

EMI TEST REPORT

Test Report No. : 26CE0142-HO-1a

Applicant : Rinnai Corporation
Type of Equipment : Remote controller for water heater
Model No. : MC-502RC-1US-M
Test standard : FCC Part 15 Subpart C
Section 15.207, Section 15.249: 2006
FCC ID : T2GMC-502RC-1US-M
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.

Date of test:

January 31 to February 2, 2006

Tested by:



Kenichi Adachi
EMC Services

Approved by :



Hiroka Umeyama
EMC Services

UL Apex Co., Ltd.

Head Office EMC Lab.

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SECTION 1: Client information

Company Name : Rinnai Corporation
Address : 103 International Drive, Peachtree City, GA 30269 U.S.A.
Telephone Number : (800)-621-9419
Facsimile Number : (678)-829-1666
Contact Person : Donald Emen

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1
Rating : DC12.6V $\pm$ 10%
Country of Manufacture : Japan
Receipt Date of Sample : January 31, 2006
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No: MC-502RC-1US-M is Remote controller for water heater.

Clock frequency	9.830MHz (Main clock), 14.7456MHz (PLL reference oscilation)
Equipment Type	Transceiver
Frequency of Operation	916.2204MHz to 922.6716MHz
Channel spacing	921.6kHz
Type of Modulation	FSK (for Transmitter)
Antenna Type	Derivative chip antenna
Antenna gain	Below 2.14 dBi
Method of frequency generation	Synthesizer
Operating temperature	-10 deg.C. to +70 deg.C.
ITU code	176KF1D (for Transmitter)

FCC 15.31 (e)

The power is supplied from transmission terminal (DC12.6V). Power supplied from water heater is stabilized to DC5.0V and provides stable voltage (DC 5.0V) constantly to Radio part. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C : 2006
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted Limits.
Section 15.249 Operation within the bands 902 – 928MHz,
2400 – 2483.5MHz, 5725 – 5875MHz, and 24.0 – 24.25GHz

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin *0)	Result
1	Conducted Emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC: Section 15.207	-	N/A	7.5 dB 24.94331MHz, N, AV	Complied
2	Electric Field Strength of Fundamental Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.249	Radiated	N/A	0.9dB 922.672MHz, Horizontal, QP	Complied
3	Electric Field Strength of Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.249, Section 15.209 *1)	Radiated	N/A	3.6 dB 1832.266MHz, 1845.381MHz, Vertical, AV	Complied
4	-20dB bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section 15.215	Radiated	N/A	-	Complied

Note: UL Apex's EMI Work procedures No. QPM05 and QPM15.

*0) The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result.

*1) The limit for above 1GHz was applied with Section 15.209 which is more stringent.

*These tests were performed without any deviations from test procedure except for additions or exclusions.

3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.4.1	-	Radiated	N/A	N/A	N/A

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3.4 Confirmation

UL Apex Co., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications, FCC Part15 Subpart C 2006.

3.5 Uncertainty

Uncertainty:

Conducted Emission

The measurement uncertainty (with a 95% confidence level) for this test is $\pm 2.6\text{dB}$.

The data listed in this test report has enough margin, more than the site margin.

Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is $\pm 4.41\text{dB}(3\text{m})/\pm 4.39\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.59\text{dB}(3\text{m})/\pm 4.58\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 4.62\text{dB}(3\text{m})/\pm 4.60\text{dB}(10\text{m})$.

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is $\pm 5.27\text{dB}$.

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.6 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. *NVLAP Lab. code: 200572-0

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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	IC4247A	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	846015	IC4247A-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.4 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1 and No.2 semi-anechoic and No.3 shielded room.

3.7 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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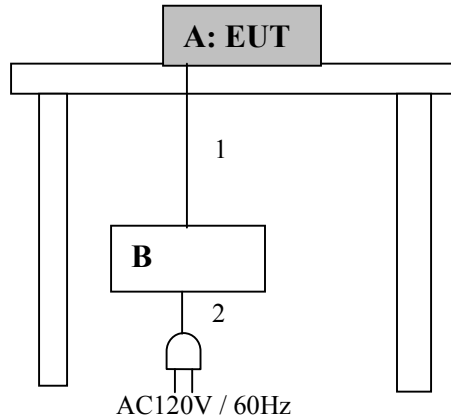
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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

The mode is used : Transmitting mode

4.2 Configuration and peripherals



*Setup was taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	Remote controller for water heater	MC-502RC-1US-M	1	Rinnai Corporation	T2GMC-502RC-1US-M
B	DC power supply	PW18-1.3AT	08016530	KENWOOD TMI	-

List of cables used

No.	Name	Length (m)	Shield	Remarks
1	DC Cable	1.8	N	Used only for the tests
2	AC Cable	2.0	N	Used only for the tests

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT itself (as a stand alone equipment)

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN /(AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Detector	: CISPR quasi-peak and average detector (IF BW 9 kHz)
Measurement range	: 0.15-30MHz
Test data	: APPENDIX 3
Test result	: Pass

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SECTION 6: Radiated emission (Fundamental and Spurious Emission)

6.1 Operating environment

Test place : No.2 semi anechoic chamber
Temperature : See data
Humidity : See data

6.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane.

The EUT was set on the edge of the tabletop.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna varied in height above the conducting ground plane to obtain the maximum signal strength.

A drawing of the set up is shown in the photos of APPENDIX 1.

6.3 Test conditions

Frequency range : 30MHz-10000MHz
Test distance : 3m
EUT position : Tabletop
EUT operation mode : Transmitting

6.4 Test procedure

The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver or the Spectrum Analyzer.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	QP: BW 120kHz	PK: RBW:1MHz/VBW: 1MHz AV: RBW:1MHz/VBW:10Hz

