



LCIE

Rapport d'essai / Test report

JDE : 60053822 N° 200612-3476C-R2-E

DELIVRE A / ISSUED TO : DIGIGRAM (M. ZANNI)
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38330 MONTBONNOT SAINT MARTIN - FRANCE

Objet / Subject : Essais de compatibilité électromagnétique conformément aux normes :
Electromagnetic compatibility tests according to the standards:
FCC CFR 47 Part 15, Subpart B.
ANSI C63.4 (2003)

Matériel testé / Apparatus under test :

- Produit / Product : Carte son PCI Express / PCI express Sound Card
- Marque / Trade mark : DIGIGRAM
- Constructeur / Manufacturer : DIGIGRAM
- Type / Model : PCX882E
- N° de série / serial number : 2345.00020002
- FCC ID : IGTMULTIE

* : information donnée par le client / information given by the customer

Date des essais / Test date : Du 15 au 16 janvier 2007 / January 15th to 16th, 2007

Lieu d'essai / Test location : LCIE
ZI des Blanchisseries
38500 VOIRON - France

Test réalisé par / Test performed by : Laurent CHAPUS

Ce document comporte / Composition of document: 16 pages.

VOIRON, LE 23 FEVRIER 2007 / FEBRUARY 23RD, 2007

Ecrit par / Written by
Laurent CHAPUS



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1. TEST PROGRAM

Standard:

- FCC Part 15, Subpart B (Digital Devices)
- ANSI C63.4 (2003)

EMISSION TEST	LIMITS			RESULTS (Comments)
Limits for conducted disturbance at mains ports 150kHz-30MHz	Frequency	Quasi-peak value (dBμV)	Average value (dBμV)	COMPLY
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
	5-30MHz	60	50	
Radiated emissions 30MHz-12.5GHz	Measure at 3m 30MHz-88MHz : 40 dB μ V/m 88MHz-216MHz : 43.5 dB μ V/m 216MHz-960MHz : 46.0 dB μ V/m Above 960MHz : 54.0 dB μ V/m			COMPLY

2. APPARATUS UNDER TEST: CONFIGURATION

2.1. JUSTIFICATION

The system was configured for testing in a typical fashion (as a customer would normally use it).
The **PCX882e** board is the most complete hardware configuration of the product range:

- **VX882e** (Software limited)
- **PCX881e** (digital only, without 882 analog daughter board)
- **VX881e** (Software limited and digital only, without 882 analog daughter board)

2.2. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

- **Equipment under test (EUT):**

PCX882E

(PCI Express sound Card)

PCI Express data rate: Up to 2.5GB/s

Serial number: 2345.00020002

- **Inputs/outputs:**

- 1x MDR SCSI (68 points) with
 - 8x Analog Audio Outputs
 - 8x Analog Audio Inputs
 - 4x Digital Audio Outputs (AES)
 - 4x Digital Audio Input (AES)
 - 1x Digital Synchro Input (AES)
 - 1x Word Clock Input
 - 1x Word Clock Output
 - 1x Synchro video Input
 - 1x LTC input

- **Cables:**

- 1x I/O Audio Cable, unshielded: 1m (P/N: SC185700101)
- 3x AC power cords (PC/Monitor/Printer): 1.8m
- 1x SVGA cable: 1.5m
- 1x Parallel printer cable: 1.5m
- 1x Serial, shielded cable: 1.5m
- 3x BNC cables for Word Clock IN and OUT, Video IN: 1m/1.8m
- 1x Audio cable for LTC input: 3m

- **Auxiliaries equipment used during test:**

- Personal Computer DELL Precision 390 Model: DCTA
- Keyboard (USB cable 1.2m) DELL CN-ODJ315-71616-64F-OVY4
- Mouse (PS2 cable 1.2m) HP P/N: C3751A
- Parallel printer HP 895CXi
- Serial Calculator HP 48GX
- Audio Load Box (DIGIGRAM Tool)
- Video Monitor HP D2846
- Microphone TELEX 700373-000

Sn: JGC8F2J
 Sn: None
 Sn: LOA54656002
 Sn: HU9C51T11C
 Sn: ID83802369
 Sn: None
 Sn: JP 74001000
 Sn: None

2.3. RUNNING MODE

The sound card is set in the test mode by the PC production software.

