

FCC CFR 47 PART 15 Subpart C**E.M.I. TEST REPORT**

Test report No..... : 01NM003EM-R01
Prepared by..... : C. Carù Signature
Approved by..... : G. Baroni Signature
Date of issue..... : June 8, 2001
Number of pages..... : 19

Test Laboratory

Name..... : CiaoLab eTechnology S.p.A. - Standard Compliance Services
Address..... : Via ai Laboratori Olivetti, 79 - 20010 Pregnana Milanese (MI) - I

Applicant for the test

Name..... : SIST&MATICA S.r.l.

Equipment under test

Model..... : FREEHAND – FU15A4
Serial Number..... : 213213
Trade Mark..... : SIST&MATICA
Manufacturer..... : SIST&MATICA S.r.l. Via S. Pertini, 17
12030 Manta - (Cuneo) Italy
Rating's..... : 2.5VDC ÷ 8VDC
Operating temperature range..... : From -20°C to +55°C

Equipment information

Equipment category..... : Radio CONTROLS
Classification of the equipment..... : Intentional Radiator
Weight..... : About 0.6Kg
Tested for IT power system..... : No

Test specification

Applicable standard..... : FCC CFR 47 - Part 15 - Subpart C - § 15.249
Additional installation requirements : No

Test results

Summary of test results..... : **COMPLIANT**
Legend..... : NA: Not Applicable - P: Pass - F: Fail

General Remarks

The test results presented in this report related only to the item tested.

This test report shall not be reproduced except in full without the written approval of the testing laboratory.

As stated in FCC §2.902:

Verification attaches to all items subsequently marketed by the manufacturer or importer which are identical as defined in §2.908 to the sample tested and found acceptable by the manufacturer.

In order to clarify the identical concept the §2.908 states:

As used in this subpart the term *identical* means identical within the variation that can be expected to arise as a result of quantity production techniques.

General Information of the Appliance

Manufacturer

SIST&MATICA S.r.l. Via S. Pertini, 17
12030 Manta (Cuneo) - Italy

Applicant for Certification

SIST&MATICA S.r.l. Via S. Pertini, 17
12030 Manta (Cuneo) - Italy

FCC ID

PPMFU15A4

Official of the Responsible party for Certification

Name Claudio Arcano Technical Director

Signature

Description of the Appliance

FreeHand is the remotely-operated radio CONTROLS switch, which permits to CONTROLS, with or wireless and in an ergonomic manner, the moving functions of electrically-operated machines or devices.

It consists of a Radio CONTROLS with handle and lever-switches, and a Receiver Unit, suitable to specific operation requirements; it substitutes or integrates the traditional CONTROLS systems, electric or hydraulics.

A version with proportional CONTROLS is available; by means of a trigger placed on the handle of the radio CONTROLS, the CONTROLS strength applied to the proportional element placed downstream the directional parts, may be adjusted, while the machine components are handled at the wanted speed.

Hereafter are described the mains characteristics of the appliance.

- Microprocessor electronics both on the Radio CONTROLS and on the Receiver Unit.
- Working frequency: It is possible to select up to 8 different channels working at the following frequencies:

Switch Position	Frequency
0	921.33
1	919.88
2	915.33
3	912.33
4	909.33
5	907.83
6	906.33
7	903.33
8	921.33
9	919.83

- - No CONTROLS relay, rather utilization of steady-state devices capable to protect the electronics in case of breakdown of the part to be CONTROLLED;
- - Direct connection to the solenoid valves;
- - Built-in circulation diodes;
- - Protection against polarity reversal;
- - Power supply:
- - Radio CONTROLS: 4.8 Volt rechargeable battery;
- - Receiver unit: 12/24 Volts d.c.

The radio CONTROLS Series FreeHand is power supplied by a 4.8 Volt rechargeable battery, which automatically powers up immediately when any one of the CONTROLS switches is moved.

To give a command to the receiver unit, the switch corresponding to the wanted movement has to be moved.

When the switch is activated the unit generate the RF signal that remains active until the switch is released.

When a switch is operated, a LED placed at the top of the radio CONTROLS lights up for a split second to signal that the command transmission has started; the same LED turns on immediately when the switch is released.

To make wire communication is necessary to connect the radio CONTROLS to the receiver group with the elicoidal wire. In this way the radio transmission is disabled and the wire communication is enabled to allow to work in particular zone where the radio transmission isn't allowed.

The appliance submitted to test is the top of a family of devices, the one tested is equipped with 6 switches that allow 12 different operating of the solenoid valves, there are also different configurations with just 4 switches and 2 switches, the differences between the 6 switch version and the 4 / 2 switch version consisting in the absence of the switches in the board defined as "Switch board".

Considering that the circuit generating the RF signal is exactly the same in all the configurations and that a preliminary analysis demonstrate that the RF signal is the same for all the switches, being the 6 switch version in compliance with the FCC Part 15 Subpart C requirements also all the reduced configuration will be compliant.

