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Certification Test Report

FCC ID: UGL633ANH
IC: 7888B-633ANH

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-210

ACS Report Number: 11-2044.W04.12.A

Manufacturer: DRS Tactical Systems, Inc.
Model: 633ANHMW

Test Begin Date: May 28, 2011
Test End Date: June 25, 2011

Report Issue Date: June 30, 2011

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ACLASS, ANSI, or any agency of the Federal Government.

Project Manager:

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This report contains **15** pages

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1 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 and Industry Canada's Radio Standards Specification RSS-210 for a class II permissive change. The class II permissive change is to add the DRS X10gx host where the host can be configured to use either the internal antennas already approved for use with the module or an unapproved external antenna with X10 vehicle dock. This report provides data showing compliance of the external 5 dBi MGW-301-3C3C2C Mobile Mark Communications Antenna for use with the DRS X10gx and associated vehicle dock.

1.2 Product description

The 633ANHMW is an Intel® Centrino® Ultimate-N 6300 embedded IEEE 802.11a/b/g/n wireless network adapter that operates in the 2.4 GHz and 5.0 GHz spectrum. The module provides 3 antenna ports (Chains A, B, C) and is capable of delivering up to 450 Mbps.

Table 1.2- 1: Product Description

Mode of Operation	Frequency Range (MHz)	Number of Channels	Data Rates Supported (Mbps)
802.11b	2412 - 2462	11	1/5.5/11
802.11g	2412 - 2462	11	6/36/54
802.11n (20 MHz)	2412 - 2462	11	Up to 450
802.11n (40 MHz Wide)	2422 - 2452	7	Up to 450
802.11a	5745- 5825	5	6/36/54
802.11n (20 MHz)	5745 - 5825	5	Up to 450
802.11n (40 MHz Wide)	5755 - 5795	2	Up to 450

The 633ANHMW is implemented inside of a host tablet PC (X10gx) that also incorporates WWAN (EVDO and GSM) and Bluetooth modules, GOBI2000 and Castlenet BTC04R, respectively.

Table 1.2- 2: Collocated Radios

Radio	Manufacturer	Model Number	FCC ID	IC
WWAN	DRS Tactical	GOBI2000	UGLGOBI2	7888B-GOBI2
Bluetooth	Castlenet	BTC04R	RK9-BTC04R	4729A-BTC04R

Manufacturer Information:

DRS Tactical Systems, Inc.
1110 W. Hibiscus Blvd.
Melbourne, FL 32901
(321) 727-3672

Test Sample Serial Number(s): G103000C6M000, G103000C4M000

Test Sample Condition: Good

1.3 Test Methodology and Considerations

The EUT was evaluated for radiated spurious emission measurements for the 802.11a/b/g/n configuration when used in conjunction with the 5 dBi MGW-301-3C3C2C Mobile Mark communications antenna with the X10 Vehicle RF Dock. The MGW-301-3C3C2C Mobile Mark communications antenna can be connected to only one port of the module (Chain A) through the X10 vehicle dock. Therefore, only Chain A was evaluated. The evaluation was performed at the channels listed in Table 1.3-1 below where the data rates described led to the worst case emissions.

Additionally, inter-modulation measurements for the collocated radios operating simultaneously were performed for the EUT configured with and without the external antenna. All inter-modulation emissions products generated by the simultaneous transmission of the collocated radios were found to be compliant.

Operation in the UNII unlicensed band is investigated in a separate certification document.

Table 1.3-1: Configurations evaluated

Mode of Operation	Channel	Frequency (MHz)	Data Rates
802.11b	1	2412	1 Mbps
	6	2437	1 Mbps
	11	2462	1 Mbps
802.11g	1	2412	6 Mbps
	6	2437	6 Mbps
	11	2462	6 Mbps
802.11n (20 MHz)	1	2412	HT0
	6	2437	HT0
	11	2462	HT0
802.11n (40 MHz Wide)	3	2422	HT0
	4	2427	HT0
	6	2437	HT0
	8	2447	HT0
	9	2452	HT0
802.11a	149	5745	6 Mbps
	157	5785	6 Mbps
	165	5825	6 Mbps
802.11n (20 MHz)	149	5745	HT0
	157	5785	HT0
	165	5825	HT0
802.11n (40 MHz Wide)	151	5755	HT0
	159	5795	HT0

2 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 587595
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