The test software is generating a 1kHz sinus signal on analog audio outputs. All inputs/outputs of the sound card are loaded by typical impedances.

2.4. EQUIPMENT MODIFICATIONS

None

3. MEASUREMENT OF RADIATED EMISSION (30MHz TO 12.5GHz)

3.1. TEST CONDITIONS

Date of test : January 18th, 2007
Test performed by : Laurent CHAPUS
Humidity : 35%

3.2. SETUP FOR RADIATED EMISSIONS MEASUREMENT

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

The EUT and auxiliaries are set on the non-conducting table of 80 cm height.

The EUT is powered by 230Vac/50Hz.

Pre-characterisation measurement:

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 on 4 faces of the EUT.

The pre-characterization graphs are obtained in PEAK detection.

For frequency band 1GHz to 12.5GHz, a manual search is performed in the anechoic chamber in order to determine frequencies radiated by the EUT.

Characterization on 10 meters open site from 30MHz to 12.5GHz:

The product has been tested according to ANSI C63.4 (2003), FCC part 15 subpart C. 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 at a distance of **10 meters** from the antenna and corrected according to requirements of 15.209.e) and compared to the FCC part 15 subpart B §15.209 limits.

Measurement bandwidth was 120kHz from 30 MHz to 1GHz and 1MHz from 1GHz to 12.5GHz.

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.

A summary of the worst case emissions found in all test configurations and modes is shown on clause 3.4 (Pre-characterization results).



3.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.4. MEASUREMENTS RESULTS

Pre-characterisation measurement: pre-scan measurement at 3m (PEAK detection)

Polarisation H: graph **Emr#H** (see annex 1)Polarisation V: graph **Emr#V** (see annex 1)QUALIFICATION: 10 meters measurement on the Open Area Test Site.

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

Frequency range 30MHz to 1GHz:

Measurements are performed using a QUASI-PEAK detection (RBW=120kHz)

No	Frequency (MHz)	Limit Quasi-Peak (dBµV/m)	Measure Quasi-Peak (dBµV/m)	Margin (Meas-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	31.968	40.0	30.3	-9.7	75	V	150	12.2	
2	110.619	43.5	34.2	-9.3	340	V	130	15.1	
3	122.879	43.5	35.2	-8.3	260	V	100	15.3	
4	125.962	43.5	30.6	-12.9	265	V	100	14.7	
5	129.036	43.5	32.5	-11.0	230	V	100	14.6	
6	144.012	43.5	32.2	-11.3	270	V	100	14.3	
7	159.760	43.5	33	-10.5	10	V	100	16.8	
8	168.013	43.5	33.9	-9.6	75	H	370	17.1	
9	184.334	43.5	40.5	-3.0	255	V	100	18.2	
10	365.910	46.0	39.2	-6.8	330	H	240	18.2	
11	511.261	46.0	40.3	-5.7	340	H	190	21.6	
12	998.059	54.0	44.4	-9.6	210	V	130	29.3	

Note: Measures have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

Frequency range 1GHz to 12.5GHz:

Measurements are performed using a PEAK and Average detection. (RBW = 1MHz)

No	Frequency (GHz)	Limit Average (dBµV/m)	Measure Average (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	1.60000	54.0	45.2	-8.8	330	H	120	29.4	
2	3.00000	54.0	53.7	-0.3	330	H	110	32.7	

No	Frequency (GHz)	Limit PEAK (dBµV/m)	Measure PEAK (dBµV/m)	Margin (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	1.60000	74.0	60.7	-13.3	330	H	120	29.4	
2	3.00000	74.0	58.7	-15.3	330	H	110	32.7	

Note: Measures have been done at 10m distance and corrected according to requirements of 15.209.e)
(M@3m = M@10m+10.5dB)

3.5. 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 52.5dBμV 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.

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

3.6. CONCLUSION

Sample of the equipment PCX882E (Sn: 2345.00020002), tested in the configuration presented in this test report satisfies to requirements of the standard ANSI C63.4 (2003), for radiated emissions.

4. MEASUREMENT OF CONDUCTED EMISSION

4.1. TEST CONDITIONS

Date of test : January 16th, 2007
Test performed by : Laurent CHAPUS

4.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT

Mains terminals:

The EUT with its auxiliaries are set on a non-conducting 80cm above the ground reference plane.
The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane.
The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.
Mains: 110Vac/60Hz (Power supply of the PC)

4.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

4.4. MEASUREMENTS RESULTS

Mains terminals 110Vac/60Hz

Measurements are performed on the phase (L1) and neutral (N) of the power line.

