No. 1116

Electromagnetic Compatibility

Test of:	Automotive Keyfob Transmitter
Model Number:	457800
Applicant:	PFK Electronics (PTY) Ltd.
Test Type:	Compliance
Test Specification:	FCC CFR 47, part 15.231: 2006
SGS Serial Number:	EMC110493/1/CL/07
Date of Receipt:	4th July 2007
Date of Test(s):	4th July 2007 to 10th July 2007
Date of Issue:	25th September 2007
Issue Number:	2

Any compliance statements in this report are made reliant on the modes of operation and the failure criteria as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT.

Authorised Signatory

A. Reynard
Technical Manager

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1. Client Information

Company Name:	PFK Electronics (PTY) Ltd.
Address:	488 Umbilo Road Durban Kwa Zulu Natal PO Box 3660 South Africa
Contact Person:	Hugh Thibaud
Telephone:	27 31 274 7200
Facsimile:	27 31 205 4324

2. Details Of Test Laboratory

Company Name:	SGS UK Ltd.
UKAS Accreditation Number:	1116
Address:	South Industrial Estate, Bowburn, Co. Durham, DH6 5AD.
Contact Persons:	Mr Alan Reynard
Telephone:	+44 191 377 2000
Facsimile:	+44 191 377 2020

3. Equipment Under Test (EUT)

3.1 Identification Of EUT

Model Number:	457800
Unique Identifier:	Not Supplied
Description of EUT:	Automotive Keyfob Transmitter
Highest Internal Clock Frequencies:	433MHz
Supply Voltage:	3V DC Battery
Ports present:	Enclosure
Accessories Supplied:	None

3.2 Overview

The product is a low power transmitter used to control the vehicle alarm and convenience features.

3.3 Circuit Description

Power is derived from a single CR2932 Lithium cell.

IC 1 is an encoder. It is programmed with the Keeloq algorithm and unique manufacturer's key. When a switch is pressed the IC outputs the next code in the sequence together with the switch information to pin 6.

Tr1 and associated components form a Colpitts oscillator. SAW1 sets the frequency. L1 is an inductor etched onto the PC Board. It is the DC path for the oscillator and also acts as the radiating element. C2 and C3 provide feedback and are resonant with L1. R3 prevents parasitic oscillations. The PWM output from pin 6 of IC1 provides the base bias for the oscillator. The oscillation is turned on and off by this signal.

C1 is a de-coupling capacitor.

The ground plane on the PC board and the battery provide the ground reference for the radiating element.

4. Test Specification, Methods and Procedures

4.1 Test Specification(s)

Specification(s)	Title
FCC CFR 47 : October 2006 Part 15	Code Of Federal Regulations part 15 Telecommunication – Radio frequency devices

4.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification(s) so that the manufacturer can apply for certification with a TCB.

4.3 Methods and Procedures

Test Procedure(s)

Procedure(s)	Title
ANSI C63.4 - 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz.

The standards listed on the previous page refer to the following tests: -

CFR 47 Clause	Test
15.231	Radiated Emissions
15.231	Modulation Bandwidth Requirements

5. Deviations or Exclusions from the Test Specifications

There were no deviations from the test specifications.

6. Operation of the EUT During Testing / Configuration and Peripherals

6.1 Operation of EUT during testing.

Refer to individual test results sections for details of EUT operation during testing.

6.2 Configuration and Peripherals

No peripherals or support equipment were required during the test.

7. Test Results

7.1 General Comments

The test methods used are referred to in the individual test results sections of this test report.

7.2 Modifications Made to the EUT

No modifications were made to the EUT during the testing process.

7.3 Summary of Test Results

CFR 47 Clause	Test	Result
15.231	Radiated Emissions	Complied
15.231	Bandwidth Requirements	Complied

Result

In the configuration tested, the EUT complies with the requirements of Clauses of CFR 47: October 2006.

