Excellence in Compliance Testing

Certification Test Report

908.42 MHz Low Power Communication Device Transceiver
372 MHz Discrete Receiver

FCC ID: KJ8-0001715
IC: 3540A-0001715

FCC Rule Part: 15.249
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0186 - 15C

Manufacturer: Wayne-Dalton Corporation
Model: 3790-Z

Test Begin Date: September 6, 2007
Test End Date: September 10, 2007

Report Issue Date: October 10, 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 15 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15, Subpart B and Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

1.2.1 General

The Torque Master i-drive Pro is an electromechanical garage door operating system intended for residential use. It has a 372 MHz receiver used to control the garage door operation. It also has a Z-Wave transceiver which receives and transmits a 908.42 MHz Z-Wave® radio frequency signal for Z-Wave device activation.

Applicant Information:
Wayne-Dalton Corporation
4400 River Green Pkwy.
Suite 220B
Duluth, GA 30096
678-417-0115

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

1.2.2 Intended Use

Residenual garage door operation and part of the Wayne-Dalton Z-Wave™ enabled prodrive™ system.

1.3 Test Methodology and Considerations

The Torque Master i-drive Pro contains a 908.42 MHz transceiver and a separate 372 MHz discrete IC receiver. This report covers the 908.42 MHz Z-Wave transceiver operation under FCC Part 15.249 and IC RSS-210 as well as including the data for the 372 MHz discrete IC receiver for FCC Part 15 Subpart B and IC RSS-210.

See test setup photographs for additional information.

1.4 EUT Modifications

To show compliance for the intentional radiated spurious emissions of the 908.42 MHz transceiver, the antenna length was modified. The 3 inch 908.42MHz Z-Wave® transceiver antenna was adjusted slightly shorter in length, from ideal, to adjust for environmental affects and FCC compliance.

2.0 TEST FACILITIES

2.1 Location

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

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

2.2 Laboratory Accreditations/Recognitions/Certifications

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

FCC Registration Number: 894540
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