Measure on L1: graph **Emc#1** (see annex 1)
Measure on N : graph **Emc#2** (see annex 1)

4.5. CONCLUSION

Sample of the equipment PCX882E (Sn: 2345.00020002), tested in the configuration presented in this test report satisfies to requirements of the standard ANSI C63.4 (2003), for conducted emissions.

5. TEST EQUIPMENT LIST

	N°LCIE	TYPE	COMPANY	REF	SN
RADIATED EMISSION MEASUREMENT					
	C2040057VO	Antenna monopole	AH SYSTEM	SAS-551	181
X	A7102026VO	Amplifier 8-26GHz	ALDETEC	ALS01452	1
X	C4040009VO	Air Compressor	ATLAS COPCO	LX111	0615-038
X	A3169050VO	Radiated emission comb generator	BARDET		PR17B
X	C2040051VO	Antenna Bi-log	CHASE	CBL6111A	1628
	C2040052VO	Antenna Loop	ELECTRO-METRICS	EM-6879	690234
X	C2042027VO	Antenna horn	EMCO	3115	6382
X	C2040050VO	Antenna biconic	EMCO	3104C	9401-4636
X	C2040056VO	Antenna log-periodic	EMCO	3146	2178
X	F2000286VO	Turntable controller	EMCO	1060-10	1217
X	F2000287VO	Antenna mast controller	EMCO	1050	8811-1295
X	F2000288VO	Antenna mast	EMCO	1050	
X	F2000289VO	Turntable	EMCO	1060	
X	F2000371VO	Turntable chamber	ETS Lingren	Model 2065	F2000371VO
X	F2000372VO	Turntable controller chamber	ETS Lingren	Model 2066	F2000372VO
X	D3044009VO	Anechoic chamber	EUROSHIELD	RDF-F-60-060	1213
X	A7102024VO	Amplifier 8 GHz	HEROTEK	A1080304A	222033
X	A4060016VO	Spectrum analyzer 9kHz –1.8GHz	HEWLETT PACKARD	8591E	3536A00384
X	A7102019VO	Amplifier 9 KHz – 1300 MHz	HEWLETT PACKARD	8447F Opt 64	3113A06394
X	A4060018VO	Spectrum Analyzer 9KHz – 26.5GHz	HEWLETT PACKARD	8593E	3409u00537
X	A4049060VO	Adapter quasi-peak	HEWLETT PACKARD	HP85650A	2811A01134
X	A4060028VO	Spectrum analyzer display	HEWLETT PACKARD	HP85662A	2816A16603
X	A4060029VO	Spectrum analyzer	HEWLETT PACKARD	HP8568B	2732A04155
X	A4060030VO	Pre-selector RF	HEWLETT PACKARD	HP85685A	2837A00784
	A5329032VO	Absorption clamp	LUTHI	MDS21	2826
	A5329044VO	Absorption clamp	RHODE ET SCHWARZ	85024A	194.0100.50
	A2640011VO	Measurement receiver 9kHz–30MHz	ROHDE ET SCHWARZ	ESH3	972079/117
	C2042028VO	Antenna horn 26GHz	SCHWARZBECK	BBHA 9170	BBHA9170232
X	A5329045VO	Cable IMR&EMR (Anechoic chamber)	SMEE	KX13	
X	A5329048VO	Cable EMR OATS	SUCOFLEX	106G	553
X	A5329038VO	Cable coaxial 3.5 m (Blue)	SUHNER	SUCOFLEX 106	26732/6
X	A5329056VO	Cable Radiat EMI (Pre-amp/Analyzer)			
X	A5329057VO	Cable Radiat. EMI (Pre-amp/cage)			
X	A5329059VO	Cable OATS (Mast at 10m)			
	A5329058VO	Cable OATS (Mast at 3m)			
CONDUCTED MEASUREMENT EMISSION					
X	A3169049VO	Conducted emission comb generator	BARDET		CGPR12
	A2320059VO	LISN	EMCO	3810/2SH	9511/1182
X	C2320068VO	LISN	EMCO	3825/2	9309/2122
X	A4049061VO	Transient limiter	HEWLETT PACKARD	11947A	3107A01596
	A2120003VO	Programable PSU, HAR/FLK	HEWLETT PACKARD	6842A	3531A00109
	A4060016VO	Spectrum analyzer 9kHz –1.8GHz	HEWLETT PACKARD	8591E	3536A00384
	A5329036VO	Direct Injection Module 100 Ohms	LCIE	MID01-100 ohms	
	A5329042VO	Ferrite Tube	LUTHI	FTC 101	4485
	A1092042VO	Ferrite Tube	LUTHI	FTC101	4763
X	D3044010VO	Faraday Cage	RAY PROOF		4854
	C2320062VO	LISN tri-phase ESH2-Z5	RHODE ET SCHWARZ	33852.19.53	841223/008
	C2320063VO	LISN tri-phase ESH2-Z5	RHODE ET SCHWARZ	33852.19.53	841223/007
X	C2320066VO	RSI 4 wires	RHODE ET SCHWARZ	ENY41	838119/023
	C2320067VO	RSI 2 x 2 wires	RHODE ET SCHWARZ	ENY22	836727/015
X	A2640011VO	Measurement receiver 9kHz–30MHz	ROHDE ET SCHWARZ	ESH3	972079/117
	A1290017VO	Current probe	SCHAFFNER	CSP9160	1097
	A5329034VO	Current injection probe	SCHAFFNER	CIP8213	52
	A4089117VO	Voltage probe	SMEE		
X	C2320061VO	LISN	TELEMETER ELECTRONIC	NNB-2/16Z	98010
X	A5329061VO	Cable Conduct. EMI (Analyzer/cage)			
X	A5329060VO	Cable Conduct. EMI (LISN/cage)			
MISCELLANEOUS (CONTROL EQUIPMENT)					
	A6440068VO	Data Logger	AGILENT	34970A	US37043935
	A6440068VO	Data Logger Board	AGILENT	34901A	MY41037442
	D1022117VO	Climatic chamber	BIA CLIMATIC	CL 6-25	200 105 6
	A7043037VO	Power supply DC 30V 10A	ELC	AL924	95/00600

