

EQUIPMENT FCC ID : KVJLML_3013

FCC CLASS B

EMI MEASUREMENT TEST REPORT

TEST LAB FCC ID : I6U

This report concerns : Original grant ☒ Class II change ☐

Equipment tested : LML_3013

Equipment FCC ID : KVJLML_3013

Designed by : THOMSON CSF COMMUNICATIONS
105 boulevard VALMY - BP 82
92340 COLOMBES - France

Manufactured by : THOMSON CSF COMMUNICATIONS

Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)

YES ☐

NO ☒

if yes, defer until :

Company Named agrees to notify the Commission by : 09-10-1998

of the intended date of announcement of the product so that the grant can be issued on the date

Transition rules requested per 15.37?

YES ☐

NO ☒

If no, assumed Part 15, Subpart B for intentional or
unintentional radiator
The new 47 CFR [10-1-96 edition] provision

Report Prepared by :
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Test facility :

Bull Electronics Angers
331 Avenue Général Patton - BP 428
49004 ANGERS Cédex - France

Test date : November 1997 and Mars 1998

Page : 1/65

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FCC/DOJ

JUL 27 1998

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DETAILS OF PRODUCT DESCRIPTION

RS232 - RS422 - ISO 2 / WIEGAND Interface description

INSTALLATION MANUEL

INTERFACE MANUEL

Attachment A, B, C, D, E, F, G, H

Attachment I, J, K

Equipment documentation

Equipment documentation

1 - GENERAL INFORMATION

1-1 Product description

The THOMSON-CSF Company name model LML_3013 Modular Reader is a high frequency field sensor, for tag identification with external antenna which cannot disconnect from Reader because the box is locked with a key .

One part is transceiver (CW emission) and detection of CW modulated and reflected by the tag. The second part is computing of detected data which are transmitting towards PC.

The data can be transferred with 3 interfaces data line to a Personnel Computer.

- RS232 interface
- RS422/485 interface
- ISO2/WIEGAND (TTL)

The reader is supplied by 12 VDC (External power supply)

This product is tested as unintentional radiator (ITE) connected to a Personnel Computer, and intentional radiator.

The frequency range of the transceiver is 2.446250 to 2.453750 GHz by 250 KHz step.

A more detailed, technical description of the EUT is contained in Attachment A

EQUIPMENT FCC ID : KVJLML_3013

1-2 Tested systems details

The FCC IDs for all equipment, plus description off all cables used in the tested system (including inserted cards which have grants) are :

Description Model& Serial number	FCC ID	Cable description	Cable terminaison	Length (m)
Reader LML_3013 S/N : 13904 (1) RS232 configuration mode(19.2 Kbauds rate)	KVJLML_3013	1 Shielded cable between Reader LML_3013 and serial port PC # 46322865 with ferrite closer plastic connector # 28B2029- 0A0 manufactured by STEWARD	Plastic /met al 5 pts/9 pts	4.50
Reader LML_3013 S/N : 13904 (1) in RS422 configuration mode(19.2 Kbauds rate) with RS422/RS232 shielded box converter S/N 46322870 (1)	KVJLML_3013	1 Shielded cable # 46322872 between Reader LML_3013 and box converter with ferrite closer plastic connector #28B2029-0A0 manufactured by STEWARD. 1 Shielded cable # 46322871 between box converter and serial port PC	Plastic/Meta 1 5 pts/9 pts Metal/Metal 9 pts/9 pts	4.50 4.50
Reader LML_3013 S/N : 13904 (1) in TTL configuration mode with TTL/Parallel shielded box converter S/N 46322860 (1)	KVJLML_3013	1 Shielded cable # 46322863 between Reader LML_3013 and box converter with ferrite closer plastic connector # 28B2029- 0A0 manufactured by STEWARD 1 Shielded cable # 46322862 between box converter and parallel port PC	Plastic/Meta 1 5 pts/ 9 pts Metal/Metal 25 pts/25 pts	4.50 2
AT1_2709 antenna S/N : P001	KVJLML_3013	RG58 emitted and received coaxial cable	BNC	5
Zenith Data System Personnal Computer Z-386SX/25-80 S/N : XVA PWN 00791	IFO-Z386SX25	1 Unshielded power cord	Plastic	2
Zenith Data System Display ZCM-1495-XT S/N : 248RK0108R0D	ATO90C2CM1492	1 Unshielded power cord 1 Shielded Video cable(2)	Plastic Metal	2 1.2
Zenith Data System Keyboard 2 KB-3 S/N : E4099	GJK101RX-5	1 Shielded cable (3)	Metal	2
Microsoft PS/2 Mouse S/N : 704195	C3K76FPS26C	1 Shielded cable (4)	Metal	2.5

1-2 Tested systems details (continued)

The FCC IDs for all equipment, plus description off all cables used in the tested system (including inserted cards which have grants) are :

Hewlett Packard Printer Model 2277A S/N : 2906A16132	B948JA2277X	1 Unshielded power cord with external power module ETT76J2A 1 Shielded serial cable # N086109000.01C(5) 1 Shielded parallel cable # N0856675000.01C (6)	Plastic	2
			Metal/Metal	3
			Metal/Metal	2
Rohde&Schwarz Power supply(7) 120V/60Hz A.C—12V D.C Model NGMD 35/1 Ref : 117.7127.02 S/N : 975		1 Unshielded power cord 1 Unshielded D.C 12V power supply cable assembly of 2 twisted wires	Plastic Plastic/Plastic	2 2.5

- (1) EUT submitted for grant
- (2) Attached cable inclues grantee supplied ferrite
- (3) Keyboard cable permanently attached to keyboard
- (4) Mouse cable permanently attached to mouse
- (5) Used to connect printer to P.C serial port in TTL configuration mode tested
- (6) Used to connect printer to P.C parallel port in RS232 or RS422 mode tested
- (7) External Power supply not submitted for grant, used for delivery 12V D.C to EUT.

1-3 Test Methodology and procedure

Unintentional radiator : ITE

Both conducted and radiated testing were performed in accordance with ANSI C63.4 procedure, as revised in 1992. The specification used was the Class B limits of FCC Rules Part 15 Subpart B for conductive (§ 15-107) and radiated (§ 15-109) interference measurements. Final radiated measurement is performed at an antenna to EUT distance of 3 meters. (Preliminary radiated emission test was realized at one meter in the underground of open area test site)

Intentional radiator :

Radiated testing was performed in accordance with ANSI C63.4 procedure, as revised in 1992. The specification used was the limit of Code of Federal Regulations 47 Part 15 Subpart C (§ 15-245, § 15-205, § 15-209) Radiated testing was performed at an antenna to EUT distance of 3 meters after a measurement was performed at one meter to determine the emission characteristics of the EUT. (Fundamental and harmonics frequencies)

1-4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at the following address :

BULL ELECTRONICS ANGERS
331 Avenue du General Patton
B.P 428
49004 ANGERS Cedex 01
France

This site has been fully described in a report dated August 21, 1997 submitted to your Office, and accepted in a letter dated October 9, 1997 (31040/SIT 1300F2)

1-5 List of measurement apparatus

APPARATUS	MANUFACTURER	REFERENCE	SERIAL NUMBER	DATE OF VERIFICATION
RECEIVERS				
CISPR Receptive chain :	Hewlett Packard	HP 8574A		June 1997
Quasi-Peak Detector	Hewlett Packard	HP 85650A	2811A01134	June 1997
Spectrum Analyser	Hewlett Packard	HP 8568B	2816A116603	June 1997
Preselector	Hewlett Packard	HP 85685A	287A00784	June 1997
Spectrum Analyser	Rohde&Schwarz	FSEM30	845112/021	January 1998
20Hz-26.5GHz (For intentional radiator emission)				
EMI Software (For conducted emission)	Hewlett Packard	HP 85869A		
REMS Software (For radiated emission)	Hewlett Packard	HP 85879A Rev A.02.01		
ARTIFICIAL MAINS NETWORKS				
LISN	Rohde&Schwarz	ESH2-Z5	861741/019	June 1997
LISN	Rohde&Schwarz	ESH2-Z5	872094/037	June 1997
ANTENNAS				
Bilog	Chase	CBL6112	2290	September 1997
Horn(For intentional radiator emission)	Emco	3115	9504-4496	August 1995

3 - SYSTEM TEST CONFIGURATION

3-1 Justification

Unintentional radiator measurement

The system was configured for testing in a typical fashion (as a customer would normally use it), with a host computer.

Communication with the host can be done with three interfaces line. The three possibilities were tested.

The LML_3013 is connected to PC on :

- Serial port for RS232 interface mode configuration. The tests are done with data transfert to P.C with the maximum speed : 19.2 Kbauds.
The RS232 interface is performed by SPI_2110 board of the reader by MAX232 component(RS232 drivers /receiver) repaired by MN13 on equipment plan of SPI_2110 board

- Serial port for RS422/485 interface mode configuration through a RS422/RS232 converter. The tests are done with data transfert to P.C with the maximum speed : 19.2 Kbauds
The RS422 interface is performed by SPI_2110 board of the reader by 75ALS180 component(Differential driver and receiver) repaired by MN14 on equipment plan of LML_3013.

- Parallel port for ISO2 /WIEGAND (TTL) interface mode configuration through TTL/Parallel converter. The tests are done with data transfert to P.C with the maximum speed : 1 Kbauds
The TTL interface is performed by SPI_2110 board of the reader by BSR14 component(Low power NPN transistor) repaired by Q6,Q7, Q8 on equipment plan of LML_3013.

The Personnal computer used for the test is a Zenith Data System Z-386SX/25-80 with mother board equipped with mouse, keyboard, video, serial and parallel connectors.

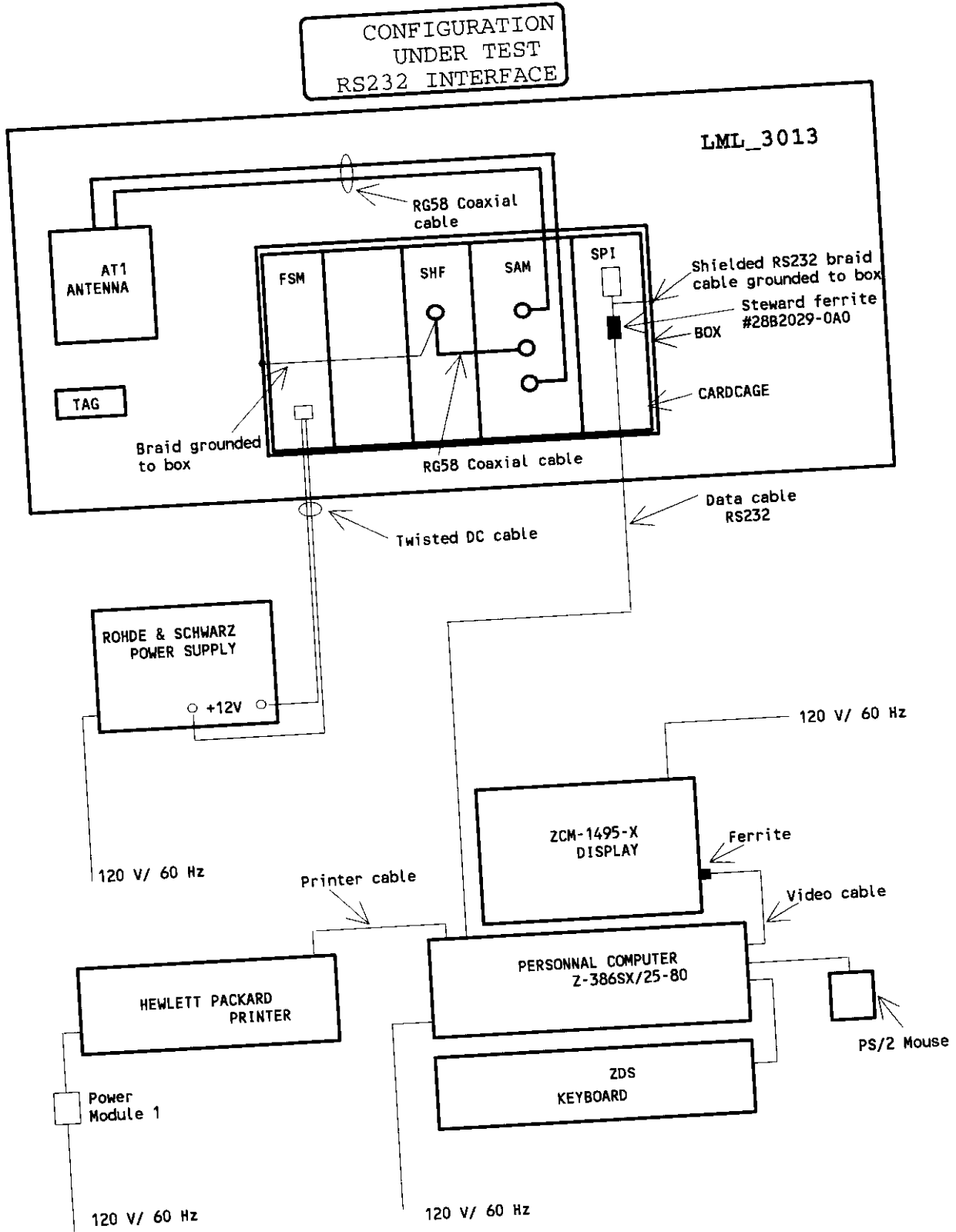
The Reader LML_3013 is powered by 12 Volts D.C external power supply. (Rohde&Schwarz)

For each configuration, two conducted lines perturbations measurements are performed, one on external power supply of the reader, and the other on P.C ,display and printer connected together. The radiated measurements are also performed for each configuration with EUT, P.C , display and printer in the field measurement.

