Actions Mesures

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EMC TEST REPORT

Nr 2627/A1-FCC

This test report applies only on equipment described hereafter.

Proposal number: 200210-2058

Date..... :	October14th 2002 and January 16th , 2003
Location ..... :	SMEE ***Actions Mesures*** Laboratory - 38 VOIRON
Performed by ..... :	Jacques LORQUIN
Customer **..... :**	**TAGSYS S.A. (M. D'ANNUNZIO)** 180, Chemin de Saint Lambert 13821 La PENNE SUR HUVEAUNE FRANCE

Product ..... :	**AEROLI + MEDIO L100**
Type of test ..... :	**Radiated and Conducted Emission Test**

Applied standards ..... :	ANSI C63-4 (1992+2000) 47 CFR Part 15 Subpart C

Result of tests..... :	**Radiated Emission : Comply** **Conducted Emission : Comply**

Written by ..... :	Jacques LORQUIN	Approved by :	Jacques LORQUIN

1. System test configuration

1.1. Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The AEROLI is connected to Medio L100, which was connected to a Personnel computer. It has been tested with a Personal Computer HP model Vectra 500 series.

1.2. HARDWARE IDENTIFICATION:

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

➢ **AEROLI pn: SE10230A0 sn:M027010039** **FCCID: QHK100AEROLI**

- Input/output: 1x I/O BNC connector

- Size : 230x230x20mm

Tested with:

➢ **MEDIO L100 pn: SE10120B0 sn:M029010009**

- Input/output:
  - * 1x serial connector (DB9)
  - * 1x parallel connector
  - * Ch1 BNC antenna connector
  - * Ch2 BNC antenna connector
  - * Syn IN/OUT BNC connector
  - * I/O ports (1,2,3,4, gnd, Vin, Vout, gnd)
  - * power supply

- Size : 250x300x75mm
- Frequencies: crystal 32.768kHz and 14.7456MHz
  oscillator 27.12MHz; (no clock or signal higher than 108Mhz)
- output power : Ch1: 1.5W; Ch2: not used

1.3. Auxiliaries

The FCC IDs for all equipment, plus description of all cables used in the tested system are :

Trade Mark – Model Number (Serial number)	FCC ID	Description	Cable description
FOLIO 20 D5 (sn: 055AA55AAFDA666242)	None	Smart label	
HEWLETT PACKARD Vectra 500 series (sn: FR72565009) pn: D5083A	B94Vectravemt	Personnel computer	All data cables are shielded Power cable unshielded
HEWLETT PACKARD pn:D2846 (sn JP74001000)	Doc of Conf	21" color monitor	Shielded video cable with ferrite at each end. Power cable unshielded.
HEWLETT PACKARD pn:C4734-60111 (sn: M971168931)	GYUR38SK	Keyboard	Shielded cable
HEWLETT PACKARD pn:C4736-60101	JNZ201213	Mouse	Shielded cable

1.4. Equipment modifications

No equipment modification has been necessary during testing to achieve compliance to FCC part 15 Subpart C requirements. The unit tested was representative to a production unit.

1.5. EUT Exercise software

The EUT exercise program (L200Explorer.EXE, running under Windows 95) used during radiated and conducted testing was designed to exercise the AEROLI in a manner similar to a typical use :

- Carrier on,
- Reading the tag's number,
- Display the number of the tag on the monitor.

1.6. Special accessories

The serial and parallel interfaces cables used for compliance testing is shielded as normally supplied. All these cables are normally recommended to be used with the product.

1.7. I/O cables

- 3x Standard power cord Length:1.8m (Monitor, PC and Medio L100)
- 1x video cable with 2 integrated ferrite (shielded cable, length: 1.8m)
- 1x Parallel cable #174-8747 (shielded cable, length: 1.9m)
- 1x serial cable #174-8545 (Shielded cable, length:4.5m)
- 1x Coaxial cable with ferrites (length: 1.4m) provided with AEROLI

2. Radiated emission data

2.1. SET-UP

The EUT is placed on a non-conducting table of 80cm height. A smart label is set on the AEROLI.

Equipment configuration and running mode:

- The MEDIO L100 is plug on serial and parallel connectors;
- The MIDIO l100 is powered by 230V/50Hz;
- The Antenna (AEROLI) is connected to the Ch1 of the Medio L100;
- All other device is connected at each relevant ports of the PC;
- PC and EUT are ON;
- software is running;

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

2.2. TEST EQUIPMENT

Test Equipment up to 1GHz on 10 meters open site:

Equipment	Company	Model	Serial	Calibration Due
Spectrum Analyzer	HP	8568B	2732A04140	March 22nd ,2003
Quasi-Peak adapter	HP	85650A	2811A01136	March 22nd ,2003
RF Pre-selector	HP	85685A	2833A00773	March 22nd ,2003
Biconical Antenna	EMCO	3104C	9401-4636	April 4th ,2003
Log Periodic Antenna	EMCO	3146	2178	April 4th ,2003
Spectrum Analyzer	HP	8593E	3409u00537	June 29th ,2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10th ,2004
Amplifier	HP	8447F H64	3113A06394	March 28th ,2003
OATS				April 9th ,2003

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).