Hereafter the table with the possible configurations.

CODE	DESCRIPTION
FU15A4	TRASM. 12 CONTROLS + GRILLETTO PROP RADIO/CABLE
FU15A5	TRASM. 12 CONTROLS RADIO/CABLE
FA15A4	TRASM. 12 CONTROLS + GRILLETTO PROP RADIO
FA15A5	TRASM. 12 CONTROLS RADIO
FF15A4	TRASM. 12 CONTROLS + GRILLETTO PROP CABLE
FF15A5	TRASM. 12 CONTROLS CABLE
FU1572	TRASM. 8 CONTROLS + GRILLETTO PROP RADIO/CABLE
FU1573	TRASM. 8 CONTROLS RADIO/CABLE
FA1572	TRASM. 8 CONTROLS + GRILLETTO PROP RADIO
FA1573	TRASM. 8 CONTROLS RADIO
FF1572	TRASM. 8 CONTROLS + GRILLETTO PROP CABLE
FF1573	TRASM. 8 CONTROLS CABLE

General Consideration of the Test

Subject of this test report is the transmitting unit of the freehand system (Radio CONTROLS), the receiver unit will be treated in a separate test report code 01NM003EM-R02.

The appliance is classified under the *Intentional Radiator Category* and in conformity to the requirements of FCC Part 15 Subpart A §15.201, it is subject to “CERTIFICATION” procedure.

As defined in FCC Part 15 Subpart C §15.207 (d) measurements to demonstrate compliance to conducted limits are not required for devices which only employ battery power for operation and which do not operate from AC power lines or contain provision for operation while connected to the AC power lines.

Being our apparatus powered from 4.8V rechargeable battery this measurement does not apply.

The appliance use an 8MHz quartz as a clock for the microprocessor, and generate the highest RF signal at 921.33MHz so in accordance to FCC Part 15 Subpart A §15.33 (a)(1) the frequency range for radiated noise emission is from 8MHz to 9.2133GHz.

The field strength of emission from intentional radiators operated in the frequency band 902MHz ÷ 928MHz in conformance to requirements of §15.249, shall comply with the following limits specified at a distance of 3m.

902MHz ÷ 928MHz	Fundamental: 50mV/m	94dbµV/m
	Harmonics: 500µV/m	54dbµV/m

All the other emission of the intentional radiator shall not exceed the following field strength levels.

The limits defined in §15.209 at a distance of 3mt are reported in the following table:

30MHz ÷ 88MHz	100µV/m	40dbµV/m
88MHz ÷ 216MHz	150µV/m	43.5dbµV/m
216 MHz ÷ 960 MHz	200µV/m	46dbµV/m
Above 960 MHz	500µV/m	54dbµV/m

Considering that the appliance use an 8MHz quartz as a clock for the microprocessor, in conformance to the requirements of §15.209 the emission test must be performed also in the frequency range from 8MHz to 30MHz.

The limits defined in §15.209 at a distance of 30mt are reported in the following table:

8MHz ÷ 30MHz	30µV/m	30dbµV/m
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As specified in §15.31(m) measurement on intentional radiator shall be performed in accordance with the table reported on this paragraph, and being the frequency range of the device between 903.33MHz and 921.33MHz, the test must be performed at the following three frequencies:

One near top: 921.33MHz

One near middle: 912.33MHz

One near bottom: 903.33MHz

A unit of product “FREEHAND – FU15A4” representative of the production was subjected to the test program.

Date of Test

The test started on May 21, 2001 and concluded on June 1, 2001.

Reference Documents

- FCC CFR 47 Code of Federal Regulations, Title 47 Part 15 Radio Frequency Devices Subpart C, Intentional Radiators
- CISPR 16-1 (1993) Specification for radio disturbance and immunity measuring apparatus and methods.
Part 1: Radio disturbance and immunity measuring apparatus.
- CISPR 16-2 (1996) Specification for radio disturbance and immunity measuring apparatus and methods.
Part 2: Methods of measurement of disturbance and immunity.
- ANSI C63.4 (1992) Methods of measurement of radio noise emission from low voltage electrical and electronic equipment in the range of 9KHz to 40GHz.
- EMC Test Site N.2 description report Code QRD-RQ-0660.

Test Laboratory Information

Radiated and conducted measurements were performed at the CiaoLab eTechnology EMI Measurement Test Site (Open Area Test Site and Shielded Room) denominated “EMC Test Site N. 2” and located at the following address:

CiaoLab eTechnology S.p.A.
Via ai Laboratori Olivetti, 79
20010 Pregnana Milanese
Milano - ITALY

The “EMC Test Site N. 2” is compliant with the requirements of section 9.248 of the FCC rules.

