

EMI Test Report
Printer 10200 Metal

EUT level: Pre-production

Date: 26 October 2001

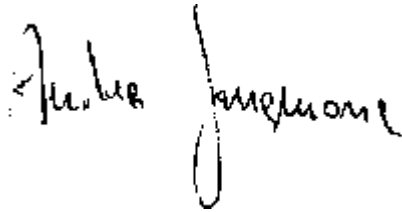
Report Nr.: RQ1002

Test Facility : Site No.1 (FCC Code 31040/SIT) of Compuprint SpA
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Test performed by: Daniele Zanino

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CONTENTS

1	EQUIPMENT UNDER TEST (EUT)	3
2	TEST OBJECTIVES	3
3	REFERENCE DOCUMENTS	3
4	TEST SUMMARY AND RESULTS	3
5	TEST RESULTS	4
5.1	CONDUCTED EMI	4
5.1.1	<i>Sample Calculations</i>	5
5.1.2	<i>PARALLEL ATTACHMENT</i>	5
5.1.3	<i>SERIAL ATTACHMENT</i>	6
5.2	RADIATED EMI.....	6
5.2.1	<i>Sample Calculations</i>	6
5.2.2	<i>PARALLEL ATTACHMENT 230Vac:</i>	6
5.2.3	<i>SERIAL ATTACHMENT 230Vac</i>	7
6	TEST METHOD AND SET-UP	8
6.1	SKETCHES.....	9
6.2	TEST EQUIPMENT	10
6.2.1	<i>Conducted EMI</i>	10
6.2.2	<i>Radiated EMI</i>	10
7	EUT SYSTEM	10
8	EUT CONFIGURATION	10

1 EQUIPMENT UNDER TEST (EUT)

Make	Type/Model	Serial Number
Compuprint	10200 Metal	PROTO B - 014

Description

1000 cps Dot Matrix Printer, 24 needles printhead, with Parallel (Centronics) and Serial (RS232) interfaces , intended primarily for use in office and business environments.

2 TEST OBJECTIVES

To verify the EUT compliance with the technical requirements under Part 15 of the FCC Rules,with Canadian requirements, under Industry Canada Standard ICES-003, and with all technical requirements based on CISPR 22 emission limits (class B).

3 REFERENCE DOCUMENTS

1. FCC: CFR 47 Ch. I: Part 15 (Radio Frequency Device) – Subpart A (General); Subpart B (Unintentional Radiators)
 2. Industry Canada: ICES-003: Digital Apparatus / NMB-003: Appariels numériques
 3. EMCAB-3 Issue 3: Implementationand Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003
 4. CISPR 22: Limits and methods of measurement of radio disturbance characteristics of Information Technology Equipment
- The test was performed according to the following procedure excluding section 5.7, section 9 and section 14;
5. ANSI C63.4-1992: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz"

4 TEST SUMMARY AND RESULTS

The 10200 printer was tested as running while attached to a personal computer via parallel (Centronics) and via serial (RS-232) interfaces.

The test configuration, cables and operations were selected following the referenced documents (section 3) and within the range of typical customer applications (see section 6 for details).

The EUT radio frequency emissions (conducted onto the AC power line and radiated, measured at 10 meters from the EUT) were compared with the class B limits specified in CISPR 22, in order to verify the EUT compliance with all applicable standards, including the FCC and Canadian requirements, as allowed by the FCC rules (Ch. 1 §15.107(e), §15.109(g)) and by ICES-003.

The 10200 printer was found to meet CISPR 22 Class B limits with a minimum margin of 14.3dB for conducted EMI and a minimum margin of 3dB for radiated EMI.

These results are deemed satisfactory evidence of compliance with the technical requirements under FCC part 15, with Industry Canada Interference-Causing Equipment Standard ICES-003 and with all requirements based on CISPR 22 Class B emissions limits.

4.1 Test Summary Table:

						Min.
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Ref. Standard	Class	Tests run	Test notes	Pass	Fail	margin [dB]
CISPR 22	B	EMI Conducted		X		14.3
CISPR 22	B	EMI radiated	10 m distance	X		3

4.2 EMI Suppression Components:

The following component are specifically used in the subject EUT in order to meet the requirements of the references standards (class B limits) with good safety margins:

- Motherboard:
IMI SM530 Spread Spectrum Clock Generator, used to spread the RF energy of clock and all clock-related signals. RC and series R filters at the output of clock and fastest logic signals.
- Power Supply:
Line Filter with two X capacitors, two Y capacitors and one CM inductance.
Ferrite core on AC power cable between power supply PCB and the AC plug.
- Ferrite cores on the following cables:
operator panel cable; sensors cable; carriage motor cable; paper motor cable; carriage motor fan cable; AC power cable (between the Power Supply PCB and the AC plug): one toroidal core on line/neutral wires and one cylindrical core on earth (yellow/green) wire.

