Excellence in Compliance Testing

Certification Test Report

FCC ID: Z9O-FAS1541
IC: 10060A-FAS1541

FCC Rule Part: 15.209
IC Radio Standards Specification: RSS-210

ACS Report Number: 15-2042.W06.1B

Manufacturer: UltraClenz, LLC
Model: FAS1541-00

Test Begin Date: **June 4, 2015**
Test End Date: **July 27, 2015**

Report Issue Date: August 27, 2015

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

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 ANAB, ANSI, or any agency of the Federal Government.

Reviewed by:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc. .

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.

1.2 Product Description

The model FAS1541-00 is a hospital bed beacon. It includes three transceivers operating at 125 kHz, 433 MHz and 2405 MHz, respectively. The Bed Beacon, along with its internal low frequency antenna, is mounted to a patient bed. Its function is to communicate with the Badge worn by the Healthcare Worker (HCW) when the HCW comes in close proximity with the patient bed (bed event), collect bed event data from that Badge and then transmit the collected data to a network where it will ultimately be sent to an offsite server for processing and archiving.

Technical Details
Frequency of Operation: 126 kHz
Number of Channels: 1
Modulation: OOK
Data Rate: 2.4 kbps
Antenna: Magnetic Loop Antenna
Input Voltage: 3 VDC (Size D Battery)

Manufacturer Information:
UltraClenz, LLC
1201 Jupiter Park Drive
Jupiter, FL 33458

Test Sample Serial Number(s): 1E000002 (internal antenna), 1E000006 (external antenna)

Test Sample Condition: Good

1.3 Test Methodology and Considerations

The FAS1541-00 is a battery operated device, with no provision for alternate power sources. The device is exempted from the power line conducted emissions requirements.

The FAS1541-00 was evaluated for radiated emissions for the 125 kHz transmitter in the orientation of typical installation. The measurements were performed for both internal and external 125 kHz antennas.The 125 kHz radio does not transmit simultaneously with the 433 MHz and the 2405 MHz co-located radios, per the customer's theory of operation. Therefore, the 125 kHz radio was not evaluated for inter-modulation products with the co-located 433 MHz and 2405 MHz radios.

The 433 MHz and 2405 MHz transmitters are assessed in their respective certification test reports. The unintentional emissions evaluation is 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 ANAB 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:

