

TEST RESULT SUMMARY

FCC PART 15 SUBPART B Class B Limit

MANUFACTURER'S NAME	Denso Corp
NAME OF EQUIPMENT	Superregenerative Receiver for Keyless Entry System
MODEL NUMBER	13BAN
MANUFACTURER'S ADDRESS	1-1 Showa-cho, Kariya-shi Aichi-ken, 448-8661 Japan
TEST REPORT NUMBER	W8541
TEST DATE	17 November 1998


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: 02 December 1998

Location: Taylors Falls MN
USA


G. S. Jakubowski
Test Engineer


J.T. Schneider
NVLAP Signatory

Not Transferable

EMC EMISSION - TEST REPORT

Test Report File No. : **W011854101** Date of issue: 02 December 1998

Model / Serial No. : 13BAN /

Product Type : Superregenerative Receiver for Keyless Entry System

Applicant : Denso Corp

Manufacturer : Denso Corp

License holder : Denso Corp

Address : 1-1 Showa-cho, Kariya-shi
Aichi-ken, 448-8661 Japan

Test Result : **Positive** **Negative**

Test Project Number :
 Reference(s) : W8541

Total pages including Appendices : 22

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.

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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

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EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

- | | | |
|---|---|---|
| <input type="checkbox"/> - EN 50081-1 / 1991 | <input type="checkbox"/> - Group 1 | <input type="checkbox"/> - Group 2 |
| <input type="checkbox"/> - EN 55011 / 1991 | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - EN 55013 / 1990 | <input type="checkbox"/> - Household appliances and similar | |
| <input type="checkbox"/> - EN 55014 / 1987 | <input type="checkbox"/> - Portable tools | |
| | <input type="checkbox"/> - Semiconductor devices | |
| <input type="checkbox"/> - EN 55014 / A2:1990 | <input type="checkbox"/> - Household appliances and similar | |
| <input type="checkbox"/> - EN 55014 / 1993 | <input type="checkbox"/> - Portable tools | |
| | <input type="checkbox"/> - Semiconductor devices | |
| <input type="checkbox"/> - EN 55015 / 1987 | | |
| <input type="checkbox"/> - EN 55015 / A1:1990 | | |
| <input type="checkbox"/> - EN 55015 / 1993 | | |
| <input type="checkbox"/> - EN 55022 / 1987 | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - EN 55022 / 1994 | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - BS | | |
| <input type="checkbox"/> - VCCI | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input checked="" type="checkbox"/> - FCC | <input type="checkbox"/> - Class A | <input checked="" type="checkbox"/> - Class B |
| <input type="checkbox"/> - AS 3548 (1992) | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - CISPR 11 (1990) | <input type="checkbox"/> - Group 1 | <input type="checkbox"/> - Group 2 |
| | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |
| <input type="checkbox"/> - CISPR 22 (1993) | <input type="checkbox"/> - Class A | <input type="checkbox"/> - Class B |

Environmental conditions in the lab:

	<u>Actual</u>
Temperature	: 22 °C
Relative Humidity	: 39 %
Atmospheric pressure	: 98.6 kPa
Power supply system	: 12 VDC

Sign Explanations:

- not applicable
- applicable

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
--------------	--------------	-------------	---------------	----------

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 - 2 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

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

- _____

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:

- | | |
|----------------------------------|--------------|
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |
| <input type="checkbox"/> - _____ | Type : _____ |

- unshielded power cable

- unshielded cables

- shielded cables

MPS.No.: _____

- customer specific cables

- _____

- _____

Emission Test Results:

Conducted emissions 450 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 _____ >10 dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

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 - 2 GHz

The requirements are - MET - NOT MET

Minimum limit margin _____ >10 dB at _____ MHz

Maximum limit exceeding _____ dB at _____ MHz

Remarks: _____

DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:**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: 17 November 1998Testing End Date: 17 November 1998

- TÜV PRODUCT SERVICE INC -



J. T. Schneider
NVLAP Signatory



Tested By:
G. S. Jakubowski

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

Not Applicable

Appendix A

Test Data Sheets

and

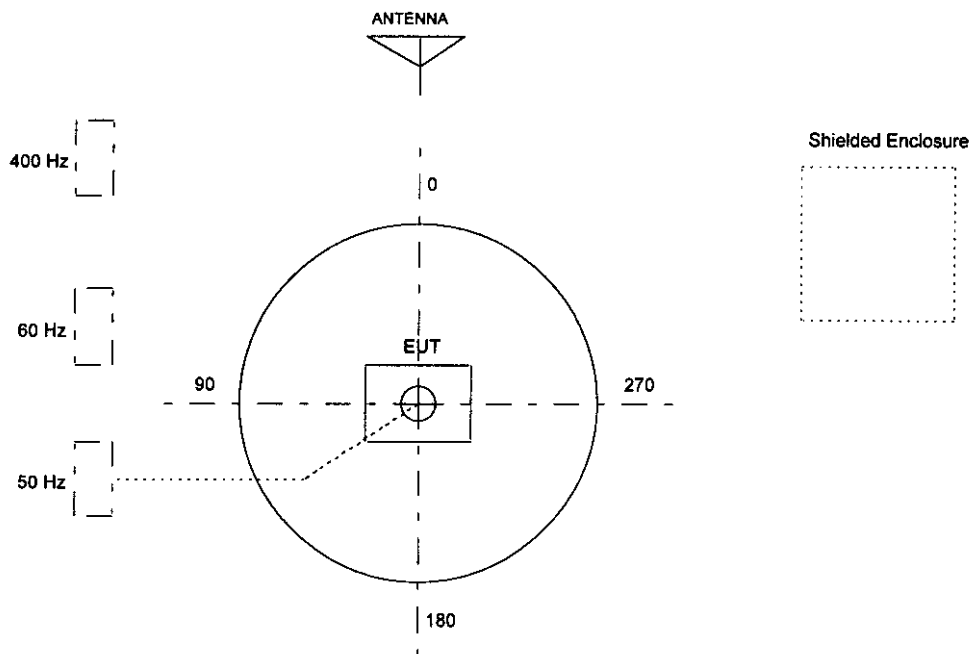
Test Setup Drawing(s)

TEST SETUP FOR EMISSIONS TESTING

 WILD RIVER LAB
 Large Test Site

Notes:

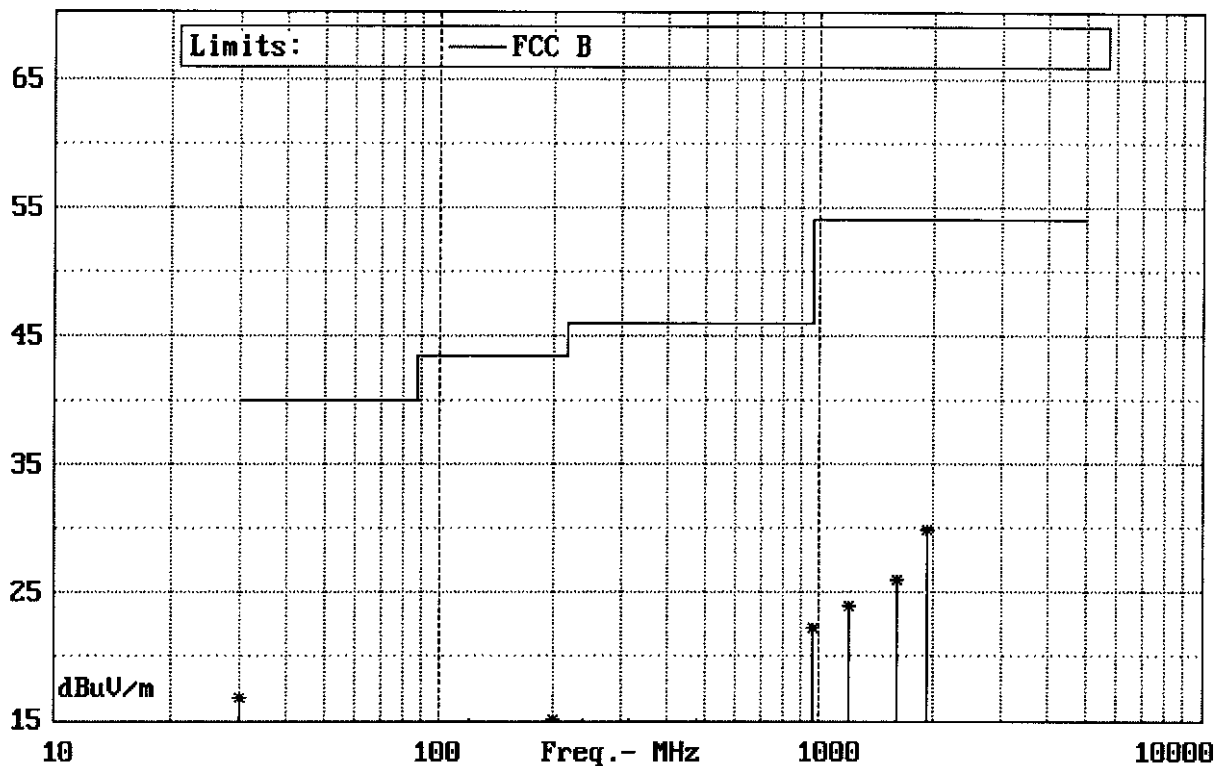
1. Items shown in dotted lines are located on the floor below the test area. It is 5 meters vertically from the ground floor to the test area.
2. 50 Hz, 60 Hz, and 400 Hz are power panels for alternating current.
3. The antenna may be positioned horizontally 3, 10 or 30 meters from the center of the 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.



