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LCIE

# EMC TEST REPORT

Nr 3587-FCC

This test report applies only on equipment described hereafter.

Proposal number : 200511-2851

Date of test .....: December 9<sup>th</sup>, 2005

Location .....: LCIE Laboratory - 38 VOIRON

Performed by .....: Jacques LORQUIN

Customer.....: **DIGIGRAM SA**  
430, rue Aristide Berges  
F- 38330 MONTBONNOT SAINT MARTIN  
FRANCE

Product.....: **ES16161**

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

Applied standards or specification: EN55022 (1999) +/A1: (2000) +/A1: (2003)  
CISPR22 (2003)  
FCC part 15 subpart B

Level .....: 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, CISPR22 and FCC part 15 subpart B standard, in radiated and conducted emissions.**

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Written by .....: Jacques LORQUIN

Approved by .....: Jacques LORQUIN

Date: December 11<sup>th</sup>, 2005

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## 1. System test configuration

### 1.1. Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). A typical ES16161 is tested, and I/O ports are connected on typical load.

### 1.2. Hardware Identification:

① Equipment Under Test (EUT): **ES16161** **Sn : 283.00000001**

➤ Size : 440x215x40mm

➤ I/O :

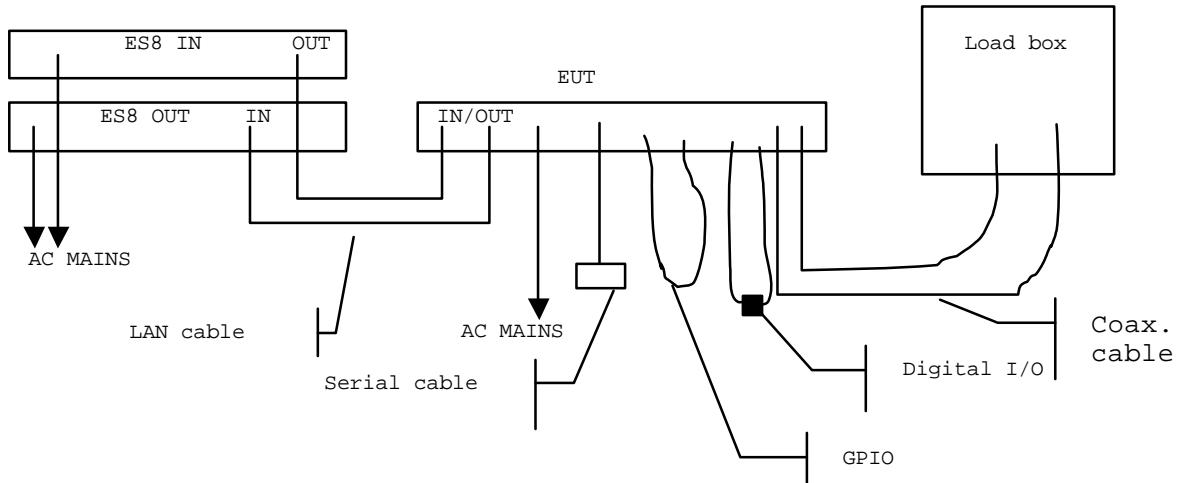
- 16X Digital audio inputs (mono, 2x XLR connectors)
- 16X Digital audio outputs (mono, 6x XLR connectors)
- 1x input synchronisation (BNC connector)
- 1x output synchronisation (BNC connector)
- 8x GPIO
- 1x serial port (Sub D9 connector)
- Power supply

➤ Frequencies:

Crystal: 50MHz, 15,7456MHz

Osc : 24,576MHz, 22,5792MHz

### 1.3. Running mode:



For testing the ES161611, I/O synchronisation are loaded by dummy loads (load box with 68ohm) in order to simulate typical load. The digital input/output port are loop back (Input connected on output port).

