

Prima Ricerca & SviluppoSrl soggetta a direzione e coordinamento da parte della Giovanni Maspero & C. S.p.A. – C.I. 02634780130
Sede legale : 22100 Tavernola (CO) Via Conciliazione, 1 Cod. FISC. e N. R.I. CO 02635860139
Sede operativa : Laboratori Via Campagna, 92 22020 Faloppio fraz. Gaggino (CO) Tel. +39 03135000.11 Fax +39 031991309

EQUIPMENT UNDER TEST :
APPARECCHIO IN PROVA :

TRANSMITTER mod. TF1

REFERENCE STANDARDS :
NORME DI RIFERIMENTO :

FCC 47CFR Part 15

CUSTOMER:

RICHIEDENTE:

- **Dept. / Firm :** *MARCO S.p.A.*
Ente / Società:
- **Mr.:** *Dr. MATTEO CIAVARELLA*
Sig.:
- **Address:** *VIA MAMELI, 28 – 25014 CASTENEDOLO (BS) - ITALY*
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Telefono : *Fax :* *e-mail*

Site of test execution: Via Campagna, 92 - 22020 Gaggino Faloppio (CO)
Località esecuzione prove:

Date of test samples receipt: 14/10/03
Data ricevimento campioni:

Date of start test: 14/10/03
Data inizio prove:

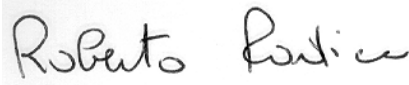
Date of end test: 11/05/04
Data fine prove:

Witness to the test:
Presenti alle prove:

Signature of the engineers:
Firma esecutore prove:

Signature of the Laboratory Director:
Firma Direttore Laboratori:

Nobody / Nessuno
.....


R. Radice
.....


R. Furfari
.....

The test results recorded in this Test Report are exclusively referred to the tested samples.

I risultati del presente rapporto di prova si riferiscono esclusivamente al campione sottoposto a prova.

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1. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

1.1 Identification

Brand name:	MARCO S.p.A.
Customer:	SIRENA S.p.A.
Equipment :	TRANSMITTER
Model name or No. :	TF1
Serial number :	Not present
FCC ID :	R8M-TF1
Country of manufacturer:	ITALY

1.2 Technical data

FCC class:	Intentional Radiators
Supply voltage:	Internal Alkaline Battery 9V
Input Power / Current :	3mA
Typical usage :	Remote control of swivel light beam
Transmitter Operation	Conform with section 15.231 (a)(1) Transmitter cease transmission immediately after being released.
EUT single or system:	Single
EUT dimensions :	14,7 x 4,8 x 4,3 cm.

1.3 Transmitter technical data

TRANSMITTER

- Working Frequency : 433,92 MHz
- Frequency Range of Operation : 433,05 ÷ 434,79 MHz
- Antenna type : integral
- Modulation : ASK

1.4 Modifications incorporated in E.U.T.

The following items are the modifications introduced in the equipment under test :

- Modified value of these component:

R3= 33k Ω

R4= 66k Ω

R10= 33k Ω

C4= 3,9pF

C2= 0,5pF

1.5 Ports identification

This section contains descriptions of all signal ports and AC/DC power input/output ports, the length and the type of the cable provided by manufacturer needed for the tests.

Moreover it is specified if the ports are ever or optionally connected.

Port		Description	Connection
1	Enclosure	Plastic surface	By 4 screws
2	AC power input/output ports	Line not present	*****
3	DC power input/output ports	Internal alkaline battery 9V	Battery support
4	Signals ports	Line not present	*****
<i>Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.</i>			

1.6 Auxiliary equipment

No auxiliary equipment

2. TEST CONDITIONS

2.1 Operating test modes and test conditions

The equipment has been tested according to the operative conditions described in the user/installation manual provided by the manufacturer and by following reference standards :

Reference Standard:

- FCC Part 15, Subpart C, Section 15.231

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item “Operating condition of the equipment under test” of all technical sheets of the tests (see Section 4)

Operating condition	Description
#1	<i>Continuous transmission of bit stream.</i>

2.2 Test overview

Sample tested is the main model of a complete set of 433,92 MHz RF transmitters (see also Section 7).

