

Test Report No.8012305210

***On Phantom II production Ltd.
Interface Unit***

Model: LEONARDO

***From The Standards Institution
Of Israel***

***Industry Division
Telematics Laboratory
EMC Section***



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 1 of 25 Pages
Model: LEONARDO

Order placed by: Phantom II production Ltd.

Address: Kibutz Yakum 60972, Israel

Sample for test selected by: The orderer

The date of test: 05/06/2000, 05/07/2000.

Description of Equipment Under Test (EUT): Interface Unit

Model: LEONARDO

Manufactured by: Phantom II production Ltd.

Reference documents:

- ❖ **CFR 47 FCC** Rules and Regulations:
 - Part 15. Radio frequency devices.
 - Subpart B: Unintentional radiators.
 - Subpart C: Intentional radiators. Sec. 15.231

This Test Report contains 25 pages
and may be used only in full.

This Test Report applies only to the specimen tested and may not
be applied to other specimens of the same product.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 2 of 25 Pages
Model: LEONARDO

Table of Contents

1. EUT DESCRIPTION AND OPERATION	3
1.1. GENERAL DESCRIPTION:	3
1.2. LEONARDO GENERAL VIEW:	5
1.3. EUT'S SUB-ASSEMBLIES LIST:	6
1.4. EUT CONNECTORS LIST:	6
1.5. AUXILIARY EQUIPMENT USED:	7
1.6. EUT SETUP AND OPERATION:	7
2. TEST SPECIFICATION, METHODS AND PROCEDURES	9
3. ADDITIONAL DEVIATIONS OR EXCLUSIONS FROM THE TEST SPECIFICATIONS	9
4. MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS	10
4.1. LOCATION OF THE TEST SITE:	10
4.2. TEST CONDITION:	10
4.3. EMISSION TESTS:	10
4.4. INITIAL VISUAL CHECK AND FUNCTIONAL TEST :	10
4.5. CONDUCTED EMISSION TESTS:	11
4.6. RADIATED EMISSION TEST:	12
5. COMPLIANCE WITH SPECIFICATION	16
6. APPENDIX 1: TEST EQUIPMENT USED	17
7. APPENDIX 2: ANTENNA FACTOR AND CABLE LOSS	18
8. APPENDIX 3: TEST CONFIGURATION ILLUSTRATION	20
9. APPENDIX 4: TEST RESULTS	23



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 3 of 25 Pages
Model: LEONARDO

1. EUT Description and operation

1.1. *General description:*

Description of Equipment Under Test (EUT): Interface Unit

Model: LEONARDO

Manufactured by: Phantom II production Ltd.

The EUT is a Smart interface that has 4 output and 4 input channels.

The LEONARDO can communicate with a PC and to be controlled by it.

The LEONARDO can save 6 different tasks, and execute each one at a time.

The EUT contains a RF transmitter and receiver, fundamental frequency - 433.92 MHz.

The EUT's dimensions are: 9 x 12 x 4 cm approx.

The EUT's power consumption from 220/110 VAC to 9-12 VDC Adaptor or battery.

The EUT's block diagram is shown in Figure 1.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 4 of 25 Pages
Model: LEONARDO

