

Rapport d'essai / Test report

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DELIVRE A / ISSUED TO : **INGENICO**
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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** : Lecteur de carte bancaire / *Bank payment terminal*
- **Marque / Trade mark** : **INGENICO**
- **Constructeur / Manufacturer** : **INGENICO**
- **Type / Model** : **ICT220-01T1217C**
- **N° de série / serial number** : **10077CT70000033**
- **FCC ID** : **XKB-ICT220**

Date des essais / Test date : Le 17 Mai 2010 / *May 17th, 2010*

Lieu d'essai / Test location : **BUREAU VERITAS LCIE SUD-EST**
ZI Centr'Alp – 170 rue de Chatagnon
38430 MOIRANS - France

Test réalisé par / Test performed by : Anthony MERLIN

document comporte / Composition of document: 18 pages

MOIRANS, LE 28 MAI 2010 / *MAY 28TH, 2010*

Ecrit par / *Written by*
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Approuvé par / *Approved by*,
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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)	PASS
	150-500kHz	66 to 56	56 to 46	
	0.5-5MHz	56	46	
Radiated emissions 30MHz-12.5GHz*	5-30MHz	60	50	PASS
	Measure at 3m 30MHz-88MHz : 40 dBµV/m 88MHz-216MHz : 43.5 dBµV/m 216MHz-960MHz : 46.0 dBµV/m Above 960MHz : 54.0 dBµV/m			

*§15.33: The highest internal source of a testing device is defined like more the highest frequency generated or used in the testing device or on which the testing device works or agrees.

- If the highest frequency of the internal sources of the testing device is lower than 108 MHz, measurement must be only performed until 1GHz.
- If the highest frequency of the internal sources of the testing device ranges between 108 MHz and 500 MHz, measurement must be only performed until 2GHz.
- If the highest frequency of the internal sources of the testing device ranges between 500 MHz and 1 GHz, measurement must be only performed until 5GHz.

If the highest frequency of the internal sources of the testing device is above 1 GHz, measurement must be only performed until 5 times the highest frequency or 40 GHz, while taking smallest of both.



2. APPARATUS UNDER TEST: CONFIGURATION

2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):

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

ICT220-01T1217C

Serial Number: 10077CT70000033

FCC ID: XKB-ICT220

Power Supply: DELTA ELECTRONICS TADP-24AB A, input 100-240V 50/60Hz, output 8VDC 3A.

Sn: ABET1016000496

MagicBox: 2961105416

- **Inputs/outputs:**

- 1x DC power input (8Vdc)
- 1x Serial link (RS232C can't be longer than 3m)
- 1x Ethernet line (may be longer than 3m)
- 1x Dial-up Modem line IN (may be longer than 3m)
- 1 x USB host, not used and without cable
- 1 x USB slave, not used and without cable
- 2 x SAMs
- 1 x CAM0
- 1 x MicroSD, not used.

- **Cables:**

- 1x Magic Box extension cord with I/O connectors, spiraled: 1m
- 1x AC power cord, 2 wires, unshielded: 2m
- 1x DC power supply cable (fixed on mains power unit), unshielded: 1.75m
- 1x Ethernet cable, Cat 5e, unshielded: 2m
- 1x RS232 Com cable, RJ11, unshielded, 1.5m
- 1x Line In cable, RJ11, unshielded, 1.5m

- **Auxiliaries equipment used during test:**

- 1x Smartcard (Bank credit card)
- 2x SAM cards
- 1x Laptop PC TOSHIBA SATELITE S1410-704 (PS141E-04YCM-3V)
with its power supply unit (PA3201U-1ACA SEB100P2-15.0)
- 1x TELTON Telephone line simulator TLS-5B-01

Sn: none

Sn: none

Sn: 13594938G

Sn: 014184



2.2. RUNNING MODE

The EUT is connected to a laptop PC with its Ethernet link. (Ping function activated).

The inboard software (TEST CEM) performed the followings tests and activates the followings functions:

- Printer ON,
- Modem is online
- Smartcards reading: CAM0, SAM1 and 2 (power ON and reading)
- Backlight and display are ON.

