HERMON LABORATORIES

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Electrical

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RADIO TEST REPORT

ACCORDING TO 47 CFR Part 15 SUBPART C §15.231, §15.205, §15.209 and SUBPART B;
RSS-210 Issue 5:2001; ICES-003 Issue 3:1997
for

VISONIC Ltd.

EQUIPMENT UNDER TEST:

Wireless keypad
MCM 140 @ 315 MHz

Document ID: visrad_fcc.14997.doc
Date of Issue: March 02

Contents

1 Project information

Description of equipment under test

Test items	: Wireless keypad
Manufacturer	: Visonic Ltd.
Brand name	: MCM 140
Equipment serial number	: Cat No 0-2460-1
Types (Models)	: MCM 140 @ 315 MHz
Equipment FCC code[1]	: DSC

Applicant information

Applicant's responsible person	: Mr. Arick Elshtein
Company	: Visonic Ltd.
Address	: 27 Habarzel Street
Postal code	: 69710
City	: Tel Aviv
Country	: Israel
Telephone number	: +972 3 6456714
Telefax number	: +972 3 6456891

Test performance

Project Number:	: 14997
Location	: Hermon Laboratories
Receipt date	: February 19, 2002
Test started	: February 19, 2002
Test completed	: March 12, 2002
Purpose of test	: Apparatus compliance verification in accordance with emission requirements
Test specification(s)	: 47CFR Part 15, subpart C, §15.231, §15.205, §15.209, and subpart B §15.109; RSS-210 Issue 5: 2001 and ICES-003 Issue 3: 1997

[1] FCC Equipment codes – see Appendix D

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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**				Refer to Installation instructions		
Bandwidth of emission	15.231(c)	**X**				Mr. M. Feldman, test engineer	March 6, 2002	
Field strength of fundamental	15.231(b)(2)	**X**				Mr. M. Feldman, test engineer	March 6, 2002	
Field strength of spurious radiation	15.231(b)(3)	**X**				Mr. Y. Neuman, test engineer; Mr. M. Feldman, test engineer	March 12, 2002	
Unintentional radiation, §15.107, §15.109								
Conducted emissions	15.107				**X**			
Radiated emissions	15.109			**X**				Refer to spurious emission test
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**				Refer to Installation instructions		
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**	This requirement does not apply to intentional radiators that must be professionally installed		
The intentional radiator must be professionally installed.	15.203				**X**			
The Intentional radiator operates at 315 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**				Refer to Installation instructions		
Radio control of toys is not permitted.	15.231 (a)	**X**				Refer to Installation instructions		

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Parameter	Subclause	C	NC	NT	NA	Tested by	Date tested	Remarks
Continuous transmissions, such as voice or video, and data transmissions are not permitted.	15.231 (a)	**X**				Refer to Installation instructions		
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**				Refer to Installation instructions		
Periodic transmissions at regular predetermined intervals are not permitted.	15.231 (a) (3)	**X**				Refer to Installation instructions		
The intentional radiator 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**				Refer to Installation instructions		
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**				Refer to Installation instructions		
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.								

Test report prepared by: Mrs. V. Mednikov, certification engineer

Test report approved by: Mr. A. Usoskin, QA manager

3 EUT description

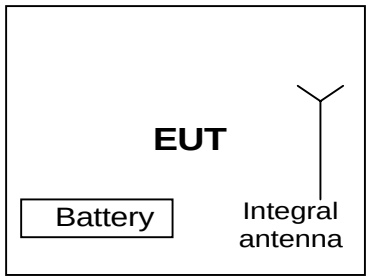
3.1 General description

The EUT is a wireless remote control unit for the PowerMax system.

3.2 EUT test configuration

Test configuration is provided in Figure 3.2.1.

Figure 3.2.1 EUT Test Configuration



3.3 Transmitter description

Operating frequency:				315 MHz			
Extreme test conditions[2]:							
	temperature		0°C; +50°C				
	power supply voltage		3 VDC				
Maximum rated output power							
	At transmitter permanent external 50 Ω rf output connector (dBm)						
	Effective radiated power (for equipment with integral antenna) (dBm)			< -2			
Transmitter duty cycle							
	Tx on (seconds)			0.025			
	Tx off (seconds)			0.075			
Modulation							
	Amplitude						
	Frequency						
	Other (specify): ASK (ON OFF KEYING)						
Can the transmitter be operated without modulation					yes	✔	no
Transmitter power source							
	Battery	**Nominal rated voltage (VDC)**					
	Nickel Cadmium						
✔	Lithium CR 123 A						
	Other						
✔	**DC**	**Nominal rated voltage (VDC)**		3			
	AC mains	**Nominal rated voltage (VAC)**					
Is there common power source for transmitter and receiver					yes		no
Antenna type							
✔	Integral						
	External						
Type of antenna jack[3] - NA							
	standard		connector type		Male		Female
	unique		connector type		Male		Female

