

TEST RESULT SUMMARY

FCC PART 15 SUBPART C Section 15.231

MANUFACTURER'S NAME	OMRON Corp
NAME OF EQUIPMENT	Transmitter, RF Keyless Entry System
MODEL NUMBER	G8D-522M-A
MANUFACTURER'S ADDRESS	1-1203, Yashirogaoka, Meito-Ku Nagoya-City, Aichi., 465-0051 Japan
TEST REPORT NUMBER	W9082
TEST DATE	15 February 1999

According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 15.

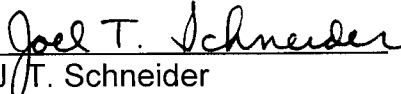
It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15.

Date: 09 March 1999

Location: Taylors Falls MN
USA


R. M. Johnson
Test Technician


J. T. Schneider
Site Manager

Not Transferable

EMC EMISSION - T E S T R E P O R T

Test Report File No.	:	WC1H908201	Date of issue:	09 March 1999
Model / Serial No.	:	G8D-522M-A /		
Product Type	:	Transmitter, RF Keyless Entry System		
Applicant	:	OMRON Corp		
Manufacturer	:	OMRON Corp		
License holder	:	OMRON Corp		
Address	:	1-1203, Yashirogaoka, Meito-Ku		
	:	Nagoya-City, Aichi., 465-0051 Japan		
Test Result	:	☒ Positive ☐ Negative		
Test Project Number Reference(s)	:	W9082		
Total pages including Appendices	:	24		

TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.

TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI

DIRECTORY - EMISSIONS

		Page(s)
A) Documentation		
Test report		<u>1 - 10</u>
Directory		<u>2</u>
Test Regulations		<u>3</u>
Deviation from standard / Summary		<u>10</u>
Test-setups (Photos)		<u>11 - 12</u>
Test-setup (drawing)		<u>Appendix A</u>
B) Test data		
Conducted emissions	10/150 kHz - 30 MHz	<u>5, 9</u>
Radiated emissions	10 kHz - 30 MHz	<u>5, 9</u>
Radiated emissions	30 MHz - 1000 MHz	<u>6, 9</u>
Interference power	30 MHz - 300 MHz	<u>6, 9</u>
Equivalent Radiated emissions	1 GHz - 18 GHz	<u>7, 9</u>
C) Appendix A		
Test Data Sheets and Test Setup Drawing(s)		<u>A2 - A7</u>
D) Appendix B		
Constructional Data Form		<u>B2</u>
Product Information Form(s)		<u>B3</u>
E) Appendix C		
Measurement Protocol		<u>C1 - C2</u>

EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

- ☐ - EN 50081-1 / 1991

☐ - EN 55011 / 1991

☐ - EN 55013 / 1990

☐ - EN 55014 / 1987

☐ - EN 55014 / A2:1990

☐ - EN 55014 / 1993

☐ - EN 55015 / 1987

☐ - EN 55015 / A1:1990

☐ - EN 55015 / 1993

☐ - EN 55022 / 1987

☐ - EN 55022 / 1994

☐ - BS

☐ - VCCI

☒ - FCC Part 15 Subpart C Section 15.231

☐ - AS 3548 (1992)

☐ - CISPR 11 (1990)

☐ - CISPR 22 (1993)

☐ - Group 1

☐ - Class A

☐ - Household appliances and similar

☐ - Portable tools

☐ - Semiconductor devices

☐ - Household appliances and similar

☐ - Portable tools

☐ - Semiconductor devices

☐ - Class A

☐ - Class A

☐ - Class A

☐ - Class A

☐ - Group 1

☐ - Class A

☐ - Class A

☐ - Group 2

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Class B

☐ - Group 2

☐ - Class B

☐ - Class B

Environmental conditions in the lab:

	<u>Actual</u>
Temperature	: 23 °C
Relative Humidity	: 18 %
Atmospheric pressure	: 97.6 kPa
Power supply system	: 3 VDC

Sign Explanations:

- ☐ - not applicable
- ☒ - applicable

1
2

3
4

Emissions Test Conditions: CONDUCTED EMISSIONS (Interference Voltage)

The CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE) measurements were performed at the following test location:

■ - Test not applicable

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room
- ☐ - New Brighton Lab Shielded Room

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Use of the calibrated equipment on this list ensures traceability to national and international standards.