2.3. EQUIPMENT MODIFICATIONS

None

2.4. SPECIAL ACCESSORIES

None

3. MEASUREMENT OF CONDUCTED EMISSION (150kHz-30MHz)

3.1. TEST CONDITIONS

Date of test : May 17th, 2010
Test performed by : A.MERLIN
Atmospheric pressure : 972mb
Relative humidity : 32%
Ambient temperature : 21°C

3.2. SETUP FOR CONDUCTED EMISSIONS MEASUREMENT

The product has been tested according to ANSI C63.4-(2003) and FCC Part 15 subpart B.

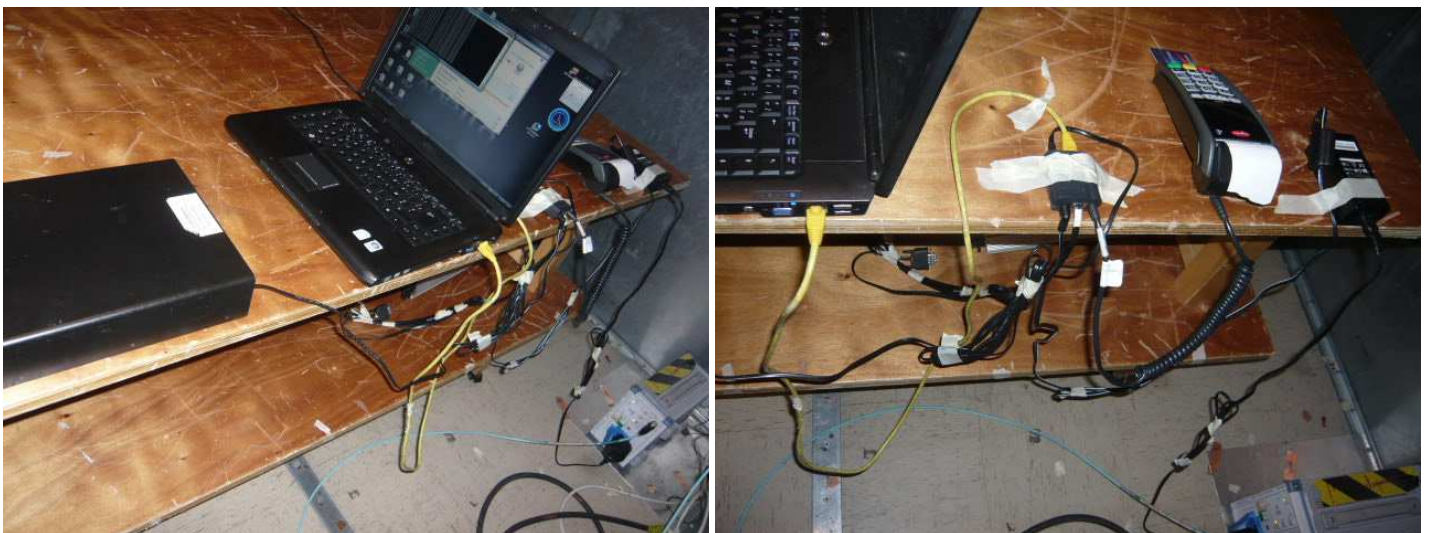
The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

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.

Measurement is made with a Rohde & Schwarz ESU8 receiver in peak mode. This was followed by a Quasi-Peak, i.e. CISPR measurement 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 LISN (measure and auxiliaries) is 50Ω / 50μH.

The Peak data are shown on plots in annex 1. 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.





3.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.4. MEASUREMENTS RESULTS

Mains terminals 110Vac/60Hz:

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

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

RESULT: PASS



4. MEASUREMENT OF RADIATED EMISSION (30MHz-12.5GHz)

4.1. TEST CONDITIONS

Date of test : May 17th, 2010
Test performed by : A.MERLIN
Atmospheric pressure : 972mb
Relative humidity : 32%
Ambient temperature : 21°C

4.2. SETUP FOR RADIATED EMISSIONS MEASUREMENT

The installation of EUT is identical for pre-characterization measures in a 3 meters semi-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 (PC and auxiliaries)

Pre-characterisation measurement:

A pre-scan of all the setup has been performed in a 3 meters semi-anechoic chamber. The distance between EUT and antenna is 3 meters. Test is performed in horizontal (H) and vertical (V) polarization. During the measurement, the EUT is rotated on a 360° range.

The pre-characterization graphs are obtained in PEAK detection.

