L. S. Compliance, Inc.
W66 N220 Commerce Court
Cedarburg, Wisconsin 53012

Phone: 262 - 375 - 4400 Fax: 262 - 375 - 4248

L. S. Compliance, Inc.

Compliance Testing of:

Access Point A2

Wireless modem

Prepared for:

Intersil

Test Report Number: 301270A2-TX

Date(s) of Testing: July, August, 2001

All results of this report relate only to the items that were tested.
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FCC ID: OSZ36356A2

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DESCRIPTION OF MEASUREMENT FACILITIES

Site on File with the FCC

ID Number: 31040/SIT 1300F2

Industry Canada listed site: IC 3088

" The site referenced above has been found to comply with the test site criteria found in ANSI C63.4-1992 and 47CFR Section 2.948."

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

L.S. COMPLIANCE, INC.
Cedarburg, WI

for technical competence in the field of

Electrical (EMC) Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 30th day of December, 1998.

President
For the Accreditation Council
Certificate Number 1255.01
Valid to January 31, 2001

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation

SIGNATURE PAGE

Testing By: 8 Aug, 2001

Thomas T. Lee, EMC engineer DATE

Testing By: 8 Aug, 2001

Kenneth L. Boston PE DATE

Prepared by:
Approved by 8 Aug, 2001

Kenneth L. Boston, EMC Lab Manager Date
PE #31926
Registered Professional Engineer
(State of Wisconsin)

1.3 SUMMARY OF TEST REPORT

MANUFACTURER:	Intersil
MODEL:	Access Point A2
SERIAL:	pre-production (rev E pcb)
DESCRIPTION:	Spread spectrum data packet transceiver
FREQUENCY RANGE:	2400-2483.5 MHz

The Access Point A2 was found to **meet** the radiated emission specification of Title 47 CFR FCC, Part 15, subpart C. for an intentional radiator

The Access Point A2 was also found to **meet** the radiated emission specification of Title 47 CFR, FCC Part 15, subpart B for emissions with regards to the receiver and digital sections of the product.

This product is a composite device, with the digital sections subject to verification. Therefore this technical report will primary contain data that is pertinent to the certification of the transmitter section of the product.

1.4 INTRODUCTION

During July and August of 2001, a series of Radiated and Conducted Emissions tests were performed on a sample model of the Access Point A2, a spread spectrum transceiver module, designed for use as a wireless Modem. These tests were performed using the test procedures outlined in ANSI C63.4-1992 for intentional radiators, and in accordance with the requirements set forth in FCC Part 15.247 for a spread spectrum transmitter. Tests were also performed as outlined in ANSI C63.4-1992 for non-intentional radiators, in order to verify compliance with the limits set forth in part 15.109 for and to allow verification of emissions for the digital section of the product. These tests were performed by Kenneth L. Boston, PE, and Thomas T. Lee of L. S. Compliance, Inc.

2.5 PURPOSE

The above mentioned tests were performed in order to determine the compliance of the Access Point A2 transceiver with limits contained in various provisions of Title 47 CFR, FCC Part 15, including:

15.207	15.247b	15.247e
15.205	15.247c	15.109
15.247a2	15.247d	

Various of these tests, including the conducted RF out the antenna port and the jamming margin test are contained in additional sections of the test report that are appended. All radiated emissions tests were performed to measure the emissions in the frequency bands described by the above sections, and to determine whether said emissions are below the limits established by the above sections. These tests were performed in accordance with the procedure described in the American National Standard for methods of measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-1992). Another document used as reference for the EMI receiver specification was the International Special Committee on Radio Interference (CISPR) number 16-1 (1993).

2.6 Conducted (AC Mains) Test and measurements

The Conducted Emission tests were performed within an 8 by 10 foot shielded room located at L. S. Compliance, Inc. in Cedarburg, WI. The test item was placed on a non-conductive rubber cart, with a height of 80 cm above the reference ground plane. The test object was spaced 40 cm from the rear wall of the shielded room and further than 80 cm from adjacent walls, and the test object power supply was plugged into a 50 (ohm) 50/250µH Line Impedance Stabilization Network (LISN). The test area and set-up are in accordance with ANSI C63.4-1992, sections 5, 6, and 7. The AC power supply to the LISN was fed into the shielded room via an appropriate broadband EMI filter. The test sample was set to operate on the channel 1 in continuous transmit during the measurements, and operation was also checked on the middle and high channels. The wall transformer DC supply normally supplied with the AP A2 was plugged into the LISN, and the sample was set to transmit. In order to properly control the unit, and create a test signal, a 2 meter length interface cable was connected to the device. This cable was routed into a fiberoptic interface, and then connected to a computer via a 10 meter fiberoptic cable. The computer software provided a test signal for setting channel, power, and test modulation for continuous and burst transmissions, and for receive mode.

After the equipment under test was set-up in the shielded room and connected to the LISN, the RF sampling port of the LISN was cabled to a 10dB attenuator-limiter, and then to the EMI analyzer. The EMCO LISN used has the facility to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral). The appropriate frequency range and bandwidths were entered into the HP 8591EM EMI analyzer, and measurements were made. The test object cables and position were varied to find the maximum signal levels. Final readings were then taken and recorded. The test procedure guidelines used are found in ANSI C63.4-1992: Sections 7 and 11 including Annex E1 and E2.

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The limits for conducted emissions for this test object are found in Title 47CFR, FCC Part 15.207 (b) for an intentional radiator. The levels of these limits are 250µV (48dBµV) from 450 kHz to 30 MHz. Test results are located in Appendix II and pictures of the test setup are in section 1.11.

2.7 RADIATED EMISSIONS TEST SETUP

The test sample was operated within the 3 meter Semi-Anechoic, FCC listed chamber located at L.S. Compliance in Cedarburg, WI. The sample was positioned on a small wood pedestal, which was centered on the flush-mounted 2m diameter metal turntable. The test sample was operated on a small auxilliary power supply. When installed, the device will be operating from batteries. The test sample was configured to run in a continuous transmit mode during the 15.247 and 15.205 measurements. The sample was also set to run in a continuous transmit loop. One test sample was set to operate on either channel 1 (low), channel 8 (medium) or channel 11(high) while being tested as an intentional radiator, in order to determine compliance within a frequency range of 2400-2483.5 MHz, as dictated by FCC part 15.31m. The Access Point A2 was mounted on the 80 CM high wooden table, centered on the turntable for measurement of spurious signals emanating from the system while in the transmit mode, at 30-24000 MHz.

Please refer to Section 2.11 for pictures of the test setup.

2.8 RADIATED EMISSION TEST PROCEDURE

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to Title 47 CFR, FCC Part 15.247c limits for Direct Sequence Spread Spectrum systems, and the 15.205 general limits, within the restricted bands. For the calculations used to determine the 1 meter limits, see Appendix A. The test sample was tested from the lowest frequency generated by the transmitter to the 10th harmonic of the fundamental frequency generated by the device. The appropriate limits were also observed where any spurious signals were located within any of the restricted bands as described in Part 15.205a. These frequencies, and their associated limits, are referenced in Section 2.10. The sample was placed on a table, or a pedestal, and placed in the 3 Meter chamber and the antenna mast was placed such that the antenna was either 1 meter or 3 meters from the test object. A biconical antenna was used to measure emissions from 30 to 200 MHz, a log periodic was used to measure emissions from 200 to 1000 MHz, and a double ridged waveguide horn was used to measure emissions from 1-18 GHz. A standard reference horn antenna was used for measurements from 18-26 GHz. The test object was programmed to operate in continuous transmit, and the resultant signals were maximized by rotating the turntable zero to 360 degrees, and by raising and lowering the antenna between 1 and 4 meters, using both horizontal and vertical antenna polarities. Emissions above 5 GHz were also measured at a 1 meter separation, using the HP Microwave spectrum analyzer, preamps and the EMCO horn antennas. The wall transformer DC supply normally supplied with the AP A2 was plugged into the LISN, and the sample was set to transmit. In order to properly control the unit, and create a test signal, a 2 meter length interface cable was connected to the device. This cable was routed into a fiberoptic interface, and then connected to a computer via a 10 meter fiberoptic cable. The computer software provided a test signal for setting channel, power, and test modulation for continuous and burst transmissions, and for receive mode.

No significant emissions were found aside from the transmitter fundamental, harmonics, and some spurious signals. The unit was scanned for emissions in both transmit and receive modes, over the range 30 to 24000 MHz to establish compliance with Part 15.247c and 15.205 for the system. Also, the scans were performed to evaluate the digital controller section of the product, which is subject to verification as a Class B digital device. The same procedures as detailed for the transmitter tests described above were

used to perform these measurements. The results of the system measurements are found in Appendix B, with graphs of the signature scans found in Appendix C.

