Excellence in Compliance Testing

Certification Test Report

FCC ID: R4N-AW900MR
IC: 5303A-AW900MR

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

ACS Report Number: 13-2161.W04.1B

Manufacturer: AvaLAN Wireless Systems
Model: AW900mTR

Test Begin Date: **December 4, 2013**
Test End Date: **December 13, 2013**

Report Issue Date: February 17, 2014

ACCREDITED TESTING

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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Reviewed by:

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This report contains 16 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 2 Permissive Change.

The purpose of the Class 2 Permissive Change is to add new antenna types to the certified module.

1.2 Manufacturer Information

AvaLAN Wireless Systems
125A Castle Drive
Madison AL 35758

1.3 Product Description

The Avalan Wireless model AW900mTR is a point to multipoint Ethernet bridge operating in the ISM band of 902 MHz - 928 MHz. The AW900mTR radio allows a user to create an ultra-long-range, wireless Ethernet network for up to 16 subscriber units.

Technical Details

Mode of Operation:	DSSS
Frequency Range:	903.125 MHz - 926.01467 MHz
Number of Channels:	12
Channel Separation:	2.0833 MHz
Transmit Data Rates:	1.536 Mbps
Modulations:	FSK
Antenna Type/Gain:	Omni Monopole Antenna, 11 dBi
	Yagi Yuda Antenna, 16 dBi
	Sector Antenna, 18.5 dBi
Input Power:	12 VDC

Model Number: AW900mTR

Test Sample Serial Number(s): AV13149830085

Test Sample Condition: The samples were in good conditions with no observable physical damage.

1.4 Test Methodology and Considerations

The model AW900mTR was tested for radiated emissions for the antennas listed above. The module was tested with a RF cable length smaller or equal to the minimum length specified by the manufacturer. Preliminary measurements were performed for the radio set in 3 orthogonal orientations. The final measurements were collected using the EUT orientation leading to the highest emissions as compared with the limits.

The unit was also evaluated for unintentional emissions for all the antenna configurations. The results are documented separately in a verification test report.

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 #: 475089
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:

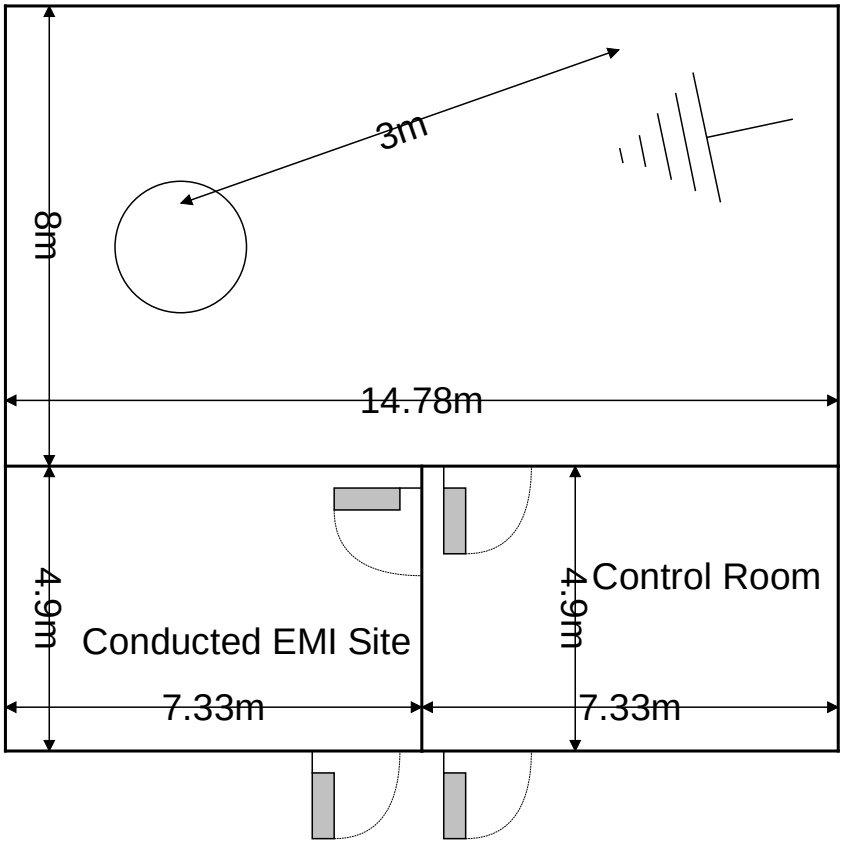


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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:

