Actions Mesures

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EMC TEST REPORT

Nr 3020-FCC

This test report applies only on equipment described hereafter.

Proposal number : 200404-2422

Date of test..... : May 10th, 2004

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

Performed by ..... : Jacques LORQUIN

Customer..... : **DIGIGRAM SA**
Parc Technologique Pré Milliet
F- 38330 MONTBONNOT SAINT MARTIN
FRANCE

Product..... : **ES 220**
ES 220-L

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

Applied standards or specification: EN55022 (1999) +/A1: (2000) +/A1: (2003)
CISPR22 (1997) +/A1: (2000) +/A1: (2002)

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.**

Written by.....: Jacques LORQUIN

Date : Jun 10th , 2004

Approved by.....: Jacques LORQUIN

1. System test configuration

1.1. Justification

The ES220 & ES220-L has the same printed wiring board (PWB), the selection between ES220 or ES220-L is realized with a jump onto the board. Consequently, all test results contained in this test report are from the ES220.

The system was configured for testing in a typical fashion (as a customer would normally use it). A typical ES220 in is connected onto ES220 & ES220-L.

1.2. HARDWARE IDENTIFICATION:

- **Equipment Under Test (EUT):** **ES220** **Sn : proto**
  (Casing : Ni)

- Size : 210x150x40mm

- Input/output :

- 1x power input 5V⎓
- 1x Ethernet IN (100 Mbits/s)
- 1x Ethernet OUT (100 Mbits/s)
- 1x GPIO SubD15 (4x TTL Inputs/ 4x open collectors Outputs)
- 2X Analog audio inputs
- 2X Analog audio outputs

- Frequencies :

50 MHz – 12.288 MHZ.
Bite rate: 100MHz
(No clock or signal higher than 108 MHz)

1.3. 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 ES220* (sn: none)	**IGTES220**	**Ethernet Audio bridges**	Standard power cable unshielded, Ethernet FTP cables CAT5+ Analog audio IN/OUT lines, shielded. GPIO cables, shielded
Analogvision PMIC050 (sn: 0100512)		Power supply of EUT	Standard power cable unshielded,
DIGIGRAM ES220-L* (sn: 150 00000050)	IGTES220	Ethernet Audio bridges	Standard power cable unshielded, Ethernet FTP cables CAT5+
Analogvision PMIC050 (sn: proto)		Power supply of ES220-L	Standard power cable unshielded,
DIGIGRAM ES220* (sn: 0051)	IGTES220	Ethernet Audio bridges	Standard power cable unshielded, Ethernet FTP cables CAT5+
DIGIGRAM (sn: none)	None	I/O Load box	Standard power cable (only for earth connection)

*** : Equipment under test**

1.4. Running mode :

ES220 is loaded by ES220, ES220-L and the load box.

For testing the **ES220**, its Ethernet OUT port is sending signal to the IN port of an ES220-L equipment. Its Ethernet IN port is connected to an ES220 (not powered, used as an auxiliary) in order to simulate typical load on the port.
Analog inputs are connected to the load box (47?).
See figure#1 for wiring diagram.

