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Testing of

Electromagnetic Emissions

per

USA: CFR Title 47, Part 15.109
Canada: RSS-210, RSS-GEN

are herein reported for

Schrader Electronics MC34MA4

Test Report No.: 20120208-01

Applicant/Provider:
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Measured by:	Dr. Joseph Brunett, EMC-002790-NE	Report Approved by:	Dr. Joseph Brunett, EMC-002790-NE
Report by:	Dr. Joseph Brunett, EMC-002790-NE	Report Date of Issue:	January 25, 2012

Results of equipment under test (EUT) testing completed before January 25, 2012 are as follows.

Emissions Radiated spurious emissions associated with the receive chain of this device meet the regulatory limit(s) by no less than 23.5 dB.

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1 Test Specifications, General Procedures, and Location

1.1 Test Specification and General Procedures

The ultimate goal of Schrader Electronics is to demonstrate that the EUT complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Schrader Electronics MC34MA4 for compliance to:

Country/Region	Rules or Directive	Referenced Section(s)
United States	Code of Federal Regulations	CFR Title 47, Part 15.109
Canada	Industry Canada	RSS-210, RSS-GEN

In association with the rules and directives outlined above, the following specifications and procedures are followed herein.

ANSI C63.4-2003	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
Industry Canada	"The Measurement of Occupied Bandwidth"

1.2 Test Location and Equipment Used

Test Location The EUT was fully tested at **Willow Run Test Labs, LLC**, 8501 Beck Road, Building 2227, Belleville, Michigan 48111 USA. The **Open Area Test Site (OATS)** description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: 688478) and with Industry Canada, Ottawa, ON (File Ref. No: IC 8719A-1).

Test Equipment Pertinent test equipment used for measurements at this facility is listed in Table 1. The quality system employed at Willow Run Test Labs, LLC has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 1: Willow Run Test Labs, LLC Equipment List.

Description	Manufacturer/Model	SN	Quality Number	Last Cal By / Date Due
Antennas				
Shielded Loop (9 kHz - 50 MHz)	EMCO/6502	2855	UMLOOP1	UMRL / July-2012
Dipole Set (20 MHz - 1000 MHz)	EMCO/3121C	9504-1121	DIPEMC001	Liberty Labs / Sept-2012
Bicone (20 MHz - 250 MHz)	JEF	1	BICJEF001	UMRL / July-2012
Bicone (200 MHz - 1000 MHz)	JEF	1	SBICJEF001	UMRL / July-2012
Log-Periodic Array (200 MHz - 1000 MHz)	JEF/Isbell	1	LOGJEF001	UMRL / July-2012
Ridge-Horn Antenna	Univ. of Michigan	5	UMHORN005	UMRL / July-2012
L-Band	JEF		HRNL001	JEF / July-2012*
LS-Band Horns	JEF/NRL	001, 002	HRN15001, HRN15002	JEF / July-2012*
S-Band Horns	Scientific-Atlanta	1854	HRNSB001	JEF / July-2012*
C-Band	JEF/NRL	1	HRNC001	JEF / July-2012*
XN-Band Horns	JEF/NRL	001, 002	HRNXN001, HRNXN002	JEF / July-2012*
X-Band Horns	JEF/NRL	001, 002	HRNXB001, HRNXB002	JEF / July-2012*
Ku-Band Horns	JEF/NRL	001, 002	HRNKU001, HRNKU002	JEF / July-2012*
Ka-Band Horns	JEF/NRL	001, 002	HRNKA001, HRNKA002	JEF / July-2012*
Receiver's / Spectrum Analyzers				
Spectrum Analyzer	HP/8593E	3649A02722	HP8593E001	DTI / Sept-2012
Signal Generators				
Tracking Generator	HP/8593E	3649A02722	HP8593E001	DTI / Sept-2012
Line Impedance Stabilization Networks				
LISN	EMCO	9304-2081	LISNEM001	JEF / Jan-2012

* Verification Only - Standard Gain Horn Antennas

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is an RF receiver. The equipment under test (EUT) is approximately 7.5 x 4 x 3 cm in dimension, and is depicted in Figure 1. It is powered by a 12 VDC vehicle supply. In use, this device is permanently affixed inside a motor vehicle. Table 2 outlines provider declared EUT specifications.