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

6.5 Results

Summary of the test results: Pass

Date: January 31 to February 2, 2006

Tested by: Kenichi Adachi

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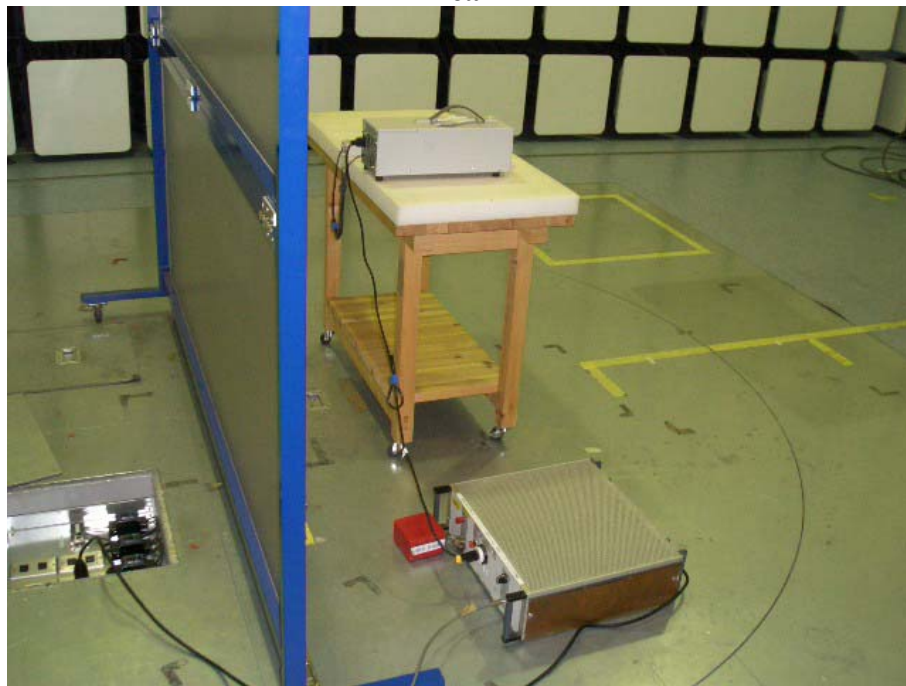
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APPENDIX 1: Photographs of test setup

Conducted Emission **Front**



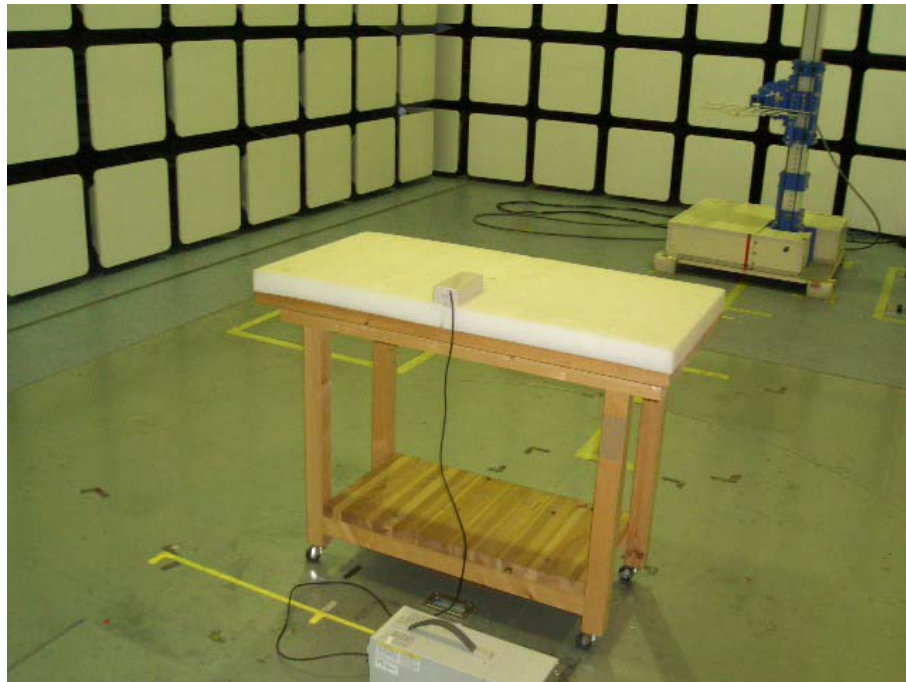
Rear



Radiated Emission
Front



Rear



Worst Case Position (Tx: Horizontal :X-axis / Vertical :Z-axis)

X-axis



Y-axis



Z-axis



APPENDIX 2:Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
MAEC-02	Anechoic Chamber	TDK	Semi Anechoic Chamber 3m	RE / CE	2005/04/11 * 12
MTR-02	Test Receiver	Rohde & Schwarz	ESCS30	RE / CE	2006/02/02 * 12
MRENT-23	Spectrum Analyzer	Advantest	R3273	RE / CE	2006/01/10 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	RE	2005/02/24 * 12
MPA-09	Pre Amplifier	Agilent	8447D	RE	2005/09/07 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	RE	2005/12/16 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	RE	2005/10/10 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2005/10/14 * 12
MDPS-04	DC Power Supply	KENWOOD TMI	PW18-1.3AT	RE / CE	Pre Check
MOS-02	Digital Humidity Indicator	N.T	NT-1800	RE / CE	2004/11/25 * 24
MCC-25	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	RE	2005/08/30 * 12
MPA-10	Pre Amplifier	Agilent	8449B	RE	2005/09/07 * 12
MCC-47	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	RE	2005/08/30 * 12
MHA-06	Horn Antenna	Schwarzbeck	BBHA9120D	RE	2006/01/09 * 12
MCC-13	Coaxial Cable	Fujikura/Agilent	-	CE	2005/02/24 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	CE	2005/02/04 * 12

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

Test Item:

CE: Conducted emission

RE: Radiated emission

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APPENDIX 3: Data of EMI test

Conducted Emission

(Tx: Ch. 1)

DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 06:10:38

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg.C / 29%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 1 (916.2204MHz) power -2dBm