REPORT #W8541
RUN 1

TUV PRODUCT SERVICE
RADIATED EMISSIONS AT 3 METERS
DENSO 12BAN & 13BAN RECEIVER

11/17/98



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:
 DENSO
 12BAN & 13BAN RECEIVER
 Notes:

Report W8541 Run 1
 Date 11/17/98 Page 1
 Engineer
 Tech: GSJ
 Requester *[Signature]*

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta FCC B	Delta
------------------	---------------	--------------	-------------	-----------------	-----------	------------------	----------------	-------

SCAN 30-200 MHz

NO EMISSIONS DETECTED - FOLLOWING ARE NOISE FLOOR MEASUREMENTS

30	2.16	14	.5	16.7	--	V --	-23.3	
60	1.58	9.6	.8	11.9	--	V --	-28.1	
120	1.05	11	1	13.1	--	V --	-30.4	
200	.94	12.8	1.3	15	--	V --	-28.5	

SCAN 200-1000 MHz

314.35 MHZ MAXED AT 160 DEGREES, VERTICAL, 1.6 METERS HIGH

314.35	-2.5	14.2	1.6	13.2	--	V --	-32.8	
--------	------	------	-----	------	----	------	-------	--

NO OTHER EMISSIONS DETECTED - FOLLOWING ARE NOISE FLOOR MEASUREMENTS

240	-3.19	14.7	1.4	12.9	--	V --	-33.1	
480	-4.44	16.8	2	14.3	--	V --	-31.7	
960	-4.7	24	2.9	22.2	--	V --	-23.8	

SCAN 1000-2000 MHz

0 DEGREES, VERTICAL, 1 METER

1144	-4.52	25.1	3.2	23.8	--	V --	-30.2	
------	-------	------	-----	------	----	------	-------	--

1144 MHZ = AMBIENT

NO EMISSIONS DETECTED - FOLLOWING ARE NOISE FLOOR MEASUREMENTS

1200	-4.72	25.3	3.3	23.9	--	V --	-30.1	
1600	-5.21	27.2	3.9	25.9	--	V --	-28.1	
1920	-4.01	29	5	29.9	--	V --	-24.1	

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:
 DENSO
 12BAN & 13BAN RECEIVER
 Notes:

Figure _____

Report W8541 Run 1
 Date 11/17/98 Page 2
 Engineer _____
 Tech: GSJ _____
 Requester _____

Measurement Summary

Frequency MHz	Final dBuV/m	Final uV/m	Azimuth deg	Polar\ Height	Delta FCC B	Delta
30	16.7	6.8391	--	V --	-23.3	
60	11.9	3.9355	--	V --	-28.1	
120	13.1	4.5185	--	V --	-30.4	
200	15	5.6234	--	V --	-28.5	
240	12.9	4.4157	--	V --	-33.1	
314.35	13.2	4.5708	--	V --	-32.8	
480	14.3	5.1880	--	V --	-31.7	
960	22.2	12.882	--	V --	-23.8	
1200	23.9	15.667	--	V --	-30.1	
1600	25.9	19.724	--	V --	-28.1	
1920	29.9	31.260	--	V --	-24.1	

Minimum Passing Margin for FCC B is 23.3 dB at 30 MHz

File W8541 Run 1

Appendix B

Constructional Data Form
and
Product Information Form(s)

Constructional Data Form

Not Applicable

Technical Description of the systemType number

- Receiver :13BAN

Specifications of receiver

- Nominal frequency :314.35 MHz
- Micro computer clock frequency :3.86 MHz
- Type of receiving system :Super regenerative
- Power supply
 - Nominal supply voltage :12 VDC (vehicle battery)
- Antenna :Built-in type (fixed)

Description of the system operation

This system is mainly used for locking or unlocking the doors of the vehicle. The transmitter sends a radio wave signal while the button is pushed. The receiver becomes active in response to the signal from the transmitter.

Installation in vehicle

The receiver is installed inside the vehicle.

Appendix C

MEASUREMENT PROTOCOL FOR FCC

GENERAL INFORMATION

In compliance with FCC Docket 92-152, "Harmonization of Rules for Digital Devices Incorporate International Standards", testing for FCC compliance may be done following the ANSI C63.4-1992 procedures and using the CISPR 22 Limits.

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 an expected 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:

$$dB\mu V = 20(\log \mu V)$$

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

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.

DENSO6. Component listing6.1. Receiver

Part Name	Description	Number of Units
IC	-	1
Transistor	-	2
Diode	-	1
Coil	-	1
Inductor	10 - 56nH	1
Inductor	10 - 68nH	1
Inductor	1. 5 μ H	1
Capacitor	0 - 100pF	1
Capacitor	1 - 10pF	2
Capacitor	1 - 20pF	1
Capacitor	2pF	1
Capacitor	56pF	1
Capacitor	220pF	1
Capacitor	330pF	2
Capacitor	1000pF	5
Capacitor	0.01 μ F	2
Capacitor	0.022 μ F	2
Capacitor	0.1 μ F	2
Resistor	100 Ω	1
Resistor	390 Ω	1
Resistor	1k Ω	2
Resistor	1 - 2k Ω	1
Resistor	3k Ω	1
Resistor	10k Ω	4
Resistor	0 - 10k Ω	1
Resistor	12k Ω	1
Resistor	12 - 27k Ω	1
Resistor	15 - 33k Ω	2
Resistor	30k Ω	1
Resistor	47k Ω	2
Resistor	470k Ω	1
Filter	314.35MHz	1
Antenna	-	1
Jumper	-	1