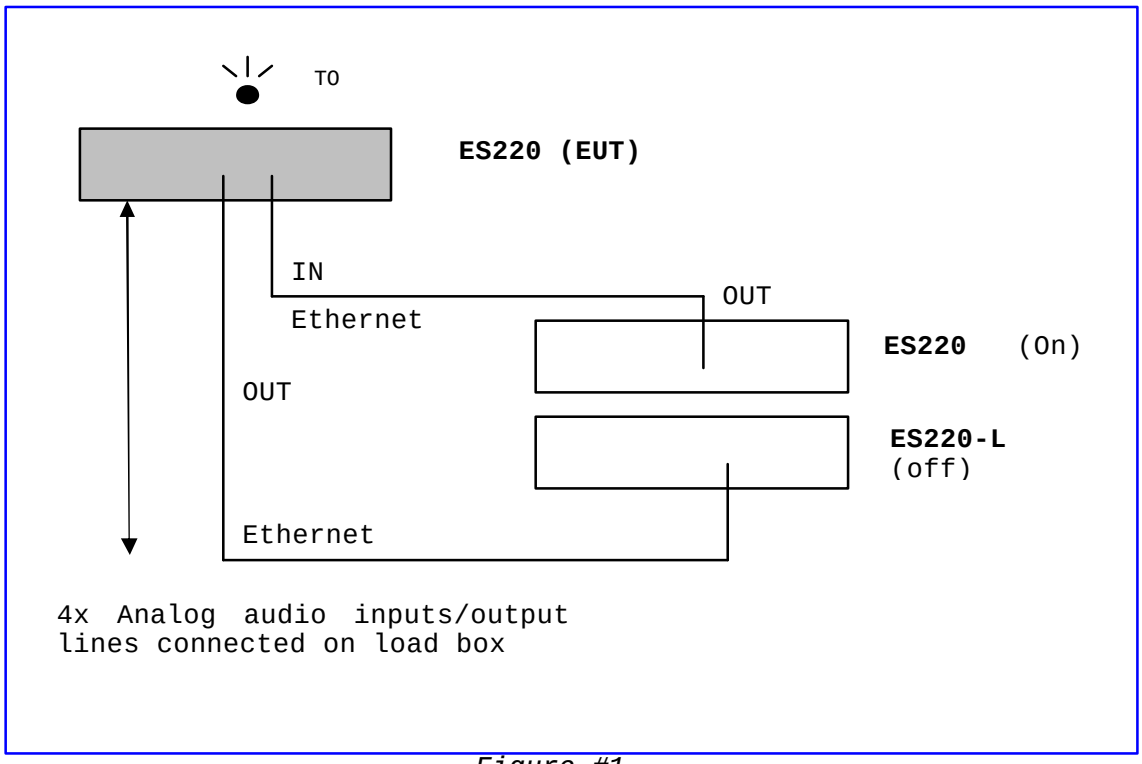


Figure #1

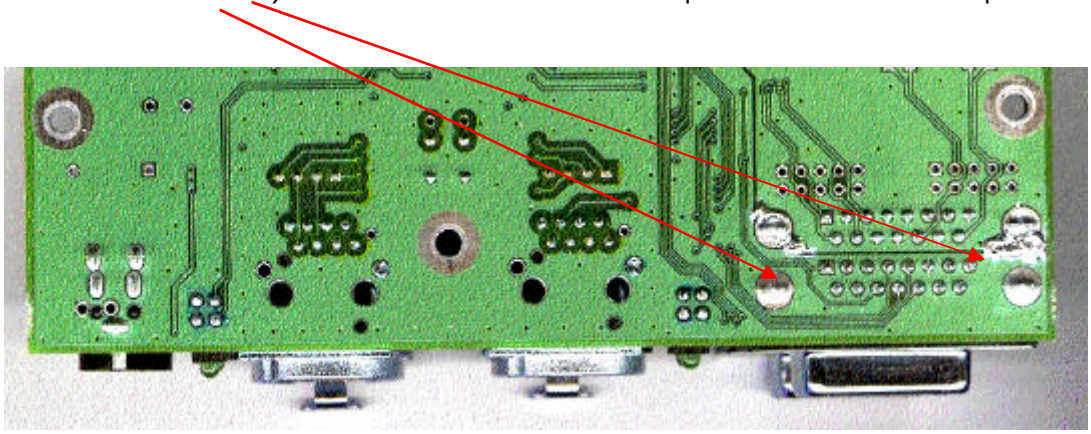
1.5. I/O cables

- 3x Power cord (power supply adapter), unshielded, length: 1.8m
- 4x XLR cords, shielded, length: 1.5m
- 1x GPIO cables, shielded, length: 1.5m
- 2x Ethernet FTP Cat5+ (shielded) cable, length: 2.1m ①
- 2x Ethernet FTP Cat5+ (shielded) cable, length: 2.1m connected on ES220-L②
- 2x Ethernet FTP Cat5+ (shielded) cable, length: 10m connected on ES220②
- 1x audio cable of ES220 (L in, R in, Lout, Rout)