5 TEST RESULTS

5.1 Conducted EMI

The conducted emissions were measured while the 10200 printer (EUT) was running via parallel and serial interface .

The quasi-peak levels of the highest points are given below.
QP and AV measurement detector bandwidth 9 kHz.

5.1.1 Sample Calculations

The equation below shows how the test results were obtained from the receiver's readings.

Final level (dB μ V) = Receiver Reading (dB μ V)+ Cable Loss (dB)

NOTE: At each frequency, the highest of the levels recorded on the line and neutral conductors is reported.

5.1.2 PARALLEL ATTACHMENT

MAINS 120 Vac									
FREQ.	LINE	LEVEL ¹		FREQ.	LINE	LEVEL	CISPR 22		Margin ²
[MHz]		[dB μ V]		[MHz]		[dB μ V]	Class B LIMIT		[dB]
		QP	AV			QP	QP	AV	
0.200	N	49.3		0.200	R	49.0	63.6	53.6	-14.3
0.269	N	42.7		0.269	R	43.0	61.1	51.1	-18.1
0.338	N	32.4		0.338	R	36.5	59.3	49.3	-22.8
0.375	N	31.3		0.375	R	31.6	58.4	48.4	-26.8
0.400	N	34.0		0.400	R	33.4	57.9	47.9	-23.9
6.570	N	39.5		7.034	R	40.2	60	50	-19.8
7.435	N	38.1		7.233	R	40.6	60	50	-19.4
8.096	N	38.0		7.433	R	41.2	60	50	-18.8
8.494	N	36.2		8.295	R	38.1	60	50	-21.9
9.288	N	33.1		9.356	R	33.2	60	50	-26.8

¹ QP= quasi-peak reading ; AV= average reading .

AV reading is reported only when the QP reading exceeds the AV limit.If the QP reading is below the AV limit,the EUT is deemed to meet both limits and the AV measurement is not required (ref. CISPR 22,section 5)

² Margin = Measured Level - Limit

5.1.3 SERIAL ATTACHMENT

MAINS 120 Vac									
FREQ.	LINE	LEVEL ¹		FREQ.	LINE	LEVEL	CISPR 22 Class B LIMIT		Margin ²
[MHz]		[dBμV]		[MHz]		[dBμV]	[dBμV]		[dB]
		QP	AV			QP	QP	AV	
0.204	N	49.1		0.204	R	49.0	63.4	53.4	-14.3
0.273	N	42.8		0.273	R	43.2	61	51	-17.8
0.332	N	32.3		0.332	R	36.4	59.4	49.4	-23.0
0.373	N	31.8		0.373	R	32.0	58.4	48.4	-26.4
0.400	N	34.5		0.400	R	33.5	57.9	47.9	-23.4
7.010	N	39.8		7.056	R	40.4	60	50	-19.6
7.520	N	38.3		7.266	R	41.2	60	50	-18.8
8.420	N	38.1		7.520	R	41.3	60	50	-18.7
8.588	N	36.0		8.310	R	37.8	60	50	-22.2
9.366	N	33.3		9.426	R	33.5	60	50	-26.5

5.2 Radiated EMI

Radiated were investigated from 30MHz to 1000MHz, according to FCC 15.33.

Here below are reported the highest points in the radiated emissions spectrum of the subject EUT.

Measurement distance: 10 meters

5.2.1 Sample Calculations

The equation below shows how the test results were obtained from the receiver's readings.

E-field level (dBμV/m) = Receiver Reading (dBμV) + Antenna factor (dB/m) + Cable Loss (dB)

NOTE 1: At each frequency, the highest of the levels recorded in vertical and horizontal polarization of the receiving antenna is reported. Each level was maximized (vs. EUT azimuth and antenna height).

NOTE 2: At each frequency, the EUT was powered off and back on, in order to check the ambient (non-EUT) noise level. The E-field level with EUT off is specified in parentheses when it is less than 6 dB below the level with EUT on.

NOTE 3: Quasi-peak measurement detector bandwidth 120kHz.

