



FCC Certification Test Report
for
Valeo Electronique
N5F-736689-A

April 9, 2002

Prepared for:

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FCC Certification Test Program

FCC Certification Test Report for the Valeo Electronique 736689-A Immobiliser N5F-736689-A

April 9, 2002

WLL JOB# 7024

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Abstract

This report has been prepared on behalf of Valeo Electronique to support the attached Application for Equipment Authorization. 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) Certification Test Report documents the test configuration and test results for a Valeo Electronique 736689-A 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 Valeo Electronique 736689-A Immobiliser complies with the limits for a Intentional Radiator device under Part 15.209 of the FCC Rules and Regulations.

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1 Introduction

1.1 Compliance Statement

The Valeo Electronique 736689-A Immobiliser complies with the limits for a 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: Valeo Electronique
2 Rue Fernand Pouillond
94042 Creteil France

Purchase Order Number: 02859

Quotation Number: 59855

1.4 Test Dates

Testing was performed on March 12, 2002.

1.5 Test and Support Personnel

Washington Laboratories, LTD Steve Koster

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 Immobiliser is part of a vehicle anti theft system. It includes a digital processing unit with memory, a transceiver and an energizer coil in the same housing. The energizer coil is fitted around the Steering Column Lock where the key is placed to start the engine. The Immobiliser is connected to the vehicle battery and the vehicle Engine Control Module unit. This system communicates with a transponder which is mounted in the head of the vehicle ignition key. The transponder has no internal power supply and is active only when it is in the electromagnetic field produced by the energizer coil.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Valeo Electronique
FCC ID Number	N5F-736689-A
EUT Name:	Immobiliser
Model:	736689-A
FCC Rule Parts:	§15.209
Frequency Range:	125kHz
Modulation:	AM
Necessary Bandwidth:	125kHz
Keying:	Manual
Type of Information:	Control
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Imbedded
Emission Type(s):	12K0K1D
Interface Cables:	None
Power Source & Voltage:	Vehicle Power 13VDC Nominal

2.2 Test Configuration

The 736689-A was configured with an external 13VDC power supply.

2.3 Testing Algorithm

The 736689-A was operated continuously by being turned on and modulated by the transponder in the key.

Worst case emission levels are provided in the test results data.

2.4 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.

2.5 Measurements

2.5.1 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)

2.6 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, Inc. Biconical Log Periodic Antenna JB1 (Site 1)	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 Occupied Bandwidth:

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

At full modulation, the occupied bandwidth was measured as shown:

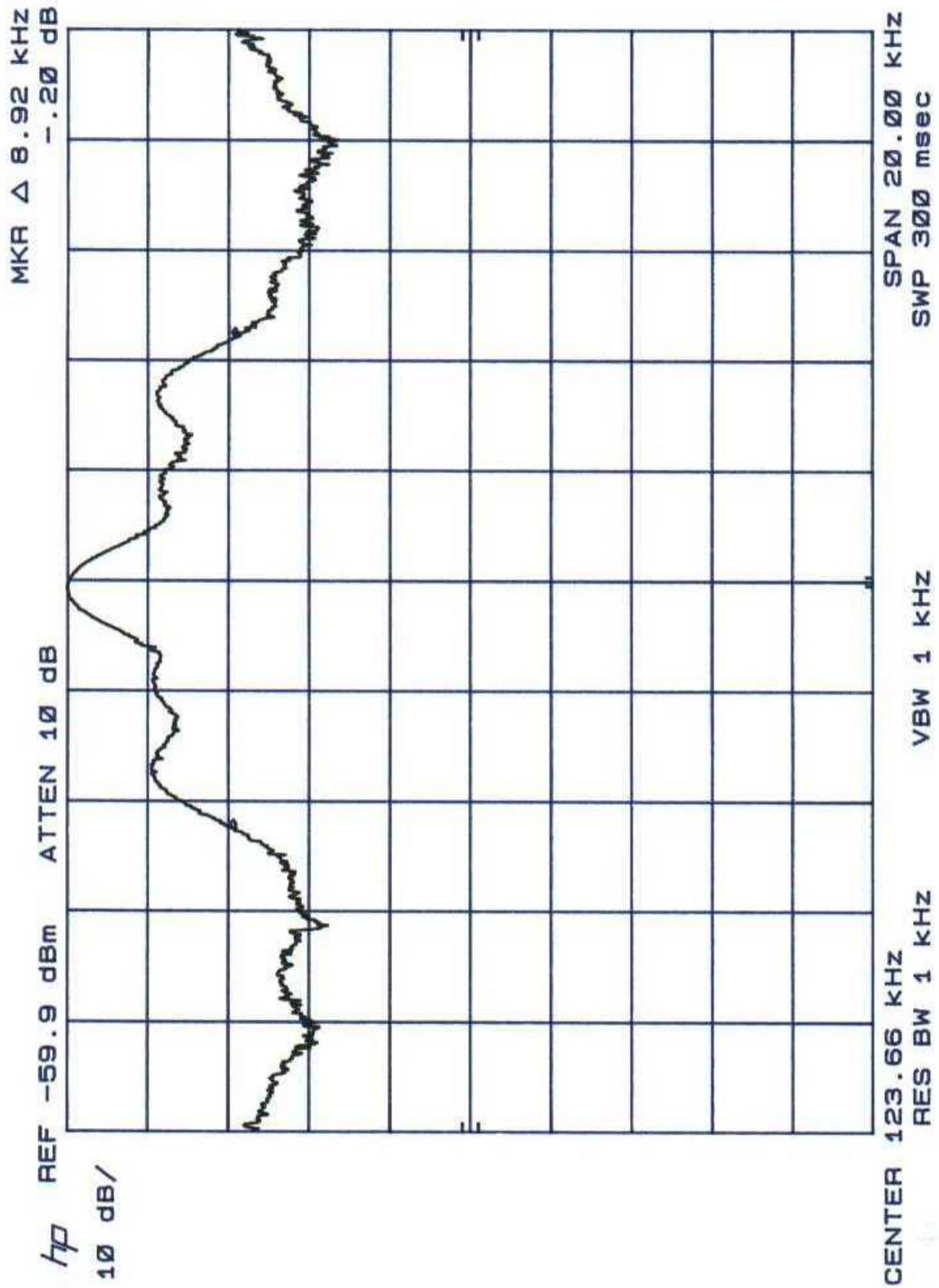


Figure 1. Occupied Bandwidth

4.2 Radiated Spurious Emissions:

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

4.2.1 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 was extrapolated using the square of an inverse linear distance extrapolation factor; (40 dB/decade).

4.2.2 Test Data

Table 3 provides the test results for radiated emissions.

4.2.3 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 dBμV to obtain the Radiated Electric Field in dBμV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage: VdBμV

Composite Antenna Factor: AFcdB/m

Electric Field: $E_{dBV/m} = V_{dB\mu V} + AF_{dB/m}$

To convert to linear units: $E_{\mu V/m} = \text{antilog}(E_{dB\mu V/m}/20)$

Table 3: Radiated Emission Test Data

CLIENT: *RFC* DATE: *3/12/02*
TESTER: *Steve Koster* JOB #: *7024*

EUT Information:

EUT: *Immobilizer 736 689-A*
CONFIGURATION: *Unit constantly transmitting*
CLOCKS: *125 kHz TX*

Test Equipment/Limit:

ANTENNA: *A_00031*
CABLE: *CSITE1_3m*
LIMIT: *LFCC_3m_Class_B*

Test Requirements:

TEST STANDARD: *FCC Part 15.209*
DISTANCE: *3m*

Freq. (MHz)	Pol. H/V	Azimuth Degree	Ant. Height (m)	SA Level (P) dBuV	Ant. Corr. dB/m	Ext. Factor 40dB /decade dB	Corr. Level dBuV/m	Corr. Level uV/m	Limit uV/m	Margin dB	Notes
0.125	F	180.0	1.0	61.5	10.6	-80.0	-7.9	0.403	19.2	-33.6	AMB
0.250	F	0.0	1.0	35.7	10.3	-80.0	-34.0	0.020	9.6	-53.6	
0.375	F	180.0	1.0	36.5	10.4	-80.0	-33.1	0.022	6.4	-49.2	
0.500	F	0.0	1.0	28.4	10.4	-40.0	-1.2	0.871	48.0	-34.8	
0.625	F	0.0	1.0	22.7	10.4	-40.0	-6.9	0.452	38.4	-38.6	
0.750	F	0.0	1.0	35.6	10.4	-40.0	6.0	1.995	32.0	-24.1	
0.875	F	0.0	1.0	23.4	10.4	-40.0	-6.2	0.490	27.4	-35.0	
1.000	F	0.0	1.0	21.9	10.4	-40.0	-7.7	0.412	24.0	-35.3	
1.250	F	0.0	1.0	16.5	10.4	-40.0	-13.1	0.220	19.2	-38.8	AMB
0.125	S	270.0	1.0	54.8	10.6	-80.0	-14.6	0.2	19.2	-40.3	AMB
0.250	S	0.0	1.0	35.7	10.3	-80.0	-34.0	0.0	9.6	-53.6	
0.375	S	0.0	1.0	33.3	10.4	-80.0	-36.3	0.0	6.4	-52.4	
0.500	S	0.0	1.0	28.4	10.4	-40.0	-1.2	0.9	48.0	-34.8	
0.625	S	0.0	1.0	22.7	10.4	-40.0	-6.9	0.5	38.4	-38.6	
0.750	S	0.0	1.0	35.6	10.4	-40.0	6.0	2.0	32.0	-24.1	
0.875	S	0.0	1.0	23.4	10.4	-40.0	-6.2	0.5	27.4	-35.0	
1.000	S	0.0	1.0	21.9	10.4	-40.0	-7.7	0.4	24.0	-35.3	
1.250	S	0.0	1.0	16.5	10.4	-40.0	-13.1	0.2	19.2	-38.8	AMB

Note: Average measurements were not made as the peak levels comply with the specified limit.