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Rapport d'essai / Test report

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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 : **Terminal de payment / Payement terminal**
- Marque / Trade mark : **INGENICO**
- Constructeur / Manufacturer : **INGENICO**
- Type / Model : **ICT220-11T2025A**
- N° de série / serial number : **12058CT00000100**
- FCC ID : **XKB-ICT220V3**

Date des essais / Test date

: Du 1 au 2 Aout 2012 / *From August 1st to 2nd, 2012*

Lieu d'essai / Test location

: **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 26 NOVEMBRE 2012 / *NOVEMBER 26TH, 2012*

ECRIT PAR / *WRITTEN BY,*
ANTHONY MERLIN



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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	
	5-30MHz	60	50	
Radiated emissions 30MHz-2GHz* <i>Highest frequency <500MHz</i> <i>Declared by provider</i>	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			PASS

*§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.

Highest frequency: 387MHz (Declaration of provider)

**2. APPARATUS UNDER TEST: CONFIGURATION****2.1. HARDWARE IDENTIFICATION (EUT AND AUXILIARIES):****• Equipment under test (EUT):**

ICT220-11T2025A

Serial Number: 12058CT00000100
FCC ID: XKB-ICT220V3**• Power supply:**

- AC / DC Adaptor: INGENICO, Model PSM24W-080, P/N: 192020864
- Rating: 100-240VAC, 0.6A / 8.0VDC, 3.0A
- Frequency: 50-60Hz

During all the tests, EUT is supplied by this adaptor.

• Inputs/outputs: Terminal

- 1 x USB Host, not used, not tested
- 1 x USB Slave, not used, not tested
- 1 x Jack power supply DC to magicbox
- 1 x COM0 to magicbox
- 1 x Ethernet to magicbox
- 1 x Line to magicbox
- 2 x SAM
- 2 x CAM
- 1 x Printer

• Inputs/outputs: Magicbox: 296105416 29/2012

- 1 x Jack power supply DC
- 1 x COM0
- 1 x Ethernet
- 1 x Line

• Cables:

- 1 x Power supply cable, unshielded, length: 1.5m
- 1 x Line cable, unshielded, length: 2m
- 1 x Ethernet cable, unshielded, length: 2m
- 1 x Com cable, unshielded, length: 2m, with load
- 1 x Magicbox cable twisted, unshielded, length: 1.5m

• Auxiliaries equipment used during test:

- 1 x Contact card
- 2 x SAM
- 1 x Laptop LENOVO with its power supply (Laptop of laboratory)
- 1 x TELTON Telephone line simulator TLS-5B-01, 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 : August 1st, 2012
Test performed by : A.MERLIN
Atmospheric pressure : 989hPa
Relative humidity : 41%
Ambient temperature : 24°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.

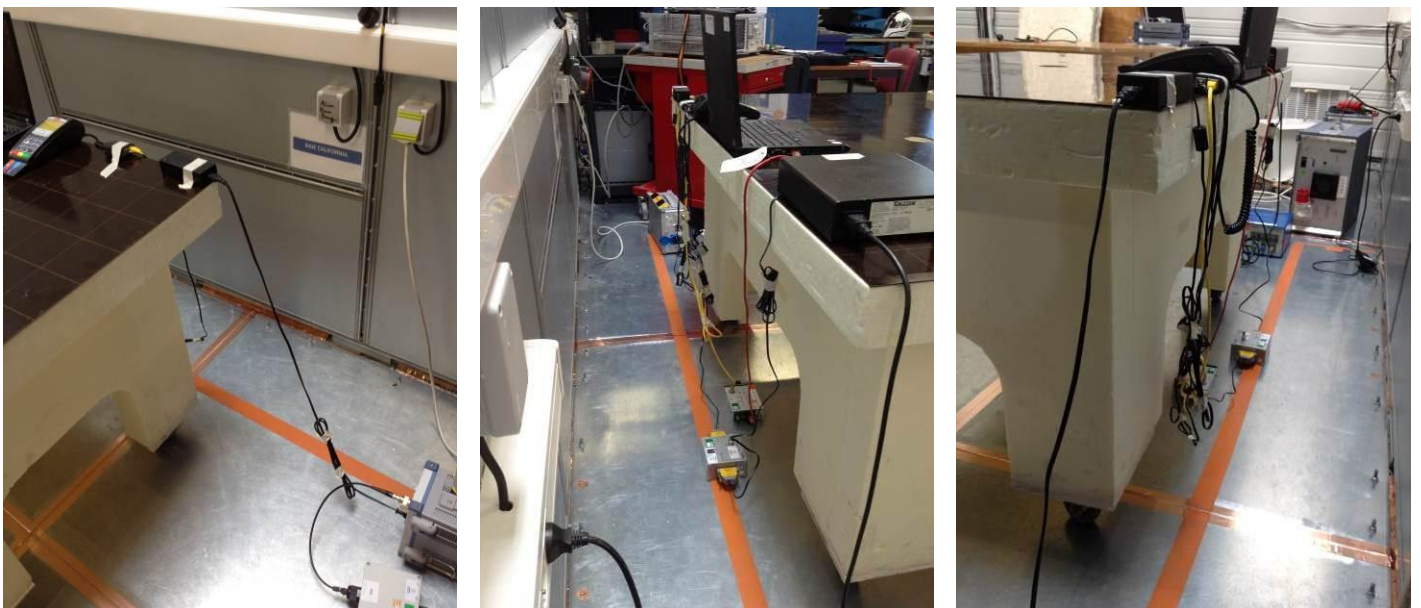
The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart B §15.107 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