A sound is playing in loop



#### 1.4. Auxiliaries

The FCC IDs for all equipment, plus description of all cables used in the tested system (including inserted cards, which have grants) are :

Trade Mark - Model Number (Serial number)	FCC ID	Description	Cable description
DIGIGRAM ES16161* (sn: 283.00000001)	IGTES8AES	Audio card	I/O cables, shielded Standard power cable unshielded,
Ethersound ES8IN (sn: 14900000120)	IGTES8	Audio card	Standard power cable unshielded, LAN cable is shielded.
Ethersound ES8OUT (sn: 15000000173)	IGTES8	Audio card	Standard power cable unshielded, LAN cable is shielded.
DIGIGRAM	None	Load box	Standard power cable unshielded

\* : Equipment under test

#### 1.5. I/O cables ES

- 2x Power cord (ES8IN & ES8OUT), unshielded, length: 2.5m
- 1x Power cord (EUT), unshielded, length: 3m
- 4x Digital audio cables (SUBD/XLR connectors), shielded, length: 0.5m
- 1x Serial cable, shielded, length: 3m
- 2x LAN cable FTP Cat5+ (shielded) cable, length: 2.2m
- 2x Coaxial cable (Zc=50ohms), shielded, length: 3m

#### 1.6. Equipment modifications

None.