The CiaoLab test facility is in the Commission’s list whose measurement data will be accepted in conjunction with application for certification or notification under part 15 and 18 of the FCC Rules.

The “EMC Test Site N. 2” complies also with the radiated and AC line conducted test site criteria described in ANSI C63.4-1992 and it is recognized by FCC with the filing number 90470.

CiaoLab eTechnology S.p.A. is also member of VCCI (Voluntary CONTROLS Council for Interference of ITE) in Japan.

The “EMC Test Site N. 2” (Shielded Room) has obtained the approval from VCCI Conference with the registration number C-813.

The “EMC Test Site N. 2” (Free Field) has obtained the approval from VCCI Conference with the registration number R-777.

Test Equipment List

	Instrument Type	Manufacturer	Model number	Serial Number	Cal./ Ver. Date
N.1	Artificial Main Network	Schwarzbeck	NNLK8121	8121170	January 26, 2001
N.1	Biconical Antenna	EMCO	3104	3503	February 28, 2001
N.1	Log Periodic 0.2-1GHz	EMCO	3146	2198	February 28, 2001
N.1	Log Periodic .02-5GHz	EMCO	3147	11966N	February 28, 2001
N.1	Active Loop Antenna	EMCO	6502	2218	February 12, 2001
N. 1	EMI RECEIVER	Hewlett Packard	HP 8574B		
The system is composed by four parts and it is yearly calibrated from Hewlett Packard, the date of the last calibration is Feb 15, 2001.					
	RF Preselector	Hewlett Packard	HP 85685A	2602A00237	
	Spectrum Analyzer RF	Hewlett Packard	HP 85680A	2634A02785	
	Spectrum Analyzer IF	Hewlett Packard	HP 85662A	2542A12241	
	Quasi peak Adapter	Hewlett Packard	HP 85650A	2521A00799	
N.1	EMI TEST RECEIVER	Rohde & Schwarz	ESBI		
The system is composed by two parts and it is yearly calibrated from Rohde & Schwarz, the date of the last calibration is Feb. 14, 2001.					
	Display Section	Rohde & Schwarz		844348/017	
	RF Section	Rohde & Schwarz		845658/002	

Devices

Antenna support
CONTROLS panel
Antenna tower
Turntable

Environmental Conditions

Radiated noise emission test

Temperature:	21°C
Relative Humidity:	43%
Atmospheric Pressure	1001mbar

Operating Conditions

During the test the appliance was exercised in a manner similar to the typical usage.

Both the transmitter and the receiver were activated.

One of the switch installed on the transmitter has been keep operated in order to continuously generate the RF signals.

The receiver detect the signal generated from the transmitter and keep active the solenoid valve corresponding to the switch operated.

EUT Test Setup

During the radiated noise measurements the EUT was installed over the free field turntable as specified in ANSI C63.4 Paragraph 6.2.1.

The transmitter was placed over a wooden table about 1m over the ground plane, it was in vertical position in order to simulate the typical usage when the transmitter is kept in hand.

The receiver used to simulate the real environment was placed on the same table at a distance of about one meter from the transmitter.

The receiver was connected to the testing system in order to simulate the load, consisting in a solenoid valves of the electro-hydraulic distributor.

It is possible to see the pictures of radiated and conducted test setups in the files uploaded to FCC site for certification.

E.M.I. Measurements Procedures

The EUT was installed in the Open Area Test Site in accordance to requirements of ANSI C63.4, the system setup is prepared in order to maximize the emissions.

The radiated noise emission measurements were performed in the Open Area Test Site and the EUT to antenna distance was 3m as specified in the FCC part 15 Subpart C §15.249 for the RF fundamental frequency and §15.209 for all other frequencies from 30MHz to 9.33GHz.

Regarding the frequency range from 8MHz to 30MHz, the measurement distance as specified in §15.209 is 30m, in this case we perform a peak measurement at a 3m distance in order to evaluate the presence of signals, and if necessary to perform the final quasi peak measurements at 30m.

The maximum radiated emissions are found by using the following step-by-step procedure:

- ↩ The EUT is installed and configured as specified in the standards ANSI C63.4 in the paragraph 8, dedicated to Radiated Emissions Testing.
- ↩ The whole frequency range (8MHz ÷ 9.33GHz) is divided in sub-ranges of about 7 - 8MHz up to 1GHz.
- ↩ For all the sub ranges a peak measurement is performed at fixed antenna high (1m for the Vertical polarization and 3.5m for the Horizontal Polarization), and rotating of 360° the turntable, holding the Spectrum Analyzer in max. hold conditions.
- ↩ The highest peaks are corrected with the antenna factors and cable losses from the software, and they are added to a list called "Suspect List".
- ↩ Now I have the availability of two different lists, the first one for the vertical polarization and the second one for the horizontal polarization.
- ↩ For each one of the Suspect list all the signals with less than 10db of margins from the specific limit are remeasured in Quasi Peak Mode as follows:
 - The test receiver is tuned on the highest point of the signal.
 - The Quasi Peak Detector is activated to store the maximum value.
 - The turntable is rotated of 360°, and the azimuth of maximum emission is found.
 - The turntable is stopped on the angle of maximum emission.
 - The antenna high is varied from 1m to 4m, and the antenna is stopped on the high of maximum emission.
 - The turntable is rotated of 360°, and the new maximum emission is found.
 - The system cables are manipulated to produce the highest amplitude signal.
 - A new scan changing the antenna height and rotating the turntable as described before is performed.
 - The Quasi Peak maximum value is corrected with cable's losses and antenna factors, and it is added to a list called "Final List".