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

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

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

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

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

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

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

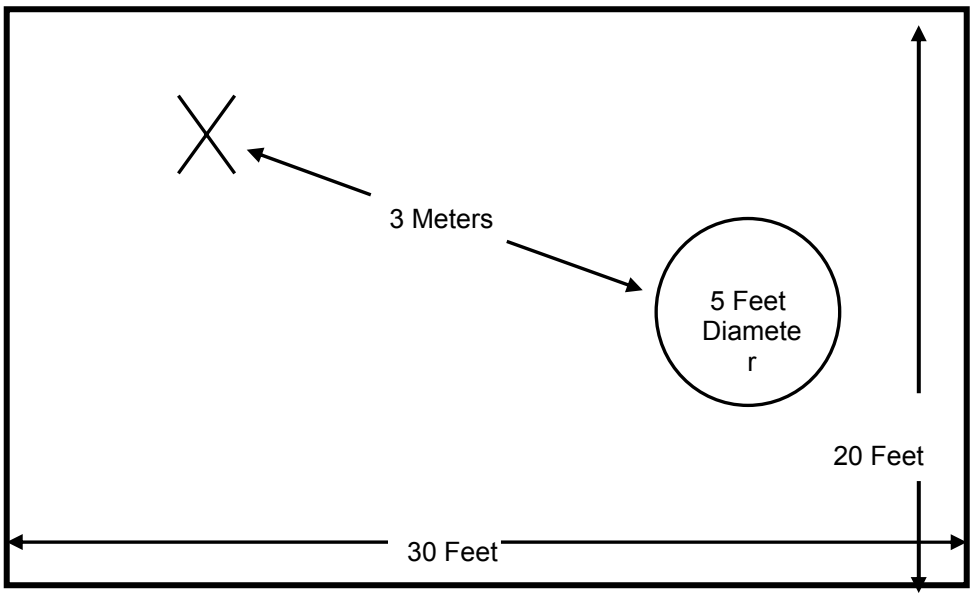

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

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

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

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

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

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

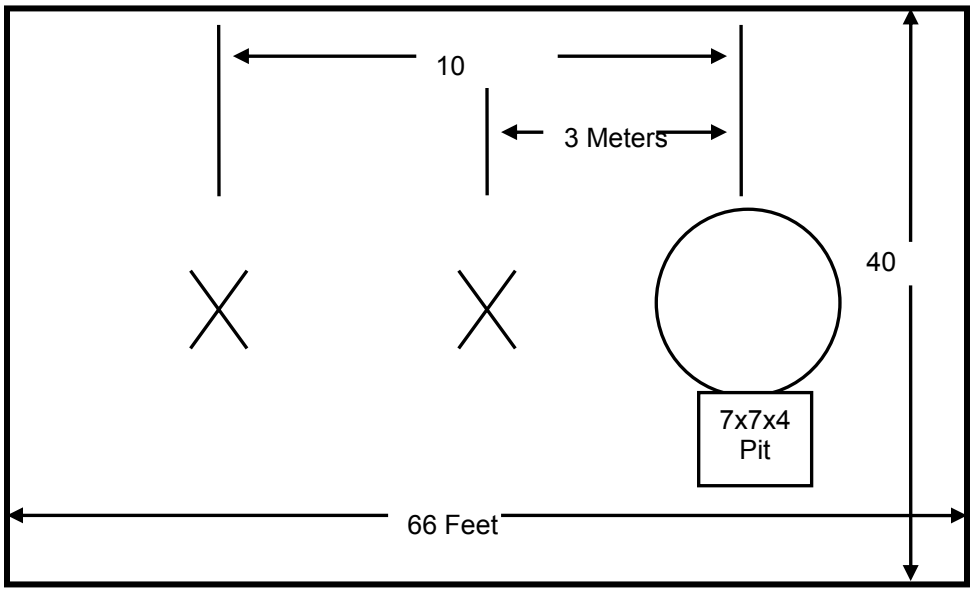

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

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

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

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

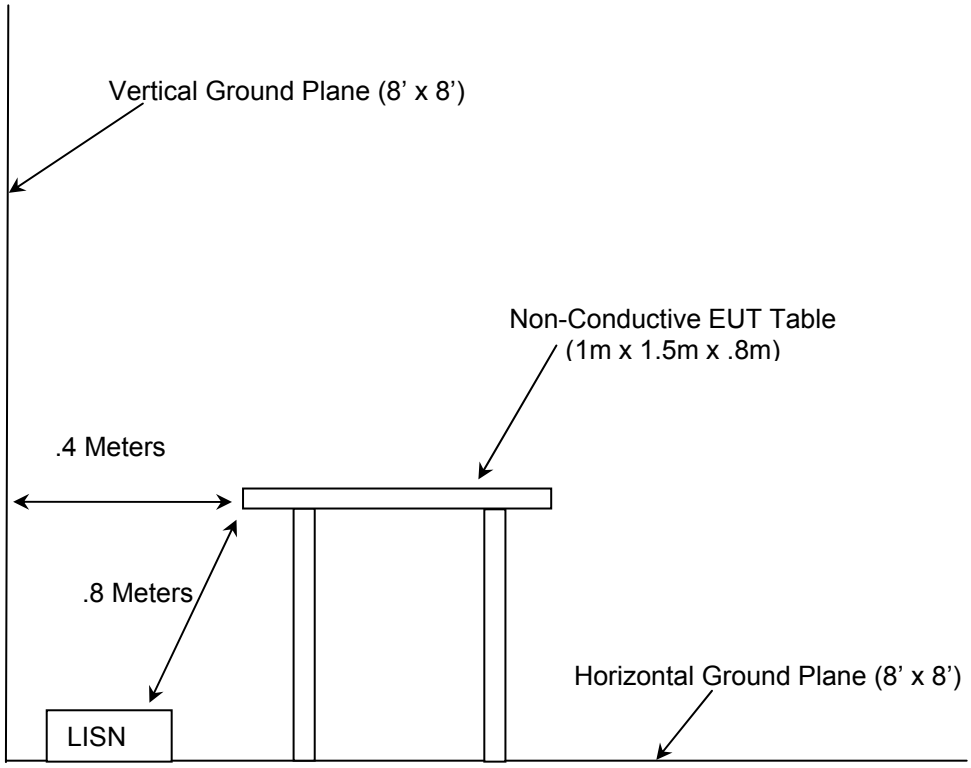

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- 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 B: Radio Frequency Devices, Unintentional Radiators, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007

