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TOYOTA ENGINEERING STANDARD	TSC7006G	CLASS C1

BENCH TEST METHODS FOR ELECTROMAGNETIC INTERFERENCE SUSCEPTIBILITY OF AUTOMOBILE ELECTRONIC EQUIPMENT

1. Scope

This standard covers test methods to evaluate the EMI (electromagnetic interference) susceptibility of automobile electronic equipment with the application of electromagnetic waves to the test vehicle on a test bench. The frequency range covered in this standard is 1 MHz to 2000 MHz.

2. Definitions

For the purpose of this standard, the following definitions shall apply.

(1) Automobile electronic equipment
The automobile electronic equipment refers to the equipment to control vehicle systems mainly by means of semiconductors, and various types of detection devices (sensors), output devices (actuators), etc. to be used in combination with the above mentioned control equipment.

(2) Electronic parts to be tested (specimens)
The parts refer to sub-assembly parts which are subject to testing.

(3) EMI (electromagnetic interference) susceptibility (electromagnetic wave resistance)
It refers to the capability to meet the design specifications of electric/electronic equipment against electromagnetic waves.

(4) Critical radio-field strength for actuation
It refers to the lowest radio-field strength at which the electric/electronic equipment that has been meeting the design specifications can no longer meet the specifications with the irradiation of electromagnetic waves.

(5) Standard state
The standard state refers to the ordinary atmosphere of test site, which shall be in the ordinary temperature range (5 to 35 ℃) and ordinary atmospheric pressure range of 86 to 106 kPa, unless otherwise specified.

(6) Standard voltage
It refers to the power supply voltage for the specimen in ordinary tests, which shall be in the range of 10 to 16 V for the 12 V parts and 20 to 32 V for the 24 V parts, with the prerequisite of using automobile batteries.

3. Test Steps

The following steps shall be taken in that sequential order for each test.

(Step 1) Preparation
(1) Selection of test method
(2) Preparation of test equipment, etc.
(3) Implementation of calibration

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(Step 2) Testing
(1) Setting specimen and test bench
(2) Implementation of test

4. Preparation for Testing

4.1 Selection of Test Method
The test methods covered in this standard are the following four methods, with the range of test frequency for each method shown in Table 1. Provided that the frequencies to be used in testing shall be within the ranges that can be measured with the test equipment concerned.
The selection of test method shall be in line with the specifications of the specimens concerned.

Table 1 Applicable Frequency Ranges of Individual Test Methods

Test method	Applicable frequency range
TEM cell test	1 to 400 MHz
Wide band width antenna nearby test	400 to 2000 MHz
Radio equipment antenna nearby test	28,50,144,430,900,1280 MHz
Mobile phone antenna nearby test	835,900,1440,1750,1880 MHz

The test frequencies for the TEM cell test and the wide band width antenna nearby test shall be selected out of those shown in Table 2 and combined properly as specified for each specimen.

Table 2 Test Frequencies

Frequency range	Frequency step	Test frequency point
1 to 10 MHz	1 MHz	10 frequency points
10 to 20 MHz	2 MHz	4 frequency points
20 to 200 MHz	2 MHz Instead of above, the frequency range of 20 to 200 MHz may be selected out of those shown in Table 3.	91 frequency points
200 to 400 MHz	20 MHz Instead of above, the frequency range of 200 to 400 MHz may be selected out of those shown in Table 3.	10 frequency points
400 to 1000 MHz	20 MHz Instead of above, the frequency range of 400 to 1000 MHz may be selected out of those shown in Table 3.	30 frequency points
1000 to 2000 MHz	1050,1100,1150,1200, 1250,1300 MHz	6 frequency points

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Table 3 Substitute Test Frequencies Instead of 20 - 1000 MHz

Test frequencies (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	

4.2 Preparation of Test Equipment, etc.

(1) Simulator

Use a simulator to monitor the state of specimen actuation and to apply a proper load equivalent to that on the vehicle. The configuration of the simulator shall meet the specifications of each specimen.

(2) Sub-wire harness

Use a sub-wire harness to connect the specimen, simulator and the power supply. The type and diameter of the cable for the sub-wire harness shall be equivalent to that on the vehicle, and the length shall be 1.5 to 4 m. If there are some other specifications for a particular specimen, follow the specifications.

(3) Artificial network (AN)

The power shall be supplied to the specimen through the artificial network (AN) with the circuit configuration shown in Fig. 1. The impedance characteristics shall not deviate more than 10 % from those shown in Fig. 2.

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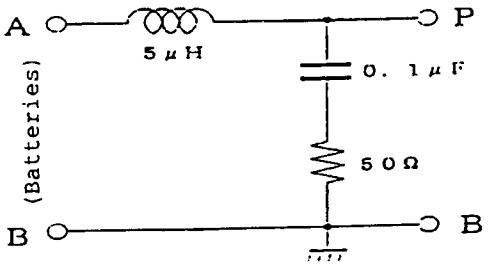

Fig. 1 Artificial Network (AN) Circuit Configuration

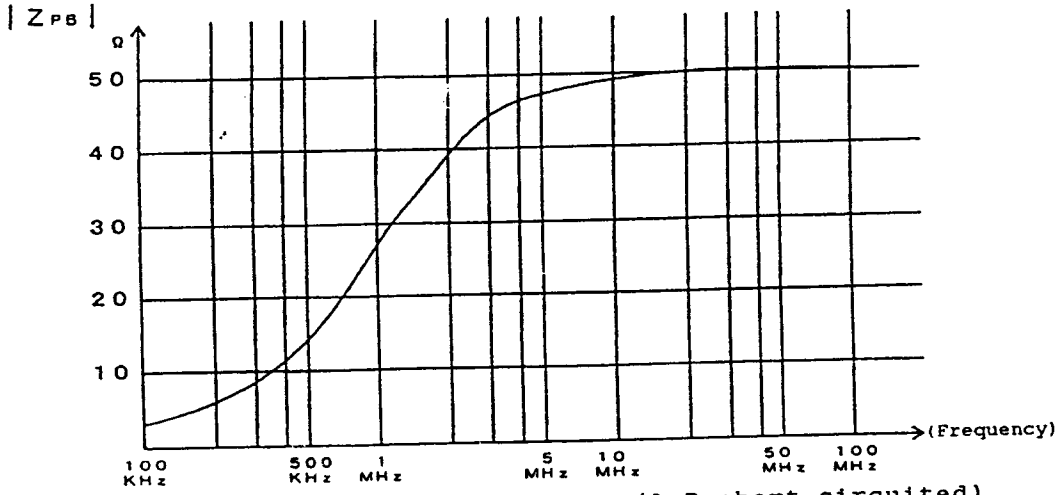

Fig. 2 Frequency Characteristics (A-B short circuited) of Artificial Network (AN)

(4) Antennas (for radio equipment antenna nearby test and mobile phone antenna nearby test)

(a) Antenna for 28 MHz
Use a λ/4 mobile antenna or a wide band width antenna sold on market in the 28 MHz frequency radio equipment antenna nearby test. A recommendable antenna is shown in Table 4.

(b) Antenna for 50 MHz
Use a λ/4 mobile antenna sold on market in the 50 MHz frequency radio equipment antenna nearby test. A recommendable antenna is shown in Table 4.

