

TELECOMMUNICATION DIVISION
CODE OF FEDERAL REGULATION
PART 15 – RADIO FREQUENCY DEVICES
SUBPART “C” – INTENTIONAL RADIATORS
MEASUREMENT / TECHNICAL REPORT

ON

Product Name/Model: MCSI Trak Reader/Writer


Manufacturer: Micro Concepts & Solutions, Inc.
5015 Paul Wayne Drive
Boling, TX 77420

Tested by Request of: Micro Concepts & Solutions, Inc.

Performed By:
Wayne Langston Incorporated
P.O. Box 1377, League City, TX 77574-1377
Tel: 281-337-6785; Fax: 281-337-7217; Email: langstoninc@msn.com

Test Results:

The test results for this sample provided show that the EUT is [x] is not [] in compliance with the requirements of the CFR 47 Part 15 Subpart C Requirements. I certify that I am the technically qualified person responsible for preparation of the technical information contained in this application, and that it is complete and accurate to the best of my knowledge

Tested By: 
Wayne Langston

Date: 08-05-2002

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THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY NVLAP OR ANY AGENCY OF THE U.S. GOVERNMENT.

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Section 1 General

1.1 Introduction

Conducted and Radiated Electromagnetic Disturbance measurements were performed on the equipment under test.

1.2 Tested System Details

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system are described on the test manifest sheets.

1.3 Test Methodology

Radiated emissions on this frequency range 9 kHz – 30 MHz will be measured initially at a distance of 3 meters. A prescan at 3 meter distance will be performed in a shielded room with the detector of the spectrum analyzer or EMI Receiver set to peak. Final measurement is then performed at 30 meter distance. In case the regulation requires testing at other distances, the result will be extrapolated. The extrapolation factor will be determined by making a second measurement at 10 meter distance. The provisions of 15.31 (d) apply,

According to section 15.209 (d) final measurements performed with the detector set to Quasi Peak except for the frequency bands 9 – 90 kHz and 110 – 490 kHz where average detector is employed.

1.4 Test Facility

This facility performs EMI measurements, which support verification of compliance with CENELEC International Standards. It has filed a “Description of the Measurement Facility” and is on file with the FCC Laboratory Division in Columbia, Maryland. The FCC approved the site for the purpose of providing test results for submission with equipment authorization applications under the Commissions Equipment Authorization Program. This

site is located adjacent to the building on FM 1266, League City, Texas. The instrumentation used to perform the test conforms to ANSI C63.2, CISPR 16, and FCC requirements for detector function and bandwidth. All equipment was calibrated and traceable to NIST. Calibration period is 1 year. Wayne Langston, Inc. has received NVLAP Accreditation, Certificate No. 200021-0.

1.5 Test Samples:

A representative test sample was tested under the test procedure and requirements of the CFR 47 Part 15 Subpart C, Section 15.225 Requirements . The Equipment Under Test (EUT) is in compliance with the applicable technical standards if no unauthorized change is made in the equipment and if the equipment is properly maintained and operated. Compliance with these standards shall not be construed to be a finding with respect to matters not encompassed by the Commission's rules.

1.5.1 Operation mode of EUT

Continuously reading a TAG

.

1.6 Test Results (Worst Case Scenario)

The test results for this sample provided show that the EUT is [x] is not [] in compliance with the requirements of the CFR 47 Part 15 Subpart C, Section 15.225 Requirements . The results from this testing and verification apply only to the sample that was tested and any identical production lot. The findings do not make any suggestions about how the product is to be used, nor does Wayne Langston Incorporated make any recommendations regarding the product's usage.

1.7 Modifications

Modifications (if any) will be noted on the test data sheets.

Section 2 Product Labeling

As required by the CFR 47, pursuant to clause 15.19(a)(3), the EUT shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operations is subject to the following two conditions: (1) This device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation

2.1 Information to the User

As required by the CFR 47, pursuant to clause 15.105(b), the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or experienced radio/TV technician for help.

As required by the CFR 47, pursuant to clause 15.21, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Section 3 Test System Measurements

Noted and complies.