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**
3	Rohde & Schwarz	ESMI - Display	839379/011	Spectrum Analyzers	10-24-2007
4	Rohde & Schwarz	ESMI - Receiver	833827/003	Spectrum Analyzers	10-24-2007
22	Agilent	8449B	3008A00526	Amplifiers	04-10-2008
25	Chase	CBL6111	1043	Antennas	06-06-2008
30	Spectrum Technologies	DRH-0118	970102	Antennas	05-10-2008
70	Rohde & Schwarz	ESH-3	879676/050	Spectrum Analyzers	08-15-2008
152	EMCO	3825/2	9111-1905	LISN	02-20-2008
153	EMCO	3825/2	9411-2268	LISN	11-16-2007
167	ACS	Chamber EMI Cable Set	167	Cables	01-05-2008
193	ACS	OATS cable Set	193	Cable Set	02-16-2008
277	Emco	93146	9904-5199	Antennas	06-18-2008
283	Rohde & Schwarz	FSP40	1000033	Spectrum Analyzers	11-09-2008
290	Florida RF Cables	SMSE-200-72.0-SMRE	None	Cables	05-15-2008
291	Florida RF Cables	SMRE-200W-12.0-SMRE	None	Cables	05-15-2008
292	Florida RF Cables	SMR-290AW-480.0-SMR	None	Cables	05-24-2008
321	Hewlett Packard	HPC 8447D	1937A02809	Amplifiers	07-17-2008
329	A.H.Systems	SAS-571	721	Antennas	08-13-2008
331	Microwave Circuits	H1G513G1	31417	Filters	03-24-2008
338	Hewlett Packard	8449B	3008A01111	Amplifiers	09-26-2007
343	Florida RF Cables	SMRE-200W-12.0-SMRE	N/A	Cables	12-21-2007
344	Florida RF Cables	SMS-290AW-480.0-SMR	N/A	Cables	12-21-2007

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number	FCC ID
1	Wonder Box Device Controller	Rheonetic	NA	NA	
2	Sensor Send Unit	Wayne Dalton	260597	NA	
3	Sensor Receive Unit	Wayne Dalton	260600	NA	
4	AC Adapter	CUI INC	DSA-0151F-12	NA	