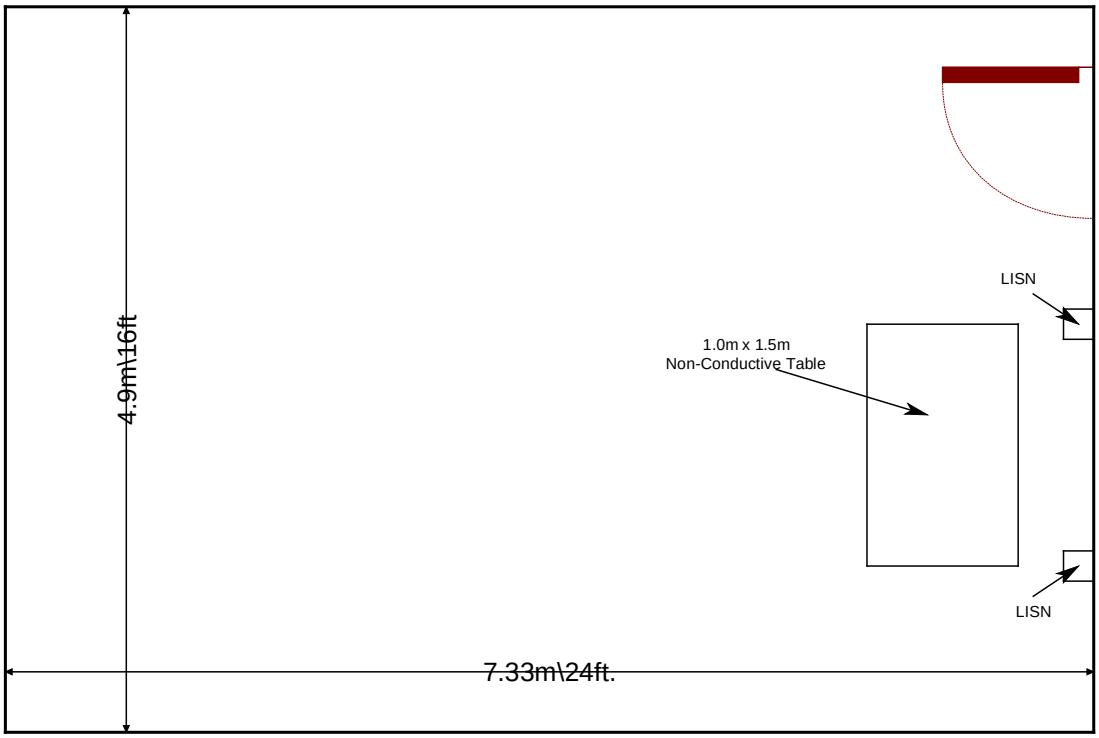


Figure 2.3.2-1: AC Mains Conducted EMI Site

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 9 kHz to 40 GHz.
- ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2013.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2013
- KDB Publication No. 558074 D01 DTS Meas Guidance v03r01 – Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247, April 9, 2013.
- 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
22	Agilent	8449B	Amplifiers	3008A00526	7/30/2013	7/30/2015
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
524	Chase	CBL6111	Antennas	1138	1/7/2013	1/7/2015
2006	EMCO	3115	Antennas	2573	4/24/2013	4/24/2015
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2012	12/31/2013
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	1/1/2013	1/1/2014
2044	QMI	N/A	Cables	2044	12/31/2012	12/31/2013
2069	Trilithic, Inc.	7NM867/122-X1-AA	Notch Filter	200315126	3/26/2013	3/26/2014
2071	Trilithic, Inc.	4HC1400-1-KK	Filter	9643263	12/31/2012	12/31/2013
2076	Hewlett Packard	HP5061-5458	Cables	2076	12/29/2012	12/29/2013
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	12/29/2012	12/29/2013
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

