



EMC TEST REPORT

Nr 3322-FCC

This test report applies only on equipment described hereafter.

Proposal number : 200502-2631

Date of test..... : February 24th, 2005

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..... : **PCX1221HR, PCX1222HR, VX1221HR, VX1222HR**

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 standards (class B), in radiated and conducted emissions.**

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Written by : Jacques LORQUIN

Approved by..... : Jacques LORQUIN

Date : March 7th, 2005



1. System test configuration

1.1. Justification

The PCX1222HR, VX1222HR card has the same mother board and daughter board, only software changed between the both cards. The VX1221HR & PCX1221HR has the same products of the first cards without the daughter board. Consequently, all test results contained in this test report are from the PCX1222HR.

The system was configured for testing in a typical fashion (as a customer would normally use it). A typical PCX1222HR is set into a PC, and I/O ports are connected on typical load. The soft test play & record in loop a sound.

1.2. HARDWARE IDENTIFICATION:

➤ **Equipment Under Test (EUT):** PCX1222HR Sn : 20000000005

➤ **Size** : PCI card

➤ **Input/output : SubD 62HD**

- 6x digital audio outputs
- 2x digital audio inputs
- 1x video input
- 1x LTC input
- 1x Word Clock input
- 1x Word clock output
- 12X Analog audio inputs
- 2X Analog audio outputs

➤ **Frequencies :**

Oscill. 49.152MHz, 45.1584MHz, 28.224MHz, 66MHz.

PLL: 254MHz

Bite rate: 66MHz

(No clock or signal higher than 500MHz)



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 PCX882HR* (sn: 00000001)	IGTX1222HR	PCI Audio card	I/O cable, shielded
DELL Precision 670 pn:WHL (sn: 188X91J)	D.O.C.	Personnel computer	Standard power cable unshielded, All I/O cables are shielded.
HEWLETT PACKARD pn:D2846 (sn: JP74001000)	D.O.C.	monitor	Shielded cable
HEWLETT PACKARD pn:C4734-60111 (sn: M971168931)	GYUR38SK	Keyboard PS/2	Shielded cable
LOGITECH pn:851841-1000 (sn:LNA34465467)	JNZ211443	Mouse PS/2	Shielded cable
Microsoft pn:X05-87477 (sn:53121-576-5475527-10000)	D.O.C.	Mouse USB	Shielded cable
HEWLETT PACKARD - Deskjet 895CXI (sn: MY9761915S)	D.O.C.	Parallel Printer	Shielded cable
HEWLETT PACKARD pn: C2106A (sn: 3110S58792)	B94C2106X	Serial Printer	Shielded cable
Telex (sn: 700373.000A)	None	Microphone	Unshielded cable
Labtec LT-100 pn:D8387A (sn: none)	None	Headset	Unshielded cable
HEWLETT PACKARD 48GX (sn:ID83802369)	None	Graphic calculator	Serial adapter shielded
Intel YC76 (sn: 0045143)	EDUYC76	WebCam	Shielded cable
Olympus C-725 (sn: 186004098)	D.O.C.	Digital Camera	Shielded cable
DIGIGRAM	None	Load box	Standard power cable unshielded

* : Equipment under test

1.4. Running mode:

PCX1222HR is loaded by load box.

For testing the PCX1222HR, I/O are loaded by dummy loads (load box) in order to simulate typical load on each ports:

AES EBU IN1 & SYNC → 110 ?

AES EBU OUT (from 1 to 5) → 100 ?

AES EBU OUT 6 → 110 ?

OUT 1 → 13k?

OUT 2 → 13k?

OUT 3 → 13k?

OUT 4 → 13k?

OUT 5 → 110?

OUT 6 → 13k?

OUT 7 → 13k?

OUT 8 → 110?

OUT 9 → 13k?

OUT 10 → 13k?

OUT 11 → IN 1

OUT 12 → IN 2



Video input, LTC, Word clocks: 68?

Soft: PCX1222.exe under Windows XP professional:

Qualification audio:

- Audio play.
- Audio processing
- Audio record.