For frequency band 1GHz to 12.5GHz, a search is performed in the semi-anechoic chamber in order to determine frequencies radiated by the EUT (Measuring distance reduced to 1m).

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 B. 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** (30MHz to 1GHz) and **3 meters** (1GHz to 12.5GHz) from the antenna and corrected according to requirements of 15.109.e).

Results are compared to the FCC part 15 subpart B §15.109 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.



Radiated emission test setup

4.3. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



4.4. MEASUREMENTS RESULTS

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

Polarisation H: graph **Emr#1** (see annex 1)
 Polarisation V: graph **Emr#2** (see annex 1)

QUALIFICATION: 10 / 3 meters measurement on the Open Area Test Site.

Frequency list has been created with semi-anechoic chamber pre-scan results.
 Measurements are performed using a QUASI-PEAK detection.

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 (Mes-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	38.921	40.0	35.3	-4.7	210	V	160	12.1	
2	53.558	40.0	32.9	-7.1	100	V	100	12.4	
3	55.889	40.0	30.6	-9.4	150	V	100	12.2	
4	58.831	40.0	30.2	-9.8	355	H	330	11.9	
5	58.645	40.0	29.9	-10.1	145	V	110	12.0	
6	155.639	43.5	34.7	-8.8	355	H	245	16.1	
7	483.843	46.0	33.2	-12.8	235	V	100	21.3	
8	530.245	46.0	40.4	-5.6	310	V	170	22.4	

Note: Measures have been done at 10m distance and corrected according to requirements of 15.109.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
No Significant Frequency Observed									

RESULT: PASS



4.5. 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 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.

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



L C I E

5. TEST EQUIPMENT LIST

	N° LCIE	TYPE	COMPANY	REF	commentaire
RADIATED EMISSION MEASUREMENT (PRE-SCAN SEMI-ANECHOIC CHAMBER #2)					
	A5329032VO	Absorption clamp	LUTHI	MDS21	
	A5329044VO	Absorption clamp	RHODE ET SCHWARZ	85024A	
X	A4049060VO	Adapter quasi-peak	HEWLETT PACKARD	HP85650A	
	A7102024VO	Amplifier 8 GHz	HEROTEK	A1080304A	
X	A7486006VO	Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447F	
	A7085008VO	Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	
	A7085009VO	Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	
	A7085010VO	Amplifier 10MHz – 1300 MHz	A-INFO INC	JXWBLA-T	
X	C2040146VO	Antenna Bi-Log XWing	TESEQ	CBL6144	
	C2042027VO	Antenna horn	EMCO	3115	
	C2042028VO	Antenna horn 26GHz	SCHWARZBECK	BBHA 9170	
	C2040052VO	Antenna Loop	ELECTRO-METRICS	EM-6879	
X	A5329045VO	Cable EMR (s-Anechoic chamber)			
X	A5329056VO	Cable Radiat EMI (Pre-amp/Analyzer)			
X	A5329057VO	Cable Radiat. EMI (Pre-amp/cage)			
X	A2642019	Measurement Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	
X	A4060030VO	Pre-selector RF	HEWLETT PACKARD	HP85685A	
X	A3169050VO	Radiated emission comb generator	BARDET		
X	D3044015VO	Semi-Anechoic chamber #2	SIEPEL		
X	A4060029VO	Spectrum analyzer	HEWLETT PACKARD	HP8568B	
X	A4060028VO	Spectrum analyzer display	HEWLETT PACKARD	HP85662A	
X	F2000404VO	Turntable chamber	ETS Lingren	Model 2165	
X	F2000393VO	Turntable controller chamber	ETS Lingren	Model 2066	
X	A5329038VO	Cable			
X	A5329206VO	Cable			
RADIATED EMISSION MEASUREMENT (OPEN AREA TEST SITE)					
	A5329032VO	Absorption clamp	LUTHI	MDS21	
	A5329044VO	Absorption clamp	RHODE ET SCHWARZ	85024A	
X	A4049059VO	Adapter quasi-peak	HEWLETT PACKARD	HP85650A	
	A7102024VO	Amplifier 8 GHz	HEROTEK	A1080304A	
	A7102026VO	Amplifier 8-26GHz	ALDETEC	ALS01452	
	A7085008VO	Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	
	A7085009VO	Amplifier 0.1MHz – 1300 MHz	HEWLETT PACKARD	8447D	
	A7085010VO	Amplifier 10MHz – 1300 MHz	A-INFO INC	JXWBLA-T	
X	C2040050VO	Antenna biconic	EMCO	3104C	
	C2040051VO	Antenna Bi-log	CHASE	CBL6111A	
	C2042027VO	Antenna horn	EMCO	3115	
	C2042028VO	Antenna horn 26GHz	SCHWARZBECK	BBHA 9170	
X	C2040056VO	Antenna log-periodic	EMCO	3146	
	C2040052VO	Antenna Loop	ELECTRO-METRICS	EM-6879	
X	F2000288VO	Antenna mast	EMCO	1050	
X	A5329048VO	Cable EMR OATS	SUCOFLEX	106G	
X	A5329199VO	Cable OATS (Mast at 10m)	UTIFLEX		
X	A5329188VO	Cable OATS (Mast at 10m)	UTIFLEX		
	A5329076VO	Cable OATS (Mast at 3m)	UTIFLEX		
	A5329196VO	Cable OATS (Turntable)	UTIFLEX		
	A5329187VO	Cable OATS (Turntable)	UTIFLEX		
	A2640011VO	Measurement receiver 9kHz–30MHz	ROHDE ET SCHWARZ	ESH3	
X	A2642019	Measurement Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	
X	A4060027VO	Pre-selector RF	HEWLETT PACKARD	HP85685A	
X	A3169050VO	Radiated emission comb generator	BARDET		
X	A4060017VO	Spectrum analyzer	HEWLETT PACKARD	HP8568B	
	A4060018VO	Spectrum Analyzer 9KHz – 26.5GHz	HEWLETT PACKARD	8593E	
	A4060016VO	Spectrum analyzer 9kHz –1.8GHz	HEWLETT PACKARD	8591E	
X	A4060019VO	Spectrum analyzer display	HEWLETT PACKARD	HP85662A	
X	F2000403VO	Turntable	ETS LINDGREN	Model 2187	
X	F2000286VO	Turntable / Antenna mast controller	ETS LINDGREN	Model 2066	
CONDUCTED MEASUREMENT EMISSION					