LIMIT : FCC15C § 15.207 (QP) / RSS-Gen / RSS-210
FCC15C § 15.207 (AV) / RSS-Gen / RSS-210

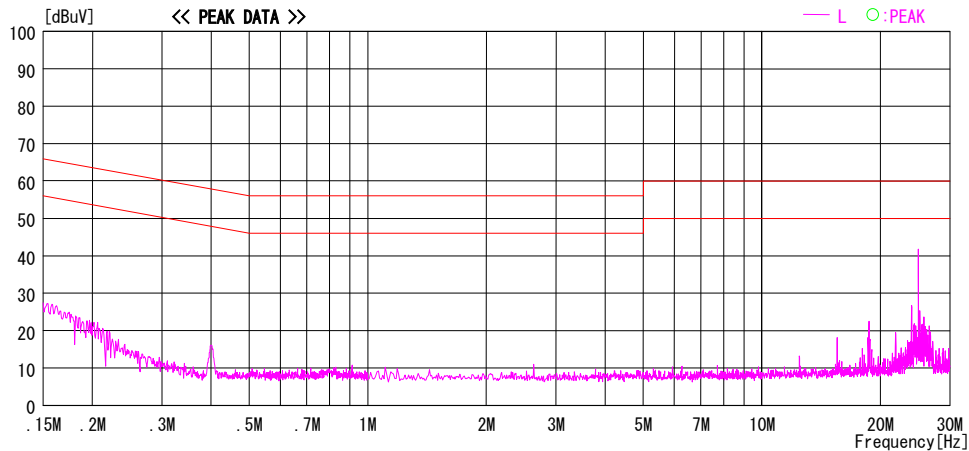
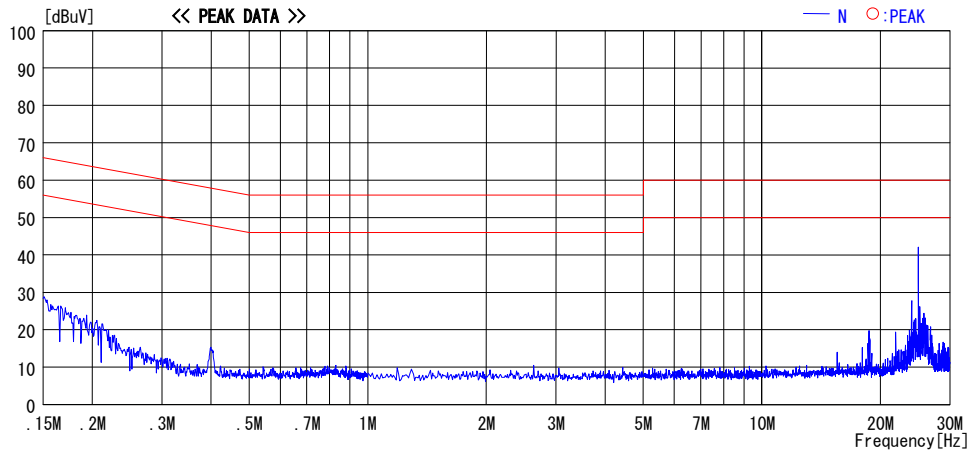


CHART: WITH FACTOR, Peak hold data. Data is uncorrected. CALCULATION: RESULT = READING + C.F (LISN LOSS + CABLE LOSS)
Except for the above table: adequate margin data below the limits.

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Conducted Emission

(Tx: Ch. 4)

DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 06:16:40

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg.C / 29%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 4 (918.9852MHz) power -2dBm

LIMIT : FCC15C § 15.207 (QP) / RSS-Gen / RSS-210
FCC15C § 15.207 (AV) / RSS-Gen / RSS-210

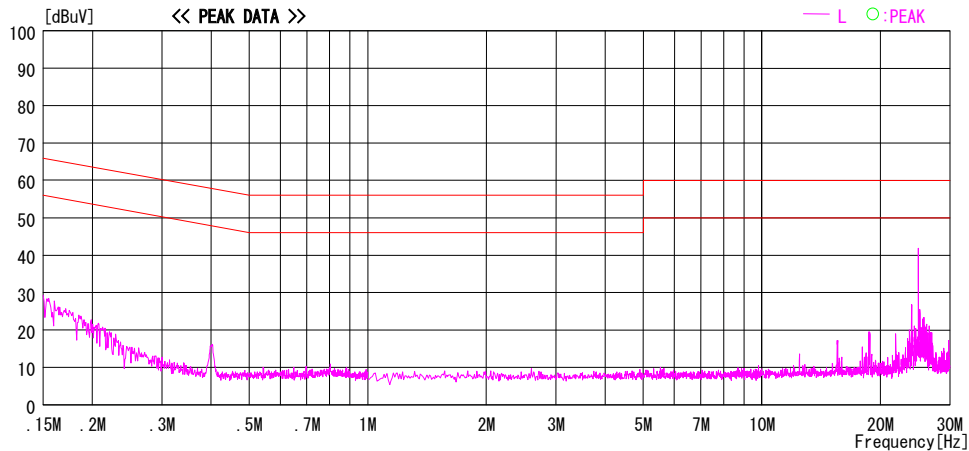
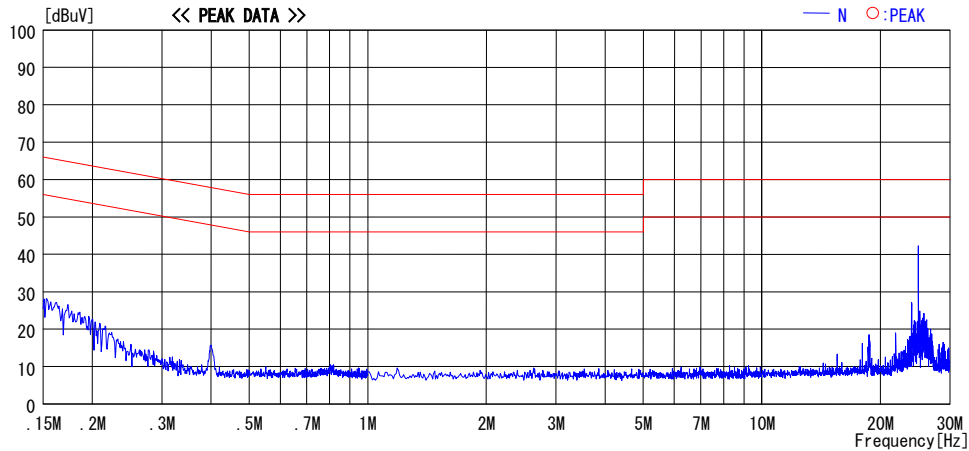


CHART:WITH FACTOR, Peak hold data. Data is uncorrected. CALCURATION: RESULT=READING+C.F (LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

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Conducted Emission

(Tx: Ch. 8)

DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 06:20:53

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg.C / 29%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 8 (922.6716MHz) power -2dBm