Over 1GHz the measurement proceeding is about the same as described above, with differences of the subranges extended to 20MHz and instead of final quasi peak measurements the average measurement has been performed.

Measurement Results***Radiated Emission Summary***

EQUIPMENT UNDER TEST	FCC Part 15 Subpart C §15.249 Fundamental frequency
FREEHAND – FU15A4	PASS

EQUIPMENT UNDER TEST	FCC Part 15 Subpart C §15.209 General requirements
FREEHAND – FU15A4	PASS

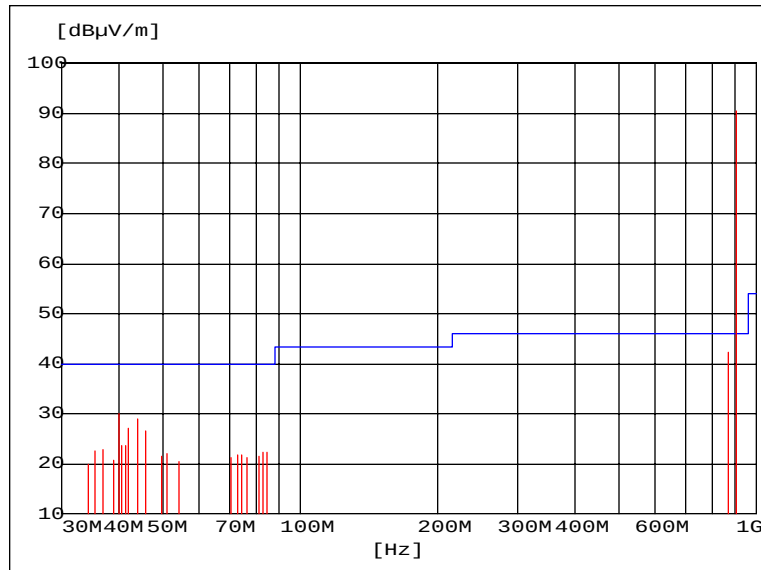
Radiated Emission Graphics and Tables

Measurement distance: 3m
Polarization: VERTICAL
Transmission Frequency: 903.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

**Table with Quasi Peak measurements results****Vertical Polarization**

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
34.323000	20.00	13.80	40.00	20.00	120	100.0	0.00	VER	
35.562000	22.70	13.70	40.00	17.30	120	100.0	0.00	VER	
36.944000	22.90	13.50	40.00	17.10	120	100.0	0.00	VER	
39.123000	20.80	13.30	40.00	19.20	120	100.0	0.00	VER	
40.000000	30.10	13.20	40.00	9.90	120	100.0	0.00	VER	
40.611000	23.60	13.10	40.00	16.40	120	100.0	0.00	VER	
41.420000	23.60	13.00	40.00	16.40	120	100.0	0.00	VER	
42.230000	27.10	12.90	40.00	12.90	120	100.0	0.00	VER	
44.050000	29.10	12.60	40.00	10.90	120	100.0	0.00	VER	
45.940000	26.60	12.40	40.00	13.40	120	100.0	0.00	VER	
49.720000	21.60	11.80	40.00	18.40	120	100.0	0.00	VER	
51.000000	22.10	11.60	40.00	17.90	120	100.0	0.00	VER	
54.380000	20.50	10.80	40.00	19.50	120	100.0	0.00	VER	
70.660000	21.20	9.90	40.00	18.80	120	100.0	0.00	VER	
73.000000	21.90	9.50	40.00	18.10	120	100.0	0.00	VER	
74.720000	21.70	9.20	40.00	18.30	120	100.0	0.00	VER	
76.650000	21.20	8.90	40.00	18.80	120	100.0	0.00	VER	
81.080000	21.60	8.50	40.00	18.40	120	100.0	0.00	VER	
83.120000	22.30	8.80	40.00	17.70	120	100.0	0.00	VER	
84.580000	22.40	8.90	40.00	17.60	120	100.0	0.00	VER	
868.69700	42.30	28.40	46.00	3.70	120	100.0	0.00	VER	
903.31600	90.60	28.80	94.00	3.40	120	100.0	0.00	VER	Fundamental

