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**EMI TEST REPORT
for
CERTIFICATION to
FCC PART 15.231 & RSS-210**

FCC ID: LXP-VIM244
Industry Canada ID: 2298A-VIM244

Test Sample: Porsche Remote Key Transmitters
Model: VIM244
Tested for: Robert Bosch Australia

Report Number: M040113_Cert_Tx

Issue Date: 5th April 2004

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NATA Accredited Laboratory
Number: 5292

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to
FCC PART 15.231 & RSS-210

Report Number: M040113_Cert_Tx

Test Sample: Porsche Remote Key Transmitters
Model: VIM244
Manufacturer: Robert Bosch (Australia) Pty Ltd

FCC ID: LXP-VIM244
Industry Canada ID: 2298A-VIM244
Equipment Type: Intentional Radiator

Tested for: Robert Bosch (Australia) Pty Ltd
Address: Cnr Centre & McNaughton Roads,
Clayton VIC 3168, Australia


Phone: +613 9541 5555
Fax: +613 9544 1137
Responsible Party: Bazil Rodricks

Test Standards: FCC Part 15, Subpart C – Intentional Radiators
FCC Part 15.231: Periodic operation in the band 40.66-40.70 MHz
and above 70 MHz
ANSI C63.4 – 1992
OET Bulletin No. 63

RSS-210 Issue 5 Low Power Licence-Exempt RadioCommunication
Devices: 6.1.1: Momentarily Operated Devices

Test Dates: 19th January – 10th March 2004

Test Officers:



Chieu Huynh B.Eng (Hons) Electronics
Jorge Lara

Attestation:

I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.

Authorised Signatory:



Chris Zombolas
Technical Director
EMC Technologies Pty Ltd



EMI TEST REPORT FOR CERTIFICATION to FCC PART 15.231 & RSS-210

1.0 INTRODUCTION

This report details the results of EMI tests and measurements performed on the Porsche Remote Key Transmitters (2 & 3 Button), Model VIM244.

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

- 47 CFR, Part 15, Subpart C: Rules for intentional radiators (particularly section 15.231)
- Section 15.203: Antenna requirements
- Section 15.205: Restricted bands of operation
- Section 15.207: Conducted Emission Limits
- Section 15.209: Radiated Emission Limits (General requirements)
- Section 15.231: Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.231.

The test sample also complied with the Industry Canada RSS-210 issue 5 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.1.1

The "Porsche Body Computer System" comprises the Remote Key (Transmitter), the Base Station (Receiver) and the Electronic Ignition Switch (Immobiliser). The results for the Remote Key (Transmitter) are reported in this test report. The results for the Base Station (Receiver) and the Electronic Ignition Switch (Immobiliser) are reported separately (refer to EMC Technologies' test reports: M040113_Cert_Rx and M040113_Cert_Immobiliser respectively).

1.1 Summary of Results

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Not Applicable
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Not Applicable
15.209	6.3	Radiated Emissions	Complies
15.231 (b)	6.1.1(b)	Field Strength Emissions	Complies
15.231 (c)	6.1.1(c)	Bandwidth	Complies

The measurement procedure used was in accordance with ANSI C63.4-1992 and OET Bulletin No. 96-43. The instrumentation conformed to the requirements of ANSI C63.2-1987.

1.2 Modifications by EMC Technologies

No modifications were required.



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2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample: Porsche Remote Key Transmitters
Model: VIM244
FCC ID: LXP-VIM244
Industry Canada ID: 2298A-VIM244
Equipment Type: Low Power Transmitter (Intentional Radiator)

2.2 Test Sample Operational Description

The test sample is a remote key transmitter (low power transmitter). It is a manually operated transmitter powered via the push button switches located on the device. The transmitter ceases transmission when the push button switch on the device is released and is programmed to transmit for approximately 5 seconds if the button is continually depressed.

A "RemoteKey" device (Electronic Key) which will be carried on the user. The RemoteKey transmits UHF messages back to the Base Station's in-built UHF receiver. The Mechanical Key blade is also part of the RemoteKey.

According to the manufacturer the 2 and 3 button keyfobs (remote key transmitters) have the same PCB and electronics. The difference between the two buttons is the soldering of a third switch and the change of top housing to accommodate the number of switches.

2.3 Test sample configuration

Measurements were tested individually with both Remote Key Transmitters (2 and 3 button versions) and the results for both transmitters are reported.

Testing was performed with new batteries fitted and rotated around 3 orthogonal planes. The worst-case results are reported.

Refer to Appendix B - Test Setup Photographs.

2.4 Test Sample Block Diagram

Refer to Appendix C – Test Sample Block Diagram

2.5 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-1992. Radiated emissions tests were performed at a distance of 3 metres from the EUT. OET Bulletin 63 dated October 1993 was used for reference.

2.6 Test Facility

2.6.1 General

Radiated Emission measurements were performed at EMC Technologies open area test site (OATS) situated at Lerderberg Gorge, near the township of Bacchus Marsh in Victoria, Australia. Bandwidth measurements were performed at EMC Technologies' laboratory in Tullamarine, (Melbourne) Victoria Australia.



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The above sites have been fully described in a report submitted to the FCC office, and accepted in a letter dated June 14, 2002, **FCC Registration Number 90560**.

2.6.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).

“FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E).”

The current full scope of accreditation can be found on the NATA website: www.nata.asn.au It also includes a large number of emission, immunity, SAR, EMR and Safety standards.

NATA is the Australian national laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Laboratory (NML) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

2.7 Units of Measurements

Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dB μ V/m).

