ELECTROMAGNETIC EMISSIONS TEST REPORT

ACCORDING TO FCC PART 15, SUBPART C, §15.231

FOR

VISONIC Ltd.

EQUIPMENT UNDER TEST

WIRELESS SMOKE DETECTOR

model MCT-423

Hermon Laboratories Ltd.
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ACCREDITED
839.01
Electrical

Description of equipment under test

Test items	Wireless smoke detector
Manufacturer	Visonic Ltd.
Type (Model)	**MCT-423**

Applicant information

Applicant's representative & responsible person	Mr. Arick Elshtein, project manager
Company	Visonic Ltd.
Address	30 Habarzel St.
Postal code	69710
City	Tel Aviv
Country	Israel
Telephone number	+972 3645 6714
Telefax number	+972 3645 6743

Test performance

Project Number	13686
Location of the test	Hermon Laboratories, Binyamina, Israel
Test started	October 18, 1999
Test completed	October 18, 1999
Purpose of test	The EUT certification in accordance with CFR 47, part 2, §2.1033
Test specification(s)	FCC part 15, subpart C, §15.231, §15.209, subpart B, §15.109

Table of Contents

1. Summary and signatures

The EUT, wireless smoke detector MCT-423, was tested according to FCC part 15 subpart C, §.15.231 and part 15 subpart B §.15.109 and found to comply with the standard requirements.

Test performed by:

Mr. M. Feldman, test technician _____

Test report prepared by:

Mrs. V. Mednikov, certification engineer _____

Test report approved by:

Mrs. E. Pitt, project manager _____

Mr. A. Usoskin, QA manager _____

The A2LA logo endorsement applies only to the test methods and the standards that are listed in the scope of
Hermon Laboratories accreditation by A2LA.
Through this report period is used as decimal separator while thousands are separated by comma.
This report is in conformity with EN 45001 and ISO GUIDE 25.
The test results relate only to the items tested.

2. General information

2.1 Abbreviations and acronyms

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

AC	alternating current
BW	bandwidth
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
DC	direct current
EUT	equipment under test
GHz	gigahertz
H	height
HL	Hermon Laboratories
Hz	hertz
IF	intermediate frequency
kHz	kilohertz
L	length
m	meter
mm	millimeter
MHz	megahertz
msec	millisecond
NA	not applicable
NARTE	National Association of Radio and Telecommunications Engineers, Inc.
Ω	Ohm
QP	quasi-peak (detector)
RBW	resolution bandwidth
RF	radio frequency
RE	radiated emission
RMS	root-mean-square
sec	second
V	volt

2.2 Specification references

CFR 47 part 15: October 1998	Radio Frequency Devices.
ANSI C63.2:06/1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
ANSI C63.4:1992	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.

2.3 EUT description

The EUT, MCT-423, is a photoelectric smoke detector fitted with a PowerCode-type fully supervised UHF transmitter. It is designed to sense smoke, not gas, heat or flame. The detector provides early warning of developing fires by sounding an alarm with its built-in alarm horn and by transmitting a coded alarm signal to a wireless alarm control panel.

SPECIFICATIONS

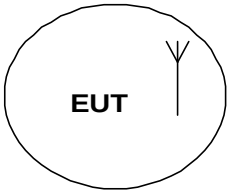
Smoke detector:
Detection sensitivity: 2.3 ± 1.2 % / ft^3.
Alarm sound level: 85 dB at 3 m.

Transmitter and coding:
Operating frequencies (MHz): 315, 404, 418, 433.92 or other frequencies according to local requirements
Message repetition: repetitive transmission (once every 3 minutes) or one-shot, as selected with on-board DIP switch.
Supervision: automatic signaling at 60-minute intervals.

Electrical data:
Power source: 9 V Alkaline or Lithium
Current drain: 28 µA standby, 20 mA in operation
Battery supervision: automatic transmission of battery status data as part of any transmitted message

The EUT configuration is given in Figure 2.3.1.

