

# CyberOptics Semiconductor, Inc.

## WaferSense Link

December 8, 2004

Report No. CYBR0040 Rev. 1

Report Prepared By



[www.nwemc.com](http://www.nwemc.com)  
1-888-EMI-CERT

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**EMC Test Report**



22975 NW Evergreen Parkway  
Suite 400  
Hillsboro, Oregon 97124

**Certificate of Test**  
**Issue Date: December 8, 2004**  
**CyberOptics Semiconductor, Inc.**  
**WaferSense Link**

Specification	Emissions		
	Test Method	Pass	Fail
FCC 15.247(a) Occupied Bandwidth:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.247(b) Output Power:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.247(d) Band Edge Compliance:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.247(d) Spurious Conducted Emissions:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.247(d) Spurious Radiated Emissions:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.247(e) Power Spectral Density:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>
FCC 15.207 AC Power Line Conducted Emissions:2004	ANSI C63.4:2003	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Modifications made to the product**

**See the Modifications section of this report**

**Test Facility**

The measurement facilities used to collect the data is located at:

Northwest EMC, Inc.  
22975 NW Evergreen Parkway, Suite 400; Hillsboro, OR 97124  
Phone: (503) 844-4066  
Fax: 844-3826

The sites have been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada.

**Approved By:**

Don Fecteau, IS Manager

*This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.*

*Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested, the specific description is noted in each of the individual sections of the test report supporting this certificate of test.*

<b>Revision Number</b>	<b>Description</b>	<b>Date</b>	<b>Page Number</b>
01	Added "Transmitter Statement" to the Certificate of Test	2/2/2005	2
01	Removed "Northwest EMC Performance Criteria" section.	2/2/2005	6,7

**FCC:** Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities, have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.



**NVLAP:** Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 89/336/EEC, ANSI C63.4, MIL-STD 461E, DO-160D and SAE J1113. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada. Accreditation has been granted to Northwest EMC, Inc. under Certificate Numbers: 200629-0, 200630-0, and 200676-0.



**Industry Canada:** Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS 212, Issue 1 (Provisional) and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements.



**CAB:** Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement



**TÜV Product Service:** Included in TÜV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TÜV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TÜV's current Listing of CARAT Laboratories available from TÜV. A certificate was issued to represent that this laboratory continues to meet TÜV's CARAT Program requirements. Certificate No. USA0401C



**TÜV Rheinland:** Authorized to carryout EMC tests by order and under supervision of TÜV Rheinland. This authorization is based on "Conditions for EMC-Subcontractors" of November 1992.



**NEMKO:** Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).



**Technology International:** Assessed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LACO196. Based upon that assessment Interference Technology International, Ltd., has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC and amendments). The scope of the approval was provided on a Schedule of Assessment supplied with the certificate and is available upon request.



**Australia/New Zealand:** The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body. (NVLAP)



**VCCI:** Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. (*Registration Nos. - Hillsboro: C-1071 and R-1025, Irvine: C-2094 and R-1943, Newberg: C-1877 and R-1760, Sultan: R-871, C-1784 and R-1761*)



**BSMI:** Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement. License No.SL2-IN-E-1017.



**GOST:** Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification



## SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/scope.asp>

### What is measurement uncertainty?

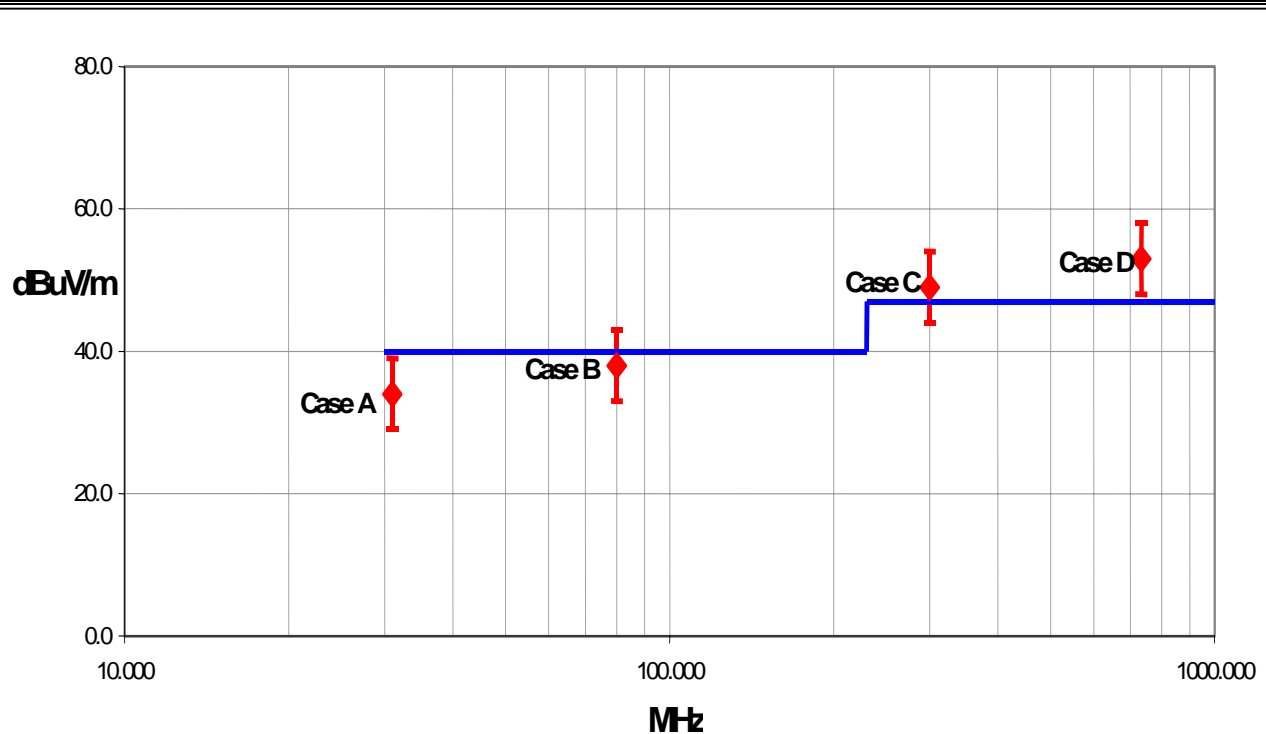
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" value. In the case of transient tests (ESD, EFT, Surge, Voltage Dips and Interruptions), the test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements.

The following documents were the basis for determining the uncertainty levels of our measurements:

- "ISO Guide to the Expression of Uncertainty in Measurements", October 1993
- "NIS81: The Treatment of Uncertainty in EMC Measurements", May 1994
- "IEC CISPR 16-3 A1 f1 Ed.1: Radio-interference measurements and statistical techniques", December 2000

### How might measurement uncertainty be applied to test results?

If the diamond marks the measured value for the test and the vertical bars bracket the range of + and - measurement uncertainty, then test results can be interpreted from the diagram below.



#### Test Result Scenarios:

**Case A:** Product complies.

**Case B:** Product conditionally complies. It is not possible to say with 95% confidence that the product complies.

**Case C:** Product conditionally does not comply. It is not possible to say with 95% confidence that the product does not comply.

**Case D:** Product does not comply.

**Radiated Emissions ≤ 1 GHz**

Value (dB)

Test Distance	Probability Distribution	Biconical Antenna		Log Periodic Antenna		Dipole Antenna	
		3m	10m	3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.86	+ 1.82	+ 2.23	+ 1.29	+ 1.31	+ 1.25
		- 1.88	- 1.87	- 1.41	- 1.26	- 1.27	- 1.25
Expanded uncertainty $U$ (level of confidence ≈ 95%)	normal (k=2)	+ 3.72	+ 3.64	+ 4.46	+ 2.59	+ 2.61	+ 2.49
		- 3.77	- 3.73	- 2.81	- 2.52	- 2.55	- 2.49

**Radiated Emissions > 1 GHz**

Value (dB)

Test Distance	Probability Distribution	Without High Pass Filter		With High Pass Filter	
		3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.29	+ 1.38	- 1.25	- 1.35
		- 1.25	- 1.35	- 1.25	- 1.35
Expanded uncertainty $U$ (level of confidence ≈ 95%)	normal (k=2)	+ 2.57	+ 2.76	- 2.51	- 2.70
		- 2.51	- 2.70	- 2.51	- 2.70

**Conducted Emissions**

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.48
Expanded uncertainty $U$ (level of confidence ≈ 95 %)	normal (k = 2)	2.97

**Radiated Immunity**

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.05
Expanded uncertainty $U$ (level of confidence ≈ 95 %)	normal (k = 2)	2.11

**Conducted Immunity**

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty $u_c(y)$	normal	1.05
Expanded uncertainty $U$ (level of confidence ≈ 95 %)	normal (k = 2)	2.10

**Legend**

$u_c(y)$  = square root of the sum of squares of the individual standard uncertainties

$U$  = combined standard uncertainty multiplied by the coverage factor:  $k$ . This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required, then  $k=3$  (CL of 99.7%) can be used. Please note that with a coverage factor of one,  $u_c(y)$  yields a confidence level of only 68%.



**California**

**Orange County Facility**

41 Tesla Ave.  
Irvine, CA 92618  
(888) 364-2378  
FAX (503) 844-3826



**Oregon**

**Evergreen Facility**

22975 NW Evergreen Pkwy.,  
Suite 400  
Hillsboro, OR 97124  
(503) 844-4066  
FAX (503) 844-3826



**Oregon**

**Trails End Facility**

30475 NE Trails End Lane  
Newberg, OR 97132  
(503) 844-4066  
FAX (503) 537-0735



**Washington**

**Sultan Facility**

14128 339<sup>th</sup> Ave. SE  
Sultan, WA 98294  
(888) 364-2378  
FAX (360) 793-2536



**Party Requesting the Test**

<b>Company Name:</b>	CyberOptics Semiconductor, Inc.
<b>Address:</b>	10220 SW Nimbus, Suite K5
<b>City, State, Zip:</b>	Portland, OR 97223
<b>Test Requested By:</b>	Greg Huntzinger
<b>Model:</b>	WaferSense ALS
<b>First Date of Test:</b>	11/11/2004
<b>Last Date of Test:</b>	11/23/2004
<b>Receipt Date of Samples:</b>	11/11/2004
<b>Equipment Design Stage:</b>	Production
<b>Equipment Condition:</b>	No visual damage.

**Information Provided by the Party Requesting the Test**

<b>Clocks/Oscillators:</b>	Not provided at the time of test.
<b>I/O Ports:</b>	Serial

**Functional Description of the EUT (Equipment Under Test):**

Bluetooth radio used for level measurement in wafer fab equipment.

Both the WaferSense ALS 300 and the WaferSense Link use the same Bluetooth Radio, therefore the antenna conducted test data from the WaferSense ALS 300 is being used to satisfy both requirements. Only the radiated spurious emissions was tested for each specific configuration.

**Client Justification for EUT Selection:**

The product is a representative production sample.

**Client Justification for Test Selection:**

These test satisfy the requirements for the FCC approval.

**EUT Photo**

**Equipment modifications**

Item	Test	Date	Modification	Note	Disposition of EUT
1	Output Power	11/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
2	Spurious Conducted Emissions	11/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
3	Band Edge Compliance	11/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
4	Occupied Bandwidth	11/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
5	Power Spectral Density	11/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
6	Spurious Radiated Emissions	11/15/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
7	AC Powerline Emissions	11/23/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.

**Justification**

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

**Channels in Specified Band Investigated:**

Low
Mid
High

**Operating Modes Investigated:**

No Hop
--------

**Data Rates Investigated:**

Maximum
---------

**Output Power Setting(s) Investigated:**

Maximum
---------

**Power Input Settings Investigated:**

120 VAC, 60 Hz. (5 Vdc from Host Device)
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**Software\Firmware Applied During Test**

Exercise software	CSR Bluetest	Version	1.19
Description			
The system was tested using special software developed to test all functions of the device during the test.			