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAMS

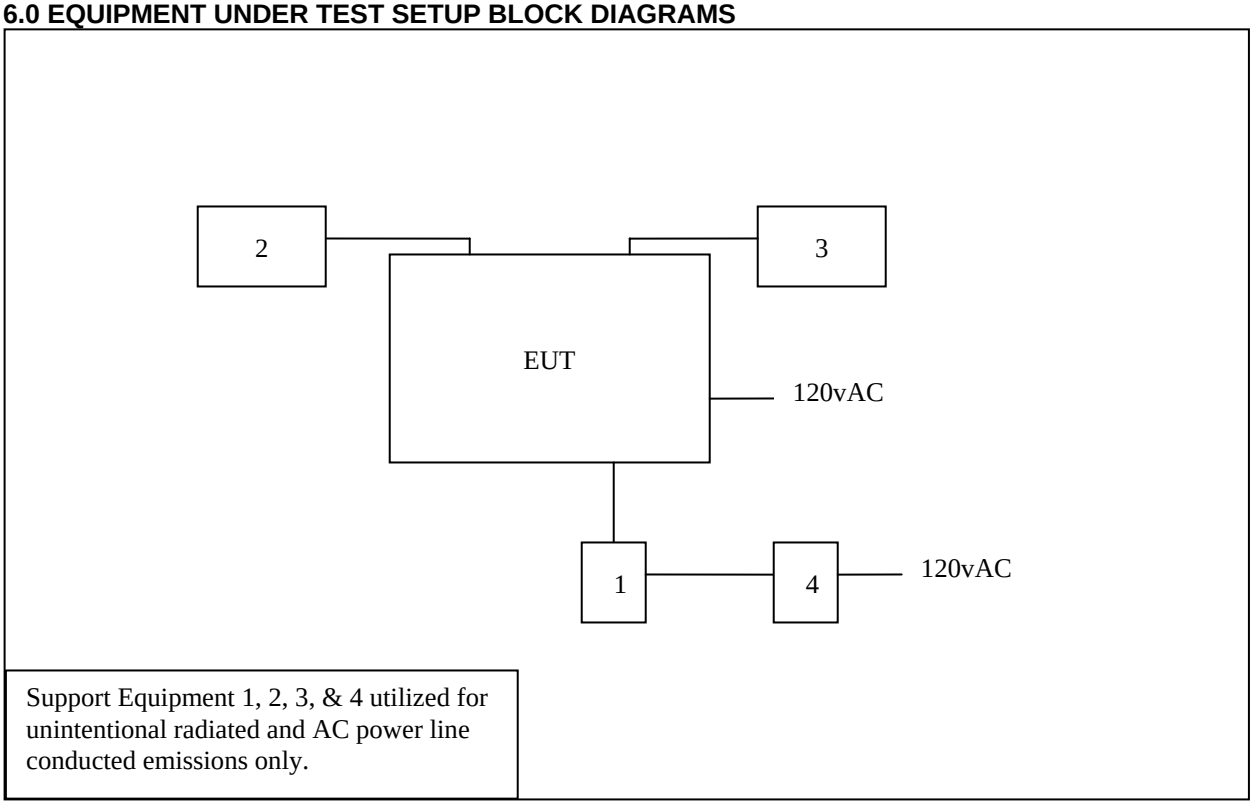

Figure 6.0-1: EUT Test Setup – Part 15.249

*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 Z-Wave Torque Master i-Drive utilizes an integral ¼ wavelength monopole wire antenna with approximate gain of 0dBi.

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-	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.21	30.4	23.6	9.80	40.20	33.40	63.21	53.21	23.0	19.8
0.37	23.2	14.1	9.80	33.00	23.90	58.50	48.50	25.5	24.6
0.52	21.2	15.6	9.80	31.00	25.40	56.00	46.00	25.0	20.6
1.04	19.9	16.1	9.80	29.70	25.90	56.00	46.00	26.3	20.1
15.18	21.3	8.4	10.00	31.30	18.40	60.00	50.00	28.7	31.6
26.52	21.7	9.7	10.11	31.81	19.81	60.00	50.00	28.2	30.2
Line 2									
0.16	28.5	17.1	9.80	38.30	26.90	65.46	55.46	27.2	28.6
0.21	30.8	25.9	9.80	40.60	35.70	63.21	53.21	22.6	17.5
0.33	26.2	16.8	9.80	36.00	26.60	59.45	49.45	23.5	22.9
1.24	23.8	18.4	9.80	33.60	28.20	56.00	46.00	22.4	17.8
15.13	21.3	10.8	10.00	31.30	20.80	60.00	50.00	28.7	29.2
16.49	23.4	15.7	10.00	33.40	25.70	60.00	50.00	26.6	24.3

7.3 Radiated Emissions - 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. For frequencies below 1000 MHz a Quasi-peak detector was enabled and measurements were taken with the Spectrum Analyzer's resolution bandwidth set to 120 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.

Both the 372 MHz receiver and the receiver section of the 908.42 MHz transceiver were active for this evaluation.

7.3.2 Test Results

Results of the test are given in Table 7.3.2-1 below:

Table 7.3.2-1 – Radiated Emissions (Unintentional)

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
38	---------	50.48	V	-12.32	---------	38.16	--------	40	---------	1.84
101.25	---------	34.15	V	-14.05	---------	20.1	--------	43.5	---------	23.4
251.25	---------	31.25	H	-11.7	---------	19.55	--------	46	---------	26.45
446	---------	36.71	V	-7.02	---------	29.69	--------	46	---------	16.31
600	---------	42.55	H	-3.6	---------	38.95	--------	46	---------	7.05
848.5	---------	26.45	V	0.445	---------	26.895	--------	46	---------	19.105
960	---------	32.85	H	2.6	---------	35.45	--------	54	---------	18.55

* Note: All emissions above 960.0 MHz were not detected above the noise floor of the measurement equipment and therefore attenuated below the permissible limit.

7.4 20dB Bandwidth

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 165.0 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	165.0