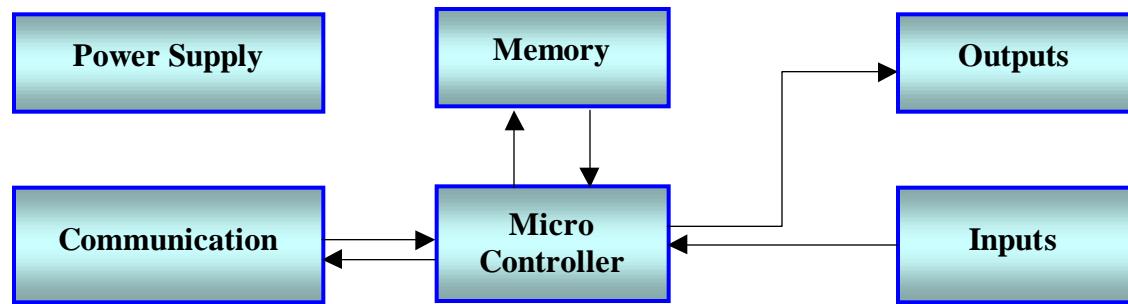


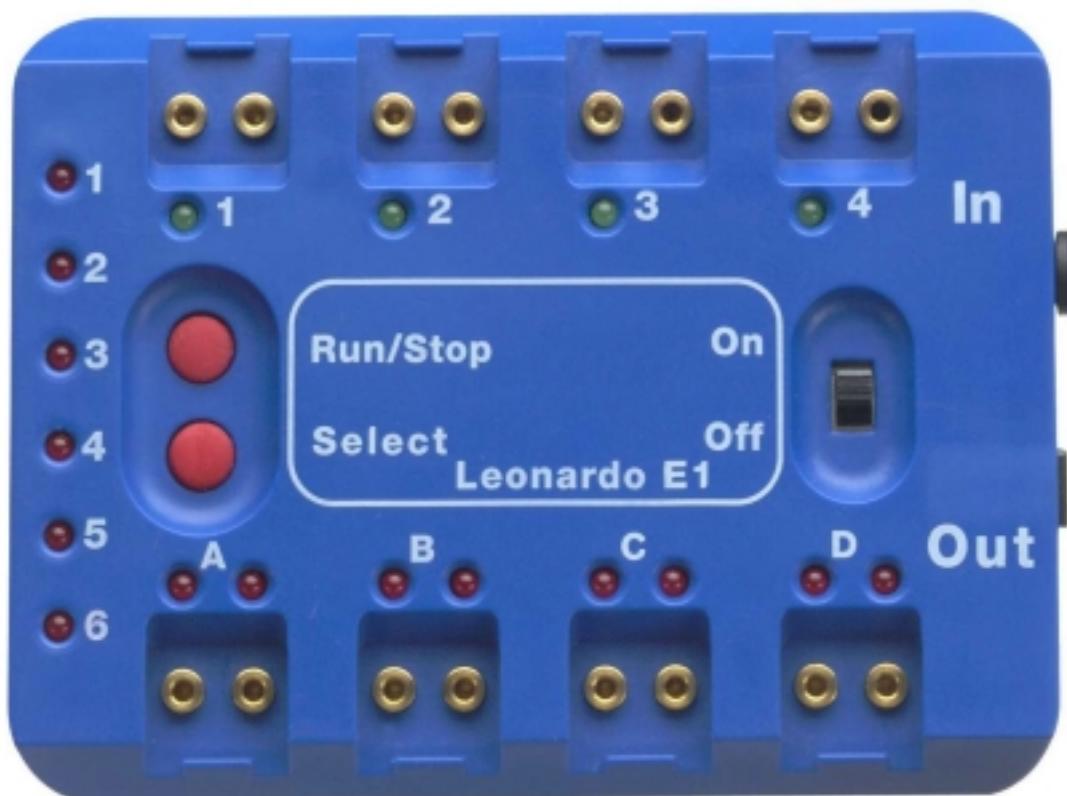
Figure 1 :EUT's block diagram



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 5 of 25 Pages
Model: LEONARDO

1.2. Leonardo General View:





Test Report No.: 8012305210
Title: Test on Interface Unit

Page 6 of 25 Pages
Model: LEONARDO

1.3. **EUT's sub-assemblies list:**

EUT's sub-assemblies list is detailed in table 1.

Table 1- Sub-assemblies list

Function	Marking/Serial No./ Model
Main LEONARDO board	LEONARDO Ver: 3.0
Modem board	MODEM Ver: 4B
AC/DC Adaptor 220 VAC/9 VDC or AC/DC Adaptor 110 VAC/12 VDC	Model: S-9880 mfr SKL Model STA-4112 C-9 mfr Knex

1.4. **EUT connectors list:**

A list of the EUT's connectors is detailed in table 2.