Figure 1: Photographs of the EUT.

Table 2: EUT Declarations.

General Declarations			
Equipment Type:	Receiver	**Country of Origin:**	UK
Nominal Supply:	12 VDC	**Oper. Temp Range:**	-40^o C to $+85^o$ C
Frequency Range:	433.9 MHz	**Antenna Dimension:**	5.5 cm
Antenna Type:	Wire molded into housing	**Antenna Gain:**	-5 dBi (declared)
United States			
FCC ID Number:	MRXMC34MA4	**Classification:**	CYY
Canada			
IC Number:	2546A-MC34MA4	**Classification:**	Vehicular Device, Receiver

2.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

2.1.2 Modes of Operation

The EUT is capable of receiving RF signals from a TPMS sensor at 433.9 MHz.

2.1.3 Variants

There is only a single variant of the EUT, as tested.

2.1.4 Test Samples

One sample was provided, capable of normal operation with an attached "keep alive" module that prevented the receiver from going to sleep.

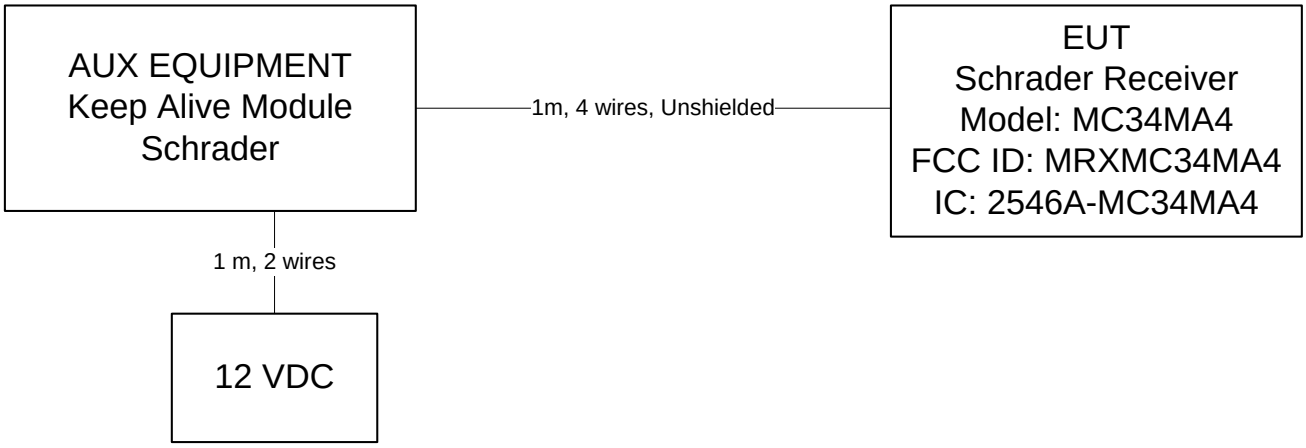

Figure 2: EUT Test Configuration Diagram.

2.1.5 Functional Exerciser

Not Applicable.

2.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

2.1.7 Production Intent

The EUT appears to be a production ready sample.

2.1.8 Declared Exemptions and Additional Product Notes

The EUT is permanently installed in a transportation vehicle. As such, digital emissions are exempt from US and Canadian digital emissions regulations (per FCC 15.103(a) and IC correspondence on ICES-003).

