FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Meru Networks

1309 S Mary, Suite 220
Sunnyvale, CA 94087

FCC ID: RE7-AP100

2004-01-20

This Report Concerns:	**Equipment Type:**
☒ Permissive Change Report	802.11b Access Point - ITE

Test Engineer: Ling Zhang /

Report No.: R0312087

Test Date: 2003-12-16

Reviewed By: Ming Jing /

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Meru Networks's*, model: *AP100* or the "EUT" as referred to in this report is an 802.11b access point which measures approximately 9.8"L x 6.8"W x 1.4"H. The EUT will operate at the frequency range of 2412 – 2462 MHz, with the maximum conducted output power of 23.73dBm (0.236W)

The EUT was fed by PowerDsine power over LAN Hub, M/N: PowerDsine 6001.

** The test data gathered are from production sample, serial number:Meru001, provided by the manuafactuer.*

Objective

This type approval report is prepared on behalf of. *Meru Networks* in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communication Commissions rules.

The manufacturer is seeking Class II permissive change approval since the enclosure material has been changed from plastic AP to sheet metal AP.

The objective is to determine compliance with FCC rules for Conducted and Spurious Radiated Emission for permissive change.

Related Submittal(s)/Grant(s)

The original FCC grant was issued on 2003-10-07, please refer to BACL report, R0308071, for details.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, 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 and FCC97114 for Direct Sequence SS.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2001.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method – 47 CFR Part – Digital Devices, CISPER 22: 1997: Electromagnetic Interference – Limits and Methods of Measurement of Information Technology Equipment test methods.

Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Toshiba	Notebook PC	Satellite 1110-S153	92338752K	DOC
HP	Printer	2225C	N/A	DOC
PowerDsine	Power Over LAN Hub	PowerDsine 6001	A032160400001375A01	DOC
Meru Networks	Network Controller	MC11001	MC11001	Intel/Lynx

External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
RJ-45 Cable	1.0	Controller	Power over LAN Hub
RJ-45 Cable	1.0	Power over LAN Hub	EUT
USB/Ethernet Cable	0.3	Notebook	Controller
Shielded Printer Cable	2.0	Parallel Port/Notebook PC	Printer

SYSTEM TEST CONFIGURATION

Justification

The host system was configured for testing according to ANSI C63.4-2001.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components in a manner similar to a typical use. The test software, provided by the customer, is started the Windows terminal program under the Windows 98/2000/ME/XP operating system.

Once loaded, set the Tx channel to low, mid and high for testing.

Special Accessories

As shown in following test setup block diagram, all interface cables used for compliance testing are shielded. The notebook and the peripherals featured shielded metal connectors.

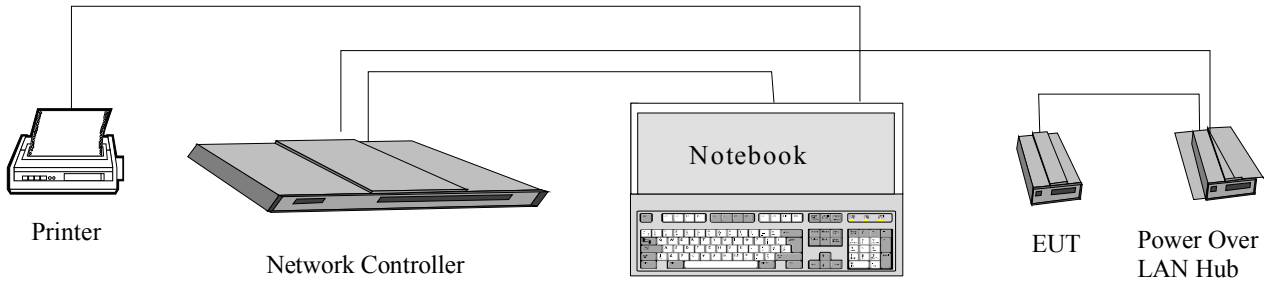
Schematics / Block Diagram

Please refer to Appendix A.

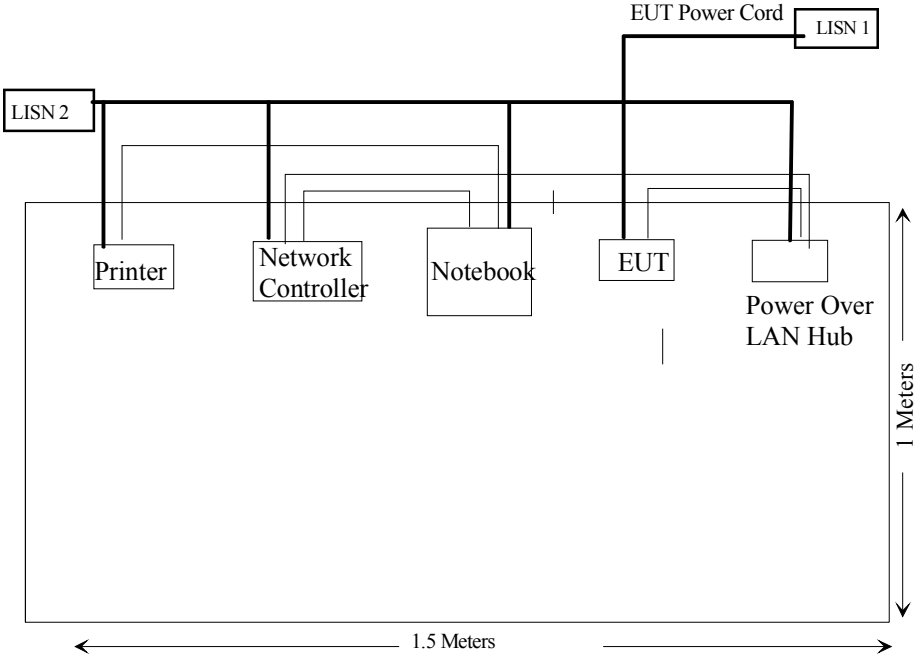
Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System



Test Setup Block Diagram



SUMMARY OF TEST RESULTS

Results reported relate only to the product tested, serial number: MERU001.

FCC RULES	DESCRIPTION OF TEST	RESULT
§2.1093	RF Exposure Requirement	Compliant
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Bands	Compliant
§15.207 (a)	Conducted Emission	Compliant
§15.209 (a)	Radiated Emission	Compliant
§15.209 (a), §15.247	Spurious Emission	Compliant
§15.247 (a) (2)	6 dB Bandwidth	Compliant
§15.247 (b) (3)	Maximum Peak Output Power	Compliant
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (d)	Peak Power Spectral Density	Compliant

§2.1093 - RF EXPOSURE

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

(A) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

(B) Limits for Occupational/Controlled Exposures

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Indoor Antenna:

Maximum peak output power at antenna input terminal: 23.73 (dBm)
Maximum peak output power at antenna input terminal: 236 (mW)
Prediction distance: 20 (cm)
Predication frequency: 2437 (MHz)
MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm^2)

Antenna Gain (typical): 3 (dBi)
Maximum antenna gain: 2.0 (numeric)
Power density at predication frequency at 20 cm: 0.09 (mW/cm^2)

Test Result

The EUT is defined to be a mobile device. Predicted power density level at 20cm is 0.09mW/cm^2 which is below the limit of 1 mW/cm^2.

§15.203 - ANTENNA REQUIREMENT

Standard Applicable

For intentional device, according to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connected Construction

The maximum gain of antenna used for transmitting is 15 dBi for the outdoor antenna and 3dBi for the indoor antenna, and the antenna connector is designed with unique attachment. Please see the antenna spec. provided by the applicant for details.

§15.205 & §15.209(a) - SPURIOUS RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-2001. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The host PC system was connected with 120Vac/60Hz power source.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Procedure

For the radiated emissions test, the Host PC system power cord was connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBµV of specification limits), and are distinguished with a "**Qp**" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Subpart C. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Subpart C Limit

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8568B	2601A02165	2003-07-03
HP	Amplifier	8447E	2944A10187	2003-09-23
HP	Quasi-Peak Adapter	85650A	3019A05393	2003-06-13
EMCO	Biconical Antenna	3110B	9309-1165	2003-10-11
EMCO	Log Periodic Antenna	3146	2101	2003-10-11

*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Summary of Test Results

According to the data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207 and 15.247, and had the worst margin of:

Original Antenna:

-10.4 dB at **7236.00 MHz** in the **Vertical** polarization, Low Channel

-10.6 dB at **7311.00 MHz** in the **Vertical** polarization, Middle Channel

-10.7 dB at **7386.00 MHz** in the **Horizontal** polarization, High Channel

-4.3 dB at **209.25 MHz** in the **Horizontal** polarization, Unintentional Emission

Final test data, 1 – 25 GHz, Original Antenna

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
Low Channel											
2412.00	108.00	FUND/PEAK	0	2.0	V	28.1	3.35	35.2	104.25		
2412.00	99.7	FUND/PEAK	45	1.8	H	28.1	3.4	35.2	95.9		
2412.00	73.8	FUND/AVE	0	2.0	V	28.1	3.4	35.2	70.1		
2412.00	68.3	FUND/AVE	45	1.8	H	28.1	3.4	35.2	64.6		
7236.00	36.3	AVE	15	1.2	V	35.1	5.6	33.5	43.6	54	-10.4
7236.00	36.2	AVE	270	1.6	H	35.1	5.6	33.5	43.4	54	-10.6
4824.00	35.2	AVE	30	1.3	V	32.5	4.9	33.0	39.6	54	-14.4
4824.00	35.0	AVE	300	1.6	H	32.5	4.9	33.0	39.4	54	-14.6
7236.00	48.5	PEAK	15	1.2	V	35.1	5.6	33.5	55.7	74	-18.3
7236.00	48.0	PEAK	270	1.6	H	35.1	5.6	33.5	55.2	74	-18.8
4824.00	47.3	PEAK	300	1.6	H	32.5	4.9	33.0	51.7	74	-22.3
4824.00	47.0	PEAK	30	1.3	V	32.5	4.9	33.0	51.4	74	-22.6
Middle Channel											
2437.00	108.3	FUND/PEAK	270	1.6	V	28.1	3.4	35.2	104.6		
2437.00	99.5	FUND/PEAK	250	2.0	H	28.1	3.4	35.2	95.8		
2437.00	73.8	FUND/AVE	270	1.6	V	28.1	3.4	35.2	70.1		
2437.00	69.0	FUND/AVE	250	2.0	H	28.1	3.4	35.2	65.3		
7311.00	36.2	AVE	270	1.4	V	35.1	5.6	33.5	43.4	54	-10.6
7311.00	36.2	AVE	300	1.6	H	35.1	5.6	33.5	43.4	54	-10.6
4874.00	35.3	AVE	300	1.5	V	32.5	4.9	33.0	39.7	54	-14.3
4874.00	35.1	AVE	90	1.8	H	32.5	4.9	33.0	39.5	54	-14.5
7311.00	48.4	PEAK	270	1.4	V	35.1	5.6	33.5	55.6	74	-18.4
7311.00	48.3	PEAK	300	1.6	H	35.1	5.6	33.5	55.5	74	-18.5
4874.00	47.2	PEAK	300	1.5	V	32.5	4.9	33.0	51.6	74	-22.4
4874.00	46.8	PEAK	90	1.8	H	32.5	4.9	33.0	51.2	74	-22.8
High Channel											
2462.00	107.2	FUND/PEAK	90	2.0	V	28.1	3.4	35.2	103.4		
2462.00	98.7	FUND/PEAK	60	1.6	H	28.1	3.4	35.2	94.9		
2462.00	72.5	FUND/AVE	90	2.0	V	28.1	3.4	35.2	68.8		
2462.00	69.2	FUND/AVE	60	1.6	H	28.1	3.4	35.2	65.4		
7386.00	36.1	AVE	30	1.4	H	35.1	5.6	33.5	43.3	54	-10.7
7386.00	36.0	AVE	270	1.5	V	35.1	5.6	33.5	43.2	54	-10.8
4924.00	35.4	AVE	100	2.2	V	32.5	4.9	33.0	39.8	54	-14.2
4924.00	35.3	AVE	45	1.8	H	32.5	4.9	33.0	39.7	54	-14.3
7386.00	48.2	PEAK	270	1.5	V	35.1	5.6	33.5	55.4	74	-18.6
7386.00	47.8	PEAK	30	1.4	H	35.1	5.6	33.5	55.0	74	-19.0
4924.00	47.0	PEAK	100	2.2	V	32.5	4.9	33.0	51.4	74	-22.6
4924.00	46.5	PEAK	45	1.8	H	32.5	4.9	33.0	50.9	74	-23.1

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB
209.25	56.2	270	1.5	H	11.5	2.2	28.2	41.7	46	-4.3
209.01	54.8	150	1.0	V	11.5	2.2	28.2	40.3	46	-5.7
238.31	53.5	250	1.5	H	12.6	2.2	28.2	40.1	46	-5.9
238.32	51.8	120	1.0	V	12.6	2.2	28.2	38.4	46	-7.6
498.83	43.2	180	1.6	V	18.7	3.1	28.9	36.1	46	-9.9
113.12	47.2	60	1.8	H	11.3	1.5	28.6	31.4	43.5	-12.1
183.88	43.7	90	1.0	H	13.2	2.0	28.2	30.6	43.5	-12.9
318.03	33.7	0	1.2	V	15.1	2.3	27.8	23.3	46	-22.7

Note:

AVG = average
Fund = fundamental

§15.207(a) - CONDUCTED EMISSIONS

Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Subpart B limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The notebook PC was connected with 120Vac/60Hz power source.

Spectrum Analyzer Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30Mhz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial LISN	ESH2-Z5	871884/039	2003-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2003-05-06

*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBµV of specification limits). Quasi-peak readings are distinguished with a "**Qp**".

Summary of Test Results

According to the data in following table, the EUT complies with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-7.8 dBμV at 0.260 MHz in the Line mode

Conducted Emissions Test Data

Environmental Conditions

Temperature:	12° C
Relative Humidity:	61%
ATM Pressure:	1025 mbar

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.260	43.6	AVG	Line	51.4	-7.8
10.800	41.2	AVG	Line	50	-8.8
11.900	40.3	AVG	Line	50	-9.7
0.530	33.9	AVG	Neutral	46	-12.1
0.260	38.7	AVG	Neutral	51.4	-12.7
0.530	42.9	QP	Neutral	56	-13.1
0.260	47.8	QP	Line	61.4	-13.6
1.600	40.3	QP	Neutral	56	-15.7
10.800	42.1	QP	Line	60	-17.9
0.260	42.8	QP	Neutral	61.4	-18.6
1.600	26.8	AVG	Neutral	46	-19.2
11.900	40.5	QP	Line	60	-19.5

Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

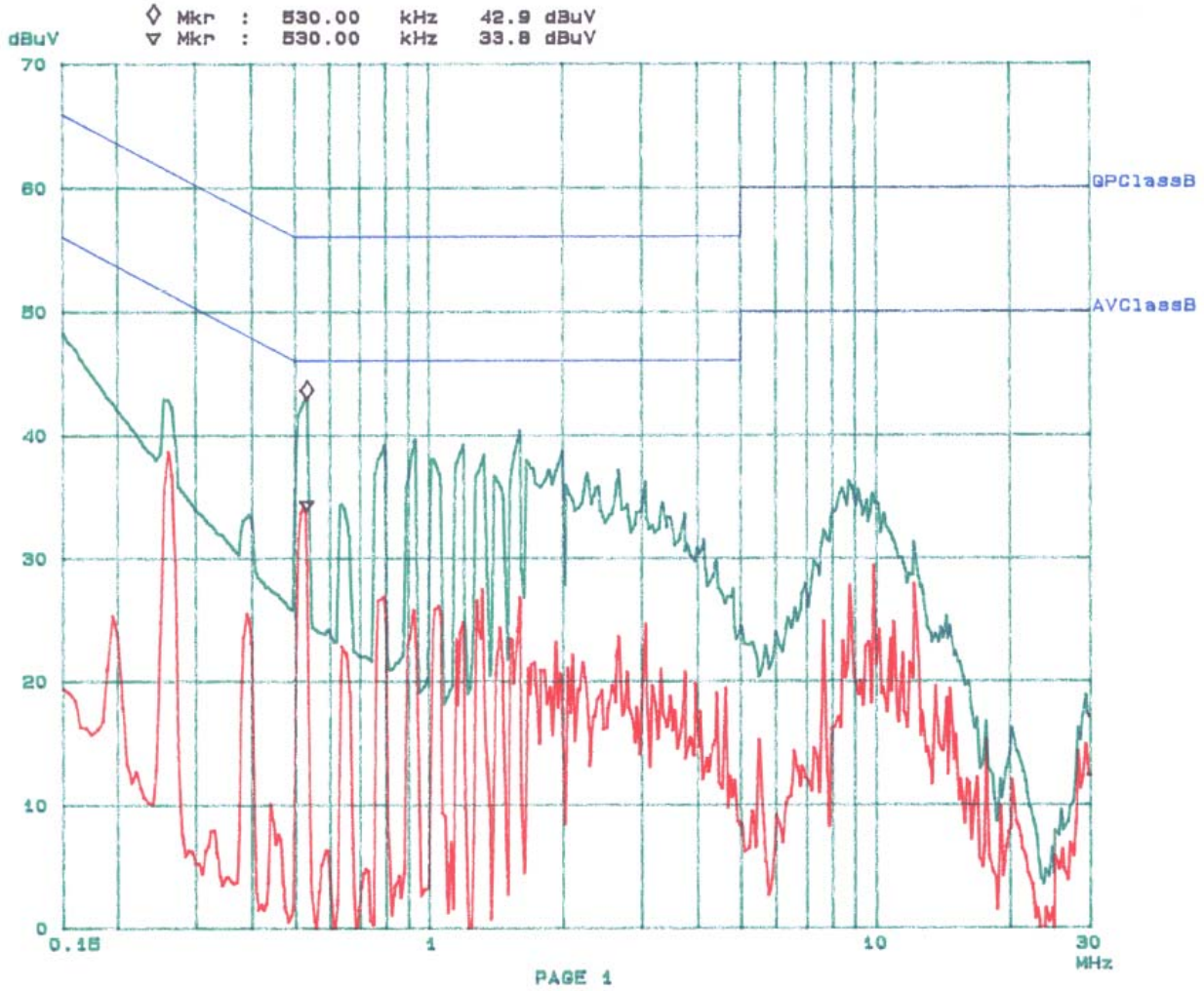
Bay Area Compliance Laboratory Corp 16. Dec 03 16:22
CISPR CLASS B

EUT: AP100
Manuf: MERU NETWORKS
Op Cond: Normal
Operator: LING
Comment: N
File name: NMBAS500.RES

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



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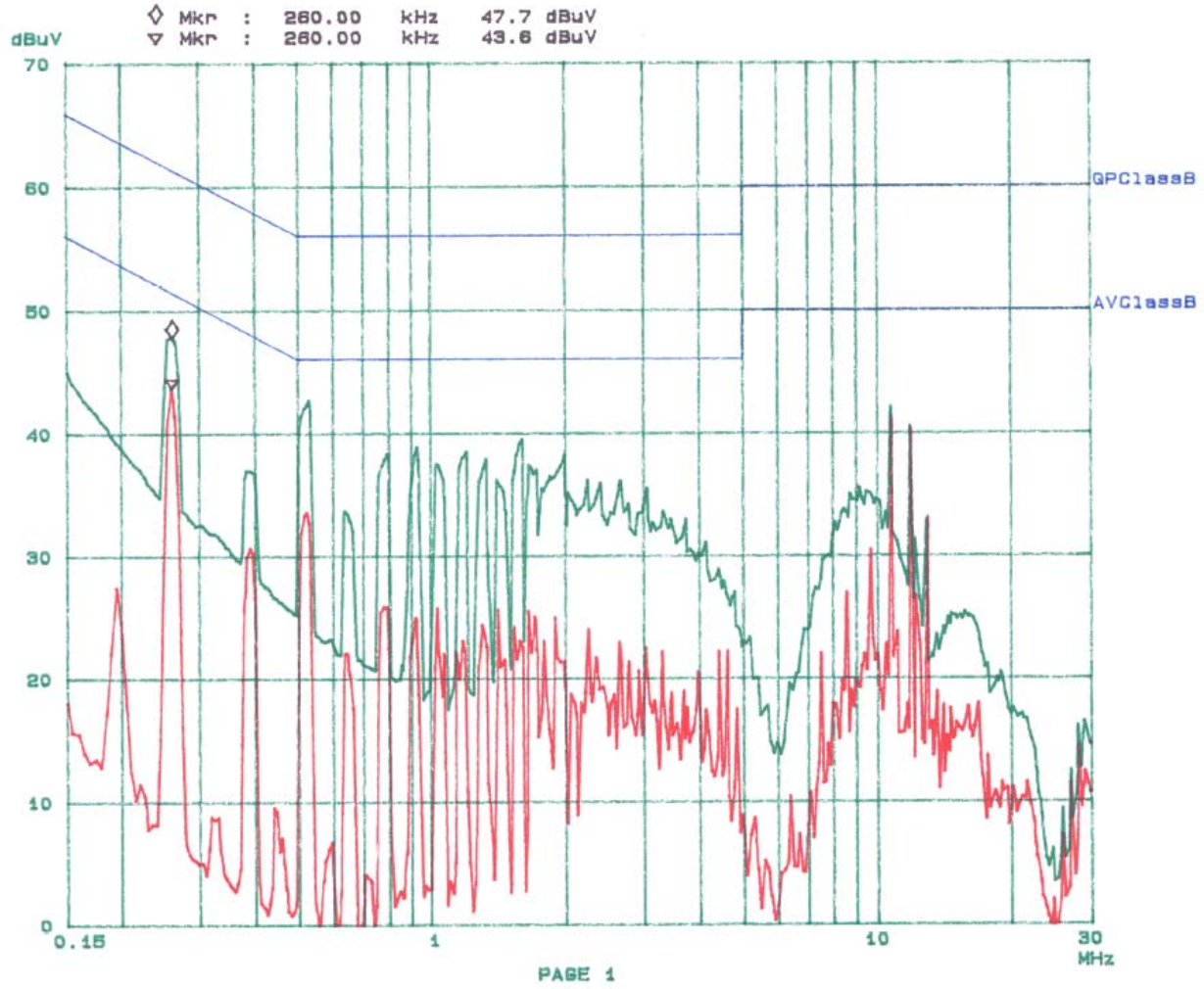
Bay Area Compliance Laboratory Corp 16. Dec 03 16:00
CISPR CLASS B

EUT: AP100
Manuf: MERU NETWORKS
Op Cond: Normal
Operator: LING
Comment: L
File name: NMBAS500.RES

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



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2003-12-16.

§15.209(a) & §15.247 - SPURIOUS EMISSION AT ANTENNA TERMINAL

Standard Applicable

According to §15.209 (a), except as provided elsewhere in the subpart of 15.209, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100 **	3
88-216	150 **	3
216-960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

Measurement Procedure

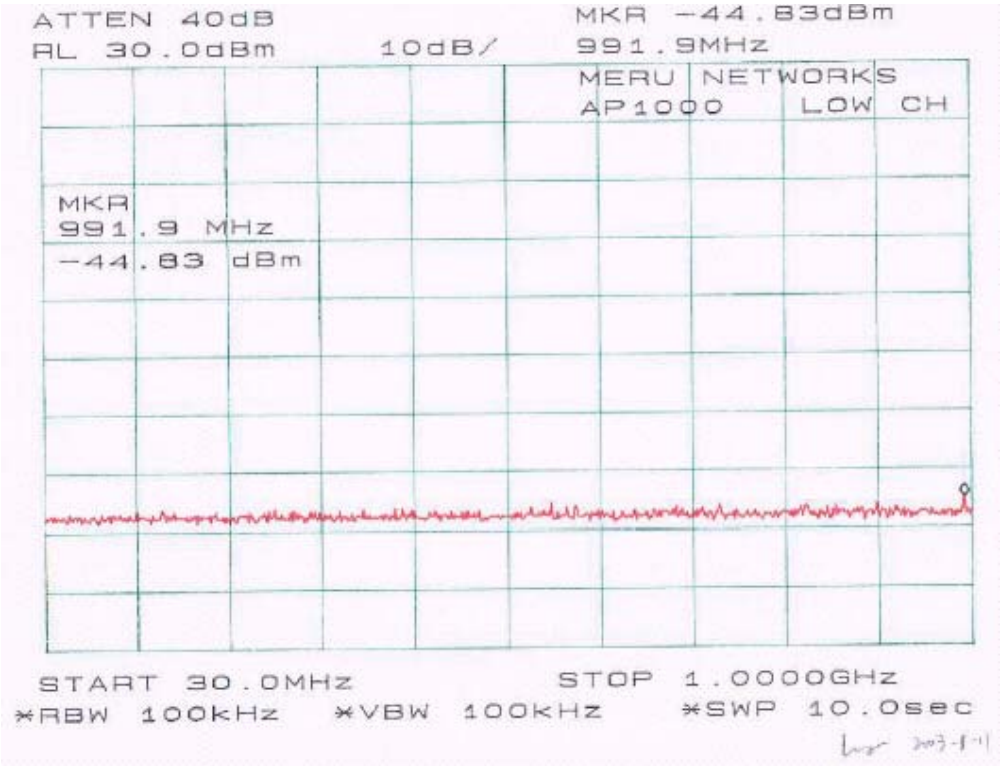
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

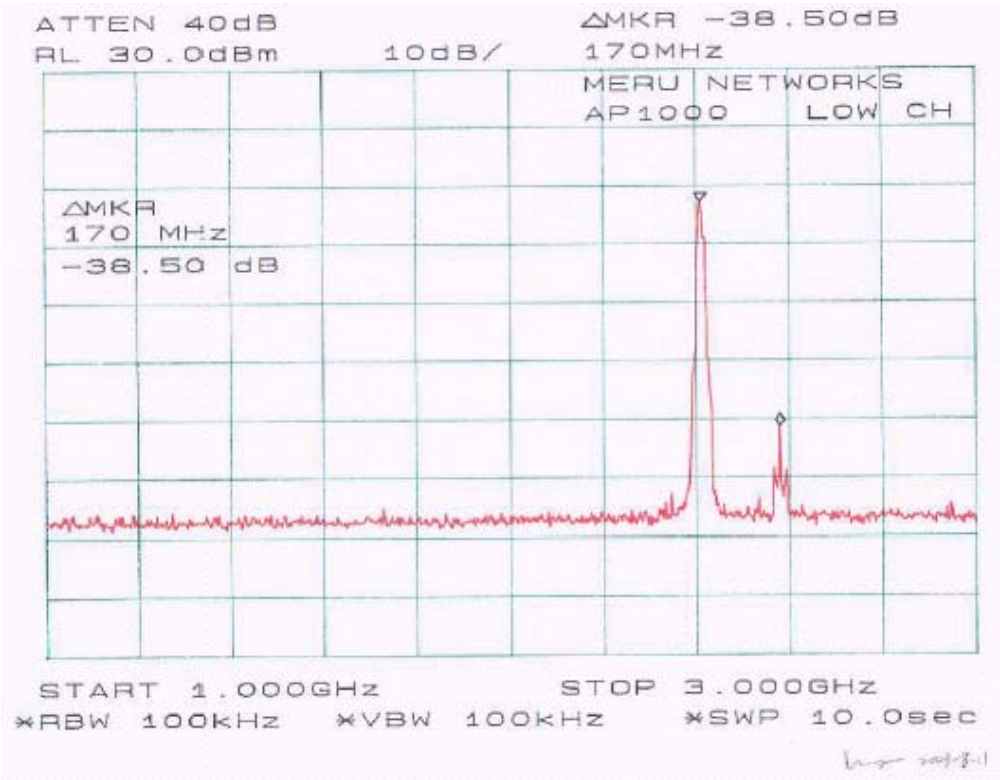
Test Equipment

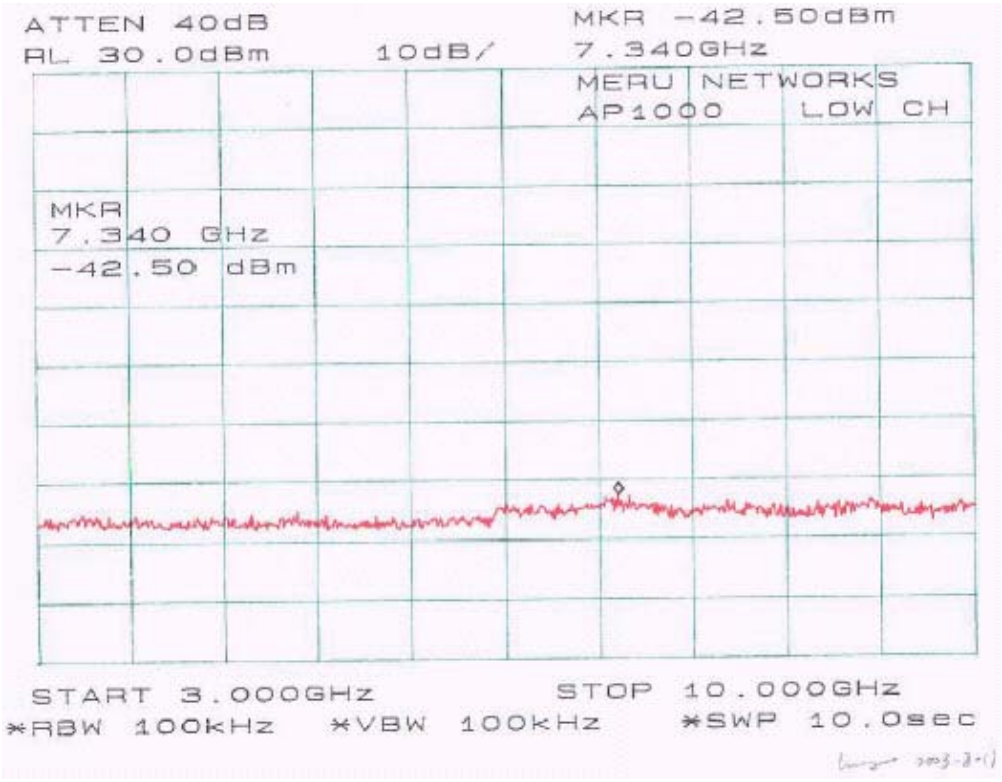
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

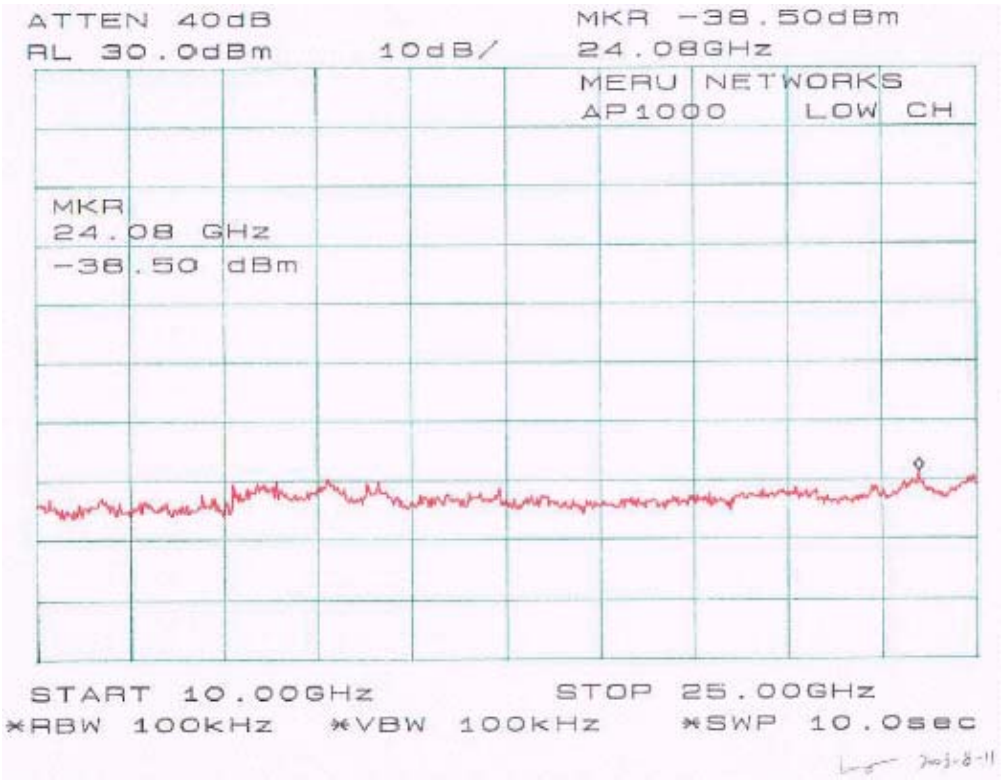
Measurement Result

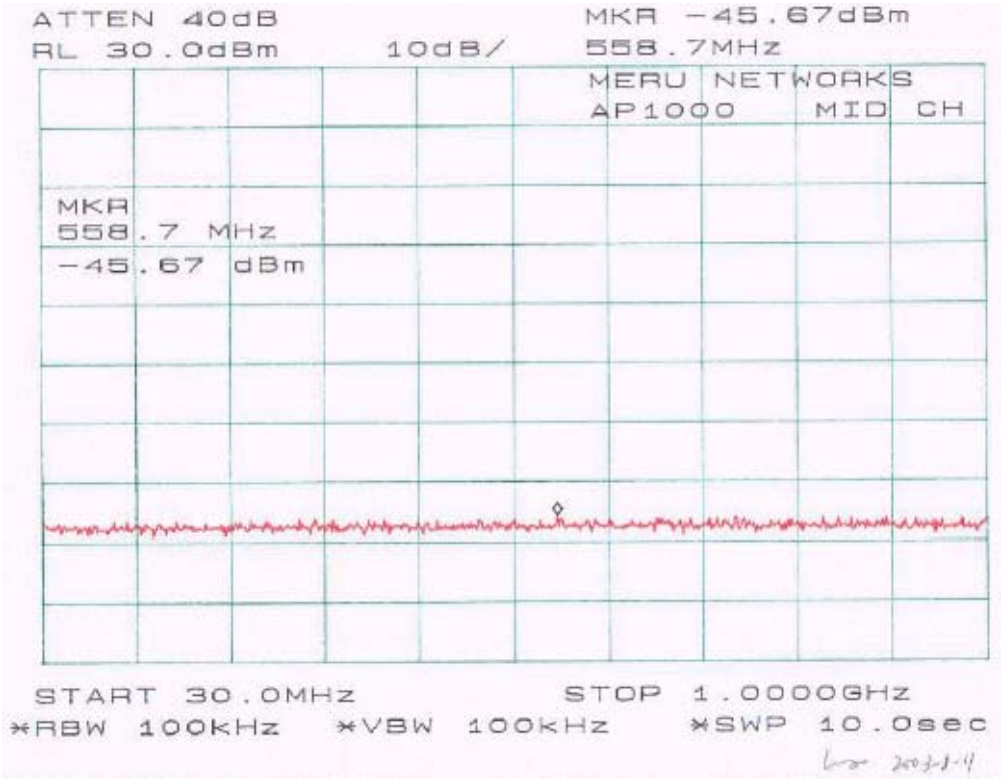
Please refer to following pages for plots of spurious emission.

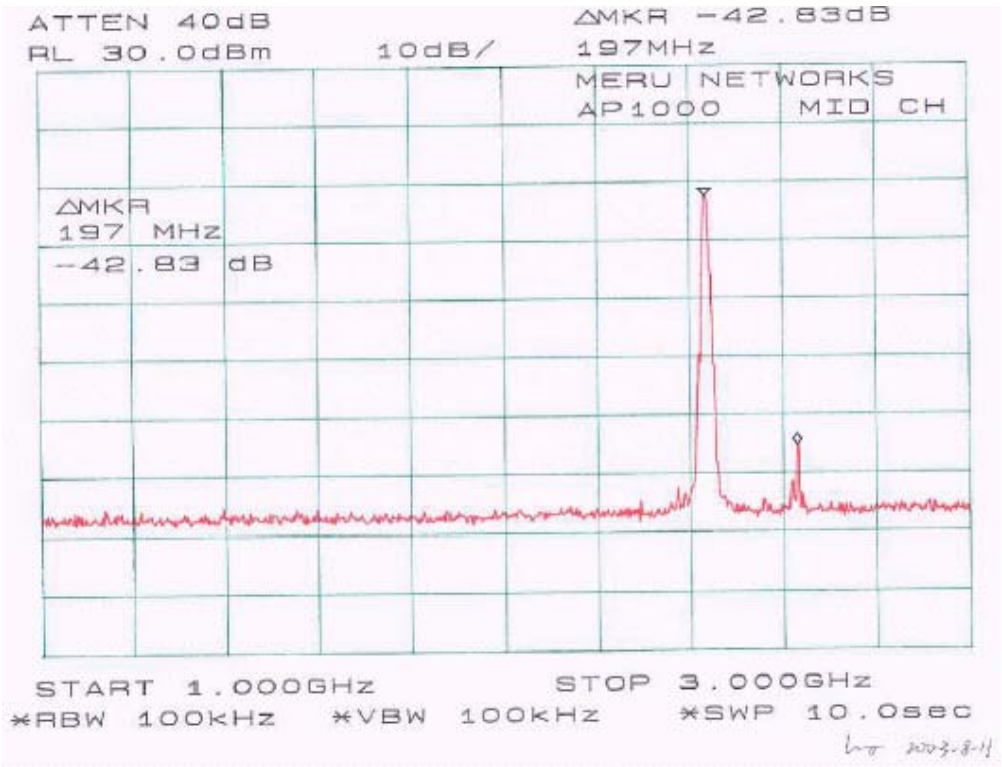

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -44.83dBm
991.9MHz
MERU NETWORKS
AP1000 LOW CH
MKR
991.9 MHz
-44.83 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

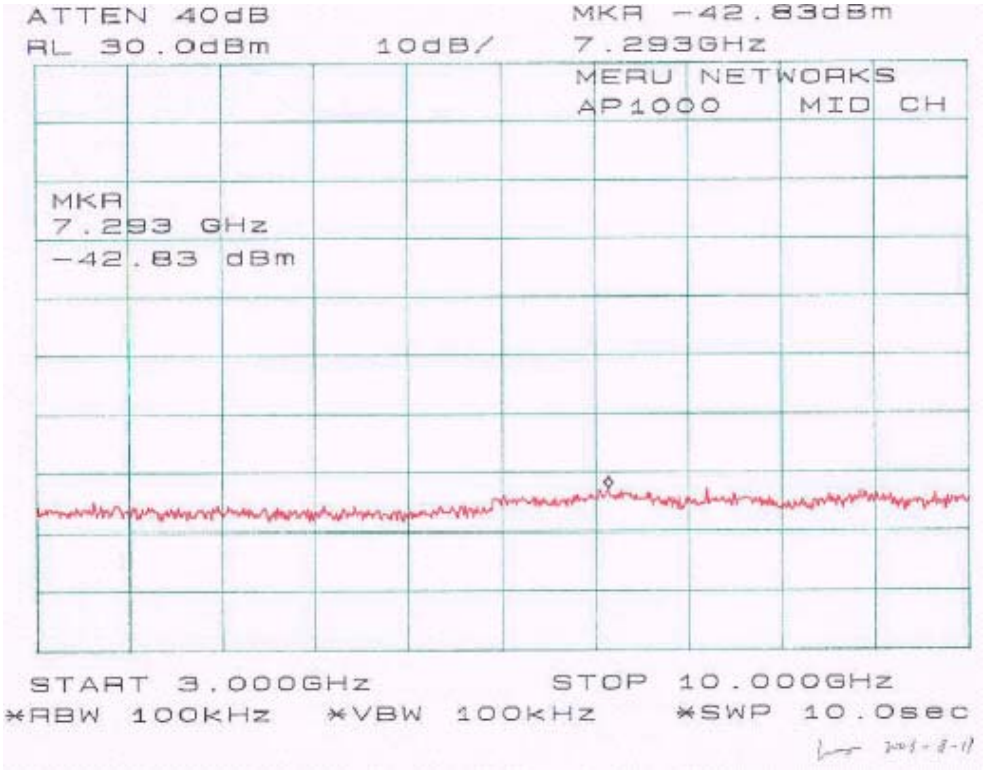

ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -38.50dB
170MHz
MERU NETWORKS
AP1000 LOW CH
ΔMKR
170 MHz
-38.50 dB
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

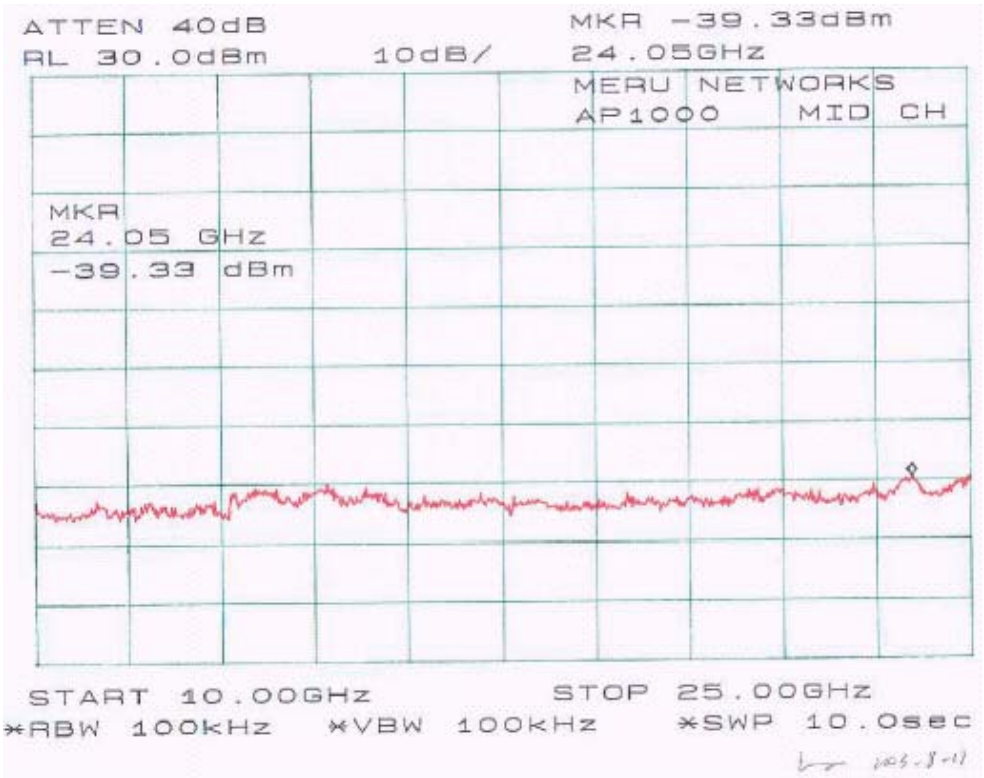

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -42.50dBm
7.340GHz
MERU NETWORKS
AP1000 LOW CH
MKR
7.340 GHz
-42.50 dBm
START 3.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

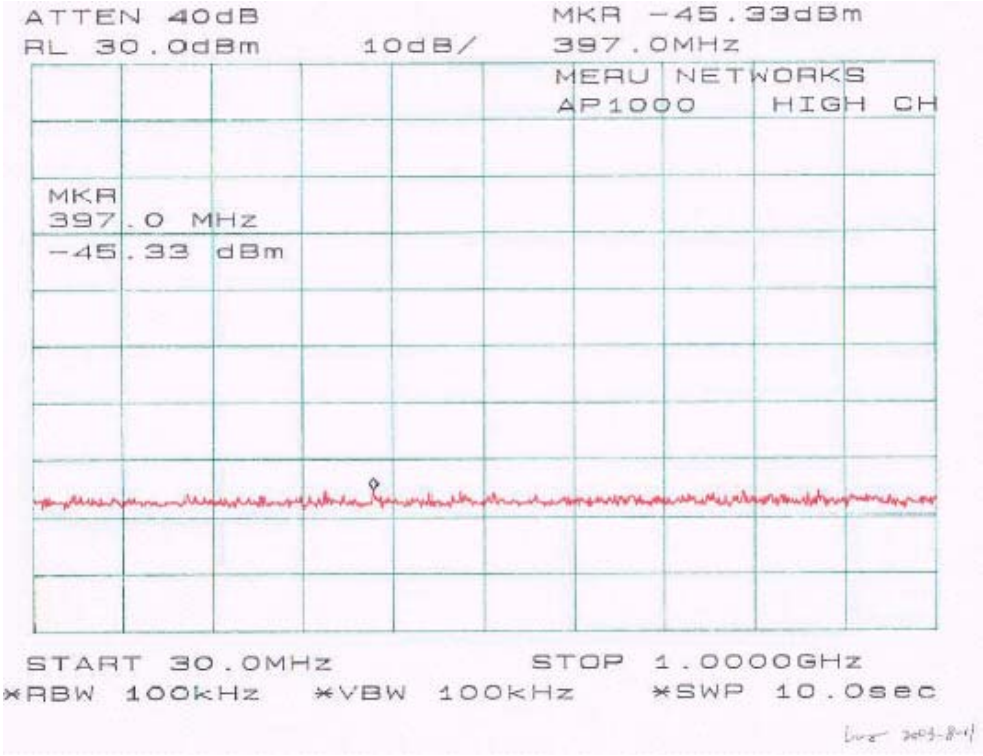

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -38.50dBm
24.08GHz
MERU NETWORKS
AP1000 LOW CH
MKR
24.08 GHz
-38.50 dBm
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

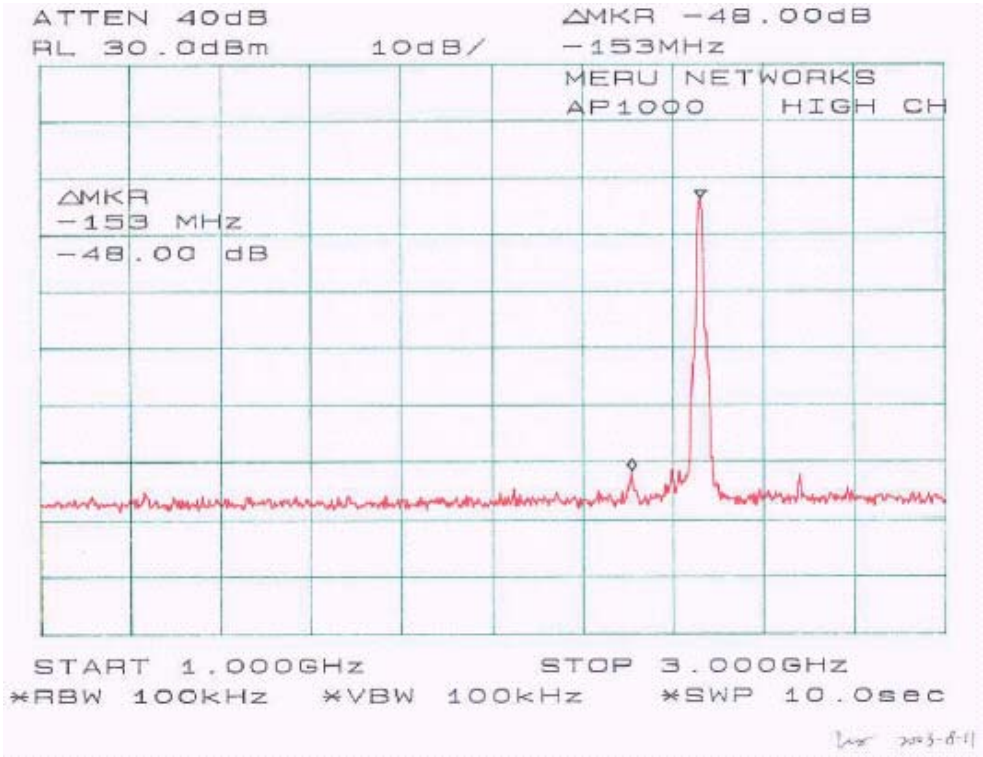

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -45.67dBm
558.7MHz
MERU NETWORKS
AP1000 MID CH
MKR
558.7 MHz
-45.67 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

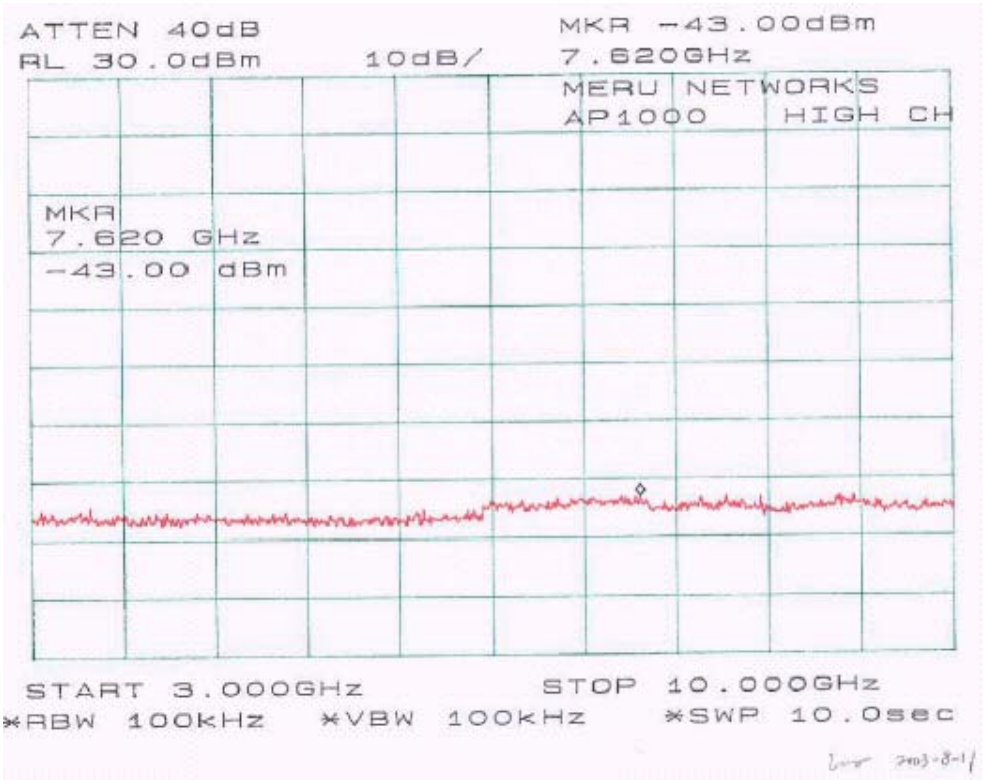

ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -42.83dB
197MHz
MERU NETWORKS
AP1000 MID CH
ΔMKR
197 MHz
-42.83 dB
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

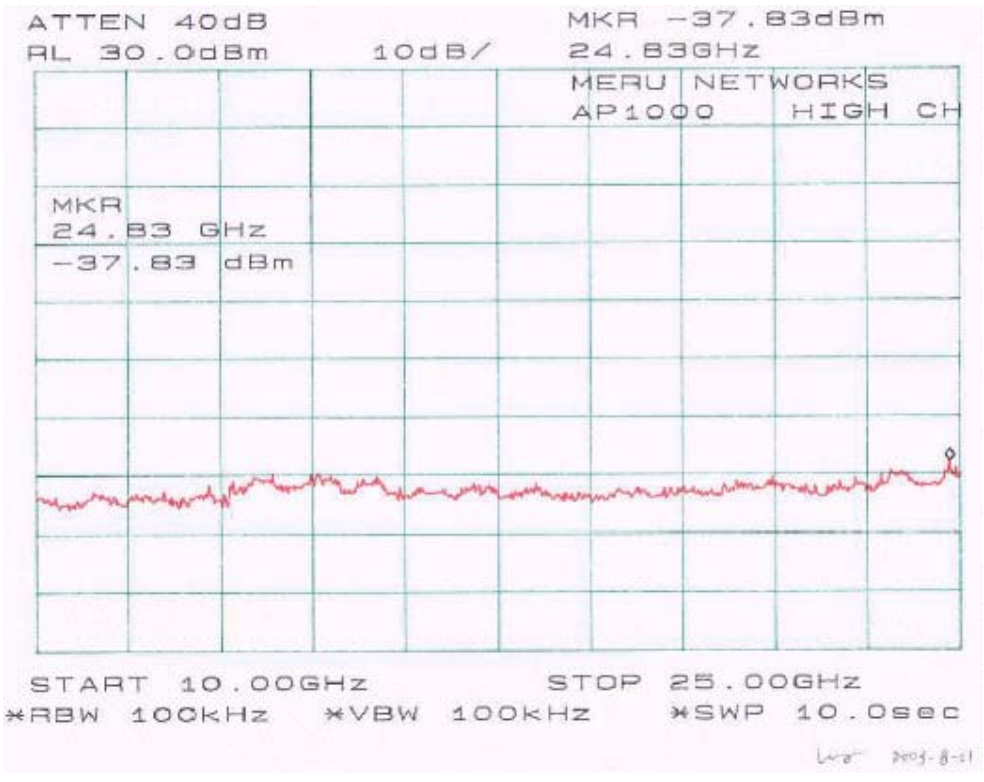

ATTEN 40dB
RL 30.0dBm
10dB/
MKR -42.83dBm
7.293GHz
MERU NETWORKS
AP1000 MID CH
MKR
7.293 GHz
-42.83 dBm
START 3.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -39.33dBm
24.05GHz
MERU NETWORKS
AP1000 MID CH
MKR
24.05 GHz
-39.33 dBm
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -45.33dBm
397.0MHz
MERU NETWORKS
AP1000 HIGH CH
MKR
397.0 MHz
-45.33 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -48.00dB
-153MHz
MERU NETWORKS
AP1000 HIGH CH
ΔMKR
-153 MHz
-48.00 dB
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -43.00dBm
7.620GHz
MERU NETWORKS
AP1000 HIGH CH
MKR
7.620 GHz
-43.00 dBm
START 3.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -37.83dBm
24.83GHz
MERU NETWORKS
AP1000 HIGH CH
MKR
24.83 GHz
-37.83 dBm
START 10.00GHz
STOP 25.00GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

§15.247(a)(2) – 6 DB BANDWIDTH

Standard Applicable

According to §15.247(a)(2), for systems using digital modulation techniques operate in 2400 – 2483.5MHz, the minimum 6dB bandwidth shall be at least 500 kHz.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

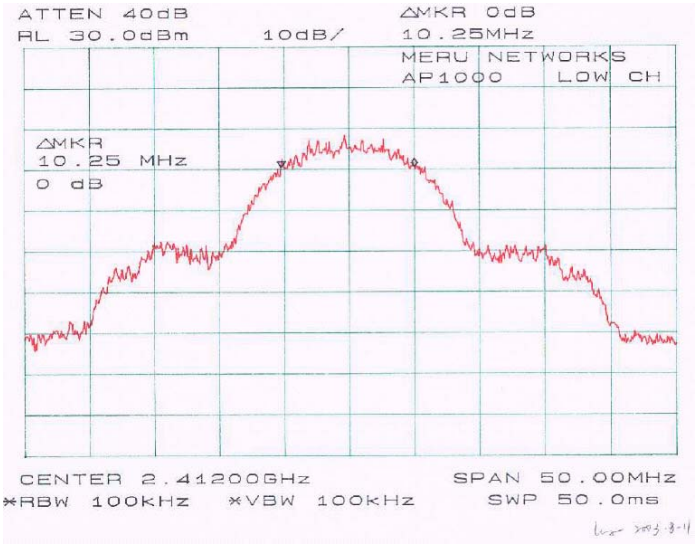
Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

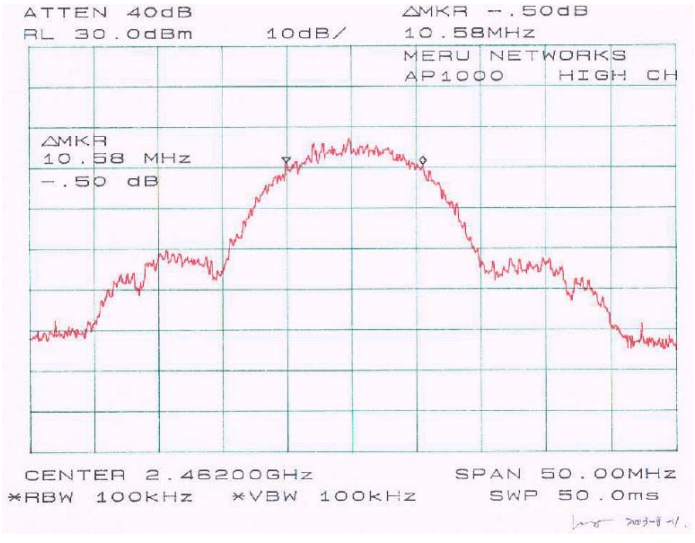
Measurement Result

Please refer to following pages for plots of 6 dB Bandwidth.

Frequency (MHz)	Measured (MHz)	Standard (kHz)	Result
2412	10.25	≥ 500	Compliant
2437	10.58	≥ 500	Compliant
2462	10.58	≥ 500	Compliant


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 0dB
10.25MHz
MERU NETWORKS
AP1000 LOW CH
ΔMKR
10.25 MHz
0 dB
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 100kHz
*VBW 100kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -.33dB
10.58MHz
MERU NETWORKS
AP1000 MID CH
ΔMKR
10.58 MHz
-.33 dB
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 100kHz
*VBW 100kHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -.50dB
10.58MHz
MERU NETWORKS
AP1000 HIGH CH
ΔMKR
10.58 MHz
-.50 dB
CENTER 2.46200GHz
SPAN 50.00MHz
*RBW 100kHz
*VBW 100kHz
SWP 50.0ms

§15.247(b)(3) - CONDUCTED OUTPUT POWER MEASUREMENT

Standard Applicable

According to §15.247(b) (3), for systems using digital modulation in 2400-2483.5 MHz: 1 Watt

Measurement Procedure

1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
3. The peak power will be obtained by adding the bandwidth correction factor, 10log(BW 6dB / RBW) to the peak power reading at RBW = 2.0 MHz of the spectrum analyzer.

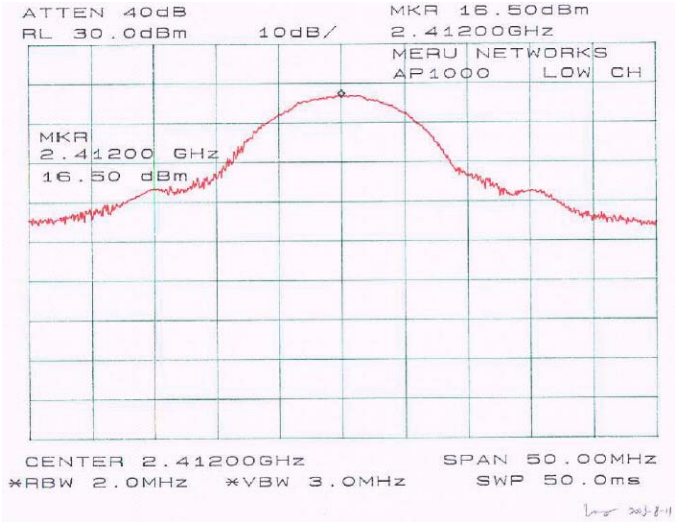
Test Equipment

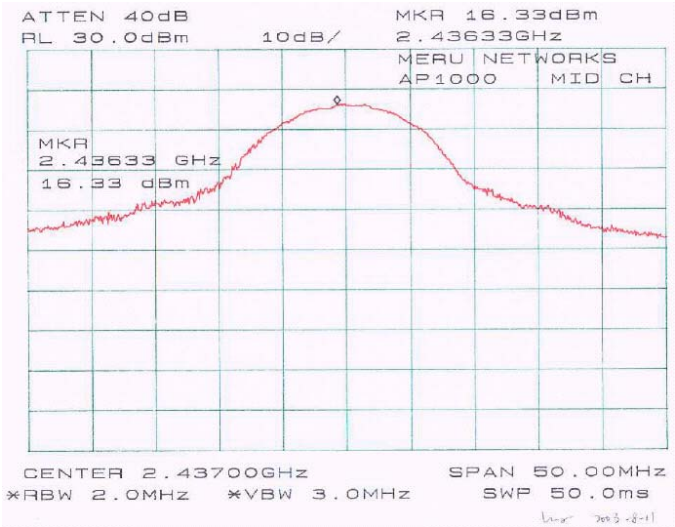
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

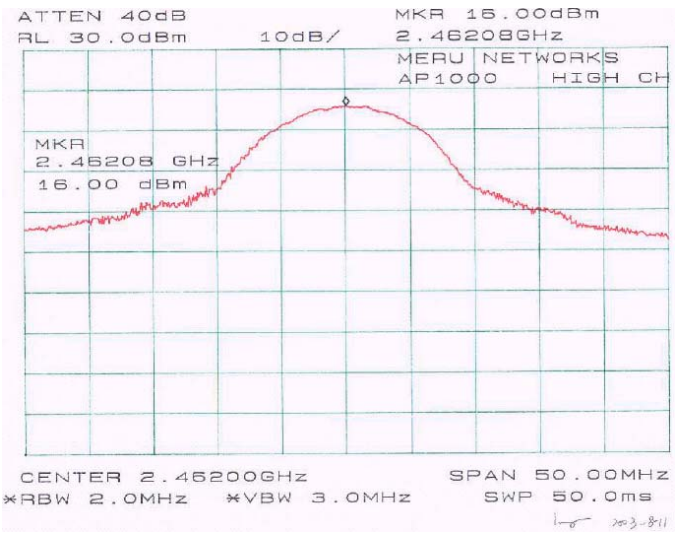
Measurement Result

Frequency (MHz)	Peak Output Power (dBm)	Correction Factor (dBm)	Corrected Power (dBm)	Output Power (W)	Standard (W)	Result
2412	16.50	7.23	23.73	0.236	≤ 1 W	Compliant
2436	16.33	7.23	23.56	0.227	≤ 1 W	Compliant
2462	16.00	7.23	23.23	0.210	≤ 1 W	Compliant

Note: Correction Factor = 10 log (BW6dB/RBW) = 10log(10.58/2) = 7.23dBm


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 16.50dBm
2.41200GHz
MERU NETWORKS
AP1000 LOW CH
MKR
2.41200 GHz
16.50 dBm
CENTER 2.41200GHz
SPAN 50.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 16.33dBm
2.43633GHz
MERU NETWORKS
AP1000 MID CH
MKR
2.43633 GHz
16.33 dBm
CENTER 2.43700GHz
SPAN 50.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 40dB
RL 30.0dBm
10dB/
MKR 16.00dBm
2.46208GHz
MERU NETWORKS
AP1000 HIGH CH
MKR
2.46208 GHz
16.00 dBm
CENTER 2.46200GHz
SPAN 50.00MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

§15.247(c) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(c), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) see §15.205(c)).

Measurement Procedure

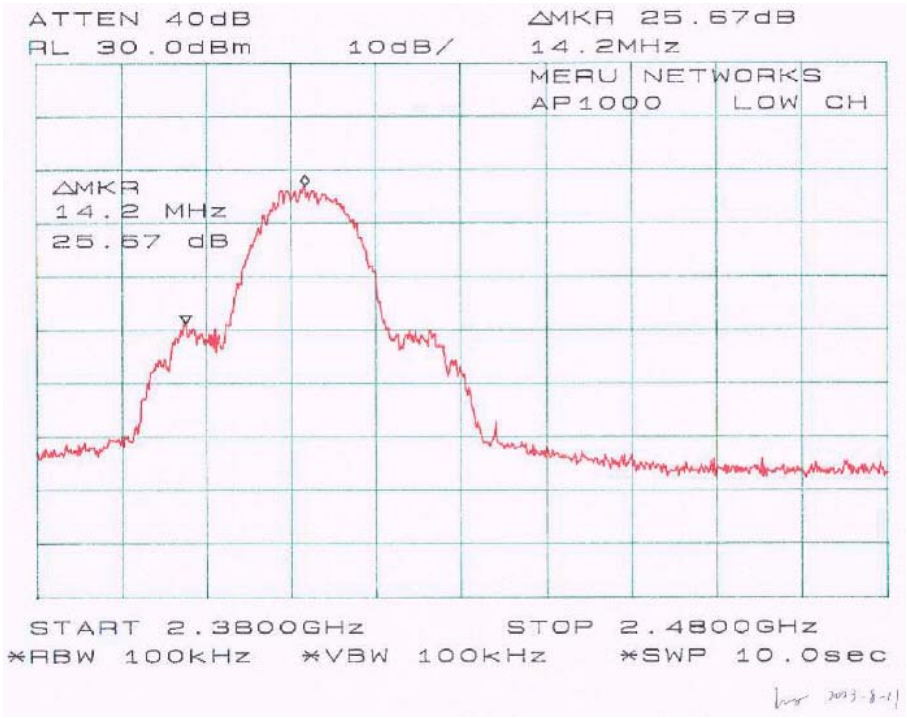
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

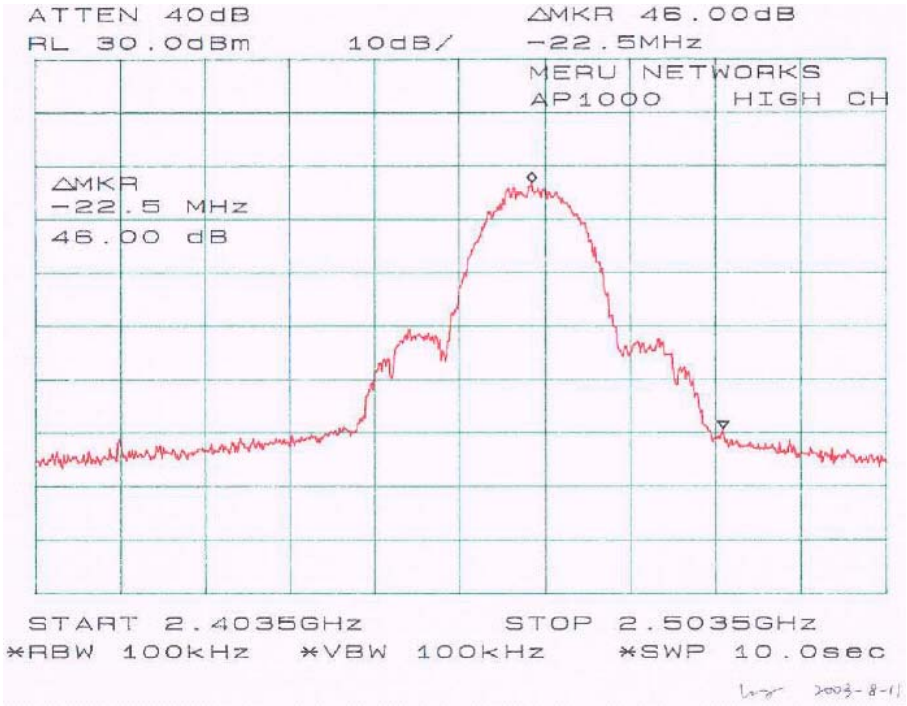
Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

Measurment Results

Please refer to following pages for plots of band edge.


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 25.67dB
14.2MHz
MERU NETWORKS
AP1000 LOW CH
ΔMKR
14.2 MHz
25.67 dB
START 2.3800GHz
STOP 2.4800GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR 46.00dB
-22.5MHz
MERU NETWORKS
AP1000 HIGH CH
ΔMKR
-22.5 MHz
46.00 dB
START 2.4035GHz
STOP 2.5035GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec

§15.247(d) - PEAK POWER SPECTRAL DENSITY

Standard Applicable

According to §15.247 (d), digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to 6MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

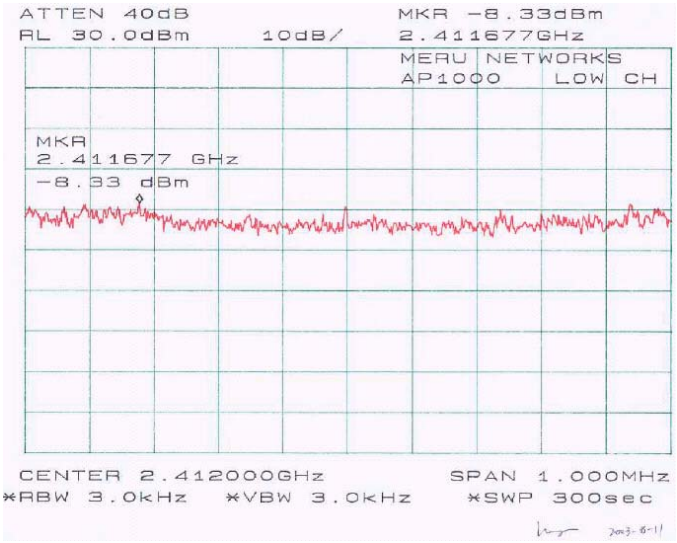
Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8564E	Spectrum Analyzer	2003-12-06

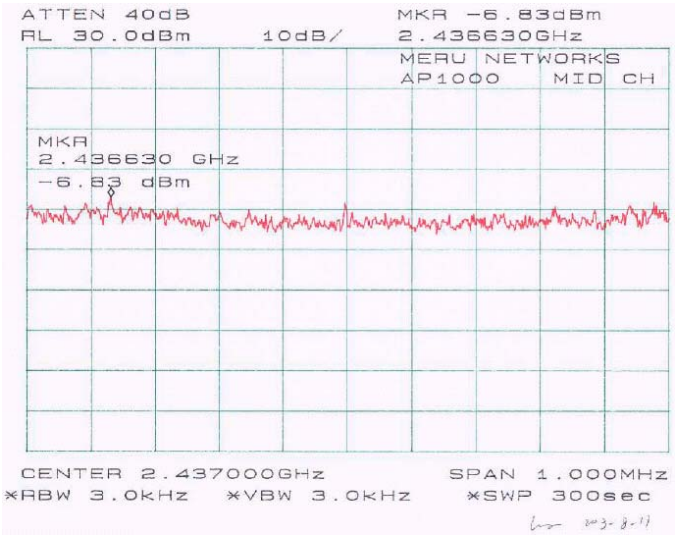
Measurement Results

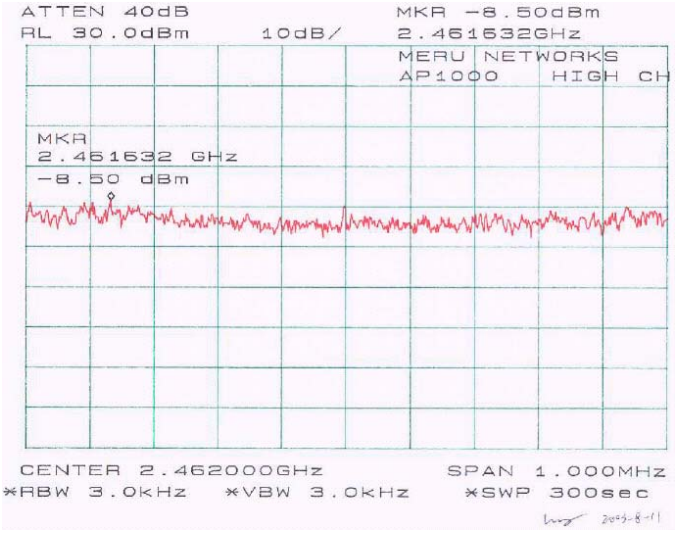
Frequency (MHz)	Peak Power Spectral Density (dBm)	Standard (dBm)	Result
2412	-8.33	≤ 8	Compliant
2437	-6.83	≤ 8	Compliant
2462	-8.50	≤ 8	Compliant

Plot of Peak Power Spectral Density

Please refer to following pages for plots of peak power spectral density.


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -8.33dBm
2.411677GHz
MERU NETWORKS
AP1000 LOW CH
MKR
2.411677 GHz
-8.33 dBm
CENTER 2.412000GHz
SPAN 1.000MHz
*RBW 3.0kHz
*VBW 3.0kHz
*SWP 300sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -6.83dBm
2.436630GHz
MERU NETWORKS
AP1000 MID CH
MKR
2.436630 GHz
-6.83 dBm
CENTER 2.437000GHz
SPAN 1.000MHz
*RBW 3.0kHz
*VBW 3.0kHz
*SWP 300sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -8.50dBm
2.461632GHz
MERU NETWORKS
AP1000 HIGH CH
MKR
2.461632 GHz
-8.50 dBm
CENTER 2.462000GHz
SPAN 1.000MHz
*RBW 3.0kHz
*VBW 3.0kHz
*SWP 300sec