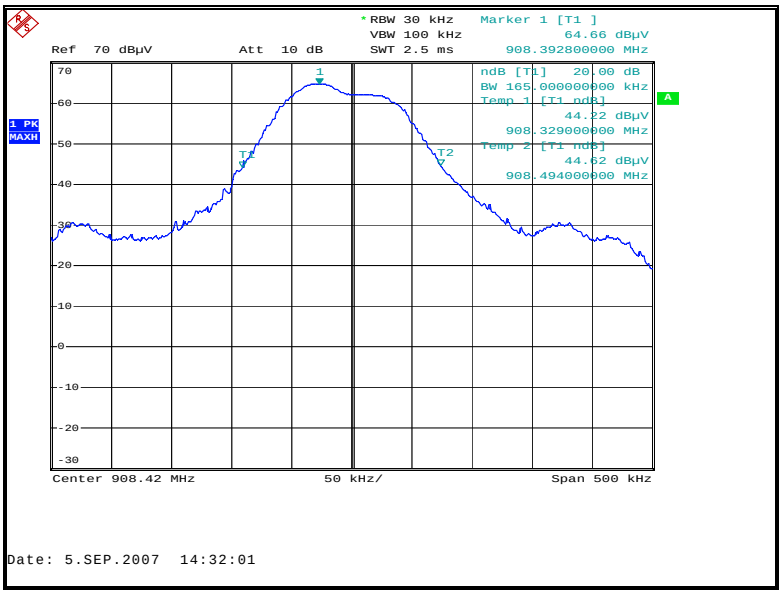

Figure 7.4.2-1: 20dB Bandwidth Low Channel

7.5 Fundamental Field Strength

7.5.1 Test Methodology

Radiated emissions tests were made on the 908.42 MHz transceiver.

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. Peak

7.5.2 Test Results

Results are shown below in Table 7.5.2-1 below:

Table 7.5.2-1: Fundamental Field Strength

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
908.42	--------	61.08	H	28.48	--------	89.56	--------	94.0	--------	4.42
908.42	--------	65.35	V	27.97	--------	93.32	--------	94.0	--------	0.66

7.6 Band-Edge Compliance and Spurious Emissions

7.6.1 Band-Edge Compliance

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 as compared to the emission limits of 15.209. The marker-delta method was used at the lower band-edge only. Based on the plot provided, the upper 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: 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	65.35	V	27.97	93.32	59.73	33.59	12.41

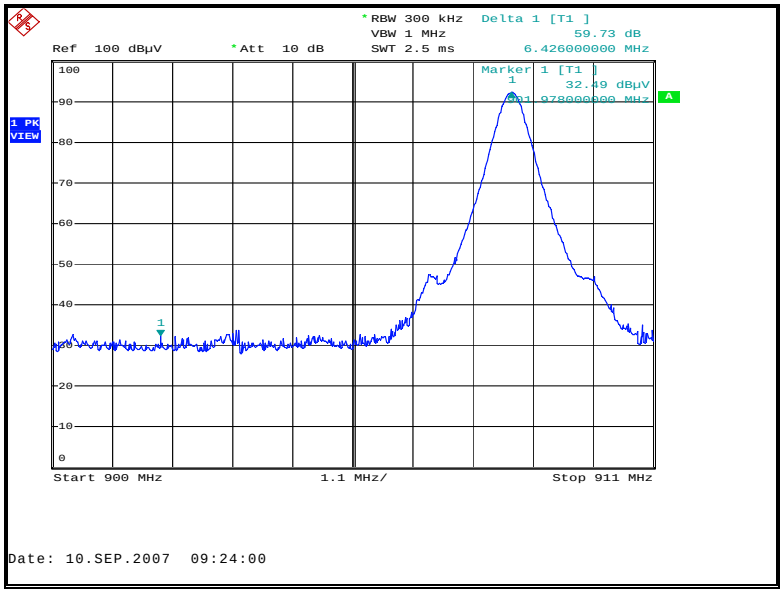

Figure 7.6.1.2-1 Band-edge

7.6.2 Radiated Spurious Emissions

7.6.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 9.0842 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 4.44dB to account for the duty cycle of the EUT. The duty cycle was determined to be 60% or 60ms with a 100ms period. The duty cycle correction factor is determined using the formula: 20log (0.6) = -4.44dB. 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
2725.26	51.19	44.71	H	-5.00	46.19	35.27	74.0	54.0	27.81	18.73
2725.26	55.42	51.21	V	-5.16	50.26	41.62	74.0	54.0	23.74	12.38
3633.68	50.02	38.47	H	-3.56	46.46	30.48	74.0	54.0	27.54	23.52
3633.68	50.24	40.96	V	-3.36	46.88	33.17	74.0	54.0	27.12	20.83

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: 51.19 - 5.00 = 46.19dBuV
Margin: 74dBuV – 46.19dBuV = 27.81dB

AVERAGE:
Corrected Level: 44.71 - 5.00 -4.44= 35.27dBuV
Margin: 54dBuV – 35.27dBuV = 18.73dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the 3790-Z manufactured by Wayne-Dalton Corporation meets the requirements of FCC Part 15 subpart B and C as well as Industry Canada's Radio Standards Specification RSS-210.

END REPORT