3 Emissions

3.1 General Test Procedures

3.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first evaluated in our shielded fully anechoic chamber. Spectrum and modulation characteristics of all emissions are recorded, and emissions above 1 GHz are fully characterized. The anechoic chamber contains a set-up similar to that of our outdoor 3-meter site, with a turntable and antenna mast. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.2 are employed. After indoor pre-scans, emission measurements up to 1 GHz are made on our outdoor 3-meter Open Area Test Site (OATS). If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3.

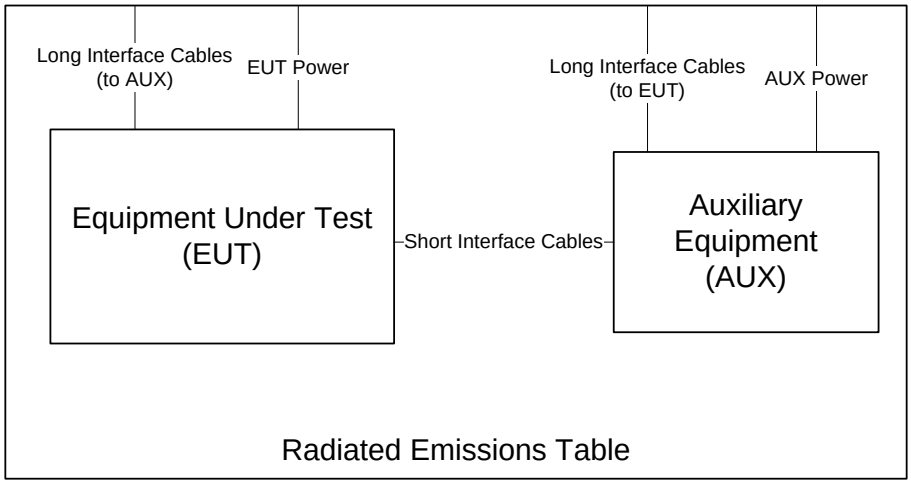

Figure 3: Radiated Emissions Diagram of the EUT.

All intentionally radiating elements are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360^o in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Photographs of the test setup employed are depicted in Figure 4.

If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied. For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. Emissions between 30 MHz and 1 GHz are measured using tuned dipoles and/or calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced.

Figure 4: Radiated Emissions Test Setup Photograph(s).

3.1.2 Conducted Test Setup and Procedures

Vehicle Power Conducted Spurious The EUT is not subject to power line conducted emissions measurements as it is powered solely by the vehicle power system.

3.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the the procedures specified in the test standard, and results of this testing are detailed in this report.

3.1.4 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report. The provider has declared that the EUT is designed for operation over the temperature range -40^o C to $+85^o$ C. Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber, temperature and humidity are recorded, and thermal balance is verified via a thermocouple based probe.

3.2 Unintentional Emissions

3.2.1 Radiated Receiver Spurious

The results for the measurement of radiated receiver spurious emissions (emissions from the receiver chain, e.g. LO or VCO) at the nominal voltage and temperature are reported in Table 3. Receive chain emissions are measured to 5 times the highest receive chain frequency employed or 4 GHz, whichever is higher. If no emissions are detected, only those noise floor emissions at the LO/VCO frequency are reported.

Table 3: Receiver Chain Spurious Emissions $\geq$ 30 MHz.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	21-Nov-11
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	**EUT Mode:**	CW
f > 1 000 MHz	Avg	1 MHz	10kHz	**Meas. Distance:**	3 meters

