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EMI TEST REPORT
for
CERTIFICATION to
FCC PART 24
Subpart E – Broadband PCS

FCC ID: **R2V-MWW1**

Test Sample: Tracker Can
Model: TGP79AB
Tested for: Momentum Worldwide Pty Ltd

Report Number: M040312_Cert_Tracker_Can

Issue Date: 20th April 2004

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CONTENTS

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Report Number:	M040312_Cert_Tracker_Can
Test Sample:	Tracker Can
Model:	TGP79AB
Serial:	001033000030552
Tested for:	Momentum Worldwide Pty Ltd
FCC ID:	R2V-MWW1
Equipment Type:	Intentional Radiator

Tested for:	Momentum Worldwide Pty Ltd
Address:	140 William Street Woolloomooloo, NSW 2011 Australia
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Contact:	Gregory Legg- Bagg

Test Standards:

FCC Part 24 – PERSONAL COMMUNICATIONS SERVICES
Subpart E – Broadband PCS

ANSI/TIA/EIA-603
ANSI C63.4 – 1992
OET Bulletin No. 63

Test Dates: 19th to 29th March 2004

Test Officer:

Chieu Huynh
B.Eng (Hons) Electronics

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 24 Subpart E – Broadband PCS

1.0 INTRODUCTION

EMI testing was performed on the Tracker Can, Model: TGP79AB.

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

47 CFR, Part 24:	Personal Communications Services (particularly subpart E)
Section 24.232:	Power Limits
Section 24.235:	Frequency Stability
Section 24.238:	Emission Limits

The test sample **complied** with the requirements of 47 CFR, Part 24 Subpart E – Broadband PCS.

1.1 Summary of Results

FCC Part 24, Subpart E Clauses	Test Performed	Result
24.232	Power Limits	**Complies**
24.235	Frequency Stability	**Complies**
24.238	Emission Limits	**Complies**

The measurement procedure used was in accordance with ANSI/TIA/EIA-603, 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:	Tracker Can
Model:	TGP79AB
Serial:	001033000030552
FCC ID:	R2V-MWW1
Manufacturer:	Momentum Worldwide Pty Ltd

2.2 Operational Description and Specifications

Refer to Appendix F – Technical Description.

2.3 Test Configuration

Radiated Measurements: The Tracker Can was configured to communicate continuously to the Rohde & Schwarz Digital Radio Tester and was transmitted continuously during all tests.

Conducted Measurements: The Tracker Can was configured to communicate continuously to the Rohde & Schwarz Digital Radio Tester. A splitter was used between the Tracker Can, the Rohde & Schwarz Digital Radio Tester and the Spectrum analyser. Refer to Appendix B2 for test setup photos.

Testing was performed while transmitter continuously transmitted on a low (1850.2 MHz), middle (1880 MHz) and high (1909 MHz) frequency channel.

2.4 Block Diagram

Refer to Appendix C - Block Diagram

2.5 Support Equipment

Rohde & Schwarz Digital Radio Tester, Model CTS65

2.6 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.

2.7 Test Facility

2.7.1 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 fully described in a report submitted to the FCC office, and accepted in a letter dated June 14, 2002, **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, (Registration Date - November 5th 2001).

2.7.2 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).

2.8 Units of Measurements

2.8.1 Conducted Emissions

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

2.8.2 Radiated Emissions

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

2.9 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.

2.10 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.

RESULTS

1.0 POWER OUTPUT MEASUREMENTS

1.1 Radiated Power Output

1.1.1 Test Procedure

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

As the transmitter has no external connections, 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 2.0 of this report. A Calibrated EMCO 3115 Horn antenna was used for the measurements.

Testing was performed while the transmitter continuously transmitted on a low (1850.2 MHz), middle (1880 MHz) and high (1909 MHz) frequency channel.

Measurements were made with the spectrum analyser operating in peak hold mode with a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz. The peak power envelope of the device was captured using the antenna in both vertical and horizontal polarisations. The power envelope was maximised by rotating the device using a turntable and by height scanning between 1 – 4 metres using the automated antenna tower.

Each of these transmitter frequencies were recorded in dBuV and then converted to dBm.

The radiated power output was then determined by adding factors for the cable losses, antenna gains and path loss.

Example Calculation - Low Channel – 1850.2 MHz

Freq MHz	Level dBuV	Level dBm	Ant Gain dB	Coax Loss dB	Path Loss dB	Power dBm	Power mW
1850.2	96.7	-18.3	9.8	2	47.6	29.5	891.3

1.1.2 Results

Channel	Frequency MHz	Level dBuV	Level W	Limit W	Result
Low	1850.2	96.7	0.891	2.0	Complies
Middle	1880	97.0	0.955	2.0	Complies
High	1909	96.8	0.912	2.0	Complies

The specification limit is 2Watts.

Result: Complies.

1.1.3 Substitution Methods

The power level at each frequency was checked by using a substitution measurement. The transmitter was replaced with a horn antenna that was connected to a signal generator.

