

Replacement Test Report for T50915_F

EMI TEST REPORT for CERTIFICATION of FCC PART 15.225 & FCC PART 15.207 TRANSMITTER

FCC ID: Q47-MCROEM
Manufacturer: ERG Transit Systems
Test Sample: Contactless Smart Card Readers
Model: MCR_OEM
Serial No's: 14.7456MHz Unit: Antenna - 0350435, Main Board - 04273566 and
22.1184MHz Unit: Antenna - 05129574, Main Board - 0504009

Date: 20th October 2005

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, interferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.



**NATA Accredited
Laboratory
Number: 5292**

The tests, calibrations or measurements covered by this document have been performed in accordance with NATA requirements which include the requirements of ISO/IEC 17025 and are traceable to national standards of measurement. This document shall not be reproduced, except in full.

EMI TEST REPORT FOR CERTIFICATION
FOR
CERTIFICATION OF FCC Part 15.225 & FCC PART 15.207 TRANSMITTER

FCC ID: Q47-MCROEM
EMC Technologies Report No. T50915R_F
Date: 20th October 2005

CONTENTS

1. SUMMARY of TEST RESULTS

2. GENERAL INFORMATION

3. CONDUCTED EMI RESULTS

4. RADIATED EMI RESULTS

5. FREQUENCY TOLERANCE

6. CONCLUSION

APPENDIX A. MEASUREMENT INSTRUMENTATION DETAILS

APPENDIX B. PHOTOGRAPHS TEST SETUP

APPENDIX C. PHOTOGRAPHS TEST SAMPLE (EXTERIOR)

APPENDIX D. PHOTOGRAPHS TEST SAMPLE (INTERIOR)

APPENDIX E. TEST SAMPLE SCHEMATICS

APPENDIX F. TEST SAMPLE PCB LAYOUTS

APPENDIX G. LABELLING – LOCATION

APPENDIX H. GRAPHS of EMI MEASUREMENT

APPENDIX I. INSTALLATION MANUAL

APPENDIX J. OPERATION DESCRIPTION

APPENDIX K. BLOCK DIAGRAM

**EMI TEST REPORT FOR CERTIFICATION
OF
FCC PART 15.225 & FCC PART 15.207 TRANSMITTER**

Report Number: T50915R_F

Test Sample Name: Contactless Smart Card Readers

Model Number: MCR_OEM

Serial Number's: 14.7456MHz Unit: Antenna - 03504035, Main Board - 04273566 and 22.1184MHz Unit: Antenna - 05129574, Main Board - 0504009

FCC ID: Q47-MCROEM

Manufacturer: ERG Transit Systems

Tested For: ERG Transit Systems
Address: 247 Balcatta Road
Balcatta WA 6021

Phone: (08) 9273 1100
Fax: (08) 9273 1570
Responsible Party: Mr Dan Zorde/Mr Gino Bertino

Test Standards: **FCC Part 15.225 Intentional Radiators**
FCC Part 15.207 Conducted Limits
ANSI C63.4:2003
OET Bulletin No. 65

Test Dates: 12/10/05, 17/10/05, 18/10/05, 19/10/05 and 20/10/05

Testing Officers:



Bruce Holdsworth



Jodie Foyle



Christian Kai

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 Signature:



Les Dickenson
Branch Manager
EMC Technologies Pty Ltd

Issued by EMC Technologies Pty Ltd, Unit 3/87 Station Road, Seven Hills, NSW, 2147, Australia.
Phone: +61 2 9624 2777 Fax: +61 2 9838 4050

**EMI TEST REPORT FOR CERTIFICATION
of
FCC PART 15.225 & FCC PART 15.207 TRANSMITTER
on the Contactless Smart Card Readers**

1. SUMMARY of RESULTS

This report details the results of EMI tests and measurements performed on the Contactless Smart Card Readers, Model: MCR_OEM, in accordance with the Federal Communications Commission (FCC) regulations as detailed in Title 47 CFR, Part 15 Rules for intentional radiators. All results are detailed in this report.

Part 15.31e

Amplitude stability with supply variation: Complied

Part 15.207

Conducted Emissions: Complied

Part 15.225 a, b & c

Carrier Signal Field Strength 13.110 – 14.010MHz: Complied

Part 15.225 d (15.209)

Field Strength Outside 13.110 – 14.010MHz: Complied

Part 15.225 e

Frequency Tolerance: Complied

2. GENERAL INFORMATION

2.1 General Description of Test Sample

Manufacturer	:	ERG Transit Systems
Test Sample	:	Contactless Smart Card Readers
Model	:	MCR_OEM
Serial Numbers	:	14.7456MHz Unit: Antenna - 03504035, Main Board – 04273566 and 22.1184MHz Unit: Antenna - 05129574, Main Board - 0504009
FCC ID	:	Q47-MCR_OEM
Power Supply	:	Lishin International Enterprise Corp, Model: LSE9901B1260, S/N: A30502139466
Equipment Type	:	Intentional Radiator

2.2 Test Sample Description

The MCR is a multiprotocol card reader that is used to read and write data to Type A and Type B contactless smart cards. The MCR is used in a range of ERG ticketing equipment in the transport industry. For further information please refer to ERG document DPG-00605.

2.3 Technical Specifications and System Overview

Crystal Frequency(s)	:	10.00 MHz, 13.56 MHz, 14.7456 MHz or 22.1184 MHz
Microprocessor	:	Mitsubishi M16C
Case Style & Material	:	Not applicable
Power Supply	:	12VDC, 200MA
Real Clock Time	:	Not applicable

Refer to Appendix I Installation Manual.

2.4 EUT Configurations

For testing the MCR is loaded with software enabling it to be operated in a standalone manner as a module only. The MCR is operating with a processor frequency of 14.7456MHz or 22.1184MHz, a SAM frequency of 10.0000MHz and an RF frequency of 13.56MHz.

Testing with the maximum population option (as per the operational description document DPG-00605) will allow the MCR to be built with lesser features, for cost saving, without the need to retest.

The EUT was tested with a Class B compliant PC with the following details:

Computer

Motherboard:	E210882, Dell, S/N DS/N CN-ON 6381 70821-4BM-A231
Processor:	Pentium (R) CPU 2.8 GHz
Case:	CN-0T6952-70821-4BR-69XL
Power Supply:	115V/230V, S/N CN-0k2583-17972-4BJ-V8VX
Hard Drive:	P/N OT962MITAC

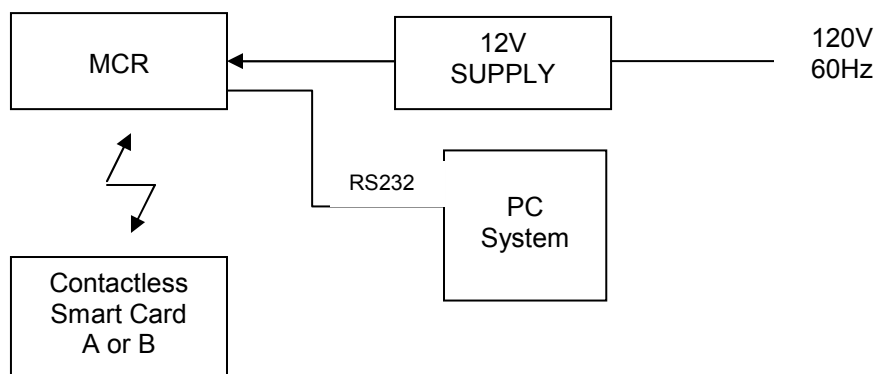
Peripherals

Mouse:	EUT
Keyboard:	Dell, Model: OY3668, S/N: 445011378
Monitor:	Tatung, Model: CM15VDE, S/N: 76490818 Dell, Model: E773S, S/N: 00551B-02

2.5 Test Sample Support Equipment

12Vdc Power Supply.

2.6 Test Sample Block Diagram



2.7 EUT Operation Conditions

Two units were tested as the unit can be supplied with two different processor clocks (14.7456 & 22.1184 MHz).

Prescreen tests were further performed to find the worst case operating mode (ie. with and without smart card). The EUT was tested with a card for radiated emissions and without a card for conducted emissions as this provided the highest emissions.

2.8 Modifications

No modifications were performed.

2.9 Test Procedure

Radiated Emissions measurements were performed in accordance with the procedures of ANSI C63.4:2003. The measurement distance for radiated emissions was 3 metres from the EUT for range 9kHz-1000MHz.

2.10 Test Facility

2.10.1 General

Conducted Emission measurements of fundamental frequency 13.56 MHz were performed at EMC Technologies Laboratory in Seven Hills, New South Wales, Australia. Radiated Emission measurements in the ranges 9kHz-1000MHz were performed at EMC Technologies' open area test site (OATS) situated at Upper Colo, NSW, Australia.

The above sites have been fully described in a report submitted to the FCC office, and accepted in a letter dated November 27th 2002, **FCC Registration number is 90561.**

2.10.2 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 18GHz 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 Institute (NMI) 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).

2.11 Units of Measurements

2.11.1 Conducted Emissions

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

2.11.2 Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dB μ V/m). The measurement distance was 3 metres from the EUT for ranges 9kHz-1000MHz.

2.12 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 Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurement Institute. The reference antenna calibration was performed by NMI 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 of this report.

2.13 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. CONDUCTED EMISSION MEASUREMENTS

3.1 Test Procedure

The arrangement specified in 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 C63.2-1987 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 duration peaks were captured.

3.2 Peak Maximizing Procedure

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 was then invoked to measure the actual Quasi-Peak level of the most significant peaks which were detected.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. Peaks that were greater than 20dB below the limit were not measured. For each numbered peak the frequency, peak field strength, Quasi-peak field strength, Average field strength and the margin relative to the limit in dB is listed. A negative margin is the level below the limit.

3.3 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:

$$V_{EMI} = V_{Rx} + L_{BPF}$$

Where:

V_{EMI} = The Measured EMI voltage in dB μ V to be compared to the limit.
 V_{Rx} = The Voltage in dB μ V read directly at the EMI receiver.
 L_{BPF} = The insertion loss in dB of the cables and the Limiter and Pass Filter.

3.4 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 was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graphs.

3.5 Conducted EMI Results

3.5.1 22.1184MHz, Antenna Connected:

Frequency MHz	Line	Measured QP Value dB μ V	QP Limit dB μ V	Δ QP $\pm$ dB	Measured Av. Value dB μ V	AV Limit dB μ V	Δ AV $\pm$ dB
13.56	Active	72.1	60.0	12.1	72.2	50.0	22.2*
13.56	Neutral	70.4	60.0	10.4	70.5	50.0	20.5*

* Fundamental Frequency of Transmitter are excluded from the conducted emissions results.

Note: The transmit carrier was excluded from the test with the antenna connected. The highest emission was 27.12MHz on the Active line, which was measured 21.2dB below the Quasi-peak and 11.2dB below the Average limits.

The measurement uncertainty for conducted emissions is ± 1.8 dB.

Refer to Appendix H, Graphs 1 and 2.

3.5.2 14.7456MHz, Antenna Connected:

Frequency MHz	Line	Measured QP Value dB μ V	QP Limit dB μ V	Δ QP $\pm$ dB	Measured Av. Value dB μ V	AV Limit dB μ V	Δ AV $\pm$ dB
13.56	Active	73.5	60.0	13.5	73.7	50.0	23.7*
13.56	Neutral	72.0	60.0	12.0	72.2	50.0	22.2*
27.12	Active	48.0	60.0	-12.0	48.1	50.0	-1.9
27.12	Neutral	47.7	60.0	-12.3	47.8	50.0	-2.2

* Fundamental Frequency of Transmitter are excluded from the conducted emissions results.

Note: The transmit carrier was excluded from the test with the antenna connected. The highest emission was 27.12MHz on the Active line, which was measured 12.0dB below the Quasi-peak and 1.9dB below the Average limits.

The measurement uncertainty for conducted emissions is ± 1.8 dB.

Refer to Appendix H, Graphs 3 and 4.

3.5.3 14.7456MHz, Antenna Disconnected & Terminated (1k Ω):

Frequency MHz	Line	Measured QP Value dB μ V	QP Limit dB μ V	Δ QP $\pm$ dB	Measured Av. Value dB μ V	AV Limit dB μ V	Δ AV $\pm$ dB
13.56	Active	44.8	60.0	-15.2	44.8	50.0	-5.2
13.56	Neutral	44.8	60.0	-15.2	44.8	50.0	-5.2

The highest emission was 13.56MHz on the Active line, which was measured 15.2dB below the Quasi-peak and 5.2dB below the Average limits.

The measurement uncertainty for conducted emissions is ± 1.8 dB.

Refer to Appendix H, Graphs 5 and 6.

3.5.4 22.1184MHz, Antenna Disconnected & Terminated (1k Ω):

Frequency MHz	Line	Measured QP Value dB μ V	QP Limit dB μ V	Δ QP $\pm$ dB	Measured Av. Value dB μ V	AV Limit dB μ V	Δ AV $\pm$ dB
13.56	Neutral	43.8	60.0	-16.2	43.5	50.0	-6.5
13.56	Active	43.6	60.0	-16.4	43.3	50.0	-6.7

The highest emission was 13.56MHz on the Neutral line, which was measured 16.2dB below the Quasi-peak and 6.5dB below the Average limits.

The measurement uncertainty for conducted emissions is ± 1.8 dB.

Refer to Appendix H, Graphs 7 and 8.

3.6 Results of Conducted Emission Measurement

The EUT complied with the limits of FCC Rule Part 15 Subpart C – Intentional Radiators. Emissions at the fundamental frequency of 13.56 MHz are excluded from the results with the antenna replaced with a 1k Ω load.

4. RADIATED EMISSION MEASUREMENTS – 9 kHz to 1 GHz

4.1 Frequency Range of Radiated Measurements

The highest frequency of the EUT is 22MHz (refer to section 2.1 of this report).

Highest frequency generated or used in the device or on which the device operates or tunes [MHz]	Upper frequency of measurement range [MHz]
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	10 th harmonic of the highest frequency or 40 GHz, whichever is lower

Frequencies above 1 GHz: Average trace taken (RBW 1MHz, VBW 100 kHz)

According to the table in FCC Part 15, Section 15.33, the radiated emissions measurement were performed from 9kHz to 1000MHz.

4.2 Test Procedure

Radiated emissions measurements were performed in accordance with the procedures of ANSI C63.4:2003 Radiated emission tests from 9 kHz to 1GHz were performed at the Open Area Test Site (OATS) an EUT distance of 3 metres. OET Bulletin 65 was used for reference.

The EUT was placed on a timber table 0.8m above an inground and operated in accordance with section 2 of this report. The EMI Receiver was operated under software control via the PC Controller.

4.2.1 0.009 – 30 MHz Range

The 0.009 MHz to 30 MHz 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. The EUT was slowly rotated with the Peak Detector set to Max-Hold. The receive loop antenna was set to 1m above the ground plane with the Quasi-Peak detector ON. 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. The orientation of the receive loop antenna was varied to ensure that the emissions were maximised. The EUT was further rotated through three orthogonal directions to ensure worst case emissions are measured. The carrier test was performed at the worst-case operation voltage.

4.2.2 30 – 1000 MHz Range

The 30 MHz to 1000 MHz 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. The EUT was slowly rotated with the Peak Detector set to Max-Hold. The EUT was further rotated through three orthogonal directions to ensure worst case emissions are measured. This was performed for two receiver antenna heights. Each significant peak was then investigated and maximised by rotating the turntable and scanning the height of the receiver antenna between 1 to 4 metres with the Quasi-Peak detector ON. 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 receive antenna polarisation.

4.3 Plotting of Measurement Data for Radiated Emissions

4.3.1 0.009 – 30 MHz Range

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges over the range 0.009 – 30 MHz. The fundamental frequency was measured at the OATS. The worst case radiated EMI peak measurements as recorded using the Max-Hold data are presented as the **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 “#” symbol.

The highest recorded EMI signals are shown on the Peaks List on the bottom right hand side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, Quasi-peak field strength, limit 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 MAX-HOLD trace has been stored. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level higher than the peak level.

4.3.2 30 – 1000 MHz

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 “#” symbol.

The highest recorded EMI signals are shown on the Peaks List on the bottom right hand side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, Quasi-peak field strength, limit 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 MAX-HOLD trace has been stored. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level higher than the peak level.

4.4 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:

Where:

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

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 (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)

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 1.9dB while the preamplifier gain is 20dB.

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

4.5 Radiated Field Strength Measurement Results – Section 15.225

4.5.1 14.7456MHz:

4.5.1.1 13.56 MHz Carrier Field Strength Measurement

Frequency MHz	Peak Level dB μ V/m	Limit @ 3m dB μ V/m	Result $\pm$ dB
13.56	51.1	124.0	-73.6

The mains supply was varied as per Section 15.31e between 100V 60 Hz to 138V 60Hz to determine if the carrier amplitude varies with supply voltage. No variation was recorded. The test was performed at 120V 60Hz.

Complied with a margin of greater than 20dB with Section 15.225 Subpart a, b & c.
The measurement uncertainty was ± 4.6 dB. **Refer to Appendix H, Graph 10.**

4.5.1.2 9 kHz to 30 MHz Field Strength Spurious Emissions

Complied with a margin of greater than 20dB with Section 15.225 Supart d (15.209).
The measurement uncertainty was ± 4.6 dB. **Refer to Appendix H, Graph 9.**

4.5.1.3 30 - 1000MHz Field Strength Spurious Emissions –Section 15.225 d (15.209)

Frequency (MHz)	Rx Antenna Polarisation	Quasi Peak Level (dB μ V/m)	Limit @ 3m (dB μ V/m)	Δ Result (dB)
81.38	Vertical	35.4	40.0	-4.6
366.15	Vertical	40.5	46.0	-5.5
81.37	Horizontal	31.0	40.0	-9.0
40.69	Horizontal	30.2	40.0	-9.8
393.28	Vertical	36.1	46.0	-9.9

Summary of Results

The highest radiated spurious emission was 4.6dB below the limit at 81.38MHz for Vertical Polarisation. The highest 16 point on both Vertical and Horizontal are reported on the graphs Appendix I. The measurement uncertainty was ± 4.6 dB.

Refer to Appendix H, Graphs 11 and 12.

4.5.2 22.1184MHz:**4.5.2.1 13.56 MHz Carrier Field Strength Measurement**

Frequency MHz	Peak Level dB μ V/m	Limit @ 3m dB μ V/m	Result $\pm$ dB
13.56	51.0	124.0	-76.1

The mains supply was varied as per Section 15.31e between 100V 60 Hz to 138V 60Hz to determine if the carrier amplitude varies with supply voltage. No variation was recorded. The test was performed at 120V 60Hz.

Complied with a margin of greater than 20dB with Section 15.225 Subpart a, b & c. The measurement uncertainty was ± 4.6 dB. **Refer to Appendix H, Graph 14.**

4.5.2.2 9 kHz to 30 MHz Field Strength Spurious Emissions

Complied with a margin of greater than 20dB with Section 15.225 Supart d (15.209). The measurement uncertainty was ± 4.6 dB. **Refer to Appendix H, Graph 13.**

4.5.2.3 30 - 1000MHz Field Strength Spurious Emissions –Section 15.225 d (15.209)

Frequency (MHz)	Rx Antenna Polarisation	Quasi Peak Level (dB μ V/m)	Limit @ 3m (dB μ V/m)	Δ Result (dB)
81.37	Vertical	32.2	40.0	-7.8
203.42	Horizontal	34.7	43.5	-8.8
81.37	Horizontal	31.1	40.0	-8.9

Summary of Results

The highest radiated spurious emission was 7.8dB below the limit at 81.37MHz for Vertical Polarisation. The highest 16 point on both Vertical and Horizontal are reported on the graphs Appendix I. The measurement uncertainty was ± 4.6 dB. **Refer to Appendix H, Graphs 15 and 16.**

5.0 FREQUENCY TOLERANCE (FCC Part 15 Sections 15.225e)

The frequency stability of the unit was verified under abnormal operating supply voltage and temperature.

FCC Sub Part C Section 15.225 e.

The mains supply was lowered from 120V 60Hz to 100V (85% of nominal supply) and maintained until the frequency was stable. No change in frequency was recorded.

The mains supply was then increased from 120V 60Hz to 138V (115% of nominal supply) and maintained until the frequency was stable. No change in frequency was recorded.

The ambient temperature with a supply voltage of 120V 60Hz was taken from 20°C to – 20° and maintained until the EUT temperature had stabilised. The frequency of the carrier was observed during the test. No change in operating frequency was recorded.

The ambient temperature with a supply voltage of 120V 60Hz was taken from 20°C to 50° and maintained until the EUT temperature had stabilised. The frequency of the carrier was observed during the test. No change in operating frequency was recorded.

6. CONCLUSION

The Contactless Smart Card Reader, Model: MCR_OEM, FCC ID: Q47-MCROEM, complied with the requirements of FCC Part 15 Rules for internal radiator when tested in accordance with FCC Part 15.31e, 15.207 and 15.225.

Part 15.31e

Amplitude stability with supply variation: Complied

Part 15.207

Conducted Emissions: Complied

Part 15.225 a, b & c

Carrier Signal Field Strength 13.110 – 14.010MHz: Complied

Part 15.225 d (15.209)

Field Strength Outside 13.110 – 14.010MHz: Complied

Part 15.225 e

Frequency Tolerance: Complied

APPENDIX A

MEASUREMENT INSTRUMENTATION DETAILS

SUBMITTED AS ATTACHMENT

APPENDIX B
PHOTOGRAPHS of TEST SETUP

SUBMITTED AS ATTACHMENT

APPENDIX C
PHOTOGRAPHS of TEST SAMPLE (EXTERIOR)

SUBMITTED AS ATTACHMENT

APPENDIX D
PHOTOGRAPHS of TEST SAMPLE (INTERIOR)

SUBMITTED AS ATTACHMENT

APPENDIX E
TEST SAMPLE SCHEMATICS

SUBMITTED AS ATTACHMENT

APPENDIX F
TEST SAMPLE PCB LAYOUTS

SUBMITTED AS ATTACHMENT

APPENDIX G
FCC ID LABELLING - LOCATION

SUBMITTED AS ATTACHMENT

APPENDIX H

GRAPHS OF EMI MEASUREMENTS

SUBMITTED AS ATTACHMENT

APPENDIX I
INSTALLATION MANUAL

SUBMITTED AS ATTACHMENT

APPENDIX J
OPERATION DESCRIPTION

SUBMITTED AS ATTACHMENT

APPENDIX K
BLOCK DIAGRAM

SUBMITTED AS ATTACHMENT