The appliance is classified as “*intentional radiator*” in conformity to FCC Part 15 Sub. A §15.201, and it is subject to “*Certification*” procedure.

The application is mainly used as remote control for swivel light beam, activated pushing its buttons; the deactivation of RF signal happens releasing the command pressure.

It is possible to declare that the appliance it is subject to additional requirements stated in §15.231.

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3. REFERENCE STANDARD FOR PERFORMED TESTS

<i>Reference standard :</i>	<i>Title :</i>
FCC Part 15 part A	Code of Regulations Part 15 (Radio Frequency Devices), Subpart A (General) of the Federal Communication Commission (FCC)
FCC Part 15 part C	Code of Regulations Part 15 (Radio Frequency Devices), Subpart C (Intentional Radiators) of the Federal Communication Commission (FCC)
ANSI C63.4	American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz – 40 GHz

4. SUMMARY OF TEST RESULTS

4.1 Tests

Port		Phenomena	Operating condition ¹	Result
1	Enclosure	Radiated emission	#1	Within the limit
		Frequency stability	#1	Within the limit
2	AC mains Input ports	RF Disturbance voltage: • continuous	Not applicable ²	
		Bandwidth of emission	Not applicable ²	
3	DC Power supply and Battery	Bandwidth of emission	#1	Within the limit

¹ Ref. Tab. of Section 2

² Not applicable: port not present in acc. To §15.207 (d)

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4.2 Emission limits

Acc. to §15.231 (b) the field strength of emission from intentional radiator with periodic operation in the band 40.66-40.70 MHz and above 70 MHz are as follows:

Frequency (MHz)	Field Strength of fundamental at a distance of 3m ($\mu\text{V/m}$)	Field Strength of spurious emission at a distance of 3m ($\mu\text{V/m}$)
40,66 – 40,70	2250	225
70 – 130	1250	125
130 - 174	1250 – 3750 (linear interpolations)	125 – 375 (linear interpolations)
174 – 260	3750	375
260 – 470	3750 – 12500 (linear interpolations)	375 – 1250 (linear interpolations)
Above 470	12500	1250

According to §15.209 all the other emission of the appliance shall not exceed the following levels:

Frequency (MHz)	Field Strength at a distance of 3m ($\mu\text{V/m}$)
30 - 88	100 **
88 – 216	150 **
216 – 960	200 **
Above 960	500

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.

5. TEST RESULTS

TX – RADIATED FIELD 30 - 1000 MHZ	11
TX – SPURIOUS EMISSION 1000 - 5000 MHZ	14
TX – FREQUENCY STABILITY	17
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**TEST
1.****TX – RADIATED FIELD 30 - 1000 MHZ****REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber
- **TEST EQUIPMENT USED FOR TEST:**
 - EMI receiver Rohde & Schwarz Mod. ESVP (20–1000 MHz)
 - Biconical Antenna Rohde & Schwarz Mod. HK116
 - Log-periodic Antenna Rohde & Schwarz Mod. HL223
 - Chase Antenna Mod. CBL 6111 A
- **TESTED PORT:** Enclosure
- **EMISSION LIMITS:** Acc. to Section 15.209 & 15.231 of reference document
- **UNCERTAINTY OF MEASURE:**
 - Combined uncertainty = ± 1.75 dB
 - Total uncertainty = $(k=2) \pm 3.5$ dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 $\pm$ 3 °C
Ambient humidity :	25 - 75 %rH	40 $\pm$ 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 $\pm$ 50 mbar
Voltage :	9 Vdc	9 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1**RESULT: WITHIN THE LIMIT**

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SCAN TABLE : “Radiated Emission”

Unit: dB μ V/m

Detector : Mode:

Curve1: Max Peak ClearWrite

Curve2: Avg ClearWrite

Subrange1:

Start Frequency: 30.0 MHz Step Size: 80 kHz

Stop Frequency: 1000.0 MHz

Measure Time: 0.01 sec.

