Intertek ETL SEMKO

TEST REPORT

Report Number: 3047900_Emissions_01
Project Number: 3047900

Test Date: September 18, 2003

Testing Performed on the
OpenCell RAN (Base and Expansion Unit)
Part Number: OP-RAN2 (Base) and EX-RAN2 (Expansion)
to
FCC Part 15, Subpart B, Class A
For
OpenCell, Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services	OpenCell, Inc.
70 Codman Hill Road	955 Perimeter Road
Boxborough, MA 01719	Manchester, NH 03103

Prepared By: Vathana F. Ven — Date: 9/29/03
Vathana F. Ven, Sr. Project Engineer

Reviewed by: _____ — Date: 9/29/03
Michael Murphy, Staff Engineer/EMC

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This report is designed to show compliance with the FCC Part 15, Subpart B Rules for an unintentional radiator. The test procedures, as described in American National Standards Institute C63.4-1992, were employed.

1.0 Introduction and Conclusions

On September 18, 2003, we tested the Opencell RAN (Base and Expansion Unit), Part Number OP-RAN2 (Base) and EX-RAN2 (Expansion), to determine if it was in compliance with the FCC Part 15, Subpart B, Class A emissions limits. We found that the unit met the requirements when tested as received.

A description of the product and operating configuration, the various provisions of the rules, the methods for determining compliance, and a detailed summary of the results are included within this test report.

Conclusion:

In summary, this report verifies that the Opencell RAN (Base and Expansion Unit), Part Number OP-RAN2 (Base) and EX-RAN2 (Expansion), is compliant with the FCC Part 15, Subpart B, Class A requirements when production units conform to the initial sample. Please address all questions and comments concerning this report to Scott Lambert, Engineering Team Leader.

2.0 Description of the Product

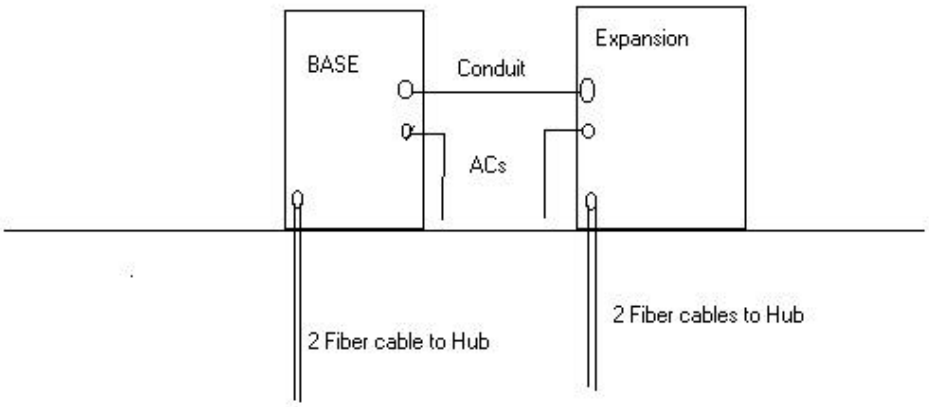
2.1 Brief Description and Received Condition

The OpenCell System consists of the RAN and the HUB. The RAN (Radio Access Node) is an RF transceiver operating in the PCS, Cellular and SMR bands (FCC Part 22, 24 and 90). The RAN is designed to be installed on utility poles along with a customer antenna.

A prototype version of the sample was received on Thursday, September 18, 2003 in good condition

2.2 System Block Diagram

The diagram shown below details the placement of the equipment under test on the turntable.



2.3 System Test Configuration

Equipment Under Test: Opencell RAN (Base and Expansion Unit)

Part Number: OP-RAN2 (Base) and EX-RAN2 (Expansion)

Serial Number: Prototype

FCC Identifier: Not Labelled

Support Equipment:

Laptop		
* Remotely Located *	Manufacturer:	Toshiba
	Model:	TECRA 8200
	Serial Number:	51013969JU
	FCC ID:	Not Applicable
Ethernet Hub		
* Remotely Located *	Manufacturer:	NETGEAR
	Model:	EN 104 TP
	Serial Number:	ENT4B9A017065
	FCC ID:	Not Applicable
AC Adapter		
* Remotely Located *	Manufacturer:	Toshiba
	Model:	PA3048U-1ACA
	Serial Number:	Not Labelled
	FCC ID:	Not Applicable
AC Adapter		
* Remotely Located *	Manufacturer:	NETGEAR
	Model:	YP-040
	Serial Number:	Not Labelled
	FCC ID:	Not Applicable
Mouse		
* Remotely Located *	Manufacturer:	Microsoft
	Model:	2.0 A 4217303
	Serial Number:	4217303
	FCC ID:	C3KSMP1

Cables:

QTY	Description	Shield Description	Hood Description	Length (m)
2	Power Cables	None	Plastic	3
2	RJ45	None	Plastic	7
1	RJ45	None	Plastic	3
4	SMA Cables	Coaxial	Metal	2

2.4 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992).

