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

FCC ID:	Q47-MCR500
Manufacturer:	SCI-SANMINA
Test Sample:	3 V PC Card Type II + with Contactless Reader and 2xSAMS
Model:	MCR500
Serial No:	None
Date:	8th March 2004

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.

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

FCC ID: Q47-MCR500
EMC Technologies Report No. T40115F
Date: 3rd February 2004

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

Report Number: T40115F

Test Sample Name: 3V PC Card Type II + with Contactless Reader and 2xSAMS

Model Number: MCR500
Serial Number: None
Part Number: 11081
FCC ID: Q47-MCR500

Manufacturer: SCI-SANMINA
249 Balcatta Road
Balcatta WA 6021

Tested for: ERG
247 Balcatta Road
Balcatta WA 6021
Phone: 08 9273 1100
Fax: 08 9273 1570
Responsible Party: Mike Hanssen

Test Standards: **FCC Part 15.225 Intentional Radiators**
FCC Part 15.207 Conducted Limits
ANSI C63.4:1992
OET Bulletin No. 63

Test Dates: 21-01-2004, 27-01-2004, 29-01-2004, 30-01-2004, 03-02-2004 and 05-03-2004

Testing Officers:

Bruce Holdsworth **Kumar Thambiaiah**

Dean Wright

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

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EMI TEST REPORT FOR CERTIFICATION of FCC PART 15.225 & FCC PART 15.207 TRANSMITTER on the 3V PC Card Type II + with Contactless Reader and 2xSAMS

1. SUMMARY of RESULTS

This report details the results of EMI tests and measurements performed on the 3V PC Card Type II+ with Contactless Reader and 2xSAMS , Model: MCR500, 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. The EUT complied with the requirements for fundamental frequencies and spurious emissions of Part 15.225 and conducted emissions of Part 15.207.

Part 15.225	Carrier Signal Field Strength:	Complied, margin of 57.4 dB.
	Radiated Emissions (Section 15.209):	Complied, margin of 2.3 dB *.
	Frequency Tolerance:	Complied.
Part 15.207	Conducted Emissions:	Complied, margin of 8.9 dB.

* This result falls within the measurement uncertainty.

2. GENERAL INFORMATION

2.1 General Description of Test Sample

Manufacturer	:	SCI-SANMINA
Test Sample	:	3V PC Card Type II+with Contactless Reader and 2xSAMS
Model	:	MCR500
Serial No	:	None
FCC ID	:	Q47-MCR500
Equipment Type	:	Intentional radiator
Accessories	:	HP 5550 (iPaq) and PC Card expansion pack
Power Supply	:	Phihong Model PSC 10S-050

2.2 Test Sample Functional Description

The MCR500 is a plug in PC Card, it has an EPLD which asynchronously decodes signals from the iPaq PC Card socket. The iPaq runs ERG drivers and software on a Windows CE Pocket PC 2003 platform. The configuration is as per deployment, except typically additional moulds and leather cases will be provided for field use.

2.3 Technical Specifications and System Overview

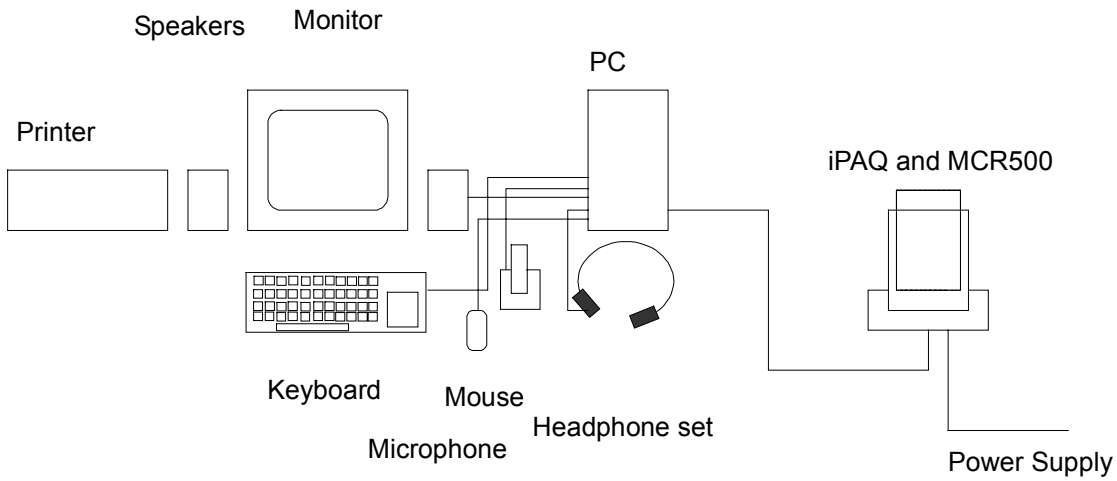
Crystal frequency(s):	14.7428 MHz and 13.56 MHz
Microprocessor:	iPaq has a 400MHz Xscale
Input supply:	3.3V, 500mA

Refer to Appendix K – Operation Instrucion, Appendix L – User manual and Appendix M – Operational Description.