Table 2- Connector list

No.	Connector's name	Connector's type	Type of cable	Length (m)	Location	No. of identical connectors
1	DC Power jack	DS-210B	Typical	<3	Side	1
2	Stereo jack	3.5mm ST-2	PC Cable #92108 by Phantom II	1	Side	1
3	I/O pin	Custom design for Leonardo			Front	16



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 7 of 25 Pages
Model: LEONARDO

1.5. Auxiliary equipment used:

The auxiliary equipment used is detailed in table 4.

Table 4 - Auxiliary equipment used

Name	Manufacturer	Model	Serial No.	Remarks
Laptop		Twinhead Model No. SLMNOTE-5	FCC ID: FXGPG2	For installation only

1.6. EUT setup and operation:

The EUT was setup as shown in Figure 2 and operated in operation modes as detailed in table 4.

Table 4 - Modes of operations

No.	Mode of operation	Test setup	Emissions Measurements
1	Normal operation –Standby	Fig.2	per FCC Part 15 Subpart B
2	Normal operation Transmission	Fig.2	per FCC Part 15 Subpart C



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 8 of 25 Pages
Model: LEONARDO

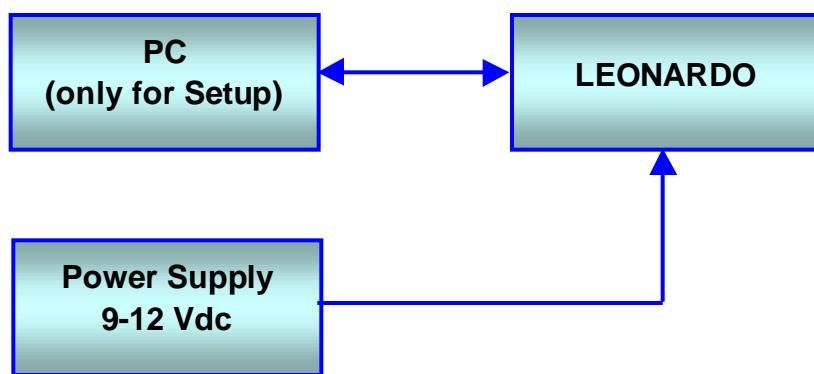


Figure 2 – EUT Test Setup



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 9 of 25 Pages
Model: LEONARDO

2. Test specification, Methods and Procedures

Test Specification:

- ❖ **CFR 47 FCC** Rules and Regulations:
 Part 15. Radio frequency devices.
 Subpart B: Unintentional radiators.
 Subpart C: Intentional radiators. Sec. 15.231

Methods and Procedures:

- ❖ **ANSI C63/4/1992:** "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

3. Additional deviations or exclusions from the test specifications

Not applicable.



4. Measurements, examinations and derived results

4.1. *Location of the Test Site:*

Conducted emission tests and immunity tests were carried out in the EMC laboratory of the Standards Institution of Israel in Tel-Aviv.

Radiated emission tests were conducted in an Open Area Test Site located at Kibbutz Native Halamed Hai in Emek HaEla, Israel.

4.2. *Test condition:*

Temperature: 22 °C

Humidity: 60 %

4.3. *Emission tests:*

- * For both radiated and conducted measurements, initial scans were made using a peak detector but still using the appropriate CISPR (Quasi-Peak) detector IF bandwidth.
- * For conducted emissions, a tolerance limit was set 6 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector or an average detector.
- * For radiated emissions, a tolerance limit was set 10 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector.
- * Unless otherwise stated, the plots shown in Appendix 4 are all from scans where a peak detector was used.
- * If the result with a Quasi-Peak detector exceeds the specification limit, it is marked with "Fails" in the margin, if it is within the limits of uncertainty for the measurement, it is marked with a "**".