## 2. Radiated emission data from 30MHz to 1GHz

### 2.1. 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 distance between equipment under test and auxiliaries is 10cm.





## 2.2. TEST EQUIPMENT

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.

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

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8568B	2732A04155
Quasi-Peak adapter	HP	85650A	2811A01134
RF Pre-selector	HP	85685A	2837A00784
Biconical Antenna	EMCO	3104C	9401-4636
Log Periodic Antenna	EMCO	3146	2178
Absorbing clamp	LÜTHI	MDS21	194.0100.50
Tube ferrite	LÜTHI	FTC101	4485
Absorbing clamp	LÜTHI	MDS21	2826

EMCO-1050, 6 meters height antenna mast & EMCO-1060, 3 meters diameter Turntable.  
A 10 meters Open site located in **LCIE** - Voiron (FRANCE).

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

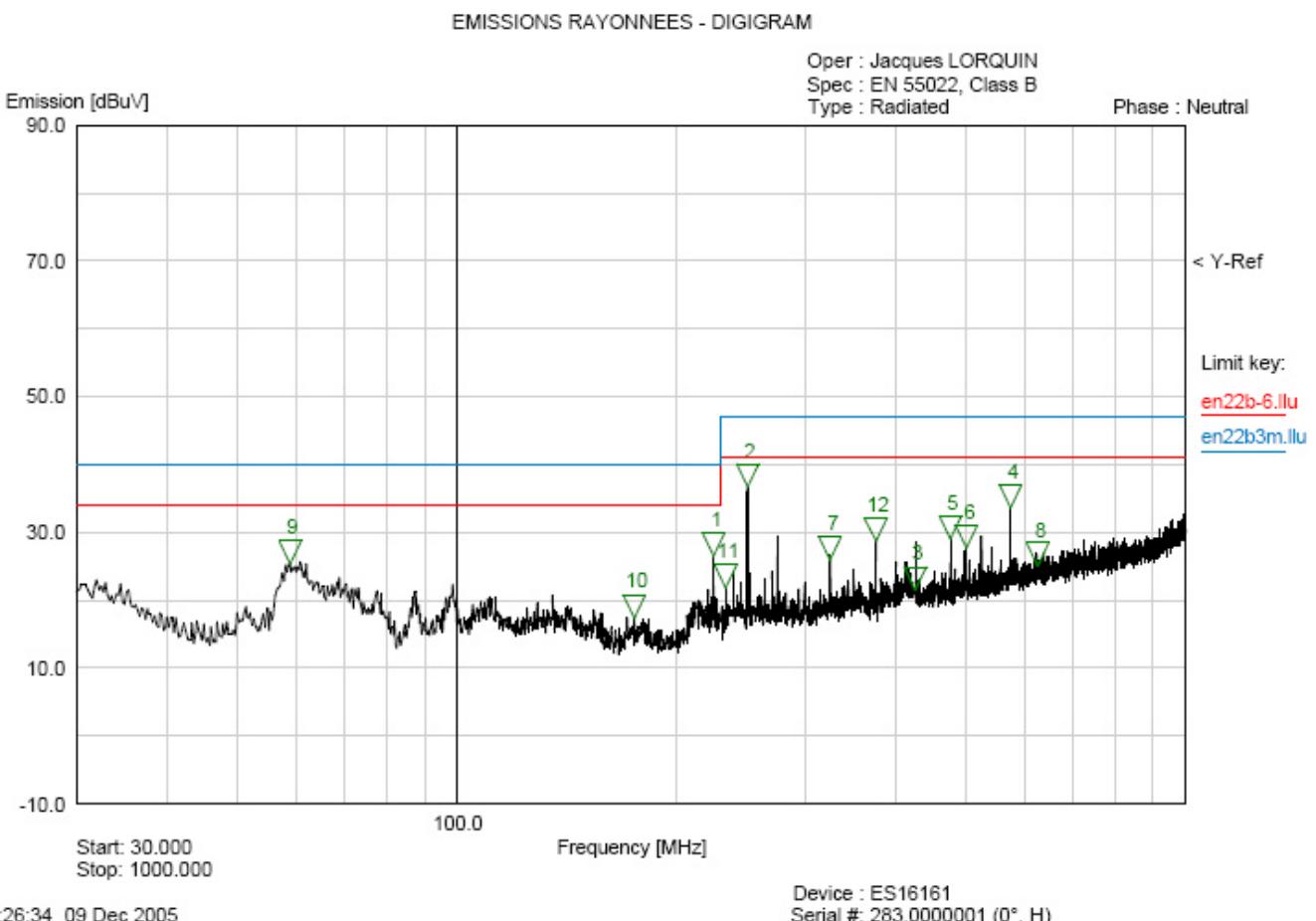
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Absorbing clamp	LÜTHI	MDS21	194.0100.50
Tube ferrite	LÜTHI	FTC101	4485
Absorbing clamp	LÜTHI	MDS21	2826

