

TEST REPORT

ACCORDING TO: FCC CFR 47 PART 15 Subpart C, section 15.225 and subpart B

FOR:

On Track Innovations Ltd.
Nozzle identification unit
Model: NID

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1 Applicant information

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Contact name: Mr. Hemy Itay

2 Equipment under test attributes

Product name: Nozzle identification unit
Product type: Transmitter
Model(s): NID
Receipt date: 9/13/2006

3 Manufacturer information

Manufacturer name: On Track Innovations Ltd.
Address: P.O.B. 32, ZHR Industrial Zone, Rosh Pina, Index 12000, Israel
Telephone: +972 4686 8000
Fax: +972 4693 8887
E-Mail: h_itay@otiglobal.com
Contact name: Mr. Hemy Itay

4 Test details




Project ID: 17385
Location: Hermon Laboratories Ltd. P.O.Box 23, Binyamina 30500, Israel
Test started: 9/13/2006
Test completed: 10/10/2006
Test specification(s): FCC Part 15, subpart C, §15.225; subpart B, §15.109

5 Tests summary

Test	Status
Transmitter characteristics	
Sections 15.225(a) (b) (c), In band radiated emissions	Pass
Sections 15.225(d), Out of band radiated emissions	Pass
Section 15.225(e), Frequency stability	Pass
Section 15.207(a), Conducted emission	Not required
Unintentional emissions	
Section 15.107, Conducted emission at AC power port	Not required
Section 15.109, Radiated emission	Pass

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. P. Kagan, test engineer	October 10, 2006	
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	October 23, 2006	
Approved by:	Mr. M. Nikishin, EMC and Radio group leader	October 29, 2006	

6 EUT description

6.1 General information

The EUT, Nozzle IDentification unit, is a part of Easy Fuel System, mounted on refueling nozzle. It includes 13.56 MHz low power transmitter with an internal loop antenna and is powered from 3.6 VDC internal battery.

6.2 Changes made in the EUT

No changes were implemented.

6.3 Transmitter characteristics

Type of equipment						
V	Stand-alone (Equipment with or without its own control provisions)					
	Combined equipment (Equipment where the radio part is fully integrated within another type of equipment)					
	Plug-in card (Equipment intended for a variety of host systems)					
Intended use		Condition of use				
	Fixed	Always at a distance more than 2 m from all people				
V	mobile	Always at a distance more than 20 cm from all people				
	portable	May operate at a distance closer than 20 cm to human body				
Assigned frequency range		13.56 MHz				
Operating frequency range		13.56 MHz				
Maximum rated output power		Equivalent isotropically radiated power			0.25 x 10 ⁻⁶ mW	
Is transmitter output power variable?		V	No			
			continuous variable			
			stepped variable with stepsize			
		Yes	minimum RF power			
		maximum RF power				
Antenna connection						
V	unique coupling	standard connector	Integral	with temporary RF connector		
				without temporary RF connector		
Antenna/s technical characteristics						
Type	Manufacturer	Model number	Gain			
Loop	On Track Innovations	NA	NA			
Transmitter aggregate data rate/s		106 kbps				
Type of modulation		BPSK				
Type of multiplexing		TDMA				
Transmitter duty cycle supplied for test		100%				
Transmitter power source						
V	Battery	Nominal rated voltage	3.6 V	Battery type	Lithium	
	DC	Nominal rated voltage				
	AC mains	Nominal rated voltage		Frequency		

Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date & Time: 9/19/2006 2:10:55 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 In band radiated emissions

7.1.1 General

This test was performed to measure field strength of fundamental emission and modulation products from the EUT within the assigned band. Specification test limits are given in Table 7.1.1.

Table 7.1.1 Radiated emission limits

Frequency, MHz	Field strength at 30 m distance*		Field strength at 3 m distance*	
	μV/m	dB(μV/m)	μV/m	dB(μV/m)**
13.110 – 13.410	106	40.5	10600	80.5
13.410 – 13.553	334	50.5	33400	90.5
13.553 – 13.567	15848	84.0	1584800	124.0
13.567 – 13.710	334	50.5	33400	90.5
13.710 – 14.010	106	40.5	10600	80.5

*- The limit is provided in quasi peak values.

