HERMON LABORATORIES

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Electrical

Hermon Laboratories Ltd.
Harakevet Industrial Zone, Binyamina 30500,
Israel
Tel. +972-4-6288001
Fax. +972-4-6288277
E-mail: mail@hermonlabs.com

TEST REPORT

ACCORDING TO:

FCC 47CFR part 15: 2007, subpart B, Class B

ICES-003: 2004 Issue 4, Class B

AS/NZS CISPR 22: 2006, Class B

EN 301 489-4 V1.3.1: 2002, other than telecommunication center equipment

EN 300 386 V1.3.3: 2005, other than telecommunication center equipment

FOR:

Radwin Ltd.

Outdoor Radio Transmission Unit

Brand: WINLINK 1000; MRL

Models: ODU, ACCESS

Frequency bands: 2 – 3 GHz, 4.9 – 6 GHz

Table of contents

1 Applicant information

Client name:	Radwin Ltd.
Address:	32 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3766 2988
Fax:	+972 3766 2922
E-mail:	shlomo_weiss@radwin.com
Contact name:	Mr. Shlomo Weiss

2 Equipment under test attributes

Product name:	Outdoor Radio Transmission Unit
Brand names:	WINLINK 1000; MRL
Models:	ODU/F24, ODU/F58
Serial number:	Prototype
Receipt date:	7/8/2007

3 Manufacturer information

Manufacturer name:	Radwin Ltd.
Address:	32 Habarzel street, Tel Aviv 69710, Israel
Telephone:	+972 3766 2988
Fax:	+972 3766 2922
E-mail:	shlomo_weiss@radwin.com
Contact name:	Mr. Shlomo Weiss

4 Test details

Project ID:	18061
Location:	Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started:	7/8/2007
Test completed:	2/26/2008
Test specifications:	FCC 47CFR part 15: 2007, subpart B, Class B
	ICES-003: 2004 Issue 4, Class B
	AS/NZS CISPR 22: 2006, Class B
	EN 301 489-4 V1.3.1: 2002, other than telecommunication center equipment
	EN 301 489-1 V1.6.1: 2005, other than telecommunication center equipment
	EN 300 386 V1.3.3: 2005, other than telecommunication center equipment

5 Tests summary

Test	Status
FCC 47 CFR part 15, subpart B	
Section 15.107 Class B, AC power lines conducted emissions	Not required*
Section 15.109 Class B, Radiated emissions	Pass
Section 15.111, Spurious emissions at RF antenna connector	Not required
ICES-003	
Section 5.3 Class B, Conducted disturbance measurements	Not required
Section 5.5 Class B, Radiated disturbance measurements	Pass
AS/NZS CISPR 22	
Section 5.1 Class B, Conducted disturbance measurements	Not required
Section 5.2 Class B, Conducted emission measurements at telecommunication port	Not required
Section 6.1 Class B, Radiated disturbance measurements	Pass
EN 301 489-4, other than telecommunication center equipment	
Conducted emission measurements at AC mains input/output port	Not required
Conducted emission measurements at DC power input port	Not required*
Conducted emission measurements at telecommunication port	Not required
Radiated emission measurements, Class B	Pass
Harmonic current emissions at AC mains input port	Not required
Voltage fluctuations and flicker at AC mains input port	Not required
Immunity to electrostatic discharge (ESD)	Pass
Radiated immunity to radio frequency electromagnetic field	Pass
Conducted immunity to electrical fast transients/ bursts (EFT/ B)	Pass
Conducted immunity to voltage surges	Pass
Conducted immunity to disturbances induced by radio frequency field	Pass
Immunity to transients and surges in the vehicular environment	Not required
Conducted immunity to voltage dips and short interruptions	Not required
EN 300 386, other than telecommunication center equipment	
Conducted emission measurements at AC power port	Not required
Conducted emission measurements at DC power port	Not required*
Conducted emission measurements at telecommunication port	Not required
Radiated emission measurements, Class B	Pass
Harmonic current emissions at AC power port	Not required
Voltage fluctuations and flicker at AC power port	Not required
Immunity to electrostatic discharge (ESD)	Pass
Radiated immunity to radio frequency electromagnetic field	Pass
Conducted immunity to electrical fast transients/ bursts (EFT/ B)	Pass
Conducted immunity to voltage surges	Pass
Conducted immunity to disturbances induced by radio frequency field	Pass
Conducted immunity to voltage dips and short interruptions	Not required

* The test was performed at DC power input of IDU as provided in the test report “RDWEMC_18059” issued by Hermon Labs in March 2008.

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.
The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

	Name and Title	Date	Signature
Tested by:	Mr. V. Shmelkin, test engineer	February 26, 2008	
	Mr. L. Markel, test engineer		
Reviewed by:	Ms. N. Averin, certification engineer	March 9, 2008	
Approved by:	Mr. M. Nikishin, EMC and radio group leader	March 27, 2008	

6 EUT description

6.1 General information

The EUT is Outdoor Radio Transmission Unit (ODU) capable of providing data exchange for High Capacity Carrier-Class Radio System. The EUT is powered from -48 VDC obtained from IDU via ODU cable.

According to customer Declaration of Identity, all EUT models ODU, ACCESS operating in 2 – 3 GHz and 4.9 – 6 GHz frequency bands, are electrically / electronically / mechanically identical. Therefore only the following two EUT models were tested: ODU/F24 with 2 GHz link and ODU/F58 with 5 GHz link.

6.2 Ports and lines

Port type	Port description	Connected		Connector type	Qty.	Cable type	Cable length	Indoor / outdoor
		From	To					
Power+signal	ODU	EUT	IDU	RJ 45	1	FTP cat.5e	10 m*	Outdoor
RF	Antenna	EUT	ODU (AE)	N-type	1	Coaxial	2.9 m**	Indoor
GND	GND	EUT	Ground	Screw	1	16 AWG	2 m	Indoor

* May be up to 100 m long.

** Always shorter than 3 m in field installation.

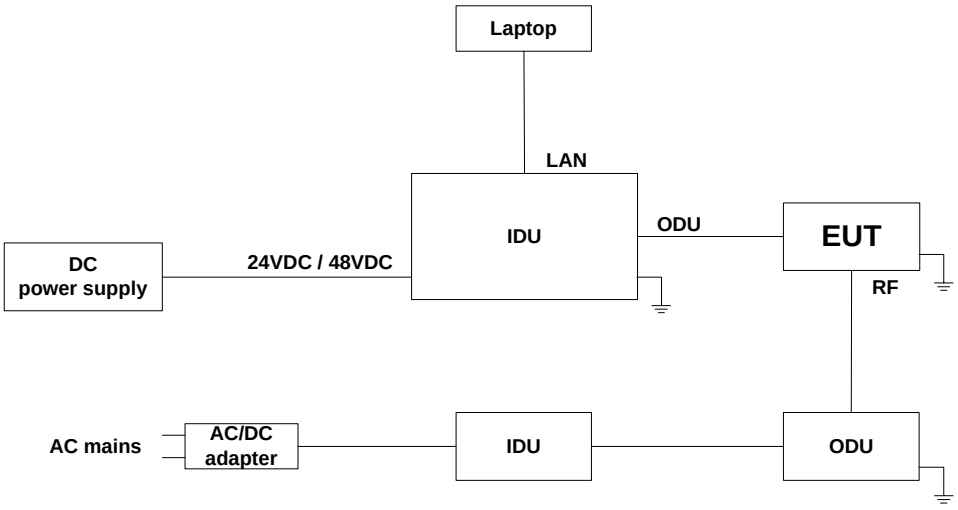
6.3 Auxiliary equipment

Description	Manufacturer	Model number	Serial number
Laptop	Acer	602TER	1902
ODU	Radwin Ltd.	ODU/F24, ODU/F58	Prototype
IDU	Radwin Ltd.	IDU- EO	Prototype
48 VDC power supply	Cisco Systems	ONS 15190-PS	1424-029
24 VDC power supply	Horizon Electronics	DHR3655D	767469

6.4 Operating frequencies

Source	Frequency, MHz		
CLK	25.0	33.33	NA
Tx/Rx (superheterodyne)	2000	5000	NA
LO	400	NA	NA

6.5 Test configuration



6.6 Performance criteria

6.6.1 Performance criteria according to EN 301-489-1

6.6.1.1 Performance criteria for continuous phenomena applied to transmitters and receivers, Section 6.1

The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.
During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.
If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and what the user may reasonably expect from the apparatus if used as intended.

6.6.1.2 Performance criteria for transient phenomena applied to transmitters and receivers, Section 6.2

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.
During the EMC exposure to an electromagnetic phenomenon, degradation of performance is however allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.
If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation, and what the user may reasonably expect from the apparatus if used as intended.

6.6.1.3 Performance criteria for equipment which does not provide a continuous communication link, Section 6.3

For radio equipment, which does not provide a continuous communication link, the performance criteria described in the clauses above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

6.6.1.4 Performance criteria for ancillary equipment tested on a stand alone basis, Section 6.4

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in the clauses above are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

6.6.1.5 Performance criteria for voltage dips and interruptions, Section 9.7.3

For a voltage dip corresponding to a reduction of the supply voltage of 30% for 10 ms:

- for transmitters the performance criteria for transient phenomena for transmitter shall apply;
- for receivers the performance criteria for transient phenomena for receiver shall apply;
- for ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter, in which case the corresponding performance criteria above shall apply.

For a voltage dip corresponding to a reduction of the supply voltage of 60% for 100 ms and/or a voltage interruption corresponding to a reduction of the supply voltage >95% for 5000 ms:

- in the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena for transmitters or for receivers shall apply;
- in the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need to be maintained and lost functions should be recoverable by user or operator;
- no unintentional responses shall occur at the end of the test;
- in the event of loss of function(s) or in the event of loss the stored data, this fact shall be recorded in the test report; for ancillary equipment the pass/failure criteria supplied by the manufacturer shall apply, unless the ancillary equipment is tested in connection with a receiver or transmitter, in which case the corresponding performance criteria above shall apply.

6.6.2 General performance criteria according to EN 301-489-4

6.6.2.1 Performance criteria for continuous phenomena applied to transmitters (CT) and receivers (CR), Section 6.1

The provision of EN 301 489-1, Section 6.1 shall apply with the following modifications.
The communication link shall be maintained during and after the test.
The specific performance criteria of Section 6.3 of EN 301 489-4, for continuous phenomena, shall additionally apply.

6.6.2.2 Performance criteria for transient phenomena applied to transmitters (TT) and receivers (TR), Section 6.2

The provision of EN 301 489-1, Section 6.2 shall apply with the following modifications.
The communication link shall be maintained during and after the test.
The specific performance criteria of Section 6.3 of EN 301 489-4, for transient phenomena, shall additionally apply.

6.6.3 Specific performance criteria according to EN 301-489-4

6.6.3.1 Digital signal ports, Section 6.3.1

The performance of the equipment shall be verified for digital signal ports:

- by measuring the number of induced bit errors on the main signal port during all exposures;
- by testing the functionality of the main signal port and the other signal ports after the exposure;
- by verifying that corruption of software and data held in memory has not occurred.

To allow for background errors, which may occur at any time, the test can be repeated up to three times to determine any correlation between eventual errors and the EMC phenomena.

6.6.3.1.1 Performance criteria for continuous phenomena

The number of bit errors at each individual exposure shall not exceed the maximum number of errors stated by the manufacturer for intended operation.
The number of errors is calculated as:
(the maximum bit error ratio specified by the manufacturer) x (bit rate) x (test time).
The test time is taken to be the dwell time at each frequency of the exposure.

6.6.3.1.2 Performance criteria for transient phenomena

Loss of frame or loss of synchronization is not allowed during each individual exposure. No alarms shall be generated as a result of the electromagnetic stress.
The above does not apply to surge testing, where some loss of frame alignment may be expected. For this test, the EUT shall operate as intended following the cessation of the exposure.

6.6.3.2 Ethernet and packet-data interfaces, Section 6.3.3

To interfaces operating in packet mode the criteria below shall be applied.

6.6.3.2.1 Performance criteria for continuous phenomena

For interfaces, which are intended for the transmission of third party data traffic, a selected port shall be connected to test equipment (e.g. data communication analyzer) as a single point-to-point data link. This will avoid excessive failed transmission attempts caused by data collisions and bus contention problems.
The interface shall be suitable exercised and monitored throughout the test period for errored frames.
No more than 5% additional errored frames above the quiescent level shall be permitted during the exposure.

6.6.3.2.2 Performance criteria for transient phenomena

The data link connection shall be maintained.

6.6.4 Performance criteria for ancillary equipment tested on a stand alone basis according to EN 301-489-4, Section 6.4

The provision of EN 301 489-1, Section 6.4 shall apply.

6.6.5 Performance criteria for voltage interruptions according to EN 301 489-4, Section 7.2.2

For voltage interruptions, temporary loss of function is allowed, provided the function is self-recoverable or cal be restored by the operation of the controls.

6.6.6 General performance criteria of EN 300 386, Section 10

6.6.6.1 Performance criterion A

The equipment shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

6.6.6.2 Performance criterion B

The equipment shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

During the exposure to an electromagnetic phenomenon, degradation of performance is, however, allowed. No change of actual operating state or stored data is allowed.

If the manufacturer does not specify the minimum performance level or the permissible performance loss, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

6.6.6.3 Performance criterion C

Temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls, or, in the case of switching equipment, by normal subsequent use.