Figure 2.3.1
EUT test configuration



3. Test facility description

3.1 General

Tests were performed at Hermon Laboratories, 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 radiated measurements (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-809 for anechoic chamber, C-845 for conducted emissions site), assessed by NMi Certin B.V. (Netherlands) for a number of EMC, Telecommunications, Safety standards, and assessed by AMTAC (UK) for safety of Medical Devices. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO GUIDE 25/EN 45001 for EMC, Telecommunications and Product Safety Information Technology Equipment (Certificate No. 839.01).

Address: PO Box 23, Binyamina 30550, Israel
Telephone: +972 6628 8001
Fax: +9726 628 8277

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

3.2 Equipment calibration

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error. The standards and instruments used in the calibration system conform to the present requirements of MIL-STD-45662A.
The laboratory standards are calibrated by the third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

3.2.1 Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Radiated emissions in the anechoic chamber at 3 m measuring distance	Biconilog antenna: ±3.2 dB Double ridged guide antenna: ±2.36 dB

3.3 Laboratory personnel

The three people of Hermon Laboratories that have participated in measurements and documentation preparation are: Dr. Edward Usoskin - C.E.O., Mr. Michael Feldman, test technician and Mrs. Valeria Mednikov - certification engineer.

3.4 Statement of qualification

The test measurement data supplied in this test measurement report having been received by me, is hereby duly certified. The following is a statement of my qualifications.

I am a technician, have obtained 30 years experience in electronics and measurements. I have been with Hermon Laboratories since 1995.

Name: Mr. Michael Feldman Signature: _____
Position: test technician Date: January 11, 2000

I hereby certify that this test measurement report was prepared by me and is hereby duly certified. The following is a statement of my qualifications.
I have a university degree and more than 10 years experience in document processing.
I have been with Hermon Laboratories since May 1999.

Name: Mrs. Valeria Mednikov Signature: _____
Position: certification engineer Date: January 11, 2000

I hereby certify that this test measurement report was prepared under my direction and that to the best of my knowledge and belief, the facts set in the report and accompanying technical data are true and correct.
The following is a statement of my qualifications.
I have a Ph.D. degree in electronics, have obtained more than 42 years of experience in EMC measurements, electronic product design and have been with Hermon Laboratories since 1986.
.Also, I am an EMC engineer certified by the National Association of Radio and Telecommunications Engineers, Inc. (USA). The certificate no. is EMC-000623-NE, Senior Member.

Name: Dr. Edward Usoskin Signature: _____
Position: C.E.O. Date: January 11, 2000

4 Radiated emission measurements

4.1 Field strength of emissions according to § 15.231 (b)

4.1.1 General

Specified limit at 3 m distance is given in Table 4.1.1 below

Table 4.1.1 The field strength limits

Frequency,	Average detector		Peak detector	
	Field strength of fundamental,	Field strength of spurious emissions,	Field strength of fundamental,	Field strength of spurious emissions,
MHz	dB(μV/m)	dB(μV/m)	dB(μV/m)	dB(μV/m)
315	75.6	55.6	95.6	75.6

The limit for spurious emissions in restricted bands, see § 15.205, is 500 μV/m according to §15.209.

4.1.2 Test procedure

The test was performed in the anechoic chamber at 3 meters test distance, i.e. the distance between measuring antenna and EUT boundary. The EUT was placed on the wooden table, as shown in Figure 4.1.1, Photographs 4.1.1 to 4.1.3, and operated in continuous transmitting mode. The frequency range from 30 MHz up to 10th harmonic was investigated with biconilog and double ridged guide antennas. 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.

The peak and average detectors with RBW = 120 kHz at frequencies below 1 GHz and RBW = 1 MHz above 1 GHz were used in course of measurements.

The EUT has met the average emission requirements and the peak emission limitations of §15.35.

The worst test results were recorded into Tables 4.1.2 and 4.1.3.

Reference numbers of test equipment used

HL 0041	HL 0465	HL 0521	HL 0604

Full description is given in Appendix A.

