DURABILITY TEST METHODS FOR COMPACT DISK PLAYERS

1. Scope

This standard covers the test methods for the durability of automotive compact disk (hereinafter referred to as "CD") players.

2. Definitions

The terms used in this standard are defined as follows:

(1) Sample

The term "sample" refers to a CD player to be tested and its system.

(2) Durability evaluation

The term "durability evaluation" refers to the evaluation of changes and effects caused directly by exposure to a given environment.

(3) Life evaluation

The term "life evaluation" refers to the evaluation of reliability to deterioration and life expectancy under exposure to a given environment for a long period.

(4) Escutcheon

The term "escutcheon" refers to the decorated portion which is visible while on the vehicle, i.e., the ornamented front panel.

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3. Test Items

The test items for CD players are listed in Table 1:

Table 1 Test Items

Group	Test item	Test method
Initial characteristics	Initial characteristics test	5.1
	- Appearance	5.1.1
	- Functioning	5.1.2
	- Performance	5.1.3
Environmental life tests	Environmental exposure tests	5.2
	- High temperature exposure test (1)	5.2.1
	- High temperature exposure test (2)	5.2.2
	- Low temperature exposure test	5.2.3
	- High temperature high humidity exposure test	5.2.4
	Migration tests	5.3
	High temperature high humidity current application test	5.4
	Thermal cycle test	5.5
	Condensation test	5.6
	Dust resistance tests	5.7
	- Dust exposure test	5.7.1
	- Dust operation test	5.7.2
	- Switch dust resistance test	5.7.3
	Impact tests	5.8
	- Unpackaged impact test	5.8.1
	- Packaged impact test	5.8.2
	- Container impact test (free fall impact test)	5.8.3
	- Container impact test (flow rack impact test)	5.8.4
	- Drop weight impact test (1)	5.8.5
	- Drop weight impact test (2)	5.8.6
Durability tests	Operation durability tests	5.9
	- Room temperature operation durability test	5.9.1
	- High temperature operation test (1)	5.9.2
	- High temperature operation test (2)	5.9.3
	- Low temperature operation test (1)	5.9.4
	- Low temperature operation test (2)	5.9.5
	- High temperature high humidity operation test	5.9.6
	Vibration durability tests	5.10
	- Resonance point detection test	5.10.1
	- Resonance vibration durability test	5.10.2
	- Sweep vibration durability test	5.10.3
	Switching durability test	5.11
	Combined stress test	5.12

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Table 1 (Continued)

Group	Test item	Test method
Electric noise tests	Power voltage fluctuation test	5.13
	Floating ground test	5.14
	Electromagnetic coupling noise test	5.15
	Field decay test	5.16
	Load dump test	5.17
	Overvoltage test	5.18
	Inverted voltage test	5.19
	Electrostatic tests	5.20
	- Electrostatic discharge test	5.20.1
	- Electrostatic operation test	5.20.2
	Electromagnetic susceptibility tests	5.21
	- For vehicles shipped to Europe and Australia	5.21.1
	- For vehicles shipped to other destinations	5.21.2
	Electromagnetic compatibility test	5.22
Extended test items	Output terminal test	5.23
	Light interference test	5.24
	Parasitic oscillation test	5.25
	Power voltage leakage test	5.26
	Differential voltage application test	5.27
	Forced strain tests	5.28
	- Housing	5.28.1
	- Escutcheon	5.28.2
	- Push switches	5.28.3
	- Displays	5.28.4
	- Volume switch	5.28.5
	Marginal voltage tests	5.29
	- Overvoltage breakdown test	5.29.1
	- Low voltage operation test	5.29.2
	Marginal temperature tests	5.30
	- Maximum operating temperature test	5.30.1
	- Minimum operating temperature test	5.30.2
	Water exposure test	5.31
	Temperature rise test	5.32
	Mishandling test	5.33
Escutcheon tests	Surface finish tests	5.34
	- Hardness	5.34.1
	- Adhesion	5.34.2
	- Impact resistance	5.34.3
	- Tack-free performance	5.34.4
	- Humidity adhesion	5.34.5
	- Water exposure discoloration	5.34.6
	- Alkali exposure discoloration	5.34.7
	- Acid exposure discoloration	5.34.8
	- Gasoline resistance	5.34.9
	- Glass haze	5.34.10
	- Colorfastness to crocking	5.34.11
	- Grease staining resistance	5.34.12
	- Perspiration resistance	5.34.13
	- Accelerated light resistance	5.34.14

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4. Test Conditions

(1) Test site

Perform the tests in a closed laboratory insulated from significant electric noise, magnetic leakage, and interfering light.

(2) Standard test environment

The standard test environment is a temperature of 25±3℃, a humidity of 65±5%, and a power voltage of 14.4±0.1 V. Normally, perform a test in the standard test environment unless otherwise specified for individual tests. However, if the atmospheric conditions do not affect the reliability of the results, a test may be performed under ordinary temperature and humidity conditions (5 to 35℃ and 45 to 85%, respectively). Also, adjust the controls as follows unless otherwise specified:

(a) Tone controls (bass and treble)

- Independent bass and treble controls: Adjust to the mechanical centers (click points).
- Treble attenuator with no bass control: Adjust to the maximum treble level.

(b) Volume control

Adjust to the point where the output is 0.5 W/Ch. as tested with a -10 dB pink noise disk.

(c) Balance and fade controls

Adjust to the mechanical centers (click points).

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(3) Test sequence
Follow the test sequence shown in Fig. 1 whenever practicable:

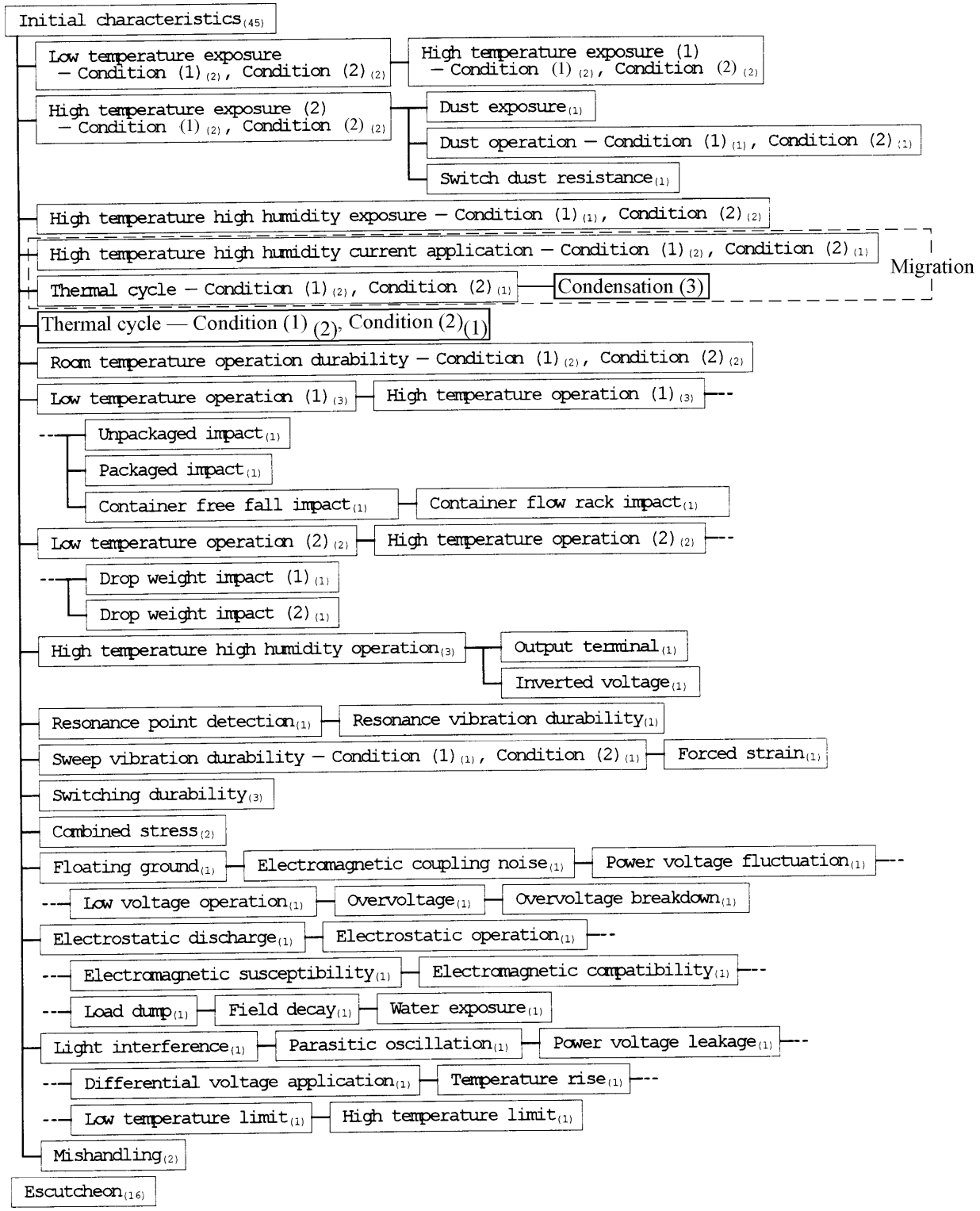

Fig. 1 Test Sequence

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Remark:
Numbers in ( ) indicate the minimum quantities of the samples. Note that the quantity that fills up a container is necessary in the container impact tests.

(4) Standard disk
Use a music disk, etc., unless otherwise specified for the tests. Check for any damages on the disk prior to testing in order to be able to identify damages caused by the test.

(5) Other conditions
If a test lasts for a long time, check for functioning and performance also during the test to quantify the durability. When testing a CD player equipped with a CD changer, use the standard magazine, as the tests are also intended to evaluate the magazine. Do not change the magazine during a test unless the test cannot be continued otherwise due to its failure.

5. Test Methods

5.1 Initial Characteristics Test
Prepare an initial characteristics check form according to the design specifications. Check the appearance, functioning and performance using this form. In the subsequent tests, check for any change in the characteristics using the same form.

5.1.1 Appearance
Check the appearance for any flaws, cracks, crimps, rust, discoloration, stains, unevenness, etc., visually and by touch, at an illuminance of at least 500 lx.

5.1.2 Functioning
Check functioning for conformity with the design specifications.

5.1.3 Performance
Measure the characteristics according to TSC7512G for all the specified items. However, the check items may be reduced as agreed upon between the parties concerned.

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5.2 Environmental Exposure Tests

5.2.1 High Temperature Exposure Test (1)

For the high temperature exposure test (1) of CD players, follow Table 2:

Table 2 High Temperature Exposure Test (1)

Item	Condition
Ambient temperature (℃)	+85±3
Loading condition	No load, no current application (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Duration (h)	192±2: durability evaluation 720±4: life evaluation (528 h in addition to durability evaluation)
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check the appearance, functioning and performance. After the test, perform the tape peel test according to Section 5.34.2 (2).

5.2.2 High Temperature Exposure Test (2)

For the high temperature exposure test (2) of CD players, follow Table 3:

Table 3 High Temperature Exposure Test (2)

Item	Condition
Ambient temperature (℃)	+60±3
Loading condition	No load, no current application (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Duration (h)	336±2
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check the appearance, functioning and performance. Disassemble the sample to check the inside.

5.2.3 Low Temperature Exposure Test

For the low temperature exposure test of CD players, follow Table 4:

Table 4 Low Temperature Exposure Test

Item	Condition
Ambient temperature (℃)	-40±3
Loading condition	No load, no current application (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Duration (h)	192±2: durability evaluation
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check the appearance, functioning and performance. Wipe off any frost or dew before checking. After the test, perform the tape peel test according to Section 5.34.2 (2).

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5.2.4 High Temperature High Humidity Exposure Test

For the high temperature high humidity exposure test of CD players, follow Table 5:

Table 5 High Temperature High Humidity Exposure Test

Item	Condition
Ambient temperature (℃)	+85±3
Ambient humidity (% RH)	85±5
Loading condition	No load, no current application (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Duration (h)	192±2: durability evaluation 720±4: life evaluation (528 h in addition to durability evaluation)
Post-test checking	After conditioning for at least 1 hour in the standard test environment, check the appearance, functioning and performance within 2 hours. Wipe off any dew before checking. After the test, perform the tape peel test according to Section 5.34.2 (2).

5.3 Migration Tests

The migration tests of CD players consist of the following:

(1) Section 5.4, high temperature high humidity current application test: 1000 h

(2) Section 5.5, thermal cycle test: 1000 cycles

(3) Section 5.6, condensation test: 48 cycles

5.4 High Temperature High Humidity Current Application Test

For the high temperature high humidity current application test of CD players, follow Table 6:

Table 6 High Temperature High Humidity Current Application Test

Item	Condition
Ambient temperature (℃)	+85±3
Ambient humidity (% RH)	85±5
Power voltage (V)	16±0.1 (+B, Acc.)
Loading condition	Stop. Turn ill. off to minimize heat. (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Duration (h)	192±2: durability evaluation 1000±4: life evaluation (808 h in addition to durability evaluation)
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check the appearance, functioning and performance within 2 hours. Wipe off any dew before checking. Disassemble the sample to check the inside for any corrosion.

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5.5 Thermal Cycle Test

For the thermal cycle test of CD players, follow TSC7010G. Test under the following two conditions:

(1) Without a disk (without a magazine for a CD changer)

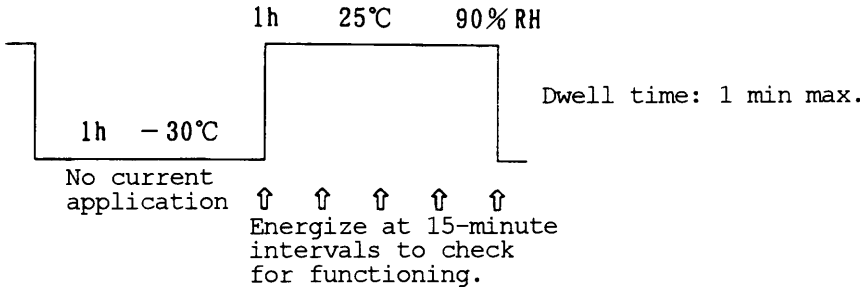
(2) With a disk (with a magazine filled with disks for a CD changer)

After 10 cycles, perform the tape peel test according to Section 5.34.2 (2). Repeat a total of 3000 cycles. Check for functioning and performance during and after the test.

5.6 Condensation Test

Carry out the condensation test of a CD player according to Table 7, after performing 1000 cycles of thermal cycle test according to TSC7010G:

Table 7 Condensation Test

Item	Condition
Sample setting	Same as on the vehicle. (Couple with the connectors, and assemble with the cover and bracket.)
Humidity cabinet	Use a cabinet large enough to accommodate the sample. Set up a windshield around the sample to protect from direct blow.
Test conditions	Perform 3 cycles continuously according to the following schedule:  After each damp phase, condition in an atmosphere of ordinary temperature (25℃) and humidity (50% RH max.) for 1.5 h (may be omitted or reduced depending on the moisture content remaining in the sample).
Check items	While maintaining the sample in the humidity cabinet, energize at 15-minute intervals to check for any malfunctioning in the operations described below. After the test, check for proper functioning and performance under the same conditions as in the damp phase of the test cycle. After conditioning for at least 1 hour in the standard test environment, check for proper functioning and performance within 2 hours. Wipe off any dew before checking.
Operation check procedures	(1) Mode switching cycle: ① tape → ② disk → ③ AM & FM → ④ traffic information (2) Volume change: up & down (3) Tuner operation cycle: ① scan up & down → ② auto-preset → ③ preset channel 3 (4) Tape operations: ① tape insertion and ejection only (playback is excluded from evaluation) (5) Disk operations: ① CD insertion and ejection only (playback is excluded from evaluation) (6) Display: ① voids; ② incomplete letters; ③ faulty illumination

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5.7 Dust Resistance Tests

5.7.1 Dust Exposure Test

For the dust exposure test of CD players, follow Table 8:

Table 8 Dust Exposure Test

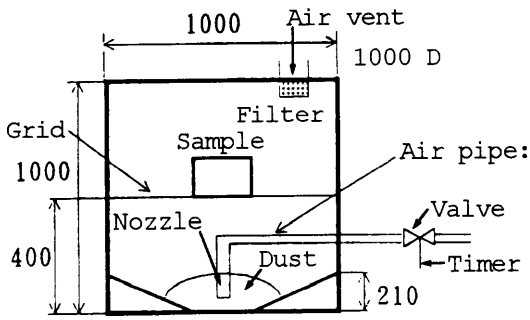
Item	Condition
Setup	Unit: mm  Remark: The inside wall of the cabinet shall be smooth. Blow up the dust for 10 seconds with compressed air at 15-minute intervals.
Duration (h)	6
Dust (kg)	Dust ①: 5 Use the dust as specified in Table 9.
Air pressure (kPa)	294 to 490
Post-test checking	After the test, remove the sample from the cabinet immediately, and brush or wipe off any dust; do not blow or vacuum. Check the appearance, functioning and performance.
Other	Dry and degrease the dust completely before use. Faces of the sample that are completely enclosed to prevent dust invasion while on the vehicle may be covered during the test.