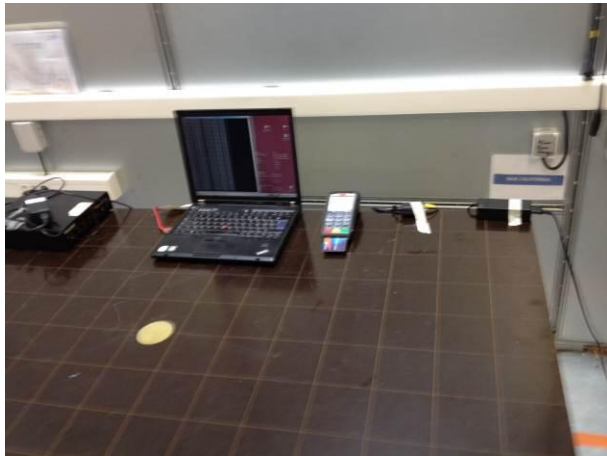
The EUT with its auxiliaries are set on a non-conducting table 80cm above the ground reference plane. The distance between the EUT and the LISN is 80cm. The EUT is 40cm away for the vertical ground plane. The EUT is powered through a LISN (measure). Auxiliaries are powered by another LISN.

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. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Cable	-	-	A5329578
Conducted emission comb generator	BARDET	-	A3169049
ISN 4 wires	RHODE & SCHWARZ	ENY41	C2320066
ISN 4 wires	TESEQ	T400A	C2320124
LISN	TELEMETER ELECTRONIC	NNB-2/16Z	C2320061
LISN	RHODE & SCHWARZ	ENV216	C2320123
Load 50Ω	-	-	A7152023
Load 50Ω	-	-	A7152032
Load 50Ω	-	-	A7152036
Receiver 20Hz – 8GHz	ROHDE & SCHWARZ	ESU8	A2642019
Thermo-hygrometer	HUGER	-	B4204052
Transient limiter	RHODE & SCHWARZ	ESH3-Z2	A7122204

3.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None

3.5. 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-2GHz)

4.1. TEST CONDITIONS

Date of test : August 2nd, 2012
Test performed by : A.MERLIN
Atmospheric pressure : 988hPa
Relative humidity : 37%
Ambient temperature : 24°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

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 2GHz, 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 1GHz:

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) 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. 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.

Characterization on 3 meters full anechoic chamber from 1GHz to 2GHz:

The product has been tested at a distance of **3 meters** (1GHz to 2GHz) 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 1MHz from 1GHz to 2GHz. 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. TEST EQUIPMENT LIST