	N°LCIE	TYPE	COMPANY	REF	SN
	A1240170VO	Multimeter	Fluke	87	75250745
	A1240171VO	Multimeter	FLUKE	189	89770115
	A4024018VO	Oscilloscope 500 MHz	Hewlett Packard	54542C	US36040602
	A4024019VO	Oscilloscope	Hewlett Packard	54720A	7426600
X	B4204052VO	Thermo-hygrometer	HUGER		
	A7043036VO	Power supply DC 300W / 150V-6A	SODILEC	7SDLIN/GB AUTO 300	493711
	A4083040VO	Oscilloscope 100 MHz 500Ms/s	Tektronix	TDS30-25	H712103

6. UNCERTAINTIES CHART

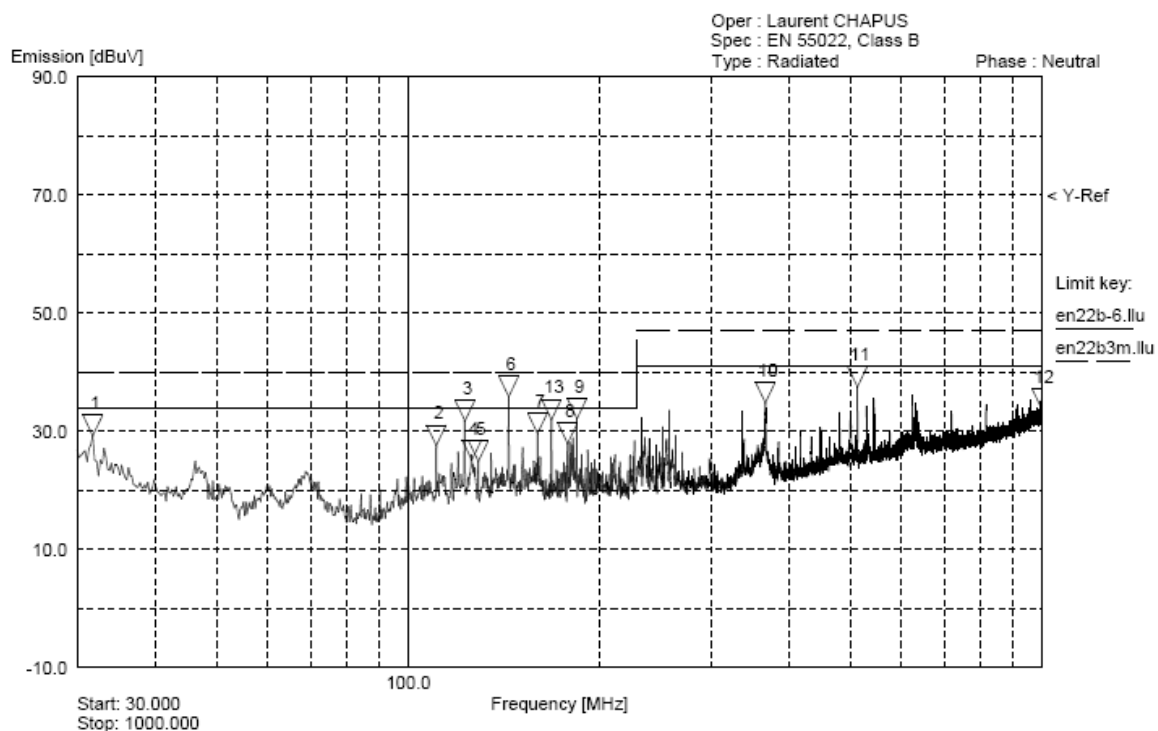
Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ± x	Incertitude limite du CISPR / CISPR uncertainty limit ± y
Mesure des perturbations conduites en tension sur le réseau d'énergie <i>Measurement of conducted disturbances in voltage on the power port</i>	3.57 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau de télécommunication <i>Measurement of conducted disturbances in voltage on the telecommunication port.</i>	3.28 dB	A l'étude / Under consid.
Mesure des perturbations discontinues conduites en tension <i>Measurement of discontinuous conducted disturbances in voltage</i>	3.47 dB	3.6 dB
Mesure des perturbations conduites en courant <i>Measurement of conducted disturbances in current</i>	2.90 dB	A l'étude / Under consid.
Mesure du champ électrique rayonné sur le site en espace libre de Voiron <i>Measurement of radiated electric field on the Voiron open area test site</i>	5.07 dB	5.2 dB
Mesure du champ électrique rayonné IN SITU de 30 à 1000 MHz <i>IN SITU measurement of radiated electric field from 30 to 1000MHz</i>	A l'étude / Under consideration	5.2 dB
Mesure de la puissance perturbatrice / <i>Measurement of disturbance power</i>	3.37 dB	4.5 dB
Mesure des harmoniques de courant / <i>Measurement of current harmonics</i>	11.11%	/
Mesure du flicker / <i>Flicker measurement</i>	9.26%	/

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par le CISPR, la conformité de l'échantillon est établie directement par les niveaux limites applicables. / The uncertainty values calculated by the laboratory are lower than limit uncertainty values defined by the CISPR. The conformity of the sample is directly established by the applicable limits values.

7. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS		Test configuration:
Graph name:	Emr#H	
Antenna polarisation	Horizontal	
Azimuth:	Max-hold measurement 0° to 360°	
RBW / VBW :	120kHz / 300kHz	

