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STS 024



Schweizerischer Prüfstellendienst
Service suisse d'essai
Servizio di prova in svizzera
Swiss testing service

Report no:
Rapport no: 12'414
Bericht Nr:

Title: **Emissions of the Minilevel NT, Leveltronic NT and
Titre: Levelmeter 2000 with wireless transmission
Titel: according to FCC Part 15 Subpart C**

Date of test:
Date de l'essai: May 17th, 2000
Prüfdatum:

Customer:
Client: Wyler AG
Kunde:

Test place: montena emc sa
Lieu de l'essai: CH-1728 Rossens
Prüfort:

Test performed by
Essai effectué par :
Prüfer

Manfred PORTMANN

Test report prepared by
Rapport d'essai préparé par :
Berichterstatter

Manfred PORTMANN

Test report controled and approved by
Rapport d'essai contrôlé et approuvé par :
Prüfbescheinigung

Jacques DING

Rossens, 2000-5-22

(Issue Date / Date d'édition / Ausstelldatum)

Main language / Langue principale / Hauptsprache: english / français / Deutsch

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No. / No. / Nr. : 12'414

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Title/Titre/Titel : **Emissions of the Minilevel NT, Leveltronic NT
and Levelmeter 2000 with wireless transmission
according to FCC Part 15 Subpart C**

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Total number of pages	
Nombre total de pages du rapport:	43
Total Anzahl Seiten	

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**1. Summary of test results / Résumé des résultats d'essais /
Zusammenfassung der Prüfergebnisse**

- ✓ Pass / Réussi / Bestanden
- X Fail / Pas réussi / Nicht bestanden
- ☐ Not applicable to this type of product / Pas applicable à ce type de produit / Nicht
anwendbar für diese Produktart
- No test / Pas d'essai / Nicht geprüft

Test Type / Type d'essai / Art der Prüfung	Result / Résultat / Ergebnis
<i>Emission / Emission / Emissionen</i>	
Mains terminal radio frequency voltage Tension perturbatrice aux bornes d'alimentation § 15.207 Störspannung auf den Energieversorgungsleitungen	✓
Radiated electromagnetic field Champ perturbateur § 15.209 Störfeldstärke	✓
Carrier level Niveau de la porteuse § 15.249 Trägerleistung	✓

The equipment is conform to all requirements of the standards :
L'appareil répond à toutes les exigences fixées dans les normes :
Das Gerät entspricht sämtlichen Anforderungen der Normen :

**United States: 47 CFR "Code of Federal Regulations" - Telecommunication
FCC Part 15, subpart C: Intentional Radiators**

No. / No. / Nr. : 12'414

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2. Client / Client / Kunde

Client name and address Nom et adresse du client Name und Adresse des Kunden	Wyler AG Im Hölderli CH – 8405 Winterthur
Contact Person / Responsable / Kontaktperson	Mr. Breu
Telephone / Téléphone / Telefon	+41 52 233 66 66
Fax / Télécopieur / Telefax	+41 52 233 20 53
Mandate no / Mandat no / Auftrag Nr.	2000-4550

3. Equipment under test / Equipement à l'essai / Prüfling

Manufacturer name and address Nom et adresse du fabricant Name und Adresse des Herstellers	Wyler AG Im Hölderli CH – 8405 Winterthur
Product name / Nom du produit / Produktname	Minilevel NT (Leveltronic NT) and Levelmeter 2000
Product description / Description du produit / Produktbeschreibung	Measuring system with wireless communication
Production country / Pays de fabrication / Ursprungsland	Switzerland
Product type / Type du produit / Typ des Produktes	---
Serial no / No. de série / Seriennummer	99 10 707 / 1
Modifications before the tests Modifications apportées avant les essais Vor den Prüfungen angebrachte Änderungen	---
Technical documentation Documentation technique Technische Dokumentation	see pages 9.1 – 9.28

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4. Test conditions / Conditions d'essai / Testbedingungen

Temperature / Température / Temperatur:

21 °C

Pressure / Pression / Druck:

1010 hPa

Relative humidity / Humidité relative / Relative Luftfeuchtigkeit:

52 %

Test period / Date des essais / Datum der Prüfungen:

May 17th, 2000

5. Persons present / Personnes présentes / Anwesende Personen

Test Engineer(s) / Ingénieur(s) d'essai / Prüfsingenieur(e) :

Manfred PORTMANN

Other(s) / Autre(s) / Andere :

Name / Nom / Name

Company / Société / Firma

Mr. Breu

Wylar AG

6. Performance criteria / Critères de performance / Bewertungskriterien

No immunity test were performed.



Measurement of the conducted disturbances 450 kHz - 30 MHz

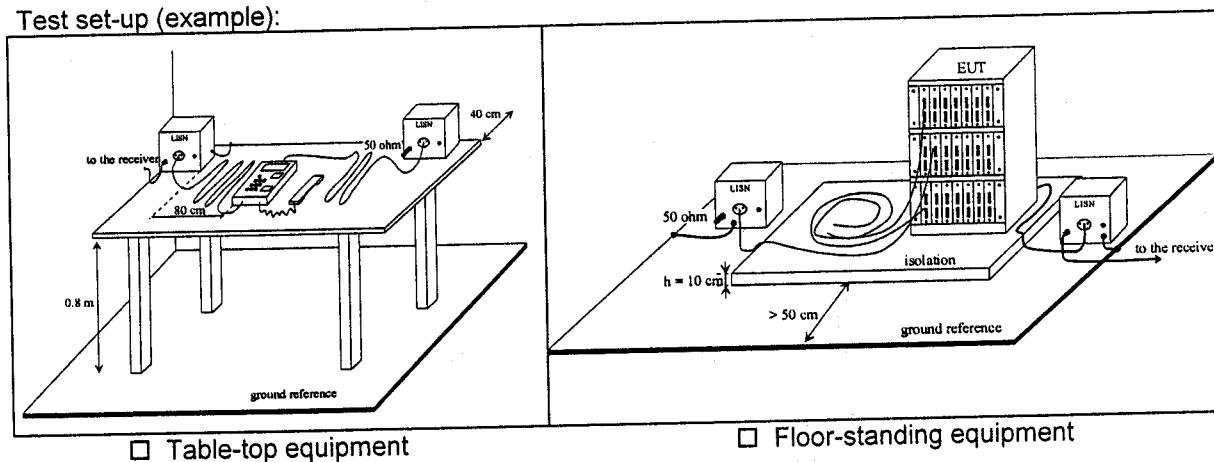
Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☐ FCC Part 15, Subpart B: Unintentional Radiators: § 15.107 (a) and (b)
☒ FCC Part 15, Subpart C: Intentional Radiators: § 15.207 and
☐ class A ☐ class B

Test site: ☒ anechoic chamber (ferrites) ☐ anechoic chamber (foam)
☐ shielded room ☐ laboratory
☐ open test site ☐

Test precision: ± 3.5 dB

Test method: The conducted disturbance on the supply line is measured from 450 kHz to 30 MHz using a spectrum analyser and a line impedance substitution network (LISN). The measurement of the radio frequency voltage between each power line and ground at the power terminals is carried out successively. Only the maximum of all the values is displayed. The peak values are recorded continuously on the graph. The values that exceed the limits are remeasured manually with the quasi-peak and the average detector of a measuring receiver. These values are indicated at the bottom of the graph.
 If the quasi-peak (QP) values exceed the limits in § 15.107 (a) and (b), and the difference of the measured quasi-peak value and the average value is 6 dB or more, that emission is considered to be broadband. In this case the QP level may be reduced by 13 dB for comparison to the limits.
 As an additional alternative to § 15.107 (a) and (b) digital devices may be shown to comply with the Standards contained in the CISPR Pub. 22 (1985) and the associated Standards.

Test set-up (example):



Test equipment:

☒ Spectrum analyser	☐ 88-14	☒ 90-26	☐ 94-24
☐ LISN	☐ 85-13	☐ 90-08	☐ 94-36
☒ LISN	☒ 94-40	☐ 95-12	☐
☐ Additional LISN	☐ 85-13	☐ 90-08	☐ 94-36 ☐ 94-40
☒ Receiver 9 kHz - 30 MHz	☐ 85-12	☐ 90-11	☒ 94-34
☐ Plotter HPIB	☐ 88-31	☐ 91-29	☐ 93-79 ☐ 93-80 ☐
☒ Protection 10 dB / 20 dB	internal		
☐			
☐			

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

Measurement Type : Voltage Interference

Wire : Line



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6.2

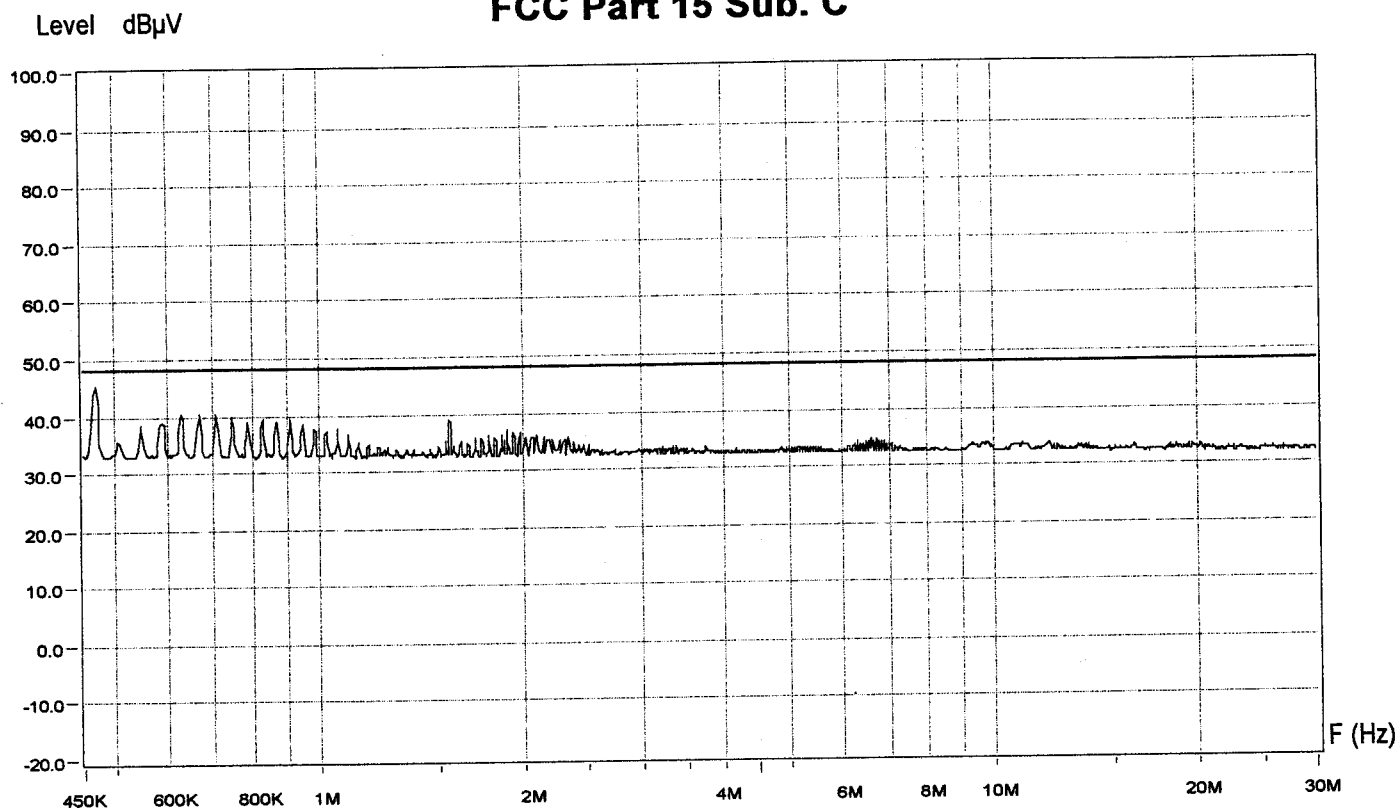
Equipment Under Test : Monteur Set Wireless 902 MHz

Set-Up :

