

Certification Test Report

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IC: 109U-89FT6014

FCC Rule Part: 15.209
ISED Canada Radio Standards Specification: RSS-210

ACS Report Number: 16-2035.W06.2B

Manufacturer: Motorola Solutions Sdn Bhd
Model: PMLN7594A

Test Begin Date: July 6, 2016
Test End Date: July 15, 2016

Report Issue Date: August 3, 2016



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.

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This report contains 14 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 Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

1.2 Applicant Information

Motorola Solutions Sdn Bhd
Plot 2 Bayan Lepas Innoplex,
Industrial Park Mukim 12 SWD
11900 Bayan Lepas, Penang Malaysia

1.3 Product Description

The Motorola Solutions Gun Holster Sensor, models PMLN7593A and PMLN7594A, include a Bluegiga Bluetooth Low Energy (BLE) module model BLE113 (FCC ID:QOQBLE113 / IC: 5123A-BGTBLE113) and an internal 615.97 kHz coil LC resonator. The equipment is used for gun withdrawal detection. The purpose of the test report is to demonstrate the compliance of the PMLN7594A 615.97 kHz transmitter.

Technical Details

Frequency of Operation: 615.97 kHz

Number of Channels: 1

Modulation: Not Modulated

Data Rate: None

Antenna: Inductive Coil Antenna

Input Voltage: 3 VDC (Lithium Battery)

Test Sample Serial Number(s): 79B4

Test Sample Condition: Good

1.4 Test Methodology and Considerations

The EUT is battery powered only without any provision for alternate power source. The EUT is exempted from the conducted power line emission requirements.

Preliminary radiated emission measurements were performed for the EUT set in 3 orthogonal orientations. Final measurements were collected using the EUT orientation leading to the highest emissions. The EUT was also evaluated for intermodulation products when transmitting simultaneously with the BLE113 transceiver module. All intermodulation products were attenuated below the limits and the noise floor of the measurement equipment.

The EUT was evaluated to the unintentional emissions requirements. 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
Innovation, Science and Economic Development 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 flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 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:

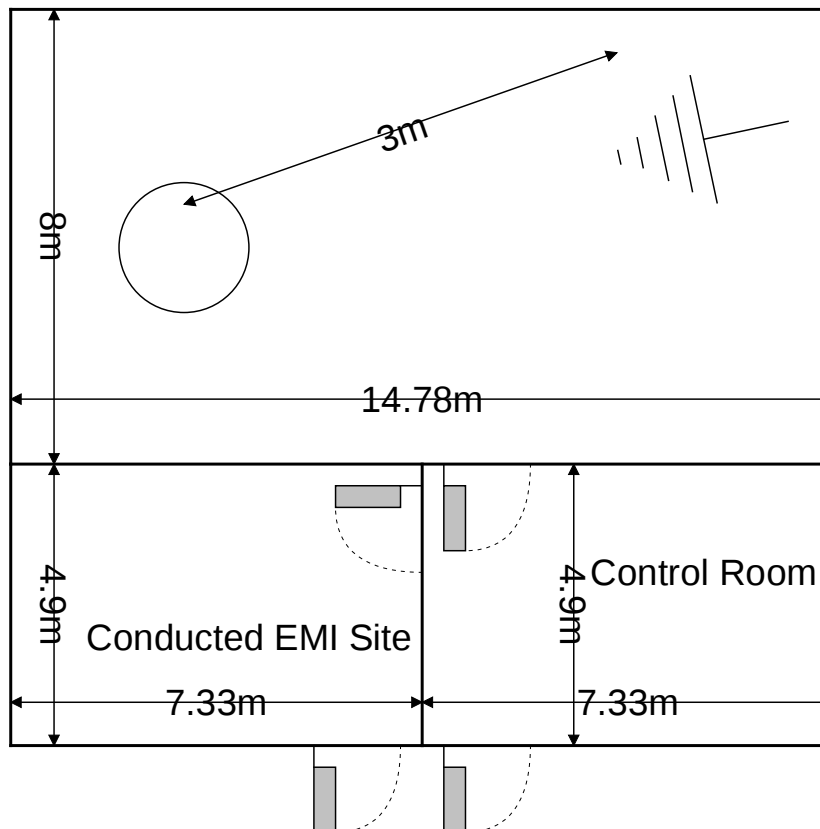


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are $7.3 \times 4.9 \times 3 \text{ m}^3$. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 $50 \Omega/50 \mu\text{H}$ and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