RADIATED EMISSIONS - DIGIGRAM



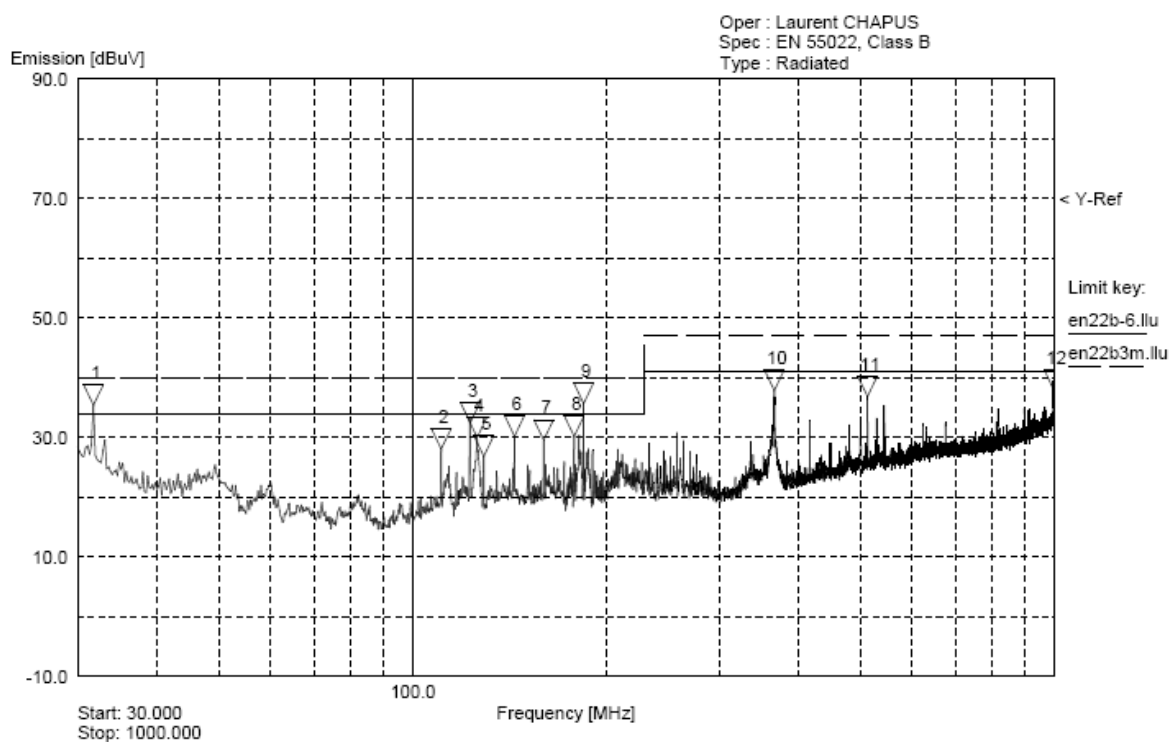
18:40:04 17 Jan 2007

Device : PCX881e
Serial #: Pol H

Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	31.76	29.27	-	-	34.00
2	110.7	27.61	-	-	34.00
3	122.8	31.75	-	-	34.00
4	125.9	25.12	-	-	34.00
5	129.0	24.89	-	-	34.00
6	144.0	35.87	-	-	34.00
7	159.8	29.63	-	-	34.00
8	178.4	27.93	-	-	34.00
9	184.5	32.14	-	-	34.00
10	366.0	34.85	-	-	41.00
11	511.3	37.54	-	-	41.00
12	997.8	33.86	-	-	41.00
13	168.2	31.97	-	-	34.00

RADIATED EMISSIONS		Test configuration:
Graph name:	Emr#V	
Antenna polarisation	Vertical	
Azimuth:	Max-hold measurement 0° to 360°	
RBW / VBW :	120kHz / 300kHz	