LIMIT : FCC15C § 15.207 (QP) / RSS-Gen / RSS-210
FCC15C § 15.207 (AV) / RSS-Gen / RSS-210

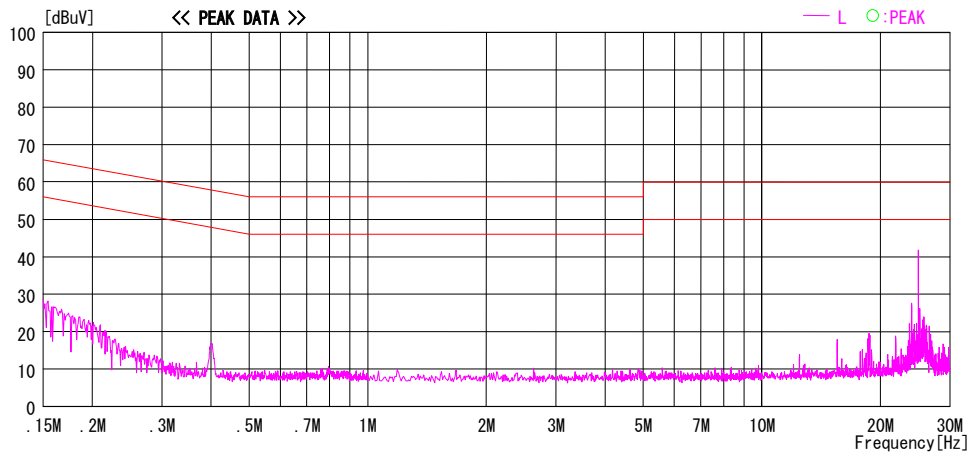
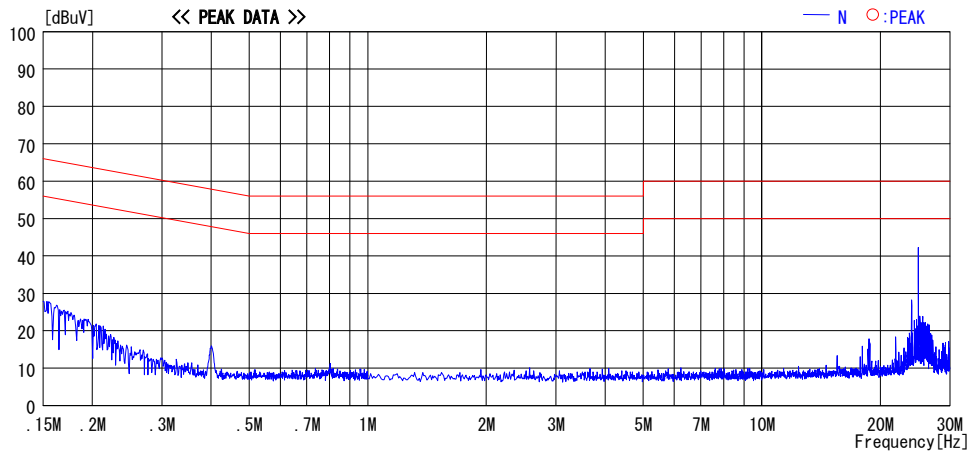


CHART:WITH FACTOR, Peak hold data. Data is uncorrected. CALCURATION: RESULT=READING+C. F (LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

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Conducted Emission

(Tx: Ch. 8)

DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 06:20:53

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1
Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg.C / 29%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 8 (922.6716MHz) power -2dBm

LIMIT : FCC15C § 15.207 (QP) / RSS-Gen / RSS-210
FCC15C § 15.207 (AV) / RSS-Gen / RSS-210

Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
0.15000	33.1	5.1	0.1	33.2	5.2	66.0	56.0	32.8	50.8	N
0.40024	12.9	12.1	0.1	13.0	12.2	57.8	47.8	44.8	35.6	N
15.53878	11.5	5.2	1.5	13.0	6.7	60.0	50.0	47.0	43.3	N
18.70765	16.5	5.2	1.8	18.3	7.0	60.0	50.0	41.7	43.0	N
23.99605	25.7	25.3	2.0	27.7	27.3	60.0	50.0	32.3	22.7	N
24.94331	40.5	40.5	2.0	42.5	42.5	60.0	50.0	17.5	7.5	N
0.15000	33.0	5.0	0.1	33.1	5.1	66.0	56.0	32.9	50.9	L
0.39984	14.0	13.2	0.1	14.1	13.3	57.9	47.9	43.8	34.6	L
15.53855	15.5	9.4	1.5	17.0	10.9	60.0	50.0	43.0	39.1	L
18.70755	19.2	8.0	1.8	21.0	9.8	60.0	50.0	39.0	40.2	L
23.99619	25.1	24.6	2.0	27.1	26.6	60.0	50.0	32.9	23.4	L
24.94301	40.1	40.1	2.0	42.1	42.1	60.0	50.0	17.9	7.9	L

CHART:WITH FACTOR,Peak hold data.Data is uncorrected. CALCURATION:RESULT=READING+C.F(LISN LOSS+CABLE LOSS)
Except for the above table : adequate margin data below the limits.

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Radiated Emission (Fundamental and Spurious emission)

(Tx: Ch. 1)

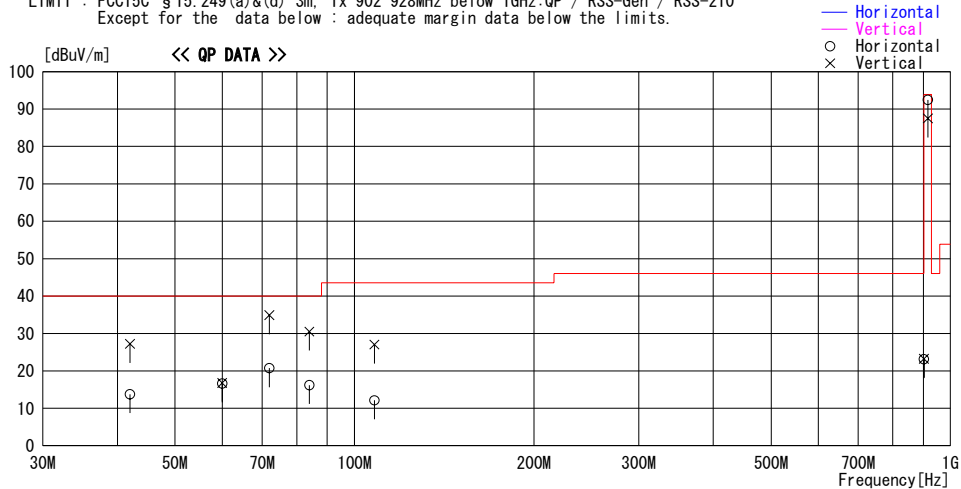
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/01 03:18:26