(c) Antenna for frequency other than 28 or 50 MHz
Use a λ/4 sleeve antenna for a test frequency other than 28 MHz (for 144 MHz, however, use a λ/4 mono-pole antenna) in a radio equipment antenna nearby test. See Section 5 Supplemental Provisions for the antenna structure and characteristics.

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Table 4 Recommendable Test Equipment

No.	Name of measuring device	Maker & model No.	Characteristics	Quantity
1	TEM cell	Dokuritsu Denshi: KTC-502 (Special)	DC: up to 400 MHz	One set
2	Wide band width antenna (For wide band width antenna nearby test)	EMCO: 3106	200 to 2000 MHz	One set
3	28 MHz mobile antenna	Diamond : CR-11	28 MHz	One set
4	50 MHz mobile antenna Antenas requeridas Poly.	Comet: SB14 or Diamond: CR-6 or DP-EL6	50 MHz	One set

4.3 Implementation of Calibration

Calibrate the test equipment as specified below prior to the TEM cell test, wide band wooden antenna nearby test and the radio equipment antenna nearby test at 28 MHz.

4.3.1 Calibration Method for TEM Cell Test

(1) Set (radio) field probes at the locations shown in Fig. 3.

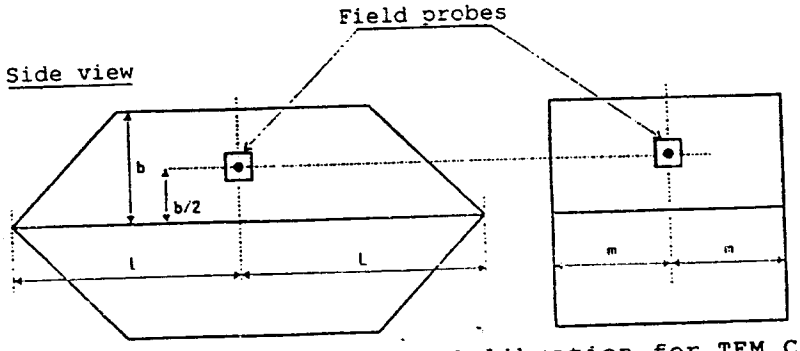

Fig. 3 Field Probe Locations upon Calibration for TEM Cell Test

(2) Adjust the RF power amplifier output properly so that the the field strength gage shows the specified value at the specified test frequency. Use the same frequency in calibration as the test frequency specified in Table 2.

(3) Measure the values of all items listed below at every test frequency.

(a) Traveling wave power
(b) Reflection wave power
(c) VSWR (voltage standing wave ratio)
(d) Signal generator output
(e) Generated field strength

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4.3.2 Calibration Method for Wide Band Width Antenna Nearby Test

(1) Set the field probe at the location shown in Fig. 4.

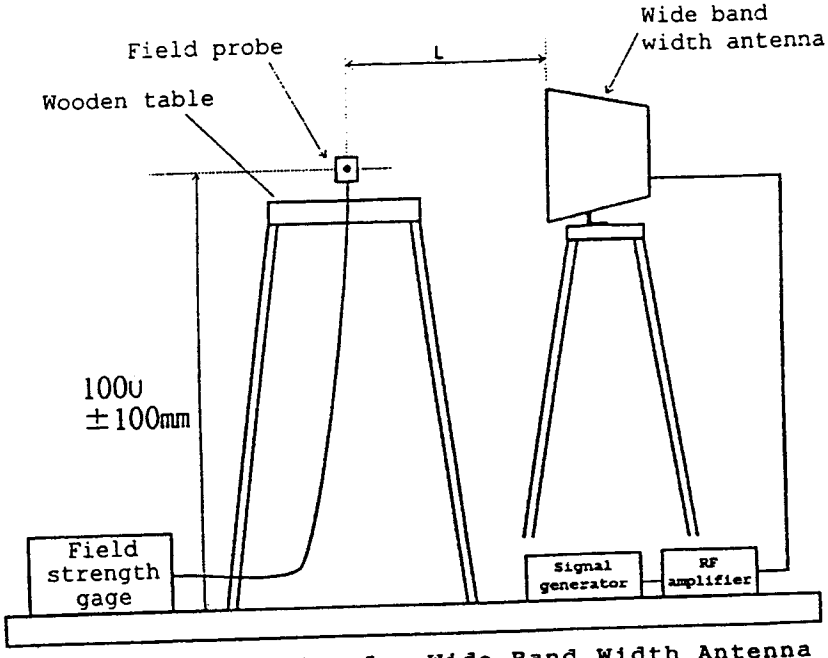

Fig. 4 Layout upon Calibration for Wide Band Width Antenna Nearby Test

Remark:
Set the L at 0.3 m or longer.

(2) Adjust the RF power amplifier output properly so that the the field strength gage shows the specified value at the specified test frequency. Use the same frequency in calibration as the test frequency specified in Table 2.

(3) Measure the values of all items listed below at every test frequency.

(a) Traveling wave power
(b) Reflection wave power
(c) VSWR (voltage standing wave ratio)
(d) Signal generator output
(e) Generated field strength

4.3.3 Calibration Method for Radio Equipment Antenna Nearby Test (28 MHz Test)

(1) Set the field probe at the location shown in Fig. 5. Select an appropriate 28 MHz mobile antenna so that the value of VSWR becomes 1.5 or smaller where no field probe is installed.

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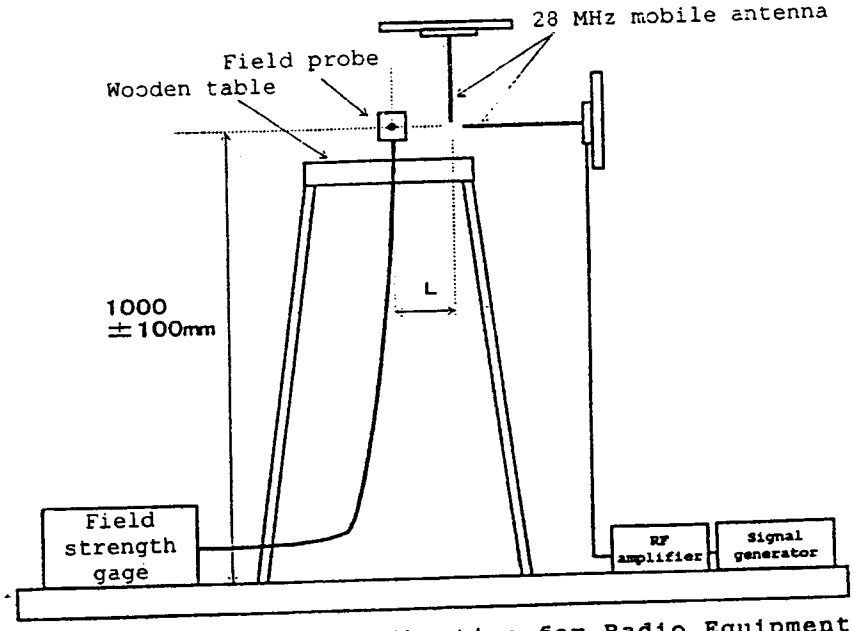

Fig. 5 Layout upon Calibration for Radio Equipment Antenna Nearby Test (28 MHz Test)

Remark:
Set the L at 0.3 m or longer.

(2) Adjust the RF power amplifier output properly so that the the field strength gage shows the specified value at 28 MHz.

(3) Measure the values of all items listed below at every test frequency.