**EUT and Peripherals**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Radio (EUT)	CyberOptics Semiconductor	WaferSense ALS	H1A01002
Host Device	Cambridge Silicon Radio	Casira	5673121101
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B
Host Device Power Adapter	EGSTON	N2GFSW3	none

**Cables**

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	3.0	No	Host Device	PC
AC Power	No	2.0	No	PC Power Adapter	AC Mains
DC Leads	PA	2.0	PA	PC Power Adapter	PC
DC Leads	PA	2.0	PA	Host Device Power Adapter	Host Device

**PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.**

**Measurement Equipment**

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

**Test Description**

**Requirement:** Per an FCC Interpretation # 20021209-001, "Bluetooth devices may apply under the rules in 15.247 as either a Digital Transmission System (DTS), a Frequency Hopping System (FHSS), or a Hybrid System whichever provides an advantage to the grantee as long as all the requirements are met... The hopping function (*of a hybrid*) must be a true hopping system, as described in Section 15.247(a)(1)."

As a DTS system, the minimum 6 dB bandwidth is 500 kHz.

As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation (see 47 CFR 15.247(a)(1)). For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.

As a Hybrid, it must meet the FHSS requirement as described above.

**Configuration:** The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

**Completed by:**

# EMISSIONS DATA SHEET

EUT: WaferSense ALS	Work Order: CYBR0040
Serial Number: H1A01002	Date: 11/11/04
Customer: CyberOptics Semiconductor	Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel
Customer Ref. No.:	Power: 120VAC/60Hz
	Humidity: 47% RH
	Job Site: EV06

TEST SPECIFICATIONS			
Specification: 47 CFR 15.247(a)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**

**COMMENTS**  
Measured with a direct connection between the RF output and a spectrum analyzer.

**EUT OPERATING MODES**  
Modulated by PRBS at maximum data rate

**DEVIATIONS FROM TEST STANDARD**  
None

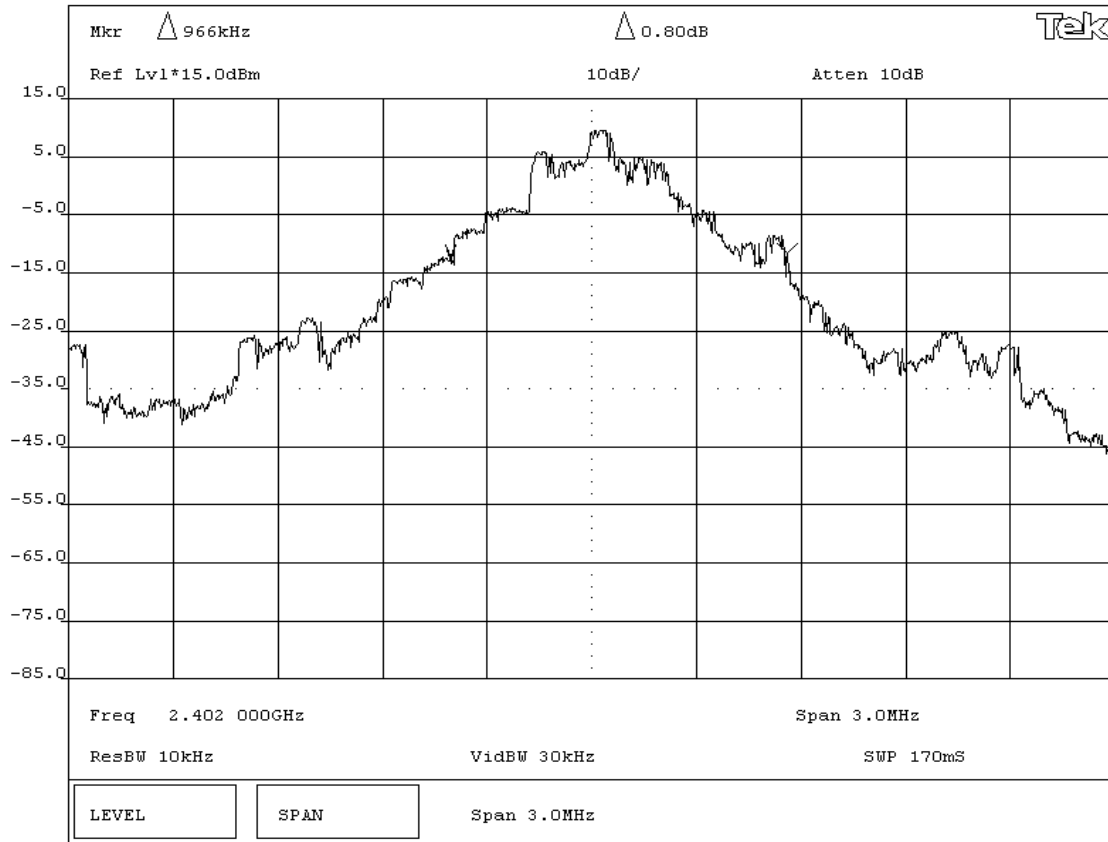
**REQUIREMENTS**  
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System.  
As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz.  
As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.

RESULTS	BANDWIDTH
Pass	0.966 MHz

**SIGNATURE**

Tested By: Greg Kiemel

**DESCRIPTION OF TEST**  
**20dB Bandwidth - Low Channel**



EUT: WaferSense ALS	Work Order: CYBR0040
Serial Number: H1A01002	Date: 11/11/04
Customer: CyberOptics Semiconductor	Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel
Customer Ref. No.:	Power: 120VAC/60Hz
	Humidity: 47% RH
	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(a)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>

**COMMENTS**  
Measured with a direct connection between the RF output and a spectrum analyzer.

**EUT OPERATING MODES**  
Modulated by PRBS at maximum data rate

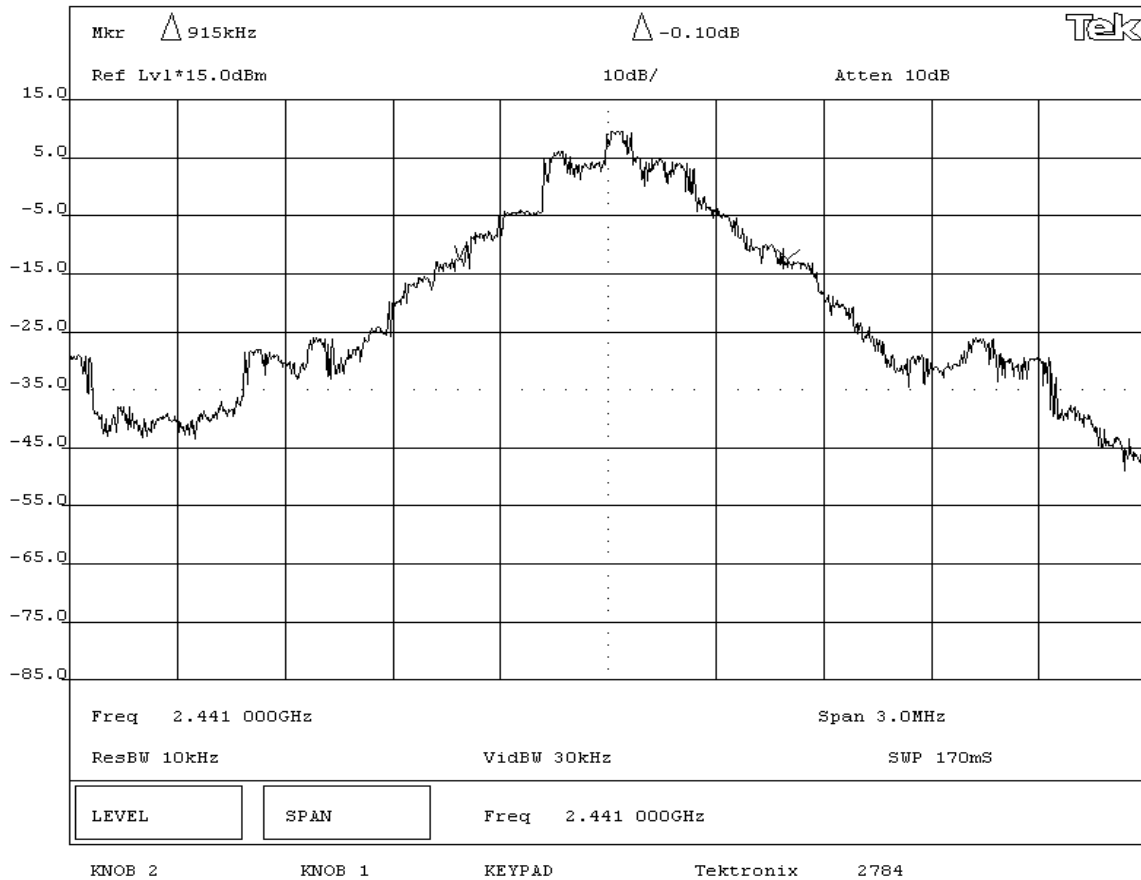
**DEVIATIONS FROM TEST STANDARD**  
None

**REQUIREMENTS**  
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System. As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz. As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.

**RESULTS**  
Pass **BANDWIDTH**  
0.915 MHz

**SIGNATURE**  
Tested By: *Greg Kiemel*

**DESCRIPTION OF TEST**  
**20dB Bandwidth - Mid Channel**



EUT: WaferSense ALS	Work Order: CYBR0040
Serial Number: H1A01002	Date: 11/11/04
Customer: CyberOptics Semiconductor	Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel
Customer Ref. No.:	Power: 120VAC/60Hz
	Humidity: 47% RH
	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(a)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**

**COMMENTS**  
Measured with a direct connection between the RF output and a spectrum analyzer.

**EUT OPERATING MODES**  
Modulated by PRBS at maximum data rate

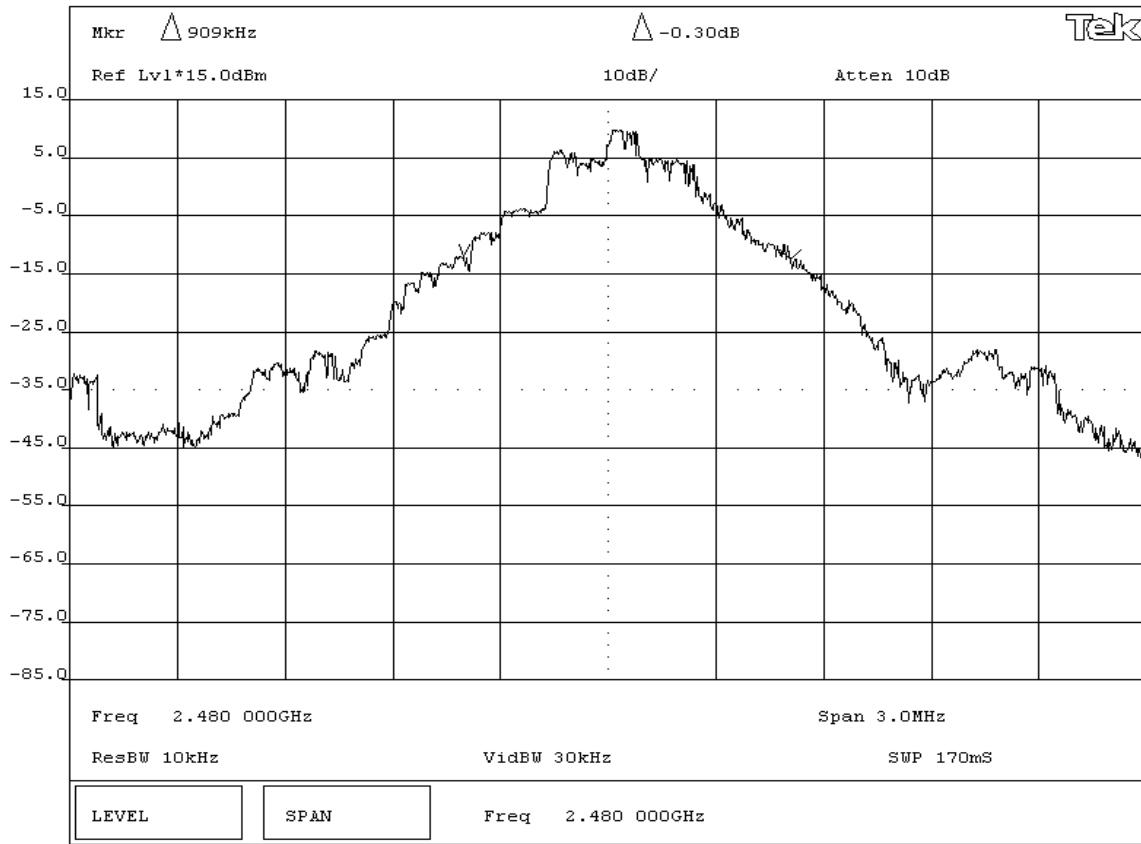
**DEVIATIONS FROM TEST STANDARD**  
None

**REQUIREMENTS**  
Bluetooth can be authorized as either a Frequency Hopping System (FHSS), a Digital Transmission System (DTS), or a Hybrid System. As a FHSS, the maximum 20dB bandwidth of the hopping channel is equal to 1.5 times the channel separation. For example, channel separation for Bluetooth is 1 MHz, therefore the maximum 20 dB bandwidth is 1.5 MHz. As a DTS system, the minimum 6 dB bandwidth is 500 kHz. As a Hybrid, it must meet the FHSS requirement as described above.

