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**EMI TEST REPORT for
CERTIFICATION to
FCC PART 24(E) – Broadband PCS and
FCC PART 22(H) – Cellular Radiotelephone Service
RSS-132 & RSS-133**

**FCC ID: P3A-K78-205R
IC ID: 2813A-K78205R**

Test Sample: Mobile Payment Terminal
Model: K78-205
Tested for: Keycorp Limited

Report Number: M050435_Cert_Terminal

Issue Date: 6th May 2005

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Number: 5292**

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to
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CONTENTS

- 1.0 INTRODUCTION**
- 2.0 GENERAL INFORMATION**

RESULTS

- 3.0 POWER OUTPUT MEASUREMENTS**
- 4.0 OUT of BAND EMISSIONS MEASUREMENTS**
- 5.0 CONDUCTED EMISSION MEASUREMENTS**
- 6.0 FREQUENCY STABILITY**
- 7.0 CHANNEL BANDWIDTH**
- 8.0 RADIO FREQUENCY EXPOSURE**
- 9.0 COMPLIANCE STATEMENT**

- APPENDIX A: MEASUREMENT INSTRUMENT DETAILS**
- APPENDIX B: REPORT PHOTOGRAPHS**
- APPENDIX C: BLOCK DIAGRAM**
- APPENDIX D: SCHEMATICS**
- APPENDIX E: PARTS LIST (BOM)**
- APPENDIX F: TECHNICAL OPERATION DESCRIPTION**
- APPENDIX G: FCC LABELLING DETAILS**
- APPENDIX H: USER MANUAL**
- APPENDIX I: BANDEDGE PLOTS**
- APPENDIX J: CHANNEL BANDWIDTH PLOTS**
- APPENDIX K: CONDUCTED RF PLOTS**
- APPENDIX L: PEAK POWER PLOTS**
- APPENDIX M: RADIATED AND CONDUCTED EMISSIONS PLOTS**



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**EMI TEST REPORT FOR CERTIFICATION to
FCC PART 24 Subpart E – Broadband PCS and
FCC PART 22 Subpart H - Cellular Radiotelephone Service
RSS-132 & RSS-133**

1.0 INTRODUCTION

EMI testing was performed on the Mobile Payment Terminal, Model: K78-205. The test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations. The test sample **complied** with the requirements of 47 CFR, Part 24 Subpart E – Broadband PCS and Part 22 Subpart H - Cellular Radiotelephone Service.

The test sample also complied with the Industry Canada RSS-132 Issue 1, RSS-133 Issue 2 and the RF exposure requirements of RSS-102.

1.1 Summary of Results

FCC Part 24 Subpart E Clauses	FCC Part 22 Subpart H Clauses	Industry Canada RSS-132 Clauses	Industry Canada RSS-133 Clauses	Test Performed	Result
24.232	22.913	4.4	6.2	Power Limits	Complies
24.235	22.355	4.3	7.0	Frequency Stability	Complies
24.238	22.917	4.5	6.3	Emission Limits	Complies

The measurement procedure used was in accordance with ANSI/TIA/EIA-603, ANSI C63.4-2003 and OET Bulletin No. 65. The instrumentation conformed to the requirements of ANSI C63.2-1996.

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:	Mobile Payment Terminal
Model:	K78-205
FCC ID:	P3A-K78-205R
IC ID:	2813A-K78205R
Manufacturer:	Keycorp Limited
Equipment Type:	Wireless mobile payment terminal
Transmitter:	GSM 850/1900 Module
Power Supply:	3.6V
Equipment Type:	Intentional Radiator

2.2 Technical Operational Description

Refer to Appendix F – Technical Operation Description.

2.3 Test Configuration

The test sample was configured to transmit continuously during all tests.

Testing was performed in the two operating frequency ranges: 824.0 – 850 MHz and 1850 -2 – 1910 MHz. The transmitter continuously transmitted at maximum output power on a low, middle and high frequency channel for each band.

850 MHz band:

Low (824.2 MHz), Middle (836.4 MHz), High (848.8 MHz)

1900 MHz band:

Low (1850.2 MHz), Middle (1880.0 MHz), High (1909.8 MHz)

2.4 Block Diagram

Refer to Appendix C - Block Diagram

2.5 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI/TIA/EIA-603 and ANSI C63.4-2003. Radiated emissions tests were performed at a distance of 3 metres from the EUT. OET Bulletin 65 dated June 2001 was used for reference.