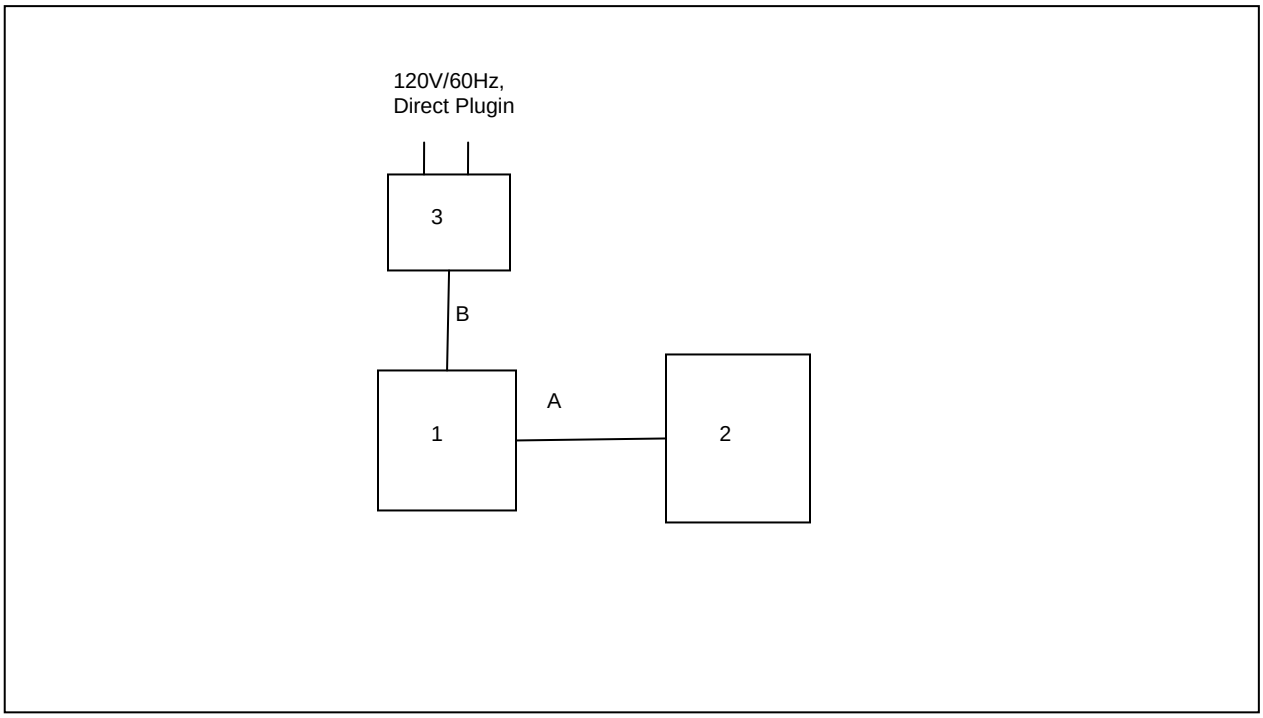
Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Avalan Wireless	AW900mTR	AV13149830085
2	11 dBi Monopole Antenna	PCTel	BOA90211	72056
	16 dBi Yagi Yuda Antenna	PCTel	BMYD890O	503113
	18.5 dBi Sector Antenna	Kathrein	730-376V02	I0F1782383
3	12 VDC Power Supply	Condor	HK-Q106-A12	N/A

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	Coaxial	0.2 m	Yes	EUT to Omni Antenna
	Coaxial	0.2m	Yes	EUT to Yagi Antenna
	Coaxial	1.5 m	Yes	EUT to Sector Antenna
B	Power	2.52m	No	Power Supply to EUT

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



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 model AW900mTR uses a reverse SMA antenna connector at the RF port. Additionally, the equipment is professionally installed, thus meeting the requirements of 15.203.