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1
Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 26deg. C. / 30%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 1 (916.2204MHz), power -2dBm, EUT max-axis (H: X, V: Z)

LIMIT : FCC15C §15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP / RSS-Gen / RSS-210
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss & Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
42.005	23.5	QP	12.8	-22.5	13.8	281	372	Hori.	40.0	26.2	
42.006	36.9	QP	12.8	-22.5	27.2	0	100	Vert.	40.0	12.8	
59.993	30.7	QP	8.2	-22.3	16.6	77	400	Hori.	40.0	23.4	
59.989	30.9	QP	8.2	-22.3	16.8	90	100	Vert.	40.0	23.2	
71.989	36.2	QP	6.5	-22.0	20.7	101	184	Hori.	40.0	19.3	
71.993	50.4	QP	6.5	-22.0	34.9	166	146	Vert.	40.0	5.1	
83.997	31.2	QP	6.9	-21.9	16.2	275	230	Hori.	40.0	23.8	
83.994	45.5	QP	6.9	-21.9	30.5	209	100	Vert.	40.0	9.5	
107.985	22.8	QP	11.0	-21.7	12.1	100	245	Hori.	43.5	31.4	
107.992	37.7	QP	11.0	-21.7	27.0	254	100	Vert.	43.5	16.5	
902.000	19.9	QP	20.9	-17.7	23.1	264	100	Hori.	46.0	22.9	
902.000	20.0	QP	20.9	-17.7	23.2	294	114	Vert.	46.0	22.8	
916.220	88.5	QP	21.3	-17.4	92.4	264	100	Hori.	93.9	1.5	carrier (Max)
916.220	83.6	QP	21.3	-17.4	87.5	294	114	Vert.	93.9	6.4	carrier

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

The spurious emissions were applied to the limit in Section 15.209.

UL Apex Co., Ltd.

Head Office EMC Lab.

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MF060b(01.06.05)

Radiated Emission (Spurious emission)

(Tx: Ch. 1)

DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 03:43:24

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg. C. / 32%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 1 (916.2204MHz), power -2dBm, EUT-max-axis(H: X, V: Z)

LIMIT : FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:PK / RSS-Gen / RSS-210
FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:AV / RSS-Gen / RSS-210

Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit	Margin
			Factor [dB/m]	Gain [dB]					[dBuV/m]	[dB]
1832.511	50.2	PK	29.1	-29.7	49.6	262	102	Hori.	73.9	24.3
1832.511	46.1	AV	29.1	-29.7	45.5	262	102	Hori.	53.9	8.4
1832.266	53.2	PK	29.1	-29.7	52.6	0	115	Vert.	73.9	21.3
1832.266	50.9	AV	29.1	-29.7	50.3	0	115	Vert.	53.9	3.6
2748.746	45.1	PK	31.2	-29.1	47.2	192	146	Hori.	73.9	26.7
2748.746	36.6	AV	31.2	-29.1	38.7	192	146	Hori.	53.9	15.2
2748.816	45.2	PK	31.2	-29.1	47.3	15	100	Vert.	73.9	26.6
2748.816	37.1	AV	31.2	-29.1	39.2	15	100	Vert.	53.9	14.7
3664.619	44.7	PK	32.0	-28.6	48.1	223	129	Hori.	73.9	25.8
3664.619	34.6	AV	32.0	-28.6	38.0	223	129	Hori.	53.9	15.9
3664.742	43.6	PK	32.0	-28.6	47.0	163	100	Vert.	73.9	26.9
3664.742	33.1	AV	32.0	-28.6	36.5	163	100	Vert.	53.9	17.4
4581.020	42.0	PK	34.3	-27.9	48.4	150	100	Hori.	73.9	25.5
4581.020	29.7	AV	34.3	-27.9	36.1	150	100	Hori.	53.9	17.8
4581.067	41.2	PK	34.3	-27.9	47.6	7	147	Vert.	73.9	26.3
4581.067	29.9	AV	34.3	-27.9	36.3	7	147	Vert.	53.9	17.6
5497.322	40.2	PK	36.3	-27.3	49.2	264	118	Hori.	73.9	24.7
5497.322	27.6	AV	36.3	-27.3	36.6	264	118	Hori.	53.9	17.3
5497.322	39.4	PK	36.3	-27.3	48.4	332	100	Vert.	73.9	25.5
5497.322	27.5	AV	36.3	-27.3	36.5	332	100	Vert.	53.9	17.4
6413.543	40.2	PK	36.9	-26.4	50.7	0	100	Hori.	73.9	23.2
6413.543	27.9	AV	36.9	-26.4	38.4	0	100	Hori.	53.9	15.5
6413.543	40.0	PK	36.9	-26.4	50.5	0	100	Vert.	73.9	23.4
6413.543	27.8	AV	36.9	-26.4	38.3	0	100	Vert.	53.9	15.6
9162.204	41.6	PK	36.9	-25.6	52.9	0	100	Hori.	73.9	21.0
9162.204	29.5	AV	36.9	-25.6	40.8	0	100	Hori.	53.9	13.1
9162.204	41.9	PK	36.9	-25.6	53.2	0	100	Vert.	73.9	20.7
9162.204	29.6	AV	36.9	-25.6	40.9	0	100	Vert.	53.9	13.0

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION:RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

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MF060b(01.06.05)

Radiated Emission (Fundamental and Spurious emission)

(Tx: Ch. 4)