Receive Chain Spurious Emissions										FCC/IC	
#	Freq. MHz	Ant. Used	Ant. Pol.	Pr (Pk) dBm	Pr (QPk/Avg)* dBm	Ka dB/m	Kg dB	E3(Pk) dBµV/m	E3(Avg) dBµV/m	FCC/IC E3lim (Avg) dBµV/m	Pass dB	Comments
1	287.95	Bic	H	-75.2	-	17.2	37.5	11.5		46.0	34.5	noise
2	287.95	Bic	V	-70.1	-	17.7	37.3	17.4		46.0	28.6	noise
3	575.9	LogPer	H	-69.2	-	13.8	36.2	15.4		46.0	30.6	noise (LO = 575.9 MHz)
4	575.9	LogPer	V	-70.1	-	13.8	36.2	14.6		46.0	31.5	noise
5	1151.8	R-Horn	H	-75.9	-	20.2	28.1	23.3		54.0	30.7	noise
6	1151.8	R-Horn	H	-76.1	-	20.2	28.1	23.1		54.0	30.9	noise
7	1727.7	R-Horn	V	-79.8	-	21.8	28.1	21.0		54.0	33.0	noise
8	1727.7	R-Horn	H	-80.2	-	21.8	28.1	20.6		54.0	33.4	noise
9	2303.6	R-Horn	V	-82.1	-	23.3	26.4	21.8		54.0	32.2	noise
10	2303.6	R-Horn	V	-78.6	-	23.3	26.4	25.3		54.0	28.7	noise
11	2879.5	R-Horn	V	-77.0	-	25.0	24.5	30.4		54.0	23.6	noise
12	2879.5	R-Horn	V	-76.9	-	25.0	24.5	30.5		54.0	**23.5**	noise

Relative relative emissions are depicted in Figure 5.

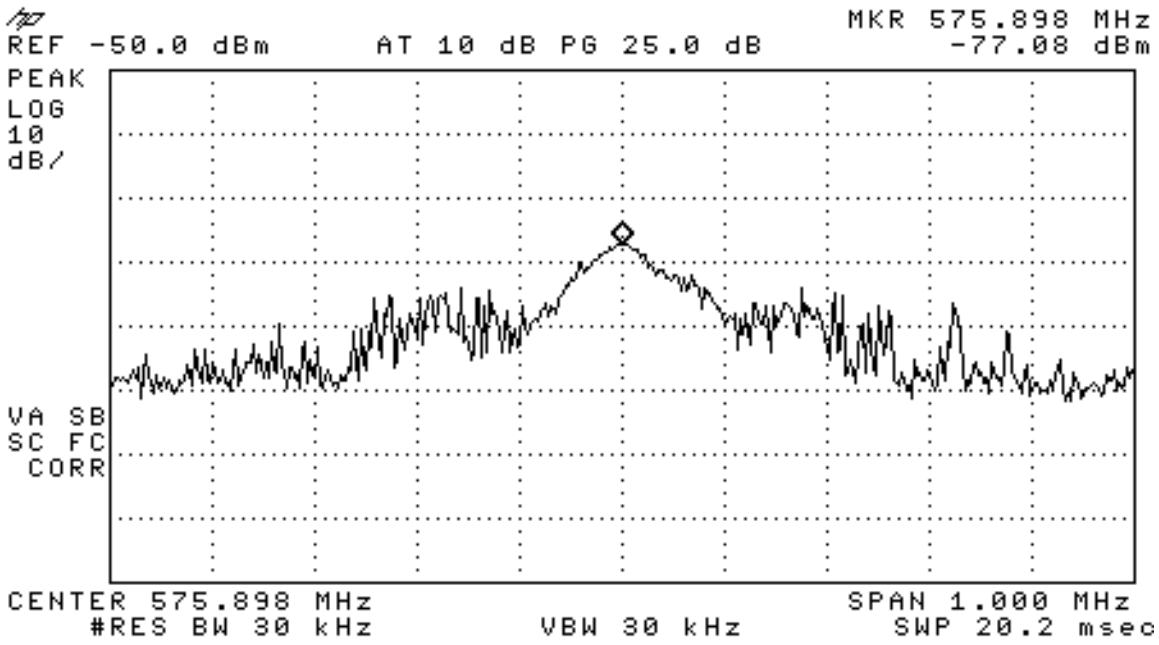

Figure 5: Receiver LO (or 2 x LO = VCO) relative emission.