**RESULTS**  
Pass BANDWIDTH 0.909 MHz

**SIGNATURE**  
Tested By: *Greg Kiemel*

**DESCRIPTION OF TEST**  
**20dB Bandwidth - High Channel**







**Justification**

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

**Channels in Specified Band Investigated:**

Low
Mid
High

**Operating Modes Investigated:**

No Hop
--------

**Data Rates Investigated:**

Maximum
---------

**Output Power Setting(s) Investigated:**

Maximum
---------

**Power Input Settings Investigated:**

120 VAC, 60 Hz.
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**Software\Firmware Applied During Test**

Exercise software	CSR Bluetest	Version	1.19
Description			
The system was tested using special software developed to test all functions of the device during the test.			

**EUT and Peripherals**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Radio (EUT)	CyberOptics Semiconductor	WaferSense ALS	H1A01002
Host Device	Cambridge Silicon Radio	Casira	5673121101
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B
Host Device Power Adapter	EGSTON	N2GFSW3	none

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	3.0	No	Host Device	PC
AC Power	No	2.0	No	PC Power Adapter	AC Mains
DC Leads	PA	2.0	PA	PC Power Adapter	PC
DC Leads	PA	2.0	PA	Host Device Power Adapter	Host Device

**PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.**

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Power Meter	Hewlett Packard	E4418A	SPA	07/23/2004	24 mo
Power Sensor	Hewlett-Packard	8481H	SPB	07/23/2004	24 mo
RF Detector	RLC Electronics	CR-133-R	ZZA	NCR	NA
Oscilloscope	Tektronix	TDS 3052	TOF	07/21/2004	12 mo
Signal Generator	Hewlett Packard	8341B	TGN	01/23/2004	13 mo

### Test Description

**Requirement:** Per 47 CFR 15.247(b)(3), the maximum peak output power must not exceed 1 Watt.

**Configuration:** The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The EUT was transmitting at its maximum output power.


The measurement was made using a direct connection between the RF output of the EUT and a RF detector diode. The DC output of the diode was measured with the oscilloscope. The signal generator, tuned to the transmit frequency, was then substituted for the EUT. The CW output of the signal generator was adjusted until the DC output of the RF detector diode match the peak level produced when connected to the EUT. To further reduce measurement error, the power meter and sensor were then used to measure the output power level of the signal generator.

**De Facto EIRP Limit:** Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

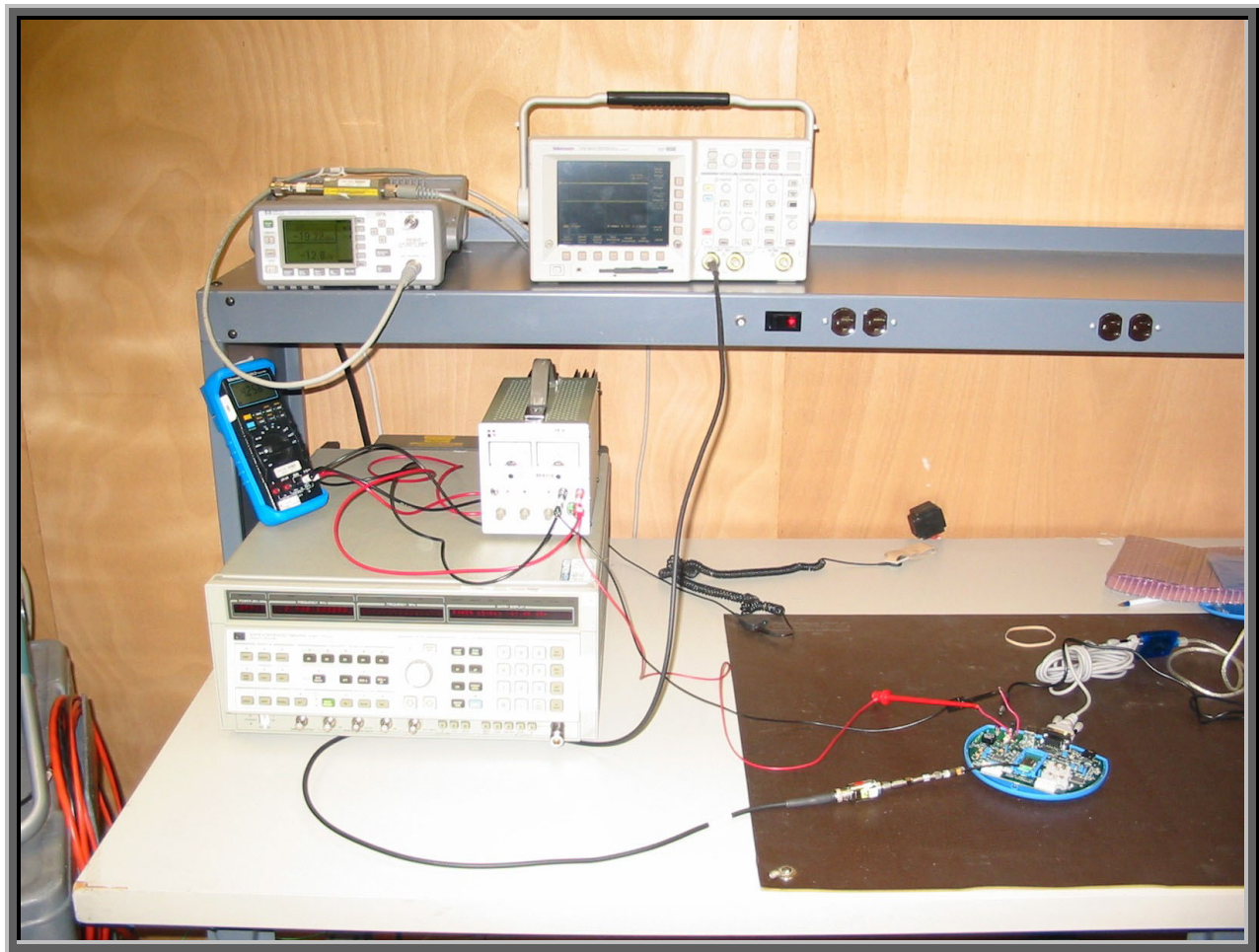
Completed by:

NORTHWEST

**EMC****EMISSIONS DATA SHEET**Rev BETA  
01/30/01

EUT:	WaferSense ALS		Work Order:	CYBR0040			
Serial Number:	H1A01002		Date:	11/11/04			
Customer:	CyberOptics Semiconductor, Inc.		Temperature:	70 °F			
Attendees:	Greg Huntzinger	Tested by:	Greg Kiemel	Humidity:	47% RH		
Customer Ref. No.:		Power:	120VAC/60Hz	Job Site:	EV06		
<b>TEST SPECIFICATIONS</b>							
Specification:	47 CFR 15.247(b)	Year:	2004	Method:	DA 00-705, ANSI C63.4	Year:	2003
<b>SAMPLE CALCULATIONS</b>							
<b>COMMENTS</b>							
<b>EUT OPERATING MODES</b>							
Modulated by PRBS at maximum data rate							
<b>DEVIATIONS FROM TEST STANDARD</b>							
None							
<b>REQUIREMENTS</b>							
Maximum peak conducted output power does not exceed 1 Watt							
<b>RESULTS</b>		<b>AMPLITUDE</b>					
Pass		34.04 mW					
<b>SIGNATURE</b>							
 Tested By: _____							
<b>DESCRIPTION OF TEST</b>							
<b>Output Power</b>							

Frequency (MHz)	Peak Power Measured w/ Diode Detector (dBm)	Peak Power (mW)	Spec (mW)
2402.0	15.32	34.04	1000.0
2441.0	15.26	33.57	1000.0
2480.0	15.30	33.88	1000.0



**Justification**

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

**Channels in Specified Band Investigated:**

Low

High

**Operating Modes Investigated:**

No Hop

**Data Rates Investigated:**

Maximum

**Output Power Setting(s) Investigated:**

Maximum

**Power Input Settings Investigated:**

120 VAC, 60 Hz (5 Vdc from Host)

**Software\Firmware Applied During Test**

Exercise software	CSR Bluetest	Version	1.19
Description			
The system was tested using special software developed to test all functions of the device during the test.			

**EUT and Peripherals**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Radio (EUT)	CyberOptics Semiconductor	WaferSense ALS	H1A01002
Host Device	Cambridge Silicon Radio	Casira	5673121101
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B
Host Device Power Adapter	EGSTON	N2GFSW3	none

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	3.0	No	Host Device	PC
AC Power	No	2.0	No	PC Power Adapter	AC Mains
DC Leads	PA	2.0	PA	PC Power Adapter	PC
DC Leads	PA	2.0	PA	Host Device Power Adapter	Host Device
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					


Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

### Test Description

**Requirement:** Per 47 CFR 15.247(d), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

**Configuration:** The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

Completed by:



EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

TEST SPECIFICATIONS			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

SAMPLE CALCULATIONS	


COMMENTS	

EUT OPERATING MODES	
Modulated by PRBS at maximum data rate	

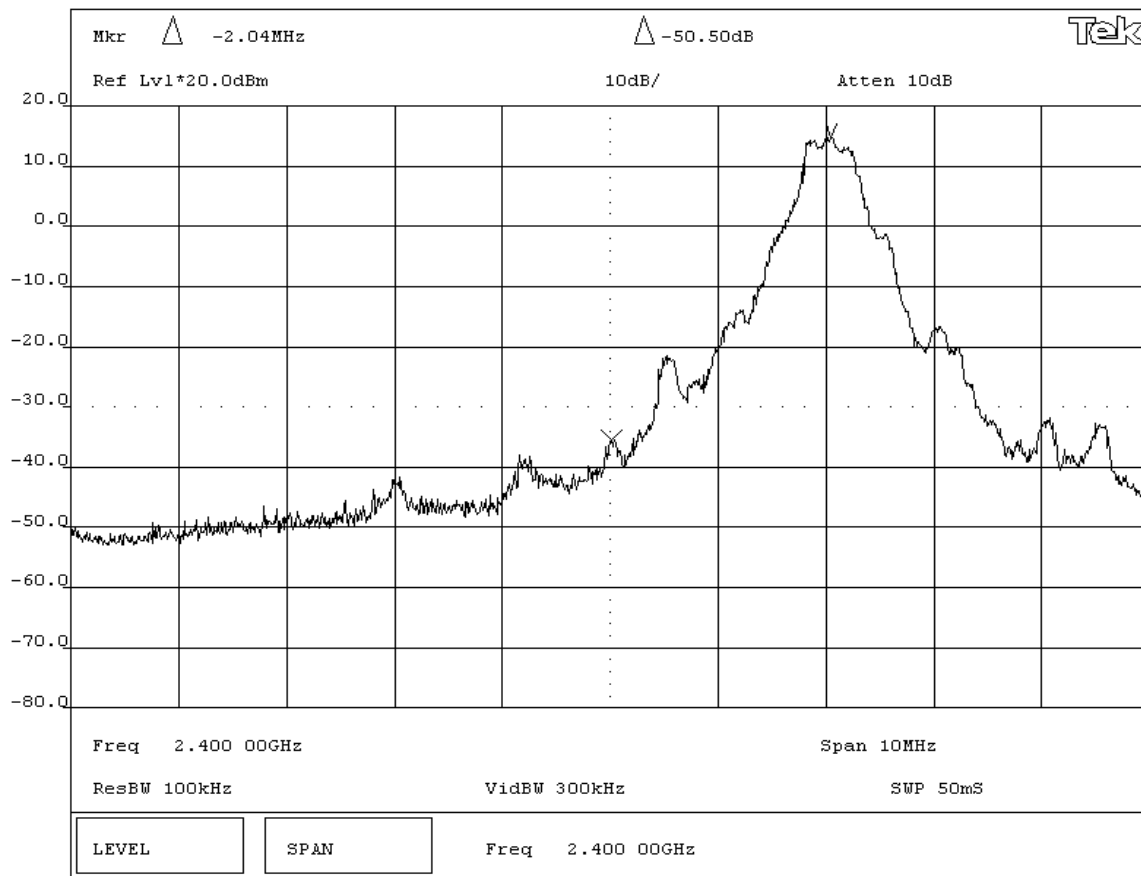
DEVIATIONS FROM TEST STANDARD	
None	

REQUIREMENTS	
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental	

RESULTS	AMPLITUDE
Pass	-50.5 dB

SIGNATURE	
Tested By: 	