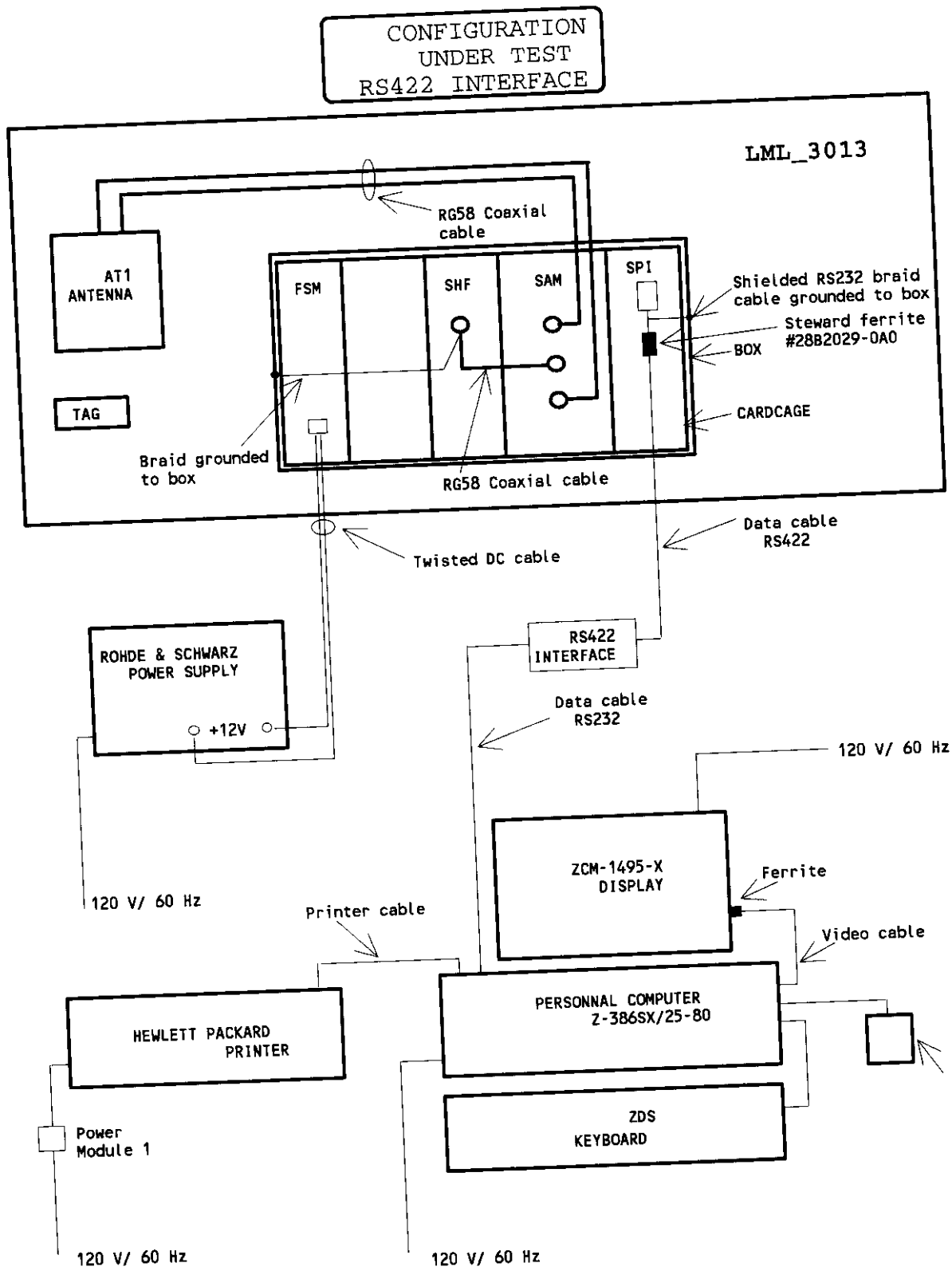
Intentional radiator measurement

The reader is disconnected from the host for radiated measurement.We test it at top, middle and bottom of the reader frequency band, in maximun detection range for the tag.

3-1-1 RS232 EUT configuration

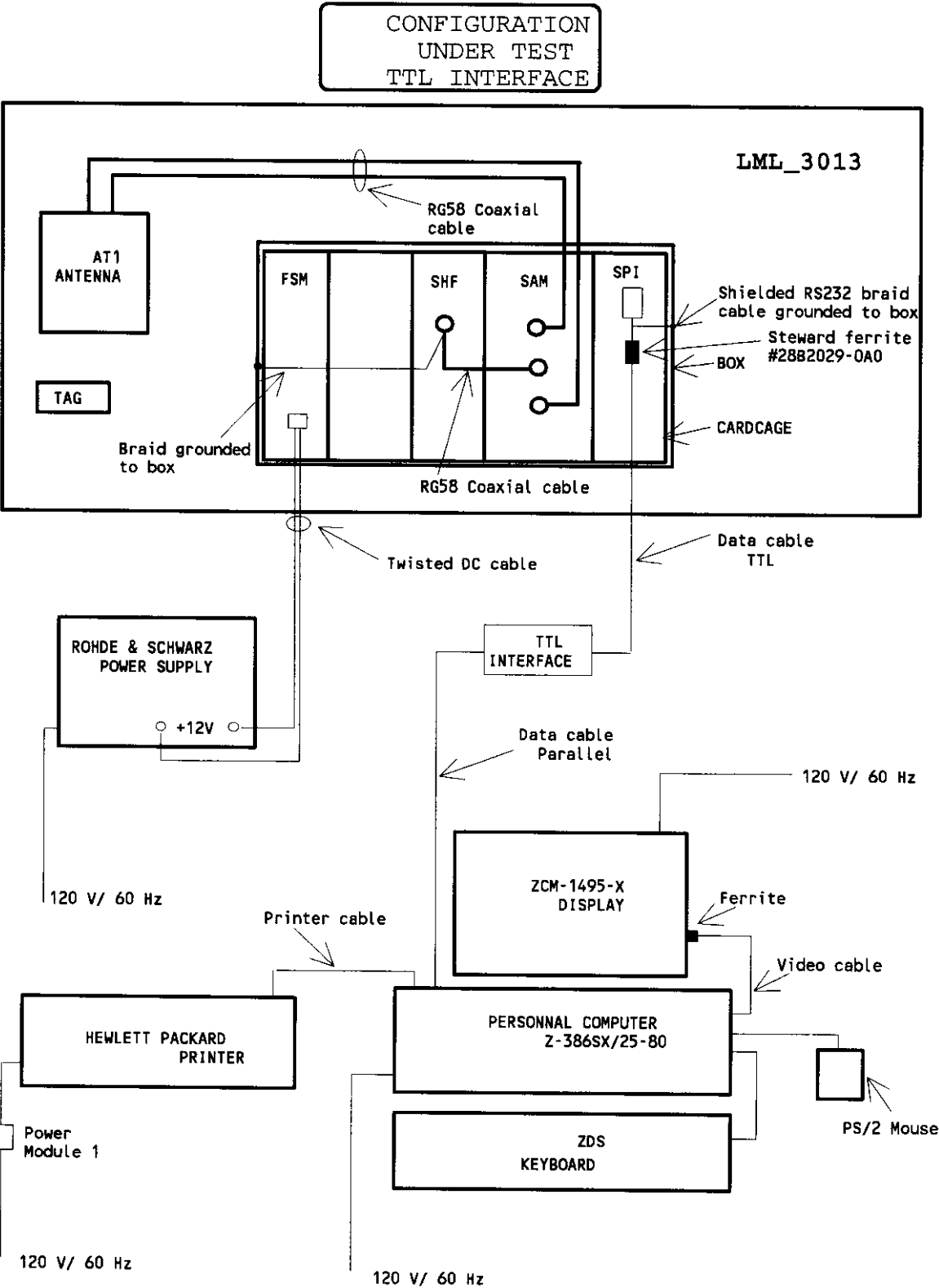


3-1-2 RS422 EUT configuration



EQUIPMENT FCC ID : KVJLML_3013

3-1-3 ISO 2 / WIEGAND (TTL) EUT configuration



3.2 EUT exciser software

Unintentional measurement

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.
The software is contained on a 3-1/2 inch disc and is inserted into the PC drive A.

Interface RS232 or RS422 :

For each one, the software used is COMSPI V3.22. It was loaded from drive A into RAM memory of the PC and started.

The tag is placed at 0.50m from reader. As soon as reader was powered, a continuous wave at 2.450 Ghz was transmitted in tag direction by external antenna.

This wave was modulated by tag identification code and was reflected by tag back to the reader. The modulated wave back to the reader was received by external antenna.

The wave was demodulated. Data was processed and sent to P.C at 19.2 Kbauds rate by communication interface.

The P.C interrogated the reader (polling mode) for got data from new tag detected.

If new tag was detected by reader the new data were send to P.C. Cycle duration is 50 ms and is repeated continuously.

Interface ISO2/WIEGAND (TTL) :

The software used is READISO V1.6. It was loaded from drive A into RAM memory of the PC and started.

The tag is placed at 0.50m from reader. As soon as reader was powered, a continuous wave at 2.450 Ghz was transmitted in tag direction by external antenna.

This wave was modulated by tag identification code and was reflected by tag back to the reader. The modulated wave back to the reader was received by external antenna.

The wave was demodulated. Data was processed and sent to P.C at 1 Kbauds rate by communication interface.

If new tag was detected by reader the new data were send to P.C. (interruption mode)

Intentional radiator

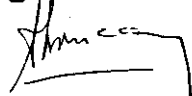
EUT had not need software from host to operate.

The host was removed of field measurement, and reader powered on with tag placed at 0.50m from it.

The measurement was performed at bottom, middle and top of frequency range.

3-3 Required Signatures

Applicant Signature :



Date 07/10/98

Typed/printed Name : A. BOISSEAU

Position : Director

Test Lab. manager Signature :



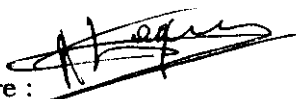
Date : 06/29/1998

Typed/printed Name : J.L. CANDELON

Position : Lab. manager

Staff test

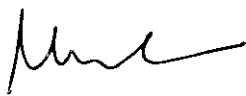
Test Signature :



Date 06/29/1998

Typed/printed Name : A. LEQUIER

Test Signature :



Date 06/29/1998

Typed/printed Name : D. RAUD

4 - E.U.T TECHNICAL DESCRIPTION

4 - 1 Modular Reader LML 3013 description :

Assembly of :

CHS_2019 Locked Box S/N : 13904

FSM_2550 Module S/N : 14027

SHF_2339 Module S/N : 13307

SAM_2419 Module S/N : 12511 with RG58 coaxial cable (20cm long) connected to SHF module (The braid of this coaxial cable is grounded to box)
SAM_2419 is composed of HF 2439 board and SAM BF 2480 board.

SPI_2110 Module S/N : 12145

AT1_2719 Antenna S/N : P001 with RG58 emitted and received coaxial cable lenght 5m

BDG_1020 Tag

4 - 2 Block diagram, electric drawing, part list, components location drawing :

4-2-1 LML_3013 Modular Reader general description : see Attachment A

4-2-2 CHS_2019 Locked box description : see Attachment B

4-2-3 FSM_2550 Module description : see Attachment C

4-2-4 SHF_2339 Module description : see Attachment D

4-2-5 SAM_2419 Module description : see Attachment E

4-2-6 SPI_2110 Module description : see Attachment F

4-2-7 AT1_2709 Antenna description : see Attachment G

4-2-8 BDG_1020 Tag description : see Attachment H

4-3 List of EMI critical components :

CHS_2019 Locked Box :

Shielded box with strip of beryllium around its door
This box is equiped with microwave absorber material to attenuate microwave harmonic signal.