Table 9 Test Dust

	Dust ①	Dust ②
Particle density (g/cm^3)	2.9 to 3.1 (dry density)	2.6 to 2.7 (dry density)
Particle size distribution (%)	5 μm and over: 61±5	45 μm and over: 100
	10 μm and over: 43±3	75 μm and over: 90±3
	20 μm and over: 27±3	106 μm and over: 80±3
	30 μm and over: 15±3	150 μm and over: 65±3
	40 μm and over: 9±3	212 μm and over: 45±3
	75 μm and over: 3 max.	300 μm and over: 0

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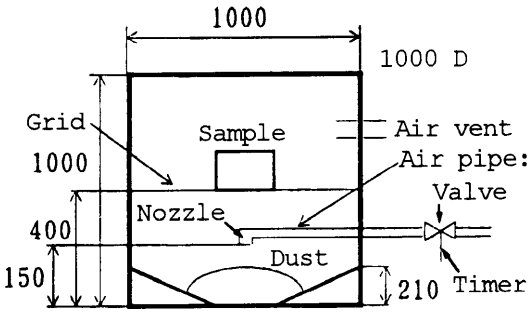
5.7.2 Dust Operation Test

For the dust operation test of CD players, follow Table 10:

Table 10 Dust Operation Test

<table>
<tr><th>Item</th><th>Condition</th></tr>
<tr><td>Setup</td><td>Unit: mm
 

Remark:
The inside wall of the cabinet shall be smooth.</td></tr>
<tr><td>Test cycle</td><td><Cycle schedule>
<table>
<tr><th>Dust</th><th>Operation</th><th>Time</th></tr>
<tr><td>Diffusion</td><td>Stop</td><td>10 s</td></tr>
<tr><td>Pause</td><td>Stop</td><td>30 s</td></tr>
<tr><td>Pause</td><td>Playback</td><td>7 min</td></tr>
<tr><td>Pause</td><td>Ejection(1)</td><td rowspan="2">(30 s)</td></tr>
<tr><td>Pause</td><td>Insertion(1)</td></tr>
<tr><td>Pause</td><td>Playback</td><td>7 min</td></tr>
<tr><td>Pause</td><td>Ejection(1)</td><td rowspan="3">(30 s)</td></tr>
<tr><td>Pause</td><td>Insertion(1)</td></tr>
<tr><td>Pause</td><td>Stop</td></tr>
</table>
Note (1):
Eject or insert a disk (or a magazine for a CD changer).</td></tr>
<tr><td>Loading condition</td><td>No load</td></tr>
<tr><td>Number of cycles</td><td>24</td></tr>
<tr><td>Power voltage (V)</td><td>13.2±0.1</td></tr>
<tr><td>Dust (kg) and air pressure (kPa)</td><td>Test under the following two sets of conditions:
(1) Dust ②: 20; 490 to 588
(2) Dust ①: 5; 294 to 490
Use the dust as specified in Table 9.</td></tr>
<tr><td>Post-test checking</td><td>After the test, check for functioning and performance.</td></tr>
<tr><td>Other</td><td>Dry and degrease the dust completely before use. Faces of the sample that are completely enclosed to prevent dust invasion while on the vehicle may be covered during the test. This test is not applicable to products shipped to the following destinations:
Condition (1): Japan, Europe, U.S.A. and Canada
Condition (2): Japan and Europe</td></tr>
</table>

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5.7.3 Switch Dust Resistance Test

For the switch dust resistance test of CD players, follow Table 11:

Table 11 Switch Dust Resistance Test

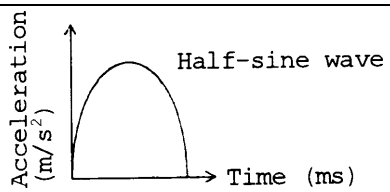
Item	Condition
Setup	Same as in Table 8. Cover the sample with a dustproof sheet except for the escutcheon.
Test cycle	<Cycle schedule> Dust: Diffusion — Operation: None — Time: 10 s Dust: Pause — Operation: None — Time: 15 s Dust: Pause — Operation: Switching — Time: 1 s per switch
Loading condition	No load
Number of cycles	20000
Dust (kg)	Dust ①: 5 Use the dust as specified in Table 9.
Air pressure (kPa)	294 to 490
Post-test checking	After the test, check for functioning and performance.
Other	Dry and degrease the dust completely before use. This test is not applicable to products shipped to Japan, Europe, U.S.A. and Canada.

5.8 Impact Tests

5.8.1 Unpackaged Impact Test

For the unpackaged impact test of CD players, follow Table 12:

Table 12 Unpackaged Impact Test

Item	Condition
Acceleration of impact (m/s^2)	392 ± 39.2
Duration of impact (ms)	11
Waveform of impact (excluding bounce)	
Direction of impact	Up, down, front, back, right and left
Number of impacts	2 per direction
Loading condition	No load, no current application
Post-test checking	After the test, check the appearance, functioning and performance.
Other	In drop testing, ignore the bounce pulses that may follow the desired impact waveform.

5.8.2 Packaged Drop Impact Test

Carry out the packaged drop impact test of a CD player as follows:
Allow the sample to drop twice on each of its corners, edges and faces from a height of 50 cm onto a concrete floor. The sample may be repackaged between drops. After the test, check the appearance, functioning and performance.

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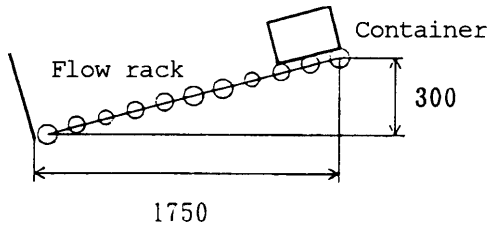
5.8.3 Container Free Fall Impact Test

Carry out the container free fall impact test of a CD player as follows: Allow the container to drop twice on its bottom from a height of 50 cm onto a concrete floor. After the test, check the appearance, functioning and performance.

5.8.4 Container Flow Rack Impact Test

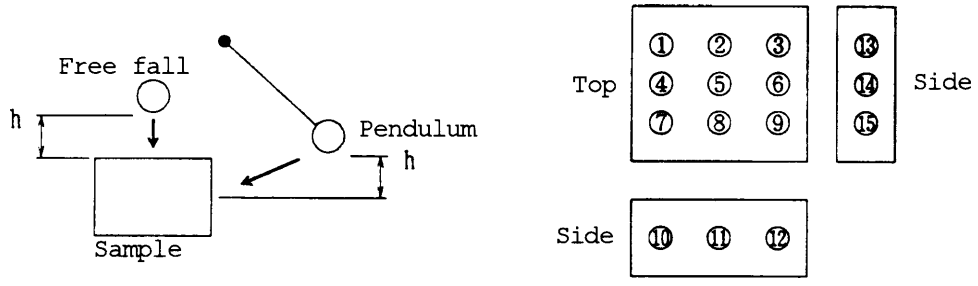
Carry out the container flow rack impact test of a CD player as follows: Allow the container to drop twice each on its sides from the top of a flow rack 300 mm in height and 1750 mm in length. Sides of the container that are not subject to impact during transport before installation may be excluded from testing. After the test, check the appearance, functioning and performance.

Unit: mm



5.8.5 Drop Weight Impact Test (1)

Carry out the drop weight impact test (1) of a CD player as follows: Allow a steel weight 50.8 mm in diameter and 536 g in mass to drop on the sample either by free fall or by pendulum, while changing the height from 100 cm to 190 cm in 10 cm increments. After the test, check for displacement and proper functioning. Impact nine points on the top and three points each on the sides, as shown in the figure. Faces of the sample that are not hit by luggage, etc., while on the vehicle may be excluded from testing.



5.8.6 Drop Weight Impact Test (2)

Carry out the drop weight impact test (2) of a CD player as follows: Allow a round iron plate 230 mm in diameter and 10 kg in mass to drop on the sample, while changing the height from 10 cm to 30 cm in 10 cm increments. After the test, check for displacement and proper functioning. Impact the top of the sample only. If the top of the sample is not hit by luggage, etc., while on the vehicle, this test may be omitted.

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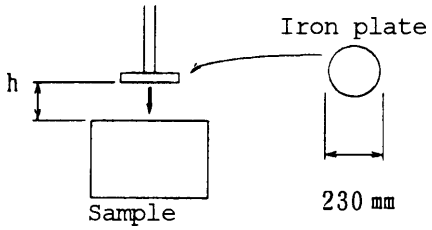

5.9 Operation Durability Tests

5.9.1 Room Temperature Operation Durability Test

For the room temperature operation durability test of CD players, follow Table 13:

Table 13 Room Temperature Operation Durability Test

Item	Condition
Ambient temperature (℃)	5 to 35 (room temperature)
Power voltage (V)	14.4±0.1
Loading condition	Applicable load
Operation	<Cycle schedule (1 h)> Operation: Playback — Time: 59 min Operation: Ejection(2) / Insertion(2) — Time: (1 min) Test under the following two conditions: (1) Switch ill. on and off at 4-hour intervals. (2) Keep ill. on throughout the test: bulb durability test
Duration (h)	1500±4: performance evaluation 5000±4: functioning evaluation (3500 h in addition to performance evaluation)
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check for functioning and performance. Disassemble the sample to check the inside. Check the disk for any damages.

Note (2):
Eject or insert a disk (or a magazine for a CD changer).

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5.9.2 High Temperature Operation Test (1)

For the high temperature operation test (1) of CD players, follow Table 14:

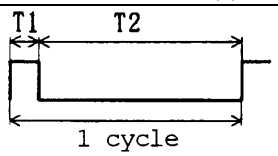
Table 14 High Temperature Operation Test (1)

Item	Condition
Ambient temperature (℃)	65±3
Power voltage (V)	16.0±0.1
Loading condition	Applicable load
Operation	Continuous playback. Switch ill. on and off at 4-hour intervals.
Duration (h)	192±2
Post-test checking	After conditioning for at least 2 hours in the standard test environment, check for functioning and performance. Disassemble the sample to check the inside. Check the disk for any damages.
Other	Set up a windshield around the sample to protect from direct blow. If playback is stopped automatically by the temperature sensing mechanism, lower the test temperature to enable continuous playback, and report the change.

5.9.3 High Temperature Operation Test (2)

For the high temperature operation test (2) of CD players, follow Table 15:

Table 15 High Temperature Operation Test (2)

Item	Condition
Ambient temperature (℃)	85±3
Power voltage (V)	16.0±0.1
Number of cycles	450
Loading condition	Applicable load
Operation cycle	 T1 = 6 min: playback T2 = 54 min: stop ill. off
Check items	Check for burning and smoking during the test. After conditioning for at least 2 hours in the standard test environment, check for functioning and performance.
Other	Even if the sample fails to work under the test conditions, follow the above cycle. Time *T2* may be reduced depending on the heat capacity of the sample (to a minimum of 0 minute).

5.9.4 Low Temperature Operation Test (1)

For the low temperature operation test (1) of CD players, follow Table 16:

Table 16 Low Temperature Operation Test (1)

Item	Condition
Ambient temperature (℃)	-20±3
Power voltage (V)	10.5±0.1
Loading condition	Applicable load, minimum volume
Other	For other conditions, follow Table 14.

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5.9.5 Low Temperature Operation Test (2)

For the low temperature operation test (2) of CD players, follow Table 17:

Table 17 Low Temperature Operation Test (2)

Item	Condition
Ambient temperature (℃)	-40±3
Power voltage (V)	10.5±0.1
Loading condition	Applicable load, minimum volume, ill. off
Other	For other conditions, follow Table 15.

5.9.6 High Temperature High Humidity Operation Test

For the high temperature high humidity operation test of CD players, follow Table 18:

Table 18 High Temperature High Humidity Operation Test

Item	Condition
Ambient temperature (℃)	65±3
Ambient humidity (% RH)	85±5
Power voltage (V)	14.4±0.1
Loading condition	Applicable load Switch ill. on and off at 4-hour intervals.
Operation	See "Note (3)."
Duration (h)	192±2
Post-test checking	After the test, check for functioning under the test conditions. Then, after conditioning for at least 1 hour in the standard test environment, check the performance within 2 hours. Wipe off any dew before checking. Disassemble the sample to check the inside. Check the disk for any damages.
Other	If playback is stopped automatically by the temperature sensing mechanism, lower the test temperature to enable continuous playback, and report the change.

Note (3):
See below for the operation cycles:

CD Player with Single Tray (90 s: 1 cycle)

Step	Operation (time in seconds)	Mode	Mode time (s)
1	Insert a disk (1).	Playback	15
2	Press the track ↑ button (3).	Forward search and playback	5
3	Press the fast ↑ button (5).	Fast forward	3
4	Press the fast ↓ button (5).	Fast backward	3
5	Press the track ↓ button (3).	Backward search and playback	5
6	Press the power button (0.5).	Stop	3
7	Press the CD button (0.5).	Playback	12
8	Press the scan button (0.5).	Pickup scan	15
9	Press the eject button (0.5).	Ejection	10

Remark:
If continuously pressing the track ↑ or ↓ button does not invoke repetitive search, press it for 0.5 s three times at 0.5 s intervals.

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CD Player with Multiple Trays (114 to 122 s: 1 cycle)

Step	Operation (time in seconds)	Mode	Mode time (s)
1	Press the disk load button (0.5).	Playback	15
2	Press the track ↑ button (3).	Playback	5
3	Press the fast ↑ button (5).	Fast forward	3
4	Press the fast ↓ button (5).	Fast backward	3
5	Press the track ↓ button (3).	Playback	5
6	Press the power button (0.5).	Stop	3
7	Press the CD button (0.5).	Playback	12
8	Press the scan button (0.5).	Pickup scan	15
9	Press the disk ↑ button 2 times (2.0).	Disk selection and playback	15
10	Press the disk ↓ button (0.5).	Disk selection and playback	15
11	Press the eject button (0.5).	Ejection	2 to 10

Remark:
If continuously pressing the track ↑ or ↓ button does not invoke repetitive search, press it for 0.5 s three times at 0.5 s intervals.

CD Player with CD Changer (644 s: 4 cycles of disk operation and 1 cycle of magazine insertion and ejection)

Step	Operation (time in seconds)	Mode	Mode time (s)
1	Insert the magazine (2).		
2	Close the lid (2).	Disk loading	
3	Press the CD button (0.5).	Playback	30
4	Press the power button (0.5).	Stop	5
5	Press the CD button (0.5).	Playback	5
6	Press the track ↑ button (3).	Forward search and playback	5
7	Press the fast ↑ button (5).	Fast forward	3
8	Press the fast ↓ button (5).	Fast backward	3
9	Press the RPT button (0.5).	Repeat playback	15
10	Press the track ↓ button (3).	Backward search and playback	5
11	Press the disk ↑ button (0.5).	Disk selection and playback	5
12	Press the D-scan button (0.5).	Pickup scan and playback	55
13	Press the disk ↓ button (0.5).	Disk selection and playback	5
14	Repeat steps 3 through 11 three times.		
15	Open the lid (2).		
16	Press the eject button (1).	Ejection	15

Remark:
Load the magazine with four test disks, and fill other trays with transparent dummy disks.
Example: In a CD changer with n trays, load the 1st, (1 + n/3)th, (n - n/3)th and n-th trays with test disks.
If continuously pressing the track ↑ or ↓ button does not invoke repetitive search, press it for 0.5 s three times at 0.5 s intervals.

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5.10 Vibration Durability Tests

5.10.1 Resonance Point Detection Test

Change the vibration frequency according to Table 19 to find the resonance point of the bracket:

Table 19 Resonance Point Detection Test

Item	Condition
Frequency (Hz)	10 to 200
Sweep cycle (min)	20 min. (linear sweep)
Acceleration of vibration (m/s^2)	9.8
Direction of vibration	Vertical, fore-and-aft and lateral (as on the vehicle)
Sample setting	Set on the tester using the applicable bracket and a fixture that closely reproduces the vehicle's rigidity.
Check item	Find the resonance point on the recorded acceleration waveform.

5.10.2 Resonance Vibration Durability Test

This test is applicable only when a resonance point was found in the bracket as tested in Section 5.10.1, "Resonance Point Detection Test." See Table 20 for the test conditions:

Table 20 Resonance Vibration Durability Test

Item	Condition
Frequency (Hz)	$\pm$3 of resonance frequency
Sweep cycle (s)	12 (linear sweep)
Acceleration of vibration	Depends on resonance frequency (see Table 21).
Number of vibrations	1×10^7 (calculated from resonance frequency and duration)
Direction of vibration	Vertical, fore-and-aft and lateral (as on the vehicle)
Sample setting	Same as in Section 5.10.1, "Resonance Point Detection Test."
Post-test checking	Check the appearance of the bracket.
Other	When the sample has several resonance points, test at one where the acceleration waveform is the most prominent. If the test equipment allows automatic searching of the resonance point, sweeping is not necessary. In this case, change the number of vibrations to 2×10^6.

Table 21 Acceleration of Vibration

Position of installation	Resonance frequency (Hz)	Acceleration of vibration (m/s^2)		
		Vertical	Lateral	Fore-and-aft
Passenger compartment	10 and over to 30 excl.	29.4	29.4	22.5
	30 and over to 50 excl.	14.7	15.7	10.8
	50 and over to 80 excl.	5.88	6.86	4.31
	80 and over to 200	2.65	2.84	1.86
Luggage compartment	10 and over to 30 excl.	29.4	29.4	29.4
	30 and over to 50 excl.	25.5	15.7	19.6
	50 and over to 80 excl.	11.8	6.86	8.33
	80 and over to 200	4.9	2.84	3.43

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5.10.3 Sweep Vibration Durability Test

For the sweep vibration durability test of CD players, follow Table 22:

Table 22 Sweep Vibration Durability Test

Item	Condition
Loading condition	No load, no current application (1) Without a disk (without a magazine for a CD changer) (2) With a disk (with a magazine filled with disks for a CD changer)
Frequency (Hz)	10 to 200
Sweep cycle (min)	15 (logarithmic sweep)
Acceleration of vibration	Depends on resonance frequency (see Table 21).
Number of sweep cycles	175 per direction
Direction of vibration	Vertical, fore-and-aft and lateral (as on the vehicle)
Sample setting	Same as in Section 5.10.1, "Resonance Point Detection Test."
Post-test checking	After the test, check the appearance, functioning and performance. Disassemble the sample to check the inside. Check the disk for any damages.

5.11 Switching Durability Test

For the switching durability test of CD players, follow Table 23:

Table 23 Switching Durability Test

Item	Condition
Power voltage (V)	14.4 ± 0.1
Loading condition	Applicable load
Operation	Follow the sequence shown in "Note (3)." Operate all the switches. (Turn ill. on and off also.)
Operating force (N)	Power button: 9.8 Other buttons: 4.9 Disk: 29.4
Force application point	Most fragile point in consideration of the design. If there is no specific point that is fragile, apply force to the center.
Stroke	Full stroke
Number of disk operation cycles	20000
Post-test checking	After the test, check for functioning and performance. Disassemble the sample to check the inside. Check the disk for any damages.