Section 3.1 MEASUREMENT METHODS

3.1.1 Field strength of in-band emissions (§15.225 (a)) and unwanted emissions < 30 MHz (§15.225 (b))

Radiated emissions in the frequency range 9 kHz – 3- MHz will be measured initially at a distance of 3 meters. A prescan at 3-meter distance will be performed in a shielded room with the detector of the spectrum analyzer or EMI Receiver set to peak. Final measurement is then performed at 30-meter distance. In case the regulation requires testing at other distances, the result will be extrapolated. The extrapolation factor will be determined by making a second measurement at 1-0 meter distance. The provisions of 15.31 (d) apply.

According to section 15.209 (d) final measurements performed with the detector set to Quasi Peak except for the frequ3ncy bands 9 – 90 kHz and 110 – 490 kHz where average detector is employed.

3.1.2 Frequency tolerance (§ 15.225 (c))

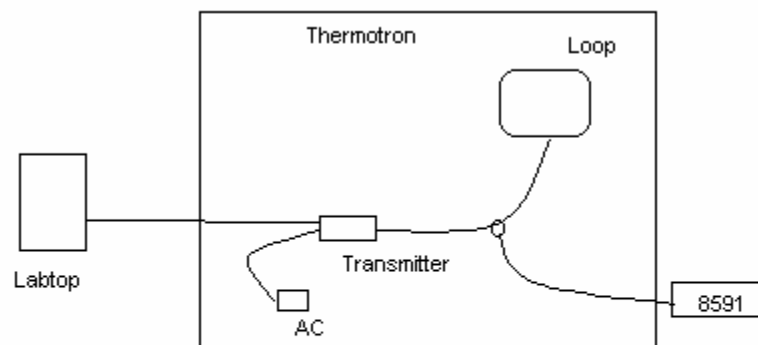
3.1.2.1 Frequency stability vs. temperature

The frequency stability vs. temperature was measured with a spectrum analyzer connected to the output of the transmitter power amplifier (conducted measurement) via dummy load while EUT was operating in transmit mode using the assigned frequency.

The trace mode of the spectrum analyzer was set to write with frequency count mode activated:

RBW = 100 Hz, VBW = 100 Hz, span = 20 kHz, sweep = 1.5 s (auto mode)

See the figure for the measurement setup



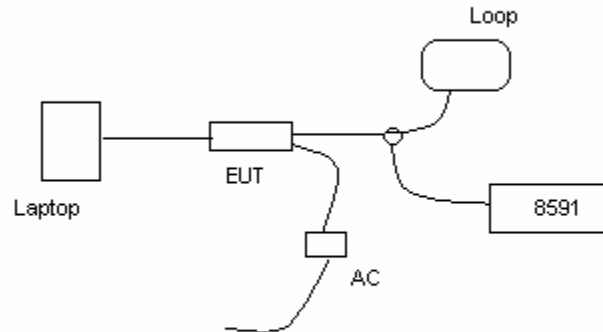
3.1.2.2 Frequency stability vs. supply voltage

The frequency stability vs. supply voltage was measured with a spectrum analyzer connected to the output of the transmitter power amplifier (conducted measurement) via dummy load while EUT was operating in transmit mode using the assigned frequency.

The trace mode of the spectrum analyzer was set to write with frequency count mode activated:

RBW = 100 Hz, VBW = 100 Hz, span = 20 kHz, sweep 1.5 s (auto mode)

See figure for the measurement setup



Test equipment used:

8591 E	11/02
8640B	10/03
8494A	10/03
8495A Attenuator	10/03
AC Adapter, Model: PV-5300PR, 5 vdc,	

3.1.2.3 Unwanted Emission 30 MHz – 1 GHz (§ 15.225 (b))

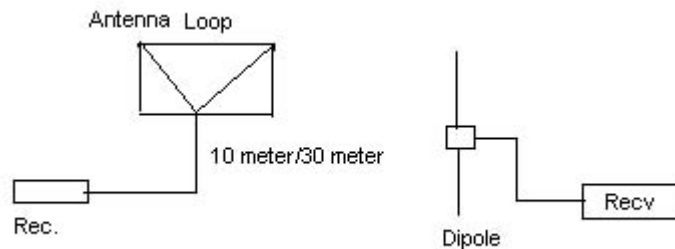
Radiated emissions were measured over the frequency range from 30 MHz to 1 GHz. For final testing the

detector-function of the spectrum analyzer was set to quasi peak using a tuned dipole antenna.