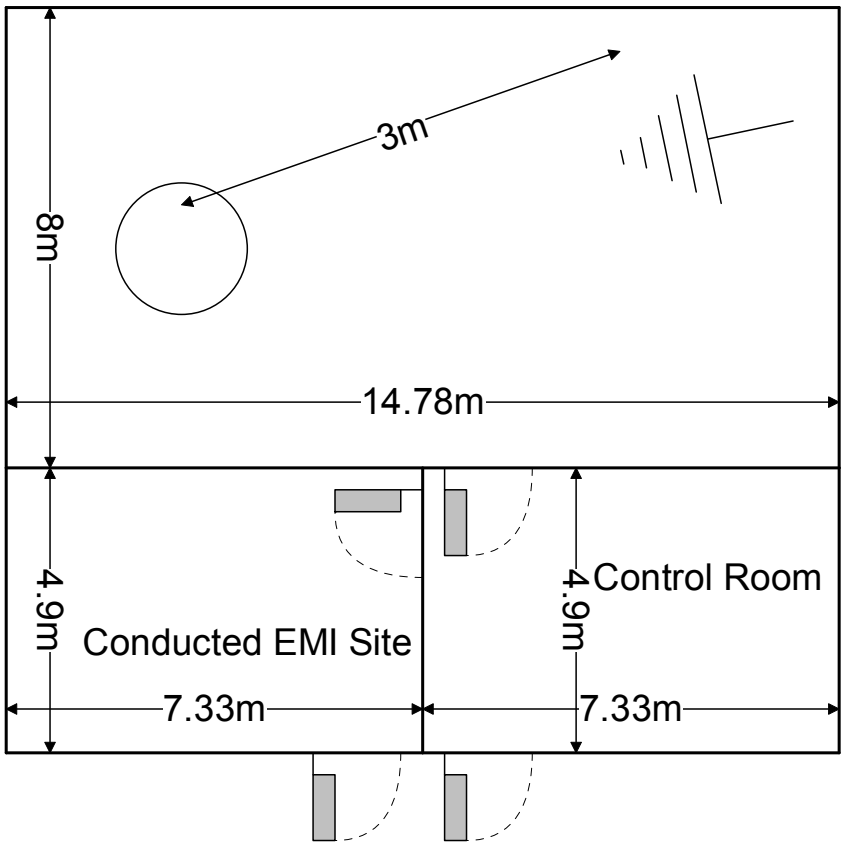

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

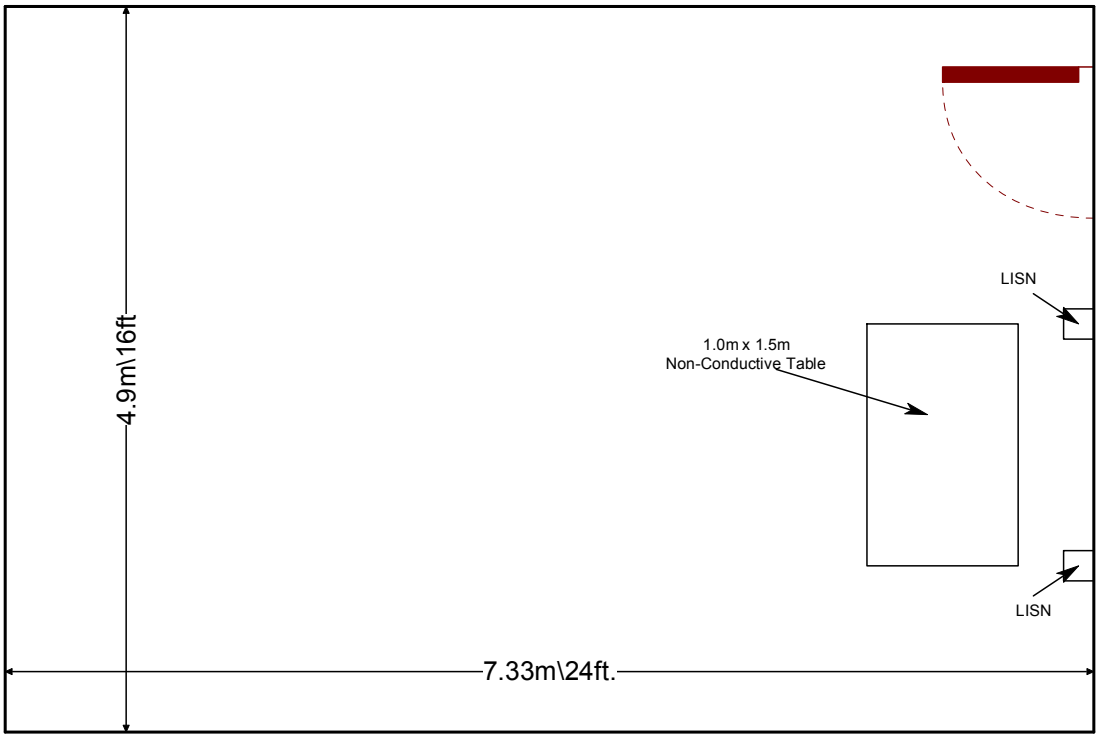

Figure 2.3.2-1: AC Mains Conducted EMI Site

3 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, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- KDB Publication No. 558074 - Measurement of Digital Transmission Systems Operating under Section 15.247, March 23, 2005
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 8, December 2010.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 3, December 2010.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
524	Chase	CBL6111	Antennas	1138	1/7/2011	1/7/2013
2081	Hewlett Packard	11975A	Amplifier	2517A00669	NCR	NCR
2001	Hewlett-Packard	11971A	Mixer	2332A01214	2/25/2011	2/25/2013
2006	EMCO	3115	Antennas	2573	3/2/2011	3/2/2013
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	1/3/2011	1/3/2012
2013	Hewlett Packard	HP8566B	Spectrum Analyzers	2407A03233	8/5/2010	8/5/2012
2014	Hewlett Packard	HP 85650A	Quasi Peak Adapter	2430A00559	8/5/2010	8/5/2012
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/7/2011	1/7/2012
2044	QMI	N/A	Cables	2044	1/7/2011	1/7/2012
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/5/2011	1/5/2013
2082	Teledyne Storm Products	90-010-048	Cables	2082	6/6/2011	6/6/2012
