EMI Test Report

Printer Compuprint mod. 9078plus

EUT level: Pre-production

Date: 28/03/2001

Report Nr.: RQ0837

Test Facility : Site No.1 (FCC Code 31040/SIT) of Compuprint SpA
Via ai Laboratori Olivetti 79/81 - 20010 Pregnana Milanese (MI)

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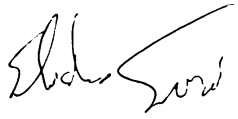

Dates of Test: 12/03/2001 to 13/03/2001

Test performed by: Franco Acquarone

REVISION RECORD

REV	DATE	DESCRIPTION	PAGES
AA	28-03-2001	FIRST ISSUE	ALL

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1.0 EQUIPMENT UNDER TEST (EUT)

Make	Type/Model	Serial / Prototype Number
Compuprint	9078plus	7GU-002

Description
700 cps Dot Matrix Printer, 24 needles printhead, with parallel (Centronics) and serial (RS-232) interface, intended primarily for use in office and business environments.

2.0 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 emissions limits (class B).

3.0 REFERENCE DOCUMENTS

1. FCC: CFR 47 Ch. I: Part 15 (Radio Frequency Devices) - Subpart A (General); Subpart B (Unintentional Radiators)
2. Industry Canada: ICES-003: Digital Apparatus / NMB-003: Appareils numériques
3. EMCAB-3 Issue 3: Implementation and 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”

4.0 TEST SUMMARY AND RESULTS

The 9078plus printer was tested as running while attached to a Personal Computer via parallel (Centronics) and via serial (RS-232) interface.
The test configuration, cables and operations were selected following the referenced documents (section 3.0) and within the range of typical customer applications (see section 6.0 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 9078plus printer was found to meet CISPR 22 Class B limits with a minimum margin of 12.3 dB for conducted EMI and a minimum margin of 5.5 dB 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

Ref. Standard	Class	Tests run	Test notes	Pass	Fail	Min. margin dB
CISPR 22	B	EMI Conducted		X		12.3
CISPR 22	B	EMI radiated	10 m distance	X		5.5

4.2 EMI Suppression Components

The following components are specifically used in the subject EUT, in order to meet the requirements of the referenced 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. Ceramic capacitor (220pF) across terminals of diodes DD21. Ceramic capacitor (100pF) between Drain and Source of transistor M21. Ferrite beads on terminals of diodes DD300 and DD21.
- Ferrite cores on the following cables:
  op. panel cable; future options cable; sensors cable; optional rear tractor 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 cilindrical core on earth (green/yellow) wire.

5.0 TEST RESULTS

5.1 Conducted EMI

Sample Calculations

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

Final level (dBµV) = Receiver Reading (dBµV)+ Cable Loss (dB)

NOTE 1: At each frequency, the highest of the levels recorded on the line and neutral conductors is reported.

NOTE 2: Quasi-peak and Average measurement detectors bandwidth 9KHz

5.1.1 ***Emissions on the printer 9078plus (EUT) power cord (120V 60Hz)***

5.1.1.1 Parallel Interface running

Freq. [MHz]	LEVEL[1] [dBµV]		Line	CISPR 22 class B LIMIT [dBµV]		Margin[2] [dB]
	QP	AV		QP	AV	
0.207	42.7		1	65	55	-12.3
0.378	34		0	58	48	-24
2.005	34.5		1	56	46	-21.5
2.427	35		1	56	46	-21
4.974	34.5		0	56	46	-21.5
7.60	36.5		0	60	50	-23.5
8.505	40.6		1	60	50	-19.4
21.08	36.2		1	60	50	-23.8

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. CISPR22, section 5)

2 Margin = Measured Level - Limit

5.1.1 ***Emissions on the printer 9078plus (EUT) power cord (120V 60Hz)*** (cont.)

5.1.1.2 Serial Interface running

Freq. [MHz]	LEVEL [dBµV]		Line	CISPR 22 class B LIMIT [dBµV]		Margin [dB]
	QP	AV		QP	AV	
0.207	41.3		1	65	55	-14.7
0.225	31		0	62	48	-31
2.005	34.4		1	56	46	-21.6
2.565	32.6		1	56	46	-23.4
4.788	33.8		1	56	46	-22.2
7.678	36		0	60	50	-24
8.505	40.6		1	60	50	-19.4
20.44	33.7		1	60	50	-26.3

5.1.1 *Emissions on the printer 9078plus (EUT) power cord (230V 50Hz)*

5.1.1.2 Parallel Interface running

Freq. [MHz]	LEVEL[3] [dBµV]		Line	CISPR 22 class B LIMIT [dBµV]		Margin[4] [dB]
	QP	AV		QP	AV	
0.207	43.2		1	65	55	-11.8
0.273	31.5		0	62	48	-29.5
2.145	36.2		1	56	46	-19.8
2.214	36.2		1	56	46	-19.8
4.839	34.7		1	56	46	-21.3
7.401	32.5		1	60	50	-27.5
20.44	39.2		1	60	50	-21.8

3 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. CISPR22, section 5)

4 Margin = Measured Level - Limit

5.1.1 ***Emissions on the printer 9078plus (EUT) power cord (230V 50Hz)*** (cont.)