For maximizing emissions, the system was rotated through 360 degrees, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data received.

All support equipment was remotely located. The EUT was on the center of the turntable.

Radiated emissions were tested in the range of 30 MHz to 2.0 GHz.

2.5 Description of how EUT was exercised during test

Two RAN enclosure (Base RAN and Expansion RAN) were interconnected along with a battery enclosure on the turntable.

The HUB was setup below the ground plane, and connected to the RAN with fiber optic cables.
An IF signal was injected into the HUB (at 32 MHz.).

The HUB was configured using the latest operating system software.

Eight RF carriers were transmitted by the RANs (6 PCS, 1 Cellular, and 1 SMR) and RAN RF outputs connected to RF loads.

2.6 Modifications Required for Compliance

No modifications were installed by Intertek Testing Services.

3.0 Radiated Emission

3.1 Radiated Emissions Limits

The following table shows the radiated emission limits for FCC Part 15 Subpart B Section 15.109:

Class A

Frequency (MHz)	Field Strength Limit		
	■V/m at 10m	dB■V/m at 10m	dB■V/m at 3m
30 to 88	90	39.1	49.6
88 to 216	150	43.5	54.0
216 to 960	210	46.4	56.9
Above 960	300	49.5	60.0

(1) Determined using a 20 dB/decade extrapolation. The specified test distance is 10 meters, however measurements at another distance is allowed provided measurements are not made in the near-field and it can be determined the emissions can be measured at that distance (See Section 15.31 (f)(1) of the FCC's rules).

(2)

(3) The tighter limit applies at the band-edge.

3.2 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m
AG = Amplifier Gain in dB

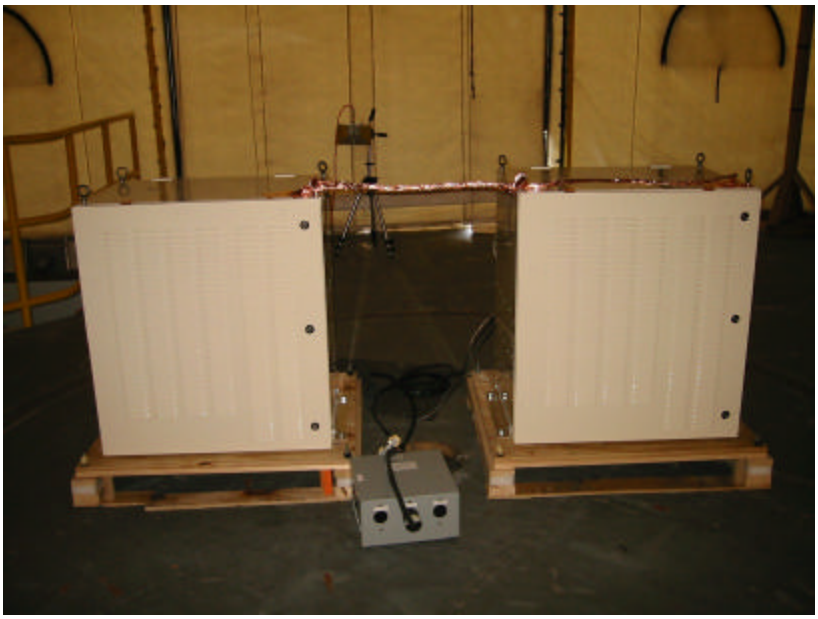
In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = $[10^{(32\ dB\mu V/m)/20)}]$ = 39.8 μV/m

3.3 Configuration Photographs - Worst-Case Radiated Emission



3.4 Test Data

The following results were obtained when the device was tested as described in this report.