[2] Frequency tolerance test for devices operating in the frequency band 40.66 – 40.70 MHz shall be performed in normal and extreme test conditions.
[3] Standard antenna jack use is prohibited excluding devices which must be professionally installed

4 Test results

4.1 Bandwidth of emission according to § 15.231 (c) and RSS-210 § 6.1.1(c)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.7
DATE: March 6, 2002
RELATIVE HUMIDITY: 50 %
AMBIENT TEMPERATURE: 21 °C
MODULATION: ON
DETECTOR USED: peak

Carrier frequency MHz	Occupied bandwidth, kHz	Reference to plot in Annex A
314.989	205	A1
Measurement uncertainty, dB	-5.73 dB/ -5.57 dB	

TEST EQUIPMENT USED:

HL 0465	HL 0521	HL 0604				

LIMIT (§ 15.231 (c))

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.

For 315 MHz frequency the specified limit is 787.5 kHz

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.

4.2 Field strength of fundamental, § 15.231 and RSS-210 § 6.1.1(b)

METHOD OF MEASUREMENT: ANSI 63.4 §13.1.5
DATE: March 6, 2002
RELATIVE HUMIDITY: 50 %
AMBIENT TEMPERATURE: 21 °C
SITE DESCRIPTION: Anechoic chamber
MODULATION: ON
DETECTOR USED: Peak

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

Peak detector

Carrier frequency, MHz	Field strength, dB(µV/m)	Peak limit, dB(µV/m)	Margin, dB	Reference to Plots in Appendix A
314.9889	86.00	95.62	9.62	A2
Measurement uncertainty, dB		+5.73.dB / -5.57 dB		

Peak detector + Average factor

Carrier frequency, MHz	Field strength, dB(µV/m)	Specified limit, dB(µV/m)	Margin, dB	Reference to Plots in Appendix A
314.9889	73.9	75.62	1.72	A2
Measurement uncertainty, dB		+5.73.dB / -5.57 dB		

4.2.1 Average factor calculation, §15.35

Tx ON	Duty cycle	Average factor	Reference to Plots in Appendix A
24.8 ms	24.8/100	-12.1 dB	A3, A4

TEST EQUIPMENT USED:

0465	0521	0604				

LIMIT § 15.231 (b)

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

The specified limit for 315 MHz frequency is 75.62 dB(µV/m)

TEST PROCEDURE

The EUT was tested, being placed on a wooden 80 cm height turntable 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 antenna polarization was changed from vertical to horizontal.

4.3 Field strength of spurious radiation, § 15.231 and RSS-210 § 6.1.1(b)

METHOD OF MEASUREMENT:	ANSI 63.4 §13.1.4
TEST PERFROMED IN:	anechoic chamber
DATE:	March 12, 2002
RELATIVE HUMIDITY:	54 %
AMBIENT TEMPERATURE:	24 °C
TEST PERFORMED AT FIELD STRENGTH:	72.0 dB(μV/m)
MODULATION	ON
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.
	The equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Frequency, MHz	**Antenna polarization**	**RBW, kHz**	**VBW, kHz**	**Radiated emission, dB (μV/m)**	**Limit @ 3 m, dB(μV/m)**	**Margin, dB**	**Ref. to plot in App. A**
630	V+H	120	300	25.3	55.62	30.32	A5, A6
945	V+H	120	300	32.7	55.62	29.92	A5, A7
1578	V+H	1000	1000	21.42	55.62	24.2	A8
2204	V+H	1000	1000	35.09	55.62	20.53	A9
1000 – 3200	V+H	1000	1000	No spurious emissions except harmonics were found			A10
Measurement uncertainty, dB				-5.73 dB/ -5.57 dB			

Notes to table:
RBW: resolution bandwidth
VBW: video bandwidth
Average factor: -14 dB

TEST EQUIPMENT USED:

0041	0465	0521	0589	0604	1947	

LIMIT § 15.231 (b)

Fundamental frequency (MHz)	**Field strength of harmonics (b) (mV/m) @ 3 m**
260 – 470	375 to 1,250

The specified limit for 315 MHz frequency is 55.62 dB(μV/m)

TEST PROCEDURE

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

4.4 Unintentional radiated emissions test according to §15.109 and ICES-003

METHOD OF MEASUREMENT: ANSI 63.4 §11.6 / ANSI 63.4 §12.1.4
TEST PERFORMED IN: ANECHOIC CHAMBER
DATE: March 12, 2002
RELATIVE HUMIDITY: 54 %
AMBIENT TEMPERATURE: 24 °C
DISTANCE BETWEEN ANTENNA AND EUT: 3 m
THE EUT WAS TESTED AS: TABLE-TOP
FREQUENCY RANGE: 30 MHz – 2 GHz
DETECTOR TYPE: peak
RESOLUTION BANDWIDTH: 120 kHz below 1 GHz, 1 MHz above 1 GHz

