Excellence in Compliance Testing

Certification Test Report

FCC ID: AZ492FT6012
IC: 109U-92FT6012

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

ACS Report Number: 13-2171.W06.2A

Applicant: Motorola Solutions SDNBHD
Model: PMMN4097A

Test Begin Date: **April 4, 2014**
Test End Date: **April 14, 2014**

Report Issue Date: April 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.

1.2 Product Description

The Motorola Solutions Model PMMN4097A is a mobile microphone for TX audio only with Bluetooth Gateway incorporated for Bluetooth pairing with Wireless RSM and Wireless Pod. Per the applicant, the equipment only supports the GFSK modulation for the 2.4 GHz Bluetooth radio. The equipment also incorporates a 125 kHz radio for near field communications.

Technical Details
Frequency of Operation: 125 kHz
Number of Channels: 1
Modulation: On Off Keying (OOK)
Data Rate: 1.212 kbps
Antenna: Telecoil Antenna
Input Voltage: 5 VDC

Manufacturer Information:

Applicant
Motorola Solutions Malaysia Sdn Bhd
Plot 2, Bayan Lepas,
Technoplex Industrial Park,
Mukim 12, SWD (CSC)
11900 Bayan Lepas, Penang Malaysia

Manufacturer
Temco
2-21-4 Honan, Suginamu-Ku
Tokyo 168-062 Japan

Model Number: PMMN4097A

Test Sample Serial Number(s): ACS#7

Test Sample Condition: The test samples were provided in good condition with no physical damage.

1.3 Test Methodology and Considerations

The EUT was evaluated for radiated emissions when transmitting at 125 kHz. The radiated emissions evaluation was performed for the EUT set in three orthogonal orientations while powered through a mobile radio. The measurements below 30 MHz were performed at a distance of 1m due to the low level of the fundamental frequency. Emissions above 30 MHz were measured at a distance of 3m from the EUT.
The EUT is intended to be used in vehicle configurations only and therefore is exempted from the power line conducted emissions requirements.

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:

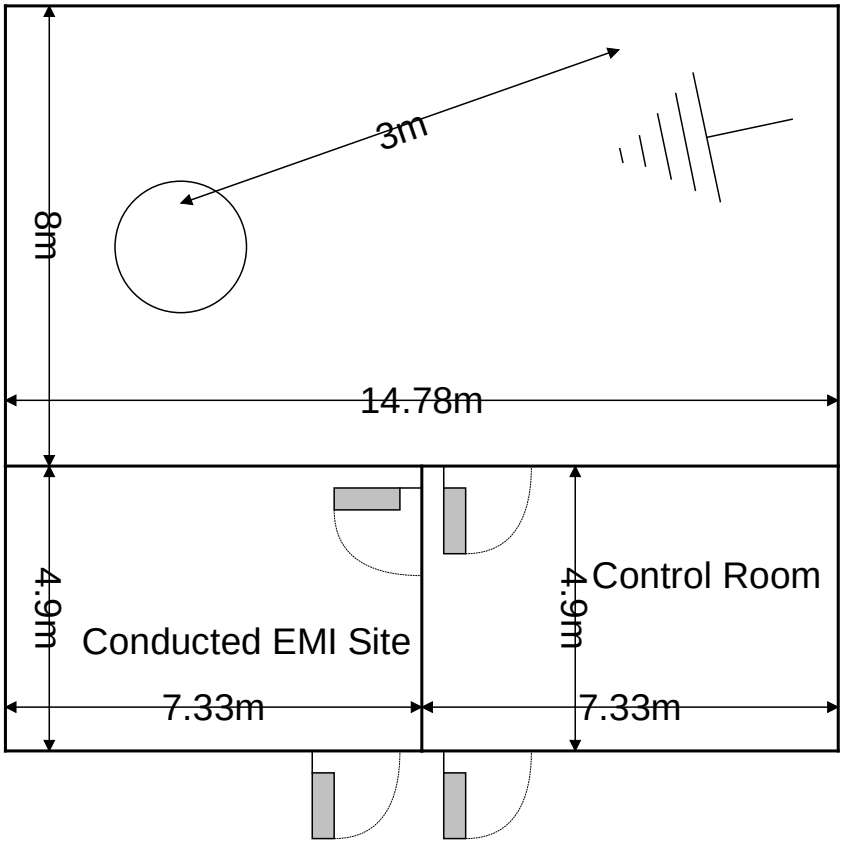

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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:

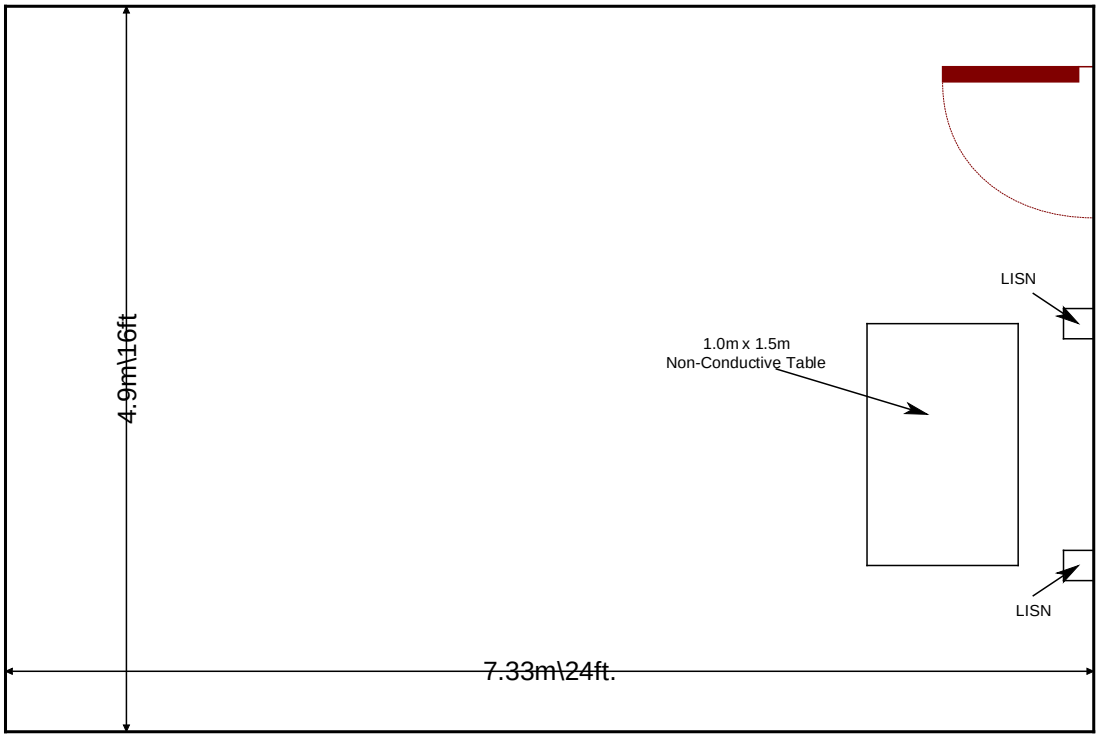

Figure 2.3.2-1: AC Mains Conducted EMI Site

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 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2014
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2014
- 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, Dec 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
78	EMCO	6502	Antennas	9104-2608	2/5/2013	2/5/2015
523	Agilent	E7405	Spectrum Analyzers	MY45103293	1/8/2013	1/8/2015
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	12/31/2013	12/31/2014
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	2/27/2014	2/27/2015
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Temco	PMMN4097A (BT Gateway)	N/A
2	GPS/PTT Antenna	Motorola	HAF4033A	N/A
3	Mobile Radio	Motorola	XPR5550 8/900 MHz (AAM28UMN9KA1AN)	203TQB0008
4	DC Power Supply	MPJA	HY5003	003700278
5	Laptop	Dell	Latitude D620	CN-0TD761-12961-68G-3106
6	Mouse	Dell	M-UAR DEL7	LZ9440C43W5

Table 5-2: Cable Description (Radiated Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Microphone cable	2 m	Yes	EUT to microphone
B	Coaxial	5.05 m	Yes	EUT to Antenna
C	Coaxial	5.16 m	Yes	EUT to Antenna
D	Power Cable	1.7 m	No	EUT to Power Supply
E	Power Cord	1.83 m	No	Power Supply to AC Mains
F	USB Data Cable	10 m	No	EUT to Laptop
G	USB Cable	1.8 m	No	Laptop to Mouse