Emissions Test Conditions: RADIATED EMISSIONS (Magnetic Field)

The RADIATED EMISSIONS (MAGNETIC FIELD) measurements were performed at the following test location:

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

- ☐ - 3 meters
- ☐ - 30 meters

■ - Test not applicable

Test equipment used :

Model Number	Manufacturer	Description	Serial Number	Cal Date
--------------	--------------	-------------	---------------	----------

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location :

☐ - Test not applicable

- ☒ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

- ☒ - 3 meters
- ☐ - 10 meters
- ☐ - 30 meters

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number	Cal Date
☒ -	SAS-200/512	A. H. Systems	Log Periodic Antenna	147	6-98
☒ -	3108	Electro-Mechanics (EMCO)	Biconical Antenna	2429	6-98
☒ -	8566B	Hewlett-Packard	Spectrum Analyzer	2221A01596	4-98
☒ -	85662A	Hewlett-Packard	Analyzer Display	2152A03640	4-98
☒ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	4-98
☒ -	ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	4-98

Use of the calibrated equipment on this list ensures traceability to national and international standards.

Emissions Test Conditions: INTERFERENCE POWER

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location :

☒ - Test not applicable

- ☐ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room
- ☐ - New Brighton Lab Shielded Room

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number	Cal Date
--	--------------	--------------	-------------	---------------	----------

Emissions Test Conditions: RADIATED EMISSIONS (Electric Field)

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 1 GHz - 3.15 GHz were performed in a horizontal and vertical polarization at the following test location :

- ☒ - Wild River Lab Large Test Site (Open Area Test Site)
- ☐ - Wild River Lab Small Test Site (Open Area Test Site)
- ☐ - Oakwood Lab (Open Area Test Site)
- ☐ - Wild River Lab Screen Room

at a test distance of:

- ☐ - 1 meters
- ☒ - 3 meters
- ☐ - 10 meters

☐ - Test not applicable

Test equipment used :					
	Model Number	Manufacturer	Description	Serial Number	Cal Date
■ -	3115	Electro-Mechanics (EMCO)	Horn Antenna	9001-3275	9-98
■ -	8566B	Hewlett-Packard	Spectrum Analyzer	2221A01596	4-98
■ -	85662A	Hewlett-Packard	Analyzer Display	2152A03640	4-98
■ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	4-98
■ -	ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	4-98

Use of the calibrated equipment on this list ensures traceability to national and international standards.

[

Equipment Under Test (EUT) Test Operation Mode - Emission tests :

The device under test was operated under the following conditions during emissions testing:

- ☐ - Standby
- ☐ - Test program (H - Pattern)
- ☐ - Test program (color bar)
- ☐ - Test program (customer specific)
- ☐ - Practice operation
- ☐ - Normal Operating Mode
- ☒ - Transmitter on. _____

Configuration of the device under test:

- ☐ - See Constructional Data Form in Appendix B - Page B2
- ☒ - See Product Information Form in Appendix B - beginning on Page B3

The following peripheral devices and interface cables were connected during the measurement:

- | | |
|---|----------------|
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - _____ | Type : _____ |
| ☐ - unshielded power cable | |
| ☐ - unshielded cables | |
| ☐ - shielded cables | MPS.No.: _____ |
| ☐ - customer specific cables | |
| ☐ - _____ | |
| ☐ - _____ | |

Emission Test Results:

Conducted emissions 10/150 kHz - 30 MHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Radiated emissions (magnetic field) 10 kHz - 30 MHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Radiated emissions (electric field) 30 MHz - 1000 MHz

The requirements are ☒ - MET ☐ - NOT MET

Minimum limit margin for fundamental _____ 0.1 dB at _____ 315.0 MHz

Minimum limit margin for spurious _____ 0.4 dB at _____ 945.0 MHz

Remarks: The fundamental was measured to be 75.5 dBuV/m in peak mode (5956 uV/m) compared to an average limit of 75.6 dBuV/m (6041 uV/m). The third harmonic was measured to be 55.2 dBuV/m (575.4 uV/m) in peak mode, compared to an average limit of 55.6 dBuV/m (604.1 uV/m). Pages A5-A6 of A7 show an on time of 37.3 msec/100 msec span, which would calculate to an 8.5 dB relaxation of the peak levels to convert to average levels. This relaxation has not been applied since the peak levels meet the limit.

Interference Power at the mains and interface cables 30 MHz - 300 MHz

The requirements are ☐ - MET ☐ - NOT MET

Minimum limit margin _____ dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

Equivalent Radiated emissions 1 GHz - 3.15 GHz

The requirements are ☒ - MET ☐ - NOT MET

Minimum limit margin _____ 2.8 dB at _____ 2520.1 MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: Peak analyzer reading of 52.8 dBuV/m (436.5 uV/m), compared to an average limit of 55.6 dBuV/m (604.1 uV/m). Pages A5-A6 of A7 show an on time of 37.3 msec/100 msec span, which would calculate to an 8.5 dB relaxation of the peak levels to convert to average levels. This relaxation has not been applied since the peak levels meet the limit.

DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:

The bandwidth of the fundamental must be less than 0.25% of the center frequency, or 787.5 kHz. Page A7 of A7 shows the bandwidth to be less than 40 kHz.

SUMMARY:

The requirements according to the technical regulations are

☒ - met

☐ - not met.

The device under test does

☒ - fulfill the general approval requirements mentioned on page 3.

☐ - not fulfill the general approval requirements mentioned on page 3.

Testing Start Date: 15 February 1999

Testing End Date: 15 February 1999

- TÜV PRODUCT SERVICE INC -

Joel T. Schneider
J. T. Schneider
Site Manager

Tested By:
R. M. Johnson

File No. WC1H908201, Page 10 of 12

Test-setup photo(s):
Conducted emission 10/150 kHz - 30 MHz

Not Applicable

Test-setup photo(s):
Radiated emission 30 MHz - 3.15 GHz



File No. WC1H908201, Page 12 of 12

Appendix A

Test Data Sheets

and

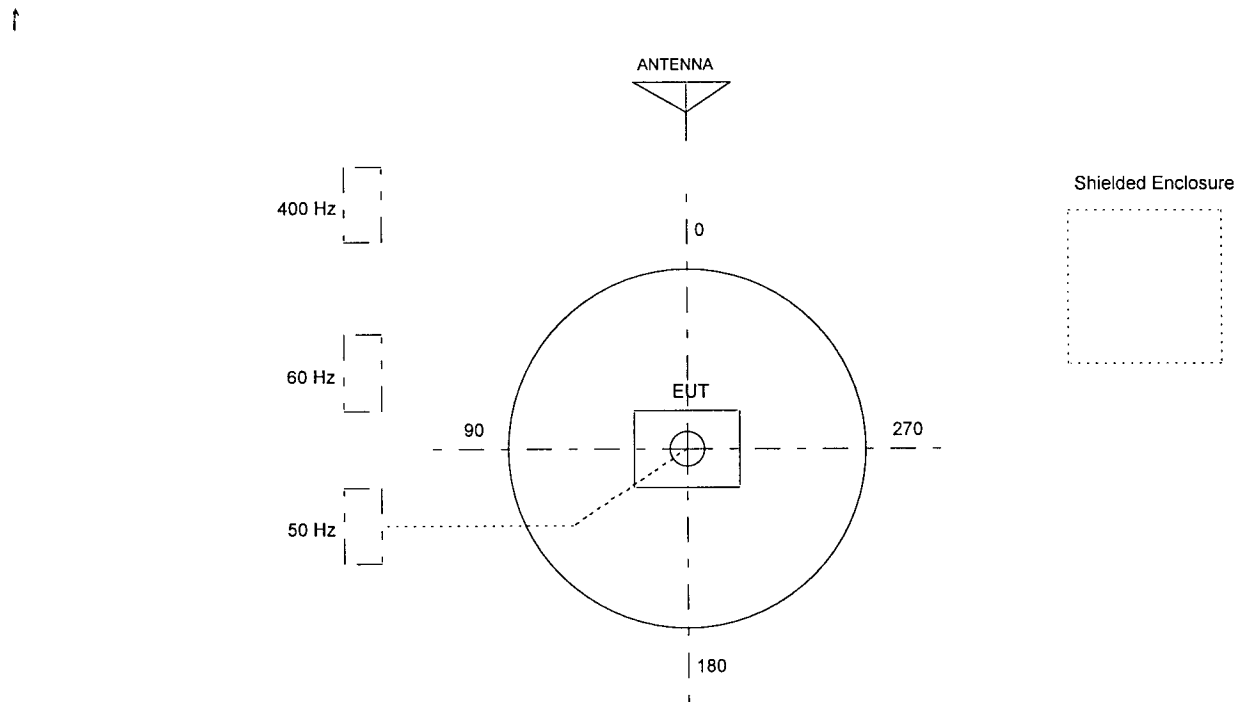
Test Setup Drawing(s)

TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Large Test Site

Notes:

1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.
2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.
3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the turntable.
4. The circle is a 6.7 meter diameter turntable.
5. A ground plane is in the plane of this sheet.
6. The test sample is shown in the azimuthal position representing zero degrees.