** - The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log(S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

7.1.2 Test procedure

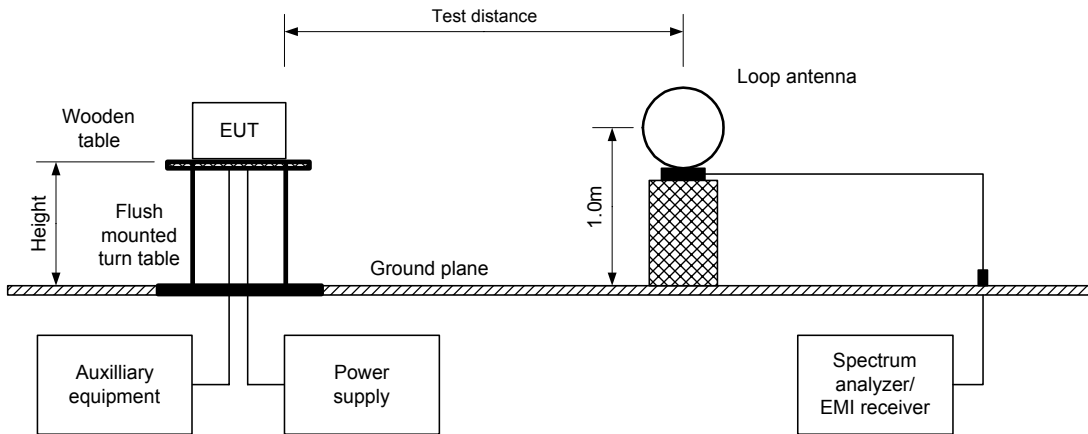
7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and the performance check was conducted.

7.1.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° , the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.1.2.3 The worst test results (the lowest margins) were recorded in Table 7.1.2 and shown in the associated plots.

Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date & Time: 9/19/2006 2:10:55 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Figure 7.1.1 Setup for in band radiated emission measurements



Test specification: Sections 15.225(a) (b) (c), In band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 9/19/2006 2:10:55 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Table 7.1.2 In band radiated emission test results

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Horizontal)
 MODULATION: BPSK
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 INVESTIGATED FREQUENCY RANGE: 13.110 – 14.010 MHz
 RESOLUTION BANDWIDTH: 9.0 kHz
 VIDEO BANDWIDTH: 30.0 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Azimuth**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*			
13.5668	28.8	25	124	-99	V	140	Pass

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

Reference numbers of test equipment used

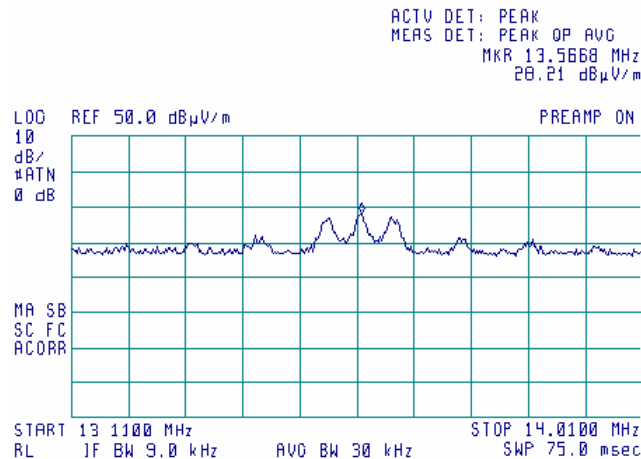
HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 2009	HL 2259
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Full description is given in Appendix A.

