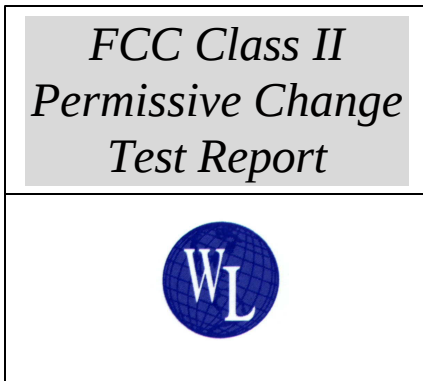




**FCC Class II Permissive Change
Test Report
for
TRW Lucas Automotive Electronics
FCC ID: KHH5EC**

December 14, 2001

Prepared for:

**TRW Lucas Automotive Electronics
Phoenix Way
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Prepared By:

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**FCC Class II Permissive Change Test Report
for the
TRW Lucas Automotive Electronics
5EC Immobiliser
KHH5EC**

December 14, 2001

WLL JOB# 6902

Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This report has been prepared on behalf of TRW Lucas Automotive Electronics to support the attached Application for a Class II Permissive Change to existing certified equipment. The test report and application are submitted for an Intentional Radiator under Part 15.209 of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Class II Permissive Change Test Report documents the test configuration and test results for a TRW Lucas Automotive Electronics 5EC Immobiliser.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The TRW Lucas Automotive Electronics 5EC Immobiliser complies with the limits for an Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

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1 Introduction

1.1 Compliance Statement

The TRW Lucas Automotive Electronics 5EC Immobiliser complies with the limits for an Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed according to the 1992 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer: RFC Technology & Norms
5, rue du Chant des Oiseaux
78360 Montesson France

On behalf of: TRW Lucas Automotive Electronics
Phoenix Way
Cirencester,
Gloucestershire GL7 1QG England

Purchase Order Number: 01848

Quotation Number: 59648

1.4 Test Dates

Testing was performed on December 4, 2001.

1.5 Test and Support Personnel

Washington Laboratories, LTD John Lam

1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
cm	centimeter
CW	Continuous Wave
dB	decibel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga - prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo - prefix for 10^3 multiplier
M	Mega - prefix for 10^6 multiplier
m	Meter
μ	micro - prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The TRW Lucas Automotive Electronics Transceiver is a 125 kHz low power transceiver that is used to activate and deactivate a vehicle alarm system, and operate the vehicle's central locking system. The transceiver is mounted on a vehicle ignition key barrel. The unit, commonly referred to as a tag system, contains a coil that generates an alternating magnetic field that energizes a transponder in the vehicle key. The unit contains: a single chip transceiver that uses an inductor, the coil that is used as an antenna, and a capacitor connected as a resonant circuit. The tag contained in the vehicle key amplitude modulates the carrier generated by the coil antenna. This modulated signal is then demodulated by the unit and converted to digital data that is sent to the vehicle alarm system control unit.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	TRW Lucas Automotive Electronics
FCC ID Number	KHH5EC
EUT Name:	Immobiliser
Model:	5EC
FCC Rule Parts:	§15.209
Frequency Range:	0.125MHz
Keying:	Manual
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Imbedded
Interface Cables:	None
Power Source & Voltage:	13.8VDC via vehicle battery

2.2 Test Configuration

The 5EC was configured with an external 13.8VDC power supply.

2.3 Changes to FCC Certified Product

1. Change of the 125KHz transceiver Integrated Circuit part number (old reference of the component V2 is MLX90106 and new is MLX90109)
2. Capacitor C9 and inductor L1 added. (See schematic exhibit)
3. Change of PCB layout (See schematic exhibit)

2.4 Testing Algorithm

The transceiver was turned on and modulated by the transponder in the key. Worst case emission levels are provided in the test results data.

2.5 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.6 Measurements

2.6.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.7 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ± 2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5 (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Equipment	Serial Number	Date Calibrated	Calibration Due
EMCO 6511 Loop Antenna	1052	8/21/01	8/21/02
Sunol Science JB1 Biconilog Antenna	A090501	9/21/01	9/21/02
Hewlett-Packard Spectrum Analyzer: HP 8568B (Site 1)	2928A04750	6/29/01	6/29/02
Hewlett-Packard Quasi-Peak Adapter: HP 85650A (Site 1)	3303A01786	6/29/01	6/29/02
Hewlett-Packard RF Preselector: HP 85685A (Site 1)	2817A00744	6/29/01	6/29/02

4 Test Results

4.1 Radiated Emissions Testing

4.1.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Part 15.209

Compliance Limits		
Frequency (MHz)	Limit (uV/m)	Test Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 – 216	150	3
216 – 960	200	3
> 960	500	3

4.1.2 Test Procedure

The EUT was placed on an 80 cm high 1 X 1.5 meters non-conductive motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Loop and Biconilog broadband antennas were mounted on an antenna mast to determine the height

of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preamplifier, to the input of the spectrum analyzer. The detector function was set to peak. For emissions above 30 MHz, the measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. For emissions below 30 MHz, the measurement bandwidth on the spectrum analyzer system was set to at least 9 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth.

Testing was performed at a measurement distance of 3 meters. The limit for measurements made below 30 MHz were extrapolated using the square of an inverse linear distance extrapolation factor; (40 dB/decade).