IF Bandwidth: 120 kHz

Receiver: ESVP

Probe Transducer: CHASE_6111_PRC

Signal Path: Path 4

System Transducer: RFin2-CP1/X11

Scan Mode: Lin

Add. Transducer: W71.01

Tracking Gen.: Off

Input: 2 DC

Preamplifier: 10 dB

Demodulation: FM Broad

RF att.: Coupled

Volume: 0.0%

Ref. Level: -50 dBm

Squelch: --

Min. RF att.: 0 dBm

Option: None

Autorange: On

Curve 1: On

Repetition: Single

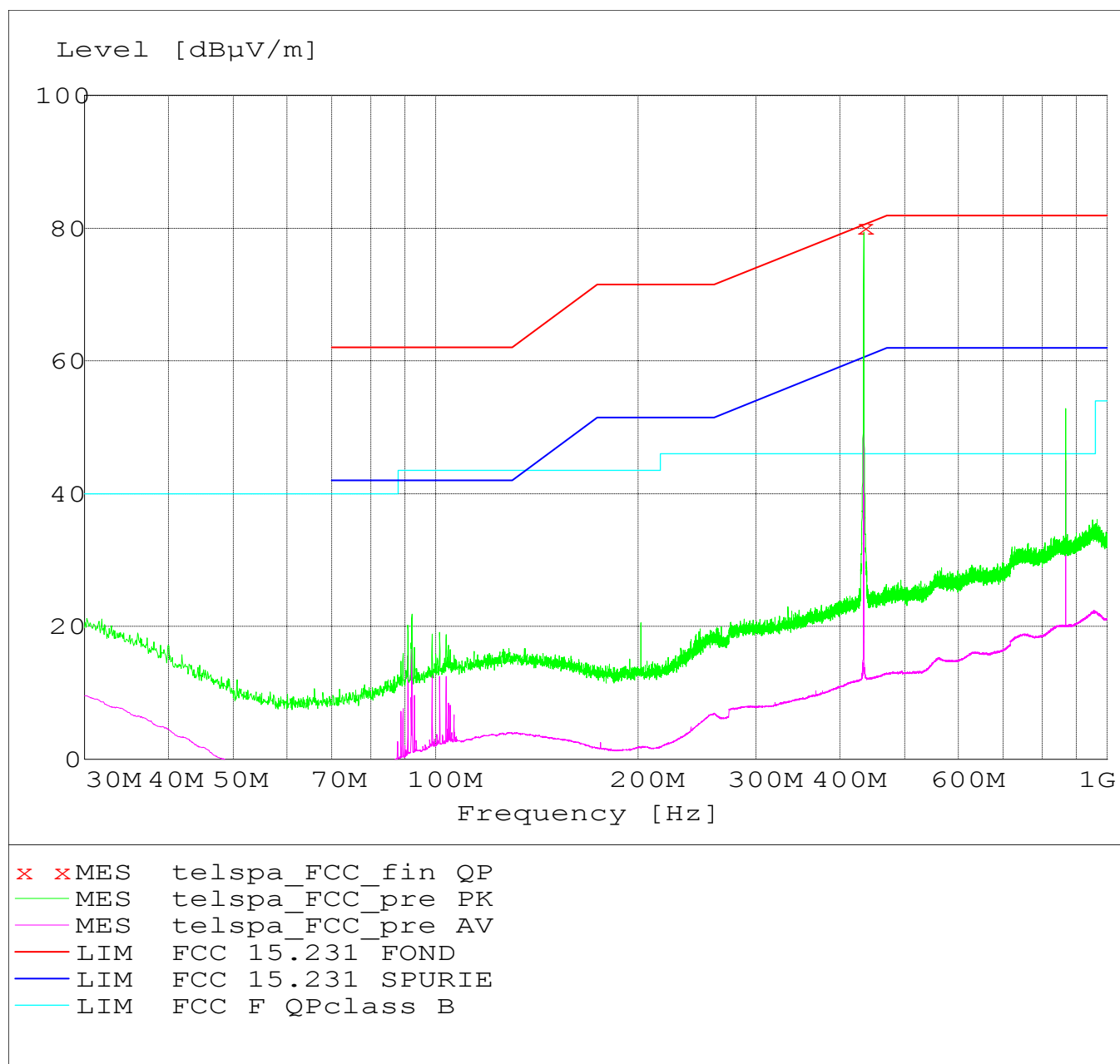
Curve 2: On

Stop Mark: On

Stop Message: On

Text: Connect antenna

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Frequency [MHz]	Remark	QP Level [dBμV/m]	Limits [dBμV/m]	Margin [dB]	Measured level - Antenna Polarisation
433.92000	Fundamental	80.20	80.52	0,32	HORIZONTAL
867.92000	Spurious	52.79	61.94	9,15	HORIZONTAL

**TEST
2.****TX – SPURIOUS EMISSION 1000 - 5000 MHZ****REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber
- **TEST EQUIPMENT USED FOR TEST:** Spectrum Analyzer Rohde & Schwarz Mod. FSP (9kHz-40GHz)
Double Ridged Guide Antenna Electro-metrics mod. EM-6961
Log-periodica Broadband Antenna mod. HL025
- **TESTED PORT:** Enclosure
- **EMISSION LIMITS:** Acc. to Section 15.209 of reference document
- **FREQUENCY BAND :** Fundamental Frequency to 10th harmonics acc. to §15.33 (a)
- **UNCERTAINTY OF MEASURE:** Combined uncertainty = ± 1.75 dB
Total uncertainty = $(k=2) \pm 3.5$ dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 $\pm$ 3 °C