### 2.3. TEST SEQUENCE AND RESULTS ON ES16161

#### 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.





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

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

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 clause 2.1.

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

No	Frequency (MHz)	QPeak (dB $\mu$ V/m)	Lmt (dB $\mu$ V/m)	QPeak (dB $\mu$ V/m)	QPeak-Lmt (dB)	Pol	Hgt (cm)	Angle (deg)	Tot Corr (dB)	Comments
1	225.008	30.0	29.6	29.6	-0.4	V	130	345	15	
2	233.497	37.0	25.1	25.1	-11.9	V	120	100	14.9	
3	250.003	37.0	25.6	25.6	-11.4	V	130	10	14.8	
4	325.024	37.0	27.5	27.5	-9.5	H	290	145	17.6	
5	375.018	37.0	27.3	27.3	-9.7	H	260	165	18.3	
6	425.047	37.0	35.6	35.6	-1.4	V	170	300	19.3	S/B<6dB
7	575.023	37.0	29.1	29.1	-7.9	V	240	180	22.4	



#### 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.

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

### 3. Conducted emission data

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

The product has been tested with 110V@60Hz and 230V@50Hz 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. SET-UP

Mains: 110V/60Hz & 230V/50Hz



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

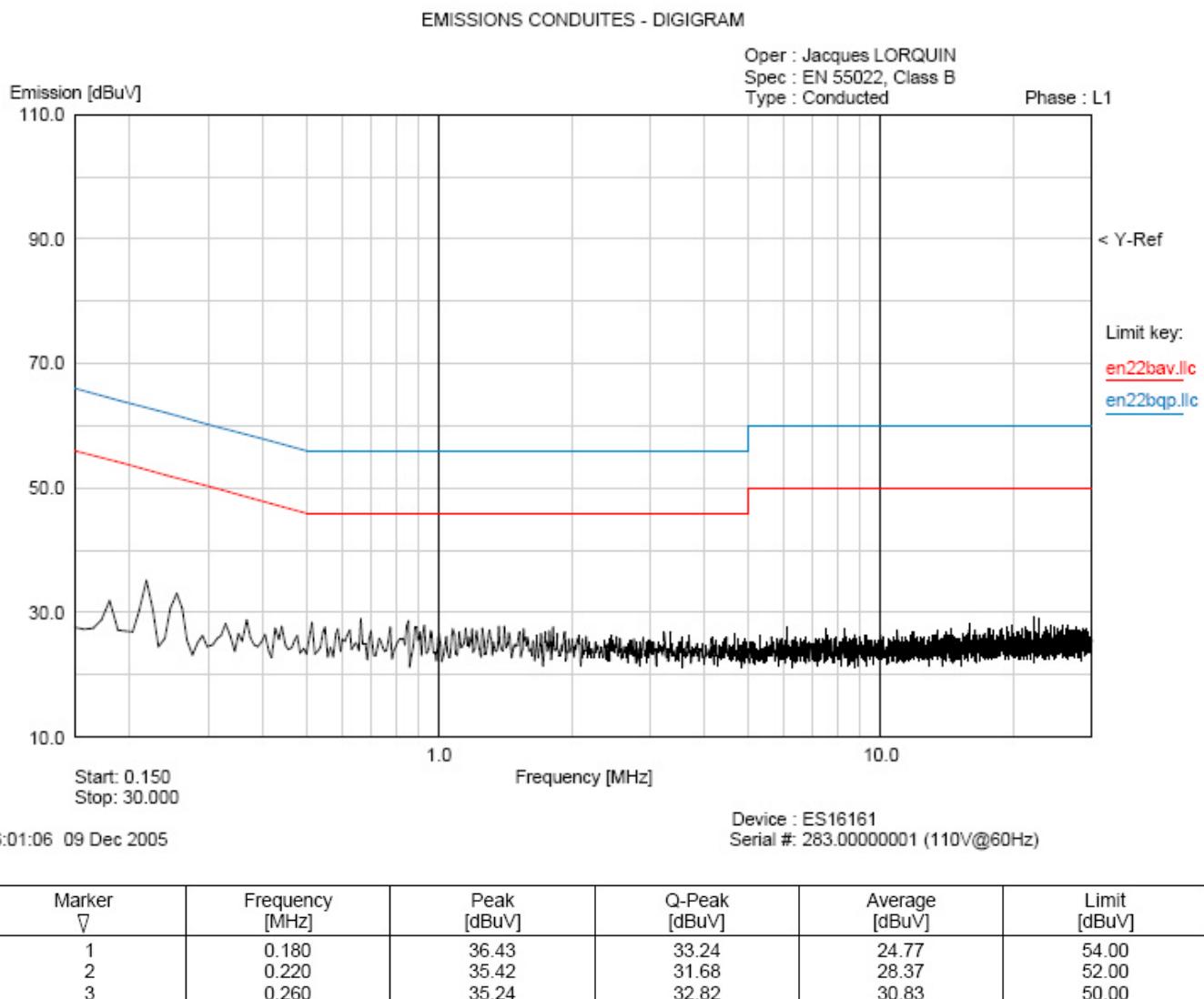
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliaries)	EMCO	3825/2	9309-2122
LISN(measure)	Telemeter	TGmbH	9511-11821628
50Ω / 50µH	Electronis	NNB 2/16	
Faraday room	Rayproof		4854