Measurements were made in both the horizontal and vertical planes of polarization. Preliminary scans were taken in a semi-anechoic room using a spectrum analyzer with the detector function set to peak and resolution bandwidth set to 100 kHz. All tests were performed at a test distance of 3 or 10 meters. For final testing an open-area test site was used. During the tests the EUT was rotated all around and the receiving antenna was raised and lowered from 1 meter to 4 meters to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions. Limits established per 15.225 as 10,000 $\mu\text{V}/\text{meter}$ at 30 meter for the carrier

and elsewhere per 15.209.

See figure for the measurement setup.



Test Equipment used:

8591E Analyzer	11/02
8640B	10/03

Section 4 GENERAL MEASUREMENT CONDITIONS

4.1 Ambient Emanations

Noted and complies.

Ambient Noise Floor: 20.0 dB.

4.2 Test Configuration of EUT and Peripheral Devices

Configuration of cables of EUT: Not Applicable

Configuration of peripheral devices connected to EUT: The EUT was connected to a Compaq 1681 via a standard R232 interface See attached FCC Label.

4.3 Firmware

The firmware is manufacturer provided.

4.4 Exercise Software.

The software used is manufacturer provided.

4.5 Ground Plane

Noted.

Test Unit is Portable. (Floor-standing, table-top or portable).

5.0 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

- | | | |
|-----|---|---------------|
| [X] | CFR 47, Part 2
(Frequency allocations and radio treaty matters,
general rules and regulations) | October 2000 |
| [] | CFR 47 Part 15, Subpart A
(Radio Frequency Devices), Subpart A | October 2000 |
| [] | CFR 47 Part 15, Subpart B
(Unintentional Radiators) | October 2000 |
| [X] | CFR 47 Part 15, Subpart C
(Radio Frequency Devices, Intentional Radiators) | October 2000 |
| [] | CFR 47 Part 95, Subpart C/E
Personal Radio Services, Radio Control Radio Service) | October 2000 |
| [X] | ANSI 63.4
Methods of Measurement of Radio-Noise Emissions
From Low-voltage electrical and electronic Equipment\ | October 1992 |
| [X] | RSS-210
Radio Standards for low power license – Exempt | February 1996 |
| [] | TIA/EIA-603
Land Mobile FM or PM Communications equipment | February 1993 |

6.0 List of Measurements: CFR 47, Part 15, Subpart C

Section(s)	Test	Page	Result
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§ 15.225 (a)	Maximum in-band field strength	Appendix A	Passed
§ 15.225 (b)	Out-of-band emissions	Appendix B	Passed
§ 15.225 (c)	Frequency tolerance of carrier signal	Appendix C	Passed

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix A
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

APPENDIX A

Test Method in Accordance with § 15.225 (a)

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix A
Test Results
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Type: Inductive Reader
Serial No.: Prototype
Applicant: Micro Concepts, Inc.
Test site: Open field Test site (with Ground Plane)
Distance: 30 Meter for carrier (no ground plane)
10 Meter for spwrs as noted

Maximum allowable level = 10,000 μ v/m @ 13,560 MHz

Freq- uency MHz	Detector	Antenna Polariz- ation	Analyzer Reading (db μ V)	Correction Factor	Field Strength (db μ v/m)	Limit (db μ v/m)	Margin Db	Dist- ance Meter
13.553	QP		10.3	None	10.3	29.5		10
13.560	QP	N/A	43.8	None	43.8	80.0	53.8	30
13.567	QP	N/A	12.3	None	12.3	29.5		10
27.120	QP	N/A	22.1	None	22.1			10

***** = No emissions above noise floor detected**

Test Equipment Used:

8591E 11/02
8640B 10/03
Loop Antenna HFH2-Z2 R&S 10/03 ANSI 63.5 substituted method

Note: HFH2-Z2 uses a correction factor of + 20 db and the readout is in db μ a/m a 51.5 db addition is made to correct the reading to db μ v/m. This is also accomplished internal to the 8591 using an internal program.