Measurement distance: 3m
Polarization: HORIZONTAL
Transmission Frequency: 903.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

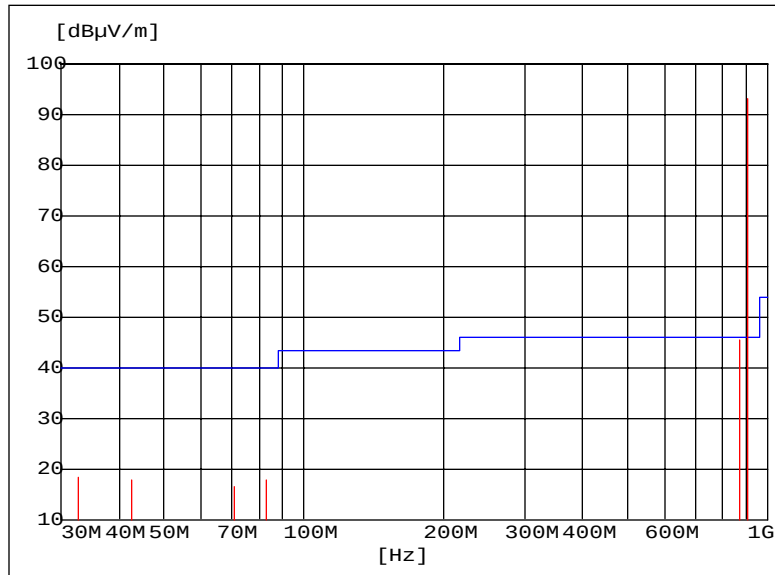


Table with Quasi Peak measurements results

Horizontal Polarization

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
32.550000	18.40	14.00	40.00	21.60	120	180.0	0.00	HOR	
42.510000	17.90	12.80	40.00	22.10	120	180.0	0.00	HOR	
70.720000	16.40	9.90	40.00	23.60	120	180.0	0.00	HOR	
83.080000	17.80	8.80	40.00	22.20	120	180.0	0.00	HOR	
868.697000	45.40	28.40	46.00	0.60	120	190.0	0.00	HOR	
903.304000	93.10	28.80	94.00	0.90	120	170.0	0.00	HOR	Fundamental

Measurements over 1GHz

With the transmitter tuned to 921.33MHz the frequency spectrum from 1GHz to 9.2133GHz has been investigated and just the following signals have been detected.

Table with Average measurements results

Frequency MHz	Level dBμV/m	Limit dBμV/m	Margin dB	IFBW MHz	Height cm	Azi deg	Pol	Comment
1806.590	50.50	54.00	3.50	1	100.0	0.00	VER	
1806.587	50.00	54.00	4.00	1	180.0	0.00	HOR	

Measurements in range 8MHz + 30MHz

Measurement in this frequency range have been performed but no relevant signals have been found.

Measurement distance: 3m
Polarization: VERTICAL
Transmission Frequency: 912.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