6.6.7 Specific performance criteria of EN 300 386, Section 12 (Transmission equipment specific requirements)

6.6.7.1 12.3.1 Digital signal ports

Performance criterion A:

The performance of the equipment shall be verified by measuring the additional errors induced due to the application of any electromagnetic phenomena. During the test sweep the established connection shall be maintained throughout the testing and the transfer of information shall be without any reproducible bit errors. If degradation in performance is observed and the system is adaptive i.e. has capability to automatically re-train in the presence of an interfering signal, then for conducted immunity tests only the following procedure shall be followed:

- For each range of interfering frequencies, where degradation in performance is observed, three frequencies (beginning, middle and end) shall be identified.
- At each of the frequencies identified in step 1, the interfering signal shall be turned and the system allowed to re-train. If the system is able to re-train and then function with respect to the performance criteria A then the system performance is considered acceptable.
- The frequencies identified in step 1 shall be recorded in the test report.

Performance criterion B:

Loss of frame alignment is not allowed during each individual exposure. No alarms shall be generated as a result of the electromagnetic stress.

The above does not apply to surge testing, where some loss of frame alignment may be expected. For this test, the EUT shall operate as intended following the cessation of the exposure.

Performance criterion C:

The general performance criterion C applies.

6.6.7.2 12.3.7 Ethernet and packet-data interfaces

Performance criterion A:

For interfaces, which are intended for the transmission of third party data traffic, a selected port shall be connected to test equipment (e.g. data communications analyzer) as a single point-to-point data link. This will avoid excessive failed transmission attempts caused by data collisions and bus contention problems.

The interface shall be suitable exercised and monitored throughout the test period for errored frames.

No more than 5% additional errored frames above the quiescent level shall be permitted during the exposure.

Performance criterion B:

The established connections shall be maintained throughout testing except in the case of surge immunity testing at 1 kV, where disconnection is allowed on the port being tested.

6.7 Acceptance criteria

6.7.1 Acceptance criterion A

The radio link shall be maintained during and after the test.

6.7.2 Acceptance criterion B

The radio link down for max. 1.5 min is allowed during the test. The EUT shall self recover its normal operation after the test as described in acceptance criterion A.

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

7 Emissions tests according to FCC 47CFR part 15 subpart B requirements

7.1 Radiated emission measurements

7.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*

* - The limit for a test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – the standard defined and the test distance respectively in meters.

7.1.2 Test procedure

7.1.2.1 The EUT was set up as shown in Figure 7.1.1 and the associated photographs, energized and the EUT performance was checked.

7.1.2.2 The preliminary measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

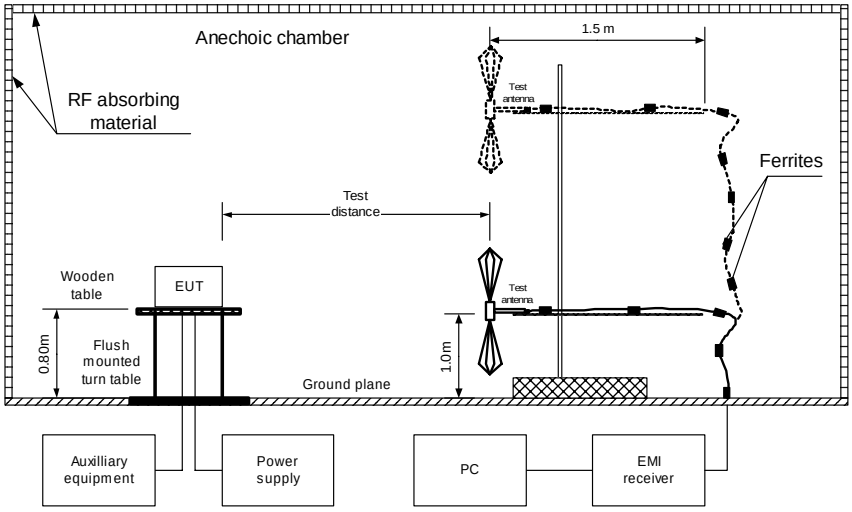
7.1.2.3 The EUT was set up as shown in Figure 7.1.2 and the associated photographs, energized and the EUT performance was checked.

7.1.2.4 The final measurements were performed at the open area test site at 3 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. At frequencies, where the high ambient noise was encountered, the final measurements were taken in the semi anechoic chamber at 3 m distance.

7.1.2.5 The worst test results with respect to the limits were recorded in Table 7.1.2, Table 7.1.3 and shown in the associated plots.

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

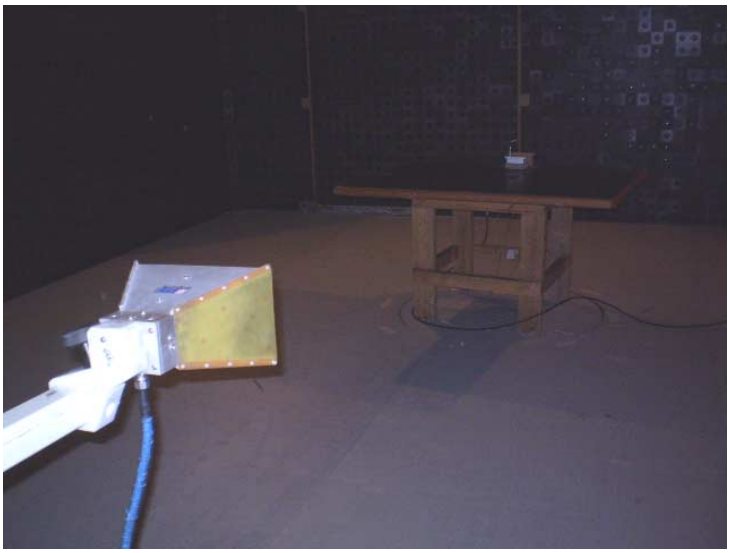
Figure 7.1.1 Setup for radiated emission measurements in semi anechoic chamber, table-top EUT



Photograph 7.1.1 Setup for radiated emission measurements in semi anechoic chamber below 1 GHz EUT model ODU/F24

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

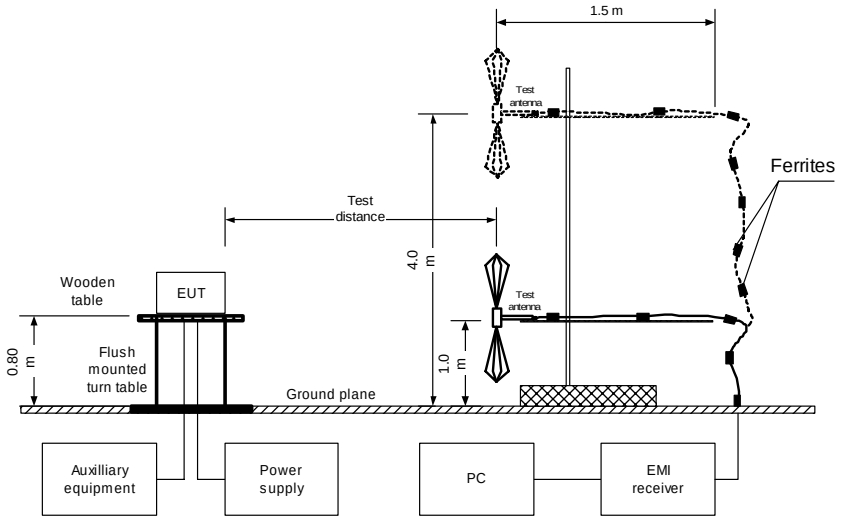
Photograph 7.1.2 Setup for radiated emission measurements in semi anechoic chamber above 1 GHz
EUT model ODU/F24



Photograph 7.1.3 Setup for radiated emission measurements in semi anechoic chamber
EUT model ODU/F58

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

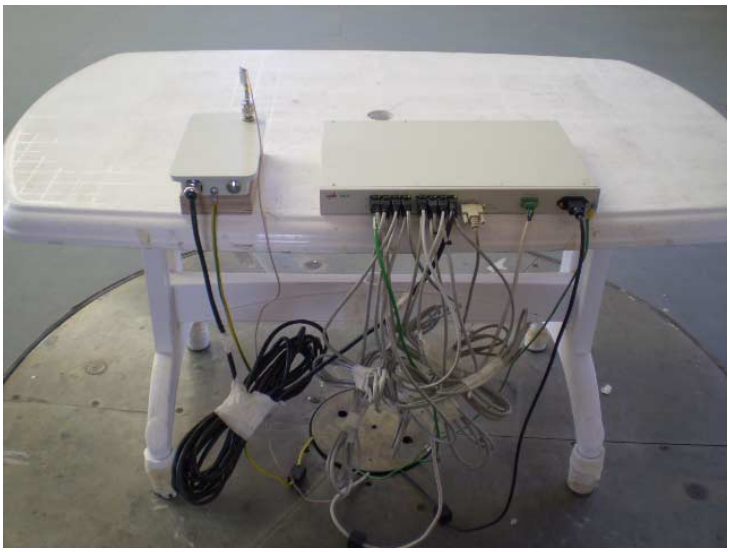
Figure 7.1.2 Setup for radiated emission measurements at OATS, table-top EUT



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Photograph 7.1.4 Setup for radiated emission measurements at OATS, general view
EUT model ODU/F24

Photograph 7.1.5 Setup for radiated emission measurements at OATS, EUT cabling
EUT model ODU/F24



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Table 7.1.2 Radiated emission test results, EUT model ODU/F24

EUT SET UP: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz
TEST SITE: OATS
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
36.176000	41.09	36.89	40.00	-3.11	Vertical	1.0	169	Pass
153.777000	38.96	35.53	43.50	-7.97	Vertical	1.2	188	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
79.772500	33.31	31.77	40.00	-8.23	Vertical	1.0	281	Pass
96.825000	34.40	33.42	43.50	-10.08	Vertical	1.0	150	
106.575000	39.98	39.26	43.50	-4.24	Vertical	1.0	064	
125.445000	37.02	36.24	43.50	-7.26	Vertical	1.0	100	

FREQUENCY RANGE: 1000 MHz – 4000 MHz
DETECTOR USED: PEAK
RESOLUTION BANDWIDTH: 1000 kHz
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No emissions were found.								Pass

*- Margin = Measured emission - specification limit.
**- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0032	HL 0415	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 0784	HL 0812	HL 1430	HL 1552	HL 1848	HL 1947	HL 1984	HL 2009

Full description is given in Appendix A.

Test specification:	**Section 15.109 Class B, Radiated emissions**		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 33 %	**Power Supply:** -48 VDC
Remarks:			

Table 7.1.3 Radiated emission test results, EUT model ODU/F58

EUT SET UP: TABLE-TOP
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
36.157000	42.31	39.56	40.00	-0.44	Vertical	1.0	180	Pass
43.798750	36.17	32.01	40.00	-7.99	Vertical	1.0	0	
51.050000	32.27	27.79	40.00	-12.21	Vertical	1.2	3	
77.207625	37.95	34.31	40.00	-5.69	Vertical	1.5	110	
110.802500	30.31	26.08	43.50	-17.42	Vertical	1.0	180	
143.295000	29.47	25.88	43.50	-17.62	Vertical	1.0	270	

FREQUENCY RANGE: 1000 MHz – 10000 MHz
DETECTOR USED: PEAK
RESOLUTION BANDWIDTH: 1000 kHz
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
No emissions were found.								Pass

*****- Margin = Measured emission - specification limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

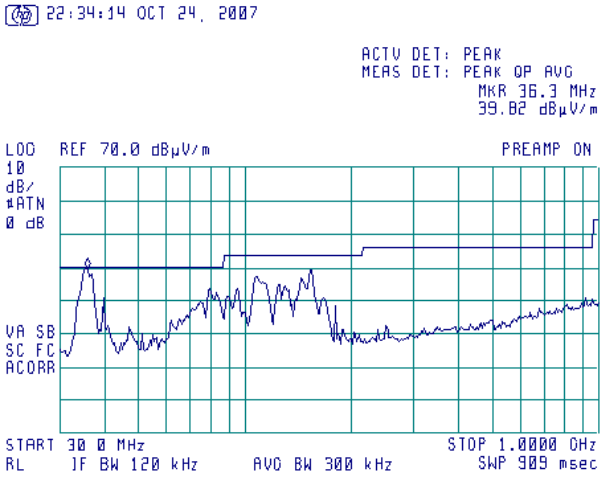
HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 1947	HL 1984
HL 2009							

Full description is given in Appendix A.

Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

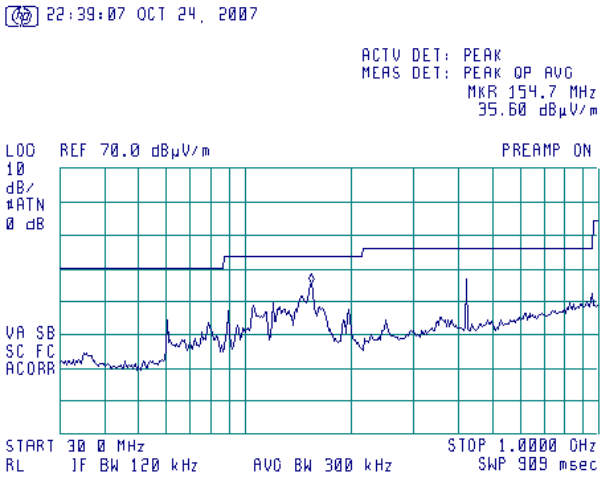
Plot 7.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F24

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F24

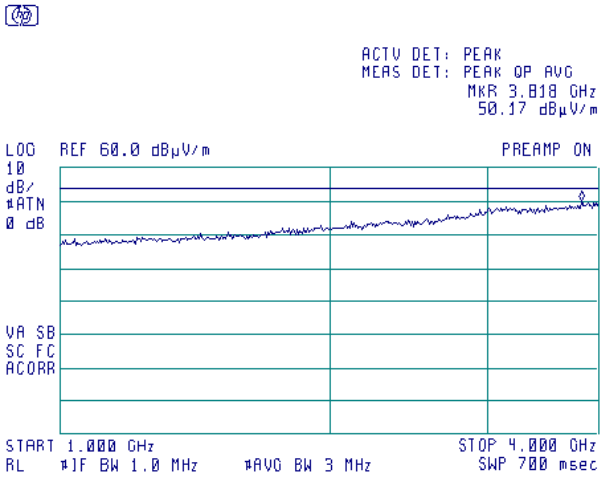
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

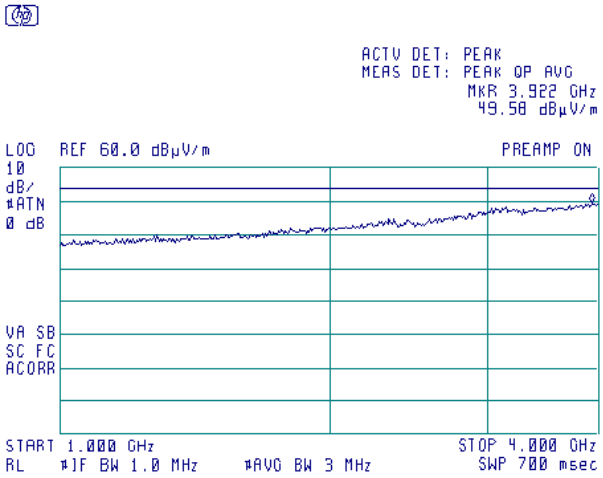
Plot 7.1.3 Radiated emission measurements in 1000 – 4000 MHz range, vertical antenna polarization
EUT model ODU/F24

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.4 Radiated emission measurements in 1000 – 4000 MHz range, horizontal antenna polarization
EUT model ODU/F24

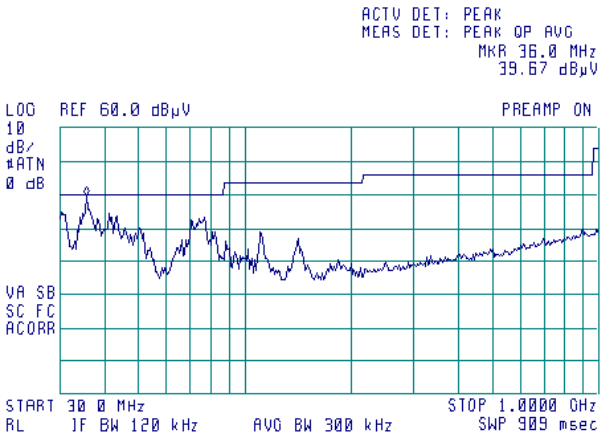
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

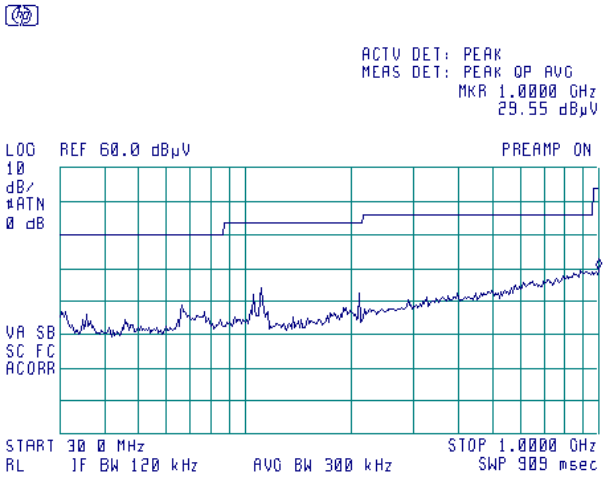
Plot 7.1.5 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.6 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F58

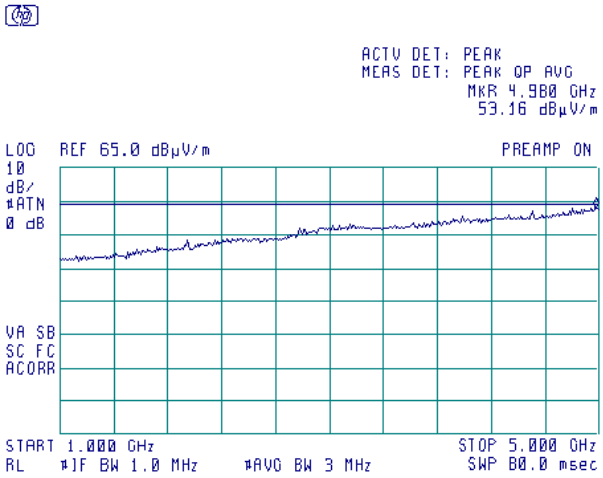
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

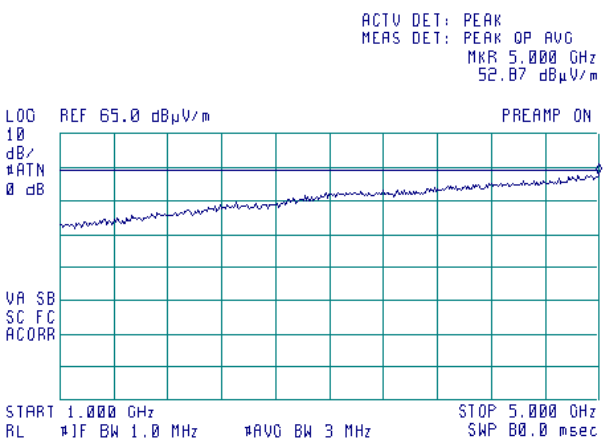
Plot 7.1.7 Radiated emission measurements in 1000 – 5000 MHz range, vertical antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.8 Radiated emission measurements in 1000 – 5000 MHz range, horizontal antenna polarization
EUT model ODU/F58

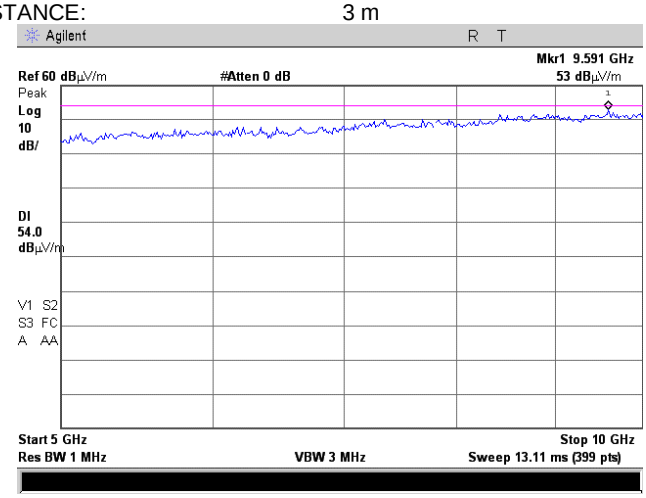
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 15.109 Class B, Radiated emissions		
Test procedure:	ANSI C63.4, Section 11.6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

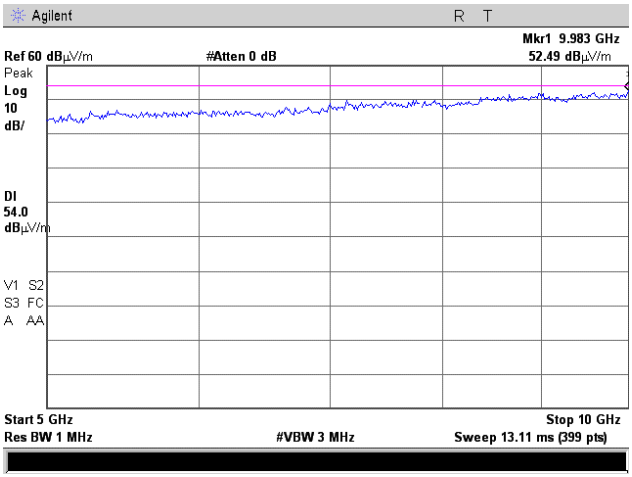
Plot 7.1.9 Radiated emission measurements in 5000 – 10000 MHz range, vertical antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 7.1.10 Radiated emission measurements in 5000 – 10000 MHz range, horizontal antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

8 Emissions tests according to ICES-003 requirements

8.1 Radiated disturbance measurements

8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 8.1.1.

Table 8.1.1 Radiated disturbance test limits

Frequency, MHz	Class B limit, dB(µV/m)		Class A limit, dB(µV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 230	30.0	40.5*	40.0	50.5*
230 - 1000	37.0	47.5*	47.0	57.5*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and the associated photographs, energized and the EUT performance was checked.

8.1.2.2 The preliminary measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

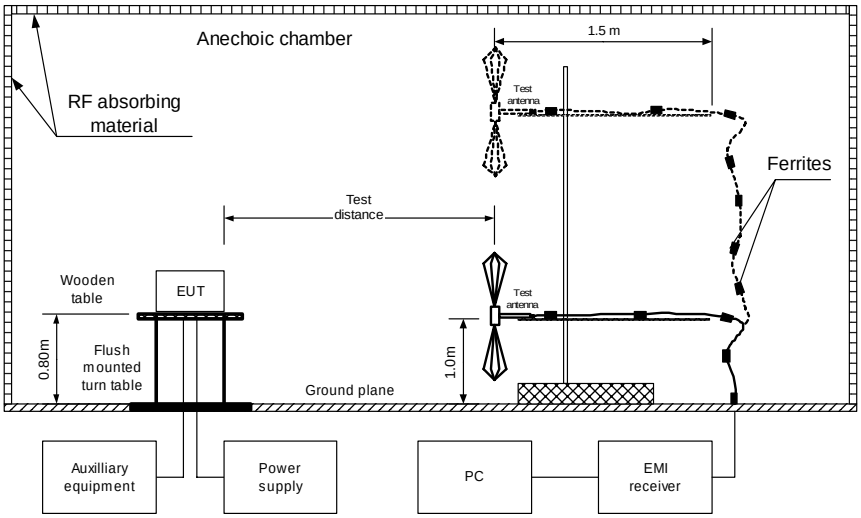
8.1.2.3 The EUT was set up as shown in Figure 8.1.2 and the associated photographs, energized and the EUT performance was checked.

8.1.2.4 The final measurements were performed at the open area test site at 3 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. At frequencies, where the high ambient noise was encountered, the final measurements were taken in the semi anechoic chamber at 3 m distance.

8.1.2.5 The worst test results with respect to the limits were recorded in Table 8.1.2, Table 8.1.3 and shown in the associated plots.

Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Figure 8.1.1 Setup for radiated disturbance measurements in semi anechoic chamber, table-top EUT



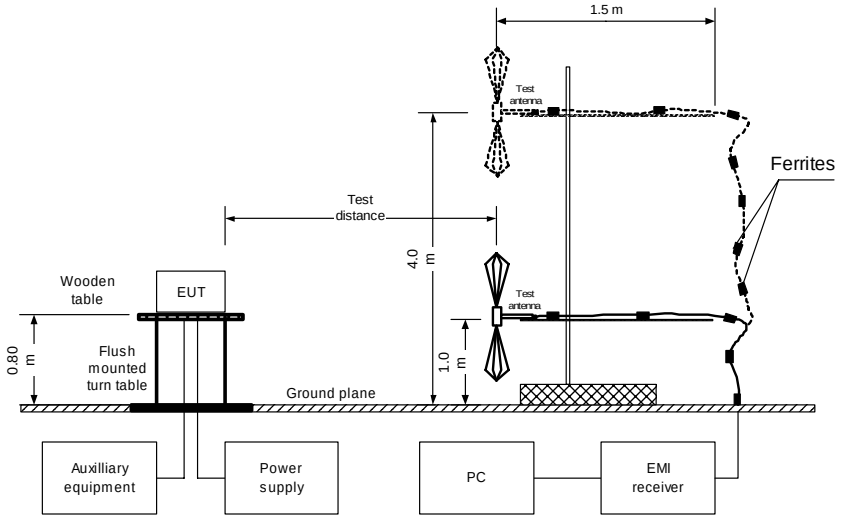
Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Photograph 8.1.1 Setup for radiated disturbance measurements in semi anechoic chamber
EUT model ODU/F24

Photograph 8.1.2 Setup for radiated disturbance measurements in semi anechoic chamber
EUT model ODU/F58

Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

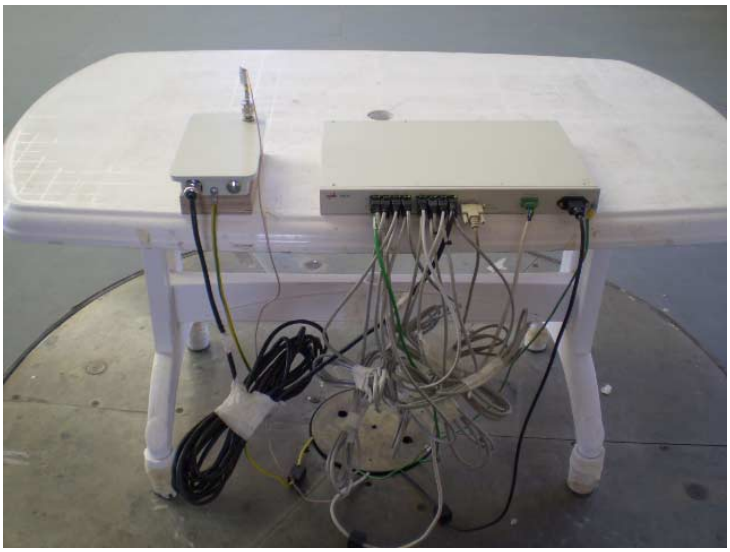
Figure 8.1.2 Setup for radiated disturbance measurements at OATS, table-top EUT



Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Photograph 8.1.3 Setup for radiated disturbance measurements at OATS, general view
EUT model ODU/F24

Photograph 8.1.4 Setup for radiated disturbance measurements at OATS, EUT cabling
EUT model ODU/F24



Test specification:	**Section 5.5 Class B, Radiated disturbance measurements**		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 33 %	**Power Supply:** -48 VDC
Remarks:			

Table 8.1.2 Radiated disturbance test results, EUT model ODU/F24

EUT SET UP: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz
TEST SITE: OATS
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
36.176000	41.09	36.89	40.50	-3.61	Vertical	1.0	169	Pass
153.777000	38.96	35.53	40.50	-4.97	Vertical	1.2	188	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
79.772500	33.31	31.77	40.50	-8.73	Vertical	1.0	281	Pass
96.825000	34.40	33.42	40.50	-7.08	Vertical	1.0	150	
106.575000	39.98	39.26	40.50	-1.24	Vertical	1.0	064	
125.445000	37.02	36.24	40.50	-4.26	Vertical	1.0	100	

*****- Margin = Measured emission - specification limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0032	HL 0415	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 0784	HL 0812	HL 1430	HL 1552	HL 1848	HL 2009		

Full description is given in Appendix A.

Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Table 8.1.3 Radiated disturbance test results, EUT model ODU/F58

EUT SET UP: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
36.157000	42.31	39.56	40.50	-0.94	Vertical	1.0	180	Pass
43.798750	36.17	32.01	40.50	-8.49	Vertical	1.0	0	
51.050000	32.27	27.79	40.50	-12.71	Vertical	1.2	3	
77.207625	37.95	34.31	40.50	-6.19	Vertical	1.5	110	
110.802500	30.31	26.08	40.50	-14.42	Vertical	1.0	180	
143.295000	29.47	25.88	40.50	-14.62	Vertical	1.0	270	

*****- Margin = Measured emission - specification limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

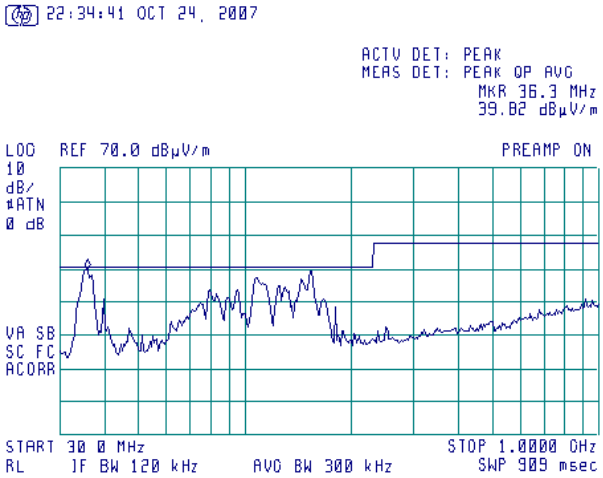
HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 2009	

Full description is given in Appendix A.

Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

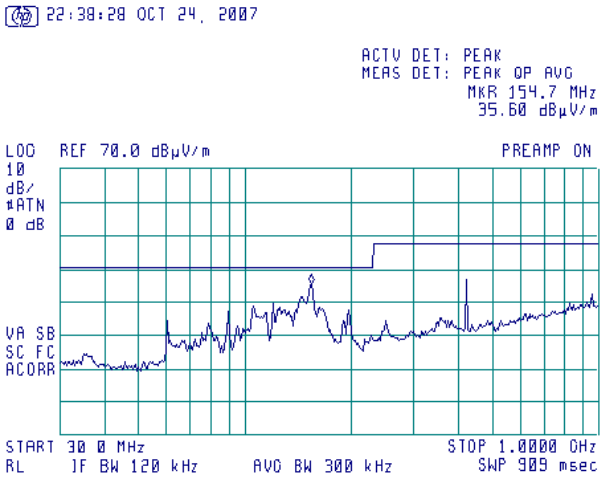
Plot 8.1.1 Radiated disturbance measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F24

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 8.1.2 Radiated disturbance measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F24

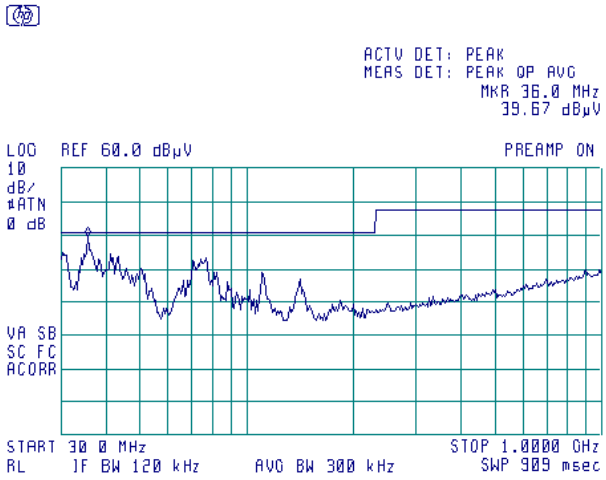
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Section 5.5 Class B, Radiated disturbance measurements		
Test procedure:	CAN/CSA-CEI/IEC CISPR 22, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

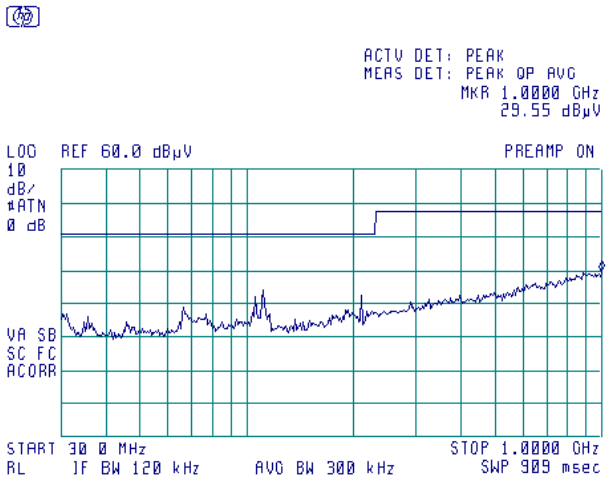
Plot 8.1.3 Radiated disturbance measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 8.1.4 Radiated disturbance measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

9 Emissions tests according to EN 301 489-4 and EN 300 386 requirements

9.1 Radiated emission measurements

9.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. The specification test limits are given in Table 9.1.1.

Table 9.1.1 Radiated emission limits

Frequency, MHz	Class B limit, dB(µV/m)		Class A limit, dB(µV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 230	30.0	40.5*	40.0	50.5*
230 - 1000	37.0	47.5*	47.0	57.5*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2)$,
where S_1 and S_2 – standard defined and test distance respectively in meters.

9.1.2 Test procedure

9.1.2.1 The EUT was set up as shown in Figure 9.1.1 and the associated photographs, energized and the EUT performance was checked.

9.1.2.2 The preliminary measurements were performed in the semi anechoic chamber at 3 m test distance. The specified frequency range was investigated with the antenna connected to the EMI receiver. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. The EUT cables position was varied to maximize emission.

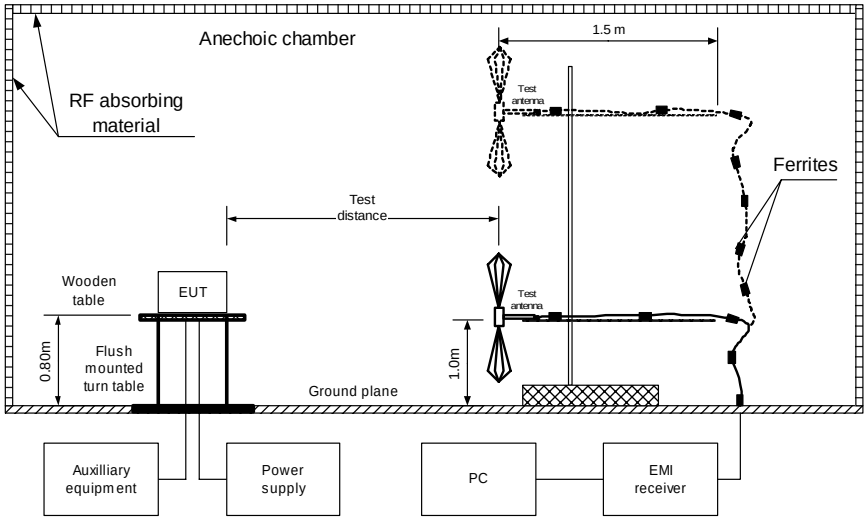
9.1.2.3 The EUT was set up as shown in Figure 9.1.2 and the associated photographs, energized and the EUT performance was checked.

9.1.2.4 The final measurements were performed at the open area test site at 3 m test distance with the antenna connected to the EMI receiver. The EUT wires and cables were arranged to produce the highest emission as it was found during the preliminary measurements. The frequencies, produced the highest emissions with respect to the limits during the preliminary test were investigated. To find the highest emission the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal polarizations. At frequencies, where the high ambient noise was encountered, the final measurements were taken in the semi anechoic chamber at 3 m distance.

9.1.2.5 The worst test results with respect to the limits were recorded in Table 9.1.2, Table 9.1.3 and shown in the associated plots.

Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Figure 9.1.1 Setup for radiated emission measurements in semi anechoic chamber, table-top EUT



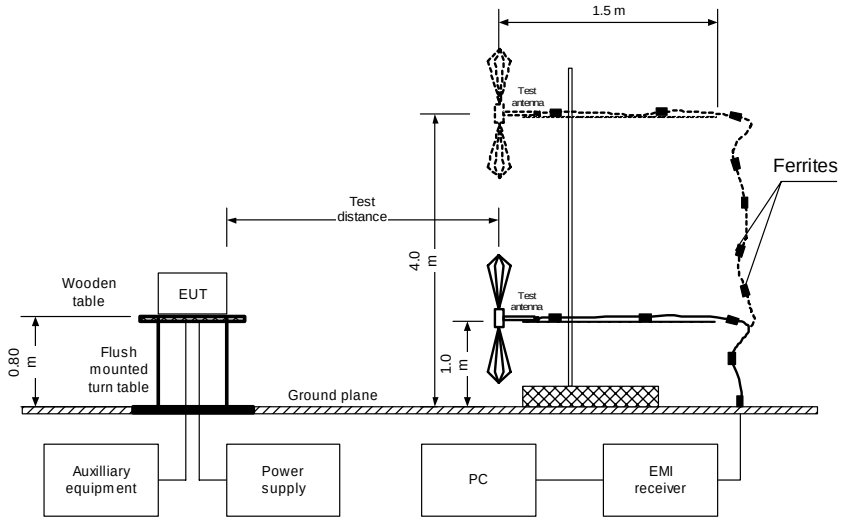
Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Photograph 9.1.1 Setup for radiated emission measurements in semi anechoic chamber
EUT model ODU/F24

Photograph 9.1.2 Setup for radiated emission measurements in semi anechoic chamber
EUT model ODU/F58

Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

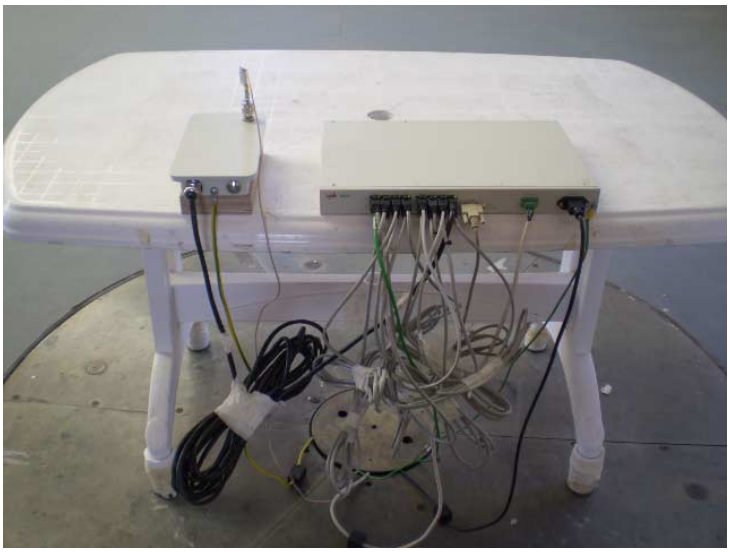
Figure 9.1.2 Setup for radiated emission measurements at OATS, table-top EUT



Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Photograph 9.1.3 Setup for radiated emission measurements at OATS, general view
EUT model ODU/F24

Photograph 9.1.4 Setup for radiated emission measurements at OATS, EUT cabling
EUT model ODU/F24



Test specification:	**Radiated emission measurements, Class B**		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 33 %	**Power Supply:** -48 VDC
Remarks:			

Table 9.1.2 Radiated emission test results, EUT model ODU/F24

EUT SET UP: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz
TEST SITE: OATS
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
36.176000	41.09	36.89	40.50	-3.61	Vertical	1.0	169	Pass
153.777000	38.96	35.53	40.50	-4.97	Vertical	1.2	188	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	Peak emission, dB(µV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
79.772500	33.31	31.77	40.50	-8.73	Vertical	1.0	281	Pass
96.825000	34.40	33.42	40.50	-7.08	Vertical	1.0	150	
106.575000	39.98	39.26	40.50	-1.24	Vertical	1.0	064	
125.445000	37.02	36.24	40.50	-4.26	Vertical	1.0	100	

*****- Margin = Measured emission - specification limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0032	HL 0415	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604
HL 0784	HL 0812	HL 1430	HL 1552	HL 1848	HL 2009		

Full description is given in Appendix A.