Ambient humidity :	25 - 75 %rH	40 $\pm$ 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 $\pm$ 50 mbar
Voltage :	9 Vdc	9 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1**RESULT: WITHIN THE LIMIT**

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SCAN TABLE : “Radiated Emission”

Unit: dB μ V/m

Detector : Mode:

Curve1: Avg ClearWrite

Curve2: -- ClearWrite

Subrange:

Start Frequency: 1000.0 MHz

Step Size: 200 kHz

Stop Frequency: 5000.0 MHz

Probe Transducer: HL025

Measure Time: 0.01 sec.

IF Bandwidth: 1000 kHz

Receiver: FSP

Signal Path: Path 4

System Transducer: RFin2-CP1/X11

Scan Mode: Lin

Add. Transducer: W71.01

Tracking Gen.: Off

Input: 2 DC

Preamplifier: 10 dB

Demodulation: FM Broad

RF att.: Coupled

Volume: 0.0%

Ref. Level: -50 dBm

Squelch: --

Min. RF att.: 0 dBm

Option: None

Autorange: On

Curve 1: On

Repetition: Single

Curve 2: Off

Stop Mark: On

Stop Message: On

Text: Connect antenna

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MEASUREMENT RESULTS

<i>Frequency</i> <i>[MHz]</i>	<i>Remark</i>	<i>AV Level</i> <i>[dBμV/m]</i>	<i>AV Limit*</i> <i>[dBμV/m]</i>	<i>Margin</i> <i>[dB]</i>
1301,8145	Spurious	53,50	54,00	0,50
1735,745	Spurious	52,25	61,94	6,69
2169,679	Spurious	43,43	61.94	18,51
2603.613	Spurious	43,85	61.94	18,09
3037,550	Spurious	58,03	61.94	3,91
3471,491	Spurious	52,38	61.94	9,56
3905,421	Spurious	47,17	54,00	6,83
4339,352	Spurious	46,56	54,00	7,44