(a) Traveling wave power
(b) Reflection wave power
(c) VSWR (voltage standing wave ratio)
(d) Signal generator output
(e) Generated field strength

4.4 Tests

4.4.1 TEM Cell Test

(1) Specimen and test bench setting

Set the specimen within the range shown in Fig. 6. It is acceptable as long as the circuitry units such as the substrate of specimen stay within the range. Apply the field in X-axial, Y-axial and Z-axial directions as shown in Fig. 7.

Connect the specimen to the simulator through the sub-wire harness. Set the sub-wire harness in the cell vertically (in the direction of field) against the specimen with the shortest possible distance. Use an ECU bench made of a material with a dielectric constant of 1.4 or smaller. The test bench configuration is shown in Fig. 8.

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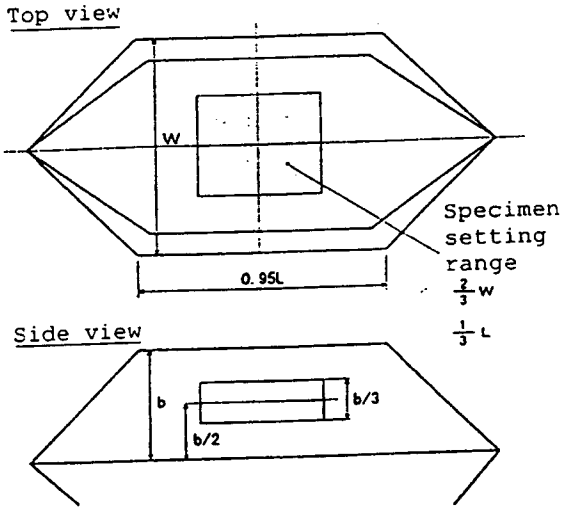

Fig. 6 Specimen Setting Range

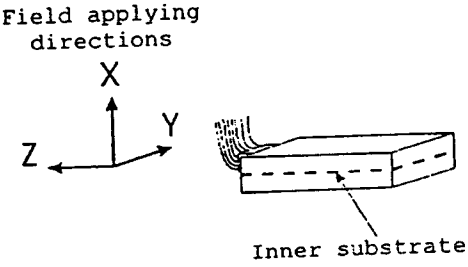

Fig. 7 Specimen Setting Directions

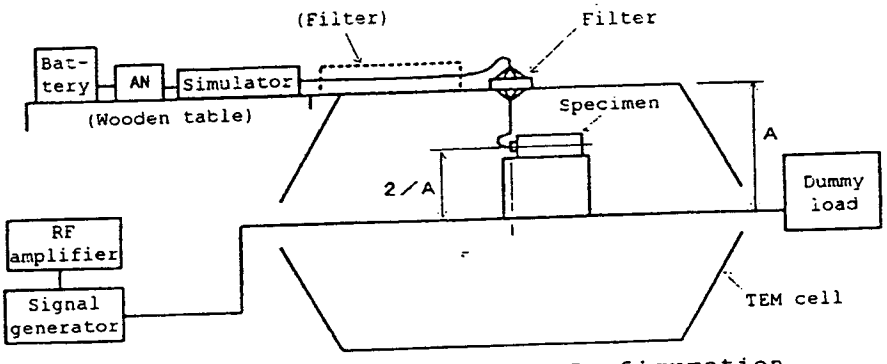

Fig. 8 TEM Cell Test Bench Configuration

(2) Field set method upon testing

Adjust the RF amplifier output per test frequency properly so that the output does not become lower than the traveling wave power measured upon calibration for each test. Then apply the field load by means of non-modulated signals (CW).

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(3) Test method

Apply a proper field load to the specimen as specified for the specimen to check on its functions. Select the proper field strength from Table 5 in line with each test level specified for the specimen. Conduct the test in the X, Y and Z axial directions of specimen respectively.

Table 5 Test Levels

Test level	Electric field strength
Level Ⅰ	200 V/m
Level Ⅱ	100 V/m
Level Ⅲ	60 V/m
Level Ⅳ	30 V/m

4.4.2 Wide Band Width Antenna Nearby Test

(1) Specimen and test bench setting

Set the specimen as shown in Fig. 9. Adjust the distance between the specimen center and the antenna the same as the distance between the antenna and field probe location specified for the calibration. Connect the specimen to the simulator through the sub-wire harness.

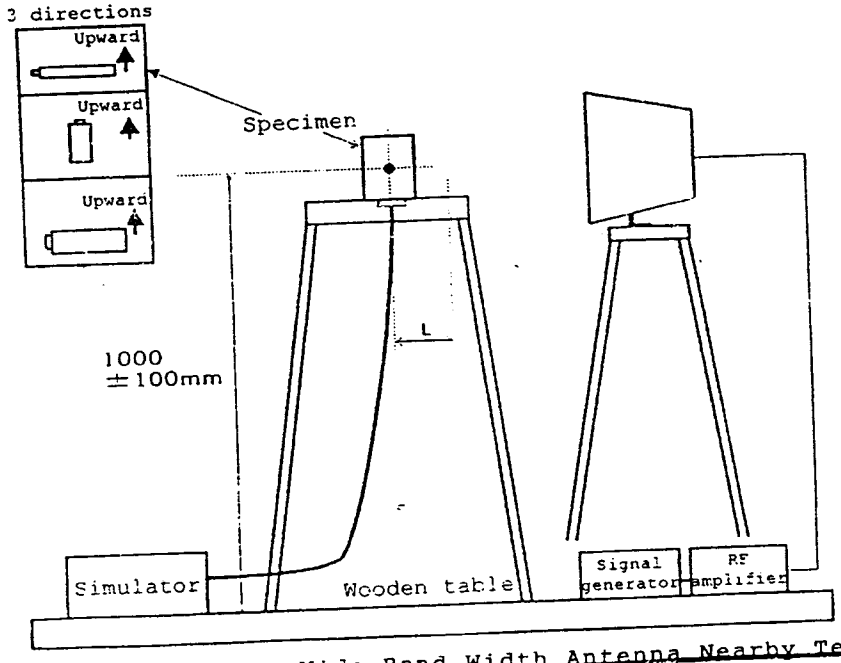

Fig. 9 Layout for Wide Band Width Antenna Nearby Test

Remark:
Set the L the same as in calibration.

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(2) Field set method upon testing
Adjust the RF amplifier output per test frequency properly so that the output does not become lower than the traveling wave power measured upon calibration for each test. Then apply the field load by means of non-modulated signals (CW).

(3) Test method
Apply a proper field load to the specimen as specified to check on its functions. Select the proper field strength from Table 5 in line with the test level specified for the specimen. Set the specimen in the three directions as shown in Fig. 9, and conduct the test in these directions.

4.4.3 Radio Equipment Antenna Nearby Test

(1) 28 MHz Test

(a) Test method
Set the specimen as shown in Fig. 10. Adjust the distance between the specimen center and the antenna the same as the distance between the antenna and field probe location specified for the calibration. Connect the specimen to the simulator through the sub-wire harness.
This 28 MHz test may be substituted by a test to be conducted in the same manner as the wide band width antenna nearby test specified in Section 4.4.2.