2.6 Test Facility

2.6.1 General

Measurements were performed at EMC Technologies open area test site (OATS) situated at Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia. and EMC Technologies' laboratory in Tullamarine, Victoria Australia.

The above sites have been accepted for testing by the Federal Communications Commission (FCC), **FCC Registration Number 90560**.

EMC Technologies open area test site (OATS) has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional). **Industry Canada File Number, IC 4161**.



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RESULTS

3.0 PEAK POWER OUTPUT MEASUREMENTS

Testing was performed in accordance with the requirements of FCC Part 24.232(b), FCC Part 22.913.

Measurements were performed while the transmitter continuously transmitted.

The transmitter output was connected to the spectrum analyser via a calibrated power divider in peak hold mode.

The resolution bandwidth of 1 MHz and the video bandwidth of 1 MHz were utilised.

3.1 PCS 850 MHz

Channel	Frequency MHz	Power Measured dBm	Power Measured Watts	Power Limit Watts	Power Plots
Low	824.2	31.34	1.363	2.0	Appendix L1
Middle	836.4	31.54	1.426	2.0	Appendix L1
High	848.8	31.53	1.424	2.0	Appendix L1

The specification limit for Part 24.232(b) is 2Watts and Part 22.913 is 7Watts.

3.2 PCS 1900 MHz

Channel	Frequency MHz	Power Measured dBm	Power Measured Watts	Power Limit Watts	Result
Low	1850.2	28.6	0.723	2.0	Appendix L2
Middle	1880	28.2	0.660	2.0	Appendix L2
High	1909.8	29.5	0.715	2.0	Appendix L2

The specification limit for Part 24.232(b) is 2Watts and Part 22.913 is 7Watts.

Variation by +/- 15% of the supply voltage (AC adaptor), in accordance with Section 15.31(e), did not vary the output power observed.

A substitution measurement was used to check the output power measured. The transmitter was replaced with the signal generator. The signal generator output level was increased until the same level on the spectrum analyser was observed. The measurement observed is the signal generator output level in dBm and corrected with the cable loss and the attenuation used. The results were within ± 1.0 dB of the reported levels above.



4.0 OUT of BAND EMISSIONS (Spurious and Harmonics)

4.1 Test Procedure

Measurements were made at the open area test site. 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 subdivided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable, and by varying the antenna height. Each significant peak was investigated with the Quasi-Peak/Average Detectors. The software for cable losses automatically corrected the measurement data for each frequency range, 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 Calculation of field strength

The 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 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 loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example 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:

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

The Field Strength result is converted into dBm.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (1000 MHz – 18000 MHz) \pm 4.1 dB
- (30 MHz – 1000 MHz) \pm 3.7 dB



4.3 Radiated Emissions Results

Testing was performed in accordance with the requirements of FCC Part 24.238 and FCC Part 22.917(a).

As per 24.238(a) – The limits of any emissions outside the frequency band shall be attenuated by at least $43 + 10\log(P)$ dB, where P is the measured transmitter output power.

4.3.1 Frequency Band: 1 – 20 GHz

Calibrated EMCO 3115 and EMCO 3116 Horn antennas were used for measurements between 1 to 20 GHz.

The resolution bandwidth of 1 MHz and the video bandwidth of 1 MHz were utilised

All measurements above 1 GHz were initially made over a distance of 3 metres. This was decreased to 1.0 metre as the emission levels from the device were very low.

4.3.1.1 PCS 850 MHz

Testing was performed while transmitter continuously transmitted on a low (824.2 MHz), middle (836.4 MHz) and high (848.8 MHz) frequency channel. Harmonics related to the transmitter are reported below.

Low Channel – 824.2 MHz

Frequency MHz	Antenna Polarization	Level dBm	Limit dBm	Result
824.20	Fundamental	31.3	-	-
1648.4	Vertical/Horizontal	-26	-13	Pass
2472.6	Vertical/Horizontal	-27	-13	Pass
3296.8	Vertical/Horizontal	-40	-13	Pass
4121.0	Vertical/Horizontal	-38	-13	Pass
4945.2	Vertical/Horizontal	-39	-13	Pass
5769.4	Vertical/Horizontal	-37	-13	Pass
6593.6	Vertical/Horizontal	low	-13	Pass
7417.8	Vertical/Horizontal	low	-13	Pass
8242.0	Vertical/Horizontal	low	-13	Pass