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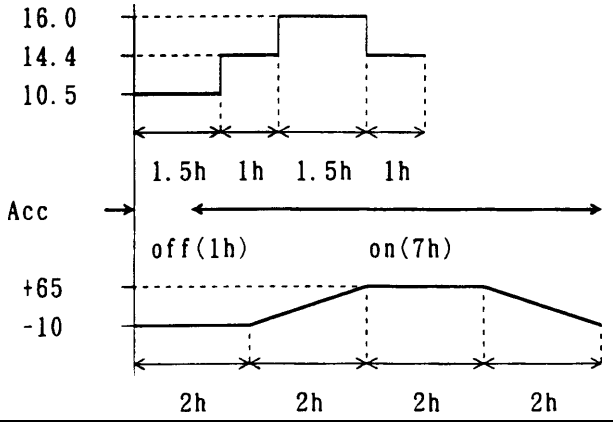
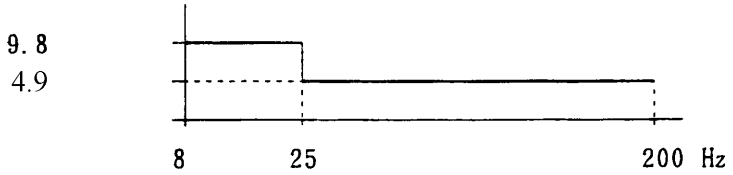
5.12 Combined Stress Test

For the combined stress test of CD players, follow Table 24:

Table 24 Combined Stress Test

Item	Condition
Power voltage (V) and ambient temperature (℃)	
Acceleration of vibration (m/s²)	Vertical vibration 
Sweep cycle (s)	360 (linear sweep)
Loading condition	Applicable load, ill. off
Operation	See "Note (3)."
Operating force (N)	Power button: 9.8 Other buttons: 4.9 Disk: 29.4
Force application point	Most fragile point in consideration of the design. If there is no specific point that is fragile, apply force to the center.
Stroke	Full stroke
Number of disk operation cycles	11000 (Stop while Acc. is off.)
Post-test checking	After the test, check for functioning and performance. Disassemble the sample to check the inside. Check the disk for any damages.
Other	If playback is stopped automatically by the temperature sensing mechanism during testing at +65℃, lower the test temperature to enable testing, and report the change.

5.13 Power Voltage Fluctuation Test

5.13.1 Preparation

The following time and voltage conditions are given as examples; the actual test conditions should be determined based on the design specifications for reset voltage and timing, which will be available at the Design Review after the entire configuration of the audio system has been finalized. The following tables give complete lists of test settings, from which necessary ones are to selected as agreed at the Design Review.

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5.13.2 Test Configuration

For the master equipment to be connected, which depends on system configuration, discuss with the relevant parties.

(1) When testing master equipment for AVC-LAN (audio head unit)

- All compatible slave equipment -- e.g., MD changer, CD changer (choose most common model available at the time of shipment), control panel, remote controller, steering switch, instrument panel ECU, gateway ECU, etc.

(2) When testing slave equipment for AVC-LAN (audio head unit, CD changer, etc.)

- Master equipment (display, audio head unit, single-DIN TV set, etc.)
- All slave equipment which can show the status of the product to be tested (control panel, etc.)
- All slave equipment which can control the equipment to be tested (remote controller, steering switch, etc.)

5.13.3 Criteria (not applicable to evaluation for persistent fluctuation)

(1) Sound from speakers (final evaluation should be based on on-vehicle aural testing)

① No clicks. In order to be able to detect mute failure, test at an output voltage of 700 mV (peak-to-peak) with the volume set at maximum and a 4 Ω dummy load or speaker connected. Criterion for clicks is to be specified elsewhere.

② No interruption.

(2) Display

① No instability in display (no visible variation such as synchronization error, brightness variation, or distortion).

② No change in display status or operation mode due to voltage fluctuation.

(3) Sound and display mode

① No change in sound and display mode due to voltage fluctuation ("last mode preservation").

(4) Memory

① No loss of backup data to be protected against Acc. shutdown.

② No loss of backup data to be protected against +B shutdown.

③ No loss of audio head unit memory (auto-preset, balance, volume, etc.) within 5 seconds after holding voltage is shut down.

(5) Dark current (not applicable to systems powered via the Acc. line)

① No deviation in dark current from design specification while Acc. is off after voltage fluctuation.

(6) Lock

① No lock that may hamper normal operation after power is restored.

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5.13.4 Test Conditions and Voltage Waveforms

(1) Number of tests

① Evaluate for all sound sources and display modes with all waveforms.

② Repeat the following number of tests per source and mode:

- Master equipment: 1
- Slave equipment: 5

③ Test at ambient temperatures of -20℃ and 25℃ (room temperature).

(2) Cranking -- waveform at normal cranking

[Objective]

Checking for any defect due to a glitch or outage during and after initialization

Select test durations and voltages based on the following design specifications:

*T*1: initialization time

*T*2: anti-chattering time

*V*a: shutdown detection voltage for +B or Acc.

[Test conditions]

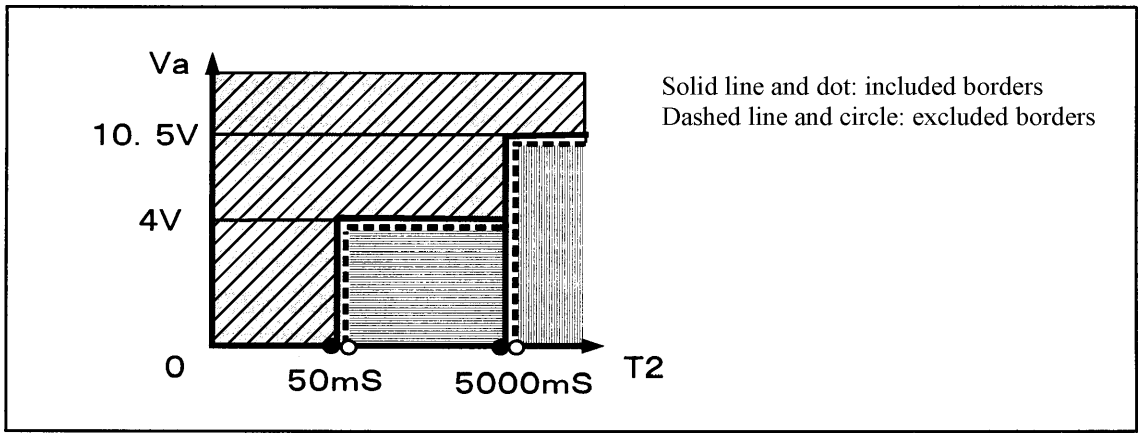
Combinations of selected values for *T*1, *T*2 and *V*a

[Criteria (specified for *T*2 and *V*a)]

Obliquely hatched area in the figure: (1) ①, (2) ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①

Horizontally hatched area in the figure: (1) ①, (4) ② & ③, (5) ① and (6) ①

Vertically hatched area in the figure: (1) ①, (4) ②, (5) ① and (6) ①



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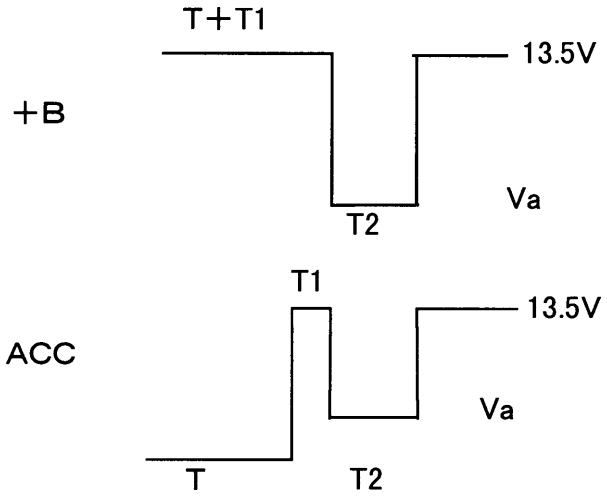

Fig. 2 Voltage Waveforms 4-1

Table 25 Settings for *T*1, *T*2 and *V*a

T1[ms]	T2[ms]	Va[v]
T1a	T2a	Vaa
T1b	T2b	Vab
T1c	T2c	Vac
T1d	T2d	
T1e		

T: any necessary time for power supply to stabilize
*T*1a: time before reset IC completes initialization
*T*1b thru *T*1d: times before internal ICs complete initialization
*T*1e: time before handshaking is completed (= 1760 ms)
*T*2a = anti-glitch time for +B
*T*2b = +B shutdown time + memory backup time
*T*2c: anti-glitch time for Acc.
*T*2d: Acc. shutdown time + memory backup time
*V*aa: shutdown detection voltage for Acc.
*V*ab: shutdown detection voltage for +B
*V*ac = 4 V

(3) Cranking -- pulsation waveform at momentary cranking

[Objective]

Checking for any defect due to pulsation around the IC reset voltage caused by momentary cranking

Select test durations and voltages based on the following design specifications:

*T*1: initialization time
*T*2: period of pulsation cycle by momentary cranking
*V*1: shutdown detection voltage for +B or Acc.
*V*2: on/off differential voltage for +B or Acc.

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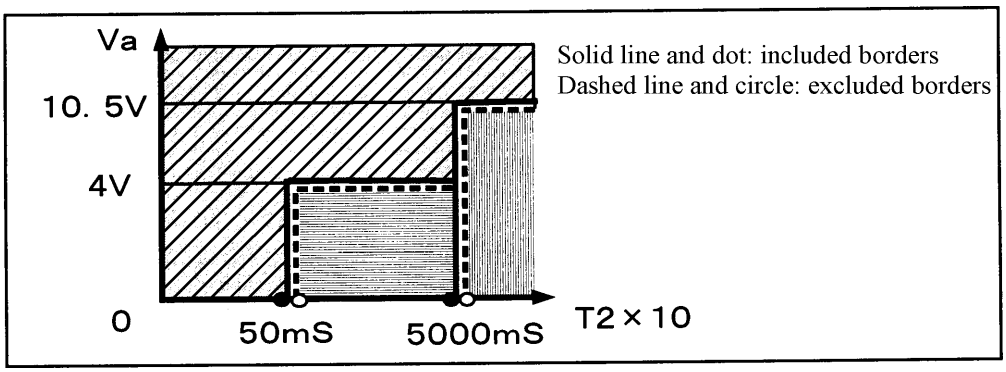
[Test conditions]
Combinations of selected values for *T*1, *T*2, *V*1 and *V*2
[Criteria (specified for *T*2 × 10 and *V*1)]
Obliquely hatched area in the figure: (1) ①, (2) ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①
Horizontally hatched area in the figure: (1) ①, (4) ② & ③, (5) ① and (6) ①
Vertically hatched area in the figure: (1) ①, (4) ②, (5) ① and (6) ①



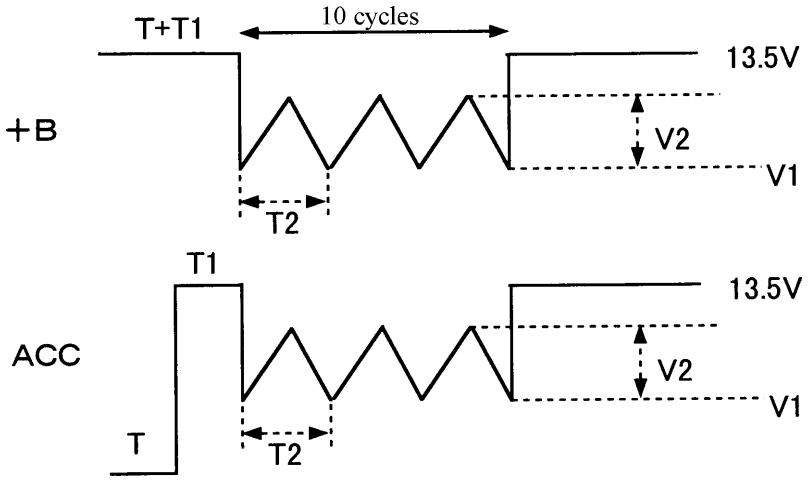


Fig. 3 Voltage Waveforms 4-2

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Table 26 Settings for *T*1, *T*2, *V*1 and *V*2

T1[ms]	T2[ms]	V1[v]	V2[v]
T1a	T2a	V1a	V2a
T1b	T2b	V1b	

T: any necessary time for power supply to stabilize
*T*1a: time before reset microcomputer (or most quickly initialized microcomputer) completes initialization
*T*1b: time before entire initialization is completed
*T*2a = 100 ms
*T*2b = 500 ms
*V*1a = Acc. reset voltage - 0.5 V
*V*1b = +B reset voltage - 0.5 V
*V*2a = 1 V

(4) Cranking -- waveform at repetitive momentary cranking

[Objective]

Checking for any defect due to repetitive cranking
Select test durations and voltages based on the following design specifications:
*T*1: initialization time
*T*2: anti-chattering time

[Test conditions]

Combinations of selected values for *T*1 and *T*2

[Criteria]

When *T*2 ≦ 500 ms: (1) ①, (2) ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①
When *T*2 > 500 ms: (1) ①, (4) ② and ③, (5) ① and (6) ①

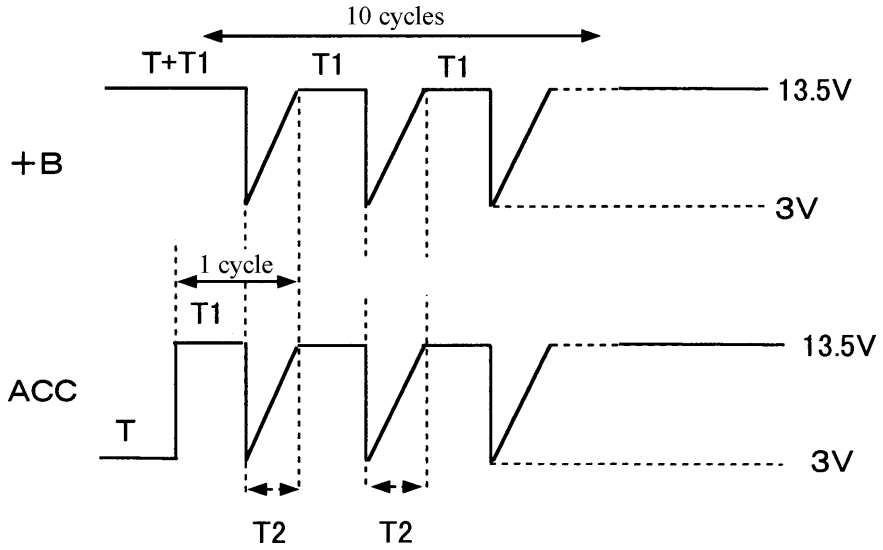

Fig. 4 Voltage Waveforms 4-3

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Table 27 Settings for *T*1 and *T*2

T1[ms]	T2[ms]
T1a	T2a
T1b	T2b

T: any necessary time for power supply to stabilize
*T*1a: time before reset microcomputer (or most quickly initialized microcomputer) completes initialization
*T*1b: time before entire initialization is completed
*T*2a: anti-chattering time for Acc.
*T*2b: anti-chattering time for Acc. × 2

(5) Battery replacement

① Chattering waveform at normal battery replacement

[Objective]

Checking for any defect due to chattering at normal battery replacement

[Test conditions]

Voltage: Follow Fig. 5 ①.
Time: See Table 28 ①.
Number of cycles: 10

[Criteria]

(1) ①, (4) ②, (5) ① and (6) ①

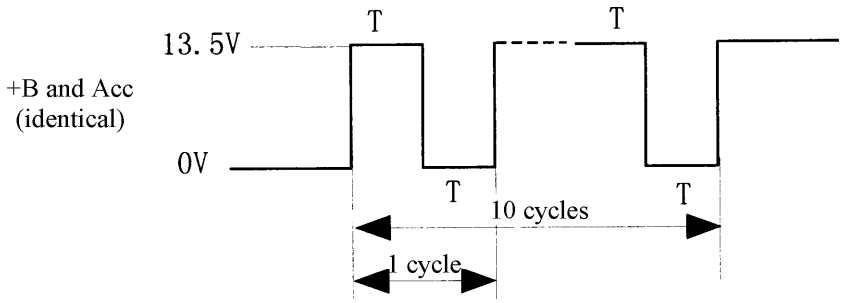

Fig. 5 ① Voltage Waveform 4-3 ①

Table 28 ① Settings for *T*

T[ms]
T=5
T=10
T=100

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② Chattering waveform at battery replacement with Acc. on

[Objective]

Checking for any defect due to battery replacement with Acc. on (or at start using an external power supply)

[Test conditions]

Voltage: See Fig. 5 ②.

Time: See Table 28 ②.

[Criteria]

(1) ②, (4) ②, (5) ① and (6) ①

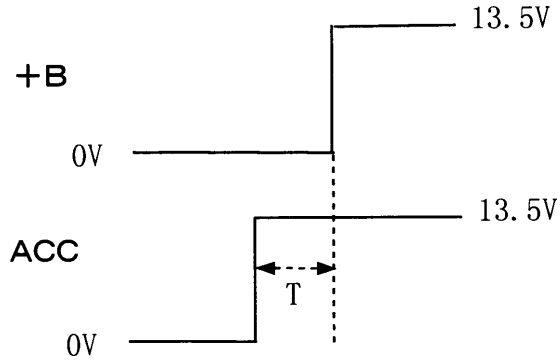

Fig. 5 ② Voltage Waveform 4-3 ②

Table 28 ② Settings for *T*

T[ms]
T=10
T=100

(6) Battery exhaustion

① Waveform at battery exhaustion

[Objective]

Checking for any defect in the AVN system due to battery exhaustion

[Test conditions]

Combinations of *T*1, *T*2, *V*1 and *V*2

[Criteria]

(1) ①, (4) ②, (5) ① and (6) ①

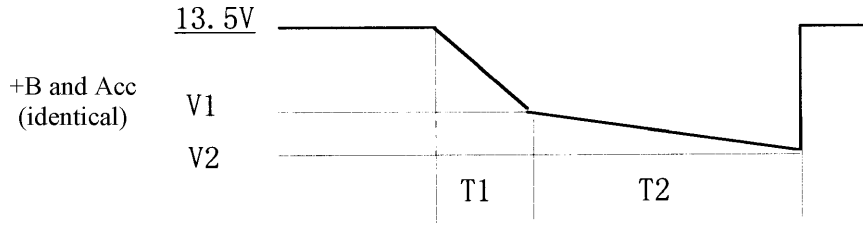

Fig. 6 ① Voltage Waveform 4-4 ①

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Table 29 ① Settings for *T*1, *T*2, *V*1 and *V*2

T1[s]	T2[s]	V1[v]	V2[v]
T1=40	T2=200	V1=6	V2=3

② Waveform at battery exhaustion followed by unloaded recovery

[Objective]

Checking for any defect while voltage gradually recovers as loads are reduced (such as by releasing the brake or turning off ignition) after battery is exhausted. In some previous cases, reset circuits did not work depending on their configurations when voltage recovery was slow.