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	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Frequency, MHz	Antenna polarization	Antenna height, m	Turntable position (°)	Radiated emissions, dB (µV/m)	Specification limit, dB (µV/m)	Ref. to plot in App. A
30 - 2000	**The limit for unintentional radiated emission, class B was used throughout spurious emission measurements in Tx mode. All emissions except carrier were found below the limit**					A2, A8
Measurement uncertainty, dB	-5.73 dB/ -5.57 dB					

Table abbreviations:
Antenna polarization: V = vertical, H = horizontal
Turntable position: 0° = EUT front panel faces the receiving antenna

TEST EQUIPMENT USED:

0465	0521	0589	0604			

LIMIT (§ 15.109)

Frequency, MHz	Class A equipment @ 10 m dB(µV/m)	Class B equipment @ 3 m dB(µV/m)
30 - 88	39.0	40
88 - 216	43.5	43.5
216 - 960	46.4	46
960 - 5000	49.5	54

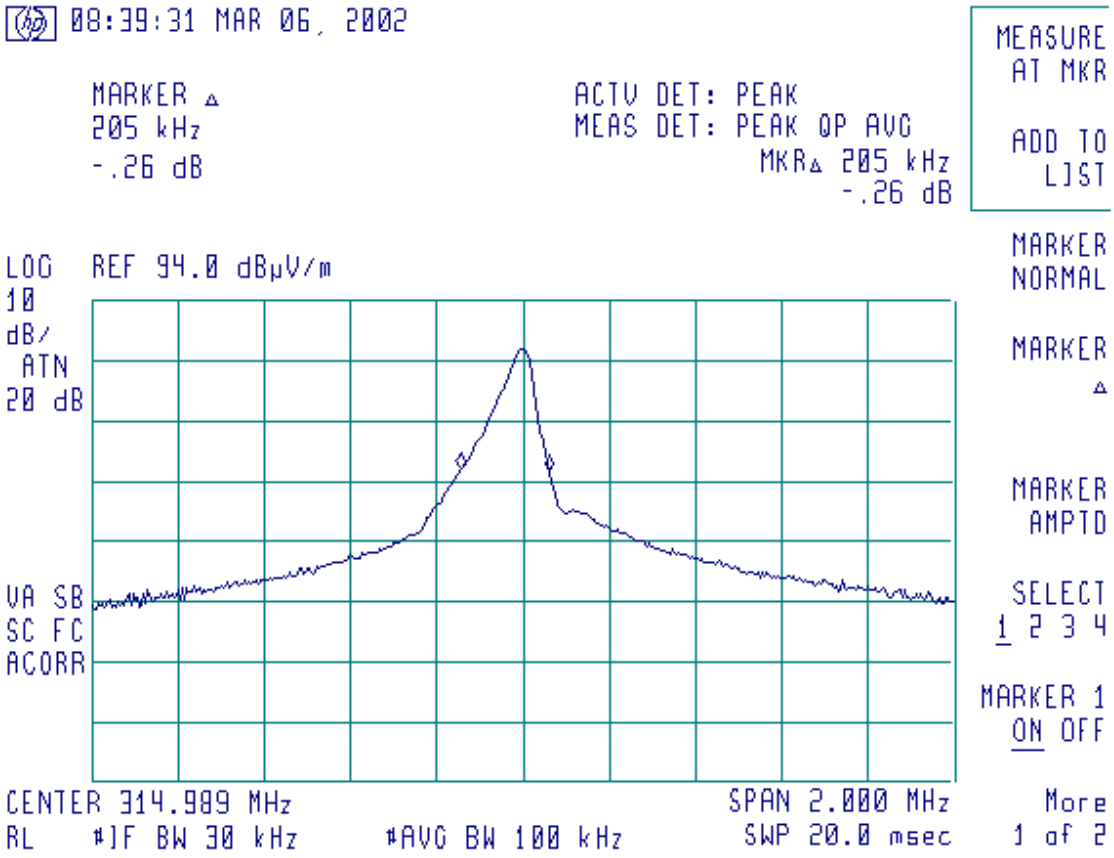
TEST PROCEDURE

The EUT was placed on a wooden 80 cm height turntable. 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.