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

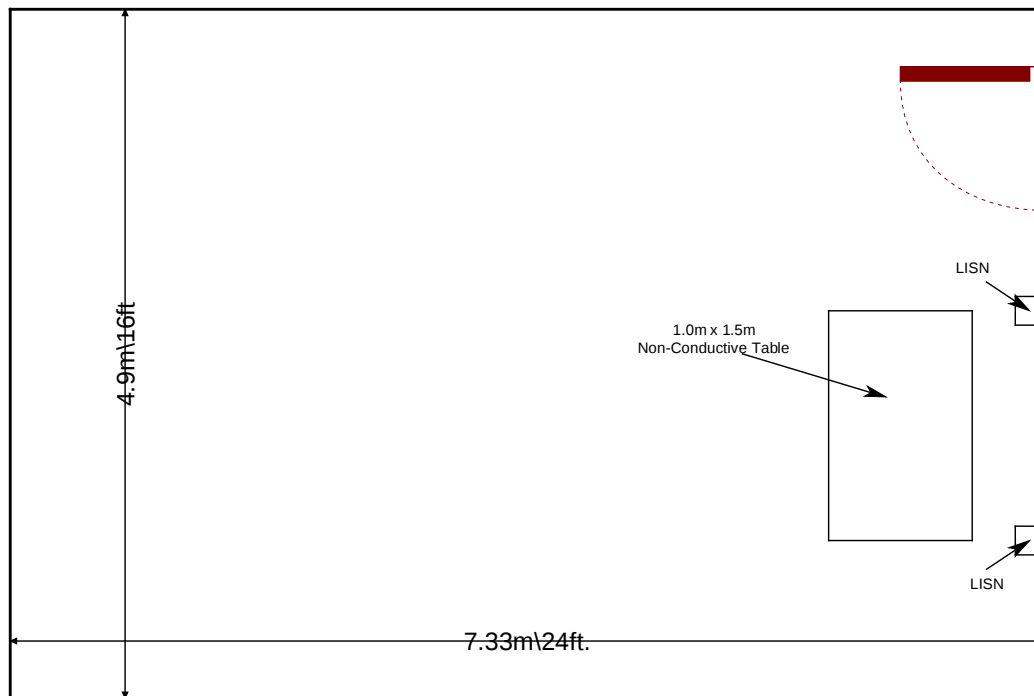


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: 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, 2016
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- ❖ 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
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/22/2015	8/22/2016
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016

NCR=No Calibration Required

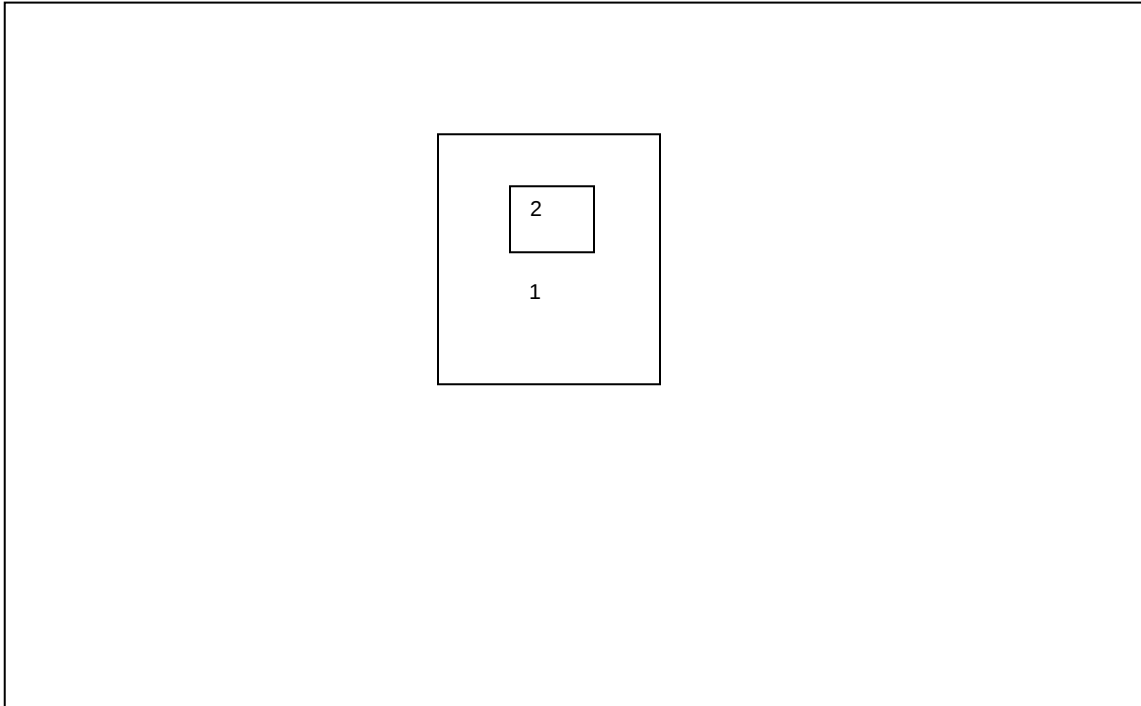
5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	PMLN7594A	79B4
2	BLE Module	Bluegiga	BLE113	N/A

Note: The EUT is standalone only and does not offer any provision for wired connection to other devices.

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 EUT uses an internal coil antenna which soldered to the PCB. The antenna is not detachable, thus meeting the requirements of FCC 15.203.