① : Cables used for radiated test
② : Cables used for conducted test

1.6. Equipment modifications

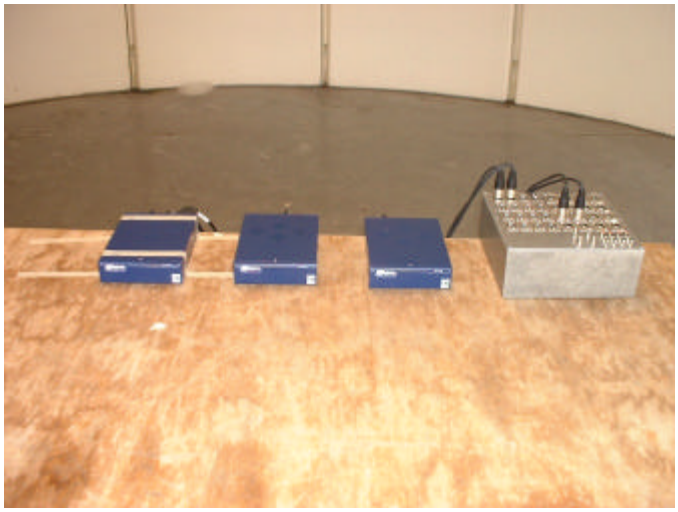
The audio GND and digital GND are connected with 2pts near SubD15 connectors (see photos for more detail). The unit tested was representative to a production unit.



2. Radiated emission data

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 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

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).

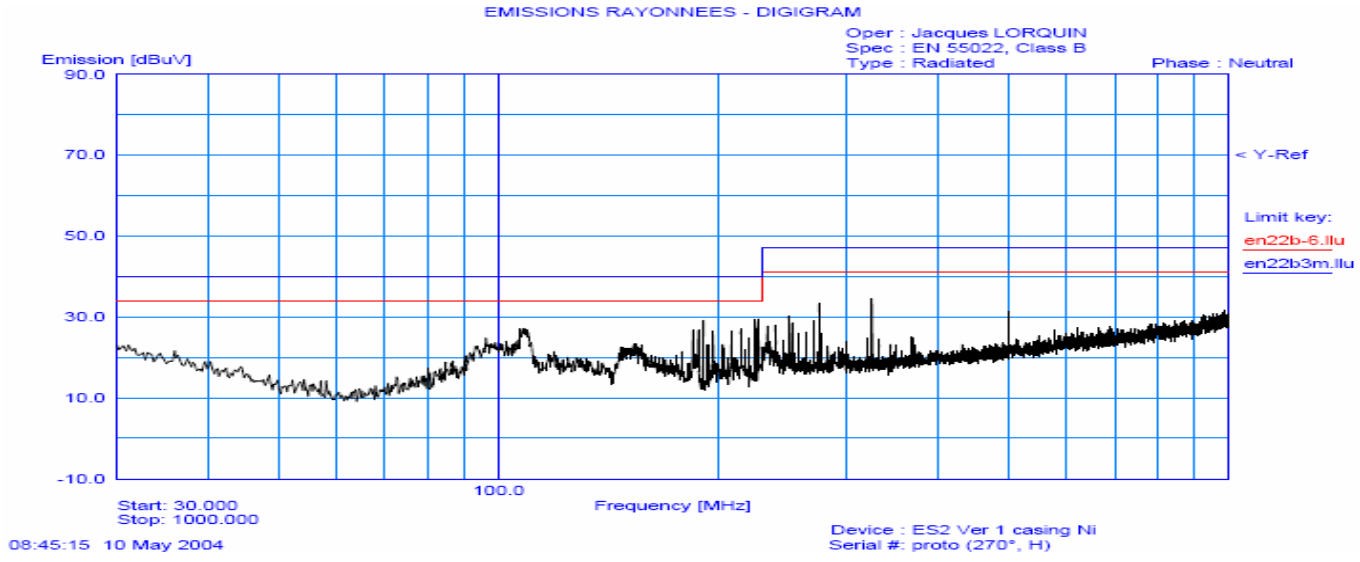
Pre-scan, test Equipment from 30MHz to 1GHz:

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

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.



