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LCIE

EMC TEST REPORT

Nr 3532/A1-FCC

This test report applies only on equipment described hereafter.

Proposal number : 200510-2798

Date of test: October 17, 2005

Location: LCIE Laboratory - 38 VOIRON

Performed by: Jacques LORQUIN

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

Product.....: **ES881 & ES1241**

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: February 4th ,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 ES881 & ES1241 are tested, and I/O ports are connected on typical load.

1.2. HARDWARE IDENTIFICATION:

① Equipment Under Test (EUT): ES1241 Sn : 28200000001

- Size : 440x215x40mm
- I/O :
 - 4X Digital audio inputs (mono,2x XLR connectors)
 - 12X 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

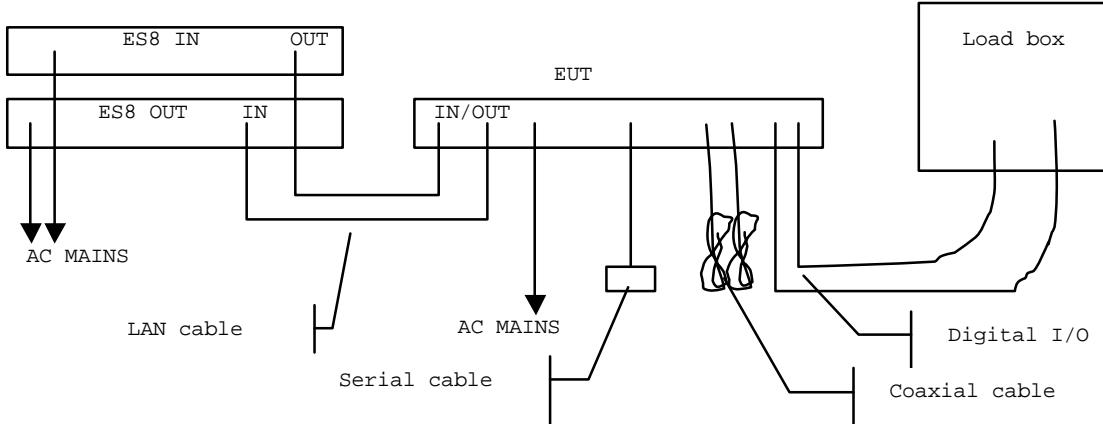
- Frequencies :
 - Crystal: 50MHz, 15,7456MHz
 - Osc : 24,576MHz, 22,5792MHz

② Equipment Under Test (EUT): ES881 Sn : 28100000001

- Size : 440x215x40mm
- I/O :
 - 8X Digital audio inputs (mono,4x XLR connectors)
 - 8X Digital audio outputs (mono,4x 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 ES1241 and ES881, I/O are loaded by dummy loads (load box) in order to simulate typical load on each ports:

ES881:

IN (1, 2, 3, 4) → 110ohms
 OUT (1, 2, 3, 4) → 110ohms

ES1241:

IN (1, 2) → 110ohms
 OUT (3, 4, 5, 6) → 110ohms & OUT (1, 2) → 100ohms

On digital output N°2, 3, 4 of ES881 and output N°4, 5, 6 of ES1241 long XLR cable are used, for all other input/output short XLR cable are used.

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 ES1241* (sn: 28200000001)	IGTES8AES	Audio card	I/O cable, 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
- 3x Digital audio cables (XLR "L"), length: 3m
- 5x Short Digital audio cables (XLR "S"), length: 1.5m
- 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

Insulated BNC connectors are replaced by shielded BNC connectors. (See photo for details).

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

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

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	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	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:

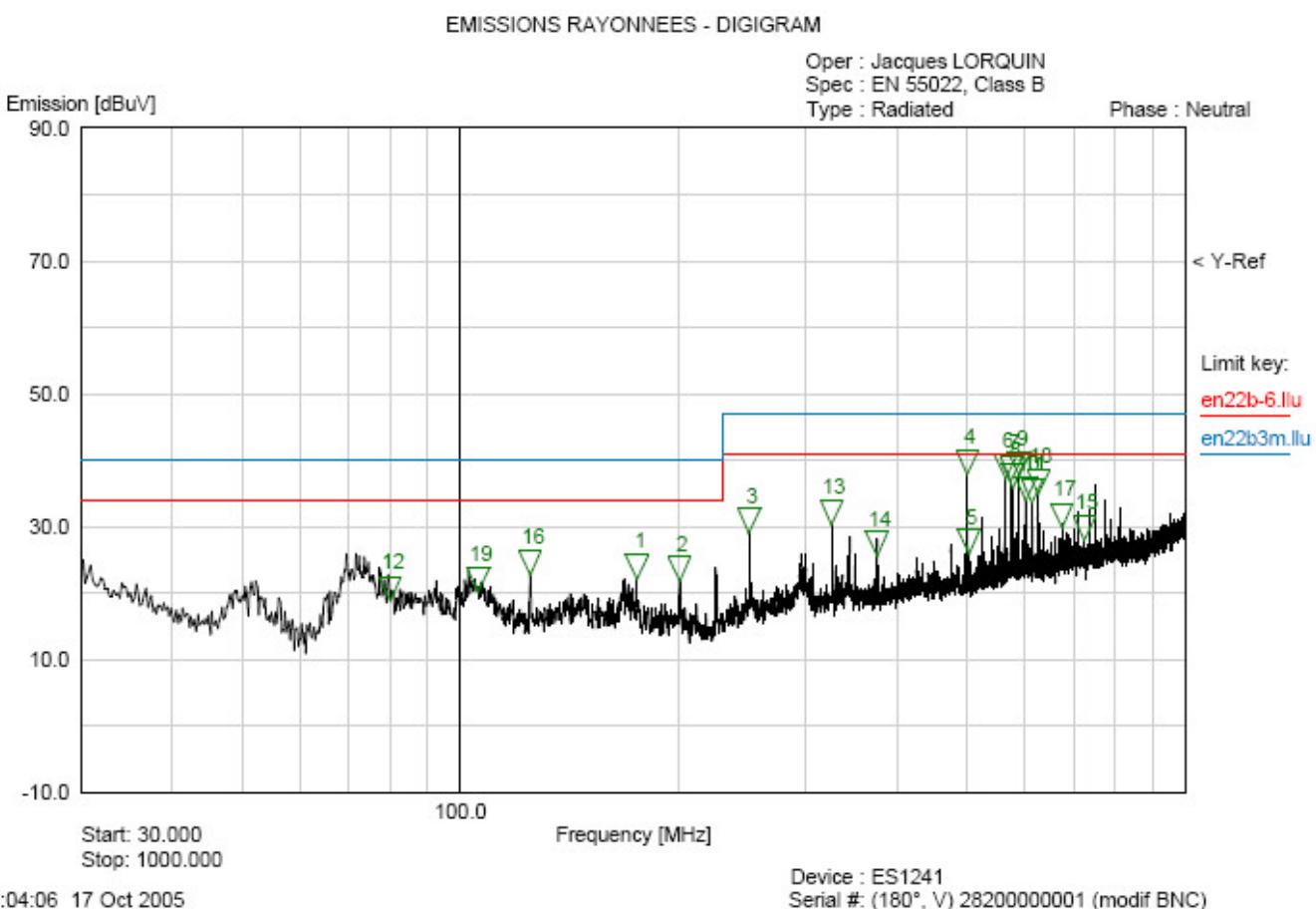
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Amplifier	HP	8447F H64	3113A06394
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628
Absorbing clamp	LÜTHI	MDS21	194.0100.50
Tube ferrite	LÜTHI	FTC101	4485
Absorbing clamp	LÜTHI	MDS21	2826