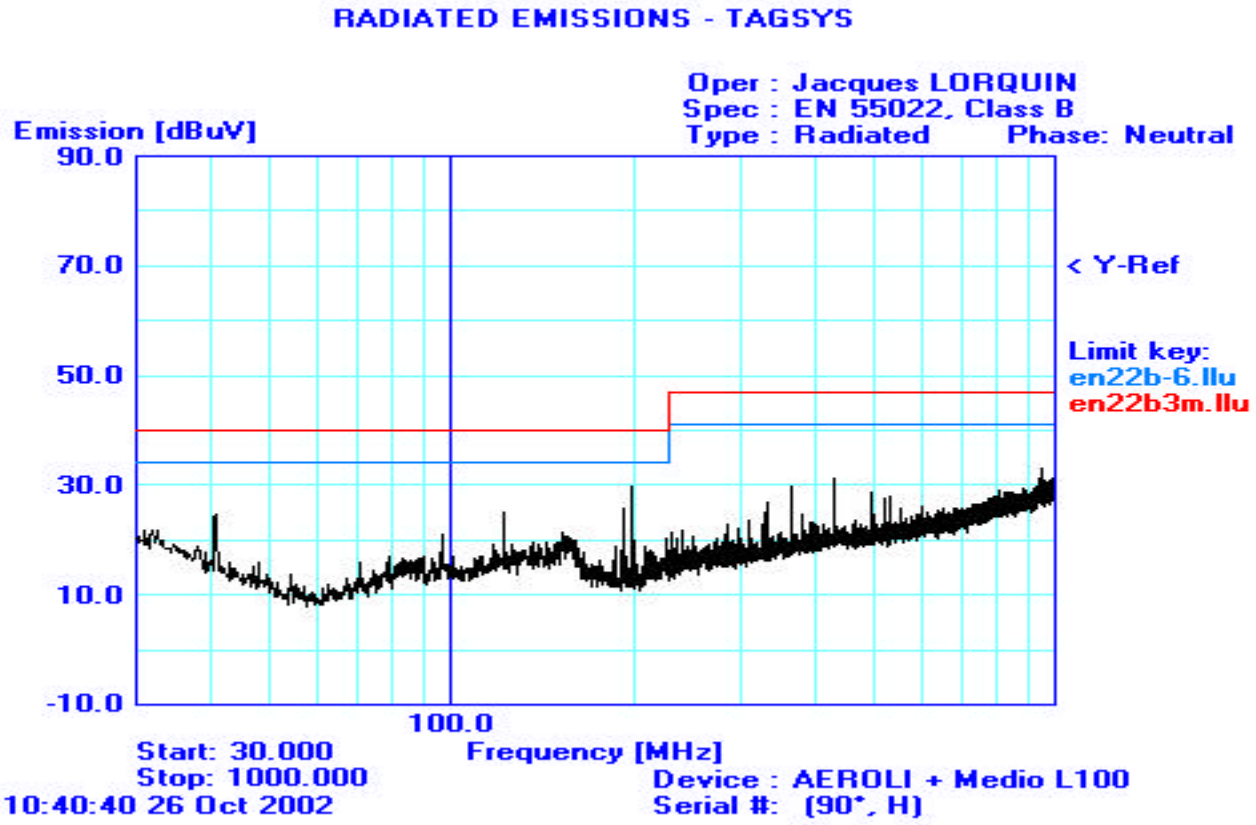
Pre-scan, test Equipment up to 1GHz:

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29th ,2003
Amplifier	HP	8447F H64	3113A06394	March 28th ,2003
Antenna (30MHz-1GHz)	CHASE	CBL6111A	1628	March 29th ,2003
Loop antenna	Electro-metrics	EM-6879	690234	February 10th ,2004

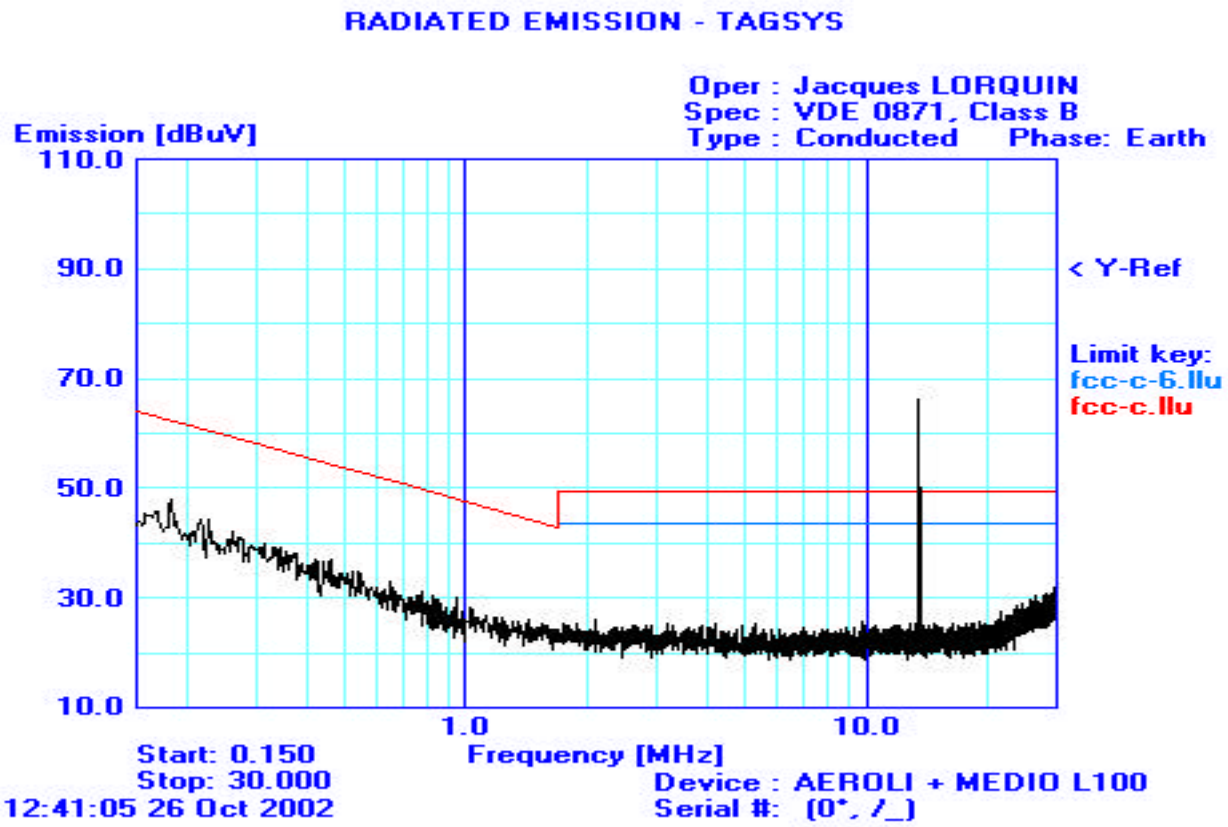
2.3. TEST SEQUENCE AND RESULTS

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 a graph example:



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) axis and the loop antenna position was rotated during the test for maximized the emission measurement. See below for a graph example:



Result below 30 MHz

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

The product has been tested according to ANSI C63.4-(1992), FCC part 15 subpart C. Radiated Emission were 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 FCC part 15 subpart C §15.209 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.

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.

No	Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Hgt (cm)	Tot Corr (dB)		Comments
1	40.711	40.0	37.1	**-2.9**	14	V	112	11.6	*	
2	122.058	40.0	33.4	**-6.7**	91	H	391	16.3	*	
3	192.013	43.5	35.9	**-7.6**	147	H	388	19.4	*	
4	198.959	43.5	34.2	**-9.3**	94	H	375	19.9	*	
5	464.218	46	40.7	**-5.3**	14	H	165	21.1	*	
6	729.499	46	41.6	**-4.4**	169	H	287	26.2	*	
7	994.756	54	46.9	**-7.1**	221	H	209	30.1	*	

*: The results are extrapolated with §15.31 requirement.

2.3.3.Characterization on 10 meters open site below 30 MHz

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56*[1]	80	66.6	-13.4	340	vertical	35.4
27.12	39.5	Not traceable signal				

*[1]: Fundamental – 15.225 limits. Measure have been done at 10m distance and corrected following requirements of 15.209.e)

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-(1992) and FCC Part 15 subpart C.

The product has been tested with 110V/60Hz power line voltage and compared to the FCC Part 15 subpart C §15.207 limits. Measurement bandwidth was 9kHz from 150 kHz to 30 MHz.

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

The EUT is placed on a non-conducting table of 80cm height. The cable of the power supply has been shorted to 1meter length. The MEDIO L100 is powered trough the LISN.

Equipment configuration and running mode:

- The MEDIO L100 is plug on serial and parallel connectors;
- The MEDIO l100 is powered by 110V/60Hz;
- The Antenna is connected to the Ch1 of the Medio L100;
- All other device is connected at each relevant ports of the PC;
- PC and EUT are ON;
- software is running;