RE581	Hewlett Packard	8449B	Amplifier	3008A00198	1/20/2011	1/20/2012
2070	Mini Circuits	VHF-8400+	Filter	2070	2/3/2011	2/3/2012
2072	Mini Circuits	VHF-3100+	Filter	30737	2/3/2011	2/3/2012
2076	Hewlett Packard	HP5061-5458	Cables	2076	2/2/2011	2/2/2012
2012	Hewlett-Packard	HP83017A	Amplifiers	3123A00324	2/25/2011	2/25/2012
332	Rohde&Schwarz	TS-PR40	Amplifiers	100021	10/29/2010	10/29/2011
333	Rohde&Schwarz	3160-09	Antennas	49404	11/4/2010	NCR
335	Suhner	SF-102A	Cables	882/2A	10/29/2010	10/29/2011

NCR = No Cal Required

*Note:
The assets 333 and 2008 are standard gain horn antennas. Hence, recurring calibration beyond initial calibration per the manufacturer is not required only in case of damage, suspected deterioration or use at distance closer than $2xa^2/\lambda$, as per ANSI C63.4 requirements.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment – RF Vehicle Dock with External Antenna

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Host Device	DRS Tactical Systems	X10gx	G103000C6M000 G103000C4M000
2	RF Car Dock	DRS Tactical Systems	Armor X10 Vehicle Dock	GX00411
3	Antenna	Mobile Mark	MGW-301-3C3C2C	N/A
4	Keyboard	Dell	SK-8115	CN-0DJ331-71616-93N-0792
5	Mouse	Hewlett Packard	M859PU	BM81416122
6	DC Power Supply	MPJA	HY5003	003700278