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix B
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

APPENDIX B

Test Method in Accordance with § 15.225 (b)

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix B
Test Results
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Type: Inductive Reader
Serial No.: Prototype
Applicant: Micro Concepts, Inc.
Test site: Open field Test site (with Ground Plane)
Distance: 3 Meter

Maximum allowable level = 10,000 μ v/m

Frequency MHz	Detector	Antenna Polarization	Analyzer Reading (db μ v)	Correction Factor	Field Strength db μ v/m)	Limit (μ v/m) db/ μ m	Margin Db
54.24	QP	Hor 1.0m	14.9	11.6	26.5	100 / 40	13.5
108.478	QP	Hor 2.5m	24.4	15.1	39.5	100 40	.5
135.600	QP	Hor 2.0m	24.8	15.1	39.9	150 43.5	3.6
244.082	QP	Hor 2.0m	22.9	21.0	43.9	200 46	2.1
271.200	QP	Hor 2.0m	22.1	21.2	43.3	200 46	2.7
325.500	QP	Hor 1.0m	15.3	25.0	40.3	200 46	5.7
54.24	QP	V 1.0	13	11.6	24.6	100 40	15.4
108.478	QP	V 1.0	22.1	15.1	37.2	100 40	2.8
135.6	QP	V 1.5	21.3	15.1	32.7	150 43.5	6.7
325.5	QP	V 1.5	11.5	25.0	28.4	200 46.0	17.6

***** = No emissions above noise floor detected**

Sample calculation of field strength values:

Field Strength (db μ v/m) = Analyzer Reading (db μ V) + Correction Factor (dB)
10,000 μ v/m @ 30

Test Equipment Used:

8591E	11/02	
8640B	10/03	
Tuned Dipole	10/03	Ansi 63.5

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix C
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

APPENDIX C

Test Method in Accordance with § 15.225 (c)

Frequency Stability vs. Temperature

Type: Inductive Reader
Serial No.: Prototype
Applicant: Micro Concepts, Inc.
Test site: Thermotron
Test Conditions:

Temperature: See table below
Supply voltage: 5.0 V DC

Specifications: ± 0.01 % of nominal carrier frequency
Temperature range: -20 to + 50° C

Temperature (°C)	Nominal carrier frequency (MHz)	Frequency measured (MHz)	Frequency deviation (Hz)	Frequency deviation (%)	Limit (%)
-20	13,560000	13560012	12		0.01
-10	13,560000	13560010	10		0.01
+ 0	13,560000	13560010	10		0.01
+ 10	13560000	13560005	5		0.01
+ 20	13560000	13560000	0		0.01
+ 30	13560000	13559999	1		0.01
+ 40	13560000	13559998	2		0.01

Result: Passed

Thermotron
Fluke 27/Amprobe TH-2

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix C
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Frequency Stability vs. Supply Voltage

Type: Inductive Reader
Serial No.: Prototype
Applicant: Micro Concepts, Inc.

Test Conditions:

Temperature: See table below
Supply voltage:

Specifications: ± 0.01 % of nominal carrier frequency
Temperature range: -20 to + 50° C

Supply Voltage (V)	Nominal carrier frequency (MHz)	Frequency measured (MHz)	Frequency deviation (Hz)	Frequency deviation (%)	Limit (%)
7.65	13,560000	13559881	119		0.01
9.00	13,560000	13559885	115		0.01
10.35	13,560000	13559883	117		0.01

Result: Passed

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

APPENDIX D

EUT PHOTOS AND TEST CONFIGURATION

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Conducted Front View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Radiated Front View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Radiated Rear View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Exterior View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

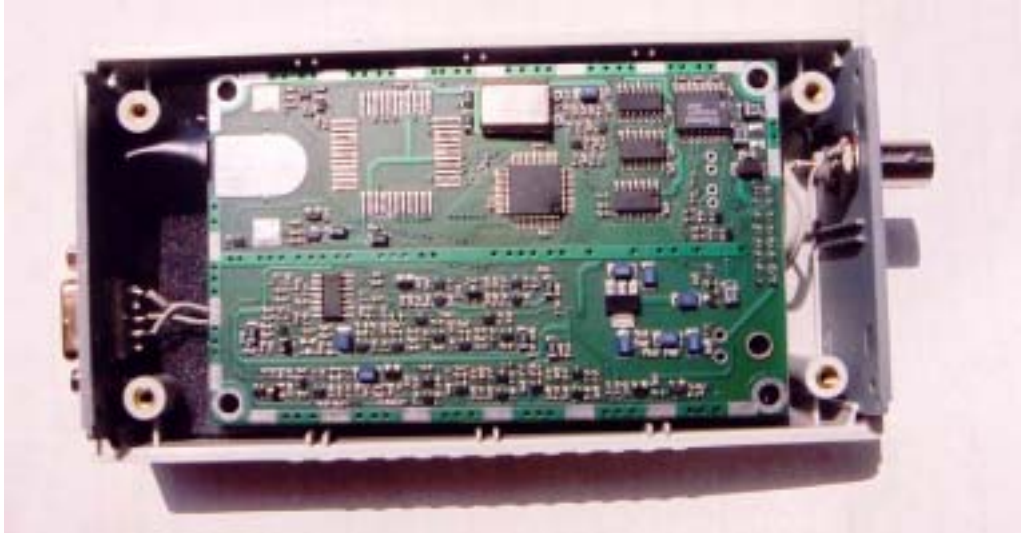
Exterior Rear View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Interior View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