Plot 7.1.1 In band radiated emission test results

TEST SITE: Anechoic chamber
 TEST DISTANCE: 3 m
 DETECTOR: Peak hold

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Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 9/19/2006 2:08:29 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

7.2 Out of band radiated emissions

7.2.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Radiated emission limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(μV/m)***		
	Peak	Quasi Peak	Average
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**
0.090 – 0.110	NA	108.5 – 106.8**	NA
0.110 – 0.490	126.8 – 113.8	NA	106.8 – 93.8**
0.490 – 1.705	NA	73.8 – 63.0**	NA
1.705 – 30.0*		69.5**	
30 – 88		40.0	
88 – 216		43.5	
216 – 960		46.0	
960 – 1000		54.0	

*- The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

** - The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:
$$\text{Lim}_{S_2} = \text{Lim}_{S_1} + 40 \log(S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

*** - The limit decreases linearly with the logarithm of frequency.

7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.2.2.2 The specified frequency range was investigated with loop antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna was rotated around its vertical axis and the measuring antenna polarization was switched from vertical to horizontal.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.2 and shown in the associated plots.

Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance		Verdict: PASS	
Date & Time: 9/19/2006 2:08:29 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Figure 7.2.1 Radiated emissions below 30 MHz test set up

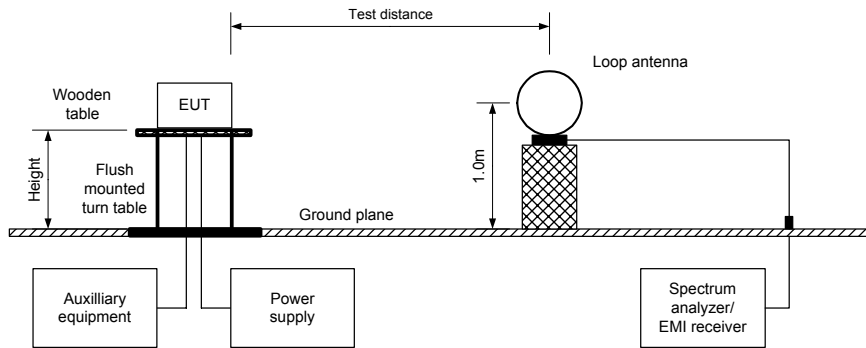
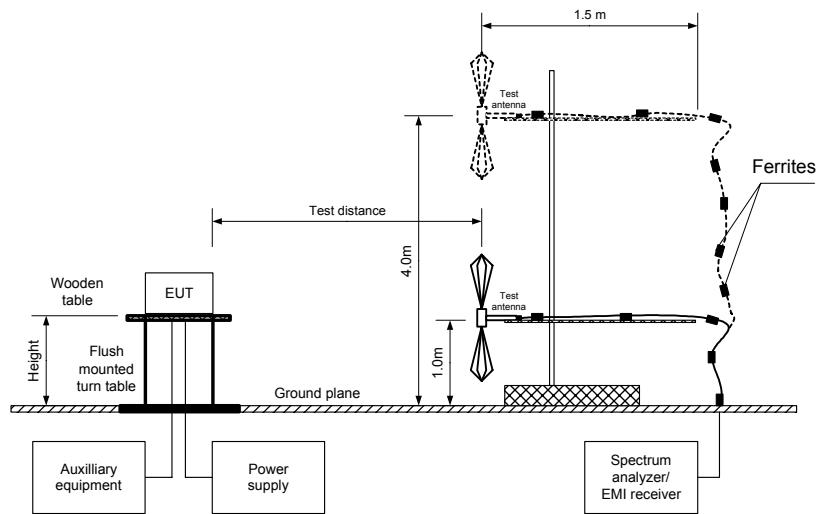


Figure 7.2.2 Radiated emissions above 30 MHz test set up



Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/19/2006 2:08:29 PM		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Table 7.2.2 Out of band radiated emissions test results

TEST DISTANCE: 3 m
EUT POSITION: Typical (Horizontal)
MODULATION: BPSK
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz
RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
9.0 kHz (150 kHz – 30 MHz)
120 kHz (30 MHz – 1000 MHz)
VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
Biconilog (30 MHz – 1000 MHz)

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*				
40.684653	31.98	29.81	40.00	-8.02	V	1	65	Pass
67.815000	30.40	28.17	40.00	-9.60	V	1	49	
122.090000	28.91	26.74	43.50	-14.59	V	1	75	
176.316500	31.60	29.24	43.50	-11.90	V	1	68	

*- Margin = Measured emission - specification limit.

** - EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0446	HL 0465	HL 0521	HL 0589	HL 0593	HL 0594	HL 0604	HL 2009
HL 2259							

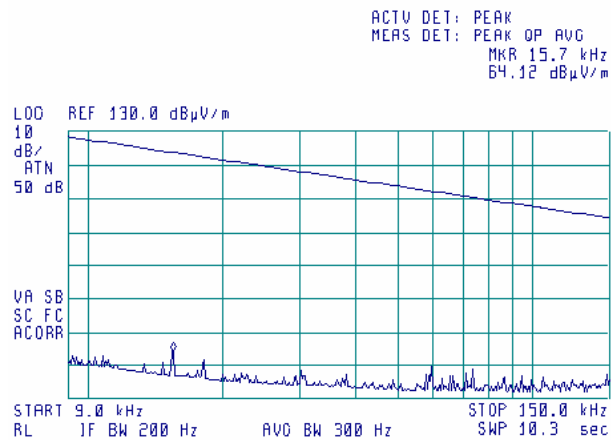
Full description is given in Appendix A.

Test specification: Sections 15.225(d), Out of band radiated emissions			
Test procedure: ANSI C63.4, Sections 5.3 and 13.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 9/19/2006 2:08:29 PM			
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.1 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
DETECTOR: Peak hold

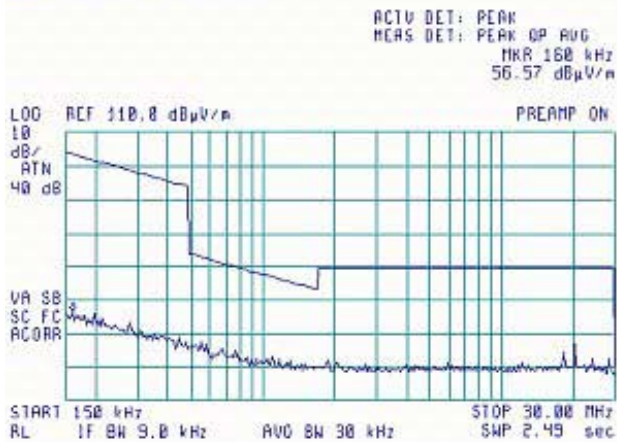
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Plot 7.2.2 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical & Horizontal
DETECTOR: Peak hold

11:30:20 SEP 17, 2006

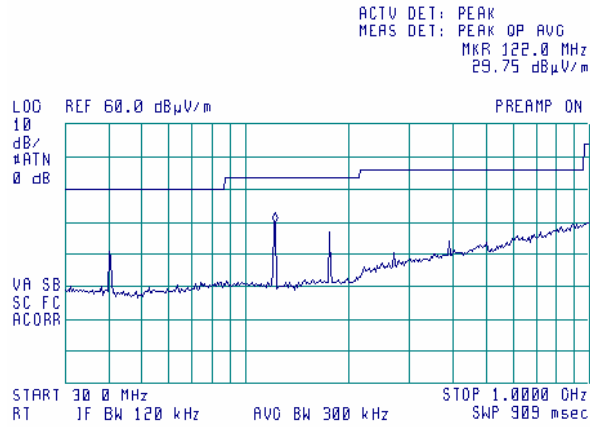


Test specification:		Sections 15.225(d), Out of band radiated emissions	
Test procedure:		ANSI C63.4, Sections 5.3 and 13.1.4	
Test mode:	Compliance	Verdict:	PASS
Date & Time:	9/19/2006 2:08:29 PM		
Temperature: 24°C	Air Pressure: 1012 hPa	Relative Humidity: 40 %	Power Supply: 3.6 V battery
Remarks:			

Plot 7.2.3 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical & Horizontal
 DETECTOR: Peak hold

12:01:27 SEP 12, 2006



Test specification: Section 15.225(e), Frequency stability			
Test procedure: ANSI C63.4, Section 13.1.6			
Test mode: Compliance	Verdict: PASS		
Date & Time: 9/21/2006 3:59:21 PM			
Temperature: 23 °C	Air Pressure: 1012 hPa	Relative Humidity: 41 %	Power Supply: 3.6 V battery
Remarks:			

7.3 Frequency stability test

7.3.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.3.1.

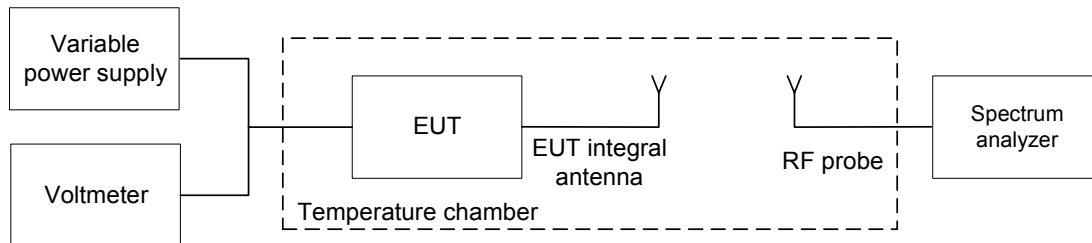
Table 7.3.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	%	Hz
13.560	± 0.01 %	1356

7.3.2 Test procedure

- 7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
- 7.3.2.2 The EUT power was turned off. Temperature within test chamber was set to the required one and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.3.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then after 2, 5 and 10 minutes. The EUT was powered off.
- 7.3.2.4 The above procedure was repeated at the rest of the test temperatures and voltages as provided in Table 7.3.2.
- 7.3.2.5 Frequency displacement was calculated and compared with the limit, the test results are provided in Table 7.3.2.

Figure 7.3.1 Frequency stability test setup



Test specification: Section 15.225(e), Frequency stability	
Test procedure: ANSI C63.4, Section 13.1.6	
Test mode: Compliance	Verdict: PASS
Date & Time: 9/21/2006 3:59:21 PM	
Temperature: 23 °C	Air Pressure: 1012 hPa
Relative Humidity: 41 %	
Power Supply: 3.6 V battery	
Remarks:	

Table 7.3.2 Frequency stability test results

OPERATING FREQUENCY: 13.560 MHz
 NOMINAL POWER VOLTAGE: 3.6 V
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 10 kHz
 VIDEO BANDWIDTH: 10 kHz
 MODULATION: Unmodulated

Temperature, °C	Voltage, V	Frequency, MHz				Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	2 nd min	5 th min	10 th min	Positive	Negative			
-20	nominal	13.561960	13.561080	13.560400	13.561400	210	-1350	1356	-6	Pass
20	15%	13.561800	13.560900	13.562250	13.561250	500	-850		-506	
20	nominal	13.561480	13.561280	13.561800	13.561750	50	-470		-886	
20	-15%	13.562250	13.562300	13.561700	13.561800	550	-50		-806	
50	nominal	13.562160	13.561440	13.562040	13.561240	410	-510		-846	

* - Reference frequency

Reference numbers of test equipment used

HL 0337	HL 0493	HL 0808	HL 2780				
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Full description is given in Appendix A.

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance			Verdict: PASS
Date & Time: 9/17/2006 2:40:59 PM			
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 3.6 V battery
Remarks:			

8 Emission tests according to 47CFR part 15 subpart B requirements

8.1 Radiated emission measurements

8.1.1 General

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

Table 8.1.1 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 test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S_2} = Lim_{S_1} + 20 \log(S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