Appendix A - Plots

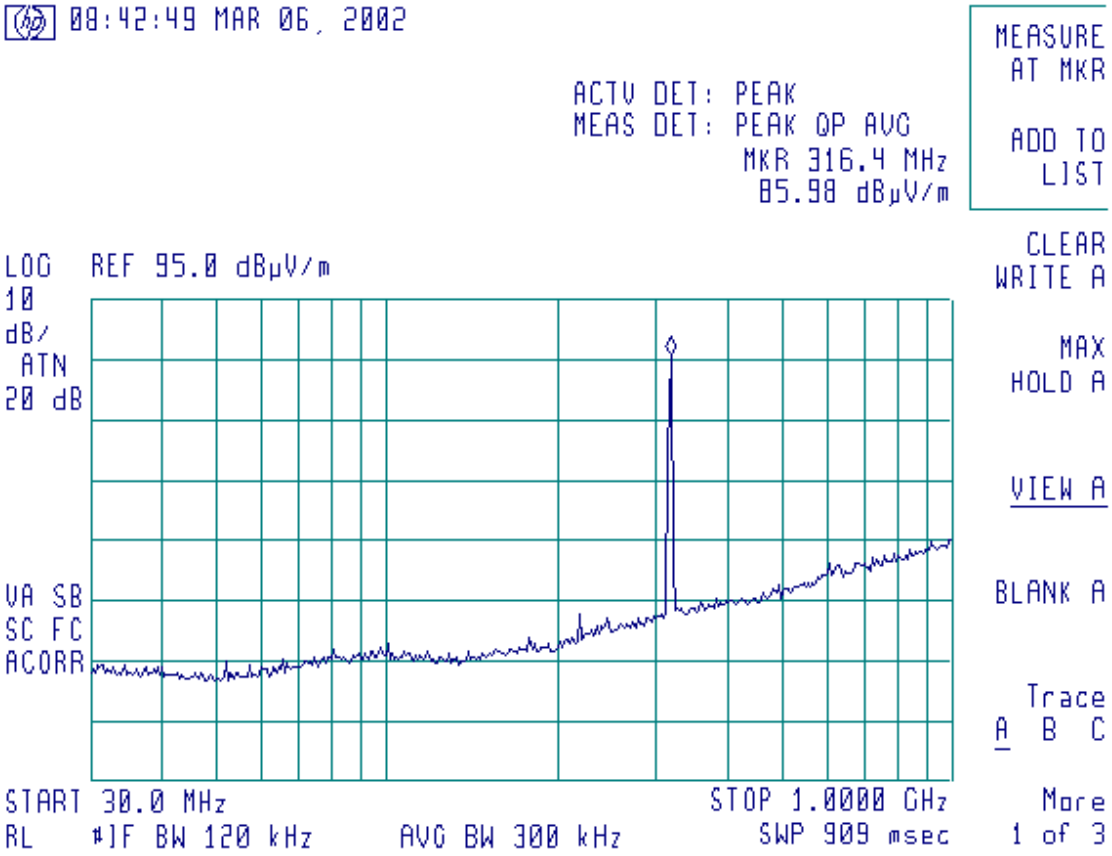
Plot A1

Occupied bandwidth measurements



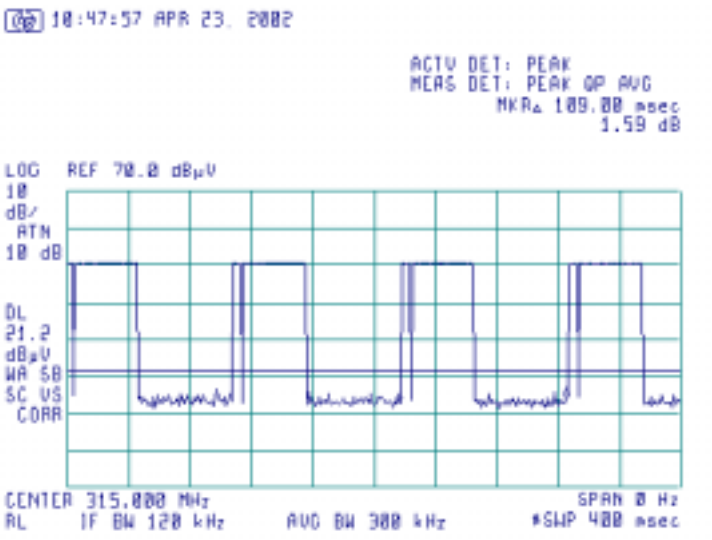
Plot A2

Field strength of fundamental measurements



Plot A3

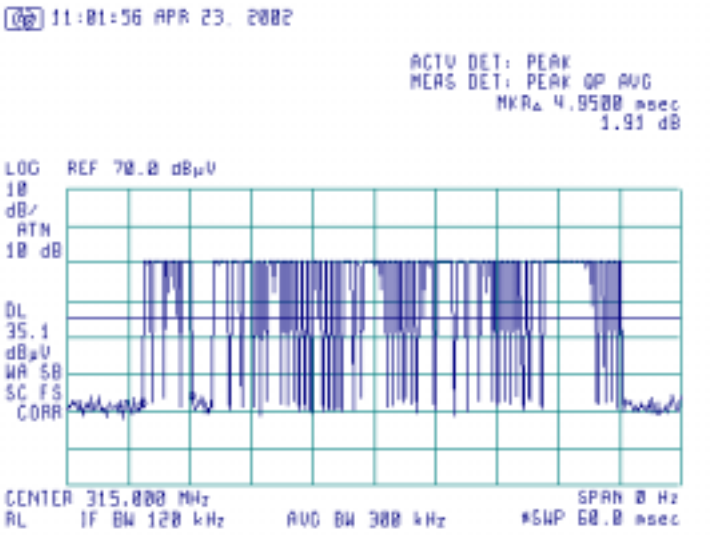
Time period between two successive transmissions



The time period between two successive transmissions is 109 ms.

Plot A4

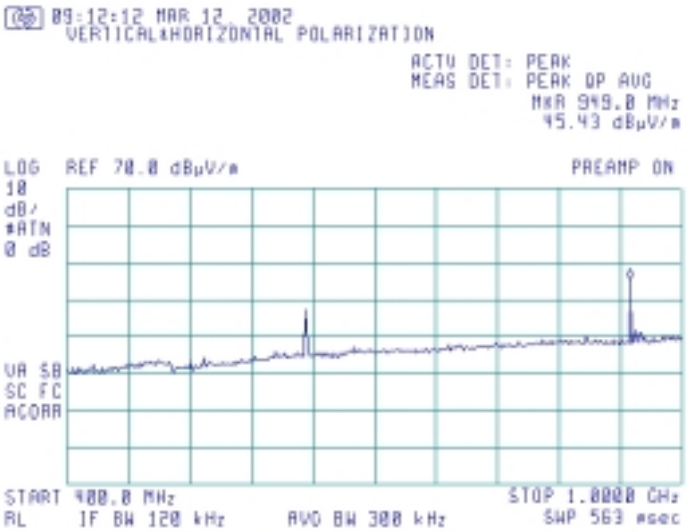
One transmission duration



Preamble: 0.2 ms x 12 = 2.4 ms
Time ON = 2.4 ms = 46x0.4 ms + 20x0.2 ms = 2.4 ms + 22.4 ms = 24.8 ms