Operating Conditions : ext. powered

Remarks :

FCC Part 15 Sub. C



Zone	450 KHz - 2 MHz	2 MHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz	9 KHz
Sweep Time	5 s	5 s	5 s

Operator :

P. M.

17.05.2000

11.12 h

Measurement Type : Voltage Interference

Wire : Neutral



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6.3

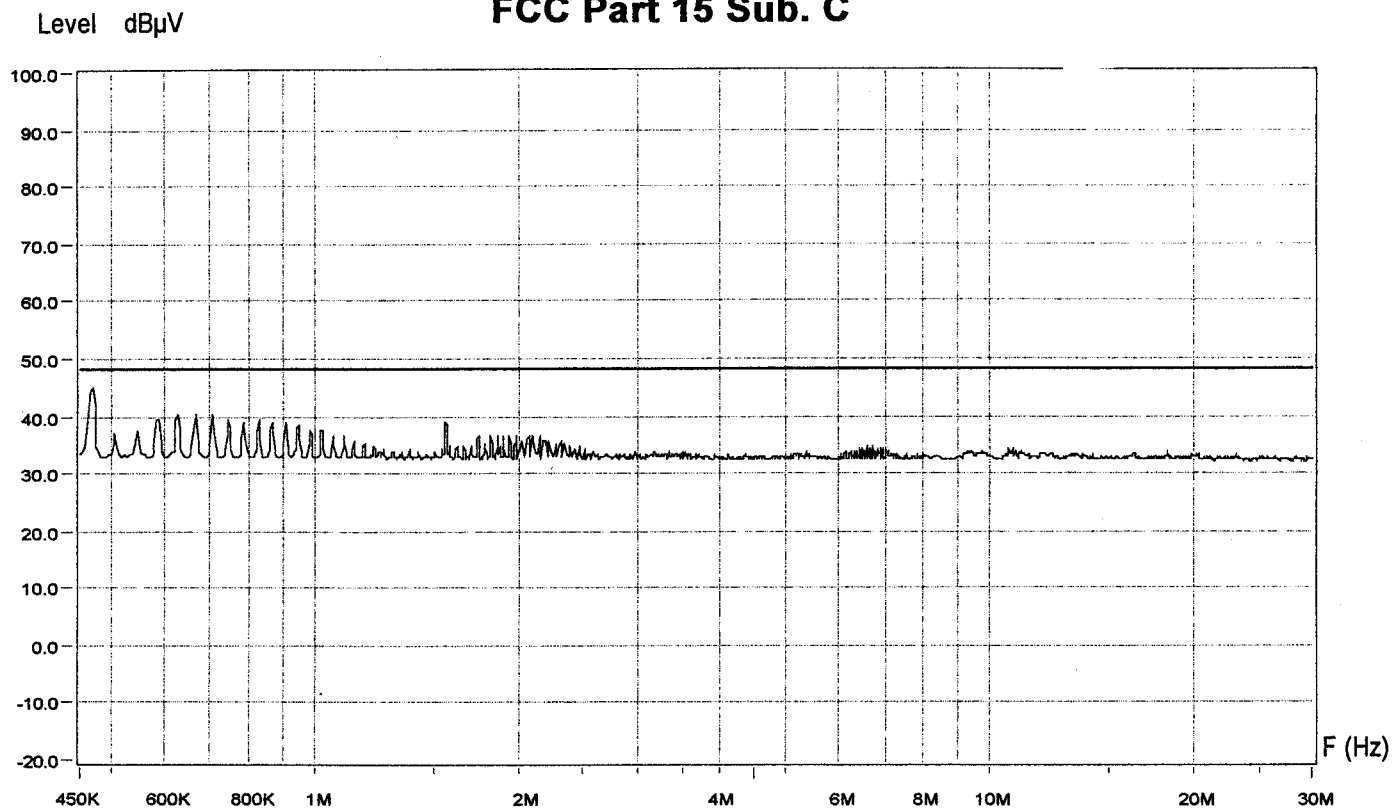
Equipment Under Test : Monteur Set Wireless 902 MHz

Set-Up :

Operating Conditions : ext. powered

Remarks :

FCC Part 15 Sub. C



Zone	450 KHz - 2 MHz	2 MHz - 8 MHz	8 MHz - 30 MHz
Video Bandwidth	30 KHz	30 KHz	30 KHz
Resol Bandwidth	9 KHz	9 KHz	9 KHz
Sweep Time	5 s	5 s	5 s

Operator :

POM

17.05.2000

11.09 h



Radiated electromagnetic field

Standard: United States: 47 CFR "Code of Federal Regulations" - Telecommunication
☐ FCC Part 15, Subpart B: Unintentional Radiators
☒ FCC Part 15, Subpart C: Intentional Radiators
☐ class A ☐ class B §15.33 frequency range of radiated meas.:
 from 0.014 MHz to 10.4 MHz

Distance: ☒ §15.249 ☐ §15.....
☐ 30 m ☒ 10 m ☐ 3 m ☒ 3m (above 1 GHz)

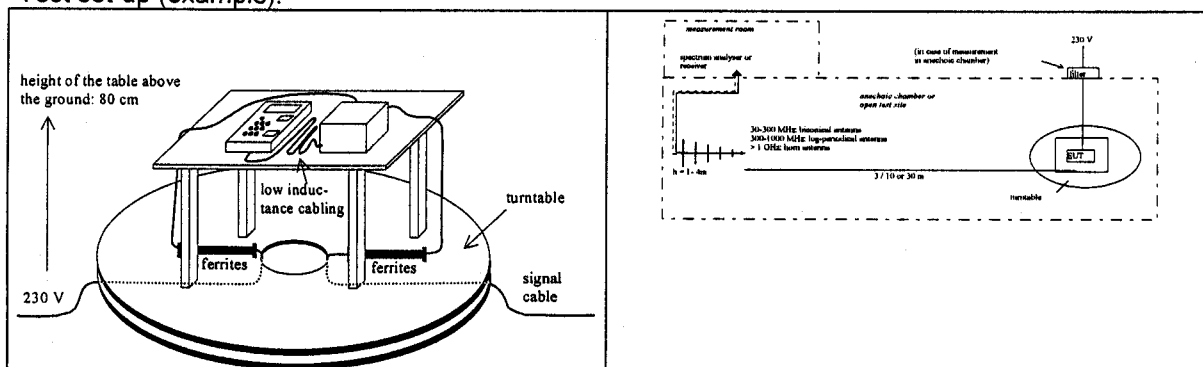
Test site: ☒ anechoic chamber (foam) ☐ open test site
☒ anechoic chamber (ferrite) ☐

Test precision: ± 4.6 dB

Position of EUT: 0.8 m (Height of equipment under test above floor)

Test method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and an antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbance appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding the limits are remeasured manually giving quasi-peak values and average values using a receiver and these measurements are indicated under the graph. The limit must be respected in quasi-peak values (QP) up to 1 GHz and in average values (AV) above 1 GHz. The 6 dB bandwidth of the spectrum analyser is adjusted to 100 kHz from 30 to 1000 MHz and 1 MHz above 1 GHz.

Test set-up (example):



Test equipment:

☒ Spectrum analyser	☒ 88-14	☒ 90-26	☐ 94-24	
☒ Receiver (CISPR 16)	☐ 85-04	☐ 90-43	☒ 94-35	
☒ Preamplifier	☐ 88-05	☒ 90-01	☐ 90-42	☐ 95-86 G = ... dB
☐ Antenna (biconical)	☐ 82-02	☐ 87-05	☐ 87-16	☐ 91-05 ☐ 94-37
☐ Antenna (log-per)	☐ 88-20	☐ 90-30	☐ 91-35	☐ 94-64 ☐
☒ Antenna (bilog, horn)	☒ 94-03	☒ 90-24	☐ 90-29	☒ 91-18
☐ Plotter HPIB	☐ 88-31	☐ 91-29	☐ 93-79	☐ 93-80 ☐
☐				

limits corrected → see graphs

Results: ☒ complies ☐ does not comply ☐ not applicable ☐ not done

Measurement Type : Radiated Field

Polarisation : Vertical

Table Angle : 360 deg

Antenna Height : 1 m

Equipment Under Test : Monteur Set Wireless 902 MHz

Set-Up : table top

Operating Conditions : RF OFF

Remarks :

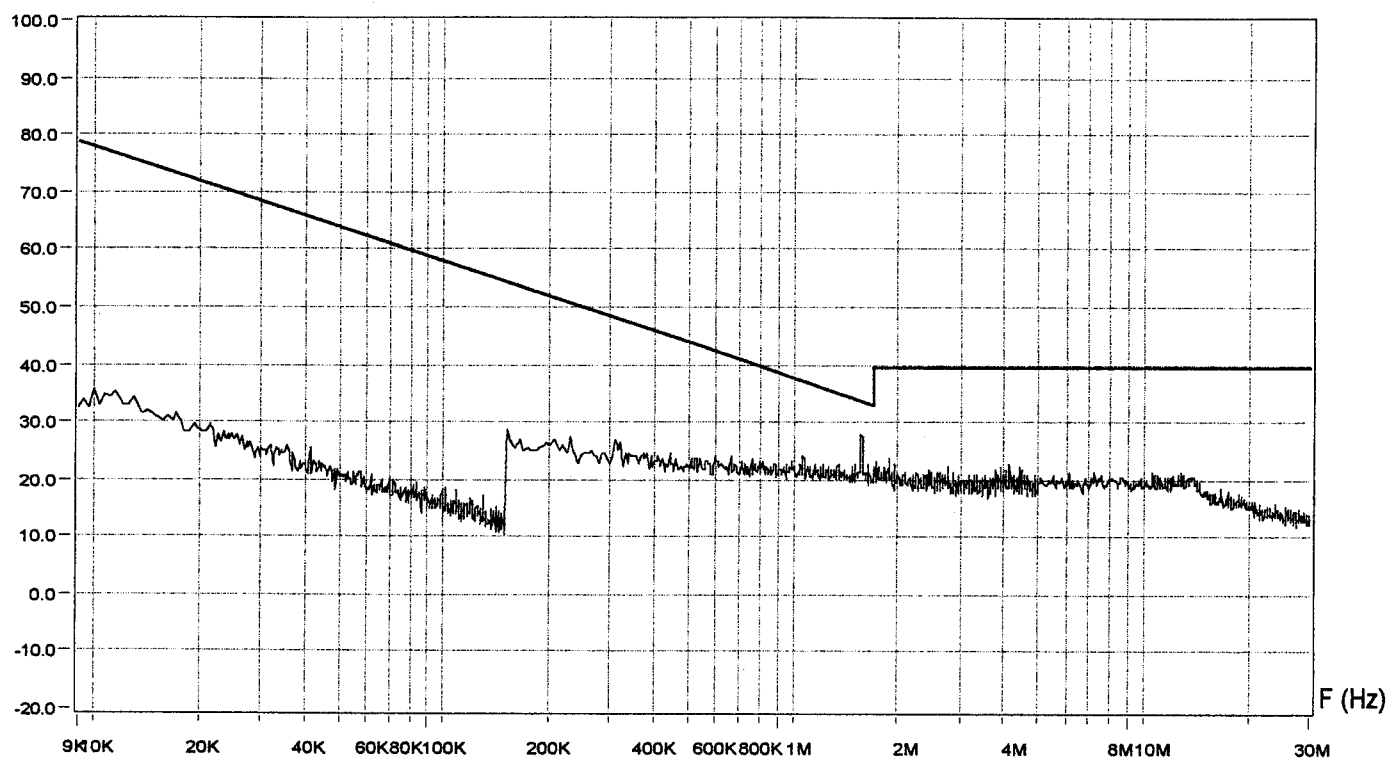


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7.2

Level dBuV/m

FCC Part 15 Sub. C



Zone	9 KHz - 150 KHz	150 KHz - 2 MHz	2 MHz - 5 MHz	5 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz
Resol Bandwidth	200 Hz	10 KHz	10 KHz	10 KHz
Sweep Time	5 s	70 ms	110 ms	930 ms

Operator :