Test specification:	**Radiated emission measurements, Class B**		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 33 %	**Power Supply:** -48 VDC
Remarks:			

Table 9.1.3 Radiated emission test results, EUT model ODU/F58

EUT SET UP: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 1000 MHz
DETECTORS USED: PEAK / QUASI-PEAK
RESOLUTION BANDWIDTH: 120 kHz
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m

Frequency, MHz	**Peak emission, dB(µV/m)**	**Quasi-peak**			**Antenna polarization**	**Antenna height, m**	**Turn-table position**, degrees**	**Verdict**
		Measured emission, dB(µV/m)	**Limit, dB(µV/m)**	**Margin, dB***				
36.157000	42.31	39.56	40.50	-0.94	Vertical	1.0	180	Pass
43.798750	36.17	32.01	40.50	-8.49	Vertical	1.0	0	
51.050000	32.27	27.79	40.50	-12.71	Vertical	1.2	3	
77.207625	37.95	34.31	40.50	-6.19	Vertical	1.5	110	
110.802500	30.31	26.08	40.50	-14.42	Vertical	1.0	180	
143.295000	29.47	25.88	40.50	-14.62	Vertical	1.0	270	

*****- Margin = Measured emission - specification limit.
******- EUT front panel refers to 0 degrees position of turntable.

Reference numbers of test equipment used

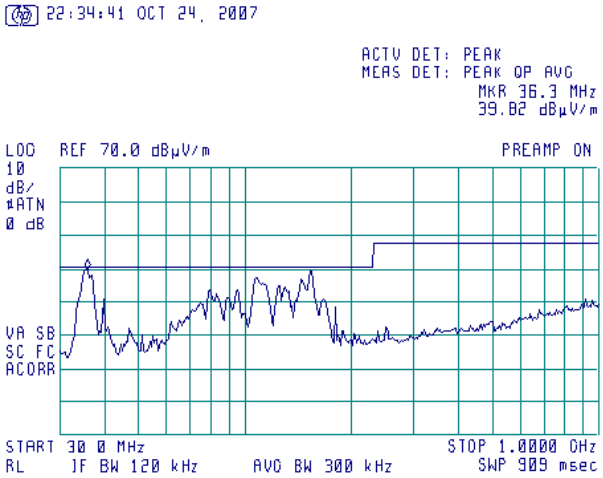
HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 2009	

Full description is given in Appendix A.

Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

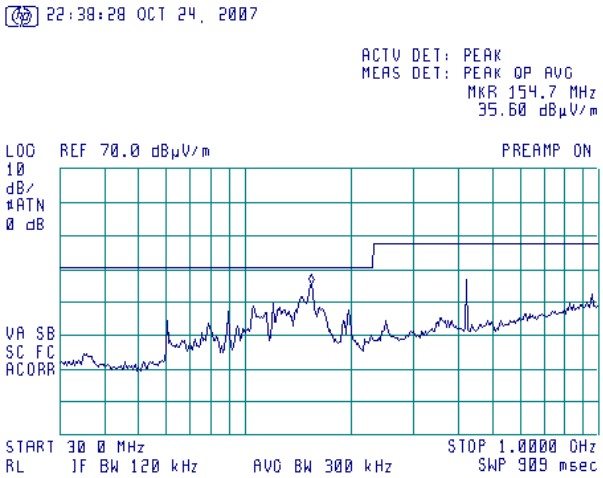
Plot 9.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F24

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 9.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F24

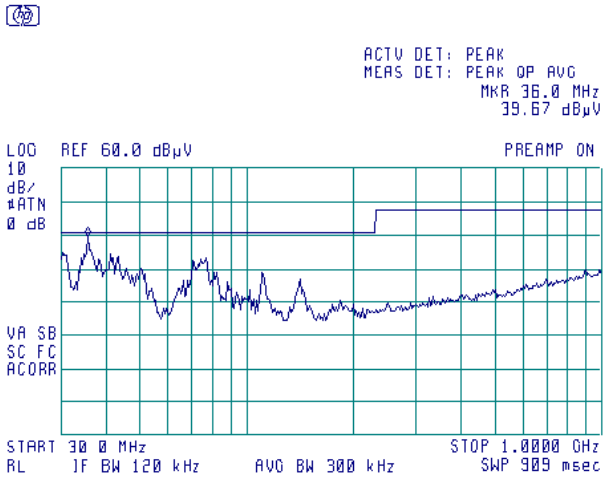
TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Radiated emission measurements, Class B		
Test procedure:	EN 301 489-1, Section 8.2; EN 300 386, Section 7.1.1; EN 55022 Class B, Section 6		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/30/2007 5:23:15 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

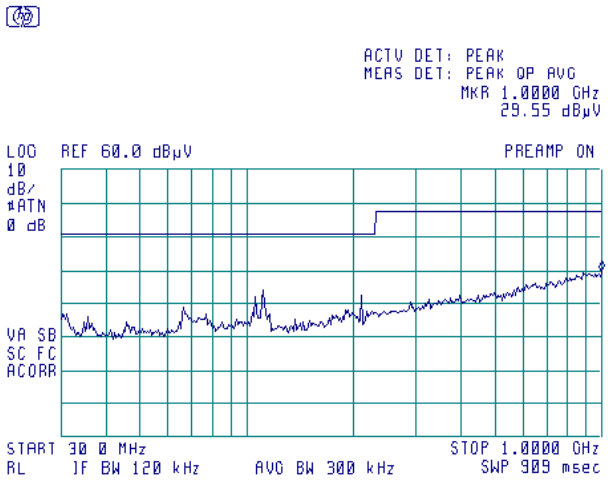
Plot 9.1.3 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Plot 9.1.4 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization
EUT model ODU/F58

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m



Test specification:	Immunity to electrostatic discharge (ESD)		
Test procedure:	EN 61000-4-2; EN 301 489-1, Section 9.3; EN 300 386, Section 7.2.2.1.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/28/2008 12:41:12 PM		
Temperature: 23.3 ºC	Air Pressure: 1015 hPa	Relative Humidity: 53 %	Power Supply: -48 VDC
Remarks:			

10 Immunity tests according to EN 301 489-4 and EN 300 386 requirements

10.1 Immunity to electrostatic discharge (ESD)

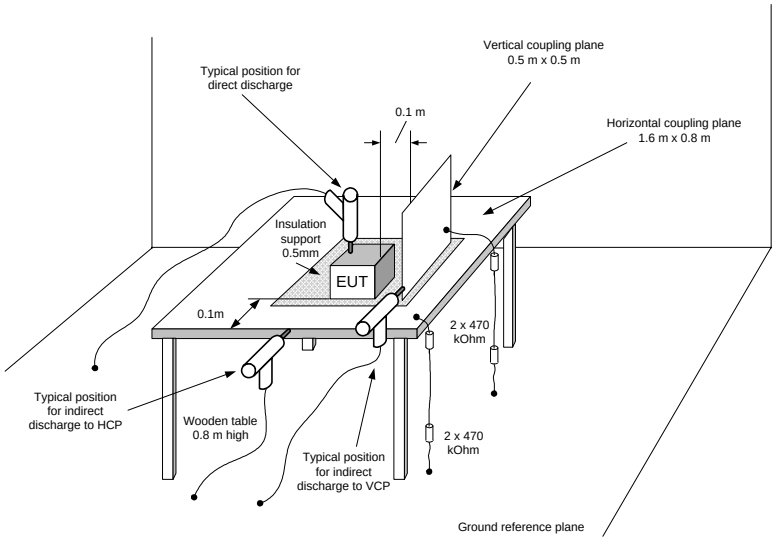
10.1.1 General

This test was performed to verify the EUT immunity to electrostatic discharges from operators directly and from adjacent objects. The ESDs were applied to all parts of the EUT, which are accessible during normal operation and maintenance.
The ESD levels, performance criterion and test results are referred to in Table 10.1.1.

10.1.2 Test procedure

10.1.2.1 The EUT was set up as shown in Figure 10.1.1 and the associated photographs, energized and the EUT performance was checked.
10.1.2.2 Single contact discharges of both polarities with 1 s time interval between pulses were applied to the horizontal coupling plane (HCP) at 10 centimeter distance from the EUT. Each side of the EUT was subjected to ESDs.
10.1.2.3 Single contact discharges of both polarities with 1 s time interval between pulses were applied to the vertical coupling plane (VCP) placed 10 centimeters from the EUT. The VCP was moved, in turn, to all sides of the EUT and it was subjected to the ESDs.
10.1.2.4 Single contact discharges of both polarities with 1 s time interval between pulses were applied to conductive parts of the EUT cabinet.
10.1.2.5 Single air discharges of both polarities with 1 s time interval between pulses were applied to non-conductive parts of the EUT.
10.1.2.6 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.
10.1.2.7 Upon this the test was completed.

Figure 10.1.1 Setup for immunity to ESD, table-top EUT



Test specification:	Immunity to electrostatic discharge (ESD)		
Test procedure:	EN 61000-4-2; EN 301 489-1, Section 9.3; EN 300 386, Section 7.2.2.1.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/28/2008 12:41:12 PM		
Temperature: 23.3 ºC	Air Pressure: 1015 hPa	Relative Humidity: 53 %	Power Supply: -48 VDC
Remarks:			

Photograph 10.1.1 Setup for immunity to ESD, general view

Photograph 10.1.2 Setup for immunity to ESD, EUT test points

Test specification:	**Immunity to electrostatic discharge (ESD)**		
Test procedure:	EN 61000-4-2; EN 301 489-1, Section 9.3; EN 300 386, Section 7.2.2.1.1		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	1/28/2008 12:41:12 PM		
Temperature: 23.3 ºC	**Air Pressure:** 1015 hPa	**Relative Humidity:** 53 %	**Power Supply:** -48 VDC
Remarks:			

Table 10.1.1 Immunity to ESD test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: TT/TR / B
NUMBER OF DISCHARGES AT EACH POINT & EACH LEVEL: 10 POSITIVE / 10 NEGATIVE

ESD applied to	Test voltage, kV	Number of test points	EUT performance description during the test	Verdict
EUT model ODU/F24 in transceive mode				
Air discharge				
EUT	2	10*	NP	Pass
	4		NP	
	8		NP	
Contact discharge				
EUT	2	20	NP	Pass
	4		NP	
	6		NP	
HCP	2	4	NP	Pass
	4		NP	
	6		NP	
VCP	2	4	NP	Pass
	4		NP	
	6		NP	
EUT model ODU/F58 in transceive mode				
Air discharge				
EUT	2	10*	NP	Pass
	4		NP	
	8		NP	
Contact discharge				
EUT	2	20	NP	Pass
	4		NP	
	6		NP	
HCP	2	4	NP	Pass
	4		NP	
	6		NP	
VCP	2	4	NP	Pass
	4		NP	
	6		NP	

* 10 positive / 10 negative air discharges were applied only to the test points, where discharges occurred. At all other points dielectric was examined for sufficient insulation to prevent disruption.

Reference numbers of test equipment used

HL 0511	HL 2328	HL 2357	HL 2735	HL 2959			

Full description is given in Appendix A.

Test specification:	Radiated immunity to radio frequency electromagnetic field		
Test procedure:	EN 61000-4-3; EN 301 489-1, Section 9.2; EN 300 386, Section 7.2.2.1.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/27/2007 4:36:23 PM		
Temperature: 25 ºC	Air Pressure: 1022 hPa	Relative Humidity: 34 %	Power Supply: -48 VDC
Remarks:			

10.2 Radiated immunity to radio frequency electromagnetic field

10.2.1 General

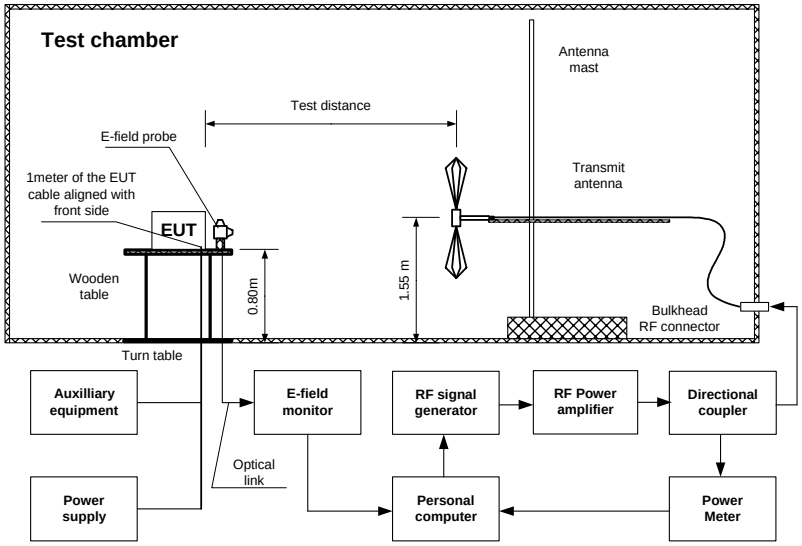
This test was performed to verify the EUT immunity to radiated radio frequency electromagnetic field.
The radiated RF electromagnetic field levels, performance criterion and test results are referred to in Table 10.2.1.