The signal generator output level was increased until the same level was observed.

The level recorded is the signal generator output level in dBm less any loss/gain due to the coax cable and the antenna. The results were:

Channel	Frequency MHz	Level dBm	Level W	Limit W	Result
Low	1850.2	29.8	0.955	2.0	Complies
Middle	1880	30.0	1.0	2.0	Complies
High	1909	29.7	0.933	2.0	Complies

1.2 Conducted Power Output

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

The EUT was set up on the table-top and operated as described in section 2.0 of this report

Measurements were performed while the transmitter continuously transmitted.

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

Testing was performed while the transmitter continuously transmitted on a low (1850.2 MHz), middle (1880 MHz) and high (1909 MHz) frequency channel.

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

Channel	Frequency MHz	Level dBm	Level W	Limit W	Result
Low	1850.2	29.6	0.912	2.0	Complies
Middle	1880	29.5	0.891	2.0	Complies
High	1909	29.3	0.851	2.0	Complies

The specification limit is 2W

2.0 OUT of BAND EMISSIONS (Spurious and Harmonics)

2.1 Radiated Measurements

2.1.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 24.238.

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 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 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.

2.1.2 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 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 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 Field Strength result is convert to power (watts) and then converted to dBm.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (1000 MHz – 18,000 MHz) ± 4.1 dB
(30 MHz – 1,000 MHz) ± 3.7 dB

2.1.3 Results

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

2.1.3.1 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.

Testing was performed while transmitter continuously transmitted on a low (1850.2 MHz), middle (1880 MHz) and high (1909 MHz) frequency channel. Harmonics related to the transmitter are reported below.

Low Channel – 1850.2 MHz

Frequency MHz	Antenna Polarization	Level dBm	Limit dBm	Result
1850.2	Fundamental			
3700.4	Vert/Hort	-	-13	Pass
5550.6	Vert/Hort	-	-13	Pass
7400.8	Vert/Hort	-	-13	Pass
9251.0	Vert/Hort	-	-13	Pass
11101.2	Vert/Hort	-	-13	Pass
12951.4	Vert/Hort	-	-13	Pass
14801.6	Vert/Hort	-	-13	Pass
16651.8	Vert/Hort	-	-13	Pass
18502	Vert/Hort	-	-13	Pass

No Harmonics were recorded within 20 dB of the limits

Middle Channel – 1880 MHz

Frequency MHz	Antenna Polarization	Level dBuV/m	Limit dBuV/m	Result
1880	Fundamental			
3760	Vert/Hort	-	-13	Pass
5640	Vert/Hort	-	-13	Pass
7520	Vert/Hort	-	-13	Pass
9400	Vert/Hort	-	-13	Pass
11280	Vert/Hort	-	-13	Pass
13160	Vert/Hort	-	-13	Pass
15040	Vert/Hort	-	-13	Pass
16920	Vert/Hort	-	-13	Pass
18800	Vert/Hort	-	-13	Pass

No Harmonics were recorded within 20 dB of the limits

High Channel – 1909 MHz

Frequency MHz	Antenna Polarization	Level dBuV/m	Limit dBm	Result
1909	Fundamental			
3818	Vert/Hort	-	-13	Pass
5727	Vert/Hort	-	-13	Pass
7636	Vert/Hort	-	-13	Pass
9545	Vert/Hort	-	-13	Pass
11454	Vert/Hort	-	-13	Pass
13363	Vert/Hort	-	-13	Pass
15272	Vert/Hort	-	-13	Pass
17181	Vert/Hort	-	-13	Pass
19090	Vert/Hort	-	-13	Pass

No Harmonics were recorded within 20 dB of the limits

No harmonics were recorded within 20 dB of the FCC limits. The measurement uncertainty for radiated emissions in this band was ±4.1 dB.

Result: Complies

2.1.3.2 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.

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

Testing was performed at 3m distance and while transmitter continuously transmitted on a middle (1880 MHz) frequency channel at a distance of 3 metres.

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.

2.1.3.3 Frequency Band: 0.009 - 30 MHz

A calibrated Loop antenna was used. The resolution bandwidth of 1 MHz and the video bandwidth of 1 MHz were utilised

Testing was performed at 3m distance and while transmitter continuously transmitted on a middle (1880 MHz) frequency channel at a distance of 3 metres.

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.

2.1.3.4 Band Edge Measurements

Testing was performed while the transmitter continuously transmitted on a low (1850.2 MHz) and high (1909 MHz) frequency channel.

The resolution bandwidth of 5 kHz and the video bandwidth of 10 kHz were utilised.

Refer to Appendix H for Band Edge plots
NB: D1 is the limit line – "any emissions outside the frequency band shall be attenuated by at least 43 + 10log(P) dB"

Result: Complies.

2.2 Conducted Measurements (9kHz to 20GHz)

Testing was performed in accordance with the requirements of FCC Part 24.238.