FSM_2550 Module:

Filter : inductance (L1) 7mH

Decoupling capacitor : capacitor 470 μ F (C1,C2)

4-3 List of EMI critical components : (continued)**SHF_2339 Module :**

Oscillator 8 MHz(Y1) ; Dielectric material resonator (HY1)
 Decoupling capacitor : 100nF (C6 to C11, C14, C20, C23, C24, C31, C32, C38, C42 to C45, C48, C53, C59, C61, C62) ; 1 μ F (C12, C19, C21, C22, C25 to C27, C33, C34, C39, C46, C49) ; 1000 μ F (C15, C16, C28, C40)
 Microwave material absorber located at foil side module
 See Clock path at page 17

SAM_2419 Module :**HF 2439 :**

Filter : inductance 68nF (L101 to L103, L201, L202) ; 120 μ H (L1)
 Decoupling capacitor : 33 μ F (C1, C4)
 HF decoupling capacitor : 47pF(C2, C101 to C107, C110 to C119, C201, C203, C206, C211, C212, C214, C220, C222)
 HF filter : printed low-pass filter at the emission output and at the mixer LO input
 HF_2439 is completely shielded by mechanical system.

SAM-BF 2480 :

Decoupling capacitor : 100nF (52 capacitor see part list) ; 4.7 μ F(C103, C104, C111, C112 to C114) ; 10 μ F(C115, C121, C128, C215, C216, C219, C220) ; 33 μ F(C100, C102, C107, C108) ; 47 μ F (C117 to C119, C124 to C126)
 Filter : inductance : 22 μ H(L102 to L104, L106, L108) ; 120 μ H(L101)

SPI_2110 Module :

Quartz : 3.84MHz(Y1) ; 11.059MHz (Y2)
 Decoupling capacitor : 100 μ F(C41, C42) ; 10 μ F(C12 to C15) ; 1 μ F(C11, C30) ; 100nF(C10, C29, C33 to C40) ; 10nF (C1 to C4)
 See Clock path page 18

AT1_2709 Antenna :

Shielded RF amplifier
 Printed high pass filter
 Printed low pass filter
 Decoupling capacitor 47pF (C1, C6)
 Filter : inductance : 68nH (L1, L2)

5 - POWER LINE CONDUCTED EMISSIONS**5-1 Test results measurements**

The initial step in collecting conducted data is a spectrum analyser peak scan of the measurement range. Significant peaks are then marked as shown on the 12 following data pages, and then are measured with quasi-peak detector

RESUME OF 12 HIGHEST SIGNALS PER WIRE MEASURED ON 3 INTERFACE CONFIGURATIONS

Interface mode	Product	Result	MINIMUM MARGIN				Data and Plot on following Pages
			LINE WIRE		NEUTRAL LINE		
			dB μ V	MHz	dB μ V	MHz	
RS232	E.U.T	Pass	-17.0	7.357	-15.3	5.744	20 and 26
	LML_3013		-18.4	20.220	-17.0	5.531	
	P.C+	Pass	-7.0	0.534	-5.4	3.921	21 and 27
	DISPLAY+PRINTER		-7.9	0.566	-5.5	2.513	
RS422	E.U.T	Pass	-21.0	4.736	-22.3	4.756	22 and 28
	LML_3013		-21.2	4.541	-23.7	4.541	
	P.C+	Pass	-8.1	0.536	-4.2	4.336	23 and 29
	DISPLAY+PRINTER		-8.8	4.939	-5.2	4.522	
TTL	E.U.T	Pass	-14.7	15.92	-17.2	5.554	24 and 30
	LML_3013		-19.7	5.349	-17.9	5.349	
	P.C+	Pass	-8.4	0.504	-5.2	3.921	25 and 31
	DISPLAY+PRINTER		-8.8	0.536	-5.4	4.318	

CISPR RECEPTIVE CHAIN H.P 8574A CONFIGURATION		
Quasi-Peak Adaptator	Normal mode	
	Band With = 9 KHz	
Spectrum Analyser	Resolution Band With = 100 KHz	
	Video Band With = 300 KHz	
	Sweep min	Peak measurement : 100 ms/MHz Quasi-peak measurement : 200s/MHz
Preselector	Normal mode	
	Internal preamplifier : 20 dB	

All readings are quasi-peak unless stated otherwise.

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : READER LML 3013
 SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
 STANDARD : FCC CFR 47 PART 15B CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - RS232 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-1

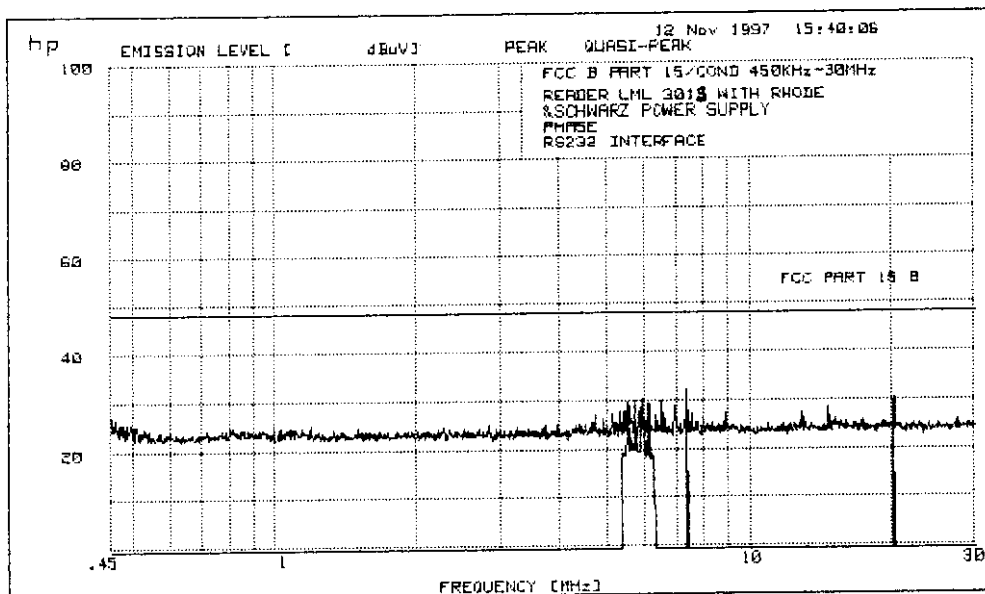
12 Nov 1997 15:40:06

1. AC POWER LINE CONDUCTED
 1.1 FCC B PART 15/COND 450KHz-30MHz

READER LML 3012 WITH RHODE
 &SCHWARZ POWER SUPPLY
 PHASE
 RS232 INTERFACE

Quasi-Peaks above -40 dB of Limit Line #1
 peak criteria = 1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	5.554	27.9	-20.1
2	5.648	22.1	-25.9
3	5.744	29	-19.0
4	5.84	28.1	-19.9
5	6.041	21.3	-26.7
6	6.143	28	-20.0
7	6.247	19.2	-28.8
8	7.357	31	-17.0
9	20.22	29.6	-18.4



EQUIPMENT FCC ID : KVJLML 3013

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
 SERIAL NUMBER : XVA P WN 00791 / 246RK0182R00 / 2906A16132
 STANDARD : FCC CFR 47 PART 1595 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - RS232 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-3

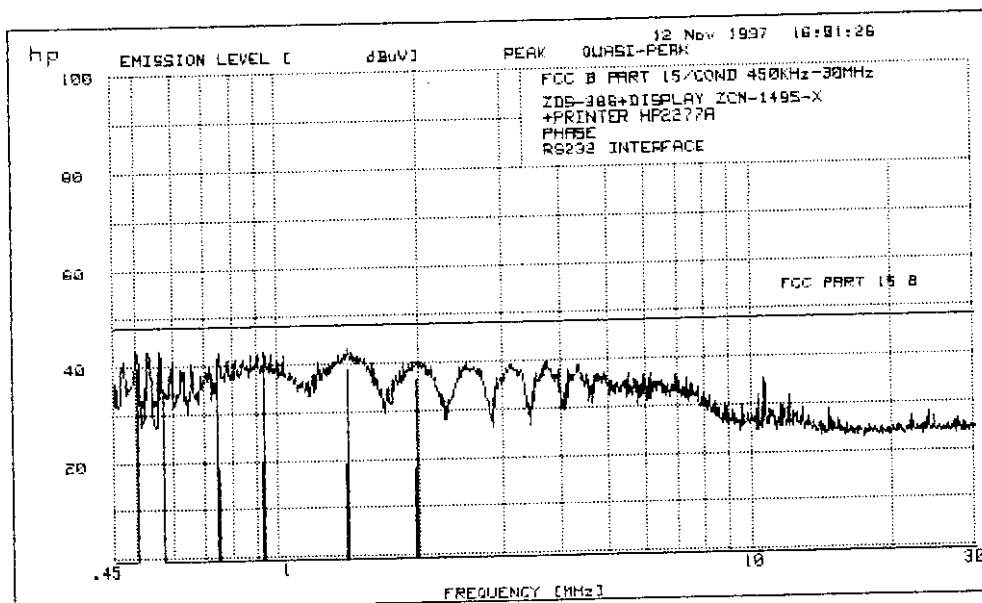
12 Nov 1997 16:01:26

1. AC POWER LINE CONDUCTED
 1.1 FCC B PART 15/COND 450KHz-30MHz

ZDS-386+DISPLAY ZCM-1495-X
 +PRINTER HP2277A
 PHASE
 RS232 INTERFACE

Quasi-Peaks above -20 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.5061	39.6	-8.4
2	.5345	41	-7.0
3	.5668	40.1	-7.9
4	.7508	37.7	-10.3
5	.9377	39.3	-8.7
6	1.409	38.6	-9.4
7	1.979	36.5	-11.5



APPENDIX:1-5

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : READER_LML 3013
 SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - RS422 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

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12 Nov 1997 15:03:09

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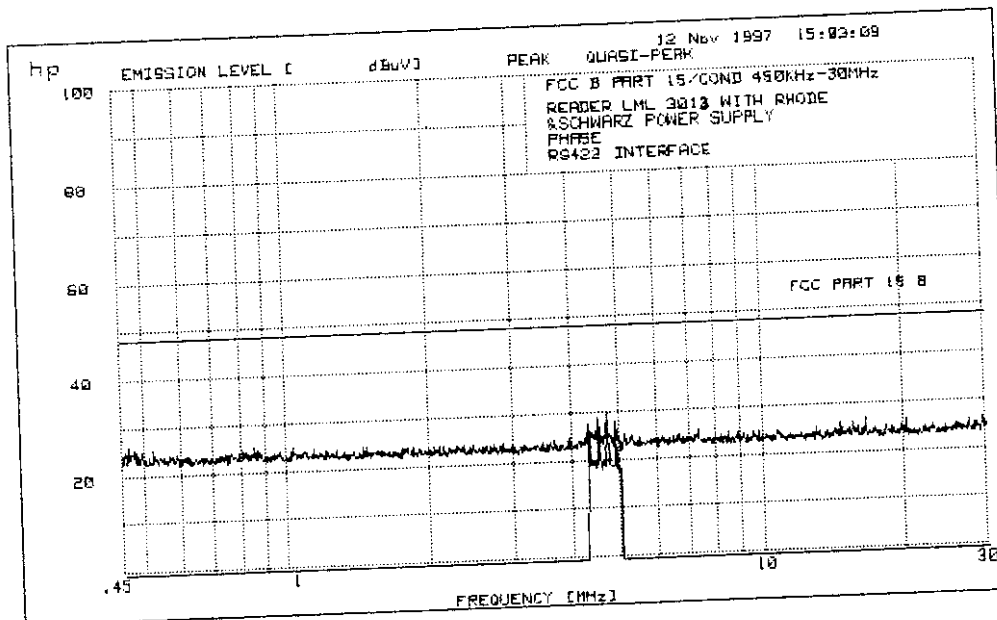
1. AC POWER LINE CONDUCTED
 1.1 FCC B PART 15/COND 450KHz-30MHz

=====

READER LML 3012 WITH RHODE
 &SCHWARZ POWER SUPPLY
 PHASE
 RS422 INTERFACE

Quasi-Peaks above -40 dB of Limit Line #1
 peak criteria = 1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	4.336	26.2	-21.8
2	4.541	26.8	-21.2
3	4.657	19.9	-28.1
4	4.736	27	-21.0
5	4.939	24.4	-23.6



REPORT NUMBER : 935-215-02/e APPENDIX:1-7
 PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
 SERIAL NUMBER : XVA P WN 00791 / 246RK0182R00 / 2906A16132
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - RS422 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