DATA OF RADIATED EMISSION TEST

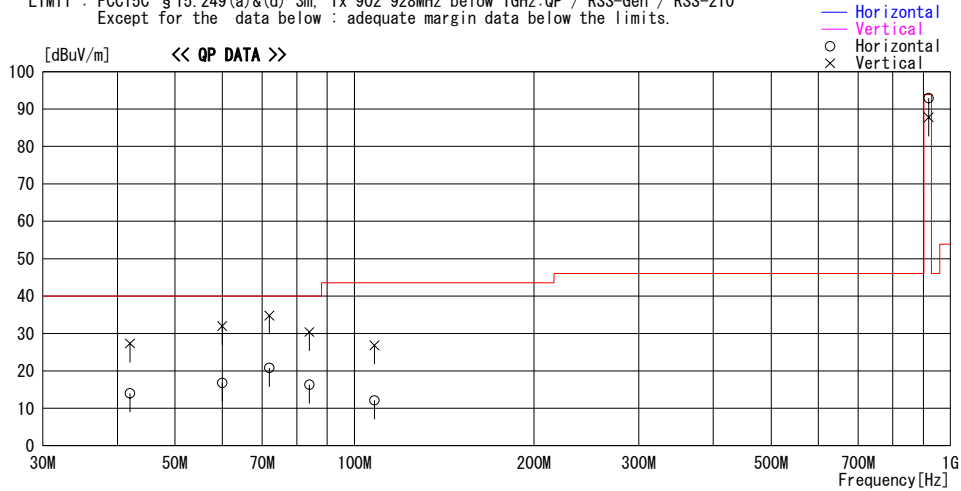
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/01/31 22:39:43

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 26deg. C. / 30%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 4 (918.985MHz), power -2dBm, EUT max-axis (H: X, V: Z)

LIMIT : FCC15C §15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP / RSS-Gen / RSS-210
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna Factor	Loss & Gain	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
42.007	23.7	QP	12.8	-22.5	14.0	285	369	Hori.	40.0	26.0	
42.007	37.0	QP	12.8	-22.5	27.3	360	100	Vert.	40.0	12.7	
59.989	30.9	QP	8.2	-22.3	16.8	76	400	Hori.	40.0	23.2	
59.990	46.1	QP	8.2	-22.3	32.0	96	100	Vert.	40.0	8.0	
71.996	36.3	QP	6.5	-22.0	20.8	103	181	Hori.	40.0	19.2	
71.989	50.3	QP	6.5	-22.0	34.8	168	144	Vert.	40.0	5.2	
83.999	45.4	QP	6.9	-21.9	30.4	203	100	Vert.	40.0	9.6	
83.992	31.3	QP	6.9	-21.9	16.3	278	228	Hori.	40.0	23.7	
107.993	37.5	QP	11.0	-21.7	26.8	243	100	Vert.	43.5	16.7	
107.984	22.8	QP	11.0	-21.7	12.1	101	244	Hori.	43.5	31.4	
918.985	88.9	QP	21.4	-17.4	92.9	260	100	Hori.	93.9	1.0	carrier (Max)
918.985	83.8	QP	21.4	-17.4	87.8	160	112	Vert.	93.9	6.1	carrier

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)
The spurious emissions were applied to the limit in Section 15.209.

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MF060b(01.06.05)

Radiated Emission (Spurious emission)

(Tx: Ch. 4)

DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 04:39:30

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg. C. / 32%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 4 (918.9852MHz), power -2dBm, EUT-max-axis(H: X, V: Z)

LIMIT : FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:PK / RSS-Gen / RSS-210
FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:AV / RSS-Gen / RSS-210

Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg.]	Height [cm]	Polar.	Limit	Margin
			Factor	Gain					[dBuV/m]	[dB]
1837.970	50.0	PK	29.2	-29.7	49.5	260	103	Hori.	73.9	24.4
1837.970	46.2	AV	29.2	-29.7	45.7	260	103	Hori.	53.9	8.2
1837.996	51.6	PK	29.2	-29.7	51.1	0	113	Vert.	73.9	22.8
1837.996	48.1	AV	29.2	-29.7	47.6	0	113	Vert.	53.9	6.3
2756.961	45.0	PK	31.2	-29.1	47.1	190	144	Hori.	73.9	26.8
2756.961	36.6	AV	31.2	-29.1	38.7	190	144	Hori.	53.9	15.2
2756.927	45.4	PK	31.2	-29.1	47.5	13	100	Vert.	73.9	26.4
2756.927	37.0	AV	31.2	-29.1	39.1	13	100	Vert.	53.9	14.8
3675.912	44.6	PK	32.1	-28.6	48.1	220	130	Hori.	73.9	25.8
3675.912	34.5	AV	32.1	-28.6	38.0	220	130	Hori.	53.9	15.9
3675.952	43.8	PK	32.1	-28.6	47.3	161	100	Vert.	73.9	26.6
3675.952	33.3	AV	32.1	-28.6	36.8	161	100	Vert.	53.9	17.1
4594.952	41.9	PK	34.4	-27.9	48.4	153	100	Hori.	73.9	25.5
4594.952	29.7	AV	34.4	-27.9	36.2	153	100	Hori.	53.9	17.7
4594.910	41.4	PK	34.4	-27.9	47.9	4	152	Vert.	73.9	26.0
4594.910	29.8	AV	34.4	-27.9	36.3	4	152	Vert.	53.9	17.6
5513.911	40.4	PK	36.3	-27.3	49.4	267	116	Hori.	73.9	24.5
5513.911	27.7	AV	36.3	-27.3	36.7	267	116	Hori.	53.9	17.2
5513.911	39.7	PK	36.3	-27.3	48.7	334	100	Vert.	73.9	25.2
5513.911	27.6	AV	36.3	-27.3	36.6	334	100	Vert.	53.9	17.3
6432.896	40.5	PK	36.9	-26.4	51.0	0	100	Hori.	73.9	22.9
6432.896	27.8	AV	36.9	-26.4	38.3	0	100	Hori.	53.9	15.6
6432.896	40.2	PK	36.9	-26.4	50.7	0	100	Vert.	73.9	23.2
6432.896	27.8	AV	36.9	-26.4	38.3	0	100	Vert.	53.9	15.6
9189.852	41.7	PK	36.8	-25.6	52.9	0	100	Hori.	73.9	21.0
9189.852	29.6	AV	36.8	-25.6	40.8	0	100	Hori.	53.9	13.1
9189.852	41.8	PK	36.8	-25.6	53.0	0	100	Vert.	73.9	20.9
9189.852	29.6	AV	36.8	-25.6	40.8	0	100	Vert.	53.9	13.1

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

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MF060b(01.06.05)

Radiated Emission (Fundamental and Spurious emission)

(Tx: Ch. 8)