7.2 20dB / 99% Bandwidth: FCC: Section 15.215 / ISSED Canada 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 set 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

Frequency [kHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
615.97	0.235	0.771

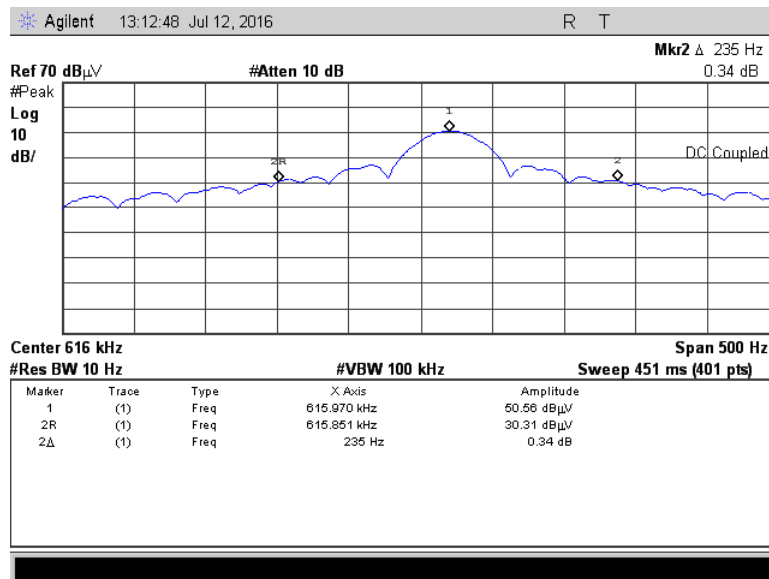


Figure 7.2.2-1: 20dB BW

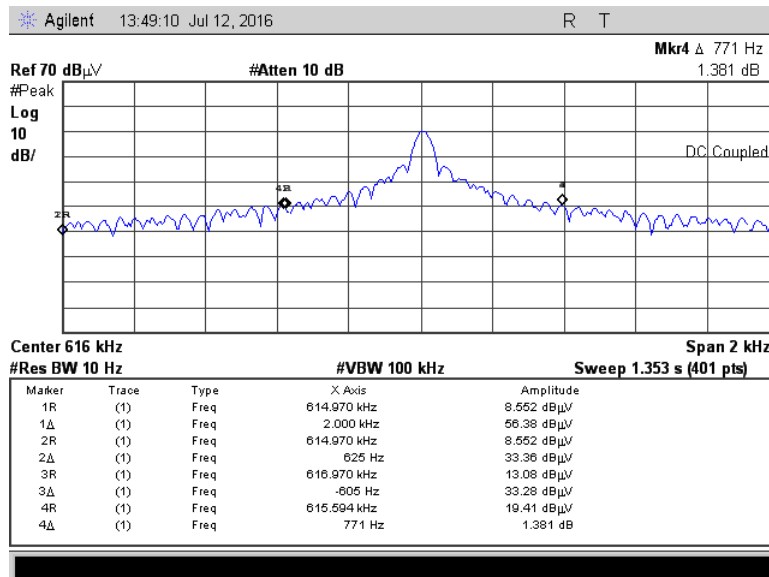


Figure 7.2.2-2: 99% OBW

7.3 Radiated Spurious Emissions – FCC: Section 15.209 / ISCED Canada: 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 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 360 and the loop antenna rotated about the vertical axis to maximize each emission. The magnetic loop receiving antenna was positioned 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 m and 30 m 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.

$$\begin{aligned}\text{Distance correction factor (300m Specified Test Distance)} &= 40 \cdot \log (\text{Test Distance}/300) \\ &= 40 \cdot \log (3/300) \\ &= -80 \text{ dB}\end{aligned}$$

$$\begin{aligned}\text{Distance correction factor (30m Specified Test Distance)} &= 40 \cdot \log (\text{Test Distance}/30) \\ &= 40 \cdot \log (3/30) \\ &= -40 \text{ dB}\end{aligned}$$

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

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk			pk	Qpk	pk	Qpk	pk	Qpk
Fundamental Frequency										
0.615	-----	32.68	V	10.27	-----	42.95	-----	71.8	-----	28.8
Spurious Emissions										
867.33	-----	21.89	H	-0.80	-----	21.09	-----	46.0	-----	24.9
989.207	-----	22.12	H	0.01	-----	22.13	-----	54.0	-----	31.9
124.5	-----	29.44	V	-15.26	-----	14.18	-----	43.5	-----	29.3
471	-----	23.11	V	-8.05	-----	15.06	-----	46.0	-----	30.9
954	-----	22.39	V	-0.70	-----	21.69	-----	46.0	-----	24.3
999.99	-----	22.23	V	0.16	-----	22.39	-----	54.0	-----	31.6

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: Quasi-Peak

Corrected Level: $21.89 + (-0.8) = 21.09$ dBμV/m

Margin: 46.0 dBμV/m – 21.09 dBμV/m = 24.9 dB

8 CONCLUSION

In the opinion of ACS, Inc. the PMLN7594A manufactured by Motorola Solutions Sdn Bhd meets the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

END REPORT