The EUT was set up on the table-top and operated as described in section 2.3 of this report

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.

Refer to Appendix K for conducted spurious emissions plots. No harmonics or spurious emissions were recorded within 20 dB of the FCC limits (the limit is –13dBm).

Result: Complies.

3.0 CHANNEL BANDWIDTH

Testing was performed while transmitter continuously transmitted on a low (1850.2 MHz), middle (1880 MHz) and high (1909 MHz) frequency channel.

The resolution bandwidth of 50 kHz and the video bandwidth of 100 kHz were utilised

Channel	Frequency MHz	Bandwidth kHz	26 dB Bandwidth Plots
Low	1850.2	344.7	Appendix I
Middle	1880	346.7	Appendix I
High	1909	356.7	Appendix I

4. 0 FREQUENCY STABILITY

Testing was performed in accordance with the requirements of FCC Part 24.235

To ensure that the fundamental emission stays within authorized frequency block, testing was performed while the transmitter continuously transmitted on a low (1850.2 MHz) and high (1909 MHz) frequency channel.

The EUT was set up on the table-top and operated as described in section 2.3 of this report

Measurements were performed while the transmitter continuously transmitted.

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

The measurements were performed with the temperature from -30 to +50 ˚C. The transmitter frequency was recorded every 10˚C step and the results are reported.

Low Channel – 1850.2 MHz

Temperature (˚C)	Frequency MHz	Frequency Deviation kHz	Deviation Limits kHz
-30	1850.115	85	92.5
-20	1850.125	75	92.5
-10	1850.115	85	92.5
0	1850.115	85	92.5
+10	1850.125	75	92.5
+20 (Battery Full)	1850.135	65	92.5
+20 (End Point)	1850.125	75	92.5
+30	1850.125	75	92.5
+40	1850.135	65	92.5
+50	1850.135	65	92.5

High Channel – 1909 MHz

Temperature (˚C)	Frequency MHz	Frequency Deviation kHz	Deviation Limits kHz
-30	1909.085	85	95.45
-20	1909.085	85	95.45
-10	1909.075	75	95.45
0	1909.085	85	95.45
+10	1909.085	85	95.45
+20 (Battery Full)	1909.075	75	95.45
+20 (End Point)	1909.055	55	95.45
+30	1909.055	55	95.45
+40	1909.065	65	95.45
+50	1909.055	55	95.45

The frequency was found to stay within the authorized frequency block 1850 – 1910 MHz.

Result: Complies.

5.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

The Personal Communications Services operating in the 1850 - 1910 MHz band 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 mobile device whereby a distance of 20 cm normally can be maintained between the user and the device.

In accordance with Section 1.1310, the Maximum Permissible Exposure (MPE) limit for the General Population/Uncontrolled Exposure of 1.0 has been applied, i.e 1mW/cm^2.

Friis transmission formula: $Pd = (P*G) / (4*\pi*r^2)$

where: Pd = power density (mW/cm^2)
P = power input to the antenna (mW)
G = antenna gain (numeric)
r = distance to the center of radiation of the antenna (cm)

The result was extracted from section 1.0 of this report.
Maximum radiated peak output power = 29.8dBm = 955mW
Prediction distance = 20 cm
Prediction frequency = 1880 MHz
MPE limit for uncontrolled exposure at prediction frequency = 1 mW/cm^2

Therefore, the power density at prediction frequency (Pd) = 0.190 mW/cm^2

Calculations show that this device with described antenna does meet the MPE requirements for portable devices falling below the 20 cm clearance required and the SAR value of 0.362 W/Kg complies with the FCC human exposure requirements of 47 CFR 2.1093 (d).
Refer to EMC Technologies' report - M040313 (FCC SAR Report) for details of SAR compliance.

Results: Complies

6.0 COMPLIANCE STATEMENT

The Tracker Can, Model: TGP79AB, tested on behalf of Momentum Worldwide Pty Ltd, **complies** with the requirements of 47 CFR, Part 24 - Personal Communications Services (Subpart E – Broadband PCS).

Results were as follows:

FCC Part 24, Subpart E Clauses	Test Performed	Result
24.232	Power Limits	**Complies**
24.235	Frequency Stability	**Complies**
24.238	Emission Limits	**Complies**

Note: Refer to M040313 (FCC SAR Report) for details of SAR Compliance.

TEST REPORT APPENDICES

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS
APPENDIX B: REPORT PHOTOGRAPHS
APPENDIX C: BLOCK DIAGRAM
APPENDIX D: SCHEMATICS
APPENDIX E: PCB LAYOUTS
APPENDIX F: TECHNICAL DESCRIPTION
APPENDIX G: FCC LABELLING DETAILS
APPENDIX H: BANDEDGE PLOTS
APPENDIX I: CHANNEL BANDWIDTH PLOTS
APPENDIX J: USER MANUAL
APPENDIX K: CONDUCTED SPURIOUS EMISSIONS PLOTS
APPENDIX L: PARTS LIST