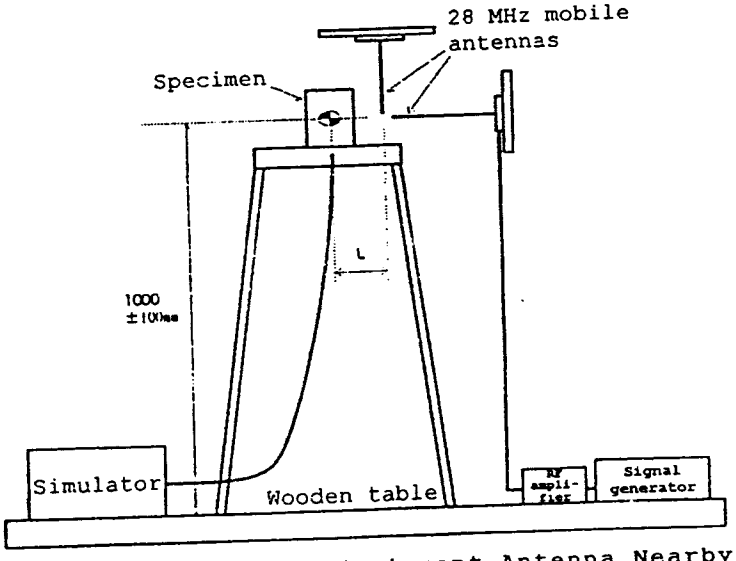

Fig. 10 Layout for Radio Equipment Antenna Nearby Test (28 MHz Test)

Remark:
Set the L the same as in calibration.

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(b) Field set method upon testing
Adjust the RF amplifier output per test frequency properly so that the output does not become lower than the traveling wave power measured upon calibration for each test. Then apply the field load by means of non-modulated signals (CW).

(c) Test method
Apply a proper field load to the specimen to check on its functions as specified. Select the proper field strength from Table 6 in line with the test level specified for the specimen.

Table 6 Test Level

Test level	Field strength
Level I	100 V/m

(2) Test Method Other than for Test at 28 MHz

(a) Specimen and test bench setting
Set the specimen as shown in Fig. 11. Select a proper antenna from Table 7 so that the VSWR becomes 1.5 or smaller without specimen.
Connect the specimen to the simulator through the sub-wire harness.

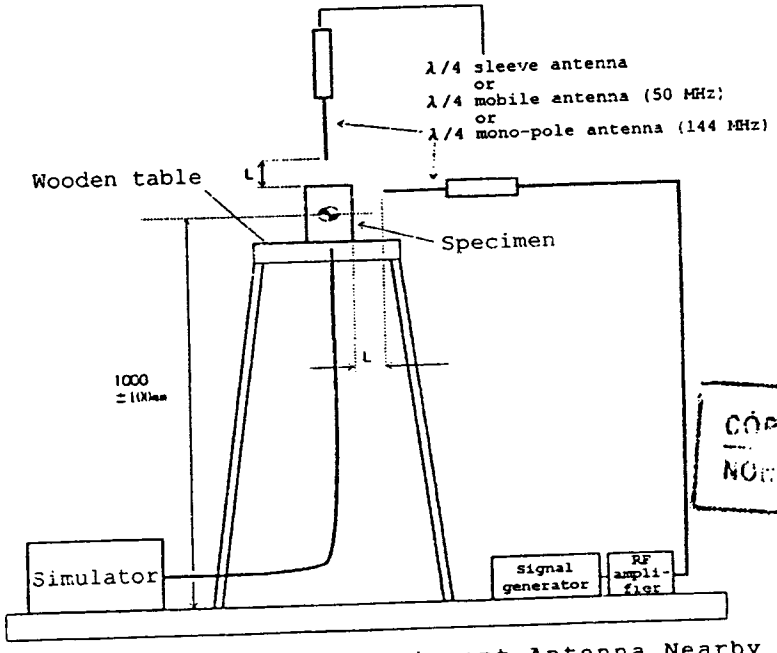

Fig. 11 Layout for Radio Equipment Antenna Nearby Test (Other than Test at 28 MHz)

Remark:
Set the distance (L) between the specimen and antenna top as specified for each specimen.

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(b) Test output set method

Set the antenna input power for test according to Table 7. In order to compensate for the power loss caused by the coaxial cable from the power meter up to the antenna input, check on the loss in advance, and set the traveling wave power correctly with the following equation.

$$P_T = P + (P \times 10^{L/10})(W)$$ where P_T : amplifier traveling wave power (W)

P : output upon test (see Table 6)

L : loss by coaxial cable (dB)

Table 7 Test Frequencies, Test Outputs and Test Antennas

Test frequency	Output upon test	Test antenna
50 MHz	10 W	λ/4 mobile antenna
144 MHz	15 W	λ/4 mono-pole antenna
430 MHz	15 W	λ/4 sleeve antenna
900 MHz	10 W	λ/4 sleeve antenna
1280 MHz	2 W	λ/4 sleeve antenna

(c) Test method

Apply the field load to the specimen and check on the functions according to the specifications. Use non-modulated signals (CW) at that time. Select a proper nearby distance to the antenna specified for the specimen in Table 8 for each test level.

Table 8 Test Levels and Antenna Nearby Distances

Test level	Antenna nearby distance
Level Ⅰ	5 cm
Level Ⅱ	10 cm

4.4.4 Mobile Phone Antenna Nearby Test

(1) Specimen and test bench setting

Set the specimen as shown in Fig. 12. Select a proper λ/4 sleeve antenna so that the VSWR becomes 1.5 or smaller without specimen. Connect the specimen to the simulator through the sub-wire harness.

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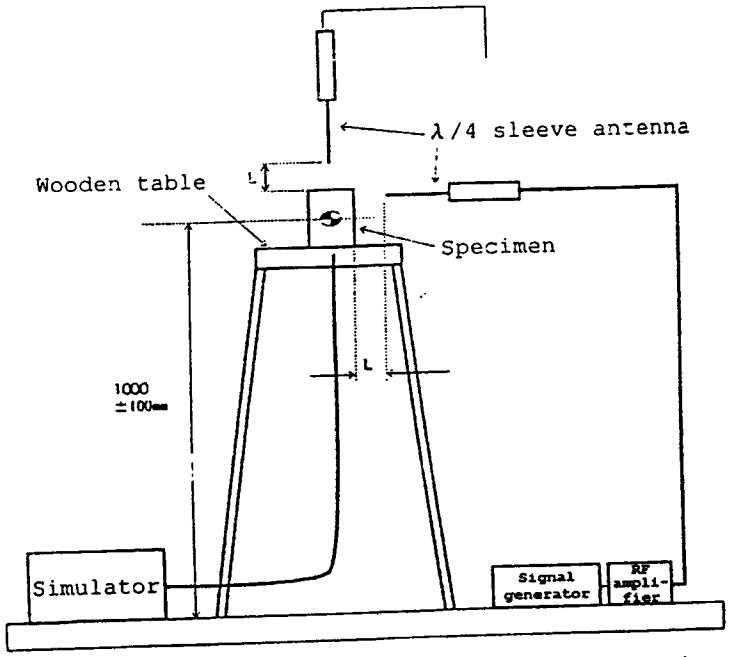

Fig. 12 Layout for Mobile Phone Antenna Nearby Test

Remark:
Set the distance (L) between the specimen and antenna top as specified for each specimen.