* In acc. to §15.231 limit

**TEST
3.****TX – FREQUENCY STABILITY****REFERENCE
DOCUMENT**

FCC PART 15 sub 2 §2.1055

- **TEST LOCATION:** Climatic chamber
- **TEST EQUIPMENT USED FOR TEST:** Climatic chamber Mazzali mod. Climatest M1574
Spectrum Analyzer Rohde & Schwarz mod. FSP
Programmable DC power supply HP mod. 6653A
- **TESTED PORT:** Enclosure

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	9 Vdc	9 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1**RESULT: WITHIN THE LIMIT**

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Frequency stability measurements

Temperature (°C)	Measured RF Frequency (Hz)
-30.0	433900000
-20.0	433898000
-10.0	433898000
0.0	433896000
10.0	433890000
20.0	433886000
30.0	433878000
40.0	433866000
50.0	433858000

Min. value (Hz)	433900000
Max. value (Hz)	433858000
Frequency deviation (Hz) [$f_H - f_L$]	42000

**TEST
4.****TX – RANGE OF MODULATION BANDWIDTH****REFERENCE
DOCUMENT**

FCC PART 15 subpart C

- **TEST LOCATION:** Semi-anechoic chamber
- **TEST EQUIPMENT USED FOR TEST:** EMI receiver Hewlett Packard Mod. 8542E
- **TESTED PORT:** AC Mains, DC Port and Battery
- **EMISSION LIMITS:** Acc. to Section 15.231 of reference document

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	24 ± 3 °C
Ambient humidity :	25 - 75 %rH	40 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar
Voltage :	9 Vdc	9 Vdc

OPERATING CONDITION (Rif. Section. 2) : #1**RESULT: WITHIN THE LIMIT**

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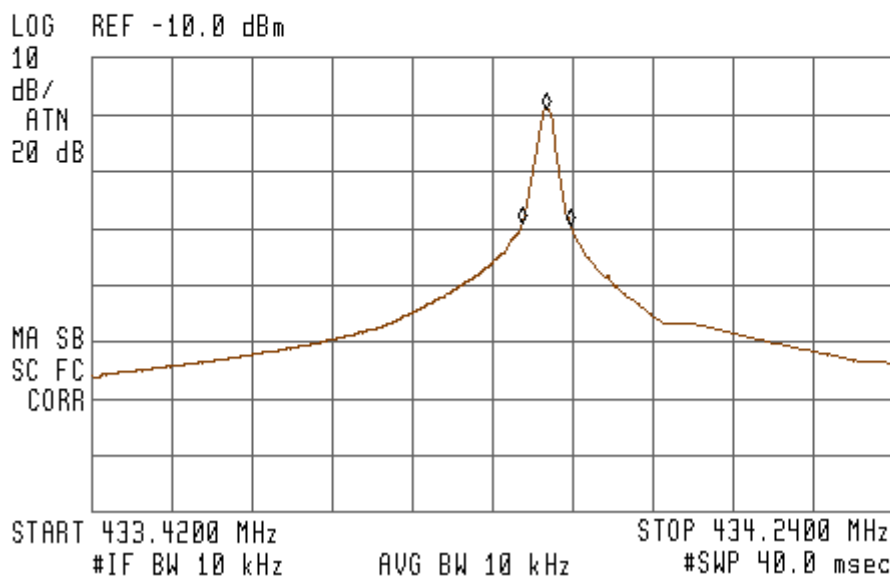
MEASUREMENT RESULTS