Table 4.1.2

Radiated emission measurements, peak limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.231
DATE: October 18, 1999
RELATIVE HUMIDITY: 56%
AMBIENT TEMPERATURE: 23°C

Frequency, MHz	Radiated emission, Peak dB (µV/m)	Peak limit, dB(µV/m)	Margin, dB	Pass/ Fail
314.98	79.68	95.6	15.92	Pass
630.06	41.59	75.6	34.01	Pass
1889.95	52.45	75.6	23.15	Pass
2835.19*	52.45	74	21.55	Pass

* Within restricted band 2655 MHz - 2900 MHz.

Notes to table:

Peak detector was used.

Peak limit = average limit dB(µV/m) +20 dB.
Margin = dB below (negative if above) limit.

Table 4.1.3

Radiated emission measurements, average limit

TEST SPECIFICATION: FCC part 15 subpart C § 15.231
DATE: October 18, 1999
RELATIVE HUMIDITY: 56%
AMBIENT TEMPERATURE: 23°C

Frequency, MHz	Radiated emission, average dB (μV/m)	Average limit, dB(μV/m)	Margin, dB	Pass/ Fail
314.98	73,29	75.6	2.31	Pass
630.06	34.07	55.6	21.53	Pass
1889.95	43.98	55.6	11.62	Pass
2835.19*	43.98	54	10.02	Pass

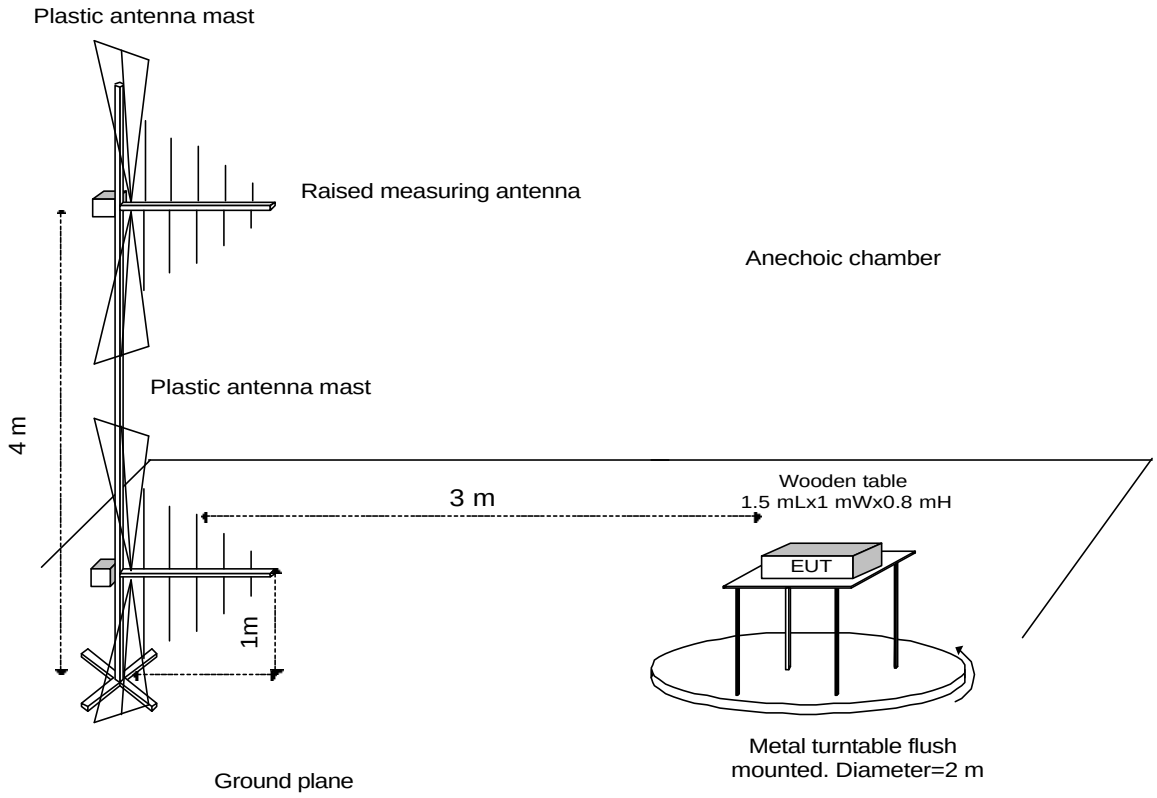
***** Within restricted band 2655 MHz – 2900 NHz.