DESCRIPTION OF TEST	
<b>Band Edge Compliance - Low Channel</b>	



NORTHWEST  
**EMC**

# EMISSIONS DATA SHEET

Rev BETA  
01/30/01

EUT: WaferSense ALS	Work Order: CYBR0040
Serial Number: H1A01002	Date: 11/11/04
Customer: CyberOptics Semiconductor	Temperature: 70 °F
Attendees: Greg Huntzinger	Humidity: 47% RH
Customer Ref. No.:	Tested by: Greg Kiemel
	Power: 120VAC/60Hz
	Job Site: EV06

TEST SPECIFICATIONS			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES  
Modulated by PRBS at maximum data rate

DEVIATIONS FROM TEST STANDARD  
None

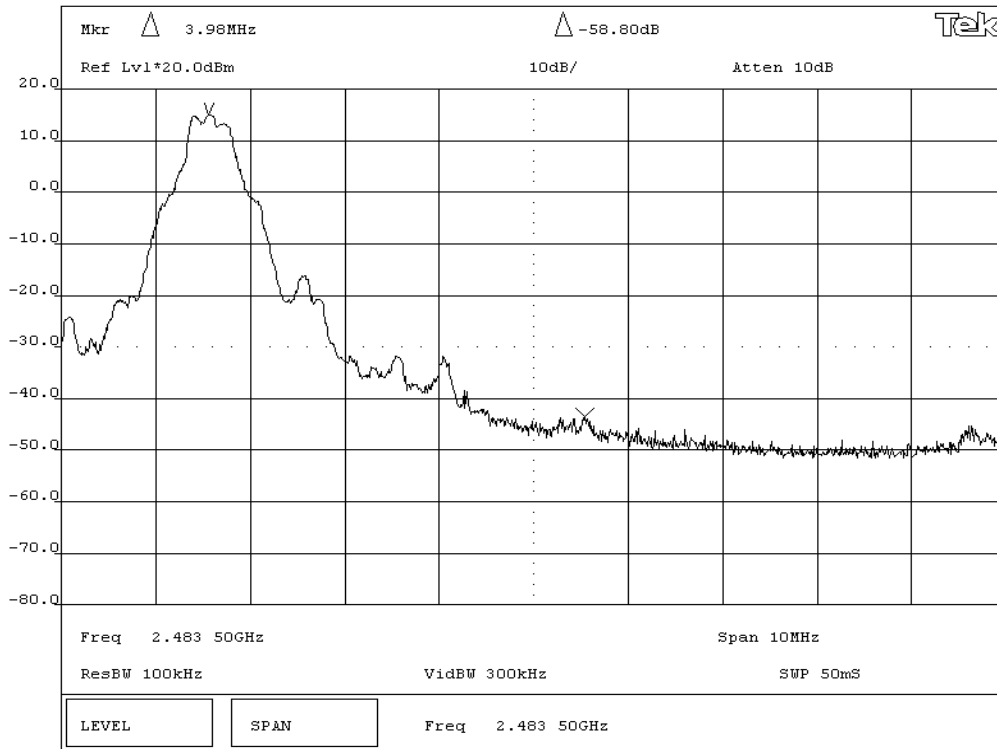
REQUIREMENTS  
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental

RESULTS	AMPLITUDE
Pass	-58.8 dB

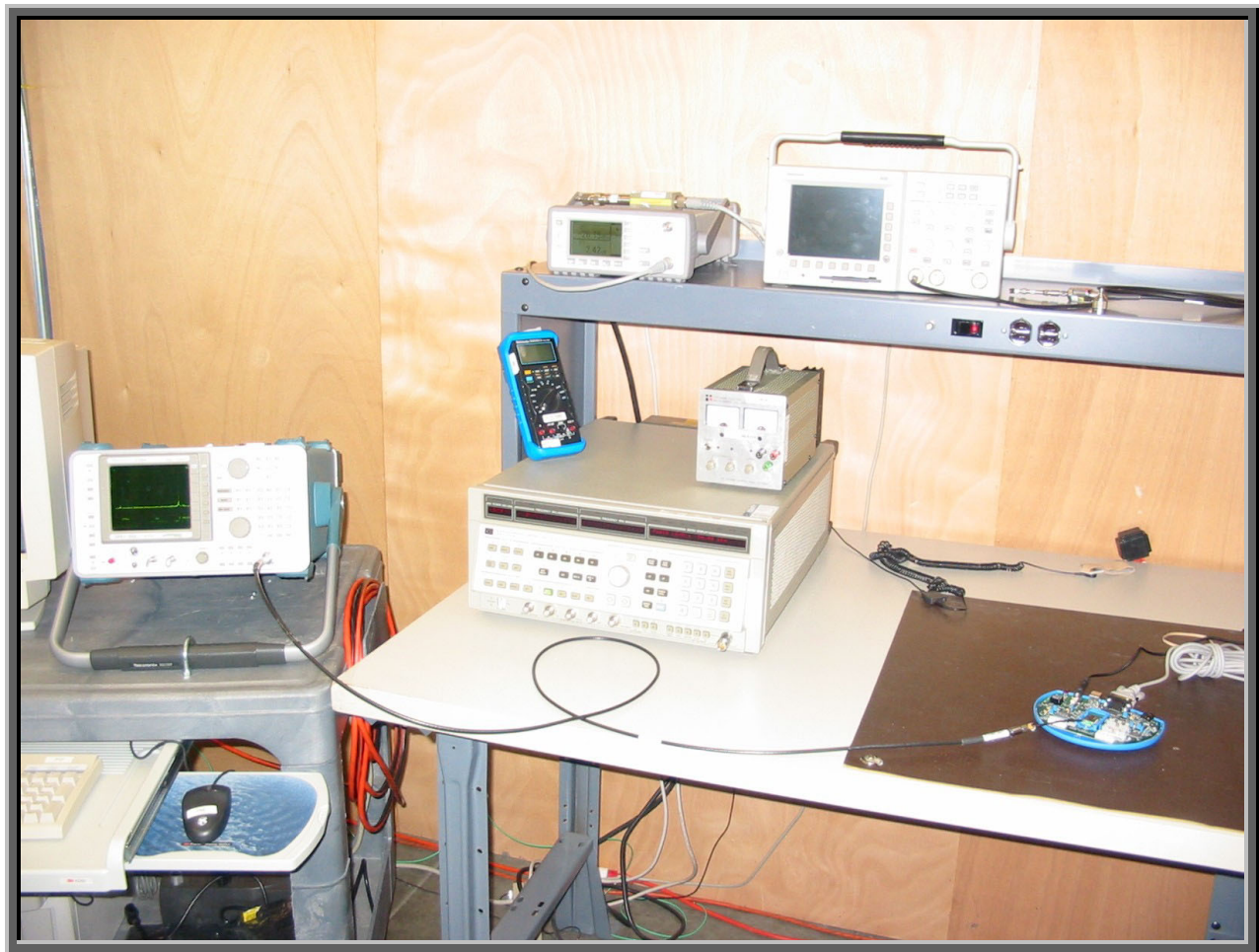
SIGNATURE

Tested By: *Greg Kiemel*

DESCRIPTION OF TEST  
**Band Edge Compliance - High Channel**







**Justification**

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

**Channels in Specified Band Investigated:**

Low
Mid
High

**Operating Modes Investigated:**

No Hop
--------

**Data Rates Investigated:**

Maximum
---------

**Output Power Setting(s) Investigated:**

Maximum
---------

**Power Input Settings Investigated:**

120 VAC, 60 Hz (5 Vdc from Host)
----------------------------------

**Software\Firmware Applied During Test**

Exercise software	CSR Bluetest	Version	1.19
Description			
The system was tested using special software developed to test all functions of the device during the test.			

**EUT and Peripherals**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Radio (EUT)	CyberOptics Semiconductor	WaferSense ALS	H1A01002
Host Device	Cambridge Silicon Radio	Casira	5673121101
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B
Host Device Power Adapter	EGSTON	N2GFSW3	none

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	3.0	No	Host Device	PC
AC Power	No	2.0	No	PC Power Adapter	AC Mains
DC Leads	PA	2.0	PA	PC Power Adapter	PC
DC Leads	PA	2.0	PA	Host Device Power Adapter	Host Device
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

### Test Description

**Requirement:** Per 47 CFR 15.247(d), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

**Configuration:** The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency.

Completed by:

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

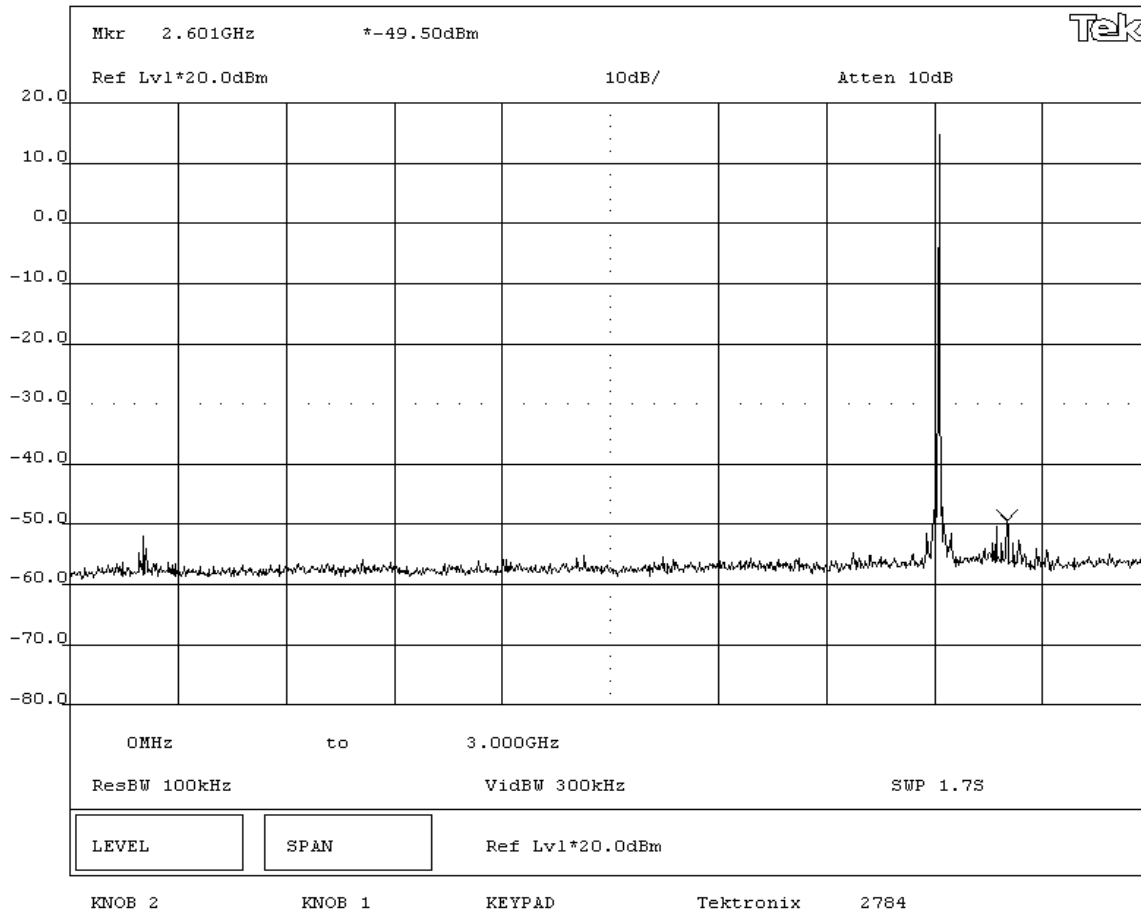
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
			
Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Low Channel 0MHz-3GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