Middle Channel – 836.6 MHz

Frequency MHz	Antenna Polarization	Level dBm	Limit dBm	Result
836.6	Fundamental	31.5	-	-
1673.2	Vertical/Horizontal	-27	-13	Pass
2509.8	Vertical/Horizontal	-26	-13	Pass
3346.4	Vertical/Horizontal	-42	-13	Pass
4183.0	Vertical/Horizontal	-40	-13	Pass
5019.6	Vertical/Horizontal	-39	-13	Pass
5856.2	Vertical/Horizontal	-36	-13	Pass
6692.8	Vertical/Horizontal	low	-13	Pass
7529.4	Vertical/Horizontal	low	-13	Pass
8366.0	Vertical/Horizontal	low	-13	Pass



Middle Channel – 1880 MHz

Frequency MHz	Antenna Polarization	Level dBm	Limit dBm	Result
1880	Fundamental	28.2	-	-
3760	Vertical/Horizontal	-24	-13	Pass
5640	Vertical/Horizontal	-25	-13	Pass
7520	Vertical/Horizontal	-40	-13	Pass
9400	Vertical/Horizontal	-39	-13	Pass
11280	Vertical/Horizontal	-41	-13	Pass
13160	Vertical/Horizontal	-38	-13	Pass
15040	Vertical/Horizontal	-39	-13	Pass
16920	Vertical/Horizontal	low	-13	Pass
18800	Vertical/Horizontal	low	-13	Pass

High Channel – 1909.8 MHz

Frequency MHz	Antenna Polarization	Level dBm	Limit dBm	Result
1909.8	Fundamental	28.5	-	-
3819.6	Vertical/Horizontal	-25	-13	Pass
5729.4	Vertical/Horizontal	-27	-13	Pass
7639.2	Vertical/Horizontal	-40	-13	Pass
9549.0	Vertical/Horizontal	-40	-13	Pass
11458.8	Vertical/Horizontal	-42	-13	Pass
13368.6	Vertical/Horizontal	-39	-13	Pass
15278.4	Vertical/Horizontal	low	-13	Pass
17188.2	Vertical/Horizontal	low	-13	Pass
19098	Vertical/Horizontal	low	-13	Pass

Harmonics were recorded within 11 dB of the FCC limits. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

A substitution measurement was used to check the harmonics measured. The transmitter was replaced with a horn antenna that was connected to the signal generator. The signal generator output level was increased until the same level on the spectrum analyser was observed. The measurement observed is the signal generator output level in dBm less any loss/gain due to the coax cable and the antenna. The results were within ± 3.1 dB of the reported levels above.

Result: Complies



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4.3.2 Frequency Band: 30 - 1000 MHz

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.

Testing was performed at 3m distance. The resolution bandwidth of 1 MHz and the video bandwidth of 1 MHz were utilised.

No spurious emissions were recorded within 30 dB of the FCC limit (the limit is -13dBm). The measurement uncertainty in this band was ± 3.7 dB. Refer to Appendix M (graphs 3 & 4) for plots.

Result: Complies.

4.3.3 Frequency Band: 0.009 - 30 MHz

A calibrated Loop antenna was used. Testing was performed at 3m distance. The resolution bandwidth of 1 MHz and the video bandwidth of 1 MHz were utilised.

No spurious emissions were recorded within 30 dB of the FCC limit (the limit is -13dBm). The measurement uncertainty in this band was ± 3.7 dB.

Result: Complies.



4.4 Band Edge Measurements

Testing was performed in accordance with the requirements of FCC Part 24.238 and FCC Part 22.917(a).

4.4.1 PCS 850 MHz

Refer to Appendix I1 for Band Edge plots

NB: D1 is the limit line – “any emissions outside the frequency band shall be attenuated by at least $43 + 10\log(P)$ dB”

Result: Complies.

4.4.2 PCS 1900 MHz

Refer to Appendix I2 for Band Edge plots

NB: D1 is the limit line – “any emissions outside the frequency band shall be attenuated by at least $43 + 10\log(P)$ dB”

Result: Complies.

4.5 Antenna Conducted RF Measurements (9kHz to 10th Harmonic)

Testing was performed in accordance with the requirements of FCC Part 24.238 and FCC Part 22.917(a).

Measurements were performed while the transmitter continuously transmitted.

The transmitter output was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised.

Testing was performed in the two operating frequency ranges. The transmitter continuously transmitted at highest output power on a low, middle and high frequency channel for each range. The transmitter also tested at low output power for each range.

