EMC TEST REPORT

No. 409268E

Electromagnetic disturbances

EQUIPMENT UNDER TEST

Equipment :	Microwave oven
Type / model :	KBMS1454R
Manufacturer :	Whirlpool Sweden AB
Tested by request of :	Whirlpool Sweden AB

SUMMARY

The equipment complies with the requirements according to the following standards.

FCC, part 18 (2003)

Date of issue: November 1, 2004

Tested by: _____ Approved by: _____

Harri Satama — Bo Berglöf

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CONTENTS

1. CLIENT INFORMATION

The EUT has been tested by request of

Company:	Whirlpool Sweden AB Box 763 601 17 Norrköping Sweden
Name of contact:	Tony Lindström

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment:	Microwave oven
Type/Model:	KBMS1454R
Brand name:	Whirlpool
Serial number:	-
Manufacturer:	Whirlpool Sweden AB Box 763 601 17 Norrköping Sweden
Rating:	W, 120 V AC, 60 Hz Class I

2.2 Additional information about the EUT

The EUT has the following noted components:

RFI-filter	Iskra, type KPL 3009, 0,47µF+2x2700pF X1Y2+2x1mH 680kΩ
Magnetron	Panasonic, type 2M167B-M16
HV-trafo	DPC, type DW-120(H)
HV-capacitor, 1,05 µF	Samwha, type CH-2101054B8N

3. TEST SPECIFICATIONS

3.1 Standards

47 CFR, Part 18 (2003)

3.2 Additions, deviations and exclusions from standards

No additions, deviations or exclusions have been made from standard.

3.3 Mode of operation during the test

The EUT was supplied with 120 VAC, 60 Hz.
The EUT was operating with a non-conductive glass beaker (1 litre) with 700/300 ml water.

4. TEST SUMMARY

The results in this report apply only to sample tested:

Test	Result	Note
Conducted emission, 0,009 – 30 MHz	Pass	
Radiated electromagnetic field, 30 - 1000 MHz	Pass	
Radiated electromagnetic field strength, 1 - 24,5 GHz	Pass	
Fundamental frequency	Pass	
Radiation leakage, 2,45 GHz	Pass	
Power output (microwave power)	Pass	

5. MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE IN THE FREQUENCY RANGE 0,15 MHz TO 30 MHz

5.1 Operating environment

Temperature: 22 °C
Relative Humidity: 38 %

5.2 Test set-up and test procedure

The mains terminal disturbance voltage was measured with the equipment under test (EUT) placed on a site for conducted emission. The EUT was connected to an artificial mains network (AMN), placed on the reference ground plane (RGP). The EUT was placed on a non-metallic table 0,8 m above a metallic, grounded floor, 0,4 m from the reference ground plane (RGP) wall and 0,8 m from the AMN.

A beaker filled with 700 ml of water was placed in the centre of the oven.

Amplitude measurements were performed with a quasi-peak detector and, if required, with an average detector.

5.3 Measurement uncertainty

Mains terminal disturbance voltage, quasi-peak detection: ± 3,6 dB
Mains terminal disturbance voltage, average detection: ± 3,6 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT in the above mentioned way.

Measurement uncertainty is calculated in accordance with EA-4/02:1997.
The measurement uncertainty is given with a confidence of 95 %.

5.4 Test equipment

Test site: Shielded room

Equipment	Manufacturer	Type	Kalib. date	Intertek Semko No.
Measurement receiver	Rohde & Schwarz	ESHS 30	20040708	3149
Artificial mains network	Rohde & Schwarz	ESH3-Z5	20030708	30232

5.5 Test protocol

Date of test: October 20, 2004

An overview sweep performed with a peak detector on next page.