1.5. I/O cables

- 2x Power cord (PC&Monitor), unshielded, length: 1.8m
- 1x Video cable with ferrites at each end, shielded, length: 1.8m
- 1x USB cable, shielded, length: 2m
- 1x serial adapter for graphic calculator, shielded, length: 1.5m
- 1x Parallel cable HP# C2950A , shielded, length: 2m
- 1x LAN cable STP Cat5e (shielded) cable, length: 2m
- 1x Serial cable HP#24542G (for printer), shielded, length: 3m
- 1x Y cable adapter (From 1xDVI to 2xVGA (HD15) connectors), shielded, length: 0.2m

1.6. Equipment modifications

No modifications are necessary for achieved test. The unit tested was representative to a production unit.

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.



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	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 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	194.0100.50
Tube ferrite	LÜTHI	FTC101	4485
Absorbing clamp	LÜTHI	MDS21	2826

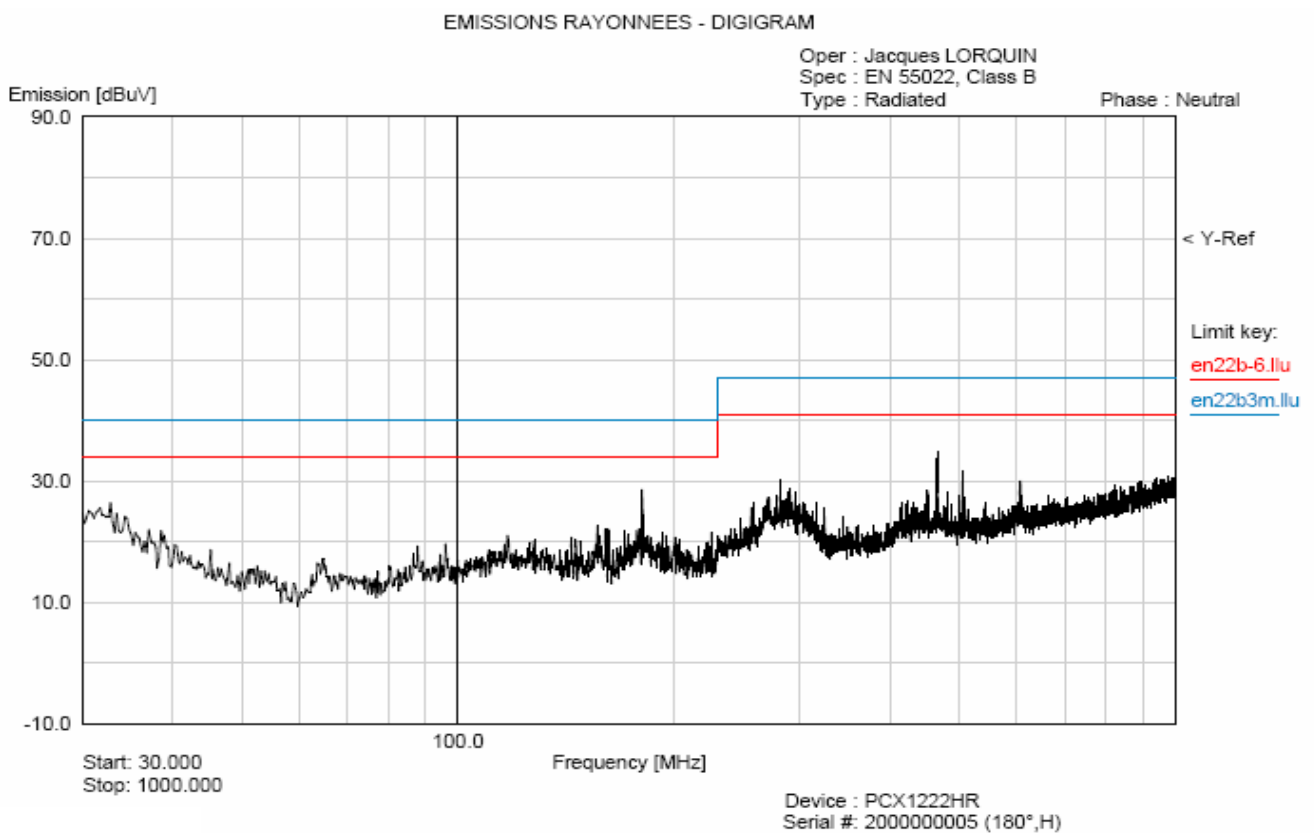


2.3. TEST SEQUENCE AND RESULTS

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-(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 (dBμV/m)	QPeak (dBμV/m)	QPeak-Lmt (dB)	Pol	Hgt (cm)	Angle (deg)	Tot Corr (dB)	Comments
1	108.678	30.0	23.1*	-6.9	V	184	62	15.1	*Peak measure
2	180.630	30.0	29.7	-0.3	V	376	39	18	S/B<6dB
3	189.026	30.0	25.7	-4.3	H	234	247	18.6	
4	195.690	30.0	20.4	-9.6	V	103	33	19	
5	220.242	30.0	24.4	-5.6	V	259	173	13.6	
6	466.415	37.0	30.1	-6.9	H	183	225	20.4	
7	899.976	37.0	28.3	-8.7	H	203	3	27.1	

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.

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

The 32 dBμV/m value can be mathematically converted to its corresponding level in μV/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. Radiated emission data from 1GHz to 2GHz