[Test conditions]

See Fig. 6 ②.

[Criteria]

(1) ①, (4) ②, (5) ① and (6) ①

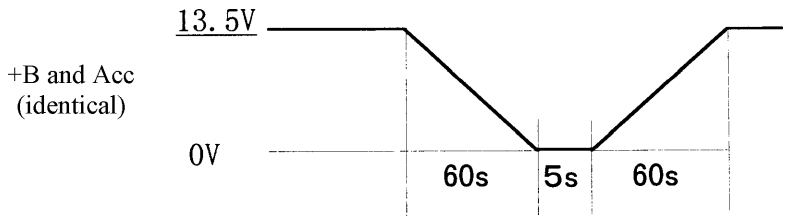

Fig. 6 ② Voltage Waveform 4-4 ②

(7) Contact interruption and load variation

① Waveform at contact interruption

[Objective]

Checking for any abnormality in the AVN system due to a glitch caused by contact failure in a connector or relay.

[Test conditions]

Combinations of selected values for *T*1 and *V*1

[Criteria (specified for *T*1 and *V*1)]

Obliquely hatched area in the figure: (1) ①, (2) ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①

Horizontally hatched area in the figure: (1) ①, (4) ② & ③, (5) ① and (6) ①

Vertically hatched area in the figure: (1) ①, (4) ②, (5) ① and (6) ①

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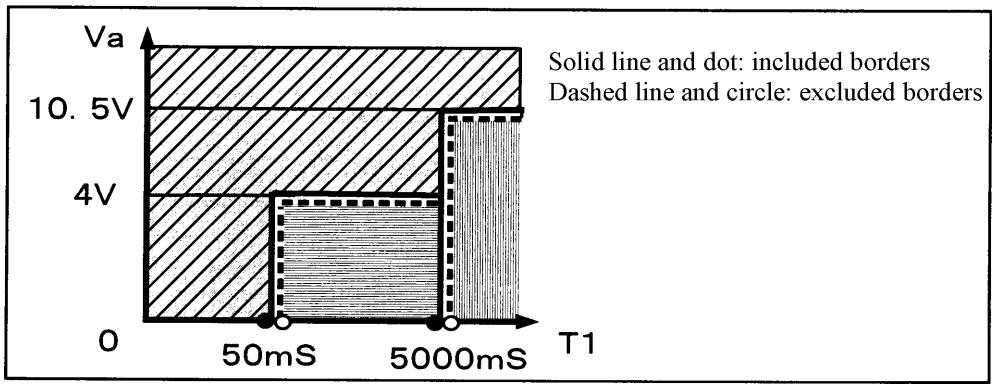

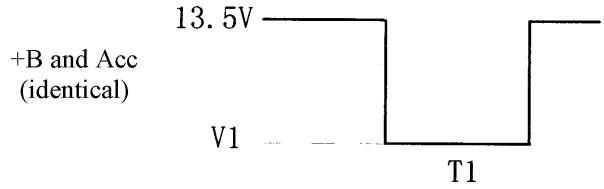

Fig. 7 ① Voltage Waveforms 4-5 ①

Table 30 ① Settings for *T*1 and *V*1

T1[ms]	V1[V]
T1a	V1a
T1b	V1=4

*T*1a: anti-chattering time for +B
*T*1b: anti-chattering time for Acc.
*V*1a: shutdown detection voltage for +B and Acc.

② Waveform at load variation

[Objective]

Checking for any fluctuation in display or sound due to load variation as the windshield wiper or blower is operated.

[Test conditions]

Selected values for *T*1
Number of cycles: 10

[Criteria]

(1) ① &②, (2) ① & ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①

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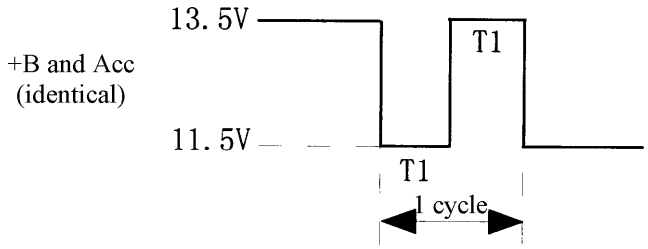

Fig. 7 ② Voltage Waveforms 4-6 ②

Table 30 ② Settings for *T*1

T1[ms]
T1=100
T1=1000

(8) Ignition switch chattering -- asynchronous onsets of +B and Acc.

[Objective]

Checking for any defect in the AVN system due to asynchronous onsets of +B and Acc., which is an inherent behavior of the mechanical contacts in the ignition switch.

[Test conditions A]

Combinations of *T*1 and *T*2

[Criteria]

(1) ①, (2) ②, (3) ①, (4) ①, ② & ③, (5) ① and (6) ①

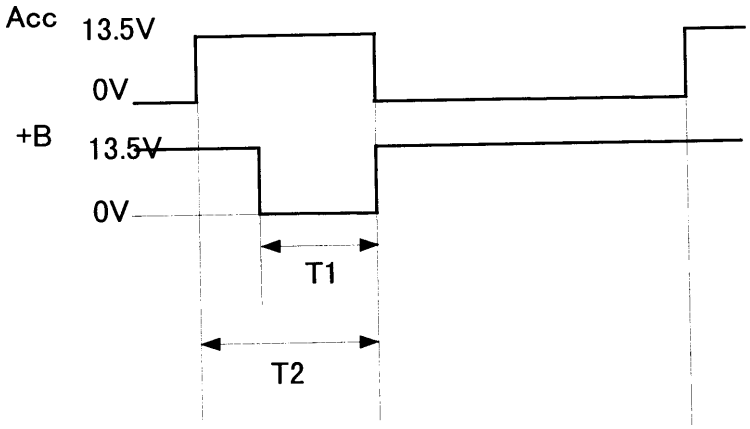

Fig. 8 Voltage Waveform 4-6

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Table 31 Settings for *T*1 and *T*2

T1[ms]	T2[ms]
T1=50	T2a
	T2b
	T2c
	T2d
	T2e

*T*1a: time before reset IC completes initialization
*T*1b thru *T*1d: times before internal ICs complete initialization
*T*1e: time before handshaking is completed (= 1760 ms)

(9) Persistent fluctuation

① Objective

Checking for any essential defect due to continual cranking

② Test conditions

Number of cycles: 10^5 min.
Input voltage: Use the waveforms as shown in Fig. 9. Superposition of other waveforms is optional.
*T*1: up to initialization time (minimum setting is arbitrary)
*T*2: 0 to any time (0 is mandatory)
*T*3: 0 to any time (0 is mandatory)
where,
*T*2 + *T*2 ≦ 5000 ms
Increase in small steps until *T*2 + *T*2 ≦ 1000 ms, and in large steps thereafter.
*V*1 = 13.5 to 8.5 V
*V*2 = 8.5 to 4 V
*T*s1: time before initialization is completed
*T*s2: time before standby process is completed

③ Criteria

(a) No blackout or whiteout.
(b) No sound loss.
(c) Dark current complying with design specification.
Evaluation point (see Fig. 9)
(a) & (B): ※1
(c): ※2

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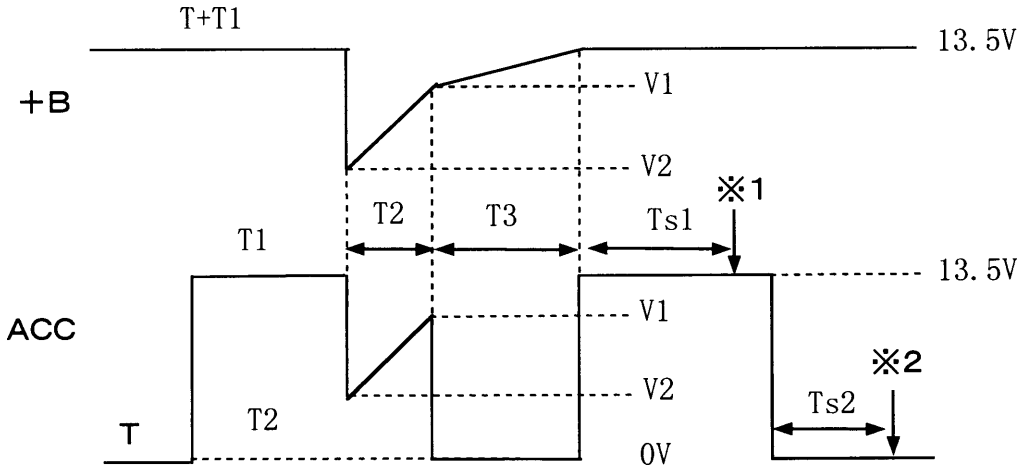

Fig. 9 Voltage Waveforms 5-1

T: any necessary time for power supply to stabilize
[Following are recommended settings for 10^5-cycle test.]
*T*1 = 60 to 3000 ms (50 settings in 60 ms steps)
*V*2 = 3 to 10 V, *V*1 = (13.5 V + *V*2)/2
(10 settings for *V*2 in 0.7 V steps)
*T*2 = 0 to 95 ms (20 settings in 5 ms steps)
*T*3 = 0 to 900 ms (10 settings in 100 ms steps)

5.14 Floating Ground Test

For the floating ground test of CD players, follow the specification below:

(1) Test equipment

For this test, use the test circuit as shown in Fig. 10. Use a fully charged battery, and a reactor with a DC resistance of $R = 0.05 \pm 0.001\ \Omega$ and an impedance of $|Z| = |R + j\omega L| = 1.3 \pm 0.1\ \Omega$ (frequency: 2.5 MHz) as a dummy ground. If the system is grounded via several wiring harnesses, test with all the combinations of harness grounding, i.e., each harness grounded either directly or via the reactor. Use two electric horns of part number 86510-30210 or 86510-33080, and connect them reversely in parallel. Use two headlamps each of part numbers 90981-13015 and 90981-13017 (230 W in total). Choose the windshield wiper with the greatest torque of those intended for use with the sample. Lock it when testing.

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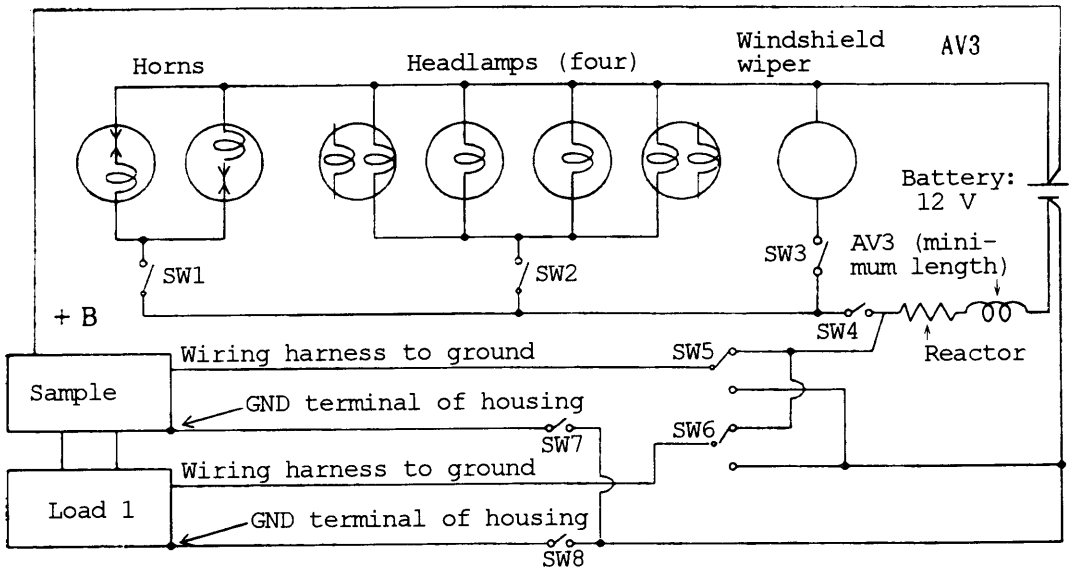

Fig. 10 Floating Ground Test Circuit (example)

Remark:
Fig. 10 shows an example for a system grounded via two wiring harnesses. Ground the housings (SW7 and SW8) using the same method as on the vehicle. In the above example, test under the following three conditions:
(1) Both SW5 and SW6 are grounded via reactor.
(2) Only SW5 is grounded via reactor.
(3) Only SW6 is grounded via reactor.
Connect the sample as shown in Table 32 depending on its configuration with the amplifier:

Table 32

Amplifier	Sample	Load 1	Load 2	...	Load *N*
Integrated with CD player	CD player	Speakers	External switches	...	
Separate from CD player	Amplifier	CD player	Speakers	...	

(2) Test method
In the stop and each working mode (playback, fast forward, fast backward, etc.), turn SW4 on and off and maintain the positions for at least 5 seconds to check for any abnormalities under seven conditions -- with SW1, SW2 and/or SW3 on. Repeat ten times. When the battery voltage has dropped to 11.0 V or less, interrupt the test to charge the battery.

Established/ 3 Revised:
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5.15 Electromagnetic Coupling Noise Test

For the electromagnetic coupling noise test of CD players, follow the specification below:

(1) Test equipment

For this test, use the test circuit as shown in Fig. 11. Tape the following wires together into a 10 m wiring harness:

- Power line of noise generating load
- Noise emitting wire
- Wires connecting the sample and the load

Use 3 sq. wires for the power line, and 0.5 sq. ones for other connections. For the use of shielded or twisted-wire cables, follow the vehicle specifications. In the 10 m taped harness, center the wires connected to the noise generating load as far as practicable. Connect the sample as shown in Table 33 depending on its configuration with the amplifier:

Table 33

Amplifier	Samples	Loads
Integrated with CD player	CD player	Speakers External switches
Separate from CD player	Amplifier Eternal switches	CD player Speakers

Use a fully charged battery. Use two electric horns of part number 86510-30210 or 86510-33080, and connect them reversely in parallel. Use two headlamps each of part numbers 90981-13015 and 90981-13017 (230 W in total). Choose the windshield wiper with the greatest torque of those intended for use with the sample. Lock it when testing. Use a coil assembly with igniter of part number 19070-26290 or 19070-52030, or Type Ⅲ or equivalent, and adjust the three-electrode gap so that the discharge voltage is 22.5±5.0 kV. Fig. 12 shows the output waveform of the oscillator.

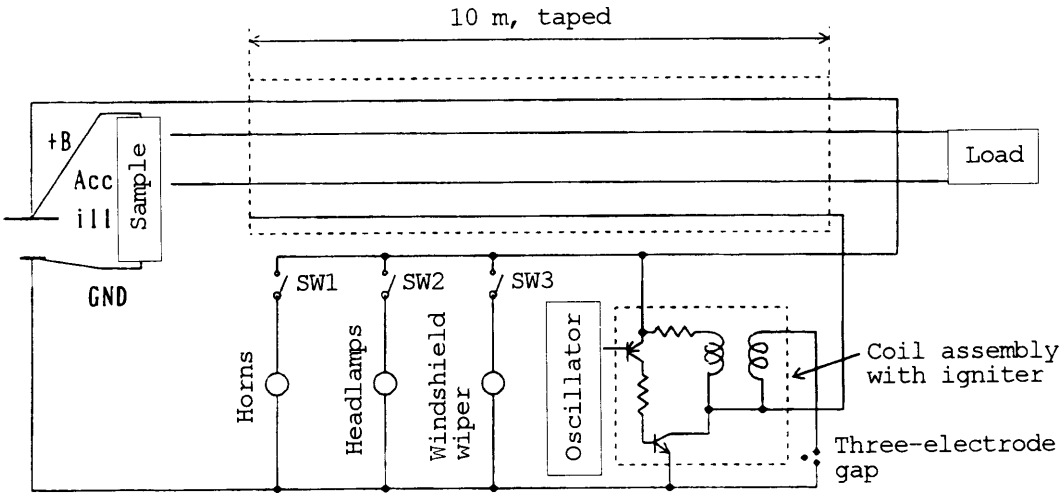

Fig. 11 Electromagnetic Coupling Noise Test Circuit

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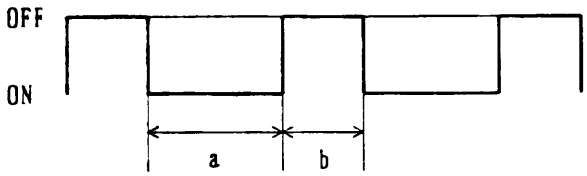

Part number of igniter	a (ms)	b (ms)
19070-26290	20	10
19070-52030	25	5

Fig. 12 Oscillator Output Waveform

(2) Test method

In the stop and each working mode (playback, fast forward, fast backward, etc.), turn SW1, SW2 and SW3 shown in Fig. 11 on and off and maintain the positions for at least 5 seconds to check for any abnormalities. Repeat at least ten times. When the battery voltage has dropped to 11.0 V or less, interrupt the test to charge the battery.

Established/ 3 Revised:
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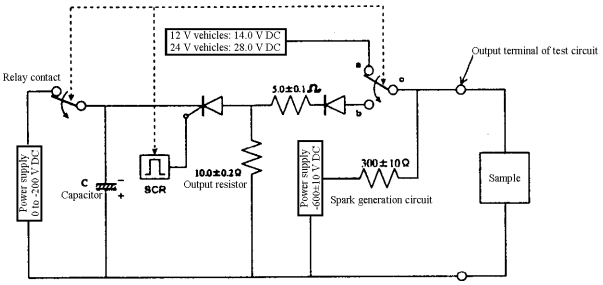
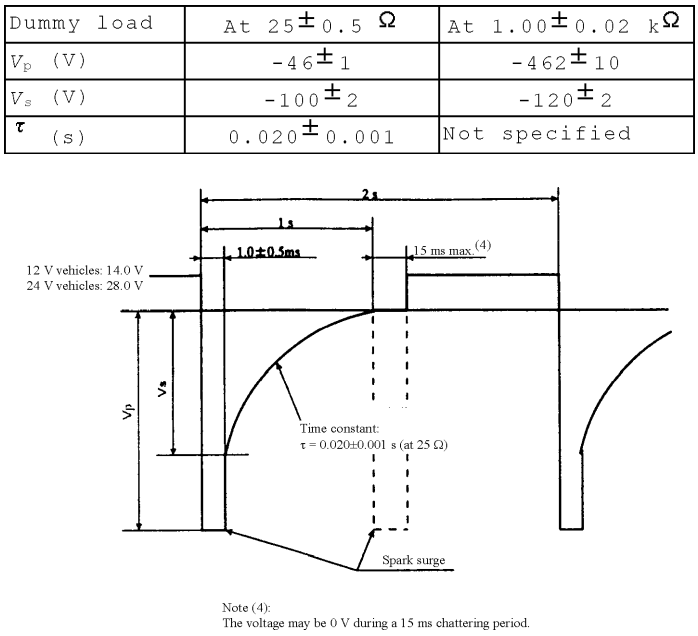
5.16 Field Decay Test

For the field decay test of CD players, follow Table 34:

Table 34 Field Decay Test

Item	Condition
Test circuit	In the test circuit, the relay and the SCR are interlocked to supply a negative surge to the sample. The relay terminal c is disconnected from contact a, and reaches contact b after an interval of 1.0±0.5 ms, during which a -600 V surge is applied from the spark generation circuit via a 300±10 Ω resistor. 
Transient voltage waveform	Before connecting the sample to the test circuit, adjust the power voltage and capacitor C so that V_p, V_s and τ of the output waveform are as specified below, with a 25±0.5 Ω or a 1.00±0.02 kΩ resistor connected to the output terminals:  Note (4): The voltage may be 0 V during a 15 ms chattering period.
Number of surges	50000
Terminals tested	+B, Acc. and ill.
Post-test checking	After the test, check for functioning and performance.

Dummy load	At 25±0.5 Ω	At 1.00±0.02 kΩ
V_p (V)	-46±1	-462±10
V_s (V)	-100±2	-120±2
τ (s)	0.020±0.001	Not specified

Established/ 3 Revised:
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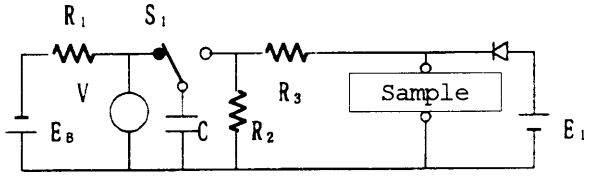
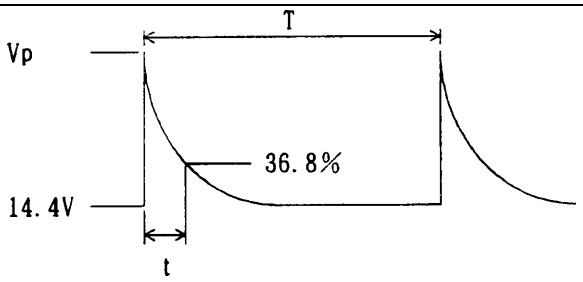
5.17 Load Dump Test

For the load dump test of CD players, follow Table 35:

Table 35 Load Dump Test

<table>
<tr><th>Item</th><th>Condition</th></tr>
<tr><td>Test circuit</td><td> 

R_1: depends on charger capacity</td></tr>
<tr><td>Transient voltage waveform</td><td> 
</td></tr>
<tr><td>Test conditions</td><td>Test under the following two sets of conditions:
<table>
<tr><td></td><td>(1)</td><td>(2)</td></tr>
<tr><td>V_p</td><td>+80 V</td><td>+110 V</td></tr>
<tr><td>t</td><td>200 ms</td><td>2.5 μs</td></tr>
<tr><td>T</td><td>60 s</td><td>30 s</td></tr>
<tr><td>R_2</td><td>2 Ω</td><td>0.6 Ω</td></tr>
<tr><td>R_3</td><td>0.8 Ω</td><td>0.4 Ω</td></tr>
<tr><td>C</td><td>0.11 F</td><td>4.7 μF</td></tr>
<tr><td>Number of voltage applications</td><td colspan="2">10</td></tr>
</table></td></tr>
<tr><td>Terminals tested</td><td>+B, Acc. and ill.</td></tr>
<tr><td>Post-test checking</td><td>After the test, check for functioning and performance.</td></tr>
</table>

5.18 Overvoltage Test

For the overvoltage test of CD players, follow Table 36:

Table 36 Overvoltage Test

Item	Condition
Terminals tested	+B, Acc. and ill.
Power voltage (V) and duration (min)	Test under the following two sets of conditions: (1) 18; 60 (2) 24; 1
Loading condition	Applicable load
Check items	Check for burning and smoking during the test. After the test, check for functioning and performance.

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5.19 Inverted Voltage Test

For the inverted voltage test of CD players, follow Table 37:

Table 37 Inverted Voltage Test

Item	Condition
Terminals tested	+B, Acc. and ill.
Power voltage (V)	16.0 to 10.0 Use a power supply with a capacity at least twice as high as the vehicle's fuse rating.
Duration (min)	1
Power line wiring harness and thickness (sq.)	5 m. Use a fuse with the same rating as in the vehicle. Select the wire thickness depending on the fuse rating as follows: 15 A and under: 0.5 20 A and under: 0.85 Over 20 A: 1.25
Test schedule	Start testing at a power voltage of 16.0 V. If the current is shut off, lower the voltage and test again. Repeat testing to 10.0 V or until the current is not shut off, whichever is higher, at a voltage accuracy of 0.1 V.
Check items	Check for burning and smoking during the test. After the test, check for functioning and performance.

5.20 Electrostatic Tests

5.20.1 Electrostatic Discharge Test

For the electrostatic discharge test of CD players, follow Table 38:

Table 38 Electrostatic Discharge Test

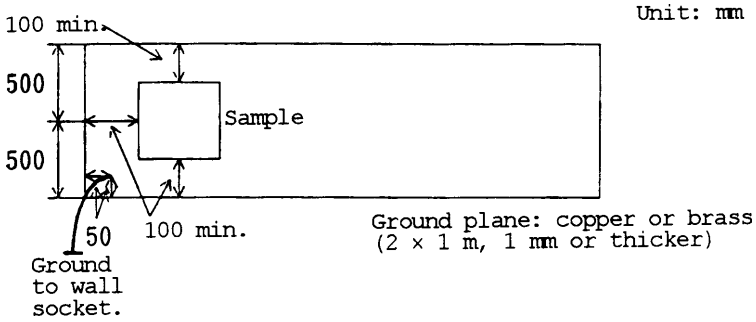
Item	Condition
Discharge resistance and capacity	$150 \pm 7.5\ \Omega$; 150 ± 15 pF
Voltage (kV)	± 5, ± 10, ± 15
Loading condition and discharge points	Test under the following two conditions: (1) Disconnected Discharge at all the points accessible to the user (except on the face on which the sample sits); i.e., all the terminals and switches, as well as the center and the four corners of the external faces. Test with each face of the sample placed down except the escutcheon. <Top view of base>  Place the sample on a wooden or plastic base. Connect the GND terminal of the tester to the ground plane.

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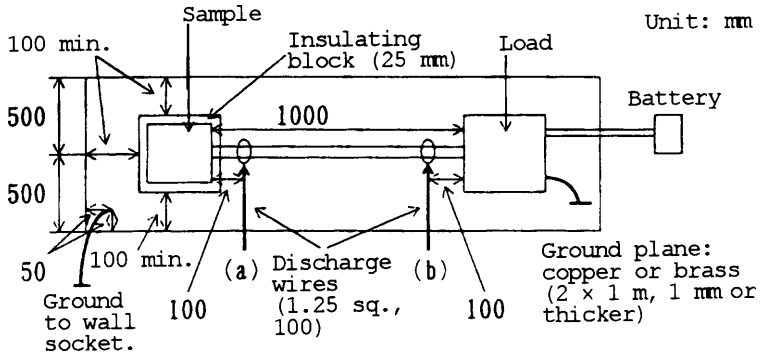
Table 38 (Continued)

<table>
<tr><th>Item</th><th>Condition</th></tr>
<tr><td>Loading condition and discharge points</td><td>(2) Connected to applicable load and battery
Discharge at points (a) and (b) on each wiring harness, as well as all the points accessible to the user. Test in the stop and each working mode (playback, fast forward, fast backward, etc.)
<Top view of base>
 

Place the sample on a wooden or plastic base. Connect the GND terminal of the tester to the ground plane. Ground the sample housing to the ground plane by the same method as on the vehicle (i.e., at the same point, using the same bracket or harness). Peel off 10 mm of the wiring harness sheath at the discharge points, and clip the discharge wires. Insulate the discharge point of the wiring harness from the ground plane, using an insulating block (100 × 100 mm, 25 mm t). Tape all the remaining portions of the harness.</td></tr>
<tr><td>Connection</td><td>Connect the sample as shown below depending on its configuration with the amplifier:
<table>
<tr><th>Amplifier position</th><th>Samples</th><th>Loads</th></tr>
<tr><td>Integrated with or underneath CD player</td><td>CD player
Amplifier</td><td>Speakers
External switches</td></tr>
<tr><td rowspan="2">Other</td><td>(a) CD player</td><td>Amplifier
Speakers
External switches</td></tr>
<tr><td>(b) Amplifier</td><td>CD player
Speakers
External switches</td></tr>
</table></td></tr>
<tr><td>Discharge method</td><td>Flashover rate: 50%</td></tr>
<tr><td>Number of discharges</td><td>10 at each point under each condition</td></tr>
<tr><td>Discharge interval (s)</td><td>1 min.</td></tr>
<tr><td>Check items</td><td>Check the responses during the test. After the test, check for functioning and performance.</td></tr>
<tr><td>Other</td><td>If the shape of the discharge probe does not allow discharging at all the points accessible to the user, a wire (1.25 sq., 100 mm) may be attached. Make sure not to coil the wire. Avoid discharging near the battery.</td></tr>
</table>

Remark:
Example of discharge device
Noise Laboratory ESS-625S (discharge probe tip: TSS-812, conical)

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5.20.2 Electrostatic Operation Test

For the electrostatic operation test of CD players, follow Table 39:

Table 39 Electrostatic Operation Test

Item	Condition
Ambient temperature (℃)	25±3
Ambient humidity (% RH)	40±5
Operation	3 cycles in accordance with "Note (5)," followed by 3 cycles in accordance with "Note (3)"
Check items	Check the responses and output sound during the test. After the test, check for functioning and performance.
Other	Use a disk with no print (or little print, if any).

Note (5):
See below for the operation cycles:

For CD Player with Single Tray

Step	Operation	Mode	Playback time (s)
1	Insert a disk.	Loading and playback	60
2	Press the eject button.	Ejection	--
3	Press the CD button.	Loading and playback	60
4	* Repeat steps 2 and 3 ten times.		

For CD Player with CD Changer

Step	Operation	Mode	Playback time (s)
1	Insert the magazine and close the lid.	Loading	30
2	Press the CD button.	Playback	60
3	Open the lid and press the eject button.	Ejection	--
4	* Repeat steps 1 through 3 ten times.		

5.21 Electromagnetic Susceptibility Test

To test the electromagnetic susceptibility of CD players designed for vehicles shipped to Europe and Australia, follow Section 5.21.1; for other destinations, follow Section 5.21.2.

5.21.1 For Vehicles Shipped to Europe and Australia

(1) This standard covers the following three test methods. Test frequency ranges applicable to each test method are shown in Table 40. Note, however, that test frequencies actually used shall be determined according to the characteristics of test facilities. Regarding TEM cell and stripline tests, either one shall be conducted.

Table 40 Applicable Frequency Range for Each Test Method

Test method	Applicable frequency range
TEM cell test	20 to 400 MHz
Free field test	200 to 1000 MHz
Stripline test	20 to 400 MHz

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(2) Test steps

Each test shall be carried out taking the following steps.

Test Method Selection

TEM cell and free field tests or stripline and free field tests shall be combined for testing within the specified test frequency ranges.

Table 41 shows test frequencies to be used.

Both TEM cell (or stripline) and free field tests shall be carried out within the range of 200 to 400 MHz.

Table 41 Test Frequencies

Test frequency (MHz)											
20.0	27.7	38.5	53.8	78.8	113	150	206	290	403	566	782
20.4	28.0	39.2	54.8	80.3	115	151	210	295	411	577	797
20.8	28.2	39.9	55.8	81.9	117	154	214	300	419	588	812
21.2	28.7	40.6	56.9	83.5	119	157	218	306	427	599	828
21.6	29.0	41.4	58.0	85.1	120	160	222	312	430	600	844
22.0	29.2	42.2	59.1	86.8	121	163	226	318	435	610	860
22.4	29.7	43.0	60.2	88.5	123	166	230	324	443	622	877
22.8	30.2	43.8	61.4	90.0	125	169	234	330	450	634	894
23.2	30.8	44.6	62.6	90.2	127	172	238	336	451	646	900
23.6	31.4	45.0	63.8	92.0	129	175	240	342	460	658	911
24.0	32.0	45.4	65.0	93.8	131	178	242	348	469	671	929
24.4	32.6	46.3	66.3	95.6	133	181	246	354	478	684	935
24.8	33.2	47.2	67.6	97.5	135	184	250	361	487	697	947
25.0	33.8	48.1	68.9	99.4	137	187	255	368	496	710	965
25.2	34.4	49.0	70.2	101	139	190	260	375	505	724	984
25.7	35.0	49.9	71.6	103	141	193	265	380	515	730	1000
26.2	35.7	50.0	73.0	105	143	196	270	382	525	738	
26.7	36.4	50.8	74.4	107	145	199	275	389	535	750	
27.0	37.1	51.8	75.8	109	147	200	280	396	545	752	
27.2	37.8	52.8	77.3	111	149	202	285	400	555	767	

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(3) Calibration
Carry out calibration taking the steps below to establish the reference field for testing.
(a) Install field probe(s) in accordance with the specifications for each test.
(b) Adjust the RF power amplifier output so that the field strength meter indicates the normal field strength at the normal test frequency. Calibration shall be carried out using the test frequencies shown in Table 41.
(c) Measure values of the following items at all the test frequencies.
(i) Forward power (*W*1)
(ii) Reflected power
(iii) VSWR (Voltage Standing-Wave Ratio)
(iv) Signal generator output
(v) Field strength generated

(4) Test bench preparation
Facilities used for testing shall be as follows. Carry out the test in standard conditions and at supply standard voltages, unless otherwise specified.
(a)Example of wiring

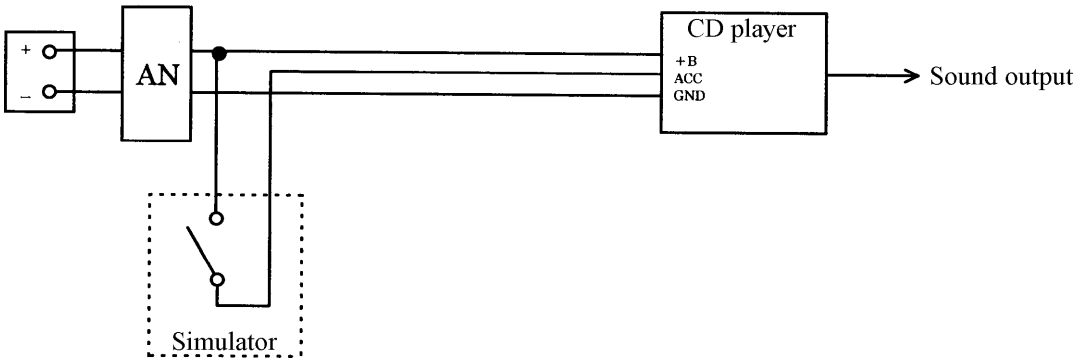

Fig. 13 Example of Wiring

(b) Artificial network (AN)
Power shall be supplied to the tested device via an artificial network (AN), whose configuration is shown in Fig. 14. The impedance of an artificial network (AN) shall not deviate more than 10% from the curve given in Fig. 15.

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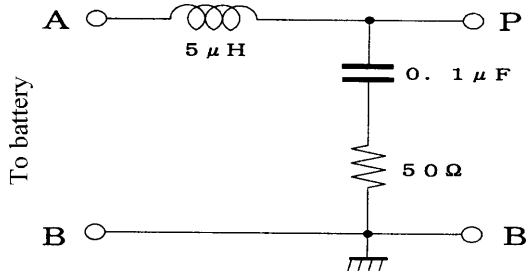

Fig. 14 Schematic Diagram of Artificial Network (AN)

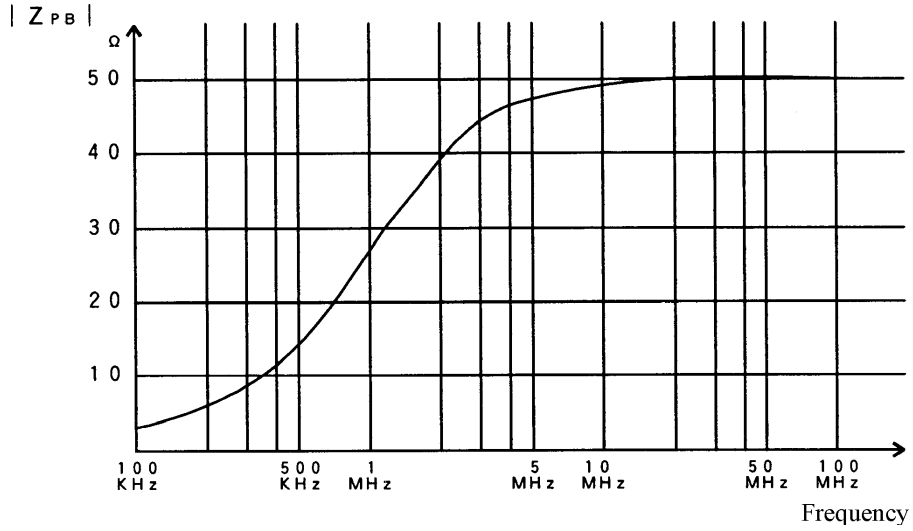

Fig. 15 Frequency Characteristics of the Artificial Network (AN) (AB short-circuited)

(c) Test wire harness
Wire types and diameters of the wire harness used to connect the tested device, simulator, and power supply shall be equivalent to those in actual vehicle. If, however, they are otherwise specified for each tested device, conform to such specifications.