4.1.3 Test Data

Table 3 provides the test results for radiated emissions.

4.1.4 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 2. The AFc in dB/m is algebraically added to the Spectrum Analyzer Voltage in dB μ V to obtain the Radiated Electric Field in dB μ V/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage:	VdB μ V
Composite Antenna Factor:	AFcdB/m
Electric Field:	EdBV/m = V dB μ V + AFcdB/m
To convert to linear units:	E μ V/m = antilog (EdB μ V/m/20)

Table 3: Radiated Emission Test Data

CLIENT: RFC
MODEL NO: 5 EC IMMOBILIZER
DATE: December 04, 2001
BY: JOHN LAM
JOB #: 6902X

Frequency	Polarity	Azimuth	Ant Height	SA Level (Peak)	Extrapolation Factor 40dB/ Decade	AFc	E-Field	E-Field	Limit	Margin
kHz	H/V	Degree	m	dBuV		dB/m	dBuV/m	uV/m	uV/m	dB
125.8	H	90.00	1.0	55.6	-80.0	10.6	-13.8	0.20	19.10	-39.4
251.6	H	90.00	1.0	32.7	-80.0	10.6	-36.7	0.01	9.53	-56.3
378.7	H	0.00	1.0	28.0	-80.0	10.3	-41.7	0.01	6.34	-57.7
503.0	H	0.00	1.0	25.0	-40.0	10.4	-4.6	0.59	47.80	-38.2
629.0	H	0.00	1.0	31.0	-40.0	10.4	1.4	1.17	38.20	-30.2
754.0	H	0.00	1.0	20.0	-40.0	10.4	-9.6	0.33	31.80	-39.6
879.8	H	0.00	1.0	18.0	-40.0	10.4	-11.6	0.26	27.30	-40.3
1005.8	H	0.00	1.0	23.0	-40.0	10.4	-6.6	0.47	23.90	-34.2
1132.4	H	0.00	1.0	26.0	-40.0	10.4	-3.6	0.66	21.20	-30.1
1258.0	H	0.00	1.0	21.0	-40.0	10.4	-8.6	0.37	19.10	-34.2

No emissions were detected above 251.6 kHz. All levels recorded from 378.7 kHz up to 1258 kHz are ambient readings.

Please check appropriate box: _____

☒ Final Test Data

Fill in frequency range scanned: _____

125.8-1258 kHz



Figure 1: Radiated Emission Test Configuration, Front

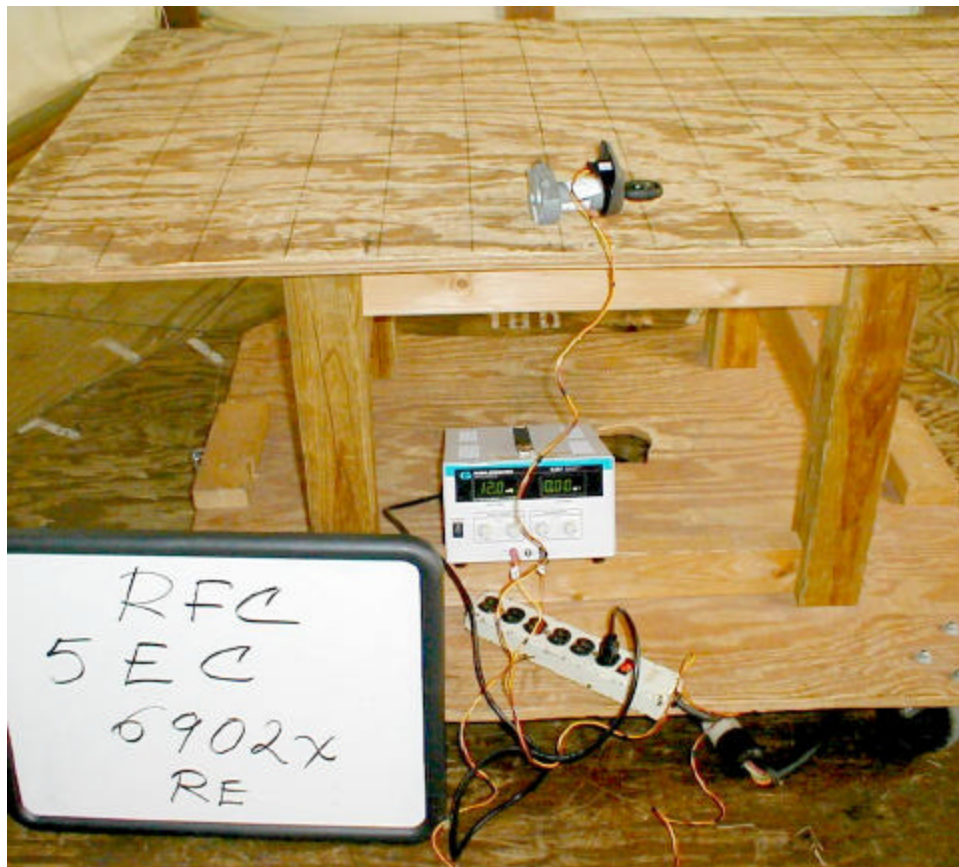


Figure 2: Radiated Emission Test Configuration, Back