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RADIO TEST REPORT

ACCORDING TO 47 CFR Part 15 subpart C §15.231 and subpart B
for

Rokonet Electronics Ltd.

EQUIPMENT UNDER TEST:

Smoke detector

brand name NOVA, model RWT30V2

This report is in conformity with ISO/IEC 17025. The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. **This test report must not be reproduced in any form except in full with the approval of Hermon Laboratories Ltd.**

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1 Project information

Description of equipment under test

Test items : Smoke detector
Manufacturer : Rokonet Electronics Ltd.
Types (Models) : RWT30V2
Equipment FCC code : DSC

Applicant information

Applicant's responsible person : Mr. David Kartoun, Chief Technology Officer
Company : Rokonet Electronics Ltd.
Address : 14 Hachoma street
Postal code : 75655
City : Rishon Lezion
Country : Israel
Telephone number : +972 3961 6555
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Test performance

Project Number: : 14927
Location : Hermon Laboratories
Receipt date : December 16, 2001
Test started : December 16, 2001
Test completed : February 10, 2002
Purpose of test : Apparatus compliance verification in accordance with emission requirements
Test specification(s) : 47CFR Part 15, subpart C, §15.231, §15.209, §15.205, and subpart B §15.109



2 Summary of tests and requirements

Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Transmitter characteristics, §15.231								
Periodic operation	15.231(a)	X						
Bandwidth of emission	15.231(c)	X				Mr. M. Feldman, test engineer	February 5, 2002	
Field strength of fundamental	15.231(b)(2)	X				Mr. M. Feldman, test engineer	February 5, 2002	
Field strength of spurious radiation	15.231(b)(3)	X				Mr. M. Feldman, test engineer	February 10, 2002	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				X			
Radiated emissions	15.109	X				Mr. M. Feldman, test engineer	February 10, 2002	
General conditions under §15.231, Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz								
The intentional radiator does not operate in the restricted bands of operation.	15.205	X						
The intentional radiator has permanently attached antenna or antenna that uses a unique coupling to the intentional radiator.	15.203	X				Integral antenna		
No antenna other than that furnished by the responsible party can be used with the device.	15.203	X						
The intentional radiator has no standard antenna jack or electrical connector.	15.203				X			
The intentional radiator must be professionally installed.	15.203				X			
The Intentional radiator operates at 318.00 MHz.	15.231 (a)	X						
Intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc.	15.231 (a)	X						
Radio control of toys is not permitted.	15.231 (a)	X						
Continuous transmissions, such as voice or video, and data transmissions are not permitted.	15.231 (a)	X						



Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	15.231 (a) (1)				X			
A transmitter activated automatically shall cease transmission within 5 seconds after activation.	15.231 (a) (2)	X						
Periodic transmissions at regular predetermined intervals are not permitted.	15.231 (a) (3)	X						
The intentional radiator is used for polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.	15.231 (a) (3)	X						
The intentional radiators employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	15.231 (a) (4)	X						
NOTE: C: The parameter is compliant with the requirements. NC: The parameter is not compliant with the requirements. NT: The parameter is not tested. NA: The test of this parameter is not applicable.								

Tests performed by:

Mr. M. Feldman, test engineer

Test report prepared by:

Mrs. M. Cherniavsky, certification engineer

Test report approved by:

Mr. M. Nikishin, EMC group leader

Dr. E. Usoskin, C.E.O.



3 EUT description

3.1 General

The EUT, RWT30V2, is a smoke detector which provides alarm and supervisory codes transmission to a base station by RF link at 318 MHz. The device is powered by two internal 3 V lithium batteries, connected in parallel. The EUT clocks generate 4 MHz and 9.9375 MHz, the data rate is 666 bps.