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12 Nov 1997 14:36:56

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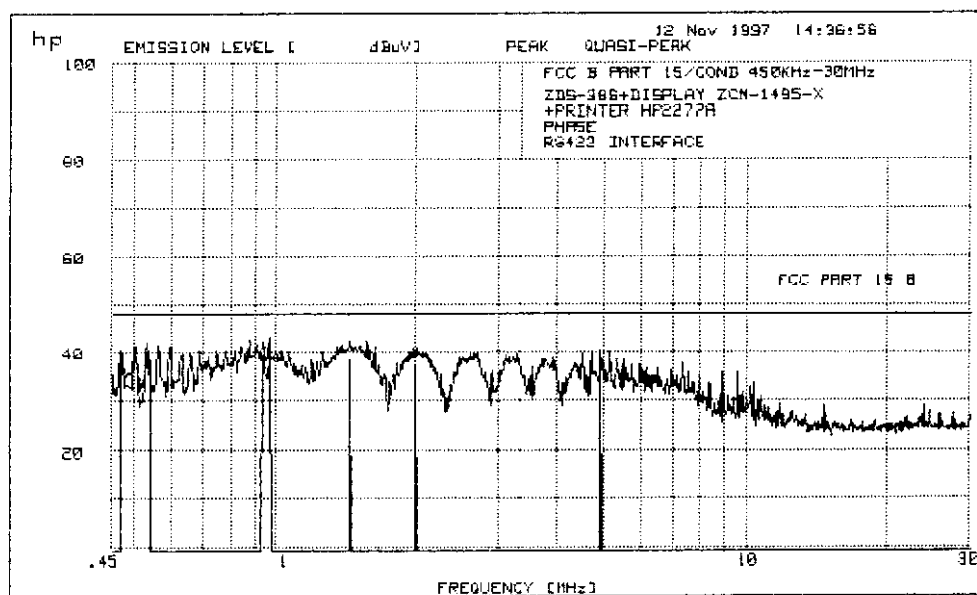
1. AC POWER LINE CONDUCTED
 1.1 FCC B PART 15/COND 450KHz-30MHz

=====

ZDS-386+DISPLAY ZCM-1495-X
 +PRINTER HP2277A
 PHASE
 RS422 INTERFACE

Quasi-Peaks above -30 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.504	38.9	-9.1
2	.5367	39.9	-8.1
3	.9417	39.1	-8.9
4	1.445	38.4	-9.6
5	2.004	37.1	-10.9
6	4.939	39.2	-8.8



EQUIPMENT FCC ID : KVJLML 3013

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : READER LML 3013
 SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
 STANDARD : FCC CFR 47 PART 15 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - TTL INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-9

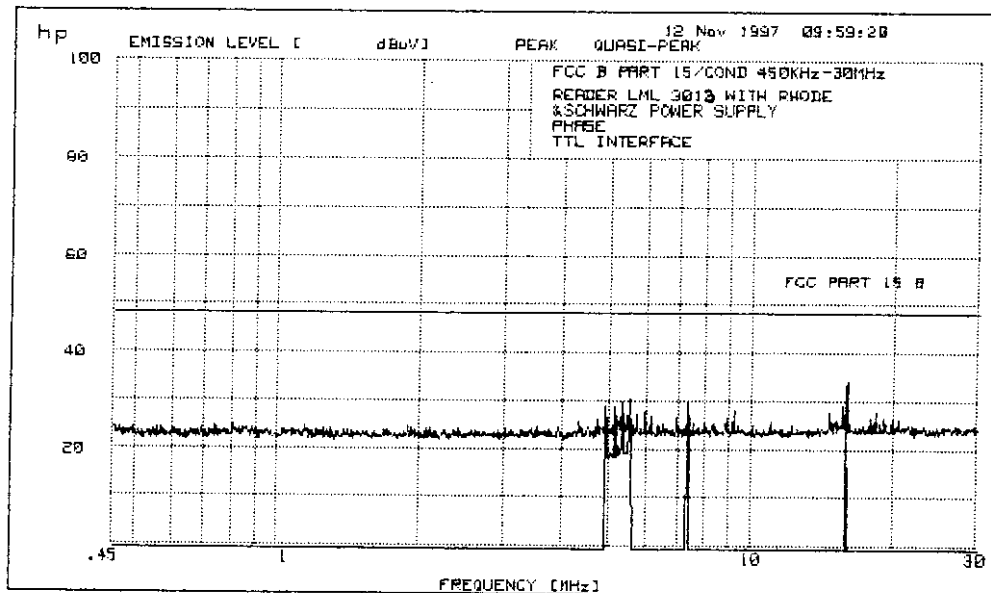
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1. AC POWER LINE CONDUCTED
- 1.1 FCC B PART 15/COND 450KHz-30MHz

READER LML 3012 WITH RHODE
 &SCHWARZ POWER SUPPLY
 PHASE
 TTL INTERFACE

Quasi-Peaks above -30 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	4.939	24.8	-23.2
2	5.15	26.8	-21.2
3	5.349	28.3	-19.7
4	5.554	28	-20.0
5	7.357	27.8	-20.2
6	15.92	33.3	-14.7



EQUIPMENT FCC ID : KVJLML_3013

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
 SERIAL NUMBER : XVA P WN 00791 / 246RK0182R00 / 2906A16132
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED PHASE
 CONDITIONS : 120/60Hz - TTL INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-11

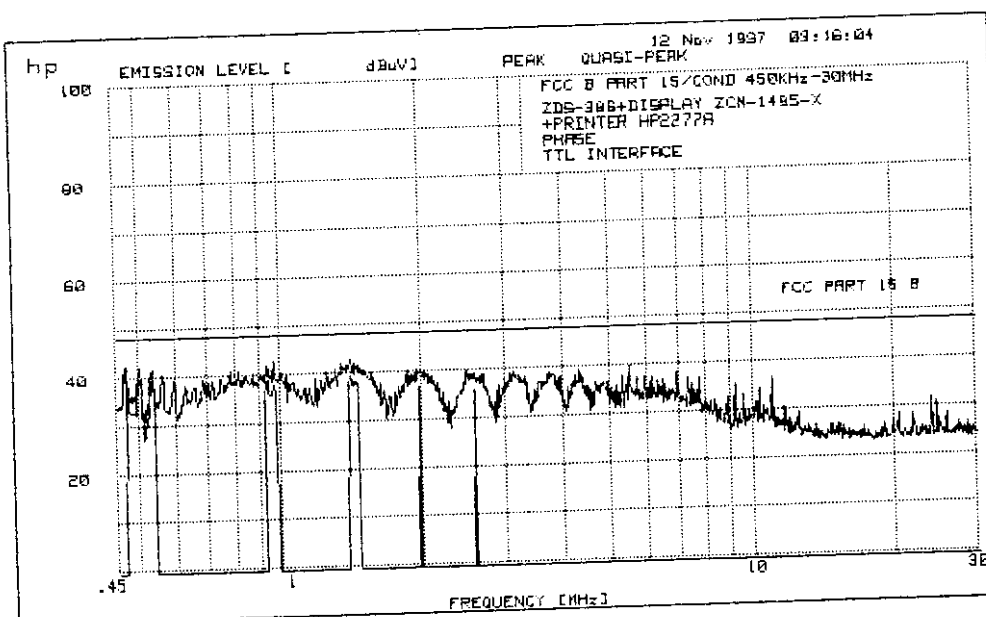
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1. AC POWER LINE CONDUCTED
 1.1 FCC B PART 15/COND 450KHz-30MHz

ZDS-386+DISPLAY ZCM-1495-X
 +PRINTER HP2277A
 PHASE
 TTL INTERFACE

Quasi-Peaks above -20 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.504	39.6	-8.4
2	.5367	39.2	-8.8
3	.9456	38.6	-9.4
4	1.415	39	-9.0
5	1.979	36.2	-11.8
6	2.599	35.5	-12.5



EQUIPMENT FCC ID : KVJLML_3013

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : READER LML_3013
 SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
 CONDITIONS : 120/60Hz - RS232 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-2

12 Nov 1997 15:50:46

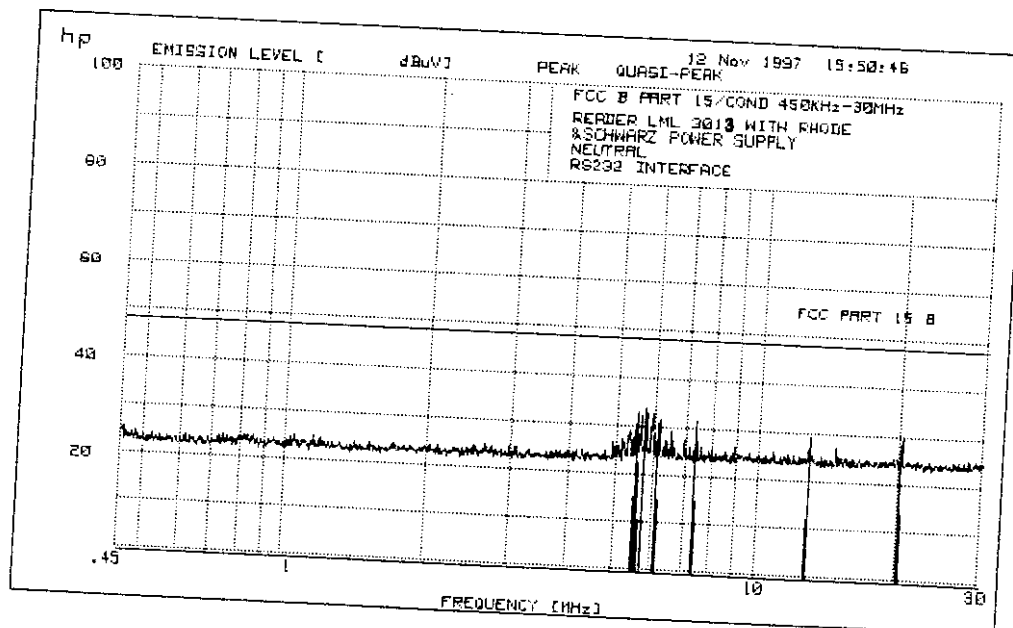
1. AC POWER LINE CONDUCTED

1.1 FCC B PART 15/COND 450KHz-30MHz

READER LML 3012 WITH RHODE
 &SCHWARZ POWER SUPPLY
 NEUTRAL
 RS232 INTERFACE

Quasi-Peaks above -40 dB of Limit Line #1
 peak criteria = 1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	5.531	31	-17.0
2	5.601	22	-26.0
3	5.744	32.7	-15.3
4	6.143	30.6	-17.4
5	7.357	30.4	-17.6
6	12.85	25.1	-22.9
7	20.22	28.4	-19.6



EQUIPMENT FCC ID : KVJLML_3013

REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
 SERIAL NUMBER : XVA P WN 00791 / 246RK0182R0D / 2906A16132
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
 CONDITIONS : 120/60Hz - RS232 INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-4

12 Nov 1997 16:11:46

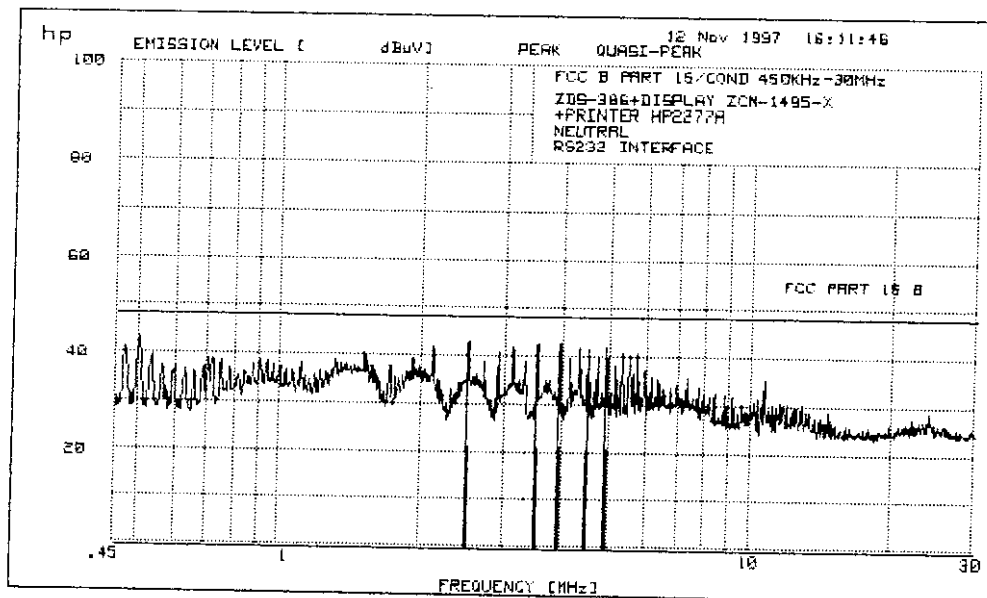
1. AC POWER LINE CONDUCTED

1.1 FCC B PART 15/COND 450KHz-30MHz

ZDS-386+DISPLAY ZCM-1495-X
 +PRINTER HP2277A
 NEUTRAL
 RS232 INTERFACE

Quasi-Peaks above -20 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	2.513	42.5	-5.5
2	3.516	42.1	-5.9
3	3.921	42.6	-5.4
4	4.522	41.1	-6.9
5	4.939	41.8	-6.2



EQUIPMENT FCC ID : KVJLML 3013

REPORT NUMBER : 935-215-02/e
PRODUCT NAME : READER LML 3013
SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
STANDARD : FCC CFR 47 PART 1995 CLASS 8
MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
CONDITIONS : 120/60Hz - RS422 INTERFACE
DATE : 12 Nov 1997
MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-6

12 Nov 1997 15:13:31

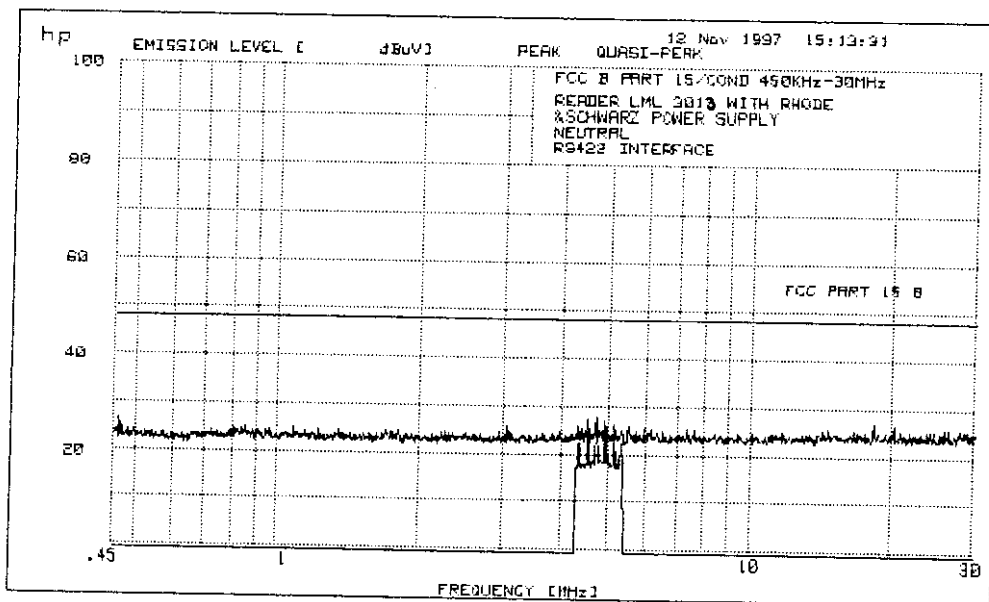
1. AC POWER LINE CONDUCTED

1.1 FCC B PART 15/COND 450KHz-30MHz

READER LML 3012 WITH RHODE
&SCHWARZ POWER SUPPLY
NEUTRAL
RS422 INTERFACE

Quasi-Peaks above -40 dB of Limit Line #1
peak criteria = 1 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	4.336	22.1	-25.9
2	4.541	24.3	-23.7
3	4.756	25.7	-22.3
4	4.939	24.1	-23.9
5	5.022	19.2	-28.8
6	5.15	23	-25.0
7	5.349	22.1	-25.9



REPORT NUMBER : 935-215-02/e
PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
SERIAL NUMBER : XVA P WN 00791 / 246RK0182R0D / 2906A16132
STANDARD : FCC CFR 47 PART 1995 CLASS B
MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
CONDITIONS : 120/60Hz - RS422 INTERFACE
DATE : 12 Nov 1997
MEASUREMENTS DONE BY : D.RAUD

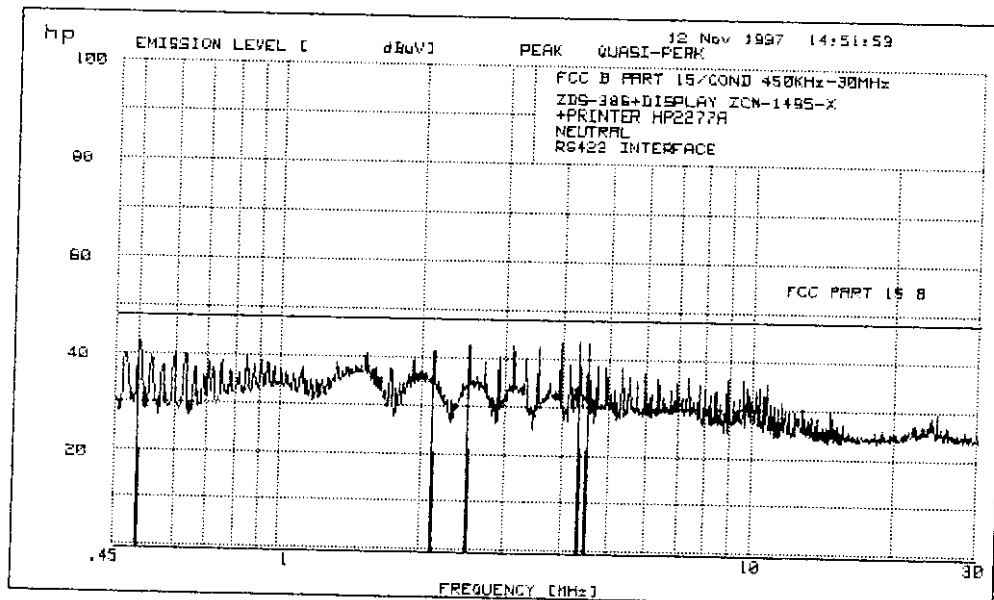
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1. AC POWER LINE CONDUCTED
1.1 FCC B PART 15/COND 450KHz-30MHz

ZDS-386+DISPLAY ZCM-1495-X
+PRINTER HP2277A
NEUTRAL
RS422 INTERFACE

Quasi-Peaks above -30 dB of Limit Line #1
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.5019	40.7	-7.3
2	2.116	41.2	-6.8
3	2.513	42.4	-5.6
4	4.336	43.8	-4.2
5	4.522	42.8	-5.2



EQUIPMENT FCC ID : KVJLML_3013

REPORT NUMBER : 935-215-02/e
PRODUCT NAME : READER LML_3013
SERIAL NUMBER : CHS 2009 (READER 3013) S/N 13904
STANDARD : FCC CFR 47 PART 1995 CLASS B
MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
CONDITIONS : 120/60Hz - TTL INTERFACE
DATE : 12 Nov 1997
MEASUREMENTS DONE BY : D.RAUD

APPENDIX:1-10

12 Nov 1997 10:19:02

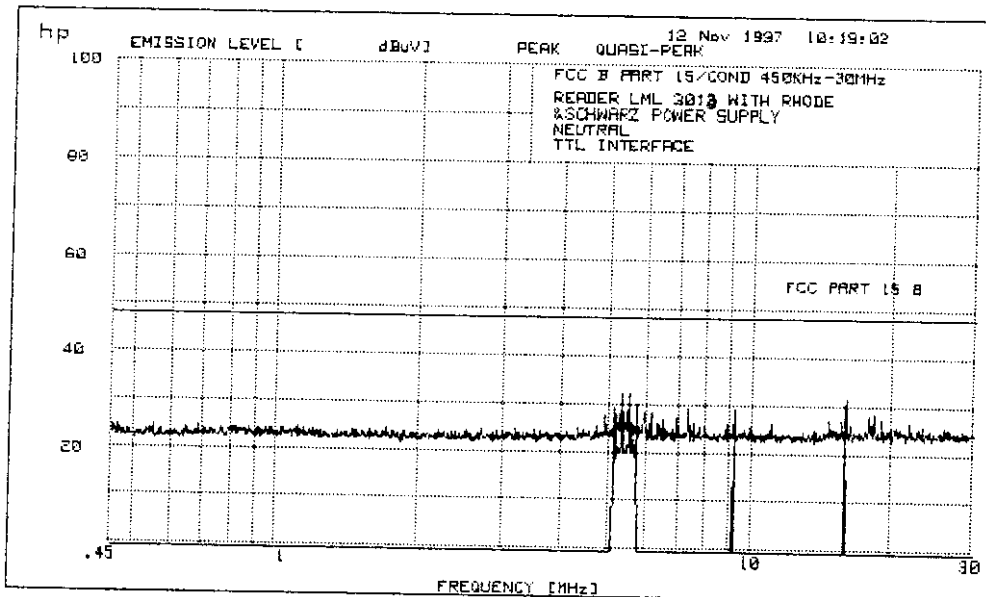
1. AC POWER LINE CONDUCTED

1.1 FCC B PART 15/COND 450KHz-30MHz

READER LML 3012 WITH RHODE
&SCHWARZ POWER SUPPLY
NEUTRAL
TTL INTERFACE

Quasi-Peaks above -30 dB of Limit Line #1
peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	5.15	27.6	-20.4
2	5.349	30.1	-17.9
3	5.554	30.8	-17.2
4	5.744	28	-20.0
5	9.19	26.9	-21.1
6	15.92	30.1	-17.9



REPORT NUMBER : 935-215-02/e
 PRODUCT NAME : PC ZDS-386 + DISPLAY ZDS-1495-X + PRINTER HP 2277A
 SERIAL NUMBER : XVA P WN 00791 / 246RK0182R0D / 2906A16132
 STANDARD : FCC CFR 47 PART 1995 CLASS B
 MEASUREMENT : AC POWER LINE CONDUCTED NEUTRAL
 CONDITIONS : 120/60Hz - TTL INTERFACE
 DATE : 12 Nov 1997
 MEASUREMENTS DONE BY : D.RAUD

12 Nov 1997 09:44:11

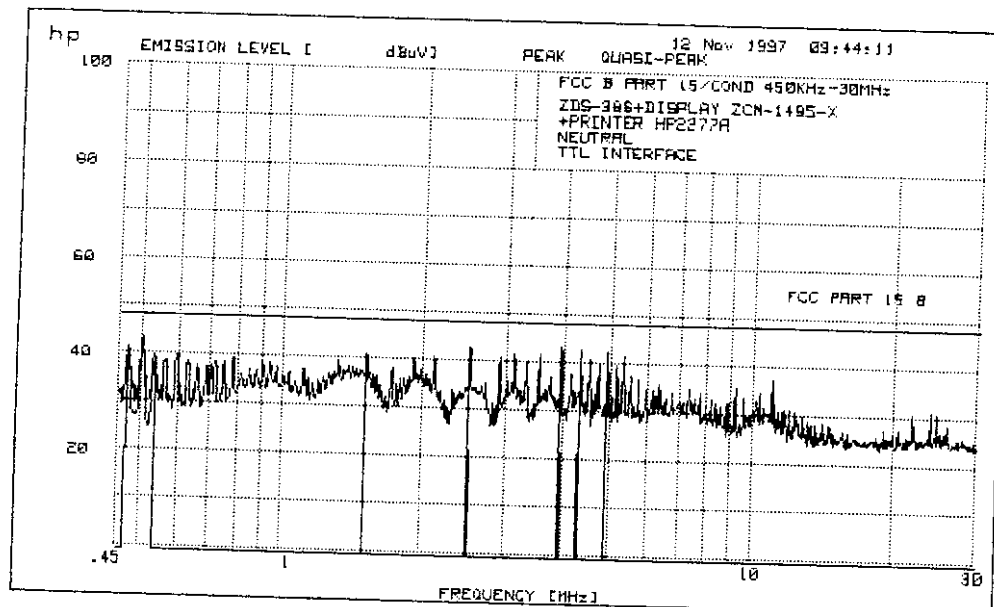
1. AC POWER LINE CONDUCTED

1.1 FCC B PART 15/COND 450KHz-30MHz

ZDS-386+DISPLAY ZCM-1495-X
 +PRINTER HP2277A
 NEUTRAL
 TTL INTERFACE

Quasi-Peaks above -20 dB of Limit Line #1
 peak criteria = 6 dB

PEAK#	FREQ (MHz)	(dBuV)	DELTA
1	.4693	39.5	-8.5
2	.504	40.4	-7.6
3	.5345	37.7	-10.3
4	1.507	38.7	-9.3
5	2.513	42.4	-5.6
6	3.921	42.8	-5.2
7	4.318	42.6	-5.4
8	4.918	42.1	-5.9



6. OPEN FIELD RADIATED EMISSION FOR UNINTENTIONAL RADIATOR

6-1 Test results measurements

The following data pages lists the significant emission frequencies, measured level, correction factor (includes cable and antenna corrections), corrected reading and the limit. The highest peaks are measured in quasi-peak detection mode . Explanation of the Correction Factor is given in paragraph 6.4.

RESUME OF 12 HIGHEST SIGNALS MEASURED ON 3 INTERFACES CONFIGURATIONS

Interface mode	Product	Result	MINIMUM MARGIN		Data and Plot on following Pages
			dB μ V	MHz	
RS232	E.U.T LML_3013+ P.C+ DISPLAY+PR INTER	Pass	-5.8 -7.2 -8.1 -8.6	217.470 607.998 799.987 44.229	36
RS422	E.U.T LML_3013+ P.C+ DISPLAY+PR INTER	Pass	-5.1 -5.8 -6.0 -10.8	217.463 106.870 800.000 40.003	37
TTL	E.U.T LML_3013+ P.C+ DISPLAY+PR INTER	Pass	-4.2 -5.1 -5.9 -5.9	608.020 217.470 77.403 649.973	38

CISPR RECEPTIVE CHAIN H.P 8574A CONFIGURATION		
Quasi-Peak Adaptator	Normal mode Band With = 120 KHz	
Spectrum Analyser	Resolution Band With = 1 MHz Video Band With = 3 MHz	
	Sweep min	Peak measurement : 1 ms/MHz Quasi-peak measurement : 20s/MHz
Preselector	Normal mode Internal preamplifier : 20 dB	

All readings are quasi-peak unless stated otherwise.