EUT Component View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix D
EUT Photos
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

EUT Foil View



Model: MCSI Trak Reader/Writer
Date: 08-05-2002

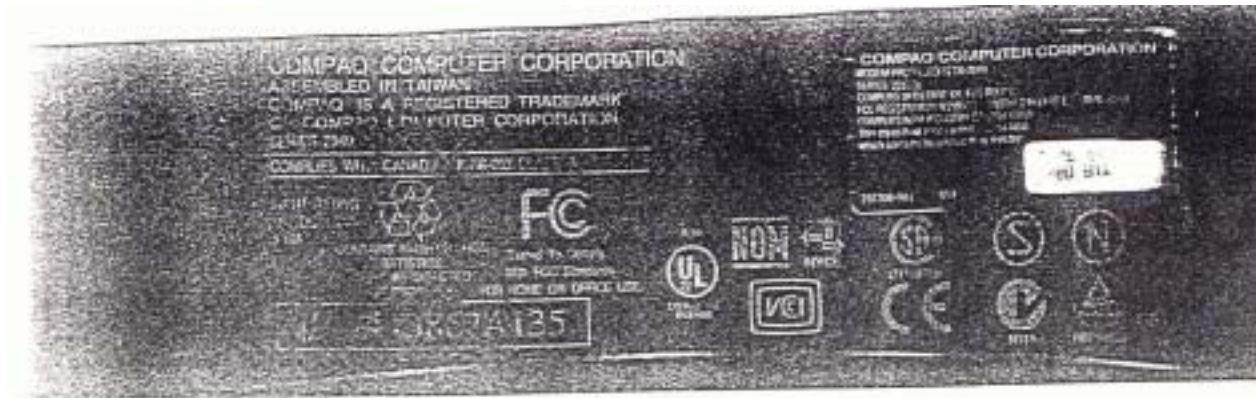
Appendix E
Certificates
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Appendix E
FCC Label and Calibration Certificates


Appendix E

Certificates

Compaq Laptop FCC Label



Calibration Certificates

 Agilent Technologies	EPSC Support Operation 10090 Foothills Blvd. Roseville, CA. 95747 (800) 403-0801	AGILENT TECHNOLOGIES INTERNAL ASSESSMENT PROGRAM : TMO-Q-07/95
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Certificate of Calibration
Accredited Calibration
Certificate No.: 31809498703



Manufacturer: Agilent/HP
Model No: 8484A
Serial No: 1635A02343
Customer:

WAYNE LANGSTON INC.

4307 MASTERS DR.

LEAGUE CITY TX 77573

Description: Power Sensor

Options installed:

Customer asset No.:

Location of calibration:

EPSC Support Operation

10090 Foothills Blvd.

Roseville, CA. 95747

(800) 403-0801

Customer PO No.: 2002-02
Date of calibration: 24 Sep 2002
Temperature: 18-28 °C
Procedure: 24BR-LCL-11760S-A.01.08

Agreement No.:
Received date: 19 Sep 2002
Humidity: 20-80 %RH

This certifies that the above product was calibrated in compliance with a quality system registered to ISO9002:1994 and accredited to ISO/IEC 17025:1999 using applicable Agilent Technologies procedures.

As received conditions:

Initial testing found the equipment to be **IN-SPECIFICATION** at the points tested.

As shipped conditions:

At the completion of the calibration, measured values were **IN-SPECIFICATION** at the points tested.