Notes to table:

Average detector was used.

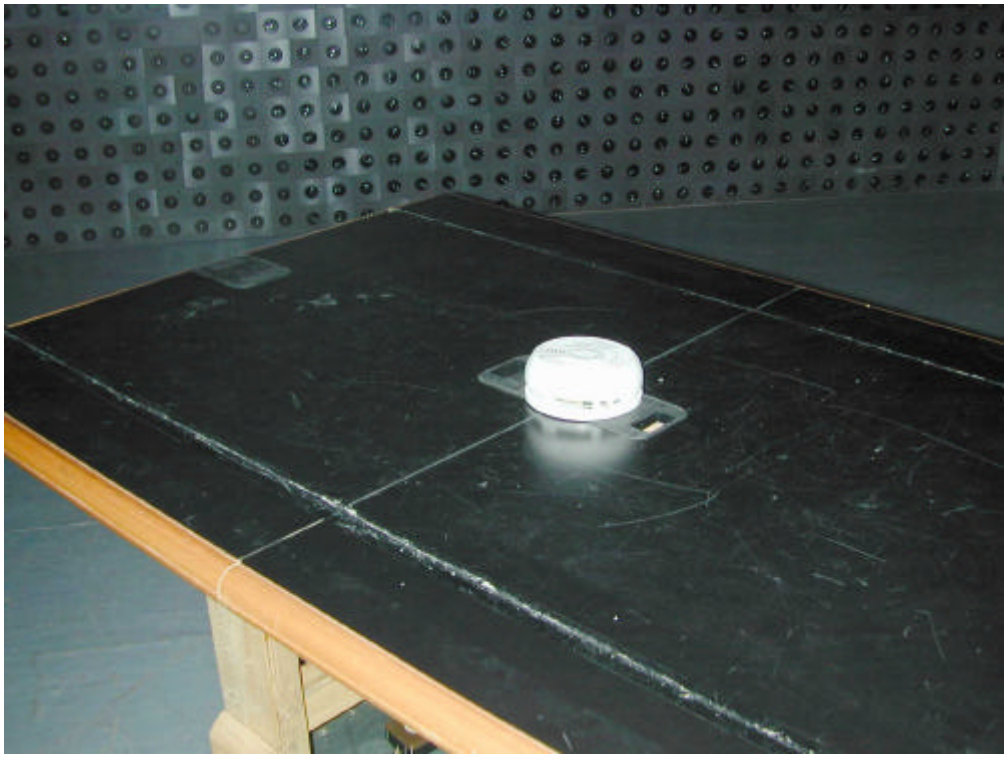
Average limit is in accordance with § 15.231(b).
Margin = dB below (negative if above) limit.