2.3. TEST SEQUENCE AND RESULTS ON ES1241

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.

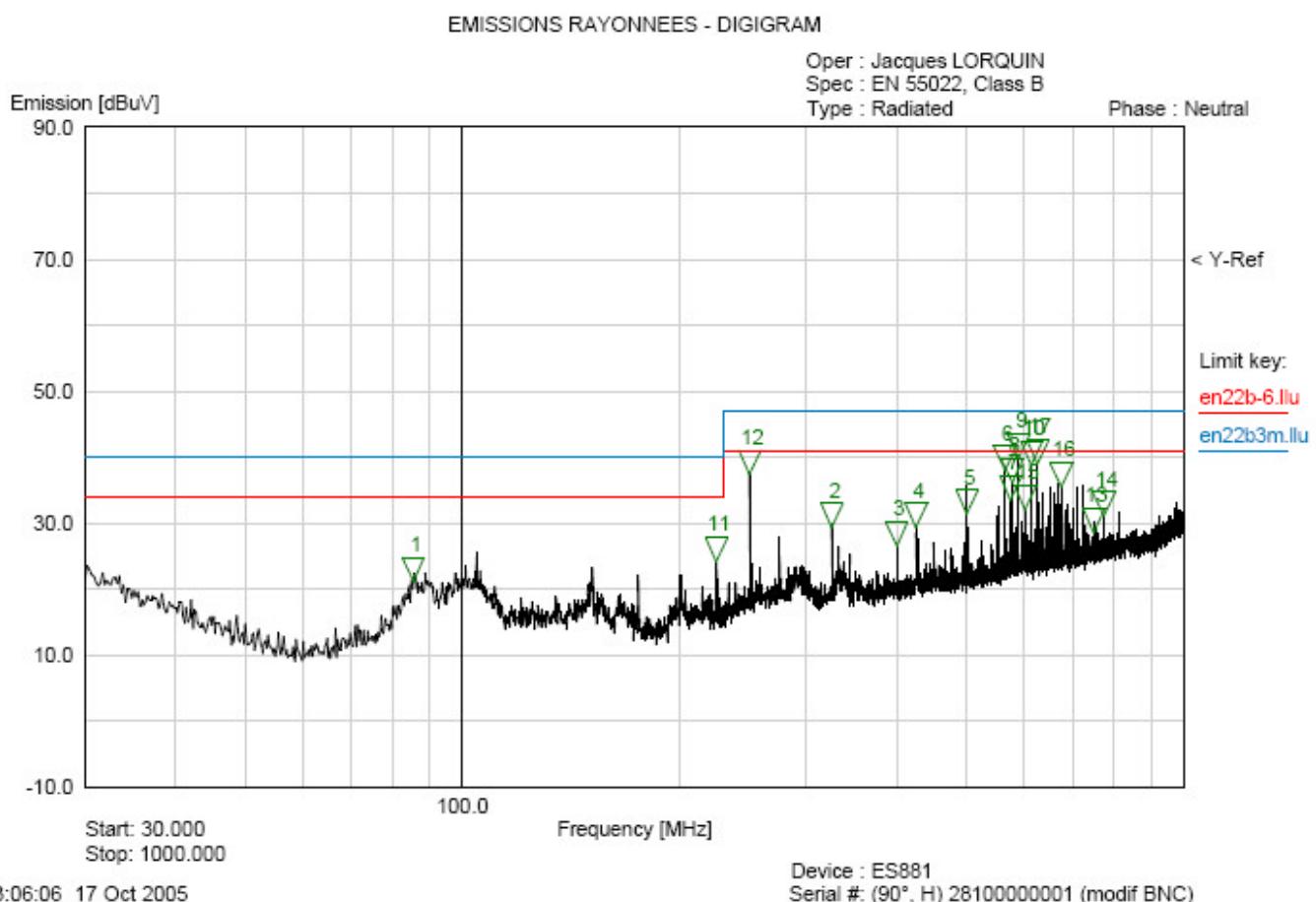
No	Frequency (MHz)	QPeak Lmt (dB μ V/m)	QPeak (dB μ V/m)	QPeak-Lmt (dB)	Pol	Hgt (cm)	Angle (deg)	Tot Corr (dB)	Comments
1	225.015	30.0	21.4	-8.6	V	120	100	13.7	
2	250.025	37.0	30.6	-6.4	H	300	90	14.3	
3	375.017	37.0	30.6	-6.4	V	120	140	18.1	
4	400.006	37.0	28.7	-8.3	H	270	125	18.4	
5	500.017	37.0	36.5	-0.5	H	180	170	21.4	
6	565.232	37.0	34.0	-3	H	160	100	22.4	
7	577.545	37.0	32.2	-4.8	H	130	135	22.6	
8	589.791	37.0	34.7	-2.3	H	210	130	22.8	
9	614.406	37.0	32.4	-4.6	H	120	95	23.3	
10	626.684	37.0	33.6	-3.4	H	150	90	23.6	

2.4. TEST SEQUENCE AND RESULTS ON ES881

2.4.1. 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.