10.2.2 Test procedure

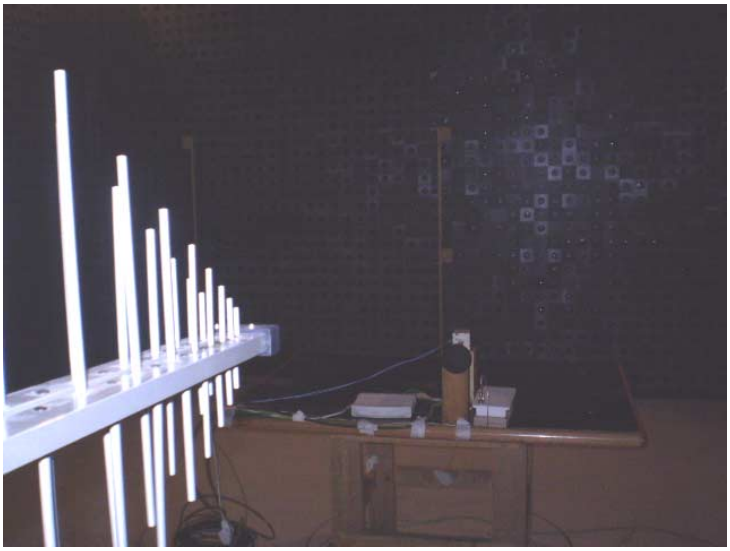
10.2.2.1 The EUT was set up as shown in Figure 10.2.1 and the associated photographs, energized and the EUT performance was checked.
10.2.2.2 The electric field generating antenna was installed facing the EUT front panel at the specified distance.
10.2.2.3 The test setup was adjusted to produce the required field strength level. The field strength was monitored by the isotropic field probe, which was placed near the EUT.
10.2.2.4 The signal frequency was scanned throughout the frequency range.
10.2.2.5 The test was performed with the antennas in both vertical and horizontal polarization.
10.2.2.6 The test was repeated at selected frequencies.
10.2.2.7 The test was repeated for the rest of the EUT orientations.
10.2.2.8 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.
10.2.2.9 Upon this the test was completed.

Test specification:	Radiated immunity to radio frequency electromagnetic field		
Test procedure:	EN 61000-4-3; EN 301 489-1, Section 9.2; EN 300 386, Section 7.2.2.1.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/27/2007 4:36:23 PM		
Temperature: 25 ºC	Air Pressure: 1022 hPa	Relative Humidity: 34 %	Power Supply: -48 VDC
Remarks:			

Figure 10.2.1 Setup for radiated immunity to RF electromagnetic field test, table-top EUT

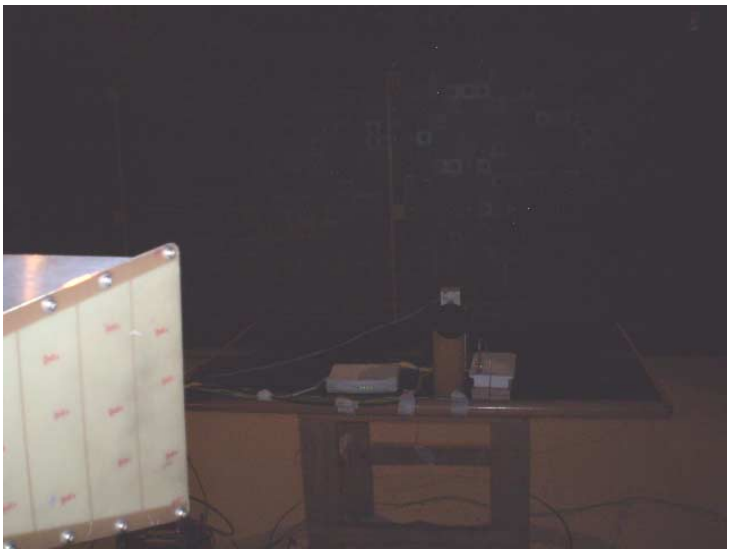


Photograph 10.2.1 Setup for radiated immunity to RF electromagnetic field test below 1 GHz, general view

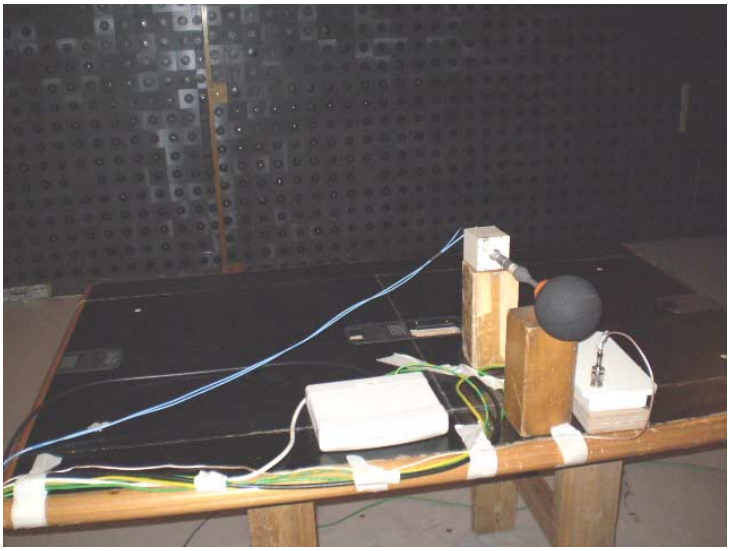


Test specification:	Radiated immunity to radio frequency electromagnetic field		
Test procedure:	EN 61000-4-3; EN 301 489-1, Section 9.2; EN 300 386, Section 7.2.2.1.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/27/2007 4:36:23 PM		
Temperature: 25 ºC	Air Pressure: 1022 hPa	Relative Humidity: 34 %	Power Supply: -48 VDC
Remarks:			

Photograph 10.2.2 Setup for radiated immunity to RF electromagnetic field test above 1 GHz, general view



Photograph 10.2.3 Setup for radiated immunity to RF electromagnetic field test, EUT cabling



Test specification:	Radiated immunity to radio frequency electromagnetic field		
Test procedure:	EN 61000-4-3; EN 301 489-1, Section 9.2; EN 300 386, Section 7.2.2.1.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	12/27/2007 4:36:23 PM		
Temperature: 25 ºC	Air Pressure: 1022 hPa	Relative Humidity: 34 %	Power Supply: -48 VDC
Remarks:			

Table 10.2.1 Radiated immunity to RF electromagnetic field test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: CT/CR / A
TEST SITE: SEMI ANECHOIC CHAMBER
ANTENNA TO EUT DISTANCE: 2.0 m
MODULATION: 80% AM with 1 kHz
DWELL TIME: 2.8 s
FREQUENCY STEP: 1 % of current frequency
FREQUENCY RANGES: 80 – 800, 960 – 1000 MHz
SELECTED FREQUENCIES: 400, 80, 120,160, 230, 434, 460, 600 MHz

EUT orientation*	Antenna polarization	Field strength**, V_{rms}/m	EUT performance description during the test	Verdict
EUT model ODU/F24 in transceive mode				
0°	Vertical	3	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	
EUT model ODU/F58 in transceive mode				
0°	Vertical	3	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	

FREQUENCY RANGES: 800 – 960, 1400 – 2000 MHz
SELECTED FREQUENCIES: 2000, 863, 900, 1750, 1950 MHz

EUT orientation*	Antenna polarization	Field strength**, V_{rms}/m	EUT performance description during the test	Verdict
EUT model ODU/F24 in transceive mode				
0°	Vertical	10	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	
EUT model ODU/F58 in transceive mode				
0°	Vertical	10	NP	Pass
	Horizontal		NP	
90°	Vertical		NP	Pass
	Horizontal		NP	
180°	Vertical		NP	Pass
	Horizontal		NP	
270°	Vertical		NP	Pass
	Horizontal		NP	

* - 0° = antenna installed facing the EUT front panel.
**- Field strength measured prior to modulation.

Reference numbers of test equipment used

HL 0317	HL 0465	HL 0589	HL 593	HL 0594	HL 0604	HL 0659	HL 1629
HL 1947	HL 1984	HL 2009	HL 2078	HL 2667	HL 2783	HL 3158	

Full description is given in Appendix A.

Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 301 489-1, Section 9.4; EN 300 386, Sections 7.2.2.5.1, 7.2.2.2.1, 7.2.2.3.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/2/2008 5:45:12 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

10.3 Conducted immunity to electrical fast transient/ burst (EFT/ B)

10.3.1 General

This test was performed to verify the EUT conducted immunity to the electrical fast transient/ burst (EFT/B) applied to the EUT power and signal line.
The EFT/B levels, performance criterion and test results are referred to in Table 10.3.1.

10.3.2 Test procedure for DC power and signal line application

10.3.2.1 The EUT was set up as shown in Figure 10.3.1 and the associated photograph, energized and the EUT performance was checked.

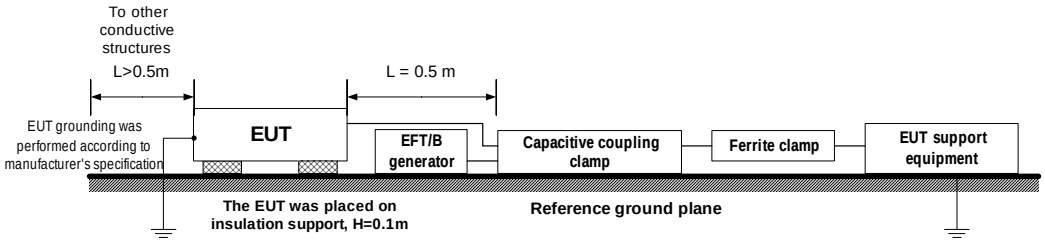
10.3.2.2 The DC power and signal line was placed into the capacitive coupling clamp. The EFT/B generator output parameters (voltage, frequency repetition and duration) were adjusted as referred to in Table 10.3.1 and the bursts were applied to the EUT DC power and signal line.

10.3.2.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

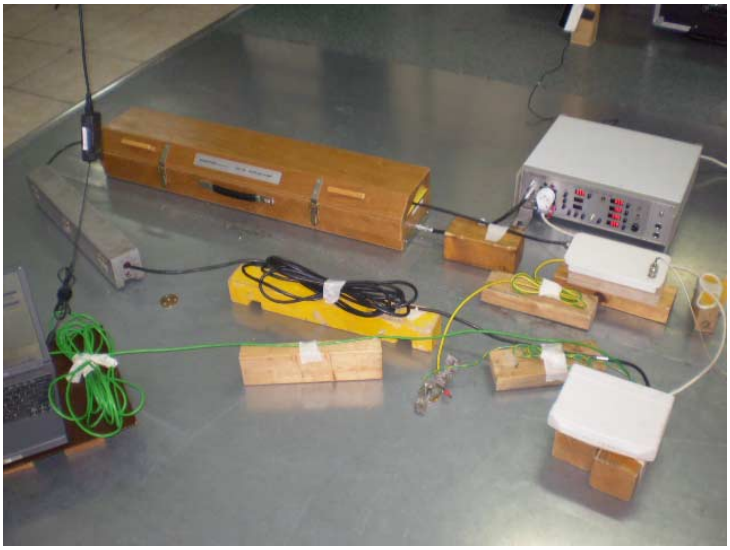
10.3.2.4 Upon this the test was completed.

Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 301 489-1, Section 9.4; EN 300 386, Sections 7.2.2.5.1, 7.2.2.2.1, 7.2.2.3.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/2/2008 5:45:12 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Figure 10.3.1 Setup for conducted immunity to EFT/B test at DC power and signal line, table-top EUT



Photograph 10.3.1 Setup for conducted immunity to EFT/B at ODU line



Test specification:	Conducted immunity to electrical fast transients/ bursts (EFT/ B)		
Test procedure:	EN 61000-4-4; EN 301 489-1, Section 9.4; EN 300 386, Sections 7.2.2.5.1, 7.2.2.2.1, 7.2.2.3.1		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	1/2/2008 5:45:12 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Table 10.3.1 Conducted immunity to EFT/ B test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: TT/TR / B
DURATION: 1 min
REPETITION FREQUENCY: 5 kHz
PULSE RISE TIME/ DURATION: 5 / 50 ns
BURST DURATION/ PERIOD: 15 / 300 ms

Type of disturbed line	Line description	Test voltage, kV	EFT/B polarity	EUT performance description during the test	Verdict
EUT in transceive mode					
Power+signal	ODU	0.5	Positive	NP	Pass
			Negative	NP	

Reference numbers of test equipment used

HL 0301	HL 0516	HL 0860					

Full description is given in Appendix A.

Test specification:	Conducted immunity to voltage surges		
Test procedure:	EN 61000-4-5; EN 301 489-1, Section 9.8; EN 300 386, Section 7.2.2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/26/2008 4:20:10 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

10.4 Conducted immunity to voltage surges

10.4.1 General

This test was performed to verify the EUT immunity to high-energy surges produced by switching and indirect lightning transients.
The surge levels, performance criterion and test results are referred to in the associated table.

10.4.2 Test procedure for shielded, both sides earthed DC power and signal line application

10.4.2.1 The EUT was set up as shown in Figure 10.4.1 and the associated photograph, energized and the EUT performance was checked.