LCIE

	N° LCIE	TYPE	COMPANY	REF	commentaire
	A5329061VO	Cable Conduct. EMI			
X	A5329060VO	Cable Conduct. EMI			
X	A5329189VO	Shielded cable	UTIFLEX		
	A5329076VO	Shielded cable	UTIFLEX		
	A5329206VO	Shielded cable	UTIFLEX		
	A5329207VO	Shielded cable	UTIFLEX		
	A5329060VO	Shielded cable	UTIFLEX		
	A5329071VO	Shielded cable	UTIFLEX		
X	A3169049VO	Conducted emission comb generator	BARDET		
	A4040015	Clickmeter	SCHAFFNER	DIA1512D	
	A5329037VO	Current injection probe	SCHAFFNER	CIP8213	
	A1290017VO	Current probe	SCHAFFNER	CSP9160	
	A5329036VO	Direct Injection Module 100+50 Ohms	LCIE	MID01-100 ohms	
	A7156004VO	Direct Injection Module 100+50 Ohms	LUTHI	CR100A	
	A5329042VO	Ferrite Tube	LUTHI	FTC 101	
	A1092042VO	Ferrite Tube	LUTHI	FTC101	
	C2320059VO	LISN	EMCO	3810/2SH	
	C2320068VO	LISN	EMCO	3825/2	
	C2320061VO	LISN	TELEMETER ELECTRONIC	NNB-2/16Z	
	C2320062VO	LISN tri-phase ESH2-Z5	RHODE ET SCHWARZ	33852.19.53	
	C2320063VO	LISN tri-phase ESH2-Z5	RHODE ET SCHWARZ	33852.19.53	
X	C2320123VO	LISN	RHODE ET SCHWARZ	ENV216	
	A2640011VO	Measurement receiver 9kHz-30MHz	ROHDE ET SCHWARZ	ESH3	
X	A2642019VO	Measurement Receiver 20Hz - 8GHz	ROHDE & SCHWARZ	ESU8	
	C2320067VO	ISN 2 x 2 wires	RHODE ET SCHWARZ	ENY22	
	C2320066VO	ISN 4 wires	RHODE ET SCHWARZ	ENY41	
	C2320124VO	ISN 4 wires	TESEQ	T400A	
	D3044016VO	Semi-Anechoic chamber #1	SIEPEL		
	D3044017VO	Semi-Anechoic chamber #3	SIEPEL		
	D3044015VO	Semi-Anechoic chamber #2	SIEPEL		
X	D3044010VO	Faraday Cage	RAY PROOF		
X	A4049061VO	Transient limiter	HEWLETT PACKARD	11947A	
	A4089117VO	Voltage probe	LCIE		



6. UNCERTAINTIES CHART

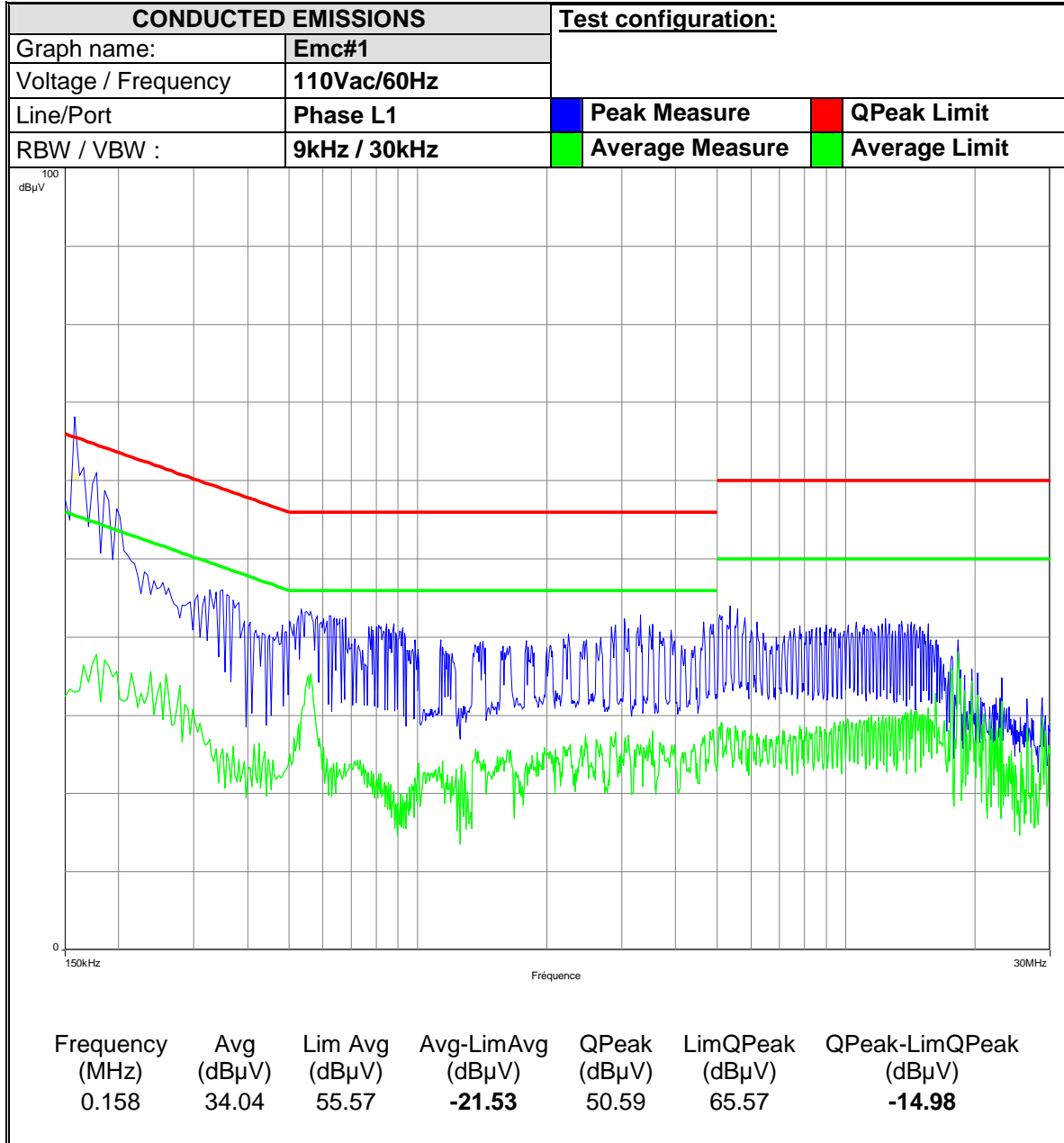
Type de mesure / Kind of measurement	Incertitude élargie laboratoire / Wide uncertainty laboratory (k=2) ± x	Incertitude limite du CISPR / CISPR uncertainty limit ± y
Mesure des perturbations conduites en tension sur le réseau d'énergie (triphase) <i>Measurement of conducted disturbances in voltage on the power port (three phases)</i>	3.6 dB	3.6 dB
Mesure des perturbations conduites en tension sur le réseau d'énergie (monophasé) <i>Measurement of conducted disturbances in voltage on the power port (single line)</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.*



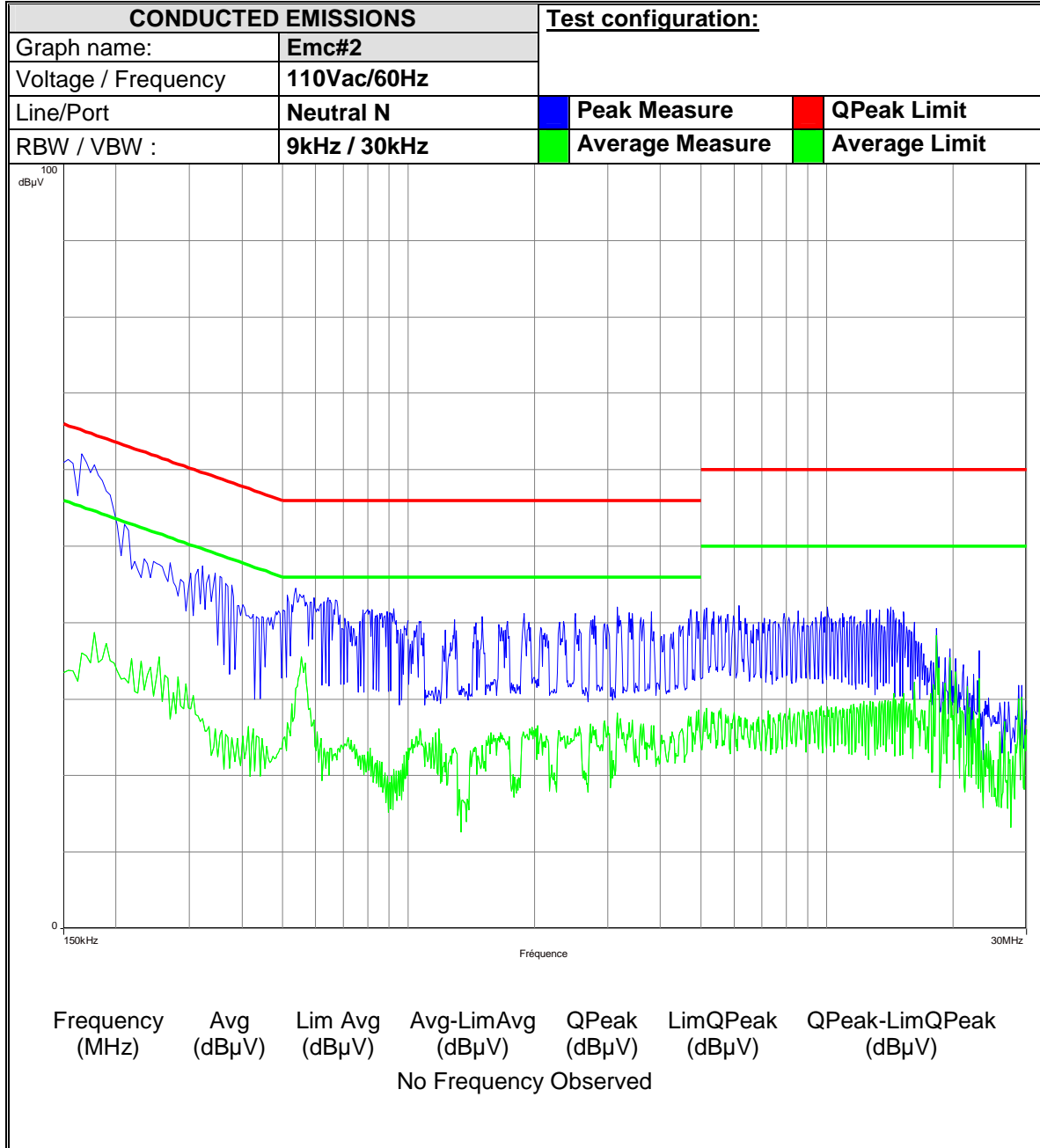
L C I E

7. ANNEX 1 (GRAPHS)