Radiated Emissions / Interference

Company:	OpenCell, Inc.			Model #:	OP-RAN2 (Base) and EX-RAN2 (Expansion)
Engineer:	Vathana F. Ven	Location:	Site 3C	Serial #:	Prototype
Project #:	3047900	Pressure:	1020 hPa	Receiver:	HP 8546A
Date:	09/18/03	Temp:	20C	Antenna:	LOG2 11-5-03 V10.ant LOG2 11-5-03 H10.ant
Standard:	FCC Part 15 Subpart B	Humidity:	66%	PreAmp:	None
Class:	A	Group:	None	Cable(s):	2C, 10MPRIME_9-19-03.cbl None
Limit Distance:	10 meters			Test Distance:	10 meters
Voltage/Frequency:	220 Vac/60 Hz			Frequency Range:	30-1000 MHz

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
NB	V	225.300	13.2	11.5	2.7	0.0	0.0	27.4	46.4	-19.0
NB	V	236.000	14.2	11.9	2.7	0.0	0.0	28.8	46.4	-17.6
NB	V	240.000	12.0	12.0	2.8	0.0	0.0	26.8	46.4	-19.6
NB	V	257.500	13.0	12.6	2.8	0.0	0.0	28.5	46.4	-17.9
NB	V	278.900	17.3	13.2	3.0	0.0	0.0	33.5	46.4	-12.9
NB	V	343.300	13.0	15.1	3.4	0.0	0.0	31.5	46.4	-14.9
NB	V	400.000	10.1	17.2	3.6	0.0	0.0	30.9	46.4	-15.5

NB-Narrowband signal

Radiated Emissions / Interference

		Company:	OpenCell, Inc.				Model #:	OP-RAN2 (Base) and EX-RAN2 (Expansion)			
		Engineer:	Vathana F. Ven		Location:	Site 3C	Serial #:	Prototype			
		Project #:	3047900		Pressure:	1020 hPa	Receiver:	HP 8546A			
		Date:	09/18/03		Temp:	20C	Antenna:	HORN1 10-31-03 V3.ant		HORN1 10-31-03 H3.ant	
		Standard:	FCC Part 15 Subpart B		Humidity:	66%	PreAmp:	None			
		Class:	A	Group:	None		Cable(s):	CBL027 11-13-03.cbl		None	
		Limit Distance:	10	meters		Test Distance:	3	meters			
		Voltage/Frequency:	220 Vac/60 Hz			Frequency Range:	1-2 GHz				

	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
NB	V	1062.000	9.3	25.9	2.1	0.0	10.5	26.9	49.5	-22.6
NB	V	1138.500	13.5	26.1	2.2	0.0	10.5	31.3	49.5	-18.2

NB-Narrowband signal

4.0 AC Mains Line-Conducted Emissions

4.1 Line-Conducted Emission Limits

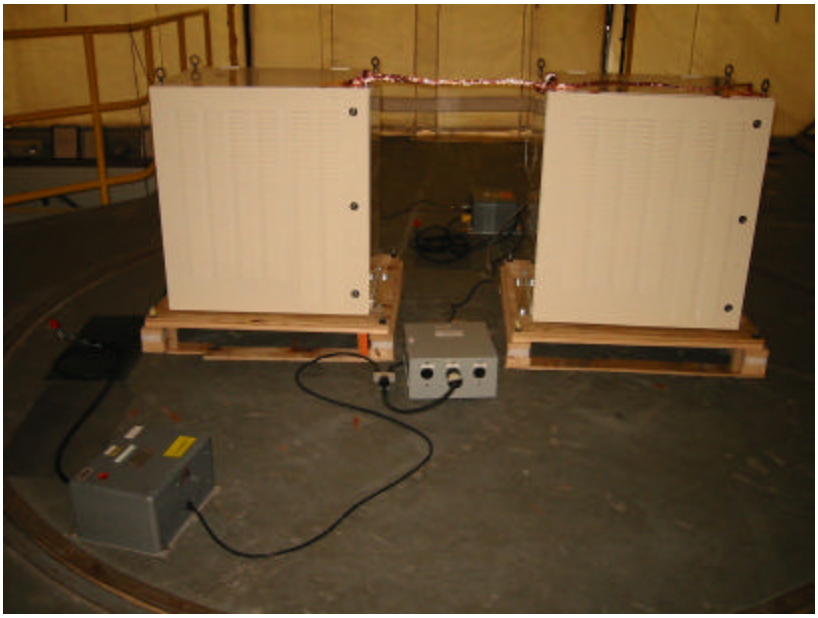
The following table shows the line-conducted emission limits for FCC Part 15 Subpart B Section 15.107:

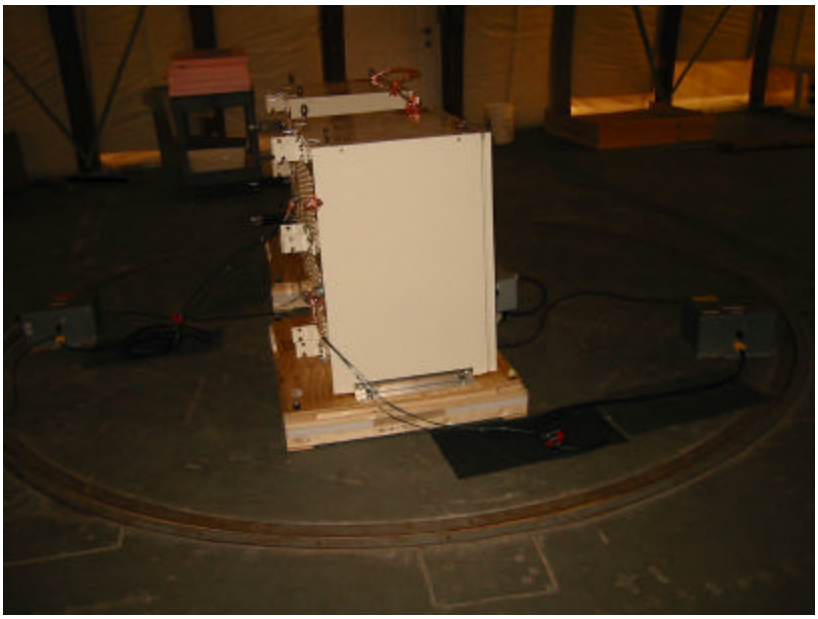
Class A

Frequency (MHz)	Conducted Limit	
	■V	dB■V
0.45 to 1.705	1000	60
1.705 to 30	3000	69.5

(1) The tighter limit applies at the band-edge.

4.2 Configuration Photographs - Worst-Case Line-Conducted Emission





4.3 Test Data

The following results were obtained when the device was tested as described in this report.

Conducted Emissions / Interference

Company:	OpenCell, Inc.			Model #:	OP-RAN2 (Base) and EX-RAN2 (Expansion)
Engineer:	Vathana F. Ven	Location:	Site 3C	Serial #:	Prototype
Project #:	3047900	Pressure:	1020 hPa	Receiver:	HP 8546A
Date:	09/18/03	Temp:	21C	Cable:	CBL10MS3 1-7-04.cbl
Standard:	FCC Part 15 Subpart B	Humidity:	63%	LISN 1, 2:	LISN11 [1] 5-29-04.lsn LISN11 [2] 5-29-04.lsn
Class:	A	Group:	None	LISN 3, N:	None None
Preamp:	None			Attenuator:	DS27 2-5-04.att
Note:	***Base Unit***				
Voltage/Frequency:	220 Vac/60 Hz		Frequency Range:		0.450-30 MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, preamp gain, and initial reading

Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Quasi-Peak Net dB(uV)	Quasi-Peak Limit dB(uV)	Quasi-Peak Margin dB
0.469	20.8	N/A	N/A	21.6	42.1	60.0	-17.9
4.972	20.4	N/A	N/A	19.8	40.9	69.5	-28.6
5.370	16.8	N/A	N/A	17.3	37.6	69.5	-31.9
7.066	27.7	N/A	N/A	23.8	48.2	69.5	-21.3
7.722	28.5	N/A	N/A	27.2	49.1	69.5	-20.4
16.870	21.0	N/A	N/A	20.0	41.8	69.5	-27.7

Conducted Emissions / Interference

Company:	OpenCell, Inc.			Model #:	OP-RAN2 (Base) and EX-RAN2 (Expansion)
Engineer:	Vathana F. Ven	Location:	Site 3C	Serial #:	Prototype
Project #:	3047900	Pressure:	1020 hPa	Receiver:	HP 8546A
Date:	09/18/03	Temp:	21C	Cable:	CBL10MS3 1-7-04.cbl
Standard:	FCC Part 15 Subpart B	Humidity:	63%	LISN 1, 2:	LISN13 [1] 3-11-04.lsn LISN13 [2] 3-11-04.lsn
Class:	A	Group:	None	LISN 3, N:	None None
Preamp:	None			Attenuator:	DS27 2-5-04.att
Note:	***Expansion Unit***				
Voltage/Frequency:	220 Vac/60 Hz			Frequency Range:	0.450-30 MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, preamp gain, and initial reading

Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Quasi-Peak Net dB(uV)	Quasi-Peak Limit dB(uV)	Quasi-Peak Margin dB
4.974	16.2	N/A	N/A	16.0	36.8	69.5	-32.7
7.069	23.8	N/A	N/A	25.2	45.6	69.5	-23.9
7.332	23.6	N/A	N/A	21.0	44.2	69.5	-25.3
7.622	23.0	N/A	N/A	22.3	43.7	69.5	-25.8
10.000	30.1	N/A	N/A	31.4	51.8	69.5	-17.7
15.660	24.2	N/A	N/A	23.8	45.0	69.5	-24.5

5.0 Miscellaneous Information

5.1 Site Description

SITE 3C - At this time, three weather-sheltered open field test sites are in use. Site 3 is surrounded by a wire mesh groundplane extension of 25m x 37m to permit 30m operation, and a turntable capacity is increased to 12,000 lbs.

Each site is comprised of a 33' x 57' continuous metal sheet groundplane, sheltered by an arched, flexible plastic cover supported by semicircular fiberglass ribs. Maximum interior height is 16'. The groundplane is earthed at 3' intervals around its periphery by grounding straps outside of the foundation. Access to the site is provided by both a personnel door and a 10' x 10' operable flap in the plastic cover.

Each site has a 12' diameter flush-mounted motorized turntable and remote-controlled mast for antenna height and polarization. A half-basement provides access below the turntable for support equipment and mains power selection.

The operation and test equipment are located below the groundplane at a mezzanine level, permitting observation of the EUT without affecting the measurement of radiated emissions.

For 30m antenna distances in Site 3, the antenna mast is located outside of the plastic shelter, on the wire mesh extension of the groundplane.

All unnecessary equipment is removed from the site following the shipping and storing procedures of the Standard Operating Procedures. Any packaging material is moved to a corner of the site. Packing material is generally non-conductive. Any metal shipping contains are removed entirely from the site, and, if necessary due to inclement weather, either sheltered in plastic or removed to another location.

5.2 Test Procedure Reference

For radiated emissions testing:

ANSI C63.4:1992

For line-conducted emissions testing

ANSI C63.4:1992

5.3 Labeling - USA

Class A Labelling and
Instruction Manual Requirements

Devices subject to Class A verification must be labelled with the following statement:

> This device complies with Part 15 of the FCC Rules. Operation 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.

In addition, for a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
>
> NOTE: This equipment has been tested and found to comply with the limits for a Class A 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 commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

If shielded cables or other specialized accessories are necessary for the unit to achieve compliance, a statement similar to the following should be added:

> Shielded cables must be used with this unit to ensure compliance with the Class A FCC limits.

5.4 Labelling - Canada

Canadian Emissions Requirements

The intent of the amendment is to establish Canadian Regulations, which are harmonized with the existing FCC Regulations. As such, no retesting is required and devices, which have been tested and comply with the FCC Specifications (Class A or B) also comply with the Canadian Specification (Class A or B).

A record of the measurements and results shall be retained by the manufacturer or importer for a period of at least five years and made available for examination on the request of the Canadian Government.

A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other restrictions, it is not feasible to affix a label to the apparatus; the notice may be in the form of a statement included in the user's manual.

This Class [*] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [*] est conforme à la norme NMB-003 du Canada.

[*] Insert either "A" or "B" but not both as appropriate for the equipment requirements.

5.5 Test Report Certification

Company Name:	OpenCell, Inc. 955 Perimeter Road Manchester, NH 03103
Attention:	Mr. Glen Thomas
Part Number:	OP-RAN2 (Base) and EX-RAN2 (Expansion)
Report Date:	November 7, 2003
Test Site Location:	Site 3C INTERTEK TESTING SERVICES NA INC. 70 Codman Hill Road Boxborough, Massachusetts 01719

5.6 Equipment List

The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
Antenna	EMCO	3142	9711-1223	11/5/2003
LISN, 50uH, .01 - 50MHz,	Solar Electronics	9252-50-R-24-BNC	941713	5/29/2004
LISN, 50uH, .01 - 50MHz,	Solar Electronics	9252-50-R-24-BNC	955107	3/11/2004
Attenuator, 20dB	Mini Circuits	20dB, 50 ohm	DS27	2/5/2004
Cable, BNC - BNC, 10m lg	Alpha	RG-58C/U	CBL10MS3	1/7/2004
Horn Antenna	EMCO	3115	9512-4632	10/31/2003
High Frequency 40Ghz	Megaphase	TM40 K1K1 197	CBL027	11/13/2003
EMI Receiver W/RF Filter	Hewlett Packard	85462A	211389	6/18/2004

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