4.4. *Initial visual check and functional test :*

Initial visual check and brief built- in- test (BIT) of the EUT was performed before testing.- No external damages were found. - The BIT test on the EUT passed successfully.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 11 of 25 Pages
Model: LEONARDO

4.5. **Conducted emission tests:**

4.5.1. Test Configuration:

The EUT was placed on a non-metallic table in a shielded chamber at a height of 80 cm from the floor of the shielded chamber and 40 cm from the wall of the shielded chamber.

4.5.2. Test procedure:

The EUT was operated according to clause 1.6.

First, initial scan were performed. Final measurements were performed for emission which exceeded the tolerance limit.

Test equipment (EMI receiver) setup was as follow:

Initial scan:

Detector type	Peak
Mode	Max hold
Bandwidth	9 kHz
Step size	Continuous sweep
Sweep time	100 msec

Measurements

Detector type	Quasi-peak (CISPR)
Bandwidth	9 kHz
Measurement time	200 seconds/MHz
Observation	>15 seconds

4.5.3. Test results:

Test results of conducted emissions can be found in Appendix 4.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 12 of 25 Pages
Model: LEONARDO

4.6. ***Radiated emission test:***

4.6.1. Preliminary radiated emission tests:

Preliminary radiated measurements were performed in a shielded chamber at a distance of 3 meters.

Operation modes: transmission, standby.

The EUT was setup in its typical configuration and operated in its various modes.

For each mode of operation the frequency spectrum was monitored.

4.6.2. Final measurements:

The EUT was arranged on a turntable at the Open Area Test Site (described in section 4) as detailed in the specification. The test layout is presented in Appendix 2.

All measurements at the Open Area Test Site were performed at a 10 m measurement distance. The antennas used for this measurement were:

1. Antenna biclog - in the frequency range 30-1000 MHz.
2. Antenna Double Ridge - in the frequency range above 1000 MHz.

The EUT was operated on fundamental frequency 433.92 MHz, the frequency range was investigated up to 2.1 GHz.

Unless stated otherwise, the measuring equipment settings were:

Initial scan:

Detector type	Peak
Mode	Max hold
Bandwidth	120 kHz
Step size	Continuous sweep
Sweep time	>1 seconds/MHz



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 13 of 25 Pages
Model: LEONARDO

Measurements:

Detector type	Quasi-peak (CISPR)
Bandwidth	120 kHz
Measurement time	20 seconds/MHz
Observation	>15 seconds
Sweep time	>1 seconds/MHz

4.6.3. Radiated emission test results:

1. Standby mode: No emissions from the EUT were found
2. Transmission mode: Test results are presented in table #6.

4.6.4. Bandwidth measurements:

According to sec.15.231 (c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

The measurements were performed on modulated carrier.

The result is presented in plot #1.

The required 0.25% bandwidth from 434 MHz is 1.085 MHz

The bandwidth obtained graphically in the plots # 1-#2 equal to 610 kHz.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 14 of 25 Pages
Model: LEONARDO

Table 6- Radiated emission test results
FCC Part 15 Subpart C Sec.15.231 (b)

Frequency (MHz)	Emission Level (dB μ V/m)	Limit of fundamental @ 3 meter distance (dB μ V/m)	Margin (dB)	Results
433.92	60.6	80.8	20.2	Complies

Frequency (MHz)	Emission Level (dB μ V/m)	Limit of spurious @ 3 meter distance (dB μ V/m)	Margin (dB)	Results
868	50.2	61.9	11.7	Complies