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

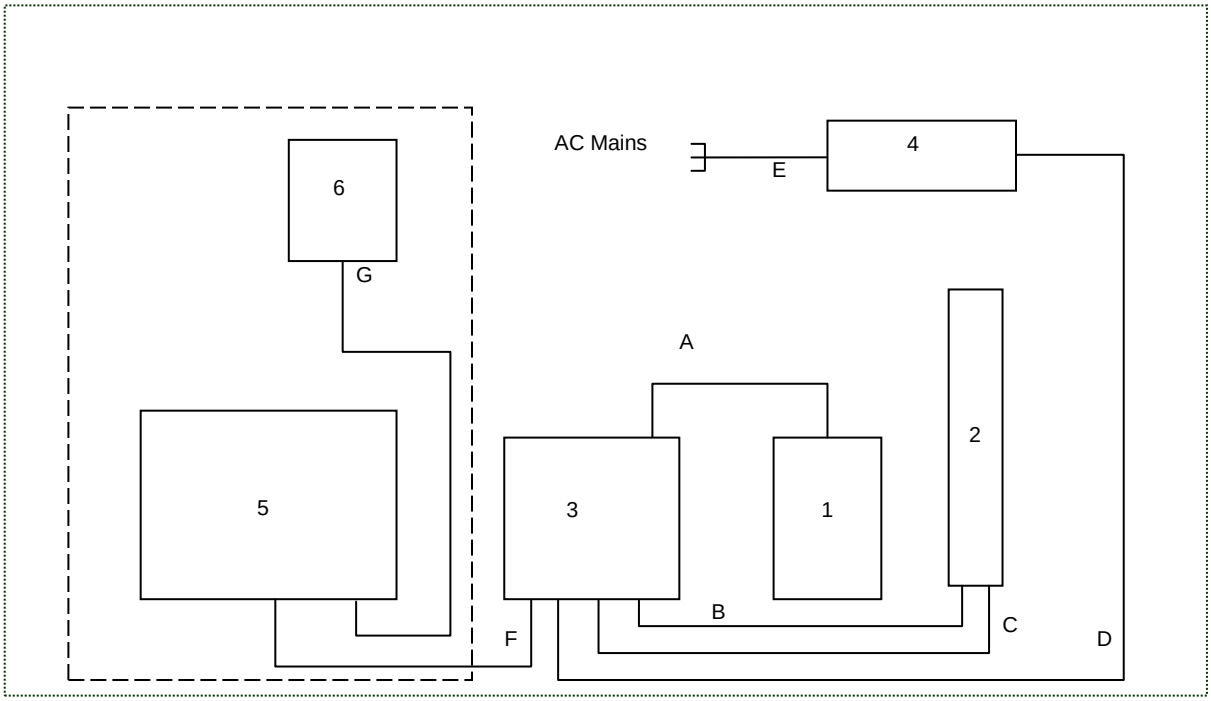

Figure 6-1: Radiated Emissions Setup

Notes:
The laptop was set outside of the test environment for the radiated emissions evaluation.

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 uses an internal non-detachable antenna thus meeting the requirements of 15.203.

7.2 20dB / 99% Bandwidth: FCC: Section 15.215 / IC RSS-Gen 4.6.1

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 20 dB bandwidth was measured with the Span of the Spectrum Analyzer configured between two to five times the 20 dB bandwidth. The RBW of the SA was set to 1% to 5% of the occupied 20 dB bandwidth. The reference level was set to the highest amplitude signal observed. The bandwidth was measured 20 dB down from the reference level.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was greater or equal to 1% of the span. 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