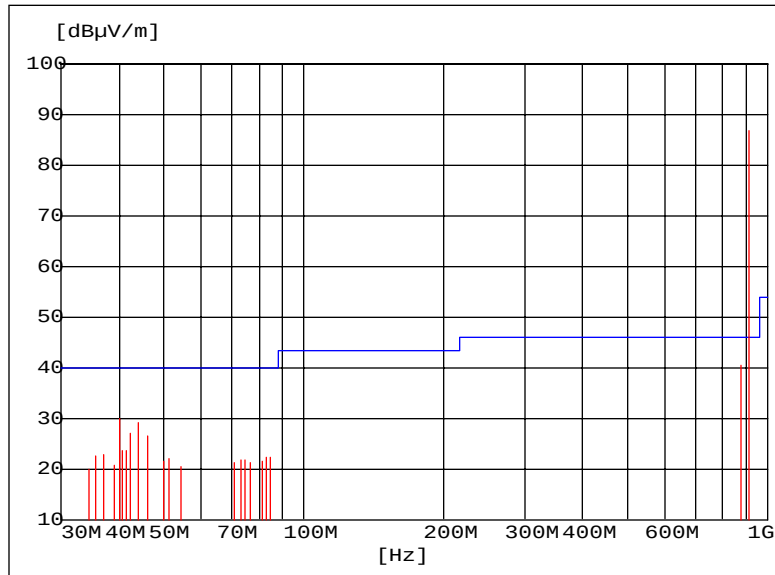


Table with Quasi Peak measurements results

Vertical Polarization

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
34.323000	20.00	13.80	40.00	20.00	120	100.0	0.00	VER	
35.562000	22.70	13.70	40.00	17.30	120	100.0	0.00	VER	
36.944000	22.90	13.50	40.00	17.10	120	100.0	0.00	VER	
39.123000	20.80	13.30	40.00	19.20	120	100.0	0.00	VER	
40.000000	30.10	13.20	40.00	9.90	120	100.0	0.00	VER	
40.611000	23.60	13.10	40.00	16.40	120	100.0	0.00	VER	
41.420000	23.60	13.00	40.00	16.40	120	100.0	0.00	VER	
42.230000	27.10	12.90	40.00	12.90	120	100.0	0.00	VER	
44.050000	29.10	12.60	40.00	10.90	120	100.0	0.00	VER	
45.940000	26.60	12.40	40.00	13.40	120	100.0	0.00	VER	
49.720000	21.60	11.80	40.00	18.40	120	100.0	0.00	VER	
51.000000	22.10	11.60	40.00	17.90	120	100.0	0.00	VER	
54.380000	20.50	10.80	40.00	19.50	120	100.0	0.00	VER	
70.660000	21.20	9.90	40.00	18.80	120	100.0	0.00	VER	
73.000000	21.90	9.50	40.00	18.10	120	100.0	0.00	VER	
74.720000	21.70	9.20	40.00	18.30	120	100.0	0.00	VER	
76.650000	21.20	8.90	40.00	18.80	120	100.0	0.00	VER	
81.080000	21.60	8.50	40.00	18.40	120	100.0	0.00	VER	
83.120000	22.30	8.80	40.00	17.70	120	100.0	0.00	VER	
84.580000	22.40	8.90	40.00	17.60	120	100.0	0.00	VER	
877.698000	40.40	28.40	46.00	5.60	120	100.0	0.00	VER	
912.318000	86.90	28.80	94.00	7.10	120	100.0	0.00	VER	Fundamental

Measurement distance: 3m
Polarization: HORIZONTAL
Transmission Frequency: 912.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

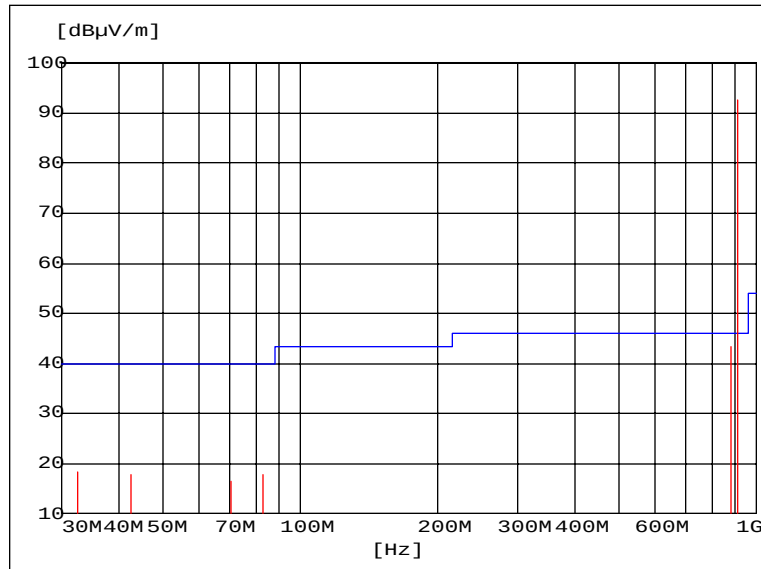


Table with Quasi Peak measurements results

Horizontal Polarization

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
32.550000	18.40	14.00	40.00	21.60	120	180.0	0.00	HOR	
42.510000	17.90	12.80	40.00	22.10	120	180.0	0.00	HOR	
70.720000	16.40	9.90	40.00	23.60	120	180.0	0.00	HOR	
83.080000	17.80	8.80	40.00	22.20	120	180.0	0.00	HOR	
877.699000	43.30	28.40	46.00	2.70	120	180.0	0.00	HOR	
912.308000	92.50	28.80	94.00	1.50	120	160.0	0.00	HOR	Fundamental

Measurements over 1GHz

With the transmitter tuned to 912.33MHz the frequency spectrum from 1GHz to 9.2133GHz has been investigated and just the following signals have been detected.

Table with Average measurements results

Frequency MHz	Level dBμV/m	Limit dBμV/m	Margin dB	IFBW MHz	Height cm	Azi deg	Pol	Comment
1824.600	49.70	54.00	4.30	1	100.0	0.00	VER	
1824.612	51.10	54.00	2.90	1	180.0	0.00	HOR	

Measurements in range 8MHz ÷ 30MHz

Measurement in this frequency range have been performed but no relevant signals have been found.