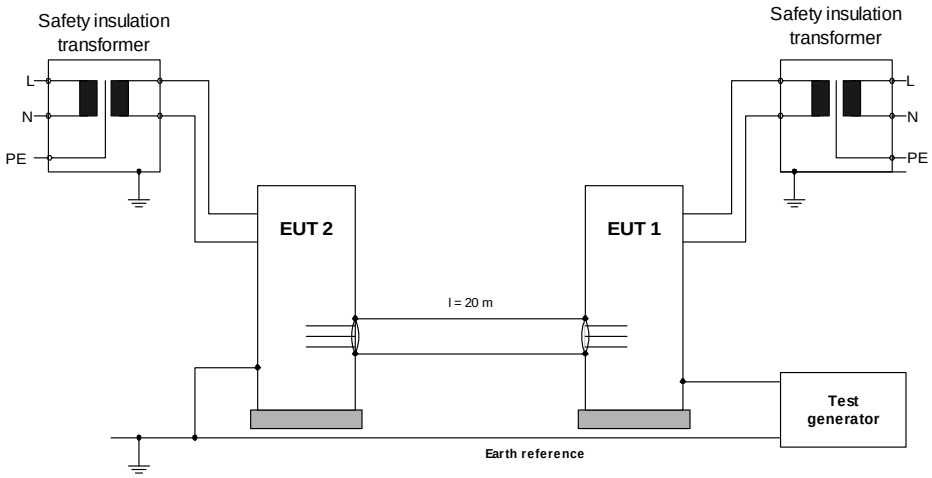
10.4.2.2 The surge generator output parameters (voltage and pulse shape) were adjusted as referred to in Table 10.4.1. Voltage surges of both polarities were applied to the EUT DC power and signal port in common (line to ground) mode with 1 per minute repetition rate.

10.4.2.3 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

10.4.2.4 Upon this the test was completed.

Test specification:	Conducted immunity to voltage surges		
Test procedure:	EN 61000-4-5; EN 301 489-1, Section 9.8; EN 300 386, Section 7.2.2.2.2		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	2/26/2008 4:20:10 PM		
Temperature: 20.5 ºC	Air Pressure: 1017 hPa	Relative Humidity: 33 %	Power Supply: -48 VDC
Remarks:			

Figure 10.4.1 Setup for conducted immunity to voltage surges test, shielded both sides earthed line



Photograph 10.4.1 Setup for conducted immunity to voltage surges at ODU line

Test specification:	**Conducted immunity to voltage surges**		
Test procedure:	EN 61000-4-5; EN 301 489-1, Section 9.8; EN 300 386, Section 7.2.2.2.2		
Test mode:	Compliance	**Verdict:**	PASS
Date & Time:	2/26/2008 4:20:10 PM		
Temperature: 20.5 ºC	**Air Pressure:** 1017 hPa	**Relative Humidity:** 33 %	**Power Supply:** -48 VDC
Remarks:			

Table 10.4.1 Conducted immunity to voltage surges test results, shielded, both sides earthed line

PERFORMANCE CRITERIA: TT/TR / B
SURGE PULSE SHAPE, Tr/Th: 1.2/50 µs
NUMBER OF PULSES (+/-): 5/5 (positive/negative) per surge application

Line description	Surge application	Applied voltage, kV	EUT performance description during the test	Verdict
Common mode				
ODU	Shield to GND	1.0	NP	Pass

Reference numbers of test equipment used

HL 2383	HL 2408						

Full description is given in Appendix A.

Test specification:	Conducted immunity to disturbances induced by radio frequency field		
Test procedure:	EN 61000-4-6; EN 301 489-1, Section 9.5; EN 300 386, Sections 7.2.2.5.2, 7.2.2.2.3, 7.2.2.3.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007 2:19:10 PM		
Temperature: 26.5 ºC	Air Pressure: 1013 hPa	Relative Humidity: 43 %	Power Supply: -48 VDC
Remarks:			

10.5 Immunity to conducted disturbances induced by radio frequency fields

10.5.1 General

This test was performed to verify the EUT immunity to conducted disturbances, induced by RF fields into the power and signal line from 0.15 to 80 MHz.
The conducted disturbances levels, performance criterion and test results are referred to in Table 10.5.1.

10.5.2 Test procedure for DC power and signal line application, direct injection through 100 Ohm method

10.5.2.1 The EUT was set up as shown in Figure 10.5.1 and the associated photograph, energized and the EUT performance was checked.

10.5.2.2 The test setup was adjusted to produce disturbing signal as referred to in Table 10.5.1. The disturbance signal was injected into the EUT DC power and signal line. The signal frequency was scanned with step less than 1% of the fundamental frequency and sweep rate less than 1.5×10^{-3} decade/s throughout the specified frequency range.

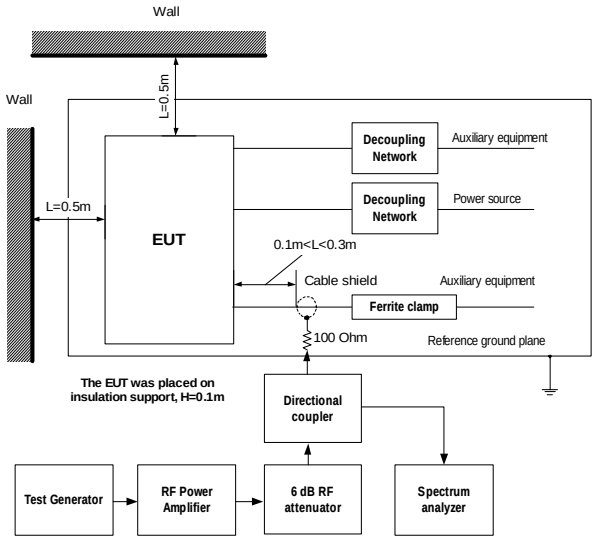
10.5.2.3 The test was repeated at selected frequencies.

10.5.2.4 The EUT operation was monitored throughout the test for any malfunction or degradation and its performance was recorded.

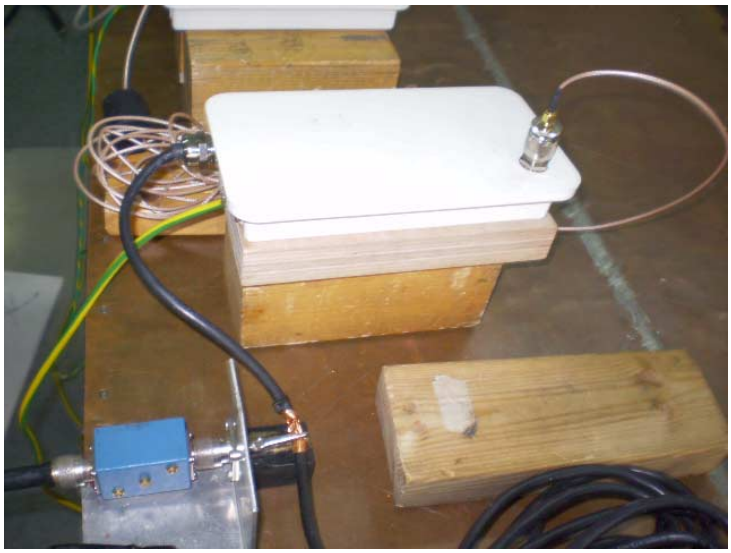
10.5.2.5 Upon this the test was completed.

Test specification:	Conducted immunity to disturbances induced by radio frequency field		
Test procedure:	EN 61000-4-6; EN 301 489-1, Section 9.5; EN 300 386, Sections 7.2.2.5.2, 7.2.2.2.3, 7.2.2.3.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007 2:19:10 PM		
Temperature: 26.5 ºC	Air Pressure: 1013 hPa	Relative Humidity: 43 %	Power Supply: -48 VDC
Remarks:			

Figure 10.5.1 Setup for immunity to conducted disturbances induced by radio frequency fields at DC power and signal line, direct injection through 100 Ohm method



Photograph 10.5.1 Setup for immunity to conducted disturbances induced by radio frequency fields at ODU line



Test specification:	Conducted immunity to disturbances induced by radio frequency field		
Test procedure:	EN 61000-4-6; EN 301 489-1, Section 9.5; EN 300 386, Sections 7.2.2.5.2, 7.2.2.2.3, 7.2.2.3.3		
Test mode:	Compliance	Verdict:	PASS
Date & Time:	10/8/2007 2:19:10 PM		
Temperature: 26.5 ºC	Air Pressure: 1013 hPa	Relative Humidity: 43 %	Power Supply: -48 VDC
Remarks:			

Table 10.5.1 Immunity to conducted disturbances induced by radio frequency fields test results

EUT SET UP: TABLE-TOP
PERFORMANCE CRITERIA: CT/CR / A
FREQUENCY RANGE: 0.15 – 80 MHz
SELECTED FREQUENCIES: 25; 33.33; 0.2; 1; 7.1; 13.56; 21; 27.12; 40.68 MHz
TYPE OF MODULATION: AM 80% @ 1 kHz
TEST VOLTAGE: 3 V_{rms} prior to modulation
DWELL TIME: 2.8 s
FREQUENCY STEP: 1 % of current frequency

Type of disturbed line	Test coupling	EUT performance during the test	Verdict
ODU	100 Ohm	NP	Pass

Reference numbers of test equipment used

HL 0027	HL 0349	HL 0539	HL 0728	HL 0796	HL 1909	HL 2066	HL 2275
HL 2892							

Full description is given in Appendix A.

11 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0027	Analyzer, Spectrum, 50 Hz - 2 GHz	Anritsu	MS-611A	4838	26-May-07	26-May-08
0032	Antenna, Biconical, 20 - 200 MHz	Electro-Metrics	BIA 25/30	3577	25-Sep-07	25-Sep-08
0301	Absorbing Clamp, 30 - 1000 MHz	Luthi	MDS-21	922242	12-Feb-08	12-Feb-10
0317	Power Sensor, 30 MHz - 18 GHz, -70 to 20 dBm	Boonton	51072	26163	24-Dec-07	24-Dec-08
0349	Amplifier, RF, 10 kHz-220 MHz,150 W	Amplifier Research	150L	12323	01-Mar-07	01-Mar-08
0415	Cable, Coax, RF, RG-214	HL	CC-3	056	02-Dec-07	02-Dec-08
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	11-Nov-07	11-Nov-08
0511	ESD simulator	Schaffner-Chase EMC	NSG 435	000260	14-Nov-07	14-Nov-08
0516	Coupling Clamp, 100 pF	Schaffner Electronic AG	CDN 125	516	14-Nov-07	14-Nov-08
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard Co	8546A	3617A 00319, 3448A002 53	28-Aug-07	28-Aug-08
0539	Generator Signal, 10 kHz - 1.2 GHz	Marconi Instruments	2023	112121/04 1	28-Mar-07	28-Mar-08
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m, 6.5 GHz	HL	GORE-3	176	02-Dec-07	02-Dec-08
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	03-Feb-08	03-Feb-09
0594	Turn Table for anechoic chamber flush mount d=1.2 m Pneumatic	HL	TT-WDC1	102	08-Oct-07	08-Oct-08
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-08	10-Jan-09
0659	Amplifier 1 to 4 GHz, 55 W	Milmega	AS0104-55/55B	971386	26-Jul-07	26-Jul-08
0728	PC computer P200,RAM 64MB, HD 3GB	Siemens-Nixdorf	Scenic Pro M5 166	QK 079909	13-Aug-07	13-Aug-08
0784	Antenna X-WING BILOG, 20 MHz - 2 GHz	Schaffner-Chase EMC	CBL6140 A	1120	10-Jan-08	10-Jan-09
0796	Coupling-decoupling network, 150 kHz -230 MHz	HL	230-M2	144	03-Jun-07	03-Jun-08
0812	Cable Coax, RG-214, 11.5 m, N-type connectors	HL	C214-11	148	02-Dec-07	02-Dec-08
0860	Generator Burst, IEC 61000-4-4, EFT	EMV-System Schloder	SFT 400	811270	19-Mar-07	19-Mar-08
1430	EMI Receiver, 9 kHz - 2.9 GHz	Agilent Technologies	8542E	3807A002 62,3705A0 0217	31-Aug-07	31-Aug-08

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
1552	Cable RF, 8 m	Alpha Wire	RG-214	1552	02-Dec-07	02-Dec-08
1629	Isotropic Field Monitor	Amplifier Research	FM2000	23308	07-Dec-07	07-Dec-08
1848	Antenna mast 4m/6m with polarity control	Sh. I. Machines	AM-5	1	03-Feb-08	03-Feb-09
1909	Non inductive resistor 100 Ohm	HL	NIR100	1909	19-Nov-07	19-Nov-08
1947	Cable 18GHz, 6.5 m, blue	Rhophase Microwave Limited	NPS-1803A-6500-NPS	T4974	05-Oct-07	05-Oct-08
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	03-Mar-07	03-Mar-08
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	01-Jan-08	01-Jan-09
2066	Attenuator 20 dB, DC to 1500 MHz	Mini-Circuits	SAT-20	9224 13	11-Feb-08	11-Feb-09
2078	Isotropic Field Probe 80 MHz - 40 GHz	Amplifier Research	FP2080	302541	01-Jan-08	01-Jan-09
2275	Attenuator 6 dB, 150 W, DC-1000 MHz, with 230VAC / 12VDC adapter	HL	6-150	2275	15-Oct-07	15-Oct-08
2328	Resistor for ESD tests EN 61000-4-2 470kOhmX2	HL	R470X2	2328	01-Jan-08	01-Jan-09
2357	Power Supply 48VDC / 10A	Advice Electronics	AR4810	009038	01-Apr-07	01-Apr-08
2383	Transformer, Isolation, 230/230, 1.8 kVA	Taiyo Yuden, Inc.	LGY1.8-21	EJ0180	26-May-07	26-May-08
2408	Advanced EMC Immunity Test System (surge generator)	Thermo KeyTek	EMCPRO	0306182	07-Apr-07	07-Apr-08
2667	Signal generator, 9 kHz - 3.3 GHz	Rohde & Schwarz	SML03	101909	25-Sep-06	25-Sep-08
2735	Resistor for ESD tests EN 61000-4-2 470 kOhm X 2	HL	R470x2	2735	01-Jan-08	01-Jan-09
2783	Power Meter, RF, IEEE-488, 100 kHz - 100 GHz, -70 to +37 dBm	Boonton	4220	156602BK	24-Dec-07	24-Dec-08
2892	Attenuator, 10 dB, DC to 1500 MHz, BNC	Mini-Circuits	CAT-10	2892	05-Apr-07	05-Apr-08
2959	Coupling Plane Vertical, EN 61000-4-2	HL	CPV-2	2959	13-Aug-07	13-Aug-08
3158	Amplifier, 80 to 1000 MHz, 500 W	Amplifier Research	500W1000A	032960	12-Apr-07	12-Apr-08

12 APPENDIX B Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility. Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47) and by Industry Canada for electromagnetic emissions (file numbers IC 2186-1 for OATS and IC 2186-2 for anechoic chamber), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, C-845 for conducted emissions site), assessed by TNO Certification EP&S (Netherlands) for a number of EMC, telecommunications, environmental, safety standards, and by AMTAC (UK) for safety of medical devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01) and approved by Israel Ministry of environmental protection, radiation hazards department (Permit number 1158).