2.8 Test Equipment Calibration

All measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Laboratory (NML). All equipment calibration is traceable to Australia national standards at the National Measurements Laboratory. The reference antenna calibration was performed by NML and the working antennas (biconical and log-periodic) calibrated by the NATA approved procedures. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A.

2.9 Ambients at OATS

The Open Area Test Site (OATS) is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.

3.0 CONDUCTED EMISSION MEASUREMENTS

Not applicable, as EUT is battery powered.



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4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.231.

Radiated emission measurements were performed to the limits as per section 15.209. The measurements were made at the open area test site at a distance of 3 metres.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated Biconical antenna was used for measurements between 30 MHz to 232 MHz and a calibrated Logperiodic antenna used for measurements between 230 MHz to 1000 MHz. Calibrated EMCO 3115 Horn antenna was used for measurements between 1 to 3.15 GHz.

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz, appearing in the restricted bands, was made using an average detector with a bandwidth of 1.0 MHz.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. Each significant peak was then investigated and maximised with the Quasi-Peak detector. The measurement data for each frequency range was automatically corrected by the software for cable losses, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

4.2 Plotting of Measurement Data for Radiated Emissions

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges over the range 30-1000 MHz. The accumulated EMI (EUT ON) was plotted as the Red trace while the Ambient signals (AMBIENT) were plotted as Green trace. The worst case radiated EMI *peak* measurements as recorded using the Max-Hold data are presented as the upper or **RED** trace while the respective ambient signals are presented as the lower or **GREEN** trace. Occasionally, an intermittent ambient arose during the EUT ON measurement (RED trace) and could not be captured when the Ambient trace was being stored. The ambient peaks of significant amplitude with respect to the limit are tagged with the "#" symbol while EMI peaks are identified with a numeral. Ambient peaks that were present during the EUT ON measurement (RED trace) and not captured during the AMBIENT measurement were also tagged with the "#" symbol.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, quasi-peak field strength and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

At times, the quasi peak level may appear to be higher than the peak level. This happens because the individual peak is further maximised with the QP detector, after the peak trace is recorded. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level.



4.3 Calculation of Peak and Average Field Strength

The peak field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

$$E = V + AF - G + L$$

Where:

- E** = Radiated Peak Field Strength in dB μ V/m.
- V** = EMI Receiver Voltage in dB μ V. (measured value)
- AF** = Antenna Factor in dB(m⁻¹). (stored as a data array)
- G** = Preamplifier Gain in dB. (stored as a data array)
- L** = Cable insertion loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example Peak Field Strength Calculation**

Assuming a receiver reading of 34.0 dB μ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$

4.4 Results - Fundamental and Spurious (30 to 3150 MHz)

The transmitter is manually operated (powered via the push button switches located on the device), employing a switch that automatically deactivates transmission within not more than 5 seconds of being released as per FCC Part 15.231(a)(1).

Two samples were tested: 3 Button Remote and 2 Button Remote.

4.4.1 Remote Key Transmitter – 3 Button Remote

Frequency MHz	Polarisation	Level Measured dB μ V/m	Limit dB μ V/m	Δ \pm dB
314.96	Horizontal	69.0	75.6	-6.6
314.98	Vertical	63.7	75.6	-11.9

The highest radiated field strength emission complied with FCC limits by a margin of 6.6 dB at 314.96 MHz (transmitter fundamental). No harmonics or spurious emissions (30 to 3150 MHz) were found within 10 dB of the limits. The measurement uncertainty for radiated field strength emissions was ± 3.7 dB. Refer to Appendix G, graphs 1 and 2.

Conclusion: Complies.



4.4.2 Remote Key Transmitter – 2 Button Remote

Frequency MHz	Polarisation	Level Measured dB μ V/m	Limit dB μ V/m	Δ \pm dB
315.0	Horizontal	72.1	75.6	-3.5
315.0	Vertical	67.9	75.6	-7.7
630.0	Horizontal	31.4	55.6	-24.3
630.0	Vertical	26.2	55.6	-29.4

The highest radiated field strength emission complied with FCC limits by a margin of 6.6 dB at 314.96 MHz (transmitter fundamental). The worst-case harmonics or spurious emissions (30 to 3150 MHz) were found to comply with the limits by a margin of 24.2 dB (second harmonics). The measurement uncertainty for radiated field strength emissions was ± 3.7 dB. Refer to Appendix G, graphs 3 and 4.

Conclusion: Complies.

5.0 BANDWIDTH

Testing was performed in accordance with the requirements of FCC Part 15.231(c).

The bandwidth of the emission shall be no wider than 0.25% of the centre frequency.

The resolution bandwidth of 30 kHz and the video bandwidth of 30 kHz were utilised

The 20 dB bandwidth for the two samples were:

	Bandwidth kHz	Limit kHz	Result
3 Button Remote	152.3	< 787.5	Complies
2 Button Remote	147.3	< 787.5	Complies

Refer to Appendix H for bandwidth plots

Conclusion: Complies.

6.0 ANTENNA REQUIREMENT

Testing to the requirements of FCC Part 15.203 was not applicable as this intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.



7.0 COMPLIANCE STATEMENT

The Porsche Remote Key Transmitters (3 button and 2 button remotes), Model VIM244, tested on behalf of Robert Bosch (Australia) Pty Ltd, **complies** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.231 – Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz.

The test sample also complies with the Industry Canada RSS-210 issue 5 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.1.1

Results were as follows:

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Not Applicable
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Not Applicable
15.209	6.3	Radiated Emissions	Complies
15.231 (b)	6.1.1(b)	Field Strength Emissions	Complies
15.231 (c)	6.1.1(c)	Bandwidth	Complies



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TEST REPORT APPENDICES

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