2.4.2. 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 Lmt (dB μ V/m)	QPeak (dB μ V/m)	QPeak-Lmt (dB)	Pol	Hgt (cm)	Angle (deg)	Tot Corr (dB)	Comments
1	250.028	37.0	29.9	-7.1	H	300	265	14.3	
2	500.042	37.0	36.7	-0.3	H	230	300	21.4	
3	565.259	37.0	34.7	-2.3	H	170	110	22.4	
4	577.651	37.0	32.8	-4.2	H	120	110	22.6	
5	589.786	37.0	35.3	-1.7	H	230	125	22.8	

2.5. 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 μ 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 μ V/m.

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

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

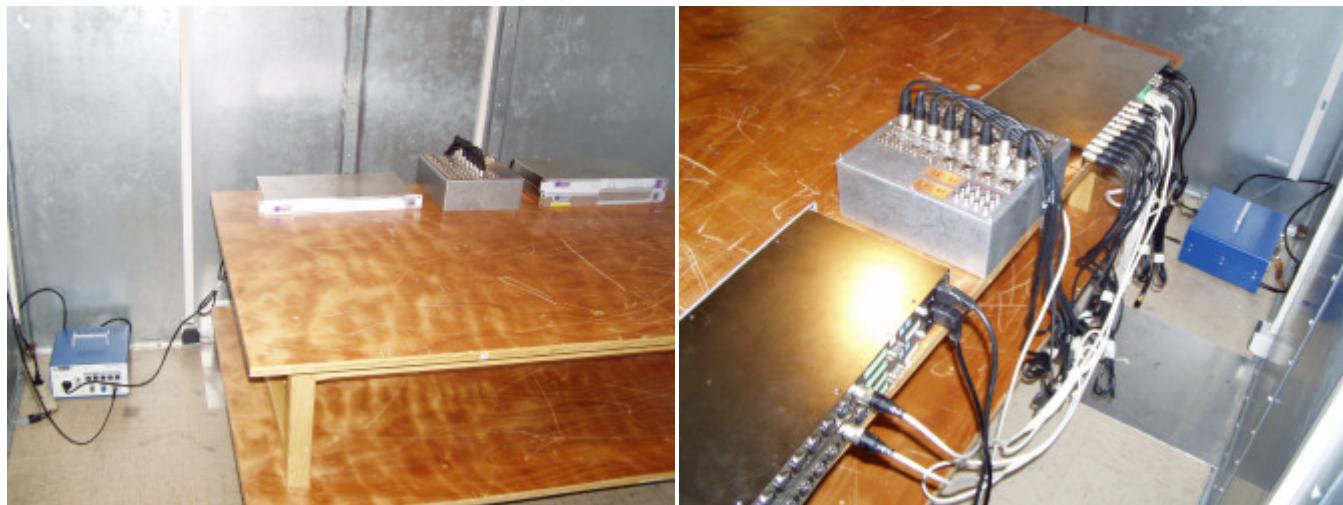
Measurement was initially made with an HP-8591EM Spectrum Analyzer in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement with the Rohde & Schwarz ESH3 receiver for any strong signal. If the average limit is met when using a Quasi-Peak detector, the EUT shall be deemed to meet both limits 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 - 50Ω / $50\mu\text{H}$) and auxiliaries are powered by another LISN.

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



3.2. TEST EQUIPMENT

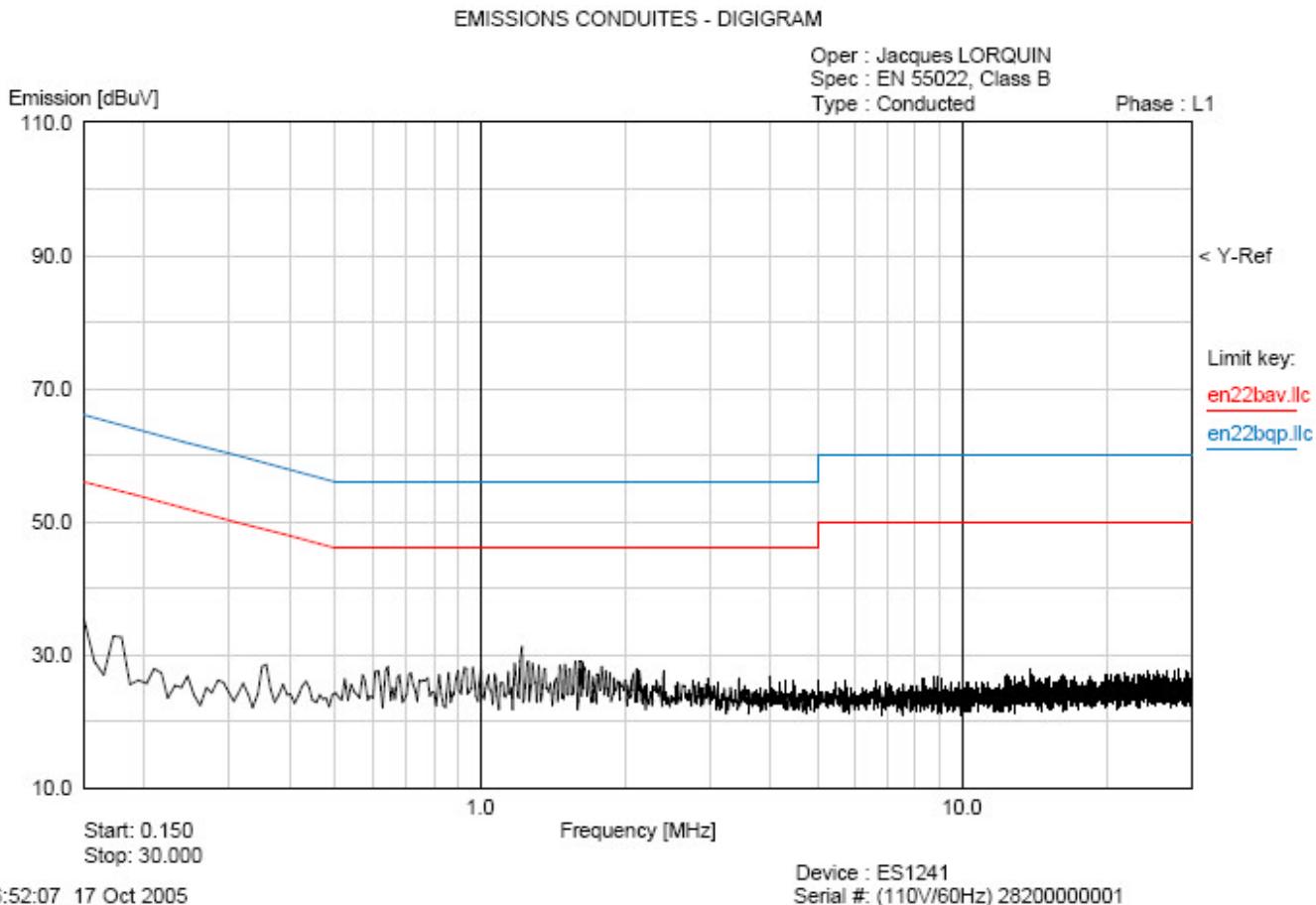
Equipment	Company	Model	Serial
EMC Analyzer	HP	8591EM	3536A00384
Test receiver	Rohde&Schwarz	ESH3	872079/117
Transient Limiter	HP	11947A	3107A01596
LISN(auxiliaries)	EMCO	3825/2	9309-2122
LISN(measure)	Telemeter	TGmbH	9511-11821628
50Ω / 50µH	Electronis	NNB 2/16	
Faraday room	Rayproof		4854