2.9 TEST EQUIPMENT UTILIZED FOR RADIATED EMISSIONS TEST

A list of the test equipment and antennas used for the tests can be found in Section 2.13, which includes the calibration information as well as the equipment description. All equipment is calibrated and used according to the user manuals supplied by the manufacturer. All antenna calibrations were performed at a N.I.S.T traceable site, and the resultant correction factors were entered into the Hewlett Packard 8546A EMI receiver software database. The connecting cables used were also measured for loss using a calibrated signal generator and the HP 8546A EMI receiver. The resulting loss factors were entered into the HP 8546A database. This allowed for automatic changes in the antenna correction factor, as well as cable loss or other corrections, to be added to the EMI receiver display while taking measurements. Thus, the resulting data taken from the HP 8546A is an actual reading and can be entered into the database as a corrected meter reading. The HP 8546A EMI receiver was operated with a bandwidth of 120 kHz when receiving signals below 1 GHz, and with a bandwidth of 1 MHz when receiving signals above 1 GHz, in accordance with CISPR 16. Both the Peak and Quasi-peak detector functions were used.

For measurements in the upper microwave region, an HP E4407B 26.5 GHz spectrum analyzer was used. Antenna factors for the horn antenna, preamplifier, a short jumper cable and a high pass filter were entered into the analyzer as correction factors. This allowed for direct readings to be made of the field strength. During emissions testing, signals where significant levels were noted were measured using the 1 MHz IF bandwidth, and a 100 Hz video bandwidth, resulting in an average measurement mode of the analyzer. Peak readings were obtained using a 1 MHz IF and 1 MHz video bandwidth.

2.10- Restricted Bands affecting this product

3 Meter limits

Frequency (MHz)	Limit (µV)	Limit (dB/µV/m)
37.5-38.25	100	40.0
73.74.6	100	40.0
74.8-75.2	100	40.0
108-121.94	150	43.5
123-138	150	43.5
149.9-150.05	150	43.5
156.52-156.53	150	43.5
156.7-156.9	150	43.5
162-167.17	150	43.5
167.72-173.2	150	43.5
240-285	200	46.0
322-335.4	200	46.0
399.9-410	200	46.0
608-614	200	46.0
960-1240	500	54.0
1300-1427	500	54.0
1435-1626.5	500	54.0
1645.5-1646.5	500	54.0
1660-1710	500	54.0
1718.8-1722.2	500	54.0
2200-2300	500	54.0
2310-2390	500	54.0
2483.5-2500	500	54.0
2655-2900	500	54.0
3260-3267	500	54.0
3332-3339	500	54.0
3345.8-3358	500	54.0
3600-4400	500	54.0
4500-5150	500	54.0
5350-5460	500	54.0
7250-7750	500	54.0
8025-8500	500	54.0
9000-9200	500	54.0
9300-9500	500	54.0
10600-12700	500	54.0
13250-13400	500	54.0
14470-14500	500	54.0
15350-16200	500	54.0
17700-21400	500	54.0
22010-23120	500	54.0

23600-24000	500	54.0

Plus others in the frequency range below 960 MHz, not listed where spurious signals were not present.

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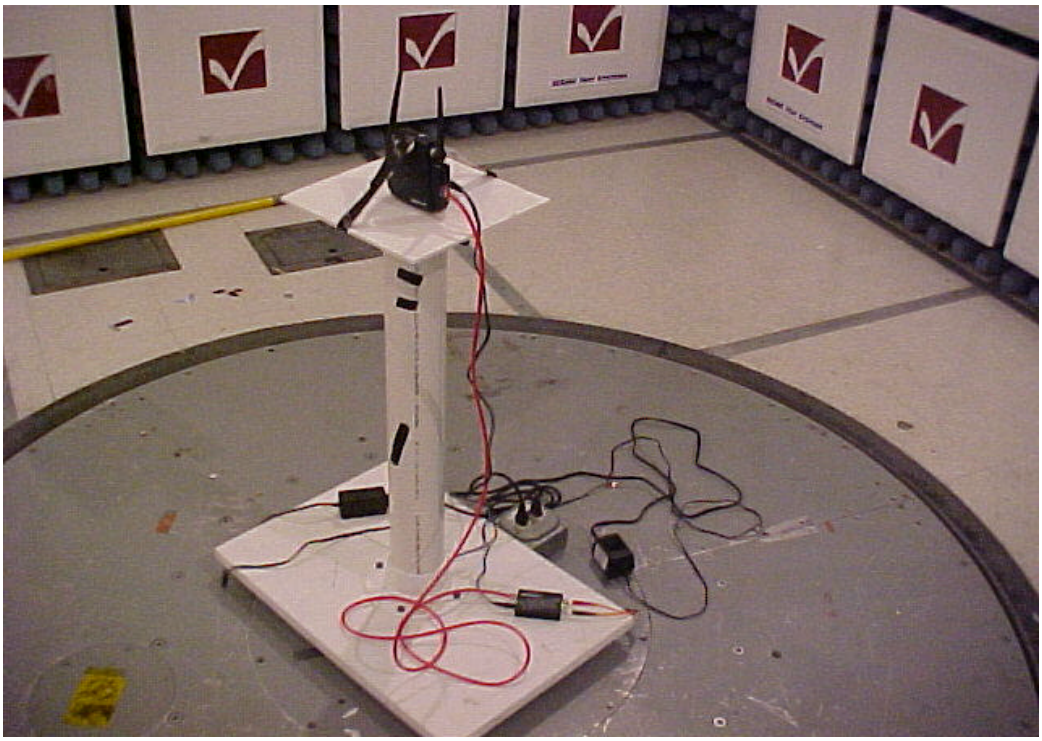
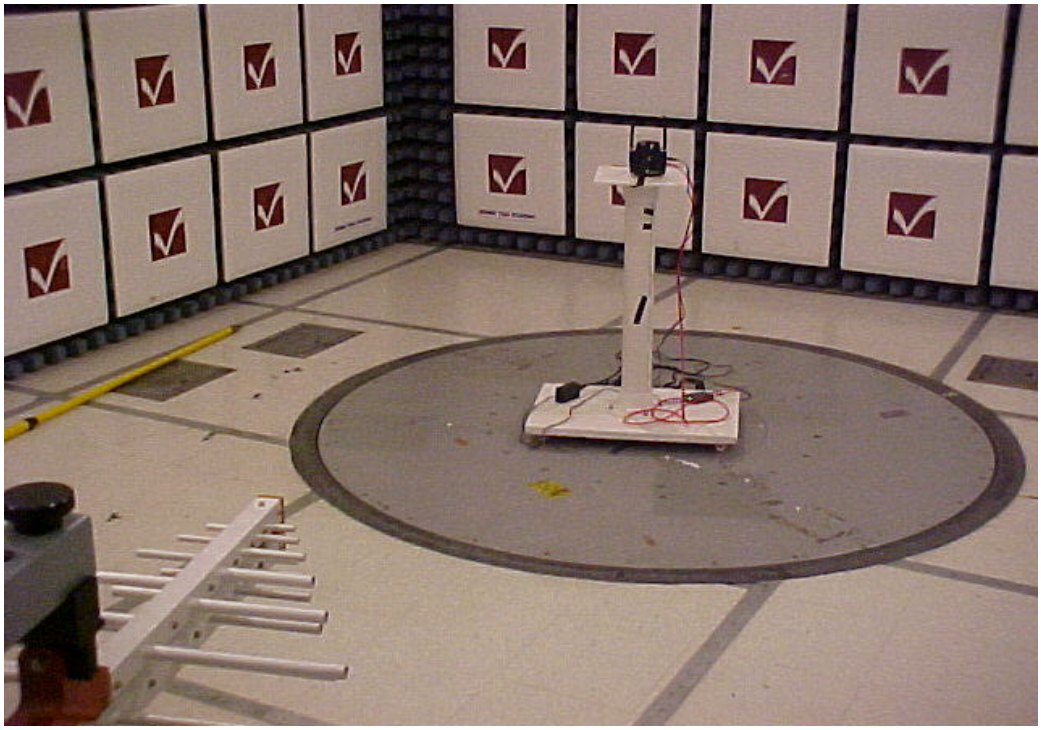
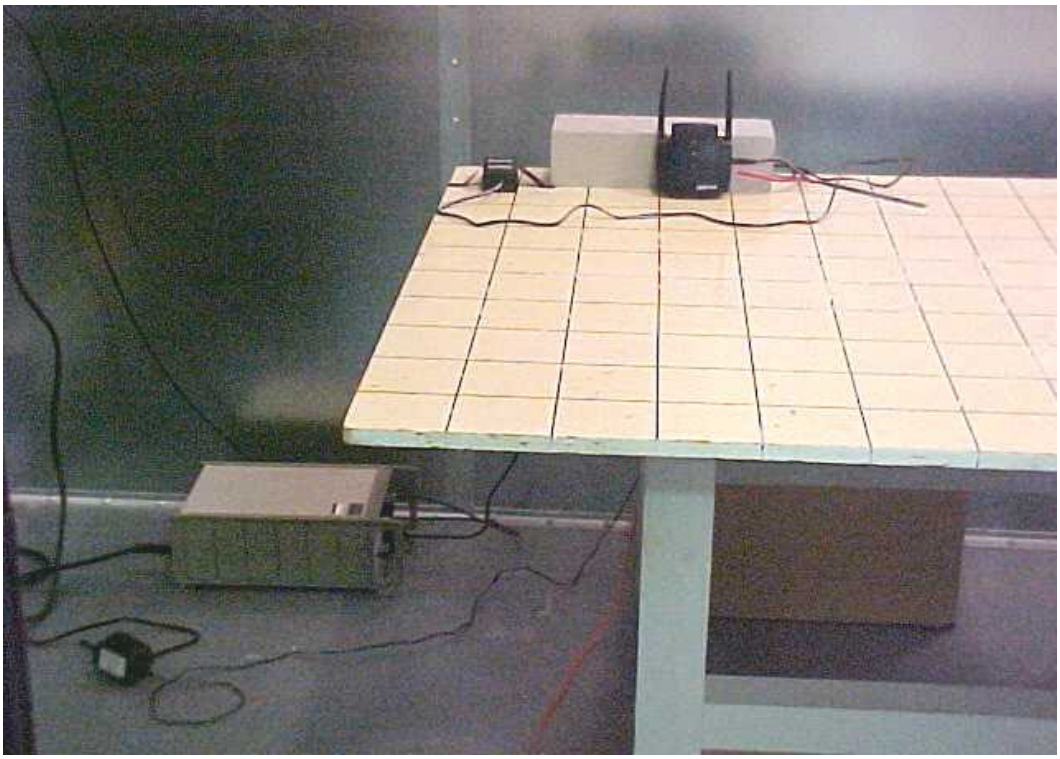
2.11 – Photos taken during testing





View of the Access Point A2 spread spectrum transceiver during the Radiated Emissions tests.



View of the access Point A2 spread spectrum transceiver during the conducted Emissions tests.

2.12 SUMMARY OF RESULTS AND CONCLUSIONS

Based on the procedures outlined in this report, and the test results included in appendices B and C, it can be determined that the Access Point A2 does **meet** the emission requirements of Title 47 CFR, FCC Part 15 Subpart C for an intentional radiator. Some of the emissions, in the restricted bands above 1 GHz, are within 4 dB of the limits, and could be found to be over the limits if these samples, or others were to be tested by another agency.

The enclosed test results pertain to the samples of the test item listed, and only for the tests performed on the data sheets. Any subsequent modification or changes to the test items could invalidate the data contained herein, and could therefore invalidate the findings of this report

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2.13 - Test Equipment

Asset #	Manufacturer	Model	Serial#	Description	Due Date
AA960004	EMCO	3146	9512-4276	Log Periodic Antenna	8/21/01
AA960005	EMCO	3110B	9601/2280	Biconical Antenna	9/28/01
AA960007	EMCO	3115	99111-4198	Double Ridge Horn Antenna	9/18/01
EE960004	EMCO	2090	9607-1164	Mast/Ttable controller	I.O.
EE960003	HP	85460	3617A00320	EMI receiver Display section	11/01/01
EE960003	HP	85462	3205A00103	EMI receiver Preselector section	11/01/01
CC000221	HP	E4407b	Us39160256	26.5 GHz Spectrum Analyzer	11/08/01
AA960008	EMCO	3816/2	9701-1057	16 amp LISN	8/21/01
AA960031	HP	11947A	3107A01708	Limiter	8/10/01
AA960060	EMCO	3160-09	981062-005	Standard gain Horn Antenna	"standard"
EE960147	Advanced Microwave	WLA612	0123101	Microwave preamplifier 2-18 GHz	6/13/02
EE960146	Advanced Microwave	WLA622	0123001	Microwave preamplifier 18-26 GHz	6/13/02
--	LSC	Cable	0011	3 meter Heliax	12/07/01
--	LSC	Cable	0038	1 meter RG214	12/07/01
--	LSC	Cable	0050	10 meter RG214	12/07/01

APPENDIX A:

SAMPLE CALCULATIONS

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Calculation of Radiated Emissions limits for FCC Part 15.209 (above 1 GHz)

The following table depicts the Class B limits for an unintentional radiator: The limits are established at a measurement distance of 3 meters and are corrected for a 1 meter measurement distance, which is extrapolated from the 3 meter limit.

Frequency (MHz)	3m limit (dB mV/m)	1m limit (dB mV/m)
960 MHz up	54	63.54

- The 1 meter limits were calculated by adding a factor of 9.54 dB, derived from:

$20\log_{10}(3/1) = 9.54$ dB uV/m

1m limit = 3m limit + factor

= 54 dB µV/m + 9.54 dB µV/m = 63.54 dB uV/m

rounded off =63.5 dB µV/m

Limits for peak emissions (TDD transients) are capped at 20 dB above the average limits per 15.35b:

3 meter peak limit: 54.0+20.0 = 74.0 dBuV/m

1 meter peak limit 63.5+20.0 = 83.5 dBuV/m

15.205/15.209 limits: (3 meters)

Frequency (MHz)	Harmonic limit (mV/m)	Harmonic limit (dB mV/m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-24000	500	54.0

APPENDIX B:

DATA CHARTS

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Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 30 to 1000 MHz

Date of Test:	July 19, August 1,2, 2001	Manufacturer:	Intersil
Location:	L. S. Compliance, Inc.	Model No.:	Access Point A2
	W66 N220 Commerce Court		
	Cedarburg, WI 53012		
Specifications:	47CFR FCC Part 15.10	Serial No.:	Prototype
Distance:	3 meters	Configuration:	TX; Channels 1,8, 11
Equipment:	HP 8546A EMI Receiver	Detector(s) Used:	Quasi-peak
	EMCO 3146A Log Periodic		
	EMCO 3110B Biconical		

The following table depicts the level of significant spurious emissions found in restricted bands

Frequency (MHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	EMI Meter Reading (dB µV/m)	15.205 Limit (dB µV/m)	Margin (dB)
123.0	V	1.0	150	28.9	43.5	14.6
613.6	V	1.0	45	32.1	46.0	13.9

All other signals seen were greater than 20 dB below the 15.247 or 15.205/209 limits

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Measurement of Electromagnetic Radiated Emission within 3 Meter FCC Listed Chamber

Frequency Range inspected: 1 to 25 GHz

Date of Test:	July 19, August 1,2, 2001	Manufacturer:	Intersil
Location:	L.S. Compliance, Inc.	Model No.:	Access Point A2
	W66 N220 Commerce Court		
	Cedarburg, WI 53012		
Specifications:	47CFR, FCC Part 15.247(c), 15.205	Serial No.:	prototype
Distance:	1 meter, 3 meter	Configuration:	TX; Channels 1,8, 11
Equipment:	HP 8546A EMI Receiver	Detector(s) Used:	Peak, average
	EMCO 3115 Double Ridged Waveguide Horn		
	2-18, 18-26 GHz preamps, 3.0 GHz Hi-pass		
	HP E4407 Spectrum Analyzer		
	EMCO 3160 -09 STD Gain Horn		

The following table depicts the level of significant spurious and harmonic emissions found within 15.205 restricted bands:

Frequency (GHz)	Antenna Polarity	Height (meters)	Azimuth (0° - 360°)	Channel	Peak reading	Feak limit	Margin peak	Average reading	15.205 Limit (dB µV/m)	Margin (dB)
4076	H	1.0	160	1	54.9	74.0	19.1	48.8	54.0	5.2
8151	H	1.0	270	1	52.0	83.5	31.5	44.1	63.5	19.4
4146	V	1.1	200	8	54.7	74.0	19.3	49.0	54.0	5.0
4894	V	1.0	340	8	63.1	74.0	10.9	51.6	54.0	2.4
8291	V	1.0	320	8	54.6	83.5	28.9	47.3	63.5	16.2
12436	V	1.0	20	8	55.5	83.5	28.0	46.3	63.5	17.2
2836	V	1.25	0	11	58.1	74.0	15.9	47.6	54.0	6.4
4176	V	1.0	245	11	60.6	74.0	13.4	49.9	54.0	4.1
4924	V	1.0	355	11	63.5	74.0	10.5	52.3	54.0	1.7
8351	H	1.0	300	11	53.9	83.5	29.6	47.0	63.5	16.5
12526	V	1.0	120	11	56.8	83.5	26.7	48.6	63.5	14.9

* measurement performed at 1 meter separation distance, all others at 3 meters.

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Measurement of Conducted Emissions within 8' X 10' FCC Listed Shielded Room.

Date of Test:	July 19, 2001	Manufacturer:	Intersil
Location:	L. S. Compliance, Inc.	Model No.:	Access Point A2
	W66 N220 Commerce Court		
	Cedarburg, WI 53012		
Specifications:	Title 47CFR, FCC Part 15 Subpart C	Serial No.:	prototype
Distance:	40 cm to vert. G.P.	Configuration:	TX: Channels 1,8,11
Equipment:	HP 85460A, 85462A EMI Receiver	Detector(s) Used:	Quasi-Peak
	EMCO 3810/2NM LISN		
	HP 11947A Limiter		
Lab Conditions:	Temp.: 72° F / Humidity:50%		

The following table depicts the level of significant spurious emissions found:

Frequency (MHz)	Line	EMI Meter Reading (dB µV)	FCC 15.207 Limit (dB µV)	Margin (dB)
13.19	L1	36.5	48	11.5
13.10	L2	38.0	48	10.0

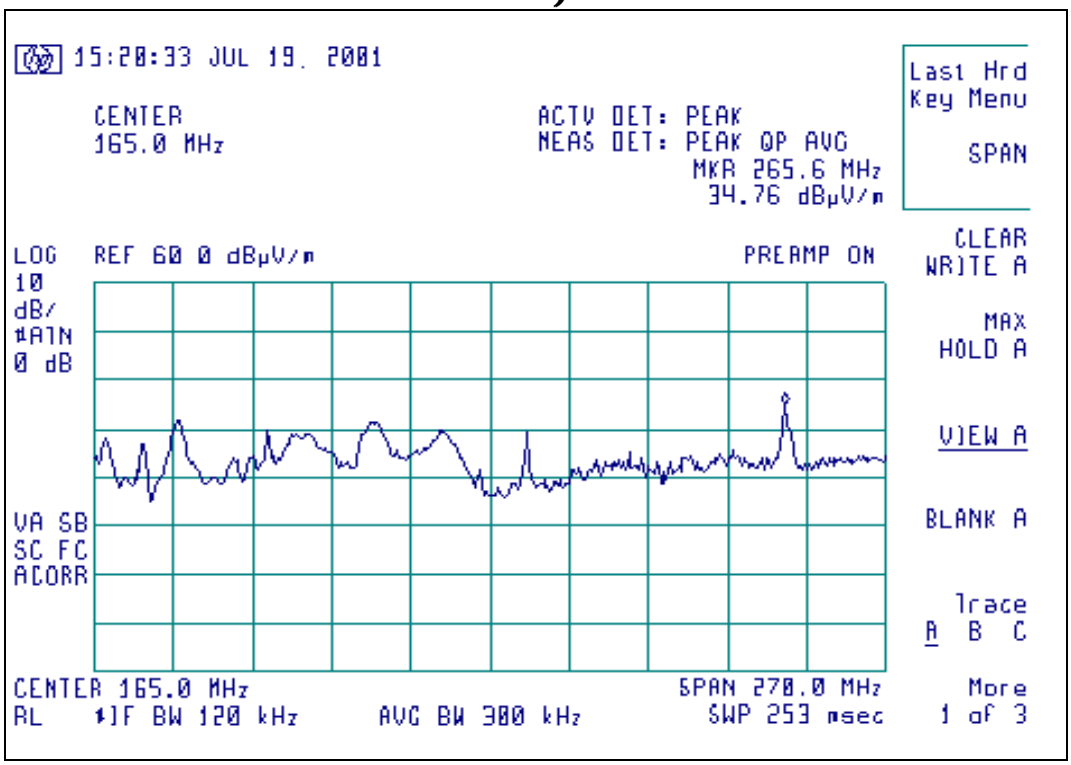
All other signals were seen to be greater than 20 DB below the limits

APPENDIX C:

GRAPHS

FCC ID: OSZ36356A2

Radiated Emissions 30-300 MHz, vertical polarity,channel 11(typical of all)



Radiated emissions 300-1000, vertical polarity, channel 1 (typical of all)

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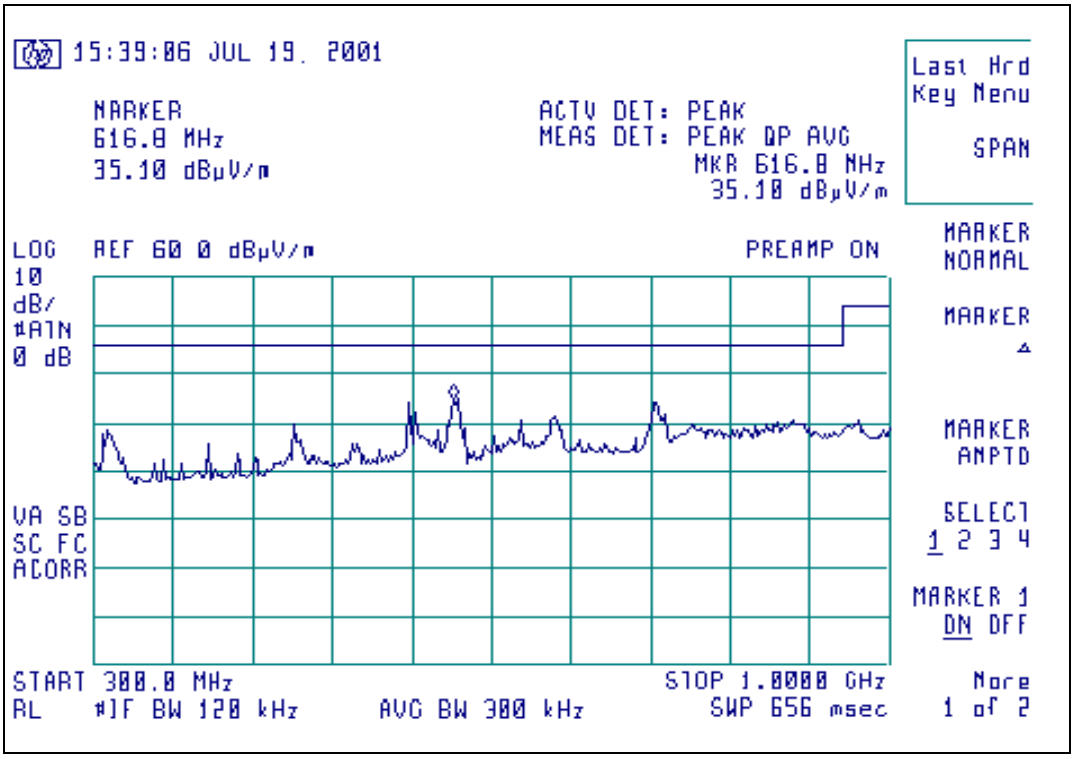

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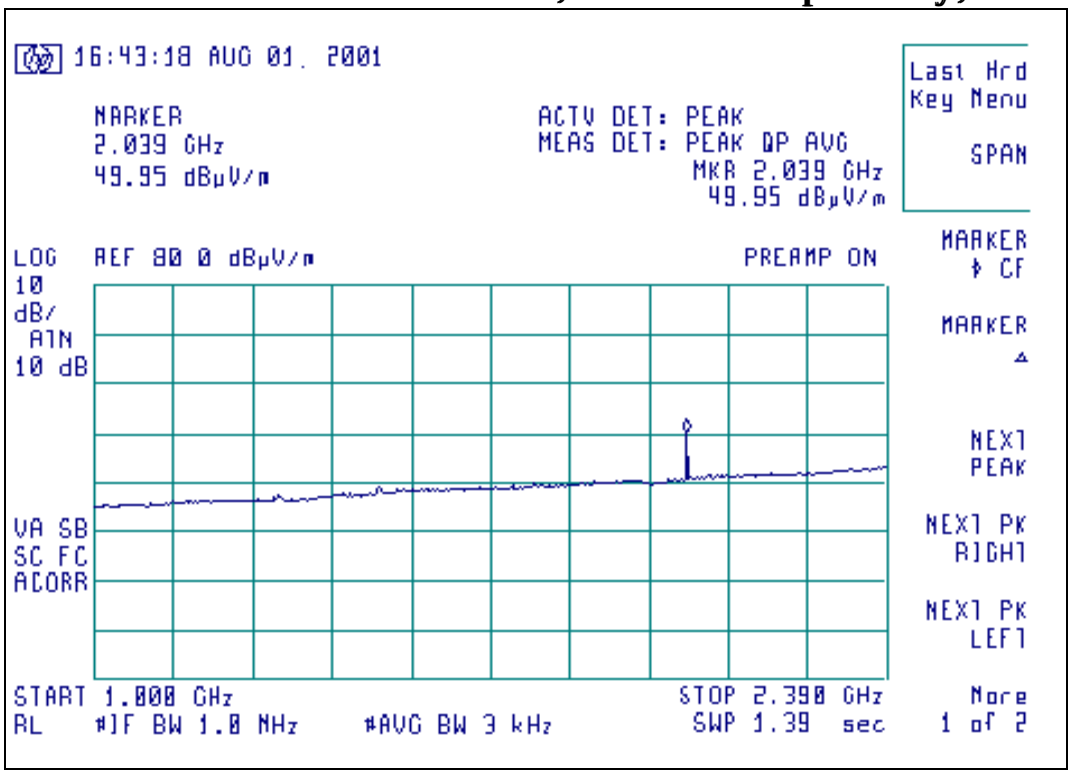
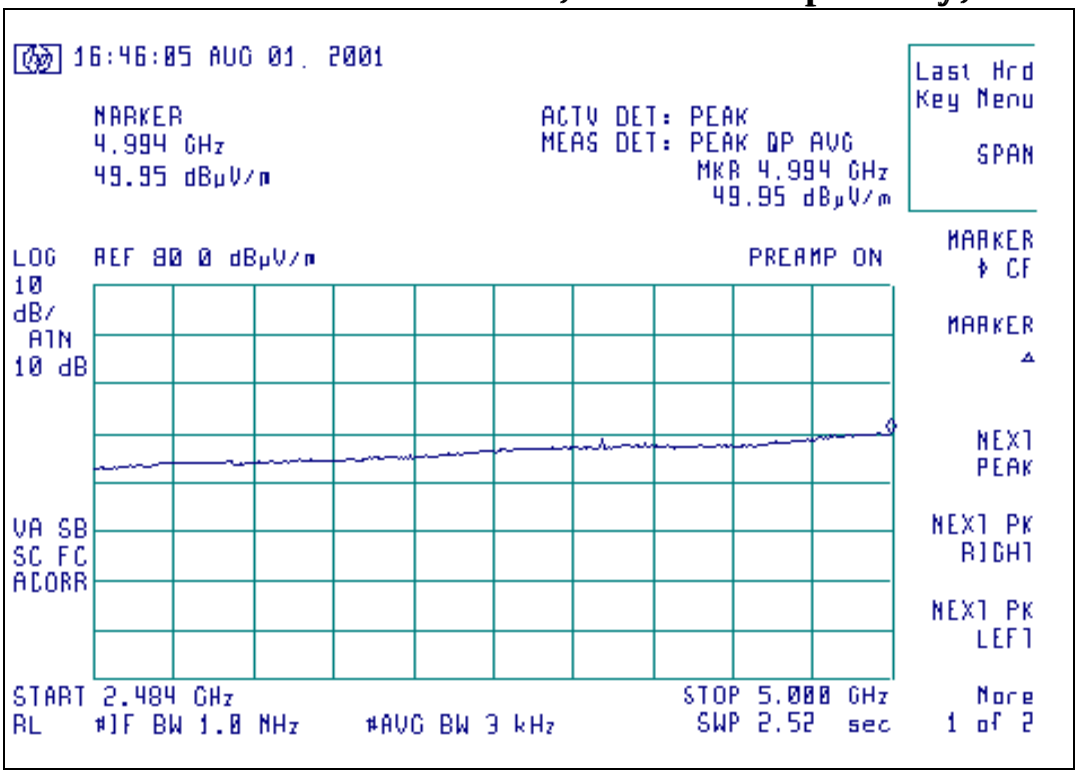
Radiated Emissions for 1-2.3 GHz, horizontal polarity, channel 1

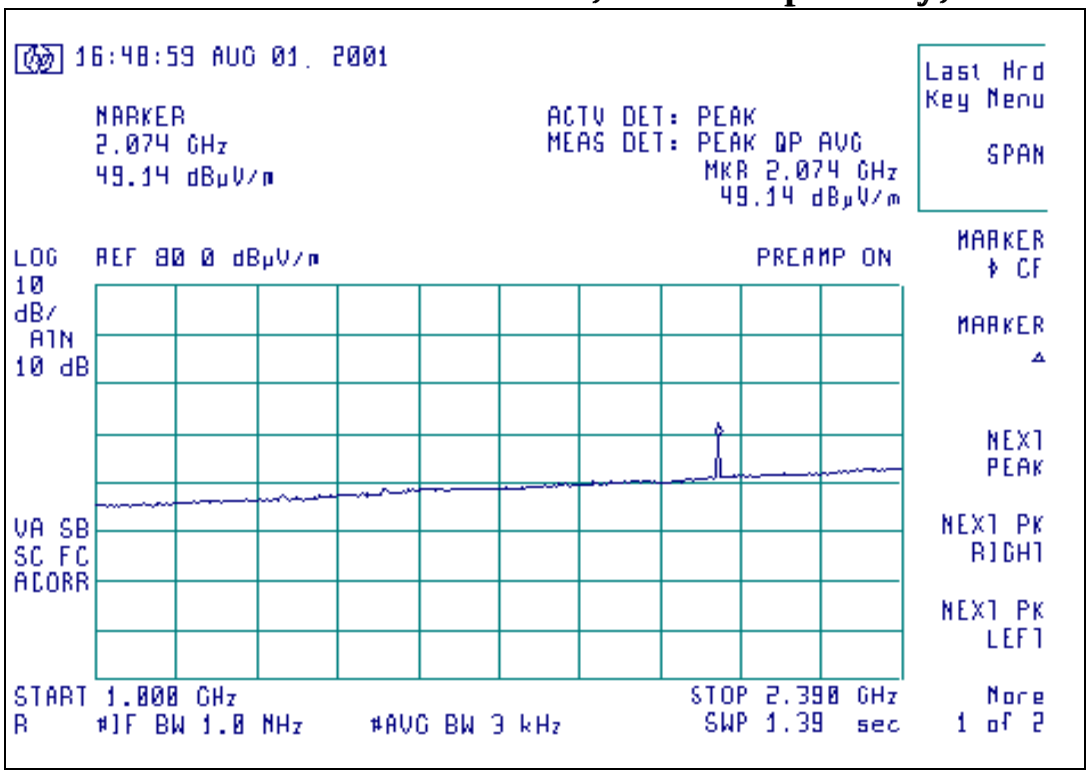


Radiated Emissions for 2.4-5 GHz, horizontal polarity, channel 1

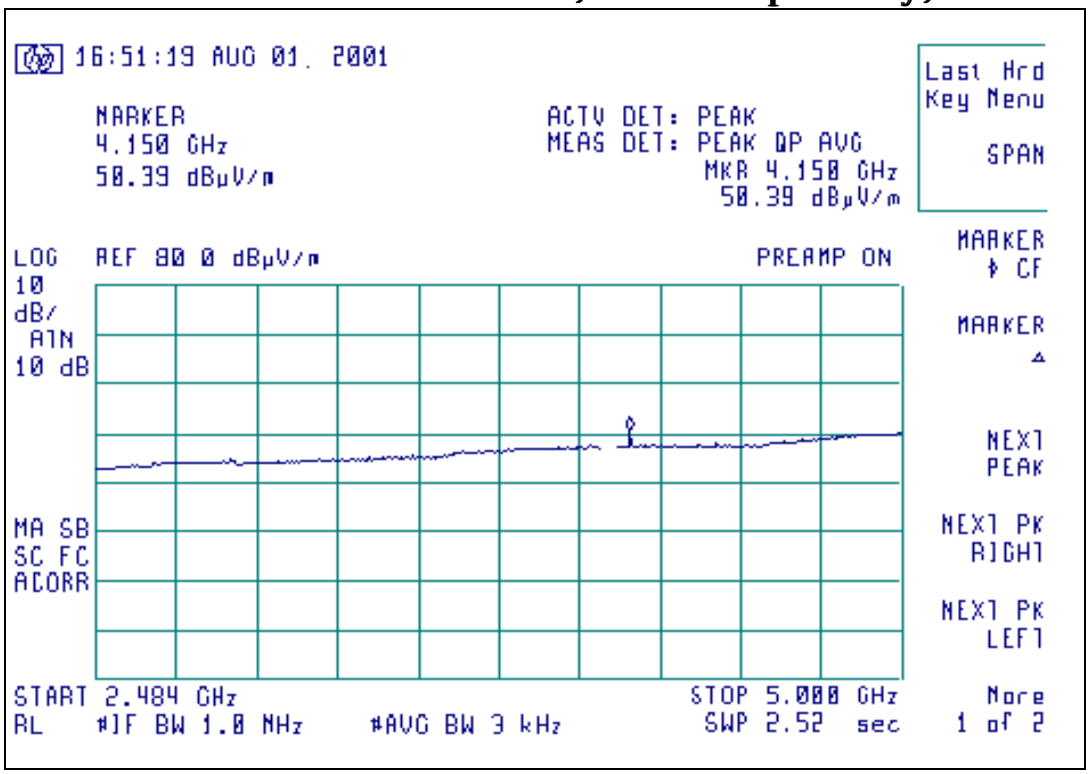


FCC ID: OSZ36356A2

Radiated Emissions for 1-2.3 GHz, vertical polarity, channel 8



Radiated emissions 2.4-5.0 GHz, vertical polarity, channel 8



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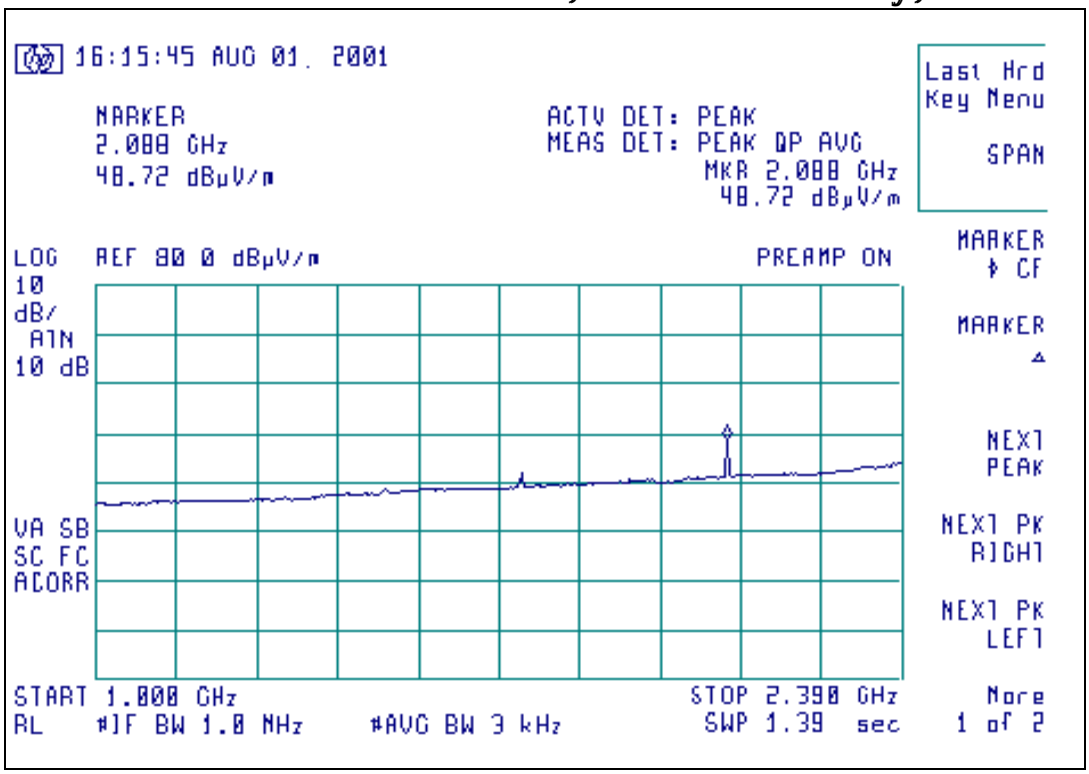
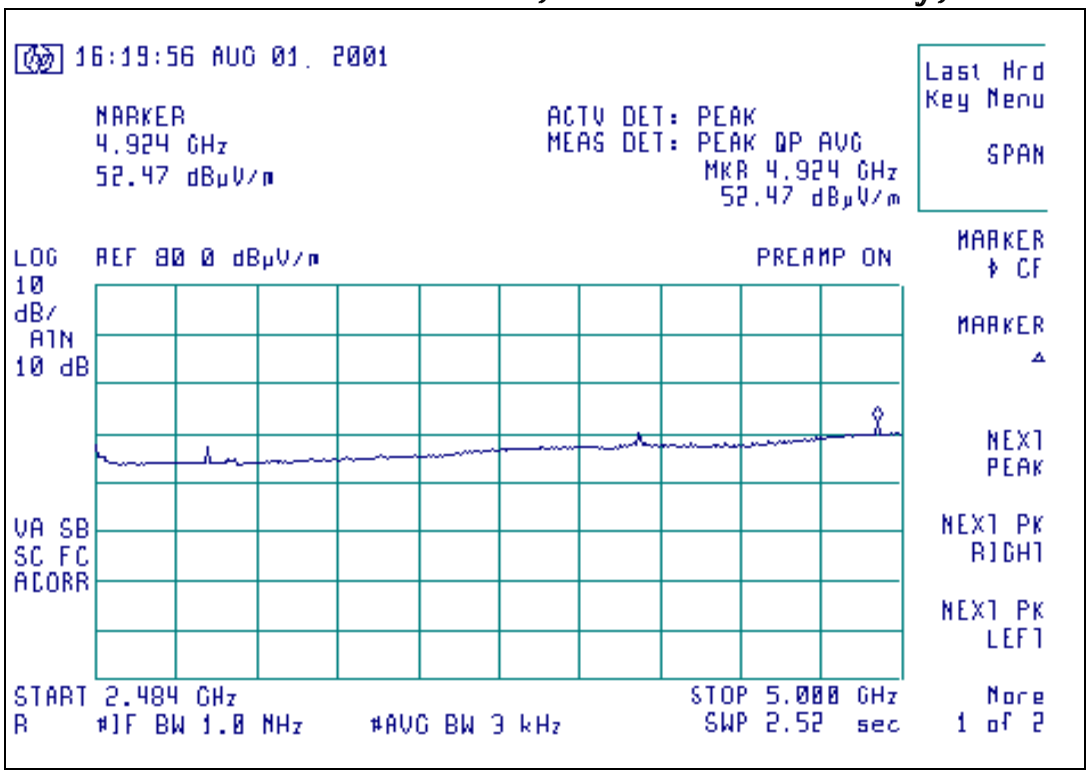
Radiated Emissions 1 to 2.3 GHz, vertical Polarity, channel 11

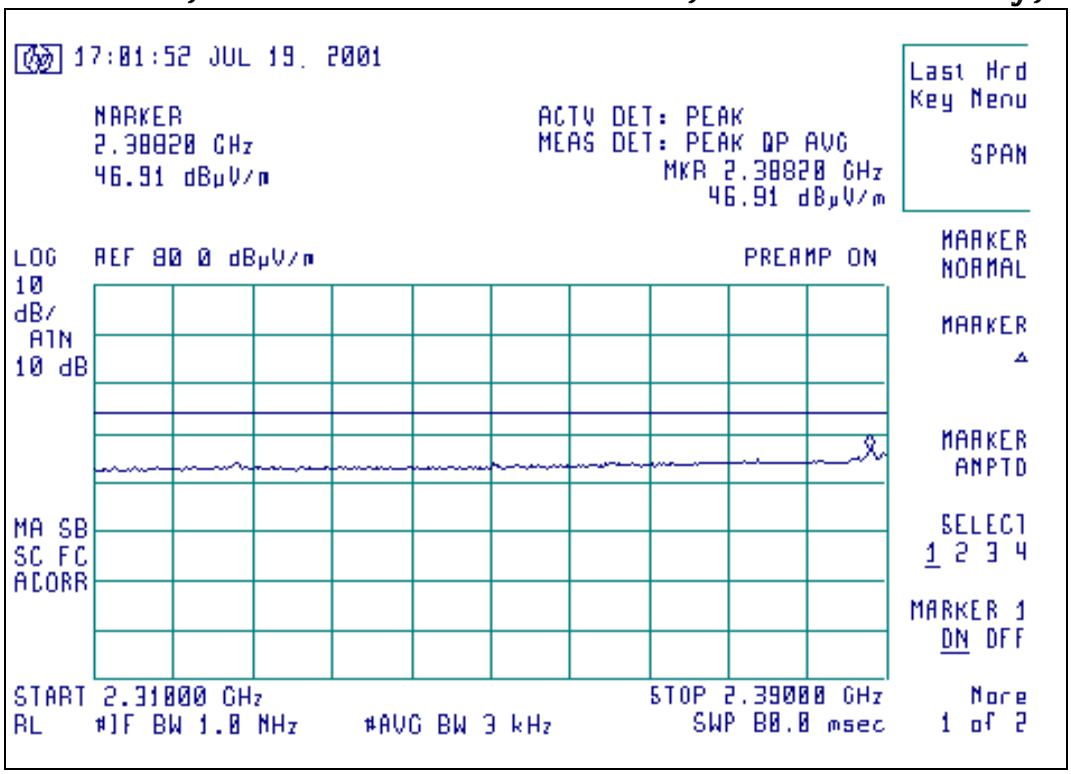


Radiated Emissions 2.4-5.0 GHz, horizontal Polarity, channel 11

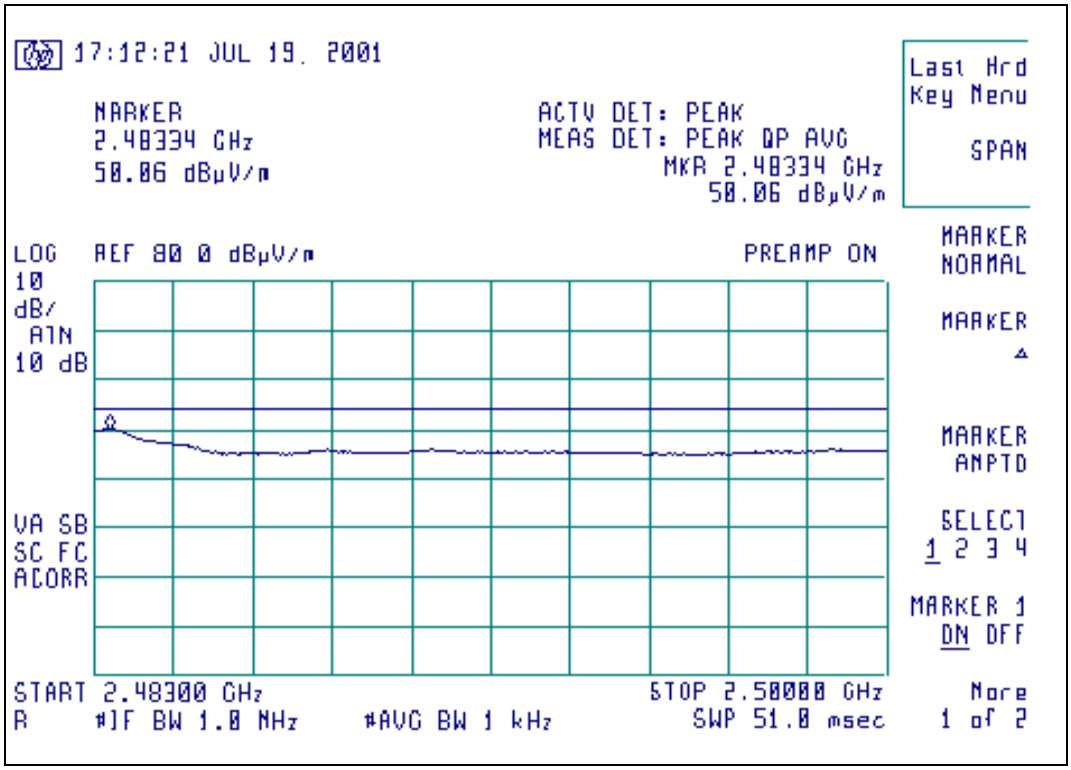


FCC ID: OSZ36356A2

Radiated Emissions, critical restricted bands, vertical Polarity, channel 1

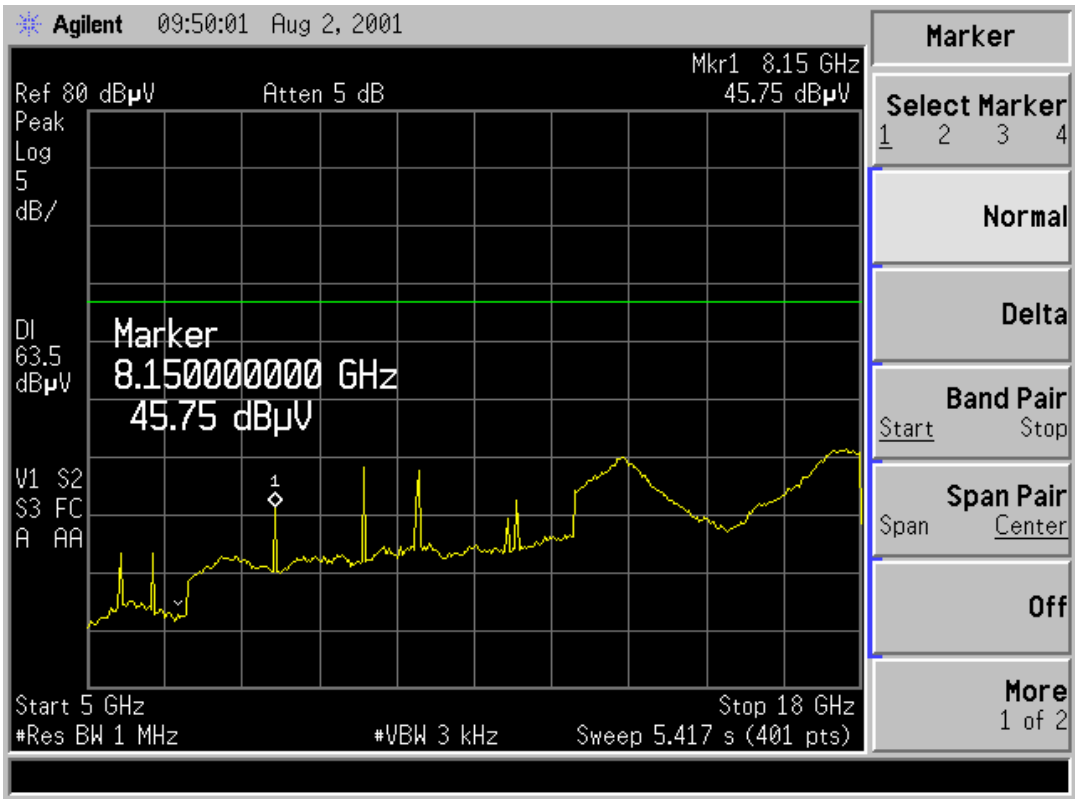


Radiated Emissions, critical restricted bands, vertical Polarity, channel 11

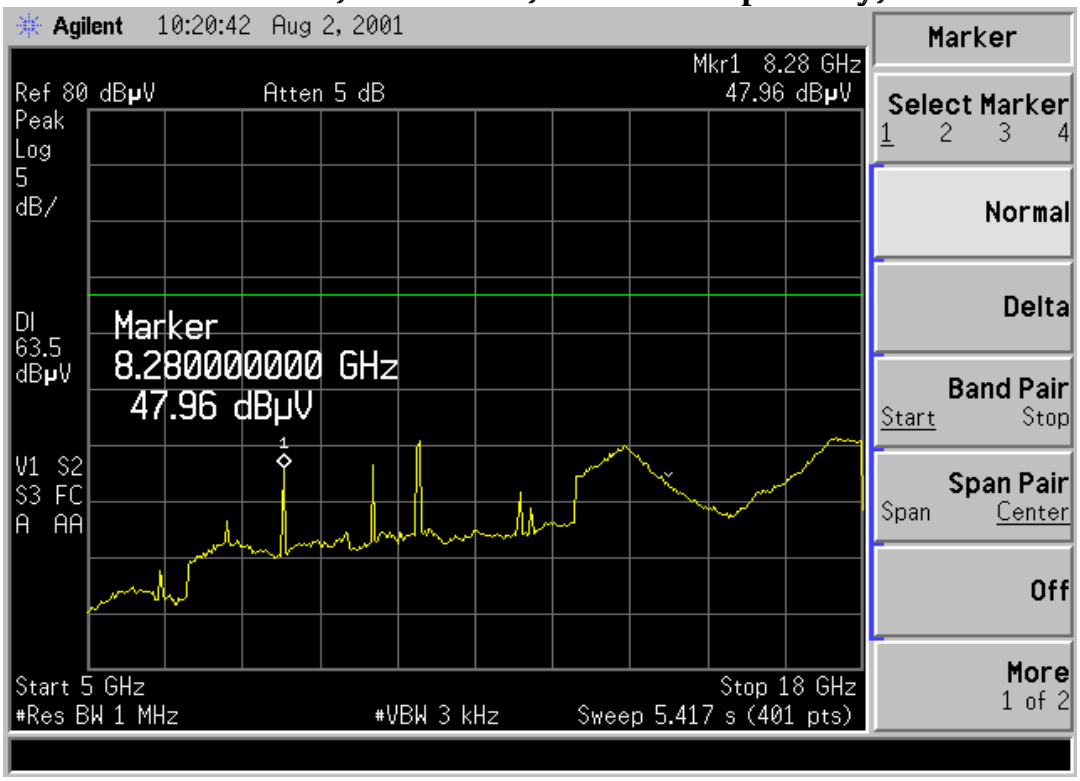


FCC ID: OSZ36356A2

Radiated Emissions, channel 1, horizontal polarity, 5-18 GHz

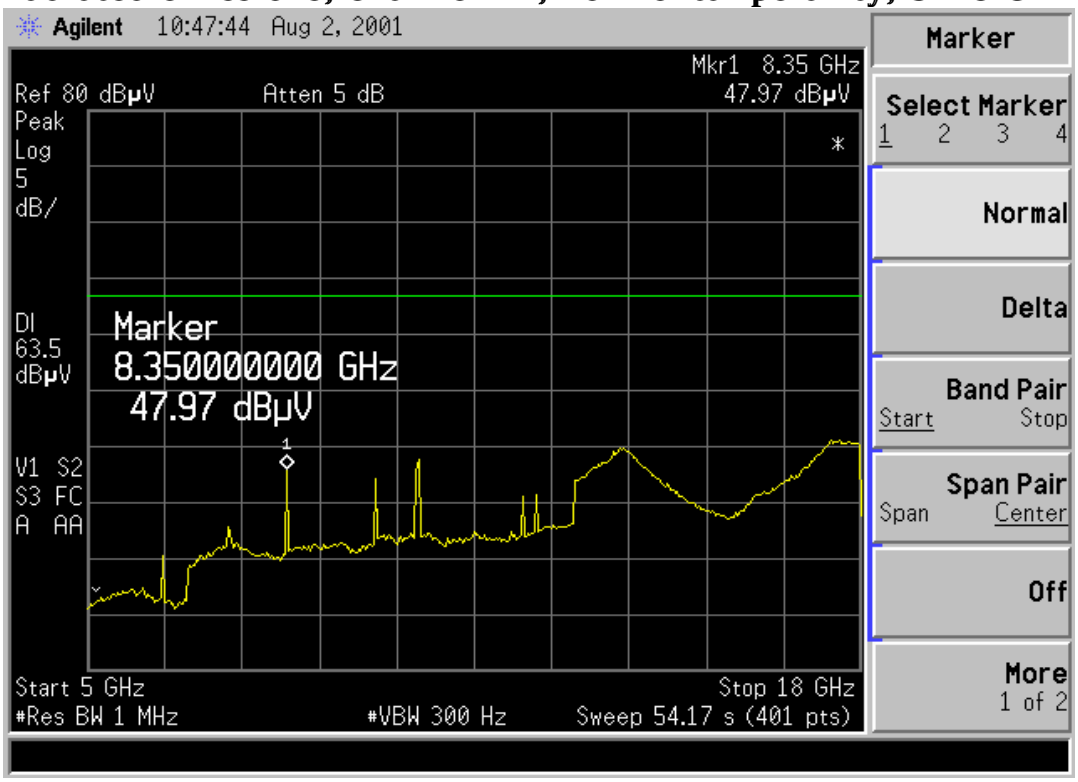


Radiated emissions, channel 8, horizontal polarity, 5-18 GHz

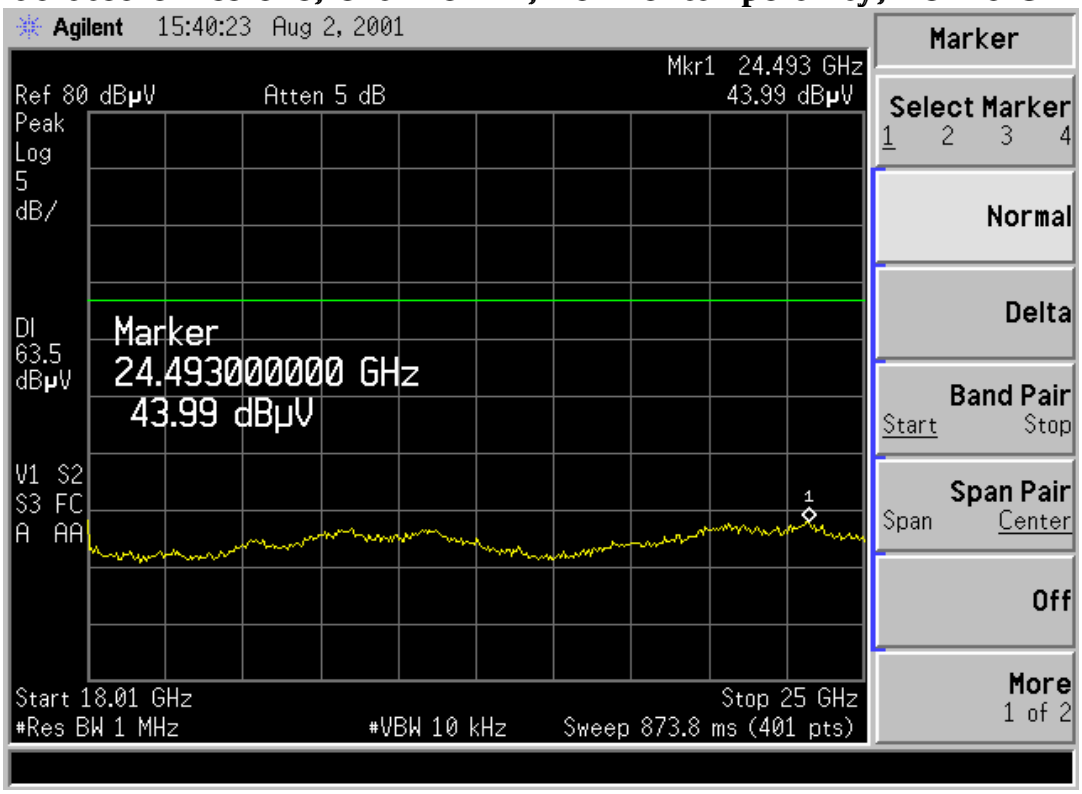


FCC ID: OSZ36356A2

Radiated emissions, channel 11, horizontal polarity, 5-18 GHz

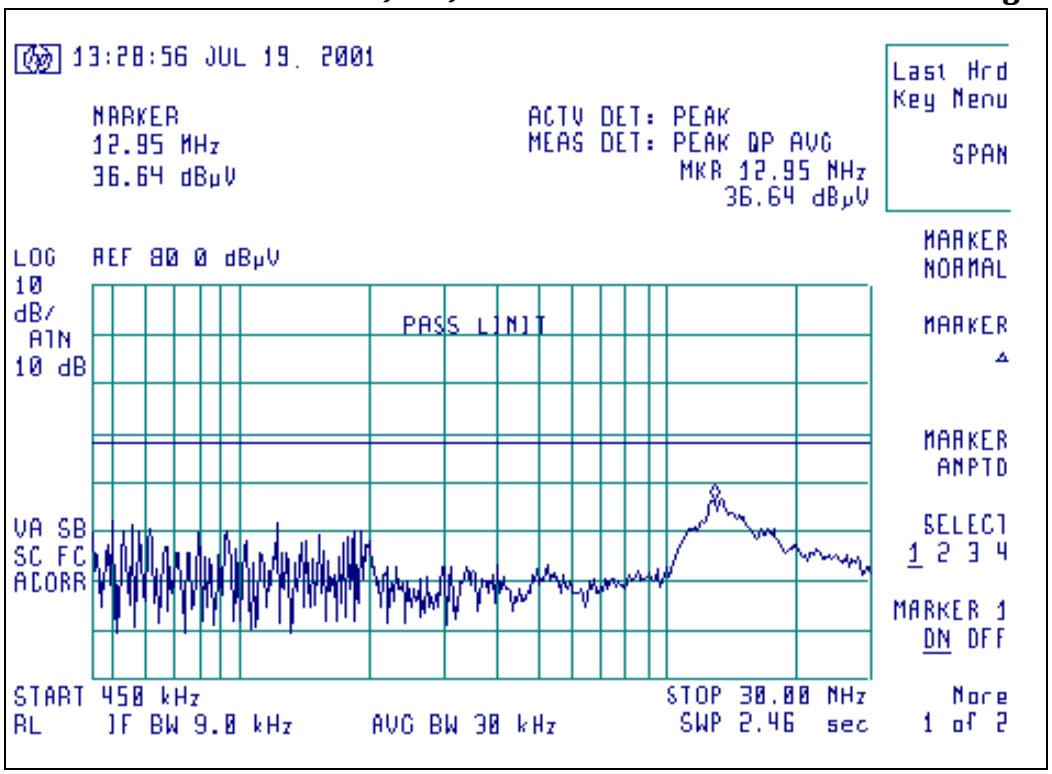


Radiated emissions, channel 11, horizontal polarity, 18-26 GHz

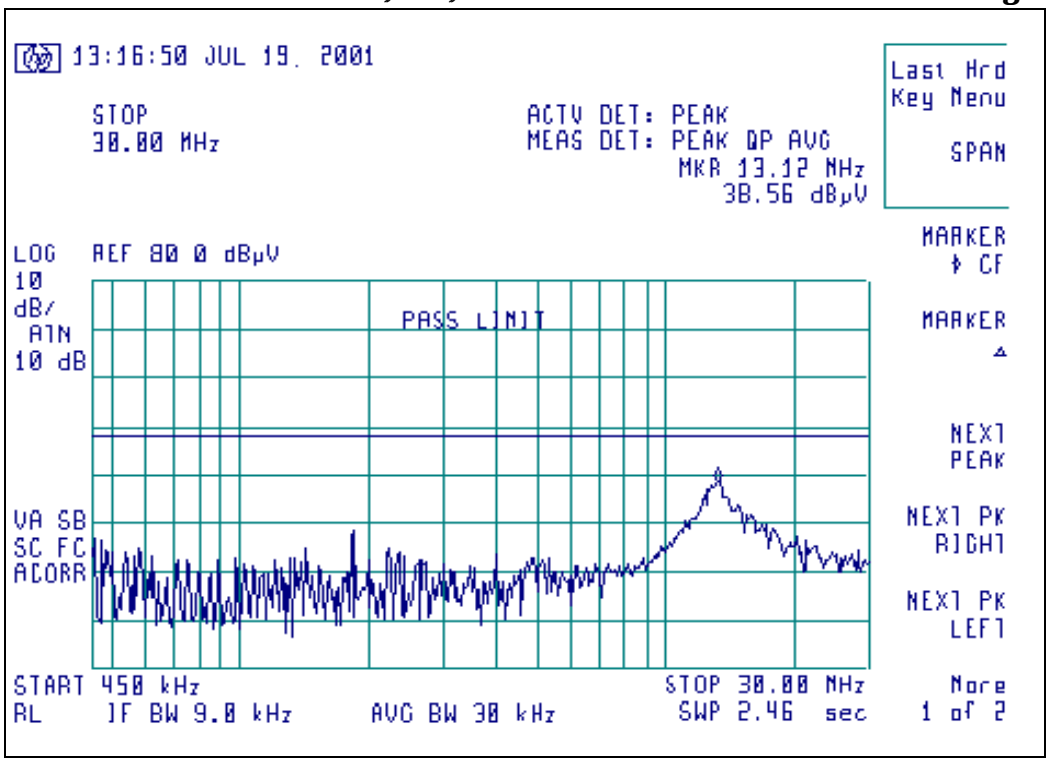


FCC ID: OSZ36356A2

Conducted Emissions, L1, while on channel 1 transmitting



Conducted emissions, L2, while on channel 1 transmitting



FCC ID: OSZ36356A2

APPENDIX D