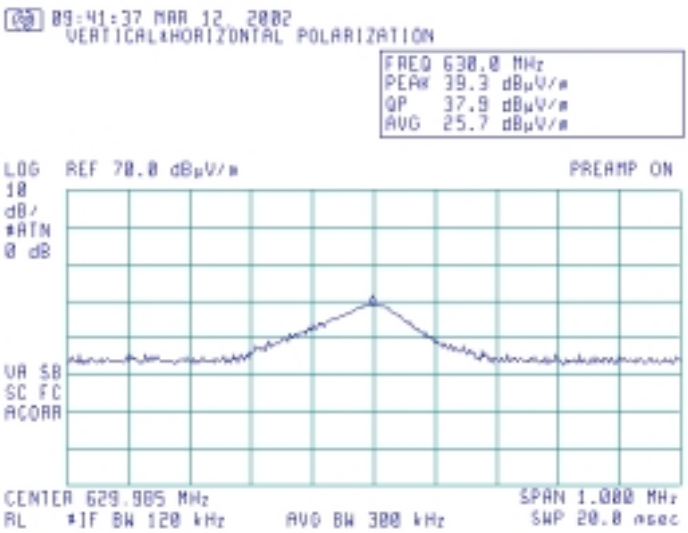
Plot A5

Spurious emission measurements
400 – 1000 MHz frequency ange



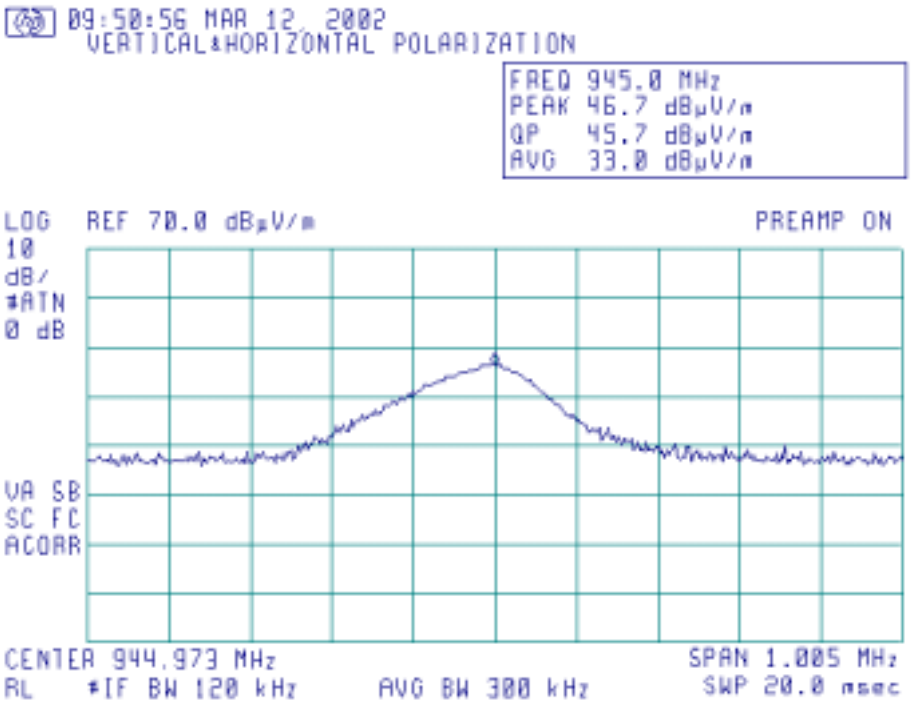
Plot A6

Field strength of 2nd harmonic measurements



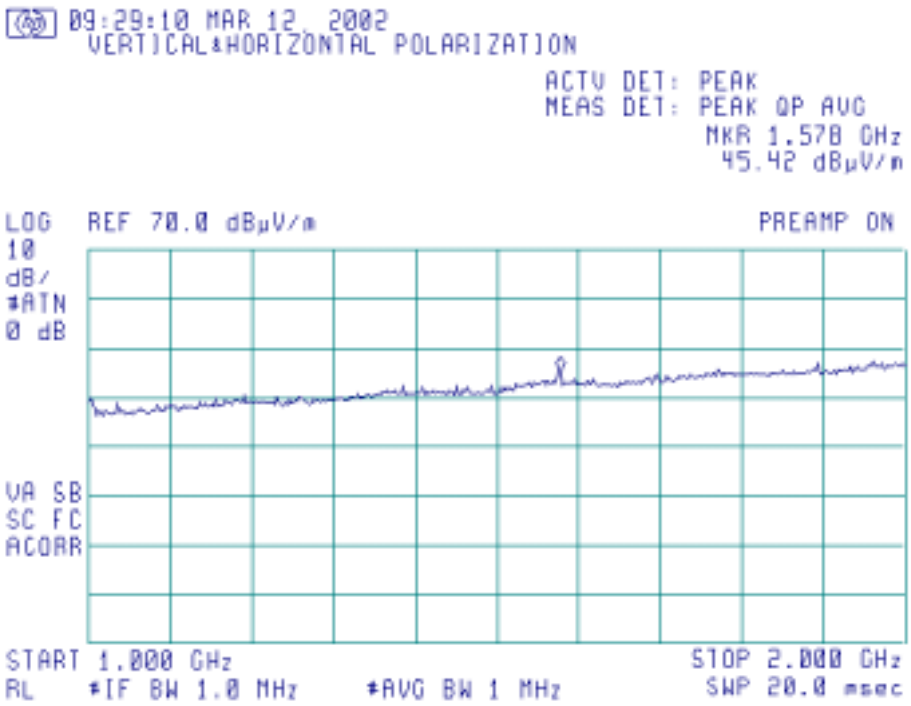
Plot A7

Field strength of 3rd harmonic measurements



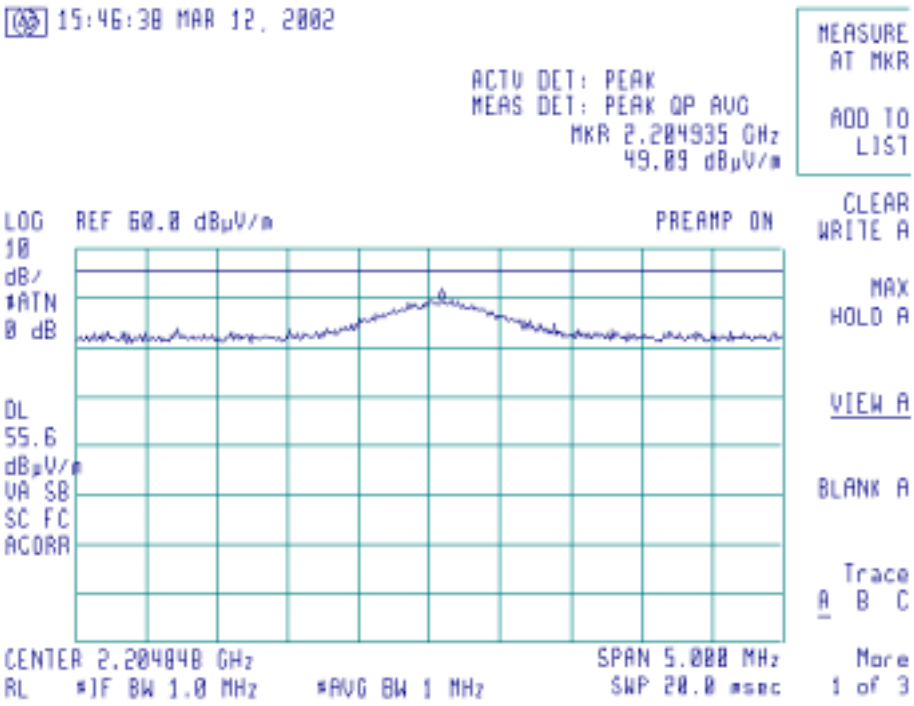
Plot A8

Spurious emission measurements
1 – 2 GHz frequency ange



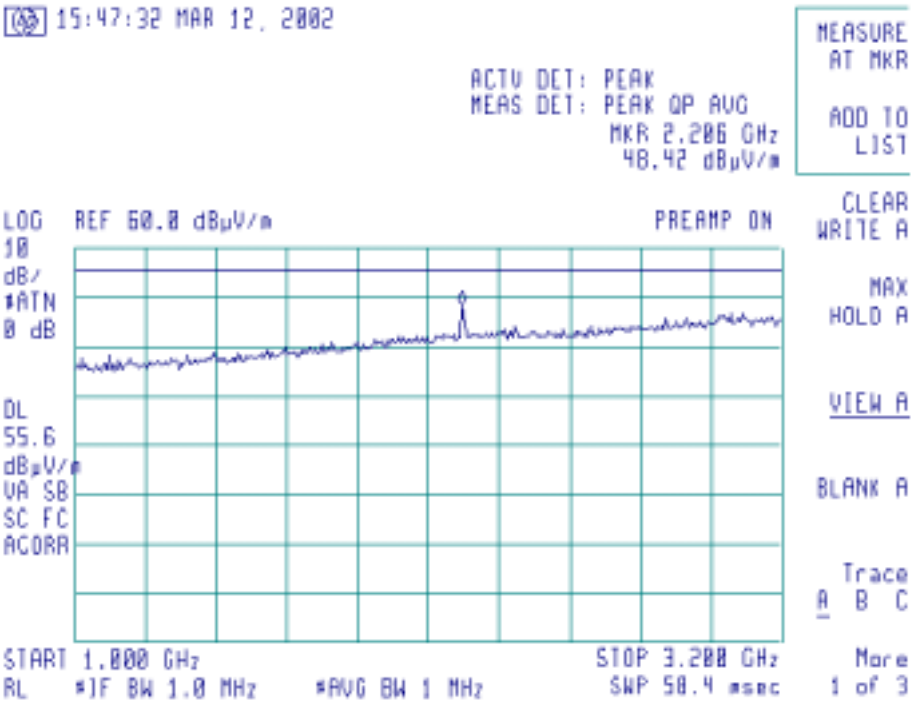
Plot A9

Field strength of 7th harmonic measurements



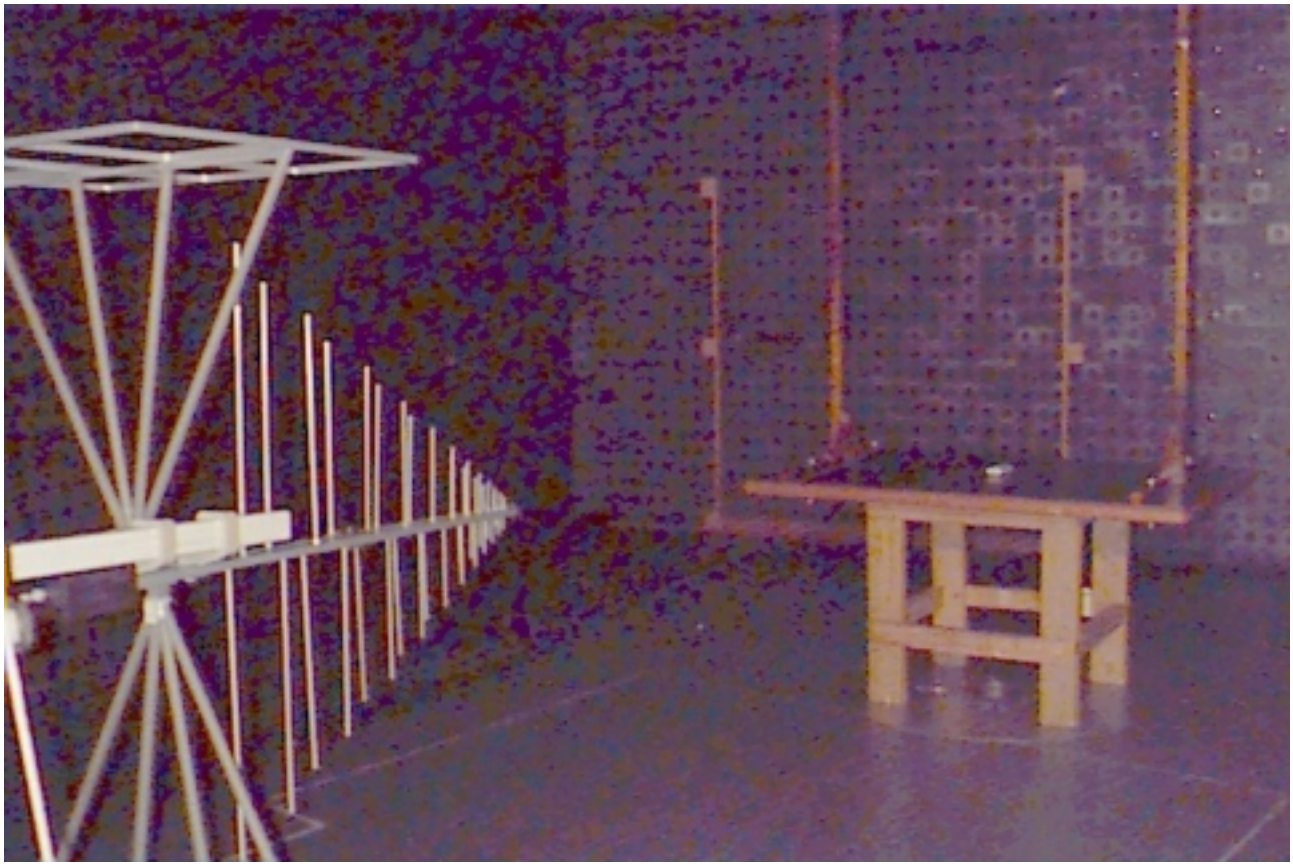
Plot A10

Spurious emission measurements
1 – 3.2 GHz frequency ange



Appendix B – Test setup photographs

RADIATED EMISSION MEASUREMENT SETUP



RADIATED EMISSION MEASUREMENT 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	8/02
0465	Anechoic Chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	023	3/03