(2) Test output set method
Set the antenna input power for test according to Table 9. In order to compensate for the power loss caused by the coaxial cable from the power meter to the antenna input, check on the loss in advance, and set the traveling wave power correctly with the following equation.

$$P_T = P + (P \times 10^{L/10})(W)$$ where P_T : amplifier traveling wave power (W)
P : output upon test (see Table 9)
L : loss by coaxial cable (dB)

Table 9 Test Frequencies, Test Outputs and Test Signals

Test frequency	Test output	Burst signal		Market concerned
		Cyclic period	ON time	
835 MHz	2 W	20 ms	6.67 ms	North America
900 MHz	4 W	4.62 ms	0.56 ms	Sold on markets excluding North America
940 MHz	2 W	20 ms	6.67 ms	Sold on markets
1440 MHz	2 W	20 ms	6.67 ms	Sold on markets
1750 MHz	2 W	4.62 ms	0.56 ms	Europe
1880 MHz	2 W	4.62 ms	0.56 ms	North America

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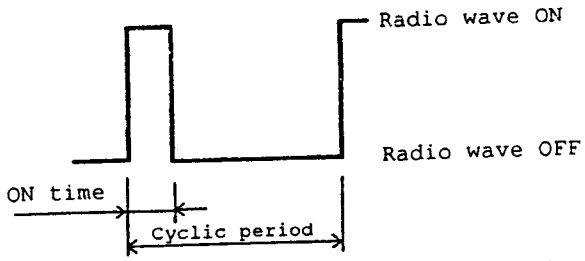

Fig. 13 Burst Signal Wave Form Specifications

(3) Test method

Apply the field load to the specimen and check on the functions according to the specifications. Use non-modulated signals (CW) at that time. Select the signals according to Table 9, and the cyclic period and ON-time of burst signal shown in Fig. 13. Select the proper nearby distance to the antenna from Table 10 for each test level specified for the specimen.

Table 10 Antenna Nearby Distances

Test level	Antenna nearby distance
Level I	Operation unit and display unit: 0 cm Other than the above: 2 cm
Level II	2 cm
Level III	5 cm

The operation unit and display unit shall be such to allow the contact between the antenna and the specimen as installed on the vehicle.

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5. Supplemental Provisions

5.1 λ/4 Mono-pole Antenna

An example of the structure of λ/4 mono-pole antenna to be used in the radio equipment antenna nearby test at 144 MHz is shown below. Select a proper antenna so that the specified value of VSWR can be attained with the coaxial cable connected.

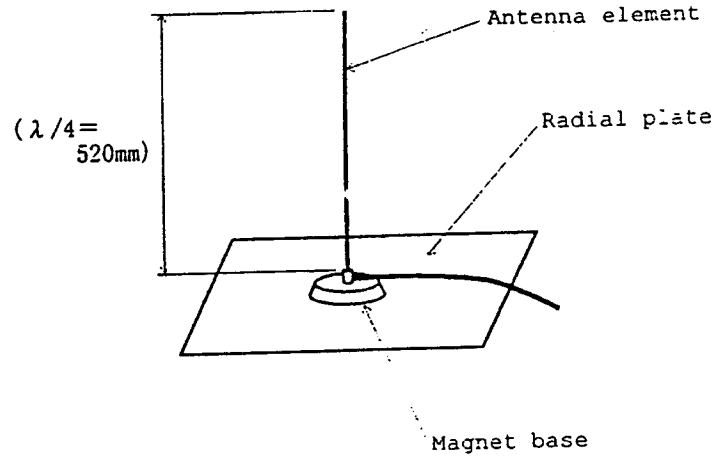

Fig. 14 Example of Configuration of λ/4 Mono-pole Antenna

(Recommendable components)
Antenna element: brass rod of approx. 2 mm diameter;
radial plate: approx. 0.5 mm thick
iron plate:
magnet base: use a magnet base sold on market.

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5.2 λ/4 Sleeve Antenna

An example of the structure of λ/4 sleeve antenna to be used in the radio equipment antenna nearby test and mobile phone antenna nearby test is shown in Fig: 15. An example of element length and sleeve length is shown in Table 11. Select a proper antenna so that the specified value of VSWR can be attained with the antenna fixed and the coaxial cable connected in the same manner as in testing.

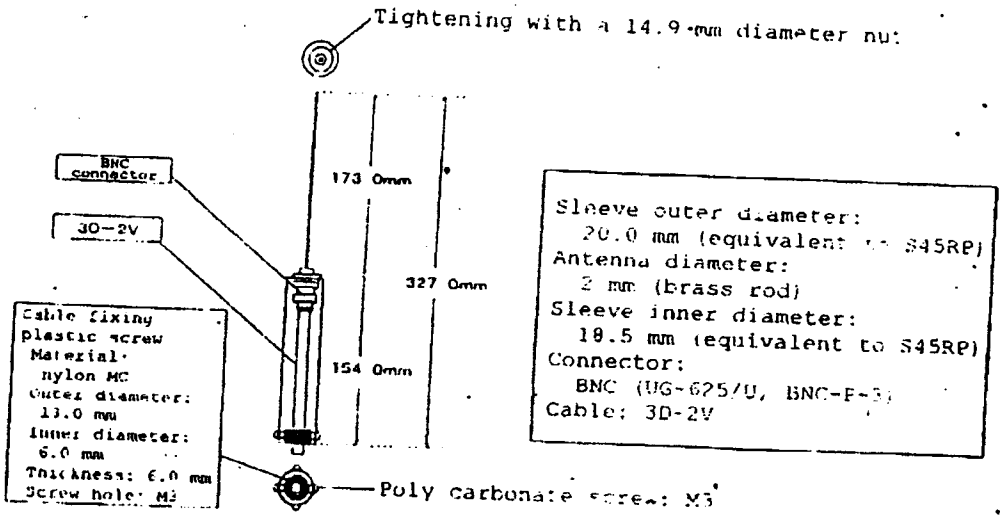

Fig. 15 Example of λ/4 Sleeve Antenna Configuration

Table 11 Example of λ/4 Sleeve Antenna Element Length and Sleeve Length

Frequency	Antenna element length (mm)	Sleeve length (mm)
430 MHz	173	154
835 MHz	90	79.5
900 MHz	83	74.5
940 MHz	80	71.5
1280 MHz	58	52
1815 MHz	41	35

One and the same antenna may be used for two or more frequencies, as long as the specified VSWR can be attained.

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5.3 Substitute Method to Set Test Power for Radio Equipment Antenna Nearby Test and Mobile Phone Antenna Nearby Test

The following method based on the calibration results may be used as a substitute method, in order to set the test output (input power to the antenna) in radio equipment antenna nearby test and mobile phone antenna nearby test.

(1) Calibration layout

Set the antenna and the field probe as shown in Fig. 16. The probes to be used here shall be FP2000 (or FP5000) and FP2080 (or FP5080)(all of them made by AR).

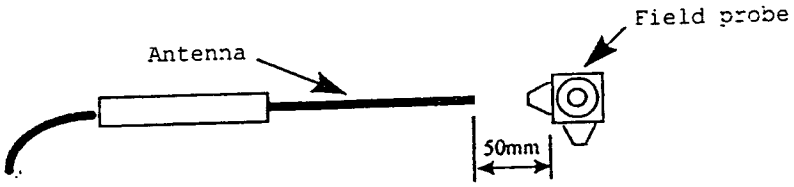

Fig. 16 Calibration Layout

(2) Calibration method

Set a proper antenna input power so that the field strength gage shows the specified value. Use the traveling wave power thus determined in testing.