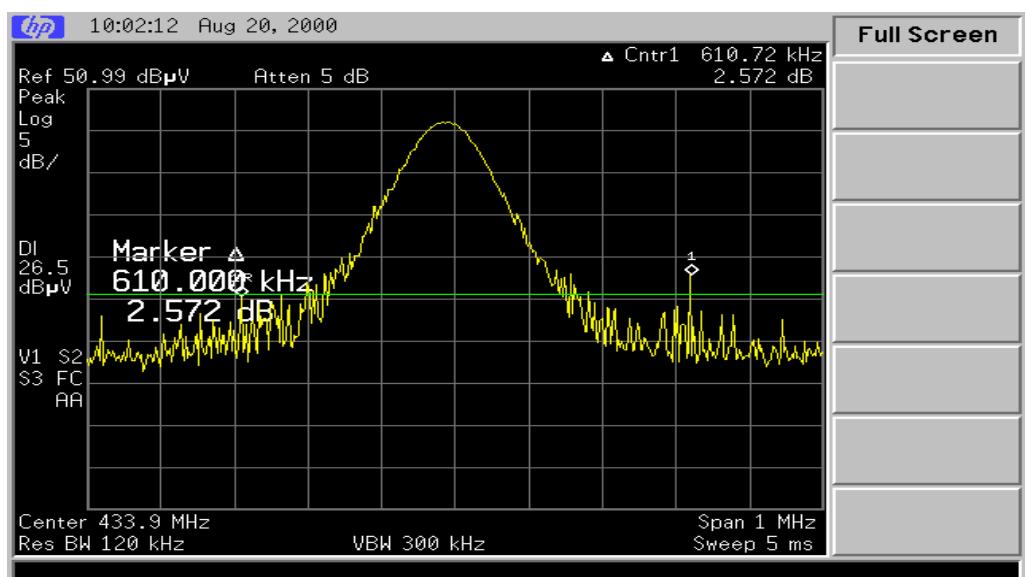
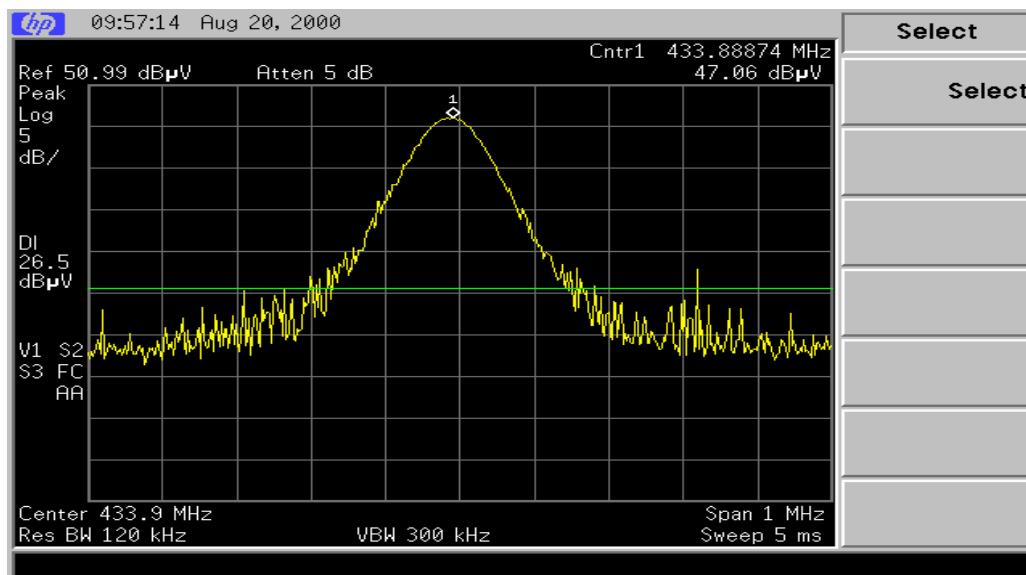
Note 1: Emission level = E Reading (dB μ V) + Cable loss (dB) + Antenna Factor (dB/m) For Cable Loss and Antenna Factor refer to Appendix 2.

Note 2: The measurements were performed at 10 m distance and the results were extrapolated to 3 m distance.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 15 of 25 Pages
Model: LEONARDO



Plots #1, #2. Bandwidth of the fundamental emissions.