TEST CONDITIONS		Occupied frequency range (at 20 dB point)		
		f_L [MHz]	F_C [MHz]	f_H [MHz]
$T_{amb} : + 24 \text{ }^{\circ}\text{C}$	$V_{nom} : 9 \text{ Vdc}$	433,860	433,885	433,910
Incertezza di misura / Measurement Uncertainty : $\pm 0.1 \text{ Hz}$				
Legenda / Abbreviations : f_L : Lowest frequency at 20dB point F_C : Central frequency f_H : Highest frequency at 20dB point				
Bandwidth at 20dB points: 50 kHz				

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16:50:21 05 FEB 2004

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 433.8600 MHz
-39.13 dBm



LIMITS	
	Permitted operating frequency range
Normal test conditions	Nominal frequency $\pm 0,25\%$ = 1084,8 kHz

6. EUT TECHNICAL DOCUMENTATION

6.1 Wiring diagrams

	<i>Document reference (n., edition, date, ...)</i>
WIRING DIAGRAM	See enclosed document
PART LIST	See enclosed document

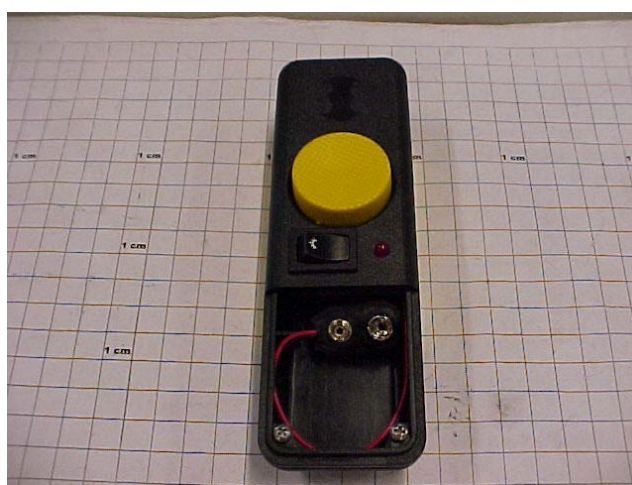
6.2 Technical manual

	<i>Document reference (n., edition, date, ...)</i>
SEARCH LIGHT FM1 DIRECTIONS FOR USE	IT-1 5902 – 24/03/03
SEARCH LIGHT FM2 DIRECTIONS FOR USE	IT-1 5912 – 24/03/03
SEARCH LIGHT FM3 DIRECTIONS FOR USE	IT-1 5922 – 03/12/03

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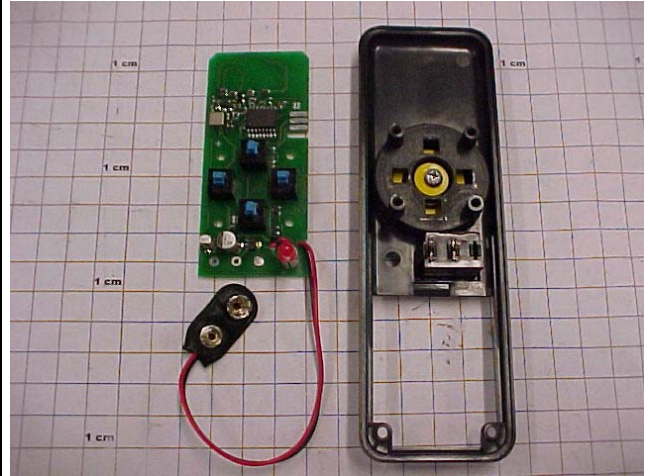
6.3 Photographic documentation