7.2 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-210 A8.5

7.2.1 Radiated Spurious Emissions into Restricted Frequency Bands - FCC 15.205, 15.209; IC: RSS-210 2.2, RSS-Gen 7.2.2, 7.2.5

7.2.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 10 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

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 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz over a 5 second sweep.

7.2.1.2 Measurement Results

Radiated band-edge and spurious emissions found in the band of 30MHz to 10 GHz are reported in the tables below.

Table 7.2.1.2-1: Radiated Spurious Emission Tabulated Data: Omni Monopole Antenna

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 903.125 MHz										
2709.375	57.65	49.32	H	-0.33	57.32	48.99	74.0	54.0	16.7	5.0
2709.375	52.66	43.89	V	-0.33	52.33	43.56	74.0	54.0	21.7	10.4
3612.5	44.73	34.05	H	2.60	47.33	36.65	74.0	54.0	26.7	17.3
3612.5	45.41	34.71	V	2.60	48.01	37.31	74.0	54.0	26.0	16.7
4515.625	52.41	43.76	H	3.75	56.16	47.51	74.0	54.0	17.8	6.5
4515.625	48.27	38.97	V	3.75	52.02	42.72	74.0	54.0	22.0	11.3
5418.75	40.56	27.66	H	6.26	46.82	33.92	74.0	54.0	27.2	20.1
5418.75	39.72	27.60	V	6.26	45.98	33.86	74.0	54.0	28.0	20.1
8128.125	41.57	29.28	H	11.73	53.30	41.01	74.0	54.0	20.7	13.0
8128.125	40.91	29.18	V	11.73	52.64	40.91	74.0	54.0	21.4	13.1
Middle Channel 913.54 MHz										
2740.62	55.19	46.64	H	-0.19	55.00	46.45	74.0	54.0	19.0	7.6
2740.62	51.69	42.35	V	-0.19	51.50	42.16	74.0	54.0	22.5	11.8
3654.16	44.31	33.53	H	2.73	47.04	36.26	74.0	54.0	27.0	17.7
3654.16	44.54	33.68	V	2.73	47.27	36.41	74.0	54.0	26.7	17.6
4567.7	51.99	43.38	H	3.89	55.88	47.27	74.0	54.0	18.1	6.7
4567.7	48.02	37.99	V	3.89	51.91	41.88	74.0	54.0	22.1	12.1
7308.32	46.01	34.51	H	10.28	56.29	44.79	74.0	54.0	17.7	9.2
7308.32	47.27	36.33	V	10.28	57.55	46.61	74.0	54.0	16.4	7.4
8221.86	41.44	29.09	H	11.65	53.09	40.74	74.0	54.0	20.9	13.3
8221.86	41.95	29.57	V	11.65	53.60	41.22	74.0	54.0	20.4	12.8
High Channel 926.04 MHz										
986.6	49.72	42.04	V	2.93	---------	44.97	--------	54.0	---------	9.0
2778.12	53.71	44.70	H	-0.03	53.68	44.67	74.0	54.0	20.3	9.3
2778.12	49.95	40.41	V	-0.03	49.92	40.38	74.0	54.0	24.1	13.6
3704.16	43.92	32.51	H	2.88	46.80	35.39	74.0	54.0	27.2	18.6
3704.16	45.14	33.27	V	2.88	48.02	36.15	74.0	54.0	26.0	17.9
4630.2	50.78	41.88	H	4.05	54.83	45.93	74.0	54.0	19.2	8.1
4630.2	45.28	34.37	V	4.05	49.33	38.42	74.0	54.0	24.7	15.6
7408.32	47.07	36.44	H	10.55	57.62	46.99	74.0	54.0	16.4	7.0
7408.32	49.42	38.96	V	10.55	59.97	49.51	74.0	54.0	14.0	4.5
8334.36	40.30	28.09	V	11.56	51.86	39.65	74.0	54.0	22.1	14.3

Note: All emissions above 8.33 GHz were attenuated below the limits and the noise floor of the measurement equipment