3.3. TEST SEQUENCE AND RESULTS

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

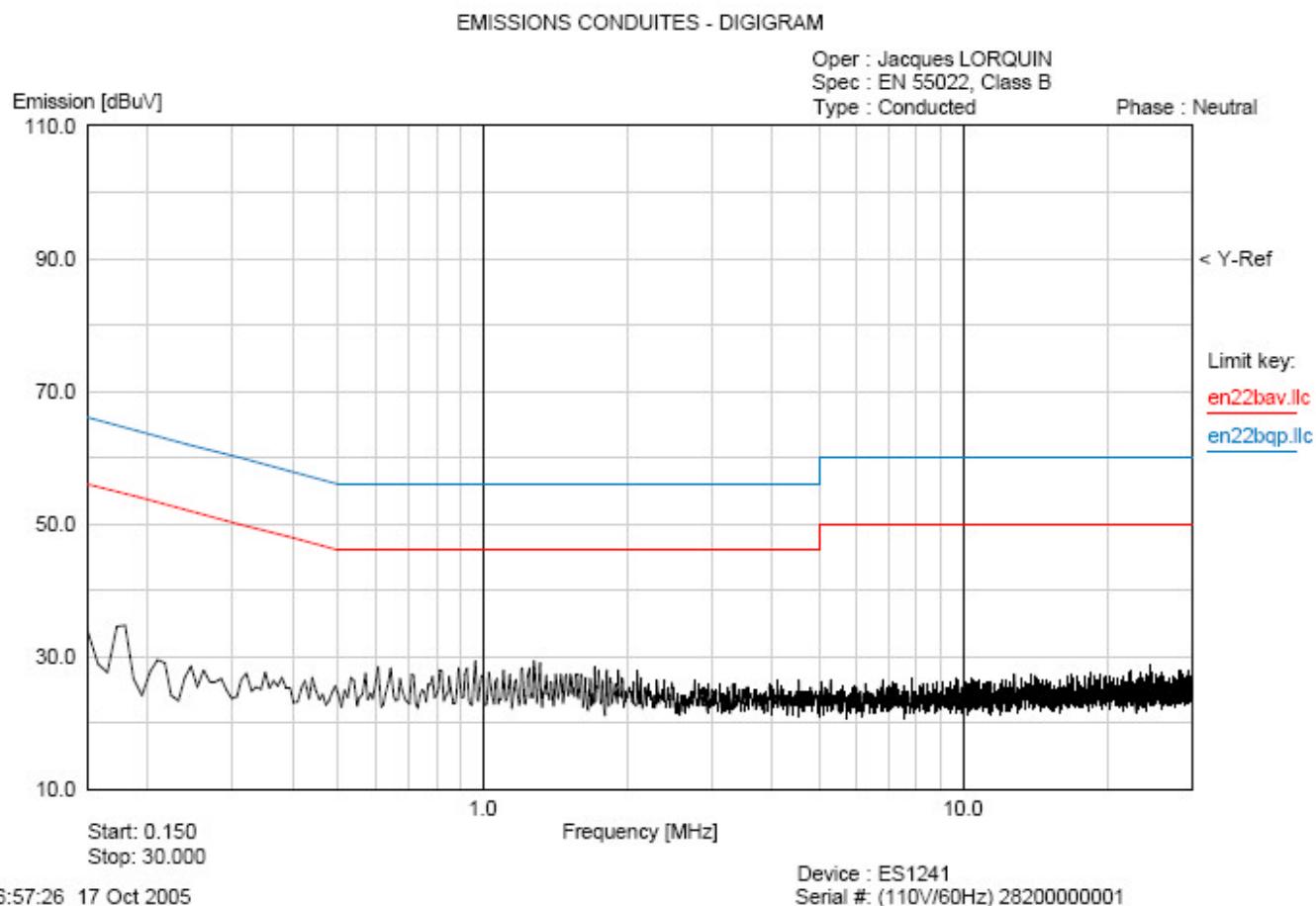
3.3.1. Line conducted emission data on ES1241 (110V@60Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.170	34.69	31.75	28.47	54.00
2	0.250	27.95	23.76	17.84	50.00
3	0.280	28.11	23.84	18.67	50.00
4	0.950	30.16	26.95	23.40	46.00
5	0.990	30.27	26.47	22.72	46.00
6	1.030	28.97	24.32	19.53	46.00



