



## EMC TEST REPORT

Nr 3046-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200405-2415

Date of test..... : May 24<sup>th</sup> and 25<sup>th</sup>, 2004

Location..... : SMEE **Actions Mesures** Laboratory - 38 VOIRON

Performed by ..... : Laurent CHAPUS

Customer ..... : **DIGIGRAM SA** (Represented by M. Patrick TISSIER)  
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FRANCE

Product..... : **ES 8 MIC**  
**(ES8 MIC TB ; ES8 MIC CL TB ; ES8 MIC XLR ; ES8 MIC CL XLR)**

Type of test..... : **Radiated and Conducted Emission Test**

Applied standards or specification: EN55022 (1999) + A1 (2000) + A2 (2003)  
CISPR22 (1997) + A1 (2000) + A2 (2002)  
ANSI C63-4 (1992+2000)

Level..... : CISPR 22 Class B

Test objective ..... : Qualification

Results ..... : **Samples tested in configuration and description presented in this test report complies with prescriptions and limits of EN 55022 and CISPR22 standards (class B), in radiated and conducted emissions.**

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Written by ..... : Laurent CHAPUS

Approved by ..... : Jean-Pierre ORY

Date : June 26<sup>th</sup>, 2004



## 1. System test configuration

### 1.1. JUSTIFICATION:

The system was configured for testing in a typical fashion (as a customer would normally use it).

Four versions of the ES8 MIC are available:

- ES8 MIC TB (Audio Terminal Block connectors)
- ES8 MIC XLR (Audio XLR-3 connectors)
- ES8 MIC CL TB (Terminal Blocks with Compressor Limiter option)
- ES8 MIC CL XLR (XLR connectors with Compressor Limiter option)

The qualification measurement will be performed with both connector types (TB and XLR) with the Compressor Limiter option (additional components on the ES8 MIC board)

Nevertheless, a pre-characterization at 3m will be performed for all ES8 MIC versions.

The ES8 MIC equipment is derived from the ES8 IN and ES8 OUT equipments (FCC ID: IGTES8). It is equipped with a daughter board for audio microphone input utility.

### 1.2. HARDWARE IDENTIFICATION:

<b>* Equipment Under Test (EUT):</b>	<b>ES8 MIC TB</b>	<b>Sn: 166 00000002</b>
	<b>ES8 MIC CL TB</b>	<b>Sn: 168 00000002</b>
	<b>ES8 MIC XLR</b>	<b>Sn: 165 00000040</b>
	<b>ES8 MIC CL XLR</b>	<b>Sn: 167 00000002</b>

XLR / TB: connectors type (XLR or Terminal Block model)

CL: Compressor Limiter option

- Input/output :
  - 1x Mains power input 100V/230Vac 50Hz/60Hz
  - 1x Ethernet IN (100 Mbits/s)
  - 1x Ethernet OUT (100 Mbits/s)
  - 1x RS232
  - 2x GPIO 8-points terminal block connectors (General Purpose Inputs/Outputs) (4 optocoupled inputs and 4 relay outputs)
  - 8x Microphone audio inputs (XLR-3 or Terminal Block connectors with compressor limiter on CL versions)
- Frequencies : 50 MHz - 12.288 MHz - 11.2896 MHz - 14.7456MHz



### 1.3. AUXILIARIES:

The FCC IDs for all equipment, plus description of all cables used in the tested system are:

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
DIGIGRAM ES8 MIC *	IGTES8MIC	Ethernet Audio bridges	Standard power cable unshielded, Ethernet FTP cables
- TB			RS232 shielded cable
- CL TB			Microphone audio inputs lines, shielded.
- XLR			GPIO wires, unshielded
- CL XLR			
DIGIGRAM ES8 OUT (sn: 150.00000050)	IGTES8	Ethernet Audio bridges	Standard power cable unshielded, Ethernet FTP cables
DIGIGRAM ES8 IN (sn: 150.00000053)			Analog audio IN/OUT lines, shielded.

\* : Equipment under test

### 1.4. RUNNING MODE:

For testing the **ES8 MIC**, its Ethernet OUT port is sending signals to the IN port of an ES8 OUT equipment. Its Ethernet IN port is connected to an ES8 IN (not powered, used as an auxiliary) in order to simulate typical load on the port. Analog microphone inputs are connected to the audio port of the ES8 OUT. See figure#1 for wiring diagram.

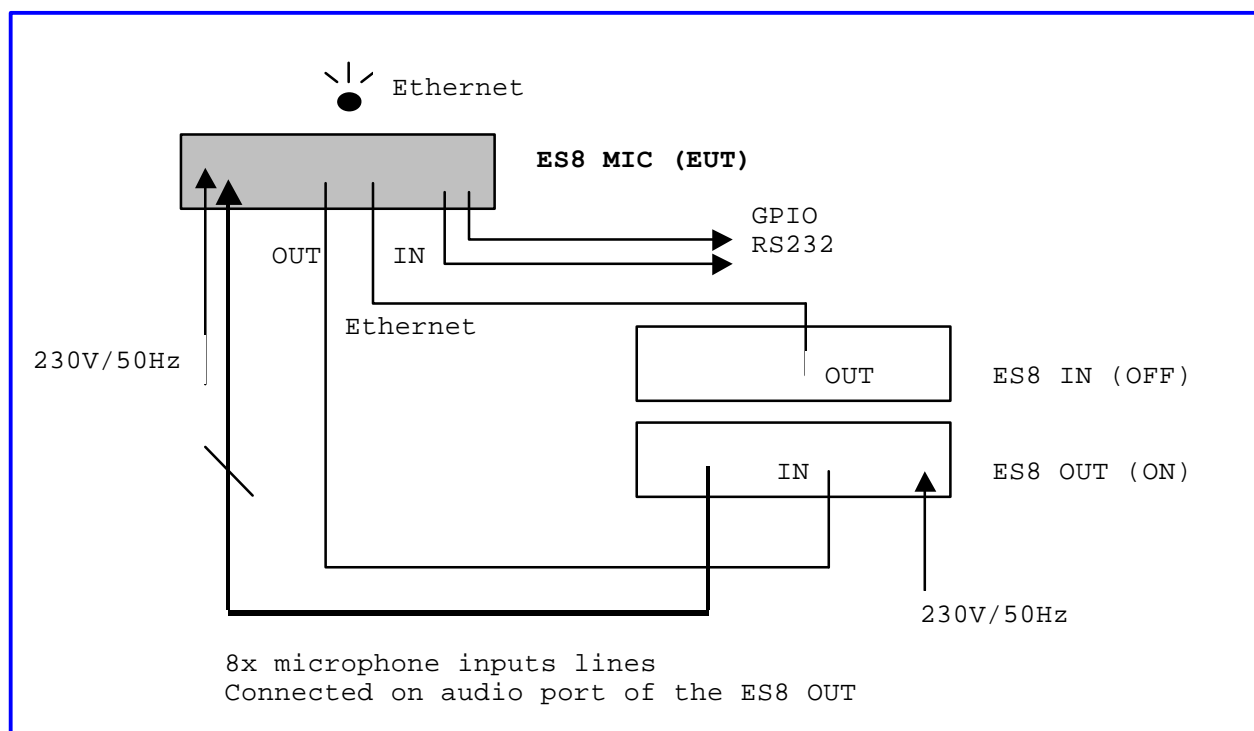


Figure 1

### 1.5. I/O CABLES:

- 3x Power cord, unshielded: 1.5m 5EUT and auxiliaries)



- 1x Shielded serial RS232 cable, SubD9 connector: 1.5m.
- 2x Ethernet FTP Cat5e (shielded) cable: 3m
- 8x XLR cords, shielded : 2m
- 8x GPIO wires, unshielded: 1m

#### 1.6. EQUIPMENT MODIFICATIONS:

No equipment modification has been necessary during testing to achieve compliance to Class B levels. The unit tested was representative to a production unit.

## 2. Radiated emission data

### 2.1. TEST SET-UP:

Mains: 230V/50Hz

The equipment under test and auxiliaries are set on a non-conducted table of 80cm height, above the ground plane.



The installation of EUT is identical for pre-characterization measures in a 3 meters full anechoic chamber and for measures on a 10 meters Open site.

### 2.2. TEST EQUIPMENT:

Test Equipment from 30MHz to 1GHz on 10 meters open site:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8568B	2732A04140
Quasi-Peak adapter	HP	85650A	2811A01136
RF Pre-selector	HP	85685A	2833A00773
Biconical Antenna	EMCO	3104C	9401-4636
Log Periodic Antenna	EMCO	3146	2178
Absorbing clamp	LÜTHI	MDS21	2826
Absorbing clamp	R&S	85024A	194.0100.50
OATS			

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.

A 10 meters Open site located in SMEE *Actions Mesures* - Voiron (FRANCE).



Pre-scan, test Equipment from 30MHz to 1GHz:

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Absorbing clamp	LÜTHI	MDS21	2826
Absorbing clamp	R&S	85024A	194.0100.50

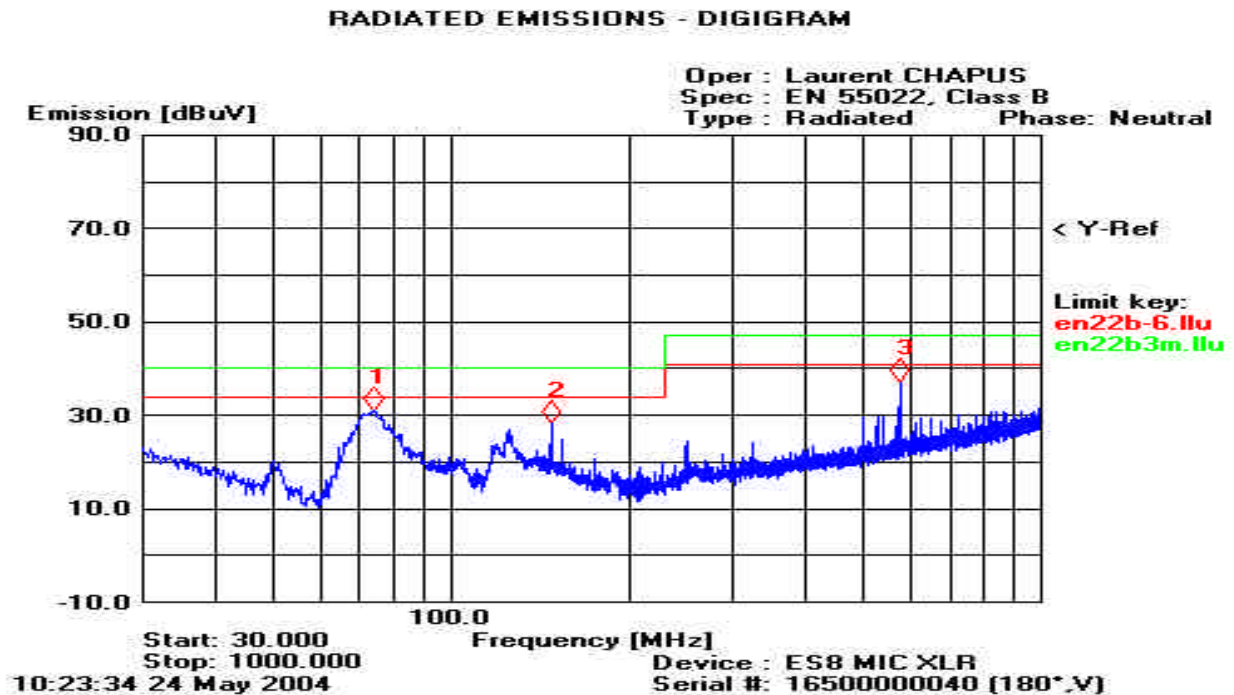
### 2.3. TEST SEQUENCE AND RESULTS:

#### 2.3.1.Pre-characterization at 3 meters

A pre-scan of all the setup has been performed in a 3 meters full anechoic chamber.

The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization, and on 4 faces of the EUT. See below for graph examples.

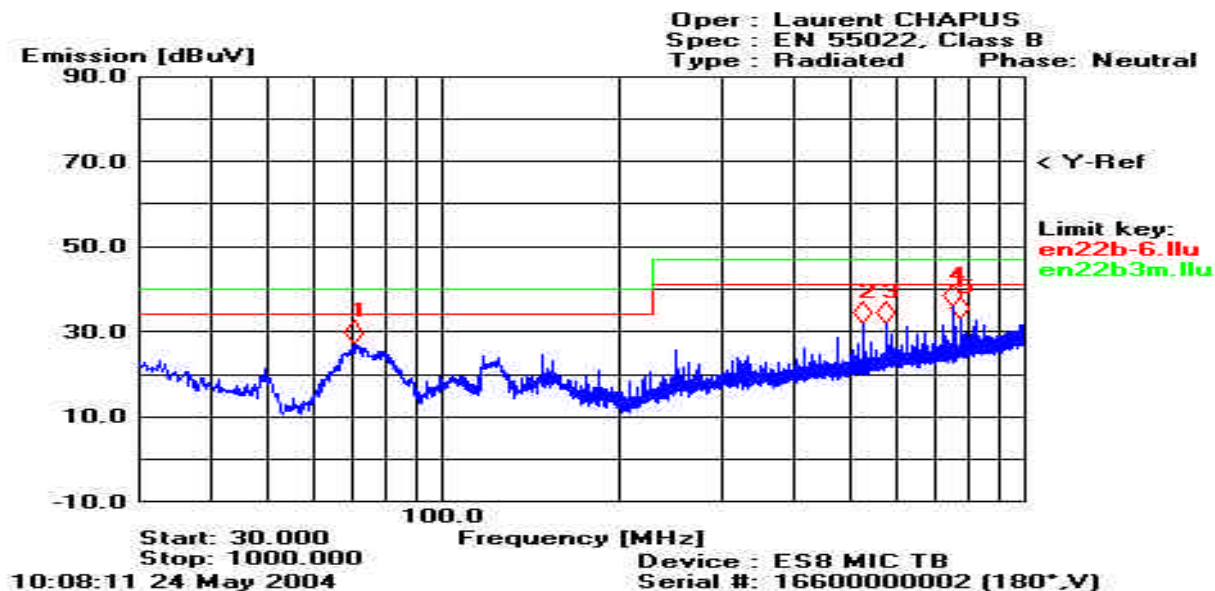
ES8 MIC models with XLR or Terminal block connectors, with or without CL option are tested in the 3 meters anechoic chamber.



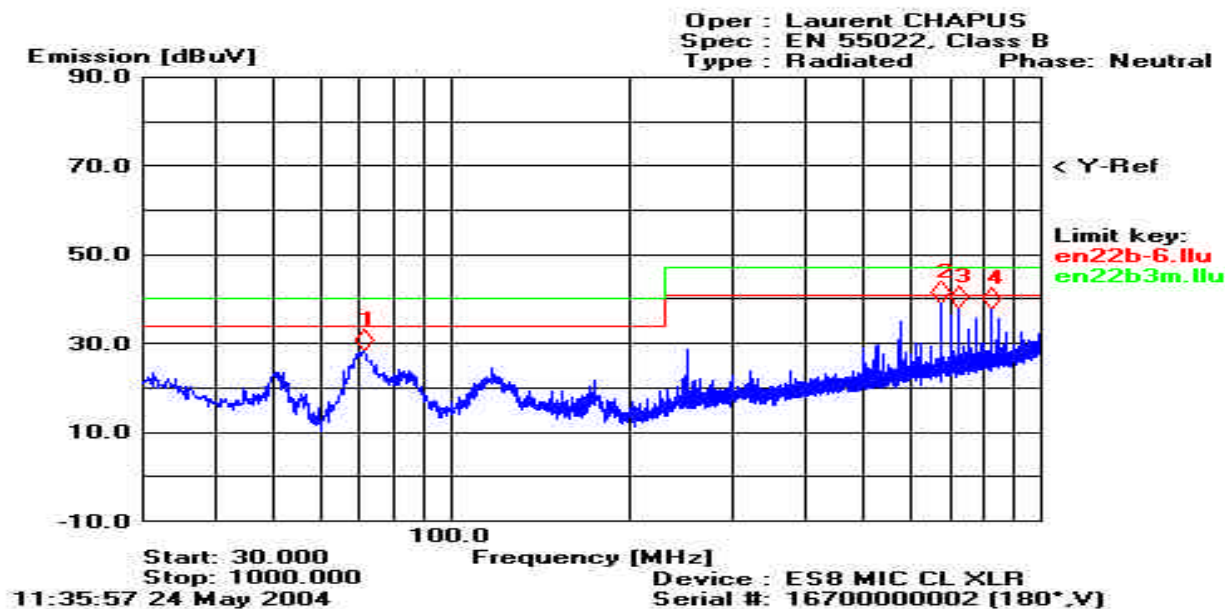
Graph [30MHz-1GHz] ES8 MIC XLR

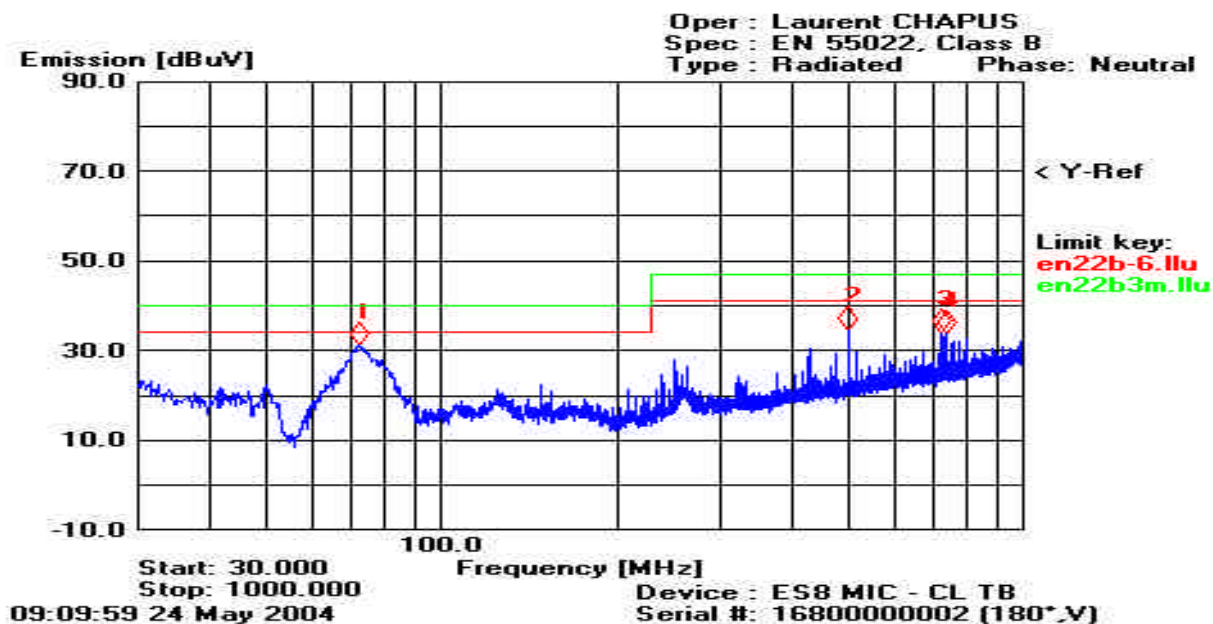


## RADIATED EMISSIONS - DIGIGRAM

Graph [30MHz-1GHz] ES8 MIC TB

## RADIATED EMISSIONS - DIGIGRAM

Graph [30MHz-1GHz] ES8 MIC CL XLR

**RADIATED EMISSIONS - DIGIGRAM**

Graph [30MHz-1GHz] ES8 MIC CL TB

**2.3.2.Characterization on 10 meters open site from 30MHz to 1GHz**

The product has been tested according to ANSI C63.4-(1992+2000), CISPR22-1997/A1:2000/A2:2002 and EN55022:1998/A1:2000/A2:2003. Radiated emissions were measured on an open area test site. A description of the facility is on file with the FCC.

The product has been tested with 230V/50Hz power line voltage, at a distance of 10 meters from the antenna and compared to the CISPR 22 Class B limits. Measurement bandwidth was 120kHz from 30MHz to 1GHz. Antenna height search was performed from 1m to 4m for both horizontal and vertical polarization. Continuous linear turntable azimuth search was performed with 360 degrees range.

Interconnecting cables and equipments were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on clause 2.3.1.

Frequency list has been created with anechoic chamber pre-scan results.





### 2.3.3. Qualification results - ES8 MIC CL TB

Frequency list has been created with anechoic chamber pre-characterization results.

Measurements are performed in QUASI-PEAK detection.

No	Frequency (MHz)	Qpeak Lmt (dBμV/m)	Qpeak (dBμV/m)	Qpeak-Lmt (dB)	Angle (deg)	Hgt (cm)	Pol	Tot Corr. (dB)	Comments
1	71.089	30.0	24.0	-6.0	51	187	V	9.2	
2	147.453	30.0	27.8	-2.2	274	104	V	14.7	Worst margin
3	225.009	30.0	17.3	-12.7	106	106	V	14.2	
4	475.019	37.0	28.4	-8.6	178	178	H	20.8	
5	500.024	37.0	28.9	-8.1	244	244	H	21.4	
6	540.674	37.0	26.3	-10.7	192	192	H	21.9	
7	575.033	37.0	32.1	-4.9	303	303	V	22.3	
8	675.017	37.0	30.1	-6.9	129	129	H	24.5	
9	725.011	37.0	34.2	-2.8	242	242	V	25.4	
10	750.017	37.0	32.5	-4.5	220	220	V	25.7	
11	761.877	37.0	30.9	-6.1	224	224	V	25.8	

Results: COMPLY.

### 2.3.4. Qualification results - ES8 MIC CL XLR

Frequency list has been created with anechoic chamber pre-characterization results.

Measurements are performed in QUASI-PEAK detection.

No	Frequency (MHz)	Qpeak Lmt (dBμV/m)	Qpeak (dBμV/m)	Qpeak-Lmt (dB)	Angle (deg)	Hgt (cm)	Pol	Tot Corr. (dB)	Comments
1	68.598	30.0	24.8	-5.2	182	101	V	9.6	
2	147.447	30.0	25.9	-4.1	278	101	V	14.7	
3	575.002	37.0	34.8	-2.2	18	162	H	22.3	Worst margin
4	625.019	37.0	34.1	-2.9	127	163	H	23.2	
5	675.008	37.0	28.7	-8.3	194	117	H	24.5	
6	725.010	37.0	31.3	-5.7	346	218	V	25.4	
7	775.041	37.0	31.2	-5.8	309	213	H	25.9	

Results: COMPLY.

## 2.4. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follow:

$$FS = RA + AF + CF - AG$$

Where  
 FS = Field Strength  
 RA = Receiver Amplitude  
 AF = Antenna Factor  
 CF = Cable Factor  
 AG = Amplifier Gain





Assume a receiver reading of 52.5dB $\mu$ V is obtained. The antenna factor of 7.4 and a cable factor of 1.1 is added. The amplifier gain of 29dB is subtracted, giving a field strength of 32 dB $\mu$ V/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dB}\mu\text{V/m}$$

The 32 dB $\mu$ V/m value can be mathematically converted to its corresponding level in  $\mu$ V/m.

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(32\text{dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}.$$

### 3. Conducted emission data

The product has been tested according to ANSI C63.4-(1992+2000), CISPR22-1997/A1:2000/A2:2002 and EN55022:1998/A1:2000/A2:2003.

The product has been tested with 110V/60Hz power line voltage and compared to the CISPR22 Class B limits. Measurement bandwidth was 9kHz from 150kHz to 30MHz.

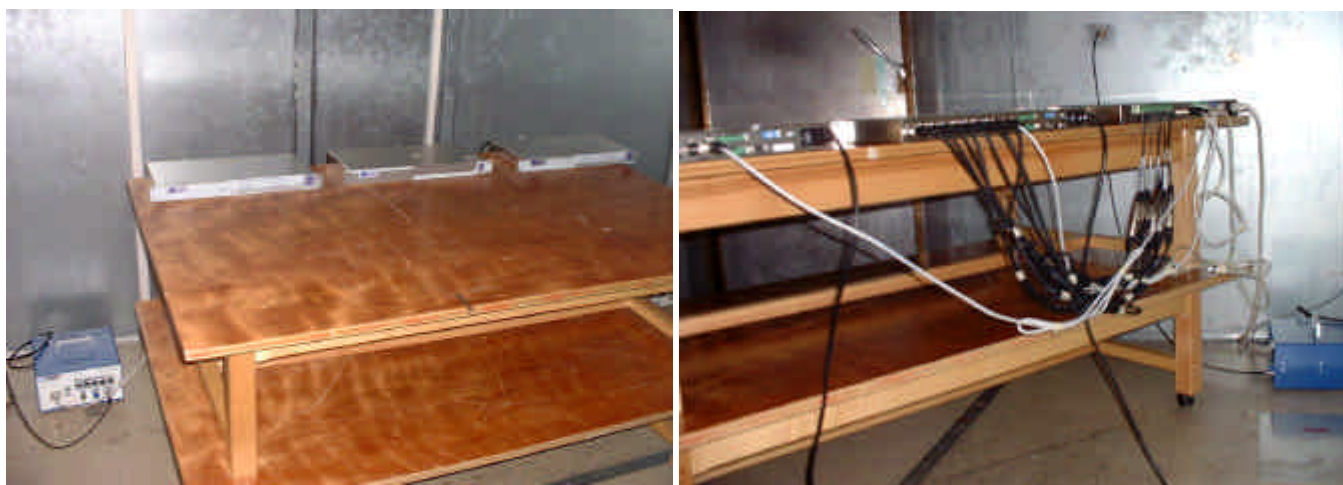
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits and measurement with the average detector is unnecessary.

The Peak data are shown on the following plots. Quasi-Peak and Average measurements are detailed in a table with frequencies and levels measured.

Interconnecting cables and equipment's were moved to position that maximized emission. A summary of the worst case emissions found in all test configurations and modes is shown on the following page.

#### 3.1. TEST SET-UP:

Mains: 110V/60Hz





The equipment under test with its auxiliaries are set 80cm above the ground reference plane on a non-conducting table. The distance between the EUT and the LISN is 80cm.

The distance between the EUT with its auxiliaries and the vertical plane is 40cm.

The EUT is powered through a LISN (measure -  $50\Omega$  /  $50\mu\text{H}$ ) and auxiliaries are powered by another LISN.

The distance between the EUT and each auxiliary is 10cm.

### 3.2. TEST EQUIPMENT:

Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
	z		
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628
LISN(measure)	Telemeter	TGmbH	NNB 9511-11821628
$50\Omega$ / $50\mu\text{H}$	Electronis	2/16	
Faraday room	Rayproof		4854

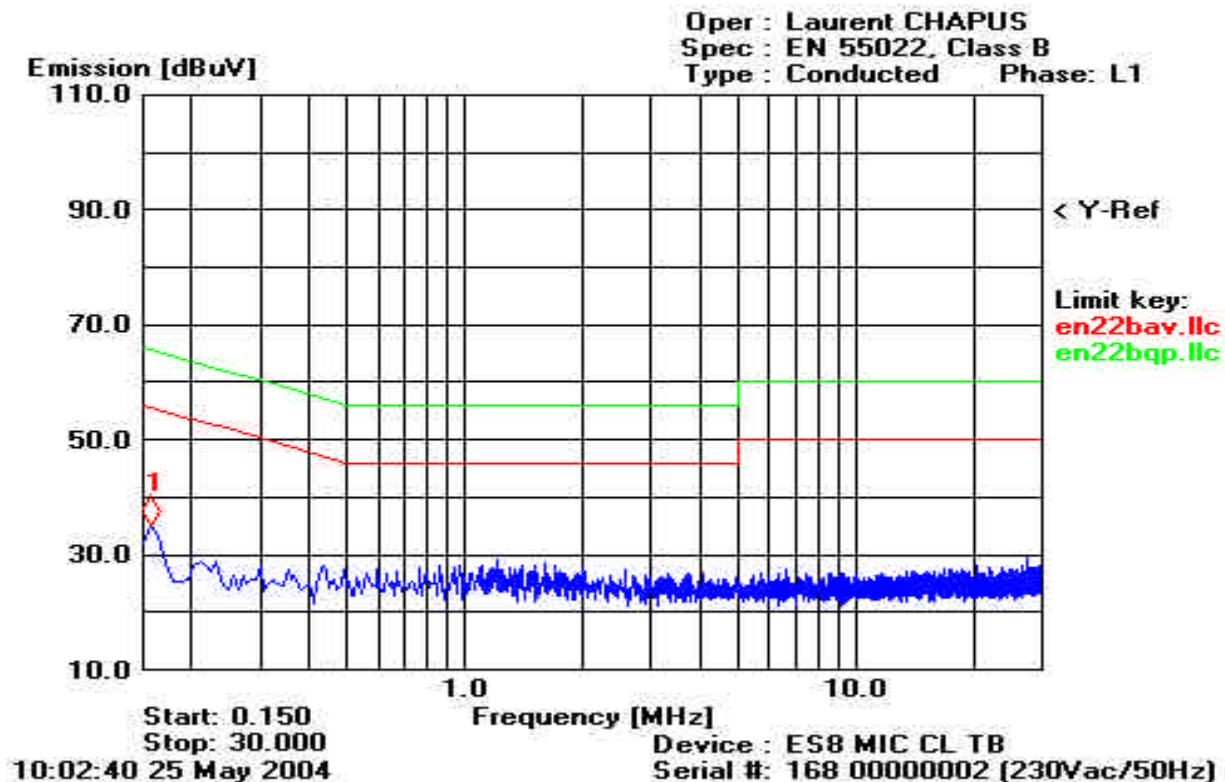
### 3.3. TEST SEQUENCE AND RESULTS:

Measures are performed on line 1 and neutral of the power supply of each of the ES8 IN and ES8 out equipment.



### 3.3.1. Line conducted emission data (110V/60Hz) on ES8 MIC

#### CONDUCTED EMISSIONS - DIGIGRAM



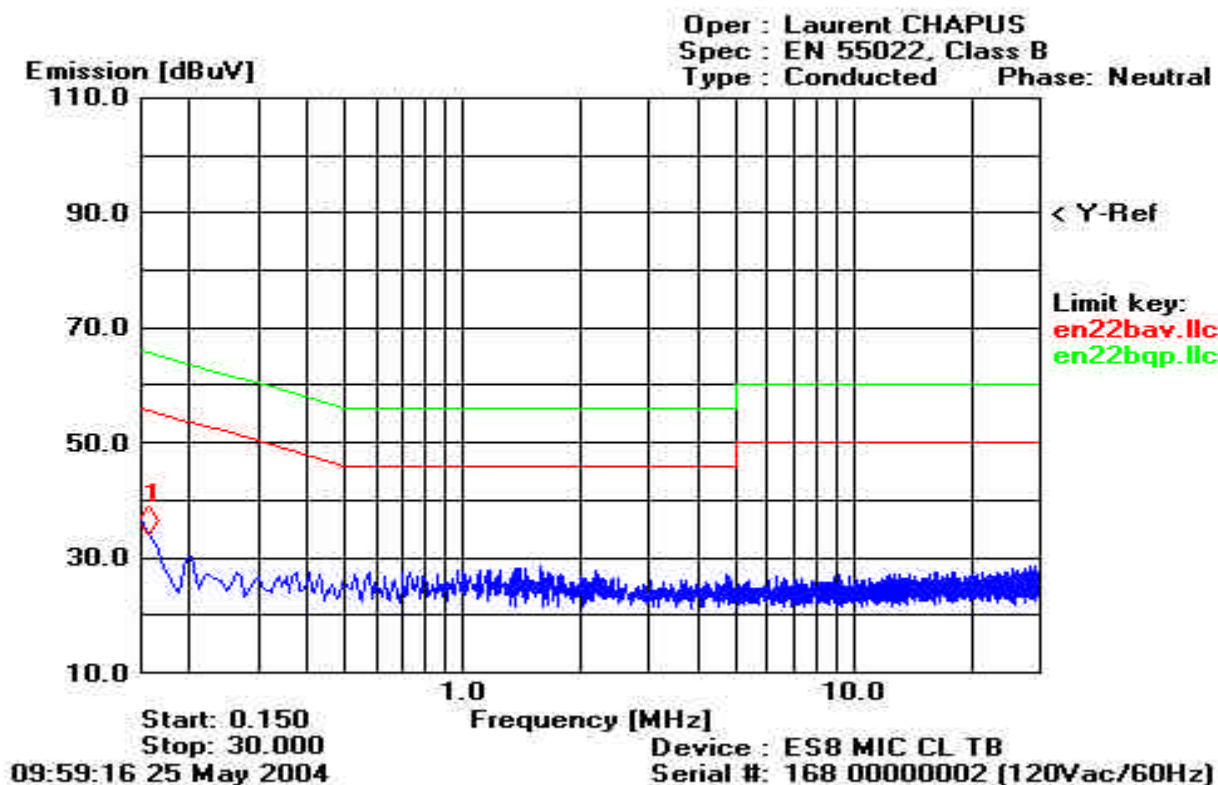
ES8 MIC - Line L1

Num.	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	QP limit [dBuV]	QP delta [dBuV]	Average [dBuV]	AVG Limit [dBuV]	AVG Delta [dBuV]	Comment.
1	0.160	39.01	29.08	65.4	-36.32	17.00	55.4	-38.4	



### 3.3.2. Neutral conducted emission data (110V/60Hz) on ES8 MIC

#### CONDUCTED EMISSIONS - DIGIGRAM



#### ES8 MIC - Neutral

Num.	Freq. [MHz]	Peak [dBuV]	Q-Peak [dBuV]	QP limit [dBuV]	QP delta [dBuV]	Average [dBuV]	AVG Limit [dBuV]	AVG Delta [dBuV]	Comment.
1	0.160	37.79	29.65	65.4	-35.75	17.14	55.4	-38.26	