17.05.2000

POM
10.44 h

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 360 deg
Antenna Height : 1 m
Equipment Under Test : Monteur Set Wireless 902 MHz
Set-Up : table top
Operating Conditions : RF ON
Remarks :

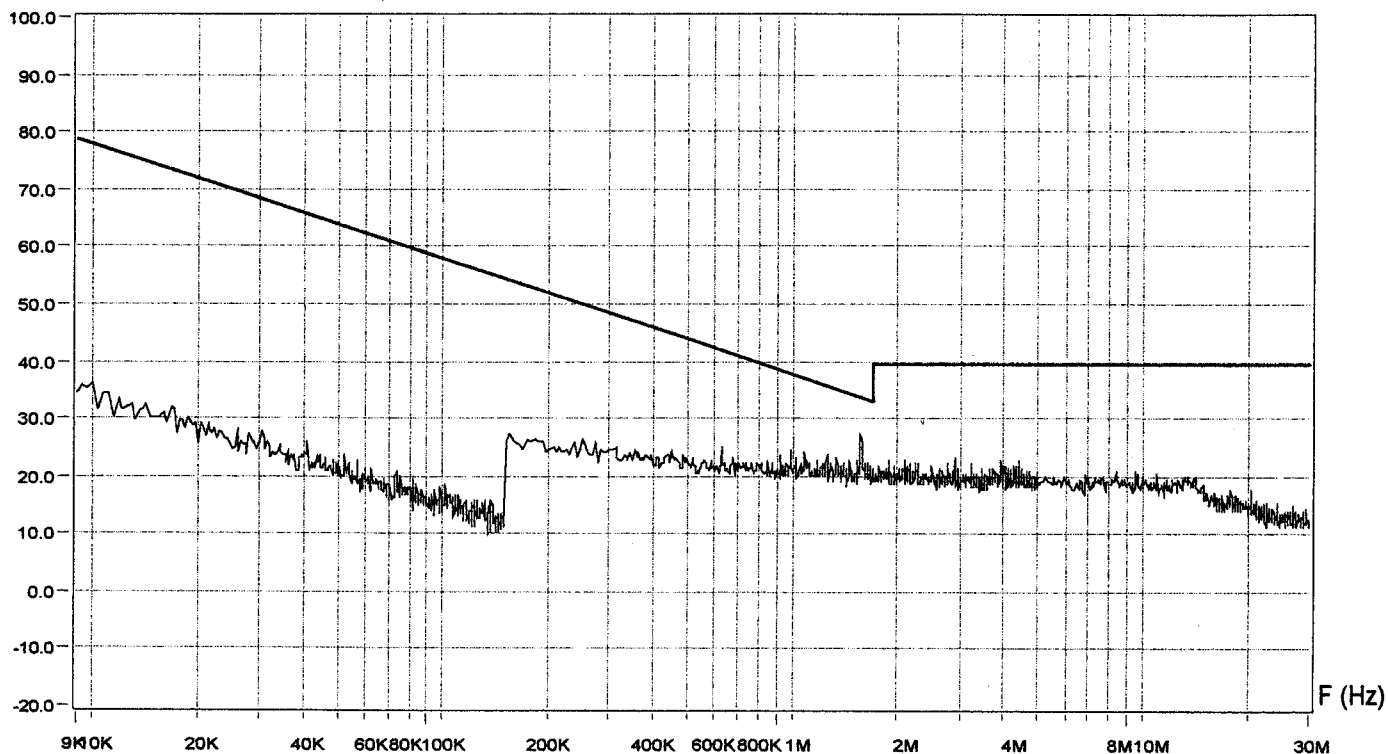


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7.3

Level dBuV/m

FCC Part 15 Sub. C



Zone	9 KHz - 150 KHz	150 KHz - 2 MHz	2 MHz - 5 MHz	5 MHz - 30 MHz
Video Bandwidth	300 Hz	10 KHz	10 KHz	10 KHz
Resol Bandwidth	200 Hz	10 KHz	10 KHz	10 KHz
Sweep Time	5 s	70 ms	110 ms	930 ms

Operator :

Pen

17.05.2000

10.51 h

Measurement Type : Radiated Field



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7.4

Equipment Under Test : Monteur Set - Wireless 902 MHz

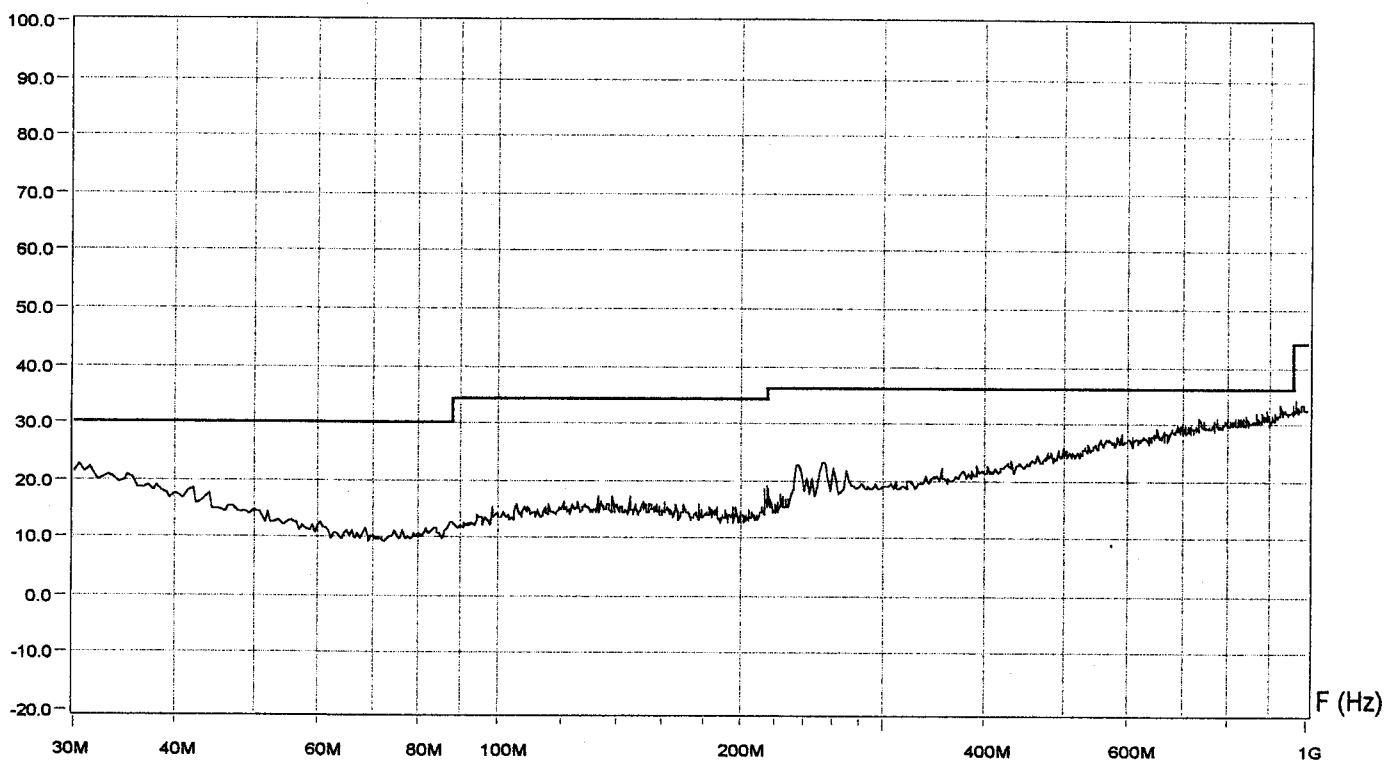
Set-Up : table top

Operating Conditions : RF OFF

Remarks :

Level dB μ V/m

FCC Part 15 Sub. C



Zone	30 MHz - 230 MHz	230 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	120 KHz	120 KHz
Sweep Time	42 ms	161 ms

Operator :

PON

17.05.2000

10.07 h

Measurement Type : Radiated Field



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7.5

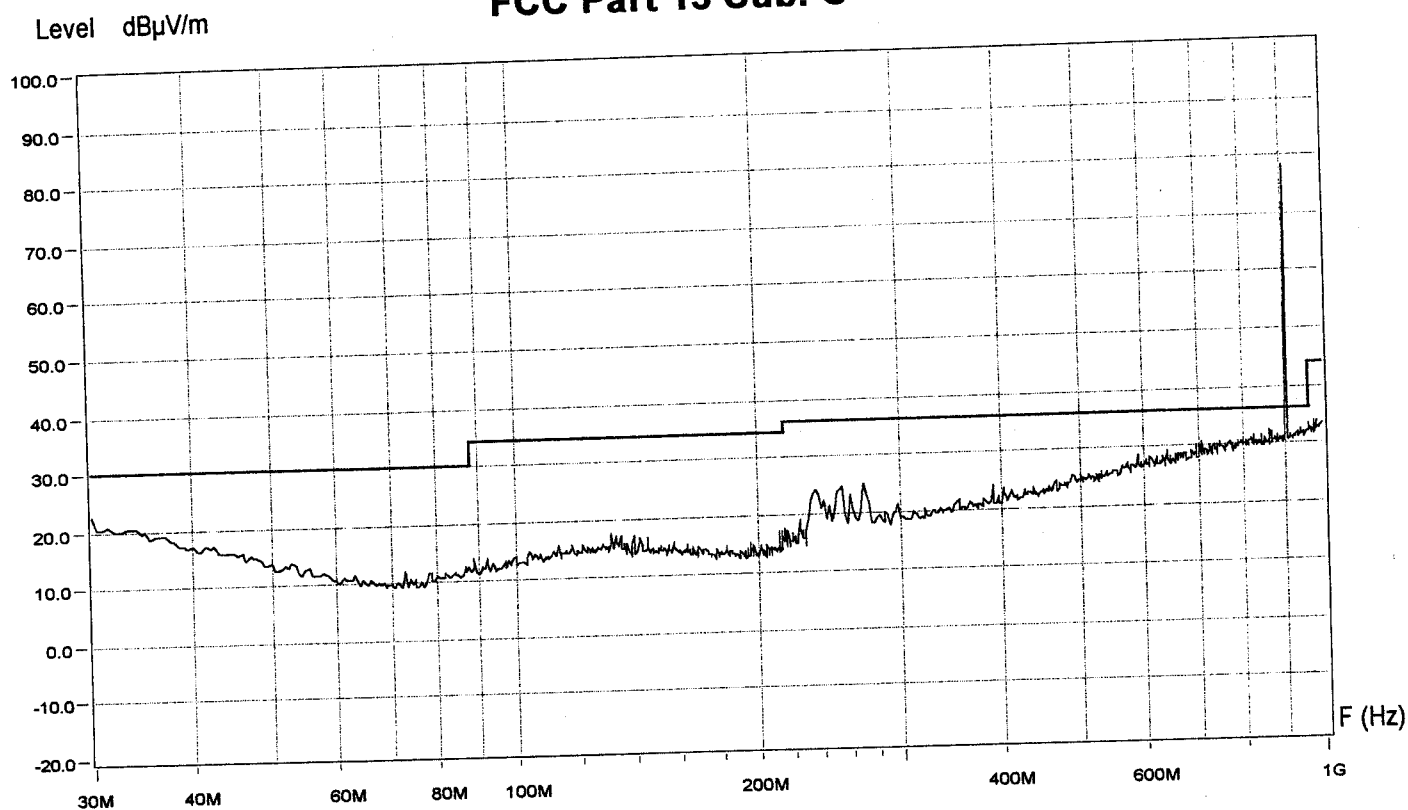
Equipment Under Test : Monteur Set - Wireless 902 MHz

Set-Up : table top

Operating Conditions : RF ON

Remarks :

FCC Part 15 Sub. C



Zone	30 MHz - 230 MHz	230 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	120 KHz	120 KHz
Sweep Time	42 ms	161 ms

Limit chap 15.249 $\Rightarrow$ 84 dB μ V/m at 10 m,
 $\Rightarrow$ 906.7 MHz

Operator :