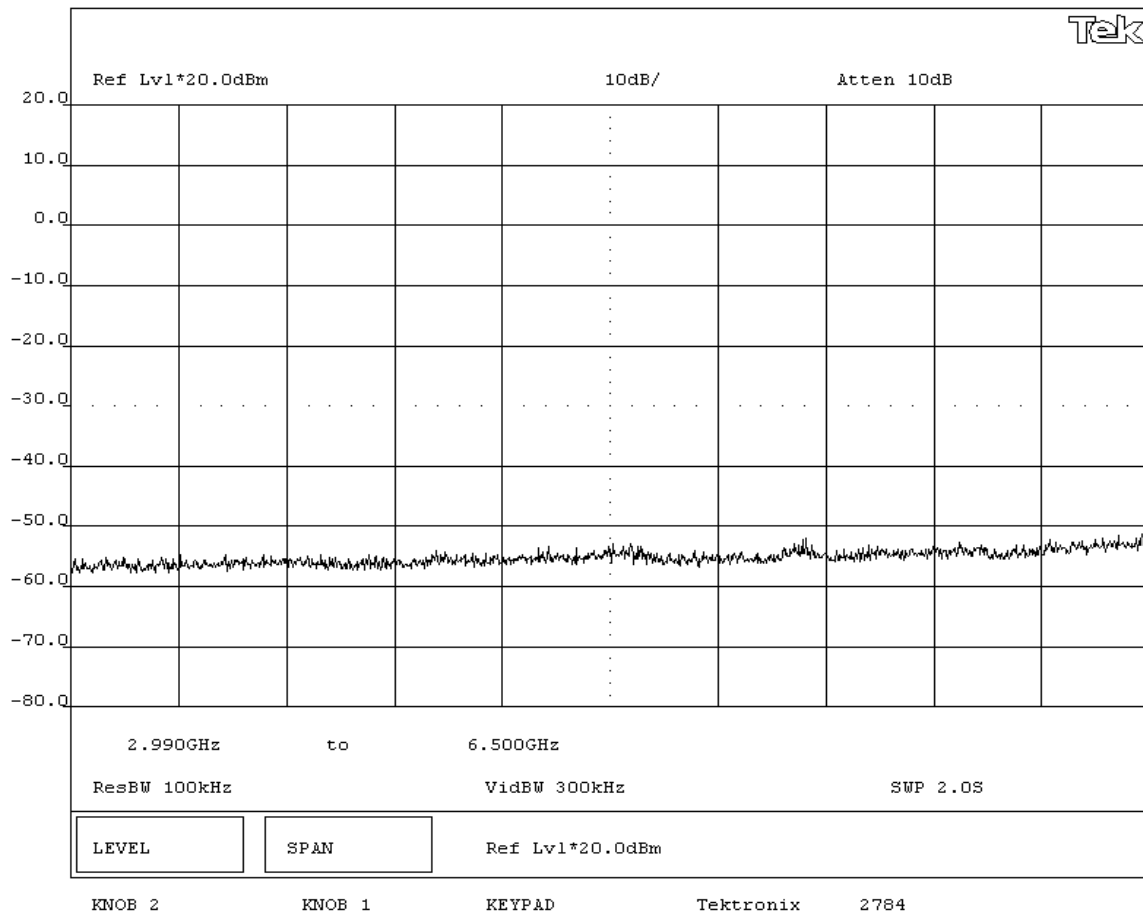
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
Antenna Conducted Spurious Emissions - Low Channel 3GHz-6.5GHz			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

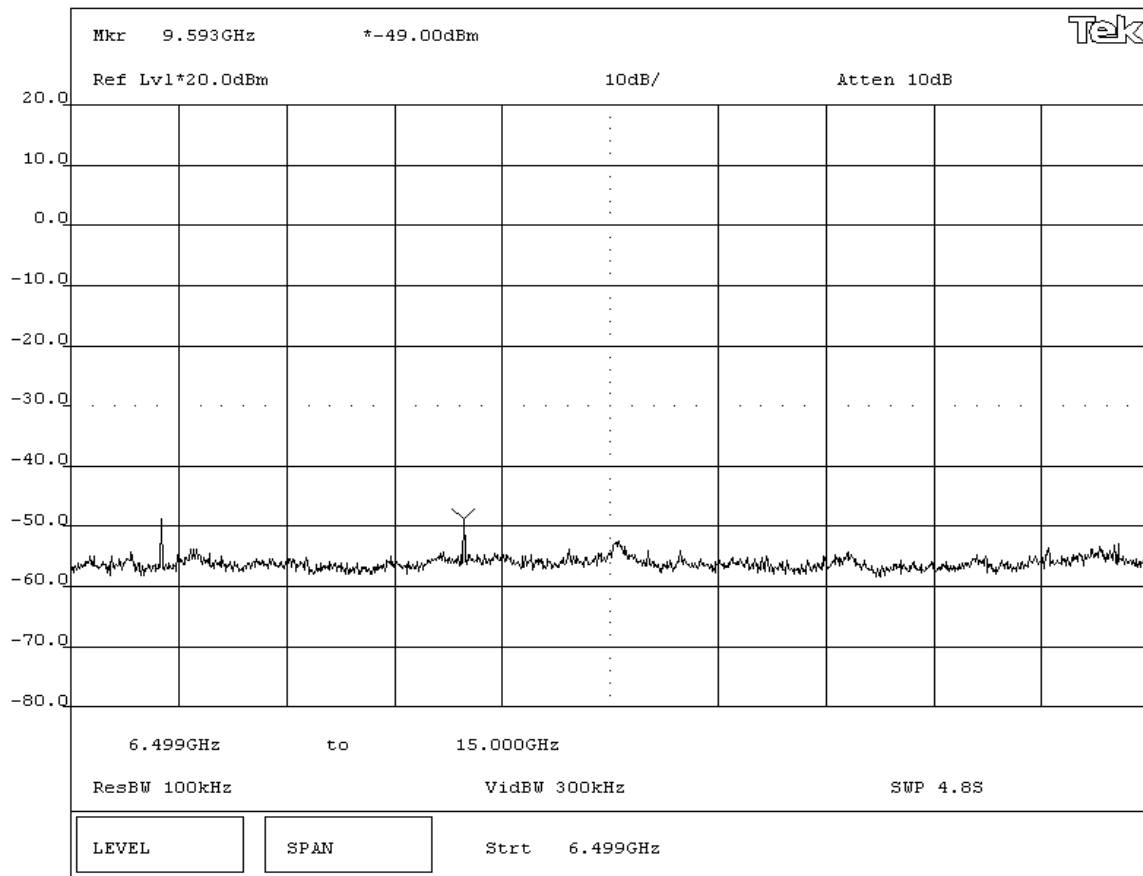
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Low Channel 6.5GHz-15GHz</b>			





# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			


<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

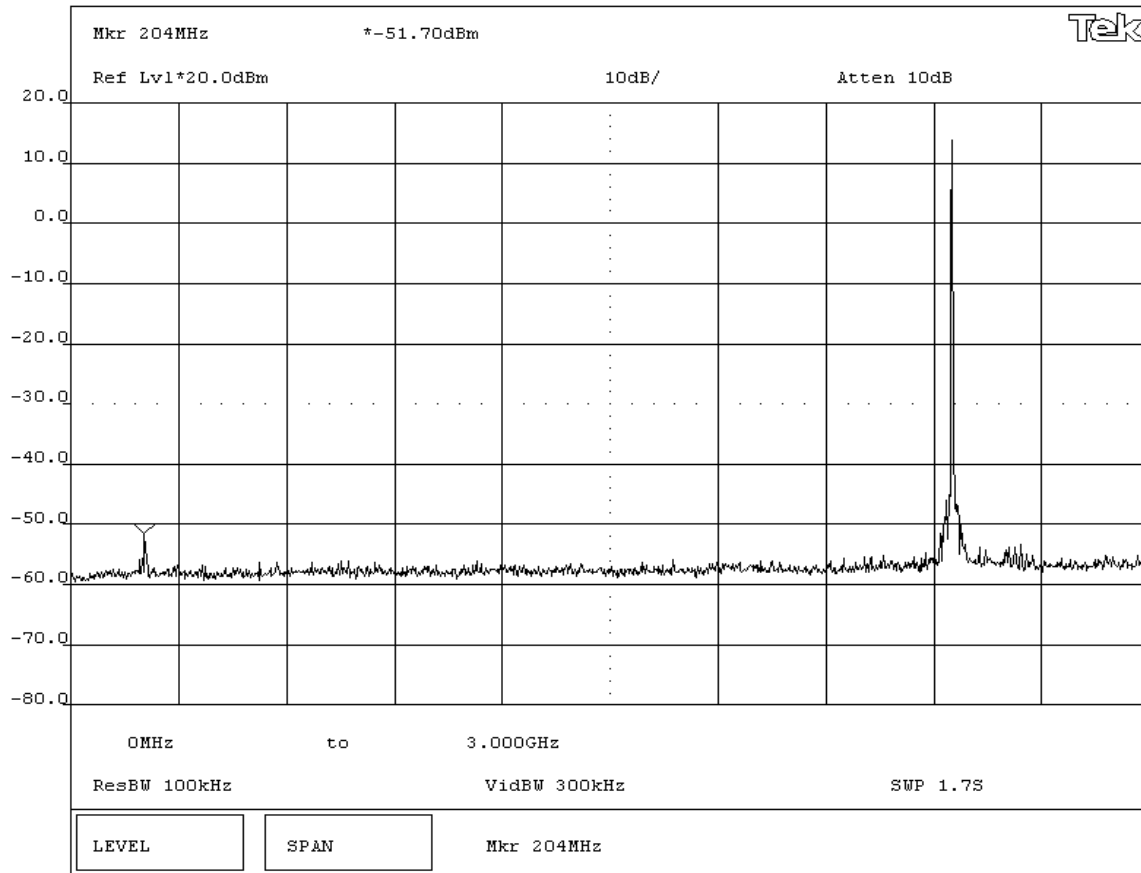
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Mid Channel 0MHz-3GHz</b>			





EUT: WaferSense ALS		Work Order: CYBR0040	
Serial Number: H1A01002		Date: 11/11/04	
Customer: CyberOptics Semiconductor		Temperature: 70 °F	
Attendees: Greg Huntzinger		Humidity: 47% RH	
Customer Ref. No.:	Tested by: Greg Kiemel	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

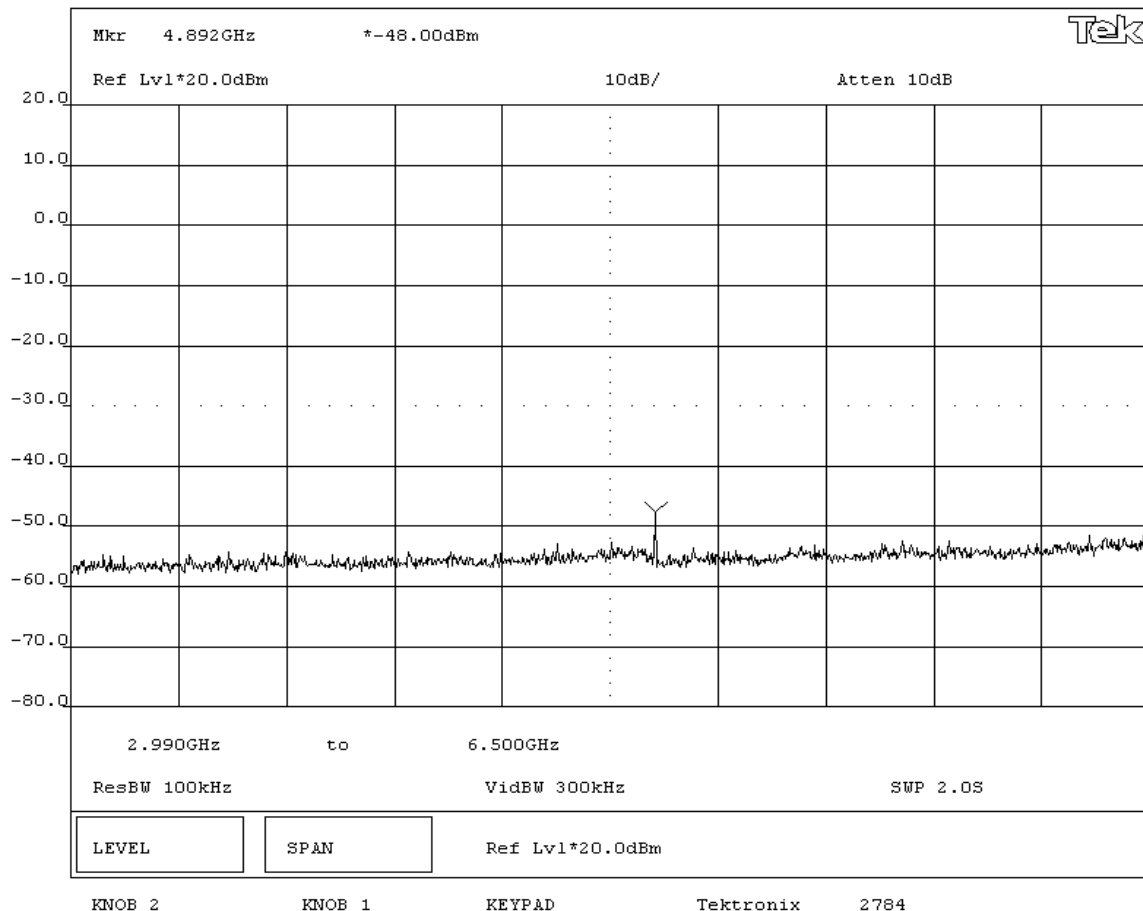
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Mid Channel 3GHz-6.5GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040	
Serial Number: H1A01002		Date: 11/11/04	
Customer: CyberOptics Semiconductor		Temperature: 70 °F	
Attendees: Greg Huntzinger		Humidity: 47% RH	
Customer Ref. No.:	Tested by: Greg Kiemel	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

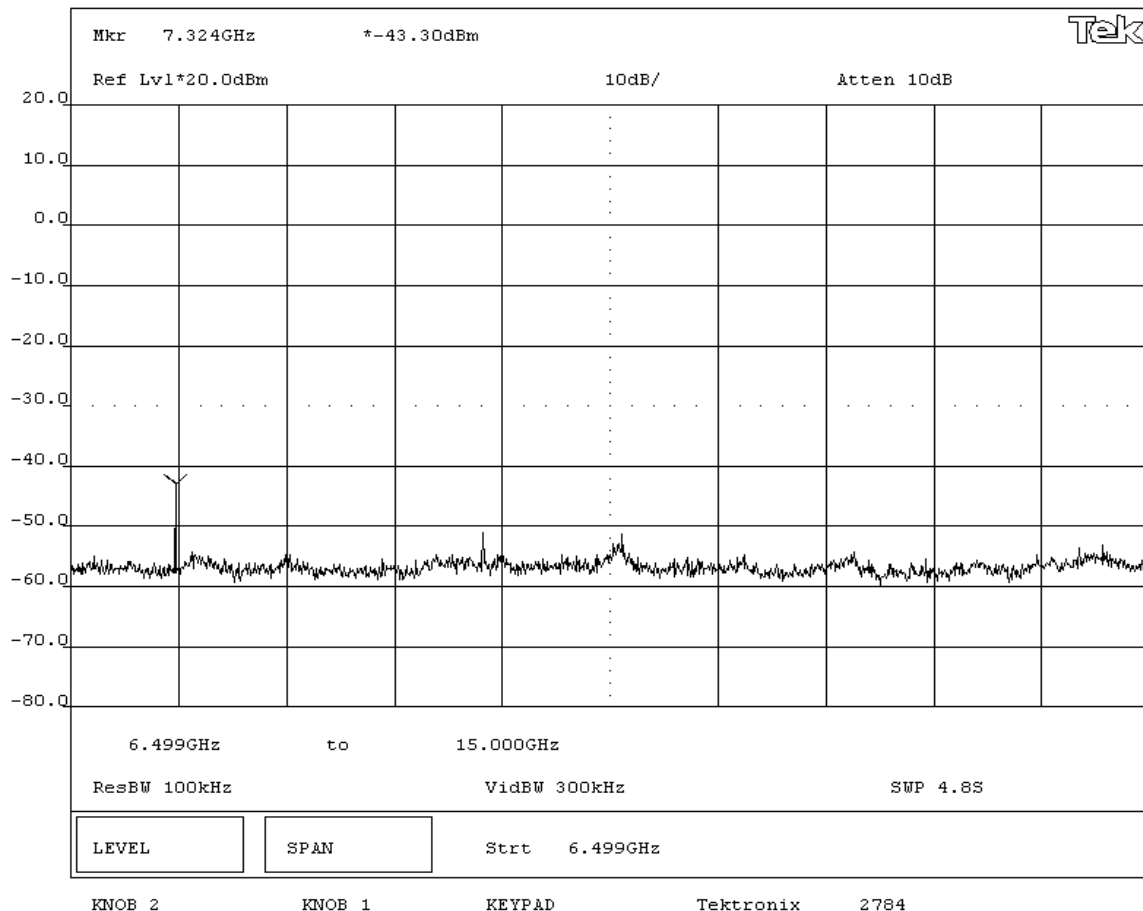
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Mid Channel 6.5GHz-15GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040	
Serial Number: H1A01002		Date: 11/11/04	
Customer: CyberOptics Semiconductor		Temperature: 70 °F	
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH	
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06	

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

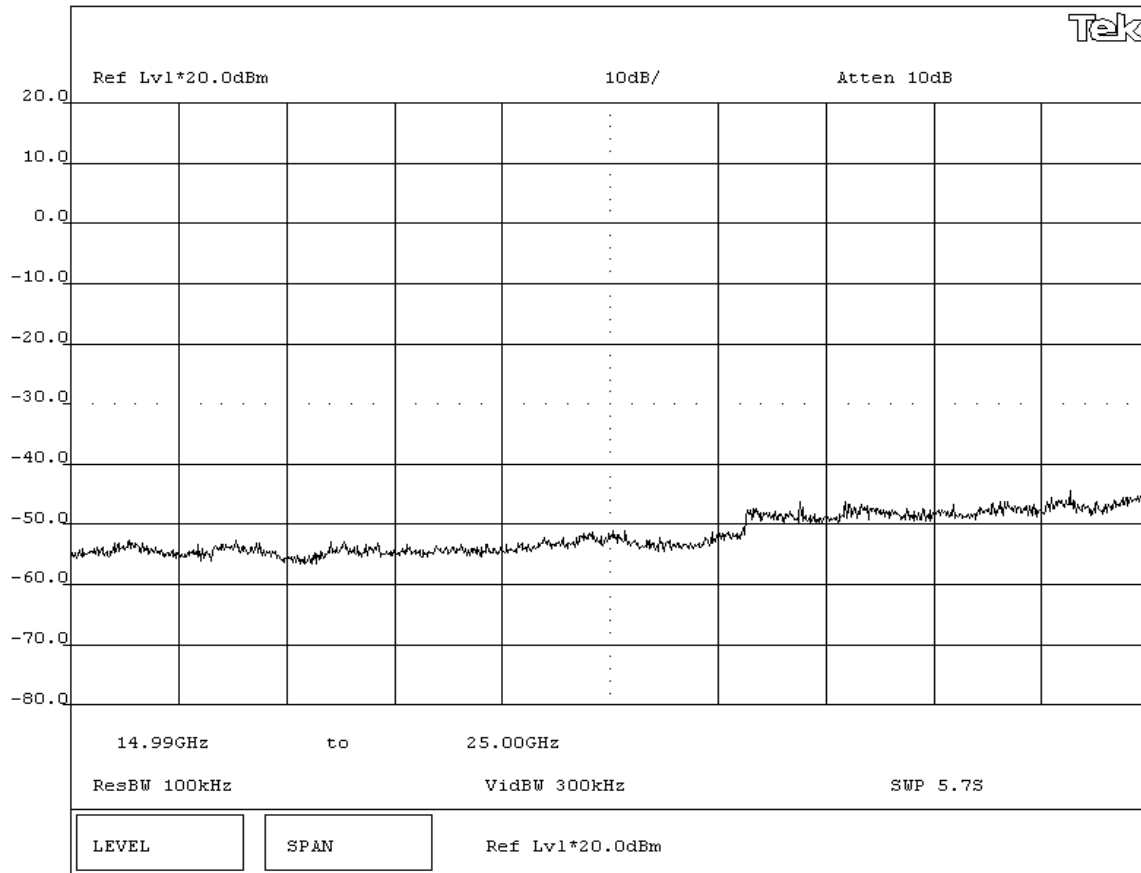
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - Mid Channel 15GHz-25GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

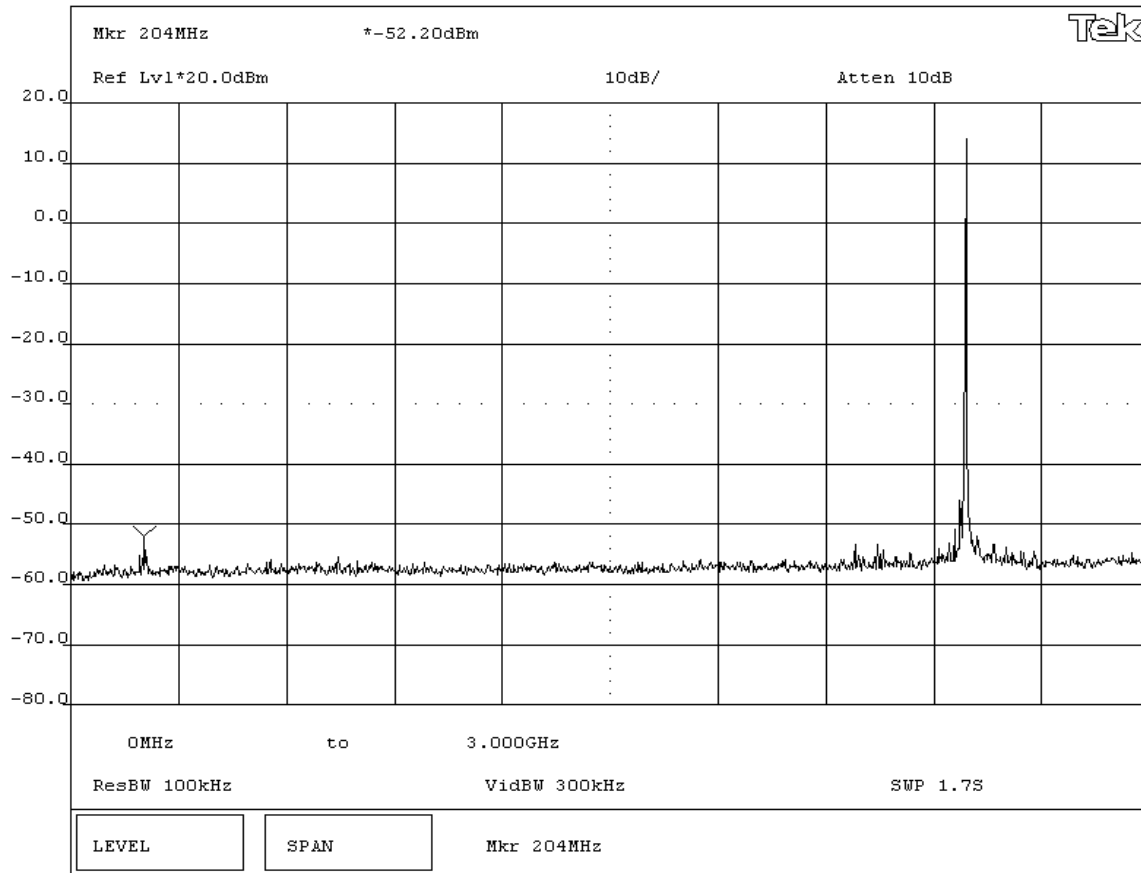
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - High Channel 0MHz-3GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040	
Serial Number: H1A01002		Date: 11/11/04	
Customer: CyberOptics Semiconductor		Temperature: 70 °F	
Attendees: Greg Huntzinger		Humidity: 47% RH	
Customer Ref. No.:	Tested by: Greg Kiemel	Power: 120VAC/60Hz	
		Job Site: EV06	

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

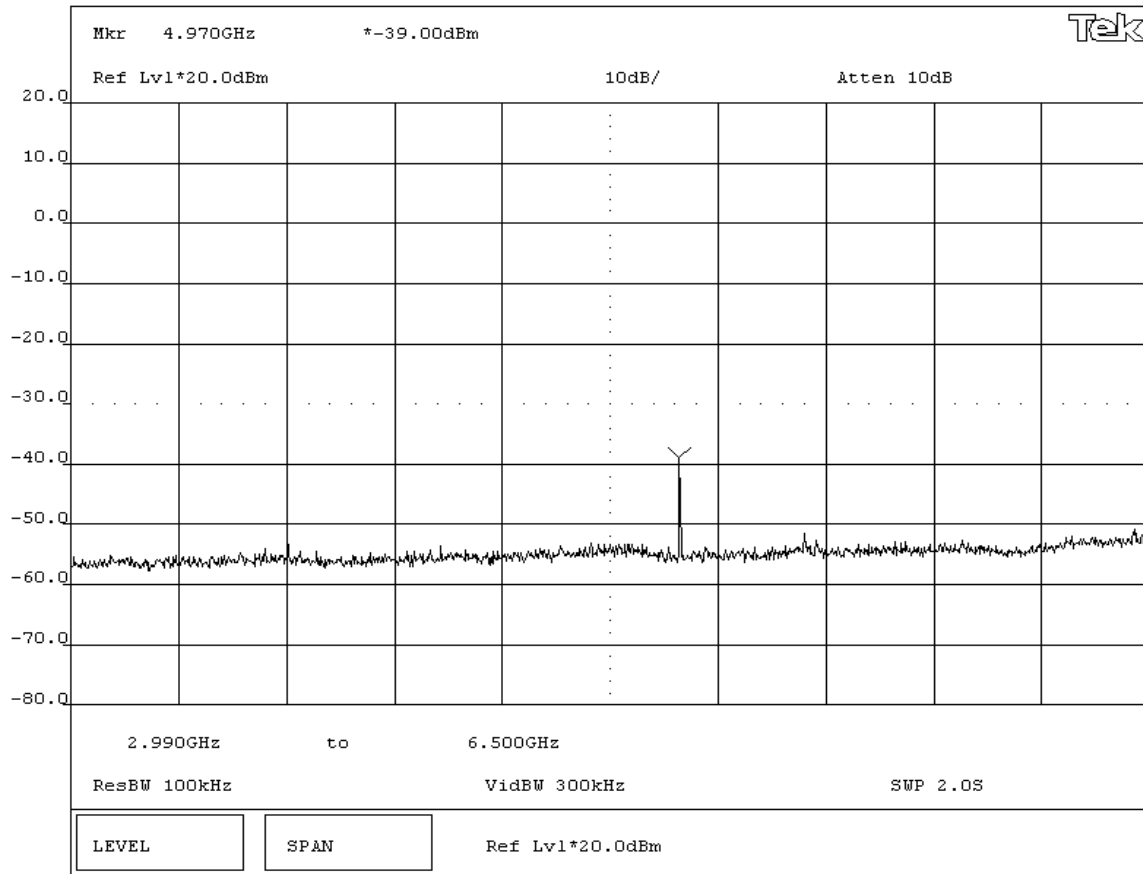
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - High Channel 3GHz-6.5GHz</b>			



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

<b>SAMPLE CALCULATIONS</b>			

<b>COMMENTS</b>			

<b>EUT OPERATING MODES</b>			
Modulated by PRBS at maximum data rate			

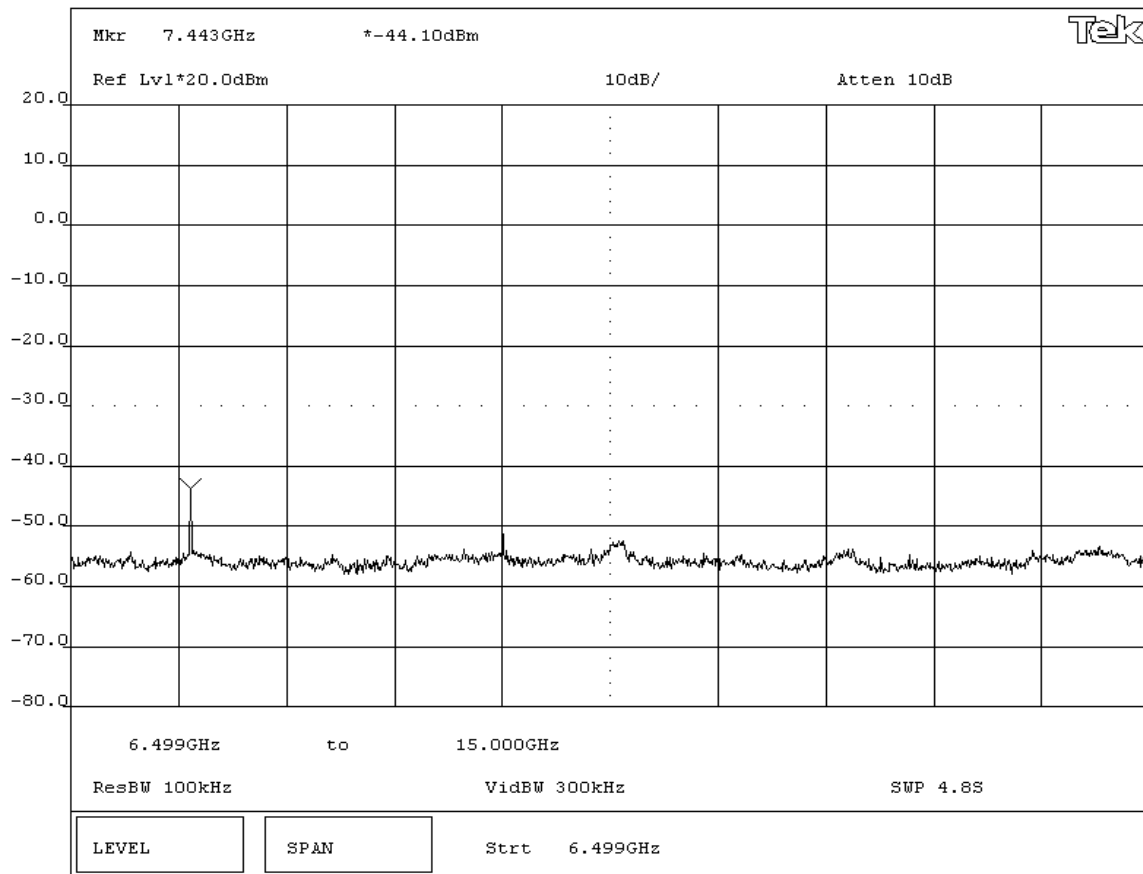
<b>DEVIATIONS FROM TEST STANDARD</b>			
None			

<b>REQUIREMENTS</b>			
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental			

<b>RESULTS</b>			
Pass			

<b>SIGNATURE</b>			
 Tested By: _____			

<b>DESCRIPTION OF TEST</b>			
<b>Antenna Conducted Spurious Emissions - High Channel 6.5GHz-15GHz</b>			



**EMC EMISSIONS DATA SHEET** Rev BETA 01/30/01

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(d)	Year: 2004	Method: DA 00-705, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**

**COMMENTS**

**EUT OPERATING MODES**  
Modulated by PRBS at maximum data rate

**DEVIATIONS FROM TEST STANDARD**  
None

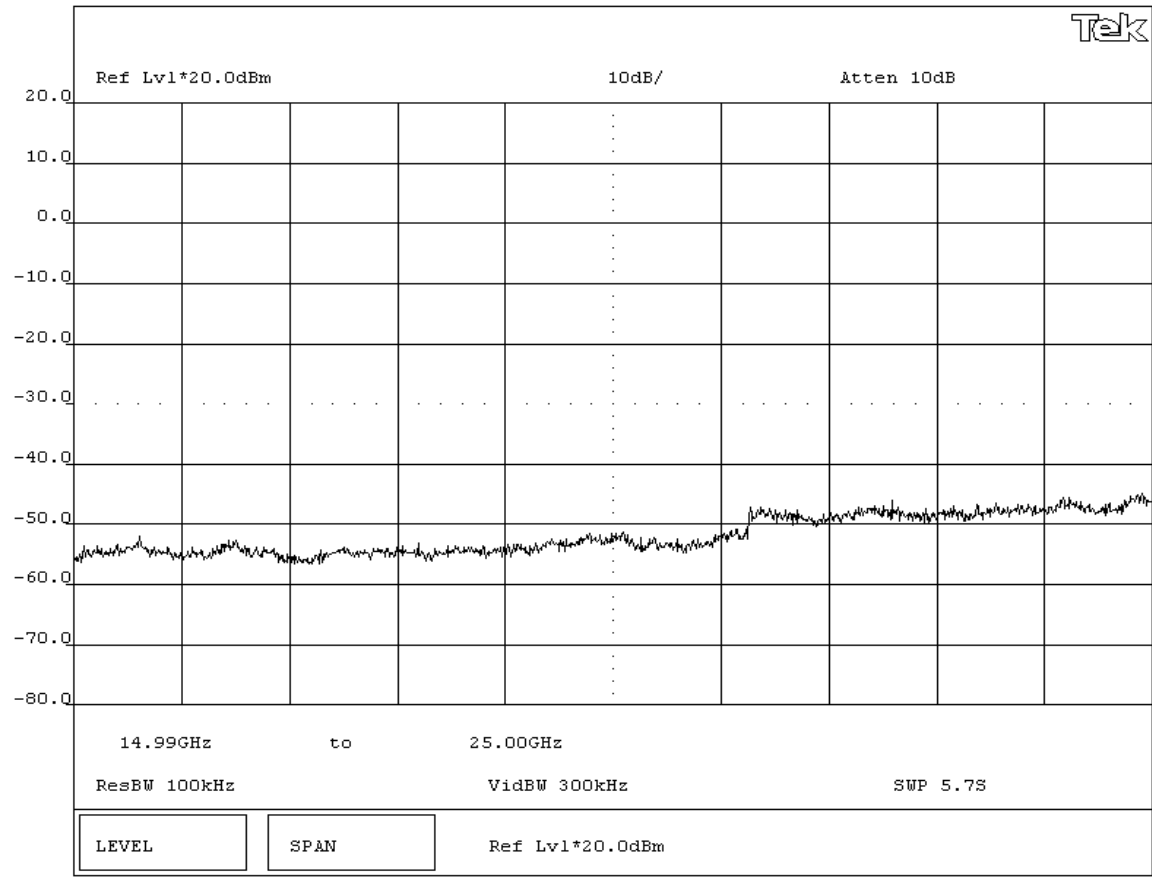
**REQUIREMENTS**  
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

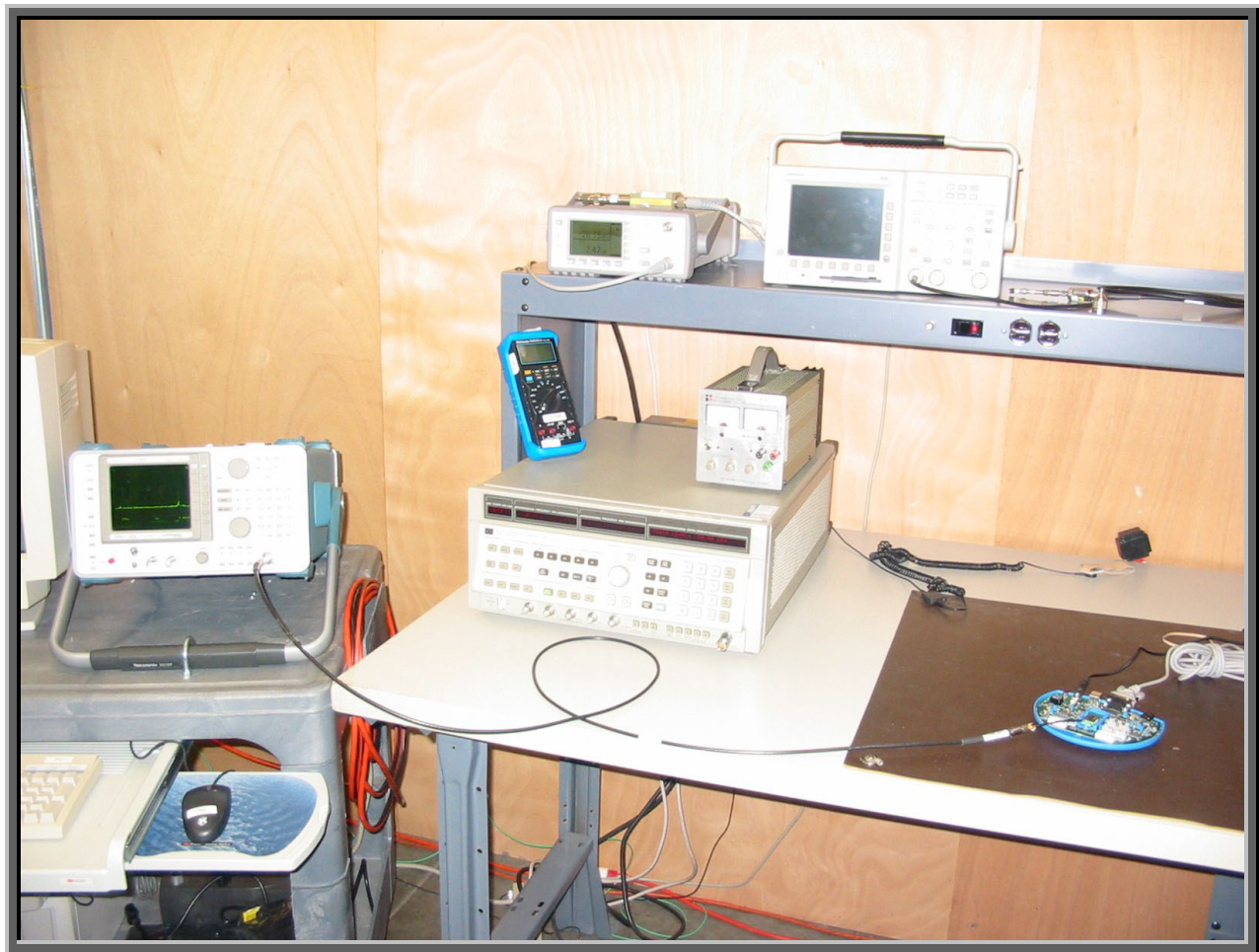
**RESULTS**  
Pass

**SIGNATURE**

  
 Tested By: \_\_\_\_\_

**DESCRIPTION OF TEST**  
**Antenna Conducted Spurious Emissions - High Channel 15GHz-25GHz**







**Justification**

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

**Channels in Specified Band Investigated:**

Low
Mid
High

**Operating Modes Investigated:**

No Hop
--------

**Data Rates Investigated:**

Maximum
---------

**Output Power Setting(s) Investigated:**

Maximum
---------

**Power Input Settings Investigated:**

120 VAC, 60 Hz (5 Vdc from Host)
----------------------------------

**Software\Firmware Applied During Test**

Exercise software	CSR Bluetest	Version	1.19
Description			
The system was tested using special software developed to test all functions of the device during the test.			

**EUT and Peripherals**

Description	Manufacturer	Model/Part Number	Serial Number
Bluetooth Radio (EUT)	CyberOptics Semiconductor	WaferSense ALS	H1A01002
Host Device	Cambridge Silicon Radio	Casira	5673121101
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B
Host Device Power Adapter	EGSTON	N2GFSW3	none

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Serial	Yes	3.0	No	Host Device	PC
AC Power	No	2.0	No	PC Power Adapter	AC Mains
DC Leads	PA	2.0	PA	PC Power Adapter	PC
DC Leads	PA	2.0	PA	Host Device Power Adapter	Host Device
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

### Test Description

**Requirement:** Per 47 CFR 15.247(e), the peak power spectral density conducted from the antenna port of a direct sequence transmitter must not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

**Configuration:** The peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. Per the procedure outlined in FCC 97-114, the spectrum analyzer was used as follows:

The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep =  $(SPAN/3 \text{ kHz})$ ). For example, given a span of 1.5 MHz, the sweep should be  $1.5 \times 10^6 \div 3 \times 10^3 = 500$  seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:

*"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 34.8 dB for correction to 3 kHz."*

Completed by:

# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor, Inc.		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

TEST SPECIFICATIONS			
Specification: 47 CFR 15.247(e)	Year: 2004	Method: FCC 97-114, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**  
 Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.  
 Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.  
 Bandwidth Correction Factor =  $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

**COMMENTS**

**EUT OPERATING MODES**

Modulated by PRBS at maximum data rate

**DEVIATIONS FROM TEST STANDARD**

None

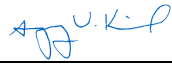
**REQUIREMENTS**

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

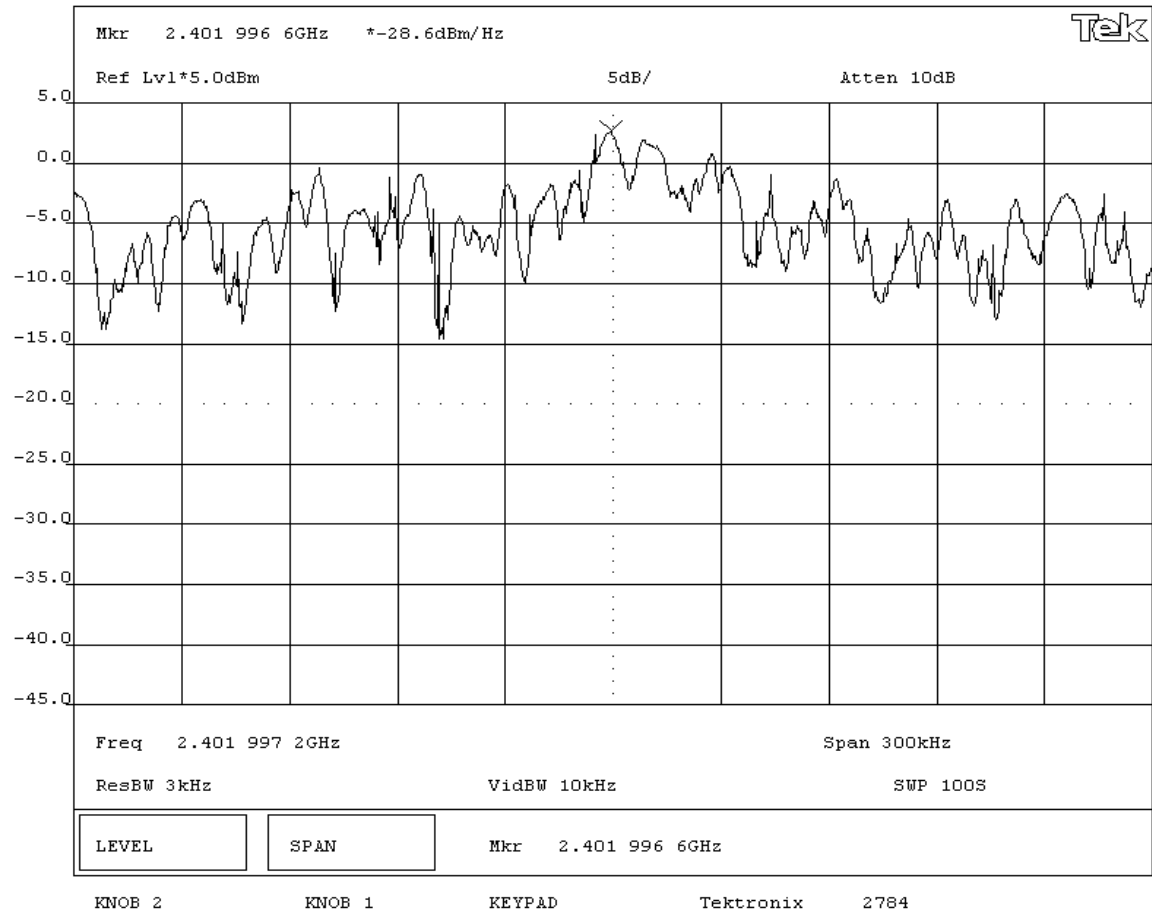
**RESULTS**

Pass AMPLITUDE  
 Power Spectral Density = 6.2 dBm / 3kHz

**SIGNATURE**

Tested By: 

**DESCRIPTION OF TEST**  
**Power Spectral Density - Low Channel**



# EMISSIONS DATA SHEET

EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor, Inc.		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(e)	Year: 2004	Method: FCC 97-114, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**  
 Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation  
 Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.  
 Bandwidth Correction Factor =  $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

**COMMENTS**

EUT OPERATING MODES

Modulated by PRBS at maximum data rate

**DEVIATIONS FROM TEST STANDARD**

None


**REQUIREMENTS**

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

**RESULTS**

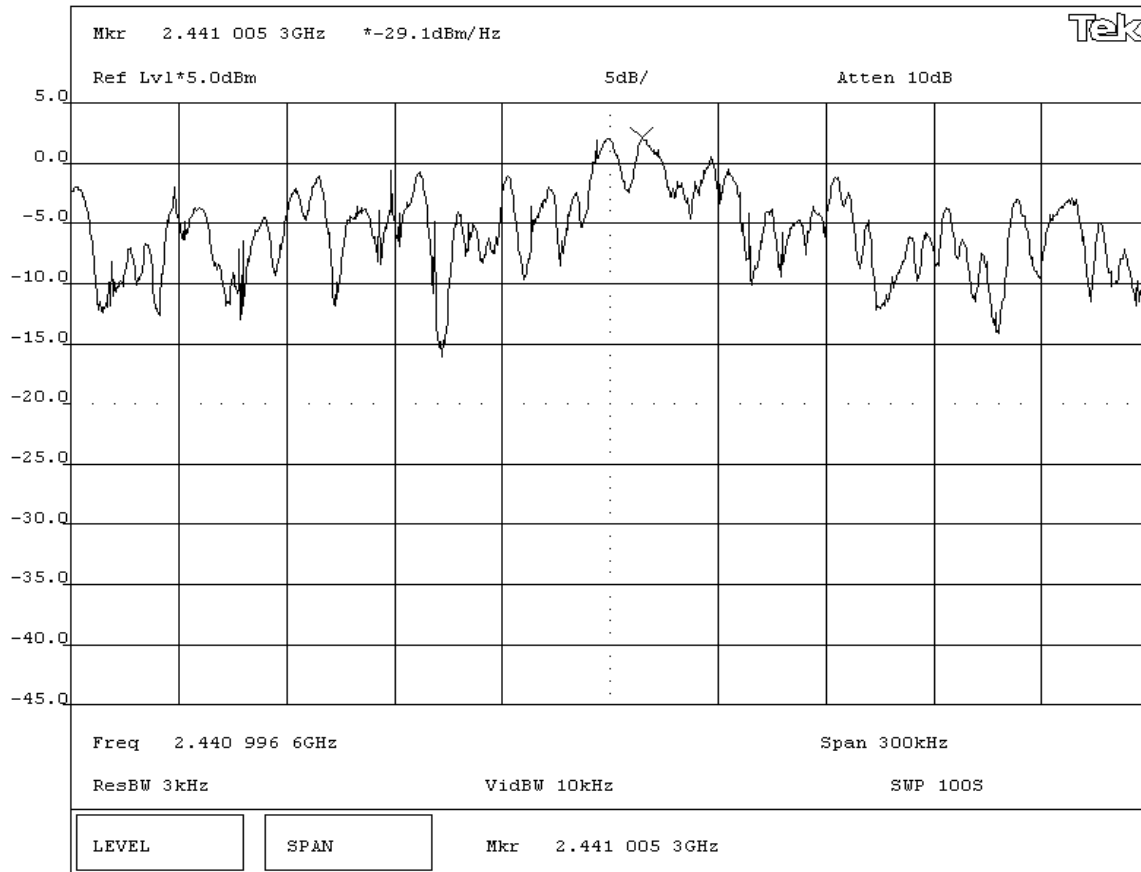
Pass AMPLITUDE  
 Power Spectral Density = 5.7 dBm / 3kHz

**SIGNATURE**

Tested By: 

**DESCRIPTION OF TEST**

**Power Spectral Density - Mid Channel**



EUT: WaferSense ALS		Work Order: CYBR0040
Serial Number: H1A01002		Date: 11/11/04
Customer: CyberOptics Semiconductor, Inc.		Temperature: 70 °F
Attendees: Greg Huntzinger	Tested by: Greg Kiemel	Humidity: 47% RH
Customer Ref. No.:	Power: 120VAC/60Hz	Job Site: EV06

<b>TEST SPECIFICATIONS</b>			
Specification: 47 CFR 15.247(e)	Year: 2004	Method: FCC 97-114, ANSI C63.4	Year: 2003

**SAMPLE CALCULATIONS**  
 Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation  
 Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.  
 Bandwidth Correction Factor =  $10 \cdot \log(3\text{kHz}/1\text{Hz}) = 34.8 \text{ dB}$

**COMMENTS**

EUT OPERATING MODES

Modulated by PRBS at maximum data rate

**DEVIATIONS FROM TEST STANDARD**

None

**REQUIREMENTS**

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

**RESULTS**

Pass AMPLITUDE  
 Power Spectral Density = 5.9 dBm / 3kHz

**SIGNATURE**

Tested By: *Greg Kiemel*

**DESCRIPTION OF TEST**

## Power Spectral Density - High Channel

