

TEST RESULT SUMMARY

FCC PART 15 SUBPART B

Class B Limit

MANUFACTURER'S NAME	Denso Corporation
NAME OF EQUIPMENT	Superheterodyne Receiver for remote keyless entry system in vehicle
MODEL NUMBER	13BBH
APPLICANT'S ADDRESS	1-1 Showa-cho, Kariya-shi Aichi-ken, 448-8661 Japan
TEST REPORT NUMBER	W0366
TEST DATE	07 July 2000

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.

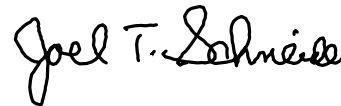
TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15.

Date: 15 August 2000

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. : **WC1H036601** Date of issue: 15 August 2000

Model / Serial No. : **13BBH /**

Product Type : Superheterodyne Receiver for remote keyless entry system
in vehicle

Applicant : Denso Corporation

Manufacturer : Denso Corporation

License holder : Denso Corporation

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

Test Result : ☒ Positive ☐ Negative

Test Project Number : **W0366**
Reference(s)

Total pages including Appendices **21**

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

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DIRECTORY - EMISSIONS

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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
- ☐ - AS 3548 (1992)
- ☐ - CISPR 11 (1990)
- ☐ - CISPR 22 (1993)

- ☐ - Group 1
- ☐ - Class A

- ☐ - Group 2
- ☐ - Class B

- ☐ - Household appliances and similar
- ☐ - Portable tools
- ☐ - Semiconductor devices

- ☐ - Household appliances and similar
- ☐ - Portable tools
- ☐ - Semiconductor devices

- ☐ - Class A
- ☐ - Class A

- ☐ - Class B
- ☐ - Class B

- ☐ - Class A
- ☐ - Class A
- ☐ - Class A

- ☐ - Class B
- ☒ - Class B
- ☐ - Class B

- ☐ - Group 1
- ☐ - Class A
- ☐ - Class A

- ☐ - Group 2
- ☐ - Class B
- ☐ - Class B

Environmental conditions in the lab:

	<u>Actual</u>
Temperature	: 23 °C
Relative Humidity	: 60 %
Atmospheric pressure	: 98.8 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
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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) – NSA measurements made 6-99, due 7-00
- ☐ - 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 Due
☒ - 8566B	Hewlett-Packard	Spectrum Analyzer	2221A01596	11-00
☒ - 85662A	Hewlett-Packard	Analyzer Display	2152A03640	11-00
☒ - 85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	11-00
☒ - ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	3-01
☒ - EM-6917B	Electro-Metrics	Biconicalog Periodic	101	9-00

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

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 Due
☒ - 8566B	Hewlett-Packard	Spectrum Analyzer	2221A01596	11-00
☒ - 85662A	Hewlett-Packard	Analyzer Display	2152A03640	11-00
☒ - 85650A	Hewlett-Packard	Quasi-Peak Adapter	2811A01127	11-00
☒ - ZHL-1042J	Mini-Circuits	Preamplifier	H072294-11	3-01
☒ - EM-6917B	Electro-Metrics	Biconicalog Periodic	101	9-00

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

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:

- | | |
|---|----------------|
| ☐ - _____ | Type : _____ |
| ☐ - _____ | 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 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

_____ 11 dB

at _____ 60.8 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: No signals detected within 10 dB of limit.

DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:

SUMMARY:

The requirements according to the technical regulations are

☒ - met

☐ - **not** met.

The device under test does

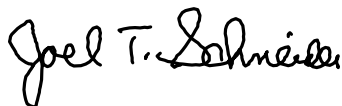
☒ - fulfill the general approval requirements mentioned on page 3.

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

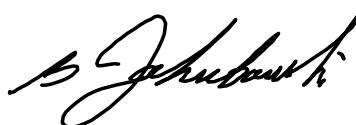
Testing Start Date: 07 July 2000

Testing End Date: 07 July 2000

- TÜV PRODUCT SERVICE INC -



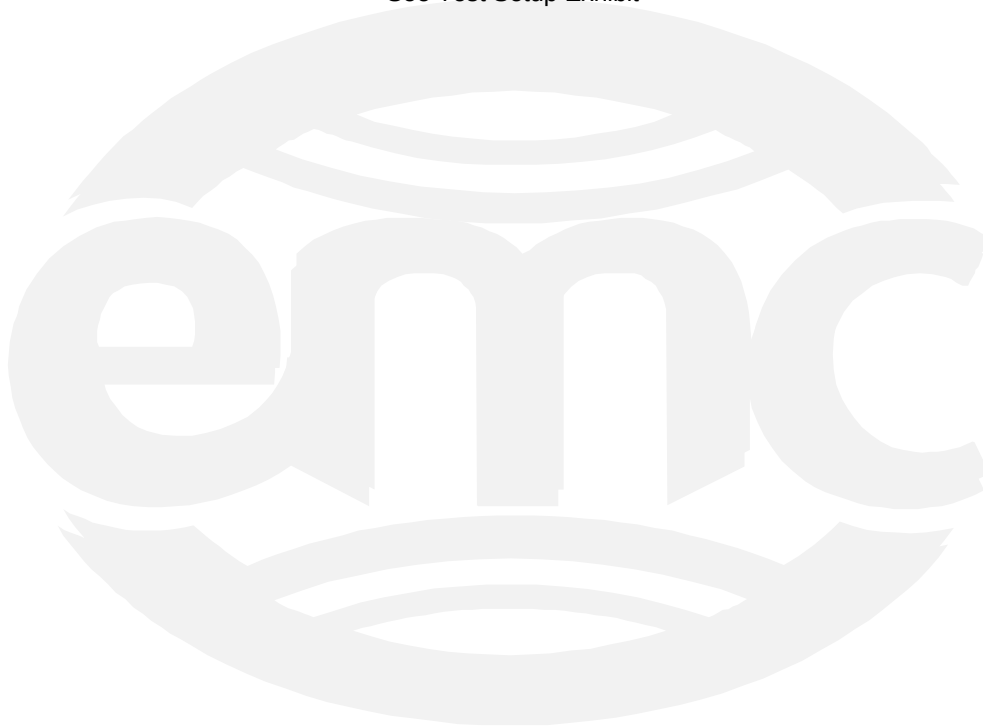
J. T. Schneider
NVLAP Signatory



Tested By:
G. S. Jakubowski

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

See Test Setup Exhibit



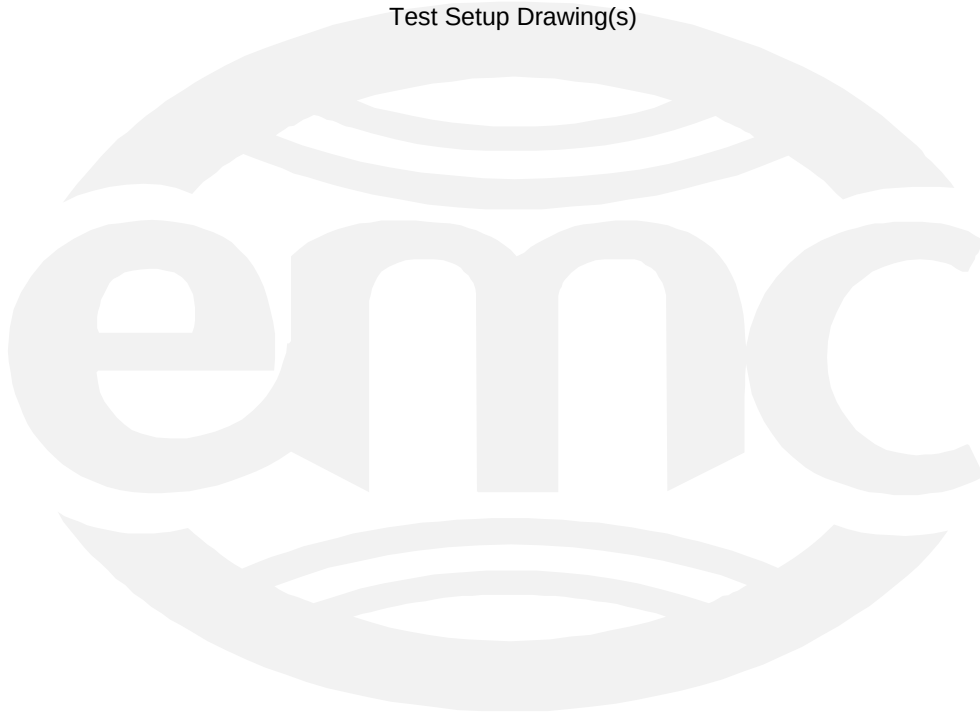
Test-setup photo(s):
Radiated emission 30 MHz - 2000 MHz

See Test Setup Exhibit



Appendix A

Test Data Sheets
and
Test Setup Drawing(s)



TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Large Test Site (LTS)

See Test Setup Exhibit



Radiated Electromagnetic Emissions

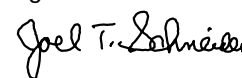
Test Report #:	W0366 Run 01	Test Area:	LTS 3m		
Test Method:	FCC Part 15	Test Date:	07-Jul-2000		
EUT Model #:	13BBH	EUT Power:	12VDC		
EUT Serial #:		Temperature:	23	°C	
Manufacturer:	DENSO	Relative Humidity:	60	%	
EUT Description:	RECEIVER	Air Pressure:	98.8	kPa	
Notes:				Page:	1 of 2

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 FCC B (< 1GHz)	DELTA2 FCC B (> 1GHz)
60.80	43.5 Pk	1.2 / 10.9 / 25.5	29.1	V / 1.0 / 0.0	-10.9	N/A
121.51	26.7 Pk	1.4 / 8.6 / 25.6	11.0	V / 1.0 / 0.0	-32.5	N/A
182.26	29.7 Pk	1.6 / 9.7 / 25.8	15.2	V / 1.0 / 0.0	-28.3	N/A
242.99	28.8 Pk	1.8 / 11.9 / 25.8	16.6	V / 1.0 / 0.0	-29.4	N/A
303.72	35.2 Pk	2.0 / 13.5 / 25.9	24.9	V / 1.0 / 0.0	-21.1	N/A
364.47	25.9 Pk	2.1 / 15.0 / 26.0	17.1	V / 1.0 / 0.0	-28.9	N/A
242.99	30.1 Pk	1.8 / 11.9 / 25.8	17.9	H / 1.0 / 270.0	-28.1	N/A
303.72	36.2 Pk	2.0 / 13.5 / 25.9	25.8	H / 1.0 / 90.0	-20.2	N/A
Maximized						
60.80	41.6 Pk	1.2 / 10.9 / 25.5	28.3	V / 1.0 / 331.0	-11.7	N/A
End Scan 30 to 2000 Mhz						

Tested by: G Jakubowski
Printed


Signature

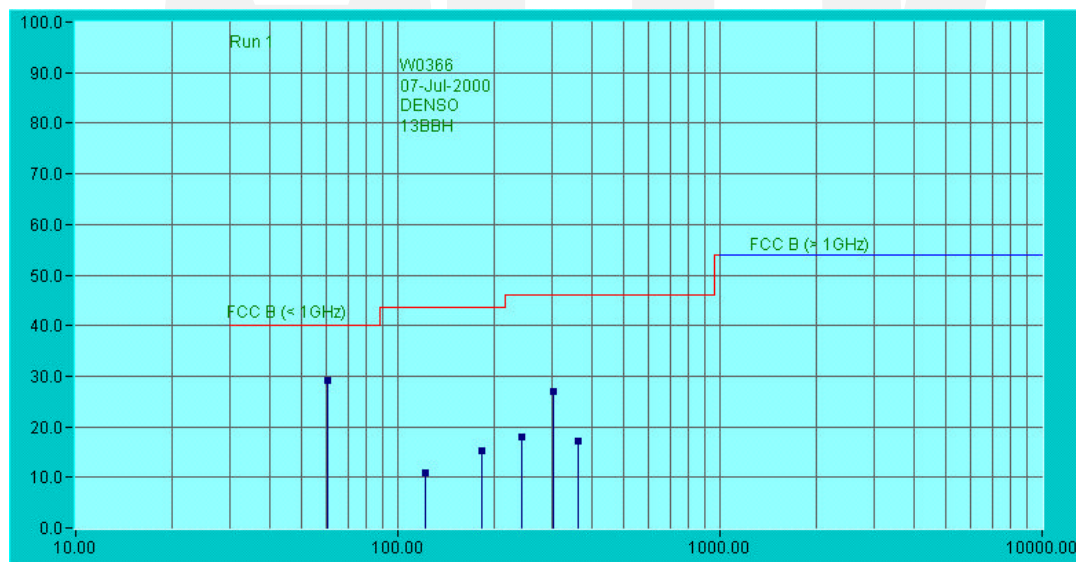
Reviewed by: J. T. Schneider
Printed


Signature

Radiated Electromagnetic Emissions

Test Report #:	W0366 Run 01	Test Area:	LTS 3m		
Test Method:	FCC Part 15	Test Date:	07-Jul-2000		
EUT Model #:	13BBH	EUT Power:	12VDC		
EUT Serial #:		Temperature:	23	°C	
Manufacturer:	DENSO	Relative Humidity:	60	%	
EUT Description:	RECEIVER	Air Pressure:	98.8	kPa	
Notes:		Page:	2 of 2		

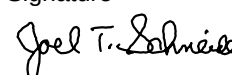
FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 FCC B (< 1GHz)	DELTA2 FCC B (> 1GHz)
***** MEASUREMENT SUMMARY *****						
60.80	42.5 Pk	1.2 / 10.9 / 25.5	29.1	V / 1.0 / 0.0	-10.9	N/A
303.72	37.4 Pk	2.0 / 13.5 / 25.9	27.0	H / 1.0 / 180.0	-19.0	N/A
242.99	30.1 Pk	1.8 / 11.9 / 25.8	17.9	H / 1.0 / 270.0	-28.1	N/A
182.26	29.7 Pk	1.6 / 9.7 / 25.8	15.2	V / 1.0 / 0.0	-28.3	N/A
364.47	25.9 Pk	2.1 / 15.0 / 26.0	17.1	V / 1.0 / 0.0	-28.9	N/A
121.51	26.7 Pk	1.4 / 8.6 / 25.6	11.0	V / 1.0 / 0.0	-32.5	N/A



Tested by: G Jakubowski
Printed


Signature

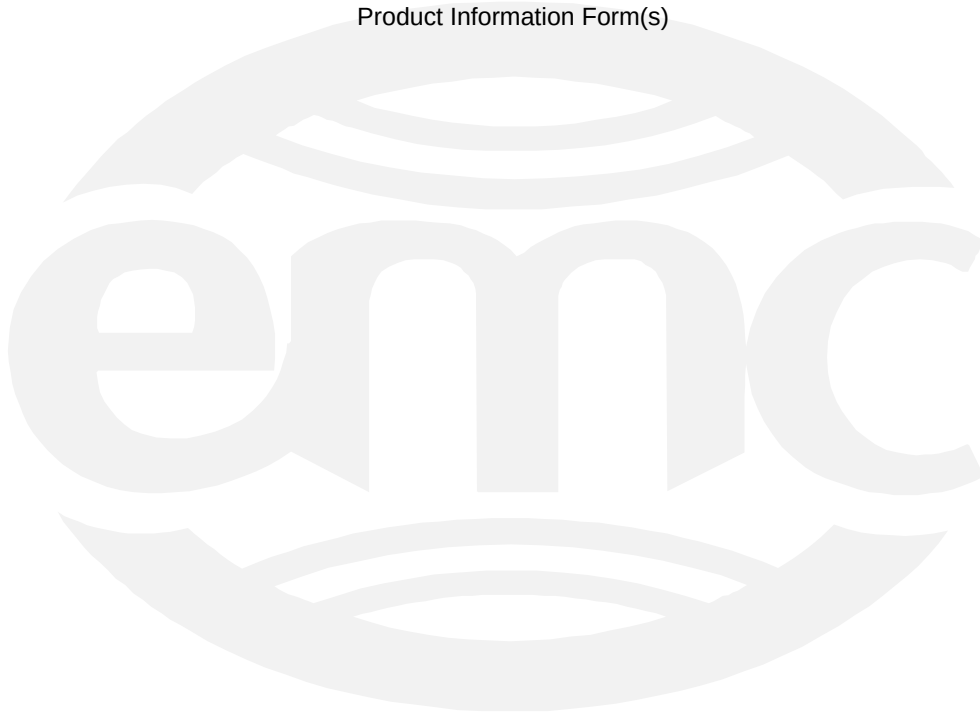
Reviewed by: J. T. Schneider
Printed


Signature

File No. WC1H036601, Page A4 of A4

Appendix B

Constructional Data Form
and
Product Information Form(s)



Constructional Data Form



Not Applicable

Technical Description of the systemType number

- Receiver :13BBH

Specifications of receiver

- Nominal frequency	:314.35 MHz
- Local Oscillator Frequency	:303.65 MHz
- Micro computer clock frequency	:3.86 MHz
- Type of receiving system	:Super heterodyne
- 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

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 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 its 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 dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dB μ V and μ V, 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 dB μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ V) 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.

Example:

FREQ (MHz)	LEVEL (dB μ V)	CABLE/ANT/PREAMP (dB)	FINAL (dB μ V/m)	POL/HGT/AZ (m) (deg)	DELTA1 FCC B
60.80	42.5Qp +	1.2 + 10.9 - 25.5 =	29.1	V 1.0 0.0	-10.9

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.