



ELECTRICAL TESTING
0839.01

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 subpart C § 15.247(DTS) and subpart B;
RSS-210 issue 8 Annex 8, RSS-Gen issue 3 section 6**

FOR:

**Essence Security International (E.S.I) Ltd.
Control Panel
Model:ES8000GP
FCC ID:YXG-ES8000GP
IC:11061A-ES8000GP**

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.



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1 Applicant information

Client name: Essence Security International (E.S.I) Ltd.
Address: 12 Abba Even Avenue, Ackerstein Towers Bldg. D, P.O.B. 2073, Herzliya 4612001, Israel
Telephone: +972 73 244 7735
Fax: +972 9772 9962
E-mail: israelgo@essence-grp.com
Contact name: Mr. Israel Gottesman

2 Equipment under test attributes

Product name: Control Panel
Product type: Transceiver
Model(s): ES8000GP
Serial number: 0002BF89
Hardware version: 3B
Software release: 03.01.02.19.01
Receipt date 5/01/2013

3 Manufacturer information

Manufacturer name: Essence Security International (E.S.I) Ltd.
Address: 12 Abba Even Avenue, Ackerstein Towers Bldg. D, P.O.B. 2073, Herzliya 4612001, Israel
Telephone: +972 73 244 7735
Fax: +972 9772 9962
E-Mail: israelgo@essence-grp.com
Contact name: Mr. Israel Gottesman

4 Test details

Project ID: 24460
Location: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Test started: 5/01/2013
Test completed: 5/19/2013
Test specification(s): FCC Part 15 subpart C §15.247 (DTS); subpart B §15.109
RSS-210 issue 8 Annex 8, RSS-Gen issue 3 section 6.1, ICES-003 issue 5:2012



5 Tests summary

Test	Status
Transmitter characteristics	
FCC Section 15.247(a)2 / RSS-210 section A8.2(a), 6 dB bandwidth	Pass
FCC Section 15.247(b)3/ RSS-210 section A8.4(4), Peak output power	Pass
FCC section 15.247(i) / RSS-Gen section 5.6, RF exposure	Pass, the exhibit to the application of certification is provided
FCC Section 15.247(d) / RSS-210 section A8.5, Radiated spurious emissions	Pass
FCC Section 15.247(d), RSS-210 section A8.5, Emissions at band edges	Pass
FCC Section 15.247(e) / RSS-210 section A8.2(b), Peak power density	Pass
FCC section 15.203 / RSS-Gen section 7.1.2, Antenna requirement	Pass
FCC section 15.207(a) / RSS-Gen section 7.2.4, Conducted emission	Pass
Unintentional emissions	
FCC section 15.107, Conducted emission at AC power port	Pass
FCC section 15.109, RSS-Gen section 6.1, 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.

This test report supersedes the previously issued test report identified by Doc ID:ESSRAD_FCC.24460.

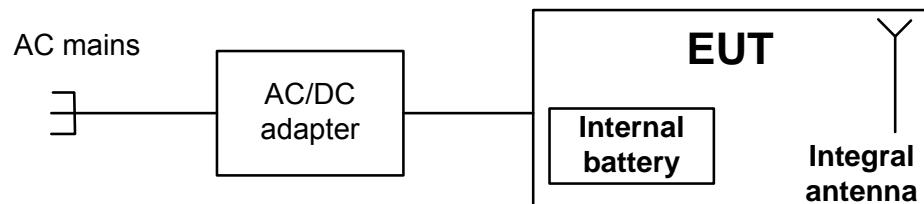
	Name and Title	Date	Signature
Tested by:	Mrs. E. Pitt, test engineer Mr. S.Samokha , test engineer	May 19, 2013	Handwritten signatures of Mrs. E. Pitt and Mr. S. Samokha.
Reviewed by:	Mrs. M. Cherniavsky, certification engineer	June 4, 2013	Handwritten signature of Mrs. M. Cherniavsky.
Approved by:	Mr. M. Nikishin, EMC and Radio group manager	July 1, 2013	Handwritten signature of Mr. M. Nikishin.

6 EUT description

6.1 General information

The EUT, ES8000GP, is a wireless control panel, used the bi-directional communication with the control system peripherals. The EUT includes the WWAN module manufactured by Telit Communications S.p.A., approved by FCC and Industry Canada, FCC ID:RI7HE910NA, IC:5131A-HE910NA.

6.2 Test configuration



6.3 Changes made in the EUT

To withstand the standard requirements the following changes were implemented in the EUT:

- 1) the C68 capacitor was removed;
- 2) the R231 resistor was changed to ferrite bead p/n BLM15AG221SN1.

It is manufacturer responsibility to implement the change in the production version of the EUT. In any case the test report applies to the tested item only.



6.4 Transmitter characteristics

Type of equipment							
<input checked="" type="checkbox"/>	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						
<input checked="" type="checkbox"/> 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	2400 - 2483.5 MHz						
Operating frequency	2425 MHz						
Maximum rated output power	Peak output power	19.07 dBm					
Is transmitter output power variable?	X	No					
		continuous variable					
	Yes	stepped variable with stepsize					
		dB					
minimum RF power							
dBm							
maximum RF power							
dBm							
Antenna connection							
unique coupling	standard connector	X	integral	with temporary RF connector			
				<input checked="" type="checkbox"/> without temporary RF connector			
Antenna/s technical characteristics							
Type	Manufacturer	Model number	Gain				
Integral	YIPSHING METAL MFY	11434	0 dBi				
Modulation	QPSK						
Transmitter aggregate data rate/s	250 kbps						
Modulating test signal (baseband)	PRBS						
Transmitter power source							
Battery	Nominal rated voltage		Battery type				
DC	Nominal rated voltage						
<input checked="" type="checkbox"/> AC mains	Nominal rated voltage	via AC/DC adapter					
Common power source for transmitter and receiver	V	yes	no				



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Test specification:	FCC section 15.247(a)(2), RSS-210 section A8.2(a), 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/14/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

7 Transmitter tests according to 47CFR part 15 subpart C and RSS-210 requirements

7.1 Minimum 6 dB bandwidth

7.1.1 General

This test was performed to measure 6 dB bandwidth of the EUT carrier frequency. Specification test limits are given in Table 7.1.1.

Table 7.1.1 The 6 dB bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points*, dBc	Minimum bandwidth, kHz
902.0 – 928.0		
2400.0 – 2483.5	6.0	500.0
5725.0 – 5850.0		

* - Modulation envelope reference points provided in terms of attenuation below the peak of modulated carrier.

Table 7.1.2 The 99% bandwidth limits

Assigned frequency, MHz	Modulation envelope reference points	Limit, kHz
902.0 – 928.0		
2400.0 – 2483.5	99%	NA
5725.0 – 5850.0		

7.1.2 Test procedure

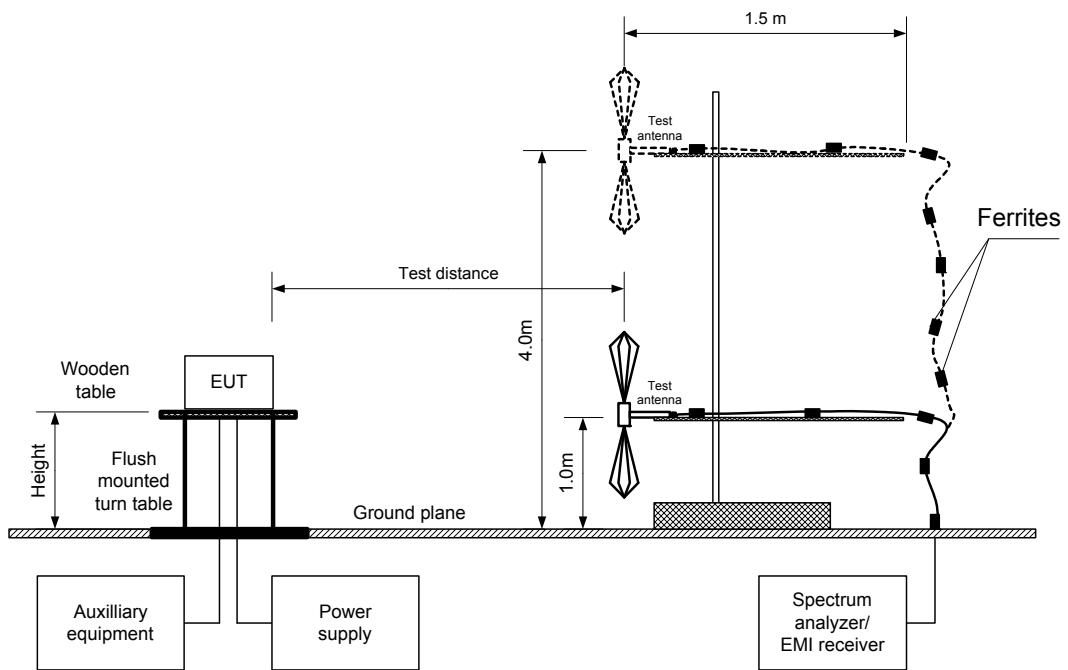
- 7.1.2.1 The EUT was set up as shown in Figure 7.1.1, energized and its proper operation was checked.
- 7.1.2.2 The EUT was set to transmit modulated carrier.
- 7.1.2.3 The transmitter minimum 6 dB bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.1.3 and associated plot.



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Test specification:	FCC section 15.247(a)(2), RSS-210 section A8.2(a), 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/14/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Figure 7.1.1 The occupied bandwidth test setup





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Test specification:	FCC section 15.247(a)(2), RSS-210 section A8.2(a), 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/14/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Table 7.1.3 The 6 dB bandwidth test results

ASSIGNED FREQUENCY BAND: 2400.0 – 2483.5 MHz
DETECTOR USED: Peak
SWEEP MODE: Max hold
SWEEP TIME: Auto
RESOLUTION BANDWIDTH: 30 kHz
VIDEO BANDWIDTH: 100 kHz
MODULATION: QPSK
MODULATING SIGNAL: PRBS

MODULATION ENVELOPE REFERENCE POINTS: 6.0 dBc
BIT RATE: 250 kbps

Carrier frequency, MHz	6 dB bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2425.0	1552.5	500.0	-1052.5	Pass

MODULATION ENVELOPE REFERENCE POINTS: 26 dBc
CHIP RATE: 250 kbps

Carrier frequency, MHz	99% bandwidth, kHz	Limit, kHz	Margin, kHz	Verdict
2425	2681.9	NA	NA	Pass

Reference numbers of test equipment used

HL 1984	HL 2871	HL 2909	HL 4353				
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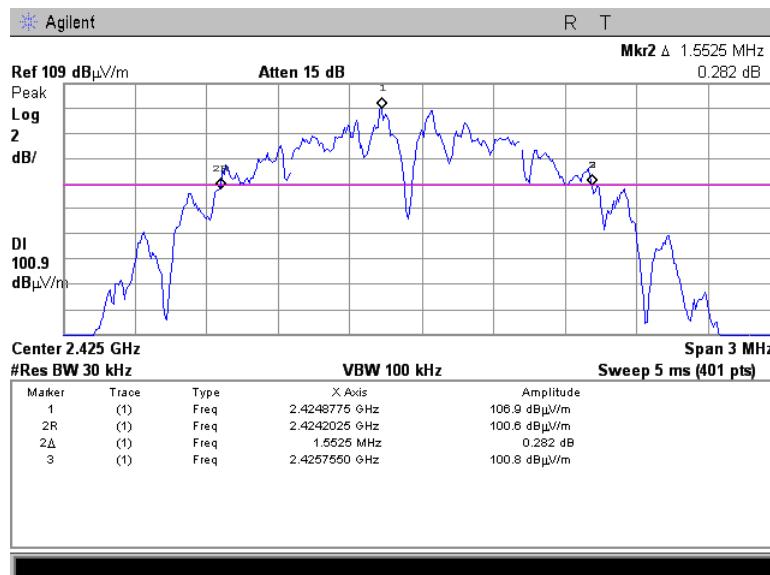
Full description is given in Appendix A.



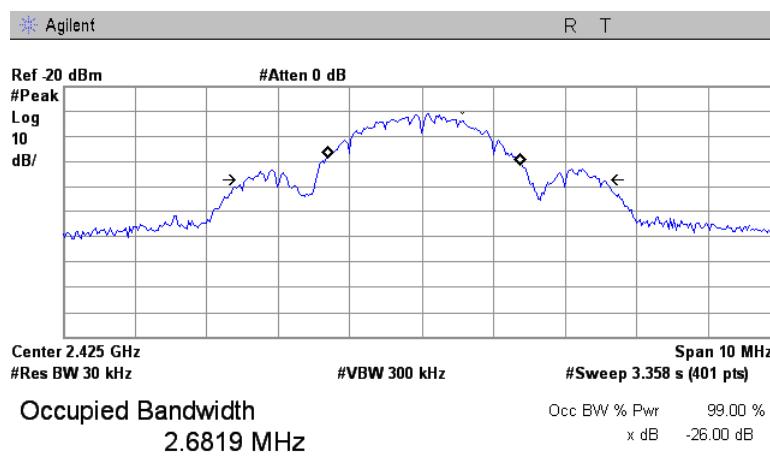
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Test specification:	FCC section 15.247(a)(2), RSS-210 section A8.2(a), 6 dB bandwidth		
Test procedure:	FR Vol.62, page 26243, Section 15.247(a)2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/14/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.1.1 The 6 dB bandwidth test result at carrier frequency



Plot 7.1.2 The 99% power bandwidth test result



Transmit Freq Error 40.712 kHz
x dB Bandwidth 4.898 MHz*



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Test specification:	FCC section 15.247(b)3, RSS-210 section A8.4(4) ,Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.2 °C	Air Pressure: 1008 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.2 Peak output power

7.2.1 General

This test was performed to measure the maximum peak output power radiated by transmitter. Specification test limits are given in Table 7.2.1.

Table 7.2.1 Peak output power limits

Assigned frequency range, MHz	Maximum antenna gain, dBi	Peak output power*		Equivalent field strength limit @ 3m, dB(µV/m)**
		W	dBm	
902.0 – 928.0				
2400.0 – 2483.5	6.0	1.0	30.0	131.2
5725.0 – 5850.0				

*- The limit is provided in terms of conducted RF power at the antenna connector. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power limit shall be reduced below the stated value as follows:

by 1 dB for every 3 dB that the directional gain of antenna exceeds 6 dBi for fixed point-to-point transmitters operate in 2400-2483.5 MHz band;

without any corresponding reduction for fixed point-to-point transmitters operate in 5725-5850 MHz band;

by the amount in dB that the directional gain of antenna exceeds 6 dBi for the rest of transmitters.

**- Equivalent field strength limit was calculated from the peak output power as follows: $E = \sqrt{30 \times P \times G} / r$, where P is peak output power in Watts, r is antenna to EUT distance in meters and G is transmitter antenna gain in dBi.

7.2.2 Test procedure

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and its proper operation was checked.

7.2.2.2 The EUT was adjusted to produce maximum available to end user RF output power.

7.2.2.3 The resolution bandwidth of spectrum analyzer was set wider than 6 dB bandwidth of the EUT and the field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.

7.2.2.4 The maximum field strength of the EUT carrier frequency was measured as provided in Table 7.2.2 and associated plots.