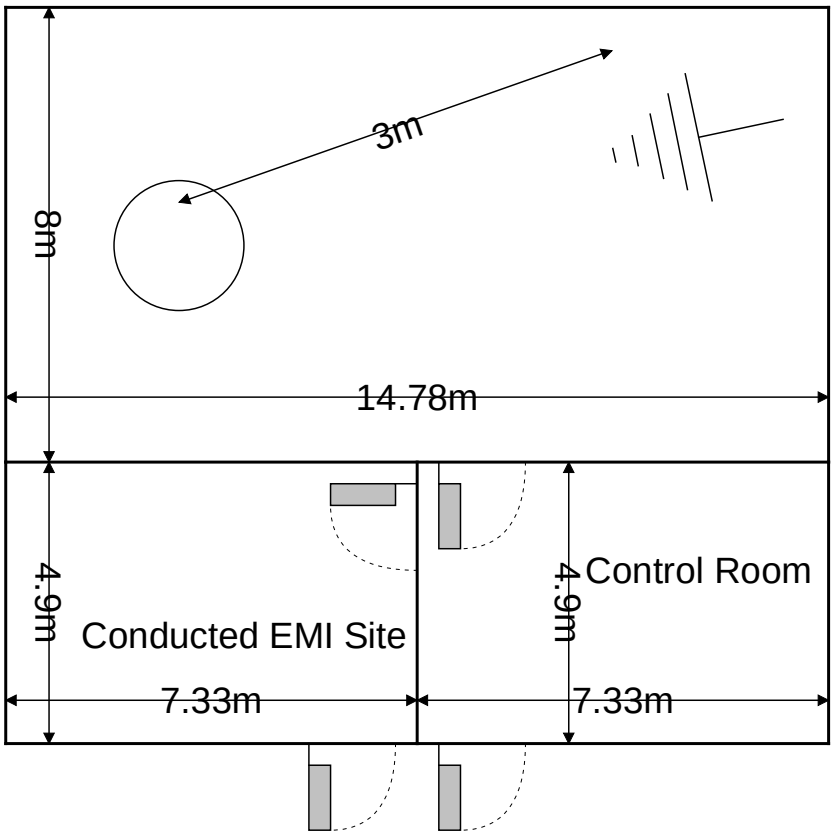


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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. Data is 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 evaluations requiring 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:

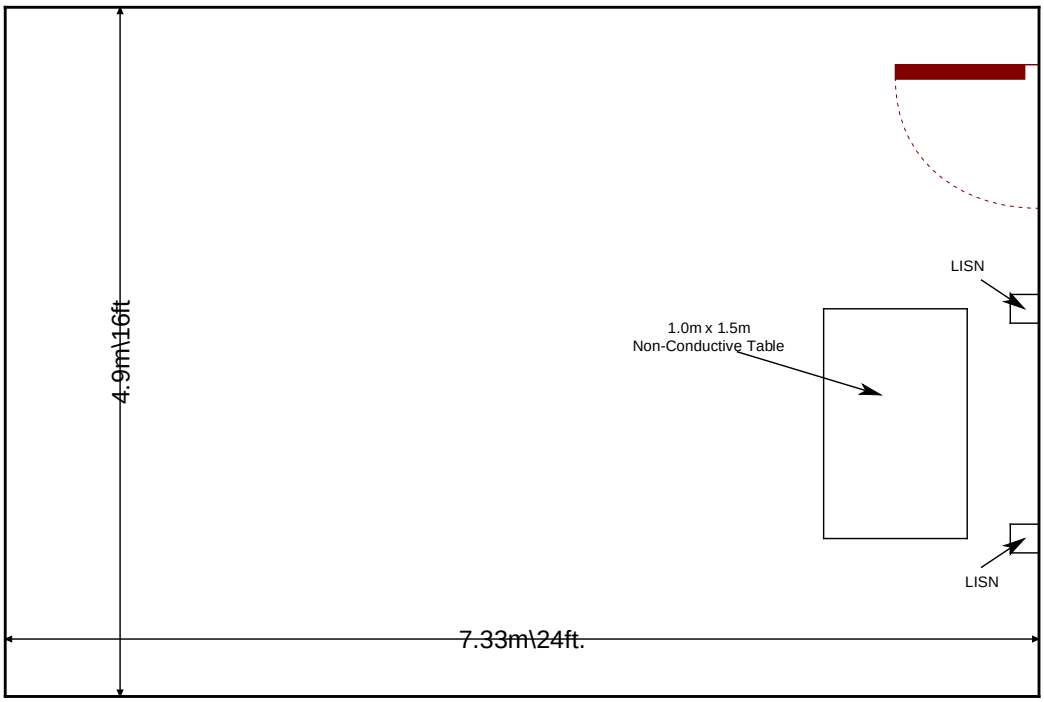


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz
- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2015
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- 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 for Compliance of Radio Apparatus, Issue 4, November 2014.

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
78	EMCO	6502	Antennas	9104-2608	2/13/2015	2/13/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
2002	EMCO	3108	Antennas	2147	11/22/2013	11/22/2015
2004	EMCO	3146	Antennas	1385	11/22/2013	11/22/2015
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	12/31/2014	12/31/2015
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	2/17/2015	2/17/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