Full details of all tests can be found in the test results section of this report.

7.4 Radiated Emissions Test Results 15.231

CFR Clause	15.231
Frequency Range	30MHz-4.3392GHz (10th Harmonic)

Operating Mode

Transmitting signal.

Test Results

The tables indicate the compliance measurements which were performed at a distance of 3m.

For frequencies below 1GHz quasi peak measurements were performed on an open area test site and for frequencies above 1GHz peak measurements were performed in an anechoic chamber.

For measurements at frequencies below 1GHz the detector resolution bandwidth was set to 120 kHz and at frequencies above 1GHz the detector resolution bandwidth was set to 1MHz.

Quasi Peak Measurements below 1GHz

Frequency (GHz)	Quasi Peak Measurement (μV/m)	Limit (μV/m)	Antenna Polarity (H/V)
215.834	7.76	375	V
349.956	4.90	750	V
433.939*	7762.47	11000	V
595.004	9.89	1250	V
660.993	11.61	1250	V
720.000	13.96	1250	V
867.809	881.05	1250	V
215.825	10.12	375	H
349.931	8.13	750	H
433.892*	3019.95	11000	H
595.208	16.79	1250	H
661.293	22.39	1250	H
720.046	27.54	1250	H
867.808	402.72	1250	H

* Fundamental Frequency

Peak Measurements above 1GHz

Frequency (GHz)	Peak Measurement (μV/m)	Limit (μV/m)	Antenna Polarity (H/V)
1301.70	326.59	1250	V
1735.70	261.52	1250	V
2169.60	691.83	1250	V
2603.70	198.15	1250	V
3037.50	428.55	1250	V
3471.20	544.50	1250	V
3905.10	140.93	1250	V
4339.20	81.75	1250	V
1301.70	80.08	1250	H
1735.70	283.47	1250	H
2169.60	601.87	1250	H
2603.70	141.58	1250	H
3037.50	157.76	1250	H
3471.20	216.52	1250	H
3905.10	118.17	1250	H
4339.20	69.82	1250	H

Radiated Emissions Test Configuration

Radiated Emissions Environmental Conditions

Power Supply	3V DC
Temperature	21°C
Relative Humidity	47%
Barometric Pressure	992mb

Radiated Emissions Measurement Uncertainties

Frequency	± 200kHz
Amplitude	± 4.6dB

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

Test Equipment Used

Equipment Type	Model Number	Last Calibration Date	Calibration Interval
Biconical Antenna	EMCO 3109	7th March 2006	2 years
Log Periodic Antenna	EMCO 3146	23rd November 2005	2 years
Hewlett Packard Receiver System	HP8573B	15th June 2006	2 years
Spectrum Analyser	Anritsu MS2613B	10th January 2006	2 years
Double Ridged Guide Antenna	EMCO 3115	20th March 2007	2 years
Pre-amplifier	ZHL-1042J	19th September 2006	2 years

7.5 Range of Modulation Bandwidth 15.231

Test Conditions		Frequency (MHz)
T_{NOM} (22ºC)	V_{NOM} (3V)	**Fc= 433.965440**
		Fl= 433.941240
		Fh= 433.987840
		Bandwidth (Fh – Fl) = 0.0466MHz **Bandwidth Limit = 1.085MHz (0.25% of the centre frequency)**
Measurement Uncertainty		**1 x 10^{-7}**

Measurement receiver bandwidth

Where Fl= Lowest frequency at the appropriate level (-20dB of carrier)
Fh= Highest frequency at the appropriate level (-20dB of carrier)
Fc= Fundamental Carrier Frequency

Band Edge Limits

Flm= 432.880440MHz

Fhm= 435.050440MHz

Test Equipment Used

Equipment Type	Model Number	Last Calibration Date	Calibration Interval
Spectrum Analyser	Anritsu MS2613B	10th January 2007	2 years
Power Supply	PDD 3010A	-	-