RADIATED EMISSIONS - DIGIGRAM

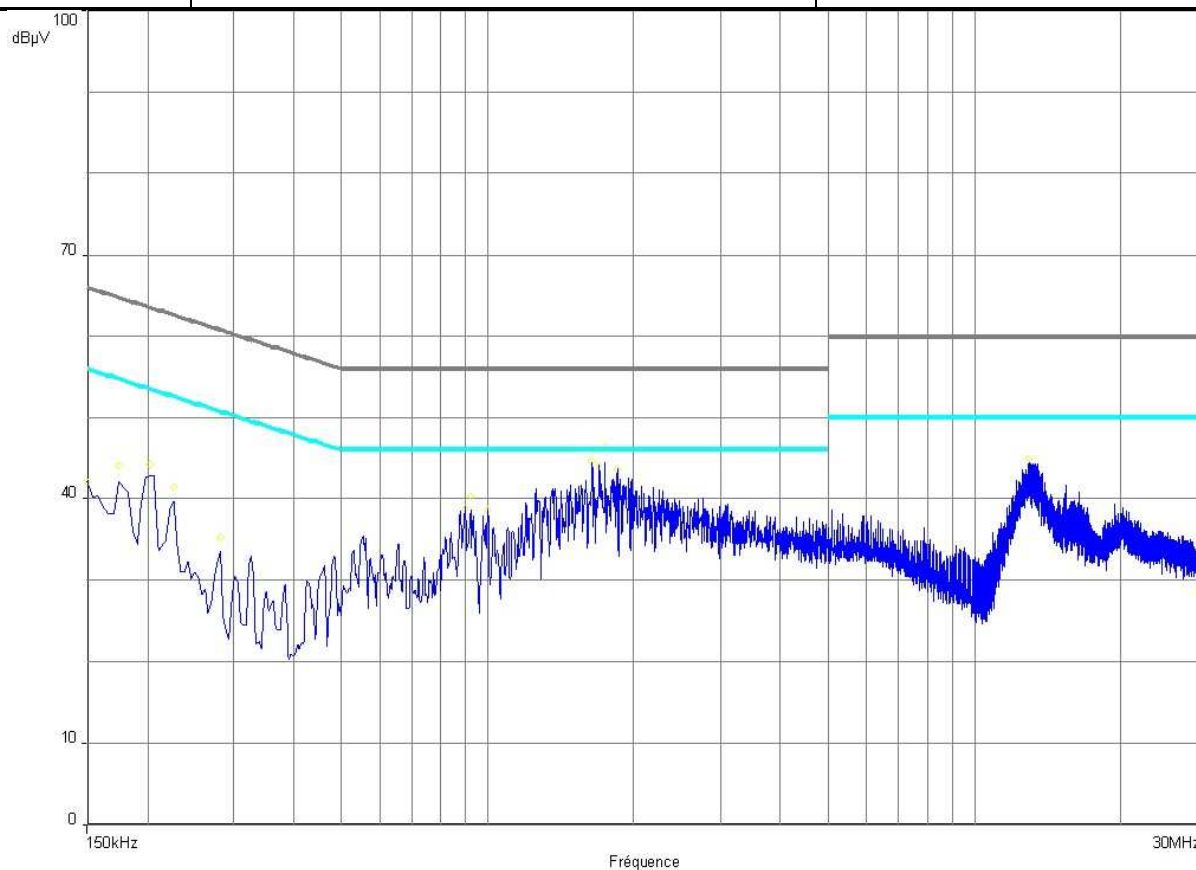


18:16:07 17 Jan 2007

Device : PCX882e
Serial #: Pol V

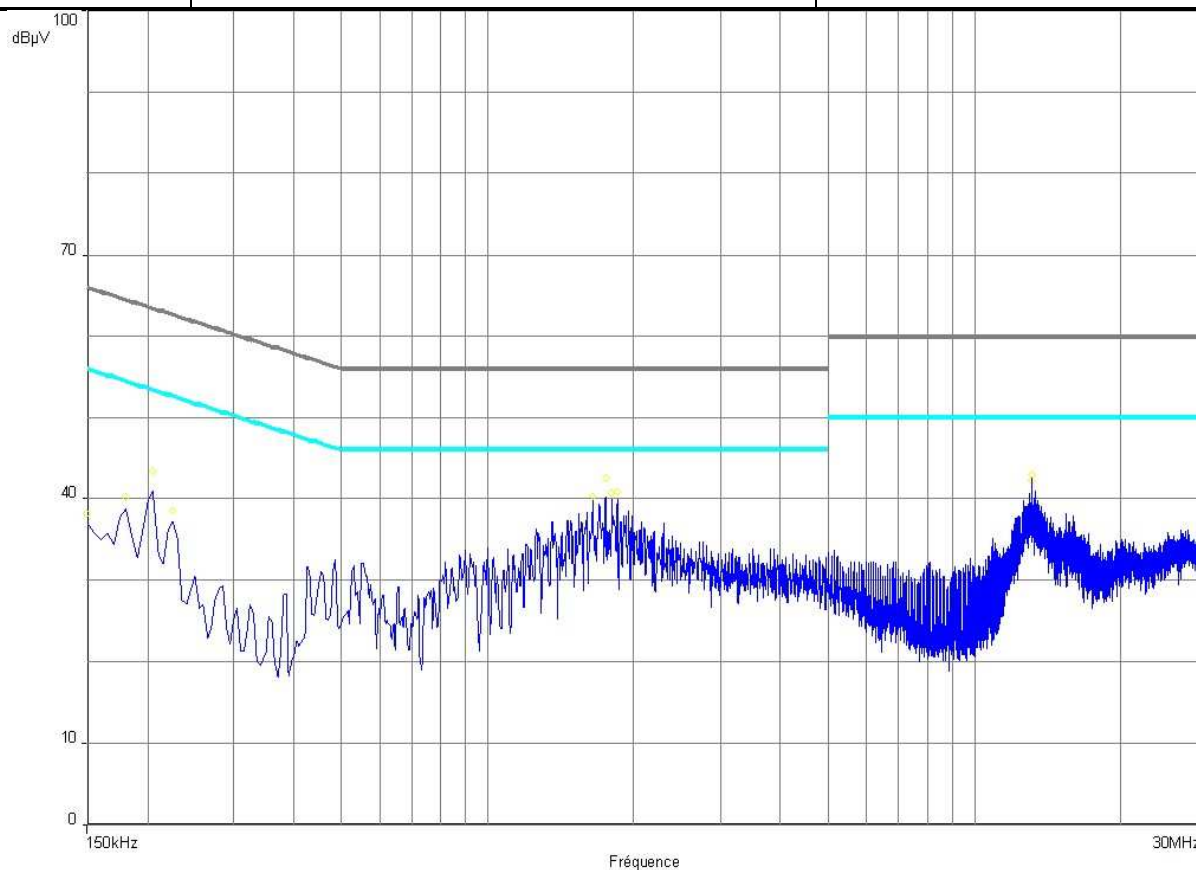
Marker ▽	Frequency [MHz]	Peak [dBuV]	Q-Peak [dBuV]	Average [dBuV]	Limit [dBuV]
1	31.76	35.42	-	-	34.00
2	110.7	28.09	-	-	34.00
3	122.8	32.48	-	-	34.00
4	125.9	29.98	-	-	34.00
5	129.0	26.83	-	-	34.00
6	144.0	30.20	-	-	34.00
7	159.8	29.54	-	-	34.00
8	178.4	30.17	-	-	34.00
9	184.5	35.67	-	-	34.00
10	366.0	37.84	-	-	41.00
11	511.3	36.88	-	-	41.00
12	997.8	37.95	-	-	41.00