Figure 4.1.1
Radiated emission test setup

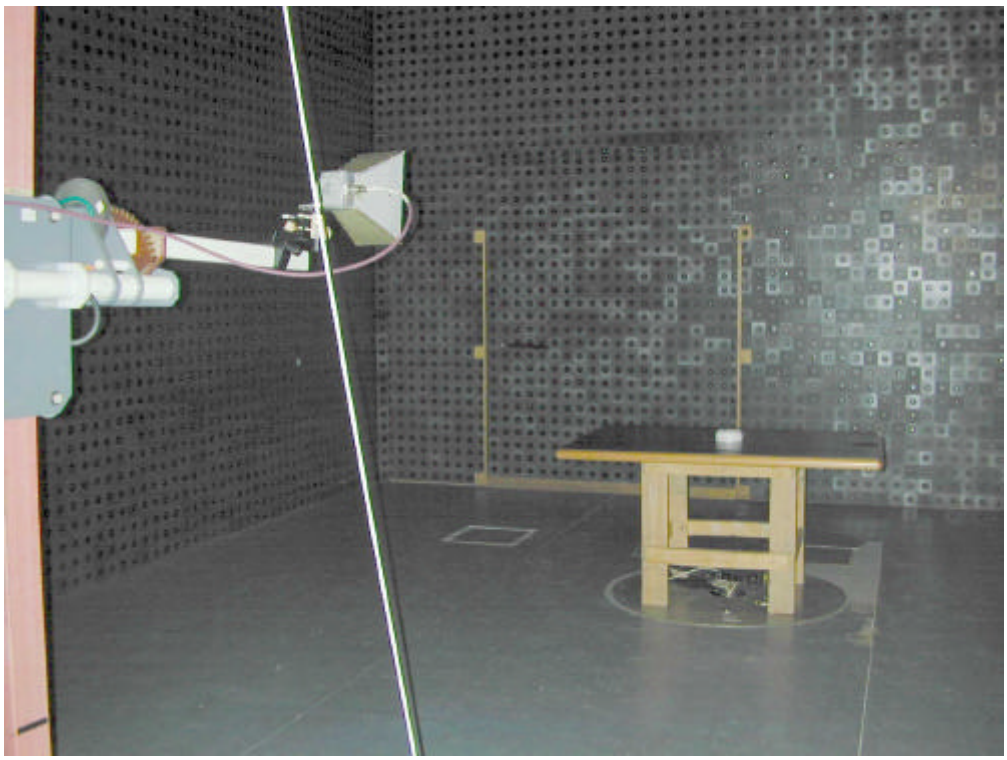


Photograph 4.1.1
Radiated emission measurements setup

Photograph 4.1.2
Radiated emission measurements setup



Photograph 4.1.3
Radiated emission measurements setup



4.2 Bandwidth of emission according to § 15.231 (c)

4.2.1 Specified limits

The bandwidth of the emissions shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.

4.2.2 Test procedure and results

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

0.0025 x 315 MHz = 787.5 kHz

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. The occupied bandwidth of 390 kHz was measured which is narrower than admitted 787.5 kHz.

The test results are shown in Plot 4.2.1.

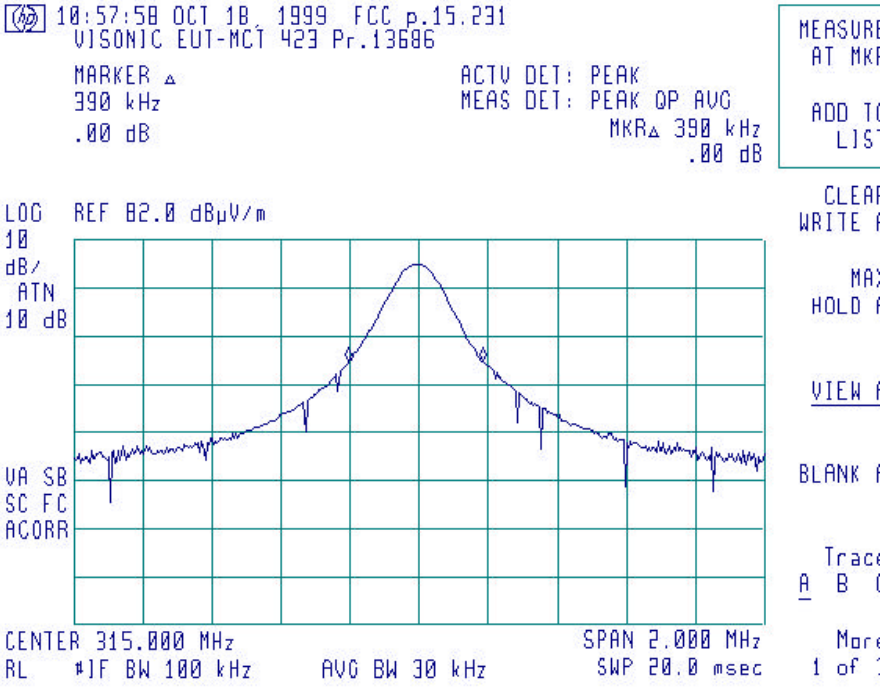
Reference numbers of test equipment used

HL 0465	HL 0521	HL 0604

Full description is given in Appendix A.