PHOTO N° 1 – E.U.T. IDENTIFICATION



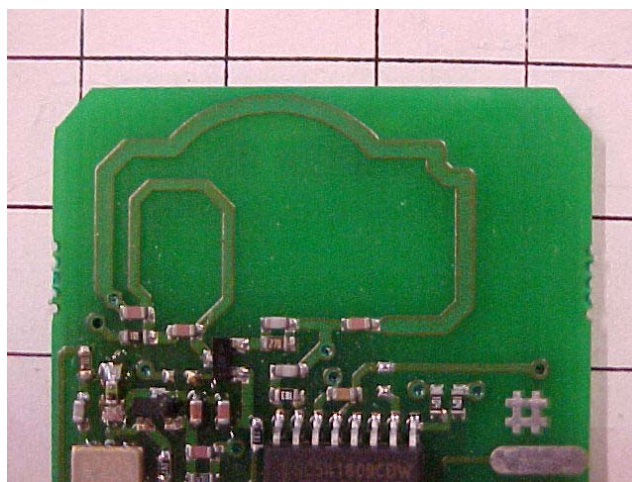
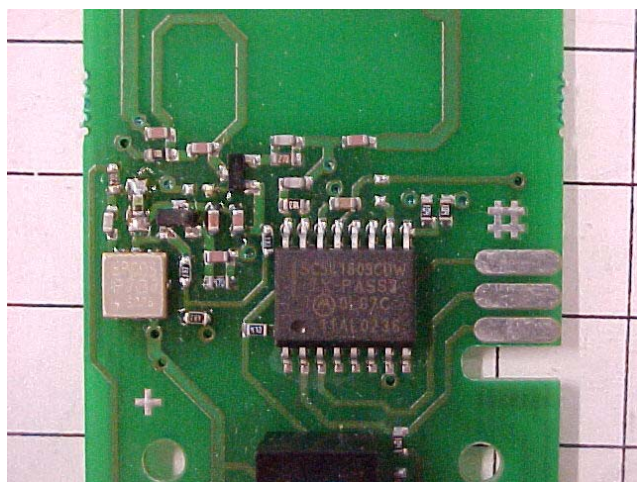
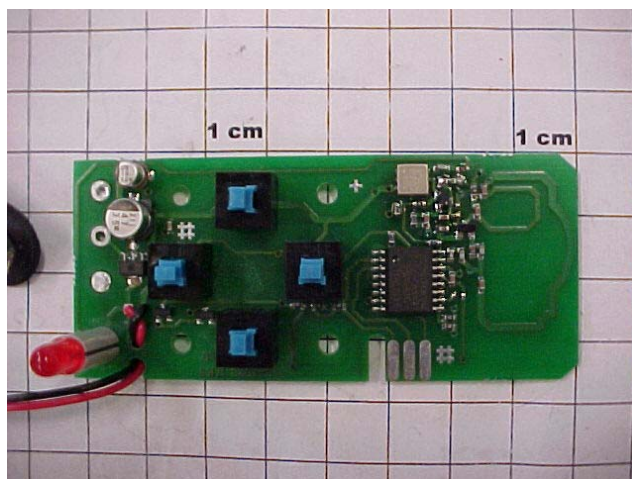
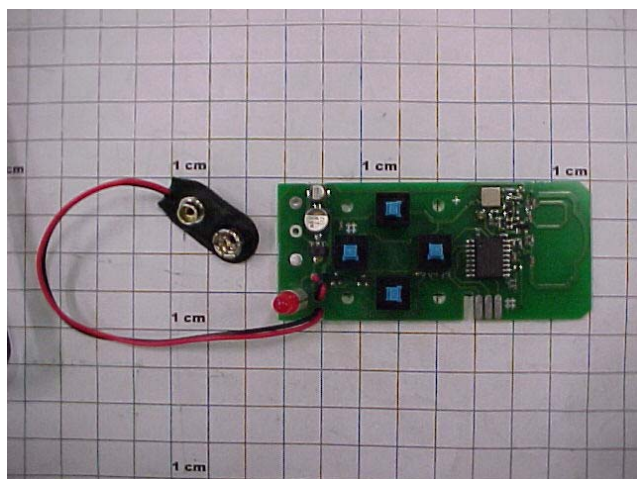
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PHOTO N° 2 – INTERNAL VIEW



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PHOTO N° 3 – INTERNAL VIEW



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PHOTO N° 4 – SET-UP FOR EMISSION RADIATED TEST