Table 7.2.1.2-2: Radiated Spurious Emission Tabulated Data: Yagi Yuda Antenna

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 903.125 MHz										
998.5	48.19	41.92	V	2.57	---------	44.49	--------	54.0	---------	9.5
2709.375	53.43	44.56	H	-0.33	53.10	44.23	74.0	54.0	20.9	9.8
2709.375	53.21	44.51	V	-0.33	52.88	44.18	74.0	54.0	21.1	9.8
3612.5	44.73	33.38	H	2.60	47.33	35.98	74.0	54.0	26.7	18.0
3612.5	44.09	33.14	V	2.60	46.69	35.74	74.0	54.0	27.3	18.3
4515.625	53.75	45.11	H	3.75	57.50	48.86	74.0	54.0	16.5	5.1
4515.625	48.40	38.64	V	3.75	52.15	42.39	74.0	54.0	21.8	11.6
5418.75	42.46	31.21	H	6.26	48.72	37.47	74.0	54.0	25.3	16.5
5418.75	42.27	30.38	V	6.26	48.53	36.64	74.0	54.0	25.5	17.4
8128.125	42.00	29.71	H	11.73	53.73	41.44	74.0	54.0	20.3	12.6
8128.125	41.40	28.81	V	11.73	53.13	40.54	74.0	54.0	20.9	13.5
Middle Channel 913.54 MHz										
612.55	43.79	41.29	V	-3.46	---------	37.83	--------	46.0	---------	8.2
999.25	48.13	41.17	V	2.53	---------	43.70	--------	54.0	---------	10.3
2740.62	53.66	44.64	H	-0.19	53.47	44.45	74.0	54.0	20.5	9.6
2740.62	49.05	37.19	V	-0.19	48.86	37.00	74.0	54.0	25.1	17.0
3654.16	44.02	32.59	H	2.73	46.75	35.32	74.0	54.0	27.3	18.7
3654.16	43.67	31.29	V	2.73	46.40	34.02	74.0	54.0	27.6	20.0
4567.7	52.93	44.09	H	3.89	56.82	47.98	74.0	54.0	17.2	6.0
4567.7	47.50	37.86	V	3.89	51.39	41.75	74.0	54.0	22.6	12.3
7308.32	47.03	36.71	H	10.28	57.31	46.99	74.0	54.0	16.7	7.0
7308.32	49.37	39.52	V	10.28	59.65	49.80	74.0	54.0	14.3	4.2
8221.86	40.51	27.44	H	11.65	52.16	39.09	74.0	54.0	21.8	14.9
8221.86	40.96	28.18	V	11.65	52.61	39.83	74.0	54.0	21.4	14.2
High Channel 926.04 MHz										
1011.93	68.25	55.26	V	-9.88	58.38	45.39	74.0	54.0	15.6	8.6
2778.12	55.70	47.05	H	-0.03	55.67	47.02	74.0	54.0	18.3	7.0
2778.12	52.67	43.58	V	-0.03	52.64	43.55	74.0	54.0	21.4	10.4
3704.16	44.32	31.17	H	2.88	47.20	34.05	74.0	54.0	26.8	20.0
3704.16	43.79	32.42	V	2.88	46.67	35.30	74.0	54.0	27.3	18.7
4630.2	55.88	47.56	H	4.05	59.93	51.61	74.0	54.0	14.1	2.4
4630.2	49.07	39.66	V	4.05	53.12	43.71	74.0	54.0	20.9	10.3
7408.32	44.91	33.71	H	10.55	55.46	44.26	74.0	54.0	18.5	9.7
7408.32	47.25	35.76	V	10.55	57.80	46.31	74.0	54.0	16.2	7.7
8334.36	40.69	28.76	H	11.56	52.25	40.32	74.0	54.0	21.7	13.7
8334.36	40.81	28.48	V	11.56	52.37	40.04	74.0	54.0	21.6	14.0

Note: All emissions above 8.33 GHz were attenuated below the limits and the noise floor of the measurement equipment