7.2.2.5 The maximum peak output power was calculated from the field strength of carrier as follows:

$$P = (E \times d)^2 / (30 \times G),$$

where P is the peak output power in W, E is the field strength in V/m, d is the test distance and G is the transmitter numeric antenna gain over an isotropic radiator.

The above equation was converted in logarithmic units for 3 m test distance:

$$\text{Peak output power in dBm} = \text{Field strength in dB}(\mu\text{V/m}) - \text{Transmitter antenna gain in dBi} - 95.2 \text{ dB}$$

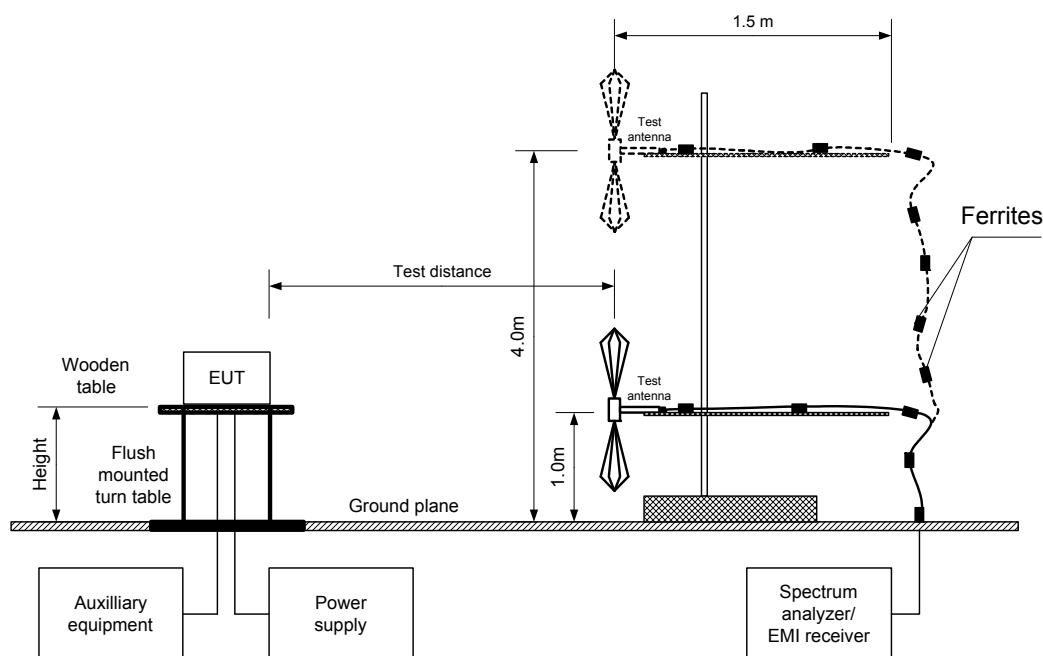
7.2.2.6 The worst test results (the lowest margins) were recorded in Table 7.2.2.



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Test specification:	FCC section 15.247(b)3, RSS-210 section A8.4(4) ,Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.2 °C	Air Pressure: 1008 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Figure 7.2.1 Setup for carrier field strength measurements





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Test specification:	FCC section 15.247(b)3, RSS-210 section A8.4(4) ,Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.2 °C	Air Pressure: 1008 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Table 7.2.2 Peak output power test results

ASSIGNED FREQUENCY:	2400.0 – 2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
DETECTOR USED:	Peak
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
EUT 6 dB BANDWIDTH:	1.5 MHz
RESOLUTION BANDWIDTH:	3 MHz
VIDEO BANDWIDTH:	3 MHz

Frequency, MHz	Field strength, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	EUT antenna gain, dBi	Peak output power, dBm**	Limit, dBm	Margin, dB***	Verdict
2424.737	114.3	Vert	1.0	53	0	19.07	30.0	-10.93	Pass
2425.300	112.9	Hor	1.1	171	0	17.67	30.0	-12.33	Pass

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

**- Peak output power was calculated from the field strength of carrier as follows: $P = (E \times d)^2 / (30 \times G)$, where P is the peak output power in W, E is the field strength in V/m, d is the test distance in meters and G is the transmitter numeric antenna gain over an isotropic radiator. The above equation was converted in logarithmic units for 3 m test distance: *Peak output power in dBm = Field strength in dB(µV/m) - Transmitter antenna gain in dBi - 95.23 dB*

***- Margin = Peak output power – specification limit.

Note: Maximum peak output power was obtained at Unom (115%Unom, 85%Unom) input power voltage.

Reference numbers of test equipment used

HL 1984	HL 2871	HL 2909	HL 4353				
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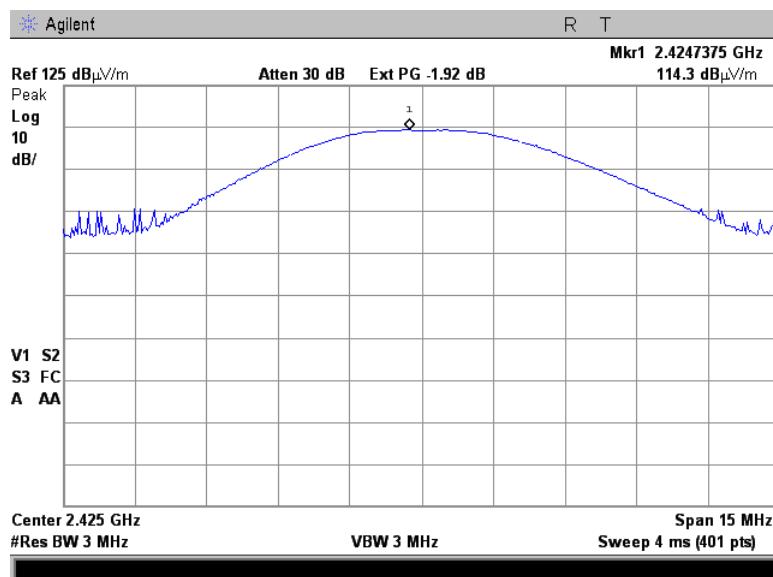
Full description is given in Appendix A.



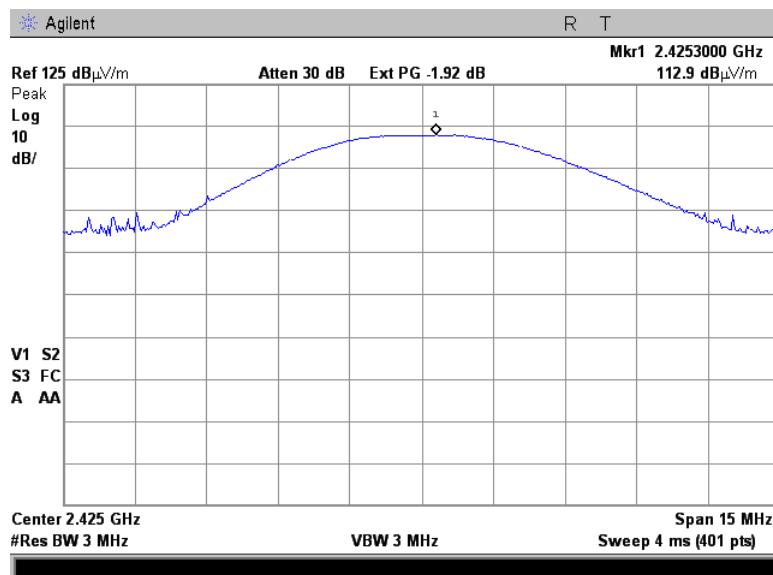
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Test specification:	FCC section 15.247(b)3, RSS-210 section A8.4(4) ,Peak output power		
Test procedure:	FR Vol.62, page 26243, Section 15.247(b)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.2 °C	Air Pressure: 1008 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.2.1 Field strength of carrier in vertical antenna polarization



Plot 7.2.2 Field strength of carrier in horizontal antenna polarization





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Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

7.3 Field strength of spurious emissions

7.3.1 General

This test was performed to measure field strength of spurious emissions from the EUT. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Radiated spurious emissions limits

Frequency, MHz	Field strength at 3 m within restricted bands, dB(µV/m)*			Attenuation of field strength of spurious versus carrier outside restricted bands, dBc***	
	Peak	Quasi Peak	Average		
0.009 – 0.090	148.5 – 128.5	NA	128.5 – 108.5**	20.0	
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			
1000 – 10 th harmonic	74.0	NA	54.0		

*- 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.

*** - The 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.

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

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and the performance check was conducted.

7.3.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

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

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

7.3.3.1 The EUT was set up as shown in Figure 7.3.2, energized and the performance check was conducted.

7.3.3.2 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.

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



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Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Figure 7.3.1 Setup for spurious emission field strength measurements below 30 MHz

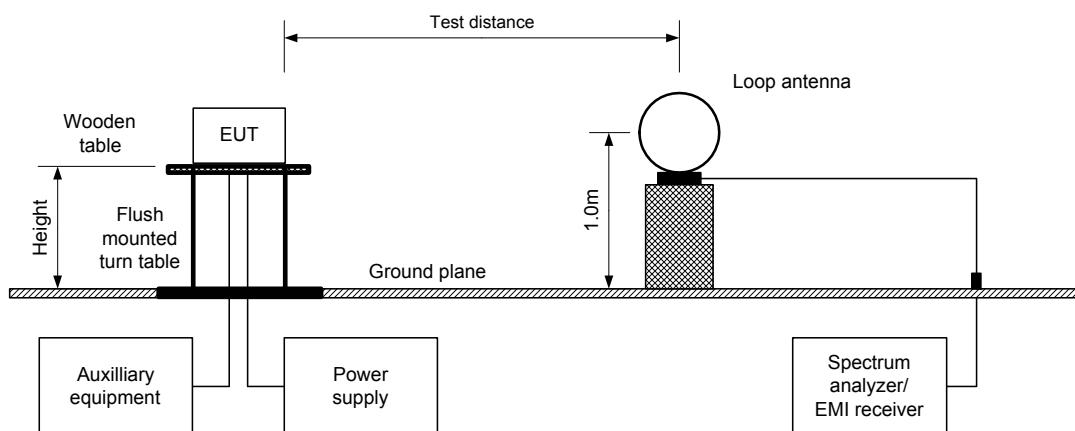
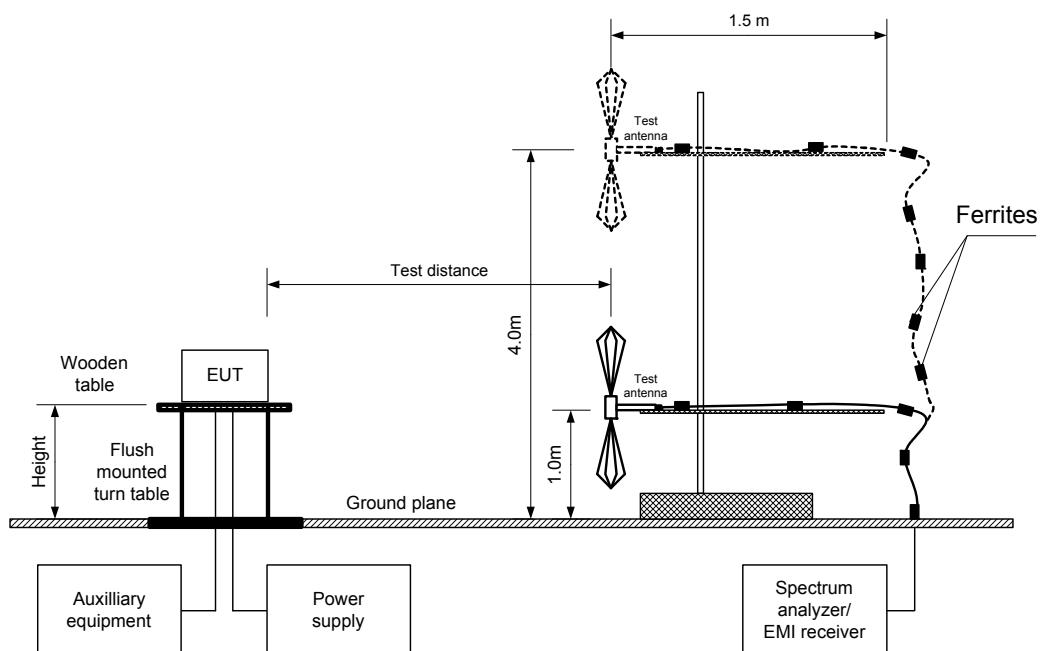


Figure 7.3.2 Setup for spurious emission field strength measurements above 30 MHz





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Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.2 Field strength of emissions outside restricted bands

ASSIGNED FREQUENCY:	2400.0 – 2483.5MHz
INVESTIGATED FREQUENCY RANGE:	0.009 - 25000 MHz
TEST DISTANCE:	3 m
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength of spurious, dB(µV/m)	Antenna polarization	Antenna height, m	Azimuth, degrees*	Field strength of carrier, dB(µV/m)	Attenuation below carrier, dBc	Limit, dBc	Margin, dB**	Verdict
9697.90	63.00	Hor	1.5	30	108.7	45.70	20.0	25.70	Pass
14552.87	71.50	Vert	1.0	80	110.2	38.70	20.0	18.70	Pass

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

**- Margin = Attenuation below carrier – specification limit.



HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY:	2400.0 – 2483.5MHz
INVESTIGATED FREQUENCY RANGE:	1000 - 25000 MHz
TEST DISTANCE:	3 m
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	1000 kHz
TEST ANTENNA TYPE:	Double ridged guide

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)			Verdict
	Polarization	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Calculated, dB(µV/m)	Limit, dB(µV/m)	
4850.975	Hor	1.35	280	62.53	74.0	-11.47	55.80	12.10	54	-41.90
7276.375	Hor	1.5	30	66.48	74.0	-7.52	58.87	15.17	54	-38.83

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

**- Margin = Measured field strength - specification limit.

***- Margin = Calculated field strength - specification limit,

where Calculated field strength = Measured field strength + average factor.

Table 7.3.4 Average factor calculation

Transmission pulse		Transmission burst		Transmission train duration, ms	Average factor, dB
Duration, ms	Period, ms	Duration, ms	Period, ms		
0.65	102.5	NA	NA	NA	-43.7

*- Average factor was calculated as follows

for pulse train shorter than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{\text{Train duration}} \times \text{Number of bursts within pulse train} \right)$$

for pulse train longer than 100 ms:

$$\text{Average factor} = 20 \times \log_{10} \left(\frac{\text{Pulse duration}}{\text{Pulse period}} \times \frac{\text{Burst duration}}{100 \text{ ms}} \times \text{Number of bursts within 100 ms} \right)$$



HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Table 7.3.5 Field strength of spurious emissions below 1 GHz within restricted bands

ASSIGNED FREQUENCY:	2400.0 – 2483.5MHz
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
TEST DISTANCE:	3 m
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum
RESOLUTION BANDWIDTH:	0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz) > Resolution bandwidth
VIDEO BANDWIDTH:	
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Log periodic (200 MHz – 1000 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*			
135.2110	34.8	26.0	43.5	-17.50	Vert	1.0	0
150.0125	42.3	41.1	43.5	-2.40	Vert	1.0	133
250.0050	45.8	44.4	46.0	-1.60	Vert	1.0	256

*- Margin = Measured emission - specification limit.