CONDUCTED EMISSIONS		Test configuration:
Graph name:	Emc#1	
Voltage / Frequency	110Vac/60Hz	
Line/Port	Phase L1	
RBW / VBW :	9kHz / 30kHz	



Frequency (MHz)	Measure Peak dBμV	Measure Average dBμV	Limit Average dBμV	Avg-Lim (Margin) dB	Measure Quasi-Peak dBμV	Limit QPeak dBμV	QPeak-Lim (Margin) dB
0.898	38.8	34.9	46.0	-11.1	37.5	56.0	-18.5
0.922	40.3	35.5	46.0	-10.5	37.8	56.0	-18.2
0.998	38.6	33.8	46.0	-12.2	35.5	56.0	-20.5
1.638	44.7	39.4	46.0	-6.6	41.9	56.0	-14.1
1.642	46.1	40.0	46.0	-6.0	43.5	56.0	-12.5
1.694	44.1	37.8	46.0	-8.2	40.7	56.0	-15.3
1.742	46.4	39.2	46.0	-6.8	43.6	56.0	-12.4
1.842	43.7	36.8	46.0	-9.2	40.4	56.0	-15.6
12.918	44.9	31.5	50.0	-18.5	38.8	60.0	-21.2

CONDUCTED EMISSIONS		Test configuration:
Graph name:	Emc#2	
Voltage / Frequency	110Vac/60Hz	
Line/Port	Neutral (N)	
RBW / VBW :	9kHz / 30kHz	



Frequency (MHz)	Measure Peak dBμV	Measure Average dBμV	Limit Average dBμV	Avg-Lim (Margin) dB	Measure Quasi-Peak dBμV	Limit QPeak dBμV	QPeak-Lim (Margin) dB
0.205	43.4	36.9	53.4	-16.5	40.5	63.4	-22.9
1.640	40.3	35.1	46.0	-10.9	37.8	56.0	-18.2
1.745	42.6	35.4	46.0	-10.6	40.2	56.0	-15.8
1.800	40.8	33.4	46.0	-12.6	38.3	56.0	-17.7
1.845	40.9	33.5	46.0	-12.5	38.4	56.0	-17.6
13.130	43.0	31.8	50.0	-18.2	37.2	60.0	-22.8
13.135	42.2	32.0	50.0	-18.0	35.8	60.0	-24.2