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

Antennas Investigated:
Integral

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
120 VAC, 60 Hz.

Frequency Range Investigated			
Start Frequency	30 MHz	**Stop Frequency**	25 GHz

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 Link	CyberOptics Semiconductor	WaferSense Link	H2A01012

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
PC	Fujitsu	Litebook	R3Y02504
Equipment isolated from the EUT so as not to contribute to the measurement result is considered to be outside the test setup boundary			

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB	Yes	3.0	No	Bluetooth Radio Link	PC

Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/23/2003	13 mo
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	12/23/2003	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	02/05/2004	13 mo
Antenna, Horn	EMCO	3115	AHC	09/07/2004	12 mo
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APJ	01/05/2004	13 mo
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/08/2003	15 mo
Antenna, Horn	EMCO	3160-09	AHG	NCR	NA
Antenna, Horn	EMCO	3160-08	AHK	NCR	NA
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APC	10/08/2003	15 mo
Attenuator		2082-6148-20	ATE	02/03/2004	13 mo
High Pass Filter	Micro-Tronics	HPM50111	HFO	04/13/2004	13 mo

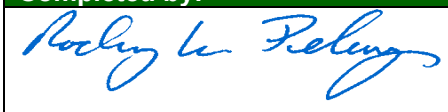
Test Description

Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

Configuration: The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:2003). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Bandwidths Used for Measurements			
Frequency Range (MHz)	**Peak Data (kHz)**	**Quasi-Peak Data (kHz)**	**Average Data (kHz)**
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

Completed by:



NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	WaferSense Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/15/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	73
Attendees:	None			Humidity:	37%
Cust. Ref. No.:				Barometric Pressure	30.11
Tested by:	Rod Peloquin	Power:	120 VAC/60 Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(d) Spurious Radiated Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop

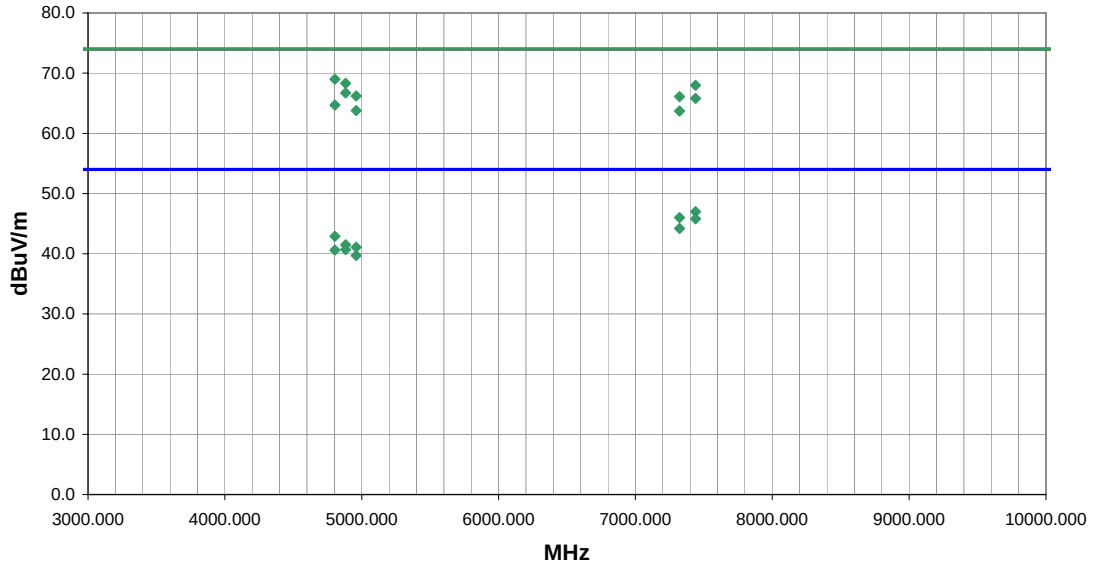
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	1

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
4804.000	65.7	3.3	100.0	1.3	3.0	0.0	H-Horn	PK	0.0	69.0	74.0	-5.0	Low channel
4882.000	64.7	3.6	183.0	1.5	3.0	0.0	H-Horn	PK	0.0	68.3	74.0	-5.7	Mid channel
7440.000	56.9	11.1	113.0	1.3	3.0	0.0	H-Horn	PK	0.0	68.0	74.0	-6.0	High channel
7440.000	35.9	11.1	113.0	1.3	3.0	0.0	H-Horn	AV	0.0	47.0	54.0	-7.0	High channel
4882.000	63.1	3.6	125.0	1.1	3.0	0.0	V-Horn	PK	0.0	66.7	74.0	-7.3	Mid channel
4960.000	62.6	3.6	188.0	1.5	3.0	0.0	H-Horn	PK	0.0	66.2	74.0	-7.8	High channel
7323.000	55.6	10.5	116.0	1.3	3.0	0.0	H-Horn	PK	0.0	66.1	74.0	-7.9	Mid channel
7323.000	35.5	10.5	116.0	1.3	3.0	0.0	H-Horn	AV	0.0	46.0	54.0	-8.0	Mid channel
7440.000	34.7	11.1	36.0	1.8	3.0	0.0	V-Horn	AV	0.0	45.8	54.0	-8.2	High channel
7440.000	54.7	11.1	36.0	1.8	3.0	0.0	V-Horn	PK	0.0	65.8	74.0	-8.2	High channel
4804.000	61.4	3.3	359.0	1.2	3.0	0.0	V-Horn	PK	0.0	64.7	74.0	-9.3	Low channel
7323.000	33.7	10.5	45.0	1.3	3.0	0.0	V-Horn	AV	0.0	44.2	54.0	-9.8	Mid channel
4960.000	60.2	3.6	117.0	1.2	3.0	0.0	V-Horn	PK	0.0	63.8	74.0	-10.2	High channel
7323.000	53.2	10.5	45.0	1.3	3.0	0.0	V-Horn	PK	0.0	63.7	74.0	-10.3	Mid channel
4804.000	39.6	3.3	100.0	1.3	3.0	0.0	H-Horn	AV	0.0	42.9	54.0	-11.1	Low channel

NORTHWEST EMC

RADIATED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	WaferSense Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/15/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	73
Attendees:	None			Humidity:	37%
Cust. Ref. No.:				Barometric Pressure	30.11
Tested by:	Rod Peloquin	Power:	120 VAC/60 Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.247(d) Spurious Radiated Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, High channel

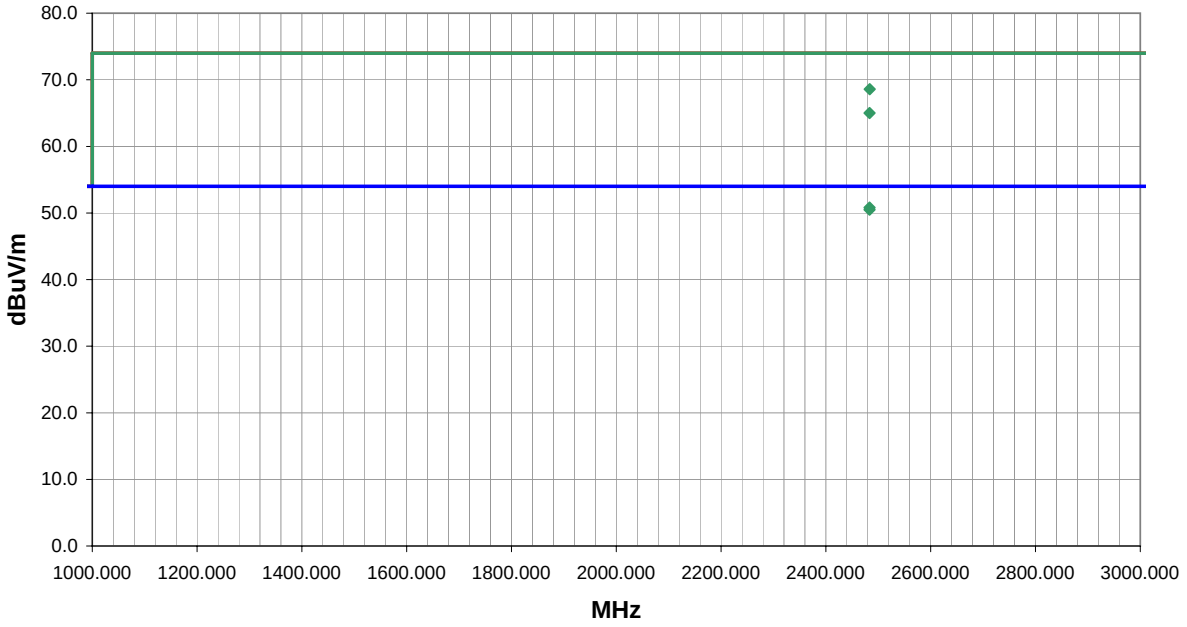
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Run #
Pass	2

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2483.500	33.0	-2.2	181.0	1.0	3.0	20.0	H-Horn	AV	0.0	50.8	54.0	-3.2
2483.500	32.7	-2.2	196.0	1.1	3.0	20.0	V-Horn	AV	0.0	50.5	54.0	-3.5
2483.550	50.8	-2.2	181.0	1.0	3.0	20.0	H-Horn	PK	0.0	68.6	74.0	-5.4
2483.510	47.2	-2.2	196.0	1.1	3.0	20.0	V-Horn	PK	0.0	65.0	74.0	-9.0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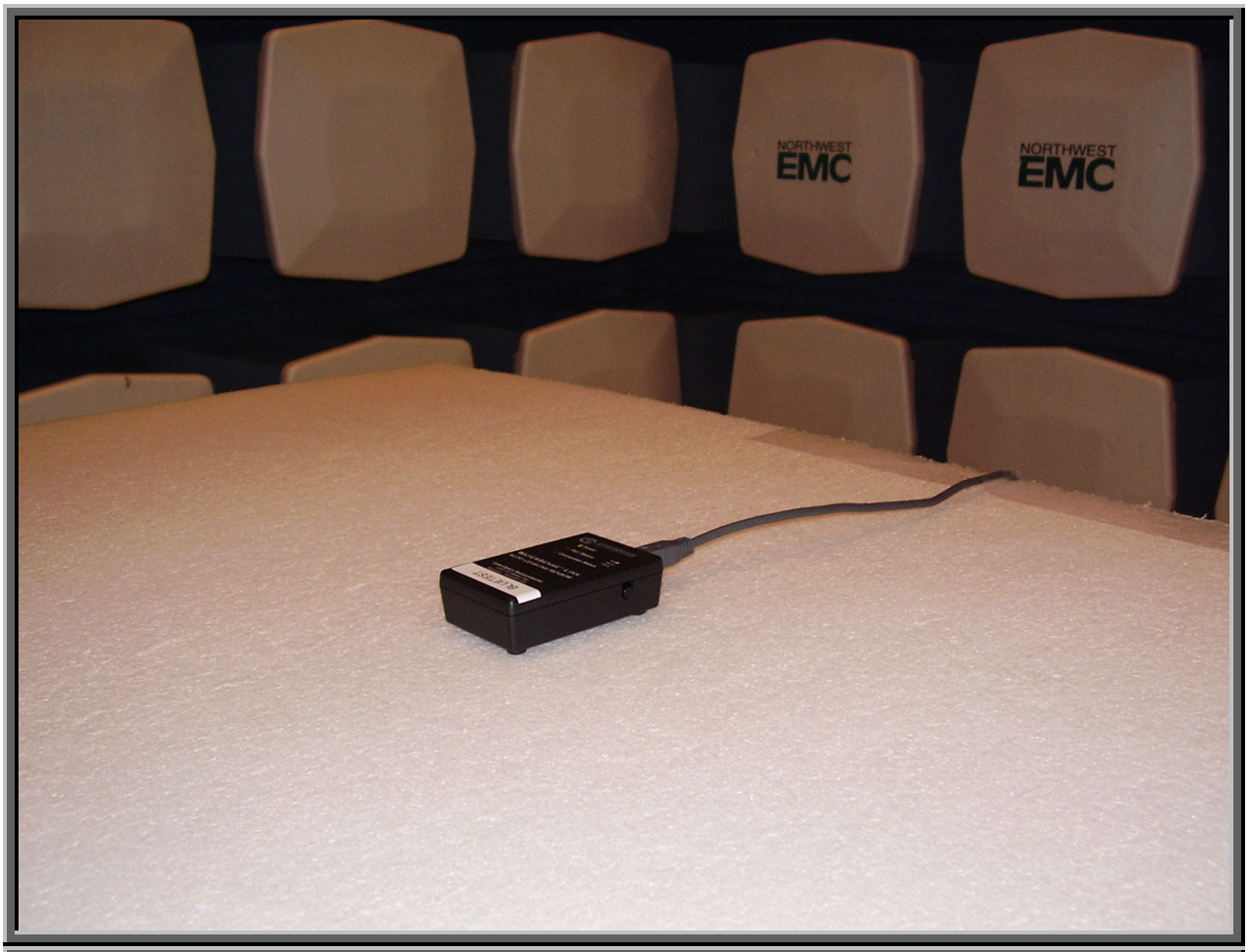
EMC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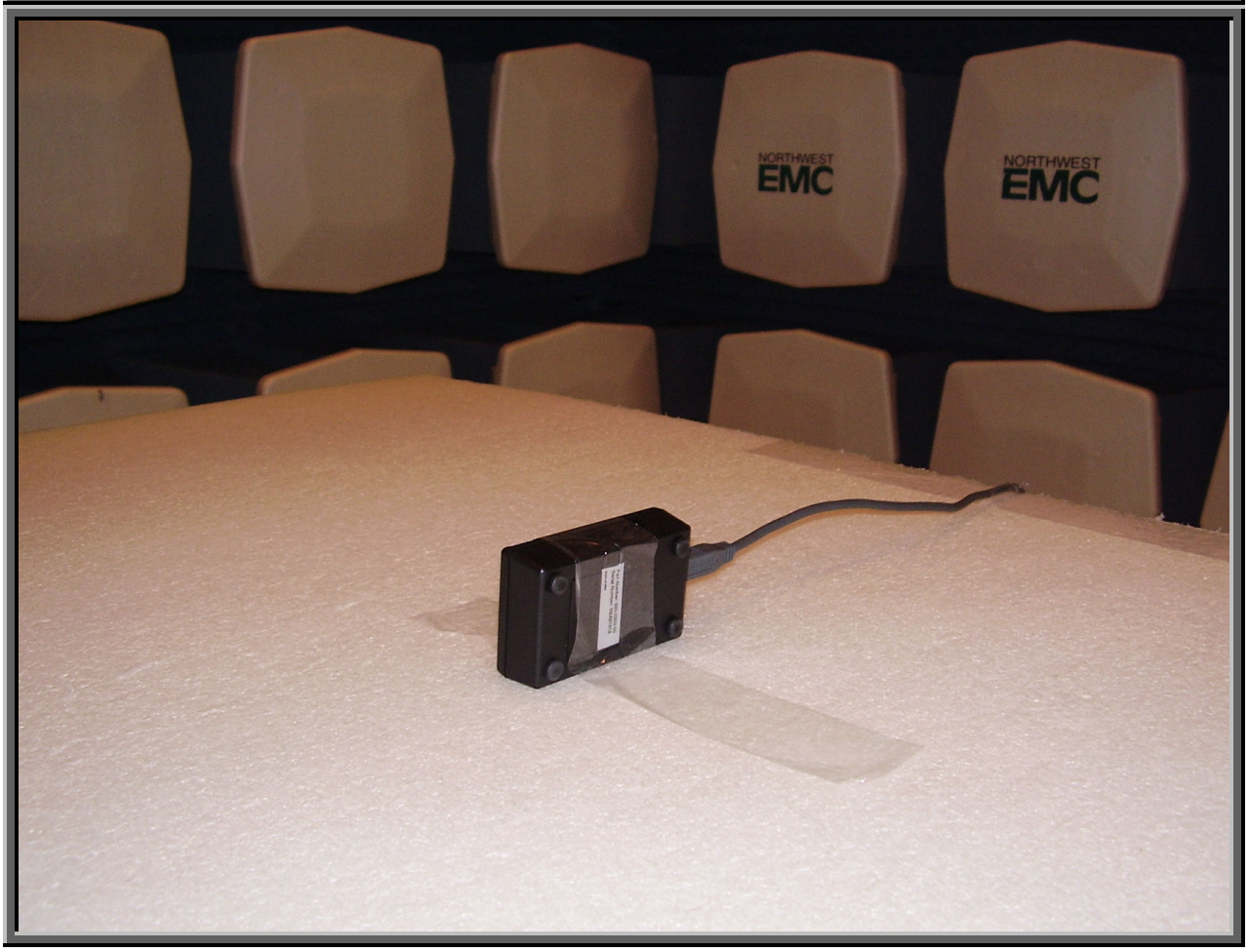
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EMC


NORTHWEST
EMC
NORTHWEST
EMC
BLUETEST

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.

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 Link	CyberOptics Semiconductor	WaferSense Link	H2A01012
PC	Fujitsu	Litebook	R3Y02504
PC Power Adapter	Fujitsu	CA01007-0870	39782749B

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

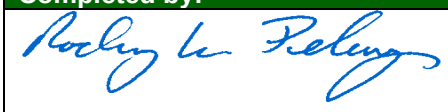
Measurement Equipment					
Description	**Manufacturer**	**Model**	**Identifier**	**Last Cal**	**Interval**
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/23/2003	13 mo
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	12/23/2003	13 mo
High Pass Filter	TTE	H97-100k-50-720B	HFC	02/01/2004	13 mo
LISN	Solar	9252-50-R-24-BNC	LIO	04/30/2004	12 mo

Test Description

Requirement: Per 47 15.207(d), if the EUT is connected to the AC power line indirectly, obtaining its power from another device that is connected to the AC power line, then it should be tested to demonstrate compliance with the conducted limits of 15.207.

Configuration: The EUT will be powered from a device that could be connected to the AC power line. Therefore, the measurements were made on the device used to power the EUT. The AC power line conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate. For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.4-2003.

Completed by:



NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	24
Attendees:	Greg Huntzinger			Humidity:	33%
Cust. Ref. No.:				Barometric Pressure	30.19
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, Low channel

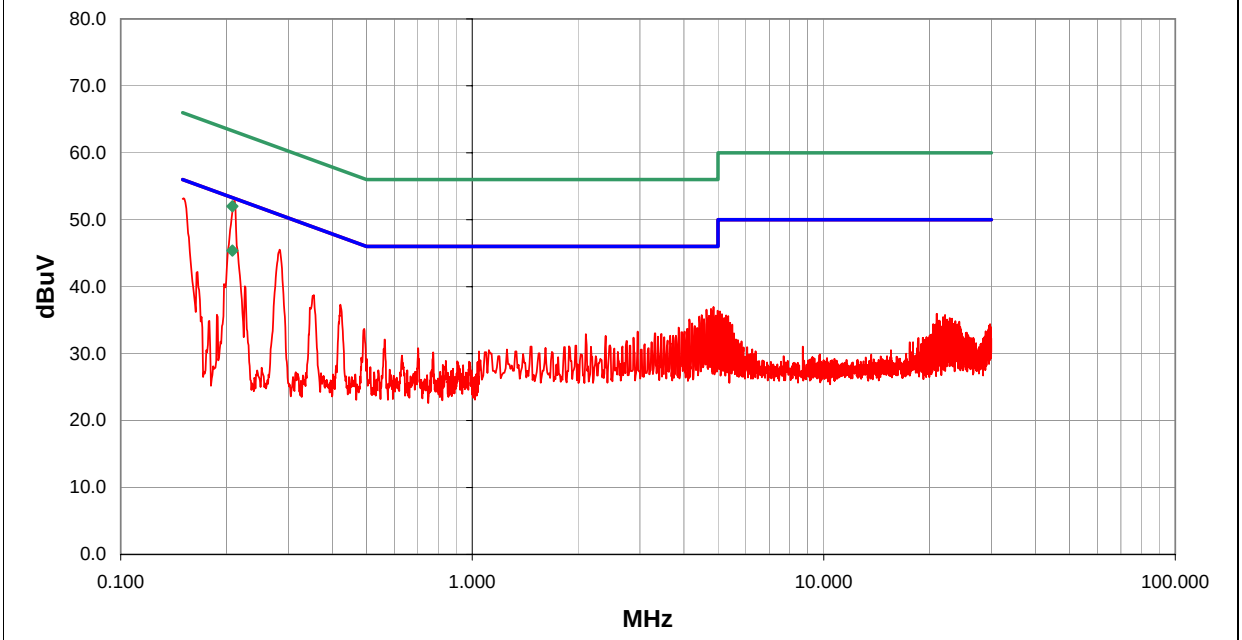
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	2

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.208	25.4			0.0	0.0	20.0		AV		45.4	53.3	-7.9
0.208	32.0			0.0	0.0	20.0		QP		52.0	63.3	-11.3
0.151	33.1			0.0	0.1	20.0				53.2	56.0	-2.8
0.283	25.4			0.0	0.1	20.0				45.5	50.7	-5.2
4.857	16.3			0.0	0.7	20.0				37.0	46.0	-9.0
4.777	16.0			0.0	0.7	20.0				36.7	46.0	-9.3
4.637	15.9			0.0	0.7	20.0				36.6	46.0	-9.4
4.997	15.7			0.0	0.7	20.0				36.4	46.0	-9.6
0.354	18.6			0.0	0.2	20.0				38.8	48.9	-10.1
0.422	17.1			0.0	0.2	20.0				37.3	47.4	-10.1
4.497	15.1			0.0	0.6	20.0				35.7	46.0	-10.3
4.927	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.717	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.427	14.9			0.0	0.6	20.0				35.5	46.0	-10.5
4.567	14.5			0.0	0.7	20.0				35.2	46.0	-10.8
4.147	14.5			0.0	0.6	20.0				35.1	46.0	-10.9
4.227	13.9			0.0	0.6	20.0				34.5	46.0	-11.5
4.297	13.5			0.0	0.6	20.0				34.1	46.0	-11.9

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link	Work Order:	CYBR0040
Serial Number:	H2A01012	Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.	Temperature:	24
Attendees:	Greg Huntzinger	Humidity:	33%
Cust. Ref. No.:		Barometric Pressure	30.19
Tested by:	Rod Peloquin Power: 120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, Low channel

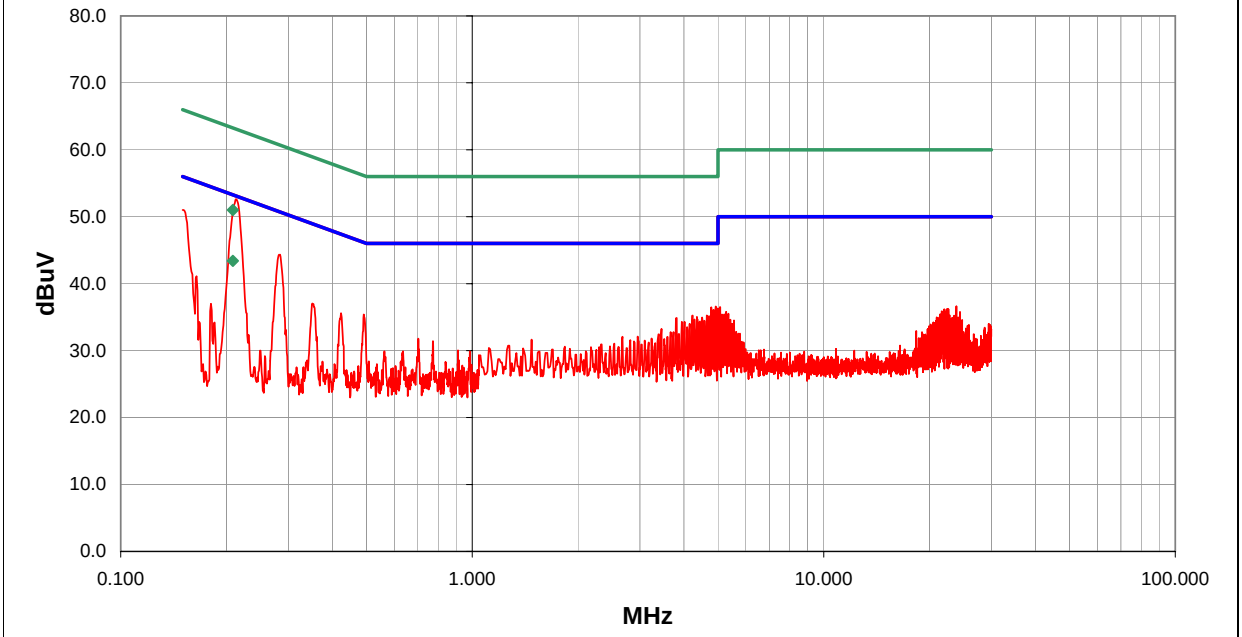
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	3

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.208	23.4			0.0	0.0	20.0		AV		43.4	53.3	-9.9
0.208	31.0			0.0	0.0	20.0		QP		51.0	63.3	-12.3
0.150	30.9			0.0	0.1	20.0				51.0	56.0	-5.0
0.282	24.2			0.0	0.1	20.0				44.3	50.7	-6.4
4.927	15.9			0.0	0.7	20.0				36.6	46.0	-9.4
4.787	15.8			0.0	0.7	20.0				36.5	46.0	-9.5
4.997	15.6			0.0	0.7	20.0				36.3	46.0	-9.7
4.857	15.4			0.0	0.7	20.0				36.1	46.0	-9.9
4.647	14.6			0.0	0.7	20.0				35.3	46.0	-10.7
0.491	15.2			0.0	0.2	20.0				35.4	46.1	-10.7
4.237	14.6			0.0	0.6	20.0				35.2	46.0	-10.8
4.717	14.5			0.0	0.7	20.0				35.2	46.0	-10.8
4.357	14.4			0.0	0.6	20.0				35.0	46.0	-11.0
4.507	14.3			0.0	0.7	20.0				35.0	46.0	-11.0
3.816	14.3			0.0	0.6	20.0				34.9	46.0	-11.1
4.287	14.0			0.0	0.6	20.0				34.6	46.0	-11.4
4.577	13.8			0.0	0.7	20.0				34.5	46.0	-11.5
4.437	13.7			0.0	0.6	20.0				34.3	46.0	-11.7

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	24
Attendees:	Greg Huntzinger			Humidity:	33%
Cust. Ref. No.:				Barometric Pressure	30.19
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, Mid channel

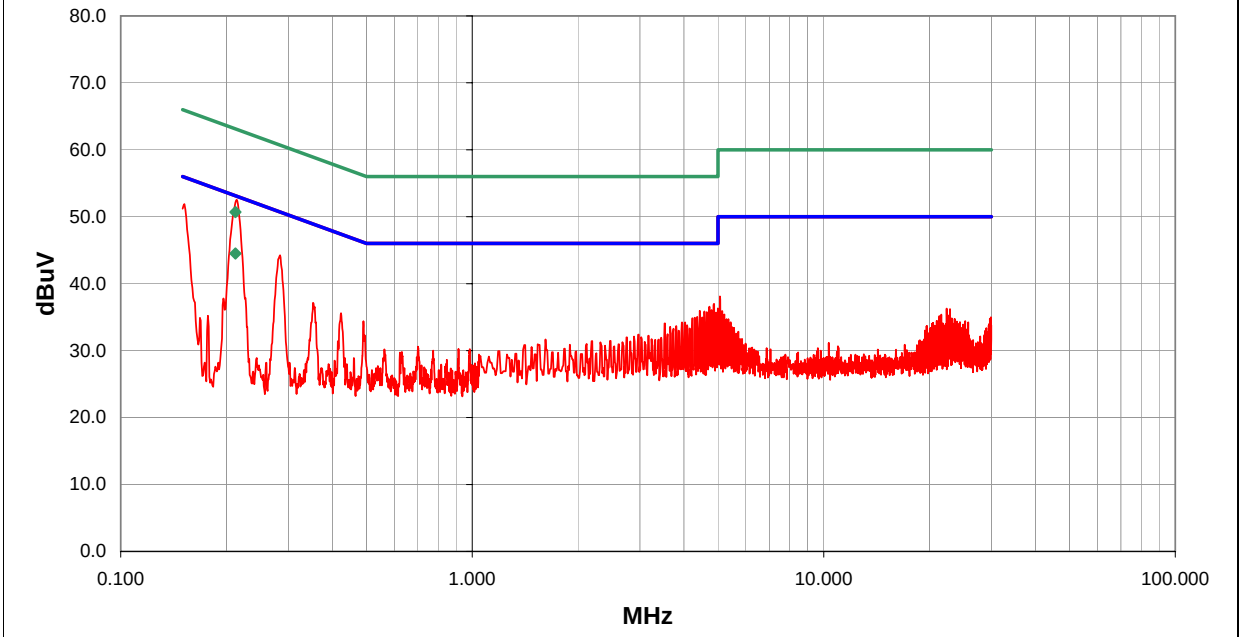
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	4

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.212	24.5			0.0	0.0	20.0		AV		44.5	53.1	-8.6
0.212	30.7			0.0	0.0	20.0		QP		50.7	63.1	-12.4
0.152	31.8			0.0	0.1	20.0				51.9	55.9	-4.0
0.284	24.1			0.0	0.1	20.0				44.2	50.7	-6.5
4.877	16.3			0.0	0.7	20.0				37.0	46.0	-9.0
4.727	15.9			0.0	0.7	20.0				36.6	46.0	-9.4
4.997	15.6			0.0	0.7	20.0				36.3	46.0	-9.7
4.797	15.4			0.0	0.7	20.0				36.1	46.0	-9.9
4.437	15.3			0.0	0.6	20.0				35.9	46.0	-10.1
4.577	15.2			0.0	0.7	20.0				35.9	46.0	-10.1
4.647	15.1			0.0	0.7	20.0				35.8	46.0	-10.2
4.937	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.367	14.4			0.0	0.6	20.0				35.0	46.0	-11.0
4.517	14.3			0.0	0.7	20.0				35.0	46.0	-11.0
4.297	14.3			0.0	0.6	20.0				34.9	46.0	-11.1
4.237	14.2			0.0	0.6	20.0				34.8	46.0	-11.2
0.353	17.0			0.0	0.2	20.0				37.2	48.9	-11.8
0.490	14.2			0.0	0.2	20.0				34.4	46.2	-11.8

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	24
Attendees:	Greg Huntzinger			Humidity:	33%
Cust. Ref. No.:				Barometric Pressure	30.19
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, Mid channel

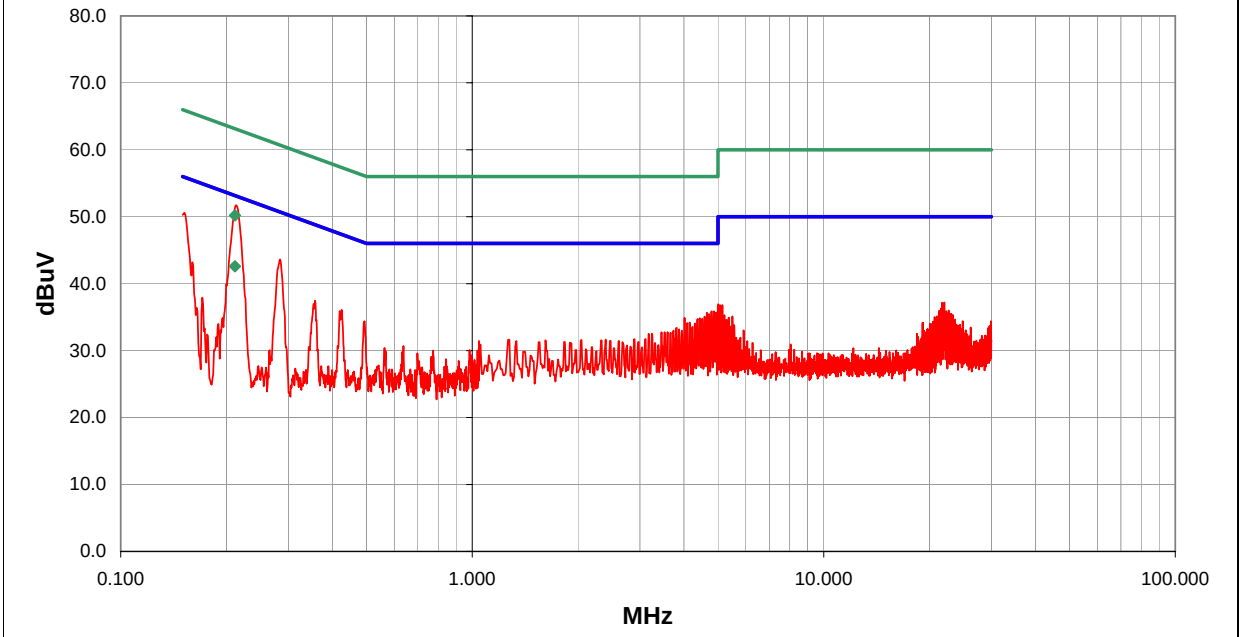
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	5

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.211	22.6			0.0	0.0	20.0		AV		42.6	53.2	-10.6
0.211	30.2			0.0	0.0	20.0		QP		50.2	63.2	-13.0
0.213	31.6			0.0	0.1	20.0				51.7	53.1	-1.4
0.152	30.5			0.0	0.1	20.0				50.6	55.9	-5.3
0.284	23.5			0.0	0.1	20.0				43.6	50.7	-7.1
4.867	15.2			0.0	0.7	20.0				35.9	46.0	-10.1
4.797	15.2			0.0	0.7	20.0				35.9	46.0	-10.1
4.937	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.647	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.717	14.8			0.0	0.7	20.0				35.5	46.0	-10.5
4.587	14.4			0.0	0.7	20.0				35.1	46.0	-10.9
4.017	14.3			0.0	0.6	20.0				34.9	46.0	-11.1
4.437	14.2			0.0	0.6	20.0				34.8	46.0	-11.2
0.425	15.9			0.0	0.2	20.0				36.1	47.3	-11.2
4.507	14.1			0.0	0.7	20.0				34.8	46.0	-11.2
4.377	14.1			0.0	0.6	20.0				34.7	46.0	-11.3
0.357	17.3			0.0	0.2	20.0				37.5	48.8	-11.3
0.494	14.2			0.0	0.2	20.0				34.4	46.1	-11.7
4.157	13.6			0.0	0.6	20.0				34.2	46.0	-11.8

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	24
Attendees:	Greg Huntzinger			Humidity:	33%
Cust. Ref. No.:				Barometric Pressure	30.19
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, High channel

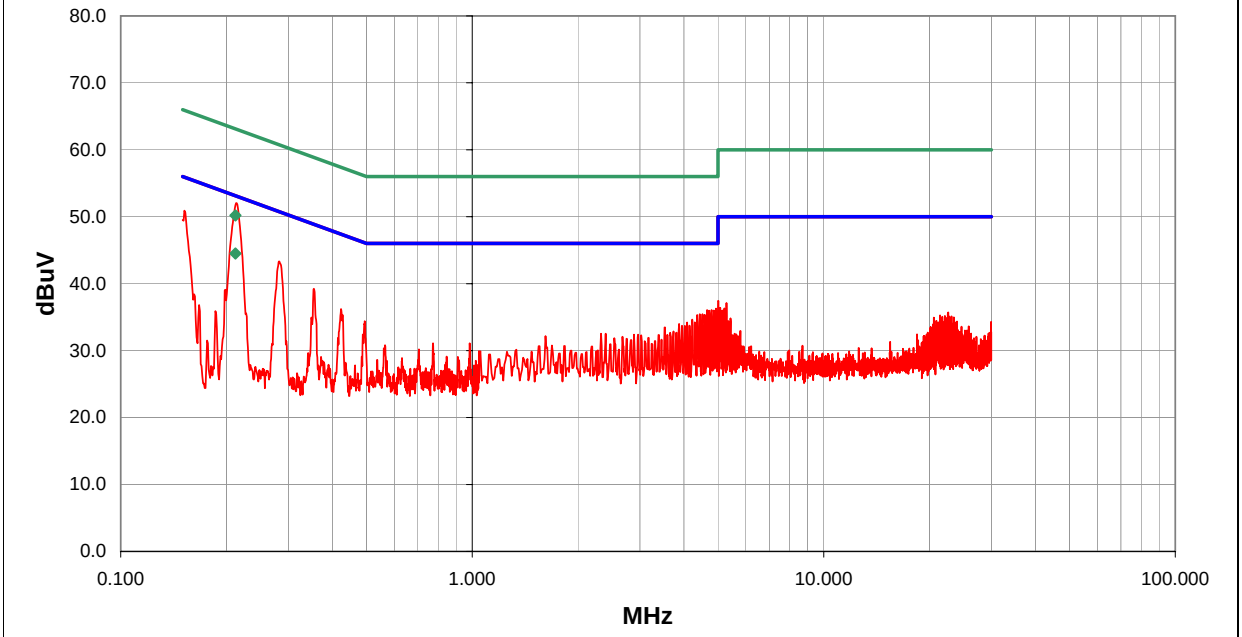
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	6

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.212	24.5			0.0	0.0	20.0		AV		44.5	53.1	-8.6
0.212	30.2			0.0	0.0	20.0		QP		50.2	63.1	-12.9
0.214	31.9			0.0	0.1	20.0				52.0	53.1	-1.0
0.152	30.8			0.0	0.1	20.0				50.9	55.9	-5.0
0.282	23.2			0.0	0.1	20.0				43.3	50.7	-7.4
0.354	19.1			0.0	0.2	20.0				39.3	48.9	-9.6
4.937	15.6			0.0	0.7	20.0				36.3	46.0	-9.7
4.797	15.4			0.0	0.7	20.0				36.1	46.0	-9.9
4.657	15.4			0.0	0.7	20.0				36.1	46.0	-9.9
4.867	15.3			0.0	0.7	20.0				36.0	46.0	-10.0
4.717	15.3			0.0	0.7	20.0				36.0	46.0	-10.0
4.517	14.8			0.0	0.7	20.0				35.5	46.0	-10.5
4.437	14.8			0.0	0.6	20.0				35.4	46.0	-10.6
4.587	14.7			0.0	0.7	20.0				35.4	46.0	-10.6
4.367	14.7			0.0	0.6	20.0				35.3	46.0	-10.7
0.424	16.0			0.0	0.2	20.0				36.2	47.4	-11.2
4.227	14.0			0.0	0.6	20.0				34.6	46.0	-11.4
0.495	14.2			0.0	0.2	20.0				34.4	46.1	-11.7
4.297	13.6			0.0	0.6	20.0				34.2	46.0	-11.8

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df4.4 10/22/2004

EUT:	Wafersense ALS Link			Work Order:	CYBR0040
Serial Number:	H2A01012			Date:	11/23/04
Customer:	CyberOptics Semiconductor, Inc.			Temperature:	24
Attendees:	Greg Huntzinger			Humidity:	33%
Cust. Ref. No.:				Barometric Pressure	30.19
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC 15.207 AC Powerline Conducted Emissions	Year:	2004
Method:	ANSI C63.4	Year:	2003

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

EUT OPERATING MODES

No hop, High channel

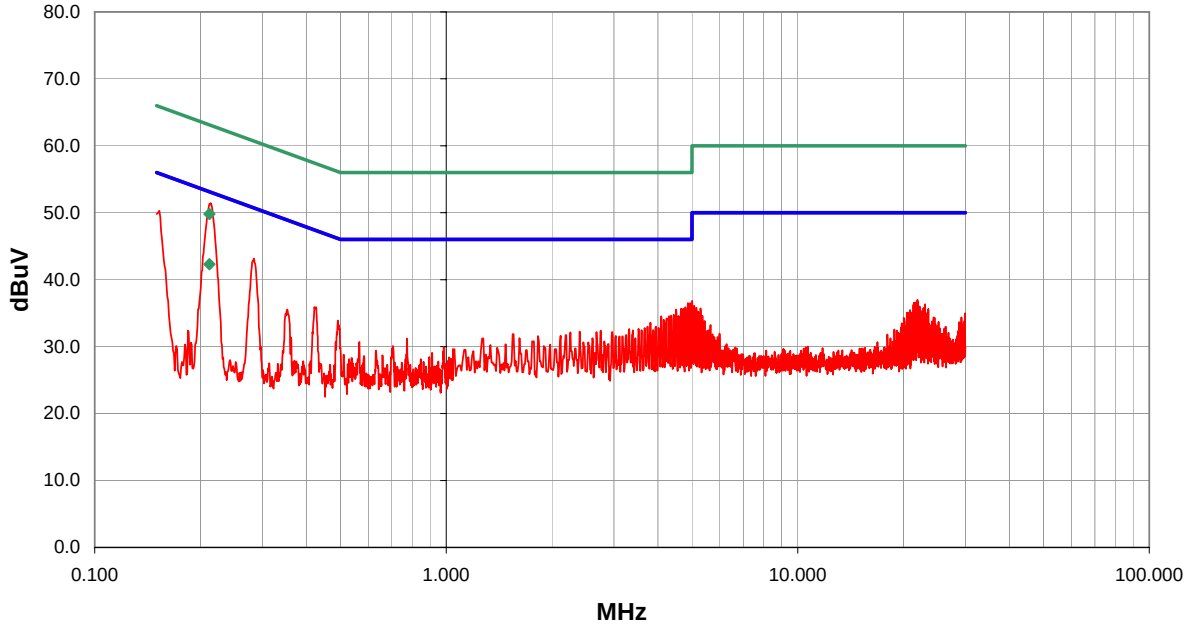
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	7

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
0.212	22.3			0.0	0.0	20.0		AV		42.3	53.1	-10.8
0.212	29.8			0.0	0.0	20.0		QP		49.8	63.1	-13.3
0.214	31.3			0.0	0.1	20.0				51.4	53.1	-1.6
0.153	30.2			0.0	0.1	20.0				50.3	55.9	-5.6
0.284	23.0			0.0	0.1	20.0				43.1	50.7	-7.6
4.937	15.8			0.0	0.7	20.0				36.5	46.0	-9.5
4.867	15.8			0.0	0.7	20.0				36.5	46.0	-9.5
4.787	15.2			0.0	0.7	20.0				35.9	46.0	-10.1
4.727	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.657	15.0			0.0	0.7	20.0				35.7	46.0	-10.3
4.507	14.9			0.0	0.7	20.0				35.6	46.0	-10.4
4.437	14.1			0.0	0.6	20.0				34.7	46.0	-11.3
4.367	14.0			0.0	0.6	20.0				34.6	46.0	-11.4
4.587	13.9			0.0	0.7	20.0				34.6	46.0	-11.4
4.307	13.9			0.0	0.6	20.0				34.5	46.0	-11.5
4.097	13.9			0.0	0.6	20.0				34.5	46.0	-11.5
0.422	15.7			0.0	0.2	20.0				35.9	47.4	-11.5
4.237	13.6			0.0	0.6	20.0				34.2	46.0	-11.8
4.157	13.4			0.0	0.6	20.0				34.0	46.0	-12.0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BLUETOOTH APPROVALS

FCC Procedure Received from Joe Dichoso on 2-15-02

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed. A Bluetooth device is a FHSS transmitter in the data mode and applies as a Hybrid spread spectrum device in the acquisition mode.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

1) The occupied bandwidth in Section 15.247(a)(1)(ii).
2) Conducted output power specified in Section 15.247(b)(1).
3) EIRP limit in Section 15.247(b)(3).
4) RF safety requirement in Section 15.247(b)(4)
5) Spurious emission limits in Section 15.247(c).
6) Processing gain and requirements for Hybrids in Section 15.247(f) in the acquisition mode.
7) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

1 Output power and channel separation of a Bluetooth device in the different operating modes:

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.
Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.

2 Frequency range of a Bluetooth device:

The maximum frequency of the device is: **2402 – 2480 M**Hz.
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification must **not be** supported by the device.

3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:

Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4 Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:
40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

5 Equally average use of frequencies in data mode and short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:
1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.
Regarding short transmissions, the Bluetooth system has the following behavior:
The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

6 Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz.
In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is a follows:
Dwell time = time slot length * hop rate / number of hopping channels *30s
Example for a DH1 packet (with a maximum length of one time slot)
Dwell time = 625 µs * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.
Example for a DH5 packet (with a maximum length of five time slots)
Dwell time = 5 * 625 µs * 1600 * 1/5 *1/s / 79 * 30s = 0.3797s (in a 30s period)
This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.
This was checked during the Bluetooth Qualification tests.
The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.
The maximum “initial carrier frequency tolerance” which is allowed for Bluetooth is fcenter = 75 kHz.
This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:
**For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.
**For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.
So it is ensured that also in hybrid mode, the frequency is used equally on average.
Example of a hopping sequence in inquiry mode:
48, 50, 09, 13, 52, 54,41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23
Example of a hopping sequence in paging mode:
08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

10 Receiver input bandwidth and synchronization in hybrid mode:

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

11 Spread rate / data rate of the direct sequence signal

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate / Data rate will be 68/1.

12 Spurious emission in hybrid mode

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.