T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

Large Test Site
3 Meter Antenna Distance
Equipment Under Test:
OMRON
G8D-522M-A TRANSMITTER
Notes:

Report W9082 Run 1
Date 02-15-99 Page 1
Engineer _____
Tech: RMJ _____
Requester _____

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	LIMIT FCC 15.231	Delta
ALL READINGS MAXIMIZED.								
315.01	59.7	14.2	1.6	75.5	--	V --	75.6	-0.1
315.01	56.6	14.2	1.6	72.4	--	H --	75.6	-3.2
630.04	25.04	20.1	2.3	47.4	--	V --	55.6	-8.2
945.04	28.66	23.6	3	55.2	--	V --	55.6	-0.4
1260.0	19.8	25.6	3.6	49.0	--	V --	55.6	-6.6
1575.0	7.95	27.1	4.2	39.3	--	V --	54.0	-14.7
1890.1	8.2	28.8	4.8	41.8	--	V --	55.6	-13.8
2205.1	9.35	29.7	5.2	44.2	--	V --	54.0	-9.8
2520.1	17	30.1	5.7	52.8	--	V --	55.6	-2.8
2835.1	9.6	30.8	6.1	46.5	--	V --	54.0	-7.5
3150.1	12.7	32	6.3	51.0	--	V --	55.6	-4.6

END OF SCAN.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

Large Test Site
3 Meter Antenna Distance
Equipment Under Test:
OMRON
G8D-582M-A TRANSMITTER
Notes:

Figure _____

Report W9082 Run 1
Date 02-15-99 Page 2
Engineer _____
Tech: RMJ _____
Requester _____

Measurement Summary

Frequency MHz	----- Final dBuV/m	----- uV/m	Azimuth deg	Polar\ Height	Delta FCC 15.231	Delta
315.01	75.5	5956.6	--	V --	-0.1	
630.04	47.4	234.42	--	V --	-8.2	
945.04	55.2	575.44	--	V --	-0.4	
1260.0	49.0	281.83	--	V --	-6.6	
1575.0	39.3	92.257	--	V --	-14.7	
1890.1	41.8	123.02	--	V --	-13.8	
2205.1	44.2	162.18	--	V --	-9.8	
2520.1	52.8	436.51	--	V --	-2.8	
2835.1	46.5	211.34	--	V --	-7.5	
3150.1	51.0	354.81	--	V --	-4.6	

Minimum Passing Margin for FCC 15.231 is 0.1 dB at 315.01 MHz

File W9082 Run 1

MKR Δ 6.860 msec
0.10 dB

h_p REF 53.0 dB μ V ATTN 0 dB

5 dB/

POS PK

320 μ sec 760 μ sec

320 μ sec 760 μ sec

CENTER
315.052 409 MHz
STEP 315.000 000 MHz

CORR'D

CENTER 315.052 409 MHz
RES BW 10 kHz

VBW 1 MHz

SPAN 0 Hz
SWP 20.0 msec

HP REF 43.0 dBμV ATTEN 0 dB

5 dB/

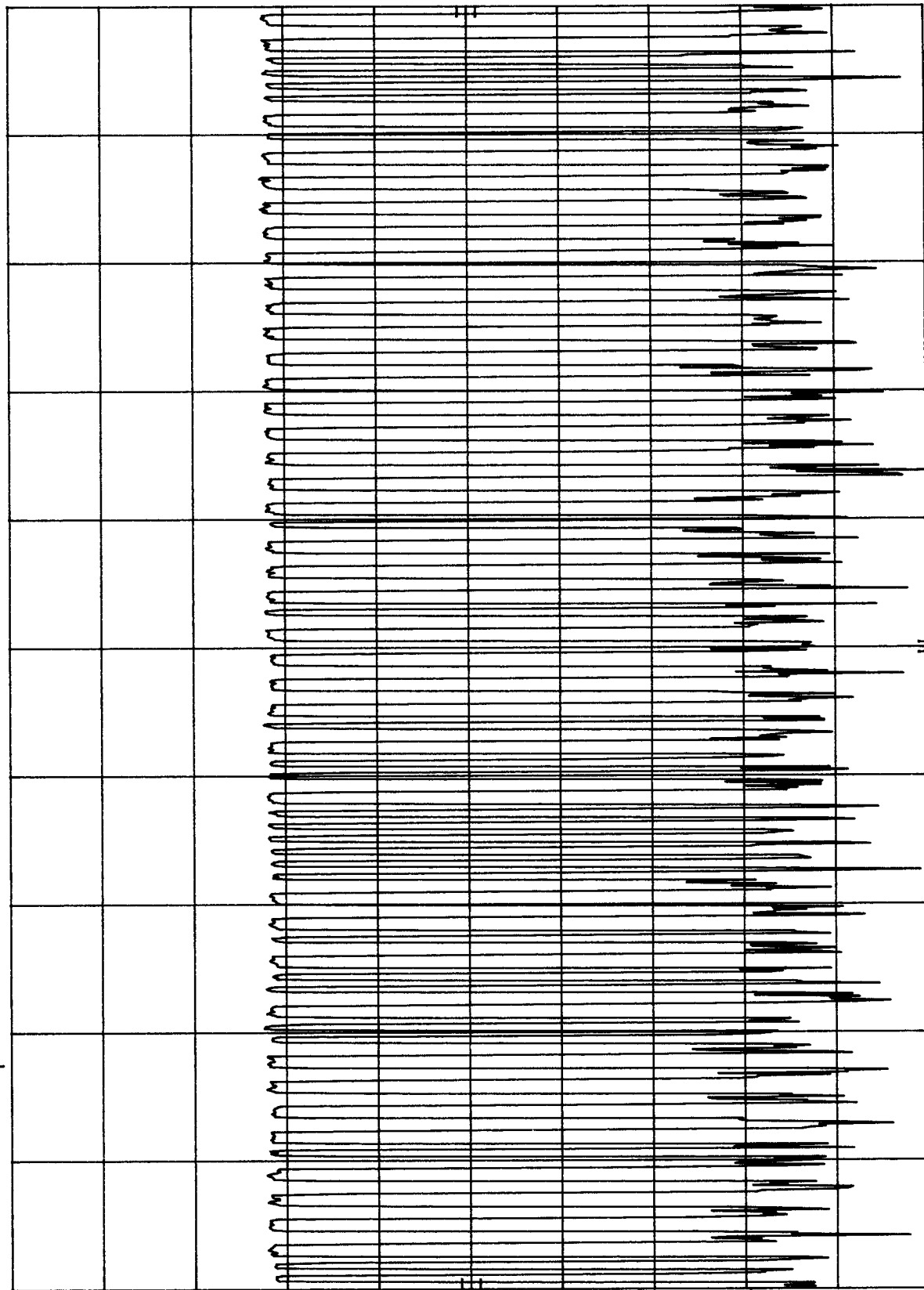
POS PK

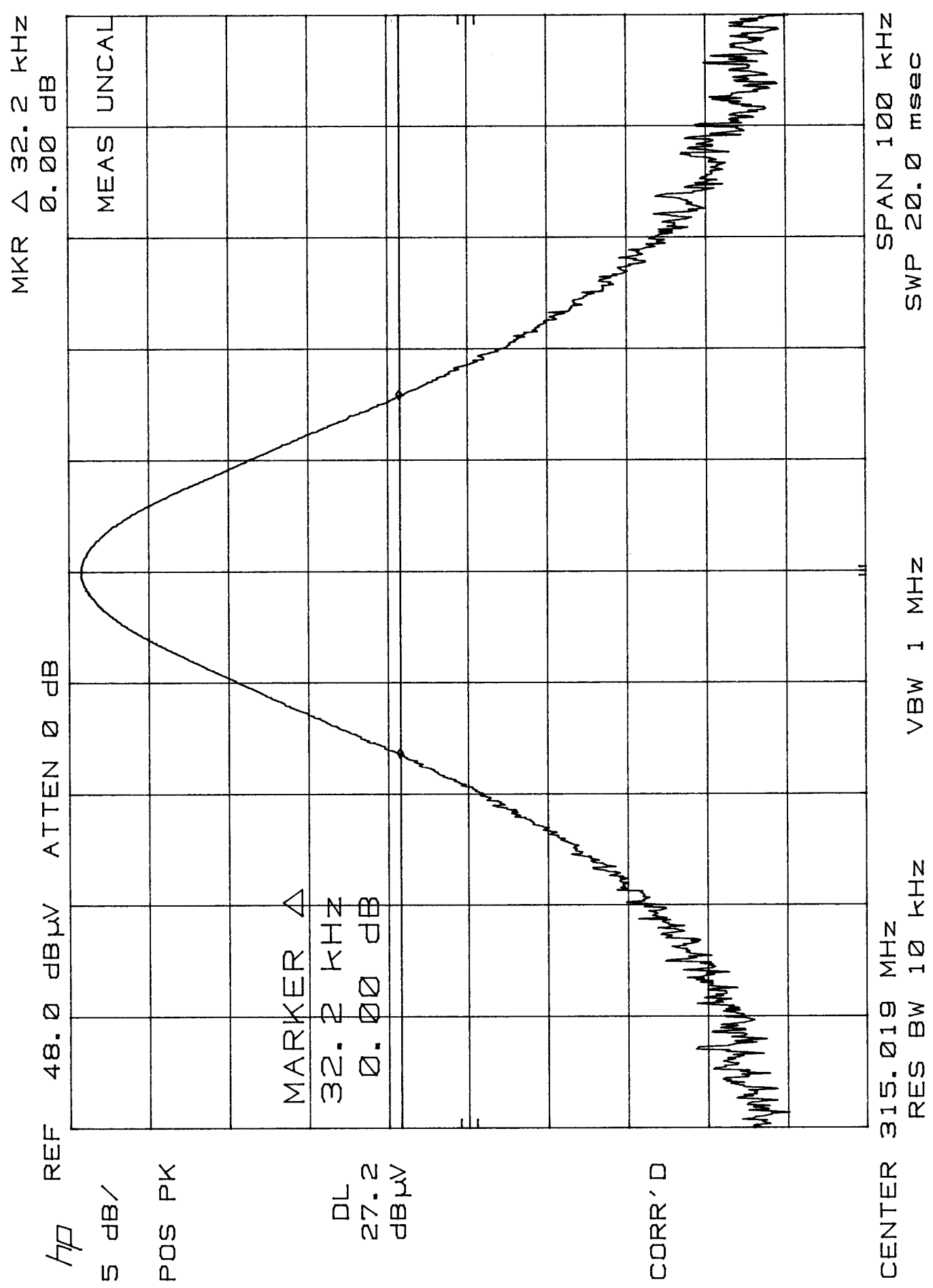
CORR'D

CENTER 315.052 409 MHz
RES BW 10 kHz

VBW 1 MHz

SPAN 0 Hz
SWP 100 msec





Appendix B

Constructional Data Form

and

Product Information Form(s)

Constructional Data Form

Not Applicable

Specification

CPU

- Type :uPD754144GS(4 bit)
- ROM :Manufacturer - NEC Corporation
- RAM :4096x8bit(4kbytes)
- EEPROM :128x4bit
- Clock frequency :16x8bit
- Clock frequency generation :500 kHz
- Package :CR oscillation
- :20pin SSOP

RF Block

- Nominal frequency :315 MHz
- Frequency generation :SAW resonator
- Modulation :ASK(A1D)
- Bit transmission rate :1000bps or 500bps
- Duty cycle :0.5
- Antenna :PCB pattern type

Others

- Dimension :53.5mm x 30mm x 12mm
- Weight :20g
- Battery :Lithium cell (CR2032)
- :Manufacturer - Matsushita Battery Corporation etc.
- Operation voltage :DC 3V, 10 mA
- Operation temperature :-20 degrees C to +60 degrees C

Appendix C

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ±4.5 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dBµV and µV, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$
$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

RADIATED EMISSIONS

The final level, expressed in dBµV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)	Level (dBµV)	+	Factor & Cable (dB)	=	Final (dBµV/m)	-	FCC B Limit (dBµV/m)	=	Delta FCC B (dB)
32.21	13.9	+	16.3	=	30.2	-	40.0	=	-9.8

DETAILS OF TEST PROCEDURES**General Standard Information**

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.