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
0.125	6.060	13.65

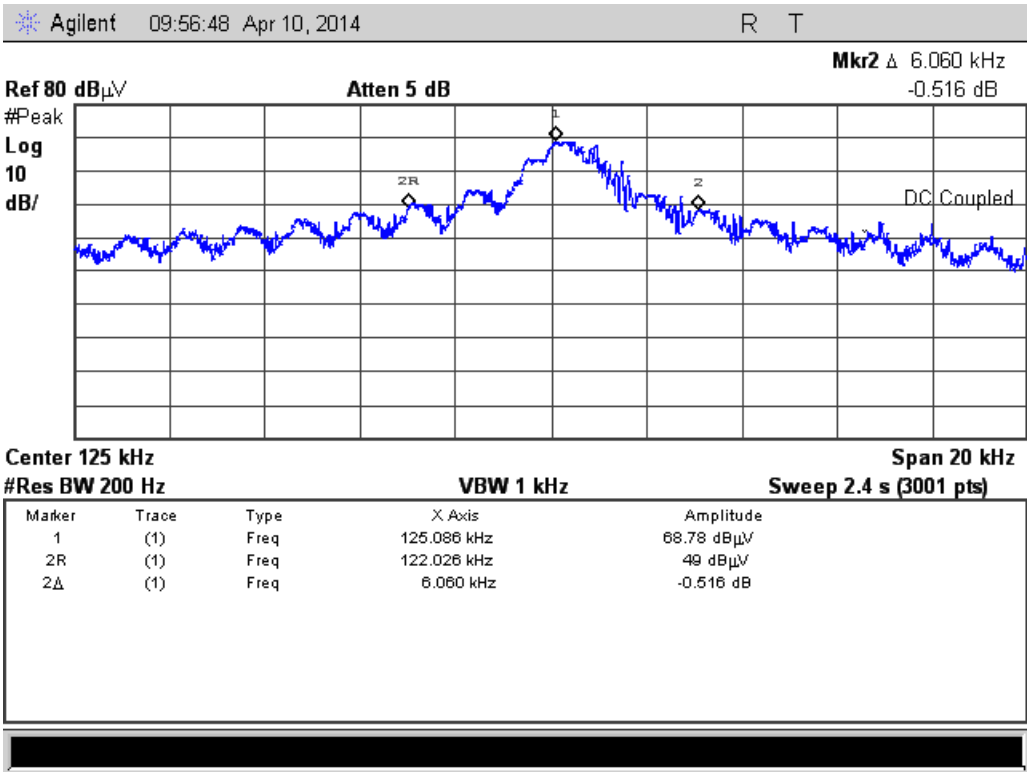

Figure 7.2.2-1: 20dB BW

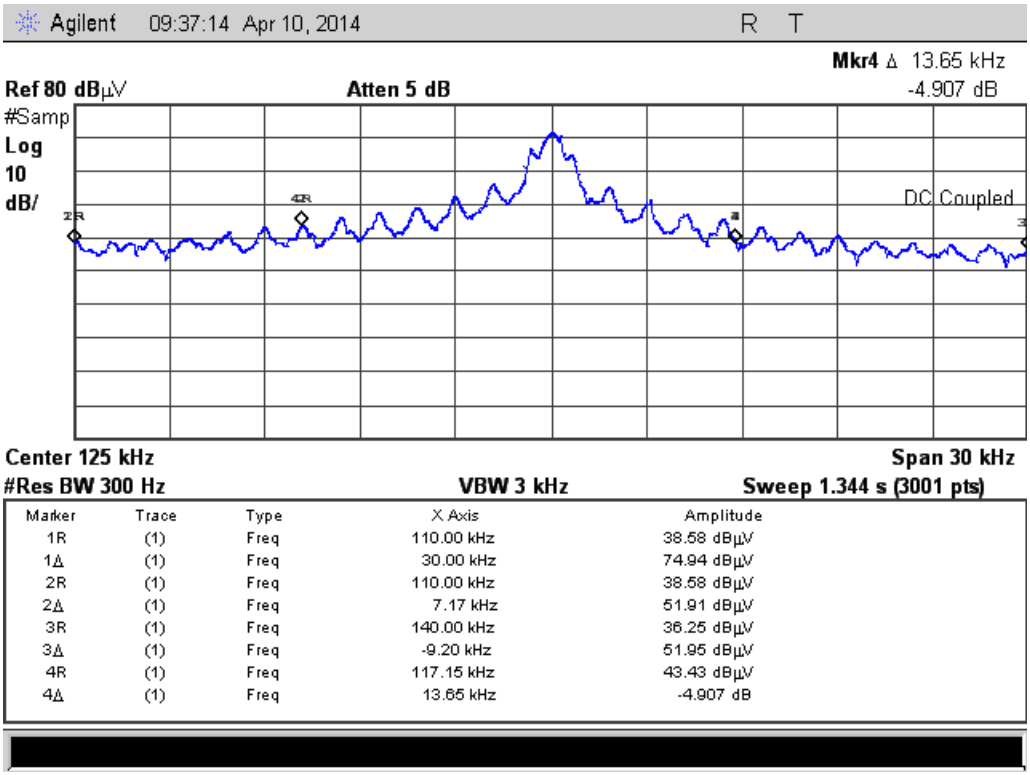

Figure 7.2.2-2: 99% OBW

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 10 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 1 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 (1/300)
= - 99.08 dB

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (1/30)
= - 59.08 dB

7.3.3 Measurement Results

Radiated spurious emissions found in the band of 10 kHz to 1GHz are reported in the Table 7.3.3-1 below.

Table 7.3.3-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg			pk	avg	pk	avg	pk	avg
Fundamental Frequency										
0.125	64.94	60.14	V	10.66	75.60	70.80	144.8	124.8	69.2	54.0
Spurious Emissions below 30 MHz										
All emissions between 10 kHz - 30 MHz were at least 40 dB below the limits										
Spurious Emissions above 30 MHz										
156.027	39.81	38.14	H	-12.81	---------	25.33	--------	43.5	---------	18.2
360.026	46.19	44.85	H	-9.33	---------	35.52	--------	46	---------	10.5
960.058	32.36	29.32	H	1.31	---------	30.62	--------	54	---------	23.4
32.6548	49.67	45.73	V	-14.00	---------	31.72	--------	40	---------	8.3
35.95	56.44	48.75	V	-14.31	---------	34.44	--------	40	---------	5.6
38.8955	39.59	36.54	V	-14.60	---------	21.95	--------	40	---------	18.1
48.0102	47.37	43.60	V	-15.49	---------	28.11	--------	40	---------	11.9
49.3396	42.84	38.21	V	-15.68	---------	22.54	--------	40	---------	17.5