Remarks or special requirements:

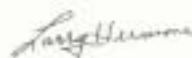
Our calibration procedures are designed to provide measurement uncertainty of less than or equal to one quarter of the specification of the unit under test, where possible, with a coverage factor of 2.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

This certificate is composed of 2 pages containing a summary of calibration information. Tests not covered by our A2LA accredited capability are clearly identified and are included for completeness of the calibration report.

Based on the recommended calibration interval, the next calibration is due on 24 Sep 2003.

Print Date: 25 Sep 2002



Larry Hermone Operations Manager

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix E
Certificates
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Certificate of Calibration

MFG. : HEWLETT PACKARD
MODEL : 54600A
S/N : 3134A04619
TECH. : BP

DEPT. :
TEMP. : 23 C
R.H. : 42 %
CAL INT : 12

LOG NUMBER : 1841-1015
CALIBRATED : 11/05/01
DUE CAL : 11/04/02
ID NUMBER :

PARAMETERS	READINGS BEFORE CAL.	BASIC ACCURACY	READINGS AFTER CAL.
CH I VERT BANDWIDTH	$\pm 0.5 \%$ > 100 MHz	$\pm 1.5 \%$ 100 MHz	$\pm 0.5 \%$ > 100 MHz
CH II VERT BANDWIDTH	$\pm 0.6 \%$ > 100 MHz	$\pm 1.5 \%$ 100 MHz	$\pm 0.6 \%$ > 100 MHz
HORIZONTAL	$\pm 0.004 \%$	$\pm 0.01 \%$	$\pm 0.004 \%$

THE FOLLOWING STANDARDS WERE USED:

NIST. #	MFG.	MODEL	CAL DATE	DUE DATE
9000-1201	FLUKE	5500A	05/04/01	05/04/02

PREVIOUSLY CALIBRATED:

Oscilloscope Services certifies that the above instrument has been calibrated to manufacturers specifications as identified by the procedure listed below using standards whose accuracies are traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration technique. The calibration system conforms to the requirements of NIST-4100A, ISO/IEC 17025, and 10 CFR 21. All test uncertainty ratios exceed four to one unless otherwise noted. Before and after readings include the total uncertainty of the measurement.

PROCEDURE USED : 1H-007

TECHNICIAN

OSCILLOSCOPE SERVICES • 7827 KINGSLEY • HOUSTON, TEXAS 77087

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix E
Certificates
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Certificate of Calibration

MFG. : HEWLETT PACKARD
MODEL : 8640B
S/N : 2421A25090
TECH. : MI

DEPT. :
TEMP. : 23 C
R.H. : 42 %
CAL INT : 12

LOG NUMBER : 1841-1008
CALIBRATED : 10/02/02
DUE CAL : 10/01/03
ID NUMBER : R13008

PARAMETERS	READINGS BEFORE CAL.	BASIC ACCURACY	READINGS AFTER CAL.
LEVEL ACCURACY	± 0.8 dB	± 1.5 dB	± 0.8 dB
TIMEBASE	$\pm 1 \times 10^{-6}$	$\pm 1 \times 10^{-5}$	$\pm 1 \times 10^{-6}$
AMPLITUDE MODULATION	± 3.2 %	± 5.5 %	± 3.2 %
FREQUENCY MODULATION	± 5.1 %	± 7.0 %	± 5.1 %

THE FOLLOWING STANDARDS WERE USED:


NIST. #	MFG.	MODEL	CAL DATE	DUE DATE
9000-1258	HEWLETT PACKARD	8901A	01/02/02	01/01/03
9000-1230	HEWLETT PACKARD	436A	01/02/02	01/01/03
9000-1005	HEWLETT PACKARD	5328A	01/02/02	01/01/03
9000-1178	IFR	AN940	01/03/02	01/02/03

PREVIOUSLY CALIBRATED: 08/26/97 04/29/96 02/27/95

Oscilloscope Services certifies that the above instrument has been calibrated to manufacturers specifications as identified by the procedure listed below using standards whose accuracies are traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration technique. The calibration system conforms to the requirements of MIL-STD-45662A, ISO/IEC 17025, and 10 CFR 21. All test uncertainty ratios exceed four to one unless otherwise noted. Before and after readings include the total uncertainty of the measurement.