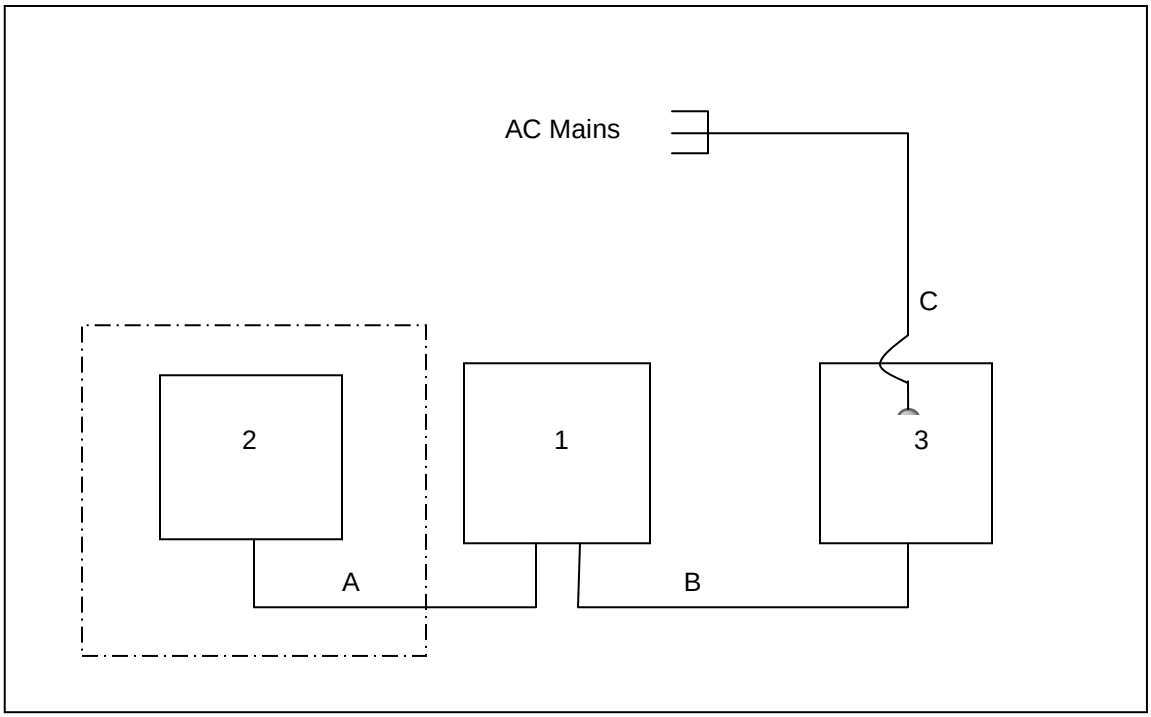
Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	UltraClenz	FAS1541-00	1E000002, 1E000006
2	125 kHz Antenna	UltraClenz	FAS1540-01	1448-001A-001188
3	Power Sensor	UltraClenz	FAS1542-03	1448-001F

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	RJ11	1.23 m	No	EUT to Antenna
B	RJ11	1.82 m	No	EUT to Sensor
C	AC Power Cord	1.5 m	No	Sensor to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



Note: The equipment within the dotted box was removed from the setup during the evaluation for the internal antenna configuration.

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 EUT utilizes an internal and an optional external coil antenna. The internal coil antenna is directly soldered to the PCB while the external antenna uses a 6P6C connector. The antenna connector for the external antenna is unique. The EUT meets the requirements of FCC 15.203 for both antenna configurations.

7.2 20dB / 99% Bandwidth: FCC: Section 15.215 / IC RSS-Gen 6.6

7.2.1 Measurement Procedure

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.

The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was to ≥ 1% to 5% of the estimated emission 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.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was set to 1% to 5% of the estimated 99% bandwidth. The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.2.2 Measurement Results

Results are shown below:

Table 7.2.2-1: 20dB / 99% Bandwidth – Internal Antenna

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
0.125	16.625	40.38

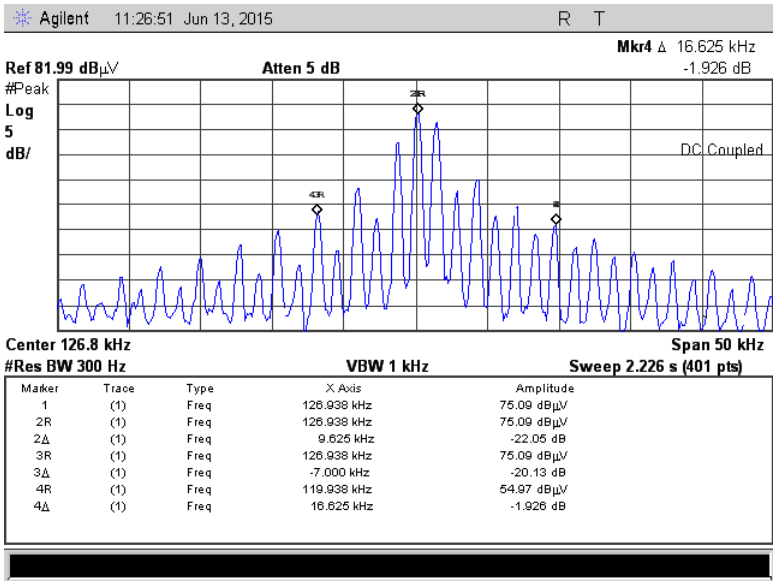


Figure 7.2.2-1: 20dB BW

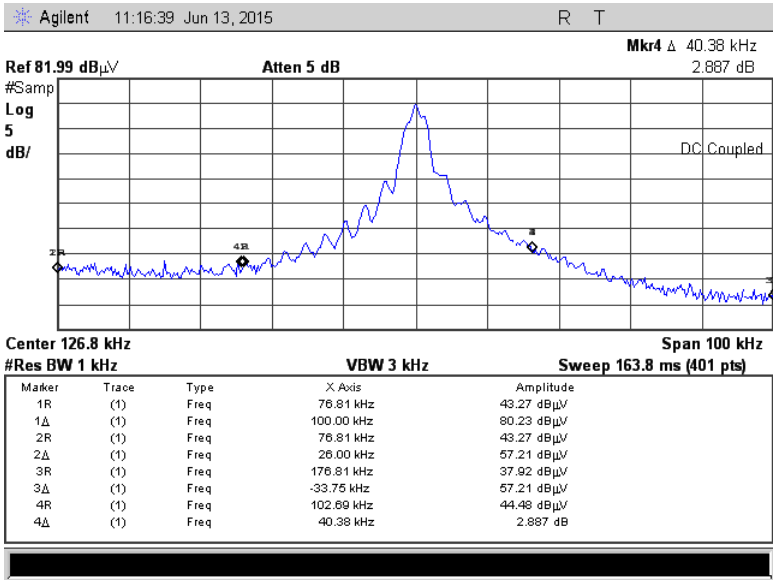


Figure 7.2.2-2: 99% OBW

Table 7.2.2-2: 20dB / 99% Bandwidth – External Antenna

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
0.125	16.500	44.75

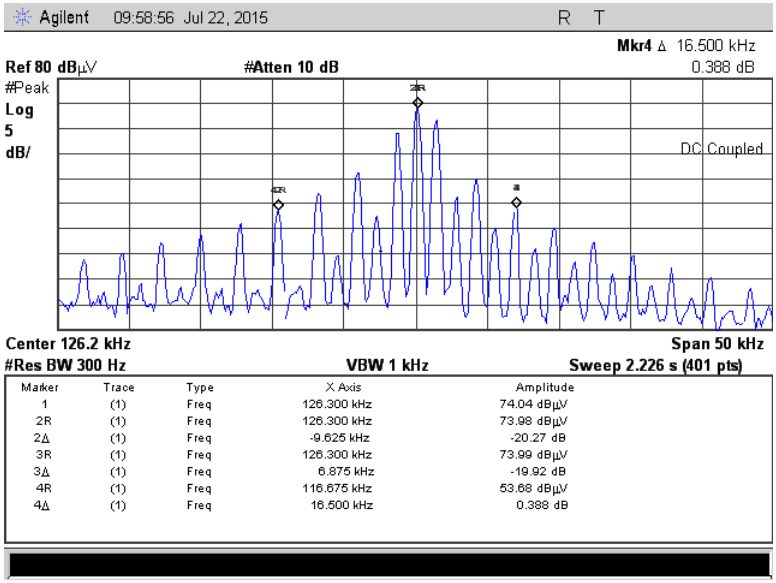


Figure 7.2.2-3: 20dB BW

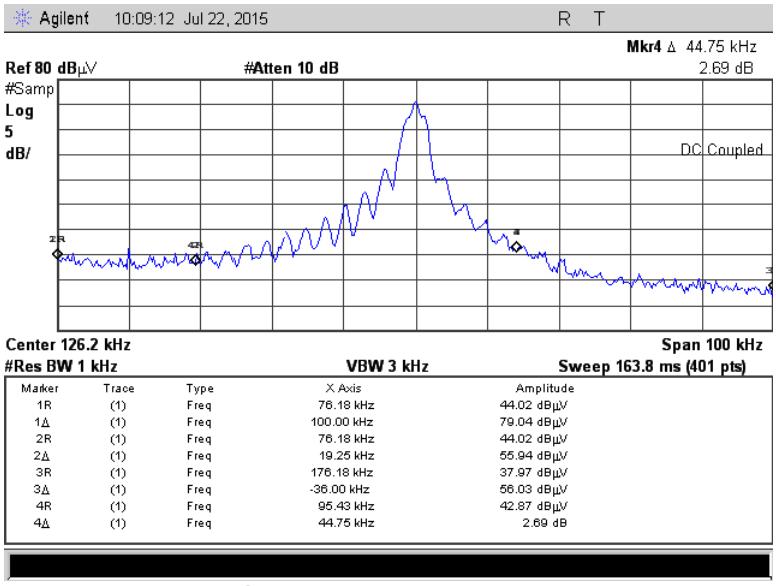


Figure 7.2.2-4: 99% OBW

7.3 Radiated Spurious Emissions – FCC: Section 15.209 / IC: RSS-210 2.5

7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 1GHz. Section 15.33(a)(4) specifies, if the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to frequency specified in 15.33(b)(1) for unintentional radiators. The upper frequency range for the digital device is 1000MHz which greater than the 10th harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

Measurements below 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360 and the loop antenna rotated about the vertical axis to maximize each emission. The magnetic loop receiving antenna was positioned with its center 1 meter above the ground.

The spectrum analyzer's resolution and video bandwidths were set to 300 Hz and 1000 Hz respectively for frequencies below 150 kHz and 9 kHz and 30 kHz respectively for frequencies above 150 kHz and below 30 MHz. The fundamental levels were measured using a resolution bandwidth of 30 kHz which is greater than the measured emission bandwidth. For measurements in the frequency bands 9-90 kHz and 110-490 kHz, an average detector was used. When average measurements are specified, the peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. All other emissions were measured using a Quasi-peak detector. The final measurements were then corrected by antenna correction factors and cable loss for comparison to the limits.

Measurements above 30 MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. 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.

7.3.2 Distance Correction for Measurements Below 30 MHz – Part 15.31

Radiated measurements were performed at a distance closer than 300 meters and 30m as required, according to Part 15.209. Therefore a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 300m measurement distance and a 30m measurement distance.

Distance correction factor (300m Specified Test Distance) = 40*Log (Test Distance/300)
= 40*Log (3/300)
= - 80 dB

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

7.3.3 Measurement Results

Radiated spurious emissions found in the band of 9 kHz to 1 GHz are reported below.