3.1. 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.



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.

3.2. TEST EQUIPMENT

Test Equipment from 1 to 2GHz:

Equipment	Company	Model	Serial
Spectrum Analyzer	HP	8593E	3409U00537
Horn Antenna	EMCO	3115	6382
Amplifier 1-8GHz	SMEE	144-CEM	

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



3.3. TEST SEQUENCE AND RESULTS

3.3.1.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 1 meters.

In order to determine frequencies to be measured on the open site, a manual search is performed in the anechoic chamber.

3.3.2.Characterization on 3 meters open site

The product has been tested according to 47 CFR Part 15/ANSI C63.4 above 1GHz.

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 3.1.

Frequency list has been created with anechoic chamber precharacterization results.

Peak measurement: IF BW = 1 MHz and AV BW = 1MHz. AV= AVERAGE

Frequency (GHz)	Peak Lmt (dBμV/m)	Peak (dBμV/m)	AV Lmt (dBμV/m)	Average (dBμV/m)	Worst Margin (dB) (at least)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)
1.00795	73.9	54.3	53.9	49.2	-4.7	165	V	101	-7.48
1.06403	73.9	43.4	53.9	/	(-10.5)	0	V	104	-5.83
1.19800	73.9	49.9	53.9	42.8	-11.1	230	H	108	-5.83
1.49500	73.9	47.9	53.9	41.5	-12.4	290	H	108	-6.71
1.60015	73.9	50.7	53.9	43.6	-10.3	313	V	114	-4.07
1.80300	73.9	48.1	53.9	38.4	-15.5	145	H	100	-3.29
1.99073	73.9	50.1	53.9	40.9	-13	14	H	132	-3.29



4. 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.

4.1. 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 (PC with audio card) 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.

**4.2. 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) 50Ω / 50μH	Telemeter Electronis	TGmbH 2/16	NNB 9511-11821628
Faraday room	Rayproof		4854