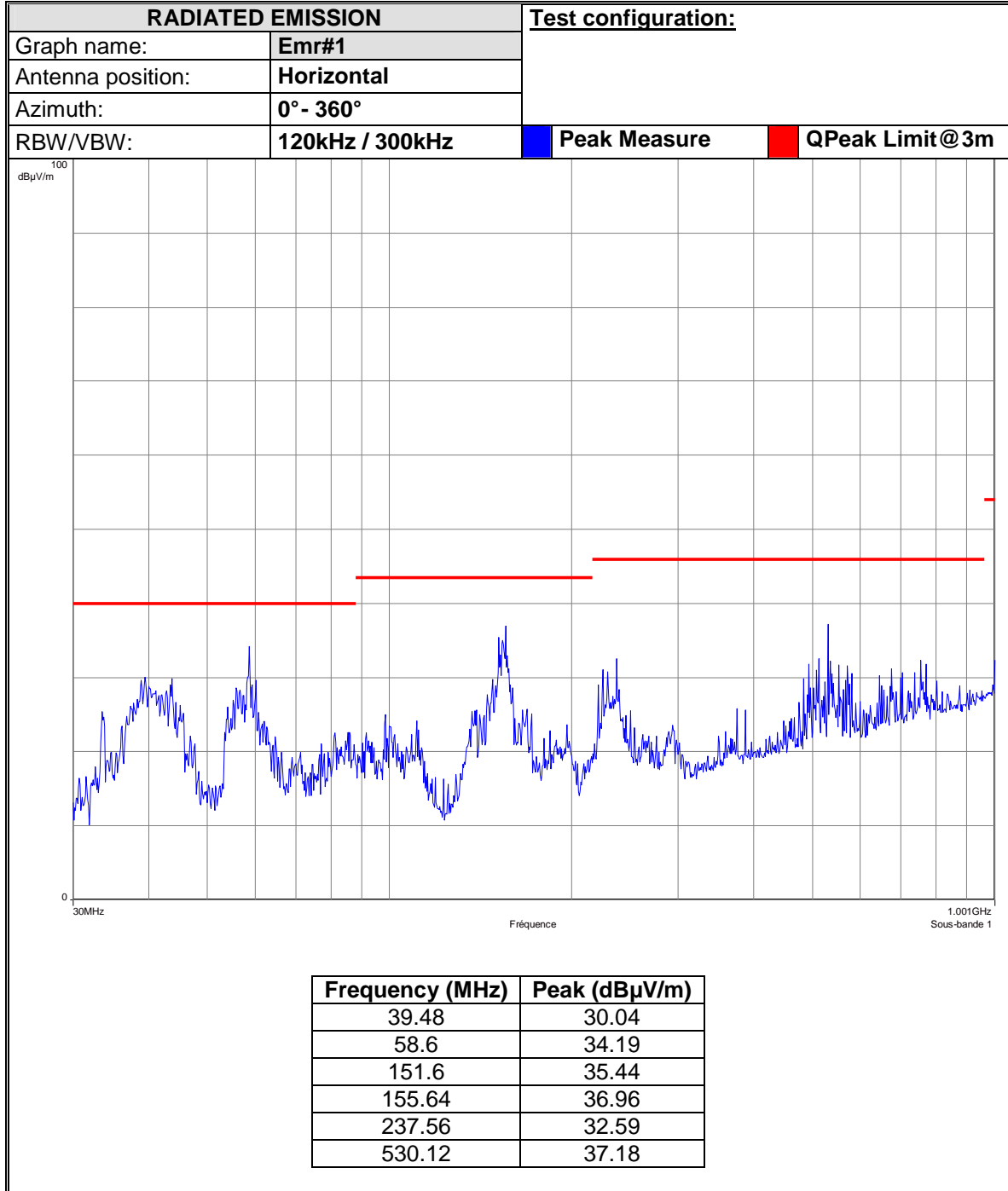


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