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

The product has been tested according to ANSI C63.4-(2000), CISPR22-1997/A1:2000 and EN55022:1998/A1:2000. Radiated Emission was 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 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 (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)	Comments
1	43.495	30.0	25.7	**-4.3**	99	V	102	11.6	
2	107.954	30.0	25.9	**-4.1**	124	V	116	15.2	
3	225.019	30.0	29.7	**-0.3**	162	V	102	14.2	
4	249.991	37.0	24.8	**-12.2**	16	V	102	14	
5	275.015	37.0	30.4	**-6.6**	100	H	292	15.3	
6	325.006	37.0	26.5	**-10.5**	293	H	292	17.2	
7	500.006	37.0	35.3	**-1.7**	191	V	343	21.4	

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 52.5dBµV 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 dBµV/m.

FS = 52.5 + 7.4 + 1.1 – 29 = 32 dBµV/m

The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm [(32dBµV/m)/20] = 39.8 µV/m.

3. Conducted emission data

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

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 / 50µH) and auxiliaries are powered by another LISN.
The distance between the EUT and each auxiliary is 10cm.

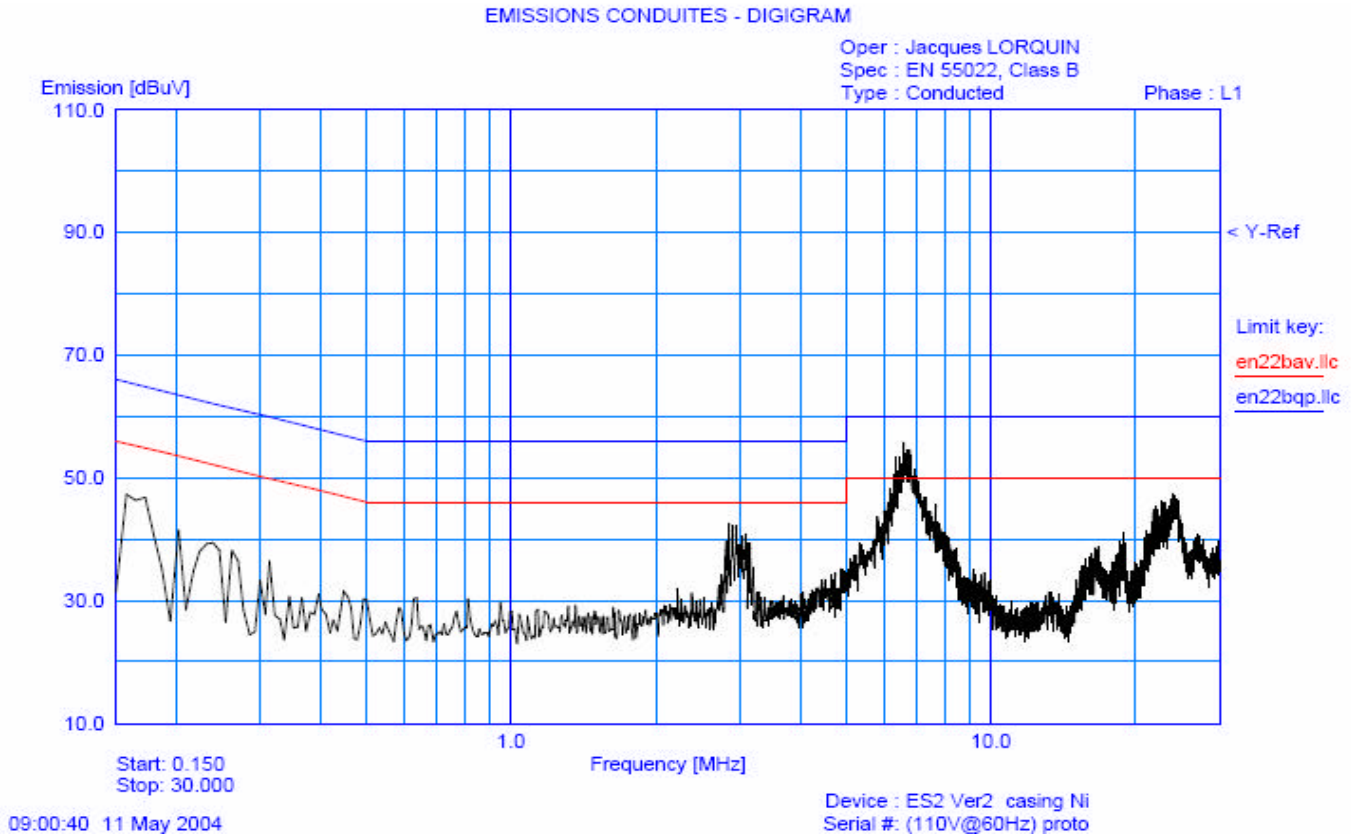
3.2. TEST EQUIPMENT

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

3.3. TEST SEQUENCE AND RESULTS

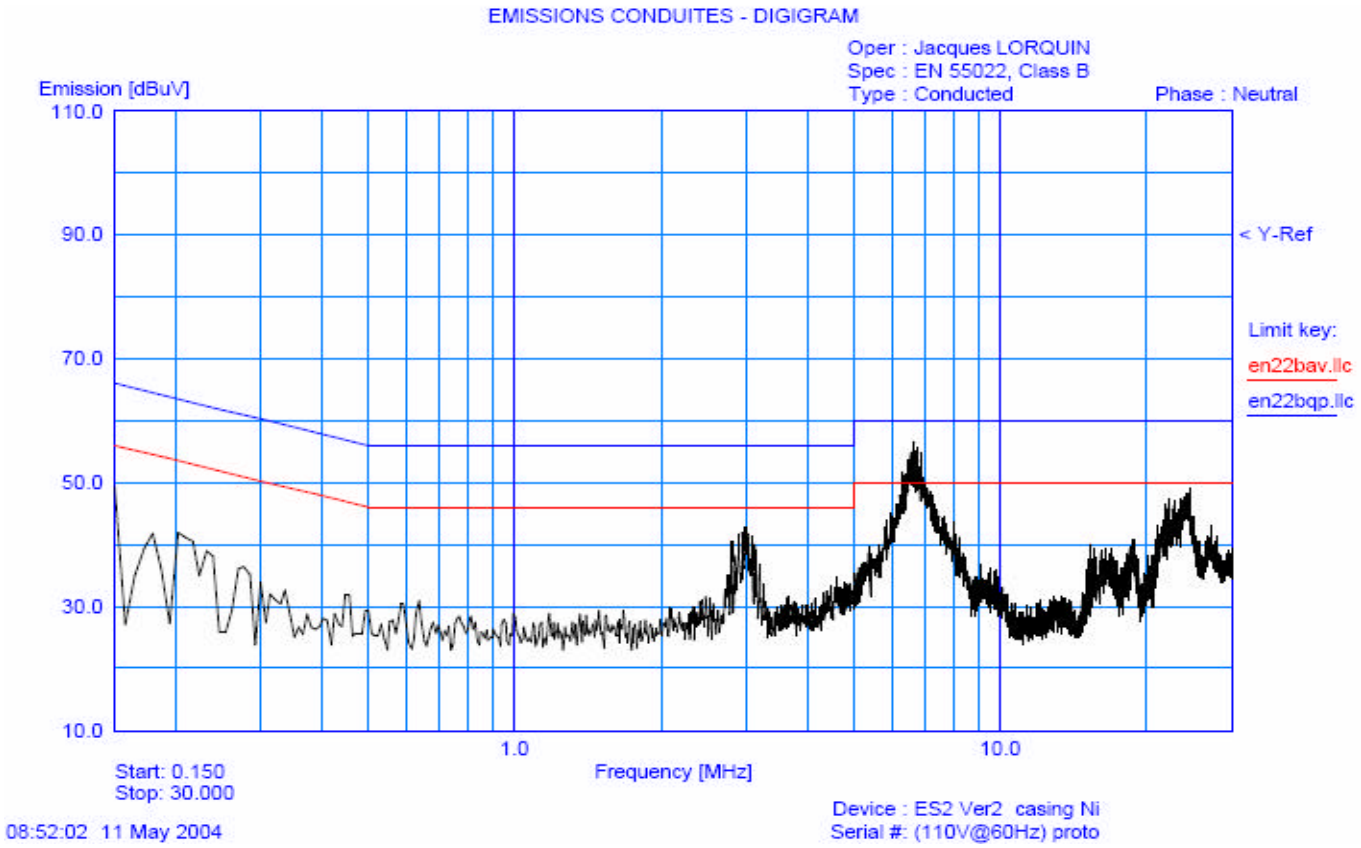
Measures are performed on line 1 and neutral of the power supply of the ES220 equipment.