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Table 18 Guideline to Selection of Load Dump Test

Classification	Both test 1 specified in Section 9.13.3 and test 2 specified in Section 9.13.4	Only test 3 specified in Section 9.13.5
Electronic devices to be used only on the vehicle adopting alternator with Zener diode	△	○
Electronic devices to be used on both the vehicle adopting alternator with Zener diode and the vehicle adopting alternator without Zener diode	○	×
Electronic devices to be used only on the vehicle adopting alternator without Zener diode	○	×

Remark:

○ ; To be performed

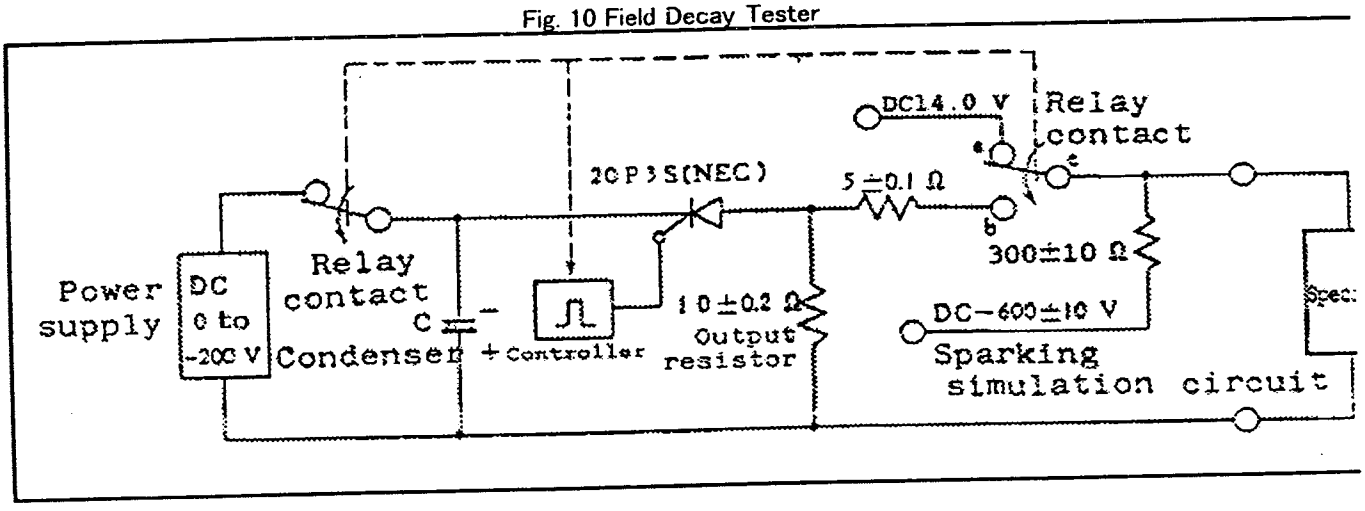
△ ; May be selected

× ; Must not be selected

9.14 Field Decay

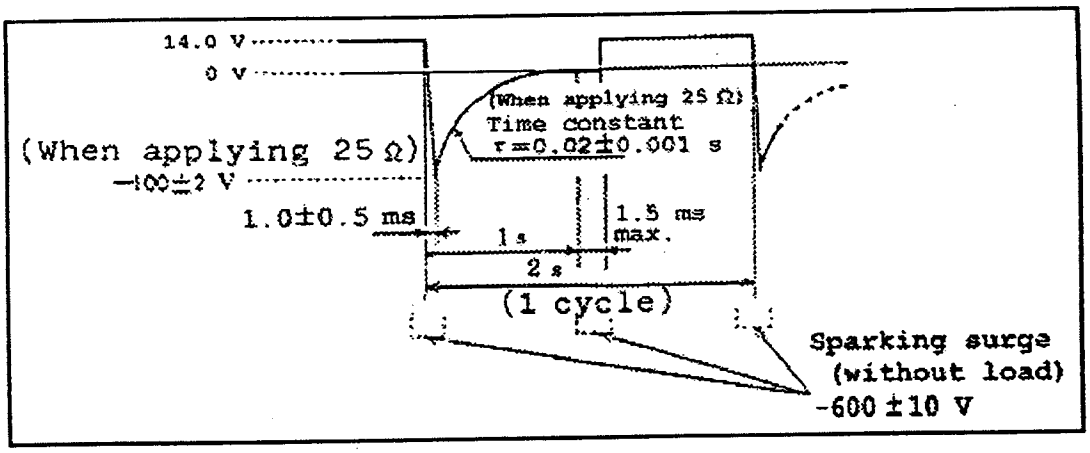
Apply the voltage generated by the apparatus shown in Fig. 10 to the clock for 50000 times. For a luminous display clock, apply the voltage at the same time to all input terminals other than the ground. In the test apparatus shown in Fig. 10, operate relay contacts and the controller in link motion, and apply a negative surge to the specimen. Adjust the time required for the relay contact c to go away from a and contact b at 1.0 ± 0.5 ms.

Fig. 10 Field Decay Tester



Connect 25 ± 0.5 Ω to the output terminal of the tester, and adjust the power supply voltage and condenser so that the output waveform shown in Fig. 11 may be generated. Next, connect 1 k Ω to the output terminal of the tester, make sure that the peak voltage is −120 ± 2 V then connect the specimen.

Fig. 11



Remark:

For Class B clocks, carry out the test on the actual vehicles.

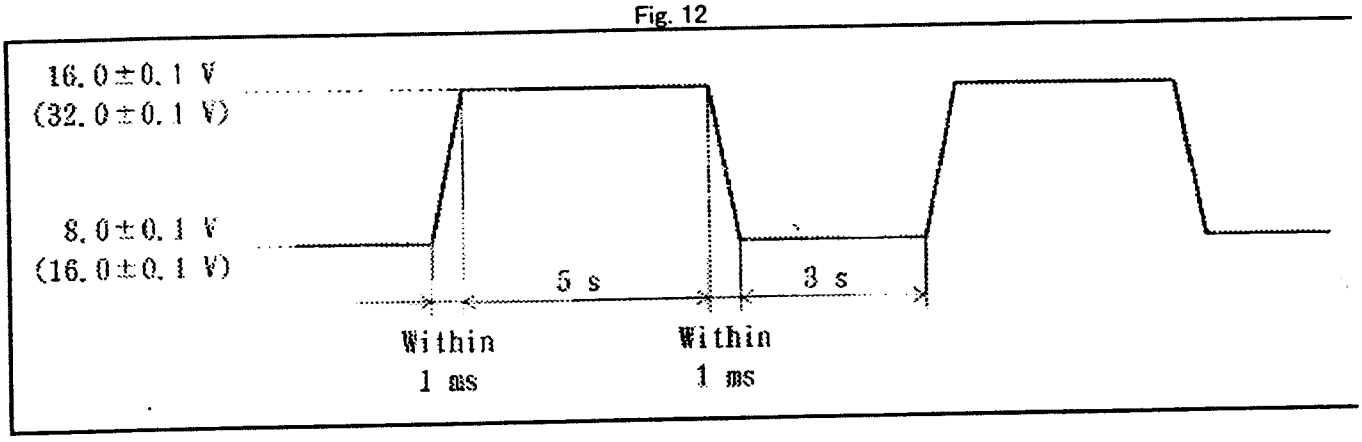
9.15 Dropping Test

Drop the clock packed in the optional accessory box onto a concrete surface naturally from 1 m height, once per side (6 sides).

9.16 Voltage Fluctuation Test

Apply fluctuating power supply voltages shown in Fig. 12 for 48 h to the clock under the standard conditions, at the standard position with the standard clock motion.