2.4 EUT Configurations

The EUT was tested as a table top unit in accordance with the guidelines contained in the relevant standard.

Refer to diagram below and Appendix B, Test Setup Photographs.



2.5 Test Sample Support Equipment

HP 5550 (iPaq) and PC Card expansion pack

2.5.1 Computer

Motherboard:	ASUS MEW
Processor:	Intel Celeron 366
Case:	A OPEN, P/N: 91.93320.004, S/N: 92119821JK
Power Supply:	A OPEN, Model: FSP250-60GTA, S/N: 02301312KS
Hard Drive:	Quantum Fireball, P/N: CR43A001, S/N: 824914519409
CD Rom:	Creative 48X, Model: BCD48SB, S/N: H229883F

2.5.2 Peripherals

Mouse:	Microsoft, Model: 92841, S/N: 04186682
Keyboard:	Cherry, Model: RS6000M, S/N: G00163176L5131
Printer:	HP Deskjet 400, S/N: SG3R1644F, FCC ID: B94C2642X
Monitor:	Tatung, Model: CM15VDE, S/N: 76490818
Speakers:	Digitor, Model: C-4198
Microphone:	Verbatim Multimedia Headset
Line Out:	Line Out Cable

2.6 Test Sample Block Diagram

Refer to Appendix G – Test Sample Block Diagram.

2.7 EUT Operation Conditions

Operation condition during testing: Place provided contactless card on MCR500 antenna and run EMCtest software from menu by pressing the start button. Two SAM's have been prior fitted for testing. The software will indicate failures if they occur.

2.8 Modifications

No modifications were performed.

2.9 Test Procedure

Radiated Emissions measurements were performed in accordance with the procedures of ANSI C63.4:1992. The measurement distance for radiated emissions was 10 metres from the EUT for ranges: 30-1000MHz and 3 metres from the EUT for the range: 9kHz – 30MHz.

2.10 Test Facility

2.10.1 General

Radiated Emission measurements of fundamental frequency 13.56 MHz (H-Field) were performed at EMC Technologies Laboratory in Castle Hill, New South Wales, Australia. Radiated Emission measurements in the ranges 9kHz – 30MHz (H-Field) and 30-1000MHz (E-Field) 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 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).

2.11 Units of Measurements

2.11.1 Conducted Emissions

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

2.11.2 Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dBμV/m). The measurement distance was 10 metres from the EUT for ranges: 30-1000MHz and 3 metres from the EUT for ranges: 9kHz-30MHz.

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 Laboratory (NML). All equipment calibration is traceable to Australia national standards at the National Measurement 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 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 C63.4-1992 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 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.

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 dBµV to be compared to the limit.
V_{Rx} = The Voltage in dBµV 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

Freq. MHz	Line	QP dBµV	QP Limit dBµV	ΔQP Limit dB	AV dBµV	AV Limit dBµV	ΔAV Limit dB
0.767	Neutral	42.3	56.0	-13.7	37.1	46.0	-8.9
3.814	Active	47.1	56.0	-8.9	28.8	46.0	-17.2
0.482	Active	39.9	56.3	-16.4	37.2	46.3	-9.1
4.110	Neutral	46.8	56.0	-9.2	29.7	46.0	-16.3
3.799	Neutral	46.5	56.0	-9.5	27.5	46.0	-18.5
4.024	Neutral	46.5	56.0	-9.5	23.5	46.0	-22.5

All measured frequencies complied with quasi-peak and average limits by margins of greater than 8.9 dB and at least 8.9 dB respectively.
The measurement uncertainty for conducted emissions is ±1.8 dB.

The measurement uncertainty for conducted emissions is ±1.8 dB

Appendix I, Graphs 1 and 2.

3.6 Results of Conducted Emission Measurement

The EUT complied with the limits of FCC Rule Part 15 Subpart B Class B for digital devices.

4. RADIATED EMISSION MEASUREMENTS – 30 MHz to 1 GHz

4.1 Test Procedure

Radiated emissions measurements were performed in accordance with the procedures of ANSI C63.4:1992 Radiated emission tests from 9 kHz to 30 MHz were performed at the Open Area Test Site (OATS) an EUT distance of 3 metres. Tests in the range 30-1000MHz were performed at an EUT distance of 10m at the Open Area Test Site (OATS). OET Bulletin 63 was used for reference.