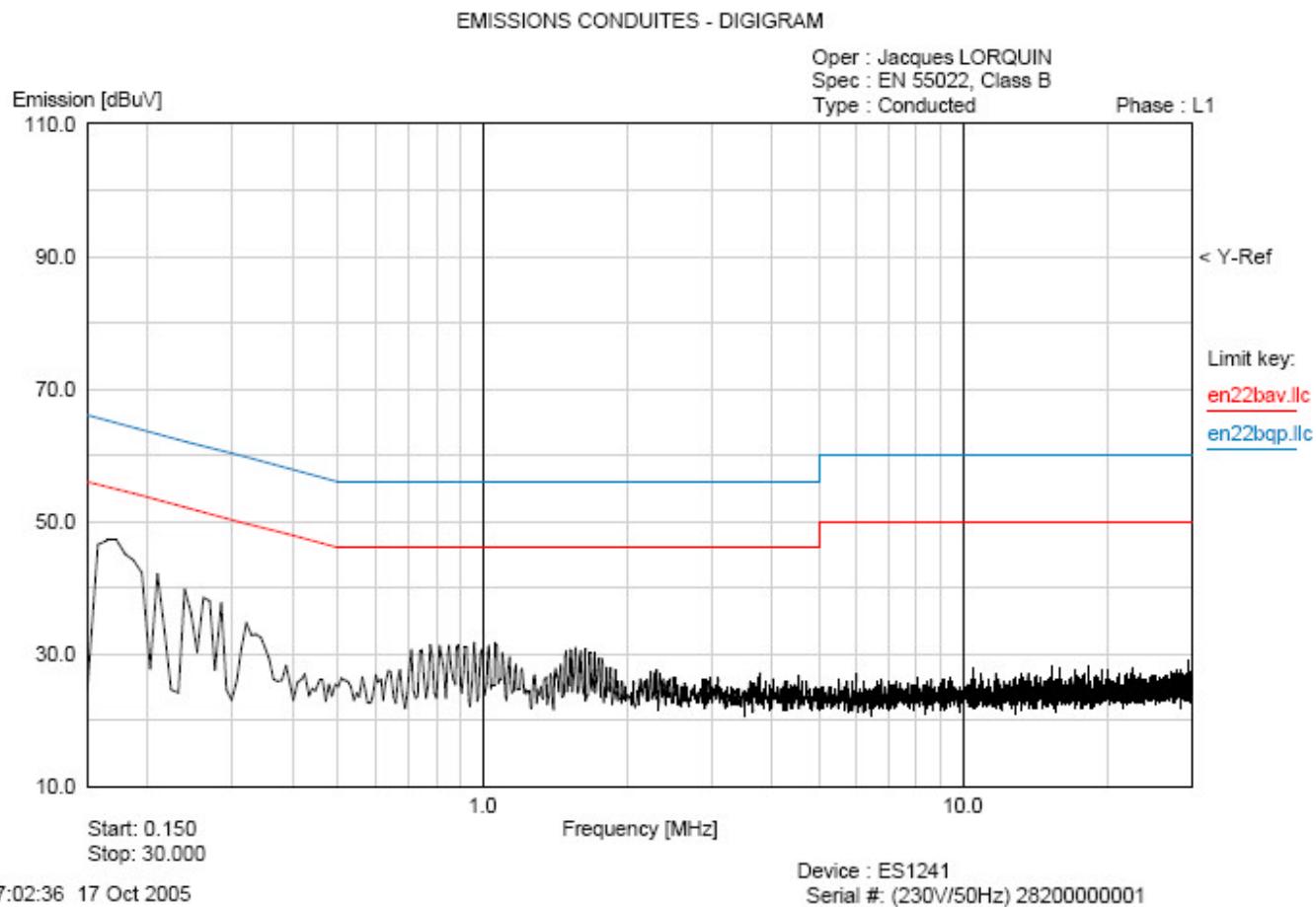
3.3.2. Neutral conducted emission data on ES1241 (110V@60Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	35.82	33.82	30.60	54.00
2	0.210	32.35	27.99	22.92	52.00
3	0.250	31.47	27.15	23.09	50.00
4	0.930	29.85	26.69	22.88	46.00
5	0.960	26.55	21.30	15.33	46.00



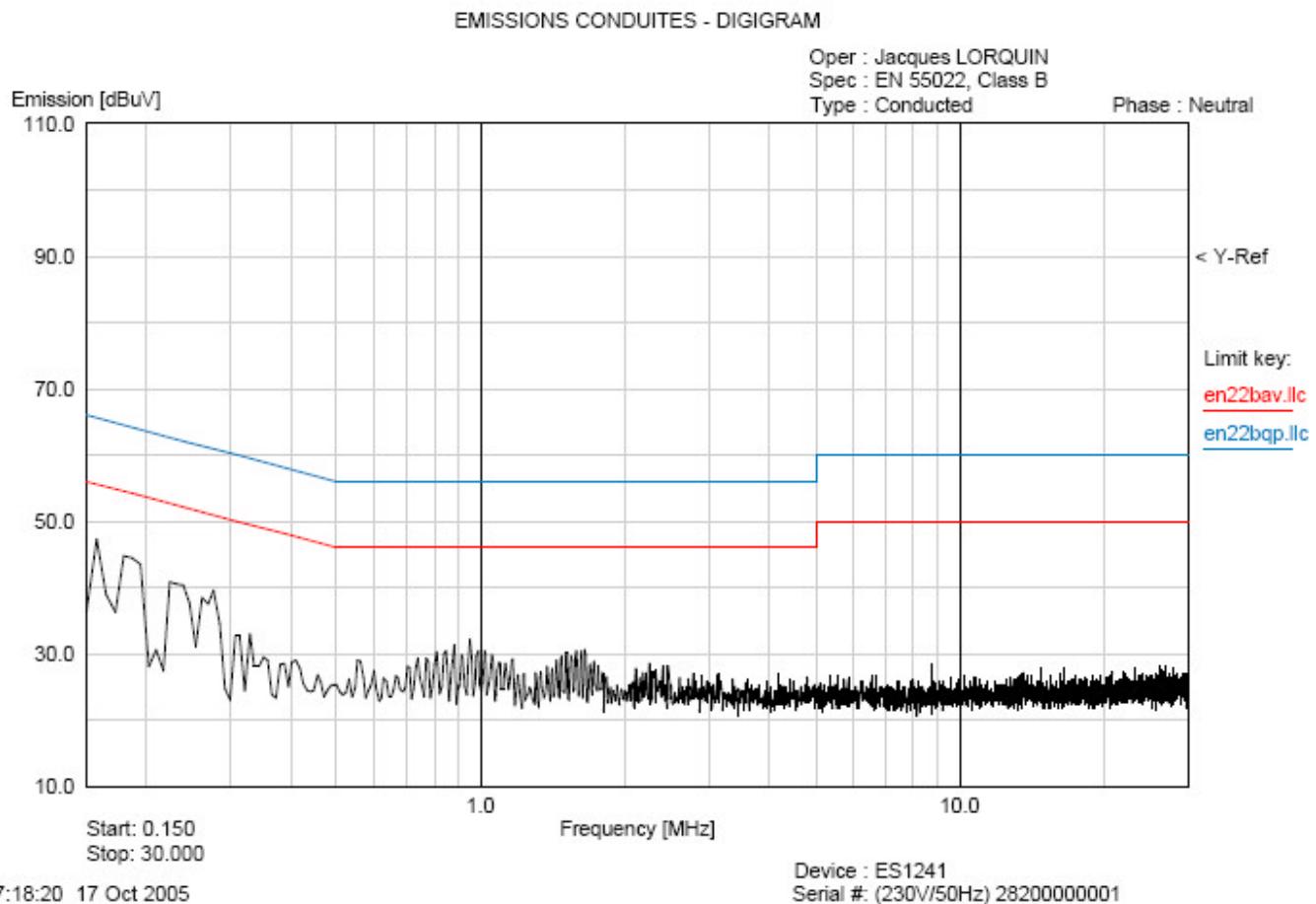
3.3.3. Line conducted emission data on ES1241(230V@50Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	48.49	41.79	19.16	54.00
2	0.190	45.76	38.55	27.36	52.00
3	0.210	42.71	35.72	25.19	52.00
4	0.240	41.18	33.23	15.62	52.00
5	0.270	39.19	30.78	15.11	50.00
6	0.340	33.88	25.72	15.17	48.00
7	0.990	31.81	29.50	26.89	46.00
8	1.020	32.20	29.76	27.21	46.00