(d) Ground plane
The ground plane used in free field test shall be 0.5 mm or more in thickness, and it's material shall be copper, brass, galvanized steel, or aluminum. The ground plane shall have an area of 2.25 m^2 or more, and its shortest side shall be 0.75 m or longer.

(e) Grounding cable
The grounding cable used in free field test shall have a DC resistance of 2.5 mΩ or less.

(f) Test table
The table on which the tested device and test wire harness are placed shall be made of a non-conductive material such as wood.

(5) Test

(a) Field strength setting method using continuous wave (CW)
Adjust the RF amplifier output so that at least the forward power set during calibration for each test is reached.

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(b) Field strength setting method using amplitude modulating (AM) signal
Obtain the forward power (*W*) from the forward power (*W*1) set during calibration for each test, using the equation below. Adjust the RF amplifier output so that at least the forward power (*W*) is reached.

$$W\ (\text{dBm}) = W1\ (\text{dBm}) - 5.1\ \text{dB}$$

After determining the RF amplifier output, generate the modulating signal specified below.

1 kHz sine wave amplitude modulation (AM) of 80%

(c) Functionality checking of tested device
Check for any malfunctioning or abnormal noise as stationary and during playback and for proper functioning such as mode switching. Apply field for at least 2 second at each frequency.

(d)Immunity level measurement
If the tested device does not meet specification requirements in the test reference field, the minimum inoperable field strength shall be measured.

(6) TEM Cell Test

(a)Calibration
Install a field probe at the location shown in Fig. 16.

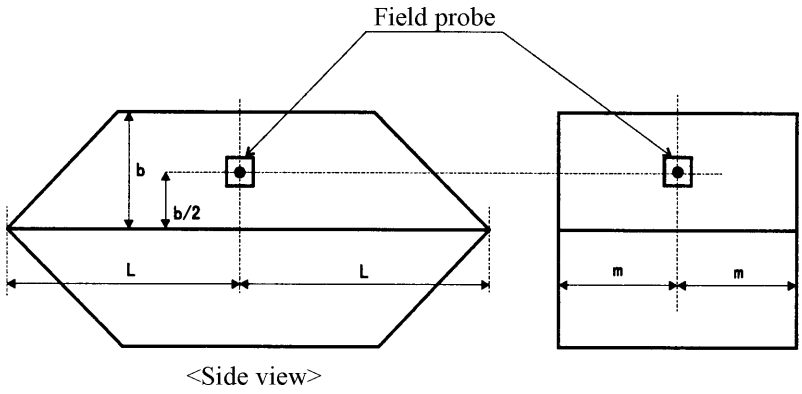

Fig. 16 Field Probe Installation Location for Calibration for TEM Cell Test

(b)Testing

(i)Tested device installation
Install the tested device within the space shown in Fig. 17. The installation space applies to the circuitry of the tested device, such as the circuit board. Directions of the installed tested device shall be defined as *X*-, *Y*-, and *Z*-axes, as shown in Fig. 18.

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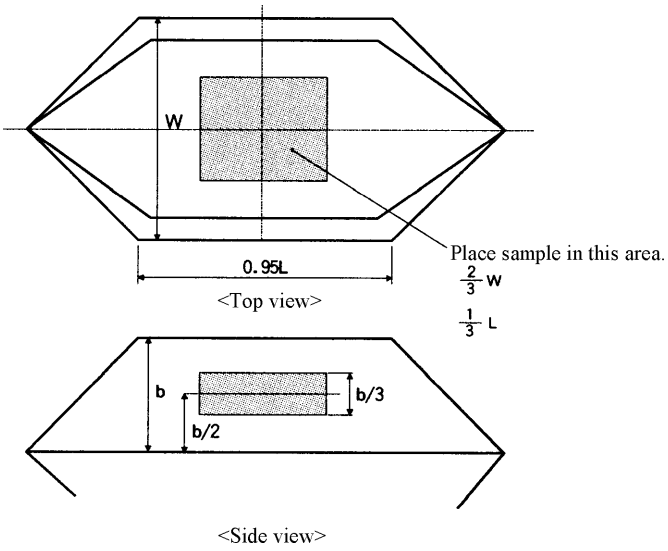

Fig. 17 Tested Device Installation Space

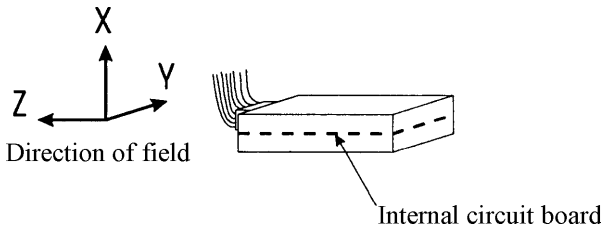

Fig. 18 Tested Device Installation Direction

(ii)Test bench configuration

Set up the test bench configuration as shown in Fig. 19. The wire harness in the cell shall be installed perpendicularly (in the field direction) to the tested device taking the shortest route. The dielectric constant shall be 1.4 or less.

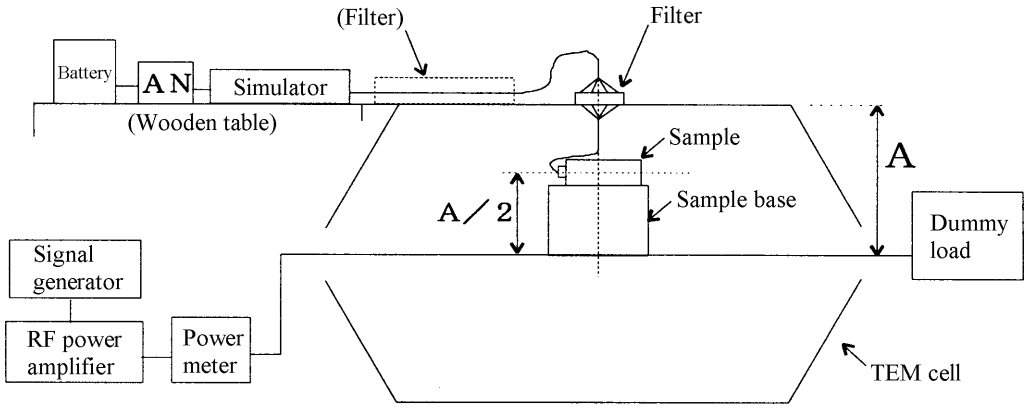

Fig. 19 Test Bench Configuration for TEM Cell Test

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(iii)Test method

Carry out test in accordance with Section 4 for functionality checking. Table 42 shows the normal field strength and test frequency range for the test.

Table 42 TEM Cell Test Conditions

Item	Condition
Normal field strength	150 V/m (CW and AM)
Field direction	Apply field along each of *X*-, *Y*- and *Z*-axes of installed tested device.
Test frequency range	20 to 400 MHz (To be determined according to facility characteristics)

(7) Free Field Test

(a)Calibration

Install field probes at three locations, the reference, right reference, and left reference points, as shown in Fig. 20. The field strength of the right and left reference points shall not be less than 50% of the field strength of the reference point. Carry out calibration for horizontal and vertical polarization planes.

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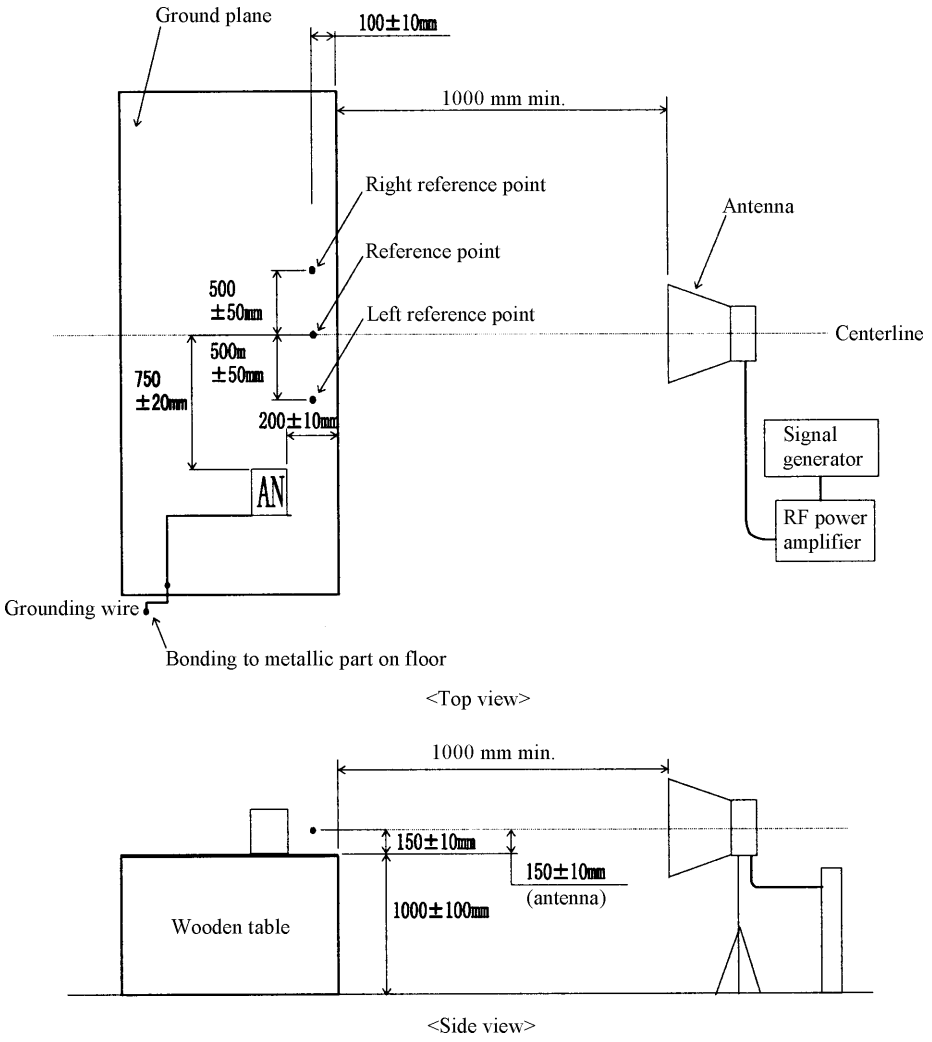

Fig. 20 Layout for Calibration for Free Field Test

(b) Testing

(i)Tested device installation and test bench configuration

Install the tested device at the location shown in Fig. 21. Install no objects other than AN, tested device, and test wire harness within the radius of 1 m around the reference point on the ground plane. For components whose cases are electrically connected to vehicle body, connect the grounded portion of the tested device case to the ground plane.

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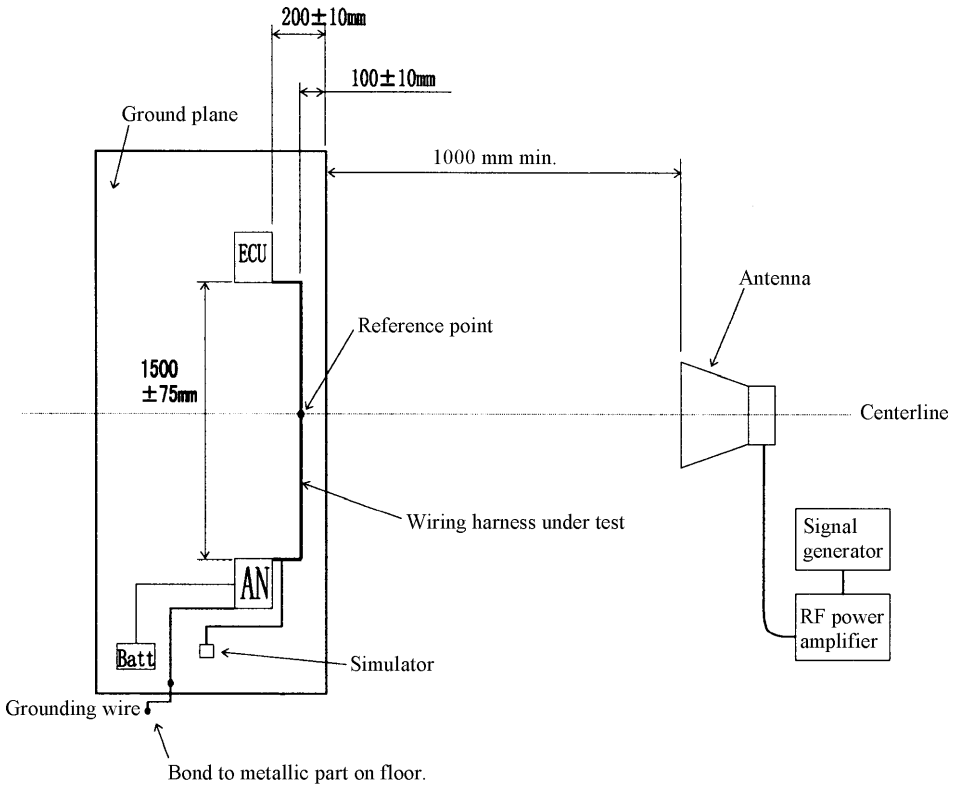

Fig. 21 Test Bench Configuration for Free Field Test

(ii)Test method

Carry out test in accordance with Section 4 for functionality checking. Table 43 shows the normal field strength and test frequency range for the test.

Table 43 Free Field Test Conditions

Item	Condition
Normal field strength	60 V/m (CW and AM)
Polarization direction	Test with both horizontal and vertical polarization.
Test frequency range	200 to 1000 MHz (To be determined according to facility characteristics)

Established/ 3 Revised: May.2001

(8) Stripline Test

(a)Calibration

Install a field probe at the location within the stripline, as shown in Fig. 22.

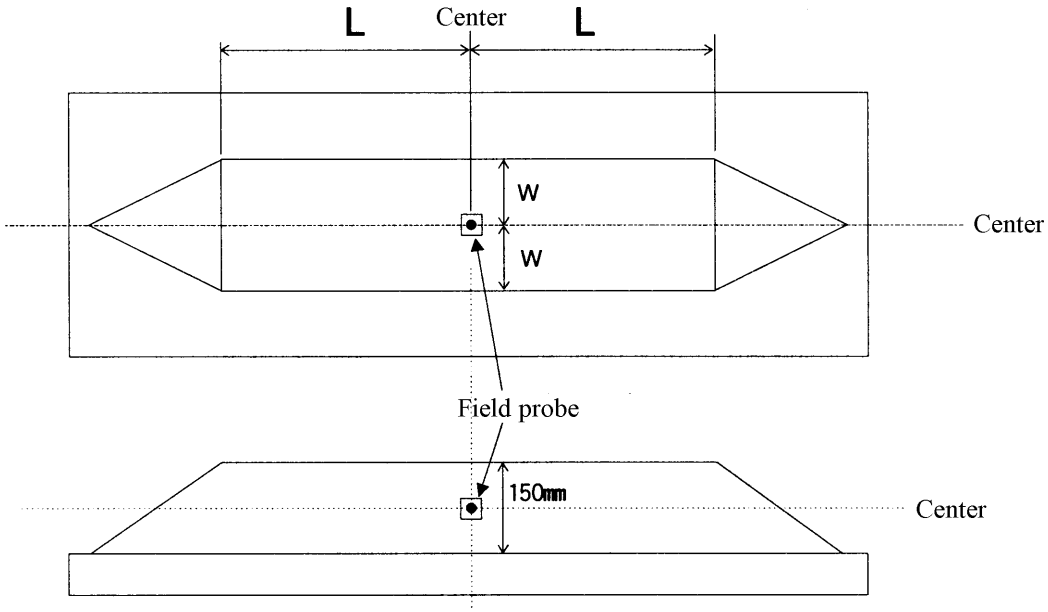

Fig. 22 Field Probe Installation Location for Calibration for Stripline Test

(b)Testing

(i)Tested device installation

Install the tested device and wire harness at the locations shown in Fig. 23.

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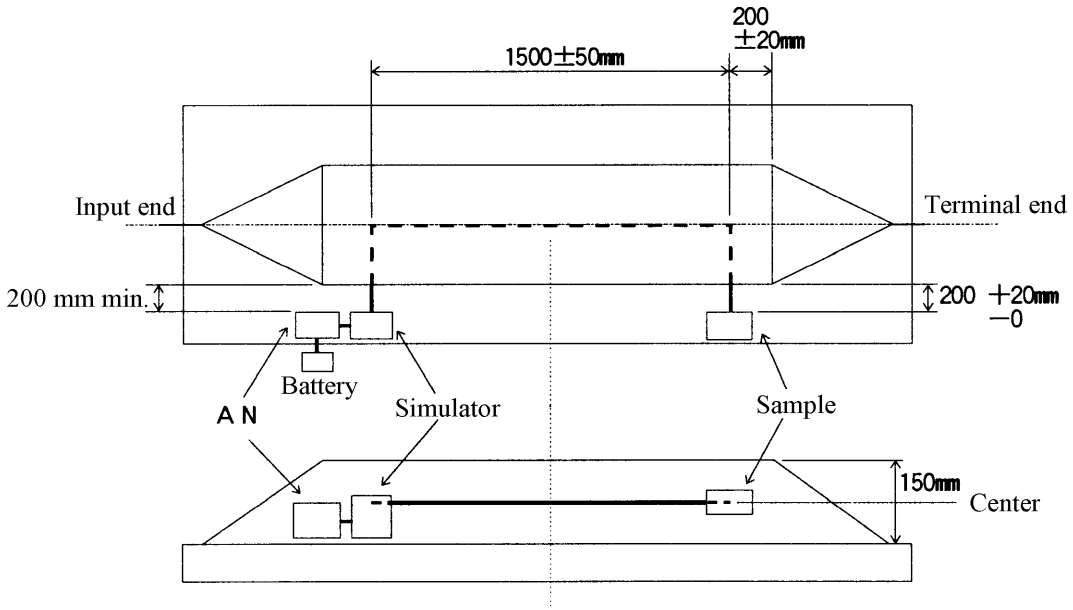

Fig. 23 Test Bench Configuration for Stripline Test

(ii)Test method

Carry out test in accordance with Section 4 for functionality checking. Table 44 shows the normal field strength and test frequency range for the test.

Table 44 Stripline Test Conditions

Item	Condition
Normal field strength	120 V/m (CW and AM)
Test frequency range	20 to 400 MHz (To be determined according to facility characteristics)

5.21.2 For Vehicles Shipped to Other Destinations

Test at the frequencies and field intensities specified in Table 45. To adjust field intensity, calibrate it relative to traveling wave power prior to testing, and control the latter. Fig. 13 shows an example of sample connection to loads. Note that line impedance stabilizing network AN in the figure must have the configuration as shown in Fig. 14 and the characteristic as shown in Fig. 15. For sample conditions, follow Table 46.

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Table 45 Conditions for Electromagnetic Susceptibility Test

Item	Condition	
Method	TEM cell test (see Figs. 24 and 25)	Free field test (see Figs. 26 and 27)
Frequencies (MHz)	21, 28, 50 and 144	430, 900 and 1280 (handy transceiver)
		940 and 1440 (Japan cellular phone)
		835 and 1880 (USA cellular phone)
		1750 (Europe cellular phone)
		900 (other destinations cellular phone)
Normal field strength	100 V/m	--
RF power	--	15 W (430 MHz handy transceiver)
		10 W (900 MHz handy transceiver)
		4 W (900 MHz cellular phone)
		2 W (other)
Antenna	--	λ/4 sleeve antenna (VSWR: 1.5 max.)
Distance	--	5 cm (handy transceiver)
		2 cm (cellular phone) Displays & controls: 0 cm
Evaluation	Check for any malfunctioning or abnormal noise as stationary and during playback, and for proper functioning such as mode switching. If there is any, record the minimum field strength where it is observed at that frequency, as well as the mode of malfunctioning.	

Table 46 Examples of Sample Conditions

No.	Condition
Condition 1	CD stop
Condition 2	CD playback

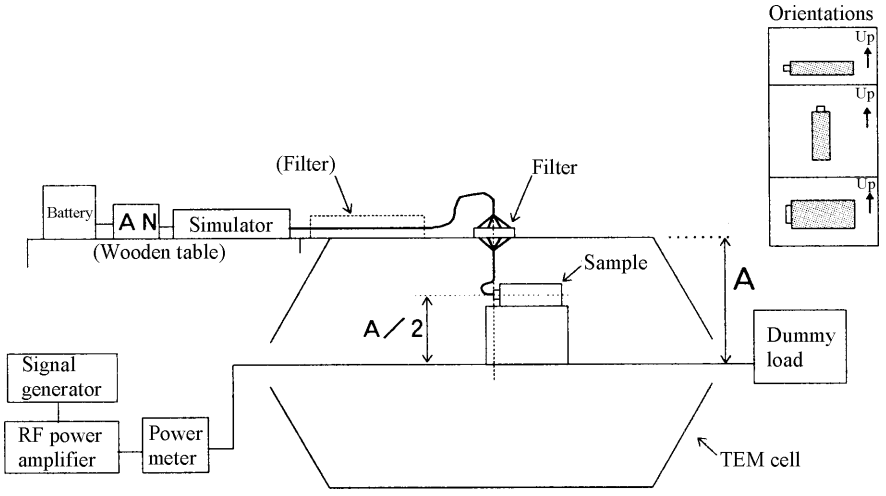

Fig. 24 Test Setup for TEM Cell Method

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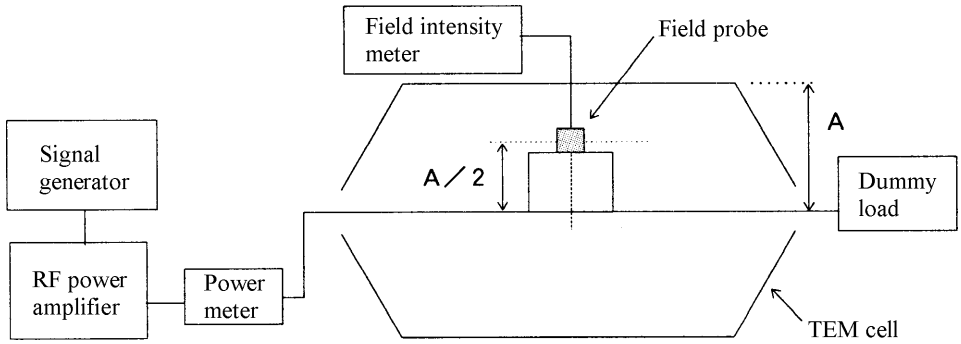
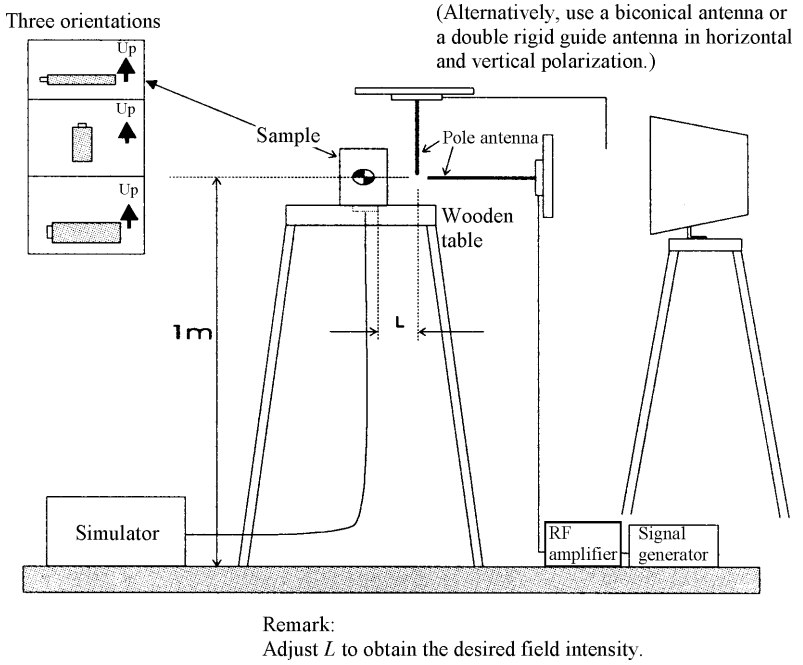


Fig. 25 Calibration for TEM Cell Method



Remark:
Adjust *L* to obtain the desired field intensity.

Fig. 26 Test Setup for Moving Antenna Method

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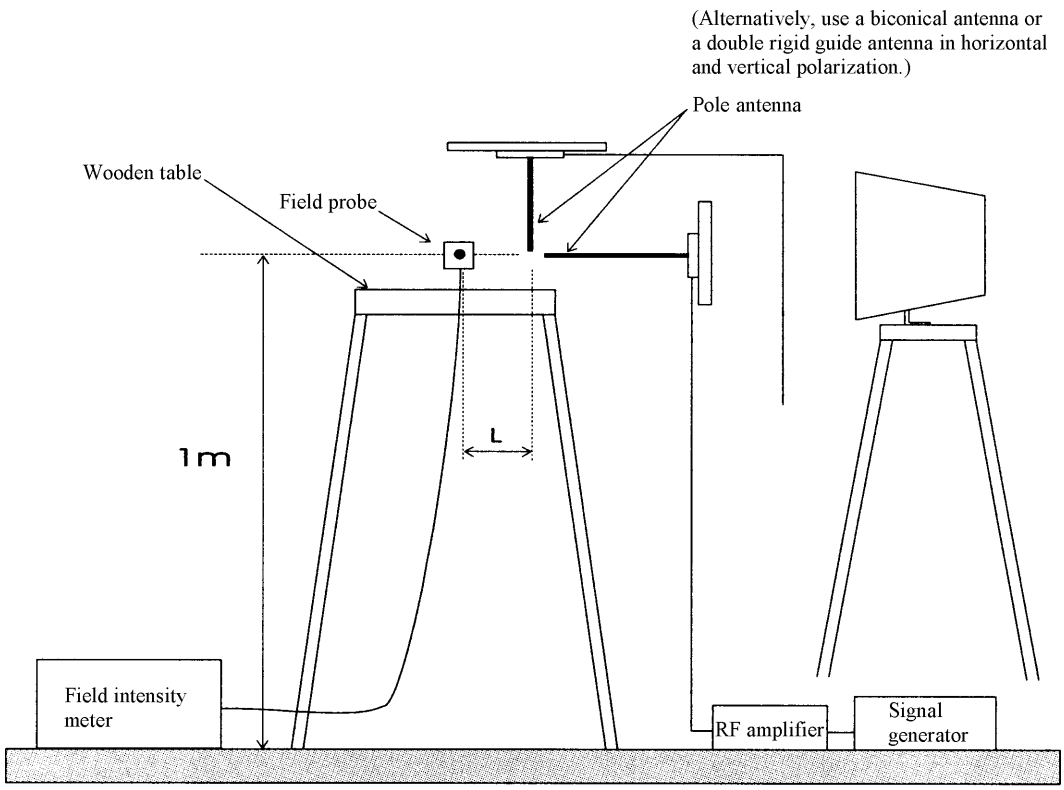

Remark:
Adjust L to obtain the desired field intensity.

Fig. 27 Calibration for Moving Antenna Method

5.22 Electromagnetic Compatibility Test

(1) For the electromagnetic compatibility test of CD players, follow TSC7508G. Test in the GPS band (1.57542 GHz ± 10 MHz) also, according to the dipole method described in TSC7508G.

(2) To test the narrow-band emission noise of CD players designed for vehicles shipped to Europe and Australia, follow TSC7026G.

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5.23 Output Terminal Test

For the output terminal test of CD players, follow Table 47:

Table 47 Output Terminal Test

Item	Condition
Power voltage (V)	16.0 to 10.0 Use a power supply with a capacity at least twice as high as the vehicle's fuse rating.
Operation	Test under the following two conditions: (1) Stop (2) Playback (maximum volume)
Terminals tested and duration (min)	Speaker line - The '+' and '-' terminals are open, shorted to each other, or grounded: 60 each - The '+' and '-' terminals are shorted to +B of power line: 1 Other terminals (except +B) - Shorted to +B and ground: 1 each
Power line wiring harness and thick-ness (sq.)	5 m. Use a fuse with the same rating as on the vehicle. Select the wire thickness depending on the fuse rating as follows: - 15 A and under: 0.5 - 20 A and under: 0.85 - Over 25 A: 1.25
Test schedule	Start testing at a power voltage of 16.0 V. If the current is shut off, lower the voltage until it is not, and test again. Repeat testing to 10.0 V in decrements of 0.1 V.
Check items	Check for burning and smoking during the test. After the test, check for functioning and performance.

5.24 Light Interference Test

For the light interference test of CD players, follow Table 48:

Table 48 Light Interference Test

Item	Condition
Illuminant	Xenon lamp that can irradiate the front panel up to an illumi-nance of 10^5 lx
Light beam direction	Move the illuminant at a constant distance to the sample along a spherical path in the upper front quarter of surrounding space.
Check items	While illuminating, operate the sample in each mode to check for proper functioning.

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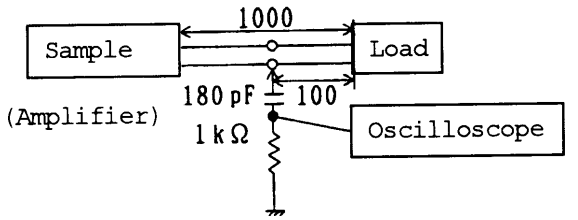
5.25 Parasitic Oscillation Test

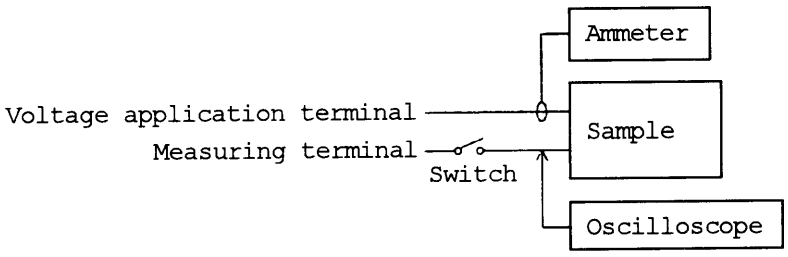
For the parasitic oscillation test of CD players, follow Table 49:

Table 49 Parasitic Oscillation Test

Item	Condition
Test setup	Unit: mm 
Loading condition	Test with the speaker terminals connected in the following seven ways: (1) Open; (2) *R*; (3) Speakers; (4) *C*1; (5) *R* + *C*1; (6) *C*2; (7) *R* + *C*2 *R*: minimum impedance of all the applicable loads *C*1 = 1000 pF *C*2 = 0.1 μF (In conditions (5) and (7), connect two elements in parallel.) Output: Adjust the volume control so that the distortion factor is 1 to 3%, with all the channels active. Disk: 20 Hz, 0 dB
Power voltage (V) and ambient temperature (℃)	10.5 and 16.0; -20 and 25 Test with all the four combinations of voltage and temperature.
Check items	During the test, check for any oscillation and, if any oscillation is detected, measure its intensity as an effective value.

5.26 Power Voltage Leakage Test

Using the test setup as shown in Fig. 28, measure the change in the voltage and current when the switch is turned on and off in the following three configurations:



	Voltage application terminal	Measuring terminal
(1)	+B	Acc. and ill.
(2)	Acc.	+B and ill.
(3)	ill.	+B and Acc.

Fig. 28 Power Voltage Leakage Test Setup

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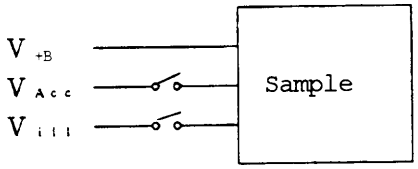
5.27 Differential Voltage Application Test

Using all the combinations of the +B, Acc., and ill. terminal voltages shown below, check for functioning. However, voltage combinations or functions that would not pose any problem may be excluded in consideration of the design.



V_{+B} = 10.0 to 16.0 V (1.0 V steps)
$V_{Acc.}$ = 10.0 to 16.0 V (1.0 V steps)
$V_{ill.}$ = 10.0 to 16.0 V (1.0 V steps)

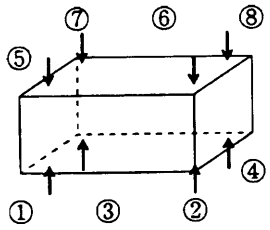
Fig. 29 Differential Voltage Application Test Setup

5.28 Forced Strain Tests

5.28.1 Housing

For the forced strain test of the housing of CD players, follow Table 50:

Table 50 Forced Strain Test of Housing

Item	Condition
Positioning	 For initial positioning, press at points ⑤, ⑥, ⑦ and ⑧ using a rigid cylinder with a 1 cm diameter while maintaining points ①, ②, ③ and ④ at the same height. (① to ④ and ⑤ to ⑧ are the four corners on opposite faces of the housing.)
Direction of force	Press the corners, one corner at a time, up and down. Example: When testing ① and ⑤, - Free ⑤ and press ① (upward pressure). - Free ① and press ⑤ (downward pressure).
Force (N)	49, 98, 147, 196
Check items	During the test, check the appearance, functioning and performance. Disassemble the sample to check the inside.

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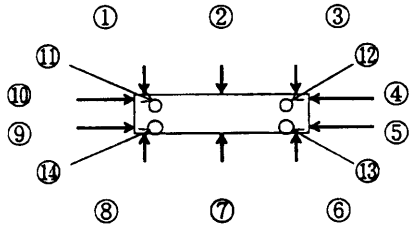
5.28.2 Escutcheon

For the forced strain test of the escutcheon of CD players, follow Table 51:

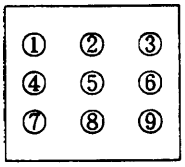
Table 51 Forced Strain Test of Escutcheon

Item	Condition
Points of force application	 With the housing secured, press each point on the escutcheon using a urethane rubber cylinder with a 1 cm diameter. For a sample with the "2 DIN" size, press also between ④ and ⑤ and between ⑨ and ⑩.
Force (N)	49, 98, 147, 196
Check items	During and after pressing at each point, check the appearance and proper functioning, particularly the catch of a switch during the test. Disassemble the sample to check the inside.

5.28.3 Push Switches

For the forced strain test of the push switches of CD players, follow Table 52:

Table 52 Forced Strain Test of Push Switches

Item	Condition
Points of force application	 Switch With the housing secured, press nine points on each switch, using a urethane rubber cylinder with a 5 mm diameter. The number of the points of force application may be reduced unless it affects the reliability of the results.
Force (N)	49, 98, 147
Check items	During pressing at each point and after testing all the points, check the appearance and proper functioning. Disassemble the sample to check the inside.

5.28.4 Displays

For the forced strain test of the displays of CD players, follow Table 53:

Table 53 Forced Strain Test of Displays

Item	Condition
Points of force application	Press the center of the display, using a urethane rubber cylinder with a 1 cm diameter. For a large display, however, press at several points at a rate of one point per 15 × 50 mm^2 area.
Force (N)	49, 98, 147, 196
Check items	During pressing at each point and after testing all the points, check the appearance and proper functioning. Disassemble the sample to check the inside.

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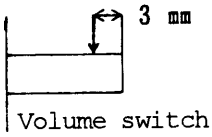
5.28.5 Volume Switch

For the forced strain test of the volume switch of CD players, follow Table 54:

Table 54 Forced Strain Test of Volume Switch

Item	Condition
Points of force application	 For a push-pull switch, test in the pulled position.
Force (N)	49, 98, 147, 196
Check items	After testing, check the appearance and proper functioning.