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

Table 7.3.6 Restricted bands

MHz	MHz	MHz	MHz	MHz	GHz
0.09 - 0.11	8.37625 - 8.38675	73 - 74.6	399.9 - 410	2690 - 2900	10.6 - 12.7
0.495 - 0.505	8.41425 - 8.41475	74.8 - 75.2	608 - 614	3260 - 3267	13.25 - 13.4
2.1735 - 2.1905	12.29 - 12.293	108 - 121.94	960 - 1240	3332 - 3339	14.47 - 14.5
4.125 - 4.128	12.51975 - 12.52025	123 - 138	1300 - 1427	3345.8 - 3358	15.35 - 16.2
4.17725 - 4.17775	12.57675 - 12.57725	149.9 - 150.05	1435 - 1626.5	3600 - 4400	17.7 - 21.4
4.20725 - 4.20775	13.36 - 13.41	156.52475 - 156.52525	1645.5 - 1646.5	4500 - 5150	22.01 - 23.12
6.215 - 6.218	16.42 - 16.423	156.7 - 156.9	1660 - 1710	5350 - 5460	23.6 - 24
6.26775 - 6.26825	16.69475 - 16.69525	162.0125 - 167.17	1718.8 - 1722.2	7250 - 7750	31.2 - 31.8
6.31175 - 6.31225	16.80425 - 16.80475	167.72 - 173.2	2200 - 2300	8025 - 8500	36.43 - 36.5
8.291 - 8.294	25.5 - 25.67	240 - 285	2310 - 2390	9000 - 9200	
8.362 - 8.366	37.5 - 38.25	322 - 335.4	2483.5 - 2500	9300 - 9500	Above 38.6

Reference numbers of test equipment used

HL 0446	HL 0521	HL 0604	HL 0768	HL 0769	HL 1984	HL 2871	HL 2909
HL 4353							

Full description is given in Appendix A.

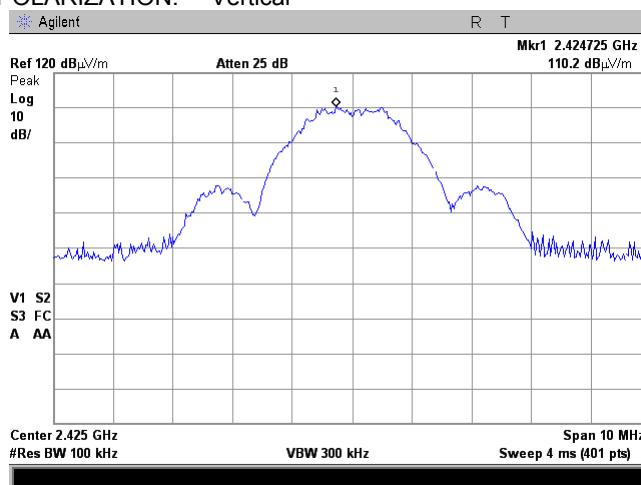


HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

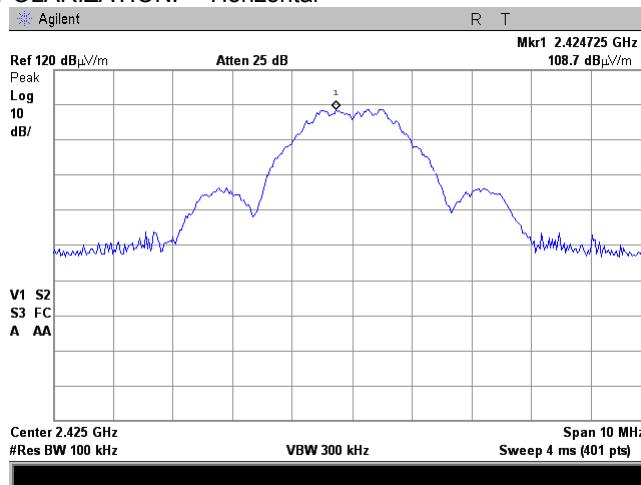
Plot 7.3.1 Radiated emission measurements at the carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Plot 7.3.2 Radiated emission measurements at the carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal



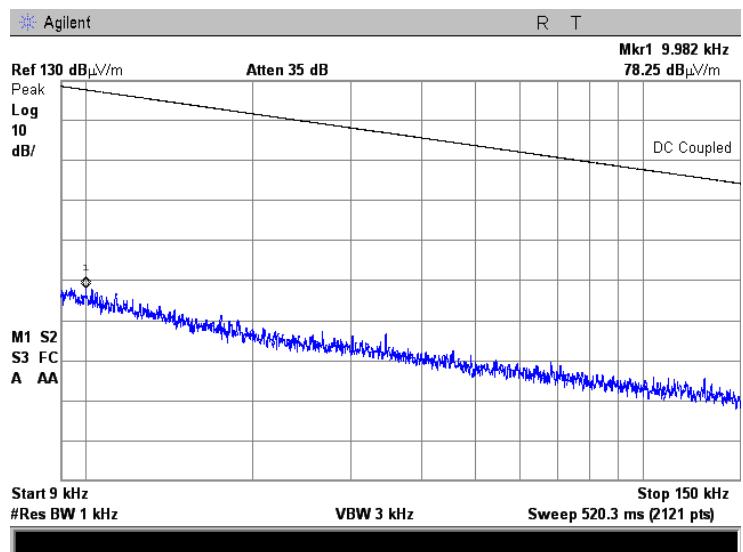


HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

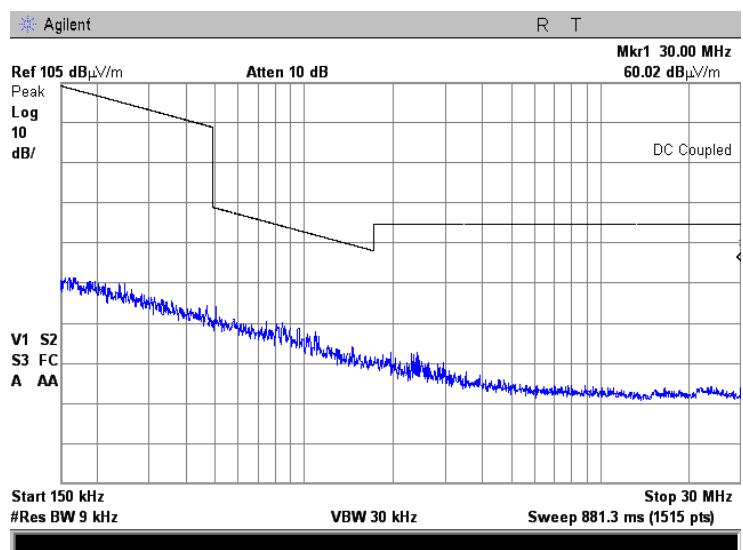
Plot 7.3.3 Radiated emission measurements from 9 to 150 kHz at the carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



Plot 7.3.4 Radiated emission measurements from 0.15 to 30 MHz at the carrier frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical



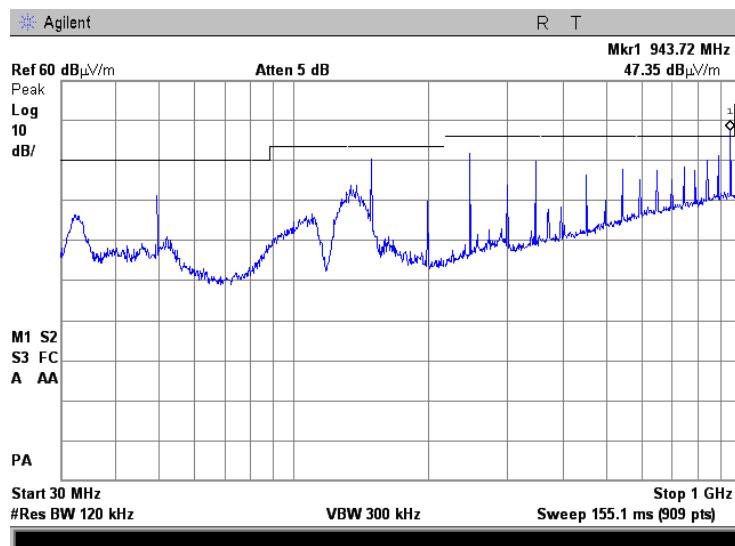


HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.5 Radiated emission measurements from 30 to 1000 MHz at carrier frequency

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal



Note: The highest emission was found outside the restricted bands.

Plot 7.3.6 Radiated emission measurements from 1000 to 14000 MHz at carrier frequency

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





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.7 Radiated emission measurements from 14000 to 18000 MHz at the carrier frequency

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

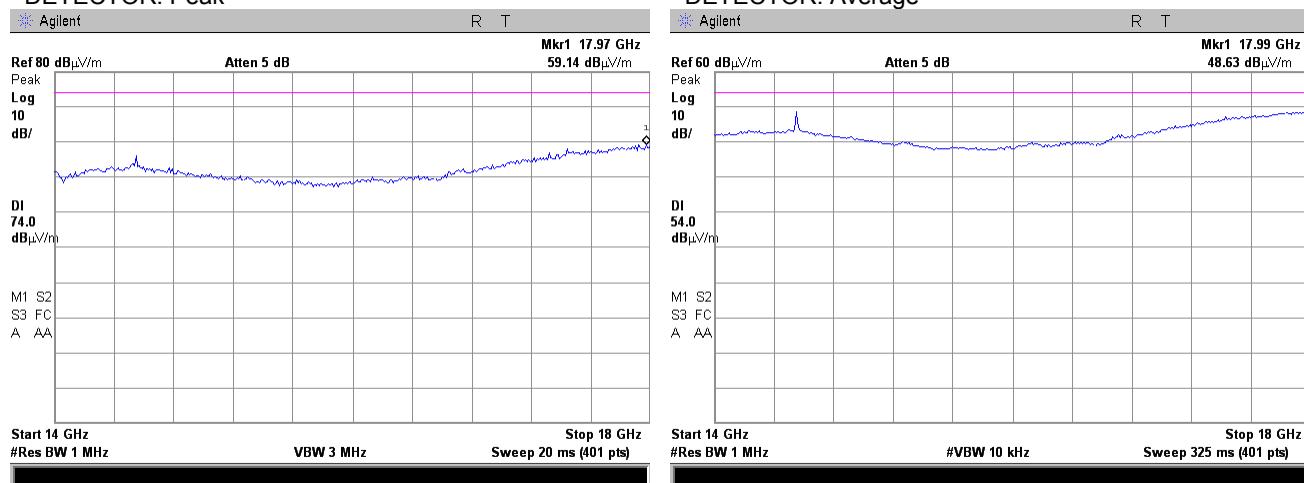
3 m

ANTENNA POLARIZATION:

Vertical and Horizontal

DETECTOR: Peak

DETECTOR: Average

**Plot 7.3.8 Radiated emission measurements from 18000 to 25000 MHz at the carrier frequency**

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

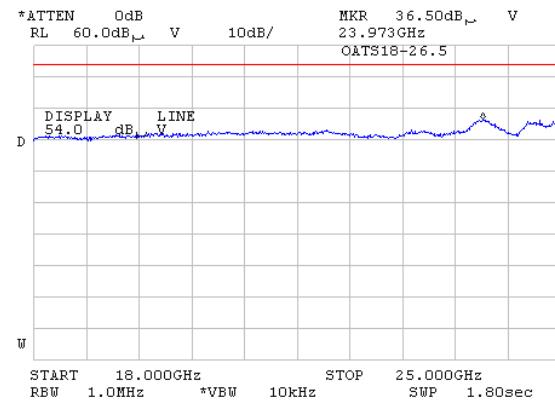
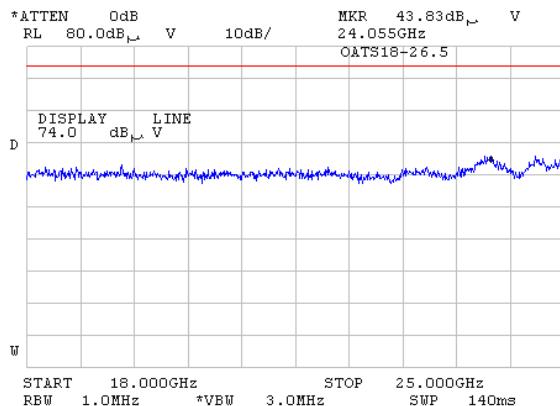
3 m

ANTENNA POLARIZATION:

Vertical and Horizontal

DETECTOR: Peak

DETECTOR: Average





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.9 Radiated emission measurements at the second harmonic of carrier frequency

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

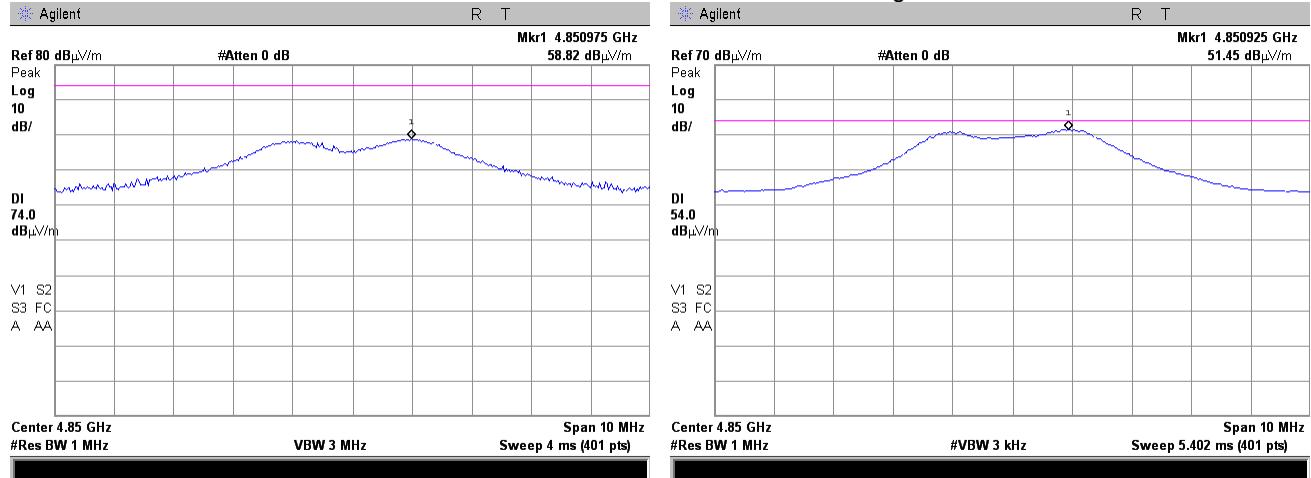
3 m

ANTENNA POLARIZATION:

Vertical

DETECTOR: Peak

DETECTOR: Average

**Plot 7.3.10 Radiated emission measurements at the second harmonic of carrier frequency**

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

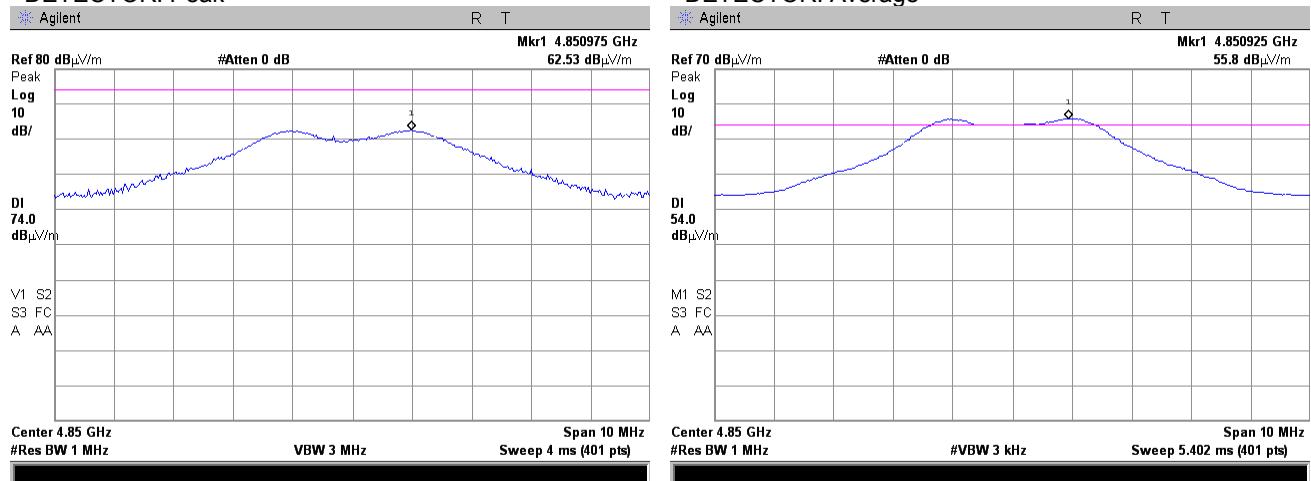
3 m

ANTENNA POLARIZATION:

Horizontal

DETECTOR: Peak

DETECTOR: Average





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.11 Radiated emission measurements at the third harmonic of low carrier frequency

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

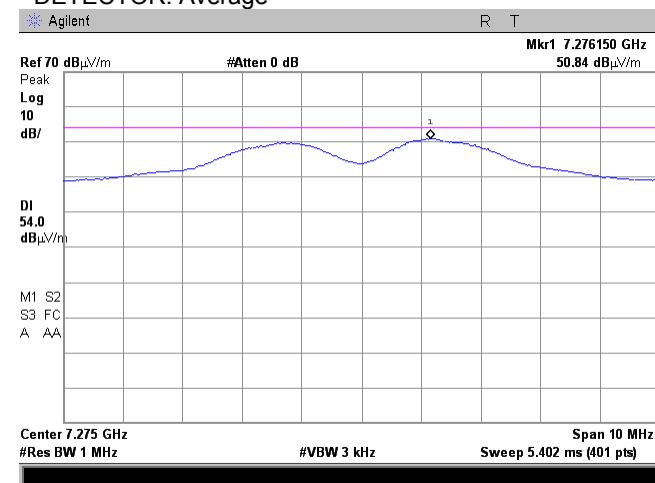
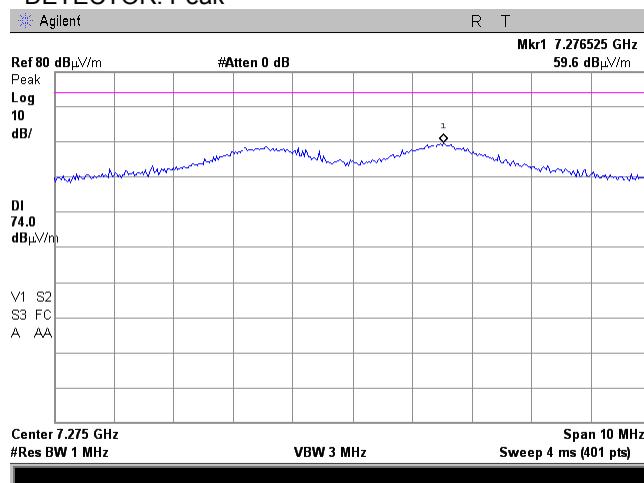
3 m

ANTENNA POLARIZATION:

Vertical

DETECTOR: Peak

DETECTOR: Average

**Plot 7.3.12 Radiated emission measurements at the third harmonic of mid carrier frequency**

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

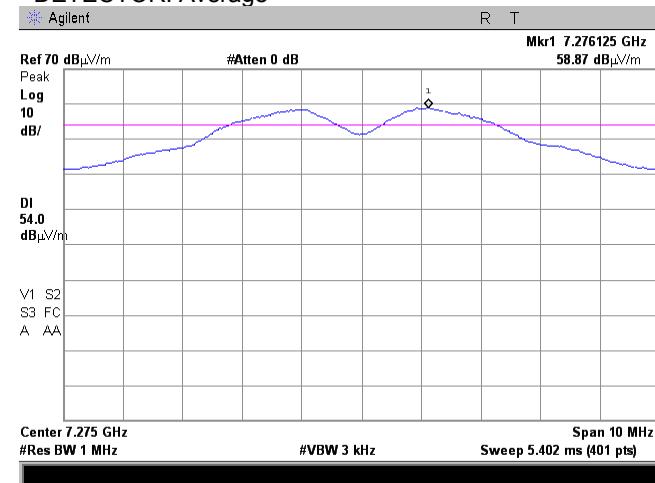
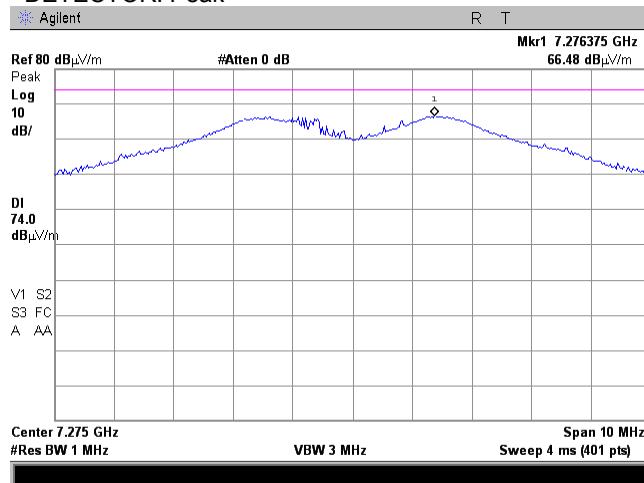
3 m

ANTENNA POLARIZATION:

Horizontal

DETECTOR: Peak

DETECTOR: Average





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.13 Radiated emission measurements at the fourth harmonic of low carrier frequency

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

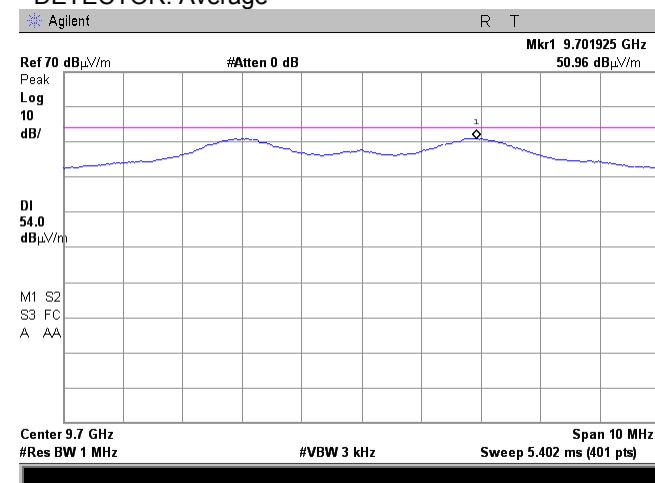
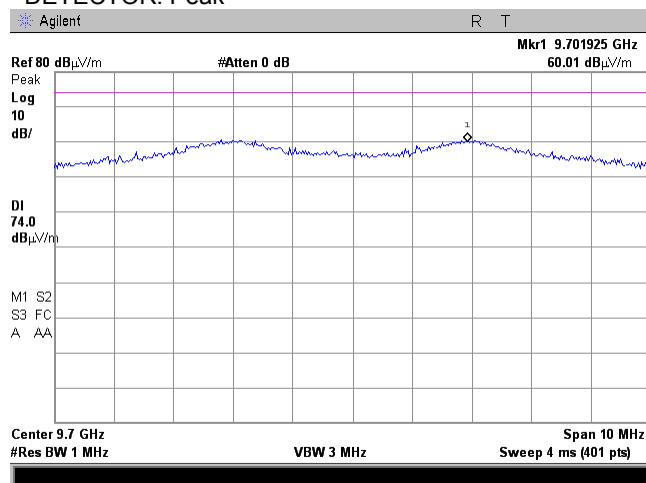
3 m

ANTENNA POLARIZATION:

Vertical

DETECTOR: Peak

DETECTOR: Average

**Plot 7.3.14 Radiated emission measurements at the fourth harmonic of mid carrier frequency**

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

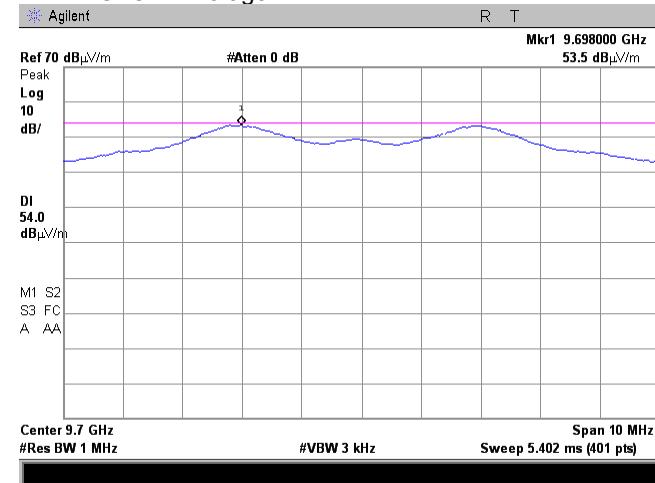
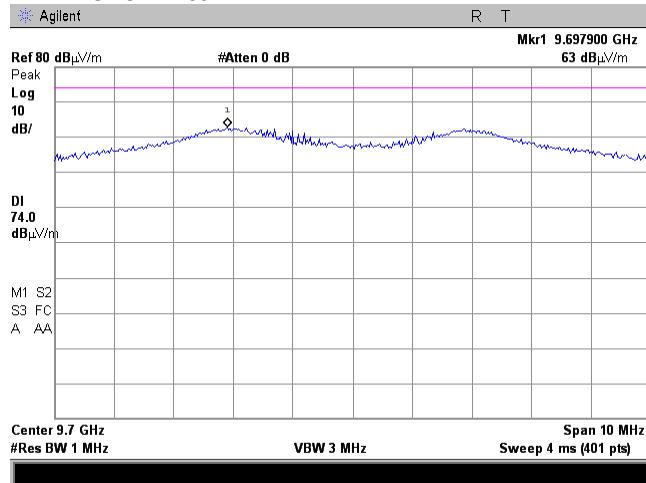
3 m

ANTENNA POLARIZATION:

Horizontal r

DETECTOR: Peak

DETECTOR: Average





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.15 Radiated emission measurements at the sixth harmonic

TEST SITE:

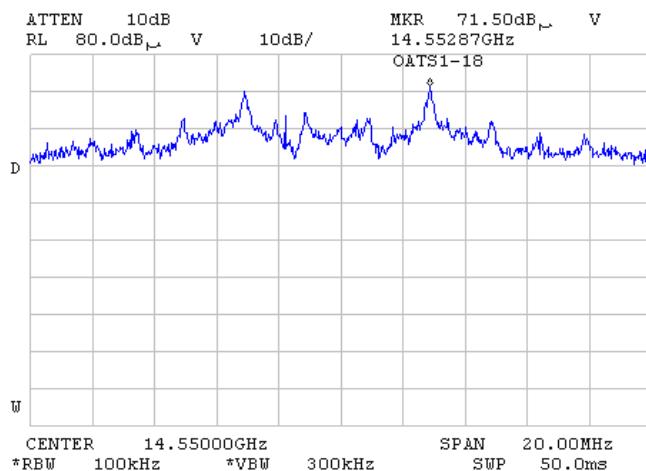
OATS

TEST DISTANCE:

3 m

ANTENNA POLARIZATION:

Vertical



Plot 7.3.16 Radiated emission measurements at the sixth harmonic

TEST SITE:

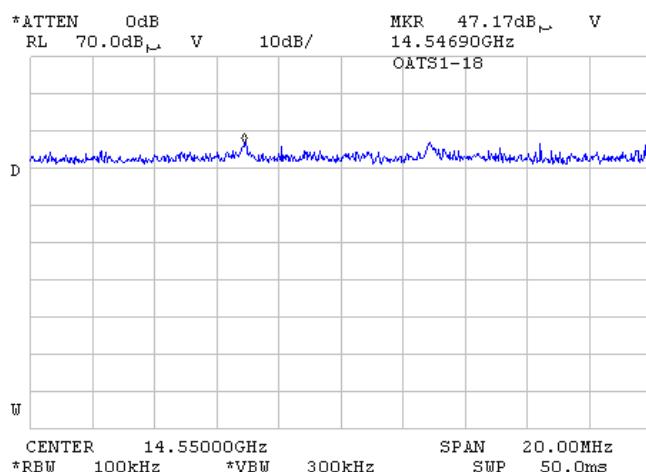
OATS

TEST DISTANCE:

3 m

ANTENNA POLARIZATION:

Horizontal

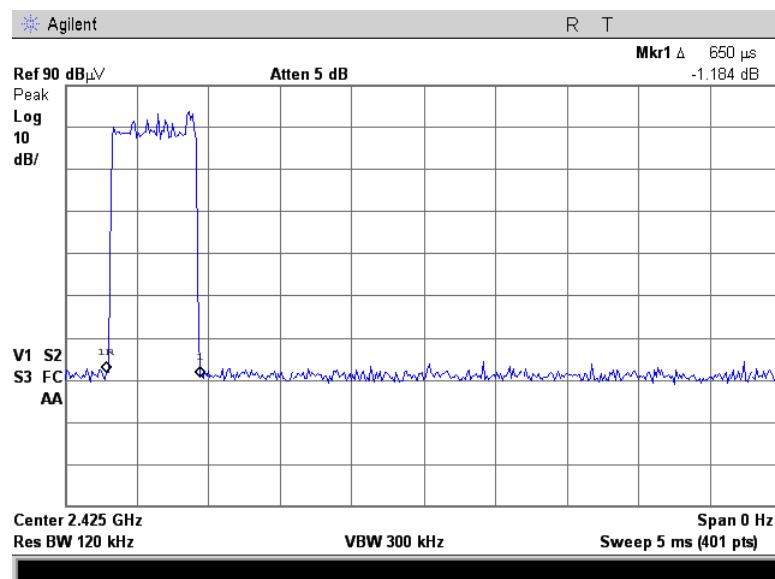




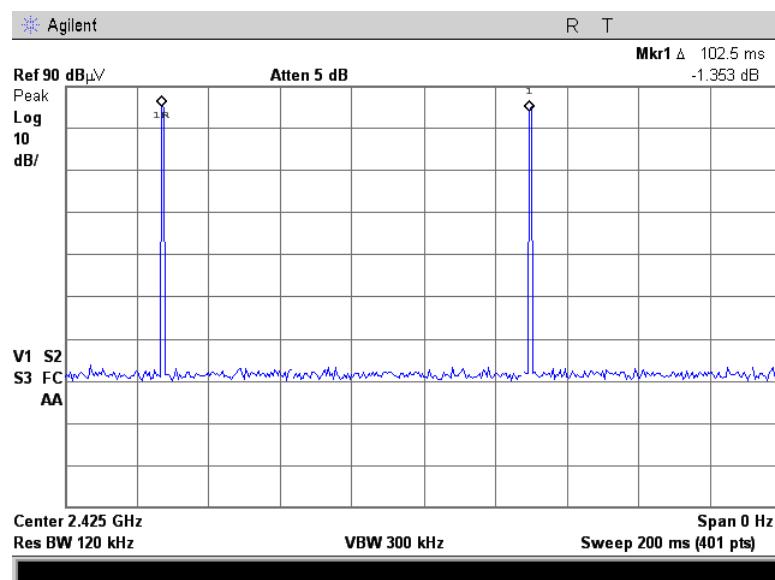
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Radiated spurious emissions		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(d) / ANSI C63.4, Section 13.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/1/2013 - 5/12/2013		
Temperature: 25.4 °C	Air Pressure: 1009 hPa	Relative Humidity: 36 %	Power Supply: 120 VAC
Remarks:			

Plot 7.3.17 Transmission pulse duration



Plot 7.3.18 Transmission pulse period





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/2/2013	Air Pressure: 1010 hPa	Relative Humidity: 47 %
Temperature: 23.5 °C		Power Supply: 120 VAC	
Remarks:			

7.4 Band edge radiated emissions

7.4.1 General

This test was performed to measure emissions, radiated from the EUT at the assigned frequency band edges. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Band edge emission limits

Output power	Assigned frequency, MHz	Attenuation below carrier*, dBc	Field strength at 3 m within restricted bands, dB(μV/m)	
			Peak	Average
Peak	902.0 – 928.0	20.0	74.0	54.0
	2400.0 – 2483.5			
	5725.0 – 5850.0			
Averaged over a time interval	902.0 – 928.0	30.0	74.0	54.0
	2400.0 – 2483.5			
	5725.0 – 5850.0			

* - Band edge emission limit is provided in terms of attenuation below the peak of modulated carrier measured with the same resolution bandwidth.