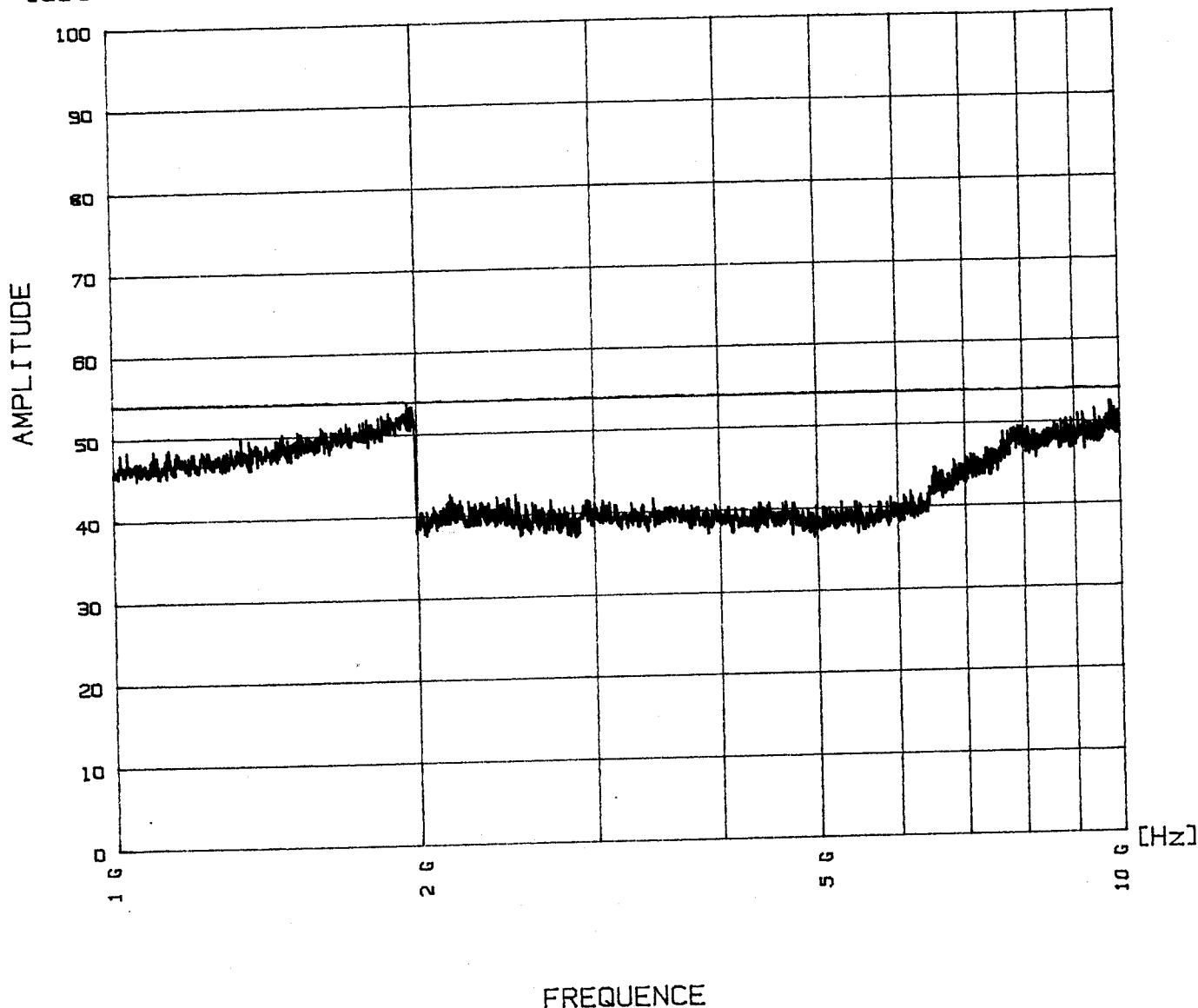
17.05.2000

Pon

10.18 h

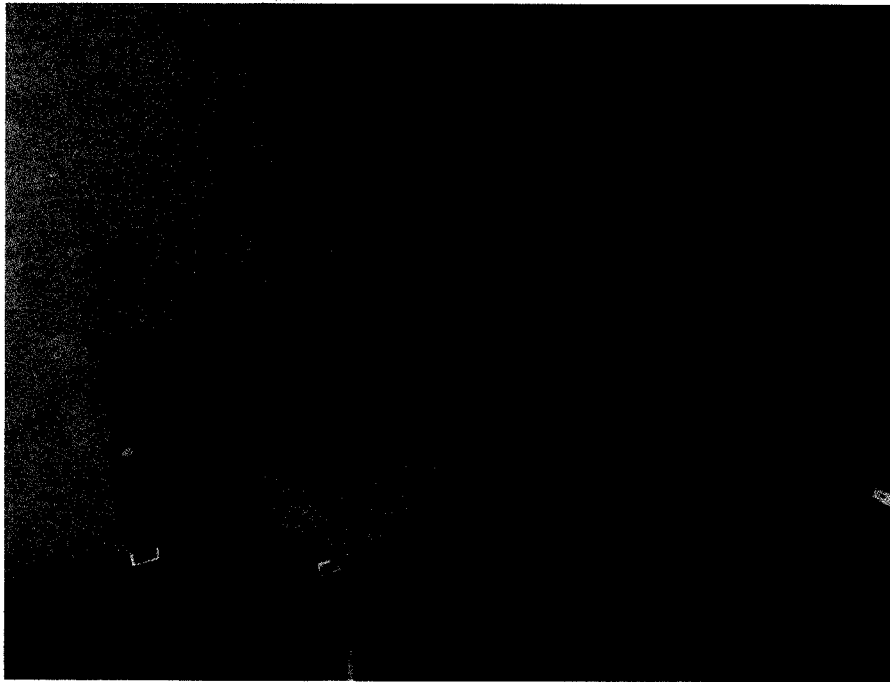
7.6

[dBuV/m] FCC 15 sub C 3m

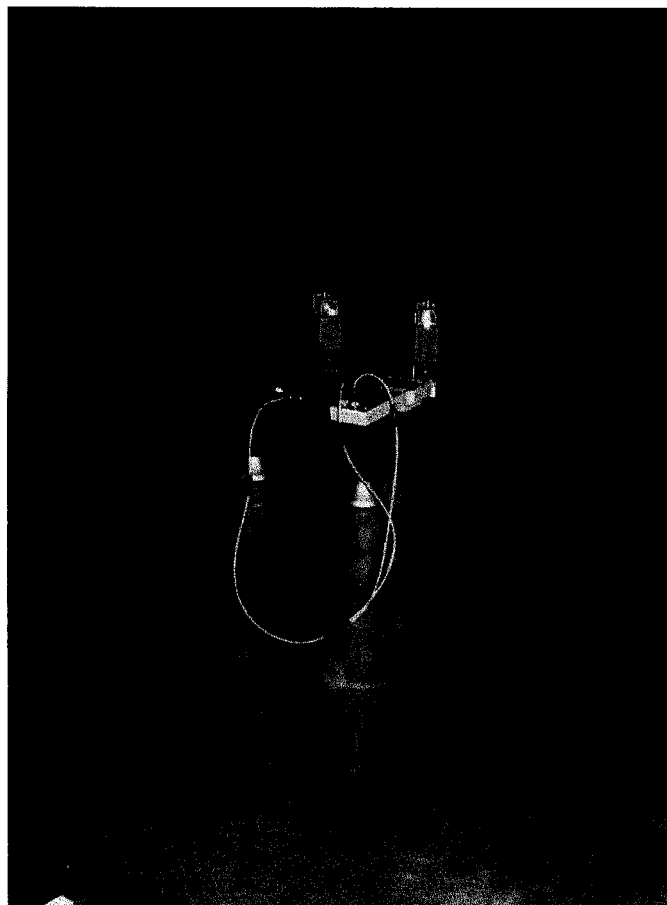


Type of measurement : Pointeur Set Wireless 902 MHz
 Mesure effectuée :
 Equipment under test : radiated field
 Appareil mesuré :
 Set-up :
 Configuration :
 Operating conditions : RF ON / RF OFF
 Fonctionnement :
 Remarks : Hor & Vert
 Remarques :
 } Max hold

Date/Date : 17-5-00
 Time/Heure : 10.11
 Operator/Collaborateur :



conducted emission



radiated emission

RADIO MODEM RFM902-LC

Version 1.41a

Radio Modem RFM 902-LC
INTERFACE & COMMANDS

Copyright August 1997 / Stamptronic S.A.

9.2

MODIFICATION SHEET

FEUILLE DE MODIFICATION

DATE OF UPDATE <i>DATE DE MISE A JOUR</i>	MODIFIED PART <i>(section & page)</i> <i>PARTIE MODIFIEE (chap. et page)</i>	NEW REVISION INDEX <i>NOUVEL INDICE DE REVISION</i>	MODIFICATIONS Type (adding, cancelling) and Description <i>MODIFICATIONS Nature (ajout, modif., suppression) et Description</i>
21/08/97	-	1.0	Création

(I) RFM 902-LC INTRODUCTION :

This document concerning RFM902-LC interface and commands, must be used for a quick and safe evaluation of the RFM902-LC with the EVALUATION KIT .

RFM902-LC evaluation KIT description :

The RFM902-LC evaluation kit is based on 2 RFM 902 MHz modems with FCC part 15 compliant, including :

- Casing , antenna , power supply conversion , RS232 levels conversion , cabling ,...
- Host interface (PC , ...) is a classic SUBD 9 points cable .

RFM902-LC evaluation kit uses RFM902-LC OEM radio modem, a module designed to be integrated in portable system such as : Bar-code reader , hand held terminal, printers , etc.

EVALUATION KIT DESIGN :

TTL / RS232 converter and power supply conversion are located on a first PCB with a Molex connector. The TTL OEM radio module is plugged between both PCBs (connector to connector) using a flat cable.

TTL / RS232 converter and power supply conversion are linked on the first PCB with a Molex connector .

Power supply is provided through a small jack connector. Power supply is delivered in a 6 to 15 volts range (standard power supply block). The consumption is 100 mA for the complete modem .

EVALUATION SOFTWARE :

The main software proposed for an evaluation is Window terminal.

CR,(LF), communication parameters , function buttons , etc ... are managed by window terminal. Stamptronic RFM902-LC.TRM file provides functions buttons ready to be used with RFM902-LC modem.

9.4

RFM902-LC OEM module performances :

Frequency	: 902 MHz band (FCC part 15)
NBR. of channels	: 10 channels (~ 400 Khz spacing)
Channel select.	: HAYES commands on the serial link
Serial data rate	: 1200 to 38600 bds(true transparent)
Modul./Demodul.	: FSK (Frequency Shift Keying)
Power supply	: 4,75 volts up to 5,25 volts
RF Consumption	: < 45 mA reception, < 60 mA emission
Stdby mode	: Yes (200 microAmps)
Sensitivity	: -95 Dbm on 50 Ohms antenna
RSSI trigger	: YES , threshold at -90 dbm
Power radiated	: +3 dbm during emission
Error data rate	: Below 10 ⁻⁴ for -90 dbm
Saturation	: Two RFM902 can be at 10 cm together
Temperature	: 0°C up to 50 °C

II) RFM902-LC radio module connection :

MOLEX 52271-1190(reference nbr) is the 11 points connector welded on the PCB :

- | | | |
|-----|----------|--|
| 1. | VCC | (4,75 v à 5,25 v) |
| 2. | GND | (electrical ground) |
| 3. | SP1 | or SCK I2C bus when SP5 = 0 |
| 4. | SP2 | or SDA I2C bus when SP5 = 0 |
| 5. | SP3 | or RSSI trigger copy when SP5 = 0 |
| 6. | TX | (data to be transmitted from the host) |
| 7. | RX | (data to be received by the host) |
| 8. | SP4 | (N.C) LED status is copied when SP5 = 0 |
| 9. | SP5 | |
| 10. | STDBY | (to VCC=STDBY; module is running when 0 volts is applied) |
| 11. | GND MECA | (Mechanical ground) |

SP1 TO SP4 :

RFM902-LC module is fully programmable with HAYES commands (following) . .

SP5 defines how SP1 to SP4 can operate .