Plot 4.2.1

Emission bandwidth measurements result


10:57:58 OCT 18, 1999 FCC p.15.231
VISONIC EUT-MCT 423 Pr.13686
MARKER Δ
390 kHz
.00 dB
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 390 kHz
.00 dB
LOG REF 82.0 dBµV/m
10
dB/
ATN
10 dB
VA SB
SC FC
ACORR
CENTER 315.000 MHz
SPAN 2.000 MHz
RL #IF BW 100 kHz
AVG BW 30 kHz
SWP 20.0 msec
MEASURE
AT MKR
ADD TO
LIST
CLEAR
WRITE
MAX
HOLD
VIEW
BLANK
Trace
A B
More
1 of

4.3 Periodic operation requirements §15.231 (a) (3), (4)

Supervision of transmitter integrity is realized by automatic signaling at 60-minute intervals.

Each message block is 300 ms and there are three message blocks in each transmission, separated by about 300 ms, the total duration is about 1500 ms = 1.5 s.
As long as the alarm is on, message repetition occurs as set via DIP switch by the installer: repetitive transmission (once every three minutes) or one-shot.

Therefore the requirements are fully met.

4.4 Unintentional radiated emissions test according to §15.109

4.4.1 General

This test was performed to measure radiated emissions from the incorporated digital device of the EUT and also to verify the EUT full compliance with §15.109.

Radiated emission measurements specification limits are given in Table 4.4.1 below:

Table 4.4.1
Limits for electric field strength, quasi-peak detector

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

4.4.2 Test procedure

The radiated emissions measurements of the EUT incorporated digital device were performed in the anechoic chamber at 3 meter measuring distance in the frequency range from 30 MHz to 1 GHz. The EUT was placed on the wooden table as shown in Figure 4.1.1 and Photographs 4.1.1, 4.1.2. The biconilog antenna was used. To find maximum radiation the turntable was rotated 360^{o}, the measuring antenna height changed from 1 to 4 m, and the antenna polarization was changed from vertical to horizontal.

The measurements were performed with the EMI receiver settings: RBW=120 kHz, peak detector.

All emissions were found at least 15 dB below the limit.

The test measurement results are shown in Plot 4.4.1.