Frequency /MHz	Quasi-Peak		Average	
	Disturbance level /dB(µV)	Permitted limit /dB(µV)	Disturbance level /dB(µV)	Permitted limit /dB(µV)
0,009	65	110	-	-
0,057	45	89	-	-
0,15	47	66	33	56
0,60	54	56	28	46
0,78	40	56	<20	46
0,93	38	56	<20	46
3,55	36	56	21	46
15,65	46	60	35	50
19,80	48	60	37	50
30,00	53	60	42	50

Limit according to FCC, part 18 (2003)

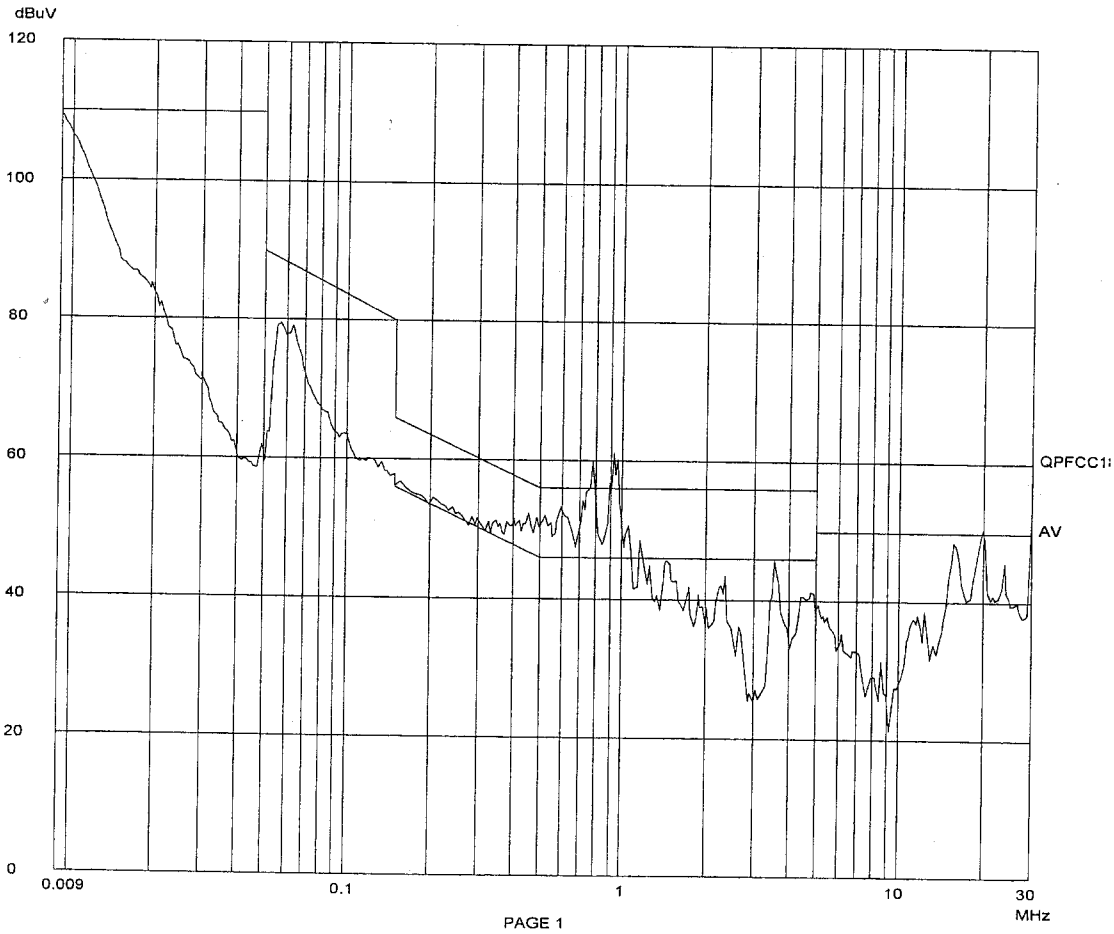
Qntertek SEMKO
FCC 18, Conducted

20. Oct 04 08:23

EUT:	Microwave oven, type KBMS 145 R
Manuf:	Whirlpool Sweden AB
Op Cond:	Max. heating
Operator:	HAS
Test Spec:	Mains terminals. Peak measurements.

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
9k	150k	200Hz	10k	PK	20ms	AUTO	LN OFF	60dB
150k	30M	7k	10k	PK	20ms	AUTO	LN OFF	60dB



6. RADIATED ELECTROMAGNETIC FIELD IN THE FREQUENCY RANGE 30 MHz TO 1000 MHz

6.1 Operating environment

Temperature: 20 °C
Relative Humidity: 31 %

Measurements were performed in a semi-anechoic chamber.