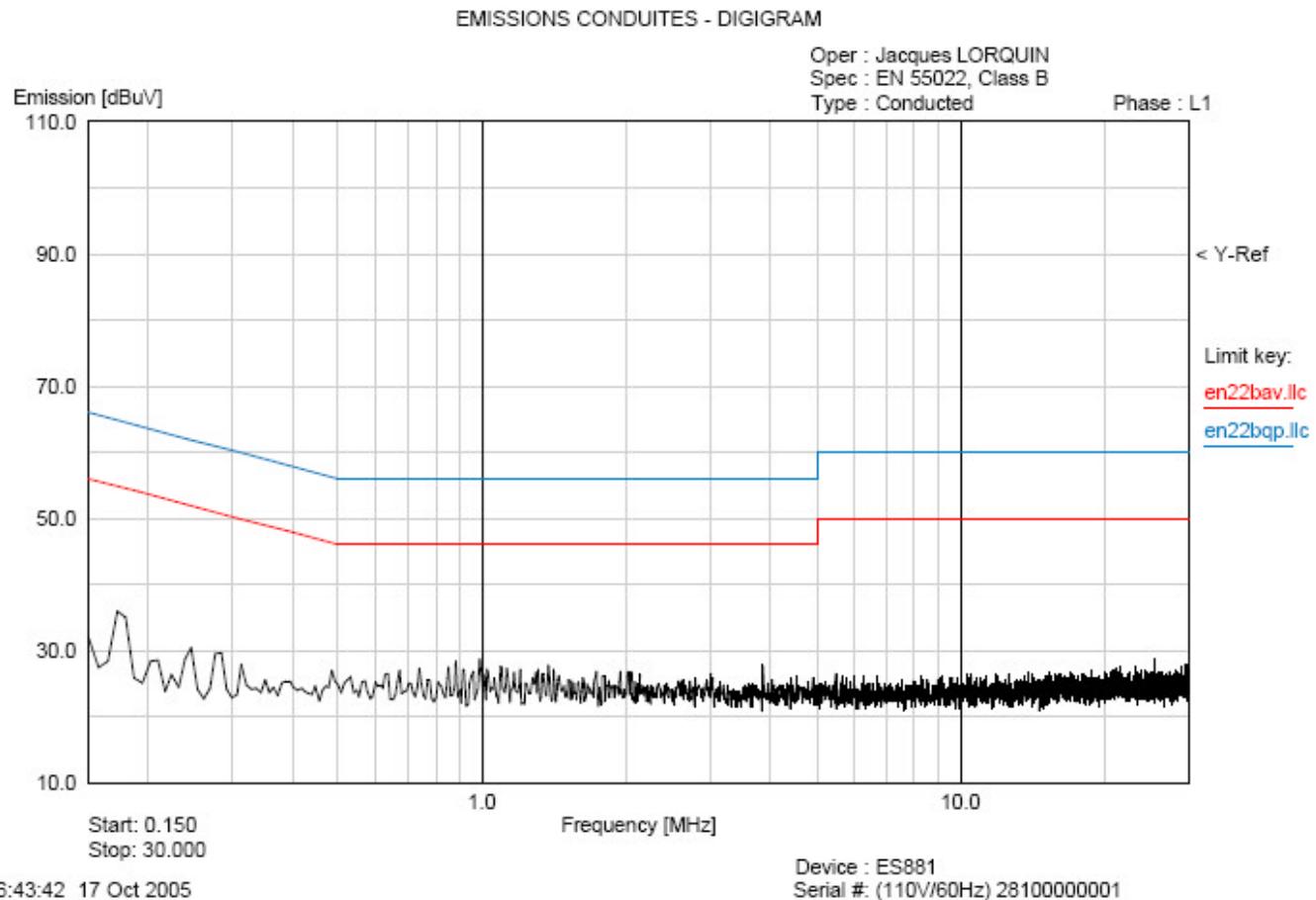
3.3.4. Neutral conducted emission data on ES1241(230V@50Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.160	50.30	42.80	20.33	54.00
2	0.190	47.30	39.99	27.75	54.00
3	0.230	41.51	34.47	16.15	52.00
4	0.270	38.65	31.34	15.09	50.00
5	0.310	34.15	26.53	18.11	48.00
6	0.330	35.14	26.65	19.23	48.00
7	0.360	32.96	26.90	22.99	48.00
8	0.880	31.92	29.58	27.04	46.00
9	0.920	32.41	30.01	27.40	46.00
10	0.940	32.31	29.40	26.70	46.00