EQUIPMENT FCC ID : KVJLML 3013

REPORT : 935-215-02/e
 PRODUCT NAME : READER LML 3013+PC ZDS-386+DISPLAY ZDS-1495+PRINTER HP 2277 A
 SERIAL NUMBER : CHS 2009(READER LML3013)S/N 13904 CONFIGURATION ON APPENDIX A
 STANDARD : FCC CFR 47 PART 15 1995 CLASS B
 MEASUREMENT : ELECTRIC FIELD 30-1000 MHz
 CONDITIONS : 120V/60Hz
 DATE : 7 Nov 1997 - RS232 INTERFACE
 MEASUREMENT DONE BY : D.RAUD

APPENDIX 2-1

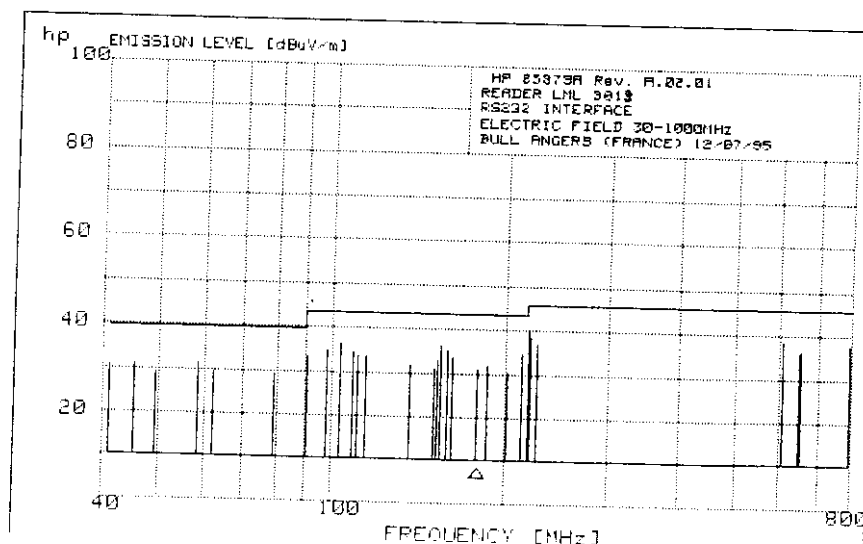
PRODUCT EMISSIONS

HP 85879A Rev. A.02.01

Data File: E FIELD RS232

7 Nov 1997 14:22

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS			SITE		CORR FACTOR dB	COMMENTS
			ABS	dLIM	MODE	POL	HGT AZM cm deg		
1	40.003	40.0	30.7	-9.3	PK	V	110 100	15.1	
2	44.229	40.0	31.4	-8.6	QP	V	120 270	13.2	
3	47.960	40.0	29.2	-10.8	PK	V	110 270	11.5	
4	57.122	40.0	31.7	-8.3	PK	V	110 70	8.4	
5	60.789	40.0	29.9	-10.1	PK	V	110 180	7.8	
6	77.380	40.0	29.3	-10.7	PK	V	110 90	9.2	
7	88.423	43.5	33.6	-9.9	PK	V	120 15	11.3	
8	95.814	43.5	35.1	-8.4	PK	V	110 15	12.4	
9	101.362	43.5	36.3	-7.2	PK	V	120 80	13.	RBW=30KHz
10	106.882	43.5	34.8	-8.7	QP	V	100 20	13.1	
11	108.734	43.5	33.7	-9.8	PK	V	110 15	13.1	
12	112.410	43.5	34.0	-9.5	PK	V	110 25	13.1	
13	134.556	43.5	32.0	-11.5	PK	V	110 90	13.4	
14	149.280	43.5	31.2	-12.3	PK	V	110 60	13.6	
15	151.120	43.5	33.0	-10.5	PK	V	110 40	13.5	
16	152.970	43.5	36.5	-7.0	PK	V	110 45	13.5	
17	156.690	43.5	35.3	-8.2	PK	V	110 40	13.4	
18	160.311	43.5	33.8	-9.7	QP	V	110 30	13.3	
19	177.154	43.5	31.3	-12.2	PK	H	120 345	12.7	
20	184.523	43.5	31.8	-11.7	PK	H	130 10	12.4	
21	199.280	43.5	30.3	-13.2	PK	V	130 15	11.8	
22	211.944	43.5	35.1	-8.4	PK	V	110 15	12.8	
23	217.470	46.0	40.2	-5.8	QP	H	160 140	13.3	
24	219.300	46.0	38.3	-7.7	PK	H	140 155	13.4	
25	224.841	46.0	37.2	-8.8	PK	H	140 165	13.9	
26	507.998	46.0	38.8	-7.2	QP	V	130 130	23.5	
27	650.000	46.0	36.2	-9.8	PK	V	130 125	23.8	
28	656.014	46.0	36.6	-9.4	PK	V	130 195	23.8	
29	799.987	46.0	37.9	-8.1	QP	V	100 190	25.6	



EQUIPMENT FCC ID : KVJLML 3013

REPORT : 935-215-02/e
 PRODUCT NAME : READER LML_3013+PC ZDS-386+DISPLAY ZDS-1495+PRINTER HP 2277 A
 SERIAL NUMBER : CHS 2009(READER LML3013)S/N 13904 CONFIGURATION ON APPENDIX A
 STANDARD : FCC CFR 47 PART 15 1995 CLASS B
 MEASUREMENT : ELECTRIC FIELD 30-1000 MHz
 CONDITIONS : 120V/60Hz
 DATE : 7 Nov 1997 - RS422 INTERFACE
 MEASUREMENT DONE BY : D.RAUD

APPENDIX 2-2

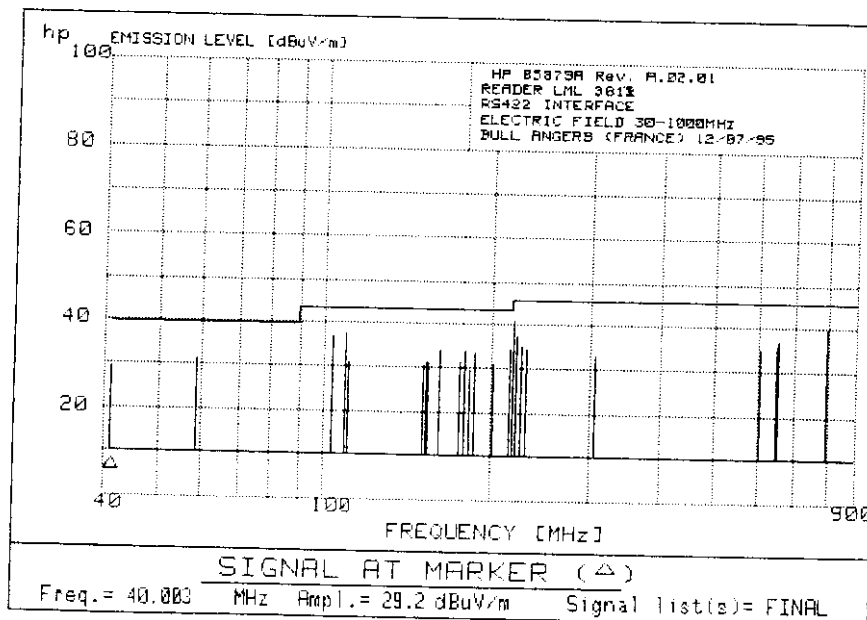
PRODUCT EMISSIONS

HP 85879A Rev. A.02.01

Data File: E FIELD RS422

7 Nov 1997 11:19

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS		MODE	POL	SITE		CORR FACTOR dB	COMMENTS
			ABS	dLIM			HGT	AZM		
			dBuV/m	dB			cm	deg		
1	40.003	40.0	29.2	-10.8	QP	V	110	50	15.1	
2	57.122	40.0	31.3	-8.7	PK	V	110	75	8.4	
3	101.362	43.5	36.7	-6.8	PK	V	100	70	13.	RBW=30KHz
4	106.870	43.5	37.7	-5.8	QP	V	110	360	13.1	
5	108.732	43.5	30.9	-12.6	QP	V	110	30	13.1	
6	149.280	43.5	30.4	-13.1	PK	H	140	360	13.6	
7	151.120	43.5	31.0	-12.5	PK	H	120	305	13.5	
8	152.970	43.5	30.9	-12.6	PK	H	120	30	13.5	
9	160.320	43.5	33.7	-9.8	PK	H	120	10	13.3	
10	173.451	43.5	31.3	-12.2	PK	H	140	360	12.8	
11	177.154	43.5	33.9	-9.6	PK	H	130	0	12.7	
12	180.830	43.5	29.2	-14.3	PK	H	150	0	12.5	
13	184.523	43.5	33.3	-10.2	PK	H	130	360	12.4	
14	199.280	43.5	30.9	-12.6	PK	H	140	95	11.8	
15	214.046	43.5	34.2	-9.3	PK	H	150	360	13.	
16	217.463	46.0	40.9	-5.1	QP	H	150	145	13.3	
17	219.300	46.0	37.1	-8.9	PK	H	160	160	13.4	
18	224.841	46.0	35.0	-11.0	PK	H	160	0	13.9	
19	228.539	46.0	34.2	-11.8	PK	H	140	360	14.2	
20	304.069	46.0	33.2	-12.8	PK	H	190	120	17.2	
21	608.012	46.0	34.9	-11.1	PK	V	150	45	23.5	
22	650.000	46.0	35.9	-10.1	PK	V	120	100	23.8	
23	656.014	46.0	37.0	-9.0	PK	V	100	50	23.8	
24	800.000	46.0	40.0	-6.0	QP	V	120	195	25.6	



EQUIPMENT FCC ID : KVJLML_3013

PRODUCT NAME : READER LML 3013+PC ZDS-386+DISPLAY ZDS-1495+PRINTER HP 2277 A
 SERIAL NUMBER : CHS 2009(READER LML3013)S/N 13904 CONFIGURATION ON APPENDIX A
 STANDARD : FCC CFR 47 PART 15 1995 CLASS B
 MEASUREMENT : ELECTRIC FIELD 30-1000 MHz
 CONDITIONS : 120V/60Hz - TTL INTERFACE
 DATE : 7 Nov 1997
 MEASUREMENT DONE BY : D.RAUD

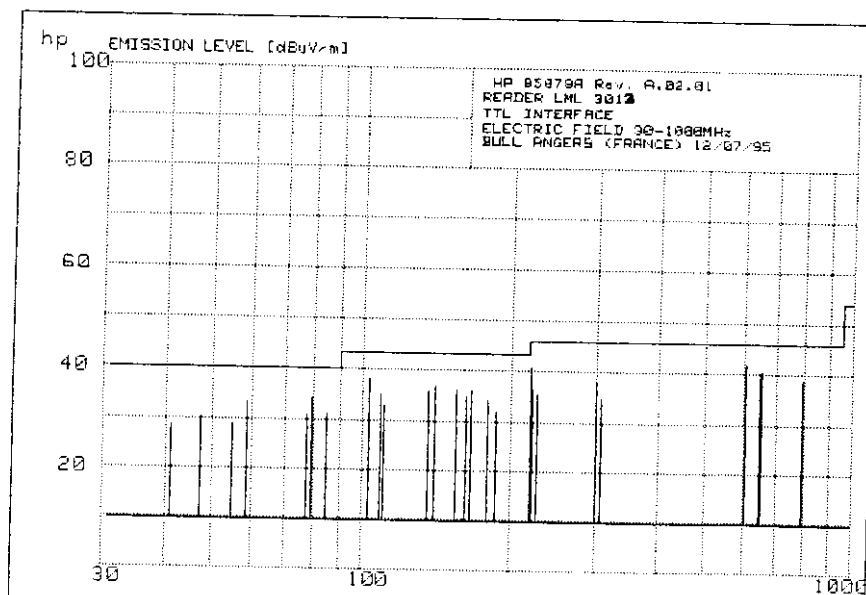
PRODUCT EMISSIONS

HP 85879A Rev. A.02.01

Data File: E FIELD TTL

7 Nov 1997 17:55

EMISSION No	FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS			SITE POL	HGT		CORR FACTOR dB	COMMENTS
			ABS	dLIM	MODE		cm	deg		
1	40.003	40.0	28.8	-11.2	PK	V	110	65	15.1	
2	46.040	40.0	30.3	-9.7	PK	V	110	95	12.4	
3	53.432	40.0	28.9	-11.1	PK	V	110	160	9.4	
4	57.122	40.0	33.4	-6.6	PK	V	170	75	8.4	
5	75.580	40.0	31.1	-8.9	QP	V	130	85	8.8	
6	77.403	40.0	34.1	-5.9	QP	V	110	75	9.2	
7	82.966	40.0	31.2	-8.8	QP	V	120	65	10.3	
8	101.362	43.5	38.2	-5.3	PK	V	110	335	13.	RBW=30KHz
9	106.870	43.5	35.3	-8.2	PK	V	110	60	13.1	
10	108.732	43.5	33.0	-10.5	PK	V	110	40	13.1	
11	134.556	43.5	35.9	-7.6	PK	V	110	120	13.4	
12	138.205	43.5	36.8	-6.7	PK	V	110	140	13.4	
13	152.970	43.5	36.1	-7.4	PK	V	110	40	13.5	
14	160.313	43.5	35.0	-8.5	QP	H	140	115	13.3	
15	164.047	43.5	36.1	-7.4	QP	H	140	115	13.2	
16	177.136	43.5	34.3	-9.2	QP	H	120	355	12.7	
17	184.477	43.5	32.1	-11.4	PK	H	120	10	12.4	
18	217.470	46.0	40.9	-5.1	QP	H	130	265	13.3	
19	219.300	46.0	36.6	-9.4	PK	V	120	20	13.4	
20	224.841	46.0	35.7	-10.3	PK	V	120	15	13.9	
21	296.027	46.0	38.3	-7.7	PK	H	190	290	17.	
22	304.069	46.0	35.0	-11.0	PK	H	190	275	17.2	
23	608.020	46.0	41.8	-4.2	QP	V	150	255	23.5	
24	649.973	46.0	40.1	-5.9	QP	V	120	200	23.8	
25	656.009	46.0	40.3	-5.7	QP	V	150	280	23.8	
26	799.994	46.0	38.8	-7.2	QP	V	140	350	25.6	



6.3 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and cable loss, and subtracting the preamplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows :

$$FS = RA + AF + CF - PG$$

FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable loss

PG = Preamplifier Gain (Preselector)

Assume a receiver reading. The antenna factor and the cable loss are added. The internal preselector gain of 20 dB is subtracted, giving the field strength.

REMS software performs calculation and result of table in column ABS (MEASUREMENTS) is FIELD STRENGTH.

6.4 ANTENNA FACTORS AND CABLE LOSS FOR 3m DISTANCE MEASUREMENT

6-4-1 Cable loss

E field 3 meters cable losses

FREQUENCY	LOSS
F (MHz)	(dB)
30	0.4
40	0.8
50	1.1
100	1.1
120	1.3
160	1.8
200	1.7
250	2.3
300	2.7
400	3
500	3.4
600	3.3
700	3.6
800	4.3
900	4.3
1000	4.6
1100	4.6
1200	5.2
1300	5.6
1400	5.8
1500	5.9
1600	6.2
1700	6.3
1800	6.8
1900	7
2000	7.2

6-4-2 Antenna factor BILOG CBL6112 30-2000 MHz (3m)

Frequency (MHz)	Factor antenna (dB)
30	19.4
35	16.9
40	14.3
45	11.9
50	9.5
55	7.7
60	6.7
65	6.4
70	6.7
75	7.6
80	8.6
90	10.5
100	11.9
150	11.9
200	10.1
250	13.7
300	14.4
400	17.1
500	19.0
600	20.2
700	20.4
800	21.3
900	21.8
1000	22.6
1100	23.4
1200	24.3
1300	24.8
1400	25.7
1500	26.6
1600	26.9
1700	28.0
1800	28.1
1900	28.6
2000	29.2

7. OPEN FIELD RADIATED EMISSION FOR INTENTIONAL RADIATOR**7-1 Test procedure**

The reader LML_3013 is placed on a wood table 0.80m in height above ground and is powered on by 12 V DC external power supply . (The tag is near the reader)

We test it at bottom, middle and top of its operating frequency range
The frequency range of the transceiver is 2.446250 to 2.453750 GHz by 250 KHz step.

For each tuned frequency the maximum level amplitude is recorded for fundamental and highest harmonics frequencies.

To increase the signal to noise ratio, a pre- measurement is performed at 1m from E.U.T. Then the measurement is performed at 3 meters from E.U.T. with spectrum analyser RBW = 100 KHz for fundamental frequencies and RBW = 5 KHz for harmonics frequencies measurement.

CFR 47 Part 15 Subpart C specifications limits applied :

Fundamental frequency : § 15.245 limit

Harmonic frequency in restricted band listed in § 15.205 : § 15.209 limit

Harmonic frequency outside restricted band listed in § 15.205 : § 15.245 limit

Bandedge measurement is performed in accordance of § 15.245 (3).

7.2 Tests results

7-2-1 Fondamental and harmonics frequencies data

FIELD STRENGTH OF INTENTIONAL RADIATOR VERSUS FCC PART 15SUBPART C §15.245, 15.209, 15.205

PRODUCT: HYPER X Reader LML_ 3013 with AT1 antenna
 OPERATOR: A.LEQUIER / D.RAUD
 DATE: 03/12/1998

1 Harmonic level measurement :

The measurements are performed on channel number 31 (lowest frequency), 9 (central frequency), and 30 (highest frequency) on fundamental frequency h1, until 10 th harmonic frequency. Preliminary a spectrum signature is performed at one meter from E.U.T. The final measurement is performed at 3 meters from E.U.T. The measurements are performed according to ANSI C63.4 - 1992 method measurement described in § 8. Measurements are performed at maximum range corresponding to 2 meters distance detection (worst case measurement). The tag is reading continuously.

For fundamental frequency measurement peak detection is used instead of average, the result is equal for Continuous Wave (RBW = 100 KHz and VBW=3xRBW=300KHz)

For harmonic frequencies measurement average detection is used to increase the ratio signal/noise. RBW = 5 KHz and VBW=30Hz, therefore noise level is -10dBµV.

Channel	Harmonic number	Frequency GHz	Antenna Factor dB		Cable Loss dB	Measured Level dBµV/m (corrected value)		Limit (D=3m) dBµV/m (**) CFR47 §		Margin (dBµV/m)	Test result
			D=1m	D=3m		D = 1 m	D = 3 m	15.245	15.209		
31	h1	2.446250	28.8	30.7	2.6	115.4	111.3	114		-2.7	Pass
	h2	4.892500	33.7	35.4	3.8	53.5	50.2		54	-3.8	Fail
	h3	7.338750	37.1	38	5	52.1	45		54	-9	Pass
	h4	9.786000	38.5	40.2	6.5	43	39.7	64		-24.3	Pass
	h5*	12.231250	39.2	41.1	7.5	42.7	41.6		54	-12.4	Pass
9	h1	2.450000	28.8	30.7	2.6	116.4	111.3	114		-2.7	Pass
	h2	4.900000	33.7	35.4	3.8	53.5	52.2		54	-1.8	Pass
	h3	7.350000	37.1	38	5	55.1	49		54	-5	Pass
	h4	9.800000	38.5	40.2	6.5	41	38.7	64		-25.3	Pass
	h5*	12.250000	39.2	41.1	7.5	46.7	41.6		54	-12.4	Pass
30	h1	2.453750	28.8	30.7	2.6	116.4	111.3	114		-2.7	Pass
	h2	4.907500	33.7	35.4	3.8	52.5	52.4		54	-1.6	Pass
	h3	7.361250	37.1	38	5	55.1	49		54	-5	Pass
	h4	9.815000	38.5	40.2	6.5	40	37.7	64		-26.3	Pass
	h5*	12.268750	39.2	41.1	7.5	44.7	41.6		54	-12.4	Pass

(*) For harmonic >h5 to h10 no signal found: analyser level noise = -10 dBµV (RBW = 5 KHz and VBW=30Hz)

(**) unit change : 114 dBµV/m = 500 mV/m, 64 dBµV/m = 1.6mV/m and 54 dBµV/m = 500 µV/m.

2. Measurement outside of specified band (§15-245 (a)(3)) :

- lower frequency of band (2.446250GHz) : attenuation > 67 dB (not signal found)
- upper frequency of band (2.453750GHz) : attenuation > 65 dB (not signal found)

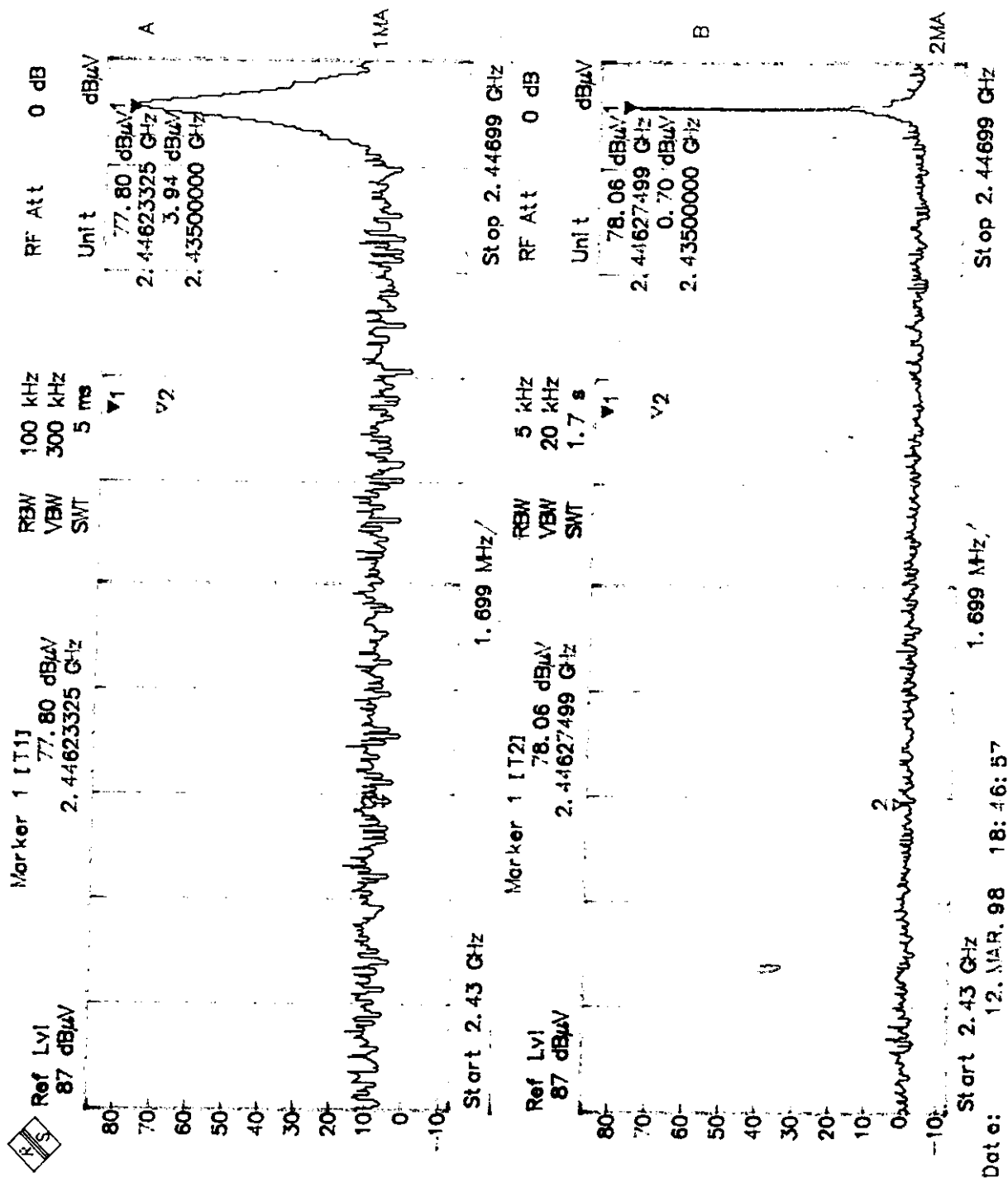
see page 47

see page 48

7-2-2 Lowest Bandedge measurements plot

§ 15.245 (3) PLOT OF BANDEDGE MEASUREMENT (Transmitter operating on the lowest channel)

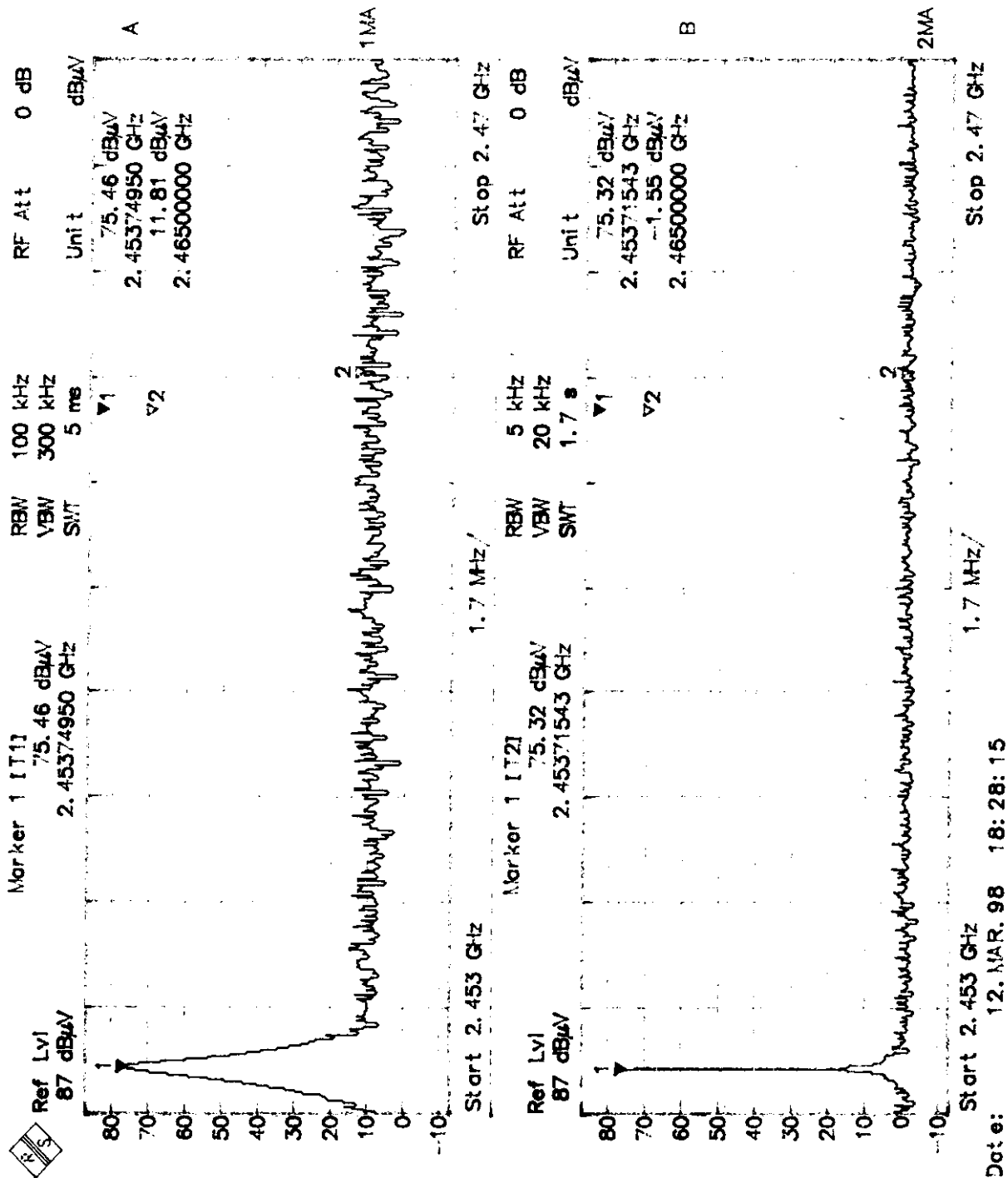
PRODUCT: LML_3013



7-2-3 Highest Bandedge measurement plot

§15.245 (3) PLOT OF BANEDGE MEASUREMENT (Transmitter operating on the highest channel)

PRODUCT: LML_3013



7-2-5 Correction factor

Cable loss

F (GHz)	Loss (dB)
2	2.2
4	3.3
5	3.5
7	5.5
8	4.9
9	5.1
10	5.5
11	6.0
12	5.1
13	5.8

Antenna factors

F (GHz)	Antenna Factor (dB)	Antenna Factor (dB)
	D=1m	D=3m
1	24.2	25.9
1.5	25.5	27.0
2	27.9	29.2
2.5	28.8	30.7
3	30.6	32.3
3.5	31.5	33.3
4	32.9	34.6
4.5	32.8	34.3
5	33.9	35.6
5.5	34.7	36.4
6	34.8	36.7
6.5	35.2	36.6
7	36.1	37.3
7.5	37.4	38.2
8	37.5	38.9
8.5	37.9	39.1
9	38.3	39.5
9.5	38.3	40.1
10	38.8	40.2
10.5	38.8	40.2
11	38.8	40.3
11.5	39.4	40.8
12	39.2	41.2
12.5	39.2	41.1
13	40.2	41.2
13.5	41.0	40.9
14	41.5	41.1
14.5	41.0	41.6
15	39.3	42.4
15.5	37.8	40.4
16	38.1	40.0
16.5	39.7	41.1
17	41.9	43.5
17.5	45.0	46.3
18	46.7	47.2

7-2-6 Field Strength calculation

The field strength is calculated by adding the Antenna Factor and cable loss. The basic equation with a sample calculation is as follows :

$$FS = RA + AF + CF$$

FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable loss

Modular reader LML_3013

Human exposure to radiofrequencies : Calculation the power density .

A calculation in accordance with the OET Bulletin 65 Edition 97-01 august 1997 page 19 , leads to :

$$S = \text{EIRP} / (4 \cdot \pi \cdot R^2)$$

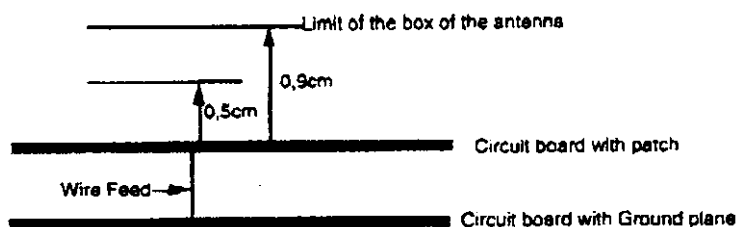
S: power density (mW/cm²)

EIRP : equivalent isotropically radiated power (mW)

R : distance of the center of radiation of the antenna (cm)

The antenna of this reader is AT1_2709. The antenna circuit board is inside the antenna housing AT1_2709. The distance between the circuit board and the top of the housing is 0,9cm and the EIRP is 20mW , so the power density calculates with this formula is:
 $S = 0,9 \text{EIRP} = 20 \Rightarrow S = 2 \text{mW/cm}^2$.

We can read in the OET Bulletin 65 Edition 97-01 august 1997 page 19 that this calculation is a worst case , so we requested the services of an antenna laboratory , the CREAPE (Centre de Recherche en Electromagnétisme des Antennes à Pointage Electronique) which is a laboratory of CNRS (Centre National de Recherche Scientifique) in France, to compute the near-field of this antenna (AT1_2709). The calculation was made with a Cray computer and the method employed was the FDTD 3D (Finite Difference Time Domain with 3 dimensions). The structure of the antenna is simulated with two circuit boards in epoxy. The first circuit board is a ground plane and the second circuit board is a patch.



The distance between the circuit board containing the antenna patch and the top of the box is 0,9cm, so the computation of the the power density was made at 0,9cm. Another computation was made at 0,5cm to observe the evolution and to be sure the power density is not too high at a very close distance to the antenna.

We can see the result of this calculation on the graphs n°1 and n°2. On these graphs Pz is the power density and Pacc=1W is the power send to the antenna. With the reader LML_3013, the power send to the antenna is only 5mW. So the result of the graph has to be divided by 200.

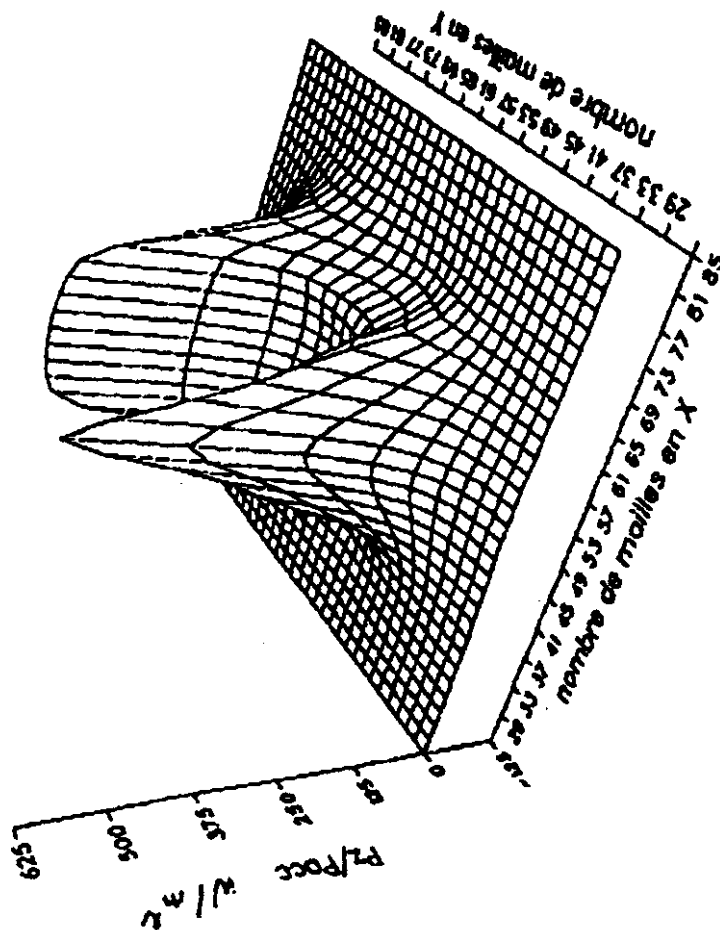
The result is:

- at a distance of 0,5cm the power density is : 560W/m² for Pacc=1W wich corresponds to a power density of $S = 0,28 \text{mW/cm}^2$ for Pacc=5mW.
- at a distance of 0,9cm the power density is : 320W/m² for Pacc=1W wich corresponds to a power density of $S = 0,16 \text{mW/cm}^2$ for Pacc=5mW.

The frequency of the reader is 2,45 GHz , so the accepted limit for the power density is 1mW/cm² It can thus be concluded that , there is no problem concerning the human exposure to radiofrequencies for this reader . No special installation is needed to use this reader .k;

GRAPH N°1

Normalised Pz Power Density


 $max = 558 W/m^2$

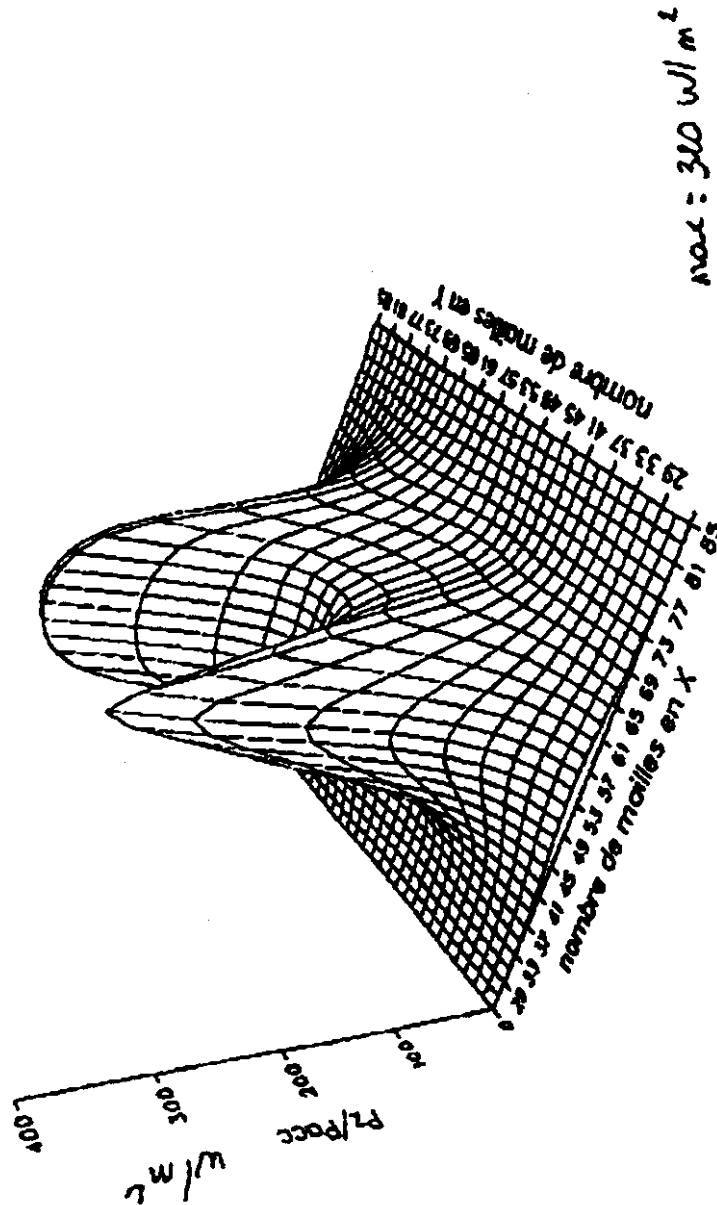
Result at a distance of 5mm from the circuit board of antenna

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GRAPH N°2

Normalised Pz Power Density



Result at a distance of 9mm from the circuit board of antenna