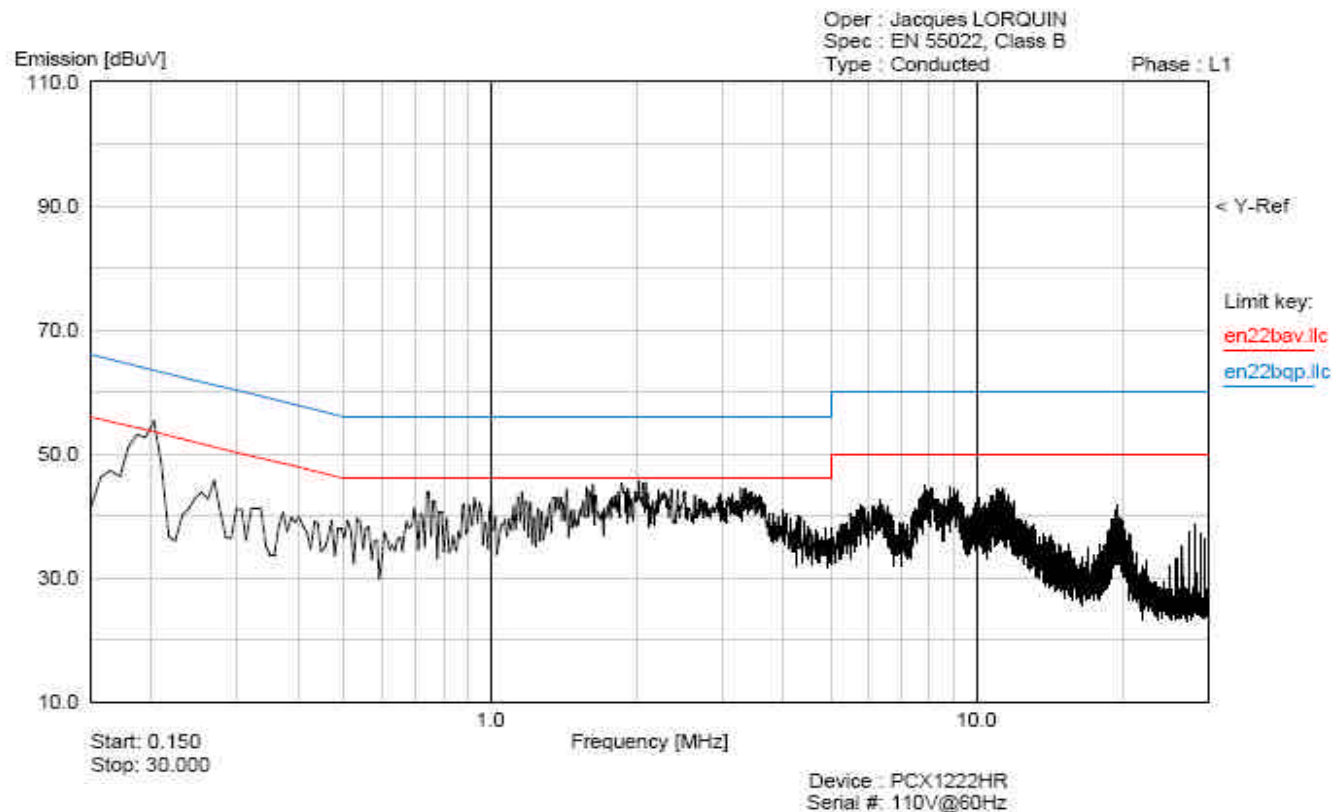


4.3. TEST SEQUENCE AND RESULTS

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

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

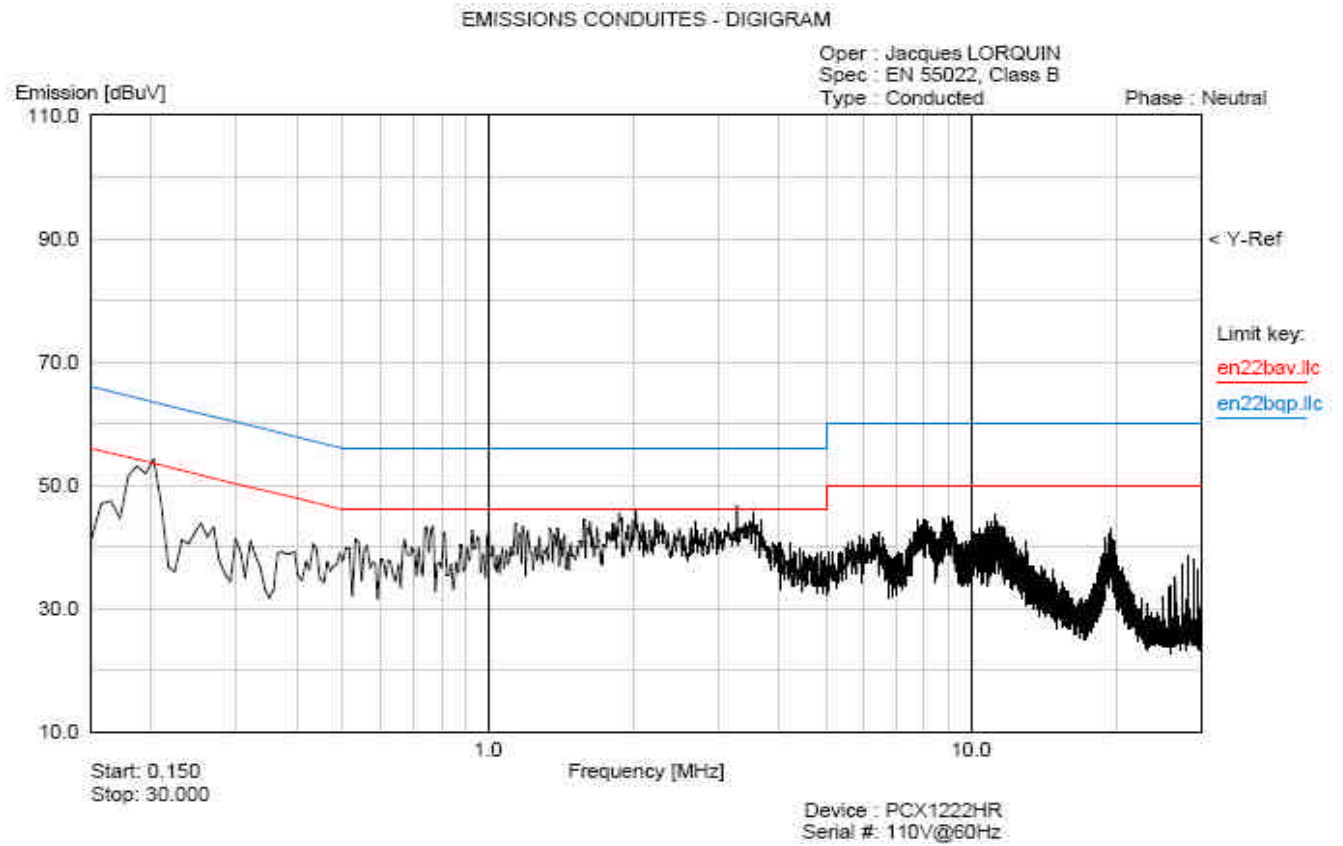
EMISSIONS CONDUITES - DIGIGRAM



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	53.65	51.26	44.58	54.00
2	0.200	55.76 *	54.09 *	47.54	52.00
3	0.270	46.56	44.54	37.85	50.00
4	0.330	42.76	39.97	35.18	48.00
5	2.020	44.80	40.07	34.78	46.00
6	2.070	46.30 *	42.50	37.04	46.00
7	8.080	45.06	42.63	40.63	50.00
8	9.030	45.78	42.37	38.76	50.00
9	19.44	42.20	36.45	27.06	50.00