72.0074	54.52	52.53	V	-17.96	---------	34.56	--------	40	---------	5.4
95.9979	46.20	44.42	V	-17.60	---------	26.82	--------	43.5	---------	16.7
120.006	54.90	54.05	V	-14.28	---------	39.77	--------	43.5	---------	3.7
144.015	43.16	41.54	V	-13.37	---------	28.17	--------	43.5	---------	15.3
156.008	43.86	42.03	V	-12.81	---------	29.22	--------	43.5	---------	14.3

Notes:

- The fundamental frequency was measured with RBW = 30 kHz, which is greater than the measured emission bandwidth.
- The measurements below 30 MHz were performed at a distance of 1m from the EUT while the emissions above 1 GHz were measured at a distance of 3m.

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 : Average/Quasi-Peak Limit < 30MHz
Measurement Distance 300m @ 125kHz

Limit (dBuV/m) = 20*Log(2400/F(kHz)) - Distance Correction Factor (Section 7.3.2)
Limit (dBuV/m) = 20*Log(2400/125) + 99.08
Limit (dBuV/m) = 124.8

Example Calculation : -Peak Limit < 30MHz
Measurement Distance 300m @ 125kHz

Limit (dBuV/m) = Average/Quasi-Peak Limit < 30MHz + 20
Limit (dBuV/m) = 20*Log(2400/F(kHz)) - Distance Correction Factor (Section 7.3.2) + 20
Limit (dBuV/m) = 20*Log(2400/125) + 99.08 + 20
Limit (dBuV/m) = 144.8

Example Calculation: Peak
Corrected Level: 64.94 + 10.66 = 75.6 dBµV/m
Margin: 144.8 dBµV/m – 75.6 dBµV/m = 69.2 dB

Example Calculation: Average
Corrected Level: 60.14 + 10.66 – 0= 70.8 dBµV/m
Margin: 124.8 dBµV/m – 70.8 dBµV/m = 54.0dB

8 CONCLUSION

In the opinion of ACS, Inc. the PMMN4097A submitted by Motorola Solutions SDNBHD meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT