



EMI TEST REPORT

Test Report No. : 28JE0209-HO-01-C-R1

Applicant : **Mitsubishi Electric Corporation Sanda works**
Type of Equipment : **Navigation system**
Model No. : **NR-212-6U**
FCC ID : **UJHNR21263AF39508**
Test regulation : **FCC Part 15 Subpart B 2008**
Test Result : **Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. Original test report number of this report is 28JE0209-HO-01-C.

Date of test: September 29 to October 29, 2008

Tested by:



 Kazufumi Nakai
 EMC Services

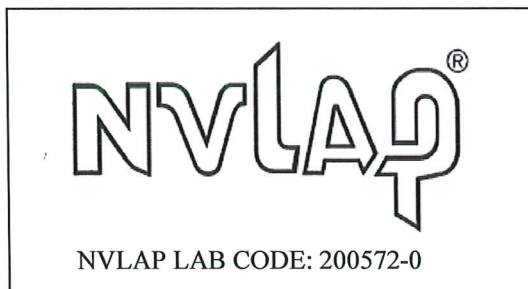


 Akio Hayashi
 EMC Services

Approved by :



 Mitsuru Fujimura
 Assistant Manager of EMC Services



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SECTION 1: Customer information

Company Name : Mitsubishi Electric Corporation Sanda works
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Telephone Number : +81-79-559-3859
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Contact Person : Koichi Sugimoto

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

2.1 Identification of E.U.T.

Type of Equipment : Navigation system
Model No. : NR-212-6U
Serial No. : ME395084170028
Rating : DC 12.0V
Receipt Date of Sample : July 25, 2008
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

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2.2 Product Description

Model No: NR-212-6U (referred to as the EUT in this report) is the Navigation system.
The test in this report was performed for FM and WB Tuner parts.
As Bluetooth part, please refer to UL Japan's report No. 28JE0209-HO-01-A.

Clock frequency(ies) in the system : 26MHz

[Bluetooth (Ver. 1.2 without EDR function)]

Equipment Type : Transceiver
Frequency of Operation : 2402-2480MHz
Bandwidth & Channel Spacing : 1MHz & 1MHz
Modulation : FHSS
ITU code : F1D
Mode of operation : Simplex
Method of Frequency Generation : Crystal
Antenna Type : Pattern antenna
Antenna Connector Type : FAKRA
Antenna Gain : 2.32 dBi max
Operating voltage (inner) : DC 3.3V
Operating temperature range : -20 deg. C. to +75 deg. C.

[GPS Receiver]

Equipment Type : Receiver
Frequency of Operation : 1575.42MHz
Other Clock Frequency : 16.37MHz
Method of Frequency Generation : Crystal
Antenna Type : GPS/TELEPHONE ANTENNA
Antenna Connector Type : FAKRA
Operating voltage (inner) : DC 3.3V
Operating temperature range : -30 deg. C. to +85 deg. C.

Type of radio	Tuner		
	FM	AM MW	WB
Frequency of Operation (FO)	87.75 - 107.9MHz	530 - 1710kHz	162.400 - 162.550MHz
Local Frequency Range (LF)	196.9 - 237.2MHz	224.6 - 248.2MHz	173.1 - 173.25MHz
Method of Frequency Generation	LF(min)=RC*1969 LF(max)=RC*2372 FO=LF/2-10.7	LF(min)=RC/5*11230 LF(max)=RC/5*12410 FO=LF/20-10.7	LF(min)=RC/4*6924 LF(max)=RC/4*6930 FO=LF-10.7
Intermediate Frequency (IF)	10.7MHz		
Reference frequency	100kHz	20kHz	25kHz
Radio Module Internal Clock (RC)	No internal clock in the radio module. 100kHz reference clock is transferred to the radio from the External DSP.		
Antenna Type	Glass antenna		
Antenna Connector Type	FAKRA coding B		
Operating voltage	8 - 9V		
Operating temperaturerange	-40 to +85 deg. C.		

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test Specification : FCC Part 15 Subpart B 2008, final revised on May 19, 2008
Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Procedures and results

Item	Test Procedure	Limits	Deviation	Worst margin	Result
Conducted emission	FCC: ANSI C63.4: 2003 7. AC powerline conducted emission measurements ----- IC: RSS-Gen 7.2.2	Receiver	N/A	N/A	N/A *1)
Radiated emission	FCC: ANSI C63.4: 2003 8. Radiated emission measurements ----- IC: RSS-Gen 4.10	Receiver	N/A	6.7dB 36.219MHz, QP Vertical	Complied
Antenna Terminal	FCC: ANSI C63.4: 2003 12. Measurement of unintentional radiators other than ITE ----- IC: RSS-Gen 4.10	Receiver	N/A	14.4dB 444.809MHz, PK	Complied

*Note: UL Japan, Inc's EMI Work Procedure QPM05.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

*These tests were performed without any deviations from test procedure except for addition or exclusion.

3.3 Additions or deviations to standards

No addition, deviation, nor exclusion has been made from standards.

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3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor $k=2$.

Test room	Conducted emission	Radiated emission (10m*)			Radiated emission (3m*)			Radiated emission (3m*)	
	150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz	18GHz-40GHz
No.1 semi-anechoic chamber (±)	3.7dB	3.1dB	4.4dB	4.2dB	3.2dB	3.8dB	3.9dB	5.9dB	6.1dB
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.4dB	4.0dB	5.9dB	6.1dB
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.6dB	4.0dB	5.9dB	6.1dB
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	3.9dB	3.9dB	5.9dB	6.1dB

*10m/3m = Measurement distance

Radiated emission test(3m)

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

Antenna Terminal

The measurement uncertainty for this test is 3.0dB.

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3.5 Test Location

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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	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test set up, Data of EMI and Test instruments

Refer to APPENDIX 1 to 3.

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

4.1 Operating modes

The mode is used :

- (a) FM Receiving (87.7MHz) + GPS Receiving (1575.42MHz) + Bluetooth Communication mode *1)
- (b) FM Receiving (97.9MHz) + GPS Receiving (1575.42MHz) + Bluetooth Communication mode *1)
- (c) FM Receiving (107.9MHz) + GPS Receiving (1575.42MHz) + Bluetooth Communication mode *1)
- (d) FM searching mode *2) *3)
- (e) WB Receiving (162.475MHz) + GPS Receiving (1575.42MHz) + Bluetooth Communication mode *1)
- (f) WB searching mode *2) *3)

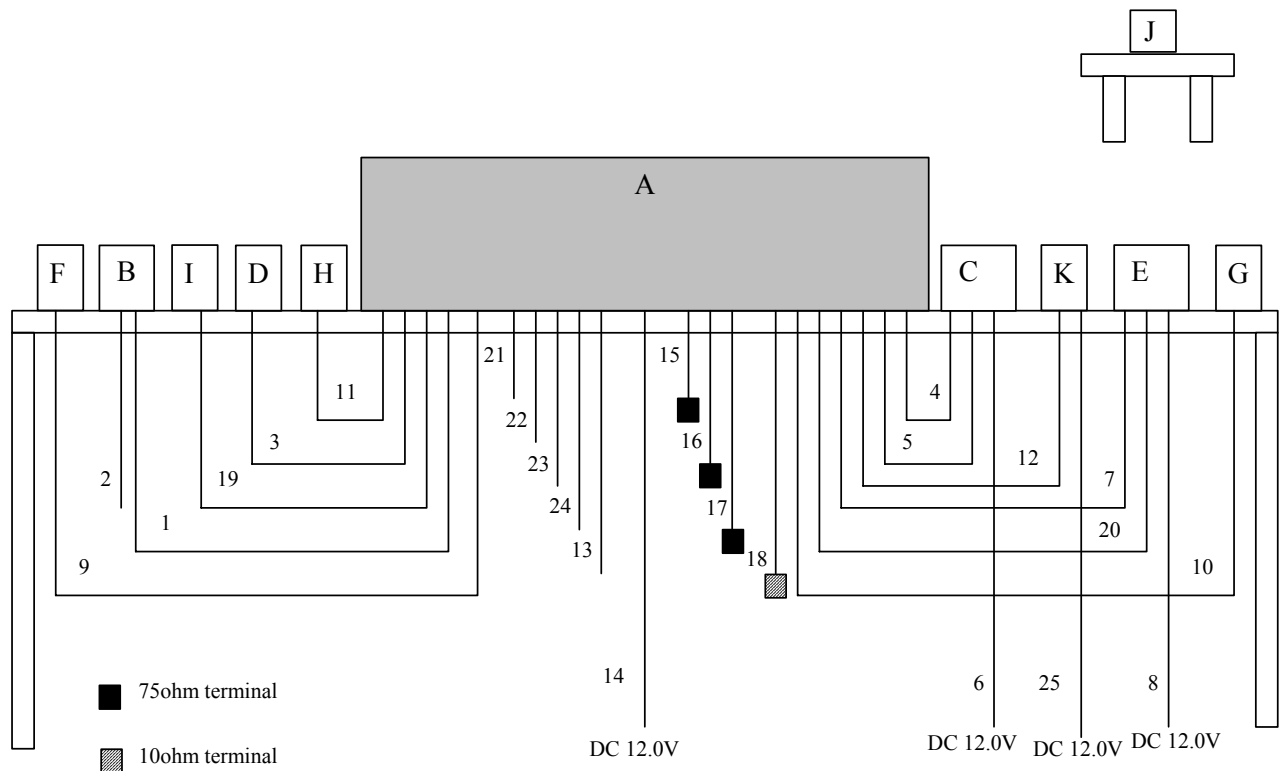
*1) Used for Radiated Emission test

*2) Used for Antenna Terminal test

*3) EUT has two antenna ports (UP port and Down port)

4.2 Configuration and peripherals

(Side View)



*Cabling and setup were taken into consideration and test data was taken under worse case conditions.

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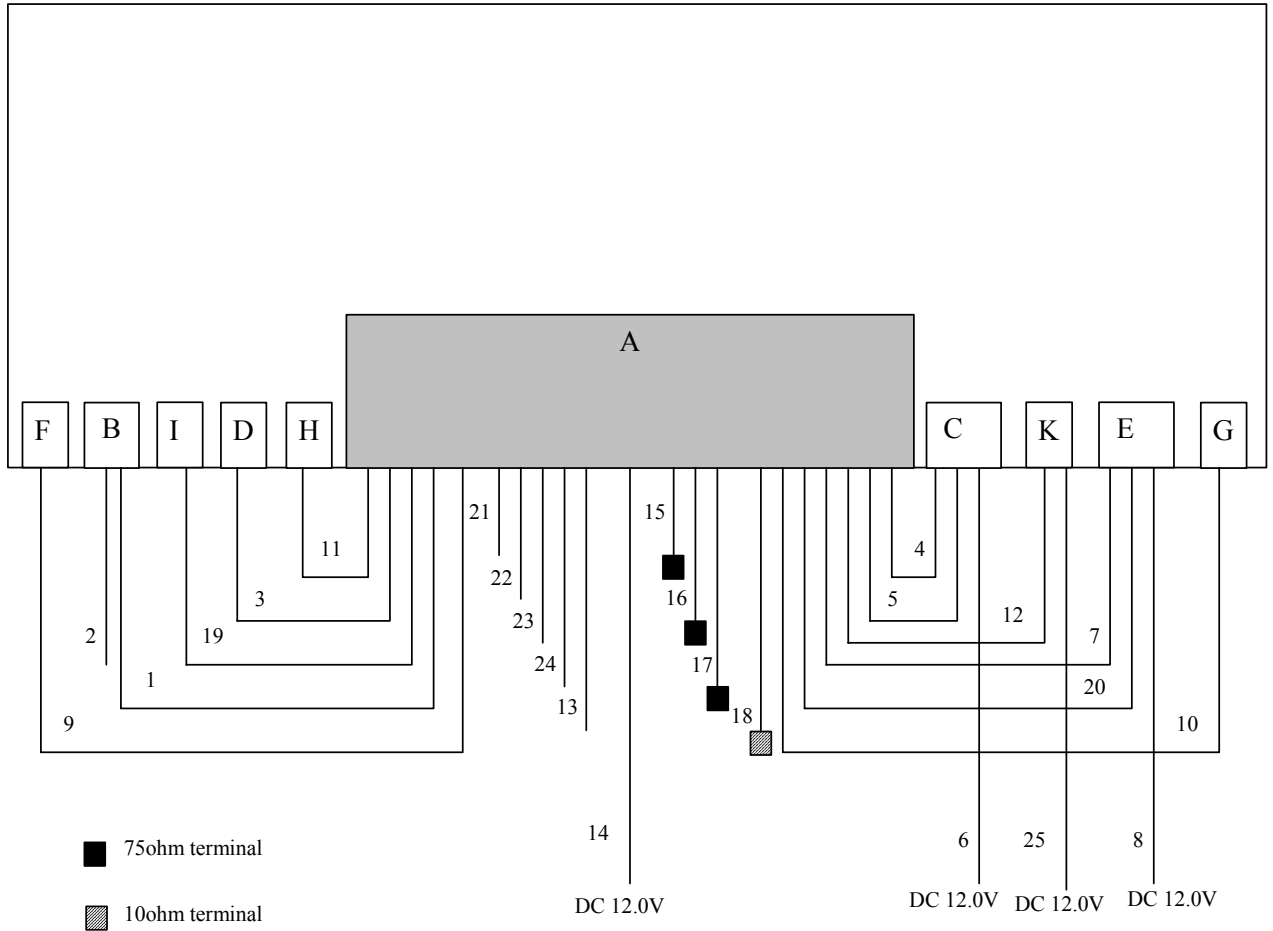
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(Top View)

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*Cabling and setup were 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	Remarks
A	Navigation system	NR-212-6U	ME395084170028	mitsubishi	EUT
B	GPS Antenna	A 204 820 16 75	T-2	MITSUBISHI	*1)
C	Display	LN12200101F	6227/02	SIEMENS	-
D	AM/FM Antenna	LR-31R	-	MITSUBISHI	-
E	External AMP	9008	9008DJ07B001472	HARMAN/BECKER AUTOMOTIVE SYSTEMS	-
F	Dummy Speaker	-	-	MITSUBISHI	-
G	MIC	6-7-05#1	2	-	-
H	External FAN	RV40-18/12L	-	ebmpapst	-
I	BT Antenna	AG90	-	MITSUBISHI	*1)
J	Mobile Phone	P903i	359482001243499	Panasonic	*2)
		W54T	STSED013260 82	TOSHIBA	*3)
K	CCU Unit	ZBE W204	-	MARQUAROT	-

*1) These GPS Antenna and BT Antenna for the tests are not EUT, however, this Navigation system (EUT) is limited to be installed with these GPS Antenna and BT Antenna only (including with cable length and cable type) which were used in the tests.

*2) Used for tests on September 29, 2008.

*3) Used for tests on October 28 and 29, 2008.

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	GPS Antenna Cable	1.2	Shielded	Shielded
2	Signal Cable	1.2	Shielded	Shielded
3	AM/FM Antenna Cable	5.3	Shielded	Shielded
4	Display Cable	0.8	Shielded	Shielded
5	CAN Cable	4.0	Unshielded	Unshielded
6	DC Cable	1.0	Unshielded	Unshielded
7	Most-Wake up Cable	3.5	Unshielded	Unshielded
8	DC Cable	1.8	Unshielded	Unshielded
9	Dummy Speaker Cable	3.0	Unshielded	Unshielded
10	MIC Cable	3.4	Unshielded	Unshielded
11	FAN Cable	3.2	Unshielded	Unshielded
12	H-CAN Cable	3.0	Unshielded	Unshielded
13	B-CAN Cable	3.0	Unshielded	Unshielded
14	DC Cable	1.8	Unshielded	Unshielded
15	75 ohm Terminal Cable	2.1	Shielded	Shielded
16	75 ohm Terminal Cable	2.1	Shielded	Shielded
17	75 ohm Terminal Cable	2.1	Shielded	Shielded
18	10 ohm Terminal Cable	3.0	Unshielded	Unshielded
19	BT Antenna Cable	1.2	Shielded	Shielded
20	Optical Cable	3.0	Unshielded	Unshielded
21	Signal Cable	3.0	Unshielded	Unshielded
22	Signal Cable	3.0	Unshielded	Unshielded
23	Signal Cable	3.0	Unshielded	Unshielded
24	Signal Cable	3.0	Unshielded	Unshielded
25	DC Cable	2.8	Unshielded	Unshielded

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SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.1 and No.3 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0m by 2.0m, raised 0.8m 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 was varied in height above the conducting ground plane to obtain the maximum signal strength. Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 30MHz-300MHz (Biconical antenna) / 300MHz-1000MHz (Logperiodic antenna)
1GHz-10GHz (Horn antenna)
Test distance : 3m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring 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. The test was made with the detector (RBW/VBW) in the following table. When using Spectrum analyzer, the test was made by using peak hold. Only for Average measurement, the test was made with adjusting span to zero.

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

*1) The Spectrum Analyzer was used in 3dB resolution bandwidth on FM Receiving+GPS Receiving+Bluetooth Communication mode above 1GHz.

The test was made on EUT at the normal use position.

5.5 Test result

Summary of the test results: Pass

Date: September 29, 2008
October 28 and 29, 2008

Test engineer: Kazufumi Nakai
Akio Hayashi

SECTION 6: Antenna Terminal

6.1 Operating environment

Test place : No.1 and No.3 semi anechoic chamber
Temperature : See data
Humidity : See data

6.2 Test configuration

EUT was placed on a urethane platform of nominal size, 1.0m by 2.0m, raised 0.8m from the ground.
Photographs of the set up are shown in Appendix 1.

6.3 Test conditions

Frequency range : 30MHz-1000MHz / 1000MHz-2000MHz
Test distance : N/A
EUT position : Table top
EUT operation mode : See Clause 4.1

6.4 Test procedure

The Antenna Terminal was measured with a spectrum analyzer connected to the antenna port.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer *1)
IF Bandwidth	PK: RBW:100kHz/VBW: 100kHz	PK: RBW:1MHz/VBW: 1MHz

*1) The Spectrum Analyzer was used in 3dB resolution bandwidth on FM searching mode above 1GHz.

6.5 Test result

Summary of the test results: Pass

Date: September 29, 2008
October 29, 2008

Test engineer: Kazufumi Nakai
Akio Hayashi

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