6.2 Test set-up and test procedure

Beaker with 700 ml water were placed in the centre of the oven. A beaker was not placed in the right front corner since the oven has a turntable.

The EUT was positioned in order to emit maximum disturbance.

An overview sweep with peak detection of the electric field intensity was performed in a semi-anechoic chamber. The overview sweep was performed with the measurement receiver in max-hold and the antenna was varied between 1 to 4 m in both horizontal and vertical polarisation. The measurements were repeated with the EUT rotated in 45-degree steps.

The radiated disturbance electric field intensity was measured at a distance of 3 m and the EUT was placed on a non-metallic table, 1,0 m above the reference ground plane.

In the final measurements the height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarisation, and the maximum value is presented in the report. The measurements were performed with a quasi-peak detector.

6.3 Measurement uncertainty

Radiated disturbance electric field intensity, 30-300 MHz: ± 4,6 dB
Radiated disturbance electric field intensity, 200-1000 MHz: ± 4,6 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT in the above-mentioned way.

Measurement uncertainty is calculated in accordance with EA-4/02:1997.
The measurement uncertainty is given with a confidence of 95 %.

6.4 Test equipment

Test site: Semi-anechoic shielded chamber. 10 x 20 x 8,5 m (W x L x H).

Equipment	Manufacturer	Type	Kalib. date	Intertek Semko No.
Software	Rohde & Schwarz	ES-K1, ver 1.50		
Test receiver	Rohde & Schwarz	ESAI	20030715	2973/2974
Preamplifier	Intertek Semko	-	20040709	7992/7993
Antenna, bilog	Chase	CBL6111	20020910	8578

6.5 Test protocol

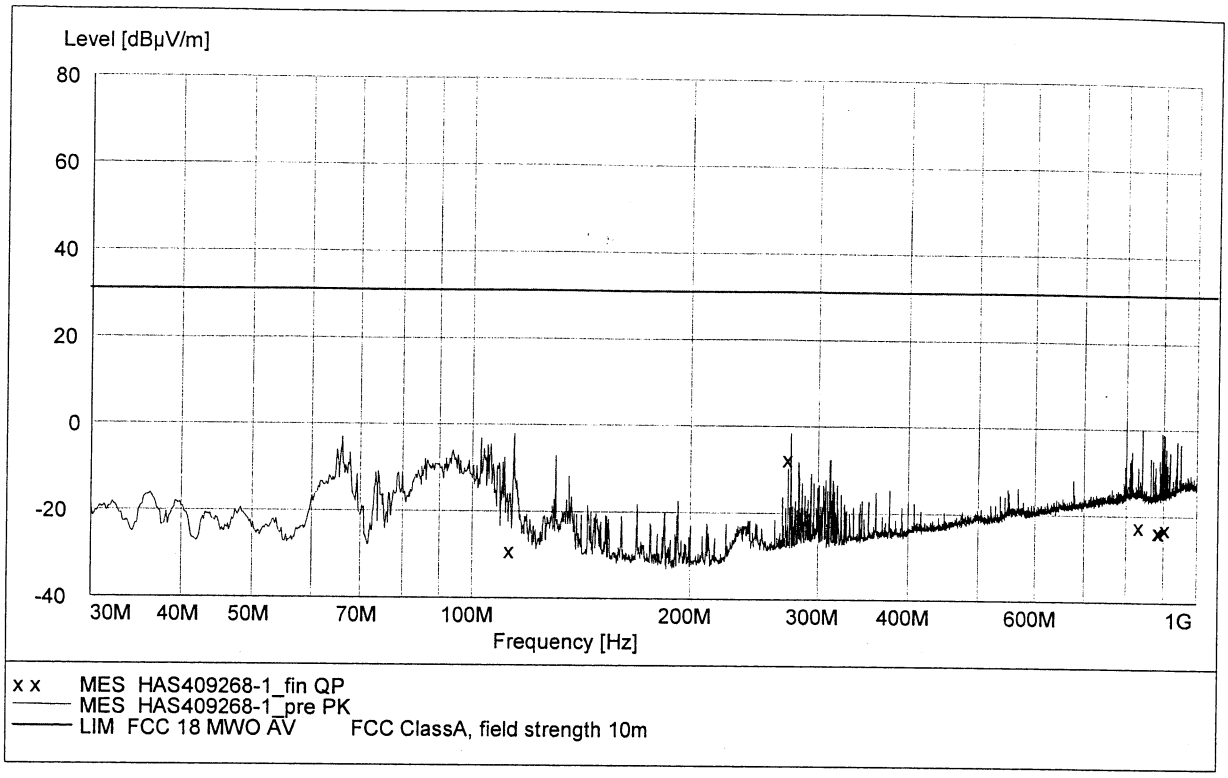
Date of test: October 15, 2004

An overview sweep performed with a peak detector on next page.

Frequency /MHz	Quasi-Peak Disturbance level /dB(µV/m)	Quasi-Peak Permitted limit /dB(µV/m)
113,36	-28,8	30,3
274,80	-7,3	30,3
839,44	-22,2	30,3
891,92	-23,3	30,3
895,12	-23,4	30,3
911,04	-22,6	30,3

Limit according to FCC, part 18 (2003)

The measured field strength levels have been recalculated to 300 m. The limit has been calculated using the output power calculated according to clause 10.


Level [dBµV/m]
80
60
40
20
0
-20
-40
30M
40M
50M
70M
100M
200M
300M
400M
600M
1G
Frequency [Hz]
x x MES HAS409268-1_fin QP
MES HAS409268-1_pre PK
LIM FCC 18 MWO AV
FCC ClassA, field strength 10m

7. RADIATED ELECTROMAGNETIC FIELD STRENGTH IN THE FREQUENCY RANGE 1 GHz TO 24,5 GHz

7.1 Operating environment

Measurements were performed in a semi-anechoic chamber.

Temperature: 20 °C
Relative Humidity: 44 %

7.2 Test set-up and test procedure

Beaker with either 700 ml or 300 ml were placed in the centre of the oven. A beaker was not placed in the right front corner since the oven has a turntable.

The radiated electromagnetic field strength was measured in a semi-anechoic chamber at a distance of 3 m.The EUT was placed on a non-metallic turntable 1,0 m above the ground plane.

An overview sweep with peak detection of the electric field intensity was performed. The overview sweep was performed with the measurement receiver in max-hold and the antenna was varied between 1 to 4 m in both horizontal and vertical polarisation.

In the final measurements the height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarisation, and the maximum value is presented in the report. The measurements were performed with average detection, the video bandwidth was set to 10 Hz .

In all cases, the starting phase of the oven is ignored.

7.3 Measurement uncertainty

Radiated electromagnetic power,	1,0 GHz – 2,90 GHz	±5,7 dB
	2,75 GHz – 6,50 GHz	±5,9 dB
	6,0 GHz – 12,8 GHz	±6,2 dB
	12,4 GHz – 18,0 GHz	±6,7 dB

The measurement uncertainty describes the overall uncertainty of the given measured value during operation of the EUT in the above-mentioned way.

Measurement uncertainty is calculated in accordance with EA-4/02, 1997.
The measurement uncertainty is given with a confidence of 95 %.

7.4 Test equipment

Test site: Semi-anechoic shielded chamber. 10 x 20 x 8,5 m (W x L x H).

Equipment	Manufacturer	Type	Kalib .date	Intertek Semko No.
Spectrum analyzer	Hewlett Packard	8593E	20040714	6661
Preamplifier	Hewlett Packard	8449B	20040707	6685
Band reject filter	K&L	6N45-2450/T100-0/0	20040226	12388
Highpass filter	K&L	4H10-X4500/18000-0/0	20040429	5133
Horn antenna 1 - 18 GHz	EMCO	3115	20040623	4628
Horn antenna 18 – 24,5 GHz	EMCO	3160-08	20040706	30099
Antenna cable	Midwest	FSCM 34078	20040915	8000
Antenna cable	Suhner	S 104	20040915	6677

7.5 Test protocol

Date of test: October 28, 2004

Frequency /GHz		Peak measurement	
Freq. range	Meas. peak	Disturbance Level dB(µV/m)	Limit dB(µV/m)
1 – 2,9	2,200	- 11,5	30,3
	2,225	- 11,0	30,3
	2,760	- 11,1	30,3
	2,765	- 10,8	30,3
2,9 – 5,5	4,967	- 5,4	30,3
5,5 – 18	14,880	8,2	30,3
18 – 24,5	-	-	30,3

Limit according to FCC, part 18 (2003)

The measured field strength levels have been recalculated to 300 m. The limit has been calculated using the output power calculated according to clause 10.