7.4.2 Test procedure

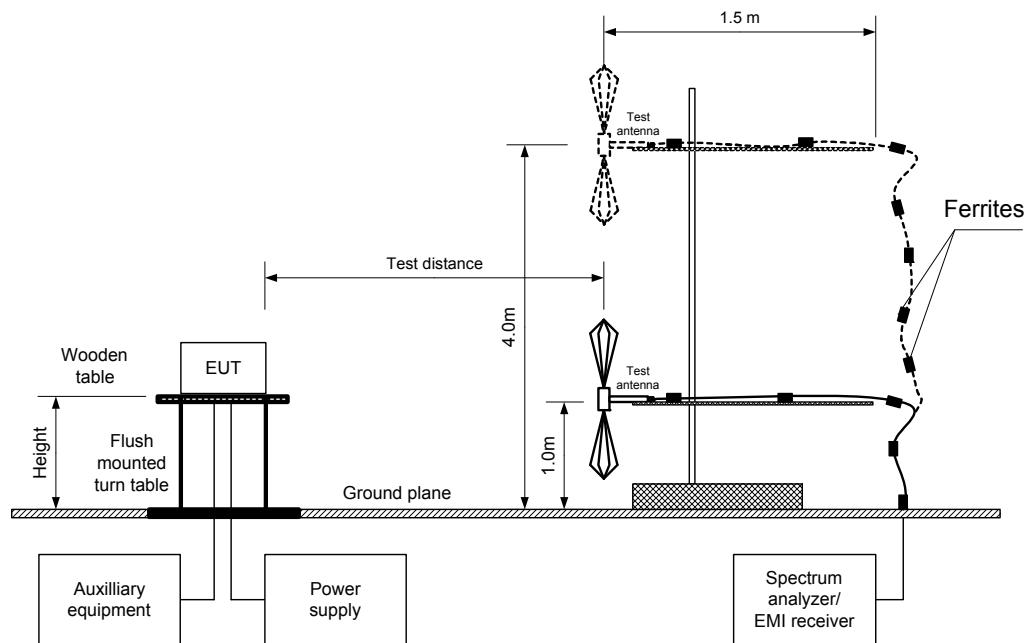
- 7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized normally modulated at the maximum data rate and its proper operation was checked.
- 7.4.2.2 The EUT was adjusted to produce maximum available to end user RF output power at the lowest carrier frequency.
- 7.4.2.3 The spectrum analyzer span was set to capture the carrier frequency and associated modulation products. The resolution bandwidth was set wider than 1 % of the frequency span.
- 7.4.2.4 The spectrum analyzer was set in max hold mode and allowed trace to stabilize. The highest emission level within the authorized band was measured.
- 7.4.2.5 The maximum band edge emission and modulation product outside of the band were measured as provided in Table 7.4.2 and associated plots and referenced to the highest emission level measured within the authorized band.
- 7.4.2.6 The above procedure was repeated with the EUT adjusted to produce maximum RF output power at the highest carrier frequency.



HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Figure 7.4.1 Band edge emission test setup





HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Table 7.4.2 Band edge emission test results

ASSIGNED FREQUENCY RANGE: 2400.0 – 2483.5 MHz
 DETECTOR USED: Peak
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 BIT RATE: 250 kbps
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum
 RESOLUTION BANDWIDTH: $\geq 1\%$ of the span
 VIDEO BANDWIDTH: \geq RBW
 NOTE: Outside restricted bands

Frequency, MHz	Band edge emission, dBuV	Emission at carrier, dBuV	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Antenna Vertical						
2391.00	71.09	111.5	40.41	20.0	20.41	Pass
Antenna Horizontal						
2397.50	69.49	108.9	39.41	20.0	19.41	Pass

NOTE: Inside restricted bands

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)			Verdict
	Polarization	Height, m		Measured, dB(μ V/m)	Limit, dB(μ V/m)	Margin, dB**	Measured, dB(μ V/m)	Limit, dB(μ V/m)	Margin, dB***	
Low carrier frequency										
2389.50	Vert	1.0	53	71.09	74.0	-2.91	46.10	54.0	-7.90	Pass
2484.08	Vert	1.0	53	61.66	74.0	-12.34	42.57	54.0	-11.43	
2383.00	Hor	1.1	171	69.49	74.0	-4.51	45.22	54.0	-8.78	
2487.09	Hor	1.1	171	62.29	74.0	-11.71	42.72	54.0	-11.28	

*- Margin = Attenuation below carrier – specification limit.

Reference numbers of test equipment used

HL 1984	HL 2871	HL 2909	HL 4353				
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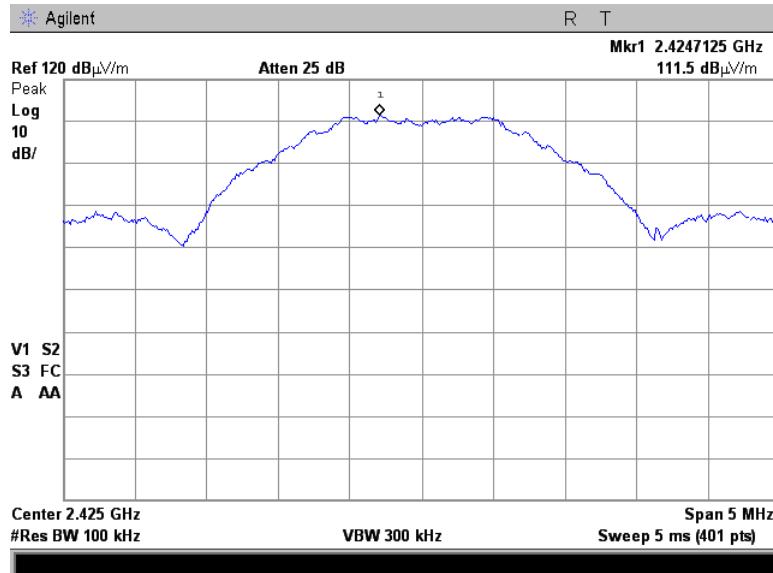
Full description is given in Appendix A.



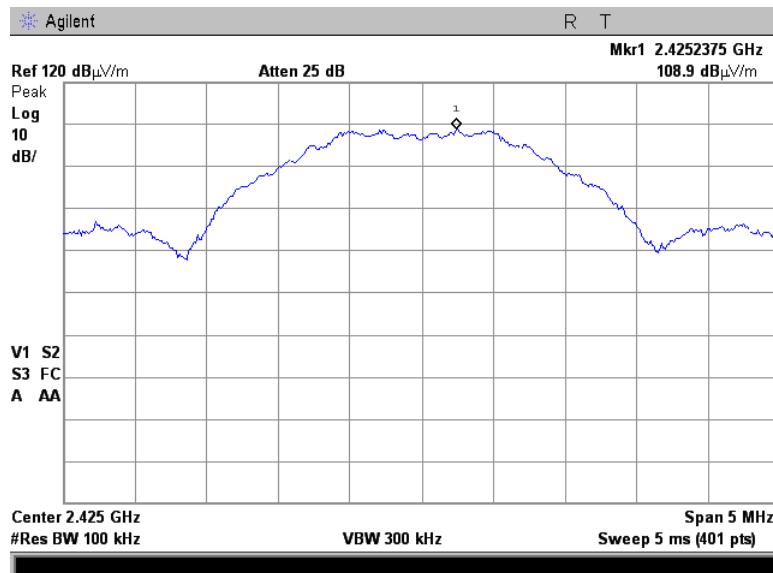
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.1 The highest emission level within the assigned band at carrier frequency, vertical antenna polarization



Plot 7.4.2 The highest emission level within the assigned band at carrier frequency, horizontal antenna polarization

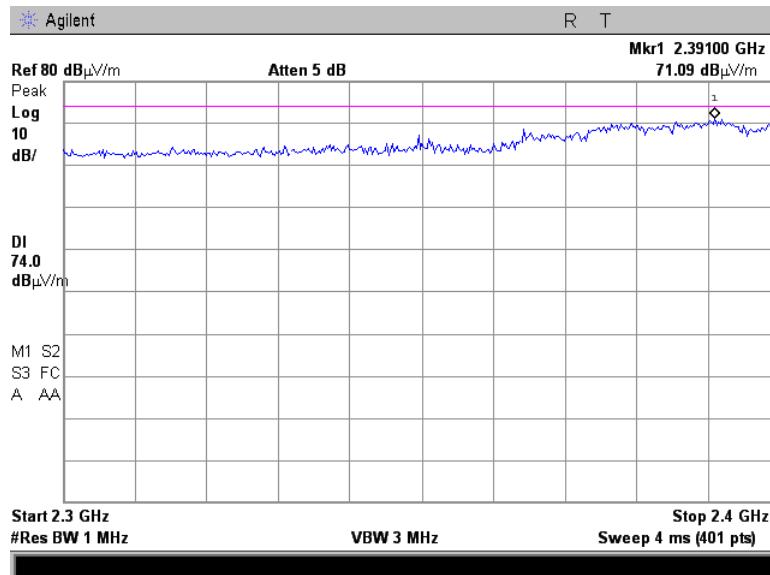




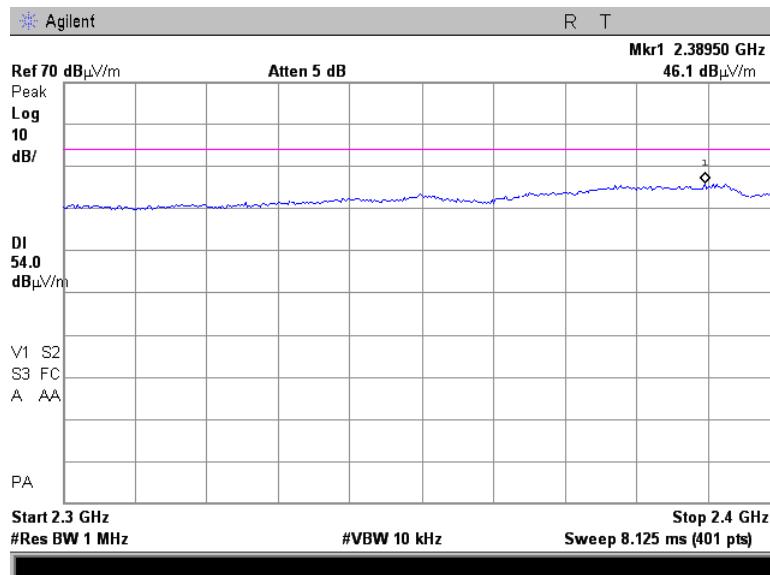
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.3 The low band edge emission in vertical antenna polarization, VBW=3 MHz



Plot 7.4.4 The low band edge emission in vertical antenna polarization, VBW=10 kHz

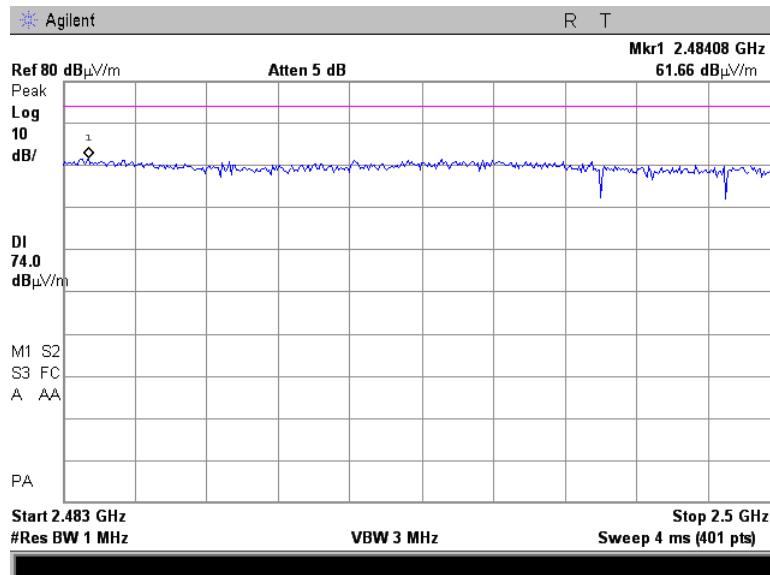




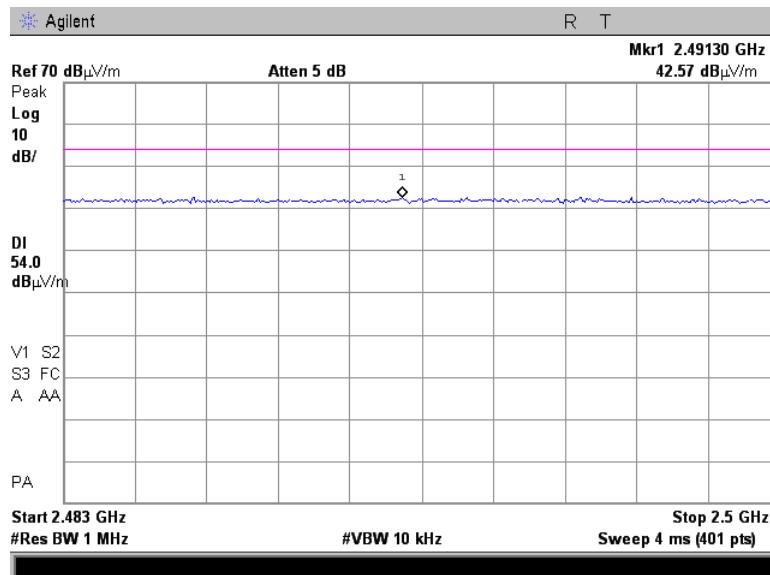
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.5 The high band edge emission in vertical antenna polarization, VBW=3 MHz



