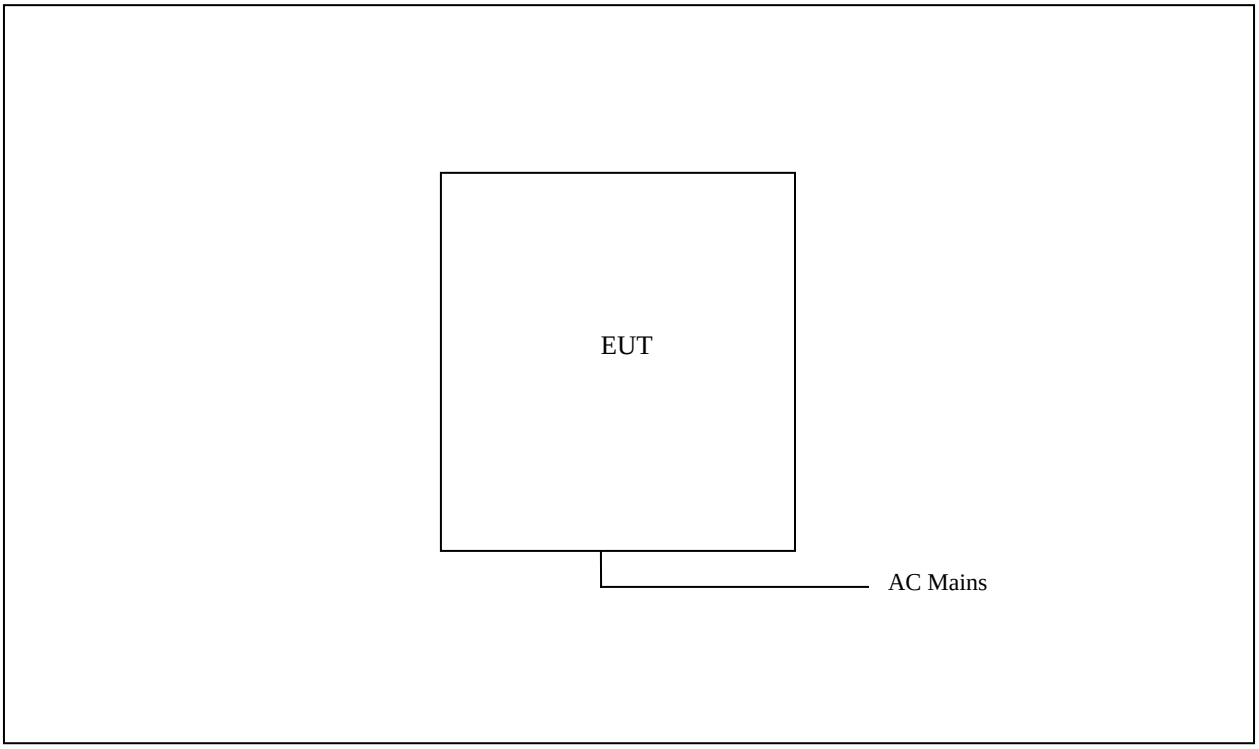

Figure 6.0-1: EUT Test Setup

*See Test Setup photographs for additional detail.

7.0 SUMMARY OF TESTS

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

7.1 Antenna Requirement - FCC Section 15.203

The product uses a permanently attached ¼ wavelength, 22 AWG, wire monopole with an estimated 0dBi gain antenna.

7.2 Power Line Conducted Emissions - FCC Section 15.207

7.2.1 Test Methodology

Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

Measurements were made using a peak detector for comparison to the average limits. Results of the test are shown below in and Table 7.2.2-1.