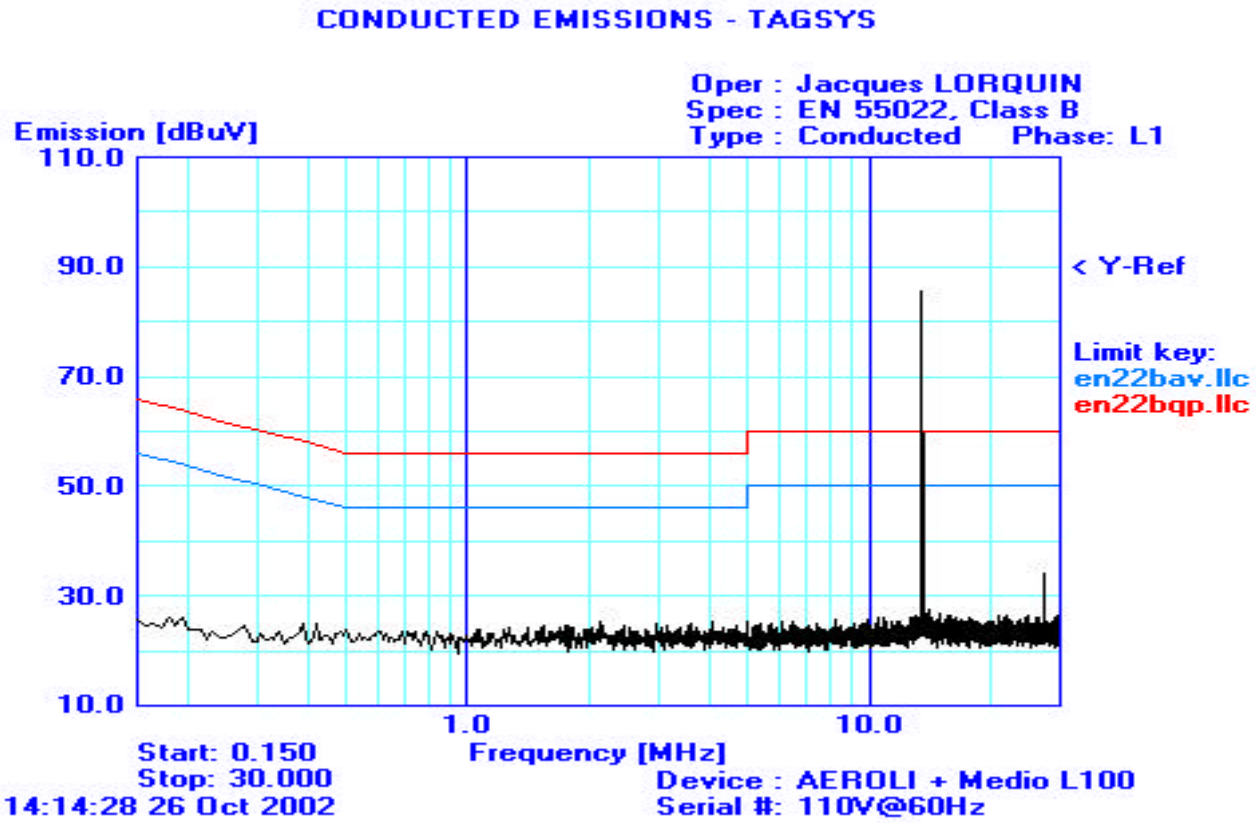
3.2. TEST EQUIPMENT

Equipment	Company	Model	Serial	Calibration Due
EMC Analyzer	HP	8591EM	3536A00384	March 29th ,2003
test receiver	Rohde&Schwarz	ESH3	872079/117	March 21st ,2003
Transient Limiter	HP	11947A	3107A01596	March 28th ,2003
LISN(auxiliary)	EMCO	3810/2SH	9511-11821628	December 12th ,2003
LISN(measure) 50Ω / 50µH	Telemeter Electronis	TGmbH NNB 2/16	9511-11821628	September 13th ,2003
Faraday room	Rayproof		4854	none

3.3. TEST SEQUENCE AND RESULTS

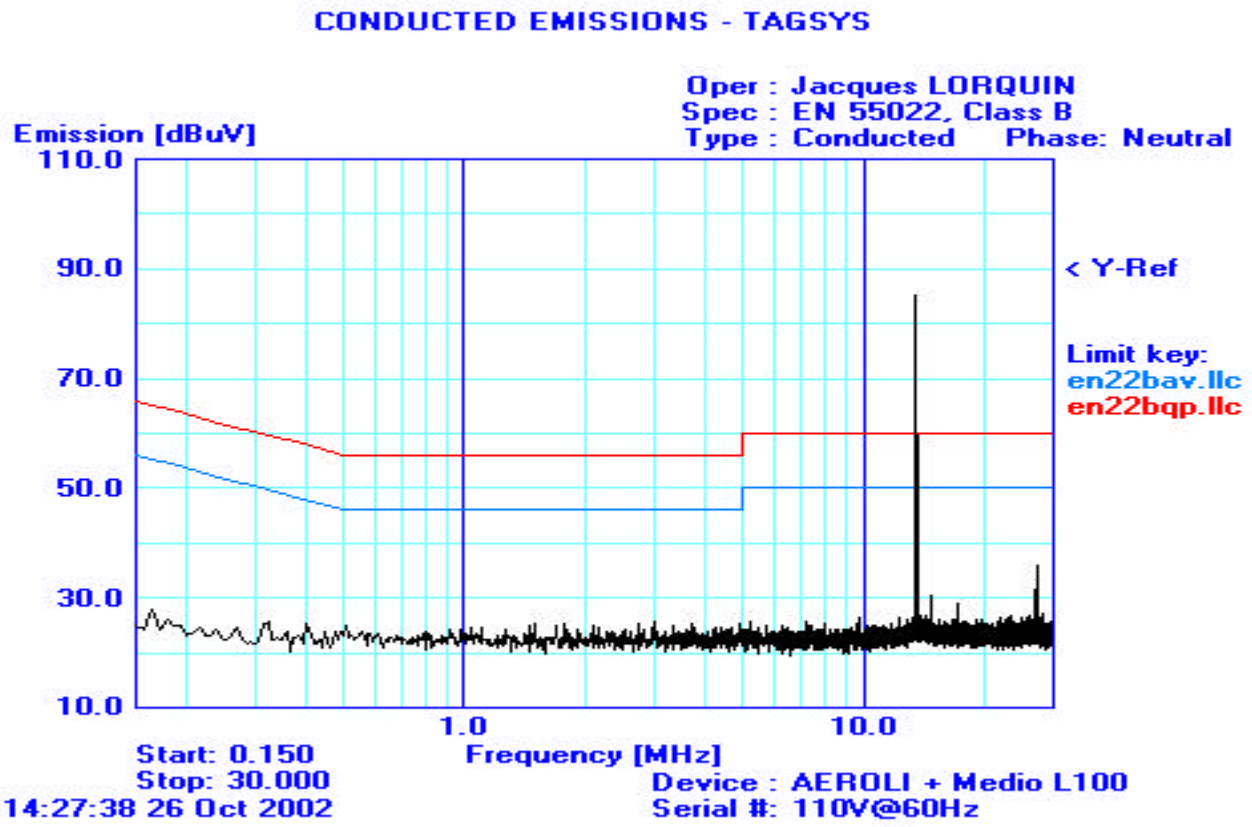
Measures are performed on line 1 and line 2 of the power supply of the PC,