Plot 7.4.6 The high band edge emission in vertical antenna polarization, VBW=10 kHz

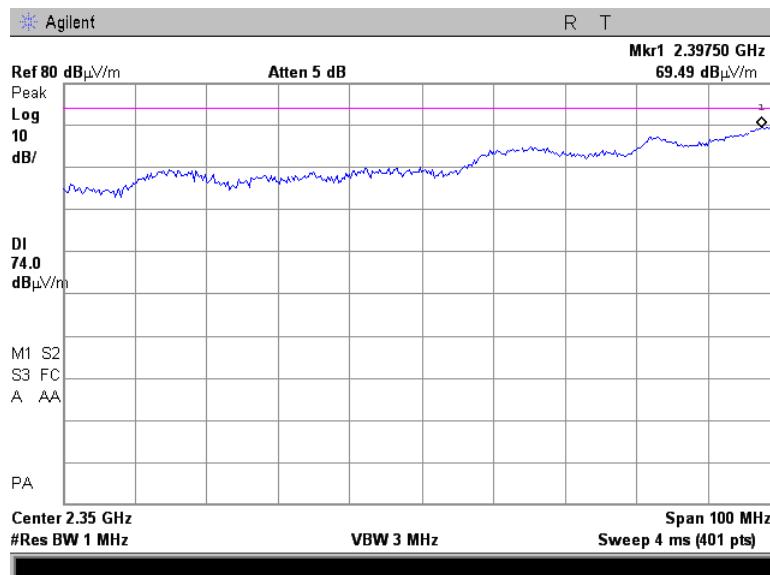




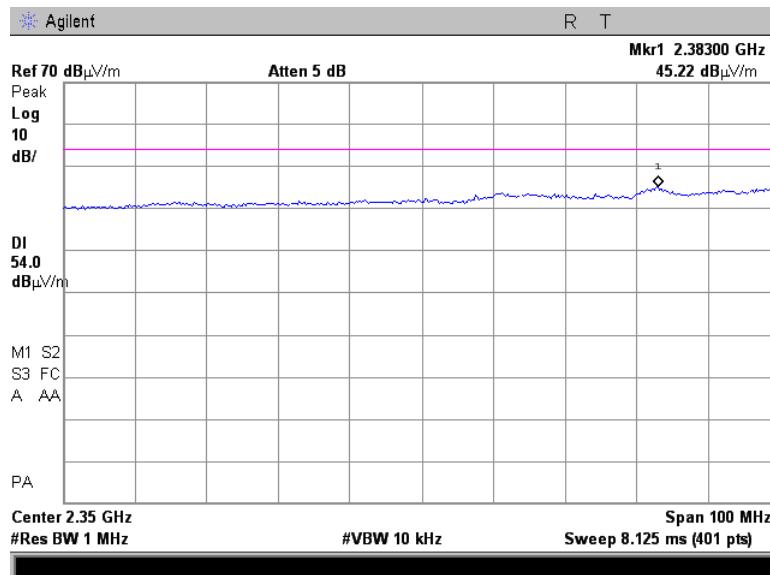
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.7 The low band edge emission in horizontal antenna polarization, VBW=3 MHz



Plot 7.4.8 The low band edge emission in horizontal antenna polarization, VBW=10 kHz

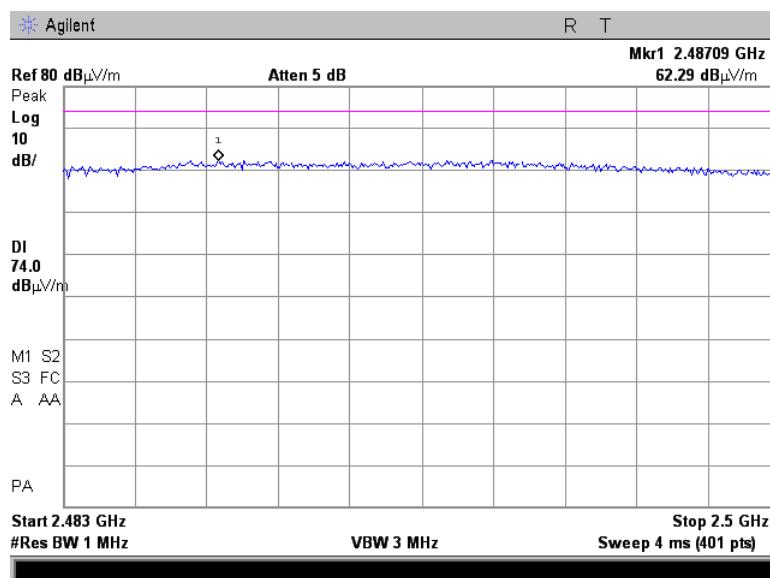




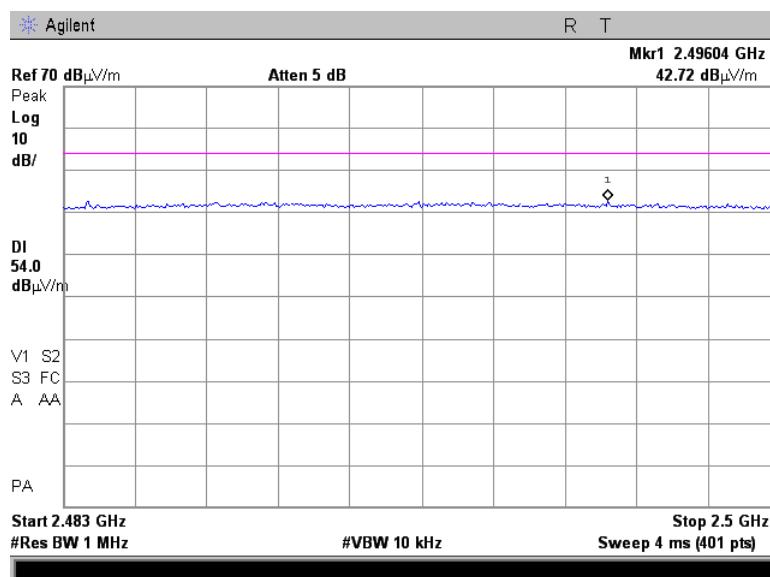
HERMON LABORATORIES

Test specification:	FCC section 15.247(d), RSS-210 section A8.5, Band edge emissions		
Test procedure:	Public notice DA 00-705		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013		
Temperature: 23.5 °C	Air Pressure: 1010 hPa	Relative Humidity: 47 %	Power Supply: 120 VAC
Remarks:			

Plot 7.4.9 The high band edge emission in horizontal antenna polarization, VBW=3 MHz



Plot 7.4.10 The high band edge emission in horizontal antenna polarization, VBW=10 kHz





HERMON LABORATORIES

Test specification:	FCC section 15.247(e), RSS-210 A8.2(b), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(e)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013 - 5/12/2013		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.5 Peak spectral power density

7.5.1 General

This test was performed to measure the peak spectral power density radiated by the transmitter RF antenna. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Peak spectral power density limits

Assigned frequency range, MHz	Measurement bandwidth, kHz	Peak spectral power density, dBm	Equivalent field strength limit @ 3m, dB(µV/m)*
902.0 – 928.0			
2400.0 – 2483.5	3.0	8.0	103.2
5725.0 – 5850.0			

* - Equivalent field strength limit was calculated from the peak spectral power density as follows: $E = \sqrt{30 \times P} / r$, where P is peak spectral power density and r is antenna to EUT distance in meters.

7.5.2 Test procedure for field strength measurements

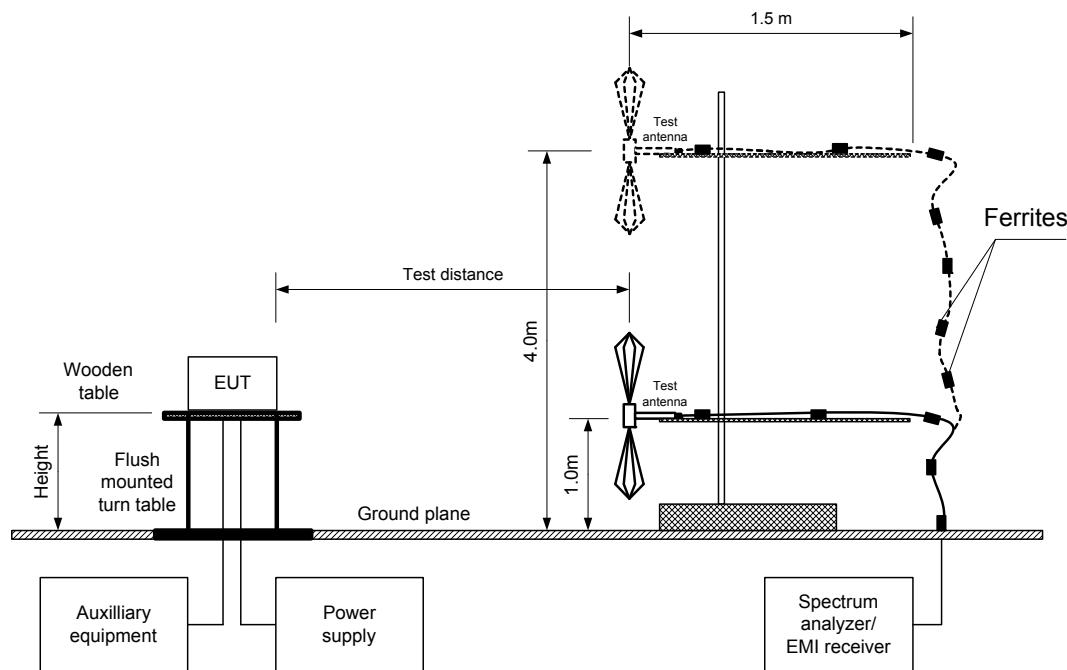
- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT was adjusted to produce maximum available to end user RF output power.
- 7.5.2.3 The field strength of the EUT carrier frequency was measured with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna height was swept in both vertical and horizontal polarizations.
- 7.5.2.4 The frequency span of spectrum analyzer was set to capture the entire 6 dB band of the transmitter, in peak hold mode with resolution bandwidth set to 3.0 kHz, video bandwidth wider than resolution bandwidth, auto sweep time and sufficient number of sweeps was allowed for trace stabilization. The spectrum lines spacing was verified to be wider than 3 kHz. Otherwise the resolution bandwidth was reduced until individual spectrum lines were resolved and the power of individual spectrum lines was integrated over 3 kHz band.
- 7.5.2.5 The peak of emission was zoomed with span set just wide enough to capture the emission peak area and sweep time was set equal to span width divided by resolution bandwidth. Spectrum analyzer was set in peak hold mode, sufficient number of sweeps was allowed for trace stabilization and peak spectral power density was measured as provided in Table 7.5.2 and associated plots.



HERMON LABORATORIES

Test specification:	FCC section 15.247(e), RSS-210 A8.2(b), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(e)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013 - 5/12/2013		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Figure 7.5.1 Setup for carrier field strength measurements





HERMON LABORATORIES

Test specification:	FCC section 15.247(e), RSS-210 A8.2(b), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(e)		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/2/2013 - 5/12/2013		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Table 7.5.2 Field strength measurement of peak spectral power density

ASSIGNED FREQUENCY:	2400.0 – 2483.5 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
EUT HEIGHT:	0.8 m
DETECTOR USED:	Peak
RESOLUTION BANDWIDTH:	100 kHz
VIDEO BANDWIDTH:	300 kHz
TEST ANTENNA TYPE:	Biconilog (30 MHz – 1000 MHz) Double ridged guide (above 1000 MHz)
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
BIT RATE:	250 kbps
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
2425.044	95.39	103.2	-7.81	V	1.0	53	Pass

*- Margin = Field strength - EUT antenna gain - calculated field strength limit.

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

Reference numbers of test equipment used

HL 0521	HL 1984	HL 2871	HL 4353				
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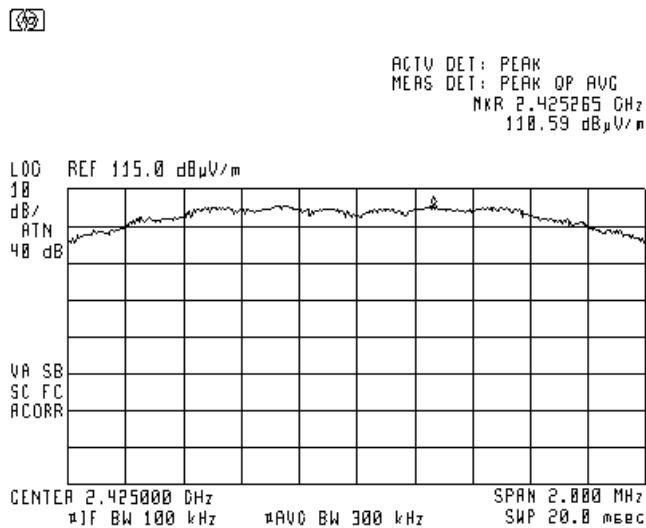
Full description is given in Appendix A.



HERMON LABORATORIES

Test specification:	FCC section 15.247(e), RSS-210 A8.2(b), Peak power density		
Test procedure:	FR Vol. 62, page 26243, Section 15.247(e)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/2/2013 - 5/12/2013		
Temperature: 24 °C	Air Pressure: 1009 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.5.1 Peak spectral power density at carrier frequency within 6 dB band



The resulting peak PSD = SA Reading + 10log(3kHz/100kHz) = 110.59 - 15.2 = 95.39 dB μ V/m



HERMON LABORATORIES

Test specification:	FCC section 15.207(a), RSS-Gen section 6.1, Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.6 Conducted emissions

7.6.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

7.6.2 Test procedure

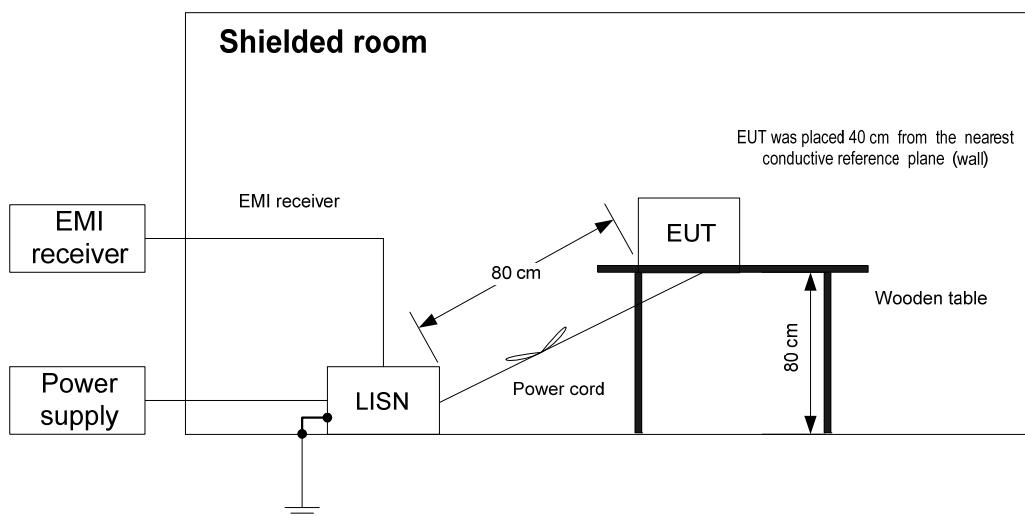
7.6.2.1 The EUT was set up as shown in Figure 7.6.1 and associated photographs, energized and the performance check was conducted.

7.6.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.6.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.6.2.3 The position of the device cables was varied to determine maximum emission level.

7.6.2.4 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

Figure 7.6.1 Setup for conducted emission measurements, table-top equipment





HERMON LABORATORIES

Test specification:	FCC section 15.207(a), RSS-Gen section 6.1, Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Table 7.6.2 Conducted emission test results

LINE: AC mains
 EUT OPERATING MODE: Transmit
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.322075	43.38	37.07	59.69	-22.62	25.87	49.69	-23.82	L1	Pass
0.526925	44.69	37.95	56.00	-18.05	25.90	46.00	-20.10		
0.566675	52.57	44.93	56.00	-11.07	33.11	46.00	-12.89		
0.758325	43.34	32.62	56.00	-23.38	21.34	46.00	-24.66		
1.369000	43.13	33.80	56.00	-22.20	23.25	46.00	-22.75		
1.554925	43.39	32.56	56.00	-23.44	20.60	46.00	-25.40		
0.258725	44.28	41.89	61.52	-19.63	29.53	51.52	-21.99	L2	Pass
0.323550	44.69	41.88	59.65	-17.77	28.49	49.65	-21.16		
0.570275	55.99	51.91	56.00	-4.09	39.19	46.00	-6.81		
0.640525	44.44	40.07	56.00	-15.93	27.79	46.00	-18.21		
0.709000	45.66	41.11	56.00	-14.89	28.10	46.00	-17.90		
1.465025	44.22	38.47	56.00	-17.53	24.97	46.00	-21.03		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 1425	HL 1512	HL 2888	HL 3612				
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Full description is given in Appendix A.



HERMON LABORATORIES

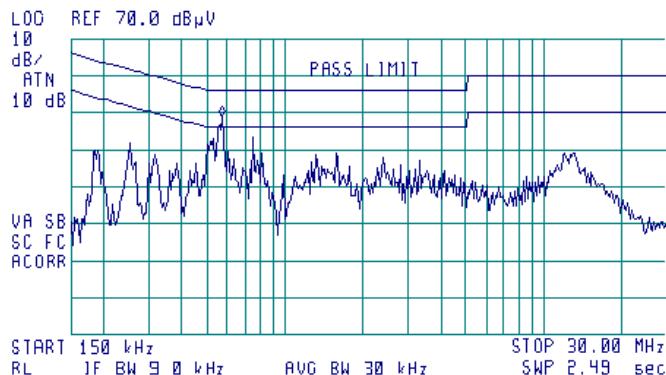
Test specification:	FCC section 15.207(a), RSS-Gen section 6.1, Conducted emission		
Test procedure:	ANSI C63.4, Section 13.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

Plot 7.6.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 580 kHz
46.85 dB μ V

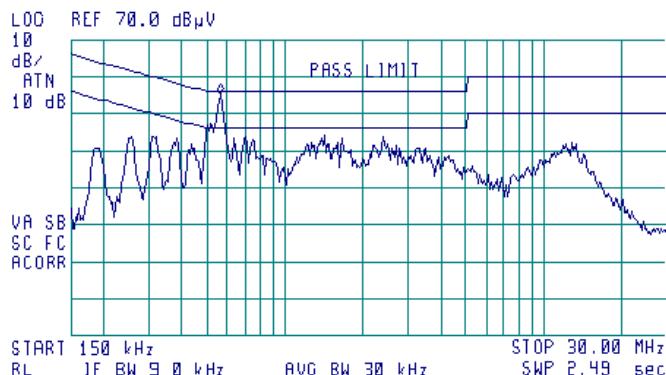


Plot 7.6.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 570 kHz
55.15 dB μ V





HERMON LABORATORIES

Test specification:	Section 15.203, RSS-Gen section 7.1.2, Antenna requirements		
Test procedure:	Visual inspection		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 44 %	Power Supply: 120 VAC
Remarks:			

7.7 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.7.1.

Table 7.7.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	Comply



HERMON LABORATORIES

Test specification:	FCC section 15.107, ICES-03 class B, conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 47 %	Power Supply: 1120 VAC
Remarks:			

8 Unintentional emissions tests

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1.

Table 8.1.1 Limits for conducted emissions a

Frequency, MHz	Class B limit, dB(µV)		Class A limit, dB(µV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

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

8.1.2 Test procedure

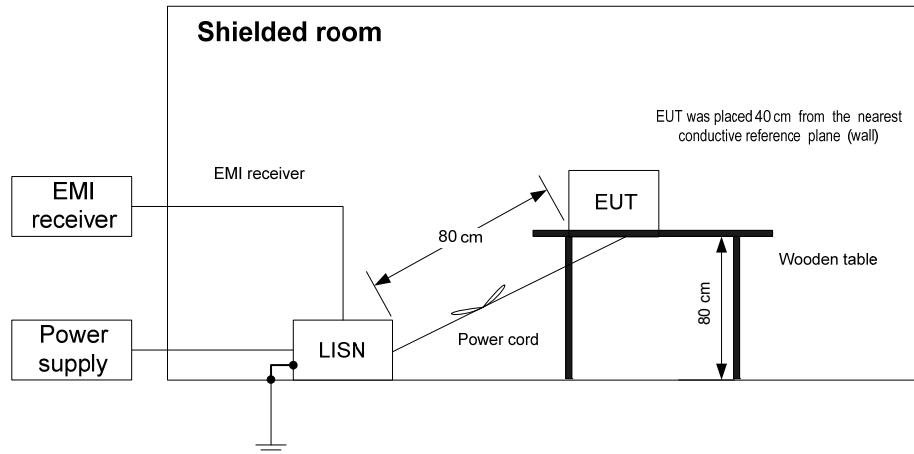
- 8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.
- 8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.
- 8.1.2.3 The position of the device cables was varied to determine maximum emission level.
- 8.1.2.4 The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.



HERMON LABORATORIES

Test specification:	FCC section 15.107, ICES-03 class B, conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 47 %	Power Supply: 1120 VAC
Remarks:			

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment



Photograph 8.1.1 Setup for conducted emission measurements





HERMON LABORATORIES

Test specification:	FCC section 15.107, ICES-03 class B, conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 47 %	Power Supply: 1120 VAC
Remarks:			

Table 8.1.2 Conducted emission test results

LINE:

AC mains

EUT OPERATING MODE:

Stand-by and receive

EUT SET UP:

TABLE-TOP

TEST SITE:

SHIELDED ROOM

FREQUENCY RANGE:

150 kHz - 30 MHz

RESOLUTION BANDWIDTH:

9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.322075	43.38	37.07	59.69	-22.62	25.87	49.69	-23.82	L1	Pass
0.526925	44.69	37.95	56.00	-18.05	25.90	46.00	-20.10		
0.566675	52.57	44.93	56.00	-11.07	33.11	46.00	-12.89		
0.758325	43.34	32.62	56.00	-23.38	21.34	46.00	-24.66		
1.369000	43.13	33.80	56.00	-22.20	23.25	46.00	-22.75		
1.554925	43.39	32.56	56.00	-23.44	20.60	46.00	-25.40		
0.258725	44.28	41.89	61.52	-19.63	29.53	51.52	-21.99		
0.323550	44.69	41.88	59.65	-17.77	28.49	49.65	-21.16		
0.570275	55.99	51.91	56.00	-4.09	39.19	46.00	-6.81		
0.640525	44.44	40.07	56.00	-15.93	27.79	46.00	-18.21		
0.709000	45.66	41.11	56.00	-14.89	28.10	46.00	-17.90		
1.465025	44.22	38.47	56.00	-17.53	24.97	46.00	-21.03		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 1425	HL 1512	HL 2888	HL 3612				
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Full description is given in Appendix A.

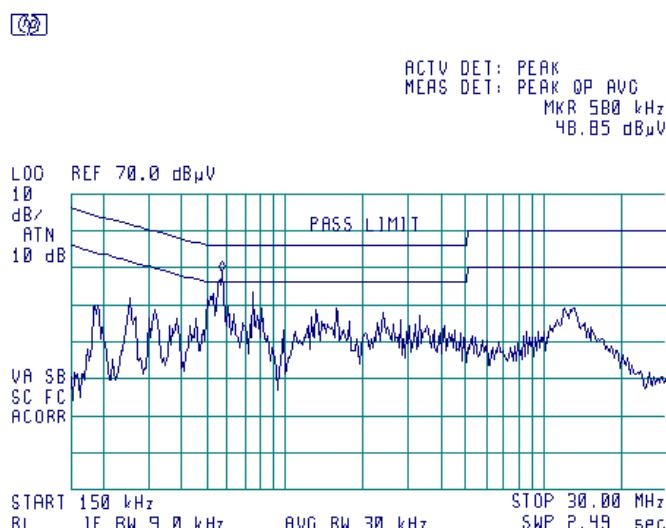


HERMON LABORATORIES

Test specification:	FCC section 15.107, ICES-03 class B, conducted emission at AC power port		
Test procedure:	ANSI C63.4, Sections 11.5 and 12.1.3		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/16/2013 - 5/19/2013		
Temperature: 23.4 °C	Air Pressure: 1012 hPa	Relative Humidity: 47 %	Power Supply: 1120 VAC
Remarks:			

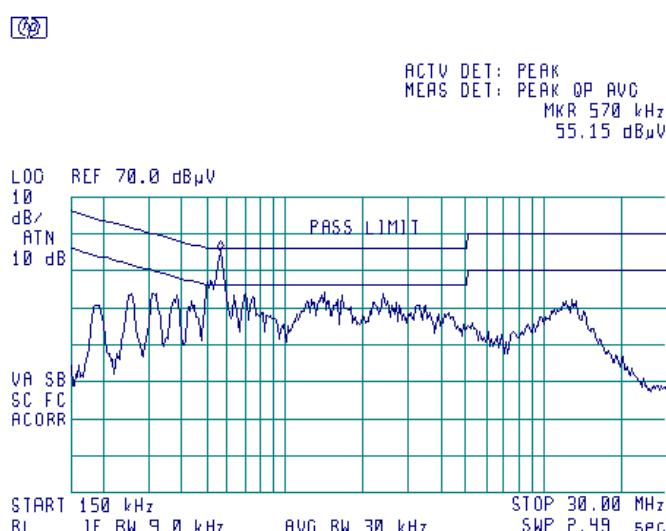
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

LINE: L2
LIMIT: Class B
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK





HERMON LABORATORIES

Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 6.1, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1, Table 8.1.2.

Table 8.2.1 Radiated emission test limits according to FCC Part 15 Section 15.109

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: $\text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log(S_1/S_2)$, where S_1 and S_2 – standard defined and test distance respectively in meters.

Table 8.2.2 Radiated emission limits according to RSS-Gen, Section 6.1

Frequency, MHz	Field strength limit at 3 m test distance, dB(µV/m)
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
960 - 3 rd harmonic**	54.0

** - harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

8.2.2 Test procedure

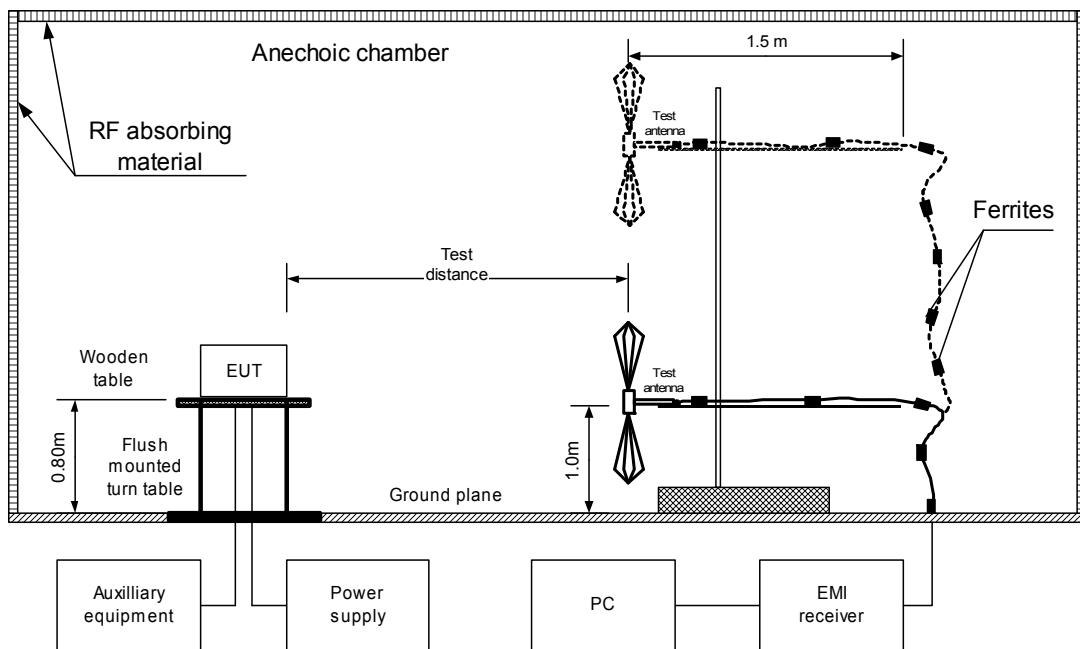
- 8.2.2.1 The EUT was set up as shown in Figure 8.2.1 and associated photograph/s, energized and the performance check was conducted.
- 8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the 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.
- 8.2.2.3 The worst test results (the lowest margins) were provided in the associated tables and plots.



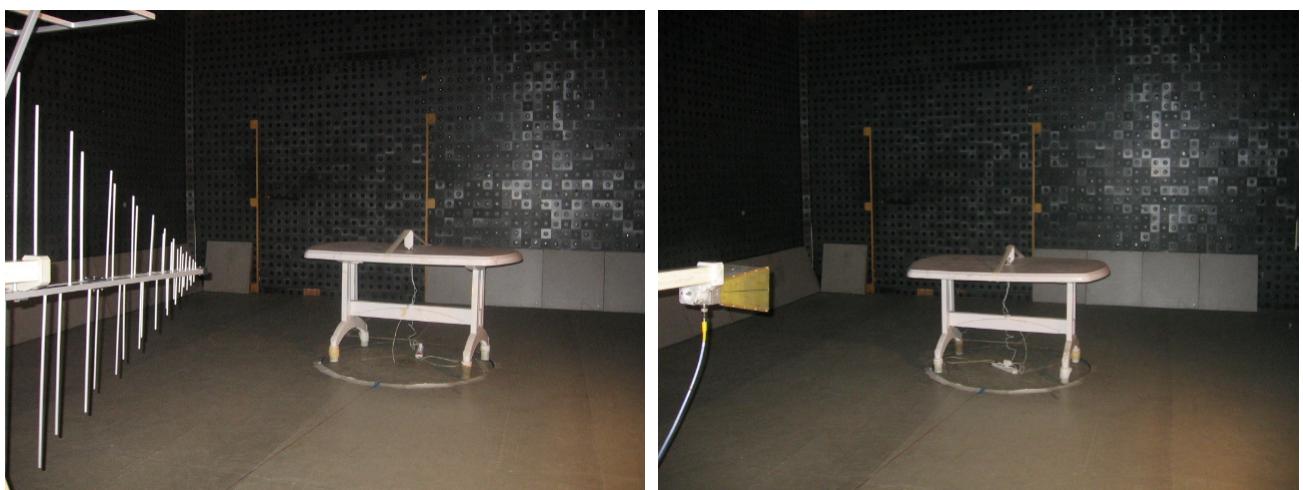
HERMON LABORATORIES

Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 6.1, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment



Photograph 8.2.1 Setup for radiated emission measurements





HERMON LABORATORIES

Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 6.1, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict: PASS	
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Table 8.2.3 Radiated emission test results

EUT SET UP:

TABLE-TOP

LIMIT:

Class B

EUT OPERATING MODE:

Stand-by and Receive

TEST SITE:

SEMI ANECHOIC CHAMBER

TEST DISTANCE:

3 m

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*				
50.005	31.4	30.1	40.0	-9.9	Vert	1.0	50	Pass
150.0125	40.3	39.1	43.5	-4.4	Vert	1.0	133	
250.0050	45.8	44.4	46.0	-1.6	Vert	1.0	256	
350.008	39.3	38.3	46.0	-7.7	Vert	1.1	262	
850.017	41.6	40.0	46.0	-6.0	Vert	1.1	125	
950.018	44.6	43.1	46.0	-2.9	Vert	1.0	135	

TEST SITE:

SEMI ANECHOIC CHAMBER

TEST DISTANCE:

3 m

DETECTORS USED:

PEAK / AVERAGE

FREQUENCY RANGE:

1000 MHz – 12500 MHz

RESOLUTION BANDWIDTH:

1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	Measured emission, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*				
1050.012	46.4	74	-27.6	43.27	54	-10.73	Vert	1.1	120	Pass
4850.070	53.51	74	-20.49	49.21	54	-4.79	Hor	1.3	240	

Reference numbers of test equipment used

HL 0604	HL 1984	HL 2871	HL 3818	HL 4160	HL 4353		
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Full description is given in Appendix A.

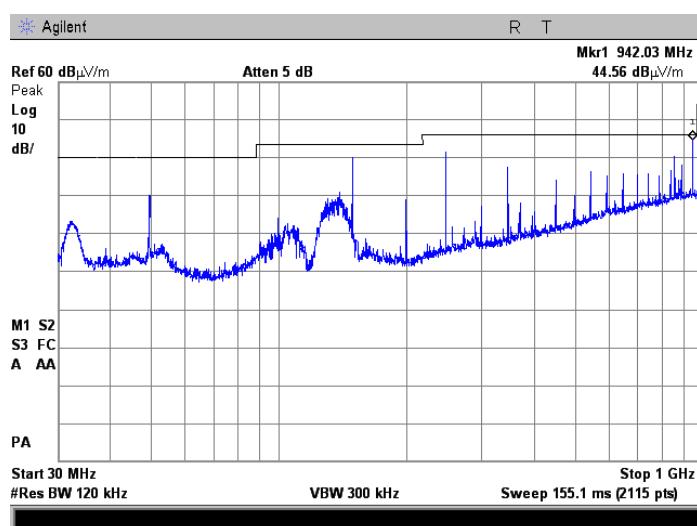


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Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 6.1, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

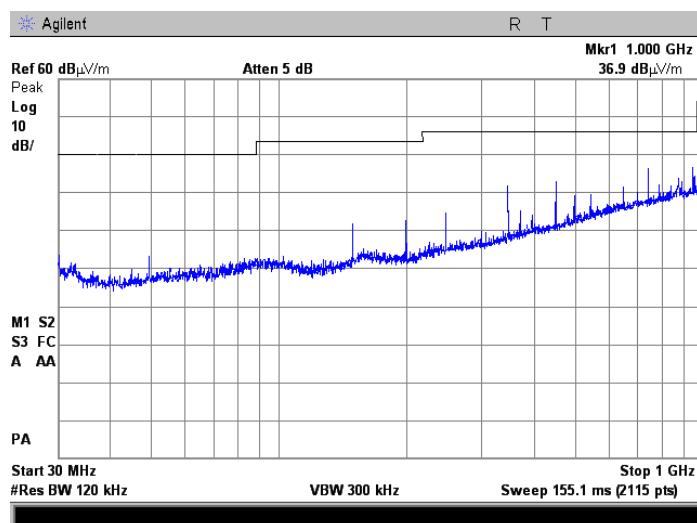
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

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



Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

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





HERMON LABORATORIES

Test specification:	FCC section 15.109, ICES-003, RSS-Gen section 6.1, Radiated emission		
Test procedure:	ANSI C63.4, Sections 11.6 and 12.1.4		
Test mode:	Compliance	Verdict:	PASS
Date(s):	5/12/2013		
Temperature: 24 °C	Air Pressure: 1010 hPa	Relative Humidity: 46 %	Power Supply: 120 VAC
Remarks:			

Plot 8.2.3 Radiated emission measurements above 1000 MHz, vertical antenna polarization

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

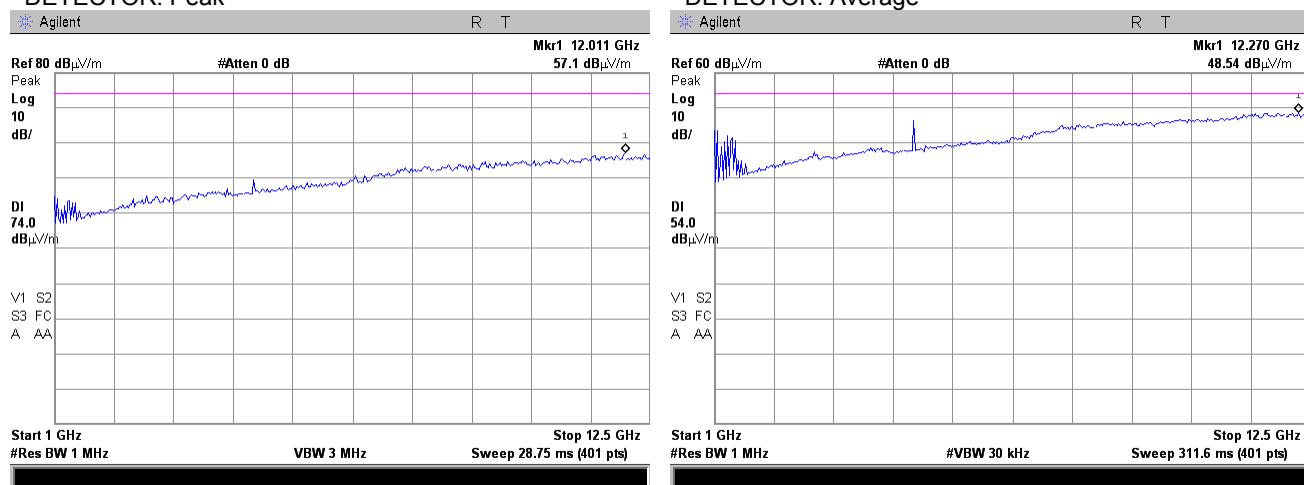
3 m

EUT OPERATING MODE:

Receive/ Stand-by

DETECTOR: Peak

DETECTOR: Average

**Plot 8.2.4 Radiated emission measurements above 1000 MHz, horizontal antenna polarization**

TEST SITE:

Semi anechoic chamber

TEST DISTANCE:

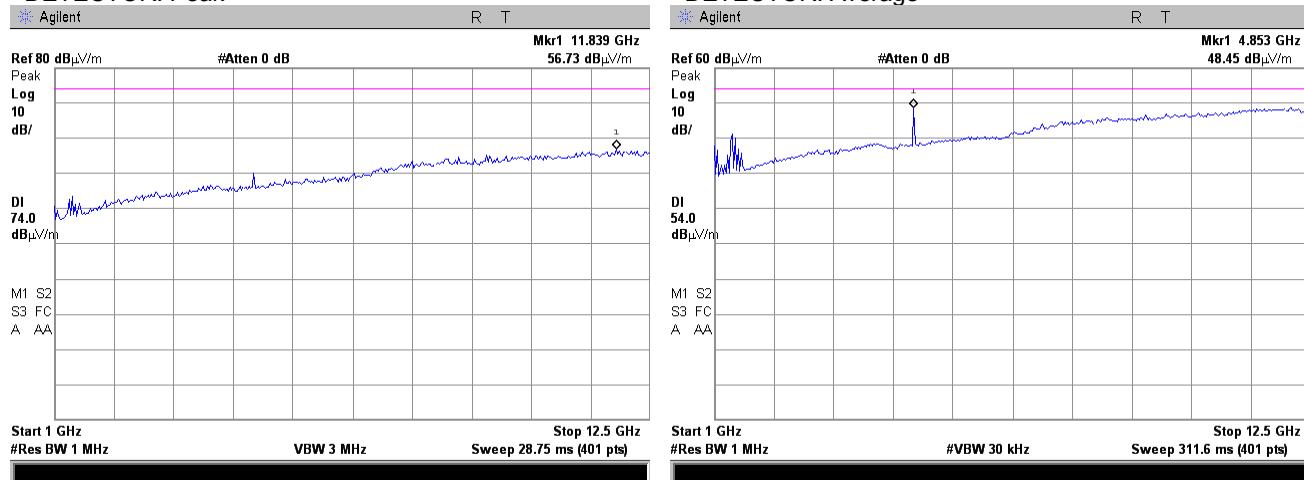
3 m

EUT OPERATING MODE:

Receive/ Stand-by

DETECTOR: Peak

DETECTOR: Average





HERMON LABORATORIES

9 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
0446	Antenna, Loop, Active, 10 kHz - 30 MHz	EMCO	6502	2857	03-Jul-12	03-Jul-13
0521	EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz	Hewlett Packard	8546A	3617A 00319, 3448A002 53	22-Apr-13	22-Apr-14
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	20-May-12	20-May-14
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 25 dB gain	Quinstar Technology	QWH-4200-BA	110	12-Dec-12	12-Dec-15
0769	Antenna Standard Gain Horn, 26.5-40 GHz, WR28, 25 dB gain	Quinstar Technology	QWH-2800-BA	112	12-Dec-12	12-Dec-15
1425	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1426, HL1427	Agilent Technologies	8542E	3710A002 22, 3705A002 04	26-Aug-12	26-Aug-13
1512	Cable RF, 8 m	Belden	M17/167 MIL-C-17	1512	01-Jan-13	01-Jan-14
1984	Antenna, Double-Ridged Waveguide Horn, 1-18 GHz, 300 W	EMC Test Systems	3115	9911-5964	07-Dec-12	07-Dec-13
2871	Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA	Huber-Suhner	198-8155-00	2871	04-Dec-12	04-Dec-13
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	19-Mar-13	19-Mar-14
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY414447 62	20-Dec-12	20-Dec-13
3612	Cable RF, 17.5 m, N type-N type	Teldor	RG-214/U	NA	02-Dec-12	02-Dec-13
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY482502 88	24-Apr-13	24-Apr-14
4160	Preamplifier, 0.1 to 18 GHz, Gain 25 dB, N-type(f) in, N-type(m) out	Agilent Technologies	87405C	MY470105 94	08-Aug-12	08-Aug-13
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101 003	06-Mar-13	06-Mar-14



HERMON LABORATORIES

10 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted carrier power at RF antenna connector	Below 12.4 GHz: ± 1.7 dB 12.4 GHz to 40 GHz: ± 2.3 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
Occupied bandwidth	± 8.0 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 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 Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Vertical polarization	

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.



HERMON LABORATORIES

11 APPENDIX C 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), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. 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). The FCC Designation Number is US1003.

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.

12 APPENDIX D Specification references

FCC 47CFR part 15: 2012	Radio Frequency Devices
558074 D01 DTS Meas Guidance v01, 1/18/2012	FCC Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
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
RSS-210 Issue 8: 2010	Low Power Licence- Exempt Radiocommunication Devices
RSS-Gen Issue 3: 2010	General Requirements and Information for the Certification of Radiocommunication Equipment



HERMON LABORATORIES

13 APPENDIX E 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
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.110, HL 0768, HL 0769

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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



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**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).



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Antenna factor
Double-ridged wave guide horn antenna
Model 3115, S/N 9911-5964, HL1984

Frequency, MHz	Antenna factor, dB(1/m)
1000.0	24.7
1500.0	25.7
2000.0	27.6
2500.0	28.9
3000.0	31.2
3500.0	32.0
4000.0	32.5
4500.0	32.7
5000.0	33.6
5500.0	35.1
6000.0	35.4
6500.0	34.9
7000.0	36.1
7500.0	37.8
8000.0	38.0
8500.0	38.1
9000.0	39.1
9500.0	38.3
10000.0	38.6
10500.0	38.2
11000.0	38.7
11500.0	39.5
12000.0	40.0
12500.0	40.4
13000.0	40.5
13500.0	41.1
14000.0	41.6
14500.0	41.7
15000.0	38.7
15500.0	38.2
16000.0	38.8
16500.0	40.5
17000.0	42.5
17500.0	45.9
18000.0	49.4

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



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Cable loss
**Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00,
HL 2871**

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.12	5750	2.34	12000	3.55
30	0.14	6000	2.39	12250	3.61
100	0.27	6250	2.46	12500	3.67
250	0.45	6500	2.52	12750	3.74
500	0.63	6750	2.58	13000	3.79
750	0.76	7000	2.64	13250	3.82
1000	0.89	7250	2.68	13500	3.83
1250	1.01	7500	2.73	13750	3.83
1500	1.12	7750	2.78	14000	3.88
1750	1.23	8000	2.83	14250	3.93
2000	1.32	8250	2.88	14500	3.96
2250	1.41	8500	2.94	14750	4.01
2500	1.49	8750	2.97	15000	4.00
2750	1.58	9000	3.02	15250	4.01
3000	1.66	9250	3.07	15500	4.00
3250	1.73	9500	3.13	15750	4.13
3500	1.80	9750	3.18	16000	4.22
3750	1.87	10000	3.21	16250	4.29
4000	1.93	10250	3.26	16500	4.29
4250	2.01	10500	3.30	16750	4.32
4500	2.06	10750	3.36	17000	4.37
4750	2.12	11000	3.39	17250	4.45
5000	2.17	11250	3.44	17500	4.49
5250	2.24	11500	3.48	17750	4.53
5500	2.29	11750	3.52	18000	4.55



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Cable loss
Cable coaxial, RG-214/U, N type-N type, 17 m
Teldor, HL 3612

Frequency, MHz	Cable loss, dB
0.1	0.05
0.5	0.07
1	0.10
3	0.22
5	0.29
10	0.39
30	0.68
50	0.90
100	1.27
150	1.58
200	1.80
250	2.12
300	2.36
350	2.60
400	2.82
450	2.99
500	3.23
550	3.40
600	3.56
650	3.71
700	3.90
750	4.04
800	4.23
850	4.39
900	4.55
950	4.65
1000	4.79



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Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		



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14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
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
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
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
µs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
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
WB	wideband

END OF DOCUMENT