The EUT was set up on the turntable above the ground plane and operated in accordance with section 2 of this report. The EMI Receiver was operated under software control via the PC Controller.

4.1.1 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. 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.

4.1.2 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.

4.2 Plotting of Measurement Data for Radiated Emissions

4.2.1 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, antenna height 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.

4.2.2 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 (H-Field) 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.

4.3 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 dBµV/m.
- **V** = EMI Receiver Voltage in dBµV. (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 dBµV 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 dBµV/m

4.4 Radiated Field Strength Measurement Results

4.4.1 13.56 MHz Carrier Field Strength Measurement

The fundamental field strength measurement was performed with a fully charged battery and with the mains voltage of the IPAQ Pocket PC varied between 85% and 115 % of the nominal rated supply voltage.

Frequency MHz	Peak Level dBµV/m	Limit @ 3m dBµV/m	Result ± dB
13.56	62.6	120.0	-57.4

Complied with a margin of greater than 10dB.
The measurement uncertainty was ±4.6dB. Refer to Appendix I, Graph 4.

4.4.2 9 kHz to 30 MHz Field Strength Spurious Emissions

Complied with a margin of greater than 10dB.
The measurement uncertainty was ±4.6dB. Refer to Appendix I, Graph 3.

4.4.3 30 - 1000MHz Field Strength Spurious Emissions

Frequency (MHz)	Rx Antenna Polarisation	Quasi Peak Level (dBμV/m)	Limit @ 3m (dBμV/m)	ΔResult (dB)
40.68	Vertical	37.7	40.0	-2.3
736.47	Horizontal	40.2	46.0	-5.8
803.51	Vertical	38.8	46.0	-7.2
800.25	Vertical	38.8	46.0	-7.2
792.17	Horizontal	38.5	46.0	-7.5
800.22	Horizontal	38.0	46.0	-8.0
792.18	Vertical	38.0	46.0	-8.0
840.20	Vertical	38.0	46.0	-8.0
866.94	Vertical	36.9	46.0	-9.1
870.46	Vertical	36.5	46.0	-9.5
870.45	Vertical	36.5	46.0	-9.5
40.68	Horizontal	30.4	40.0	-9.6

Summary of Results
The highest radiated spurious emission was 2.3 dB below the limit at 40.68 MHz for Vertical Antenna Polarisation. The measurement uncertainty was ±4.6dB.
Refer to Appendix I, Graphs 5 and 6.

5.0 FREQUENCY TOLERANCE

The frequency tolerance of the carrier signal was within 0.01% of the operating frequency over the temperature variation of –20degrees C to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at the temperature of 20 degrees C.
The EUT complied with the frequency tolerance of the carrier signal with a worst case of less than 0.001%.

6. CONCLUSION

The 3V PC Card Type II+ with Contactless Reader and 2xSAMS, Model: MCR500, FCC ID: Q47-MCR500, complied with the requirements of FCC Part 15 Rules for low power transmitters when tested in accordance with FCC Part 15.225 and 15.207.

Part 15.225	
Carrier Signal Field Strength:	Complied, margin of 57.4 dB.
Radiated Emissions (Section 15.209)	Complied, margin of at least 2.3 dB.
Frequency Tolerance:	Complied.
Part 15.207	
Conducted Emissions:	Complied, margin of at least 8.9 dB.

APPENDIX A

MEASUREMENT INSTRUMENTATION DETAILS

SUBMITTED AS ATTACHMENT

APPENDIX B

PHOTOGRAPHS TEST SETUP

SUBMITTED AS ATTACHMENT

APPENDIX C

PHOTOGRAPHS TEST SAMPLE (EXTERIOR)

SUBMITTED AS ATTACHMENT

APPENDIX D

PHOTOGRAPHS TEST SAMPLE (INTERIOR)

SUBMITTED AS ATTACHMENT

APPENDIX E

TEST SAMPLE SCHEMATICS

SUBMITTED AS ATTACHMENT

APPENDIX F

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SUBMITTED AS ATTACHMENT

APPENDIX G

TEST SAMPLE BLOCK DIAGRAM

SUBMITTED AS ATTACHMENT

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APPENDIX I

GRAPHS OF EMI MEASUREMENTS

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APPENDIX K

OPERATION INSTRUCTION

SUBMITTED AS ATTACHMENT

APPENDIX L

USER MANUAL

SUBMITTED AS ATTACHMENT

APPENDIX M

OPERATIONAL DESCRIPTION

SUBMITTED AS ATTACHMENT