### 3.3. TEST SEQUENCE AND RESULTS

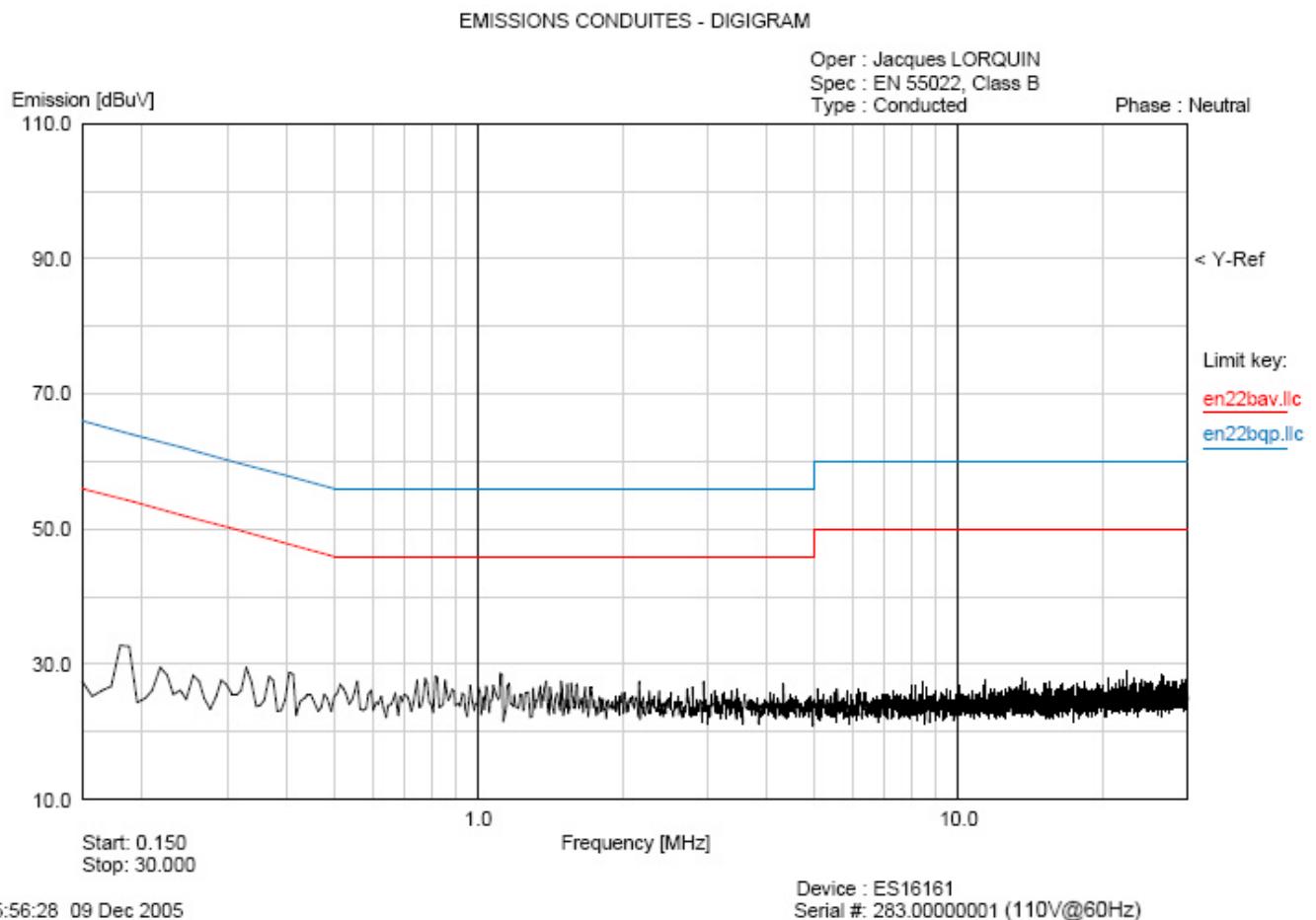
The measures are made on the two lines of the power supply of the PC giving the power supply of the EUT.