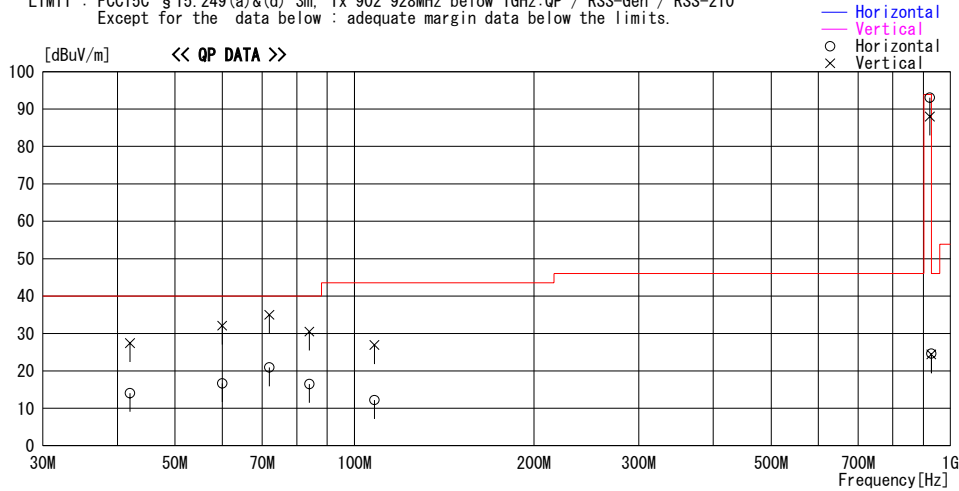
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/01 02:23:31

Applicant : Rinnai Corporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1
Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 26deg. C. / 30%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 8 (922.6716MHz), power -2dBm, EUT max-axis (H: X, V: Z)

LIMIT : FCC15C §15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP / RSS-Gen / RSS-210
Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain							
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
42.003	23.8	QP	12.8	-22.5	14.1	282	365	Hori.	40.0	25.9	
42.004	37.1	QP	12.8	-22.5	27.4	0	100	Vert.	40.0	12.6	
59.997	30.8	QP	8.2	-22.3	16.7	79	400	Hori.	40.0	23.3	
59.998	46.2	QP	8.2	-22.3	32.1	100	100	Vert.	40.0	7.9	
71.992	36.4	QP	6.5	-22.0	20.9	100	184	Hori.	40.0	19.1	
71.993	50.5	QP	6.5	-22.0	35.0	164	142	Vert.	40.0	5.0	
83.991	31.5	QP	6.9	-21.9	16.5	280	229	Hori.	40.0	23.5	
83.997	45.5	QP	6.9	-21.9	30.5	204	100	Vert.	40.0	9.5	
107.983	22.9	QP	11.0	-21.7	12.2	100	242	Hori.	43.5	31.3	
107.992	37.6	QP	11.0	-21.7	26.9	240	100	Vert.	43.5	16.6	
922.672	88.8	QP	21.5	-17.3	93.0	263	100	Hori.	93.9	0.9	carrier (Max)
922.672	83.8	QP	21.5	-17.3	88.0	290	100	Vert.	93.9	5.9	carrier
928.000	20.2	QP	21.7	-17.3	24.6	263	100	Hori.	46.0	21.4	
928.000	20.0	QP	21.7	-17.3	24.4	290	100	Vert.	46.0	21.6	

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)
The spurious emissions were applied to the limit in Section 15.209.

Radiated Emission (Spurious emission)

(Tx: Ch. 8)

DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber
Date : 2006/02/02 05:03:45

Applicant : Rinnai Coporation
Kind of EUT : Remote controller for water heater
Model No. : MC-502RC-1US-M
Serial No. : 1

Report No. : 26CE0142-HO
Power : DC 12.6V
Temp./Humi. : 25deg. C. / 32%
Operator : Kenichi Adachi

Mode / Remarks : Transmitting ch 8 (922.6716MHz), power -2dBm, EUT-max-axis(H: X, V: Z)

LIMIT : FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:PK / RSS-Gen / RSS-210
FCC15C § 15.249(a)&(d) 3m, Tx 902~928MHz below 1GHz:QP, above 1GHz:AV / RSS-Gen / RSS-210

Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg.]	Height [cm]	Polar.	Limit	Margin
			Factor [dB/m]	Gain [dB]					[dBuV/m]	[dB]
1845.218	52.4	PK	29.3	-29.7	52.0	267	103	Hori.	73.9	21.9
1845.218	49.6	AV	29.3	-29.7	49.2	267	103	Hori.	53.9	4.7
1845.381	53.3	PK	29.3	-29.7	52.9	0	112	Vert.	73.9	21.0
1845.381	50.7	AV	29.3	-29.7	50.3	0	112	Vert.	53.9	3.6
2768.015	45.3	PK	31.2	-29.1	47.4	190	143	Hori.	73.9	26.5
2768.015	37.2	AV	31.2	-29.1	39.3	190	143	Hori.	53.9	14.6
2768.015	45.4	PK	31.2	-29.1	47.5	12	100	Vert.	73.9	26.4
2768.015	36.9	AV	31.2	-29.1	39.0	12	100	Vert.	53.9	14.9
3690.686	44.9	PK	32.1	-28.6	48.4	230	130	Hori.	73.9	25.5
3690.686	34.5	AV	32.1	-28.6	38.0	230	130	Hori.	53.9	15.9
3690.686	43.9	PK	32.1	-28.6	47.4	165	100	Vert.	73.9	26.5
3690.686	33.4	AV	32.1	-28.6	36.9	165	100	Vert.	53.9	17.0
4613.358	41.9	PK	34.5	-27.9	48.5	147	100	Hori.	73.9	25.4
4613.358	29.6	AV	34.5	-27.9	36.2	147	100	Hori.	53.9	17.7
4613.358	41.5	PK	34.5	-27.9	48.1	0	144	Vert.	73.9	25.8
4613.358	29.7	AV	34.5	-27.9	36.3	0	144	Vert.	53.9	17.6
5536.030	40.3	PK	36.3	-27.3	49.3	270	116	Hori.	73.9	24.6
5536.030	27.6	AV	36.3	-27.3	36.6	270	116	Hori.	53.9	17.3
5536.030	40.1	PK	36.3	-27.3	49.1	328	100	Vert.	73.9	24.8
5536.030	27.6	AV	36.3	-27.3	36.6	328	100	Vert.	53.9	17.3
6458.701	40.5	PK	36.9	-26.4	51.0	0	100	Hori.	73.9	22.9
6458.701	27.7	AV	36.9	-26.4	38.2	0	100	Hori.	53.9	15.7
6458.701	40.3	PK	36.9	-26.4	50.8	0	100	Vert.	73.9	23.1
6458.701	27.6	AV	36.9	-26.4	38.1	0	100	Vert.	53.9	15.8
9226.716	42.0	PK	36.8	-25.6	53.2	0	100	Hori.	73.9	20.7
9226.716	29.7	AV	36.8	-25.6	40.9	0	100	Hori.	53.9	13.0
9226.716	41.8	PK	36.8	-25.6	53.0	0	100	Vert.	73.9	20.9
9226.716	29.6	AV	36.8	-25.6	40.8	0	100	Vert.	53.9	13.1

CHART:WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

UL Apex Co., Ltd.