Table 7.2.1.2-3: Radiated Spurious Emission Tabulated Data: Sector Antenna

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 903.125 MHz										
2709.375	55.96	47.56	H	-0.33	55.63	47.23	74.0	54.0	18.4	6.8
2709.375	52.26	43.02	V	-0.33	51.93	42.69	74.0	54.0	22.1	11.3
3612.5	48.50	39.21	H	2.60	51.10	41.81	74.0	54.0	22.9	12.2
3612.5	47.73	37.94	V	2.60	50.33	40.54	74.0	54.0	23.7	13.5
4515.625	53.19	44.47	H	3.75	56.94	48.22	74.0	54.0	17.1	5.8
4515.625	47.96	38.20	V	3.75	51.71	41.95	74.0	54.0	22.3	12.0
5418.75	43.51	31.30	H	6.26	49.77	37.56	74.0	54.0	24.2	16.4
5418.75	41.64	29.54	V	6.26	47.90	35.80	74.0	54.0	26.1	18.2
8128.125	41.04	28.51	H	11.73	52.77	40.24	74.0	54.0	21.2	13.8
8128.125	44.07	31.68	V	11.73	55.80	43.41	74.0	54.0	18.2	10.6
9031.25	41.28	28.54	V	11.77	53.05	40.31	74.0	54.0	20.9	13.7
Middle Channel 913.54 MHz										
2740.62	54.96	46.15	H	-0.19	54.77	45.96	74.0	54.0	19.2	8.0
2740.62	50.93	41.64	V	-0.19	50.74	41.45	74.0	54.0	23.3	12.6
3654.16	46.29	35.97	H	2.73	49.02	38.70	74.0	54.0	25.0	15.3
3654.16	46.17	36.26	V	2.73	48.90	38.99	74.0	54.0	25.1	15.0
4567.7	54.26	45.82	H	3.89	58.15	49.71	74.0	54.0	15.9	4.3
4567.7	48.38	39.06	V	3.89	52.27	42.95	74.0	54.0	21.7	11.1
7308.32	47.60	38.09	H	10.28	57.88	48.37	74.0	54.0	16.1	5.6
7308.32	49.05	39.21	V	10.28	59.33	49.49	74.0	54.0	14.7	4.5
8221.86	43.73	30.46	H	11.65	55.38	42.11	74.0	54.0	18.6	11.9
8221.86	44.00	31.66	V	11.65	55.65	43.31	74.0	54.0	18.3	10.7
High Channel 926.04 MHz										
968.8	45.02	40.03	V	2.22	---------	42.25	--------	54.0	---------	11.8
2778.12	54.18	45.76	H	-0.03	54.15	45.73	74.0	54.0	19.8	8.3
2778.12	51.47	42.26	V	-0.03	51.44	42.23	74.0	54.0	22.6	11.8
3704.16	44.60	33.21	H	2.88	47.48	36.09	74.0	54.0	26.5	17.9
3704.16	46.74	35.55	V	2.88	49.62	38.43	74.0	54.0	24.4	15.6
4630.2	53.26	44.59	H	4.05	57.31	48.64	74.0	54.0	16.7	5.4
4630.2	48.24	37.92	V	4.05	52.29	41.97	74.0	54.0	21.7	12.0
7408.32	44.81	33.01	H	10.55	55.36	43.56	74.0	54.0	18.6	10.4
7408.32	45.26	34.01	V	10.55	55.81	44.56	74.0	54.0	18.2	9.4
8334.36	40.77	27.55	H	11.56	52.33	39.11	74.0	54.0	21.7	14.9
8334.36	41.06	28.92	V	11.56	52.62	40.48	74.0	54.0	21.4	13.5

Note: All emissions above 9.03 GHz were attenuated below the limits and the noise floor of the measurement equipment

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: 57.65+ (-0.33) = 57.32dBµV/m
Margin: 74 dBµV/m – 57.32dBµV/m = 16.7dB

Example Calculation: Average
Corrected Level: 49.32 + (-0.33) = 48.99dBµV/m
Margin: 54 dBµV/m – 48.99 dBµV/m = 5.0dB

8 CONCLUSION

In the opinion of ACS, Inc., the AW900mTR meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210 for the test procedures documented in the test report.

END REPORT