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

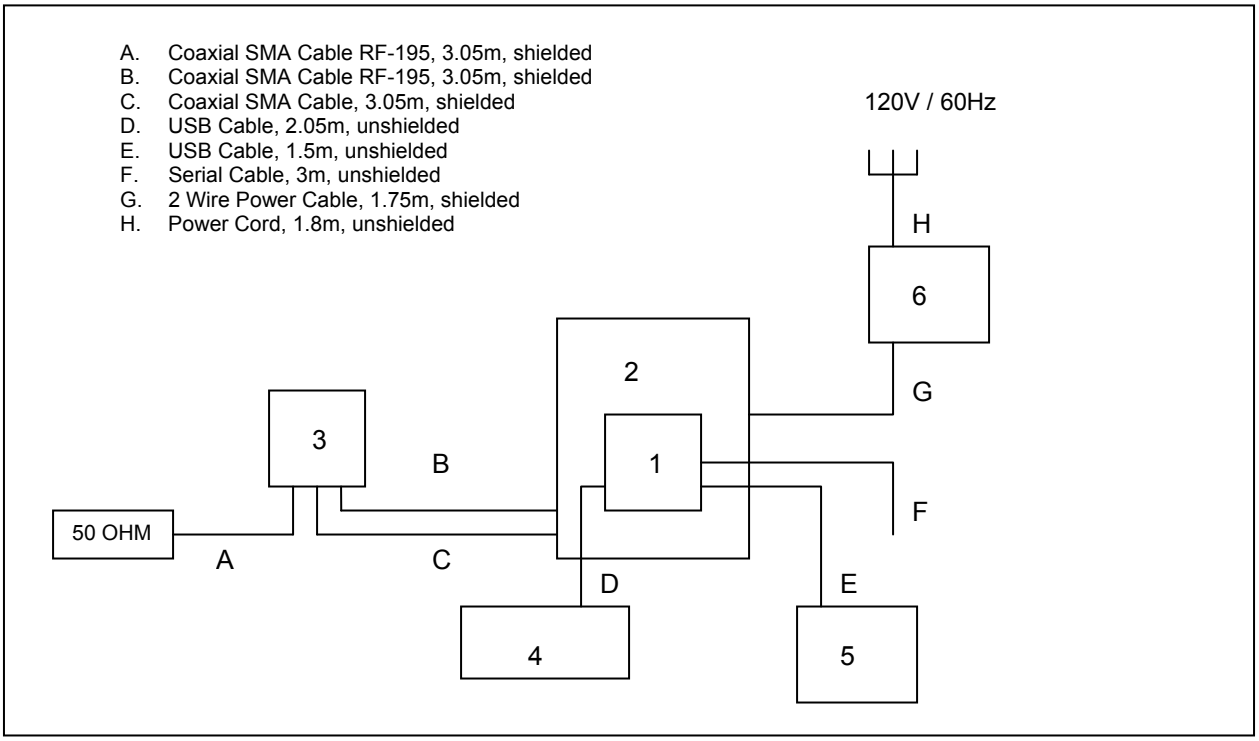

Figure 6- 1: Test Setup Block Diagram – RF Vehicle Dock with External Antenna

7 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 633ANHMW uses a 5 dBi MGW-301-3C3C2C Mobile Mark communications antenna with the vehicle dock. The vehicle dock will provide an RP-SMA connector for the WLAN transceiver in order to meet the requirements of 15.203.

7.2 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.5

7.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency ranges of 30MHz to 25 GHz and 30MHz to 40 GHz, 10 times the highest fundamental frequency, for the 802.11b/g/n and the 802.11a/n transmitters, respectively.

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 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3 MHz respectively.

7.2.2 Measurement Results

Radiated spurious emissions found in the band of 30 MHz to 25 GHz for the 802.11b/g and 30 MHz to 40 GHz for the 802.11a/n transmitters are reported in the Tables 7.2.2-1 to 7.2.2-7 below.

Table 7.2.2-1: Radiated Spurious Emissions Tabulated Data - 802.11b

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
Low Channel (2412 MHz)										
2390	49.48	41.10	H	-3.73	45.75	37.37	74.0	54.0	28.20	16.60
2390	56.78	49.66	V	-3.73	53.05	45.93	74.0	54.0	20.90	8.10
4824	42.86	36.06	V	4.41	47.27	40.47	74.0	54.0	26.70	13.50
Middle Channel (2437 MHz)										
Noise Floor										
High Channel (2462 MHz)										
2483.5	50.21	40.39	H	-3.38	46.83	37.01	74.0	54.0	27.20	17.00
2483.5	54.73	47.24	V	-3.38	51.35	43.86	74.0	54.0	22.60	10.10
3913	38.65	27.16	H	2.36	41.01	29.52	74.0	54.0	33.0	24.5

* Note: All Emissions above 4824 MHz were attenuated below the noise floor and the limits.

Table 7.2.2-2: Radiated Spurious Emissions Tabulated Data - 802.11g

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
Low Channel (2412 MHz)										
2390	59.37	41.42	H	-3.73	55.64	37.69	74.0	54.0	18.40	16.30
2390	62.04	41.87	V	-3.73	58.31	38.14	74.0	54.0	15.70	15.90
Middle Channel (2437 MHz)										
Noise Floor										
High Channel (2462 MHz)										
2483.5	65.27	43.41	H	-3.38	61.89	40.03	74.0	54.0	12.10	14.00
2483.5	69.07	52.23	V	-3.38	65.69	48.85	74.0	54.0	8.30	5.10

* Note: All emissions above 2483.5 MHz were attenuated below the noise floor and the limits.