#### 3.3.1. Line conducted emission data on ES16161 (110V@60Hz)





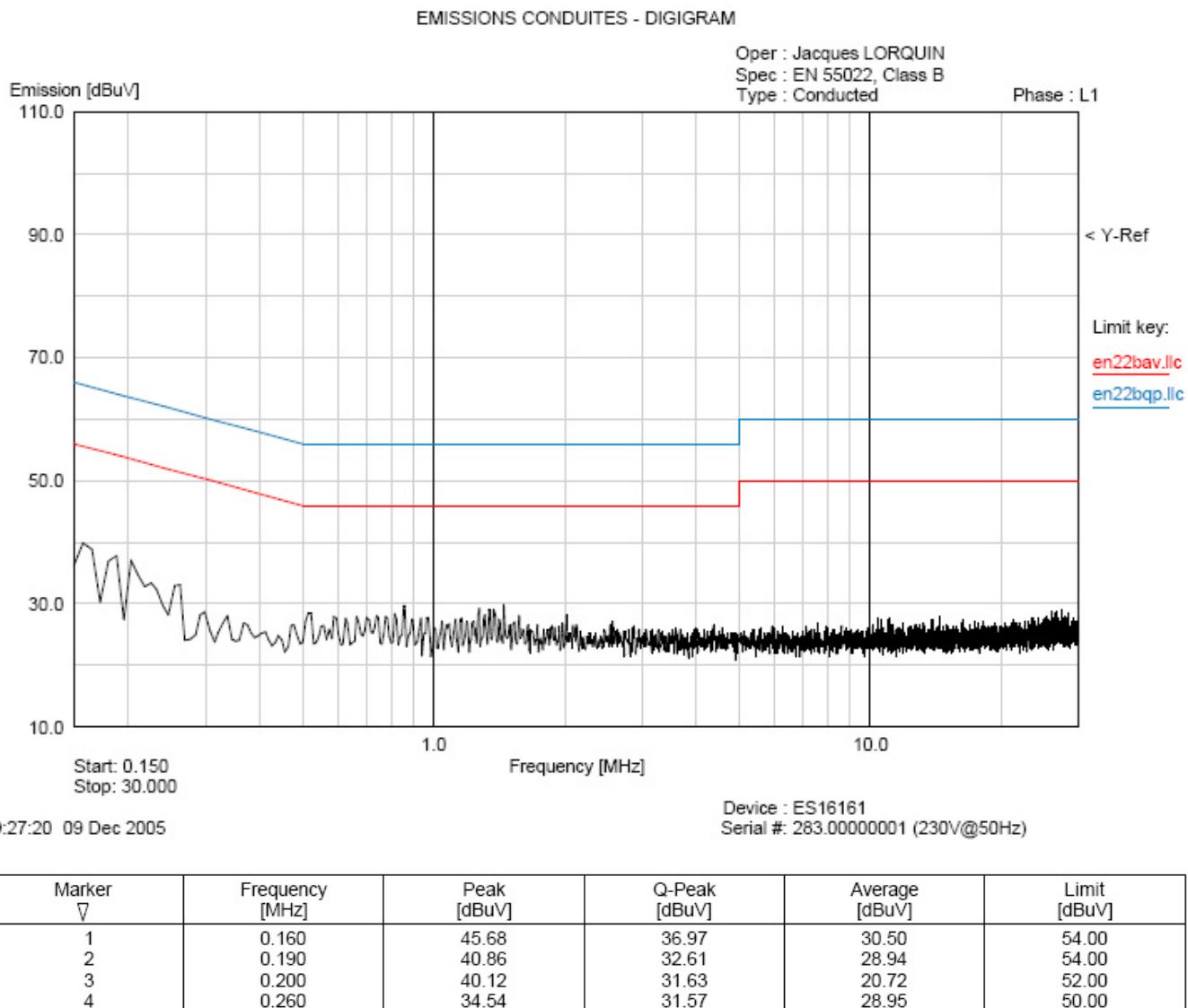
### 3.3.2. Neutral conducted emission data on ES16161 (110V@60Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	32.76	-	-	54.00
2	0.220	29.54	-	-	52.00
3	0.250	24.90	-	-	50.00
4	0.330	29.53	-	-	48.00