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



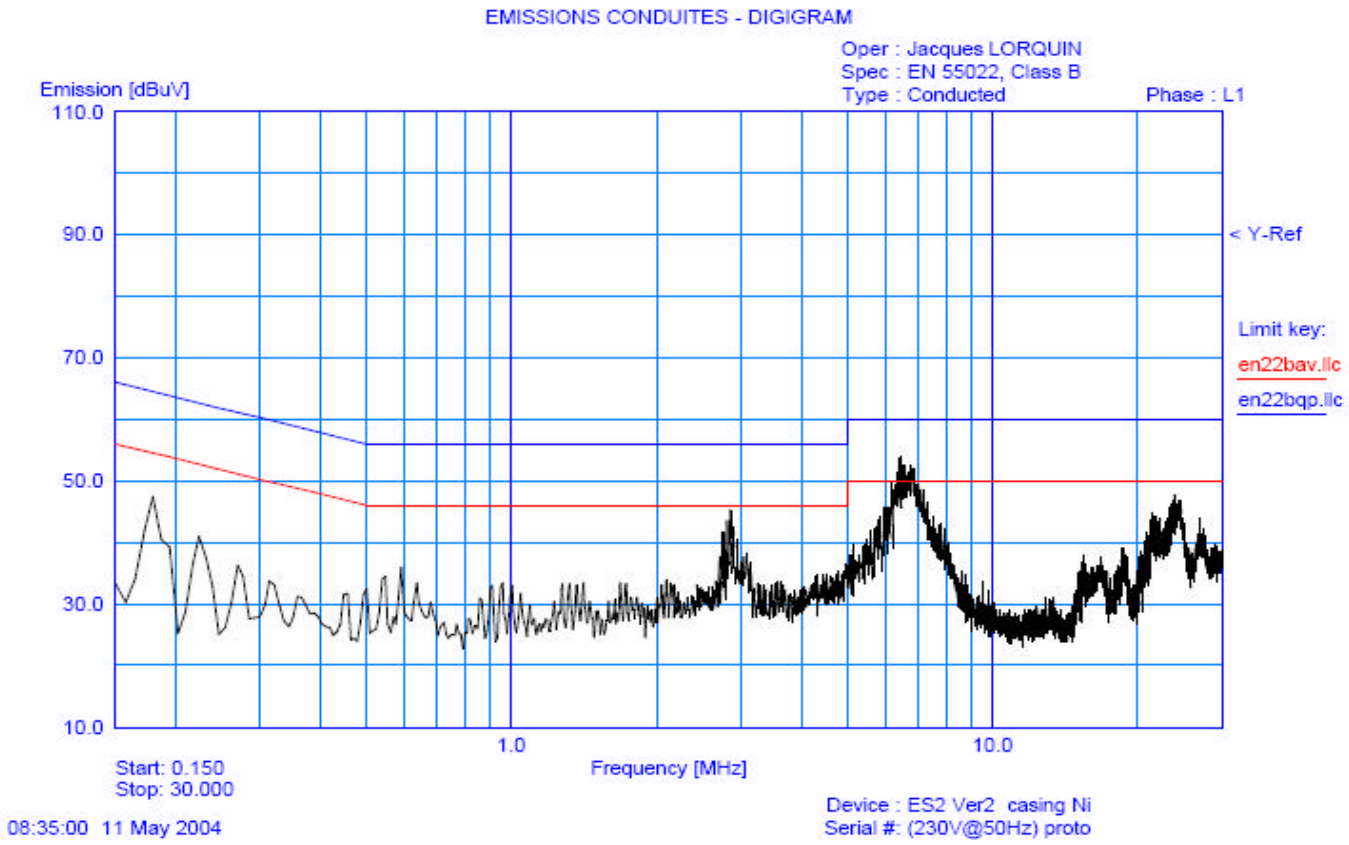
Marker ▽	Frequency [MHz]	Peak [dBuV]		Q-Peak [dBuV]		Average [dBuV]	Limit [dBuV]
1	0.170	49.04		41.80		19.72	54.00
2	0.230	42.40		34.67		23.35	52.00
3	0.260	37.44		30.35		21.02	50.00
4	2.840	44.82		40.81		32.06	46.00
5	2.930	41.75		37.26		29.94	46.00
6	3.030	39.80		35.84		26.99	46.00
7	3.080	37.25		33.38		24.85	46.00
8	6.340	52.93	*	48.72		37.83	50.00
9	6.570	56.31	*	51.15	*	40.62	50.00
10	6.660	57.00	*	50.96	*	41.42	50.00
11	6.760	55.72	*	49.97		41.69	50.00
12	22.54	45.03		38.97		29.38	50.00
13	24.26	47.02		42.10		35.03	50.00