SP5 = 0 ; SP1 and SP2 are I2C bus for an external Eeprom .

This memory is not necessary to run the radio module ; in that case the module is initiated with default parameters .Eeprom is necessary to save automatically the PCB parameters ...

SP3 is the RSSI copy (signal , noise) , SP4 is the synchro detection from LC (led copy) .

SP5 = 1 ; .SP1 à SP4 are dedicated to the radio channel hardware detection .

Channels 0 up to 9 can be selected , any other combination provides a 0 channel selection .

Channel selection can be achieved by HAYES commands as well.

WARNING : SP1 - SP5 are not connected , they must be pulled up to VCC .
If channel selection number is > to channel 9, providing a 0 channel selection

How to define Software or Hardware Channel selection ? :

The last order (last change) is most important. A software order overwrites the hardware selection , the opposite case is also available .

RFM902-LC Mechanical overview :

Size : 50 x 50 x 7 mm³
Cover : CUZN with SNPB surface process
Connector : Molex 52271-1190
Antenna : MMS coaxial connector
LED : Display emission and reception status

(III) RFM902-LC functional aspects :

RESET phase :

With each power on, the RFM902-LC RESET with the ROM parameters , that is to say :

- Radio channel = 0,
- Serial link is : 9600 baud , 8 bits , 1 stop bit , no parity ,
- Transparent mode, module ready to receive ...

After power on all the parameters can be changed with HAYES command

Eeprom version : some spares I/O on the Molex RFM902-LC module can be used to connect an Eeprom . When power is on, in case the board starts detection, the Eeprom works with given pre-set parameters. Each change concerning functional parameters is automatically stored in the Eeprom .

WARNING !!! : RESET time is about 0.5 sec ...

AT PROTOCOL :

AT protocol enables not only a direct access to a specific programming mode, but also gives the possibility to change functional parameters through the serial link :

- When the user works in AT command mode (' + + +'), the following orders always start with ASCII 'AT' characters for "ATTENTION".
- Further characters (after AT characters) stand for the order itself.
- AT commands always end up with <CR> * (except ' + + +' to enter in AT mode).

This matrix describes AT commands and how to enter and leave the mode :

9.6

TO enter in AT mode	Function
+++	Start AT command mode (return 0 after 200 ms)
AT header (+ Code + <CR>)	Function
AT	Before each order (head of each message)
ORDER ITSELF (After AT characters)	Function
PO (**)	Get in low power mode
P1 (**)	Leave low power mode
ORDER ITSELF (After AT characters)	Function
O	Leave AT command mode ; enter Transparent mode
Sn?	Display Register S, number n content.
Sn = m	Affect m value to register S, number n.
/S	Display configuration summary.
/V	Display Software Version.

(*) <CR> = Carriage Return

(**) STBY mode :

Two way to manage the STDBY mode :

Software controlled : ATP0 or ATP1

Hardware controlled : STDBY activated through a specific pin located on the Molex connector.
(Strapped on the evaluation kit, not available) .

Internal pull up references the STDBY pin to the VCC level when not connected (STBY level)
A GND level (effective on the evaluation kit) is the normal mode (emit & transmit) .

A 5 ms time is necessary to wake up the module and a 15 ms time to be ready to receive or transmit .

NOTA 1 : After a AT command (ended by <CR>), Serial link return an error code,
OK (0 character) or ERROR (value <> 0) .

NOTA 2 : "+++ " return 0 value .

ABOUT TRANSPARENT MODE :

Transparent mode emulate a wired serial link in RS232 (HALF-DUPLEX) .

All characters transmitted by the transmission PC on the RS232 TX line through the radio module, are received by the other radio modules configured on the same channel; the received characters are sent on the RS232 / RX line to the reception PC .

Flow control, framing , errors correction , etc. ... must be controlled by the application

WARNING 1 :

It is not possible to change functional parameters in transparent mode . In case you want to modify functional parameters, it is necessary to switch the application into the AT command mode and then proceed relevant orders. When changes are done, return to Transparent Mode (" ATO ") .

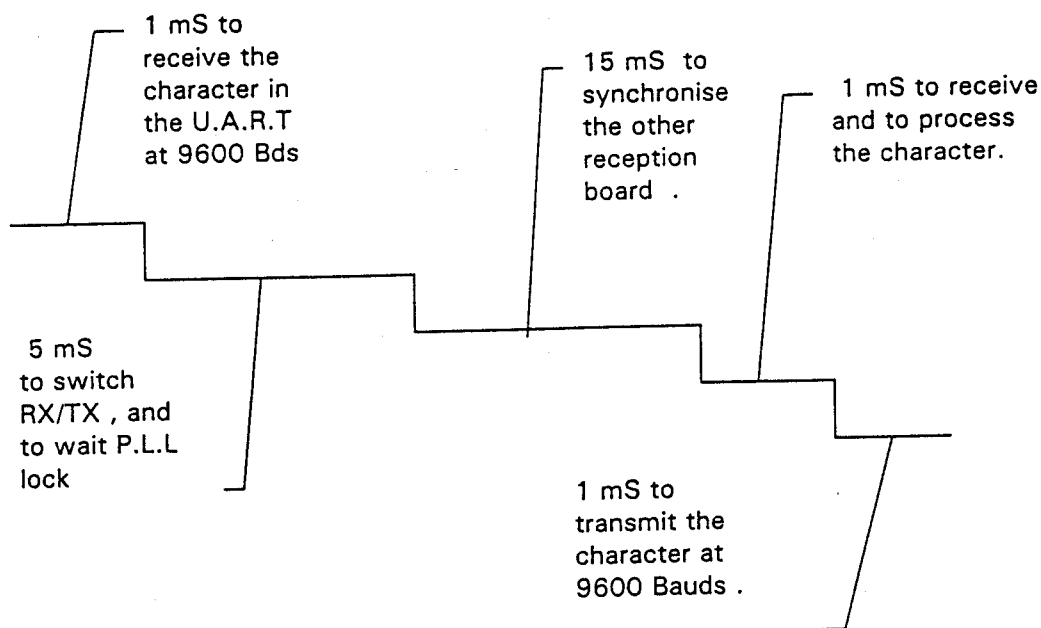
WARNING 2 :

Radio header used on the carrier to synchronise emitter and receiver added to processing time, introduce a time delay between emission and reception.

The delay is about 20 ms at 9600 Baud, the next characters follow at the nominal data rate. The last character of the frame is received by the reception PC from the reception module 20 ms

after being transmitted by the transmission PC to the transmission module. Above value can be modified by HAYES commands ... with the necessary cautions !!!!

TIME BETWEEN A FIRST CHARACTER EMITTED AND RECEIVED :



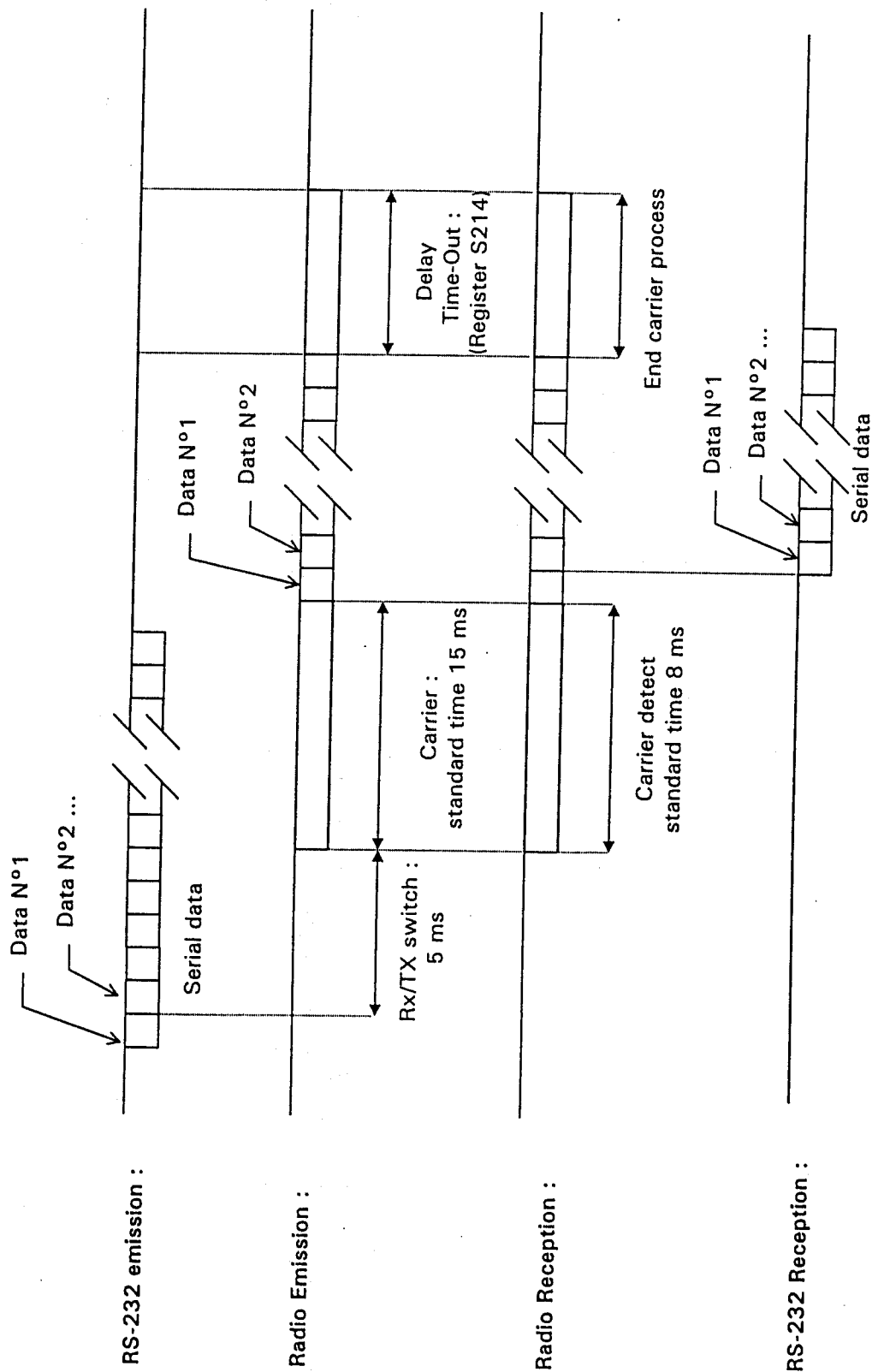
Measured in our laboratory : The standard delay time does not exceed 20 ms

PRIORITY TO EMISSION :

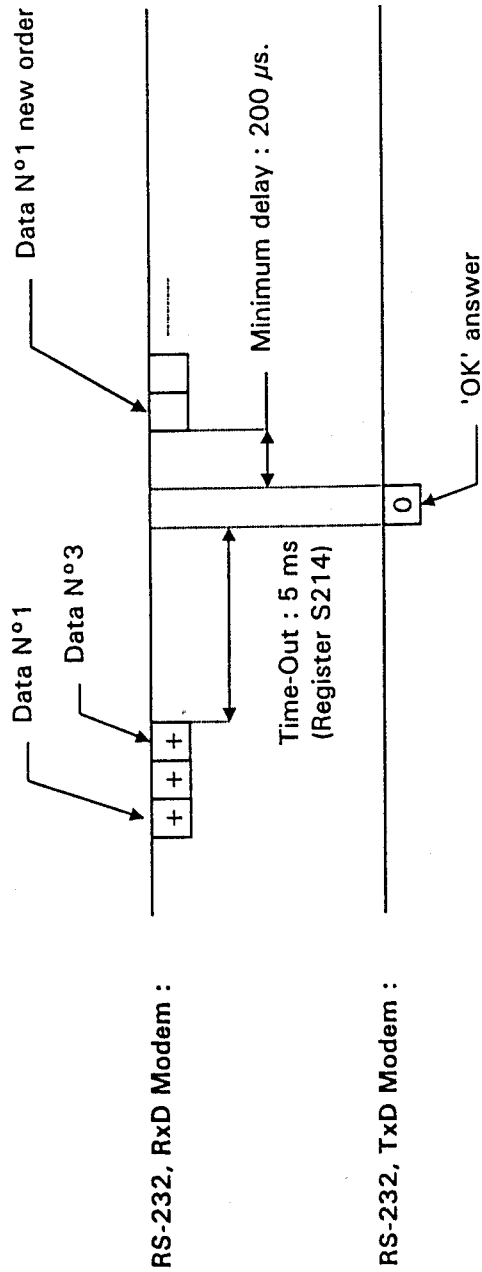
RFM902-LC gives the priority to transmit characters.
After a reception, Host transmitted characters have a priority status.

NOTA : This feature enables channel change, even when a carrier is detected.

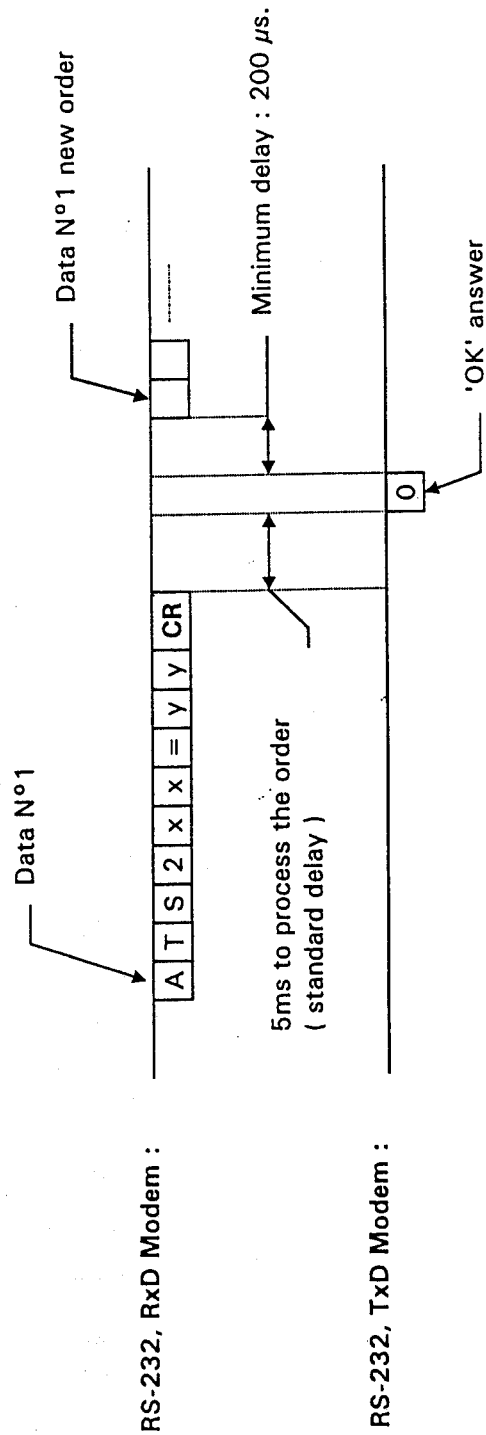
Tx / Rx timing :



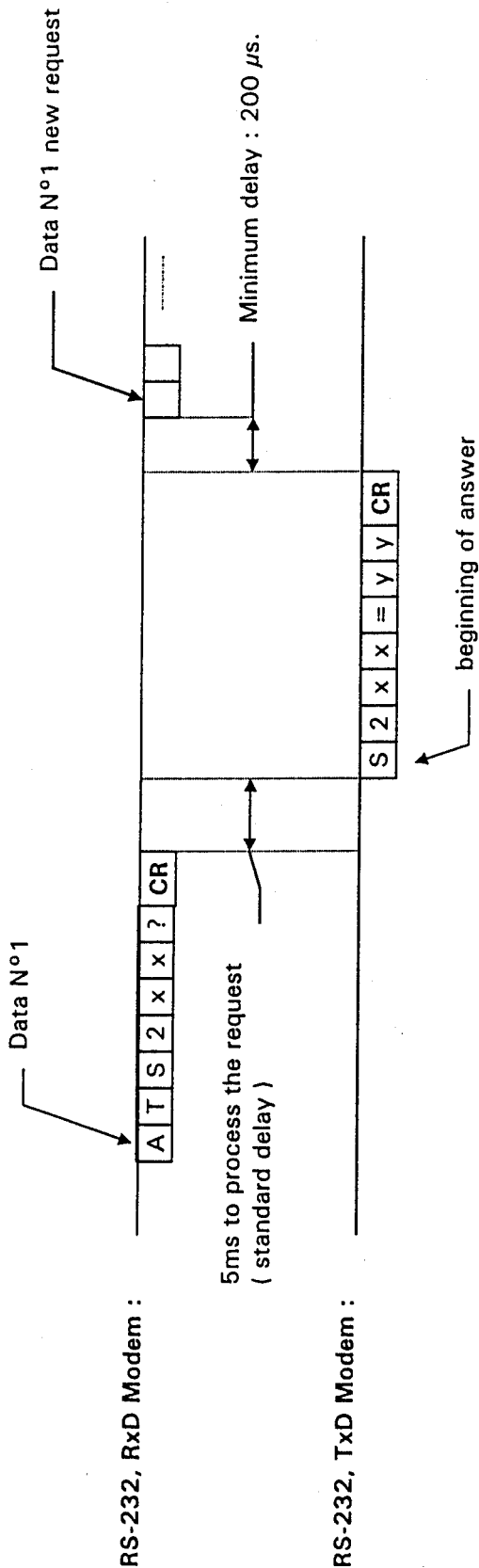
2) Enter in Hayes mode (timing) :



3) Any order in Hayes mode (timing) :



4) To read any register in Hayes mode (timing)



(IV) RFM902-LC AT COMMANDS :

GENERAL MESSAGES STRUCTURE :

A	T	Order	(parameters)	...	<CR>
---	---	-------	---------------	-----	------

EXCEPTION: " + + + " to enter in AT command mode not followed by <CR> .

S register	Contents	INFORMATION
S200 (*)	Radio channel number	Channel value = 0 to 9 (10 channels) RESET prom value = 0
S210 (*)	Data rate on the RS232 serial link	Speed value = 1 to 6 '1' : 1200 Baud '2' : 2400 Baud '3' : 4800 Baud '4' : 9600 Baud '5' : 19200 Bauds. '6' : 38400 Bauds. N.B. : For speed value 5 and 6 , do not use more than 40 bytes / frame because radio speed is 12 kbit/S and radio modem buffer is only 40 bytes . RESET prom value = 4
S211(*)	Number of bits on the RS232 link	Number of bits on the serial link '7' : 7 data bits . '8' : 8 data bits RESET prom value = 8
S212(*)	Parity on the RS232 serial link	Parity value : 1 to 3 '1' : No parity . '2' : ODD parity. '3' : EVEN parity. RESET prom value = 1
S213(*)	Number of stop bit on the RS232 serial link .	Number of stop bits '1' : 1 stop bit '2' : 2 stop bits RESET prom value = 1
S214(*)	Time-out in milliseconds between two characters on the RS232 serial link	Value = time-out in milliseconds. between 1 and 255 milliseconds. RESET prom value = 5 ms.

S20A	Carrier time synchronisation (emission)	Between 1 ms and 255 ms RESET prom value = 15 ms D' ont go below 10 ms ...
S20B	Confirmation time of the synchro carrier (reception)	Between 1 ms and 255 ms RESET prom value = 8 ms Don't go below 5 ms ...

WARNING : S20A and S02B must be changed together ...

S216 (*)	Status format during a channel scanning (Scanning = status of the radio activity as noise or data, in the selected channel) .	Status can be delivered as a binary value or ASCII characters . '0' : Binary value is returned (Reset value) '1' : ASCII character is returned
S23x	Scanning for selected channel N°x	Scanning for the channel N°x (0 to 9) during a selected time which is a multiple of 10 ms . Return value is the % of busy time during the scanning time . <u>Example :</u> ATS235=20<CR>, means a scanning on channel 5 during 20x10 = 200 ms, return value could be : "=100 " if busy time is 200 ms , (means 100%) "= 50 " if busy time is 100 ms , (means 50%)
S240	Scanning all channels	Scanning all channels from 0 to 9;each scanning time / channel is 10 ms. ASCII return value will be that kind of frame : "100;020;000;005;000;000;000;000;010" The value between each ";" is the value affected to channel 0 (first value) up to channel 9 (last value in the frame) . Binary mode will return "=xdy0d00x00" where each value is 0 or 1 from channel 0 to 9 .
S241	Permanent scanning for all the channels	Idem order S240 but scanning starts-up immediately after each result sent to the host. Scanning stops right after the first new character on the serial line .

(*) : Those commands are effective after 10 ms ;
OK return character (value = 0) confirms that the command is accepted ;
A new order can be send immediately after the OK status received (value 0)

WARNING :

when one or more parameters are changed on the serial line communication , each order is send via the existing format .Then the new format is valid so the application must change the same parameter to communicate with the new format

(V) RFM902- LC SPECIFIC TEST ORDER :

Specific order can be used to test the RFM902-LC module

ATT0 : Pure carrier is emitted on the channel

ATT1 : The carrier is modulated at F0 (9600 Hz) on the channel

ATT2 : The carrier is modulated at F1(15000 Hz) on the channel

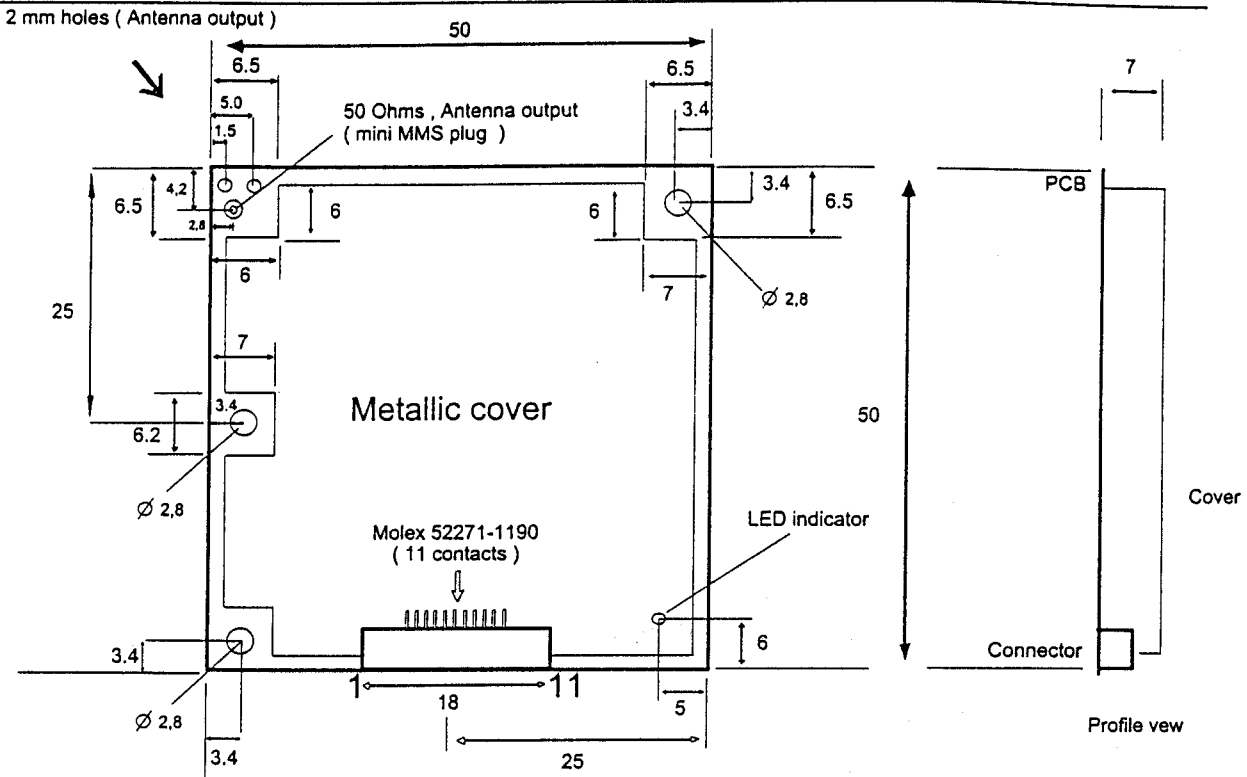
ATT3 : The carrier is modulated at F0 and F1 alternatively

NOTE : all those commands must be followed by <CR> .