3.2 Transmitter description

Operating frequency:		318.00 MHz	
Maximum rated output power			
At transmitter permanent external 50 Ω rf output connector (dBm)		NA	
Effective radiated power (for equipment with integral antenna) (dBm)		- 22.3 dBm (0.006 mW)	
Transmitter duty cycle			
Tx on		31.92 msec	
Modulation			
Amplitude			
Frequency			
Other (specify): on/off keying (pulse modulation)			
Can the transmitter be operated without modulation		<input type="checkbox"/>	<input checked="" type="checkbox"/> X
Transmitter power source			
Battery		Nominal rated voltage (VDC)	3.2
Lithium			
DC		Nominal rated voltage (VDC)	NA
AC mains		Nominal rated voltage (VAC)	NA
Is there common power source for transmitter and receiver		<input type="checkbox"/> yes	<input type="checkbox"/> no
Antenna type			
Integral			
§15.231(a)(2)			
An RWT30V2 device includes a microcontroller which is clocked by a resonator. All time activities of the RWT30V2 device are strictly dictated by the software programmed into the memory of the microcontroller. The microcontroller is OTP type (OTP=One Time Programming).			



4 Test results

4.1 Bandwidth of emission according to § 15.231 (c)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
 DATE: February 5, 2002
 RELATIVE HUMIDITY: 37 %
 AMBIENT TEMPERATURE: 22 °C
 MODULATION: Pulse
 DETECTOR USED: Peak

Carrier frequency MHz	Occupied bandwidth, MHz	Limit, MHz	Reference to plot in Annex A
318	0.5	0.795	No.1
Measurement uncertainty		0.21 ppm	

The maximum allowed occupied bandwidth was calculated as 0.0025 of the center frequency.

TEST PROCEDURE

The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between two points 20 dB down from the modulated carrier.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0593	HL 0594	HL 0604		
---------	---------	---------	---------	---------	--	--

LIMIT § 15.231 (c)

<p>The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.</p>

**4.2 Field strength of fundamental, § 15.231(b)(2)**

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.5
 DATE: February 5, 2002
 RELATIVE HUMIDITY: 37 %
 AMBIENT TEMPERATURE: 22 °C
 MODULATION: Pulse
 DETECTOR USED: Peak

	§ 15.231 (b)	§ 15.231 (e)
The EUT complies with the requirements of	X	

Frequency, MHz	Measured field strength, dB(mV/m)	Average factor, dB	Result, dB(mV/m)	Specification limit, dB(mV/m)	Margin, dB	Reference to plot in Annex A
318.0312	72.86	-9.9	62.96	75.8	12.84	No.2
Measurement uncertainty, dB		+5.73 / -5.57				

LIMIT § 15.231 (b)

Fundamental frequency (MHz)	Field strength of fundamental (mV/m) @ 3 m
260 – 470	3,750 to 12,500

4.2.1 Average factor calculation, §15.35

Tx ON	Duty cycle	Average factor	Reference to plot in Annex A
31.92 msec	31.92/100	-9.9 dB	No. 3 - 5

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0593	HL 0594	HL 0604		
---------	---------	---------	---------	---------	--	--

**4.3 Field strength of spurious radiation, § 15.231(b)(3)**

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.4
 DATE: February 10, 2002
 RELATIVE HUMIDITY: 37 %
 AMBIENT TEMPERATURE: 22 °C
 TEST PERFORMED IN: Anechoic chamber
 DISTANCE BETWEEN ANTENNA AND EUT: 3 m (refer to Photographs No.1, No.2 in Appendix B)
 DETECTOR USED: Peak

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

X	The equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
---	---

Limit @ 3 m = 55.8 dB(mV/m)

Antenna type: loop

Frequency, MHz	Antenna polarization	RBW, kHz	VBW, kHz	Radiated emission, dB (mV/m)	Limit @ 3 m, dB(mV/m)	Margin, dB	Ref. to plot in App. A
0.009 – 0.150	V, H	0.2	0.3	All emissions were found below the limit			No.6
0.150 - 30	V, H	9	30	All emissions were found below the limit			No.7
Measurement uncertainty, dB				± 4			

Antenna type: biconilog

Frequency, MHz	Antenna polarization	RBW, kHz	VBW, kHz	Radiated emission, dB (mV/m)	Margin, dB	Ref. to plot in App. A
30 - 1000	V, H	120	300	All emissions were found below the limit		No.2
Measurement uncertainty, dB				+5.73 / -5.57		

Antenna type: double ridged guide

Frequency, MHz	Antenna polarization	RBW, MHz	VBW, MHz	Radiated emission, dB (mV/m)	Margin, dB	Ref. to plot in App. A
1000 - 5000	V, H	1	3	All emissions were found below the limit		No.8
Measurement uncertainty, dB				+5.73 / -5.57		

Notes to table:

RBW: resolution bandwidth

VBW: video bandwidth

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height table in each of three orthogonal planes in turn. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m in the range above 30 MHz, and the antennas polarization was changed from vertical to horizontal excluding the range below 30 MHz.