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MF060b(01.06.05)

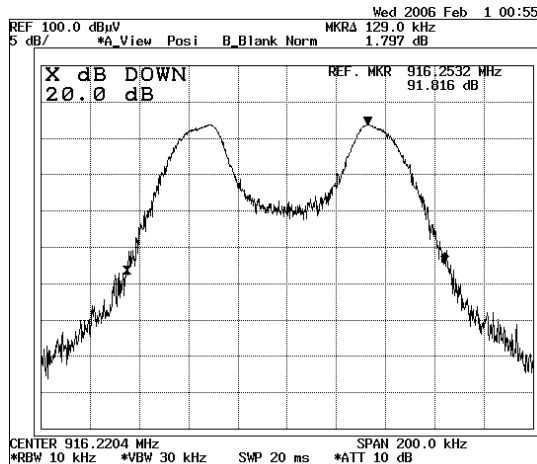
-20dB Bandwidth

Company : Rinnai Corporation
Equipment : Remote Controller for water heater
Model : MC-502RC-1US-M
S/N : 1
Power : DC 12.6V
Mode : Transmitting

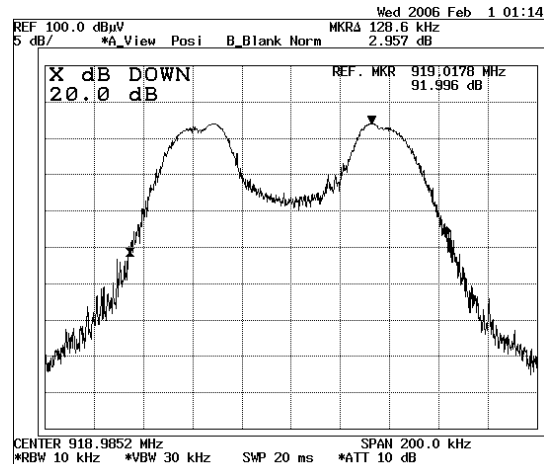
UL-Apex
Head Office EMC Lab. No.2 Semi Anechoic Chamber
Regulation : FCC 15.215
Test Distance : 3m
Date : 01/31/2006
Temperature : 26 deg.C.
Humidity : 30 %
Engineer : Kenichi Adachi

FREQ [MHz]	-20dB Bandwidth [kHz]
916.2204	129.00
918.9852	128.60
922.6716	129.20

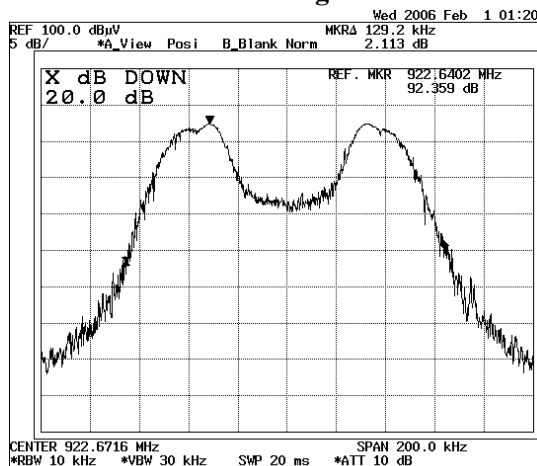
Ch.: Low



Ch.: Mid



Ch.: High



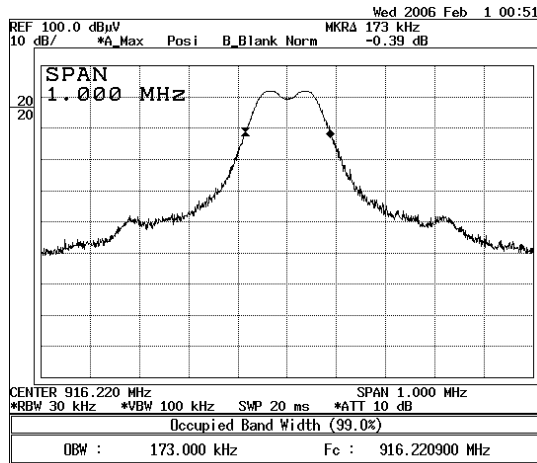
99% Occpied Bandwidth

Company : Rinnai Corporation
Equipment : Remote Controller for water heater
Model : MC-502RC-1US-M
S/N : 1
Power : DC 12.6V
Mode : Transmitting

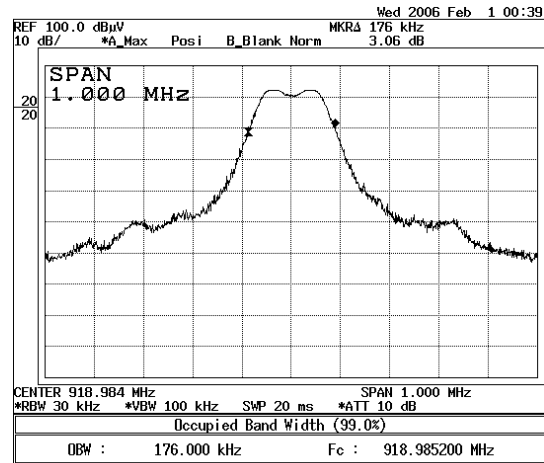
UL-Apex
Head Office EMC Lab. No.2 Semi Anechoic Chamber
Regulation : RSS-Gen 4.4.1
Test Distance : 3m
Date : 01/31/2006
Temperature : 26 deg.C.
Humidity : 30 %
Engineer : Kenichi Adachi

FREQ [MHz]	99% Occpied Bandwidth [kHz]
916.2204	173.00
918.9852	176.00
922.6716	175.00

Ch.: Low



Ch.: Mid



Ch.: High