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

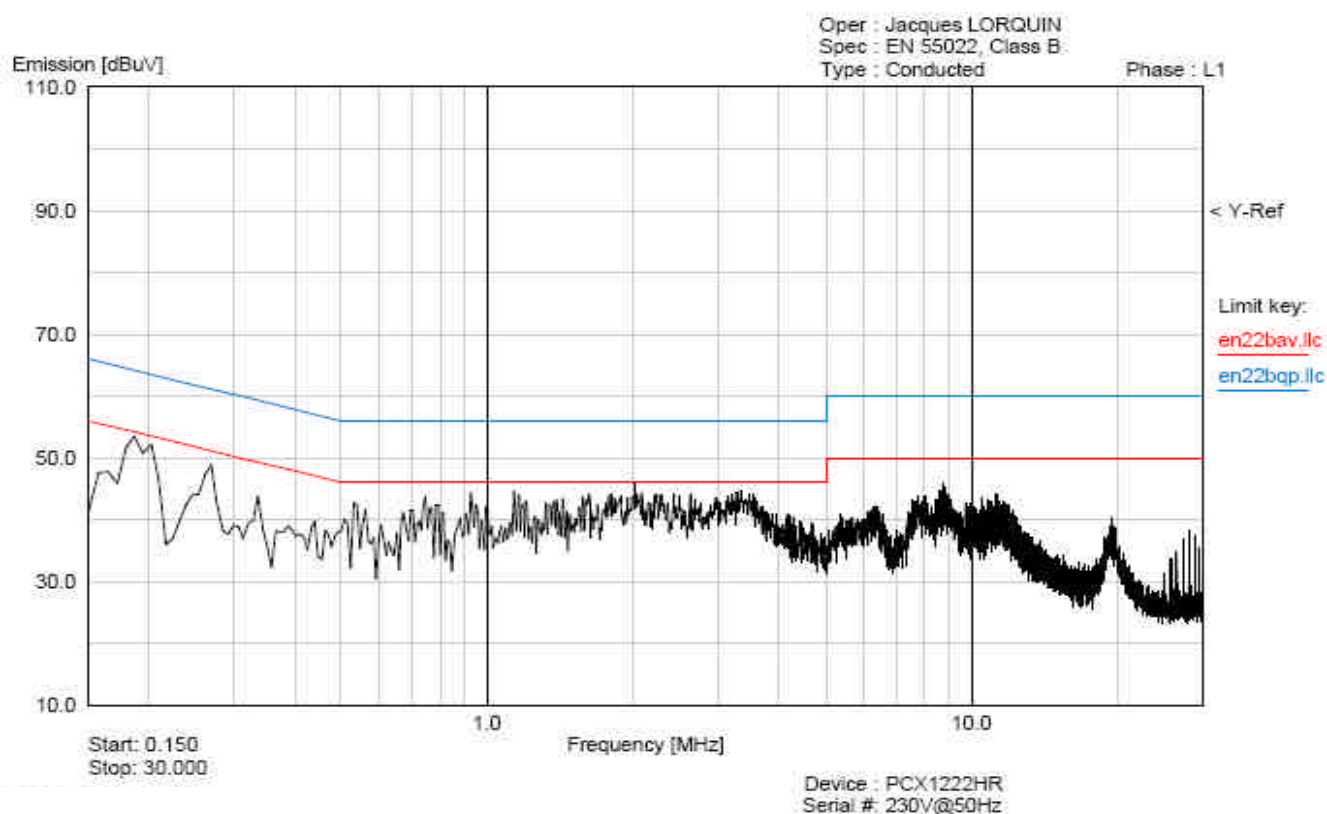


Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	53.31	51.16	44.30	54.00
2	0.200	54.62	52.53	47.76	52.00
3	0.250	45.40	41.59	35.32	50.00
4	1.870	46.49	42.17	36.19	46.00
5	2.020	47.13	43.99	38.72	46.00
6	3.280	45.94	43.32	38.09	46.00
7	11.16	44.01	41.34	34.86	50.00