Fig. 12



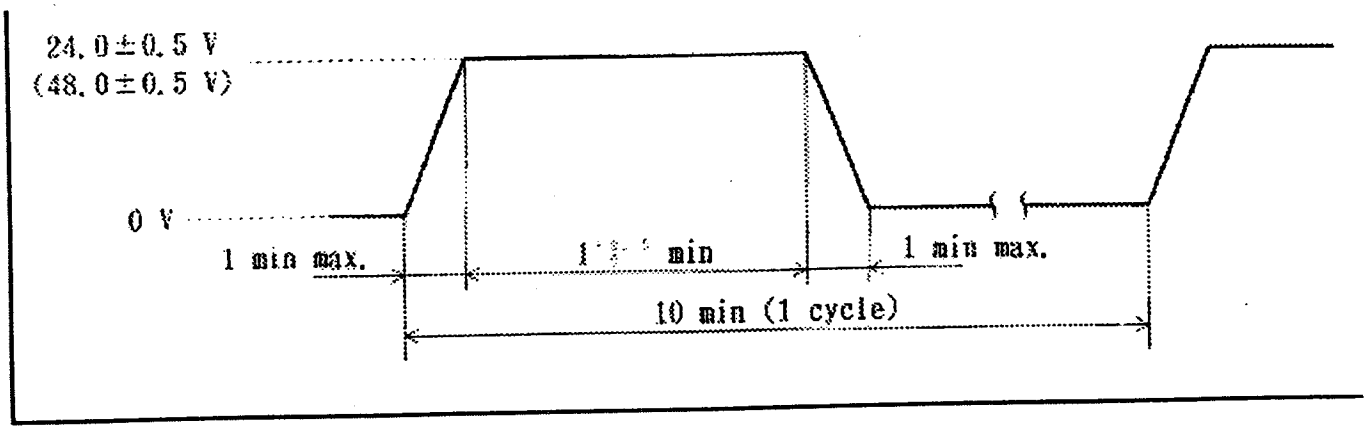
Remark:

Values in parentheses are applicable to Class B clocks.

9.17 Overvoltage Test

Apply the power supply voltage shown in Fig. 13 for 10 cycles to clock placed under standard conditions, at the standard position with the standard clock motion. In case of a luminous display, apply the voltage to all input terminals other than the ground.

Fig. 13



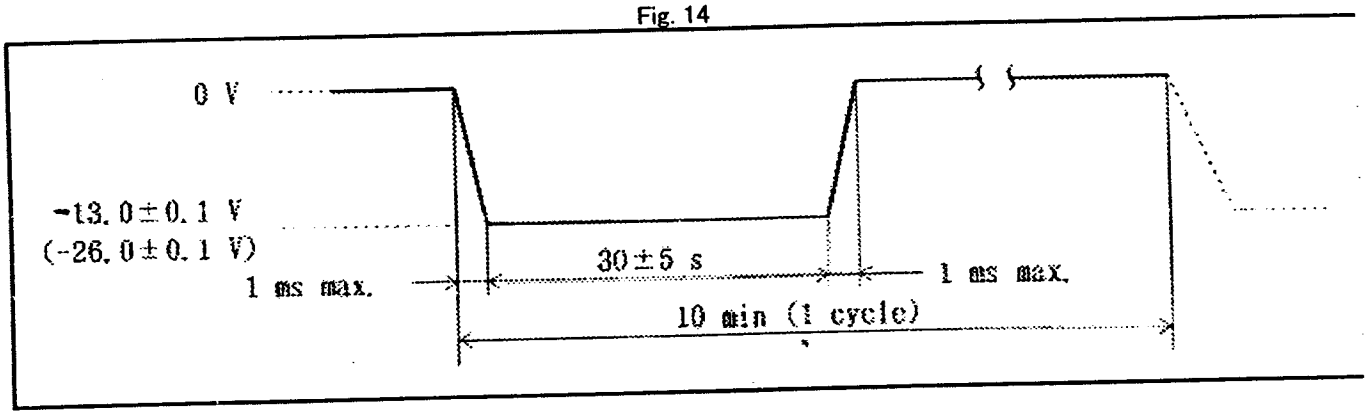
Remark:

Values in parentheses are applicable to Class B clocks.

9.18 Reverse Connection Test

Apply the power supply voltage shown in Fig. 14 for 10 cycles to the clock placed under the standard conditions, at the standard position with the standard clock motion. For a luminous display clock, apply the voltage to all input terminals other than the ground.

Fig. 14



Remark:

Values in parentheses are applicable to Class B clocks.

9.19 Momentary Power-Off Characteristics

Carry out the test under the conditions given in Table 19.

Remark:

"Reset voltage ± 1 V" indicated hereunder refers to two voltages, nominal reset voltage +1 V and nominal reset voltage −1 V.

Table 19 Power Supply Voltage Fluctuation Pattern

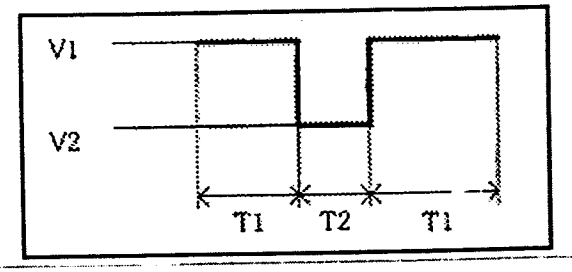
No.	Power supply voltage fluctuation pattern	Conditions
①	Instantaneous power supply interruption (+B, ACC) <Non-repetitive> 	① V1=13.5 V ② V2=0, 2, reset voltage ± 1 V ③ T1=5 s ④ T2=1, 5, 10, 100 ms ⑤ Number of tests: 10 times

Table 19 (Continued)

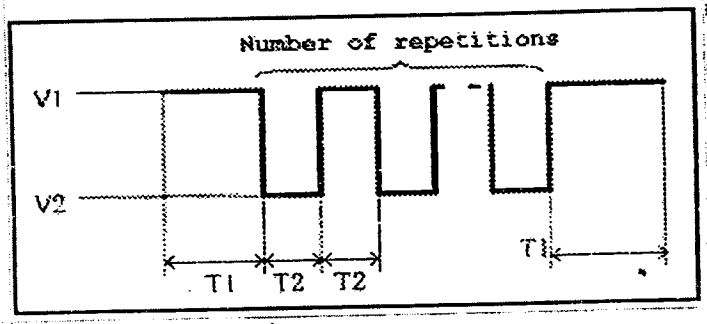
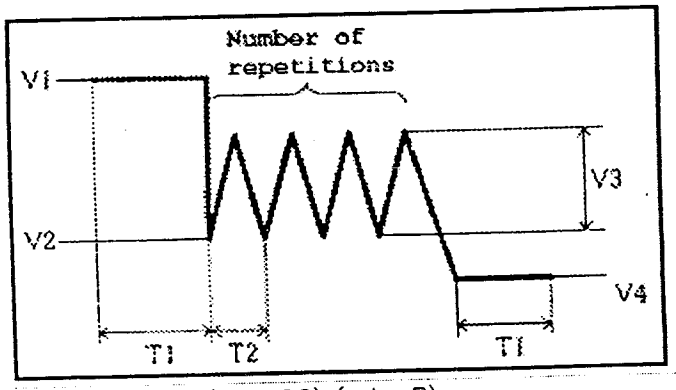
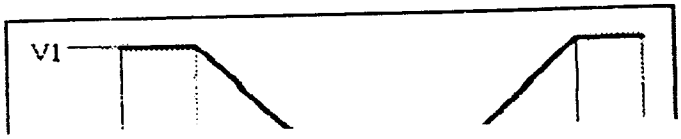
No.	Power supply voltage fluctuation pattern	Conditions
②	Instantaneous power supply interruption (+B, ACC) <Repetitive instantaneous interruption (Chattering)> 	① V1=13.5 V ② V2=0, 2, reset voltage ± 1 V ③ T1=5 s ④ T2=1, 5, 10, 100 ms ⑤ Number of repetitions: 10 cycles ⑥ Number of tests: 10 times
③	Voltage drop (+B, ACC) 	① V1=13.5 V ② V2=2, reset voltage ± 1 V ③ V3=3 V ④ V4=0 V ⑤ T1=5 s ⑥ T2=1, 2 s ⑦ Number of repetitions: 10 cycles ⑧ Number of tests: 10 times
④	Battery discharge (+B, ACC), (only +B) <Pattern I> 	① V1=13.5 V ② V2=0, 2 V ③ T1=5 s ④ T2=60 s ⑤ Number of tests: 10 times