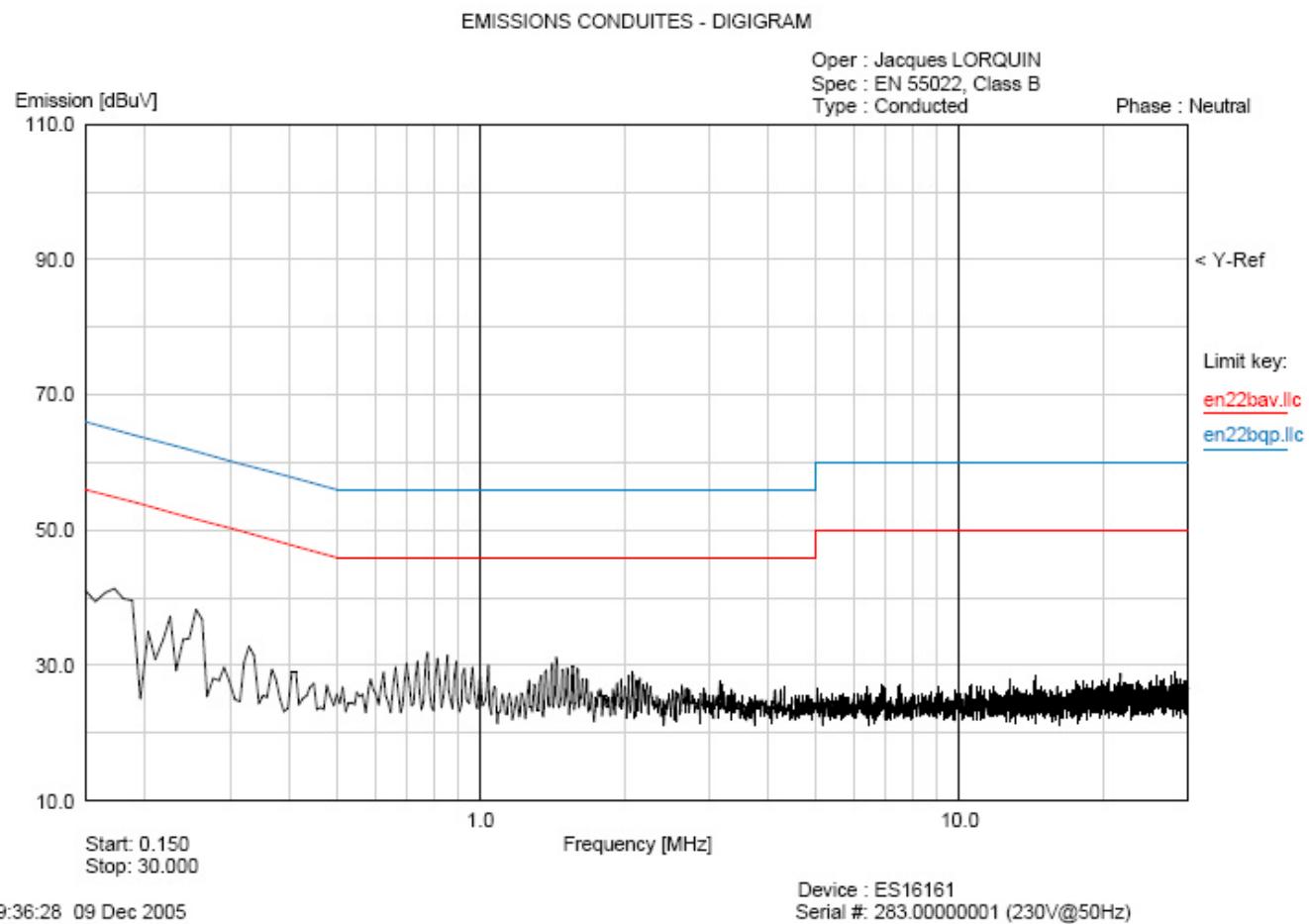


### 3.3.3. Line conducted emission data on ES16161(230V@50Hz)





### 3.3.4. Neutral conducted emission data on ES16161(230V@50Hz)



Marker V	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	44.70	39.34	33.10	54.00
2	0.220	40.00	32.14	26.17	52.00
3	0.250	39.47	34.62	31.52	50.00
4	0.330	35.88	33.16	31.70	48.00

*End of Tests*