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

EMISSIONS CONDUITES - DIGIGRAM

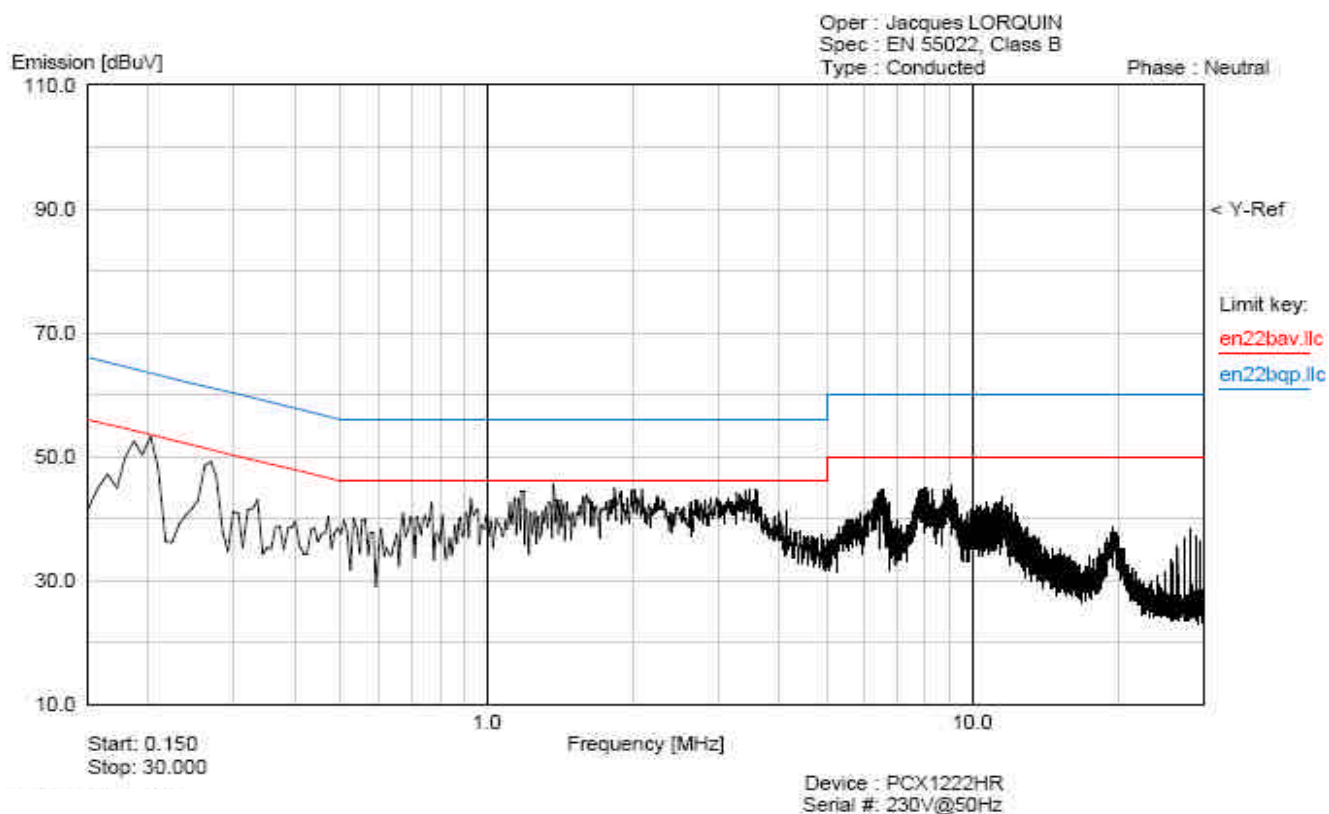


Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	53.35	51.07	42.89	54.00
2	0.200	53.44	51.25	46.54	52.00
3	0.270	50.39	47.58	37.85	50.00
4	0.340	45.98	42.81	33.43	48.00
5	2.020	43.97	40.32	34.87	46.00
6	2.230	44.00	41.23	36.65	46.00
7	3.340	45.35	41.67	36.16	46.00
8	8.830	44.92	42.58	40.17	50.00
9	28.05	38.66	37.23	36.46	50.00
10	28.82	37.56	35.81	34.86	50.00



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

EMISSIONS CONDUITES - DIGIGRAM



Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	0.190	53.90	51.32	42.84	54.00
2	0.200	54.26	51.88	45.44	52.00
3	0.270	52.76	49.43	37.75	50.00
4	0.340	49.42	47.15	36.73	48.00
5	1.370	45.17	41.57	37.70	46.00
6	3.463	41.51	-	-	46.00
7	3.590	42.31	-	-	46.00

End of Tests