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

FCC ID: **LXP-RK225**
Industry Canada ID: **2298A-RK225**

Test Sample: HMC GK Integrated Remote Key Transmitter

Tested for: Robert Bosch Australia

Report Number: M040611_Cert_Tx

Issue Date: 17th September 2004

NATA Accredited Laboratory
Number: 5292

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Report Number:	**M040611_Cert_Tx**
Test Sample:	HMC GK Integrated Remote Key Transmitter
Manufacturer:	Robert Bosch (Australia) Pty Ltd
FCC ID:	LXP-RK225
Industry Canada ID:	2298A-RK225
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:	Marinko Basic
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:	16th June to 8th July 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
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FCC PART 15.231 & RSS-210

1.0 INTRODUCTION

This report details the results of EMI tests and measurements performed on the HMC GK Integrated Remote Key Transmitter.

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

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.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	HMC GK Integrated Remote Key Transmitter
FCC ID:	LXP-RK225
Industry Canada ID:	2298A-RK225
Equipment Type:	Low Power Transmitter (Intentional Radiator)

2.2 Test Sample Operational Description

The test sample is a remote key transmitter. It is a manually operated transmitter powered via the push button switches located on the device. When any one of the three buttons is pressed, the on-board microprocessor MC68HC05K3 of Motorola shall wake up from Sleep Mode and transmit a corresponding command that lasts for approximately one second. During the transmission, the LED shall be blinking at 8 Hz. After the transmission, the microprocessor shall return to Sleep Mode.

Refer to Appendix C for further details.

2.3 Test sample configuration

Measurements were tested with the transmitter transmit continuously.

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 D – 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 Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia. Bandwidth measurements were performed at EMC Technologies' laboratory in Tullamarine, (Melbourne) Victoria Australia.

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 (A^2LA).

2.7 Units of Measurements

Radiated Emissions
Measurements are reported in units of dB relative to one microvolt per metre (dBμV/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.

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 dBµV/m.
V = EMI Receiver Voltage in dBµV. (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 dBµV 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 dBµV/m

The average field strength level was calculated from the peak field strength measurement (uV/m) multiply with the duty cycle over 100 mS. The duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train including blanking interval. Refer to Appendix J for pulsewidths duty cycle and blanking.

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).

Testing was carried out in accordance with the requirements of FCC Part 15.231(b), 15.205(a) and 15.209(a).

Frequency MHz	Polarisation	Peak Level Measured dBµV/m	*Calculated Average Level dBuV/m	Average Limit dBµV/m	Δ Average ± dB
315.02	Horizontal	77.5	71.5	75.6	-4.1
315.02	Vertical	71.6	65.6	75.6	-10.0
630.06	Horizontal	40.4	34.4	55.6	-21.2
630.06	Vertical	40.0	34.0	55.6	-21.6

*The duty cycle of 50% was recorded, Refer to Appendix J for pulsewidths duty cycle

The highest radiated field strength emission complied with FCC limits by a margin of 4.1 dB at 315.02 MHz (transmitter fundamental). Harmonics or spurious emissions (30 to 3150 MHz) were found within 20 dB of the limits. The measurement uncertainty for radiated field strength emissions was ±3.7 dB. Refer to Appendix H, graphs 1 and 2.

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

Bandwidth kHz	Limit kHz	Result	20 dB Bandwidth Plots
132.3	< 787.5	Complies	Appendix I

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 HMC GK Integrated Remote Key Transmitter, 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
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TEST REPORT APPENDICES

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS

APPENDIX B: TEST SAMPLE PHOTOGRAPHS

APPENDIX C: OPERATIONAL DESCRIPTIONS

APPENDIX D: TEST SAMPLE BLOCK DIAGRAM

APPENDIX E: TEST SAMPLE SCHEMATIC

APPENDIX F: TEST SAMPLE PCB LAYOUT

APPENDIX G: FCC ID LABELLING

APPENDIX H: GRAPHS of EMI MEASUREMENTS

APPENDIX I: CHANNEL BANDWIDTH PLOTS

APPENDIX J: PULSEWIDTH & DUTY CYCLE

APPENDIX K: USER MANUAL