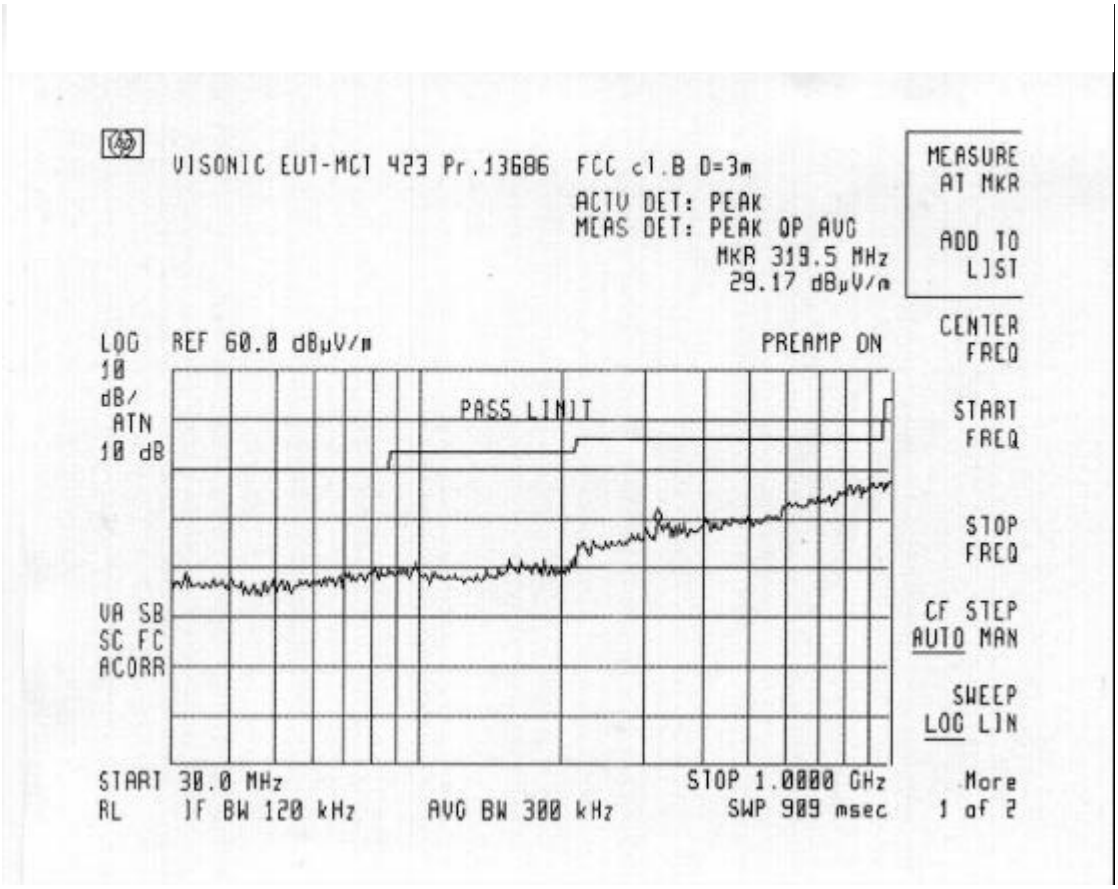
Reference numbers of test equipment used

HL 0465	HL 0521	HL 0604

Full description is given in Appendix A.

Plot 4.4.1

Test specification: §15.109
Radiated emissions of digital incorporated device



APPENDIX A – Test equipment and ancillaries used for tests

HL Serial No.	Serial No.	Description	Manufacturer	Model No.	Due Calibr.
0041	2811	Double ridged guide antenna, 1-18 GHz	Electro-Metrics	RGA 50/60	8/00
0465	023	Anechoic chamber 9 (L) x 6.5 (W) x 5.5 (H) m	Hermon Labs	AC-1	3/00
0521	0319	Spectrum analyzer with RF filter section (EMI receiver 9 kHz - 6.5 GHz)	Hewlett Packard	8546A	7/00
0604	9611-1011	Antenna biconilog log-periodic/T bow-tie, 26 - 2000 MHz	EMCO	3141	7/00

APPENDIX B-Test equipment correction factors

Antenna Factor
Double Ridged Guide Antenna
Model RGA-50/60, S/N 2811

Frequency, MHz	Antenna Factor, dB
1000	24.3
1500	25.4
2000	28.4
2500	29.2
3000	30.5
3500	31.6
4000	33.7
4500	32.2
5000	34.5
5500	34.5
6000	34.6
6500	35.3
7000	35.5
7500	35.9
8000	36.6
8500	37.3
9000	37.7
9500	37.7
10000	38.2
10500	38.5
11000	39.0
11500	40.1
12000	40.2
12500	39.3
13000	39.9
13500	40.6
14000	41.1
14500	40.5
15000	39.9
15500	37.8
16000	39.1
16500	41.1
17000	41.7
17500	45.1
18000	44.3

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

Antenna factor at 3m calibration
Biconilog antenna, EMCO, model 3141,Ser.No.1011

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 is to be added to receiver meter reading in dB(μV) to convert to field intensity in dB(μV/meter).