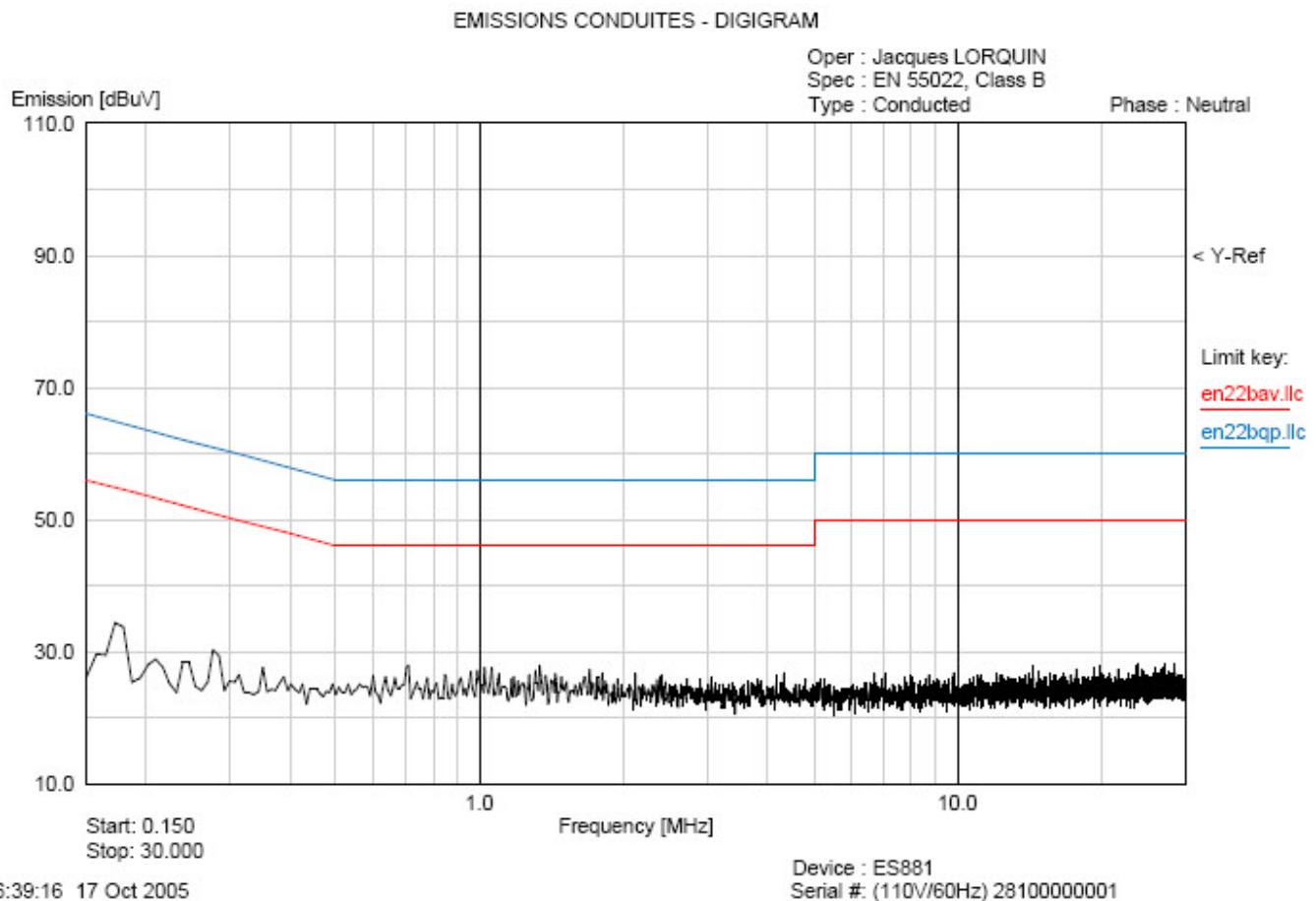
3.3.5. Line conducted emission data on ES881 (110V@60Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.170	36.18	34.15	31.79	54.00
2	0.250	32.38	28.26	25.33	50.00
3	0.280	30.94	27.89	24.67	50.00
4	0.950	28.18	24.60	19.90	46.00
5	0.990	29.40	25.53	20.93	46.00
6	1.030	26.93	21.52	15.73	46.00