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 16 of 25 Pages
Model: LEONARDO

5. Compliance with specification

Test	Standard	Class	Test result
Conducted emission on mains terminal Frequencies range of 450 kHz to 30 MHz	FCC Part 15 Subpart B	Class B	Complies
Radiated emission Frequencies range of 30-1000 MHz	FCC Part 15 Subpart B	Class B	Complies
Radiated emission from fundamental and spurious	FCC Part 15 Subpart C Sec.15.231 (b)	NA	Complies
The bandwidth of the emission	FCC Part 15 Subpart C Sec.15.231 (c)	NA	Complies

Telematics Laboratory

08 August 2000

Name: Eng. Yuri Rozenberg
Position: Head of EMC Branch

Name: Rami Nataf
Position: Test Technician



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 17 of 25 Pages
Model: LEONARDO

6. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding once a year.

FCC Part 15

Instrument	Manufacturer	Model	Serial No.	Last calibration date	Next calibration date
Spectrum analyzer	HP	8568B	SII 2371	01/00	01/01
RF preselector	HP	85685A	SII 2371	01/00	01/01
Quasi-Peak adapter	HP	85650A	SII 2371	01/00	01/01
EMI Receiver	HP	8546A	SII 4068	11/99	11/00
LISN	FCC	LISN-2	SII4025	01/00	01/01
Antenna Biclog	Chase	CBL6112B	SII2146	03/00	03/01
Antenna Double Ridge	EMCO	3115	SII4873	10/99	10/00
Antenna Mast	R&S	HCM	100002	NA	NA
Metallic turntable	R&S	HCT12	100001	NA	NA
Positioning controller	R&S	HCC	100002	NA	NA



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 18 of 25 Pages
Model: LEONARDO

7. Appendix 2: Antenna Factor and Cable Loss

Cable Loss (10m cable + Mast)

Point	Frequency (MHz)	Cable Loss (dB)
1	30	-0.95
2	50	-1.2
3	100	-1.8
4	200	-2.5
5	300	-3.-2
6	400	-3.6
7	500	-4.1
8	600	-4.3
9	700	-4.9
10	800	-5.2
11	900	-5.5
12	1000	-5.9



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 19 of 25 Pages
Model: LEONARDO

Antenna Factor

Point	Frequency (MHz)	Antenna Factor (dB/m)
1	25	19.9
2	30	18
3	40	15.4
4	50	14.5
5	60	13.5
6	70	9.9
7	80	9.6
8	90	8.9
9	100	9.3
10	110	9.7
11	120	10
12	130	9
13	140	7.7
14	150	9.4
15	160	7
16	170	9.1
17	180	9.3
18	190	9.5
19	200	9.2
20	250	10.6
21	300	11.5
22	400	14.7
23	500	16.2
24	600	17.8
25	700	19.3
26	850	20.9
27	1000	21.6
28	1100	23.3
29	1200	24.6
30	1300	26.5



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 20 of 25 Pages
Model: LEONARDO

8. Appendix 3: Test configuration illustration

This appendix contains the following illustrations:

- * A photo of the front radiated emission test setup:..
- * A photo of the rear radiated emission test setup:



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 21 of 25 Pages
Model: LEONARDO



Radiated emission test setup



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 22 of 25 Pages
Model: LEONARDO



Radiated emission test setup



Test Report No.: 8012305210
Title: Test on Interface Unit

Page 23 of 25 Pages
Model: LEONARDO

9. Appendix 4: Test results

This appendix contains the following plots:

Plot 1. Scan of conducted emission, FCC Part 15 Subpart B Phase line, peak detector

Plot 2. Scan of conducted emissions, FCC Part 15 Subpart B Neutral line, peak detector



THE STANDARDS INSTITUTION OF ISRAEL

Telematics Laboratory

Test Report No.: 8012305210
Title: Test on Interface Unit

Page 24 of 25 Pages
Model: LEONARDO

Plot 1. Conducted emission test result ;Phase line, peak detector