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



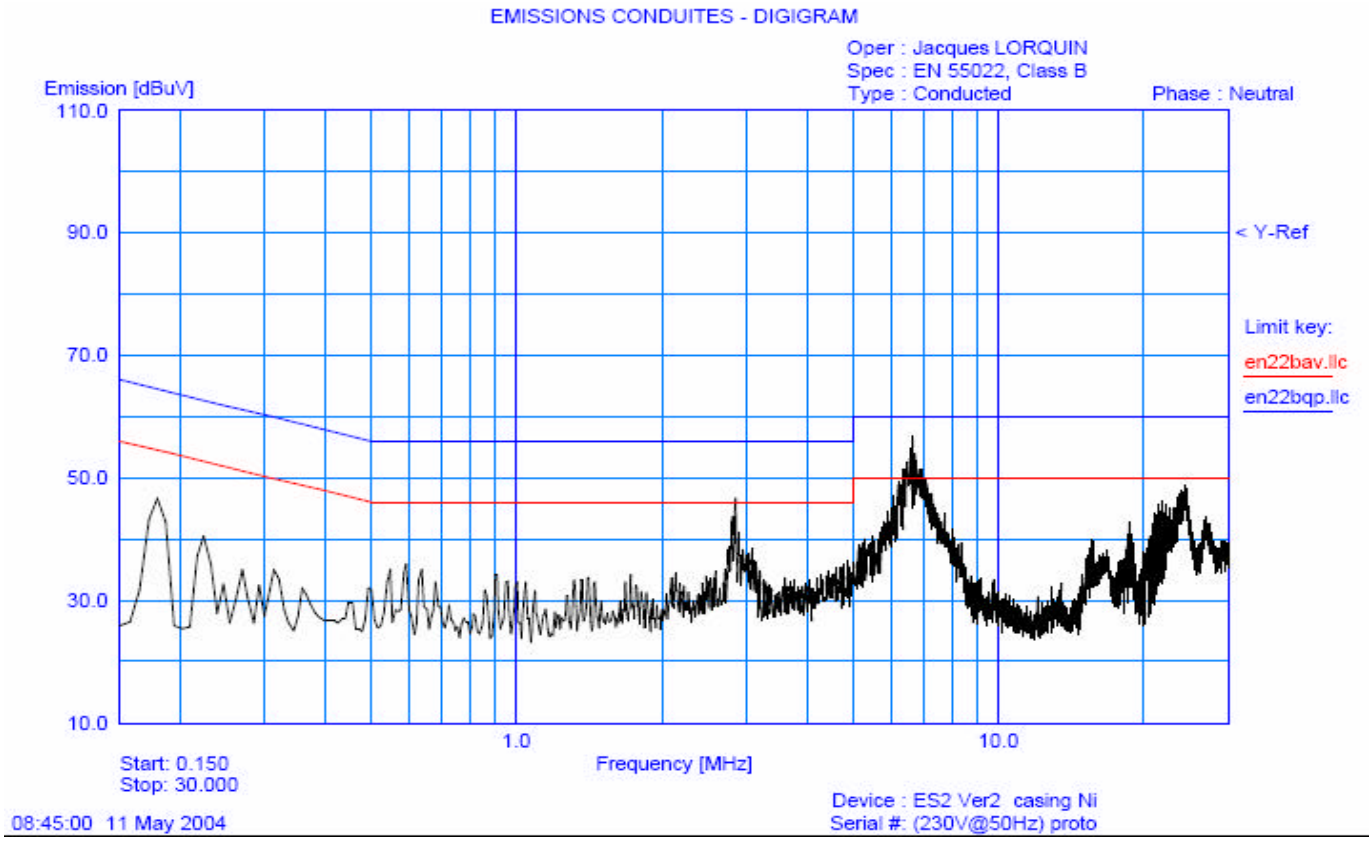
Marker ▽	Frequency [MHz]	Peak [dBuV]		Q-Peak [dBuV]		Average [dBuV]	Limit [dBuV]
1	0.180	47.36		41.05		28.72	54.00
2	0.200	44.26		37.02		19.21	52.00
3	0.230	42.22		35.05		23.58	52.00
4	2.930	43.92		37.90		30.44	46.00
5	2.970	43.44		37.48		30.27	46.00
6	3.010	41.18		36.58		29.83	46.00
7	6.300	53.32	*	48.19		37.85	50.00
8	6.530	56.80	*	51.72	*	40.89	50.00
9	6.570	56.97	*	52.30	*	41.72	50.00
10	6.620	57.34	*	51.82	*	41.55	50.00
11	6.670	55.99	*	50.51	*	40.28	50.00
12	6.710	56.20	*	51.61	*	42.77	50.00
13	6.760	55.95	*	50.91	*	42.49	50.00
14	6.850	51.75	*	47.28		40.54	50.00
15	22.85	45.71		39.75		31.89	50.00
16	24.23	49.71		43.05		36.11	50.00