Table 19 (Continued)

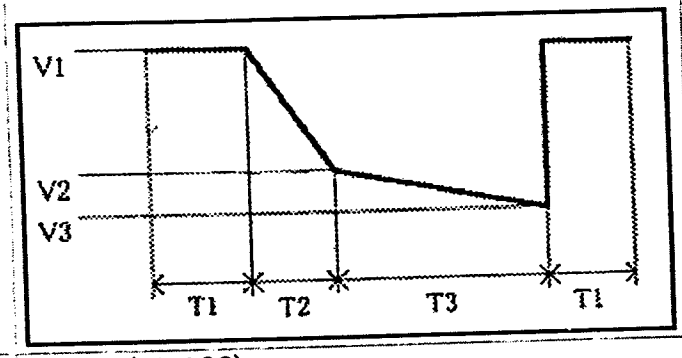
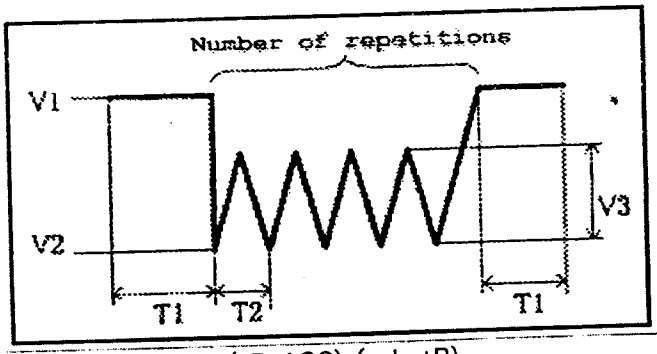
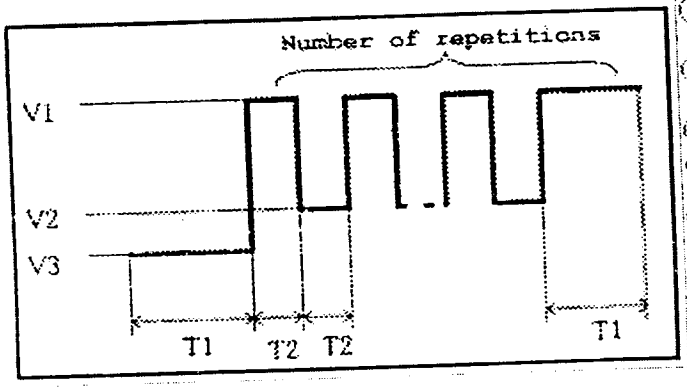
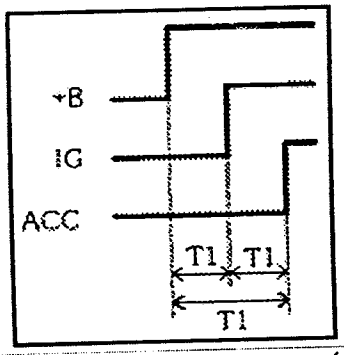
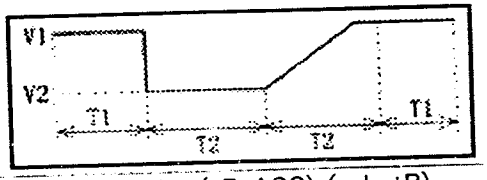
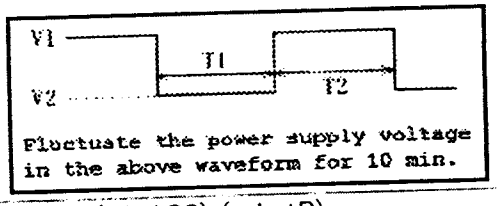
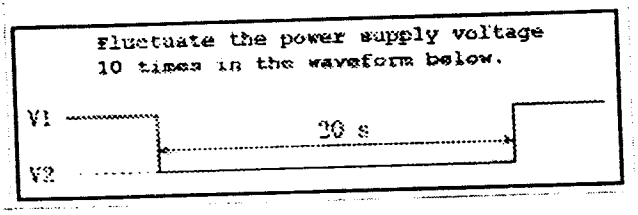
No.	Power supply voltage fluctuation pattern	Conditions
⑤	Battery discharge (+B, ACC), (only +B) <Pattern II> 	① V1=13.5 V ② V2=4, 6 V ③ V3=0, 2 V ④ T1=5 s ⑤ T2=0, 30 s ⑥ T3=60 s
⑥	Cranking (+B, ACC) 	① V1=13.5 V ② V2=2, reset voltage ± 1 V ③ V3=3 V ④ T1=5 s min. ⑤ T2=0.1, 0.5, 1.0 s ⑥ Number of repetitions: 10 cycles ⑦ Number of tests: 10 times
⑦	Battery connection (+B, ACC), (only +B) <Chattering> 	① V1=13.5 V ② V2=0, reset voltage ± 1 V ③ V3=0 V ④ T1=5 s ⑤ T2=1, 10, 100 ms ⑥ Number of repetitions: 10 cycles ⑦ Number of tests: 10 times

Table 19 (Continued)

No.	Power supply voltage fluctuation pattern	Conditions
⑧	Power supply ON after the battery is connected <Power supply voltage start-up sequence> 	① T1=0, ± 1, ± 10, ± 100 ms ② Number of tests: 10 times The time period between the start-up of +B and ACC shall be deemed as T1 when not using IG terminal.
⑨	Instantaneous power supply interruption (+B, ACC), (only +B) <Non-repetitive> 	① V1=13.5 V ② V2=2, 4 V ③ T1=4 s ④ T2=1 s ⑤ Number of tests: 10 times
⑩	Continuous fluctuation (+B, ACC), (only +B) 	① V1=13.5 V ② V2=10.5 V ③ T1=0.5 s ④ T2=0.5 s ⑤ Test duration=10 min
⑪	Voltage drop (+B, ACC), (only +B) 	① V1=13.5 V ② V2=3 V

Remark:

Tolerance of the power supply voltage shall be ± 0.1 V.

9.20 Electrostatic Characteristics

Set the clock under the standard conditions and at the standard position, and carry out the test under conditions shown in Table 20.