8. FUNDAMENTAL FREQUENCY (2450 ± 50 MHZ) OF THE MICROWAVE OVEN

8.1 Operating environment

Measurements were performed in a semi-anechoic chamber.

Temperature: 20 °C
Relative Humidity: 25 %

8.2 Test set-up and test procedure

The fundamental frequency was measured at a distance of 3 m. The test site was equipped with a metallic ground plane. The EUT was placed on a non-metallic turntable 1,0 m above the ground plane.

The measuring antenna was placed with its centre the same height as the centre of the radiating source. The measurement was made in vertical polarisation, with the measurement receiver in max-hold. The overview sweep is presented in the report.

Measurements were performed with peak detector.

8.3 Measurement uncertainty

Fundamental frequency at 2450 MHz ± 0,2 %

Measurement uncertainty is calculated in accordance with EA-4/02:1997.
The measurement uncertainty is given with a confidence of 95 %.

8.4 Test equipment

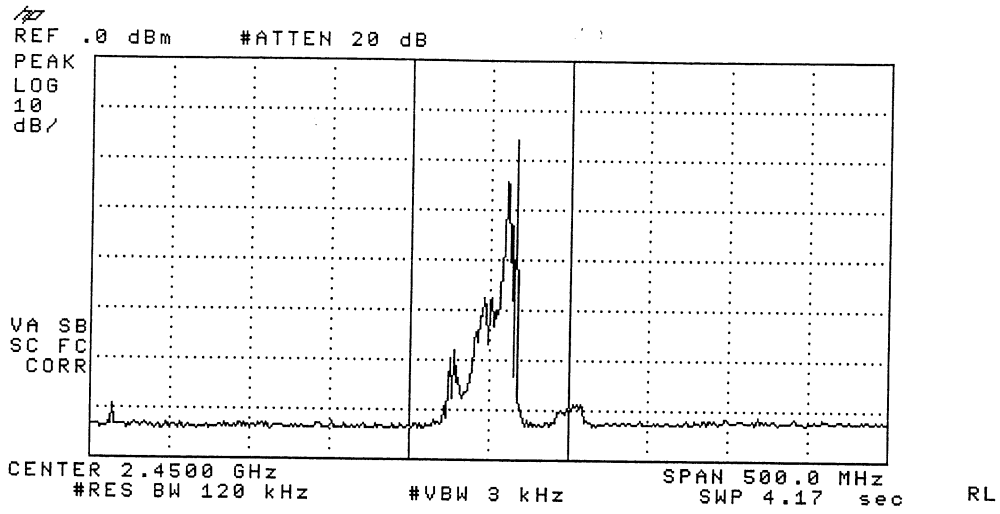
Test site: Semi-anechoic shielded chamber. 10 x 20 x 8,5 m (W x L x H).

Equipment	Manufacturer	Type	Kalib. date	Intertek Semko No.
Spectrum analyzer	Hewlett Packard	8593E	20040714	6661
Horn antenna 1 - 18 GHz	EMCO	3115	20040623	4628
Antenna cable	Suhner	S 104	20040915	6676

8.5 Test protocol

Date of test: October 12, 2004

An overview sweep performed with peak detector.



9. RADIATION LEAKAGE, 2,45 GHZ

9.1 Test equipment

Equipment	Manufacturer	Type	Kalib. date	Intertek Semko No.
Microwave survey meter	Holaday Ind.	1500	20041115	710

9.2 Test protocol

Date of test: October 18, 2004

< 0,2 mW/cm^2 (limit 1 mW/cm^2)

10. POWER OUTPUT, MICROWAVE POWER

10.1 Calorimetric method

$$P = \frac{4{,}187 \times M_W (T_2 - T_1) + 0{,}55 \times M_C (T_2 - T_0)}{t}$$

$$P = \frac{4{,}187 \times 1000(24 - 13) + 0{,}55 \times 392(24 - 22)}{54} = 860 \text{ W}$$

APPENDIX