PROCEDURE USED : 1C-030

TECHNICIAN



OSCILLOSCOPE SERVICES • 7827 KINGSLEY • HOUSTON, TEXAS 77087

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix E
Certificates
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Certificate of Calibration

MFG. : HEWLETT PACKARD
MODEL : 8591R
S/N : 3501A03599
TECH. : BF

DEPT. :
TEMP. : 23 C
R.H. : 42 %
CAL INT : 12

LOG NUMBER : 1841-1016
CALIBRATED : 11/05/01
DUE CAL : 11/04/02
ID NUMBER :

PARAMETERS	READINGS BEFORE CAL.	BASIC ACCURACY	READINGS AFTER CAL.
CALIBRATOR:			
AMPLITUDE	± 0.2 DB	± 0.4 DB	± 0.2 DB
FREQUENCY	± 1.80 KHZ	± 2.25 KHZ	± 1.80 KHZ
SCALE FIDELITY/4 DB	± 0.2 DB	± 0.4 DB	± 0.2 DB
REFERENCE LEVEL	± 0.2 DB	± 0.3 DB	± 0.2 DB
BANDWIDTH SWITCHING:			
3 KHZ TO 3 MHZ	± 0.2 DB	± 0.4 DB	± 0.2 DB
3 KHZ TO 1 KHZ	± 0.3 DB	± 0.5 DB	± 0.3 DB

THE FOLLOWING STANDARDS WERE USED:

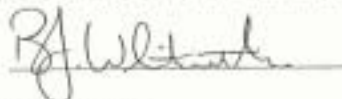
NIST. #	MFG.	MODEL	CAL DATE	DUE DATE
9000-1227	FLUKE	6080A/AN	02/19/01	02/18/02
9000-1178	IFR	AN940	02/19/01	02/18/02
9000-1068	HEWLETT PACKARD	436A	02/20/01	02/19/02
9000-1069	HEWLETT PACKARD	8481A	11/13/00	11/13/01
9000-1090	HEWLETT PACKARD	8901A	02/19/01	02/18/02

PREVIOUSLY CALIBRATED:

Oscilloscope Services certifies that the above instrument has been calibrated to manufacturer specifications as identified by the precision listed below using standards whose accuracies are traceable to the National Institute of Standards and Technology, or have been derived from accepted values of national physical constants, or have been derived by the ratio type of self-calibration technique. The calibration system conforms to the requirements of MIL-STD-45662A, EEC/ENC 17025, and ISO 9001 21.

PROCEDURE USED : 2Z-001

TECHNICIAN



OSCILLOSCOPE SERVICES • 7827 KINGSLEY • HOUSTON, TEXAS 77067

Model: MCSI Trak Reader/Writer
Date: 08-05-2002

Appendix E
Certificates
Corrected WLI Project: 20021789
FCC ID: QJFTRAKRW

Certificate of Calibration

MFG. : AMPROBE
MODEL : TH-2
S/N : 9104518
TECH. : BP

DEPT. :
TEMP. : 23 C
R.H. : 42 %
CAL INT : 12

LOG NUMBER : 1841-1018
CALIBRATED : 10/15/02
DUE CAL : 10/14/03
ID NUMBER :

PARAMETERS	READINGS BEFORE CAL.	BASIC ACCURACY	READINGS AFTER CAL.
TEMPERATURE:	± 0.7 DEG C	± 1 DEG C	± 0.7 DEG C
HUMIDITY:	± 3 %	± 5 %	± 3 %

THE FOLLOWING STANDARDS WERE USED:

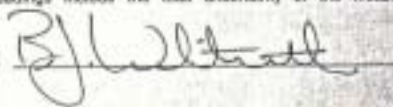
NIST. #	MFG.	MODEL	CAL DATE	DUE DATE
9000-1247	ISOTECH	VENUS 2125B	12/03/01	12/02/03
9000-1211	HEWLETT PACKARD	34420A	01/03/02	01/02/03
9000-1209	BELFORT INSTRUMENT	566	01/02/02	01/01/03

PREVIOUSLY CALIBRATED:

Oscilloscope Services certifies that the above instrument has been calibrated to manufacturers specifications as identified by the procedures listed below using standards whose accuracies are traceable to the National Institute of Standards and Technology, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration technique. The calibration system conforms to the requirements of MIL-STD-45662A, ISO/IEC 17025, and 10 CFR 21. All test uncertainty ratios exceed four to one unless otherwise noted. Before and after readings include the total uncertainty of the measurement.

PROCEDURE USED : 2G-002K

TECHNICIAN



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