7.2.2 Test Results

Table 7.2.2-1: Conducted EMI Results

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
1.12	35.2	0.2	9.80	45.00	10.00	56.00	46.00	11.0	36.0
1.16	34.7	0.4	9.80	44.50	10.20	56.00	46.00	11.5	35.8
1.54	31.9	0.2	9.80	41.70	10.00	56.00	46.00	14.3	36.0
1.9	31.9	0.8	9.80	41.70	10.60	56.00	46.00	14.3	35.4
2.82	32.7	0.4	9.80	42.50	10.20	56.00	46.00	13.5	35.8
4.25	30.1	0.2	9.80	39.90	10.00	56.00	46.00	16.1	36.0
Line 2									
0.48	32.7	0.6	9.80	42.50	10.40	56.34	46.34	13.8	35.9
0.55	30.8	0.2	9.80	40.60	10.00	56.00	46.00	15.4	36.0
1.02	29.7	0.6	9.80	39.50	10.40	56.00	46.00	16.5	35.6
1.3	30.1	0.4	9.80	39.90	10.20	56.00	46.00	16.1	35.8
2.07	32.5	0.6	9.80	42.30	10.40	56.00	46.00	13.7	35.6
3.43	30.1	0.4	9.80	39.90	10.20	56.00	46.00	16.1	35.8

7.3 Radiated Emissions - FCC Section 15.109(Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 5000 MHz to account for the 908.42MHz transceiver. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. A Quasi-peak detector was enabled and measurements were taken with the Spectrum Analyzer's resolution bandwidth set to 120 KHz.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1 – Radiated Emissions (Unintentional)

Frequency (MHz)	Measured Reading (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Total Correction Factor (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Results
48.28	27.28	V	100	-17.21	10.07	40.0	29.93	**Pass**
157.1	42.05	V	100	-13.98	28.07	43.5	15.43	**Pass**
167.9	30.98	V	100	-14.30	16.68	43.5	26.82	**Pass**
355.4	20.89	H	100	-8.08	12.81	46.0	33.19	**Pass**
387.8	20.89	H	100	-7.79	13.10	46.0	32.90	**Pass**
51.5	26.82	V	100	-18.14	8.68	40.0	31.32	**Pass**
181.9	41.72	V	100	-14.88	26.84	43.5	16.66	**Pass**

* Note: All emissions above 181.9 MHz were attenuated below the permissible limit.

7.4 20dB Bandwidth FCC Section 15.215

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

7.4.2 Test Results

The 20dB bandwidth was determined to be 162.5 kHz. The frequency band designated under Part 15.249 is 902-928MHz, therefore the 20dB bandwidth is contained within the frequency band designated under this rule part. Results are shown below in Table 7.4.2-1 and Figure 7.4.2-1.

Table 7.4.2-1

Frequency (MHz)	20dB Bandwidth (kHz)
908.42	162.5

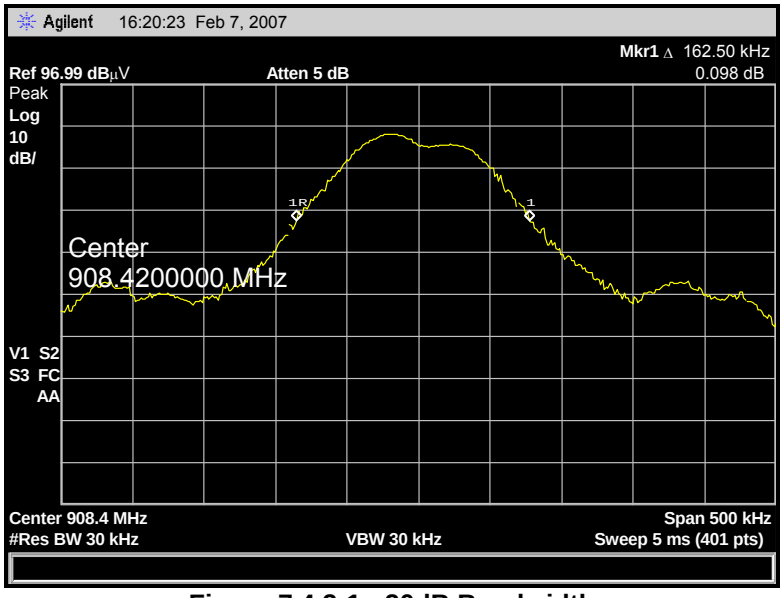

Figure 7.4.2-1: 20dB Bandwidth

7.5 Fundamental Field Strength – FCC Section 15.249(a)

7.5.1 Test Methodology

Radiated measurements of the fundamental field strength were made at 908.42MHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz.