0521	Spectrum Analyzer with RF filter section (EMI Receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	0319	7/02
0589	Cable Coaxial, GORE A2POL118.2, 3m	Hermon Labs	GORE-3	589	11/02
0604	Antenna Biconilog Log-Periodic/T Bow-Tie, 26 - 2000 MHz	EMCO	3141	9611-1011	01/03
1947	Cable 18 GHz, 6.5 m, blue	Rhophase Microwave Ltd	NPS-1803A-6500-NPS	T4974	10/02

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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Person for contact: Mr. Alex Usoskin, QA manager.

Abbreviations and acronyms

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

AC	alternating current
AE	auxiliary equipment
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
EMC	electromagnetic compatibility
EUT	equipment under test
GHz	gigahertz
H	height
Hz	hertz
kHz	kilohertz
kV	kilovolt
L	length
LISN	line impedance stabilization network
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.

FCC Equipment codes and descriptions

CYY	Communications Receiver used w/ P.15 transmitter
DCD	Part 15 Low Power transmitter Below 1705 kHz
DSC	Part 15 Security/Remote Control Transmitter
DSR	Part 15 Remote Control/Security Device Transceiver
DSS	Part 15 Spread Spectrum Transmitter
DXX	Part 15 Low Power Communication Device Transmitter
EAV	Part 15 Automatic Vehicle Identification System
ETB	Part 15 Cordless Telephone Base Transceiver
ETR	Part 15 Cordless Telephone Remote Transceiver
ETS	Part 15 Cordless telephone system
FAP	Part 15 Anti-Pilferage Device
FDS	Part 15 Field Disturbance Sensor
GAT	Part 15 Auditory Assistance Device (Transmitter)
HID	Part 15 TV Interface Device
JBC	Part 15 Class B Computing Device/ Personal Computer
JBP	Part 15 Class B Computing Device Peripheral
PUB	Part 15 Unlicensed PCS base station
PUE	Part 15 Unlicensed PCS portable Tx held to ear
PUF	Part 15 Unlicensed PCS portable Tx held to face
PUT	Part 15 Unlicensed PCS portable Tx worn on body