8.1.2 Test procedure

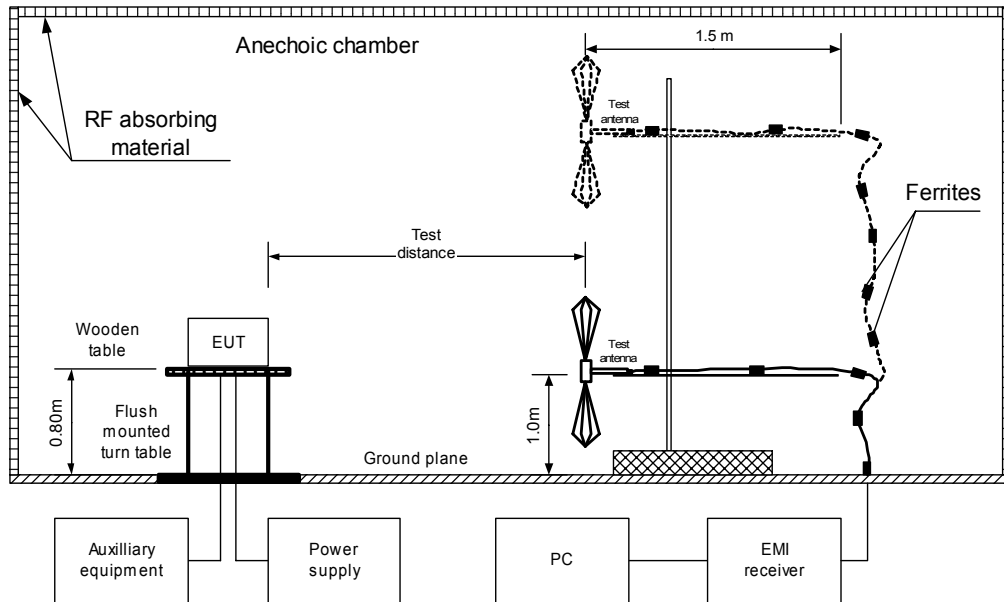
8.1.2.1 The EUT was set up as shown in Figure 8.1.1, energized and the performance check was conducted.

8.1.2.2 The measurements were performed in the semi-anechoic chamber at 3 m test distance. The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.1.2.3 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date & Time: 9/17/2006 2:40:59 PM			
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 3.6 V battery
Remarks:			

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance	Verdict: PASS		
Date & Time: 9/17/2006 2:40:59 PM			
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 3.6 V battery
Remarks:			

Table 8.1.2 Radiated emission test results

EUT SETUP:	TABLE-TOP
LIMIT:	Class B
EUT OPERATING MODE:	Stand-by
TEST SITE:	SEMI ANECHOIC CHAMBER
TEST DISTANCE:	3 m
DETECTORS USED:	PEAK / QUASI-PEAK
FREQUENCY RANGE:	30 MHz – 1000 MHz
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*				
All emissions were found more than 20 dB below the specified limit								Pass

*- Margin = Measured emission - specification limit.

** - EUT front panel refer 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	HL 2259
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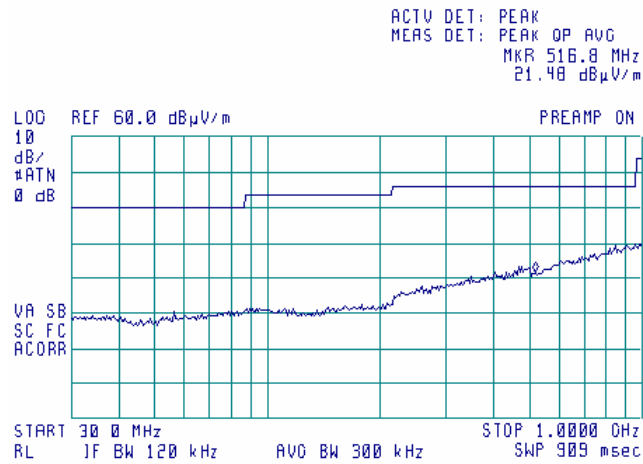
Full description is given in Appendix A.

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 11.6 and 12.1.4			
Test mode: Compliance		Verdict: PASS	
Date & Time: 9/17/2006 2:40:59 PM			
Temperature: 23 °C	Air Pressure: 1011 hPa	Relative Humidity: 44 %	Power Supply: 3.6 V battery
Remarks:			

Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical & horizontal antenna polarization

TEST SITE: Semi anechoic chamber
 LIMIT: Class B
 TEST DISTANCE: 3 m
 EUT OPERATING MODE: Stand-by

13:26:37 SEP 17, 2006



9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
0337	Probe Set, Hand held, 5 probes	Electro-Metrics	EHFP-30	238	08-Jun-06	08-Jun-07
0446	Antenna, Loop active, 10kHz-30MHz	EMCO	6502	2857	28-Jun-06	28-Jun-07
0465	Anechoic Chamber 9(L) x 6.5(W) x 5.5(H) m	HL	AC - 1	023	11-Nov-05	11-Nov-06
0493	Oven temperature -45...175 deg C	Thermotron	S-1.2 Mini-Max	14016	08-Mar-06	08-Mar-07
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	26-Sep-06	26-Sep-07
0589	Cable Coaxial, GORE A2P01POL118, 2.3 m	HL	GORE-3	176	02-Dec-05	02-Dec-06
0593	Antenna Mast, 1-4 m Pneumatic	Madgesh	AM-F1	101	02-Feb-06	02-Feb-07
0594	Turn Table FOR ANECHOIC CHAMBER flush mount d=1.2 m Pneumatic	HL	TT- WDC1	102	26-Jan-06	26-Jan-07
0604	Antenna BiconiLog Log-Periodic/T Bow- TIE 26 - 2000 MHz	EMCO	3141	9611-1011	10-Jan-06	10-Jan-07
0808	Analyzer Spectrum 100 Hz to 2.2 GHz	Anritsu	MS2601B	M178731	27-Mar-06	27-Mar-07
2009	Cable RF, 8 m	Alpha Wire	RG-214	C-56	02-Dec-05	02-Dec-06
2259	Amplifier Low Noise 2-20 GHz	Sophia Wireless	LNA0220- C	0223	05-Nov-05	05-Nov-06
2780	EMC analyzer, 100 Hz to 26.5 GHz	Agilent Technologies	E7405A	MY451024 6	11-Jun-06	11-Jun-07

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Radiated emissions at 10 m measuring distance Horizontal polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	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	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of ISO/IEC 17025 (or alternately ANSI/NC SL Z540-1).

The laboratory calibrates its measurement standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements. The Hermon Labs EMC measurements uncertainty is given in the table above.

11 APPENDIX C Test facility 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).

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12 APPENDIX D Specification references

47CFR part 15: 2006	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.

13 APPENDIX E Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
PCB	printed circuit board
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere
WB	wideband

14 APPENDIX F Test equipment correction factors

**Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446**

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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

**Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604**

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

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

Cable loss
Cable Coaxial, GORE A2P01POL118, 2.3 m, model:GORE-3, HL 0589
+ Cable Coaxial, ANDREW PSWJ4, 6m, model: ANDREW-6, HL 1004

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	30	0.33	≤ 6.5	±0.12
2	50	0.40		
3	100	0.57		
4	300	0.97		
5	500	1.25		
6	800	1.59		
7	1000	1.81		
8	1200	1.97		
9	1400	2.15		
10	1600	2.28		
11	1800	2.43		
12	2000	2.61		
13	2200	2.75		
14	2400	2.89		
15	2600	2.97		
16	2800	3.21	≤ 6.5	±0.12
17	3000	3.32		
18	3300	3.47		
19	3600	3.62		
20	3900	3.84		
21	4200	3.92		
22	4500	4.07		
23	4800	4.36		
24	5100	4.62		
25	5400	4.78		
26	5700	5.16		
27	6000	5.67		
28	6500	5.99		

Cable loss
RF cable 8 m, model RG-214, HL 2009

No.	Frequency, MHz	Cable loss, dB	Tolerance (Specification), dB	Measurement uncertainty, dB
1	1	0.10	NA	±0.12
2	10	0.14		
3	30	0.25		
4	50	0.34		
5	100	0.53		
6	300	0.99		
7	500	1.31		
8	800	1.73		
9	1000	1.98		
10	1100	2.11		
11	1200	2.21		
12	1300	2.35		
13	1400	2.46		
14	1500	2.55		
15	1600	2.68		
16	1700	2.78		
17	1800	2.88		
18	1900	2.98		
19	2000	3.09		