4.5.1 PCS 850 MHz

Refer to Appendix K1 for antenna conducted RF plots. Harmonics or spurious emissions were below the FCC limits (the limit is -13dBm).

Result: Complies.

4.5.2 PCS 1900 MHz

Refer to Appendix K2 for antenna conducted RF plots. Harmonics or spurious emissions were below the FCC limits (the limit is -13dBm).

Result: Complies.



5.0 CONDUCTED EMISSION MEASUREMENTS

5.1 Test Procedure

The arrangement specified in ANSI/TIA/EIA-603 and ANSI C63.4-2003 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2-1996 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

5.2 Peak Maximising Procedure

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

5.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$VEMI = VRx + LBPF$$

Where: **VEMI** = the Measured EMI voltage in dB μ V to be compared to the limit.
VRx = the Voltage in dB μ V read directly at the EMI receiver.
LBPF = the loss in dB of the cables and the Limiter and Pass Filter.

5.4 Plotting of Conducted Emission Measurement Data

The measurement data pertaining to each frequency sub-range were then concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph were subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

5.5 Results of Conducted Emission Measurements (AC Mains Ports)

The worst case conducted EMI complied with both quasi peak and average limits by margins of > 10 dB. The measurement uncertainty was ± 2.0 dB. Refer to Appendix M (graphs 1 & 2) for plots.

Result: Complies

6.0 FREQUENCY STABILITY

Refer to original filing - RFI Ltd Test Report Serial No. RFI/MPTB1/RP44962JD01A.



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7.0 CHANNEL BANDWIDTH

Testing was performed in the two operating frequency ranges: 824.0 – 850.0 MHz and 1850 -2 – 1910 MHz. The transmitter continuously transmitted at maximum output power on a low, middle and high frequency channel for each band.

7.1 PCS 850 MHz

The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised

Channel	Frequency MHz	Bandwidth kHz	26 dB Bandwidth Plots
Low	824.2	336.7	Appendix J1
Middle	836.6	337.9	Appendix J1
High	848.8	332.7	Appendix J1

7.2 PCS 1900 MHz

The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised

Channel	Frequency MHz	Bandwidth kHz	26 dB Bandwidth Plots
Low	1850.2	336.7	Appendix J2
Middle	1880	328.7	Appendix J2
High	1909.8	332.7	Appendix J2

8.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

The Personal Communications Services operating in the 824 – 850 MHz and 1850 - 1910 MHz bands are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

In accordance with this section and also section 2.1091 this device has been defined as a portable device and SAR testing was performed in accordance with OET Bulletin 65 and reported under EMC Technologies M050436. The highest SAR value of 0.761 mW/g complies with the FCC human exposure requirements of 47 CFR 2.1093 (d).

Results: Complies



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9.0 COMPLIANCE STATEMENT

The Mobile Payment Terminal, Model: K78-205, tested on behalf of Keycorp Limited, **complies** with the requirements of 47 CFR, Part 24 Subpart E – Broadband PCS and Part 22 Subpart H - Cellular Radiotelephone Service.

The test sample also complied with the Industry Canada RSS-132 Issue 1, RSS-133 Issue 2 and the RF exposure requirements of RSS-102.

Results were as follows:

FCC Part 24 Subpart E Clauses	FCC Part 22 Subpart H Clauses	Industry Canada RSS-132 Clauses	Industry Canada RSS-133 Clauses	Test Performed	Result
24.232	22.913	4.4	6.2	Power Limits	Complies
24.235	22.355	4.3	7.0	Frequency Stability	Complies
24.238	22.917	4.5	6.3	Emission Limits	Complies

Note: Refer to M050436 (FCC SAR Report) for details of SAR Compliance.



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TEST REPORT APPENDICES

- APPENDIX A: MEASUREMENT INSTRUMENT DETAILS**
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- APPENDIX E: PARTS LIST (BOM)**
- APPENDIX F: TECHNICAL OPERATION DESCRIPTION**
- APPENDIX G: FCC LABELLING DETAILS**
- APPENDIX H: USER MANUAL**
- APPENDIX I: BANDEDGE PLOTS**
- APPENDIX J: CHANNEL BANDWIDTH PLOTS**
- APPENDIX K: CONDUCTED RF PLOTS**
- APPENDIX L: PEAK POWER PLOTS**
- APPENDIX M: RADIATED AND CONDUCTED EMISSIONS PLOTS**



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