3.3.1.Line conducted emission data on Medio L100



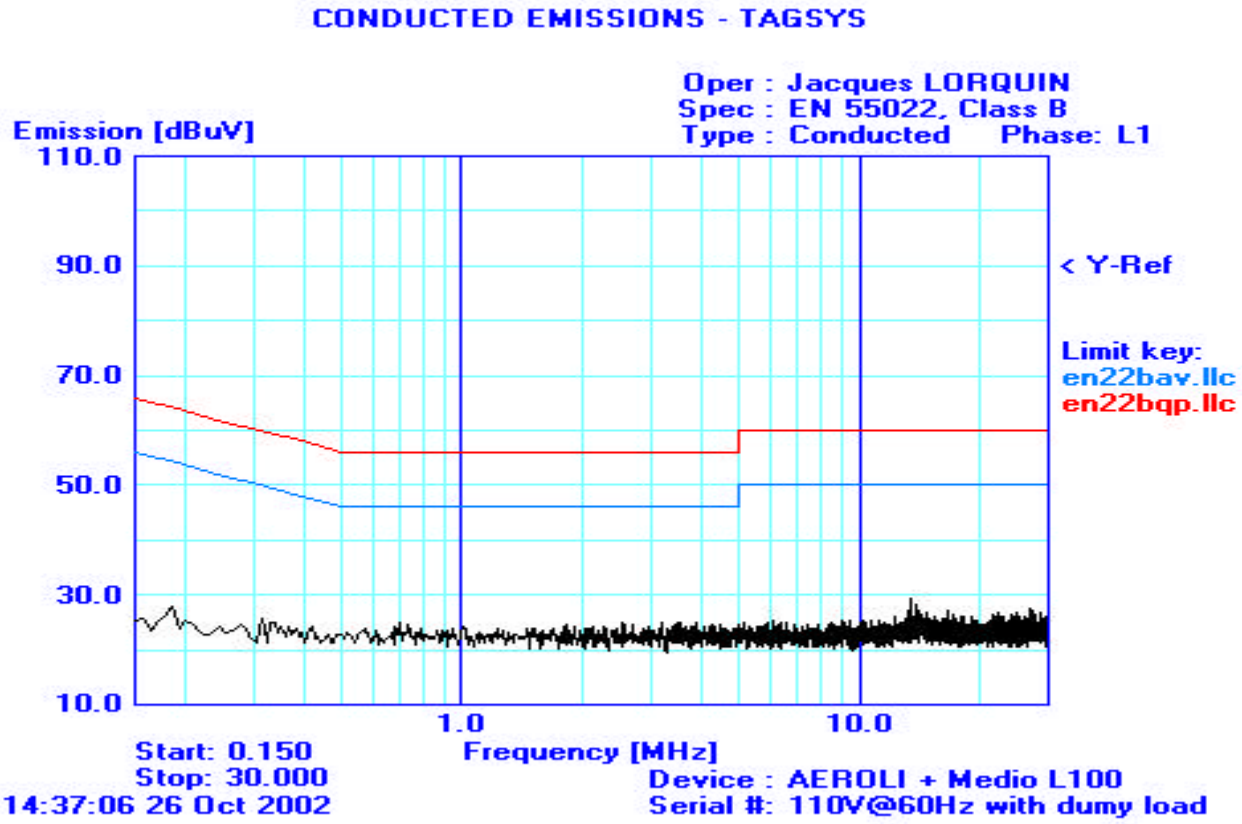
Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	QP delta [dBµV]	Average [dBµV]	AVG Limit [dBµV]	AVG Delta [dBµV]	Comment
1	13.57	85.44	-	60.0	(+25.44)	-	50.0	(+35.44)	Carrier
2	27.12	35.51	33.41	60.0	-26.59	32.39	50.0	-17.61	

3.3.2.Neutral conducted emission data on Medio L100

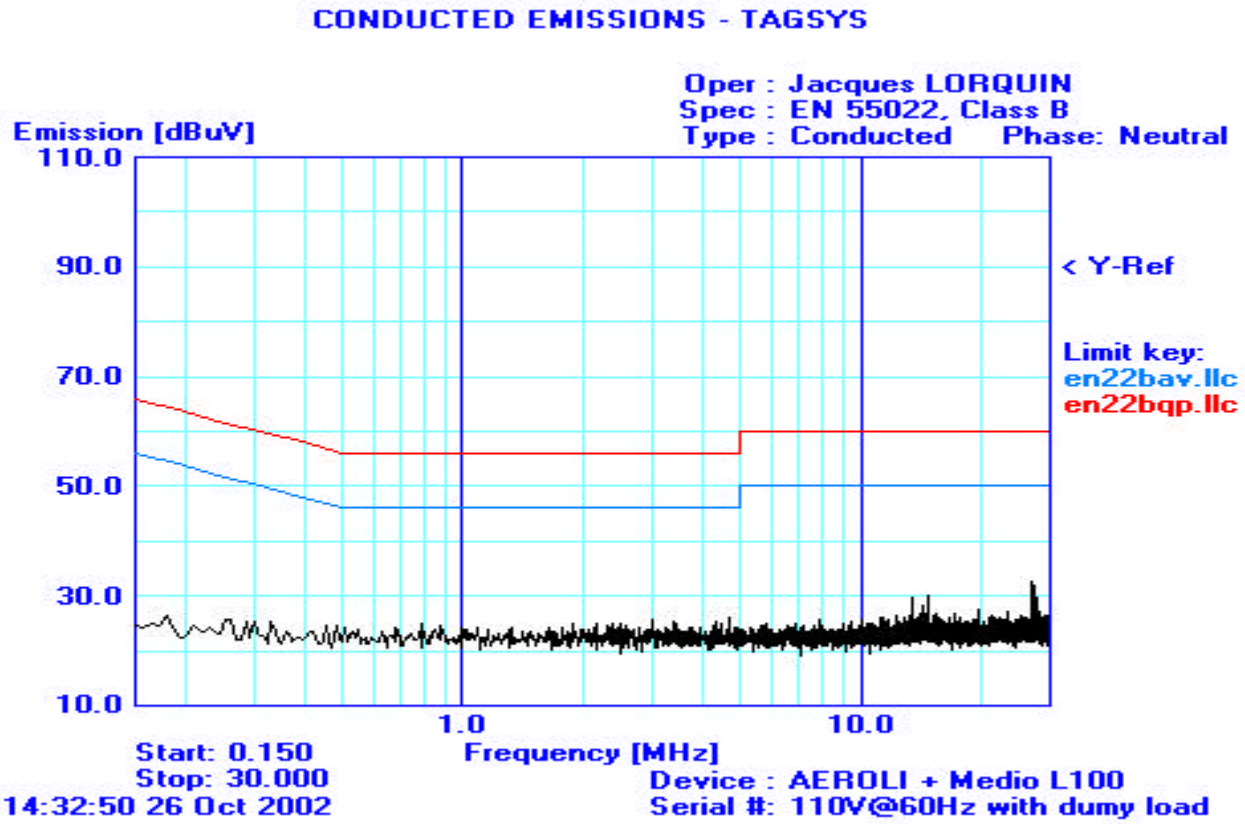


Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	QP delta [dBµV]	Average [dBµV]	AVG Limit [dBµV]	AVG Delta [dBµV]	Comment.
1	13.57	85.21	-	60.0	(+25.21)	-	50.0	(+35.21)	Carrier
2	27.03	32.30	29.41	60.0	-30.59	27.35	50.0	-22.65	
3	27.12	36.89	35.13	60.0	-24.87	34.32	50.0	-15.68	

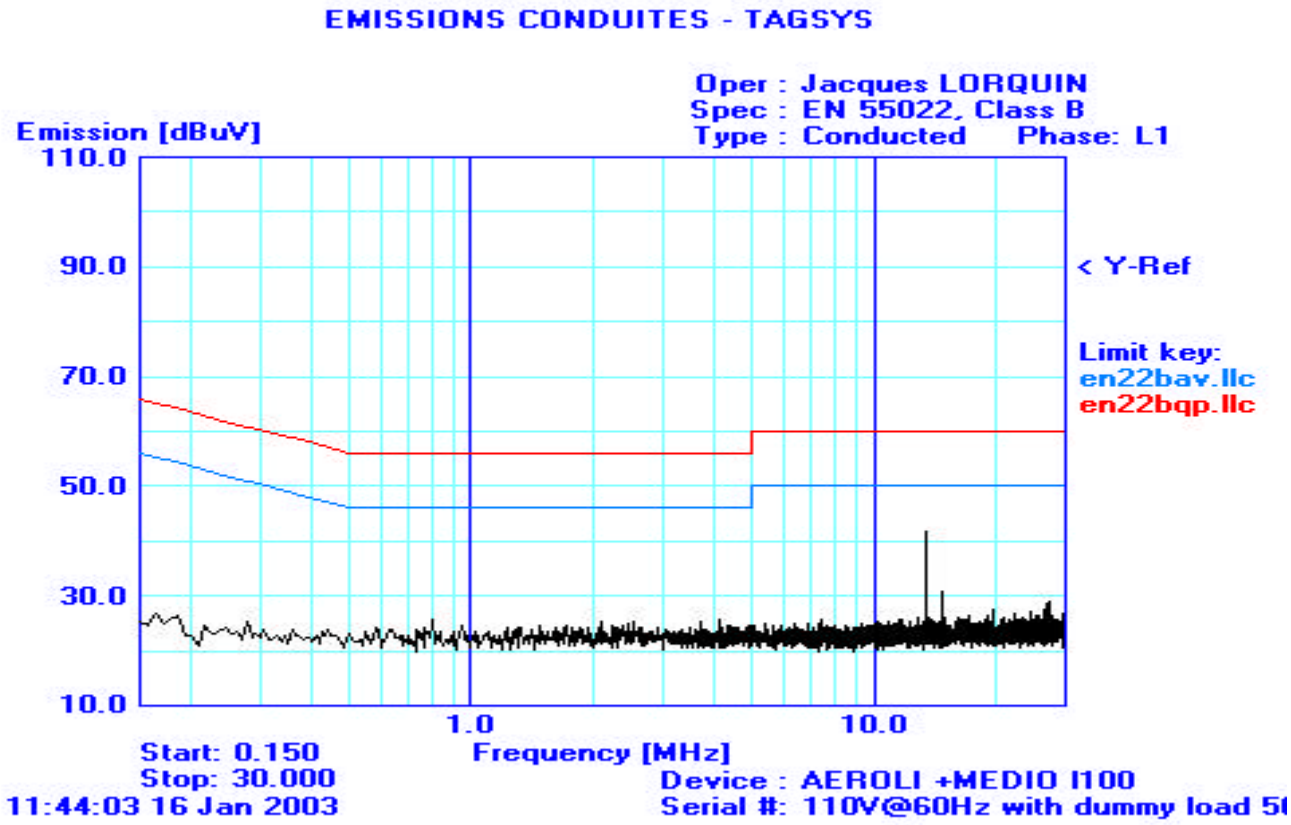
3.3.3.Line conducted emission data on Medio L100 with dummy load



3.3.4.Neutral conducted emission data on Medio L100 with dummy load

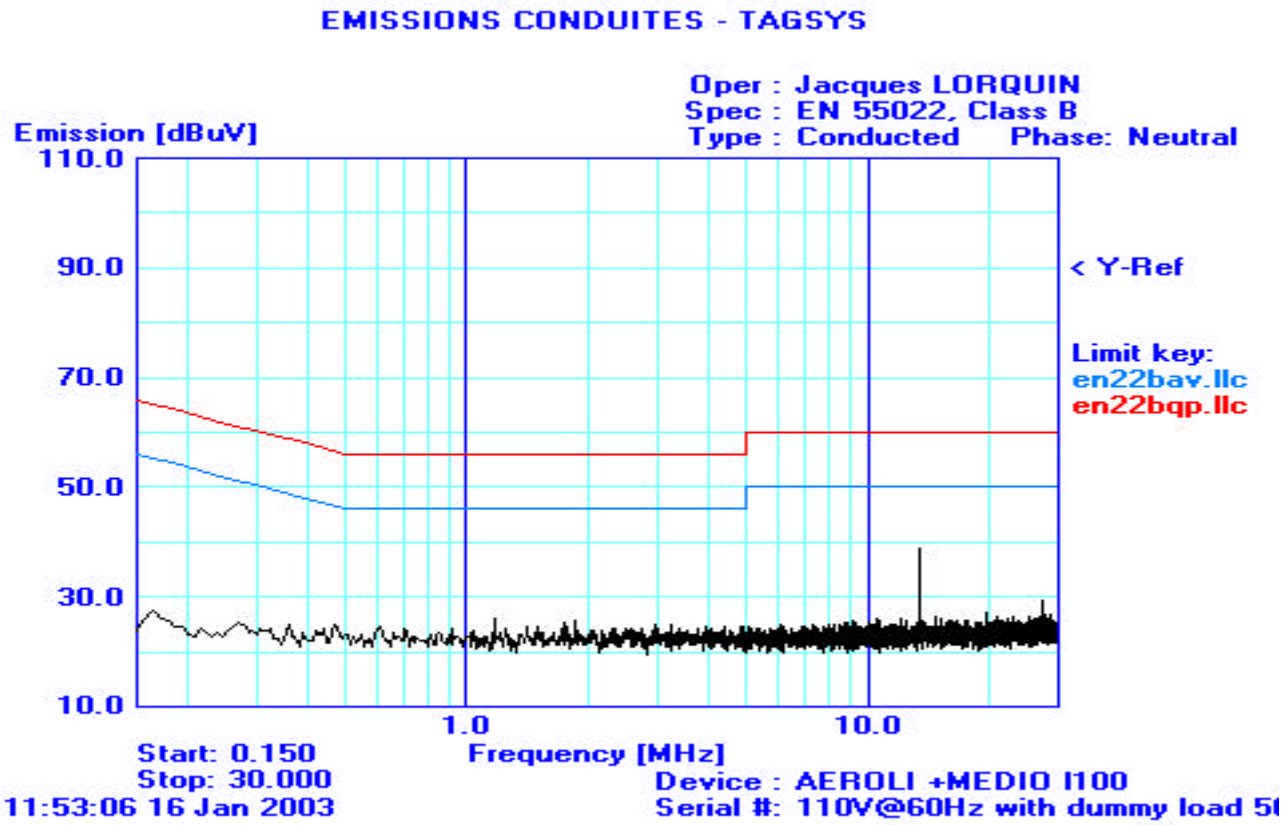


3.3.5.Line conducted emission data with dummy load set at end of coaxial cable



Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	QP delta [dBµV]	Average [dBµV]	AVG Limit [dBµV]	AVG Delta [dBµV]	Comment.
1	13.56	41.4	(41.4)	60.0	(-18.6)	41.0	50.0	-9	Carrier
2	14.77	32.31	29.1	60.0	-30.9	27.1	50.0	-22.9	

3.3.6. Neutral conducted emission data with dummy load set at end of coaxial cable



Num.	Freq. [MHz]	Peak [dBµV]	Q-Peak [dBµV]	QP limit [dBµV]	QP delta [dBµV]	Average [dBµV]	AVG Limit [dBµV]	AVG Delta [dBµV]	Comment.
1	13.56	41.7	(41.7)	60.0	(-18.3)	41.5	50.0	-8.5	Carrier

4. Field strength of fundamental §15.225(a)

The polarization of the measurements for the larger power level is vertical (the test is perform for both vertical and horizontal axis, and the loop antenna position was rotated during the test for maximized the emission measurement.)
Measure have been done at 10m distance and corrected following requirements of 15.209.e)

Frequency (MHz)	QPeak Lmt (dBµV/m)	QPeak (dBµV/m)	QPeak-Lmt (dB)	Angle (deg)	Pol	Tot Corr (dB)
13.56	80	66.6	**-13.4**	340	Vertical	35.4

No significantly variation of the fundamental amplitude during voltage variation testing per 15.31(e). Maximum deviation under extreme test condition (voltage variation): 1.5dBc

Limits Subclause §15.225(a)

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.56	10 000 80dBµV/m	30

5. Fundamental frequency tolerance (15.225.c)

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency.

5.1. Voltage fluctuation

Power supply has been set at 85% and 115% of nominal voltage, at 20°C.
Nominal voltage : 110-230V/60Hz
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

Voltage	85V	230V	276V
Frequency (MHz)	13.560000	13.559960	13.560025
Result	Pass	-	Pass

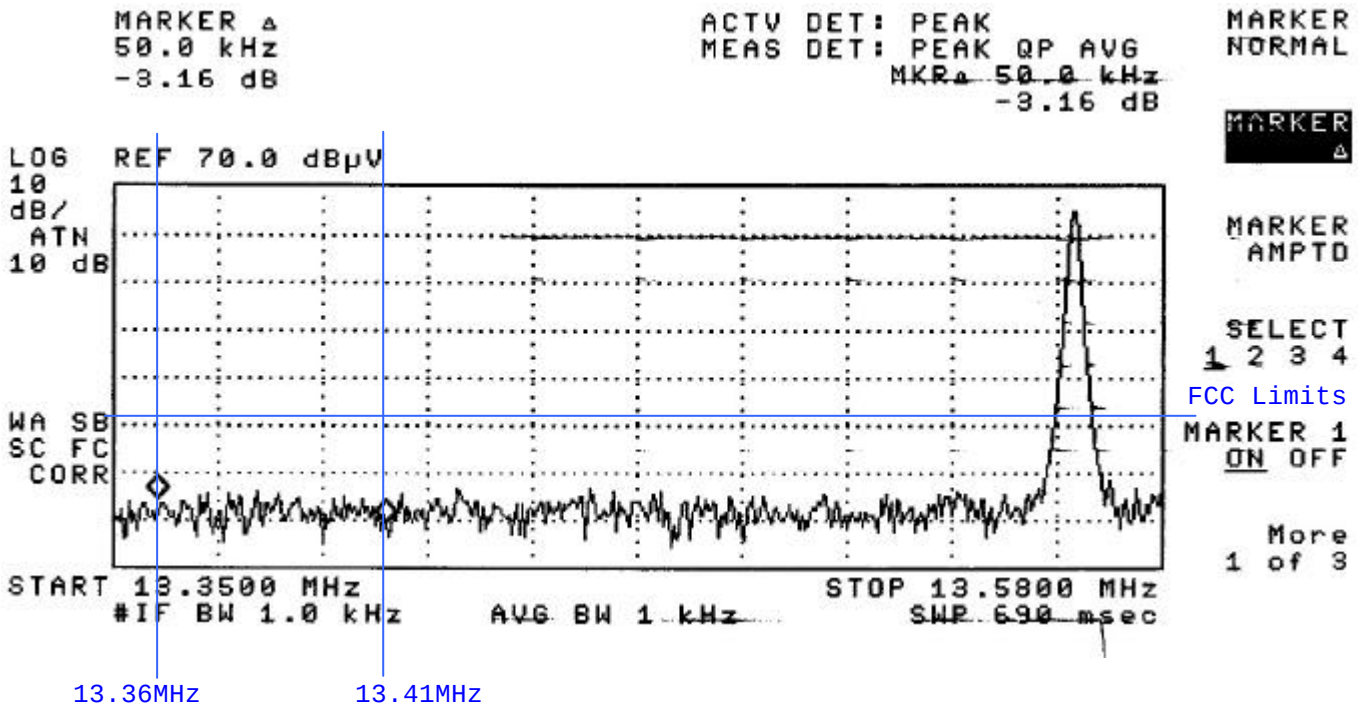
5.1.1.temperature

Temperature has been set at –20°C and +50°C at nominal voltage 230V/50Hz.
Frequency of carrier: 13.56 MHz
Upper limit: 13.561356 MHz
Lower limit: 13.558644 MHz

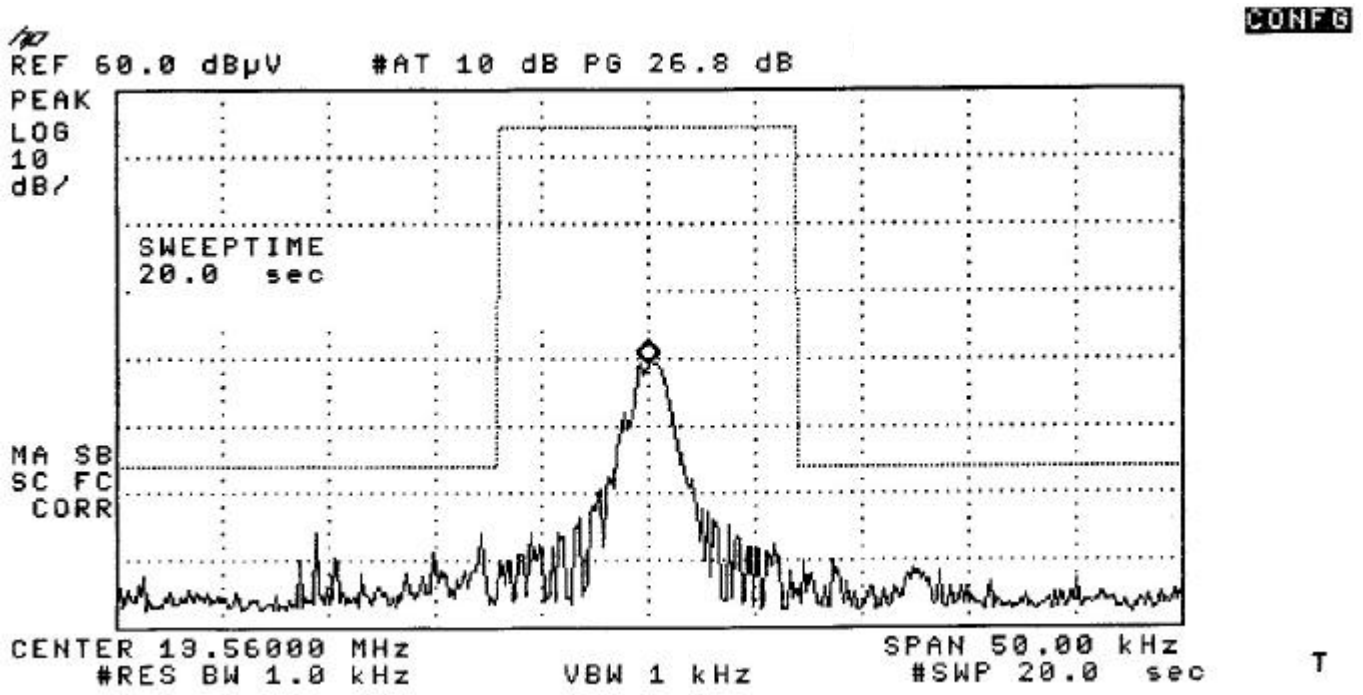
Voltage	-20°C	20°C	+50°C
Frequency (MHz)	13.559925	13.559960	13.560015
Result	Pass	-	Pass

6. Occupied bandwidth

Here is a plot of the occupied bandwidth, which show that , 13.36MHz - 13.41MHz restricted band is free of spurious emission.



7. Band-edge compliance §15.209



End of Tests