5.29 Marginal voltage Tests

5.29.1 Overvoltage Breakdown Test

For the overvoltage breakdown test of CD players, follow Table 55:

Table 55 Overvoltage Breakdown Test

Item	Condition
Ambient temperature (℃)	25±3
Power voltage (V)	16.0 to failure (increment: 1)
Loading condition	Applicable load, ill. on
Operation	Perform the cycle shown in "Note (3)" for 15 minutes. If the sample fails to operate, simply energize it.
Check items	After testing at each voltage, check for functioning. If the sample has failed, check the degree and condition of failure.

5.29.2 Low Voltage Operation Test

For the low voltage operation test of CD players, follow Table 56:

Table 56 Low Voltage Operation Test

Item	Condition
Power voltage (V)	10.5 to failure in operation (decrement: 1)
Loading condition	Applicable load, minimum volume, ill. off
Other	Follow Table 55.

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5.30 Marginal temperature Tests

5.30.1 Maximum Operating Temperature Test

For the maximum operating temperature test of CD players, follow Table 57:

Table 57 Maximum Operating Temperature Test

Item	Condition
Ambient temperature (℃)	80 to 120 (step: 10; tolerance: ±3)
Power voltage (V)	16.0±0.1
Loading condition	Applicable load, ill. off
Operation	Perform the cycle shown in "Note (3)" for 15 minutes. If the sample fails to operate, simply energize it.
Check items	Check for proper operation at each test temperature. After testing at each temperature, condition for at least 2 hours in the standard test environment, and check for functioning. If the sample has failed, check the degree and condition of failure. Do not energize before the ambient temperature stabilizes.

5.30.2 Minimum Operating Temperature Test

For the minimum operating temperature test of CD players, follow Table 58:

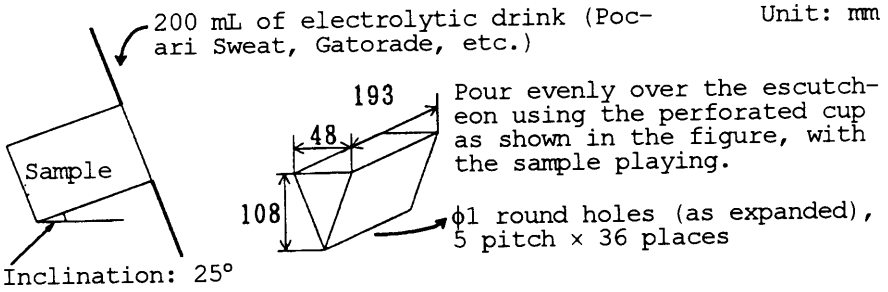
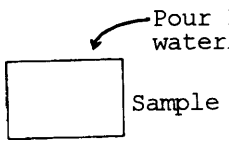
Table 58 Minimum Operating Temperature Test

Item	Condition
Ambient temperature (℃)	-30 to -50 (step: 10; tolerance: ±3)
Power voltage (V)	10.5±0.1
Loading condition	Applicable load, minimum volume, ill. off
Other	Follow Table 57.

5.31 Water Exposure Test

For the water exposure test of CD players, follow Table 59:

Table 59 Water Exposure Test

Item	Condition
Water exposure condition	<CD player mounted on instrument panel>  <CD player mounted in luggage compartment> 
Operation	Play the sample during exposure. After exposure, operate in all the modes and play for 8 hours continuously. If the sample fails to operate, simply energize it for 8 hours.
Check items	Check for burning and smoking during the test. After the test, check for functioning.
Other	For a product having a lid on the escutcheon, test under two conditions: open and closed.

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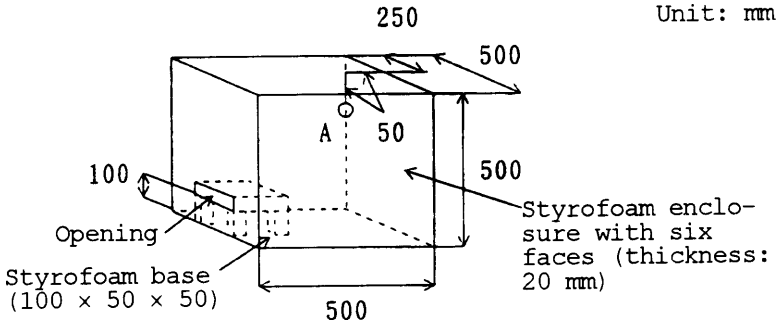
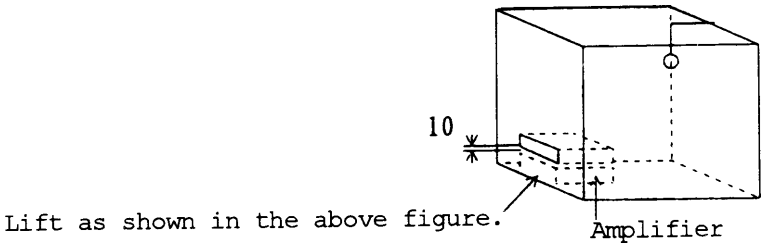
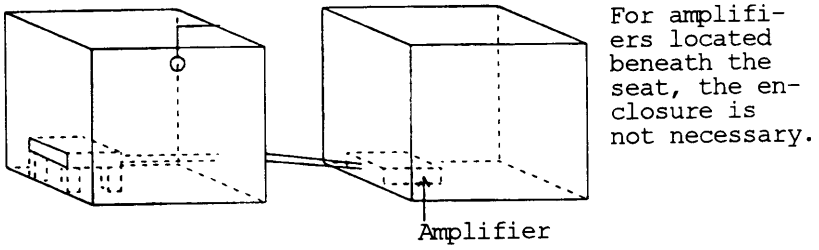
5.32 Temperature Rise Test

For the temperature rise test of CD players, follow Table 60:

Table 60 Temperature Rise Test

Item	Condition
Ambient temperature (℃)	25±3
Power voltage (V)	14.4±0.1
Loading condition	Applicable load Set ill. to whichever condition is more restrictive in terms of temperature rise. If the effect of the setting is unclear, test under both conditions: on and off.
Setup	Tilt the enclosure to reproduce the angle of the sample as on the vehicle. <Player integrated with amplifier>  <Player heated by amplifier from underneath>  <Player separate from amplifier> 
Temperature measuring points	Switches, disk, point A shown in the figure (inside the enclosure), and heat sink
Maximum time (h)	4
Other	Measure the temperature inside the sample also. To measure the temperature of the disk, use a thermosensitive label.

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5.33 Mishandling Test

With the sample set in a service condition, perform the operations listed in Table 61:

Table 61

Component	No.	Operation	Check items
Switches	1	Press the edge.	Functions, depression and catch
	2	Press in the vertical, lateral and oblique directions.	Functions, depression and catch
	3	Slide and rotate with fingers.	Functions, depression and catch
	4	Flip with finger.	Protrusion and disengagement
	5	Release abruptly in the pushed position.	Protrusion and disengagement
	6	Press two or more switches simultaneously.	Functioning
	7	Repeat tapping 10 times.	Functioning
	8	Keep pressing.	Functioning
	9	Pull-out strength.	Breaking strength
	10	Push-in strength (along the *x*-, *y*- and *z*-axes).	Breaking strength
	11	Rotational strength of the volume switch.	Breaking strength
Lid	12	Chatter.	Functions, depression and catch
	13	Press in the vertical, lateral and oblique directions.	Functions, depression and catch
	14	Slide at various rates (quickly or slowly).	Abnormalities
	15	Repeat opening and closing 10 times.	Abnormalities
	16	Pull-out strength.	Breaking strength
	17	Push-in strength (along the *x*-, *y*- and *z*-axes).	Breaking strength
Front panel	18	Scratch the front panel and switches with nails.	Scratch marks
	19	Apply a lighted cigarette to the front panel.	Burning
Connectors	20	Pry the connectors while in operation.	Functioning
	21	Chatter the connectors while in operation.	Functioning
	22	Couple and uncouple the connectors 10 times while in operation.	Abnormalities
	23	Couple the connector upside down.	Coupling
	24	Couple the connector in oblique directions.	Abnormalities
	25	Couple the wrong pair of connectors.	Coupling and abnormalities
	26	Push-in strength of the connectors.	Breaking strength
	27	Lock strength of the connectors.	Breaking strength
Bracket	28	Screw strength of the bracket bolting holes.	Breaking strength
	29	Bracket bolting screws longer than designed.	Maximum allowable length
Radio	30	Operate the CD player while in the radio mode.	Functioning
Tape player	31	Operate the CD player while in the tape mode.	Functioning

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Table 61 (Continued)

Component	No.	Operation	Check items
CD player	32	Operate the radio and tape player while in the CD mode.	Functioning
	33	Disk push strength (Acc. off)	Breaking strength
	34	Alternate between fast forward and backward frequently.	Functioning
	35	Tap a disk or a magazine.	Functioning
	36	Insert a disk or a magazine at various rates (while pushing quickly or slowly).	Abnormalities
	37	Eject a disk or a magazine at various rates (while pushing strongly or lightly).	Abnormalities
	38	Insert a disk or a magazine while pressing the eject button.	Functioning
	39	Insert a disk or a magazine while pressing the source switch.	Functioning
	40	Insert a disk or a magazine while pressing the power switch.	Functioning
	41	Perform invalid operations in all the modes.	Functioning
	42	Eject a disk or a magazine while pressing the lid.	Functioning
	43	Eject a disk or a magazine while obstructing the access port.	Functioning and abnormalities
	44	Push in and pull out a disk or a magazine during ejection.	Functioning and abnormalities
	45	Pull out and push in a disk or a magazine during loading.	Functioning and abnormalities
	46	Power off during ejection and loading.	Functioning
	47	Press the eject button immediately after insertion.	Functioning
	48	Press the eject button while pushing a disk or a magazine. After making sure that ejection is automatically disabled, operate other functions.	Functioning
	49	With the player inclined, insert and eject a disk or a magazine.	Maximum inclination that allows loading and ejection
	50	Apply vibration during playback.	Functioning
	51	Insert two disks(6) at a time.	Loading
	52	Insert a disk or a magazine in the wrong orientation(7) at 5 kgf force.	Functioning
	53	Insert a disk or a magazine in oblique orientations (up, down, right and left) at 5 kgf force.	Abnormalities

Note (6):
Test with all possible combinations of 8 cm and 12 cm disks, one on top of another or one after another.

Note (7):
Load the backside of a disk also.

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Table 61 (Continued)

Component	No.	Operation	Check items
CD player	54	Pull out a disk or a magazine in oblique directions (up, down, right and left).	Catch
	55	Push a disk or a magazine up, down, right and left, while it is in an ejected position.	Internal deformation
	56	Insert and eject a wet (bedewed) disk or magazine.	Functioning and abnormalities
	57	Insert, play and eject a non-standard disk or magazine.	Abnormalities
	58	Insert, play and eject a deformed disk or magazine.	Abnormalities
	59	Insert, play and eject a chipped or cracked disk or magazine.	Abnormalities
	60	Insert a CDV disk.	Abnormalities
	61	Insert a disk protecting sheet.	Abnormalities
	62	Insert a disk with a protecting sheet.	Abnormalities
	63	Insert a labeled disk or magazine.	Functioning and abnormalities
	64	Insert a disk or a magazine with an almost peeled label.	Functioning and abnormalities
	65	Insert a disk with a protective seal.	Functioning and abnormalities
	66	Insert a coin.	Burning and smoking
	67	Insert a cleaning disk.	Functioning and abnormalities
	68	Insert a cleaning disk upside down.	Functioning and abnormalities
	69	Insert a transparent dummy disk.	Functioning and abnormalities
	70	Insert a disk with no (or little) print.	Functioning and abnormalities
	71	Lock the motor for 2 hours.	Burning and smoking
CD changer	72	Insert a magazine with its trays ejected.	Functioning and abnormalities
	73	Insert a magazine with its trays unlocked.	Abnormalities
	74	Insert a magazine with its trays sticking to inside.	Abnormalities
	75	Insert a magazine with its 12 cm tray loaded with an 8 cm disk.	Functioning and abnormalities
	76	Insert a magazine with its 12 cm tray loaded with an adapter for 8 cm disks.	Functioning and abnormalities
	77	Insert a magazine with its 12 cm tray loaded with an 8 cm disk and an adapter.	Functioning and abnormalities
	78	Insert a magazine with no disks.	Functioning and abnormalities
	79	Insert a magazine with no trays.	Functioning and abnormalities
	80	Insert a magazine partially loaded with disks.	Functioning and abnormalities
	81	Insert a magazine partially loaded with trays.	Functioning and abnormalities
	82	Insert a magazine with a disk slightly displaced on the tray.	Abnormalities
	83	Insert a magazine loaded with an obliquely positioned tray.	Abnormalities
	84	Place an 18 L PVC tank filled with water on top and maintain for 24 hours.	Functioning and abnormalities
	85	Place an 18 L PVC tank filled with 60℃ water on top and maintain for 8 hours.	Functioning and abnormalities

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Table 61 (Continued)

Component	No.	Operation	Check items
Magazine	86	Pull out a tray without unlocking.	Ejection and abnormalities
	87	Push the tray up, down, right and left.	Abnormalities
	88	Shake the magazine loaded with disks with the access ports facing down.	Disk dropping and abnormalities
	89	Insert a non-standard tray.	Loading
	90	Insert two disks in the same tray.	Loading
	91	Insert a tray with the wrong side forward.	Loading
	92	Bend the tray.	Abnormalities
	93	Drop the magazine on each of its corners, edges and faces from the following heights: - Without disks: 50 cm - With disks: 30 cm	Abnormalities
	94	Expose at 100℃ for 24 hours.	Abnormalities
	95	Insert the magazine after each of the operations in Nos. 86 through 94.	Functioning and abnormalities
Power supply	96	Power on +B, Acc. and ill. simultaneously.	Functioning
	97	Power +B on after powering Acc. on.	Functioning
	98	In all the modes, power off +B and Acc. simultaneously, then power on +B and Acc.	Functioning
	99	In all the modes, power +B off only, then power Acc. on.	Functioning
	100	Insert a disk or a magazine with +B off, then power +B on.	Functioning
	101	With Acc. off, insert a disk or a magazine while pressing the eject button.	Functioning
Other	102	Connect with all the possible components.	Functioning
	103	Insert immediately after ejection.	Abnormalities
	104	Repeat inserting and ejecting.	Abnormalities
	105	Load and unload disks repeatedly in the changer.	Abnormalities
	106	Test with abnormal disks (transparent disk, noncircular disk, CD-ROM, etc.)	Abnormalities

5.34 Surface Finish Tests of Escutcheon

5.34.1 Hardness

Follow TSH1539G Section 2.1, "Pencil Scratch Hardness."

5.34.2 Adhesion

(1) Grid adhesion test

Follow TSH1503G Section 2.1, "Grid Adhesion Test."

(2) Tape adhesion test

Follow the same procedure as in the grid adhesion test, except that the sample is not engraved. Check for any peeling.

5.34.3 Impact Resistance

Follow TSH1504G Section 2.1, "DuPont Impact Test."

5.34.4 Tack-Free Performance

Follow TSH1501G Section 2.1, "Method A (gauze sticking method)."

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5.34.5 Humidity Adhesion
Follow TSH3130G Section 5.7, "Humidity Adhesion."

5.34.6 Water Exposure Discoloration
Follow TSH1509G Section 2.1.1, Water Exposure Discoloration."

5.34.7 Alkali Exposure Discoloration
Follow TSH1509G Section 2.1.2, "Alkali Exposure Discoloration."

5.34.8 Acid Exposure Discoloration
Follow TSH1509G Section 2.1.3, Acid Exposure Discoloration."

5.34.9 Gasoline Resistance
Follow TSH1508G Section 2.1.2, "Gasoline Resistance (Method B)." Use No. 1 gasoline.

5.34.10 Glass Haze
Follow TSM0503G Section 3.2.1 Method A. Heat in a glycerol bath at a temperature of 100±2℃ for 20 hours.

5.34.11 Colorfastness to Crocking
Follow TSL5100G Section 4.8, "Colorfastness to Dry Crocking," and Section 4.9, "Colorfastness to Wet Crocking." Test a flat sample with a surface abrasion tester. Cover the abrading surface of the abradant with five sheets of gauze (Japanese Pharmacopoeia). Under a load of 49 kPa, abrade the sample over a distance of 100 mm for 500 cycles at a rate of 100 cycles/min. Test also using gauze soaked with the following liquids:
(1) Distilled water
(2) Artificial perspiration solution
(3) Ethyl alcohol

5.34.12 Grease Staining Resistance
Follow TSH3130G Section 5.14, "Grease Staining Resistance."

5.34.13 Perspiration Resistance
Clean the surface to be tested thoroughly using alcohol, and apply 3 to 8 mm spots of artificial perspiration solution at five points. After conditioning for 24 hours at a temperature of 60±2℃, clean and dry the test surface, then check the appearance.

Remark:
The artificial perspiration solution (pH = 4.5) is prepared by dissolving 8 g of sodium phosphate dibasic 12-water, 8 g of sodium chloride, and 5 g of acetic acid in distilled water to 1 L.

5.34.14 Accelerated Light Resistance
Follow TSH3130G Section 5.15, "Accelerated Light Resistance."

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Applicable Standards

TSC7010G	Life Test Method for Soldering of Automotive Electronic Equipment
TSC7026G	Bench Measurement Method for Narrow-Band Emission Noise on EC Regulation (Commission Directive, 95/54/EC) for Automotive Electronic Equipment
TSC7508G	Electric Parts Test Method for Radio Noise Interference
TSC7512G	Measurement Method for Electrical Characteristics of Compact Disc Player
TSH1501G	Test Method for Print Resistance of Paint Film
TSH1503G	Test Method for Adhesive Property of Paint Film
TSH1504G	Test Method for Flexibility of Paint Film
TSH1508G	Test Method for Volatile Solvent Resistance of Paint Film
TSH1509G	Test Method for Chemical Resistance of Paint Film
TSH1539G	Test Method for Hardness of Paint Film
TSH3130G	Coating for Interior Plastic Parts
TSL5100G	General Test Methods for Vinyl Leathers
TSM0503G	Fogging Test Method for Non-Metallic Materials

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