5.2.2 PARALLEL ATTACHMENT (120V 60Hz):

FREQ.	E-field level	Antenna height	EUT angle	Polar. V/H	CISPR 22 classB limit	Margin
[MHz]	[dBμV/m]	[cm]	[degr]		[dBμV/m]	[dBμV/m]
56.388	22.0	100	45	V	30	8
80.392	26.5	100	45	V	30	3.5
122.206	24.0	100	150	V	30	6
158.518	20.0	400	90	H	30	10
186.736	21.5	400	90	H	30	8.5
188.290	26.0	100	0	V	30	4
189.853	22.3	400	90	H	30	7.7
191.530	26.0	100	0	V	30	4
193.110	27.0	100	0	V	30	3
214.610	25.3	100	0	V	30	4.7
228.590	23.5	100	0	V	30	6.5
256.968	23.3	100	0	V	37	13.7

5.2.3 SERIAL ATTACHMENT (120V 60Hz):

FREQ.	E-field level	Antenna height	EUT angle	Polar. V/H	CISPR 22 classB limit	Margin
[MHz]	[dBμV/m]	[cm]	[degr]		[dBμV/m]	[dBμV/m]
56.450	23.0	100	45	V	30	7
81.230	25.5	100	45	V	30	4.5
116.457	22.8	100	150	V	30	7.2
122.860	24.1	100	150	V	30	5.9
185.630	25.3	100	0	V	30	4.7
187.090	22.0	400	90	H	30	8
189.556	22.3	400	90	H	30	7.7
191.133	26.2	100	0	V	30	3.8
194.040	26.4	100	0	V	30	3.6
195.056	21.3	400	90	H	30	8.7
215.036	25.0	100	0	V	30	5
217.988	23.8	100	0	V	30	6.2

6 TEST METHOD AND SET-UP

EMI tests were performed in Compuprint's proprietary EMC facility, with a shielded room (used for conducted EMI) and a 3/10 meter open area test site (radiated EMI). The site is filed with the FCC data-base as Site No. 1 (ref. 31040/SIT).

The 10200 printer was tested as part of a typical table-top system, with a Personal Computer driving the EUT and an additional peripheral device connected at the same PC. The auxiliary peripheral was an FCC certified printer, with a parallel and a serial interface. When testing the EUT printer on the parallel interface, the auxiliary printer was connected to the PC serial port and powered on. When testing the EUT printer on the serial interface, the auxiliary printer was connected to the PC parallel port and powered on.

PC, EUT and auxiliary equipment were placed on a 0.8 m high wooden table. All cables were arranged as specified in CISPR22-1997 (sec.8.1) and ANSI C63.4-1992 (sec.6).

The printer was tested using an "H" pattern, 136 columns on continuous form. This thoroughly exercises the EUT and its functions. The EUT was exercised via the parallel (Centronics) and the serial (RS232).

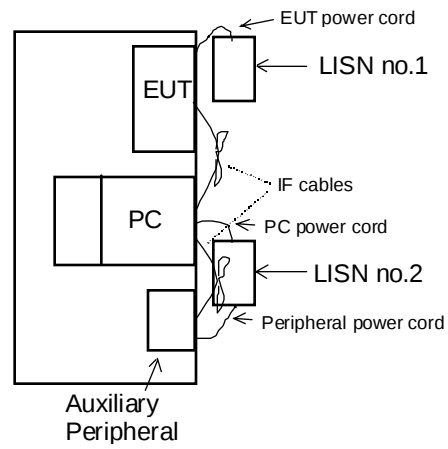
For the **conducted emissions** test on AC power lines, the EUT system was placed 0.4 m from a vertical wall of the shielded room, and kept at least 0.8 m from any other metal surface, as specified in CISPR22-1997 (sec.9 and fig.4) and ANSI C63.4 (sec.7.2.1 and fig.9(a)). The EUT power cord was connected to one AMN (Artificial Mains Network), as defined in CISPR16-1 (sec. 11.3, fig.7.b), equivalent to a LISN (Line Impedance Stabilization Network) as defined in ANSI C63.4 (sec.4.1.2). The power cords of the PC main unit, PC video and that of the auxiliary equipment were connected to a multiple outlet and powered through a second AMN/LISN (ref. CISPR22-1997 sec.9.2 (e) and ANSI C63.4 sec.7.2.1). The conducted emissions on each current-carrying conductor of the EUT power cord were measured using the first AMN/LISN.

For the **radiated emissions** test, the EUT system was rotated 360 deg. and the receiving antenna scanned from 1 to 4 meters in height, with vertical and horizontal polarization.

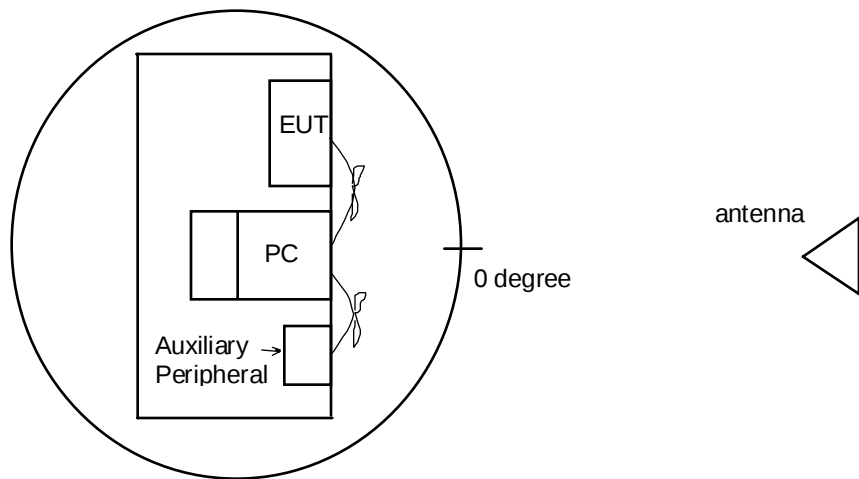
The EUT set-up and orientation was such that the rear of the system (printer+ PC+auxiliary equipment) was facing the receiving antenna at the zero degree angle of rotation (see sketch below).

The radiated test distance of 10 meters was measured as the horizontal distance between the receiving antenna and the boundary of the EUT system, as specified in CISPR22-1997 (sec.10.2.1) and FCC Part 15 (§15.31(f)).

6.1 Sketches



Conducted test layout (top view)



Radiated test layout (top view)

6.2 Test Equipment

6.2.1 Conducted EMI

Receivers: Rohde & Schwarz ESN 1027.3007.30 (s/n 842789/008): 10 kHz - 1000 MHz (peak scan)
LISN #1: Schwarzbeck NSLK 8128 (serial # 9002-090000012), on EUT (printer) power cord
LISN #2: Rohde & Schwarz ESH3-Z5 (serial # 862770/022), on power cords of PC and auxiliary devices.

6.2.2 Radiated EMI

Receiver: Rohde & Schwarz ESN 1027.3007.30 (s/n 842789/008): 10 kHz - 1000 MHz
Antennas: Rohde & Schwarz HK116 (s/n 843562/06) biconical (20 - 300 MHz)
EATON Mod. 96005 (s/n 2490) log-periodic (200 - 1000 MHz)

7 EUT SYSTEM

- Printer Compuprint 10200 (Equipment Under Test) – PROTO B - 014
- PC DIGITAL mod. 500 233 100-120/220-240Vac 60-50Hz - FCC ID: N2XWW1 s/n:PC81214947
- Video unit Jean Company LTD mod JD144L 100/240V 60/50Hz – FCC ID: AMP JD144K s/n:8745001001
- Keyboard: Digital mod RT 2158 TWIT - FCC ID: AQ6-71Z15 - s/n: 81221564
- Mouse : Logitech mod M-S34 - FCC ID : DZL 211029 - s/n: LC80100558
- Auxiliary printer (with parallel and serial ports): Compuprint MDP 40C – FCC ID : CTZ-MDP40 s/n : ZCS-S46-01240 120V 50-60Hz
- Parallel (Centronics) IF cable: part # 158392-4 (IEEE 1284 compliant) - 3m shielded
- Serial (EIA 232) IF cable: Misco pn 2329 - 3m shielded
- AC power cables: standard, non shielded

8 EUT CONFIGURATION

Motherboard: 4VG962 (p/n 78408839-001)
Oscillator frequencies: 31.3344 MHz
Clock frequencies: 15.6672 MHz
Bus / Control signal frequencies: 3.9168 MHz

Expansion board: 4NDL01 (p/n 78409148-001)

Serial attachment card: 2SERIV

Operator panel: 2PO9TA (p/n 78409639-001)

Power Supply: p/n 78202081-102 / Roal Bafin mod.139 (100-240 Vac)
Switching frequencies 65 kHz (converter forward); 60 kHz (converter boost)

Options installed: None