Table 7.3.3-1: Radiated Spurious Emissions Tabulated Data – Internal 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
Fundamental Frequency										
0.1268	72.41	64.80	V	10.53	82.94	75.33	125.5	105.5	42.6	30.2
Spurious Emissions below 30 MHz										
0.2536	45.85	36.42	V	10.43	56.28	46.85	119.5	99.5	63.2	52.6
0.3804	42.16	33.03	V	10.41	52.57	43.44	116	96	63.4	52.6
Unintentional Emissions above 30 MHz										
125.13	46.09	43.41	H	-14.09	---------	29.32	--------	43.5	---------	14.2
860.377	25.73	21.53	H	1.46	---------	22.99	--------	46	---------	23.0
988.579	25.67	21.91	H	1.62	---------	23.54	--------	54	---------	30.5
35.2417	44.76	42.61	V	-14.37	---------	28.23	--------	40	---------	11.8
43.1447	46.01	44.06	V	-15.15	---------	28.91	--------	40	---------	11.1
44.7823	48.25	46.16	V	-15.27	---------	30.89	--------	40	---------	9.1
46.7078	44.83	42.67	V	-15.52	---------	27.15	--------	40	---------	12.8
63.107	51.45	48.04	V	-17.41	---------	30.63	--------	40	---------	9.4
125.069	51.79	48.41	V	-14.09	---------	34.32	--------	43.5	---------	9.2
132.59	46.78	44.41	V	-13.78	---------	30.63	--------	43.5	---------	12.9
181.729	44.13	41.22	V	-12.02	---------	29.20	--------	43.5	---------	14.3
990.466	26.40	22.00	V	1.73	---------	23.74	--------	54	---------	30.3

Note: The fundamental emission level was measured using the spectrum analyzer RBW greater than the measured occupied bandwidth of the equipment.

Table 7.3.3-2: Radiated Spurious Emissions Tabulated Data – External 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
Fundamental Frequency										
0.126	73.07	65.25	V	10.53	83.60	75.78	125.6	105.6	42.0	29.8
Spurious Emissions below 30 MHz										
0.252	44.21	34.13	V	10.43	54.64	44.56	119.6	99.6	65.0	55.0
0.378	42.82	34.20	V	10.41	53.23	44.61	116.1	96.1	62.9	51.5
0.63	37.68	27.86	V	10.59	---------	38.45	--------	71.6	---------	33.1
0.882	32.68	22.32	V	10.63	---------	32.95	--------	68.7	---------	35.7
Unintentional Emissions above 30 MHz										
40.3336	43.97	41.07	H	-14.93	---------	26.14	--------	40	---------	13.9
44.49	36.36	34.49	H	-15.25	---------	19.24	--------	40	---------	20.8
57.0223	46.51	44.52	H	-16.81	---------	27.71	--------	40	---------	12.3
121.121	37.76	33.34	H	-14.45	---------	18.89	--------	43.5	---------	24.6
208.009	45.97	42.13	H	-14.53	---------	27.60	--------	43.5	---------	15.9
998.042	26.08	21.82	H	2.35	---------	24.17	--------	54	---------	29.8
40.96	58.28	54.69	V	-14.98	---------	39.71	--------	40	---------	0.3
44.4992	53.48	51.35	V	-15.25	---------	36.10	--------	40	---------	3.9
56.2743	51.13	49.18	V	-16.73	---------	32.45	--------	40	---------	7.5
122.44	50.72	48.87	V	-14.33	---------	34.54	--------	43.5	---------	9.0
189.122	39.23	36.11	V	-11.87	---------	24.24	--------	43.5	---------	19.3
873.949	25.76	21.63	V	0.85	---------	22.48	--------	46	---------	23.5
986.765	25.96	21.79	V	1.53	---------	23.32	--------	54	---------	30.7

Note: The fundamental emission level was measured using the spectrum analyzer RBW greater than the measured occupied bandwidth of the equipment.

7.3.4 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: 44.21 + 10.43 = 54.64 dBµV/m
Margin: 119.6 dBµV/m – 54.64 dBµV/m = 65.0 dB

Example Calculation: Average
Corrected Level: 34.13 + 10.43 – 0= 44.56 dBµV/m
Margin: 99.6 dBµV/m – 44.56 dBµV/m = 55.0 dB

8 CONCLUSION

In the opinion of ACS, Inc. the FAS1541-00 manufactured by UltraClenz, LLC meet the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT