

FCC PART 15 SUBPART C
EMI MEASUREMENT AND TEST REPORT

For

Ambit Microsystems Corporation

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Tu Chen, Taipei Hsien 236, Taiwan, R.O.C.

FCC ID: MCLT60M665

2004-01-28

This Report Concerns: <input checked="" type="checkbox"/> Permissive Change Report	Equipment Type: Bluetooth Wireless Card in Notebook PC
Test Engineer: Ling Zhang / 	
Report No.: R0312235	
Test Date: 2003-12-30	
Reviewed By: Ming Jing / 	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Ambit Microsystems Corporation's* Model: *T60M665* or the "EUT" as referred to in this report is a Wireless Card & Antenna installed in the ACER notebook PC. During the test the EUT was connected to the HannStar Electronics Antenna. The wireless card measures approximately 2.4" L x 1.7" W x 0.1"H.

** The test data gathered are from production sample, serial number: B0032, provided by the manufacturer.*

Objective

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

This is a PCII application. The original application was granted on 3/19/03. The difference between the original device and the current one is the EUT was connected with a new antenna manufactured by HannStar Electronics Corporation. Please see the Antenna Specification for the detailed information.

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

Related Submittal(s)/Grant(s)

The PCII application was originally granted on 3/19/03. Please refer to BACL report R0301173 for the details of the original application.

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 List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
ACER	Notebook PC	MS2143	9143D0103134500 599M000	DOC
HP	Printer	2225C	N/A	DOC

External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded Printer Cable	1.5	Parallel Port/Notebook PC	Printer

Power Supply Information

Manufacturer	Description	Model	Serial Number	FCC ID
LITEON	AC Adapter	PA-1121-02	3X04048302	DOC

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 exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The test software, bluetest, provided by the customer, is started the Windows 98 terminal program under the Windows 98 operating system. Once started, select USB from “choose a protocol”, select TXDATA1 from “bluetest” then click execute. The process is continuous throughout all tests.

Special Accessories

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

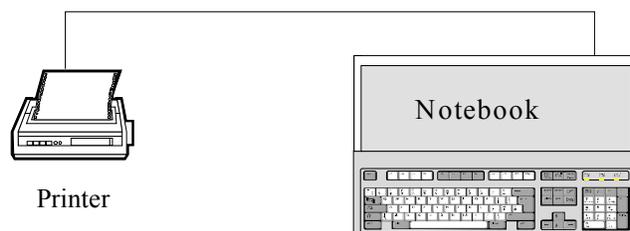
Schematics / Block Diagram

Please refer to Appendix A.

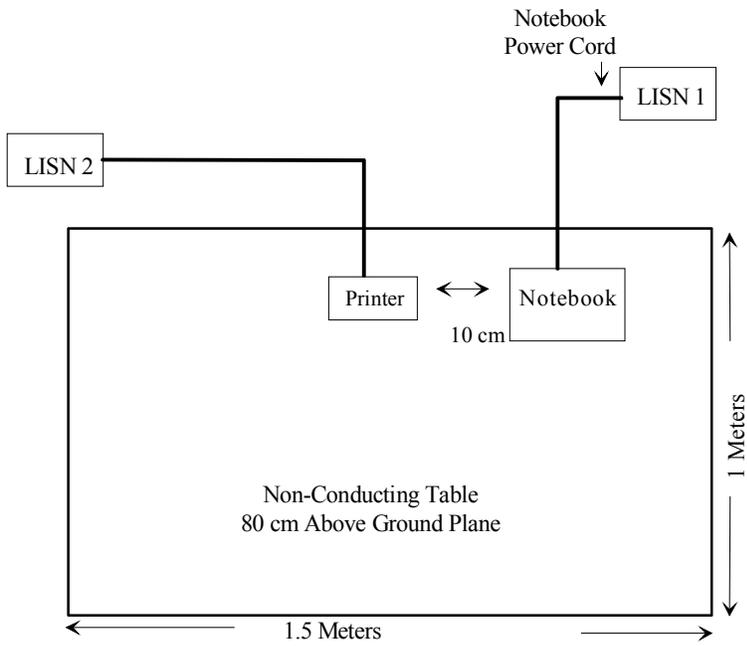
Equipment Modifications

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: B0032.

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.205, §15.209(a)	Restricted Bands, Radiated Emission	Compliant
§ 15.207(a)	AC Line Conduction	Compliant

§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 directional gain of the antenna used for transmitting is 1.23 dBi. The antenna is installed by OET integrator.

§15.205, & §153209(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 ± 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:

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

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
A.H. Systems, Inc.	DRG Horn Antenna	SAS-200/571	261	2003-08-02

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

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 dB μ V 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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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

$$\text{Margin} = \text{Corr. Ampl.} - \text{Subpart C Limit}$$

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:

- 12.46 dB at 7206.00 MHz in the **Vertical** polarization, Low Channel
- 12.56 dB at 7323.00 MHz in the **Vertical** polarization, Middle Channel
- 12.46 dB at 7440.00 MHz in the **Vertical** polarization, High Channel
- 10.28 dB at 432.084 MHz in the **Horizontal** polarization, Unintentional Emission

Environmental Conditions

Temperature:	15° C
Relative Humidity:	71%
ATM Pressure:	1125 mbar

INDICATED			TABLE Angle Degree	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE Corr. Ampl. dBµV/m	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBµV/m	Comments		Height Meter	Polar H/V	Antenna dBµV/m	Cable DB	Amp. DB		Limit dBµV/m	Margin dB
Low Channel, 1 – 25 GHz											
2402	90.0	FUND/PEAK	250	1.4	V	28.1	3.350	35.2	86.250		
2402	83.0	FUND/PEAK	270	1.6	H	28.1	3.350	35.2	79.250		
2402	89.17	FUND/AVE	250	1.4	V	28.1	3.350	35.2	85.420		
2402	82.17	FUND/AVE	270	1.6	H	28.1	3.350	35.2	78.420		
7206	34.3	AVE	300	1.4	V	35.1	5.645	33.5	41.545	54	-12.46
7206	34.0	AVE	120	1.2	H	35.1	5.645	33.5	41.245	54	-12.76
4804	32.5	AVE	220	1.5	V	32.5	4.910	33.0	36.910	54	-17.09
4804	32.3	AVE	180	1.8	H	32.5	4.910	33.0	36.710	54	-17.29
7206	46.2	PEAK	300	1.4	V	35.1	5.645	33.5	53.445	74	-20.56
7206	45.5	PEAK	120	1.2	H	35.1	5.645	33.5	52.745	74	-21.26
4804	43.9	PEAK	220	1.5	V	32.5	4.910	33.0	48.310	74	-25.69
4804	43.5	PEAK	180	1.8	H	32.5	4.910	33.0	47.910	74	-26.09
Middle Channel											
2441	90.2	FUND/PEAK	220	1.8	V	28.1	3.350	35.2	86.450		
2441	84.0	FUND/PEAK	150	2.0	H	28.1	3.350	35.2	80.250		
2441	90.0	FUND/AVE	220	1.8	V	28.1	3.350	35.2	86.250		
2441	83.5	FUND/AVE	150	2.0	H	28.1	3.350	35.2	79.750		
7323	34.2	AVE	250	1.6	V	35.1	5.645	33.5	41.445	54	-12.56
7323	34.1	AVE	90	1.0	H	35.1	5.645	33.5	41.345	54	-12.66
4882	32.1	AVE	270	1.4	V	32.5	4.910	33.0	36.510	54	-17.49
4882	32.0	AVE	90	1.2	H	32.5	4.910	33.0	36.410	54	-17.59
7323	45.7	PEAK	250	1.6	V	35.1	5.645	33.5	52.945	74	-21.06
7323	45.2	PEAK	90	1.0	H	35.1	5.645	33.5	52.445	74	-21.56
4882	44.1	PEAK	270	1.4	V	32.5	4.910	33.0	48.510	74	-25.49
4882	43.8	PEAK	90	1.2	H	32.5	4.910	33.0	48.210	74	-25.79
High Channel											
2480	91.33	FUND/PEAK	250	1.0	V	28.1	3.350	35.2	87.580		
2480	85.50	FUND/PEAK	220	1.8	H	28.1	3.350	35.2	81.750		
2480	91.00	FUND/AVE	250	1.0	V	28.1	3.350	35.2	87.250		
2480	83.83	FUND/AVE	220	1.8	H	28.1	3.350	35.2	80.080		
7440	34.30	AVE	220	1.6	V	35.1	5.645	33.5	41.545	54	-12.46
7440	34.20	AVE	200	1.0	H	35.1	5.645	33.5	41.445	54	-12.56
4960	32.20	AVE	270	1.4	V	32.5	4.910	33	36.610	54	-17.39
4960	32.10	AVE	180	1.2	H	32.5	4.910	33	36.510	54	-17.49
7440	46.10	PEAK	220	1.6	V	35.1	5.645	33.5	53.345	74	-20.66
7440	45.70	PEAK	200	1.0	H	35.1	5.645	33.5	52.945	74	-21.06
4960	44.40	PEAK	270	1.4	V	32.5	4.910	33	48.810	74	-25.19
4960	44.20	PEAK	180	1.2	H	32.5	4.910	33	48.610	74	-25.39

Frequency MHz	Indicated		Table Height Meter	Antenna		Correction Factor			FCC 15 Subpart B	
	Ampl. dB μ V/m	Direction Degree		Polar H/V	Antenna dB μ V/m	Cable Loss dB μ V/m	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
432.084	44.33	30	1.4	H	16.9	2.79	28.3	35.72	46.0	-10.28
480.073	40.33	60	1.0	V	18.3	3.10	28.9	32.83	46.0	-13.17
71.747	44.50	30	1.5	H	9.2	1.16	28.8	26.06	40.0	-13.94
59.760	42.7	270	1.0	H	9.8	1.70	28.7	25.5	40.0	-14.50
122.040	43.00	90	1.2	V	11.7	1.57	28.6	27.67	43.5	-15.83
252.133	41.83	90	1.4	V	13.3	2.17	27.8	29.50	46.0	-16.50
241.457	39.33	270	1.8	H	13.8	2.17	28.2	27.10	46.0	-18.90

Note:

AVG = average

§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 ± 2.4 dB.

EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was 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

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 dB μ V 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:

-12.32 dB μ V at 0.280 MHz in the Line mode

Conducted Emissions Test Data

Environmental Conditions

Temperature:	15° C
Relative Humidity:	71%
ATM Pressure:	1125 mbar

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dB μ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
0.280	48.5	QP	Line	60.8	-12.32
0.285	47.0	QP	Neutral	60.7	-13.67
0.610	42.0	QP	Line	56.0	-14.00
0.280	34.9	AVG	Line	50.8	-15.92
0.285	34.4	AVG	Neutral	50.7	-16.27
0.615	39.4	QP	Neutral	56.0	-16.60
19.700	28.9	AVG	Neutral	50.0	-21.10
19.700	28.0	AVG	Line	50.0	-22.00
0.610	23.2	AVG	Line	46.0	-22.80
0.615	21.6	AVG	Neutral	46.0	-24.40
19.800	34.3	QP	Neutral	60.0	-25.70
19.700	33.5	QP	Line	60.0	-26.50

Plot of Conducted Emissions Test Data

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

Bay Area Compliance Laboratory Corp
Class B

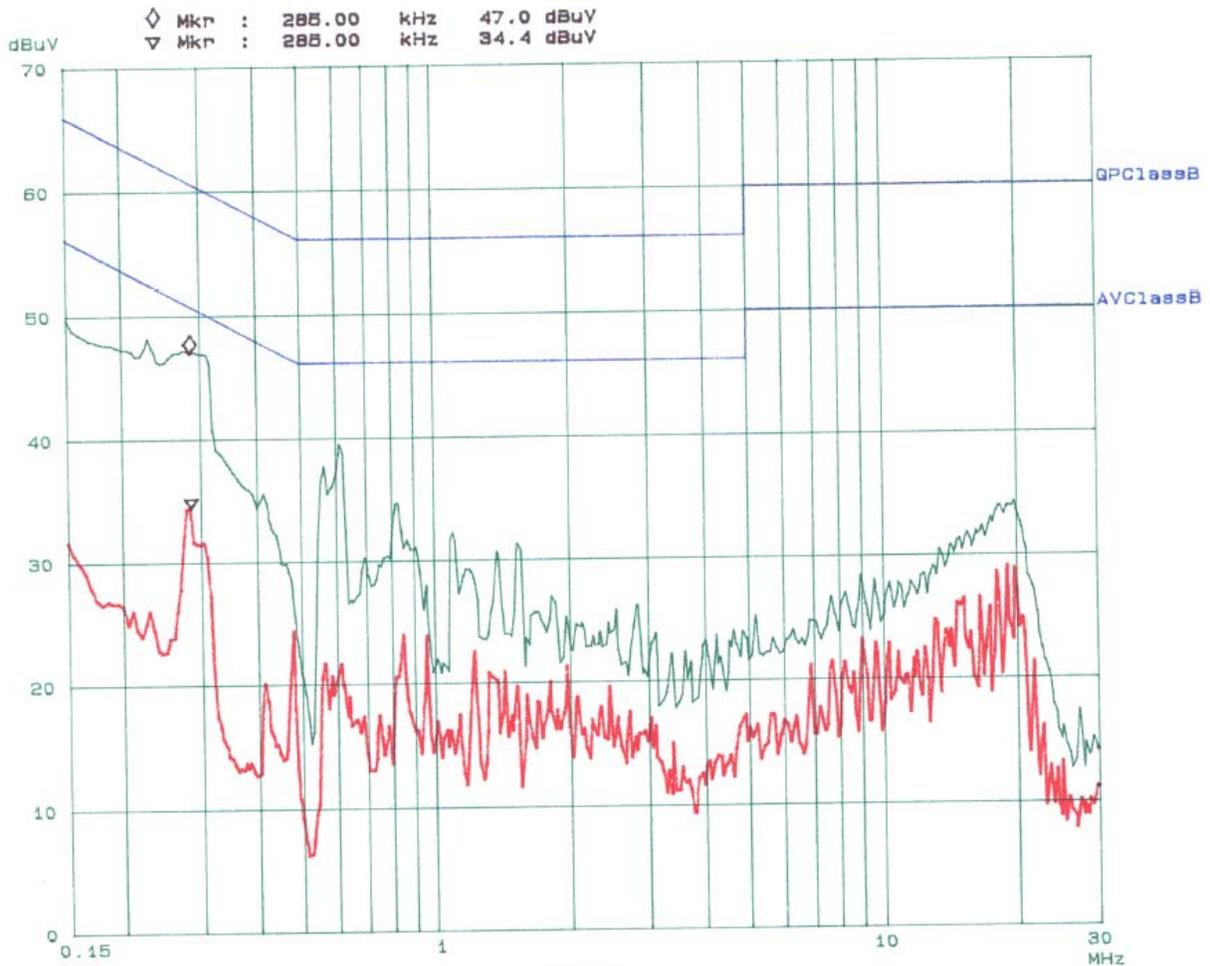
30. Dec 03 14:17

EUT: T60M665
Manuf: AMBIT
Op Cond: Normal
Operator: LING
Comment: N

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	15dB	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB	OFF

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



ling 2003-12-30

Bay Area Compliance Laboratory Corp
Class B

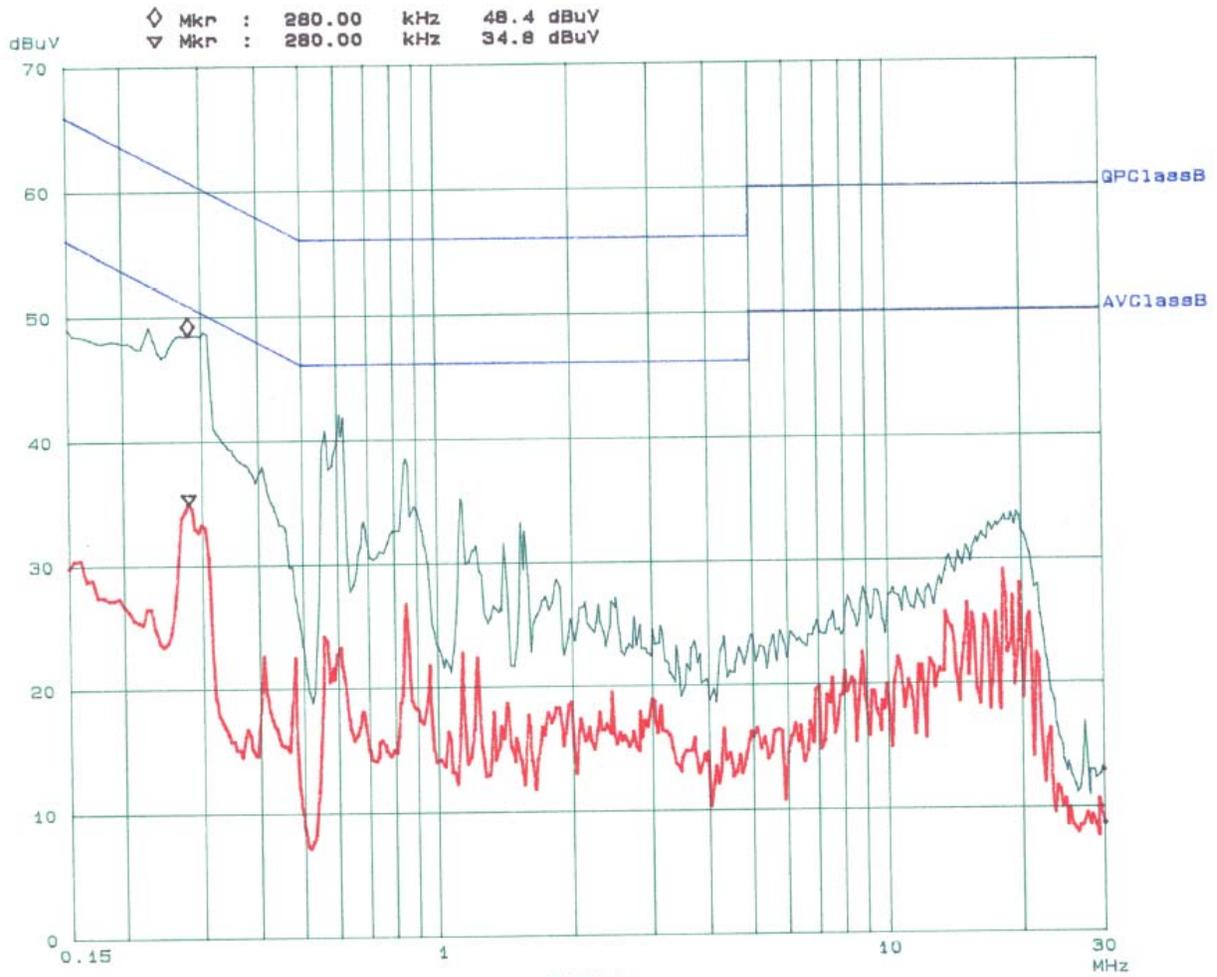
30. Dec 03 13:55

EUT: T60M665
Manuf: AMBIT
Op Cond: Normal
Operator: LING
Comment: L

Scan Settings (3 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	
150k	1M	5k	9k	QP+AV	20ms	15dB	OFF	
1M	5M	10k	9k	QP+AV	1ms	15dB	OFF	
5M	30M	100k	9k	QP+AV	1ms	15dB	OFF	

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



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