Measurement distance: 3m
Polarization: VERTICAL
Transmission Frequency: 921.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

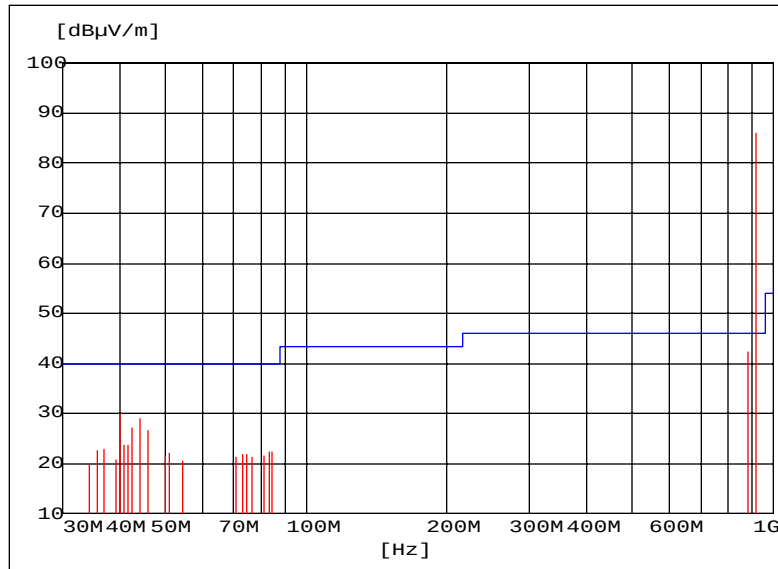


Table with Quasi Peak measurements results

Vertical Polarization

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
34.323000	20.00	13.80	40.00	20.00	120	100.0	0.00	VER	
35.562000	22.70	13.70	40.00	17.30	120	100.0	0.00	VER	
36.944000	22.90	13.50	40.00	17.10	120	100.0	0.00	VER	
39.123000	20.80	13.30	40.00	19.20	120	100.0	0.00	VER	
40.000000	30.10	13.20	40.00	9.90	120	100.0	0.00	VER	
40.611000	23.60	13.10	40.00	16.40	120	100.0	0.00	VER	
41.420000	23.60	13.00	40.00	16.40	120	100.0	0.00	VER	
42.230000	27.10	12.90	40.00	12.90	120	100.0	0.00	VER	
44.050000	29.10	12.60	40.00	10.90	120	100.0	0.00	VER	
45.940000	26.60	12.40	40.00	13.40	120	100.0	0.00	VER	
49.720000	21.60	11.80	40.00	18.40	120	100.0	0.00	VER	
51.000000	22.10	11.60	40.00	17.90	120	100.0	0.00	VER	
54.380000	20.50	10.80	40.00	19.50	120	100.0	0.00	VER	
70.660000	21.20	9.90	40.00	18.80	120	100.0	0.00	VER	
73.000000	21.90	9.50	40.00	18.10	120	100.0	0.00	VER	
74.720000	21.70	9.20	40.00	18.30	120	100.0	0.00	VER	
76.650000	21.20	8.90	40.00	18.80	120	100.0	0.00	VER	
81.080000	21.60	8.50	40.00	18.40	120	100.0	0.00	VER	
83.120000	22.30	8.80	40.00	17.70	120	100.0	0.00	VER	
84.580000	22.40	8.90	40.00	17.60	120	100.0	0.00	VER	
886.666000	42.30	28.60	46.00	3.70	120	100.0	0.00	VER	
921.304000	85.90	28.90	94.00	8.1	120	100.0	0.00	VER	Fundamental

Measurement distance: 3m
Polarization: HORIZONTAL
Transmission Frequency: 921.33MHz

Quasi Peak measurement results

Blue limit line: FCC CFR 47 Part 15 Subpart C - Requirements §15.209

Red bar graph: Quasi Peak measured signals.