7.5.2 Test Results

Results are shown below in table 7.4.2-1 below:

Table 7.4.2-1: Fundamental Field Strength

Frequency [MHz]	Uncorrected Level [dBuV/m]	Correction Factors [dB]	Corrected Level [dBuV/m]	Limit [dBuV/m]	Margin [dB]
908.42	88.75	1.37	90.12	94.00	3.86

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.249

7.6.1 Band-Edge Compliance - FCC Section 15.249(c)

7.6.1.1 Test Methodology

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

The EUT was investigated at 908.42 MHz to determine band-edge compliance. The radiated field strength of the fundamental emission was first determined and then the mark-delta method as outlined in FCC DA 00-705 was used to determine the field strength of the band-edge emissions. The marker-delta method was used at the upper band-edge only. Based on the plot provided, the lower band-edge field strength is equivalent.

7.6.1.2 Test Results

Band-edge compliance is displayed in Table 7.6.1.2-1 and Figure 7.6.1.2-1.

Table 7.6.1.2-1: Upper Band-edge Marker Delta Method

Frequency (MHz)	Level (dBuV)	Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Field Strength (dBuV/m)	Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)	Band-edge Margin to Limit (dBuV/m)
Fundamental Frequency							
908.42	88.75	V	1.37	90.12	55.1	35.02	10.98

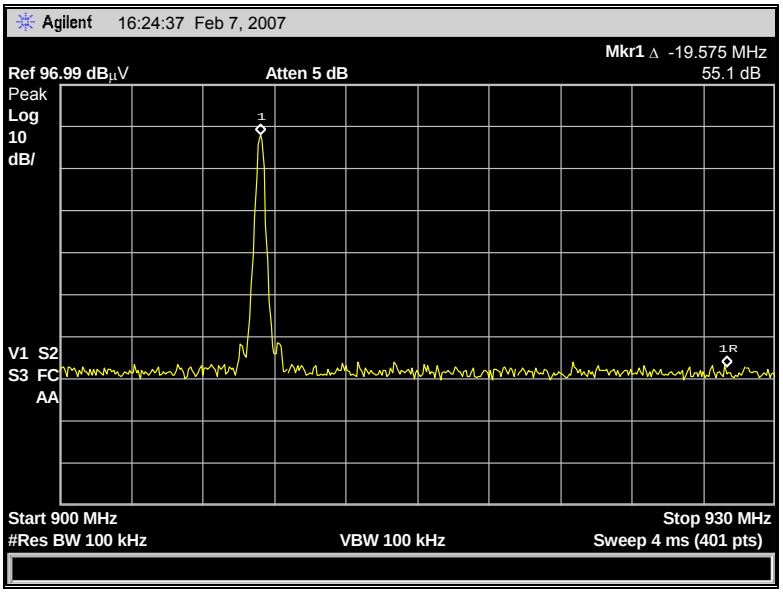

Figure 7.6.1.2-1: Upper Band-edge

7.6.2 Radiated Spurious Emissions – FCC Section 15.249(a), (c)

7.6.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

7.6.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 4.43dB to account for the duty cycle of the EUT. The duty cycle was determined to be 60.0% or 60.0ms with a 100ms period. The duty cycle correction factor is determined using the formula: 20log (0.600) = -4.43dB. Additional justification of the duty cycle can be found in the Theory of Operation supplied with this filing.

7.6.2.3 Test Results

Results are shown below in Table 7.6.2.3-1.

Table 7.6.2.3-1 - Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
1816.84	48.86	41.01	H	-1.91	46.95	34.66	74.0	54.0	27.05	19.34
1816.84	48.15	38.88	V	-1.81	46.34	32.64	74.0	54.0	27.66	21.36
3633.68	44.69	31.31	H	4.71	49.40	31.58	74.0	54.0	24.60	22.42
3633.68	45.20	31.90	V	4.69	49.89	32.15	74.0	54.0	24.11	21.85

The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.6.2.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation

PEAK:
Corrected Level: 48.86 - 1.91 = 46.95dBuV
Margin: 74dBuV – 46.95dBuV = 27.05dB

AVERAGE:
Corrected Level: 41.01 - 1.91 -4.43= 34.66dBuV
Margin: 54dBuV – 34.66dBuV = 19.34dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the models 3220C-Z, 3222C-Z, 3224C-Z, 3320B-Z, 3322B-Z, 3324B-Z, and 3221C-Z, manufactured by Wayne-Dalton Corporation meet the requirements of FCC Part 15 subpart C.

END REPORT