5.1.1.2 Serial Interface running

Freq. [MHz]	LEVEL [dBµV]		Line	CISPR 22 class B LIMIT [dBµV]		Margin [dB]
	QP	AV		QP	AV	
0.207	42.6		1	65	55	-12.4
0.273	31.5		1	62	48	-29.5
2.145	32.4		1	56	46	-23.6
3.318	35.1		1	56	46	-20.9
4.799	34.7		1	56	46	-21.3
7.671	36.5		1	60	50	-23.5
9.744	40		0	60	50	-20
20.44	39.2		1	60	50	-21.8

5.2 Radiated EMI

Radiated emissions were investigated from 30MHz up to 1000MHz, according to FCC 15.33.
Measurement distance: 10 meters

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.

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

5.2.1 *Parallel Interface running (120V 60Hz)*

Freq. [MHz]	E-field LEVEL [dBµV/m]	Pol. V/H	Antenna Heigth m	Rotation angle deg.	CISPR 22 class B LIMIT [dBµV/m]	Margin [dB]
35.454	23	V	1	90	30	-7
54.301	23	V	1	90	"	-7
74.49	20	V	1.60	90	"	-10
76.807	22.6	V	1.60	90	"	-7.4
111.258	24.5	V	1	45	"	-5.5
139.234	20.5	V	1	330	"	-9.5
152.586	23	H	4	180	"	-7
155.703	24	H	4	180	"	-6
178.487	21.3	V	1	0	"	-8.7
219.514	21.3	V	1	0	"	-8.7
274.904	24 (22)	V	1	110	37	-13

5.2.2 *Serial Interface running (120V 60Hz)*

Freq. [MHz]	E-field LEVEL [dBµV/m]	Pol. V/H	Antenna Heigth m	Rotation angle deg.	CISPR 22 class B LIMIT [dBµV/m]	Margin [dB]
35.454	23	V	1	90	30	-7
54.301	24	V	1	90	"	-6
74.49	23	V	1.60	90	"	-7
76.807	22.8	V	1.60	90	"	-7.2
111.258	23	V	1	45	"	-7
139.234	21.5	V	1	330	"	-8.5
152.586	21.8	H	4	180	"	-8.2
155.703	24	H	4	180	"	-6
178.487	21	V	1	0	"	-9
219.514	22	V	1	0	"	-8
274.904	24 (22)	V	1	110	37	-13

5.2.1 *Parallel Interface running (230V 50Hz)*

Freq. [MHz]	E-field LEVEL [dBµV/m]	Pol. V/H	Antenna Heigth m	Rotation angle deg.	CISPR 22 class B LIMIT [dBµV/m]	Margin [dB]
35.454	21 (17)	V	1	90	30	-9
74.49	22	V	1.60	90	"	-8
76.807	22.6	V	1.60	90	"	-7.4
111.258	23.5	V	1	45	"	-6.5
139.234	20.5	V	1	330	"	-9.5
149.368	21	v	1	0	"	-9
152.586	22	H	4	180	"	-8
155.703	22	H	4	180	"	-8
174.006	22.6	H	4	180	"	-7.4
178.487	21.3	V	1	0	"	-8.7
209.515	24 (22)	V	1	0	"	-6
219.514	21.3	V	1	0	"	-8.7
274.904	25 (22)	V	1	110	37	-12

5.2.2 *Serial Interface running (230V 50Hz)*

Freq. [MHz]	E-field LEVEL [dBµV/m]	Pol. V/H	Antenna Heigth m	Rotation angle deg.	CISPR 22 class B LIMIT [dBµV/m]	Margin [dB]
35.454	20	V	1	90	30	-10
74.49	20	V	1.60	90	"	-10
76.807	22	V	1.60	90	"	-8
111.258	23	V	1	45	"	-7
139.234	21.5	V	1	330	"	-8.5
149.386	20.8	V	1	0	"	-9.2
155.703	20	H	4	180	"	-10
174.006	22	H	4	180	"	-8
178.487	21	V	1	0	"	-9
219.514	22	V	1	0	"	-8
274.904	24 (22)	V	1	110	37	-13

6.0 TEST METHOD AND SET-UP

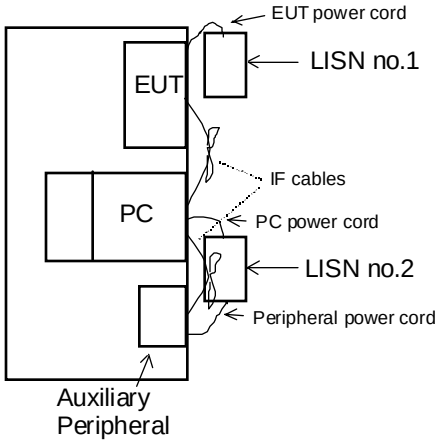
EMI tests were performed in Compuprint's proprietary EMC test facility, with a shielded room (used for conducted EMI) and a 10 meter open area test site (radiated EMI). The site is filed with the FCC data- base as Site No.1 (ref. 31040/SIT).

The EUT (9078plus printer) was tested as part of a typical table-top system, with a Personal Computer driving the EUT and an additional peripheral device connected to the same PC. The auxiliary peripheral was an FCC certified printer, with a parallel and a serial interface port.
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.
The EUT system was tested on a 0.8 m high wooden table. All cables were arranged as specified in ANSI C63.4 (sec.6 and figs. 9(a) and 9(c)). Cables were moved, where appropriate, to maximize emissions.
The EUT was tested using an "H" pattern, 136 columns on continuous form. This thoroughly exercises the EUT and its functions.

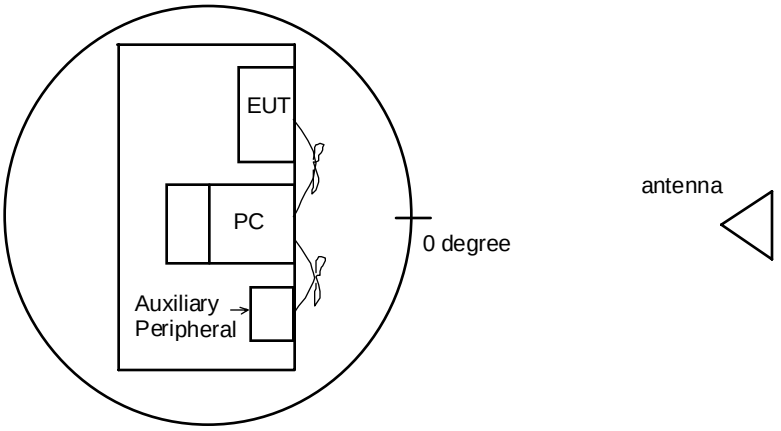
For *conducted EMI*, the EUT system was placed 0.4 m from a vertical wall of the shielded room, and kept at least 0.8 m from any other metal surface, as specified in ANSI C63.4 (sec.7.2.1 and fig.9(a)). The EUT power cord was connected to one LISN (Line Impedance Stabilization Network, as defined in ANSI C63.4, sec.4.1.2). The power cords of the PC and of the other units in the system were connected to a multiple outlet and powered through a second LISN. The conducted emissions on each current-carrying conductor of the EUT AC power cord were measured using the first LISN.

For *radiated EMI*, 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 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 FCC Part 15 (§ 15.31(f)).

6.1 Sketches



Conducted test layout (top view)



Radiated test layout (top view)

6.2 Test Equipment

Conducted EMI
Receiver: Rohde & Schwarz ESH3 (s/n 879599/043): 9 kHz - 30 MHz
LISN #1: NSLK 8128 Schwarzbeck (9002-090000012), on EUT (printer) power cord
LISN #2: Rohde & Schwarz ESH3-Z5 (9103-0910009), on power cords of PC and auxiliary devices.

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)

7.0 EUT SYSTEM

- Printer Compuprint 9078plus (Equipment Under Test) - s/n 004 - FCC ID: CTZ-CASTORE
- PC Zenith Z-Staton 425 Sh - mod.IKS-4427 100/250V 50/60Hz - FCC ID: IFO-ZDESK425 s/n:XVAPQHO1552
- Video unit Zenith model ZCM-1390 120/230V 50/60Hz – FCC ID: AT09M7CM1390 s/n: 822NB0032TOG
- Keyboard: Zenith model B-0110 - FCC ID: GJK101WN-5 - s/n: 163-0089-2T A4390
- Auxiliary printer (with parallel and serial ports): Memorex-Telex – FCC ID: CTZ-970 s/n: ZCS-R70-00357 120-240V 50/60 Hz
- Parallel (Centronics) IF cable: pn 158392-4 (IEEE 1284 compliant) - 3m shielded
- Serial (EIA 232) IF cable: Misco pn 2329 - 3m shielded
- AC Power cables: standard, non shielded

8.0 EUT (Printer Compuprint 9078PLUS) CONFIGURATION

Motherboard:	4VSTP1 (cod.78409300-001)
Oscillator frequencies:	31.3344 MHz
Clock frequencies:	15.6672 MHz
Bus / Control signal frequencies:	3.9168 MHz
Operator panel	2PO9TA (cod.78409639-001)
POWER SUPPLY	Cod. 78202681-551; 100-240 V; 50-60 Hz
Switching frequencies:	65 kHz (Converter forward); 60 KHz (Converter boost)
Options installed	Serial Interface 2SERIV (cod: 78409030-001)
EUT power	100-230 Vac – 50/60 Hz