Address: P.O. Box 23, Binyamina 30500, Israel.
Telephone: +972 4628 8001
Fax: +972 4628 8277
e-mail: mail@hermonlabs.com
website: www.hermonlabs.com

Person for contact: Mr. Alex Usoskin, CEO.

13 APPENDIX C Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
CDN	coupling/ decoupling network
CR	continuous phenomena applied to receivers
CT	continuous phenomena applied to transmitters
dB	decibel
dB(µV)	decibel referred to one microvolt
dB(µV/m)	decibel referred to one microvolt per meter
dB(µA)	decibel referred to one microampere
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EN	European Norm
EUT	equipment under test
GHz	gigahertz
GND	ground
H	height
HCP	horizontal coupling plane
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
µs	microsecond
NA	not applicable
NP	normal performance
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
TR	transient phenomena applied to receivers
TT	transient phenomena applied to transmitters
VCP	vertical coupling plane
W	width

14 APPENDIX D Test equipment correction factors

Biconical antenna factor

Electro-Metrics, model BIA-25/30, serial number 3577

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
20	15.1	115	16.7
25	14.6	120	14.1
30	13.7	125	13.1
35	11.8	130	13.0
40	11.4	135	12.9
45	11.7	140	12.7
50	11.4	145	12.5
55	10.5	150	14.3
60	10.3	155	14.8
65	8.9	160	14.7
70	7.6	165	15.1
75	7.3	170	15.6
80	7.3	175	16.5
85	7.8	180	16.7
90	9.4	185	17.3
95	10.6	190	17.9
100	11.8	195	17.6
105	12.5	200	17.9
110	13.7		

Antenna factor in dB (1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Antenna factor

Biconilog antenna EMCO, model 3141, serial number 1011

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	560	19.8	1300	27.0
28	7.8	580	20.6	1320	27.8
30	7.8	600	21.3	1340	28.3
40	7.2	620	21.5	1360	28.2
60	7.1	640	21.2	1380	27.9
70	8.5	660	21.4	1400	27.9
80	9.4	680	21.9	1420	27.9
90	9.8	700	22.2	1440	27.8
100	9.7	720	22.2	1460	27.8
110	9.3	740	22.1	1480	28.0
120	8.8	760	22.3	1500	28.5
130	8.7	780	22.6	1520	28.9
140	9.2	800	22.7	1540	29.6
150	9.8	820	22.9	1560	29.8
160	10.2	840	23.1	1580	29.6
170	10.4	860	23.4	1600	29.5
180	10.4	880	23.8	1620	29.3
190	10.3	900	24.1	1640	29.2
200	10.6	920	24.1	1660	29.4
220	11.6	940	24.0	1680	29.6
240	12.4	960	24.1	1700	29.8
260	12.8	980	24.5	1720	30.3
280	13.7	1000	24.9	1740	30.8
300	14.7	1020	25.0	1760	31.1
320	15.2	1040	25.2	1780	31.0
340	15.4	1060	25.4	1800	30.9
360	16.1	1080	25.6	1820	30.7
380	16.4	1100	25.7	1840	30.6
400	16.6	1120	26.0	1860	30.6
420	16.7	1140	26.4	1880	30.6
440	17.0	1160	27.0	1900	30.6
460	17.7	1180	27.0	1920	30.7
480	18.1	1200	26.7	1940	30.9
500	18.5	1220	26.5	1960	31.2
520	19.1	1240	26.5	1980	31.6
540	19.5	1260	26.5	2000	32.0
		1280	26.6		

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Biconilog antenna factor

Schaffner Chase EMC, model CBL 6140A, serial number 1120

Frequency, MHz	Antenna factor, dB(1/m)
20	12.1
22	8.8
24	5.5
26	3.0
28	2.8
30	3.9
40	8.4
50	9.3
60	9.7
70	9.3
80	7.5
90	6.8
100	7.6
110	6.6
120	6.9
140	7.6
160	11.6
170	8.3
190	9.2
200	9.9
220	10.5
240	11.2
260	12.9
280	12.1
300	12.9
320	13.2
340	13.9
360	15.2
380	15.3
400	15.7
420	16.6
440	16.8
460	17.6
480	18.3
500	18.0
520	18.0
540	18.7
560	19.2
580	19.0

Frequency, MHz	Antenna factor, dB(1/m)
600	19.1
620	19.8
640	20.6
660	20.7
680	20.9
700	21.0
720	21.4
740	21.7
760	21.6
780	21.6
800	21.9
820	22.2
840	22.6
860	22.7
880	22.7
900	22.9
920	23.2
940	23.7
960	24.3
980	24.6
1000	24.4
1.060	24.3
1.120	24.8
1.180	25.3
1.240	26.1
1.300	26.9
1.360	27.6
1.420	26.8
1.480	26.9
1.520	28.1
1.560	28.1
1.640	28.2
1.700	28.6
1.760	30.0
1.840	31.3
1.900	31.8
1.960	31.6
2.000	32.0

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

Antenna factor
Double-ridged wave guide horn antenna
Model 3115
Serial number: 9911-5964

Frequency, MHz	Antenna factor. dB(1/m)
1000.0	24.5
1500.0	24.8
2000.0	27.6
2500.0	28.7
3000.0	30.8
3500.0	32.9
4000.0	32.7
4500.0	32.0
5000.0	33.6
5500.0	35.3
6000.0	35.7
6500.0	35.8
7000.0	36.2
7500.0	37.2
8000.0	37.2
8500.0	38.1
9000.0	38.6
9500.0	38.3
10000.0	38.4
10500.0	38.3
11000.0	38.8
11500.0	39.9
12000.0	39.6
12500.0	39.5
13000.0	40.5
13500.0	41.1
14000.0	41.5
14500.0	40.8
15000.0	39.5
15500.0	38.1
16000.0	38.1
16500.0	40.1
17000.0	42.6
17500.0	45.4
18000.0	48.7

Antenna factor is to be added to receiver meter reading in dB(μV) to convert it into field intensity in dB(μV/m).

15 APPENDIX E Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions at mains port with LISN and HP 8542E or HP 8546A receiver	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Conducted emissions at telecommunication port with HP 8542E or HP 8546A receiver	ISN: ± 3.3 dB Current probe: ± 3.5 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	 Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Harmonic current	± 4.0%
Voltage fluctuations and flickers	± 5.3%
ESD	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-2 standard reduced by uncertainty of calibration that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: First peak current of discharge: ±10% (refer to standard Table 2) Current at 30 ns: ±30% (refer to standard Table 2) Current at 60 ns: ±30% (refer to standard Table 2) Rise time: 0.7 – 1 (ns)
Radiated immunity AR FP2000 E-field probe AR FP2080 E-field probe	 10 kHz to 250 MHz: ± 1.9 dB; 250 MHz to 1 GHz: ± 2.1 dB 80 MHz to 26 GHz: ± 2.7 dB; 26 GHz to 40 GHz: ± 4.0 dB
Conducted RF immunity - CDN injection - Current probe injection	 150 kHz to 230 MHz: ± 3.1 dB 10 kHz to 400 MHz: ± 2.3 dB

Test description	Expanded uncertainty
EFT - CDN injection - Capacitive clamp injection	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-4 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: Peak voltage: (0.125 to 2 kV) ±10% at 50 Ω Peak voltage: (0.24 to 3.8 kV) ±10% at 1000 Ω Rise time: 5 ns ±30% at 50 Ω / 5 ns ±30% at 1000 Ω Crest time: 50 ns ±30% at 50 Ω / 50 ns -15 ns / +100 ns at 1000 Ω Burst duration: 15 ms ± 20% at 5 kHz / 0.75 ms ± 20% at 100 kHz Burst period: 300 ms ± 20% Repetition frequency: 5 or 100 kHz ±20% Peak voltage at CDN output: (0.125 to 2 kV) ±10% at 50 Ω under 4 kV Rise time at CDN output: 5 ns ±30% at 50 Ω under 4 kV Crest time at CDN output: 50 ns ±30% at 50 Ω under 4 kV
High voltage surges	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-5 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: **1.2/50 µs combination wave generator:** Open-circuit output voltage: (0.5 to 6 kV) ±10% Short-circuit output current: (0.25 to 3 kA) ±10% Effective output impedance: 2 Ω ±10% Phase shifting: 0 to 360º ±10º Undershoot: < 30% of the output voltage Coupling: Direct / 18 µF / 9 µF+10 Ω Open-circuit front time: 1.2 µs ±30% / 1.2 µs ±30% / 1.2 µs ±30% Open-circuit time to half-value: 50 µs ±20% / 50 µs ±10 µs / 50 µs +10/-25 µs Short-circuit front time: 8 µs ±20% / 8 µs ±20% / 2.5 µs ±30% Short-circuit time to half-value: 20 µs ±20% / 20 µs ±20% / 25 µs ±30% **10/700 µs combination wave generator:** Open-circuit output voltage: (0.5 to 6 kV) ±10% Short-circuit output current: (12.5 A to 150 A) ±10% Effective output impedance: 40 Ω ±10% Open-circuit front time: 10 µs ± 30% Open-circuit time to half-value: 700 µs ± 20% Short-circuit front time: 5 µs ± 20% Short-circuit time to half-value: 320 µs ± 20%
Voltage dips, short interruptions and variations	It has been demonstrated that calibration results are within the limits specified in the EN 61000-4-11 standard reduced by uncertainty of calibration, that prove compliance with standard requirements with at least a 95% confidence. Parameters that have been calibrated and tolerances are shown below: Open-circuit voltage: ±5% Voltage change under full load: Nominal voltage: ±5% 70% of nominal voltage: ±7% 40% of nominal voltage: ±10%
Immunity to electrical transient	± 6.96%

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

16 APPENDIX F Specification references

FCC 47CFR part 15: 2007 subpart B	Radio Frequency Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4: 2003	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.
ICES-003: 2004, Issue 4	Spectrum Management and Telecommunications Policy. Interference-Causing Equipment Standard. Digital Apparatus
CAN/CSA-CEI/IEC CISPR 22: 2002	Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement
AS/NZS CISPR 22: 2006	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
EN 301 489-1 V1.6.1: 2005	Electromagnetic compatibility and Radio spectrum Matters (ERM). ElectroMagnetic Compatibility (EMC) standard for radio equipment and services. Part 1: Common technical requirements
EN 301 489-4 V1.3.1: 2002	Electromagnetic compatibility and Radio spectrum Matters (ERM). ElectroMagnetic Compatibility (EMC) standard for radio equipment and services. Part 4: Specific conditions for fixed radio links and ancillary equipment and services
EN 300 386 V1.3.3: 2005	Electromagnetic compatibility and Radio spectrum Matters (ERM). Telecommunication network equipment. ElectroMagnetic Compatibility (EMC) requirements
EN 55022: 1998+A1(00)+A2(03)	Limits and methods of measurement of interference characteristics of information technology equipment
CISPR 16-1-1: 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus
EN 61000-3-2: 2006	Electromagnetic compatibility (EMC) - Part 3: Limits. Section 2. Limits for harmonic current emissions for equipment with input current <16 A
EN 61000-3-3: 1995+A1(01)+A2(05)	Electromagnetic compatibility (EMC) - Part 3: Limits. Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16 A
EN 61000-4-2: 1995+A1(98)+ A2(01)	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 2: Electrostatic discharge immunity test
EN 61000-4-3: 2006	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 3: Radiated, radio frequency, electromagnetic field immunity test
EN 61000-4-4: 2004	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test
EN 61000-4-5: 2006	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques. Section 5: Surge immunity test
EN 61000-4-6: 2007	Electromagnetic compatibility (EMC) Part 4: testing and measurement techniques. Section 6: Immunity to conducted disturbances, inducted by radio-frequency fields
EN 61000-4-11: 2004	Electromagnetic compatibility (EMC). Part 4: testing and measurement techniques Section 11: Voltage dips, short interruptions and voltage variations immunity test
ISO 7637-2: 2004	Road vehicles – Electrical disturbance from conduction and coupling. Part 2: Electrical transient conduction along supply lines only