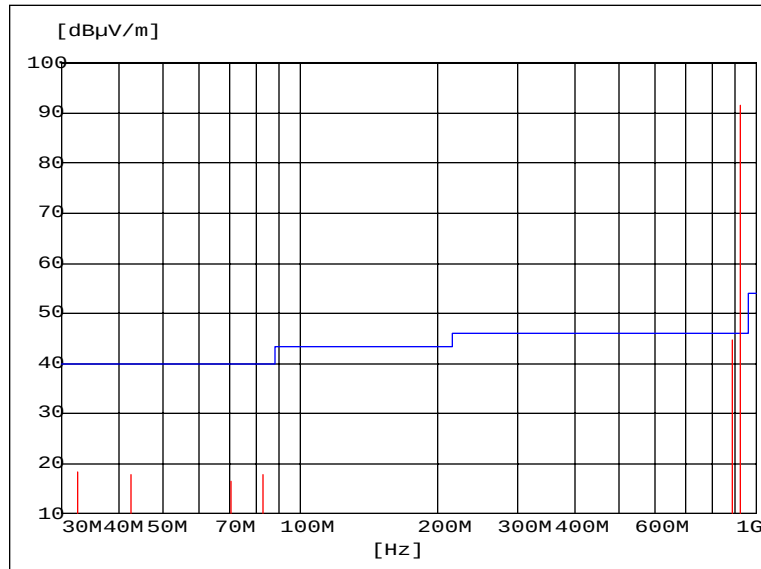


Table with Quasi Peak measurements results

Horizontal Polarization

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	IFBW kHz	Height cm	Azi deg	Pol	Comment
32.550000	18.40	14.00	40.00	21.60	120	180.0	0.00	HOR	
42.510000	17.90	12.80	40.00	22.10	120	180.0	0.00	HOR	
70.720000	16.40	9.90	40.00	23.60	120	180.0	0.00	HOR	
83.080000	17.80	8.80	40.00	22.20	120	180.0	0.00	HOR	
886.662000	44.60	28.60	46.00	1.40	120	180.0	0.00	HOR	
921.310000	91.60	28.90	94.00	2.40	120	160.0	0.00	HOR	Fundamental

Measurements over 1GHz

With the transmitter tuned to 921.33MHz the frequency spectrum from 1GHz to 9.2133GHz has been investigated and just the following signals have been detected.

Table with Average measurements results

Frequency MHz	Level dBμV/m	Limit dBμV/m	Margin dB	IFBW MHz	Height cm	Azi deg	Pol	Comment
1842.660	51.70	54.00	2.30	1	100.0	0.00	VER	
1842.658	50.20	54.00	3.80	1	180.0	0.00	HOR	

Measurements in range 8MHz + 30MHz

Measurement in this frequency range have been performed but no relevant signals have been found.

Frequency stability measurements

In accordance to the requirements of FCC CFR 47 Part 15 Subpart 2 §2.1055, the frequency stability of the RF generated signal has been measured from -30°C to $+50^{\circ}\text{C}$ at three frequencies in according to §15.31(m), in the following table are reported the measurement results.

Temperature $^{\circ}\text{C}$	Measured RF Frequency MHz
-30	921.322
-20	921.323
-10	921.320
0	921.320
+10	921.320
+20	921.313
+30	921.310
+40	921.308
+50	921.303

Temperature $^{\circ}\text{C}$	Measured RF Frequency MHz
-30	912.323
-20	912.323
-10	912.320
0	912.320
+10	912.315
+20	912.310
+30	912.306
+40	912.300
+50	912.300

Temperature $^{\circ}\text{C}$	Measured RF Frequency MHz
-30	903.324
-20	903.323
-10	903.323
0	903.320
+10	903.316
+20	903.313
+30	903.306
+40	903.300
+50	903.299

Equipment Under Test Details

Manufacturer: SIST&MATICA S.r.l.
Mark: SIST&MATICA
Model number: FREEHAND-FU15A4
Serial number: 213213

The appliance is composed by a plastic enclosure with inside two electronic boards, one with the switch to activate the transmitter and the second one used to CONTROLS and generate the RF signal.

Hereafter the manufacturer code of the boards:

Switch board: HM12PA Rev. 2
Transmitter board: HM16PB Rev. 2

All the details regarding the appliance are contained in the file uploaded to FCC site for certification.

Antenna requirements

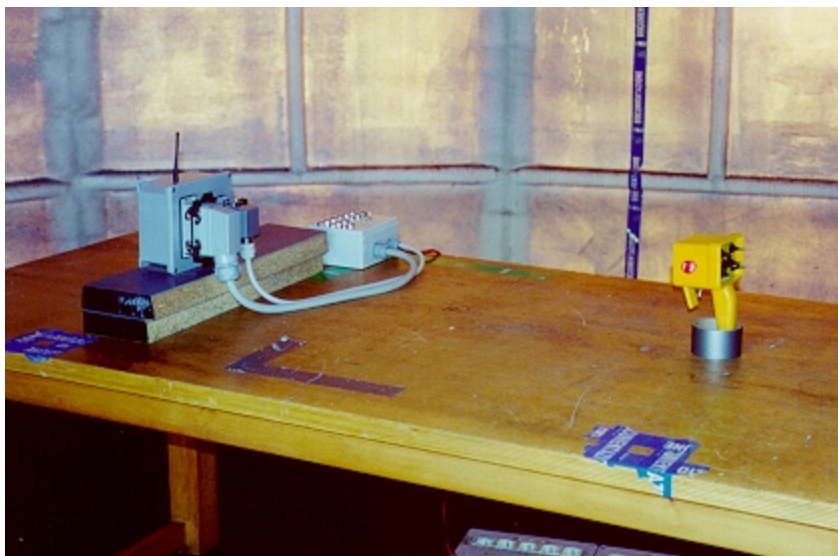
As requested in FCC CFR 47 Part 15 §15.203 the antenna of the transmitter is composed by a wire directly soldered on the board, the antenna is also inside the plastic enclosure, this two conditions made impossible that no antenna other than that mounted from the manufacturer shall be used with the device.

Pictures

External view of the appliance



Test setup



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