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



Marker ▽	Frequency [MHz]	Peak [dBuV]		Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	6.410	51.95	*	46.49	34.23	50.00
2	6.570	53.19	*	48.15	37.33	50.00
3	6.810	53.74	*	48.57	40.70	50.00
4	0.180	45.70		44.18	33.12	54.00
5	0.220	40.67		38.74	28.99	52.00
6	0.270	38.15		33.36	27.41	50.00
7	0.320	33.41		31.08	27.83	48.00
8	2.790	44.15		41.40	30.33	46.00
9	2.830	46.56	*	44.06	33.13	46.00
10	2.870	45.61		42.61	33.67	46.00
11	21.63	43.52		37.50	24.66	50.00
12	23.94	46.64		41.48	34.53	50.00
13	24.46	46.95		42.38	35.67	50.00

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



Marker ▽	Frequency [MHz]	Peak [dBuV]		Q-Peak [dBuV]		Average [dBuV]	Limit [dBuV]
1	0.180	47.46		46.02		34.33	54.00
2	0.220	40.72		38.97		29.37	52.00
3	0.270	36.60		34.27		27.47	50.00
4	2.790	43.91		41.27		30.56	46.00
5	2.840	45.38		42.24		31.35	46.00
6	2.890	41.18		36.27		29.54	46.00
7	6.450	53.89	*	48.27		36.17	50.00
8	6.550	55.77	*	50.58	*	38.66	50.00
9	6.630	56.60	*	52.57	*	41.02	50.00
10	6.720	56.98	*	50.72	*	41.97	50.00
11	6.830	53.73	*	49.46		42.77	50.00
12	21.74	44.83		39.30		26.34	50.00
13	24.32	47.74		43.24		36.38	50.00

End of Tests