DESCRIPTION	MANUFACTURER	MODEL	N° LCIE
Antenna Bi-log	CHASE	CBL6111A	C2040051
Antenna Bi-log	CHASE	CBL6111A	C2040172
Antenna horn	EMCO	3115	C2042027
Cable N/N	-	-	A5329038
Cable	SUCOFLEX	106G	A5329061
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329188
Cable	UTIFLEX	-	A5329192
Cable OATS (Mast at 10m)	UTIFLEX	-	A5329199
Cable N/N	-	-	A5329206
Semi-Anechoic chamber #3	SIEPEL	-	D3044017
Radiated emission comb generator	BARDET	-	A3169050
OATS	-	-	F2000409
Receiver 9kHz - 6GHz	ROHDE & SCHWARZ	FSL6	A2642020
Receiver 20-1000MHz	ROHDE & SCHWARZ	ESVS30	A2642006
Thermo-hygrometer	OREGON	BAR206	B4204078
Turntable chamber (Cage#3)	ETS Lingren	Model 2165	F2000371
Turntable / Mast controller (OATS)	ETS Lindgren	Model 2066	F2000372
Antenna mast (OATS)	ETS Lindgren	2071-2	F2000392
Turntable (OATS)	ETS Lindgren	Model 2187	F2000403
Table	MATURO Gmbh	-	F2000437
Turntable controller (Cage#3)	ETS Lingren	Model 2090	F2000444

4.4. DIVERGENCE, ADDITION OR SUPPRESSION ON THE TEST SPECIFICATION

None



4.5. MEASUREMENTS RESULTS

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

Polarisation H: *axis XY worst case* graph **Emr#1** (see annex 1)
 Polarisation V: *axis XY worst case* 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 (Meas-Lim) (dB)	Angle Table (deg)	Pol Ant.	Ht Ant. (cm)	Correc. factor (dB)	Comments
1	30.624	40.0	37.3	-2.7	120	V	100	17.9	Axis XY
2	38.982	40.0	35.8	-4.2	75	V	100	13.9	Axis XY
3	40.391	40.0	39.3	-0.7	170	V	100	13.4	Axis XY
4	43.772	40.0	38.6	-1.4	160	V	100	11.7	Axis XY
5	47.796	40.0	38.2	-1.8	180	V	100	9.7	Axis XY
6	49.876	40.0	35.7	-4.3	220	V	100	8.7	Axis XY
7	64.775	40.0	36.3	-3.7	335	V	100	7.3	Axis XY
8	65.316	40.0	21.3	-18.7	185	H	300	7.4	Axis XY
9	122.881	43.5	37.0	-6.5	0	V	100	15.6	Axis XY
10	552.971	46.0	34.8	-11.2	280	H	150	22.9	Axis XY

Note: Measures have been done at 10m distance and corrected according to requirements of 15.109.e)
(M@3m = M@10m+10.5dB)



4.5.1. Characterization in full anechoic chamber at 3m from 1GHz to 2GHz

The product has been tested at a distance of **3 meters** from the antenna and compared to the FCC part 15 subpart B §15.109 limits and C §15.209 limits. Measurement bandwidth was 1MHz from 1GHz to 2GHz. 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. Measurement performed on 3 axis of EUT. A summary of the worst case emissions found in all test configurations and modes is shown on clause 3.2

Frequency band 1GHz to 2GHz

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									

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
No Significant Frequency observed									

Note: Measures have been done at 3m distance.

RESULT: PASS



4.6. 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.

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



5. 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 Moirans <i>Measurement of radiated electric field on the Moirans open area test site</i>	5.07 dB	5.2 dB

Les valeurs d'incertitudes calculées du laboratoire étant inférieures aux valeurs d'incertitudes limites établies par la norme, 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 standard. The conformity of the sample is directly established by the applicable limits values.



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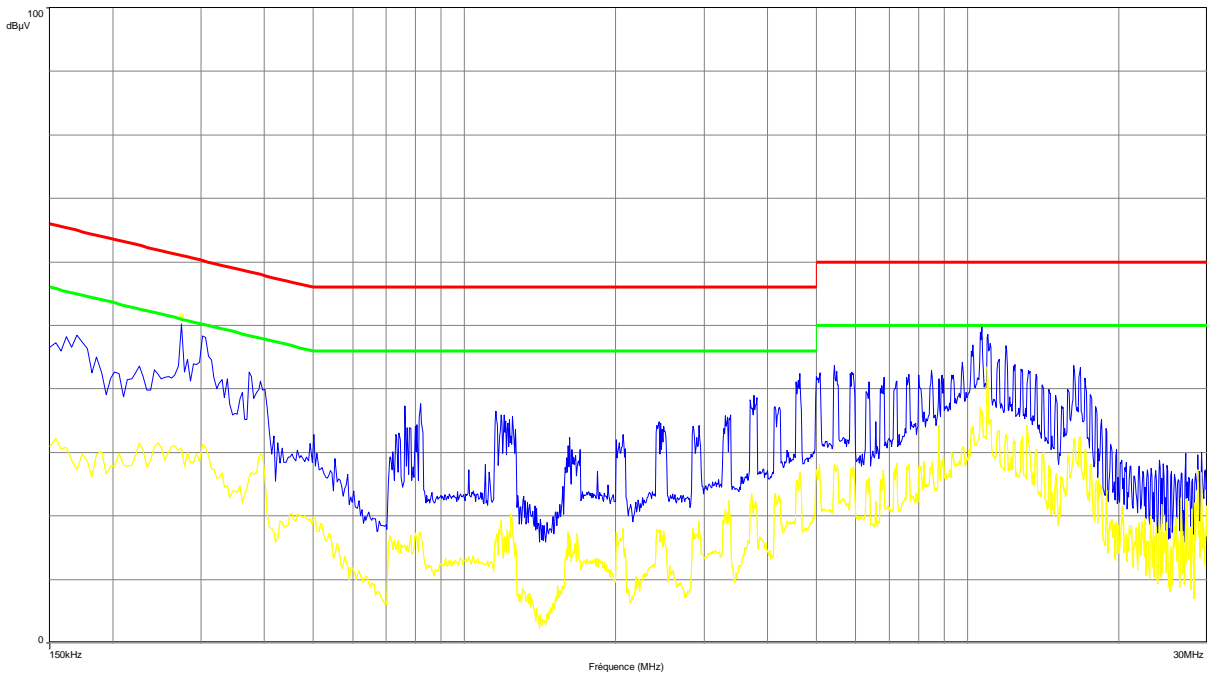
6. ANNEX 1 (GRAPHS)

RADIATED EMISSIONS

Graph name :	Emc#1	Test configuration:
Limit :	EN 55022	ICT220
Class :	B	

PARAMETERS

Voltage / Frequency :	110VAC / 60Hz	Legend:
Line :	Phase1	Peak Measure
RBW :	9kHz	Average Measure
VBW :	30kHz	QPeak Limit
Frequency :	150kHz- 30MHz	Average Limit



Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.274	29.30	51.00	-21.70	42.14	61.00	-18.86
10.67	33.30	50.00	-16.70	41.33	60.00	-18.67



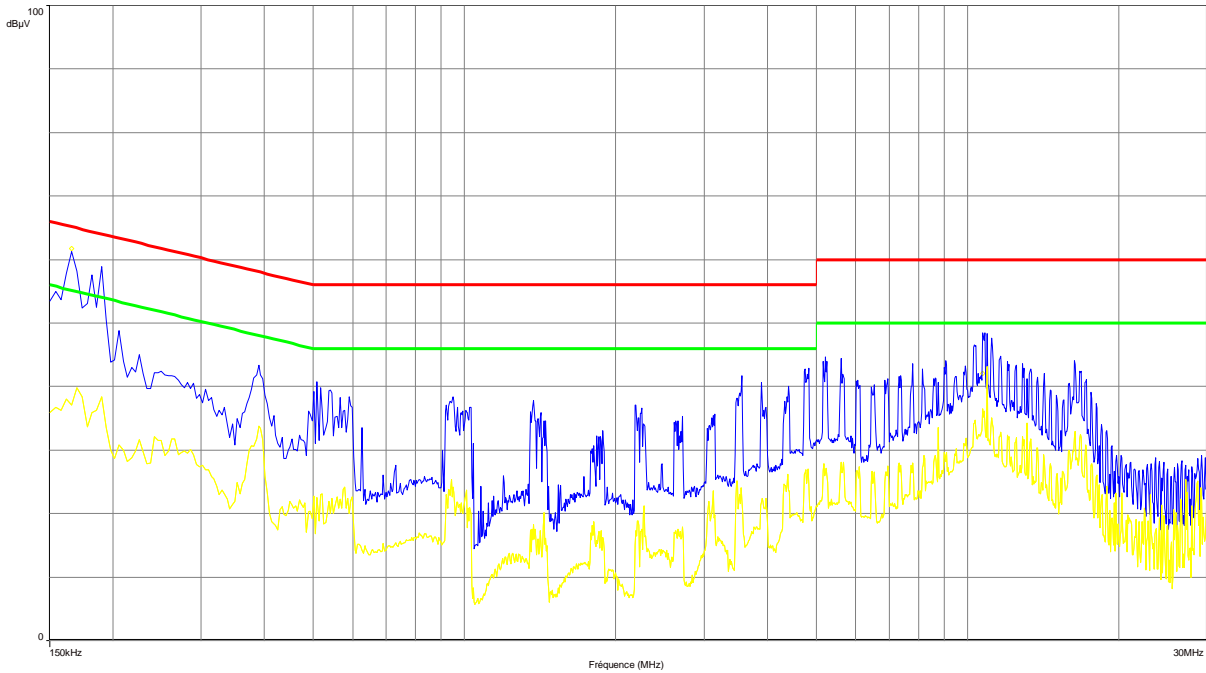
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RADIATED EMISSIONS

Graph name :	Emc#2	Test configuration:
Limit :	EN 55022	ICT220
Class :	B	

PARAMETERS

Voltage / Frequency :	110VAC / 60Hz	Legend:	
Line :	Neutral	Peak Measure	Average Measure
RBW :	9kHz		
VBW :	30kHz	QPeak Limit	Average Limit
Frequency :	150kHz- 30MHz		



Frequency (MHz)	Avg (dBµV)	Lim Avg (dBµV)	Avg-LimAvg (dBµV)	QPeak (dBµV)	LimQPeak (dBµV)	QPeak-LimQPeak (dBµV)
0.166	33.20	55.16	-21.96	49.37	65.16	-15.79
10.718	31.75	50.00	-18.25	39.94	60.00	-20.06



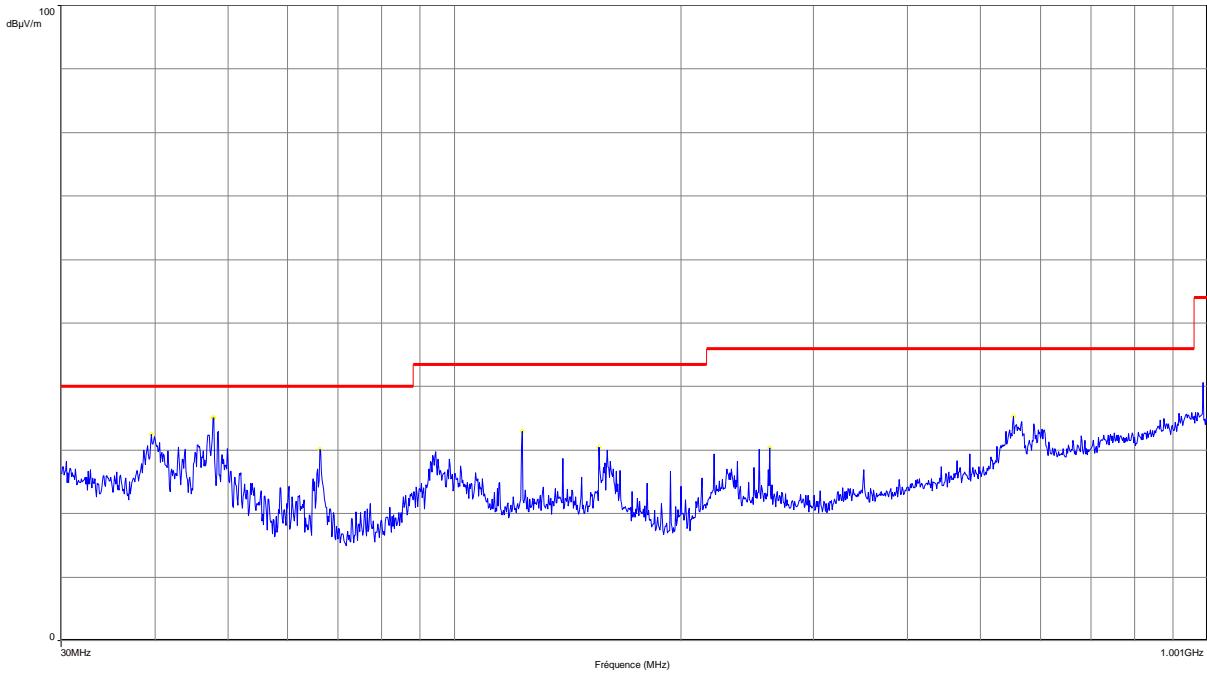
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RADIATED EMISSIONS

Graph name :	Emr#1	Test configuration:
Limit :	FCC Part15B	ICT220 - Axis XY (Worst case)
Class :	B	

PARAMETERS

Antenna polarization:	Horizontale	Legend:
Azimuth :	0° - 360°	█ Peak Measure
RBW :	100kHz	█ QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
39.52	32.43
47.80	35.09
47.84	35.11
66.28	30.09
122.88	32.93
155.64	30.45
262.16	30.30
552.60	35.30



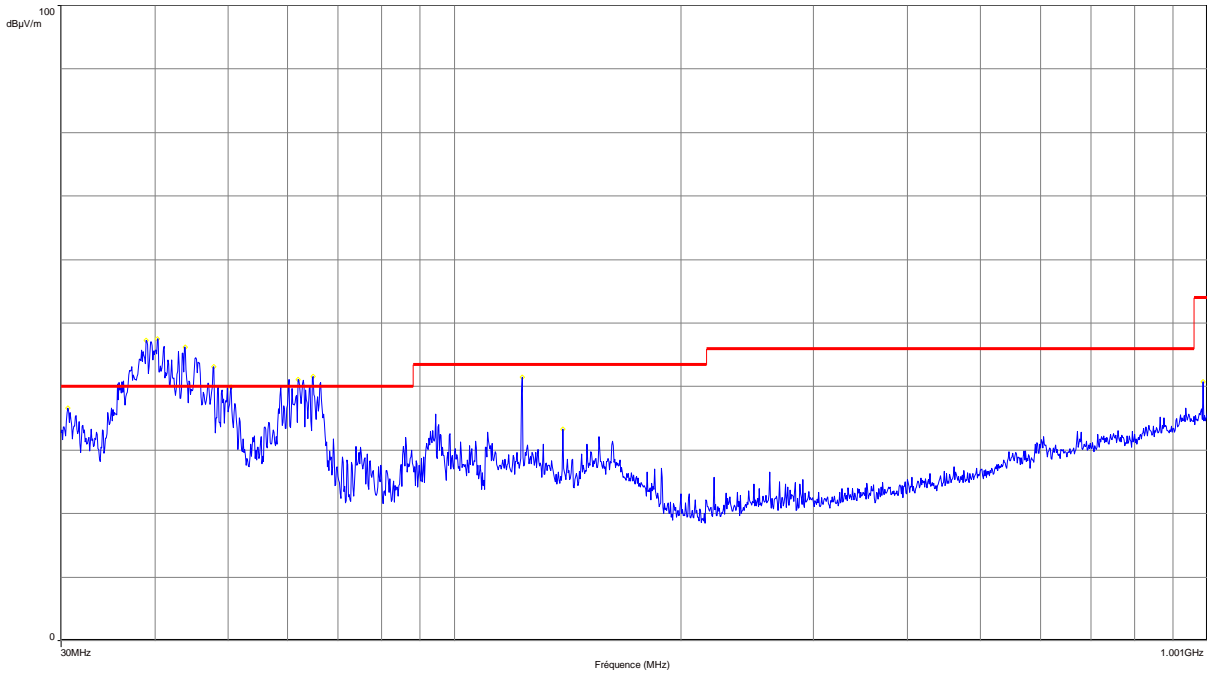
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RADIATED EMISSIONS

Graph name :	Emr#2	Test configuration:
Limit :	FCC Part15B	ICT220 - Axis XY (Worst case)
Class :	B	

PARAMETERS

Antenna polarization:	Verticale	Legend:
Azimuth :	0° - 360°	█ Peak Measure
RBW :	100kHz	█ QPeak Limit@3m
VBW :	300kHz	
Frequency :	30MHz- 1.001GHz	



Frequency (MHz)	Peak (dBµV/m)
30.64	36.62
38.88	47.28
40.32	47.57
43.84	46.19
47.84	43.18
50.44	39.88
62.00	41.09
64.80	41.56
122.88	41.48
139.28	33.32
987.52	40.74