TEST EQUIPMENT USED:

HL 0041	HL 0446	HL 0465	HL 0521	HL 0593	HL 0594	HL 0604
---------	---------	---------	---------	---------	---------	---------



4.4 Unintentional radiated emissions test according to §15.109

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
 DATE: February 10, 2002
 RELATIVE HUMIDITY: 37 %
 AMBIENT TEMPERATURE: 22 °C
 TEST PERFORMED IN: Anechoic chamber
 DISTANCE BETWEEN ANTENNA AND EUT: 3 m (refer to Photograph No.2 in Appendix B)
 THE EUT WAS TESTED AS: Table-top
 FREQUENCY RANGE: 30 MHz – 1 GHz
 DETECTOR TYPE: Quasi-peak
 RESOLUTION BANDWIDTH: 120 kHz
 ANTENNA TYPE: BICONILOG in vertical and horizontal polarization

The EUT highest used frequency (not including operating frequency), MHz	Upper frequency of measurement range, MHz
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position (°)	Radiated emissions, dB (mV/m)	Specification limit, dB (mV/m)	Margin, dB
All measured emissions were at least 20 dB below the specified limit – refer to Plot No.9 in Annex A						
Measurement uncertainty, dB	+5.73 / -5.57					

TEST PROCEDURE

The EUT was placed on a wooden 80 cm height table. To find maximum radiation the turntable was rotated 360°, measuring antenna height was changed from 1 to 4 m, and the antennas polarization was changed from vertical to horizontal.

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0593	HL 0594	HL 0604		
---------	---------	---------	---------	---------	--	--

LIMIT (§ 15.109)

Frequency, MHz	Class B equipment @ 3 m dB(mV/m)
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 5000	54



Appendix A - Plots

Plot No.1
Occupied bandwidth measurement test result

16:49:45 FEB 05, 2002

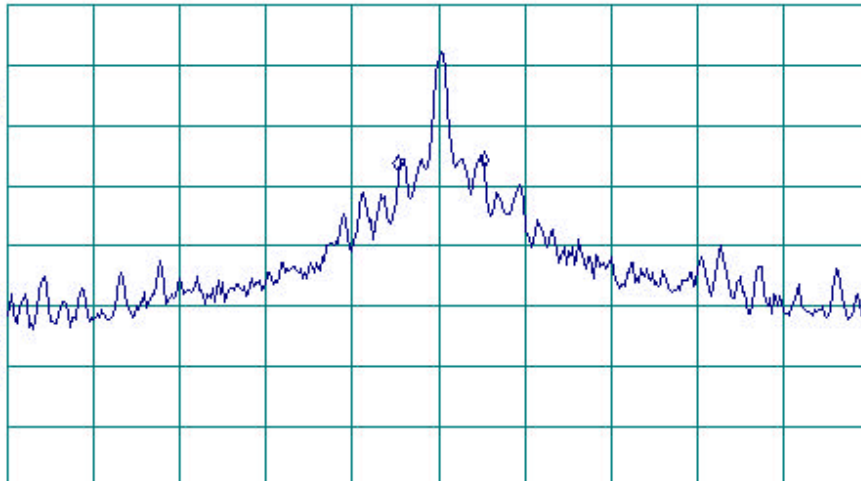
MARKER Δ
500 kHz
.78 dB

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR Δ 500 kHz
.78 dB

MEASURE
AT MKR
ADD TO
LIST

LOG REF 80.0 dB μ V/m
10
dB/
ATN
10 dB

VA SB
SC FC
ACORR



CENTER 318.000 MHz
RL #1F BW 30 kHz

AVG BW 30 kHz

SPAN 5.000 MHz
SWP 20.0 msec

MARKER
NORMAL

MARKER
 Δ

MARKER
AMPTD

SELECT
1 2 3 4

MARKER 1
ON OFF

More
1 of 2



Plot No.2
Field strength of fundamental test result

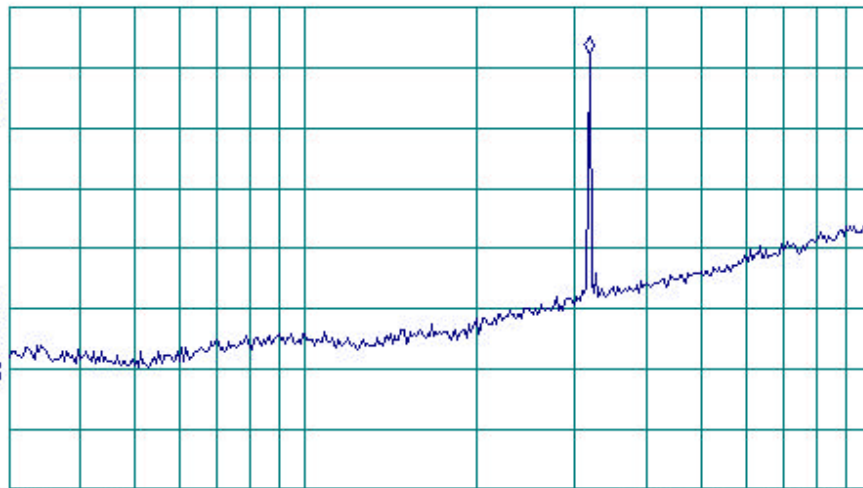
16:47:24 FEB 05, 2002

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 316.4 MHz
72.43 dB μ V/m

MEASURE
AT MKR
ADD TO
LIST

LOG REF 00.0 dB μ V/m
10
dB/
ATN
10 dB

VA SB
SC FC
ACORR



START 30.0 MHz STOP 1.0000 GHz
RL 1F BW 120 kHz AVG BW 300 kHz SWP 909 msec

CLEAR
WRITE A
MAX
HOLD A

VIEW A

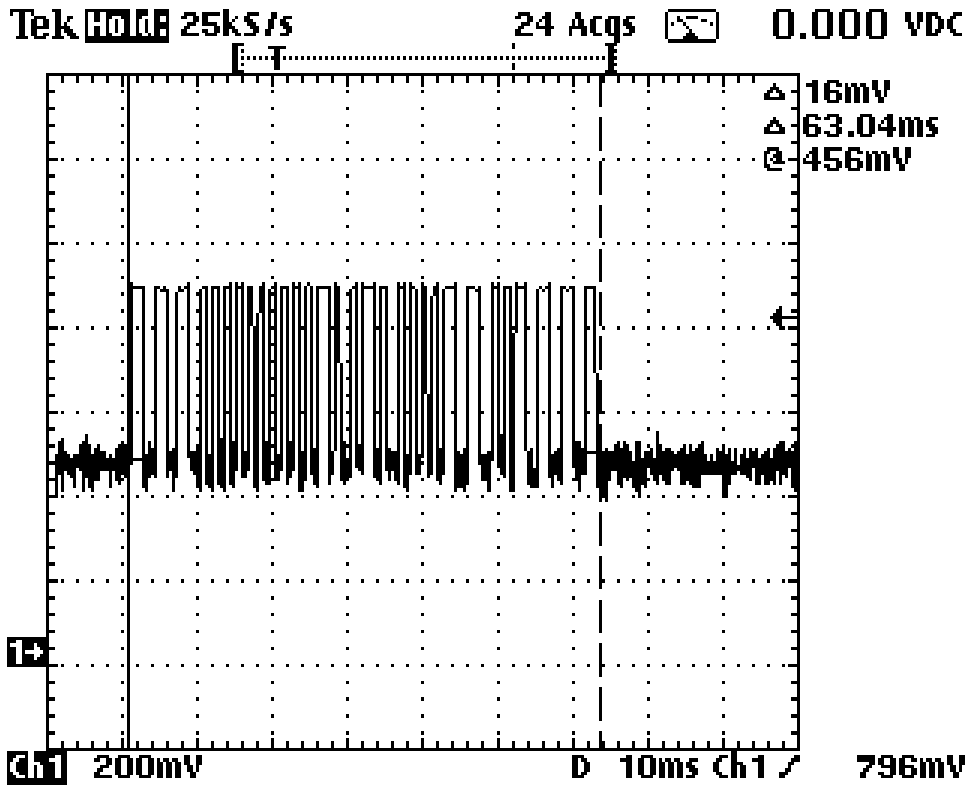
BLANK A

Trace
A B C

More
1 of 3



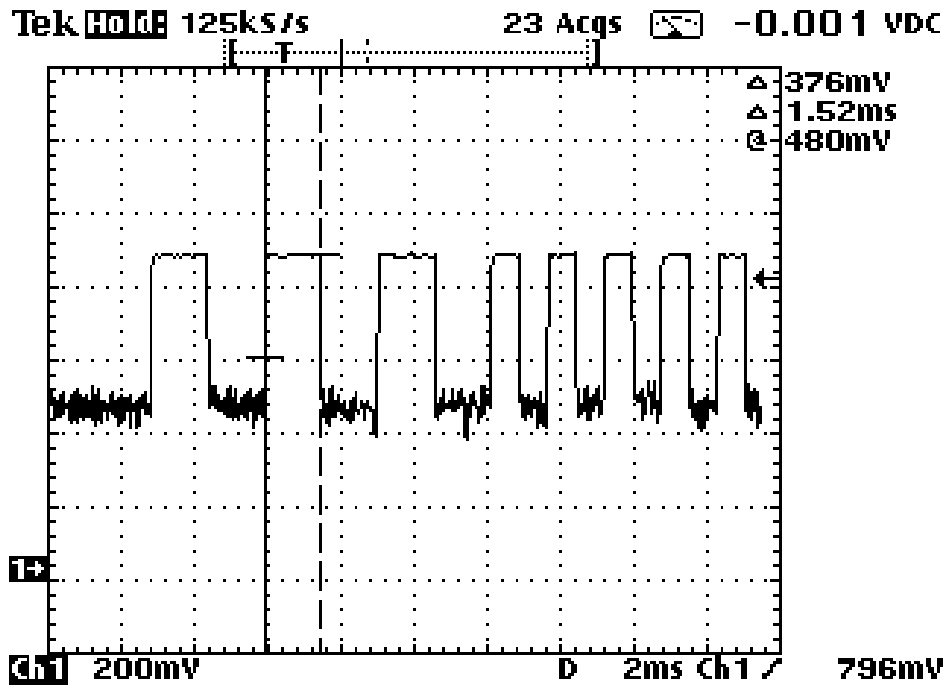
Plot No.3
Tx on (duty cycle) measurement test result



11 x 1.52 ms = 16.72 ms
19 x 0.8 ms = 15.2 ms
Tx on = 31.92 ms
Average factor = $20 \log 31.9/100 = -9.9$ dB

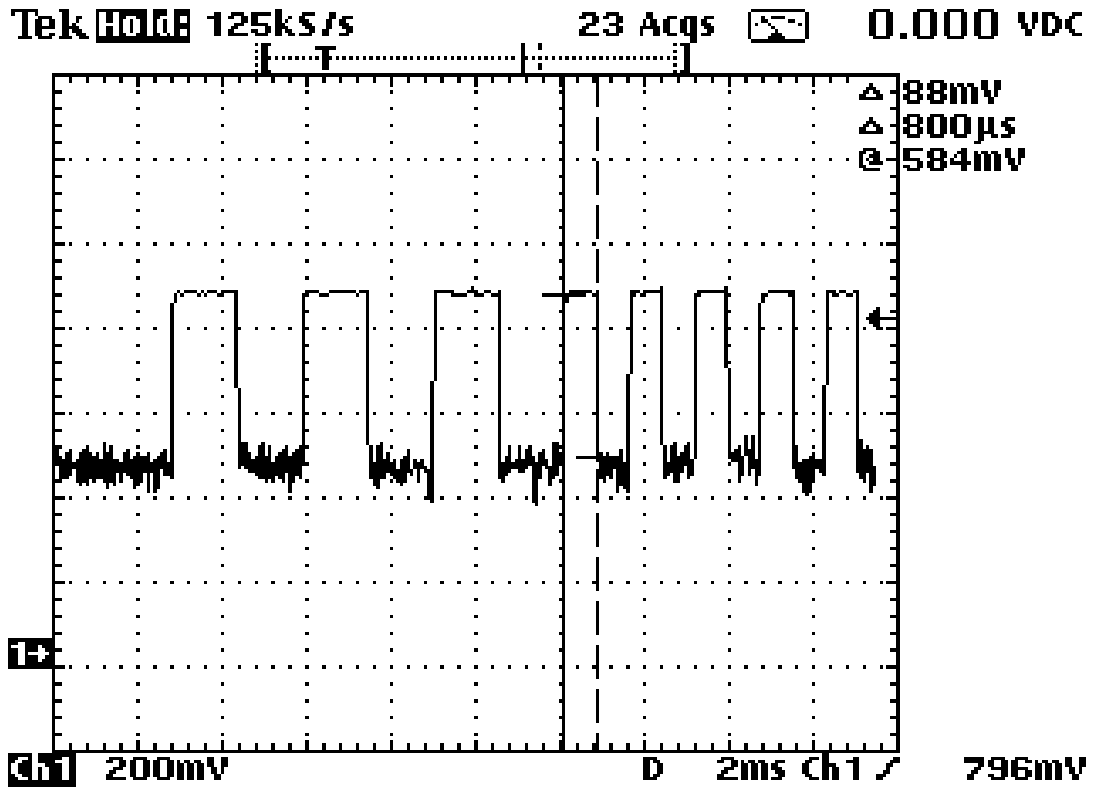


Plot No.4
Tx on (duty cycle) measurement test result





Plot No.5
Tx on (duty cycle) measurement test result





Plot No.6
Spurious emissions test results

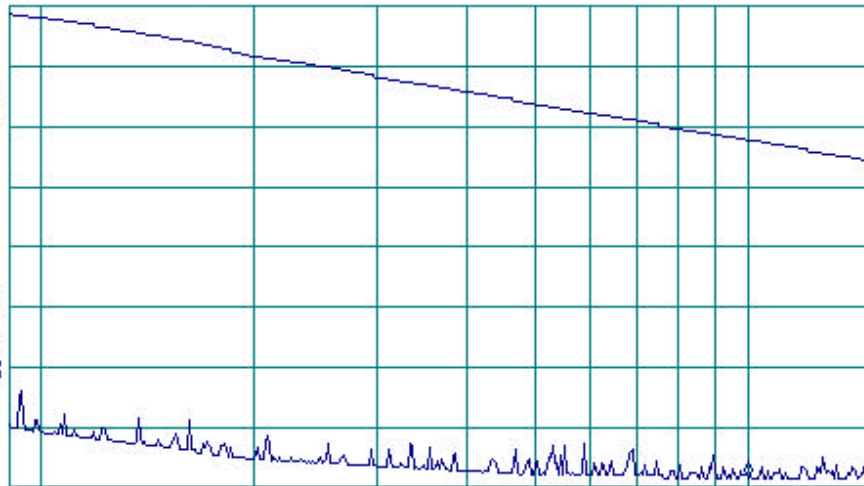
09:20:54 FEB 10, 2002

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 100.4 kHz
51.31 dB μ V/m

MEASURE
AT MKR
ADD TO
LIST

LOG REF 130.0 dB μ V/m
10
dB/
ATN
50 dB

VA SB
SC FC
ACORR



START 9.0 kHz STOP 150.0 kHz
RL #1F BW 200 Hz AVG BW 300 Hz SWP 10.3 sec

CLEAR
WRITE A
MAX
HOLD A
VIEW A
BLANK A
Trace
A B C
More
1 of 3

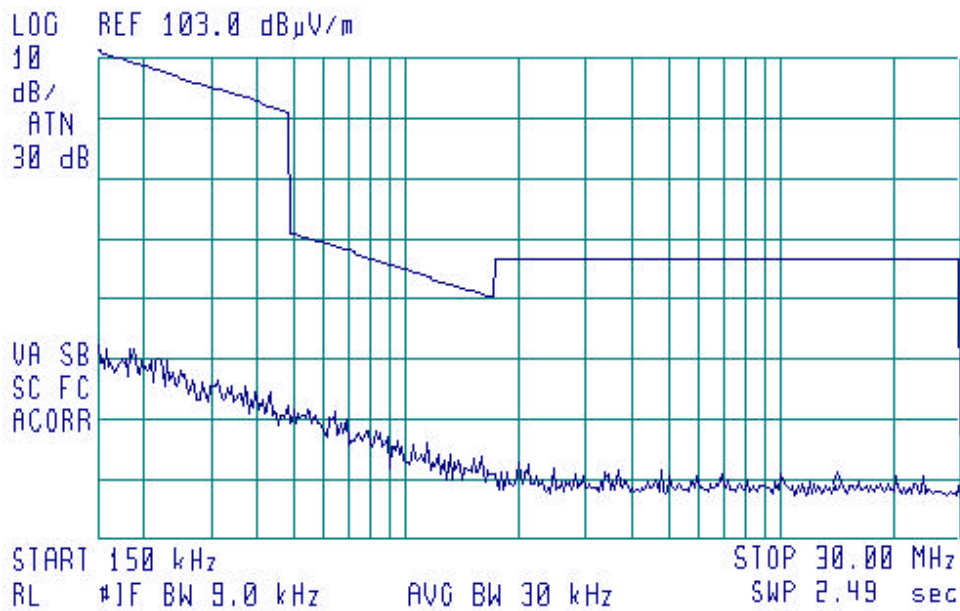


Plot No.7
Spurious emissions test results

09:23:11 FEB 10, 2002

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 14.07 MHz
31.04 dBμV/m

MEASURE
AT MKR
ADD TO
LIST



CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3



Plot No.8
Spurious emissions test results

08:44:28 FEB 10, 2002

ACTV DET: PEAK
MEAS DET: PEAK OP AVG

MEASURE
AT MKR

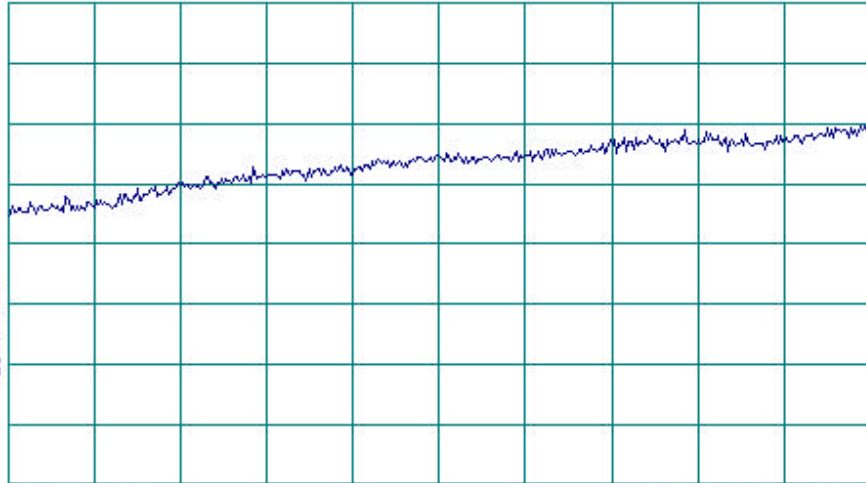
ADD TO
LIST

LOG REF 70.0 dBμV/m

PREAMP ON

10
dB/
#ATTN
0 dB

VA SB
SC FC
ACORR



START 1.000 GHz

STOP 5.000 GHz

RL #1F BW 1.0 MHz

#AVG BW 3 MHz

SWP 00.0 msec

CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3



Plot No.9
Unintentional radiated emissions test results

09:02:41 FEB 10, 2002

ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 606.0 MHz
21.63 dBμV/m

MEASURE
AT MKR

ADD TO
LIST

LOG REF 60.0 dBμV/m

PREAMP ON

CLEAR
WRITE A

10
dB/
#ATN
0 dB

PASS LIMIT

MAX
HOLD A

VA SB
SC FC
ACORR

VIEW A

BLANK A

Trace
A B C

START 30.0 MHz

STOP 1.0000 GHz

RL #1F BW 120 kHz

AVG BW 300 kHz

SWP 909 msec

More
1 of 3



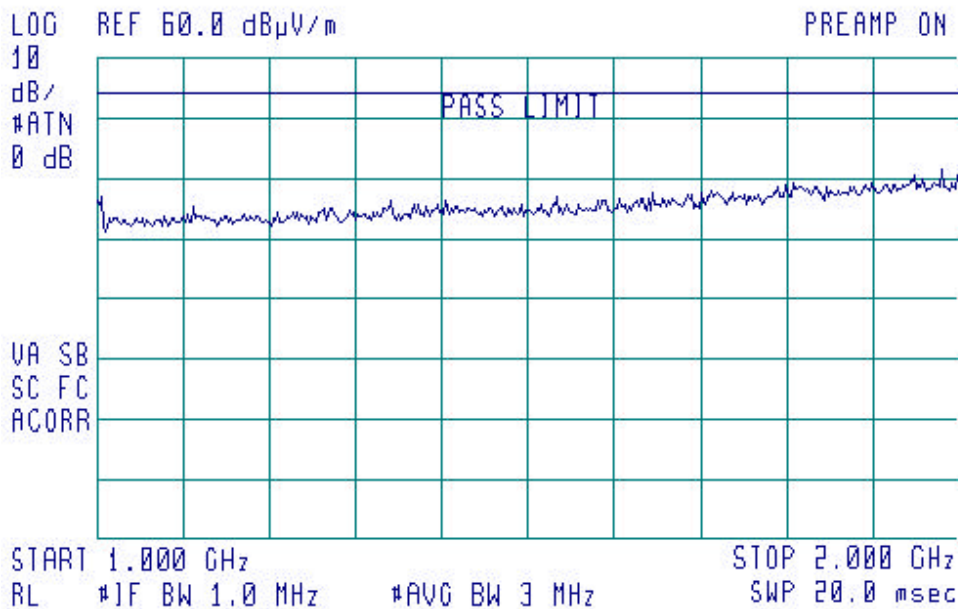
Plot No.10
Unintentional radiated emissions test results

08:38:48 FEB 10, 2002

ACTV DET: PEAK
MEAS DET: PEAK OP AVG

MEASURE
AT MKR

ADD TO
LIST



CLEAR
WRITE A

MAX
HOLD A

VIEW A

BLANK A

Trace
A B C

More
1 of 3



Appendix B - Photographs

Photograph No.1
Radiated emissions measurement test setup





Photograph No.2
Radiated emissions measurement test setup





Appendix C - Test equipment used for tests

HL Serial No.	Description	Manufacturer information			Due Calibration Month/ year
		Name	Model No.	Serial No.	
0041	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	2811	3/03
0446	Active loop antenna 10 kHz-30 MHz	Electro- Mechanics	6502	2857	11/02
0465	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	11/02
0521	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	9/02
0593	Antenna mast, 1-4 m/ 1-6 m pneumatic	Hermon Labs	AM-F1	101	2/03 Check
0594	Turntable for anechoic chamber, flush mounted, d=1.2 m, pneumatic	Hermon Labs	WDC1	102	1/03 Check
0604	Antenna biconilog log- periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	1/03



Appendix D - General information

Test facility description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private EMC, Safety 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, 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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Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

AC	alternating current
bps	bit per second
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
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
m	meter
MHz	megahertz
NA	not applicable
QP	quasi-peak
RF	radio frequency
RE	radiated emission
rms	root mean square
s	second
V	volt
W	width

Specification references

47CFR part 15: 2001	Radio Frequency Devices
ANSI C63.2:96	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:92	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.