3.3.6. Neutral conducted emission data on ES881 (110V@60Hz)

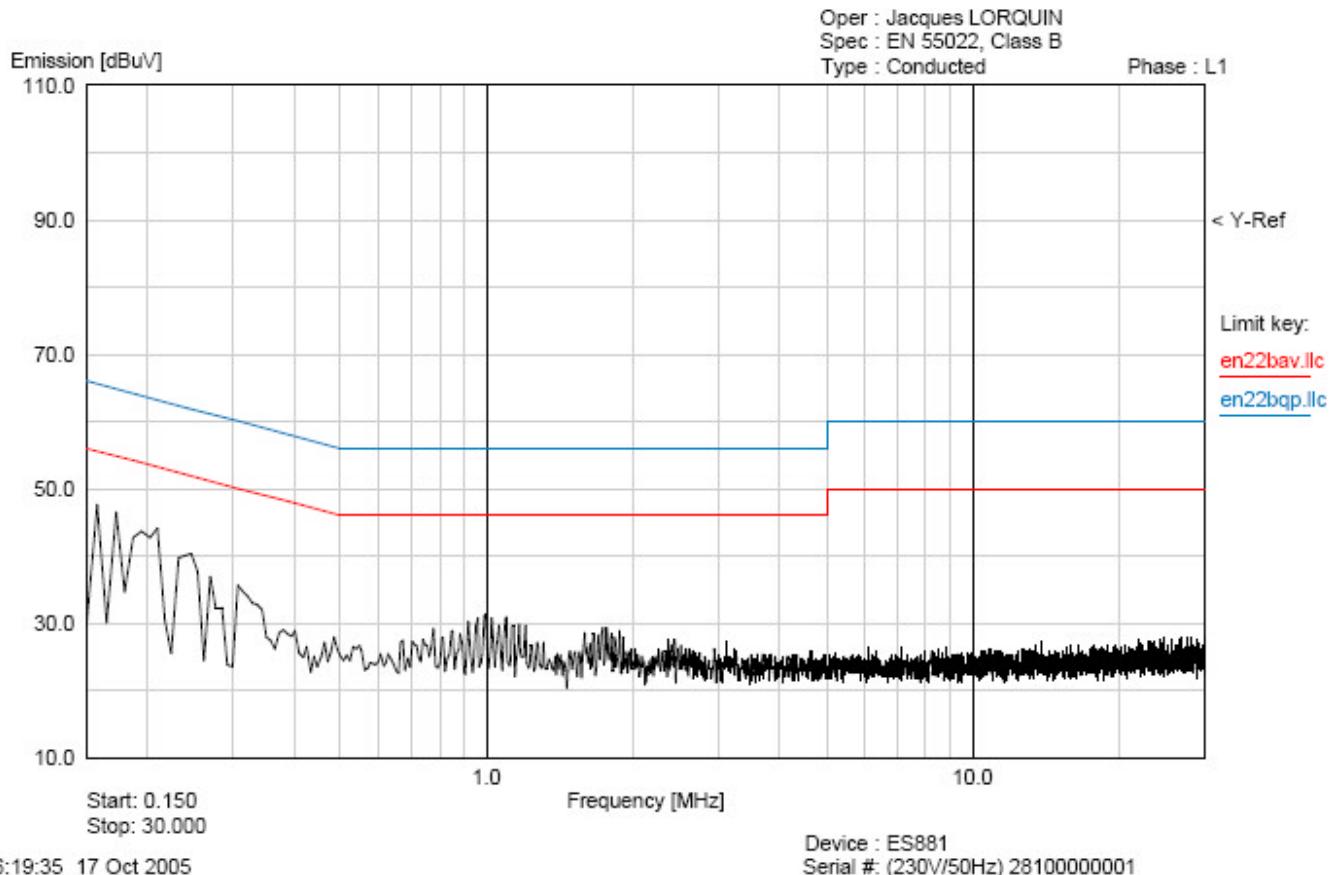


Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	35.90	33.72	31.45	54.00
2	0.210	32.78	26.80	20.58	52.00
3	0.280	32.29	28.69	25.92	50.00
4	0.910	28.83	24.15	19.22	46.00
5	0.950	27.09	23.55	18.27	46.00
6	0.990	28.62	24.78	20.21	46.00



3.3.7. Line conducted emission data on ES881(230V@50Hz)

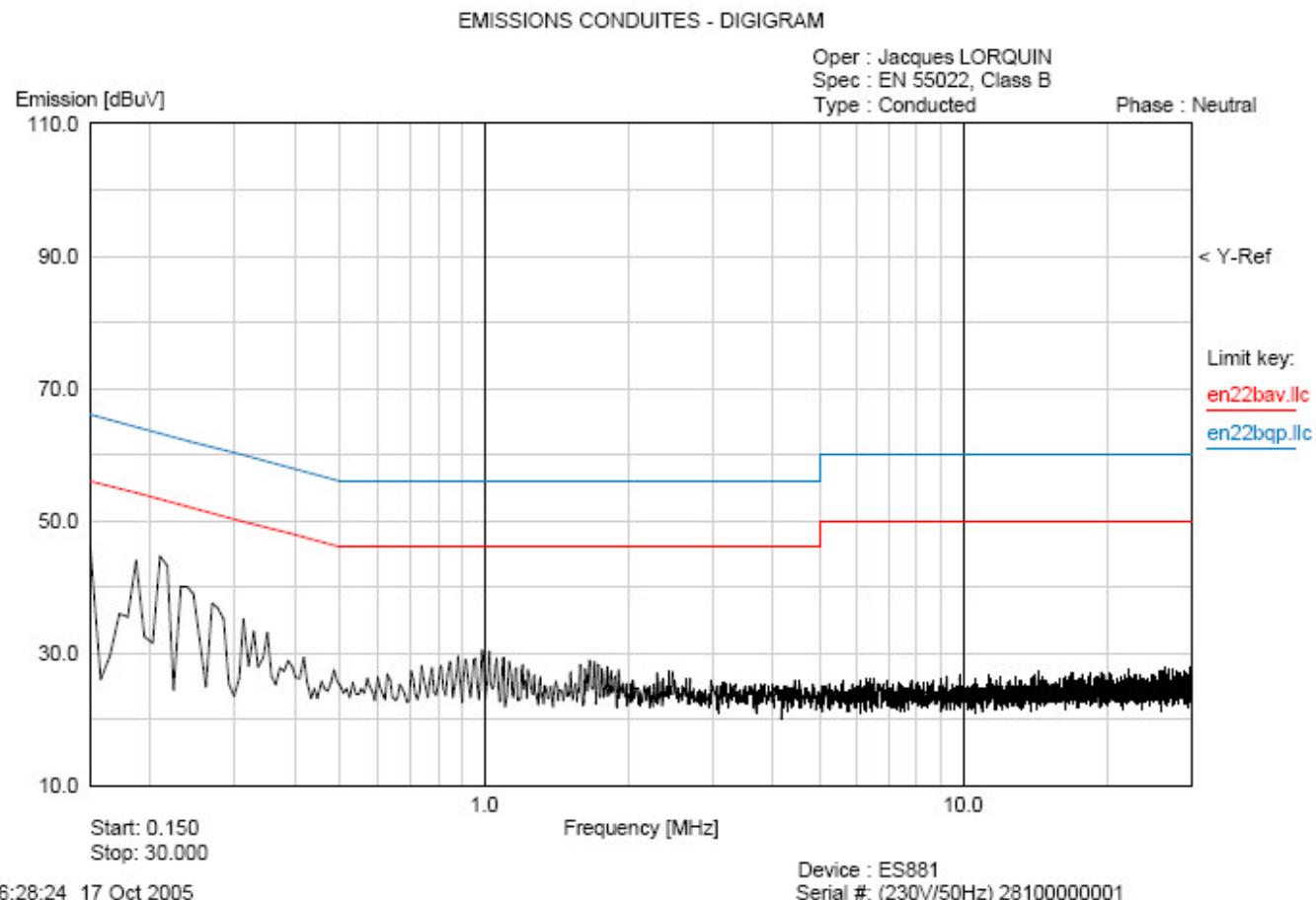
EMISSIONS CONDUITES - DIGIGRAM



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	46.72	39.61	30.93	54.00
2	0.210	44.82	36.21	28.56	52.00
3	0.280	39.11	31.27	28.02	50.00
4	0.160	49.59	42.66	22.36	54.00
5	0.990	31.93	29.16	26.33	46.00
6	1.030	31.93	29.37	26.53	46.00



3.3.8. Neutral conducted emission data on ES881(230V@50Hz)



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.180	47.13	40.29	29.62	54.00
2	0.210	44.79	36.65	29.47	52.00
3	0.280	38.77	31.91	27.41	50.00
4	0.910	31.29	28.07	24.93	46.00
5	0.950	31.05	28.42	25.32	46.00
6	0.990	30.80	28.54	25.50	46.00

End of Tests