TO STOP the test :

Any character sent to the module can stop the test

9.14



Size overall : L 50 x l 50 x H 7 mm

RFM900LC	1.0	
JANUARY 1997		
Physical drawing		

RFM900LC V1-5

Version:1.5
04/11/99
RFM90015.xls

9.15

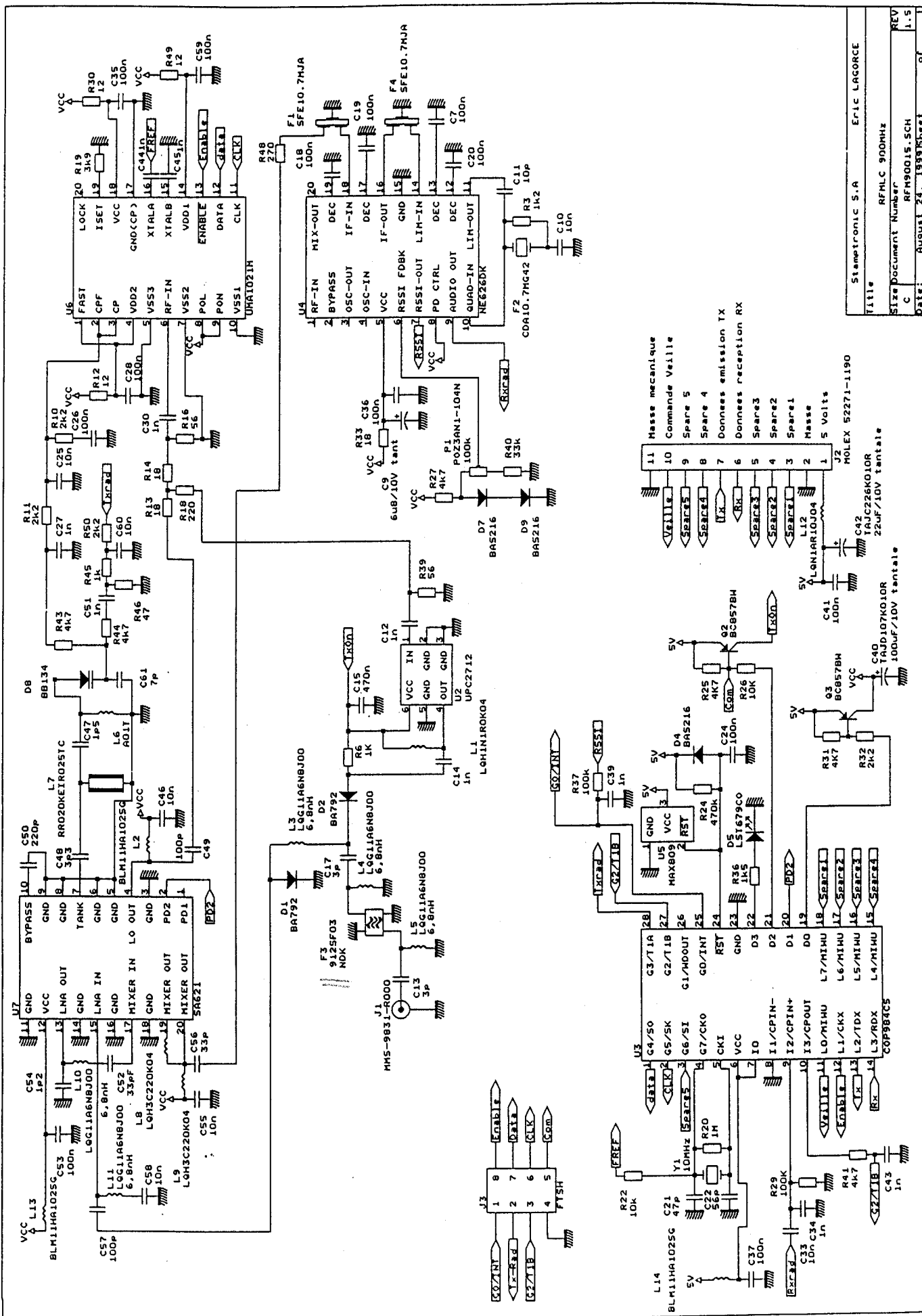
item	Qté	référence	Désignation	REMARQUES	Fabricant	
1	1	C40	100uF/10V tantale TAJD107K010R		AVX	A fournir
2	1	C42 (Non montée)	22uF/10V tantale TAJC226K010R		AVX	A fournir
3	1	C9	6,8uF/10V tantale B TAJB685K010R		AVX	A fournir
4	12	C7,C18,C19,C20,C26,C28, C35,C36,C37, C41,C53,C59	100nF/50V 0603 GRM39X7R104K16		Murata	A fournir
4a	1	C24	100nF/50V 0603 GRM39X7R104K16	Sur RFMLC/S		
5	8	C10,C15,C25,C33,C46,C55,C58, C60	10nF/50V 0603 GRM39X7R103K50		Murata	A fournir
6	10	C12,C14,C27,C30,C34,C39,C43, C44,C45,C51	1nF/50V 0603 GRM39X7R102K50		Murata	A fournir
7	1	C50	220pF/50V 0603 GRM39COG221J50		Murata	A fournir
8	2	C49,C57	100pF/50V 0603 GRM39COG101J50		Murata	A fournir
9	2	C56,C21	47pF/50V 0603 GRM39COG470J50		Murata	A fournir
10	1	C52	33pF/50V 0603 GRM39COG330J50		Murata	A fournir
11	1	C22	56pF/50V 0603 GRM39COG560J50		Murata	A fournir
13	1	C11	10pF/50V 0603 GRM39COG100C50		Murata	A fournir
15	2	C13,C17	3pF/50V 0603 GRM39COG30C50		Murata	A fournir
15a	1	C48	6 pF/50V 0603 GRM39COG6R0C50		Murata	A fournir
16	1	C54	1,2pF/50V 0603 GRM39COG1R2C50		Murata	A fournir
16a	1	C47	3 pF/50V 0603 GRM39COG3R0C50		Murata	A fournir
16b	1	C61	BB134 (SOD110)		Murata	Stampronic
17	2	F1,F4	SFE10.7MJA	F1,F4 montés couchés côté U4, inscriptions côté U3	Murata	Stampronic
18	1	F2	CDA10.7MG42		Murata	Stampronic
19	1	F3	912SF05 912,12MHz		NDK	Stampronic
20	1	J1	MMS-9831-R000	Sur RFMLC/N	3M	Stampronic
21	1	J2	MOLEX		52271-1190	Stampronic
22	1	L6	A01T		Coilcraft	Stampronic
23	5	L3,L11,L4,L5,L10	6,8 nH LQG11A6N8J00		Murata	Stampronic
24	1	L2	27 nH LQG11A27NJ00		Murata	Stampronic
26	1	L7	DRR020KE1R025TC		Murata	Stampronic
27	2	L8,L9	LQH3C220K04		Murata	Stampronic
28	1	L1	LQH1N1R0K04		Murata	Stampronic
28a	1	L12	LQN1A1R10K04		Murata	Stampronic
29	1	P1	100 kOhm RVG3S08-104VMTL		Murata	A fournir
30	1	R3	1,2 kOhm 0603			A fournir
31	2	R6,R45	1 kOhm 5% 0603			A fournir
32	2	R22,R26	10 kOhm 5% 0603			A fournir

9.16

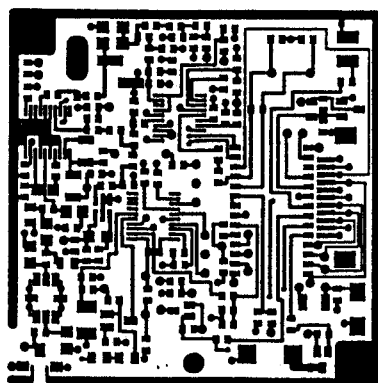
33	4	R12,R30,R47,R49	12 Ohm 5% 0603			A fournir
34	4	R13,R14,R33,R35	18 Ohm 5% 0603			A fournir
35	2	R16,R39	56 Ohm 5% 0603			A fournir
36	1	R18	180 Ohm 5% 0603			A fournir
37	1	R50	5,6k kOhm 5% 0603			A fournir
37a	1	R19	3,9 kOhm 5% 0603			A fournir
38	1	R20	1 MOhm 5% 0603			A fournir
39	1	R24	470 kOhm 5% 0603	Sur RFMLC/S		A fournir
40	6	R25,R27,R31,R41,R43,R44	4,7 kOhm 5% 0603			A fournir
41	2	R29,R37	100 kOhm 5% 0603			A fournir
42	1	R36	1,5 kOhm 5% 0603			A fournir
44	3	R10,R11,R32	2,2 kOhm 5% 0603			A fournir
45	1	R48	270 Ohm 5% 0603			A fournir
45a	1	R46	47 Ohm 5% 0603			A fournir
45b	1	R40	33 kOhm 5% 0603			A fournir
47	2	D1,D2	BA792 (SOD110)		Philips	Stampronic
48	2	D7,D9	BAS216 (SOD110)		Philips	A fournir
48a	1	D4	BAS216 (SOD110)	Sur RFMLC/S	Philips	A fournir
49	1	D5	LST679CO	Sur RFMLC/N et RFMLC/R	Siemens	Stampronic
50	1	D8	6 pF/50V 0805 GRM40COG60D50		Philips	A fournir
51	2	Q2,Q3	BC857BW SOT323		Philips	A fournir
52	1	U2	UPC2712T-E3		NEC	Stampronic
53	1	U3	COP984CS-CBU/WM SO28		NS	Stampronic
54	1	U4	NE626DK SSOP20		Philips	Stampronic
55	1	U5	MAX809MEUR	Sur RFMLC/N et RFMLC/R	Maxim	Stampronic
56	1	U6	UMA1021M		Philips	Stampronic
57	1	U7	SA621DK		Philips	Stampronic
58	1	Y1	AT51 10MHz LN-G102-494J		NDK	Stampronic
60	1	Capot				A fournir
61	1	Assemblage				A fournir
62	1	Ci1	CI 0,8 4 couches, 50x50 V1.2			A fournir
63	1	Etiquette	FG99SSNNNNN	Sur RFMLC/N		A fournir
64	1	Etiquette	EG99SSNNNNN	Sur RFMLC/S		A fournir
65	1	Etiquette	XA99SSXXXXX	Sur RFMLC/R		A fournir

9.17

Item	Modifications	nouvelle valeur		ancienne valeur	Date	Version
15	C13	3pF	au lieu de	3,3pF	21/10/98	1.3a
15	C17	3pF	au lieu de	3,3pF	21/10/98	1.3a
24	L2	27nH LQG11A27NJ00	au lieu de	R42 24 Ohm	21/10/98	1.3a
45a	R46	47	au lieu de	39	21/10/98	1.3a
9	C21	47pF	au lieu de	22pF	17/11/98	1.3b
11	C22	56pF	au lieu de	22pF	17/11/98	1.3b
29	P1	100 kOhm RVG3S03104VMTP	au lieu de	100 kOhm POZ3AN1- 104N	17/11/98	1.3b
58	Y1	AT51 10MHz LN-G102-494J	au lieu de	AT51 10MHz SI 0055-3000-	17/11/98	1.3b
50	D8	7pF	au lieu de	BB134	22/01/99	1.4
16b	C61	BB134	au lieu de	7pF	22/01/99	1.4
52	U2	UPC2712T	au lieu de	UPC2710T	22/01/99	1.4
35	R39	56	au lieu de	10	22/01/99	1.4
37a	R19	3k9	au lieu de	5k6	22/01/99	1.4
44	R10	2k2	au lieu de	4k7	22/01/99	1.4
36	R18	220	au lieu de	560	22/01/99	1.4
15a	C48	3,3pF	au lieu de	3pF	22/01/99	1.4
16a	C47	1,5pF	au lieu de	1,2pF	22/01/99	1.4
15a	C48	6p F	au lieu de	3,3 p F	06/10/99	1,5
16a	C47	3 p F	au lieu de	1,5 p F	06/10/99	1,5
50	D8	6 p F	au lieu de	7 p F	06/10/99	1,5
36	R18	180 Ohm	au lieu de	220 Ohm	06/10/99	1,5
16B	BB134	Stamptronic	au lieu de	A fournir	06/10/99	1,5
50	D8	A fournir	au lieu de	Stamptronic	06/10/99	1,5
55	U5	MAX809MEUR	au lieu de	MAX809LEUR	06/10/99	1,5
55	U5	ajout de la mention sur RFMLC/R			04/11/99	1,5
49	D5	ajout de la mention sur RFMLC/R			04/11/99	1,5
65	étiquette	création de la nouvelle étiquette RFMLC/R XA99SSXXXXX			04/11/99	1,5



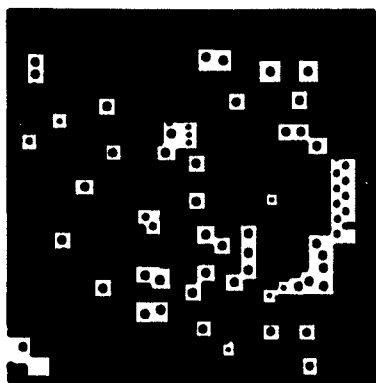
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MIRE

COTE SOUDURE - COUCHE 1
RFM-LC 900MHz V1.2 FG 22/07/98

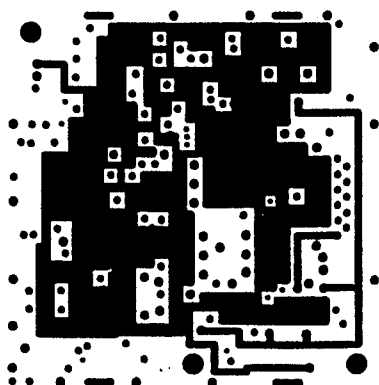
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WIRE

CODE WYSE - COOCH S

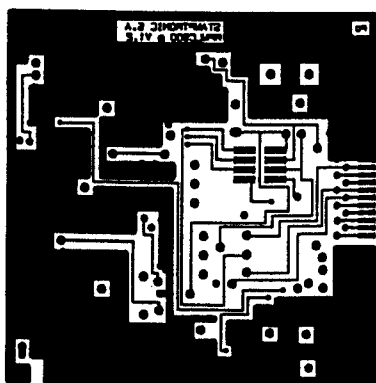
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WIRE

CODE WTM - CODE 3

9.22

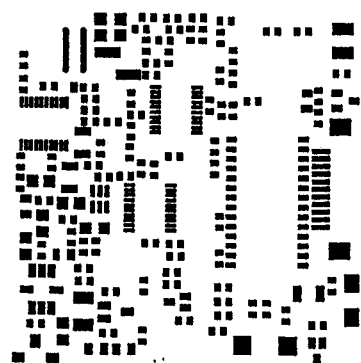


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RFM-LC 800MHZ V1.5 FG 55\07\88

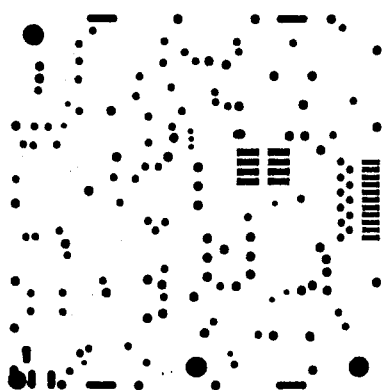
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BRASURE
RFM-LC 900MHz V1.2

FG 22/07/98

9.24

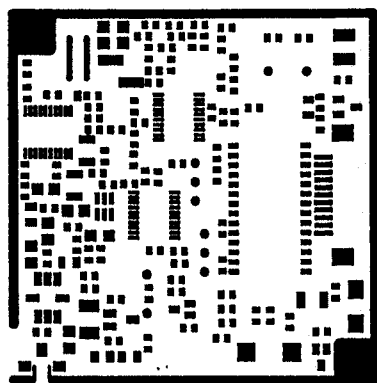


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RFM-LC 800MHZ V1.5 FG 55\02\98

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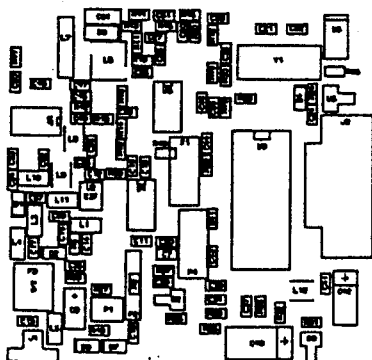


COTE EPARGNE SOUTURE

MIRE

RFM-LC 900MHz V1.2 FG 22/07/98

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MIRE

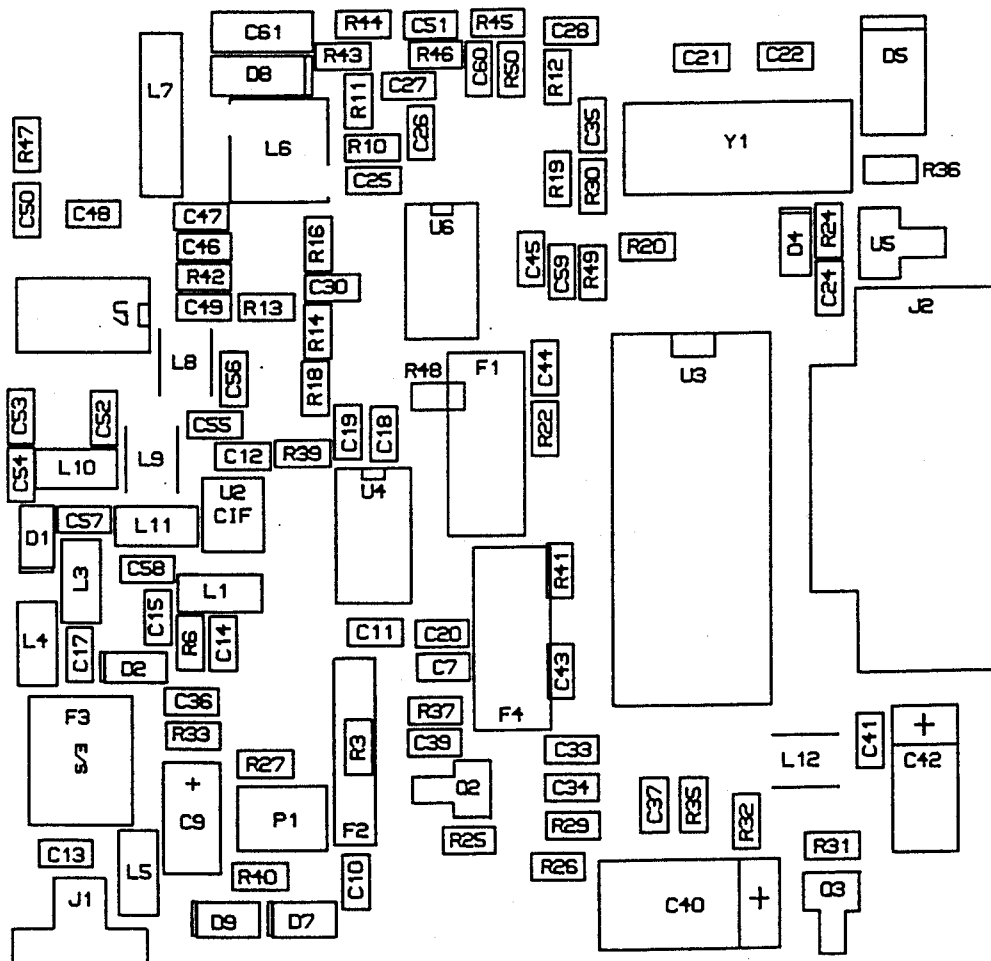
RFM-LC 900MHz V1.2 FG 22/07/98

9.27

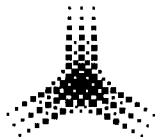


MIRE

9.28



MIRE



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MACHINERY - COMPONENTS - TECHNOLOGY

Test laboratory accredited by the Swiss Federal Office of Metrology
Laboratoire d'essai accrédité par l'Office Fédéral de Métrologie (Suisse)
Durch das Eidgenössische Amt für Messwesen (Schweiz) akkreditiertes Prüflabor

Registration number
Numéro d'accréditation : **STS 024**
Akkreditierungsnummer



Schweizerischer Prüfstellendienst
Service suisse d'essai
Servizio di prova in svizzera
Swiss testing service

Report no:
Rapport no: **A-12'414**
Bericht Nr:

Title: **Complementary information for test report no**
Titre: **12'414**
Titel:

Date of test:
Date de l'essai: **May 17th, 2000**
Prüfdatum:

Customer:
Client: **Wylar AG**
Kunde:

Test place: **montena emc sa**
Lieu de l'essai: **CH-1728 Rossens**
Prüfort:

Test performed by
Essai effectué par :
Prüfer

Manfred PORTMANN

Test report prepared by
Rapport d'essai préparé par :
Berichterstatter

Manfred PORTMANN

Test report controled and approved by
Rapport d'essai contrôlé et approuvé par :
Prüfbescheinigung

Jacques DING

Rossens, June 16, 2000

(Issue Date / Date d'édition / Ausstelldatum)

Main language / Langue principale / Hauptsprache: english / français / Deutsch

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montena emc sa

CH-1728 Rossens - phone ++41 (0)26/411 93 33 - fax ++41(0)26/411 93 30 - <http://www.montena.com>

No. / No. / Nr. : **A-12'414**

Date/Date/Datum : **May 17th, 2000**

Title/Titre/Titel : **Complementary information for test report no
12'414**



montena

Page/Page/Seite 2 / 2

Complementary information regarding chap. 15.249 of CFR 47

The measurement performed show that:

- The general requirements of 15.209 and 15.249 are fulfilled.
- The emission at the bandedge are 50 dB below the level of the fundamental or below the general requirements.

Information:

The RF-transmitter is a 10-channel unit. The first channel is at 906.7 MHz and the last ist at 910.3 MHz. The channel separation is 400 kHz.

APPLICANT/GRANTEE CODE ASSIGNMENT

Date: June 19, 2000
File No: 31010/EQU-CODE

Applicant/Grantee

Wylar AG
Im Holderli
8405 Winterthur
Switzerland

Attention: Heinz E. Hinner

RE: Request for Grantee/Applicant Code

In response to the referenced application, please be advised that assignment of the code listed below is **NOT** an authorization to market equipment in the United States. Marketing of equipment requiring a Grant of Equipment Authorization (FCC Form 731A) to be issued by the Commission, prior to the issuance of the prerequisite grant, is prohibited by Section 2.803 of the Rules. Violation of Section 2.803 may subject the violator to the fines and penalties specified in Sections 501 and 502 of the Communications Act of 1934, as amended.

We have entered your company name and address into our records based on the information provided in the request. If this is **NOT** your legal company name, or if there is any other discrepancy, please advise us **IMMEDIATELY**. Changes in name/address of grantee must be reported to: **FEDERAL COMMUNICATIONS COMMISSION, EQUIPMENT AUTHORIZATION BRANCH, 7435 OAKLAND MILLS ROAD, COLUMBIA, MD 21046.**

The code listed below is assigned **PERMANENTLY** to, and is valid **ONLY** for, the party listed above. The same applicant/grantee code shall be used for all equipment authorization applications. Reference Section 2.926(c)(1).

CODE

APPLICANT/GRANTEE

O3T

Name and address as listed above

PLEASE NOTE: The numeral **ONE** and the digit **ZERO** are not assigned as characters in applicant/grantee codes.

This Notice should be retained in the applicant/grantee's files as a permanent record of the assignment of an applicant/grantee code.

Inquiries may be directed to Marianne T. Bosley, Legal Instruments Examiner.

26 JUNI 2000

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