Table 7.2.2-3: Radiated Spurious Emissions Tabulated Data - 802.11n – 20 MHz (2400 MHz – 2483.5 MHz)

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
Low Channel (2412 MHz)										
2390	64.57	45.58	H	-3.73	60.84	41.85	74.0	54.0	13.20	12.10
2390	67.09	46.66	V	-3.73	63.36	42.93	74.0	54.0	10.60	11.10
3784	40.04	28.00	H	1.92	41.96	29.93	74.0	54.0	32.00	24.10
Middle Channel (2437 MHz)										
Noise Floor										
High Channel (2462 MHz)										
2483.5	67.92	48.37	H	-3.38	64.54	44.99	74.0	54.0	9.50	9.00
2483.5	76.13	55.66	V	-3.38	72.75	52.28	74.0	54.0	1.20	1.70

*Note: All emissions above 3784 MHz were attenuated below the limits and the noise floor.

Table 7.2.2-4: Radiated Spurious Emissions Tabulated Data - 802.11n – 40 MHz Wide (2400 MHz – 2483.5 MHz)

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
Channel 3 (2422 MHz)										
2390	60.96	44.17	H	-3.73	57.23	40.44	74.0	54.0	16.80	13.60
2390	69.83	53.00	V	-3.73	66.10	49.27	74.0	54.0	7.90	4.70
Channel 4 (2427 MHz)										
2390	60.97	45.08	H	-3.73	57.24	41.35	74.0	54.0	16.80	12.60
2390	68.42	49.83	V	-3.73	64.69	46.10	74.0	54.0	9.30	7.90
Channel 6 (2437 MHz)										
Noise Floor										
Channel 8 (2447 MHz)										
2483.5	61.75	44.37	H	-3.38	58.37	40.99	74.0	54.0	15.60	13.00
2483.5	67.85	51.51	V	-3.38	64.47	48.13	74.0	54.0	9.50	5.90
Channel 9 (2452 MHz)										
2483.5	61.40	41.59	H	-3.38	58.02	38.21	74.0	54.0	16.00	15.80
2483.5	70.88	51.80	V	-3.38	67.50	48.42	74.0	54.0	6.50	5.60

* Note: All emissions above 2483.5 MHz were attenuated below the limits and the noise floor.

Table 7.2.2-5: Radiated Spurious Emissions Tabulated Data - 802.11a (5725 MHz – 5850 MHz)

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
Low Channel (5745 MHz)										
Noise Floor										
Middle Channel (5785 MHz)										
Noise Floor										
High Channel (5825 MHz)										
3795.583	39.98	27.91	H	1.40	41.38	29.31	74.0	54.0	32.6	24.7

* Note: All emissions above 5825 MHz were attenuated below the limits and the noise floor

Table 7.2.2-6: Radiated Spurious Emissions Tabulated Data - 802.11n – 20 MHz (5725 MHz – 5850 MHz)

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
Low Channel (5745 MHz)										
3783.72	39.33	27.61	H	1.35	40.69	28.96	74.0	54.0	33.30	25.00
Middle Channel (5785 MHz)										
3795.392	39.36	27.83	H	1.40	40.76	29.23	74.0	54.0	33.2	24.8
High Channel (5825 MHz)										
Noise Floor										

Note: All emissions above 5825 MHz were attenuated below the limits and the noise floor

Table 7.2.2-7: Radiated Spurious Emissions Tabulated Data - 802.11n – 40 MHz Wide (5725 MHz – 5850 MHz)

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
Low Channel 5755 MHz)										
Noise Floor										
High Channel (5795 MHz)										
Noise Floor										*

Note: All emissions above 5795 MHz were attenuated below the noise floor and the limits.

7.2.2.1 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: 39.36 + 1.4 = 40.76dBuV/m
Margin: 74dBuV/m – 40.76dBuV/m = 33.2dB

Example Calculation: Average
Corrected Level: 27.83 + 1.4 - 0= 29.23dBuV/m
Margin: 54dBuV/m – 29.23dBuV/m = 24.8dB

8 CONCLUSION

In the opinion of ACS, Inc. the 633ANHMW, manufactured by DRS Tactical Systems, Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT